Temporary Pipe Slope Drains

Source: Mississippi State University

BENEFITS

	L	M	H
Flow Control			
Erosion Control			
Sediment Control			
Runoff Reduction			
Flow Diversion	■	■	■

Description: Temporary slope drains consist of a pipe or tubing, installed from the top to the bottom of a disturbed slope. The drain transports concentrated runoff down the slope to a stabilized outlet, reducing the potential for erosion caused by runoff flowing over the disturbed slope.

Typical Uses: Used to transport concentrated runoff collected by a diversion structure, down a slope to a stable outlet or channel.

Advantages:
- Highly effective method for transporting runoff down a disturbed slope with minimal erosion.
- Easily constructed.
- Materials may be reused.

Limitations:
- Area around drain inlet must be carefully constructed to prevent water from flowing along the pipe, and breaching the diversion.
- The drain outlet must be discharged to a stable area, or outlet protection must be provided.

Longevity: Temporary, until vegetation is established

SUDAS Specifications: Refer to Section 9040, 2.10 and 3.14

A. Description/Uses

Temporary slope drains are constructed of flexible pipe or tubing, running from the top to the bottom of a disturbed slope. Slope drains provide a means of transporting collected runoff from the top of the slope to the bottom of the slope and prevent the erosive potential created by concentrated runoff flowing over the face of a disturbed slope.

Slope drains are commonly used in conjunction with diversion structures. A diversion structure at the top of the slope collects upland runoff and transports it to the desired outlet point. The slope drain provides an outlet for the diversion structure, safely carrying the collected runoff down the slope.

After grading, slopes are highly susceptible to erosion caused by sheet and concentrated flows from upland areas. Stabilizing the slope by seeding can be difficult as runoff over the slope may wash away seed and seedlings. Slope drains are used as a temporary measure to transport runoff down a slope, until the slope can be permanently stabilized. Eliminating flows over the face of a slope reduces erosion and provides newly planted seed an opportunity to establish itself without being washed away.

B. Design Considerations

Temporary slope drains should be sized to carry a two-year storm event. Table 7E-11.01 provides a summary of recommended pipe diameters based upon the contributing drainage area.

Table 7E-11.01: Slope Drain Diameters by Drainage Area

Maximum Drainage Area (acre)	Minimum Pipe Diameter (inches)
0.5	8
1.0	10
1.5	12
2.5	15
4	18
5	21
> 5	Special Design Required

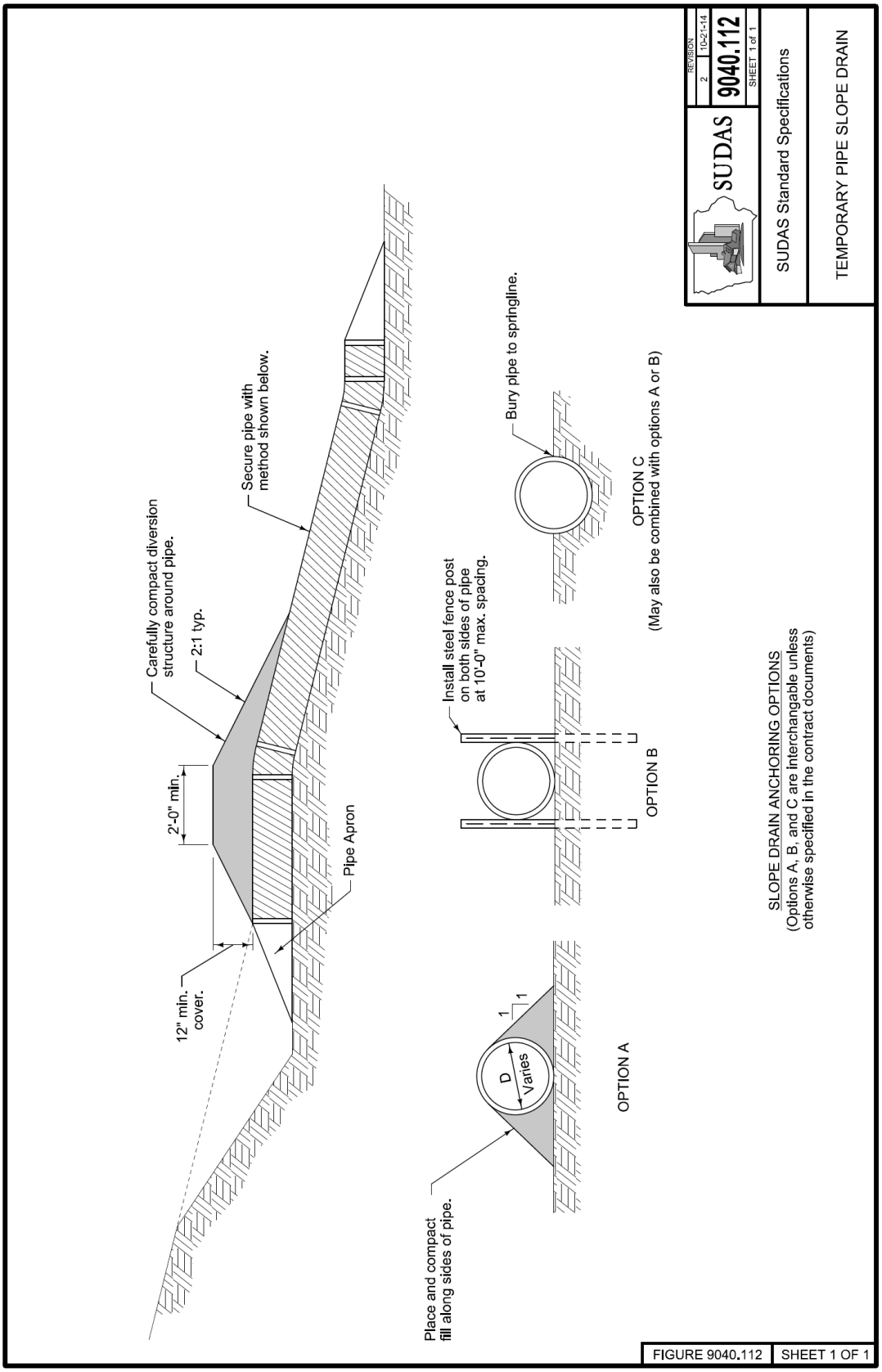
Note: Values assumed a 2 year storm, 15 minute T_c, and a runoff coefficient of 0.5

Slope drains are normally installed in conjunction with diversion structures. The diversion structure should have a height or depth at the pipe inlet of at least 18 inches, or 6 inches greater than the pipe diameter, whichever is larger. The soil under and around the inlet of the pipe should have a low permeability, and be carefully compacted to ensure that seepage does not occur along the pipe-soil interface. The area around the inlet should be graded to ensure that flows are directed toward the pipe inlet.

The slope drain should have a minimum grade of 3%. A metal or flexible apron should be provided at the inlet of the pipe. If the area draining to the diversion and slope drain is disturbed, the slope drain should outlet to a sediment trap or sediment basin. If the upland area is undisturbed, the pipe outlet should bypass any sediment basins or traps, and drain to a stabilized area.

Unless the pipe drains to a stable outlet, protection such as rip rap or a rolled erosion control product may be required at the outlet.

Figure 7E-11.01: Temporary Pipe Slope Drain
(SUDAS Specifications Figure 9040.112)



C. Application

Slope drains should be considered whenever a diversion structure is constructed on a disturbed slope steeper than 3%. When properly incorporated, diversion structures with slope drains provide a method to separate runoff from disturbed and stabilized areas, reducing the size requirements for sediment basins or traps.

D. Maintenance

The slope drain should be inspected for signs of leaking joints, pipe movement, erosion at the inlet and outlet, and seepage through the berm at the inlet.

E. Design Example

Assume the runoff from 7.5 acres of bare ground is intercepted by a diversion structure and carried to the location of a proposed slope drain. Determine the required diameter of the slope drain.

Using the techniques described in Chapter 2 - Stormwater, the following information is determined:

Time of Concentration, T_c = 15 minutes
Rainfall Intensity, I = 3.48 (Region 7)
Runoff Coefficient for bare ground, C = 0.5.

Using this information, the peak runoff is found to be 13.1 cfs by the Rational Method.

The minimum pipe diameter is found with the orifice equation (assume head to top of pipe).

$$Q = (0.6)(A)\sqrt{2gh}$$

Where:

Q	=	Runoff volume, cfs
A	=	Area of pipe opening
g	=	Acceleration of gravity, 32.2 ft/s^2
h	=	Head pressure (h=D/2 for head to top of pipe)

$13.1 = (0.6)\left(\frac{\pi \times D^2}{4}\right)\sqrt{2 \times 32.2 \times \frac{D}{2}}$, Solving for D yields a diameter of 1.9' or 23 inches.

Conclusion: Based upon the analysis, a 24 inch diameter pipe would be selected.