Technical Document LA23050

Part 2 — Technical Requirements

NRCB Natural Resources Conservation Board

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

NRCB USE ONLY	Application number	Legal land description
☒ Approval ☐ Registration ☐ Authorization ☐ Amendment	LA23050	Sec 31-14-26 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 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.

May 3 2024
Date of signing

Paul Wipf
Signature

Hutterian Brethren of Ivy Ridge
Corporate name (if applicable)

Paul Wipf
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)
Chicken & Pullet Barn	111.56 m x 30.48 m
Dairy Barn (two manure collection pits 30.6 m x 1 m x 1.6 m deep & 3.7 m x 3.3 m x 3.7 m deep, each)	~~By 3.7 Dep~~ 111.56m X 36.58m
Calf Shed & Dry Cows (Calf and Dry Cow Shed)	111.56m x 45.72m
Broiler Barn	111.56m X 36.58m
Goose Barn / Mixed Poultry	76.20m X 18.29m

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

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

NRCB USE ONLY

AO Comment: Proposed facilities list is continued on next page of this document.

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NRCB | Natural Resources Conservation Board

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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.

Date of signing

Paul Wipf
Signature

Hutterian Brethren of Ivy Ridge
Corporate name (if applicable)

Paul Wipf
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)
Feed mill	29 m x 31
Hay Shed	111.56m x 36.58m
Manure Storage for Liquid for Dairy	5 m high 46.3 m inside dia
~~Catch Basin~~	~~13m length 25m width, 3.31m dep~~
Solid Manure Storage Pad	40 x 60 meters

AO Comment: Feed mill and hay shed are ancillary facilities.

Manure Storage Tank

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

AO Comment: On December 3, 2024, the applicant indicated in an email that they will no longer be proposing a catch basin for the solid manure storage pad. Instead, they are proposing to construct berms around the solid manure storage pad to contain run-off.

Part 2 — Technical Requirements

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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 5 years February 2029

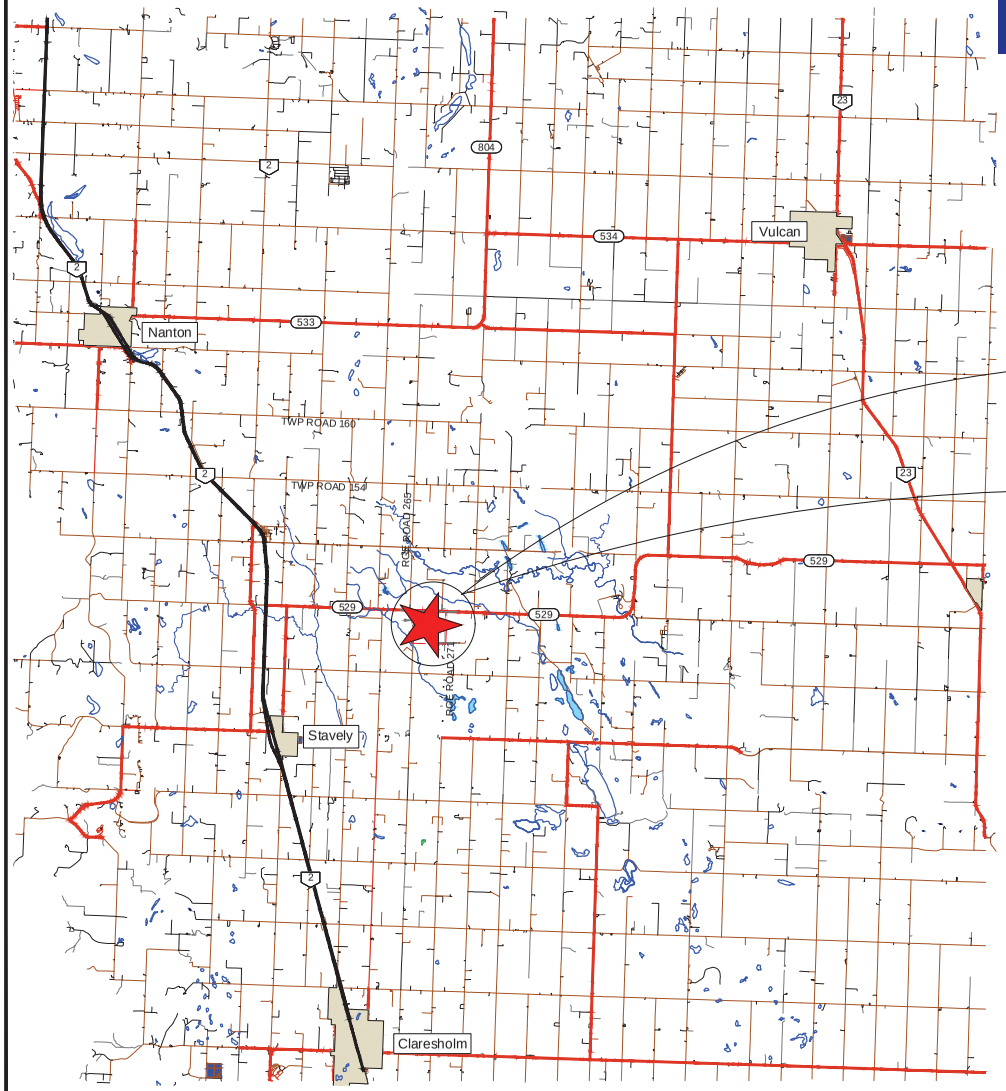
Additional information

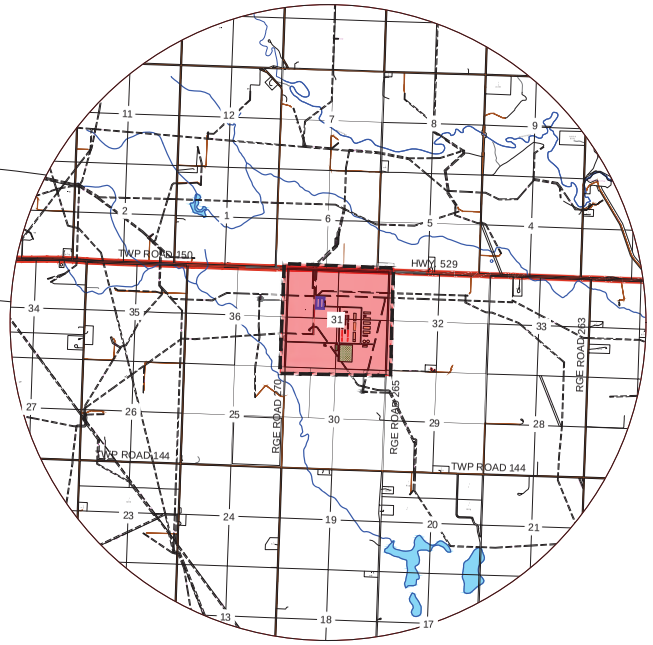
Livestock numbers: Complete only if livestock numbers are different from what was identified in the Part 1 application. Note: if livestock numbers increase in your Part 2 application, a new Part 1 application must be submitted which may result in a loss of priority for minimum distance separation (MDS).

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**
Laying Hens		18,000	18,000
Pullets / Broilers		34,000	34,000
Dairy Cows, associated dry cow replace		150	150
Ducks		1000	1000
Geese		100	100
AO Comment: Livestock numbers have not changed from Part 1 application.			

IVY RIDGE Hutterite Colony

New Colony Design





PROJECT LOCATION

MD of Willow Creek

SW$\frac{1}{4}$ Sec. 32, Twp.15, Rge.26, W4M

REVISIONS	BY	Y	M	D

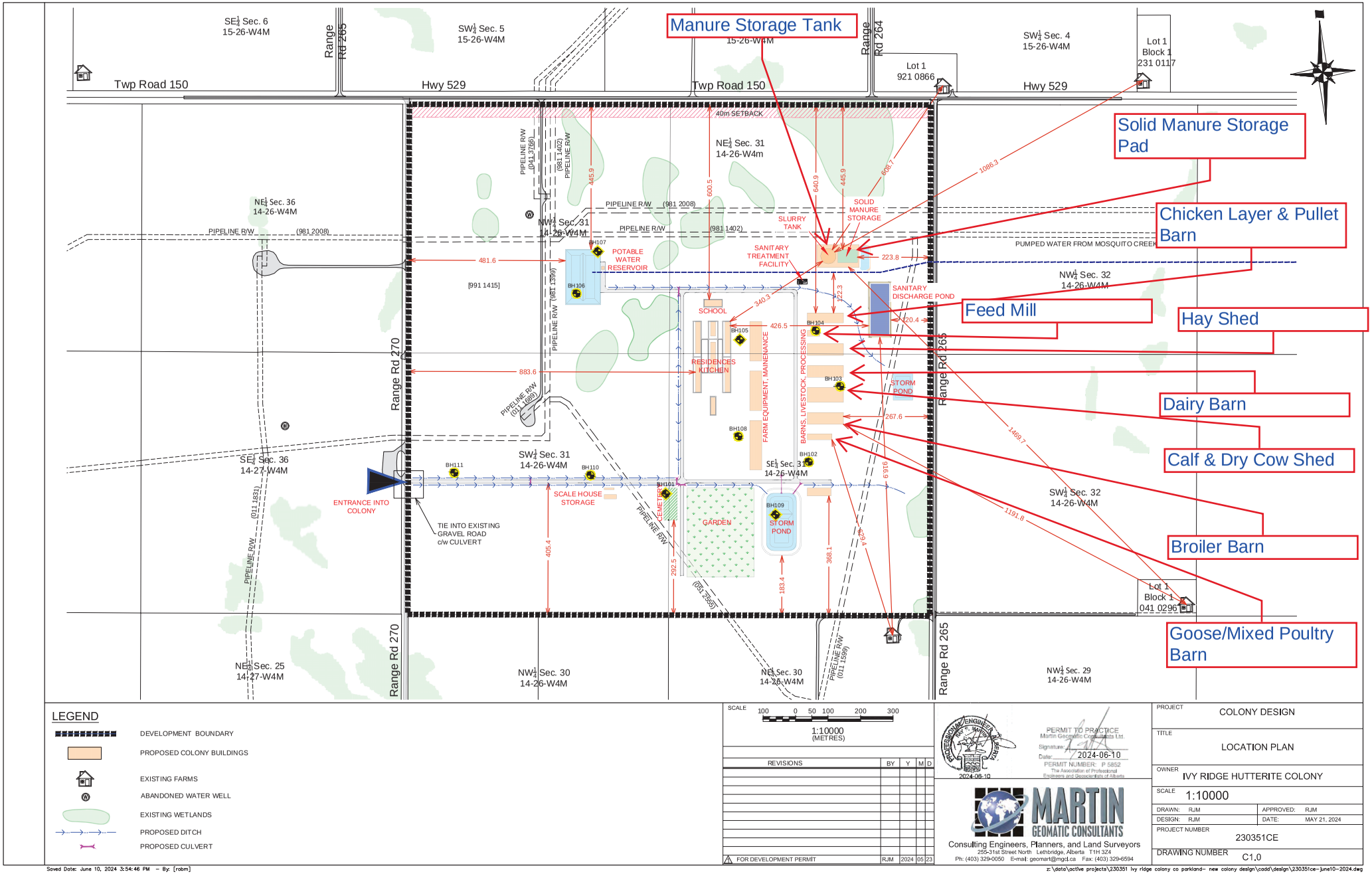
Consulting Engineers, Planners, and Land Surveyors
255-31st Street North Lethbridge, Alberta T1H 3Z4
Ph: (403) 329-0050 E-mail: geomart@mgcl.ca Fax: (403) 329-6594

Job Number: 230351CE

Saved Date: November 21, 2023 3:41:37 PM – By: [robm]

z:\data\active projects\230351 ivy ridge colony co parkland– new colony design\cadd\design\coverpage.dwg

AO Comment: On June 11, 2024, applicant provided this amended site plan that moved the manure storage tank and solid manure storage pad from the SE quarter to the NE quarter.



LEGEND

- DEVELOPMENT BOUNDARY
- PROPOSED COLONY BUILDINGS
- EXISTING FARMS
- ABANDONED WATER WELL
- EXISTING WETLANDS
- PROPOSED DITCH
- PROPOSED CULVERT

SCALE 1:10000 (METRES)

REVISIONS	BY	Y	M	D
FOR DEVELOPMENT PERMIT	RJM	2024	05	23

PERMIT TO PRACTICE Martin Geomatic Consultants Ltd. Signature: Date: 2024-06-10 PERMIT NUMBER: P 5852 The Association of Professional Engineers and Geoscientists of Alberta

2024-06-10

MARTIN GEOMATIC CONSULTANTS
Consulting Engineers, Planners, and Land Surveyors
255-31st Street North Lethbridge, Alberta T1H 3Z4
Ph: (403) 329-0050 E-mail: geomart@mgcl.ca Fax: (403) 329-6594

PROJECT	COLONY DESIGN
TITLE	LOCATION PLAN
OWNER	IVY RIDGE HUTTERITE COLONY
SCALE	1:10000
DRAWN: RJM	APPROVED: RJM
DESIGN: RJM	DATE: MAY 21, 2024
PROJECT NUMBER	230351CE
DRAWING NUMBER	C1.0

Saved Date: June 10, 2024 3:54:46 PM – By: [robm]

z:\data\active projects\230351 ivy ridge colony co parkland– new colony design\cadd\design\230351ce–june10–2024.dwg

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)

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) 00033215-00-00 & 00034968-00-00 Transfer 39 ac-ft Transfer 21 ac ft

Signed this 3 day of May, 2024. Paul Wipf
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

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

WATER WELL AND SURFACE WATER INFORMATION

Well IDs: No water wells on site

Well ID #'s 223444 & 1770218 (used for determining UGR, not located on site)

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:

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)

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: N/A **Proposed 1:** Chicken & Pullet Barn

Proposed 2: Hay Shed **Proposed 3:** Dairy Barn

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 in a known flood plain; confirmed during site visits
Surface water information	How many springs are within 100 m of the manure storage facility or manure collection area?	NA	none	none	none	☑ YES ☐ NO ☐ YES with exemption	None known; confirmed during site visits
	How many water wells are within 100 m of the manure storage facility or manure collection area?	NA	none	none	none	☑ YES ☐ NO ☐ YES with exemption	No water wells on site; confirmed during site visits
	What is the shortest distance from the manure collection or storage facility to a surface water body? (e.g., lake, creek, slough, seasonal)	NA	greater then 30 meters	greater then 30 meters	greater then 30 meters	☑ YES ☐ NO ☐ YES with exemption	Greater than 300 m to marshes
Groundwater information	What is the depth to the water table?	NA	conservative 2.01	2.01	2.01	☑ YES ☐ NO ☐ YES with exemption	Shallowest water level observed 2.01 m below grade, report indicates it varies throughout site
	What is the depth to the groundwater resource/aquifer you draw water from?	NA	coming from mosquito Creek	mosquito creek	mosquito Creek	☑ YES ☐ NO ☐ YES with exemption	Between 9.14 m - 12.19 m below grade, ID #'s 223444 & 1770218

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

AO Comment: There are no water wells on Sec 31-14-26 W4. Water well reports from NE 30-14-26 W4 were used for determining depth to groundwater resource only.

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 | Natural Resources Conservation Board

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: N/A **Proposed 1:** Manure Storage

Proposed 2: Feed Mill **Proposed 3:** ~~Catch Basin~~

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 in known flood plain; confirmed during site visits
Surface water information	How many springs are within 100 m of the manure storage facility or manure collection area?	NA	none	none	None	☑ YES ☐ NO ☐ YES with exemption	None known; confirmed during site visits
	How many water wells are within 100 m of the manure storage facility or manure collection area?	NA	none	none	None	☑ YES ☐ NO ☐ YES with exemption	No water wells on site; confirmed during site visits
	What is the shortest distance from the manure collection or storage facility to a surface water body? (e.g., lake, creek, slough, seasonal)	NA	greater then 30 meters			☑ YES ☐ NO ☐ YES with exemption	Manure storage tank approximately 170 m to marsh in north portion of NE quarter
Groundwater information	What is the depth to the water table?	NA	2.01	2.01	2.01	☑ YES ☐ NO ☐ YES with exemption	Shallowest water level observed 2.01 m below grade; report indicates it varies throughout site
	What is the depth to the groundwater resource/aquifer you draw water from?	NA	coming from Mosquito Creek	Mosquito Creek		☑ YES ☐ NO ☐ YES with exemption	Between 9.14 m - 12.19 m below grade, ID #'s 223444 & 1770218

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

AO Comment: There are no water wells on Sec 31-14-26 W4. Water well reports from NE 30-14-26 W4 were used for determining depth to groundwater resource only.

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NRCB | Natural Resources Conservation Board

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: N/A

Proposed 1: Calf Shed (Calf and Dry Cow Shed)

Proposed 2: Broiler Room (Broiler Barn)

Proposed 3: Goose Barn

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 in known flood plain; confirmed during site visits
Surface water information	How many springs are within 100 m of the manure storage facility or manure collection area?	NA	none	none	none	☑ YES ☐ NO ☐ YES with exemption	None known; confirmed during site visits
	How many water wells are within 100 m of the manure storage facility or manure collection area?	NA	none	none	none	☑ YES ☐ NO ☐ YES with exemption	No water wells on site; confirmed during site visits
	What is the shortest distance from the manure collection or storage facility to a surface water body? (e.g., lake, creek, slough, seasonal)	NA	greater then 30 meters	greater than 30 metres	greater then 30 meters	☑ YES ☐ NO ☐ YES with exemption	Greater than 300 m to marshes
Groundwater information	What is the depth to the water table?	NA	2.01	2.01	2.01	☑ YES ☐ NO ☐ YES with exemption	Shallowest water level observed 2.01 m below grade; report indicates it varies throughout site
	What is the depth to the groundwater resource/aquifer you draw water from?	NA	coming from Miquisto Creek	misquito Creek	misquito Creek	☑ YES ☐ NO ☐ YES with exemption	Between 9.14 m - 12.19 m below grade, ID #'s 223444 & 1770218

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

AO Comment: There are no water wells on Sec 31-14-26 W4. Water well reports from NE 30-14-26 W4 were used for determining depth to groundwater resource only.

AO Comment: Water well report used for determining depth to groundwater resource.

Water Well Drilling Report

View in Imperial | Export to Excel

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.

GIC Well ID 223444
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1964/01/01

GOWN ID

Well Identification and Location

Measurement in Metric

Owner Name	Address	Town	Province	Country	Postal Code
OLSON		STAVELY			

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	NE	30	14	26	4				

Measured from Boundary of
m from
m from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 50.204900 Longitude -113.532699
How Location Obtained
Field

Elevation 986.03 m
How Elevation Obtained
Survey-Air

Drilling Information

Method of Drilling
Unknown

Proposed Well Use
Domestic & Stock

Type of Work
Well Inventory

Formation Log

Measurement in Metric

Depth from ground level (m)	Water Bearing	Lithology Description
12.19		Clay & Sand
15.24		Shale
18.29	Yes	Gray Water Bearing Sandstone
23.16		Shale
26.82		Gray See Comments Shale
27.43		Sandstone
30.18	Yes	Water Bearing Sandstone
30.48		Shale

Yield Test Summary

Measurement in Metric

Recommended Pump Rate L/min

Test Date	Water Removal Rate (L/min)	Static Water Level (m)
1958/01/01	72.74	7.32

Well Completion

Measurement in Metric

Total Depth Drilled	Finished Well Depth	Start Date	End Date
30.48 m			1958/01/01

Borehole

Diameter (cm)	From (m)	To (m)
0.00	0.00	30.48

Surface Casing (if applicable)
Unknown
Size OD : 15.24 cm
Wall Thickness : cm
Bottom at : 23.77 m

Well Casing/Liner
Unknown
Size OD : 12.70 cm
Wall Thickness : cm
Top at : 0.00 m
Bottom at : 30.48 m

Perforations

From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval(cm)

Perforated by

Annular Seal Driven
Placed from 0.00 m to 0.00 m
Amount

Other Seals

Type	At (m)

Screen Type
Size OD : cm

From (m)	To (m)	Slot Size (cm)

Attachment
Top Fittings Bottom Fittings

Pack
Type Grain Size
Amount

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
PREGODA GEORGE

Copy of Well report provided to owner Date approval holder signed

Water Well Drilling Report

View in Imperial | Export to Excel

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.

GIC Well ID 223444
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1964/01/01

GOWN ID

Well Identification and Location

Measurement in Metric

Owner Name	Address	Town	Province	Country	Postal Code
OLSON		STAVELY			

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	NE	30	14	26	4				

Measured from Boundary of
m from
m from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 50.204900 Longitude -113.532699
How Location Obtained: Field

Elevation 986.03 m
How Elevation Obtained: Survey-Air

Additional Information

Measurement in Metric

Distance From Top of Casing to Ground Level: cm
Is Artesian Flow:
Rate: L/min
Is Flow Control Installed:
Describe:

Recommended Pump Rate: L/min
Recommended Pump Intake Depth (From TOC): m
Pump Installed:
Depth: m
Type:
Make:
H.P.:
Model (Output Rating):

Did you Encounter Saline Water (>4000 ppm TDS):
Depth: m
Gas:
Depth: m
Remedial Action Taken:
Well Disinfected Upon Completion:
Geophysical Log Taken:
Submitted to ESRD:
Sample Collected for Potability:
Submitted to ESRD: Yes

Additional Comments on Well

DRILLER CALLS INTERVAL 76-88 FT "GREY STONE AND SHALE", REPORTS WATER AT 60 FT CONTAINING TO MUCH ALKALI TO BE USED. THE FOLLOWING INFORMATION WAS TAKEN FROM DROUGHT EMERGENCY GROUNDWATER TESTING PROGRAM APPLICATION RECEIVED ON MARCH 7, 1985. OWNER (TERRY OLSEN) REPORTS THAT FOR THE LAST 3 YEARS THE YIELD OF THIS WELL DOES NOT MEET HOUSE AND STOCK NEEDS. OWNER ALSO REPORTS WELL IS APPROXIMATELY 100 FEET DEEP AND WAS CONSTRUCTED APPROXIMATELY IN 1955.

Yield Test

Taken From Ground Level
Measurement in Metric

Test Date	Start Time	Static Water Level
1958/01/01	12:00 AM	7.32 m

Depth to water level

Pumping (m)	Elapsed Time Minutes:Sec	Recovery (m)

Method of Water Removal

Type: Unknown
Removal Rate: 72.74 L/min
Depth Withdrawn From: 0.00 m

If water removal period was < 2 hours, explain why

Water Diverted for Drilling

Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
PREGODA GEORGE

Copy of Well report provided to owner

Date approval holder signed

AO Comment: Water well report used for determining depth to groundwater resource.

Water Well Drilling Report

View in Imperial | Export to Excel

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.

GIC Well ID 1770218
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 2014/07/29

GOWN ID

Well Identification and Location

Measurement in Metric

Owner Name	Address	Town	Province	Country	Postal Code
OLSEN, TERRY	P.O. BOX 302	STAVELY	ALBERTA	CANADA	T0L 1Z0

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	NE	30	14	26	4				

Measured from Boundary of Quarter
240.00 m from North
93.00 m from East

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 50.204901 Longitude -113.532688
How Location Obtained: Not Verified

Elevation 989.08 m
How Elevation Obtained: Hand held autonomous GPS 20-30m

Drilling Information

Method of Drilling
Combination

Type of Work
New Well

Proposed Well Use
Domestic & Stock

Formation Log

Measurement in Metric

Depth from ground level (m)	Water Bearing	Lithology Description
9.14		Brown Clay & Rocks
13.11		Gray Soft Shale
14.63		Light Gray Sandstone
19.81		Gray Soft Shale
26.82		Brown Sandstone
28.04		Gray Sandstone
41.45		Light Gray Hard Sandstone
45.11		Gray Shale
49.38	Yes	Salt & Pepper Sandstone
53.95	Yes	Fractured Sandstone
54.86		Dark Gray Shale
57.91		Gray Shale

Yield Test Summary

Measurement in Metric

Recommended Pump Rate 13.64 L/min

Test Date	Water Removal Rate (L/min)	Static Water Level (m)
2014/06/24	13.64	3.66

Well Completion

Measurement in Metric

Total Depth Drilled	Finished Well Depth	Start Date	End Date
57.91 m	54.86 m	2014/06/12	2014/06/24

Borehole

Diameter (cm)	From (m)	To (m)
26.04	0.00	11.58
15.88	11.58	54.86

Surface Casing (if applicable)
Steel
Size OD : 16.83 cm
Wall Thickness : 0.478 cm
Bottom at : 11.58 m

Well Casing/Liner
Plastic
Size OD : 12.55 cm
Wall Thickness : 0.478 cm
Top at : 3.05 m
Bottom at : 48.77 m

Perforations

From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval(cm)

Perforated by

Annular Seal Bentonite Chips/Tablets
Placed from 0.00 m to 11.58 m
Amount 200.00 Pounds

Other Seals

Type	At (m)

Screen Type Plastic
Size OD : 12.55 cm

From (m)	To (m)	Slot Size (cm)
48.77	54.86	0.051

Attachment
Top Fittings Coupler
Bottom Fittings Plug

Pack
Type
Grain Size
Amount

Contractor Certification

Name of Journeyman responsible for drilling/construction of well: DAN UHL
Certification No: 8361Q
Company Name: UHL DRILLING LTD.
Copy of Well report provided to owner: Yes
Date approval holder signed: 2014/06/24

Water Well Drilling Report

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.

View in Imperial | Export to Excel

GIC Well ID 1770218
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 2014/07/29

GOWN ID

Well Identification and Location

Measurement in Metric

Owner Name	Address	Town	Province	Country	Postal Code
OLSEN, TERRY	P.O. BOX 302	STAVELY	ALBERTA	CANADA	T0L 1Z0

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	NE	30	14	26	4				

Measured from Boundary of Quarter
240.00 m from North
93.00 m from East

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 50.204901 Longitude -113.532688
How Location Obtained: Not Verified

Elevation 989.08 m
How Elevation Obtained: Hand held autonomous GPS 20-30m

Additional Information

Measurement in Metric

Distance From Top of Casing to Ground Level 30.48 cm
Is Artesian Flow
Rate L/min
Is Flow Control Installed
Describe

Recommended Pump Rate 13.64 L/min
Recommended Pump Intake Depth (From TOC) 42.67 m
Pump Installed Depth m
Type Make H.P.
Model (Output Rating)

Did you Encounter Saline Water (>4000 ppm TDS) Depth m
Gas Depth m
Remedial Action Taken
Well Disinfected Upon Completion Yes
Geophysical Log Taken
Submitted to ESRD
Sample Collected for Potability
Submitted to ESRD

Additional Comments on Well

DRILLING METHOD ROTARY AIR AND ROTARY MUD. TDS - 1865

Yield Test

Taken From Ground Level
Measurement in Metric

Test Date	Start Time	Static Water Level
2014/06/24	1:00 PM	3.66 m

Method of Water Removal

Type Pump
Removal Rate 13.64 L/min
Depth Withdrawn From m

If water removal period was < 2 hours, explain why

Depth to water level

Pumping (m)	Elapsed Time Minutes:Sec	Recovery (m)
3.66	0:00	22.25
4.27	1:00	21.03
5.49	2:00	20.12
5.79	3:00	19.51
6.10	4:00	18.59
6.40	5:00	17.98
6.71	6:00	17.07
7.01	7:00	16.76
7.32	8:00	16.31
7.62	9:00	15.85
7.92	10:00	15.54
8.69	12:00	14.63
9.14	14:00	13.72
10.06	16:00	13.11
10.67	18:00	12.19
10.97	20:00	11.58
12.19	25:00	10.36
13.11	30:00	9.14
13.72	35:00	8.23
14.48	40:00	7.62
15.90	50:00	6.71
16.51	60:00	6.10
18.14	75:00	5.49
19.20	90:00	4.88
21.03	105:00	4.27
22.25	120:00	3.66

Water Diverted for Drilling

Water Source	Amount Taken		Diversion Date & Time
STAVELY WELL	6819.14	L	2014/06/12 10:00 AM

Contractor Certification

Name of Journeyman responsible for drilling/construction of well: DAN UHL
Certification No: 8361Q
Company Name: UHL DRILLING LTD.
Copy of Well report provided to owner: Yes
Date approval holder signed: 2014/06/24

NRCB USE ONLY

ENVIRONMENTAL RISK SCREENING INFORMATION

ERST for **proposed** facilities

Facility	Groundwater score	Surface water score	File number
Chicken layer & pullet barn	Low	Low	LA23050
Dairy barn	Low	Low	LA23050
Calf shed & dry cow barn	Low	Low	LA23050
Broiler barn	Low	Low	LA23050
Mixed poultry barn	Low	Low	LA23050
Manure storage tank	Low	Low	LA23050

~~**ERST** for **existing** facilities~~ ERST for proposed facilities continued

Facility	Groundwater score	Surface water score	File number
Manure storage pad	Low	Low	LA23050

ERST related comments:

AO Comment: "RG" is land zoned "Rural General" in the MD of Willow Creek Land Use Bylaw, which is considered agricultural land.

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
1	Dora Margaret Coreman	SE 6-15-26-W5	2,305m	RG	1	2,200 m	N/A	Yes
2	Stacey Lee Irwin & Dallas Irwin	Lot 1 Plan 9210866	763m	RG	1	505 m	N/A	Yes
3	Francis William Heidmiller	Lot 1, Block 1; Plan 2310117	1,167m	RG	1	954 m	N/A	Yes
4	Dale Albert & Katrina Albert	Lot 1, Block 1: Plan 0410296	1,096m	RG	1	1,140 m	N/A	Yes
5	Terry L Olsern & Beverly J Olsen	NE 30-14-26-W4	516m/1,230m	RG	1	629 m	N/A	Yes

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)
H.B Ivry Ridge	NW 4-26-15-32	65.2	Brown, Brown	34.55	N/A
H.B Ivry Ridge	NE 4-26-15-32	65.2	Brown, Brown	35.6	N/A
H.B Ivry Ridge	SW 4-26-15-32	65.2	Brown, Brown	65.2	N/A
H.B Ivry Ridge	SE 4-26-15-4	63.1	Brown, Brown	51.2	N/A
H.B Ivry Ridge	NW 4-26-14-31	62.7	Brown, Brown	0	N/A
		Total		520.81 ha (brown) 116.14 ha (irrigated)	

* 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

AO Comment: NE 30-14-26 W4 has two residences. The measured distance of 629 m is measured from the Mixed Poultry Barn to the closest residence on that quarter.

Additional information (attach any additional information as required)

AO Comment: Numbers next to neighbour list correspond with numbers on map on page 19 of this document; Legal land descriptions for manure spreading written in the format Meridian-Range-Township-Section; NW 4-26-14-31, SW 4-26-14-31, NE 4-26-14-31, and SE 4-26-14-31 are not usable for manure spreading as applicant is proposing to construct the new CFO on these land locations.

See attached list for additional manure spreading land

Name of land owner(s)*	Legal land description	Usable area** (ha)	Soil zone ***	Usable area (ha)	Agreement attached (if required)
H.B. Ivy Ridge	S.W. 4-26-14-31	64.7	Dark Brown, Brown	0	N/A
H.B. Ivy Ridge	N.E. 4-26-14-31	62.7	Dark Brown, Brown	0	N/A
H.B. Ivy Ridge	S.E. 4-26-14-31	64.7	Dark Brown, Brown	0	N/A
H.B. Ivy Ridge	N.W. 4-26-14-32	62.7	Dark Brown, Brown	57.7	N/A
H.B Ivy Ridge	S.W. 4-26-14-32	64.7	Dark Brown, Brown	46.4	N/A

Name of land owner(s)*	Legal land description	Usable area** (ha)	Soil zone ***	Usable area (ha)	Agreement attached (if required)
H.B. Ivy Ridge	N.E 4-26-14-32	64.7	Dark Brown, Brown	60.39	N/A
H.B Ivy Ridge	N.W. 4-26-15-11	65.2	Dark Brown, Brown	51.4	N/A
H.B Ivy Ridge	S.W. 4-26-14-34	64.7	Dark Brown, Brown	53.82	N/A
H.B. Ivy Ridge	N.W 4-26-15-3	64.7	Dark Brown, Brown	54.55	N/A
	These listed below is irrigated				
H.B Ivy Ridge	N.W. 4-26-15-2		~~Dark Brown, Brown~~		
H.B Ivy Ridge	SW. 4-26-15-2	76.8.	~~Dark Brown, Brown~~	56.79	N/A
H.B Ivy Ridge	SE 4-26-15-3		~~Dark Brown, Brown~~		
H.B Ivy Ridge	NE 4-26-15-3	64.7	~~Dark Brown, Brown~~	59.35	N/A

AO Comment: These land locations listed are irrigated and the soil zone would therefore be irrigated.

Name	Hutterian Brethren of Ivy Ridge
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		-
	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	150	264.0
	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	18,000	201.6
	Chicken - Layers - (Deep Pit)	2.000	0.700	0.008	0.0112		-
	Chicken - Pullets/Broilers	1.000	0.700	0.002	0.0014	34,000	47.6
	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	1,000	7.0
	Geese	1.000	0.700	0.020	0.0140	100	1.4
	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		521.6

For New Operations

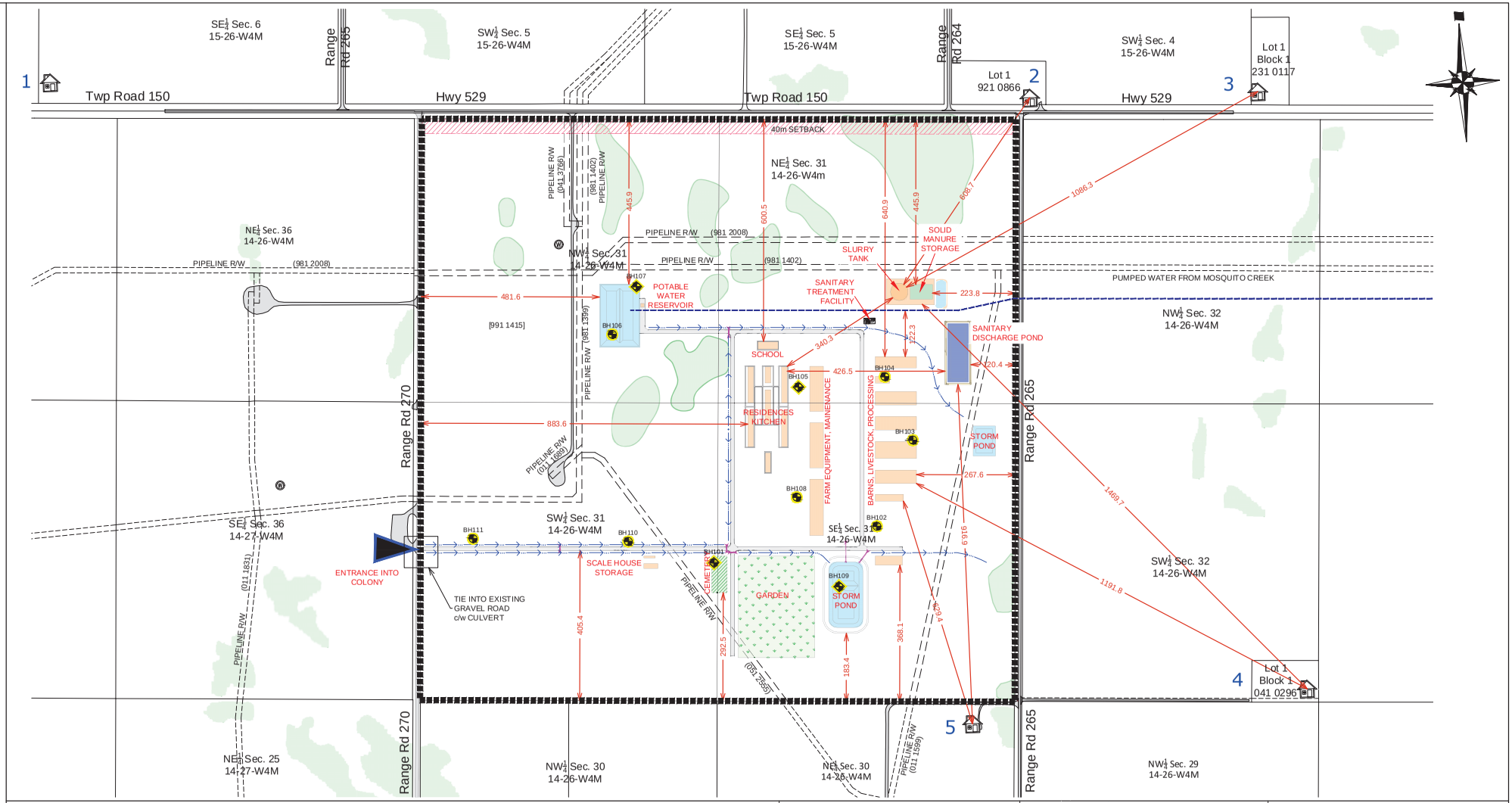
Dispersion Factor	1

Category	Odour Objective	Distance Feet	Distance Metres
1	41.04	1,321	403
2	54.72	1,762	537
3	68.4	2,202	671
4	109.44	3,524	1,074

For Expanding Operations

Dispersion Factor	1
Expansion Factor	0.77

Category	Odour Objective	Distance Feet	Distance Metres
1	41.04	1,017	310
2	54.72	1,357	413
3	68.40	1,696	517
4	109.44	2,713	827



LEGEND

- DEVELOPMENT BOUNDARY
- PROPOSED COLONY BUILDINGS
- EXISTING FARMS
- ABANDONED WATER WELL
- EXISTING WETLANDS
- PROPOSED DITCH
- PROPOSED CULVERT

SCALE 100 0 50 100 200 300
1:10000
(METRES)

REVISIONS	BY	Y	M	D
FOR DEVELOPMENT PERMIT	RJM	2024	05	23

PERMIT TO PRACTICE
Martin Geomatic Consultants Ltd.
Signature:
Date: 2024-06-10
PERMIT NUMBER: P 5852
The Association of Professional Engineers and Geoscientists of Alberta

2024-06-10

MARTIN GEOMATIC CONSULTANTS
Consulting Engineers, Planners, and Land Surveyors
255-31st Street North Lethbridge, Alberta T1H 3Z4
Ph: (403) 329-0050 E-mail: geomart@mgcl.ca Fax: (403) 329-6594

PROJECT	COLONY DESIGN
TITLE	LOCATION PLAN
OWNER	IVY RIDGE HUTTERITE COLONY
SCALE	1:10000
DRAWN: RJM	APPROVED: RJM
DESIGN: RJM	DATE: MAY 21, 2024
PROJECT NUMBER	230351CE
DRAWING NUMBER	C1.0

Saved Date: June 10, 2024 3:54:46 PM – By: [robm]

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Name	Hutterian Brethren of Ivy Ridge	
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)	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)	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*	150.0	222.8	185.6	139.2	111.3
	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)	18000.0	99.0	82.8	61.2	50.4
	Chicken - Layers - (Deep Pit)	0.0	0.0	0.0	0.0	0.0
	Chicken - Pullets/Broilers	34000.0	110.5	92.1	69.0	55.4
	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	1000.0	1.6	1.3	1.0	0.8
	Geese	100.0	0.3	0.3	0.2	0.2
	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		434	362.1	270.6	218.1
	Total Acres		1,073	894.7	668.7	538.9

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: 403 Category 2: 537 Category 3: 671 Category 4: 1,074

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: 434 ha brown or 218.1 ha irrigated

Land base listed: 1,200.2 ha brown and 141.5 ha irrigated

Area not suitable: 679.39 ha brown and 25.36 ha irrigated

Available area 520.81 ha brown and 116.14 ha irrigated 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 _____

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)

LIQUID MANURE COLLECTION AND/OR STORAGE: In-barn - Concrete liner

*(complete a copy of this section for **EACH** proposed in-barn liquid manure storage facility with a concrete liner)*

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

1. Dairy Barn
2.
3.

Manure storage capacity *(use one row in the table for **EACH** in-barn storage. Attach additional pages if you require more rows)*

	Length (m)	Width (m)	Total depth (m)	Depth below ground level (m)	**NRCB USE ONLY** Calculated storage capacity (m^3)
1.	111.56M	36.58M	3.7	3.7M	
2.					48.96 m^3
3.					45.18 m^3
				TOTAL CAPACITY	94.14 m^3

AO Comment: Dairy barn is 111.56 m x 36.58 m. The barn is designed to have two in barn pits. The first pit measures 30.6 m x 1 m x 1.6 m deep that flows into a second pit that measures 3.7 m x 3.3 m x 3.7 m deep.

Concrete liner details

Scrape alleys or unslatted portions of barn floors (if applicable)	Concrete thickness: 6"	Method of sulphate protection: Type 50	
	Concrete strength: 32 MPA	Concrete reinforcement size and spacing: 10m at 12" on centre	
In-barn manure pit floors	Concrete thickness: 6"	Method of sulphate protection: Type 50	
	Concrete strength: 32 MPA	Concrete reinforcement size and spacing: 15m and 8" on centre	
In-barn manure pit walls	Concrete thickness: 12" wall	Method of sulphate protection: Type 50	
	Concrete strength: 32 MPA	Horizontal reinforcement size and spacing: 10 mm Rebar 12" on centre	Vertical reinforcement size and spacing: 15mm Rebar 18" on centre

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)

LIQUID MANURE COLLECTION AND/OR STORAGE: In-barn - Concrete liner (cont.)

Describe how the joints at the junction of the pit walls, pit floors and any other joints will be sealed

with a Volclay Water Stop - RX

Describe sealing practices for piping, etc. that penetrates the liner

8" pipe
Pipe will be connected with flange fittings to Pump and, DR9 HDPE Poly pipe will be used all pipe connections will be fused, and flange fittings at the tank

Concrete requirements can be found in Technical Guideline Agdex 096-93
Guideline minimums:
Solid manure: 25MPa (D)
Solid manure (wet): 30MPa (C)
Liquid manure: 32MPa (B)
Category A is required to be engineered
Method of sulphate protection:
Type 50 or Type 10 with fly ash or equivalent

NRCB USE ONLY

Requirements met: ☑ YES ☐ NO

Condition required: ☑ YES ☐ NO

Additional information

NRCB USE ONLY

Liquid manure storage volume calculator attached: ☑ YES ☐ NO

Depth to water table: Greater than 2.01 m below grade — Requirements met: ☑ YES ☐ NO

Depth to uppermost groundwater resource: 9.14 m below grade — Requirements met: ☑ YES ☐ NO

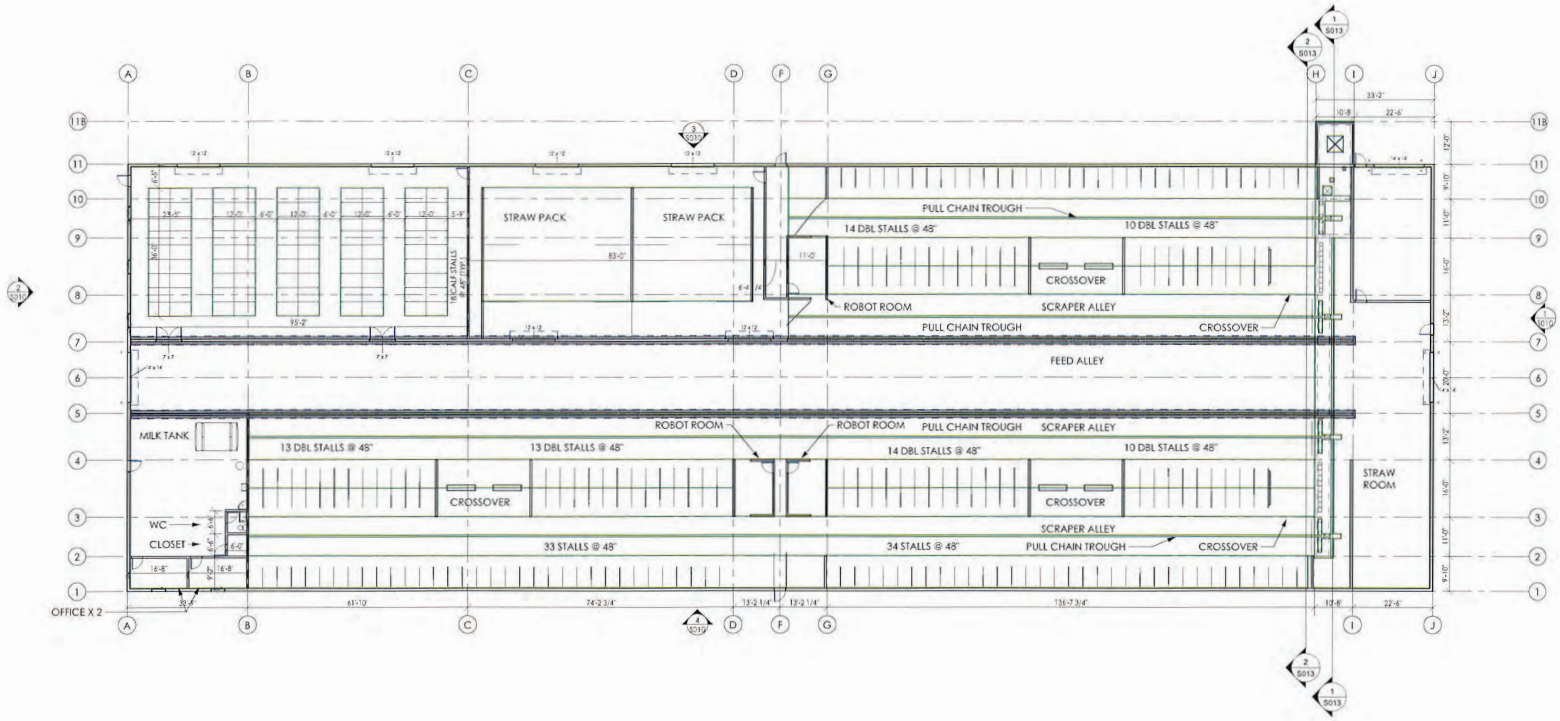
AO Comment: A condition is included in this permit that the applicant is to immediately cease construction and notify the NRCB if the water table is observed to be 1 m or less from the bottom of the in-barn pits at the time of construction.

ERST completed: ☑ see ERST page for details

Concrete liner requirements

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

A condition is included in this permit requiring the applicant to provide a report from a professional engineer that certifies the concrete used to construct the dairy barn and in-barn pits will meet the specifications for category B (liquid manure - shallow pits) as outlined in Technical Guideline Agdex 096-93 "Non-Engineered Concrete Liners for Manure Collection and Storage Areas".



Professional Seal

24/02/14

PERMIT TO PRACTICE
SIGMA RHO SQUARED ENGINEERING
SIGNATURE
SIGNED ON: 24/02/14
PERMIT NUMBER: P12966
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Sub-consultant

SIGMA Rho 2 ENGINEERING
DESIGN BUILD COMMUNITY
260-104 13 Street North
Lethbridge, Alberta T1H 2R4
403-942-0981
sam@sr2eng.ca

NOTES

Contractor to check and verify all the dimensions before construction, any errors and omissions shall be reported to the engineer immediately

Drawing shall not be used for construction until approved and issued for construction by the engineer

Do not scale the drawing

All construction shall be in accordance with latest codes.

SHEET SIZE: 24" x 36"
SCALE: 1/16" = 1'-0"

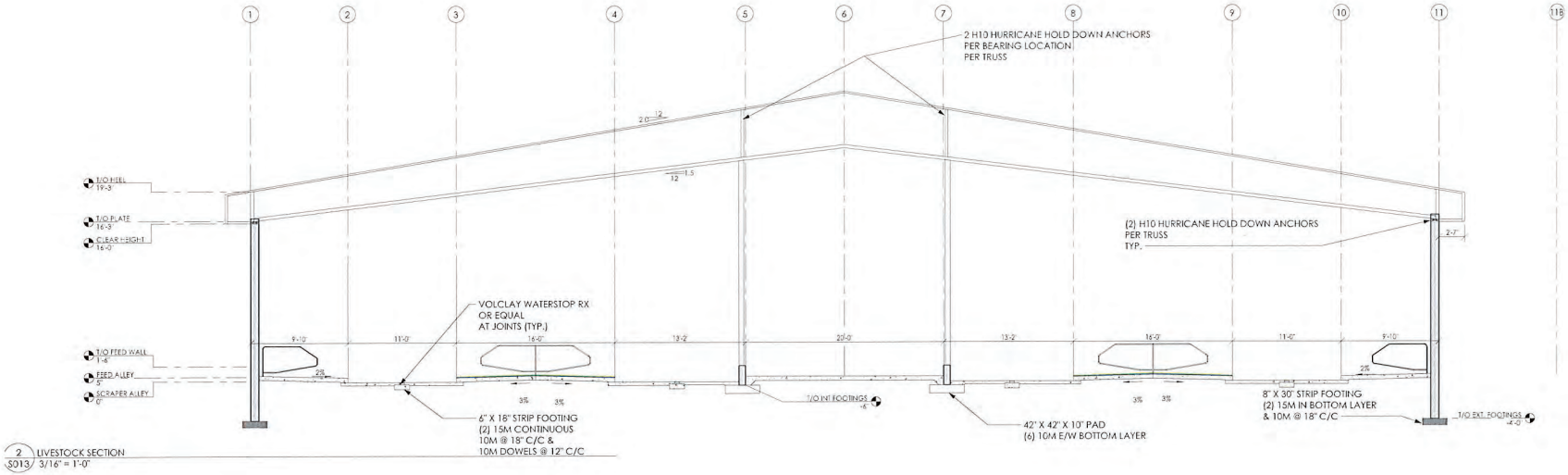
#	DATE	DRAWING STATUS	DSN	DRW	CHK	APP
0	24/02/14	ISSUE FOR APPROVAL	S.NR	M.WH	S.NR	

CLIENT
IVY RIDGE COLONY

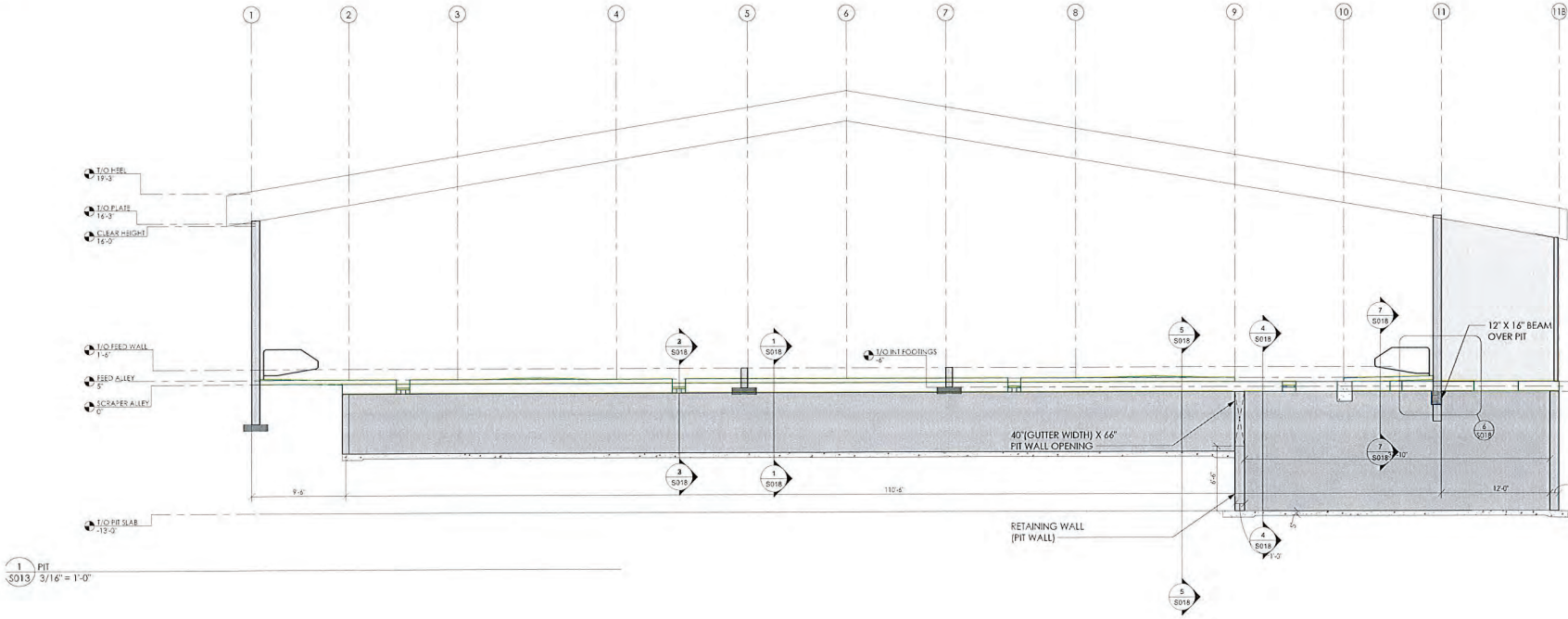
PROJECT TITLE
DAIRY BARN

DRAWING TITLE
FLOORPLAN

PROJECT NUMBER 24-011
SHEET NUMBER S012



2 / S013 LIVESTOCK SECTION
3/16" = 1'-0"



1 / S013 PIT
3/16" = 1'-0"

Professional Seal

24/02/14

PERMIT TO PRACTICE
SIGMA RHO SQUARED ENGINEERING
RM SIGNATURE
RM APEGA ID # 67475
DATE 24/02/14
PERMIT NUMBER: P12966
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Sub-consultant

SIGMA Rho² ENGINEERING
DESIGN. BUILD. COMMUNITY
260-104 13 Street North
Lethbridge, Alberta T1H 2R4
403-942-0981
sam@sr2eng.ca

NOTES

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Do not scale the drawing

All construction shall be in accordance with latest codes.

SHEET SIZE: 24" x 36"
SCALE: 3/16" = 1'-0"

#	DATE (YYMMDD)	DRAWING STATUS	DSN	DRW	CHK	APP
0	24/02/14	ISSUE FOR APPROVAL	SJNR	AP	SJNR	

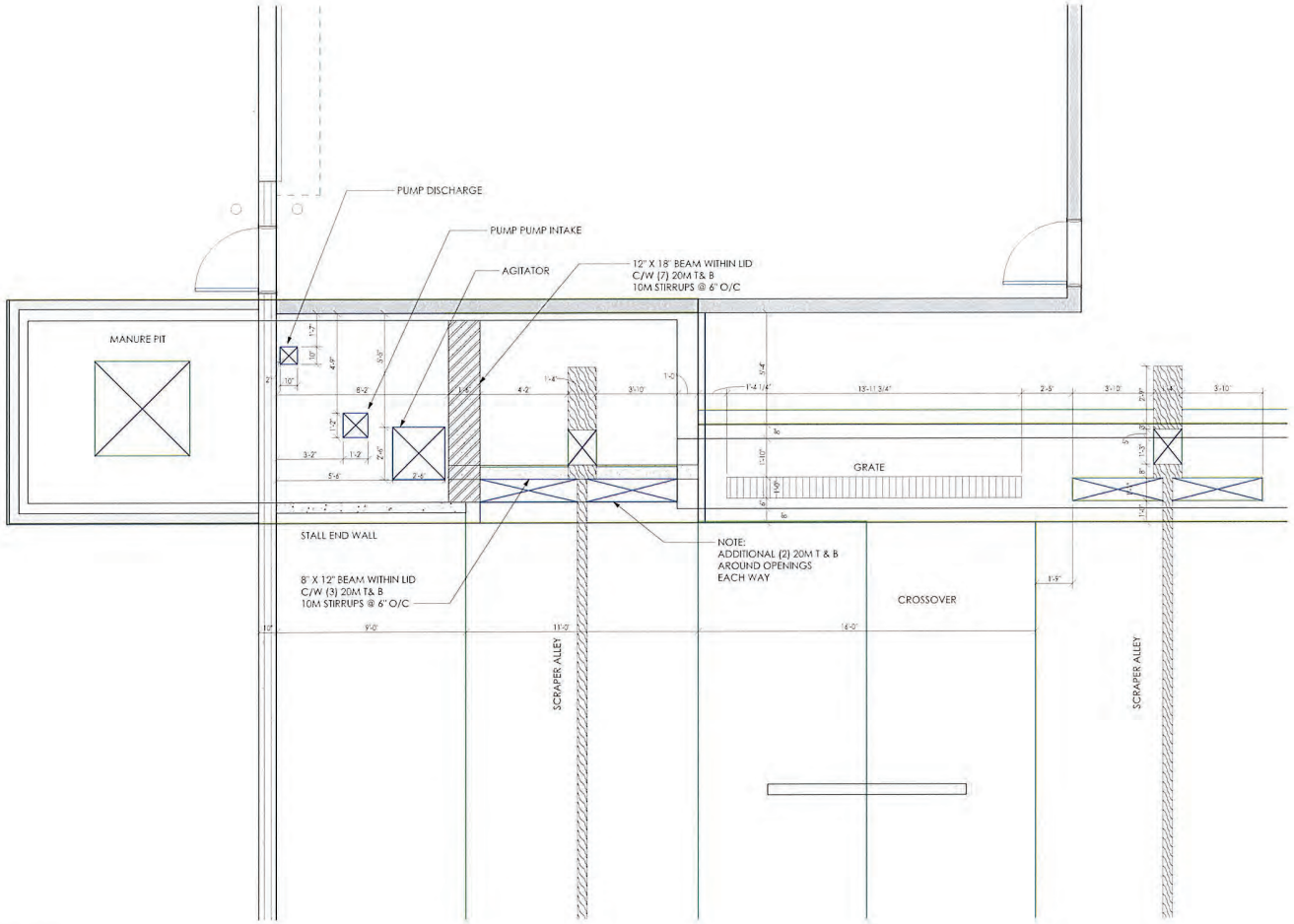
CLIENT
IVY RIDGE COLONY

PROJECT TITLE
DAIRY BARN

DRAWING TITLE
INTERIOR ELEVATIONS

PROJECT NUMBER
24-011

SHEET NUMBER
S013



1 / S017 MANURE CONTAINMENT PLAN
3/8" = 1'-0"

Professional Seal

24/02/14

PERMIT TO PRACTICE
SIGMA RHO SQUARED ENGINEERING
SIGNATURE
SIGNED ON: 24/02/14
PERMIT NUMBER: P12966
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Sub-consultant

SIGMA Rho2 ENGINEERING
DESIGN BUILD COMMUNITY
260-104 13 Street North
Lethbridge, Alberta T1H 2R4
403-942-0981
sam@sr2eng.ca

NOTES

This is a copyright drawing and shall not be reproduced in any form without written permission of the engineer

Contractor to check and verify all the dimensions before construction, any errors and omissions shall be reported to the engineer immediately

Drawing shall not be used for construction until approved and issued for construction by the engineer

Do not scale the drawing

All construction shall be in accordance with latest codes.

#	DATE	DRAWING STATUS	DSN	DRW	CHK	APP
0	24/02/14	ISSUE FOR APPROVAL	SJNR	AP	SJNR	

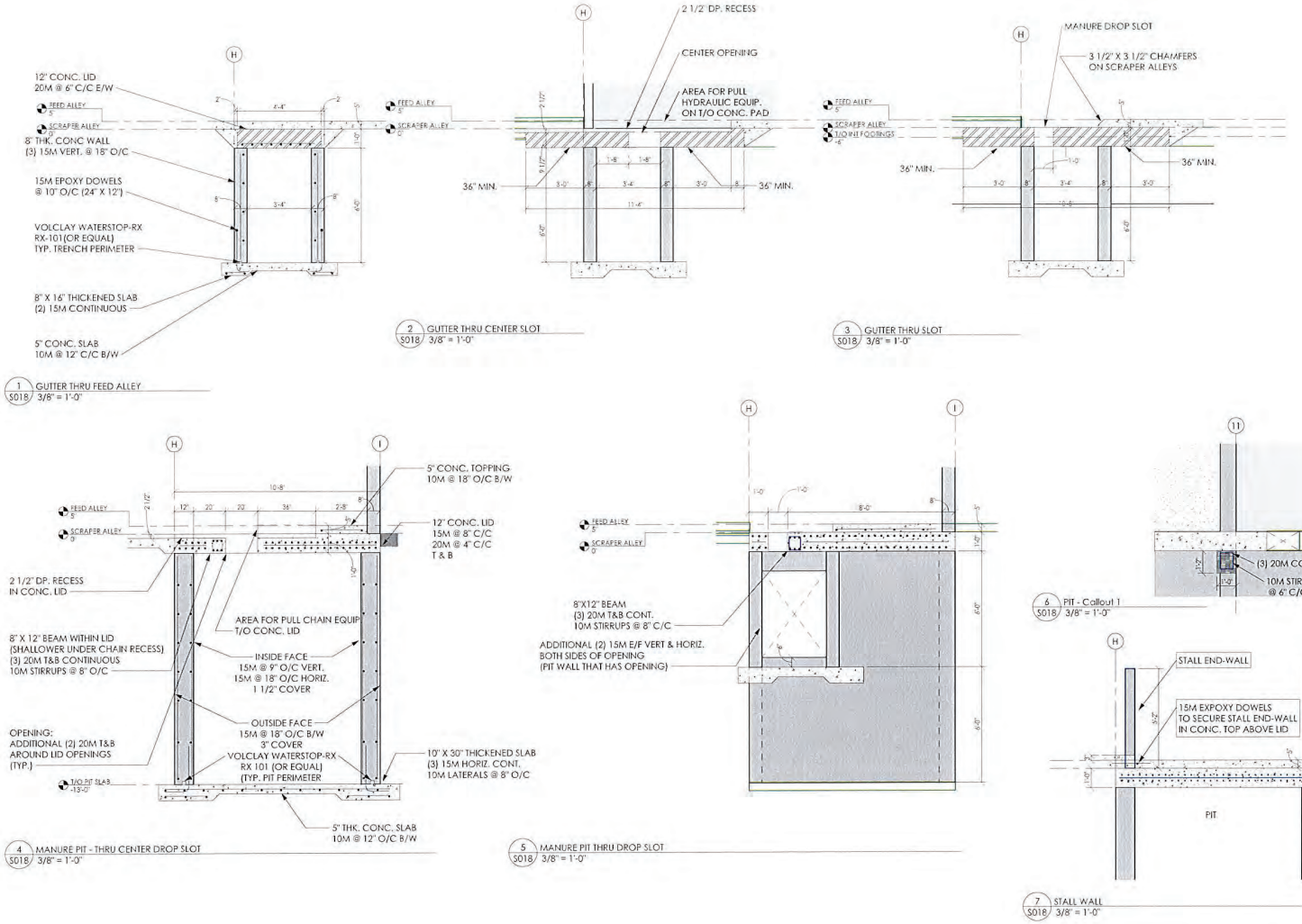
SHEET SIZE: 24" x 36"
SCALE: 3/8" = 1'-0"

CLIENT
IVY RIDGE COLONY

PROJECT TITLE
DAIRY BARN

DRAWING TITLE
MANURE SLOTS PLAN

PROJECT NUMBER 24-011
SHEET NUMBER S017



Professional Seal

24/02/14

PERMIT TO PRACTICE
SIGMA RHO SQUARED ENGINEERING
RP SIGNATURE
RP APEGA ID #: 67475
DATE: 24/02/14
PERMIT NUMBER: P12966
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Sub-consultant

SIGMA Rho 2 ENGINEERING
DESIGN BUILD COMMUNITY
260-104 13 Street North
Lethbridge, Alberta T1H 2R4
403-942-0981
som@sr2eng.ca

NOTES

#	DATE	DRAWING STATUS	DSN	DRW	CHK	APP
0	24/02/14	ISSUE FOR APPROVAL	SJNR	AP	SJNR	

SHEET SIZE: 24" x 36"
SCALE: 3/8" = 1'-0"

CLIENT
IVY RIDGE COLONY

PROJECT TITLE
DAIRY BARN

DRAWING TITLE
MANURE CONTAINMENT

PROJECT NUMBER 24-011
SHEET NUMBER S018

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)

LIQUID MANURE STORAGE: Concrete or steel tank (required to be engineered)

*(complete a copy of this section for **EACH** proposed concrete or steel tank for liquid manure)*

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

1. Manure Storage tank (Concrete) in plastic walls
2. _____

Manure storage capacity

	Dimensions (or length and width / diameter) (m)	Depth (m)	Depth below ground level (m)	NRCB USE ONLY	
				Calculated storage capacity (excl. 0.3 m freeboard) (m^3)	Filled in lower ¼? Y/N
1.	46.6 m	4.8 m	0	7,579 m^3	Y
2.					

46.3 m (internal diameter)

Surface water control systems

Describe the run-on and runoff control system

Will be sloped and drained to a catch basin

AO Comment: The applicant indicated they are no longer proposing a catch basin. The area surrounding the tank will be sloped away from the tank to prevent water pooling around the tank.

Concrete or steel tank details

Manure tank floor	Concrete thickness: 6"	Method of sulphate protection: Type 50
	Concrete strength: 32 MPA	Concrete reinforcement size and spacing: 10m at 12" on centre

Manure storage tank walls: provide details on the construction of the proposed manure storage tank walls

12" thick walls

LIQUID MANURE STORAGE: Concrete or steel tank (cont.)

Describe sealing practices for piping, etc. that penetrates the liner

All pipes are coming in through the concrete floor and will be in before pouring concrete, and after Sika flex

Describe how the joints at the junction of the tank walls, tank floors and any other joints will be sealed

PVC water stop to seal between walls and floor & Sika top seal

NRCB USE ONLY

Requirements met: ☑ YES ☐ NO

Condition required: ☑ YES ☐ NO

Report attached: ☑ YES ☐ NO

NRCB USE ONLY

Liquid manure storage volume calculator attached: ☑ YES ☐ NO

Depth to water table: Greater than 2.01 m below grade — Requirements met: ☑ YES ☐ NO

Depth to uppermost groundwater resource: 9.14 m below grade — Requirements met: ☑ YES ☐ NO

ERST completed: ☑ see ERST page for details

Surface water control systems

Requirements met: ☑ YES ☐ NO

Details/comments:

A condition is included in this permit that requires the applicant to provide a report from a professional engineer that certifies the manure storage tank was constructed at the location specified in the site plan provided, the manure storage tank was constructed according to the recommended construction procedures and design specifications in the report titled :Ivy Ridge Colony Farming Manure Storage Tank (below), the thickness, type, and compressive strength of the concrete, and types of sealants used to seal joints and extrusions which penetrate the manure storage tank walls and floor, the final dimensions, including elevations above and below grade, liner thickness, height, and diameter, and was constructed to be filled in the lower 1/4.

Concrete or steel tank requirements

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

Liquid Manure Storage Tank Volume Calculator

Construction Dimensions of Liquid Manure Storage

*** Only cells in blue can be changed.**

Overall Dimensions of Liquid Manure Storage Tank			Liquid MS Tank Dimensions
Internal Diameter*[4]	46.3	m	152 ft
Maximum Depth*4	4.8	m	16 ft
Design Capacity Depth	*4.50*	m	15 ft
Total Capacity @ top of Tank	*8,085*	m^3	*Total Capacity @ tot 285,511* ft^3 *1,778,401 Imp. Gal.*
Design Capacity of Liquid Manure Storage (freeboard level)			**Design Capacity (freeboard level)**
Design Capacity (freeboard level)	**7,579**	m^3	**267,667** ft^3 **1,667,251 Imp. Gal.**
Surface Area of Liquid Manure	*1,684*	m^2	*18,130* ft^2

CFO Name [1] Hutterian Brethren of Ivy Ridge
Land Location [1]

Type(s) of Livestock [2]	Number of Livestock	Annual Manure Production (m^3/hd)
Free Stall: Lactating with Dry Cows	150	42.6
N/A		0.0
N/A	0	0.0
N/A	0	0.0
Total manure Production (m^3/yr)		

Minimum 9 Month Liquid Manure Storage Volume Required			
4,793	m^3 **	**169,246**	ft^3
		1,054,202	**Imp. Gal.**

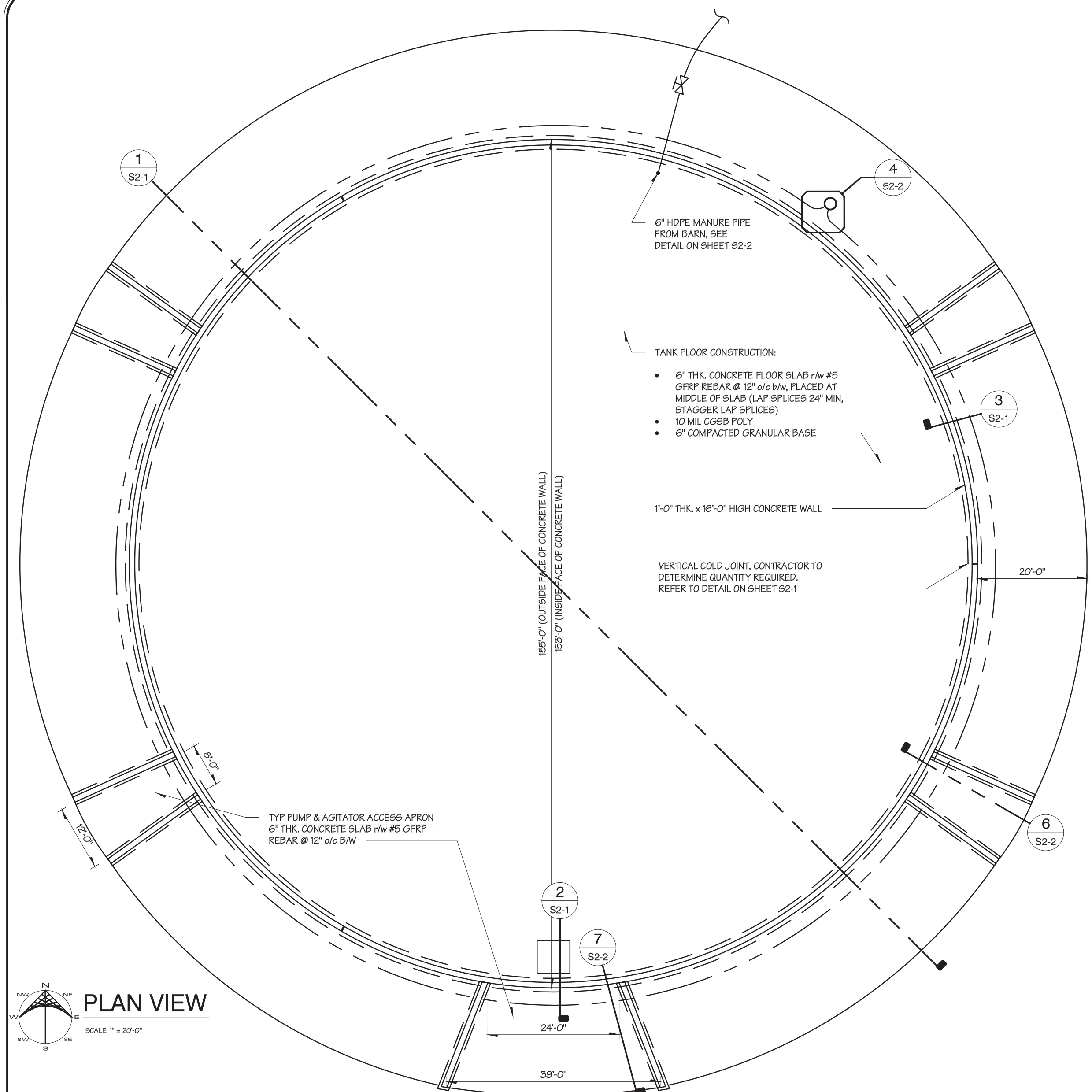
Instructions

1. Enter CFO name and legal land location. (Section-Township-Range-Meridian)
2. Select type(s) of Livestock to automatically upload annual liquid manure production data.
3. Enter number of livestock for each type of livestock
4. Adjust dimensions of liquid manure storage tank to ensure that minimum 9 month liquid manure storage volume requirement is met or exceeded.

NRCB USE ONLY

LIQUID MANURE STORAGE VOLUME CALCULATOR (if applicable)

Facility 1			
Name / description	Manure storage tank	Capacity	7,579 m^3
Facility 2			
Name / description	Dairy barn in-barn pits	Capacity	94.14 m^3
Facility 3			
Name / description		Capacity	
Facility 4			
Name / description		Capacity	
TOTAL CAPACITY			7,673.14 m^3
REQUIRED 9 MONTH STORAGE CAPACITY			4,793 m^3
MEETS THE REQUIREMENTS FOR A MINIMUM OF 9 MONTHS STORAGE			☑ YES ☐ NO



PLAN VIEW

SCALE: 1" = 20'-0"

STRUCTURAL NOTES

1. Concrete Manure Storage Design Loads
   1.1. Climatic loads referenced from ABC 2019 edition, Stavely, Alberta

        Wind load q50   12.5 psf

   1.2. Soil, manure and ice loads provided in Tank Wall Load Profile detail on sheet S2-1.

2. General Construction Notes
   2.1. Tank Use: Liquid Manure Storage
   2.2. Tank and foundation designed in accordance with the ABC 2019 edition.
   2.3. The contractor is required to review the complete set of contract documents and co-ordinate all trades. The work must be a complete, functioning facility, as explicitly & implicitly described by the contract documents.
   2.4. The contractor is to verify all dimensions prior to commencing with the work. The contractor is to notify the engineer of any discrepancy or deviation in the existing condition prior to commencing with the work for further instructions.
   2.5. Drawings are not to be scaled but must be used to determine the general layout. All dimension discrepancies are to be reported to the engineer.
   2.6. Verify finished slab elevation relative to site with engineer prior to commencement of work.
   2.7. All new grade work is to be sloped away from the tank as per slopes indicated in sealed drawings.

3. Concrete General Notes
   3.1. The national building code latest edition and all pertinent recommendations of CSA standard A23.1 and A23.3 shall be the basis for the design and construction of all work on this project.
   3.2. All concrete, unless otherwise stated, shall be designed as follows

unit:	Floor & Footing:	Walls:
A) Min. Compressive Strength (28 days):	4640 psi (32 MPa)	4640 psi (32 MPa)
B) Aggregate Size (maximum):	¾"	½"
C) Air entrainment:	Natural	5%-8%
D) Exposure Class:	A2	A2
E) W/C ratio:	0.45	0.45
F) Cement:	HS	HS

   3.3. Design based on the following conditions as referenced from geotechnical investigation report no. USG1809 dated February 2, 2024 provided by Union Street Geotechnical Ltd.:
   - Soil bearing pressure of 2976 psf (ULS) for a raft foundation on dense compact gravel.
   - Owner or contractor shall notify engineer if local conditions differ from those listed above.

   3.4. Typical thickened edge slab subgrade preparation as referenced from geotechnical investigation report no. USG1809 dated February 2, 2024 provided by Union Street Geotechnical Ltd.:
   - Strip site minimum 8" underneath footprint of manure storage tank foundation. Remove all topsoil, organics, and deleterious materials to their full depths. Excavate further as required to reach design subgrade elevation. Exposed subgrade should consist of native sand or till.
   - Proof roll site to identify any soft areas. If any soft areas are encountered, excavate an additional 12" and replace with suitable granular material and compact to 98% standard proctor density.
   - Scarify and compact the exposed subgrade to a minimum 98% standard proctor density.
   - Exposed subgrade to be inspected by Union Street Geotechnical Ltd. prior to backfilling or placing granular sub-base/base materials. Subgrade is not to be left exposed for an extended period of time to avoid excess wetting, softening or drying of the subgrade.
   - If backfill is required to reach the desired tank floor elevation, a non-expansive, low to medium plastic soil is to be placed in maximum 12" lifts and compacted to 98% standard proctor density. Backfill material to be approved by Union Street Geotechnical Ltd. prior to use.
   - Install 6" granular base underneath tank floor in a single lift and compact to 100% standard proctor density. Install a layer of 10 mil CGSB poly on top of the granular material prior to placing slab reinforcement.

   3.5. Concrete cover for reinforcing steel to be as follows (U.N.O.):

Unit:	Measurement:
A) concrete deposited against soil:	3"
B) concrete exposed to weather, water, or soil after removal of forms:	1½"
C) slabs and walls, except as noted in (a) and (b):	¾"

   3.6. All reinforcing steel shall be high bond deformed bars conforming to CSA G30.18 grade 400 for 10m, 15m or larger; or GFRP bars conforming to CSA S806-12 and CSA 807-19 for #3, #4, #5, #6 or larger bars.
   3.7. All bending details, dimensions, anchorage, cut-off lengths, bar supports, spacers, and location of reinforcing splices shall be in accordance with CSA A23.3 latest edition, unless otherwise shown.
   3.8. Construction joint details are provided on sheet S2-1 intended to allow contractor to pour walls in separate pours. Contractor to determine number of intended pours and notify engineer.
   3.9. Raft foundation is designed to be one continuous pour. Construction joints are not allowed in the floor.
   3.10. In lieu of cone shaped snap ties, standard flat bar ties may be used. Seal all snap ties on the interior face of the tank walls with SikaTop Seal-107CA; or equivalent.

NOTE TO PERMIT AUTHORITY:

NEITHER DGH ENGINEERING LTD. NOR THE ENGINEER WHO HAS SEALED THESE DRAWINGS HAS BEEN ENGAGED FOR FIELD REVIEW SERVICES. FIELD REVIEW SERVICES TO BE PROVIDED BY OTHERS.

PROJECT TITLE
IVY RIDGE COLONY FARMING
MANURE STORAGE TANK
PROJECT LOCATION: SECTION 31-14-26 W4M IN THE MD of Willow Creek No. 26, AB
PROJECT NUMBER: 24-1889-003-50

CLIENT
WILLIAMS CONSTRUCTION MANAGEMENT INC
4 CYPRESS PLACE
STEINBACH, MB. R5G 2A7

DESIGNED	DRAWN	COORDINATOR
BR	SSM	BR
DATE	SCALE	X'REF PATH(S)
MARCH/2024	AS NOTED	

CONCRETE TANK - PLAN VIEW SECTION & NOTES

S1

REV. R00

DGH ENGINEERING LTD.
CIVIL | STRUCTURAL | MECHANICAL | ELECTRICAL | INDUSTRIAL
12 Aviation Boulevard
St. Andrews MB R1A 3N5 Canada
T: 204-334-8846
www.dghengineering.com

NOTE TO CONTRACTOR:

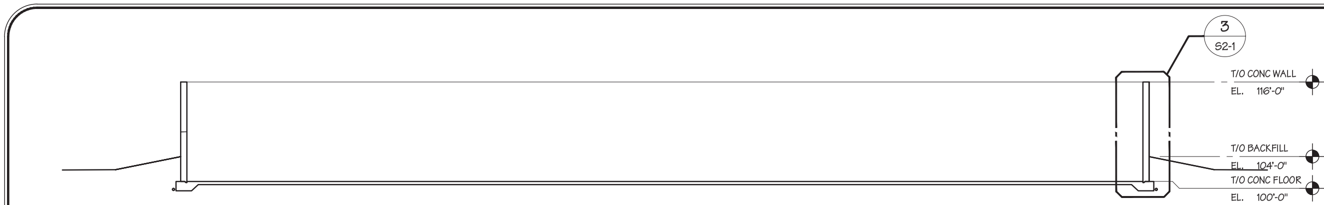
ENGINEER'S SEAL

ISSUED FOR CONSTRUCTION

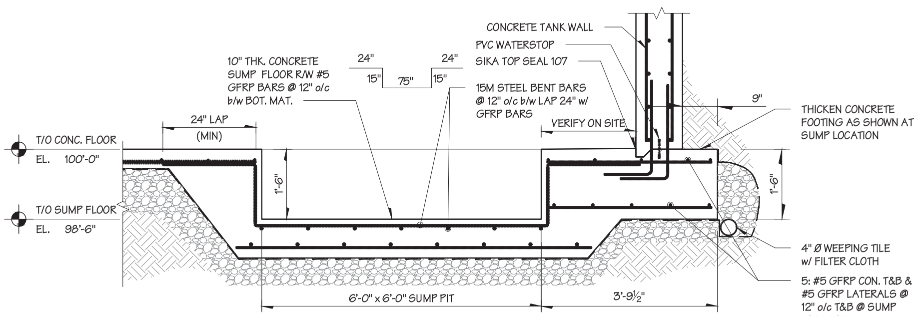
ISSUE (AND REVISION)

NO.(REV.)	DATE	DESCRIPTION	INITIAL(S)
01	2024-03-27	ISSUED FOR REVIEW	SSM
02	2024-04-05	ISSUED FOR CONSTRUCTION	SSM

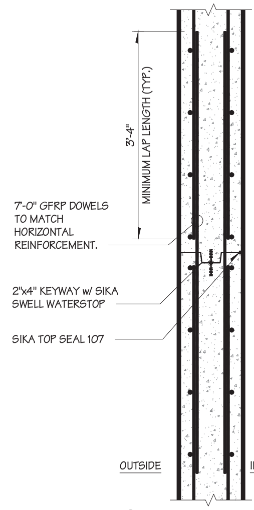
PRINTED DATE: 4/3/2024 3:09:25 PM



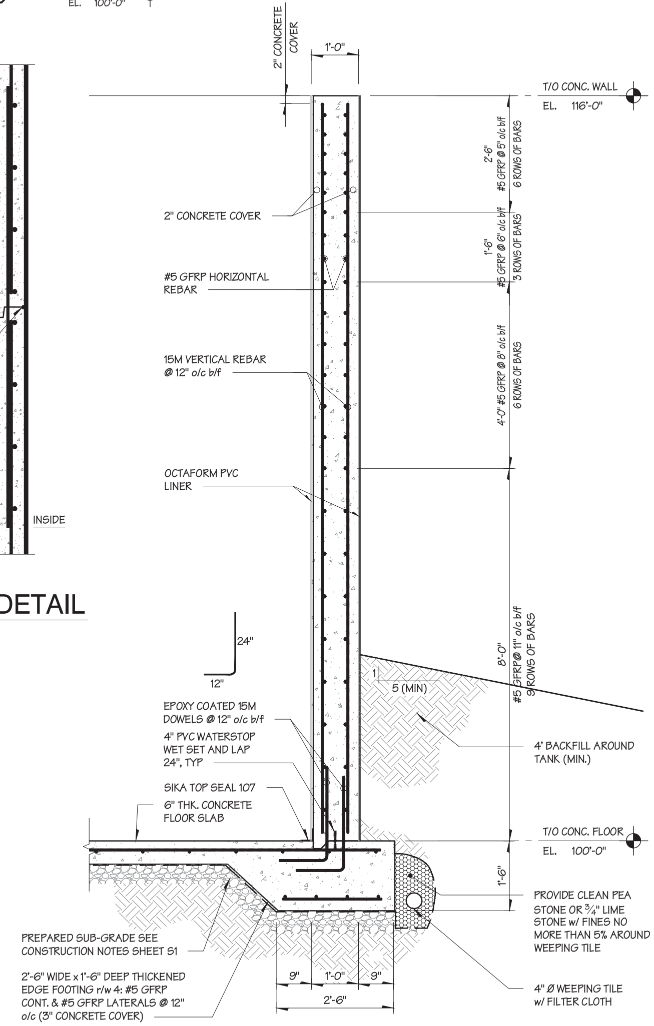
1 TANK SECTION
S2-1
SCALE: 1" = 20'-0"
SHEET REF. S1


CONCRETE TANK WALL
PVC WATERSTOP
SIKA TOP SEAL 107
10" THK. CONCRETE SUMP FLOOR R/W #5 GFRP BARS @ 12" o/c b/w BOT. MAT.
24"
15"
75"
15"
24"
15M STEEL BENT BARS @ 12" o/c b/w LAP 24" w/ GFRP BARS
24" LAP (MIN)
VERIFY ON SITE
9"
THICKEN CONCRETE FOOTING AS SHOWN AT SUMP LOCATION
T/O CONC. FLOOR
EL. 100'-0"
T/O SUMP FLOOR
EL. 98'-6"
1'-6"
1'-6"
4" Ø WEEPING TILE w/ FILTER CLOTH
5: #5 GFRP CON. T&B & #5 GFRP LATERALS @ 12" o/c T&B @ SUMP LOCATION
6'-0" x 6'-0" SUMP PIT
3'-9½"

2 PUMP OUT SUMP DETAIL
S2-1
SCALE: 3/8" = 1'-0"
SHEET REF. S1



VERTICAL COLD JOINT DETAIL
SCALE: 1/2" = 1'-0"


2" CONCRETE COVER
1'-0"
T/O CONC. WALL
EL. 116'-0"
2" CONCRETE COVER
#5 GFRP HORIZONTAL REBAR
15M VERTICAL REBAR @ 12" o/c b/f
OCTAFORM PVC LINER
2'-6"
#5 GFRP @ 5" o/c b/f
6 ROWS OF BARS
1'-6"
#5 GFRP @ 6" o/c b/f
3 ROWS OF BARS
4'-0" #5 GFRP @ 8" o/c b/f
6 ROWS OF BARS
8'-0"
#5 GFRP @ 11" o/c b/f
9 ROWS OF BARS
24"
12"
1
5 (MIN)
4' BACKFILL AROUND TANK (MIN.)
EPOXY COATED 15M DOWELS @ 12" o/c b/f
4" PVC WATERSTOP WET SET AND LAP 24", TYP
SIKA TOP SEAL 107
6" THK. CONCRETE FLOOR SLAB
T/O CONC. FLOOR
EL. 100'-0"
1'-6"
PROVIDE CLEAN PEA STONE OR ¾" LIME STONE w/ FINES NO MORE THAN 5% AROUND WEEPING TILE
PREPARED SUB-GRADE SEE CONSTRUCTION NOTES SHEET S1
2'-6" WIDE x 1'-6" DEEP THICKENED EDGE FOOTING r/w 4: #5 GFRP CONT. & #5 GFRP LATERALS @ 12" o/c (3" CONCRETE COVER)
9"
1'-0"
9"
2'-6"
4" Ø WEEPING TILE w/ FILTER CLOTH

3 TYP. TANK WALL DETAIL
S2-1
SCALE: 3/8" = 1'-0"
SHEET REF. S2-1

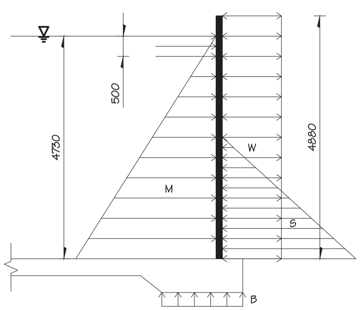
NOTE TO PERMIT AUTHORITY:

NEITHER DGH ENGINEERING LTD. NOR THE ENGINEER WHO HAS SEALED THESE DRAWINGS HAS BEEN ENGAGED FOR FIELD REVIEW SERVICES. FIELD REVIEW SERVICES TO BE PROVIDED BY OTHERS.

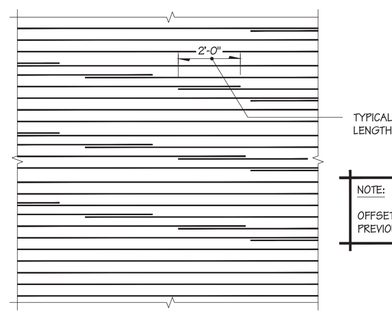
NOTE: DIMENSIONS FOR LOAD PROFILE DETAIL ARE IN mm.

W - WIND, Q50,	0.6 kPa
M - MANURE,	10.0 kN/m³
(EQUIVALENT FLUID DENSITY	
B - SOIL BEARING,	142.5 kPa
I - ICE LOAD,	50.0 kPa
S - SOIL PRESSURE,	4.7 kN/m³

LOAD COMBINATIONS:
1. MANURE AND ICE
2. WIND AND SOIL
3. MANURE



TANK WALL LOAD PROFILE



NOTE:
OFFSET GFRP JOINTS FROM THE PREVIOUS JOINT AS SHOWN.

HORIZONTAL WALL REBAR STAGGERING DETAIL - PARTIAL
SCALE: 1/4" = 1'-0"

ISSUED FOR CONSTRUCTION

NO.	REV. DATE	DESCRIPTION	INITIAL(S)
01	2024-03-27	ISSUED FOR REVIEW	SSM
02	2024-04-05	ISSUED FOR CONSTRUCTION	SSM

PRINTED DATE: 4/3/2024 3:09:19 PM

ENGINEER'S SEAL

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CIVIL | STRUCTURAL | MECHANICAL | ELECTRICAL | INDUSTRIAL
12 Aviation Boulevard, St. Andrews MB R1A 3N5 Canada
T: 204-334-8846
www.dghengineering.com

NOTE TO CONTRACTOR:

CLIENT: WILLIAMS CONSTRUCTION MANAGEMENT INC
4 CYPRESS PLACE
STEINBACH, MB. R5G 2A7

DESIGNED	DRAWN	COORDINATOR
BR	SSM	BR
DATE	SCALE	X'REF PATH(S)
MARCH/2024	AS NOTED	

PROJECT TITLE: IVY RIDGE COLONY FARMING MANURE STORAGE TANK
PROJECT LOCATION: SECTION 31-14-26 W4M IN THE MD of Willow Creek No. 26, AB
PROJECT NUMBER: 24-1-3889-003-50

CONCRET MANURE STORAGE TANK DETAILS

S2-1
REV. R00

AO Comment: Applicant is proposing to fill the tank in the lower 1/4, with an agitator at the top of the tank. A condition is included in this permit that an engineer must certify that the tank will be constructed to be filled in the lower 1/4.

NOTE TO PERMIT AUTHORITY:

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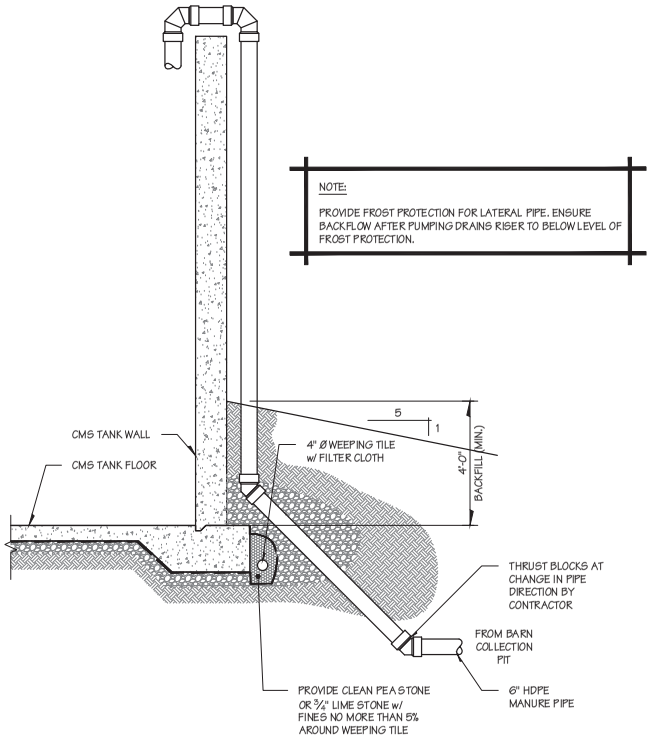
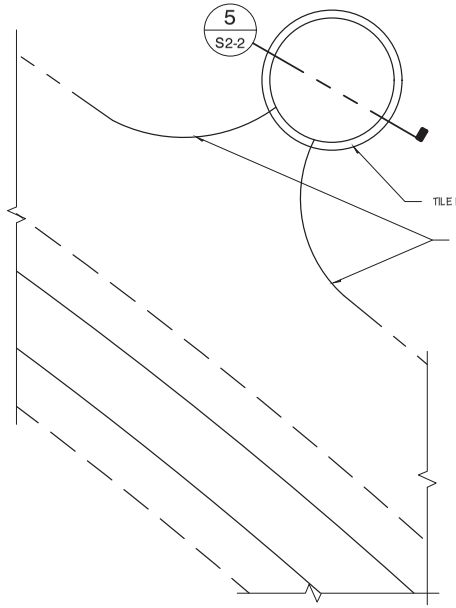
NOTE:

PROVIDE FROST PROTECTION FOR LATERAL PIPE. ENSURE BACKFLOW AFTER PUMPING DRAINS RISER TO BELOW LEVEL OF FROST PROTECTION.



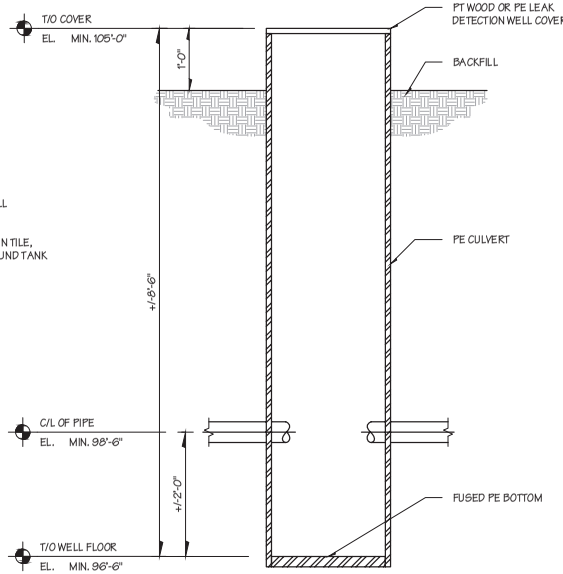
INFLUENT PIPE DETAIL

SCALE: NOT TO SCALE



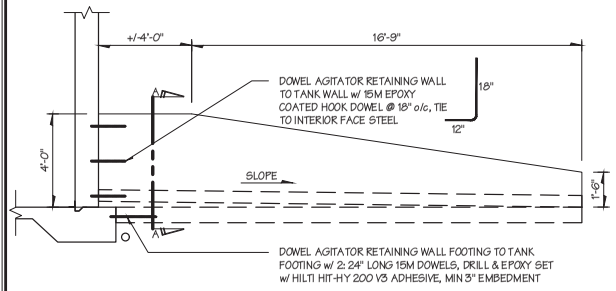
4 S2-2 TILE DRAIN WELL - PLAN

SCALE: 1/2" = 1'-0"
SHEET REF. S1



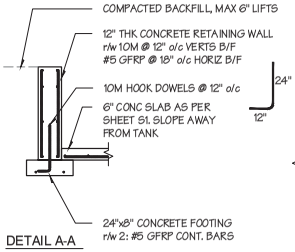
5 S2-2 TILE DRAIN WELL DETAIL

SCALE: 1/2" = 1'-0"
SHEET REF. S2-2

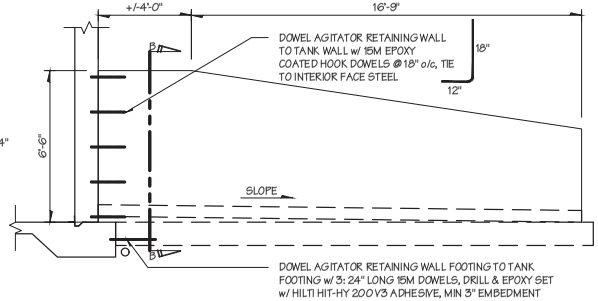


6 S2-2 TYP AGITATOR RETAINING WALL

SCALE: 1/2" = 1'-0"
SHEET REF. S1

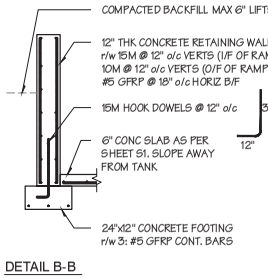


DETAIL A-A



7 S2-2 TYP PUMP & AGITATOR RETAINING WALL

SCALE: 1/2" = 1'-0"
SHEET REF. S1



DETAIL B-B

ISSUED FOR CONSTRUCTION

ISSUE (AND REVISION)	DATE	DESCRIPTION	INITIALS
02	2024-04-23	ISSUED FOR CONSTRUCTION	DSW
01	2024-04-17	ISSUED FOR REVIEW	DSW

PRINTED DATE: 4/17/2024 3:09:22 PM

ENGINEER'S SEAL

DGH ENGINEERING LTD.
CIVIL | STRUCTURAL | MECHANICAL | ELECTRICAL | INDUSTRIAL
12 Aviation Boulevard
St. Andrews MB R1A 3N5 Canada
T: 204-334-8846
www.dghengineering.com

NOTE TO CONTRACTOR:

COPYRIGHT - 2024

CLIENT: WILLIAMS CONSTRUCTION MANAGEMENT INC
4 CYPRESS PLACE
STEINBACH, MB. R5G 2A7

DESIGNED	DRAWN	COORDINATOR
BR	SGM	BR
DATE	SCALE	X-REF PATH(S)
MARCH/2024	AS NOTED	

PROJECT TITLE: IVY RIDGE COLONY FARMING MANURE STORAGE TANK
PROJECT LOCATION: SW-21-14-26 WAM IN THE MD of Willow Creek No. 26, AB
PROJECT NUMBER: 24-1585-005-50

LEAK DETECTION WELL & INFLUENT PIPE DETAILS

S2-2
REV. 00 R00

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 - Concrete liner

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

Facility description / name *(as indicated on site plan)* **1.** Chicken & Pullet Barn

2. Calf Shed and Dry Cow

Manure storage capacity

	Length (m)	Width (m)	Depth below grade to the bottom of the liner (m)	**NRCB USE ONLY** Estimated storage capacity (m^3)
1.	111.56	30.48	0 m	
2.	111.56	45.72	0 m	
			TOTAL CAPACITY	Sufficient storage with manure storage pad

☐ 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

All barns under Roof

Liner protection

Describe how the physical integrity of the liner will be maintained

Will visualy inspect for crack, and seal as needed

NRCB USE ONLY

Requirements met: ☑ YES ☐ NO

Last updated February 26, 2021

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

Concrete liner details

Concrete thickness	Method of sulphate protection:
6-8"	Type 50
Concrete strength	**Concrete reinforcement size and spacing**
25 MPA	10-15 m rebar, 12" spacing

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

NRCB USE ONLY

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

Additional information *(attach as required)*

NRCB USE ONLY

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

Depth to water table: Greater than 2.01 m below grade Requirements met: ☑ YES ☐ NO

Depth to Uppermost groundwater resource: 9.14 m below grade Requirements met: ☑ YES ☐ NO

ERST completed: ☑ see ERST page for details

Surface water control systems

Requirements met: ☑ YES ☐ NO Details/comments:

Chicken layer and pullet barn is under roof and will not have any run-on or run-off. The calf and dry cow shed is a 3-sided structure with an open area for feeding. The facility will have concrete footings around it and will be sloped towards the bedding pack (under roof) to contain run-off.

Concrete liner details

Conditions are included in this permit requiring the applicant to provide proof that the concrete for the chicken layer and pullet barn will meet the specifications for category D (solid manure - dry) and the concrete for the calf and dry cow shed will meet the specifications for category C (solid manure - wet) as outlined in Technical Guideline Agdex 096-93 "Non-Engineered Concrete Liners for Manure Collection and Storage Areas".

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

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 - Concrete liner

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

Facility description / name *(as indicated on site plan)* **1.** Broiler Barn

2. Mixed Poultry

Manure storage capacity

	Length (m)	Width (m)	Depth below grade to the bottom of the liner (m)	**NRCB USE ONLY** Estimated storage capacity (m^3)
1.	111.56 m	36.58	0 m	
2.	76.20 m	18.29	0 m	
			TOTAL CAPACITY	Sufficient storage with manure storage pad

☐ 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

All barns under Roof

Liner protection

Describe how the physical integrity of the liner will be maintained

Will visuly inspect for cracks, and seal as needed

NRCB USE ONLY

Requirements met: ☑ YES ☐ NO

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 - Concrete liner (cont.)

Concrete liner details

Concrete thickness	Method of sulphate protection:
6-8"	Type 50
Concrete strength	**Concrete reinforcement size and spacing**
25 MPA	10-15 mm rebar, 12" spacing

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

NRCB USE ONLY
Requirements met: ☑ YES ☐ NO
Condition required: ☑ YES ☐ NO
Report attached: ☐ YES ☑ NO

Additional information *(attach as required)*

NRCB USE ONLY

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

Depth to water table: Greater than 2.01 m below grade Requirements met: ☑ YES ☐ NO

Depth to Uppermost groundwater resource: 9.14 m below grade Requirements met: ☑ YES ☐ NO

ERST completed: ☑ see ERST page for details

Surface water control systems

Requirements met: ☑ YES ☐ NO Details/comments:

Both facilities are under roof and will not have any run-on or run-off.

Concrete liner details

Conditions are included in this permit requiring the applicant to provide proof that the concrete for both facilities will meet the specifications for category D (solid manure - dry) as outlined in Technical Guideline Agdex 096-93 "Non-Engineered Concrete Liners for Manure Collection and Storage Areas".

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

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 - Compacted soil liner

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

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

1. Compacted Soil Liner, Under Manure Storage Pad
2. _____

Manure storage capacity

	Length (m)	Width (m)	Depth below grade to the bottom of the liner (m)	NRCB USE ONLY Estimated storage capacity (m^3)
1.	40	60	1.01	
2.				
			TOTAL CAPACITY	
			Sufficient storage	

☐ 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

Run off water will be diverted to a catch basin

AO Comment: On December 3, 2024, the applicant indicated in an email that they are no longer proposing a catch basin to contain run-off from the solid manure storage. Instead, they are proposing to construct berms around the solid manure storage pad to contain run-off and divert run-on.

Liner protection

Describe how the physical integrity of the liner will be maintained

Pad will be clay lined, will get inspected on a regular base, will get repaired if needed.

NRCB USE ONLY

Requirements met: ☑ YES ☐ NO

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 - Compacted soil liner (cont.)

Compacted soil liner details

Thickness of compacted liner	1.01 (m)	Provide compacted liner details (as required) Recompacted clay liner must be composed of clay till recompacted to at least 1,904 kg/m3 (98% of 1,952 kg/m3).	
Soil texture	21.8 % sand	23.3* % silt	46.6* % clay
Atterberg limits	Plastic limit 15.2	Liquid limit 38.3	Plasticity index 23.1
Hydraulic conductivity	Hydraulic conductivity (cm/s) 5.07x10-8 cm/s		
	Describe test standard used Flexible Wall Permeameter, ASTM D5084-10		

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

* Silt and clay component estimated from total fines.

AO Comment: See attached geotechnical report.

NRCB USE ONLY

Requirements met: ☑ YES ☐ NO

Condition required: ☑ YES ☐ NO

Report attached: ☑ YES ☐ NO

NRCB USE ONLY

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

Depth to water table: Greater than 2.01 m below grade Requirements met: ☑ YES ☐ NO

Depth to uppermost groundwater resource: 9.18 m below grade Requirements met: ☑ YES ☐ NO

ERST completed: ☑ see ERST page for details

Surface water control systems

Requirements met: ☑ YES ☐ NO Details/comments: Run-off from solid manure storage pad will be contained with berms.

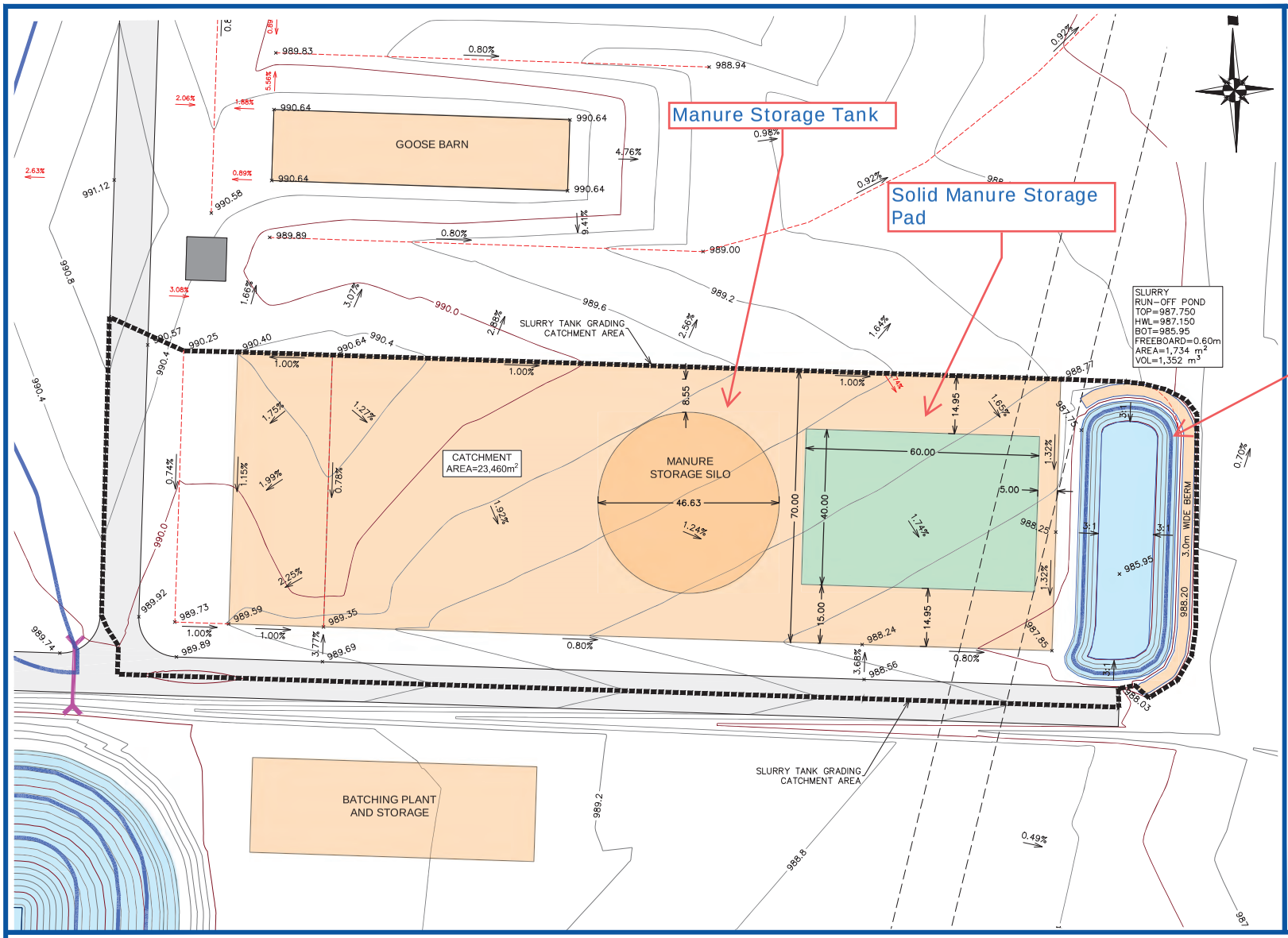
Compacted soil liner details

Hydraulic conductivity after adjustment: 5.07×10^{-7} cm/s

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

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

A condition is included in this permit that the applicant is to immediately cease construction and notify the NRCB if the water is observed to be one meter or less from the bottom of the compacted clay liner at the time of construction.



LEGEND:

1:1000

IVY RIDGE HUTTERITE COLONY

SLURRY TANK GRADING
FIGURE 1

Apr 23, 2024

229729LS

MARTIN GEOMATIC CONSULTANTS
Consulting Engineers, Planners, and Land Surveyors
255-31st Street North Lethbridge, Alberta T1H 3Z4
Ph: (403) 329-0060 E-mail: geomart@mgcl.ca Fax: (403) 329-6594

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

January 23, 2024	
April 22, 2024	
September 19, 2024	

CORRESPONDENCE WITH MUNICIPALITIES AND REFERRAL AGENCIES

Date deeming letters sent: May 22, 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: Campus Energy Partners Operations Inc., ATCO Gas and Pipelines, Rampart Oil Inc. ☐ N/A

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

Other: Long Term Asset Management Inc., Exxonmobil Resources Ltd. ☐ N/A

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

AO Comment: Entire engineering report was not included, as it was not applicable to CFO facilities. Only the pages relevant to the CFO facilities were included.

Atterberg Limit (AL) and Mechanical Wash Sieve (MWS) analyses were performed on a mudstone sample obtained from Borehole BH107. The AL result is summarized in Table 4.4.

TABLE 4.4: SUMMARY OF MUDSTONE ATTERBERG LIMIT TEST RESULT

Sample No. and Depth	Borehole No.	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Moisture Content (%)	MUSC - Soil Type
MW39 - 3.81 m	BH107	46.7	14.6	32.1	15.7	CI

Based on the result in Table 4.3, the mudstone has a MUSC of "CI" - Clays or Silts of medium plasticity. The MWS result also indicated that the mudstone contained, by mass, 0.0% gravel, 2.5% sand, and 97.5% clay and silt.

4.2 GROUNDWATER

Seepage was not encountered during drilling. Following drilling, piezometers were installed in Boreholes BH101, BH105, BH107, and BH109 which were monitored fifty days following drilling, on 30th January, 2024. The monitoring results are summarized in Table 4.5.

TABLE 4.5: SUMMARY OF GROUNDWATER MONITORING

Borehole No.	Borehole Depth[1] (m)	Borehole Elevation[2] (m)	Water Level[1] (m), 30th January, 2024	Groundwater Elevation[1] (m)
BH101	3.81	992.37	Dry[3]	Below 988.56[3]
BH105	5.18	991.24	4.34	986.90
BH107	5.49	994.39	Dry[3]	Below 988.90[3]
BH109	3.81	990.87	2.01	988.86
Average:			**3.91**	**988.31**

Notes:
1 - Below existing grade.
2 - Elevations based on survey performed by others.
3 - Maximum borehole depth utilized as the water level in average result.

Based on the lack of seepage observed during drilling and the water level observed in the piezometer, the groundwater level at the site varies, but is likely between 2.0 to 4.0 m below ground surface across the site at an approximate elevation of 988.31 m.

compaction testing, monitoring, and proper documentation, will be required to minimize potential impacts regarding settlement;

3. Based on the AL and MWS results, the sand had a MUSC of "CL" - Lean Clay to "ML" - Silty or Clayey Sand of low plasticity and is not expected to experience volume changes with fluctuating moisture conditions. However, the sand is frost active and will experience volume changes during freezing/thawing cycles. Construction of unheated on-grade structures, where movement would be detrimental, is not recommended on the sand unless the bearing surface extends past the frost depth;

4. Based on the AL and MWS results, the till had an average MUSC of "CI" - Clays or Silts of medium plasticity and is expected to experience minor to moderate volume changes with fluctuating moisture conditions. However, the till is frost active and will experience volume changes during freezing/thawing cycles. Construction of unheated on-grade structures, where movement would be detrimental, is not recommended unless the bearing surface extends past the frost depth;

5. The low plastic sand and medium plastic till offers moderate to good bearing support for shallow foundations;

6. The till and mudstone offer good to excellent skin friction resistance and end bearing support for deep foundations;

7. A flexible wall permeameter analyses was performed on an undisturbed till sample obtained 3.05 m below grade in Borehole BH109 to aid in the stormwater retention pond design. The result indicated a laboratory soil hydraulic conductivity of 5.07×10^{-10} m/s;

8. For large, heavy structures, a building specific geotechnical investigation is recommended to hone the design once the building footprint is known;

9. Information obtained from installed piezometers indicates that the depth to groundwater table varies, but is likely at an approximate elevation of 988.31 m. Excavations beyond this elevation may likely start seeping and filling with water if they are left open for extended periods of time; and,

11 CLOSURE

Union Street Geotechnical Ltd. prepared this report for the use of Martin Geomatic Consultants Ltd., and their agents, for the design and construction of the Ivy Ridge Hutterite Colony located within Section 31-14-26 W4M in the M.D. of Willow Creek No. 26, Alberta.

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

Yours truly,

Union Street Geotechnical Ltd.

Prepared By:

Neil Tomaszewski, P.Eng.
Project Engineer

Reviewed By:

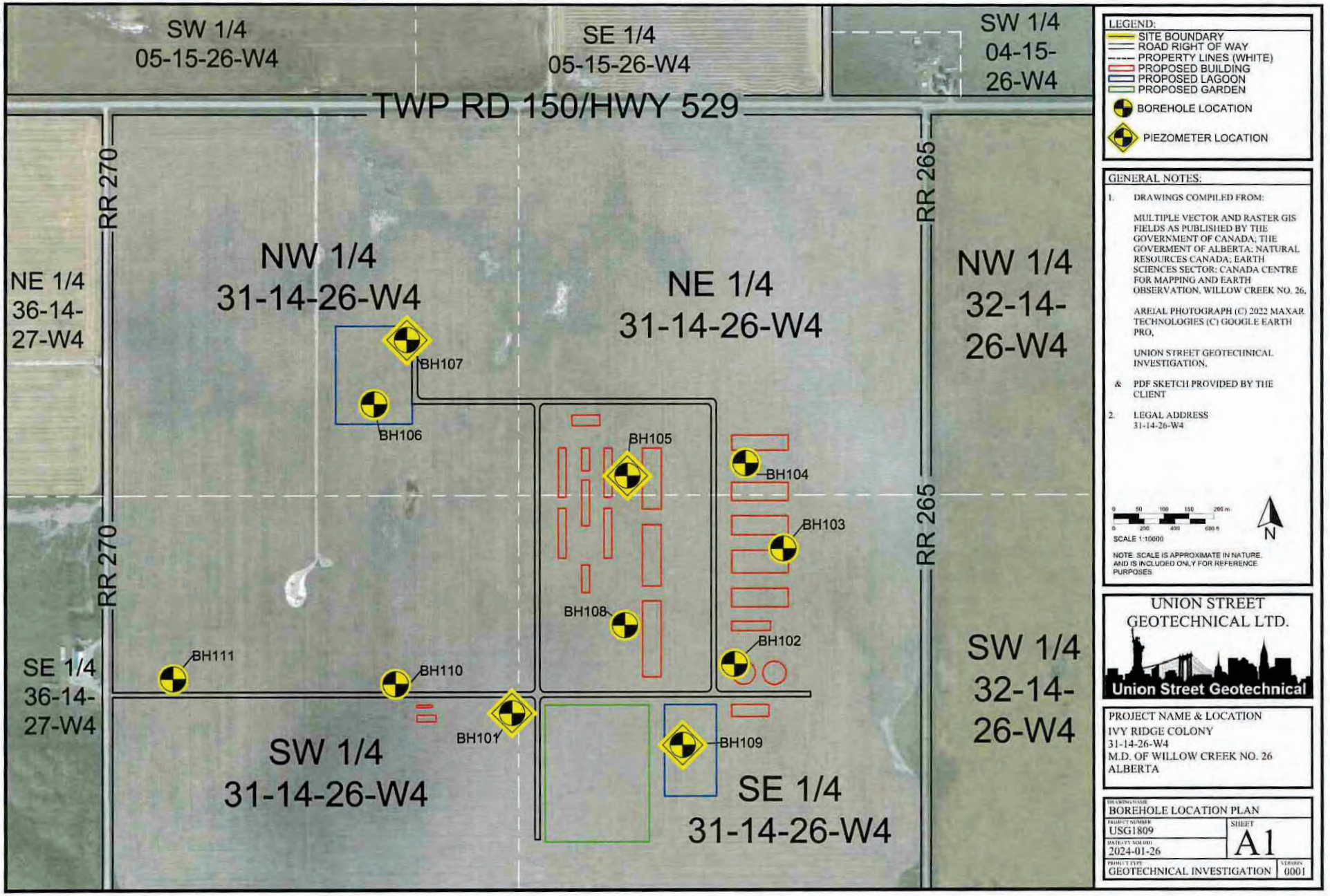
PROFESSIONAL ENGINEER ALBERTA
JOSHUA M. WILSON
ID 80317

2nd Feb, 2024

Joshua Wilson, P.Eng.
Geotechnical Manager

PERMIT TO PRACTICE
Union Street Geotechnical Ltd.
RM SIGNATURE:
RM APEGA ID#: 80317
DATE: 2nd Feb, 2024
PERMIT NUMBER: P12644
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

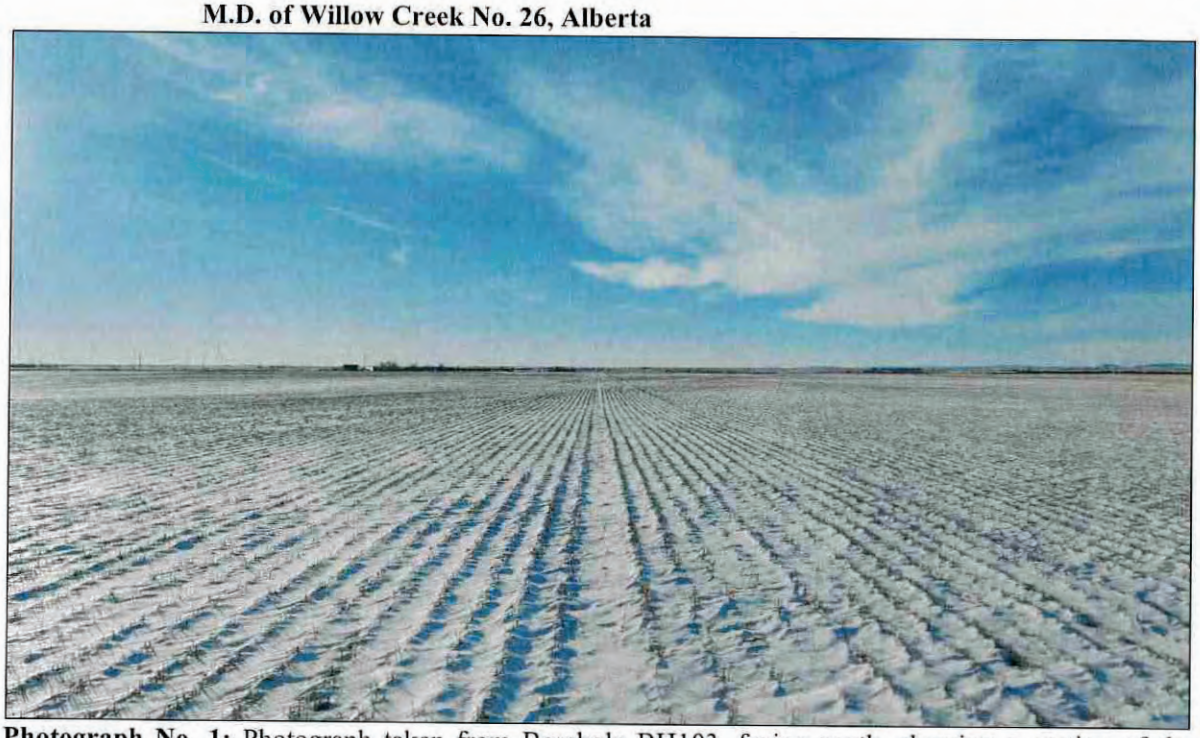
Drawing


SW 1/4
05-15-26-W4
SE 1/4
05-15-26-W4
SW 1/4
04-15-
26-W4
TWP RD 150/HWY 529
RR 270
RR 265
NW 1/4
31-14-26-W4
NE 1/4
31-14-26-W4
NE 1/4
36-14-
27-W4
NW 1/4
32-14-
26-W4
BH107
BH106
BH105
BH104
BH103
BH108
BH102
BH111
BH110
BH101
BH109
SE 1/4
36-14-
27-W4
SW 1/4
31-14-26-W4
SE 1/4
31-14-26-W4
SW 1/4
32-14-
26-W4
LEGEND:
SITE BOUNDARY
ROAD RIGHT OF WAY
PROPERTY LINES (WHITE)
PROPOSED BUILDING
PROPOSED LAGOON
PROPOSED GARDEN
BOREHOLE LOCATION
PIEZOMETER LOCATION
GENERAL NOTES:
1. DRAWINGS COMPILED FROM:
MULTIPLE VECTOR AND RASTER GIS FIELDS AS PUBLISHED BY THE GOVERNMENT OF CANADA; THE GOVERMENT OF ALBERTA; NATURAL RESOURCES CANADA; EARTH SCIENCES SECTOR; CANADA CENTRE FOR MAPPING AND EARTH OBSERVATION, WILLOW CREEK NO. 26,
AREIAL PHOTOGRAPH (C) 2022 MAXAR TECHNOLOGIES (C) GOOGLE EARTH PRO,
UNION STREET GEOTECHNICAL INVESTIGATION,
& PDF SKETCH PROVIDED BY THE CLIENT
2. LEGAL ADDRESS
31-14-26-W4
0 50 100 150 200 m
0 200 400 600 ft
SCALE 1:10000
N
NOTE: SCALE IS APPROXIMATE IN NATURE, AND IS INCLUDED ONLY FOR REFERENCE PURPOSES.
UNION STREET GEOTECHNICAL LTD.
Union Street Geotechnical
PROJECT NAME & LOCATION
IVY RIDGE COLONY
31-14-26-W4
M.D. OF WILLOW CREEK NO. 26
ALBERTA
DRAWING NAME
BOREHOLE LOCATION PLAN
PROJECT NUMBER
USG1809
SHEET
A1
DATE (Y/M/D)
2024-01-26
PRODUCT TYPE
GEOTECHNICAL INVESTIGATION
VERSION
0001
USG1809 - Drawing.dwg
02.03.2022

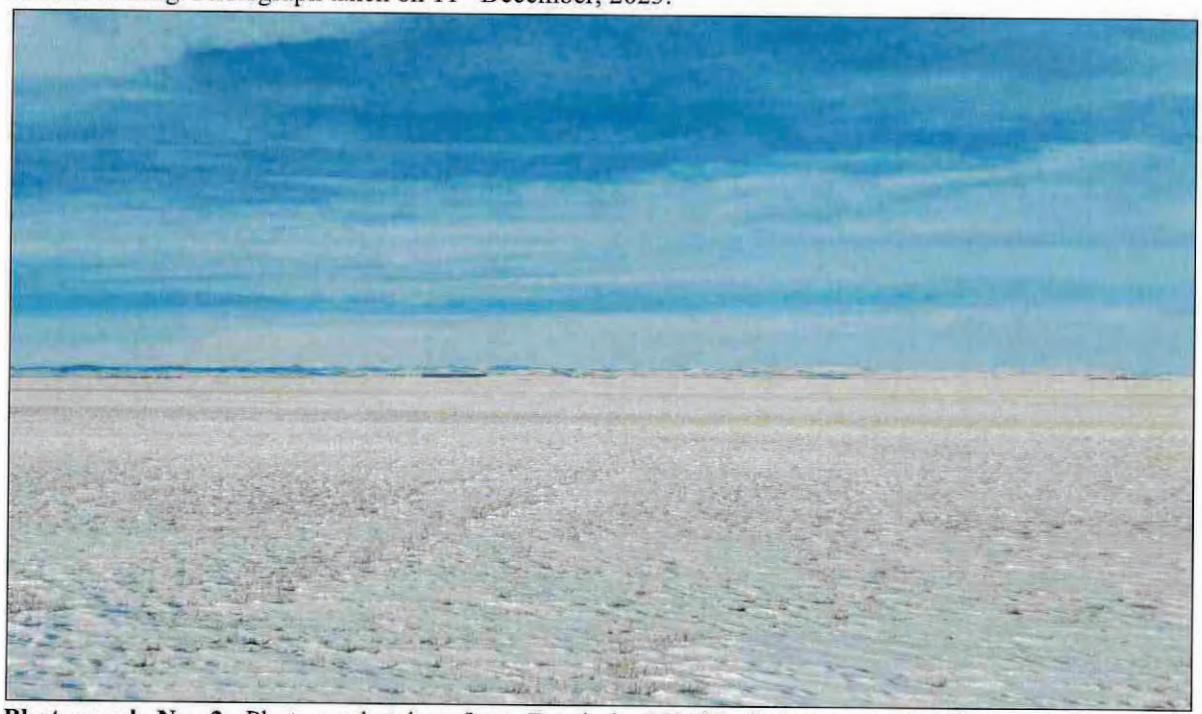
Union Street Geotechnical

Photographs

Photographs - Geotechnical Investigation
Section 31-14-26 W4M
M.D. of Willow Creek No. 26, Alberta



Photograph No. 1: Photograph taken from Borehole BH103, facing south, showing a portion of the proposed development footprint, site grading, snow cover, and general site conditions observed at the time of drilling. Photograph taken on 11th December, 2023.



Photograph No. 2: Photograph taken from Borehole BH103, facing west, showing a portion of the proposed residential housing development footprint, site grading, snow cover, and general site conditions observed at the time of drilling. Photograph taken on 11th December, 2023.

Photographs Cont'd - Geotechnical Investigation
Section 31-14-26 W4M
M.D. of Willow Creek No. 26, Alberta

Photograph No. 3: Photograph taken from Borehole BH110, facing north, showing a portion of the proposed water reservoir footprint, site grading, snow cover, and general site conditions observed at the time of drilling. Photograph taken on 11th December, 2023.

Union Street Geotechnical

Borehole Logs

FIELD BOREHOLE LOG

BOREHOLE NUMBER: BH101

PROJECT NUMBER:	**USG1809**
PROJECT NAME:	**Geotechnical Investigation**
LOCATION:	**S.W. 1/4 of 31-14-26 W4M, M.D. of Willow Creek No. 26, AB**
CLIENT:	**Martin Geomatic Consultants Ltd.**
DRILLING METHOD:	**150 mm Solid Stem Auger**
LOGGED BY:	**M.W.**
DATE BEGUN:	**11 December, 2023**
DATE COMPLETED:	**11 December, 2023**
CASING STICKUP:	**0.96 m**
TOTAL DEPTH:	**3.81 m**
GROUND SURFACE ELEVATION:	**992.37 m**

Union Street Geotechnical

DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE Type	SAMPLE No.	SPT "N"	POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
0.0		TOPSOIL: 203 mm thick.										Cap.
		TILL: Clay, silty, sandy, trace gravel. Pale brown (10YR 6/3) to dark greyish brown (10YR 4/2). Oxidized. Dry. Stiff to very stiff. Massive. Calcareous.										Solid 25 mm PVC casing.
												Bentonite.
1.0				MW1		-	7.5					
		@ 1.52 m, moist, some sand.										
2.0												Auger cuttings.
				MW2		144	13.5					Hand slotted 25 mm PVC.
3.0		NOTES: Refusal at 3.81 m below surface. No seepage or sloughing encountered during drilling. Piezometer installed, annulus backfilled to surface with auger cuttings. Piezometer dry on 30 January, 2024.										
				MW3		144	15.7					
4.0												

FIELD BOREHOLE LOG

BOREHOLE NUMBER
BH102

PROJECT NUMBER: **USG1809**
PROJECT NAME: **Geotechnical Investigation**
LOCATION: **S.E. 1/4 of 31-14-26 W4M, M.D. of Willow Creek No. 26, AB**
CLIENT: **Martin Geomatic Consultants Ltd.**
DRILLING METHOD: **150 mm Solid Stem Auger**
LOGGED BY: **M.W.**
DATE BEGUN: **11 December, 2023**
DATE COMPLETED: **11 December, 2023**

CASING STICKUP: **N/A**
TOTAL DEPTH: **5.33 m**
GROUND SURFACE ELEVATION: **989.89 m**

Union Street Geotechnical

DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE Type	SAMPLE No.	SPT "N"	POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
0.0		TOPSOIL: 203 mm thick.										
		TILL: Clay, silty, sandy. Brown (10YR 5/3) to greyish brown (10YR 5/2). Oxidized. Dry. Stiff to very stiff. Massive. Gravel inclusions. Calcareous.		MW4		-	9.1					
1.0												
		@ 1.52 m, moist.		MW5	19	84	20.8					
2.0				MW6		-	13.1					Auger cuttings.
3.0		MUDSTONE: Clay, silty, sandy. Light grey (10YR 7/1) to dark greyish brown (10YR 4/2). Non-oxidized. Dry. Very stiff to hard. Massive. Calcareous.		MW7	28	192	21.4					
				MW8		-	15.4					
4.0												
				MW9	91	215	11.8					
5.0				MW10		-	13.9					
		NOTES: Refusal at 5.33 m below surface. Sloughing, but no seepage encountered during drilling. Borehole backfilled to surface with auger cuttings.										
6.0												

FIELD BOREHOLE LOG

BOREHOLE NUMBER: BH103

PROJECT NUMBER: **USG1809**
PROJECT NAME: **Geotechnical Investigation**
LOCATION: **S.E. 1/4 of 31-14-26 W4M, M.D. of Willow Creek No. 26, AB**
CLIENT: **Martin Geomatic Consultants Ltd.**
DRILLING METHOD: **150 mm Solid Stem Auger**
LOGGED BY: **M.W.**
DATE BEGUN: **11 December, 2023**
DATE COMPLETED: **11 December, 2023**

CASING STICKUP: **N/A**
TOTAL DEPTH: **7.32 m**
GROUND SURFACE ELEVATION: **989.17 m**

Union Street Geotechnical

DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE Type	SAMPLE No.	SPT "N"	POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
0.0		TOPSOIL: 178 mm thick.										
1.0		TILL: Clay, silty, sandy. Brown (10YR 5/3) to greyish brown (10YR 5/2). Oxidized to non-oxidized. Moist. Firm to hard. Massive. Gravel inclusions. Calcareous. @ 1.52 m, moist.		MW11		-	9.2	CI	40.5	16.0		
2.0				MW12	7	-	14.0					
				MW13		-	18.1					
3.0				MW14	41	144	10.7					
4.0				MW15		-	12.9					Auger cuttings.
5.0				MW16	67	215	6.2					
				MW17		-	15.6					
6.0		MUDSTONE: Clay, silty, sandy. Dark greyish brown (10YR 4/2). Non-oxidized. Moist. Hard. Massive. Calcareous.		MW18	71	215	13.4					
7.0				MW19		-	19.7					
		NOTES: Refusal at 7.32 m below surface. Sloughing, but no seepage encountered during drilling. Borehole backfilled to surface with auger cuttings.										
8.0												
9.0												
10.0												

FIELD BOREHOLE LOG

BOREHOLE NUMBER: BH104

PROJECT NUMBER: **USG1809**
PROJECT NAME: **Geotechnical Investigation**
LOCATION: **N.E. 1/4 of 31-14-26 W4M, M.D. of Willow Creek No. 26, AB**
CLIENT: **Martin Geomatic Consultants Ltd.**
DRILLING METHOD: **150 mm Solid Stem Auger**
LOGGED BY: **M.W.**
DATE BEGUN: **11 December, 2023**
DATE COMPLETED: **11 December, 2023**

CASING STICKUP: **N/A**
TOTAL DEPTH: **3.66 m**
GROUND SURFACE ELEVATION: **988.52 m**

Union Street Geotechnical

DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE Type	SAMPLE No.	SPT "N"	POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
0.0		TOPSOIL: 102 mm thick.										
		SAND: Clayey, silty. Brown (10YR 5/3) to very dark brown (10YR 2/2). Oxidized. Dry to moist. Loose to compact. Massive. Calcareous.		MW20		-	6.7					
1.0												
				MW21	10	36	14.9					Auger cuttings.
2.0				MW22		-	9.8					
3.0		MUDSTONE: Clay, silty, sandy. Brown (10YR 5/3) to greyish brown (10YR 5/2). Non-oxidized. Dry to moist. Hard. Massive. Calcareous.		MW23	85	215	8.4					
				MW24		-	9.4					
4.0		NOTES: Refusal at 3.66 m below surface. No seepage or sloughing encountered during drilling. Borehole backfilled to surface with auger cuttings.										
5.0												

FIELD BOREHOLE LOG

BOREHOLE NUMBER: BH105

PROJECT NUMBER: **USG1809**
PROJECT NAME: **Geotechnical Investigation**
LOCATION: **N.E. 1/4 of 31-14-26 W4M, M.D. of Willow Creek No. 26, AB**
CLIENT: **Martin Geomatic Consultants Ltd.**
DRILLING METHOD: **150 mm Solid Stem Auger**
LOGGED BY: **M.W.**
DATE BEGUN: **11 December, 2023**
DATE COMPLETED: **11 December, 2023**

CASING STICKUP: **0.78 m**
TOTAL DEPTH: **5.18 m**
GROUND SURFACE ELEVATION: **991.24 m**

Union Street Geotechnical

DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE Type	SAMPLE No.	SPT "N"	POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
0.0		TOPSOIL: 127 mm thick.										Cap.
1.0		SAND: Some clay, some silt. Brown (10YR 5/3) to greyish brown (10YR 5/2). Oxidized. Dry to moist. Compact. Massive. Calcareous.		MW25		-	7.5					Bentonite.
2.0		@ 1.52 m, clayey, silty.		MW26	19	96	12.0					Solid 25 mm PVC casing.
3.0				MW27		-	10.6					
4.0		TILL: Clay, silty, some sand. Brown (10YR 5/3) to very dark grey (10YR 3/1). Oxidized to non-oxidized. Dry to moist. Very stiff to hard. Massive. Calcareous.		MW28	18	120	12.3					Auger cuttings.
				MW29		-	11.8	CI	36.1	14.4		Hand slotted 25 mm PVC.
5.0				MW30	45	215	15.6					
				MW31		-	14.8					
6.0		NOTES: Refusal at 5.18 m below surface. Sloughing, but no seepage encountered during drilling. Piezometer installed, annulus backfilled to surface with auger cuttings. Water level at 4.34 m below grade on 30 January, 2024.										
7.0												
8.0												
9.0												

FIELD BOREHOLE LOG

BOREHOLE NUMBER: BH106

PROJECT NUMBER: **USG1809**
PROJECT NAME: **Geotechnical Investigation**
LOCATION: **N.W. 1/4 of 31-14-26 W4M, M.D. of Willow Creek No. 26, AB**
CLIENT: **Martin Geomatic Consultants Ltd.**
DRILLING METHOD: **150 mm Solid Stem Auger**
LOGGED BY: **M.W.**
DATE BEGUN: **11 December, 2023**
DATE COMPLETED: **11 December, 2023**

CASING STICKUP: **994.78 m**
TOTAL DEPTH: **3.66 m**
GROUND SURFACE ELEVATION: **N/A**

Union Street Geotechnical

DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE Type	SAMPLE No.	SPT "N"	POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
0.0		TOPSOIL: 152 mm thick.										
		SAND: Clayey, silty. Brown (10YR 5/3) to dark greyish brown (10YR 4/2). Oxidized. Dry to moist. Loose to compact. Massive. Calcareous.		MW32		-	7.0					
1.0												
2.0				MW33		-	16.6					Auger cuttings.
3.0		MUDSTONE: Clay, silty, sandy. Greyish brown (10YR 5/2). Non-oxidized. Dry to moist. Hard. Massive. Calcareous.		MW34		-	12.3					
		NOTES: Refusal at 3.66 m below surface. No seepage or sloughing encountered during drilling. Borehole backfilled to surface with auger cuttings.										
4.0												
5.0												

FIELD BOREHOLE LOG

BOREHOLE NUMBER: BH107

PROJECT NUMBER: **USG1809**
PROJECT NAME: **Geotechnical Investigation**
LOCATION: **N.W. 1/4 of 31-14-26 W4M, M.D. of Willow Creek No. 26, AB**
CLIENT: **Martin Geomatic Consultants Ltd.**
DRILLING METHOD: **150 mm Solid Stem Auger**
LOGGED BY: **M.W.**
DATE BEGUN: **11 December, 2023**
DATE COMPLETED: **11 December, 2023**

CASING STICKUP: **0.96 m**
TOTAL DEPTH: **5.49 m**
GROUND SURFACE ELEVATION: **994.39 m**

Union Street Geotechnical

DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE Type	SAMPLE No.	SPT "N"	POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
0.0		TOPSOIL: 102 mm thick.										Cap.
		TILL: Clay, silty, sandy, trace gravel. Brown (10YR 5/3). Oxidized. Dry. Very stiff. Massive. Calcareous.		MW37		144	7.0					Bentonite.
1.0												Solid 25 mm PVC casing.
2.0		MUDSTONE: Clay, silty, trace sand. Greyish brown (10YR 5/2). Non-oxidized. Moist. Hard. Massive. Calcareous.		MW38		-	6.0					
3.0												Auger cuttings.
4.0				MW39		-	15.7	CI	46.7	14.6		Hand slotted 25 mm PVC.
5.0				MW40		-	13.7					
6.0		NOTES: Refusal at 5.49 m below surface. No seepage or sloughing encountered during drilling. Piezometer installed, annulus backfilled to surface with auger cuttings. Piezometer dry on 30 January, 2024.										
7.0												
8.0												
9.0												

FIELD BOREHOLE LOG

BOREHOLE NUMBER: BH108

PROJECT NUMBER: **USG1809**
PROJECT NAME: **Geotechnical Investigation**
LOCATION: **S.E. 1/4 of 31-14-26 W4M, M.D. of Willow Creek No. 26, AB**
CLIENT: **Martin Geomatic Consultants Ltd.**
DRILLING METHOD: **150 mm Solid Stem Auger**
LOGGED BY: **M.W.**
DATE BEGUN: **11 December, 2023**
DATE COMPLETED: **11 December, 2023**

CASING STICKUP: **N/A**
TOTAL DEPTH: **3.66 m**
GROUND SURFACE ELEVATION: **992.00 m**

Union Street Geotechnical

DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE Type	SAMPLE No.	SPT "N"	POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
0.0		TOPSOIL: 127 mm thick.										
		SAND: Clayey, silty. Brown (10YR 5/2) to grey (10YR 6/1). Oxidized. Moist. Loose to dense. Massive. Calcareous.										
				MW41		-	5.6	CL-ML	25.2	18.5		
1.0												
												Auger cuttings.
2.0				MW42		-	14.9					
3.0				MW43		-	15.1					
		NOTES: Refusal at 3.66 m below surface. No seepage or sloughing encountered during drilling. Borehole backfilled to surface with auger cuttings.										
4.0												
5.0												

FIELD BOREHOLE LOG

BOREHOLE NUMBER: BH109

PROJECT NUMBER:	USG1809	CASING STICKUP:	1.07 m
PROJECT NAME:	Geotechnical Investigation	TOTAL DEPTH:	3.81 m
LOCATION:	S.E. 1/4 of 31-14-26 W4M, M.D. of Willow Creek No. 26, AB	GROUND SURFACE ELEVATION:	990.87 m
CLIENT:	Martin Geomatic Consultants Ltd.		
DRILLING METHOD:	150 mm Solid Stem Auger		
LOGGED BY:	M.W.		
DATE BEGUN:	11 December, 2023		
DATE COMPLETED:	11 December, 2023		

Union Street Geotechnical

DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE Type	SAMPLE No.	SPT "N"	POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
0.0		TOPSOIL: 127 mm thick.										Cap.
		SAND: Clayey, silty. Greyish brown (10YR 5/2) to dark greyish brown (10YR 4/2). Oxidized. Moist. Loose to compact. Massive. Calcareous.		MW44		-	8.3					Solid 25 mm PVC casing.
1.0												Bentonite.
2.0				MW45		-	14.9					Auger cuttings.
3.0		TILL: Clay, silty, sandy. Brown. Oxidized. Moist. Hard. Massive.		MW46		215	13.2					Hand slotted 25 mm PVC.
		MUDSTONE: Clay, silty, trace sand. Greyish brown (10YR 5/2). Non-oxidized. Moist. Hard. Massive. Calcareous.		MW47		-	13.1					
4.0		NOTES: Refusal at 3.81 m below surface. Sloughing, but no seepage encountered during drilling. Piezometer installed, annulus backfilled to surface with auger cuttings. Water level at 2.01 m below grade on 30 January, 2024.										
5.0												

FIELD BOREHOLE LOG

BOREHOLE NUMBER
BH110

PROJECT NUMBER: **USG1809**
PROJECT NAME: **Geotechnical Investigation**
LOCATION: **S.W. 1/4 of 31-14-26 W4M, M.D. of Willow Creek No. 26, AB**
CLIENT: **Martin Geomatic Consultants Ltd.**
DRILLING METHOD: **150 mm Solid Stem Auger**
LOGGED BY: **M.W.**
DATE BEGUN: **11 December, 2023**
DATE COMPLETED: **11 December, 2023**

CASING STICKUP: **N/A**
TOTAL DEPTH: **3.05 m**
GROUND SURFACE ELEVATION: **992.96 m**

Union Street Geotechnical

DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE Type	SAMPLE No.	SPT "N"	POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
0.0		TOPSOIL: 152 mm thick.										
		SAND: Clayey, silty, trace gravel. Brown (10YR 5/3) to dark greyish brown (10YR 4/2). Oxidized. Moist. Loose to compact. Massive. Calcareous.		MW48		-	8.2					
1.0												Auger cuttings.
2.0				MW49		120	8.4					
3.0		NOTES: End of borehole at 3.05 m below surface. No seepage or sloughing encountered during drilling. Borehole backfilled to surface with auger cuttings.										
4.0												
5.0												

FIELD BOREHOLE LOG

BOREHOLE NUMBER: BH111

PROJECT NUMBER: **USG1809**
PROJECT NAME: **Geotechnical Investigation**
LOCATION: **S.W. 1/4 of 31-14-26 W4M, M.D. of Willow Creek No. 26, AB**
CLIENT: **Martin Geomatic Consultants Ltd.**
DRILLING METHOD: **150 mm Solid Stem Auger**
LOGGED BY: **M.W.**
DATE BEGUN: **11 December, 2023**
DATE COMPLETED: **11 December, 2023**

CASING STICKUP: **N/A**
TOTAL DEPTH: **3.05 m**
GROUND SURFACE ELEVATION: **996.27 m**

Union Street Geotechnical

DEPTH (m)	LITHOLOGY	DESCRIPTION	SAMPLE Type	SAMPLE No.	SPT "N"	POCKET PEN (kPa)	MOISTURE CONT. (%)	USC	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	SULPHATE (%)	WELL INSTALLATION
0.0		TOPSOIL: 102 mm thick.										
		TILL: Clay, silty, sandy. Dark greyish brown (10YR 4/2). Oxidized. Dry. Very stiff. Massive. Calcareous.		MW50		-	11.8					
1.0												Auger cuttings.
2.0		MUDSTONE: Clay, silty, trace sand. Greyish brown (10YR 5/2). Non-oxidized. Dry. Very stiff. Massive. Calcareous.		MW51		144	9.4					
3.0		NOTES: End of borehole at 3.05 m below surface. Sloughing, but no seepage encountered during drilling. Borehole backfilled to surface with auger cuttings.										
4.0												
5.0												

Laboratory Test Results

Laboratory Proctor

Sample No.: W373

Sample Information

Date: 13-Dec-23 **By:** M.W. **of:** USG **Type:** Pail

Location: Ivy Ridge Hutterite Colony, M.D. of Willow Creek No. 26 **Natural Moisture:** 8.0 %

Description: Clay, silty, sandy, trace gravel

Specfication: ASTM D 698 - Method A

Comments: Sample obtained from Borehole BH105, 0.50 m to 1.52 m below grade

Proctor Results:

Test Number	1	2	3	4	5
Dry Density (Kg/m^3)	**1850**	**1920**	**1941**	**1886**	**1822**
Moisture Content (%)	**7.5**	**9.1**	**11.1**	**13.5**	**15.3**

Oversize Correction (Calculated using assumed Specific Gravity of 2.40)

Oversize (%)	5	10	15	20	25
Density	**1963**	**1985**	**2006**	**2027**	**2048**

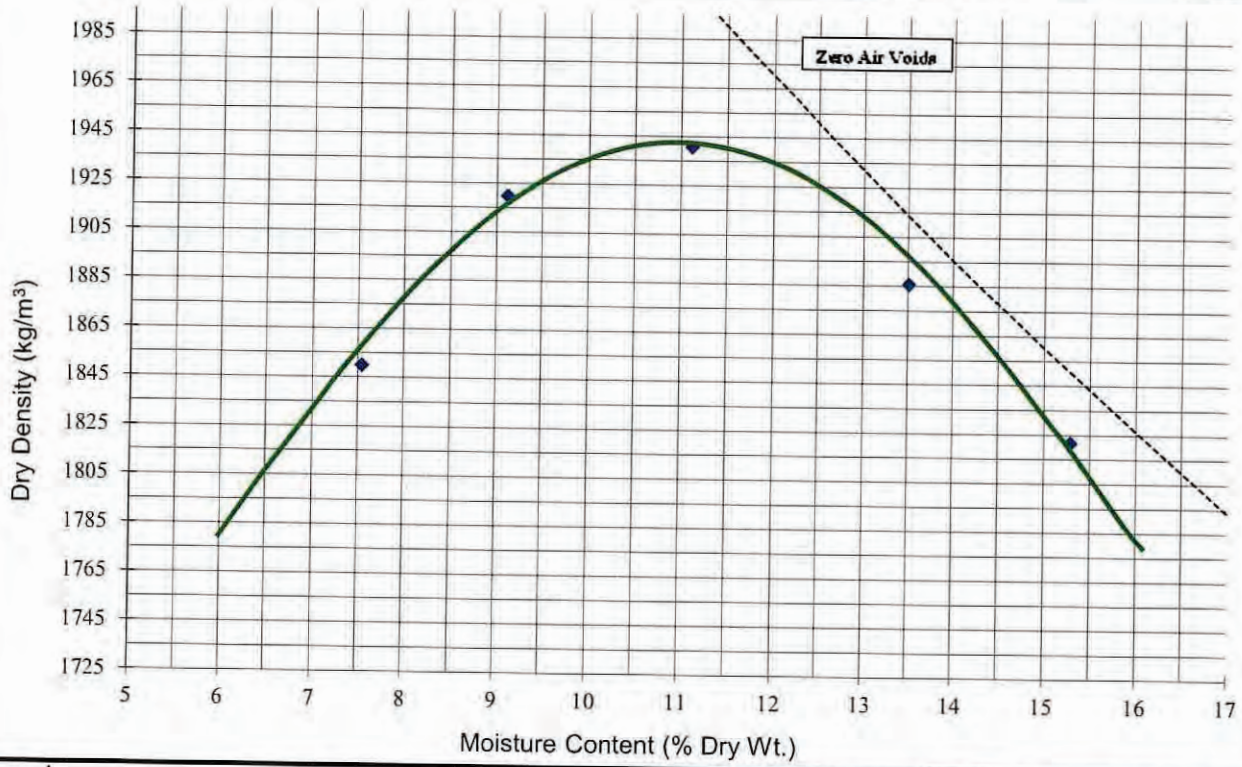
Optimum Results:

Moisture Content = **10.9** %

Dry Density = **1942** Kg/m^3

Corrected Density = **1952** Kg/m^3

Oversize Material = **2.3** %



Union Street Geotechnical

CLIENT: Martin Geomatic Consultants **FILE No.:** USG1809

PROJECT: 2023 Geotechnical Inv. **DATE:** 18-Dec-23

LOCATION: Red Deer, Alberta **TECH:** D.J.W.

Project Name:	Geotechnical Investigation	Depth:	3.05 m
Project Number:	USG1809	Testing Company:	Union Street Geo.
Client:		Field Technician:	M.W.
Testhole:	BH109	Sample Date:	11 December, 2023
Location:		Lab Technician:	B.B.
Sample Number:	MW46	Date Tested:	20 December, 2023

Flexible Wall Permeameter (ASTM D5084-10)

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

Material and Test Description

Material Description:
Clay till

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

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

Initial Sample Characteristics

Water Content	
Wet + Tare (g):	579.3
Dry + Tare (g):	513.2
Tare (g):	12.6
Water Content (%):	13.2%

Sample Size					
Trial	1	2	3	4	Average
Diameter (mm):	73.1	73.3	72.6	73	73.0
Length (mm):	83.7	83.8	83.4	83.6	83.6
Weight (g)	754.4				

Area (cm^2):	41.9
Volume (cm^3):	350.0
Wet Density (kg/m^3):	2155
Dry Density (kg/m^3):	1904

Specific Gravity (Note 2):	2.75
Void Ratio:	0.44
Saturation:	82.0%
Porosity:	30.7%

Final Sample Characteristics

Water Content	
Wet + Tare (g):	793.7
Dry + Tare (g):	664.2
Tare (g):	11.6
Water Content (%):	19.8%

Sample Size					
Trial	1	2	3	4	Average
Diameter (mm):	74.8	74.3	73.8	74.1	74.3
Length (mm):	84.8	84.8	84.8	84.8	84.8
Weight (g)	782.2				

Area (cm^2):	43.3
Volume (cm^3):	367.2
Wet Density (kg/m^3):	2130
Dry Density (kg/m^3):	1778

Specific Gravity (Note 1):	2.75
Void Ratio:	0.54
Saturation:	100.0%
Porosity:	35.3%

Note 1: Specific gravity for final sample characteristics calculation adjusted to result in 100.0% saturation.
Note 2: Specific gravity for initial sample characteristics calculation set equal to that of the final.

Project Name:	Geotechnical Investigation	Depth:	3.05 m
Project Number:	USG1809	Testing Company:	Union Street Geo.
Client:		Field Technician:	M.W.
Testhole:	BH109	Sample Date:	11 December, 2023
Location:		Lab Technician:	B.B.
Sample Number:	MW46	Date Tested:	20 December, 2023

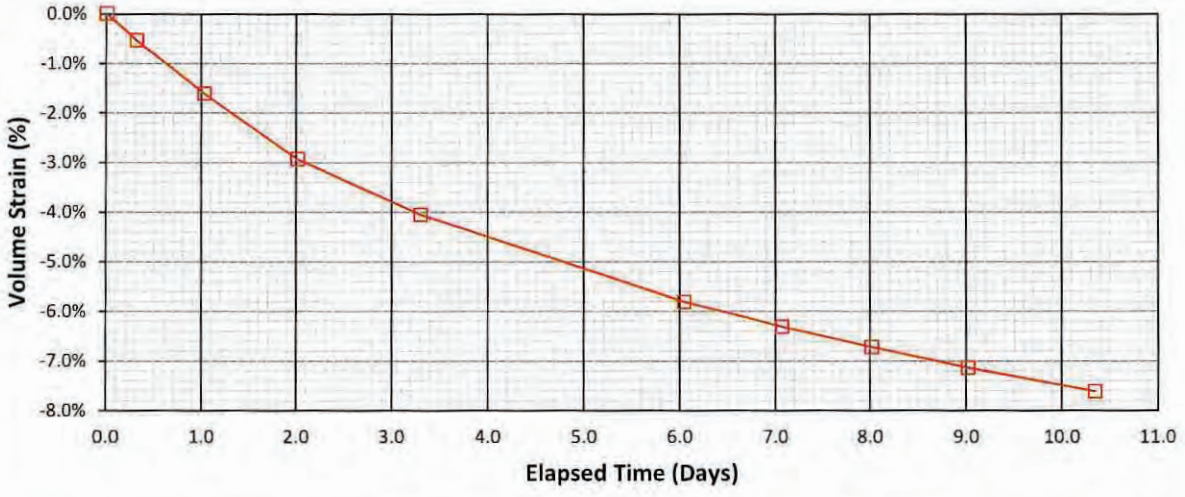
Flexible Wall Permeameter (ASTM D5084-10)

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

Saturation Data

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

Date & Time	Elapsed Time (Days)	Room Temp (°C)	Top Burret (mL)	Bottom Burret (mL)	Cell (mL)	Total Vol. Change (mL)	Volume Strain (%)
12/20/23 7:37	0.00	20.0	4.0	4.0	17.8	0	0.00%
12/20/23 15:04	0.31	20.0	3.8	4.1	19.8	-1.88	-0.54%
12/21/23 8:14	1.03	20.0	3.8	4.3	23.4	-5.66	-1.62%
12/22/23 7:50	2.01	20.0	4.3	4.7	27.1	-10.26	-2.93%
12/23/23 14:56	3.30	20.0	4.6	4.9	30.5	-14.20	-4.06%
12/26/23 8:38	6.04	20.0	5.0	5.1	36.0	-20.34	-5.81%
12/27/23 9:12	7.07	20.0	5.1	5.2	37.6	-22.10	-6.31%
12/28/23 7:48	8.01	20.0	5.2	5.2	38.9	-23.54	-6.73%
12/29/23 7:58	9.01	20.0	5.3	5.3	40.2	-24.98	-7.14%
12/30/23 15:49	10.34	20.0	5.4	5.4	41.7	-26.65	-7.61%
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-



Project Name:	Geotechnical Investigation	Depth:	3.05 m
Project Number:	USG1809	Testing Company:	Union Street Geo.
Client:		Field Technician:	M.W.
Testhole:	BH109	Sample Date:	11 December, 2023
Location:		Lab Technician:	B.B.
Sample Number:	MW46	Date Tested:	20 December, 2023

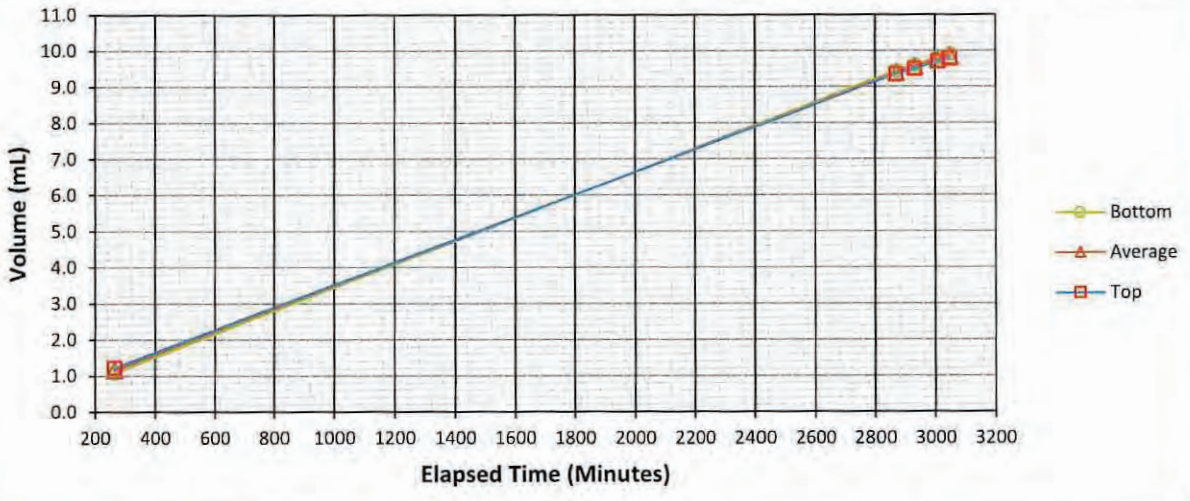
Flexible Wall Permeameter (ASTM D5084-10)

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

Permeation Data

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

Date & Time	Elapsed Time (Minutes)	Room Temp (°C)	Top Burret (mL)	Bottom Burret (mL)	Top Vol. Change (mL)	Bottom Vol. Change (mL)	Average Vol. Change (mL)
1/3/24 7:47	0	20.0	9.85	0.09	0.00	0.00	0.00
1/3/24 12:09	262	20.0	8.63	1.17	1.22	1.08	1.15
1/5/24 7:34	2867	20.0	0.52	9.52	9.33	9.43	9.38
1/5/24 8:36	2929	20.0	0.37	9.68	9.48	9.59	9.54
1/5/24 9:55	3008	20.0	0.17	9.89	9.68	9.80	9.74
1/5/24 10:35	3048	20.0	0.08	9.99	9.77	9.90	9.84
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-



Project Name:	Geotechnical Investigation	Depth:	3.05 m
Project Number:	USG1809	Testing Company:	Union Street Geo.
Client:		Field Technician:	M.W.
Testhole:	BH109	Sample Date:	11 December, 2023
Location:		Lab Technician:	B.B.
Sample Number:	MW46	Date Tested:	20 December, 2023

Flexible Wall Permeameter (ASTM D5084-10)

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

Permeation Data

Head Difference (m):	2.0	Area of Sample (m^2)	4.258E-03
Length of Sample (m):	8.421E-02	Gradient, i	2.421E+01

Elapsed Time (Minutes)	Average Volume Change (mL)	Average Temperature (°C)	k_t (m/s)	R_T	k_{20} (m/s)
2867	9.38	20.0	5.108E-10	1.000	5.108E-10
2929	9.54	20.0	5.083E-10	1.000	5.083E-10
3008	9.74	20.0	5.058E-10	1.000	5.058E-10
3048	9.84	20.0	5.040E-10	1.000	5.040E-10
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	AVERAGE	5.072E-10		5.072E-10