

ALABAMA SUPPLEMENTS TO THE
NATIONAL ENGINEERING FIELD HANDBOOK

CHAPTER 7. GRASSED WATERWAYS AND OUTLETS

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DESIGN

The following steps are used in the design of grassed waterways and disposal areas with the data recorded on Form AL-ENG-16 or worksheet. Secure the design criteria from Conservation Practice Standard Code 412, Grassed Waterways.

For drainage areas up to 15 acres, AL-ENG Worksheet 16 (1 thru 4) (Exhibit AL7-3) is acceptable to use as a quick design procedure. Approved computer programs are also acceptable.

Determine Grade of Waterway

Plan the location of the waterway centerline to minimize impacts and maximize use. Use topographic map, surveying level or hand level to determine the grade (slope) in feet per 100 feet of length and record in survey notes or on waterway data sheet. (Exhibit AL7-2).

Determine Retardance

Vegetation considered for waterways range from 2.5 to 18 inches in height. The retardance used for design of waterways should be "D" and "C" to produce a safe velocity and capacity.

Determine Maximum Permissible Velocity (V_1) in Waterway

- A. Classify soil into erosion resistant cohesive (clayey) fine and coarse grained soils or easily eroded noncohesive silt, clays, and sands.
- B. Determine the type of vegetative cover to be established on waterway.
- C. Enter Exhibit 7-3 with cover, slope, and soil erodibility to determine permissible velocity. A maximum of 4 feet per second on clay soils (erosion resistant) and 3.0 feet per second on sandy soils (easily eroded) should be used under normal conditions where vegetation is to be established by seeding.

Example: Tall fescue, 0-5% slope, and an erosion resistant soil give a permissible velocity of 7 feet per second. Under normal conditions, if vegetation is to be established by seeding, use as permissible velocity 4.0 feet per second.

Determine Parabolic Waterway Dimensions

Enter Exhibit 7-4 or 7-5 with "Q" peak discharge, grade, V_1 (permissible velocity), and retardance to determine parabolic waterway dimensions.

Disposal Areas

Engineering notes for disposal areas should follow the form of Waterway Design (AL-ENG-16) through the vegetative cover item. The remainder of the design should include the upper area width (minimum 20 feet), middle area width (minimum 40 feet), bottom area width (minimum 60 feet), total area, and vegetation. (See Figure AL7-1.)

Construction Check Survey Notes and documentation should follow the Waterway Construction Check Survey notes. (See Exhibit AL7-1).

WATERWAY DESIGN

WATERWAY NO. 1
 RAINFALL DIST. TYPE II OR III D.A. 20 AC. CLASS I
 SOIL Madison LAND USE OR PRACT. Row Crop C&T
 HYD. CONDITION Good HYD. GROUP B
 C.N. 70 W/S SLOPE 4 % GRADE 3.0 FT/100 FT.
 FLOW LENGTH 1,200 FT. Tc 0.409 HRS
 RAINFALL(10 YRS) 5.5 IN. Ia 0.857 IN. Ia/P 0.16
 RUNOFF 2.41 IN. Qu 0.873 CFS/AC/IN
 Q 10 YRS. = 42 (Use 45) CFS VEG. COVER Coastal Berm.
 COND OF VEG. Resistant, 2 IN. TO 12 IN. TALL
 ERODIBILITY. Good PERM. VEL (V₁) 4.0* FT./SEC.
 Tw = 24.8 + 4 = 29 FT. DEPTH = 0.8 + .25 = 1.1 FT.
 V₂ = 3.4 FT./SEC. TOP WIDTH (USED) 29-40-60 FT.
 AREA = (W) 43 (avg) FT. X (L) 700 FT./43560 = 0.7 AC.
 VEGETATION Coastal Bermuda Grass
 DESIGNED WWD CHECKED IMW

*Waterway to be seeded.

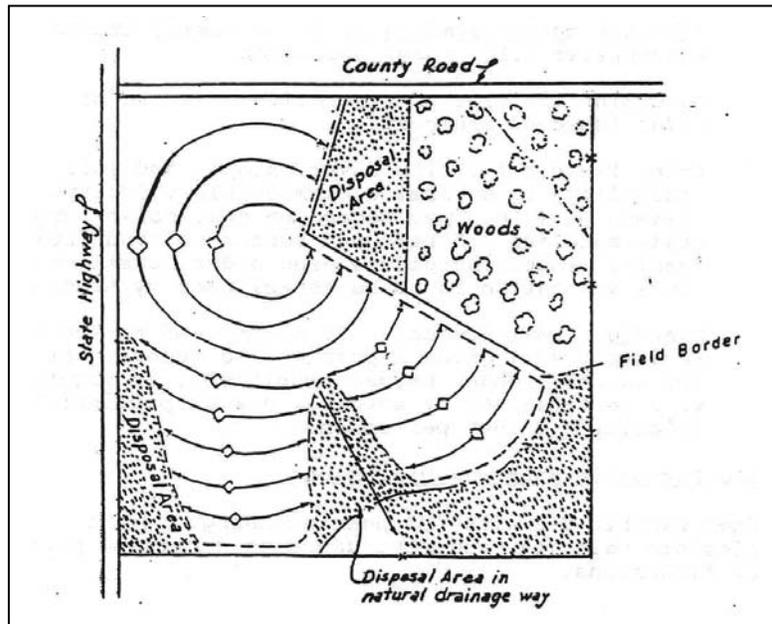


Figure AL7-1. Types of Disposal Areas

Example: A waterway has a peak discharge of 60 cfs, a grade of 2%, permissible velocity of 4 fps, and retardance "D" and "C". In Exhibit 7-5 sheet 8 of 14, we find the dimensions as follows: Top width = 22.6 feet; Depth = 1.10 feet; and V_2 (velocity when retardance is "C") = 3.50 fps. The waterway must be crossed with farm equipment (need 40 foot width); therefore, use a permissible velocity $V_1 = 3.0$ fps, we then find the dimensions as follows: Top width = 38.0 feet; depth = 1.0 feet and velocity $V_2 = 2.5$ fps.

Adjusted Waterway Dimensions

Add 0.25 foot to depth and 4.0 feet minimum to top width as allowances for freeboard and vegetation. Use 40 feet minimum width when waterway will be used for crossing by farm equipment.

Example: Adjust dimensions on previous example.
Depth = 1.00 + 0.25 ft. = 1.25 feet
Width = 38.0 + 4.0 ft. = 42.0 feet (use 42 feet)

Operations and Maintenance

Timely operations and maintenance is important for keeping a waterway, disposal area or filter strip in good working condition. Recommended maintenance includes mowing regularly (two or more times) and removing the surplus cuttings that may retard flow or cause excessive sedimentation in the channel. The area should be fertilized annually and controlled grazing permitted. Vehicular traffic should be excluded or managed on the waterway area.

Sediment deposit should be removed and eroded area should be promptly repaired by reseeding or solid sodding. Transition sections of waterways usually are susceptible to erosion damage. Repair should be made immediately and if it continues, a lined waterway section or grade stabilization structure will need to be constructed. In all cases an operation and maintenance plan should be developed with the owner or operator.

**SUPPLEMENTAL ENGINEERING NOTES
FOR SIMPLE-TYPE NATURAL AND
SHAPED WATERWAYS**

This set of notes includes a combination of design and construction layout survey, and a construction check survey. These notes are adequate for simple-type waterways where only minor shaping during construction is needed.

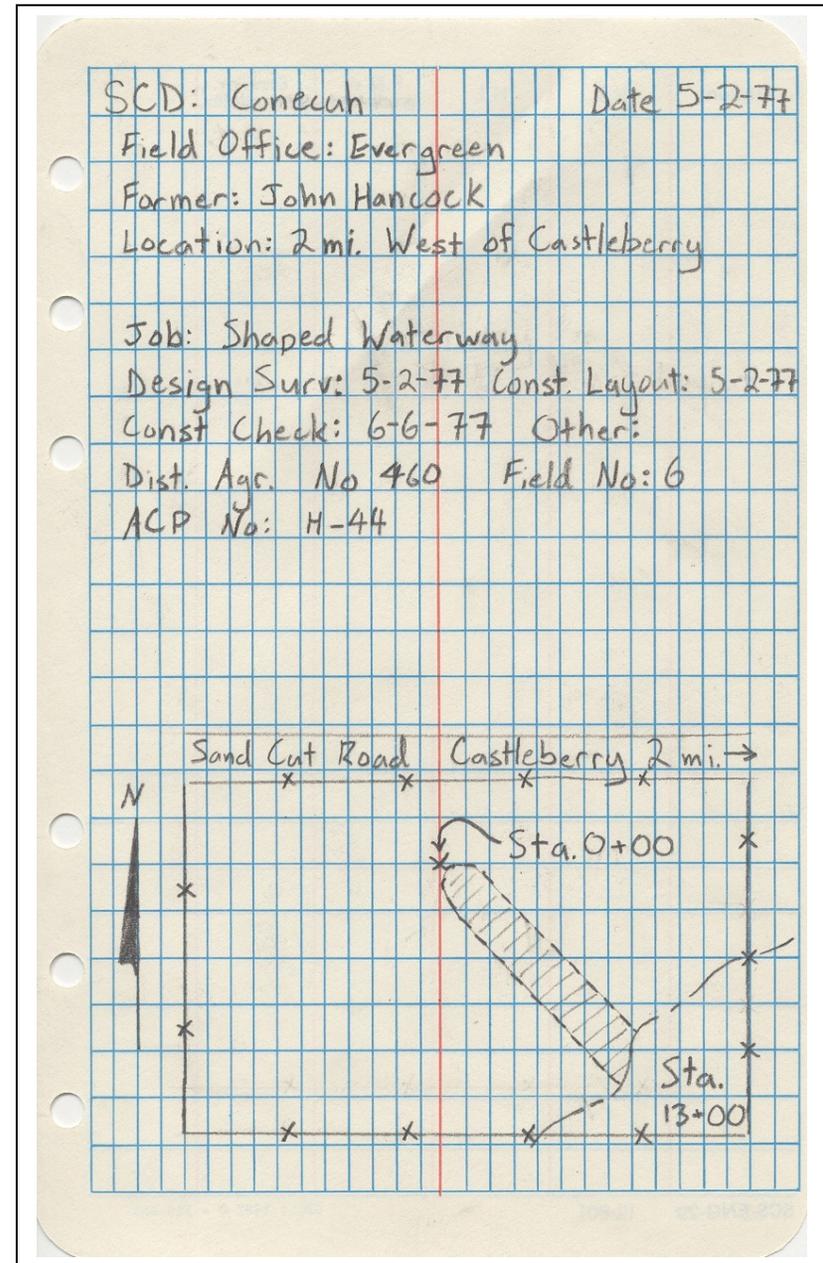
Design and Construction Layout Surveys

Generally, only typical profile survey shots are required to determine average grade of the waterway for design. If outlet conditions are questionable, surveys should be done to verify adequacy of the outlet. Design cross sections are needed only if significant alteration in cross section is required or if constructed widths are physically limited.

Construction Check Survey

Record cross section surveys as needed to verify design dimensions. Measure length and width for computation of area. Provide statements as needed to verify completion.

NOTE: For the more complex type grassed waterways, use the typical profile and cross section survey notes. See Figure 1-23, Chapter 1 of the National Engineering Field Handbook.



210-VI-NEH, Amend. AL3, November 2004)

AL-7-48(1)

U.S. Dept. of Agriculture Natural Resources Conservation Service	AL-ENG-16 Rev. 2/04
WATERWAY DESIGN	
WATERWAY NO. <u>1</u>	
RAINFALL DIST. TYPE <u>II</u> OR III D.A. <u>20</u> AC. CLASS <u>I</u>	
SOIL <u>Madison</u> LAND USE OR PRACT. <u>Row Crop C&T</u>	
HYD. CONDITION <u>Good</u> HYD. GROUP <u>B</u>	
C.N. <u>70</u> W/S SLOPE <u>4</u> % GRADE <u>3.0</u> FT/100 FT.	
FLOW LENGTH <u>1,200</u> FT. Tc <u>0.409</u> HRS	
RAINFALL(10 YRS) <u>5.5</u> IN. Ia <u>0.857</u> IN. Ia/P <u>0.16</u>	
RUNOFF <u>2.41</u> IN. Qu <u>0.873</u> CFS/AC/IN	
Q 10 YRS. = <u>42 (Use 45)</u> CFS VEG. COVER <u>Coastal Berm.</u>	
COND OF VEG. <u>Resistant</u> , <u>2</u> IN. TO <u>12</u> IN. TALL	
ERODIBILITY. <u>Good</u> PERM. VEL (V ₁) <u>4.0*</u> FT./SEC.	
Tw = <u>24.8</u> + 4 = <u>29</u> FT. DEPTH = <u>0.8</u> + .25 = <u>1.1</u> FT.	
V ₂ = <u>3.4</u> FT./SEC. TOP WIDTH (USED) <u>29-40-60</u> FT.	
AREA = (W) <u>43 (avg)</u> FT. X (L) <u>700</u> FT./43560 = <u>0.7</u> AC.	
VEGETATION <u>Coastal Bermuda Grass</u>	
DESIGNED <u>WWD</u> CHECKED <u>IMW</u>	

*Waterway to be seeded.

John Hancock
Shaped Waterway
Design - Const. Layout

J.F. Reynolds
F.A. Sweatt
5/2/00

Average Grade of w/w

STA.	Rod Rd.
5+00	4.5
12+00	18.5

A Stable outlet exists
J.F. Reynolds
S.C.T.

Station	B.S.	H.I.	F.S. or grade rod	Elev. or planned elev.
CONSTRUCTION CHECK				
W/WAY No. 1				
LENGTH = 1300 ft.				
	WIDTH (ft.)			
2+00		30		
7+00		30		
12+00		30		
AREA = 30' x 1300' / 43,560 = 0.9 ac.				

SCS-ENG-29

(2-80)

GPO : 1982 O - 369-853

John Hancock T, □ - J.F. Reynolds
 Shaped Waterway Φ - A.M. Creary
 Const. Check Survey 6-6-00

Typical Constructed Cross-Sections
 (Hand Level)

3.7	4.0	4.9	5.1	4.8	4.0	3.7
15	10	5	0	5	10	15

Sta. 12+00

Construction meets plans & specs
 w/w is smooth and has been
 seeded & mulched.

J.F. Reynolds
6-6-00

The w/w has a good stand of
 grass and needs maintenance
 Fertilizer

J.F. Reynolds
8-1-00

Exhibit AL7-1. Survey Notes – Design and Construction Layout.

CONSTRUCTION CHECK

Party _____

Date _____

Cross section at station _____ Measured constructed length _____

(Take cross section rod readings at 2' or 4' intervals. Mark out distance line that does not apply.)

Distance	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50		
	0	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84	88	92	96	100		
Rod																												
Datum																												
Difference																												
(Elevations)																												

Cross section sq. ft. Channel _____ or Ridge _____ Height _____

PROFILE

Station																												
Channel																												
Ridge																												
Height																												
(Elevations)																												

Yes No This practice meets specifications. Remarks: _____

U.S. Department of Agriculture

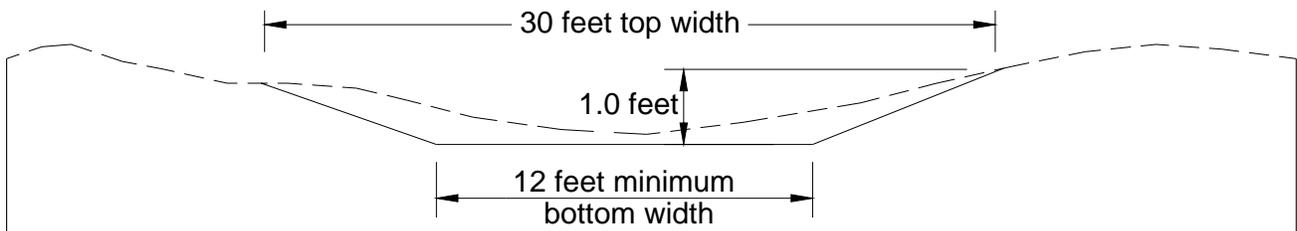
Natural Resources Conservation Service

Auburn, Alabama

GRASSED WATERWAY

AL-ENG Worksheet 16-1
March 1995

Drainage area 0 to 10 acres
Used for channel slopes of 1 through 10 percent
North and Central Alabama



Seeding area

Length (Linear feet) _____ x 0.00069 = _____ Acres

Construction

The waterway shall be constructed with a top width of 30 feet, a depth of 1.0 foot, and a bottom width of 12 feet. The final parabolic shape may be obtained by disking the corners with a small disk during seedbed preparation. The waterway shall be constructed with a constant grade throughout each reach. A break in grade is required when there is a change in land shape.

Approval

Cooperator _____

Approved _____ Date _____

Location

Field number, description of sketch

Seeding Rates			
Materials	Kind	Rate	Total
Seed	Bermuda grass, common	10 lb per acre	
	Bahiagrass	40 lb per acre	
	Tall fescue	40 lb per acre	
Sprigs	Bermuda grass	____ bu per acre	
Fertilizer	Nitrogen	100 lb per acre	
	P ₂ O ₅	100 lb per acre	
	K ₂ O	100 lb per acre	
Lime	Ground limestone (agricultural lime)	2 tons per acre	
Mulch (if needed)	Hay or straw	1 ½ ton per acre	

Vegetation establishment

Seed permanent grass or temporary cover immediately after construction on a firm seedbed. Prepare a good seedbed, mixing fertilizer and lime into the soil during seed preparation. The seedbed should be prepared at least 8 inches deep. Use a chisel plow as needed to breakup hard, restrictive soil.

Seed perennial grass during the recommended planting dates. With late fall seeding, use a small grain companion crop such as wheat or rye. Use temporary cover of Sudan-sorghum hybrid or millet in constructed waterways shaped in the spring or early summer, which are to be fall seeded to fescue.

Use a cultipacker seeder, a grassland drill, grain drill with press wheel or broadcast and compact before and after seeding. Do not seed deeper than ¼ to ½ inch except small grain (companion crop) that should be seeded 1-inch deep. Mulch should be applied immediately after seeding. Also mulch may be anchored by running back and forth over the area with a mulch anchoring tool or disk harrow with the disc set to run straight.

Operation and maintenance

1. Avoid grazing the waterway grass to shorter than 3 inches.
2. Protect the waterway from damage by farm equipment and vehicles. Avoid using it as a roadway and practice care in crossing to prevent tillage marks or wheel tracks.
3. Maintain the constructed width by lifting or disengaging tillage equipment properly and avoid farming operations along the waterways which would hinder water entry.
4. Avoid spraying herbicides such as atrazine and crossing waterways during spray operations unless the equipment is completely shut off.
5. Fertilize waterways the first spring after seeding and as necessary thereafter to maintain a vigorous stand of grass.
6. Mow waterways regularly to maintain a healthy and vigorous sod. Time the first mowing after ground nesting birds have hatched (about August 15). Remove excess top growth. (Do not burn.)
7. Repair damage to waterways immediately. Repair all broken subsurface drain lines or blowouts adjacent in the waterway when first observed. Construct water bars if needed to force water into the waterway.

As constructed

Width _____ Depth _____ Length _____

Certified correct by _____ Date _____

U.S. Department of Agriculture

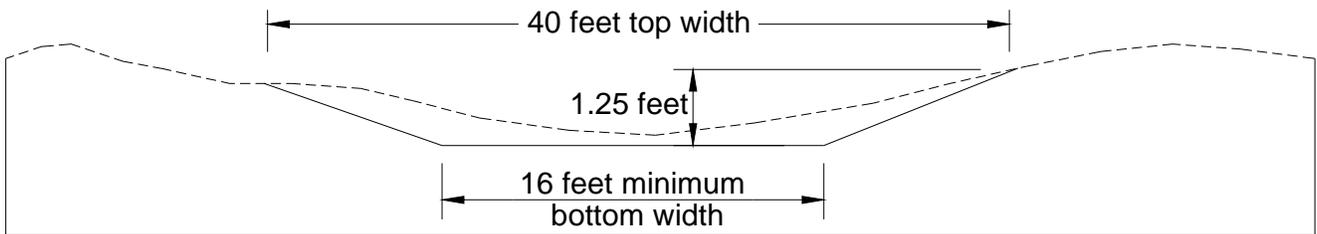
Natural Resources Conservation Service

Auburn, Alabama

GRASSED WATERWAY

AL-ENG Worksheet 16-2
March 1995

Drainage area 10 to 15 acres
Used for channel slopes of 1 through 10 percent
North and Central Alabama



Seeding area

Length (Linear feet) _____ x 0.00092 = _____ Acres

Construction

The waterway shall be constructed with a top width of 40 feet, a depth of 1.25 foot, and a bottom width of 16 feet. The final parabolic shape may be obtained by disking the corners with a small disk during seedbed preparation. The waterway shall be constructed with a constant grade throughout each reach. A break in grade is required when there is a change in land shape.

Approval

Cooperator _____

Approved _____ Date _____

Location

Field number, description of sketch

Seeding Rates			
Materials	Kind	Rate	Total
Seed	Bermuda grass, common	10 lb per acre	
	Bahiagrass	40 lb per acre	
	Tall fescue	40 lb per acre	
Sprigs	Bermuda grass	____ bu per acre	
Fertilizer	Nitrogen	100 lb per acre	
	P ₂ O ₅	100 lb per acre	
	K ₂ O	100 lb per acre	
Lime	Ground limestone (agricultural lime)	2 tons per acre	
Mulch (if needed)	Hay or straw	1 ½ ton per acre	

Vegetation establishment

Seed permanent grass or temporary cover immediately after construction on a firm seedbed. Prepare a good seedbed, mixing fertilizer and lime into the soil during seed preparation. The seedbed should be prepared at least 8 inches deep. Use a chisel plow as needed to breakup hard, restrictive soil.

Seed perennial grass during the recommended planting dates. With late fall seeding, use a small grain companion crop such as wheat or rye. Use temporary cover of Sudan-sorghum hybrid or millet in constructed waterways shaped in the spring or early summer, which are to be fall seeded to fescue.

Use a cultipacker seeder, a grassland drill, grain drill with press wheel or broadcast and compact before and after seeding. Do not seed deeper than ¼ to ½ inch except small grain (companion crop) that should be seeded 1-inch deep. Mulch should be applied immediately after seeding. Also mulch may be anchored by running back and forth over the area with a mulch anchoring tool or disk harrow with the disc set to run straight.

Operation and maintenance

8. Avoid grazing the waterway grass to shorter than 3 inches.
9. Protect the waterway from damage by farm equipment and vehicles. Avoid using it as a roadway and practice care in crossing to prevent tillage marks or wheel tracks.
10. Maintain the constructed width by lifting or disengaging tillage equipment properly and avoid farming operations along the waterways which would hinder water entry.
11. Avoid spraying herbicides such as atrazine and crossing waterways during spray operations unless the equipment is completely shut off.
12. Fertilize waterways the first spring after seeding and as necessary thereafter to maintain a vigorous stand of grass.
13. Mow waterways regularly to maintain a healthy and vigorous sod. Time the first mowing after ground nesting birds have hatched (about August 15). Remove excess top growth. (Do not burn.)
14. Repair damage to waterways immediately. Repair all broken subsurface drain lines or blowouts adjacent in the waterway when first observed. Construct water bars if needed to force water into the waterway.

As constructed

Width _____ Depth _____ Length _____

Certified correct by _____ Date _____

U.S. Department of Agriculture

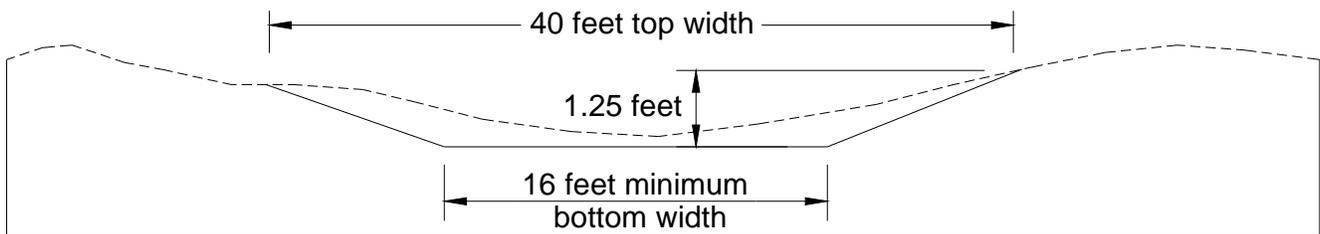
GRASSED WATERWAY

AL-ENG Worksheet 16-3
March 2004

Natural Resources Conservation Service

Drainage area 0 to 10 acres
Used for channel slopes of 1 through 10 percent
South Alabama and Blackland Prairie

Auburn, Alabama



Seeding area

Length (Linear feet) _____ x 0.00092 = _____ Acres

Location

Construction

The waterway shall be constructed with a top width of 40 feet, a depth of 1.25 foot, and a bottom width of 16 feet. The final parabolic shape may be obtained by disking the corners with a small disk during seedbed preparation. The waterway shall be constructed with a constant grade throughout each reach. A break in grade is required when there is a change in land shape.

Approval

Cooperator _____

Approved _____ Date _____

Field number, description of sketch

Seeding Rates			
Materials	Kind	Rate	Total
Seed	Bermuda grass, common	10 lb per acre	
	Bahiagrass	40 lb per acre	
	Tall fescue	40 lb per acre	
Sprigs	Bermuda grass	____ bu per acre	
Fertilizer	Nitrogen	100 lb per acre	
	P ₂ O ₅	100 lb per acre	
	K ₂ O	100 lb per acre	
Lime	Ground limestone (agricultural lime)	2 tons per acre	
Mulch (if needed)	Hay or straw	1 ½ ton per acre	

Vegetation establishment

Seed permanent grass or temporary cover immediately after construction on a firm seedbed. Prepare a good seedbed, mixing fertilizer and lime into the soil during seed preparation. The seedbed should be prepared at least 8 inches deep. Use a chisel plow as needed to breakup hard, restrictive soil.

Seed perennial grass during the recommended planting dates. With late fall seeding, use a small grain companion crop such as wheat or rye. Use temporary cover of Sudan-sorghum hybrid or millet in constructed waterways shaped in the spring or early summer, which are to be fall seeded to fescue.

Use a cultipacker seeder, a grassland drill, grain drill with press wheel or broadcast and compact before and after seeding. Do not seed deeper than ¼ to ½ inch except small grain (companion crop) that should be seeded 1-inch deep. Mulch should be applied immediately after seeding. Also mulch may be anchored by running back and forth over the area with a mulch anchoring tool or disk harrow with the disc set to run straight.

Operation and maintenance

- 15. Avoid grazing the waterway grass to shorter than 3 inches.
- 16. Protect the waterway from damage by farm equipment and vehicles. Avoid using it as a roadway and practice care in crossing to prevent tillage marks or wheel tracks.
- 17. Maintain the constructed width by lifting or disengaging tillage equipment properly and avoid farming operations along the waterways which would hinder water entry.
- 18. Avoid spraying herbicides such as atrazine and crossing waterways during spray operations unless the equipment is completely shut off.
- 19. Fertilize waterways the first spring after seeding and as necessary thereafter to maintain a vigorous stand of grass.
- 20. Mow waterways regularly to maintain a healthy and vigorous sod. Time the first mowing after ground nesting birds have hatched (about August 15). Remove excess top growth. (Do not burn.)
- 21. Repair damage to waterways immediately. Repair all broken subsurface drain lines or blowouts adjacent in the waterway when first observed. Construct water bars if needed to force water into the waterway.

As constructed

Width _____ Depth _____ Length _____

Certified correct by _____ Date _____

U.S. Department of Agriculture

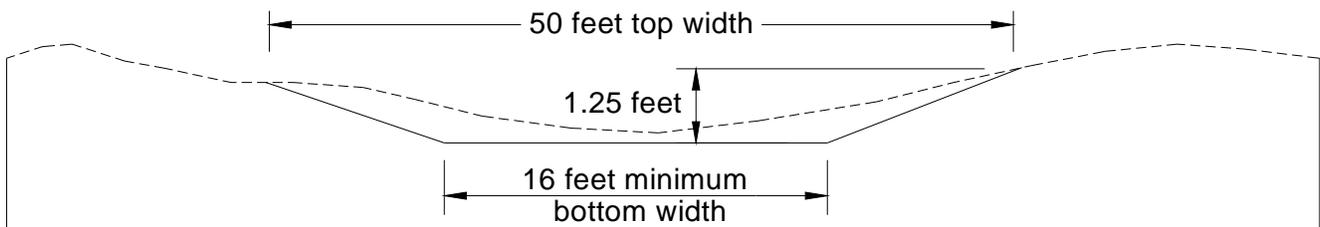
GRASSED WATERWAY

AL-ENG Worksheet 16-4
March 2004

Natural Resources Conservation Service

Drainage area 10 to 15 acres
Used for channel slopes of 1 through 10 percent
South Alabama and Blackland Prairie

Auburn, Alabama



Seeding area

Length (Linear feet) _____ x 0.00115 = _____ Acres

Construction

The waterway shall be constructed with a top width of 50 feet, a depth of 1.25 foot, and a bottom width of 16 feet. The final parabolic shape may be obtained by disking the corners with a small disk during seedbed preparation. The waterway shall be constructed with a constant grade throughout each reach. A break in grade is required when there is a change in land shape.

Approval

Cooperator _____

Approved _____ Date _____

Location

Field number, description of sketch

Seeding Rates			
Materials	Kind	Rate	Total
Seed	Bermuda grass, common	10 lb per acre	
	Bahiagrass	40 lb per acre	
	Tall fescue	40 lb per acre	
Sprigs	Bermuda grass	____ bu per acre	
Fertilizer	Nitrogen	100 lb per acre	
	P ₂ O ₅	100 lb per acre	
	K ₂ O	100 lb per acre	
Lime	Ground limestone (agricultural lime)	2 tons per acre	
Mulch (if needed)	Hay or straw	1 ½ ton per acre	

Vegetation establishment

Seed permanent grass or temporary cover immediately after construction on a firm seedbed. Prepare a good seedbed, mixing fertilizer and lime into the soil during seed preparation. The seedbed should be prepared at least 8 inches deep. Use a chisel plow as needed to breakup hard, restrictive soil.

Seed perennial grass during the recommended planting dates. With late fall seeding, use a small grain companion crop such as wheat or rye. Use temporary cover of Sudan-sorghum hybrid or millet in constructed waterways shaped in the spring or early summer, which are to be fall seeded to fescue.

Use a cultipacker seeder, a grassland drill, grain drill with press wheel or broadcast and compact before and after seeding. Do not seed deeper than ¼ to ½ inch except small grain (companion crop) that should be seeded 1-inch deep. Mulch should be applied immediately after seeding. Also mulch may be anchored by running back and forth over the area with a mulch anchoring tool or disk harrow with the disc set to run straight.

Operation and maintenance

- 22. Avoid grazing the waterway grass to shorter than 3 inches.
- 23. Protect the waterway from damage by farm equipment and vehicles. Avoid using it as a roadway and practice care in crossing to prevent tillage marks or wheel tracks.
- 24. Maintain the constructed width by lifting or disengaging tillage equipment properly and avoid farming operations along the waterways which would hinder water entry.
- 25. Avoid spraying herbicides such as atrazine and crossing waterways during spray operations unless the equipment is completely shut off.
- 26. Fertilize waterways the first spring after seeding and as necessary thereafter to maintain a vigorous stand of grass.
- 27. Mow waterways regularly to maintain a healthy and vigorous sod. Time the first mowing after ground nesting birds have hatched (about August 15). Remove excess top growth. (Do not burn.)
- 28. Repair damage to waterways immediately. Repair all broken subsurface drain lines or blowouts adjacent in the waterway when first observed. Construct water bars if needed to force water into the waterway.

As constructed

Width _____ Depth _____ Length _____

Certified correct by _____ Date _____

EROSION CONTROL STRUCTURE FOR PRE-VEGETATED SHALLOW CHANNELS

“The Burgess Hide-A-Bale Barrier”

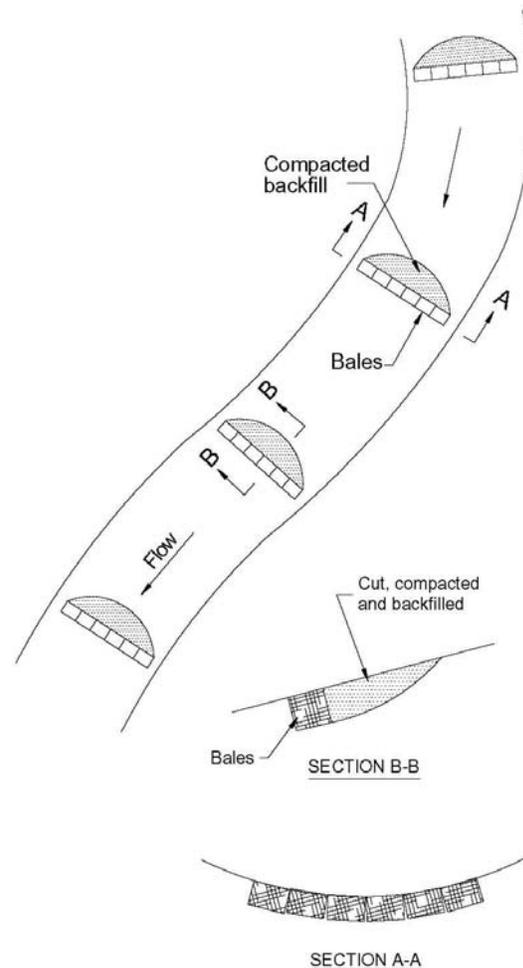
It is unusual when a newly shaped waterway or diversion channel can be established to a protective vegetative cover without undergoing damaging erosion. Mulching the bare soil surface will help to lessen the loss of seedbed, fertilizer, and seed by sheet erosion. The most damaging erosion, however, is the rills and gullies that can so easily develop in the bottom of the newly constructed seeded waterway. Mulch alone is of minimal value in preventing the start of gully erosion in the bottom section during the pre-vegetated period. Generally, it is less

costly to apply erosion preventive measures than to take the risk of loss of soil material and cost of repair.

One technique that has proven effective in preventing excessive erosion is the “Burgess Hide-A-Bale Barrier” described by the sketches and notes below.

AT THE TIME THE WATERWAY IS PLANNED WITH THE LANDUSER, PLAN FOR THE USE OF EROSION CONTROL BARRIERS.

1. Select the spacing and number of barriers needed:
 - at changes to steeper slopes.
 - usually not over 200 feet apart.
 - as indicated by existing eroding gully points.
2. Select specific locations and install barriers before dressing up the newly shaped waterway.
3. Usually, only 4 to 6 bales of hay or straw are needed for each barrier.
4. Make cuts across the bottom section of the waterway deep enough to hold the bales placed end-to-end, preferably lying on their side.
5. The top side of the bales lying in the cuts should be approximately even with the finished graded floor of the completed waterway.
6. The down slope wall of the cut should be vertical.
7. Fill around the bales to ground level and compact with equipment wheel tracks.
8. Grade and waterway floor to a smooth surface, prepare seedbed, and plant as if the below-surface barriers were not there.



The recommended hay bales in descending order are: Sericea Lespedeza, fescue small grain straw, wild hay, common Bermuda, bahiagrass, and Coastal Bermuda grass.

Materials

Erosion Control Barriers:

$$\frac{\text{_____}}{\text{(No.)}} \text{ barriers X } \frac{\text{_____}}{\text{(Bales per barrier)}} = \frac{\text{_____}}{\text{(Total no. of bales)}}$$

Mulch Material:

$$\frac{\text{_____}}{\text{(No. of bales or tons)}} \text{ Per acre X } \frac{\text{_____}}{\text{(Acreage in structure)}} = \frac{\text{_____}}{\text{(Bales or Tons)}}$$

Seed, Springs, or Plants:

$$\frac{\text{_____}}{\text{(Kind)}} : \frac{\text{_____}}{\text{(Rate/Unit)}} \text{ X } \frac{\text{_____}}{\text{(Ac. or 1000 sq.ft.)}} = \frac{\text{_____}}{\text{(Total)}}$$

$$\frac{\text{_____}}{\text{(Kind)}} : \frac{\text{_____}}{\text{(Rate/Unit)}} \text{ X } \frac{\text{_____}}{\text{(Ac. or 1000 sq.ft.)}} = \frac{\text{_____}}{\text{(Total)}}$$

$$\frac{\text{_____}}{\text{(Kind)}} : \frac{\text{_____}}{\text{(Rate/Unit)}} \text{ X } \frac{\text{_____}}{\text{(Ac. or 1000 sq.ft.)}} = \frac{\text{_____}}{\text{(Total)}}$$

Fertilizer:

$$\frac{\text{_____}}{\text{(Analysis)}} : \frac{\text{_____}}{\text{(Rate/Unit)}} \text{ X } \frac{\text{_____}}{\text{(Ac. or 1000 sq.ft.)}} = \frac{\text{_____}}{\text{(Total)}}$$

$$\frac{\text{_____}}{\text{(Analysis)}} : \frac{\text{_____}}{\text{(Rate/Unit)}} \text{ X } \frac{\text{_____}}{\text{(Ac. or 1000 sq.ft.)}} = \frac{\text{_____}}{\text{(Total)}}$$

Lime:

$$\frac{\text{_____}}{\text{(Type)}} : \frac{\text{_____}}{\text{(Rate/Unit)}} \text{ X } \frac{\text{_____}}{\text{(Ac. or 1000 sq.ft.)}} = \frac{\text{_____}}{\text{(Total)}}$$

Other Materials:

Establishment Recommendations:
