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	RA23017	Sec 3-48-20 W4M and SE 10-48-20 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.

Nov 6/23
Date of signing

[redacted]
Signature

Camrose Colony
Corporate name (if applicable)

Len T
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)
Catch Basin extension	~~133 x 25 x 10~~
	by an additional
	130 x 35 x 3.5 deep

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

Existing facilities	Dimensions (m) (length, width, and depth)	NRCB USE ONLY
~~See RA22006~~		
See list below		

NRCB USE ONLY

Existing catch basin is permitted under RA15054 in which the same engineering report is being utilized for this application; existing dimensions are 130 x 35 x 3.5 deep

Last updated September 11, 2023

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

Existing facilities continued	Dimensions (m) (length, width, and depth)	NRCB USE ONLY
Feedlot catch basin	130 x 35 x 3.5	
Feedlot Corrals / North pens	135 x 275 x 55 x 35	
Feedlot + dairy corrals (east)	300 x 110	
Calf barn	41.2 x 12.2	
layer barn	67.1 x 15.2	
broiler barn / turkey barn	45.7 x 12.2	
Swine finishing barn	122 x 36.6	
duck / geese barn	4.6 x 3.1	
liquid manure storage tank	68.6 diam. x 3.7	
EMS	166.1 x 45.7 x 5.5	
Dairy loafing pen (irregular shape)	84 x 95 x 125 x 41	
Converted Dairy barn (previously swine barn)	122 x 36.6	
Dry cow + heifer pens	110 x 150.	
AO note: Dimensions of above facilities are confirmed accurate		

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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 The end of 2025

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**
N/A			
No increase in livestock			

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

DECLARATION AND ACKNOWLEDGMENT OF APPLICANT CONCERNING *WATER ACT* LICENCE
issued by Alberta Environment and Protected Areas (EPA) for a confined feeding operation (CFO)
Date and sign one of the following four options

OPTION 1: Applying through the NRCB for both the AOPA permit and the *Water Act* licence

I **DO** want my water licence application coupled to my AOPA permit application.

Signed this ____day of _____, 20____. _____
Signature of Applicant or Agent

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

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

Signed this ____ day of _____, 20____. _____
Signature of Applicant or Agent

OPTION 3: Additional water licence not required

1. I (we) declare that the CFO will not need a new licence from EPA under the *Water Act* for the development or activity proposed in this AOPA application.
2. **Provide**: Water license number(s) or water conveyance agreement details _____

Signed this 6 day of Nov, 2023. [redacted]
Signature of Applicant or Agent

Last updated September 11, 2023

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

1. At this time, I (we) do not know whether a new water licence is needed from EPA under the *Water Act* for the development or activity proposed in this AOPA application.
2. If a new *Water Act* licence is needed, I (we) request that the NRCB process the AOPA application **independently of** EPA's processing of the CFO's application for a water licence.
3. In making this request, I (we) recognize that, if this AOPA application is granted by the NRCB, the NRCB's decision will not be considered by EPA as improving or enhancing the CFO's eligibility for a water licence under the *Water Act*.
4. I (we) acknowledge that any construction or actions to populate the CFO with additional livestock pursuant to an AOPA permit in the absence of a *Water Act* licence will **not** be relevant to EPA's consideration of whether to grant my *Water Act* licence application, if a new water licence is needed.
5. I (we) acknowledge that any such construction or livestock increase will be at the CFO's sole risk if the *Water Act* licence application is denied or if the operation of the CFO is otherwise deemed to be in violation of the *Water Act*. This risk includes being required to depopulate the CFO and/or to cease further construction, or to remove "works" or "undertakings" (as defined in the *Water Act*).
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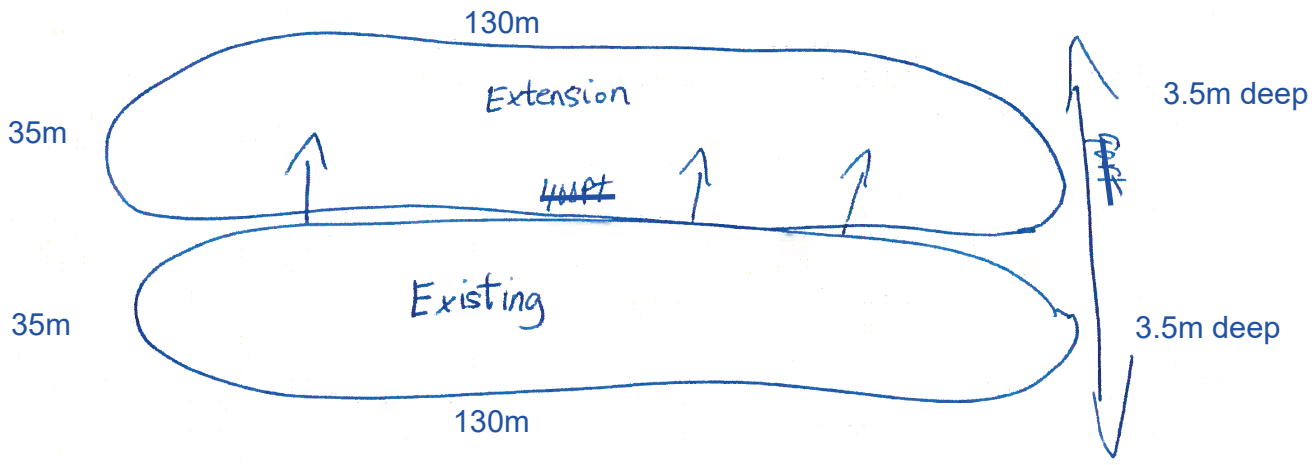
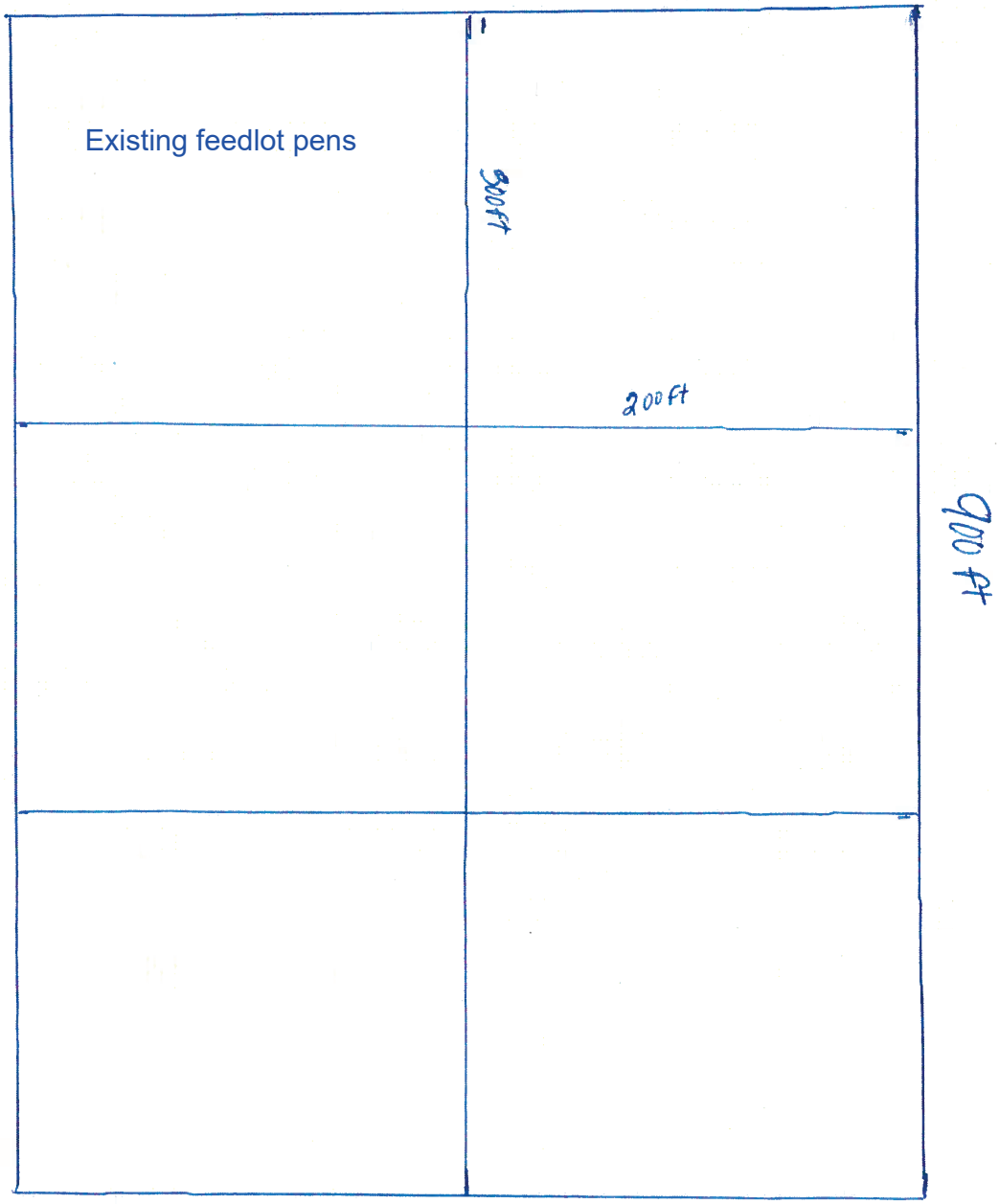
7. **Provide:** Water license number(s) or water conveyance agreement details _____

_____

Signed this _____ day of _____, 20_____.

_____
Signature of Applicant or Agent


130m
Extension
3.5m deep
35m
~~44ft~~
~~8ft~~
Existing
35m
3.5m deep
130m


Existing feedlot pens
900ft
200ft
900 ft

Proposed expansion
Existing catch basin
633

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: Feedlot catch Basin **Proposed 1:** Extented catch Basin

Proposed 2: **Proposed 3:**

Facility and environmental risk information		Facilities: Existing	Proposed 1	Proposed 2	Proposed 3	NRCB USE ONLY: 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	>1m confirmed
Surface water information	How many springs are within 100 m of the manure storage facility or manure collection area?	0	0			☒ YES ☐ NO ☐ YES with exemption	None, confirmed on site
	How many water wells are within 100 m of the manure storage facility or manure collection area?	0	0			☒ YES ☐ NO ☐ YES with exemption	None, confirmed on site
	What is the shortest distance from the manure collection or storage facility to a surface water body? (e.g., lake, creek, slough, seasonal)	150 m	150m			☒ YES ☐ NO ☐ YES with exemption	Slough, ~ 55m west of proposed expansion
Groundwater information	What is the depth to the water table?		14m	14m		☒ YES ☐ NO ☐ YES with exemption	>9 m (see attached eng. report)
	What is the depth to the groundwater resource/aquifer you draw water from?	18m	18m	18m		☒ YES ☐ NO ☐ YES with exemption	13.7 m using WWID 1590183

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

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

NRCB USE ONLY

WATER WELL AND SURFACE WATER INFORMATION

Well IDs: 1590183 0153314

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:

N/A

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NRCB USE ONLY

ENVIRONMENTAL RISK SCREENING INFORMATION

ERST for **proposed** facilities See Decision Summary RA23017

Facility	Groundwater score	Surface water score	File number

ERST for **existing** facilities

Facility	Groundwater score	Surface water score	File number
Feedlot catch basin	low	low	RA22006
EMS	low	low	RA22006
Liquid manure storage tank	low	low	RA22006
AO note: These facilities are assumed to present the highest potential risk to surface water and groundwater, and all present a low potential risk to both when scored with the ERST. Based on this, all of the other MSFs and MCAs at this CFO are presumed to present a low potential risk to surface water and groundwater.			

ERST related comments:

Last updated February 26, 2021

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

NRCB | Natural Resources Conservation Board

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
Larry Baerg ~~H. Steil~~	NW-1/4 S34 T44 R20 W4	760	Agriculture	1	760	N/A	Yes
H. Steil and Karin Vassberg	NW 1/4 S34 T47 R20 W4	728	Ag	1	740	N/A	Yes
Ducks unlimited Canada	NW 1/4 S10 T48 R20 W4	1665	Ag	1	1,915	N/A	Yes
Aline Wenig	NW 4-48-20 W4	1740	Ag	1	1,740	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)
				N/A for authorization applications	
			Total		

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

** Available manure spreading area (excluding setback areas from residences, common bodies of water, water wells, etc. as identified in Agdex 096-5 Manure Spreading Regulations)

*** Brown, dark brown, black, grey wooded, or irrigated

Additional information (attach any additional information as required)

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NRCB USE ONLY

MINIMUM DISTANCE SEPARATION

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

Margin of error (if applicable): +/- 5m

Requirements (m): Category 1: 721 Category 2: 961 Category 3: 1,202 Category 4: 1,923

Technology factor: ☐ YES ☒ NO

Expansion factor: ☐ YES ☒ NO

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

LAND BASE FOR MANURE AND COMPOST APPLICATION

Land base required: _____ N/A for authorization applications

Land base listed: _____

Area not suitable: _____

Available area _____ Requirement met: ☐ YES ☐ NO

Land spreading agreements required: ☐ YES ☐ NO

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

PLANS

Submitted and attached construction plans: ☒ YES ☐ NO

Submitted aerial photos: ☐ YES ☒ NO

Submitted photos: ☐ YES ☒ NO

GRANDFATHERING

Already completed: ☒ YES ☐ NO ☐ N/A

If already completed, see decision summary RA09027

Part 2 — Technical Requirements

NRCB Natural Resources Conservation Board

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

RUNOFF CONTROL CATCH BASIN: Naturally occurring protective layer

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

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

1. Catch Basin Extension
2.
3.

Determination of runoff area

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

Catch basin capacity

	Length (m)	Width (m)	Total depth (m)	Depth below ground level (m)	Slope run:rise Inside end walls	Slope run:rise Inside side walls	Slope run:rise Outside walls	NRCB USE ONLY Calculated storage capacity (excl. 0.5 m freeboard) (m^3)
1.	~~133~~	~~25~~	~~10~~					8,223 m^3
2.	130	35	3.5					
3.								
							TOTAL CAPACITY	8,223 m^3

Naturally occurring protective layer details

Thickness of naturally occurring protective layer	5.0 (m)	Provide details (as required)	
Soil texture	32.6 % sand	43 % silt	23.8 % clay
Hydraulic conductivity - naturally occurring protective layer	Depth and type of soil tested: 17.5 To 20.5	Hydraulic conductivity (cm/s): 1.37 x 10 Exp-7	Describe test standard used: Rising head Test

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

If soil info differs per facility include additional soils page.

NRCB USE ONLY

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

*AO note: See attached engineering report (from RA15054)

Last updated February 26, 2021

Catch Basin Storage Volume Calculator

Construction Dimensions of Catch Basin

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

Overall Dimensions of Catch Basin			Catch Basin Dimensions	
Total Length*[4]	130.0	m	427	ft
Total Width*[4]	35.0	m	115	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	109.0	m	358	ft
Width of Bottom	14.0	m	46	ft
Capacity @ top of Bank	*10,376*	m^3	*Capacity (@tob)* *366,416*	ft^3
			2,282,345	*Imp. Gal.*

Design Capacity of Catch Basin (freeboard level)			Design Capacity (freeboard level)	
Length (design capacity depth)	127.0	m	417	ft
Width (design capacity depth)	32.0	m	105	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)	**8,223**	m^3	**290,393**	ft^3
			1,808,806	**Imp. Gal.**
level)	*4,064*	m^2	*43,745*	ft^2

CFO Name [1]	
Land Location [1]	

Paved Runoff Catchment Area(s)

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

Unpaved Runoff Catchment Area(s)

Area [2]	Length (m)	Width (m)	Area (m^2)
6	271	131	35,501.0
7			0.0
8			0.0
9			0.0
10			0.0
		Total Area (m^2)	**35,501**

Rainfall (Select Town [3]**)**

Camrose 85

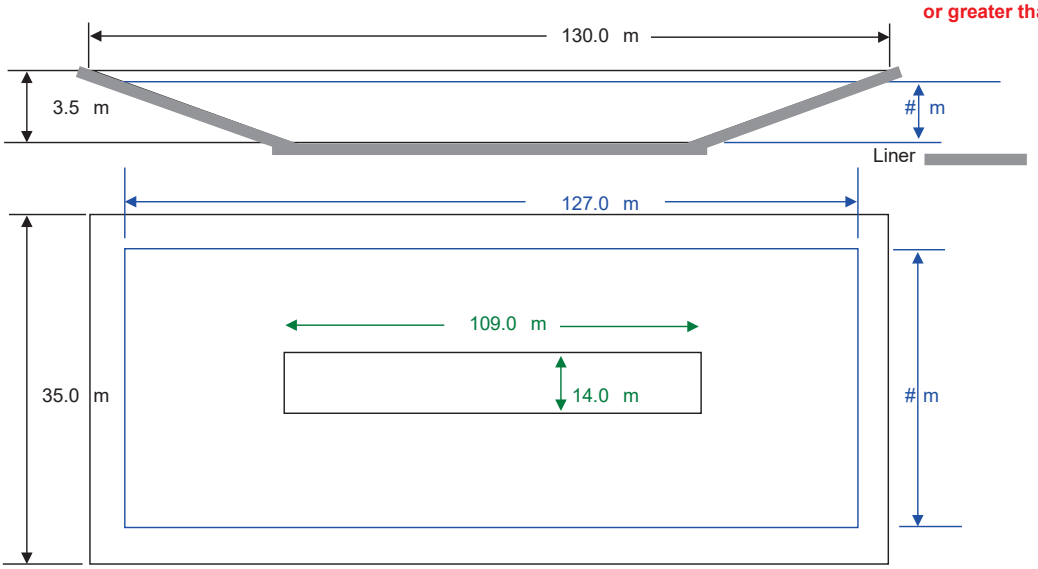
AOPA Design Rainfall **85 mm**

Minimum Catchbasin Storage Volume Required

1,811 m^3 ** **63939.0051 ft^3**

398265.385 Imp. Gal.

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



Lines in Black - Overall catch basin dimensions

Lines in Blue - Design capacity depth dimensions (excludes freeboard)

NTS - Not To Scale

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

NRCB USE ONLY

Catch basin calculator. Total volume @ freeboard level: 8,223 m^3 Runoff capacity requirements met: ☒ YES ☐ NO

Calculation of the volume attached: ☒ YES ☐ NO

Depth to water table: >9 m Requirements met: ☒ YES ☐ NO

Depth to uppermost groundwater resource: 13.7 m Requirements met: ☒ YES ☐ NO

ERST completed: ☐ See ERST page for details

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

5 m thick naturally occurring protective layer. See attached engineering report (from RA15054).

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

NRCB USE ONLY **RUNOFF CONTROL CATCH BASIN CAPACITY SUMMARY (if applicable)**	
Facility 1 Proposed catch basin expansion	
Name / description	Capacity 8,223 m^3
Facility 2 Existing catch basin	
Name / description	Capacity 8,223 m^3
Facility 3	
Name / description	Capacity
Facility 4	
Name / description	Capacity
TOTAL CAPACITY	16,446 m^3
RUNOFF VOLUME FROM CONTRIBUTING AREAS	1,811 m^3
MEETS AOPA RUNOFF CONTROL VOLUME REQUIREMENTS	☒ YES ☐ NO

Part 2 — Technical Requirements

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

NRCB USE ONLY

ALL SIGNATURES IN FILE ☒ YES ☐ NO

DATES OF APPROVAL OFFICER SITE VISITS

November 6, 2023	

CORRESPONDENCE WITH MUNICIPALITIES AND REFERRAL AGENCIES

Date deeming letters sent: November 22, 2023

Municipality: Camrose County

☒ 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: Telus, Ducks Unlimited, Enermark Inc. ☐ 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

Hagstrom Geotechnical Services Ltd.
5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3
Tel: (780) 996-5621• Fax: (780) 475-5671
e-mail: h_gsl@telus.net

Hutterian Brethren Church of Camrose Colony
P.O. Box 1918
Camrose, Alberta
T4X 1X8

Our File: H1604-1005
July 11,2016

Attention: **Mr. Mike Tschetter**

Dear Sirs:

Re: Geotechnical Site Investigation
Proposed Modifications to Beef Finishers Feedlot Catch Basin
NE 3-48-20-W4M
County of Camrose, Alberta

1.0 INTRODUCTION

Hagstrom Geotechnical Services Ltd. (HGSL) was retained by Hutterian Brethren Church of Camrose Colony to carry out a geotechnical investigation for proposed modifications to feedlot catch basin located at the above referenced site. The purpose of the investigation was to obtain subsurface information in order to provide recommendations for the design and construction modifications to the existing feedlot catch basin. The scope of work consisted of field drilling, installation of monitoring wells, field and laboratory testing and evaluation of results. Recommendations along with design and construction details are also provided.

2.0 PROJECT DESCRIPTION

The beef finishers feedlot is located within the northeast quarter of Section 3, Township 48, Range 20, West of the 4th Meridian, in County of Camrose, Alberta. The feedlot is located in the north east limits of the farmyard in a poorly drained low area and has six large pens (refer to Plate 9, Appendix A), that supports up to 1200 head of beef finishers. An existing liquid manure catch basin is located immediately north of Pens 3 and 4 and measures about 130 meters long and 25 meters wide and is about 3.5 meters deep (estimated elevation of 733.5 m). The east and west slopes of predominately clay are inclined at 6 H:1V to accommodate tractor and heavy pump equipment. The south slope is inclined at about 1.5 H:1V and the north slope is inclined at about 0.5 H:1V (very steep). The total area of the six beef finishers pens is about 35,500 square meters and has a 50 cm diameter culvert, (invert elevation of 734.36 m), that crosses a gravel surfaced access road and drains into the existing catch basin. The total drainage area for the project including six pens, three perimeter roads and existing/new catch basin is about 52,800 square meters. Based on AOPA regional rainfall data, a 1 in 30 year rainfall in Camrose County will deliver about 85 mm of rain and a surface runoff coefficient of 0.6 shall be used. The

Hagstrom Geotechnical Services Ltd.
5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3
Tel: (780) 996-5621• Fax: (780) 475-5671
e-mail: h_gsl@telus.net

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freeboard height should be no less than 0.5 meters and expansion of the catch basin will be located to the north direction only. Based on discussions with the client, it is preferable to modify the proposed catch basin by using a natural occurring liner for protection to the underlying potable groundwater aquifer.

3.0 LOCAL GEOLOGY

3.1 Surficial

Surficial deposits in the area are unconsolidated sediments found between the ground surface and the underlying consolidated bedrock. At this site, these deposits are composed of stagnation moraine till of undulating topography with local relief of less than 3 meters. The till in the general area can be described as water sorted material of uneven thickness and is up to 30 meters in thickness.

3.2 Bedrock

Bedrock is composed of sediment that has undergone consolidation and cementation to create competent rock. According to Alberta Water Well records, the upper bedrock at the site is clay shale and coal deposits that commence at depths of about 14 to 17 meters. Significant water bearing coal layers underlie the site and commence at depths of about 17 to 21 meters. The coal layers, according to water wells drilled at the colony, generate large quantities of potable water (range of 90 to 1135 liters per minute) and have static water levels within the wells of 0.5 to 2.5 meters (confined aquifer conditions).

4.0 INVESTIGTION METHODOLOGY

Six boreholes were drilled at the site on April 28, 2016 to depths ranging from 9.0 to 12.0 meters using a drill rig equipped with 150 mm diameter solid stem augers. All boreholes were drilled around the perimeter of the existing catch basin. The approximate borehole locations are shown on Plate 9, Appendix A. A drilling completion, 50 mm diameter standpipes was installed in each borehole. The various soil strata encountered in the boreholes were described and logged as drilling proceeded and disturbed soil samples were obtained for laboratory testing. The soils were classified using the Modified Unified Soils Classification System and described in accordance with the explanation sheets presented in Plates 1 and 2, Appendix A. Borehole logs can be referred to on Plates 3 to 8, Appendix A.

Soil sampling for laboratory analysis generally consisted of disturbed auger soil samples at 0.75 meter intervals obtained from all boreholes. In addition, pocket penetrometer (PP) readings were taken on intact cohesive soil samples at approximately 0.75 meter intervals from all boreholes to obtain an indication of the unconfined compressive strength (Q_u) of the soil. Laboratory testing consisted of routine moisture content tests, Atterberg limit tests, grain size analysis, and constant head permeability tests on two selected Shelby tube samples.

The ground surface elevation at each borehole was surveyed on April 28, 2016 by HGSL and was referenced to an estimated Geodetic datum. A bench mark was established in the north east corner of Pen 4, (top of concrete bunker) and was assigned an elevation of 737.5 meters. This bench mark should be used for all further construction work.

5.0 SUBSOIL CONDITIONS

The ground level elevation at the six borehole locations ranged from 736.0 to 737.5 meters (average of 737.0 m). The soil profile encountered at the six borehole locations consists of a thin cover of topsoil (two boreholes only) followed by an extensive deposit of clay that extended below a depth of about 12.0 meters. The clay was described as silty, medium plasticity, stiff to very stiff consistency, with occasional gravel size rocks, coal chips, sandstone inclusions and dark brown to dark grey in colour. Rust stained fissures and clay till appearance were common within the clay. In situ moisture contents in the clay ranged from 13 to 22 percent with a majority of the values between 19 and 21 percent. Pocket penetrometer (PP) readings taken on intact auger samples of clay revealed approximate unconfined strengths, Q_u, ranging from 95 to 515 kPa. The consistency of the clay generally decreased with increasing depths. Four Atterberg limit tests conducted on clay samples yielded liquid limits of 43 to 49 percent and plastic limits of 15 to 21 percent (medium plasticity soil). Grain size tests conducted on three samples of clay yielded sand contents of 21 to 27 percent, silt contents of 46 to 53 percent and clay contents of 26 to 28 percent.

Two undisturbed Shelby tube samples of clay from Boreholes 16-1 and 16-2 at depths of 4.5 to 4.8 meters, were subjected to laboratory constant head permeability tests. Three trials were carried out on each sample and the results yielded a laboratory permeability of 2.9×10^{-8} cm/sec and 1.8×10^{-8} cm/sec. (refer to Plates 1 and 2, Appendix B). Based on these results, the permeability of the clay in an undisturbed condition, is considered to be suitable as a natural clay liner for the new catch basin.

6.0 GROUNDWATER CONDITIONS

No groundwater seepage was observed during drilling in all boreholes. Standpipe piezometers of 50 mm in diameter were installed in each borehole and groundwater levels were monitored up to 62 days after drilling completion. All individual water measurements taken in the standpipe piezometers are summarized and plotted on Plates 3 to 12, in Appendix B.

The final 62 day water levels are summarized on Table 1, below. Based on this data, the elevation of the groundwater table around the existing catch basin is quite variable. For example, the groundwater elevation in Boreholes 16-2, 16-5 and 16-6 are variable and generally high. In this case, they appear to reflect surface water conditions from recent heavy rains and possible leakage into the backfilled boreholes. It is noted that the Camrose Airport has experienced about 200 mm of rain since about May 20, 2016 and have appeared to contribute to these variable and high groundwater levels. The groundwater levels in Boreholes 16-1, 16-3 and 16-4 are more consistent and have stabilized between elevations 732.3 and 733.0 meters. An elevation of 733.0 meters should be used for groundwater design purposes. It should be noted that the elevation of

the liquid within the existing catch basin at the time of field drilling was at about 733.7 meters (and has risen significantly because of the large rains) and thus the natural clay appears to be providing an adequate groundwater barrier for protection to the underlying aquifer. It is recommended that the bottom of the new modified catch basin be constructed 1 meter above this elevation and at an elevation no lower than 734.0 meters. This elevation would be applicable at the time of proposed construction.

Table 1: Summary of Groundwater Information

Borehole	Ground Surface Elevation (m)	Groundwater Level 62 Days Later (m)	Groundwater Elevation (m)
16-1	736.55	4.2	732.35
16-2	736.04	1.9	734.14
16-3	737.25	4.5	732.75
16-4	737.48	4.5	732.98
16-5	737.30	0.5	736.80
16-6	737.40	1.3	736.10

7.0 RECOMMENDATIONS

7.1 NRCB Agricultural Operations Practices Act

The existing livestock feedlot is considered a solid manure storage facility and the proposed catch basin is considered a collection basin for liquid manure runoff from the adjacent six pens. According to the Natural Resources Conservation Board (NRCB) Act on Agricultural Operations Practices[4]:

- The owner or operator of a manure storage facility or manure collection area must prove out naturally occurring impermeable material or include a liner (clay or synthetic) in its construction that lies below the bottom of the facility and above the uppermost groundwater resource of the site. The base of the protective layer or the liner of a manure storage facility or of a manure collection area must not be less than 1 meter above the top of groundwater table resource at the time of construction.

- The natural occurring protective layer of a catch basin must provide equal to or greater protection than 5 meters of clay with a hydraulic conductivity of not more than 1

[4] Agricultural Operations Practices Act Regulations, Natural Resources Conservation Board. November 2005

x 10^{-6} centimeters per second. The interior side slopes must be constructed no steeper than 3 (horizontal) to 1 (vertical).

- A catch basin, if constructed with compacted soil, must provide equal or greater protection than that provided by compacted soil of 1 meter in thickness with a hydraulic conductivity of not more than 5 x 10^{-7} centimeters per second.

- A solid manure storage facility within each holding pen must be constructed to have positive drainage to prevent the collection of water.

- The catch basin must have as storage capacity that can accommodate rainfall that has a 1 in 30 year probability. For the Camrose area, this value is 85 mm and the runoff coefficient should be 0.6. The calculated run-off area for the new subject catch basin is about 52,800 square meters and using the above criteria, the required volume of liquid for long term storage is about 2695 cubic meters.

Based on the current borehole information in the existing catch basin area, the native clay is considered suitable natural occurring material. The clay is at least 5 meters thick and the soil permeability is no greater than 1x10^{-6} cm/sec. As such, no clay or synthetic liner is required for this project. The highest measured groundwater table is at about elevation 733.0 meters and thus the bottom of the catch basin should be at an elevation no lower than 734.0 meters. Based on the above calculations, it is recommended that the new catch basin be increased in width by about 10 meters for a total width of 35 meters. It is noted that the existing collection culvert located along the south wall must be raised by 1.1 meters to an outlet invert elevation of 735.5 meters. Rip-rap rocks must be provided for erosion and scour protection (refer to details on Plate 10, Appendix A). Under these conditions, there is 2.0 meters of free board. The recommended elevation of the perimeter berm is 737.5 meters. Further design and construction details are presented on Plate 10, Appendix A.

The south wall of the existing catch basin is sloped at about 1H:1V and thus is presently too steep. In addition, the bottom of the existing catch basin is estimated to be about elevation 733.5 meters and must be cleaned out and replaced with compacted dry clay. Where new clay fill is required for the new south slope, bottom of existing catch basin and for new perimeter berm, the exposed subgrade should be scarified/reworked to a depth of 150 mm, and re-compacted to a minimum of 98 percent of SPMDD at a moisture content slightly in excess (1 to 2 percent) of the optimum moisture content (0MC). Excavation and exposed soil preparation should be undertaken under close engineering supervision. Any soft and wet areas including buried topsoil/organic layer(s) should be removed completely and replaced with suitable compacted clay material. Site inspections and soil compaction tests must be carried out by an engineering firm during construction.

8.0 CONCLUSIONS

Based on the above geotechnical data, it is concluded that:

- The on-site soils within the new catch basin have natural occurring clay materials that are suitable for protection of the underlying groundwater table.

- Based on the data and recommendations presented in this report, it is our opinion that the proposed catch basin modifications are feasible for the site in terms of soil type, groundwater table position and groundwater supply protection. The catch basin should be modified such that the final overall top dimensions are no less than 130 meters long and 35 meters wide. Based on the above dimensions, the calculated liquid volume capacity for the new catch basin is about 2753 cubic meters or about 5 percent above the minimum amount of 2695 cubic meters as required by NRCB.

We trust the foregoing satisfies your requirements at this time. Should you have any questions, or require further geotechnical input in the design/construction of the new modified catch basin, please feel free to call our office at (780) 996-5621.

Yours very truly;
Hagstrom Geotechnical Services Ltd.

[redacted]

Merle Hagstrom, B.Sc. P.Eng.
Senior Engineer

PROFESSIONAL ENGINEER [redacted] ALBERTA
16 2016
Permit: P9693

APPENDIX A

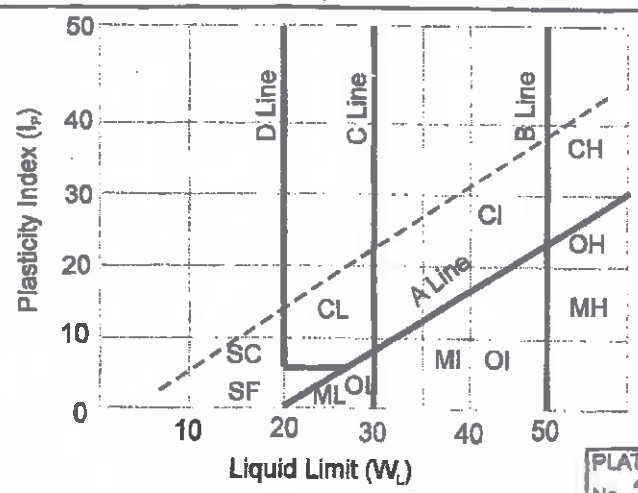
Explanation of Terms and Symbols Used on Logs
Borehole Logs
Site Plan Showing Borehole Locations
Catch Basin Construction Details

Modified Unified Classification System For Soils

Major Division			Group Symbol	Graph Symbol	Color Code	Typical Description	Laboratory Classification Criteria	
Coarse-Grained Soils (more than half by weight larger than 200 sieve)	Gravels more than half coarse grains larger than No. 4 sieve	Clean Gravels (little or no fines)	GW		Red	Well graded gravels, little or no fines	$C_U = (D_{60}/D_{10}) > 6$ $C_c = D_{30}^2/(D_{10}*D_{60}) = 1$ to 3	
			GP		Red	Poorly graded gravels, and gravel sand mixtures, little or no fines	Not meeting above requirements	
		Dirty Gravel (with some fines)	GM		Yellow	Silty gravels, gravel-sand-silt mixtures	Content of fines exceeds 12%	Below "A" line P.I. less than 4
			GC		Yellow	Clayey gravels, gravel-sand-(silt) clay mixtures		Above "A" line P.I. more than 7
	Sands more than half fine grains smaller than No. 4 sieve	Clean Sands (little or no fines)	SW		Red	Well graded sands, gravely sands, little or no fines	$C_U = (D_{60}/D_{10}) > 4$ $C_c = D_{30}^2/(D_{10}*D_{60}) = 1$ to 3	
			SP		Red	Poorly graded sands, little or no fines	Not meeting above requirements	
		Dirty Sands (with some fines)	SM		Yellow	Silty sands, sand-silt mixtures	Content of fines exceeds 12%	Below "A" line P.I. less than 4
			SC		Yellow	Clayey sands, sand-(silt) clay mixtures		Above "A" line P.I. more than 7
Fine-Grained Soils (more than half by weight passes 200 sieve)	Silts below "A" line negligible organic content	$W_L < 50\%$	ML		Green	Inorganic silts and very fine sands, rock flour, silty sands of slight plasticity	Classification is based upon plasticity chart	
		$W_L > 50\%$	MH		Blue	Inorganic silts, micaceous or diatomaceous, fine sandy or silty soils		
	Clays above "A" line negligible organic content	$W_L < 30\%$	CL		Green	Inorganic clays of low plasticity, gravelly, sandy, or silty clays, lean clays		
		$30\% < W_L < 50\%$	CI		Green-Blue	Inorganic clays of medium plasticity, silty clays		
		$W_L > 50\%$	CH		Blue	Inorganic clays of high plasticity		
	Organic Silts & Clays bellow "A" line on chart	$W_L < 50\%$	OL		Green	Organic silts and organic silty clays of low plasticity	Whenever the nature of the fine content has not been determined it is designated by the letter "F". E.G. SF is a mixture of sand with silt or clay	
		$W_L > 50\%$	OH		Blue	Organic clays of high plasticity		
Highly Organic Soils			PI		Orange	Peat and other highly organic soils	Strong color or odor, and often fibrous texture	

Bedrock Symbols

- Bedrock (Undifferentiated)
- Shale
- Sandstone
- Siltstone
- Fill
- Coal



Hagstrom Geotechnical Services Ltd.
5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3

PLATE No. 2

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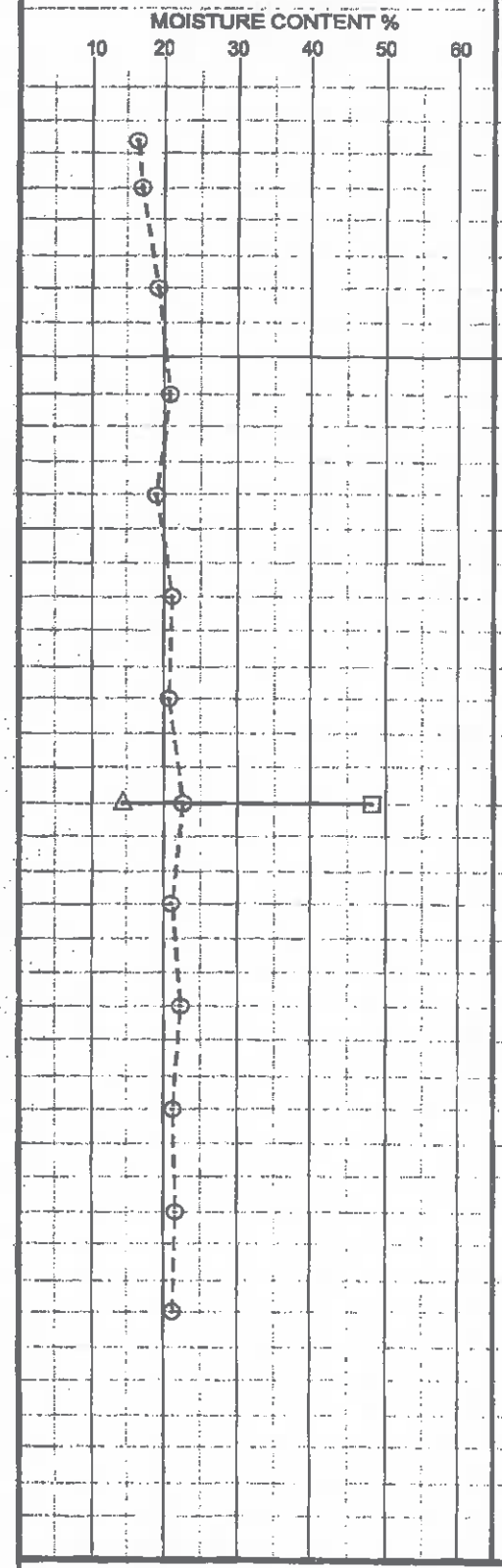
Hagstrom Geotechnical Services Ltd.
5807 - 134 A Avenue, Edmonton, Alberta T5A 0M3

CLIENT: Hutterian Brethren Church of Camrose Colony.
PROJECT: Modifications to Feedlot Catch Basin
LOCATION: NE-3-48-20-W4M, County of Camrose, Alberta
JOB No.: H1604-1005
DATE: April 28, 2016
TECH: MH

TEST BORING 16-1

DRILL TYPE: Solid Stem Auger

MOISTURE CONDITIONS
ATTERBERG LIMITS



SOIL PROFILE & DESCRIPTION

DATUM: Geodetic
SURFACE ELEVATION: 736.55 m

DEPTH IN FEET	DEPTH (m)	SOIL PROFILE	SAMPLE TYPE	BLOW COUNT -N	MISCELLANEOUS TESTS
		CLAY; silty, very stiff, medium plasticity, moist, occasional gravel chips and coal chips, dark brown			PP = 515 kPa PP = 470 kPa
3	1	– very stiff, medium plasticity			PP = 425 kPa
6	2	– stiff, medium plasticity, dark greyish-brown			PP = 315 kPa
10	3	– silty, moist, very stiff, medium plasticity, occasional gravel chips, dark grey			PP = 185 kPa Gradation Sand = 21% Silt = 53% Clay = 26%
	4	– very stiff, moist			PP = 155 kPa
15	5				PP = 135 kPa k = 2.9 x 10 - 8 cm/sec PP = 115 kPa
20	6	– moist, occasional gravel chips			PP = 105 kPa
		– clay till like, very moist			PP = 115 kPa
	7	– stiff, moist, medium plasticity, dark grey			
		– occasional coal chips and sandstone inclusions			PP = 105 kPa
25	8				PP = 145 kPa
30	9	– no evidence of groundwater accumulations 9.0 m			PP = 130 kPa
	10	End of Borehole = 9.0 m Slough = 8.9 m, 0 hours Water level = 8.9 m, 0 hours Water level = 8.9 m (dry), 4.5 hours later Water level = 4.2 m, 54 days later Water level = 4.2 m, 62 days later			
35					

TEST RESULTS

MOISTURE CONTENT	Q_u UNCONFINED COMPRESSION	SO_4 SULPHATE CONTENT	STANDARD PENETRATION SAMPLE
LIQUID LIMIT	γ_d DRY UNIT WEIGHT	WATER TABLE	UNDISTURBED SAMPLE (SHELBY)
PLASTIC LIMIT		N PENETRATION RESISTANCE	BAG SAMPLE

PLATE No. 3

Hagstrom Geotechnical Services Ltd.
5807 - 134 A. Avenue, Edmonton, Alberta T5A 0M3

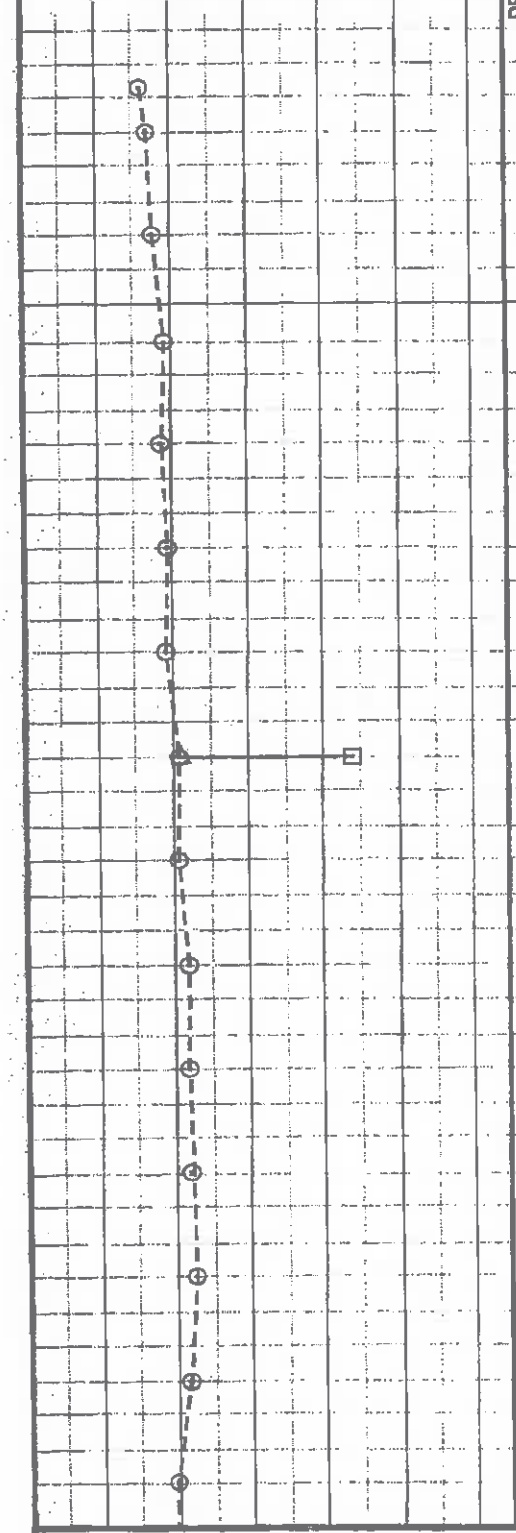
CLIENT: Hutterian Brethren Church of Camrose Colony.
PROJECT: Modifications to Feedlot Catch Basin
LOCATION: NE-3-48-20-W4M, County of Camrose, Alberta
JOB No.: H1604-1005
DATE: January 13, 2016 TECH: MH

TEST BORING 16-2

DRILL TYPE: Solid Stem Auger

MOISTURE CONDITIONS
ATTERBERG LIMITS

MOISTURE CONTENT %



SOIL PROFILE & DESCRIPTION

DATUM: Geodetic
SURFACE ELEVATION: 736.04 m

DEPTH IN FEET	DEPTH (m)	SOIL PROFILE & DESCRIPTION	TEST RESULTS: MISCELLANEOUS TESTS
		CLAY; silty, very stiff, medium plasticity, moist, occasional silt lenses and sand lenses, dark olive brown	PP = 515 kPa
			PP = 479 kPa
3	1	– very stiff, medium plasticity, moist	
			PP = 365 kPa
6	2	– clay till like	
			PP = 330 kPa
	3	– dark grey, moist, medium plasticity	PP = 200 kPa
10			
		– moister with depth	PP = 125 kPa
	4		
15		– stiff, dark grey, medium plasticity	PP = 125 kPa k = 1.8 x 10 - 8 cm/sec
	5		
			PP = 145 kPa
20	6	– occasional gravel chips and coal chips	PP = 125 kPa
		– clay till like	PP = 115 kPa
	7		
25			PP = 95 kPa
	8		PP = 95 kPa
30	9	– stiff, moist	PP = 100 kPa
			PP = 125 kPa
	10		
35			PP = 120 kPa

SOIL SYMBOL | SAMPLE TYPE | BLOW COUNT -N

⊙ MOISTURE CONTENT ⊡ LIQUID LIMIT △ PLASTIC LIMIT	Q_u UNCONFINED COMPRESSION γ_d DRY UNIT WEIGHT	SO_4 SULPHATE CONTENT ▽ WATER TABLE N PENETRATION RESISTANCE	STANDARD PENETRATION SAMPLE UNDISTURBED SAMPLE (SHELBY) B BAG SAMPLE	PLATE No. 4

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Hagstrom Geotechnical Services Ltd.

5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3

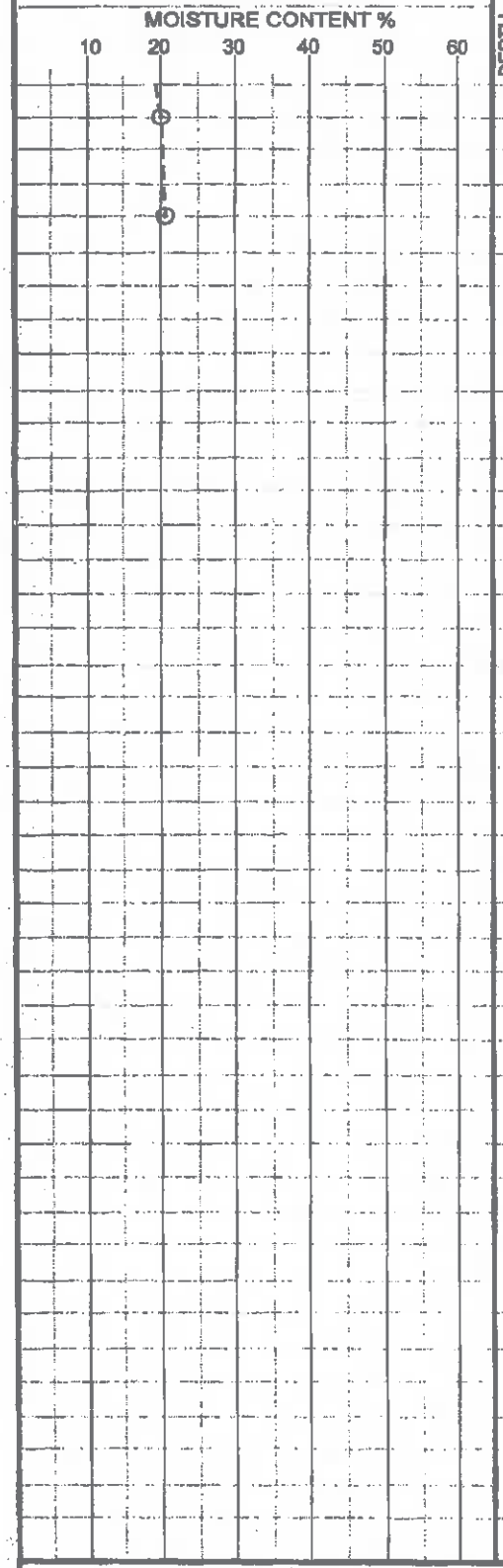
CLIENT: Hutterian Brethren Church of Camrose Colony
PROJECT: Modification to Feedlot Catch Basin
LOCATION: NE-3-48-20-W4M, County of Camrose, Alberta
JOB No.: H1604-1005
DATE: April 28, 2016 TECH: MH

TEST BORING 16-2 (Cont'd.)

DRILL TYPE: Solid Stem Auger

MOISTURE CONDITIONS
ATTERBERG LIMITS

MOISTURE CONTENT %



SOIL PROFILE & DESCRIPTION

DATUM: Geodetic

SURFACE ELEVATION: 736.04

DEPTH IN FEET	DEPTH (m)	SOIL PROFILE & DESCRIPTION	SOIL SYMBOL	SAMPLE TYPE	BLOW COUNT -N	MISCELLANEOUS TESTS
	11	CLAY;(continued), silty, very stiff, medium plasticity, occasional silt lenses and sand lenses, dark olive brown				PP = 115 kPa
39	12	– no evidence of groundwater accumulations 12.0 m				PP = 145 kPa
		End of Borehole = 12.0 m Slough = 11.9 m, 0 hours Water level = 11.9 m, 0 hours Water level = 11.9 m (dry), 4 hours Water level = 1.3 m, 54 days later				
43	13	Water level = 1.9 m, 62 days later				
46	14					
49	15					
52	16					
55	17					
59	18					
62	19					
66	20					
70	30					

TEST RESULTS

⊙ MOISTURE CONTENT ⊡ LIQUID LIMIT △ PLASTIC LIMIT	Q_u UNCONFINED COMPRESSION γ_d DRY UNIT WEIGHT	SO_4 SULPHATE CONTENT ▼ WATER TABLE N PENETRATION RESISTANCE	STANDARD PENETRATION SAMPLE UNDISTURBED SAMPLE (SHELBY) BAG SAMPLE

PLATE No. 4A

Hagstrom Geotechnical Services Ltd.
5607 - 134 A Avenue, Edmonton, Alberta T5A 0M3

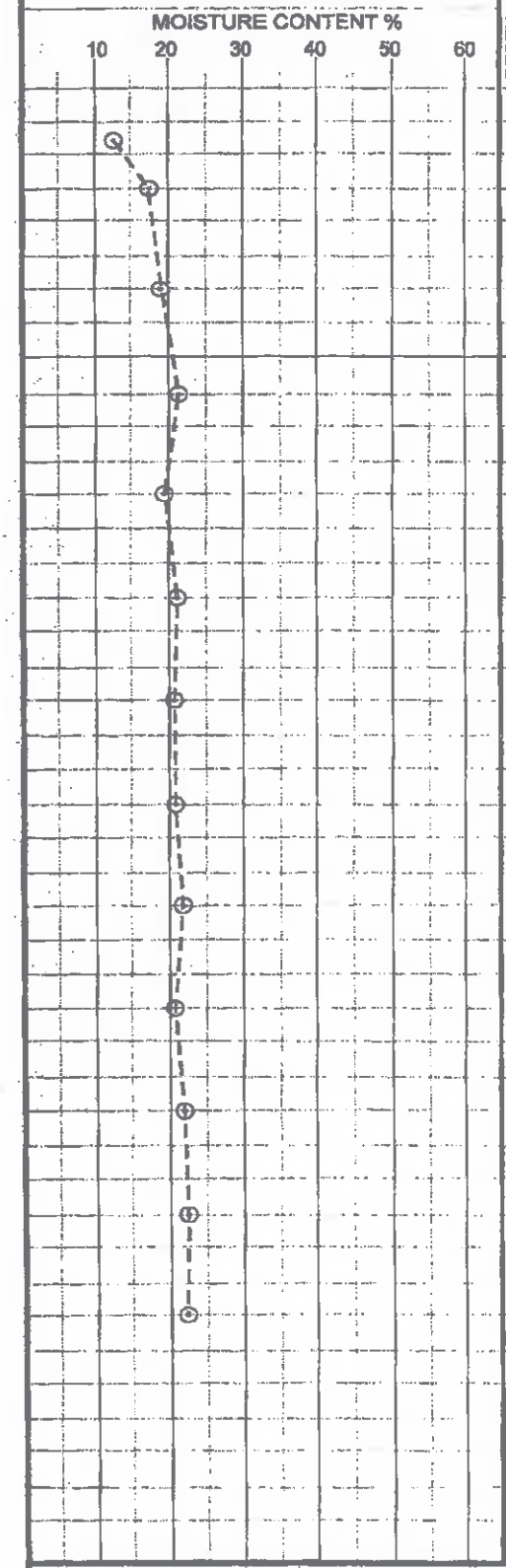
CLIENT: Hutterian Brethren Church of Camrose Colony.
PROJECT: Modifications to Feedlot Catch Basin
LOCATION: NE-3-48-20-W4M, County of Camrose, Alberta
JOB No.: H1604-1005
DATE: April 28, 2016 TECH: MH

TEST BORING 16-3

DRILL TYPE: Solid Stem Auger

DATUM: Geodetic
SURFACE ELEVATION: 737.25 m

MOISTURE CONDITIONS
ATTERBERG LIMITS



DEPTH IN FEET	DEPTH (m)	SOIL PROFILE & DESCRIPTION	SOIL SYMBOL	SAMPLE TYPE	BLOW COUNT -N	MISCELLANEOUS TESTS
		CLAY; silty, very stiff, medium plasticity, moist, dark brown				PP = 485 kPa
						PP = 520 kPa
3	1	– very stiff, medium plasticity				
						PP = 485 kPa
6	2	– clay till like				
						PP = 305 kPa
10	3					PP = 245 kPa
		– dark grey, very stiff, medium plasticity				
	4					PP = 155 kPa
15		– occasional rust stained fissures				PP = 155 kPa
	5	– stiff, moist, clay till like				
						PP = 125 kPa
20	6					PP = 125 kPa
		– stiff, moist				
	7					PP = 145 kPa
25						PP = 140 kPa
	8	– stiff, moist, dark grey				PP = 115 kPa
		– no evidence of groundwater accumulations 9.0 m				
30	9	End of Borehole = 9.0 m				PP = 135 kPa
		Slough = 8.9 m, 0 hours				
		Water level = 8.9 m, 0 hours				
		Water level = 8.9 m (dry), 3 hours later				
		Water level = 7.8 m, 54 days later				
	10	Water level = 4.5 m, 62 days later				
35						

⊙ MOISTURE CONTENT
⊡ LIQUID LIMIT
△ PLASTIC LIMIT

Q_u UNCONFINED COMPRESSION
γ_d DRY UNIT WEIGHT

SO_4 SULPHATE CONTENT
▽ WATER TABLE
N PENETRATION RESISTANCE

STANDARD PENETRATION SAMPLE
UNDISTURBED SAMPLE (SHELBY)
BAG SAMPLE

PLATE No. 5

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Hagstrom Geotechnical Services Ltd.
5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3

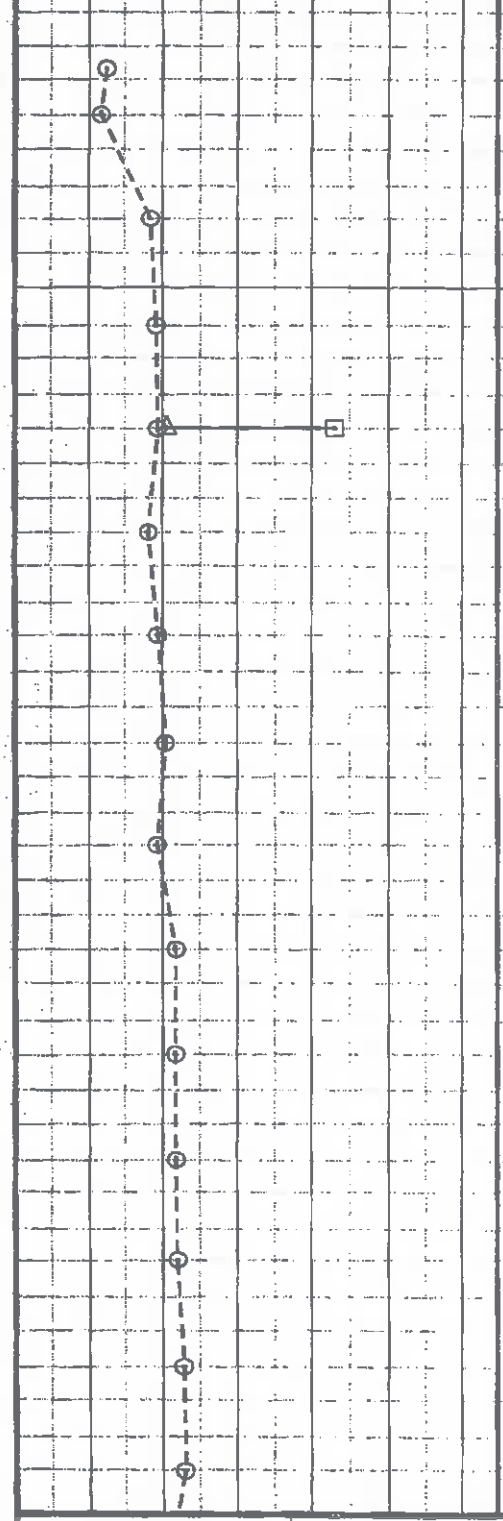
CLIENT: Hutterian Brethren Church of Camrose Colony.
PROJECT: Modifications to Feedlot Catch Basin
LOCATION: NE-3-48-20-W4M, County of Camrose, Alberta
JOB No.: H1604-1005
DATE: April 28, 2016
TECH: MH

TEST BORING 16-4

DRILL TYPE: Solid Stem Auger

MOISTURE CONDITIONS
ATTERBERG LIMITS

MOISTURE CONTENT %



SOIL PROFILE & DESCRIPTION

DATUM: Geodetic
SURFACE ELEVATION: 737.48 m

DEPTH IN FEET	DEPTH (m)	SOIL PROFILE & DESCRIPTION	SOIL SYMBOL	SAMPLE TYPE	BLOW COUNT -N	TEST RESULTS: MISCELLANEOUS TESTS
		TOPSOIL; silty, moist, compressible, black, 45 cm thick — 45 cm				
		CLAY; silty, medium plasticity, damp, very stiff, occasional gravel size rocks, dark brown				PP = 485 kPa
3	1	– very stiff, medium plasticity				PP = 365 kPa
						PP = 355 kPa
6	2					
						PP = 335 kPa
10	3	– moist, very stiff, medium plasticity				PP = 355 kPa
	4					PP = 275 kPa
15		– very stiff, dark grey				PP = 255 kPa
	5					
						PP = 215 kPa
20	6	– occasional coal chips, clay till like, medium plasticity				PP = 165 kPa
						PP = 125 kPa
	7	– stiff, moist, occasional gravel size rocks				
25						PP = 125 kPa
	8	– stiff, moist, dark grey				PP = 105 kPa
30	9					PP = 120 kPa
		– firm to stiff				PP = 95 kPa
	10					
35						PP = 95 kPa

⊙ MOISTURE CONTENT
⊡ LIQUID LIMIT
△ PLASTIC LIMIT
Q_u UNCONFINED COMPRESSION
γ_d DRY UNIT WEIGHT
SO_4 SULPHATE CONTENT
▽ WATER TABLE
N PENETRATION RESISTANCE
STANDARD PENETRATION SAMPLE
UNDISTURBED SAMPLE (SHELBY)
BAG SAMPLE

PLATE No. 6

Hagstrom Geotechnical Services Ltd.
5607 - 134 A Avenue, Edmonton, Alberta T5A 0M3

CLIENT: Hutterian Brethren Church of Camrose Colony
PROJECT: Modification to Feedlot Catch Basin
LOCATION: NE-3-48-20-W4M, County of Camrose, Alberta
JOB No.: H1604-1005
DATE: April 28, 2016
TECH: MH

TEST BORING 16-4 (Cont'd.)

DRILL TYPE: Solid Stem Auger

MOISTURE CONDITIONS
ATTERBERG LIMITS

MOISTURE CONTENT %
10 20 30 40 50 60

SOIL PROFILE & DESCRIPTION

DATUM: Geodetic
SURFACE ELEVATION: 737.48 m

DEPTH IN FEET	DEPTH (m)	SOIL SYMBOL	SAMPLE TYPE	BLOW COUNT -N	MISCELLANEOUS TESTS
	11	CLAY;(continued), silty, damp, very stiff, medium plasticity, occasional gravel size rocks, dark brown			PP = 100 kPa
39	12	– no evidence of groundwater accumulations 12.0 m			PP = 95 kPa
		End of Borehole = 12.0 m Slough = 12.0 m, 0 hours Water level = 12.0 m, 0 hours Water level = 12.0 m (dry), 3 hours later Water level = 9.7 m, 54 days later			
43	13	Water level = 4.5 m, 62 days later			
46	14				
49	15				
52	16				
55	17				
59	18				
62	19				
66	20				
70	30				

TEST RESULTS

⊙ MOISTURE CONTENT
⊡ LIQUID LIMIT
△ PLASTIC LIMIT
Q_u UNCONFINED COMPRESSION
γ_d DRY UNIT WEIGHT
SO_4 SULPHATE CONTENT
▼ WATER TABLE
N PENETRATION RESISTANCE
STANDARD PENETRATION SAMPLE
UNDISTURBED SAMPLE (SHELBY)
BAG SAMPLE

PLATE No. 6A

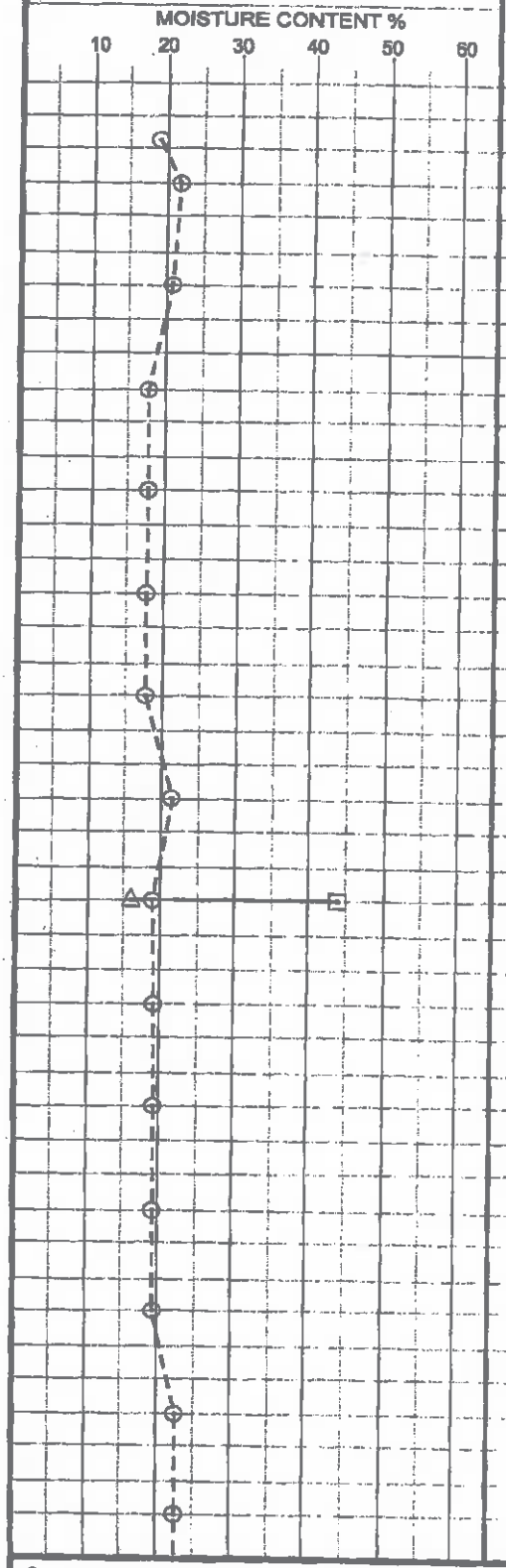
Hagstrom Geotechnical Services Ltd.
5807 - 134 A. Avenue, Edmonton, Alberta T5A 0M3

CLIENT: Hutterian Brethren Church of Camrose Colony.
PROJECT: Modifications to Feedlot Catch Basin
LOCATION: NE-3-48-20-W4M, County of Camrose, Alberta
JOB No.: H1604-1005
DATE: April 28, 2016
TECH: MH

TEST BORING 16-5

DRILL TYPE: Solid Stem Auger

MOISTURE CONDITIONS
ATTERBERG LIMITS



SOIL PROFILE & DESCRIPTION

DATUM: Geodetic
SURFACE ELEVATION: 737.48 m

DEPTH IN FEET	DEPTH (m)	SOIL PROFILE & DESCRIPTION	TEST RESULTS: MISCELLANEOUS TESTS
		TOPSOIL; silty, moist, compressible, black, 45 cm thick (45 cm)	
		CLAY; silty, medium plasticity, damp to moist, very stiff, frequent gravel size rocks, dark brown	PP = 365 kPa
3	1	– very stiff, dark brown	PP = 395 kPa
		– clay till like	PP = 385 kPa
6	2		
		– very stiff, moist	PP = 455 kPa
10	3		PP = 395 kPa
		– moist, dark grey, medium plasticity	PP = 365 kPa
	4		
15		– very stiff, damp, occasional gravel chips, dark grey	PP = 330 kPa
	5		PP = 310 kPa
20	6	– dark grey, very stiff	PP = 340 kPa
	7		PP = 280 kPa
25		– stiff, medium plasticity, dark grey	PP = 225 kPa
	8		PP = 215 kPa
30	9		PP = 95 kPa
		– stiff medium plasticity	PP = 120 kPa
	10		
35			PP = 105 kPa

⊙ MOISTURE CONTENT
⊡ LIQUID LIMIT
△ PLASTIC LIMIT

Q_u UNCONFINED COMPRESSION
γ_d DRY UNIT WEIGHT

SO_4 SULPHATE CONTENT
▽ WATER TABLE
N PENETRATION RESISTANCE

STANDARD PENETRATION SAMPLE
UNDISTURBED SAMPLE (SHELBY)
BAG SAMPLE

PLATE No. 7

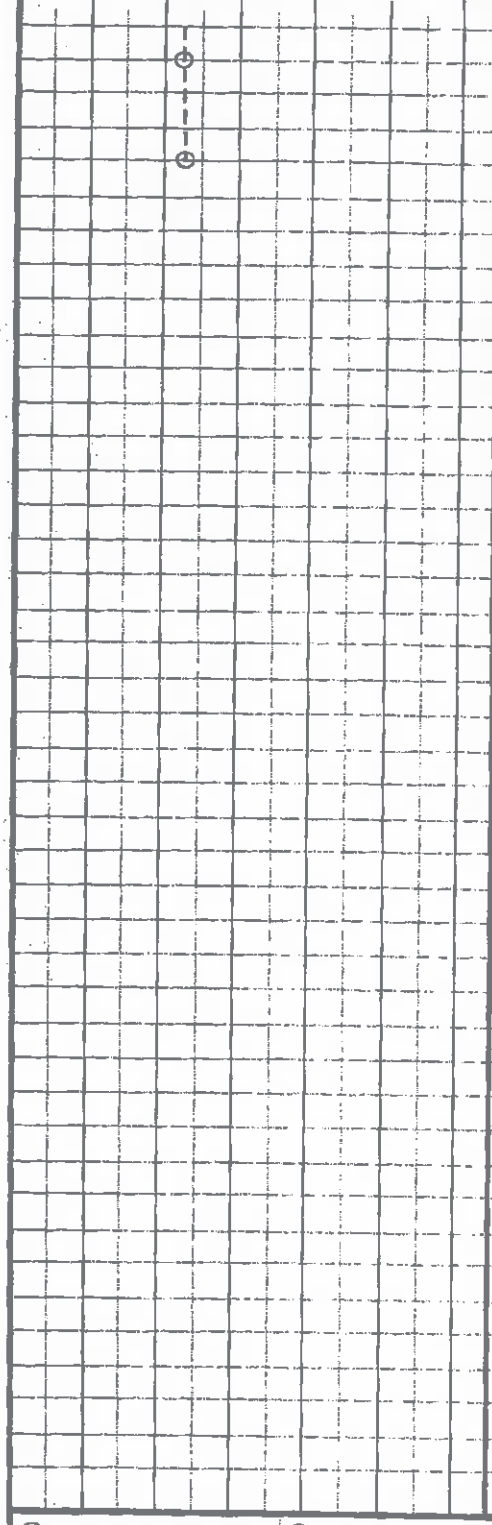
Hagstrom Geotechnical Services Ltd.
5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3

CLIENT: Hutterian Brethren Church of Camrose Colony
PROJECT: Modification to Feedlot Catch Basin
LOCATION: NE-3-48-20-W4M, County of Camrose, Alberta
JOB No.: H1604-1005
DATE: April 28, 2016
TECH: MH
DRILL TYPE: Solid Stem Auger

TEST BORING 16-5 (Cont'd.)

MOISTURE CONDITIONS
ATTERBERG LIMITS

MOISTURE CONTENT %
10 20 30 40 50 60



DEPTH IN FEET	DEPTH (m)	SOIL PROFILE & DESCRIPTION (DATUM: Geodetic; SURFACE ELEVATION: 737.30)	SOIL SYMBOL	SAMPLE TYPE	BLOW COUNT -N	MISCELLANEOUS TESTS
	11	CLAY;(continued), silty, medium plasticity, damp to moist, very stiff, frequent gravel size rocks, dark brown – moist sand layer at 11.1 to 11.4 m				PP = 105 kPa
39	12	– no evidence of groundwater accumulations 12.0 m				PP = 100 kPa
		End of Borehole = 12.0 m Slough = 12.0 m, 0 hours Water level = 12.0 m, 0 hours Water level = 11.9 m (dry), 3 hour Water level = 0.9 m, 54 days later				
43	13	Water level = 0.5 m, 62 days later				
46	14					
49	15					
52	16					
55	17					
59	18					
62	19					
66	20					
70	30					

TEST RESULTS

⊙ MOISTURE CONTENT
⊡ LIQUID LIMIT
△ PLASTIC LIMIT

Q_u UNCONFINED COMPRESSION
γ_d DRY UNIT WEIGHT

SO_4 SULPHATE CONTENT
▽ WATER TABLE
N PENETRATION RESISTANCE

STANDARD PENETRATION SAMPLE
UNDISTURBED SAMPLE (SHELBY)
BAG SAMPLE

PLATE No. 7A

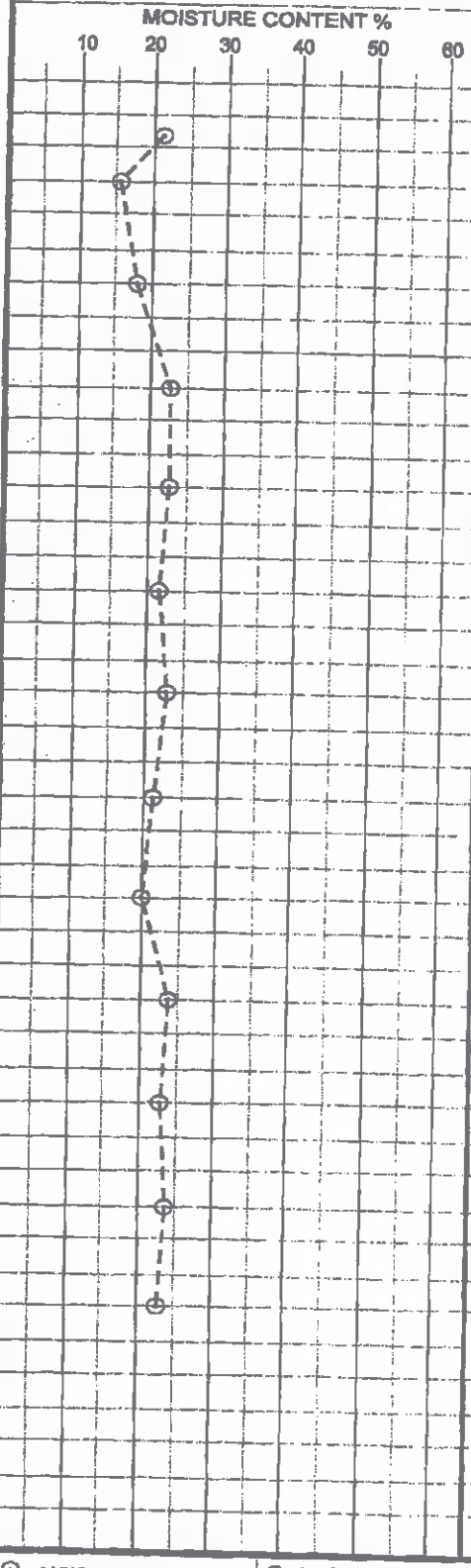
Hagstrom Geotechnical Services Ltd.
5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3

CLIENT: Hutterian Brethren Church of Camrose Colony.
PROJECT: Modifications to Feedlot Catch Basin
LOCATION: NE-3-48-20-W4M, County of Camrose, Alberta
JOB No.: H1604-1005
DATE: April 28, 2016
TECH: MH

TEST BORING 16-6

DRILL TYPE: Solid Stem Auger

MOISTURE CONDITIONS ATTERBERG LIMITS



SOIL PROFILE & DESCRIPTION

DATUM: Geodetic

SURFACE ELEVATION: 737.40 m

DEPTH IN FEET	DEPTH (m)	SOIL SYMBOL	SAMPLE TYPE	BLOW COUNT - N	MISCELLANEOUS TESTS
		CLAY; silty, damp, very stiff, medium plasticity, occasional gravel size rocks and coal chips, dark brown			PP = 505 kPa
					PP = 480 kPa
3	1	– very stiff, medium plasticity			
					PP = 500 kPa
6	2				
					PP = 305 kPa
	3	– very stiff, dark brown			
10					PP = 345 kPa
		– dark grey, very stiff, medium plasticity			
	4	– moist, very stiff, medium plasticity			PP = 330 kPa
15					PP = 215 kPa
	5	– moist, clay till like, dark grey			
					PP = 170 kPa
20	6				PP = 135 kPa
		– stiff, medium plasticity, dark grey			
	7				PP = 110 kPa
25					PP = 95 kPa
	8				
					PP = 110 kPa
	9	– no evidence of groundwater accumulations 9.0 m			
30		End of Borehole = 9.0 m			PP = 95 kPa
		Slough = 9.0 m, 0 hours			
		Water level = 9.0 m, 0 hours			
		Water level = 8.9 m (dry), 2 hours later			
	10	Water level = 1.6 m, 54 days later			
		Water level = 1.3 m, 62 days later			
35					

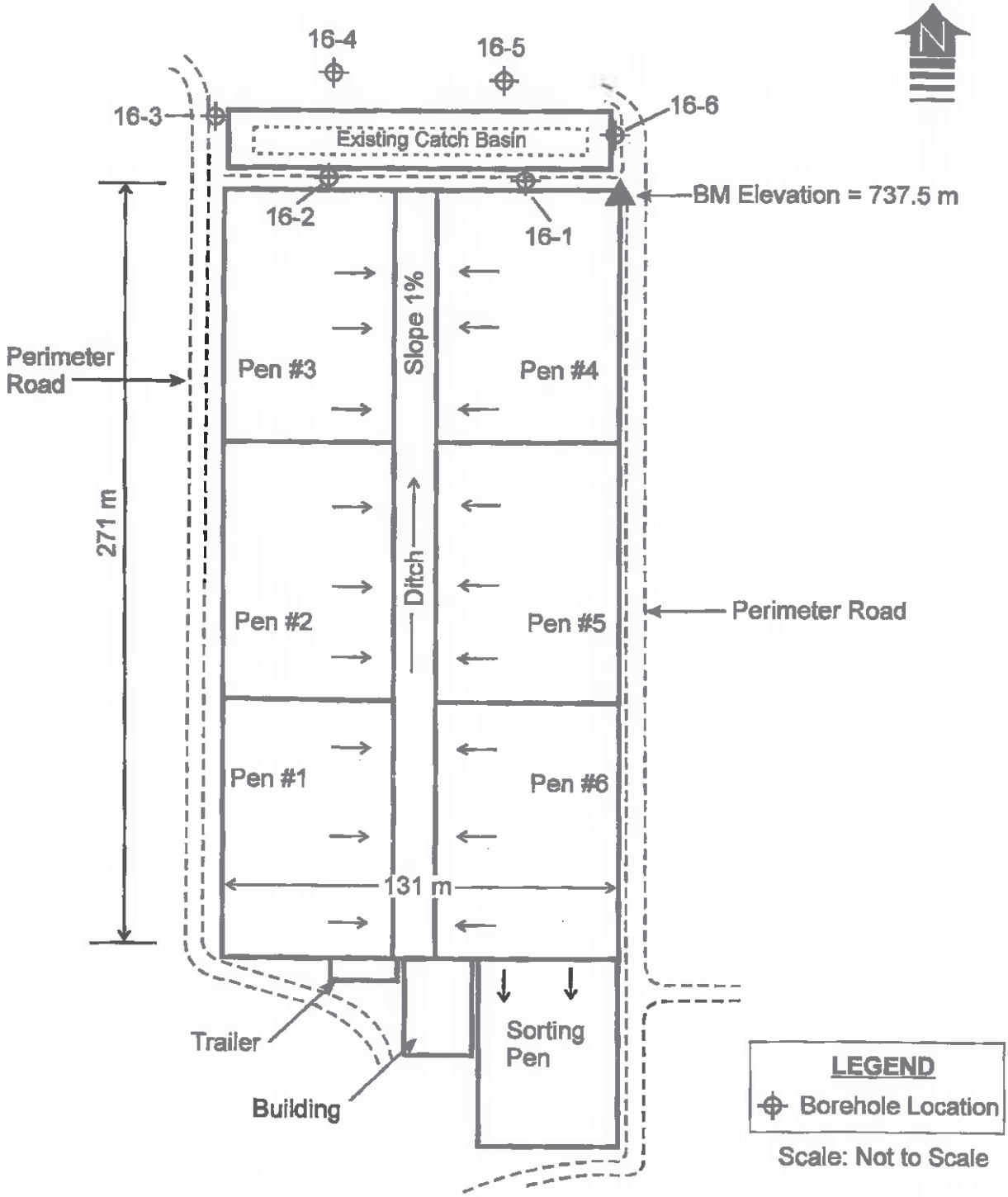
⊙ MOISTURE CONTENT
⊡ LIQUID LIMIT
△ PLASTIC LIMIT

Q_u UNCONFINED COMPRESSION
γ_d DRY UNIT WEIGHT

SO_4 SULPHATE CONTENT
▼ WATER TABLE
N PENETRATION RESISTANCE

STANDARD PENETRATION SAMPLE
UNDISTURBED SAMPLE (SHELBY)
BAG SAMPLE

PLATE No. 8



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HUTTERIAN BRETHREN CHURCH OF CAMROSE COLONY
Modifications to Feedlot Catch Basin
NE 3-48-20-W5M
County of Camrose, Alberta
Site Plan

Job No: H1604-1005	Date: May 9, 2016	Plate: 9

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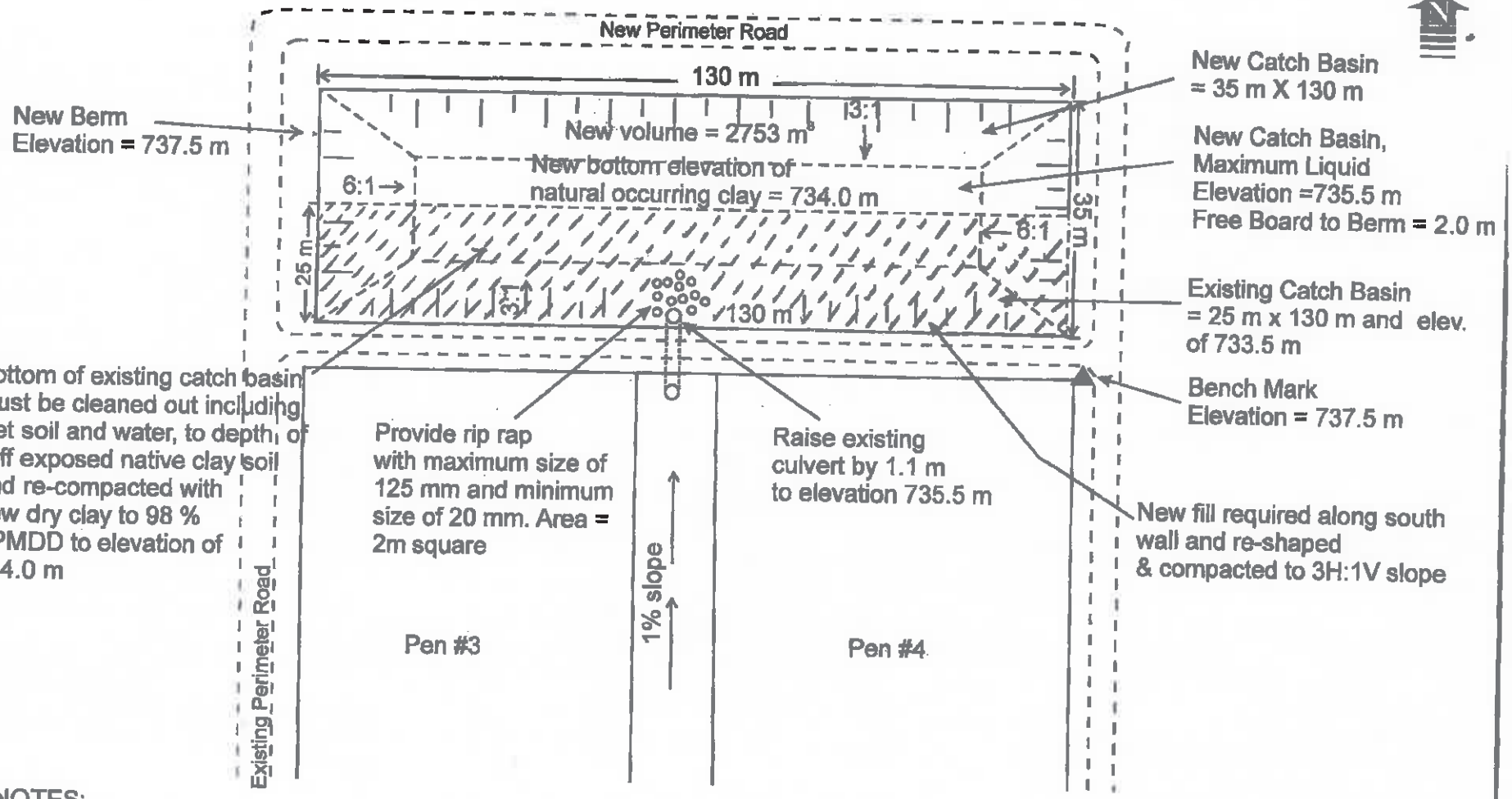

NOTES:

Total run-off area = 52,800 m². Required catch basin volume based on one in thirty year storm and runoff coefficient of 0.6 = 2695 m³. Design volume = 2753 m³. Therefore ok.

Scale: Not to Scale

Hagstrom Geotechnical Services Ltd.
5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3

HUTTERIAN BRETHREN CHURCH OF CAMROSE COLONY
Modifications to Feedlot Catch Basin, NE-3-48-20-W4M
County of Camrose, Alberta
Catch Basin Construction Details

Job No: H1604-1005	Date: July 4, 2016	Plate: 10

APPENDIX B

Laboratory Permeability Test Results
Water Table Measurements

Explanation of Field and Laboratory Test Data

The following pages are an explanation of the terms and symbols used in the Test Hole Log

Soil Profile and Description

Soil types are described by the Modified Unified Soil Classification System.
(See Plate 2 for terms and symbols)

Soils classified by particle size fall in the following ranges:

BOULDERS	- greater than 200 mm	SAND	- 0.08 mm to 5 mm
COBBLES	- 75 mm to 200 mm	SILT	- 0.002 mm to 0.08 mm
GRAVEL	- 5 mm to 75 mm	CLAY	- finer than 0.002 mm

Additional graphic symbols include:

→ seepage
▽ water level surface

Soil Sample Type

Standard Penetration Sample (D)

Undisturbed Sample (Shelby) (U)

B Bag Sample

Penetration Resistance

Field test indication number of blows (N) of a 140 pound hammer dropping 30 inches (76cm) required to drive a 2 inch (5 cm) O.D. open end sampler a distance of 1 foot (30 cm) from 0.5 to 1.5 feet (15 to 45 cm) into the undisturbed soil. This test is outlined in A.S.T.M., D1568.

Miscellaneous Tests

In this column are summarized results of all the laboratory test as indicated by the following symbols:

HVR	Hydrocarbon Vapour Readings, ppm or % LEL
* MA	Mechanical grain size analysis
G	Specific gravity
k	Coefficient of permeability
PP	Pocket penetrometer strength kg/cm2
* q	Triaxial compression test
* C	Consolidation test
Qu	Unconfined compressive strength kg/cm2
SO_4	Soluble sulphate concentration
γ	Bulk unit weight
γd	Dry unit weigh

* Tests normally summarized on separate data sheets

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PLATE No. 1

Hagstrom Geotechnical Services Ltd
5607 - 134 A Avenue, Edmonton, Alberta T5A 0M3
Tel: (780) 996-5621• Fax: (780) 476-5671
e-mail: h_gsl@telus.net

CONSTANT HEAD PERMEABILITY TEST

ASTM D5084-03

Project: CAMROSE COLONY
Job. No H1604-1005
Sample Hole: BOREHOLE 16-1
Sample Depth: 4.5-4.8m
Test Date: MAY 16 to 26. 2016
Technician: M. HAGSTROM
Sample Description: CLAY, silty, very stiff, moist, C.I. dark brown
Sample Diameter: 73.0m
Sample Area: 41.85 cm²
Mass Wet Soil + Tare: 3535 GMS
Sample Height: 233.0 cm
Mass Dry Soil + Tare: ---
Sample Volume: 975.1 cc
Mass of Tare: 1363 GMS.
Sample Wet Density
Mass of Sample: 2172 GMS
Before Test: 2227 kg/m³
Sample Moisture Before Test: 23.7%
Sample Dry Density
Sample Moisture After Test: 25.9%
Before Test: 1802 kg/m³

Constant Head Test

Water Head h = 243.8 cm

Test No	Date	Time	Elapsed Time (sec)	Q Cm³	T °C	REMARK
1	MAY16	14:21	--	3	20	START
2	MAY17	14:20	86399	--	20	---
3	MAY21	14:20	345606	--	21	---
4	MAY 25	14:21	385601	16	20	---
			777600	13	≈20	END

Remarks: 1. K = 2.9 x 10⁻⁸ cm/SEC.
2. SOIL TEXTURE: 28% SAND, 46% SILT, 26% CLAY
3. ATTERBERG LIMITS: LL=45.4%, PL=15.3%

PLATE 1

Hagstrom Geotechnical Services Ltd
5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3
Tel: (780) 996-5621* Fax: (780) 475-5671
e-mail: h_gsl@telus.net

CONSTANT HEAD PERMEABILITY TEST

ASTM D5084-03

Project: CAMROSE COLONY Job. No H1604-1005

Sample Hole: BOREHOLE 16-2 Sample Depth: 4.5 - 4.8 m

Test Date: MAY 27 to JUNE 6/16 Technician: M. HAGSTROM

Sample Description: CLAY, silty, stiff to very stiff, moist. medium plasticity, occasional silt lenses, dk brown

Sample Diameter: 73.0 cm Sample Area: 41.89 cm^2

Mass Wet Soil + Tare: 3812 Gms Sample Height: 295 cm

Mass Dry Soil + Tare: --- Sample Volume: 12346 cm

Mass of Tare: 1264 Gms Sample Wet Density

Mass of Sample: 2548 Gms Before Test: 2064 Kg/m^3

Sample Moisture Before Test: 18.6% Sample Dry Density

Sample Moisture After Test: 20.6% Before Test: 1748 Kg/m^3

Constant Head Test Water Head h = 243.6 cm.

Test No	Date	Time	Elapsed Time (sec)	Q Cm^3	T °C	REMARKS
1	MAY 27	16:30	--	4	21	START
2	MAY 28	16:25	86395	--	20	
3	JUNE 2	16:32	345607	--	21	
4	JUNE 6	16:42	345610	9	20	END
			777612	5	≈20	

Remarks: 1. $K = 1.8 \times 10^{-8}$ cm/SEC.

2. SOIL TEXTURE: 27% SAND, 46% SILT, 27% CLAY

3. ATTERBERG LIMIT: LL=38.1%, PL=15.5%

PLATE 2

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WATER TABLE MEASUREMENTS

DATE: _____ FILE NO: H.1604-1005

PROJECT NAME: Proposed Catch Basin TECH: M.T.

Borehole	Elevation of Top of Pipe/Ground (m)	Depth to Water (m)*	Elevation of Water (m)	Remarks (Days After Drilling)
		APRIL 28, 2016		
16-1	736.55	8.9 (dry)		0 DAYS
16-2	736.04	11.9 (dry)		
16-3	737.25	8.9 (dry)		
16-4	737.48	12.0 (dry)		
16-5	737.30	12.0 (dry)		
16-6	737.40	9.0 (dry)		
		May 2, 2016		
16-1	736.55	9.0	727.55	
16-2	736.04	12.0	724.04	
16-3	737.25	9.1	728.15	
16-4	737.48	11.9	725.58	
16-5	737.30	11.2	726.10	
16-6	737.40	7.6	729.80	
		May 7, 2016		
16-1	36.55	9.0	727.55	
16-2	36.04	12.0	724.04	
16-3	37.25	9.1	728.15	
16-4	37.48	11.8	725.68	
16-5	37.30	6.8	730.50	
16-6	37.40	5.9	731.50	

* If pipe or borehole is dry, please record depth that it is dry at.

PLATE 3

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WATER TABLE MEASUREMENTS

DATE: -- FILE NO: H1604-1005

PROJECT NAME: Camrose Colony TECH: M.T.

Borehole	Elevation of Top of Pipe/Ground (m)	Depth to Water (m)	Elevation of Water (m)	Remarks (Days After Drilling)
		May 12, 2016		
16-1	736.55	8.9	727.65	
-2	736.04	11.2	724.84	
-3	737.25	9.1	728.15	
-4	737.48	11.7	725.78	
-5	737.30	2.8	734.50	
-6	737.40	3.8	733.60	
		May 19, 2016		
16-1	736.55	8.8	727.75	
-2	36.04	10.7	725.34	
-3	37.25	9.1	728.15	
-4	37.48	11.5	725.98	
-5	37.30	2.1	735.20	
-6	37.40	2.8	734.60	
		May 24, 2016		
16-1	736.55	5.0	731.55	
-2	36.04	4.2	731.84	
-3	36.25	8.0	728.35	
-4	36.48	9.1	728.38	
-5	36.30	1.4	735.90	
-6	37.40	1.8	735.60	

* If pipe or borehole is dry, please record depth that it is dry at.

PLATE 4
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WATER TABLE MEASUREMENTS

DATE: - - FILE NO: H1604-1005

PROJECT NAME: Camrose Colony TECH: M.T

Borehole	Elevation of Top of Pipe/Ground (m)	Depth to Water (m)	Elevation of Water (m)	Remarks (Days After Drilling)
		May 29, 2016		
16-1	736.55	4.4	732.15	
-2	736.04	1.9	734.14	
-3	737.25	8.8	728.45	
-4	737.68	6.5	730.98	
-5	737.30	0.0	737.30	
-6	737.40	0.7	736.70	
		June 6, 2016		
16-1	736.55	4.2	732.35	
-2	736.04	0.8	735.24	
-3	737.25	8.0	729.25	
-4	737.68	4.7	732.78	
-5	737.30	0.6	736.70	
-6	737.40	1.1	736.30	
		June 16, 2016		
16-1	737.55	4.2	732.35	
-2	736.04	1.2	734.84	
-3	737.25	7.8	729.45	
-4	737.68	4.7	732.78	
-5	737.30	0.8	736.50	
-6	737.40	1.5	735.90	

* If pipe or borehole is dry, please record depth that it is dry at.

PLATE 5

WATER TABLE MEASUREMENTS

DATE: -- FILE NO: H1604-1005

PROJECT NAME: Camrose Colony TECH: M.T.

Borehole	Elevation of Top of Pipe/Ground (m)	Depth to Water (m)	Elevation of Water (m)	Remarks (Days After Drilling)
		June 21, 2016		
16-1	736.55	4.2	732.35	54 days later
-2	736.04	1.3	734.74	
-3	737.25	7.8	729.45	
-4	737.48	4.7	732.78	
-5	737.30	0.9	736.40	
-6	737.40	1.6	735.80	
		June 29, 2016		
16-1	736.55	4.2	732.35	62 days later
-2	736.04	1.9	734.14	
-3	737.25	4.5	732.75	
-4	737.48	4.5	732.98	
-5	737.30	0.5	736.80	
-6	737.40	1.3	736.10	

* If pipe or borehole is dry, please record depth that it is dry at.

PLATE 6

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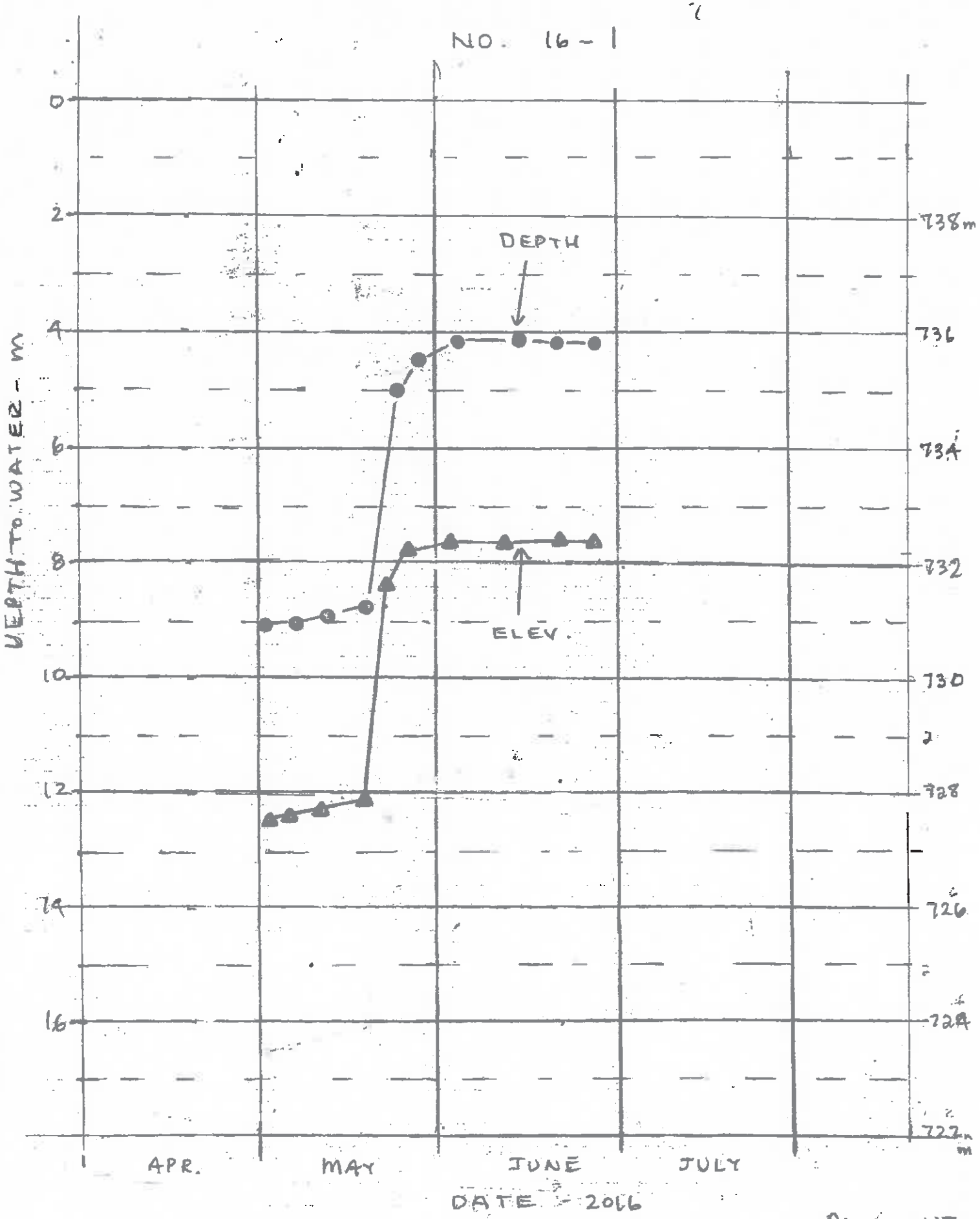

PLATE 7
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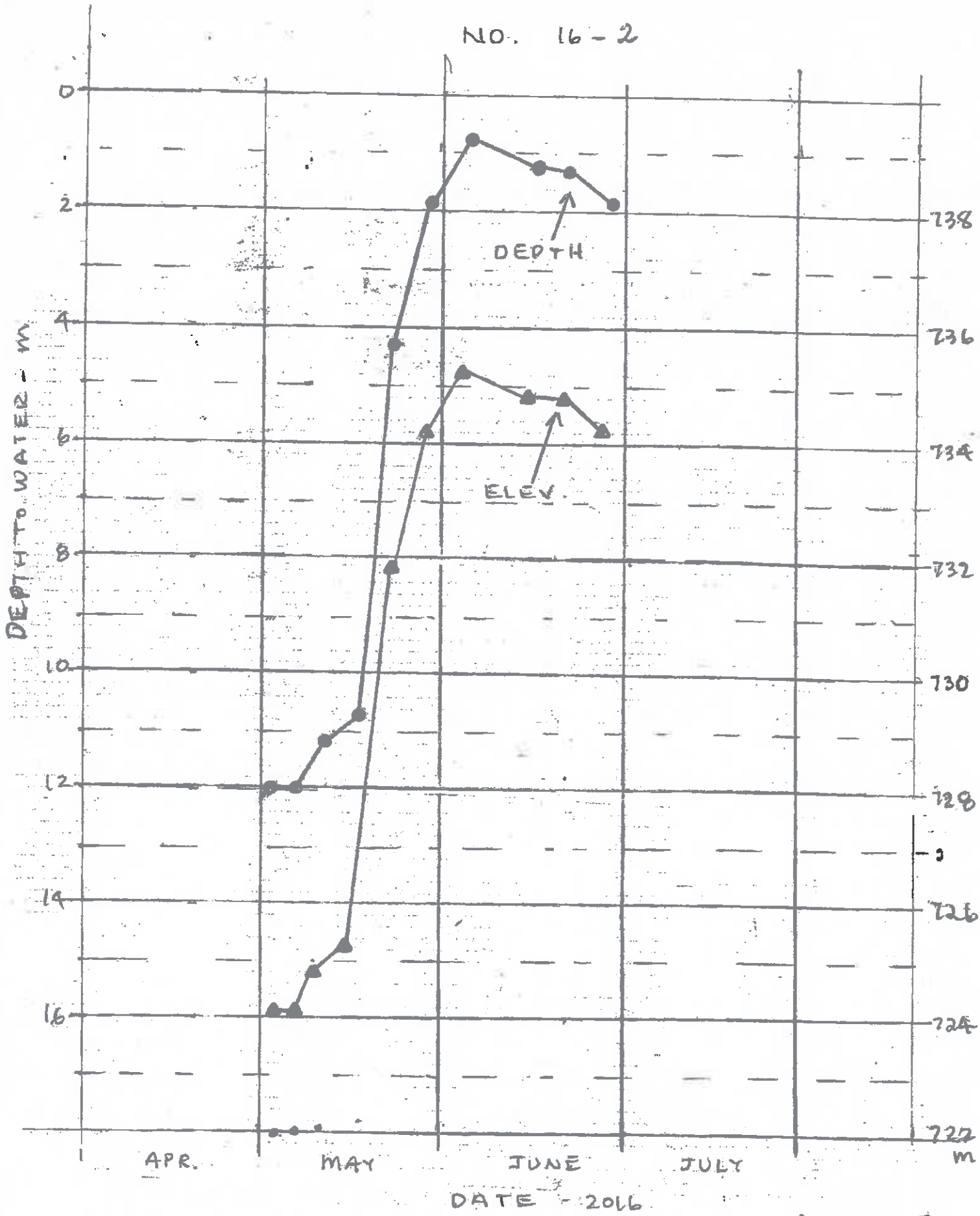
NO. 16 - 2
DEPTH TO WATER - m
0
2
4
6
8
10
12
14
16
DEPTH
ELEV.
738
736
734
732
730
728
726
724
722
m
APR.
MAY
JUNE
JULY
DATE - 2016

PLATE 8

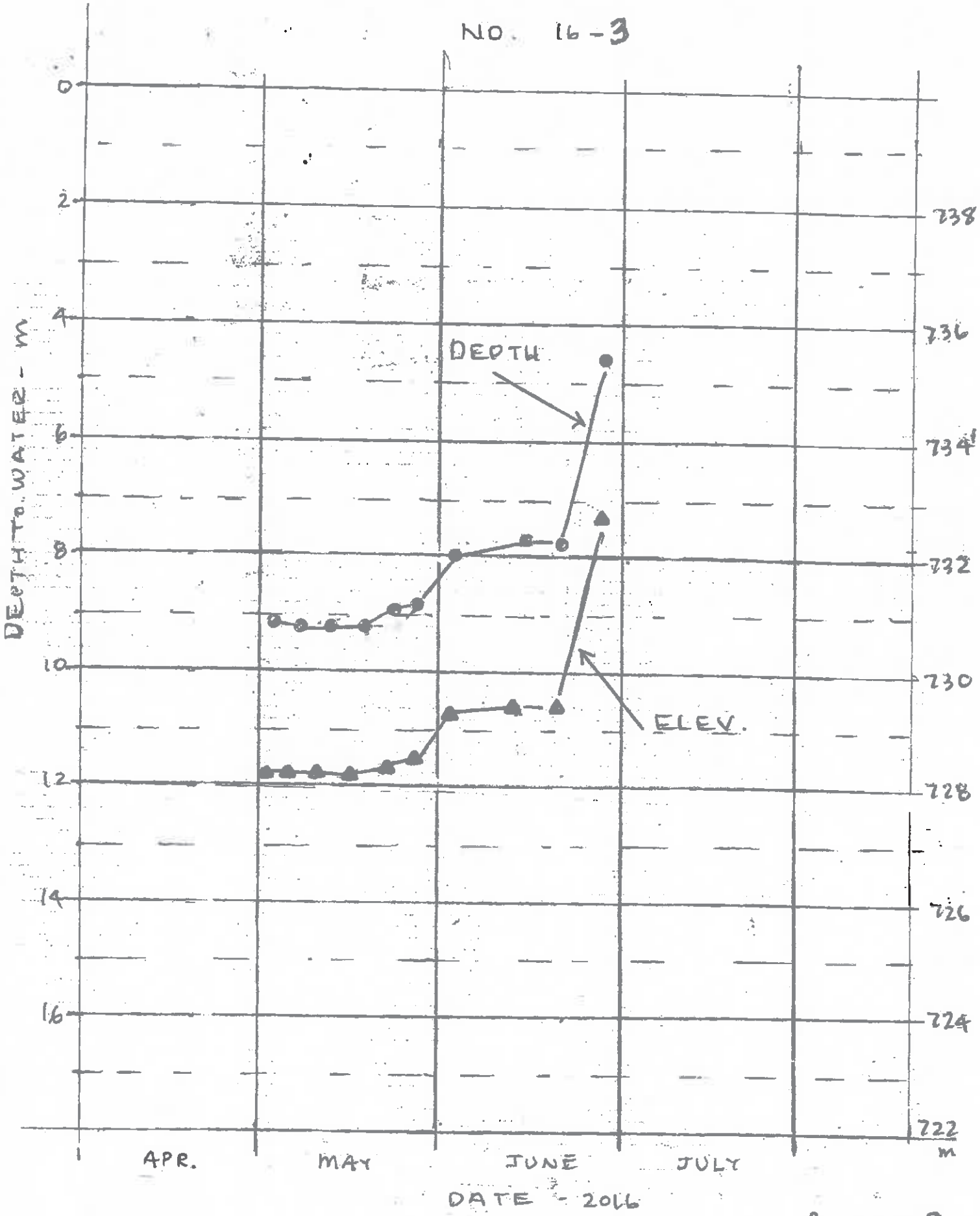

PLATE 9

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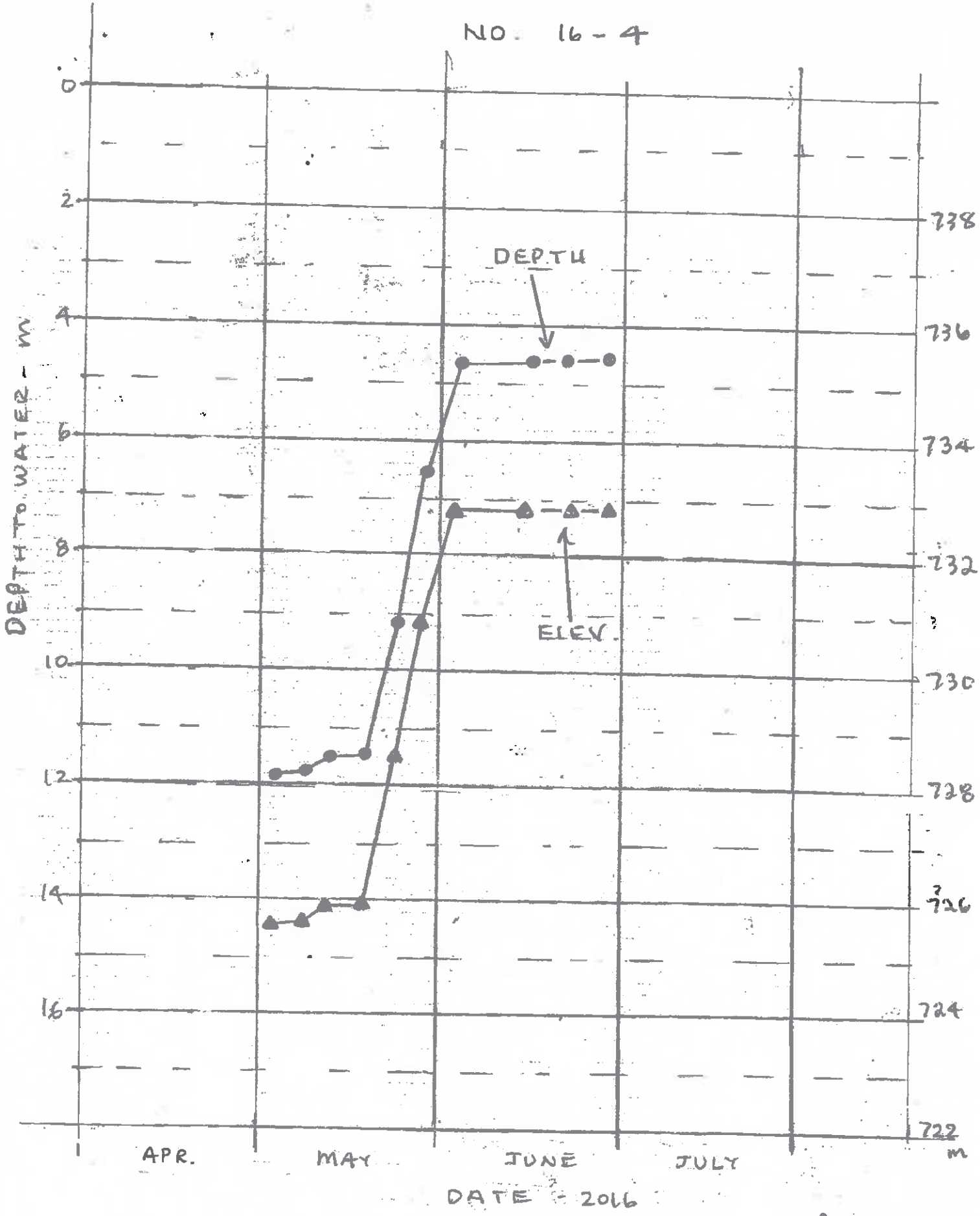
NO. 16-4
DEPTH
ELEV.
DEPTH TO WATER - m
0
2
4
6
8
10
12
14
16
738
736
734
732
730
728
726
724
722
m
APR.
MAY
JUNE
JULY
DATE - 2016

PLATE ID

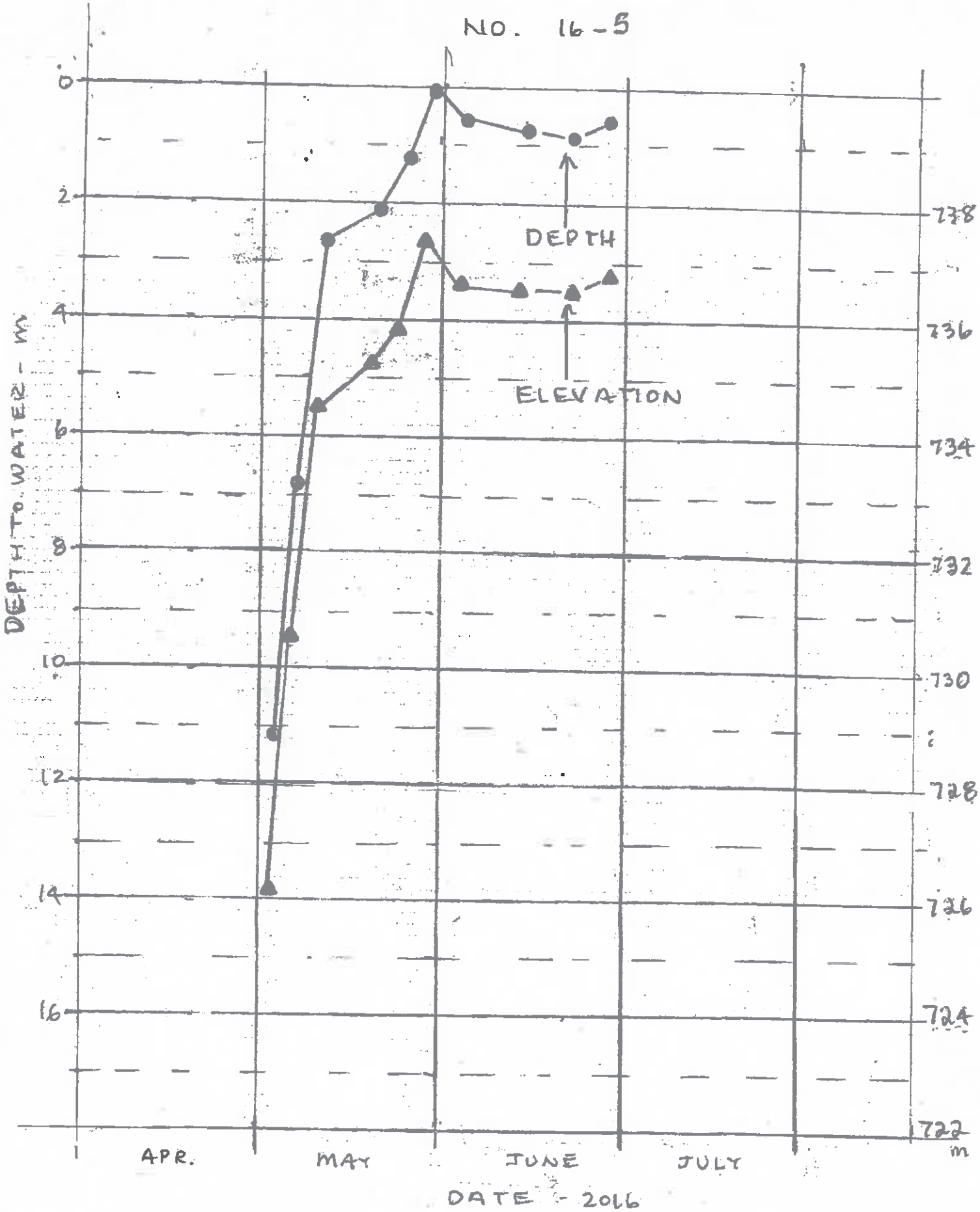

PLATE 11
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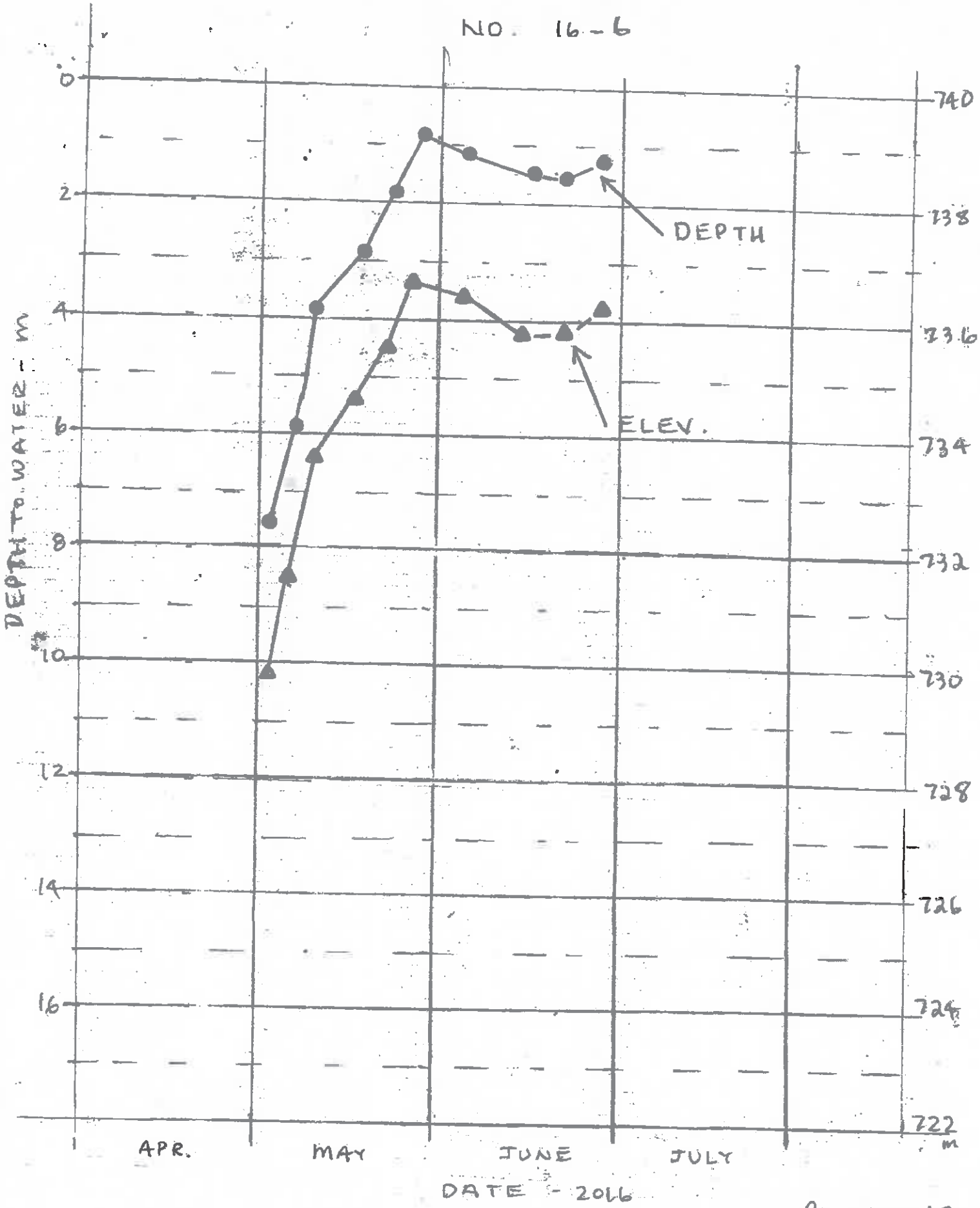

PLATE 12

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Catch Basin Dimensions Calculator

Construction Dimensions of Catch Basin	Metric		English Units Capacity of Catch Basin	
Size of Catch Basin				
Length*4	130.0	m	426.51	Feet
Width*4	35.0	m	114.83	Feet
Total Depth*4	2.0	m	6.56	Feet
Water Depth	1.50	m	4.92	Feet
End Slope*4	3	run:rise	3	run:rise
Side Slope*4	6	run:rise	6	run:rise
Length of Bottom	118.0			
Width of Bottom	11.0			
Total Capacity @ top of Bank	5,752	m^3	203,130	ft^3
			1,265,263	Imp. Gal.

* Only cells in blue can be changed

Storage Volume of Catch Basin at Design Capacity (without freeboard)			Volume at Freeboard	
Length (Top of liquid level)	127.0	m	416.67	Feet
Width (Top of liquid level)	29.0	m	95.14	Feet
Depth	2.0	m	6.56	Feet
Water Depth	1.50	m	4.92	Feet
End Slope	3	run:rise	3	run:rise
Side Slope	6	run:rise	6	run:rise
Total Volume@ freeboard depth	3,695	m^3	130,497	ft^3
			812,841	Imp. Gal.
Surface Area of Liquid Manure	3,683	m^2	39,643	ft^2

Name$_1$ Camrose County RA15054

Land Location$_1$ NE-35-48-20-W4M

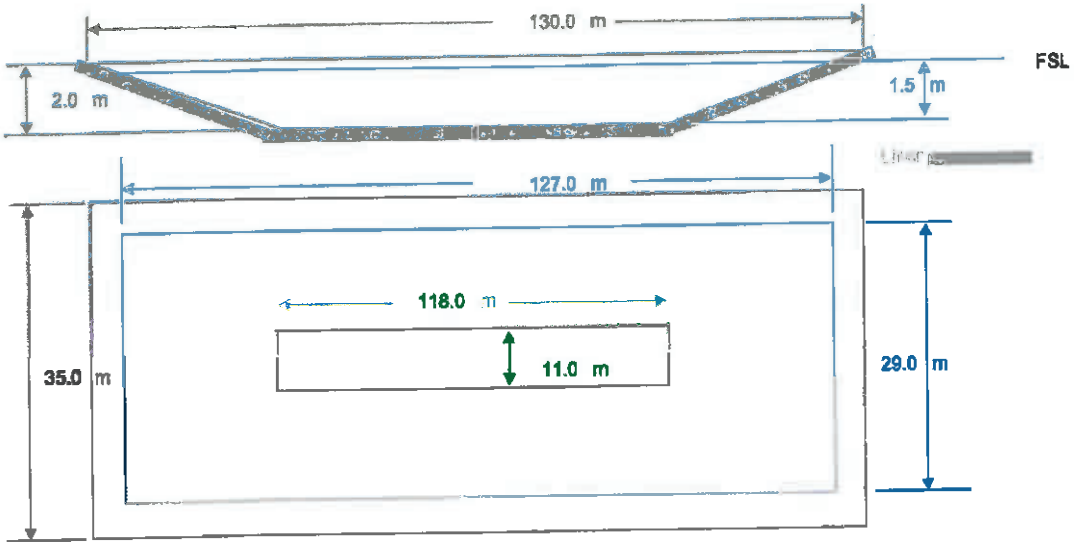
Area$_2$	Length (m)	Width (m)	Area (m^2)
1			52,800
2			0
3			0
4			0
5			0
Total Area			52,800

Camrose 85

Design Rainfall 85 mm

Catch Basin Design Volume	
2,693 m^3	95,095 ft^3
	592,333 Imp. Gal.

** Storage volume should be same or slightly greater than design storage volume.



Note:
The lowest surveyed elevation on the southwall of the catch basin is 735.0 m. The proposed bottom of the catch basin will be 734.0 m. Effective depth of the catch basin is 2 m.

Lines In Black - Catch basin dimension
Lines In Blue - full level

NTS - Not Drawn To Scale

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