NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

VEGETATIVE BARRIER

(Ft.)
CODE 601

DEFINITION

Permanent strips of stiff, dense vegetation established along the general contour of slopes or across concentrated flow areas.

PURPOSE

- Reduce sheet and rill erosion.
- Reduce ephemeral gully erosion.
- Manage water flow.
- Stabilize steep slopes.
- Trap sediment.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land uses where sheet and rill and/or concentrated flow erosion are resource concerns.

This practice is not well-suited to soils that are shallow to rock or other restrictive layers and where tillage is used on the cropped strips. The "benching" process that occurs on slopes where barriers are installed (tillage erosion moves soil from the upper part of the cropped strip, which then accumulates in the lower part of the cropped strip) can expose soil material unfavorable for crop growth.

CRITERIA

General Criteria Applicable to All Purposes

Physical Characteristics of Plants.

Stiffness Index. Vegetative barriers will be planted to vegetation having the minimum Vegetation Stiffness Index (VSI) designated in Table 1 measured at a point 6 inches above the ground.

Table 1. Stem Diameter and Minimum Stem Density Values for Vegetation Stiffness Index (VSI) Values of 0.05 and 0.10.

Stem Diameter (Inch)	Concentrated Flow Areas Stem Density Per Square Foot @VSI=0.1	Other Purposes Stem Density Per Square Foot @VSI=0.05
0.10	1000	500
0.15	200	100
0.20	60	30
0.25	30	15
0.50	20	10
=/>1.00	1.0	1.0

Density. Gaps between plants will be no greater than 3 inches at the end of the first growing season.

Species Selection. Species must be adapted to local soil and climate conditions, be easily established, long-lived, and manageable.

Select species which exhibit characteristics that are required for adequate function such as: emergence though several inches of sediment or resuming growth from buried stem nodes; rhizomatous or stoloniferous growth habit; and stems that remain intact and erect year round.

Vegetation in the barrier will be tolerant to herbicides used in the cropped field.

Do not establish any plant that is on the Federal or State noxious weed list.

Establishment. Barriers may be established vegetatively or from seed.

Seeding dates, depths and rates will be appropriate for the species selected and the

conditions of the site. Seeds will be placed to insure good seed-to-soil contact.

Barriers established vegetatively will be planted at a density to insure a functional barrier as quickly as possible (usually two growing season). For most herbaceous species, this will require a spacing in the row of no more than 6 inches for bare-root seedlings, cuttings, sod chunks, plugs, rhizomes, or divisions consisting of no less than 5 viable stems. Suckering shrubs or herbaceous species established from 6-inch (gallon) potted material will be established at a spacing in the row of no more than 12 inches.

Site preparation must be sufficient to ensure seed germination or proper rooting conditions for vegetated material establishment. Plants will be placed to insure good root-to-soil contact and packed after planting.

Use appropriate site stabilization measures, such as erosion control blankets, silt barriers or mulches, during the barrier establishment period.

Barrier Width. Barrier widths will be the larger of 3 feet wide or 0.75 times the design vertical interval. Broadcast or drilled seed will be sown in a strip at least 3 feet wide. Seed sown with a row planter will be seeded in a minimum of 2 rows.

Additional Criteria for Reducing Sheet and Rill Erosion

Gradient. Gradients along the barrier will be no less than 0.2 percent and no greater than 1.0 percent except where the vegetative barrier crosses concentrated flow areas. Gradients entering a concentrated flow area may be up to 1.5 percent for 100 feet in order to get better row alignment.

All tillage and equipment operations in the interval between barriers will be parallel to the vegetative barrier.

A berm must exist at the upslope edge of the barrier and/or a channel must exist immediately upslope of the barrier to divert water along the vegetative barrier. Minimum berm height/channel depth will be 3 inches. Water flowing along a vegetative barrier berm/channel must be delivered to a stable outlet.

Spacing. Horizontal spacing between the vegetative barriers will be determined using the lesser of:

1. the horizontal distance between barriers when the vertical interval is 6 feet, or
2. the RUSLE2 “L” that achieves the allowable soil loss for the field, considering the planned practices in the conservation management system.

Crop strip width will be planned in multiples of widths of planting, tillage, spraying and harvest equipment. This spacing may be adjusted up to 10 percent between the barriers.

Vegetation. The vegetation will be of species to provide the designated minimum stem density with the designated stem diameter and have a minimum VSI of 0.05. See Table 1 for guidance.

Additional Criteria for Reducing Concentrated Flow Erosion

Alignment. Vegetative barriers may be installed across concentrated flow areas perpendicular to the direction of water flow.

Width and Length. Vegetative barriers for this purpose will consist of a minimum of 2 rows. Vegetative barrier length will vary depending on the topography. Each strip will be long enough to ensure that the ends of the strip are at least 1.5 feet higher than the center of the concentrated flow area (see Figure 1). When the concentrated flow area has a pre-existing headcut, place one row of a barrier at the bottom of the headcut and the other row at the top.

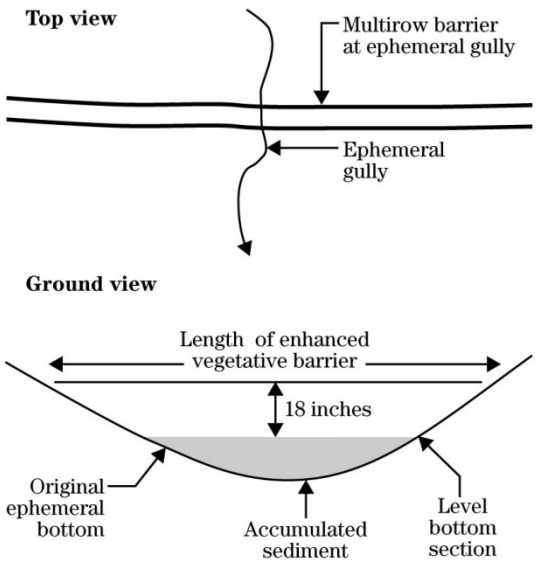

Figure 1. Barriers in concentrated flow areas must extend far enough up the hillslope to avoid bypass around the ends during peak flows.

Spacing. Spacing between the vegetative barriers will be based on the vertical interval of 1.5 feet for conditions where no tillage is performed between the barriers and 3 feet for all other conditions where sediment deposition and bench development is anticipated.

Crop strip width will be in multiples of widths of planting, tillage, spraying, and harvesting equipment. Adjustments of ±10 percent in the width of the crop strip are allowed to accommodate equipment operations.

Minimum Level Bottom Section Length. The minimum level bottom section length (in feet) shall be numerically equal to the peak discharge [in cubic feet per second (cfs)] for a 2-year 24-hour design storm from the total watershed upslope of the lowest barrier. This equates to a specific discharge of 1 cfs/ft of vegetative barrier. Level bottom section is defined as the bottom width of a trapezoidal waterway. This will be shaped during construction or formed by sediment deposition. (See Figure 1) Use methods in Chapter 2 of the Engineering Field Handbook to estimate peak discharge for local soil, climate and management conditions.

If the channel does not have a level bottom section, design the barriers so that the peak discharge through the barriers for a 2-year, 24-hour storm does not exceed allowable velocities for the soil, vegetation, and slope conditions as determined using Chapter 7 of the Engineering Field Handbook.

Vegetation. Establish species that will provide the designated minimum stem density with the designated stem diameter and have a VSI of 0.10. See Table 1 for guidance.

Additional Criteria for Managing Water Flow

Gradient. Barriers will have a minimum grade of 0.2 percent and a maximum grade of 1.0 percent, except where the vegetative barrier crosses a concentrated flow area. Gradients entering a concentrated flow area may be up to 1.5 percent for 100 feet in order to get better row alignment.

Minimum berm height/channel depth along the upper edge of the barrier will be 3 inches

Water flowing along the barrier must be delivered to a stable outlet.

Width and Length. Vegetative barriers may consist of 1 or 2 rows. Vegetative barriers may be wider to adjust for planter and/or sprayer width, or for improved contour alignment. Vegetative barrier length will vary depending on the topography. Each strip will be long enough to ensure that the ends of the strip are at least 1.5 feet higher than the center of the concentrated flow area (see Figure 1).

Spacing. Horizontal spacing between barriers shall be the lesser of:

- the horizontal distance between barriers with a vertical interval of four feet, or
- the RUSLE2 “L” that achieves the allowable soil loss for the field, considering the planned practices in the conservation management system.

For barriers intended to retard and spread run-off, the maximum vertical interval will be 1 foot.

Crop strip width will be planned in multiples of widths of planting, tillage, spraying and harvest equipment. This spacing may be adjusted up to 10 percent between the barriers.

Maximum Watershed. The total watershed in a vegetative barrier system will be the smaller of the size that will:

a) provide runoff to impound 1 foot of water upslope of the lowest barrier in the system, or

b) generate the maximum allowable velocity on bare soil for the soil texture in the concentrated flow area as determined in Chapter 7 in the Engineering Field Handbook.

Vegetation. Establish species that will provide the designated minimum stem density with the designated stem diameter and have a VSI of 0.05 for areas diverting runoff and VSI of 0.1 for areas retarding and ponding runoff. See Table 1 for guidance.

Additional Criteria for Stabilizing Steep Slopes

No concentrated flow channels may exist on slopes where vegetative barriers are used for this purpose. Any concentrated flows must be dispersed.

Barrier Row Grade. The maximum grade of barrier rows shall not exceed:

- one-half of the up-and-down hill slope percent used for conservation planning, or
- 2 percent,

whichever is less.

Spacing. The maximum vertical interval for this purpose is:

- 6 feet when barriers are designed so that runoff water flows along the barrier and not through it (i.e. functions as a terrace);
- 4 feet when overland flow occurs between barriers.

Vegetation. The vegetation will be deep-rooted species that establish easily and grow rapidly.

The vegetation stiffness shall provide the designated minimum stem density with the designated stem diameter and have a VSI of 0.05 based on Table 1.

Additional Criteria for Trapping Sediment at the Bottom of Fields and/or the Ends of Furrows

Alignment. Barriers will be aligned as close to perpendicular as possible to flow coming off of fields or out of the ends of furrows.

Width. Vegetative barriers for this purpose will be a minimum of 3 feet wide.

CONSIDERATIONS

General Considerations

Management practices such as Conservation Crop Rotation (code 328) and the residue and tillage management practices (codes 329, 345 and 346) must be considered in designing the conservation management system on cropland.

Practices such as water and sediment control basins, subsurface drainage, and underground outlets may be needed to adequately handle surface and subsurface water.

This practice may improve the efficiency of other practices such as stripcropping, filter strips, riparian forest buffers, grassed waterways, diversions and terraces.

On tilled fields, consider soil profiles that have sufficient depth to retain productivity where benches will develop as soil is moved down gradient by tillage. Soil upslope of barriers will gradually build up while soil will be removed down slope of the barrier. The effect of this movement should be considered with respect to soil depth, subsoil characteristics and response to amendments.

Established vegetative barriers systems can pond water above the barriers. Subsurface drains may need to be installed across the slope parallel to the barrier, or through the ponded areas above barriers that are installed across concentrated flow areas.

Increasing the minimum width of the barrier and choosing species with greater above- and below-ground biomass will increase the potential for carbon sequestration.

Considerations to Enhance the Functioning of Other Practices

Filter Strips. Vegetative barriers incorporated into the upslope portion of filter strips will

increase filter strip longevity by promoting sediment deposition above the filter strip.

Field Borders. Vegetative barriers incorporated into the upslope portion of field borders at the bottom of slopes will increase field border longevity by promoting sediment deposition above the field border.

Riparian Forest Buffers. Vegetative barriers can reduce sediment delivery to riparian buffers when located just upslope of the buffer. Shading effects on vegetative barrier growth should be considered in selecting species.

PLANS AND SPECIFICATIONS

Plans and specifications will include:

1. Field map with location of vegetative barriers.
2. Width of crop strip.
3. Vegetative barrier and crop strip orientation.
4. Width of barrier.
5. Vegetative species and cultivar.
6. Establishment date, establishment method, seeding rate (when seeded) or spacing of vegetative planting stock
7. Site stabilization, if needed to ensure establishment.

OPERATION AND MAINTENANCE

The following actions will be carried out to insure that this practice functions as intended. These actions include normal activities in the application and use of the practice and repair and maintenance of the practice.

1. Establishment failures will be replanted or reseeded immediately; short gaps in seeded barriers may be reestablished more effectively and immediately with transplanted plant material.
2. Mowing of herbaceous barriers may be used as a management practice to encourage the development of a dense stand and prevent shading of crops in adjacent fields. Mow at a 15-inch stem height, or the recommended height for the species, whichever is taller.
3. Mow barriers in concentrated flow areas during their dormant period to avoid reducing the average stem diameter and thus lowering the VSI.
4. Barriers may be burned, if the species used will tolerate fire. Carry out burns just prior to the spring regrowth period, while the vegetation is dormant.

   All burns will be conducted in accordance with a smoke management plan.
5. Control any plant on the Federal or State noxious weed list. Control other weeds as necessary to ensure a dense stand within the barrier.
6. Crop tillage and planting operations will be parallel with the vegetative barrier.
7. Pest control in adjacent fields will be performed with techniques and pesticides that will not damage the vegetative barrier.
8. Washouts or rills that develop will be filled and replanted immediately. Short gaps in established barriers will be reestablished with transplanted plant material.
9. Vegetative barriers will not be used as a field road or turn row. Vegetative barriers in concentrated flow areas will not be crossed with machinery.
10. Vegetative barriers will not be crossed with water furrow plows or similar implements to cut drainage ditches to allow the passage of surface and subsurface water. If necessary, water will be drained with underground outlets installed up gradient of the barrier

REFERENCES

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