Agricultural Model Data Inputs and Assumptions: Presentation to the Water Quality GIT October, 2014

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USDA-ARS PSWMRU
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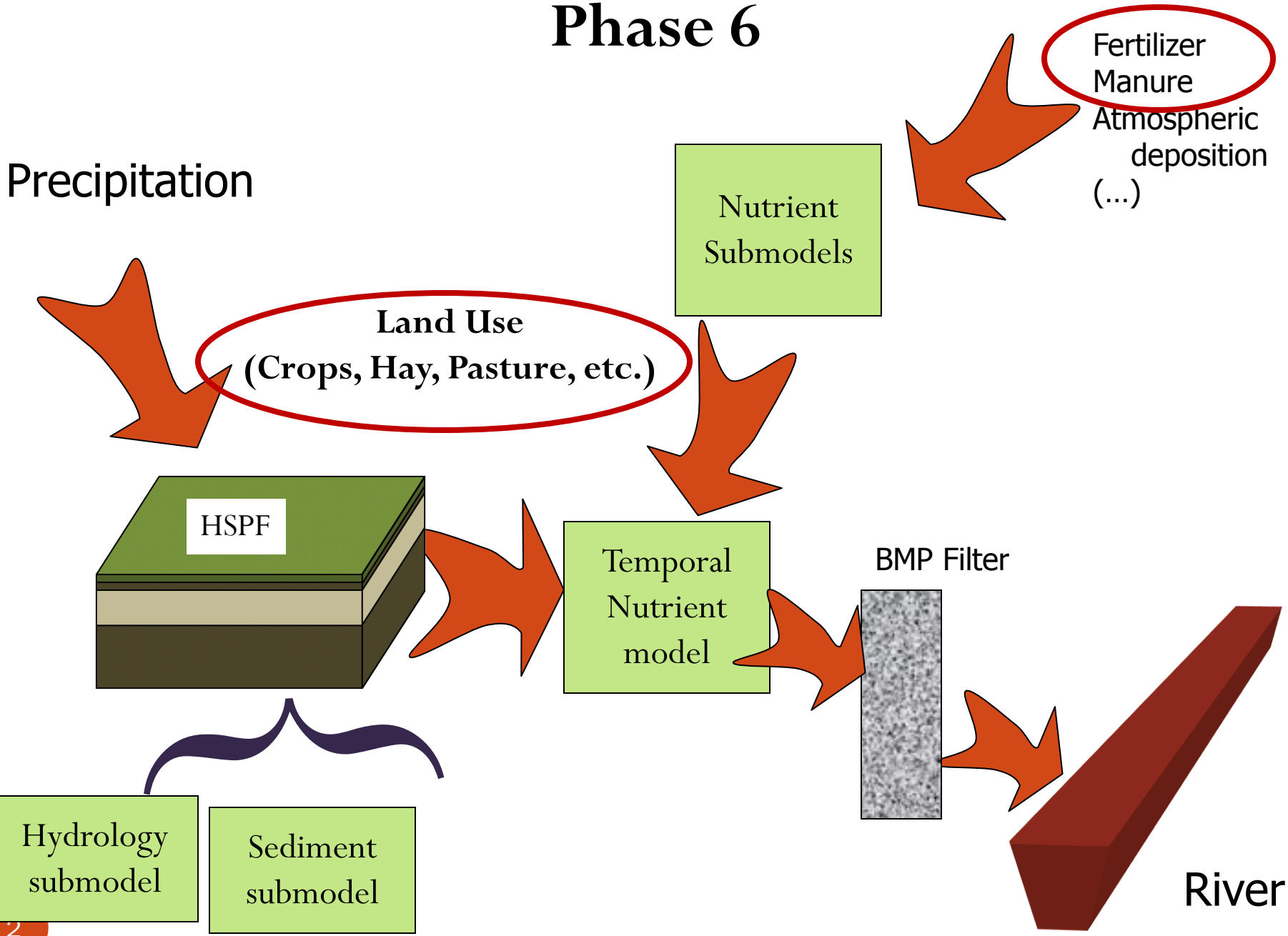
Phase 6


Fertilizer
Manure
Atmospheric deposition
(…)
Precipitation
Nutrient Submodels
Land Use
(Crops, Hay, Pasture, etc.)
HSPF
Temporal Nutrient model
BMP Filter
Hydrology submodel
Sediment submodel
River

Midpoint Assessment Priorities

- Land use categories and conversions — **LAND USE**
- Fertilizer application rates — **FERTILIZER**
- Blended crop yield data
- Utilizing annual agricultural statistics — **NASS DATA**
- Animal Manure
- Animal numbers and distribution of animals
- Manure production estimates
- Manure nutrient concentration estimates
- Manure storage and handling loss and volatilization
- Mineralization assumptions — **MANURE**
- Manure losses, distribution and fertilizer algorithm — **NUTRIENT SPREAD**

Building a Better Bay Model Workshop

- Organized by the Agriculture Workgroup
- Held May 22-23, 2013 in College Park
- Focused on Midpoint Assessment Priorities for agricultural lands
- Primary focus was Scenario Builder
- Structured interaction between Bay Program modeling team and representatives from ag industry, farm organizations, state and federal agencies, universities, and environmental organizations
- Resulted in long list of recommendations primarily focused on improving nutrient input estimates

Building a Better Bay Model Tasks Prioritized by AMS September, 2013

Priority	Task Category	Task	Line Reference in Detailed Recommendations Sheet
High Priority Tasks	Soils	Characterize how legacy nutrients (especially legacy P) impact nutrient losses from agricultural lands.	59,60,61,62
	Soils	Incorporate soil and nutrient content data into the next version of the Watershed Model. Soils test data is available in annual reports from Maryland and Deleware and in nutrient management plans.	55,56,58
	Manure	Collect and analyze data from industry sources on animal populations, manure and nutrients produced, and mortality rates to update Scenario Builder assumptions. Some sources include: Milk Processor Surveys; Dairy, Calves and Heifers Association; National Pork Board Environmental Committee; Pig Production Environmental Footprint Calculator; Iowa State University; Virginia Tech; Poultry Growers Association	33,34,35,36,38,39, 42,44,51
Medium to High Priority Tasks	Manure	Investigate additional sources of data for manure nutrient content and application including: state extension publications; Gilmore and Gilmore, 1992; ASABE Standards; state laboratory results	32,37,39,41,43,46
	Manure	Track annual application of manure through state or other data rather than estimating manure production.	49
	Land Uses	Investigate loading rates for a number of land uses including AFO/CAFOs, trampled riparian pasture, nutrient management lands, etc.	18,19,26,30,31
	Yields	Consider replacing estimated yields with yearly yield values obtained from nutrient management plans or FSA individual farm records.	64,66
	Application	Analyze chemical fertilizer sales data from International Plant Nutrition Institute to estimate amount of fertilizer being applied.	15,17
	Land Uses	Investigate the use of more detailed land use information by using the Cropland Data Layer, USDA-FSA Common Land Units, and local land use data.	20,23,24,27,28,29
	Manure	Collect better litter, manure and biosolids transport data from the states and the industry to better understand how nutrients move around the watershed.	45,50,51
	Application	Analyze farmer surveys completed in Delaware and Maryland which describe biosolids, manure and fertilizer applied to crops.	3,4,15
	Yields	Consider modifying or eliminating the use of theoretical maximum nutrient uptake in Scenario Builder, and using solely local yield data to estimate crop need.	63,65
	Manure	Consider using annual NASS production data where possible to estimate animal populations	47,48
	Soils	Explore soil data for slope and permeability used in USDA-NRCS CEAP modeling.	57
	Land Uses	Compare land uses in the USDA-CEAP project to Watershed Model land uses.	22
	Land Uses	Consider creating a new set of land uses based off of USDA's CDSI land use list.	25
	Application	Investigate extension recommendations for the timing and rates of nutrient applications to crops.	1
	Soils	Investigate mineralization rates in soils and differences in rates between wet and dry years. This info is available from PSWMRU.	54
	Application	Investigate the use of nutrient management planning software such as Maryland's NUMAN or similar software being used at Purdue.	5
	Application	Determine crops that need manure and those that do not. Participants stated that some pasture forage types do not receive manure beyond direct deposition.	2

LAND USES

- GOAL: Review Phase 5.3.2 agricultural land uses and recommend new agricultural land uses
- TASKS COMPLETED
  - Ag Census reports acres >120 crops. Considered typical management and nutrient application conditions on these crops
  - Recommended five categories (Row Crops, Hays and Legumes, Specialty and Other crops, Animal Area, and Farmstead), further broken out to reflect typical management methods
- FUTURE TASKS (to be completed by Dec. 2014)
  - Complete mapping of >120 crops to each land use.
  - Determine procedure to assign "double-crop" acres of crops grown within the same year.
  - Recommend how to best model pasture near streams.
  - Work with TetraTech and workgroups as loading rates and BMP questions arise

LAND USES

2.1 Commodity crops

- 2.1.1 Corn - With manure
  - 2.1.1.1 Grain - fallow
  - 2.1.1.2 Grain - fall sm grain
  - 2.1.1.3 Silage - fallow
  - 2.1.1.4 Silage - fall sm grain
- 2.1.2 Soybeans - With Manure
  - 2.1.2.1 Fall fallow
  - 2.1.2.2 Fall sm grain
- 2.1.3 Small grains-with manure
  - 2.1.3.1 Sm grain - Dbl Crop Beans
  - 2.1.3.2 Forage
  - 2.1.3.3 Sm grain - fallow
- 2.1.4 Corn - Without manure
  - 2.1.4.1 Grain - fallow
  - 2.1.4.2 Grain - fall sm grain
  - 2.1.4.3 Silage - fallow
  - 2.1.4.4 Silage - fall sm grain
- 2.1.5 Soybeans - Without Manure
  - 2.1.2.1 Fall fallow
  - 2.1.2.2 Fall sm grain
- 2.1.6 Small grains-Without manure
  - 2.1.5.1 Sm grain - Dbl Crop Beans
  - 2.1.5.2 Forage
  - 2.1.5.3 Sm grain - fallow

2.2 Hay and Legume and forage

- 2.2.1 Alfalfa and Other Legumes
  - 2.2.1.1 Alfalfa and Other Legumes with manure
  - 2.2.1.2 Alfalfa and Other Legumes without manure
- 2.2.2 Non-legume Forage
  - 2.2.2.1 Non-Legume Forage with manure
  - 2.2.2.2 Non-legume Forage without manure
- 2.2.3 Pasture and pastured cropland

2.3 Specialty & Other crops

- 2.3.1 Vines
  - 2.3.1.1 High nutrient input
  - 2.3.1.2 Medium nutrient input
  - 2.3.1.3 Low nutrient input
- 2.3.2 Low cover
  - 2.3.2.1 High nutrient input
  - 2.3.2.2 Medium nutrient input
  - 2.3.2.3 Low nutrient input
- 2.3.3 High cover
  - 2.3.3.1 High nutrient input
  - 2.3.3.2 Medium nutrient input
  - 2.3.3.3 Low nutrient input

2.4 Animals

- 2.4.1 Animal Impervious
  - 2.4.1.1 CAFO (regulated)
  - 2.4.1.2 AFO (unregulated)

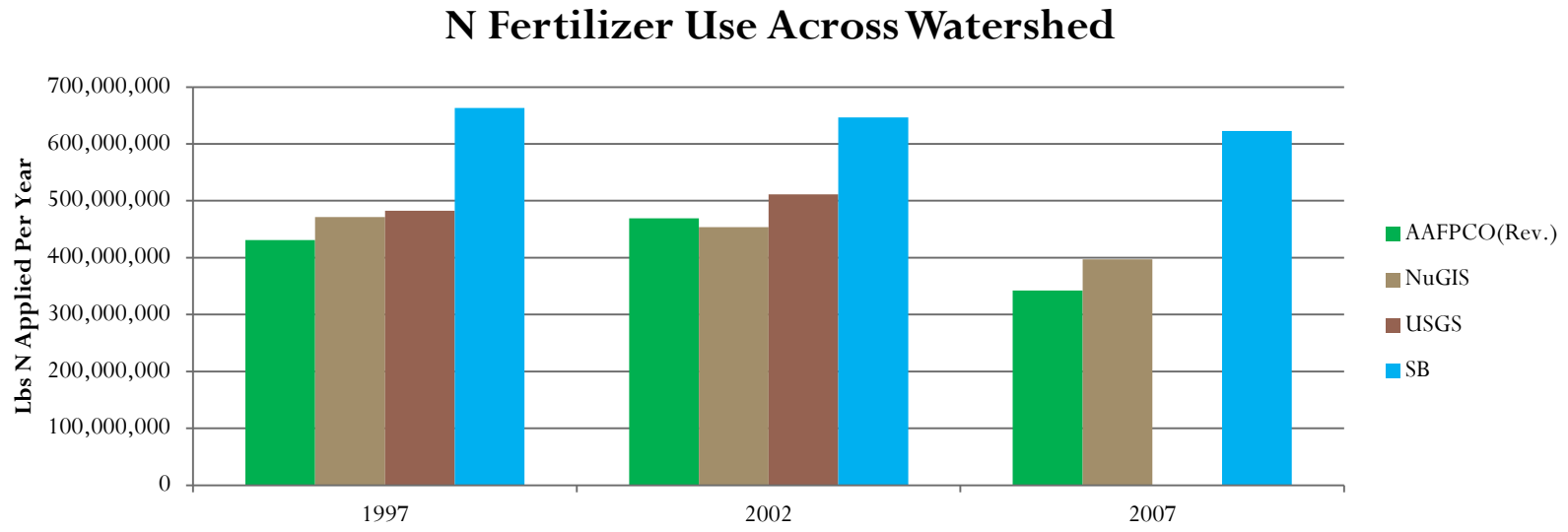
2.5 Farmstead

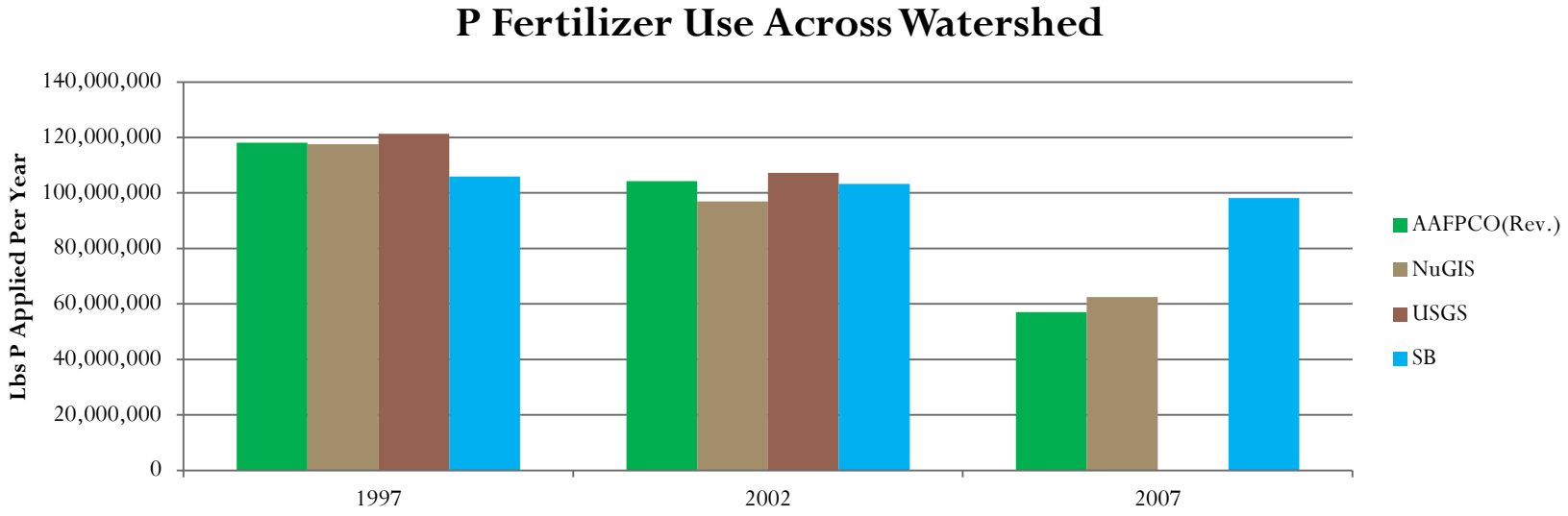
- 2.5.1 Impervious
- 2.5.2 Pervious

FERTILIZER

- GOAL: Review the current fertilizer estimates in Scenario Builder (SB) and propose alternative data sources and methods if necessary.
- TASKS COMPLETED
  - Compared current SB fertilizer estimates to USGS and other estimates.
  - Analyzed annual AAPFCO and Ag Census fertilizer sales/expenditure data.
  - Presented concept of using annual fertilizer sales data in SB to Ag Workgroup. (Previously estimated annual fertilizer inputs based upon a relationship between crop nutrient need and manure availability).
- FUTURE TASKS (to be completed by June. 2015)
  - Propose alternative fertilizer application process.
  - Further assess the volatility in fertilizer sales and Ag Census expenditure data.
  - Propose final method for estimating fertilizer use across years.

FERTILIZER - COMPARISON





NASS DATA

- Goal: Review yearly NASS data to determine if crop yields and animal numbers could be varied based on yearly data rather than Ag Census five-year data.

- TASKS COMPLETED
  - Reviewed availability of yearly crop yield data across states and counties.

- FUTURE TASKS (to be completed by Sept. 2015)
  - Further analyze yearly crop yield data variability to determine it is sufficient.
  - Collect and analyze yearly animal data to determine if it is sufficient .
  - Analyze yearly poultry data to determine if it can be used in conjunction with PLS recommendations.

NASS DATA – YEARLY CROP

Type of Crop	Geographic Scale	Yearly NASS Survey Data (in 100s of acres) Years Available by State					
		DE	MD	NY	PA	VA	WV
Corn for Grain Harvested Area	County	1928-2012	1928-2012	1972-2012	1960-2012	1958-2012	1924-2012
Soybeans for beans Harvested Area	County	1934-2012	1934-2012	2000-2012	1983-2012	1943-2012	1997-2012
Corn for silage or greenchop Harvested Area	County	1978-2008	1974-2008	1974-2012	1960-2012	1974-2008	1975-2009
Alfalfa Hay Harvested Area	County	—	2002-2009	1983-2012	1955-2012	1994-2012	1979-2008
Wheat for Grain Harvested Area	County	1926-2008	1926-2008	1972-2008	1953-2008	1931-2008	1924-2008
Barley for grain Harvested Area	County	1956-2008	1956-2012	1972-2008	1953-2012	1964-2012	1949-1984
Oats for grain Harvested Area	County	--	1978-1999	1974-2012	1954-2012	1974-2008	1994-2009
Other managed hay Harvested Area (Hay, excl. alfalfa & wild)	State	1939-1970	1954-1964	1954-1964	1954-1964	1954-1964	1954-1964
Haylage or greenchop from alfalfa or alfalfa mixtures Harvested Area	State	--	--	2000-2012	2000-2012	--	2001-2004
Wild hay Harvested Area	State	--	--	--	--	--	--
Other haylage, grass silage, and greenchop Harvested Area	State	--	--	--	--	--	--
Small grain hay Harvested Area	State	--	--	--	--	--	--

Yellow indicates crops that are available from 1985 through 2012 at the county scale.
Blue indicates crops that are available from 1985 through 2012 only at the state scale.

MANURE

- Goal: Review the current manure estimates in SB and propose alternative sources and methods if needed.
- TASKS COMPLETED
  - Compared ASABE's 2003 and 2005 manure nutrient concentrations.
  - Began comparing USDA estimation methods with current SB methods.
- FUTURE TASKS (to be completed by Sept. 2015)
  - Propose alternative manure estimate method for each animal group.
  - Propose alternative manure application process in SB.
  - Analyze data collected from Poultry Litter Subcommittee and recommend an alternative litter estimation method.
  - Develop manure mineralization and volatilization estimates from literature.
  - Work with TetraTech to develop estimates of nutrient losses from animal operations.

NUTRIENT SPREAD

- Goal: Review the nutrient application process in the current Scenario Builder and recommend changes to this process if necessary.
- TASKS COMPLETED
  - States reviewed and updated current nutrient application rates to crops.
  - Group reviewed the current "manure disposal" process, and is brainstorming improvements.
  - Modeling Team provided potential alternative application procedure for group to consider.
- FUTURE TASKS (to be completed by Sept. 2015)
  - Complete group review of state-specific nutrient application rates, and determine how rates should be used.
  - Propose and test various methods for applying estimated nutrients from manure and fertilizer.
  - Analyze the impact a new method has on application rates within EVERY county, and adjust method if application rates are unreasonable (unreasonable application rates would suggest data input errors).

OTHER TASKS (to be completed by Sept. 2015)

- SOIL NUTRIENT LEVELS
  - The Phase 6 Model may utilize APLE, a P runoff estimation tool. Soil P levels by county will be needed for SB.
    - The group is awaiting the compilation of soil nutrient concentration data before analyzing how data should be used.
- BIOSOLDS
  - Wastewater Workgroup was asked to compile biosolids data to complete the estimates of nutrient inputs to agriculture.
- SCENARIO BUILDER SOURCE DATA
  - Group needs to review current estimates for the following:
    - Crop Plant and Harvest Dates
    - Amount of Soil Cover by Crop
    - Amount of Detached Sediment Available for Runoff by Crop
    - Nitrogen Fixation by Crop
    - Time Spent in Pasture by Animals