Technical Document LA21018

Part 2 — Technical Requirements

NRCB Natural Resources Conservation Board

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

NRCB USE ONLY	Application number	Legal land description
☒ Approval ☐ Registration ☐ Authorization ☐ Amendment	LA21018	SW 11-15-18 W4M

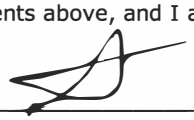
APPLICATION DISCLOSURE

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.

July 8, 2021
Date of signing


Signature

JBC Cattle Inc.
Corporate name (if applicable)

Shane Schooten
Print name

GENERAL INFORMATION REQUIREMENTS

Proposed facilities. List all proposed confined feeding operation facilities and their measurements, including if it is an addition to a an existing facility (attach additional pages if needed)

Proposed manure collection areas & manure storage facilities	Dimensions (m)
Proposed typical Pen (within pen areas 1-3)	62 x 80
Proposed Effluent Pond (total 5 - same size) Catch Basins #1-5	122 x 24.5 x 3.5 deep
Area 1 -Requiring Compacted Clay Liner Pen area A1	431 x 80
Area 2A & 2B - Confirmed Naturally Occuring Liner Pen area 2A & 2B	274x416 & 336x431
Area 3 - Requiring Compacted Clay Liner Pen area 3	705 x 144

Existing facilities. List **ALL** existing confined feeding operation facilities and their measurements (use additional pages if needed)

Existing barns, manure collection areas & manure storage facility	Dimensions (m)	NRCB USE ONLY
None on site		
AO comments: New CFO		

NRCB USE ONLY

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If a new facility is replacing an old facility, what will be done with the old facility and when? ☑ **N/A**

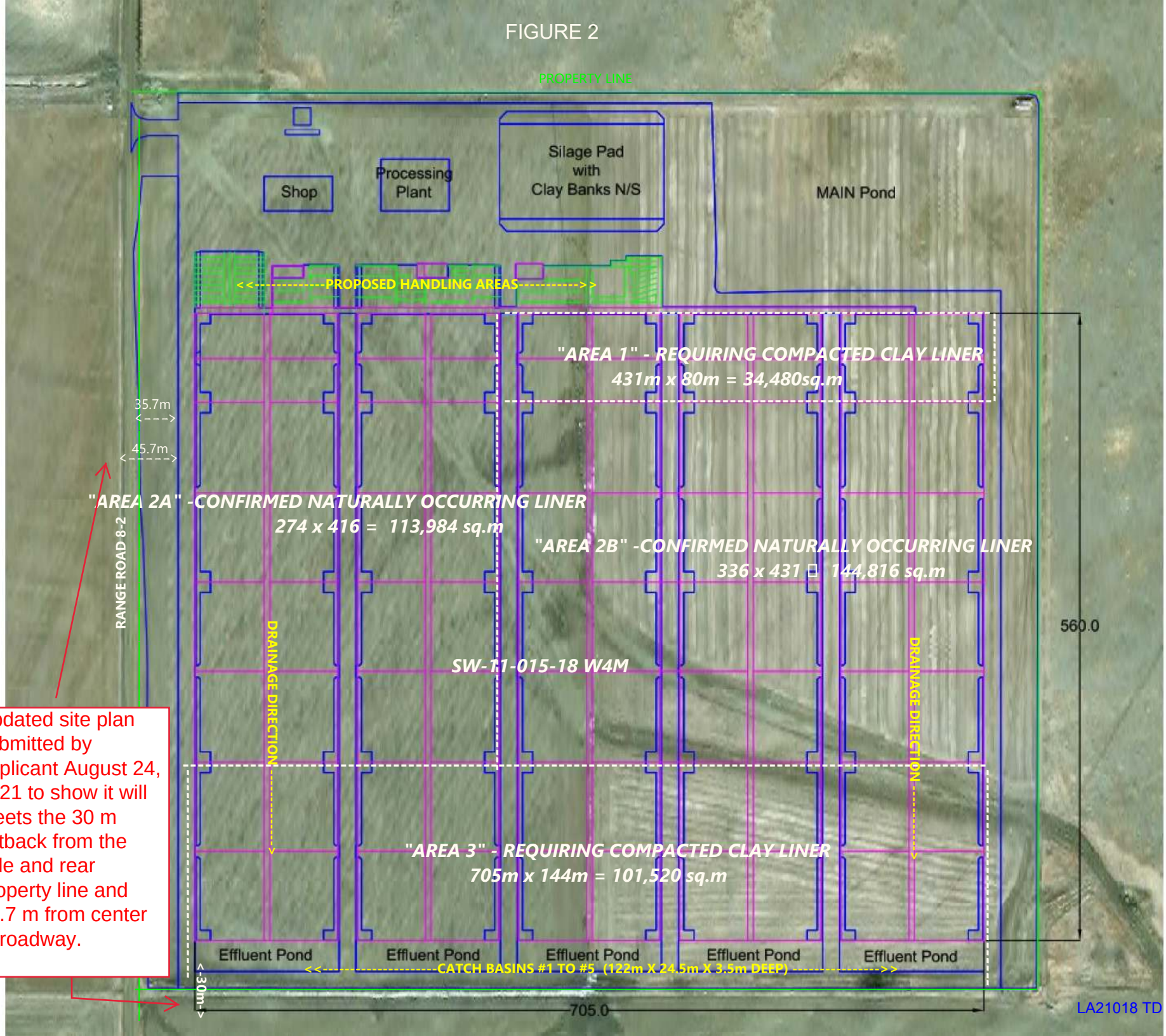
Proposed construction completion date: Fall 2024

Additional information:

Livestock Numbers: (include all livestock)
Note: Livestock numbers in this table will be used when processing the application)

Livestock type/ category	Existing number	Change in number (if applicable)	Total
beef finishers	0	30,000	30,000

FIGURE 2



Updated site plan submitted by applicant August 24, 2021 to show it will meets the 30 m setback from the side and rear property line and 45.7 m from center of roadway.

FIGURE 2

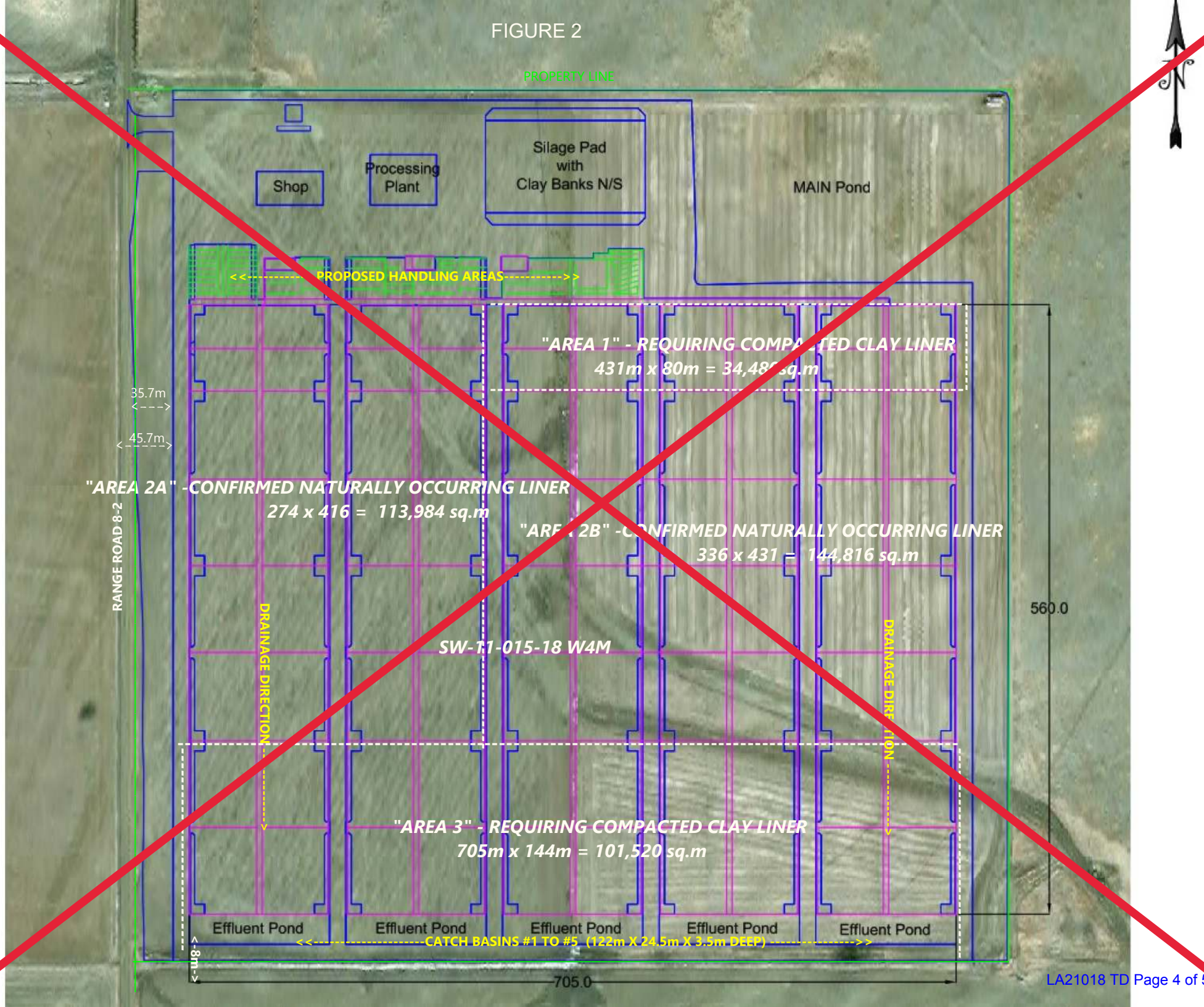
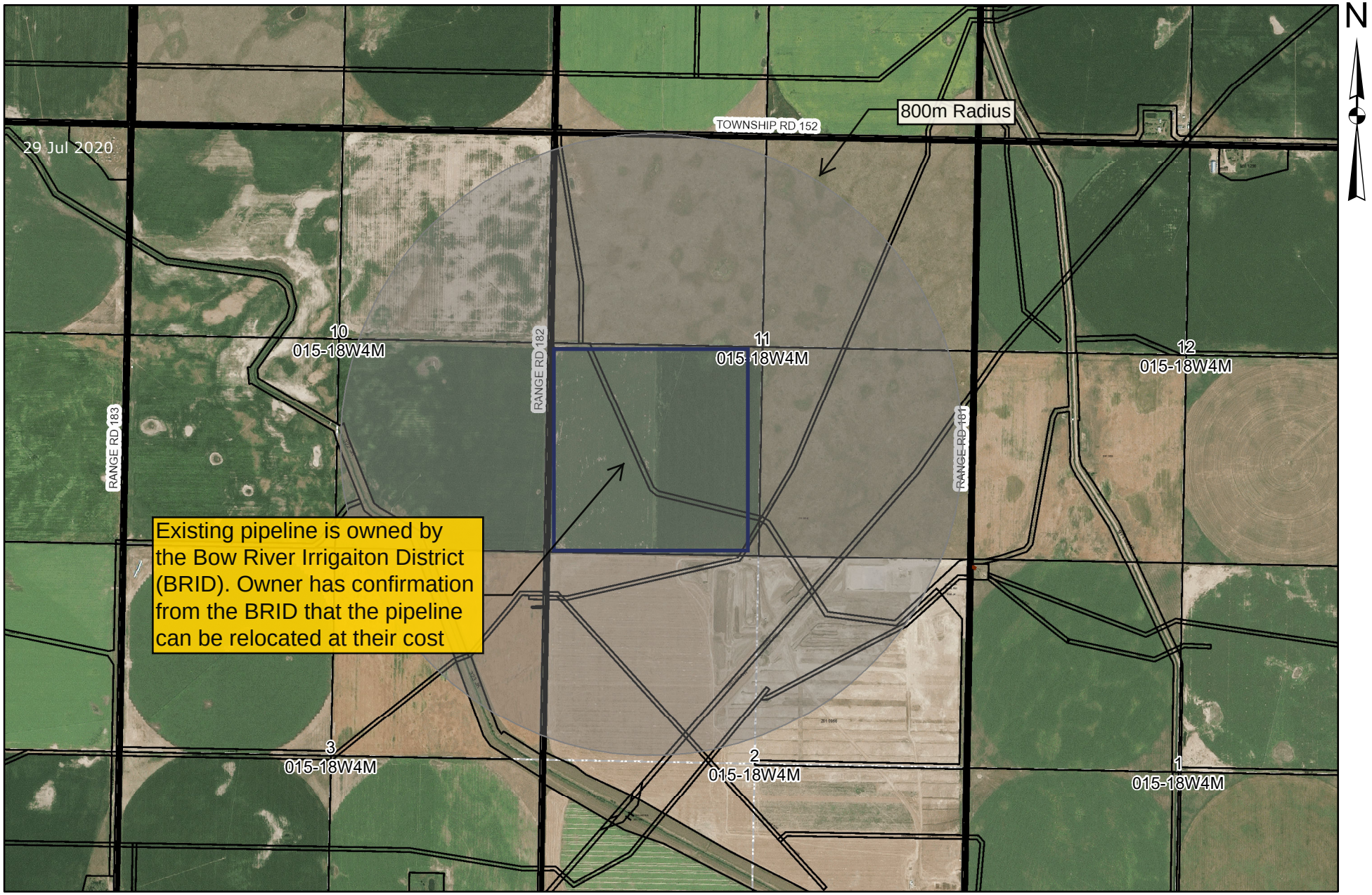

PROPERTY LINE
Shop
Processing Plant
Silage Pad with Clay Banks N/S
MAIN Pond
<<---------- PROPOSED HANDLING AREAS ---------->>
"AREA 1" - REQUIRING COMPACTED CLAY LINER
431m x 80m = 34,480 sq.m
35.7m
45.7m
"AREA 2A" -CONFIRMED NATURALLY OCCURRING LINER
274 x 416 = 113,984 sq.m
"AREA 2B" -CONFIRMED NATURALLY OCCURRING LINER
336 x 431 = 144,816 sq.m
RANGE ROAD 8-2
DRAINAGE DIRECTION
DRAINAGE DIRECTION
560.0
SW-11-015-18 W4M
"AREA 3" - REQUIRING COMPACTED CLAY LINER
705m x 144m = 101,520 sq.m
Effluent Pond
Effluent Pond
Effluent Pond
Effluent Pond
Effluent Pond
<<---------- CATCH BASINS #1 TO #5 (122m X 24.5m X 3.5m DEEP) ---------->>
<-8m->
705.0

Figure 1



WELLS

- Abandoned Wellhead
- Suspended Gas Wellhead
- Suspended Oil Wellhead
- Flowing Gas Wellhead
- Location Wellhead
- Flowing Oil Wellhead
- Miscellaneous Wellhead
- Water Wellhead
- Well Downhole Location
- Newly Licenced Well
- Newly Spudded Well
- AB Environment Water Well
- User Water Well
- Monitor Well

PIPELINES

- Gas Pipeline
- Oil Pipeline
- Water Pipeline
- LVP/HVP Pipeline
- Foreign Pipeline (When Filtering by Company)
- Gas Co-op Pipeline (Low Pressure)

0 162.5 325 650 975 1,300 m

AO comments: applicant is responsible for any costs associated with relocating any pipelines

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DECLARATION AND ACKNOWLEDGMENT OF APPLICANT CONCERNING *WATER ACT* LICENCE

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

Date and sign one of the following four options

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 AEP 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** AEP'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 AEP 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 AEP'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.

Signed this 30 day of June, 20 21. _____

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 AEP under the *Water Act* for the development or activity proposed in this AOPA application.

Signed this ____ day of _____, 20 21. _____

Signature of Applicant or Agent

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

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

Signed this ____ day of _____, 20____. _____

Signature of Applicant or Agent

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GENERAL WATER INFORMATION – PROPOSED **Use the proposed manure storage facility that is closest to a common body of water or water well**			**NRCB USE ONLY** **Comments**	**Meets regulations**
Proposed facility name Catch basin (SW corner)			Worse case scenario	
Flood plain information What is the elevation of the floor of the lowest **proposed** manure storage or collection facility above the 1:25 year flood plain or the highest known flood level?	>10 (m)	☑ Estimated ☐ From records	Not located in a known flood plain	☒ YES ☐ NO ☐ YES with exemption
Springs, wells, and surface water information a. How many springs are within 100 m of **proposed** manure storage facilities or manure collection areas?		0	Confirmed	☒ YES ☐ NO ☐ YES with exemption
b. How many water wells are within 100 m of **proposed** manure storage facilities or manure collection areas?		0	Confirmed	☒ YES ☐ NO ☐ YES with exemption
c. What is the shortest distance from a **proposed** manure collection or storage facility to a surface water body? (ie, lake, creek, slough, seasonal, etc.)		470m canal	482 m	☒ YES ☐ NO ☐ YES with exemption
Groundwater information a. What is the depth to bedrock?	54.86 (m)	☐ Estimated ☐ Measured ☑ Drilling reports	N/A	
b. What is the depth to the water table?	5.4+ (m)	☐ Estimated ☐ Measured ☑ Drilling reports	5.4 m from eng report	☒ YES ☐ NO ☐ YES with exemption
c. What is the shallowest depth to the uppermost groundwater resource?	70 (m)	☐ Estimated ☐ Measured ☑ Drilling reports	10.67 m (water well #237253)	☒ YES ☐ NO ☐ YES with exemption

Additional information: (attach borehole logs and records, as required)

Chilako Drilling Report from December 8 & 14, 2020 (attached). Water levels 5.4m BGL at the shallowest location.

Water well record #223714 from NE14-015-18 W4M (attached). Static water level 39.62m below ground level.
54.86m to bedrock

AO comments: drilling logs seen on page 45-50 of this technical document.

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 223714
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1986/03/07

GOWN ID

Well Identification and Location

Measurement in Metric

Owner Name	Address	Town	Province	Country	Postal Code
ELLEFSON, GRANT	P.O. BOX 285 LOMOND				

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	NE	14	15	18	4				

Measured from Boundary of
m from
m from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 50.262781 Longitude -112.370091
How Location Obtained
Map

Elevation m
How Elevation Obtained
Not Obtained

Drilling Information

Method of Drilling
Rotary

Proposed Well Use
Stock

Type of Work
New Well

Formation Log

Measurement in Metric

Depth from ground level (m)	Water Bearing	Lithology Description
13.11		Brown Sandy Clay
14.02		Dry Gravel
54.86		Blue Claystone
56.69		Blue Sandstone
59.44		Brown Shale
64.62		Blue Sandy Shale
70.41	Yes	Blue Water Bearing Sandstone
70.71		Hard Bentonite
75.29	Yes	Blue Water Bearing Sandstone
77.72		Blue Shale

Yield Test Summary

Measurement in Metric

Recommended Pump Rate 22.73 L/min

Test Date	Water Removal Rate (L/min)	Static Water Level (m)
1986/02/25	22.73	39.62

Well Completion

Measurement in Metric

Total Depth Drilled	Finished Well Depth	Start Date	End Date
77.72 m		1986/02/12	1986/02/25

Borehole

Diameter (cm)	From (m)	To (m)
0.00	0.00	77.72

Surface Casing (if applicable)
Size OD : 0.00 cm
Wall Thickness : 0.000 cm
Bottom at : 0.00 m

Well Casing/Liner
Steel
Size OD : 14.12 cm
Wall Thickness : 0.478 cm
Top at : 0.00 m
Bottom at : 72.54 m

Perforations

From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval(cm)
62.48	70.10	0.000		0.00

Perforated by Unknown

Annular Seal Driven
Placed from 0.00 m to 58.52 m
Amount
Other Seals

Type	At (m)

Screen Type
Size OD : 0.00 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
M&M DRILLING CO. LTD.

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.

GOWN ID

GIC Well ID 223714
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1986/03/07

Well Identification and Location

Measurement in Metric

Owner Name	Address	Town	Province	Country	Postal Code
ELLEFSON, GRANT	P.O. BOX 285 LOMOND				

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	NE	14	15	18	4				

Measured from Boundary of
m from
m from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 50.262781 Longitude -112.370091
How Location Obtained
Map

Elevation m
How Elevation Obtained
Not Obtained

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 22.73 L/min
Recommended Pump Intake Depth (From TOC) 71.63 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

Well Disinfected Upon Completion
Geophysical Log Taken
Submitted to ESRD

Sample Collected for Potability Submitted to ESRD

Additional Comments on Well

Yield Test

Taken From Ground Level
Measurement in Metric

Test Date	Start Time	Static Water Level
1986/02/25	12:00 AM	39.62 m

Depth to water level

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

Method of Water Removal

Type Bailer
Removal Rate 22.73 L/min
Depth Withdrawn From 71.63 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
M&M DRILLING CO. LTD.

Copy of Well report provided to owner

Date approval holder signed

NRCB Natural Resources Conservation Board

NRCB USE ONLY

ENVIRONMENTAL RISK SCREENING INFORMATION

ERST for **proposed** facilities

Facility	Groundwater score	Surface water score	File number
Catch basins #1-5	Low	Low	LA21018
Feedlot pens (natural and compacted)	Low	Low	LA21018

ERST for **existing** facilities

Facility	Groundwater score	Surface water score	File number
N/A - New CFO			

NRCB Natural Resources Conservation Board

NRCB USE ONLY

WATER WELL AND SURFACE WATER INFORMATION

Well IDs: Well ID 237253 _____ _____ _____

_____ _____ _____

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

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

Name	Legal Land Description	Distance (m)	Zoning (LUB) Category	MDS Cat (1-4)	Distance (m)	Meets Regulations
Marlene Wiest	SE-03-15-18 W4M	1500	Ag	1	1,594 m	Yes
Serfas Farms Ltd	NW-34-014-18 W4M	1730	Ag	1	1,665 m	Yes
Melvin & Martha Crowson	SW-13-015-18 W4M	1800	Ag	1	1,850 m	Yes
Chinook Hay Farms Ltd	NE12-015-18 W4M	1930	Ag	1	2,043 m	Yes

Methods used/margins of error to determine distance:

Additional information:

No residence's in the MDS

NRCB USE ONLY

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

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

Requirements: Category 1: 1,316 m Category 2: 1,755 m Category 3: 2,194 m Category 4: 3,510 m

Technology factor: ☐ YES ☒ NO

Expansion factor: ☐ YES ☒ NO

Waivers required: ☐ YES ☒ NO # _____

Waivers attached: ☐ Waivers in file: ☐

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

Comments:

Name	JBC Cattle
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	30,000	13,377.0
	Beef Feeders (450 - 900 lbs)	0.700	0.700	0.500	0.2450		-
	Beef Feeder Calves (<550 lbs)	0.700	0.700	0.275	0.1348		-
	Horses - PMU	0.650	0.700	1.000	0.4550		-
	Horses - Feeders > 750 lbs	0.650	0.700	1.000	0.4550		-
	Horses - Foals < 750 lbs	0.650	0.700	0.300	0.1365		-
	Mules	0.600	0.700	1.000	0.4200		-
	Donkeys	0.600	0.700	0.670	0.2814	-	-
	Bison	0.600	0.700	1.000	0.4200		-
	Other						-
Dairy (*count lactating cows only)	Free Stall – Lactating Cows with all associated dries, heifers, and calves*	0.800	1.100	2.000	1.7600		-
	Free Stall – Lactating Cows with Dry Cows only*	0.800	1.100	1.640	1.4432		-
	Free Stall – Lactating Cows only	0.800	1.100	1.400	1.2320		-
	Tie Stall – Lactating Cows only	0.800	1.000	1.400	1.1200		-
	Loose Housing – Lactating Cows only	0.800	1.000	1.400	1.1200		-
	Dry Cow	0.800	0.700	1.000	0.5600		-
	Replacements – Bred Heifers (Breeding to Calving)	0.800	0.700	0.875	0.4900		-
	Replacements - Growing Heifers (350 lbs to breeding)	0.800	0.700	0.525	0.2940		-
	Calves (< 350 lbs)	0.800	0.700	0.200	0.1120		-
	Other						-
Swine Liquid (*count sows only)	Farrow to finish *	2.000	1.100	1.780	3.9160		-
	Farrow to wean *	2.000	1.100	0.670	1.4740		-
	Farrow only *	2.000	1.100	0.530	1.1660		-
	Feeders/Boars	2.000	1.100	0.200	0.4400		-
	Growers/Roasters	2.000	1.100	0.118	0.2600		-
	Weaners	2.000	1.100	0.055	0.1210		-
	Other						-
Swine Solid (*Count sows only)	Farrow to finish *	2.000	0.800	1.780	2.8480		-
	Farrow to wean *	2.000	0.800	0.670	1.0720		-
	Farrow only *	2.000	0.800	0.530	0.8480		-
	Feeders/Boars	2.000	0.800	0.200	0.3200		-
	Growers/Roasters	2.000	0.800	0.118	0.1888		-
	Weaners	2.000	0.800	0.055	0.0880		-
	Other						-
Poultry	Chicken - Breeders - Solid	1.000	0.700	0.010	0.0070		-
	Chicken - Layers - Liquid (includes associated pullets)	2.000	1.100	0.008	0.0176		-
	Chicken - Layers - (Belt Cage)	2.000	0.700	0.008	0.0112		-
	Chicken - Layers - (Deep Pit)	2.000	0.700	0.008	0.0112		-
	Chicken - Pullets/Broilers	1.000	0.700	0.002	0.0014		-
	Turkey - Toms/Breeders	1.000	0.700	0.020	0.0140		-
	Turkey - Hens (light)	1.000	0.700	0.013	0.0091		-
	Turkey - Broilers	1.000	0.700	0.010	0.0070		-
	Ducks	1.000	0.700	0.010	0.0070		-
	Geese	1.000	0.700	0.020	0.0140		-
	Other						-
Sheep and Goats	Sheep - Ewes/Rams	0.600	0.700	0.200	0.0840		-
	Sheep - Ewes with lambs	0.600	0.700	0.250	0.1050		-
	Sheep - Lambs	0.600	0.700	0.050	0.0210		-
	Sheep - Feeders	0.600	0.700	0.100	0.0420		-
	Goats - Meat/Milk (per Ewe)	0.700	0.700	0.170	0.0833		-
	Goats - Nannies/Billies	0.700	0.700	0.140	0.0686		-
	Goats - Feeders	0.700	0.700	0.077	0.0377		-
	Other						-
Cervid	Elk	0.600	0.700	0.600	0.2520		-
	Deer	0.600	0.700	0.200	0.0840		-
	Other						-
Wild Boar	Feeders	2.000	0.800	0.140	0.2240		-
	Sow (farrowing)	2.000	0.800	0.371	0.5936		-
	Other						-
					Total		13,377.0

For New Operations

Dispersion Factor	1

Category	Odour Objective	Distance	
		Feet	Metres
1	41.04	4,318	1,316
2	54.72	5,758	1,755
3	68.4	7,197	2,194
4	109.44	11,515	3,510

For Expanding Operations

Dispersion Factor	1
Expansion Factor	0.77

Category	Odour Objective	Distance	
		Feet	Metres
1	41.04	3,325	1,013
2	54.72	4,433	1,351
3	68.40	5,542	1,689
4	109.44	8,867	2,703

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LAND BASE FOR MANURE AND COMPOST APPLICATION (for approvals and registrations only)

Name of landowner(s)*	Legal Land Description	Area ** (usable hectares)	Soil Zone	NRCB USE ONLY Area unsuitable:
Please see attached		1191.8	total irrigated	
Please see attached		1578.3	total brown	
	TOTAL	2770.1 ha		

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

** Available manure spreading area (do not include required setback areas from residences, common bodies of water, water wells, etc.) (to convert from acres to hectares divide acres by 2.47)

Additional information: (attach copies of all signed land use agreements)

NRCB USE ONLY

Land base required: 1,860 ha irrigated or 3,750 ha brown

Land base listed: 1,191.8 ha irrigated and 1,578.3 ha brown

Area not suitable: N/A

Available area: 1,191.8 ha irrigated and 1,578.3 ha brown

AO comment: 1 acre of irrigated is equivalent to about 2 acres of brown. The applicant has provided sufficient land base for manure and compost application.

Requirement Met: ☒ YES ☐ NO

Land spreading agreements required: ☒ YES ☐ NO If yes, Agreements in file: ☒ Agreements attached: ☒

Manure Management Plan: ☐ YES ☒ NO Plan attached: ☐ Plan in file: ☐

Serfas Farms Manure Spreading Agreement Acres

Irrigated						
VanderStoel N	SE	18	14	19	160	
VanderStoel S	NE	7	14	19	160	
						320
Dryland						
JS1	SW	1	13	18	160	
JS2	SE	1	13	18	160	
JS3	NE	21	12	18	160	
JS4	NW	22	12	18	160	
JS5	NW	15	12	18	160	
JS6	SW	15	12	18	160	
JS7	SE	16	12	18	160	
RT2	NW	5	12	17	160	
W1	NW	8	12	18	160	
W2	NE	8	12	18	160	
W3	SW	13	12	18	160	
P1	SE	12	12	18	160	
P2	NE	2	12	18	160	
P3	SW	1	12	18	160	
GN2	SE	34	12	19	155	
GN4	NW	23	12	19	160	
HD1	NE	23	12	19	160	
T1	NW	19	12	18	130	
T2	NE	19	12	18	160	
L 1	NE	32	12	18	160	
L2	NW	33	12	18	160	
						3325

Manure Spreading Agreement

Serfas Farms Ltd _____ agree to allow JBC Cattle Inc _____ (applicant) to spread manure on the following fields during 2021-2022 _____ (calendar year).

Land location	Acres	Suitable for spreading	Soil zone
See Attached Schedule			

Signed: Kevin Serfas _____

Date: July 7, 2021 _____

Prairieview Manure Agreement
xxxxxxxxxxxxxxxxxxxxxxxxxx

The Manufacturers' Life Insurance Company

							Total Acres	Irrigation	Dryland
42	**Pigfarm East**	SE	25	13	17		160	130	30
49	**Dryland West**	NE	27	13	17		160	130	30
50	**Dryland East**	NW	26	13	17		160	130	30
43	Pigfarm West	SW	25	13	17		160	130	30
44	Pigfarm SW	NE	23	13	17		160	130	30
27	**Leeson**	SE	3	13	16		160	155	5
46	**Broderson SE**	SW	14	13	17		160	130	30
47	**Broderson SW**	SE	15	13	17		160	130	30
48	**Broderson N**	NE	15	13	17		160	130	30
30	**Hart NW**	SE	14	13	17		160	130	30
28	**Hart**	NE	12	13	17		160	130	30
29	**Hart**	NW	12	13	17		160	130	30
53	**Brown**	SW	13	13	17		160	130	30
31	**Parkinson 1A**	SW	12	13	17		160	130	30
33	**Parkinson 3**	SW	1	13	17		160	130	30
37	**Parkinson 6**	NE	35	12	17		160	130	30
32	**Parkinson 1**	NW	1	13	17		160	130	30
34	**Parkinson 5**	NW	36	12	17		160	130	30
35	**Parkinson 2**	NE	2	13	17		160	130	30
36	**Parkinson 4**	SE	2	13	17		160	130	30
								2625	**575**

Manure Spreading Agreement

Prairieview Seed Potatoes Ltd. agree to allow JBC Cattle Inc (applicant) to spread manure on the following fields during 2021 -2022 (calendar year).

Land location	Acres	Suitable for spreading	Soil zone
See Attached Schedule			

Signed: DocuSigned by: Josh Sawchuk ED6E750B1E6E480...

Date: July 7, 2021

Name	JBC Cattle	
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)	30000.0	3750.0	3120.0	2340.0	1860.0
	Feeders (450 - 900 lbs)	0.0	0.0	0.0	0.0	0.0
	Feeder Calves (<550 lbs)	0.0	0.0	0.0	0.0	0.0
	Horses - PMU	0.0	0.0	0.0	0.0	0.0
	Horses - Feeders > 750 lbs	0.0	0.0	0.0	0.0	0.0
	Horses - Foals < 750 lbs	0.0	0.0	0.0	0.0	0.0
	Mules	0.0	0.0	0.0	0.0	0.0
	Donkeys	0.0	0.0	0.0	0.0	0.0
	Bison	0.0	0.0	0.0	0.0	0.0
	Other	0.0				
Dairy (*count lactating cows only)	Free Stall – Lactating Cows with all associated dries, heifers, and calves*	0.0	0.0	0.0	0.0	0.0
	Free Stall – Lactating Cows with Dry Cows only *	0.0	0.0	0.0	0.0	0.0
	Free Stall – Lactating Cows only*	0.0	0.0	0.0	0.0	0.0
	Tie Stall – Lactating Cows only	0.0	0.0	0.0	0.0	0.0
	Loose Housing – Lactating Cows only	0.0	0.0	0.0	0.0	0.0
	Dry Cow (Solid manure)	0.0	0.0	0.0	0.0	0.0
	Dry Cow (Liquid manure)	0.0	0.0	0.0	0.0	0.0
	Replacements – Bred Heifers (Breeding to Calving)	0.0	0.0	0.0	0.0	0.0
	Replacements - Growing Heifers (350 lbs to breeding)	0.0	0.0	0.0	0.0	0.0
	Calves (< 350 lbs)	0.0	0.0	0.0	0.0	0.0
	Other	0.0				
Swine Liquid (*count sows only)	Farrow to finish *	0.0	0.0	0.0	0.0	0.0
	Farrow to wean *	0.0	0.0	0.0	0.0	0.0
	Farrow only *	0.0	0.0	0.0	0.0	0.0
	Feeders/Boars	0.0	0.0	0.0	0.0	0.0
	Growers/Roasters	0.0	0.0	0.0	0.0	0.0
	Weaners	0.0	0.0	0.0	0.0	0.0
	Other	0.0				
Swine Solid (*Count sows only)	Farrow to finish *	0.0	0.0	0.0	0.0	0.0
	Farrow to wean *	0.0	0.0	0.0	0.0	0.0
	Farrow only *	0.0	0.0	0.0	0.0	0.0
	Feeders/Boars	0.0	0.0	0.0	0.0	0.0
	Growers/Roasters	0.0	0.0	0.0	0.0	0.0
	Weaners	0.0	0.0	0.0	0.0	0.0
		0.0				
Poultry	Chicken - Breeders - Solid	0.0	0.0	0.0	0.0	0.0
	Chicken - Layers - Liquid (includes associated pullets)	0.0	0.0	0.0	0.0	0.0
	Chicken - Layers - (Belt Cage)	0.0	0.0	0.0	0.0	0.0
	Chicken - Layers - (Deep Pit)	0.0	0.0	0.0	0.0	0.0
	Chicken - Pullets/Broilers	0.0	0.0	0.0	0.0	0.0
	Turkey - Toms/Breeders	0.0	0.0	0.0	0.0	0.0
	Turkey - Hens (light)	0.0	0.0	0.0	0.0	0.0
	Turkey - Broilers	0.0	0.0	0.0	0.0	0.0
	Ducks	0.0	0.0	0.0	0.0	0.0
	Geese	0.0	0.0	0.0	0.0	0.0
	Other	0.0				
Goats and Sheep	Sheep - Ewes/Rams	0.0	0.0	0.0	0.0	0.0
	Sheep - Ewes with lambs	0.0	0.0	0.0	0.0	0.0
	Sheep - Lambs	0.0	0.0	0.0	0.0	0.0
	Sheep - Feeders	0.0	0.0	0.0	0.0	0.0
	Goats - Meat/Milk (per Ewe)	0.0	0.0	0.0	0.0	0.0
	Goats - Nannies/Billies	0.0	0.0	0.0	0.0	0.0
	Goats - Feeders	0.0	0.0	0.0	0.0	0.0
	Other	0.0				
Cervid	Elk	0.0	0.0	0.0	0.0	0.0
	Deer	0.0	0.0	0.0	0.0	0.0
	Other	0.0				
Wild Boar	Feeders	0.0	0.0	0.0	0.0	0.0
	Sow (farrowing)	0.0	0.0	0.0	0.0	0.0
	Other	0.0				
	Total Hectares		3,750	3120.0	2340.0	1860.0
	Total Acres		9,266	7709.5	5782.1	4596.1

NRCB Natural Resources Conservation Board

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MINIMUM DISTANCE SEPARATION

AO comments: See page 12

Methods used to determine distance (if applicable): _____

Margin of error (if applicable): _____

Requirements (m): Category 1:_____ Category 2:_____ Category 3:_____ Category 4:_____

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: _____

Land base listed: _____

Area not suitable: _____

Available area _____

AO comments: See page 14

Requirement met: ☐ YES ☐ NO

Land spreading agreements required: ☐ YES ☐ NO

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

AO comment: completed above

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 _____

NRCB USE ONLY

ALL SIGNATURES IN FILE ☒ YES ☐ NO

DATES OF APPROVAL OFFICER SITE VISITS

June 3, 2021	

CORRESPONDENCE WITH MUNICIPALITIES AND REFERRAL AGENCIES

Date deeming letters sent: July 22, 2021

Municipality: M.D. of Taber

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

Alberta Health Services:

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

Alberta Environment and Parks: ☐ N/A

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

Alberta Transportation: ☐ N/A

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

Alberta Regulatory Services: ☒ N/A

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

Other: BRID (Bow River Irrigation District) ☐ N/A

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

Other: _____ ☐ N/A

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

Part 2 — Technical Requirements

NRCB Natural Resources Conservation Board

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

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

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

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

1. Area 2A (113,984 sq. m)
2. Area 2B (144,816 sq. m)

Manure storage capacity

	Length (m)	Width (m)	Depth below ground level (m)	**NRCB USE ONLY** Estimated storage capacity (m^3)
1.	416	274	1.29	
2.	336	431	1.29	
			TOTAL CAPACITY	

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

Surface water control systems

Describe the run-on and runoff control system

Run-on is controlled by site grading to direct surface water flow around pen and catch basin areas.
Run-off from new pens to be captured in the new catch basin to be constructed at the south side of the new pens.
~~The new pen/catch basin area will be graded so that surface water around the facilities does not run into the proposed expansion area.~~

Naturally occurring protective layer details

Thickness of naturally occurring protective layer	>2m (m)	Provide details (as required) For "Area 2" (see Figure 2), a minimum of 2 m of naturally occuring clay was identified below the surface of each of the boreholes advanced in the area of the proposed pens.	
Soil ~~texture~~Class CI - med plastic clay	n/a % sand	n/a % silt	n/a % clay
Hydraulic conductivity - naturally occurring protective layer	Depth and type of soil tested 2.0m-44m depth medium plastic CLAY till	Hydraulic conductivity (cm/s) 3.6 x 10(-8) cm/sec to 8.0 x 10(-7) cm/sec (varies)	Describe test standard used in-situ falling head test

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

The naturally occuring soil conditions are summarized in Wood's report BX11555 dated 18 June 2021, attached.

NRCB USE ONLY

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

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

NRCB USE ONLY

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

Depth to water table: varies 5.4 - 8.6 m Requirements met: ☒ YES ☐ NO

Depth to uppermost groundwater resource: 10.67 m Requirements met: ☒ YES ☐ NO

ERST completed: ☒ see ERST page for details

Surface water control systems

Requirements met: ☒ YES ☐ NO Details/comments:

Naturally occurring protective layer details

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

See discussion in Wood engineering report attached.

Part 2 — Technical Requirements

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

SOLID MANURE, COMPOST & COMPOSTING MATERIALS: Barns, feedlots & storage facilities - 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. Area 1 (34,480 sq.m) **2.** Area 3 (104,520 sqm)

Manure storage capacity

	Length (m)	Width (m)	Estimated storage capacity (m^3)	Depth below grade to the bottom of the liner (m)
1.	431	80		1.29
2.	705	~~155~~ 144		1.29

NRCB USE ONLY

Depth to water table: varies 5.4 - 8.6 m Requirements met: ☒ YES ☐ NO

Depth to UGR: 10.67 m Requirements met: ☒ YES ☐ NO

ERST completed: ☒ YES ☐ NO

Groundwater risk level: Low Surface Water risk level: Low

UGR: Uppermost Groundwater Resource as defined under AOPA's *Standards and Administration Regulation*.

Surface water control systems

☐ Under roof: Surface water will be controlled by the walls and roof of the building and by the finished landscaping.

☑ Outdoor: Describe the run-on and runoff control system proposed for feedlots and outdoor manure storage facilities:

Run-on to be controlled by site grading
Run-off to be captured in series of catch basins at south side of feedlot

NRCB USE ONLY

Requirements met: ☒ YES ☐ NO Details/comments:

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

compacted clay liner; material from grading of feedlot

Compacted soil liner details

a. Thickness of compacted liner (m) 1.29m	Provide details: **compacted clay liner; material from grading of feedlot**		
b. Soil texture	30 % sand	40 % silt	30 % clay
c. Atterberg limits medium plastic clay	Plastic limit	Liquid limit	Plasticity index
d. Hydraulic conductivity	Hydraulic conductivity (cm/s)	1.00E-7 to 1.29E-7 cm/sec (unfactored)	
	Describe test standard used	Laboratory Test (falling-head test)	

Liner protection

Describe how the physical integrity of the liner will be maintained	Provide details: Pen bases will be graded in order to minimize the potential for standing water on the clay liner; following pen cleaning activities, additional compacted clayto be placed over any low areas.

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

The proposed clay fill conditions are summarized in Wood's report BX11555 dated 18 June 2021, attached. Laboratory permeability test reports are included in the referenced report.

NRCB USE ONLY

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

Protective liner requirements met: ☒ YES ☐ NO Condition required: ☒ YES ☐ NO

Comments:

Has to provide proof that the constructed liner has a minimum thickness of 1.29 m and that the required density of the compacted clay has been reached

Hydraulic conductivity after adjustment: 1.29 E-6 cm/sec Condition required: ☒ YES ☐ NO

Comments on testing method/origin of material:

Part 2 — Technical Requirements

NRCB Natural Resources Conservation Board

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

RUNOFF CONTROL CATCH BASIN: Compacted soil liner

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

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

1. Effluent Pond (x5) AO comment: catch basins #1-5
2. _____
3. _____

Determination of minimum required catch basin volume

Show your calculations for determining the minimum required catch basin volume	Provide calculation assumptions:
Feedlot pen footprint & surrounding area: 403,200m2	Design rainfall = 85mm; Assume run-off coefficient = 0.6 Required capacity = 403,200m2 x 85mm x 0.6 = 20,563m3 or 4,523,269 imp gallons Freeboard = 0.5m

Catch basin capacity

	Length (m)	Width (m)	Depth (m)	Slope run:rise			Estimated storage capacity (excl. freeboard) (m^3)	Depth below grade of the bottom of the liner(m)
				Inside end walls	Inside side walls	Outside walls		
1.	122	24.5	3.5	3:1	3:1	N/A	4,206	AO comment: varies 2.82 m
2.								to 6.07 m
3.								

TOTAL CAPACITY

5 Catch basins each 4,206 m3 or 925,187 imp gallons
5 total = 21,030 m3 or 4,625,935 imp gallons

NRCB USE ONLY

Catch basin calculator (calculation attached). Total volume @ freeboard: 21,030 m3 Requirements met: ☒ YES ☐ NO

Depth to water table: varies 5.4 - 8.6 m Requirements met: ☒ YES ☐ NO

Depth to UGR: 10.67 m Requirements met: ☒ YES ☐ NO

ERST completed: ☒ YES ☐ NO

Groundwater risk level: Low Surface Water risk level: Low

UGR: Uppermost Groundwater Resource as defined under AOPA's *Standards and Administration Regulation*.

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

Compacted soil liner details

a. Compacted soil liner	Thickness of liner: 2.58 (m)	Provide details: compacted clay liner; material from grading of feedlot	
b. Soil texture	_____% sand	_____% silt	_____% clay
c. Atterberg limits	Plastic limit: _____	Liquid limit: _____	Plasticity index: _____
d. Hydraulic conductivity	Hydraulic conductivity (cm/s)	1.0E-7 cm/sec to 1.29E-7 cm/s (unfactored)	
	Describe test standard used	Laboratory Test (falling-head test)	

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

Clay liner material is medium plastic clay
Laboratory permeability test is attached
Natural soils are low to medium plastic clay with minor sand layers
minimum groundwater 5.4mbg as per drill logs dated Dec 8 & 14, 2020

NRCB USE ONLY

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

Protective liner requirements met? ☒ YES ☐ NO Condition required: ☒ YES ☐ NO

Comments:

The liner requirements for catch basins can be met with the attached condition. The condition will state that the compacted clay liner must have a minimum thickness of 2.58 m. Proof of liner thickness and compaction that meets the reg. requirements must be submitted.

Hydraulic conductivity after adjustment: 1.29 E-6 cm/sec

Comments on testing method/origin of material:

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

Comments:

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

NRCB USE ONLY

Catch basin calculator (calculation attached). Total volume @ freeboard: 21,030 m3

Runoff capacity requirements met: ☒ YES ☐ NO

Calculation of the volume attached: ☒ YES ☐ NO

Depth to water table: varies 5.4 - 8.6 m Requirements met: ☒ YES ☐ NO

Depth to Uppermost Groundwater Resource: 10.67 m Requirements met: ☒ YES ☐ NO

ERST completed: ☒ see ERST page for details

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

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

Catch Basin Storage Volume Calculator

AO comments: 5 catch basins
Totaling 21,030 m3 at freeboard

Construction Dimensions of Catch Basin

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

Overall Dimensions of Catch Basin			Catch Basin Dimensions
Total Length*[4]	122.0	m	400 ft
Total Width*[4]	24.5	m	80 ft
Total Depth*[4]	3.5	m	11 ft
Design Capacity Depth	*3.00*	m	10 ft
End Slope*[4]	3	run:rise	3 run:rise
Side Slope*[4]	3	run:rise	3 run:rise
Length of Bottom	101.0	m	331 ft
Width of Bottom	3.5	m	11 ft
Capacity @ top of Bank	*5,592*	m^3	*Capacity @tob* *197,484* ft^3 *1,230,095 Imp. Gal.*

Design Capacity of Catch Basin (freeboard level)			Design Capacity (freeboard level)
Length (design capacity depth)	119.0	m	390 ft
Width (design capacity depth)	21.5	m	71 ft
Total Depth	*3.5*	m	*11* ft
Design Capacity Depth	3.00	m	10 ft
End Slope	3	run:rise	3 run:rise
Side Slope	3	run:rise	3 run:rise
Design Capacity (freeboard level)	**4,206**	m^3	148,533 ft^3
			925,190 Imp. Gal.
level)	*2,559*	m^2	*27,539* ft^2

CFO Name [1]	JBC Cattle
Land Location [1]	SW-11-15-18 W4M

Paved Runoff Catchment Area(s)

Area [2]	Length (m)	Width (m)	Area (m^2)
1			0.0
2			0.0
3			0.0
4			0.0
5			0.0
		Total Area (m^2)	**0**

Unpaved Runoff Catchment Area(s)

Area [2]	Length (m)	Width (m)	Area (m^2)
6	705	560	394,800.0
7			0.0
8			0.0
9			0.0
10			0.0
		Total Area (m^2)	**394,800**

Rainfall (Select Town [3])

Vauxhall 85

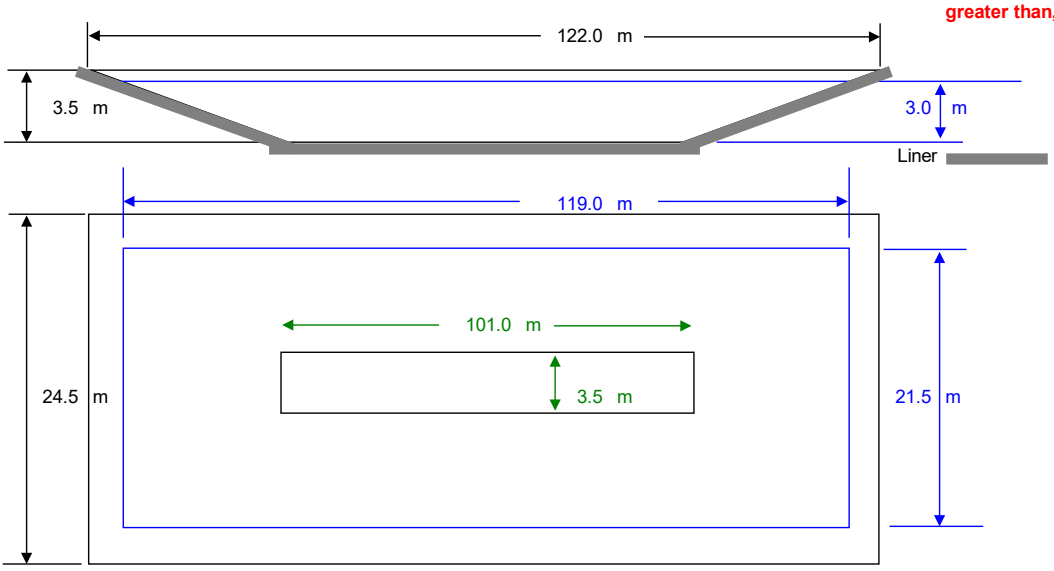
AOPA Design Rainfall **85 mm**

Minimum Catchbasin Storage Volume Required

20,135 m^3 ** 711053.752 ft^3

4429035.07 Imp. Gal.

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



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

NTS - Not To Scale

NRCB Natural Resources Conservation Board

NRCB USE ONLY **RUNOFF CONTROL CATCH BASIN CAPACITY SUMMARY (if applicable)**	
Facility 1 Catch basins #1-5	4,206 m3 x 5 catch basins
Name / description	Capacity
Facility 2	
Name / description	Capacity
Facility 3	
Name / description	Capacity
Facility 4	
Name / description	Capacity
TOTAL CAPACITY	21,030 m3
RUNOFF VOLUME FROM CONTRIBUTING AREAS	20,135 m3
MEETS AOPA RUNOFF CONTROL VOLUME REQUIREMENTS	☒ YES ☐ NO

18 June 2021

Wood File: BX11555

Serfas Farms Ltd.
SE 7-12-19-W4
Turin, AB T0K 0H0

Attention: Mr. Kevin Serfas:

Re: Geotechnical Review and Evaluation
Proposed Feedlot Expansion
SW-11-015-18-W4M, near Enchant, Alberta

As requested, Wood Environment & Infrastructure Solutions (Wood) has carried out a geotechnical review and evaluation of the above-captioned site relative to the required protection of the groundwater resource, as required by the Agricultural Operation Practices Act, AB Reg. 267/2001 (hereinafter referred to as "AOPA"). This letter describes site soil conditions to support a permit application related to a new feedlot (pens and catch basins) which will encompass the parcel legally described as SW-11-015-18-W4M (see Figure 1).

In order to demonstrate the suitability of the naturally existing soils for consideration as a naturally occurring protective layer to the groundwater, forty-three (43) boreholes were advanced at the site on December 8 & 14, 2020 and in May, 2021. The boreholes were advanced at the approximate locations illustrated on Figure 1 as SF1-20 to SF43-21. As illustrated on Figure 1, boreholes SF1-20 to SF7-20 were advanced along the south side of the subject parcel, in the area of the proposed catch basins, while boreholes SF8-20 to SF43-21 were advanced throughout the remainder of the site, in the proposed pen areas.

The boreholes were advanced by a truck-mounted drill rig owned and operated by Chilako Drilling Services and extended to depths ranging between 3.0 m and 12.2 m below existing grades. The boreholes were logged by Larry Delong of Chilako Drilling Services.

In general, the natural mineral soils encountered within the boreholes comprised of medium plastic clay till, with an area of low to medium plastic clay till identified in about the northeast quadrant of the proposed feedlot. The clay till was generally characterized as damp to moist, with occasional sand lenses identified at many of the boreholes.

Along the south side of the proposed feedlot area (i.e., catch basin area, including boreholes SF1-20 to SF7-20), some sand and gravel was encountered below about depths of 3 m to 5 m below grade, with free groundwater encountered below depths ranging between 5.4 m and 8.6 m below existing grade.

In order to measure the *in situ* permeability of the subsurface soils, a series of twelve 50 mm diameter PVC monitoring wells were constructed at the site, with heavier focus on the south-centre to the north areas of the site, rather than the proposed catch basin areas. The monitoring wells were screened at various depths, ranging between 1.1 m and 4.5 m below existing grade.

Well saturation of the 50 mm diameter monitoring wells was carried out by filling the monitoring wells to the top for several consecutive days, and monitoring the 24-hour water drop at the discrete well locations.

In general, the combination of low plastic clay, intermittent sand lenses, and relatively dry (and fissured) nature of the subsurface soils in the northeast quadrant of the site (monitoring wells SF12-20, SF21-20 and SF23-20) did not yield permeability test results which would satisfy the AOPA requirements for a naturally occurring protective layer.

Further, test locations SF26-20 and SF43-21 also could not verify satisfactory performance of the naturally occurring soils relative to the AOPA permeability requirements, though in this case the medium plastic and moist clay soils (based on engineering review) were generally considered adequate to meet the AOPA permeability requirements, but the *in situ* testing appeared to be compromised by intermittent sand layers in the clay till stratum.

In the centre and northwest areas of the site, a total of eight in situ permeability tests yielded favourable results. In these monitoring wells, the observed 24-hour water drop ranged between about 0.35 m and 3.40 m. It again noted that the higher drops observed at several of these boreholes were reflective of intermittent sand and silt lenses in the clay till stratum, rather than a reflection of higher permeability of the clay till itself.

In order to calculate the permeability of the screened portion of the clay till at the test well locations, a modified falling head test (as outlined in the USBR Engineering Geology Field Manual Volume 2 [2001]) was used. The input variables and output data are outlined on the In Situ Permeability Test report sheets, attached. As outlined on the reports, the results of the *in situ* permeability testing indicate hydraulic conductivity, k_s, values ranging between 3.6×10^{-8} cm/s and 8.0×10^{-7} cm/s, as follows:

- 3.1×10^{-7} cm/s at SF10-20;
- 4.3×10^{-7} cm/s at SF20-20;
- 3.6×10^{-8} cm/s at SF30-20;
- 3.3×10^{-7} cm/s at SF31-20;
- 5.8×10^{-7} cm/s at SF32-20;
- 1.1×10^{-7} cm/s at SF34-20;
- 8.0×10^{-7} cm/s at SF38-20;
- 4.7×10^{-8} cm/s at SF41-20.

Using the measured permeability of the clay stratum, the following equivalent natural soil thicknesses of naturally occurring materials having a hydraulic conductivity of 1 x 10^{-6} cm/s (the reference standard in AOPA) at the monitoring well locations has been estimated:

- at SF10-20, the equivalent thickness is 5.2 m;
- at SF20-20, the equivalent thickness is 3.7 m;
- at SF30-20, the equivalent thickness is 44 m;
- at SF31-20, the equivalent thickness is 4.8 m;
- at SF32-20, the equivalent thickness is 3.1 m;
- at SF34-20, the equivalent thickness is 15 m;
- at SF38-20, the equivalent thickness is 2.0 m;
- at SF41-20, the equivalent thickness is 34 m.

This represents natural material protection in excess of the minimum requirements outlined by the AOPA for solid manure storage (minimum 2 m, Section 9.5-c).

Delineation of Naturally Occurring Liner

Based on the results of the current investigation, approximately two-thirds of the proposed pen area has been assessed to be underlain by a naturally occurring clay liner, in accordance with the requirements of Section 9.5 of the AOPA. This area is illustrated on Figure 1, attached.

As discussed previously, the near-surface soils in the northeast portion of the site (see Figure 1) were found to be generally low-plastic, damp, and sandy, and do not meet the AOPA requirements for naturally occurring liner. Similarly, the near-surface soils along the south side of the site (Figure 1) were not proven to meet the AOPA requirements for naturally occurring liner. Specifically, for the catch basins, the presence of groundwater below about 5.4 m depth limits the naturally occurring material available for consideration of a naturally-occurring liner, and that layer of naturally occurring material could also not be proven to meet the AOPA requirements for naturally occurring liner. Accordingly, both the northeast and south side of the site (refer to Figure 1) will require a compacted clay liner to meet the requirements for solid manure storage and catch basins.

Compacted Clay Liner

The requirements for compacted clay liners for solid manure storage (i.e., pens) and catch basins are provided in Section 9.6 of the AOPA. Catch basins require the equivalent protection of 1 m of compacted soil having hydraulic conductivity of 5 x 10^{-7} cm/s, while pens (solid manure storage) require the equivalent protection 0.5 m of compacted soil having hydraulic conductivity of 5 x 10^{-7} cm/s. As the naturally occurring clay encountered at most of the site was generally deemed suitable (from a field textural classification), bulk samples of the clay were recovered from the test pits and subjected to laboratory permeability testing. Initially a composite sample from boreholes SF1 to SF5 (i.e., south side of the site) was subjected to permeability testing (Permeability Test #1), then that permeability testing was expanded to include a composite sample of boreholes SF1 to SF5, SF15 to SF20, and SF30 to SF34 (Permeability Test #2). A composite sample of the boreholes from the northeast corner of the site was

not subjected to permeability testing, as that material was deemed too sandy (based on visual textural review by the geotechnical engineer) to be used for clay liner construction.

The results of the permeability testing indicate a laboratory hydraulic conductivity, k, of 1.0 x 10^{-7} cm/s to 1.29 x 10^{-7} cm/s. The laboratory test reports are attached. The corresponding laboratory textural analyses are also attached, for reference.

It is understood that NRCB requires laboratory tests of one order of magnitude higher than the AOPA requirements. Accordingly, a hydraulic conductivity of 1.29 x 10^{-6} cm/s has been assumed for the onsite soils for design of the liner thicknesses. To this end, the following compacted clay liner thicknesses have been calculated, as required by Section 9.6 of the AOPA:

> For pens (solid manure storage), the required compacted clay liner thickness is **1.29 m**;
>
> For catch basins, the required compacted clay liner thickness is **2.58 m** (measured perpendicular to the base and face of sideslopes).

For construction of the compacted clay liner, the following recommendations are offered:

- The AOPA provides guidance on the minimum separation between the groundwater table and the bottom of the liner, and indicates that the bottom of a liner must not be less than 1 m above the water table at the time of construction (Section 9.2). Accordingly, the depth of the catch basins should be limited to satisfy this AOPA requirement;
- The sideslopes of the catch basins should be sloped at an inclination of no steeper than 3 horizontal to 1 vertical (i.e., 3H:1V);
- the clay liner material should be moisture conditioned to between optimum and three percent above optimum, placed in maximum 150mm thick lifts, and be thoroughly compacted using a sheepsfoot compactor. Based on the results of the permeability testing, the targeted minimum dry density for the clay liner material is 1,800 kg/m^3, or to a minimum of 98 percent of the Standard Proctor Maximum Dry Density (SPMDD). *In situ* compaction testing should be carried out to verify that the targeted material density has been achieved.
- Where lift surfaces dry out between lift placement, the surfaces will require scarification, moisture conditioning, and re-compaction prior to placement of the subsequent lift;
- Upon completion of the catch basin, all areas of the catch basin sideslopes deemed susceptible to erosion by surface water inflow or by wave action should be surfaced with amour gravel/rock. All other areas above the design water level, including crests and backslopes, should be dressed with topsoil and seeded with a suitable grass mix to further assist in minimizing the potential for erosion at the catch basins.

Conclusion

As detailed herein, it is Wood's opinion that the naturally occurring materials within the centre and northwest portions of the site (refer to Figure 1) satisfy the AOPA requirements for a naturally occurring liner relative to permitting the pens in these areas.

For the south and northeast areas of the site, a compacted clay liner will be required, and the existing subsurface soils from the south, centre, and northwest areas of the site can be used for construction of the clay liner, provided the liner is constructed in accordance with the recommendations provided herein.

The recommendations given in the above sections are based upon interpreted conditions found within the boreholes advanced at this site as described herein. Should subsurface conditions other than those presented in this report be encountered during construction, the Client should notify our office so that these recommendations can be reviewed.

This report has been prepared for the exclusive use of Serfas Farms Ltd. and their designers for the specific application to the development described in this report, as well as the NRCB for permitting of the proposed development. Any use that a third party makes of this report, or any reliance or decisions based on this report are the sole responsibility of those parties. This report has been prepared in accordance with generally accepted soil and foundation engineering practices. No other warranty, express or implied, is made.

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

Yours truly,

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

PROFESSIONAL ENGINEER JOHN LOBBEZOO ALBERTA

21 June 2021

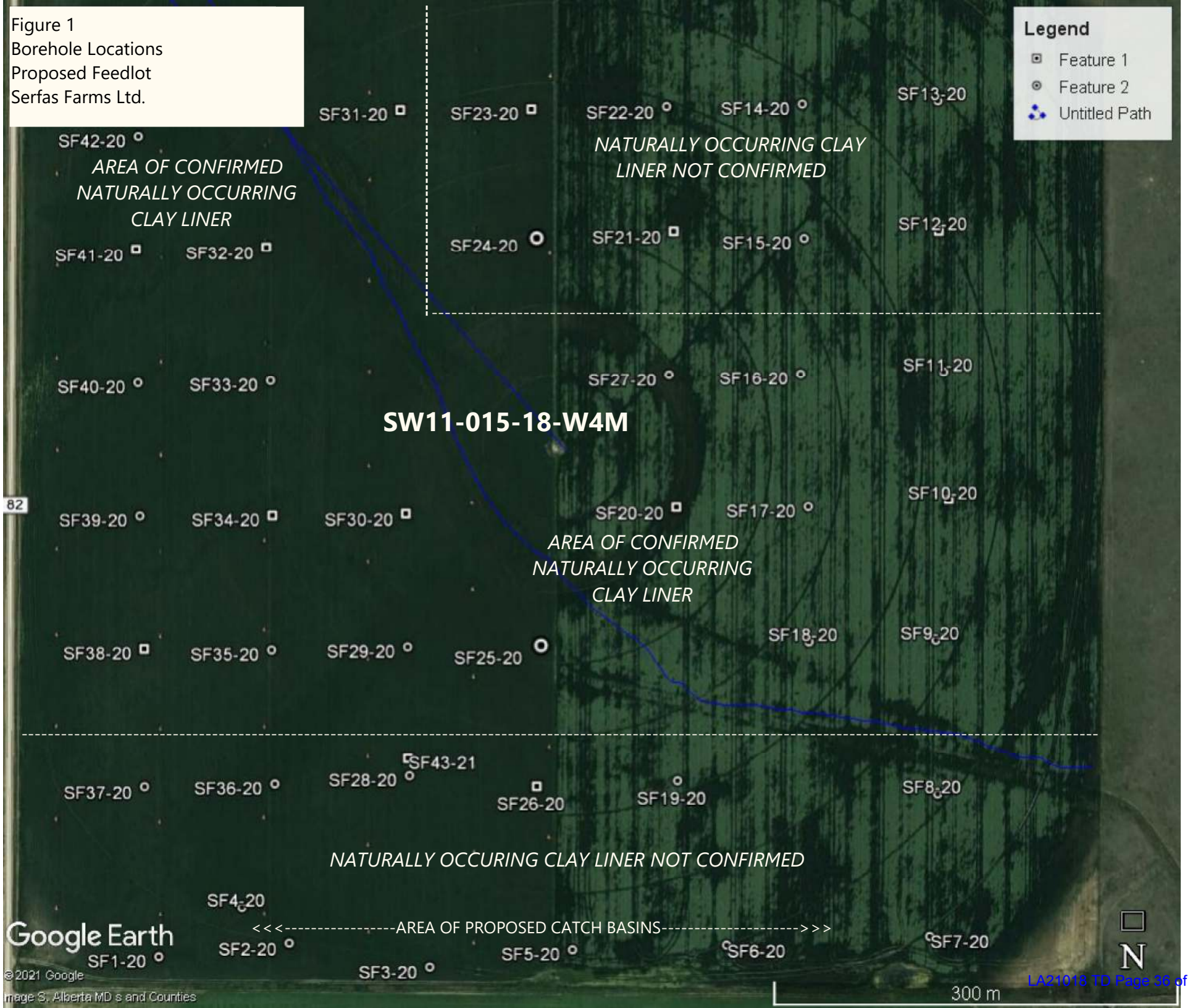
John Lobbezoo, P.Eng.
Associate Engineer, Geotechnical
Lethbridge & Medicine Hat Area Lead

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

PERMIT TO PRACTICE
WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS
RM SIGNATURE: _____
RM APEGA ID #: 110450
DATE: 21 June 2021
PERMIT NUMBER: P004546
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

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

Figure 1
Borehole Locations
Proposed Feedlot
Serfas Farms Ltd.



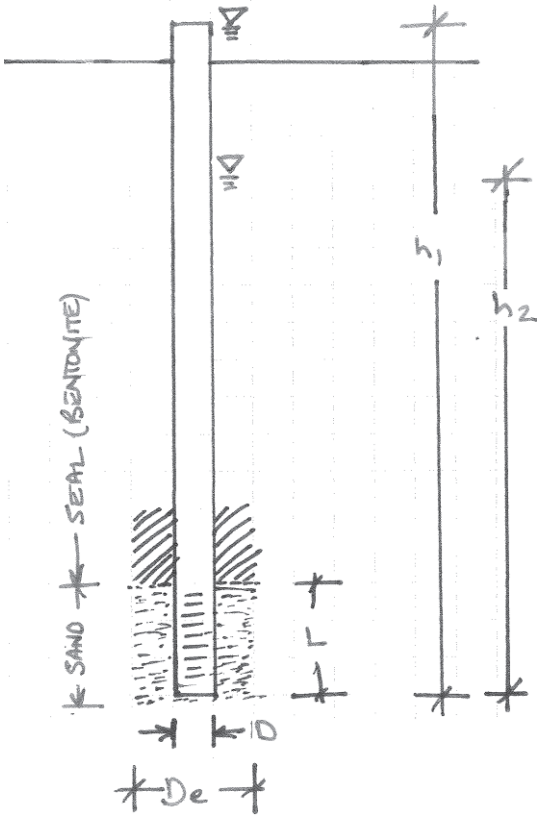
SF10-20

In Situ Permeability Test

Modified Falling Head Permeability Equation

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

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



SF10-20 - Feedlot

Wood File: BX11555

INPUT VARIABLES

Terms	Value	Definition
D	0.0520	diameter of standpipe (m)
De	0.1500	diameter of borehole (m)
L	1.60	length of sand section (m)
h1	5.10	initial height of water above base of hole (m)
h2	2.82	final height of water above base of hole (m)
t	24.0	time of test (h)

k_s = 3.1E-07 cm/sec

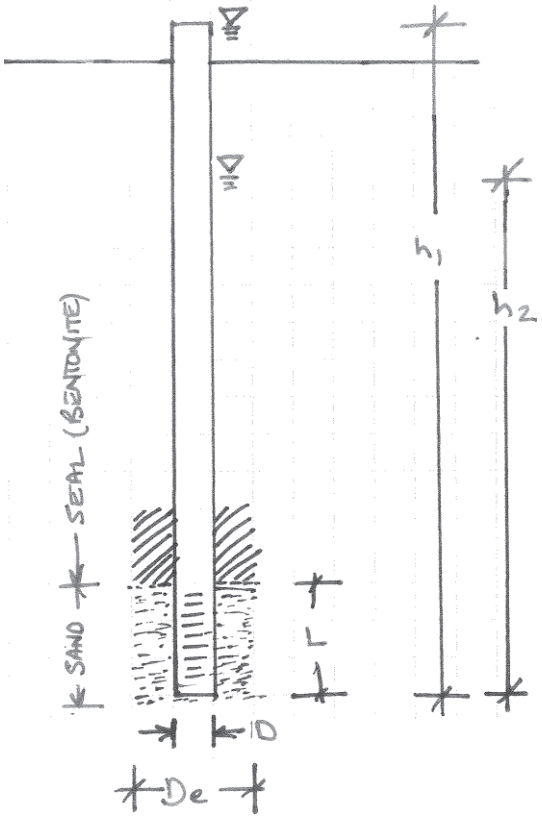
SF20-20

In Situ Permeability Test

Modified Falling Head Permeability Equation

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

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



SF20-20 - Feedlot

Wood File: BX11555

INPUT VARIABLES

Terms	Value	Definition
D	0.0520	diameter of standpipe (m)
De	0.1500	diameter of borehole (m)
L	1.60	length of sand section (m)
h1	3.60	initial height of water above base of hole (m)
h2	1.68	final height of water above base of hole (m)
t	24.0	time of test (h)

k_s = 4.3E-07 cm/sec

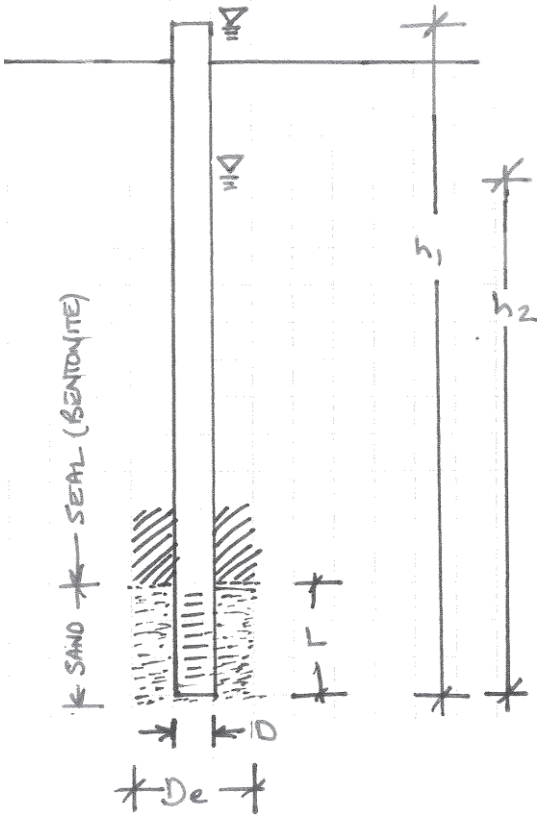
SF30-20

In Situ Permeability Test

Modified Falling Head Permeability Equation

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

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



SF30-20 - Feedlot

Wood File: BX11555

INPUT VARIABLES

Terms	Value	Definition
D	0.0520	diameter of standpipe (m)
De	0.1500	diameter of borehole (m)
L	1.60	length of sand section (m)
h1	5.10	initial height of water above base of hole (m)
h2	4.75	final height of water above base of hole (m)
t	24.0	time of test (h)

k_s = 3.6E-08 cm/sec

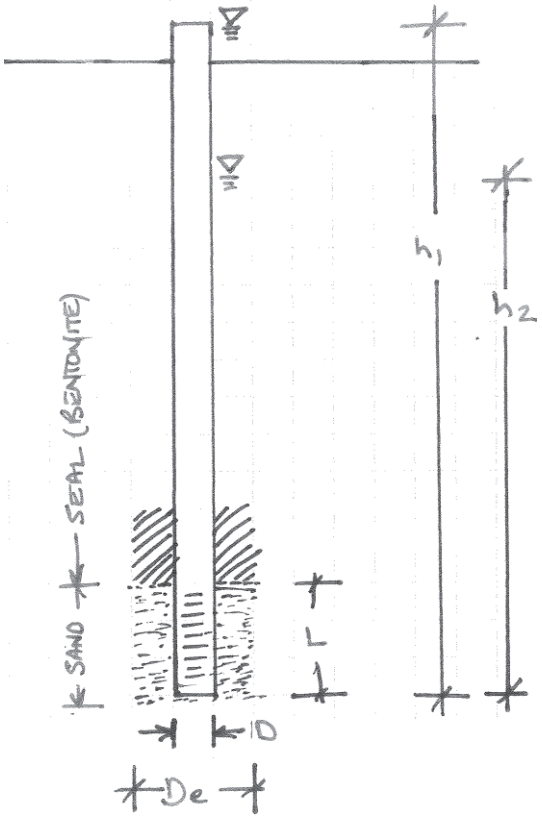
SF31-20

In Situ Permeability Test

Modified Falling Head Permeability Equation

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

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



SF31-20 - Feedlot

Wood File: BX11555

INPUT VARIABLES

Terms	Value	Definition
D	0.0520	diameter of standpipe (m)
De	0.1500	diameter of borehole (m)
L	1.60	length of sand section (m)
h1	3.60	initial height of water above base of hole (m)
h2	1.98	final height of water above base of hole (m)
t	24.0	time of test (h)

k_s = 3.3E-07 cm/sec

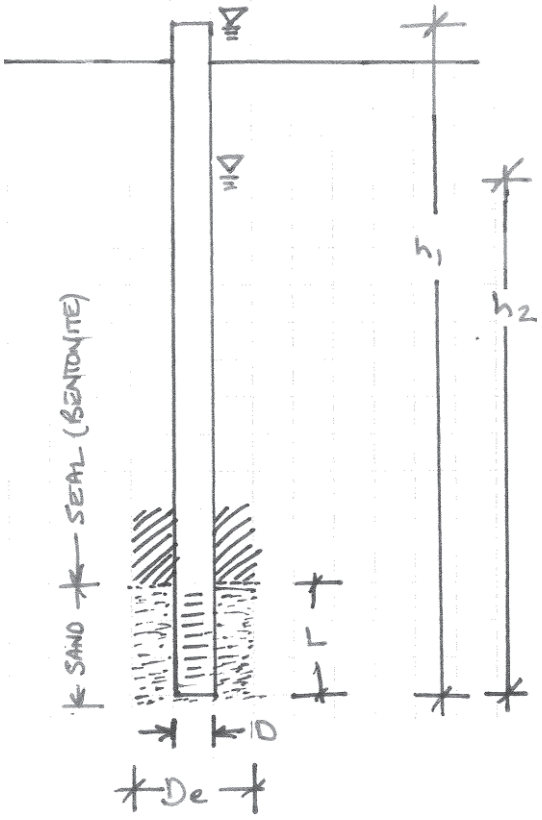
SF32-20

In Situ Permeability Test

Modified Falling Head Permeability Equation

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

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



SF32-20 - Feedlot

Wood File: BX11555

INPUT VARIABLES

Terms	Value	Definition
D	0.0520	diameter of standpipe (m)
De	0.1500	diameter of borehole (m)
L	1.80	length of sand section (m)
h1	5.10	initial height of water above base of hole (m)
h2	1.70	final height of water above base of hole (m)
t	24.0	time of test (h)

k_s = 5.8E-07 cm/sec

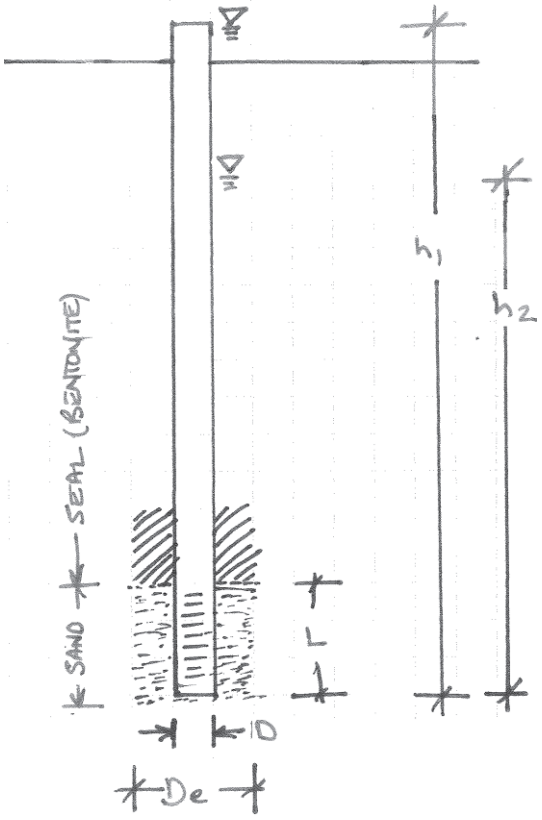
SF34-20

In Situ Permeability Test

Modified Falling Head Permeability Equation

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

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



SF34-20 - Feedlot

Wood File: BX11555

INPUT VARIABLES

Terms	Value	Definition
D	0.0520	diameter of standpipe (m)
De	0.1500	diameter of borehole (m)
L	1.60	length of sand section (m)
h1	3.60	initial height of water above base of hole (m)
h2	2.92	final height of water above base of hole (m)
t	24.0	time of test (h)

k_s = 1.1E-07 cm/sec

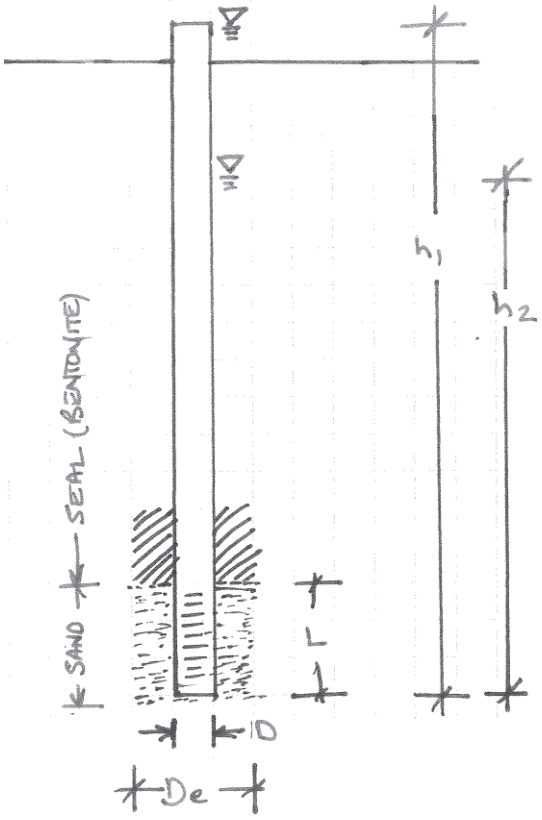
SF38-20

In Situ Permeability Test

Modified Falling Head Permeability Equation

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

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



SF38-20 - Feedlot

Wood File: BX11555

INPUT VARIABLES

Terms	Value	Definition
D	0.0520	diameter of standpipe (m)
De	0.1500	diameter of borehole (m)
L	1.60	length of sand section (m)
h1	3.60	initial height of water above base of hole (m)
h2	1.07	final height of water above base of hole (m)
t	24.0	time of test (h)

k_s = 8.0E-07 cm/sec

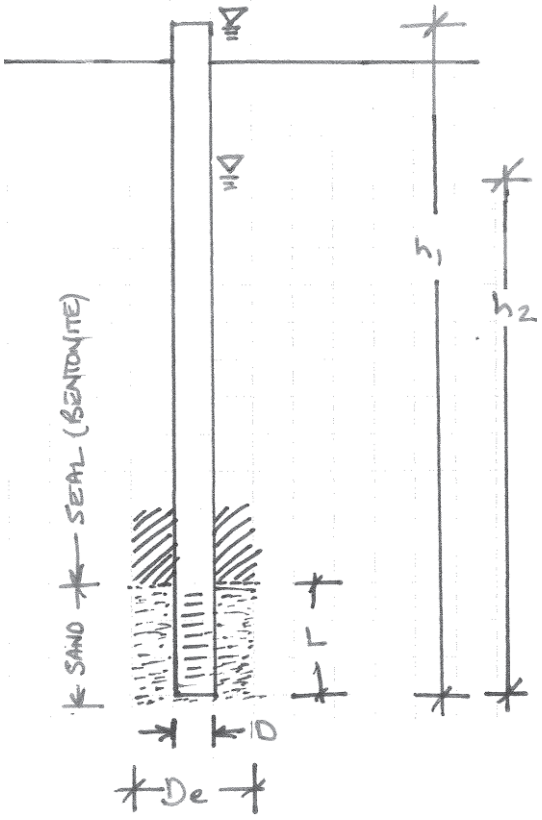
SF41-20

In Situ Permeability Test

Modified Falling Head Permeability Equation

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

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



SF41-20 - Feedlot

Wood File: BX11555

INPUT VARIABLES

Terms	Value	Definition
D	0.0520	diameter of standpipe (m)
De	0.1500	diameter of borehole (m)
L	1.60	length of sand section (m)
h1	4.60	initial height of water above base of hole (m)
h2	4.19	final height of water above base of hole (m)
t	24.0	time of test (h)

k_s = 4.7E-08 cm/sec

CHILAKO DRILLING SERVICES LTD

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

SOIL PROFILE AND PARENT MATERIAL DESCRIPTION

Site Location: Sw11-15-18W4 Serfas Farms Date: Dec 8, 14, 2020

Hole #	Location	Depth	Texture	Moisture	Geological	Sample	Remarks
SF1-20	0401190	0-0.15	CL	D	Topsoil		
	5565951	0.15-1.0	CL	D	Till		
		1.0-1.5	CL	D	Till		V. firm, med plastic, brown
		1.5-3.1	CL-C	SM	Till		Stiff, med plastic, dark brown, sulphates, coal chips
		3.1-4.8	LFS	SM	Till		Loose, clay stringers
		4.8-5.2	Gr+C	VM	Till		
		5.2-5.9	Gr+C	Sat	Till		Free water @ 5.4m
		5.9-9.2	LFS	Sat	Till		Loose, silt lensing
SF2-20	0401288	0-0.15	CL	D	Topsoil		
	5565961	0.15-3.0	CL	D	Till		Stiff, med plastic, brown, trace gravel
		3.0-5.7	CL	M	Till		Stiff, med plastic, dark brown, coal chips
		5.7-6.4	FSC	M	Till		Loose
		6.4-8.8	SiL	Sat	Till		Free water @ 6.1m, trace clay
		8.8-9.1	FSL	Sat	Till		Soft
SF3-20	0401394	0-0.15	CL	D	Topsoil		
	5565941	0.15-1.5	CL	D	Till		V. firm, med plastic, yellow brown
		1.5-3.2	CL	M	Till		Stiff, med plastic, dark brown, gypsum salts, coal chips
		3.2-4.5	SCL*	VM-Sat	Till		Mixed with gravel, sand layers
		4.5-6.3	CL-C	M	Till		Stiff, med plastic, dark brown, trace gravel
		6.3-8.6	Silt	Sat	Till		Soft, sand layers, free water @ 6.3m
		8.6-9.2	LFS	Sat	Till		V. soft
SF4-20	0401253	0-0.15	CL	D	Topsoil		
	5565988	0.15-1.2	CL	D	Till		Stiff, med plastic, dark brown
		1.2-3.3	CL	M	Till		Stiff, med plastic, dark brown
		3.3-4.0	S+Gr	M	Till		Trace clay
		4.0-4.6	CL	M	Till		Some gravel
		4.6-6.0	S+Gr	M	Till		Mixed with clay, sand lens @ 4.6m
		6.0-9.2	SiL	Sat	Till		Very soft, free water @ 6.0m
SF5-20	0401616	0-0.15	CL	D	Topsoil		
	5565955	0.15-0.9	CL	D	Till		
		0.9-3.3	CL	SM	Till		Stiff, med plastic, dark brown
		3.3-8.0	CL	M	Till		Stiff, med plastic, dark brown, sand lenses oxidation, silt lenses
		8.0-8.6	FSL	Sat	Till		V. soft
		8.6-9.2	Sil-SiCL	VM	Till		Soft, low plastic, olive brown, free water @ 8.0m
SF6-20		0-0.15	CL	D	Topsoil		
		0.15-1.0	CL	D	Till		
		1.0-1.6	CL	M	Till		Stiff, med plastic, dark brown, gypsum salts trace gravel
		1.6-5.2	CL	M	Till		Sand lenses throughout
		5.2-6.5	FSL	M-VM	Till		Loose, olive brown
		6.5-8.6	CL	M	Till		Stiff, med plastic, fractured, oxidized silt lenses
		8.6-9.2	CL-SCL	VM	Till		Sat sand lenses, free water @ 8.6m

SOIL PROFILE AND PARENT MATERIAL DESCRIPTION (CONTINUED)

Hole #	Location	Depth	Texture	Moisture	Geological	Sample	Remarks
SF7-20	0401767	0-0.15	CL	D	Topsoil		
	5565960	0.15-1.0	CL	D	Till		
		1.0-6.3	CL	M	Till		Stiff, med plastic, dark brown, gypsum salts trace gravel
		6.3-7.9	SiCL	M-VM	Till		V. firm, low plastic, dark brown, silt layers fractured oxidized
		7.9-9.2	CL-C	M	Till		Stiff, low-med plastic, dark brown, fractured, oxidized
SF8-20	0401755	0-0.15	CL	D			
	5566074	0.15-1.0	SiCL	D			V. firm, med plastic, yellow brown
	Pens	1.0-3.0	CL	M	Till		Stiff, med plastic, brown
SF9-20	0401774	0-0.15	CL	D	Topsoil		
	5566180	0.15-1.0	CL	D	Till		
	Pens	1.0-2.9	CL	SM	Till		
		2.9-4.1	S+Gr	SM	Till		Mixed with some clay
		4.1-4.5	CL	SM	Till		Stiff, med plastic, brown
SF10-20	0401780	0-0.15	CL	D	Topsoil		
	5566284	0.15-0.7	CL-SCL	D	Till		
		0.7-1.6	SCL	SM	Till		
		1.6-2.9	CL	SM	Till		V. firm, low plastic, brown, silt layers
		2.9-4.5	CL	SM	Till		Stiff, med plastic, dark brown
							50mm H.C. well installed to 4.5m
							Screen: 4.5-3.0m
							Sand: 4.5-2.9m
							Bentonite: 2.9-0.0m
							Stickup: 0.6m
							Hole Diameter: 0.15m
SF11-20	0401782	0-0.15	CL	D	Topsoil		
	5566380	0.15-2.6	CL	D	Till		Silty lenses
		2.6-3.1	CL-SCL	M	Till		V. firm, low-med plastic, yellow brown
		3.1-4.5	CL	M	Till		Stiff, med plastic, brown, oxidized
SF12-20	0401780	0-0.15	CL	D	Topsoil		
	5566485	0.15-1.5	CL	D	Till		
		1.5-2.6	CL	M	Till		V. firm, low plastic, brown, some sand
		2.6-4.5	SCL	M	Till		Firm, low plastic, brown
							50mm H,C, well installed to 4.5m
							Screen: 4.5-3.0m
							Sand: 4.5-2.9m
							Bentonite: 2.9-0.0m
							Stickup: 0.6m
							Hole Diameter: 0.15m
SF13-20	0401782	0-0.15	CL	D	Topsoil		
	5566881	0.15-3.0	CL	D	Till		Stiff, med plastic, brown
SF14-20	0401680	0-0.15	CL	D	Topsoil		
	5566580	0.15-3.0	CL	SM	Till		Stiff, med plastic, brown-dark brown, gypsum salts

SOIL PROFILE AND PARENT MATERIAL DESCRIPTION (CONTINUED)

Hole #	Location	Depth	Texture	Moisture	Geological	Sample	Remarks
SF15-20	0401680	0-0.4	CL	D	Blowdirt		
	5566480	0.4-0.7	CL	D	Organic		Organic buried a horizon
		0.7-1.6	CL	D	Till		
		1.6-3.8	CL	M	Till		V, firm, low plastic, trace sand, yellow brown
		3.8-4.5	CL	M	Till		Stiff, med plastic, fine sand lenses
SF16-20	0401676	0-0.15	CL	D	Topsoil		
	5566380	0.15-1.4	CL	D	Till		V. firm, med plastic, yellow brown
		1.4-3.3	CL	SM	Till		Stiff, med plastic, dark brown
		3.3-4.0	C-SCL	SM	Till		Sand pockets
		4.0-4.5	CL	SM	Till		Stiff, low plastic, brown
SF17-20	0401681	0-0.15	CL	D	Topsoil		
	5566280	0.15-1.0	CL	D	Till		
		1.0-3.0	CL	D	Till		Stiff, med plastic, brown, a few silt lenses
SF18-20	0401680	0-0.15	CL	D	Topsoil		
	5566180	0.15-0.8	CL	D	Till		V. firm, brown
		0.8-3.0	CL	M	Till		Stiff, med plastic, dark brown, gypsum salts
SF19-20	0401580	0-0.15	CL-SCL	D	Topsoil		
	5566074	0.15-0.6	CL-SCL	D	Till		
		0.6-1.2	CL	M	Till		
		1.2-1.6	SCL	M	Till		Silt lenses
		1.6-3.0	CL	M	Till		Stiff, med plastic, dark brown, gypsum salts, oxidized along fractures
SF20-20	0401582	0-0.15	CL	D	Topsoil		
	5566281	0.15-1.4	CL	D	Till		V. firm, med plastic, brown, trace gravel
		1.4-3.0	CL	SM	Till		Stiff, med plastic, brown, oxidized 50mm H.C. well installed to 3.0m Screen: 3.0-1.5m Sand: 3.0-1.4m Bentonite: 1.4-0.0m Stickup: 0.6m
SF21-20	0401583	0-0.15	CL	D	Topsoil		
	5566488	0.15-0.6	CL	D	Till		
		0.6-1.0	FSCL	D	Till		
		1.0-1.9	CL	D	Till		Stiff, med plastic, brown
		1.9-4.0	LFS	D	Till		Loose
		4.0-4.5	CL-C	SM	Till		Stiff, med plastic, dark brown 50mm H.C. well installed to 4.5m Bentonite: 4.5-2.45m Screen: 2.4-1.2m Sand: 2.45-1.1m Bentonite: 1.1-0.0m Stickup: 0.5m Hole Diameter: 0.15m
SF22-20	0401579	0-0.15	CL	D	Topsoil		
	5566580	0.15-0.9	CL	D	Till		Trace sand
		0.9-1.7	CL	D	Till		Stiff, med plastic, dark brown
		1.7-2.6	SCL	SM	Till		Firm, low plastic, sand layers
		2.6-3.0	CL	SM	Till		Stiff, med plastic, dark brown, trace sand

SOIL PROFILE AND PARENT MATERIAL DESCRIPTION (CONTINUED)

Hole #	Location	Depth	Texture	Moisture	Geological	Sample	Remarks
SF23-20	0401479	0-0.15	CL	D	Topsoil		
	5566580	0.15-0.8	CL	D	Till		V. firm, med plastic, brown
		0.8-3.0	CL	SM	Till		Stiff, med plastic, dark brown
							50mm H.C. well installed to 3.0m
							Screen: 3.0-1.5m
							Sand: 3.0-1.4m
							Bentonite: 1.4-0.0m
							Stickup: 0.6m
							Hole Diameter: 0.15m
SF24-20	0401480	0-0.15	CL	D	Topsoil		
	5566481	0.15-2.5	CL	D	Till		V. firm, med plastic, brown
		2.5-3.1	SCL	SM	Till		Low plastic, brown, sand lenses
		3.1-4.5	CL	SM	Till		Stiff, med plastic, brown
SF25-20	0401480	0-0.15	CL	M	Topsoil		
	5566179	0.15-2.6	CL	SM	Till		
		2.6-3.4	CL	M	Till		Stiff, med plastic, dark brown, sand lens
		3.4-4.5	CL	M	Till		Stiff, med plastic, dark brown
SF26-20	0401476	0-0.15	CL	D	Topsoil		
	5566075	0.15-3.0	CL	SM	Till		V. firm, med plastic, brown, trace gravel
		3.0-3.6	CL	SM	Till		Trace gravel
		3.6-5.7	VFSL	SM	Till		Non plastic, yellow brown, silty
		5.7-6.2	CL	M	Till		Stiff, med plastic, oxidized along fracures
		6.2-6.4	CL	M	Till		Stiff, med plastic, sand lensing (M)
		6.4-7.8	CL	M	Till		Stiff, med plastic, dark brown
		7.8-8.2	S+Gr	M	Till		
SF27-20	0401579	0-0.15	CL	D	Topsoil		
	5566381	0.15-1.5	CL	D	Till		V. firm, low-med plastic, trace sand
		1.5-3.0	CL	SM	Till		Stiff, med plastic, gypsum salts, coal chips
SF28-20	0401380	0-0.15	CL	SM	Topsoil		
	5566088	0.15-1.3	CL	SM	Till		V. firm-stiff, med plastic, brown
		1.3-3.0	CL	SM	Till		Stiff, med plastic, brown, gypsum salts
SF29-20	0401380	0-0.15	CL	SM	Topsoil		
	5566180	0.15-1.0	CL	SM	Till		V. firm, med plastic, brown
		1.0-3.0	CL-C	SM	Till		Stiff, med plastic, dark brown, gypsum salts sand streaks
SF30-20	0401380	0-0.15	CL	SM	Topsoil		
	5566279	0.15-1.4	CL	SM	Till		V. firm, med plastic, brown
		1.4-2.7	CL-C	SM	Till		Stiff, med plastic, dark brown, sand lenses
		2.7-4.5	CL-C	M	Till		Stiff, med plastic, dark brown, sand lenses oxidized along fractures
							50mm H.C. well installed to 4,.5m
							Screen: 4.5-3.0m
							Sand: 4.5-2.9m
							Bentonite: 2.9-0.0m
							Stickup: 0.6m
							Hole Diameter: 0.15m

SOIL PROFILE AND PARENT MATERIAL DESCRIPTION (CONTINUED)

Hole #	Location	Depth	Texture	Moisture	Geological	Sample	Remarks
SF31-20	0401380	0-0.15	CL	SM	Topsoil		
	5566580	0.15-1.1	CL	SM	Till		V. firm, med plastic, brown, silt lenses
		1.1-3.0	CL	SM	Till		Stiff, med plastic, dark brown, gypsum salts
							sand streaks
							50mm H.C. well installed to 3.0m
							Screen: 3.0-1.5m
							Sand: 3.0-1.4m
							Bentonite: 1.4-0.0m
							Stickup: 0.6m
							Hole Diameter: 0.15m
SF32-20	0401280	0-0.15	CL	SM	Topsoil		
	5566479	0.15-0.6	CL-VFSCL	SM	Till		
		0.6-1.6	CL	SM	Till		V. firm, med plastic, brown
		1.6-2.7	FSCL	M	Till		Firm, low plastic, brown
		2.7-4.5	CL	M	Till		Stiff, med plastic, brown, sand lenses
							50mm H.C. well installed to 4.5m
							Screen: 4.5-2.8m
							Sand: 4.5-2.7m
							Bentonite: 2.7-0.0m
							Stickup: 0.6m
							Hole Diameter: 0.15m
SF33-20	0401282	0-0.15	CL	SM	Topsoil		
	5566381	0.15-1.0	CL-VFSCL	SM	Till		
		1.0-2.5	CL	SM	Till		Stiff, med plastic, brown
		2.5-3.0	CL	SM	Till		Stiff, med plastic, brown, sand layers
SF34-20	0401280	0-0.15	CL	SM	Topsoil		
	5566279	0.15-3.0	CL	SM	Till		V. firm, med plastic, brown, sand streaks
							50mm H.C. well installed to 3.0m
							Screen: 3.0-1.5m
							Sand: 3.0-1.4m
							Bentonite: 1.4-0.0m
							Stickup: 0.6m
							Hole Diameter: 0.15m
SF35-20	0401278	0-0.15	CL	SM	Topsoil		
	5566180	0.15-1.0	CL	SM	Till		
		1.0-3.0	CL	SM	Till		V. firm, med plastic, brown, sand & silt streaks
SF36-20	0401280	0-0.15	CL	SM	Topsoil		
	5566080	0.15-1.0	CL	SM	Till		V. firm, med plastic, some sand
		1.0-1.4	FSL	SM	Till		V. firm, med plastic
		1.4-3.0	CL	SM	Till		Stiff, med plastic, trace sand
SF37-20	0401179	0-0.15	CL	SM	Topsoil		
	5566080	0.15-1.2	CL	D	Till		V. firm, med plastic, trace sand
		1.2-3.0	CL	M	Till		Stiff, med plastic, dark brown
SF38-20	0401180	0-0.15	CL	D	Topsoil		
	5566181	0.15-1.4	CL	D	Till		V. firm, med plastic, brown
		1.4-3.0	CL	SM	Till		Stiff, med plastic, dark brown, gypsum salts
							50mm H.C. well installed to 3.0m
							Screen: 3.0-1.5m
							Sand: 3.0-1.4m
							Bentonite: 1.4-0.0m
							Stickup: 0.6m
							Hole Diameter: 0.15m

SOIL PROFILE AND PARENT MATERIAL DESCRIPTION (CONTINUED)

Hole #	Location	Depth	Texture	Moisture	Geological	Sample	Remarks
SF39-20	0401180	0-0.15	CL	SM	Topsoil		
	5566280	0.15-1.1	CL	D	Till		V. firm, med plastic, yellow brown, some silt
		1.1-3.0	CL	SM	Till		Stiff, med plastic, brown, silt lenses
SF40-20	0401182	0-0.15	CL	SM	Topsoil		
	5566380	0.15-1.3	CL	M	Till		V. firm, med plastic, yellow brown
		1.3-3.0	CL	M	Till		Stiff, med plastic, brown, trace sand & gravel
SF41-20	0401180	0-0.15	CL	SM	Topsoil		
	5566482	0.15-0.9	CL	SM	Till		V. firm, med plastic, brown
		0.9-1.9	CL	SM	Till		Stiff, med plastic, dark brown, sand lensing
		1.9-4.0	CL	SM	Till		Stiff, med plastic, dark brown, sand streaks iron staining 50mm H.C. well installed to 4.0m Screen: 4.0-2.5m Sand: 4.0-2.4m Bentonite: 2.4-0.0m Stickup: 0.6m Hole Diameter: 0.15m
SF42-20	0401184	0-0.15	CL	SM	Topsoil		
	5566565	0.15-1.4	FSCL	SM	Till		Firm, low plastic, yellow brown
		1.4-3.0	CL	SM	Till		Stiff, med plastic, dark brown
SF43-21	0401379	0-0.15	CL	SM	Topsoil		
	5566098	0.15-1.2	CL	SM	Till		V. firm, yellow brown, sand lensing
		1.2-3.6	CL	SM	Till	1.7-3.0	Stiff, med plastic, brown
		3.6-4.5	CL	SM	Till		Sand lenses 50mm H.C. well installed to 3.0m BGS Benonite: 4.5-3.1m Screen: 3.0-1.8m Sand: 3.1-1.7m Bentonite: 1.7-0.0m Stickup: 0.6m Hole Diameter: 0.15m

Legend:

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

Eg. VFSCL = Very Fine Sandy Clay Loam

PERMEABILITY TEST

wood.

CLIENT :	**Serfas Farms Ltd.**		
PROJECT :	**Proposed New Feedlot (Project 2)**		
JOB No. :	BX11555		
LOCATION :		SAMPLE:	--
BOREHOLE:	Composite - SF1 to SF5	DEPTH :	1.5 - 3.1m
DATE :	29-Jan-21	TECHNICIAN :	AJ

SAMPLE DATA

Sample Description :	Medium Plastic Clay		
Sample Diameter (mm) :	101.4	Cross Section Area (cm²)	80.7
Initial Sample Length (mm) :	112	Initial Volume (cm³)	904.0
Final Sample Length (mm)	112	Final Volume(cm³)	904.0
		Change in Volume (cm³)	

MOISTURE DETERMINATION	Before	After	DENSITY DETERMINATION	Before	After
Tare No. :	1	1	Mould No.	1	
Wt. Sample (wet + tare) (g)	203.0	203.0	Wt. Sample (wet + mould) (g)	4038.0	4038.0
Wt. Sample (dry + tare) (g)	174.2	174.2	Wt. Mould (g)	2041.3	2041.3
Wt. Tare (g)	10.0	10.2	Wt. Sample (wet) (g)	1996.7	1996.7
Wt. Water (g)	28.8	28.8	Volume Mould (cm³)	936.0	936.0
Wt. Sample (dry) (g)	164.2	164.0	Wet Density (kg/m³)	2133	2133
Moisture Content (%)	17.5%	17.6%	Dry Density (kg/m³)	1815	1815

PERMEABILITY TEST DATA

				Elapsed Time (sec)			Permeability (cm/s)	
Date	Temp	h_0	h_1	Time	Elapsed Time		Initial	Average
January 30, 2021	21	25.0		9:00 AM				
January 31, 2021	21		22.0	9:00 AM	86400.0		2.13E-07	
January 31, 2021	21	25.0		9:00 AM				
February 1, 2021	21		23.1	9:00 AM	86400.0		1.32E-07	1.72E-07
February 1, 2021	21	25.0		9:00 AM				
February 2, 2021	21		23.8	9:00 AM	86400.0		8.20E-08	1.07E-07
February 2, 2021	21	23.8		9:00 AM				
February 3, 2021	21		22.0	9:00 AM	86400.0		1.31E-07	1.07E-07
						Average Permeabilty, *k*, for test:	**1.29E-07**	**cm/sec**

REMARKS:

FORM : Serfas Project 2 Laboratory Permeability 1_ January 29, 2021
DATE: 6/18/2021

PERMEABILITY TEST

wood.

CLIENT :	**Serfas Farms Ltd.**		
PROJECT :	**Proposed New Feedlot**		
JOB No. :	BX11555		
LOCATION :	SW11-015-18-W4M	SAMPLE:	--
BOREHOLE:	Composite - SF1-SF5, SF15-20, SF30-34	DEPTH :	1.5 - 3.1m
DATE :	26-Apr-20	TECHNICIAN :	AJ

SAMPLE DATA

Sample Description :	Medium Plastic Clay		
Sample Diameter (mm) :	101.4	Cross Section Area (cm²)	80.7
Initial Sample Length (mm) :	112	Initial Volume (cm³)	904.0
Final Sample Length (mm)	112	Final Volume(cm³)	904.0
		Change in Volume (cm³)	

MOISTURE DETERMINATION	Before	After	DENSITY DETERMINATION	Before	After
Tare No. :			Mould No.		
Wt. Sample (wet + tare) (g)		204.3	Wt. Sample (wet + mould) (g)		4010.5
Wt. Sample (dry + tare) (g)		174.0	Wt. Mould (g)		2042.9
Wt. Tare (g)		10.0	Wt. Sample (wet) (g)		1967.6
Wt. Water (g)		30.3	Volume Mould (cm³)		936.0
Wt. Sample (dry) (g)		164.0	Wet Density (kg/m³)		2102
Moisture Content (%)		18.5%	Dry Density (kg/m³)		1774

PERMEABILITY TEST DATA

				Elapsed Time (sec)			Permeability (cm/s)	
Date	Temp	h_0	h_1	Time	Elapsed Time		Initial	Average
April 21, 2020	21	25.0		11:00 AM				
April 22, 2020	21		22.9	11:00 AM	86400.0		1.46E-07	
April 22, 2020	21	25.0		11:00 AM				
April 23, 2020	21		23.5	11:00 AM	86400.0		1.03E-07	1.25E-07
April 23, 2020	21	25.0		11:00 AM				
April 24, 2020	21		23.7	11:00 AM	86400.0		8.90E-08	9.61E-08
April 24, 2020	21	25.0		11:00 AM				
April 27, 2020	21		22.0	11:00 AM	259200.0		7.10E-08	8.00E-08
						Average Permeabilty, *k*, for test:	**1.00E-07**	**cm/sec**

REMARKS:

FORM : Serfas Project 2 Laboratory Permeability 2_April26_2021
DATE: 6/18/2021

TO: Serfas Farms Ltd.

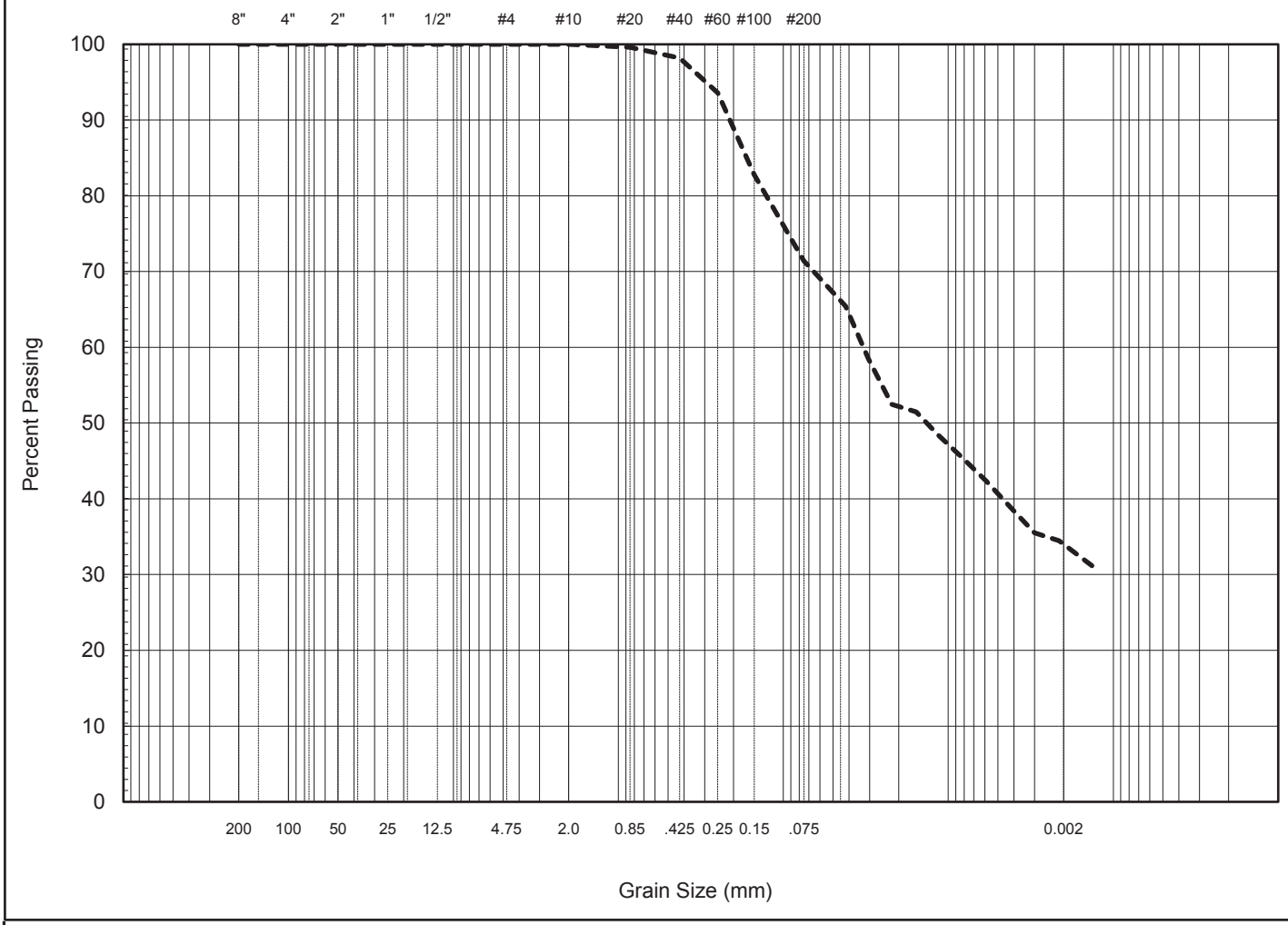
Turin, AB T0K-0H0

HYDROMETER TEST

wood.

ATTENTION: Mr. Kevin Serfas

COBBLES	GRAVEL		SAND			SILT	CLAY
	Coarse	Fine	C	M	F		



Remarks:

Summary					
D10 =	--	mm	**Gravel**	0	%
D30 =	--	mm	**Sand**	29	%
D60 =	0.0330	mm	**Silt**	37	%
Cu =	--		**Clay**	34	%
Cc =	--				

Project No: BX11555
Hole No: Composite: SF1 to SF5

Sample: --
Date: May 12, 2021

Tech: PP

Hydrometer 01

TO: Serfas Farms Ltd.

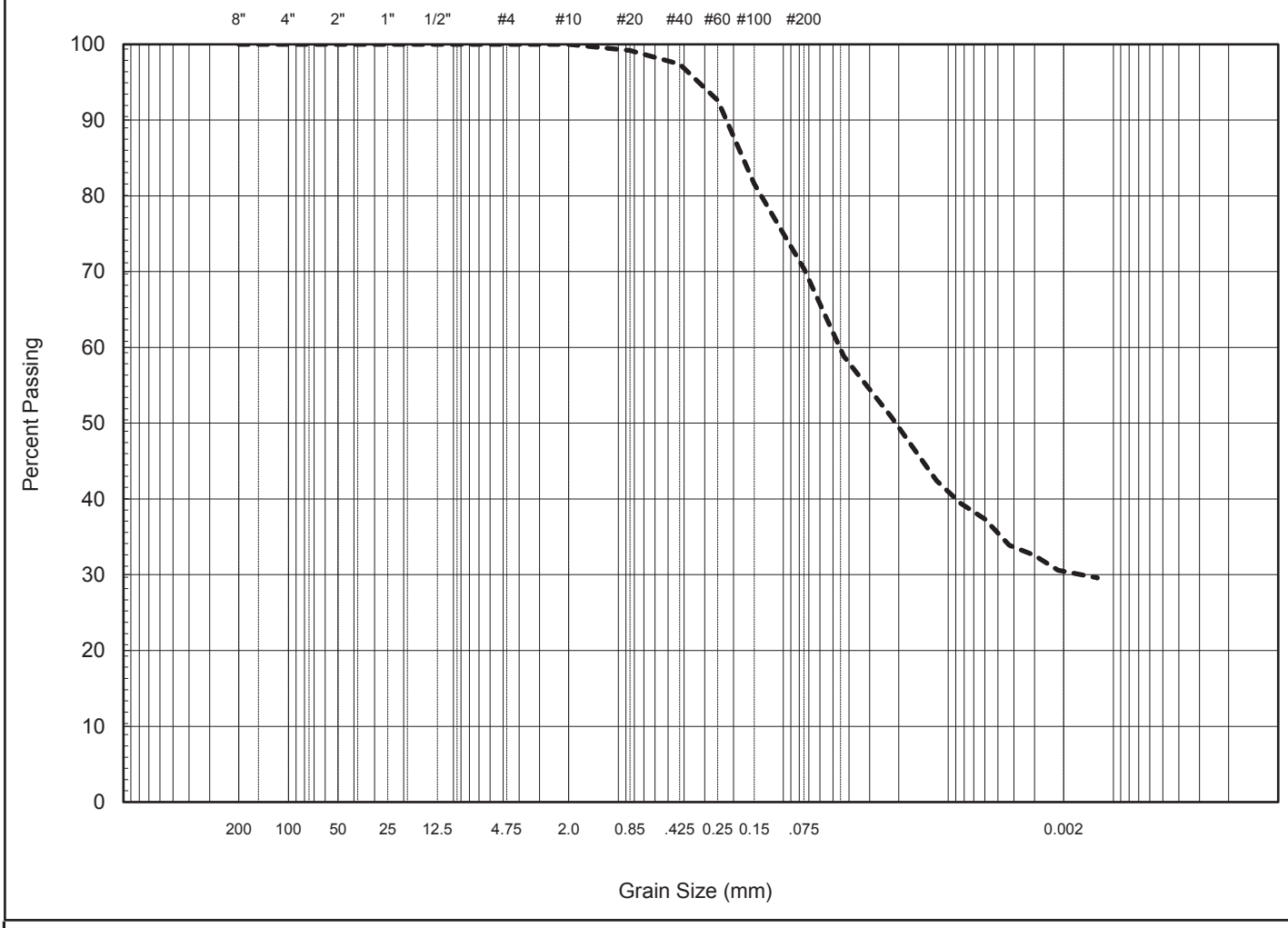
Turin, AB T0K-0H0

HYDROMETER TEST

wood.

ATTENTION: Mr. Kevin Serfas

COBBLES	GRAVEL		SAND			SILT	CLAY
	Coarse	Fine	C	M	F		



Remarks:

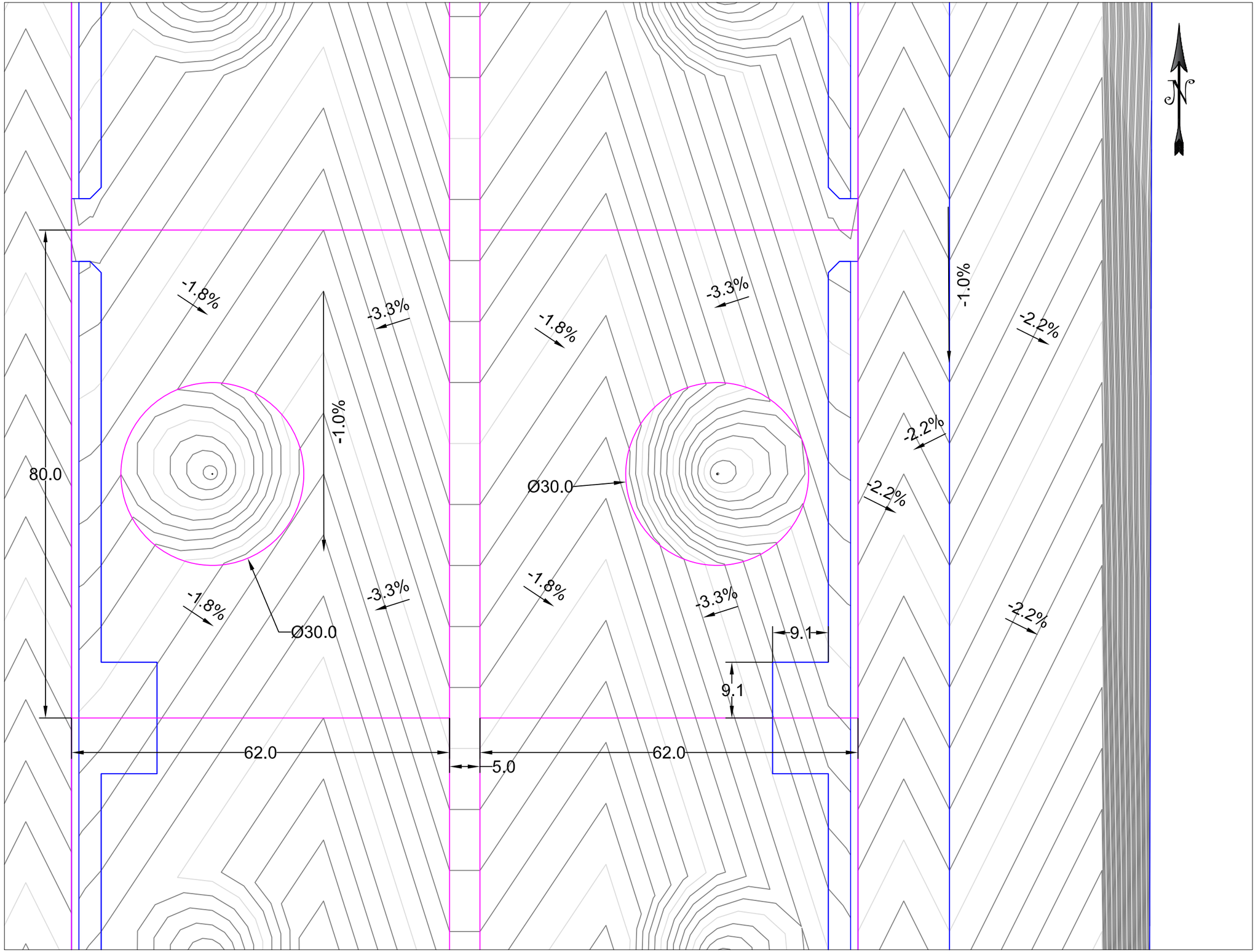
Summary					
D10 =	--	mm	**Gravel**	0	%
D30 =	0.0016	mm	**Sand**	30	%
D60 =	0.0463	mm	**Silt**	40	%
Cu =	--		**Clay**	30	%
Cc =	--				

Project No: BX11555

Hole No: Comp: SF1-SF5, 15-20, 30-34

Date: May 12, 2021 **Tech:** PP

Hydrometer 02



Notes:

1. Entire feedlot graded at 1.0% from North edge of Hospital to South.

2. Dimensions in Meters.

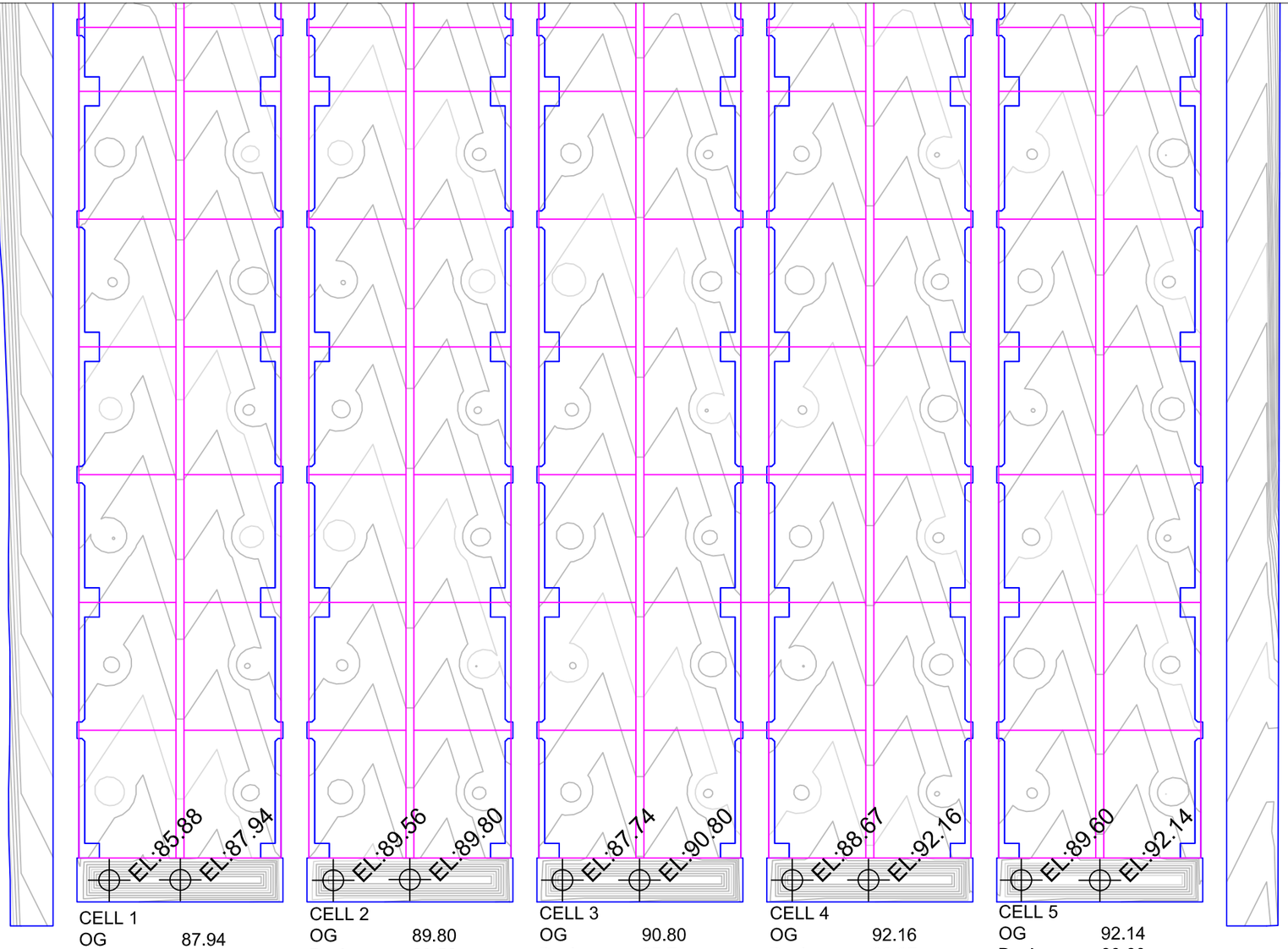
3. Backgrounder Feedbunk used.

For Discussion Only

Dennis Dirtworx LTD

GRADES TYPICAL

Date	Mar 2021	Drawn	Dan Dyck
Scale	NTS	Drawing #	



CELL 1	
OG	87.94
Design	85.88
Cut	2.06

CELL 2	
OG	89.80
Design	89.56
Cut	0.24

CELL 3	
OG	90.80
Design	87.74
Cut	3.06

CELL 4	
OG	92.16
Design	88.67
Cut	3.49

CELL 5	
OG	92.14
Design	89.60
Cut	2.54

Notes:

1. Effluent Pond Calcs:
   - 720 meters
   - x 560 meters
   - = 403,200 meters square

   4,523,269 Gallons required as per:
   agric.gov.ab.ca/app19/loadcatchbasin

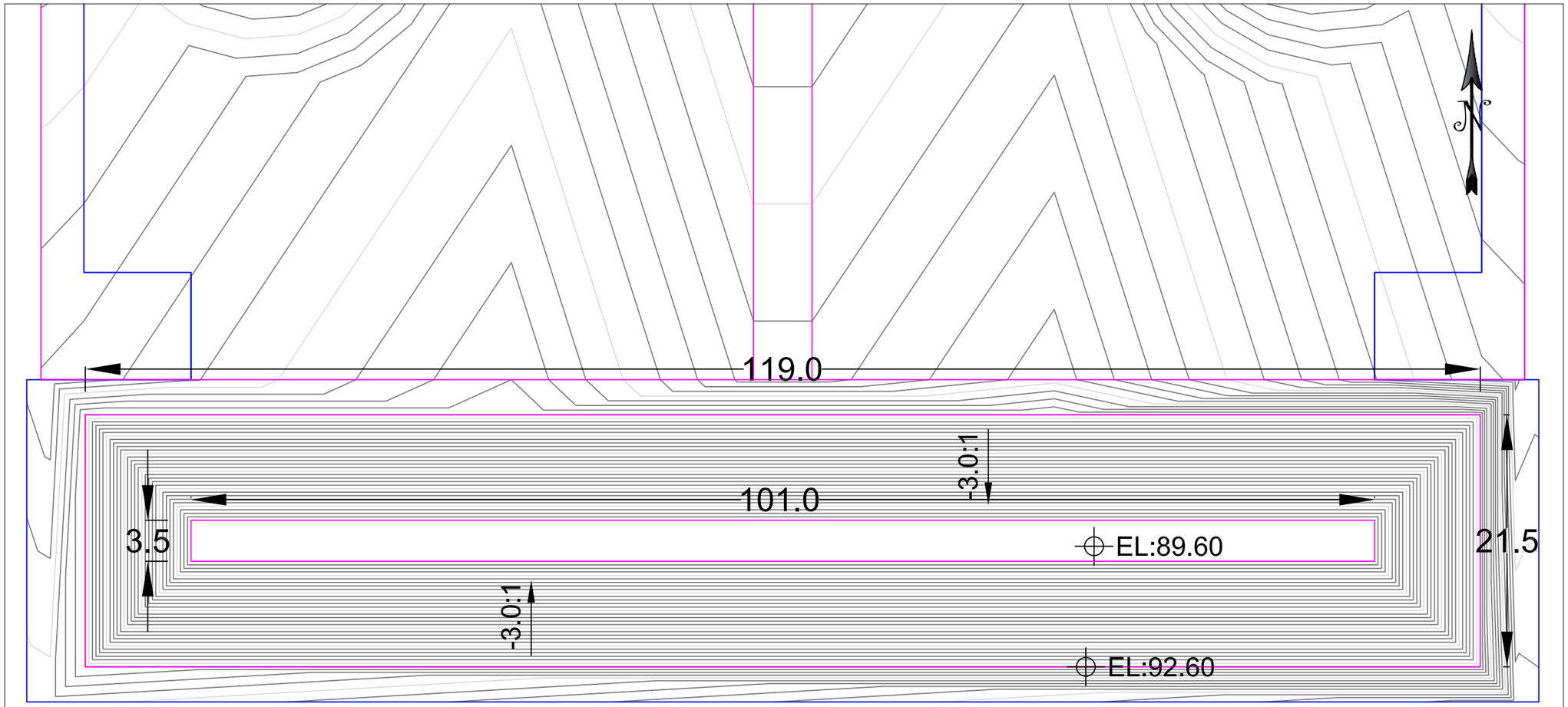
5 Ponds connected with 600mm CSP and gate valves to isolate. Each Pond at water level:
- 119 meters
- x 21.5 meters
- x 3 meters @ 3:1 slope
- = 925,190 Gallons
- x 5 Ponds
- = 4,625,950 Gallons

For Discussion Only

Dennis Dirtworx LTD

Effluent Ponds C/F

Date	APR 2021	Drawn	Dan Dyck
Scale	NTS	Drawing #	LA21018-TD



Notes:

1. Effluent Pond Calcs:
   - 720 meters
   - x 560 meters
   - = 403,200 meters square

   4,523,269 Gallons required as per:
   agric.gov.ab.ca/app19/loadcatchbasin

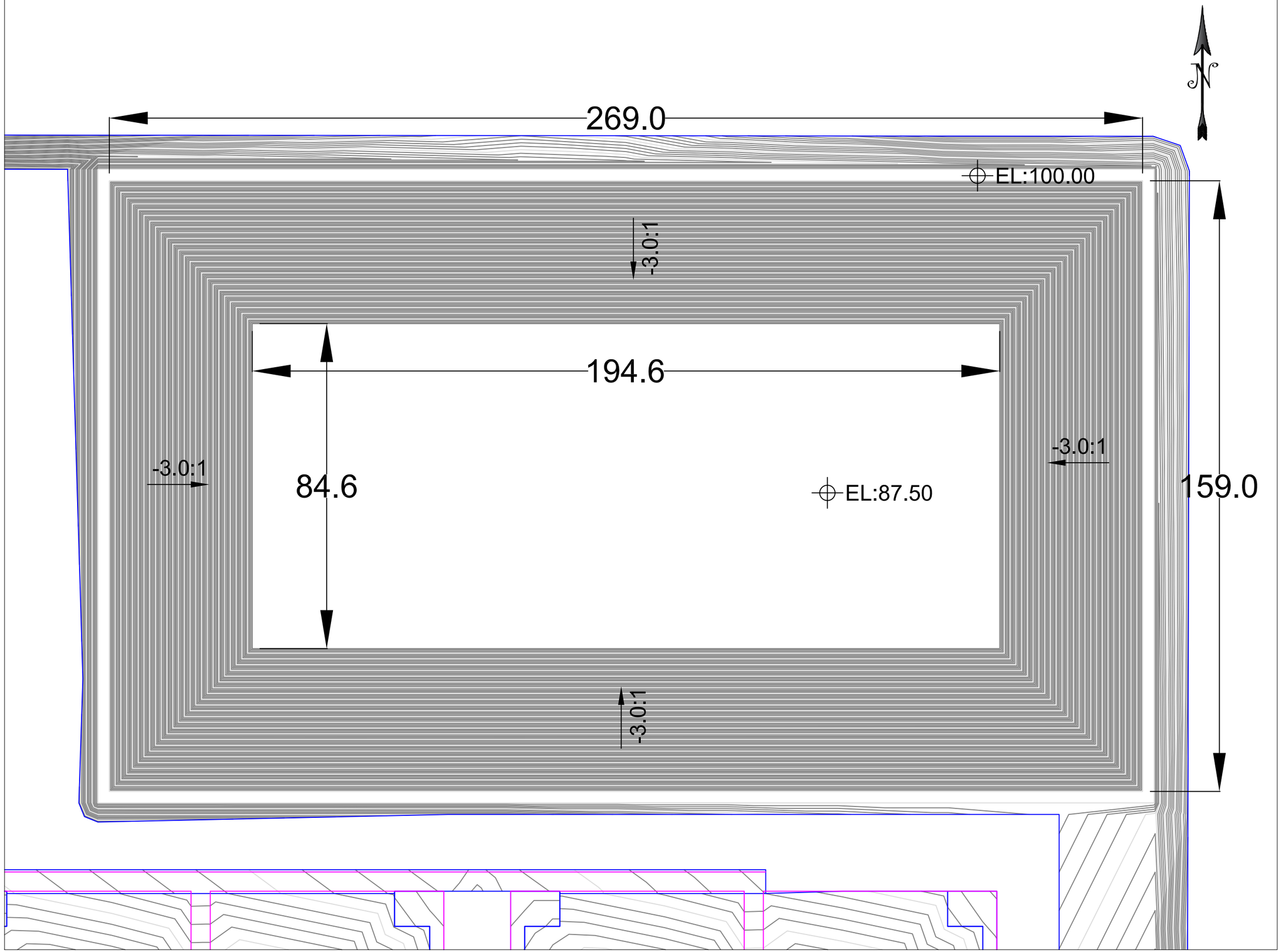
5 Ponds connected with 600mm CSP and gate valves to isolate. Each Pond at water level:
- 119 meters
- x 21.5 meters
- x 3 meters @ 3:1 slope
- = 925,190 Gallons
- x 5 Ponds
- = 4,625,950 Gallons

For Discussion Only

Dennis Dirtworx LTD

Effluent Ponds

Date	Mar 2021	Drawn	Dan Dyck
Scale	NTS	Drawing #	



Notes:

1. Main Pond Calcs:

	70 Pens
x	400 Head
=	28,000 Head
x	10 Gallons/day (winter usage)
=	280,000 Gallons per Day
x	240 Days (8 months)
=	67,200,000 Gallons
+	10% margin
=	73,920,000 Gallons Required

Main Pond (includes 0.5m Freeboard):

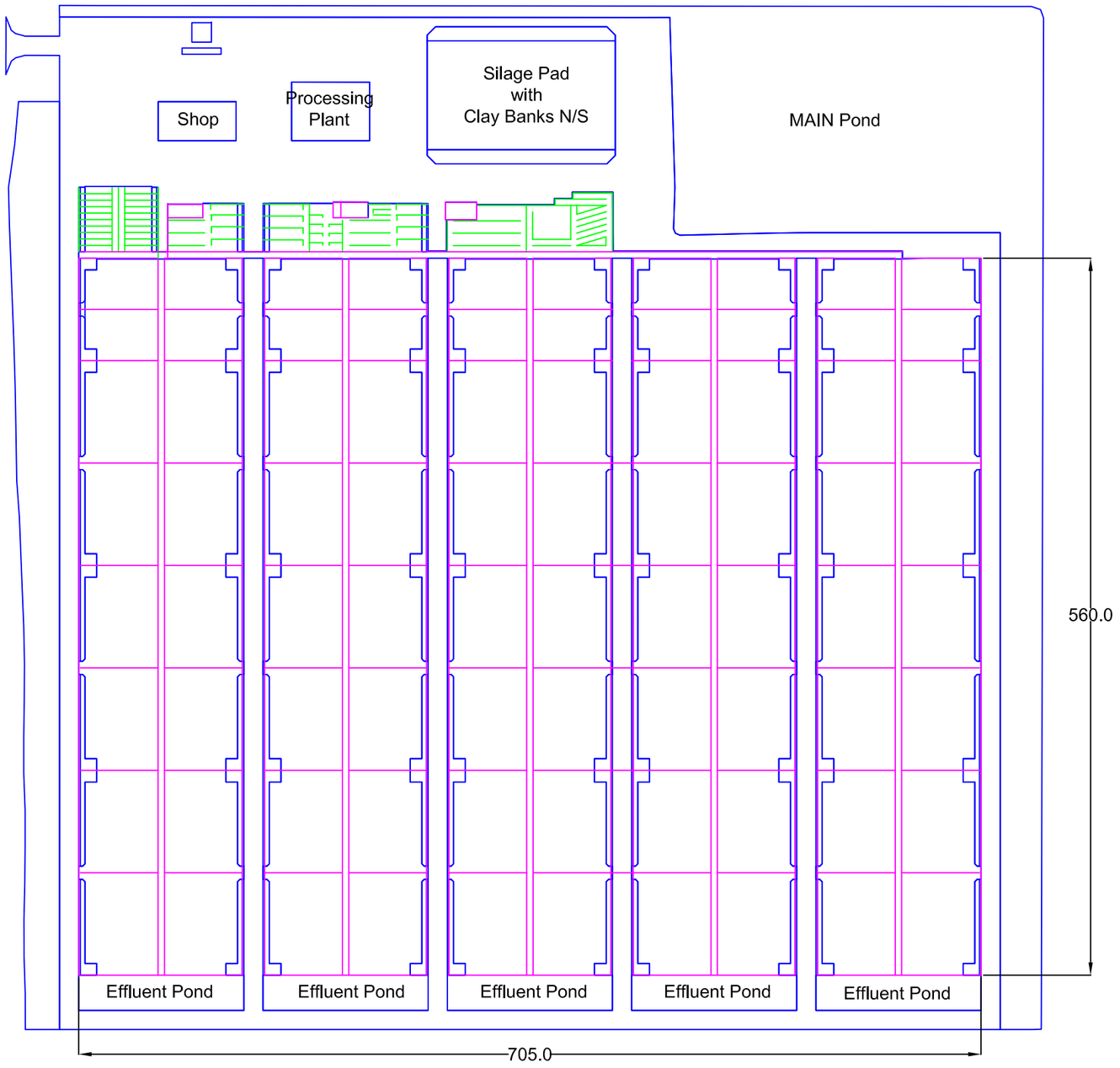
	269m
x	159m
x	12.5m @ 3:1 slope
=	73,994,093 Gallons

For Discussion Only

Dennis Dirtworx LTD

Main Pond

Date	Mar 2021	Drawn	Dan Dyck
Scale	NTS	Drawing #	



Notes:

1.

For Discussion Only

Dennis Dirtworx LTD

Overview

Date	Mar 2021	Drawn	Dan Dyck
Scale	NTS	Drawing #	LA21018 TD