

# **Guideline for Agricultural Waste Management**

## **1 Introduction**

Definitions

## **2 Roles and Responsibilities**

Environmental Protection Service  
Territorial Farmer's Association  
Industry  
Other Regulatory Agencies

## **3 Siting to Minimize Odour**

Application of Separation Requirements

## **4 Manure Storage**

Manure Storage Capacity  
Liquid Manure  
Earthen Manure Storage: Design and Construction  
Solid Manure  
Solid Manure Storage – Design and Location  
Earthen Catch Basins – Design and Construction

## **5 Use of Manure**

Composting of Manure  
Land Application of Manure  
Application Rates and Techniques

## **6 Dead Animal Management**

Rendering  
Composting  
Landfilling  
Burial Pits  
Storage  
Alternative Disposal Methods

May 1999

## **7 Conclusion**

## **8 Bibliography**

### **Appendix I**

Animal Units By Livestock Types

### **Appendix II**

Separation Requirements

### **Appendix III**

Nutrient Content of Livestock Manures  
Crop Nutrient Requirements

### **Appendix IV**

IV-1 Application Rates for Livestock and Poultry Manure

IV-2 Application Rates for Liquid Hog Manure

IV-3 Application Rates for Solid Poultry Manure

### **Appendix V**

Conversion Table

# Guideline for Agricultural Waste Management

## 1 Introduction

The purpose of this guideline is to establish clear and consistent waste management standards for the Northwest Territories' intensive livestock and agricultural industry.

This guideline has been developed by the Environmental Protection Service of the Department of Resources, Wildlife and Economic Development in conjunction with the Territorial Farmer's Association, taking into consideration northern conditions. It is intended to:

- increase awareness of agricultural waste management in the Northwest Territories
- provide direction for the management of wastes from intensive livestock facilities, and
- protect the environment

Section 2.2 of the *Environmental Protection Act* (EPA) gives the Minister of Resources, Wildlife and Economic Development the authority to develop, co-ordinate and administer guidelines. This guideline complements existing Acts and regulations concerning waste which should be consulted for interpretation and application. Section 2.3 of this guideline provides additional information on others' regulatory roles and responsibilities.

### 1.1 Definitions

<i>Animal Unit (General)</i>	A live weight of 455 kilograms (1,000 lbs.) of livestock or any combination of livestock, poultry and farmed game that equals 455 kilograms.
<i>Animal Unit (Poultry)</i>	Layers/Breeders: 100 birds; Broilers: 200 birds
<i>Animal Unit (other)</i>	Refer to Appendix I
<i>Catch basin</i>	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.
<i>CCME</i>	The Canadian Council of the Ministers of the Environment (CCME) is the major intergovernmental forum in Canada for discussion and joint action on environmental issues of national and global concern. The 13 member governments work as partners in developing nationally consistent environmental standards, practices and legislation.

<i>Commissioner's Land</i>	Lands in the NWT that have been transferred by order-in-Council to the Government of the Northwest Territories. This includes highways, block land transfers and most lands within municipalities.
<i>Composting</i>	The biological decomposition (bio-oxidation) of organic materials, substances or objects under controlled circumstances to a condition sufficiently stable for nuisance-free storage and safe use in land applications. The composting process includes a biological phase (thermophilic phase) characterized by the predominance of micro-organisms which thrive at a temperature of 45° to 75°C. For purposes of this guideline, composting is understood to be an <b>aerobic</b> process.
<i>Earthen storage</i>	A structure constructed primarily of soil materials serving as a continuous liquid manure storage for livestock facilities.
<i>Farmed Game</i>	Domesticated wild animals such as, but not restricted to, bison, musk-oxen and fur-bearers, such as mink, fox, fisher and marten.
<i>Intensive livestock facility</i>	A feedlot or covered facility of significant investment or permanence, capable of confining a minimum number of livestock <sup>1</sup> at a housing density of not more than 1,000 lbs. (455 kg) of live weight per 184 m <sup>2</sup> (2000 ft <sup>2</sup> ) for growing or finishing for market, dairying or egg production.
<i>Livestock</i>	Any farm animals, farmed game and/or poultry reared for commercial purposes.
<i>Livestock facility</i>	Buildings, shelters, fences, corrals or other structures which confine or would be capable of confining livestock for feeding and rearing purposes.
<i>Manage</i>	To handle, store, treat, recycle or dispose of.
<i>Manure storage facility</i>	A structure, reservoir, lagoon, catch basin, cistern, gutter, tank, deep pit or bermed area for temporarily containing livestock wastes, until they can be used or properly disposed of.
Minimum # of livestock	<ul style="list-style-type: none"> <li>- dairy (5)</li> <li>- beef feeders (10)</li> <li>- bison, musk-oxen &amp; other large ungulates (10)</li> <li>- hogs - farrow-finish (30)</li> <li>- hogs - farrow- wean (50)</li> <li>- poultry - broilers (10,000ft<sup>2</sup>)(refers to size of barn)</li> <li>- poultry - layers (5,000 hens)</li> <li>- poultry - breeders (500 hens)</li> <li>- fur bearers: mink, marten, fisher (200)</li> </ul>

## **2 Roles and Responsibilities**

### **2.1 Environmental Protection Service**

The Environmental Protection Service (EPS) of the Department of Resources, Wildlife & Economic Development is the Government of the Northwest Territories' (GNWT) agency responsible for initiatives which control the discharge of contaminants and their impact on the natural environment. EPS is responsible for ensuring that, environmentally acceptable management procedures, emission levels, and disposal methods are maintained. By practice programs are applied primarily to Commissioner's Land, lands administered by municipal governments or GNWT undertakings. Legislative authority is provided by the *Environmental Protection Act* (EPA) and *Pesticide Act*. Readers are encouraged to contact EPS for a listing of relevant regulations and guidelines.

### **2.2 Territorial Farmer's Association**

The Territorial Farmers Association is a non-profit organization dedicated to promoting the development of agriculture in the Northwest Territories. As the key stakeholder in the agriculture sector, the Association encourages co-operation among its members and acceptance of responsible waste management goals and principles.

### **2.3 Industry**

**The responsibility for proper waste management rests with the generator and should be considered part of the cost of doing business.**

Industry has a responsibility to develop a comprehensive operating program that ensures the impacts of its operations on the natural environment and workplace are minimized. This involves developing sound waste management practices for waste generation, storage, handling, treatment and disposal.

### **2.4 Other Regulatory Agencies**

The GNWT Department of Municipal and Community Affairs (MACA) administers Commissioner's Lands. MACA's responsibilities include the issuance and inspection of leases, licences and land use permits. MACA, on behalf of the GNWT, is ultimately responsible for any activities taking place on land that they lease, and must therefore ensure that such activities are conducted in accordance with existing laws, regulations, guidelines and standards.

Crown lands outside of Commissioner's land is administered by the Federal Department of Indian Affairs and Northern Development, who review land use applications and issue permits for activities occurring on federal land.

Waste management activities have the potential to affect public health. Environmental Health Officers of Regional Public Health Boards should be consulted regarding requirements under the *Public Health Act*.

The Northwest Territories Water Board and/or Regional Land and Water Management Boards issue water licences under the federal *Northwest Territories Waters Act* and the *Mackenzie Valley Resource Management Act*. The issuance of a water licence is based on a number of criteria; one of these being the volume of water consumed as well as the volume of waste generated. An industrial process whose water use and waste disposal requirements exceed 100 m<sup>3</sup>/day would require a water licence. A water licence supersedes the requirements of this guideline. Please consult the Department of Indian Affairs and Northern Development for further water licence requirements.

The NWT *Safety Act's Occupational Health and Safety Regulations* address the safety of workers and the work place. The Act states that the employer shall maintain their establishment and take all reasonable precautions to ensure the safety and health of every person in the establishment. The Regulations also prescribe standards for protective clothing and equipment to be used by workers. *Workplace Hazardous Materials Information System Regulations* (WHMIS) were adopted to ensure employee training and safe storage and handling of controlled products at the employer's work site. Consultation with a Safety Officer from the Prevention Services Division of the Workers' Compensation Board is the responsibility of every employer.

Under comprehensive land claim agreements, renewable resource management institutions have broad authority for land use planning, impact assessment, and administration of land and water activities in settlement areas outside municipal boundaries. Through the setting of terms and conditions in licensing and permitting procedures, such institutions will have authority over waste disposal in some cases.

### 3 Siting to Minimize Odour

Odour nuisance results when the size of the intensive livestock operation, the type of livestock or manure management system impact the health or enjoyment of life by surrounding neighbours due to smell. Separation between livestock facilities and neighbours can, to some degree, offset normal odour production thereby reducing odour nuisance conflicts.

Some municipalities have land use bylaws, which specify separation requirements for siting intensive livestock operations. In the absence of bylaws, the siting requirements table located in Appendix I should be used as a reference in siting livestock operations.

#### 3.1. *Application of Separation Requirements*

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

The separation requirements also provide a recommended minimum distance between new intensive livestock developments, and/or the expanded portion of existing livestock developments, and other uses.

All the variables included with livestock facilities can not be incorporated into setting separation requirements. Factors such as visual screening, prevailing winds, and odour control technology, which may mitigate odour nuisance, should be evaluated if variances to the recommended separation requirement are being considered.

### 4 Manure Storage

***Manure storage facilities should be considered as a temporary measure, therefore a sound manure management plan must be developed for the complete purging of the storage site and, treatment of the manure, on an annual basis. Continually adding manure to the pile, without annual treatment is unacceptable.***

The facility must be designed to minimize impact on water quality, including groundwater and surface water. A manure storage facility should be located at least 100 metres from any watercourse or any source of water used for domestic purposes. Operators should minimize odour from manure storage locations using appropriate management techniques or technology. Operators shall develop a sound management plan as manure cannot be stored indefinitely.

If manure is to be stored and/or treated off of the intensive livestock operation (ILO) site, the operator is still obligated to comply with the recommended minimum siting distances (as described in these guidelines) to avoid conflict with the public.

#### **4.1 Manure Storage Capacity**

A suitable manure storage facility enables the operator to;

- i) store on-site a sufficient volume for the period of time needed to allow for the use of manure as a nutrient resource or value-added material.
- ii) manage and annually treat and remove manure effectively.
- iii) prevent the escape of any material which could contaminate adjacent land, surface water or groundwater.

Eight months storage of manure is the minimum to allow operators enough flexibility to maximize the value of the manure and avoid the need for further waste management in winter months. *Twelve months manure storage allows even greater flexibility in manure management and is recommended.*

#### **4.2 Liquid Manure**

***Liquid manure storage facilities should be considered as a temporary measure, therefore the operator must have a sound manure management plan in place which will include procedures for the complete purging of the storage site and treatment of the manure on an annual basis.***

Particular care must be given in developing a management plan for liquid manure; facilities must not be located on or near floodplains or in areas subject to periodic flooding. The floor of the facility should be greater than 1metre (3 feet) above the water table or bedrock. Liquid manure should be stored in tanks or earthen manure storage areas adjacent to the barn. Naturally-occurring crust formed on some types of manure helps to control odour that results from anaerobic decomposition. If a crust does not form naturally, barley straw or some other suitable material can be applied to the manure surface to assist in controlling odour.

##### **4.2.1 Earthen Manure Storage: Design and Construction**

To reduce volume requirements of earthen manure storage, surface water should be diverted from the area. To minimize seepage from the storage unit, the following design points should be considered;

- construct floor and sides of the storage unit with suitable material and compact to achieve a hydraulic conductivity of less than  $1 \times 10^{-7}$  cm/sec.
- line the storage unit with a flexible membrane, concrete or equivalent material if it is sited on highly permeable materials, such as sands and gravel, if clay is unavailable.
- construct side slopes appropriate for the stability of the soil and do not exceed 1.5:1 (run:rise) in soil or 2:1 where a clay liner exists.



### **4.3 Solid Manure**

***Solid manure storage facilities should be considered as a temporary measure. A sound manure management plan must be developed for the complete purging of the storage site and treatment of the manure, on an annual basis.***

It is recognized that solid manure accumulates in the feedlot or barn where animals are confined until the pen or barn is cleaned. It is further recognized that the decomposition of manure creates heat which is key to animal health and comfort during the winter and that this is a common farm practice, however, this does not exempt the operator from enacting sound manure management practices as described in this guideline.

#### **4.3.1 Solid Manure Storage - Design and Location**

Well drained feedlot and other dry lot areas will yield better animal performance, require less fly control, accommodate better manure management and reduce odour. The following design points for solid manure storage should be considered;

- stockpile manure on a low permeability base to prevent seepage from entering the groundwater.
- divert surface water away from stockpile.
- implement a fly control program.
- contain any contaminated run-off.

#### **4.3.2 Earthen Catch Basins- Design and Construction**

Catch basins prevent direct discharge of contaminated water from the property where the intensive livestock operation is housed. To optimize the use of catch basins the following points should be considered;

- determine the storage capacity of the catch basin by considering hydrological, topographic and climatic factors.
- provide at least 0.5 m of freeboard to provide a safety margin of storage volume.
- divert surface water from the storage area to minimize the catch basin's storage volume.

## 5 Use of Manure

### 5.1 Composting of Manure

***Composting of manure is a valuable management tool that increases the flexibility for land application and storage, while significantly reducing the potential for contamination to soils and water that might occur if raw manure were to be improperly stored or landspread.***

Where there is insufficient cropland available to recycle manure as a fertilizer it may be composted for off-farm use. The following points should be considered in development and operation of a composting site;

- locate the site a minimum of 90 m from a watercourse.
- ensure that manure is placed on relatively impermeable soils such as silts or clays.
- divert all clean surface water away from the composting site.
- contain all contaminated surface runoff from the composting area to prevent flow into surface watercourse.
- store raw and composted material in a suitable storage structure as outlined in Section 4.
- finished compost to be used off-site **must meet** the criteria set out in the Guidelines for Compost Quality by the Canadian Council of Ministers of the Environment.

### 5.2 Land Application of Manure

Before applying manure to land, evaluate the quantity and quality of the nutrients present in the manure, soil conditions and topographical conditions. Application rates and time of season must also be given consideration to avoid contaminating adjacent land, groundwater and surface waters.

Manure should not be spread on frozen and/or snow-covered soil unless it can be demonstrated that the practice will not result in contamination to water. If it becomes necessary to apply manure during the winter, the following should be considered:

1. Select land that is relatively flat and does not discharge directly into a watercourse.
2. Do not spread on land that is subject to water erosion.
3. Select land where any runoff that might occur will be contained on your own land.
4. Maintain the minimum recommended separation distance listed in Appendix 2.
5. Stubble fields are preferred as they are less subject to soil erosion and there is greater infiltration of the snowmelt
6. Spread only enough manure from the storage to get through until spring, including the possibility of a wet spring.

7. Minimize excessive nutrient loss by targeting application rates to meet crop nutrient demands.
8. In next year's crop planning, ensure some acres are set aside and available for manure application during the growing season.

### **5.2.1 Application Rates and Techniques**

When properly managed, manure can be an integral part of a soil nutrient program. Manure application rates should not exceed the nutrient requirements of the planned crop.

The following should be considered in determining application rates;

- determine the nutrient content of the manure to be applied (refer to Appendix II).
- evaluate the nutrient requirements and growing characteristics of the planned crop (refer to Appendix II).
- conduct soil analysis where manure application will exceed suggested rates.

Application rates must be adjusted for variations in manure nutrient and moisture content. See Appendix III for determining application for common livestock types.

The following techniques should be incorporated into a manure management plan;

- apply manure when it is least likely to cause odour impacts on neighbouring residents.
- avoid spreading manure on sloping land adjacent to a watercourse.

## **6 Dead Animal Management**

***This guideline does not apply to diseased animals; Public Health should be consulted in all matters pertaining to the handling and disposal of diseased animals; in cases involving diseased farmed game, the Disease/Contaminants Specialist from the Department of Resources Wildlife & Economic Development, or the local Renewable Resource Officer, in addition to Public Health, should be contacted.***

Dead animals, waste eggs and other putrescible material should be managed within 48 hours of death to minimize odours, flies, transmission of disease and the potential for environmental contamination. Dead animals which are prone to rapid decomposition, such as poultry, should be managed within 24 hours or less. The handling and disposal of dead animals is legislated under the *Public Health Act*.

It is unacceptable practice to bury carcasses in manure piles or manure storage facilities. The burial of carcasses in manure results in anaerobic decomposition, which is both slow and incomplete and does not generate a high enough temperature to destroy disease-causing pathogens. Acceptable dead animal management practices include;

## **6.1 Rendering**

It is acceptable to consign dead animals to another user who intends to process them for other purposes, including pet food and animal feed. The feasibility of this option will be determined by such factors as the type and volume of carcasses and the location of the processing plant.

## **6.2 Composting**

Composting of carcasses should be restricted to poultry and small animals. Composting systems should be located at least 90 metres from a water course or a water body. Proper management of the composting system is required to ensure optimum conditions are maintained for decomposition. Refer to Section 5.1: *Composting of Manure*, for additional information. The proponent is also referred to the references listed in section 8 of this guideline, which includes the detailed and informative *B.C. Agricultural Composting Handbook*.

## **6.3 Landfilling**

Dead animals may be landfilled provided approval for immediate disposal is obtained from the municipal authority. Upon arrival at a landfill, dead animals must be covered with a minimum of 1 metre of soil to minimize the potential for animal attraction to the site.

## **6.4 Burial Pits**

Dedicated burial pits should be used only if all other options prove to be impractical. If they are used, they must meet the following criteria:

- They must be located no closer than 120 meters from any well or spring that is used as a water supply; 90 meters from any other surface water
- The bottom of the pit must be at least 1 meter (3 feet) above highest expected level of the water table and the animal must immediately be covered with at least 1 meter of fill.
- Burial pits should not be dug on a floodplain or in low-lying areas where water can seep into the pit
- The pit should not contain any more than 700kg. of dead animal (one large animal) or one animal unit of poultry or other small farm animals.
- The pits should be staggered throughout the property and not crowded together; the pit locations should also be recorded and clearly marked.

## **6.5 Storage**

Dead animals held in an uncovered location for further management must be kept frozen and/or out of reach of scavengers until such time as they can be properly disposed of.

## **6.6 Alternative Disposal Methods**

EPS will give consideration to proposals for alternate disposal methods that provide an equivalent level of environmental protection to those identified in this guideline.

## **7 Conclusion**

This document is intended as a source of basic information about the issues involved in the management of agricultural waste. Please contact the appropriate agency for further information before proceeding.

1. Environmental Protection Service  
Department of Resources, Wildlife & Economic Development  
600, 5102-50th Avenue  
Yellowknife, NT X1A 3S8  
Phone: (867) 873-7654; Fax (867) 873-0221
  
2. Wildlife and Fisheries (Disease/Contaminants Specialist)  
Department of Resources, Wildlife & Economic Development  
600, 5102-50th Avenue  
Yellowknife, NT X1A 3S8  
Phone: (867) 873-7761; Fax (867) 873-0293
  
3. Hay River Public Health Unit  
Department of Health & Social Services  
3 Gaetz Drive, Suite 2  
Hay River, NT X0E 0R7  
Phone: (867) 874-6551; Fax: (867) 874-2593
  
4. Yellowknife Public Health Unit  
Department of Health & Social Services  
Yellowknife, NT  
Phone: (867) 920-6570; Fax: (867) 873-0158

## 8 Bibliography

- Alberta Agriculture, Food and Rural Development. Code of Practice for the Safe and Economic Handling of Animal Manures, Red Deer (1995).
- British Columbia Ministry of Agriculture and Food. B.C. Agricultural Composting Handbook, 2<sup>nd</sup> edition, Victoria (1998).
- British Columbia Ministry of Agriculture and Food. Environmental Guidelines for Poultry Producers, Victoria (1994).
- British Columbia Ministry of Agriculture and Food. Environmental Guidelines for Dairy Producers, Victoria (1994).
- British Columbia Ministry of Environment and Food. B.C. Reg. 131/92. *Code of Agricultural Practice for Waste Management*, Victoria (1992).
- Canadian Council of Ministers of the Environment. Guidelines for Compost Quality, Ottawa (1996).
- Genesis Environmental Ltd.. Northwest Territories Agricultural Waste Management Options-Phase I, Lethbridge (1995).
- Genesis Environmental Ltd.. Northwest Territories Agricultural Waste Management Options-Phase II, Lethbridge (1997).
- PEI Department of Agriculture and Forestry, Guidelines for Manure Management for PEI. Charlottetown (1998).
- Saskatchewan Agriculture and Food, Agricultural Operations Section. Guidelines for Establishing and Managing Livestock Operations, Regina (1997)

## Appendix I

### Animal Units by Livestock Types

Type	Kind of Animal	Number which Equals One Animal Unit
Poultry	Hens, Cockerels, Capons	100.0
	Chicks, Broiler Chickens	200.0
	Turkeys, Geese, Ducks	50.0
Hogs	Boars or Sows	3.0
	Gilts	4.0
	Feeder Pigs	6.0
	Weanling Pigs	20.0
Sheep	Rams or Ewes	7.0
	Lambs	14.0
Goats		7.0
Cattle	Cows or Bulls	1.0
	Feeder Cattle	1.5
	Replacement Heifers	2.0
	Calves	4.0
Horses	Colts or Ponies	2.0
	Other than Colts or Ponies	1.0
Bison & Musk-oxen	Cows or Bulls	1.0
	Calves	4.0
Fallow Deer	Fallow Deer	8.0
	Fallow Deer Fawns	32.0
Domestic Indigenous	Elk	5.0
	Elk Calves	20.0
	White Tail Deer	8.0
	White Tail Deer Fawns	32.0
	Mule Deer	8.0
	Mule Deer Fawns	32.0

## Appendix II Separation Requirements

Separation Requirements (metres)						
	<i>Animal Units</i>					
Population	<i>10-50</i>	<i>50-300</i>	<i>300-500</i>	<i>500-2000</i>	<i>2000-5000</i>	<i>&gt;5000</i>
Single Rural Residence	300 <i>450</i>	300 <i>450</i>	400 <i>600</i>	800 <i>1200</i>	1200 <i>1600</i>	1600 <i>2000</i>
<100	400 <i>600</i>	400 <i>600</i>	800 <i>1200</i>	1200 <i>1600</i>	1600 <i>2000</i>	2000 <i>2400</i>
100-500	400 <i>600</i>	800 <i>1200</i>	1200 <i>1600</i>	1600 <i>2000</i>	2400 <i>2400</i>	2400 <i>2400</i>
500-5000	800 <i>1200</i>	1200 <i>1600</i>	1600 <i>2000</i>	2400 <i>2400</i>	3200 <i>3200</i>	3200 <i>3200</i>
>5000	800 <i>1200</i>	1600 <i>2000</i>	2400 <i>2400</i>	3200 <i>3200</i>	3200 <i>3200</i>	3200 <i>3200</i>

NOTE: numbers in *italics* are for open liquid manure storage.

## Appendix III

### Nutrient Content of Livestock Manures

Livestock type	Moisture %	Total N %	Total N		Crop N	
			lbs/ton	kg/tonne	lbs/ton	kg/tonne
Poultry	71.5	1.7	34	17	24	12
Hogs-Farrow-finish	96	0.4	7	3.6	3.0	1.5
Dairy	80	0.6	11	5.6	4.2	2.1



## Crop Nutrient Requirements

Crop	Annual uptake of Nitrogen	
	lbs/acre	kg/ha
Barley	60	67.4
Oats	70	78.6
Cereal Silage	86	96.7
Second Growth Trees <sup>1</sup>	Up to 45	50
Grass for Hay	89	100

---

<sup>1</sup> Commercial applications of N of approximately 224 kg/ha (200 lbs./acre) would be required to provide First Growth Trees with enough N to meet their estimated uptake rate of 50 kg/ha (23 lbs./acre). The application of N at this rate can occur about every 5 years.

## Appendix IV

### Application Rates for Livestock and Poultry Manure

#### Explanation

- 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, determines the amount of N that may be applied as manure and/or fertilizer. This amount of N is referred to as manure Crop N (30 – 100 lbs/acre)
- Total N (%) (the first column) for use in the following tables is obtained either from a manure analysis or by the Total Nitrogen content value given in Appendix III.

#### Appendix IV-1. Application Rates (gallons/acre) for Dairy-Free Stall Manure (Manure at 92 % Moisture)

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

**Appendix IV-2. Application Rates (gallons/acre) for Liquid Hog Manure (Manure at 96 % Moisture)**

<b>Total N %</b>	<b>Manure Crop N (lbs/acre)</b>							
	<b>30</b>	<b>40</b>	<b>50</b>	<b>60</b>	<b>70</b>	<b>80</b>	<b>90</b>	<b>100</b>
<b>0.20</b>	35268	47053	58839	70725	82411	94196	105893	117678
<b>0.25</b>	28214	37678	47053	56518	65893	75357	84732	94196
<b>0.30</b>	23571	31428	39196	47023	54911	62768	70625	78482
<b>0.35</b>	20178	26875	33660	40357	47053	53839	60535	67232
<b>0.40</b>	17678	23571	29464	35268	41161	47053	53946	58839
<b>0.45</b>	15714	20892	26161	31428	36607	41875	47053	52321
<b>0.50</b>	14107	18839	23571	28214	32946	37678	42411	47053

**Appendix IV-3. Application rates (tons/acre) for Solid Poultry Manure (Manure at 60 % moisture)**

<b>Total N %</b>	<b>Manure Crop N (lbs/acre)</b>							
	<b>30</b>	<b>40</b>	<b>50</b>	<b>60</b>	<b>70</b>	<b>80</b>	<b>90</b>	<b>100</b>
<b>1.80</b>	1.4	1.9	2.4	2.9	3.4	3.8	4.3	4.8
<b>1.90</b>	1.4	1.8	2.3	2.7	3.2	3.6	4.1	4.6
<b>2.00</b>	1.3	1.7	2.2	2.6	3.0	3.5	3.9	4.3
<b>2.20</b>	1.2	1.6	2.0	2.4	2.8	3.1	3.5	3.9
<b>2.30</b>	1.1	1.5	1.9	2.3	2.6	3.0	3.4	3.8

## Appendix V

### Conversion Table

To Convert	Multiply by	To Obtain
Acres(ac)	0.405	hectares (ha)
cubic yards (yd <sup>3</sup> )	0.765	cubic metres (m <sup>3</sup> )
gallons per acre (gal/ac)	11.22	litres per hectare (l/ha)
tons per acre (t/ac)	2.24	tonnes 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)