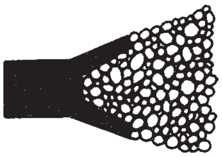
Practice no. 6.41

OUTLET STABILIZATION STRUCTURE



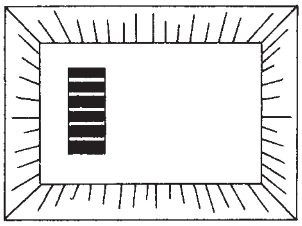
Erosion at the outlet of channels, culverts, and other structures is common, and can cause structural failure with serious downstream problems. It is necessary that exit velocities into streams be non-erosive for site conditions. Outlet stabilization structures are often installed to provide the necessary energy dissipation. A riprap-lined apron is the most commonly used structure for this purpose because it has relatively low cost and can be installed easily on most sites.

Other types of outlet stabilization structures include plunge pools, concrete impact basins, and paved outlets.

Outlet stabilization with riprap prevents erosion from high-velocity, concentrated flow.

Practice no. 6.50

EXCAVATED DROP INLET PROTECTION (Temporary)



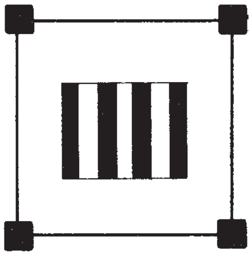
Protection against sediment entering a storm drain drop inlet can be provided by excavating an area in the approach to the drain. This temporary sediment-trapping device allows the storm drain to operate before the drainage area is permanently stabilized. The early use of storm drains during project development significantly reduces erosion problems.

The drainage area for a protected drain is limited to 1 acre, and the size, shape, and depth of excavation are designed for optimal sediment trapping. Weep holes are provided to drain the shallow pool. Frequent maintenance is required.

This practice can be used effectively in combination with other inlet protection devices.

Temporary excavated drop inlet protection creates an effective settling pool to remove sediment at a stormwater inlet.

Practice no. 6.51



HARDWARE CLOTH AND GRAVEL INLET PROTECTION

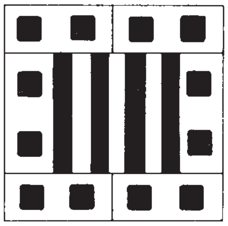
Hardware cloth and gravel inlet protection is used to temporarily protect yard inlets, grated storm drains, or drop inlets from sedimentation during construction. A wire-mesh hardware cloth is supported by steel posts and is surrounded by washed stone. It should be used where flow is light to moderate and is most effective where the inlet is expected to drain shallow sheet flow.

The drainage area should not exceed 1 acre per inlet. The immediate land area around the inlet should be relatively flat and located so that accumulated sediment can be easily removed. Frequent maintenance is required and excess sediment should be removed from the pool after each rainfall for maximum efficiency.

This practice must not be used near the edge of fill material and must not divert water over cut or fill slopes.

Hardware cloth and gravel inlet protection keeps sediment and debris from construction out of this drop inlet.

Practice no. 6.52



BLOCK AND GRAVEL INLET PROTECTION (Temporary)

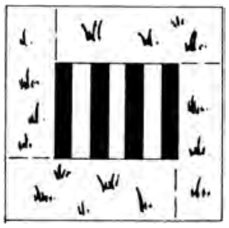
A small, sturdy barrier to trap sediment at the entrance to a storm drain can be formed for standard concrete block and gravel. Preventing sediment from entering the drain allows it to be used for stormwater disposal early in project development.

Lay blocks without mortar closely around the drain. Lay some blocks sideways to provide drainage. Place gravel around the outside of the blocks to restrict the flow and form a sedimentation pool. The pool should drain slowly through the gravel. Drainage area is limited to 1 acre and pool depth is limited to 2 feet. Frequent maintenance is required.

Block and gravel inlet protection prevents sediment from entering this storm drain during construction.

Practice no. 6.53

SOD DROP INLET PROTECTION



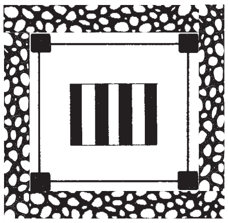
Grass sod properly placed around a storm drain can provide permanent stabilization of the drain entrance under certain site conditions. The drainage area should not exceed 2 acres, the entrance flow velocity must be low, and the general area around the inlet should be planned for vegetation. Maintain the sod in a healthy, vigorous condition.

Although the storm drain entrance could be stabilized by paving, using pre-cast blocks, or other structural means, the use of permanent vegetation is usually preferred for aesthetic reasons.

Sod drop inlet provides permanent protection for a storm drain after the drainage area is stabilized.

Practice no. 6.54

ROCK DOUGHNUT INLET PROTECTION



A rock doughnut inlet protection is used to prevent sediment from getting into drop inlets with 1 acre drainage areas, or inlets that receive high velocity water flows from many directions. Sediment is captured in an excavated depression surrounding the inlet. Other measures may be necessary for a larger drainage area.

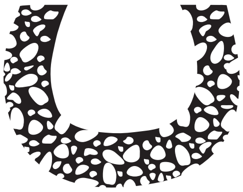
The stone structure must have a top elevation of at least 12 inches lower than the ground elevation downslope from the inlet. The practice may be altered if the flow is received from only one direction.

Frequent maintenance is required and excess sediment should be removed from the pool after each rainfall for maximum efficiency.

Rock Doughnut Inlet Protection uses larger riprap for the structure base and smaller washed stone to keep smaller particles of sediment from entering the storm drain inlet.

Practice no. 6.55

ROCK PIPE INLET PROTECTION



The rock pipe inlet protection allows the early use of the storm drain system. Prior to stabilization of the disturbed area, this practice prevents sediment from entering, accumulating in, and being transferred by a culvert or storm drain system. The horseshoe shaped rock dam structure may protect a pipe with a maximum diameter of 36 inches.

This inlet protection may be used to supplement additional sediment traps or basins at the pipe outlet, or used in combination with an excavated sediment storage area to serve as a temporary sediment trap. The maximum drainage area should not exceed 5 acres. When used as a sediment trap, the surface area and volume requirements must be met. Frequent inspections are necessary.

Do not install this measure in an intermittent or perennial stream.

Rock Pipe Inlet Protection uses a small rock dam-type barrier to divert sediment laden water away from the pipe.

Practice no. 6.60

TEMPORARY SEDIMENT TRAP

Trapping sediment at selected points in a construction area reduces potential for sediment damage, simplifies structural design, provides for convenient removal of sediment, and limits damage should a structure fail.

Small sediment traps are often installed in outlets for diversions, channels, slope drains, and other points where sediment-laden water is concentrated. Restrict the drainage area to 5 acres or less and limit the embankment height. Locate sites where emergency bypass flow is possible and potential damage from failure is low. Include 3 baffles in the sedimentation pool to maximize trapping efficiency. Traps must be readily accessible for periodic sediment removal and other necessary maintenance.

The trap is usually formed by constructing an earthen embankment across a low area to form a sedimentation pool during rainfall runoff events. It may also be made by excavation or a combination of excavation and fill. The outlet spillway section is constructed of stone, and provides drainage for the pool. The inside face of the outlet section is lined with gravel to slow the release of drainage water and improve sediment trap efficiency.

Temporary sediment trap provides a settling pool for a small drainage area. Gravel allows dewatering and a stable outlet.

Practice no. 6.61 SEDIMENT BASIN

Sediment basins are usually constructed by building a low earthen dam across a drainageway to form a temporary sediment storage pool. A properly designed spillway outlet with adequate freeboard is essential. The embankment should be well compacted and vegetated. Sediment basins may also be formed by excavation, but these are usually more costly. A combination embankment/ excavated basin is often utilized.

Basins are located to capture sediment from as much of the disturbed area of the site as possible and should be installed before clearing and grading begin. Ease of basin cleanout and spoil disposal should be considered in site selection.

To improved trap efficiency the basin should have the maximum surface area possible, and sediment should enter the basin as far from the outlet as possible. Baffles should be installed in the sedimentation pool to maximize trapping efficiency.

Dams should not be constructed in intermittent or perennial streams or where failure might cause loss of life or serious property damage.

Sediment basins are strategically located to trap sediment near the outlet of a work site.

Practice no. 6.62 SEDIMENT FENCE (Silt Fence)

A sediment fence is a permeable barrier erected on small disturbed areas to capture sediment from sheet flow. It is made of filter fabric buried at the bottom, stretched and supported by steel posts.

The sediment fence reduces the velocity of flow, allows deposition, and retains sediment. Because sediment fences are not designed to withstand high heads, the drainage area must be restricted and the fence located so that water depth does not exceed 1.5 feet at any point. Sediment fences may be designed to store all the runoff from the design storm, or located to allow bypass flow when the temporary sediment pool reaches a predetermined level. Sediment fences may also divert small volumes of flow to protected outlets.

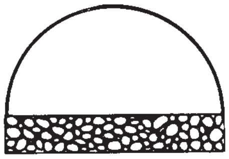
In the design of a sediment fence exercise care to prevent failure from undercutting, overtopping, or collapsing. Ensure that flow bypass areas and overflow outlets are stable.

Check sediment fences after each significant rainfall, remove the necessary sediment, and make repairs promptly. The design life of a synthetic sediment fence is 6 months or less.

Do not install sediment fence across streams or ditches where flows are concentrated.

Sediment fences help prevent off-site sedimentation when properly located, installed, and maintained.

Practice no. 6.63 ROCK DAM



A rock dam is a rock embankment that forms a sedimentation basin. It may be used in drainage areas too large for temporary sediment traps, but not over 10 acres. The rock dam is suitable for sites where a stable earthen embankment would be difficult to construct, and riprap and gravel are readily available. The maximum height is 8 feet at the spillway.

The spillway is designed with a long weir crest to keep flow shallow and discharge velocities low. To further reduce sedimentation, install baffles for more effective filtration of smaller particles. The inside face of the dam is lined with gravel to reduce seepage velocity and maintain a sedimentation pool during runoff events. The pool should drain slowly between runoff events.

The rock dam should never be located in an intermittent or perennial stream.

Rock dam forms a sedimentation basin with a broad-crested principal spillway to keep flow depth and discharge velocity low.

Practice no. 6.64

SKIMMER SEDIMENT BASIN

Skimmer sediment basins are an earthen embankment suitably located to capture sediment, with a trapezoidal spillway lined with an impermeable geotextile or laminated plastic membrane, and equipped with a floating skimmer for dewatering. The skimmer is a sedimentation basin dewatering control device that withdraws water from the basin's water surface, thus removing the highest quality water for discharge downstream.

These practices are needed where drainage areas are too large for temporary sediment traps, and may require less volume and area than a temporary sediment trap or a rock dam. The maximum drainage area is 10 acres. Baffles should be installed in the sedimentation pool to maintain trapping efficiency.

Do not locate the skimmer sediment basin in intermittent or perennial streams.

All parts of the basin require frequent inspection and maintenance as needed to remain efficient and prevent failures.

Skimmer sediment basins dewater the sedimentation pool from the surface to ensure the highest quality water is being discharged.

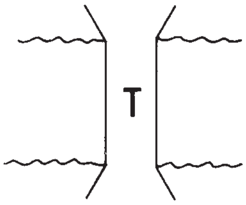
Practice no. 6.65 BAFFLES

Porous baffles are installed inside temporary sediment traps, rock dams, skimmer basins, and sediment basins to reduce the velocity and turbulence of the water flowing through the measure, and facilitate the settling of sediment from the water before discharge. Baffles improve the rate of sediment retention by distributing the flow and reducing turbulence. This process can improve sedimentation retention and allow the capture of soil particles 50 percent smaller than those that can be captured without baffles.

Recommended materials for the baffles include jute backed by coir erosion blankets, coir mesh, and tree protection fence folded over to reduce pore size. Installation is similar to a sediment fence. It is essential to install the measure securely to avoid blow outs and other malfunctions. Frequent inspections are required.

Baffles reduces the velocity and turbulence of water flowing through a measure and assists in the settling of sediment before the water exits the site.

Practice no. 6.70 TEMPORARY STREAM CROSSING

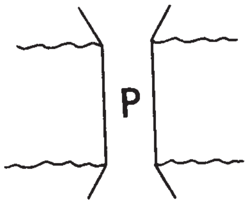


Stream crossings are direct sources of water pollution. They cause flooding and safety hazards, and can be expensive to construct. If washed out or damaged, they can also cause costly construction delays. Plan the development to complete work on each side separately to minimize stream crossings.

Stream crossings are of three general types: bridges, culverts, and fords. In selecting a stream crossing practice consider: frequency and kind of use, stream channel conditions, overflow areas, potential flood damage, surface runoff control, safety requirements, and installation and maintenance costs. Temporary crossings may overflow during peak storm periods, however, the structure and approaches must remain stable.

Temporary stream crossing may be a ford, culvert or bridge. Bridges allow full stream flow, but must be designed and built to support expected loads.

Practice no. 6.71 PERMANENT STREAM CROSSING



Permanent stream crossings provide suitable means for crossing streams or other watercourses during and after construction.

Planning considerations for permanent stream crossings are essentially the same as for temporary stream crossings except that permanent stream crossings should be subject to less frequent overflow. Flooding and erosion can be minimized by locating permanent stream crossings in higher, better drained stream sections.

Depending on location and ultimate use, permanent stream crossings may have to meet local government or NCDOT standards. Considerations include maximum anticipated loads, safety, and flow capacities.

Permanent stream crossings require structures that will not erode, overtop, or cause flooding.

Practice no. 6.72 VEGETATIVE STREAMBANK STABILIZATION

Upstream development accelerates channel erosion be increasing the velocity, frequency, and duration of flow. As a result, many natural channels that were stable become unstable following urbanization.

Stream channels may be stabilized by selected vegetation or by structural means. In many cases a combination of vegetative and structural measures should be used. Wherever possible, it is best to protect banks with living plants that are adapted to the site. Natural plant communities are aesthetically pleasing, provide a habitat for fish and wildlife, afford a self-maintaining cover, and are less expensive and damaging to the environment.

Evaluated the erosion potential of the channel carefully and establish appropriate vegetation wherever sire conditions permit. Stream channel velocities for the 10-year storm should generally be less than 6 feet per second for effective stabilization by vegetative means.

Vegetative Streambank Stabilization protect streamsbanks from erosion