Addendum to

CURRENT CALCULATIONS IN THE WISCONSIN P INDEX, November 2010:

Updates to Lookup Tables in SnapPlus v.15

December, 2015

While the Wisconsin P Index equations remain the same as those listed in the November 18, 2010 document, some P Index look-up databases are updated in SnapPlus version 15. Updates are explained below.

Precipitation databases:

The "Average precipitation by season for selected rainfall stations in Wisconsin" (p.13) and the "Appendix: Frost-free period and seasonal Rainfall Runoff Histograms for the Wisconsin P Index" have been expanded to include county-specific average precipitation and histograms for calculating average rainfall runoff. The period of record for this data is 1990 to 2012. The updated tables are in WI P Index Precipitation 2015.

Soil groups for Runoff Dissolved P calculation:

The Wisconsin P Index is designed to work within Wisconsin's nutrient management planning framework and takes advantage of soil classifications already used within that framework. UW-Extension soil fertility guidelines are part of that framework, and they assign a Soil Group classification to each soil map unit component in Wisconsin (Soil Testing Laboratories, 2015). In the P Index, we use the Soil Group classifications to assign a factor for estimating runoff dissolved P concentrations from Surface Bray P1 as outlined in the table on p. 8. UW-Extension guidelines, however, no longer use the A, B, C, D, E, and O Soil groups shown in that table. The current guidelines use just three soil groups: Loamy (L), Sandy (S) and Organic (O) (Laboski and Peters, 2012). The L group contains most of the soils that were formerly in the A, B, C, and D groups, while the new O group is equivalent to the former one and the S group is roughly equivalent to the former E group.

To determine the relationship between the new soil groups and runoff dissolved P concentrations, we measured dissolved reactive P in 1:50 soil: water extractions of 398 soil samples. These were a subset of samples from the incubation experiments that Pagliari (2011) undertook for his PhD research (25 surface soils from 23 series x 8 manure or fertilizer amendment treatments x 2 replicates). Bray P1 ranged from 12 to 106 ppm. Of the 25 surface soils, 21 were classified as L and four were S. The L soils had an average Water-extractable P to Bray P1 ratio of 0.006 ($r^2 = 0.76$), so L soils are now assigned to the equation used for soil groups A, B, and C in table 8. Note, however, that this was relationship was established with the removal of the Chetek sandy loam samples (control and amended) from the L dataset. Chetek soils were formerly classified as E (sandy) soils but now meet the criteria for L. With the Chetek

samples included, the ratio was 0.005 and $r^2 = 0.67$. The average ratio of Water-extractable P to Bray P for samples from the S soils was 0.003 ($r^2 = 0.19$), higher than the 0.002 shown for E soils in table 8. The factor used for S is not 0.003. Due to the poor fit, particularly for the S soils, we are continuing to look for better ways to categorize soils for assigning a Water-extractable P to Bray P1 ratio.

Note that the A, B, C, D, E and O groups are still used in the WI P Index to assign base winter runoff (p.5). We hope to have sufficient information to implement a new system for assigning these values by the 2016 release of SnapPlus.

Upper limit set on water soluble P release from manure in a single season:

To ensure that the P Index does not estimate more manure soluble P release in a season than could be carried by the average amount of precipitation in that season, we set an upper limit for the soluble P in surface-applied manure in each season that can be entered into this equation on p. 8:

Season *n* DP_{manure} = Soluble P from surface-applied manure $_{season\ n}$ x Runoff to precipitation ratio $_{season\ n}$ x Phosphorus Distribution Factor $_{season\ n}$

The Soluble P from surface applied manure should be summed for all applications for each season and the results compared to the upper limits for each season listed below.

Fall- 20 lb/acre

Winter – 21 lb/acre

Spring – 27 lb/acre

Summer – 37 lb/acre

Any amount that is greater than this should be added to the Soluble P from surface manure for the next season.

This change will only affect P Index calculations for areas with very high manure application rates such as cattle exercise lots. To illustrate, these maximum amounts of soluble P are approximately what would be in the following rates of semi-solid dairy manure applications: fall - 28 tons per acre; winter - 30 tons per acre, spring - 38 tons per acre; and summer - 52 tons per acre.

Corrections to Frozen Ground Acute Winter Loss P Index description:

The following statement on p.14 contains two inaccuracies, *"On the Snap-Plus cropping screen for each field where the Annual Total PI components are displayed (under "details"), the Acute loss (frozen) PI is in a separate row below the Soluble PI. The Soluble P I displayed there includes all Soluble PI components except for the Frozen Ground Acute Loss Index, so if you add those two together, you will get the complete Soluble P Index."*

Correction 1: This section of the SnapPlus cropping screen display has been changed. The name of this index is now Acute Winter Loss PI and it is only displayed for WPDES-permitted farms. It is used to help permitted farms comply with NR243.

Correction 2: The Soluble P Index now includes **all** of the estimated runoff dissolved P loads from a field, including the losses from manure on frozen ground. When both are displayed, the Acute Winter loss PI should be considered a component of the Soluble PI and not an additional loss.

References:

Laboski, C. A. M., J. B. Peters, and L. G. Bundy. 2012. A2809 Nutrient application guidelines for field, vegetable, and fruit crops in Wisconsin. University of Wisconsin Extension. Madison, Wisconsin.

Pagliari, P. H. 2011. Investigation of inorganic and organic phosphorus in animal manure and their effects on soil test phosphorus. Dissertation. University of Wisconsin-Madison.

Soil Testing Laboratories. 2015. A2809 Soil Map Unit Series Interpretations. University of Wisconsin. Available at https://uwlab.soils.wisc.edu/a2809-soil-map-unit-info .