Comprehensive Nutrient Management Plan

For
Cold Springs Farm
6636 West Blanding Road
Hanover, Illinois 61041
PROJECT #: 238-08012A

Prepared in Cooperation with the:

USDA – Natural Resources Conservation Service

And

Elizabeth Field Office
Jo Daviess Soil and Water Conservation District

227North Main Street
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Approved Conservation Planner and Certified CNMP Specialist
As an Approved Conservation Planner, I certify that I have reviewed this CNMP for technical adequacy and that the elements of the CNMP are technically compatible, reasonable and implementable.

MANURE AND WASTEWATER HANDLING AND STORAGE
Signature____ Date: ____________
Name & Title: James L. Evans, PE TSP # 075737

LAND TREATMENT PRACTICES
Signature____ Date: ____________
Name & Title: JIM E. McQUILKIN, CCA TSP # 055168

NUTRIENT MANAGEMENT PLAN
Signature____ Date: ____________
Name & Title: JIM E. McQUILKIN, CCA TSP # 055168

Owner/Operator
As the owner/operator of this CNMP, I certify that I, as the decision maker, have been involved in the planning process and agree the items/practices listed in each element are needed. I understand that I am responsible for keeping all the necessary records associated with the implementation of this CNMP. It is my intent to implement/accomplish this CNMP in a timely manner as described in the plan.

Signature: ____ Date: _________

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SECTION 1
CNMP Purpose and Conditions

Purpose of the Comprehensive Nutrient Management Plan (CNMP)

The Comprehensive Nutrient Management Plan (CNMP) is a conservation system for your animal feeding operation. It is designed to address, at a minimum, the soil erosion and water quality concerns on your operation. The following soil erosion and water quality concerns have been identified on your farm:
(Check those that apply)

	Soil Quality Concerns		Water Quality Concerns		Other Concerns Addressed
X	Ephemeral Gully Erosion	X	Facility Wastewater Runoff	X	Aesthetics
	Gully Erosion	X	Manure Runoff (From Facilities)	X	Time Available for Manure Application
	Stream/Ditchbank Erosion		Manure Runoff (Field Application)	X	Biosecurity
X	Sheet and Rill Erosion		Nutrient in Ground Water		Minimize Nutrient Costs
	Soil Compaction	X	Silage Leachate		Neighbor Relations
		X	Excessive Soil Phosphorus Test	X	Profitability
			Tile-Drained Fields	X	Regulations
		X	Maximize Nutrient Utilization		Odors
		X	Acres Available for Manure Application		Air Quality

Manure and Nutrient Management is managing the source, rate, form, timing, placement and utilization of manure, other organic by-products, bio-solids, and other nutrients in the soil and residues. The goal is to effectively and efficiently use the nutrient resources to adequately supply soils and plants to produce food, forage, fiber, and cover while minimizing the transport of nutrients to ground and surface water and environmental degradation.

Nitrogen and Phosphorus vs. Water Quality

Nitrogen and Phosphorus are two nutrients that have the potential to impair the quality of our groundwater and surface water. Nitrogen leaching out the root zone may enter a tile and be transported to surface water or it may leach to the groundwater. The EPA Drinking Water Maximum Contaminant Level (MCL) for Nitrates is 10 mg/L. Phosphorus leachate, or runoff entering the surface water may contribute to excessive algae growth, which may cause low oxygen levels in surface water. This in turn may impair aquatic life. This manure and nutrient management plan will help to protect the groundwater and surface water.

Conditions:

The State of Illinois has several regulations which apply to your facility including but not limited to the Livestock Management Facilities Act 510 ILCS 77/1, the Illinois Environmental Protection Act 415 ILCS 5/27, and the Illinois Dead Animal Disposal Act 225 ILCS 610 and 415 ILCS 5/1. Your CNMP provides the basic information on how the wastes produced from your operation, and/or applied on your fields, will be utilized. Following your CNMP will help keep you in compliance with the State of Illinois Pollution Abatement Regulations.

Note: If the number of livestock change (10% or more), your fields change, your rotation changes, the method of storage changes, or if the method of application needs to change contact the plan developer to get this plan revised.

Utilization of Excess Manure: If wastes will be utilized on land not controlled by you an agreement shall be signed by the individual, broker, or group accepting the waste stating: THE ANIMAL WASTE WILL BE APPLIED TO LAND TO MEET THE MINIMUM “NRCS FIELD OFFICE TECHNICAL GUIDE” STANDARDS FOR WASTE UTILIZATION (633) AND NUTRIENT MANAGEMENT (590); OR HAVE A “NUTRIENT

MANAGEMENT PLAN" (NMP) DEVELOPED ON THEIR LAND WITH NRCS OR APPROVED 3RD PARTY ASSISTANCE.

SECTION 2
Farm Overview
(Farm Pictures, Plat maps, Topo maps)

All fields have been identified as reasonably close to the site (<5 miles). The LMFA and NRCS standard 590/633 allow a buildup of up to 300 lb/acre of P1. It is not desirable to reach levels higher than 300lb/ac of P1.

The setbacks for all the application fields are listed below. All setbacks are in conjunction with the application of manure with or without incorporation.

Setback	Distance, ft
Wells	150
Surface Water	200
Residence[1]	1320

[1] If manure is not injected or incorporated on day of application.

{*Describe Topography*}

SECTION 3
Emergency Response Plan

(See Emergence response plan folder for forms)

SECTION 4
Manure and Wastewater Handling and Storage Component

SECTION 5
Land Treatment Component
(Fields and Yields, Practices, RUSLE2)

SECTION 6
Cost and Quantities of New Practices

SECTION 7
Nutrient Management Component
(Soil Testing Plan, Manure Testing Plan, Nutrient Management Plan Spreadsheet)

Manure Application Plan
Basis of Nutrient Management
Manure application rates in this plan are based upon crop uptake of Phosphorus. The owners need to be investigating ways to make off-site transfer of manure or contract more acres for spreading the animal waste. Phosphorus Soil test on this farm are very high, ranging from a high of 550 to a low of 81 pounds per acre.

Notes and Assumptions:
- **Avail. N*** is the estimated amount of nitrogen remaining after losses due to application method and timing.
- For liquid manure applications, see attached spreadsheets in this section
- When liquid manure is applied to fields with tile, drainage tile plugs (or similar devices) shall be available on-site to plug tile outlets should manure begin to flow from the tile outlets.

Soil Testing Plan
Soil test will be taken every 4 years on each field. Soil tests will be taken in the spring using University of Illinois Agronomy Handbook recommendations. SEE APPENDIX B (Soil Testing Procedures & Results)

Manure and Wastewater Testing/Analysis Plan
Manure shall be analyzed on an annual basis from each storage structure for: % Solids, Total N, Organic N, NH_4 or NH_3, P_2O_5, K_2O, and pH. SEE APPENDIX C (Manure Analysis/Sampling Procedures & Results)

Estimated Manure Nutrient Analysis
See attached Nutrient Management Plan for manure sources and analysis.

Commercial Fertilizer Application Plan

Commercial Fertilizer applications are planned in accordance with those shown in the attached spreadsheets.
Fields 80A and 80B is the combination of strip crop fields 30, 32, 33, 34, 35, 40, 110 that have a corn (80A) and Hay (80B) rotation.
Fields 81A and 81B is the combination of 38, 39, 41, 42 , 43, 44, 68, 78, 109 that have a corn (81A) and hay (81B) rotation.
Field 82 is the combination of 6, 47, 48, 49, 50, 51, 53, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 111 that have a corn (82A) and hay (82) rotation.

A complete nutrient management plan using manure and commercial fertilizers to balance crop needs follows.
{Insert the MSI Manure Nutrient Management Program spreadsheets}

Any changes to manure analysis, soil tests, yields, cropping rotations or fields where manure is applied will require this plan to be updated.

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Illinois Phosphorus Risk Assessment Procedure

Phosphorus (P) loading to surface water can accelerate Eutrophication. The availability of other nutrients and light penetration into the water column will also influence the response of water bodies to phosphorus. Factors such as: the amount of erosion and runoff; the form, amount, and distribution of phosphorus in the soil: and fertilizer and manure application rate, timing and placement determine P loss from agricultural fields and the resulting P loading to water resources. Most phosphorus compounds found in soils have low water solubility. Consequently, P loss from agricultural land was once thought to be primarily associated with soil erosion. In many cases, sediment-bound P is still the dominant form in which P losses from agricultural fields occur. Over the past decade, research has shown that phosphorus can be lost in runoff in dissolved forms. High dissolved P concentration in runoff is more frequently observed where soil P levels are high particularly near the soil surface. High soil P levels, however, do not automatically equate to high dissolved P in runoff. As stated earlier, numerous factors interact to create the potential for P losses from agricultural fields. Many of the basic processes that govern P transport are known. It is difficult, however, to know at any given site which factor(s) influence P loss rates proportionally more than others. Insufficient data exist in Illinois to definitively guide landowners as to which factors in a specific field contribute the most to P losses. There are indications, however, that where solution P losses from crop fields are dominant, high soil P concentration at the surface are likely the most dominant factor.

The purpose of this guide is to (1) help land managers identify factors in agricultural fields known to contribute "P" runoff loss and, (2) identify practices that can reduce phosphorus loss from agricultural fields. The factors most commonly associated with both dissolved and sediment bound P loss are presented. For each factor, guidance is provided to help land managers estimate the relative potential for P transport to surface water. It is important to realize that the procedure is not a predictive tool for P loading. It is merely a tool for assessing the relative potential for phosphorus transport.

Use of P- Risk Assessment:

When possible, land managers should adopt management practices that minimize phosphorus loss risk factors. If phosphorus containing materials need to be applied to fields that have medium or high risk potentials, recommended management practices should be used to reduce the risk of phosphorus transport.

Examples of Practices to Reduce Phosphorus Risk Potential Soil Erosion Control:

- Use residue management and/or structural practices to reduce sheet and rill erosion.
- Install filter strips, riparian forest buffers, contour buffer strips, field borders, or wetlands

Minimize Connectivity to Water Bodies:

- Install water and sediment control basins to reduce quantity of sediment transported offsite
- Install conservation buffers adjacent to water resources to create nutrient application setbacks.

Reduce Runoff Potential:

- Terrace fields to reduce slope length.
- Contour strip cropping, contour buffer strips, cover crops, crop rotations that include meadow and/or small grains, and crop residue management.

Lower Soil Test Phosphorus:

- Sample soils on high testing fields to determine vertical distribution of the phosphorus.
- If phosphorus is concentrated in the top two inches of soil, invert the soil (e.g. moldboard plow) where soil erosion will not be a problem.
- Avoid stratification by placing phosphorus materials beneath the top two inches of the soil surface.

Practice Nutrient Management:

- Apply no more than maintenance levels of phosphorus when soil test P reaches the levels described in the Illinois Agronomy Handbook, Chapter 11.

Phosphorous Risk Assessment - Site Characteristic Definitions:

1. SOIL EROSION – Sheet and rill erosion as measured by the most current version of the Revised Universal Soil Loss Equation (RUSLE).
2. CONNECTIVITY TO WATER – Defines the potential for P to be transferred from the site to a perennial stream or water body. The more closely connected the runoff is from the field via concentrated flow (from a defined grassed waterway or surface drain) to a perennial stream or water body the higher the potential for of P transport.
3. RUNOFF CLASS – Represents the effect of the Hydrologic Soil Group (A, B, C, D) on runoff. This factor represents the site's runoff vulnerability.
4. SOIL "P" TEST (BRAY P1 or Mehlich 3) – The soil test procedure using the Bray P1 extraction, or other extraction test calibrated to Bray P1, that provides an index of plant available P expressed in lbs. P/ac (PPM X 2 = lbs./ac where soil samples are obtained to the 6 2/3" depth).
5. "P INPUTS" - Represents the combined effect of application method and application rate on the potential for phosphorus to be transported in runoff in both dissolved and sediment-bound phases. Phosphorus application rate is expressed in terms of the University of Illinois maintenance phosphorus recommendations applicable to crops/yields grown on the site being evaluated. See the "P Inputs Matrix" below. Phosphorus may be in the form of commercial fertilizer or organic materials such as manure, animal waste lagoon supernatant, wastewater from municipal or agricultural sources or nonagricultural biosolids such as sewage sludge or landscape waste. When using the "P Input Matrix, it is assumed that soil incorporation is performed prior to runoff events. Instances where incorporation is typically not performed prior to runoff events will

be considered as non-incorporated surface applications.

P INPUT MATRIX

	Application Rate		
Application Method	**<= UI Recommendations**	**>UI – 150% UI**	**>150% UI**
Incorporation or Injection > 3" below surface	Low	Low	Low
Shallowly incorporated surface applications <3 inches	Low	Medium	High
Non-incorporated surface applications	Medium	High	High

<u>Recommended Management Practices to Reduce Phosphorus Losses</u>

1. Perform soil test regularly (minimum of every four years) and follow University of Illinois' recommendations for application rates.
2. Do not maintain excessively high phosphorus soil test levels, especially in areas prone to phosphorus transport.
3. Use variable rate applications to increase the precision of phosphorus applications and to maintain rates needed for optimal crop production.
4. In areas where phosphorus losses occur primarily from surface runoff, incorporate or inject phosphorus beneath the soil surface.
5. Control soil erosion to 'T' or less.
6. Utilize agronomic practices that optimize crop production to maximize phosphorus utilization.
7. Use filter strips or riparian forest buffers to reduce offsite transport of particulate phosphorus.
8. Avoid applying nutrients when soils are frozen or covered with ice or snow.
9. Fall applications of phosphorus that are not incorporated into the soil should not be applied on slopes greater than 5% unless runoff control measures such as heavy residue cover, contour mulch tillage, contour strip cropping, or terraces have been applied.
10. Minimize surface runoff of water by reducing compaction, maintaining high crop residue levels, installing runoff control structures such as terraces, etc.
11. Avoid stratification on soils that are susceptible to runoff and erosion.

<u>Field Specific Phosphorus Risk Factors</u>

The table below identifies specific risk factors that may present in a given field. No attempt should be made to "average" the factors and assign a composite rating for the field. It is recognized that the risk factors do not act independently to influence phosphorus loss from agricultural fields and P loading into water resources. Simple averaging however, assumes that all risk factors have the same amount of influence. Attempts to objectively weight some factors more or less than others would be desirable but difficult without supporting data. The phosphorus assessment procedure is not a process based or empirical model. The procedure was developed as a conservation planning tool. The tool is designed to provide guidance to select and plan conservation measures that will lower the potential for phosphorus loss from agricultural fields and P loading into water resources.

	P Risk Factors					
Field Number	Soil Erosion Factor RUSLE	Connectivity to surface water	Runoff potential (Hydrological group)	P1 Soil Test	"P inputs"	**Management to maintain Low 'P inputs' risk**
T4316-1,13,16,21,28,29,89,90	Low	Low	Medium	High	Low	Manure will be surface applied and incorporated on day of application and current tillage practices will be maintained to minimize erosion
T4316-10, 15,18,19,20, 22,73	Low	High	Medium	High	Low	Manure will be injected and current tillage practices will be maintained to minimize erosion
T4316-71,72, 74,75,77,80, 81,82,108	Low	Medium	Medium	High	Low	Manure will be injected and current tillage practices will be maintained to minimize erosion
T3608-8	Low	Low	Medium	High	Low	Manure will be injected and current tillage practices will be maintained to minimize erosion. Manure will be applied at the crop P uptake rate and will not build.
3608-14	Low	High	Medium	High	Low	Manure will be injected and current tillage practices will be maintained to minimize erosion. Manure will be applied at the crop P uptake rate and will not build.
3605-15	Low	High	Medium	High	Low	Manure will be injected and current tillage practices will be maintained to minimize erosion. Manure will be applied at the crop P uptake rate and will not build.
3605-9	Low	low	Medium	High	Low	Manure will be injected and current tillage practices will be maintained to minimize erosion. Manure will be applied at the crop P uptake rate and will not build.

For this plan Strip crop fields 30,32,33,34,35,40,110 have been combined into field 80. Rotation corn and hay.
Strip crop fields 38,39,41,42,43,44,68,78,109 have been combined into field 81. Rotation corn and Hay
Strip crop fields 6,47,48,49,50,51,53,58,59,60,62,63,64,65,66,67,111 have been combined into field 83. Rotation is corn – hay.

Generalized Interpretation of Phosphorus Ratings & Management

LOW potential for P movement from the field. If current farming practices are maintained there is a low probability of an adverse impact to surface waters from P loss.

MEDIUM potential for P movement from the field.

HIGH potential for P movement from the field and for an adverse impact on surface waters.

VERY HIGH potential for P movement from the field and an adverse impact on surface water. A complete soil and water conservation system is needed. No P application should be planned until risk is reduced.

Illinois Nitrogen Risk Assessment Procedure

Nitrate loss potentials based on soil texture, timing, and nitrification inhibitors			
FIELDS:	**None**	**All Fields**	**None**
Application Timing[1]	**Soil Texture[2]**		
	Coarse	**Medium**	**Fine**
Fall with an inhibitor > 60^{o} F	High	High	High
Fall with an inhibitor < 60^{o} F	High	Medium	Medium
Fall without an inhibitor > 50^{o} F	High	High	High
Fall without an inhibitor < 50^{o} F	High	Medium	Medium
Spring without an inhibitor	Medium	Medium	Medium-Low
Spring with an inhibitor	Medium-Low	Low	Low
Spring split applied or sidedress	Medium-Low	Low	Low

Foot notes:

1. Temperatures refer to soil temperature measured at a depth of 4 inches. For this assessment, inhibitors refer to nitrification inhibitors.
2. Soil Texture: Coarse - sand, loamy sand, sandy loam
   Medium - silt, silt loam, loam
   Fine - silty clay loam, silty clay, clay, clay loam, sandy clay, loam, sandy clay

NITROGEN RISK SUMMARY

All of the fields behave essentially the same under the following management regarding nitrogen conservation:

- High risk of nitrogen losses if fall applied without use of an inhibitor until temperatures are below 50 degrees at a depth of 4”.
- Medium risk of nitrogen loss if fall applied with a nitrification inhibiter added.
- Medium to Low risk if spring applied without an inhibiter.
- Low risk if spring applied with a nitrification inhibitor added.
- Low risk if split applied or sidedress.

Recommended Management Practices to Reduce Nitrogen Losses:

1. Set realistic yield goals and follow University of Illinois' nitrogen recommendations.
2. Take credit for nitrogen from **all** sources: previous legume crop, incidental nitrogen contained in diammonium phosphate (DAP) and other fertilizers, manure applications, etc.
3. Determine nitrate loss potential using the table above. Use this as a guideline to determine application timing for fields with various soil textures. (More detailed information on total nitrogen loss potential is available in the University of Illinois Agricultural Experiment Station Bulletin 784, Nitrogen-Loss Potential Ratings for Illinois Soils.)
4. In fields where spring applications are not usually troublesome, apply the majority of the nitrogen shortly before or after planting.
5. For fall applications, use a nitrification inhibitor or wait until the soil has cooled down to 50^{o} F. Even when applying a nitrification inhibitor, do not apply nitrogen until soil has cooled to 60^{o} F. Probable dates when these soil temperatures are expected are contained in the *Illinois Agronomy Handbook.* In most cases, fall nitrogen and manure applications should not begin prior to the third week in October.
6. Use adequate levels of phosphorus, potassium, and other nutrients to ensure optimum yields and nitrogen use efficiency.
7. Conduct a post-harvest evaluation of the nitrogen program:
    - Compare actual yields vs. yield goal;
    - Evaluate factors affecting yields and nitrogen use efficiency;
    - Consider using plant tissue analyses and an end-of-season corn stalk nitrate test to evaluate plant nitrogen sufficiency;
    - Refine nitrogen rates for future years.
8. Review each nutrient management plan annually to determine if changes in the nutrient budget are needed.
9. Calibrate application equipment annually, at minimum, to ensure uniform distribution of material at planned rates.
10. Use filter strips and riparian forest buffers to intercept nutrients transported surface runoff to the stream. (Note: these practices will have minimal effect in areas with extensive subsurface drainage.)
11. Avoid applying nitrogen around environmentally sensitive areas such as sinkholes, wells, gullies, ditches, surface inlets, or rapidly permeable areas.
12. Use cover crops, such as rye, to capture residual nitrogen after harvest and prevent nitrogen from being lost between harvest and planting of the next crop.
13. Utilize water table management to reduce artificial drainage when it is not needed for crop growth or field operations.
14. Utilize water table management to reduce artificial drainage when it is not needed for crop growth or field operations.
15. Outlet tiles into constructed wetlands to remove a portion of the nitrogen before tile effluent discharges into lakes or streams.

SECTION 8

Amendments/Changes/RECORDS

As records are collected each year. They should be placed in this section. All records are considered potential changes to this plan. Changes to this plan will require it to be updated.

Call Maurer-Stutz, Inc. at (309)693-7615

CNMP

APPENDICES

APPENDIX A
Maps
(Aerial Maps, Soils Maps)

{*Insert soil survey maps – mark field boundaries*}

{*Insert Aerial maps – field maps, mark field boundaries, wells, setback distances, sensitive areas, proposed practices*}

APPENDIX B
Soil Testing Procedures
(Soil Test Results)

Soil samples for soil tests should not represent more than 2.5 acres. The fields will be sub-divided into units of approximately 2.5 acres for soil sampling and nutrient planning purposes. Soil sampling depth for P and K shall be 7 inches. Under no till conditions pH can be tested using the top 4 inches only.

Soil samples shall be collected and prepared according to The Illinois Agronomy handbook. Take soil samples prior to manure application (e.g., Mid Autumn). Since manure will typically be applied to soybean stubble anticipating a corn crop in the spring, soil tests should either be taken in corn stalks or soybean stubble prior to manure application. Wait 9 months after manure application before soil testing.

Soil testing shall include analysis for any nutrients for which specific information is needed to develop the nutrient plan. Request analyses pertinent to monitoring or amending the annual nutrient budget, e.g. pH, electrical conductivity (EC), soil organic matter, nitrogen, phosphorus, and potassium.

Soil Analysis

The minimum analysis for Illinois is to include:

- pH
- Phosphorus (P as indicated by Bray P1 test)
- Potassium (K)

{INSERT SOIL TESTS}

APPENDIX C
Manure Analysis Procedures
(Manure Analysis Results)

Solid Manure (Dairy, Beef, Swine, Poultry)

Collect a composite sample by following one of the procedures listed below. A method for mixing a composite sample is to pile the manure and then shovel from the outside to the inside of the pile until well mixed. Fill a one-gallon plastic heavy-duty zip lock bag approximately one-half full with the composite sample, squeeze out excess air, close and seal. Store sample in freezer if not delivered to the laboratory immediately.

Procedure 1. Sampling while loading - *Recommended method for sampling from a stack or bedded pack.* Take at least ten samples while loading several spreader loads and combine to form one composite sample. Thoroughly mix the composite sample and take an approximately one pound sub sample using a one-gallon plastic bag. *Sampling directly from a stack or bedded pack is not recommended.*

Procedure 2. Sampling during spreading - Spread a tarp in field and catch the manure from one pass. Sample from several locations and create a composite sample. Thoroughly mix the composite sample together and take a one-pound sub sample using a one-gallon plastic bag.

Procedure 3. Sampling daily haul - Place a five-gallon bucket under the barn cleaner 4-5 times while loading a spreader. Thoroughly mix the composite sample together and take a one-pound sub sample using a one-gallon plastic bag. Repeat sampling 2-3 times over a period of time and test separately to determine variability.

Procedure 4. Sampling poultry in-house - Collect 8-10 samples from throughout the house to the depth the litter will be removed. Samples near feeders and waterers may not be indicative of the entire house and sub samples taken near here should be proportionate to their space occupied in the whole house. Mix the samples well in a five-gallon pail and take a one-pound sub sample, place it in a one-gallon zip lock bag.

Procedure 5. Sampling stockpiled litter - Take ten sub samples from different locations around the pile at least 18 inches below the surface. Mix in a five-gallon pail and place a one-pound composite sample in a gallon zip lock bag.

Liquid Manure - Dairy, Beef, Swine

Obtain a composite following one of the procedures listed below and thoroughly mix. Using a plunger, an up-and-down action works well for mixing liquid manure in a five-gallon bucket. Fill a one-quart plastic bottle not more than three-quarters full with the composite sample. Store sample in freezer or refrigerator if not delivered to the lab immediately.

Procedure 1. Sampling from storage- Agitate storage facility thoroughly before sampling. Collect at least five samples from the storage facility or during loading using a five-gallon bucket. Place a sub sample of the composite sample in a one-quart plastic container. *Sampling a liquid manure storage facility without proper agitation (2-4 hrs. minimum) is not recommended due to nutrient stratification, which occurs in liquid systems. If manure is sampled from a lagoon that was not properly agitated, typically the nitrogen and potassium will be more concentrated in the top liquid, while the phosphorus will be more concentrated in the bottom solids.*

Procedure 2. Sampling during application- Place buckets around field to catch manure from spreader or irrigation equipment. Combine and mix samples into one composite sub sample in a one-quart plastic container.

Procedure 3. (Recommended for storage tanks). Use a round pip with a stopper to obtain a composite sample. Open the sampler (one left with the farm) and extend vertically into the pit slowly so air can be released and manure at each depth enters the sampler. After reaching the bottom of the pit/tank, close the sampler and remove. Place end of sampler into the sample bottle and release the stopper. Repeat as necessary to fill bottle about 2/3 full (~ 1 pint).

Sample Identification and Delivery

Identify the sample container with information regarding the farm, animal species and date. This information should also be included on the sample information sheet along with application method, which is important in determining first year availability of nitrogen.
Keep all manure samples frozen until shipped or delivered to a laboratory. Ship early in the week (Mon.-Wed.) and avoid holidays and weekends.

Manure Analysis

The minimum analysis for Illinois is to include:

- Total Nitrogen
- Ammonia Nitrogen
- Phosphorus
- Potassium

{insert manure lab analysis}

Appendix D

Manure Equipment Calibration Methods

Appendix 13A Calibrating Manure Spreading

The use of animal manure as a cropland fertilizer is economically and environmentally important. However, farmers cannot simply spread manure. They must know the nutrient quality of the manure and control the quantity and uniformity of the manure spread to ensure that the entire crop receives the nutrients.

The nutrient content of the manure is estimated from laboratory tests, and the quantity to apply is determined through computations of crop need. Farmers can receive this information from their county Extension office or other nutrient management planners. In practice, farmers often do not know exactly how much or how uniformly manure has been applied. Manure spreader calibration provides this important information.

Manure spreaders can discharge manure at varying rates, depending on forward travel speed, PTO speed, gear box settings, discharge opening, width of spread, overlap patterns, and other parameters. Calibration defines the combination of settings and travel speed needed to apply manure at a desired rate. Following is a description of the measurement methods used to determine manure application rates and ensure uniform application.

Calibration techniques

Calibration requires the measurement of the quantity of manure applied to the soil under different conditions. There are two calibration techniques: the *load-area* method, which involves measuring the amount of manure in a loaded spreader and then calculating the number of spreader loads required to cover a known land area; and the *weight-area* method, which requires weighing manure spread over a small surface and computing the quantity of manure applied per acre.

The calibration method to use depends on the type of manure spreader. Soil-injection, liquid manure spreaders must be calibrated using the load-area method because soil-injected manure cannot be collected. Liquid manure surface applied through a tank spreader is also best measured by the load-area method because of the difficulty in collecting the liquid manure, but it can be measured with the weight-area method. Solid and semisolid manure also can be measured with either method.

Load-area calibration

Load-area calibration requires measuring the quantity of manure (tons or gallons) held in a spreader load; spreading a number of identical loads at a constant speed, spreader setting and overlap; measuring the total area of the spread; and computing the quantity of manure applied per acre. After completing the following steps, record the calculations on Worksheet 1, Manure Spreader Capacity and Worksheet 2, Load-Area Calibration.

Step 1. Determine the capacity of the manure spreader. The capacity of the manure spreader must be expressed in units compatible with the units used for the nutrient analysis and recommended application rate. In some cases, the manufacturer provides the appropriate information; in other instances. the manufacturer's information must be converted.

Liquid manure. Liquid manure analysis is expressed in pounds of nutrient per gallon and the application rate is provided in gallons per acre; therefore, use gallons to express the capacity of a liquid manure spreader. Manufacturers specify liquid manure spreaders by gallons of volumetric capacity. This information can be found in the owner's manual.

Solid and semisolid manure. Solid and semisolid manure analysis is expressed in pounds of nutrient per ton and the application rate is provided in tons per acre; therefore, solid and semisolid manure spreader capacity must be expressed in tons of manure.

Solid and semisolid manures of different moisture content have different weights; thus, the weight capacity of the spreader changes according to the kind of manure held. The most direct and accurate method of determining the weight of a load of manure is to actually weigh the spreader load on farm scales. If scales are not available, use the procedure in the next section to convert the volumetric capacity of the spreader to weight capacity for the particular manure held. Record your calculations on Worksheet 1, Manure Spreader Capacity.

Converting volumetric capacity to weight capacity. The volumetric capacity of box-type and open-tank or barrel spreaders for solid and semisolid manure is expressed in cubic feet. The manufacturer provides this information in the owner's manual. Two capacities are usually provided: heaped load (manure piled higher than the sides of the box) and struck load (the volume contained within the box). The capacity of older spreaders is sometimes designated in bushels; multiply the bushel capacity by 1.24 to determine capacity in cubic feet.

Multiply the volumetric capacity in cubic feet by the bulk density of the manure (in pounds per cubic foot) and convert it to tons. Bulk density depends on the amount of water, solids and air in the manure and can be measured by weighing a known standard volume of manure. A 5-gallon bucket has a volume of 2/3 cubic foot and can be used as a standard volume as follows:

1. Weigh the empty bucket and write the weight on the side of the bucket. This establishes the bucket's tare weight (the container weight subtracted from the gross weight to determine the weight of the manure).
2. Fill the bucket with manure from the loaded spreader. Use all the space in the bucket and pack the manure to the same density as in the spreader.
3. Weigh the full bucket and subtract the tare weight. The result is the manure weight in pounds.
4. Multiply the manure weight by 3 and then divide the product by 2. This gives the manure bulk density in pounds per cubic foot of volume.
5. Multiply the manure bulk density (in pounds per cubic foot) by the spreader capacity (in cubic feet) to get the weight of the spreader load in pounds. Divide by 2,000 to get tons.
6. Repeat this procedure at least three times. Sample the manure at different places and in different spreader loads. Average the values to obtain a representative composite of the manure.

Step 2. Spread manure on a selected field. Spread at least three full loads of manure on a field. Maintain the same speed and spreader setting for each load. Choose spreader path spacing to achieve what appears to be the most uniform coverage. Try to spread in a rectangle or square for easy calculation.

Step 3. Measure the area of the spread. Place flags at the corners of the spread area. Measure the width and length between the flags in feet using a measuring tape, measuring wheel, or consistent pace. Multiply the length by the width and divide that product by 43,560 to determine the area in acres.

Step 4. Compute the application rate. Multiply the number of loads spread by the number of tons or gallons per load to determine the total amount of manure applied to the area. Divide the total amount of manure by the area of the spread in acres to determine the application rate in tons per acre or gallons per acre.

The load-area method should be repeated at different speeds and spreader settings until the desired application rate is obtained. Maintain a record of the application rates at different settings to avoid recalibrating the spreader each season.

Weight-area calibration

Spreader calibration by weight-area requires laying out a ground sheet of known dimensions on the soil; spreading manure over it at a selected speed, spreader setting and overlap; retrieving the ground sheet and the manure deposited on it; weighing the manure retrieved; and computing the quantity of manure applied per acre. The weight-area method does not require measuring the amount of manure in the spreader. As you complete the following steps, record your calculations on Worksheet 3. Weight-Area Calibration.

Step 1. Select a manure collection surface. A ground sheet can be a cloth or plastic (6 mil) sheet of at least 100 square feet (10 feet by 10 feet) in area. Multiply the length of the sheet by the width to determine its area in square feet.

Liquid manure may run off a flat ground sheet; shallow plastic or metal pans are more useful. The pans should have a minimum area of 1 square foot each. Multiply the length of one pan by its width to determine the area of one pan. Multiply the area of one pan by the number of pans used to determine the total collection area in square feet. For handling and cleaning convenience, place the pan inside a plastic garbage bag for each field test so that the bag and manure can be discarded leaving the pan clean. Six or more pans are necessary for a test.

Weigh the ground sheet or pan and record the weights for use as a tare weight in calculations. Dirty sheets and pans can be used for multiple tests only after major manure deposits have been removed. Dirty sheets and pans must be weighed before each test so that any manure residue is included in the new tare weight.

Step 2. Secure the collection surface in the field. Lay the ground sheet out fully extended. Lay the sheet on the ground so that as the sheet is removed from the field the manure applied over the surface can be collected easily in its folds. If dirty sheets are being used for additional tests turn the dirty side up so that any manure residue included in the tare weight is not lost. Weights of stone metal or earth clods will be required to hold the ground sheet on the soil surface. A small breeze can easily fold the sheet or tractor wheels and forceful applications of manure can move it.

Pans are not as easily affected by wind, but may be moved by forceful streams from side outlet manure spreaders. Evenly space pans in a row perpendicular to the spreader's path. Pans are easily crushed by tires; allow for wheel tracks and adhere to the path provided. Placing flags at designated wheel tracks helps avoid pan damage.

Step 3. Spread manure over the collection area. Spread manure over and near the ground sheet or pans in a manner that best duplicates the spreading pattern you plan for the field. With rear outlet spreaders, make three passes: the first pass directly over the center of the collection area and the remaining two passes on the opposite sides of the first pass with an overlap. With side outlet spreaders, locate a first pass off of, but along one edge of, the collection area. Follow with subsequent passes farther away from the collection area and at the intended overlap until manure no longer reaches the surface.

In all cases. start spreading manure far enough before the collection area to ensure that the spreader is functioning. If a ground sheet is folded or a pan is moved during a spread pass, investigate its condition before continuing with the test. Folded edges can be straightened without major loss of accuracy. If more than one-fourth of the surface has moved and did not receive manure, the test should be conducted again with a newly weighed sheet. Pans that have been crushed but retain the applied manure can still be used. Return moved pans to their original position.

Step 4. Collect and weigh the manure. Remove weights used to hold the ground sheet in place. Fold the ground sheet and manure in short sections from all sides and corners inward to avoid losing any manure. A 10-foot by 10-foot sheet folded with wet manure may weigh as much as 150 pounds and tends to slip around when carried; place it in a feed tub or other container for easier handling.

Pans are easy to handle and will usually weigh less than 4 pounds each. Careful handling is required to avoid spilling liquid manure.

Select scales capable of accurately weighing the type and quantity of manure collected. A single pan may collect from 2 ounces to 4 pounds and can be weighed with a kitchen scale. A ground sheet may collect from 10 to 50 pounds with application rates of less than 10 tons per acre. A ground sheet can be weighed with spring-tension or milk scales. A ground sheet with application rates greater than 10 tons per acre will require a platform balance with a capacity of 50 to 150 pounds or greater.

The weight indicated on the scale will include the tare weight of the ground sheet or pan as well as that of any container used to hold the ground sheet or pan during weighing. Subtract the tare weights from the total weight to determine the net weight of the manure collected.

Step 5. Compute the application rate. The number of steps and the procedure used to compute the application rate depend on the method of collection and the units per acre.

Ground sheet to tons per acre. Divide the net pounds of manure collected by the area of the ground sheet to obtain the manure application rate in pounds of manure per square foot. Multiply the result by 43,560 and then divide by 2,000 to convert to tons per acre.

Pans to tons per acre. Add the net weights of manure collected in individual pans to determine the total weight of manure collected. Divide the total manure weight by the total collection area to obtain pounds of manure per square foot. Multiply the result by 43,560 and divide by 2000 to obtain tons per acre.

Pans to gallons per acre. If working with weight from pans to determine liquid applications in gallons per acre, make an additional measurement to calculate the weight per gallon of manure. Fill a 5-gallon bucket with liquid manure of the same consistency of that applied. Weigh the bucket of manure and subtract the tare weight of the bucket to determine the net weight of 5 gallons of manure. Divide the result by 5 to determine the weight in pounds per gallon. Follow the procedure for "Pans to tons per acre" through obtaining pounds of manure per square foot. Then multiply by 43,560 and divide by pounds per gallon to obtain gallons per acre.

Uniformity testing

The results of nonuniform manure spreading are often indicated by the lush, green growth within the spreader paths and the not-so-lush growth between spreader paths. This occurs because more manure was deposited in and near the spreader path than farther away from the path. Uniform application can be obtained by adjusting the application overlap. The amount of overlap necessary can be determined by a uniformity test. As you complete the steps in this uniformity test, record your calculations on Worksheet 4, Uniformity Testing.

The test procedure is identical to the weight-area calibration method, using pans or a series of 24-inch by 24-inch ground sheet sheets laid out with equal spacing across two spreader path widths. After the manure is applied, each pan or sheet is compared with the others. Uniformity can be recorded when manure is spread to determine the application rate.

If all containers collect about the same amount of manure during a test, the application is uniform; if some collect more than others, the overlap should be adjusted. High application in the center of paths and low application between paths indicate a need to increase the overlap by decreasing the path spacing. Higher application between paths than within paths indicates a need to decrease overlap by increasing path spacing.

Shortcuts

Developing a range of application rates for different manure spreader speeds can be simplified if the spreader is PTO-powered and the tractor or truck is equipped with a groundspeed indicator. Conduct one test at low groundspeed and one at high groundspeed, maintaining the same spreader setting and PTO speed for both tests. Plot these two application rates on a graph of groundspeed versus application and draw a straight line connecting the two points. The application rate available at intermediate groundspeeds can then be estimated from the graph. Conducting additional high-low tests at different settings or at different PTO speeds will define a full range of available application rates.

If solid or semisolid manure changes moisture content from season to season, the weight capacity in the spreader and the application rate by weight will change. Adjust previously calibrated spreader conditions for these changes by determining the bulk density of the new manure. To estimate the field application rate for the new manure for a particular speed and spreader setting, multiply the old application rate by the new bulk density and then divide by the old bulk density. This calculation eliminates the need to repeat the field test every time manure properties change.

Summary

By measuring the application rate and uniformity of manure spreading, a farmer can be sure of the amount of manure nutrients applied to a crop. This measurement, called calibration, can be accomplished with a little time and a few dollars. For further information, contact your county Extension office.

Source—Adapted from Calibrating Manure Spreaders, Fact Sheet 419, Cooperative Extension Service, University of Maryland System, H.L. Brodie, extension agricultural engineer, and G.L. Smith, extension agricultural engineer, Department of Agricultural Engineering, University of Maryland at College Park, Published 1985-86, revised 1990-91.

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Worksheet 13A–1—Manure Spreader Capacity

A. Description of spreader.

Manufacturer ________________________________ Model _________________________________

Type: ❑ box ❑ open-tank ❑ liquid-tank

Capacity: This information is available from your dealer or owner's manual.

Older models: bushels x 1.24 = cubic feet

Box or open-tank: ________ ft^3 struck load ________ ft^3 heaped load

Liquid-tank: ________ gal

B. For open-tank and box spreaders, determine the pounds per cubic foot of manure and the weight capacity of the spreader.

Type of manure: ❑ solid ❑ semisolid

1. Determine manure density using a 5-gallon bucket.

	Trial 1	Trial 2	Trial 3	
a. Empty bucket weight or tare weight	______	______	______	lb
b. Bucket filled with manure	______	______	______	lb
c. Net weight of manure (b – a)	______	______	______	lb
d. Manure density [(c x 3) ÷ 2]	______	______	______	lb/ft^3
e. Average of three trials	______ lb/ft^3			

2. Weight capacity of the spreader.

	Struck load	Heaped load
Spreader capacity	______ ft^3	______ ft^3
x	x	x
Manure density	______ lb/ft^3	______ lb/ft^3
=	=	=
Load weight	______ lb	______ lb
÷	÷	÷
2,000	______ tons	______ tons

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Worksheet 13A–2—Load-Area Calibration

Liquid-Tank Spreaders (Liquid Manure)

1. Determine the capacity of the manure spreader. ________ gal
2. Spread at least three full loads at the desired speed, spreader setting and overlap.
3. Measure the area of the spread.
   a. Spread manure area width ________ ft
   b. Spread manure area length ________ ft
   c. Spread area (a x b) ________ ft^2
   d. Spread area in acres (c ÷ 43,560) ________ acres
4. Compute the application rate.
   e. Number of loads spread
   f. Capacity per load ________ gal
   g. Total manure spread (e x f) ________ gal
   h. Application rate (g ÷ d) ________ gal/acre

Box and Open-Tank Spreaders (Solid and Semisolid Manure)

1. Determine the capacity of the manure spreader. ________ tons
2. Spread at least three full loads at the desired speed, spreader setting and overlap.
3. Measure the area of the spread.
   a. Spread manure area width ________ ft
   b. Spread manure area length ________ ft
   c. Spread area (a x b) ________ ft^2
   d. Spread area in acres (c ÷ 43,560) ________ acres
4. Compute the application rate.
   e. Number of loads spread ________
   f. Capacity per load ________ tons
   g. Total manure spread (e x f) ________ tons
   h. Application rate (g ÷ d) ________ tons/acre

Nutrient application = tons/acre x pounds of nutrient per ton
or gallons/acre x pounds of nutrient per gallon

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Worksheet 13A–3—Weight-Area Calibration

1. Select a manure collection surface.
   a. Determine collection area
   Ground sheet:
   width ________ ft x length ________ ft = area ________ ft^2
   Pans:
   pan width ________ inch x pan length ________ inch ÷ 144 = pan area ________ ft^2
   pan area ________ x number of pans ________ = collection area ________ ft^2

2. Secure ground sheet or pans.

3. Spread manure over the collection area.

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	
Forward speed, gear or throttle setting	________	________	________	________	________	
PTO speed	________	________	________	________	________	
Spreader setting	________	________	________	________	________	

4. Collect and weigh the manure and compute the application rate.

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	
a. Tare weight of sheet or pan andweighing container	________	________	________	________	________	lb
b. Gross weight of sheet or pan, collected manure and weighing container	________	________	________	________	________	lb
c. Net weight of manure (b – a)	________	________	________	________	________	lb
d. Area of sheet or pans	________	________	________	________	________	ft^2
e. Application rate (c ÷ d)	________	________	________	________	________	lb/ft^2
Ground sheet or pans to tons per acre.						
f. Application rate [(e x 43,560) ÷ 2,000]	________	________	________	________	________	ton/ac
Pans to gallons per acre.						
g. Tare weight of a 5-gallon bucket	________	________	________	________	________	lb
h. Weight of a 5-gallon bucket full of manure	________	________	________	________	________	lb
i. Net weight of 1 gallon of manure [(h - g) - 5]	________	________	________	________	________	lb/gal
j. Application rate [(e x 43,560) ÷ g]	________	________	________	________	________	gal/ac

Nutrient application = tons/acre x pounds of nutrient per ton
or gallons/acre x pounds of nutrient per gallon.

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Worksheet 13A–4—Uniformity Testing

1. Layout a line of small ground sheet sheets or pans of equal size, equally spaced across two spreader path widths

   a. Determine the pan or sheet area.

   width ________ inch x length ________ inch ÷ 144 = area ________ ft^2

2. Spread manure over the collection area.

   Forward speed, gear or throttle setting ________

   PTO speed ________

   Spreader setting ________

	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	
a. Tare weight of sheet or pan and weighing container	______	______	______	______	______	______	______	lb
b. Gross weight of sheet or pan, collected manure and weighing container	______	______	______	______	______	______	______	lb
c. Net weight of manure (b – a)	______	______	______	______	______	______	______	lb
d. Area of sheet or pans	______	______	______	______	______	______	______	ft^2
e. Application rate (c ÷ d)	______	______	______	______	______	______	______	lb/ft^2

Uniformity is achieved when all pans or sheets collect the same amount of manure. To improve uniformity, adjust spreader paths to increase or decrease overlap.

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APPENDIX E
Record Keeping Forms

Land Application Record Keeping

Record Keeping (Maintain for 5 years)

Maintaining records to document plan implementation. As applicable, records include:

- Soil test results and recommendations for nutrient application.
- Quantities, analyses and sources of nutrients and manure applied.
- Dates and methods of nutrient and manure applications.
- Crops planted, planting and harvest dates, yields, and crop residues removed.
- Results of water, plant, and organic by-product analyses.
- Dates of review and person performing the review, and recommendations that resulted from the review.

Operation and Maintenance

a. Review the Manure and Nutrient Management Plan component annually and make adjustments when needed.
b. Calibrate application equipment to ensure uniform distribution and accurate application rates (SEE SECTION 12).
c. Inspect and repair manure hauling and application equipment to minimize potential of accidental spillage.
d. Protect fertilizer storage areas from weather to minimize runoff, leakage, and lost of material.
e. Avoid unnecessary exposure to fertilizer and organic waste (bio-solids), and wear protective clothing when necessary.
f. Observe set backs required for nutrient applications (specified in this plan) adjacent to water bodies, drainage ways, sink holes, and other sensitive areas.
g. Maintain records of manure and nutrient applications for 5 years (SEE SECTION 7).
h. Clean up residual materials from equipment and dispose of properly.

Summary:

This Plan only applies to the fields and conditions stated in this Plan. If changes occur in your livestock operations or fields contact the NRCS/SWCD Office to get this Plan revised.

- **Manure and Wastewater Storage and Handling**
- **Manure and Fertilizer Applications**
- **Crop History**

Documentation will include:

- Annual manure tests for nutrient contents for each manure storage containment.
- Current soil test results, in accordance with Nutrient Management Code 590. Application records for each manure or commercial fertilizer application event, including:
- Containment source or type and form of commercial fertilizer.
- Field(s) where manure or organic by-products are applied.
- Amount applied per acre.
- Time and date of application.
- Weather conditions during nutrient application.
- General soil moisture condition at time of application (i.e., saturated, wet, moist, dry).
- Application method and equipment used.
- Crops planted and planting and/or harvesting dates, by field-
- Records that address manure and wastewater storage containment structures: .Dates of emptying, level before emptying, and level after emptying, and .Discharge or overflow events, including level before and after event.
- Transfer of manure off-site or to third parties:
- Manure nutrient content.
- Amount of manure transferred.
- Date of transfer.
- Recipient of manure.
- Activities associated with emergency spill response plan.
- Records associated with any reviews by NRCS, third-party consultants, or representatives of regulatory agencies:
- Dates of review.
- Name of reviewer and purpose of the review.
- Recommendations or follow-up requirements resulting from the review. Actions taken as a result of the review.
- Records of maintenance performed associated with operation and maintenance plans.
- Nutrient application equipment calibration.
- Changes made in CNMP.

Appendix E - Record Keeping - Manure and Wastewater Storage and Handling - Record Keeping

Type and Number of Animals	Date	Date	Date	Date	Date	Date
1.	#	#	#	#	#	#
2.	#	#	#	#	#	#
3.	#	#	#	#	#	#
4.	#	#	#	#	#	#
5.	#	#	#	#	#	#

Type of Inspections Completed	Date	Date	Date	Date	Date	Date
1.	#	#	#	#	#	#
2.	#	#	#	#	#	#
3.	#	#	#	#	#	#
4.	#	#	#	#	#	#

Type of Repairs Completed	Date	Date	Date	Date	Date	Date
1.						
2.						
3.						
4.						

Type Manure or Waste Removed	Date	Amt.	Date	Amt.	Date	Amt.	Date	Amt.	Date	Amt.	Date	Amt.
1.												
2.												
3.												
4.												
5.												

Type of Manure Transported Off the Farm	Where	Date	Amount.	Where	Date	Amount.	Where	Date	Amount.
1.									
2.									
3.									
4.									

Comments / Notes:

Appendix E - Fertilizer and Manure Application Record

Farm Name: ________________________________

Field ID	Date	Manure or Fertilizer Type	Method of Application (Surface, Injected, Irrigated, Incorporated, etc.)	Ground Cover	% Soil Moisture	Rate of Application					Weather and Comments
						Rate Gallons or Tons /Acre	Acres Applied	N Lbs/A	P2O5 Lbs/A	K2O Lbs/A	

Comments / Notes:

Appendix E - Crops Record Keeping. (Year _______)

Field	Crop	Date Planted	Variety	Date Harvested	Yield	Comments

Crop Yield Summary (Year _______)

Field Id	Manure Source	Acres	Harvested Crop	Date Planted	Date Harvested	Yield

S:\238\2008 project numbers\238-08012A (Cold Springs Farm CNMP)\Section 1-3 8 D-I (CNMP Write Up)\Cold Springs Farms CNMP.doc

Daily Application Log For Solids

Date	Field ID	Acres Used	Manure Source	Loads Applied	Rate / acre	Wind Direc.	Wind Speed	Air Temp	Soil Moist.

**Make note of AM and PM climatic conditions.

Make and model of Spreader ________________________________

List Capacity __________________________ cu. Yds.

Daily Application Log for Liquid Manure

Date	Field ID	Acres Used	Manure Source	Gallons Applied	Rate / acre	Wind Direc.	Wind Speed	Air Temp	Soil Moist.

**Make note of AM and PM climatic conditions.

Make and model of Spreader

____

List Capacity ________________________ gals

Annual Manure Application Summary

Date	Field Id	Amount Applied	Acres Used
	Totals		

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Manure Containment Liquid Level & Berm Inspection Report

Site ID	
Inspection Done By	

Containment ID	**Date**	**Time**	**Liquid Level**	**Change from Last**	**Berm Condition**	**Comments**

Note: Use one report sheet per site.

Manure Application -- Load Record Log

Date		**Tank Size**	
Driver		**Time on Job**	
Driver		**Time on Job**	
Driver		**Time on Job**	
Time of Day	**Loads Hauled**	**Manure Source**	**Field Id**
Midnight - 2 AM			
2 AM - 4 AM			
4 AM - 6 AM			
6 AM - 8 AM			
8 AM - 10 AM			
10 AM - NOON			
NOON - 2 PM			
2 PM - 4 PM			
4 PM - 6 PM			
6 PM - 8 PM			
8 PM - 10 PM			
10 PM - Midnight			

Field Drawing/Comments:

Mortality Management Record			
Date	Number of Mortalities	Approximate Weight	Management Used

Management Used = Incinteration, Composting or Rendering

Composter Record					
Date	Compost Bin Number	Compost Pile Temperature	Turned or Mixed	Amount of Carbon Material added	Number and Approx. Weight of Mortalities added

APPENDIX F
Feed Management Considerations

APPENDIX G
Guidance Information

Air Quality AND Pathogen Management Considerations

It may not be practical or feasible to eliminate all odor emissions from the operation, but it is possible to manage or mitigate the odor. Some variables that effect odor are:

* Type of operation	* Building design
* Ventilation method	* Animal numbers
* Animal diets	* Manure treatment systems
* Season	* Topography
* Management skill or effort	*

1. Animal Cleanliness

   a. Clean, dry, and healthy animals are less odorous. Dirty, manure-covered animals promote accelerated bacterial growth and the production of odorous gases.

   b. Animal stress can also be correlated to an increase in odor production. Ventilation and environmental controls for the buildings must be properly designed and maintained to keep the animals healthy.

2. Minimize Dust

   a. It has been established that there is a correlation between dust and odor emission. Dust particles absorb and concentrate odorous compounds. As the dust particles are carried by the wind, so is the odor.

   b. Therefore, minimizing dust will reduce odor. Most farm dust comes from feed, fecal matter and, in the case of poultry, from feathers and litter. Dust also comes from animal skin, insects, and other sources.

   c. Buildings should be cleaned of all dust between batches of animals (including fans, shutters, and screens.)

3. **Waste Storage Facility** – to reduce emissions of greenhouse gases, ammonia, volatile organic compounds, and odor:

   Consider alternatives and additional practices including covered anaerobic digesters (365), and composting facilities (317).

   Adjusting pH below 7 may reduce ammonia emissions from the waste storage facility but may increase odor when waste is surface applied.

   Consideration should be also given to the separation of the solids from the waste mixture. This will dilute the liquid waste product being treated in the lagoon and cause less odor. The solid separated material can be composted and sold or land applied.

4. **Animal diets** can also be manipulated to produce less manure production and odors from the manure. Much of the odors from manure are from nitrogen, sulfur, and carbohydrate containing

volatile compounds. Balancing the diet with proper amounts and forms of protein and reducing excess protein in the diet will reduce nitrogen excretion and odor emissions from the manure.

5. **Proper Disposal of Mortality** – Normal mortality for the animal feeding operation *must* be properly handled for both odor control and biological security of the operation. Composting, incineration, and rendering are acceptable methods for mortality disposal.

6. **Good Fly and Rodent Control Programs** – These programs must be a continuous process on the farm. When feed and waste products are properly handled, these problems are minimized.

7. **Utilize Trees** – While trees should not grow directly adjacent to facilities, wind breaks of trees correctly positioned near the facility not only create a visual barrier but can also provide a large filtration surface for dust and odorous compound removal. Trees can absorb odorous compounds and create turbulence that enhances odor dispersion and dilution. Trees also can create a cooler microclimate around the facility, which can reduce odors.

8. **Land Application**

    a. Note wind direction and avoid spreading when the wind is blowing toward populated areas.

    b. Avoid spreading on weekend/holidays when people are likely to be engaged in nearby outdoor and recreational activities.

    c. Spread in the morning when air begins to warm and is rising, rather than in the afternoon.

    d. Use available weather information to best advantage. Turbulent breezes will dissipate and dilute odors. Hot and humid weather tends to concentrate and intensify odors, particularly in the absence of breezes. Rain will remove the odor from the atmosphere.

    e. Use natural vegetation barriers, such as woodlots or windbreaks, to help dissipate and filter odors.

    f. Establish vegetated air filters in the field border area by planting conifers and shrubs as windbreaks and visual screens between cropland and residential developments.

<u>Pathogen Management</u>

Many of the same conservation practices used to prevent nutrient movement from this animal feeding operation, such as runoff and erosion control are likely to minimize the movement of pathogens. Pathogenic organisms occur naturally in animal wastes. Exposure to some pathogens can cause illness to humans and animals, especially for immune-deficient populations.

Livestock Management Facilities Act Waste Application Provisions

a)Waste applied within 1320' (1/4 mile) of any residence not owned by the facility shall be injected or incorporated on the day of application.

b) Waste shall not be applied within:

1. 200' of surface water unless the water is up-gradient or there is adequate diking to prevent runoff, and
2. 150' of a potable water supply well.

c) Waste shall not be applied in a 10-year flood plain unless the injection or incorporation method of application is used.

d) Livestock waste shall not be applied in waterways.

e) Waste that is spread on frozen or snow-covered land shall be limited to areas which:

1. Land slope is 5% or less, or
2. Adequate erosion control practices exist

f) The certified livestock manager shall inspect all berm tops, exterior sides, non-submerged interior sides for evidence of erosion, burrowing animal activity, and other indications of berm degradation at least every two weeks and keep an inspection log.

g) Livestock waste shall not be applied during a rainfall or to saturated soil and conservative application rates shall be used in the case of a high water table or shallow earth cover to fractured bedrock. Caution shall be exercised in applying livestock waste, particularly on porous soils, so as not to cause nitrate or bacteria contamination of the groundwater.

Winter Application

Application of wastes to frozen and snow covered soil. Application on frozen and snow covered soil is not recommended. However, if manure application becomes necessary on frozen or snow covered soils, only limited quantities of manure shall be applied to address waste storage limitations until non frozen soils are available for manure application. These situations need to be documented in the CNMP and in the producer records. If winter application becomes necessary, applications are to be applied only if ALL the following criteria are met:

Application rate is limited to 10 wet tons/acre for solid manure more than 50% moisture and 5 wet tons for manure less than 50% moisture. For Liquid manure the application rate is limited to 5000 gallons/acre.

Applications are to be made on land with at least 90% surface residue cover (e.g. good quality hay or pasture field, all corn grain residue remaining after harvest, all wheat residue cover remaining after harvest).

Manure shall not be applied on more than 20 contiguous acres. Contiguous areas for application are to be separated by a break of at least 200 feet. Utilize those areas for manure application that are furthest from streams, ditches, waterways, surface water, etc (areas that present the least runoff potential and are furthest from surface water).

Increase the application setback distance to 200 feet “minimum” from all grassed waterways, surface drainage ditches, streams, surface inlets, water bodies. This distance may need to be further increased due to local conditions.

The rate of application shall not exceed the rates specified in Table 4 - Determining The Most Limiting Manure Application Rates for winter application.

Additional winter application criteria for fields with significant slopes more than 6% (fields exceeding 6% are to be identified in the CNMP). Manure shall be applied in alternating strips 60 to 200 feet wide generally on the contour, or in the case of contour strips on the alternating strips.

Manure Application on Steep Fields

Steep Fields

Wastes are not to be applied to cropland over 15% slopes or to pastures/hayland over 20% slopes unless one of the following precautions is taken:

Immediate incorporation or injection with operations done on the contour, UNLESS the field has 80% ground cover (residue and/or canopy).

1. Applications are timed during periods of lower runoff and/or rainfall (Late May to Mid-October).
2. Apply low rates through split applications (separated by rainfall events). Apply no more than 10 wet tons/acre for solid manure/wastes; or 5000 gallons/acre for liquid manure/wastes.
3. The field is established and managed in contour strips with alternate strips in grass or legume.

Manure Application on Fields Subject to Flooding

Fields Subject to Flooding

Manure is not to be land-applied on soils that are frequently flooded unless incorporated immediately on the day of application.

General Liquid Manure Applications

LIQUID MANURE APPLICATIONS - For liquid wastes, the application rate is to be adjusted to the most limiting factor to avoid ponding, surface runoff, subsurface drainage (tile) discharge, the nutrient needs of the field, or the nitrogen or phosphorus risks for the field. The total application is not to exceed the field capacity of the upper 8 inches of soil. See **Table 2. Section12** (**Available Water Capacity (AWC) Practical Soil Moisture Interpretations for Various Soils Textures and Conditions to Determine Liquid Waste Volume Applications not to exceed AWC)** to determine AWC and the amount (volume) that can be applied to reach the AWC. The actual application rate shall be adjusted during application to avoid ponding or runoff. Bare/Crusted soils may require some tillage to improve infiltration. See **Table 1, Section 12,** (**Determining The Most Limiting Manure Application Rates)** to determine the most limiting application rate factor base on the field condition and site limitations.

Liquid Manure Application – Tile Drained Fields

Fields or areas of fields that are subsurface (TILE) drained require additional precautions. When liquid wastes are applied to fields with subsurface (TILE) drains, the liquid can follow soil macropores directly to the tile drains creating a surface water pollution hazard from direct tile discharge. <u>A field is considered subsurface (tile) drained if 1/3 or more of the field is subsurface (tiled) drained; however, even a field with one subsurface drainage line may present a risk of manure/wastewater movement to subsurface drains and cause a direct discharge.</u>

Do not apply application rates (volume) that would exceed the lesser of the AWC in the upper 8 inches or 13,000 gallons/acre per application.

Prior to manure application, use a tool (AERWAY tool or similar tool) that can disrupt/close (using horizontal fracturing) the preferential flow paths (worm holes, cracks, root channels) in the soil, or till the surface of the soil 3-5 inches deep to a condition that will absorb the liquid wastes. The purpose is to have the surface soil act as a sponge to soak up the liquid manure and keep it out of preferential flow channels. This is especially important if shallow tile are present (< 2 feet deep). Any pre-application tillage should leave as much residue as possible on the soil surface. The adsorption of liquid manure by the soil in the root zone will minimize nitrogen loss and the manure/nutrient runoff potential. For perennial crops (hay or pasture), or continuous no till fields where tillage is not an option, all tile outlets from the application area are to be plugged prior to application. This criteria (4b.) may be waived if the producer can verify there is no prior history of manure discharge via subsurface drains. However, if there is a discharge the producer is liable for damages and may risk being classified as a CAFO.

If injection is used, inject only deep enough to cover the manure with soil. Till the soil at least 3 inches below the depth of injection prior to application, or all tile outlets from the application area are to be plugged prior to application. This criteria (4c.) may be waived if the producer can verify there is no prior history of manure discharge via subsurface drains. However, if there is a discharge the producer is liable for damages and may risk being classified as a CAFO.

In addition to tillage prior to surface liquid waste application or injection, install in-line tile flow control structures or inflatable tile plugs that can mechanically stop or regulate tile flow either prior to application, or have on site if needed to stop tile flow. Use caution not to back tile water where it may impair the functioning of an offsite subsurface drainage system. This criteria (4d.) may be waived if the producer can verify there is no prior history of manure discharge via subsurface drains. However, if there is a discharge the producer is liable for damages and may risk being classified as a CAFO. Repair broken tile or blow holes prior to application.

Manure Application on Fields with "Systematic Surface Drainage"

Criteria for Systematic Surface Drained Fields:

Fields or areas of fields that have systematic "surface drainage" systems (e.g. shallow surface drains spaced 100 – 200 feet apart). These "internal" surface drains are considered concentrated flow areas. However, if special precautions are taken, manure can be applied in the surface drains with minimal risk of surface runoff. THIS DOES NOT APPLY TO THE COLLECTOR SURFACE DRAINS (mains) OR DRAINS BORDERING THE FIELDS. The following special manure application techniques shall be used:

Till the surface at least 3 to 5 inches deep prior to liquid manure surface application. For SOLID manure till either prior to application or incorporate within 24 hours. This can be done with a heavy disk, chisel plow, plow, field cultivator, AERWAY tool, or similar tool that can provide "full-width" soil disturbance to a depth of 3-5 inches.

Surface apply the liquid manure uniformly over the entire soil surface on the freshly tilled soil. The purpose of the surface application on the freshly tilled soil is to allow the liquid manure to be soaked/absorbed into the entire 3-5 inches of loose soil surface.

For fields that have no subsurface drainage, the liquid manure can be injected directly with no prior tillage.

Limit LIQUID application rates to 13,000 gallons per acre or less per application.

Minimum Ground Cover for Manure Applications

Medium Phosphorus Risk Fields

- The fields shall have at least 30% ground cover at the time of application or the manure or other organic by-products shall be incorporated within one week.

High Phosphorus Risk Field

- The field shall have at least 50% ground cover at the time of application unless the manure is incorporated within 7 days on areas with < 50% cover.

Generalized Interpretation of the Nitrogen Leaching Risk Analysis:

a. Fields with a rating of "LOW" or " MEDIUM" have a low/medium potential to leach nitrates below the root zone. These fields have more flexibility for timing of nitrogen application; however, care must be taken to limit loss of applied nitrogen through denitrification.
b. Fields with a rating of HIGH" have a high potential to leach nitrates below the root zone. Fields with systematic subsurface drains (tile) are rated "HIGH" potential to leach nitrates out of the root zone. These fields require management that applies the nitrogen closer to the time the crop can utilize the applied nitrogen.

Criteria for Nitrogen via Commercial Fertilizer Sources:

On fields with a "High Nitrogen Leaching Potential" apply the recommended nitrogen for spring planted crops prior to planting spring crops or split applications between pre-plant and a sidedress application. For perennial crops split the recommended application between two or three periods including early spring, early summer, or late summer. For fall planted crops apply 20-30 Lbs/Ac of the recommended amount in the fall and the remainder in the spring. Nitrogen may be fall applied for spring planted crops following the guidance in Table 1 of this standard.

Criteria for Nitrogen Application via Manure (during Summer and Fall Periods):

On fields with a "High Nitrogen Leaching Potential" (rating more than 10) and with no growing crop, manure and other organic by-products application is to be limited to 50 Lbs/ac of Nitrogen (Ammonium N + 1/3 of the Organic N) calculated at the time of application from June to October 1st to limit nitrogen leaching. When a grass or legume cover crop is growing or established immediately after waste application, manure or other organic by-products can be applied prior to October 1st at the recommended Nitrogen rate for the next non-legume crop or the nitrogen removal rate for the next legume (maximum

150 Lbs/ac) crop. See Table 1, Section 12 - Determining the Most Limiting Manure Application Rates.

APPENDIX H
Other Utilization Component

APPENDIX I

Table 1. Available Water Capacity (AWC) Practical Soil Moisture Interpretations for Various Soils Textures and Conditions to Determine Liquid Waste Volume Applications Not to Exceed AWC

This table shall be used to determine the AWC at the time of application and the liquid volume in gallons that can be applied not to exceed the AWC. To determine the AWC in the upper 8 inches use a soil probe or similar device to evaluate the soil to a depth of 8 inches.

Available Moisture in the Soil	Sands and Loamy Sands	Sandy Loam and Fine Sandy Loam	Very Fine Sandy Loam, Loam, Silt Loam, Silty Clay Loam, Clay Loam, Sandy Clay Loam	Sandy Clay, Silty Clay, Clay
< 25% Soil Moisture	Dry, loose and single-grained; flows through fingers.	Dry and loose; flows through fingers.	Powdery dry; in some places slightly crusted but breaks down easily into powder.	Hard, baked and cracked; has loose crumbs on surface in some places.
Amount to Reach AWC	20,000 gallons/ac	27,000 gallons/ac	40,000 gallons/ac	27,000 gallons/ac
25-50% or Less Soil Moisture	Appears to be dry; does not form a ball under pressure.	Appears to be dry; does not form a ball under pressure.	Somewhat crumbly but holds together under pressure.	Somewhat pliable; balls under pressure.
Amount to Reach AWC	15,000 gallons/ac	20,000 gallons/ac	30,000 gallons/ac	20,000 gallons/ac
50 - 75 % Soil Moisture	Appears to be dry; does not form a ball under pressure.	Balls under pressure but seldom holds together.	Forms a ball under pressure; somewhat plastic; slicks slightly under pressure.	Forms a ball; ribbons out between thumb and forefinger.
Amount to Reach AWC	10,000 gallons/ac	13,000 gallons/ac	20,000 gallons/ac	13,000 gallons/ac
75% to Field Capacity	Sticks together slightly; may form a weak ball under pressure.	Forms a weak ball that breaks easily, does not stick.	Forms ball; very pliable; slicks readily if relatively high in clay.	Ribbons out between fingers easily; has a slick feeling.
Amount to Reach AWC	5,000 gallons/ac	7,000 gallons/ac	11,000 gallons/ac	7,000 gallons/ac
100% Field Capacity	On squeezing, no free water appears on soil, but wet outline of ball on hand.	On squeezing, no free water appears on soil, but wet outline of ball on hand.	On squeezing, no free water appears on soil, but wet outline of ball on hand.	On squeezing, no free water appears on soil, but wet outline of ball on hand.
Above Field Capacity	Free water appears when soil is bounced in hand.	Free water is released with kneading.	Free water can be squeezed out.	Puddles: free water forms on surface