Michigan Phosphorus Risk Assessment (MPRA) Guidance Document
Adapted for Use with General Permit MIG010000
Concentrated Animal Feeding Operations (CAFO)

The Michigan Phosphorus Risk Assessment (MPRA) tool is a set of phosphorus indices used in nutrient management planning. The MPRA included in the General Permit MIG01000 is based on the tool developed according to the Michigan Phosphorus Risk Assessment, (Phosphorus Index, Version 2) Date: August 2007 (REV January 2014)" by the Natural Resources Conservation Service (NRCS). The Department of Environment, Great Lakes, and Energy (EGLE) has adapted the NRCS MPRA tool for Michigan's CAFO General Permit. This guidance document is meant to be used with the MPRA Microsoft Excel spreadsheet which can be accessed at https://www.michigan.gov/egle (select 'Water', 'Permits', Surface Water', 'NPDES Permits', 'Concentrated Animal Feeding Operations (CAFO)'; Search under 'CAFO Guidance Documents').

The MPRA is composed of two primary components that influence phosphorus movement off the landscape; transport and source. Within each of the two primary factors are several phosphorus index categories that influence the potential risk of offsite phosphorus movement. A description of each of the phosphorus index categories, and guidance for using the MPRA spreadsheet to evaluate individual field land applications is provided below.

TRANSPORT FACTOR

Water Erosion (RUSLE2)- Single Year

Water erosion can greatly influence the movement of phosphorus off the landscape. Water erosion, as it relates to the MPRA tool, is predicted using the Revised Universal Soil Loss Equation (RUSLE2) software that guides conservation planning, inventories erosion rates, and estimates sediment delivery. RUSLE2 is a model that estimates soil loss and sediment delivery and is based on a single crop year method. Based on field and landowner inventory, users identify county and field location, soil map unit, predominant slope gradient and slope length, current crop including yield at the time of application, and any conservation practices installed (e.g., grassed waterway, buffer strips, contour planting). Depending on the distance to surface water, a field may be segmented into smaller portions. Users should NOT use the crop rotation method.

Runoff Curve Number (RCN)

The Runoff Curve Number, RCN, ranks the relative infiltration of a field's surface based on a combination of Hydraulic Soil Group (A, B, C or D), land use factors, and farming practices. Generally, runoff potential is lowest in "A" soils and highest in "D" soils. However, "D" soils can be artificially drained using subsurface drainage. If a field is artificially drained, the drained Soil Hydraulic Group should be used. The description of land use is based on field cover type (e.g., cultivated crop land, permanent pastureland) and surface condition. Users may modify the land use by designating the surface condition as "good" if the field encourages infiltration, or "poor" if compaction has increased bulk density and infiltration is discouraged, or surface residue at the time of application is < 20% cover.

Users select the RCN from NRCS tables listed in the RCN sheet of the MPRA Excel spreadsheet. Lower RCN numbers indicate higher infiltration, less surface runoff potential, and therefore, lowers the score of this category.

Distance to Surface Water and/or Surface Inlets

The distance to surface waters is an important factor when considering the impact manure application will have on the potential eutrophication of the waterbody. Users will measure the distance to surface water (wetland, drain, lake, river, stream) from the edge of the field boundary (in feet). Setbacks are to be measured from the ordinary high-water mark, where applicable, or from the upper edge of the bank if the ordinary high-water mark cannot be determined. Setbacks, or a 35 feet vegetated buffer, is required for any open tile line intake structures, sinkholes, agricultural wellheads, or any ditches that are conduits to surface waters of the state.

The greater the distance from surface waters, the lower the potential for surface transport of phosphorus into a waterbody. This transport factor does not include an assessment of slope gradient. Slope is accounted for in using RUSLE2 when predicting water erosion potential. Users may mitigate the distance to surface water by segmenting the crop field into that portion near surface water, and that portion of the field that is greater than 300 feet from the waterbody.

Subsurface Drainage

The category of subsurface drainage refers to a network of conveyances at some depth (usually 3 feet or 1 meter) in the soil profile that lowers the water table and increases soil water drainage above the vertical depth of the network. In most Michigan fields the subsurface drainage will be patterned or random with an outlet to a surface ditch or stream. A surface inlet provides another conveyance structure, usually a pipe, for directly transporting surface water to a ditch or stream from a depressional area. This will require a 100 feet setback or a 35 feet vegetated buffer. If multiple surface inlets are mitigated by providing a greater than 35 feet permanent buffer, then a higher rank of 2 or 4 in this category can be offset by a 0 score in the buffer category. If the field edge is greater than 300 feet from a surface water, then this category is scored a 0. Similarly, if the landowner uses a 300 feet manure application setback from surface water and/or surface inlets, then this category will also score 0.

Buffers

The category of buffers refers to native or established permanent vegetation that may or may not be a part of the field. The ability of a buffer to reduce velocity of overland water flow, enhance sediment deposition, and treat soluble phosphorus by plant uptake is a function of width and buffer quality. The user will select this category based on width only. The quality of the buffer is field site-specific. No buffer is required if the field edge is greater than 300 feet from surface water. In this case, the category rank is 0. If surface water is 300 feet or less from the field edge, then the buffer width drives the category rank. Regardless of buffer width, the minimum setback of manure application shall follow the setback requirements in Part. I.B.3.h. of the General Permit. In general, CAFO waste cannot be applied closer than 100 feet to any open tile line intake structures, sink holes, agricultural well heads, and ditches that are conduits to surface waters, or surface waters of the state. The 100 feet setback can be substituted with a 35 feet wide vegetated buffer, and CAFO waste cannot be applied within the 35 feet buffer. In addition, CAFO waste cannot be applied within grassed waterways and swales that are conduits to surface waters of the state.

SOURCE FACTOR

Soil Test Phosphorus (STP)

The source category of Soil Test Phosphorus, or STP, is the concentration of labile phosphorus in the soil that is predicted to be available for plant uptake during the growing season in the soluble form. The required analysis for testing soil phosphorus is the Bray P1 method. The units are in parts per million (ppm). If the soil test results list units of phosphorus as pounds per acre, and if the soil sampling depth is at the acre furrow slice depth of 7 inches, then divide the STP (pounds per acre) by 2.

If the Bray P1 soil test result is 150 ppm or more, CAFO waste applications shall be discontinued (denoted in the MPRA Excel spreadsheet with *).

P fertilizer Method

This source category evaluates the timing and method of fertilizer used on fields. Phosphate fertilizer refers to any blended or custom inorganic fertilizer containing phosphorus. This category also applies to other organic wastes not considered manure. Based on landowner application method, users will select the placement (injected, incorporated, or surface application) and timing (less than 2 days, 3-7 days, 8-15 days, or greater than 15 days before planting). For most landowners, option 1 (less than 2 days) is the likely rank, unless the field STP does not require additional phosphate, then a score of 0 will be selected.

Manure Method

This source category evaluates the timing and method of application of animal manure on fields. Manure refers to solid or liquid, and from all species of livestock.

Fields Receiving Tillage

Based on landowner application method, users will select the method of manure placement (injected, incorporated, or surface application), and the surface application resident time (fields receiving tillage must incorporate manure within 24 hours). Landowner injecting or incorporating manure within 24 hours will receive the lowest rank if manure is applied on a field.

No-Till Fields

On no-till or perennial crop (alfalfa, pasture) fields, manure surface applied during the crop growing period will score a 2. On no-till fields, manure applied during the fall after harvest season, and that is not incorporated until the next spring, will score an 8. However, this manure timing can be mitigated by planting a cover crop, which reduces the score to 2. Irrigation of liquid manure (and/or processed wastewater) that is incorporated within 24 hours will score a 1. Irrigation of liquid manure on a growing crop, perennial crop, or cover crop will score a 2.

P2O5 Rate All Sources

This source category is based on both fertilizer and manure application rates. If no phosphate fertilizer is applied, this will result in a score of 0. If no greater than 1-year's phosphate is applied at one time, this practice will score a 0. Landowners can mitigate a “high” score by reducing the application rate of phosphate from multiple years to 1- or 2-year's crop removal. Note that crop removal is field- and yield goal- specific.

If the field MPRA total score is “low” (less than 11), then the 3- and 4-year crop removal application rates are acceptable (denoted in the MPRA Excel spreadsheet with ***). The application of phosphate at a rate greater than 4-year crop removal is not allowed (denoted in the MPRA Excel spreadsheet with **).

References

NRCS 2014. Michigan Phosphorus Risk Assessment, (Phosphorus Index, Version 2) Date: August 2007 (REV January 2014).