Wisconsin Conservation Planning Technical Note 1

Nutrient Management

INTRODUCTION

This Technical Note has been developed in order to provide guidance for nutrient management planning in addition to NRCS Field Office Technical Guide (FOTG) Standard 590. A Comprehensive Nutrient Management Plan (CNMP) is different from a 590 plan and additional documentation is required. More information on CNMPs can be found in the NRCS National Planning Procedures Handbook, Subpart F, Part 600.75 and this fact sheet: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_019284.pdf.

NRCS, Field Office Technical Guide (FOTG), Section IV, Conservation Practice Technical Standard 590, Nutrient Management, provides specific criteria for nutrient management planners (see section V). It identifies the necessary components of a nutrient management plan (see section VII), and lists operation and maintenance requirements of the practice (see section VIII). Federal, state, and local laws may provide additional requirements and guidance. The Wisconsin Conservation Planning Technical Note WI-1 is the companion document to NRCS FOTG Standard 590 and provides additional guidance and references for plan development.

This technical note is updated periodically. To find the most current information for developing nutrient management plans, use Snap Plus nutrient management software from developed by the UW Madison, Soil Science Department and available free of charge. (http://www.snapplus.wisc.edu/) This nutrient management planning tool will allow nutrient management planners to use the most current application rate guidelines found in UWEX Publication A2809 and the most current manure book values for estimating manure production and nutrient availablility. Soil restriction map units are listed in Appendix 1 of this technical note and will be changing to numerical map units as county soil surveys are updated. Soil restriction map units are continuously updated so this Tech Note may not be current. The most recent soil restriction units are available in SnapPlus.

This technical note provides detailed guidance on the following:

Part I:	Minimum Requirements for a NRCS 590 Nutrient Management Plan
Part II:	Minimum Requirements for a Winter Spreading Plan
Part III	Enhanced Nutrient Management Planning
Part IV:	Determining Manure Nutrient Credits
Part V:	DNR Contacts
Part VI:	Certified Laboratories

The appendices below are in a separate document.

Appendix 1: Soil Restriction Map Units

Appendix 2: Nutrient Management for Wisconsin Cranberry Production

Appendix 3: Guidelines for Adaptive Nutrient Management

PART I

MINIMUM REQUIREMENTS FOR A NUTRIENT MANAGEMENT PLAN

The landowner/producer (person required to have the plan developed, or receiving the cost share monies) is responsible for annually updating the plan and keeping records of all the components of the nutrient management plan for a minimum of four years. A nutrient management plan shall be developed according to the criteria defined in the NRCS FOTG Standard 590, Nutrient Management and include the following:

A. Plan Narrative summarizing the implementation and operation of the nutrient management plan as it pertains to the entire farm unit. Details shall include:

1. An overview of the operation including typical crops grown and the sources of nutrients other than fertilizer applied to the land.
2. A summary of Phosphorus reduction strategies, as appropriate.
3. An explanation for any fields that are out of compliance with the standard and the schedule for bringing them into compliance.

B. Aerial photographs and/or maps of the farm containing:

1. Boundaries, identification numbers, and acreage for all crop fields, pastures, and nutrient management units. Provide consistent field identification in the nutrient management plan, soil test record, and conservation plan.
2. Soil series and soil series boundaries.
3. Location and identification of spreading restrictions as identified in FOTG 590 Standard Criteria V.A.2. and V.A.3.a. Each map shall have a legend defining map symbols. The 590 spreading restriction maps can be downloaded from http://www.manureadvisorysystem.wi.gov/.

C. Field-specific (or nutrient management unit specific) documentation of:

1. Planned crop rotation including the previous crop and crop to be grown this year.

2. Projected yield goals for each crop based on previous yields.

3. Dominant critical soil map unit for soil erosion calculations (most erosive soil map unit comprising greater than 10% of field area) and the predominant soil map unit to obtain nutrient application rates.

4. Previous year's actual and current year's proposed nutrient and soil amendment application rates including the form, rate, and timing for:

    a. Commercial fertilizers
    b. Manure (If you are collecting and applying livestock manure, complete Part IV, Step 1 below.)
    c. Other organic byproducts
    d. Credits for Legume Nitrogen
    e. Soil Amendments (e.g., lime)

5. Soil test information per Criteria V.A.1.e.

6. Where P (all sources) is applied in excess of crop need, the credits for surplus P must be tracked and subsequent nutrient applications shall be adjusted using FOTG 590 Criteria V.A.1.g. and V.C.

7. The current NRCS soil loss estimates for sheet and rill or wind, or equivalent should be included.

8. Document current year's actual crop yield and nutrient application rates including form, timing, and application method. Changes to nutrient applications that are not consistent with the plan should be documented in the plan. Include the reasons why the changes were made and revise the P budget in #6 above as necessary. The plan for the production year is not considered complete until all actual nutrient application rates are documented.

9. For Nitrogen Restricted Soils see Appendix 1. For certified soil testing laboratories see Part VI of this document. For Nutrient Management for Wisconsin Cranberry Production see Appendix 2.

10. Pastures must be included in the nutrient management plan. Further information regarding state rules and exceptions associated with nutrient management planning for pastures can be found at:
    - http://datcp.wi.gov/uploads/Environment/pdf/ATCP50GuidanceNutrientManagementOnPastures.pdf
    - UWEX Soil Fertility Guidelines for Pastures in Wisconsin - http://learningstore.uwex.edu/Assets/pdfs/A4034.pdf

PART II

REQUIREMENTS FOR A WINTER SPREADING PLAN

The Winter Spreading Plan shall be consistent with the WI NRCS 590 Nutrient Management practice standard.

A. Winter Spreading Plan Implementation Maps:

These maps should be simplified for use in the field by farmer or manure hauler and contain the following:

1. Field boundaries, identification numbers, and acreage.
2. Field access locations.
3. Location of stacking areas (See NRCS FOTG Standard 313 or Table 1 in "Additional Considerations").
4. Planned mitigation practices by field as defined by Criteria V.A.2.d.
5. Identification of fields or portions of fields not spreadable due to access limitations or nutrient management prohibitions.

B. Documentation records:

The landowner/producer (person responsible for the land application of manure) shall review the winter spreading plan annually prior to winter application of manure, and keep records of all the components of the winter spreading plan for a minimum of four years. Utilize data forms, spreading logs, GPS data, or photos to document implementation activities.

ADDITIONAL CONSIDERATIONS AND RESOURCES FOR WINTER SPREADING

A. Assessment of Seasonal or Annual Field Conditions at Time of Manure Application:

The following factors are used to select fields or portions of those fields with the lowest risk for runoff at the time of winter manure application:

1. Previous crop and condition/amount of residue cover
2. Cover crops (type/condition)
3. Surface roughness (primary/secondary tillage practices completed prior to manure spreading)
4. Field rutting or surface compaction (presence)
5. Previous manure application (timing/rate)
6. Other in-field considerations identified by the planner

B. Assessment of Forcasted Weather Charicteristics and Snow Conditions at Time of Manure Application:

Consider the following conditions before winter manure application.

1. Snow depth (< 6 inches, <12 inches, >12 inches or more)
2. Snow charicteristics (powder, compacted) and uniformity of cover
3. Presence of ice (soil surface, crust on snow etc.)
4. Frost depth and uniformity
5. Predicted air temperature (5-day forecast)
6. Predicted preciptiation (5-day forecast)
7. Month of application (sun intensity– angle and duration i.e. mid-winter vs. early/late winter)

C. Winter Manure Spreading Research Findings – UW Discovery Farms Publications:

Runoff Lessons: Frozen and Snow Covered Ground
Considerations for Early Winter Applications of Manure (Nov 2013)
Considerations for Mid-Late Winter Manure Applications (Jan 2014)

D. Table 1. NRCS FOTG Conservation Practice Standard 313, Waste Storage Facility Table 10 Temporary, Unconfined Stacks of Manure and Derivatives Outside the Animal Production Area

1. Waste Consistencies Note 1		
	> 32% Solids	16% to 32% Solids Note 2
2. Size & Stacking Period		
Stacking Period	8 months	8 months
Maximum Volume/Stack	≤ 40,000 cu ft.	≤ 15,000 cu ft.
Maximum Number of Stacks/40 acres Note 3	–	2
Frequency of Stacking Site Use	1 year out of 2	1 year out of 3
3. *Hydrologic Soil Groups*		
	B or C	B or C
4. Subsurface Separation Distance		
Subsurface Saturation	≥ 3 ft.	≥ 3 ft.
Bedrock	≥ 3 ft.	≥ 5 ft.
5. Surface Separation Distance		
Wells Note 4	≥ 250 ft.	≥ 250 ft.
Lakes	≥ 1,000 ft.	≥ 1,000 ft.
Sinkholes, or other Karst Features	≥ 1,000 ft.	≥ 1,000 ft.
Quarries	≥ 1,000 ft.	≥ 1,000 ft.
Streams	≥ 300 ft.	≥ 500 ft.
Wetlands and Surface Inlets	≥ 300 ft.	≥ 500 ft.
Areas of Concentrated Flow	≥ 100 ft.	≥ 300 ft.
Land Slope Down Gradient of Stack	≤ 6%	≤ 3%
Floodplain	≥ 100 ft.	≥ 300 ft.
Tile lines	≥ 40 ft.	≥ 40 ft.

Note 1 Refer to AWMFH, Figure 9-1 for consistency values and Chapter 4 for % solids, for specific livestock types.

Note 2 16% to 32% solids represents waste at near saturation conditions where additions of free water from runoff, rain, or snowmelt can result in liquid flow conditions.

Note 3 The separation distance between stacks shall be at least 100 feet.

Note 4 Community water system wells may require larger separation distances (see NR 812).

PART III
ENHANCED NUTRIENT MANAGEMENT PLANNING

The practices listed in this section are recommendations that will enhance nutrient management planning and provide additional water quality benefit. The rate, timing, and placement of nutrients are important considerations that may affect water quality.

A. General

1. Nutrients should be applied as near to the time of crop use as possible.

2. Minimize manure applications on frozen or snow-covered soils.

3. Apply nutrients to the least environmentally sensitive areas first at rates needed to supply the crop N requirements or the anticipated crop removal of P and/or K. Criteria to consider include: hydraulic loading rate of the soil profile, soil permeability, infiltration capacity, slope, distance to surface water features, erodibility, accessibility, present crop, potential fate of runoff, infiltration, and presence of conservation practices.

4. Apply manure to crops which can use all of its nutrients, including nitrogen, whenever possible. Grasses such as corn are best. Applying manure to a forage legume crop adds substantial cropland available for spreading throughout summer months and provides a good utilization of all nutrients. Manure applied to forages may stimulate grass production and weed growth resulting lower forage protein and tend to reduce the alfalfa stand. The following recommendations are suggested in "Applying Manure to Alfalfa," North Central Regional Research Report 346.

   a. Preplant manure applications generally can have a positive effect on seedling-year alfalfa dry matter production where weeds are adequately controlled. This response may also be carried over into the full production years. Although manure may increase certain seedling-year weed problems, these usually do not persist past first cutting. Repeated manure applications at high rates may increase forage potassium to unacceptably high levels.

   b. Topdressing manure to established alfalfa is somewhat more risky. While benefits can be obtained, especially on low-testing soils or on legume-grass mixtures, problems from compaction, salt burn and stand suffocation can occur. Alfalfa can be a major sink for recycling nitrogen and other nutrients; however, topdress applications, especially to frozen soils, may result in large nutrient runoff losses. Various management practices, including using low rates on the poorest stands immediately after cutting, will help reduce the agronomic and environmental risks associated with following this strategy.

   c. Applying at the end of the alfalfa rotation may leave more nitrogen than the following crop can use. This can lead to large, unacceptable environmental risks from nitrate leaching. A producer who takes this approach must consider the nitrogen contributed from both the legume and the manure. Removing all of the alfalfa top growth before application and limiting manure rates by taking into account the alfalfa nitrogen credit is essential.

B. Nitrogen

1. Nitrogen management practices to improve nitrogen use efficiency are summarized in UWEX Publication A3340, "Corn Fertilization" (1998).

   a. Use the appropriate nitrogen rate for the production conditions.

   b. Make proper adjustments for high corn residue cover.

   c. Fully credit nitrogen that may be available from organic sources such as manure legumes and soil organic matter.

   d. Use soil nitrate tests when appropriate to help identify the optimum N rate.

e. Avoid fall applications of N fertilizers.

f. Use sidedress N applications or delay N applications to coincide with the crop N demand, especially on coarse-textured soils where nitrate leaching is likely.

g. Use a nitrification inhibitor with ammonium forms of nitrogen where the risk of N loss through leaching or denitrification is high.

h. Control ammonia losses from urea containing fertilizers by incorporating or injecting these materials within 72 hours, by using urease inhibitor, or by selecting a non-urea material for surface applications.

i. Control ammonia losses from dairy farms by removing excess protein from the cow's diet. Incorporate manure in the field being aware of the potential for increased erosion and P losses. Cover manure storage structures or use organic matter in bedding to form a crust cover. Consider diverting urine away from feces.

2. Reference list of articles related to nitrification inhibitors, urease inhibitors, and slow release fertilizers.

Extension Publications and Conference Proceedings

Franzen, D.W. 2013. Nitrification Inhibitor Claims – Are They Real? Proc. Wisconsin Crop Management Conference. 52:124-137. http://www.soils.wisc.edu/extension/wcmc/2013/pap/Franzen_inhibitor.pdf

Franzen, D.W. 2013. Volatilization Losses from Urea. Proc. Wisconsin Crop Management Conference. 52:139-155. http://www.soils.wisc.edu/extension/wcmc/2013/pap/Franzen_urea.pdf

Franzen. D.W. 2011. Nitrogen Extenders and Additives for Field Crops. North Dakota State University Extension Publication SF-1581. http://www.ag.ndsu.edu/pubs/plantsci/soilfert/sf1581.pdf

Goos, R.J. 2011. Nitrogen Fertilizer Additives Which Ones Work? Proc. North Central Extension-Industry Soil Fertility Conference. 27:5-15. http://extension.agron.iastate.edu/nce/ncepdfs/2011/ncsfc%202011%20goos%20p5.pdf

Goos, R.J. 1987. Ammonium Thiosulfate as a Urease Inhibitor: A Suggested Mechanism. Proc. North Central Extension-Industry Soil Fertility Conference. 3:103-105. http://extension.agron.iastate.edu/nce/ncepdfs/1987/ammoniumthiosulfate.pdf

Laboski, C. 2006. Does it pay to use nitrification and urease inhibitor? Proc. Wisconsin Crop Management Conference. 45:44-50.

3. When concerned with the rate and placement of nitrogen, consider these points in addition to those found in Section VI of NRCS FOTG, Standard 590, Nutrient Management:

a. Unused or residual nitrate may be leached from the soil and impact groundwater and surface waters. In years of normal fertilizer application and unexpected low yields, excess nutrients, including nitrate, may accumulate in the soil. Pre-plant soil nitrate tests can be used to measure carryover nitrogen and adjust nitrogen applications (see UWEX Pub A2809, "Nutrient application guidelines for field, vegetable, and fruit crops in Wisconsin," 2012). Additional options for reducing the amount of nitrogen subject to leaching include:

(1) Growing a winter cover crop to use carryover nitrogen.

(2) Growing legume crops (when managed without supplemental N inputs) to "scavenge" N remaining in the profile.

(3) Growing high N demanding crops such as corn and forage grasses.

b. Nitrification inhibitors used with ammonium or ammonium-forming N fertilizers can improve N efficiency and limit loss of fertilizer N on soils where the potential for nitrate loss through leaching or denitrification is high.

c. Consider using the Wisconsin Nitrogen Leaching Index—An Index approach to Assess Nitrogen Losses to the Environment. Include NRCS reference when available.

The Nitrogen Leaching Index (N-Index) is a Tier-1 Tool that provides an assessment of the effects of N management on agricultural landscapes and N losses to the environment. The tool can be used by conservation planners to conduct prompt assessments of management practices and how specific management practices affect N losses to the environment. The tool allows nutrient management planners to compare current benchmark N management activities with other N best management practices, providing a positive or negative response to the change in the environment.

The N-Index can separate and rank the effects of nitrogen management on atmospheric and surface N losses when calibrated using local/regional data of N uptake, yields, N cycling, N content in manures, and other local parameters to facilitate the decision making process in identifying the potential, local best management practices and alternatives that reduce N losses. The tool keeps track of inorganic N sources, such as the N fertilizer, initial soil NO3-N, initial soil NH4-N, NH4-N from manures, irrigation NO3-N, and atmospheric N deposition inputs. The tool assesses N transformations, such as mineralization of N from crop residues, organic soil matter, and other organic sources that contribute and sum all of the N inputs for the system.

$S_{NI} = N_f + N_{in} + N_{min} + N_{atm} + N_{ma1} + N_{ma2} + N_{cr} + N_{irb} + N_{iro}$ where:

- S_{NI} = total system nitrogen inputs (lbs./ac/yr.);
- N_f = N applied as fertilizer (lbs./ac/yr.);
- N_{in} = root zone initial inorganic N before planting (0–3.3 ft. depth or 0 – depth of the deepest rooted crop – lbs. NH4- N + NO_3-N acre);
- N_{min} = mineralization of N from soil organic matter (0–1.0 ft. depth; (lbs. N/ ac/ year);
- N_{atm} = atmospheric N deposition (lbs. N /ac/ year);
- N_{ma1} = initial NH4-N + N mineralization from manure (lbs. N/ac/ year);
- N_{ma2} = N mineralization from manure applied last year (lbs.N ac/year) ;
- N_{cr} = crop residue N mineralization (lbs N/ac/year);
- N_{iro} = available organic N applied in irrigation water (lbs. N /ac.).

Instrumental to the assessment are the components of the cropping system N pathways for removal:

S_{NR} = cropping system N pathways for removal (lbs N/ac/year);

- N_c =N uptake by crops (lbs. N/ac.);
- N_d =N denitrification (lbs. N/ac);
- N_v =N ammonia volatilization (lbs. NH3-N/ac);
- N_{erav} =N erosion (lbs. N/ac.).

4. First year annual N removal by legumes and companion crops

Legume crop maximum N applications:

Most legume crops can fix sufficient N from the air to ensure adequate growth without applying additional N to the soil; therefore recommended N fertilization rates for most legume crops are zero. However, legumes will use available N in the soil in preference to fixing their own. Thus, manure N applied to legume crops is considered to have a low risk of loss through leaching if it does not exceed the crop N removal rate or is no more than 205 lb of available N per acre.

Table 2. First-year available manure N application rates allowed for legume and legume plus companion crops*

Crop	Yield range	**Manure available N allowed** (lb/acre)
Alfalfa; alfalfa/brome; red clover; or trefoil, birdsfoot, seeding or established †	< 1.5 ton/a	50
	1.5 – 2.5 ton/a	100
	2.6 – 3.5 ton/a	155
	> 3.5 ton/a	205
Barley for grain underseeded with alfalfa, alfalfa/brome, or red clover seeding ‡	All yield levels, bu/a	150
Dry beans	10-20 cwt/a	75
	21-30 cwt/a	125
	31-40 cwt/a	175
Oats for grain underseeded with alfalfa, alfalfa/brome, or red clover seeding ‡	All yield levels, bu/a	140
All pastures §	0.5-1.9 ton/a	55
	2 -3 ton/a	115
	3.1 - 4.0 ton/a	160
	4.1 - 5.0 ton/a	205
Small grain silage underseeded with alfalfa	2 - 3.5 ton/a	170
Small grain & legume silage	2 - 3.5 ton/a	70
Small grain & legume silage underseeded with alfalfa	2 - 3.5 ton/a	170
Soybean	15-25 bu/a	75
	26-35 bu/a	115
	36-45 bu/a	155
	> 45 bu/a	195

*Some legume crops such as peas and snap beans are not included in this table because N removal in the harvested portions of the crop is similar to their N fertilizer recommendation.

†To minimize the potential for stand injury, single applications should not exceed 5,000 gal/acre for liquid or 10 ton/acre for solid maures.

‡ Nitrogen allowed is the recommended rate for the grain crop plus removal in the forage crop. This rate may be too high for successful management of the grain crop.

§ Nitrogen allowed is the total available N deposited by grazing animals plus manure applied mechanically.

Note: As per the FOTG 590 Standard, commercial N should not be applied to legume crops that do not have an N requirement unless it is an unavoidable ingredient of a fertilizer needed to provide other required nutrients.

Non-leguminous crops maximum N application rates:

If commercial N fertilizer is applied in any amount: Total N applications, including N in starter, should not exceed the UW recommended rate for the crop. For non-legume crops other than corn or wheat, there is only one N rate recommended for a given crop or, in the case of potatoes, crop and yield range combination.

If only organic sources are applied: The 590 Standard recognizes that there will always be some uncertainty in estimating manure N availability because of variability in manure nutrient contents, uneven application rates, and weather. When organic sources of nutrients are used to meet 100% of the N requirement: 1) an additional 20 lb N/a of may be applied as commercial starter fertilizer for corn; 2) no additional commercial N should be applied to wheat beyond the top end of the MRTN range at a wheat: N price ratio of 0.050; and 3) up to 20% more N than recommended may be applied to crops other than corn or wheat.

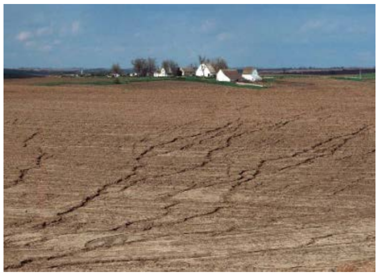
C. Phosphorus

1. Phosphorus losses are usually greatest on sites with high erosion.

Definitions of types of ephemeral:

- **Sheet erosion**, sometimes referred to as inter-rill erosion, is the detachment of soil particles by raindrop impact and the removal of thin layers of soil from the land surface by the action of rainfall and runoff.

- **Rill erosion** is the formation of small, generally parallel channels formed by runoff water and usually do not re-occur in the same place on the landscape from one storm event to the next, season to season or from one year to the next.



- **Ephemeral erosion** means erosion which forms rills that may converge to form shallow channels. These shallow channels can easily be filled with soil by typical tillage operations and usually re-formed in the same general location by subsequent runoff events.

- **Classical gullies or classic gullies** are concentrated flow channels formed when rills converge to form well defined permanent incised drainage ways that cannot be crossed by ordinary farming operations.

2. When applying nutrients on non-frozen ground, consider the following:

    a. Use runoff and erosion control practices such as spring tillage, maintaining high levels of crop residue on the soil surface, contour farming, and utilization of vegetated riparian buffers.b. Limit corn starter P applications on row crops to 20 pound P_2O_5 per acre, to the extent possible, eliminate all non-starter P applications.

    c. Whenever possible, apply manure on fields with lower P soil tests.

    d. Where possible, develop a means to move nutrients off the farm to areas with less environmental hazard.

3. Consider following National Research Council dietary P recommendations to lower P levels in rations and avoid high levels of P in manure.

4. To limit high-risk manure applications to frozen or snow-covered soil, complete a Winter Spreading Plan (Part II) and implement the following additional management practices:

    a. Temporary stacking of manure, manure storage, manure trading, and additional rental land for manure spreading.

    b. Where supplemental feeding of P in current rations is above National Research Council recommended levels, a feed management strategy will be discussed with the producer and their animal health and feed supply professionals with the goal of reducing supplemental feeding of P and reducing manure P losses.

D. Subsurface Drainage resources

- Michigan State University: http://animalagteam.msu.edu/animalagteam/tile_drains
- University of Wisconsin Discovery Farms: http://www.uwdiscoveryfarms.org/OurResearch/AgriculturalTileDrainage.aspx
- University of Minnesota Extenstion: http://www.extension.umn.edu/agriculture/water/publications/

E. Other Considerations

1. Use appropriate pH management to keep the soil pH in the proper range for optimum crop production. Soil pH affects the availability of almost all of the essential elements. See UWEX Pub. A2809.

2. Good soil tilth should be maintained because it encourages infiltration, reduces runoff, and enhances crop vigor. This is especially important when the objective is to protect surface water.

    a. Organic matter additions promote good soil tilth.

    b. Equipment travel on saturated soils should be avoided to reduce soil compaction and rutting.

3. The hydraulic loading rate of the upper horizons should be considered. If the loading rate is low, or if there is a horizon that prohibits downward movement of liquid (i.e., hard pan or a clay horizon), it is important not to apply more liquid manure than the soil can absorb.

PART IV

DETERMINING MANURE NUTRIENT CREDITS

Proper crediting of manure nutrients can lower commercial fertilizer needs and reduce the potential for surface and groundwater pollution. Manures contain significant amounts of the major plant nutrients (N, P and K) and many other essential nutrients. Only a portion of the nutrients from field-spread manure is available in the first year. The rest becomes available over time as the nutrients are released from the organic fraction. Calculating the fertilizer value of manure involves three steps:

1) Estimate quantity of on-farm manure production;
2) Estimate available - nutrients;
3) Estimate the manure nutrient credit and application rates

An example of how to estimate the quantity of on-farm manure production is provided below. Chapter 9 Nutrient credits in UWEX Pub A2809 describes manure nutrient availability and the process for estimating manure nutrient credits including example calculations. Manure nutrient content can vary significantly from the average values provided in UWEX Pub A2809. Therefore, sampling manure and analyzing for nutrient composition is encouraged as a means to more accurately assess manure nutrients. UWEX Publication A3769 Recommended Methods of Manure Analysis provides guidance on how to collect and handle manure samples.

Estimate Quantity of On-Farm Manure Production

Manure production can be estimated by utilizing the information provided in Table 3. Manure production can vary considerably between production systems. Other manure production estimates are acceptable. Estimates of the percent of the total manure production that is actually collected may also aid in the planning process. The planner may explain the manure production/collection system in the narrative section as described in Part 1.

Manure storage size may provide a better quantity estimate:

- What is the manure storage facility size?
- Multiply storage facility size by the number of times emptied/year. This equals the total annual manure collection.

SnapPlus2 offers a Manure Production Estimator or a Grazing Application Estimator and is available for free at http://snapplus.wisc.edu/.

Table 3. Manure Quantity Estimation for Crop Production *Version January 16, 2003*

Animal	Size Lbs.	Daily Manure Production To Apply: Solid Lbs/day	Solid ft^3/day	Liquid: MWPS ft^3/day x WI dairy & beef dilution factor	ft^3/day & WI dilution	MWPS gal./day x WI dairy & beef dilution factor	gal./day & WI dilution	Annual Manure Production To Apply: Number of Head x	Daily Total Tons or Gal. x	365 Day Total x	% Collected =	Total Collected Tons or Gal.
Dairy												
Calf	150	13	0.200	.21*1.8=	.37	1.53*1.8=	2.80					
Calf	250	21	0.320	.33*1.8=	.60	2.47*1.8=	4.50					
Heifer	750	65	1.000	1.03*1.8=	1.85	7.70*1.8=	13.8					
Lact. Cows	1000	106	1.700	1.71*1.8=	3.07	12.7*1.8=	23.0					
	1400	148	2.400	2.38*1.8=	4.28	17.7*1.8=	32.0					
Dry Cows	1000	82	1.300	1.30*1.8=	2.35	9.7*1.8=	18.0					
	1400	115	1.820	1.82*1.8=	3.33	13.6*1.8=	25.0					
Beef												
Calf	450	26	0.420	.415*3.2=	1.3	3.1*3.2=	9.9					
High Forage	750	62	1.000	1.00*3.2=	3.2	7.5*3.2=	24.0					
High Forage	1100	92	1.400	1.48*3.2=	4.8	11*3.2=	35.0					
High Energy	750	54	0.870	.87*3.2=	2.7	6.5*3.2=	20.8					
High Energy	1100	80	1.260	1.27*3.2=	4.1	9.5*3.2=	30.5					
Beef Cow	1000	63	1.000	1.00*3.2=	3.2	7.5*3.2=	24.0					
Swine												
Nursery Pig	25	2.7	0.040	.04		.30						
Grow-Finish Pig	150	9.5	0.150	.17		1.20						
Gestating Sow	275	7.5	0.120	.14		1.00						
Sow & Litter	375	22.5	0.360	.42		3.00						
Boar	350	7.2	0.120	.14		1.00						
Poultry / Other												
Layers	4	0.26	0.004	.004		.03						
Broilers	2	0.18	0.003	.003		.02						
Turkeys	20	0.9	0.014	.015		.11						
Duck	6	0.33	0.005	.006		.04						
Sheep	100	4	0.060	.055		.40						
Horse	1000	50	0.800	.827		5.98						

Source: Midwest Plan Service publication number MWPS-18 “Manure Characteristics” Section 1, copyright 2000. Solid volumes are as excreted. The liquid dairy and beef values are computed from the MWPS daily production and have approximately equal nutrient values annually as solid manure. MWPS liquid dairy and beef factors are multiplied by 1.8 and 3.2 respectively. Dilution on your operation may be substantially different. **Use manure analysis and manure storage volumes** to determine manure production whenever possible.

Manure quantities are likely to be more accurate estimated from storage size:

What is the manure storage pit size? ___________________________ gallons or tons?

Multiply pit size x Number of times emptied/year ______________ = Total annual manure collection

PART V

DNR CONTACT INFORMATION AND RESOURCES FOR NUTRIENT MANAGEMENT

DNR Service Center Locations by Region - The State of Wisconsin is divided into five regional areas. They include Northern Region, Northeast Region, West Central Region, South Central Region, and Southeast Region. The DNR Central Office is located in Madison.

Contacts

CAFO - AG Runoff Management Staff (by DNR office and county)
http://dnr.wi.gov/topic/AgBusiness/CAFO/Contacts.html

Agricultural Nonpoint Source Specialists (by DNR office and county)
http://dnr.wi.gov/topic/Nonpoint/NPScontacts.html

Drinking and Groundwater Staff (link in lower left corner) by county
http://dnr.wi.gov/topic/drinkingwater/

Resources

Reporting Concerns regarding Agricultural Operations
http://dnr.wi.gov/topic/Nonpoint/dischargesComplaints.html

Manure Spills Response Planning and Prevention
http://dnr.wi.gov/topic/agbusiness/manurespills.html

Nonpoint Source Pollution
http://dnr.wi.gov/topic/nonpoint/

CAFO’s and Nutrient Management
http://dnr.wi.gov/topic/AgBusiness/CAFO/NutrientManagementPlan.html

Agricultural TMDL’s
http://dnr.wi.gov/topic/tmdls/npstmdls.html

Impaired Waters
http://dnr.wi.gov/topic/impairedwaters/

PART VI

CERTIFIED SOIL TEST LABORATORIES

The following laboratories have been approved as of the publication date of this document.

UW Soil & Forage Laboratory
8396 Yellowstone Drive
Marshfield, WI 54449
Ph: (715) 387-2523

Rock River Laboratory
710 Commerce Drive
P. O. Box 169
Watertown, WI 53094
Ph: (920) 261-0446

Dairyland Laboratories
217 E. Main Street
Arcadia, WI 54612
Ph: (608) 323-2123

Agsource Soil & Forage Laboratory
106 N. Cecil Street
Bonduel, WI 54107
Ph: (715) 758-2178

A&L Great Lakes Laboratories
3505 Conestoga Drive
Fort Wayne, IN 46808
Ph: (260) 483-4759