NRCB | Natural Resources Conservation Board

NATURAL RESOURCES CONSERVATION BOARD

How to complete the AOPA application form:

Part 2—Technical Requirements, Liquid Manure Storage

February 2018

This guide is intended to help applicants complete the Part 2—Technical Requirements, Liquid Manure Storage form for an application under the *Agricultural Operation Practices Act* for an approval, registration or authorization to expand or construct a confined feeding operation, manure collection area or manure storage facility.

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How to complete Part 2—Technical Requirements, Liquid Manure Storage

Applicants who wish to construct or expand a confined feeding operation, manure collection area, or manure storage facility must complete the required Part 2 application forms. Part 2—Technical Requirements, Liquid Manure must be completed if relevant to the proposed expansion or new construction being applied for.

To determine which sections of this form must be completed for your proposed development, please contact a Natural Resources Conservation Board (NRCB) approval officer in your region (see Appendix 1). The approval officer will confirm which sections must be completed and whether other information is required for your application.

! In order to complete the Part 2—Technical Requirements, Liquid Manure Storage form, you must provide the information, measurements, calculations, plans, and reports as indicated. The NRCB approval officer can identify where you may wish or be required to hire a third party consultant or professional, at your expense, to assist with technical information.

An NRCB approval officer can also help you determine the permit implications of the options you are considering. NRCB approval officers will not carry out any design work or conduct any testing or sampling on behalf of an applicant.

! **Note: A delay by the applicant, the agent or their consultants in providing the required information will result in a delay in processing the application.**

Filling out the form

If the space provided is not sufficient to enter all of your information, please use a separate sheet for additional information.

Shaded portions of the form are marked “NRCB USE ONLY.” Please do not write in these sections. These sections will be completed by the NRCB approval officer during the technical review of the application.

! Sections of the form are provided below with examples to illustrate the information applicants should provide.

Naturally occurring protective layer

An engineering soils investigation is required for most liquid manure storages that have a naturally occurring protective layer (earthen manure storage, or EMS). Contact an NRCB approval officer to determine the scope of the required soils investigation.

Naturally occurring protective layers for liquid manure storages are required to have a minimum thickness of 10 metres and a maximum hydraulic conductivity of 1 x 10^{-6} cm/s.

The **primary** cell of liquid manure storages must have the fill pipe located in the bottom quarter of the primary cell of the liquid manure storage.

Not all naturally occurring protective layers require hydraulic conductivity testing. In instances where it is not clear whether the naturally occurring material can provide adequate protection, in-situ hydraulic conductivity testing will likely be required. Contact an NRCB approval officer to confirm whether hydraulic conductivity testing is required for the proposed site.

Include in the additional information section any information that will help explain factors that will need to be considered for the proposed liquid manure storage.

A calculator for determining the volume of a liquid manure storage is available online at http://www.agric.gov.ab.ca/app19/calc/volume/dugout.jsp.

LIQUID MANURE STORAGE: Earthen manure storage (EMS): Naturally occurring protective layer

*(complete a copy of this section for **EACH** earthen liquid manure storage facility with a naturally occurring protective layer)*

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

1. Hog EMS Cell #1 (1)
2. Hog EMS Cell #2
3. _____

Manure storage capacity *(complete a separate row of this table for each cell of the EMS)*

	Length (m)	Width (m)	Depth (m)	Slope run:rise			Estimated storage capacity (m^3) (excl. freeboard)	Depth below grade to EMS floor (m)	Filled in lower ¼?
				Inside end walls	Inside side walls	Outside walls			
1.	60	60	4.5	3:1	3:1	4:1	8292 m^3	4.0	✓
2.	60	60	4.5	3:1	3:1	4:1	8292 m^3	4.0	✓
3.		(2)			(3)		(4)	(5)	(6)
						TOTAL CAPACITY	16584 m^3		

1 Enter the facility description/name as it is indicated on the site plan.

2 Enter the length and width in metres. The dimensions should be measured at the interior top of the liquid manure storage cell. Enter in the appropriate box the depth in metres measured from the interior top of the liquid manure storage cell to the top of the floor of the liquid manure storage cell.

3 Enter in the appropriate box the proposed interior end wall and interior sidewall slopes. The interior slope of a liquid manure storage wall may be no steeper than 3:1 (3 m horizontal to 1 m vertical). Enter the proposed exterior wall slope of the EMS. The exterior slope of a liquid earthen manure storage wall may be no steeper than 4:1 (4 m horizontal to 1 m vertical).

4 Enter in the space provided the calculated storage capacity and the total storage capacity of all EMS cells. All open liquid manure storages must have extra space above the maximum design capacity. This is typically referred to as freeboard. The minimum freeboard required for an open liquid manure storage is 0.5 metres.

5 Enter the depth of the top of the liquid manure storage floor below the current ground level (grade).

6 Check that the inlet pipe into the liquid manure storage is located in the lower quarter of the facility. For example, in a 6.1 m deep storage, the inlet pipe must be at a depth of 4.6 m or deeper.

Surface water control systems:

Describe the run-on and runoff control system (7)	Provide details:
	A minimum 0.5 high berm will be Constructed around the EMS

7 Describe the run-on and runoff control system. A run-on control prevents upstream surface water from coming into contact with manure. A runoff control prevents water that has come into contact with manure from leaving the confined feeding operation property.

Surface run-on water should be prevented from coming into contact with manure. With liquid manure storages, this is typically accomplished by having the walls of the liquid manure storage higher than the surrounding ground.

Naturally occurring protective layer details

a. Naturally occurring protective layer (8)	Thickness of naturally occurring protective layer: 11 (m)	Provide details: Borehole logs indicate a heavy clay material for a depth of 11 m below bottom of EMS.	
b. Soil texture (9)	18-20 % sand	20-22 % silt	20-62 % clay
c. Hydraulic conductivity - naturally occurring protective layer (10)	Material tested	Hydraulic conductivity (cm/s)	Describe test standard used
	Borehole: 5 Depth 4.0-15.0 (m)	1×10^{-6} cm/sec	Field falling head test conducted in borehole

Additional information: *(attach copies of soil test reports)* (11)

See attached engineering soils report for details on hydraulic conductivity & soil information.

8 Enter the proposed thickness of the naturally occurring protective layer(s), in metres, that is proposed to provide the groundwater protection. Provide the details of the type of soil proposed for the naturally occurring protective layer(s).

9 Provide the results of laboratory tests for the percentage of sand, silt and clay for the naturally occurring protective layer(s), as a range using the highest and lowest values found, and enter the values in the appropriate box. Copies of the test results should be attached to the application.

10 If hydraulic conductivity testing is done, provide the borehole number and the range of depth in metres across the borehole over which the hydraulic conductivity test was conducted. Enter the hydraulic conductivity test results in centimetres per second and describe the test method used to determine the hydraulic conductivity.

Hydraulic conductivity determined using re-compacted soil samples or consolidation tests is typically **not** accepted for naturally occurring protective layers. In-situ hydraulic conductivity testing is generally accepted.

11 If there is additional information you would like to provide, enter it in this space. Include details of any leakage detection or groundwater monitoring being proposed. Attach copies of soil test reports.

Note: 1 metre = 3.2808 feet **1 foot = 0.3048 metres**
1 m^3 = 35.315 ft^3 **1 ft^3 = 0.0283 m^3**

Compacted soil liner

An engineering soils investigation is required for most liquid manure storages that have a compacted soil liner (an earthen manure storage, or EMS). Contact an NRCB approval officer to determine the scope of the required soils investigation.

Compacted soil liners for liquid manure storages are required to have a minimum thickness of one metre and a maximum hydraulic conductivity of 1 x 10^{-7} cm/s.

The **primary** cell of liquid manure storages must have the fill pipe located in the bottom quarter of the primary cell of the liquid manure storage.

Not all compacted soil liners require hydraulic conductivity testing. In instances where it is not clear whether or not the compacted soil liner material can provide adequate protection, hydraulic conductivity testing will likely be required. Contact an NRCB approval officer to confirm whether hydraulic conductivity testing is required for the proposed site.

Include in the additional information section any information that will help explain factors that will need to be considered for the proposed liquid manure storage.

A calculator for determining the volume of a liquid manure storage is available online at http://www.agric.gov.ab.ca/app19/calc/volume/dugout.jsp.

LIQUID MANURE STORAGE: Earthen manure storage (EMS): Compacted soil liner

*(complete a copy of this section for **EACH** earthen liquid manure storage facility with a compacted soil liner)*

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

1. EMS Cell #1 (12)
2. EMS Cell #2
3.

Manure storage capacity *(complete a separate row of this table for each cell of the EMS)*

	Length (m)	Width (m)	Depth (m)	Slope run:rise			Estimated storage capacity (excl. freeboard) (m^3)	Depth below grade to the bottom of the liner (m)	Filled in lower ¼?
				Inside end walls	Inside side walls	Outside walls			
1.	60m	60m	4.5m	3:1	3:1	4:1	8292m^3	4.0	✓
2.	60m	60m	4.5m	3:1	3:1	4:1	8292m^3	4.0	✓
3.		(13)			(14)		(15)	(16)	(17)
						TOTAL CAPACITY	16584m^3		

12 Enter the facility description/name as it is indicated on the site plan.

13 Enter the length and width, in metres. The dimensions should be measured at the interior top of the liquid manure storage cell. Enter the depth, in metres, measured from the interior top of the liquid manure storage cell to the top of the floor of the liquid manure storage cell in the appropriate box.

14 Enter the proposed interior end wall and interior sidewall slopes in the appropriate box. The steepest allowed interior slope of a liquid earthen manure storage wall is 3:1 (3 m horizontal to 1 m vertical).

Enter the proposed exterior wall slope of the liquid manure storage. The steepest allowed exterior slope of a liquid earthen manure storage wall is 4:1 (4 m horizontal to 1 m vertical).

15 Provide the calculated storage capacity and the total storage capacity of all liquid manure storage cells. All open liquid manure storages are required to have extra space above the maximum design capacity. This is typically referred to as freeboard. The minimum freeboard required for an open liquid manure storage is 0.5 metres.

16 Provide the depth of the bottom of the liner below the current ground level.

17 Check that the inlet pipe into liquid manure storage is located in the lower quarter of the facility. For example, in a 6.1 m deep storage, the inlet pipe must be at a depth of 4.6 m or deeper.

Surface water control systems

Describe the run-on and runoff control system (18)	Provide details:
	A minimum 0.5m high berm will be constructed around EMS to control run on + runoff

18 Describe the run-on and runoff control system. A run-on control prevents upstream surface water from coming into contact with manure. A runoff control prevents water that has come into contact with manure from leaving the confined feeding operation property.

Surface run-on water should be prevented from coming into contact with manure. With liquid manure storages, this is typically accomplished by having the walls of the liquid manure storage higher than the surrounding ground.

Sealing

How will the liner be sealed to piping and other extrusions that penetrate it? (19)	Provide details:
	Bentonite seal and collar around the inlet pipe

NRCB USE ONLY Requirements met: ☐ YES ☐ NO

Liner protection

a. Describe how the inside walls, bottom and outside walls are protected from erosion and damage (20)	Provide details: Outside walls will be covered with topsoil, vegetated with grass. Concrete pad underneath fill pipe to be poured.
b. Describe how the physical integrity of the liner will be maintained (21)	Provide details: Liquids will be maintained within the EMS to protect it from freeze/thaw damage

NRCB USE ONLY Requirements met: ☐ YES ☐ NO

19 Describe how the compacted soil liner will be sealed to the piping and other extrusions that penetrate it. This seal is required to ensure that liquid manure does not seep back around the outside of the extrusions. Not only does this liquid manure seeping back along an extrusion create a potential source of contamination, in some cases it has caused the manure storage to fail and release its contents. Special care should be exercised when installing extrusions through compacted soil liners.

20 Provide the details on how the facility will be constructed so that the inside walls, bottom, and outside walls are protected from erosion and damage. The compacted soil liner needs to be protected from erosion to help ensure holes are not made in the liner due to filling, agitating or emptying of the earthen manure storage or due to wave action.

21 Provide the details about how the physical integrity of the liner or protective layer will be maintained.

Compacted soil liner details

a. Thickness of compacted liner 22	1.0 (m)	Provide details: Borehole logs indicate clay loam for depth of 4m in area where material will be sourced.	
b. Soil texture 23	34-36 % sand	30-34 % silt	26-32 % clay
c. Atterberg limits 24	Plastic limit 19-22	Liquid limit 42-45	Plasticity index 24-27
d. Hydraulic conductivity	Hydraulic conductivity (cm/s)	1 x 10⁻⁷ cm/sec	
25	Describe test standard used	Falling head test done in lab on recompacted sample	

Additional information: ***(attach copies of soil test reports)*** 26

See attd engineering rpt.
Groundwater monitoring is being proposed
All points where agitation pumping or filling take place will have concrete pads to prevent erosion of the liner

22 Provide the proposed thickness of the compacted soil liner material, in metres, and provide details about the type of soil material proposed for the liner.

23 Provide the results of laboratory tests for the percentage of sand, silt, and clay for the soil to be used as the compacted liner. The results should be provided as a range, using the highest and lowest values found. Enter the values in the appropriate box. Copies of the test results should be attached to the application.

24 Provide in the appropriate boxes the range of values for plastic and liquid limits and the plasticity index. If an engineering soils investigation is carried out, the range of values should be contained in the engineering soils report.

25 If hydraulic conductivity testing is done, provide the test results in centimetres per second, and the test method used to determine the hydraulic conductivity. If an engineering soils investigation is carried out, the hydraulic conductivity information should be contained in the engineering soils report and the report must be attached to the application.

The results of consolidation tests for hydraulic conductivity are typically **not** accepted for compacted soil liners.

Hydraulic conductivity test results from samples that have been tested in a laboratory are typically reduced by an order of magnitude to better reflect what can be obtained in the field.

26 If there is additional information you would like to provide, enter it in this space. Include details of any leakage detection or groundwater monitoring that is being proposed, a description of the manure storage, etc.

Attach copies of soil test reports.

Note: 1 metre = 3.2808 feet 1 foot = 0.3048 metres
1 m^3 = 35.315 ft^3 1 ft^3 = 0.0283 m^3

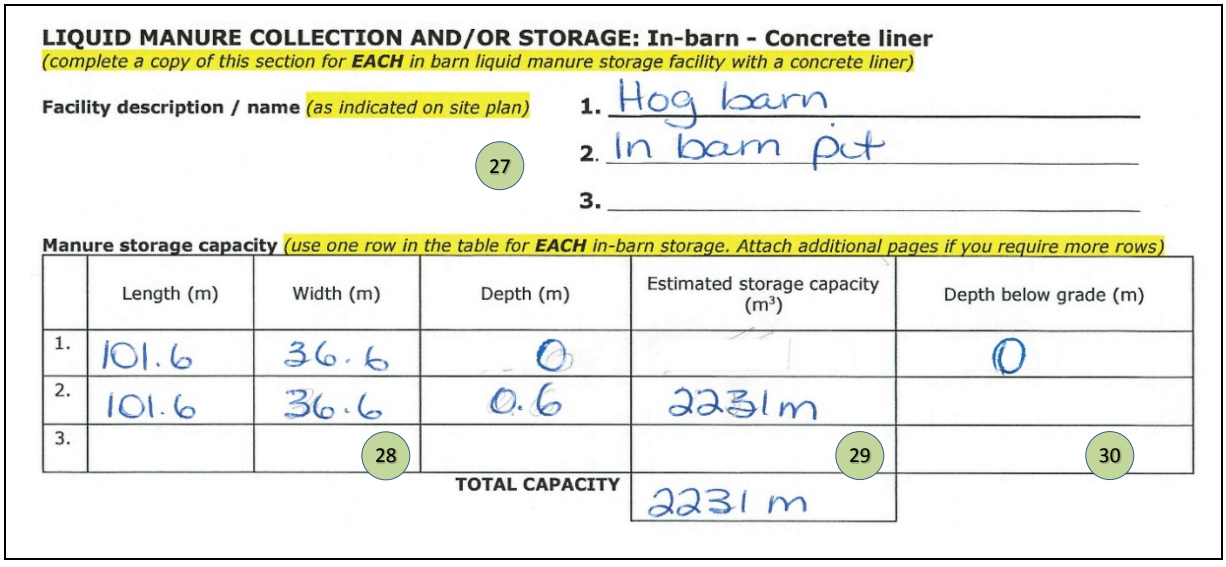
In-barn concrete liner

Generally, surface water control for barns is provided by the walls and roof of the building and the finished landscaping. If another type of surface water control is proposed, enter this information in the additional information section.

Technical guidelines on the liners required for barn floors and the type of concrete typically used are available from an NRCB approval officer and the NRCB website, at www.nrcb.ca.

The following concrete mixes are for information purposes only and are provided to help applicants understand the information that is typically required:

Example: Concrete mix #1 specifications
1. Maximum water to cementing materials ratio of 0.45 2. Type 10 cement with 20-25% fly ash added (sulphate resistance) 3. Air entrainment
Example: Concrete mix #2 specifications
1. Maximum water to cementing materials ratio of 0.45 2. Type 50 cement (sulphate resistance) 3. Air entrainment
Example: Concrete mix #3 specifications
1. Maximum water to cementing materials ratio of 0.5 2. Type 10 cement with 20-25% fly ash added (sulphate resistance) 3. Air entrainment
Example: Concrete mix #4 specifications
1. Maximum water to cementing materials ratio of 0.5 2. Type 50 cement (sulphate resistance) 3. Air entrainment



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

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

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

1. Hog barn
2. In barn pit
3.

27

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

	Length (m)	Width (m)	Depth (m)	Estimated storage capacity (m^3)	Depth below grade (m)
1.	101.6	36.6	0		0
2.	101.6	36.6	0.6	2231 m	
3.		28		29	30
			TOTAL CAPACITY	2231 m	

27 Enter the facility description/name as it is indicated on the site plan.

28 Enter the length and width, in metres. The dimensions should be measured at the interior top of the liquid manure storage cell. Enter in the appropriate box the depth, in metres, measured from the interior top of the liquid manure storage cell to the top of the floor of the liquid manure storage cell.

29 Enter the volume and the total capacity, in cubic metres, of the manure storage facility.

30 Provide the depth below grade of the bottom of the concrete liner.

Concrete liner details

a. Scrape alleys or unslatted portions of barn floors (if applicable)	Concrete thickness 31	Provide details: .13m
	Concrete strength 32	Provide details: 30 mpa (@56 days)
	Method of sulphate protection 33	Provide details: Type 10 cement with 20-25% flyash
	Concrete reinforcement size and spacing 34	Provide details: 10M rebar at .61m spacing both ways
b. In-barn manure pit floors	Concrete thickness 31	Provide details: .15m
	Concrete strength 32	Provide details: 32 mpa (@56 days)
	Method of sulphate protection 33	Provide details: Type 10 cement with 20-25% flyash
	Concrete reinforcement size and spacing 34	Provide details: 10M rebar spaced at .61m both ways

31 Provide the thickness of the concrete liner to be used. Please refer to the examples of concrete specifications provided above.

32 Provide the strength of the concrete to be used for the liners. Specify whether the concrete strength is measured at 28 days or 56 days. Please refer to the examples of concrete specifications provided above.

33 Provide the method of sulphate protection to be used (examples of typical sulphate protection include: type 10 cement with 20-25% fly ash, or type 50 cement). Please refer to the examples of concrete specifications provided above. Further information is also available in technical guidelines available on the NRCB website, at www.nrcb.ca.

34 Provide the size of the concrete reinforcement to be used for the liner. Enter the spacing of the reinforcement, for both the length and the width, to be used for the scrape alleys, the unslatted portions of barn floors, and manure pit floors.

Provide the size of the reinforcement to be used, horizontally and vertically, to reinforce the exterior manure pit walls. Enter the spacing of the horizontal and vertical rebar to be used for the outside manure pit walls (in contact with soil).

c. In-barn manure pit walls	Concrete thickness 31	Provide details: .20m
	Concrete strength 32	Provide details: 32mpa (@ 56 days)
	Method of sulphate protection 33	Provide details: Type 10 cement with 20-25% flyash
	Horizontal reinforcement size and spacing 34	Provide details: Horizontal - 10M rebar spaced at .61 m.
	Vertical reinforcement size and spacing 34	Provide details: 15M rebar spaced at .30m
d. How will the joints at the junction of the pit walls, pit floors and any other joints be sealed?	Provide details: Bentonite strip placed prior to the concrete wall being poured. 35	
e. How will the concrete liner to the piping and other extrusions that penetrate it be sealed?	Provide details: Using piping boots clamped to the pipes and sealed to concrete liner. 36	

Additional information:

See attached diagrams and plans. 37

35 Provide a description of the sealant to be used at the junction of the exterior pit walls, the pit floors and any other joints where leakage could occur.

36 Describe how the concrete liner will be sealed to the piping and other extrusions that penetrate it. This seal is required to ensure that liquid manure does not seep out around any piping or extrusions.

37 If there is additional information you would like to provide, enter it in this space. Include details of any leakage detection or groundwater monitoring that is being proposed, storage covers, etc.

Note: 1 metre = 3.2808 feet **1 foot = 0.3048 metres**
1 m^3 = 35.315 ft^3 **1 ft^3 = 0.0283 m^3**

Synthetic liner

An engineering soils investigation is required for most liquid manure storages with a synthetic liner. Contact an NRCB approval officer to determine the scope of the required soils investigation.

The **primary** cell of liquid manure storages must have the fill pipe located in the bottom quarter of the primary cell of the liquid manure storage.

Include in the additional information section any information that will help explain factors that will need to be considered for the proposed liquid manure storage.

A calculator for determining the volume of a liquid manure storage is available online at http://www.agric.gov.ab.ca/app19/calc/volume/dugout.jsp.

LIQUID MANURE STORAGE: Synthetic liner

*(complete a copy of this section for **EACH** liquid manure storage facility with a synthetic liner)*

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

1. Lagoon cell #1 (38)
2. Lagoon cell #2
3.

Manure storage capacity *(use one row in the table for **EACH** cell of the synthetic lined storage, attach additional pages if you require more rows)*

	Length (m)	Width (m)	Depth (m)	Slope run:rise			Estimated storage capacity (excl. freeboard) (m^3)	Depth below grade to bottom of the liner (m)	Filled in bottom ¼?
				Inside end walls	Inside side walls	Outside walls			
1.	60	60	4.5	3:1	3:1	4:1	8292m^3	4.0	✓
2.	60	60	4.5	3:1	3:1	4:1	8292m^3	4.0	✓
3.		(39)			(40)		(41)	(42)	(43)
						TOTAL CAPACITY	16584m^3		

38 Enter the facility description/name as it is indicated on the site plan.

39 Enter the length and width, in metres. The dimensions should be measured at the interior top of the liquid manure storage cell. Enter in the appropriate box the depth, in metres, measured from the interior top of the liquid manure storage cell to the top of the floor of the liquid manure storage cell.

40 Enter in the appropriate box the proposed interior end wall and interior sidewall slopes. The slopes are required to calculate the volume. Enter the proposed exterior wall slope of the liquid manure storage.

41 Provide the calculated storage capacity and the total storage capacity of the liquid manure storage cells. All open liquid manure storages are required to have extra space above the maximum design capacity, typically referred to as freeboard. The minimum freeboard required for an open liquid manure storage facility is 0.5 metres.

42 Provide the depth of the synthetic liner below the current ground level (grade).

43 Check that the inlet pipe into the liquid manure storage is located in the lower quarter of the facility. For example, in a 6.1 m deep storage, the inlet pipe must be at a depth of 4.6 m or deeper.

Surface water control systems

Describe the run-on and runoff control system (44)	Provide details:
	A minimum 0.5m high berm will be Constructed around Lagoon

44 Describe the run-on and runoff control system. A run-on control prevents upstream surface water from coming into contact with manure. A runoff control prevents water that has come into contact with manure from leaving the confined feeding operation property.

Surface run-on water should be prevented from coming into contact with manure. With liquid manure storages, this is typically accomplished by having the walls of the liquid manure storage higher than the surrounding ground.

Sealing

How will the liner be sealed to piping and other extrusions that penetrate it? (45)	Provide details: Piping. boot welded to the liner material & clamped to the pipe.

Liner protection

a. Describe how the inside walls, bottom and outside walls are protected from erosion and damage (46)	Provide details: Concrete pad will be poured under the full pipe to protect liner while filling.
b. Describe how the physical integrity of the liner will be maintained (47)	Provide details: A soil cover will be placed on the synthetic liner.

Synthetic liner details

Synthetic liner (48)	Thickness and type of liner material:	Provide liner material details:
	60 mil	60 mil HDPE liner (manufactured by ABC Ltd.)

Additional information: ***(attach copies of soil test reports/proof of liner specs)***

See attached manufacturer's specifications (49)

45 Describe how the synthetic liner will be sealed to piping and other extrusions that penetrate it. This seal is required to ensure that liquid manure does not seep back out of the manure storage around the outside of the extrusions or other liner penetrations.

46 Provide details on how the facility will be constructed so that the inside walls, bottom, and outside walls are protected from erosion and damage. The synthetic liner needs to be protected from erosion to help ensure holes are not made in the liner due to filling, agitating, or emptying the earthen manure storage, or due to wave action.

47 Describe how the physical integrity of the liner or protective layer will be maintained. Some synthetic liners will need to be protected from erosion, mechanical damage and/or the sun. Liner manufacturers will typically specify what protection should be provided.

48 Provide the thickness and type of the proposed synthetic liner. Attach other details relating the synthetic liner (manufacturer, inspection reports, construction methods, etc.).

49 If there is additional information you would like to provide, enter it in this space. Include details of any leakage detection or groundwater monitoring that is being proposed, storage covers, etc.

Note: 1 metre = 3.2808 feet **1 foot = 0.3048 metres**
1 m^3 = 35.315 ft^3 **1 ft^3 = 0.0283 m^3**

Concrete or steel tank

Engineering plans approved by an accredited engineer registered in Alberta are required for concrete or steel manure storage tanks, and must be submitted to the NRCB as part of an application.

The fill pipe must be located in the bottom quarter of the liquid manure storage tank.

LIQUID MANURE STORAGE: Concrete or steel tank

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

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

1. Steel tank (50)
2.
3.

Manure storage capacity

	Diameter (or length and width) (m)	Depth (m)	Estimated storage capacity (excl. freeboard) (m^3)	Depth below grade of the bottom of the tank floor (m)	Filled in lower ¼?
1.	36.0	4.0	3562	0	
2.	(51)		(52)	(53)	(54)
3.					

50 Enter the facility description/name as it is indicated on the site plan.

51 Enter in the appropriate box the diameter (or length and width) and depth (in metres) of the proposed tank.

52 Enter the estimated manure storage capacity of the proposed tank (excluding the required freeboard).

53 Enter the maximum depth of the bottom of the proposed tank floor below grade.

54 Check that the inlet pipe into the liquid manure storage is located in the lower quarter of the facility. For example, in a 6.1 m deep storage, the inlet pipe must be at a depth of 4.6 m or deeper.

Surface water control systems

Describe the run-on and runoff control system (55)	Provide details:
	Run on will be controlled by finished landscaping. Runoff will be Controlled by the tank walls.

55 Describe the run-on and runoff control system. A run-on control prevents upstream surface water from coming into contact with manure. A runoff control prevents water that has come into contact with manure from leaving the confined feeding operation property.

Surface run-on water should be prevented from coming into contact with manure. With liquid manure storages this is typically accomplished by having the walls of the liquid manure storage higher than the surrounding ground.

a. Manure tank floor	Concrete thickness 56	Provide details: .13
	Concrete strength 57	Provide details: 32 mpa (@ 56 days)
	Method of sulphate protection 58	Provide details: Type 10 cement with 20-25% fly ash
	Concrete reinforcement size and spacing 59	Provide details: 10M rebar spaced at .61 both ways
b. Manure storage tank walls: provide details on the construction of the proposed manure storage tank walls. *(complete this section for concrete or steel tank walls)* 60		Provide details: As per attached engineering design & plans.
c. How will the liner be sealed to piping and other extrusions that penetrate it? 61		Provide details: Piping penetrating the liner will be sealed using rubber gaskets & flanges or bentonite sealing strips.
d. How will the joints at the junction of the tank walls, tank floor and any other joints be sealed? 62		Provide details: Bentonite sealing strip placed prior to the concrete wall being poured.

Additional information:

See manufacturer's specifications attached 63

56 Provide the thickness of the concrete liner to be used.

57 Provide the strength of the concrete to be used for the liners. Specify whether the concrete strength is measured at 28 days or 56 days.

NRCB technical guidelines list the concrete strength required for liquid manure as 32 MPa at 56 days (maximum water to cement ratio of 0.45), with sulphate resistance, and proper air entrainment. The guidelines are available on the NRCB website, at www.nrcb.ca.

58 Provide the method of sulphate protection to be used (examples of typical sulphate protection include type 10 cement with 20-25% fly ash, or type 50 cement). For further information, please refer to NRCB technical guidelines, available on the NRCB website at www.nrcb.ca.

59 Provide the size of the concrete reinforcement to be used for the floor. Provide the spacing of the reinforcement for both directions of reinforcement of the concrete floor.

60 For tanks with concrete walls, provide the thickness and strength of the concrete, the method of the sulphate protection and the size of the concrete reinforcement to be used for the wall horizontally and vertically. Provide the spacing of the reinforcement for the horizontal and vertical wall reinforcement.

For tanks with steel walls, provide the technical information about the manure tank walls.

61 Describe how the liner will be sealed to the piping and other extrusions that penetrate it. This seal is required to ensure that liquid manure does not seep out around the outside of any piping or other extrusions.

62 Describe the sealant to be used at the junction of the tank walls, the tank floor and any other joints.

63 If there is additional information you would like to provide, enter it in this space. Include details of any leakage detection or groundwater monitoring that is being proposed, storage covers, operation of the storage, etc.

Note: 1 metre = 3.2808 feet 1 foot = 0.3048 metres
1 m^3 = 35.315 ft^3 1 ft^3 = 0.0283 m^3

Alternative liner

An alternative liner must provide equivalent or greater protection than the protection provided by a compacted soil liner with a thickness of one metre and a hydraulic conductivity of 1 x 10^{-7} cm/s.

LIQUID MANURE STORAGE: Alternative liner

*(complete a copy of this section for **EACH** liquid manure storage facility with an alternative liner)*

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

64

1. Barn
2. Lagoon
3. _____

Manure storage capacity

	Length (m)	Width (m)	Estimated manure storage capacity (m^3)	Depth below grade of the bottom of the liner (m)	Filled in lower ¼?
1.					
2.	65		66	67	68
3.					

64 Enter the facility description/name as it is indicated on the site plan.

65 Provide the length and width of the proposed alternative liner in the appropriate box.

66 Enter the estimated manure storage capacity of the alternative liner.

67 Enter the depth below the current ground level of the bottom of the alternative liner.

68 Check that the inlet pipe into the liquid manure storage is located in the lower quarter of the facility. For example, in a 6.1 m deep storage, the inlet pipe must be at a depth of 4.6 m or deeper.

Surface water control systems

Describe the run-on and runoff control system	Provide details:
69	

69 Describe the run-on and runoff control system. A run-on control prevents upstream surface water from coming into contact with manure water. A runoff control prevents water that has come into contact with manure from leaving the confined feeding operation property.

Surface run-on water should be prevented from coming into contact with manure. With liquid manure storages this is typically accomplished by having the walls of the liquid manure storage higher than the surrounding ground.

a. Describe the proposed alternative liner 70	Provide details:
b. Information and calculations used to show equivalency 71	Provide details:

Additional information:

72

70 Provide a description of the alternative liner.

71 Provide the details and calculations used to show that the alternative liner is equivalent to AOPA requirements. Alternative liners need to provide equivalent or greater groundwater protection than a one-metre thick compacted soil liner with a hydraulic conductivity of 1 x 10^{-7}cm/s.

72 If there is additional information you would like to provide, enter it in this space. This would include details on the alternative liner, leakage detection or groundwater monitoring being proposed, storage covers, liner protection requirements, etc.

Note: 1 metre = 3.2808 feet 1 foot = 0.3048 metres
1 m^3 = 35.315 ft^3 1 ft^3 = 0.0283 m^3

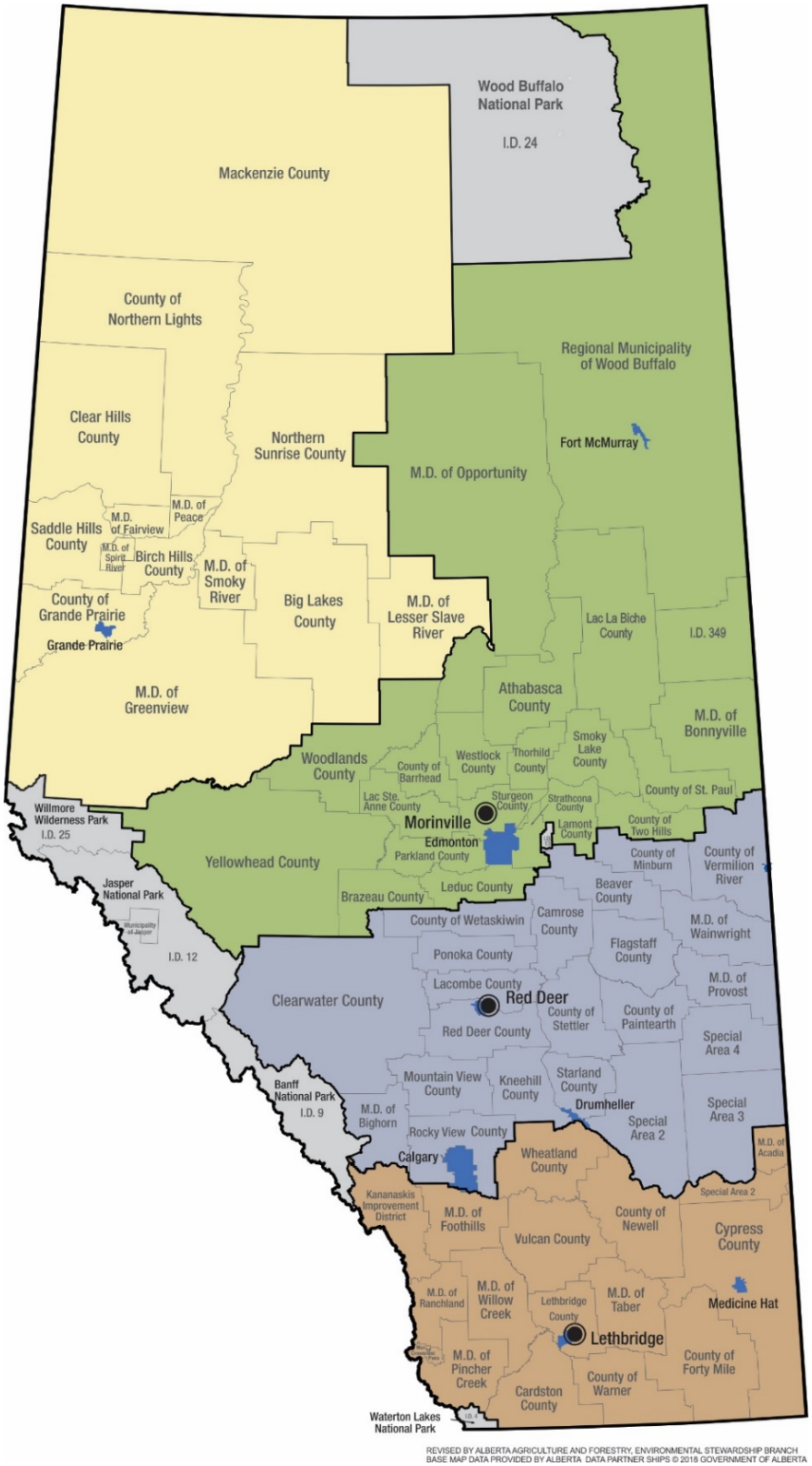
Appendix 1: NRCB field office service areas

Peace and North Central Regions - Morinville
Provincial Building
201, 10008 – 107 Street
Morinville AB T8R 1L3 Phone: 780-939-1212
Fax: 780-939-3194

Central Region - Red Deer
Provincial Building
303, 4920 – 51 Street
Red Deer AB T4N 6K8 Phone: 403-340-5241
Fax: 403-340-5599

Southern Region - Lethbridge
Agriculture Centre
100, 5401 – 1 Avenue S
Lethbridge AB T1J 4V6
Phone: 403-381-5166
Fax: 403-381-5806

Response line (toll-free)
1-866-383-6722
www.nrcb.ca



REVISED BY ALBERTA AGRICULTURE AND FORESTRY, ENVIRONMENTAL STEWARDSHIP BRANCH
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Appendix 2: Glossary of terms

These definitions are based on existing definitions in AOPA and its associated regulations.

Affected party	A person or municipality determined in accordance with the regulations to be an affected person.
Agent	A party that is authorized in writing to act on behalf of the applicant.
AOPA	Alberta provincial legislation consisting of the Agricultural Operation Practices Act (AOPA) and its associated regulations.
Applicant	The person or company that is applying to the NRCB for a permit, or an amendment to an existing permit, for a new or expanded confined feeding operation, manure collection area, or manure storage facility.
Application	A two-part application for an approval, registration, or authorization to construct a new or expanded CFO, manure collection area, or manure storage facility, or an application for an amendment to an existing permit issued by the NRCB, municipal district, or health authority.
Approval	The permit type required to construct or expand a confined feeding operation in accordance with the number of animals and livestock type set out in Column 3, Schedule 2 of the Part 2 Matters Regulation.
Authorization	The permit type required to construct or to expand a manure storage facility that is for containment of 500 tonnes or more of manure for seven months or more in any calendar year.
Compost	A solid mature product resulting from composting. Does not include compost to which the Fertilizer Act (Canada) applies.
Composting	A managed process of bio-oxidation of composting materials, including a thermophilic phase.
Composting materials	Organic material generated by an agricultural operation described in clause (b)(ii), (iv), (v), or (vi) of AOPA, other than carcasses or parts of carcasses. Includes other substances permitted by the regulations.
Construct	Includes reconstructing, renovating, altering, or expanding a structure, operation or facility, but does not include general maintenance of a structure, operation or facility, or the clearing and levelling of land.
Confined feeding operation (CFO)	Fenced or enclosed land or buildings where livestock are confined for the purpose of growing, sustaining, finishing, or breeding by means other than grazing, and any other building or structure directly related to that purpose. Does not include residences, livestock seasonal feeding and bedding sites, equestrian stables, auction markets, racetracks, or exhibition grounds.
Development permit	A permit issued under a land use bylaw, pursuant to the Municipal Government Act.
Expansion	The construction of additional facilities to store more manure, composting materials, or compost, or to accommodate more livestock.
Freeboard	The vertical distance between the full storage level of a structure and the upper edge of the structure.
Liner	A layer constructed out of natural or manufactured materials that restricts the migration of the contents of the manure storage facility or manure collection area.

Liquid manure	Manure that is in a predominantly liquid state or manure to which water has been added.
Manure	Livestock excreta, associated feed losses, bedding, litter, soil and wash water. Does not include manure to which the Fertilizers Act (Canada) applies.
Manure collection area	The floor of a barn, the under-floor pits of a barn, the floor of a feedlot pen or a catch basin where manure collects. Does not include the floor of a livestock corral.
Manure storage facility	A facility for storing manure, composting materials or compost, or a composting facility. Does not include such a facility at an equestrian stable, an auction market, a racetrack or exhibition grounds.
Minimum distance separation	Under AOPA, the minimum distance required between a manure storage operation or facility and the nearest residence that is not owned or controlled by the facility's operator.
Municipal development plan	A municipal land use plan adopted by bylaw, under the Municipal Government Act.
Operator	The operator of a confined feeding operation, manure collection area, or manure storage facility.
Permit	An approval, registration, or authorization that is issued by the NRCB or grandfathered under AOPA.
Registration	The permit type required to construct or expand a confined feeding operation in accordance with the number of animals and livestock type set out in Column 2, Schedule 2 of the Part 2 Matters Regulation.
Referral agency	Government of Alberta authorities with responsibility for agriculture, health, the environment, and transportation that are provided by the NRCB with a copy of applications to expand or construct a confined feeding operation, for their information, review and response.
Runoff	Liquid (including rainwater and meltwater) that drains as surface flow out of an agricultural operation or part of an agricultural operation.
Run-on	Liquid (including rainwater and meltwater) that drains as surface flow onto an agricultural operation or part of an agricultural operation.
Solid manure	Manure that is 20% or more solid matter, and that does not flow when piled.