Standard 635 Companion Document Index

There is also an EXCEL spreadsheet entitled “Vegetated Treatment Areas” available for use with Companion Documents 635-1 through 635-3.

It is the intent of these companion documents to provide design guidance in implementing Conservation Practice Standard 635, Vegetated Treatment Area. These companion documents will be updated as experience is gained with the new standard, new information is found, or better methods are developed. These documents will be maintained by the NRCS State Conservation Engineer. Comments, questions, or suggestions should be directed there.

COMPANION DOCUMENT 635 - 1

PRACTICE STANDARD 635 – VEGETATED TREATMENT AREA

SLOW RATE INFILTRATION PROCESS

General

The slow rate infiltration process is a way to treat contaminated runoff by letting the runoff soak into the soil, where nutrients in the runoff can be used by plants and soil microbes, and moisture can be transpired back to the atmosphere. The amount of runoff that is allowed to soak into the soil is limited to the available water holding capacity of the soil in the root zone of the plants that are to be grown. The concept is to hold the contaminated runoff in the soil at a depth where plant roots can use the moisture and nutrients in the runoff. This process is most effective when plants are growing, so it is not appropriate for milk house waste unless the waste is stored during seasons when plants are dormant. This practice is limited to medium textured, well drained soils listed in Table 2 of this Companion Document. If soils other than those listed are proposed, suitability must be documented with appropriate test pit observations and laboratory test results. The goal is to use soils that allow infiltration of runoff, and then hold the runoff in a position for plant use. Soils that are wet or too slowly permeable will promote shallow rooting depths and/or wetland conditions, potentially resulting in inadequate treatment under this process. Soils that are too droughty or excessively permeable will allow nutrients to pass through the soil profile to groundwater. The ideal soil for this process is a deep, well drained silt loam.

Pretreatment

Pretreatment is required, and must be done off of the animal lot. A spreading device must be incorporated to distribute the runoff evenly to the treatment area. The spreading device can be a level lip concrete curb, a concrete wall with weep holes large enough to prevent plugging, a concrete wall with slots, or a level gravel spreader.

Procedure

- Calculate Runoff Volume in Acre-Inches from the lot, contributing roof areas, and upstream drainage area where diversion is not practicable. Use procedures in the EFH Chapter 2, or TR-55.

- Determine peak discharge from the 25-year 24-hour storm, using procedures in the EFH Chapter 2, or TR-55. The peak discharge from animal lots is assumed to be 1010 cu. ft. per second per square mile for each inch of runoff. This comes from tables in TR-55. A factor of 0.0000362 is used in peak discharge computations (see example). This is obtained by dividing 1010 by 5280^2 (the number of feet in a mile, squared).

- Calculate the minimum sediment basin volume: (see Standard 350, Sediment Basin).

  Volume = 25 yr. Peak Discharge x (0.65) x 15 min. x (60 sec./min.) + solids volume
  (solids volume = animals x 10 days x 25% time on lot x manure production; per Standard 350)

- Determine rooting depth of plants to be grown in the infiltration area from Table 1.

- Determine Available Water Capacity of the soil at the rooting depth of the plants from Table 2.

- Calculate the Infiltration Area needed as:

  Infiltration Area (Acres) = Runoff Volume (Acre-inches) / Available Water Capacity (inches)

- Design the sediment basin (Standard 350) and treatment area (Standard 635) in accordance with standards.

Example Computation

Given:

70 Dairy Cows
Lot Area = 10,000 square feet, paved
Infiltration Area Soil = Fayette
Plants in infiltration area = grass

Find minimum Sediment Basin Volume and Size of Infiltration Area:

Paved lot, RCN = 95, depth of runoff = 3.43 inches
Runoff = (10,000 sq. ft. /43,560 sq. ft./acre) x 3.43 inches = 0.79 acre-inches
Peak Flow = 10,000 sq. ft. x 0.0000362 (factor from TR-55) x 3.43 inches = 1.24 cfs

Minimum Sediment Basin Volume = (1.24 cfs x 0.65 x 15 min. x 60 sec./min.) + (70 cows x 10 days x .25 x 1.6 cu. ft./day) = 1,005 cubic feet

Plant Root Depth = 18" (Table 1)
Available Water Capacity = 3.9" (Table 2, Fayette soil at 18")

Infiltration Area = 0.79 acre-inches / 3.9 inches = 0.2026 Acres = 8,824 Square Feet

An infiltration area 66' x 133' will meet the standard.

A concrete sediment basin meeting the 350 standard must be designed for pretreatment. A level gravel spreader or a curb with vertical slots could be used as a spreader after the sediment basin.

A spreadsheet entitled “Vegetated Treatment Areas” has been developed to aid in these calculations. Example output follows on the last page of this companion document. (Slight differences between manual answers and the spreadsheet are due to rounding.)

Table 1
Plant Rooting Depths

Plant	Root Depth
Corn	30"
Soybeans	24"
Alfalfa	48"
Grass	18"
Grain	24"
Trees	60"

TABLE 2									
Soil Series	**Available Water Capacity at:**								
	12"	**18"**	**24"**	**30"**	**36"**	**42"**	**48"**	**54"**	**60"**
ALBAN	1.9	2.9	3.8	4.8	5.8	6.8	7.7	8.7	9.6
ANIGON	2.4	3.6	4.7	5.8	6.8	7.1	7.3	7.6	7.8
ANKENY	2.0	3.1	4.1	5.1	6.1	7.0	7.9	8.7	9.5
ANTIGO	2.6	3.8	4.9	5.3	5.7	6.0	6.2	6.5	6.7
BATAVIA	2.7	3.9	5.1	6.3	7.5	8.5	9.4	9.7	9.9
BERTRAND	2.6	3.8	5.0	6.2	7.4	8.4	9.4	10.4	11.3
BILLETT	1.7	2.5	3.3	3.8	4.3	4.7	5.0	5.4	5.7
BOYER	1.5	2.1	2.6	2.8	3.0	3.2	3.3	3.5	3.7
BRILL	2.5	3.7	4.8	5.9	6.9	7.3	7.6	7.9	8.1
CAMPIA	2.6	3.8	4.9	6.0	7.1	8.1	9.1	10.2	11.2
CASCO	1.8	2.3	2.8	3.0	3.1	3.3	3.5	3.7	3.9
CHETEK	1.5	1.9	2.3	2.5	2.6	2.8	3.0	3.2	3.3
DAKOTA	1.7	2.4	3.1	3.3	3.5	3.7	3.9	4.1	4.2
DELTON	1.9	2.5	3.0	3.7	4.3	5.2	6.0	6.9	7.8
DICKINSON	1.7	2.6	3.4	3.9	4.4	4.6	4.8	5.0	5.1
DODGE	2.6	3.8	5.0	6.0	7.0	7.9	8.7	9.5	10.2
DOWNS	2.8	4.0	5.1	6.3	7.4	8.5	9.6	10.8	11.9
DRESDEN	2.5	3.5	4.5	5.3	6.0	6.2	6.3	6.5	6.7
DUNNVILLE	2.0	2.9	3.8	4.1	4.3	4.6	4.8	5.1	5.3
DURAND	2.8	4.0	5.2	6.0	6.8	7.6	8.4	9.2	9.9
EMMET	1.7	2.5	3.3	4.2	5.0	5.7	6.3	7.0	7.7
FAYETTE	2.7	3.9	5.1	6.3	7.5	8.6	9.6	10.1	10.6
FLAGG	2.5	3.5	4.5	5.6	6.6	7.5	8.4	8.9	9.4
FOX	2.5	3.5	4.4	4.9	5.3	5.6	5.9	6.2	6.5
FRIESLAND	2.5	3.5	4.5	5.5	6.4	7.5	8.6	9.5	10.4
GRAYS	2.6	3.7	4.8	5.9	7.0	8.1	9.2	10.3	11.3
GRELLTON	2.0	3.0	3.9	5.0	6.0	7.2	8.4	9.4	10.4
GRISWOLD	2.3	3.3	4.3	5.1	5.8	6.5	7.2	8.0	8.7
HEBRON	2.5	3.5	4.5	5.4	6.3	7.2	8.1	9.0	9.9
HOCHHEIM	2.2	3.0	3.7	4.5	5.2	5.9	6.6	7.3	8.0
JASPER	2.6	3.6	4.6	5.6	6.6	7.7	8.7	9.9	11.1
JEWETT	2.8	3.9	5.0	5.4	5.7	6.1	6.4	6.6	6.7
JUDSON	2.6	4.0	5.3	6.6	7.9	9.2	10.5	11.9	13.2
KEGONSA	2.8	4.0	5.2	6.1	7.0	7.2	7.4	7.6	7.7
KIDDER	1.7	2.6	3.5	4.3	5.1	5.8	6.4	7.1	7.8
LANGLADE	2.6	3.9	5.2	6.5	7.7	8.8	9.8	10.1	10.4
LAPEER	2.0	3.0	3.9	4.8	5.7	6.6	7.4	8.3	9.1
LOMIRA	2.7	3.9	5.0	6.0	6.9	7.7	8.4	9.1	9.8
LORENZO	2.4	3.0	3.5	3.8	4.1	4.4	4.7	5.0	5.3
MENDOTA	2.6	3.8	5.0	6.0	6.9	7.6	8.2	8.9	9.5
MERIDIAN	1.7	2.5	3.3	3.8	4.2	4.6	4.9	5.3	5.6
METEA	1.5	2.2	2.8	3.7	4.6	5.5	6.4	7.3	8.1
MIAMI	2.3	3.4	4.4	5.5	6.5	7.6	8.6	9.7	10.8
MT. CARROLL	2.8	4.1	5.3	6.6	7.8	9.1	10.3	11.6	12.9
OCKLEY	2.4	3.5	4.5	5.6	6.7	7.8	8.9	9.3	9.7
OGLE	2.8	4.2	5.5	6.7	7.8	9.0	10.1	10.7	11.2
ONAMIA	2.4	3.4	4.4	5.2	5.9	6.1	6.3	6.5	6.6
ONAWAY	1.9	2.9	3.9	4.8	5.6	6.5	7.4	8.4	9.3
OSHTEMO	1.6	2.6	3.5	4.4	5.3	5.6	5.9	6.1	6.2
OSTRANDER	2.6	3.7	4.7	5.8	6.9	8.0	9.0	10.1	11.2
PECATONICA	2.7	3.9	5.1	6.1	7.1	8.0	8.9	9.6	10.2
PILLOT	2.8	4.0	5.2	6.1	7.0	7.5	8.0	8.6	9.1
PLANO	2.8	4.0	5.2	6.4	7.6	8.7	9.7	10.1	10.5
PORT BYRON	2.7	4.0	5.2	6.5	7.8	9.1	10.3	11.6	12.8
RENOVA	2.7	3.9	5.1	6.2	7.3	8.4	9.5	10.6	11.6
RICHWOOD	2.8	4.1	5.3	6.5	7.7	8.4	9.1	9.5	9.8
ROSHOLT	1.7	2.5	3.2	3.6	4.0	4.2	4.3	4.5	4.7
SALTER	2.0	2.9	3.8	4.7	5.6	6.5	7.4	8.3	9.2
SATTRE	2.3	3.3	4.3	4.9	5.5	5.8	6.0	6.3	6.5
SCONSIN	2.6	3.9	5.1	5.9	6.7	7.1	7.5	7.8	8.1
SEATON	2.6	3.9	5.2	6.5	7.7	9.0	10.2	10.6	10.9
SISSON	2.6	3.8	4.9	5.8	6.6	7.5	8.3	9.1	9.9
ST. CHARLES	2.7	3.9	5.1	6.3	7.5	8.0	8.5	8.7	8.9
SYMERTON	2.4	3.4	4.3	5.2	6.0	6.6	7.2	7.8	8.4
TAMA	2.7	3.9	5.1	6.3	7.5	8.6	9.7	10.2	10.6
TELL	2.6	3.8	5.0	5.5	5.9	6.3	6.7	7.1	7.4
TERRIL	2.5	3.8	5.0	6.1	7.2	8.2	9.2	10.3	11.3
THERESA	2.6	3.7	4.7	5.2	5.7	6.1	6.4	6.8	7.1
TREMPEALEAU	2.0	3.0	3.9	4.7	5.4	6.1	6.8	7.3	7.8
WARSAW	2.5	3.6	4.6	5.2	5.8	6.0	6.1	6.3	6.5
WAUKEGAN	2.6	3.9	5.2	6.1	6.9	7.1	7.3	7.5	7.6
WAYMOR	2.6	3.6	4.6	5.4	6.1	6.6	7.1	7.7	8.2
WESTVILLE	1.7	2.7	3.7	4.7	5.7	6.8	7.8	8.8	9.7
WHITEHALL	2.8	4.1	5.4	6.6	7.8	9.0	10.1	10.9	11.6
WINNEBAGO	2.2	3.2	4.2	5.3	6.3	7.3	8.3	9.3	10.3
ZURICH	2.6	3.8	5.0	6.1	7.2	8.3	9.4	10.5	11.5

Slow Rate Infiltration Treatment Strip Design ver 11-14-2008

CLIENT:		COUNTY: Outagamie	DATE: 11/07/08
DSN BY:		CHK BY: ___________	DATE: ___________
COMMENTS:			

Note: Input data requirements are shaded

Inputs:

Paved Lot Area =	10,000	Sq.Ft.
Unpaved Lot Area =		Sq.Ft.
Roof Area =		Sq.Ft.
Upstream Watershed Area =		Sq.Ft.
Upstream Watershed Runoff Curve No. =	80	
Number of Animals	70	
Animal Type	cow	
25 yr 24 hr Precipitation =	4	in.
Infiltration Area Soil =	fayette	(only soils from Table 2, AWMFH can be used)
Plants in infiltration area =	grass	(from Table 1, AWMFH)
Infiltration Area Length/Width Ratio:	2.00	Choose value between 1 & 4

Calculations:

<u>Runoff Volumes</u>:

Paved Area =	0.79	Acre-inches
Unpaved Area =	0.00	Acre-inches
Roof Area =	0.00	Acre-inches
Upstream Watershed =	0.00	Acre-inches
Total =	0.79	Acre-inches

Peak Flow =	1.24	cfs	
Minimum Sediment Basin Volume =	**1,005**	**Cubic Feet**	
Plant Root Depth =	18	in.	(from Table 1)
Available Water Capacity =	3.9	in.	(from Table 2)
Minimum Infiltration Area =	**8,824**	**Square Feet**	

Infiltration Area Dimensions:
(note - to fit area to site change length/width ratio; try using "goal seek" under Tools)

Length =	133	feet
Width =	66	feet

Sediment Basin shall be designed to meet Standard 350 criteria.

COMPANION DOCUMENT 635 - 2

PRACTICE STANDARD 635 - VEGETATED TREATMENT AREA

OVERLAND FLOW PROCESS

A vegetated treatment area shall only be designed if it is identified as an appropriate solution on the "Waste Management System-Inventory and Planning" sheet (See Chapter 9 of AWMFH). Before designing the strip the management and site assessment (as outlined in Standard 635) shall be performed. The animal lot management, and an assessment of the potential to impact onsite resources shall be used to design an appropriate pretreatment practice and treatment strip.

Pretreatment - Pretreatment is required. This can be done with a "settling basin", NRCS standard 350, which is either on or off the animal lot. On-lot basins usually have a gently sloping concrete floor, 1% to 5%, and outlet through a picket or screens with an orifice to control the outlet peak flow, Q. Outside the animal lot most designers use a settling pad of concrete and some form of spreader to distribute the runoff across the treatment strip. Some designers prefer one outlet or another, but the real key is the management by the farmer. If the farmer takes ownership of the settling basin/ treatment strip concept and if he keeps the yard clean, the outlet and treatment strip will work well. Off lot settling areas can also be effective.

Treatment strip – (A spreadsheet entitled "Vegetated Treatment Area" is available to do the design.)
- 25-year, 24-hour storm (EFH Chapter 2 or TR55)

1. Use Mannings equation to compute **velocity** in the treatment strip using these values from Standard 635: Depth of flow = 1" ; Mannings "n" = .3

   Mannings equation.: $V = (1.486 \times (s^{1/2}) \times (r^{2/3})) / n = .945 \times s^{1/2}$

   s = slope, ft/ft   r = hydraulic radius = Area / Wetted Perimeter
   Area = 1" X Width = 1/12 W
   Wetted Perimeter = Width = W
   Therefore: r = (1/12 W / W) = .0833

2. Compute the distance in feet that the runoff will flow in 755 seconds using the velocity from step 1 in 755 seconds. This distance is the **length** of the strip. However, the minimum length in Standard 635 is 100 feet.

   Minimum length = Velocity X 755 sec = ______ ft

3. **Width** is based on the site topography with a maximum allowable of 30' from Standard 635.

4. **Outflow from the sediment basin**- This is set by the velocity of flow in the strip times the width:

   Q = V X A

   This Q is used to size the sediment basin.

EXAMPLE:

Assumptions: Depth of flow = 1" ; Mannings n = .3 ; Slope is 2% ;
Available width is 30 feet

V = (1.486 X (.02$^{1/2}$) X ((1/12)$^{2/3}$) / .3 = .134 fps

Strip Length = .134 ft/sec X 755 sec = 101 feet

Strip Width is 30 feet as set by the site topography. 30 feet is also the maximum width allowed per Standard 635.

Outflow from sediment basin = V X A = .134 fps X (30 X .0833) = .33 cfs
(This is the maximum outflow from the basin; more flow would cause the water to flow deeper than 1 inch.)

BEYOND END OF STRIP
Beyond the strip follow one of the three options listed in the standard and shown on Figure 1 in the standard.

VEGETATION
The vegetation must be well established before pretreated animal lot runoff is directed onto the strip. This will usually be a minimum of 3 months unless sod is used. Often a full year will be necessary for adequate establishment.

Mow the vegetation at least once a year. More frequent mowing and removal of the cut vegetation is beneficial since it will remove some of the nutrients. Controlled grazing is also acceptable if well managed.

COMMENTS
Treatment strips depend on good management of the pretreatment facility and the animal lot. The animal lot should be cleaned often, every day or so for paved lots, and the pretreatment facility must be cleaned as solids build up. Other possibilities which may be helpful on a given job:

Reduce the pollutant and runoff load on the treatment strip by collecting the "**first flush**" from the animal lot and storing it in a Waste Storage Facility, NRCS standard 313, or pumping it elsewhere.

The total runoff from the animal lot or the downstream end of the treatment strip may be caught and **pumped elsewhere** to a suitable location for the treatment strip.

Using a paved animal lot for the settling basin will help encourage cleanout of the settling basin.

Don't try to store lot runoff unless the farmer is **committed** to installing and using an effective liquid hauling or pumping scheme.

COMPANION DOCUMENT 635-3

PRACTICE STANDARD 635 - VEGETATED TREATMENT AREA

BUFFER PROCESS

General

The buffer shall be designed as part of a group of practices planned to reduce pollution from the animal lot. All associated practices which are needed to make the buffer area operate properly shall be installed concurrently or before the buffer. A Management Assessment and Site Assessment shall be done with the farmer, as required in NRCS Standard 635, Vegetated Treatment Area, to use as a basis for design of the buffer area and associated practices.

Runoff may flow directly onto the buffer or be conveyed to it. The buffer will attenuate the pollutants coming off the animal lot.

The attenuation of the buffer will be measured using the Wisconsin Barnyard Runoff Model (BARNY). BARNY is a program based on research by R. A. Young, Terry Huntrods, and Wayne Anderson at the Agricultural Research Station (ARS) in Minnesota, "Effectiveness of Nonstructural Feedlot Discharge Control Practices," Paper No. 78-2572 at ASAE in 1978. The rating system was later presented as an Agricultural Research Service document, ARM-NC-17, "An Evaluation System to Rate Feedlot Pollution Potential," April 1982.

In the research, rainfall was simulated on an earthen beef feedlot. Rainfall simulators were located over a portion of the lot, and various constituents were measured in the runoff at the lot edge and periodically down slope in various types of vegetation such as corn, grass, grain, etc. In order to make the research data into a model to predict phosphorus (P) and chemical oxygen demand (COD) in runoff, assumptions were added regarding tributary flow above the lot and channelized flow below the buffer. Wisconsin added assumptions regarding concrete lots, sediment basins, and roof runoff. Once all the assumptions were added to the original ARS model, the model became BARNY. The overland flow buffer portion of BARNY retains Young's research. This portion is the part of BARNY used in Wisconsin to measure pollutant attenuation and to size buffers.

Buffer Criteria as Set Forth in Standard 635

- The runoff must be distributed uniformly across the upper end of the buffer.
- The buffer must be graded adequately to maintain overland flow. Any flow section that becomes channelized is not part of the buffer.
- All tributary areas including roofs must be diverted, as practicable.
- The soil below the buffer for a minimum of 2 feet must have at least 20% fines.
- Soil must be 2 feet above saturated soil or bedrock.
- Only slopes in the 1% to 6% range are part of the buffer.
- Manure solids must be kept off the buffer.

The buffer shall be sized according to BARNY (P in pounds per year; not 10-year storm) for the specific inputs of animal numbers, lot size and surfacing and amount of use, tributary areas, buffer slope and buffer cover condition. See Standard 635 for maximum P level after the buffer, based on the distance to a potentially affected resource.

The minimum buffer area shall be: Surfaced lot - 150% of lot size (1.5:1)
Earth lot - 100% of lot size (1:1)

If a row crop is used as part of the buffer, it must be planted on the contour. The slope of the buffer shall be between 1% and 6%. Steeper or flatter sections are acceptable but are not part of the required buffer length.

The design shall include an appropriate method of removing the manure solids before the runoff is distributed to the buffer. Solids removal can occur on the lot or off lot. Sediment Basins (Standard 350) may be used but are not required.

BARNY Methodology for Determining Buffer Dimensions According to Standard 635

1. Compute the minimum buffer area required in Standard 635:

   Paved lot = ________ sq. ft. x 1.5 = _________ sq. ft.
   (Ep)

   Earth lot = ________ sq. ft. x 1.0 = _________ sq. ft.
   (Ee)

   Minimum buffer area (Ep + Ee) = __________ sq. ft.
   (A-buf)

2. Select a buffer width that will fit the site topography

   Buffer Width: (W) _______ ft. (from site topography)

3. Calculate the minimum length (in direction of flow) computed from BARNY (Lbarny).

   BARNY Length: (Lbarny) ______ ft. (P Output = ______lbs./ yr.)

4. Calculate the buffer length required based on the width set by the site topography. (length needed to achieve the required minimum buffer area)

   Minimum Buffer length (based on area): ________ / _____ = __________ ft.
   (A-buf) (W) (Larea)

5. The Minimum Buffer length is the greater of Lbarny (computed to achieve a Max Pout) or the Larea. (length needed to achieve the required minimum buffer area based on the width set by the site topography)

   Lmin ___________________ feet

Examples

Given:
Lot area - 12,000 sq. ft. Concrete, heavy use, 100 cows.
Located near Appleton.
Available buffer width - 90 feet. Buffer cover - permanent meadow.
Buffer slope - 2%.
Maximum P level - 15 lbs. per year since 800 feet to intermittent stream.

Design:
1. Minimum Area is 12,000 x 1.5 (concrete lot) = 18,000 sq. ft. (Ep) and (A-buf).
2. Buffer that fits the site topography width is 90 feet (W).
3. BARNY Length (Lbarny) = 120 feet.
   Phosphorus output: P = 64.0 lbs./year without buffer.
   P = 14.1 lbs./year with buffer.
4. Minimum buffer length based on Area is:
   $$\frac{18{,}000}{90} = 200 \text{ feet long (Larea)}$$
5. The minimum buffer length is 200 feet (Lmin).

Heifer Example

Given:

500 heifers, Lot - earth, heavy use, 80 feet by 500 feet on contour.
Located near Appleton.
Maximum P level - 5 lbs. per year due to stream in 500 feet and large number of animals.
Buffer slope - 3% for 100 feet, then 1%. Buffer vegetation - permanent meadow.
Available buffer width - 500 feet same width as lots which are on contour.

Design:

1. Minimum Area is: 40,000 x 1.0 (earth lot) = 40,000 sq. ft. (Ee) & (A-buf).
2. Buffer that fits the site topography width is 500 feet (W).
3. BARNY length (Lbarny) = 235 feet.
   Phosphorus output: P = 108.8 lbs./year without buffer.
   P = 4.5 lbs./year with buffer.
4. Minimum buffer length based on area is:
   $$\frac{40{,}000}{500} = 80 \text{ feet long (Larea)}$$
5. The minimum buffer length is 235 feet (Lmin).

Beef Example

Given:

120 slaughter steers, Lot - earth, heavy use, 16,000 sq. ft.
Located near Appleton.
Maximum P level - 5 lbs. per year due to 800 feet to trout stream.
Buffer slope - 2%. Buffer cover - permanent meadow.
Available buffer width - 80 feet.

Design:

1. Minimum Area is: 16,000 x 1.0 (earth lot) = 16,000 sq. ft. (Ee) & (A-buf).
2. Buffer that fits the site topography width is 80 feet (W).
3. BARNY Length (Lbarny) = 195 feet.
   Phosphorus output: P = 43.5 lbs./year without buffer.
   P = 5.0 lbs./year with buffer.
4. Minimum buffer length based on Area is:
   $$\frac{16{,}000}{80} = 200 \text{ feet long (Larea)}$$
5. The minimum buffer length is 200 feet (Lmin).

Output Goal

The maximum output of phosphorus in pounds per year at the end of the buffer shall be between 0 and 15 pounds as determined by the planner based on the proximity of surface water resources or undrained depressions and sinkholes as described in the Site Assessment done for Standard 635.

Output of P in Pounds	Approximate distance to resources in feet	
	Lakes or Sinkholes	Int. Stream, Stream or Wetland
0 to 5	1000 or less	300 or less
5.1 to 10	1001 to 3000	301 to 1000
10.1 to 15	3001 or more	1001 or more