APPENDIX C

Imperial Units

Table 2: Required Manure Storage Setbacks[1]

Storage Type	Distance (ft) to	
	Surface watercourse, sinkhole, spring, or well	Property Boundary
All manure storage structures	328	328
Field storage	328	N/A
Composting	328	328

[1] Refer to Appendix B, Livestock Manure and Mortalities Management Regulation.

Table 3a: Minimum Manure Storage Volume Requirements (Including Spilled And Wash Water)

Livestock	Storage Volume	
	Gallons per day	Cubic feet per day
1 Sow, Farrow to Finish (243-254 lbs)	14.3	2.30
1 Sow, Farrow to Weanling (up to 11 lbs)	4.98	0.80
1 Sow, Farrow to Nursery (51 lbs)	6.23	1.00
1 Weanling, Nursery (11-51 lbs)	0.62	0.10
1 Grower/Finisher Pig (51-249 lbs)	1.56	0.25

Table 3b: Estimated Rates Of Solid Manure Production For Pigs[1]

Livestock Type	Volume-basis (ft^3/day)	Weight-basis (lb/day)
1 Sow, Farrow to Finish (243-254 lbs)	1.74	86.4
1 Sow, Farrow to Weanling (up to 11 lbs)	0.54	26.6
1 Weanling, Nursery (11-51 lbs)	0.06	2.8
1 Grower/Finisher (51-249 lbs)	0.17	8.2

[1] Adapted from Table 5 of the Province of Alberta's Agricultural Operation Practices Act - Standards and Administration Regulation (AR 267/2001)

Table 4a: Nutrient (lb/1000 Gallons) And Dry Matter (%) Content For Liquid Pig Manure[1] (Pre-phytase Use)

Parameter[2]	Farrow			Nursery			Finisher			Farrow to Finish		
	Avg	Min	Max	**Avg**	Min	Max	**Avg**	Min	Max	**Avg**	Min	Max
Total N	**17**	6	65	**27**	15	46	**34**	15	64	**28**	12	40
NH_4-N	**12**	5	32	**20**	13	30	**26**	12	41	**24**	11	34
Total P_2O_5	**15**	1	127	**27**	3	59	**23**	1	81	**24**	3	48
Total K_2O	**12**	3	42	**20**	15	24	**18**	11	32	**17**	8	21
Dry Matter	**3.0**	0.3	38.6	**3.1**	1.1	5.6	**3.7**	0.0	11.8	**2.1**	0.6	4.0

[1] Values are on an as-is basis (i.e. untreated). SOURCE: Racz and Fitzgerald 2001. Nutrient and Heavy Metal Contents of Hog Manure – Effect on Soil Quality and Productivity. Proceedings: Livestock Options for the Future. Results based on 37, 11, 92 and five samples for farrow, nursery, finisher and farrow to finish, respectively.

[2] Total N refers to all forms of nitrogen in manure, but typically only includes ammonium N (NH_4-N) and organic N. NH_4-N is the inorganic, readily available form of nitrogen in manure. Total P_2O_5 refers to all forms of phosphorus in manure expressed in the fertilizer equivalent (P content x 2.3). Total K_2O refers to all forms of potassium in manure expressed in the fertilizer equivalent (K content x 1.2).

Table 4b: Nutrient (lb/1000 Gallons) And Dry Matter (%) Content For Pig Manure (Phytase Use)

Parameter[2]	Farrow			Nursery			Finisher		
	Avg	Min	Max	**Avg**	Min	Max	**Avg**	Min	Max
Total N	**22**	4	60	**27**	11	56	**34**	4	67
NH_4-N	**17**	4	27	**20**	6	33	**24**	4	47
Total P_2O_5	**15**	0	94	**11**	1	47	**15**	0	65
Total K_2O	**13**	7	20	**19**	13	28	**18**	1	34
Dry Matter	**2.1**	0.3	9.1	**2.2**	0.6	7.4	**3.4**	0.4	11.2

[1] Values are on an as-is basis (i.e. untreated). SOURCE: Industry co-operators. Results based on 132, 58 and 181 samples for farrow, nursery and finisher, respectively.

[2] Total N refers to all forms of nitrogen in manure, but typically only includes ammonium N (NH_4-N) and organic N. NH_4-N is the inorganic, readily available form of nitrogen in manure. Total P_2O_5 refers to all forms of phosphorus in manure expressed in the fertilizer equivalent (P content x 2.3). Total K_2O refers to all forms of potassium in manure expressed in the fertilizer equivalent (K content x 1.2).

Table 5: Nutrient (lb/ton) And Dry Matter (%) Content For Solid Finishing Pig Manure[1] (Pre-phytase Use)

Parameter[2]	Fresh			Stockpiled[3]			Composted[4] Fresh			Composted Stockpiled		
	Avg	Min	Max	**Avg**	Min	Max	**Avg**	Min	Max	**Avg**	Min	Max
Total N	**12.6**	9.6	17.8	**12.0**	7.4	25.8	**12.8**	10.0	16.2	**14.4**	11.6	17.6
NH_4-N	**2.8**	2.0	3.6	**4.2**	2.2	6.2	**1.0**	0.2	2.4	**1.4**	0.4	2.0
Total P_2O_5	**13.0**	10.0	19.8	**11.0**	6.8	17.6	**18.4**	15.2	21.0	**17.2**	12.8	19.8
Total K_2O	**17.6**	12.0	30.2	**18.0**	13.6	26.4	**20.8**	17.8	24.0	**21.6**	18.0	28.4
Dry Matter	**33.2**	24.0	45.3	**47.1**	32.1	63.7	**66.4**	63.4	69.4	**58.2**	44.0	63.4

[1] Values are on an as-is basis (i.e. untreated). SOURCE: Agriculture and Agri-Food Canada 2005. Results based on 10 samples.

[2] Total N refers to all forms of nitrogen in manure, but typically only includes ammonium N (NH_4-N) and organic N. NH_4-N is the inorganic, readily available form of nitrogen in manure. Total P_2O_5 refers to all forms of phosphorus in manure expressed in the fertilizer equivalent (P content x 2.3). Total K_2O refers to all forms of potassium in manure expressed in the fertilizer equivalent (K content x 1.2).

[3] Maintained in a pile for approximately six months and minimally disturbed (i.e. not moved repeatedly or mixed).

[4] Carefully managed to maintain necessary moisture and temperature, resulting in the breakdown of manure to form a stable and uniform material.

Table 6: Crop Removal Rates For N And P_2O_5 [1]

Crop[2]	Example Target Yield[3]	Average Nutrient Uptake Rate[4]		Average Nutrient Removal Rate[5]	
		N	P_2O_5	N	P_2O_5
Spring Wheat	40 bu/acre	2.11 lb/bu	0.8 lb/bu	1.5 lb/bu	0.59 lb/bu
Winter Wheat	50 bu/acre	1.35 lb/bu	0.61 lb/bu	1.04 lb/bu	0.51 lb/bu
Barley	80 bu/acre	1.39 lb/bu	0.56 lb/bu	0.97 lb/bu	0.42 lb/bu
Oats	100 bu/acre	1.07 lb/bu	0.41 lb/bu	0.62 lb/bu	0.26 lb/bu
Rye	55 bu/acre	1.67 lb/bu	0.84 lb/bu	1.06 lb/bu	0.45 lb/bu
Grain Corn	100 bu/acre	1.53 lb/bu	0.63 lb/bu	0.97 lb/bu	0.44 lb/bu
Canola	35 bu/acre	3.19 lb/bu	1.47 lb/bu	1.93 lb/bu	1.04 lb/bu
Flax	24 bu/acre	2.88 lb/bu	0.83 lb/bu	2.13 lb/bu	0.65 lb/bu
Sunflowers	50 bu/acre	1.49 lb/bu	0.51 lb/bu	1.07 lb/bu	0.32 lb/bu
Alfalfa	5 tons/acre	N/A[6]	N/A	58.0 lb/ton	13.8 lb/ton
Grass	3 tons/acre	N/A	N/A	34.2 lb/ton	10.0 lb/ton
Corn Silage	5 tons/acre	N/A	N/A	31.2 lb/ton	12.7 lb/ton
Barley Silage	4.5 tons/acre	N/A	N/A	34.4 lb/ton	11.8 lb/ton

[1] Adapted from Nutrient Uptake and Removal by Field Crops, Western Canada, 2001. Compiled by the Canadian Fertilizer institute.

[2] As bushel weights can vary considerably among some crop varieties, values other than those presented here may need to be chosen to better reflect a given cropping scenario.

[3] Example target yields for Manitoba. Site specific and actual yields for any parcel of land will depend on the agricultural capability of the land, climate and the producer's management practices.

[4] Total nutrient taken up by the Crop.

[5] Nutrient removed in the harvested portion of the crop.

[6] Not applicable

Table 7: Volatilization Losses (%)[1]

Method of Application	Cool Wet	Cool Dry	Warm Wet	Warm Dry	Average
Injected	0	0	0	0	0
Incorporated within 1 day	10	15	25	50	25
Incorporated within 2 day	13	19	31	57	30
Incorporated within 3 day	15	22	38	65	35
Incorporated within 4 day	17	26	44	72	40
Incorporated within 5 day	20	30	50	80	45
Not Incorporated	40	50	75	90	64
Irrigated	Above + 10%	Above + 10%	Above + 10%	Above + 10%	Above + 10%
Applied to Standing Crop	25	25	40	50	35

[1] MARC 2005. Manitoba Agriculture, Food and Rural Initiatives.

Table 8a: Manure Application Rate Calculation Worksheet For Liquid Manure

Field I.D.: _____ **Crop:** _____ **Target Yield:** _____

Step 1. Target Nutrient Rate			**Units**
Nitrogen (based on soil test recommendation)	(A)	80	lb/ac
Phosphorus (as P_2O_5): 2x Crop Removal	(B1)	54	lb/ac
Phosphorus (as P_2O_5): 1x Crop Removal	(B2)	27	lb/ac
Other:	(B3)		lb/ac
Step 2. Manure Test Data			
Total Nitrogen	(C)	25.9	lb/1000 gal
Ammonium Nitrogen	(D)	15.9	lb/1000 gal
Organic Nitrogen = (C) - (D)	(E)	10	lb/1000 gal
Phosphorus	(F)	8.4	lb/1000 gal
P_2O_5 = (F) ? 2.3	(G)	19.3	lb/1000 gal
Step 3. Amount of manure nitrogen available to crop:			
Application method		Incorporated within 1 day	
Volatilization losses due to application method (Table 6)	(H)	25%	
Ammonium nitrogen available = (D) ? [100 - (H)]% = 15.9 x 0.75 = 11.9	(I)	11.9	lb/1000 gal
Organic nitrogen available to the next crop = (E) ? 0.25	(J)	2.5	lb/1000 gal
Total available N = (I) + (J) = 11.9 + 2.5 = 14.4	(K)	14.4	lb/1000 gal
Total available N in spring = (K) x 100% = 14.4 x 1.0 = 14.4	(L)	14.4	lb/1000 gal
Total available N in fall = (K) x 83% = 14.4 x 0.83 = 12.0	(M)	12.0	lb/1000 gal
Step 4. Application rate based on N requirements:			
Spring N-based Application Rate = (A) ÷ (L) x 1000 = 80 ÷ 14.4 x 1000 = 5555.6 ***or*** Fall N-based Application Rate = (A) ÷ (M) x 1000 = 80 ÷ 12 x 1000 = 6666.7	(N)	6666.7	gal/ac
Amount of P_2O_5 applied = (G ÷ 1000) x (N) = 19.3 ÷ 1000 x 6666.7 = 128.7	(O)	128.7	lb/ac
P_2O_5 balance[1] (using 1x crop removal) = (O) - (B2) = 128.7 - 27 = 101.7	(P)	+101.7	lb/ac
Step 5. Application rate based on P removal:			
2x crop removal P-based Application Rate[2] = (B1) ÷ (G) x 1000 = 54 ÷ 19.3 x 1000 = 2797.9 ***or*** 1x crop removal P-based Application Rate[2] = (B2) ÷ (G) x 1000 = 27 ÷ 19.3 x 1000 = 1399.0	(Q)	1399.0	gal/ac
Amount of available N applied spring = (L) ÷ 1000 x (Q) = 20.1 = 14.4 ÷ 1000 x 1399.0 = 20.1 ***or*** Amount of available N applied in fall = (M) ÷ 1000 x (Q) = 12.0 ÷ 1000 x 1399.0 = 16.8	(R)	16.8	lb/ac
N balance[3] (N applied - N recommended) = (R) - (A) = 16.8 - 80 = -63.2	(S)	-63.2	lb/ac
Step 6. Compare N rate (N) with P rate (Q):			
If soil test P is low to moderate (< 60 ppm), apply manure at N rate (N)		6667	gal/ac
If soil test P is high (> 60 ppm), apply manure at P rate (Q)[4]		1399	gal/ac

[1] A positive value indicates that more P_2O_5 will be applied than the crop will remove (1x crop removal) when manure is applied based on N. A negative value indicates that less P_2O_5 will be applied than the crop will remove (1x crop removal) and the rate should be compared to the soil test recommendation to determine if the crop requirement for P will be met.

[2] When soil test phosphorus (STP) is low to moderate, manure can be applied based on N. When STP is high, a P-based application rate can be used up to 2X the crop removal of P_2O_5. At very high to excessive STP, no more than 1X crop removal of P_2O_5 should be applied.

[3] Positive values indicate N application rate is above soil test recommendation when manure is applied based on P_2O_5. Negative values indicate N application rate is below soil test recommendation and supplemental commercial fertilizer is required to meet crop requirements.

[4] If annual applications are too low, multi-year application rates and rotation of fields should be considered.

Table 8b: Manure Application Rate Calculation Worksheet For Solid Manure

Field I.D.: _____ **Crop:** _____ **Target Yield:** _____

Step 1. Target Nutrient Rate			**Units**
Nitrogen (based on soil test recommendation)	(A)	80	lb/ac
Phosphorus (as P_2O_5): 2x Crop Removal	(B1)	54	lb/ac
Phosphorus (as P_2O_5): 1x Crop Removal	(B2)	27	lb/ac
Other:	(B3)		lb/ac
Step 2. Manure Test Data			
Total Nitrogen	(C)	12	lb/t
Ammonium Nitrogen	(D)	4.2	lb/t
Organic Nitrogen = (C) - (D)	(E)	7.8	lb/t
Phosphorus	(F)	4.8	lb/t
P_2O_5 = (F) × 2.3	(G)	11.0	lb/t
Step 3. Amount of manure nitrogen available to crop:			
Application method		Incorporated within 1 day	
Volatilization losses due to application method (Table 6)	(H)	25%	
Ammonium nitrogen available = (D) × [100 - (H)]% = 4.2 x 0.75 = 3.2	(I)	3.2	lb/t
Organic nitrogen available to the next crop = (E) × 0.25 = 7.8 x 0.25 = 2.0	(J)	2.0	lb/t
Total available N = (I) + (J) = 3.2 + 2.0 = 5.2	(K)	5.2	lb/t
Total available N in spring = (K) x 100% = 5.2 x 1.0 = 5.2	(L)	5.2	lb/t
Total available N in fall = (K) x 83% = 5.2 x 0.83 = 4.3	(M)	4.3	lb/t
Step 4. Application rate based on N requirements:			
Spring N-based Application Rate = (A) ÷ (L) = 80 ÷ 5.2 = 15.4 ***or*** Fall N-based Application Rate = (A) ÷ (M) = 80 ÷ 4.3 = 18.6	(N)	18.6	t/ac
Amount of P_2O_5 applied = (G) x (N) = 11.0 x 18.6 = 204.6	(O)	204.6	lb/ac
P_2O_5 balance[1] (using 1x crop removal) = (O) - (B2) = 204.6 - 27 = 177.6	(P)	+177.6	lb/ac
Step 5. Application rate based on P removal:			
2x crop removal P-based Application Rate[2] = (B1) ÷ (G) = 54 ÷ 11 = 4.9 ***or*** 1x crop removal P-based Application Rate[2] = (B2) ÷ (G) = 27 ÷ 11 = 2.5	(Q)	4.9	t/ac
Amount of available N applied in spring = (L) x (Q) = 5.2 x 4.9 = 25.5 ***or*** Amount of available N applied in fall = (M) x (Q) = 4.3 x 4.9 = 21.1	(R)	21.1	lb/ac
N balance[3] (N applied - N recommended) = (R) - (A) = 21.1 - 80 = -58.9	(S)	-58.9	lb/ac
Step 6. Compare N rate (N) with P rate (Q):			
If soil test P is low to moderate (< 60 ppm), apply manure at N rate (N)		19	t/ac
If soil test P is high (> 60 ppm), apply manure at P rate (Q)[4]		5	t/ac

[1] A positive value indicates that more P_2O_5 will be applied than the crop will remove (1x crop removal) when manure is applied based on N. A negative value indicates that less P_2O_5 will be applied than the crop will remove (1x crop removal) and the rate should be compared to the soil test recommendation to determine if the crop requirement for P will be met.

[2] When soil test phosphorus (STP) is low to moderate, manure can be applied based on N. When STP is high, a P-based application rate can be used up to 2X the crop removal of P_2O_5. At very high to excessive STP, no more than 1X crop removal of P_2O_5 should be applied.

[3] Positive values indicate N application rate is above soil test recommendation when manure is applied based on P_2O_5. Negative values indicate N application rate is below soil test recommendation and supplemental commercial fertilizer is required to meet crop requirements.

[4] If annual applications are too low, multi-year application rates and rotation of fields should be considered.

Table 8c: Manure Application Rate Calculation Worksheet Template For Liquid Manure

Field I.D.: _____ **Crop:** _____ **Target Yield:** _____

Step 1. Target Nutrient Rate			**Units**
Nitrogen (based on soil test recommendation)	(A)		kg/ha or lb/ac
Phosphorus (as P_2O_5): 2x Crop Removal	(B1)		kg/ha or lb/ac
Phosphorus (as P_2O_5): 1x Crop Removal	(B2)		kg/ha or lb/ac
Other:	(B3)		kg/ha or lb/ac
Step 2. Manure Test Data			
Total Nitrogen	(C)		kg/m^3 or lb/1000 gal
Ammonium Nitrogen	(D)		kg/m^3 or lb/1000 gal
Organic Nitrogen = (C) - (D)	(E)		kg/m^3 or lb/1000 gal
Phosphorus	(F)		kg/m^3 or lb/1000 gal
P_2O_5 = (F) × 2.3	(G)		kg/m^3 or lb/1000 gal
Step 3. Amount of manure nitrogen available to crop:			
Application method			
Volatilization losses due to application method (Table 6)	(H)		
Ammonium nitrogen available = (D) × [100 - (H)]%	(I)		kg/m^3 or lb/1000 gal
Organic nitrogen available to the next crop = (E) × 0.25	(J)		kg/m^3 or lb/1000 gal
Total available N = (I) + (J)	(K)		kg/m^3 or lb/1000 gal
Total available N in spring = (K) x 100%	(L)		kg/m^3 or lb/1000 gal
Total available N in fall = (K) x 83%	(M)		kg/m^3 or lb/1000 gal
Step 4. Application rate based on N requirements:			
Spring N-based Application Rate = (A) ÷ (L) x [1000 gal for imperial units] ***or*** Fall N-based Application Rate = (A) ÷ (M) [x 1000 gal for imperial units]	(N)		m^3/ha or gal/ac
Amount of P_2O_5 applied = (G) x (N) ÷ [1000 gal for imperial units]	(O)		m^3/ha or gal/ac
P_2O_5 balance[1] (using 1x crop removal) = (O) - (B2)	(P)		m^3/ha or gal/ac
Step 5. Application rate based on P removal:			
2x crop removal P-based Application Rate[2] = (B1) ÷ (G) [x 1000 gal for imperial units] ***or*** 1x crop removal P-based Application Rate[2] = (B2) ÷ (G) [x 1000 gal for imperial units]	(Q)		m^3/ha or gal/ac
Amount of available N applied in spring = (L) x (Q) [÷ 1000 gal for imperial units] ***or*** Amount of available N applied in fall = (M) x (Q) [÷ 1000 gal for imperial units]	(R)		kg/ha or lb/ac
N balance[3] (N applied - N recommended) = (R) - (A)	(S)		kg/ha or lb/ac
Step 6. Compare N rate (N) with P rate (Q):			
If soil test P is low to moderate (< 60 ppm), apply manure at N rate (N)			m^3/ha or gal/ac
If soil test P is high (> 60 ppm), apply manure at P rate (Q)[4]			m^3/ha or gal/ac

[1] A positive value indicates that more P_2O_5 will be applied than the crop will remove (1x crop removal) when manure is applied based on N. A negative value indicates that less P_2O_5 will be applied than the crop will remove (1x crop removal) and the rate should be compared to the soil test recommendation to determine if the crop requirement for P will be met.

[2] When soil test phosphorus (STP) is low to moderate, manure can be applied based on N. When STP is high, a P-based application rate can be used up to 2X the crop removal of P_2O_5. At very high to excessive STP, no more than 1X crop removal of P_2O_5 should be applied.

[3] Positive values indicate N application rate is above soil test recommendation when manure is applied based on P_2O_5. Negative values indicate N application rate is below soil test recommendation and supplemental commercial fertilizer is required to meet crop requirements.

[4] If annual applications are too low, multi-year application rates and rotation of fields should be considered.

Table 8d: Manure Application Rate Calculation Worksheet Template For Solid Manure

Field I.D.: _____ **Crop:** _____ **Target Yield:** _____

Step 1. Target Nutrient Rate			**Units**
Nitrogen (based on soil test recommendation)	(A)		kg/ha or lb/ac
Phosphorus (as P_2O_5): 2x Crop Removal	(B1)		kg/ha or lb/ac
Phosphorus (as P_2O_5): 1x Crop Removal	(B2)		kg/ha or lb/ac
Other:	(B3)		kg/ha or lb/ac
Step 2. Manure Test Data			
Total Nitrogen	(C)		kg/t or lb/t
Ammonium Nitrogen	(D)		kg/t or lb/t
Organic Nitrogen = (C) - (D)	(E)		kg/t or lb/t
Phosphorus	(F)		kg/t or lb/t
P_2O_5 = (F) × 2.3	(G)		kg/t or lb/t
Step 3. Amount of manure nitrogen available to crop:			
Application method			
Volatilization losses due to application method (Table 6)	(H)		
Ammonium nitrogen available = (D) × [100 - (H)]%	(I)		kg/t or lb/t
Organic nitrogen available to the next crop = (E) × 0.25	(J)		kg/t or lb/t
Total available N = (I) + (J)	(K)		kg/t or lb/t
Total available N in spring = (K) x 100%	(L)		kg/t or lb/t
Total available N in fall = (K) x 83%	(M)		kg/t or lb/t
Step 4. Application rate based on N requirements:			
Spring N-based Application Rate = (A) ÷ (L) ***or*** Fall N-based Application Rate = (A) ÷ (M)	(N)		t/ha or t/ac c
Amount of P_2O_5 applied = (G) x (N)	(O)		kg/ha or lb/ac
P_2O_5 balance[1] (using 1x crop removal) = (O) - (B2)	(P)		kg/ha or lb/ac
Step 5. Application rate based on P removal:			
2x crop removal P-based Application Rate[2] = (B1) ÷ (G) ***or*** 1x crop removal P-based Application Rate[2] = (B2) ÷ (G)	(Q)		t/ha or t/ac
Amount of available N applied in spring= (L) x (Q) ***or*** Amount of available N applied in fall = (M) x (Q)	(R)		kg/ha or lb/ac
N balance[3] (N applied - N recommended) = (R) - (A)	(S)		kg/ha or lb/ac
Step 6. Compare N rate (N) with P rate (Q):			
If soil test P is low to moderate (< 60 ppm), apply manure at N rate (N)			t/ha or t/ac
If soil test P is high (> 60 ppm), apply manure at P rate (Q)[4]			t/ha or t/ac

[1] A positive value indicates that more P_2O_5 will be applied than the crop will remove (1x crop removal) when manure is applied based on N. A negative value indicates that less P_2O_5 will be applied than the crop will remove (1x crop removal) and the rate should be compared to the soil test recommendation to determine if the crop requirement for P will be met.

[2] When soil test phosphorus (STP) is low to moderate, manure can be applied based on N. When STP is high, a P-based application rate can be used up to 2X the crop removal of P_2O_5. At very high to excessive STP, no more than 1X crop removal of P_2O_5 should be applied.

[3] Positive values indicate N application rate is above soil test recommendation when manure is applied based on P_2O_5. Negative values indicate N application rate is below soil test recommendation and supplemental commercial fertilizer is required to meet crop requirements.

[4] If annual applications are too low, multi-year application rates and rotation of fields should be considered.

Table 9. Setback Requirements For Livestock Manure Application On Land Adjacent To Surface Water Or A Surface Watercourse (ft)

Surface Water or Surface Watercourse Feature	Manure Application Method	Manure Application Setback Width with Permanently Vegetated Buffer Width	Manure Application Setback Width with no Permanently Vegetated Buffer
Lakes	Injection or low-level application followed by immediate incorporation	49 ft setback, consisting of 49 ft permanently vegetated buffer	66 ft setback
	High-level broadcast or low-level application without incorporation	98 ft setback, including 49 ft permanently vegetated buffer	115 ft setback
Rivers, creeks and large unbermed drains, designated as an Order 3 or greater drain on a plan of Manitoba Water Stewardship, Planning and Coordination, that shows designations of drains	Injection or low-level application followed by immediate incorporation	10 ft setback, consisting of 10 ft permanently vegetated buffer	26 ft setback
	High-level broadcast or low-level application without incorporation	33 ft setback, including 10 ft permanently vegetated buffer	49 ft setback
All other types of surface water or surface watercourses	No manure application allowed		

Table 10: Required[1] Distances From Watercourses, Sinkholes, Springs, Wells And Recommended Distances From Residential Property Lines For Applying Manure Between November 10 And April 10 (ft)

Slope	Application Method		
	Surface Applied and Irrigation		Injection
	No incorporation	Incorporation within 48 hours	
less than 4%	492	N/A	N/A
4 – less than 6%	984	N/A	N/A
6 – less than 12%	1476	N/A	N/A
12% or greater	Prohibited	Prohibited	Prohibited

[1]Refer to the Livestock Manure and Mortalities Management Regulation – Appendix B.

Table 11: Recommended Distances From Residential Areas, Residences And Property Lines For Applying Manure (ft)

Application method	Odour suppression	Designated residential area	Residence	Property line with residence	Property line without residence
Irrigation	None	5249	984	49	3.3
Surface applied, no incorporation	Moderate to none	2625	492	33	3.3
Surface applied, incorporated within 48 hours	Good	1312	246	33	3.3
Injection	Maximum	246	49	10	3.3

Table 12: Setbacks[1,2] From Property Lines, Watercourses, Sinkholes And Wells

Recommended	To animal housing structure (excluding hoop shelters)	164 ft
Required	To confined areas including hoop shelters and feedlots To manure storage structures[2]	328 ft 328 ft

[1]Agencies such as Manitoba Hydro or the rural municipality may have requirements in addition to these.

[2]Requirement of the Livestock Manure and Mortalities Management Regulation– see Appendix B

Table 13: Recommended Criteria For Siting Livestock Operations

Animal Units[1] (A.U.)	Maximum Number of Residences[2] Within One Mile	Minimum Distance[3]					
		From Single Residence		From Designated[4] Residential or Recreational Area			
		To Earthen Storage (ft)	To Buildings[5] (ft)	To Earthen Storage		To Buildings	
				(ft)	(mi)	(ft)	(mi)
10 – 100	18	656	328	2 625	(1/2)	1 739	(1/3)
101 – 200	16	984	492	3 937	(3/4)	2 625	(1/2)
201 - 300	15	1 312	656	5 250	(1.0)	3 511	(2/3)
301– 400	14	1 476	738	5 906	(1 1/8)	3 937	(3/4)
401 – 800	12	1 641	820	6 562	(1 1/4)	4 364	(5/6)
801 – 1600	10	1 969	984	7 874	(1 1/2)	5 250	(1.0)
1601 – 3200	8	2 297	1 148	9 187	(1 3/4)	6 135	(1 1/6)
3201 – 6400	6	2 625	1 312	10 499	(2.0)	6 989	1 1/3)
6401 – 12800	4	2 953	1 476	11 812	(2 1/4)	7 874	(1 1/2)
12801 and greater	2	3 281	1 641	13 124	(2 1/2)	8 760	1 2/3)

[1] Refer to Table 14 for number of animals.
[2] Number of residences within one mile of the centre of the facility applies only to new facilities. Expansions of existing facilities and the proponent's residence are excluded.
[3] These separation distances apply to new and expanding operations.
[4] Officially designated areas in a development plan or basic planning statement.
[5] The distance to buildings includes barns and non-earthen manure storage such as above or below grade tanks which may be covered or uncovered.

Table 14: Converting Number Of Animals To Animal Units

Animal Units[1] (A.U.)	Barn Capacity or Animal Places				
	Sows, Farrow-Finish (243 – 253 lb)	Sows, Farrow-Weanling (11 lb)	Sows, Farrow-Nursery (51 lb)	Weanlings (11 - 51 lb)	Grower/ Finishers (51 – 249 lb)
10 – 100	8 – 80	32 – 319	40 – 400	303 – 3030	70 – 699
101 – 200	81 – 160	323 – 639	404 – 800	3061 – 6061	706 – 1399
201 – 300	161 – 240	642 – 958	804 – 1200	6091 – 9091	1406 – 2098
301 – 400	241 – 320	962 – 1278	1204--1600	9121 – 12121	2105 – 2797
401 – 800	321 – 640	1281 – 2556	1604 – 3200	12152 – 24242	2804 – 5594
801 – 1600	641 – 1280	2559 – 5112	3204 – 6400	24273 – 48485	5601 – 11189
1601 – 3200	1281 – 2560	5115 – 10224	6404 – 12800	48515 – 96970	11196 – 22378
3201 – 6400	2561 – 5120	10227 – 20447	12804 – 25600	97000 – 193939	22385 – 44755
6401 – 12800	5121 – 10240	20450 – 40895	25604 – 51200	193970 – 387879	44762 – 89510
12801 and greater	10241 and greater	40898 and greater	51204 and greater	387909 and greater	89517 and greater

[1] Refer to Appendix I for definition of Animal Unit.
[2] Based on live weight.

Table 15a: Total Landbase[1] Required For The Livestock Operation In Acres – Liquid Manure

STEP 1:	Determine the total number of animals produced by the livestock operation (i.e. pig places or barn capacity).	
STEP 2:	Determine the total annual volume of manure generated by the operation.	
STEP 3:	Determine the total landbase required for the operation based on nitrogen (N).	
OR STEP 4:	Determine the total landbase required for the operation based on 2X phosphorus (P_2O_5) removal by the crop.	
OR STEP 5:	Determine the total landbase required for the operation based on 1X phosphorus (P_2O_5) removal by the crop.	
STEP 1:	Number of livestock places	_____ (A)
STEP 2:	Volume of manure in gal/day or ft^3/day (Table 3A)	_____ (B)
	Number of days per year animals are at the operation	_____ (C)
	Volume of manure per year for the operation (A x B x C)	_____ (D)
STEP3:	Total nitrogen **(N)** content of the manure in lb/1000 gal (Table 4A or 4B)	_____ (E)
	Amount of N per year from the operation (D x E ÷ 1000) in lb	_____ (F)
	Nitrogen requirement (based on Soil Test) or removal in lb/acre	_____ (G)
	Acres Required for Nitrogen (F ÷ G)	_____ **(ac)**
STEP4:	Total phosphorus **(P_2O_5)** content of the manure in lb/1000 gal (Table 4A or 4B)	_____ (H)
	Amount of P_2O_5 per year from the operation (D x H ÷ 1000) in lb	_____ (I)
	1X crop P_2O_5 removal (Table 6) in lb/acre	_____ (J)
	2X crop P_2O_5 removal (J x 2) in lb/acre	_____ (K)
	Acres Required for 2X crop P_2O_5 removal [I ÷ K]	_____ **(ac)**
STEP 5:	**Acres Required for 1X crop P_2O_5 removal [I÷ J]**	_____ **(ac)**

[1] The landbase calculation is an estimate of the total landbase required for the disposition of all of the manure generated by the operation in a year. It is for planning purposes only. Actual manure application rates are determined through manure management planning.

Table 15b: Total Landbase[1] Required For The Livestock Operation In Acres – Solid Manure

STEP 1:	Determine the total number of animals produced by the livestock operation (i.e. pig places or barn capacity).	
STEP 2:	Determine the total annual volume of manure generated by the operation.	
STEP 3:	Determine the total landbase required for the operation based on nitrogen (N).	
OR STEP 4:	Determine the total landbase required for the operation based on 2X phosphorus (P_2O_5) removal by the crop.	
OR STEP 5:	Determine the total landbase required for the operation based on 1X phosphorus (P_2O_5) removal by the crop.	
STEP 1:	Number of livestock places	_____ (A)
STEP 2:	Volume of manure in lb/day or ft^3/day (Table 3B)	_____ (B)
	Number of days per year animals are at the operation	_____ (C)
	Volume of manure per year for the operation (A x B x C)	_____ (D)
STEP3:	Total nitrogen **(N)** content of the manure in lb/ton (Table 5)	_____ (E)
	Amount of N per year from the operation (D x E) in lb	_____ (F)
	Nitrogen requirement (based on Soil Test) or removal in lb/acre	_____ (G)
	Acres Required for Nitrogen (F ÷ G)	_____ **(ac)**
STEP4:	Total phosphorus **(P_2O_5)** content of the manure in lb/ton (Table 5)	_____ (H)
	Amount of P_2O_5 per year from the operation (D x H) in lb	_____ (I)
	1X crop P_2O_5 removal (Table 6) in lb/acre	_____ (J)
	2X crop P_2O_5 removal (J x 2) in lb/acre	_____ (K)
	Acres Required for 2X crop P_2O_5 removal [I ÷ K]	_____ **(ac)**
STEP 5:	**Acres Required for 1X crop P_2O_5 removal [I÷ J]**	_____ **(ac)**

[1] The landbase calculation is an estimate of the total landbase required for the disposition of all of the manure generated by the operation in a year. It is for planning purposes only. Actual manure application rates are determined through manure management planning.