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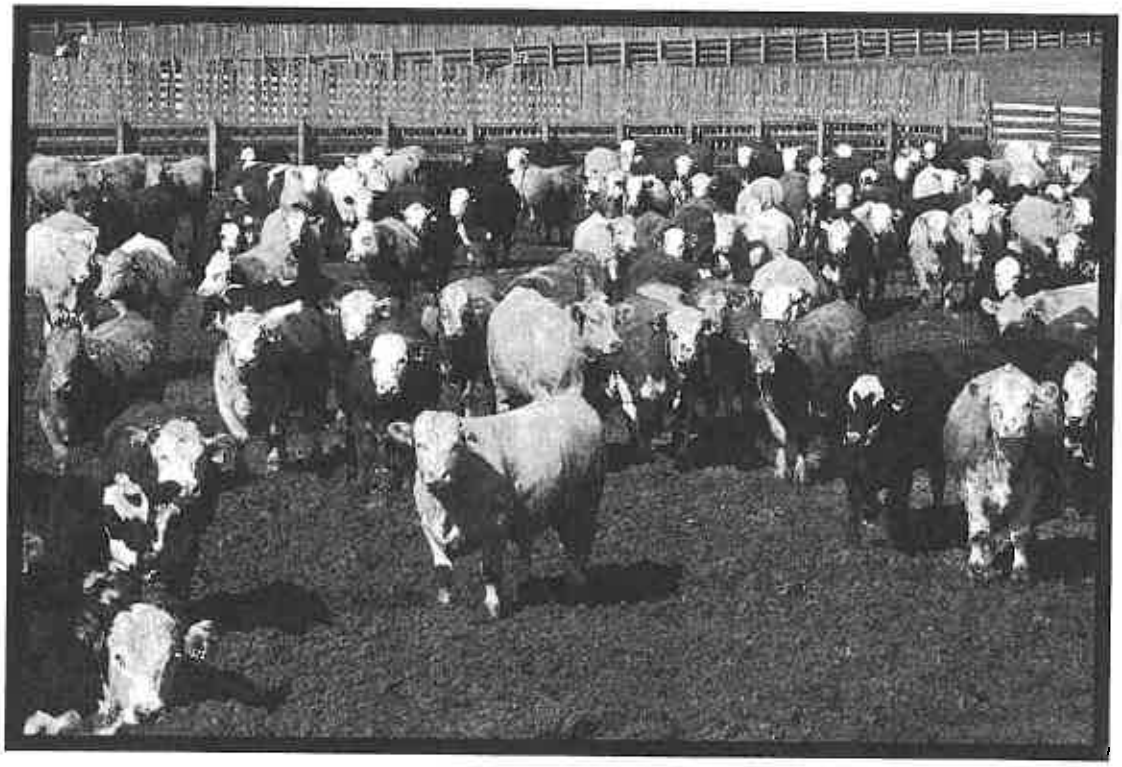
CODE OF PRACTICE



FOR THE SAFE AND ECONOMIC HANDLING OF
ANIMAL MANURES

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A. Cunningham.

Code of Practice

For The Safe And Economic Handling of Animal Manures

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Foreword

The *Code of Practice For The Safe And Economic Handling of Animal Manures* was prepared by the Intensive Livestock Operations Committee. Committee membership was comprised of the following organizations:

Alberta Cattle Commission
Alberta Cattle Feeders Association
Alberta Milk Producers Society
Alberta Poultry Industry Council
Alberta Pork Producers Development Corporation
Alberta Sheep and Wool Commission
Alberta Turkey Board
Western Stock Growers Association

Alberta Association of Municipal Districts and Counties
Rural and Improvement Districts Association of Alberta

Alberta Agriculture, Food and Rural Development
Alberta Environmental Protection
Alberta Health
Alberta Health Units
Alberta Municipal Affairs
Farmer's Advocate

Contents

Section 1

Purpose and Intended User of The Code of Practice

Purpose

The *Code of Practice: For The Safe And Economic Handling Of Animal Manures* gives direction for establishing and operating livestock facilities. It is the successor to the 1982 *Confinement Livestock Facilities Waste Management Code of Practice.*

The *Code of Practice* outlines a two part approach to reduce rural conflicts through proper land use siting and animal manure management. It is intended to reduce conflicts through appropriate siting of new livestock facilities and encroaching non-farm developments. It is also intended to assist producers in minimizing the potential for nuisance and environmental problems by providing practical alternatives for manure storage and use.

The siting and manure management elements in the *Code of Practice* provides flexibility in designing and operating manure management systems including using alternative handling methods not specifically listed in this document.

The *Code of Practice* encourages environmental sustainability. Livestock manure is promoted as a valuable resource for enhancing soil fertility and conservation, or for use as a feed source or other usable by-product. Emphasis is placed on the use of land as a recycling system where manure nutrients applied to farmland are used to balance those removed by the crops grown.

This document does not specifically define **generally accepted practice** referred to in the Agricultural Operations Practices Act.

The Intended User

The *Code of Practice* is intended for producers, municipal officials, land use planners, and others concerned with the siting, design and management of new and expanding livestock facilities.

The *Code of Practice* can assist producers and the livestock industry in improving manure management strategies. Producers considering new livestock operations, or changes in existing operations, are encouraged to develop a farmstead operation and management plan based on the *Code of Practice.*

This document also provides the basis for municipalities and Alberta Agriculture, Food and Rural Development (AAFRD) staff to assess the environmental sensitivity of new intensive livestock operations and the expanding portion of existing intensive facilities. An environmental sensitivity analysis is recommended for all new and expanding intensive livestock developments requiring a municipal development permit. A sensitivity analysis ensures the siting and manure management components of a proposed development are reviewed and, if necessary, refined to minimize environmental impacts.

Section 2

Definitions

2.1. Animal Wastes
Poultry or livestock excreta and associated feed losses, bedding, washwater and other production by-products.

2.2. Average Working Capacity
The average occupancy of the livestock facility on a year-round basis.

2.3. Catch Basin
Any excavated, diked or walled structure or combination of structures designed to intercept and temporarily store run-off water contaminated by animal manure, washwater, or associated wastes.

2.4. Earthen Storage
A structure constructed primarily of soil materials serving as a continuous liquid manure storage for livestock facilities.

2.5. Grazing Area
A pasture or rangeland where livestock are primarily sustained by feed growing on the land.

2.6. Groundwater
All water under the surface of the ground.

2.7. Livestock
Includes any farm animals and/or poultry reared for commercial purposes.

2.8. Livestock Facility
Buildings, shelters, fences, corrals or other structures which confine or would be capable of confining livestock for feeding and rearing purposes.

2.8.1. Feedlot
An uncovered livestock facility where livestock are confined for growing or finishing for market.

2.8.2. Covered facility
A livestock facility where livestock are confined within a building for growing or finishing for market.

2.8.3. Intensive livestock facility
A feedlot or covered facility of significant investment or permanence, capable of confining a minimum number of livestock[1] (see Table 1.) at a housing density of more than 1 livestock manure unit per 2000 ft^2 (184 m^2) (approximately 22 cattle per acre or 54 cattle per hectare) for growing or

finishing for market.

The following are not considered to be an intensive livestock facility:

- a seasonal feeding site confining livestock from November 1 to May 31,
- livestock confined for branding, sorting, herd health management and market delivery with confinement not exceeding 30 consecutive days.

Table 1. Intensive Livestock Operations - Minimum Size

Livestock Type	Threshold #
Beef Feeder (500 - 1200 lbs)	300
Dairy (milking)	All
Piggery (sows: farrow - finish)	30
Piggery (sows: farrow - wean)	50
Piggery (feeders only)	300
Veal	100
Horses (PMU)	75
Poultry (broilers)	10000 ft^2 (920 m^3)
Poultry (breeders)	500
Poultry (layers)	5000
Poultry (turkey broilers)	3000
Sheep (ewes)	650
Other	Discretionary

[1] Minimum livestock numbers have been set by industry based on significant potential nuisance and environmental impact, and/or significant investment in facility infrastructure. The minimum numbers are intended to be used as a guide for applying development permits.

2.9. Livestock Manure Unit

The number of livestock needed to produce sufficient manure to meet the nitrogen requirements of 1 acre of crop land. For many species, 1000 lbs (454 kg) of live weight approximates a livestock manure unit.

2.10. Livestock Siting Unit (LSU)

A means of comparing the odour potential of livestock facilities based on livestock type, manure production and manure handling system.

2.11. Manure Storage Facility

Includes a structure, reservoir, catch basin, lagoon, cistern, gutter, tank or bermed area for containing livestock wastes prior to the waste being used or disposed. It does not include a vehicle or any mobile equipment used for transportation or disposal of livestock wastes.

2.12. Minimum Distance Separation (MDS)

A setback or buffer established between an intensive livestock facility (source) and adjacent land uses (receptors) to minimize odour nuisance. Recommended separation distances are found in Appendix D. The LSU is the basis unit for determining siting recommendations.

2.13. Seasonal Livestock Feeding Site

An overwintering area where mature breeding animals and their unweaned young are fed and sheltered. Animals at such sites are primarily sustained by supplemental feeding.

2.14. Watercourse

The bed and shore of a river, stream, lake, creek, lagoon, swamp, marsh or other natural body of water, or a canal, ditch, reservoir or other man-made feature, whether it contains or conveys water continuously or intermittently.

Section 3

Siting To Reduce Odour Nuisance

Minimum Distance Separation (MDS) Method

Separation between intensive livestock facilities and neighbours can compensate for normal odour production, thereby reducing potential nuisance conflicts. The MDS applies reciprocally for the siting of either the source (intensive livestock operation) and/or the receptor of the nuisance (neighbour). The MDS method is based on Livestock Siting Units which includes specific factors such as livestock type, manure production and manure handling system.

Application of MDS

MDS provides a consistent and uniform technique for assessing the conflict potential of a land use change.

3.1. Application of MDS for Non-agricultural Developments

MDS provides a recommended minimum separation distance between new or expanding non-agricultural developments (residential, commercial, or recreational) and existing intensive livestock facilities.

3.2. Application of MDS for Agricultural Developments

MDS provides the recommended minimum separation distance between new intensive livestock developments or the expanded portion of existing livestock developments and other uses. MDS is applied to the expanding portion of existing intensive livestock operations based on the total LSU's of the operation. Improved management may be required for the existing portion of the facility.

3.3. MDS Tables

MDS distances have been pre-calculated into tabular form to simplify their use (Appendix D). In no case shall the distance be less than 500 ft (150 m). Distance is determined as follows:

3.3.1. Intensive livestock facility <—> neighbouring residence

Measure the distance from the livestock facility at the point nearest the neighbouring residence. The manure storage is considered part of the facility and if possible, should be located the greatest distance from the neighbouring land use.

3.3.2. Intensive livestock facility <—> land use zoning change

Measure the distance from the receptor's property line. This ensures the required distance to the development is automatically met.

3.4. Variance to MDS

All the possible variables of livestock facility design, siting and manure

management cannot be included in the MDS method. Variance to the MDS may be allowed by Alberta Agriculture, Food and Rural Development staff after consideration and documentation of the following factors:

3.4.1. Unique topography and/or micro-climate which mitigate nuisance

3.4.2. Visual screening

Screening can reduce visual impact by improving aesthetics of the facility.

3.4.3. Prevailing winds

The nearest available meteorological data may be used.

3.4.4. Unique management/technology

Methods of management or technology capable of reducing nuisance levels can be considered.

Section 4

Manure Storage

Liquid Manure Storage Facilities

Manure storage facilities should be designed and located to avoid contamination of groundwater, prevent contaminated surface water from leaving the property, and not contribute to undue odour nuisance.

4.1. Design and Construction Standards of Earthen Storages and Catch Basins

4.1.1 Divert surface water

Divert surface water away from the storage to reduce volume requirements.

4.1.2. Minimize seepage with natural materials

Construct floor and sides of suitable material and compact to achieve a hydraulic conductivity of less than 1×10^{-7}cm/sec.

4.1.3. Storage liner

Line the storage with a flexible membrane, concrete or equivalent material if it is sited on highly permeable sands and gravels and clay is unavailable. A leak detection system may be required in combination with a flexible membrane in the event of a liner failure.

4.1.4. Proper side slopes

Construction of side slopes should be appropriate for the stability of the soil and should not exceed 1.5:1 (run:rise) in parent soil or 2:1 where a clay liner exists.

4.2. Location of Earthen Storages and Catch Basins

4.2.1. Water table

Avoid areas where the normal water table is less than 3 ft (1 m) below the floor elevation of the storage.

4.2.2. Area subject to flood

Do not locate an earthen storage in any area subject to flooding where flood waters could damage the integrity of the storage.

4.2.3. Soil permeability

Locate on soils of sufficient clay content to achieve the hydraulic conductivity stated in Section 4.1.2.

4.3. Earthen Catch Basins

Catch basins prevent direct discharge of contaminated water from the owner's property.

4.3.1. Local design guidelines

Determine storage capacity by considering hydrological, topographic and

climatic factors. See Appendix G for run-off values for selected locations within Alberta.

4.3.2. Divert surface water

Divert surface water around the lot to minimize storage requirements.

4.3.3. Utilize catch basin contents

Following major run-off events between May and October, apply the run-off to cropland in preparation for further run-off.

4.3.4. Freeboard

Provide 18 in. (0.5 m) of freeboard to provide a safety margin of storage volume.

Solid Manure Storages

Solid manure storages allow operators to spread manure on land where soil conditions are favourable. Seepage and run-off from solid manure storages should be controlled.

4.4. Design and Location of Solid Manure Storage (temporary)

Temporary storage helps manage manure when climatic and seasonal constraints prevent continuous cleaning of lots and/or the removal and transport of manure to land application sites.

4.4.1. Seepage

Contain seepage on the owner's property.

4.4.2. Divert surface water

Divert surface water away from the stockpile.

4.4.3. Avoid permeable soils

Protect groundwater by locating on low permeability soils.

4.4.4. Fly control

A fly control program is recommended.

4.4.5. Utilize manure

Spread manure when land and climatic conditions are favourable unless further treatment is planned.

4.5. Design and Location of Solid Manure Storage (long-term)

Long-term storage refers to manure stored for extended periods awaiting land spreading, sale, or further processing such as composting.

4.5.1. Impermeable site

Build on a low permeability base to prevent seepage from entering groundwater.

4.5.2. Contain seepage

Collect any leachate from de-watered semi-solid or solid manure in a separate liquid holding structure of suitable materials to achieve a hydraulic conductivity as specified in Section 4.1.2.

Manure Storage Capacity

Proper storage capacity should allow the operator to:

- store for the period of time needed to use manure as a nutrient resource,
- facilitate the removal and management of the manure,
- prevent the escape of any material that could contaminate surface or groundwater,
- minimize odour nuisance by reducing the frequency of spreading manure on land.

4.6. Manure Storage Volume Guidelines

4.6.1. Design storage volumes

Storage volumes for all of the most common livestock types have been pre-calculated in tabular form in Appendix B-1 and B-2.

4.6.2. Maximize manure utilization

Storage volume should be provided to allow manure spreading on land at optimum times for maximum nutrient benefits.

4.7. Exemptions to Long-term Storage

Exemptions to the above manure storage guidelines may be considered where at least two of the following conditions are met:

4.7.1. Control of land for manure utilization

The operator of the livestock facility must have access to sufficient land at all times of the year.

4.7.2. Run-off risk

Land referred to in Section 4.7.1. should not be subject to surface run-off at the time of manure application.

4.7.3. Environmental/odour risk

Where a long-term manure storage itself would cause a high nuisance or water contamination potential **and/or** the manure is treated to reduce land spreading odours.

Safety Considerations of Liquid Manure Handling

Note: Stored liquid manure is capable of producing lethal quantities of toxic and explosive gases. Operators and their employees must take extreme care when working near such storages especially when agitating and removing the manure.

Manure storage facilities must be adequately protected from entry by unauthorized personnel, children and animals.

4.8. Safety Recommendations for Manure Storage Facilities

4.8.1. Posting of storage area

Liquid manure storage areas should be designated with warning posters.

4.8.2. Obtain further information

Consult Alberta Agriculture, Food and Rural Development extension materials or other technical sources for further safety recommendations.

Section 5

Topography, Soils and Run-off Management

Site Investigation for Livestock Facilities

Soil, topographic and hydro-geologic conditions should be considered for livestock facility sites to avoid the movement of manure nutrients into surface and groundwater. Clay content determines the permeability of the soil and should be determined prior to construction.

5.1. Soil and Subsoil Identification

In any location where manure is in contact with soil, conditions of the soil should be evaluated to determine permeability.

5.1.1. Soil test

Soil profiles need to be examined to sufficient depth to provide useful information. Developments below ground level such as catch basins should be tested to 3.3 ft (1 m) below the maximum depth of the structure. Surface developments should be tested to 10 ft (3 m) below the manure/ soil interface.

5.2. Groundwater Hydrology

Groundwater hydrological information should include:

5.2.1. Water source and supply

Groundwater sources, quantity and quality.

5.2.2. Water table

Depth to the static water table.

5.2.3. Depth to bedrock

Approximate depth to bedrock.

5.2.4. Water permit

Withdrawal of groundwater is legislated under the Alberta Water Resources Act. Alberta Environmental Protection should be contacted for the necessary permits.

Location and Management of Feedlots and Seasonal Feeding Sites

Risk of contamination from feeding sites must be minimized through proper siting and run-off management.

5.3. Feedlots

5.3.1. Permeability of site

Avoid sites with porous soils and/or fractured bedrock that would allow contaminants direct access to groundwater.

5.3.2. Maintain the compacted soil-manure surface layer

Avoid overcleaning of the lot surface that would disturb this compacted layer.

5.3.3. Surface water

Direct surface water away from the feedlot site.

5.3.4. Drain lot surface

Provide positive drainage of the lot to catch basins to prevent the retention of contaminated liquids on the lot surface.

5.3.5. Areas subject to flooding

A feedlot should not be located in any area where flood waters would cause significant risk of carrying contaminants off the producer's land.

5.3.6. Use of vegetative buffers

A vegetative buffer with sufficient width and infiltration area between the feedlot and receiving water may be considered as an alternative to a catch basin.

5.3.7. Abandoned feedlots

Feedlots abandoned for periods of greater than one year should be completely cleaned to prevent movement of nutrients into groundwater.

5.4. Seasonal Feeding Sites

5.4.1. Divert surface run-off

Take reasonable means to prevent spring thaw run-off from entering the feeding site by diverting it around the site.

5.4.2. Location of water, shelter, feed and bedded areas

Locate water source, shelter, feed and bedding areas to minimize manure accumulations.

5.4.3. Setback from watercourse

Locate away from the water source. Provide a vegetative buffer strip as wide as possible between the feeding site and the watercourse.

5.4.4. Minimize manure accumulation

Provide a sufficient exercise area to disperse the manure.

Section 6

Use of Animal Manures

Land Application of Animal Manure

Consider meteorological, topographical and soil conditions before applying manure to land. To avoid watercourse or groundwater contamination the application time and rate must also be taken into consideration. The nuisance potential associated with spreading manure on land should be minimized by considering the time, location and frequency of application.

6.1. Nutrient Management on Land: Application Rates

The sustainable use of manure should include the total crop management system and all the nutrients used on the farm over the long term. Crop requirements can be met with a combination of commercial fertilizers, manure and residual soil nutrients. Consult other technical sources for further information and recommendations on nutrient management. The following should be considered in determining manure application rates:

6.1.1. Nutrient content of manure

The basis for determining nutrient content of typical stored manure is found in Appendix A.

6.1.2. Application rates

Manure application rates plus those of purchased nutrients should not exceed the nutrient requirements of the planned crop. Land base guidelines found in Appendix E are based on typical crop production levels for the major soil types in Alberta. Application rates must be adjusted for variations in manure nutrient and moisture content. See Appendix F for determining application rates for common livestock types.

6.1.3. Use of soil analysis

Manure application exceeding recommended rates should be supported by manure and/or soil analysis.

6.2. Land Base Requirements

To keep within recommended application rates, sufficient land must be available for the manure nutrients produced.

6.2.1. Land base guidelines

The recommended land base for manure utilization is found in Appendices E-2 to E-9.

6.2.2. Control of land base

Land suitable for utilizing available manure nutrients should either be owned by the livestock owner or access arrangements made with neighbouring land owners by informal/formal contract or easement.

6.3. Time and Frequency of Application

6.3.1. Frequency of land application

Choose a method of storage which minimizes the frequency of land spreading.

6.3.2. Consideration of neighbours

Apply manure to land when it is least likely to cause odour impacts on neighbouring residents.

6.3.3. Weather conditions

Spread manure during favourable weather conditions when possible. Wind and weather conditions can greatly help or hinder odour nuisance when applying manure to land.

6.3.4. Land subject to run-off

Do not spread manure on sloping land adjacent to a watercourse without immediate incorporation or the provision of an appropriate buffer strip to prevent contamination of the watercourse.

6.4. Method of Application

The following should be considered to minimize odour nuisance and nutrient losses:

6.4.1. Incorporation of manure into land

Manure should be incorporated into the soil within 48 hours of application, subject to the exceptions in Section 6.5.

6.4.2. Method of incorporation

Ensure methods of incorporation are suitable for the soil type, crop type, time of year and location with respect to neighbours. See appropriate manure management extension materials for further information.

6.4.3. Acceptable methods of incorporation

Tillage, plough-down and direct injection into the soil are considered acceptable methods of incorporation.

6.5. Exceptions to Incorporation

Surface broadcasting of manure without incorporation within 48 hours is acceptable only in the following situations:

6.5.1. Forage crops

Such land should not be subject to run-off or nuisance conflict.

6.5.2. Irrigation water

Where manure is applied with irrigation water extreme care must be taken to minimize odour nuisance and prevent run-off.

6.5.3. Land not subject to run-off

On any land that can be demonstrated not to cause an odour or run-off problem.

6.5.4. Under exceptional soil or weather conditions

Land under minimum or no till management would be considered exempt from incorporation guidelines.

Section 7

Dead Animal Disposal

Dead animals should be properly handled, stored and/or disposed of within 48 hours of death to minimize odours, flies, transmission of disease and threat of pollution. The handling and disposal of dead animals is legislated under The Livestock Diseases Act - Regulations Regarding the Destruction and Disposal of Dead Animals (128/66) and the Public Health Act, Waste Management Regulations Sections 2 and 33.

7.1. Approved Methods

7.1.1. Delivery to a rendering service

7.1.2. Delivery to a municipal waste management facility

Deliver to a municipal waste management facility specifically allowing the disposal of dead animals under the Public Health Act, Waste Management Regulation Sections 2 and 33. Contact the local Health Unit or Waste Management Authority for a list of waste management facilities which will accept agricultural wastes.

7.1.3. On-farm disposal

On-farm treatment may include incineration and/or burial techniques as specified in the regulation (The Livestock Diseases Act). Open burning is not permitted.

7.1.4. Appropriate storage (containment or freezing)

Dead animals held for disposal should be kept covered and not located in an area subject to run-off or exposure to other animals.

SIZE LIMITATION FOR INCINERATORS

LESS THAN 10 TONS/MONTH — NO PERMIT REQ'D FROM ENVIRONMENT.

Appendices

Appendix A

Nutrient Content of Livestock Manures

Explanation of Appendix A:

Total N: Includes both mineral (nitrate and ammonium nitrogen) and organic nitrogen. The organic portion is not available to the plant without further microbial mineralization into available nitrogen.

Available N: This is the portion of the total nitrogen that is in the mineral (usually ammonium), plant available form at the time of application.

Crop N: This is an estimate of the available nitrogen plus the portion of the organic nitrogen that is mineralized over the growing season. Estimated volatilization losses are subtracted from the sum of available plus mineralized nitrogen to give the *Crop N.*

P_2O_5: Phosphorus is expressed as phosphate equivalent in lbs/ton (kg/tonne) of manure because phosphorus exists in both mineral and organic form. Phosphate is contained mostly in the solids portion of the manure so mixing of the manure is necessary for uniformity of phosphate content.

K_2O: Potassium is expressed as lbs of potash/ton (kg/tonne) of manure.

Appendix A-1: Manure Nutrient Content for Various Livestock Species*

* Based on averages from a variety of sources. Actual farm values may vary greatly.

Type of Livestock		Moisture %	Total N %	Total N		Available N		Crop N		P_2O_5 lbs/ton		K_2O	
				lbs/ton	kg/tonne	lbs/ton	kg/tonne	lbs/ton	kg/tonne	lbs/ton	kg/tonne	lbs/ton	kg/tonne
Beef	Open lot	50	0.9	17	8.7	4.4	2.2	5.1	2.6	11	5.6	16	8.2
	Paved	65	0.7	13	6.6	5.0	2.6	4.4	2.3	4.0	2.0	9	4.6
	Closed	92	0.5	9	4.6	3.9	2.0	3.3	1.7	4.0	2.0	10	5.1
Dairy	Free stall	92	0.5	9	4.6	4.1	2.1	3.7	1.9	4.0	2.0	10	5.1
	Tie stall	80	0.6	11	5.6	4.6	2.3	4.2	2.1	4.0	2.0	10	5.1
Hogs	Farrow - finish	96	0.4	7	3.6	3.2	1.6	3.0	1.5	5.0	2.6	4	2.0
	Farrow - wean	96	0.4	7	3.6	3.2	1.6	3.0	1.5	5.0	2.6	4	2.0
	Feeder	96	0.4	7	3.6	3.2	1.6	3.0	1.5	5.0	2.6	4	2.0
Poultry	Layers (solid)	60	1.6	32	16	25	13	22	11	56	29	20	10
	Layers (liquid)	90	1.0	19	9.8	15	7.5	13	6.6	34	17	12	6.1
	Broilers	35	1.9	37	19	25	13	21	11	30	15	20	10
	Breeders	35	2.0	39	20	26	13	23	12	60	31	20	10
Turkey	Hens	35	1.9	37	19	25	13	21	11	30	15	20	10
	Toms	35	1.9	37	19	25	13	21	11	30	15	20	10
	Broilers	35	1.9	37	19	25	13	21	11	30	15	20	10
Horse			0.6	12	6.1	6.0	3.1	5.7	2.9	6.0	3.1	12	6.1
Mink			1.8	36	18	18	9.2	17	8.7	50	26	40	20
Fox			0.4	8	4.1	4.0	2.0	3.8	1.9	4.0	2.0	2	1.0
Rabbit			0.5	10	5.1	4.2	2.1	4.6	2.4	24	12	10	5.1
Veal			0.4	7.6	3.9	3.8	1.9	4.0	2.0	10	5.1	7	3.8
Elk			0.7	13	6.6	3.9	2.0	4.5	2.3	10	5.1	12	6.1
Bison			0.7	13	6.6	3.9	2.0	4.5	2.3	10	5.1	12	6.1
Sheep	Ewes	50	0.7	14	7.1	5.6	2.9	5.3	2.7	9	4.6	25	13
	Lambs	50	0.7	14	7.1	5.6	2.9	5.3	2.7	9	4.6	25	13

Appendix B

Manure Design Volumes for Various Livestock Types

Explanation of Appendix B: The following design volumes are the average volumes expected from typical livestock housing systems in Alberta. Actual volumes could differ due to variations in housing systems, type of manure storage, amount of dilution or wash water, precipitation, bedding, mechanical drying and treatment. These variables should be taken into account and adjustments made where appropriate.

Appendix B-1: Liquid Manure Design Volumes for Various Livestock Species (per animal or as otherwise noted)

Species		Daily			Monthly			Yearly		
		gallons	litres	cu. ft	gallons	litres	cu. ft.	gallons	litres	cu.ft.
Sows	Farrow - finish	14.4	66	2.31	433	1970	69.3	5272	24	844
	Farrow - wean	4.4	20	0.71	133	606	21.3	1622	7.4	260
Hogs	Feeders	1.6	7	0.25	47	212	7.5	568	2.6	91
Dairy	Free stall	20	91	3.2	600	2728	96	7300	33.2	1168
	Tie stall	17.8	81	2.84	533	2425	85.3	6489	29.5	1038
Beef	Closed	4	18	0.64	120	546	19.2	1460	6.6	234
Poultry	100 layers	5	23	0.79	149	676	23.8	1810	8.2	290

Appendix B-2: Solid manure Design Volumes for Various Species (per animal or as otherwise noted)

Species		Daily			Monthly			Yearly		
		lbs	kgs	cu. ft	lbs	kgs	cu. ft.	tons	tonnes	cu.ft.
Beef	Open lot	13.1	5.9	0.32	392	178	9.6	2.4	2.1	117
	Paved	19.8	9	0.43	594	270	12.8	3.6	3.2	156
Dairy	Tie stall	149.6	68	2.84	4488	2040	85.3	27.3	24.4	1038
Poultry per	100 layers	11.4	5.2	0.41	342	155	12.3	2.1	1.9	149
	100 broilers	6.6	3	0.36	198	90	10.7	1.2	1.1	130
	100 breeders	15.8	7.2	0.64	475	216	19.2	2.9	2.6	234
	100 Turkey hens	31.6	14.4	1.46	947	431	43.7	5.8	5.1	532
	100 Turkey toms	36.2	16.5	1.67	1086	493	50.1	6.6	5.9	610
	100 Turkey broilers	25.5	11.6	1.03	766	348	30.9	4.7	4.2	376
Horse		45.8	20.8	0.92	1373	624	27.7	8.4	7.5	337
Mink	per 100	30.8	14	0.71	924	420	21.3	5.6	5	260
Fox	per 100	77	35	1.24	2310	1050	37.3	14.1	12.5	454
Rabbit	per 100	100.1	45.5	2.49	3003	1365	74.7	18.3	16.3	908
Veal		11.9	5.4	0.19	356	162	5.8	2.2	1.9	70
Elk		5.8	2.6	0.14	174	79	4.3	1.1	0.9	52
Bison		7.3	3.3	0.18	218	99	5.3	1.3	1.2	65
Sheep	Ewes	3.1	1.4	0.1	92	42	3	0.6	0.5	36
	Lambs	0.6	0.3	0.02	17	7	0.5	0.1	0.1	6

Appendix C

LSU and Expansion Factors

Explanation of Appendix C: This table provides the factors for determining the MDS between intensive livestock operations and neighbours. See Appendix D for pre-calculated tables for the common livestock types. The LSU is the result of combining the following factors:

Factor A The relative nuisance of various livestock species.
Factor D The contribution of the manure management system to the nuisance level.
MU Reciprocal This factor takes into account the relative size of the animal, therefore the amount of manure produced.

Appendix C-1: LSU Factors (used to determine Minimum Distance Separation distances)

Species		Factor A	Factor D	MU Reciprocal	LSU Factor
Beef	450 - 1300 lbs (200 - 590 kg)	0.70	0.70	0.750	0.367
	450 - 750 lbs (200 -340 kg)	0.70	0.70	0.670	0.328
	750 - 1300 lbs (340 - 590 kg)	0.70	0.70	0.900	0.441
	Cow with calf	0.70	0.70	1.000	0.455
Dairy	Milking	0.80	1.10	1.400	1.232
Swine	Farrow - finish	2.00	1.10	1.800	3.960
	Farrow - wean	2.00	1.10	0.670	1.474
	Feeders	2.00	1.10	0.200	0.440
Veal		1.50	1.10	0.330	0.545
Horse		0.70	0.60	1.000	0.420
Mink		2.00	0.80	0.013	0.021
Fox		2.00	0.80	0.025	0.040
Rabbits		0.80	0.80	0.020	0.013
Poultry	Broilers	0.60	0.60	0.004	0.001
	Breeders	0.60	0.60	0.008	0.002
	Layers	3.00	0.90	0.008	0.020 0.025
Turkeys	Broilers	0.70	0.60	0.010	0.004
Sheep	Ewes	0.60	0.70	0.200	0.084
	Lambs	0.60	0.70	0.080	0.034
Elk		0.60	0.70	0.600	0.252
Bison		0.60	0.70	1.000	0.420

Appendix C-2: Expansion Factor

Expansion %	Factor	Expansion %	Factor	Expansion %	Factor
0.0	0.6	90.0	0.7	225.0	0.9
40.0	0.7	100.0	0.7	250.0	0.9
50.0	0.7	125.0	0.8	275.0	0.9
60.0	0.7	150.0	0.8	300.0	0.9
70.0	0.7	175.0	0.8	400.0	0.9
80.0	0.7	200.0	0.8	> 500	1.0

Appendix D

Minimum Distance Separation Tables

Explanation of Appendix D:

Category One Low sensitivity neighbours. e.g. single residence

Category Two Moderate sensitivity neighbours. e.g. multi-parcel country residential, low use recreational.

Category Three High sensitivity neighbours. Large scale country residential development, high use recreational, etc.

Appendix D-1: Recommended MDS (ft) for Beef Finishers

No. of Animals	Category 1	Category 2	Category 3	No. of Animals	Category 1	Category 2	Category 3
100	539	719	899	3500	1975	2633	3291
200	695	926	1158	4000	2073	2765	3456
300	806	1074	1343	5000	2249	2999	3749
400	895	1193	1491	6000	2404	3206	4007
500	971	1294	1618	7000	2543	3391	4239
600	1037	1383	1729	8000	2670	3560	4451
700	1097	1463	1829	9000	2788	3717	4646
800	1152	1536	1921	10000	2897	3863	4828
900	1203	1604	2005	12000	3096	4128	5160
1000	1250	1667	2083	14000	3276	4367	5459
1200	1336	1781	2227	16000	3439	4585	5732
1400	1413	1885	2356	18000	3590	4787	5984
1600	1484	1979	2473	20000	3731	4975	6218
1800	1549	2066	2582	25000	4048	5397	6746
2000	1610	2147	2683	30000	4326	5768	7210
2500	1747	2329	2911	40000	4805	6407	8008
3000	1867	2489	3111	50000	5213	6950	8688

Appendix D-2: Recommended MDS (ft) for Farrow - Finish Piggeries

No. of Sows	Category 1	Category 2	Category 3	No. of Sows	Category 1	Category 2	Category 3
25	725	966	1208	300	1795	2393	2991
50	933	1244	1555	350	1899	2532	3165
75	1082	1443	1804	400	1994	2658	3323
100	1202	1603	2003	500	2163	2884	3605
125	1304	1739	2173	600	2312	3082	3853
150	1394	1858	2323	750	2508	3344	4180
175	1474	1966	2457	1000	2785	3714	4642
200	1548	2064	2580	1500	3230	4306	5383
250	1679	2239	2799	2000	3587	4783	5979

Appendix D-3: Recommended MDS (ft) for Farrow - Wean Piggeries

No. of Sows	Category 1	Category 2	Category 3	No. of Sows	Category 1	Category 2	Category 3
25	505	674	842	300	1251	1668	2086
50	651	868	1084	350	1324	1765	2206
75	754	1006	1257	400	1390	1853	2316
100	838	1117	1397	500	1508	2010	2513
125	909	1212	1515	600	1612	2149	2686
150	972	1295	1619	750	1748	2331	2914
175	1028	1370	1713	1000	1942	2589	3236
200	1079	1439	1799	1500	2252	3002	3753
250	1171	1561	1951	2000	2501	3335	4168

Appendix D-4: Recommended MDS (ft) for Feeder Piggery

No. of Animals	Category 1	Category 2	Category 3	No. of Animals	Category 1	Category 2	Category 3
100	539	719	898	2000	1609	2145	2681
200	694	926	1157	2500	1745	2327	2909
300	805	1073	1341	3000	1865	2487	3109
400	894	1192	1490	3500	1973	2631	3289
500	970	1293	1616	4000	2072	2762	3453
600	1037	1382	1728	4500	2163	2884	3605
750	1125	1499	1874	5000	2248	2997	3746
1000	1249	1665	2082	6000	2402	3203	4004
1200	1335	1780	2225	7500	2606	3475	4343
1500	1448	1931	2414	10000	2895	3859	4824

Appendix D-5: Recommended MDS (ft) for Total Yearly Confinement Dairies Including Replacement Stock*

*Based on milking cows.

No. of Milking Cows	Category 1	Category 2	Category 3	No. of Milking Cows	Category 1	Category 2	Category 3
40	562	749	936	250	1097	1462	1828
50	609	813	1016	275	1135	1514	1892
60	651	868	1086	300	1172	1563	1953
70	689	919	1148	350	1240	1653	2066
80	723	965	1206	400	1302	1736	2170
100	785	1046	1308	450	1359	1812	2265
120	839	1118	1398	500	1412	1883	2354
140	887	1183	1479	550	1462	1950	2437
160	932	1242	1553	600	1509	2013	2516
180	973	1297	1621	700	1597	2129	2661
200	1011	1348	1685	800	1677	2235	2794
225	1055	1407	1759	900	1750	2334	2917
250	1097	1462	1828	1000	1819	2425	3031

Appendix D-6: Recommended MDS (ft) for Poultry Layer Operations

No. of Birds	Category 1	Category 2	Category 3
5000	733	977	1221
6000	783	1044	1305
7000	828	1104	1381
8000	870	1160	1449
9000	908	1211	1513
10000	943	1258	1572
12000	1008	1345	1681
15000	1094	1459	1823
20000	1215	1620	2025
30000	1409	1879	2348
50000	1698	2264	2829
75000	1968	2625	3281
100000	2186	2915	3644

Appendix D-7: Recommended MDS (ft) for Broiler Poultry Operations

No. of Birds	Category 1	Category 2	Category 3
10000	336	449	561
15000	390	520	650
20000	433	578	722
25000	470	627	783
30000	502	670	837
35000	532	709	886
40000	558	744	930
50000	605	807	1009
75000	702	936	1170
100000	780	1040	1300
250000	1089	1453	1816
500000	1403	1871	2338
1000000	1807	2409	3012

Appendix D-8: MDS Table (ft) for Livestock Facilty Developments Based on Livestock Siting Units (LSUs)
This table is useful in determining MDS for livestock operations of mixed species, unique types of livestock, and expansions.

LSU	Category 1	Category 2	Category 3	LSU	Category 1	Category 2	Category 3
20	404	539	674	400	1206	1608	2011
30	469	625	781	410	1217	1623	2029
40	521	694	868	420	1228	1637	2047
50	565	753	941	430	1239	1651	2064
60	604	805	1006	440	1249	1665	2082
70	639	851	1064	450	1259	1679	2099
80	670	894	1117	460	1269	1693	2116
90	700	933	1166	470	1279	1706	2132
100	727	970	1212	480	1289	1719	2149
110	753	1004	1255	490	1299	1732	2165
120	777	1036	1296	500	1309	1745	2181
130	800	1067	1334	520	1328	1770	2213
140	822	1096	1371	540	1346	1795	2243
150	843	1124	1406	560	1364	1819	2273
160	863	1151	1439	580	1382	1842	2303
170	883	1177	1471	600	1399	1865	2331
180	901	1202	1502	620	1416	1887	2359
190	919	1226	1532	640	1432	1909	2387
200	937	1249	1561	660	1448	1931	2414
210	954	1271	1589	680	1464	1952	2440
220	970	1293	1616	700	1480	1973	2466
230	986	1314	1643	720	1495	1993	2492
240	1001	1335	1669	740	1510	2013	2517
250	1016	1355	1694	760	1525	2033	2541
260	1031	1374	1718	780	1539	2052	2566
270	1045	1394	1742	800	1554	2072	2589
280	1059	1412	1765	820	1568	2090	2613
290	1073	1430	1788	840	1582	2109	2636
300	1086	1448	1810	860	1595	2127	2659
310	1099	1466	1832	880	1609	2145	2681
320	1112	1483	1853	900	1622	2163	2703
330	1125	1499	1874	920	1635	2180	2725
340	1137	1516	1895	940	1648	2197	2746
350	1149	1653	1915	960	1661	2214	2768
360	1161	1548	1935	980	1673	2231	2788
370	1173	1563	1954	1000	1685	2247	2809
380	1184	1579	1973	1025	1701	2268	2835
390	1195	1594	1992	1050	1716	2288	2860

Appendix D-8: MDS Table (ft) for Livestock Facility Developments Based on LSUs (continued)

LSU	Category 1	Category 2	Category 3	LSU	Category 1	Category 2	Category 3
1075	1731	2307	2884	2900	2486	3315	4143
1100	1745	2327	2909	2950	2502	3335	4169
1125	1760	2346	2933	3000	2517	3356	4195
1150	1774	2365	2956	3100	2547	3396	4245
1175	1788	2384	2979	3200	2577	3436	4295
1200	1801	2402	3002	3300	2606	3475	4343
1250	1828	2438	3047	3400	2635	3513	4391
1300	1855	2473	3091	3500	2663	3550	4438
1350	1881	2507	3134	3600	2690	3587	4484
1400	1906	2541	3176	3700	2717	3623	4529
1450	1930	2574	3217	3800	2744	3658	4573
1500	1954	2606	3257	3900	2770	3693	4616
1550	1978	2637	3296	4000	2796	3727	4659
1600	2001	2668	3335	4100	2821	3761	4701
1650	2023	2698	3372	4200	2846	3794	4743
1700	2046	2728	3409	4300	2870	3827	4784
1750	2067	2757	3446	4400	2895	3859	4824
1800	2089	2785	3481	4500	2918	3891	4864
1850	2110	2813	3516	4600	2942	3923	4903
1900	2130	2841	3551	4700	2965	3953	4942
1950	2151	2868	3585	4800	2988	3984	4980
2000	2171	2894	3618	4900	3011	4014	5018
2050	2190	2920	3651	5000	3033	4044	5055
2100	2210	2946	3683	5200	3077	4102	5128
2150	2229	2972	3715	5400	3119	4159	5199
2200	2249	2997	3746	5600	3161	4215	5268
2250	2266	3021	3777	5800	3202	4269	5336
2300	2284	3046	3807	6000	3242	4322	5403
2350	2302	3070	3837	6200	3281	4374	5468
2400	2320	3093	3867	6400	3319	4425	5531
2450	2338	3117	3896	6600	3356	4475	5594
2500	2355	3140	3925	6800	3393	4524	5655
2550	2372	3163	3953	7000	3429	4572	5715
2600	2389	3185	3981	7200	3465	4619	5774
2650	2406	3207	4009	7400	3499	4666	5832
2700	2422	3229	4037	7600	3534	4711	5889
2750	2438	3251	4064	7800	3567	4756	5945
2800	2454	3272	4091	8000	3600	4801	6001
2850	2470	3294	4117	8200	3633	4844	6055

Appendix D-8: MDS Table (ft) for Livestock Facility Developments Based on LSUs (continued)

LSU	Category 1	Category 2	Category 3	LSU	Category 1	Category 2	Category 3
8400	3665	4887	6108	22500	5251	7002	8752
8600	3697	4929	6161	23000	5294	7058	8823
8800	3728	4970	6213	23500	5335	7114	8892
9000	3759	5011	6264	24000	5376	7169	8961
9200	3789	5052	6315	24500	5417	7223	9029
9400	3819	5092	6364	25000	5457	7276	9095
9600	3848	5131	6414	25500	5497	7329	9161
9800	3877	5170	6462	26000	5536	7381	9226
10000	3906	5208	6510	26500	5575	7433	9291
10500	3976	5301	6627	27000	5613	7484	9354
11000	4044	5392	6740	27500	5650	7534	9417
11500	4110	5480	6851	28000	5688	7584	9479
12000	4175	5566	6958	28500	5725	7633	9541
12500	4237	5650	7062	29000	5761	7681	9602
13000	4298	5731	7164	29500	5797	7729	9662
13500	4358	5811	7263	30000	5833	7777	9721
14000	4416	5888	7360	31000	5903	7871	9838
14500	4473	5964	7455	32000	5972	7962	9953
15000	4529	6039	7548	33000	6039	8052	10065
15500	4583	6111	7639	34000	6105	8140	10176
16000	4637	6182	7728	35000	6170	8227	10284
16500	4689	6252	7815	36000	6234	8312	10390
17000	4741	6321	7901	37000	6297	8396	10495
17500	4791	6388	7985	38000	6358	8478	10597
18000	4841	6454	8068	39000	6419	8559	10698
18500	4889	6519	8149	40000	6478	8638	10797
19000	4937	6583	8228	41000	6537	8716	10895
19500	4984	6645	8307	42000	6595	8793	10991
20000	5030	6707	8384	43000	6652	8869	11086
20500	5076	6786	8460	44000	6708	8944	11180
21000	5121	6828	8535	45000	6763	9017	11272
21500	5165	6887	8608	46000	6818	9090	11363
22000	5208	6945	8681	47000	6871	9162	11452

Appendix E

Land Base Guidelines for Livestock Operations

Explanation of Appendix E:

- These land base guidelines are intended for use at the environmental screening stage of planning.
- They **are not** to be used to determine recommended application rates on specific farms.
- These tables are based on average soil fertility levels in the four soil zones and manure nutrient from typical production systems. They do not allow for soil fertility and texture variability within soil zones, variations in manure nutrients, specialized crop types and/or rotations.
- Due to these variations the land base recommendations below may not be sustainable for specific sites.
- The column labelled *Intermittent* is the minimum recommended land base where manure is not applied to the same land on consecutive years.
- The column labelled *Annual* is the recommended land base where manure application is made on a yearly basis in conjunction with regular monitoring of soil nutrients.
- The land base recommendations are determined by the nitrogen requirements of the crop less it's carryover from previous applications. The assumed supply of nutrients from manure are listed in Appendix E-1.
- Manure utilization in sensitive watersheds and/or where erosion or run-off potential is high should also consider phosphorus in determining an adequate land base.

Appendix E-1: Assumed Crop Nutrient Requirements for Determining Land Base Guidelines

	Dark Brown & Brown		Grey Wooded		Black		Irrigated	
Nutrient	lbs/acre	kg/hectare	lbs/acre	kg/hectare	lbs/acre	kg/hectare	lbs/acre	kg/hectare
Nitrogen	50	56	60	67	80	90	100	112
Phosphate	20	22	30	34	40	45	45	50
Potash	10	11.2	15	17	15	17	15	17

Appendix E-2: Land Base Requirements (acres) for Farrow - Finish Piggeries

No. of Sows	Soil Type							
	Dark Brown & Brown		Grey Wooded		Black		Irrigated	
	Intermittent	Annual	Intermittent	Annual	Intermittent	Annual	Intermittent	Annual
25	39	45	33	38	24	28	20	23
50	78	90	65	75	49	56	39	45
75	118	135	98	113	73	85	59	68
100	157	180	131	150	98	113	78	90
125	196	225	163	188	122	141	98	113
150	235	270	196	225	147	169	118	135
175	274	316	229	263	171	197	137	158
200	314	361	261	300	196	225	157	180
250	392	451	327	376	245	282	196	225
300	470	541	392	451	294	338	235	270
400	627	721	523	601	392	451	314	361
500	784	901	653	751	490	563	392	451
600	941	1082	784	901	588	676	470	541
800	1254	1442	1045	1202	784	901	627	721
1000	1568	1803	1306	1502	980	1127	784	901
1200	1881	2163	1568	1803	1176	1352	941	1082
1500	2352	2704	1960	2254	1470	1690	1176	1352
2000	3135	3606	2613	3005	1960	2254	1568	1803

Appendix E-3: Land Base (acres) for Farrow - Wean Piggeries

No. of Sows	Soil Type							
	Dark Brown & Brown		Grey Wooded		Black		Irrigated	
	Intermittent	Annual	Intermittent	Annual	Intermittent	Annual	Intermittent	Annual
25	12	14	10	12	8	9	6	7
50	24	28	20	23	15	17	12	14
75	36	42	30	35	23	26	18	21
100	48	55	40	46	30	35	24	28
125	60	69	50	58	38	43	30	35
150	72	83	60	69	45	52	36	42
175	84	97	70	81	53	61	42	49
200	96	111	80	92	60	69	48	55
250	121	139	100	116	75	87	60	69
300	145	166	121	139	90	104	72	83
400	193	222	161	185	121	139	96	111
500	241	277	201	231	151	173	121	139
600	289	333	241	277	181	208	145	166
800	386	444	322	370	241	277	193	222
1000	482	555	402	462	301	347	241	277
1200	579	666	482	555	362	416	289	333
1500	724	832	603	693	452	520	362	416
2000	965	1109	804	925	603	693	482	555

Appendix E-4: Land Base (acres) for Feeder Piggeries

No. of Feeders	Soil Type							
	Dark Brown & Brown		Grey Wooded		Black		Irrigated	
	Intermittent	Annual	Intermittent	Annual	Intermittent	Annual	Intermittent	Annual
100	17	19	14	16	11	12	8	10
150	25	29	21	24	16	18	13	15
200	34	39	28	32	21	24	17	19
300	51	58	42	49	32	36	25	29
400	68	78	56	65	42	49	34	39
500	84	97	70	81	53	61	42	49
600	101	116	84	97	63	73	51	58
700	118	136	98	113	74	85	59	68
800	135	155	113	129	84	97	68	78
900	152	175	127	146	95	109	76	87
1000	169	194	141	162	106	121	84	97
1200	203	233	169	194	127	146	101	116
1500	253	291	211	243	158	182	127	146
2000	338	388	281	324	211	243	169	194
3000	506	582	422	485	317	364	253	291
4000	675	777	563	647	422	485	338	388
5000	844	971	703	809	528	607	422	485
10000	1688	1942	1407	1618	1055	1213	844	971

Appendix E-5: Land Base (acres) for Dairy Operations. Based on milking cows and replacements.

No. of Cows	Soil Type							
	Dark Brown & Brown		Grey Wooded		Black		Irrigated	
	Intermittent	Annual	Intermittent	Annual	Intermittent	Annual	Intermittent	Annual
40	109	126	91	105	68	79	55	63
50	137	157	114	131	85	98	68	79
60	164	188	137	157	102	118	82	94
70	191	220	159	183	119	137	96	110
80	218	251	182	209	137	157	109	126
90	246	283	205	236	154	177	123	141
100	273	314	228	262	171	196	137	157
125	341	393	284	327	213	245	171	196
150	410	471	341	393	256	294	205	236
175	478	550	398	458	299	344	239	275
200	546	628	455	523	341	393	273	314
225	615	707	512	589	384	442	307	353
250	683	785	569	654	427	491	341	393
300	819	942	683	785	512	589	410	471
350	956	1099	797	916	597	687	478	550
400	1092	1256	910	1047	683	785	546	628
500	1366	1570	1138	1309	853	982	683	785
600	1639	1885	1366	1570	1024	1178	819	942
800	2185	2513	1821	2094	1366	1570	1092	1256
1000	2731	3141	2276	2617	1707	1963	1366	1570

Appendix E-6: Land Base (acres) for Poultry Layers

No. of Hens	Soil Type							
	Dark Brown & Brown		Grey Wooded		Black		Irrigated	
	Intermittent	Annual	Intermittent	Annual	Intermittent	Annual	Intermittent	Annual
1000	8.9	10.3	7.5	8.6	5.6	6.4	4.5	5.1
1500	13	15	11	13	8.4	10	6.7	7.7
2000	18	21	15	17	11	13	8.9	10
2500	22	26	19	21	14	16	11	13
3000	27	31	22	26	17	19	13	15
4000	36	41	30	34	22	26	18	21
5000	45	51	37	43	28	32	22	26
6000	54	62	45	51	34	39	27	31
7000	63	72	52	60	39	45	31	36
8000	72	82	60	69	45	51	36	41
10000	89	103	75	86	56	64	45	51
15000	134	154	112	129	84	96	67	77
20000	179	206	149	171	112	129	89	103
50000	447	514	373	428	279	321	224	257

Appendix E-7: Land Base (acres) for Poultry Broilers

No. of Broilers	Soil Type							
	Dark Brown & Brown		Grey Wooded		Black		Irrigated	
	Intermittent	Annual	Intermittent	Annual	Intermittent	Annual	Intermittent	Annual
5000	26	30	21	25	16	19	13	15
6000	31	36	26	30	19	22	15	18
7000	36	41	30	35	23	26	18	21
8000	41	47	34	39	26	30	21	24
9000	46	53	39	44	29	33	23	27
10000	51	59	43	49	32	37	26	30
12000	62	71	51	59	39	44	31	36
15000	77	89	64	74	48	56	39	44
20000	103	118	86	99	64	74	51	59
30000	154	178	129	148	97	111	77	89
50000	257	296	215	247	161	185	129	148
75000	386	444	322	370	241	278	193	222
100000	515	592	429	494	322	370	257	296

Appendix E-8: Land Base (acres) for Turkey Broilers

No. of Turkeys	Soil Type							
	Dark Brown & Brown		Grey Wooded		Black		Irrigated	
	Intermittent	Annual	Intermittent	Annual	Intermittent	Annual	Intermittent	Annual
1000	20	23	17	19	12	14	10	11
1500	25	30	21	25	16	19	13	15
2000	34	40	28	33	21	25	17	20
3000	51	60	42	50	32	37	25	30
4000	68	80	56	66	42	50	34	40
5000	85	100	71	83	53	62	42	50
6000	102	119	85	100	63	75	51	60
7000	118	139	99	116	74	87	59	70
8000	135	159	113	133	85	100	68	80
9000	152	179	127	149	95	112	76	90
10000	169	199	141	166	106	124	85	100
15000	254	299	212	249	159	187	127	149
20000	339	398	282	332	212	249	169	199

Appendix E-9: Land Base (acres) for Beef Feedlots (finishers)

No. of Cattle	Soil Type							
	Dark Brown & Brown		Grey Wooded		Black		Irrigated	
	Intermittent	Annual	Intermittent	Annual	Intermittent	Annual	Intermittent	Annual
100	24	28	20	23	15	17	12	14
200	48	56	40	46	30	35	24	28
300	72	83	60	69	45	52	36	42
400	97	111	80	93	60	69	48	56
500	121	139	101	116	75	87	60	69
750	181	208	151	174	113	130	91	104
1000	241	278	201	231	151	174	121	139
1500	362	417	302	347	226	260	181	208
2000	483	555	402	463	302	347	241	278
3000	724	833	604	694	453	521	362	417
4000	966	1111	805	926	604	694	483	555
5000	1207	1388	1006	1157	755	868	604	694
6000	1449	1666	1207	1388	906	1041	724	833
7000	1690	1944	1409	1620	1056	1215	845	972
8000	1932	2222	1610	1851	1207	1388	966	1111
9000	2173	2499	1811	2083	1358	1562	1087	1250
10000	2415	2777	2012	2314	1509	1736	1207	1388
15000	3622	4165	3018	3471	2264	2603	1811	2083
20000	4829	5554	4025	4628	3018	3471	2415	2777
30000	7244	8331	6037	6942	4528	5207	3622	4165
40000	9659	11108	8049	9257	6037	6942	4829	5554
50000	12074	13885	10061	11571	7546	8678	6037	6942

Appendix F

Application Rates for Livestock and Poultry Manure

Explanation of Appendix F:

- A soil test of the proposed manure application site is recommended to make proper use of these tables. The crop requirement, less the soil available nitrogen, will give the amount of nitrogen that may be applied as manure and/or fertilizer. Application rates are based on manure *Crop N*.
- *Total N* (%) for use in the following tables is obtained either from a manure analysis or by the *Total Nitrogen* content value given in Appendix A-1.

Appendix F-1: Application Rates (gallons/acre) for Hog Manure (Manure at 96% moisture)

Total N %	N Supplied by Manure for Crop Production (lbs/acre)							
	Application in gallons/acre							
	30	40	50	60	70	80	90	100
0.20	3500	4700	5900	7100	8200	9400	10600	11800
0.25	2800	3800	4700	5700	6600	7500	8500	9400
0.30	2400	3100	3900	4700	5500	6300	7100	7800
0.35	2000	2700	3400	4000	4700	5400	6100	6700
0.40	1800	2400	2900	3500	4100	4700	5300	5900
0.45	1600	2100	2600	3100	3700	4200	4700	5200
0.50	1400	1900	2400	2800	3300	3800	4200	4700

Appendix F-2: Application Rates (gallons/acre) for Dairy - Free Stall Manure (Manure at 92% moisture)

Total N %	N Supplied by Manure for Crop Production (lbs/acre)							
	Application in gallons/acre							
	30	40	50	60	70	80	90	100
0.25	2900	3800	4800	5800	6700	7700	8700	9600
0.30	2400	3200	4000	4800	5600	6400	7200	8000
0.35	2100	2700	3400	4100	4800	5500	6200	6900
0.40	1800	2400	3000	3600	4200	4800	5400	6000
0.45	1600	2100	2700	3200	3700	4300	4800	5300
0.50	1400	1900	2400	2900	3300	3800	4300	4800
0.55	1300	1800	2200	2600	3100	3500	3900	4400
0.60	1200	1600	2000	2400	2800	3200	3600	4000

Appendix F-3: Application Rates (tons/acre) for Beef Feedlot Manure (Manure at 92% moisture)

Total N %	N Supplied by Manure for Crop Production (lbs/acre)							
	Application in tons/acre							
	30	40	50	60	70	80	90	100
0.50	10.1	13	17	20	24	27	30	34
0.55	9.2	12	15	18	21	24	27	31
0.60	8.4	11	14	17	20	22	25	28
0.65	7.7	10.3	13	15	18	21	23	26
0.70	7.2	9.6	12	14	17	19	22	24
0.75	6.7	9.0	11	13	16	18	20	22
0.80	6.3	8.4	10.5	13	15	17	19	21
0.85	5.9	7.9	9.9	12	14	16	18	20
0.90	5.6	7.5	9.3	11	13	15	17	19

Appendix F-4: Application Rates (tons/acre) for Solid Poultry Manure (Manure at 60% moisture)

Total N %	N Supplied by Manure for Crop Production (lbs/acre)							
	Application in tons/acre							
	30	40	50	60	70	80	90	100
1.50	1.7	2.3	2.9	3.5	4.0	4.6	5.2	5.8
1.60	1.6	2.2	2.7	3.2	3.8	4.3	4.9	5.4
1.70	1.5	2.0	2.5	3.1	3.6	4.1	4.6	5.1
1.80	1.4	1.9	2.4	2.9	3.4	3.8	4.3	4.8
1.85	1.4	1.9	2.3	2.8	3.3	3.7	4.2	4.7
1.90	1.4	1.8	2.3	2.7	3.2	3.6	4.1	4.6
1.95	1.3	1.8	2.2	2.7	3.1	3.6	4.0	4.4
2.00	1.3	1.7	2.2	2.6	3.0	3.5	3.9	4.3
2.10	1.2	1.6	2.1	2.5	2.9	3.3	3.7	4.1
2.20	1.2	1.6	2.0	2.4	2.8	3.1	3.5	3.9
2.30	1.1	1.5	1.9	2.3	2.6	3.0	3.4	3.8

Appendix F-5: Application Rates (litres/hectare) for Liquid Hog Manure (Manure at 96% moisture)

Total N %	N Supplied by Manure for Crop Production (kg/hectare)							
	Application in litres/hectare							
	34	45	56	67	78	90	101	112
0.20	39500	52700	65900	79100	92300	105500	118600	131800
0.25	31600	42200	52700	63300	73800	84400	94900	105500
0.30	26400	35200	43900	52700	61500	70300	79100	87900
0.35	22600	30100	37700	45200	52700	60300	67800	75300
0.40	19800	26400	33000	39500	46100	52700	59300	65900
0.45	17600	23400	29300	35200	41000	46900	52700	58600
0.50	15800	21100	26400	31600	36900	42200	47500	52700

Appendix F-6: Application Rates (litres/hectare) for Dairy - Free Stall Manure (Manure at 92% moisture)

Total N %	N Supplied by Manure for Crop Production (kg/hectare)							
	Application in litres/hectare							
	34	45	56	67	78	90	101	112
0.25	32300	43100	53900	64700	75400	86200	97000	107800
0.30	26900	35900	44900	53900	62900	71800	80800	89800
0.35	23093	30800	38500	46200	53900	61600	69300	77000
0.40	20200	26900	33700	40400	47100	53900	60600	67400
0.45	18000	23900	29000	35900	41900	47900	53900	59900
0.50	16200	21600	26900	32300	37700	43100	48500	53900
0.55	14700	19600	24500	29400	34300	39200	44100	49000
0.60	13500	18000	22500	26900	31400	35900	40400	44900

Appendix F-7: Application Rates (tonnes/hectare) for Solid Beef Manure (Manure at 50% moisture)

Total N %	N Supplied by Manure for Crop Production (kg/hectare)							
	Application in tonnes/hectare							
	34	45	56	67	78	90	101	112
0.50	23	30	38	45	53	60	68	75
0.55	21	27	34	41	48	55	62	68
0.60	19	25	31	38	44	50	56	63
0.65	17	23	29	35	41	46	52	58
0.70	16	21	27	32	38	43	48	54
0.75	15	20	25	30	35	40	45	50
0.80	14	19	24	28	33	38	42	47
0.85	13	18	22	27	31	35	40	44
0.90	13	17	21	25	29	33	38	42

Appendix F-8: Application Rates (tonnes/hectare) for Solid Poultry Manure (Manure at 60% moisture)

Total N %	N Supplied by Manure for Crop Production (kg/hectare)							
	Application in tonnes/hectare							
	34	45	56	67	78	90	101	112
1.50	3.9	5.2	6.5	7.8	9.0	10.3	11.6	12.9
1.60	3.6	4.8	6.1	7.3	8.5	9.7	10.9	12.1
1.70	3.4	4.6	5.7	6.8	8.0	9.1	10.3	11.4
1.80	3.2	4.3	5.4	6.5	7.5	8.6	9.7	10.8
1.85	3.1	4.2	5.2	6.3	7.3	8.4	9.4	10.5
1.90	3.1	4.1	5.1	6.1	7.1	8.2	9.2	10.2
1.95	3.0	4.0	5.0	6.0	7.0	8.0	8.9	9.9
2.00	2.9	3.9	4.8	5.8	6.8	7.8	8.7	9.7
2.10	2.8	3.7	4.6	5.5	6.5	7.4	8.3	9.2
2.20	2.6	3.5	4.4	5.3	6.2	7.0	7.9	8.8
2.30	2.5	3.4	4.2	5.1	5.9	6.7	7.6	8.4

Appendix G

Estimating the Run-off Volume from Open Lots

Explanation of Appendix G: The table below should be used as a first estimate for predicting run-off from feedlots. Actual run-off volumes depend on moisture conditions, manure buildup, slope, soil type, age of lot, etc. The precipitation data is based on a 25 year storm.

Appendix G-1: Precipitation Data for Estimating Open Feedlot Run-off

$^{1}V = A \times (0.48\ P_m + 0.65\ P_s)$ for paved lots $^{2}V = A \times (0.22\ P_m + 0.45\ P_s)$ for unpaved lots

Location	P_m (snowfall)		P_s (rainfall)		Volume for unpaved feedlot[1] Area x		Volume for paved feedlot[2] Area x	
	mm	inches	mm	inches	mm	inches	mm	inches
Athabasca	131	5.15	88	3.46	68	2.69	120	4.72
Brooks	113	4.45	89	3.50	65	2.55	112	4.41
Calgary (Intl. Airport)	117	4.62	95	3.74	69	2.70	118	4.65
Cardston	202	7.94	102	4.02	90	3.56	163	6.42
Claresholm	151	5.93	97	3.82	73	2.89	135	5.33
Cold Lake	133	5.25	94	3.70	72	2.82	125	4.93
Coronation	116	4.56	99	3.90	70	2.76	120	4.72
Drumheller	98	3.86	73	2.87	55	2.15	95	3.73
Edmonton (Intl. Airport)	120	4.71	114	4.49	78	3.06	132	5.18
Edson	159	6.25	79	3.11	70	2.78	128	5.02
Fairview	162	6.36	64	2.52	64	2.53	119	4.69
Fort Vermilion	127	4.99	60	2.36	55	2.16	100	3.93
Grande Prairie	167	6.56	78	3.07	72	2.83	131	5.14
Lac La Biche	152	6.00	82	3.23	70	2.77	122	4.80
Lethbridge	151	5.95	93	3.66	75	2.96	133	5.24
Fort McMurray	126	4.96	61	2.40	55	2.17	100	3.94
Medicine Hat	118	4.65	122	4.80	81	3.18	136	5.35
Peace River	121	4.76	48	1.89	48	1.90	89	3.51
Pincher Creek	214	8.43	128	5.04	105	4.13	186	7.32
Red Deer	113	4.50	154	6.06	94	3.72	155	6.10
Rocky Mountain House	149	5.86	77	3.03	67	2.64	121	4.76
Slave Lake	142	5.61	76	2.99	66	2.58	118	4.64
Stettler	112	4.42	165	6.50	99	3.90	161	6.35
Turner Valley	178	7.01	82	3.23	76	3.00	139	5.46
Vermilion	104	4.11	75	2.95	57	2.23	99	3.89
Wetaskiwin	137	5.39	78	3.07	65	2.57	116	4.58
Whitecourt	155	6.12	89	3.50	74	2.92	132	5.21

Appendix H

Useful Conversions

To Convert	Multiply By	To Obtain
feet (ft)	0.305	metres (m)
yards (yds)	0.914	metres (m)
pounds (lbs)	0.455	kilograms (kg)
gallons (gal)	4.546	litres (l)
acres (ac)	0.405	hectares (ha)
cubic yards (yd^3)	0.765	cubic metres (m^3)
gallons per acre (gal/ac)	11.22	litres per hectare (l/ha)
tons per acre (t/ac)	2.24	tonnnes per hectare (t/ha)
pounds per ton (lb/t)	0.5	kilograms per tonnes (kg/t)
pounds per acre (lbs/ac)	1.12	kilograms per hectare (kg/ha)

1 Mile	1.61	Kilometers	1,6093
	1610	Meters	
	1760	Yards	1759,95
	5280	Feet	5279,856
1/2 Mile	2640	Feet	
	805	Meters	
1 Kilometer	0.621	Miles	0,621388
	1094	Yards	1093,6133
	3281	Feet	3280,84

1 yd = 0,9144 m

1 m = 1,0936 yds = 3, 28084 ft.

Common Conversions

1 Mile	1.6093	Kilometres
	1759.95	Yards
	5279.856	Feet
1/2 Mile	0.80465	Kilometres
	879.975	Yards
	2639.928	Feet
1 Yard	0.91444	Meters
1 Meter	1.0936	Yards
	3.28084	Feet
1 Hectare	2.47105	Acres
	11961.7225	Sq. Yards
	107526.88	Sq. Feet
1 Acre	0.404686	Hectares
1 Sq. Mile	640.002	Acres
	259	Hectares
1 Sq. Yard	0.836	Sq. Meters
	0.0002066	Acres
1 Sq. Foot	0.111244	Sq. Yards
	0.093	Sq. Meters
1 Cubic Ft	0.0283169	Cubic Meters
	28.3169	Litres
	6.229	Imp. Gals.
1 Cubic Yd.	0.765	Cubic Meters
	765	Litres
	168.28	Imp. Gals
1 Cubic Meter	1.3072	Cubic Yds.
	35.3146	Cubic ft.
	219.973	Imp. Gals.
1 Acre Foot	1233.46	Cubic Meters
	271335.24	Imp. Gals.
1 Imp. Gal.	4.546	Litres
1 US Gal.	3.785	Litres

Manufactured in Canada

Alberta
AGRICULTURE, FOOD AND
RURAL DEVELOPMENT

AGDEX 400/27-2

ADDENDUM

TO THE

1995
CODE OF PRACTICE

FOR THE SAFE AND ECONOMIC HANDLING
OF ANIMAL MANURE

MAY 3, 1999

Alberta
AGRICULTURE, FOOD AND
RURAL DEVELOPMENT

Note:
This Addendum includes
corrected pages 12 and 16

nts

Introduction

This document updates the following sections of the 1995 *Code of Practice for the Safe and Economic Handling of Animal Manures*.

Section 2

The definition of an Intensive Livestock Operation (ILO) has been rewritten to clarify the three criteria used to qualify an ILO. These criteria being: threshold size, density of confinement, and confinement time.

Section 3

This section has been updated and several new clauses added to clarify former areas of ambiguity and confusion.

Appendices

Appendix A: Values have been updated. Phosphorus and potassium are expressed in elemental forms.

Appendix B: Several new categories have been added in keeping with changes in the industry.

Appendix C: These tables have been simplified and updated with new categories in keeping with changes in the industry.

Appendix D: Several new Minimum Distance Separation category tables have been added.

This addendum supercedes the corresponding sections of the 1995 *Code of Practice for the Safe and Economic Handling of Animal Manures*.

Section 2

Definitions

2.8 Livestock Facility

2.8.3 Intensive Livestock Facility (ILO)

The following definition may be used to define an Intensive Livestock Facility (ILO) as a conditional use under the Land Use Bylaw. For the purpose of this *Code*, all three of the following criteria must be met to be considered an Intensive Livestock Operation.

An ILO is deemed to have permanence, significant cost, service and resource requirements, environmental, and community implications.

1. Threshold Size

Any feedlot or covered facility of significant investment or permanence, capable of confining the minimum number of livestock set out in **Table 1** or such table in the Land Use Bylaw that sets out the threshold size.

2. Density of Confinement

- livestock housed at a density of more that one livestock manure unit per 90 m^2 (1000 ft^2) in open confinement or
- housing in a covered facility necessitating feed to be brought to the livestock.

3. Confinement Time Interval

Continuous confinement of at least 90 days.

The following are not considered an intensive livestock operation for the purpose of this Code:

- where livestock are confined for branding, sorting, herd health management, and market delivery with confinement not exceeding 30 consecutive days or
- livestock in intensive grazing management systems.

Table 1. Intensive Livestock Operations - Min. Size

Livestock Type	Threshold #
Beef Feeder (500 - 1200 lbs)	300
Dairy (milking)	All
Piggery (sows: farrow - finish)	30
Piggery (sows: farrow - wean)	50
Piggery (feeders only)	300
Veal	100
Horses (PMU)	75
Poultry (broilers)	10000 ft^2 (920 m^3)
Poultry (breeders)	500
Poultry (layers)	5000
Poultry (turkey broilers)	3000
Sheep (ewes)	650
Other	Discretionary

Section 3

Livestock Facility Siting Guidelines

Minimum Distance Separation (MDS) Method

Separation between intensive livestock facilities and neighbours can compensate for normal odour production, thereby reducing potential nuisance conflicts. The MDS applies reciprocally for the siting of either the odour source (intensive livestock operation) and/or the neighbouring landowner (neighbour). The MDS method is based on Livestock Siting Units (LSUs) which considers site specific factors such as livestock type, manure production, and manure handling system.

Application of MDS

MDS provides a consistent and uniform technique for assessing the conflict potential of a land use or development change.

3.1 Application of MDS for Non-agricultural Developments

MDS provides a recommended minimum separation distance between new or expanding non-agricultural developments (residential, commercial, or recreational) and existing intensive livestock facilities.

3.2 Application of MDS for Agricultural Developments

MDS provides a recommended minimum separation distance between new intensive livestock developments, the expansion of existing intensive livestock operations, and neighbouring land uses. Where expansion to existing facilities is involved, the MDS may be applied in either of two ways:

- MDS may be applied to the existing portion of an expanding operation. In such case the expansion factor (**Appendix C-2**) is applied.
- MDS may be applied to the expanding portion of an existing intensive livestock operation. In such case the MDS is based on the total LSUs of the operation as if it was entirely new (no expansion factor applied) but the measurement is applied to the expanded portion of the development. Changes in management may be required for the existing portion of the facility to bring it into compliance with present standards.

3.3 MDS Tables

MDS distances have been pre-calculated into tabular form to simplify their use (**Appendix D**). In no case shall the MDS be less than 500 feet (150 metres). Distance is determined as follows:

3.3.1 Intensive Livestock Facility to a Neighbouring Residence

Measure the distance from the neighbouring residence (not property line) to the developing livestock facility at the point nearest the neighbouring residence. The livestock facility, for the purpose of determining MDS, is considered to be that part of the operation confining the livestock. The manure storage is considered part of the

facility. Facilities associated with the livestock facility, such as feed handling and storage, office, and water supply, are not considered to be part of the livestock facility.

3.3.2 Intensive Livestock Facility to a Neighbouring Land Use Change

Measure the distance from the existing livestock facility to the property line of the land undergoing the zoning or land use change (no development involved). This ensures that any development on the land undergoing the zoning change will be in compliance with the reciprocal MDS.

3.4 Operations on Separate Land Parcels

Livestock operations on separate land titles are considered to be separate for the purpose of determining MDS.

3.5 Exemptions to MDS

Residences owned or under the control of the livestock operation are exempted from MDS siting requirements of the livestock operation.

3.6 Variance to MDS

All possible ways of reducing nuisance associated with a livestock facility design such as siting, topography, climate, and manure management cannot be included in the MDS tables. Management techniques or technology that clearly reduce nuisance are encouraged by allowing a reduction in the MDS. Variance to the MDS may be permitted by the approving authority upon consultation with Alberta Agriculture, Food and Rural Development staff after consideration and documentation of the following factors.

3.6.1 Unique Topography and/or Micro-climate which Mitigate Nuisance

Where topographical features will reduce the effect of odour movement and dispersion.

3.6.2 Physical and Visual Screening

Physical screening can assist in minimizing odours by reducing wind effects at the storage site. Natural or constructed screening can also improve the aesthetics of the facility.

3.6.3 Prevailing Winds

Where the nearest available meteorological data demonstrates a significant reduction of odour intensity or frequency of occurrence to a neighbouring land use.

3.6.4 Unique Management/Technology

The use of management or technology capable of significant reduction in nuisance.

3.7 Application of MDS to Creeping Expansion

A series of developments at the same site in any three year period shall use an MDS as if it were one development.

Appendices

Appendix A

Nutrient Content of Typical Agricultural Livestock Manures for Various Species

Explanation of Appendix A:

Total N: Includes both mineral (nitrate and ammonium nitrogen) and organic nitrogen. The organic portion is not available to the plant without further microbial mineralization into available nitrogen.

Available N: This is the portion of the total nitrogen that is in the mineral (usually ammonium), plant available form at the time of application.

Crop N: This is an estimate of the available nitrogen plus the portion of the organic nitrogen that is mineralized over the growing season less estimated losses.

Total P: Total P is expressed as total phosphorus in the manure including mineral and organic forms. Phosphorus is largely contained in the solids portion of the manure so mixing of the manure is necessary for uniformity of phosphorus content.

Total K: Total K is expressed as total potassium in the manure.

Appendix A-1: Nutrient Content of Typical Agricultural Livestock Manures for Various Species

Type of Livestock		Moisture %	Total N % Range	Total N - Typical			Available N			Crop N		Total P			Total K		
				%	lbs/ton	kg/tonne	%	lbs/ton	kg/tonne	lbs/ton	kg/tonne	%	lbs/ton	kg/tonne	%	lbs/ton	kg/tonne
Beef	*Open*	30 - 70 (50)	0.65 - 1.25	1.00	20.0	10.0	0.26	5.1	2.6	6.5	3.2	0.24	4.8	2.4	0.67	13.3	6.7
	Paved	50 - 75 (65)	0.45 - 0.80	0.70	14.0	7.0	0.27	5.4	2.7	5.0	2.5	0.09	1.7	0.9	0.38	7.5	3.8
Dairy	*Free stall*	85 - 95 (92)	0.35 - 0.60	0.40	8.0	4.0	0.18	3.6	1.8	3.3	1.7	0.09	1.7	0.9	0.42	8.3	4.2
	Tie stall	70 - 85 (80)	0.45 - 0.65	0.50	10.0	5.0	0.21	4.2	2.1	3.8	1.9	0.09	1.7	0.9	0.42	8.3	4.2
Hogs		90 - 99 (96)	0.20 - 0.55	0.35	7.0	3.5	0.16	3.2	1.6	3.1	1.6	0.11	2.2	1.1	0.17	3.3	1.7
Poultry	*Layers (solid)*	50 - 70 (60)	1.0 - 2.0	1.60	32.0	16.0	1.31	24.6	12.3	21.5	10.8	1.22	24.3	12.2	0.83	16.7	8.4
	Layers (liquid)	85 - 95 (90)	0.65 - 1.2	0.96	19.2	9.6	0.77	14.8	7.4	12.9	6.5	0.73	14.6	7.3	0.50	10.0	5.0
	Broilers	30 - 50 (35)	1.5 - 2.0	1.85	37.0	18.6	1.23	24.7	12.4	21.4	10.7	0.65	13.0	6.5	0.83	16.7	8.4
	Breeders	30 - 50 (35)	1.6 - 2.1	1.96	39.2	19.7	1.31	26.1	13.1	22.6	11.4	1.30	26.1	13.1	0.83	16.7	8.4
Turkeys		30 - 50 (35)	1.5 - 2.0	1.85	37.0	18.6	1.23	24.7	12.4	21.4	10.7	0.65	13.0	6.5	0.83	16.7	8.4
Horses		-----	-----	0.60	12.0	6.0	0.30	6.0	3.0	5.7	2.9	0.13	2.6	1.3	0.50	10.0	5.0
Mink		-----	-----	1.80	36.0	18.0	0.90	18.0	9.0	17.1	8.6	1.09	21.7	10.9	1.67	33.3	16.7
Fox		-----	-----	0.40	8.0	4.0	0.20	4.0	2.0	3.8	1.9	0.09	1.7	0.9	0.08	1.7	0.8
Rabbit		-----	-----	0.50	10.0	5.0	0.21	4.2	2.1	4.6	2.3	0.52	10.4	5.2	0.42	8.3	4.2
Veal		-----	-----	0.38	7.6	3.8	0.19	3.8	1.9	4.0	2.0	0.22	4.3	2.2	0.31	6.2	3.1
Elk		-----	-----	0.65	13.0	6.5	0.20	3.9	2.0	4.5	2.2	0.22	4.3	2.2	0.50	10.0	5.0
Bison		-----	-----	0.65	13.0	6.5	0.20	3.9	2.0	4.5	2.2	0.22	4.3	2.2	0.50	10.0	5.0
Sheep		30 - 65 (50)	-----	0.70	14.0	7.0	0.28	5.6	2.8	5.3	2.7	0.20	3.9	2.0	1.04	20.8	10.4

Appendix B

Manure Production Volumes for Various Livestock Types

Explanation of Appendix B:

The following values are the average manure volumes expected from common livestock species. Volumes are from typical housing systems and include added water (spillage, wash and precipitation) as well as bedding and spilled feed. These variables should be taken into account and adjustments made where appropriate. These volumes are used to determine recommended manure storage volumes and land spreading.

Appendix B-1: Liquid Manure Production Volume

Species		Daily			Monthly			Yearly		
		gal	*litres*	*cu. ft.*	*gal*	*litres*	*cu. ft.*	*gal*	*cu. m*	*cu. ft*
Sows	*Farrow - finish*	14	66	2.31	433	1970	69	5270	24	840
	Farrow - wean	4.4	20	0.71	133	610	21	1620	7.4	260
	Farrow - early wean	3.5	16	0.56	105	480	17	1280	5.8	200
Weaners	*Early*	0.4	2	0.07	13	60	2	160	0.7	26
	Standard	0.5	2.2	0.08	14.5	66	2.3	180	0.8	28
Hogs	*Feeders*	1.6	7	0.25	47	210	7	570	2.6	91
Dairy	*Free stall*	20	91	3.20	600	2730	96	7300	33	1170
	Tie stall	18	81	2.88	540	2440	86	6570	30	1050

Appendix B-2: Solid Manure Production Volume

Species		Daily			Monthly			Yearly		
		lbs	*kgs*	*cu. ft.*	*lbs*	*kgs*	*cu. ft.*	*tons*	*tonnes*	*cu. ft.*
Beef	*Open lot*	13	5.9	0.32	390	180	9.6	2.4	2.1	117
	Paved	20	9.0	0.43	590	270	12.8	3.6	3.2	156
Dairy	*Tie stall*	150	69	2.88	4540	2060	86.4	27.6	25.1	1050
Poultry	*per 100 layers*	9	4.0	0.41	264	120	12.3	1.6	1.4	149
	per 100 broilers	6.6	3.0	0.36	198	90	10.7	1.2	1.1	130
	per 100 breeders	16	7.2	0.64	480	220	19.2	2.9	2.6	234
	per 100 Turkey hens	32	14.3	1.46	950	430	43.7	5.8	5.1	532
	per 100 Turkey toms	36	16.5	1.67	1090	490	50.1	6.6	5.9	610
	per 100 Turkey broilers	26	11.6	1.03	770	350	30.9	4.7	4.2	376
Horses		46	21	0.92	1370	620	27.7	8.4	7.5	337
Mink	*per 100*	31	14.0	0.71	920	420	21.3	5.6	5.0	260
Fox	*per 100*	77	35	1.24	2310	1050	37.3	14.1	12.5	454
Rabbit	*per 100*	100	45	2.49	3000	1370	74.7	18.3	16.3	908
Veal		12	5.4	0.19	360	160	5.8	2.2	1.9	70
Elk		5.8	2.6	0.14	170	80	4.3	1.1	0.9	52
Bison		7.3	3.3	0.18	220	100	5.3	1.3	1.2	65
Sheep	*Ewes*	3.1	1.4	0.10	90	40	3.0	0.6	0.5	36
	Feeders	0.6	0.3	0.02	17	7	0.5	0.1	0.1	6

Appendix C

Livestock Siting Units and Expansion Factors

Explanation of Appendix C:

This table provides the factors for determining the MDS between intensive livestock operations and neighbours. See **Appendix D** for pre-calculated tables for the common livestock types. The Livestock Siting Unit (LSU) is used in determining the MDS and combines into one factor the contribution of species type, size of operation, and manure system to the level of nuisance. The LSU factor multiplied by the number of livestock can be looked up in **Appendix D-11** to give the required MDS for the livestock operation.

Appendix C-1: Livestock Siting Unit Table for Various Livestock Types*

Species		LSU Factor	Species		LSU Factor
Beef	*Feeders 450 - 900 lbs*	0.328	Veal		0.545
	Finishers 900 - 1300 lbs	0.441	Horses	*Solid*	0.455
	Cow with calf	0.504		*Liquid*	0.715
Dairy	*Milking cows*	1.232	Mink		0.0228
Swine - Liquid	*Farrow - finish*	3.96	Fox		0.0438
	Farrow - wean	1.474	Rabbits		0.0119
	Farrow - early wean	1.166	Poultry	*Broilers*	0.002
	Weaners (early)	0.120		*Breeders*	0.0028
	Weaners (standard)	0.110		*Layers (solid)*	0.017
	Feeders	0.44		*Layers (liquid)*	0.026
Swine - Solid	*Farrow - finish*	2.88	Turkeys	*Broilers*	0.004
	Farrow - wean	1.072	Sheep	*Ewes*	0.084
	Farrow - early wean	0.848		*Lambs*	0.034
	Weaners (early)	0.088	Goats	*Dairy herd*	0.2
	Weaners (standard)	0.080	Elk		0.252
	Feeders	0.32	Bison		0.42

* LSU for other livestock types to be determined by AAFRD.

Appendix C-2: Expansion Factors

Expansion %	Factor	Expansion %	Factor	Expansion %	Factor
0 - 29	0.6	100 - 199	0.8	> 300	1.0
30 - 99	0.7	200 - 299	0.9		

Appendix D

Minimum Distance Separation Tables

Explanation of Appendix D:

Category 1: Low sensitivity siting (e.g. single residence).

Category 2: Moderate sensitivity siting (e.g. multi-parcel country residential, low use recreational, etc.).

Category 3: High sensitivity siting (e.g. large scale country residential development, high use recreational, etc.).

Category 4: From boundary of rural hamlet, village, or residential zoning.

Appendix D-1: Recommended MDS (ft) for Beef Feeders

No. of Animals	Category 1	Category 2	Category 3	Category 4	No. of Animals	Category 1	Category 2	Category 3	Category 4
400	800	1070	1340	2160	4000	1870	2490	3110	4970
500	870	1160	1460	2330	5000	2020	2700	3370	5400
600	930	1240	1560	2480	6000	2160	2880	3600	5770
700	990	1320	1660	2630	7000	2290	3060	3810	6100
800	1040	1380	1730	2760	8000	2400	3200	4000	6410
900	1080	1440	1800	2890	9000	2510	3340	4180	6690
1000	1120	1500	1870	3000	10000	2610	3470	4340	6950
1200	1200	1600	2000	3210	12000	2790	3710	4640	7430
1400	1270	1700	2120	3390	14000	2960	3930	4810	7860
1600	1340	1780	2230	3560	16000	3090	4120	5160	8260
1800	1390	1860	2320	3720	18000	3230	4310	5380	8610
2000	1460	1930	2410	3860	20000	3360	4480	5690	8960
2500	1570	2090	2620	4190	25000	3640	4860	6070	9710
3000	1680	2240	2800	4480	30000	3890	5190	6490	10380
3500	1780	2370	2960	4740	40000	4320	5760	7200	11630
4000	1870	2490	3110	4970	50000	4690	6250	7820	12600

* Beef animals in the 450 - 900 lb (200 - 400 kg) weight range.

Appendix D-2: Recommended MDS (ft) for Beef Finishers*

No. of Animals	Category 1	Category 2	Category 3	Category 4	No. of Animals	Category 1	Category 2	Category 3	Category 4
300	800	1070	1340	2150	4000	2070	2760	3450	5520
400	890	1190	1490	2380	5000	2250	3000	3760	5990
500	970	1290	1620	2590	6000	2400	3200	4000	6410
600	1040	1380	1730	2760	7000	2540	3390	4240	6780
700	1100	1460	1830	2920	8000	2670	3560	4450	7120
800	1150	1540	1920	3070	9000	2790	3710	4640	7430
900	1200	1600	2000	3210	10000	2890	3860	4820	7720
1000	1250	1670	2080	3330	12000	3090	4120	5160	8250
1200	1340	1780	2230	3560	14000	3270	4360	5450	8730
1400	1410	1880	2350	3770	16000	3440	4580	5730	9160
1600	1480	1980	2470	3950	18000	3590	4780	5980	9570
1800	1550	2060	2580	4130	20000	3730	4970	6210	9940
2000	1610	2140	2680	4290	25000	4040	5390	6740	10780
2500	1750	2330	2910	4650	30000	4320	5760	7200	11530
3000	1870	2490	3110	4970	40000	4800	6400	8000	12800
3500	1970	2630	3290	5260	50000	5210	6940	8680	13890

* Beef animals in the 900 - 1300 lb (400 - 500 kg) weight range.

Appendix D-3: Recommended MDS (ft) for Hogs - Farrow to Finish*

No. of Sows	Category 1	Category 2	Category 3	Category 4	No. of Sows	Category 1	Category 2	Category 3	Category 4
100	1200	1600	2000	3210	500	2160	2880	3600	5770
125	1300	1740	2170	3480	600	2310	3080	3850	6160
150	1390	1860	2320	3720	750	2510	3340	4180	6690
175	1470	1970	2460	3930	1000	2790	3710	4640	7430
200	1550	2060	2580	4130	1500	3230	4310	5380	8610
250	1680	2240	2800	4480	2000	3590	4780	5980	9570
300	1790	2390	2990	4790	2500	3890	5190	6490	10380
350	1900	2530	3160	5060	3000	4160	5550	6930	11090
400	1990	2660	3320	5320	3500	4400	5870	7330	11730
500	2160	2880	3600	5770	4000	4620	6160	7700	12320

* Piggery raising hogs from birth to market. Size is based on farrowing sow herd and includes all associated hogs.

Appendix D-4: Recommended MDS (ft) for Hogs - Farrow to Wean (Early)*

No. of Sows	Category 1	Category 2	Category 3	Category 4	No. of Sows	Category 1	Category 2	Category 3	Category 4
100	770	1030	1280	2050	500	1390	1850	2310	3700
125	840	1110	1390	2230	600	1480	1980	2470	3950
150	890	1190	1490	2380	750	1610	2140	2680	4290
175	940	1260	1570	2520	1000	1780	2380	2970	4760
200	990	1320	1650	2650	1500	2070	2760	3450	5520
250	1080	1430	1790	2870	2000	2300	3060	3830	6130
300	1150	1530	1920	3070	2500	2490	3330	4160	6650
350	1220	1620	2030	3240	3000	2670	3550	4440	7110
400	1280	1700	2130	3410	3500	2820	3760	4700	7520
500	1390	1850	2310	3700	4000	2960	3950	4930	7890

* Piggery raising hogs from birth to about 18 days. Size based on farrowing sow herd and all associated hogs.

Appendix D-5: Recommended MDS (ft) for Hogs - Farrow to Wean (Standard)*

No. of Sows	Category 1	Category 2	Category 3	Category 4	No. of Sows	Category 1	Category 2	Category 3	Category 4
100	840	1120	1400	2230	500	1510	2010	2510	4020
125	910	1210	1510	2420	600	1610	2150	2680	4290
150	970	1290	1620	2590	750	1750	2330	2910	4660
175	1030	1370	1710	2740	1000	1940	2590	3230	5170
200	1060	1440	1800	2870	1500	2250	3000	3750	6000
250	1170	1560	1950	3120	2000	2500	3330	4160	6660
300	1250	1670	2080	3330	2500	2710	3610	4520	7230
350	1320	1760	2200	3530	3000	2900	3860	4830	7730
400	1390	1850	2310	3700	3500	3060	4090	5110	8170
500	1510	2010	2510	4020	4000	3220	4290	5360	8580

* Piggery raising hogs from birth to about 21 days. Size based on farrowing sow herd and all associated hogs.

Appendix D-6: Recommended MDS (ft) for Hogs - Weaners*

No. of Weaners	Category 1	Category 2	Category 3	Category 4	No. of Weaners	Category 1	Category 2	Category 3	Category 4
500	580	780	970	1560	2500	1050	1400	1750	2810
600	620	830	1040	1670	3000	1120	1500	1870	3000
700	660	880	1100	1760	4000	1250	1670	2080	3330
800	690	930	1160	1850	5000	1360	1810	2260	3610
900	720	970	1210	1930	6000	1450	1930	2410	3860
1000	750	1000	1260	2010	7000	1530	2040	2550	4090
1500	870	1160	1460	2330	8000	1610	2140	2680	4290
2000	970	1290	1620	2590	9000	1680	2240	2800	4480
2500	1050	1400	1750	2810	10000	1750	2330	2910	4650

* Piggery housing piglets in a 13 - 45 lb (6 - 20 kg) weight range.

Appendix D-7: Recommended MDS (ft) for Hogs - Finishing* (Table corrected May 31, 1999)

No. of Animals	Solid Manure				No. of Animals	Liquid Manure			
	Category 1	Category 2	Category 3	Category 4		Category 1	Category 2	Category 3	Category 4
500	860	1150	1440	2300	500	970	1290	1620	2590
600	920	1230	1530	2450	600	1040	1380	1730	2760
750	1000	1330	1670	2670	750	1130	1500	1870	3000
1000	1110	1480	1850	2970	1000	1250	1660	2090	3330
1200	1180	1580	1970	3160	1200	1330	1780	2220	3560
1500	1290	1720	2150	3440	1500	1450	1930	2420	3860
2000	1430	1910	2390	3820	2000	1610	2140	2680	4290
2500	1550	2070	2590	4140	2500	1740	2320	2910	4650
3000	1660	2210	2770	4430	3000	1870	2480	3110	4970
3500	1760	2350	2990	4690	3500	1970	2630	3280	5270
4000	1840	2450	3060	4900	4000	2070	2760	3450	5530
4500	1930	2570	3220	5150	4500	2170	2880	3600	5770
5000	2000	2670	3330	5340	5000	2240	3000	3750	6000
6000	2130	2840	3550	5680	6000	2400	3200	4000	6400
7000	2270	3020	3780	6040	7000	2540	3380	4240	6770
8000	2370	3160	3950	6330	8000	2670	3560	4450	7110
9000	2480	3300	4130	6610	9000	2780	3610	4640	7430
10000	2580	3440	4290	6870	10000	2890	3860	4820	7720

* Piggery housing hogs from about 50 lbs to market.

Appendix D-8: Recommended MDS (ft) for Dairies*

No. of Milking Cows	Category 1	Category 2	Category 3	Category 4	No. of Milking Cows	Category 1	Category 2	Category 3	Category 4
80	720	960	1210	1930	300	1170	1560	1960	3120
100	780	1050	1310	2090	350	1240	1650	2070	3300
120	840	1120	1400	2240	400	1300	1730	2170	3470
140	890	1180	1480	2370	450	1360	1810	2260	3620
160	930	1240	1550	2480	500	1410	1880	2350	3760
180	970	1300	1620	2590	550	1460	1950	2440	3900
200	1010	1350	1680	2690	600	1510	2010	2510	4020
225	1050	1410	1760	2810	700	1600	2130	2660	4260
250	1100	1460	1830	2920	800	1680	2230	2790	4470
275	1130	1510	1890	3030	900	1750	2330	2920	4660
300	1170	1560	1950	3120	1000	1820	2420	3030	4850

* Size based on lactating cows but includes all associated animals and replacement stock. Full year confinement.

Appendix D-9: Recommended MDS (ft) for Poultry Layer Operations

No. of Birds	Category 1	Category 2	Category 3	Category 4	No. of Birds	Category 1	Category 2	Category 3	Category 4
5000	680	910	1140	1820	12000	910	1210	1520	2430
6000	720	970	1210	1930	15000	980	1310	1630	2610
7000	760	1020	1270	2030	20000	1080	1440	1800	2870
8000	800	1060	1330	2120	30000	1230	1640	2050	3280
9000	830	1100	1380	2210	50000	1460	1940	2430	3890
10000	860	1140	1430	2290	75000	1670	2220	2780	4440
12000	910	1210	1520	2430	100000	1830	2440	3050	4890

Appendix D-10: Recommended MDS (ft) for Poultry Broiler Operations

No. of Birds	Category 1	Category 2	Category 3	Category 4	No. of Birds	Category 1	Category 2	Category 3	Category 4
10000	500	520	650	1040	40000	620	820	1030	1640
15000	500	590	740	1190	50000	660	880	1100	1770
20000	500	650	820	1310	75000	760	1010	1260	2020
25000	530	700	880	1410	100000	830	1110	1390	2220
30000	560	750	930	1490	250000	1130	1500	1880	3000
35000	590	790	980	1570	500000	1420	1890	2360	3780
40000	620	820	1030	1640	1000000	1780	2370	2970	4750

Appendix D-11: MDS Table (ft) for Livestock Facility Developments Based on Livestock Siting Units (LSUs)

This table is useful in determining MDS for livestock operations of mixed species, unique types of livestock, and expansions.

LSU	Category 1	Category 2	Category 3	Category 4	LSU	Category 1	Category 2	Category 3	Category 4
20	500	540	670	1080	340	1140	1520	1890	3030
30	500	620	780	1250	350	1150	1530	1910	3060
40	520	690	870	1390	360	1160	1550	1930	3100
50	560	750	940	1510	370	1170	1560	1950	3130
60	600	800	1010	1610	380	1180	1580	1970	3160
70	640	850	1060	1700	390	1200	1590	1990	3190
80	670	890	1120	1790	400	1210	1610	2010	3220
90	700	930	1170	1870	410	1220	1620	2030	3250
100	730	970	1210	1940	420	1230	1640	2050	3270
110	750	1000	1260	2010	430	1240	1650	2060	3300
120	780	1040	1300	2070	440	1250	1670	2080	3330
130	800	1070	1330	2130	450	1260	1680	2100	3360
140	820	1100	1370	2190	460	1270	1690	2120	3390
150	840	1120	1410	2250	470	1280	1710	2130	3410
160	860	1150	1440	2300	480	1290	1720	2150	3440
170	880	1180	1470	2350	490	1300	1730	2170	3460
180	900	1200	1500	2400	500	1310	1740	2180	3490
190	920	1230	1530	2450	520	1330	1770	2210	3540
200	940	1250	1560	2500	540	1350	1790	2240	3590
210	950	1270	1590	2540	560	1360	1820	2270	3640
220	970	1290	1620	2590	580	1380	1840	2300	3680
230	990	1310	1640	2630	600	1400	1870	2330	3730
240	1000	1330	1670	2670	620	1420	1890	2360	3770
250	1020	1350	1690	2710	640	1430	1910	2390	3820
260	1030	1370	1720	2750	660	1450	1930	2410	3860
270	1050	1390	1740	2790	680	1460	1950	2440	3900
280	1060	1410	1770	2820	700	1480	1970	2470	3950
290	1070	1430	1790	2860	720	1500	1990	2490	3990
300	1090	1450	1810	2900	740	1510	2010	2520	4030
310	1100	1470	1830	2930	760	1520	2030	2540	4070
320	1110	1480	1850	2970	780	1540	2050	2570	4100
330	1120	1500	1870	3000	800	1550	2070	2590	4140

Appendix D-11: MDS Table (ft) for Livestock Facility Developments Based on Livestock Siting Units (LSUs) (continued)

LSU	Category 1	Category 2	Category 3	Category 4	LSU	Category 1	Category 2	Category 3	Category 4
820	1570	2090	2610	4180	2050	2190	2920	3650	5840
840	1580	2110	2640	4220	2100	2210	2950	3680	5890
860	1600	2130	2660	4250	2150	2230	2970	3710	5940
880	1610	2140	2680	4290	2200	2250	3000	3750	5990
900	1620	2160	2700	4330	2250	2270	3020	3780	6040
920	1630	2180	2720	4360	2300	2280	3050	3810	6090
940	1650	2200	2750	4390	2350	2300	3070	3840	6140
960	1660	2210	2770	4430	2400	2320	3090	3870	6190
980	1670	2230	2790	4460	2450	2340	3120	3900	6230
1000	1690	2250	2810	4490	2500	2350	3140	3920	6280
1025	1700	2270	2830	4540	2550	2370	3160	3950	6330
1050	1720	2290	2860	4580	2600	2390	3190	3980	6370
1075	1730	2310	2880	4610	2650	2410	3210	4010	6410
1100	1750	2330	2910	4650	2700	2420	3230	4040	6460
1125	1760	2350	2930	4690	2750	2440	3250	4060	6500
1150	1770	2360	2960	4730	2800	2450	3270	4090	6540
1175	1790	2380	2980	4770	2850	2470	3290	4120	6590
1200	1800	2400	3000	4800	2900	2490	3310	4140	6630
1250	1830	2440	3050	4880	2950	2500	3340	4170	6670
1300	1850	2470	3090	4950	3000	2520	3360	4190	6710
1350	1880	2510	3130	5010	3100	2550	3400	4250	6790
1400	1910	2540	3180	5080	3200	2580	3440	4290	6870
1450	1930	2570	3220	5150	3300	2610	3470	4340	6950
1500	1950	2610	3260	5210	3400	2630	3510	4390	7030
1550	1980	2640	3300	5270	3500	2660	3550	4440	7100
1600	2000	2670	3330	5340	3600	2690	3590	4480	7170
1650	2020	2700	3370	5400	3700	2720	3620	4530	7250
1700	2050	2730	3410	5460	3800	2740	3660	4570	7320
1750	2070	2760	3450	5510	3900	2770	3690	4620	7390
1800	2090	2790	3480	5570	4000	2800	3730	4660	7450
1850	2110	2810	3520	5630	4100	2820	3760	4700	7520
1900	2130	2840	3550	5680	4200	2850	3790	4740	7590
1950	2150	2870	3580	5740	4300	2870	3830	4780	7650
2000	2170	2890	3620	5790	4400	2890	3860	4820	7720

Appendix D-11: MDS Table (ft) for Livestock Facility Developments Based on Livestock Siting Units (LSUs) (continued)

LSU	Category 1	Category 2	Category 3	Category 4	LSU	Category 1	Category 2	Category 3	Category 4
4500	2920	3890	4860	7780	12000	4170	5570	6960	11130
4600	2940	3920	4900	7850	12500	4240	5650	7060	11300
4700	2970	3950	4940	7910	13000	4300	5730	7160	11460
4800	2990	3980	4980	7970	13500	4360	5810	7260	11620
4900	3010	4010	5020	8030	14000	4420	5890	7360	11780
5000	3030	4040	5050	8090	14500	4470	5960	7460	11930
5200	3080	4100	5130	8200	15000	4530	6040	7550	12080
5400	3120	4160	5200	8320	15500	4580	6110	7640	12220
5600	3160	4210	5270	8430	16000	4640	6180	7730	12360
5800	3200	4270	5340	8540	16500	4690	6250	7820	12500
6000	3240	4320	5400	8640	17000	4740	6320	7900	12640
6200	3280	4370	5470	8750	17500	4790	6390	7990	12780
6400	3320	4430	5530	8850	18000	4840	6450	8070	12910
6600	3360	4480	5590	8950	18500	4890	6520	8150	13040
6800	3390	4520	5660	9050	19000	4940	6580	8230	13170
7000	3430	4570	5720	9140	19500	4980	6650	8310	13290
7200	3460	4620	5770	9240	20000	5030	6710	8380	13410
7400	3500	4670	5830	9330	20500	5080	6770	8460	13540
7600	3530	4710	5890	9420	21000	5120	6830	8530	13660
7800	3570	4760	5950	9510	21500	5160	6890	8610	13770
8000	3600	4800	6000	9600	22000	5210	6940	8680	13890
8200	3630	4840	6050	9690	22500	5250	7000	8750	14000
8400	3670	4890	6110	9770	23000	5290	7060	8820	14120
8600	3700	4930	6160	9860	23500	5340	7110	8890	14230
8800	3730	4970	6210	9940	24000	5380	7170	8960	14340
9000	3760	5010	6260	10020	24500	5420	7220	9030	14450
9200	3790	5050	6310	10100	25000	5460	7280	9100	14550
9400	3820	5090	6360	10180	25500	5500	7330	9160	14660
9600	3850	5130	6410	10260	26000	5540	7380	9230	14760
9800	3880	5170	6460	10340	26500	5570	7430	9290	14870
10000	3910	5210	6510	10420	27000	5610	7480	9350	14970
10500	3980	5300	6630	10600	27500	5650	7530	9420	15070
11000	4040	5390	6740	10780	28000	5690	7580	9480	15170
11500	4110	5480	6850	10960	28500	5720	7630	9540	15270

Appendix D-11: MDS Table (ft) for Livestock Facility Developments Based on Livestock Siting Units (LSUs) (continued)

LSU	Category 1	Category 2	Category 3	Category 4	LSU	Category 1	Category 2	Category 3	Category 4
29000	5760	7680	9600	15360	38000	6360	8480	10600	16960
29500	5800	7730	9660	15460	39000	6420	8560	10700	17120
30000	5830	7780	9720	15550	40000	6480	8640	10800	17280
31000	5900	7870	9840	15740	41000	6540	8720	10900	17430
32000	5970	7960	9950	15920	42000	6590	8790	10990	17590
33000	6040	8050	10070	16100	43000	6650	8870	11090	17740
34000	6110	8140	10180	16280	44000	6710	8940	11180	17890
35000	6170	8230	10280	16450	45000	6760	9020	11270	18030
36000	6230	8310	10390	16620	46000	6820	9090	11360	18180
37000	6300	8400	10490	16790	47000	6870	9160	11450	18320