FIELD MANUAL FOR UNPAVED ROAD BEST MANAGEMENT PRACTICES

2020 Edition

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Georgia Better Back Roads Field Manual 2020 Edition

“Driving Home the Point of Clean Water”

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Georgia Department of Transportation
Georgia Forestry Commission
Georgia Resource Conservation and Development Council
Georgia Soil and Water Conservation Commission
USDA Forest Service
USDA Natural Resources Conservation Service
US Environmental Protection Agency
US Fish and Wildlife Service

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INTRODUCTION

Georgia is rich with an abundance and diversity both in aquatic life and soil types that stretch from the mountains to the coast. Soil diversity, topography, and the soils unique erodibility within the state all contribute to the varying sedimentation loads that occur within the creeks, streams, estuaries, and state waters.

The State of Georgia contains 23,307.167 miles (Georgia Department of Transportation 2018 Mileage of Public Roads) of unpaved roads that run through the 14 major river basins. There are 70,150 miles of stream that traverse the state, of which 1373 miles are listed for a biological impairment by some type of pollution. (EPD 2015 surface and groundwater report)

Sediment in Georgia comes from many sources including agricultural operations, forestry practices, construction projects and other activities that con-vert land from one use to another. Sedimentation has detrimental impacts on habitat, aquatic life, local economy, and increased operational and maintenance costs for local and state governments. Sedimentation from unpaved dirt roads ranks second only to row crop run-off within the state.

Georgia Erosion and Sedimentation Act 1975

The Georgia Law is called the “Erosion and Sedimentation Act” (O.C.G.A. 12-7-1). O.C.G.A. § 12-7-2 states: “It is found that soil erosion and sediment deposition onto lands and into waters within the watersheds of this state are occurring as a result of widespread failure to apply proper soil erosion and sedimentation control practices in land clearing, soil movement and construction activities, and that such erosion and sediment deposition result in pollution of state waters and damage to domestic, agricultural, recreational, fish and wildlife, and other resource uses.

It is, there-fore, declared to be the policy of this state and the intent of this chapter to strengthen and extend the present erosion and sediment control activities and programs of this state and to provide for the establishment and implementation of a state-wide comprehensive soil erosion and sediment control program to conserve and protect land, water, air and other resources of this state."

Municipalities and counties should have an Erosion & Sediment Ordinance plan currently in place prior to land disturbing activities or they can be subject to rules, regulations and or fines by GA Environmental Protection Division. Source- Georgia Environmental Protection

Type of Streams within Georgia

Understanding stream type and flow requirements are essential for ensuring the correct BMP is selected.

Perennial streams flow in a well-defined channel throughout most of the year under normal climatic conditions. Some may dry up during drought periods or due to excessive upstream uses.

Intermittent streams flow in a well-defined channel during wet seasons of the year but not for the entire year. They generally exhibit signs of water velocity sufficient to move soil material, litter and fine debris.

Ephemeral areas can direct stormflow into surface waters. Care should be taken to minimize these areas from becoming sources of pollutants.

PURPOSE:

This road manual has been specifically prepared to assist field personnel, public works personnel, county road department personnel, operators and/or anyone involved in on-site land-disturbing activities. This manual is a quick reference in the actual installation and maintenance of Best Management Practices (BMP). BMP's can be both structural practices, and vegetative measures to control soil erosion. Successful erosion control includes pre-planning of the site, use of structural practices and immediate post application of ground cover that includes mulch and vegetation.

.*This manual is arranged into five sections:*

(1) Road surface conditions
(2) Road drainage issues
(3) Stabilization and erosion control
(4) Road materials and additives
(5) References, websites, and glossary

Each section is divided into topics to define or describe the issue or practice; provide general comments and recommendations, common causes related to that topic; along with inspection, installation and maintenance guidelines for the appropriate Best Management Practice to reduce or eliminate the pollution cause(s). Photos, structural sketches and diagrams, or tables are also included to illustrate the practice(s). For detailed information please reference the "Manual for Erosion and Sediment Control in Georgia".

DISCLAIMER:

BMPs listed in this manual are intended to provide minimum control for erosion and sedimentation problems as required by Georgia State Law.

This manual is NOT intended to replace design manuals for construction or material specifications. All design work for roads, stream crossings, culverts, and permanent sediment traps must be done by qualified professionals.

Identify federal, state and local laws, regulations or ordinances that apply to road purpose, construction, and maintenance prior to construction and operation work.

While the emphasis is on meeting the requirements of the State Law, land disturbers must also comply with all other local, state, and federal laws including the Section 404 Permit issued by the Army Corps of Engineers (USACE) and the NPDES (National Pollution Discharge Elimination System) Permits administered by the Georgia Environmental Protection Division (GA EPD). Local Issuing Authorities (LIA) must ensure compliance on these regulations before issuing a land disturbing activity permit (LDA).

GTRCD along with all partners assumes no responsibility for failures or issues with BMPs or any products referenced within the manual.

SECTION1.

ROAD SURFACE CONDITIONS

ROAD SURFACE MAINTENANCE

Well maintained unpaved road; wide, grassed, rock lined ditches. Mitchell County Georgia. Photo courtesy of Golden Triangle RCD

BEST MANAGEMENT PRACTICES: GENERAL COMMENTS

- DO NOT grade during extended dry periods.
- Avoid blading, grading, or dragging for 48 hours following 1 inch of rain or during freezing temperatures.
- Limit blading and grading to times of optimal moisture content (see aggregate topic).
- Use blended composite on roadway surfaces. Combination of fine and coarse aggregate.
- Stabilize all exposed soil, ditches, and culvert pipes with erosion control blankets, vegetative seeding, and rock.
- Regular inspection and maintenance of road surfaces, culverts, and ditches. After September 15th statewide, stabilize soils with erosion control blankets and hyrdoseeding not just seed and mulch.
- Remove all false ditches, berms, and windrows along with any debris
- Crown roads to allow surface water flow to ditches
- Do not disturb road sections which do not need maintenance.

WASHBOARDING

DESCRIPTION: Series of ridges and depressions across road surface.

Washboarding; lack of surface cohesion.
Photo: Courtesy of Limestone Valley RC&D Council

CAUSES:

- Loss of fines, especially during very dry conditions.
- Excessive vehicle speeds and traffic volumes.

INSPECTION, INSTALLATION, MAINTENANCE:

- Blade when damp, ***only if*** sufficient surface fines are still present.
- Scarify road surface ***if*** excessive loss of surface fines has occurred to re-mix, re-grade, re-establish crown, and recompact surface.

Scarify surface to re-mix surface fines.
Photo: Courtesy of Golden Triangle RCD

RAVELLING

DESCRIPTION: Loss of coarser aggregates.

Road surface raveling; coarse aggregates worn away by traffic.
Photo: Courtesy of Two Rivers RC&D Council

CAUSES: Loss of coarse aggregates after fine binder aggregates have been lost due to erosion or dust.

INSPECTION, INSTALLATION AND MAINTENANCE: Blade with addition of fine aggregates to improve surface composition.

Mixing fines back into road surface.
Photo: Courtesy of Golden Triangle RCD

SURFACE DISTORTIONS

DESCRIPTION: Surface depressions at an angle to traffic flow.

This distortion was cut into the road surface by operating motor grader too fast. The angle of depressions matches the angle of the moldboard.
Source: Federal Highway Administration, South Dakota LTAP Manual

CAUSES:

- Blading operation speeds too fast.
- Moldboard angle (pitch and tilt) too great.
- Blading when not necessary.
- Blading when too wet or too dry.

INSPECTION, INSTALLATION AND MAINTENANCE

- Maximum blading or dragging speed of *3-5 mph*.
- Tilt moldboard blade at *30-40 degrees*.
- Adjust angle of front wheels *10-15 degrees* toward direction of roll.
- *Don't blade* for the sake of blading.
- *Don't blade* in extended dry periods (contributes to loss of fines).
- Blade against traffic flow.
- Use carbide tipped blades.
- Maintain recommended equipment tire pressure.

POTHOLES

Description: Small depressions or voids in road surface one or more inches deep.

This road section suggests poor road drainage.
Photo: Courtesy of Limestone Valley RC&D Council

CAUSES:

- Excessive soil moisture content.
- Poor drainage/lack of crown.
- Poorly graded aggregates.
- High speed traffic.

INSPECTION, INSTALLATION AND MAINTENANCE

- Patch and compact with graded material.
- Spot grading for individual or small sections.
- Re-grade, re-crown, and re-compact in extended sections of potholes to mix aggregates for a better graded road fill.
- Install underdrain if necessary to drain and/or improve sub-grade drainage.

DEPRESSIONS

Description: Areas of road surface or sub-grade made weak by poor drainage, depressing under vehicle weights.

Poor drainage causing weak sub-grade and road surface from vehicle weights during “dry” periods.
Photo: Courtesy of Two Rivers RC&D Council

CAUSES:

- Poor surface drainage.
- Weak strength soils and/or sub-grade.

INSPECTION, INSTALLATION AND MAINTENANCE:

- Fill, grade, and compact with well graded aggregate.
- Use underdrains or cross drains to improve drainage.
- Use geo-textile to improve strength and drainage.

RUTTING

DESCRIPTION: Longitudinal depressions in wheel paths.

Inadequate surface water control and crowning contributed to the ruts
Photo: Courtesy of Golden Triangle RCD

CAUSES:

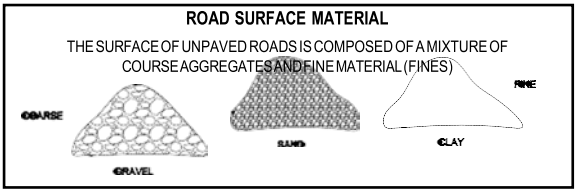
- High moisture content in subsurface base.
- Inadequate surface thickness.
- Heavy traffic loads.
- Poor surface drainage.

INSPECTION, INSTALLATION AND MAINTENANCE:

- *DO NOT* simply fill with stone or soil.
- Add suitable material, grade, and roll surface.
- Crown surface if necessary.
- Re-mix and blade, or grade surface in severe situations.
- Add geo-textile or drain system in situations of repeated or sustained rutting.

AGGREGATES

DESCRIPTION: Any of various loose particulate material used on road base or surface such as sand, gravel, or pebbles.

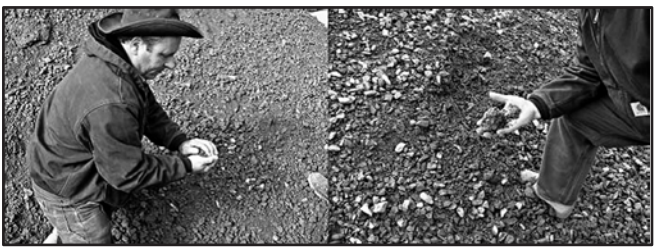


Source: LV RC&D adapted from Choctawhatchee, Pea, Yellow Rivers Watershed Management Authority

BEST MANAGEMENT PRACTICE GENERAL COMMENTS:

- Good gradation of a road is a mixture of coarse (gravel, stone), sand, and fines (clay). Problems arise when there is a loss or predominance of one material or another.
- Coarse aggregate increases the strength of road fill soils, improves traction, is less erosive, and reduces road surface degradation.
- Sand helps clay soils drain better; and clays help retain moisture in coarse materials.
- Fines (clay) act like cement holding the aggregate together. Dust indicates fines are blowing away. Insufficient fine material prevents formation of a crust, reduces capacity to maintain moisture, and contributes to loss of cohesion, and compaction of road material.
- Conduct road maintenance operations during optimal moisture content.

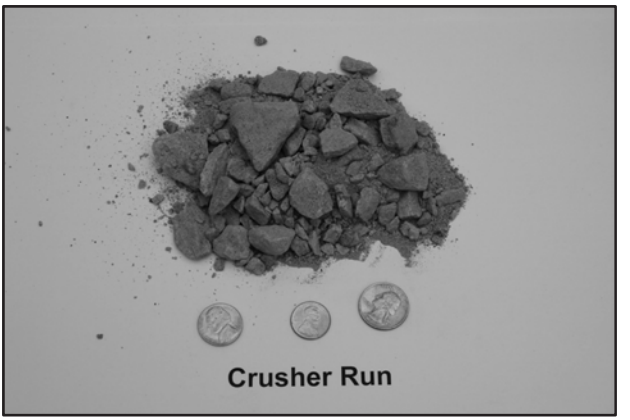
Tip: Grab a handful of material and make into a ball. If the material sticks together when you open your hand you have good moisture content. If it falls apart it is too dry. If water runs out between your fingers, it is too wet.



Source: US Environmental Protection Agency

Aggregates (continued)

Examples of Aggregate Stone Sizes in Georgia



AGGREGATES (CONTINUED)

#6 Stone

#57 Stone

#5 Stone

Aggregates (continued)

Photo series: Courtesy of Two Rivers RC&D Council

APPROXIMATE SIZES OF COARSE AGGREGATES
(ADAPTED FROM GDOT SECTIONS 800, 805)

Typical Reference Name	Approximate Size (inches)	Comments/other names
GAB	varies	graded aggregate; crusher run; includes fines
# 89 stone	0.05 - 0.4	used around under drains and for paving
# 7 stone	0.2 - 0.5	used for pipe bedding and for paving
#57 stone	0.2 - 1	used for pipe bedding
# 6 stone	0.4 - 0.75	seldom used
# 5 stone (un-washed)	0.5 - 1	most commonly used for road surfaces and paving
# 3 stone	3" - 4"	most commonly used on forest roads and construction entrances
Riprap Type I	12" - 24"	most commonly used for outlet protection
Riprap Type III	6" - 12"	surge stone
"Shot" rock	> 36"	boulder sized

BLADING

DESCRIPTION: Using an earthmoving blade to move loose surface materials from high spots, road sides and windrows without cutting into the road crust to fill or smooth surface irregularities.

Blading to move surface materials; note slight tilt of front wheels.
Photo: Courtesy of Two Rivers RC&D Council

Note this is not the same as "grading" which does cut into the road crust i.e. the compacted, durable, impermeable layer at or below the road surface. Sometimes referred to as "dragging" or "smoothing".

INSPECTION, INSTALLATION AND MAINTENANCE:

- Adjust *moldboard* angle between *30 and 45 degrees.*
- Tilt *front wheels* slightly *10 to 15 degrees* in direction of aggregate roll.
- Generally operate *3 mph* in second gear.
- DO NOT blade in extended dry weather.
- DO NOT blade within 48 hours after *1-inch* rain or during freezing temperatures.
- Ideal time for blading or dragging is soon after a rain while surface is moist but not wet.
- Periodically blade against traffic flow to prevent aggregate drifting.

GRADING

DESCRIPTION: The cutting, redistribution, and re-compacting of the road surface crust, or adding new road material to obtain or change roadway shape and profile.

Note tilt of front wheels and grading against traffic flow. *Photo: Courtesy of Two Rivers RC&D Council*

This is not the same as "blading or dragging" which does not cut into the road crust. Grading should be performed only when needed.

INSPECTION, INSTALLATION AND MAINTENANCE:

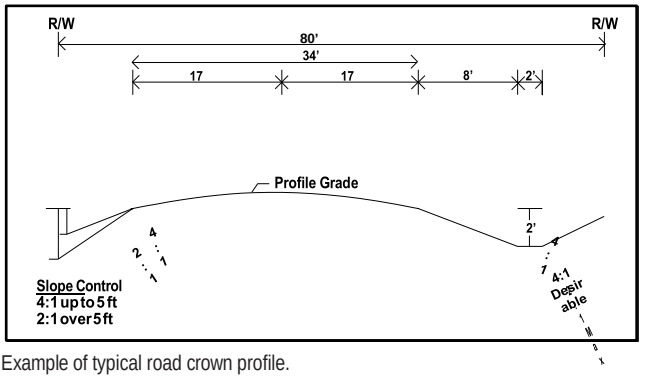
- Perform with outer edge of moldboard at the edge of road surface.
- Tilt moldboard backward with sufficient down pressure to produce cutting action.
- Scarify (rake) existing road surface before adding new material to "blend" materials.
- Add new materials by running dump truck down center of roadway and then blending with scarified surface using a grader.
- Compact entire width of disturbed roadway before end of day.
- Re-establish drainage to ditches or other outlets.
- Minimum one-foot distance from ditch line to avoid disturbance.
- Bring road surface back to and slightly above ditch line to avoid false ditch along roadway. Windrows which can act as a dam.

CROWNS

DESCRIPTION: Center of the road is higher than the outer edges to aid in drainage.

BEST MANAGEMENT PRACTICE GENERAL COMMENTS: Crowns are first line of defense against water and subsequent problems with poor drainage causing softening of road crust, rutting, potholes, and depressions.

- Over time the crown will lose its shape and may become "rounded" (parabolic).
- Parabolic crown may also be caused by worn cutting edge in center of blade.
- Always preserve and maintain the crown for good drainage



Example of typical road crown profile.

Source: Limestone Valley RC&D adapted from GDOT

INSPECTION, INSTALLATION AND MAINTENANCE

- Maintain a cross slope drop of ½ inch to ¾ inch per foot from center to edge of road; or 4-6 inch drop for an 8-foot lane.
- Maintain straight-edge on grader blades (use cutting torch to straighten edge whenever center wear is ½ to ¾ inch or more).
- Use blade with carbide bits (resists wearing).

CROWNS (CONTINUED)

Re-shaping Crowns

Re-shaping crown step 1: cutting road surface.

Re-shaping crown step 2: re-distributing road surface.

Re-shaping crown step 3: re-mixing road surface.

CROWNS (CONTINUED)

Re-shaping crown step 4: final shaping.

Re-shaping crown: completed.
Photo series: Courtesy of Two Rivers RC&D Council

SHOULDERS

DESCRIPTION: The edge of the roadway between the traveled portion and the drainage.

BEST MANAGEMENT PRACTICE GENERAL COMMENTS:
Functions of the shoulder are to:
(1) support the edge of the traveled portion of the road;
(2) provide a safety area for drivers; and (3) carry water away from the road surface. In relation to the roadway edge, the shoulder should be no higher than the roadway creating a berm which may pool water, or lower than the roadway which creates a drop-off from the driving surface.

PROBLEMS:

- Secondary ditches (other terms: false ditch, berms, Curbs or windrows).
- Water channels through secondary ditch creating additional erosion along the roadway.
- Water collects on road edge and then seeps into Subgrade or flows laterally across roadbed.

CAUSES OF PROBLEMS:

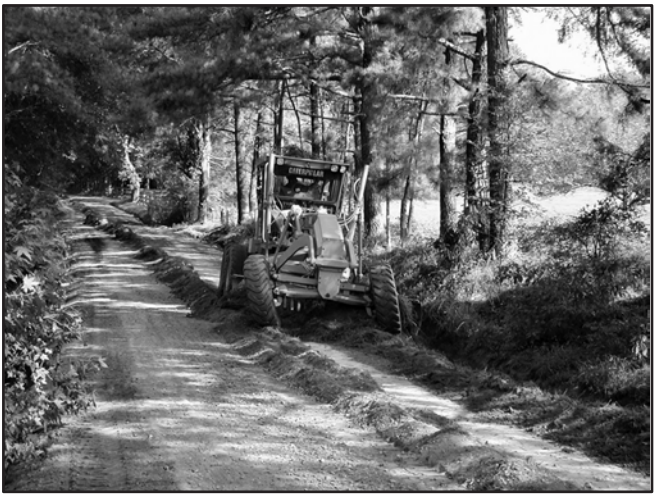
- Cutting too deep at the shoulder line with the toe of the moldboard.
- Losing material from the toe of grader's moldboard.
- Cutting edge is not reasonably straight, i.e., greater than ½ to ¾ inch wear on blade.
- Excessive "whip-off" of loose material by fast traffic resulting in "piling" along edge.
- Heavy loads on roads with weak subgrades shoving shoulder area up.
- Traveling near shoulders causing ruts in roadway and shoving shoulder area up.

SHOULDERS (CONTINUED)

INSPECTION, INSTALLATION AND MAINTENANCE:

"Pull and Cover" Steps:

- Existing surface gravel is cut loose and windrowed to opposite side of road.
- Cut secondary ditch slightly deeper, place material in roadway.
- Pull material from high shoulder into cut and work into cut. Do not leave material on the shoulder creating a windrow.
- Cover with windrowed gravel and restore proper crown to roadway. Note: material from high shoulder may not be suitable to be re-used on roadway.



Example of "pulling" ditch and re-establishing crown. Monroe County, Georgia *Photo: Courtesy of Two Rivers RC&D Council*

INTERSECTIONS

DESCRIPTION: An area of maintenance concern where roads meet

INSPECTION, INSTALLATION AND MAINTEANCE

Controlled intersection: Side road traffic has to stop or yield.

- Primary road retains crown.
- Side roads eliminate crown gradually 100 feet from intersection.
- Side roads should be flat and match primary road at intersection.

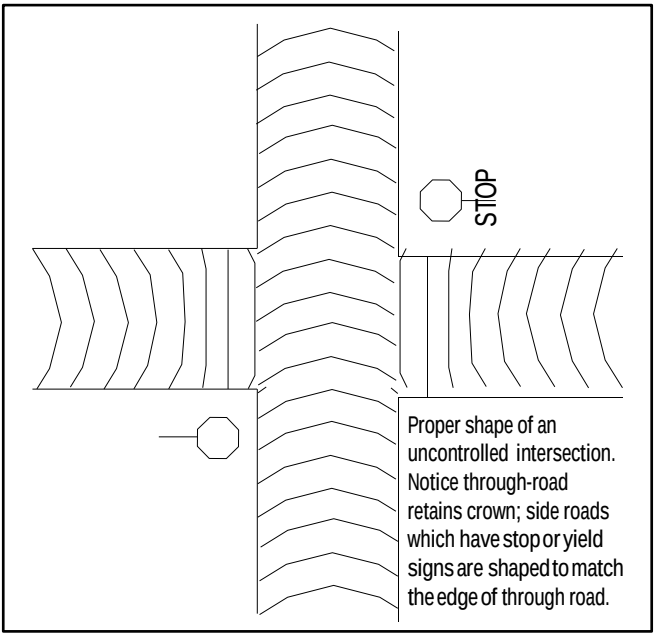


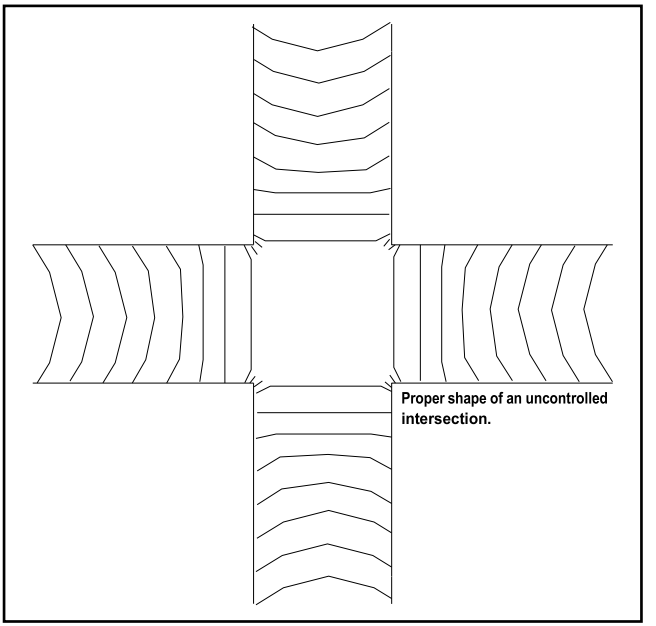
Illustration of proper crown shape at controlled intersections. Curved lines indicate road crowns at intersection.
Source: Limestone Valley RC&D adapted from Federal Highway Administration, South Dakota LTAP Manual

INTERSECTIONS (CONTINUED)

INSPECTION, INSTALLATION AND MAINTEANCE

Uncontrolled intersection: All traffic stops or yield at intersection.

- All roads gradually eliminate crowns 100 feet from intersection.
- Intersection is flat, but not lower than roads (to avoid collecting water).
- Eliminate crown from all directions approaching the intersection.



Proper crown shape at uncontrolled intersections. Curved lines indicate road crowns at intersection. *Source: Limestone Valley RC&D adapted from Federal Highway Administration, South Dakota LTAP Manual*

INTERSECTIONS (CONTINUED)

INSPECTION, INSTALLATION AND MAINTEANCE

Intersection with paved surfaces: such as bridge decks, driveways, railroads, paved roads

- Eliminate crown gradually 100 feet from intersection.
- Gravel road should match paved surface at intersection.
- Avoid gravel on paved surface.
- Use backdragging to fill potholes at edge of pavement, i.e., moldboard lifted up and set down in front of material to "pull" gravel back onto gravel road.
- Contact railroad or your supervisor ***immediately*** if rails are snagged or damaged.

Gravel to pavement problems: potholes.

Replace and back-drag gravel from pavement.
Source: Federal Highway Administration, South Dakota LTAP Manual

SENSITIVE AREAS: WETLANDS

DESCRIPTION: Areas vulnerable to road runoff due to proximity to water bodies and limited space for road runoff control or treatment.

Unpaved road adjacent to wetland (right shoulder); note vegetated shoulder, banks and ditch to trap sediment. Lamar County, Georgia
Photo: Courtesy of Two Rivers RC&D Council

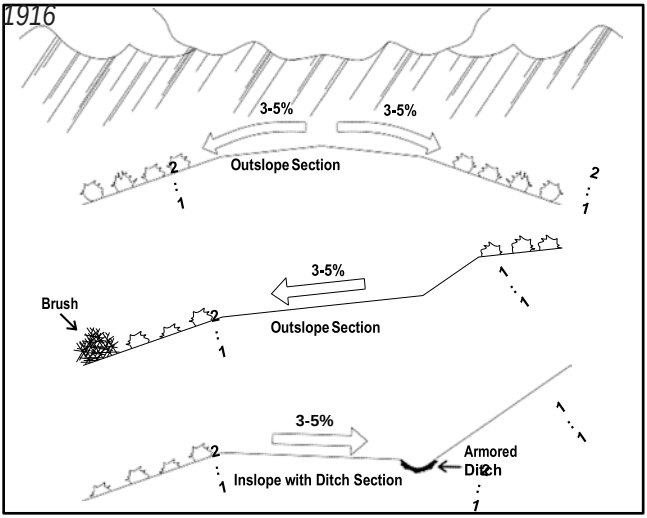
INSPECTION, INSTALLATION, AND MAINTENANCE

- **Avoid** discharge to wetlands.
  - Stabilize road and ditch banks.
  - Maintain vegetated ditches.
  - Use turnouts to stable, mature vegetated areas.
- **Minimize** discharge to wetlands.
  - Use vegetated filter strips.
  - Use permanent sediment traps. (will require regular maintenance).
- **Mitigate** wetland damage.
  - Last resort; costly.
  - Requires permits.
- **Gravel** or do road surface treatment a minimum of **100 feet** above discharge outlet(s).
- **Hydro-seed** and mulch ditch banks a minimum of **300 feet** upstream of discharge outlet(s).
- Use **check dams** upstream of discharge outlet.

SECTION 2. DRAINAGE

DRAINAGE

"Keep water OFF your road, OUT of your road, and AWAY from your road." *New Hampshire Highway Department Handbook 1916*



Typical road surface drainage options.
Source: Keller and Sherar, USDA Forest Service 2003

INSPECTION, INSTALLATION AND MAINTENANCE:

- Maintain "sheet flow" (thin, evenly spread) water as much as possible by controlling ditch shape, bottom slope, and width to reduce "concentrated flow" (forceful, high velocity).
- Maintain positive surface drainage with an out-sloped or crown roadway section.
- Avoid in-sloping roads when possible (requires careful ditching and culvert cross-drains).
- Avoid steep grades, i.e., less than 10% south of fall line; less than 18% north of fall line.
- No discharge of concentrated flow to sensitive areas such as streams, wetlands, estuaries.

DRAINAGE: (CONTINUED)

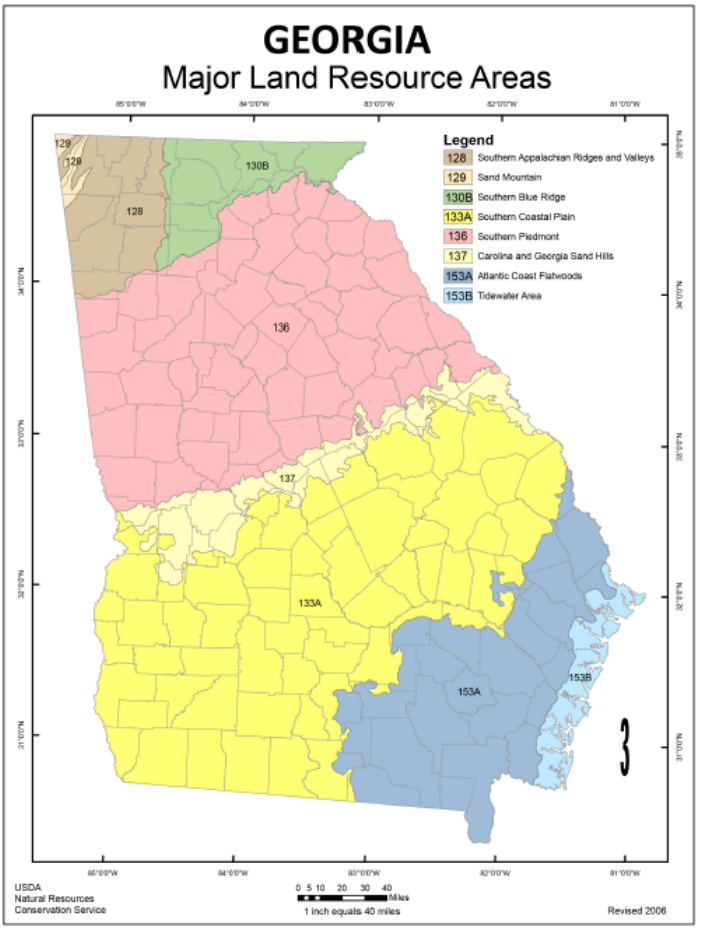


Illustration of major land divisions of Georgia as indicated by shaded areas.*Source: Manual for Erosion and Sediment Control in Georgia, GSWCC*

Legend Code 128,129, 130B-(previously listed as Mountains) Drainage ranges from slow to very rapid. Saturated soil layers (seasonal water table) are typically 24 to greater than 80 inches below the surface.

Legend Code 136 and 137-(previously listed as Piedmont) Drainage ranges from slow to rapid. Saturated soil layers are typically 20 to greater than 60 inches below the surface.

Legend Code 133A, 153A, and 153 B (previously listed as Coastal) Drainage ranges from very slow to rapid. Saturated soil layers are typically 10 to 60 inches below the surface.

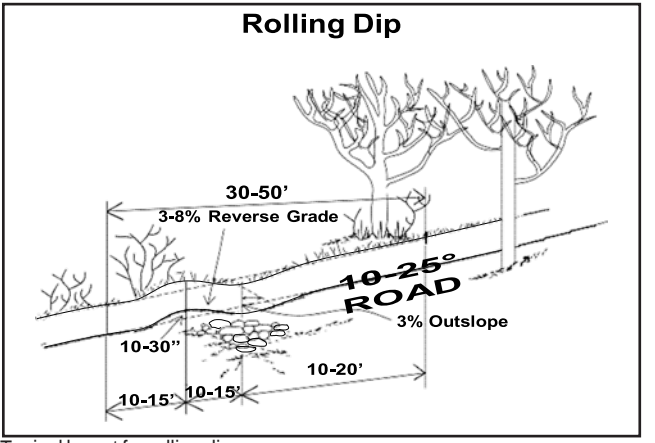
BROAD-BASED DIPS (OR ROLLING DIP)

DESCRIPTION: A surface drainage diversion built into the bed of a road to intercept and divert surface water out of the road while allowing vehicles to maintain normal speeds.

Example of broad-based dips. Murray County, Georgia
Photo: Courtesy of Limestone Valley RC&D Council

INSPECTION, INSTALLATION AND MAINTENANCE:

- Dips consist of a long down-slope approach section of 2-12%.
- Low out-sloped mid-section outlet of 3%.
- Short terminal section on reverse grade of about 3-8%.
- Stabilize outlet with vegetation, gravel, rock, or geo-textiles.
- Discharge to established vegetated areas.



Typical layout for rolling dips.
Source: Best Management Practices for Forestry Keller and Sherar 2003

BROAD-BASED DIPS (CONTINUED)

GeneralRuleforSpacingofDips

Road Grade, percent	Distance between dips and turnouts, feet
3	235
4	200
5	180
6	165
7	155
8	150
9	145
10	140
12	135

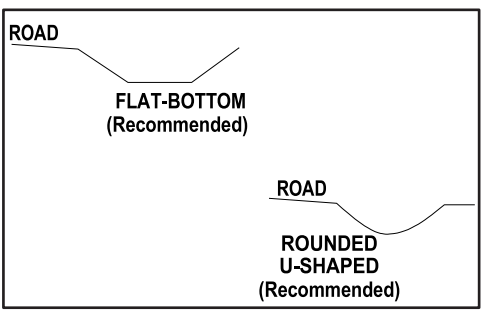
Source: Best Management Practices for Forestry Keller and Sherar 2003

DITCHES

DESCRIPTION: The most common drainage structure used to convey water from the roadway. Location, profile, shape, lining, and outlets contribute to a ditch that removes water efficiently.

INSPECTION, INSTALLATION AND MAINTENANCE:

- Locate ditches on **upslope side** of road.
- Design and grade ditch and bank side slopes at **2:1 maximum slope**, i.e., 2 feet horizontal for each 1-foot vertical rise.
- Ditch bottom at least **2 feet wide** and 1-2 feet below road base.
- Ditch bottom should be **flat, parabolic, or rounded**-U shaped, **but NOT** straight U-shaped or V-shaped.
- Line ditches with **channel slopes less than 5%** with grass; greater than 5% with geo-textiles and rock, but NOT concrete.
- Provide **stable ditch** outlets to prevent standing water next to roadway (which can seep into and weaken road base).
- Install **frequent turnouts** into vegetate areas.
- Use **dropinlet** structures and culverts for ditch grade control.



Best Management Practice ditch shapes. *Source: Limestone Valley RC&D Council adapted from Choctawhatchee, Pea, Yellow River Management Authority*

DITCHES (CONTINUED)

INSPECTION, INSTALLATION AND MAINTENANCE CONT:

- Use rubber-tired excavator with articulated bucket to create ditches.
- Check all ditches and turnouts after major storms for sediment, debris, erosion, or collapse.
- Re-grade ditch only when absolutely necessary and line with vegetation or stone immediately.
- Limit re-grading to late spring or when weather pattern suggest high erosion potential will be minimal.
- Use "roll" ditch to get rounded-U shape (see following photos).
- Revegetate; seed and stabilize as soon as possible (see grass seeding section pages 59-64).

Using wheel for "shaping and tamping" ditch; creates a "roll" or "rounded U" shape ditch. Meriwether County, Georgia Photo*: Courtesy of Two Rivers RC&D Council*

Final shape of roll ditch is a rounded U-shape.Ditch needs to be revegetated. .Meriwether County, Georgia

DITCH LINING		
Channel Slope	Lining	Thickness
0-5 %	grass	
5-10%	R#3 (2-6 inch)diameter rock	7.5''
>10	R#4 (3-12 inch)diameter rock	12''

CHECK DAMS

DESCRIPTION: A small barrier constructed across a drainage ditch or area of concentrated flow to reduce water velocity, filter sediment, and stabilize grade.

Photo- Georgia Soil and Water Commission-Erosion and Sediment Control Manual

Inspection, Installation, Maintenance:

- Install according to the approved plan.
- Place in small, open channels, not in live streams.
- Construct center at least 9" lower than outer edges.
- Extend across entire width of ditch or swale.
- Make side slopes 2:1 or flatter.
- Toe of the upstream dam should be at the same elevation as the top of the downstream dam.
- Check dams may be used in conjunction with other BMPs for any flows exceeding 2.0 cfs.

CHECK DAMS (CONTINUED)

Stone Check Dams

- Drainage area not to exceed 2 acres.
- Constructed of graded size 2”-10” stone.
- The center of the check dam should be at least 9” lower than the outer edges.
- The dam height should be a maximum of 2 ft from the center to the rim edge.
- Place a suitable geotextile between the graded stone and the soil base and abutments.

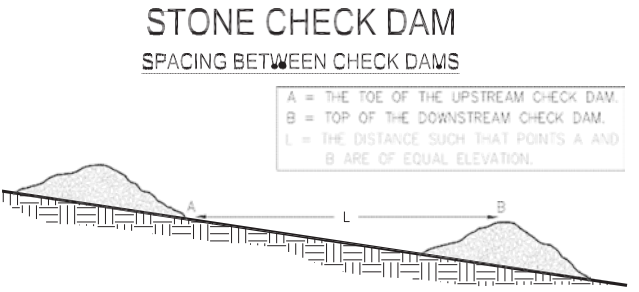
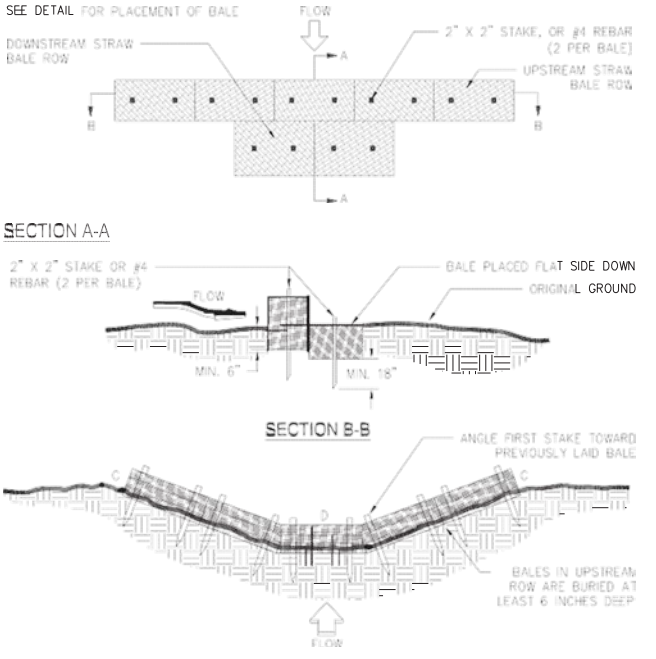


Figure 1. Stone Check Dam Spacing- Source Georgia Soil and Water Commission-Erosion and Sediment Control Manual Requirements

Straw Bale Check Dams

- Drainage area not to exceed 1 acre.
- Bales should be bound with wire or nylon string.
- Bales should be placed in rows with bale ends tightly abutting the adjacent bales.
- A trench shall be dug across the channel deep enough that the wide side of the 2nd bale is level with the ground.
- Drive the standard 2x2 stakes or #4 rebar through the bales into the ground 18”-24” for anchorage. The first stake in each bale should be driven toward a previously laid bale in order to force bales together.

CHECK DAMS (CONTINUED)



Source: Georgia Soil and Water Commission-Erosion and Sediment Control Manual

Figure 1. Straw Bale Check Dam Installation Requirements

Compost Filter Sock

- Drainage area not to exceed 1 acre.
- Place one stake in the filter sock at the center of the ditch/ channel.
- Place stakes at the bed/bank junction and at the end of the device not spaced more than 2 ft apart.
- Compost filter sock to be at least 18" in diameter
- Minimum staking depth is 18".
- Can be seeded at the time of installation.

CHECK DAMS (CONTINUED)

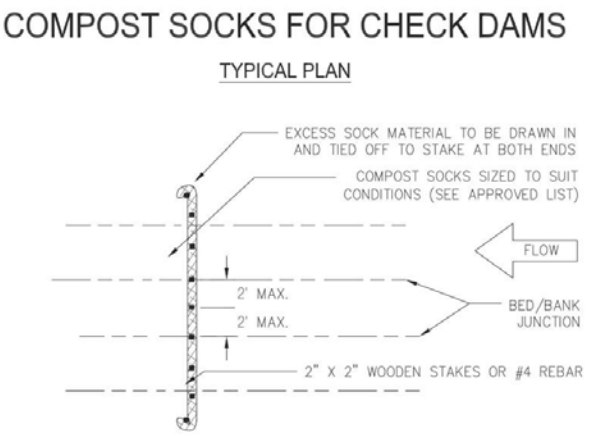


Figure 1. Compost Filter Sock Installation
Source: Georgia Soil and Water Commission-Erosion and Sediment Control Manual

Requirements

- Periodically inspect and maintain all structures.
- Remove sediment when it reaches a depth of one-half the original dam height.
- May remain in place permanently.

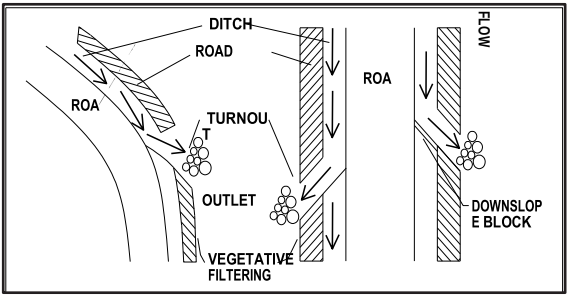
TURNOUTS

DESCRIPTION: Extension of a road's ditch into a vegetated area to disperse water.

NEED PIC

Turnout into stable vegetated outlet area. Baker County, Georgia *Photo: Golden Triangle RCD*

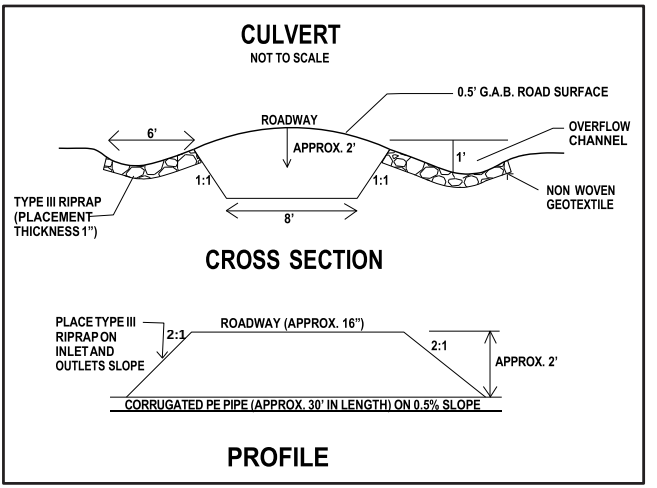
GENERAL COMMENT: The goal is to create a "sheet" flow discharge pattern (thin relatively uniform depth of runoff water) to vegetated adjacent areas.



Typical locations for turnouts (tail ditches). *Source: Limestone Valley RC&D adapted from Choctawhatchee, Pea, and Yellow Rivers Management Authority*

CULVERTS AND CROSS DRAINS

DESCRIPTION: Metal, concrete, plastic, or constructed box-type conduit used to carry water under roads.



Typical layout profile for culverts and drains. *Source: Limestone Valley RC&D adapted from Manual for Erosion and Sediment Control in Georgia, GSWCC*

BEST MANAGEMENT PRACTICES- GENERAL COMMENTS

- Single large pipes are preferred over multiple smaller diameter pipes to minimize plugging.
- Road crossing should be perpendicular to natural stream channel.
- Fish passage design is a consideration in several Georgia streams.
- Bottomless arch culvert, concrete, or high density plastic pipe are preferred material for stream crossing. "Bottomless" culvert means the culvert extends over the natural channel material.
- Install headwalls (concrete) or extend culvert beyond toe of roadway and stabilize with geo-textile and riprap.
- Align culverts in middle and bottom of natural stream channel.
- Sized for 25-year 24-hour storm (Georgia's Best Management Practices for Forestry, 2019).
- Minimum pipe slope of 0.5% to allow for positive flow and self-cleaning.

BEST MANAGEMENT PRACTICES- GENERAL COMMENTS CONT.

- Minimum of 1-foot fill (2-foot preferred) over culvert.
- Space no more than 500 feet apart, closer on steeper slopes.
- Extend culvert pipe at least 2 feet beyond toe of road bank slopes.
- Protect outlets with rock, aprons, plunge pools, drains, geo-textiles, or discharge to stable vegetated areas.
- Pipe material should be resistant to abrasiveness of particles in the water.

Recommended Culvert Sizes

Drainage Area (acres)	Lower Coastal Plain (inches)	Upper Coastal Plain (inches)	Piedmont (inches)	Mountains and Ridge and Valley (inches)
PERMANENT	BASED ON 25-YEAR, 24-HOUR STORM FLOWS)			
10	24	15	30	24
50	36 or (2-30")	18	48 or (2-36")	48
100	48	24	54 or (2-42")	60 or (2-48")
200	60	36	72 or (2-54")	72
300	2-48"	54	84 or (2-60")	78 or (2'60")

Source- US Forestry Service

*Note: This is intended to be a guide for field inspections and maintenance of culverts and NOT for design purposes. Sizing of culverts should be done by qualified individuals to account for design storm precipitation and runoff.

COMMENTS: INSTALLATION

- The spacing between pipes is equal to the diameter of the pipe up to pipes 36 inches in diameter. For example, 12-inch pipes are spaced 12 inches apart.
- The spacing between pipes equal to or greater than 36 inches in diameter should be 36 inches apart. For example, the spacing between 48-inch pipes is 36 inches.
- Use 1 foot (12 inches) of #5 stone for bedding under the pipe.
- Use #5 stone to backfill up to 1/2 the diameter of the pipe.

COMMENTS: MAINTENANCE

- Inspect at least twice per year (spring and fall) and after major storm events.
- Look for signs of corrosion, joint separation, bottom sag, sediment buildup, blockage (debris), settling of fill.
- Inspect inlet and outlet channels for scour, blockage, bank erosion, debris, channel blockage, flow diversion.

Culvert Inspection and Maintenance Chart

What you observe:	Possible causes:	Fixes:
Scouring or erosion at the inlet	Ditch grade to steep Poor location or alignment with water flow Clogged pipe	Line inlet with stone Align culvert with stream flow Clean or flush culvert
Scouring or erosion at the outlet	Pipe slope too steep Pipe is too small	Add stone splash apron Consult with road engineer; replace with larger pipe if needed
Ponded or puddled water	Inlet is too high Ditch grade is too flat	Reset pipe to match channel Re-grade ditch (during dry weather) to maintain flow
Dented or crushed ends	Traffic or debris hitting ends	Replace or straighten back out
Heavy corrosion	Water through pipe is acidic or aggressive (loaded with sand and	Install a sleeve of PVC in existing pipe or replace with
Piping (erosion/cavities) around outlet	Pipe is incorrectly installed resulting in water flowing outside of pipe	Re-install with proper bedding and compacti on Install a headwall Consult with road

Source: Adapted from Coastal and Satilla River SWCD

CULVERTS (CONTINUED)

BEST MANAGEMENT PRACTICES

Example of fish passage culvert. Pickens County, Georgia
Photo: Courtesy of GDOT

Example of bottomless culvert; note natural bottom material remains exposed. Cherokee County, Georgia *Photo: Courtesy of GDOT*

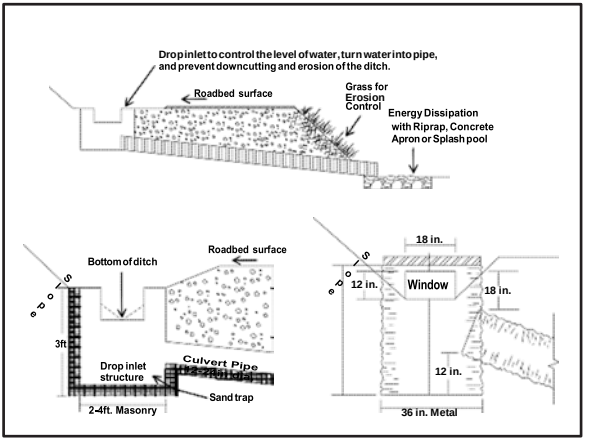
DROP BOX INLET STRUCTURES

DESCRIPTION: Structural devices used to convey runoff water from ditches and culverts in a stable, controlled manner to help dissipate water energy and prevent scouring, erosion, and sedimentation.

BEST MANAGEMENT PRACTICE- GENERAL COMMENT

- An enclosed constructed or prefabricated structure of reinforced concrete, blocks, or plastic.
- Used to receive water from a ditch, culvert, or flume and safely "drop" the water to a lower downstream elevation release point (the drop reduces and helps dissipate water energy
- Used in high to severe road cross-slope situations or where ditch slopes need to be reduced.

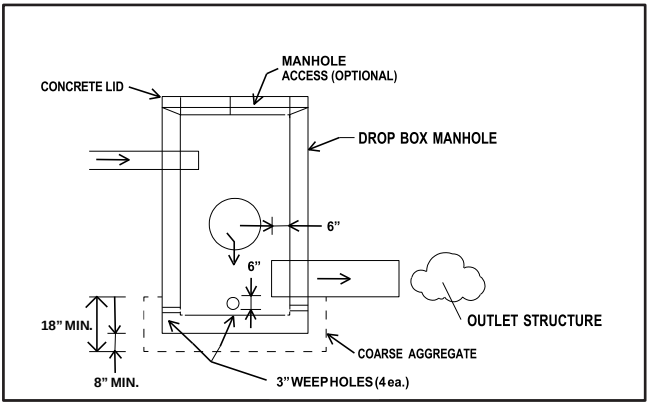
Example of inlet drop box.
Source: US Forest Service Low Volume Roads



Example diagram of "shallow-drop" box.
Source: Limestone Valley RC&D adapted from US Forest Service

DROP BOX (CONTINUED)

Example of drop inlet box structure. *Source: US Forest Service*



Example of typical drop inlet box diagram.
Source: Limestone Valley RC&D Council adapted from Choctawhatchee, Pea, Yellow River Management Authority

STORM DRAIN OUTLET PROTECTION

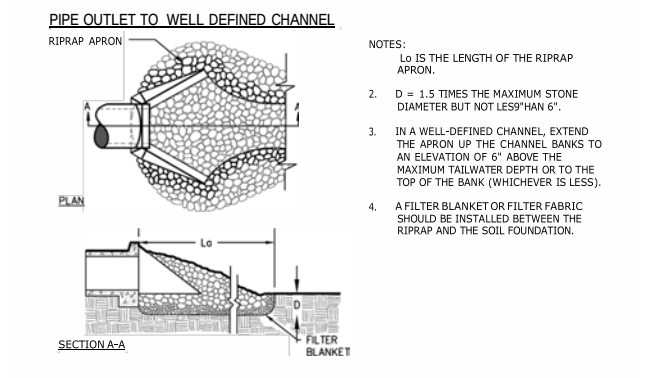
DESCRIPTION: Paved or riprap channel placed downstream at culvert outlet to prevent scouring and erosion.

Example of outlet protection rock apron. *Source: Georgia Soil and Water Commission Manual for Erosion and Sediment Control in Georgia*

INSPECTION, INSTALLATION AND MAINTENANCE:

- Install according to the approved plan.
- The apron may be lined with riprap, grouted riprap, or concrete.
- Compact any fill required in the subgrade to the density of the surrounding undisturbed material.
- Ensure that the riprap and gravel filter conform to the specified grading limits on the plan.
- Install geotextile between the riprap and the soil base.
- Protect the geotextile from punching or tears during installation. Overlap connecting joints a minimum of 1 ft.
- The minimum thickness of the riprap should be 1.5x the maximum stone diameter.
- Place riprap by hand or equipment. Be careful to avoid damaging the filter fabric.

STORM DRAIN OUTLET PROTECTION (CONT)



Source: Georgia Soil and Water Commission Erosion and Sediment Control Manual

Figure 1. Outlet Protection for a Well-Defined

- Construct the apron on zero grade with no overfall at the end. Ensure the top of the riprap at the downstream end is level with the receiving area or slightly below it.
- Place any necessary curves in the upper section of the apron.
- Ensure the apron is properly aligned and preferably straight throughout its length.
- Stabilize all disturbed areas after construction.

Apron Width for a Well-Defined Channel

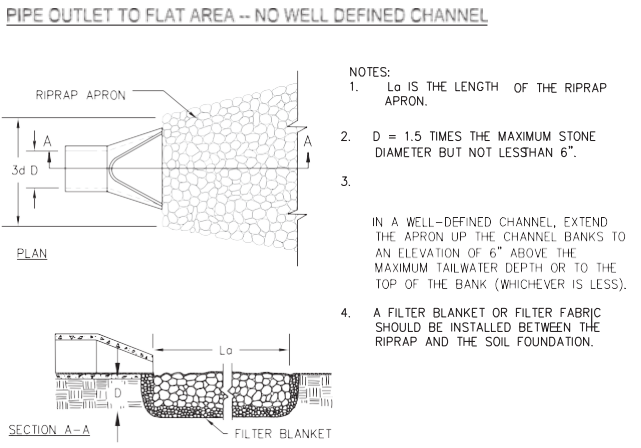
- Side slopes of the channel shall be no steeper than 2:1.
- Extend the apron across the channel bottom.
- Extend the apron up the channel banks to an elevation one foot above the maximum tailwater depth or to the top of the bank (whichever is less).

Apron Width for a Flat Area

- The upstream end of the apron shall have a width
- 3x the diameter of the outlet pipe.
- For a Minimum Tailwater Condition, the downstream end of the apron shall have a width equal to the pipe diameter plus the length of the apron.

STORM DRAIN OUTLET PROTECTION (CONT)

- For a Maximum Tailwater Condition, the downstream end shall have a width equal to the pipe diameter plus 0.4x the length of the apron.



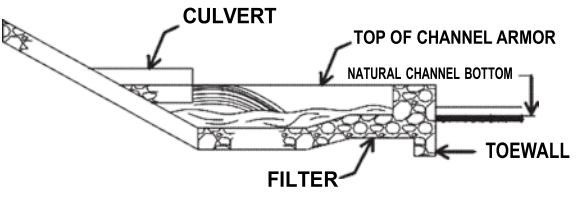
Source: Georgia Soil and Water Commission Erosion and Sediment Control Manual

Figure 2. Outlet Protection for a Flat Area

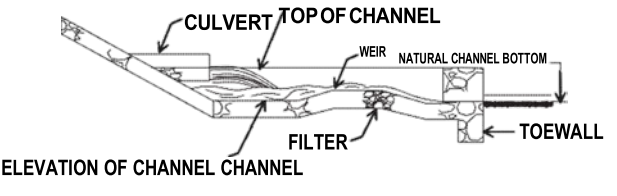
- Inspect riprap outlet structures after heavy rain events to see if any erosion has taken place around or below the riprap.
- Make all needed repairs immediately to prevent further damage.

PLUNGE BASINS (POOLS)

DESCRIPTION: Depressions located at high energy outlets to dissipate water energy.



Depressed Type Plunge Basin Illustration



Weir-formed Plunge Basin Illustration

Typical layout of plunge pool to reduce water energy. *Source: Limestone Valley RD&C Council adapted from Choctawhatchee, Pea, Yellow River Management Authority*

BEST MANAGEMENT PRACTICE- GENERAL COMMENT

- Underlain with filter fabric.
- Lined with riprap, mats, gabions.
- Designed by professional engineer.
- Reduce energy upslope with other practices than at outfalls.
- Inspect at lease twice per year or after extreme rain-runoff events.
- Remove debris from basins.
- Remove large woody vegetation (if rock-lined).
- Replace stones as needed.

SEDIMENT BASINS

DESCRIPTION: Constructed basin either excavated or dammed to settle and store suspended sediment from roads, banks, and ditches.

INSPECTION, INSTALLATION, AND MAINTEANCE:

- Permanent, effective treatment system.
- Requires regular maintenance.

Removal of stored sediment after 3 full.
Lamar County, Georgia *Photo: Courtesy of Two Rivers RC&D Council*

Section 3

GABIONS

DESCRIPTION: Large, multi-celled, welded wire or rectangular wire mesh boxes, used in channel revetments, retaining walls, abutments, check dams, etc.

Source: Georgia Soil and Water Commission Erosion and Sediment Control Manual

INSPECTION, INSTALLATION AND MAINTENANCE:

- Install according to the approved plan.
- Foundations must be smooth and level.
- Use only galvanized or PVC coated wire. For highly corrosive conditions, the PVC coating must be used over the galvanizing.
- Set individual baskets into place, wire them together in courses, and fill with rock to form flexible monolithic building blocks.
- Rock should be durable and adequately sized typically 4"-8") to be retained in the baskets.
- Hand-pack the basket in order to completely fill.
- "Key" structure securely into foundations and abutment surfaces.
- Geotextiles should be used behind all gabion structures.
- Periodically inspect for signs of undercutting or excessive erosion at transition areas.
- Make any necessary repairs immediately.

Section 3

SURFACE ROUGHENING

DESCRIPTION: Providing a rough soil surface with horizontal depressions created by operating a tillage or other suitable implement on the contour. Aids in the establishment of vegetative cover with seed. Reduces runoff velocity and increases infiltration and provides sediment trapping.

Source: Georgia Soil and Water Commission Erosion and Sediment Control Manual

INSPECTION, INSTALLATION AND MAINTENANCE

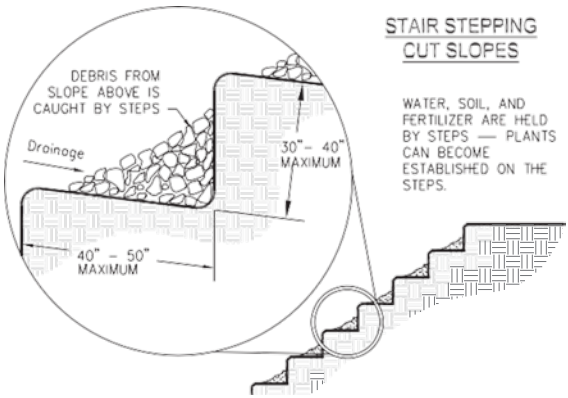
- Required on all slopes steeper than 3:1 if they are to be stabilized with vegetation.
- If slope is to be stabilized with matting and blankets, the surface should not be roughened.
- Not required on slopes with a stable rock face.
- Lightly roughen and loosen soil to a depth of 2”-4” on slopes 3:1 or flatter.
- Areas that will be mowed should have slopes less than 3:1.
- Groove or maintain roughness of slopes steeper than 3:1.
- Stair-step grade or groove cut slopes steeper than 3:1.

SURFACE ROUGHENING CONT.

Roughening Methods

Stair-Step Grading

- May be carried out on any material soft enough to be ripped with a bulldozer.
- Particularly good for slopes with soft rock and some subsoil.
- The ratio of the vertical cut distance to the horizontal distance shall be less than 1:1.
- Horizontal portion of the "step" shall slope toward the vertical wall.



Source :Georgia Soil and Water Commission Erosion and Sediment Control Manual

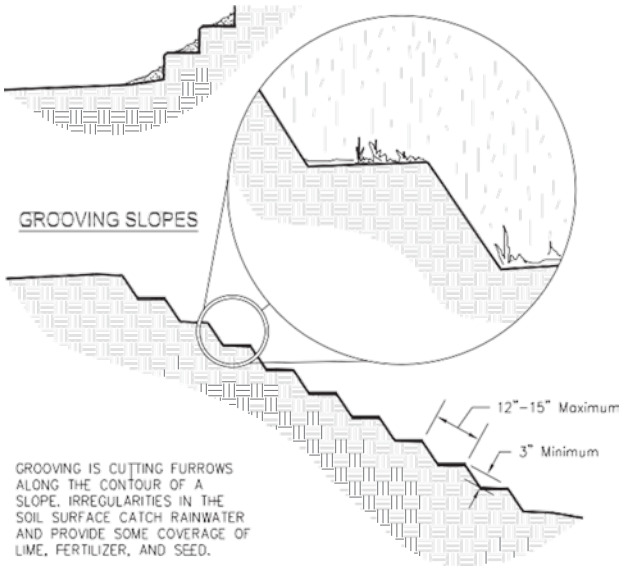
Figure 1. Stair-Stepping Cut Slopes

- Individual vertical cuts are not to exceed 30" on soft materials and not more than 40" in rocky materials.

Grooving

- Use discs, tillers, spring harrows, or the teeth on a front-end loader.
- On un-mowed slopes, minimum groove depth of 3" and maximum groove spacing of 15".
- On mowed slopes, minimum depth of 1" and maximum groove spacing of 12".

SURFACE ROUGHENING cont

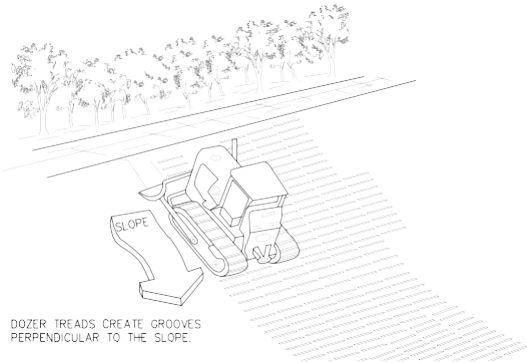


Source: Georgia Soil and Water Commission Erosion and Sediment Control Manual

Figure 2. Grooving Slopes

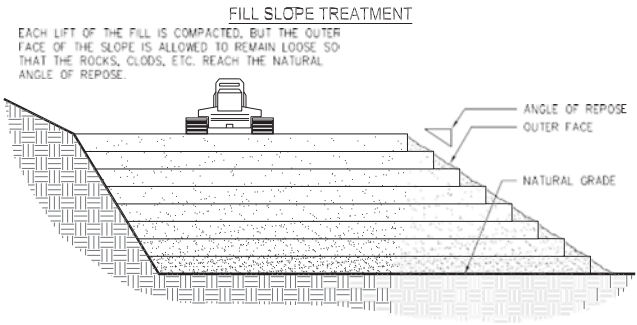
Tracking

- Not recommended on clayed soils unless no alternatives are available.
- Sandy soils may be tracked because they do not compact severely.
- Minimize machine passes to minimize compaction.
- Roughened areas shall be seeded and mulched as soon as possible to obtain optimum seed germination and growth.



Source: Georgia Soil and Water Commission Erosion and Sediment Control Manual

Figure 3. Tracking



Source- Georgia Soil and Water Commission- Erosion and Sediment Control Manual

VEGETATION: GRASS SEEDING

BEST MANAGEMENT PRACTICE GENERAL COMMENTS:

- **Grass seeding (and mulching)**—the most efficient and cost effective method for stabilization which should always be considered first and wherever possible.
- **Live stakes**—cuttings of pruned tree branches ½ to 1-1/2 inches diameter and 2-3 feet long, usually willow, alder, or dogwood.
- **Fascines or live bundles**—long bundles 5-30 feet long and 6-8 inches in diameter of live branches tied together with growing tips all oriented in the same direction, and partially laid into bank.

INSPECTION, INSTALLATION AND MAINTENANCE:

- Use tables on pages 63-64 as a guide to select grasses and for recommended planting rates and dates according to region of the state.
- Use native grasses for row maintenance and wildlife benefits.
- Use companion or mixture of compatible grasses.
- Use "fresh" seed, i.e., look for germination test date on seed label. Georgia recommends seed that has a test within 9 months of planting (older seed has much lower germination rate).
- Scarify (rake) or trench crusted or sealed soil; do NOT simply throw seed on ground.
- Apply by hand, cyclone seeder, or hydro-seeder.
- If using hydro-seeder, do not allow mixture to sit at site longer than 1 hour.
- Apply agricultural lime at a rate of 1-2 tons per acre (0.5 tons if hydro-seeding).
- Mulch at a rate of 2 tons per acre with dry straw; 2-1/2 tons per acre with dry hay; or wood fibers (note: add fiber mulch to hydro-seeding mix).
- Anchor mulch with netting, mesh or mats, or tackifiers.
- Use mats on slopes steeper than 2.5:1 or for heights greater than 10 feet.
- Hydro-seed when seeds will germinate within 14 days.
- Apply mulch to prevent erosion and hold seed for germination.

- May take several years to establish; warm season grasses typically take 2-3 year; cool season grasses typically take 1-2 years.
- Commercial availability may be limited; consult local natural resource agent for guidance.
- Native grasses typically prefer full sun and are adaptable for a variety of soil and site conditions.
- Height of some native grasses may present roadside visibility and safety concerns.
- Recommended seeding rate 8-12 pounds per acre on prepared seed bed.
- Mixture of grasses is preferred; annual ryegrass may be needed as initial erosion control cover.
- Use bio-mat especially on slopes greater than 2.5 to 1 or slopes greater than 10 feet high; however, most native grasses must have less than18" cover.

Table 1. Some Permanent Plant Species, Seeding Rates, and Planting Dates

Species	Rates per Acre	Rates per 1,000 sq. ft	Planting Dates by Region			Remarks
			M- L	P	C	
Bahia, Pensacola Alone or with temporary cover With other perennials	60 lbs. 30 lbs.	1.4 lbs. 0.7 lb.	---	4/1 -5/31	3/1-5/31	Low growing; sod producing; will spread into Bermuda lawns.
Bahia, Wilmington Alone or with temporary cover With other perennials	60 lbs. 30 lbs.	1.4 lbs. 0.7 lb.	3/15-5/31	3/1-5/31	—	Same as above
Bermuda, Common (Hulled seed) Alone With other perenials	10 lbs. 6 lbs.	0.2 lb. 0.1 lb.	---	4/1-5/31	3/15-5/31	Quick cover; low growing; sod forming; needs full sun.
Bermuda, Common (Unhulled seed) With temporary cover With other perennials	10 lbs. 6 lbs.	0.2 lb. 0.1 lb	---	10/1-2/28	11/1-1/31	Plant with Winter annuals. Plant with Tall Fescue

Table 1. Permanent Plant Species, Seeding Rates, and Planting Dates

Species	Rates per Acre	Rates per 1,000 sq. ft	Planting Dates by Region			Remarks
			M- L	P	C	
Bermuda Springs Common lawn and forage hybrids	40 cu. ft.	0.9 cu.ft.	4/15-6/15	4/1-6/15	4/1-5/31	1 cu. ft. = 650 sprigs 1 bu. = 1.25 cu. ft. or 800 sprigs
Centipede	Blcok Sod Only	Block Sod Only	---	11/1-5/31	11/1-5/31	Drought tolerant. Full sun or partial shade.
Crown Vetch With winter annuals or cool season grasses	15 lbs.	0.3 lb.	9/1-10/15	9/1-10/15	--	Mix with 30 lbs. Tall Fescue or 15 lbs. Rye; inoculate seed; plant only North of Atlanta
Fescue, Tall Alone With other perennials	 50 lbs. 30 lbs.	 1.1 lbs. 0.7 lb.	3/1-4/15 or 8/15-10/15	9/1-10/15	---	Can be mixed with perennial Lespedezas or Crown Vetch; not for droughty soils or heavy use areas

Table 1. Some Permanent Plant Species, Seeding Rates, and Planting Dates

Species	Rates per Acre	Rates per 1,000 sq. ft	Planting Dates by Region			Remarks
			M- L	P	C	
Lespedeza, Sericea Scarified	60 lbs.	1.4 lbs.	4/1-5/31	3/15-5/31	3/1-5/15	Widely adapted and low maintenance; takes 2-3 years to establish; inoculate seed with EL inoculant; mix with Weeping lovegrass, Common Bermuda, Bahia or Tall Fescue.
Unscarified	75 lbs.	1.7 lbs.	9/1-2/28	9/1-2/28	9/1-2/28	Mix with Tall Fescue or winter annuals.
Seed-bearing hay	3 tons	138 lbs.	10/1-2/28	10/1-1/31	10/15-1/15	Cut when seed is mature but before it shatters. Add Tall Fescue or winter annuals.

Table 1. Some Permanent Plant Species, Seeding Rates, and Planting Dates (continued)

Species	Rates per Acre	Rates per 1,000 sq. ft	Planting Dates by Region			Remarks
			M- L	P	C	
Lespedeza Ambro Virgata or Appalow						Spreading growth with height of 18"-24"; good in urban areas; slow to develop good stands; mix with Weeping Lovegrass, Common Bermuda, Bahia Tall Fescue or winter annuals; do not mix with Sericea Lespededeza; inoculate seed with EL inoculant.
Scarified	60 lbs.	1.4 lbs.	4/1-5/31	3/15-5/31	3/1-5/15	
Unscarified	75 lbs.	1.7 lbs.	9/1-2/28	9/1-2/28	9/1-2/28	
Lespedeza, Shrub (Lespedeza Bicolor or Lespedeza Thumbergii) Plants	3' x 3' spacing		10/1-3/31	11/1-3/15	11/15-2/28	Plant in small clumps for wildlife food and cover.

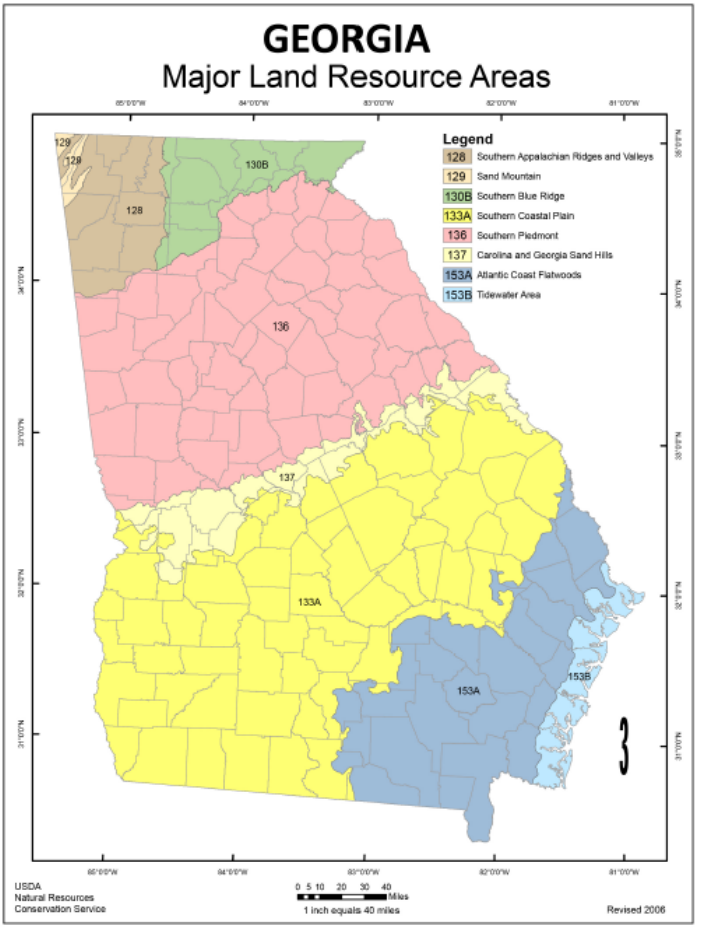
Table 1. Some Permanent Plant Species, Seeding Rates, and Planting Dates

Species	Rates per Acre	Rates per 1,000 sq. ft	Planting Dates by Region			Remarks
			M- L	P	C	
Lovegrass, weeping Alone With other perennials	4 lbs. 2 lbs.	0.1 lb. 0.05 lb.	4/1-5/31	3/15-5/31	3/1-5/31	Quick cover; drought tolerant; grows well with Sericea Lespedeza on road-banks and other steep slopes; short lived.
Maidencane sprigs	2' x 3' spacing		2/1-3/31	2/1-3/31	2/1-3/31	For very wet sites such as river banks and shorelines. Dig sprigs locally.
Panicgrass, Altantic Coastal	20 lbs.	0.5 lb.	---	3/1-4/30	3/1-4/30	Grows well on coastal sand dunes; mix with Sericea Lespedeza but not on sand dune.
Red Canary Grass With other perennials	50 lbs. 30 lbs.	1.1 lbs. 0.7 lb.	8/15-10/15	9/1-10/15	___	Grows similar to Tall Fescue; for wet sites

Table 2. Fertilizer Requirements for Permanent Vegetation

Types of Species	Planting Year	Fertilizer (N-P-K)	Rate (lbs./ acre)	N Top Dressing Rate (lbs./acre)
Cool season grasses	First Second Maintenance	6-12-12 6-12-12 10-10-10	1500 1000 400	50-100 --- 30
Cool grasses and legumes	First Second Maintenance	6-12-12 0-10-10 0-10-10	1500 1000 400	0-50 --- ---
Warm season grasses	First Second Maintenance	6-12-12 6-12-12 10-10-10	1500 800 400	50-100 50-100 30
Warm season grasses and legumes	First Second Maintenance	6-12-12 0-10-10 0-10-10	1500 1000 400	50 --- ---

VEGETATION: GRASS SEEDING (CONTINUED)



Source: Georgia Soil and Water Commission Erosion and Sediment Control Manual

Planting dates based on resource areas of Georgia (see previous tables)

Notes:
Legend 128, 129,130B- previously listed as M-L is Mountain, Blue Ridge, Limestone Ridge and Valley Region
Legend 136 and 137- previously listed as P is Southern Piedmont Region-
Legend 133A, 153A, 153B- previously listed as C is Coastal Plain, Sand Hills, and Atlantic Coast Region-Legend

SEDIMENT BARRIERS

DESCRIPTION: A temporary structure made up of porous material typically supported by steel or wood posts. Types include silt fence, brush piles, mulch berms, compost filter sock or other filtering material

BEST MANAGEMENT PRACTICE GENERAL COMMENTS:

DO NOT INSTALL ACROSS streams, ditches, waterways, or other concentrated flow areas.

- Silt barriers DO NOT replace check dams to control erosion in ditches.
- Use Type "C" silt fence classified for sensitive areas such as wetlands, stream crossings, and construction of turn-outs.

INSPECTION, INSTALLATION AND MAINTENANCE:

- Inspect after each rain event, and repair or clean immediately.
- Remove the sediment once it has accumulated to one-half the original height of the barrier.
- Replace barrier whenever it has deteriorated to such an extent that the effectiveness of the product is reduced (~ 6 months) or the height of the product is not maintaining 80% of its properly installed height.
- Remove and dispose of all accumulated sediment at the barrier before it is removed.
- Leave in place until all disturbed areas are permanently stabilized.

Placement Criteria and Guide for Silt Barrier Use in Georgia.

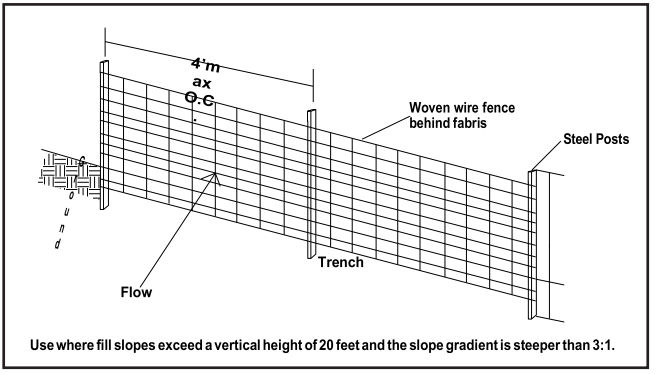
Land Slope (percent)	Maximum Slope Length Behind Fence, (feet)
< 2	100
2 to 5	75
5 to 10	50
10 to 20	25
> 2	15

Source: Georgia Soil and Water Commission Erosion and Sediment Control Manual

SEDIMENT BARRIER (CONTINUED)

SILT BARRIER INSTALLATION

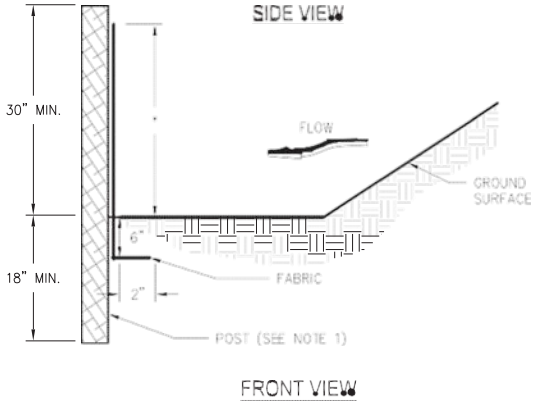
- Along all state waters and other sensitive areas, 2 rows of Type S shall be used. The 2 rows should be placed a minimum of 36" apart
- Use where slope gradient is steeper than 3:1 or slope heights are greater than 20 feet.
- Start post installations at center of lowest point for fence and work out.
- Space posts 6 feet apart, and at least 1.5 feet deep.
- Trench fence 6-inches deep.
- Place at least 2 inches of fabric into direction of flow in trench to hold fabric in place during runoff.
- Cover and tamp trench soil.



Use where fill slopes exceed a vertical height of 20 feet and the slope gradient is steeper than 3:1.

Type C Silt Fence

- 36" wide with wire reinforcement or equivalent backing



FRONT VIEW

SEDIMENT BARRIER (CONTINUED)

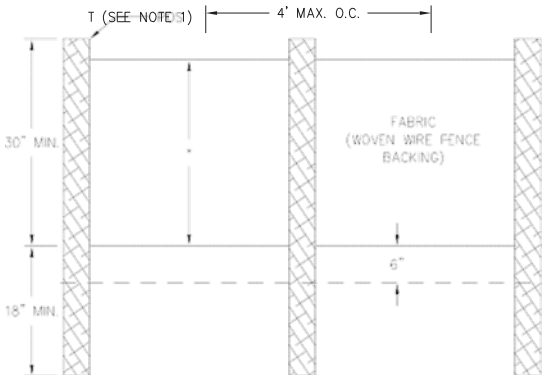


Illustration of Type C silt fence. *Source: Manual for Erosion and Sediment Control in Georgia, GSWCC*

Example of type "C" sediment barrier silt barriers (Sd1-C). Note that the fence is slightly angled into the direction of runoff. *Source: Georgia Soil and Water Commission Erosion and Sediment Control Manual*

Slope Stabilization

DESCRIPTION: Protective coverings made of a variety of materials used to establish temporary or permanent vegetation on steep slopes, shorelines or channels. This provides a microclimate to protect and promote vegetation establishment.

BEST MANAGEMENT PRACTICE GENERAL COMMENTS:

Rolled Erosion Control Products (RECP)

A natural fiber blanket with single or double photodegradable or biodegradable nets.

Hydraulic Erosion Control Products (HECP)

HECP shall utilize straw, cotton, wood or other natural based fibers held together by a soil binding agent which works to stabilize soil particles. Paper mulch should not be used for erosion control.

Example of installation of jute (wood fiber) matting, erosion control blanket/matting (Mb).
Source: Field Manual for Erosion and Sediment Control in Georgia, GSWCC

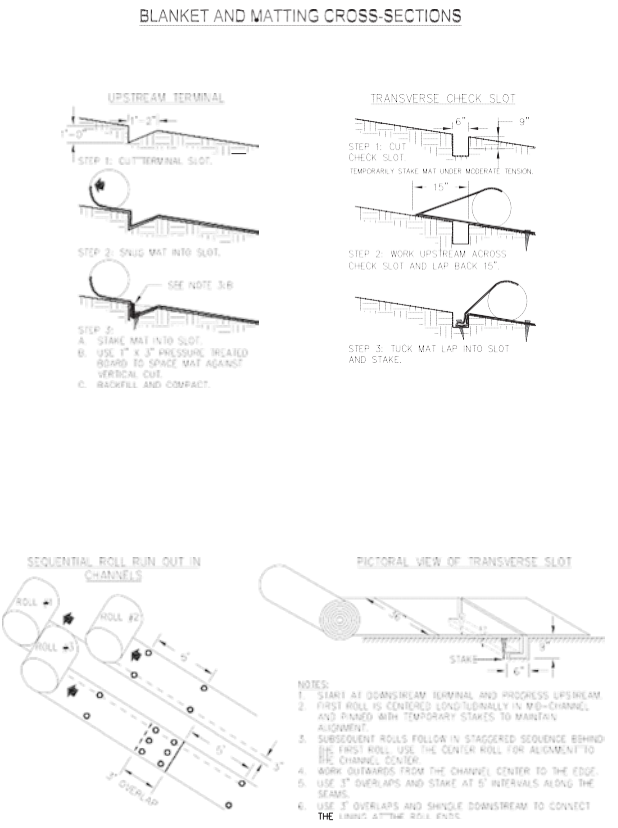
SLOPE STABILIZATION (CONT)

Source: Erosion and Sediment Control in Georgia, GSWCC

INSPECTION, INSTALLATION AND MAINTENANCE

- Installation and stapling of RECPs and application rates for the HECPs shall conform to manufacturer's guidelines for application.
- Hydraulic erosion control products shall be prepackaged from the manufacturer. Field mixing of performance enhancing additives will not be allowed. Fibrous components should be all natural or biodegradable.
- Inspect all erosion control blankets and matting periodically after installation. Inspect immediately after rainstorms to check for erosion and undermining.
- Repair all dislocations and failures immediately.
- Re-install all materials after washouts or breakage occurs. Repair damage to the slope or ditch first.
- Monitor all areas until they are permanently stabilized

SLOPE STABILIZATION (CONT)



Source: Georgia Soil and Water Commission Erosion and Sediment Control Manual

GEO-TEXTILES

DESCRIPTION: Permeable fabrics either woven or unwoven which, used are used to reinforce or separate soils and other materials. Fabrics have the ability to separate, filter, reinforce, protect, or drain when placed within the area.

BEST MANAGEMENT PRACTICE GENERAL COMMENTS:

- Use under rock-lined channels.
- Use under soft spots or where “soft” road materials are present.
- Use to cover cross-drains and/or culverts in roads where road cover may be minimal.

Approved reference examples

- QPL #62 for blankets
- QPL # 49 for matting
- (Materials) Section 800 for coarse aggregate
- (Materials) Section 805 for Riprap
- Check for products, applications, and specifications on Georgia Department of Transportation listing of Materials and Qualified Products List (QPL). Reference website: http://www.dot.ga.gov/PS/Materials/QPLRequirements

DUST CONTROLS

DESCRIPTION: Controlling surface and air movement of dust on construction sites, roads, and demolition sites

Petroleum emulsion application. Harris County, Georgia
Photo: Courtesy of Two Rivers RC&D Council

GENERAL COMMENTS:

Dust indicates a lost to the air of fine particles which are needed as part of a good surface mix to help "bind" the road and provide road surface cohesion. Dust represents a potential road surface condition that ultimately leads to road surface problems.

- Degradation of the road surface itself: fine soil particles act somewhat as a binder. Corrugations, potholes, and rutting are all evidence of loss of the fine particles, ultimately producing uncomfortable and unsafe driving conditions. Loss of fines from the surface requires frequent, expensive maintenance.
- Poor visibility: large, nearly opaque clouds of dust lofting from behind vehicles can quickly (sometimes completely) obscure a driver's vision for several seconds or longer.
- Health and quality of life issue:

DUST CONTROLS

The following is a list of dust control product categories. All are relatively expensive, have a short-term duration, and may be feasible to apply only in severe situations or extremely sensitive areas. Before using any dust control agent check the materials safety data sheets (MSD). Names and terms generally used for dust control agents include:

Chlorides—typically calcium chloride which acts to absorb moisture from the air to control dust
Emulsifiers—typically petroleum-based which act to provide a protective binding and/or coating on the road surface
Resins—a family of materials including pine tree sap which is formulated into a modified emulsion which penetrates road surface to bind with aggregates; some resins may be appropriate for environmentally sensitive areas around streams and wetlands e.g. Road Oyl ®
Lignin Sulfates—typically a by-product of the pulp wood industry sprayed on road surface and then mixed in the top few inches of surface
Latex—a name collectively given to a group of preparations of stable polymers dispersed in water
Binders—a generic term referring to any material used to hold loose road particles together
Water—a very short-term dust control practice

SECTION5.
REFERENCES

"Georgia's Best Management Practices for Forestry", Georgia Forestry Commission, January 2019

"Manual for Erosion and Sediment Control in Georgia" Georgia Soil and Water Conservation Commission Amended, 2016 (commonly referred to as "Green book")

"Field Manual for Erosion and Sediment Control in Georgia", Georgia Soil and Water Conservation Commission 4th Edition, 2016 (commonly referred to as "Field manual")

"Gravel Roads Maintenance and Design Manual", US Federal Highway Administration and South Dakota Local Transportation Assistance Program, August 2015

"Low Volume Roads Engineering Best Management Practices Field Guide", Gordon Keller and James Sherar, USDA Forest Service, July 2003

"Environmentally Sensitive Maintenance for Dirt and Gravel Roads", Alan L. Gesford and John A. Anderson, US EPA and Pennsylvania Department of Transportation, April 2012

"Comparing Warm - Season and Cool - Season Grasses for Erosion Control, Water Quality, and Wildlife Habitat" Conservation Fact Sheet, Natural Resource Conservation Service (NRCS) Maryland, January 2004

"Recommended Practices Manual a Guideline for Maintenance and Service of Unpaved Roads", Choc-tawhatchee, Pea, and Yellow River Watershed Management Authority, February 2000

"Unpaved Public Roads Best Management Practices Demonstration Guidelines for Erosion and Sediment Control to Improve Water Quality", Coastal and Satilla River Soil and Water Conservation Districts, January 2002

WEBSITES

www.gaepd.org
(Georgia Environmental Protection Division homepage)

https://www.nrcs.usda.gov/wps/portal/nrcs/detail/ga/people/partners/?cid=nrcs144p2_021892 (website for Georgia RC&D Council offices)

www.dot.ga.gov
(Georgia Department of Transportation homepage)

http://tomcat2.dot.state.ga.us/thesource/specs/index
(Georgia Department of Transportation listing of qualified products and materials)

https://gatrees.org/wp-content/uploads/2020/02/BMP-Manual-2019-Web.pdf Georgia Forestry BMP Manual.pdf ("Georgia's Best Management Practices for Forestry")

https://gaswcc.georgia.gov/document/document/field-manual-erosion-sediment-control-2016-edition-pdf/download ("Field Manual for Erosion and Sediment Control in Georgia")

https://gaswcc.georgia.gov/document/document/manual-erosion-and-sediment-control-2016-edition/download ("Manual for Erosion and Sediment Control in Georgia")

https://www.epa.gov/nps/environmentally-sensitive-maintenance-dirt-and-gravel-roads
("Environmentally Sensitive Maintenance for Dirt and Gravel Roads")

https://www.epa.gov/nps/gravel-roads-maintenance-and-design-manual
("Gravel Roads: Maintenance and Design Manual")

Aggregate – various loose particulate materials such as sand,gravel, or stones

Apron – an erosion control device placed at or below the elevation of an area of high velocity water flow such as culvert outlets

Articulated bucket – an excavating bucket hinged and jointed at the end of an operating arm, which is also hinged and jointed

Back blading – practice of pulling soil or debris away from an area with the blade on the ground surface

Backhoe – a tractor with a hinged boom and bucket with movable jaws

Blading – use of an earthmoving blade to smooth high spots and irregularities in road surface to restore the crown without cutting into the road crust. Sometimes it is referred to dragging, but this is NOT the same as "grading" which cuts into the crust.

Bench – a horizontal or nearly so surface or step in a slope

Berm – a narrow shelf or rise that breaks the continuity of a slope

Best management practices – a series of practices or combination of methods or measures used to prevent water pollution including structural and non-structural controls, operations, or procedures

Binder – a material used to hold loose road materials together

Broad-based dip – a long, low sloped surface drainage diversion built into the road bed used to intercept and divert water flow out of the road while allowing normal vehicle speeds to be maintained. Also referred to as a rolling dip.

Brush barrier – linear pile of limbs, tree tops, logs, and other forest debris used to slow, diffuse, or intercept sediment in runoff

Buffer strip – the transitional land area between a stream or other water body and the adjacent land use that is used to intercept, trap, or filter sediment and other pollutants in surface runoff

Canopy cover – the amount of ground (or stream) shading provided by trees and shrubs

Channel – a natural or man-made ditch that conveys water in a concentrated flow pattern

Cohesion - the attraction on a molecular level that holds particles together

Compaction – process by which soil particles and/or aggregates are rearranged to decrease space between particles thereby increasing material strength and resistance to water infiltration

Cross-drain – a conduit through which ditch flow is directed under the road surface to the opposite side of the road

Crust – the compacted, durable, impermeable layer of an unpaved road usually at or just below the road surface

Culvert –a metal, concrete, or plastic conduit used to convey water under a road; differing from a bridge in that a culvert is usually placed entirely below the road surface

Detention structure – a basin or pond used to temporarily hold and then gradually release stormwater at a controlled rate

Ditch – man-made water course to convey runoff water

Ditch line – the top edge of a ditch's side slope where runoff falls into the ditch channel

Diversion – a channel with an associated berm or dike across or at the bottom of a slope to intercept and divert runoff into the channel

Dragging - use of an earthmoving blade to smooth high spots and irregularities in road surface to restore the crown without cutting into the road crust. Sometimes this is referred to blading, but this is NOT the same as "grading" which cuts into the crust.

Drop inlet – a structure designed to drop water from one level to another in a drain intending to dissipate surplus water energy and minimize downstream erosion

Embankment – a structure of soil, aggregate, or rock constructed above the natural ground surface

Energy dissipater – a device used to reduce the energy of flowing water such as stilling basins and plunge pools

Ephemeral stream – commonly referred to as drains, draws, or dry washes that typically do not have a well defined channel and flow only during and for short periods after precipitation, but may have leaf

litter/piles in the flow area

Erosion – the process by which soil particles are detached and transported by water, wind, ice, and gravity to a point downslope or downstream

Estuary – an inlet or arm of the sea where tides meet river currents

Filter strip – a long vegetative area planted to slow, trap, and filter pollutants transported in overland runoff

Gabion – large, multi-celled woven wire mesh baskets filled with rock to stabilize steep or highly erosive slopes

Geo-textile – manufactured fabrics used to improve the load capacity of roads or base materials

Gradient – the change in elevation per unit of length; the slope

Grading – cutting, redistribution, and re-compaction of road crust (often adding new road material) to re-shape the roadway profile

Gully – a highly eroded, swell defined channel

Headwall/header – a structure built at the inlet of a culvert of concrete or rock to protect the inlet from erosion

Hydroseeding – sowing of grass seed (may also include lime, fertilizer, or mulch) by pressurized water hose

Inslope – the feature of a road surface that slants to the inner or uphill side of a road to direct and concentrate runoff into a ditch

Intermittent stream – a watercourse that flows in a well-defined channel during wet seasons of the year

Live stakes – living, freshly cut branches of woody trees and shrubs used to establish a vegetative slope

Mold board – the iron plate (blade) of a dozer or motor grader which turns over the earth

Motor grader – a long wheel-base tractor with a long adjustable moldboard blade mounted underneath and forward of the driver's seat used to construct and smooth surfaces of roadways

Mulching – any loose covering of soil with organic or artificial materials to conserve soil moisture, hold soil in place, and minimize soil temperature fluctuations

Nonpoint source pollution – water pollution that is induced by precipitation and runoff not traceable to any discrete, identifiable source but coming from a multitude of individual sources. This pollution is best controlled by BMPs (best management practices) on the land

Outlet – the point of water discharge from a pipe, culvert, stream, lake, reservoir or estuary

Outslope – the feature of a road surface that slants to the outer or downhill side of a road to facilitate diffuse runoff flow drainage into stable vegetated areas. Outsloping road design is an alternative to crowned roadbeds or insloped to ditches

Perennial stream – a watercourse that flows in a well-defined channel most of the year under normal precipitation patterns

Permeability – capacity of soil to pass the flow of water through pore spaces

Plunge pool – a device used to dissipate flowing water energy with a variety of materials e.g. concrete, rip rap

Pollutants – any natural or man-made material that contaminates water for human use or stresses/kills aquatic life

Riparian buffer – the strip of undisturbed vegetated (usually matured trees, shrubs, grasses) land between the water body and adjacent land use

Riprap – rock and other large aggregate placed on soil surfaces to resist water energy

Road crown – the convex (curved) section or outline of the road surface

Runoff – the portion of precipitation that is discharged into a stream from adjacent land areas

Scarify – to break the road surface with a narrow blade

Sediment – soil particles that have been detached and transported into water during erosion

Sheet flow – runoff that flows in a thin layer over the ground surface

Shoulder – the edge of the roadway between the traveled portion of the roadway and the drainage

Silt fence – a manufactured fabric used to catch storm runoff and soil particles

Slope – the degree of deviation of ground surface from horizontal expressed as a ratio or percentage. The first number is the horizontal distance (run) and the second number is the vertical distance (rise). For example 2:1 means for every 2-foot horizontal distance the slope “rises” one-foot. 50 percent is another way to express this slope.

Slope board – a device usually of wood, used to confirm the cross slope of a road, ditch, or bank

Soil bioengineering – use of live woody vegetative cuttings to repair or stabilize slopes often in combination with other "non" riprap alternatives

Spoil – the soil or rock material excavated from a ditch, canal, pond, basin, or hill

Storm frequency – the statistical average (water flow) expected for a probability storm event. For example, a 10-year storm means the water flow at a particular bridge (or other site) has a 10 percent probability of occurring in any given year

Sub-base – the drainage layer of a road between the road surface and existing ground

Swale – an elongated depression (usually grass or pebbles) to convey, spread, and slow stormwater runoff discharge to a primary drainage

Tamp – repeated light strokes to force (aggregates) in place

Terrace – an embankment or combination of embankments and channels across a slope (generally following a contour) to control erosion by diverting or storing runoff instead of letting it flow uninterrupted down the slope

Toe of slope – the base of a slope (hill, streambank, or embankment)

Tracking – the process of running a tracked vehicle such as a dozer up and down a slope

Turbidity – measure of water clarity effected by suspended silt, sediment, and other particles in the water

Turn-out – the extension of the road's drainage ditch into a matured, established vegetative area to disperse and filter stormwater runoff

Water bar – a hump or small dam-like surface drainage structure used to close roads or trails and divert runoff

Under-drain – a drain placed under the road surface

Vegetated structures – a structure with living plant materials incorporated into the structure. For example grass swales, log cribs, coir (coconut) logs used at toe of slopes

Waters of the state – any and all rivers, streams, creeks, branches, ponds, lakes, reservoirs, drainage systems, springs, wells and other bodies of surface or subsurface water natural or artificial lying within or forming part of the boundaries of the state which are not entirely confined and retained completely upon the property of a single individual, partnership, or corporation

Water quality – a term used to describe the chemical, physical, and biological characteristics of water with respect to its suitability for a particular purpose such as human water supply, agricultural, industrial, and aquatic life support

Watershed – the land area that drains to a given point on a stream, lake, or estuary

Wetland – land that has a wet and spongy soil such as swamps, bogs, wet floodplains, or marshes

Windrow – logging debris and un-marketable woody material that is piled into rows for decomposition or burning

Georgia Better Back Roads Project

Before Implementation: Eroding road surface, road banks, and ditches

After Implementation: Better Back Roads BMPs;

- **Road re-surfacing** with grading, blading, aggregate gradation, crown and shoulder re-shaping.
- **Road bank re-shaping** and stabilization with hydro-seeding and mulching.
- **Ditch stabilization** with geo-textiles and type 1 riprap.

Photos: Courtesy of Two Rivers RC&D Council

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