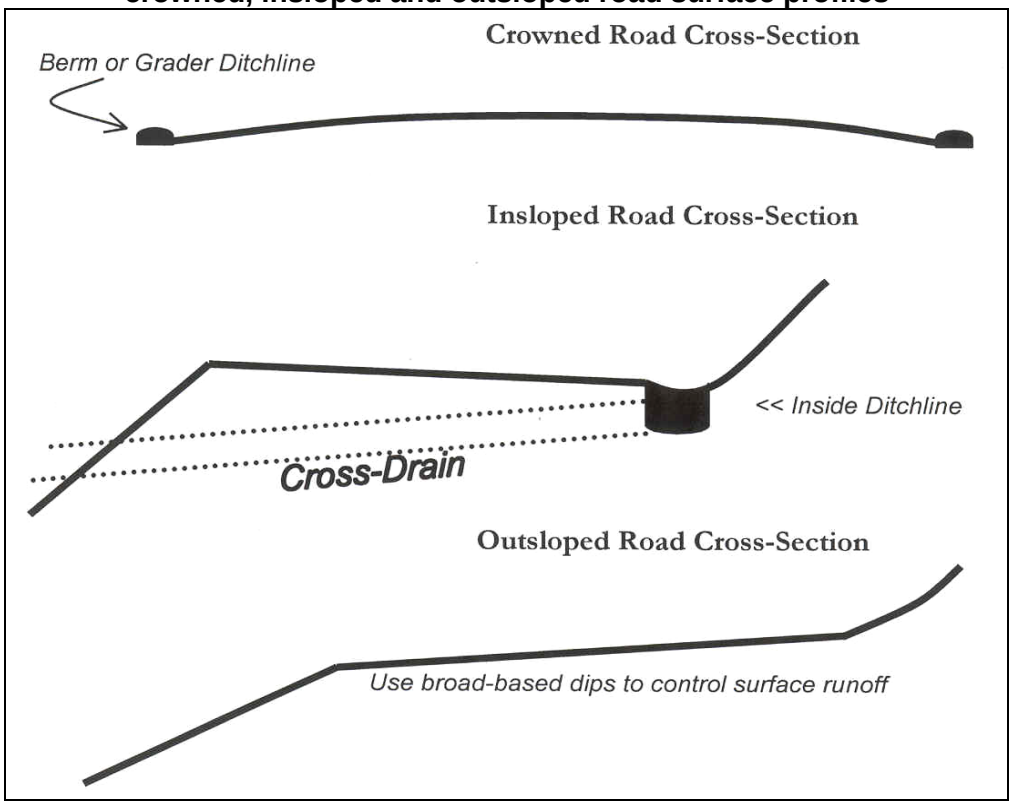
- For freshly graded outsloped or crowned roads, a temporary low berm along the outside (downslope side) edge of the road may prevent washing away of the soft soil and fill material:
  -- If a temporary berm is installed, provide outlets or gaps so runoff can move away from the road surface in a controlled manner.

- Maintain the road surface as needed to minimize or repair ruts, holes, or depressions that hold water, which can weaken the roadbed or create concentrated runoff with sediment transport.

Figure 5I: Schematic cross-sectional sketch of crowned, insloped and outsloped road surface profiles



Caption:
A crowned road may need slight berms and/or grader ditchlines alongside either edge to control runoff.

An insloped road needs appropriate inside ditchlines to collect runoff. A cross-drain (dotted line) is also needed to drain the inside ditchline.

An outsloped road can effectively use broad-based dips to manage surface water runoff.

Part 2 -- BMP Tools to Capture Sediment

Capturing or containing sediment is the second part of using BMPs related to roads, skid trails, stream crossings and decks.

Your first goal should be to prevent or halt accelerated erosion once you have controlled the runoff. When those efforts are not adequate, capturing the sediment before it reaches a stream is the last option you have:

-- Stop or prevent sediment transport at its source.
-- If that doesn't work, keep the sediment on site.
-- Above all else, keep the sediment out of the streams and waterbodies.

The BMP tools discussed in Part 2 are:

- Filter Areas
- Silt Fences
- Brush Barriers
- Sediment Traps / Pits
- Straw Bales
- Check Dams

Consider the long-term potential for effectiveness and maintenance when deciding which BMP tools to use when capturing sediment.

Locations where these BMP tools are especially useful include:
-- Disturbed soil areas near streams or other waterbodies.
-- Approaches to stream crossings.
-- Steep slopes or slopes with soil of high erosion and runoff risk.
-- Along slopes or grades to periodically capture sediment in runoff.
-- As a catchment for collected or diverted surface runoff.

Some Benefits of Capturing Sediment

- Protection of water quality from pollution potential by containing sediment in runoff before flow picks up speed and volume or enters a waterbody.
- Improved access on your forestland.
- Added value of your financial investment in sustaining forestland access.

Figure 5J: Temporary sediment capture alongside a forest road

Caption:
This temporary holding area, reinforced with stone, is successfully capturing runoff and sediment.

The stone provides good support and backing.

Filter Areas

Filter areas are usually a long-term, low-cost option to capture, slow, and contain runoff so sediment and other potential pollution can settle out before reaching a waterbody.

Filter areas can be differently shaped or sized, depending upon the application and needs of the soil and site.

FPG

Refer to FPG .0201 as it relates to SMZs, which are a type of required filter area.

The DWQ riparian buffer rules are also a type of <u>mandatory</u> filter area that must be applied in certain parts of North Carolina.

BMPs for Filter Areas

- Permanent groundcover should be retained or established that allows runoff to slow down and soak into the soil:
  - -- Natural, relatively undisturbed groundcover and/or vegetation is usually the best choice for a filter area.
  - -- Established groundcover can also be effective, but may require additional BMPs and/or maintenance.

- Intensive soil disturbance should be minimized.

- Use stable, well-drained soils for filter areas when available.
  - -- If unstable soils must be used for a filter area, install treatments such as erosion matting or other methods to stabilize the soil.

Did You Know?

Other names for these include:
- *Sediment basins*
- *Settling pit*
- *Silt trap or silt pit*
- *Tank traps*

Sediment Traps or Pits

Sediment traps are excavated holes that trap and store runoff, and are usually installed where runoff is concentrated nearby streams and other waterbodies.

Traps or pits can be used for either temporary runoff control, or long-term installation. Permanent use of traps / pits will require more substantial construction and periodic maintenance.

Helpful Hints:

Traps or pits are effective to collect runoff that is diverted by a broad-based dip, waterbar, cross-drain, turnout or ditchline.

BMPs for Sediment Traps or Pits

- Excavate the pit with a suitable opening and depth to capture the expected sediment runoff while minimizing soil disturbance to the adjacent area. Refer to Appendix 14 for suggested sediment pit sizing dimensions.

- Locate the pit within stable, well-drained soils when available.
  - -- If the pit must be situated within unstable soils, install additional measures to provide soil stabilization around the pit.

- Dispose or stabilize the excavated spoil material to keep it from washing away. Avoid using the spoil to build up the sides of the pit, since this loose spoil material can easily wash away or fall back into the pit.

- For sediment pit installations intended to be permanently functional:
  - -- Create a reinforced outlet for overflow capacity that will reduce the likelihood of the pit walls being washed away or ‘blown out’.
  - -- Harden the walls of the pit to minimize the risk of structural failure.
  - -- Revegetate exposed soil around the perimeter of the pit.
  - -- Periodically clean out accumulated sediment. A useful rule is whenever the pit is half full, remove and stabilize the accumulated sediment.

Caption:
This sediment pit is located in a good position to capture sediment that flows off of this graveled, outsloped forest road.

The pit is positioned well away from the stream (in background).

NOTE -- The headwall on this pit may need reinforcement, or have to be sloped back, to keep soil from falling into the pit after being saturated from precipitation.

Figure 5K: A functioning sediment pit excavated alongside a forest road

Silt Fence

Silt fence is a geotextile or fabric that is supported with stakes, with the bottom partially buried into the ground and is for temporarily capturing runoff.

Helpful Hints:

Silt fences are usually man-made materials.

Think of a silt fence as similar to a coffee filter - - the idea is to capture the sediment in the runoff, while allowing the water to still trickle through.

A silt fence is most effective for temporarily capturing sediment and delaying runoff that occurs across the ground surface, before reaching a channel or forming gullies and erosion trenches in the land.

Silt fence cannot effectively capture mass movement of sediment or capture runoff for an extended period of time.

Silt fencing may be useful to capture sediment in areas of exposed bare soil until vegetation can be established. Due to the natural roughness and uneven terrain on forestry job sites, a silt fence can be very difficult to correctly install and still remain effective.

BMPs for Silt Fence

- Additional measures upslope and downslope of the silt fence may be required to slow, control and capture sediment.
  -- If there is considerable sediment build-up along the silt fence, determine the sediment source and adjust or add BMPs accordingly.

- The suggested drainage area limit is 100 feet of fence for every one-quarter acre of land. Refer to Table 5-2 below for further reference.

- Set fencing along the land contours and extend the fencing far beyond the expected pathway(s) of runoff flow. The ends of the fencing should be gently turned like a sideways 'J', with the hook facing uphill.

Watch Out!

Silt fence should never be used as the only BMP tool on the job site.

Additional BMPs are needed to control runoff and capture sediment.

You should expect silt fencing to fail during heavy precipitation - - plan accordingly.

If you observe a heavy sediment accumulation, look up-slope and re-evaluate your BMPs.

- Bury the bottom 4 to 6 inches of silt fence securely into the ground to keep runoff from flowing underneath:
  -- Install the fence so that the buried portion is along the upslope face of the fence, to prevent the fence from getting washed over by sediment.

- Adequately reinforce the silt fencing from being knocked over or blown out. Wire fencing backer or additional staking can be used.

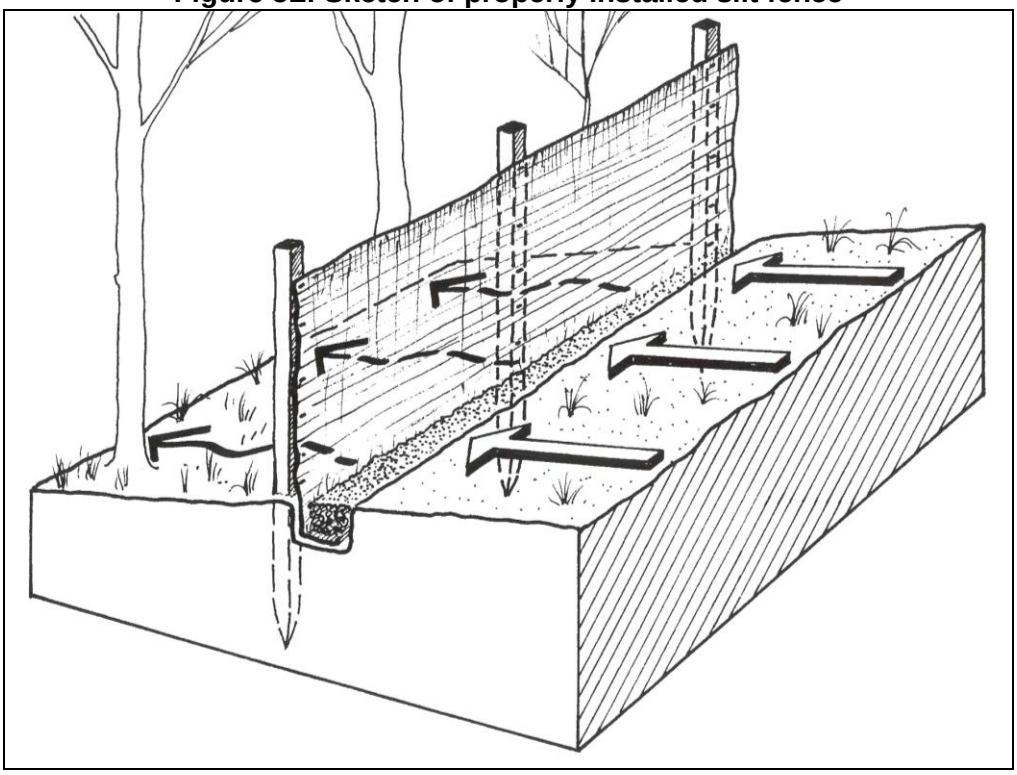
- Frequently monitor the silt fence after installation. Promptly take action to maintain or improve the filtering effectiveness.

Table 5-2: Recommended Applications for Every 100 Feet of Silt Fence

Slope	Maximum Slope Length Between Fence-rows (feet)	Maximum Drainage Area (acres)
0 to 2%	100	0.23
2% to 5%	75	0.17
5% to 10%	50	0.11
10% to 20%	25	0.06
20% +	15	0.03

Table 5-2 was adapted from N.C. Division of Land Resources' Erosion and Sediment Control Handbook "Practice Standards and Specifications."

Figure 5L: Sketch of properly installed silt fence



Caption:
This sketch depicts the proper installation of silt fence.

Note the bottom of the silt fence along the upslope side is buried into the soil, and the fence is securely staked.

Consider setting multiple rows of fencing to provide additional protection.

Avoid using silt fence to divert water - - it should be used only as a temporary sediment filter.

(Illustration provided with permission and courtesy of Maine Forest Service).

Helpful Hints:

Places where bales may be helpful:

- *Outlets of water diversion tools described in Part 1*
- *Stream crossing approachways*
- *Alongside freshly graded outsloped roads*
- *Around edges of log decks*
- *Supporting or supplementing silt fence installations*

Straw Bales

Straw bales, or a bale of other natural fibers, can be a low-cost and effective tool to slow runoff and capture sediment. Bales often are better than silt fence or brush barriers since they can conform better to the ground surface.

Bales can be placed around the perimeter of an area with exposed soil, or across the pathway of runoff flow. The bales will help control the runoff, and act as a sediment filter.

However, since they are natural fibers, the bales will eventually decompose and breakdown. As a result, they should be used for temporary runoff capture and control.

BMPs for Straw Bales

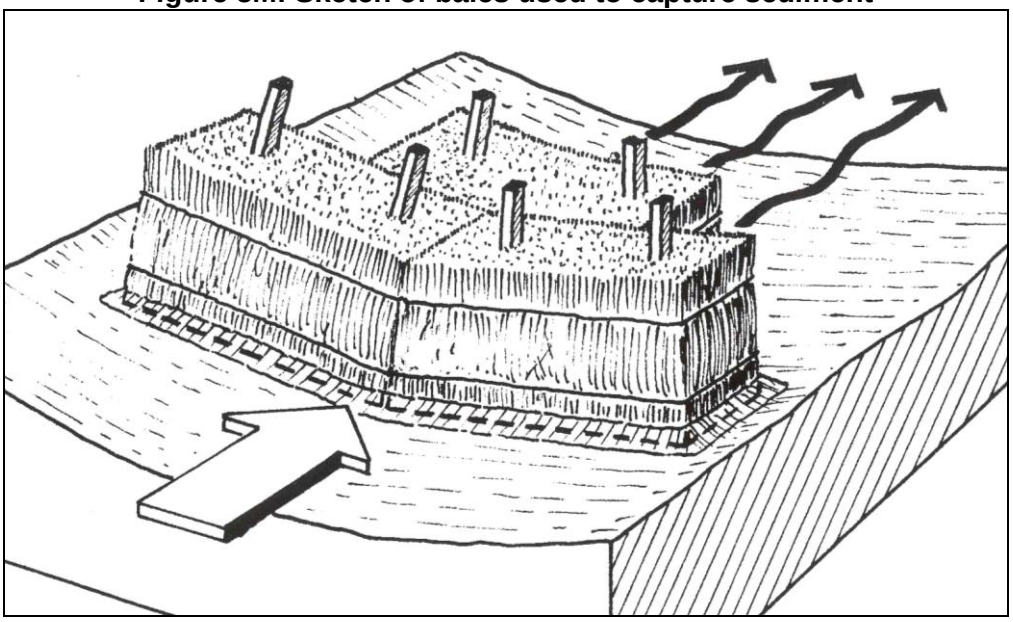
- Additional measures upslope and downslope of the bales may be needed to slow, control and/or capture sediment.
  -- If there is considerable sediment build-up along the bales, determine the sediment source and adjust your BMPs accordingly.

- Set bales tightly against the ground surface and anchor the bales firmly into the soil if the bales are likely to wash away.

- If square bales must be stacked, stagger the joints between bales so they do not line up over the joints in the previous layer, similar to brick laying.

- Frequently monitor bales after installation. Promptly take action to maintain or improve effectiveness.

Figure 5M: Sketch of bales used to capture sediment



Caption:
When bales are used to capture sediment, you should make sure that:
-- Bottom of the bales conforms to the ground surface to prevent leakage.

-- Bales are secured if needed to prevent them from being washed away.

-- Joints between successive bales are staggered like bricks.

(Illustration provided with permission and courtesy of Maine Forest Service)

Helpful Hints:

Places where brush barriers may be helpful:

- *Alongside newly constructed or graded roads*
- *Alongside and on top of skid trails*
- *Around edges of log decks*
- *Stream crossing approachways*

Brush Barriers

Brush barriers are piles of leftover, unusable tree and vegetation debris that is carefully piled and packed down to act as a temporary filter barrier to slow runoff and capture sediment.

Creating brush barriers is a productive use and disposal for debris that is generated by road or skid trail construction and can be a low-cost method of temporary sediment capture.

BMPs for Brush Barriers

- Pile and pack down brush to achieve close contact with the ground surface.
  -- This may require breaking or cutting large pieces of material into smaller chunks that more easily conform to the surface of the ground.

- Use additional BMP tools such as silt fences, bales, filter areas or other methods to improve trapping effectiveness where brush barriers fail to capture enough sediment because of their loose configuration.

- Avoid removing the brush barrier once it is established.

Figure 5N: A brush barrier alongside a closed road in Caldwell Co., N.C.

Caption:
The brush barrier installed along the right edge of this stabilized forest road will help capture sediment before it can move downslope.

Figure 5O: A brush barrier at the base of an active road

Caption:
Brush has been laid down at the base of the roadbed, in the center of the photo. Also note the well-vegetated roadbed and side / cut bank.

(Photo figure 5O provided courtesy of Coweeta Hydrologic Laboratory, Southern Research Station, USDA-Forest Service.)

Helpful Hints:

While usually constructed of stone rip-rap, check dams can also be built from sandbags, sacks of concrete, logs or other suitable hardened materials.

Watch Out!

Check dams are not appropriate for installation within streams.

Check Dams

Check dams are short, hardened barriers established within inside ditchlines to slow the speed of runoff and capture sediment. Check dams can also be useful to control the runoff that comes from the outlets of water diversions (such as those described in Part 1 of this chapter.)

BMPs for Check Dams

- Consider laying down geotextile fabric before placing the check dam's construction material. This keeps material from sinking into the ground.
- Provide ample support at the base of the check dam in order to hold back and contain the sediment.
- Tie-in the base of the check dams with the soil to keep runoff from seeping under or 'blowing out' around sides of the the dam location.
- The center of the check dam should be lower than each outer edge to provide overflow capacity of water during heavy flows.
- The total height of the check dam should not exceed 3 feet. Taller structures are more prone to failure.
- Space the check dams within the channel so the top of each downslope check dam matches the same elevation as the base of the next higher dam.
- If check dam effectiveness is compromised by sediment buildup, periodically remove built-up sediment from behind the dams. Dispose of or stabilize this material to keep it from washing into waterbodies.

Figure 5P: Check dams installed within a turnout from a forest road

Caption:

These small check dams provide sediment capture within a turnout that drains a graveled forest road.

Note the sediment accumulation captured by the front two check dams.

The rear two check dams appear to not have any sediment accumulation yet, but provide good reinforcements.

The area is well vegetated and stabilized.