

NUTRIENT MANAGEMENT WORKING DRAFT 3-23-15

(Acre)

Code 590

Natural Resources Conservation Service
Conservation Practice Standard

I. Definition

Managing the amount (rate), source, placement (method of application), and timing of plant nutrients and soil amendments.

II. Purposes

- To *budget*¹, supply, and conserve nutrients for plant production.
- To minimize the risk of agricultural nonpoint source pollution of surface and groundwater resources.
- To properly utilize manure or organic by-products as a plant nutrient source.
- To protect air quality by reducing odors and reactive nitrogen emissions (ammonia, inorganic oxidized forms, and organic compounds).
- To maintain or improve the physical, chemical, and biological condition of the soil.

III. Conditions Where Practice Applies

This standard applies to all *fields* where plant nutrient sources and soil amendments are applied during the course of a *rotation*.

IV. Federal, State, and Local Laws

Users of this standard are responsible for compliance with applicable federal, state, and local laws, rules, or regulations governing nutrient management systems. This standard does not contain the text of federal, state, or local laws. Implementation of this standard may not eliminate nutrient losses that could result in a violation of law.

V. Criteria

This section establishes requirements for planning, design parameters, acceptable management processes, and performance requirements for nutrient management plan development and implementation. Nutrient management plans shall be prepared according to all of V. Criteria A., B., C., D., and E., as well as VII. Plans and Specifications, and VIII. Operations and Maintenance.

All of the information contained in this section is required. Wisconsin Conservation Planning Technical Note WI-1 is the companion document to this standard and includes criteria that are required where referenced within this section.

A. Criteria for Surface and Groundwater Resources

1. Nutrient Criteria for All Sites

- a. Develop and implement an annual field-specific nutrient application plan. Account for the source, rate, timing, form, and method of application for all *major nutrients* consistent with this standard and nutrient application guidelines found in University of Wisconsin-Extension (UWEX) Publication A2809, "Nutrient application guidelines for field, vegetable, and fruit crops in Wisconsin," unless use of one the following options are appropriate:
 - For crops not listed in A2809, use other appropriate Land Grant University recommendations.

¹ Words in the standard that are shown in italics are described in X. Definitions. The words are italicized the first time they are used in the text.

- For nutrient application decisions based on plant tissue analysis, the sampling and testing of plants and the resulting nutrient recommendations shall be done in accordance with University of Wisconsin recommendations. See V.A.1.o.

Annual plan updates shall document the crops, tillage, nutrient application rates, and methods actually implemented.

- b. The plan shall be based on yield goals that are attainable under average growing conditions and established using soil productivity, local climate information, multi-year *documented yields*, and/or local research on yields for similar soils and crop management systems. Yield goals should not be higher than 15% above the previous 3-5 year average.
- c. The plan shall include a Winter Manure Spreading Risk Assessment for the manure to be spread during the winter months consistent with this standard (see WI Conservation Planning Technical Note – 1 Part II).
- d. The plan shall demonstrate that adequate acreage is available for all manure nutrients applied to fields. If an adequate land base is NOT present the plan shall document the strategy to utilize the remaining projected volume of manure or other organic nutrient source produced on the farm.
- e. Soils shall be tested a minimum of once every four years by a DATCP-certified laboratory for pH, phosphorus (P), potassium (K), and organic matter. A laboratory list is provided in Part VI of the Wisconsin Conservation Planning Technical Note WI-1. Soil sampling shall be consistent with UWEX Publication A2809, “Nutrient application guidelines for field, vegetable, and fruit crops in Wisconsin,” or A2100, “Sampling Soils for Testing.” For perennial fruit crops, use of soil test recommendations from UWEX Publication A2809 is only required as the basis for fertilizer applications prior to establishment of new plantings. Subsequent nutrient recommendations should be based on plant tissue analysis results. See V.A.1.o.
- f. Where practical, adjust soil pH to the specific range of the crop(s) grown to optimize nutrient utilization.
- g. Annual P and K nutrient recommendations may be combined into a single commercial fertilizer application that does not exceed the total nutrient recommendation for the rotation. This combined annual application is not allowed on frozen or snow covered soil. Commercial P fertilizers shall not be applied to soils testing excessively high in P for the crop being grown with the exception below (V.A.1.h).
- h. All the N, P, and K fertilizer shall be credited against crop needs, which are based on the crop to be grown and on soil test results. The exceptions are: 1. Up to 20 pounds per acre of P₂O₅ *starter fertilizer* may be applied to corn grown on soils testing excessively high, where no fertilizer is recommended. 2. To account for variability in N mineralization and manure application, when *organic sources* of nutrients are used to meet 100% of the N requirement for corn, an additional 20 pounds per acre of commercial N may be applied as starter fertilizer.
- i. Where *gleaning/pasturing* occurs, verify through computations that the manure nutrients deposited within a field, do not exceed the N and P requirements of this standard.
- j. Available nitrogen from all sources shall not exceed the annual N requirement of non-legume crops consistent with UWEX Publication A2809, or the annual N removal by a legume crop or a legume and companion crop. See Wisconsin Conservation Planning Technical Note WI-1, Part III.B.
- k. First and second-year legume nitrogen credits shall be applied as described in UWEX Publication A2809 Table 9.4 through 9.6 or through soil nitrate testing as identified in Chapter 6 of UWEX Publication A2809.
- l. Estimates of first-year available nutrient credits for manure shall be established in accordance with one of the following methods:

- (1) Manure samples shall be collected for three or more consecutive years, as necessary, to establish a representative baseline. After which samples should be collected once every four years. If no operational changes occur, less frequent manure testing is allowable.
 - Sample all manure types separately according to UWEX Publication A3769 “Recommended Methods of Manure Analysis.”
 - Send manure samples to a laboratory participating in the Manure Analysis Proficiency (MAP) testing program where the manure analyses shall consist of total N, total P₂O₅, total K₂O, and dry matter content at a minimum and the results shall be interpreted according to Table 9.1 in UWEX Publication A2809.
- (2) Use an average or “book” value of available nutrients. Follow Table 9.3 in UWEX Publication A2809. See Part IV, Table 4 of the Wisconsin Conservation Planning Technical Note WI-1.

Notes: Consider analysis for ammonium-N for liquid (<4.0% dry matter) manures, which have the potential for more than 50% of the total N to be in the ammonium form.

For areas receiving manure applications in consecutive years, it is recommended that a second-year N credit be included in the nutrient management plan. Follow Chapter 9 in UWEX Publication A2809 to determine second-year N credits.

- m. Organic byproducts other than manure (i.e., industrial wastes, municipal sludge, and septage) shall be analyzed for nutrient content and applied to fields in accordance with this standard and any applicable regulations including restrictions on heavy metal content and land application rates.
 - n. Manures, organic byproducts, and fertilizers shall not run off the field site during or immediately after application. If the applied material ponds, runs off, infiltrates to subsurface tiles, or flows toward wells or *direct conduits to groundwater*, implement the following activities as appropriate:
 - (1) Stop application.
 - (2) Take corrective action to prevent offsite movement.
 - (3) Modify the application rate, method, depth of injection, timing.
 - (4) Notify the Wisconsin Department of Natural Resources (WDNR) in the event that a spill or accidental release of any material or substance when required by the Agricultural Spill Law (s.289.11, Wis. Stats.) or the terms of a WPDES permit. Refer to “Agricultural Spills and How to Handle Them,” Pub-RR-687-2002, August 2002 and the Wisconsin Conservation Planning Technical Note WI-1, Part VI, for DNR contact information.
 - o. Where nutrient application decisions are based on plant tissue analysis, for crops such as cranberries or established fruits, the sampling and testing of plants and the resulting nutrient recommendations shall be done in accordance with University of Wisconsin recommendations in the references section of this standard.
2. Nutrient Application Prohibitions
- a. Nutrients shall not be spread on the following areas:
 - (1) Surface water, *saturated soils*, during periods of active snow melt, where water is flowing, *concentrated flow channels*, or non-harvested *vegetative buffers*. Nutrients may be added for the establishment of perennial vegetation only.
 - (2) A non-farmed wetland or direct conduits to groundwater, such as a sinkhole or nonmetallic mine.
 - (3) Within 50 feet of a *Private Potable Water Well* or direct conduits to groundwater, unless directly deposited by gleaning or pasturing animals.

- (4) Land where vegetation is not removed mechanically or by grazing, except to provide nutrients for establishment and maintenance of a conservation practice.
 - (5) Fields exceeding *tolerable soil loss (T)*. Erosion controls shall be implemented so that tolerable soil loss (T) over the crop rotation will not be exceeded on fields that receive nutrients.
- b. *Untreated manure* shall not be mechanically applied on the following areas:
- (1) Within 1000 feet of a public water supply designated as a *Community Potable Water Well*.
 - (2) Within 250 feet of a public water supply designated as a *Non-community Potable Water Well*.
 - (3) Within locally identified areas delineated in a *conservation plan*, or nutrient management plan, or other sources recognized by the local Land Conservation Committee as *areas contributing direct runoff* to direct conduits to groundwater unless *substantially buried* within the soil surface within 24 hours of application.
- c. When frozen or snow-covered soils prevent *effective incorporation* at the time of application and the nutrient application is allowed, implement the following according to a Winter Spreading Plan in Section VII.B.:
- (1) Do not apply nutrients within the *Surface Water Quality Management Area (SWQMA)* except for manure deposited through winter gleaning or pasturing of plant residue.
 - (2) Do not apply nutrients to locally identified areas delineated in a *conservation plan*, or nutrient management plan, or designated by the local Land Conservation Committee as areas contributing direct runoff nutrients to surface and ground water.
 - (3) Winter manure applications shall be conducted according to a Winter Spreading Plan consistent with Section VII.B. Do not exceed the P removal of the following growing season's crop when applying manure. Liquid manure applications are limited to 7,000 gallons per acre, not to exceed 60lbs of P₂O₅. The balance of the crop nutrient requirement may be applied the following spring or summer.
 - (4) Do not mechanically apply nutrients on slopes greater than 9%, except for manure on slopes up to 12% where cropland is contoured or contour strip cropped. Grazing may occur on all slopes.
 - (5) Do not apply N and P in the form of commercial fertilizer. An exception is allowed for grass pastures and on winter grains that do not fall within a prohibition area defined by V.A.2.
 - (6) Do not surface apply liquid manure during February and March on areas depicted on the 590 spreading restriction maps as areas where DNR Well Compensation funds provided replacement water supplies for wells contaminated with livestock manure or *Silurian dolomite (SD) soils*.
3. Nutrient Application Restrictions
- a. For all nutrient applications on non-frozen soil within a SWQMA use one or more of the following practices as appropriate to address water quality concerns for the site:
- (1) Install/maintain permanent vegetative buffers (harvesting is allowed unless restricted by other laws or programs). Refer to NRCS Field Office Technical Guide (FOTG), Section IV, Standard 393, Filter Strip, or ATCP 48 for land in drainage districts.
 - (2) Maintain greater than 30% crop residue or vegetative cover on the soil surface after nutrient application.
 - (3) Effective incorporation of nutrients within 72 hours of application shall occur leaving adequate residue to meet tolerable soil losses.

- (4) Establish a *cover crop* prior to, at, or promptly following application.
 - (5) Apply nutrients within seven days of planting on *long term no-till* ground with less than 30% residue.
- b. When unincorporated liquid manure applications less than or equal to 11.0% dry matter occur on non-frozen soils within a SWQMA, OR where *subsurface drainage* is present:
- Limit applications of liquid manure to 12,000 gallons per acre per application.
 - No applications are allowed on saturated soils.
 - No ponding of manure is allowed at the application site.
 - Follow V.A.1.n. to address ponding, drainage to subsurface tiles, or runoff of applied manure.

Sequential applications may be made to meet the desired nutrient additions consistent with this standard. Wait a minimum of 7 days between sequential applications.

B. Criteria to Minimize Entry of Nutrients to Groundwater

1. To minimize N leaching to groundwater on *N restricted soils* which include *high permeability soils (P)*, or *rock soils* with less than 20 inches to bedrock (R), or *wet soils* with less than 12 inches to *apparent water table (W)*, or areas within 1,000 feet of a *community potable water well*, use the following applicable management practices and the crop N rate guideline from UWEX Pub. A2809 or rates specified below:

Note: The balance of the crop N requirements may be applied the following spring or summer. The Wisconsin Conservation Planning Technical Note WI-1 provides a list of N-restricted soils which have a higher potential for N leaching to groundwater in Appendix 1 and more information on nitrification inhibitors.

- a. In late summer or fall:

- (1) No commercial N applications on areas identified as having soil depth of 5 feet or less over bedrock, P, R, W soils, areas within 1,000 feet of a community potable water well, except where needed for establishment of fall seeded crops or blended commercial fertilizer materials are needed to meet UWEX Pub. A2809 guidelines. For these exceptions, the N application rate shall not exceed 36 pounds N per acre and all nutrients must be credited towards the requirement of the crop.
- (2) When manure is applied on W soils or combination W soils, use rates that will not smother crops and limit the available N to the crop N guidelines or legume N removal applying no more than 120 pounds per acre.

In addition, when applying manure with less than or equal to 4.0% solids reduce applications to 90 pounds per acre of available N or apply no more than 120 pounds of N per acre and use at least one of the following practices:

- Use a *nitrification inhibitor*.
 - Apply on an established cover crop, or an overwintering annual crop, or a perennial crop.
 - Establish a cover crop within 14 days of application.
 - Surface apply and do not incorporate for at least 3 days.
- (3) When manure is applied on P and R soils prior to October 1 and *soil temperatures are greater than 50°F*, use the following:

- For perennial or overwintering annual crops, including cover crops, use rates that will not smother these crops and limit available manure N to 60 pounds per acre.
 - For annual crops, delay applications until after soils are below 50 °F and follow V.B.1.a.5.
- (4) When manure is applied on P and R soils on or after October 1 or soil temperatures are less than 50°F, use the following:
- For perennial or overwintering annual crops, including cover crops, use rates that will not smother these crops and limit available manure N to 120 pounds per acre.
 - For annual crops, limit available manure N to the lesser of 90 pounds per acre or N applications rate guidelines specified in UWEX Pub A2809. In addition, when applying manure with less than or equal to 4.0% solids, use a nitrification inhibitor or surface apply and do not incorporate for at least 7 days.
- b. In spring:
- (1) On R, W, and combination soils, when commercial N is applied, do not exceed the crop N rate guidelines from all sources.
 - (2) On P soils, when commercial N is applied, do not exceed the crop N rate guidelines and apply one of the following management strategies:
 - A split or delayed N application to apply a majority of crop N requirement after crop establishment.
 - Use a nitrification inhibitor with ammonium forms of N.
 - Use *slow and controlled release fertilizers* for a majority of the crop N requirement applied near the time of planting.
2. Where P enrichment of groundwater is identified as a conservation planning concern, implement practices to reduce delivery of P to groundwater.

C. Additional Criteria to Minimize Entry of Nutrients to Surface Water

1. Where manure, organic byproducts, or fertilizers are applied:
 - a. Avoid building soil test P values, when possible, beyond the non-responsive soil test range for the most demanding crop in the rotation. For most agronomic crops in Wisconsin, the non-responsive soil test range is 30 to 50 parts per million (ppm) Bray P-1 soil test.
 - b. Establish perennial vegetative cover in all areas of concentrated flow that result in reoccurring gullies.
 - c. In crop fields where *ephemeral erosion* is an identified problem, a minimum of one of the following runoff-reducing practices shall be implemented:
 - Install/maintain contour strips and/or contour buffer strips. Refer to NRCS FOTG, Section IV, Standard 585, Strip Cropping, and/or Standard 332, Contour Buffer Strip.
 - Install/maintain filter strips (NRCS FOTG, Section IV, Standard 393, Filter Strip) along surface waters and concentrated flow channels that empty into surface waters.
 - Maintain greater than 30% crop residue or vegetative cover on the soil surface after planting.
 - Establish fall cover crops.

2. Develop a P management strategy when manure or organic by-products are applied during the crop rotation to minimize surface water quality impacts. Use either the *Phosphorus Index (PI)* in section V.C.2.a. or Soil Test Phosphorus Management Strategy in section V.C.2.b. on all fields within a farm or tract.

Note: First year available N in manure applied to fields prior to legume crop establishment shall not exceed the first year's annual N removal by legumes and companion crop. See Wisconsin Conservation Planning Technical Note WI-1, Part III B.4. Available N applied cannot exceed the N need or legume crop N removal of the next crop to be grown.

- a. PI Strategy – The planned average PI values for up to an 8-year rotation in each field shall be 6 or lower. P applications on fields with an average PI greater than 6 may be made only if additional P is needed and according to UWEX soil fertility recommendations. Strategies for reducing the PI, algorithms, and software for calculating the Wisconsin PI can be found at <http://wpindex.soils.wisc.edu/>.
- b. Soil Test Phosphorus Strategy - Management strategies based on soil test phosphorus may be used. Operations using this strategy shall have a conservation plan addressing all soil erosion that is consistent with the current crops and management or use the erosion assessment tools included with the Phosphorus Index model.

Available phosphorus applications from all sources shall be based on the following soil test P values (Bray P-1):

- (1) Less than 50 ppm soil test P - nutrient application rates allowed up to the N needs of the following crop or the N removal for the following legume crop.
- (2) 50-100 ppm soil test P - P application shall not exceed the total crop P removal for crops to be grown over a maximum rotation length of 8 years.
- (3) Greater than 100 ppm soil test P - eliminate P applications unless required by the highest P demanding crop in the rotation. If applications are necessary, applications shall be 25% less than the cumulative annual crop removal over a maximum rotation length of 8 years.
- (4) For land with potatoes in the rotation, total P applications shall not exceed UWEX Publication A2809, "Nutrient application guidelines for field, vegetable, and fruit crops in Wisconsin" guidelines, including fertilizer, over a maximum rotation length of 8 years if soil tests are in the optimum, high, or excessively high range for potatoes.

D. Additional Criteria to Protect Air Quality by Reducing Particulates, Odors, and Reactive Nitrogen Emissions Where Air Quality is Identified in a Conservation Plan or Nutrient Management Plan as a Resource Concern

1. Apply one or more of the following management strategies that minimizes nutrient volatilization and particulate losses while maintaining tolerable soil erosion levels for wind and water:
 - Slow or controlled release fertilizers
 - Nitrification inhibitors
 - *Urease inhibitors*
 - Nutrient enhancement technologies
 - Immediate incorporation or injection
 - Stabilized nitrogen fertilizers
 - Residue and tillage management
 - No-till or strip-till
 - In-field and edge-of-field wind breaks
 - NRCS Wind Erosion Prediction System (WEPS) to confirm fields meet tolerable soil loss
 - Other technologies that minimize the impact of these emissions
2. Do not apply poultry litter, manure, or organic by-products of similar dryness/density when there is a high probability that wind will blow the material offsite.

E. Additional Criteria to Protect the Physical, Chemical, and Biological Condition of the Soil

1. Nutrients shall be applied in a manner that does not permanently degrade the soil's structure, chemical properties, or biological condition.
2. To the extent practical, nutrients shall not be applied when the potential for soil compaction and/or the creation of ruts is high.

VI. Considerations

The following statements are optional management considerations and are not required practices.

- A. Seed and stabilize all concentrated flow channels. Install and maintain vegetative filter strips, riparian buffers, and other buffer areas adjacent to surface water and wetlands in conjunction with other conservation practices in order to reduce the amounts of sediment and nutrients that reach surface water and/or groundwater.
- B. Use additional management practices found in the Wisconsin Conservation Planning Technical Note WI-1, Part III to improve N use efficiency.

Use variable-rate nitrogen, phosphorus, and potassium application rates based on site-specific variability in crop yield, soil characteristics, soil test values, and other soil productivity factors.

Develop site-specific yield maps using a yield monitoring system. Use the data to further diagnose low and high yield areas, or zones, and make the necessary management changes. See Title 190, Agronomy Technical Note (TN) 190.AGR.3, Precision Nutrient Management Planning.

- C. Implement *adaptive nutrient management* strategies to improve nutrient use efficiency on the farm. Refer to NRCS National Nutrient Policy GM 190, Part 402, Nutrient Management.
- D. Apply nutrients not specifically addressed by this standard (i.e., secondary and micro nutrients) based on recommendations found in UWEX Publication A2809.
- E. To minimize N leaching on medium and fine-textured soils, avoid fall commercial N applications for crops to be seeded the following spring. If commercial N is applied in the fall, use ammonium forms of N and delay N application until soil temperatures drop below 50°F. Use of a nitrification inhibitor with fall-applied N is recommended.
- F. For liquid and slurry manure, consider using a nitrification inhibitor to limit the potential risk for N loss.
- G. Use irrigation strategies (ex. irrigation scheduling, reduced-pressure drop nozzles for center pivots, etc) to minimize N leaching losses, improve crop water use efficiency, and not exceed intake/infiltration capacity of the soil.
- H. Consider the use of animal feeding strategies based on published nutrition research findings (National Research Council, etc.) to reduce excess P in rations when manure applications are made to cropland.
- I. Consider delaying surface applications of nutrients if precipitation capable of producing runoff is forecast within 24 hours of the time of planned application.
- J. Consider modifying the crop rotation in order to provide crop fields for the application of manure during the summer crop growing season.
- K. On fields directly adjacent to or on fields with areas of concentrated or channelized flow that drain directly to surface waters, consider the following:

- For operations using the soil test P strategy, avoid raising soil test P levels beyond optimum. In addition, implement conservation practices that reduce delivery of nutrients.
 - For operations using the P-Index, reduce the P-Index values by applying additional conservation practices.
- L. Where residual nitrate carryover is probable, the preplant soil nitrate test is recommended to adjust N application rates for corn.
- M. To improve N use efficiency of wheat, the preplant soil nitrate test is recommended to adjust the N application rate.
- N. Where cropland with less than 50' soil depth overlays Silurian Carbonate Bedrock, identify karst land features that are direct conduits to groundwater and use management practices to minimize N loss to groundwater. See WI Conservation Planning Technical Note for list of soils and/or map.
- O. When there is a high risk of transport of nutrients, the coordinated installation of conservation practices can be used to avoid, control, or trap manure or nutrients before they can leave the field by surface and subsurface drainage. The number of applications and application rates must also be considered to limit the transport of nutrients to tile.
- P. Vertical fractures in fine textured soils can also be a pathway for nutrients and manure to groundwater. Where cracks are identified, consider tillage to break up cracks and macropores before application. See UWEX publication "Preferential Flow of Manure in Tile Drainage" at www.extension.org/animal_manure_management.
- Q. Avoid unincorporated nutrient applications in flood prone areas of a field in order to prevent nutrient losses to surface waters. Consider surface applying manure nutrients after seasonal flooding risk period(s) has passed.
- R. Nutrient containers should be recycled in compliance with State and local guidelines or regulations.
- S. Avoid applying manure and other by-products upwind of inhabited areas.
- T. Use a Wisconsin NRCS recognized nitrogen loss index to evaluate N loss reduction alternatives. Refer to Wisconsin Conservation Planning Technical Note WI-1, Part III.B.
- U. Evaluate conditions for high risk of snow melt within a minimum of ten days before manure nutrient application.

VII. Plans and Specifications

- A. The minimum requirements for a nutrient management plan are specified in the previous sections of this standard and expanded in Part I of the Wisconsin Conservation Planning Technical Note WI-1. The following items are required in a nutrient management plan:
- Field features identified on maps or aerial photos including:
 - Field location, soil survey map unit(s), field boundary, acres, and field identification number;
 - Areas prohibited from receiving nutrient applications: Surface water, established concentrated flow channels with perennial cover, non-farmed wetlands, lands where established vegetation is not removed, and fields eroding at a rate exceeding tolerable soil loss (T)
 - Direct conduits to groundwater, such as wells, sinkholes, swallets, fractured bedrock at the surface, mine shafts, non-metallic mines, tile inlets discharging to groundwater, quarries, or depressional groundwater recharge areas over shallow fractured bedrock, and their restrictions or prohibited areas defined in V.A.2. and V.A.3.
 - Regulated water sources including private potable water wells, community potable water wells, and non-community potable water wells, and their restrictions or prohibition areas
 - Areas prohibited from receiving nutrient applications to frozen or snow-covered ground: Slopes > 9% or between 9 -12% if contour-cropped; Surface Water Quality Management Areas (SWQMA); Areas where DNR Well Compensation funds provided replacement water supplies for wells contaminated with livestock manure; Silurian Dolomite soils; Additional areas identified as contributing runoff to surface or groundwater

- N-restriction soils including areas identified as having soil depth of 5 feet or less over bedrock, P, R, W soils, and areas within 1,000 feet of a community potable water well, and listed in Appendix 1 of the Conservation Planning Technical Note WI-1
- Areas of concentrated flow that result in reoccurring gullies
- Each field's tolerable and actual soil losses;
- Soil test reports and results of soil, plant, manure, or organic byproduct sample analysis with the initial plan and upon resampling. For subsequent updates this information should be available upon request. Tissue test reports must be provided annually to document the need for nutrient applications based on tissue analysis results;
- Current and planned crops and crop yields, realistic yield goals;
- Recommended nutrient application rates;
- Documentation of actual nutrient applications including the rate, form, timing, and method. Revise the plan to reflect any changes in crops, yields, tillage, management, and soil or manure analyses;
- Guidance for implementation and maintaining records;
- Soil test P-ppm, P balance, or P Index level where applicable;
- Other management activities required by regulation, program requirements, or producer goals;
- A narrative to explain other implementation clarifications.
- The location, to the maximum extent practical, of subsurface drainage systems in fields where nutrients are applied. Review and follow the tile line/subsurface drainage location guidance in WI Conservation Planning Technical Note.
- An Emergency Action Plan to address discharges of liquid manure or organic byproducts from the tile lines following the guidance in WI Conservation Planning Technical Note.
- When grouping fields for nutrient application purposes, N, P, and K application rates shall match individual field recommendations as closely as possible to improve implementation.

- B. Winter Spreading Plan – The plan shall be developed according to the criteria defined in the NRCS FOTG Standard 590, Nutrient Management and be consistent with the Winter Manure Spreading Risk Assessment in Part II of Tech Note WI-1.

The plan shall:

- Identify areas of fields that meet the restrictions for applications of manure frozen or snow-covered ground;
- Evaluate the risk for manure runoff on all fields;
- Identify runoff mitigation practices;
- Reflect a minimum of 30 days of manure and process wastewater generated by the farm or all manure and process wastewater anticipated to be spread during frozen or snow covered ground, whichever is greater. Farms with greater than 180 days of available manure storage as of December 1 only have to plan for a minimum of 7 days of manure and process wastewater;
- Identify a minimum of three temporary manure stacking sites, with no more than two stacking sites per 40 acres per year, to provide an alternative to spreading manure during frozen or snow-covered ground. All stacking sites shall be consistent with stacking requirements within the NRCS 313 standard;
- Record manure applications to the fields determined to have the lowest runoff risk and accessible at the time of application.

- C. Persons who review or approve plans for nutrient management shall be certified through any certification program acceptable to the NRCS (NRCS General Manual, Title 180, Part 409.9, NRCS TechReg) or other appropriate agencies within the state.

- D. Industrial wastes and byproducts and municipal sludge are regulated by the Wisconsin Department of Natural Resources (WDNR). They must be spread in accordance with a Wisconsin Pollution Discharge Elimination System (WPDES) permit as obtained from the WDNR and also in accordance with V.A.I.m.
- E. Plans for nutrient management shall be developed in accordance with policy requirements of the NRCS General Manual Title 450 Part 401.03 and Title 190, Part 402, the contents of this standard, the procedures contained in the National Planning Procedures Handbook, and NRCS National Agronomy Manual, Section 503.
- F. Plans for Nutrient Management that are elements of a more comprehensive conservation plan or nutrient management plan shall recognize other requirements of the plan and be compatible with the other requirements. A Comprehensive Nutrient Management Plan (CNMP) is a conservation system unique to animal feeding operations (AFO). The CNMP will be developed to address the environmental risks identified during the resource inventory of an AFO. A CNMP will require use of all the applicable criteria in this technical standard along with the additional criteria located in NRCS National Planning Procedures Handbook, Subpart B, Part 600.54.

VIII. Operation and Maintenance

The minimum operations and maintenance requirements for a nutrient management plan are specified in this section. The following items are required:

- A. Document the actual nutrient application including the rate, form, timing, and method of the application. Revise the plan to reflect any changes in crops, tillage, management, soils, and manure tests. Producers shall have access to the current version of the nutrient management plan.
- B. Visually monitor accessible tile outlets before, during, and after liquid manure applications for potential discharge of manure or organic by-products. If a discharge is observed implement the activities in V.A.n. Evaluate the need to modify field operations to reduce the risk of large nutrient losses during a single runoff event based on current field conditions or forecasted weather events. Review and follow tile/subsurface drainage guidance in the WI Conservation Planning Technical Note.
- C. Minimize operator exposure to potentially toxic gases associated with manure, organic wastes, and chemical fertilizers, particularly in enclosed areas. Wear personal protective equipment appropriate to the material being handled.
- D. Protect commercial fertilizer from the weather, and agricultural waste storage facilities from accidental leakage or spillage. See Wisconsin administrative rules and county or local ordinances concerning regulations on siting, design, operation, and maintenance of these facilities.
- E. Temporary placement or storage of manure shall be in accordance with the criteria for temporary unconfined stacks of manure contained in NRCS FOTG Standard 313, Waste Storage Facility.
- F. When cleaning equipment after nutrient application, remove and save fertilizers or wastes in an appropriate manner. If the application equipment system is flushed, use the rinse water in the following batch of nutrient mixture where possible or dispose of according to state and local regulations. Always avoid cleaning equipment near high runoff areas, ponds, lakes, streams, and other water bodies. Extreme care must be exercised to avoid contaminating potable drinking water wells.
- G. Document the methodology to determine the nutrient application rate of equipment.
- H. Concentrated flow channels where gully erosion has/will occur shall be maintained in permanent vegetation, which does not include low velocity surface drains where channel erosion is not observed.

IX. References

Cranberry Tissue Testing for Producing Beds in North America (1995) Davenport et al., Oregon State Univ. Ext. Serv. Pub. CM8610.

Mineral Nutrition for Fruit Crops, Roper, Univ. of Wisconsin Dept. of Horticulture Pub.

National Research Council (NRC) Nutrient Requirements of Dairy Cattle, National Academy Press, 7th Revised Edition, 2001.

Nitrogen for Bearing Cranberries in North America (2000) Davenport et al., Oregon State Univ. Ext. Pub.

North Central Regional Research Report 346, Applying Manure to Alfalfa, December 2003.

Phosphorus for Bearing Cranberries in North America (2004) Roper et al., Univ. of Wisconsin Ext. Pub.

TechReg Website: <http://techreg.usda.gov>

USDA, NRCS, General Manual, Title 180, Part 409 Conservation Planning Policy, Wisconsin Supplement 409.9, Minimum Criteria to Achieve an NRCS Certified Conservation Planner Designation.

USDA, NRCS, General Manual, Title 190, Part 402, Nutrient Management.

USDA, NRCS, National Agronomy Manual, October 2002.

USDA, NRCS, National Planning Procedures Handbook, Amendment 4, March 2003.

USDA, NRCS, National Handbook of Conservation Practices, Subpart B, Part 600.54, Element Criteria for CNMP Development.

USDA, NRCS, Wisconsin Conservation Planning Technical Note WI-1, Companion Document to NRCS FOTG Standard 590, Nutrient Management.

USDA, NRCS, Wisconsin Field Office Technical Guide (FOTG), Section I, Erosion Prediction, Maps.

USDA, NRCS, Wisconsin Field Office Technical Guide (FOTG), Section II, Soil Interpretations (T-Value).

USDA, NRCS, Wisconsin Field Office Technical Guide (FOTG), Section IV, Practice Standards and Specifications.

University of Wisconsin-Extension (UWEX) Publication A2100, Sampling Soils for Testing, May 2, 2001.

University of Wisconsin-Extension (UWEX) Publication A2809, Soil Test Recommendations for Field, Vegetable, and Fruit Crops, revised 1998.

University of Wisconsin-Extension (UWEX) Publication A3340, Corn Fertilization.

University of Wisconsin-Extension (UWEX) Publication A3392, Guidelines for Applying Manure to Cropland and Pasture in Wisconsin, August, 1995.

University of Wisconsin-Extension (UWEX) Publication A3422, Commercial Vegetable Production in Wisconsin, 2005.

University of Wisconsin-Extension (UWEX) Publication A3512, Wisconsin's Preplant Soil Profile Nitrate Test, 1990.

University of Wisconsin-Extension (UWEX) Publication A3517, Using Legumes as a Nitrogen Source, September 1997.

University of Wisconsin Extension (UWEX) Publication A3557, Nutrient Management: Practices for Wisconsin Corn Production, September 1994.

University of Wisconsin-Extension (UWEX) Publication A3568, A Step-by-Step Guide to Nutrient Management, May 1992.

University of Wisconsin-Extension (UWEX) Publication A3624, Soil Nitrate Tests for Wisconsin Cropping Systems, 1994.

University of Wisconsin-Extension (UWEX) Publication A3634, Nitrogen Management on Sandy Soils, 1995.

Wisconsin Irrigation Scheduling Program 2012, <http://wisp.cals.wisc.edu> – (Check to see if UWEX Pub A3600 is updated by March. Panuska is in the process of updating.)

University of Wisconsin-Extension (UWEX), Nitrogen Source and \$ Rate of Return Calculator, Rankin, <http://www.uwex.edu/ces/crops/NComparison.htm>

University of Wisconsin-Extension (UWEX), NPM Program, Know How Much You Haul!, ipcm.wisc.edu.

University of Wisconsin-Extension (UWEX) Publication A3769, Recommended Methods of Manure Analysis, 2003.

University of Wisconsin Soil and Forage Analysis Lab Sampling for plant analysis: <http://uwlab.dyndns.org/marshfield/> (Click on Lab procedures and then plant analysis).

Wisconsin Administrative Code, Department of Agriculture, Trade and Consumer Protection, Chapter 48, Drainage Districts.

Wisconsin Phosphorus Index: <http://wpindex.soils.wisc.edu/>.

X. Definitions

Adaptive Nutrient Management (VI.C.) - A process used to plan, implement, evaluate, and adjust nutrient application strategies over time (multiple seasons). The process is intended to achieve better nutrient-use efficiency by calibrating nutrient application strategies to site-specific field conditions. Implementation of Adaptive Nutrient Management must use nutrient evaluation methods recognized by the University of Wisconsin including comparison of adaptive management practices with current practices, in-field replication, and evaluation over multiple years. Documentation of improved nutrient-use efficiency shall be based upon crop yield, detailed nutrient application records, soil testing, analysis of plant/grain nutrient composition, and/or nutrient concentrations in water or air as appropriate.

Apparent Water Table (V.B.1.) - Continuous saturated zone in the soil to a depth of at least 6 feet without an unsaturated zone below it.

Areas contributing direct runoff (V.A.2.b.(3)) – Areas located up gradient from an identified feature which generate surface runoff during precipitation and/or melting periods that flows toward and eventually reaches the feature. The contribution area may be identified utilizing digital elevation models, topographic maps or infield measurement and/or observation.

Budget (II) - Document present and prior year's crop, estimated nutrient removal by these crops and known nutrient credits. When nutrients are applied for future crop needs in the rotation, implement a tracking process to allow adjustment of subsequent nutrient applications so that the total amount of nutrients applied to the farm or tract complies with this standard and is documented in the plan. Required as a component for all nutrient management plans.

Community Potable Water Well (V.A.b.(1)) - Found in NR 811.02 (16) means a public water system, regulated under NR 811, which has at least 15 service connections and is used by at least 25 residents for at least 6 months per year. Any water system serving 7 or more single family homes, 10 or more mobile homes, 10 or more apartment units, 10 or more duplex living units or 10 or more condominium units shall be considered a community water system unless information is provided by the owner indicating that 25 year-round residents will not be served.

Concentrated Flow Channel (V.A.2.a.(1)) - A natural channel or constructed channel that has been shaped or graded to required dimensions and established in perennial vegetation for the stable conveyance of runoff. This definition may include non-vegetated channels caused by ephemeral erosion. These channels include perennial and intermittent streams, drainage ditches, and drainage ends identified on the NRCS soil survey and not already classified as SWQMAs. Concentrated flow channels are also identifiable as contiguous up-gradient deflections of contour lines on the USGS 1:24,000 scale topographic map. The path of flow to surface water or direct conduits to groundwater must be documented. Refer to NRCS FOTG Standard 412, Grassed Waterway, for more information on construction.

Conservation Plan (V.A.2.c.(2)) - A plan developed and field verified by a conservation planner to document crop management and the conservation practices used to control sheet and rill erosion to tolerable levels (T) and to provide treatment of ephemeral soil erosion. A conservation plan must be signed by the land operator and approved by the county Land Conservation Committee or their representative. A conservation plan will be needed for designating winter spreading restrictions other than those specifically listed in this standard, and when implementing the soil test P management strategy where the soil erosion assessment is not calculated with the Wisconsin Phosphorus Index model. A conservation planner must develop conservation plans using the minimum criteria found in the USDA, NRCS National Planning Procedures Handbook and the Wisconsin Field Office Technical Guide and be qualified by one of the following:

1. Meeting the minimum criteria in the NRCS General Manual, Title 180, Part 409.9(c), NRCS Certified Conservation Planner Designation.
2. Meeting criteria established by the county Land Conservation Committee.
3. Meeting the NRCS TechReg Certified Conservation Planner Option 1, 2, 3.

Cover Crop (V.A.3.a.(4)) – Grasses, legumes, forbs or other herbaceous established for seasonal cover and conservation purposes. Cover crops are typically terminated prior to the production of viable seed.

Direct Conduits to Groundwater (V.A.1.n.) – Wells, sinkholes, swallets (a sinkhole or rock hole that intercepts a stream, diverting all or a portion of it to the groundwater), fractured bedrock at the surface, mine shafts, non-metallic mines, tile inlets discharging to groundwater, quarries, or depressional groundwater recharge areas over shallow fractured bedrock. For the purpose of nutrient management planning, these features will be identified on the Nutrient Application Restriction Maps, NRCS soil survey and/or USGS 1:24,000 scale topographic map, or otherwise determined through on-site evaluation and documented in a conservation plan, nutrient management plan or other local process approved by the Land Conservation Committee.

Documented yields (V.A.1.b.) - Crop production yield records documented by field for at least two consecutive years that are used to determine phosphorus and potassium fertility recommendations. Yield record documentation may include measurements of harvested crop weight, volume, or the use of calibrated yield-monitors.

Effective Incorporation (V.A.2.c.) - Means the mixing with the topsoil or residue or subsurface placement of nutrients with topsoil by such means as injector, disc, sweep, mold-board plow, chisel plow, or other tillage/infiltration methods. Nutrients will not run off the field or drain to subsurface tiles during application.

Ephemeral Erosion (V.C.1.c.) – Refers to soil erosion by water that has caused more soil loss than sheet and rill erosion. Each succeeding type of soil erosion including sheet erosion, rill erosion, ephemeral gully, and classical gully, are associated with the progressive concentration of runoff water into channels as it moves downslope. See the WI Conservation Planning Technical Note Part III for specific erosion type definitions and photos.

Fields (III) - A group or single nutrient management unit with the following conditions: similar soil type, similar cropping history, same place in rotation (i.e., second year corn fields, established alfalfa), similar nutrient requirements, and close proximity. Examples include: alternate strips in a contour strip system, pasture, variable rate nutrient application management units, and other management units where grouping facilitates implementation of the nutrient management plan.

Gleaning or Pasturing (V.A.1.i.) - An area of land where animals graze or otherwise seek feed in a manner that maintains the vegetative cover over all the area and where the vegetative cover is the primary food source for the animals. Livestock shall be managed to avoid the routine concentration of animals within the same area of the field. Manure deposited near a well by grazing of livestock does not require incorporation.

Long-term no-till (V.A.3.a.5.) – No tillage has occurred for a minimum of three consecutive previous years.

Major Nutrients (V.A.1.a) - Nitrogen (N), phosphorus (P), and potassium (K).

Nitrification inhibitor (V. B.1.a.(2))- A compound that temporarily blocks the activity of nitrifying bacteria and limits the conversion of ammonium to nitrate. Use of a nitrification inhibitor with ammonium based fertilizers or manure has the potential to reduce nitrate loss via leaching or denitrification.

Non-community Potable Water Well (V.a.2.b.(2)) – Means a public water system, regulated under NR 812, which serves at least 25 or more people for 6 months or more per year. Well users may be non-transient (same 25 people) or transient. Non-community potable wells include schools, restaurants, or churches and private potable water wells that meet the use definition.

N Restricted Soils (V.B.1.) Are defined below and include the area within 1000 feet draining to community potable water wells or areas identified as having soil depth of 5 feet or less over bedrock (See Tech Note).

High Permeability Soils (P) – Are equivalent to drained hydrologic group A meeting both of the following criteria:

1. Permeability = 6 inches/hour or more in all parts of the upper 20 inches and
2. Permeability = 0.6 inches/hour or more in all parts of the upper 40 inches.

Use the lowest permeability listed for each layer when evaluating a soil. For a multi-component map unit (complex), evaluate each component separately. If the high permeability components meet the criteria and cannot be separated, the entire map unit should be considered as high permeability.

Wet soils (W) have an Apparent Water Table within 12 inches of the surface at any time of the year. The apparent water table is a continuous saturated zone in the soil to a depth of at least 6 feet without an unsaturated zone below it. A W soil is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions. These soils can be non-hydric, saturated, or soggy for short periods in the spring after periods of rain or flooding and usually occur in low areas of the landscape.

Rock soils (R) have less than or equal to 20 inches to bedrock. Bedrock is a general term for the solid rock (lithic) or unconsolidated material (paralithic) that underlies the soil or is exposed at the surface. If R soils are field verified and the depth is more than 20 inches to bedrock, then the soil is not considered restricted for bedrock.

Note (V.A.1.1.) - Any section labeled as a 'note' is to be considered a recommendation rather than a requirement. The note is included in the criteria section to ensure subject continuity.

Organic Sources (V.A.1.h.) – Sources of nutrients from plants, manures, or animal sources that are not manufactured specifically as fertilizers. Examples include paunch, manure solids, cheese production wastes, and waste water treatment plant bio-solids and waste water if land applied. This does not include industrial waste or manufactured nutrient sources. Use of the term “organic” is not intended to meet certification criteria of the USDA National Organic Program.

Phosphorus Index (PI) (V.C.2.) - The Wisconsin Phosphorus Index (PI) is an assessment of the potential for a given field to deliver P to surface water. The PI assessment takes into account factors that contribute to P losses in runoff from a field and subsequent transport to a water body, including:

- Soil erosion as calculated using the current approved NRCS soil erosion prediction technology located in Section I of the NRCS FOTG.
- Estimated annual field rainfall and snowmelt runoff volume.
- Soil P concentrations as measured by routine soil test P (Bray P-1).
- Rate and management of P applications in the form of fertilizer, manure, or other organic material.
- Characteristics of the runoff flow pathway from the field to surface water.

The algorithms and software for calculating the Wisconsin PI can be found at <http://wpindex.soils.wisc.edu/>.

Private Potable Water Well (V.A.2.a.(3)) - Means a private water system, regulated under NR 812, which has fewer than 15 service connections and serves fewer than 25 people for more than 60 days a year.

Rotation (III) - The sequence of crops to be grown for up to an 8-year period as specified by the conservation plan or as part of the soil erosion assessment calculated with the Wisconsin Phosphorus Index model.

Saturated Soils (V.A.2.a.(1)) - Soils where all pore spaces are occupied by water and where any additional inputs of water or liquid wastes cannot infiltrate into the soil.

Silurian dolomite (SD) soils (V.A.2.c.(6)) - areas where Silurian dolomite bedrock is present within 60 inches of the surface. The location of Silurian dolomite limestone is determined by maps created by the Wisconsin Geologic and Natural History Survey. Depth to bedrock assessment is based on the most current Natural Resources Conservation Service soil survey map unit interpretations.

Slow and controlled release fertilizer (V.B.1.b.(2)) – Fertilizer materials that have been coated with a material (eg. polymers, sulfur) that prevents the nutrients from being immediately available. Instead the nutrients become slowly available over time.

Soil Temperature greater than 50 °F (V.B.1.a.(3)) – The soil temperature can be documented with soil temperature at at least 4” depth, or by a 5-day average maximum daily air temperature =55°F, or 5-day average minimum daily air temperature =40°F.

Starter fertilizer (V.A.1.h.) – Fertilizer applied at the time of planting and placed with or in a band in close proximity to the seed.

Substantially buried (V.A.2.b.(3)) – Means mixing the manure or process wastewater with surface soil so that at least 80% of applied manure or process wastewater is covered with soil and the application rate is controlled to ensure that applied material stays in place and does not run off. Incorporation includes standard agricultural practices such as tillage or other practices that are the equivalent to providing 80% soil coverage.

Subsurface Drainage (V.A.2.b.(3)) – A conduit installed beneath the ground surface to collect and/or convey excess water. Tile drainage is an example of subsurface drainage. For the purposes of this standard, subsurface drainage does not include structures that divert surface water from ponding or running off a field.

Surface Water Quality Management Areas (SWQMA) (V.A.2.c.(1)) - For the purposes of nutrient management planning, Surface Water Quality Management Areas are defined as follows:

1. The area within 1,000 feet from the ordinary high-water mark of navigable waters that consist of a lake, pond or flowage, except that, for a navigable water that is a glacial pothole lake, “surface water quality management area” means the area within 1,000 feet from the high-water mark of the lake.
2. The area within 300 feet from the ordinary high-water mark of navigable waters that consists of a river or stream that is defined as:
 - Perennial streams (continuous flow) identified on the NRCS soil survey and/or USGS 1:24,000 scale topographic map as solid lines,
 - Otherwise determined through an onsite evaluation and documented in an approved conservation plan or nutrient management plan.

Areas within the SWQMA that do not drain to the water body are excluded from this definition.

Tolerable Soil Loss (T) (V.A.2.a.(6)) - For sheet and rill erosion. T-value means the maximum rate of soil erosion established for each soil type that will permit crop productivity to be sustained economically and indefinitely. Erosion calculations shall be based on current approved erosion prediction technology found in NRCS FOTG Section I or the soil loss assessment calculated using the Phosphorous Index Model. Tolerable soil erosion rates shall be determined using the RUSLE2 Related Attributes Report located in Section 2, e-FOTG, Soil Report.

Untreated manure (V.A.2.b.) – Manure and/or manure constituents that HAVE NOT been subjected to treatment or processing that has the documented effect of substantially eliminating pathogens. Treatment or processing examples include thermophilic anaerobic digestion, high temperature composting of manure solids or manipulation of pH.

Urease inhibitor (V.D.1.) - A compound that prevents the hydrolysis of urea by blocking the urease enzyme. Use of a urease inhibitor will reduce ammonia volatilization losses from surface applied urea.

Vegetative Buffer (V.A.2.a.(1)) - A strip or area of perennial herbaceous vegetation situated between cropland, grazing land, or disturbed land (including forest land) and environmentally sensitive areas (as defined in NRCS Technical Standard 393, Filter Strip).