Time to Check Out the Interim Wisconsin DNR Turf Nutrient Management Standards

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Increased public awareness of water quality issues is resulting in steps to curb non-point source pollution. Non-point source pollution is that which occurs in typically minimal amounts from a wide variety of sources as opposed to a single large source such as a factory. In recent years both farms and turf areas have been viewed as potential sources of non-point pollution due to their fertilizer applications. Consequently the state has taken action to reduce non-point source pollution from fertilizer. Beginning in March 2008, farms and non-farm entities (construction sites and urban areas) will need to comply with Wisconsin Department of Natural Resource (WDNR) Rule 151. NR 151 is a set of performance standards developed to maintain if not improve surface and groundwater quality for Wisconsin residents. Performance standards describe the conditions that have to be met. The performance standards for NR151 were the subject of considerable public discussion and were finalized several years ago. Technical standards are a separate set of documents which describe how the performance standards are to be achieved. Part of the technical standards for NR 151 include standards for turf fertilization. The objective is to have in place guidelines for turf fertilization which will safeguard surface and groundwater quality. Realizing the need to have a meaningful and practical set of guidelines, the WDNR developed a committee composed of persons from the turf industry, environmental consultants, University of Wisconsin-Extension (UWEX), Wisconsin

Department of Agriculture, Trade and Consumer Protection, and WDNR employees to draft the technical standards for turf fertilization. Day to day assemblage of the document was maintained by the Standards Oversight Council (SOC) which is a semi-independent entity of WDNR and UWEX responsible for maintaining technical standards for the WDNR. The committee met monthly from January 2005 through March 2006 to discuss the science and practice of turf management, fertilizers, and water quality. The end result is WDNR Code 1100, the Interim Technical Standard for Turf Nutrient Management. The standard was assembled based on scientific data to the greatest extent possible and in accord with other WDNR rules. Much of the document relies on information currently recommended in various University Wisconsin-Extension bulletins.

Purpose of the Document and Sites Affected

The purpose of the technical standard is to manage the amount, method, timing, and source of nutrient applications to turf. The ultimate goal is to minimize nutrient entry into surface and groundwater while maintaining turf density of at least 70%. The standard affects all parcels of 5 or more acres that receive fertilizer. Land areas split by non-turf areas (tree line, sidewalk, etc.) are still considered to be the same parcel. It includes "municipally-owned parcels within an incorporated municipality and non-municipally owned parcels regardless of location". At this point in time the document is strictly a guideline and is not backed by regulatory power. The document was initiated, however, with the idea that it would be adopted as regulation either on a local or statewide basis. The 5 acre parcel size is not inflexible either: ultimately it could be applied to any size turf area. Golf courses, schools, parks, and homeowners are all affected.

What the Document Contains

WDNR Code 1100 requires soil tests to be conducted and utilized for nutrient, primarily phosphorus (P), applications to turf. It states when, how, and with what frequency soil tests are to be conducted. Included is information on the number and depth of soil cores to be collected. From greens and tees, soil cores are to be collected from a minimum depth of the root system or two inches, whichever is

the maximum. The reason for the shallow sampling is because many sites have a preponderance of *Poa annua* which has a short root system; it simply doesn't make sense to collect soil deeper than the root mass. Acceptable phosphorus tests will be limited to either the Bray P1 or Mehlich III for golf turf (Tables 1 and 2). Testing shall be done at 5 yr periods if P is applied, though testing may be done more frequently and is not necessary if no P is applied.

The document also defines how and when nutrients will be applied-primarily N and P, though some consideration is given to potassium even though it is not considered a potential water contaminant of concern.

The committee made significant attempts to develop a reasonable document. For example, it recognizes that soil test results cannot always be practically obtained prior to establishment but that P as starter fertilizer is often helpful to produce a dense turf cover which reduces erosion and runoff. Consequently up to 1 lb N from a starter fertilizer may be applied in the absence of a soil test if necessary. Such an application would provide approximately up to 2 lb of P expressed as $P_2 0_5$ or about 0.9 lb actual P/1000 ft^2. However, documentation will be required as to the reasons why test results could not be used and to provide justification for the rates applied.

Nitrogen applications will be limited to a maximum of 6 lb/1000 ft^2 during the first 12 months of establishment on native soils and 10 lb N/1000 ft^2 on sand based root zones. Following the first year of establishment on general turf areas, N applications cannot exceed 4 lb N/1000 ft^2 annually and 3 lb N/1000 ft^2 annually after the third year of establishment if clippings are returned. Due to the need to recover from high intensity damage, up to 8 lb N/1000 ft^2 can be applied to tees composed of native soil and 10 lb N/1000 ft^2 for tees on sand based root zones. The different values are based in part on soil test results and other data collected over time by Dr. Kussow (UW-Madison Soil Science Department).

Phosphorus fertilization is limited to soil test recommendations as shown in Tables 1 and 2. If the soil is calcareous then P fertilization may be applied monthly until soil test P levels stabilize between 38-50 ppm.

In order to protect groundwater from fertilizer runoff, fertilizer is not to be applied to saturated or frozen soils. An allowance is pro-

Table 1. Bray P1 (Phosphorus) Soil Test Interpretations and Recommendations for Turf Nutrient Management Technical Standard, Wisconsin 2006.

	Nutrient Concentrations			**Phosphorus Recommendations** [Note 1]			
	Soil Test P		Concentration	lb P_2O_5/1000 ft^2		lb P_2O_5/acre	
	ppm P	lbs/acre	Interpretation				
Turf Establishment	0-15	0-30	Very low	3		131	
From Seed	16-30	31-60	Low	2		87	
	31-45	61-90	Medium	1		44	
	45-50	91-100	Optimal	0		0	
	>50	>100	Very High	0		0	
Turf Establishment	0-10	0-20	Very low	3		131	
From Sod	11-20	21-40	Low	2		87	
	21-30	41-60	Medium	1		44	
	31-40	61-80	Optimal	0		0	
	>40	>80	Very High	0		0	
Established Turf,	0-5	0-10	Very low	3		131	
Low Traffic	6-10	11-20	Low	2		87	
Areas	11-15	21-30	Medium	1		44	
	16-20	31-40	Optimal	0		0	
	>20	>40	Very High	0		0	
				High Traffic Areas [Note 4]	**Fairway**	**Tees and Greens**	
Established Turf,						**Sand** [Note 5]	**Push-up** [Note 6]
High Traffic				lb P_2O_5/1000 ft^2	lb P_2O_5/acre	lb P_2O_5/1000 ft^2	
Areas [Note 2]	0-12	0-24	Very low	5	200	3	5
	13-25	25-50	Low	3.5	150	2	3.5
	26-37	51-74	Medium	2	100	1	2
	38-50	75-100	Optimal [Note 3]	1	50	0.5	1
	>50	>100	Very High	0	0	0	0

Table 2. Mehlich III (Phosphorus) Soil Test Interpretations and Recommendations for Turf Nutrient Management Technical Standard, Wisconsin 2006.

	Nutrient Concentrations			Phosphorus Recommendations [Note 1]			
Established	Soil Test P		Concentration	**Sand** [Note 5]		**Push-up** [Note 6]	
Golf Turf [Note 2]	ppm P	lbs/acre	Interpretation	lb P_2O_5/1000 ft^2		lb P_2O_5/1000 ft^2	lb P_2O_5/acre
Fairways				NA		6	260
	0-12	0-25	Very Low	NA		4	175
	13-24	26-49	Low	NA		2.5	100
	25-37	50-75	Medium	NA		1.5	50
	38-50	76-100	Optimal [Note 3]	NA		0	0
	>50	>100	Very High	NA			
Established				**Sand** [Note 5]		**Push-up** [Note 6]	
Golf Turf [Note 2]				lb P_2O_5/1000 ft^2	lb P_2O_5/acre	lb P_2O_5/1000 ft^2	lb P_2O_5/acre
Tees and Greens	0-5	0-11	Very Low	3	130	5	220
	6-10	12-21	Low	2	90	3.5	150
	11-19	22-39	Medium	1	45	2	90
	20-30	40-60	Optimal [Note 3]	0.5	20	1	45
	>30	>60	Very High	0	0	0	0

Note 1 Recommendations provide the maximum amount of fertilizer that can be applied between soil tests. When soils require phosphorus, one of two approaches may be taken. Option one is to make what is known as a corrective application. This is a one-time application of the amount of phosphorus recommended. The second option is that of gradual buildup, and then re-testing of the soil to check if the desired level of phosphorus was achieved. Gradual buildup of phosphorus is accomplished by seeking the proper type or grade of fertilizer to apply at different times of the year. Use either the ppm of lbs/acre column for the soil test, and either the lbs/1000 ft^2 or lbs/acre column for the recommendation.

Note 2 Low maintenance turf and roughs shall follow recommendations for established turf, low traffic areas.

Note 3 The application recommendation is to maintain the level at the ppm which is considered the optimal range for turf that receives high traffic.

Note 4 Areas including but not limited to athletic fields, intensively used paths in low traffic areas, and high use park areas.

Note 5 50% or more of the root zone by depth is sand.

Note 6 More P needs to be applied to pushup greens in order to increase the soil test P. This is because native soils have a greater capacity to bind P, thus making it less available than in sand based greens.

vided to allow for application of fertilizers (e.g., Milorganite) to melt snow or ice on greens. If such an application is made, the amount of N and P applied will probably need to be incorporated into the nutrient management plan. Whether or not the application will count towards the annual N rate is unknown.

The committee invited experts in turf soils and water quality management to clarify pertinent issues or situations. Dr. Kussow provided substantial guidance and recommendations throughout the process due to the relevancy of his research program. Considerable discussion occurred regarding entry of nutrients, primarily N, into groundwater. The document was subsequently written to further restrict N applications in particularly sensitive areas. For example, in areas with highly permeable soils, soils with less than 20 inches to bedrock, or less than 12 inches to the apparent water table, N sources will have to be no more than 50% water soluble, unless no more than 1/4 lb N/M is applied at a given time. In recognition that spoon-feeding of nutrients is often the most efficient method of application to prevent nutrient movement, this last statement allows superintendents to use foliar fertilization which relies on water-soluble N sources. The document goes on to state that tile inlets and other entrances into storm water drains must be covered prior to fertilizer application if these drain off-site or to other on-site areas connected to surface and/or groundwater.

Steps to protect surface water contamination include prohibitions against applying fertilizer to saturated soils, wetlands, surface water or impervious surfaces such as driveways or sidewalks. If slopes are steeper than 10%, N sources will be at least 50% water soluble in order to facilitate soil absorption. Lightweight natural-organic sources of N, which are not soluble, are more likely to runoff from slopes than water soluble sources for a longer time period following application. If turf to be fertilized is within 20 feet of a water body or ordinary high water mark, only foliar applications are allowed for general turf areas. Tees and greens may be fer-

tilized with a drop spreader but in either case no more than 2 lb N/M/year may be applied.

Management Plans Required

Nutrient management plans will need to be developed for areas that receive fertilizer. Such plans are already being required for conventional agriculture in Wisconsin. The management plan will have to include a map showing site topography, designated uses, soil test locations, sensitive areas and surface waters. The narrative will include information on the turf species and soil types of the site, a response plan for addressing fertilizer spills, soil test results, and a fertilization plan. The plan will have to be developed by a certified golf course superintendent, an individual with a bachelor's degree in turf and grounds management or equivalent experience or training in turf. Some original proposals would have required a Certified Crop Advisor (CCA) to develop the plan but the group agreed turf management has a different goal, and requires different strategies, than yield-based agriculture and CCA training and testing programs do not address turf.

How Code 1100 Will Impact Superintendents

Superintendents will have to develop, or pay a qualified person to develop, a nutrient management plan for their golf course. Soil testing may be a new expense for some courses, particularly those unused to soil testing, but will not be a major expense for most courses. Recordkeeping of fertilization will be required but is unlikely to burden most superintendents as this sort of recordkeeping is already commonplace.

Perhaps the most negative aspect is the implied idea that turf fertilization is automatically bad for the environment: the technical nature of the document does not allow statements to explain the purpose or relationship of fertilization to turf density and nutrient runoff or leaching. Without such a statement the document may have the unintended consequence of sending a negative signal to the public. Parks, schools, homeowners and other entities will likely find the nutrient management plan too cumbersome and soil testing too expensive and stop fertilizing all together. In such a case the document may actually have an effect opposite of that intended as research shows properly fertilized turf actually has less nutrient runoff than unfertilized turf. Nutrients, especially N, is required for maximum turf density and dense vegetation is known to reduce runoff, erosion and both soluble and sediment-bound nutrients. On the other hand such a document shows the public that steps have been taken to minimize nutrient loading into the environment from turf fertilization, and for the most part the guidelines will allow for good turf. One potential agronomic problem with such regulations is that they have inherent inflexibility which hampers response to unique situations. For example, how will turf be managed to recover from root rot diseases when soil tests indicated sufficient P exists in soil for established turf, yet the absence of a root system prevents the turf from accessing the phosphorus?

Reviews are Planned

One of the most enlightening aspects of the situation is that the WDNR realizes modifications may be needed in the future and have planned for the technical standard to be subject to revision as necessary. Part of the flexibility is due to the recognition that new technologies and/or fertilizer formulations may change some agronomic practices for the betterment of the environment. A review of the document is planned for approximately December 2008. Questions or suggestions can be sent to Mary Ann Lowndes, Urban Stormwater Engineer, Madison DNR Office, P.O. Box 7921, 101 S. Webster St., Madison, WI, 53707. You may also contact me directly (jstier@wisc.edu; 608-262-1624). The document can be viewed at http://dnr.wi.gov/org/water/wm/nps/stormwater/techstds.htm.