

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

FILTER STRIP

Acre
393

DEFINITION

A strip or area of permanent herbaceous vegetation situated between cropland, grazing land, or disturbed land and environmentally sensitive areas.

plantings to treat runoff and are not part of the adjacent cropland's rotation.

Overland flow entering the filter strip shall be primarily sheet flow. Concentrated flow shall be dispersed. (See Appendix)

PURPOSES

- Reduce sediment, particulate organic matter, and sediment adsorbed contaminant loading in runoff.
- To reduce dissolved contaminant loading in runoff.
- To restore or maintain sheet flow in support of a Riparian Forest Buffer (391), Zone 3.
- Restore, create, or enhance herbaceous habitat for wildlife and beneficial insects.

Filter strips cannot be installed on unstable channel banks eroding due undercutting of the bank toe.

Permanent herbaceous vegetation shall consist of a single species or a mixture of grasses, legumes and/or other forbs adapted to the soil, climate, and farm chemicals used in adjacent cropland.

State listed noxious weeds will be controlled if present.

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

Filter strips must be properly maintained so that they function properly

CONDITIONS WHERE PRACTICE APPLIES

This practice applies (1) in areas situated between cropland, grazing land, or disturbed land; and environmentally sensitive areas: (2) where sediment, particulate organic matter and/or dissolved contaminants may leave these areas and are entering environmentally sensitive area; (3) in areas where permanent vegetation is needed to enhance wildlife and beneficial insects, along with conditions 1 and 2 above. This practice applies only when used in conjunction with other conservation practices as part of a conservation management system. This practice does not apply where runoff or subsurface water does not interact with planned vegetation.

Additional criteria to reduce sediment, particulate organic matter, and sediment-adsorbed contaminants in runoff.

Filter strip flow length shall be determined based on field slope percent and length and filter strip slope percent, erosion rate, amount and particle size distribution of sediment delivered to the filter strip, density, and height of filter strip vegetation, and runoff volume associated with erosion producing events. The minimum flow length will be determined using Table 1. Approved seed mixtures are listed in Tables 3 and 4.

CRITERIA

Criteria applicable to all purposes

Filter strips shall be permanently designated

Filter strip location requirements:

- The filter strip shall be located along the down-slope edge of a field or disturbed area on the approximate contour.
- The average slope for the field or disturbed area above the filter strip shall have a

393-2

minimum of 0.5% but less than 10 percent.

- The ratio of the field or disturbed area to the filter strip area shall be less than 60:1 in regions with a RUSLE R Factor less than 175 and 50:1 in regions with a RUSLE R Factor greater than 175.
- The average annual sheet and rill erosion rate above the filter strip shall not exceed 10 tons per acre per year. Erosion rates will be estimated using the Revised Universal Soil Loss Equation (RUSLE).
- Where the average annual sheet and rill erosion rate above the filter strip exceeds 10 tons per acre per year, field(s) or disturbed areas contributing runoff to the filter strip shall be planned to the following applicable practices: Conservation Cropping System (328), Residue Management (329), Contour Farming (330), and appropriate gully control.

Additional criteria to reduce dissolved contaminants in runoff

Additional criteria to reduce sediment, particulate organic matter, and sediment adsorbed contaminant loading in runoff apply to this purpose and:

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 herbaceous buffer's area and infiltration capacity.

Minimum widths established for this purpose will be determined from Table 1 and vegetated with appropriate species listed in Tables 3 and 4.

Field(s) or disturbed areas contributing runoff to the filter strip shall be planned according to the following applicable practices Nutrient Management (590), Pest Management (595), and/or Waste Utilization (633).

Sheet and rill erosion rates shall not exceed the sustainable level (T) established for the predominate soil map units present.

Additional criteria to restore or maintain sheet flow within the filter strip or in support of a Riparian Forest Buffer, Practice Standard 391, Zone 3.

Except for the location requirements, the criteria given in "Additional criteria to reduce sediment, particulate organic matter, and sediment bound contaminant loading in runoff" also apply to this purpose.

If concentrated flows entering the riparian forest buffer are greater than its ability to disperse them, other means of dispersal, such as spreading devices, must be incorporated.

Additional criteria to restore, create, or enhance herbaceous habitat for wildlife and beneficial insects

If this purpose is intended, then the **minimum** criteria for the primary purpose(s) must be met and additional filter strip flow length devoted to this purpose must be added.

Any addition to the flow length for wildlife or beneficial insects shall be added to the downhill slope of the filter strip. Plantings to enhance wildlife may be added to that portion of the filter strip devoted to other purposes to the extent they do not detract from its primary functions.

Plant species selected for this purpose shall be adapted to the wildlife or beneficial insect species targeted.

The filter strip shall not be mowed during the nesting season of the target species.

Livestock and vehicular traffic in the filter strip shall be excluded during the nesting season of the target species.

If wildlife enhancement the only purpose intended, then this practice does not apply. Refer to Conservation Cover (327), Wildlife Upland Habitat Management (644), or Wildlife Wetland Management (645) for specifications.

CONSIDERATIONS

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

Filter strips should be strategically located to intercept contaminants thereby enhancing the water quality of the watershed.

Filter strips may be included as a part of a riparian forest buffer system. To avoid damage

to the filter strip vegetation, consider using plant species that are tolerant to herbicides used in the upslope crop rotation.

Consider using this practice to enhance the conservation of declining species of wildlife, including those that are threatened or endangered.

Filter strip size should be adjusted to accommodate planting, harvesting, and maintenance equipment.

Filter strip widths greater than that needed to achieve a 30 minute flow through time at 1/2 inch depth will not likely improve the effectiveness of the strip in addressing water quality concerns, created by sediment, particulate organics, and sediment adsorbed contaminants.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared for each specific field site, based on this standard, where a filter strip will be installed. A plan includes information about the location, construction sequence, vegetation establishment, and management and maintenance requirements. Use Job Sheet 393.

Specifications will include:

- Length, width, and slope of the filter strip to accomplish the planned purpose (length refers to flow length across the filter strip).
- Species selection and seeding rates to accomplish the planned purpose.
- Planting dates, care, and handling of the seed to ensure that planted materials have an acceptable rate of survival.
- Statement that only viable, high quality, and regionally adapted seed will be used.
- Site preparation sufficient to establish and grow selected species.

ESTABLISHMENT OF VEGETATION

Site Preparation

All trees, stumps, brush, rocks, and similar materials that can interfere with installing the filter strip shall be removed. Trees growing on stream

banks that will not interfere with the establishment and maintenance of the filter strip shall be left undisturbed. The materials shall be disposed of in a manner that is consistent with all federal, state, and local regulations and will allow for the functioning of the vegetative filter strip.

The filter strip shall be shaped to the grade and dimensions shown in the plan or as staked in the field. If necessary, topsoil shall be stockpiled and spread to the required grade and thickness. Excess spoil shall be disposed of in areas where it does not interfere with the required flow characteristics of the filter strip.

Seed, Seeding Rates and Mixtures

Seed shall meet all requirements of Illinois seed laws. Use of certified seed is recommended. Where optimal conditions for seed placement and seed/soil contact are expected, the minimum width determined for a site shall be sown using grass or grass/legume seed mixtures that provide at least 40 PLS/ft² grass species with at least 60 percent (24 PLS/ft²) sod forming species. Local conservationists shall increase seed rates to account for less optimal site conditions. Seed mixtures will consist of native grasses or introduced grass/legumes. See Tables 3 for approved seed mixtures and Table 4 for legume seeding rates required for introduced cool season grass mixtures. All seedings should be planted within the appropriate seeding dates listed in Table 2. Use tables provided in the Appendix for designing additional seed mixtures.

A companion crop is to be used for introduced cool season grass/legume mixtures where it is deemed necessary for temporary erosion control while the desired species become established. Seed one bushel per acre (32 pounds) of oats for spring seedings and twenty pounds of wheat or cereal rye for fall seedings. The companion crop shall be mowed by early boot stage. Companion crops should not be used when establishing native mixtures unless needed to bulk up seed volume for light, chaffy seeds or when severe weedy grass pressure is expected e.g. foxtail. No more than one bushel of oats per acre (32 pounds) shall be used for this situation.

To aid in establishment of vegetation, prevention of surface water runoff from entering the filter strip through the use of temporary diversions should be considered until vegetation is

393-4

established to a minimum height of 4 inches and 90 percent ground cover.

Lime and Fertilizer

Apply lime to correct soil pH to levels required for species selected for the filter strip. (See SCS *Ready Reference Binder, Section - Agronomy page 3-4 or the NRCS National Range and Pasture Handbook Chapter 3*) In cases where soil pH is less than 5.5, apply agricultural limestone at rates that will raise soil pH to a level of 6.2. Refer to the current *Illinois Agronomy Handbook* for specifications on calculating limestone rates.

Minimum soil test levels respectively for phosphorous (P1) and potassium are 15 and 150 pounds per acre.

Where soil test phosphorus (P1) levels are below 15 pounds per acre, apply 60 pounds P₂O₅ per acre at planting.

Where soil test potassium levels are below 150 pounds per acre, apply 200 pounds K₂O per acre at planting

Apply 30 pounds per acre of nitrogen at planting when introduced cool season grass/legume seed mixtures are being used. Nitrogen application for establishing cool season grass/legume mixtures may be omitted when seedings follow within nine months after the harvest of a legume crop.

Do not apply nitrogen in the seeding year where native warm season grass and grass/forb mixtures are planned. Apply nitrogen at 50 pounds per acre to the native stands only when the required plants per square foot are established and exhibit growth inhibiting nutrient deficiencies. For guidelines on assessing the adequacy of the stand(s), see *Agronomy Technical Note IL-2, "Guidelines for Herbaceous Stand Evaluation."* Use the densities established for Critical Areas when using this tool for evaluating stand densities for this practice. To prevent excessive weed competition, apply nitrogen only during the peak growth period for the predominate species(s).

Seedbed Preparation and Seeding

Conventional seedings for spring and late summer seeding periods.

Prepare a smooth, firm seedbed, at a minimum depth of 3 inches using tillage methods most suited to the soils within the filter strip site. Place seed at a depth of 1/4 to 1/2 inch with a grassland drill equipped with double disc openers, depth wheels or bands, and packer wheel. Grain drills and cultipacker-type seeders are acceptable if the seed delivery mechanism is designed to handle the type of seed being planted. Broadcast seedings are allowed where light, chaffy, and/or bearded is not being used and where seed will be covered to 1/4 to 1/2¹ inch depth with a cultipacker/mulcher, harrow, or similar tool is used.

No-till seedings for spring, late summer, and dormant seeding periods.

Approved burndown herbicides shall be used to kill or suppress existing vegetation where necessary. A seed drill designed for no-till seedings will be used. No-till grain drills are acceptable if the seed delivery mechanism is designed to handle the type of seed being used. Seeds will be placed at a depth of 1/4 to 1/2 inch¹.

Note:1. Seeding depth for eastern gamagrass should be 1- 1/2 inches.

OPERATION AND MAINTENANCE

Filter strip vegetation 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 undesired weed species, especially state-listed noxious weeds. Follow herbicide label instructions when used for weed control.

Prescribed burning may be used to manage and maintain the filter strip when an approved burn plan has been developed.

Inspect and repair the filter strip after storm events to fill in gullies, remove flow disrupting sediment accumulation, re-seed disturbed areas, and take other measures to prevent concentrated flow. Sediments removed shall be placed in upland areas outside the high water mark of regulated water bodies.

Apply supplemental nutrients as needed to maintain the desired species composition and stand density of the filter strip.

To maintain or restore the filter strip's function, periodically re-grade the filter strip area when sediment deposition at the filter strip-field interface jeopardizes its function, as necessary, and then reestablish the filter strip vegetation, if needed. Sediments removed shall be placed in upland areas outside the high water mark of regulated waterbodies

Grazing shall not be permitted in the filter strip unless a planned grazing system is being implemented. Grazing will be permitted under a planned grazing system only when soil moisture conditions support livestock traffic without excessive compaction. See Prescribed Grazing (NRCS Practice Code 538A).

Livestock will be excluded from surface waters. A setback between the grazed area and the waterbody will be a minimum length to provide a 15 minute flow through time at 1/2 inch flow depth. (See Table 1)

Caution must be observed when tilling or spraying herbicides next to the vegetative filter strip to maintain the designed flow length.

REFERENCES

- In *Southern Forages*, Potash & Phosphate Institute (PPI) and Foundation for Agronomic Research (FAR, p.85.
- Dabney, S.M., L.D. Meyer, G.H. Dunn, G.R. Foster, and C.V. Lonso. 1996. Stiff-grass hedges, A vegetative alternative for sediment control. Proc. of Interagency Sedimentation Conf. 2:62-69.
- Dewald, C.L., J. Henry, S. Bruckerhoff, J. Ritchie, S. Dabney, D. Shepard, J. Douglas, and D. Wolf. 1996. Guidelines for establishing warm season grass hedges for erosion control. J. Soil and Water Cons. 51:16-20.
- Dillaha, T.A., J.H. Sherrard, and D. Lee. 1986. Long-term effectiveness of vegetative filter strips. Virginia Polytechnic Institute and State Univ. Water Resources Research Center. Bulletin 153.
- Mersie, W., C.A. Sybold, C. McNamee, and J. Huang. 1999. Effectiveness of Switchgrass filter strips in removing dissolved atrazine and metolachlor from runoff. J. Environ. Qual. 28:816-821.
- Metcalf, D.S., Forage Statistics. In *Forages*, Iowa State Univ. Press, Ames, IA, Third Edition, pp. 68-72.
- Plummer, M., *Buffer Strips for Water Quality*, University of Illinois Cooperative Extension Service.
- United States Department of Agriculture, Natural Resources and Conservation Service. 1992. *Animal Waste Management Field Handbook*. pp. IL 10-66(1-12).
- United States Department of Agriculture, Natural Resources and Conservation Service. 1997. *National Pasture and Range Handbook*. Chapter 3. United States Department of Agriculture, Natural Resources and Conservation Service. 1998.
- Nebraska Field Office Technical Guide*. Filter Strip, Practice Code 393, April 1998

TABLES

Table 1. Filter strip flow lengths based on land slope to achieve a minimum flow through time of 15 and 30 minutes respectively at 1/2 inch depth.

Percent Slope	0.5%	1.0%	2.0%	3.0%	4.0%	5.0% or greater
Minimum	36	54	72	90	108	117
Maximum	72	108	144	180	216	234

Table 2. Seeding Dates.

SEEDING PERIOD	PLANT SUITABILITY ZONE ¹	COOL SEASON MIXTURES ²	WARM SEASON MIXTURES ³
SPRING	I II III	Early spring-June 1 Early spring-May 15 Early spring-May 15	Early spring to June 15 Early spring to June 5 Early spring to June 1
SUMMER	I II III	August 1-September 1 August 1-September 10 August 1-September 20	Not Recommended Not Recommended Not Recommended
DORMANT	I II III	November 1-Freeze up November 15-Freeze up November 15-Freeze up	

Footnotes:

1. Refer to the "Plant Suitability Zones" map located in Section 1 IL-FOTG-Climatic Data.
2. Includes all species considered introduced.
3. Includes all cool season and warm season native species.

Table 3. Approved grasses to be used with a selected legume in Table 4.

SEED MIXTURE	PURE LIVE SEED Pounds/Acre	SITE SUITABILITY
Switchgrass	6	Well, adapted to mesic and moist sites. Will withstand droughty sites. Tolerant to atrazine.
Switchgrass Indiangrass Big Bluestem	3.5 2.0 2.5	Adapted to most sites except for extremely wet soils. Tolerant to atrazine. Indiangrass susceptible to atrazine prior to establishment.
Eastern Gamagrass Switchgrass	6 4	Adapted to well drained and poorly drained soils. Tolerant to atrazine.
Switchgrass Maximilian sunflower	5.5 1	Maximilian sunflower is adapted to well drained sites only. Fair tolerance to atrazine.
Redtop ¹	5	Adapted to poorly drained soils. Low tolerance to atrazine.
Redtop ¹ Timothy	4 2	Adapted to poorly drained soils. Fair tolerance to atrazine.
Smooth Bromegrass ¹	13	Adapted to well drained to somewhat poorly drained soils. Fair tolerance to atrazine.
Smooth Bromegrass ¹ Timothy	8 2	Adapted to well drained to somewhat poorly drained soils. Fair tolerance to atrazine.
Redtop ¹ Virginia Wildrye	4 3	This mixture is tolerant to frequent, short duration floods. Low tolerance to atrazine.
Western Wheatgrass	15	This mixture is tolerant to frequent, short duration floods. Low tolerance to atrazine.

1. These introduced cool season grasses must be planted with a legume listed in Table 4.

Table 4. Companion legumes to be selected along with a grass mixture in Table 3.

COMPANION LEGUME	Pure Live Seed Pounds/Ac.	SITE SUITABILITY
Alsike Clover	3-4	Adapted to poorly drained soils
Ladino Clover	0.5-0.75	Adapted to poorly drained soils
Alfalfa	3-5	Not adapted to poorly drained soils.
Annual lespedeza	6	Plant Suitability Zone 2 and 3 only. Not adapted to poorly drained soils.

APPENDIX

Guidelines for Managing Concentrated Flows

Filter strips are far less effective where flows are concentrated as opposed to sheet flow. This often requires land grading, the creation of spreader ditches, or other measures to ensure maximum effectiveness of the filter strip. The use of stiff grass hedges in areas of concentrated flow will allow for the deposition of sediments at the upstream edge producing a level bench. Once this bench is formed, runoff temporarily ponds and flows through the hedge more diffusely. Where runoff is substantial enough to overtop the hedge, the bench formed will function as a spreader device. The following guidelines are to be used when planning this component of the filter strip.

Stiff-grass hedge strips must be at least 3 feet in width and must extend across the channel to a point a minimum of one vertical foot above the low point of the channel. Stiff-grass hedges will be installed at the upslope edge of the filter strip and the concentrated flow channel (See Figure 1). As a minimum, one stiff-grass hedge will be installed at the upslope edge of the filter strip where the concentrated flow enters and at the outlet of the concentrated flow channel (See Figure 2). Stiff-grass hedges shall not be mowed shorter than 12 inches. As stiff-grass hedges mature, the amount of ponding at the upslope edge can increase. The wetness created may eventually impede timely field operations in the adjacent agricultural land. Installing a subsurface drain may need to be considered during the planning of this measure.

Approved species and rates for stiff-grass hedge establishment:

- Switchgrass 10 lbs. PLS per acre
- Eastern Gamagrass 12 lbs. PLS per acre

Figure 1. Stiff-grass hedge installed across the channel to an elevation of one foot above the low point

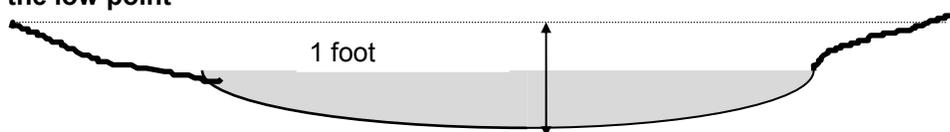
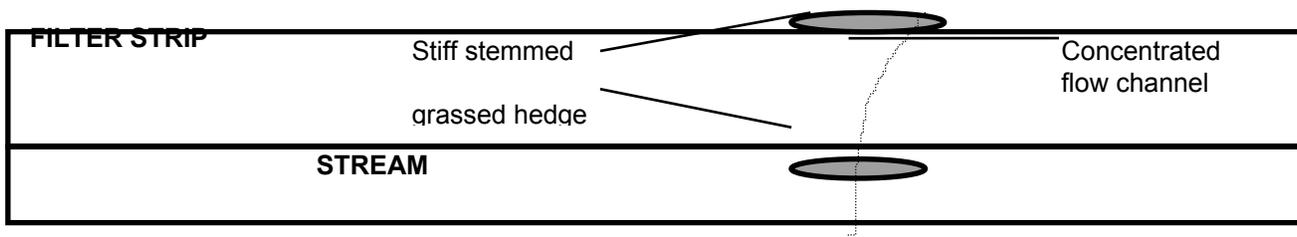


Figure 2.



Guide for evaluating and designing seed mixtures suitable for filter strips

Common sod forming species suited for filter strips.

SPECIES	FULL SEEDING RATE (PLS LB. /AC)	60% FULL SEED RATE (PLS LB/AC)
Smooth Bromegrass ¹	13	7.8
Redtop ¹	5	3
Switchgrass	6	3.6
Western Wheatgrass	15	9

Seed rates of sod forming grasses can be adjusted from those shown in Table 3 of the Filter Strip Standards and Specifications (393) as long as 60% of the seed mixture contains sod forming grasses based on the full seeding rates shown in the above table.

Common bunch forming species suited for filter strips.

SPECIES	FULL SEEDING RATE (PLS LB. /AC)	40% FULL SEED RATE (PLS LB/AC)
Orchardgrass ¹	8	3.2
Timothy ¹	3	1.2
Big Bluestem ²	8	3.2
Indiangrass ²	8	3.2
Eastern Gamagrass	10	4
Canadian Wildrye	10	4
Sideoats Grama ²	10	4
Virginia Wildrye	10	4

Seeding rates of bunch forming grasses can be adjusted from those shown in Table 3 as long as the total seeding rate of sod and bunch forming grasses meet or exceed their combined full seeding rate.

Note: Often grassed waterway mixtures are selected for filter strips. There are advantages and disadvantages of using waterway mixes for filter strips. The advantages are that most species selected for waterways are sod forming and tolerant of wet soils.

The disadvantage is that ideal waterway species protect the channel while providing low retardance to the flow, in order to minimize siltation. Filter strip species by contrast, need to have stiff erect, stems that will remain erect in flowing water and provide maximum retardance to promote sedimentation.

393-10

Footnotes:

¹Companion legumes are required where introduced grasses are used and optional where native grasses are used. For choices of companion legumes see Table 4 contained in the Filter Strip (393) Practice Standards and Specifications.

²Big Bluestem and Indiangrass are considered weak sod formers and may be used as part of the required sod forming component of the seed mixture. These species, alone or combined, shall not exceed 30% of the total seed mixture.

Example: A mixture of native cool and warm season grasses is desired in order to provide actively growing vegetation during the entire growing season. Western Wheatgrass, Big Bluestem, and Eastern Gamagrass are the desired species. Western Wheatgrass and Big Bluestem are sod formers and need to comprise 60% of the mixture.

Western Wheatgrass 30% x 15 lbs. PLS/ac = 4.5 lbs. PLS/ac

Big Bluestem 30% x 8 lbs. PLS/ac = 2.4 lbs. PLS/ac

Eastern Gamagrass 40% x 10 lbs. PLS/ac = 4 lbs. PLS/ac