

STANDARD AND SPECIFICATIONS FOR VEGETATING WATERWAYS



Definition

Waterways are a natural or constructed outlet, shaped or graded. They are vegetated as needed for safe transport of runoff water.

Purpose

To provide for the safe transport of excess surface water from construction sites and urban areas without damage from erosion.

Conditions Where Practice Applies

This standard applies to vegetating waterways and similar water carrying structures.

Supplemental measures may be required with this practice. These may include: subsurface drainage to permit the growth of suitable vegetation and to eliminate wet spots; a section stabilized with asphalt, stone, or other suitable means; or additional storm drains to handle snowmelt or storm runoff.

Retardance factors for determining waterway dimensions are shown in Table 5B.1 and "Maximum Permissible Velocities for Selected Grass and Legume Mixtures," are shown in Table 3.6.

Design Criteria

Waterways or outlets shall be protected against erosion by vegetative means as soon after construction as practical. Vegetation must be well established before diversions or other channels are outletted into them. Consideration should be given to the use of synthetic products, jute or excelsior matting, other rolled erosion control products, or sodding of channels to provide erosion protection as soon after construction as possible. It is strongly recommended that the center line of the waterway be protected with one of the above materials to avoid center gullies.

1. Liming, fertilizing, and seedbed preparation.
 - A. Lime to pH 6.5.
 - B. **The soil should be tested to determine the amounts of amendments needed.** If the soil must be fertilized before results of a soil test can be obtained to determine fertilizer needs, apply commercial fertilizer at 1.0 lbs/1,000 sq. ft. of N, P₂O₅, and K₂O.
 - C. Lime and fertilizer shall be mixed thoroughly into the seedbed during preparation.
 - D. Channels, except for paved section, shall have at least 4 inches of topsoil.
 - E. Remove stones and other obstructions that will hinder maintenance.
2. Timing of Seeding.
 - A. Early spring and late August are best.
 - B. Temporary cover to protect from erosion is recommended during periods when seedings may fail.
3. Seed Mixtures:

<u>Mixtures</u>	<u>Rate per Acre (lbs)</u>	<u>Rate per 1,000 sq. ft. (lbs)</u>
A. Birdsfoot trefoil or ladino clover ¹	8	0.20
Tall fescue or smooth bromegrass	20	0.45
Redtop ²	2	0.05
	30	0.70
OR		
B. Kentucky bluegrass ³	25	0.60
Creeping red fescue	20	0.50
Perennial ryegrass	10	0.20
	55	1.30

¹ Inoculate with appropriate inoculum immediately prior to seeding. Ladino or common white clover may be substituted for birdsfoot trefoil and seeded at the same rate.

² Perennial ryegrass may be substituted for the redtop but increase seeding rate to 5 lbs/acre (0.1 lb/1,000 sq. ft.).

³ Use this mixture in areas which are mowed frequently. Common white clover may be added if desired and seeded at 8 lbs/acre (0.2 lb/1,000 sq. ft.).

4. Seeding

Select the appropriate seed mixture and apply uniformly over the area. Rolling or cultipacking across the waterway is desirable.

Waterway centers or crucial areas may be sodded. Refer to the standard and specification for Stabilization with Sod. Be sure sod is securely anchored using staples or stakes.

5. Mulching.

All seeded areas will be mulched. Channels more than 300 feet long, and/or where the slope is 5 percent or more, must have the mulch securely anchored. Refer to the standard and specifications for Mulching for details.

6. Maintenance

Fertilize, lime, and mow as needed to maintain dense protective vegetative cover.

Waterways shall not be used for roadways.

If rills develop in the centerline of a waterway, prompt attention is required to avoid the formation of gullies. Either stone and/or compacted soil fill with excelsior or filter fabric as necessary may be used during the establishment phase. See Figure 3.2, Rill Maintenance Measures. Spacing between rill maintenance barriers shall not exceed 100 feet.

Table 3.6
Maximum Permissible Velocities for Selected Seed Mixtures

Cover	Slope Range ² (%)	Permissible Velocity ¹	
		Erosion-resistant Soils (ft. per sec.) K=0.10 - 0.35 ³	Easily Eroded Soils (ft. per sec.) K=0.36 - 0.80
Kentucky Bluegrass	0-5	7	5
Smooth Brome	5-10	6	4
Tall Fescue	Over 10	5	3
Grass Mixtures	² 0-5	5	4
Reed Canarygrass	5-10	4	3
Redtop Alfalfa Red Fescue	⁴ 0-5	3.5	2.5

¹ Use velocities exceeding 5 feet per second only where good covers and proper maintenance can be obtained.

² Do not use on slopes steeper than 10 percent except for vegetated side slopes in combination with a stone, concrete, or highly resistant vegetative center section.

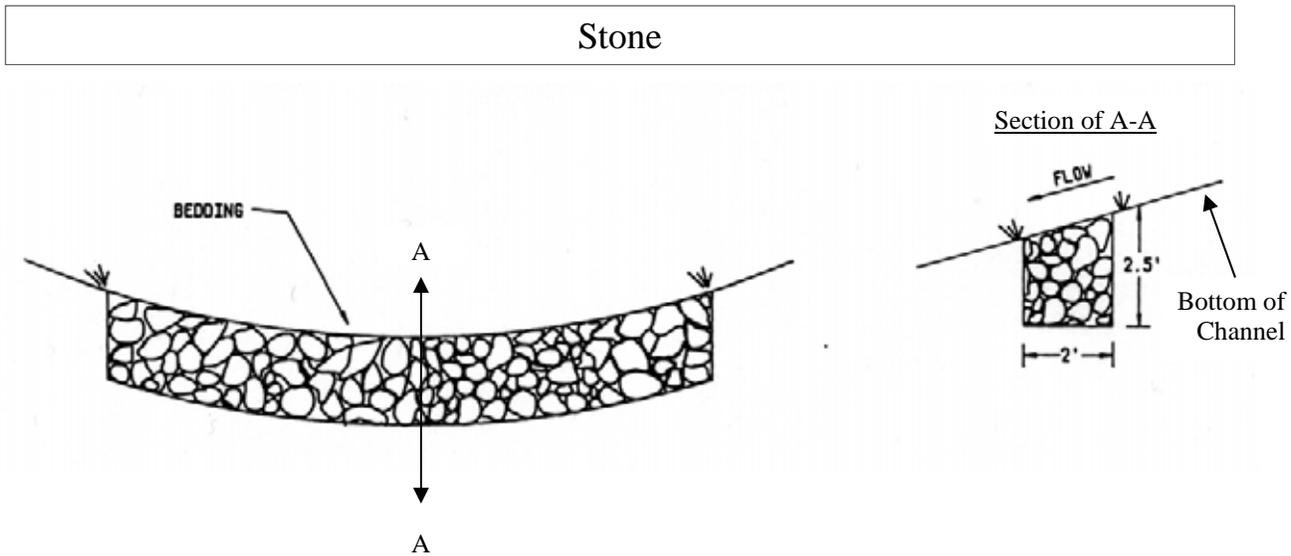
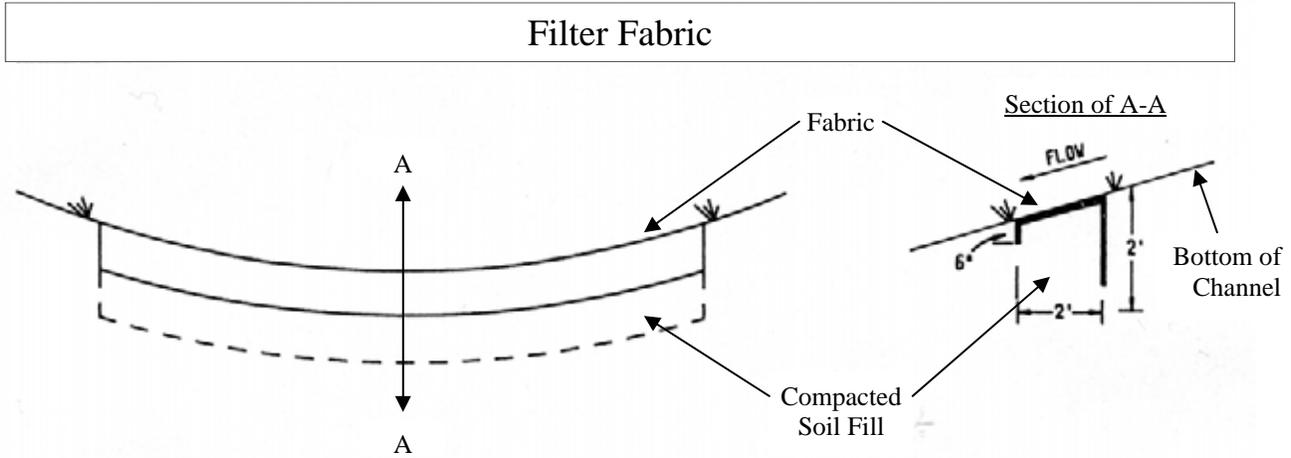
³ K is the soil erodibility factor used in the Revised Universal Soil Loss Equation. Visit Appendix A or consult the appropriate USDA-NRCS technical guide for K values for New York State soils.

⁴ Do not use on slopes steeper than 5 percent except for vegetated side slopes in combination with a stone, concrete, or highly resistant vegetative center section.

⁵ Annuals - use on mild slopes or as temporary protection until permanent covers are established.

⁶ Use on slopes steeper than 5 percent is not recommended.

Figure 3.2
Rill Maintenance Measures



STANDARD AND SPECIFICATIONS FOR TOPSOILING



Definition

Spreading a specified quality and quantity of topsoil materials on graded or constructed subsoil areas.

Purpose

To provide acceptable plant cover growing conditions, thereby reducing erosion; to reduce irrigation water needs; and to reduce the need for nitrogen fertilizer application.

Conditions Where Practice Applies

Topsoil is applied to subsoils that are droughty (low available moisture for plants), stony, slowly permeable, salty or extremely acid. It is also used to backfill around shrub and tree transplants. This standard does not apply to wetland soils.

Design Criteria

1. Preserve existing topsoil in place where possible, thereby reducing the need for added topsoil.
2. Conserve by stockpiling topsoil and friable fine textured subsoils that must be stripped from the excavated site and applied after final grading where vegetation will be established.
3. Refer to USDA Soil Conservation Service (presently Natural Resource Conservation Service) soil surveys or soil interpretation record sheets for further soil texture information for selecting appropriate design topsoil depths.

Site Preparation

1. As needed, install erosion control practices such as diversions, channels, sediment traps, and stabilizing measures, or maintain if already installed.
2. Complete rough grading and final grade, allowing for depth of topsoil to be added.
3. Scarify all compact, slowly permeable, medium and fine textured subsoil areas. Scarify at approximately right angles to the slope direction in soil areas that are steeper than 5 percent. Areas that have been overly compacted shall be decompacted to a minimum depth of 12 inches with a deep ripper or chisel plow prior to topsoiling.
4. Remove refuse, woody plant parts, stones over 3 inches in diameter, and other litter.

Topsoil Materials

1. Topsoil shall have at least 6 percent by weight of fine textured stable organic material, and no greater than 20 percent. Muck soil shall not be considered topsoil.
2. Topsoil shall have not less than 20 percent fine textured material (passing the NO. 200 sieve) and not more than 15 percent clay.
3. Topsoil treated with soil sterilants or herbicides shall be so identified to the purchaser.
4. Topsoil shall be relatively free of stones over 1 1/2 inches in diameter, trash, noxious weeds such as nut sedge and quackgrass, and will have less than 10 percent gravel.
5. Topsoil containing soluble salts greater than 500 parts per million shall not be used.

Application and Grading

1. Topsoil shall be distributed to a uniform depth over the area. It shall not be placed when it is partly frozen, muddy, or on frozen slopes or over ice, snow, or standing water puddles.
2. Topsoil placed and graded on slopes steeper than 5 percent shall be promptly fertilized, seeded, mulched, and stabilized by "tracking" with suitable equipment.

3. Apply topsoil in the following amounts:

Site Conditions	Intended Use	Minimum Topsoil Depth
1. Deep sand or loamy sand	Mowed lawn	6 in.
	Tall legumes, unmowed	2 in.
	Tall grass, unmowed	1 in.
2. Deep sandy loam	Mowed lawn	5 in.
	Tall legumes, unmowed	2 in.
	Tall grass, unmowed	none
3. Six inches or more: silt loam, loam, or silt	Mowed lawn	4 in.
	Tall legumes, unmowed	1 in.
	Tall grass, unmowed	1 in.

STANDARD AND SPECIFICATIONS FOR MULCHING



Definition

Applying coarse plant residue or chips, or other suitable materials, to cover the soil surface.

Purpose

The primary purpose is to provide initial erosion control while a seeding or shrub planting is establishing. Mulch will conserve moisture and modify the surface soil temperature and reduce fluctuation of both. Mulch will prevent soil surface crusting and aid in weed control. Mulch is also used alone for temporary stabilization in non-growing months.

Conditions Where Practice Applies

On soils subject to erosion and on new seedlings and shrub plantings. Mulch is useful on soils with low infiltration rates by retarding runoff.

Criteria

Site preparation prior to mulching requires the installation of necessary erosion control or water management practices and drainage systems.

Slope, grade and smooth the site to fit needs of selected mulch products.

Remove all undesirable stones and other debris to meet the needs of the anticipated land use and maintenance required.

Apply mulch after soil amendments and planting is accomplished or simultaneously if hydroseeding is used.

Select appropriate mulch material and application rate or material needs. Determine local availability.

Select appropriate mulch anchoring material.

NOTE: The best combination for grass/legume establishment is straw (cereal grain) mulch applied at 2 ton/acre (90 lbs./1000sq.ft.) and anchored with wood fiber mulch (hydromulch) at 500 – 750 lbs./acre (11 – 17 lbs./1000 sq. ft.). The wood fiber mulch must be applied through a hydroseeder immediately after mulching.

Table 3.7
Guide to Mulch Materials, Rates, and Uses

Mulch Material	Quality Standards	per 1000 Sq. Ft.	per Acre	Depth of Application	Remarks
Wood chips or shavings	Air-dried. Free of objectionable coarse material	500-900 lbs.	10-20 tons	2-7"	Used primarily around shrub and tree plantings and recreation trails to inhibit weed competition. Resistant to wind blowing. Decomposes slowly.
Wood fiber cellulose (partly digested wood fibers)	Made from natural wood usually with green dye and dispersing agent	50 lbs.	2,000 lbs.	—	Apply with hydromulcher. No tie down required. Less erosion control provided than 2 tons of hay or straw.
Gravel, Crushed Stone or Slag	Washed; Size 2B or 3A—1 1/2"	9 cu. yds.	405 cu. yds.	3"	Excellent mulch for short slopes and around plants and ornamentals. Use 2B where subject to traffic. (Approximately 2,000 lbs./cu. yd.). Frequently used over filter fabric for better weed control.
Hay or Straw	Air-dried; free of undesirable seeds & coarse materials	90-100 lbs. 2-3 bales	2 tons (100-120 bales)	cover about 90% surface	Use small grain straw where mulch is maintained for more than three months. Subject to wind blowing unless anchored. Most commonly used mulching material. Provides the best micro-environment for germinating seeds.
Jute twisted yarn	Undyed, unbleached plain weave. Warp 78 ends/yd., Weft 41 ends/yd. 60-90 lbs./roll	48" x 50 yds. or 48" x 75 yds.	—	—	Use without additional mulch. Tie down as per manufacturers specifications. Good for center line of concentrated water flow.
Excelsior wood fiber mats	Interlocking web of excelsior fibers with photodegradable plastic netting	8" x 100" 2-sided plastic, 48" x 180" 1-sided plastic	—	—	Use without additional mulch. Excellent for seeding establishment. Tie down as per manufacturers specifications. Approximately 72 lbs./roll for excelsior with plastic on both sides. Use two sided plastic for centerline of waterways.
Compost	Up to 3" pieces, moderately to highly stable	3-9 cu. yds.	134-402 cu. yds.	1-3"	Coarser textured mulches may be more effective in reducing weed growth and wind erosion.
Straw or coconut fiber, or combination	Photodegradable plastic net on one or two sides	Most are 6.5 ft. x 3.5 ft.	81 rolls	—	Designed to tolerate higher velocity water flow, centerlines of waterways, 60 sq. yds. per roll.

Table 3.8
Mulch Anchoring Guide

Anchoring Method or Material	Kind of Mulch to be Anchored	How to Apply
1. Peg and Twine	Hay or straw	After mulching, divide areas into blocks approximately 1 sq. yd. in size. Drive 4-6 pegs per block to within 2" to 3" of soil surface. Secure mulch to surface by stretching twine between pegs in criss-cross pattern on each block. Secure twine around each peg with 2 or more tight turns. Drive pegs flush with soil. Driving stakes into ground tightens the twine.
2. Mulch netting	Hay or straw	Staple the light-weight paper, jute, wood fiber, or plastic nettings to soil surface according to manufacturer's recommendations. Should be biodegradable. Most products are not suitable for foot traffic.
3. Wood cellulose fiber	Hay or straw	Apply with hydroseeder immediately after mulching. Use 500 lbs. wood fiber per acre. Some products contain an adhesive material ("tackifier"), possibly advantageous.
4. Mulch anchoring tool	Hay or straw	Apply mulch and pull a mulch anchoring tool (blunt, straight discs) over mulch as near to the contour as possible. Mulch material should be "tucked" into soil surface about 3".
5. Tackifier	Hay or straw	Mix and apply polymeric and gum tackifiers according to manufacturer's instructions. Avoid application during rain. A 24-hour curing period and a soil temperature higher than 45 ⁰ Fahrenheit are required.

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STANDARD AND SPECIFICATIONS FOR STABILIZATION WITH SOD



Definition

Stabilizing silt producing areas by establishing long term stands of grass with sod.

Purpose

To stabilize the soil; reduce damage from sediment and runoff to downstream areas; enhance natural beauty.

Conditions Where Practice Applies

On exposed soils that have a potential for causing off site environmental damage where a quick vegetative cover is desired. Moisture, either applied or natural, is essential to success.

Design Criteria

1. Sod shall be bluegrass or a bluegrass/red fescue mixture or a perennial ryegrass for average sites. (CAUTION: Perennial ryegrass has limited cold tolerance and may winter kill.) Use turf type cultivars of tall fescue for shady, droughty, or otherwise more critical areas. For variety selection, contact Cornell Cooperative Extension Turf Specialist.
2. Sod shall be machine cut at a uniform soil thickness of 3/4 inch, plus or minus 1/4 inch. Measurement for thickness shall exclude top growth and thatch.
3. Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape when suspended vertically from a firm grasp on the upper 10 percent of the section.
4. Sod shall be free of weeds and undesirable coarse weedy grasses. Wild native or pasture grass sod shall not be used

unless specified.

5. Sod shall not be harvested or transplanted when moisture content (excessively dry or wet) may adversely affect its survival.
6. Sod shall be harvested, delivered, and installed within a period of 36 hours. Sod not transplanted within this period shall be inspected and approved by the contracting officer or his designated representative prior to its installation.

Site Preparation

Fertilizer and lime application rates shall be determined by soil tests. Under unusual circumstances where there is insufficient time for a complete soil test and the contracting officer agrees, fertilizer and lime materials may be applied in amounts shown in subsection 2 below. Slope land such as to provide good surface water drainage. Avoid depressions or pockets.

1. Prior to sodding, the surface shall be smoothed and cleared of all trash, debris, and of all roots, brush, wire, grade stakes and other objects that would interfere with planting, fertilizing or maintenance operations.
2. **The soil should be tested to determine the amounts of amendments needed.** Where the soil is acid or composed of heavy clays, ground limestone shall be spread to raise the pH to 6.5. If the soil must be fertilized before results of a soil test can be obtained to determine fertilizer needs, apply commercial fertilizer at 20 lbs. of 5-10-10 (or equivalent) and mix into the top 3 inches of soil with the required lime for every 1,000 square feet. Soil should be moist prior to sodding. Arrange for temporary storage of sod to keep it shaded and cool.

Sod Installation

1. For the operation of laying, tamping, and irrigating for any areas, sod shall be completed within eight hours. During periods of excessively high temperature, the soil shall be lightly moistened immediately prior to laying the sod.
2. The first row of sod shall be laid in a straight line with subsequent rows placed parallel to, and tightly wedged against, each other. Lateral joints shall be staggered to promote more uniform growth and strength. Ensure that sod is not stretched or overlapped and that all joints are butted tight in order to prevent voids which would cause air drying of the roots. On sloping areas where erosion may be a problem, sod shall be laid with the long edges parallel to the contour and with staggered joints.

3. Secure the sod by tamping and pegging, or other approved methods. As sodding is completed in any one section, the entire area shall be rolled or tamped to ensure solid contact of roots with the soil surface.

4. Sod shall be watered immediately after rolling or tamping until the underside of the new sod pad and soil surface below the sod are thoroughly wet. Keep sod moist for at least two weeks.

Sod Maintenance

1. In the absence of adequate rainfall, watering shall be performed daily, or as often as deemed necessary by the inspector, during the first week and in sufficient quantities to maintain moist soil to a depth of 4 inches. Watering should be done in the morning. Avoid excessive watering during applications.

2. After the first week, sod shall be watered as necessary to maintain adequate moisture and ensure establishment.

3. The first mowing should not be attempted until sod is firmly rooted. No more than 1/3 of the grass leaf shall be removed by the initial cutting or subsequent cuttings. Grass height shall be maintained between 2 and 3 inches unless

otherwise specified. Avoid heavy mowing equipment for several weeks to prevent rutting.

4. If the soil must be fertilized before results of a soil test can be obtained to determine fertilizer needs, apply fertilizer three to four weeks after sodding, at a rate of 1 pound nitrogen/1,000 sq.ft. Use a complete fertilizer with a 2-1-1 ratio.

5. Weed Control: Target herbicides for weeds present. Consult current Cornell Pest Control Recommendations for Commercial Turfgrass Management or consult the local office of Cornell Cooperative Extension.

6. Disease Control: Consult the local office of the Cornell Cooperative Extension.

Additional References

1. Home Lawns, Establishment and Maintenance, CCE Information Bulletin 185, Revised November 1994. Cornell University, Ithaca, NY.

2. Installing a Sod Lawn. CCE Suffolk County, NY. Thomas Kowalsick February 1994, Revised January 1999. www.cce.cornell.edu/counties/suffolk/grownet

STANDARD AND SPECIFICATIONS FOR VEGETATING SAND AND GRAVEL BORROW AREAS



Definition

Vegetating inactive borrow areas with sustainable herbaceous perennial plants.

Purpose

To provide appropriate vegetation to stabilize the soil, thus preventing wind and water erosion from causing on-site or off-site damages.

To create a more aesthetically pleasing view.

To enhance the wildlife habitat for greater diversity.

Condition Where Practice Applies

Sand and gravel borrow areas which have had EITHER the top portion of the soil profile replaced as 'topsoil' or overburden with greater than 15 percent fines included, OR the sand and gravel mined condition remains without 'topsoil' being replaced resulting in sand and gravel with less than 15 percent fines.

Design Criteria

- Depending upon the type of unconsolidated material being mined, side slopes shall be graded in accordance with the New York State Mined Land Reclamation Law. Minimum requirements are: for fine sand, silt, clay the slope shall not exceed 2 horizontal to 1 vertical (26°); for coarse sand and gravel the slope shall not exceed 1.5 horizontal to 1 vertical (33°)
- Rocks and other debris shall be removed from the site or buried during grading.

- Surface soil layer shall be sampled from 0-6" in depth. Combine about 15 core samples to represent the site soil conditions. Analyze to determine pH, P and K.
- Obtain a larger (5-10 lbs.) soil sample to represent the surface soil texture. Analyze for percent fines (particles less than .074 mm or 200 mesh sieve).
- Apply soil amendments as indicated by soil chemical test. The surface to be seeded shall be limed to a pH of 6.0 using agricultural ground limestone. Fertilize to achieve a moderate level of available phosphorus (P₂O₅) and potassium (K₂O). If the soil must be fertilized before results of a soil test can be obtained to determine fertilizer needs, apply 50 pounds per acre of nitrogen. Incorporation will be accomplished following the seeding.
- Select the appropriate seed mix based on percent fines and time of planting.
 - IF 15 percent fines or less:** use the warm season grass mix. If fall planting is necessary, use a temporary cover to allow planting of the warm season grasses in early spring. Two (2) bushels of oats per acre is suggested as this will winter kill and not be competitive when the permanent seeding is made. Another option is small grain straw at two (2) tons per acre. Do not use old hay.
 - Warm Season Grass Table:

Species	Variety	Certified Seed PLS*/Acre (lbs.)
Switchgrass	Blackwell, Shelter Pathfinder, or Trailblazer	2
Coastal panicgrass	Atlantic	2
Big bluestem	Niagara	4
Little bluestem	Aldous or Camper	4
Sand bluestem	Goldstrike	2
Sand lovegrass	Nebraska 27 or Bend	2
Total mix (PLS/acre)		16 lbs.

*Pure Live Seed (PLS) = (% germination x % purity)/100

Pounds to be seeded = (100 x lbs. of 100% PLS required)/% PLS of commercial seed being used.

- c. **IF greater than 15 percent fines:** use a grass/legume mixture, or the warm season grass mix.
- d. Grass/Legume Table:

Species	Variety	Pure Live Seed Per Acre (lbs.)
Tall fescue	KY-31/Rebel	10
Redtop	Common	2
Perennial rye-grass	Pennfine/Linn	5
Birdsfoot trefoil*	Empire plus Pardee	8**

* legume in seed mixture needs to be inoculated.
 ** 4 lbs. of each is best. 8 lbs. of either one is good.

OR

Species	Variety	Pure Live Seed per Acre (lbs.)
Flatpea*	Lathco	10.0
Perennial pea*	Lancer	2.0
Crownvetch*	Penngift/Chemung	10.0
Tall fescue	KY-31/Rebel	10.0
Total Mix (lbs./acre)		32.0

* legume in seed mixture needs to be inoculated.

7. Planting instructions:

- a. Planting dates are very critical for warm season grasses. Very early spring (March/April) is best. The success rate decreases notably by the end of May. Fall seedings are not recommended. Grass/legume mixes may be reliably planted from early spring through June 15. Avoid June 16 through August 15. After August 15, seed anytime until ground freezes.

- b. A temporary cover of 2 bushels of oats may be seeded between August 15 and September 15 (oats will winter kill). This works well preparing for early spring seedings.
- c. Inoculate legume seed immediately prior to actual seeding. Use 4 times the standard agricultural rates.
- d. The seed mix must be uniformly broadcast. A hydroseeder works well or spread by hand if necessary. The use of spinner type seeders is difficult due to the lightweight and fluffy seed characteristics of some species.
- e. Incorporate the soil amendments and seed.
 - i. "Tracking" an area is using a bulldozer having cleats at least 1 inch in depth. Operation of the dozer shall be perpendicular to the contour and such that the entire area is covered by the tracks.

OR

- ii. Pulling a cultipacker over the entire site with the tines up or no deeper than 1 inch. This option only works if soil moisture is near field capacity.

- 8. Mulching is essential for immediate erosion control and uniform establishment of cool season grasses and legumes on sands and gravels. Use a heavier rate for the grass/legume seedings of 4000 lbs./ac. Use only small grain straw. Mulching of warm season grasses may not be necessary when runoff and sediment delivery is not an issue. If erosion control is necessary for warm season grass sites, mulch with 3000 lbs./ac. of small grain straw (not grass hay). On sites where mulch can be avoided, warm season grasses will respond favorably.
- 9. Anchor the mulch by using the bulldozer tracking technique. This may be done simultaneously with seed incorporation. Optional anchoring techniques and materials are available in the Mulching Standard.
- 10. Site protection is necessary to avoid wheel and tire damage.

STANDARD AND SPECIFICATIONS FOR PROTECTING VEGETATION DURING CONSTRUCTION



Definition

The protection of trees, shrubs, ground cover and other vegetation from damage by construction equipment.

Purpose

To preserve existing vegetation determined to be important for soil erosion control, water quality protection, shade, screening, buffers, wildlife habitat, wetland protection, and other values.

Condition Where Practice Applies

On planned construction sites where valued vegetation exists and needs to be preserved.

Design Criteria

1. Planning Considerations

A. Inventory:

- 1) Property boundaries, topography, vegetation and soils information should be gathered. Identify potentially high erosion areas, areas with tree windthrow potential, etc. A vegetative cover type map should be made on a copy of a topographic map which shows other natural and manmade features. Vegetation that is desirable to preserve because of its value for screening, shade, critical erosion control, endangered species, aesthetics, etc., should be identified and marked on the map.
- 2) Based upon this data, general statements should be prepared about the present condition, potential problem areas, and unique features of the property.

B. Planning:

- 1) After engineering plans (plot maps) are prepared, another field review should take place and recommendations made for the vegetation to be saved. Minor adjustments in location of roads, dwellings, and utilities may be needed. Construction on steep slopes, erodible soils, wetlands, and streams should be avoided. Clearing limits should be delineated (See Section 2).
- 2) Areas to be seeded and planted should be identified. Remaining vegetation should blend with their surroundings and/or provide special function such as a filter strip, buffer zone, or screen.
- 3) Trees and shrubs of special seasonal interest, such as flowering dogwood, red maple, striped maple, serviceberry, or shadbush, and valuable potential shade trees should be identified and marked for special protective treatment as appropriate.
- 4) Trees to be cut should be marked on the plans. If timber can be removed for salable products, a forester should be consulted for marketing advice.
- 5) Trees that may become a hazard to people, personal property, or utilities should be removed. These include trees that are weak-wooded, disease-prone, subject to windthrow, or those that have severely damaged root systems.
- 6) The vigor of remaining trees may be improved by a selective thinning. A forester should be consulted for implementing this practice.

2. Measures to Protect Vegetation

- A. Limit soil placement over existing tree and shrub roots to a maximum of 3 inches. Soils with loamy texture and good structure should be used.
- B. Use retaining walls and terraces to protect roots of trees and shrubs when grades are lowered. Lowered grades should start no closer than the dripline of the tree. For narrow-canopied trees and shrubs, the stem diameter in inches is converted to feet and doubled, such that a 10 inch tree should be protected to 20 feet.

- C. Trenching across tree root systems should be the same minimum distance from the trunk, as in "B". Tunnels under root systems for underground utilities should start 18 inches or deeper below the normal ground surface. Tree roots which must be severed should be cut clean. Backfill material that will be in contact with the roots should be topsoil or a prepared planting soil mixture.
- D. Construct sturdy fences, or barriers, of wood, steel, or other protective material around valuable vegetation for protection from construction equipment. Place barriers far enough away from trees, but not less than the specifications in "B", so that tall equipment such as backhoes and dump trucks do not contact tree branches.
- E. Construction limits should be identified and clearly marked to exclude equipment.
- F. Avoid spills of oil/gas and other contaminants.
- G. Obstructive and broken branches should be pruned properly. The branch collar on all branches whether living or dead should not be damaged. The 3 or 4 cut method should be used on all branches larger than two inches at the cut. First cut about one-third the way through the underside of the limb (about 6-12 inches from the tree trunk). Then (approximately an inch further out) make a second cut through the limb from the upper side. When the branch is removed, there is no splintering of the main tree trunk. Remove the stub. If the branch is larger than 5-6 inches in diameter, use the four cut system. Cuts 1 and 2 remain the same and cut 3 should be from the underside of the limb, on the outside of the branch collar. Cut 4 should be from the top and in alignment with the 3rd cut. Cut 3 should be 1/4 to 1/3 the way through the limb. This will prevent the bark from peeling down the trunk. Do not paint the cut surface.
- H. Penalties for damage to valuable trees, shrubs, and herbaceous plants should be clearly spelled out in the contract.