

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD**

**FILTER STRIP**

(Ac.)

CODE 393

**DEFINITION**

A strip or area of herbaceous vegetation that removes contaminants from overland flow.

**PURPOSE**

- Reduce suspended solids and associated contaminants in runoff.
- Reduce dissolved contaminant loadings in runoff.
- Reduce suspended solids and associated contaminants in irrigation tailwater.

**CONDITIONS WHERE PRACTICE APPLIES**

Filter strips are established where environmentally-sensitive areas need to be protected from sediment; other suspended solids and dissolved contaminants in runoff.

***This practice applies: 1) in areas situated below cropland, grazing land, forest land, or disturbed land; 2) where sediment, particulate organic matter and/or dissolved contaminants may leave these areas and enter environmentally sensitive areas; 3) in areas where permanent vegetative establishment is needed to enhance wildlife and beneficial insects, or maintain or enhance watershed function.***

***This practice does not apply to components of a planned agricultural waste management system, the treatment of runoff from such areas as feedlots, barnyards, and other livestock holding areas; or effluent and diluted silage leachate. Refer to WV conservation***

***practice standard (635) Vegetative Treatment Area.***

***This practice should not be used alone to address resource concerns associated with logging operations. Refer to Field Office Technical Guide reference BMP's for Controlling Soil Erosion and Sediment from Logging Operations in WV.***

**CRITERIA**

**General Criteria Applicable to All Purposes**

Filter strips shall be designated as vegetated areas to treat runoff and are not part of the adjacent cropland rotation.

Concentrated flow shall be dispersed before it enters the filter strip.

Overland flow entering the filter strip shall be primarily sheet flow. Concentrated flow shall be dispersed.

The maximum gradient along the leading edge of the filter strip shall not exceed one-half of the up-and-down hill slope percent, immediately upslope from the filter strip, up to a maximum of 5%.

***If present, noxious weeds shall be controlled within the filter strip.***

Filter strip establishment shall comply with local, state and federal regulations.

***Pesticide application within a field may require a specific filter flow length as indicated on product labels or state regulations. These requirements for filter flow length will always be used if greater than the minimum criteria in this standard.***

***Frequent vehicular traffic shall be excluded from the filter strip and shall not be utilized as access areas, roadways or travel lanes.***

***Only viable, high quality and regionally adapted seed will be used to plant filter strips.***

***Where appropriate, fences or other exclusionary measures may be necessary. Refer to WV Conservation Practice Standard Access Control (472).***

The minimum flow length shall be 20 feet.

The filter strip shall be located along the downslope edge of a field or disturbed area. To the extent practical, it shall be established on the contour. Variation in placement on the contour should not exceed a 0.5 percent longitudinal (perpendicular to the flow length) gradient.

The immediate drainage area above the filter strip shall have greater than 1 percent but less than a 10 percent slope.

**Additional Criteria to Reduce Suspended Solids and Associated Contaminants in Runoff**

Filter strip flow length required to reduce dissolved contaminants in runoff shall be based on management objectives, contaminants of concern, and the volume of runoff from the filter strip's drainage area compared with the filter strip's area and infiltration capacity.

The filter strip will be designed to have a 10-year life span, following the procedure in the Agronomy Technical Note No. 2 (Using RUSLE2 for the Design and Predicted Effectiveness of Vegetative Filter Strips (VFS) for Sediment), based on the sediment delivery in RUSLE2 to the upper edge of the filter strip and ratio of the filter strip flow length to the length of the flow path from the contributing area. The minimum flow length through the filter strip shall be 20 feet.

The filter strip shall be located immediately downslope from the source area of contaminants.

The drainage area above the filter strip shall have a slope of 1% or greater.

**Vegetation**

***The filter strip shall be established to permanent herbaceous vegetation consisting of a single species or a mixture of grasses, legumes, and/or other forbs adapted to the soil, climate, nutrients, chemicals, and cultural practices used in the current management system.***

Species selected shall be:

- able to withstand partial burial from sediment deposition and
- tolerant of herbicides used on the area that contributes runoff to the filter strip.

***Species selected shall have stiff stems and a high stem density near the ground surface.***

***Vigorous vegetative cover with adequate stem density will be established and/or maintained. Permanent herbaceous cover shall be established using the seeding recommendations, seedbed and site preparation methods outlined in the WV conservation practice standard Critical Area Planting (342) or Forage and Biomass Planting (512).***

Species, rates of seeding or planting, minimum quality of planting stock, such as PLS or stem caliper, and method of establishment shall be specified before application. Only viable, high quality seed or planting stock will be used.

***Table 1 below lists species that may be utilized in addition to those listed in WV conservation practice standard Critical Area Planting (342).***

SPECIES/MIX <sup>1/</sup>	RATE (lbs/ac) PLS	Drainage
Eastern gamagrass	10	Well – Moderately Well
switchgrass	10	Well – Somewhat Poorly
switchgrass	3	Well – Moderately Well
big bluestem	4	
Indiangrass	2	
Eastern gamagrass	3	
little bluestem	3	
costal panicgrass	2	Well – Somewhat Poorly
big bluestem	2	
Indiangrass	2	
little bluestem	3	
sideoats grama	2	
switchgrass	2	Well – Moderately Well
big bluestem	1	
little bluestem	3	
Indiangrass	3	Well – Moderately Well
switchgrass	4	
big bluestem	2	
Indiangrass	2	

**Table 1. Warm season grass mixtures for use in filter strips.**

<sup>1/</sup> Use stratified seed and inoculate all legumes. Warm season grasses should be planted April 1 – May 15. Some species may require special seeding techniques and equipment.

Site preparation and seeding or planting shall be done at a time and in a manner that best ensures survival and growth of the selected species. What constitutes successful establishment, e.g. minimum percent ground/canopy cover, percent survival, stand density, etc. shall be specified before application.

Planting dates shall be scheduled during periods when soil moisture is adequate for germination and/or establishment.

The minimum seeding and stem density shall be equivalent to a high quality grass hay seeding rate for the climate area or the density of vegetation selected in RUSLE2 to determine trapping efficiency, whichever is the higher seeding rate.

#### **Additional Criteria to Reduce Dissolved Contaminants in Runoff**

The criteria given in “Additional criteria to reduce suspended solids and associated contaminants in runoff” for location, drainage area and vegetation characteristics also apply to this purpose.

The minimum flow length for this purpose shall be 30 feet.

#### **Additional Criteria to Reduce Suspended Solids and Associated Contaminants in Irrigation Tailwater**

Filter strip vegetation shall be a small grain or other suitable annual plant

The seeding rate shall be sufficient to ensure that the plant spacing does not exceed 4 inches.

Filter strips shall be established early enough prior to the irrigation season so that the vegetation is mature enough to filter sediment from the first irrigation.

The minimum flow length for this purpose shall be 20 feet.

#### **Additional Criteria to Restore, Create or Enhance Herbaceous Habitat for Wildlife Pollinators and Beneficial Insects**

***This purpose is intended to be used in combination with one or more of the previous purposes and should not be utilized as a primary single purpose. The minimum criteria for the primary purpose(s) must be met initially.***

***Additional filter strip flow length devoted to this purpose must be added to the flow length required for the other purpose(s). The minimum additional flow length shall be 10 feet.***

***Any addition to the flow length for pollinators, wildlife or beneficial insects may be added to the downhill slope of the filter strip.***

***Vegetation to enhance wildlife habitat may be added to that portion of the filter strip devoted to other purposes to the extent this vegetation does not detract from the primary functions.***

**Plant species selected for this purpose shall be permanent vegetation adapted to the targeted wildlife or beneficial insect populations. Refer to the West Virginia Pollinator Handbook (WVPH) or the WV Wildlife Habitat Evaluation Technique (WVWHET) for herbaceous species that benefit certain wildlife species or as recommended by state staff specialists.**

**A total of ten species shall be established for pollinators. Including a minimum of one native grass species and three species of forbs in each of the very early and/or early, mid and late bloom periods.**

**Density of the vegetative stand established for this purpose shall consider targeted wildlife habitat requirements and encourage plant diversity. Dispersed woody vegetation may be used to the extent it does not interfere with herbaceous vegetative growth the primary purpose or the operation and maintenance of the filter strip.**

**Pesticide use shall be minimized and applied with the most targeted method and only to control noxious weeds or crop damaging pests.**

**The filter strip shall not be harvested during the nesting season for avian species from March 15 to July 15 or during critical pollinating periods (i.e. during crop bloom)**

**Filter strips shall be strategically located to maximize the connectivity of corridors and non-cultivated patches of vegetation to facilitate dispersal and movement of wildlife and species populations.**

**Filter strips shall be strategically located to enhance aesthetics of the watershed.**

## **CONSIDERATIONS**

**General.** Filter strip width (flow length) can be increased as necessary to accommodate harvest and maintenance equipment.

Filters strips with the leading edge on the contour will function better than those with a gradient along the leading edge.

Seeding rates that establish a higher stem density than the normal density for a high

quality grass hay crop will be more effective in trapping and treating contaminants.

**Consider the type and density of vegetation and how it influences filter effectiveness.**

Stem diameter (inches)	Number of stems (stems per square foot)
0.10	50
0.25	25
0.50	12
0.75	8
1.00	5

Table 2. Recommended stem densities of vegetation for filter strips.

**Consider using this practice to protect National Register listed or eligible (significant) archaeological and traditional cultural properties from potential damaging contaminants.**

**Filter strip size should be adjusted to accommodate harvest and maintenance equipment.**

**Consider the use of this practice to sequester more carbon.** Increasing the width of filter strip will increase the potential for carbon sequestration.

**Consider the amount of time to establish some species of vegetation. In some instances this may be as long as 3 years (i.e. warm season grasses).**

**Consider the effectiveness of the filter strips outside of the growing season and determine the need for additional conservation practices.**

**The design width should consider the soils permeability to ensure satisfactory performance.**

**Hydrologic soil groups (A, B, C, and D) are indicative of the infiltration and runoff potential. Soil groups A and B have higher infiltration potential; therefore, less runoff than groups C and D. Soil drainage class also determines the extent of soil moisture**

**conditions and water storage available in a soil. Filter strips located on hydrologic soil groups C and D are less effective than filter areas on A and B soils. Refer to the local soil survey for information regarding the hydrologic soil group for a particular soil.**

**Consider the use of filter strips in conjunction with other practices such as Contour Farming (330) and Contour Buffer Strips (332).**

#### **Considerations for Reducing Suspended Solids and Associated Contaminants in Runoff**

Increasing the width of the filter strip beyond the minimum required will increase the potential for capturing contaminants in runoff.

#### **Considerations for Creating, Restoring or Enhancing Herbaceous Habitat for Wildlife and Beneficial Insects and Pollinators**

Filter strips are often the only break in the monotony of intensively-cropped areas. The wildlife and pollinator benefits of this herbaceous cover can be enhanced by:

Increasing the width beyond the minimum required, and planting this additional area to species that can provide food and cover for wildlife and pollinators. This additional width should be added on the downslope side of the filter strip.

Adding even one or two herbaceous plant species to the filter strip seeding mix that are beneficial to wildlife and pollinators. Changing the seeding mix should not detract from the purpose for which the filter strip was established.

#### **Considerations for Maintaining or Enhancing Watershed Functions and Values**

Filter strips can:

- enhance connectivity of corridors and non-cultivated patches of vegetation within the watershed.
- enhance the aesthetics of a watershed.

- be strategically located to reduce runoff, and increase infiltration and ground water recharge throughout the watershed.

#### **Considerations for Air Quality**

Increasing the width of a filter strip beyond the minimum required will increase the potential for carbon sequestration.

### **PLANS AND SPECIFICATIONS**

Plans and specifications shall be prepared for each field site where a filter strip will be installed. A plan includes information about the location, construction sequence, vegetation establishment, and management and maintenance requirements.

***Specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets, job sheets, technical notes, and narrative statements in the conservation plan, or other acceptable documentation.***

***At a minimum, specifications shall include (as applicable):***

- ***Length, width, and slope of the filter strip and the contributing area to accomplish the planned purpose (width refers to flow length across the filter strip).***
- ***Species and seeding rates***
- ***Planting dates, methods, care, and handling of seed.***
- Site preparation sufficient to establish and grow selected species
- A statement that only viable, high quality and regionally adapted seed will be used
- ***CPA-52 or similar acceptable environmental evaluation***
- ***Operation and maintenance requirements***

### **OPERATION AND MAINTENANCE**

For the purposes of filtering contaminants, permanent filter strip vegetative plantings should be harvested as appropriate to encourage dense growth, maintain an upright

growth habit and remove nutrients and other contaminants that are contained in the plant tissue.

***Control weeds or undesirable plants within the filter strip.***

Inspect the filter strip after storm events and repair any gullies that have formed, remove unevenly deposited sediment accumulation that will disrupt sheet flow, reseed disturbed areas and take other measures to prevent concentrated flow through the filter strip.

***Apply supplemental nutrients according to soil test to maintain the desired species composition and stand density of the filter strip.***

***Avoid maintenance activities during the primary nesting season (March 15- July 15). If mowing is necessary to maintain the filter strip, mow between July 15 and August 15. Exceptions may be granted for filter strip renovation and repair. Disturb no more than 50% of the entire area of the filter strip at one time if feasible.***

Periodically re-grade and re-establish the filter strip area when sediment deposition at the filter strip-field interface jeopardizes its function. Reestablish the filter strip vegetation in these re-graded areas, if needed.

If grazing is used to harvest vegetation from the filter strip, the grazing plan must insure that the integrity and function of the filter strip is not adversely affected. ***Refer to practices such as Prescribed Grazing (528) or Forage Harvest Management (511) for relevant information including a grazing schedule specifying timing and intensity.***

## REFERENCES

Dillaha, T.A., J.H. Sherrard, and D. Lee. 1986. Long-Term Effectiveness and Maintenance of Vegetative Filter Strips. VPI-VWRRRC Bulletin 153.

Dillaha, T.A., and J.C. Hayes. 1991. A Procedure for the Design of Vegetative Filter Strips: Final Report Prepared for U.S. Soil Conservation Service.

Foster, G.R. Revised Universal Soil Loss Equation, Version 2 (RUSLE2) Science Documentation (In Draft). USDA-ARS, Washington, DC. 2005.

Renard, K.G., G.R. Foster, G.A. Weesies, D.K. McCool, and D.C. Yoder, coordinators. 1997. Predicting Soil Erosion by Water: A Guide to Conservation Planning with the Revised Universal Soil Loss Equation (RUSLE). U.S. Department of Agriculture. Agriculture Handbook 703.

***\* Bold italics indicate changes made or information added to the national standard by West Virginia.***