

# Jurisdictional Scan of Nutrient Management Regulations

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A part of the Hullcar Situation Review  
Nutrient Management Practices - Technical Report

**September 2017**

**File No. 631.700-3**

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## Table of Contents

|                                                                            |    |
|----------------------------------------------------------------------------|----|
| 1.0 Introduction/Scope .....                                               | 1  |
| 2.0 Review of the Regulations on Nutrient Management by Jurisdiction ..... | 1  |
| 2.1 Canada .....                                                           | 1  |
| 2.1.1 Alberta.....                                                         | 1  |
| 2.1.2 Saskatchewan.....                                                    | 3  |
| 2.1.3 Manitoba.....                                                        | 3  |
| 2.1.4 Ontario .....                                                        | 5  |
| 2.1.5 Quebec .....                                                         | 5  |
| 2.1.6 Nova Scotia .....                                                    | 7  |
| 2.2 United States.....                                                     | 8  |
| 2.2.1 Washington .....                                                     | 10 |
| 2.2.2 Pennsylvania .....                                                   | 10 |
| 2.2.3 California .....                                                     | 11 |
| 2.3 Europe.....                                                            | 12 |
| 2.3.1 UK.....                                                              | 13 |
| 2.3.2 Denmark.....                                                         | 14 |
| 2.3.3 Netherlands.....                                                     | 15 |
| List of References and Web Pages .....                                     | 18 |
| Appendices.....                                                            | 21 |
| Appendix A – Alberta’s Soil Nitrogen Limits .....                          | 21 |
| Appendix B – Saskatchewan’s Animal Units .....                             | 22 |
| Appendix C – Manitoba’s soil nutrient class limits .....                   | 24 |

## 1.0 Introduction/Scope

This section reviews the results of a jurisdictional scan investigating agriculture regulations related to nutrient management and water protection, currently recommended agricultural best management practices, support programs and government incentives available to producers, and regulation criteria related to carrying capacity.

The jurisdictions reviewed include:

- Canada: Alberta, Saskatchewan, Manitoba, Ontario, Quebec, and Nova Scotia.
- United States: Washington, Pennsylvania, and California.
- Europe: UK, Denmark, and the Netherlands.

Information on the jurisdictions was found through web-based public government sources that contained related information on the regulations, BMPs, and programming present. Relevant background information was also gathered when necessary from these sources to provide context. The information used in the jurisdictional scan is based on the most up to date publicly available data present at the time. This section has been included to provide information on how other jurisdictions are approaching agricultural nutrient management and drinking water protection with the consideration of a broad spectrum of beneficial management practises.

## 2.0 Review of the Regulations on Nutrient Management by Jurisdiction

### 2.1 Canada

#### 2.1.1 Alberta

The information on this jurisdiction was directly transferred from the document “Jurisdictional Scan of Agricultural Waste Management Regulations and Guidelines” by R. McDougall. 2010.

Through the *Alberta Operation Practices Act* (AOPA, 2002) and government directives Alberta regulates agricultural manure management practices, groundwater resource protection, and nutrient management practices.

#### *Manure Management Regulations*

Manure application requirements in the legislation apply to all agricultural operations in the province while manure storage requirements must be met only by operations that meet the definition of a concentrated feeding operation (CFO). Large CFO’s are required to operate under an approval. The following size of operation is considered a large CFO:

- >350 beef cows or finishers
- >500 beef feeders

- >200 milking dairy cows
- >250 sows in a farrow to finish operation
- >30,000 layer birds
- >60,000 broilers

Medium sized CFO's are required to operate under a registration. Medium CFO's are operations with the following livestock numbers:

- 150-349 beef cows or finishers
- 50-199 milking dairy cows
- 30-249 sows in a farrow to finish operation
- 5,000-29,999 layer birds
- 2,000-59,999 broilers

Size allocation for other types of livestock and poultry are outlined in the legislation.

Manure application regulations also provide minimum distance separation (MDS) requirements for applications near a common body of water and water wells. Alberta also restricts application on frozen or snow-covered land that surpasses a distance and slope requirement. Approval is required for applications on frozen or snow-covered lands if other requirements are met. Manure application and nutrient management standards apply to all agricultural operations in the province.

### ***Manure Storage Regulations***

Under the AOPA, manure collection areas such as feedlots and barn floors are required to meet the same siting and construction standards as manure storage facilities, such as a required impermeable layer to prevent leaching from the site. New CFO's are required to have 9 months manure storage capacity unless they are able to field-store solid manure prior to application. CFO's in operation prior to 2002 are exempt from meeting the storage requirements.

### ***Nutrient Management Regulations and Guidelines***

Manure application is regulated by limiting the nitrogen level in the soil (nitrate-N) and the soil conductivity level. It is restricted if the soil nutrients will surpass the allowable thresholds for the soil (appendix A). New CFOs must demonstrate that they have access to sufficient land to comply with the nitrogen standard before they are issued a permit. An accompanying *Manure Characteristics and Land Base Code (2006)* contains minimum land base requirements for different livestock species and sizes of operation that are used to determine whether the proposed operation has access to sufficient land. The land base requirements are based on standard values for crop-available nitrogen in the manure and standard crop nitrogen requirements. Alternatively, the operation can have a Nutrient Management Plan written and approved.

### 2.1.2 Saskatchewan

In Saskatchewan, *The Agricultural Operations Regulations* (1996) under The Agricultural Operations Act controls the management of intensive livestock operations and agricultural waste management.

#### *Manure Management Regulations*

For an intensive livestock operation to function, a waste storage and management plan must first be approved by the Minister. Saskatchewan regulations define intensive livestock operations as those that:

- contains an earthen manure storage area or a lagoon;
- involves the rearing, confinement or feeding of 300 or more animal units (see appendix B for animal unit definitions) for more than 10 days in any 30-day period; or
- involves the rearing, confinement or feeding of more than 20 animal units but less than 300 animal units, for more than 10 days in any 30-day period, and any part of which is within 300 metres of surface water or 30 metres of a domestic water well not controlled by the person who operates the intensive livestock operation

#### *Manure Storage Requirements*

The waste storage plan for an earthen manure storage area must include in detail the:

- storage volume,
- construction details,
- setback distances from roads, property lines, surface water and watercourses; and
- records of any water wells in the area

A waste storage plan for a holding pond includes all the requirements found for earthen manure storages with the addition of runoff areas and details on disposal. Liquid manure storage tanks also require all those found for earthen manure storages as well as the material type to be contained and the construction material to be used.

#### *Nutrient Management Regulations and Guidelines*

The Minister may request further information before approval of a waste storage plan. Information on the water table, testing details, soil class, ground water monitoring programs, and construction techniques may be asked by the Minister.

To be able to use the manure produced from an intensive livestock operation a waste management plan is required and must specify the manure contents, application methods, crop characteristics, application rates, and available land for application.

### 2.1.3 Manitoba

Manitoba currently has the *Livestock Manure and Mortalities Management Regulation* (2004) through the Environment Act and the *Nutrient Management Regulation* (2008) through the Water Protection Act regulates agriculture waste management, water quality protection, and proper nutrient management.

### *Manure Management and Manure Storage Requirements*

In Manitoba, it is required that manure be stored in a proper facility, either in a manure storage facility or as field storage. Locations of the storage facilities are determined through setback distances. The operator of the storage facility would be responsible in ensuring that the storage volume can withhold

- Between a minimum of 400-days to a maximum of 500-days unless directed for an earthen storage facility or at least the amount of manure being produced.
- For other storage facilities other than an under-floor concrete storage pit the minimum storage amount is 250-days to a maximum of 500-days unless directed.
- Under-floor concrete storage pits should be able to store 30-days or less of manure

The operators are responsible in ensuring that the design and construction does not allow any leakages that can cause pollution. Construction or any change to a storage facility requires a permit given by the director.

### *Nutrient Management Requirements*

Agriculture operations with 300 animal units or more (animal unit = 73kg N/year) must submit an annual water analysis report from the operation's livestock drinking water source and analyzed in accordance with regulation. The director may require a monitoring program if they believe that the storage, handling, and management of livestock manure in the agricultural operation is causing or would likely cause pollution of surface water, groundwater, or soil.

Manure stored as field storage is required to only be stored as solid manure and ensure that it does not cause pollution of surface water, groundwater, or soil. Manure must be removed from temporary field storage every year and that storage must remain empty for at least 12 months with crops planted in place to deplete any leached nutrients.

Regulations have also been put into place that limit the amount of residual nitrate in soils and prohibit manure application annually based on soil classes. The limits are:

- More than 157.1 kg/ha within the top 0.6m for soil classes 1, 2, and 3 other than 3M or 3MW (See appendix C for soil classes).
- More than 101 kg/ha within the top 0.6m for soil classes 3M, 3MW, and 4
- More than 33.6 kg/ha within the top 0.6m for soil class of 5

Regulations have also been put into place that limit the amount of phosphorus in soils and prohibit manure application annually based on removal rates. The limits are as follows:

- The rate of application does not exceed two times the applicable phosphorus removal rate, if the soil test phosphorus levels are less than 120 ppm, or
- The rate of application does not exceed the applicable phosphorus removal rate; if the soil test phosphorus levels are 120 ppm or more but less than 180 ppm.

### 2.1.4 Ontario

The information on this jurisdiction was directly transferred from the document “Jurisdictional Scan of Agricultural Waste Management Regulations and Guidelines” by R. McDougall. 2010.

In Ontario the *Nutrient Management Act* (2002) is the primary legislation that regulates the requirements for producers to meet proper nutrient management and waste management.

#### *Manure Management and Manure Storage Requirements*

The Nutrient Management Act outlines strict guidelines for manure storage construction and siting requirements that must be followed to ensure the least possibility of pollution or contamination. These include application setbacks and buffers, limits on winter application of manure and it places restrictions on certain methods of manure application. Runoff management systems have also been outlined to reduced overland flow of contaminants. Ontario’s regulations include a large portion of non-agricultural sourced material (NASM) such as municipal bio solids and leaf litter are also regulated under the Act.

#### *Nutrient Management*

The Nutrient Management Act requires Ontario farms with large numbers of livestock and poultry to comply with the Act (defined as farms that generate 300 or more nutrient units annually where a nutrient unit is the fertilizer replacement value of the lower of 43 kg nitrogen or 55 kg of phosphate). Regulated farms are required to implement a Nutrient Management Strategy that describes how agricultural wastes are managed on the farm, and, if the manure is applied on-site, to implement a Nutrient Management Plan that outlines land application requirements.

Application of nutrients in manure to farm land is regulated on the basis of nitrogen, phosphorus and potassium, but the rate-limiting nutrient is phosphorus. Manure application is limited to sites where the plant-available phosphorus and potassium are less than 101 and 251 mg/kg respectively. Farmers must limit phosphorus application in manure to either crop uptake or crop requirements balanced over the 5 year period of each Nutrient Management Plan. The application of nutrients in chemical fertilizer is not regulated under the Nutrient Management Act.

### 2.1.5 Quebec

The *Agricultural Operations Regulation* (2002) regulates the agricultural practices in Quebec with legislation on nutrient management and agricultural waste control.

#### *Manure Management Regulations*

Manure and fertilizer use regulations apply to farms that either:

1. Generate more than 1,600 kilograms per year of phosphorus in liquid or solid manure regardless of operation size, and
2. Operates spreading sites whose cumulative area is greater than 15 ha, excluding pasture areas and grasslands. For market crops or fruit production, the cumulative area is reduced to 5 ha, or



3. Operates animal raising sites with solid manure management whose annual phosphorus production is 1,600 kg or less and who have cultivated parcels whose cumulative area is that referred to regulation.

The operator of an animal raising site, except those with solid manure management whose annual phosphorus production is 1,600 kg or less, must give a written mandate to an agrologist to have the livestock waste produced characterized.

The regulation limits the application of manure and fertilizers are based on the phosphorus content of the manure, soil, and phosphorus requirement of the crop. Farms are required to have access to sufficient land to spread manure based on its phosphorus content. New or expanding farms that will produce more than 3200 kg of phosphorus per year in manure must apply for a permit to operate. Regulations also outline restrictions on the spreading of fertilizers and manure near sensitive areas and in areas where there is an absence of runoff controls. Winter spreading of manure has also been prohibited.

### *Manure Storage Requirements*

Quebec requires the ground on which a livestock building is constructed or laid out must be protected from any contact with the livestock waste produced by means of a watertight floor. The livestock building must have the capacity to store, without overflow. Construction must also meet the MDS requirements for sensitive areas and high risk contamination zones.

Temporary field storage is allowable in a cultivated field but must:

- Ensure no contact to runoff and that contaminated water does not enter surface waters,
- Store no more than 2,000 kg of phosphorus ( $P_2O_5$ ),
- Have an MDS of 100m from a pile that has been removed for 12 months or less, and
- Be completely removed and reclaimed or eliminated within 12 months of the first input of solid manure forming the pile

The operator must keep all related documentations of the storage facilities, manure usage, and land base used for a minimum of 5 years.

### *Nutrient Management Regulations*

Regulated farms are required to have a professional agrologist or other appropriately trained person prepare an Agro-Environmental Fertilization Plan that details the crop and fertilizer application limits for each field. Following fertilizer and manure applications, there must be a sign off by the professional indicating that the applications were done according to the plan.

For the purpose of determining the fertilizing content of animal waste, the operator must have the number of livestock waste samples determined by the agrologist analyzed by a laboratory accredited by the Minister, with regard to the following variables:

- total nitrogen;
- calcium;
- magnesium;
- dry matter;
- total phosphorus;
- potassium

If found necessary the analysis must also include:

- Ammoniacal nitrogen
- Carbon/nitrogen ratios

The operator must keep a copy of every laboratory's certificate of analysis and of the characterization report made by the agrologist pursuant to his or her mandate for a minimum of 5 years

Every operator of a raising site or spreading site must send the yearly phosphorus report to the Minister. Where, after a change in the raising site or spreading site, the operator no longer has cultivated parcels, the operator must immediately send to the Minister the update of the phosphorus report.

### 2.1.6 Nova Scotia

In Nova Scotia, the *Environmental Regulations Handbook 2<sup>nd</sup> edition* (2004) for Nova Scotia Agriculture regulates farm waste management and water related management practices for the province.

#### *Manure Management Regulations*

There are no municipal by-law restrictions that limit manure application by minimal annual hectares, however this is highly recommended. There are also no specific pieces of legislation, regulations, or by-laws which deal with soil management.

#### *Manure Storage Requirements*

The storage of manure is not regulated under Federal or Provincial Statutes at present. However, an environmental assessment through the NS Department of Environment and Labour is required on any storage holding more than 5000 m<sup>3</sup> of liquid or gaseous substances, which would include liquid manure. There is no mention specifically of solid manure storage requirements.

Municipal by-laws, the location of manure storages, as well as setback distances from neighbouring properties and or streams, may be regulated.

Only storage of very large quantities of fertilizer is regulated. An approval from the NS Department of Environment and Labour is required for the construction or operation of a storage facility that has the capacity to store 250t or more of anhydrous ammonia or 500t or more of granular or prilled ammonia phosphate, ammonium nitrate or urea fertilizer products.

### *Nitrogen Management Regulations*

The Nova Scotia Federation of Agriculture and the NS Department of Agriculture and Fisheries have developed an Environmental Farm Plan Program. This program is voluntary and its goal is to help farmers identify and assess environmental risk by examining their farm operation from an environmental management perspective. It allows farmers to incorporate environmental considerations into their business decision making process rather than addressing environmental issues on a stop gap basis. Since it is voluntary there is very little regulation specific to nutrient management in the region.

Included in the assessment is a consideration of water use and management, farm waste management, manure storage and handling, fertilizer management and livestock production, pest management practices, pesticide storage and application practices. Although the Environmental Farm Plan is voluntary, farmers are encouraged to participate in this program. In 2014, 67 percent of farmers in the province had completed the EFP.

## **2.2 United States**

The section was directly transferred from the document “Jurisdictional Scan of Agricultural Waste Management Regulations and Guidelines” by R. McDougall. 2010.

In the U.S., the Federal CAFO (confined animal feeding operation) rule requires all confined animal agriculture operations that meet the definition of a large or medium-sized CAFO to operate under a permit and to implement a nutrient management plan, with the goal of reducing point source pollution from agriculture. The administration of this rule is delegated to individual states which have developed new, more restrictive regulations to meet the requirements of the rule. The federal definition of a CAFO is an AFO that meets the size definition of either a large or medium CAFO as outlined below. An AFO is an animal feeding operation where animals are confined for 45 days or more in any 12 month period and a crop or vegetation is not maintained on the confined area. Small AFO’s (those with fewer numbers of animals than medium CAFO’s as defined below) are not subject to the federal CAFO rule unless it has been determined on a case-by-case basis that they are significant polluters in which case they can be designated as a CAFO for regulatory purposes. A large CAFO is defined as an animal feeding operation with animal numbers equal to or greater than:

- 700 mature cows, milked or dry,
- 1000 veal calves,
- 1000 cattle other than dairy cows, including heifers, steers, bulls and cow/calf pairs,
- 2,500 swine of 55 pounds or more,
- 10,000 swine of less than 55 pounds,
- 500 horses,
- 10,000 sheep or lambs,

- 55,000 turkeys
- 30,000 laying hens or broilers, if the facility uses a liquid manure handling system,
- 125,000 chickens (other than laying hens) if the facility uses other than a liquid manure handling system,
- 82,000 laying hens if the facility uses other than a liquid manure handling system,
- 30,000 ducks if the facility uses other than a liquid manure handling system,
- 5,000 ducks if the facility uses a liquid manure handling system.

A medium CAFO is defined as an animal feeding operation with:

- 200-699 dairy cows, milked or dry,
- 300 to 999 veal calves,
- 300 to 999 cattle other than dairy cows, including heifers, steers, bulls and cow/calf pairs,
- 750 to 2,499 swine of 55 pounds or more,
- 3,000 to 9,999 swine of less than 55 pounds,
- 150 to 499 horses,
- 3,000 to 9,999 sheep or lambs,
- 16,500 to 54,999 turkeys,
- 9,000 to 29,999 laying hens or broilers if the facility uses a liquid manure handling system,
- 37,500 to 124,999 chickens (other than laying hens) if the facility uses other than a liquid manure handling system,
- 25,000 to 81,999 laying hens, if the facility uses other than a liquid manure handling system,
- 10,000 to 29,999 ducks if the facility uses other than a liquid manure handling system,
- 1,500 to 4,999 ducks if the facility uses a liquid manure handling system.

Individual states have developed various strategies for meeting the CAFO rule. California and Washington State have chosen to regulate by commodity group as well as by size of operation. For instance, CAFO poultry farms must comply with additional manure management regulations. California has identified dairy farms in the Central Valley region of the state as a significant contributor of nitrates in groundwater so the state has opted to regulate all dairy farms in that area of the state. Other CAFO's in the state have less stringent regulations to comply with. Washington State regulates all dairy farms and large CAFO's. Pennsylvania

regulates on the basis of livestock numbers and density; farms with more than 8000 pounds of animals on-site and more than 2000 pounds of animals per acre are regulated, including non-production livestock such as horses and exotic animals. Non-regulated farms in Pennsylvania have to comply with much less rigorous standards based on a voluntary Code of Practice.

### **2.2.1 Washington**

The information on this jurisdiction was directly transferred from the document “Jurisdictional Scan of Agricultural Waste Management Regulations and Guidelines” by R. McDougall. 2010.

Washington State regulates agricultural waste and nutrients through state-approved Nutrient Management Plans for those livestock facilities that are regulated.

#### ***Manure Management & Manure Storage Requirements***

Small or medium sized non-dairy confined livestock operations may also be required to operate under a Nutrient Management Plan at the discretion of regulatory authorities. The Nutrient Management Plan is required to demonstrate that the manure handling and storage system will not cause pollution of state waters (e.g. public water) and that the application of manure is done at an agronomic rate such that there will be minimal risk to groundwater.

#### ***Nutrient Management Regulations***

The state regulates all dairy farms and large non-dairy concentrated animal feeding operations (CAFO's) that have more than 1000 beef animals or 2500 mature swine. The dairy program began in 1998 and nutrient management planning requirements were phased in by 2002. This program is administered by the Washington State Department of Agriculture. Regulation of non-dairy CAFO's came into force in 2006 and requirements were fully phased in by the end of 2010. Non-dairy CAFO's are permitted through the Department of Ecology and must submit a professionally-prepared Nutrient Management Plan for approval. Federally approved Best Management Practices must form the basis of the recommendations in the Plan and once approved, it must be implemented. State legislation contains few standards or requirements for manure storage or application. Surface water and groundwater are protected through the use of federally-approved management practices contained in federal guidance documents or through the use of state-approved equivalent practices.

### **2.2.2 Pennsylvania**

Pennsylvania Nutrient Management Program is regulated by *Act 38* and primarily concerns the management of concentrated animal operations (CAO). Pennsylvania characterizes CAOs as agricultural operations with eight or more animal equivalent units (AEU) where the animal density exceeds two AEU's per acre on an annualized basis. Animal equivalent units are defined as one thousand pounds live weight of livestock or poultry animals, on an annualized basis, regardless of the actual number of individual animals comprising the unit.

#### ***Manure Management & Storage Regulations***

The construction of manure storage facilities is not required unless necessary to protect surface water and groundwater. Nutrient management plans that require the construction of a manure storage facility must describe the planned type, dimensions and capacity of the proposed facility, and the location of the proposed facility shall be identified on a plan map. The siting,

design and installation of manure storage facilities must meet a set of requirements. In cases of excess manure that cannot be stored, utilization plans must be made in place to find alternative uses for the excess.

### ***Nutrient Management Regulations & Guidelines***

CAOs and voluntary operations are required to develop compliance plans relating to nutrient management plans. The plan must contain:

- A summary table of all the purposes of the manure on premises
- A nutrient application summary documenting the planned nutrient applications
- General procedures and provisions for the utilization or proper disposal of excess manure.
- Information on planned beneficial management practices (BMPs); Nitrogen and phosphorus are the only nutrient elements of concern to be addressed by BMPs in the plan

Information of the nutrients in the manure and a determination of nutrients needed for crop production must also be found. Strict guidelines are in place for soil and manure testing to ensure proper and standardized nutrient management. Manure application is limited to nitrogen requirements of the crop, if the application of phosphorus to the soil is not expected to pose an immediate risk of impacts to surface water. On sites that are considered to have the potential for impacting surface water due to runoff or subsurface drainage, the field must be rated using the Pennsylvania phosphorus index.

### **2.2.3 California**

The information on this jurisdiction was directly transferred from the document “Jurisdictional Scan of Agricultural Waste Management Regulations and Guidelines” by R. McDougall. 2010.

Until 2007, California had very limited manure handling and land application standards. As the result of increasing incidences of elevated nitrates and total suspended solids in groundwater in the state, new and much more extensive regulations were passed into law in 2007.

### ***Manure Management and Storage Requirements***

At this time the new regulations apply only to dairy farms located in the Central Valley region of the State. This part of the state has the majority of large confined livestock operations and the highest density of dairy farms in the U.S. There are approximately 2,000 confined livestock operations in the area, 1,700 dairies, 200 poultry operations and 100 others (swine, horse, sheep and others). Most dairy farms have 200-1,400 milking cows. Because of the large number of dairy operations and the fact that the level of nitrates in groundwater under dairy farms has been increasing as the number and size of operations has increased, the state chose to regulate

the dairy industry first. At this time, dairy farms in other areas of the state and other CAFO's are still required to comply with the much less stringent pre-2007 regulations.

The 2007 regulations (*Waste Discharge Requirements General Order for Existing Milk Cow Dairies R5-2007-0035*) require all 1,700 dairy farms in the Central Valley region to:

- Implement annual or more frequent monitoring of manure and waste water, plant tissue, soil, tile drainage water, well water and surface runoff from their property.
- Upgrade existing manure storages to provide sufficient storage to hold all waste produced between manure land application events, all drainage from manure-affected areas and the storm runoff from a 25-year, 24-hour storm event.
- Implement a Nutrient Management Plan prepared for their operation using the results of the required monitoring to ensure that application of manure, wastewater and other nutrients does not exceed crop requirements for nitrogen.
- Submit an Annual Report containing the required monitoring data and evidence that manure storages are adequate and properly maintained and that land application was done in accordance with the Nutrient Management Plan.

### ***Nutrient Management Regulations***

The new regulations in California were driven by the desire to slow the rate of impact on groundwater in addition to reducing impacts on surface water from runoff and leachate from manure collection and storage areas as well as from land application areas. To this end, the regulations require extensive monitoring to set baseline conditions for groundwater quality, surface water quality, and manure, soil and crop nutrient levels. Annual or more frequent sampling of water from all wells on site, of water from tile drains, of irrigation water and of surface runoff water during storm events is required with the results used to determine whether nutrient application rates are in balance with crop uptake. Testing data from manure and crop tissue is used to develop application rates. Dairies where one or more existing wells have nitrate-N levels over 10 mg/L will be required to install monitoring wells up-gradient and down-gradient from manure storages and land application areas on a case-by-case basis (studies have shown that up to 63% of dairy farms have at least one well with elevated nitrates) and monitoring results are to be used to assess to what extent these operations are reducing nutrient movement into ground and surface water.

## **2.3 Europe**

### ***Nutrient Management Regulations Criteria***

This section was directly transferred from the document "Jurisdictional Scan of Agricultural Waste Management Regulations and Guidelines" by R. McDougall. 2010.

The EU passed into law its *Nitrates Directive* in 1991. This required all member states to institute measures to reduce the impacts of nitrates from agriculture on surface and ground water. Each member state was required to identify areas of the state that were vulnerable to impacts from agriculture as 'nitrate vulnerable zones', and apply nutrient restrictions in those areas. As the result of this law, all member states have developed new manure management regulations in the past 5-10 years. Ireland and Holland have designated the whole country as a vulnerable zone, and regulations apply to all farms in those countries. The whole of Denmark is also designated as a vulnerable zone but it regulates only farms with greater than 10 livestock units (for example, more than 9 dairy cows) on 10 hectares. The UK has regulations that apply only to farms within the identified vulnerable zones; all others voluntarily comply with a Code of Practice.

### 2.3.1 UK

The *Nitrate Pollution Prevention Regulations* (2008) regulate the use of manure and fertilizers, specifically targeting the reduction of nitrate contamination. The UK has designated 70% of the land base of the country as nitrate vulnerable zones based on existing or potential nitrate pollution of the surface or ground water, and has developed an action program for those areas. All farms located in these vulnerable zones are required to comply with the regulations.

#### *Manure Management Requirements*

Manure application is limited by certain conditions that must be met. Annually the total amount of nitrogen in livestock manure applied to the holding or operation, whether directly by an animal or by spreading, does not exceed 170 kg multiplied by the area of the holding in hectares. The operator must also record in detail the exact quantity, use, and nutrient content of the manure to be spread. There have also been strict guidelines to MDS for manure application, winter application, and applications periods based on soil type.

#### *Manure Storage Requirements*

For the storage of manure regulation states that it must be stored:

- In a vessel;
- In a covered building;
- On an impermeable surface; or
- In the case of solid manure that can be stacked in a free standing heap and that does not drain liquid from the material, on a temporary field site.

For temporary field storage it must not be:

- in a field liable to flooding or becoming waterlogged;
- within 50 metres of a spring, well or borehole or within 10m of surface water or a land drain (other than a sealed impermeable pipe)
- located in any single position for more than 12 consecutive months
- located in the same place as an earlier one constructed within the last two years



### *Nutrient Management Regulations*

In nitrate vulnerable zones, farms are required to limit the application of nitrogen in manure to 170 kg per hectare per year averaged over the whole farm, and a maximum of 250 kg per hectare per year on an individual field. Manure volume and content of nitrogen are based on standard values found in the legislation. Farms are also required to have sufficient storage capacity to cover the winter prohibited manure application period or to demonstrate that they have sufficient land base that is considered at low risk of nitrogen runoff into surface water. As in Ireland, farm subsidy payments are linked to compliance with the regulation. Failure to comply with the requirements of the regulations could result in deductions to subsidy payments.

#### **2.3.2 Denmark**

The information on this jurisdiction was directly transferred from the document “Jurisdictional Scan of Agricultural Waste Management Regulations and Guidelines” by R. McDougall. 2010.

Denmark has had nutrient management Action Plans in place since 1987 to address concerns about nitrogen and phosphorus loading of the land base and subsequent pollution of surface and groundwater.

### *Manure Management and Storage Requirements*

The goal of the country’s first Action Plan in 1987 was to reduce nitrogen loading by 50% country-wide and the amount of phosphorus runoff from farmyards (Action Plan 2004, Kronvang, date unknown). Measures instituted to accomplish this included:

- 9 months manure storage capacity - recommended
- Limits on manure application rates
- Incorporation of manure within 12 hours
- Optimal use of nitrogen through appropriate application rates and crop rotations
- Mandatory green cover on fields over winter.

Additional measures were instituted in 1991 in the country’s second Action Plan because it was clear that the 1987 measures were not sufficient to meet the nutrient reduction goals. These included:

- Mandatory 9 months storage capacity for all regulated farms.
- More stringent and fixed requirements for application of nitrogen in manure
- Farms required documenting fertilizer application.
- Application of slurry prohibited from harvest to February.

### ***Nutrient Management Regulations***

The following measures were instituted in 2005:

- A tax on phosphorus in feed (4 Denmark Kroner or USD 0.74 per kilogram of Phosphorus).
- A nitrogen quota system for farms.
- A 10% reduction in standard nitrogen application rates for crops.
- 50,000 hectares of crop-free buffer zones 10 metres wide along lake and river shores to reduce phosphorus runoff from agricultural sites.
- Annual reporting requirements for farms, and random inspections to ensure compliance. Subsidy payments linked to compliance with nutrient regulations.
- Enhanced odour guidelines and increased setback requirements to minimize odour complaints

Denmark's current nutrient management strategy is based on limiting over-application of nitrogen in manure and fertilizer by requiring farms to adhere to a nitrogen budget. Manure nitrogen content and availability to crops are determined using standard values. Crop uptake is also based on standard values that vary depending on expected yield, soil type and irrigation rate. Phosphorus application is limited through a two-fold approach. The tax on phosphorus in feed brought onto the property encourages feed companies to reduce the level in feed. The system of crop-free buffers between cropped land and surface water will reduce runoff of phosphorus in soil and manure.

#### ***2.3.3 Netherlands***

The information on this jurisdiction was directly transferred from the document "Jurisdictional Scan of Agricultural Waste Management Regulations and Guidelines" by R. McDougall. 2010.

The Netherlands has one of the highest densities of livestock in the EU and as a result has had a manure surplus for many years which has impacted surface and ground water quality throughout the country (Manure policy and MINAS, 2005). In 1997, the country as a whole had a nitrogen surplus of 249 kilograms per hectare from manure and chemical fertilizer. The country has instituted various policies to deal with the manure surplus and has reduced but not eliminated the surplus. Nitrate levels in surface and ground water in many areas of the country remain above the EU standard of 50 mg/L.

#### ***Manure management***

The Netherlands has had programs in place since 1985 to reduce the excess loading of nitrogen and phosphorus from agriculture. The first program placed a moratorium on expansion of the pig and poultry industries and capped application rates of phosphorus on agricultural land. It introduced a milk quota system to cap expansion of the dairy industry. The program also

encouraged technological solutions to the manure surplus such as pelletizing of manure so that it could be exported. This program resulted in only minor reductions in the nutrient surplus.

### ***Manure Application Regulations***

Further restrictions on application of nutrients were enforced in 1990. These included a gradual reduction of the application limit for phosphorus from all sources (as phosphate) from 350 kg per hectare in 1990 to 80 kg per hectare in 2002. There was also a ban on winter application of manure, a legislated lowering of protein and phosphorus in animal feeds and increasing transport of manure from surplus areas to undersupplied areas.

Manure programs also focused on reducing the ammonia emissions from agricultural activities as per an EU directive. Measures included requiring manure to be injected or incorporated, requiring covers for manure storages and requiring new livestock facilities to incorporate low emissions design. The result of the low emissions program was to increase the amount of nitrogen in manure by decreasing gaseous losses which further exacerbated the nitrogen surplus problem.

The current program was put in place in 2004 and is called the 'Netherlands 3rd Action Program'. It consists of a number of regulations designed to reduce the loading of nitrogen and phosphorus from agriculture to the country's surface and ground water. The whole of the country was designated a 'nitrate vulnerable zone' and manure storage and application regulations were developed to meet the requirements of the EU *Nitrate Directive*. The regulations apply to every farm in the country. These include:

- A prohibition on manure and fertilizer nitrogen application from September 1 to January 31 and the requirement for all farms to have 6 months of storage or demonstrate on a case-by-case basis that they have access to land that can, without risk of pollution, receive manure during the winter months. Fields planted to winter crops are allowed to apply some manure and fertilizer.
- Application of nitrogen from manure is limited to 170 kilograms per hectare per year.
- Application of phosphorus in all forms is limited to 41 kilograms per hectare on grassland and 32 kilograms per hectare on arable land (95 and 75 kilograms per hectare phosphate respectively). In some cases, this reduces the allowable application rate of nitrogen from manure to below 170 kilograms per hectare.
- Manure application must be done with low emissions techniques including injection and incorporation.

### ***Nutrient Management***

The calculation of the amount of nitrogen and phosphorus in manure for confined animal operations is based on the difference between the amount of these nutrients in the feed and the amount leaving the property in the 'products', less gaseous losses of ammonia from the system. It was found that basing the nutrient content on average manure values was less accurate. For grazed animals, the calculation is based on a nutrient balance that considers the

amount of nutrients cycled during grazing as well as inputs and outputs. This is different from the system in place in the UK and Ireland where manure nutrient content is based either on 'book values' or on site-specific analytical values. The calculation of nitrogen required by crops must consider the amount of soil residual nitrogen and the expected mineralization of nitrogen from the soil as well as crop requirements. Crop requirements are based on country-wide research-based standards for each crop.

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## Appendices

### Appendix A – Alberta’s Soil Nitrogen Limits

#### Nitrate-Nitrogen Limits

The nitrate-nitrogen (NO<sub>3</sub>-N) levels in the top 60 cm of the soil profile must not exceed the following limits shown in Table 3.

**Table 3**  
**Nitrate-Nitrogen Limits**

| Soil               | Sandy (> 45% Sand and Water Table < 4m) | Sandy (> 45% Sand and Water Table > 4 m) | Medium and Fine Textured Soils |
|--------------------|-----------------------------------------|------------------------------------------|--------------------------------|
| <b>Brown</b>       | 80 kg/ha (75 lb/ac)                     | 110 kg/ha (100 lb/ac)                    | 140 kg/ha (125 lb/ac)          |
| <b>Dark Brown</b>  | 110 kg/ha (100 lb/ac)                   | 140 kg/ha (125 lb/ac)                    | 170 kg/ha (150 lb/ac)          |
| <b>Black</b>       | 140 kg/ha (125 lb/ac)                   | 170 kg/ha (150 lb/ac)                    | 225 kg/ha (200 lb/ac)          |
| <b>Grey Wooded</b> | 110 kg/ha (100 lb/ac)                   | 140 kg/ha (125 lb/ac)                    | 170 kg/ha (150 lb/ac)          |
| <b>Irrigated</b>   | 180 kg/ha (160 lb/ac)                   | 225 kg/ha (200 lb/ac)                    | 270 kg/ha (240 lb/ac)          |



## Appendix B – Saskatchewan’s Animal Units

### Animal Unit

| Type | Kind of Animal                | Number that equals<br>One Animal Unit |
|------|-------------------------------|---------------------------------------|
| 1    | Poultry                       |                                       |
|      | a) Hens, cockerels, capons    | 100.0                                 |
|      | b) Chicks, broiler chickens   | 200.0                                 |
|      | c) Turkeys, geese, ducks      | 50.0                                  |
| 2    | Hogs                          |                                       |
|      | a) Boars or sows              | 3.0                                   |
|      | b) Gilts                      | 4.0                                   |
|      | c) Feeder pigs                | 6.0                                   |
|      | d) Weanling pigs              | 20.0                                  |
| 3    | Sheep                         |                                       |
|      | a) Rams or ewes               | 7.0                                   |
|      | b) Lambs                      | 14.0                                  |
| 4    | Goats                         | 7.0                                   |
| 5    | Cattle                        |                                       |
|      | a) Cows or bulls              | 1.0                                   |
|      | b) Feeder cattle              | 1.5                                   |
|      | c) Replacement heifers        | 2.0                                   |
|      | d) Calves                     | 4.0                                   |
| 6    | Horses                        |                                       |
|      | a) Colts or ponies            | 2.0                                   |
|      | b) other than colts or ponies | 1.0                                   |
| 7    | Bison                         |                                       |
|      | a) Cows or bulls              | 1.0                                   |
|      | b) Calves                     | 4.0                                   |
| 8    | Fallow Deer                   |                                       |
|      | a) Fallow deer                | 8.0                                   |
|      | b) Fallow deer fawns          | 32.0                                  |

|                              |      |
|------------------------------|------|
| <b>9 Domestic Indigenous</b> |      |
| a) Elk                       | 5.0  |
| b) Elk calves                | 20.0 |
| c) White-tailed deer         | 8.0  |
| d) White-tailed deer fawns   | 32.0 |
| e) Mule deer                 | 8.0  |
| f) Mule deer fawns           | 32.0 |

7 Jun 96 cA-12.1 Reg 1.

## Appendix C – Manitoba’s soil nutrient class limits

**Table 1. Soil Nitrate-Nitrogen Limits and Phosphorus Thresholds**

| Nutrient Management Zone and Agriculture Capability |                                                                     | Residual <sup>†</sup> soil nitrate-nitrogen limits within the top 60 cm (24 inches) of soil | Nutrient Management Zone | Soil phosphorus (P) thresholds within the top 15 cm (6 inches) of soil (Olsen P) | Allowable application rate of P expressed as P <sub>2</sub> O <sub>5</sub> |
|-----------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------------------------------|--------------------------|----------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| Zone                                                | Soil Class                                                          | kg/ha (lb/ac)                                                                               | Zone                     | Parts per million (ppm)                                                          | kg/ha (lb/ac)                                                              |
| N1                                                  | class 1, 2 and 3 except any 3M* subclass                            | 157.1 (140)                                                                                 | N1                       | <60                                                                              | no restriction                                                             |
|                                                     |                                                                     |                                                                                             |                          | between 60 and <120 (ppm)                                                        | two times the crop removal rate **                                         |
| N2                                                  | any 3M* subclass, class 4 and 5M* subclass if it is being irrigated | 101 (90)                                                                                    | N2 and                   | between 120 and <180                                                             | one times the crop removal rate **                                         |
| N3                                                  | class 5 except 5M§ under irrigation                                 | 33.6 (30)                                                                                   | N3                       | 180 and more                                                                     | no application without approval by the director                            |
| N4                                                  | class 6, 7, and unimproved organic                                  | no nitrogen applications                                                                    | N4                       | no phosphorus applications                                                       |                                                                            |
| NB                                                  | not applicable                                                      | no nitrogen applications                                                                    | NBZ                      | no phosphorus applications                                                       |                                                                            |

\* A “3M” subclass includes soil classes 3M, 3ME, 3MI, 3MN, 3MP, 3MT, 3MW and any other subclass of soil class 3 having an “M” subclass designation.

§ A “5M” subclass includes soil classes 5M, 5ME, 5MP, 5MT or 5RM and any other subclass of soil class 5 having an “M” subclass designation.

NBZ Nutrient Buffer Zone (Table 2)

\*\* May apply manure at up to five times the annual crop removal rate provided the next application does not occur until the equivalent number of application years have passed or soil test phosphorus levels at any place in the field do not exceed the soil test values prior to the manure application. However, the annual nitrate nitrogen limits must not be exceeded.

† At the end of the growing season after the production of a crop.

Information on soil class (agriculture capability) may be accessed via Agri-Maps at the following link:  
<http://geoapp2.gov.mb.ca/website/mafri/index3.html>