ATCP 51.20 Runoff Management

ATCP 51 TEC Meeting

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DEPARTMENT OF AGRICULTURE, TRADE AND CONSUMER PROTECTION

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ATCP 51.20 RUNOFF MANAGEMENT
~ OUTLINE ~

1. Runoff areas to be addressed
2. Runoff management options
3. Vegetated Treatment Area (VTA)
4. NRCS Conservation Practice Standard 635 (2002 vs. 2016 standard)
5. Modeling Phosphorus Runoff from Animal Lots (BARNY vs. BERT vs. APLE-Lots)

RUNOFF MANAGEMENT
~ AREAS TO BE ADDRESSED ~

Animal Lots:

- ATCP 51.20 (1) New or Substantially Altered
  - Comply with NRCS CPS 635 Wastewater Treatment Strip (ver. 2002)
- ATCP 51.20 (2) Existing
  - Has to meet Phosphorus requirement
  - No discharge to any direct conduit to groundwater

RUNOFF MANAGEMENT
~ AREAS TO BE ADDRESSED ~

Feed Storage [ATCP 51.20 (3)]

- Feed with greater than 70% moisture content must collect leachate and divert surface water runoff

RUNOFF MANAGEMENT
~ AREA TO BE ADDRESSED & AN OPTION ~

Clean Water Diversion [ATCP 51.20 (4)]:

- Runoff from a livestock facility shall be diverted from contact with:
  - Animal lots
  - Waste storage facilities
  - Paved feed storage areas
  - Manure piles within 1,000 feet of navigable lake or 300 feet of a navigable stream

RUNOFF MANAGEMENT
~ OPTIONS ~

Collect and Store

RUNOFF MANAGEMENT
~ OPTIONS ~

Vegetated Treatment Area (VTA):

- Can be used to address
  - Animal lots [ATCP 51.20 (1) & (2)]
  - Feed storage areas [Not an option in ATCP 51.20]

BACKGROUND INFO - VEGETATED TREATMENT AREA (VTA)

- WHAT IS A VTA?
- CONTAMINATION SOURCES APPLIED TO VTAs
- HOW DO THEY WORK?

VEGETATED TREATMENT AREA (VTA)
~ WHAT IS A VTA? ~

Exactly what it sounds like

- Improve water quality by using vegetation
- Vegetation includes:
  - Grasses
  - Legumes
  - and other forbs
  - Row crops:
    - Ok in 2002 635 standard (ATCP 51)
    - Not allowed in 2016 (current) 635 standard

VEGETATED TREATMENT AREA (VTA)
~ CONTAMINATION SOURCES APPLIED TO VTAs~

- Animal lot runoff
  - Not manure solids
- Feed storage runoff
  - Not leachate
- Milking center waste
  - Not fats/solids

VEGETATED TREATMENT AREA (VTA)
~ HOW DO THEY WORK? ~

Wastewater applied over the width of the VTA

VEGETATED TREATMENT AREA (VTA)
~ HOW DO THEY WORK? ~

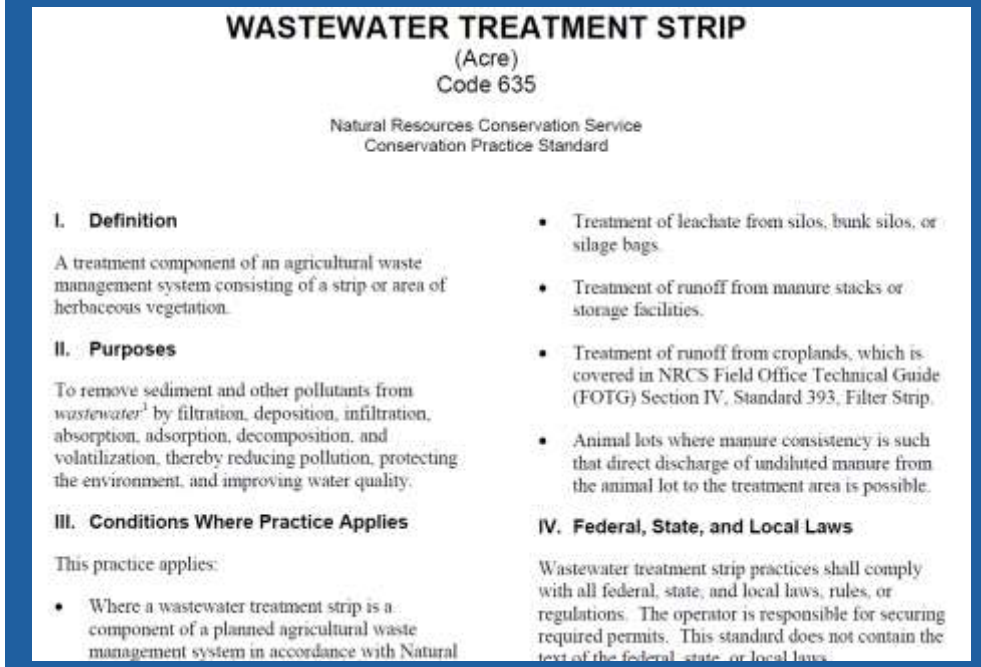
What about when saturated?

VEGETATED TREATMENT AREA (VTA)
~ HOW DO THEY WORK? ~

What about in winter?

NRCS CONSERVATION PRACTICE STANDARD (CPS) 635

WASTEWATER TREATMENT STRIP (JAN. 2002) vs. VEGETATED TREATMENT AREA (SEPT. 2016)



WASTEWATER TREATMENT STRIP

(Acre)
Code 635

Natural Resources Conservation Service
Conservation Practice Standard

I. Definition

A treatment component of an agricultural waste management system consisting of a strip or area of herbaceous vegetation.

II. Purposes

To remove sediment and other pollutants from *wastewater*[1] by filtration, deposition, infiltration, absorption, adsorption, decomposition, and volatilization, thereby reducing pollution, protecting the environment, and improving water quality.

III. Conditions Where Practice Applies

This practice applies:

- Where a wastewater treatment strip is a component of a planned agricultural waste management system in accordance with Natural
- Treatment of leachate from silos, bunk silos, or silage bags.
- Treatment of runoff from manure stacks or storage facilities.
- Treatment of runoff from croplands, which is covered in NRCS Field Office Technical Guide (FOTG) Section IV, Standard 393, Filter Strip.
- Animal lots where manure consistency is such that direct discharge of undiluted manure from the animal lot to the treatment area is possible.

IV. Federal, State, and Local Laws

Wastewater treatment strip practices shall comply with all federal, state, and local laws, rules, or regulations. The operator is responsible for securing required permits. This standard does not contain the text of the federal, state, or local laws

VS.

USDA United States Department of Agriculture

635-CPS-1

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

VEGETATED TREATMENT AREA

CODE 635

(ac)

DEFINITION

An area of permanent vegetation used for agricultural wastewater treatment.

PURPOSE

This practice is used to accomplish the following purpose:

- Improve water quality by using vegetation to reduce the loading of nutrients, organics, pathogens, and other contaminants associated with livestock, poultry, and other agricultural operations

CONDITIONS WHERE PRACTICE APPLIES

NRCS 635 - REFERENCE & REVISION HISTORY

ATCP 51.20 Runoff management

References NRCS Technical Guide Wastewater Treatment Strip Standard 635 (January, 2002) for new or substantially altered animal lots

NRCS Conservation Practice Standard 635 Wisconsin Revision History:

- Jan. 2002
- May 2008
- Aug. 2008
- Sep. 2012
- Sep. 2016 (Current Version)
- 2023/2024?

NRCS CPS 635
2002 STANDARD vs. 2016 STANDARD

Waste Treatment Strip (2002)

2 categories based on contamination source:

- Animal Lots
  - Slow-rate infiltration process
  - Overland flow process
  - Buffer process
- Milking Center Effluent (NOT part of ATCP 51.20)
  - Overland flow process
  - Buffer process

NOTE:

- Feed Storage Areas
  - NOT covered in 2002 version of standard

Vegetated Treatment Area (2016)

3 main categories based on animal units (AUs)

- 0-300 AUs
  - Animal lot - Criteria 1, 2 and 3
  - Feed storage area - Criteria 1, 2 and 3
  - Milking center wastewater - Criteria 1, 2 and 3
- 301-500 AUs
  - Animal lot
  - Feed storage area
  - Milking center wastewater
- 500+ AUs
  - Contamination source doesn't matter

Separation Distances Important

NRCS CPS 635
2002 STANDARD vs. 2016 STANDARD

0 to 300 A.U. Separation Distances

Criteria (1)

Criteria for sites where the down gradient end of the VTA is:

1. ≥ 1000 feet from navigable lakes, ponds and flowages,
2. ≥ 300 feet from wetlands and navigable streams and rivers,
3. ≥ 500 feet from conduits to groundwater,
4. ≥ 300 feet from surface inlets that discharge to navigable waters,
5. ≥ 150 feet from channelized flow (i.e., a drainage area of ≥ 5 acres), a
6. ≥ 150 feet from subsurface drains.

Locate the VTA > 100 feet from any private water well.

Criteria (2)

Criteria for sites where the down gradient end of the VTA (x) is between:

1. 250 ≤ x < 1000 feet from navigable lakes, ponds and flowages,
2. 150 ≤ x < 300 feet from wetlands and navigable streams and rivers,
3. 250 ≤ x < 500 feet from conduits to groundwater,
4. 150 ≤ x < 300 feet from surface inlets that discharge to navigable waters,
5. 50 ≤ x < 150 feet from channelized flow (i.e., a drainage area of ≥ 5 acres),
6. 50 ≤ x < 150 feet from subsurface drains.

Locate the VTA > 100 feet from any private water well.

Criteria (3)

Criteria for sites where the down gradient end of the VTA is:

1. < 250 feet from navigable lakes, ponds and flowages,
2. < 150 feet from wetlands and navigable streams and rivers,
3. < 250 feet from conduits to groundwater,
4. < 150 feet from surface inlets that discharge to navigable waters,
5. < 50 feet from channelized flow (i.e., a drainage area of ≥ 5 acres), or
6. < 50 feet from subsurface drains.

See criteria for operations with over 300 and 500 or less Animal Units

NRCS CPS 635
2002 STANDARD vs. 2016 STANDARD

Waste Treatment Strip (2002)

Categories and criteria are the same regardless of Animal Units (A.U.)

Vegetated Treatment Area (2016)

3 main categories based on Animal Units (A.U.) with different criteria based on separation distance

- 0-300 A.U.s
  - Criteria (1) Further away from sensitive areas
  - Criteria (2) Closer to sensitive areas
  - Criteria (3) Very close to sensitive areas
- 301-500 A.U.s
  - Basically takes:
    - 0-300 A.U. Criteria (1) distances with
    - 0-300 A.U. Criteria (2) design requirements
- 500+ A.U.s
  - Is it's own animal

ANIMAL LOTS

NRCS CPS 635: WASTEWATER TREATMENT STRIP (2002) vs. VEGETATED TREATMENT AREA (2016)

NRCS CPS 635
2002 STANDARD vs. 2016 STANDARD
~ ANIMAL LOTS ~

Waste Treatment Strip (2002)

Animal Lots (All Size Farms)

Slow Rate Infiltration Process

- Pre-treatment with sediment basin
- Sized based on soil water holding capacity

Overland Flow Process

- Pre-treatment with sediment basin
- Flood-routed design storm through basin, then VTA based on contact time

Buffer Process

- 150% of paved lot size and 100% for earthen
- Less than 5 or 15 lbs. P from BARNY

Vegetated Treatment Area (2016)

Animal Lots (0 to 300 A.U.) – Criteria (1) Separation Dist.

~~Slow Rate Infiltration Process~~

- ~~Pre-treatment with sediment basin~~
- ~~Sized based on soil water holding capacity~~

Overland Flow Process

- Pre-treatment with sediment basin
- Flood-routed design storm through basin, then VTA based on contact time

Buffer Process

- 150% of paved lot size and 100% for earthen
- Less than 5 or ~~15 lbs. P~~ from BARNY

NRCS CPS 635
2002 STANDARD vs. 2016 STANDARD
~ ANIMAL LOTS ~

Vegetated Treatment Area (2016)

Animal Lots (0 to 300 A.U.) – Criteria (2) Separation Dist.

Basically Criteria (1) with storage for sunny day release

Designed 313 or send to 313 if non-growing season

Vegetated Treatment Area (2016)

Animal Lots (0 to 300 A.U.) – Criteria (3) Separation Dist.

Follows Criteria for 301 to 500 A.U.,

Animal Lots (301 to 500 A.U.)

Basically 0 to 300 A.U. Criteria (2) plus:

- No designed infiltration
- Analysis demonstrating no discharge to navigable waters for 25-year, 24-hour storm event

NRCS CPS 635
2002 STANDARD vs. 2016 STANDARD
~ ANIMAL LOTS ~

Waste Treatment Strip (2002)

Animal Lots (All Size Farms)

Slow Rate Infiltration Process

- Pre-treatment with sediment basin
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Overland Flow Process

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Buffer Process

- 150% of paved lot size and 100% for earthen
- Less than 5 or 15 lbs P from BARNY

Vegetated Treatment Area (2016)

Animal Lots >500 A.U.

- Zero discharge for 25-year, 24-hour Storm
  - Water
  - Nutrients
- Application over entire VTA by sprinkler irrigation only during the growing season
- 313 Waste Storage Facility for leachate, wastewater, and manure during the non-growing and growing season.
- VTA shall be:
  1. ≥ 250 feet from any private well,
  2. ≥ 1000 feet from any community well,
  3. ≥ 35 feet from wetlands and navigable streams and rivers, and
  4. ≥ 75 feet from navigable lakes, ponds and flowages.

FEED STORAGE

NRCS CPS 635: WASTEWATER TREATMENT STRIP (2002) vs. VEGETATED TREATMENT AREA (2016)

(NOTE: 2002 version of CPS 635 does not cover feed storage. Specific criteria in ATCP 51.20 (3) applies.)

NRCS CPS 635
2002 STANDARD vs. 2016 STANDARD
~ FEED STORAGE ~

Waste Treatment Strip (2002)

Feed storage not covered by 2002 CPS 635 standard

ATCP 51.20 (3)

Feed w70% Moisture or Higher -
Existing & New or Substantially Altered Feed Storage

- No storm event criteria & no control of flow depth
- Criteria consists of items such as:
  - No significant discharge of leachate or polluted runoff
  - Divert surface water
  - Collect and store leachate
    (NOTE: If Existing feed storage and paved area <1 acre, collecting and storing leachate is NOT required.)

Vegetated Treatment Area (2016)

Feed storage 0 to 300 A.U. – Criteria (1)

Design the feed storage area/collection system to achieve a maximum VTA flow depth of 1.75 inches for the 10-year, 24-hour storm event.

Design the VTA for a minimum flow through time of 22 minutes. The maximum VTA width shall not be greater than 200 feet.

Collect all leachate and the initial runoff volume of 0.10 inches from each rain event to a Reception Structure designed in accordance with the criteria contained in WI CPS, Waste Transfer (Code 634). This leachate and runoff shall not be applied to the VTA.

Feed storage 0 to 300 A.U. – Criteria (2) & 301 to 500 A.U.

Design the feed storage area/collection system to achieve a maximum VTA flow depth of 1.75 inches flow depth on the VTA for the 25-year, 24-hour storm event.

Design the VTA for a minimum flow through time of 22 minutes. The maximum VTA width shall not be greater than 200 feet.

Feed storage contaminated runoff can be applied year-round.

Collect all leachate and the initial runoff volume of 0.20 inches from each rain event to a Reception Structure designed in accordance with the criteria contained in WI CPS, Waste Transfer (Code 634). This leachate and runoff shall not be applied to the VTA.

NRCS CPS 635
2002 STANDARD vs. 2016 STANDARD
~ FEED STORAGE ~

Waste Treatment Strip (2002)

Feed storage not covered by 2002 CPS 635 standard

ATCP 51.20 (3)

Feed w70% Moisture or Higher -
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  - Divert surface water
  - Collect and store leachate
    (NOTE: If Existing feed storage and paved area <1 acre, collecting and storing leachate is NOT required.)

Vegetated Treatment Area (2016)

Feed storage >500 A.U.

- Zero discharge for 25-year, 24-hour Storm
  - Water
  - Nutrients
- Application over entire VTA by sprinkler irrigation only during the growing season
- Divert surface water
- 313 Waste Storage Facility for leachate and wastewater

ATCP 51.20 (3) REQUIREMENTS vs. CPS 561 HEAVY USE AREA (2022)
~ FEED STORAGE AREAS ~

ATCP 51.20 (3)

New or Substantially Altered ONLY

Feed storage area structure criteria:

- 3 feet separation to groundwater & bedrock
- If >10,000 square feet, have subsurface leachate collection

CPS 561 - Heavy Use Area (2022)

Note: Formerly feed storage area requirements were part of NRCS CPS 629 - Waste Treatment

- 2 to 4 feet separation to saturation & bedrock depending on liner type and soils
- Subsurface leachate collection for earthen and flexible membrane feed storage area liner systems only

MODELING PREDICTED PHOSPHORUS RUNOFF FOR EXISTING ANIMAL LOTS

- WHAT IS BARNY
- OTHER OPTIONS
- DIFFERENCES BETWEEN OTHER OPTIONS

ATCP 51.20 (2) EXISTING ANIMAL LOT CRITERIA

Predicted average annual phosphorus runoff from each existing animal lot shall be less than:

1. 15 lbs. P if >1,000 feet to lake or >300 feet to navigable stream
2. 5 lbs. P if < 1,000 feet to lake or <300 feet to navigable stream

BARNY
(WISCONSIN BARNYARD RUNOFF MODEL)

EXISTING BUFFER P OUTPUT (Based on BARNY)

Farmer: Example Farm Planner/Designer: Date: 2/22/23

	Input	Output	
Closest City of similar climate:	1		1 Madison 2 Appleton 3 Wausau 4 Eau Claire
Paved lot area:	7,500		sq ft
Earth lot area:	1,500		sq ft
Animal Lot size:		9,000	sq ft
Is there a designed settling basin?	1		Yes= 1; No= 2
Animals on lot:	60 number		number
Type of animal:	1		(Dairy = 1;Beef=2)
Ave. Animal Weight:	1,000 lbs		lbs
Lot Use:	2		1= Heavy;2=Med;3= Light)

Clear Data Cells

TRIBUTARY AREAS

Tributary area:	2,000 sq ft		sq ft
Runoff Curve Number:	98		← See RCN tab below for typical values
Roof Trib. area:	1,000 sq ft		

30.1 lbs P per year at downstream lot edge

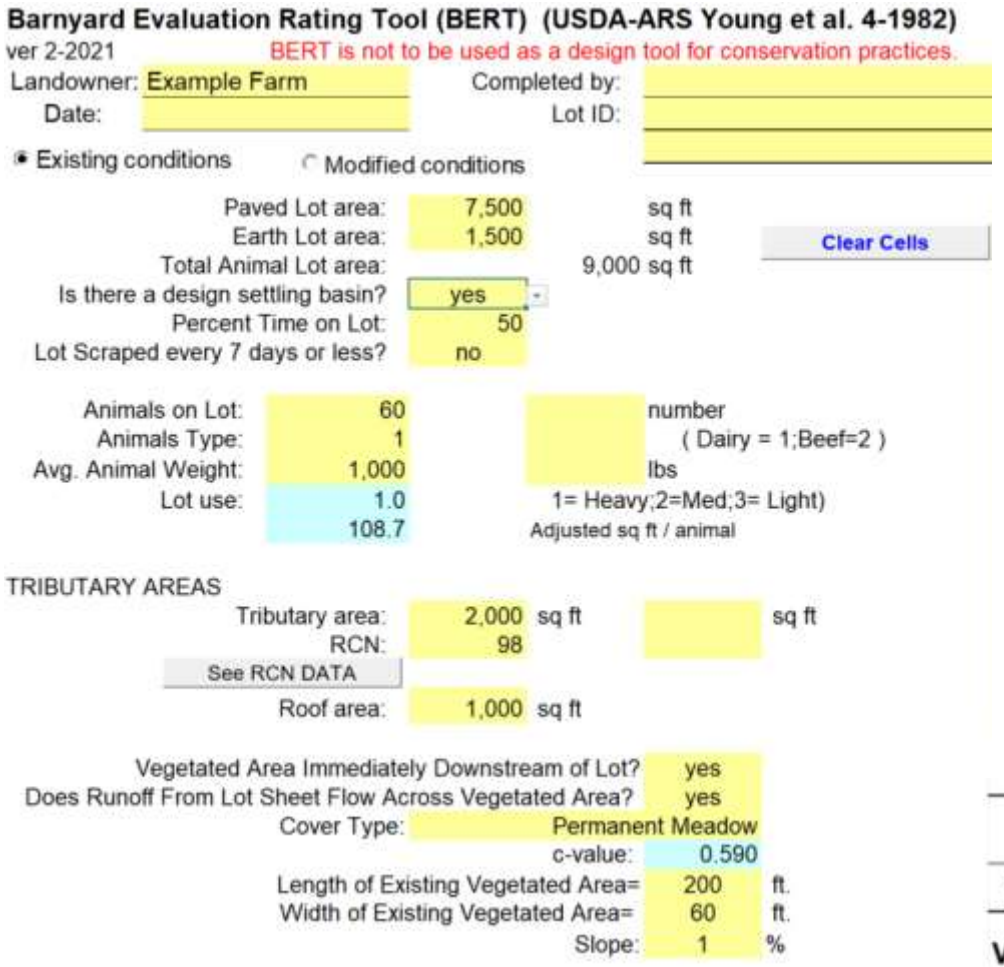
- Developed from USDA-ARS feed lot runoff model (Young et al. 1982)
- Uses simulated rainfall on beef lot (annual precipitation)
  - Measured at edge-of-lot and along buffer
- Estimates average annual P loss (lbs.) at edge-of-lot
- Estimates P based on vegetated buffer nutrient reduction

Enter Existing Buffer Data:

Length:	200	ft
Width:	60	ft
Buffer area:		
Slope:	1	%
c value	0.59	For c values see table below

P Output: 4.0 lb

BERT
(BARNYARD EVALUATION RATING TOOL)



Barnyard Evaluation Rating Tool (BERT) (USDA-ARS Young et al. 4-1982)

ver 2-2021 BERT is not to be used as a design tool for conservation practices.

Landowner: Example Farm Completed by:

Date: Lot ID:

◉ Existing conditions ○ Modified conditions

Paved Lot area:	7,500	sq ft	
Earth Lot area:	1,500	sq ft	Clear Cells
Total Animal Lot area:		9,000 sq ft	
Is there a design settling basin?	yes		
Percent Time on Lot:	50		
Lot Scraped every 7 days or less?	no		

Animals on Lot:	60	number
Animals Type:	1	(Dairy = 1;Beef=2)
Avg. Animal Weight:	1,000	lbs
Lot use:	1.0	1= Heavy;2=Med;3= Light)
	108.7	Adjusted sq ft / animal

TRIBUTARY AREAS

Tributary area:	2,000	sq ft		sq ft
RCN:	98			
See RCN DATA				
Roof area:	1,000	sq ft		

Vegetated Area Immediately Downstream of Lot?	yes
Does Runoff From Lot Sheet Flow Across Vegetated Area?	yes
Cover Type:	Permanent Meadow
c-value:	0.590
Length of Existing Vegetated Area=	200 ft.
Width of Existing Vegetated Area=	60 ft.
Slope:	1 %

- Developed from USDA-ARS feed lot runoff model (Young et al. 1982)
- Uses data from a single rainfall event
- Estimates "Lot use" based on user entries
- Estimates P reduction based on vegetated buffer
- Analyzes flow depth over vegetated area
- Considers distance to waters of the state
- Rating tool to help decide if lot runoff is a resource concern

Distance to Type 1 Feature:	100	ft.
Distance to Type 2 Feature:	100	ft.

Is Facility in Good Operating Condition: yes

Edge of Lot BERT =	180	LOT IS ASSUMED TO NOT BE A RESOURCE CONCERN
End of buffer BERT =	6	

Vegetated area flow depth is less than 2 inches deep.

APLE-Lots
(ANNUAL PHOSPHORUS LOSS ESTIMATOR FROM OUTDOOR FEED LOTS)

- Developed by USDA-ARS (Vadas 2009, Bolster 2022)
- Models particulate and dissolved P loss
- Estimates total P loss (lbs.) at edge-of-lot ONLY
  - Does NOT analyzes P reductions from vegetated areas
- More robust, dynamic simulation of P loss based off more variables:
  - Soils test P for earthen lots
  - % vegetative cover for earthen lots
  - Uses an annual precipitation AND considers each event
  - Tested model based on measured events

BARNY vs. BERT vs. APLE-Lots

BARNY

- Estimates average annual P loss (lbs.)
  - At edge-of-lot AND
  - End of vegetated area
- Credit for settling basin
- Annual rainfall from 1990 Green Bay data, and adjusted for other areas
- Data (input/output):
  - Uses constant conc. of P (85 mg/L)
  - Some outputs credible, some questionable
- Too Simple?

BERT

- Resource concern rating tool (NO P loss)
  - At edge-of-lot AND
  - End of vegetated area
- Credit for settling basin
- Single rainfall event
- Data (input/output):
  - Very similar to BARNY
  - Allows for additional considerations
  - Pollution potential
- No lbs. of P loss

APLE-Lots

- Estimates average annual P loss (lbs.)
  - At edge-of-lot
  - NO vegetated area option
- NO settling basin option
- Annual precipitation AND considers single event
- Data (input/output):
  - More complex inputs
  - More complex calculations
  - More accurate results
- Edge-of-Lot ONLY

Questions?

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