Clark County Land Conservation Department

Manure Storage Informational Packet

2018 Land Conservation Committee
Chairman, Frederick Garbisch
Supervisor, Bryce Luchterhand
Supervisor, Dan Clough
FSA Representative, Martin Nigon
Citizen-at-Large, Donald Koerner

Clark County Land Conservation
517 Court Street, Room 102
Neillsville, WI 54456-1982
Telephone (715-743-5102
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Revised 04/2018

CLARK COUNTY LAND CONSERVATION DEPARTMENT

517 Court St, Room 102 Neillsville WI 54456 715-743-5102

Cost-Share Assistance

The Land Conservation Department works cooperatively with the Wisconsin Department of Agriculture, Trade, and Consumer Protection and the Department of Natural Resources to provide cost-share funding for a number of conservation practices that will help enhance our land and water resources. Project planning begins in the fall with construction occurring the following year. Funding is limited and projects vary from year to year. More than $2.5 million in cost-share funds have been distributed to farmers, their contractors, and the rural community over the last five years. Approved practices may include:

- *Drinking Well Abandonment*
- *Filter Strip or Conservation Buffer Strip*
- *Roof Runoff System*
- *Waterway and Diversion Systems*
- *Silage Leachate Control System*
- *Manure Storage Construction*
- *Manure Storage Abandonment*
- *Milking Center Waste Control System*
- *Streambank and Shoreline Protection*
- *Wetland Development or Restoration*
- *Reduced Tillage, Contour Strip Cropping and other Cropping Practices*
- *Access Road or Cattle Crossing*
- *Heavy-Use Area Protection*
- *Underground Outlet*
- *Barnyard Collection Basin*
- *Rotational Grazing Planning*
- *Nutrient Management Planning*

Technical Engineering Assistance

The Land Conservation Department provides technical assistance to Clark County landowners who are designing and installing conservation infrastructure on their properties that improve the county's soil and water resources. Technical assistance ranges from initial project planning to engineering design and inspection. The department ensures that the proper Federal and State engineering standards and specifications are being followed during the design and construction phases of the conservation practices, thereby protecting the landowner's financial investment and the public's natural resources.

Watershed Planning and Management

The Land Conservation Department works cooperatively with the Wisconsin Department of Natural Resources and local Waterway Associations and Districts to implement lake and river planning and management activities within specific watersheds. Planning and management grants may be applied for and administered by the Land Conservation Department. These grants assist local landowners by providing cost-share based funding for technical engineering design and project construction and implementation. Current Clark County projects are located in the Lake Arbutus, Sportsman Lake, and Mead Lake Watersheds.

Nutrient Management Farmer Education and Soil Testing Information

A Nutrient Management Plan (NMP) helps farmers obtain a maximum return from fertilizer/manure/legume nutrient sources, while also protecting Clark County's surface water and groundwater resources. The County's Land Conservation and UW-Extension Departments, in cooperation with Northcentral and Chippewa Valley Technical Colleges, assist farmers in developing and implementing a NMP by offering annual educational training sessions. Graduates of the NMP training are considered to be qualified to develop and implement a state-qualified NMP. Limited cost-share grants are available for development of the NMP. Plan development includes soil testing, manure analysis, and on-farm agronomic consulting. More than 350 farmers implement NMPs on >120,000 acres. Without soil tests and a NMP, you are guessing your money and time away!

Surface and Groundwater Education & Monitoring

Water is the most important shared resource that we need for our healthy existence. The Land Conservation Department collects water quality and quantity data about the health of Clark County's surface water and groundwater. By combining water monitoring data with land use data, the department is able to develop a targeted approach to working with landowners who are willing to solve their conservation challenges and reduce the potential for water resource degradation. The water monitoring data can also track the positive improvements Clark County residents have made upon their water resources. Through the assistance of numerous County Department partnerships, the Land Conservation Department can also assist homeowners assess the quality of their drinking water. Drinking water testing and education is provided by the department. It is recommend that your drinking water be tested annually for at least bacterial and nitrate contamination. Your water may look, smell and taste fine, but it may not be safe.

***Working Lands Initiative/Farmland Preservation Program* (FPP)**

Wisconsin's Farmland Preservation Program encourages agricultural economic growth, rural community stability, and promotes the conservation of soil and water resources. Participants enter into a Farmland Preservation Agreement to maintain their land in agricultural production for 15 years. In return they receive an annual refundable income tax credit. Landowners in the towns of Beaver, Colby, Fremont, Loyal, Lynn, Mayville, Unity, Weston, and York are eligible to sign a Farmland Preservation Agreement. Landowners who live in the towns of Colby and Mayville (Exclusive Agricultural Zoning) are eligible to claim a higher tax credit. Clark County currently has ~200 landowners (~40,000 acres) receiving an average tax credit of $1,750.00.

Sportsman Lake Recreational Area, Wildlife Refuge and PL566 Flood Protection District

The Clark County Land Conservation Committee owns and operates a 305-acre reservoir in northern Clark County that primarily serves as a flood protection structure for the city of Owen. The reservoir also allows for seasonal recreational uses such as sport fishing for bass and northern pike, off-trail hiking, canoeing/kayaking, and scenic picnicking. Approximately 300 acres adjacent to the reservoir is a state designated waterfowl refuge and remains undisturbed by human activity. Sportsman Lake is located on the Chequamegon Flyway and offers the best bird watching (waterfowl and song) opportunities in the area. The property also contains 200 cropland acres and 500 woodland acres, some of which is designated as Clark County Forest. This land is managed for wildlife habitat, scenic diversity and timber/crop production. Over 1,300 acres are there for you.

Conservation Reserve Enhancement Program (CREP)

The Conservation Reserve Enhancement Program provides an opportunity for landowners to receive federal and state financial incentives by enrolling targeted agricultural lands into conservation practices, such as grassed buffers along stream (riparian) corridors, wildlife habitat construction, and wetland restorations. Riparian buffers are designed to reduce sediment/fertilizer/manure delivery to streams. Buffers also provide permanent nesting and brood rearing habitat for grassland bird species and other wildlife. This program is limited to the eastern edge of Clark County where the Northern Grassland Project Restoration Area exists.

Wildlife Damage Abatement and Claims Program (WDACP)

This program is cooperatively implemented by the Land Conservation Department, Wisconsin Department of Natural Resources, and United States Department of Agriculture- Wildlife Services. Local Wildlife Damage Specialists work with farmers to prevent and reduce crop damage caused by deer, bear, geese and turkeys. Landowners may be reimbursed for damage to agricultural crops. Enrollment requirements must be met in order to receive hunting permits for abatement and/or financial compensation for crop damage claims. Most of the lands enrolled are open to public hunting. Please check with the landowner first!

Clean Sweep Household and Agricultural Hazardous Waste Collection

Clean Sweep is a cooperative program administered by Clark County UW-Extension and the Land Conservation Department; Wisconsin Department of Agriculture, Trade, and Consumer Protection; and the cities, towns, and villages. During the 2011 Clean Sweep, more than 10,000 lbs of hazardous wastes were collected from the residents of Clark County. Once collected, these wastes are properly disposed, thereby reducing their potential to pollute the environment and harm human life.

Conservation Education and Agricultural Field Days

Each year the department gives numerous presentations to local schools and civic groups on the environmental topic of their choice. In partnership with UW-EX, the department holds conservation field days on topics including shoreland restoration, groundwater protection, soil quality, conservation tillage, emergency spill response and cleanup, animal manure storage design and manure application techniques.

Ordinances Administered

- Animal Manure Management (Manure Storage Construction, Altering, and Abandonment)
- Land spreading of Petroleum Contaminated Soils (with Zoning Department)
- Non-Metallic Mining Reclamation (with Zoning Department)

For more information on any of these programs listed or to find out more about what your Land Conservation Department can do for you, please stop in the office or call 715-743-5102

Wisconsin's Runoff Rules

what farmers need to know

January 2013 DNR Pub. No. WT 756 REV 1/13

Farms, like all major industries, must follow environmental requirements to control runoff from fields, pastures and livestock facilities. Otherwise this pollution can harm our lakes, streams, wetlands and groundwater.

Wisconsin adopted administrative rules in 2002 (NR 151), with revisions effective in 2011 that set statewide performance standards and prohibitions for all Wisconsin farms. All farmers must comply with these standards and prohibitions. Cost-share funding may be available to assist with compliance. Some state and local programs may require compliance whether or not cost-share funds are available.

This fact sheet explains the basic information that farmers need to know about these rules and how to comply with them. It is recommended that farmers contact their county land conservation staff for further details on these rules and their impact on farm operations.

► Agricultural Standards and Prohibitions:

ALL FARMERS MUST:

- *Meet tolerable soil loss ("T") on cropped fields and pastures.*
- *Annually develop and follow a Nutrient Management Plan (NMP) designed to keep nutrients and sediment from entering lakes, streams, wetlands and groundwater. Farmers may hire a certified crop advisor or prepare their own NMP if they have received proper training.*
- *Use the phosphorous index (PI) standard to ensure that their NMP adequately controls phosphorous runoff over the accounting period.*
- *Avoid tilling within 5 feet of the edge of the bank of surface waters. This setback may be extended up to 20 feet to ensure bank integrity and prevent soil deposition.*

► Additional Standards:

FARMERS WITH LIVESTOCK MUST:

- *Prevent direct runoff from feedlots or stored manure from entering lakes, streams, wetlands and groundwater.*
- *Limit access or otherwise manage livestock along lakes, streams and wetlands to maintain vegetative cover and prevent erosion.*
- *Prevent significant discharges of process wastewater (milkhouse waste, feed leachate, etc.) into lakes, streams, wetlands, or groundwater.*

FARMERS WHO HAVE, OR PLAN TO BUILD, MANURE STORAGE STRUCTURES MUST:

- *Maintain structures to prevent overflow and maintain contents at or below the specified margin of safety.*
- *Repair or upgrade any failing or leaking structures to prevent negative impacts to public health, aquatic life and groundwater.*
- *Close idle structures according to accepted standards.*
- *Meet technical standards for newly constructed or significantly altered structures.*

FARMERS WITH LAND IN A WATER QUALITY MANAGEMENT AREA *(300 feet from streams, 1,000 feet from a lake, or in areas susceptible to groundwater contamination)* **MUST:**

- *Avoid stacking manure in unconfined piles.*
- *Divert clean water away from feedlots, manure storage areas, and barnyards located within this area.*

Photos: Jeffrey J. Strobel, Duane Popple and Lynda Schweikert

► Farmland Preservation Tax Credit:

A farmer must comply with applicable state standards to receive the Farmland Preservation Tax Credit, even if cost sharing is not available. Farmers may be considered in compliance by entering into a schedule of compliance.

This requirement applies to farmers whose land is located in a certified farmland preservation zoning district (i.e. exclusive agriculture), or for farmers who signed a farmland preservation agreement after standards were in effect for that county. Farmers should contact their county land conservation staff for more information regarding applicable standards and compliance documentation.

► Implementation and Financial Assistance:

Under DNR rules, a landowner is normally entitled to cost sharing if the landowner is required to implement best management practices on "existing cropland" or an "existing" livestock facility or operation in order to comply with a DNR performance standard. Cropland or livestock facilities brought into service after the effective date of the standard are considered "new" and must meet standards and prohibitions without cost-share funding. Farmers with existing cropland or livestock facilities may be eligible for state or federal cost sharing and are encouraged to contact their county land conservation staff or USDA Natural Resources Conservation Service (NRCS) office for information about current funding sources, rates and practices eligible for cost sharing.

Farmers also should work with their land conservation staff to determine how these performance standards and prohibitions may affect their participation in various federal, state and local programs, such as Farmland Preservation. You can find a directory of land conservation offices and related agencies at http://datcp.wi.gov/Environment under "Land and Water Conservation."

► Permits and Licensing:

Farmers may be required to meet NR 151 Standards in order to obtain local and state permits. For livestock siting and manure storage ordinance permits, for example, nutrient management plans and other requirements may be imposed on livestock operations without providing cost sharing. Contact your local officials for additional information.

Farmers with 1,000 or more animal units must operate under a Wisconsin Pollutant Discharge Elimination System (WPDES) permit and do not qualify for state cost sharing to meet permit requirements. Contact your DNR Service Center for more information about WPDES permits.

For more information about runoff management in Wisconsin and topics found in this brochure please visit:

runoffinfo.uwex.edu

USDA NRCS United States Department of Agriculture Natural Resources Conservation Service

UW Extension Cooperative Extension

Wisconsin Dept. of Natural Resources

Department of Agriculture, Trade & Consumer Protection · Wisconsin

Wisconsin Land and Water Conservation Association, Inc. wlwca.org

Wisconsin Department of Natural Resources (WDNR), Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP), in cooperation with: USDA Natural Resources Conservation Service (NRCS), University of Wisconsin-Extension (UWEX), County Land Conservation Departments (LCD).

Graphic design by Jeffrey J. Strobel
UW-Extension Environmental Resources Center

Environmental Resources Center

Clark County Manure Storage Application

Clark County Land Conservation Department
517 Court Street, Courthouse Room 102
Neillsville, WI 54456
715-743-5102

For Office Use Only

Permit #:

Date:

Landowner Name:	***Applicant Name:***
Address:	***Address:***
City, State, Zip:	***City, State, Zip:***
Telephone:	***Telephone:***

Reason for Permit (Check one):

New Facility__ Closure of Facility__ Substantially Altering __

Location of Facility:

Parcel I.D. Number_____

Legal Description _____

Property Address_____

Permit Fee: $200 check made payable to – *Clark County Land Conservation Department*
[There is *no fee* for a closure permit]

The undersigned hereby makes application for a permit to construct, substantially alter or close a manure storage facility. The undersigned agrees that all work shall be done in accordance with the requirements of the Clark County Animal Manure Management Ordinance. By submitting this application, the applicant and landowner permit the Land Conservation Department staff to enter the property for inspection purposes.

Landowner or Applicant's Signature: _____ Date: _____
(If applicant is not the landowner, attach a notarized statement authorizing applicant to act as landowner's agent.)

For Office Use Only

Land Conservation Review by:

Plan Review _____ Date: _____

Authorizing Signature _____ Date: _____

For questions related to this permit application, please contact the Clark County Land Conservation Department at (715) 743-5102.

Clark County Land Conservation Department
517 Court Street, Courthouse Room 102
Neillsville, WI 54456
715-743-5102

For Office Use Only
Permit #:
Date:

I (landowner) _____ have obtained the

services of _____ from _____
(Certified Crop Advisor) (Business)
to prepare and annually update a Nutrient Management Plan (NMP) to fulfill the requirement of the Clark County Animal Manure Management Ordinance.

The NMP will meet the Natural Resource Conservation Service Technical Standard 590 and include all land where nutrients are applied. **The plan shall be submitted to the Clark County Land Conservation Department**.*

*Note: If you plan on writing your own NMP, soil tests must be current (within the last 4 years, 1 sample per 5 acres) and submitted to the Land Conservation Office.

Landowner Signature: _____Date_____

Certified Crop Advisor Signature: _____Date_____
(CCA signature only required if applicant not writing the NMP)

Please initial where applicable:

_____ Unused and noncompliant manure storages on the property will be abandoned.

_____ Safety fences will be constructed within the permit timeframe of two years.

_____ Permanent slope stabilization will occur within six months of construction completion.

Adopted November 12, 2009 at November Land Conservation Committee Meeting (Revised October 5, 2016)

2018 Contractor List

Contractor Name	foote	Address	City	State	Zip	Telephone	Cell	Primary Service	Fax	E-mail
Digger's Hotline						**800-242-8511**		Utility Location		
Advance Concrete and Excavating Inc.	Dennis Krause	S3276 Eagle Rd.	Spencer	WI	54479	715-669-4275		Excavating/Concrete		
Artac Excavating	Lawrence Artac	W6484 Sladich Road	Greenwood	WI	54437	715-267-7395	715-797-8220	Excavating/Stormwater and Erosion Control		
Becker Excavating	Dick/Jerod Becker	3420 Lobner Rd	Milladore	WI	54454-	715-652-2034	715-572-6127			
Braun Concrete	Tom Reigel	609 W South St.	Loyal	WI	54446	715-255-8355		Concrete		
Bugar Trucking	Paul Bugar Jr.	W2944 STH 98	Loyal	WI	54446	715-255-9098		Excavating/ Sotrmwater Eosion Control/ Gravel/Rock		
C & J Concrete Walls	Curvin Brubaker	W8498 CTH X	Thorp	WI	54771	715-669-7326	715-271-5943	Concrete	715-669-7363	cjconcrete@centurylink.net
CAS Concrete	Chad Schmidt	710 West Clark Street	Spencer	WI	54479	715-659-5112	715-572-5596	Concrete	715-381-2349	cms_cas02@yahoo.com
Central Culvert & Supply, LLC	Dave Newman	W1646 Kington Road	Unity	WI	54488	715-223-4051	715-212-7914		715-223-8234	centralculvert@ceas.coop
Ciolkosz Earthmoving	Al Ciolkosz	N12993 Cty Rd M	Thorp	WI	54771-	715-669-7158				
County Materials	Todd	205 North St.	Marathon	WI	54448	715-571-0735	715-356-9429	Concrete	715-848-1365	
Dairyland Construction, LLC	Dan Bohl	W11379 CTH X	Stanley	WI	54768	715-644-5171	715-703-3446	Excavating/Concrete/Stormwater Erosion Control	715-644-3595	
Dennis Ovyn Trucking, Inc.	Dennis Ovyn/ Bill	W11158 CTH A - T	Withee	WI	54498	715-229-2596	715-223-5463	Excavating/Concrete/Manure Transfer (Pumps)	715-229-2896	ovyntrucking@aol.com
Doine Excavating, Inc.	Brad Doine or Ron Doine	10883 CTH A	Marshfield	WI	54449	715-591-8491	715-305-2203	Excavating/Stormwater Erosion Control	715-591-2716	
Dragline Excavation	Glenn Killian	W6545 N. Loop Rd.	Phillips	WI	54555	715-339-6067		Excavating/Dredging		
Elmhorst Excavating & Trucking	Scott Elmhorst	W4512 Sand Road	Neillsville	WI	54456	715-743-4476	715-429-0827	Excavating		
Foxland Harvestore	Stuart Fenendoel	1400 Rosetill Road, PO Box 245	Little Chute	WI	54140	920-766-3783	920-304-6296	Concrete/Manure Transfer (Pumps)	920-766-0571	stuartf@FoxlandHarvestore.com
Francis Melvin, Inc. (Melvin Companies)	Rick Berg	1022 E. Spruce Street, PO Box 646	Abbotsford	WI	54405	715-223-6331		Excavating	715-223-6351	rberg.melvinco@frontier.com
Friedenfels Equipment & Construction	Michael Friedenfels	N1379 Oak Drive	Medford	WI	54451	715-678-2860	715-965-7010	Excavating/Concrete/Manure Transfer (Pumps)		
Froeba Construction	Kevin Froeba	N7523 Sparrow Ave.	Loyal	WI	54446	715-255-9097	715-937-1741	Excavating		froeba1994@frontier.com
FSRC Tanks	Nate Blackwood	11029 Industrial Pkwy NW	Bolivar	OH	44612	234-221-2015	330-309-2518	Steel Manure Storage Structure		
Goetz Excavating	Brad Goetz	W4996 Carlyle Rdoad	Neillsville	WI	54456	715-743-2432	715-937-0503	Excavatin/Stormwater Erosion Control		goetzexcavating@tds.net
Greenleaf Lime & Excavating	Paula Knutson	320 Badger Drive, PO Box 147	Taylor	WI	54659	715-662-2315	715-229-0138	Excavating/Concrete/Manure Transfer (Pumps)	715-662-4008	greenleaf.trucking@centurytel.net
Greenwood Silo, LLP	Marvin Reiff	N10828 CTH O	Greenwood	WI	54437	715-267-1416	715-773-2580	Metal Manure Tanks/Manure Transfer Pumps		
Haas Sons Construction	Craig Haas	203 E Birch Street	Thorp	WI	54771	715-829-7120		Excavating/Concrete/Erosion Control/Gravel/Rock		craig@haas4.com
Hatlestad Construction, LLC	Jim Hatlestad	509 Progress Street	Withee	WI	54498	715-229-2248	715-703-0176	Excavating/Concrete	715-229-4444	hatlestad@frontier.com
Hoover Excavating	Aaron Hoover	W3375 CTH N	Owen	WI	54460	715-223-4483		Excavating		
J & L Excavating	Jeffrey Leid	French Town Ave	Withee	WI	54498	715-229-4928		Excavating		
James Reiff Excavating	James Reiff		Greenwood	WI	54437	715-937-0161		Excavating		

Contractor Name	foote	Address	City	State	Zip	Telephone	Cell	Primary Service	Fax	E-mail
Janke Contractors	Chris Kirchner	1223 River View Lane	Athens	WI	54411	715-257-9701	715-574-9052			ckirchner@jankegeneral.com
Jim Westaby Excavating	Jim Westaby	20298 CTH H	Gilman	WI	54433	715-447-8312	715-703-0954	Excavating		
John S. Olynick, Inc.	Chris Olynick	N7918 STH 73	Gilman	WI	54433	715-668-5211	715-314-0018	Excavating/Concrete/Stormwater Erosion Control	715-668-5710	chrisolynick@gmail.com
Komro Sales & Service	Corey Boch	W4666 STH 85	Durand	WI	54736	715-672-4263	715-279-3828	Concrete/Manure Transfer (Pumps)	715-672-8479	coreyboch@komrosales.com
Kurt Kalepp Excavating	Kurt Kalepp	507 W. Hemlock Street	Abbotsford	WI	54405	715-223-3832	715-613-3832	Excavating		
Lindner Excavating, LLC	Luke & Stacy Lindner	M133 Galvin Avenue	Marshfield	WI	54449	715-384-3777	715-613-8827	Excavating	715-384-3778	lindnerx@frontier.com
Marawood Construction Services, Inc.	Nicolas Bloome	2025 W. Veteran's Parkway	Marshfield	WI	54449	715-387-1256	715-302-0480	Excavating/Concrete/ Stormwater Erosion Control	715-389-2158	nicb@marawood.com
Montana & Son Grading	Montana Birt	N14358 Koser Avenue	Stanley	WI	54768	715-644-4959	715-828-7798	Excavating/Concrete/ Stormwater Erosion Control	715-644-4959	
Nielsen Specialty Cement Contractor	David Nielsen	N7633 Thomas Avenue	Greenwood	WI	54437	715-267-6020		Concrete		
Opelt Sand and Gravel/ G&S Trucking	Mike Opelt	N2429 State Hwy 95	Neillsville	WI	54456	715-743-3019				
PAW Concrete	Paul Wojcik	N2838 Hipke Rd	Gilman	WI	54433	715-447-8585	715-456-3355	Concrete		
Podevels Farm Service	Jim Podevels	S639 W. 26th Rdoad	Marshfield	WI	54449	715-384-6193	715-323-2321	Manure Transfer (Pumps)	715-384-8650	
Quality Excavating, LLC	Dallas Nelson	N9017 Sandhill Avenue	Loyal	WI	54446	715-255-9338	715-613-0303	Excavating	715-255-9553	jeananddallas@gmail.com
R&H	Ed Rasch	16727 Clark	Withee	WI	54498	715-229-2312				
Russ Thums Construction	Russ Thums	N3235 Brook Drive	Medford	WI	54451	715-748-3269	715-965-4745	Concrete		Barb26@tds.net
S.D. Ellenbecker, Inc.	Tom Ellenbecker	1222 Mount View Lane	Athens	WI	54411	715-257-7666	715-581-6404	Concrete/Manure Transfer (Pumps)	715-257-7982	tom@sdellenbecker.com
Slobodnik Gravel & Excavating	Cole Szpara	W11730 CTH A	Withee	WI	54498	715-229-4003	715-773-2420	Excavating	815-550-8872	
Slurry Store/CST/Foxland Harvestor			Stratford	WI		715-387-8991		Steel Manure Storage Structure		
Sternweis & Sons, Inc.	Glen Sternweis	11397 Wren Road	Marshfield	WI	54449	715-384-8995		Concrete	715-384-3315	gsmk@sternweisandsons.com
Steve Colby Excavating	Steve Colby	108 N 6th Street	Abbotsford	WI	54405	715-223-2246	715-507-0136	Excavating/ Stormwater Erosion Control	715-223-2246	
Stroinski Excavation	John or Ann Stroinski	W8202 Walnut Road	Thorp	WI	54771	715-669-3865		Excavating		
Tri-County Equipment, Inc.	Haa	W5401 CTH X	Withee	WI	54498	715-229-2000	715-613-0349	Manure Transfer (Pumps)	715-229-9832	tricounty@frontier.com
Trierweiler Construction & Supply Co., Inc.	Dan Trieweiler	2916 South Cherry Avenue	Marshfield	WI	54449	715-389-2655	715-223-7970	Concrete	715-384-5599	dan@trieweilerco.com
Wampole Custom Concrete	Sam Wampole	604 N Thorp Street	Thorp	WI	54771	715-669-5541	715-773-1305	Excavating/Concrete	715-669-5541	SWampole1@gmail.com
Webster Excavating	Kelly Webster	1880 E. Main St.	Gilman	WI	54433	715-447-8119				
Westaby Excavating	Ryan Westaby	222 Urquhart Road	Stanley	WI	54768	715-644-5933	715-313-0108	Excavating	715-644-2293	westaby_trucking@yahoo.com
Wheels Excavating	Neil Rueden	F2008 CTH N	Colby	WI	54421	715-571-5127		Excavating		
Zeiset Excavating	Henry Zeiset	N14313 Fairground Ave	Owen	WI	54460	715-229-2990	715-223-7305	Exvacating		
Zimmerman Excavating	Glen Zimmerman	N12737 Resewood Avenue	Greenwood	WI	54437	715-229-4782		Excavating		

Consulting Engineers for Agricultural Engineering Design

This is only a partial list of registered engineers who can design and supervise the construction of agricultural engineering projects. It is your responsibility to verify the consultant's credibility by requesting and contacting their references.

Auth Consulting and Associates, Inc.
S&N Land Surveying
406 Technology Drive East
Menomonie, WI 54751
Contact: Tim Auth
tauth@authconsulting.com
Phone: 715-232-8490

Ayres and Associates
3433 Oakwood Hills Parkway
Eau Claire, WI 54701-7698
Contact:
Phone: 715-834-3161

Becher-Hoppe Associates, Inc.
330 N 4th Street
Wausau, WI 54403
Contact: Randy Van Natta
rvannatta@becherhoppe.com
Phone: 715-845-8000

Insight FS
814 Lewellen Street
Marshall, WI 53559
Contact: Naomi Bernstein
nbernstein@insightfs.com
Phone: 608-482-2508

MSA Professional Services
146 North Central Avenue, Suite 201
Marshfield, WI 54449
Contact: Andrew Skwor
askwor@msa-ps.com
Phone: 877-204-0572

Oakridge Engineering
220 ½ North Bridge Street
PO Box 44
Chippewa Falls, WI 54729
Contact: Erik Lietz
Erik@oakridgeeng.com
Website: www.oakridgeeng.com
Phone: 715-723-6777

Outland Design LLC
559 D'Onofrio Drive #17
Madison, WI 53719
Contact: Jess Ray
jray@outlanddesignllc.com
Phone: 608-438-3400

Ratsch Engineering Company, LTD
547 Hewett Street
PO Box 189
Neillsville, WI 54456
Contact: Russell Ratsch/ Henry Berry
henry@ratschengineering.com
Phone: 715-743-2240

REI
4080 North 20th Avenue
Wausau, WI 54401
Contact: Mike Mohr
mmohr@reiengineering.com
Contact: Jim Borysenko
jborysenko@reiengineering.com
Phone: 715-675-9784

Resource Engineering Associates, Inc.
3510 Parmenter Street
Middleton, WI 53562
Contact: Bob Pofahl
bob@reaeng.com
Phone: 608-831-5522

Roach and Associates, LLC
856 North Main Street
Seymour, WI 54165
Contact: John Roach
john@jmroach.com
Phone: 920-833-6340

SEH
10 North Bridge Street
Chippewa Falls, WI 54729
Contact: Dan Hedrington
dhedrington@sehinc.com
Phone: 715-720-6200

Stantec Consulting, LTD
12075 Corporate Parkway, Suite 200
Mequon, WI 53092
Contact: Eric Maki
eric.maki@stantec.com
Phone: 262-241-4466

Williams Engineering Service, LLC
E14910 Bears Grass Rd.
Augusta, WI 54722
Contact: Ronnie Williams
wes@chipvalley.com

Note: This list is not a complete listing and does not constitute an endorsement by the
Clark County Land Conservation Committee or by the Clark County Board of Supervisors. (Updated 3/6/2015)

CERTIFIED CROP ADVISORS: WISCONSIN PRIVATE AGRONOMISTS
590 Nutrient Management Planners in Clark County

Central Wisconsin Co-op
10391 County Road K
Auburndale, WI 54412
(Mail to Stratford Address)
Contact: Dale Walz
dwalz@cwco-op.com
Contact: Mike Gronski
mgronski@cwco-op.com
715-652-2300

Central Wisconsin Co-op
Hwy. 153, PO Box 14
Stratford, WI 54484
Contact: Tom Hoffman
cwcstratfordagronomy@frontier.com
715-687-4373

Cloverleaf Farm Supply
PO Box 63
Cadott, WI 54727
Contact: Terry Licht
terryl@cloverleaffarmsupply.com
715-289-4366

Countryside Co-op
N47748 US Hwy. 53
Osseo, WI 54758
Contact: Josh Schulner
jschulner@countrysidecoop.com
715-279-2567

CROP IMS, LLC
5944 Maplewood Rd.
Vesper, WI 54489
Contact: Paul Sturgis
psturgis@cropims.com
715-572-3625

Dairyland Laboratories Inc.
217 E. Main Street
Arcadia, WI 54612
Contact: Kevin Flyte
kflyte@dairylandlabs.com
www.dairylandlabs.com
Cell: 608-323-0667

Federation Co-op
108 N. Water St.
Black River Falls, WI 54615
Contact: Eric Jacobson
eric.jacobson@fedcoop.com
715-284-4381

Frase Crop Consulting
E10305 Cty. HH
Osseo, WI 54758
Contact: Jeff Frase
frasecrop@gmail.com
Cell: 715-577-4945
715-597-3693

Frontier Servco FS
PO Box 98
Amherst Junction, WI 54407
Contact: Scott Koth
skoth@frontierservcofs.com
715-312-0488

Frontier Servco FS
16119 Hwy 81
Darlington, WI 53530
Contact: Craig Sander
csander@frontierservcofs.com
608-776-4600

Frontier Servco FS
PO Box 359
Jefferson, WI 53549
Contact: Nikki Wagner
nwagner@frontierservcofs.com
920-674-7000 ex: 157

Frontier Servco FS
9119 Hwy. 19
Mazomanie, WI 53560
Contact: Scott Evans
sevans@frontierservcofs.com
608-482-3422

Heartland Co-op Services
PO Box 260
Dorchester, WI 54425
715-654-5134
Subcontracted: Rock River Labs

Heartland Co-op Services
414 S Main St.
Greenwood, WI 54437
(Mail to Dorchester Address)
715-267-5100
Subcontracted: Rock River Labs

Heartland Co-op Services
430 Industrial Ave.
Owen, WI 54460
(Mail to Dorchester Address)
715-229-4621
Subcontracted: Rock River Labs

Federation Cooperative
PO Box 117
Humbird, WI 54746
Contact: Duane Marty
dmarty@fedcoop.com
715-964-2411

Kerr Agronomics
N6053 Cty Rd. E
River Falls, WI 54022
Contact: Greg Kerr
wicropguy@gmail.com
Cell: 612-309-5643
715-425-8447

Marshfield Ag Service
M126 Galvin Ave.
Marshfield, WI 54449
Contact: Wayne Kayhart Jr.
foozer2005@yahoo.com
715-384-2437

Northside Elevator
227 E. Spring St.
Loyal, WI 54446
Contact: Tim Brussow
tim@northsideelevator.com
Contact: Josh Johnson
josh@northsideelevator.com
Contact: Ryan Umlauft
ryan@northsideelevator.com
715-255-8507

Precision Crop Service / ADM Grain
2417 Stockton Rd.
Stevens Point, WI 54481
Contact: Austin Ruzic
austin.ruzic@adm.com
Cell: 920-295-9158

Prill Crop Consulting
315 Irvine Ct.
Chippewa Falls, WI 54729
Contact: Todd Prill
prillcropconsultin@sbcglobal.net
715-726-9146

Provision Partners
P. O. Box 988
Marshfield, WI 54449
Contact: Dan Zierke
dzierke@provisionpartners.coop
Contact: Ron Schuh
Rschuh@provisionpartners.coop
715-223-2308

River Country Co-op
(Agri-Tech Services)
231 N. Jackson St.
Boyd, WI 54726
Contact: Josh Frederickson
joshf@rivercountrycoop.com
715-933-0255 or 715-667-3245

Rock River Laboratory
M128 County Rd. C
Marshfield, WI 54449
Contact: Matt Luther
matt_luther@rockriverlab.com
715-207-1279

Short Lane Ag Supply
W606 Short Rd.
Colby, WI 54421
Contact: Craig Oehmichen
craig.shortlane@gmail.com
715-223-4916

Vita-Plus
213 E. Mill St.
Loyal, WI 54446
Contact: Diane Beels
dbeels@vitaplus.com
715-255-8666

Note: It is recommended to first contact your local agricultural service provider and ask if there is a certified crop advisor (CCA) on staff. CCAs are qualified to write 590 Nutrient Management plans. Some providers prioritize existing clients. Ask about time and cost. (Updated 04/2018)

Wisconsin Custom Manure Applicators 2015 Equipment Listing

The listing of a firm (or lack thereof) does not constitute an endorsement (or lack thereof) by UW-Extension or PNAAW, and we do not guarantee the accuracy of any information herein. If you wish to have your firm added to the list or to correct an error, please contact Kevin Erb at 920.391.4652 or email to: kevin.erb@ces.uwex.edu. If a semi listed as "T", it transfers, or feeds a tanker, dragline or frac tank in the field; an "A" is a semi that does land application. "P" means the semi has a pump for more even application on alfalfa; "G" means gravity flow discharge. If equipment is listed as "available", the owner has access via a partnership with another firm. An ** denotes that updated information was not available, but we believe the applicator is still in business. This list is intended for private farmer use and is not for solicitation purposes. Last minor update 2/22/18

Firm Name, Contact, City (Wisconsin unless noted otherwise)	Phone	Equipment	Radius Served (miles)
Blasel Custom Field Work Lee Blasel Dorchester	715.965.0868	1 tractor tanker	10
Brandon's Farm Services, LLC Brandon Schilling Dorchester, WI	715.302.1132	8 tractor tankers-2 w/inj	30
Curvin Brubacker Curtiss	Office 715.223.3064 Cell 715.316.2825	5 tractor tankers	25
Eby Custom Farming Lester Eby Daniel Eby Colby	Lester Cell: 715.613.4227 Dan Cell: 715.613.4226	5 tractor tankers	35
Fellenz Custom Fieldwork Kevin Fellenz Spencer	Cell: 715.797.1225 Office: 715.255.9029 715.255.8668	6 tractor tankers 4 tractor solid spreaders	20
Halopka Farm Service Casey Halopka Dorchester	Casey Cell 715.613.7467 Office 715.654.5482	Dragline: 3 miles (6 inch) w/ inj toolbar 5 semis A/T P w swing booms Frac Tank (22,000 Gal) 7 tractor tankers Agitation Boat Roadside transfer system Low disturbance injectors	Statewide IL, IN, MI
Kitzhaber Trucking Brandon Kitzhaber Greenwood	715.937.4076	3 miles of dragline 8 inch layflat hose 6 inch drags Roadside transfer system Agitation Boat	80
Pitbull Custom Applications, LLC Jerry Kobylarczyk Thorp	Jerry Cell: 715.773.0101 Office 715.669.5745	2 trucks w/flotation tires 1 w/6x6 flotation tires 1 vac truck (spill response)	30

Potaczek Farms, LLC Ron and Pattie Potaczek Thorp	715.669.5181	8 trucks	60
Purgett Scott Purgett Owen	Cell: 715.613.4850	3 tractor tankers	30

Clark County Land Conservation Department

NUTRIENT MANAGEMENT PLANNING

The Clark County Land Conservation Department is committed to helping you through the process of developing, implementing, and maintaining a nutrient management plan (NMP) for your operation. As of January 1st, 2008, all farms in Wisconsin are required to begin implementing a certified NMP.

As a condition of the Clark County Animal Manure Management Ordinance, all farmers who operate a manure storage facility are required to develop, implement, and maintain a nutrient management plan on all cropland acres managed by the farm (owned and rented). The ordinance requires the following:

1. The NMP must be updated on an annual basis according to the procedure outlined in the "Nutrient Management Plan Submittal Requirements." This document is attached.

2. The NMP must meet the most current Natural Resources Conservation Service Standard 590.

3. The NMP must be developed by individuals with specific qualifications (s.ATCP 50.04(3), Wis. Admin. Code).
   - Consult with your agricultural supply dealer to see if they are qualified to write NMPs. **Included is a list of local agronomists that provide nutrient management services in Clark County.**
   - As an alternative, you may also write your own NMP provided that you attend a farmer certification training class sponsored by the Clark County Land Conservation Department. These training classes are held at various locations in Clark County during the winter months.

4. The NMP must be submitted by April 1st of every year or be subject to a late fee (unless the Land Conservation Department is notified in regard to extenuating circumstances).

The purpose of a NMP is to apply all forms of nutrients (manure, fertilizer, septage, and other organic by-products), in an economically and environmentally sustainable manner. A NMP will help you maximize crop yields while minimizing nutrient and profit losses. By matching nutrient applications to crop needs, the risk of groundwater and surface water contamination is minimized. You may also find that a NMP saves money on fertilizer purchases that may have been in excess of crop needs.

If you have any questions please contact the Clark County Land Conservation Department and we'll help get you started.

Clark County Land Conservation
517 Court Street, Room 102
Neillsville, WI 54456-1982
Telephone (715) 743-5102
Fax (715) 743-5154
james.arch@co.clark.wi.us

Nutrient Management Plan Submittal Requirements

Annual NM Plan Submittals Will Fall Into One of Two Categories:

1. **Full Plan[1] and Checklist[2]** is required for/when:
    a) New plan/first plan for a farm.
    b) Farm ownership change or landbase change (adding or deleting acres to the farm).
    c) Once every four years after first plan is written, usually coincides with soil sampling.

2. **Checklist Only** is required during every other year.

[1] Complete paper or digital Nutrient Management Plan (including all maps, soil tests, documentation, etc.) that shows/documents at least the previous (last/prior) year's actual cropping management and nutrient applications, and projects planned future cropping management and nutrient applications for the length of the rotation.

[2] Nutrient Management Plan Checklist, ARM-LWR-480.docx (REV (06/22/17).

Notes:

- All submittals are due by April 1st.
- Plans must be kept current, including entry of previous crop year's actual cropping management and nutrient applications.
- You are required to include all rented farm(s), landowner name(s) and acreage, if applicable, on submitted NM Plan Checklists.
- Please include your contact information (phone and address) on the very top portion of the Nutrient Management Plan Checklist.

Nutrient Management Plan (NMP) Component Checklist

By Hand

- ○ 590 NMP June 2017 Checklist
- ○ Narrative
- ○ Soil Test Reports
- ○ Manure Quantity Estimation Worksheet
- ○ Nutrient Spreading Log (As applied)
- ○ Fertilizer/Manure/Lime Recommendation Worksheet showing Nutrient Crediting
- ○ Recommended Nutrient Application List
- ○ Crop History/Field Data Worksheet
- ○ Manure Analysis
- ○ **Operations and Maintenance Plan**
- ○ **Conservation Plan**
- ○ **Maps showing field locations, field numbers/acres, and boundaries**
- ○ **Maps showing Soil Map Units**
- ○ **Maps showing Manure Management Areas- 590 Standard Restrictions**
- ○ **Maps showing Manure Stacking Areas**
- ○ **Manure Spreader Calibration Information**
- ○ **Winter Risk Assessment Plan and Maps**
- ○ **Manure Spill Action and Response Plan**
- ○ **Soil Information Sheets***
- ○ **Plat Maps showing Field Locations***

By Snap-Plus

- ○ 590 NMP June 2017 Checklist
- ○ Snap-Plus Farm Narrative and Crops Report
- ○ Snap-Plus Compliance Check Report
- ○ Snap-Plus Manure Tracking Report
- ○ Snap-Plus Field Data/590 Assessment Report
- ○ Snap Plus Soil Test Summary Report
- ○ Snap-Plus Spreading and Nutrient Management Sorted by Crop Report
- ○ Snap-Plus Application Summary Report
- ○ Snap-Plus Animal Units Report
- ○ Manure Analysis
- ○ **Operations and Maintenance Plan**
- ○ **Maps showing field locations, numbers, and boundaries**
- ○ **Maps showing Soil Map Units**
- ○ **Maps showing Manure Management Areas- 590 Standard Restrictions**
- ○ **Maps showing Manure Stacking Areas**
- ○ **Manure Spreader Calibration Information**
- ○ **Winter Risk Assessment Plan and Maps**
- ○ **Manure Spill Action and Response Plan**
- ○ **Soil Information Sheets***
- ○ **Plat Maps showing Field Locations***

Snap-Plus data files can be emailed to the Land Conservation Department:

amanda.kasparek@co.clark.wi.us

- ✓ *Items not required, but highly recommended to be included in a NMP.*
- ✓ **Bold Text**= Assistance to complete these components may be provided your local County Conservation Department. Contact 715-743-5102.
- ✓ All maps may be generated by using the internet-based Manure Management Advisory System (MMAS) found at the WI-DATCP web-site:

http://mmas-mapping.soils.wisc.edu/

NMP Meets 590 Standard Y or N

Date NMP Received_____

Farm Name_____

Date Reviewed_____

NM Plan Writer_____

Reviewed by_____

Follow-Up Contact_____

_____

NMP Review and Field Verification Procedure

Each plan will be reviewed for the following:

- ○ Inclusion of required components (see list)
- ○ Completed in full 2010 NMP Checklist signed by a qualified planner
- ○ Fields meet "T" (use full rotation, at least 6 years, to determine soil loss)
- ○ Phosphorus management strategy
  - ☐ Phosphorus Index
  - ☐ Soil Test Values (>50ppm and >100ppm)
    - o Phosphorus Balance is correct
- ○ Correct soil series and slope identified (10% rule)
- ○ Correct distance to water and slope to water identified (only for Phosphorus Index)
- ○ Soil sampling intensity @ 1 sample per five acres, unless nonresponsive and <5yrs old
- ○ Certified laboratory, approved by DATCP, used for soil sample analysis
- ○ Correct commercial fertilizer recommendations according to A2809 or Snap+
- ○ No excess nitrogen application
- ○ All manure produced is collected and allocated appropriately to cropland
- ○ Nutrient credits for legumes and manure appropriately determined
- ○ Nutrient application risk areas identified on maps including:
  - ☐ Wells
  - ☐ Tile Inlets
  - ☐ Concentrated Flow Areas
  - ☐ Grassed Waterways
  - ☐ Drainage Ditches (not road ditches)

Each farm will be reviewed for the following:

- ○ **Winter Manure Spreading Strategy**
- ○ **"Safe" Manure Stacking Areas Identified**
- ○ **Emergency Manure Spill and Response Plan**
- ○ **Field verification of nutrient application risk areas**
- ○ **Verification of "as-applied" nutrients**
- ○ **Verification of compliant manure storage and stacking areas**
- ○ **Verification of compliance with NR151 Agricultural Performance Standards**

Bold Text= Items not required according to the 590 Nutrient Management Standard, but these items are required for farms operating under a NR243 CAFO Permit.

Wisconsin Department of Agriculture, Trade and Consumer Protection
Division of Agricultural Resource Management
Bureau of Land and Water Resources
PO Box 8911, Madison WI 53708-8911, Phone: 608-224-4605

Use this form to check nutrient management (NM) plans for compliance with the WI NRCS 2015-590 Standard.

Nutrient Management Checklist

Wis. Stat. §92.05(3) (k), Wis. Admin. Code §ATCP50.04(3) and Ch. 51

COUNTY	DATE PLAN SUBMITTED	GROWING SEASON YEAR PLAN IS WRITTEN FOR	(from harvest to harvest)
TOWNSHIP: (T. N.) RANGE: (R. E., W).		CHECK ONE: ☐ Initial Plan or ☐ Updated Plan	

NAME OF FARM OPERATOR RECEIVING NM PLAN First Name LastName	FARM NAME (OPTIONAL)	BUSINESS PHONE ( ) -	
STREET ADDRESS	CITY	STATE	ZIP
REASON THE PLAN WAS DEVELOPED: Click and choose. (Ordinance, NR 243 WPDES or NOD, DATCP-FP or cost share (cs), DNR-cs, USDA-cs, Other)		CROPLAND ACRES (OWNED & RENTED)	
RENTED FARM(S) LANDOWNER NAME(S) AND ACREAGE: add sheet(s) if needed			

WAS THE PLAN WRITTEN IN SNAPPLUS? ☐ YES ☐ NO		If yes, which software version, if known?	
CHECK PLANNER'S QUALIFICATION: Click and choose. (1. NAICC-CPCC, 2. ASA-CCA, 3. SSSA-Soil Scientist, 4. DATCP approved training course, 5. Other approved by DATCP)			
NAME OF QUALIFIED NUTRIENT MANAGEMENT PLANNER First Name Last Name		BUSINESS PHONE ( ) -	
STREET ADDRESS	CITY	STATE	ZIP

Use header sections to add comments. Mark NA in the shaded sections if no manure is applied.

1. Does the plan include the following nutrient application requirements to protect surface and groundwater?

This section applies to fields and pastures. If no manure is applied, check NA for 1.c., 1.h., 1.i., 1.n., 1.o., 1.q., 1.s.	Yes	No	NA
a. Determine field nutrient levels from soil samples analyzed by a DATCP **certified laboratory**.	☐	☐	☐
b. For fields or pastures with mechanical nutrient applications, determine field nutrient levels from **soil samples** collected within the last **4 years** according to 590 Standard (590) and UWEX Pub. A2809*, Nutrient Application Guidelines for Field, Vegetable, and Fruit Crops in Wisconsin* (A2809) typically collecting **1 sample per 5 acres** of 10 cores. Soil tests are not required on **pastures** that do not receive mechanical applications of nutrients if either of the following applies: 1. The pasture average stocking rate is one animal unit per acre or less at all times during the grazing season. 2. The pasture is winter grazed or stocked at an average stocking rate of more than one animal unit per acre during the grazing season, and a nutrient management plan for the pasture complies with 590 using an assumed soil test phosphorus level of 150 PPM and organic matter content of 6%.	☐	☐	☐
c. For **livestock siting permit approval**, collect and analyze soil samples meeting the requirements above in 1. b., excluding pastures, within 12 months of approval and revise the nutrient management plan accordingly. Until then, either option below maybe used: 1. Assume soil test phosphorus levels are greater than 100 ppm soil test P, OR 2. Use preliminary estimates analyzed by a certified DATCP laboratory with soil samples representing > 5 ac/sample.	☐	☐	☐
d. **Identify all fields'** name, boundary, acres, and location.	☐	☐	☐
e. Use the field's previous year's legume credit and/or applications, predominant soil series, and realistic yield goals to determine the crop's nutrient **application rates consistent with A2809 for ALL forms of N, P, and K**.	☐	☐	☐
f. Make no **winter applications of N and P** fertilizer, except on grass pastures and winter grains.	☐	☐	☐
g. Document method used to determine **application rates**. Nutrients shall not runoff during or immediately after application.	☐	☐	☐
h. Identify in the plan that **adequate acreage** is available for manure produced and/or applied.	☐	☐	☐
i. Apply a single phosphorus (P) assessment using either the **P Index** or **soil test P** management strategy to all fields within a tract when fields receive manure or organic by-products during the crop rotation.	☐	☐	☐
j. Use **complete crop rotations** and the field's **critical soil** series to determine that sheet and rill erosion estimates will not exceed **tolerable soil loss** (T) rates on fields that receive nutrients.	☐	☐	☐
k. Use contours; reduce tillage; adjust the crop rotation; or implement other practices to **prevent ephemeral erosion**; and maintain perennial vegetative cover to **prevent reoccurring gullies** in areas of concentrated flow.	☐	☐	☐
l. Make no nutrient applications within 8' of **irrigation** wells or where **vegetation is not removed**.	☐	☐	☐
m. Make no nutrient applications within **50' of all direct conduits to groundwater**, unless directly deposited by gleaning/pasturing animals or applied as starter fertilizer to corn.	☐	☐	☐

	Yes	No	NA
n. Make no **untreated manure applications** to areas within 1000' of a **community potable water well** or within 100' of a **non-community potable water well** (ex. church, school, restaurant) unless manure is treated to substantially eliminate pathogens.	☐	☐	☐
o. Make no manure applications to areas **locally delineated** by the Land Conservation Committee or in a conservation plan as areas contributing runoff to direct conduits to groundwater unless manure is substantially buried within 24 hours of application.	☐	☐	☐
p. Make no applications of **late summer or fall commercial N fertilizer** to the following areas UNLESS needed for establishment of fall seeded crops OR to meet A2809 with a blended commercial fertilizer. Commercial fertilizer N applications shall not exceed 36 lbs. N/acre on: • Sites vulnerable to N leaching **PRW Soils** (P=high permeability, R= bedrock < 20 inches, or W= wet < 12 inches to apparent water table); • Soils with depths of 5 feet or less to bedrock; • Area within 1,000 feet of a community potable water well. On **P soils, when commercial N is applied** for full season crops in **spring and summer**, follow A2809 and apply one of the following: 1. A split or delayed N application to apply a majority of crop N requirement after crop establishment. 2. Use a nitrification inhibitor with ammonium forms of N. 3. Use slow and controlled release fertilizers for a majority of the crop N requirement applied near the time of planting.	☐	☐	☐
q. Limit manure applications in late summer or fall using the lesser of A2809 or the following 590 rates on **PRW Soils.** Use ≤ 120 lbs. available N/acre on: **P and R soils** on *all crops, except annual crops*. Additionally, manure with ≤ 4% dry matter (DM) wait until after soil temp. < 50°F or Oct. 1, and use either a nitrification inhibitor OR surface apply and do not incorporate for at least 3 days. **W soils or combo. W soils** on *all crops.* Additionally, manure with ≤ 4% DM on *all crops* use at least one of the following: **1**. Use a nitrification inhibitor; **2**. Apply on an established cover crop, an overwintering annual, or perennial crop; **3**. Establish a cover crop within 14 days of application; **4**. Surface apply & don't incorporate for at least 3 days; **5**. Wait until after soil temp. < 50°F or Oct. 1. Use ≤ 90 lbs. available N/acre on: **P and R soils** on *annual crops* wait until after soil temp. < 50°F or Oct. 1. Additionally, manure with ≤ 4% DM use either a nitrification inhibitor OR surface apply and do not incorporate for at least 3 days. **W soils or combination W soils** receiving manure with ≤ 4% DM on *all crops*.	☐	☐	☐
r. Use at least one of the following practices on **non-frozen soils for all nutrient applications** within Surface Water Quality Management Area **(SWQMA)** = 1000' of lakes/ponds or 300' of rivers: **1**. Maintain > 30% cover after nutrient application; **2**. Effective incorporation within 72 hours of application; **3**. Establish crops prior to, at, or promptly following application; **4**. Install/maintain vegetative buffers or filter strips; **5**. Have at least 3 consecutive years no-till for applications to fields with < 30% residue (silage) and apply nutrients within 7 days of planting.	☐	☐	☐
s. Limit mechanical applications to **12,000 gals/acre of unincorporated liquid manure or organic by-products** with 11% or less dry matter where **subsurface drainage** is present OR within **SWQMA**. Wait a minimum of 7 days between sequential applications AND use one or more of the practice options on non-frozen soils listed in 1.r.1. through 1.r.5.	☐	☐	☐

2. When frozen or snow-covered soils prevent effective incorporation, does the plan follow these requirements for winter applications of all mechanically applied manure or organic by-products? *This section doesn't apply to winter gleaning/pasturing meeting 590 N and P requirements.*

If no manure is applied, check NA for 2.a. through 2.g..	Yes	No	NA
a. Identify **manure quantities planned to be spread during the winter**, or the amount of manure generated in 14 days, whichever is greater. *For daily haul systems, assume 1/3 of the manure produced annually will need to be winter applied.*	☐	☐	☐
b. Identify **manure storage capacity** for each type applied and stacking capacity for manure ≥ 16% DM if permanent storage does not exist.	☐	☐	☐
c. Show on map and make no applications within the **SWQMA**.	☐	☐	☐
d. Show on map and make no surface applications of liquid manure during **February and March** where **Silurian dolomite** is within 60 inches of the soils surface OR where **DNR Well Compensation** funds provided replacement water supplies for wells contaminated with livestock manure.	☐	☐	☐
e. Show on map and make no applications of manure within **300 feet** of **direct conduits to groundwater**.	☐	☐	☐
f. Do not exceed the P removal of the following growing season's crop when applying manure. Liquid manure applications are limited to **7,000 g/acre**. All winter manure applications are not to exceed **60 lbs. of P2O5/acre**.	☐	☐	☐
g. Make no applications of manure to fields with **concentrated flow channels** unless using two of the following: **1.** Contour buffer strips or contour strip cropping; **2.** Leave all crop residue and no fall tillage; **3.** Apply manure in intermittent strips on no more than 50% of field; **4.** Apply manure on no more than 25% of the field waiting a minimum of 14 days between applications; **5.** Reduce manure app. rate to 3,500 gal. or 30 lbs. P2O5, whichever is less; **6.** No manure application within 200 feet of all concentrated flow channels; **7.** Fall tillage is on the contour and slopes are lower than 6%. Make no applications to **slopes greater than 6%** (soil map units with C, D, E, and F slopes) unless the plan documents that no other accessible fields are available for winter spreading AND two of the options 2.g.1. through 2.g.5. are used.	☐	☐	☐

I certify that the plan represented by the answers on this checklist complies with Wisconsin's NRCS 2015-590 NM Standard or is otherwise noted.

Qualified NM planner signature NAICC-*Certified Professional Crop Consultant*, ASA-*Certified Crop Adviser*, or SSSA-*Soil Scientist* Date

Qualified NM farmer-planner or Authorized farm operator signature receiving and understanding the plan Date Signature if reviewed for quality assurance Date

State of Wisconsin
Department of Natural Resources
PO Box 7185, Madison, WI 53707-7185
dnr.wi.gov

Instructions for Form 3400-025A
Animal Units Calculation Worksheet

A WPDES permit is required for all livestock/poultry operations that will contain 1,000 or more animal units (AU). You are required to complete these calculations as part of the "**preliminary**" application for a Wisconsin Pollutant Discharge Elimination System (WPDES) permit under NR 243, Wis. Admin. Code. **The AU Calculation Worksheet(s) must be filled out separately for the "main" site and each other site your farm owns or manages where animals are kept.** When filling out the AU Calculation Worksheet(s) for a particular site, include all animals held in confinement or feeding facilities for more than 45 days in a 12 month period. **Attach the AU calculation worksheet(s) to the corresponding Site Information pages (Section II) of Form 3400-025, which should have been completed prior to completing the AU calculations worksheet(s).**

Use the Current Animal Units Calculation Worksheet to calculate the number of AU currently on your operation and use the Projected Animal Units Calculation Worksheet to calculate the AU after any proposed expansions. The Projected Animal Units Calculation Worksheet must be filled out for each proposed increases in animal numbers at a site within the next five years**. Please fill in the name of the site in the space provided at the top of both worksheet(s).** Check the box at the bottom of the Current Animal Units Calculation Worksheet, if there are no proposed increases in animal numbers at this site within the next five years. If you plan to expand your operation, please identify the month and year you plan to implement the expansion at the bottom of the Projected Animal Units Calculation Worksheet.

All application materials must be submitted online through the Department's ePermitting System. Form 3400-025A will be provided as part of the online application process:

Water Permit Water Portal Page:
http://dnr.wi.gov/permits/water/

Completing Form 3400-025A Animal Unit Worksheet

1. Identify the name of the site for which you are calculating the AU at the top of both Current and Projected Animal Units Calculation Worksheet(s) (Form 3400-025A), if applicable. These AU calculation worksheet(s) must be filled out separately for the main site and any other site(s) which are owned or operated by your farm for the purpose of housing animals associated with your operation.

2. Calculate the animal units using both the Mixed (State) and Non-mixed (Federal) methods. The highest calculated total of the two methods determines the size of the animal feeding operation. For existing operations, enter the current number of each animal type at a site in the **Current Number** columns under both the **Mixed** and **Non-mixed Animal Units** headings of the Current Animal Unit Calculation Worksheet. To determine the current number of each animal type, include all animals held in confinement or feeding facilities for more than 45 days in a 12 month period. For new sites where there currently are not any animals present, enter zero for Total Mixed and Non-Mixed Animal Units on the Current Animal Unit Calculation Worksheet.

3. If you plan to expand your operation, enter your proposed animal numbers in the **Projected Number** columns under both the **Mixed** and **Non-mixed Animal Units** headings of the Projected Animal Unit Calculation Worksheet (Form 3400-025A). The Projected Animal Units Calculation Worksheet must be filled out each time you plan to expand a particular site within the next 5 years. Please identify the month and year you plan to implement the expansion at the bottom of the worksheet.

4. The worksheet will automatically calculate the number of Mixed and Non-Mixed Animal Units on the operation. If either "Total Animal Units" is 1000 or more, you are required to obtain a WPDES permit.

State of Wisconsin
Department of Natural Resources
PO Box 7185, Madison, WI 53707-7185
dnr.wi.gov

Animal Unit Calculation Worksheet
Form 3400-025A (R 3/2012)

The Current Animal Unit Calculation Worksheet must be filled out separately for the "main" site and each site which are owned or operated by your farm for the purposes of housing animals associated with your operation. The site name, for which you are filling this worksheet out, must be provided below and correlate with Form 3400-025 Site Information (Section II).

Current Animal Unit Calculation Numbers

Name of Site:

Animal Type		I. Mixed Animal Units			II. Non-mixed Animal Units		
		b. Equiv. factor	c. Current Number	d. No. of AUs	e. Equiv. factor	f. Current Number	g. No. of Aus
Example - Broilers (non-liquid manure):		*0.005 x*	*150,000*	*= 750*	*0.008 x*	*150,000*	*= 1200*
Dairy/Beef Calves (under 400 lbs)		0.20 x		=	*Fed.numbers in this column comply with 40 CFR s. 122.23*		
Dairy Cattle	Milking & Dry Cows	1.40 x		=	1.43 x		=
Dairy Cattle	Heifers (800 lbs to 1200 lbs)	1.10 x		=			
Dairy Cattle	Heifers (400 lbs to 800 lbs)	0.60 x		=	1.00 x		=
Beef	Steers or Cows (400 lbs to market)	1.00 x		=			
Beef	Bulls (each)	1.40 x		=	1.00 x		=
Veal Calves		0.50 x		=	1.00 x		=
Swine	Pigs (up to 55 lbs)	0.10 x		=	0.10 x		=
Swine	Pigs (55 lbs to market)	0.40 x		=			
Swine	Sows (each)	0.40 x		=			
Swine	Boars (each)	0.50 x		=	0.40 x		=
Chickens	Layers (each) -non-liquid manure system	0.01 x		=	0.0123 x		=
Chickens	Broilers/Pullets (each) -non-liquid manure system	0.005 x		=	0.008 x		=
Chickens	Per Bird -liquid manure system	0.033 x		=	0.0333 x		=
Ducks	Ducks (each) -liquid manure system	0.2 x		=	0.2 x		=
Ducks	Ducks (each) -non-liquid manure system	0.01 x		=	0.0333 x		=
Turkeys (each)		0.018 x		=	0.018 x		=
Sheep (each)		0.1 x		=	0.1 x		=
Horses (each)		2 x		=	2 x		=
Total Animal Units:		**Total Mixed Animal Units =** (add all rows above)			**Total Non-Mixed Animal Units =** (Enter the single highest number from any row above; DO NOT add the totals)		

☐ Check here if there are no proposed increases in animal numbers at this site within the next five years.

State of Wisconsin
Department of Natural Resources
PO Box 7185, Madison, WI 53707-7185
dnr.wi.gov

Animal Unit Calculation Worksheet
Form 3400-025A (R 3/2012)

The Projected Animal Unit Calculation Worksheet must be filled out separately for the "main" site and each site which are owned or operated by your farm for the purposes of housing animals associated with your operation. The site name, for which you are filling this worksheet out, must be provided below and correlate with Form 3400-025 Site Information (Section II).

Projected Animal Unit Calculation Numbers

Name of Site:

Animal Type		I. Mixed Animal Units			II. Non-mixed Animal Units		
		b. Equiv. factor	c. Projected Number	d. No. of AUs	e. Equiv. factor	f. Projected Number	g. No. of Aus
Example - Broilers (non-liquid manure):		*0.005 x*	*150,000*	*= 750*	*0.008 x*	*150,000*	*= 1200*
Dairy/Beef Calves (under 400 lbs)		0.20 x		=	*Fed.numbers in this column comply with 40 CFR s. 122.23*		
Dairy Cattle	Milking & Dry Cows	1.40 x		=	1.43 x		=
Dairy Cattle	Heifers (800 lbs to 1200 lbs)	1.10 x		=			
Dairy Cattle	Heifers (400 lbs to 800 lbs)	0.60 x		=	1.00 x		=
Beef	Steers or Cows (400 lbs to market)	1.00 x		=			
Beef	Bulls (each)	1.40 x		=	1.00 x		=
Veal Calves		0.50 x		=	1.00 x		=
Swine	Pigs (up to 55 lbs)	0.10 x		=	0.10 x		=
Swine	Pigs (55 lbs to market)	0.40 x		=			
Swine	Sows (each)	0.40 x		=			
Swine	Boars (each)	0.50 x		=	0.40 x		=
Chickens	Layers (each) -non-liquid manure system	0.01 x		=	0.0123 x		=
Chickens	Broilers/Pullets (each) -non-liquid manure system	0.005 x		=	0.008 x		=
Chickens	Per Bird -liquid manure system	0.033 x		=	0.0333 x		=
Ducks	Ducks (each) -liquid manure system	0.2 x		=	0.2 x		=
Ducks	Ducks (each) -non-liquid manure system	0.01 x		=	0.0333 x		=
Turkeys (each)		0.018 x		=	0.018 x		=
Sheep (each)		0.1 x		=	0.1 x		=
Horses (each)		2 x		=	2 x		=
Total Animal Units:		**Total Mixed Animal Units =** (add all rows above)			**Total Non-Mixed Animal Units =** (Enter the single highest number from any row above; DO NOT add the totals)		

Date of Proposed Expansion (MM/YY):

Print Form

Manure Spill Emergency Response Plan

What to do in Case of a Manure Spill

1. **Eliminate the source.**
   - Stop manure application or pumps.
   - Close valves.
   - Separate pipes, creating an air gap and stopping flow.
   - Transfer manure/liquid to another basin or lagoon.

2. **Contain the spill, if possible.**
   - Create a containment dam in the field, ditch or stream.
   - In a field, use tillage equipment to slow the flow
   - Check for tile flows.
   - Construct a temporary holding basin down slope.
   - Ensure that you do not damage the embankment while creating a temporary basis.
   - If possible, place soil over the point of seepage, ensuring that you do not drive over or compact the seepage point.

3. **Assess the extent of the spill and note any obvious damages.**
   - Did the spill reach any surface waters, well casings or other sensitive areas?
   - How much was released?
   - What time?
   - Did any damage occur (employee injury, fish kills, or property damage)?
   - Can the spill reach streams?

4. **Contact the appropriate agencies.**

5. **Clean up the spill and make repairs.**

6. **Prepare and submit summary.**

Farm Information		
Farm Name:		
Address:		
City:	**State**:	**Zip**:
Farm Owner:		
Phone:	**Mobile Phone:**	
Directions to the farm (from crossroad or highway)		

Emergency Phone Numbers	
County Sheriff Dispatch:	**Dial 911**
DNR 24-hour Spill Reporting Hotline	**1-800-943-0003**

County Land & Water Conservation Dept.	
County Conservationist	James Arch
Phone Number	715-743-5285
Department of Natural Resources	
Animal Waste Specialist	
Phone Number	
Conservation Warden	
Phone Number	

Refer to listing on back for: Earth Moving, Pumping Equipment, & Manure Hauling Contractors

Equipment Owners (other neighboring farms)	
Name	**Phone Number**

Manure Spill Emergency Response Plan

Earthmoving Contactors

Company Name	Address	Phone

Pumping Equipment

Company Name	Address	Phone

Custom Manure Applicators

Company Name	Address	Phone

This is a partial listing for informational purposes only. No endorsement is implied or intended.

Operation and Maintenance Plan for 590 Nutrient Management

Required operation and maintenance procedures for NMP include the following:

1. Document the actual nutrient application including the rate, form, timing, and method of the application. Please revise your plan to reflect any changes in crops, tillage or farm management or changes in soil and manure tests.

2. 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.

3. Minimize operator exposure to potentially toxic gases associated with manure, organic wastes, and chemical fertilizers, particularly in enclosed areas. Wear protective clothing appropriate to the material being handled.

4. Protect commercial fertilizer from the weather and agricultural waste storage facilities (manure pits, slurrystore, etc.) from accidental leakage or spillage. See Wisconsin administrative rules and local ordinances concerning regulations on sitting, design, operation, and maintenance of these facilities.

5. During periods when land application is not suitable, manure shall be stored in a manure storage facility designed in accordance with the criteria contained in NRCS FOTG Standard 313, Waste Storage Facility. Temporary management of manure shall be in accordance with the criteria for temporary unconfined stacks of manure contained in Table 10 of Standard 313.

6. When cleaning equipment after nutrient application, remove and save fertilizers or wastes in an appropriate manner. If the application equipment 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.

7. All manure/fertilizer application equipment shall be calibrated to achieve the desired application rate.

8. Develop and implement a winter manure spreading plan.

9. Manage milkhouse wastewater, silage leachate, stored/stacked manure, and barnyard/feedlot runoff in a manner that prevents discharges to surface and groundwater.

a. Frequently scrape all barnyards and feed storage areas to minimize off-site nutrient runoff..
b. Implement a milkhouse wastewater and/or silage leachate treatment system to minimize off-site nutrient runoff.

10. Limit livestock access to streambanks and wetlands to prevent erosion and maintain adequate vegetative cover to preserve streambank integrity.

11. Keep clean water clean by diverting it around sources of contamination (barnyards, feedlots, manure stackes, etc.)

12. Develop a "Manure Spill Action and Response Plan" and keep it posted.

Wisconsin Certified Soil & Manure Testing Laboratories

A Wisconsin nutrient management plan must be based on soil tests conducted at the soil testing laboratory certified by the Department of Agriculture, Trade and Consumer Protection. This requirement ensures soil test results and recommendations will be generated through analytical procedures approved by the University of Wisconsin with consistent results. Laboratories must perform with a certain level of success, to remain certified.

The following soil testing laboratories are Wisconsin DATCP certified.

UW Soil & Forage Lab
2611 Yellowstone Dr
Marshfield, WI 54449
(715)387-2523
https://uwlab.soils.wisc.edu/
MAP participant

A & L Great Lakes Laboratories, Inc.
3505 Conestoga Dr.
Fort Wayne, IN 46808
(260)483-4759
rwarden@algreatlakes.com
MAP participant

AgSource Laboratories
106 N. Cecil Street
Bonduel, WI 54107
(715)758-2178
speterson@agsource.com
bonduel@agsource.com
MAP participant

Dairyland Laboratories
709 W Meadow St
Stratford, WI 54484
(715)-687-9997
info@dairylandlabs.com

MAP participant
217 E. Main Street
Arcadia, WI 54612
(608)323-2123

Rock River Laboratory
710 Commerce Drive
PO Box 169
Watertown, WI 53094
(920)261-0446
dustin_sawyer@rockriverlab.com
MAP participant

Minnesota Valley Testing Laboratories, Inc (MVTL)
1126 N Front St PO Box 249
New Ulm, MN 56073
(800) 782-3557
bhansen@mvtl.com
MAP participant

Midwest Laboratories Inc.
13611 B Street
Omaha, NE 68144
402-334-7770
jp@midwestlabs.com
MAP participant

Estimates of first-year available nutrient credits for manure shall be established in accordance with one of the following methods:

1. **Standard "book values"** contained in UW Pub. A2809 and **Snap Plus** nutrient management software from http://www.snapplus.wisc.edu/ developed by the UW Madison, Soil Science Department and available free of charge.
2. Or, manure analysis conducted at a laboratory that participates in the **Manure Analysis Proficiency** program and interpreted according to UW Pub. A2809. Wisconsin DATCP certified soil testing laboratories participating in MAP are listed above. You can learn more about the MAP program and find other participating laboratories at http://www2.mda.state.mn.us/webapp/lis/maplabs.jsp .

For Technical Assistance Wisconsin Department of Agriculture, Trade and Consumer Protection

Sue Porter	(608)224-4605	sue.porter@wi.gov
Stephanie Schneider	(715)832-6547 x6019	stephanie.schneider@wi.gov
Mark Jenks	(608)224-4507	mark.jenks@wi.gov
Rachel Rushmann	(608)224-4622	Rachel.Rushmann@wi.gov

For nutrient management plan (NMP) information go to
https://datcp.wi.gov/Pages/Programs_Services/NutrientManagement.aspx
SNAP-Plus software and training opportunities are available at
https://snapplus.wisc.edu/

MANURE information

ESTIMATED AVAILABLE NUTRIENT CONTENT *

1st Year [2nd Year]

Manure units: Solid (lb/ton); Liquid (lb/1000 gal)		N time to incorporation > 3 days	1 hr–3 days	< 1 hr	P_2O_5	K_2O
Dairy	Solid, >20% DM	2 [1]	3 [1]	3 [1]	3	6
	Solid, 11-20% DM	2 [1]	2 [1]	3 [1]	3	5
	Liquid, 4-11% DM	7 [2]	10 [2]	12 [2]	6	17
	Liquid, <4% DM	4 [1]	6 [1]	7 [1]	3	11
Beef	Solid	3 [1]	4 [1]	5 [1]	6	10
	Liquid	5 [2]	6 [2]	8 [2]	6	12
Swine	Solid	7 [2]	9 [2]	12 [2]	10	8
	Liquid, finish, indoor pit	17 [4]	22 [4]	28 [4]	14	22
	Liquid, finish, outdoor pit	7 [2]	9 [2]	12 [2]	6	8
	Liquid, farrow-nursery, indoor pit	8 [2]	10 [2]	14 [2]	6	10
Poultry	Solid, chicken	24 [5]	27 [5]	29 [5]	35	26
	Solid, turkey	26 [5]	28 [5]	31 [5]	35	25
	Liquid	6 [1]	7 [1]	7 [1]	6	7
Horse	Solid	2 [1]	3 [1]	4 [1]	5	6

* Because manure nutrient content can vary greatly, manure analysis is encouraged.

MANURE OUTPUT

(volume as excreted)

Animal & weight	lb/day	ton/year	gal/day	1000 gal/year
Dairy 1400 lb	148	27	17.7	6.5
Beef 1100 lb	80	15	9.5	3.5
Swine 150 lb	9.5	1.7	1.2	0.44
Chicken (broiler) 2 lb	0.18	0.033	0.02	0.007
Horse 1000 lb	50	9.1	6.0	2.2

HOW TO DETERMINE MANURE APPLICATION RATE

Step 1: Figure load size:

Weigh spreader in tons for solid or semi-solid manure
Use 90% tank capacity in gallons for liquid manure

Step 2: Determine field acreage:

$$\frac{\text{field length (ft)} \times \text{field width (ft)}}{43{,}560\ \text{ft}^2/\text{a}} = \text{acres}$$

Step 3: Calculate manure application rate:

$$\frac{[(\#\ \text{of loads}) \times (\text{load size})]}{\text{field acreage}} = \text{tons or gallons / acre}$$

Nutrient Management FAST FACTS

Nutrient Management Fast Facts is a summary of University of Wisconsin recommendations. For more information, see the UWEX publication *A2809 Nutrient Application Guidelines for Field, Vegetable and Fruit Crops in Wisconsin.*

indicates information pertains to Wisconsin only.

NPM Program Contacts

Northwest Region ..... Paul Kivlin ..... (715) 425-3112
South Central Region..... Kevin Shelley ..... (608) 262-7846
Southeast Region..... Richard Proost ..... (608) 262-7845
Southwest Region ..... Dan Smith..... (608) 219-5170
Madison ..... Scott Sturgul..... (608) 262-7486

This publication is available from the Nutrient and Pest Management (NPM) Program. For more copies, please contact us at:

email (npm@hort.wisc.edu)

phone (608) 265-2660

website (ipcm.wisc.edu)

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LEGUME nitrogen credits

FORAGE

Alfalfa 1st Year Credit

In the 2nd cropping year following a fair or good stand on a fine/medium textured soil, take a 50 lb N/acre credit.

Stand Density:		MEDIUM / FINE-TEXTURED SOILS		SANDS / LOAMY SANDS	
	Regrowth:	> 8″	< 8″	>8″	<8″
		lb N /acre to credit			
70-100% alfalfa, more than 4 plants/ft²	Good	190	150	140	100
30-70% alfalfa, 1.5 - 4 plants/ft²	Fair	160	120	110	70
0-30% alfalfa, less than 1.5 plants/ft²	Poor	130	90	80	40

Red Clover, Birdsfoot Trefoil: 80% of alfalfa credit for similar stands

GREEN MANURE

Alfalfa 60-100 lb N/acre

Sweet Clover 80-120 lb N/acre

Red Clover 50-80 lb N/acre

Use 40 lb N/acre credit if less than 6 inches of growth before tillage. Use upper end of range for spring seedings that are plowed under the following spring; use low end for fall seedings.

FIELD CROPS

Soybean 20 lb N/a

Pea, Snap or Lima bean 20 lb N/acre

No credit on sandy soils. Do not take soybean credit when corn or wheat is grown; the rotation effect is factored into the N rate guidelines.

Corn Nitrogen Guidelines

Soil[1]	Previous Crop	N:Corn Price Ratio 0.05	0.10	0.15	0.20
		total lb N/acre to apply[2]			
LOAMY: HIGH YIELD POTENTIAL SOILS	**Corn**, forage legumes, legume vegetables, green manures[5]	190[3] 170 ---- 210[4]	165 155 ---- 180	150 140 ---- 160	135 125 ---- 150
	Soybean, small grains[6]	140 125 ---- 160	120 105 ---- 130	105 95 ---- 115	90 80 ---- 105
LOAMY: MEDIUM YIELD POTENTIAL SOILS	**Corn**, forage legumes,legume vegetables, green manures[5]	145 130 ---- 160	125 115 ---- 140	115 105 ---- 125	105 95 ---- 110
	Soybean, small grains[6]	130 110 ---- 150	100 85 ---- 120	85 70 ---- 95	70 60 ---- 80
SANDS/LOAMY SANDS	Irrigated—**all crops**[5]	215 200 ---- 230	200 185 ---- 210	185 175 ---- 195	175 165 ---- 185
	Non-irrigated—**all crops**[5]	140 130 ---- 150	130 120 ---- 140	120 110 ---- 130	110 100 ---- 120

[1] To determine soil yield potential, consult UWEX publication A2809 or contact your county agent or agronomist.

[2] Includes N in starter.

[3] Maximum return to N (MRTN) rate.

[4] Profitability range within $1/acre of MRTN rate.

[5] Subtract N credits for forage legumes, legume vegetables, animal manures, green manures.

[6] Subtract N credits for animal manures and second year forage legumes.

ADDITIONAL GUIDELINES:

- For maximum silage yield, use N rate for 0.05 price ratio. To adjust rates for silage, use price ratio that reflects typical prices for N and grain.
- If >50% residue at planting, use upper end of range.
- If all N is from organic sources, use top end of range. Plus, up to 20 lb N/acre as starter may be used.
- For loamy (medium & fine-textured) soils with >10% soil organic matter (OM), use low end of range.
- For all soils with <2% soil OM, use high end of range.
- For sandy (coarse-textured) soils with <2% OM, use high end of range; 2-10% OM, use mid to low end of range; 10-20% OM, use non-irrigated guidelines–regardless of irrigation status; >20% OM, apply 80 lb N/acre.
- When corn follows small grains on loamy soils, use the mid to low end of range.
- For loamy irrigated or drained soils, use rates for high yield potential soils.
- If potential for carry-over (residual) N, use low end of range or use the high end and subtract preplant soil nitrate test (PPNT) credits.

CORN nutrient recommendations

SOIL TEST LEVEL OF THE FIELD

	Yield goal (bu/acre)	Very Low	Low	Optimum	High	Very High	Ex. High
GRAIN		lb P_2O_5 or K_2O/acre to apply					
Phosphate (P_2O_5)	91-110	80	70	40	20	-	0
	111-130	85	75	45	25	-	0
	131-150	95	85	55	30	-	0
	151-170	100	90	60	30	-	0
	171-190	110	100	70	35	-	0
	191-210	115	105	75	40	-	0
	211-230	125	115	85	45	-	0
	231-250	130	120	90	45	-	0
	251-270	140	130	100	50	-	0
Potash (K_2O)	91-110	75	60	30	15	10	0
	111-130	80	65	35	20	10	0
	131-150	85	70	40	20	10	0
	151-170	90	75	45	25	10	0
	171-190	95	80	50	25	15	0
	191-210	105	90	60	30	15	0
	211-230	110	95	65	35	15	0
	231-250	115	100	70	35	20	0
	251-270	120	105	75	40	20	0
SILAGE	@35% DM (tons/acre)	lb P_2O_5 or K_2O/acre to apply					
Phosphate	15-20	105	95	65	35	-	0
	20-25	120	110	80	40	-	0
	25-30	140	130	100	50	-	0
	30-35	155	145	115	60	-	0
	35-40	175	165	135	70	-	0
Potash	15-20	200	185	145	75	35	0
	20-25	240	225	185	95	45	0
	25-30	285	270	230	115	60	0
	30-35	325	310	270	135	70	0
	35-40	365	350	310	155	80	0

-- Very high category does not exist for soil test phosphorus

For links to NPM's free apps for agriculture:
including Wisconsin's Corn Nitrogen Rate Calculator and Nitrogen Price Calculator

N:Corn Price Ratios

Price of N ($/lb N) = [$/ton N fertilizer x (100 / % N in fertilizer)] / 2000	Price of Corn ($/bu corn) 2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50	4.75	5.00	5.25
0.25	0.10	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.05
0.30	0.12	0.11	0.10	0.09	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.06
0.35	0.14	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.08	0.07	0.07	0.07
0.40	0.16	0.15	0.13	0.12	0.11	0.11	0.10	0.09	0.09	0.08	0.08	0.08
0.45	0.18	0.16	0.15	0.14	0.13	0.12	0.11	0.11	0.10	0.10	0.09	0.09
0.50	0.20	0.18	0.17	0.15	0.14	0.13	0.13	0.12	0.11	0.11	0.10	0.10
0.55	0.22	0.20	0.18	0.17	0.16	0.15	0.13	0.13	0.12	0.12	0.11	0.11
0.60	0.24	0.22	0.20	0.18	0.17	0.16	0.14	0.14	0.13	0.13	0.12	0.11
0.65	0.26	0.24	0.22	0.20	0.19	0.17	0.16	0.15	0.14	0.14	0.13	0.12
0.70	0.28	0.25	0.23	0.22	0.20	0.19	0.18	0.16	0.16	0.15	0.14	0.13
0.75	0.30	0.27	0.25	0.23	0.21	0.20	0.19	0.18	0.17	0.16	0.15	0.14
0.80	0.32	0.29	0.27	0.25	0.23	0.21	0.20	0.19	0.18	0.17	0.16	0.15

SOYBEAN nutrient recommendations

	Yield goal (bu/acre)	Very Low	Low	Optimum	High	Very High	Ex. High
		SOIL TEST LEVEL OF THE FIELD					
		----------lb P_2O_5 or K_2O/acre to apply----------					
Phosphate (P_2O_5)	26-35	65	55	25	15	-	0
	36-45	70	60	30	15	-	0
	46-55	80	70	40	20	-	0
	56-65	90	80	50	25	-	0
	66-75	95	85	55	30	-	0
	76-85	105	95	65	35	-	0
	86-95	110	100	70	35	-	0
	96-105	120	110	80	40	-	0
Potash (K_2O)	26-35	85	70	40	20	10	0
	36-45	100	85	55	30	15	0
	46-55	115	100	70	35	20	0
	56-65	130	115	85	45	20	0
	66-75	145	130	100	50	25	0
	76-85	155	140	110	55	30	0
	86-95	170	155	125	65	30	0
	96-105	185	170	140	70	35	0

-- Very high category does not exist for soil test phosphorus

ALFALFA nutrient recommendations

	Yield goal (tons/acre)	Very Low	Low	Optimum	High	Very High	Ex. High
		SOIL TEST LEVEL OF THE FIELD					
		----------lb P_2O_5 or K_2O/acre to apply----------					
Phosphate (P_2O_5)	1.5-2.5	65	55	25	15	-	0
	2.6-3.5	80	70	40	20	-	0
	3.6-4.5	90	80	50	25	-	0
	4.6-5.5	105	95	65	35	-	0
	5.6-6.5	120	110	80	40	-	0
	6.6-7.5	130	120	90	45	-	0
	7.6-8.5	145	135	105	55	-	0
	8.6-9.5	155	145	115	60	-	0
Potash (K_2O)	1.5-2.5	160	145	105	55	25	0
	2.6-3.5	235	220	180	90	45	0
	3.6-4.5	295	280	240	120	60	0
	4.6-5.5	355	340	300	150	75	0
	5.6-6.5	415	400	360	180	90	0
	6.6-7.5	475	460	420	210	105	0
	7.6-8.5	535	520	480	240	120	0
	8.6-9.5	595	580	540	270	135	0

-- Very high category does not exist for soil test phosphorus

Legume Forage:

Where an alfalfa stand is to be maintained for more than three years increase the annual top-dressed K_2O by 20%.

Apply 30 lb N/acre in the seeding year if grown on soils with less than 2% organic matter.

Nurse Crops:

Where barley or oats are seeded with a forage legume, eliminate or reduce N for the small grain by 50%.

FERTILIZER ANALYSIS & CONVERSIONS

	N	P_2O_5	K_2O	other
Nitrogen	% content			
Ammonium nitrate	34	0	0	
Ammonium sulfate (AMS)	21	0	0	24(S)
Ammonium thiosulfate (ATS)	12	0	0	26(S)
Anhydrous ammonia	82	0	0	
Aqueous ammonia	20	0	0	
Calcium nitrate (CN)	15	0	0	17(Ca)
Urea	46	0	0	
28% Urea ammonium nitrate (UAN)	28	0	0	
32% UAN	32	0	0	
Phosphorus				
Ammonium polyphosphate (dry)	15	62	0	
Ammonium polyphosphate (liquid)	10	34	0	
Diammonium phosphate (DAP)	18	46	0	
Monoammonium phosphate (MAP)	11	52	0	
Triple superphosphate (TSP)	0	46	0	
Potassium				
Potassium chloride (muriate of potash)	0	0	60-62	
Potassium-magnesium sulfate	0	0	22	22(S),11(Mg)
Potassium nitrate	13	0	44	
Potassium sulfate	0	0	50	18(S)

Liquid weights: 1 gallon water weighs 8.3 lbs
1 gallon UAN (28%) weighs 10.6 lbs
1 gallon 10-34-0 weighs 11.6 lbs
1 gallon 9-18-9 weighs 11.1 lbs

To get column 3, multiply column 1 by column 2

1	2	3
acre (a)	43,560	square feet (ft^2)
acre (a)	0.405	hectare (ha)
square mile (mi^2)	640	acres (a)
cubic yard (yd^3)	27	cubic feet (ft^3)
cubic feet (ft^3)	7.48	gallons (gal)
bushel (bu)	1.244	cubic feet (ft^3)
bushel (bu)	8	gallons - dry
bushel (bu)	9.31	gallons - liquid
ounces (oz)	29.6	milliliters (ml)
gallon (gal)	3.78	liters (l)
gallon (gal)	128	fluid ounces (fl oz)
gallon (gal)	4	quart (qt)
acre-foot	43,560	cubic feet (ft^3)
acre-foot	325,851	gallons (gal)
chain (ch)	66	feet (ft)
chain (ch)	4	rods (r)
rods (r)	16.5	feet (ft)
mile (mi)	5,280	feet (ft)
ton (t)	2,000	pounds (lb)
gallons/acre (gal/a)	9.354	liters/hectare (l/ha)
miles/hour (mph)	88	feet/minute (ft/min)
pounds/acre (lb/a)	1.12	kilograms/hectare (kg/ha)
P_2O_5 (lb)	0.44	P (lb)
K_2O (lb)	0.83	K (lb)
ppm-plow layer (6 in)	2	lb/acre (lb/a)
ppm-top soil (12 in)	4	lb/acre (lb/a)

To get column 1, divide column 3 by column 2

PLANTING & HARVEST INFORMATION

DETERMINING PLANT POPULATIONS

Row Width	20″	28″	30″	32″	36″	38″	40″
Row Length*	26′1″	18′8″	17′5″	16′4″	14′6″	13′9″	13′1″

*required to equal 1/1000 acre

Calculation: (# of plants in row length) x 1000 = plants/acre

NUTRIENTS REMOVED BY CROP AT HARVEST

	P_2O_5	K_2O
	lb per yield unit	
Alfalfa* / Red clover, per ton (dry matter)	13	60
Barley, Grain, per bu (1 bu = 48 lb @ 14.5% moisture)	0.40	0.35
Straw, per ton (dry matter)	10	32
Corn, Grain per bu (1 bu = 56 lb @ 15.5% moisture)	0.38	0.29
Silage, per ton (65% moisture)	3.6	8.3
Sweet, per ton (fresh)	3.3	6.0
Stover, per ton (dry matter)	4.6	32
Small grain silage, per ton (dry matter)	11	44
Oats, Grain, per bu/a (1 bu = 32 lb @ 14% moisture)	0.29	0.19
Straw, per ton (dry matter)	9.4	47
Potatoes, per cwt (fresh)	0.12	0.50
Rye, Grain, per bu/a (1 bu = 56 lb @ 14% moisture)	0.41	0.31
Straw, per ton (dry matter)	3.7	21
Sorghum, Grain, per bu (1bu = 56 lb @ 14% moisture)	0.40	0.40
Sorghum-sudan, Forage, per ton (65% moisture)	15	60
Soybean,* Grain, per bu (1 bu = 60 lb @ 13% moisture)	0.80	1.4
Straw, per ton (dry matter)	5.4	19
Wheat, Grain, per bu (1 bu = 60 lb @ 13.5% moisture)	0.50	0.35
Straw, per ton (dry matter)	6.0	28

*Nitrogen removal by alfalfa is 60 lb N/ton and by soybeans is 4 lb N/bu.

CONVERTING lbs HARVESTED TO bu with % moisture content corrections

Shelled Corn
[lbs harvested x (1 - % moisture in corn)] ÷ 47.32 = bu @ 15.5% moisture

Ear Corn lbs harvested ÷ number from chart below = bu @ 15.5% moisture

moisture %	15	15.5	16	17	18	19	20	21	22	23	24	25	26	27
equation #	68.1	68.2	69.2	70.4	71.6	72.8	74.1	75.4	76.6	78.0	79.4	80.7	82	83.4

Soybean
lbs harvested x (1 - % foreign matter) = adjusted lbs
[adjusted lbs x (1 - % moisture)] / 52.2 = bu @ 13% moisture

Wheat
lbs harvested x (1 - % foreign matter) = adjusted lbs
[adjusted lbs x (1 - % moisture)] / 51.9 = bu @ 13.5% moisture

CALCULATING ACRES HARVESTED

$$\text{acres harvested} = \frac{[\text{row length(ft)} \times \text{row width(ft)} \times \text{\# of rows harvested}]}{43{,}560\ ft^2/\text{acre}}$$

Example with shelled corn harvested by combine :

Step 1: 12,580 lbs corn harvested @ 21.35% moisture
12,580 lbs x (1 - .2135) ÷ 47.32 = 209 bu of corn @ 15.5 % moisture

Step 2: Four-row harvester: 16 rows , each 30 inch (2.5 ft) row is 1210 feet long
(1210 ft x 2.5 ft x 16 rows) ÷ 43,560 ft^2/acre = 1.10 acres

Step 3: 209 bu of corn ÷ 1.10 acres = 190 bu/acre

SOIL pH liming recommendations

1. Lime should be applied and incorporated at least 6 to 12 months prior to planting an acid sensitive crop such as alfalfa.
2. Lime recommendations are made using the target pH for the most acid sensitive crop in a 4-year rotation.
3. Application rates for lime should never exceed 12 ton/acre (8 ton/acre for potato). The minimum application rate is 1 ton/acre on sandy soils with <1% OM; all other soils 2 ton/acre.
4. No additional lime should be applied until the most recent application has had 2-3 years to equilibrate with the soil.

Crop	Target pH
Alfalfa	6.8
Red Clover, Soybean	6.3
Pastures, Corn (silage or grain), Wheat	6.0

Natural Resources Conservation Service
CONSERVATION PRACTICE STANDARD
NUTRIENT MANAGEMENT
Code 590
(Ac.)

I. DEFINITION

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

II. PURPOSES

To *budget*, 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. 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 IV. Criteria A., B., C., D., and E., as well as VI. Plans and Specifications, and VII. Operations and Maintenance.

All of the information contained in this section is required. Wisconsin Conservation Planning Technical Note WI-1 (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 (Pub.) A2809*, "Nutrient application guidelines for field, vegetable, and fruit crops in Wisconsin," (UWEX Pub. A2809) unless use of one of the following options are appropriate:

      - For crops not listed in UWEX Pub. A2809, use other appropriate Land Grant University recommendations.
      - 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 IV.A.1.o.
      - *Adaptive Nutrient Management* has validated alternative nutrient management strategies that improve nutrient use efficiency. See IV.A.1.i.

Annual plan updates shall document the crops, tillage, nutrient application rates, sources, 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 Spreading Plan that is consistent with sections IV.A.2.d., VI. Plans and Specifications, and Technical Note WI-1 Part II, if manure and/or organic by-products are mechanically applied.

d. The plan shall demonstrate that *adequate acreage* is available for all nutrients from manure and/ or organic by-products applied to fields while maintaining compliance with the standard. If an adequate land base is NOT present the plan shall document the strategy to utilize the remaining projected volume of manure or other nutrient sources 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 Technical Note WI-1. Soil sampling shall be consistent with UWEX Pub. 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 Pub. 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 IV.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 application that does not exceed the total nutrient recommendation for the rotation. Commercial P fertilizers shall not be applied to soils testing excessively high in P for the crop being grown with the exception below (IV.A.1.h).

h. All the nitrogen (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 nutrients other than commercial fertilizers 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. Available N from all sources shall not exceed the annual N requirement of non-legume crops consistent with UWEX Pub. A2809, or the annual N removal by a legume crop or a legume and companion crop. See Technical Note WI-1, Part III.B for additional nitrogen utilization planning guidance.

   Where excessive rainfall has caused *crop N deficiency*, up to 46 pounds per acre of in-season supplemental N may be applied if the need for rescue N is documented using "Guidelines for Adaptive Nutrient Management", Technical Note WI-1, Appendix 3. To justify applying more than 46 pounds per acre, two different methods must be used to document the need.

j. First and second-year legume nitrogen credits shall be applied as described in UWEX Pub. A2809 Table 9.4 through 9.6 or through soil nitrate testing as identified in Chapter 6 of UWEX Pub. A2809.

k. Where *gleaning or pasturing* occurs, verify through computations that the manure nutrients deposited within a field, do not exceed the N and P limitations of this standard.

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 Pub. 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 3 in UWEX Pub. A2809.

(2) Use an average or "book" value of available nutrients. Follow Table 9.3 in UWEX Pub. A2809. See Part IV, Table 3 of the Technical Note WI-1.

Note: 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 Pub. A2809 to determine second-year N credits.

m. Organic by-products other than manure shall be analyzed for total N, ammonium N, total P, total K, and solids content and applied to fields in accordance with this standard and any applicable regulations including restrictions on heavy metal content, mandatory separation distances and land application rates.

n. Manures, organic by-products, 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 off-site movement.

(3) Modify the application rate, method, depth of injection, and/or 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 Technical Note WI-1, Part V, for WDNR 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 and/or other recommendations in the references section of this standard. Also see Technical Note WI-1 Appendix 2.

2. Nutrient Application Prohibitions

a. Nutrients shall not be spread on the following:

(1) Surface water; *saturated soils*; areas of active snow melt where water is flowing; *concentrated flow channels*; or non-harvested *vegetative buffers*, except for the establishment of perennial vegetation in the concentrated flow channels, or non-harvested vegetative buffers.

(2) A non-farmed wetland.

(3) A potable well or direct conduits to groundwater and within 50 feet of these features, unless directly deposited by gleaning or pasturing animals or applied as starter fertilizer to corn. See V.A.1.h and K.

(4) Within eight feet of irrigation wells, except for nutrients applied through fertigation.

(5) Land where vegetation is not removed mechanically or by grazing, except to provide nutrients for establishment and maintenance of a conservation practice.

(6) 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.

(7) Fields with *ephemeral erosion* in which mitigation practices in IV.C. 1.c. have not been implemented.

b. Do not apply manure within areas delineated by the local Land Conservation Committee or in a *conservation plan* as *areas contributing runoff* to direct conduits to groundwater unless the manure is *substantially buried* within 24 hours of application.

c. Application of untreated manure is prohibited; however, *treated manure* may 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 100 feet of a public water supply designated as a *Non-community potable water well*.

Note: Commercial fertilizer and manure deposited by grazing animals may be applied consistent with this standard. Based on site conditions as related to well placement, an additional setback may be needed to protect wells from contamination.

d. All farms mechanically applying manure and/or organic by-products must have a Winter Spreading Plan that has application areas in compliance with criteria (1) - (7) below. The balance of the crop nutrient requirement may be applied in other seasons. These criteria do not apply to manure deposited through winter gleaning or pasturing of plant residue. Winter applications shall be conducted according to Section VI.B.

A Winter Spreading Plan identifies:

- Quantity of manure and/or organic by-products spread during periods of frozen or snow-covered soil, or generated in 14 days, whichever is greater;
- Capacity of storage for each manure type generated;
- Capacity for stacking manure that is ≥ 16% dry matter without permanent storage. Refer to NRCS *313 Standard, Waste Storage Facility*, to locate potential stacking sites.

In addition, when frozen or snow-covered soils prevent *effective incorporation* at the time of application:

(1) Do not apply nutrients within the *Surface Water Quality Management Area (SWQMA)*.

(2) Do not exceed the P removal of the following growing season's crop when applying manure. Liquid manure and/or organic by-products applications are limited to 7,000 gallons per acre. All winter applications are not to exceed 60 pounds of P2O5 per acre.

(3) Do not apply manure and/or organic by-products to fields where concentrated flow channels are present unless two or more of the following are implemented:

a. Contour buffer strips or contour strip cropping;

b. Leave all crop residue (this prohibits removal of silage or bedding) and no fall tillage;

c. Apply in intermittent strips on no more than 50% of the field;

d. Apply on no more than 25% of the field during each application waiting a minimum of 14 days between applications;

e. Reduce application rate to 3,500 gallons or 30 pounds of P2O5, whichever is less;

f. No application within 200 feet of all concentrated flow channels;

g. Fall tillage is on the contour and slopes are less than 6%.

(4) Do not apply manure and/or organic by-products on slopes greater than 6%, unless the plan documents that no other accessible fields are available for winter spreading AND two or more of the following are implemented:

a. Contour buffer strips or contour strip cropping;

b. Leave all crop residue (this prohibits removal of silage or bedding) and no fall tillage;

c. Apply in intermittent strips on no more than 50% of the field;

d. Apply on no more than 25% of the field during each application waiting a minimum of 14 days between applications; or

e. Reduce application rate to 3,500 gallons or 30 pounds of P2O5, whichever is less.

(5) Do not apply N and P commercial fertilizer. An exception is allowed for grass pastures and on winter grains that do not fall within a prohibition area defined by IV.A.2.

(6) Do not surface apply liquid manure and/or organic by-products 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*.

(7) Do not apply manure and/or organic by-products within 300 feet of direct conduits to groundwater.

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 located within a drainage district.

(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, leaving adequate residue to meet tolerable soil loss.

(4) Establish a crop or *cover crop* prior to, at, or promptly following application.

(5) Apply nutrients within seven days of planting on *long term no-till* soil with less than 30% residue.

b. When unincorporated liquid manure and/or organic by-products applications with ≤ 11.0% dry matter occur on non-frozen soils within a SWQMA, OR where *subsurface drainage* is present:

(1) Limit applications to 12,000 gallons per acre per application.

(2) No applications are allowed on saturated soils.

(3) No ponding is allowed at the application site.

(4) Visually monitor accessible tile outlets before, during, and after applications for potential discharge of manure and/or organic by-products. If a discharge is observed, implement the activities in IV.A.1.n.

(5) Follow VI.A.12. for subsurface drainage practices.

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), 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 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* in Part III.B.2.

a. For commercial N fertilizer applications:

(1) No late summer or fall 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) On P, R, W, and combination soils, when commercial N is applied, follow IV.A.1(h) and (i).

(3) On P soils, when commercial N is applied for full season crops in the spring and summer, do not exceed the UWEX Pub. A2809 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.

b. For late summer and fall applications of manure and/or organic by-products with > 4% dry matter:

(1) On W soils or combination W soils, use rates that will not smother these crops and limit N rates to those specified in UWEX Pub. A2809 or 120 pounds per acre of available N, whichever is less.

(2) On P and R soils:

a. When a crop is growing, such as perennial crops, overwintering annual crops, *double crops*, and cover crops, use rates that will not smother these crops and limit N rates to those specified in UWEX Pub. A2809 or 120 pounds per acre of available N, whichever is less.

b. For annual crops that will not be planted until the following spring or summer, delay application until *soil temperatures* are less than 50°F or October 1, whichever occurs first, and limit N rates to those specified in UWEX Pub. A2809 or 90 pounds per acre of available N, whichever is less.

c. For applications of manure and/or organic by-products with ≤ 4.0% dry matter:

(1) On W soils or combination W soils, reduce applications to 90 pounds per acre of available N or apply no more than 120 pounds of available N per acre and use at least one of the following practices:

a. Use a nitrification inhibitor.

b. Apply on an established cover crop, or an overwintering annual crop, or a perennial crop.

c. Establish a cover crop within 14 days of application.

d. Surface apply and do not incorporate for at least 3 days.

e. Delay application until October 1 or soil temperatures are less than 50°F.

(2) On P and R soils, delay applications until soil temperatures are less than 50°F or October 1, whichever occurs first, and use a nitrification inhibitor or surface apply and do not incorporate for at least 3 days. Application rates are limited to those in section IV.B.1.b.(2).

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 by-products, 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:

(1) Install/maintain contours, contour strips and/or contour buffer strips. Refer to *NRCS FOTG*, Section IV, Standard 585, Contour Farming Standard 220, Strip Cropping, and/or Standard 332, Contour Buffer Strip.

(2) Install/maintain filter strips (NRCS FOTG, Section IV, Standard 393, Filter Strip) along surface waters and concentrated flow channels that empty into surface waters.

(3) Maintain greater than 30% crop residue or vegetative cover on the soil surface after planting.

(4) Establish fall cover crops.

(5) Reduce tillage, adjust the crop rotation, or implement other practices to control ephemeral erosion.

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 IV.C.2.a. or Soil Test Phosphorus Management Strategy in section IV.C.2.b. on all fields within a farm or tract and follow IV.A.1.h.

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 Pub. A2809. 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 - total P applications from all sources shall not exceed guidelines from UWEX Pub. A2809. If manure P applications above these guidelines are necessary due to lack of suitable application sites, P applications shall be 25% less than the cumulative annual crop removal over a maximum rotation length of 8 years.

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:

a. Slow or controlled release fertilizers

b. Nitrification inhibitors

c. *Urease inhibitors*

d. Nutrient enhancement technologies

e. Immediate incorporation or injection

f. Stabilized nitrogen fertilizers

g. Residue and tillage management

h. No-till or strip-till

i. In-field and edge-of-field wind breaks

j. NRCS Wind Erosion Prediction System (WEPS) to confirm fields meet tolerable soil loss

k. 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 off-site.

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.

V. 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 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. Application rates must be consistent with recommendations found in UWEX Pub. A2809.

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. Apply nutrients not specifically addressed by this standard (i.e., secondary and micro nutrients) based on recommendations found in UWEX Pub. A2809.

D. 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.

E. For liquid and slurry manure, consider using a nitrification inhibitor to limit the potential risk for N loss.

F. 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.

G. 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.

H. Consider delaying surface applications of nutrients if precipitation capable of producing runoff is forecast within 24 hours of the time of planned application.

I. Consider modifying the crop rotation in order to provide crop fields for the application of manure during the summer crop growing season.

J. 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.

K. Where residual nitrate carryover is probable, the preplant soil nitrate test is recommended to adjust N application rates for corn.

L. To improve N use efficiency of wheat, the preplant soil nitrate test is recommended to adjust the N

application rate.

M. 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 Technical Note WI-1 for a list of soils and/or map.

N. On Silurian dolomite (SD) soils in the spring, summer or fall and before crop planting or after crop harvest, implement at least one of the following if liquid manure is injected or surface applied:

1. Complete pre-tillage prior to application
2. Immediately incorporate manure after application
3. Reduce application rate to 7,000 gallons per application; complete sequential applications to meet desired nutrient additions consistent with this standard. Wait a minimum of three days between sequential applications.

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. Incorporate nutrient applications in flood prone areas of a field in order to prevent nutrient losses to surface waters. Consider applying manure nutrients after seasonal flooding risk period(s) has passed.

Q. Nutrient containers should be recycled in compliance with State and local guidelines or regulations.

R. Avoid applying manure and other organic by-products upwind of residences.

S. Use the Wisconsin NRCS recognized *Nitrogen Leaching Index* to evaluate N pathway loss via leaching, solution runoff, reactive N emissions for planning N reduction alternatives located on the Wisconsin NRCS website under Nutrient Management: *http://www.nrcs.usda.gov/wps/portal/nrcs/main/wi/technical/cp/* or refer to Technical Note WI-1, Part III.B.

T. Evaluate conditions for high risk of snow melt within ten days or less before manure nutrient application.

VI. 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 Technical Note WI-1. The following items are required in a nutrient management plan:

1. Field features identified on maps or aerial photos including:

   a. Field location, soil survey map unit(s), field boundary, acres, field identification number, a North directional arrow if north is not oriented at the top of the page;
   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);

   b. 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 IV.A.2.and IV.A.3.;

   c. Regulated water sources including potable water wells, Community potable water wells, and Non-community potable water wells, and their restrictions or prohibition areas;

   d. Areas prohibited from receiving nutrient applications to frozen or snow-covered soil: Slopes > 6% ; 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;

   e. N-restricted 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 Technical Note WI-1;

   f. Areas of concentrated flow that result in reoccurring gullies;

2. Each field's tolerable and calculated soil losses;
3. Soil test reports and results of soil, plant, manure, or organic by-product 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;
4. Current and planned crops and crop yields, realistic yield goals;
5. Recommended nutrient application rates;
6. 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;
7. For supplemental nitrogen application, documentation of weather conditions; soil conditions; crop growth stage; and photographs, soil/tissue testing, crop canopy reflectance sensing, or nitrogen management models;
8. Guidance for implementation and maintaining records;
9. Soil test P-ppm, P balance calculation, or P Index level where applicable;
10. Other management activities required by regulation, program requirements, or producer goals;
11. A narrative to explain other implementation clarifications.
12. The location, to the maximum extent practical, of inlets, outlets, tile lines and tile depth of subsurface drainage systems in fields where nutrients are applied. To address discharges of liquid manure and/or organic by-products from the tile lines follow IV.A.1.n. See Technical Note WI-1 Part III.D. for guidance for locating tile line/subsurface drainage, preventing discharges of liquid manure or organic by-products from tile lines and emergency response actions in Technical Note WI-1.
13. When grouping fields for nutrient application purposes, N, P, and K application rates shall match individual field recommendations as closely as possible to make implementation feasible.

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

The plan shall:

1. Reflect a minimum of 14 days of manure and/or organic by-products generated by the farm or all manure and/or organic by-products anticipated to be spread during frozen or snow-covered soil, whichever is greater;
2. Document the storage capacity for each manure type generated;
3. Document the capacity for stacking manure that is = 16% dry matter without permanent storage. Refer to NRCS 313 Standard, Waste Storage Facility, to locate potential stacking sites;
4. Provide Winter Manure Spreading Plan Implementation Maps (as per Part II of Technical Note WI-1) that identify areas of fields that meet the restrictions for applications on frozen or snow-covered soil;
5. Document that fields with slopes less than 6% are not accessible for winter spreading, if winter spreading on fields with slopes greater than 6%.
6. Identify necessary runoff mitigation practices in IV.A.2.d.(3) and (4);

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, municipal sludge and some organic by-products 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 IV.A.1.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. 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.

VII. 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. Minimize operator exposure to potentially toxic gases associated with manure, organic by-products, and chemical fertilizers, particularly in enclosed areas. Wear personal protective equipment appropriate to the material being handled.

C. 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.

D. 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.

E. 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.

F. Document the methodology used to determine the nutrient application rate of equipment.

G. Concentrated flow channels where gully erosion has/will occur shall be maintained in permanent vegetation. This does not include low velocity surface drains where channel erosion does not occur.

VIII. FEDERAL, STATE, AND LOCAL LAWS

Users of this standard are responsible for compliance with applicable federal, state, tribal, 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.

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X. DEFINITIONS

Adaptive Nutrient Management (IV.A.1.a.) - A process that utilizes on-farm research data to refine nutrient management strategies based on site specific crop production conditions. Implementation of Adaptive Nutrient Management shall use multiple years of field data collected and evaluated utilizing methods recognized by the University of Wisconsin as outlined in Technical Note WI-1, Appendix 3 "Guidelines for Adaptive Nutrient Management".

Adequate Acreage (IV.A.1.d.) – There is enough land described in the plan to use all the manure generated by the farm annually while maintaining compliance with this standard.

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

Areas Contributing Runoff (IV.A.2.b.) – 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 (IV.A.2.c.(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 (IV.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. Refer to NRCS FOTG Standard 412, Grassed Waterway, for more information on construction. This definition may include non-vegetated channels caused by ephemeral erosion. These channels include intermittent streams, drainage ditches, and drainage ends identified on the NRCS soil survey. Concentrated flow channels are often identifiable as contiguous up-gradient deflections of contour lines on the USGS 1:24,000 scale topographic map.

Conservation Plan (IV.A.2.b.) - 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 the NRCS TechReg Certified Conservation Planner Option 1, 2, 3.
3. For non-NRCS funded plans meet the training and performance criteria established by the county Land Conservation Committee.

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

Crop N Deficiency (IV.A.1.i.) - The condition where plant tissue concentrations of N are low enough to limit crop growth and development. Nitrogen deficiency in corn exhibits as yellowing at the tips of the oldest leaves. As deficiency progresses yellowing moves along the midrib towards the stalk and yellowing moves from the bottom leaves towards the top. In general N deficiency produces a paler green or yellow color in the oldest leaves. For more detail see: *https://www.ipni.net/ppiweb/bcrops.nsf/$webindex/8A1BFC4E9E01AEB0852568F1005777BC/$file/97-3p08.pdf*. Crop N deficiency is often caused by low availability of soil inorganic N which may be a product of nitrate leaching, denitrification, or slow mineralization of N from soil organic matter, manure, crop residues.

Direct Conduits to Groundwater (IV.A.1.n.) – Wells, excluding irrigation 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 (IV.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.

Double Crop (IV.B.1.a.(3)) – Two crops grown and harvested in the same harvest season. A second crop is typically planted early enough to allow for at least one month's growth.

Effective Incorporation (IV.A.2.d.) - Mixing with topsoil or residue, or subsurface placement of nutrients 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 (IV.2.a.(7)) – Erosion which forms by the convergence of overland sheet flow and rill erosion to form shallow channels which reoccur in the same locations even after these channels are filled by tillage. The location of ephemeral erosion channels are typically determined by the macro topography of the field. Ephemeral erosion channels are characterized by a dendritic (branch shaped) pattern vs. the small parallel channel pattern formed by rill erosion (Page 10 Technical Note WI-1).

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 (IV.A.1.k.) - 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 (IV.A.3.a.(5)) – No tillage has occurred for a minimum of three consecutive previous years.

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

Nitrification Inhibitor (IV.B.1.) - 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. Follow product label.

Nitrogen Leaching Index (V.S.) - A tool written in the programming language Java and developed by the USDA—Agricultural Research Service and designed for use in Wisconsin to calculate nitrogen uptake and leaching for different farming and management operations.

Non-community Potable Water Well (IV.A.2.c.(2)) – 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.

N Restricted Soils (IV.B.1.) Are defined below and also 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 Technical Note WI-1).

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 (IV.A.1.l.) - 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 By-Products (II.) – Organic materials that are produced as a byproduct of an industrial or agricultural process which can be land applied as a source of nutrients. Examples include paunch, manure solids, food production wastes, process wastewater, and waste water treatment plant bio-solids and waste water if land applied. This definition does not include hazardous and/or inorganic industrial waste or manufactured nutrient sources. Use of the term "organic" refers to carbon-based materials and is not intended as a reference to the certification criteria of the USDA National Organic Program.

Phosphorus Index (PI) (IV.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/*.

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 (IV.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 (IV.A.2.d.(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 (IV.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 (IV.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 (IV.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 (IV.A.2.b.) – 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 (IV.A.3.b.) – A conduit installed beneath the soil 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) (IV.A.2.d.(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 on-site 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.

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

Tolerable Soil Loss (T) (IV.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, FOTG, Soil Report.

Treated Manure (IV.A.2.c.) – Manure and/or manure constituents that HAVE been subjected to treatment or processing that has the documented effect of substantially eliminating pathogens. Treatment or processing examples include thermophyllic anaerobic digestion, high temperature composting of manure solids or manipulation of pH.

Urease Inhibitor (IV.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 (IV.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).

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Soil Map Units with Nitrogen Application Restrictions Due to Potential for Nitrate Leaching to Groundwater, July 2016

In the following table, soil map units identified as N restricted soils (V.B.1) are listed alphabetically by county. These soil map units have a high probability of having one or more characteristics that make the susceptible to leaching. These characteristics are identified by a code:

P = *High permeability soils.*
R = *Rock Soils.*
W = *Wet soils.*
+ = An on-site investigation is needed to identify which restriction(s) may be present because the characteristics of this map unit are not defined in the soil survey database.

Definitions for N Restricted Soils

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.

County	Map Unit Symbol	Map Unit Name	N Restriction Code
Clark	AgA	Almena silt loam, 0 to 3 percent slopes	W
Clark	AnA	Au Gres-Newson complex, 0 to 3 percent slopes	W
Clark	Au	Auburndale silt loam, 0 to 2 percent slopes	W
Clark	Ba	Barronett silt loam, 0 to 2 percent slopes	W
Clark	BoC	Boone sand, 6 to 15 percent slopes	P
Clark	BoF	Boone sand, 15 to 50 percent slopes	P
Clark	BpF	Boone-Elevasil complex, 15 to 50 percent slopes	P
Clark	Ca	Capitola-Marshfield-Veedum complex, 0 to 2 percent slopes	W
Clark	Cd	Citypoint mucky peat, 0 to 1 percent slopes	W
Clark	CmA	Comstock silt loam, 0 to 3 percent slopes	W
Clark	Da	Dawsil mucky peat, 0 to 1 percent slopes	W
Clark	EaB	Eauclaire loamy sand, 1 to 6 percent slopes	P
Clark	FeA	Fairchild-Elm Lake complex, 0 to 3 percent slopes	W
Clark	FfA	Fallcreek loam, 0 to 3 percent slopes	W
Clark	FgA	Fallcreek-Merrillan complex, 0 to 3 percent slopes	W
Clark	Fm	Fordum silt loam, 0 to 2 percent slopes	W
Clark	HxB	Humbird-Merrillan fine sandy loams, 0 to 6 percent slopes	W
Clark	IxA	Ironrun-Ponycreek complex, 0 to 3 percent slopes	W
Clark	IzB	Ironrun-Ponycreek-Arbutus complex, 0 to 6 percent slopes	WP
Clark	Lk	Loxley peat, 0 to 1 percent slopes	W
Clark	Lm	Loxley, Beseman, and Dawson peats 0 to 1 percent slopes	W
Clark	LuB	Ludington sand, 1 to 6 percent slopes	P
Clark	LuC	Ludington sand, 6 to 12 percent slopes	P
Clark	LxB	Ludington-Fairchild sands, 0 to 6 percent slopes	P
Clark	LyD	Ludington-Humbird complex, 12 to 20 percent slopes	P
Clark	MaB	Magnor, very stony and Magnor silt loams, 0 to 4 percent slopes	W
Clark	MbB	Mahtomedi loamy sand, 0 to 6 percent slopes	P
Clark	MbC	Mahtomedi loamy sand, 6 to 12 percent slopes	P
Clark	McA	Maplehurst silt loam, 0 to 3 percent slopes	W
Clark	Me	Markey-Newson mucks, 0 to 2 percent slopes	W
Clark	Mf	Marshfield silt loam, 0 to 2 percent slopes	W
Clark	MgB	Menahga loamy sand, 0 to 6 percent slopes	P
Clark	MpA	Merrillan fine sandy loam, 0 to 3 percent slopes	W
Clark	MrA	Merrillan-Veedum complex, 0 to 3 percent slopes	W
Clark	M-W	Miscellaneous water +	+
Clark	MxA	Moppet-Fordum complex, 0 to 3 percent slopes	W
Clark	NmC	Newood-Magnor-Cathro complex, 0 to 15 percent slopes, very stony	W
Clark	OeA	Oesterle loam, 0 to 3 percent slopes	W
Clark	PeA	Pelkie-Winterfield loamy fine sands, 0 to 3 percent slopes	W

+ These require an on-site visit to determine risks

County	Map Unit Symbol	Map Unit Name	N Restriction Code
Clark	Pg	Pits	P
Clark	PoA	Plover very fine sandy loam, 0 to 3 percent slopes	W
Clark	Pv	Ponycreek-Dawsil complex, 0 to 2 percent slopes	W
Clark	PxA	Poskin silt loam, 0 to 3 percent slopes	W
Clark	Py	Psammaquents, nearly level	W
Clark	Rb	Rib silt loam, 0 to 2 percent slopes	W
Clark	RkA	Rockdam sand, 0 to 3 percent slopes	P
Clark	RoA	Rosholt loamy sand, 0 to 2 percent slopes	P
Clark	RoB	Rosholt sandy loam, 2 to 6 percent slopes	P
Clark	RoC	Rosholt sandy loam, 6 to 12 percent slopes	P
Clark	ScA	Simescreek sand, 0 to 3 percent slopes	P
Clark	TrB	Tarr sand, 0 to 6 percent slopes	P
Clark	Ve	Veedum silt loam, 0 to 2 percent slopes	W
Clark	Vs	Veedum-Elm Lake mucks, 0 to 2 percent slopes	W
Clark	W	Water +	+
Clark	WeA	Withee silt loam, 0 to 3 percent slopes	W
Clark	WkA	Withee-Kert silt loams, 0 to 3 percent slopes	W

+ These require an on-site visit to determine risks

2015 updates: Wisconsin Nutrient Management 590 Standard

July 28, 2016

- This bullet highlights changes to the 2005 version of the NRCS 590 Nutrient Management Standard. ***Not all of the changes, additions, or deletions made to the 590 Standard are noted in this summary sheet.***
- This bullet notes items that have not changed.

REQUIREMENTS FOR SURFACE AND GROUNDWATER PROTECTION

Guidelines for all fields where manure, organic by-products, or fertilizer nutrients are applied:

- The source, rate, timing and method of application for all major nutrients — nitrogen (N), phosphorus (P_2O_5), and potassium (K_2O)— should be accounted for and should be consistent with UWEX A2809 recommendations. Applications must not run off the intended application site; erosion must not be greater than tolerable soil loss (T) over the crop rotation; use perennial vegetation to protect areas of concentrated flow resulting in recurring gullies.
  - Control ephemeral erosion using reduced tillage, adjust the crop rotation, or implement other practices such as contouring to control this erosion.
  - Show adequate acreage and a winter spreading plan for all farms with mechanically applied manure or organic by-products.
  - Where excessive rain has caused crop N deficiency, apply up 46 lb per acre **rescue N** and document the need for this additional N using one of the methods listed in Tech Note WI-1. Appendix 3. If more than 46 lb N per acre is applied, the documentation must include two of the listed methods.
  - Estimate available manure nutrients with **book values** or **manure samples.** If sampling, establish a baseline by averaging samples collected for at least 3 consecutive years. Later samples can be 1 every 4 years unless the farm's operation changes.
  - Account for N and P_2O_5 deposited by pastured or gleaning animals. Pasturing is allowed within 50 feet of a well or direct conduit to groundwater, in SWQMA in the winter, and on all slopes in the winter.
- If manure or organic by-products are applied during a crop rotation (8 years or less), use a P management strategy: **Phosphorus Index of 6 or less** or **Soil test P thresholds:**
  - **Greater than 50 ppm soil test P:** Balance the total P applications with P removed by crops.
    - **Greater than 100 ppm soil test P:** Total P applications from **all** sources shall not exceed guidelines from UWEX A2809. If manure P applications above these guidelines are necessary due to lack of suitable application sites, P applications shall be 25% less than the cumulative annual crop removal over a maximum rotation length of 8 years.

Applications are prohibited on:

- Concentrated flow channels; surface water; **saturated soils**; areas of active **snow melt** where water is flowing; land where vegetation is not removed — unless needed for establishment and maintenance of a **conservation practice.**
- Direct conduits to groundwater, a potable well, or within 8 feet of irrigation wells.
- Areas within 50 feet of direct conduits to groundwater, unless directly deposited by gleaning or pasturing animals or **as starter fertilizer to corn.**
- Areas near **public water supplies** within 1000 feet of a community potable water well; or areas within 100 feet of a non-community potable water well (church, school, and restaurant) unless **manure is treated** to substantially eliminate pathogens.
- Areas locally delineated by the Land Conservation Committee or in a conservation plan **as areas contributing runoff to direct conduits to groundwater** unless manure is substantially buried within 24 hours of application.

Nutrients applied within Surface Water Quality Management Area (SWQMA) 1,000 feet of lakes/ ponds or 300 feet of rivers use one or more of the following:

- 1. Install/maintain vegetative buffers or filter strips; 2. Maintain > 30% cover after nutrient application; 3. Incorporate within 72 hours of application; 4. Establish crops prior to, at, or promptly following application.
- 5. Have a minimum of 3 consecutive years no-till when making applications to fields with **< 30% residue**, such as silage fields, and apply nutrients within 7 days of planting.
- Mechanical applications of **unincorporated liquid manure 11% or less dry matter** within the SWQMA, or **where subsurface drainage is present** — limit applications to 12,000 gal/acre and visually monitor accessible tile outlets before, during, and after applications for discharge of liquid manure or organic by-product.
  - If a discharge is observed, stop applications. Sequential applications may be made to meet the nutrient need. Wait a minimum of 7 days between sequential applications.

A winter spreading plan is required for all farms mechanically applying manure or organic by-products:

- Identify quantities of **manure spread during winter**, or **generated in 14 days**, whichever is greater; **storage/ stacking capacity** for each manure type applied on the farm — manure that is ≥ 16% solids without permanent storage, complete an evaluation to determine if stacking sites consistent with NRCS 313 standard are available.

2015 updates: Wisconsin Nutrient Management 590 Standard

July 28, 2016

When frozen or snow-covered soils prevent effective incorporation:

- Do not apply nutrients within the SWQMA or apply N and P fertilizer, except on grass pastures and winter grains.
- Do not exceed the P removal of the following growing season's crop when applying manure. Liquid manure applications are limited to 7,000 gal/acre. All winter manure applications are not to exceed **60** lb of P_2O_5/acre.
- Do not surface apply **liquid manure during February and March** on areas depicted on the 590 spreading restriction maps where DNR Well Compensation funds provided replacement water supplies for wells contaminated with livestock manure or where Silurian dolomite is within **60 inches** of the soils surface.
- Do not apply manure within **300 feet** of direct conduits to groundwater. (in version 2005, 200 feet).
- Do not apply nutrients to fields with **slopes** greater than 6% (C,D,E,F) unless the plan documents that no other accessible fields are available for winter spreading and two of the following are implemented:
  - 1. Contour buffer strips or contour strip cropping.
  - 2. Leave all crop residue and no fall tillage.
  - 3. Apply manure in intermittent strips on no more than 50% of field.
  - 4. Apply manure on no more than 25% of the field during each application, waiting a minimum of 14 days between applications.
  - 5. Reduce manure application rate to 3,500 gal/acre or 30 lb P_2O_5/acre, whichever is less.
- Do not apply nutrients to fields where **concentrated flow channels** are present unless two of the following are implemented:
  - Options 1-5 above.
  - 6. No manure application within 200 feet of all concentrated flow channels.
  - 7. Fall tillage is on the contour and slopes are lower than 6%.

ADDITIONAL REQUIREMENTS FOR GROUNDWATER PROTECTION

On N restricted soils that 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):

- **In late summer or fall:** No commercial N applications should be applied 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 lb N** per acre, and all nutrients must be credited towards the crop requirement.
- **In spring or early summer:** When commercial N is applied on R, W, and combination soils, do not exceed the crop N A2809 rates from all sources. On P soils, for full season crops, do not exceed the crop N rate guidelines and apply one of the following management strategies:
  - A split or delay 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.
- **In late summer or fall:** When **manure and/or organic by-products** are applied, use rates of available N that do not smother the crop; do not exceed UWEX Pub. A2809; do not exceed Part III. B.4. Table 2 of the Technical Note WI-1; or do not exceed the rate listed below, whichever is less:

Use ≤ 120 lb available N/acre on:

P and R soils

- Applications > 4.0% dry matter (DM) on all crops, except single annual crops.
- Applications ≤ 4.0% DM on all crops, except single annual crops wait until after soil temp. < 50°F or Oct. 1, use either a nitrification inhibitor, or surface apply and do not incorporate for at least 3 days.

W soils or combination W soils

- Applications > 4.0% DM on all crops.
- Applications ≤ 4.0% DM on all crops use at least one of the following practices:
  - Use a nitrification inhibitor.
  - Apply on an established cover crop, an overwintering annual, or perennial crop.
  - Establish a cover crop within 14 days of application.
  - Surface apply & do not incorporate for at least 3 days.
  - Delay application until October 1 or soil temperatures are less than 50°F.

Use ≤ 90 lb available N/acre on:

P and R soils (wait until after soil temp. < 50°F or Oct. 1)

- Applications > 4.0% DM on single annual crops; or
- Applications ≤ 4.0% DM on all crops use either a nitrification inhibitor, or surface apply and do not incorporate for at least 3 days.

W soils or combination W soils

- Applications ≤ 4.0% DM on all crops.

Why have a **NMP?**

- To know what nutrients crops actually need, avoiding nutrient over-application
- To use on-farm nutrients first, such as legume nitrogen and manure, before purchasing commercial fertilizers
- To save money and increase farm profitability by not over-purchasing commercial fertilizer
- To improve soil stability, structure, and water holding capacity
- To improve surface and groundwater water quality
- To enable participation in the Farmland Preservation Program to receive annual income tax credit
- To meet regulations under a county ordinance for manure storage or livestock siting or if under a DNR WPDES permit

How do I develop a **NMP?**

- Work with a local certified crop advisor
  - Find a NM planner near you: datcp.wi.gov/Pages/Programs_Services/NMPlanning.aspx
- Learn to write your own nutrient management plan for your farm by completing a DATCP-approved training course, once every four years. Contact your local Land Conservation Department for more info.
  - Find training courses on the SnapPlus website: snapplus.wisc.edu

How often does a NMP need to be **updated?**

- Submit your NM Checklists annually to county/DATCP to help us show the conservation efforts of WI farmers
- Sample soils every four years, one sample for every five acres
- Review and update your plan annually

Crop **management strategies** to reduce erosion and nutrient losses

- Farm on the contour
- Use low-disturbance manure injection
- Try no-till or minimal tillage and reduce the number of passes across the field
- Install conservation buffers
- Install and maintain grassed waterways where needed
- Leave crop residues on fields after harvest, or plant cover crops with least tillage possible
- Plant grass or woody buffer areas to stop field runoff from entering streams, ditches, lakes, etc.
- Maintain pastures to limit erosion from livestock trails, feeding areas and watering areas
- Use SnapPlus to know your erosion rates and nutrient balances for the practices on your fields.

In the past ten years, NMPs have increased from 0.9M to 2.96M – **nearly a 70% increase in NMP acres** – covering **32%** of Wisconsin's 9 million cropland acres.

Wisconsin Department of Agriculture, Trade and Consumer Protection

2811 Agriculture Drive, P.O. Box 8911
Madison, Wisconsin 53708-8911

For more information:
https://datcp.wi.gov/Pages/Programs_Services/NutrientManagementPlan.aspx

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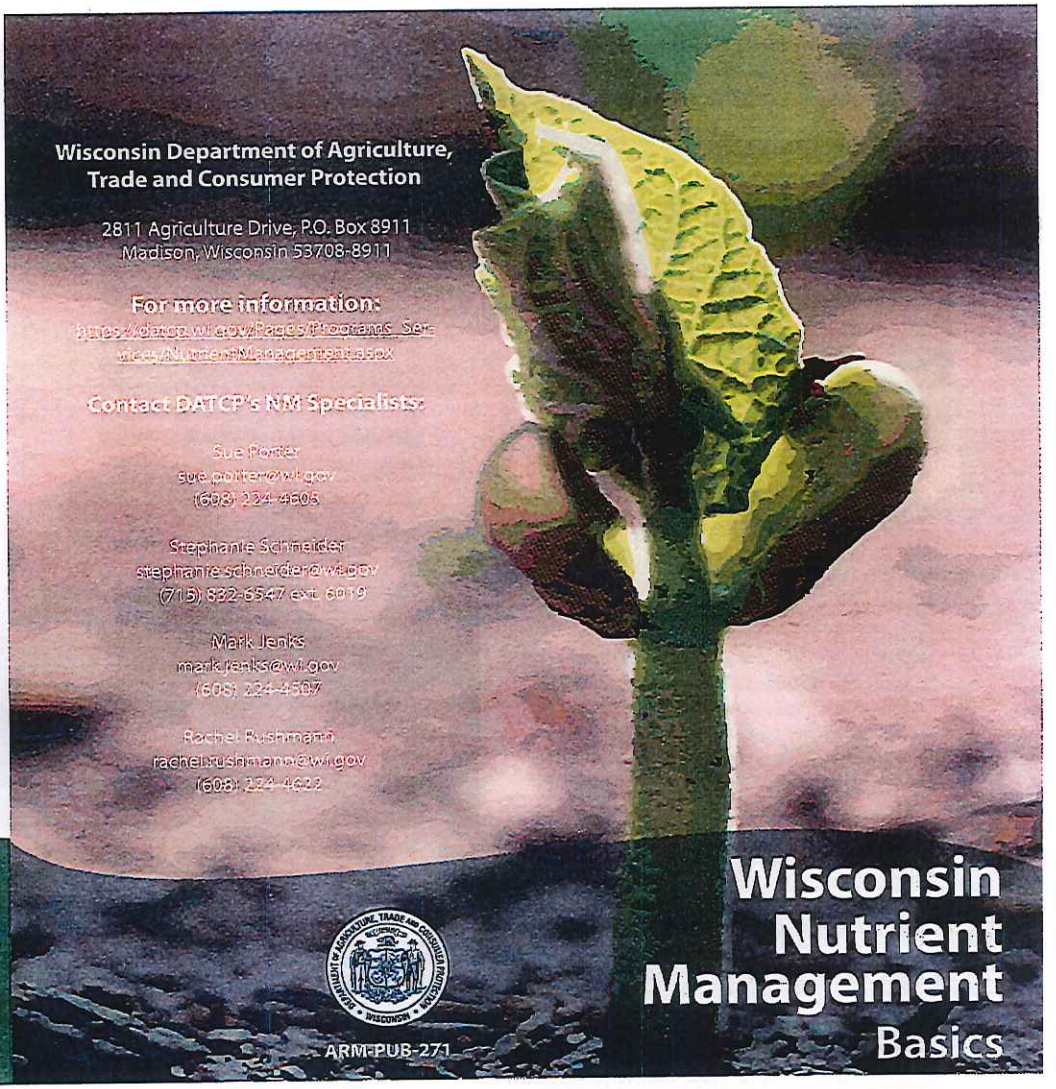


Wisconsin Nutrient Management Basics

ARM-PUB-271

Wisconsin Nutrient Management 101

Implementing a **nutrient management plan (NMP)** is one of the best practices farmers can use to protect their soil and water resources and farm profitability. NMPs account for all Nitrogen, Phosphorus and Potassium (N-P-K) nutrients that you apply, and plan to apply to fields over the entire crop rotation. This includes manure and fertilizer, so every type of operation should have a NMP regardless of whether or not they have animals on the farm. NMPs are unique to each farm. They include special considerations for when farmers may need to adjust nutrient application timing, rates, or application methods. For instance, field applications near conduits to groundwater such as wells or sinkholes, and near lakes and streams have winter restrictions to minimize the risk of losing nutrients to surface and groundwater.

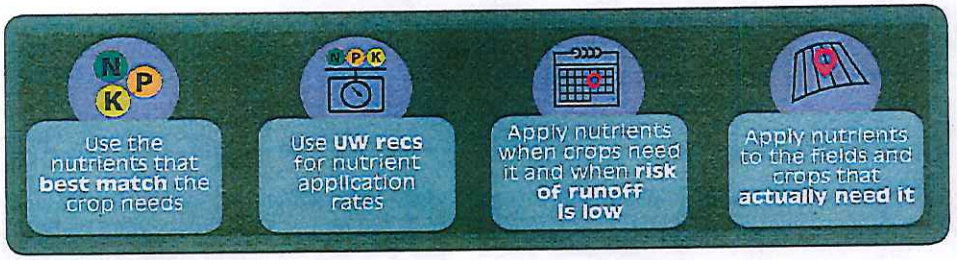
NMPs are also cropping practice records that are reviewed annually and updated when crop management deviates from the plan. NMPs help farmers get a handle on their farm's soil fertility so they know where they do and do not need to apply nutrients. This way, farmers apply nutrients economically, while also ensuring they are not over-applying nutrients, which could cause negative water quality impacts. A NMP is considered compliant with federal, state, and local programs when it follows the Natural Resources Conservation Service (NRCS) 590 Nutrient Management Standard and is prepared by a qualified planner, which may be a certified crop adviser or the farmers themselves, if they take a DATCP-certified training course.

Tolerable Soil Loss = "T"

Tolerable soil loss (T) is the amount of annual erosion that can occur on a field without losing crop productivity and profitability.

What's in a **NM Plan?**

A 590 NMP follows the requirements of the NRCS WI NM 590 Standard and UW fertilizer recommendations found in *UWEX Pub. A2809: Nutrient application guidelines for field, vegetable, and fruit crops in Wisconsin* to apply plant nutrients at economic optimum rates and reduce nutrient losses to the environment.



A 590 NMP:

- Protects farm profitability, water, and soil
- Describes ALL N-P-K nutrient applications for the crop rotation
  - Nutrients shall not run off the field during or immediately after application
  - Annually update NMP when crops, nutrients, and tillage methods change
- Requires soil testing; one sample for every 5 acres every 4 years, using a DATCP-certified laboratory
- Identifies setbacks and considerations for nutrient application rates, timing and methods near water bodies, conduits to groundwater and where sensitive landscape features exist
- Is often created using the free SnapPlus nutrient management planning software
  - SnapPlus helps farmers make the best use of their on-farm nutrients, as well as make informed and economical commercial fertilizer purchases.
  - Visit: snapplus.wisc.edu

Who **needs a NMP**?

- All farms! All landowners must have and follow a NMP when applying nutrients to any field, including pastures if:
  - Offered cost-share for developing a NMP, or
  - Accepting manure storage cost-share, or
  - Participating in the Farmland Preservation Program, or
  - Regulated under a local ordinance for manure storage or livestock siting, or
  - Regulated under a WI Pollutant Discharge Elimination System (WPDES) permit, or
  - Issued a Notice of Discharge (NOD) for causing a significant discharge.

Follow these conservation practices to implement **state water quality standards:**

- Meet tolerable soil loss (T) on fields and pastures – *Make sure your soils remain productive!*
- Follow 590 NMP over the entire crop rotation – *Ensure crop rotation is sustainable for the soil types and slopes of each field*
- Maintain a minimum 5 foot tillage setback from surface water – *Protect streambanks from eroding*
- Prevent direct runoff from feedlots, feed, waste water, or manure storage to surface and groundwater
- Limit livestock access along surface waters to maintain banks – *Prevent streambank erosion*
- Maintain manure storage structures to prevent leaking and overflow
- Follow NRCS technical standards for constructing and abandoning manure storage
- Near surface water or areas susceptible to groundwater contamination:
  - Do not stack manure in an unconfined pile
  - Divert clean water away from barnyards, feedlots, and manure storage facilities

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD
WASTE STORAGE FACILITY
CODE 313
(No.)

DEFINITION

An agricultural waste storage impoundment or containment made by constructing an embankment, excavating a pit or dugout, or by fabricating a structure.

PURPOSE

To store manure, agricultural by-products, wastewater, manure processing derivatives, leachate, and contaminated runoff to provide the agricultural operation management flexibility for waste utilization.

CONDITIONS WHERE PRACTICE APPLIES

Use where regular storage is needed for wastes generated by agricultural production or processing, where soils, geology, and topography are suitable for construction of the facility, and where the construction, operation, and maintenance will protect the soil and water resources.

For structures and conduits used to transfer waste and other byproducts, use the Wisconsin NRCS Conservation Practice Standard (WI NRCS CPS) Waste Transfer (Code 634).

For liquid waste storage facilities implemented with an embankment, this practice applies only to low hazard facilities as defined in the NRCS National Engineering Manual (NEM), Part 520 subpart C with a maximum effective height of 25 feet.

This standard applies to:

- Waste storage impoundments or structures up to 25 feet of impoundment depth; and
- Facilities that are part of a planned agriculture waste management system intended to meet the facility management goals, regulatory requirements, or nutrient management plans by providing storage of waste.

For the purposes of this standard, liquid waste is used to describe any waste that is too wet to stack. It includes both liquid and slurry waste.

This practice does not apply to the storage of human waste, routine animal mortality, the unstacked waste that accumulates in animal housing units (barns) or animal production areas not intended to store waste (animal confinement/feed areas).

CRITERIA

General Criteria Applicable to All Waste Storage Facilities.

The following criteria establish minimum allowable limits for design parameters, acceptable installation processes, or performance requirements for all waste storage facilities (impoundments and structures).

Laws and Regulations. Plan, design, and construct the waste storage facility to meet all Federal, Tribal, State, and local laws and regulations. This standard does not contain the text of the federal, tribal, state, or local laws governing waste storage facilities. Regulatory approval may be needed prior to accepting off-site material(s) or adding chemicals to the waste storage facility. The operator is responsible for securing required permits.

Location. Locate and design the waste storage facility such that it is outside the 100-year floodplain unless site restrictions require locating it within the floodplain. Where waste storage facilities are located in flood prone areas, protect these facilities from inundation, structural damage, and instability. Design these facilities to accommodate any additional loading resulting from static water levels or saturated soils. The lowest point at which floodwater could potentially enter the waste storage facility must be 2 feet above the maximum flood elevation resulting from a 100-year, 24-hour rainfall event. Additionally, follow the policy found in the NRCS General Manual (GM) 190, Part 410.25, Flood Plain Management.

Management Assessment

Conduct, document, and incorporate a management assessment into the design. Perform the assessment with the owner/operator to explore options and to determine the purpose of storage components, available resources, manure disposal schemes, sand and manure solids separation methods, and waste characteristics.

The management assessment shall address the following as appropriate to the system being designed:

- Waste Characterization
  - » Sources, volumes, and consistency of manure, contaminated runoff, manure processing derivatives, leachate, wastewater, and other inputs to the waste storage facility
  - » Animal type, size, number and weight
  - » Bedding types and quantity
  - » Chemical characteristics which may impact facility design
- Land base available for utilization of waste
- Method of distribution of manure onto the land base
- Planned storage period
- Waste handling and transfer methods from the waste source to the storage facility
- Facility waste removal methods
- Storage facility liner possibilities and preferences
- Access needs and limitations
- Safety needs, including those to address the hazards of manure gases
- Labor and equipment needs
- Potential odor concerns
- Provisions for facility expansion

When the intent of the owner/operator is to process and/or treat the various waste streams within the animal production area, provide a narrative describing the system. The description will include the intent and purpose of the processing or treatment strategies relative to land spreading or waste distribution strategies, stabilization of organic by-products, separation of sand bedding, reducing pollutant loads, nutrient concentration, waste consistencies, odor control, energy production, and volume reduction.

Site Assessment

Conduct, document, and incorporate a site assessment into the design. Perform the assessment to determine physical site characteristics that will influence the placement, construction, maintenance, and environmental integrity of a proposed waste storage facility, liner(s) and transfer components. Include input from the owner/operator in the site assessment. The site assessment shall include:

- Locations and elevations of buildings, roads, lanes, soil investigations, property lines, setbacks, easements, wells, springs, floodplains, surface waters, surface drains, subsurface drains, utilities, overhead lines, cultural resources, and wetlands.
- The location of sinkholes and other karst features and conduits to groundwater within 1,000 feet of the facility. Features within 1,000 feet of the facility must be further analyzed per WI NRCS Engineering Field Handbook Supplement Chapter 4, Exhibit A (Chapter 4, Exhibit A) to determine if they pose a hazard to the facility or environment.
- Log subsurface investigations for all waste storage facilities sufficient in detail and analysis to support the design in accordance with Chapter 4, Exhibit A. Describe the soil material encountered, location of any seeps, depth to subsurface saturation, and depth to bedrock (Note: Chapter 4, Exhibit A follows NRCS NEM Part 531, Geology, by utilizing ASTM D2488 procedures).
    - » Document the location of test pits or soil borings, soil test results, photos taken during the soils investigation, and a narrative describing the design parameters that have been derived from the soils data. Note the bedrock type, if encountered, such as sandstone, limestone, dolomite, or granite.
    - » Locate test pits and borings used to meet the criteria within the footprint or no more than 100 feet from the footprint. A minimum of one test pit or boring per 15,000 square feet of facility footprint, with a minimum of two per facility, is required. Extend these test pits/soil borings to bedrock, a free water surface, or to a minimum depth to ensure subsurface saturation and bedrock separation distances required in this standard or associated Pond Sealing or Lining standards are achieved.
    - » Complete soil tests for soils (in-place), sub-soil or sub-liner soils in a laboratory on representative samples of soil beneath the proposed grade at a rate of 1 test per 30,000 square feet of facility footprint, with a minimum of two tests. The Plasticity Index (PI) shall be determined in accordance with ASTM D4318 and the percent fines (% fines) in accordance with ASTM D1140.
    - » Increase the number and distribution of test pits and soil borings needed to characterize the subsurface (soils, saturation, and bedrock) if there is inconsistency within or between test pits or borings.

» Characterize soil for liners and sub-liners according to Chapter 4, Exhibit A. Soils for liners and sub-liners may be located within the footprint of the storage, on site, or off site and transported to the site for construction. Include locations, dimensions and elevations, soil volumes, soil samples, testing results, and reclamation plans of any borrow areas. Complete soil characterization at a rate of one test per 30,000 square feet of borrow source, with a minimum of two tests per area. Distribute the test pit or borings evenly across the borrow source. Additional soils testing may be needed to meet the requirements of the selected liner type. See the appropriate Pond Sealing or Lining standards and Wisconsin construction specifications for additional criteria.

Separation from Subsurface Saturation or Bedrock. The separation is determined to be the closest distance from any point on the inside surface (bottom and sides) of the storage facility to the feature from which separation is required.

For the purposes of this standard, factors used to identify subsurface saturation shall include observed saturation, gleyed soil, gray redoximorphic features, and soil color in conjunction with nearby surface water features. The highest subsurface saturation elevation in a test pit/soil boring will be identified by any of the following soil properties:

- Free water or wet soil identified by glistening, due to the slow release of water
- Gleyed soil, that may extend uninterrupted from an observed free water surface.
- The presence of distinct gray redoximorphic features with a chroma of 2 or less based on Munsell color charts.
- Depleted matrices having a value of 4 or more and chroma of 2 or less based on Munsell color charts. In some cases soil parent materials have a natural color with a chroma of 2 or less or gleyed color that is not due to saturation. In these cases other indicators may be used such as landscape position, relative elevation or soils in relation to nearby water features.

In soils not conducive to mottling, such as sand, establish the subsurface saturation elevation by evaluating the soil morphology of the soil profile. Other indicators that may be considered in making the determination are the position of the soil in the landscape, topography, nearby wetlands and well construction logs. In sites susceptible to groundwater contamination or complex hydrogeological sites, additional saturation verification methods may be required. Verification methods could include but are not limited to groundwater monitoring wells, piezometers, and soil test pits conducted during the wet season. Other information to consider includes historic precipitation and groundwater elevation records from nearby locations, which can indicate whether or not the area is experiencing a local high or low trend in groundwater elevation.

If the site assessment indicates artesian features, complete a hydrogeologic and geotechnical evaluation of the site to determine the site suitability for an in-ground waste storage facility. Include a groundwater monitoring well or piezometer below the apparent confining layer and a water table observation monitoring well in the evaluation. Monitor the site through the wettest portion of the annual groundwater recharge cycle.

Construct and develop groundwater monitoring wells and piezometers according to WI NRCS CPS Monitoring Well (Code 353) or appropriate state monitoring well construction requirements.

Subsurface saturation, pockets of sand and gravel, or water-bearing materials, if encountered, shall not be removed or drained except for perched conditions. Include documentation to demonstrate that subsurface saturation is perched and its effects can be eliminated.

Excavation of bedrock is permitted to achieve the required separation distance as specified in Table 5 of this standard and tables in associated Pond Sealing or Lining standards. Do not remove bedrock by blasting. Evaluate the exposed bedrock surface to ensure a structurally sound base for a liner or other soil material. Treat fractures or voids to prevent migration of soil material. The entire surface of the excavated bedrock shall have a positive grade, minimum of 1 percent, under and away from the storage facility, as to prevent any significant ponding on the rock surface. If bedrock is excavated, the material placed between the liner and the bedrock shall meet the requirements of sub-liner soil in the appropriate Pond Sealing or Lining standards.

Perched Conditions. Pockets of sand and gravel, or other water-bearing materials may be removed or drained to achieve separation distances in Tables 1 and 5 within this standard, or tables in associated Pond Sealing or Lining standards, and to relieve hydrostatic loads on the facility and its liner(s). All drainage systems shall drain to the ground surface or surface water by gravity. Evaluate the effect of temporary tailwater on the structure or liner and the effects of out-letting to perennial and intermittent waterways. Locate a drainage system around the outside perimeter of the facility footprint and drain to a surface outlet. Protect outlets against erosion and undermining of the conduit, entry of vegetation, damaging periods of submergences, and entry of rodents or other animals into the subsurface drain. A drainage system may also be located around the outside perimeter of an impoundment floor within the facility footprint if the drainage system enters an observation and pumping port and then continues by gravity to a surface outlet. Design the port such that the outlet can be blocked and a pump can be utilized to remove the polluted liquids until the source is identified and repairs can be completed.

Sensitive Environmental Settings. Wisconsin Sensitive Environmental Settings are sites where one or more of the following conditions are met:

- Bedrock or subsurface saturation separation distances are less than those listed in Tables 1 of this standard, Table 1 of WI NRCS CPS Pond Sealing or Lining – Compacted Soil Treatment (Code 520), Tables 5 and 6 of WI NRCS CPS Pond Sealing or Lining – Geomembrane or Geosynthetic Clay Liner (Code 521), or Table 2 of WI NRCS CPS Pond Sealing or Lining – Concrete (Code 522);
- Sub-liner soils do not meet both the required thickness and percent fines listed in Table 1 of WI NRCS CPS 520, Tables 5 and 6 of WI NRCS CPS 521, or Table 2 of WI NRCS CPS 522;
- For facilities with one or more sloped sides or structures with vertical sides with any part of the storage floor below existing ground surface, a sinkhole or other karst feature is present within 400 feet horizontally from the footprint of the proposed storage facility; or
- For above ground structures where the storage floor is entirely above existing ground surface, a sinkhole or other karst feature is present within 200 feet horizontally from the footprint of the proposed storage facility.

In-situ soils that do not meet both the sub-liner required thickness and percent fines listed in the applicable liner standard can be removed and replaced with compliant materials. When designed and constructed in this manner, the site is no longer classified as Wisconsin Sensitive Environmental Settings.

Where liquid-storage is to be provided in sensitive environmental settings, design according to WI NRCS CPS Pond Sealing or Lining – Concrete (Code 522), Sensitive Environmental Settings.

Storage Period. The storage period is the maximum length of time anticipated between emptying events. Base the minimum storage period on the timing required for environmentally safe waste utilization considering the climate, crops, soils, equipment, in accordance with the operations and maintenance plan, nutrient management plan and Federal, State, and local regulations.

Design Storage Volume. Calculate design storage volumes with the procedures and default values found in the Wisconsin supplement to Chapter 10 of the NRCS Agricultural Waste Management Field Handbook (AWMFH) or site-specific estimates and measurements documented in the design. Include the sum of the following during the storage period in the design volume:

The maximum operating level (MOL) for liquid storage facilities is the level that provides the operational volume (Figure 1 contains a diagram of this information). This includes the following:

- Manure, wastewater, bedding, and all other wastes accumulated during the storage period.
- For liquid storage facilities, include normal precipitation (omit diverted roof runoff) less evaporation during the storage period.
- Normal runoff from the facility's drainage area during the storage period. Exclude clean water from the facility to the fullest extent practical except where including the runoff is advantageous to the operation of the agricultural waste management system.
- Additional storage when required to meet management goals or regulatory requirements.

Emergency Volume (liquid storages only) includes the following:

- 25-year, 24-hour precipitation on the surface of the liquid storage facility at the maximum level of the required design storage.
- 25-year, 24-hour runoff from the facility's drainage area.

Remaining Waste. Add a minimum of two feet to storage depth for facilities with side slopes and one foot for vertical walled facilities for planned maximum remaining waste. The additional storage depth can be reduced if a sump is installed or other provisions to empty the facility have been made. The anticipated method for solids removal must be accommodated in design, particularly in determining the configuration of impoundments and the type of liner to be used and maintained.

Freeboard Volume. This volume applies to liquid waste storage exposed to precipitation. Add a minimum of one foot of depth to the design storage volume to reduce the risk of over-topping. This depth is not intended to add storage capacity.

Inlet. Design inlets to resist corrosion, plugging, freeze damage, and ultraviolet deterioration. Incorporate erosion protection for in-place earth (Table 1 of this standard), soil liner (WI NRCS CPS 520, Table 1), and geosynthetic clay liners (WI NRCS CPS 521, Table 6).

Waste Removal. Provide components for removing waste such as gates, pipes, docks, wet wells, pumping platforms, retaining walls, or ramps. Incorporate features to protect against erosion, tampering, and accidental release of stored waste as necessary. Design ramp slopes to accommodate anticipated equipment and traction available. Use WI NRCS CPS Nutrient Management (Code 590) for land application of stored material or follow other disposal options outlined in a Comprehensive Nutrient Management Plan (CNMP).

Outlet. An outlet that can automatically release stored material is not permitted except for outlets leading to another storage facility with adequate capacity for releases due to accident or system component failure. Design a permanent outlet that will resist corrosion and plugging. Provide a backflow prevention measure for an outlet that pumps wastewater to secondary storage located at a higher elevations.

Staff Gauge. Place a staff gauge or other permanent marker that does not compromise the integrity of the liner in the liquid storage facility to clearly indicate the following elevations:

- Maximum operating level (top of the operational volume)
- Emergency level (top of the design storage volume)
- State or local codes may require additional markers

For storages where the contents or staff gage are not visible, such as below a slatted floor, identify the method for the operator to measure the depth of stored waste.

Safety. Identify and minimize the hazards to animals and people in the safety design. In particular, waste storage facility designs may create confined spaces, which may pose significant hazards in terms of the inhalation of poisonous gases, asphyxiation, or explosion. At a minimum, the safety design shall include the following:

- Include appropriate safety features to minimize the hazards of the facility (refer to American Society of Agricultural and Biological Engineers (ASABE) Standard EP470, Manure Storage Safety for guidance, as needed). Design and operate confined spaces where human entry might occur in compliance with the provisions contained in ASABE EP470, Manure Storage Safety.
- Characterize and identify any combination of effluent and amendments currently in use that may have the potential to create hazardous conditions.
- Provide warning signs, fences, ladders, ropes, bars, rails, and other devices as appropriate, to ensure the safety of humans and livestock. Provide ventilation and warning signs for covered waste holding facilities, as necessary, to prevent explosion, poisoning, or asphyxiation.
- Install safety stops, gates, or both at push-off ramps and load-out areas of impoundments and structures to reduce the potential for accidental entry of machinery.
- Ensure equipment access ramps and embankment slopes are compatible with the equipment intended to be used.
- Design covers and grating over openings such that livestock or humans cannot accidentally displace them and fall into the facility.
- Design pipelines with a water-sealed trap and vent, or similar device, if there is a potential for gases from the pipe to accumulate in confined spaces.
- Place a fence around impoundments and uncovered tanks which have exposed walls less than 5 feet above ground surface. Use the WI NRCS CPS Fence (Code 382) for design of a fence that will restrict access to safety hazards by people and animals likely to be on-site.
- Post universal warning signs to warn children and others from entering liquid waste storage facilities.
- Safety features should be added to the Operation and Maintenance Plan.

Roofs and Covers. Use WI NRCS CPS Roofs and Covers (Code 367) for design of waste storage facility covers or roofs, as needed.

Failure Analysis. Evaluate the overall functionality of the waste storage facility for possible malfunctions which could lead to sudden breach of embankment or accidental release of waste from the storage facility under normal operational conditions. Identified failure modes should be addressed in the design phase, the operation and maintenance plan, and the emergency action plan.

The Failure Analysis should include features, safeguards, and/or management measures to minimize the risk of failure or accidental release, or to mitigate impact of this type of failure when any of the features listed below might be significantly affected:

- Human safety
- Surface water bodies – perennial and intermittent streams, lakes, wetlands and estuaries
- Conduits to groundwater
- Artesian well features
- Critical habitat for threatened and endangered species
- Riparian areas
- Farmstead, or other areas of habitation
- Off-farm property
- Historical and archaeological sites or structures

Seeding and Mulching. Seed and mulch disturbed areas and embankments in accordance with WI NRCS CPS Critical Area Planting (Code 342).

Additional Criteria for Liquid Waste Storage Impoundments

The following criteria establish additional design parameters, acceptable installation processes, or performance requirements for liquid waste storage impoundments.

Foundation. Locate the impoundment in soils with a permeability that meets all applicable regulations (Table 1 meets the specific discharge requirements specified in the National Engineering Handbook (NEH), Part 651, Agricultural Waste Management Field Handbook (AWMFH), Chapter 10, Appendix 10D). Alternately, line the impoundment with suitable material. If a liner is needed, use liners which meet or exceed WI NRCS CPS 520, 521, or 522. Construction shall not occur on or with organic soils.

A combination of liners is acceptable. Join the liners so as to preserve the performance and integrity of all liner types. Concrete walls used within impoundments shall maintain the integrity of any liner. Construct and maintain any penetration and overfall/outfalls of the liner to maintain the performance and integrity of the liner used.

Waste storage impoundments that store milkhouse waste or feed storage runoff may be subject to the requirements of Wisconsin Administrative Code, Chapter NR 213 (NR 213) if the operation is considered a concentrated animal feeding operation or if compliance with NR 213 is required by other NRCS standards. NR 213 contains requirements not contained within this standard. If the waste storage impoundment is regulated under NR 213, the design must meet the requirements of both NR 213 and this standard.

Embankments. Non liner components of an impoundment embankment shall be constructed with mineral soil material compacted to WCS-204 requirements. The impoundment embankment shall be lined with (CPS 313) Table 1 Soils (In Place) material, a soil liner (CPS 520), or the selected liner component and soil component (WI NRCS CPS 521 or 522). The soil component shall be compacted following the Wisconsin Construction Specification listed in the applicable standard. The bottom of the liner shall be extended until it daylights the embankment. Minimum embankment top widths are shown in Table 2. Design the combined side slopes of the settled embankment to be equal to or flatter than 5 horizontal to 1 vertical. Interior side slopes must meet the design requirements listed in either Table 1 or the selected liner requirements, found in the pond liner standards (WI NRCS CPS 520, 521, and 522). Exterior side slopes may be no steeper than 2 horizontal to 1 vertical.

The top of the embankment may be constructed to drain, either toward or away from the stored waste, as desired by the designer. Add additional material above the required top width to accommodate desired drainage.

Increase the constructed embankment height by at least 5 percent to allow for settlement. After settlement, the top of the embankment shall be greater than or equal to 1 foot above the surrounding grade. Stabilize all embankments to prevent erosion or deterioration. Compact according to WI FOTG Construction Specification 204, Earthfill for Waste Storage Facilities or Construction Specification 300, Clay Liner, as applicable. For an impoundment with greater than one acre of surface area and where wave action is a concern, increase the embankment height to account for calculated wave height.

Any diversion or waterway along the embankment shall have a capacity for 25-year, 24-hour storm plus 0.5 feet of freeboard, with a minimum depth of 1 foot.

Construct a core trench whenever the settled embankment fill height at the centerline is greater than or equal to 10 feet. Minimum dimensions of the core trench shall be 8-foot bottom width, 2-foot depth, and 1 horizontal to 1 vertical or flatter side slopes.

Spillway or Equivalent Protection. For a facility having an effective height greater than 20 feet, construct an auxiliary (emergency) spillway designed to handle the peak flow or routed peak flow from the 25-year, 24 hour precipitation event, as defined in the Design Storage Volume section of this standard. The crest of the spillway shall be sited above the design storage volume elevation.

Excavations. Design embankments and excavated side slopes to meet the requirements of WI NRCS CPS 313, 520, 521 and 522, as applicable.

Table 1. In-Place Earth Criteria for Waste Storage Facility Impoundments 20 Feet Deep or Less [Note 1, 2]

Size		
Design Storage Volume	≤ 300,000 cu. feet	> 300,000 cu. feet
Manure Produced at Farm per Year	≤ 600,000 cu. feet	> 600,000 cu. feet
Waste Characteristics	≥ 4% manure solids in stored waste, ruminant animals only	All
Soils (In Place)		
% Fines	≥ 40%	≥ 40%
Plasticity Index (PI)	≥ 7	≥ 12
Total Thickness (measured perpendicular to storage surface, includes thickness of recompacted layer)	≥ 5 feet [Note 3]	≥ 5 feet [Note 3]
Thickness of Recompacted Surface Layer	≥ 1 foot	≥ 1 foot
WI FOTG Construction Specification for Recompacted Layer	204, Earthfill for Waste Storage Facilities	300, Clay Liner
Sub-Soil [Note 4]		
% Fines	≥ 20%	≥ 20%
Plasticity Index (PI)	—	—
Thickness (bottom and sides)	≥ 3 feet	≥ 3 feet
Separation Distances		
Well Distance [Note 5]	≥ 250 feet	≥ 250 feet
Sinkholes or Other Karst Features	≥ 800 feet	≥ 400 feet
Subsurface Saturation	≥ 8 feet	≥ 8 feet
Bedrock	≥ 8 feet	≥ 8 feet
Impoundment		
Inside Slope	2.5:1 or flatter	
Other		
Scour Protection	Agitation and Pumping Locations	Minimum 20 feet wide x 30 feet long x 4 inches thick concrete pad or sump in bottom and 20 feet wide ramp or a 16-foot wide ramp with 12-inch high curbs to the top of the facility.
	Scraping and Other Mechanical Means of Removing Solids and Sand	Protect with hard surfacing designed for the expected conditions and loads, a minimum of 4 inches thick.
Existing Field Drain Tile	Additional site investigation shall be completed to determine the presence of existing subsurface drain or underground outlet within 100 feet of the footprint of the facility. Any tile found must be abandoned or removed.	

[Note 1] The depth is measured from the bottom of the impoundment to the maximum operating level.
[Note 2] Facilities in this table do not meet the requirements of NR 213.
[Note 3] Thickness is calculated based on a maximum permeability of 1x10 cm/sec
[Note 4] Sub-soils are located beneath the required in place soils and above subsurface saturation or bedrock. Sub-soils must be in situ materials.
[Note 5] Community water system wells may require larger separation distances (see Wisconsin Administrative Code, Chapter NR 811 (NR 811)).

Table 2. Minimum Embankment Top Widths

Effective Height (feet)	Top width (feet)
< 15	8
15–19.9	10
20–25	12

Additional Criteria for Fabricated Structures

The following criteria establish additional design parameters, acceptable installation processes, or performance requirements for waste storage structures.

Foundation. Based on subsurface investigation, provide a foundation for fabricated waste storage structures to safely support all superimposed loads without excessive movement or settlement.

Total and Differential Settlement. Where a non-uniform foundation cannot be avoided or where applied loads may create highly variable foundation loads, calculate both total and differential settlement based upon site-specific soil test data. Index tests (such as Atterberg limits, moisture content, etc.) of site soils may allow correlation with similar soils for which test data is available.

Bearing Capacity. If no site specific test data are available, presumptive bearing strength values for assessing actual bearing pressures obtained from Table 3 or another nationally recognized building code may be used. In using presumptive bearing values, provide adequate detailing and articulation to avoid distressing movements in the structure (i.e., settlement).

Structural Loadings. Design the waste storage structure to withstand all anticipated loads in accordance with the requirements in NRCS NEM, Part 536, Structural Design. Such loads should include internal and external loads, hydrostatic uplift pressure, concentrated surface and impact loads, and water pressure due to subsurface saturation, frost or ice. If a dense ice cover can be expected, account for the additional point load associated with an ice sheet against a vertical wall.

Calculate loading from lateral earth pressures using soil strength values determined from the results of appropriate soil tests and procedures described in NRCS Technical Release 210-74, Lateral Earth Pressures. Table 4 provides minimum lateral earth pressure values when soil strength tests are not available. If heavy equipment will operate near the wall, use an additional soil surcharge as indicated in footnote 4 in Table 4 in the wall analysis.

For the lateral load from stored waste not protected from precipitation, use a minimum 65 pounds/square foot/foot of depth as the design internal lateral pressure. Use a minimum value of 60 pounds/square foot/foot of depth for the lateral load from stored waste protected from precipitation and not likely to become saturated. Use a minimum internal lateral pressure of 72 pounds/square foot/foot of depth for sand-laden manure storage if the percentage of sand exceeds 20 percent. Designers may use lesser values if supported by measurement of actual pressures of the waste to be stored.

Design structure covers to withstand both dead and live loads. Use the minimum live load values for covers contained in ASABE EP378, Floor and Suspended Loads on Agricultural Structure Due to Use, and in ASABE EP393, Manure Storages. Use the actual axle load for tank wagons having more than a 2,000 gallon capacity.

If the structure is to have a roof, use WI NRCS CPS Roofs and Covers (Code 367) for design of waste storage facility covers or roofs, as needed. Use snow and wind loads specified in American Society of Civil Engineers (ASCE) SEI/ASCE 7-10 or newer version, Minimum Design Loads for Buildings and Other Structures. If the facility is to serve as part of a foundation or support for a building, consider the total load in the structural design.

Concrete Joints. Wall control joints with embedded waterstop – Cast-in-place cantilevered vertical walls shall have a control joint spacing less than or equal to 100 feet of running wall length, including around corners and bends. This criterion does not apply to hoop strength design or tanks with pin connections at both the top and bottom of the wall or to liquid-tight concrete walls designed in compliance with ACI-350.

Table 3. Presumptive Allowable Foundation and Lateral Pressure [Note 1]

Class of materials	Allowable foundation pressure (pounds per square foot)	Lateral bearing	Coefficient of friction	Cohesion (pounds per square foot)
Crystalline bedrock	12,000	1,200	0.70	-
Sedimentary and foliated rock	4,000	400	0.35	-
Sandy gravel or gravel (GW and GP)	3,000	200	0.35	-
Sand, silty sand, clayey sand, silty gravel, clayey gravel (SW, SP, SM, SC, GM and GC)	2,000	150	0.25	-
Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH and CH)	1,500	100	-	130

[Note 1] International Building Code (IBC), 2015, International Code Council (ICC)

Waterstop. Use embedded or expansive waterstop in accordance with WI Construction Specification 004-WS Embedded or Expansive Waterstop. The type of waterstop is based on the joint movement criterion indicated below.

Install an embedded waterstop at the wall to footing intersection if the joint is designed for movement. Install either an expansive or embedded waterstop at this joint if it is not designed for movement (fixed).

If there is no embedded waterstop at the wall base, cast the wall joint waterstop a minimum of 4 inches into the footing. If there is an embedded waterstop between the footing and the bottom of the wall, weld the wall joint waterstop to a factory fabricated intersection at the base of the wall.

Floor joints in vertical walled structures, if used, should be extended through the footing and continue to the top of the vertical wall. Joints and liner shall meet the criteria listed in WI NRCS CPS Pond Sealing or Lining – Concrete (Code 522).

Joints for pre-cast walls shall demonstrate evidence of equivalent performance to waterstop joints as determined by the NRCS State Conservation Engineer.

Make transitions from concrete wall footings to concrete slabs at a ratio of one inch of thickness change to one inch of run (1:1) or flatter.

Table 4. Lateral Earth Pressure Values [Note 1]

Description of Backfill Material [Note 2]	Unified Soil Classification [Note 3]	Design lateral soil load (pounds/square foot/foot of depth) [Note 4]
Well-graded, clean gravels; gravel-sand mixes [Note 5]	GW	60
Poorly graded clean gravels; gravel-sand mixes	GP	60
Silty gravels, poorly graded gravel-sand mixes	GM	60
Clayey gravels, poorly graded gravel-sand mixes	GC	60
Well-graded, clean sands; gravely sand mixes	SW	60
Poorly graded, clean sands; gravely sand mixes	SP	60
Silty sands, poorly graded sand-silt mixes	SM	60
Sand-silt clay mix with plastic fines	SM-SC	100
Clayey sands, poorly graded sand-clay mixes	SC	100
Inorganic silts and clayey silts	ML	100
Mixture of inorganic silt and clay	CL-ML	100
Inorganic clays of low to medium plasticity	CL	100
Inorganic clayey silts, elastic silts	MH	Note 6
Inorganic clays of high plasticity	CH	Note 6

Note 1 Table 1610.1, Lateral Soil Load, International Building Code (IBC), 2015, International Code Council (ICC). For lightly compacted soils (85% to 95% maximum standard density). Includes compaction by use of typical farm equipment.

Note 2 Base the definition and classification of soil in accordance with ASTM D2487 and D2488.

Note 3 All definitions and procedures in accordance with ASTM D2488 and D653.

Note 4 Design loads based on moist conditions for the specified soils at optimum density. Include the weight of the buoyant soil plus hydrostatic pressure for submerged or saturated soil. Pressures are calculated for level backfill for a distance equal to the wall height. If backfill exceeds wall height at a distance equal to or less than the wall height, increase pressures accordingly. If equipment loads are expected or are possible to operate within a distance equal to the wall height behind the wall, use an additional live load soil surcharge equal to 2 feet of backfill for 5,000 pound wheel loads and more or less for other wheel loads, as appropriate.

Note 5 Generally, only washed materials are in this category.

Note 6 Not recommended. Requires special design if used.

Structural Design. Design structures with reinforced concrete, steel, wood, or masonry materials in accordance with NRCS-NEM, Part 536, Structural Engineering. Account for all items that will influence the performance of the structure, including loading assumptions, durability, serviceability, material properties, construction quality, waterstops, pipe penetration, channel penetrations, anchor plates, or other attachments to walls such as fence posts. Ensure that the material used for a fabricated structure is compatible with the waste product to be stored.

Indicate design assumptions and construction requirements on the construction plans. Construct any penetration of the structure to maintain the performance and integrity of the structure.

Tanks may be designed with or without a cover. Design covers, beams, or braces that are integral to structural performance accordingly and indicate their location and design requirements on the construction drawings. Design openings in a covered tank to accommodate equipment for loading, agitating, and emptying. Equip these openings with fencing, grills or secure covers for safety, and for odor and vector control as necessary.

Fabricated structures shall be designed according to the following criteria:

- Steel: Manual of Steel Construction, American Institute of Steel Construction.
- Timber: National Design Specifications for Wood Construction, American Forest and Paper Association.
- Concrete:
  - » Building Code Requirements for Reinforced Concrete, American Concrete Institute (ACI) 318. Concrete design calculations shall use a minimum design compressive strength of 3,500 psi.
  - » Code Requirements of Environmental Engineering Concrete Structures, ACI 350.
  - » Concrete used as part of a structure: WI Construction Specification 4, Concrete.

Separation Distance. Fabricated structures must meet the separation distances listed in the liner standard(s) used; see WI NRCS CPS 520, 521 and 522, as applicable.

Additional Criteria - Stacking Facilities

This criteria applies to stacking the following materials at the animal production area:

- Separated manure solids
- Compost
- Dewatered, recycled sand storage
- Poultry litter (turkey or broiler operations)
- Dry poultry layer manure
- Bedded manure (> 50% solids)
- Waste feed

Criteria for stacking facilities are shown in Table 5. Solids stacking within the animal production area may be done in an impoundment, fabricated structure or stacking slab, when provisions are made to capture seepage and runoff.

A stacking facility may be open, covered, or roofed and is used for wastes which behave primarily as solid. Determine the wall height using the anticipated stacking angle of the waste material. Construct a stacking facility of durable materials such as reinforced concrete, reinforced concrete block, or treated lumber. Design the stacking facility with adequate safety factors to prevent failure due to internal or external pressures, including hydrostatic uplift pressure and imposed surface loads such as equipment which may be used within, on, or adjacent to the structure.

Reduced seepage concrete with waterstop is allowed as a liner in place of the soil requirements of Table 5.

Seepage. All facilities lacking permanent, engineered roofs are considered not roofed for the purposes of this standard. Tarps, plastic coverings, or other temporary measures are considered not roofed. Facilities that are not roofed must have floors sloped to control surface drainage and all leachate and runoff (up to the 25-year, 24-hour storm) must be managed. Prevent influent seepage in amounts that would infringe on designed storage capacity. Seepage control may not be necessary on sites that have a roof or waste material with little seepage potential.

Internal Drainage. Make provisions for drainage of leachate, and rainfall from the stacking areas without a roof. Collect leachate and runoff in a facility suitable for liquid containment (as defined within this standard) or transfer receptacle meeting WI NRCS CPS Waste Transfer (Code 634), until land applied in accordance with WI NRCS CPS Nutrient Management (Code 590), or provide other acceptable treatment.

Poultry Litter Stacking Facility. To reduce the potential for spontaneous combustion damage to wood walled facilities, design the height of the litter stack not to exceed 7 feet, with litter to wood contact limited to 5 feet. Compost facilities should be designed and operated to meet the requirements of WI NRCS CPS Composting Facility (Code 317).

Design facilities to prevent run-on and runoff, and operate them to prevent ponding and significant hydrostatic head. Facilities may commonly be located near the ground surface, but may be above or below ground. Determine the wall height using the anticipated stacking angle of the waste material.

Table 5. Liner Criteria for Permanent Solids Stacking Facilities at the Animal Production Area [Note 1]

	Roofed		Not Roofed	
	Work Surface Note 2	No Surface Note 3	Work Surface Note 2	No Surface Note 3
Soils In-Place Liner [Note 3]				
% Fines	≥ 30%	≥ 30%	≥ 40%	≥ 40%
Plasticity Index (PI)	-	≥ 7	-	≥ 7
Thickness	≥ 2 feet	≥ 2.5 feet	≥ 3 feet	≥ 5 feet
Soils Compacted Liner [Note 3]				
% Fines	≥ 30%	≥ 40%	≥ 40%	≥ 40%
Plasticity Index (PI)	≥ 5	≥ 7	≥ 7	≥ 7
Thickness	≥ 1.5 feet	≥ 2 feet	≥ 2 feet	≥ 3 feet
Compaction	WI Spec 204	WI Spec 204	WI Spec 204	WI Spec 204
Separation Distances				
Sinkholes	≥ 400 feet	≥ 400 feet	≥ 400 feet	≥ 400 feet
Well Distance [Note 4]	≥ 100 feet	≥ 100 feet	≥ 100 feet	≥ 100 feet
Subsurface Saturation	≥ 3 feet	≥ 3 feet	≥ 5 feet	≥ 5 feet
Bedrock	≥ 3 feet	≥ 3 feet	≥ 5 feet	≥ 5 feet
Stacking Area	Stacking area not to exceed 7 acres for unroofed managed compost, 2 acres for sand, 2 acres for roofed facilities, or 1 acre for all other materials.			

[Note 1] Solids and sand stacking facilities, treatment areas and other production area structures and systems may be subject to surface water setbacks and other requirements under state and local rules. MOL requirements do not apply to this Table.

[Note 2] The work surface may be constructed of any of the following: minimum 3 in. for asphalt; minimum 4 in. for concrete; or minimum 8 in. for macadam, and designed for anticipated equipment loads. Refer to industry standard design criteria for each work surface material. The purpose of the work surface is to protect the liner material.

[Note 3] Facilities without a work surface must be operated to minimize rutting and removal of the soil liner. Ruts must be repaired and the soil liner thickness maintained after material handling. Stacking height is not to exceed 10 feet.

[Note 4] Additional separation distances to wells may be necessary on WDNR regulated farms.

CONSIDERATIONS

Additional recommendations relating to design which may enhance the use of, or avoid problems with, this practice, but are not required to ensure its basic conservation function are as follows:

Consider using the companion documents located in Chapter 10 of the NRCS, Agriculture Waste Management Field Handbook (AWMFH).

Consider using the Waste Storage Design spreadsheet located in Chapter 10 of the NRCS AWMFH for design storage volume, liner thicknesses, and other calculations described in this standard.

This standard does not preclude the addition of other off farm organic materials not specifically prohibited by standard, pending approval by the appropriate regulatory authority. During planning, consider discussing the potential for off farm organic material storage with the landowner. Encourage the landowner to investigate the impact of accepting off farm organic material to waste consistency, toxic gas generation, nutrient management, and remaining volume prior to accepting any off farm waste. Incorporate any additional operation or maintenance requirements resulting from these discussions.

Consider implementing erosion control methods on the top half of the inside slopes of earthen impoundments.

Consider adding agitation locations on different sides of the storage facility, or different cardinal directions, allowing the location of agitation to be adjusted if wind direction changes.

Consider adding curbs, structural or visual components to all agitation and pumping locations, which may reduce the risk of accidental entry and damage to the liner during agitation.

When designing impoundment embankments, consider using flatter slopes on the outside embankment slope for better operation access and easier maintenance.

Consider adding an auxiliary spillway, additional embankment height, or both as needed to help protect the embankment, particularly for systems that store large volumes of runoff. Factors such as downstream hazards and receiving waters should be evaluated in this consideration.

Consider adding or including steel reinforcement in slabs that will be scraped; this may prevent vertical displacement at crack locations.

Consider placing a permanent marker to designate the empty level. This consideration is particularly important for operations considering future herd expansion to WPDES permit size (see Figure 1).

Monitoring and leakage collection systems should be considered for larger waste storage facilities, especially where the site assessment indicates the area is sensitive for groundwater impacts. This is particularly important for operations considering future expansion to WPDES permit size. Components of a designed system may include secondary containment (soil or synthetic), leachate collection, leachate recirculation, monitoring sumps, and/or monitoring wells. See Wisconsin Administrative Code, Chapter NR 141 (NR 141) for regulations concerning monitoring wells.

For exposed liners utilizing HDPE or similar materials that are slippery when wet, consider the use of textured liners or addition of features such as tire ladders that would allow for escape from the waste storage facility.

Consider solid/liquid separation of runoff or wastewater entering impoundments to minimize the frequency of accumulated solids removal and to facilitate pumping and application of the stored waste.

Due consideration should be given to environmental concerns, economics, the overall waste management system plan, and safety and health factors.

Since the economics and risks associated with waste storage facilities are quite high, consider providing the operator with the cost to close the facility. Cost should include removal of the planned sludge accumulation volume and the waste stored at the maximum operating volume.

Consider using well construction logs within ½ mile of the proposed facility, available from the Wisconsin Geologic and Natural History Survey and/or the Wisconsin Department of Natural Resources, which promote understanding of water supply aquifers in the area along with area hydrogeology.

Considerations for Improving Air Quality

Liquid manure storage may result in emissions of volatile organic compounds, ammonia, hydrogen sulfide, methane, nitrous oxide, and carbon dioxide. Solid manure storage may result in emissions of particulate matter, volatile organic compounds, ammonia, carbon dioxide, and nitrous oxide.

To reduce emissions of greenhouse gases, ammonia, volatile organic compounds, particulate matter and odor, other WI NRCS CPSs such as Anaerobic Digester (Code 366), Roofs and Covers (Code 367), Waste Treatment (Code 629), Amendments for Treatment of Agricultural Waste (Code 591), and Composting Facility (Code 317) can be added to the waste management system. Additionally, consider adding the following components: siting of livestock housing or feedlots, manure storage, and land application; biofilters; feed ration additives and adjustments; manure additives, disinfectants, or aeration; incorporation of manure when land-applied; moisture and dust control within livestock housing areas; and dead animal disposal plans.

For additional information on odor abatement, see ASABE EP379.54 April 2012, Management of Manure Odors.

Adjusting pH below 7 may reduce ammonia emissions from the waste storage facility but may increase odor when waste is surface applied, see WI NRCS CPS Nutrient Management (Code 590).

Some fabric and organic covers have been shown to be effective in reducing odors.

Maintain appropriate manure moisture content for solid manure storage facilities. Excessive moisture will increase the potential for air emissions of volatile organic compounds, ammonia, and nitrous oxide, and may lead to anaerobic conditions, which will increase the potential for emissions of methane and hydrogen sulfide. Too little moisture will increase the potential for particulate matter emissions.

PLANS AND SPECIFICATIONS

Prepare plans and specifications that describe the requirements for applying the practice to achieve its intended use. This should include:

- Plan view of system layout.
- Minimum of two cross sections, perpendicular to each other, for each waste storage facility.
- Structural details of all components, including reinforcing steel, type of materials, thickness, anchorage requirements, and lift thickness, sufficient to clearly show the construction requirements.
- Locations, sizes, and type of pipelines and appurtenances including a profile of the waste transfer system.
- Requirements for foundation and preparation and treatment, including bedrock treatment.
- Surface Drainage/Grading plan.
- Subsurface drainage details.

- Location of soil test pits within 100 feet of the facility footprint on the plan view, and a summary of soil logs plotted on the cross sections or profile, with subsurface saturation and bedrock elevations marked, if encountered.
- Safety features, roof covers, fencing, ladders, and safety signs.
- Construction site erosion control practices.
- Specifications for materials and installation.
- Vegetative requirements.
- Quantity of materials.
- Approximate location of utilities and notification requirements.
- Other site-specific information necessary to construct the waste storage facility.
- Applicable Wisconsin Construction Specifications.
- Signature of the person responsible for the design, their engineering stamp, NRCS Job Approval or WDATCP Agricultural Engineering Practitioner Certification level, the date, and a statement attesting the plans meet the requirements of this standard and appropriate liner standard(s).

The following information should be included only if applicable to the project:

- Details for joining different liner types or new liners to existing liners.
- Waterstop joint layout for slabs and walls.
- References to components supplied by others (pumps, etc.).
- Identification of borrow source location(s).
- Reclamation plans for borrow area.

Engineering Design Documentation. Prepare engineering design documentation in compliance with the Design Deliverables in the WI NRCS Statement of Work for the WI NRCS CPS Waste Storage Facility (Code 313), and demonstrate that the criteria in the NRCS practice standard have been met. Include all substantiating data, assumptions, computations and analyses in design documentation. The design documentation shall include:

- Management assessment,
- Site assessment,
- Operation and maintenance plan,
- Construction plan,
- Construction Quality Assurance Plan,
- Engineering computations, such as runoff, structural (unless using NRCS Standard Drawings), earthwork quantities, and volumetric computations for sizing of waste storage facility.

Construction Quality Assurance Plan

A construction quality assurance plan is required that describes the type and frequency of testing, items requiring observation, and the documentation required. The plan shall be approved by a person with NRCS Job Approval, WDATCP Agricultural Engineering Practitioner Certification, a Wisconsin registered professional engineer, or staff under the direction and control of the person holding the aforementioned credentials. The construction quality assurance plan shall address all the following items:

- Contact information and responsibilities of key parties (including owner, designer, construction observer, and contractor).
- Pre-construction meeting agenda items (including quality assurance plan, construction plans and specifications, design change procedures, and critical project-specific items).
- Observation and construction verification (including items to be verified, sequencing, layout/staking, notification requirements, and on-site materials testing documentation).
- Items to be noted on as-built plans, job diary, and other certification (attesting) documentation.

OPERATION AND MAINTENANCE

Develop an operation and maintenance plan that is consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for its design. At a minimum, the plan will contain where appropriate:

Include a narrative describing the purpose of the system or structure and how it is intended to operate. This narrative should include design criteria such as number and type of animals, type of waste, type of bedding, days of storage, method for emptying, vehicle sizes intended to operate within or near the system and other pertinent operational information. Include the operational requirements for emptying the storage facility, including the expected storage period. Also include the requirement that waste be removed from storage and utilized at locations, times, rates, and volume in accordance with the overall waste management system plan and WI NRCS CPS Nutrient Management (Code 590).

Manage the stored waste such that it remains below the maximum operating level during normal operating conditions. Include a contingency plan, which shall be implemented when the maximum operating level is reached. The contingency plan shall include how to handle unexpected volumes of wastewater and/or runoff that could cause the system to overflow or negatively impact the liner before scheduled emptying can occur. The contingency plan shall provide for the safe disposition of waste. Include requirements for location and methods of waste removal and emergency disposal.

For impoundments and other liquid storages include an explanation of the staff gauge or other permanent marker to indicate the maximum operating level. For storages where the contents are not visible and a staff gauge would not be visible, such as below a slatted floor, identify the method for the operator to measure the depth of accumulated waste. Include requirements for monitoring the waste level relative to the permanent maximum operating level markers or indicators.

Include a provision for emergency removal and disposition of liquid waste in the event of an unusual storm event that may cause the waste storage facility to fill to capacity prematurely.

If an observation and pumping port is installed, monitor the discharge in the port for flow depth and pollutants. If pollutants are identified, block the gravity outlet and utilize a pump to remove the polluted liquids until the source is identified and repairs can be completed. Pump pollutants to an appropriate location (e.g. pumped back to the structure or spread per a nutrient management plan).

Describe safety issues and procedures/requirements connected with waste storage facilities, including confined spaces. Include additional measures needed to address the fatal or serious inhalation hazards of gases including, but not limited to, hydrogen sulfide (H2S), carbon dioxide (CO2), methane (CH4), and ammonia (NH3), which may or may not exist where manure gases are generated through the handling of liquid or semi-solid manure through activities such as pumping, mixing, agitating, spreading, or cleaning-out. Agitating open-air manure storage facilities can be especially hazardous when high humidity and low winds may cause hydrogen sulfide gas to reside near the storage.

Include instructions as needed for ventilating confined spaces according to ASABE Standard S607, Venting Manure Storages to Reduce Entry Risk.

Develop an emergency action plan for waste storage facilities where there is a potential for significant impact from breach or accidental release. Include site-specific provisions for emergency actions that will minimize these impacts.

Include a requirement to contact the appropriate regulatory authority for approval prior to storing any off-farm waste material in a waste storage facility that has been constructed using the criteria in this standard.

Include a description of the routine maintenance needed for each component of the facility. Also include provisions for maintenance that may be needed as a result of waste removal or material deterioration and requirements for inspecting and maintaining the structural components and mechanical systems.

Maintain appropriate manure moisture content for solid manure storage facilities. Excessive moisture will increase the potential for air emissions of volatile organic compounds, ammonia, and nitrous oxide, and may lead to anaerobic conditions, which will increase the potential for emissions of methane and hydrogen sulfide. Too little moisture will increase the potential for particulate matter emissions.

REFERENCES

American Society for Testing and Materials. Annual Book of ASTM Standards. Standards D 653, D 698, D 1140, D 1760, D 2487, D 2488, D5084. ASTM, Philadelphia, PA.

American Society of Civil Engineers (ASCE), Minimum Design Loads for Buildings and Other Structures, SEI/ASCE 7-10 or newer version.

American Society of Agricultural and Biological Engineers (ASABE), Standards EP378, EP393, EP379, and EP470.

Manual of Steel Construction, American Institute of Steel Construction.

National Design Specifications for Wood Construction, American Forest and Paper Association.

USDA NRCS. 1992. Agricultural Waste Management Field Handbook. USDA-NRCS, Washington, DC.

USDA NRCS. General Manual. USDA-NRCS, Washington, DC.

USDA NRCS. National Engineering Manual. USDA-NRCS, Washington, DC.

USDA NRCS. National Handbook of Conservation Practices.

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

USDA Soil Conservation Service. 1989. Technical Release Number 74, Lateral Earth Pressures, USDA-SCS, Washington, DC.

Wisconsin Administrative Code, Department of Natural Resources, Chapters NR 141, NR 213, NR 243 and NR 811.

DEFINITIONS

Animal Production Area – Means any part of the livestock operation that is used for the feeding and housing of livestock. This includes the entire animal confinement and feeding area, and any adjacent manure storage areas, raw materials storage areas, and waste containment areas. This does not include pasture and cropland.

Bedrock – The solid or consolidated rock formation typically underlying loose surficial material such as soil, alluvium or glacial drift. Bedrock includes but is not limited to limestone, dolomite, sandstone, shale and igneous and metamorphic rock.

> *Note: Although solid or consolidated bedrock can sometimes be removed with typical excavation equipment, these materials are included in the above definition.*

Clean Water – Water that has not been mixed with manure, wastewater or other contaminants

Conduits to Groundwater – 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. Wells were intentionally left out of this NR 151 list.

Confined Space – Confined Space is a space that 1) contains or has the potential to contain a hazardous atmosphere; 2) is large enough and so configured that a person can bodily enter; 3) has limited or restricted means for entry or exit; and 4) is not designed for continuous human occupancy.

Contaminated Runoff – Runoff that has come through or across a barnyard or animal lot or feed storage area. It generally includes the runoff and any manure, sediment, feed, or other material carried in the runoff. It contains lower concentrations of contaminants than leachate from feed or manure.

Control Joints – Control joints, often called contraction joints, are used to control the location of cracks caused by concrete shrinkage during setting and thermal changes. Steel reinforcement is interrupted in control joints with embedded waterstop.

Cultural Resources – Cultural resources are the traces of any past activities and accomplishments of people. They include tangible traces such as historic districts, sites, buildings, structures, historical documents and cemeteries. They also include traces of less tangible objects such as dance forms, aspects of folk-life, cultural or religious practices, and some landscapes and vistas.

Drainage System – Water conveyance measures of specified capacity, location, and material that insure the removal of water to a free outlet.

Effective Height – The difference in elevation between the auxiliary (emergency) spillway crest or the settled top of the embankment if there is no auxiliary spillway and the lowest point in the cross section taken along the centerline of the embankment at existing ground surface.

Flood Prone Areas – These include areas delineated as floodplains on Federal Emergency Management Agency (FEMA) maps, or local floodplain maps as well as areas along perennial streams (blue lines) shown on the United States Geologic Survey quadrangle sheets that may be subject to out of bank flows.

Footprint – This is the horizontal area within the perimeter of a facility liner, or the perimeter of a work surface that may cover a liner. For a liquid or solids containment facility, the footprint is the maximum horizontal extent of containment. For a liquid impoundment facility or pond, the footprint is normally defined by the inside top of the embankment. For a solids storage facility, the footprint is normally defined by the edge of the pad, the curb on a pad, or the inside surface of bunker walls.

Gleyed Soil – A soil condition resulting from prolonged soil saturation, which is manifested by the presence of grayish, bluish or greenish colors through the soil matrix. Gleying occurs under reducing conditions, by which iron is reduced predominantly to the ferrous state.

Impoundment – A waste storage facility constructed of an earthen embankment(s) (which is lined) and/or excavations for the purpose of storing waste. The impoundment, below the existing ground, may be lined or unlined if meeting CPS 313, Table 1 Soils (In Place).

Impoundment depth – Depth is the distance from the bottom of the impoundment up to the maximum operating level (M.O.L.).

In-Place Earth – A waste storage facility impoundment where the entire bottom surface is sited where in-situ soils have sufficiently low hydraulic conductivity to provide waste storage without a constructed liner. The bottom is excavated a minimum depth of one foot into the in-situ soils as measured from the planned floor elevation.

Karst features – Refers to areas of land underlain by carbonate bedrock (limestone or dolomite). Typical land features in karst areas include sinkholes, network of interconnected fissures, fractures, disappearing streams, closed depressions, blind valleys, caves, and springs. See the companion document in Chapter 10 of the AWMFH for additional discussion of karst features.

Leachate – Concentrated liquid waste which has percolated through or drained by gravity from a pile of manure, manure processing derivative, or animal feed. It contains much higher concentrations of contaminants than Contaminated Runoff.

Liquid Waste Storage Impoundment – A facility where the stored material does not consistently stack and is either a manmade excavation, or diked area formed primarily of earthen materials, such as soil (although the unit may be lined with earthen or manmade materials) .

Manure Processing Derivatives – The by-products and waste components that are produced as a result of treatment and processing practices. These include, but are not limited to, the following waste components: separated sand, separated manure solids, precipitated manure sludges, supernatants, digested liquids, composted biosolids, process waters.

Nutrient Management Plans – A planning document that outlines the requirements for managing the amount, form, placement, and timing of applications of plant nutrients to cropland.

Perched Conditions – A soil moisture condition consisting of limited area including 1) saturated soil 2) depleted, gleyed or reduced matrices or, 3) reduced redoximorphic features, located above or part of a barrier to downward flow. Directly below the barrier to downward flow and above the normal free water elevation a soil moisture condition exists in a soil layer(s) which does not display 1) saturation; 2) depleted, gleyed or reduced matrices; or 3) reduced redoximorphic features.

Percent Fines (% Fines) – Percentage of given sample of soil which passes through a #200 sieve.

Permeability – The coefficient of permeability (K) is a measure of the ability of soil to transmit liquids. It is used to compute the flow rate of liquid through a soil liner for specific conditions of soil thickness and fluid head (e.g., $1x10^{-7}$ cm/s).

Plasticity Index (PI) – A soil property indicating moldability. Measured by ASTM D4318.

Sinkholes – Closed, usually circular depressions which form in karst areas. Sinkholes are formed by the downward migration of unconsolidated deposits into solutionally enlarged openings in the top of bedrock.

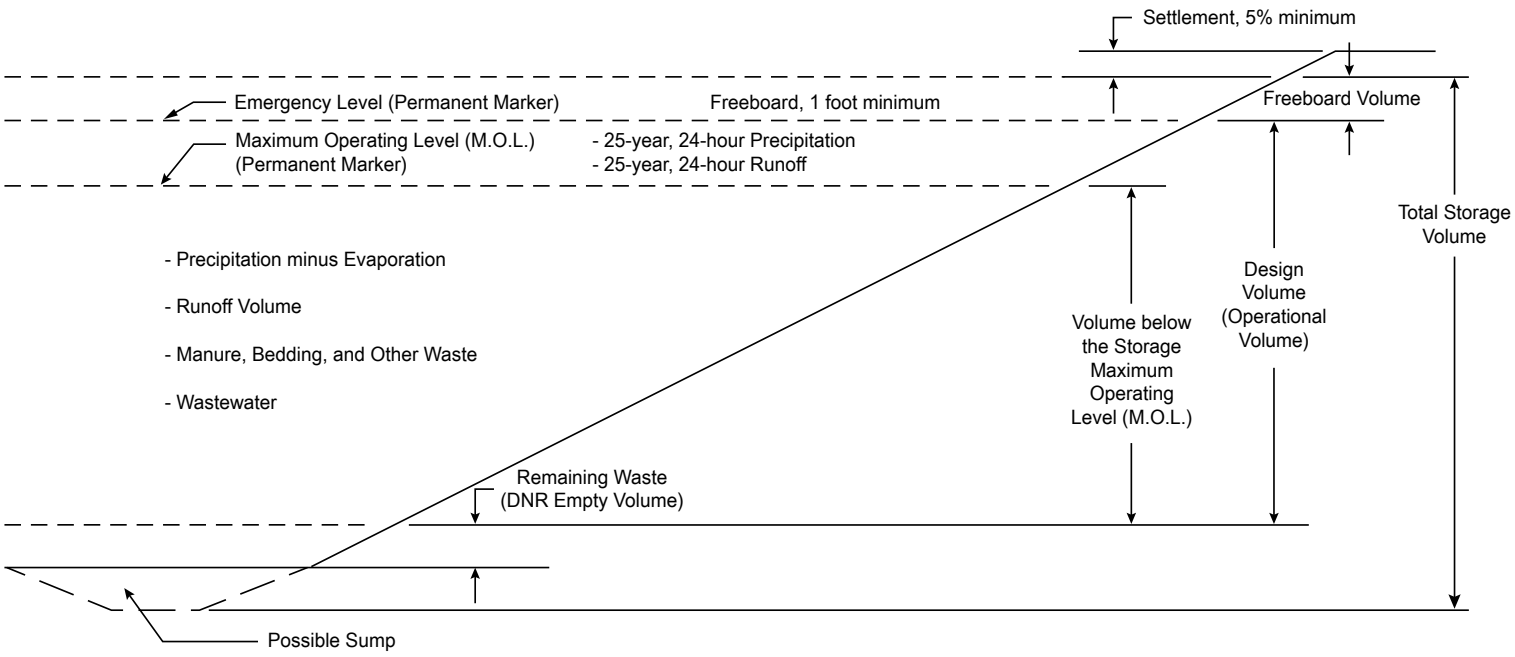
Structure – A waste storage facility consisting of constructed surfaces, tanks, or walls for the purpose of storing waste above or below the ground surface. Structures may be constructed of concrete, steel, wood or other construction materials.

Sub-Liner Soil – The soil directly below the bottom of the liner. This may be placed or in-situ material.

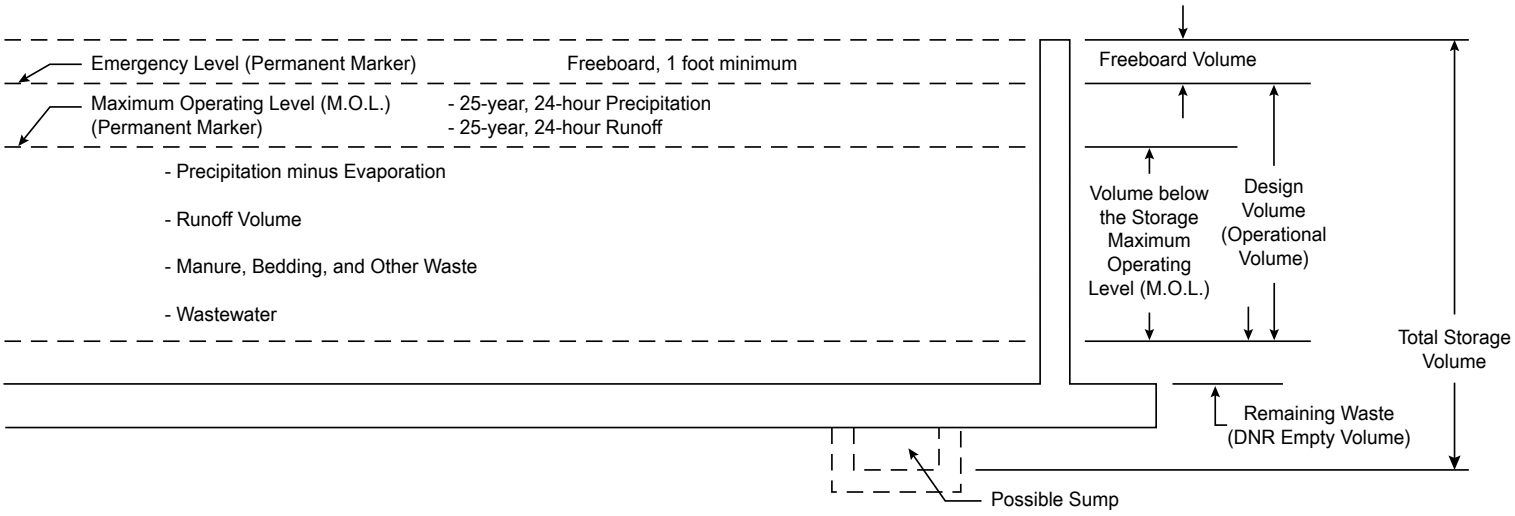
Sub-Soil – The soil directly below the bottom of the liner. This must be in-situ material.

Wastewater – Milking center waste, flush water, leachate from feed holding areas, and similar waste materials generated at the animal production area.

FIGURE 1
Design Storage Volume



IMPOUNDMENT



STRUCTURE

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD
POND SEALING OR LINING – COMPACTED SOIL TREATMENT
CODE 520
(Ft.^{2})

DEFINITION

A liner for an impoundment constructed using compacted soil with or without soil amendments.

PURPOSE

This practice is installed to reduce seepage losses from impoundments constructed for water conservation and environmental protection.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where:

- In-place natural soils have excessive seepage rates, and
- An adequate quantity and type of soil suitable for constructing a compacted soil liner without amendments is available, or
- An adequate quantity and type of soil suitable for treatment with a soil dispersant or bentonite amendment is available for an amended soil liner.

CRITERIA

General Criteria Applicable to All Soil Liners

Design Seepage Requirements. Design a compacted soil liner for a waste storage impoundment to reduce specific discharge (unit seepage) to rates specified in the National Engineering Handbook (NEH), Part 651, Agricultural Waste Management Field Handbook (AWMFH), Chapter 10, Appendix 10D, or rates mandated in State regulations, if more restrictive. Lower specific discharge rates must be used if required by regulatory authorities, and may be used at the discretion of the designer even if no such lower limit exists. Tables 1 and 2 of this standard achieve the specific discharge requirements referenced in the AWMFH.

Laboratory testing of compacted soil liner material for a waste storage impoundment is required to document the specific discharge to meet the design seepage threshold.

Design a compacted soil liner for a clean water pond to reduce seepage to a rate that will allow the pond to function as intended.

Liner filter compatibility. Design a compacted soil liner that is filter-compatible with the subgrade on to which it is placed to prevent loss of the liner soil into larger openings in the subgrade material. NEH, Part 633, Chapter 26, Gradation Design of Sand and Gravel Filters, provides criteria on filter compatibility.

Liner Thickness. The minimum thickness of the finished compacted liner must be the greater of:

- The liner thickness required to achieve a specific discharge (unit seepage) design value required by State regulations, or
- A liner thickness required by State regulations, or
- The minimum liner thickness as shown in Table 1 (manure storage) or Table 4 (clean water)

Liner Construction. Use methods described in the AWMFH, Appendix 10D, for liner construction. Properly seal all penetrations through the liner (e.g. pipes)

Liner Protection. Protect the soil liner against damage caused by the effects of waste or water surface fluctuations, desiccation and cracking, wave action, rainfall during periods when the liner is exposed, water falling onto the liner from pipe outlets, agitation equipment, solids and sludge removal activity, animal activity, penetrations through the liner, and any other activity capable of causing physical damage to the liner.

A protective soil cover may be used to protect the soil liner from desiccation or erosion. The soil cover will be of a soil type, thickness, and density that is resistant to erosion and desiccation. Under severe conditions, a protective soil cover may not adequately protect the liner from desiccation. For example during long periods, of hot, low-humidity condition, a soil cover constructed with very high plasticity soils may experience damage. Under severe conditions, additional design measures such as installation of a geomembrane in conjunction with the soil cover may be required. The side slope liner thickness listed in Table 1 includes an additional two feet to act as a protective soil cover for desiccation (No additional measure is required). Additional erosion or agitation protection may still be needed based on the management assessment performed for waste storage facilities.

Side Slopes. The side slopes of the impoundment should be 3H (horizontal) to 1V (vertical) or flatter to facilitate compaction of soil on the slopes when the "bathtub" method of construction is used, as described in AWMFH, Appendix 10D. Slopes as steep as 2H to 1V can be considered if the "stair-step" method of construction as described in appendix 10D of the AWMFH is used.

Foundation. Evaluate the foundation for conditions such as karstic bedrock, joints, and other discontinuities of the underlying bedrock to determine the appropriateness for a compacted soil liner.

Additional Criteria for Waste Storage Facilities (WI CPS 313)

Tables 1 and 2 summarize the liner and separation distance requirements for waste storage facilities.

Determine the plasticity index (PI) in accordance with ASTM D4318 and the percent fines in accordance with ASTM D1140. Permeability shall be determined by ASTM D5084 from undisturbed samples of the compacted liner. Additional soil testing requirements are found in WI FOTG Construction Specification 300, Clay Liner.

All waste storage facilities shall also meet the requirements of Wisconsin NRCS Conservation Practice Standard (WI CPS) 313, Waste Storage Facility (WI CPS 313).

Use WI CPS 313 criteria to determine subsurface saturation and bedrock depth.

Table 1. Soil Liner Criteria for Waste Storage Facility Impoundments [Note 1]

Soil Liner	
Thickness, Bottom	As specified in Table 2
Thickness, Sides [Note 2]	≥ 5 feet
% Fines	≥ 50%
Plasticity Index	≥ 12
Permeability	≤ $1x10^{-7}$
WI FOTG Construction Specification	Spec 300
Sub-Liner	**See Table 3**
Separation Distances	
Wells [Note 3]	≥ 250 feet
Sinkholes or other Karst Features	≥ 400 feet
Subsurface Saturation	As specified in Table 2
Bedrock	As specified in Table 2
Liner Protection Required	
Agitation and Pumping Locations	Minimum 20 feet wide x 30 feet long x 4 inches thick concrete pad or sump in bottom and 20 feet wide ramp or a 16 feet wide ramp with 12 inches high curbs to the top of the facility.
Scraping and Other Mechanical Means of Removing Solids and Sand	Protect with hard surfacing designed for the expected conditions and loads, a minimum of 4 inches thick.

[Note 1] This liner may be used to meet the requirements of Wisconsin Administrative Code, Chapter NR 213 (NR 213), with additional restrictions (e.g. soils investigations, separation distances, liner properties, maintenance requirements). See NR 213 and WI AWMFH 313 companion documents.

[Note 2] Thickness measured perpendicular to slope.

[Note 3] Community water system wells may require larger separation distances (see Wisconsin Administrative Code, Chapter NR 811 (NR 811)).

Table 2. Soil Liner Thickness (Bottom) and Separations for Waste Storage Facility Impoundments [Note 1]

Impoundment Depth [Note 2]	Liner Thickness (feet)	Separation to Subsurface Saturation (feet)
0 – 13	≥ 3.0	≥ 5.0
13.1 – 14	≥ 3.2	≥ 5.2
14.1 – 16	≥ 3.6	≥ 5.6
16.1 – 18	≥ 4.1	≥ 6.1
18.1 – 20	≥ 4.5	≥ 6.5
20.1 – 22	≥ 5.0	≥ 7.0
22.1 – 24	≥ 5.4	≥ 7.4
24.1 - 25	≥ 5.7	≥ 7.7

[Note 1] Thickness is calculated based on a maximum permeability of $1x10^{-7}$ cm/sec.

[Note 2] Depth is the distance from the bottom of the impoundment up to the maximum operating level (M.O.L.).

Sub-Liner Soils. Sub-liner soil requirements are listed in Table 3. These sub-liner soils can be placed or be in situ materials. There is no compaction requirement for in situ materials. Sub-liner soil is required under the footprint of all waste storage facilities. For structures, the sub-liner soil must be wrapped around to the top of the footing to provide continuous protection. For pre-engineered structures, requirements for sub-liner soil configurations are included in the approval letter for the manufacture, written by the SCE.

Sub-liner soil thickness is in addition to any liner thickness requirement.

Table 3. Sub-Liner Soil Requirements for Waste Storage Facility Impoundments

	Minimum Soil Requirements			
	A	B	C	D
% Fines	≥ 20%	≥ 20%	≥ 40%	Foundry Sand [Note 1]
Plasticity Index (PI)	≥ 7	—	≥ 12	—
Thickness (bottom and sides)	≥ 1.5 feet	≥ 2 feet	≥ 8 inches	≥ 1.5 feet
Compaction of Placed Material	WI Spec 204	WI Spec 204	WI Spec 300	WI Spec 204

[Note 1] The foundry sand must be ferrous foundry sand with only minimal concentrations of hazardous constituents, cores and other over-size materials crushed or removed, and at least 5% bentonite content. A site specific WDNR approval is required under Wisconsin Administrative Code, Chapter NR 538 (NR 538) that may specify greater separation distances and parameters not addressed by this standard. An NR 538 Category I or II ferrous foundry sand may be appropriate.

Additional Criteria for Compacted Soil Lined Clean Water Applications

Table 4 lists required liner thickness for clean water applications.

Table 4. Minimum Liner Thickness For Clean Water

Design Storage Depth (feet)	Liner Thickness (inches)
≤16	12
16.1–24	18
24.1–30	24

Additional Criteria for Soil Dispersant Treatment for Clean Water Applications

This liner treatment does not meet the requirements for a waste storage facility liner.

Dispersant Materials. The dispersant must be tetrasodium pyrophosphate (TSPP), sodium tripolyphosphate (STPP), or soda ash unless laboratory tests using other dispersant types are used in the design.

Application Rate. Laboratory permeability tests may be conducted using a dispersant of the same quality and fineness as that proposed for use. To meet the liner design threshold, use the application rate and the number and thickness of compacted soil lifts specified in the geotechnical laboratory report. In the absence of laboratory tests or field performance data on soils similar to those to be treated, apply dispersant at a rate equal to or greater than the amount listed in Table 5. Install the liner with a maximum 6-inch-lift thickness.

Safety. During dispersant handling, application and mixing, personnel on-site must wear masks and goggles for protection against dispersant dust.

Table 5. Minimum Dispersant Application Rates for Clean Water Ponds

Dispersant Type	Minimum Application Rate per 6-inch lift thickness (pounds/100 square feet)
Polyphosphate (TSPP, STPP)	7.5
Soda Ash	15

Additional Criteria for Bentonite Treatment for Clean Water Applications

This liner treatment does not meet the requirements for a waste storage facility liner.

Bentonite Material. The bentonite must be a sodium bentonite with a free swell of at least 22 milliliters as measured by ASTM Standard Test Method D5890, unless laboratory tests using other bentonite types are used for design.

Application Rate. Laboratory permeability tests may be conducted using a bentonite of the same quality and fineness as that proposed for use. To meet the liner design threshold, use the application rate and the number and thickness of compacted soil lifts specified in the geotechnical laboratory report. In the absence of laboratory tests or field performance data on soils similar to those to be treated, apply bentonite at a rate equal to or greater than the amount listed in Table 6. Install the liner with a maximum 6-inch-lift thickness.

Table 6. Minimum Bentonite Application Rates for Clean Water Ponds

Pervious Soil Description	Minimum Application Rate (pounds/square foot) per 1-inch lift thickness
Silts (ML, CL-ML)	0.375
Silty Sands (SM, SC-SM, SP-SM)	0.5
Clean Sand (SP, SW)	0.625

Safety. During bentonite handling, application and mixing, personnel on site must wear masks and goggles for protection against bentonite dust.

CONSIDERATIONS

Consider maintenance access safety and slope stability when selecting inside side slopes for design.

Consider using a composite liner system, including a geomembrane and/or geosynthetic clay liner (GCL) for sites that have liquid depths greater than 24 feet.

Consider installing a 12-inch protective soil cover over the compacted soil liner.

In areas where the liner can potentially be damaged or scoured by agitation, pumping, or other equipment access, consider installing a concrete pad over the liner.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for a compacted soil liner for a pond or a waste storage impoundment that describe the requirements for applying the practice to achieve its intended purpose. This should include:

- Soils investigation, including subgrade.
- Soil amendment requirements, as needed.
- Quantities of soil liner material and soil cover material, as needed.
- Quantity and gradation of filter material, as needed.
- Compaction requirements.
- Supplemental practices, such as geomembrane, as needed.
- Construction and material specifications.
- Safety requirements.
- Applicable Wisconsin Construction Specifications

OPERATION AND MAINTENANCE

Maintenance activities required for this practice consist of those operations necessary to prevent and/or repair damage to the compacted soil liner. This includes, but is not limited to:

- Excluding animals and equipment from the treated area.
- Repairing damage to the liner; restoring the liner to its original thickness and condition.
- Removing roots from trees and large shrubs at first appearance.

REFERENCES

USDA Natural Resources Conservation Service. 2012. Agricultural Waste Management Field Handbook (AWMFH). USDA-NRCS, Washington, D.C.

National Engineering Handbook, Part 633, Chapter 26 – Gradation Design of Sand and Gravel Filters.

DEFINITIONS

Bedrock – The solid or consolidated rock formation typically underlying loose surficial material such as soil, alluvium or glacial drift. Bedrock includes but is not limited to limestone, dolomite, sandstone, shale and igneous and metamorphic rock.

> *Note: Although solid or consolidated bedrock can sometimes be removed with typical excavation equipment, these materials are included in the above definition.*

Clean Water – Water that has not been mixed with manure, wastewater or other contaminants.

Geomembrane – Very low permeability synthetic membrane liner or barrier used with any geotechnical engineering related material so as to control fluid migration in a man-made project, structure or system (ASTM D 4439).

Geosynthetic Clay Liner (GCL) – A manufactured hydraulic barrier consisting of clay bonded to a layer or layers of geosynthetic materials.

Karst features – Refers to areas of land underlain by carbonate bedrock (limestone or dolomite). Typical land features in karst areas include sinkholes, network of interconnected fissures, fractures, disappearing streams, closed depressions, blind valleys, caves, and springs. See the companion document in Chapter 10 of the AWMFH for additional discussion of karst features.

Leachate – Concentrated liquid waste which has percolated through or drained by gravity from a pile of manure, manure processing derivative, or animal feed. It contains much higher concentrations of contaminants than Contaminated Runoff.

Percent Fines (% Fines) – Percentage of given sample of soil which passes through a #200 sieve.

Permeability – The coefficient of permeability (K) is a measure of the ability of soil to transmit liquids. It is used to compute the flow rate of liquid through a soil liner for specific conditions of soil thickness and fluid head (e.g., $1x10^{-7}$ cm/s).

Plasticity Index, PI – A soil property indicating moldability. Measured by ASTM D4318.

Sinkholes – Closed, usually circular depressions which form in karst areas. Sinkholes are formed by the downward migration of unconsolidated deposits into solutionally enlarged openings in the top of bedrock.

Structure – A waste storage facility consisting of constructed surfaces, tanks, or walls for the purpose of storing waste above or below the ground surface.

Sub-Liner Soil – The soil directly below the bottom of the liner. This may be placed or in situ material.

Wastewater – Milking center waste, flush water, leachate from feed holding areas, and similar waste materials generated at the animal production area.

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD
POND SEALING OR LINING – CONCRETE
CODE 522
(Ft.^{2})

DEFINITION

A liner for an impoundment constructed using reinforced or non-reinforced concrete.

PURPOSE

This practice is installed to reduce seepage losses from impoundments constructed for water conservation and environmental protection.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where:

- In-place natural soils have excessive seepage rates.
- Construction of a compacted soil liner is not feasible with available soils.
- Use of impoundment requires concrete both as a liner and a protective subgrade cover.

CRITERIA

General Criteria Applicable to All Concrete Liners

Select the concrete liner design for either 'reduced seepage' or 'liquid tight' criteria, depending on the site conditions and management needs.

Liquid Tight. Where liquid tightness is required to provide an additional level of protection for sensitive environmental settings (SES), geologic concerns, groundwater resources and risk factors as described in the Agricultural Waste Management Field Handbook (AWMFH), Chapter 10, building code requirements must be one of the following:

- Structural Engineering, NRCS National Engineering Manual (NEM) Part 536, Structural Engineering.
- Requirements for Environmental Concrete Structures, Slabs-on-Soil, American Concrete Institute (ACI) 350 Appendix H.

Reduced Seepage. Where liquid tightness is not required, building code requirements must be one of the following:

- ACI 318, Building Code Requirements for Reinforced Concrete
- ACI 330R, Guide for the Design and Construction of Concrete Parking Lots
- ACI 360R, Guide to Design of Slabs-on-Ground
- Concrete Floors on Ground, Chapter 5, Portland Cement Association (PCA)

Include temperature and shrinkage reinforcing steel equal to or greater than shown in Table 1 in floors and slabs.

Table 1. Reinforcing Steel Size (Grade 60) and Spacing for Temperature and Shrinkage Control for Reduced Seepage Concrete with Waterstop

Concrete Thickness	Spacing Between Control Joints			
	< 100 feet	< 125 feet	< 150 feet	< 175 feet
= 5"	#4 @ 18"	#4 @ 15"	#4 @ 15"	#5 @ 18"
≤ 6"	#4 @ 18"	#4 @ 12"	#5 @ 18"	#5 @ 15"
≤ 7"	#4 @ 15"	#5 @ 18"	#5 @ 15"	#5 @ 12"
≤ 8"	#5 @ 18"	#5 @ 15"	#5 @ 15"	#5 @ 12"

Joints. Design construction joints and control joints to meet the appropriate ACI code specified above.

Side Slopes. Design side slopes of the pond or impoundment to be stable during construction. Design liners to withstand all anticipated internal and external loads, and resist agitation scouring, as specified in Table 2 or 3. Proportion the concrete mixture for a sufficiently stiff mix that can be installed on the slope without slumping or bulging.

Foundation and Liner Protection. Design floors and slabs used as a liner for anticipated loads including crack control and joint treatments stated below. Penetrations through the liner, such as pipes, must be properly sealed. Design slabs on ground that will be subject to heavy truck or heavy equipment loads in accordance with ACI 360R, Guide to Design of Slabs-on-Ground, Concrete Floors on Ground, Chapter 5, Portland Cement Association (PCA), or ACI 330R, Guide for the Design and Construction of Concrete Parking Lots.

- Concrete with waterstop – Include distributed reinforcing steel within the concrete, and include embedded waterstop in all joints in accordance with Wisconsin FOTG Construction Specification 004-WS, Waterstop.

  Place steel in the top ½ of the slab thickness with a minimum clear distance from the top of the slab of 1.5 inches.

- Include a waterstop joint plan in the construction plans and include the following: location of joints; cross- section details of joint(s); waterstop materials including factory fabricated corners, intersections, and transitions; and installation specifications.
- Plan additional waterstop control joints where stresses can be predicted to exceed the reinforcing steel's ability to restrain cracking and minimize leakage.
- All waterstop joints in areas subject to equipment traffic shall be designed with a dowel system to transfer the load across the joint. Slab thickness changes at these joints shall be made with a minimum transition ratio of one inch of thickness change over ten inches of run (10:1).
- Concrete used as part of a liner is required to meet WI Construction Specification 4 Concrete.

Additional Criteria for Waste Storage Facilities (WI CPS 313).

For waste storage facilities, design foundation conditions for concrete liners in accordance with Tables 2 and 3. All waste storage facilities shall also meet the requirements of WI CPS Waste Storage Facility (WI CPS 313). Use WI CPS 313 criteria to determine subsurface saturation and bedrock depth.

Reduced seepage concrete soil composite (Table 2) – Determine the plasticity index (PI) in accordance with ASTM D4318 and the percent fines in accordance with ASTM D1140. Place the concrete in intimate contact with the foundation soil. Design floors and slabs to be a minimum of 5 inches thick with reinforcing consisting of #4 bars spaced at 18 inches on center each way. No control joints are required. Maintain continuous reinforcing steel through all construction joints. Drain tile and/or drain fill material may not be installed within the soil liner component of the composite liner.

Table 2. Concrete Liner System Criteria for Waste Storage Facility Structure Floors and Impoundments [Note 1]

	Reduced Seepage Concrete with Waterstop	Reduced Seepage Concrete - Soil Composite			
	A	B	C	D	E
Concrete Component	Design Requirement: ACI-318, ACI-330R, or ACI-360R				
Soil Component					
% Fines	N/A Concrete Component Only	≥ 20%	≥ 20%	≥ 40%	Foundry Sand [Note 2]
Plasticity Index (PI)		≥ 7	—	≥ 12	—
Thickness (bottom and sides)		≥ 1.5 feet	≥ 3 feet	≥ 8 inches	≥ 1.5 feet
Compaction of Placed Material		WI Spec 204	WI Spec 204	WI Spec 204	WI Spec 204
Sub-Liner Soils (Soil Directly Below Concrete or Soil Component)	See Table 2A for Options				
Separation Distances					
Sinkholes Or Other Karst Features					
Impoundment or Structure below ground	≥ 400 feet	≥ 400 feet	≥ 400 feet	≥ 400 feet	≥ 400 feet
Structure above ground	≥ 200 feet	≥ 200 feet	≥ 200 feet	≥ 200 feet	≥ 200 feet
Well Distance	≥ 100 feet	≥ 100 feet	≥ 100 feet	≥ 100 feet	≥ 100 feet
Subsurface Saturation	≥ 2.5 feet (1.5 feet for sump)	≥ 4.0 feet (3.0 feet for sump)	≥ 5.5 feet (4.5 feet for sump)	≥ 3.5 feet (2.5 feet for sump)	≥ 4.0 feet (3.0 feet for sump)
Bedrock	≥ 2.5 feet (1.5 feet for sump)	≥ 4.0 feet (3.0 feet for sump)	≥ 5.5 feet (4.5 feet for sump)	≥ 3.5 feet (2.5 feet for sump)	≥ 4.0 feet (3.0 feet for sump)
Impoundment					
Inside Side Slopes	2.5:1 or flatter	2:1 or flatter			

[Note 1] This liner may be used to meet the requirements of Wisconsin Administrative Code, Chapter NR 213 (NR 213), with additional restrictions (e.g. soils investigations, separation distances, liner properties, maintenance requirements). See NR 213 and WI AWMFH 313 companion document.

[Note 2] The foundry sand must be ferrous foundry sand with only minimal concentrations of hazardous constituents, cores and other over-size materials crushed or removed, and at least 5% bentonite content. A site specific WDNR approval is required under NR 538 that may specify greater separation distances and parameters not addressed by this standard. An NR 538 Category I or II ferrous foundry sand may be appropriate.

Sub-Liner Soils. Sub-liner soil requirements are listed in Table 2A. These sub-liner soils can be placed or in situ materials. There is no compaction requirement for in situ materials. Sub-liner soil, if required, must be under the entire footprint of all waste storage facilities. For structures, the sub-liner soil must be wrapped around to the top of the footing to provide continuous protection.

For pre-engineered structures, requirements for sub-liner soil configurations are included in the approval letter for the manufacturer, written by the SCE.

Determine the PI in accordance with ASTM D4318 and the percent fines in accordance with ASTM D1140.

Sand or gravel is allowed between the concrete with waterstop liner or structure and the sub-liner soil. The sub-liner soil thickness must be present below the sand or gravel.

Sub-liner soil thickness is in addition to any concrete or concrete-soil composite thickness requirement.

Table 2A. Sub-Liner Soil Requirements for Waste Storage Facility Impoundments

	Minimum Soil Requirements			
	A	B	C	D
% Fines	≥ 20%	≥ 20%	≥ 40%	Foundry Sand [Note 1]
Plasticity Index (PI)	≥ 7	—	≥ 12	—
Thickness (bottom and sides)	≥ 1.5 feet	≥ 2 feet	≥ 8 inches	≥ 1.5 feet
Compaction of Placed Material	WI Spec 204	WI Spec 204	WI Spec 300	WI Spec 204

[Note 1] The foundry sand must be ferrous foundry sand with only minimal concentrations of hazardous constituents, cores and other over-size materials crushed or removed, and at least 5% bentonite content. A site specific WDNR approval is required under NR 538 that may specify greater separation distances and parameters not addressed by this standard. An NR 538 Category I or II ferrous foundry sand may be appropriate.

Sensitive Environmental Settings. Table 3 contains the criteria for constructing liquid waste storage facilities in Wisconsin's sensitive environmental settings, as defined in WI CPS 313. Determine the PI in accordance with ASTM D4318 and the percent fines in accordance with ASTM D1140.

Design the storage facility as a reinforced concrete hydraulic or environmental structure according to NRCS NEM, Part 536, Structural Design with liquid tight concrete. (Concrete with waterstop ACI 350 or 350 Appendix H)

Alternatively, construct a facility with reduced seepage concrete and secondary liquid containment. Three components must be present for this system, a concrete liner, a drainage layer, and a secondary liquid containment liner. Design the concrete liner to meet the reduced seepage liner requirements contained within this standard. The drainage layer will consist of a minimum of twelve (12) inches of clean stone, with a drainage system that enters into an observation and pumping port with gravity outlet discharging to the surface. This port must be monitored for discharge for flow depth and pollutants. If pollutants are identified, the gravity outlet must be blocked and the port pumped until the source is identified and repairs can be completed. Evaluate the effects of out-letting to perennial or intermittent waterways.

Pre-engineered structures may contain specific additional requirements which are included in the approval letters for the manufacturer, written by the SCE.

Table 3. Structural Concrete and Concrete Liners with Secondary Liquid Containment System for Waste Storage Facilities in Sensitive Environmental Settings

	Liquid Tight Concrete with Waterstop	Reduced Seepage Concrete with waterstop PLUS Secondary Liquid Containment-Soil Liner	Reduced Seepage Concrete with waterstop PLUS Secondary Liquid Containment-Geomembrane Liner Note 2	Reduced Seepage Concrete with waterstop PLUS Secondary Liquid Containment-Foundry Sand Liner
	A	B	C	D
Concrete Component	ACI-350	Design Requirement: ACI-318, ACI-330R, or ACI-360R		
Drainage Layer	—	Drainage layer with a minimum of twelve (12) inches of clean stone between the concrete liner and the secondary liquid containment liner.		
Soils of the Secondary Liquid Containment				
Fines	—	≥ 40%	**No Soil Component or Sub-liner is required for secondary containment system**	Foundry sand
Plasticity Index (PI)	—	≥ 12		—
Thickness (bottom and sides)	—	1.5 feet		1.5 feet
Compaction of Placed Material	—	WI Spec 204		WI Spec 204
Separation Distances				
Sinkhole or other Karst Features	250 feet	250 feet	250 feet	250 feet
Well	100 feet	100 feet	100 feet	100 feet
Subsurface Saturation	2 feet	4 feet	3 feet	4 feet
Bedrock	1.5 feet	3 feet	2 feet	3 feet
Impoundment				
Inside Side Slopes	2.5:1 or flatter	2.5:1 or flatter	2.5:1 or flatter	2.5:1 or flatter

Note 1 Separation distance assumes a concrete thickness of 6 inches. Increase separation distance when slab thickness is greater than 6 inches by an equal amount.

Note 2 Design geomembrane secondary containment with the Design, Materials, Subgrade Preparation, Penetrations, and Cover Soil sections of WI NRCS CPS 521- Pond Sealing or Lining- Geomembrane or Geosynthetic Clay Liner (Additional Criteria for Waste Storage Facilities of CPS-521 does not apply)

Additional Criteria for Clean Water Applications

Liners for clean water applications shall be according to Table 2, Reduced Seepage Concrete with waterstop or Reduced Seepage Concrete - soil composite. No sub-liner soil is required.

Determine the plasticity index (PI) in accordance with ASTM D4318 and the percent fines in accordance with ASTM D1140. Place the concrete in intimate contact with the foundation soil. Design floors and slabs to be a minimum of 5 inches thick with reinforcing consisting of #4 bars spaced at 18 inches on center each way. No control or expansion joints are required. Maintain continuous reinforcing steel through all construction joints.

CONSIDERATIONS

Consider texturing concrete surfaces to provide traction for rubber-tired equipment. Texturing may not compromise the integrity of the liner.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for a concrete liner for a pond or a waste storage impoundment that describe the requirements for applying the practice to achieve its intended purpose. This should include:

- Soils investigation, including subgrade.
- Concrete and reinforcing requirements.
- Quantities of concrete and reinforcement as specified.
- Subgrade preparation, materials and compaction.
- Construction and material specifications.
- Safety requirements.
- Applicable Wisconsin Construction Specifications

OPERATION AND MAINTENANCE

Maintenance activities required for this practice consist of those operations necessary to prevent and/or repair damage to the concrete liner. This includes, but is not limited to:

- Visually inspecting liner annually.
- Excluding animals.
- Repairing damage to concrete liner, as necessary. Repairing liner to its original condition.
- Preventing damage from roots of tree and large shrubs by removing such vegetation at first appearance.
- Preventing and/or repairing rodent damage to concrete subgrade.

REFERENCES

American Concrete Institute (ACI), Farmington Hills, MI

ACI 318, Building Code Requirements for Reinforced Concrete

ACI 330R, Guide for the Design and Construction of Concrete Parking Lots

ACI 350, Appendix H, Requirements for Environmental Concrete Structures, Slab-on-Soil

ACI 360, Design of Slabs on Grade

DEFINITIONS

Bedrock – The solid or consolidated rock formation typically underlying loose surficial material such as soil, alluvium or glacial drift. Bedrock includes but is not limited to limestone, dolomite, sandstone, shale and igneous and metamorphic rock. Although solid or consolidated bedrock can sometimes be removed with typical excavation equipment, these materials are included in this definition of bedrock.

Construction Joints – These joints are used where a fresh pour of concrete abuts an existing recent pour. Construction joints where the steel is continuous through the joint are considered to be monolithic if constructed properly.

Control Joints – Control joints are used to control the location of cracks caused by concrete shrinkage during setting and thermal changes. Steel reinforcement is interrupted in control joints with embedded waterstop. (Includes expansion, contraction, and isolation joints).

Environmental Structure – Any structure intended for conveying, storing, or treating water, wastewater, or other liquids and nonhazardous materials, such as solid waste, and for secondary containment of hazardous liquids or solid waste and designed to be liquid-tight, with minimal leakage under normal service conditions.

Expansion Joints (Expansion or contraction joints) – These joints are used to prevent crushing of abutting concrete or other structural units due to compressive forces developed during expansion caused by high temperature.

Hydraulic structure – Any structure subjected to hydrostatic or hydrodynamic pressures, either externally or internally.

Impoundment – A waste storage facility constructed of earthen embankments and/or excavations for the purpose of storing waste. An impoundment may be lined or unlined.

Intimate Contact – Direct contact between liner materials (concrete, GCL, and geomembrane) and soil.

Isolation Joint – Joint installed to separate one section of concrete from another. Isolation joints prevent transfer of loading from one section to another, and allow movement to occur between a concrete slab and adjoining columns or walls. They also separate new concrete from existing or adjacent construction which might expand, contract, or settle at different rates.

Karst features – Refers to areas of land underlain by carbonate bedrock (limestone or dolomite). Typical land features in karst areas include sinkholes, network of interconnected fissures, fractures, disappearing streams, closed depressions, blind valleys, caves, and springs. See the companion document in Chapter 10 of the AWMFH for additional discussion of karst features.

Sinkholes – Closed, usually circular depressions which form in karst areas. Sinkholes are formed by the downward migration of unconsolidated deposits into solutionally enlarged openings in the top of bedrock.

Structure – A waste storage facility consisting of constructed surfaces, tanks, or walls for the purpose of storing waste above or below the ground surface. Structures may be constructed of concrete, steel, wood or other construction materials.

Sub-Liner Soil – The soil directly below the bottom of the liner. This may be placed or in situ material.

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD
POND SEALING OR LINING – GEOMEMBRANE OR GEOSYNTHETIC CLAY LINER
CODE 521
(Ft.^{2})

DEFINITION

A liner for an impoundment constructed using a geomembrane or a geosynthetic clay material.

PURPOSE

This practice is applied to:

- Reduce seepage losses from an impoundment for water conservation.
- Protect soil and water from contaminants.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where in-place natural soils have excessive seepage rates.

CRITERIA

General Criteria Applicable to all Purposes

Design. The facility to be lined must meet all applicable NRCS standards. All inlets, outlets, ramps, and other appurtenances may be installed before, during, or after the liner placement, but must be done in a manner that does not damage or impair the proper operation of the liner.

Design and install the liner in accordance with manufacturer's recommendations and applicable specifications, found in Tables 3 and 4.

Follow manufacturer's recommendations with regard to protection from weather and ultraviolet exposure.

Design liners to withstand all anticipated internal and external loads, and resist agitation scouring.

Materials. Geomembrane and geosynthetic clay liner (GCL) materials must meet the requirements in Tables 1 – 4.

Safety. Include appropriate safety features in the design to minimize the hazards of the completed pond facility. Use warning signs, fences, ladders, ropes, bars, rails, and other devices, as appropriate, to ensure the safety of humans, wildlife, and livestock.

Underliner Drainage and Venting. Design the drainage and venting system beneath the geomembrane liner based on subsurface conditions such as soil type and groundwater levels. Liners used for waste storage require venting at the top of slope. For clean water applications, incorporate a drainage and venting system when conditions exist that may result in floating of the geomembrane liner. Ponds with an underliner drainage system must have a bottom slope of at least 1 percent.

Do not install a drainage layer or venting system beneath a GCL, as they could compromise the liner.

Table 1. Minimum Geomembrane Thickness Criteria

Type	Name	Minimum Thickness	
		Manure & Wastewater	Clean Water
HDPE	High Density Polyethylene	60 mil [Note 1]	30 mil
LLDPE	Linear Low Density Polyethylene	60 mil	30 mil
LLDPE-R	Reinforced Linear Low Density Polyethylene	Not Applicable	24 mil
PVC	Polyvinyl Chloride	Not Applicable	30 mil
EPDM	Ethylene Propylene Diene Terpolymer	60 mil	45 mil
FPP	Flexible Polypropylene	Not Applicable	30 mil
FPP-R	Reinforced Flexible Polypropylene	Not Applicable	24 mil
PE-R	Reinforced, Slit – Film, Woven Polyethylene	Not Applicable	24 mil

[Note 1] 1 mil = 1/1000 of an inch

Table 2. Minimum Bentonite Content for Geosynthetic Clay Liners

Type	Minimum Bentonite Content	
	Manure & Wastewater	Clean Water
GCL	0.75	

Table 3. Reference Specifications for Geomembranes

Type	Applicable Specification
HDPE	WI FOTG Construction Specification 202, Polyethylene Geomembrane Lining
LLDPE	WI FOTG Construction Specification 202, Polyethylene Geomembrane Lining
LLDPE-R	NRCS Material Specification 594, Geomembrane Liner
PVC	NRCS Material Specification 594, Geomembrane Liner
EPDM	WI FOTG Construction Specification 205, Ethyl Propylene Diene Monomer (EPDM) Geomembrane Lining
FPP	NRCS Material Specification 594, Geomembrane Liner
FPP-R	NRCS Material Specification 594, Geomembrane Liner
PE-R	NRCS Material Specification 594, Geomembrane Liner

Table 4. Reference Specifications for Geosynthetic Clay Liners

Reference Specifications for Geosynthetic Clay Liners	
Type	**Applicable Specification**
GCL	WI FOTG Construction Specification 203, Geosynthetic Clay Liner

Groundwater and Leakage Drainage. If a soil investigation indicates that the groundwater level may be near the invert elevation of the pond, install groundwater monitoring wells to verify the expected water table location. Use NRCS Conservation Practice Standard (CPS) Monitoring Well (CPS 353). In some situations, monitoring wells may need to be installed for a year or more to determine the groundwater levels and gather enough information to properly determine the required flow capacity of the drainage system. If the monitoring wells indicate a seasonal high water table within 2 feet of the pond bottom, install subsurface or other type of drainage to control the potential uplift pressures.

Gas Venting. All pond liners with anchor trenches require venting near the top of the side slopes. Design and install venting in accordance with the manufacturer's recommendations, with a spacing not to exceed 20 feet between vents. Investigate the need for additional venting beneath wastewater pond liners as part of the design. If the investigation determines the potential of gas buildup under the liner, the liner must be vented in accordance to the manufacturer's recommendations. Site conditions conducive to gas production include sites which have been subject to long-term seepage of animal waste into the foundation soil, sites with naturally occurring organics in the soil, or fine-grained foundation soils where fluctuating groundwater levels may trap gases present in the soil. If site conditions are determined to be conducive to gas production, the bottom of the liner must include features to allow gas to flow along the bottom and up the side slopes to the liner vents in the crown.

Subgrade Preparation. Prepare the subgrade to conform to manufacturer's recommendations. The subgrade materials must be free from sharp, angular stones, and the surface free from oversized particles, or any objects that could damage the liner. The subgrade surface must provide a smooth, flat, and unyielding foundation for the liner. Do not use sub-liner soil that contains sharp, angular stones or any objects that could damage the liner. No standing water, mud, vegetation, snow, frozen subgrade, or excessive moisture may be present at the time of liner placement. The maximum allowable particle size of sub-liner soil is 3/8 inch for geomembrane liners and 1/2 inch for GCLs.

Liner protection. Protect liners from mechanical damage from all sources, including equipment access points and agitation operations. If pond management plans indicate locations where agitation operations may result in abrasion or other mechanical damage to the liner, provide protective measures. Measures to ensure the integrity of the liner include increasing the liner thickness above the minimum values listed in table 1 or providing protective ramps and aprons at agitation locations. For GCL liners, analyze the wastewater, subgrade soil, and cover soil to ensure that undesirable cation exchange (calcium and magnesium for sodium) will not occur in the GCL.

Anchorage. Anchor the liner to prevent uplift due to wind or slippage down the side slope, in accordance with manufacturer's recommendations.

Penetrations. Install penetrations through the liner in accordance with manufacturer's recommendations. Penetrations associated with waste storage must be watertight.

Cover Soil. PVC and GCL liners shall be covered with a minimum of 12 inches of soil, with an additional 12 inches on side slopes, unless protected from erosion for a total of 24 inches of soil measured perpendicular to the finished surface (see Table 6). Cover soil may be used on other liners but is not required unless essential for the proper performance, protection, and durability of the installation. Do not use cover soil that contains sharp, angular stones or any objects that could damage the liner. The maximum allowable particle size of soil cover material is 3/8 inch for geomembrane liners and 1/2 inch for GCLs. Use cover materials that are stable against slippage down the slope under all operational and exposure conditions, such as rapid drawdown or saturation by precipitation or snowmelt.

Place cover soil within 24 hours after placement of the liner to minimize the potential for damage from various sources, including precipitation, wind, and ultraviolet light exposure.

Cover soil for GCLs must provide uniform confinement pressure as recommended by the manufacturer.

Additional Criteria for Waste Storage Facilities.

Table 5 and 6 summarizes the liner and separation distance requirements for waste storage facilities. Table 7 describes sub-liner soil requirements. All waste storage facilities shall also meet the requirements of Wisconsin Conservation Practice Standard (WI CPS) Waste Storage Facility (WI CPS 313). Wisconsin Construction Specifications 202, 203, 204 and 205 contain construction requirements for geomembrane and geosynthetic clay liners. All designs must meet these requirements.

The geomembrane shall be installed with intimate contact to the soil below. Intimate contact does not exclude the use of trenches for gas venting or leak detection. The plasticity index (PI) shall be determined in accordance with ASTM D4318 and the percent fines in accordance with ASTM D1140.

The geomembrane must have a leak detection line to a free outlet or observation well.

The leak detection line must enter into an observation pumping port with gravity outlet discharging to the surface. This port must be monitored for discharge, for flow depth and pollutants. If pollutants are identified, the gravity outlet must be clocked and the port pumped until the source is identified and repairs can be completed. Evaluate the effects of out-letting to perennial or intermittent waterways.

Poured-in-place concrete slabs shall meet requirements of WI CPS Pond Sealing or Lining – Concrete (WI CPS 522), if the geomembrane will be joined to the concrete. All connections between the geomembrane and concrete shall be liquid tight and structurally sound.

Liner protection installation over the geomembrane shall be completed by methods that will maintain the integrity and performance of the liner. Liner protection placed on top of the geomembrane shall be structurally sound, but liquid-tightness is not required. Concrete liner protection poured on top of the geomembrane shall be separated from the geomembrane by a sacrificial layer of the same weight geomembrane and a cushioning layer of 10 oz/sy non-woven geotextile. The sacrificial layer shall not be welded to the geomembrane liner. Liner protection placed on slopes shall be designed with provisions to ensure stability.

Sand bedding may be used in conjunction with a geomembrane liner, but the design must include a method to remove sand from the waste stream before it enters the waste storage facility. Multiple liners may be installed to address the accumulation of sand in the waste storage facility.

Use WI CPS 313 criteria to determine subsurface saturation and bedrock depth.

Sub-Liner Soils. Sub-liner soil requirements are listed in Table 7. These sub-liner soils can be placed or in situ materials. There is no compaction requirement for in situ materials. Sub-liner soil is required under the footprint of all waste storage facilities. For structures, the sub-liner soil must be wrapped around to the top of the footing to provide continuous protection. For pre-engineered structures, requirements for sub-liner soil configurations are included in the approval letter for the manufacture, written by the SCE.

Sub-liner soil thickness is in addition to any soil liner or soil cover requirement.

Table 5. Geomembrane Liner System Criteria for Waste Storage Facility Impoundments [Note 1]

Liner Material		
Geomembrane Component	See Table 1	
Soil Component		
% Fines	≥ 40%	≥ 40%
Plasticity Index (PI)	≥ 7	—
Thickness	≥ 2 feet	≥ 4 feet
Compaction of Placed Material	WI FOTG Construction Specification 204, Earthfill for Waste Storage Facilities	
Subgrade preparation requirements	WI FOTG Construction Specification 202, Polyethylene Geomembrane Lining and 205, Ethyl Propylene Diene Monomer (EPDM) Geomembrane Lining	
Sub-Liner Soil (Soil Directly Below Soil Component)		**See Table 7**
Separation Distances		
Well Distance [Note 2]	≥ 250 feet	≥ 250 feet
Sinkholes or Other Karst Features	≥ 400 feet	≥ 400 feet
Subsurface Saturation	≥ 4 feet	≥ 6 feet
Bedrock	≥ 4 feet	≥ 6 feet
Impoundment		
Inside Slope	2.5:1 or flatter.	
Other		
Liner Protection Required	Agitation and pumping locations	Minimum dimension of 20 feet wide x 30 feet long x 4 inches thick concrete pad or sump in bottom and 20 feet wide ramp with 18-inch curb to the top of the facility with provisions for liner integrity. Ramps shall be located to be accessible to the agitation equipment used.
	Scraping and other mechanical means of removing solids and sand	Protect with hard surfacing designed for the expected conditions and loads.
Vent system	Required for all facilities. The system shall be designed in such a manner to vent gas from the system. Waste and runoff shall be prevented from entering the venting system. Liquid detection points may be installed as part of the system.	
Liner Installation	WI FOTG Construction Specification 202, Polyethylene Geomembrane Lining and 205, Ethyl Propylene Diene Monomer (EPDM) Geomembrane Lining	

[Note 1] This liner may be used to meet the requirements of Wisconsin Administrative Code, Chapter NR 213 (NR 213), with additional restrictions (e.g. soils investigations, separation distances, liner properties, maintenance requirements). See NR 213 and WI AWMFH 313 companion document.

[Note 2] Community water system wells may require larger separation distances (see Wisconsin Administrative Code, Chapter NR 811 (NR 811)).

Table 6. Geosynthetic Clay Liner (GCL) System Criteria for Waste Storage Facility Impoundments [Note 1]

Liner Material		
Geosynthetic Clay Liner Component	See Table 2 and 4. Non-woven needle punched. Manufacturer's specifications and WI FOTG Construction Specification 203, Geosynthetic Clay Liner.	
Soils Component		
% Fines	≥ 40%	≥ 40%
Plasticity Index (PI)	≥ 7	—
Thickness (from bottom and sides)	≥ 2 feet	≥ 4 feet
Compaction of placed material	WI FOTG Construction Specification 203, Geosynthetic Clay Liner	
Liner Cover Material Thickness		
Bottom	≥ 1 foot	≥ 1 foot
Side Slopes	≥ 2 feet	≥ 2 feet
Compaction of Placed Materials	WI FOTG Construction Specification 203, Geosynthetic Clay Liner	
Sub-Liner Soil (Soil Directly Below Soil Component)		**See Table 7**
Separation Distances		
Well Distance [Note 2]	≥ 250 feet	≥ 250 feet
Sinkholes or Other Karst Features	≥ 400 feet	≥ 400 feet
Subsurface Saturation	≥ 4 feet	≥ 6 feet
Bedrock	≥ 4 feet	≥ 6 feet
Impoundment		
Inside Slope [Note 3]	3:1 or flatter	
Other		
Liner Protection	Agitation and Pumping Locations	Minimum dimension of 20 feet wide x 30 feet long x 4 inches thick concrete pad or sump in bottom and 20 feet wide ramp or a 16 feet wide ramp with 18-inch high curb to top of facility. GCL continues under the concrete pad or sump. Poured in place concrete slabs shall meet requirements of WI CPS 522.
	Scraping and Other Mechanical Means of Removing Solids and Sand	Sand bedding may be used in conjunction with a geosynthetic clay liner, but the design must include a method to remove sand from the waste stream before the waste is stored in the liner or the liner must be protected to allow mechanical removal of the sand. Poured in place concrete slabs shall meet requirements of WI CPS 522.
Liner Installation	WI FOTG Construction Specification 203, Geosynthetic Clay Liner.	

[Note 1] This liner may be used to meet the requirements of NR 213, with additional restrictions (e.g. soils investigations, separation distances, liner properties, maintenance requirements). See NR 213 and WI AWMFH 313 companion document.

[Note 2] Community water system wells may require larger separation distances (see NR 811).

[Note 3] The GCL and soil cover shall be stable at the designed side slope.

Table 7. Sub-Liner Soil Requirements for Waste Storage Facility Impoundments

	Minimum Soil Requirements			
	A	B	C	D
% Fines	≥ 20%	≥ 20%	≥ 40%	Foundry Sand [Note 1]
Plasticity Index (PI)	≥ 7	—	≥ 12	—
Thickness (bottom and sides)	≥ 1.5 feet	≥ 2 feet	≥ 8 inches	≥ 1.5 feet
Compaction of Placed Material	WI Spec 204	WI Spec 204	WI Spec 300	WI Spec 204

[Note 1] The foundry sand must be ferrous foundry sand with only minimal concentrations of hazardous constituents, cores and other oversize materials crushed or removed, and at least 5% bentonite content. A site specific WDNR approval is required under Wisconsin Administrative Code, Chapter NR 538 (NR 538) that may specify greater separation distances and parameters not addressed by this standard. An NR 538 Category I or II ferrous foundry sand may be appropriate.

CONSIDERATIONS

Designs for waste storage facilities should consider leakage through the liner due to liner damage. Giroud and Bonaparte (1989) recommends designing the drainage system based on a frequency of one hole (0.16 square-inch) per acre of surface area. Therefore, drainage and venting systems are strongly recommended for all waste storage facilities.

Minimize the number of penetrations through the liner for pond management appurtenances. Detail the trenching and backfilling of pipes to prevent charging of the underside of the liner with subsurface water.

For HDPE liners associated with waste water with penetrations over 2 inches in diameter, consider using concrete pads matching the slope with embedded channels to connect the liner, instead of manufactured boots.

PVC geomembranes are not recommended for aquatic production. The stabilizers in the PVC liner material leach out and may be harmful to aquatic species. Consult with manufacturers before selecting a geomembrane material used for aquatic production.

Where access is needed, consider installing concrete ramps with embedded channels to connect the liner. Pond corners are typically good locations for concrete ramps due to the flatter slopes. Consider placing the access ramp at a corner location.

If the entire waste storage pond is lined and access is needed on the bottom, consider placing concrete over the liner, bedded with geotextile.

Consider the use of a geosynthetic such as a geonet or geocomposite under the liner to facilitate collection, drainage of liquids, and venting of gas. If geocomposite materials are used for drainage and/or venting, use materials recommended by the manufacturer in the system design. Use Geosynthetic Research Institute (GRI) Standard GC8, “Standard Guide for the Allowable Flow Rate of a Drainage Geocomposite” to determine the allowable flow rate of the geocomposite. Slope the pond bottom a minimum of 1 percent to permit positive flow of the liquids or gases. In most cases, the geocomposite will serve both purposes of drainage and venting. For large impoundments, the bottom may need to be sloped in multiple directions in order to decrease the required drainage and venting flow travel distances.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for a geomembrane or GCL for a pond or a waste storage impoundment that describe the requirements for applying the practice to achieve its intended purpose. This should include:

- Layout of the containment facility, collection points, waste transfer locations or pipelines, and topography of the site.
- Soils investigation and subgrade details, including tolerances on smoothness of the finished grade.
- Required properties of selected liner, geosynthetics, and cushion materials.
- Quantities of liner materials, cover soil, and geosynthetic materials as needed.
- Subsurface drainage and venting details.
- Construction and material specifications.
- Safety requirements for installed liner.
- Details of liner installation, seaming requirements, and requirements for attachments and appurtenances.
- Minimum qualifications of installers and quality control testing requirements.
- Warranty requirements, if desired.
- Fence and signage requirements, if required.
- Applicable Wisconsin Construction Specifications

OPERATION AND MAINTENANCE

Prepare a plan for O&M of the liner and facility consistent with the purposes of the type of liner chosen, intended life, safety requirements, and design criteria. Include site-specific information regarding design capacity and liquid level of the facility and repair procedures for liner material. Maintenance activities required for this practice consist of those operations necessary to prevent and repair damage to the geomembrane or GCL. These include, but are not limited to:

- Excluding animals and equipment from the treated area.
- Repairing damage to the liner and restoring the liner and cover to its original thickness and condition.
- Removing roots from trees and large shrubs at first appearance.
- Monitoring leak-detection system.
- Protecting the liner during filling and agitation procedures.
- Provide guidance on items to inspect periodically, including:
- Visible portions of the liner for tears, punctures, or other damage.
- Liner interface with inlets, outlets, ramps, or other appurtenances for damage.
- Liquid level in the facility.
- Ballooning of the liner indicating presence of gas beneath the liner.

REFERENCES

ASTM D 5887, Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter.

ASTM D 5890, Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners.

ASTM D 5891, Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners.

ASTM D 5993, Test Method for Measuring of Mass Per Unit of Geosynthetic Clay Liners.

ASTM D 6102, Guide for Installation of Geosynthetic Clay Liners.

ASTM D 6214, Test Method for Determining the Integrity of Field Seams Used in Joining Geomembranes by Chemical Fusion Methods.

ASTM D 6392, Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.

ASTM D 6497, Guide for Mechanical Attachment of Geomembrane to Penetrations or Structures.

ASTM D 7176, Specification for Non-Reinforced Polyvinyl Chloride (PVC) Geomembranes Used in Buried Applications.

ASTM D 7272, Test Method for Determining the Integrity of Seams Used in Joining Geomembranes by Pre-manufactured Taped Methods.

ASTM D 7408, Specification for Non Reinforced PVC (Polyvinyl Chloride) Geomembrane Seams.

ASTM D 7465, Specification for Ethylene Propylene Diene Terpolymer (EPDM) Sheet Used in Geomembrane Applications.

Daniel, D.E., and R.M. Koerner. 1993. Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities. EPA/600/R-93/182 (NTIS PB94-159100).

Geosynthetic Research Institute, GRI Standard GC8, Standard Guide for the Allowable Flow Rate of a Drainage Geocomposite.

Geosynthetic Research Institute, GRI Test Method GT12(a) – ASTM Version, Test Methods and Properties for Nonwoven Geotextiles Used as Protection (or Cushioning) Materials.

Geosynthetic Research Institute, GRI Test Method GM13, Standard Specification for Test Methods, Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes.

Geosynthetic Research Institute, GRI Test Method GM17, Standard Specification for Test Methods, Test Properties and Testing Frequency for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes.

Geosynthetic Research Institute, GRI Standard GM18, Standard Specification for Test Methods, Test Properties and Testing Frequencies for Flexible Polypropylene (fPP and fPP-R) Nonreinforced and Reinforced Geomembranes.

Geosynthetic Research Institute, GRI Test Method GM19, Standard Specification for Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes.

Geosynthetic Research Institute, GRI Test Method GM21, Standard Specification for Test Methods, Properties, and Frequencies for Ethylene Propylene Diene Terpolymer (EPDM) Nonreinforced and Scrim Reinforced Geomembranes.

Geosynthetic Research Institute, GRI Test Method GM25, Standard Specification for Test Methods, Test Properties and Testing Frequency for Reinforced Linear Low Density Polyethylene (LLDPE-R) Geomembranes.

Giroud, J.P., and R. Bonaparte. 1989. Leakage through liners constructed with geomembranes—Part 1. Geomembrane Liners. In Geotextiles and Geomembranes, vol. 8, pgs. 27–67.

Koerner, R.M. 2005. Designing with Geosynthetics, 5th ed. Pearson Prentice Hall, Upper Saddle River, NJ.

U.S. Department of Agriculture, Natural Resources Conservation Service. National Engineering Handbook, Part 642, Specifications for Construction Contracts.

U.S. Department of Agriculture, Natural Resources Conservation Service. National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook. (AWMFH)

U.S. Department of Agriculture, Natural Resources Conservation Service. Conservation Practice Standard Monitoring Well (Code 353).

DEFINITIONS

Bedrock – The solid or consolidated rock formation typically underlying loose surficial material such as soil, alluvium or glacial drift. Bedrock includes but is not limited to limestone, dolomite, sandstone, shale and igneous and metamorphic rock.

> *Note: Although solid or consolidated bedrock can sometimes be removed with typical excavation equipment, these materials are included in the above definition.*

Clean Water – Water that has not been mixed with manure, wastewater or other contaminants

Geomembrane – Very low permeability synthetic membrane liner or barrier used with any geotechnical engineering related material so as to control fluid migration in a man-made project, structure or system. (ASTM D 4439)

Geosynthetic Clay Liner (GCL) – A manufactured hydraulic barrier consisting of clay bonded to a layer or layers of geosynthetic materials.

Impoundment – A waste storage facility constructed of earthen embankments and/or excavations for the purpose of storing waste. An impoundment may be lined or unlined.

Intimate Contact – Direct contact between liner materials (concrete, GCL, and geomembrane) and soil.

Karst features – Refers to areas of land underlain by carbonate bedrock (limestone or dolomite). Typical land features in karst areas include sinkholes, network of interconnected fissures, fractures, disappearing streams, closed depressions, blind valleys, caves, and springs. See the companion document in Chapter 10 of the AWMFH for additional discussion of karst features.

Percent Fines (% Fines) – Percentage of given sample of soil which passes through a #200 sieve.

Permeability – The coefficient of permeability (K) is a measure of the ability of soil to transmit liquids. It is used to compute the flow rate of liquid through a soil liner for specific conditions of soil thickness and fluid head (e.g., $1x10^{-7}$ cm/s).

Plasticity Index, (PI) – A soil property indicating moldability. Measured by ASTM D4318.

Sinkholes – Closed, usually circular depressions which form in karst areas. Sinkholes are formed by the downward migration of unconsolidated deposits into solutionally enlarged openings in the top of bedrock.

Sub-Liner Soil – The soil directly below the bottom of the liner, having at least 20% fines. This may be placed or in situ material.

Structure – A waste storage facility consisting of constructed surfaces, tanks, or walls for the purpose of storing waste above or below the ground surface.

Wastewater – Milking center waste, flush water, leachate from feed holding areas, and similar waste materials generated at the animal production area.

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

SHORT TERM STORAGE OF ANIMAL WASTE AND BY-PRODUCTS

CODE 318
(FT.^{3})

DEFINITION

Temporary, non-structural measures used to store solid or semi-solid, organic agricultural waste or manure (stackable livestock and poultry manure, bedding, litter, spilled feed, or soil mixed with manure) on a short-term basis between collection and utilization.

PURPOSE

Apply this practice to achieve one or more of the following purposes:

- Temporarily stockpile or store manure in an environmentally safe manner for improved nutrient utilization and conservation.
- Provide the agricultural operation management greater flexibility in nutrient utilization.
- Protect surface and groundwater resources.
- Reduce energy use.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where a Comprehensive Nutrient Management Plan (CNMP) or a nutrient management plan (NMP) has been developed and where a temporary stockpile or storage is needed because:

- Clean out of animal housing facilities or transfer of manure is required at a time when the manure cannot be readily land applied due to weather, soil conditions, or farm management requirements.
- Daily spreading operations are not possible when weather or cropping conditions are not appropriate for field spreading.
- Land area is limited and split applications of manure nutrients are required for proper nutrient management and water quality protection.
- Temporary stockpiling of solid manure is needed until it is applied to the field where it is stockpiled or transferred off-site.
- Imported organic material is temporarily stored on farm for the purpose of Wisconsin NRCS Conservation Practice Standard (WI NRCS CPS) Waste Recycling (Code 633).

This practice does not apply to the short-term management of human waste or animal mortality.

For long-term stockpile periods (greater than 30 days) in animal production areas, use WI NRCS CPS Waste Storage Facility (Code 313), Table 6.

CRITERIA

General Criteria

Laws and Regulations. Plan, design, and implement the practice to meet all federal, state, and local laws and regulations.

Nutrient Utilization. Utilize nutrients in the amounts, at the location, at the identified rates, and at the specified time consistent with the requirements of WI NRCS CPS Nutrient Management (Code 590).

Consistency. Waste stockpiled will be of a consistency that permits stacking and pile formation. Total solids (manure solids plus bedding or amendments) will be greater than 25 percent. Waste having a lower percentage of solids may be acceptable with verification that suitable pile formation is achievable. For the purpose of this standard, stackable solids are defined as the ability to maintain at least a 4 foot high stack, with a 4:1 angle of repose or steeper, in a non-frozen state.

Criteria Applicable To Temporary Field Stockpile Areas

Locate the storage pad on a site-specific basis to minimize seepage and meet conditions and functional requirements. Table 1 contains siting requirements for these facilities. Use WI NRCS CPS Waste Storage Facility (Code 313) criteria to determine subsurface saturation and bedrock depth.

The separation distance between stacks shall be at least 100 feet. Provide positive drainage away from the field stockpile area in all directions. Protect adjacent infrastructure and water bodies such as ponds, streams, and springs from runoff.

Maintain at least 30 feet of vegetative buffer on the downslope side of the stockpile storage area for filtering solids in the runoff. A manure stockpile may be placed in a fallow field when appropriately sited.

Provide adequate germination of newly established buffers prior to stockpile formation. Install a sediment barrier (synthetic silt fence or hay bales) around the pile if vegetation is not well established.

Maintain the stockpile so that no dust and debris transport to waters or drainage ways occurs.

Seed all disturbed areas beyond the edges of the stored manure to an approved vegetative cover.

Size. Design field stockpile storage areas to store the manure until it can be utilized as identified in the CNMP or NMP. Base the size on the required manure utilization schedule.

The manure stockpile area may be at one or more locations and will have sufficient area to store accumulated manure. Consider manure consistency and moisture characteristics when locating and sizing the manure stockpile area.

Soils and Foundation. Perform the stacking operations on a firm, uniform surface. When compaction of on-site soils alone are not adequate to resist rutting from normal equipment operation, select a more suitable site or use WI NRCS CPS Waste Storage Facility (Code 313).

Covering. When specific site and local conditions or regulations require covers, cover field stacked manure or store in geotextile bags.

Acceptable materials include geotextiles (tarps) that shed rainfall and allow transpiration, opaque plastic or polyethylene sheeting having a minimum thickness of 6 mils, or other water resistant material.

Ensure that the cover is placed over the pile with care to prevent tearing. Provide a minimum of 24 inches of overlap. Use weights, anchors or other tie down mechanisms to anchor the cover and prevent tearing during high winds. Place screw type anchors on 2-foot centers around the pad.

Table 1. Temporary, Unconfined Stacks of Manure and Derivatives Outside the Animal Production Area [Note 1]

Waste Consistencies		
	≥ 25% Solids	**< 25% and Stackable Solids**
Size & Stacking Period		
Stacking Period	180 Days	180 Days
Maximum Volume/Stack [Note 2]	≤ 40,000 cu. feet	≤ 15,000 cu feet
Maximum Number of Stacks/40 acres	–	2
Maximum Stack Height	7 feet	7 feet
Frequency of Stacking Site Use [Note 3]	1 year out of 2	1 year out of 3
Hydrologic Soil Groups		
	B, C, or D	B, C, or D
Subsurface Separation Distance		
Subsurface Saturation	≥ 3 feet	≥ 3 feet
Bedrock	≥ 3 feet	≥ 5 feet
Surface Separation Distance		
Wells [Note 4]	≥ 250 feet	≥ 250 feet
Lakes	≥ 1,000 feet	≥ 1,000 feet
Sinkholes or other Karst Features	≥ 1,000 feet	≥ 1,000 feet
Quarries	≥ 1,000 feet	≥ 1,000 feet
Streams	≥ 300 feet	≥ 500 feet
Wetlands and Surface Inlets	≥ 300 feet	≥ 500 feet
Areas of Concentrated Flow	≥ 100 feet	≥ 300 feet
Land Slope Down Gradient of Stack	≤ 6%	≤ 3%
Floodplain	≥ 100 feet	≥ 300 feet
Public Roads, or Neighboring Residences	≥ 100 feet	≥ 100 feet
Tile lines	≥ 40 feet	≥ 40 feet

[Note 1] This table may not meet the requirements of Wisconsin Administrative Code, Chapter NR 243, and additional or different criteria may apply.

[Note 2] 1.24 cubic feet = 1 bushel.

[Note 3] New stacks shall be located outside of the footprint of the previous year's stack.

[Note 4] Community water system wells may require larger separation distances (see Wisconsin Administrative Code, Chapter NR 811).

CONSIDERATIONS

Divert non-polluted runoff around the storage facility site to the fullest extent possible. Consider runoff from the covering in water management planning around the stockpile site.

To reduce migration of nutrients into the soil, consider spreading a bedding layer of compost, sawdust or similar material prior to stockpile formation.

Consider monitoring the temperature of the manure stack to ensure temperature does not reach unsafe levels.

Where material is spread on land not owned or controlled by the producer, a nutrient management plan establishing environmentally acceptable utilization of the material is recommended.

Due consideration should be given to environmental concerns, economics, the overall waste management system plan, and safety and health factors.

Considerations for Site Selection

Consider the following factors in selecting a site for manure stockpile areas:

- Proximity of the manure stockpile storage facility to its source and land application area;
- Access to other facilities;
- Ease of loading and unloading manure;
- Adequate maneuvering space for operating loading and unloading equipment.
- Appropriate health regulations;
- Compatibility with respect to prevailing winds and landscape elements such as building arrangement, landforms, and vegetation, in order to minimize odors and protect aesthetic values.

Considerations for Improving Air Quality

Maintain appropriate manure moisture content for solid manure stockpile facilities. Excessive moisture will increase the potential for air emissions of volatile organic compounds, ammonia, and nitrous oxide, and may lead to anaerobic conditions, which will increase the potential for emissions of methane and hydrogen sulfide. Too little moisture will increase the potential for particulate matter emissions, although covering the stockpile will reduce that potential.

Some fabric covers are effective in reducing odors.

PLANS AND SPECIFICATIONS

Plans and specifications shall describe the requirements for applying this practice. As a minimum, include in the engineering plans, specification, and reports the following:

- Plan view of stockpile location(s) and layout. A plan map showing the location of all stockpile areas, access roads to these areas, slopes, surfaces to be graded, necessary cuts and fills, and location of sensitive areas such as wells, springs, streams, and floodplains, with setback distances from water bodies, streams, sinkholes, etc.
- Stockpile period. The stockpile needs to be linked to the nutrient management plan/ crop rotation for the field in which the manure is stockpiled.

- Dimensions of field stockpile storage areas including length, width, and additional width for edge area for working and cover anchor, as appropriate.
- Maximum design height for stacking manure.
- Type of covering and details for anchoring the cover, as needed.
- Specifications for cover or bagging material, as needed.
- Vegetative buffer requirements.
- Quantities of stockpiled material to be managed.
- Soil and foundation findings, interpretations, and reports, as required for site suitability
- Pad and liner specifications, as required.
- Temporary erosion control measures during construction, as required.
- Odor management or minimization requirement and pest management (fly control)
- Location of utilities and notification requirements.
- Applicable Wisconsin Construction Specifications

Documentation for siting temporary, unconfined stacks of manure and derivatives outside the animal production area shall include:

- Management assessment,
- Site assessment, and
- Location maps, soils maps, and USGS quadrangle maps.

OPERATION AND MAINTENANCE

Develop an operation and maintenance plan that is consistent with the purposes of the practice and safety requirements.

Provide for the proper utilization of the stockpiled material in the plan. Include the requirement that manure will be removed from the stockpile and utilized at locations, times, rates, and quantities in accordance with the overall waste management system plan.

Include a strategy for removal and disposition of manure with the least environmental damage during the normal stockpile period. Provide for establishment of vegetation on areas disturbed by removal of the stockpiled material.

Develop an emergency action plan where there is a potential for an accidental manure spill event. Include site-specific provisions for emergency actions that will minimize these impacts.

Include instruction for replacement of plastic or polyethylene covering which will deteriorate over time. Provide for disposal of damaged liners and covers in conformance with local laws and regulations.

Provide maintenance and reconstruction of the soil pads if soil material is inadvertently removed during the manure removal process.

Where geomembranes are used to line the pad, care must be taken during removal of the stored material to not damage the geomembrane. Insure that any needed repairs of the geomembrane are completed promptly.

Inspect and repair, as needed, the pad, cover, and adjacent area after each major storm event.

Maintain the area surrounding the field stockpile area in such a manner to prevent ponding of water and to ensure runoff is diverted from the stockpile area.

Provide instructions for record keeping for the hauling of stockpiled material from one geographical area to another including the:

- Type, and amount of material transferred;
- Solids percentage of the material;
- Date of the transfer;
- Name and address of the source and destination of the material; and
- Condition of the material as left at the destination (spread, stockpiled and covered, etc.).

REFERENCES

USDA Natural Resources Conservation Service. National Engineering Handbook. Part 651. Agricultural Waste Management Field Handbook. USDA-NRCS, Washington, DC.

USDA Natural Resources Conservation Service. Soil Survey Technical Note 6, Saturated Hydraulic Conductivity: Water Movement Concepts and Class History, USDA-NRCS, Washington, DC.

DEFINITIONS

Animal Production Area – Means any part of the livestock operation that is used for the feeding and housing of livestock. This includes the entire animal confinement and feeding area, and any adjacent manure storage areas, raw materials storage areas, and waste containment areas. This does not include pasture and cropland.

Bedrock – The solid or consolidated rock formation typically underlying loose surficial material such as soil, alluvium or glacial drift. Bedrock includes but is not limited to limestone, dolomite, sandstone, shale and igneous and metamorphic rock.

Note: Although solid or consolidated bedrock can sometimes be removed with typical excavation equipment, these materials are included in the above definition.

Hydrologic Soil Groups – Hydrologic Groups (HSG) are assigned for all soils mapped by USDA soil scientists. The HSG, designated A, B, C, or D, indicates, in general, the amount of runoff to be expected from the soil after prolonged wetting. Soils in Group A yield very little runoff because they are rapidly permeable. Soils in Hydrologic Group D take water very slowly and yield large amounts of runoff. See Section II of the NRCS Wisconsin Field Office Technical Guide for HSG designations.

Karst features – Refers to areas of land underlain by carbonate bedrock (limestone or dolomite). Typical land features in karst areas include sinkholes, network of interconnected fissures, fractures, disappearing streams, closed depressions, blind valleys, caves, and springs. See the companion document in Chapter 10 of the AWMFH for additional discussion of karst features.

Sinkholes – Closed, usually circular depressions which form in karst areas. Sinkholes are formed by the downward migration of unconsolidated deposits into solutionally enlarged openings in the top of bedrock.

Natural Resources Conservation Service
CONSERVATION PRACTICE STANDARD
WASTE FACILITY CLOSURE
Code 360
(No.)

DEFINITION

The decommissioning of facilities, and/or the rehabilitation of contaminated soil, in an environmentally safe manner, where agricultural waste has been handled, treated, and/or stored and is no longer used for the intended purpose.

PURPOSE

- Protect the quality of surface water and groundwater resources.
- Mitigate air emissions.
- Eliminate a safety hazard for humans and livestock.
- Safeguard the public health.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to agricultural waste storage facilities that are no longer needed as a part of a waste management system and are to be permanently closed or converted for another use.

This practice applies where impoundments that are to be converted to fresh water storage meet the current Wisconsin NRCS Conservation Practice Standard (WI CPS) to which the impoundment is proposed to be converted.

This practice applies to removal of soil contaminated by agricultural wastes that have been stored at the animal production area.

This practice does not apply to sites contaminated by materials that are considered hazardous wastes or are subject to specific clean-up criteria in state or federal laws, such as fuel or pesticides.

CRITERIA

General Criteria Applicable to all Purposes

The closure of waste facilities shall comply with all federal, tribal, state, and local laws, and rules or regulations including national pollutant discharge elimination system (NPDES) requirements.

Existing waste transfer components that convey waste to facilities or provide drainage from the facility area shall be removed and replaced with compacted earth material or otherwise rendered unable to convey waste.

Fill used for closure may include solid waste materials exempt for use pursuant to Wisconsin Administrative Code, Section NR 500.08, including used brick, building stone, concrete, reinforced concrete, broken pavement, and unpainted and untreated wood. If these materials are used, they shall be covered with at least 3 feet of clean mineral soil. The backfill height shall exceed the design finished grade by a minimum of 5 percent to allow for settlement. The top one foot of the backfill shall be constructed of the most impervious soil material readily available and mounded to shed rainfall runoff. If the area will have a soil surface, it shall also be covered with at least 3 inches of topsoil and be vegetated.

Precautions (fencing and warning signs) shall be used where necessary to ensure that the facility is not used for purposes incompatible with the facility modification.

Entry into an enclosed waste storage or waste transfer component shall not be allowed unless procedures published in ASABE Standard 470, Manure Storage Safety, are followed.

Erosion and Pollution Control. All disturbed areas shall be re-vegetated or treated with other suitable measures used to control erosion and restore the aesthetic value of the site. Sites, not suitable for re-vegetation through normal cropping practices, shall be vegetated in accordance with WI CPS Critical Area Planting (Code 342).

Measures shall be taken during construction to minimize site erosion and pollution of downstream water resources. This may include such items as silt fences, hay bale barriers, temporary vegetation, and mulching.

Liquid or Slurry Waste and Sludge (Accumulated Solids) Removal. Liquid and slurry wastes shall be agitated and pumped out to the maximum extent possible. Water shall be added as necessary to facilitate the agitation and pumping.

Remove manure and agricultural waste from the storage facility and waste transfer system to the maximum extent practicable. All manure and agricultural waste that could negatively impact water and/or air quality or pose a safety hazard shall be removed as deemed practical. All liquid, slurry, sludge, and solid waste, and soil removed from the facility shall be utilized in accordance with WI CPS Nutrient Management (Code 590) or stored in a facility meeting WI CPS Waste Storage Facility (Code 313). In lieu of field application, removed soil may also be thinly spread as topsoil at the closure location and vegetated.

During sludge removal operations, the integrity of the liner, if one is present, shall be maintained to the extent possible to minimize the volume of contaminated soil removal.

Impoundment Liner Removal.

1. Flexible membrane liners shall be:
   - Removed and properly disposed of, or
   - Cleaned and rendered unable to impound water (punctured).

   Removed flexible membrane liners may be buried within the closure with a minimum cover of 3 feet of mineral soil.

2. Concrete liners shall be:
   - Removed and properly disposed of, or
   - Cleaned and rendered unable to impound water (punctured), or
   - Cleaned and remain in place if the site grade allows rainfall to drain off the concrete surface.

   Removed concrete liners may be buried within the closure with a minimum cover of 3 feet of mineral soil.

   Foundry sand previously placed under a concrete liner in accordance with NR 538, Beneficial Use of Industrial Byproducts, will require site-specific Wisconsin Department of Natural Resources (WDNR) approval of the closure plan.

3. Constructed clay liners shall be:
    - Completely removed, or
    - Rendered unable to impound water (partially excavated), or
    - Remain in place if the site grade allows rainfall to drain off the surface.

Contaminated Soil Removal. Flexible membrane, concrete, soil liners, or in-place soils shall be systematically investigated for leaks and contaminated soils (soil mixed with waste) beneath them. When contaminated soils are found, they must be removed to the extent necessary with a minimum depth of 6 inches.

The extent (area and depth) of contaminated soil to be removed shall be determined by color, odor, or consistency of the soil indicating permeation or saturation with waste.

Additional Criteria Applicable to Impoundment Closure or Conversion

Embankment Impoundments shall be breached so that they no longer impound waste. Portions of the embankment may remain in place. The slopes and bottom of the breach shall be stable for the soil material involved, however the side slopes shall be no steeper than three horizontal to one vertical (3:1).

The embankment material can be graded into the impoundment area; compacted in accordance with Wisconsin Construction Specification 3, Earthfill; and the area vegetated for another use.

Excavated Impoundments shall be backfilled and compacted in accordance with Wisconsin Construction Specification 3, Earthfill, so that these areas may be reclaimed for other uses.

Impoundments converted to fresh water storage shall be closed in accordance with the General Criteria and converted to a use that meets the requirements as set forth in the appropriate NRCS practice standard for the intended purpose. Where the original impoundment was not constructed to meet NRCS standards, the investigation for structural integrity shall be in accordance with National Engineering Manual (NEM) 501.23. When it is not possible to remove all the sludge and contaminated soils from a waste impoundment that is being converted to fresh water storage, the impoundment shall not be used for fish production, swimming, or livestock watering until the water quality is adequate for these purposes.

Additional Criteria Applicable to Fabricated Liquid Waste Facilities

If fabricated structures are to be demolished, disassembled or otherwise altered, it shall be done to such an extent that no water can be impounded. Disassembled materials such as pieces of metal shall be temporarily stored in such a manner that they do not pose a hazard to animals or humans until their final disposition.

Demolished materials shall be buried on-site within the facility or moved off-site to locations designated for such use by state or local officials.

Under-building reception structures, channels, or storage structures may be filled with clean mineral soil, sand, or controlled low strength materials (flowable fill) after complete removal of manure. The fill shall be surfaced with concrete, gravel, or other material appropriate for the intended use following closure.

CONSIDERATIONS

Considerations include additional design recommendations that are not required criteria, but may be used to enhance or avoid problems with the design and function of this practice.

Conduct pre-closure soil and water (surface and subsurface) testing to establish base line data surrounding the site at the time of closure. Establishing baseline data can be used in the future to address soil and water issues.

Alternative methods of sludge removal may be required where the impoundments contain large amounts of bedding, sand, oyster shells, soil, or other debris.

Minimize the impact of odors associated with land applying dry wastes and with agitation, emptying, and land applying wastewater and sludge from a waste impoundment by conducting these operations at a time when the humidity is low, when winds are calm, and when wind direction is away from populated areas. Adding chemical and biological additives to the waste prior to agitation and emptying can reduce odors. Odor impacts from land application can also be mitigated by using an incorporation application method.

Minimize agitation of the wastes to only the amount needed for pumping to reduce the potential for release of air emissions.

Soil to fill excavated areas should not come from important farmlands (prime, statewide, local, and/or unique).

If large-size material or wood is used as fill, consideration shall be given to filling methods and additional thickness of clean mineral soil cover to prevent and accommodate excess settling. It may be necessary to limit the quantity of wood, because it degrades.

Waste facility closure may improve utilization and aesthetics of the farmstead.

Breached embankments may detract from the overall aesthetics of the operation. Embankments should be removed and the site returned to its original grade.

Disassembled fabricated structures may be suitable for assembly at another site. Care should be taken during closure to minimize damage to the pieces of the facility, particularly coatings that prevent corrosion of metal pieces.

To minimize potential impacts to livestock, such as nitrate poisoning, initiate a testing and monitoring program of nutrient levels in crop products, particularly livestock feeds, harvested from sites of closed animal confinement facilities.

Consider the need for special permits or procedures concerning harmful materials to demolish an adjacent or associated buildings.

PLANS AND SPECIFICATIONS

Plans and specifications for the decommissioning of abandoned waste facilities and the rehabilitation of contaminated soil shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. At a minimum, include the following:

- A plan view showing the location and extent of the practice.
- Pertinent elevations and cross sections of the existing facility and excavation limits.
- Number, capacity, and quality of facility(ies) and estimate of liner material and soil volume to be moved.
- Location of known utilities.

- Requirements for salvage and disposal of structural or liner materials.
- Vegetative requirements.
- Utilization Plan for animal wastes and soil.
- Odor management or mitigation requirement.
- Safety plan requirements. Note: Per Occupational Safety and Health Administration (OSHA) confined space entry protocol, personnel shall not enter confined space of an enclosed waste facility without breathing apparatus or taking other appropriate measures.

OPERATION AND MAINTENANCE

The proper decommissioning and rehabilitation of a waste facility should require little or no operation and maintenance. However, if it is converted to another use, such as a fresh water facility, operation and maintenance shall be in accordance with the needs as set forth in the appropriate NRCS conservation practice standard for the intended purpose.

Monitor the closed site for settlement of filled areas that may need grading to shed rainfall runoff.

REFERENCES

USDA, NRCS National Engineering Handbook (NEH), Part 651, Agricultural Waste Management Field Handbook.

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

Wisconsin Administrative Code, Department of Natural Resources, Chapter NR 500, General Solid Waste Management Requirements.

Wisconsin Administrative Code, Department of Natural Resources, Chapter NR 538, Beneficial Use of Industrial Byproducts.

American Society of Agricultural and Biological Engineers (ASABE) Standard 470, Manure Storage Safety.

Rice, J.M., D.F. Caldwell, and F.J. Humenik. Ed. 2006. Closure of Earthen Manure Structures in Animal Agriculture and the Environment: National Center for Manure and Animal Waste Management White Papers. ASABE. Pub. Number 913C0306.

DEFINITIONS

Animal Production Area – Means any part of the livestock operation that is used for the feeding and housing of livestock. This includes the entire animal confinement and feeding area, and any adjacent manure storage areas, raw materials storage areas, and waste containment areas. This does not include pasture and cropland.

Embankment Impoundments – those with a depth of waste at the design level that is three feet or more above natural ground.

WASTE TRANSFER

(No.)
Code 634

Natural Resources Conservation Service
Conservation Practice Standard

I. Definition

A system using structures, conduits or equipment to convey byproducts (wastes) from agricultural operations to points of usage.

II. Purposes

To transfer waste (manure, *manure processing derivatives*[1], *contaminated runoff*, and *wastewater*, which includes milking center waste, *leachate* from feed holding areas, and similar waste materials) in a manner which safeguards the environment. It includes transfer through a *hopper*, *reception structure*, a pump, *channel*, or permanently installed conduit to:

- A waste storage facility,
- A waste treatment facility,
- A wastewater treatment system,
- A loading area,
- Cropland.

III. Conditions Where Practice Applies

The waste transfer component is part of a planned agricultural waste management or comprehensive nutrient management system.

This practice standard applies where manure and other waste is generated by livestock production or processing, and a permanently installed conveyance system is necessary to transfer material from the source to a storage facility, treatment facility or system, loading area, or cropland. This includes moving nutrients from one geographical area with excess nutrients to a geographical area that can utilize the nutrients in an acceptable manner.

This practice standard does not apply to conveyance systems using equipment or mechanisms such as *gutters*, barn cleaners, alley scrapers, or belts for moving manure in the housing facility to the manure transfer system.

This practice standard does not apply to transfer by vehicles or temporary surface pipe or hoses from the storage facility, treatment facility or system, or loading area to the field or another storage facility.

IV. Federal, Tribal, State and Local Laws

Waste transfer systems shall comply with all federal, tribal, state and local laws, rules or regulations or permit requirements governing waste transfer. The operator is responsible for securing required permits. This standard does not contain the text of the federal, tribal, state or local laws.

V. Criteria

The following minimum criteria shall apply to all waste transfer designs.

A. General Criteria

1. Management Assessment

A management assessment shall be conducted, documented, and incorporated into the design. The assessment shall be performed with the owner/operator to explore options and to determine the purpose of transfer components, available resources, manure handling practices, and waste characteristics.

The management assessment shall address the following:

a. Waste Characterization.

   1) Sources, volumes and consistency of manure, contaminated runoff, manure processing derivatives, leachate, wastewater, and other inputs to the waste transfer system.

   2) Animal types.

   3) Bedding types and quantity.

b. Waste handling, transfer methods and duration.

c. Facility waste removal methods.

d. Access needs and limitations.

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

e. Safety needs.

f. Labor and equipment needs.

g. Odor production concerns and control strategies.

h. Aesthetics and animal health.

i. Provisions for facility expansion.

2. Site Assessment

A site assessment shall be conducted, documented, and incorporated into the design. The assessment shall be performed to determine physical site characteristics that will influence the placement, construction, maintenance, and environmental integrity of a proposed waste transfer system. The assessment shall include input from the owner/operator. The site assessment shall include the following.

a. Locations and elevations of buildings, roads, lanes, soil test pits, property lines, setbacks, easements, wells, springs, floodplains, surface waters, surface drains, drain tile, utilities, overhead lines, *cultural resources*, and wetlands.

b. Subsurface investigations for reception structures, channels and transfer pipes in the *animal production area* shall be located such that no portion of the structure, channel or pipe is greater than 100 feet from a subsurface investigation point. The investigation shall extend to a minimum depth to ensure required separation distances for the proposed component are achieved.

c. Additional soil investigations shall be conducted if there are substantial variations within or between the soil investigations that may affect the design.

d. Subsurface investigation logs shall include:

1) Soil layers described with respect to thickness, texture using the Unified Soil Classification System (USCS), Munsell color, presence and color of redoximorphic features (soil mottling), *gleyed soil* and moisture condition.

2) The elevation of *bedrock* and bedrock type, if encountered, such as sandstone, limestone, dolomite, or granite.

3) The upper elevation of all saturated layers encountered shall be recorded in the field.

e. Subsurface investigations shall include a narrative describing the design limitations that have been derived from the soils data.

3. Separation from Subsurface Saturation or Bedrock

The separation is determined to be the closest distance from any point on the inside surface of the component to the feature from which separation is required.

The definition of subsurface saturation is not intended for application in any context other than to protect components installed from hydrostatic loadings.

a. For the purposes of this standard, factors used to identify subsurface saturation shall include observed saturation, gleyed soil, gray mottles, and soil color in conjunction with nearby surface water features. The highest subsurface saturation elevation identified in a test pit/soil boring will be identified by any of the following soil properties.

1) Free water or wet soil identified by glistening, due to the slow release of water.

2) Gleyed soil, that may extend uninterrupted from an observed free water surface.

3) The presence of distinct gray redoximorphic features with a chroma of 2 or less based on Munsell color charts.

4) Depleted matrices having a value of 4 or more and chroma 2 or less based on Munsell color charts. In some cases soil parent materials have a natural color of 2 chroma or less or gleyed color that is not due to saturation. In these cases other indicators may be used: landscape

position, elevation or soils in relation to nearby water features.

b. In soils not conducive to mottling, such as sand, the subsurface saturation elevation shall be established by evaluating the soil morphology of the soil profile. Other indicators that may be considered in making the determination are the position of the soil in the landscape, topography, nearby wetlands and well construction logs.

c. Subsurface saturation, if encountered, shall not be drained (or have water-bearing layers removed) except as described for *perched conditions*. Perched conditions may be drained or water-bearing materials removed to achieve separation distances in the tables and relieve hydrostatic loads. Documentation to demonstrate that subsurface saturation is perched and of drainable extent or its effects otherwise eliminated shall be included in the site assessment. All *drainage systems* shall drain by gravity. The effect of temporary tailwater on the component and the effects of outletting to perennial and intermittent waterways shall be evaluated. A drainage system shall be located around the outside perimeter of the component footprint and drain to a surface outlet.

d. If the site assessment indicates artesian features, a hydrogeologic and geotechnical evaluation of the site shall be completed to determine the site suitability for in-ground components.

e. Excavation of bedrock is permitted to achieve the required separation distance as specified in the tables. Bedrock shall not be removed by blasting. The exposed bedrock surface shall be evaluated to ensure a structurally sound base. Fractures or voids shall be treated to prevent migration of soil material. The surface of excavated bedrock shall have a positive grade, minimum of 1 percent, under and away from the component, as to prevent any significant ponding on the rock surface unless otherwise stated in specific criteria sections. If bedrock is excavated, the material placed between the component and the bedrock shall have a minimum of 20% passing the #200 sieve.

4. Flood Prone Areas

a. Reception structures, channels and hoppers located in *flood prone areas* shall be protected from inundation, structural damage and instability from the maximum water elevation resulting from the 25-year, 24-hour rainfall event.

b. Waste transfer components located within the maximum water elevation resulting from the 25-year, 24-hour rainfall event, shall be designed for additional loadings such as hydrostatic pressures and buoyancy/uplift. These systems shall also be evaluated for additional protections such as automatic shutoff systems, backflow prevention valves or check valves, watertight connections, main power disconnects, submersible type splices on electrical lines, etc. Any vents, power supplies, and automatic or manual shutoff controls shall be located at or above the maximum water elevation resulting from the 25-year, 24-hour rainfall event so that access is possible.

5**. Safety**

The system design shall identify and minimize the hazards to animals and people during construction and operation. Waste transfer designs may create *confined spaces*, which can pose significant hazards to people. At a minimum, a design shall include the following.

a. Open structures shall be provided with covers or barriers such as gates, safety fences (see Wisconsin NRCS Field Office Technical Guide, Section IV (WI FOTG), Conservation Practice Standard 382, Fence), etc., to restrict access of animals or people. Include warning signs as necessary.

b. Tank covers shall be designed to withstand both dead and live loads. The live load values for covers contained in ASAE EP378.4, Floor and Suspended Loads on Agricultural Structures Due to Use, and in ASAE EP393.3, Manure Storages, shall be the minimum used. For vehicles or equipment in excess of 20,000 pounds

gross vehicle weight, the actual axle load shall be used.

c. In push-off areas, barriers shall be installed to prevent the accidental entry of tractors or other equipment.

d. Warning signs shall be provided for waste transfer systems as necessary to warn of the danger of entry and to reduce the risk of explosion, poisoning, or asphyxiation. Appropriate signage shall be visibly located at all access points.

e. Ventilation of enclosed areas shall be provided as necessary to reduce the risk of explosion and asphyxiation.

f. Waste transfer lines from enclosed buildings shall be provided with a water-sealed trap and vent or similar devices where necessary to control gas entry into buildings.

g. A minimum of one in-line manual valve in the transfer pipe, located as close to the storage facility as practical, shall be installed when the top of the storage facility is higher than the top of the transfer structure. An in-line valve is not required if the transfer pipe does not penetrate the liner and terminates at an elevation above the top of the storage facility, thus providing an air gap.

h. Confined spaces where human entry may occur shall be designed and operated in compliance with the provisions contained in ASABE EP470, Manure Storage Safety. Covered channels and reception structures that require humanly occupied equipment operated in the transfer system for cleaning shall not be utilized because they do not meet this safety standard.

6. Failure Analysis

The overall functionality of the waste transfer system shall be evaluated for possible malfunctions that could lead to a release of the waste transfer system contents outside the normal operational confines of the waste management system. Identified potential failures should be addressed in the design phase, the operation and maintenance plan, and the emergency response plan**.**

7. Construction Plans and Specifications

Construction plans and specifications for installing waste transfer systems shall be in accordance with this standard and shall describe the requirements for applying the practice to achieve its intended purpose, including the maximum design *working pressure* and the *transfer system pressure rating* of each transfer system. Construction plans and specifications shall include a location map, plan view, profiles, cross sections, details and specifications to ensure that the project can be properly constructed.

8. Engineering Design Documentation

Engineering design documentation shall be prepared in compliance with the Design Deliverables in the Wisconsin NRCS Statement of Work for the WI FOTG Standard 634, and shall demonstrate that the criteria in the NRCS practice standard have been met. Design documentation shall include all substantiating data, assumptions, computations and analyses, and the maximum design working pressure and the transfer system pressure rating of each transfer system.

9. Quality Assurance Plan

A quality assurance plan is required that describes the type and frequency of testing, the items requiring inspection, the documentation required, and the qualifications of the person doing the work.

The quality assurance plan shall address the following items:

a. Site and Contact Information.

b. Introduction and Project Description – Narrative Format.

c. Responsibilities of Key Parties.

d. Pre-Construction Meeting.

e. Items Requiring Inspection, Observation, and Testing.

f. As-built Plans and other Certification (Attesting) Documentation.

10. Operation and Maintenance

An Operation and Maintenance (O&M) Plan shall be prepared and reviewed with the landowner and/or operator responsible for the application of this practice. The O&M Plan shall provide specific instructions for proper operation and maintenance of each component of this practice and shall detail the routine maintenance needed to assure the effectiveness and useful life of this practice. The O&M Plan shall be consistent with the purpose of this practice, safety requirements, criteria for design and the Operation and Maintenance Plan in WI FOTG Standard 313, Waste Storage Facility.

At a minimum, the O&M Plan shall include the following items:

a. System information including the general system description, assumed system performance, maximum design working pressure and the transfer system pressure rating of each transfer system.

b. Safety and emergency response including actions to address potential component failures identified in the waste transfer system failure analysis and an emergency response plan for actions needed to address spills and overflows.

c. Operating procedures including: typical operating procedures, procedures for proper start-up and shutdown for the operation of pumped transfer systems and valve operation sequence if applicable.

d. Maintenance items including: scheduled routine maintenance required by the component manufacturer, procedures for cleaning and unplugging pipe, and inspection and maintenance of all safety items.

B. Specific Criteria

1. Reception Structures, Channels, Hoppers, and Pumps

Reception structures, channels, hoppers, and pumps shall meet the following criteria.

a. Joints and appurtenances shall be liquid tight.

b. Separation distances criteria in Table 1 shall be met.

c. Reception structures shall be sized as follows:

1) Reception structures that are part of a manure transfer system.

a) Reception structures not receiving runoff and/or precipitation shall be sized to contain a minimum of one full day's manure production, plus six inches extra depth for safety; or

b) Reception structures receiving runoff and/or precipitation shall be sized to contain a minimum of one full day's manure production, plus six inches extra depth for safety, and the volume of runoff and/or precipitation from a 25-year, 24-hour rainfall event. The increase in storage volume due to runoff and/or precipitation may be reduced if a portion of this runoff and/or precipitation can be safely routed to and contained within the waste management system.

2) Reception structures that are part of a contaminated runoff or wastewater management system.

a) Reception structures not receiving runoff and/or precipitation shall be sized according to the appropriate conservation practice standard and design needs of the system; or

b) Reception structures receiving runoff and/or precipitation shall be sized according to the appropriate conservation practice standard and design needs of the system, plus the volume of runoff and/or precipitation from a 25-year, 24-hour rainfall event. The increase in storage volume due to runoff and/or precipitation may be reduced if a portion of this

runoff and/or precipitation can be safely routed to and contained within the waste management system.

d. Openings to structures to receive material from alley scrape collection shall be a minimum of 9 square feet with one dimension no smaller than 4 feet. The opening shall be equipped with a grate designed to support the anticipated loads, or otherwise protected to prevent accidental entry.

e. Cast in place reception structures and channels shall be designed for static and dynamic loading, including uplift (buoyancy). Reception structures and channels shall be designed to withstand soil and hydrostatic loading in accordance with WI FOTG Standard 313, Waste Storage Facility. Covers, when needed, shall be designed to support the anticipated dead and live loads.

f. Prefabricated reception structures and channels used to transfer manure and manure processing derivatives shall be designed according to the structural and soil criteria in WI FOTG Standard 313, Waste Storage Facility.

g. Prefabricated reception structures used to transfer only wastewater and/or contaminated runoff are not required to meet the structural and soil criteria in WI FOTG Standard 313, Waste Storage Facility, but shall meet, at a minimum, the following requirements:

The structure shall be currently listed in the Wisconsin Department of Safety and Professional Services (DSPS), Safety and Building Division, Plumbing Products Database.

1) The structure shall comply with all stipulations listed in the Wisconsin DSPS approval that relate to liquid tightness and/or structural strength.

2) The structure shall be located a minimum of 15 feet from established or planned roadways, or designed for anticipated loads.

3) No structural modifications to prefabricated structures, such as pump attachments, shall be made unless approved in writing by the manufacturer.

h. Pre-manufactured manholes shall conform to the criteria in ASTM C478 and the base section shall have the riser wall and base slab cast monolithically as a single unit.

i. Pumps shall be sized to transfer waste at the required system head and flow rate. The type of pump shall be based on the consistency of the waste and the type of bedding used, if applicable. Requirements for pump installations, including connecting appurtenances, shall be based on manufacturer's recommendations. Pumps installed for transfer shall meet the requirements of WI FOTG Standard 533, Pumping Plant.

l. When penetrating waste storage liners, the performance and integrity of the liner shall be maintained. All penetrations and restraints shall meet the criteria in WI FOTG Construction Specification 634, Waste Transfer (Spec. 634).

m. When solid/liquid waste separation is planned, a filtration or screening device, settling tank, settling basin, or settling channel used to separate a portion of solids from the manure or liquid waste stream shall be designed in accordance with WI FOTG Standard 632, Solid/Liquid Waste Separation Facility.

Table 1
Separation Distances for Reception Structures Hoppers, Channels, Pumps, and Pipes

Transfer Components	Bottom of Pump, Floor Surface, or Pipe Invert Relative to Bedrock	Bottom of Pump, Floor Surface, or Pipe Invert Relative to Subsurface Saturation	Well, Spring, and Reservoir Separation Distance [Note 1]
Pumps			
Pumps encased in concrete	≥ 6 inches	Bottom of pump maximum depth into saturation shall be 2 feet	≥ 50 feet
Pumps housed in a drywell [Note 2]	≥ 6 inches	Floor may be at the subsurface saturation level	≥ 50 feet
Reception Structures and Hoppers			
Capacity < 6,000 gallons	≥ 1 foot	Floor may be at the subsurface saturation level[Note 3]	≥ 50 feet
Capacity ≥ 6,000 gallons	≥ 2 feet	≥ 2 feet (≥1 foot for sumps)[Note 3]	≥ 100 feet
Channels			
(≥ 2 foot depth)	≥ 2 feet	≥ 2 feet (≥1 foot for sumps)[Note 3]	≥ 100 feet
Pipes			
All	≥ 6 inches	No restrictions	≥ 25 feet

[Note 1] Well, spring, and reservoir separation distances are in accordance with NR 812, Well Construction and Pump Installation. Items not listed in the table shall also be in accordance with NR 812. DNR-permitted animal feeding operations need to follow the 250-foot well separation distance requirements of NR 243.

[Note 2] Drywells contain pump hardware and are not intended to contain waste.

[Note 3] Separation distances from subsurface saturation is not required if the reception structure, hopper, or channel is designed to withstand anticipated hydrostatic loads and uplift (buoyancy).

2. Pipes

This applies to systems using pipes to carry waste to reception structures, waste storage facilities, waste treatment facilities, wastewater treatment systems, loading areas or cropland. Transfer pipe and severe service transfer pipe shall meet the following criteria.

a. Transfer Pipe

Transfer pipes shall meet the following criteria:

1) Design of transfer pipe systems shall be in accordance with sound engineering principles taking into account the static and dynamic loads on the pipe, working pressure, transfer system pressure rating, site conditions, required capacity, and other applicable design factors. Pipe shall be designed based on the properties of the material to be transferred and shall convey the required flow without plugging. Working pressure shall not exceed 72% of the transfer system pressure rating.

2) Flow velocity for pumped systems, other than pumps which produce pulsating flow, shall be between 3 feet per second and 6 feet per second to minimize settling of solids. Flow velocity may exceed 6 feet per second if the transfer system design takes into account requirements for joints and other appurtenances that accommodate the velocity and any potential loss of pipe integrity due to internal erosion by the materials being transported.

3) Pipe exposed to sunlight shall be made of materials, or otherwise protected, to withstand ultraviolet radiation throughout the intended life of the pipe.

4) Pipe at risk to being damaged shall be identified by fences or markers placed along the pipe.

5) Pipe shall be installed in accordance with the requirements of the Wisconsin FOTG Specification 634, or equivalent specification. All joints, couplings and appurtenances shall be liquid tight in accordance with the manufacturer's specifications and Wisconsin FOTG Specification 634.

6) Pipe shall meet the criteria in Wisconsin FOTG Specification 634. Pipe of equivalent strength, durability, and liquid tightness are acceptable.

7) Pipe and appurtenances shall be compatible with the working pressure of the system. Air and water pressures used to clear the pipe shall not exceed the transfer system pressure rating. A warning sign shall be placed on all risers indicating the transfer system pressure rating. Pressure pipe shall be matched to the pump connected to it, and pipe working pressures shall be no less than the *pump shut-off head;* otherwise, pressure relief (designed per Section V.B.2.b.(2) below) shall be provided near the pump.

8) Thrust control for all buried pressure pipe 4 inches and larger in diameter shall be provided at all angled fittings and valves, and be designed in accordance with standard engineering practices.

9) Pipe penetrating waste storage liners, reception tanks, or channels shall be installed so that the performance and integrity of the liner is maintained. Pipes shall be continuous through walls. The section of pipe that penetrates the liner of a waste storage facility shall be a minimum of 10 feet in length and shall be supported with a cast-in-place concrete restraint. All joints within 25 feet of where the pipe penetrates the inside surface of the waste storage facility (measured along the length of the pipe) shall have a mechanical and/or concrete restraint. All penetrations and restraints shall meet the criteria in Wisconsin FOTG Specification 634.

10) Pipe may be installed in any location within the soil profile regardless of subsurface saturation or bedrock elevations. Pipe subjected to hydrostatic forces shall be protected from uplift. Pipe shall have at least 6 inches of bedding providing separation from bedrock. Excavation of bedrock is acceptable. Storage structure liners shall be protected from hydrostatic pressures that may be caused by preferential flow paths along installed pipe.

11) If cold weather operation is planned, transfer pipe shall be: insulated, heated, buried below anticipated frost depth, constructed of freeze tolerant material, or installed such that it can be evacuated after each use by draining or using compressed air. Buried pipe shall be protected from freezing with either a minimum of 4 feet of soil cover or an equivalent amount of soil and insulation, unless the pipe is evacuated after each use.

12) *Clean-out access* shall be provided at a maximum interval of 150 feet along the pipe length, or a maximum interval of 300 feet along the pipe length if bi-directional clean-outs are used, to allow for removal of settled solids or obstructions.

    A minimum of one in-line manual valve in the pipe, located as close to the storage facility as practical shall be provided if any clean-out riser is lower than the top of the waste storage structure.

    Clean-out access is not required for pipes transferring wastewater, contaminated runoff, and similar wastes with a low solids content or pipes used for transfer to cropland for application. A method to clean these pipes in the event of plugging shall be incorporated into the design and described in the Operation and Maintenance Plan.

13) Pipe shall be installed with appropriate backflow prevention devices to prevent contamination of private or public water supply distribution systems and groundwater.

14) Air vents and vacuum relief valves shall be provided where necessary to eliminate air locks, as well as to protect the pipe against negative pressures.

b. Severe Service Transfer Pipe

Severe service transfer pipe includes pressure pipes supplying flush water to gravity flume systems and pipe extending to cropland application. It does not include gravity transfer pipe. In addition to the transfer pipe criteria in V.B.2.a (1)-(12), severe service transfer pipe shall meet the following criteria:

1) A check valve shall be provided near the outlet of each pump except when backflow is incorporated into the design of the transfer system.

2) A pressure relief valve shall be provided near the pump(s) to protect the pipe against pump shut-off head due to a blockage (unless the pump shut-off head is less than the working pressure of the transfer system). A pressure relief valve or properly sized water hammer arrestor shall be provided on the pressure side of shut-off valves to protect against water hammer due to the sudden closing of a valve. Pressure relief valves shall be no smaller than ¼-inch nominal size for each inch of the pipe diameter. Pressure relief valves shall be set to open at a pressure no greater than 5 lb./in^2 above the transfer system working pressure.

3) Air and water pressures used to clear the pipe shall not exceed the transfer system pressure rating. A warning sign shall be placed on all risers indicating the transfer system pressure rating.

4) Pipe shall be pressure tested prior to being placed into service. The test protocol and results shall be included

in the as-built documentation. The pipe shall be tested for leaks in accordance with Wisconsin FOTG Specification 634. Pipeline used for transferring material to an irrigation system shall meet the requirements of WI FOTG Standard 430, Irrigation Water Conveyance, Pipeline.

c. Gravity Transfer System

This criteria applies to systems using pipe to carry waste to reception structures, waste storage facilities, waste treatment facilities, wastewater treatment systems, loading areas or cropland. Gravity transfer pipe and structures shall meet the following criteria.

1) There shall be no gravity outlets used to empty waste storage facilities.

2) There shall be no gravity outlets from transfer systems to load-out areas without secondary containment volume greater than the transfer system capacity.

3) Gravity discharge pipe used for transferring waste from one storage facility to another shall have a minimum of two shut off valves if one facility can release a volume that would exceed the maximum operating level of the receiving facility. The valves shall be located as close to each of the storage facilities as practical. One valve shall be manually operated.

4) Gravity transfer pipe shall follow all previous transfer pipe criteria (V.B.2.a 1)-14)) plus the following additional criteria listed in Table 2.

Table 2
Summary of Criteria for Gravity Transfer Systems

	Slower Flowing Wastes	Faster Flowing Wastes
Description	For wastes that tend to be slower flowing due to bedding, feed, or dryness (typically stanchion barns or thick slurries with higher viscosities).	For wastes that tend to be faster flowing due to additional liquids or lack of bedding (typically free stall barns, veal or hog facilities, and contaminated runoff with lower viscosities).
Minimum Pipe Diameter	24 inches	No minimum diameter
Minimum Head in Gravity Flow Systems (as measured from the Maximum Operating Level (MOL) of the Waste Storage Facility)	Shall be a minimum of 4 feet below the bottom of the barn cleaner, scrape alley, etc., For pipe over 100 feet in length an additional height equal to 1% of the transfer pipe length shall be included.	Liquid or semi-solid wastes shall have a minimum of: • 2 feet below the scrape alley, barn cleaner, channel, etc., and • An additional height equal to 1% of the transfer pipe length Diluted wastes shall have a minimum of: • 1 foot below the scrape alley, barn cleaner, channel, etc., and • An additional height equal to 1% of the transfer pipe length
Minimum Volume of Reception Structure	One full day's manure production. A minimum of one-half a day's manure volume must be between the MOL of the waste storage facility and the bottom of the barn cleaner or scrape alley.	One full day's manure production.
Vent Pipe	A 6-inch diameter minimum vent pipe is required. Install within 10 feet of the reception structure.	A 6-inch diameter minimum vent pipe installed within 10 feet of the reception structure is required for reception structures with knife valves.

VI. Considerations

Considerations include additional design recommendations that are not required criteria, but may be used to enhance, or avoid problems with, the design and function of this practice.

A. Consider the operating space requirements of loading and unloading of equipment in the vicinity of the transfer components.

B. Consider the use of leak detection methods and equipment for monitoring and periodic pressure testing of waste transfer systems.

C. Consider how operating temperatures may affect the *pressure rating* of the pipe.

D. Consider installing thrust control consisting of a cast-in-place thrust block installed at every third joint, or a mechanical joint restraint device installed at every joint for gasketed pipe subjected to pulsating flow.

E. Consider the need for additional check valves, clean-outs, vent risers, knife valves, anti-siphon protection, vacuum relief valves and open air breaks, as appropriate, on all transfer pipe systems.

F. Consider the potential for salt (struvite) deposits in small pipe. Preventative measures may be needed, such as acid washing the pipe to prevent deposits.

G. Consider pressure testing pipe installed in sensitive areas, large daily flow volumes, long flow lengths, high flow pressures, etc.

H. Consider installing permanent aboveground or buried pipe for hoses and temporary pipe that is used on a regular basis to transfer waste.

I. Consider the effects of adding liquid to manure that contains sand bedding. Liquid can enhance sand settling.

J. Consider having gravity pipe follow as direct a route as possible. Risers, such as pre-manufactured manholes, may be used to change direction.

K. Consider installing a clean-out or vent riser within 10 feet of the reception structure, for gravity transfer systems that are not required to have a vent riser in order to reduce the risk of air lock in the pipe.

L. Consider installing a manually operated shut off valve for isolation purposes for gravity discharge pipe used for transferring waste from one structure to another.

M. Consider the use of a wet sump to reduce solids separation within the gravity reception structure.

N. Consider abandonment, relocation, or additional floodproofing for existing reception structures located in flood prone areas. For additional information on floodproofing structures, see "Floodproofing Non-Residential Structures," FEMA 102, May 1986, Federal Emergency Management Agency.

VII. References

USDA, NRCS, Agricultural Waste Management Field Handbook, Part 651.

Wisconsin Department of Safety and Professional Services (DSPS), Safety and Building Division, Plumbing Products Database: http://dsps.wi.gov.

Wisconsin Administrative Code, Department of Natural Resources, Chapter NR 812, Well Construction and Pump Installation.

FEMA, Floodproofing Non-Residential Structures, FEMA 102, May 1986.

USDA, NRCS, National Handbook of Conservation Practices.

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

American Society of Agricultural and Biological Engineers (ASABE), Standard EP470, Manure Storage Safety.

VIII. Definitions

Animal Production Area (V.A.2.b) – Means any part of the livestock operation that is used for the feeding and housing of livestock. This includes the entire animal confinement and feeding area, and any adjacent manure storage areas, raw materials storage areas, and waste containment areas. This does not include pasture and cropland.

Bedrock (V.A.2.d.2)) – The solid or consolidated rock formation typically underlying loose surficial material such as soil, alluvium or glacial drift. Bedrock includes but is not limited to limestone, dolomite, sandstone, shale and igneous and metamorphic rock.

Note: Although solid or consolidated bedrock can sometimes be removed with typical excavation

equipment, these materials are included in the above definition.

Channel (II) – A narrow structure, 4 feet or less in width, into which wastes are scraped or flushed for immediate transfer to reception structures, hoppers or waste storage facilities. They include field-fabricated or cast-in-place drop inlet structures incorporated into gravity transfer pipe. They also include existing gutters modified from how they were originally operated and constructed. Channels may include internal mechanical or hydraulic transfer mechanisms.

Clean-out Access (V.B.2.a.12)) –Pipe appurtenances such as air flushing valves, risers, manholes, and accessible openings of pipe into reception structures or storage facilities that allow mechanical cleaning or unplugging of a pipe.

Confined Space (V.A.5) – Confined Space is a space that 1) contains or has the potential to contain a hazardous atmosphere; 2) is large enough and so configured that a person can bodily enter; 3) has limited or restricted means for entry or exit; and 4) is not designed for continuous human occupancy.

Contaminated Runoff (II) – Runoff that has come through or across a barnyard or animal lot or feed storage area. It generally includes the runoff and any manure, sediment, feed, or other material carried in the runoff. It contains lower concentrations of contaminants than leachate from feed or manure.

Cultural Resources (V.A.2.a.) – Cultural resources are the traces of any past activities and accomplishments of people. They include tangible traces such as historic districts, sites, buildings, structures, historical documents and cemeteries. They also include traces of less tangible objects such as dance forms, aspects of folk-life, cultural or religious practices, and some landscapes and vistas.

Flood Prone Areas (V.A.4.a.) – These include areas delineated as floodplains on Federal Emergency Management Agency (FEMA) maps, or local floodplain maps as well as areas along perennial streams (blue lines) shown on the United States Geologic Survey quadrangle sheets that may be subject to out of bank flows.

Gleyed Soil (V.A.2.d.1)) – Soil that has been subject to prolonged saturated conditions, exhibited by gray, blueish gray, greenish gray, dark greenish gray, dark blueish gray as the dominant soil colors. (These colors appear on the Munsell color charts for Gley) Soil color and patterns must be observed immediately upon excavation because air exposure may rapidly transform colors to a mottled pattern of reddish, yellow or orange patches.

Gutters (III) – Existing open troughs within housing facilities that are used to transfer wastes to a reception structure or waste storage facility. Existing gutters modified from how they were originally operated and constructed are considered to be channels.

Hopper (II) – Structure meant solely to feed wastes into a transfer pump. Hoppers larger than 6,000-gallon capacity are defined as reception structures.

Leachate (II) – Concentrated liquid waste which has percolated through or drained by gravity from a pile of manure, manure processing derivative, or animal feed. It contains much higher concentrations of contaminants than contaminated runoff.

Manure Processing Derivatives (II) – The by-products and waste components that are produced as a result of treatment and processing practices. These include, but are not limited to, the following waste components: flush water, separated sand, separated manure solids, precipitated manure sludges, supernatants, digested liquids, composted biosolids, and process waters.

Perched Conditions (V.A.3.c.) – Perched conditions describe a soil moisture regime where saturated soil is located above unsaturated soil.

Pump shut-off head (V.B.2.a.7)) - Maximum pressure a pump can produce. Represented by the highest point on the pump flow curve.

Pressure Rating (VI.D) – Estimated maximum water pressure the pipe is capable of withstanding continuously with a high degree of certainty that failure of the pipe will not occur. Pressure rating is determined by the pipe manufacturer.

Reception Structure (II) – A collection vessel that will hold waste and facilitate its transfer.

Transfer System Pressure Rating (V.A.7) - The lowest pressure rating of any pipe, pipe fittings, and other appurtenances. This is independent of pump shut-off head pressure.

Wastewater (II) – Milkhouse and milking parlor washwater, leachate from feed storage areas, and similar waste materials. Wastewater from holding area is considered manure.

Working Pressure (V.A.7) – The maximum designed operating pressure of the transfer system. Working pressure is a maximum of 72% of the transfer system pressure rating. For pumped systems, this is determined by the shut-off head of the pump and static head.

Clark County Animal Manure Management Ordinance

As Adopted by the Clark County Board of Supervisors April 17, 1985.

Recreated by the Clark County Board of Supervisors on August 22, 1992.

Amended by the Clark County Board of Supervisors on February 24, 1993.

Amended by the Clark County Board of Supervisors on May 18, 1999.

Rescinded & Recreated by the Clark County Board of Supervisors on December 20, 2005.

Revised by the Clark County Board of Supervisors on January 26, 2011.

ARTICLE IV. - ANIMAL MANURE MANAGEMENT

DIVISION 1. - GENERALLY

Sec. 12-300. - Definitions.

The following words, terms and phrases, when used in this article, shall have the meanings ascribed to them in this section, except where the context clearly indicates a different meaning:

Adequate sod or *self-sustaining vegetative cover* means maintenance of sufficient vegetation types and densities such that the physical integrity of the streambank or lakeshore is preserved. Self-sustaining vegetative cover includes grasses, forbs, sedges and duff layers of fallen leaves and woody debris.

Agricultural land use means the use of land for agricultural practices.

Agricultural practice means beekeeping; commercial feedlots; dairying; egg production; floriculture; fish or fur farming; grazing; livestock raising; orchards; poultry raising; raising of grain, grass, mint or seed crops; raising of fruits, nuts or berries; sod farming; placing land, at least 35 acres of which is enrolled in the conservation reserve program under 16 USC 3831 to 3836; or vegetable raising.

Animal manure means livestock excreta. The term "animal manure" includes livestock bedding, water, soil, hair, feathers, and other debris that becomes intermingled with livestock excreta in normal waste handling operations.

Best management practices or *BMPs* means structural or nonstructural measures, practices, techniques or devices employed to avoid or minimize soil, sediment or pollutants carried in runoff to water of the state.

County land conservation committee means the committee created by a county board under Wis. Stats. § 92.06. The term "county land conservation committee" includes employees or agents of a County Land Conservation Committee who, with committee authorization, act on behalf or the committee.

DATCP means the department of agriculture, trade and consumer protection.

Direct runoff means a discharge of a significant amount of pollutants to waters of the state resulting from any of the following practices:

(1) Runoff from a manure storage facility.
(2) Runoff from an animal lot that can be predicted to reach surface waters of the state through a defined or channelized flow path or manmade conveyance.
(3) Discharge of leachate from manure piles.
(4) Seepage from a manure storage facility.
(5) Construction of a manure storage facility in permeable soils or over fractured bedrock without a liner designed in accordance with Wis. Admin. Code § NR 154.04(3).

DNR means the state department of natural resources.

Floodplain means land which has been or may be hereafter covered by floodwater during the regional flood. The floodplain includes the floodway and the flood fringe, and may include other designated floodplain areas for regulatory purposes.

Idle storage facility means an animal waste storage facility where the operations cease or manure has not been added or removed for 24 months.

Landowner means any of the following:
(1) A person who owns a parcel of land.
(2) A person who rents, controls or uses a parcel of land for agricultural purposes.

Livestock means domestic animals such as cattle, horses, sheep, hogs, poultry, fish, etc., or exotic animals such as llamas, ostriches, etc.

Livestock operation means a feedlot or other facility or pasture where animals are fed, confined, maintained or stabled.

Manure storage facility means an impoundment made by constructing an embankment or excavating a pit or dugout or by fabricating a structure to contain manure and other animal or agricultural wastes.

Navigable waters or navigable waterway means any body of water, which is navigable under the laws of the state.

NRCS means the Natural Resources Conservation Service of the U.S. Department of Agriculture.

Nutrient management plan means any of the following:
(1) A plan required under Wis. Admin. Code § ATCP 50.04(3) or 50.62(5)(f).
(2) A farm nutrient plan prepared or approved, for a landowner, by a qualified nutrient management planner.

Operator means a person responsible for the oversight or management of equipment, facilities or livestock at a livestock operation, or is responsible for land management in the production of crops.

Permit means the signed, written statement issued by the county land conservation department under this article authorizing the applicant to construct, install, reconstruct, enlarge, substantially alter or close an animal manure storage facility.

Permittee means any person to whom a permit is issued under this article.

Stored manure means manure that is kept in a manure storage facility or an unconfined manure pile.

Substantially altered means a change initiated by an owner or operator that results in a relocation of a structure or facility or significant changes to the size, depth or configuration of a structure or facility including:
(1) Replacement of a liner in a manure storage structure.
(2) An increase in the volumetric capacity or area of a structure or facility.
(3) A change in a structure or facility related to a change in livestock management from one species of livestock to another such as cattle to poultry.

Technical guide means the current Wisconsin version of the United States Department of Agriculture Natural Resources Conservation Service Technical Guide as adopted by the County land conservation committee.

Technical standard means a document that specifies design, predicted performance and operation and maintenance specifications for a material, device or method.

Unconfined manure pile means a quantity of manure that is at least 175 feet^3 in volume and which covers the ground surface to a depth of at least two inches and is not confined within a manure storage facility, livestock housing facility or barnyard runoff control facility or covered or contained in a manner that prevents stormwater access and direct runoff to surface water or leaching of pollutants to groundwater.

Water pollution means contaminating or rendering unclean or impure the groundwaters or surface waters of the state, or making the same injurious to public health, harmful for commercial or recreational use, or deleterious to fish, bird, animal or plant life.

Water quality management area or *WQMA* means the area within 1,000 feet from the ordinary high-water mark of navigable waters that consists of a lake, pond or flowage, except that, for a navigable that is a glacial pothole lake, the term means the area within 1,000 feet from the high-water mark of the lake; the area within 300 feet from the ordinary high-water mark of navigable waters that consist of a river or stream; and a site that is susceptible to groundwater contamination, or that has the potential to be a direct conduit for contamination to reach groundwater.

Waters of the state means those portions of Lake Michigan and Lake Superior within the boundaries of Wisconsin, all lakes, bays, rivers, streams, springs, ponds, wells, impounding reservoirs, marshes, water courses, drainage systems and other surface water or groundwater, natural or artificial, public or private within the state or under its jurisdiction, except those waters which are entirely confined and retained completely upon the property of a person.

Wetlands means an area where water is at, near, or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation and which has soils indicative of wet conditions.

(Compiled Ords. of 2009, ch. 16.16, art. II)

Sec. 12-301. - Authority.

This section is adopted under authority granted by Wis. Stats. §§ 59.01, 59.02, 59.03, 59.04, 59.54, 59.69, 59.70, 66.0113, 92.07, 92.09, 92.11, 92.15, and 92.16.

(Compiled Ords. of 2009, § 16.16.010)

Sec. 12-302. - Findings and declaration of policy.

(a) The county board of supervisors finds that manure generated by the livestock industry, when properly managed, is important for maintaining soil quality, reduces reliance on commercial fertilizer, and is of significant importance for the agricultural economy of the county. The county board of supervisors finds that storage of manure in facilities not meeting technical design and construction standards or livestock operations having any overflow of manure from storage facilities or any unconfined manure piles in a water quality management area may cause pollution of the surface waters and groundwaters of the county, and may result in actual or potential harm to the health of county residents and transients; and to livestock, aquatic life and other animals and plants.

(b) The county board of supervisors also finds that improper land application of manure may cause pollution of the groundwater and surface water of the county.

(c) The county board of supervisors further finds that the technical standards developed and maintained by the USDA-Natural Resources Conservation Service and adopted by the land conservation committee provide effective, practical and environmentally safe methods of storing and utilizing animal manure. The board further finds that where operations have ceased, the manure storage facility shall be closed according to USDA-NRCS standards.

(Compiled Ords. of 2009, § 16.16.030)

Sec. 12-303. - Purpose.

The purpose of this article is to regulate the design, construction, maintenance and proper closure of manure storage facilities and provide for proper utilization of manure. It is also intended to provide for the administration and enforcement of this article and to provide penalties for its violation.

(Compiled Ords. of 2009, § 16.16.040)

Sec. 12-304. - Applicability.

This article applies to the entire geographical area of the county, except as otherwise provided by law.

(Compiled Ords. of 2009, § 16.16.050)

Sec. 12-305. - Interpretation.

The interpretation and application of the provisions of this article shall be minimum requirements, be liberally construed in favor of the county, and not be deemed a limitation or repeal of any other power granted by state statutes.

(Compiled Ords. of 2009, § 16.16.060)

Sec. 12-306. - Variances.

(a) The board of adjustment may, upon application, grant a variance from the dimensional standards of this title where an applicant convincingly demonstrates that:

- **(1)** Literal enforcement of the provisions of the title will result in practical difficulty or unnecessary hardship on the applicant.
- **(2)** The hardship is due to adoption of this article and special conditions unique to the property.
- **(3)** Such variance is not contrary to the public interest.

(b) A variance shall not:

- **(1)** Grant, extend or increase any use of property prohibited in the zoning district.
- **(2)** Be granted for a hardship based solely on an economic gain or loss.
- **(3)** Be granted for a hardship which is self-created.
- **(4)** Damage the rights of property values of other persons in the area.

(c) The department of natural resources may grant a variance to the manure management prohibitions, technical Standards or other nonstatutory requirements of this article in accordance with Wis. Admin. Code § NR 151.097.

(Compiled Ords. of 2009, § 16.16.730)

Secs. 12-307—12-330. - Reserved.

DIVISION 2. - ADMINISTRATION

Sec. 12-331. - Delegation of authority.

The county hereby designates the county land conservation department to administer and enforce the provisions of this article.

(Compiled Ords. of 2009, § 16.16.410)

Sec. 12-332. - Administrative duties.

The provisions of this article shall be administered by the county land conservation department under the oversight of the land conservation committee. The county land conservation department shall be primarily responsible for:

(1) Keeping an accurate record of all permit applications, animal waste facility plans, permits issued, inspections made, and other official actions.
(2) Reviewing permit applications and issue permits in accordance with this article.
(3) Investigating complaints relating to compliance with this article.
(4) Performing other duties as specified in this article.

(Compiled Ords. of 2009, § 16.16.420)

Sec. 12-333. - Entry and inspection authority.

The county land conservation department is authorized to enter upon any lands affected by this article to inspect the land to determine compliance with this article pursuant to the authority granted by Wis. Stats. § 92.07(14). If permission cannot be received from the applicant or permittee, entry by the county land conservation department shall be according to Wis. Stats. §§ 66.0119 and 66.0119(3). Refusal to grant permission to enter lands affected by this article for purposes of inspection shall be grounds for an order of noncompliance, permit denial or revocation.

(Compiled Ords. of 2009, § 16.16.430)

Sec. 12-334. - Enforcement authority.

(a) The county land conservation department is authorized to issue an order to stop work upon land which has had a permit revoked or on land currently undergoing activity in violation of this article. The order shall specify that the activity must cease immediately and remain stopped until a plan to bring the project into compliance is approved by the county land conservation department.
(b) Any permit revocation or order stopping work shall remain in effect unless retracted by the county land conservation department, or by a court of record; or until the activity is brought into compliance with this article. The county land conservation department is authorized to refer any violation of this article or of any order stopping work issued pursuant to this article to the district attorney or corporation counsel for commencement of further legal proceedings.
(c) The county may institute other proceedings in any court of competent jurisdiction and pursue any remedy or relief afforded by law, including a civil forfeiture or injunction.

(Compiled Ords. of 2009, § 16.16.440)

Secs. 12-335—12-356. - Reserved.

DIVISION 3. - ACTIVITIES SUBJECT TO REGULATION

Sec. 12-357. - General requirement.

Any person who constructs, installs, substantially alters, or closes an animal waste storage facility, or possesses an idle storage facility; or who employs another person to do the same on land subject to this article shall be subject to the provisions of this article.

(Compiled Ords. of 2009, § 16.16.450)

Sec. 12-358. - Compliance with permit requirements.

A person is in compliance with this article if he follows the procedures of this article, receives a permit from the county land conservation department before beginning activities subject to regulation under this article, and complies with the requirements of the permit. Modification or closure of preexisting facilities requires a permit, subject to all terms of this article.

(Compiled Ords. of 2009, § 16.16.460)

Sec. 12-359. - Manure management prohibitions.

(a) All livestock operations shall comply with the following:
- **(1)** A livestock operation shall have no overflow of manure storage facilities.
- **(2)** A livestock operation shall have no unconfined manure pile in a water quality management area.
- **(3)** A livestock operation shall have no direct runoff from a feedlot or stored manure into the waters of the state.
- **(4)** A livestock operation may not allow unlimited access by livestock to waters of the state in a location where high concentrations of animals prevent the maintenance of adequate sod or self-sustaining vegetative cover. This prohibition does not apply to properly designed, installed and maintained livestock or farm equipment crossings.

(b) Cost-sharing requirement pursuant to Wis. Stats. § 281.16(3). A livestock operation that is in existence prior to October 1, 2002, shall not be required to comply with the manure management prohibitions unless cost-sharing is made available.

(c) Noncompliance with the manure management prohibitions shall result in enforcement actions in accordance with Wis. Admin. Code § NR.151.095.

(Compiled Ords. of 2009, § 16.16.470)

Secs. 12-360—12-376. - Reserved.

DIVISION 4. - SETBACKS

Sec. 12-377. - Setbacks from roadways.

(a) All state and federal highways, county trunks, town roads, and public streets are designated as roadways.

(b) The setback from roadways shall be 110 feet from the centerline of the roadway or 50 feet from the right-of-way line, whichever is greater.

(c) Visual clearance triangle. In each quadrant of every public road intersection, there shall be a visual clearance triangle bounded by the road centerlines and a line connecting points on them 300 feet from an intersection. Except for open fences, no part of any animal waste storage facility shall be more than three feet above the natural grade within the visual clearance triangle.

(Compiled Ords. of 2009, § 16.16.480)

Sec. 12-378. - Setbacks from water.

Animal waste storage facilities shall be located at least 300 feet from any navigable water and shall be designed, as specified in NRCS Field Office Technical Guide, to protect navigable waters and drainageways from accidental spills and runoff from loading areas.

(Compiled Ords. of 2009, § 16.16.490)

Sec. 12-379. - Floodplains and other water bodies.

(a) No animal waste storage facility will be permitted to be built in the 100-year floodplain of a stream, lake or flowage.

(b) No animal waste storage facility will be permitted to be built in a wetland, or within 100 feet of its outermost boundary.

(Compiled Ords. of 2009, § 16.16.500)

Sec. 12-380. - Lot lines.

Animal manure storage facilities shall be located at least 100 feet from a property line.

(Compiled Ords. of 2009, § 16.16.510)

Sec. 12-381. - Residences.

Animal manure storage facilities shall be located not less than 300 feet from any residential building other than that of the owner of the premises, or owned by the owner of the premises but occupied by his family, agent or employee.

(Compiled Ords. of 2009, § 16.16.520)

Secs. 12-382—12-405. - Reserved.

DIVISION 5. - STANDARDS

Sec. 12-406. - Animal manure storage facilities.

Standards and specifications for design, construction and management of animal manure storage facilities are those in Standard 313 (Waste Storage Facility), and Standard 634 (Waste Transfer) of the USDA Natural Resources Conservation Service Field Office Technical Guide. Construction specifications referenced within the above listed standards shall be included.

(Compiled Ords. of 2009, § 16.16.530)

Sec. 12-407. - Nutrient management.

The standards for nutrient management of land-applied animal wastes are those in Standard 590 of the USDA Natural Resources Conservation Service Field Office Technical Guide.

(Compiled Ords. of 2009, § 16.16.540)

Sec. 12-408. - Animal manure storage facility closure.

Standards for closure of an idle storage facility are those in Standard 360 of the USDA Natural Resources Conservation Service Field Office Technical Guide.

(Compiled Ords. of 2009, § 16.16.550)

Sec. 12-409. - Subsequent modification of standards.

The standards of the technical guide are adopted and by reference made a part of this article as if fully set forth herein. Any future amendment, revision or modification of the standards incorporated herein are made a part of this article, unless otherwise acted upon by the land conservation committee.

(Compiled Ords. of 2009, § 16.16.560)

Secs. 12-410—12-431. - Reserved.

DIVISION 6. - PERMITS

Sec. 12-432. - Required.

No person may undertake an activity subject to this article without obtaining a permit from the county land conservation department prior to beginning any of the following activities:

(1) The construction of a manure storage facility.
(2) The closure of a manure storage facility.
(3) Substantially altering an existing facility involving the relocation of an existing structure or facility or significant changes to the size, depth or configuration of a structure or facility including:
  a. Replacement of a liner in a manure storage facility.
  b. An increase in volumetric capacity or area of a structure.
  c. A change in a structure or facility related to a change in livestock management due to livestock species change.

(Compiled Ords. of 2009, § 16.16.570)

Sec. 12-433. - Exception to permit requirement.

Emergency repairs for broken pipes or equipment, leaking dikes or removal of obstructions may be performed without an animal manure storage facility permit. Emergency repairs shall not result in increased capacity to the animal manure storage facility. The responsible person (owner or operator) shall contact the county land conservation department on the first working day following emergency repairs for determination by the department on whether a permit will be required for any additional modification or repair to the facility.

(Compiled Ords. of 2009, § 16.16.580)

Sec. 12-434. - Fee.

(a) All applicants, except those applying for an animal manure storage facility closure permit, shall be required to pay a nonrefundable fee of $200.00 at the time of permit application.
(b) If the application is submitted after the commencement of activities requiring a permit, then the fee will be doubled. All applicable federal, state, and local standards and ordinance provisions still apply.
(c) Applications received after the commencement of activities requiring a permit do not preclude the land conservation department from taking enforcement action.

(Compiled Ords. of 2009, § 16.16.590)

Sec. 12-435. - Application.

(a) An application for an animal manure storage facility permit or animal waste storage facility closure permit shall be filed with the land conservation department on forms supplied by the land conservation department. The land conservation department shall mail a copy of the approved permit application to the appropriate town board. In addition, the land conservation department may mail a copy of the approved permit to other agencies or units of government that may have jurisdiction over the proposed activity.
(b) Each application for an animal manure storage facility permit under this article shall include an animal manure storage facility plan and a nutrient management plan.

(Compiled Ords. of 2009, § 16.16.600)

Sec. 12-436. - Manure storage facility plan required.

Each application for a permit under this section shall at a minimum include:

(1) A management assessment that addresses the storage components, available resources, waste manure disposal schemes and waste characterization consistent with Standard 313 and Standard 634 of the USDA Natural Resources Conservation Service Field Office Technical Guide.

(2) A site assessment that describes the physical characteristics that will influence the placement, construction, maintenance and environmental integrity of the proposed site consistent with Standard 313 of the USDA Natural Resources Conservation Service Field Office Technical Guide.

(3) A facility design, construction plan preparation and operation and maintenance plan consistent with Standard 313 of the USDA Natural Resources Conservation Service Field Office Technical Guide, prepared by a professional engineer registered with the state examining board of architects, professional engineers, designers and land surveyors under Wis. Stats. ch. 443 or by an agricultural engineer practitioner certified under Wis. Admin. Code § ATCP 50.46.

(Compiled Ords. of 2009, § 16.16.610)

Sec. 12-437. - Nutrient management plan required.

A nutrient management plan that conforms to Standard 590 of the USDA Natural Resources Conservation Service Field Office Technical Guide shall be developed by individuals with qualifications described in Wis. Admin. Code § ATCP 50.04(3). The plan shall be updated and implemented on an annual basis. The nutrient management plan shall include:

(1) All land on which the landowner mechanically applies manure.

(2) Soil nutrient tests conducted at a laboratory certified under Wis. Admin. Code § ATCP 50.50.

(3) Compliance with Standard 590 of the USDA Natural Resources Conservation Service Field Office Technical Guide.

(4) Recommendations for nutrient management applications in the University of Wisconsin Extension Soil Test Recommendations for Field and Vegetable, and Fruit Crops, UWEX Publication A-2809 (1998), unless it is established that the circumstances of the particular land requires nutrients in excess of the recommended application.

(Compiled Ords. of 2009, § 16.16.620)

Sec. 12-438. - Facility closure plan required.

(a) Closure of a manure storage facility shall occur when a facility ceases operations, or manure has not been added to or removed from the facility for a period of 24 consecutive months. Manure storage facilities shall be closed in a manner that will prevent contamination of groundwaters and surface waters.

(b) The owner or operator may retain the facility for a longer period of time by demonstrating to the department that all of the following conditions are met:

- **(1)** The facility is designed, constructed and maintained in accordance with NRCS Field Office Technical Guide Standard 313.
- **(2)** The facility is designed to store manure for a period of time longer than 24 months.
- **(3)** Retention of the facility is warranted based on anticipated future use.

(c) To close a facility, a site-specific design and inspection plan will be developed. A closure plan will be consistent with NRCS Field Office Technical Guide Standard 360, prepared by a professional engineer registered with the state examining board of architects, professional engineers, designers and land surveyors under Wis. Stats. ch. 443 or by an agricultural engineer practitioner certified under Wis. Admin. Code § ATCP 50.46.

(d) A facility closure plan shall be approved by the department prior to implementation.

(Compiled Ords. of 2009, § 16.16.630)

Sec. 12-439. - Review of application.

The department shall receive and review all permit applications and shall determine if the proposed facility meets required standards. Within 20 working days after receiving the completed application, the department shall inform the applicant in writing whether the permit application is approved or disapproved. If additional information is required, the department shall so notify the permit applicant. The department has ten working days from the receipt of the additional information in which to approve or disapprove the permit application. If the department fails to approve or disapprove the permit application or additional information, as appropriate, the application shall be deemed approved and the applicant may proceed as if a permit had been issued.

(Compiled Ords. of 2009, § 16.16.640)

Sec. 12-440. - Conditions and requirements for issuance.

(a) All permits issued under this division shall be issued subject to the following conditions and requirements:
- **(1)** Manure storage facilities design and construction shall be carried out in accordance with the manure storage facility plan and applicable standards of this article.
- **(2)** The permittee shall give two working days' notice to the department before starting any construction activity authorized by the permit.
- **(3)** Approval in writing must be obtained from the department prior to any modifications to the approved manure storage facility plan.
- **(4)** Prior to use of the facility, a certificate of installation signed by a professional engineer registered with the state examining board of architects, professional engineers, designers and land surveyors under Wis. Stats. ch. 443 or by an agricultural engineer practitioner certified under Wis. Admin. Code § ATCP 50.46.

(b) Activities authorized by permit must be completed within two years from the date of issuance, after which such permit shall be void.

(Compiled Ords. of 2009, § 16.16.650)

Sec. 12-441. - Revocation.

The department may revoke any permit issued under this division if the holder of the permit has misrepresented any material fact in the permit application or manure facility plan, or if the holder of the permit violates any of the conditions of the permit.

(Compiled Ords. of 2009, § 16.16.660)

Secs. 12-442—12-465. - Reserved.

DIVISION 7. - VIOLATIONS

Sec. 12-466. - Penalties.

Any person who violates, or fails, neglects, or refuses to comply with any of the provisions of the article shall, upon conviction thereof, forfeit up to $200.00 and costs of prosecution for each violation. Each day a violation exists or continues to exist shall constitute a separate offense. An unlawful violation includes failure to comply with any standard of this article or with any condition or qualification attached to the permit, or any failure to comply with notice of a permit revocation or stop work order.

(Compiled Ords. of 2009, § 16.16.670)

Sec. 12-467. - Enforcement by injunction.

As a substitute for, or in addition to forfeiture actions, the county may seek enforcement of any part of this article by court actions seeking injunctions or restraining orders.

(Compiled Ords. of 2009, § 16.16.680)

Secs. 12-468—12-487. - Reserved.

DIVISION 8. - APPEALS

Sec. 12-488. - Authority.

Under the authority of Wis. Stats. ch. 68, the county land conservation committee, created under Wis. Stats. § 59.70 and acting as an appeal authority under Wis. Stats. § 68.09(2), is authorized to hear and decide appeals where it is alleged that there is error in any order, requirement, decision, or determination by the county land conservation department in administering this article.

(Compiled Ords. of 2009, § 16.16.690)

Sec. 12-489. - Who may appeal.

Appeals may be taken by any person having a substantial interest that is adversely affected by the order, requirement, decision, or determination made by the county land conservation department.

(Compiled Ords. of 2009, § 16.16.700)

Sec. 12-490. - Limitations of appeal.

Only one appeal on a particular concern can be made of an order, requirement, decision, or determination made by the county land conservation department.

(Compiled Ords. of 2009, § 16.16.710)

Sec. 12-491. - Procedure.

(a) Any appeal shall be made by written request mailed or delivered to the county land conservation department. The request shall state the grounds upon which it is contended that the order, requirement, decision, or determination should be modified or reversed, and/or the grounds upon which a variance is sought. The request shall be filed within 30 calendar days of the date when the order, requirement, decision was received. The county land conservation committee shall schedule a hearing within 15 working days of the filing of the appeal. The hearing shall be conducted in accordance with Wis. Stats. ch. 68. A copy of the hearing notice shall be sent to the applicant and the appropriate town board.

(b) The final decision on an appeal shall be made within 20 working days of completion of the hearing and shall be in the form of a written determination signed by the chair of the land conservation committee. The determination shall state the specific facts, which are the basis for the committee's decision, and shall affirm, reverse, vary, or modify the order, requirement, decision, or determination appealed, in whole or in part; deny the appeal for lack of justification; or grant or deny the application for a variance. The reasons or justifications for granting an appeal, which were demonstrated by the applicant in the case of a variance, shall be clearly stated in the recorded minutes of the committee meeting. If a final decision on an appeal is not made within 20 working days, the appeal shall be deemed approved and the applicant may proceed with activities that were requested in the appeal.

(Compiled Ords. of 2009, § 16.16.720)