Chesapeake Bay Program
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DATE: June 6, 2016

FROM: Karl Berger, Chair, Biosolids Task Force

TO: Tanya Spano, Chair
Wastewater Treatment Workgroup

RE: Recommendations for Use of Biosolids Data in Scenario Builder and the Phase 6.0 Watershed Model

This memo provides the recommendations of an ad hoc Task Force for the use of biosolids information in the Chesapeake Bay Program's Phase 6.0 Watershed Model and Scenario Builder. Seven specific recommendations are listed below, and represent the consensus of the Biosolids Task Force members. These recommendations will be incorporated into the third beta calibration run of the Phase 6.0 Watershed Model, and may be adjusted as necessary in subsequent beta runs by the Task Force and the Wastewater Treatment Workgroup.

Organization

The Biosolids Task Force was created by the WWTWG to respond to guidance from the WQGIT to address the issue of biosolids application in the Bay watershed and to develop recommendations on how to best address these potential loads within the Watershed Model. The Task Force membership and charge was approved by the Wastewater Treatment Workgroup in February 2016. Membership was solicited from each of the Bay Partner jurisdictions and industry stakeholders/experts.

Biosolids Task Force Membership:

Brian Churchill	DE DNREC
Allison Marong	MDE
Alisha Mulkey	MDA
Anita Stabile	PA DEP
Neil Zahradka	VA DEQ
Bill Keeling	VA DEQ
Brian Cauthorn	VA DEQ
James Summers	WV DEP
Al Razik	Maryland Environmental Service
Karl Berger	MWCOG
Nasser Ameen	MWCOG
Trudy Johnston/Lisa Boudeman	Material Matters

John Uzupis	Synagro

Bay Program staff participation included:

David Wood	CRC, CBPO
Matt Johnston	UMD, CBPO
Ning Zhou	VT, CBPO

The Task Force held four conference calls:

- February 9
- March 1
- March 31
- April 28

Details are available on the calendar pages of the Bay Program website: http://www.chesapeakebay.net/calendar.

Scope and Purpose

The Task Force was charged with the following items:

(1) Encourage further submission of biosolids data by states.
(2) Develop recommendations for how biosolids data should be used in the modeling suite and develop rules for how to address data gaps.

Recommendations

1. Definition of Biosolids

For the purposes of providing input to the Chesapeake Bay Program's modeling framework, biosolids are defined as the solid, semisolid, or liquid materials removed during the treatment of domestic sewage in a treatment facility – when those materials have been further treated to meet the standards established in state and federal regulations for use of such residual materials for application to farmland[1]. At the discretion of each individual Bay Partner jurisdiction, it also may include data on septage processed outside of wastewater plants and applied to farmland[2]. Any influent material that is processed through such treatment facilities, including food waste, can contribute to the total mass of biosolids.

Notes:

(1) Biosolids also are applied to forest land, to mine land reclamation sites, and in a variety of horticultural settings in the urban environment. These uses will not be tracked for their impact on nutrient loads, as applications of organic sources to these settings are not simulated by the modeling tools.
(2) Some states include information on separately-processed septage in their biosolids records. Although lacking precise data, the Task Force estimated that separately processed septage accounts for less than one percent of the amount of nutrients supplied by biosolids application to farmland. For those who do not, the Task Force recommends that each state determine for itself whether to report septage data.

2. Gap Filling Rules

The following rules are recommended by the Task Force for use by Bay Program analysts to fill gaps in the biosolids data supplied by the states and by state analysts in processing their own data. State analysts can use other reasonable methods as long as they provide documentation of those methods.

- INTERPOLATION: If a state provides data for certain years with missing data for years in between, interpolation should be used to fill in unknown years.

- BACK-CAST: If data are not provided in previous years going back to 1985, the most recent year's data should be used.

- FUTURE: For every future year unreported or unknown, data from the most recent year provided should be used.

- NUTRIENT SPECIES STATE-WIDE: If only total pounds of nutrients are provided, then the statewide, average species concentrations from the most recent year should be used.

- NUTRIENT SPECIES WATERSHED-WIDE: If a state NEVER reports nutrient concentrations, then the watershed-wide species concentrations from the most recent year should be used.

- COUNTY DISTRIBUTION - 1: If county-applied data is provided for some years and not others, then biosolids should be proportioned to counties based upon the most recent county distribution supplied.

- COUNTY DISTRIBUTION - 2: If county-applied data is NEVER provided by state, then biosolids should be proportioned to counties based upon manure-eligible crop application goal for that year.

3. Crop Distribution Process

The application distribution of total biosolids across the major crop types within the Phase 6.0 Model's agricultural land uses differs across the states in the Chesapeake Bay watershed. In addition, crop use patterns vary from county to county within a state based on the crops being grown and other factors. However, the Task Force agreed that the crop allocation method used in Scenario Builder for manure – which weights the likelihood of a particular crop receiving manure based on overall watershed-wide data for manure use by crop – could also be used for biosolids.

Accordingly, the Task Force has developed an overall biosolids distribution scheme, by crop group type, for the entire watershed based upon 2010 application data provided by MD, VA and WV. These data indicated that biosolids were more likely to be applied to pasture and hay than to row crops. Figure 1 shows the relative percentage breakdown of applications to different crop groups. This distribution is used to produce weighting factors that represent the likelihood that biosolids will be applied to a particular crop group in a particular county. These weighting factors are listed in Table 1. Used in combination with the biosolids data provided by the jurisdictions and Ag Census data on crop acreages by county, the resulting distribution should approximate the county-by-county variation in biosolids application, by crop, throughout the watershed.

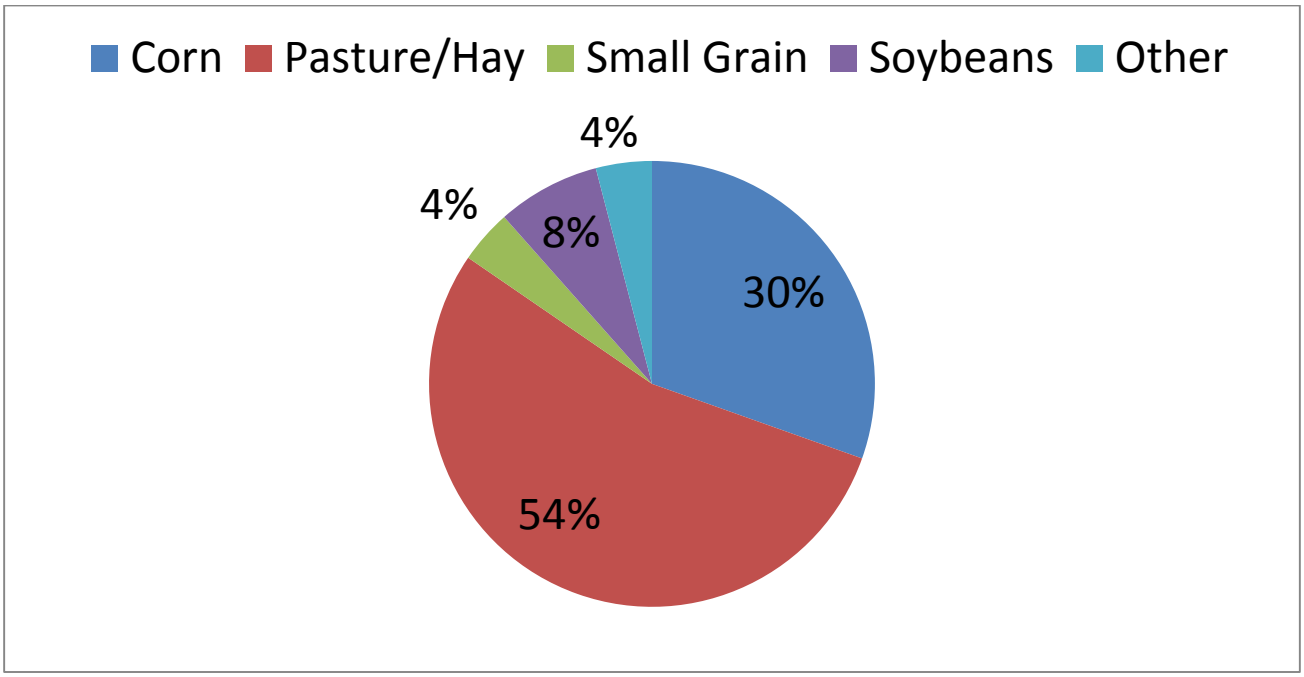

Figure 1. 2010 Biosolids Applications Across MD, VA and WV by Crop Group Type

Table 1. Weighting Factors for Biosolids Applications to Meet Crop Application Goal

Crop	Percent	Percent/Percent Corn
Corn	30.43	1
Pasture/Hay	54.14	1.7792
Small Grain	3.89	0.1278
Soybeans	7.48	0.2458
Other	4.06	0.1334

Although members of the Task Force believe that biosolids crop distribution has changed somewhat over time in response to changes in state regulations and other factors, there is no complete data set for biosolids application throughout the model's calibration period and very little data for the early years of the calibration period. Therefore, the Task Force recommends that the crop distribution model be used throughout the calibration period. The Chesapeake Bay Program has taken the same approach for simulating manure application to crops, and the Task Force felt it was also appropriate for biosolids application.

4. Nutrient Species Composition

For the most part, state data is available that disaggregates the pounds of total nitrogen from biosolids applications by the nitrogen nutrient species required by the modeling suite (nitrate, ammonium N, and organic N). For states where nutrient species composition is not available, the Task Force recommends using the gap-filling methods outlined above, or providing documentation for another reasonable method.

The phosphorus nutrient species used within the modeling suite are currently under investigation for their usefulness in model simulation of biosolids phosphorus fate and transport, which is different than the same dynamics for manure and fertilizer phosphorus. However, fate and transport of nutrients was not a

main concern of the Task Force. Instead the group was more concerned with total nitrogen and phosphorus applications to the land.

5. Eligible Crops

Each state will provide a list of crops that are eligible to receive biosolids. The list may vary by state. As of this writing, DE, MD, PA and VA have provided such a list. For all states who have not provided a list, biosolids will be applied to all crops eligible for manure applications. Below is an example of crops eligible to receive biosolids in DE.

Crops Eligible to Receive Biosolids in DE

- Barley for grain Harvested Area
- Corn for Grain Harvested Area
- Corn for silage or greenchop Harvested Area
- Cropland in cultivated summer fallow Area
- Cropland on which all crops failed or were abandoned Area
- Haylage or greenchop from alfalfa or alfalfa mixtures Harvested Area
- Oats for grain Harvested Area
- Other haylage, grass silage, and greenchop Harvested Area
- Other managed hay Harvested Area
- Rye for grain Harvested Area
- Ryegrass seed Harvested Area
- Small grain hay Harvested Area
- Sorghum for Grain Harvested Area
- Sorghum for silage or greenchop Area
- Soybeans for beans Harvested Area
- Sunflower seed, non-oil varieties Harvested Area
- Sunflower seed, oil varieties Harvested Area
- Wheat for Grain Harvested Area

6. Simulation of Biosolids Nutrient Fate and Transport in the Watershed Model

The Task Force agreed that the Chesapeake Bay Program's Modeling Team should use the same simulation algorithms for biosolids nitrogen that exist for manure nitrogen, since they exhibit similar behaviors. However, the Task Force recommends that the modelers develop separate algorithms for biosolids phosphorus fate and transport, since they have very different behaviors.

7. Review of Final Data

Because the Task Force was limited to examining scenarios using hypothetical data, it would like to reconvene in fall 2016, when all of the biosolids data have been collected and the model results are available for review, in order to verify the validity of these recommended methods.