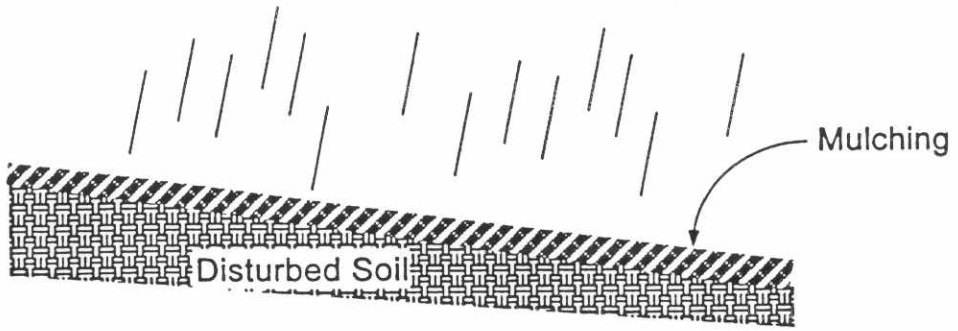
# Mulching




**Applications**

- Perimeter Control
- **Slope Protection**
- Sediment Trapping
- Channel Protection
- **Temporary Stabilization**
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**Targeted Constituents**

- ● Sediment
- ○ Nutrients Toxic Materials
- ○ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Wastes

**Implementation Requirements**

- ◒ Capital Costs
- ◒ Maintenance
- ○ Training
- ○ Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**

1

## DESCRIPTION

Mulching is the application of a layer of chopped straw, hay or other material which is spread uniformly over barren areas to reduce the effects of erosion from rainfall. Types of mulch include organic materials, straw, wood chips, bark or other fibers. Mulch also comes in prepackaged forms, using straw, hay or other material with organic and inorganic binding systems.

## PRIMARY USE

Mulch is used to temporarily and/or permanently stabilize clear or freshly seeded areas. It protects the soil from erosion and moisture loss by lessening the effects of wind, water, and sunlight. It also decreases the velocity of sheet flow, thereby reducing the volume of sediment-laden water flow leaving the mulched area.

## APPLICATIONS

Mulch may be used on any construction-related disturbed area for surface protection including:

- Freshly seeded or planted areas,
- Areas at risk due to the time period being unsuitable for growing vegetation,
- Areas that are not conducive to seeding or planting.

## DESIGN CRITERIA

Mulch may be used by itself or in combination with netting or other anchors to promote soil stabilization.

Several manufacturers provide an organic mulch with an attached netting to simplify installation. Installation should adhere to manufacturer's specifications and requirements.

- Choice of mulch depends largely on slope, climate, and soil type in addition to availability of different materials. Straw and hay are the recommended choices due to their availability and biodegradability.
- Mulch should be applied in an even and uniform manner where concentrated water flow is negligible.

# Mulching

- Application of straw or hay mulch should be approximately 2 tons dry per acre spread uniformly across the disturbed area. Other material should be applied such that 25% of the soil is visible through the mulch.
- For areas using straw mulch and the slope is greater than 3-5%, anchoring of the mulch with a Krimper Tool is required.

**LIMITATIONS**

Mulches are subject to removal by wind or water under severe climatic conditions. Mulches lower the soil temperature which may result in longer seed germination periods.

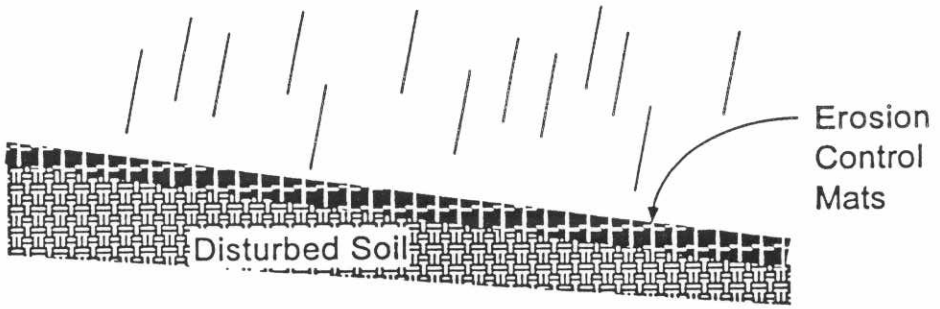
**MAINTENANCE REQUIREMENTS**

Mulched areas must be inspected on a weekly basis, and after significant (>0.5 inch) rainfall, for thin or bare spots caused by natural decomposition or weather related events. Mulch in high traffic areas should be replaced on a regular basis to maintain uniform protection.

BMP

1

# Erosion Control Mats




**Applications**

- Perimeter Control
- Slope Protection
- Sediment Trapping
- Channel Protection
- Temporary Stabilization
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**Targeted Constituents**

- ◒ Sediment
- ○ Nutrients
- ○ Toxic Materials
- ○ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Wastes

**Implementation Requirements**

- ● Capital Costs
- ◒ Maintenance
- ◒ Training
- ◒ Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**

2

## DESCRIPTION

An erosion control mat (ECM) is a geomembrane or biodegradable fabric placed over disturbed areas to limit the effects of erosion due to rainfall impact and runoff across barren soil. Erosion control mats are manufactured by a wide variety of vendors addressing a wide variety of conditions such as vegetation establishment, protection from heavy rainfall, and high velocity flow. Types of matting include organic (jute, straw) and synthetic (plastic and glass fiber) materials.

## PRIMARY USE

Mats can provide both temporary and/or permanent stabilization for disturbed soil or barren areas. It is used for difficult to stabilize areas such as steep slopes, temporary or permanent drainage swales, embankments or high traffic (pedestrian) areas. Some mats are reusable, reducing the initial cost of the installation.

## APPLICATIONS

Mats can be used on any construction-related disturbed area, but are particularly effective for erosion control of fine grained soils, and on short, steep slopes (such as stream banks) where erosion is high and growth of vegetation is slow.

## DESIGN CRITERIA

A mat may be used by itself or in combination with netting or other anchors to promote soil stabilization. Choice of matting depends largely on slope, climate, soil type, and durability. Mats are usually installed according to the manufacturer's recommended guidelines. After appropriate installation, the matting should be checked for: uniform contact with the soil; security of the lap joints; and flushness of the staples with the ground.

Manufacturers information will verify acceptable applications for a particular product.

## LIMITATIONS

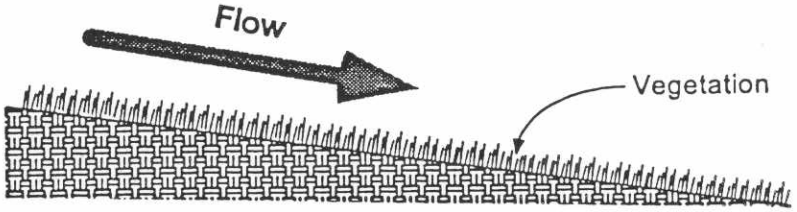
Although matting is highly effective in controlling erosion, it may be less cost-effective than other BMPs for erosion control and it may require a

contractor with considerable mat installation experience for installation.

**MAINTENANCE REQUIREMENTS**

Matted areas must be inspected on a weekly basis, and after significant (>0.5 inch) rainfall, for bare spots caused by weather related events. Missing or loosened matting must be replaced or re-anchored.

# Vegetation




**Applications**

- Perimeter Control
- **Slope Protection**
- Sediment Trapping
- **Channel Protection**
- **Temporary Stabilization**
- **Permanent Stabilization**
- Waste Management
- Housekeeping Practices

**Targeted Constituents**

- ● Sediment
- ◒ Nutrients Toxic Materials
- ○ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Wastes

**Implementation Requirements**

- ◒ Capital Costs
- ◒ Maintenance
- ○ Training
- ● Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**

3

## DESCRIPTION

Vegetation, as a Best Management Practice, is the sowing of annual grasses, small grains or legumes to provide interim and permanent vegetative stabilization for disturbed areas. Unless otherwise specified, Bermuda Grass is to be used for permanent seeding. Temporary stabilization may be achieved during winter by seeding with Rye Grass.

## PRIMARY USE

Vegetation is used as a temporary or permanent stabilization technique for areas disturbed by construction but not protected by pavement, building or other structures. As a temporary control, vegetation is used to stabilize stockpiles and barren areas which are inactive for long periods of time. As a permanent control, grasses and other vegetation provide good protection for the soil along with some filtering for overland runoff. Subjected to acceptable runoff velocities, vegetation can provide a good method of permanent storm water management as well as a visual amenity to the site.

Other BMPs may be required to assist in the establishment of vegetation. These other techniques include erosion control matting, swales and dikes to direct flow around newly seeded areas and proper grading to limit runoff velocities during construction.

## APPLICATIONS

Vegetative techniques can and should apply to every construction project with few exceptions. Vegetation effectively reduces erosion in swales, stock piles, berms, mild to medium slopes and along roadways. Vegetative strips can provide some protection when used as a perimeter control for utility and site development construction.

In many cases, the initial cost of temporary seeding may be high compared to tarps or covers for stockpiles or other barren areas subject to erosion yet inactive. This initial cost should be weighed with the amount of time the area is to remain inactive, since maintenance cost for vegetated areas is much less than most structural controls.

# Vegetation

**DESIGN CRITERIA**

*Surface Preparation*

- Interim or final grading must be completed prior to seeding, minimizing all steep slopes.
- Install all necessary erosion structures such as dikes, swales, diversions, etc., prior to seeding.
- Groove or furrow slopes steeper than 3:1 on the contour line before seeding.
- Provide 4-6 inches of topsoil over unsuitable soils.
- Seed-bed should be well pulverized, loose and uniform.

*Plant Selection, Fertilization and Seeding*

- Use only high quality, USDA certified seed.
- For permanent vegetative cover during the period from March to August (inclusive) use hulled Bermuda Grass applied at 10 - 12 pounds per acre.
- For permanent vegetative cover during the period from September to February (inclusive) use unhulled Bermuda Grass applied at 15 - 20 pounds per acre.
- For temporary stabilization on disturbed areas or stockpiles, use Rye Grass seed applied at 40 - 50 pounds per acre.
- Fertilizer shall be applied according to the manufacturer's recommendation with proper spreader equipment. Typical application rate for 10-10-10 grade fertilizer is 700-1000 pounds per acre. DO NOT OVER APPLY FERTILIZER.
- If hydro-seeding is used, do not mix seed and fertilizer more than 30 minutes before application.
- Evenly apply seed using cyclone seeder, seed drill, cultipacker or hydroseeder.
- Provide adequate water to aid in establishment of vegetation.
- Use appropriate mulching techniques where necessary.

**LIMITATIONS**

Vegetation is not appropriate for areas subjected to heavy pedestrian or vehicular traffic. As a temporary technique, vegetation may be costly when compared to other techniques.
Vegetation is not appropriate for rock, gravel or coarse grained soils unless 4 to 6 inches of topsoil is applied.

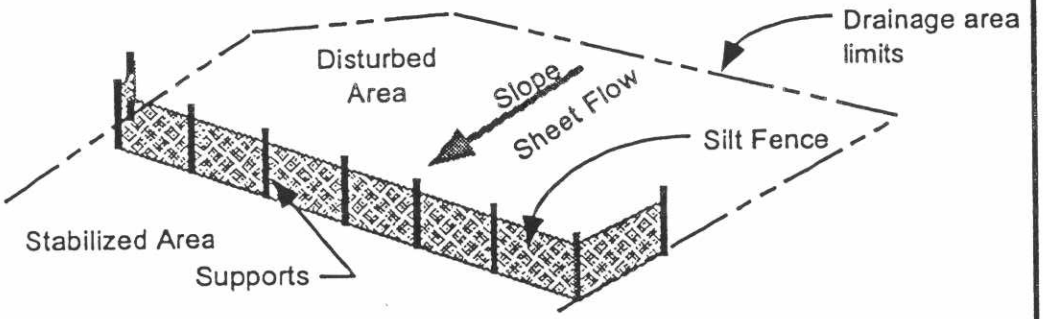
**MAINTENANCE REQUIREMENTS**

Protect newly seeded areas from excessive runoff and traffic until vegetation is established (mulching may be necessary). A watering and fertilizing schedule will be required as part of the SWPPP to assist in the establishment of the vegetation.

**BMP**

3

# Silt Fence




**Applications**

- Perimeter Control
- Slope Protection
- Sediment Trapping
- Channel Protection
- Temporary Stabilization
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**Targeted Constituents**

- ● Sediment
- ○ Nutrients Toxic Materials
- ○ Oil & Grease
- ◒ Floatable Materials
- ○ Other Construction Wastes

**Implementation Requirements**

- ◒ Capital Costs
- ● Maintenance
- ○ Training
- ◒ Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**

4

## DESCRIPTION

A silt fence consists of geotextile fabric supported by poultry netting or other backing stretched between either wooden or metal posts with the lower edge of the fabric securely embedded in the soil. The fence is typically located downstream of disturbed areas to intercept runoff in the form of sheet flow. Silt fence provides both filtration and time for sedimentation to reduce sediment and it reduces the velocity of the runoff. Properly designed silt fence is economical since it can be re-located during construction and re-used on other projects.

## PRIMARY USE

Silt fence is normally used as perimeter control located downstream of disturbed areas. It is only feasible for non-concentrated, sheet flow conditions.

## APPLICATIONS

Silt fence is an economical means to treat overland, non-concentrated flows for all types of projects. Silt fences are used as perimeter control devices for both site developments and linear (roadway) type projects. They are most effective with coarse to silty soil types. Due to the potential of clogging, silt fence should not be used with clay soil types.

In order to reduce the length of silt fence, it should be placed adjacent to the down slope side of the construction activities.

## DESIGN CRITERIA

- Fences are to be constructed along a line of constant elevation (along a contour line) where possible.
- Maximum slope adjacent to the fence is 1:1.
- Maximum distance of flow to silt fence should be 200 feet or less.
- Maximum concentrated flow to silt fence shall be 1 CFS per 20 feet of fence.
- If 50% or less of soil, by weight, passes the U.S. Standard sieve No. 200, select the equivalent opening size (E.O.S.) to retain 85% of the soil.
- Maximum equivalent opening size shall be 70 (#70 sieve).

- Minimum equivalent opening size shall be 100 (#100 sieve).
- If 85% or more of soil, by weight, passes the U.S. Standard sieve No. 200, silt fences shall not be used due to potential clogging.
- Sufficient room for the operation of sediment removal equipment shall be provided between the silt fence and other obstructions in order to properly maintain the fence.
- The ends of the fence shall be turned upstream to prevent bypass of stormwater.

**LIMITATIONS**

Minor ponding will likely occur at the upstream side of the silt fence resulting in minor localized flooding.

Fences which are constructed in swales or low areas subject to concentrated flow may be overtopped resulting in failure of the filter fence. Silt fences subject to areas of concentrated flow (waterways with flows > 1 cfs) are not acceptable.

Silt fence can interfere with construction operations, therefore planning of access routes onto the site is critical.

Silt fence can fail structurally under heavy storm flows, creating maintenance problems and reducing the effectiveness of the system.

**MAINTENANCE REQUIREMENTS**

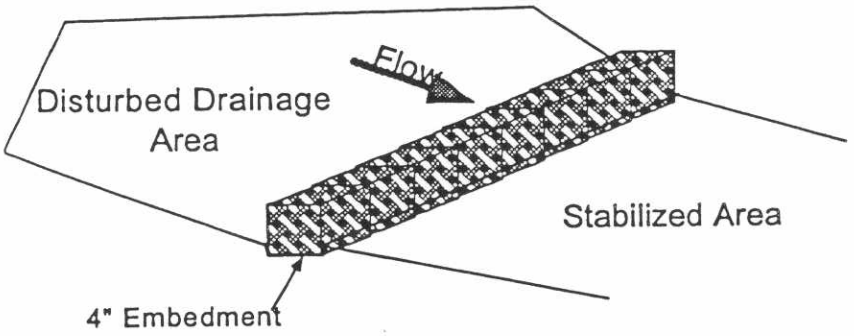
Inspections should be made on a weekly basis, especially after large storm events. If the fabric becomes clogged, it should be cleaned or if necessary, replaced.

Sediment should be removed when it reaches approximately one-half the height of the fence.

**BMP**

4

# Straw Bale Dike




**Applications**

- Perimeter Control
- Slope Protection
- Sediment Trapping
- Channel Protection
- Temporary Stabilization
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**DESCRIPTION**

A straw bale dike is a temporary barrier constructed of straw bales anchored with wood posts, that is used to intercept sediment-laden runoff generated by small disturbed areas. The straw bales can serve as both a filtration device and a dam/dike device to treat and redirect flow. Bales can consist of hay or straw in which straw is defined as best quality straw from wheat, oats or barley, free of weed and grass seed and hay is defined as straw which includes weed and grass seed.

**PRIMARY USE**

A straw bale dike is used to trap sediment-laden storm runoff from small drainage areas with relatively level grades, allowing for reduction of velocity thereby causing sediment to settle out.

**APPLICATIONS**

Straw bale dikes are used to treat flow after it leaves a disturbed area on a relatively small (<1 acre) site. Due to the limited life of the straw bale, it is cost effective for small projects of a short duration. The limited weight and strength of the straw bale makes it suitable for small, flat (< 2 percent slope) contributing drainage areas. Due to the problems with straw degradation and the lack of uniform quality in straw bales, their use is discouraged except for small residential applications.

Straw bales can also be used as check dams (see Check Dam BMP S-7) for small watercourses such as interceptor swales and borrow ditches. Due to the problems in securely anchoring the bales, only small watercourses can effectively use straw bale check dams.

**DESIGN CRITERIA**

- Straw bale dikes are to be constructed along a line of constant elevation (along a contour line).
- Straw bale dikes are suitable only for treating sheet flows across grades of 2% or flatter.
- Maximum contributing drainage area shall be 0.25 acre per 100 linear feet of dike.
- Maximum distance of flow to dike should be 100 feet or less.

**Targeted Constituents**

- ◒ Sediment
- ○ Nutrients
- ○ Toxic Materials
- ○ Oil & Grease
- ◒ Floatable Materials
- ○ Other Construction Wastes

**Implementation Requirements**

- ◒ Capital Costs
- ● Maintenance
- ○ Training
- ◒ Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**

5

- Dimensions for individual bales shall be 30 inches minimum length, 18 inches minimum height, 24 inches minimum width and shall weigh no less than 50 pounds when dry.
- Each straw bale shall be placed into an excavated trench having a depth of 4 inches and a width just wide enough to accommodate the bales themselves.
- Straw bales shall be installed in such a way that there is no space between bales prevent seepage.
- Individual bales shall be held in place by at least two wood stakes driven a minimum distance of 6 inches below the 4" excavated trench to undisturbed ground, with the first stake driven at an angle toward the previously installed bale.
- The ends of the dike shall be turned upgrade to prevent bypass of stormwater.
- Place bales on sides such that bindings are not buried.

**LIMITATIONS**

Due to a short effective life caused by biological decomposition, straw bales must be replaced after a period of no more than 3 months. During the wet and warm seasons, however, they must be replaced more frequently as is determined by periodic inspections for structural integrity.

Straw bale dikes are not recommended for use with concentrated flows of any kind except for small check flows in which they can serve as a check dam.

The effectiveness of straw bales in reducing sediment is very limited. Improperly maintained, straw bales can have a negative impact on the water quality of the runoff.

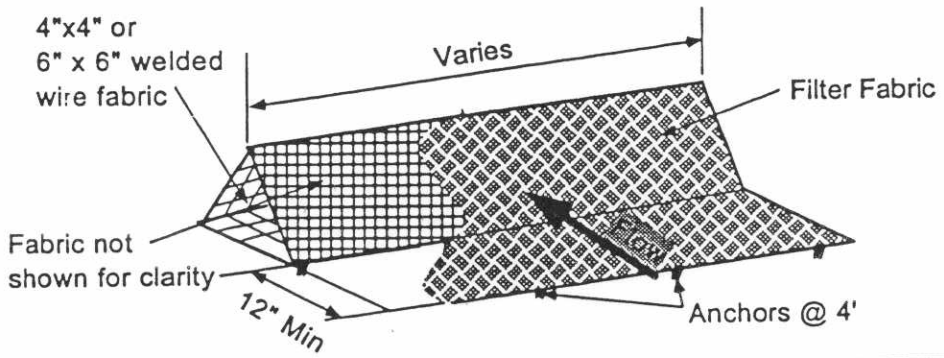
**MAINTENANCE REQUIREMENTS**

Straw bales shall be replaced if there are signs of degradation such as straw located downstream from the bales, structural deficiencies due to rotting straw in the bale or other signs of deterioration. Sediment should be removed from behind the bales when it reaches a depth of approximately 6 inches.

BMP

5

# Triangular Sediment Filter Dike




**Applications**

- Perimeter Control
- Slope Protection
- Sediment Trapping
- Channel Protection
- Temporary Stabilization
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**Targeted Constituents**

- ● Sediment
- ○ Nutrients
  Toxic Materials
- ○ Oil & Grease
- ◒ Floatable Materials
- ○ Other Construction
  Wastes

**Implementation Requirements**

- ◒ Capital Costs
- ◒ Maintenance
- ○ Training
- ◒ Suitability for
  Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or
  Questionable Impact

**BMP**

6

## DESCRIPTION

A Triangular Sediment Filter Dike is a self contained silt fence consisting of filter fabric wrapped around welded wire fabric shaped into a triangular cross section. While similar in use to a silt fence, the dike is reusable, sturdier, transportable and can be used on paved areas or in situations where it is impractical to install embedded posts for support.

## PRIMARY USE

Triangular filter dikes are used in place of silt fence, treating sediment flow at the perimeter of construction areas and at the perimeter of the site. Also, the dikes can serve as stream protection devices by preventing sediment from entering the streams or as check dams in small swales.

Triangular sediment filter dikes are especially useful for construction areas surrounded by pavement, such as roadways, taxiways, ramps, etc., where silt fence or hay bale installation is impractible. Since they can be anchored without penetration, pavement damage can be minimized.

## APPLICATIONS

Triangular dikes are used to provide perimeter control by detaining sediment on a disturbed site with drainage that would otherwise flow onto adjacent areas. Triangular dikes also serve as sediment trapping devices when used in areas of sheet flow across disturbed areas or are placed along stream banks to prevent sediment-laden sheet flow from entering the stream. The dikes can be subjected to more concentrated flows and a higher flowrate than silt fence.

## DESIGN CRITERIA

- Dikes are to be installed along a line of constant elevation (along a contour line).
- Maximum slope perpendicular to the dike is 1:1.
- Maximum drainage flow to the dike shall be 11 CFS per 100 linear feet of dike.
- Maximum distance of flow to dike should be 200 feet or less.
- Maximum concentrated flow to dike shall be 1 CFS.

- If 50% or less of soil, by weight, passes the U.S. Standard sieve No. 200, select the equivalent opening size (E.O.S.) to retain 85% of the soil.
- Maximum equivalent opening size shall be 70 (#70 sieve).
- Minimum equivalent opening size shall be 100 (#100 sieve).
- If 85% or more of soil, by weight, passes the U.S. Standard sieve No. 200, triangular sediment dike shall not be used due to clogging.
- Sufficient room for the operation of sediment removal equipment shall be provided between the dike and other obstructions in order to properly remove sediment.
- The ends of the dike shall be turned upgrade to prevent bypass of stormwater.

**LIMITATIONS**

Ponding will likely occur directly adjacent to the dike which may possibly cause flooding.

Triangular sediment filter dikes are not effective for conditions which include substantial concentrated flows or when they are not constructed along a contour line due to the potential for flow concentration and overtopping.

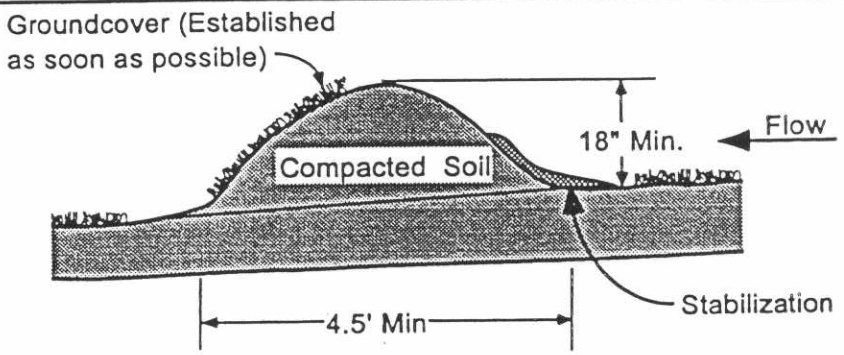
**MAINTENANCE REQUIREMENTS**

Inspections should be made on a weekly basis, especially after large (> 0.5 inches) storm events. If the fabric becomes clogged, it should be cleaned or if necessary, replaced.

Sediment should be removed when it reaches approximately 6 inches in depth. In addition, inspections should be made on a regular basis to check the structural integrity of the dike. If structural deficiencies are found, the dike should be immediately repaired or replaced.

As with silt fence, integrity of the filter fabric is important to the effectiveness of the dike. Overlap between dike sections must be checked on a regular basis and repaired if deficient.

# Diversion Dike




**DESCRIPTION**
A diversion dike is a compacted soil mound which redirects runoff to a desired location. The dike is typically stabilized with natural grass for low velocities or with stone or erosion control mats for higher velocities.

**PRIMARY USE**
The diversion dike is normally used to intercept offsite flow upstream of the construction area and direct the flow around the disturbed soils. It can also be used downstream of the construction area to direct flow into a sediment reduction device such as a sediment basin or protected inlet. The diversion dike serves the same purpose and, based on the topography of the site, can be used in combination with an interceptor swale.

**APPLICATIONS**
By intercepting runoff before it has the chance to cause erosion, diversion dikes are very effective in reducing erosion at a reasonable cost. They are applicable to a large variety of projects including site developments and linear projects such as roadways and pipeline construction. Diversion dikes are normally used as perimeter controls for construction sites with large amounts of offsite flow from neighboring properties. Used in combination with swales, the diversion dike can be quickly installed with a minimum of equipment and cost, using the swale excavation as the dike. No sediment removal technique is required if the dike is properly stabilized and the runoff is intercepted prior to crossing disturbed areas.

Significant savings in structural controls can be realized by using diversion dikes to direct sheet flow to a central area such as a sediment basin or other sediment reduction structure if the runoff crosses disturbed areas.

**DESIGN CRITERIA**
- The maximum contributing drainage area should be 10 acres or l ess depending on site conditions.
- Maximum depth of flow at the dike shall be 1 foot for 2 year design storm.
- The maximum width of the flow at the dike shall be 20 feet.
- Side slopes of the diversion dike shall be 3:1 or flatter.

**Applications**
- Perimeter Control
- Slope Protection
- Sediment Trapping
- Channel Protection
- Temporary Stabilization
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**Targeted Constituents**
- ● Sediment
- ○ Nutrients Toxic Materials
- ○ Oil & Grease
- ◒ Floatable Materials
- ◒ Other Construction Wastes

**Implementation Requirements**
- ◒ Capital Costs
- ◒ Maintenance
- ○ Training
- ● Suitability for Slopes >5%

**Legend**
- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**
**7**

- Minimum width of the embankment at the top shall be 2 feet.
- Minimum embankment height shall be 18 inches as measured from the toe of slope on the upgrade side of the berm.
- For velocities less than 6 feet per second, the minimum stabilization for the dike and adjacent flow areas is grass, erosion control mats or mulch. For velocities greater than 6 feet per second, stone stabilization or high velocity erosion control mats should be used. Velocities greater than 8 feet per second must be approved by the local jurisdiction.
- The dikes shall remain in place until all disturbed areas which are protected by the dike are permanently stabilized unless other controls are put into place to protect the disturbed area.
- Flow line at dike shall have a positive grade to drain to a controlled outlet.

**LIMITATIONS**

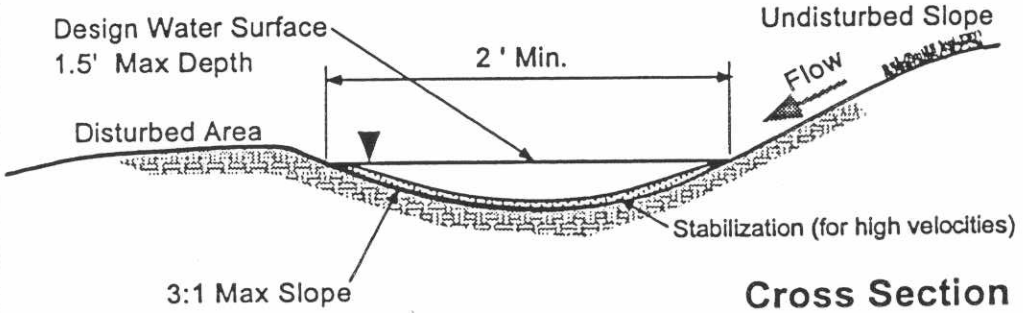
Compacted earth dikes require stabilization immediately upon placement so as not to contribute to the problem they are addressing.

The diversion dikes can be a hinderance to construction equipment moving on the site, therefore their locations must be carefully planned prior to installation.

**MAINTENANCE REQUIREMENTS**

Dikes must be inspected on a weekly basis and after each significant (>0.5 inch) rainfall to determine if silt is building up behind the dike, or if erosion is occurring on the face of the dike. Silt shall be removed in a timely manner. If erosion is occurring on the face of the dike, the slopes of the face shall either be stabilized through mulch or seeding or the slopes of the face shall be reduced.

# Interceptor Swale




**Cross Section**

**Applications**

- Perimeter Control
- Slope Protection
- Sediment Trapping
- Channel Protection
- Temporary Stabilization
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**Targeted Constituents**

- ● Sediment
- ○ Nutrients Toxic Materials
- ○ Oil & Grease
- ● Floatable Materials
- ◒ Other Construction Wastes

**Implementation Requirements**

- ◒ Capital Costs
- ◒ Maintenance
- ○ Training
- ● Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**

8

## DESCRIPTION

An interceptor swale is a small v-shaped or parabolic channel which collects runoff and directs it to a desired location. It can either have a natural grass lining or depending on slope and design velocity, a protective lining of erosion matting, stone or concrete.

## PRIMARY USE

The interceptor swale can either be used to direct sediment laden flow from disturbed areas into a controlled outlet or to direct 'clean' runoff around disturbed areas. Since the swale is easy to install during early grading operations, it can serve as the first line of defense in reducing runoff across disturbed areas. As a method of reducing runoff across the disturbed construction area, it reduces the requirements of structural measures to capture sediment from runoff since the flow is reduced. By intercepting sediment laden flow downstream of the disturbed area, runoff can be directed into a sediment basin or other BMP for sedimentation as opposed to long runs of silt fence, straw bales or other filtration method.

Based on site topography, swales can be effectively used in combination with diversion dikes.

## APPLICATIONS

Common applications for interceptor swales include roadway projects, site development projects with substantial offsite flow impacting the site and sites with a large area(s) of disturbance. It can be used in conjunction with diversion dikes to intercept flows. Temporary swales can be used throughout the project to direct flows away from staging, storage and fueling areas along with specific areas of construction. Note that runoff which crosses disturbed areas or is directed into unstabilized swales must be routed into a treatment BMP such as a sediment basin.

Grass lined swales are an effective permanent stabilization technique. The grass effectively filters both sediment and other pollutants while reducing velocity.

# Interceptor Swale

**DESIGN CRITERIA**

- Maximum depth of flow in the swale shall be 1.5 feet based on a 2 year design storm peak flow. Positive overflow must be provided to accommodate larger storms.

- Side slopes of the swale shall be 3:1 or flatter.

- Minimum design channel freeboard shall be 6 inches.

- The minimum required channel stabilization for grades less than 2 percent and velocities less than 6 feet per second may be grass, erosion control mats or mulching. For grades in excess of 2 percent, or velocities exceeding 6 feet per second, stabilization in the form of high velocity erosion mats, a three inch layer of crushed stone or rip rap is required. Velocities greater than 8 feet per second will require approval by the PROGRAM MANAGER.

- Check dams can be used to reduce velocities in steep swales. See check dam BMP fact sheet for design criteria.

- Interceptor swales must be designed for flow capacity based on Manning's Equation to ensure a proper channel section. Alternate channel sections may be used when properly designed and accepted.

- Consideration must be given to the possible impact that any swale may have on upstream or downstream conditions.

- Swales must maintain positive grade to an acceptable outlet.

**LIMITATIONS**

Interceptor swales must be stabilized quickly upon excavation so as not to contribute to the erosion problem they are addressing.

Swales may be unsuitable to the site conditions (too flat or steep).

Limited flow capacity for temporary swales. For permanent swales, the 1.5 feet maximum depth can be increased as long provisions for public safety are implemented.

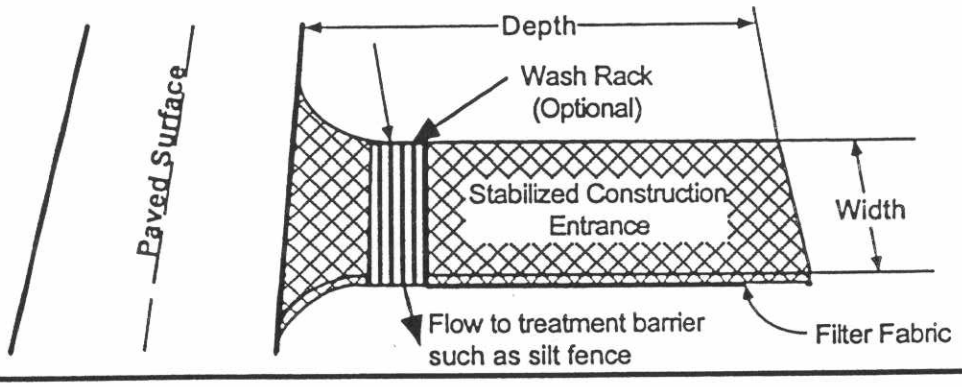
**MAINTENANCE REQUIREMENTS**

Inspection must be made weekly and after each significant (0.5" or greater) rain event to locate and repair any damage to the channel or to clear debris or other obstructions so as not to diminish flow capacity. Damage from storms or normal construction activities such as tire ruts or disturbance of swale stabilization shall be repaired as soon as practical.

BMP

8

# Stabilized Construction Entrance




**Applications**

- Perimeter Control
- Slope Protection
- Sediment Trapping
- Channel Protection
- **Temporary Stabilization**
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**Targeted Constituents**

- ◒ Sediment
- ○ Nutrients
  Toxic Materials
- ○ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Wastes

**Implementation Requirements**

- ● Capital Costs
- ◒ Maintenance
- ○ Training
- ○ Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**

9

## DESCRIPTION

A stabilized construction entrance consists of a pad consisting of gravel, crushed stone, recycled concrete or other rock like material on top of geotextile filter cloth to facilitate the wash down and removal of sediment and other debris from construction equipment prior to exiting the construction site. For added effectiveness, a wash rack area can be incorporated into the design to further reduce sediment tracking. For long term projects, cattle guards or other type of permanent rack system can be used in conjunction with a wash rack. This directly addresses the problem of silt and mud deposition in roadways used for construction site access.

## PRIMARY USE

Stabilized construction entrances are used primarily for sites in which significant truck traffic occurs on a daily basis. It reduces the need to remove sediment from streets. If used properly, it also directs the majority of traffic to a single location, reducing the number and quantity of disturbed areas on the site and providing protection for other structural controls through traffic control.

## APPLICATIONS

Stabilized construction entrances are a required part of the erosion control plan for all site developments larger than 5 acres and a recommended practice for all construction sites. It is not suitable for long, linear projects. If possible, small entrances should be incorporated into small lot construction due to the large percentage of disturbed area on the site and the high potential for offsite tracking of silt and mud.

## DESIGN CRITERIA

- Stabilized construction entrances are to be constructed such that drainage across the entrance is directed to a controlled, stabilized outlet on site with provisions for storage proper filtration and removal of wash water.
- The entrance must be properly graded so that storm water is not allowed to leave the site and enter roadways.
- Minimum width of entrance shall be 15 feet, but in no case shall the width be less than that of the entry way to be used.

- Minimum depth of entrance shall be 8 inches for the entire length of the control.

- Minimum dimensions for the entrance shall be as follows:

| Tract Area | Avg. Lot Depth | Min. Width of Entrance | Min. Depth of Entrance |
|---|---|---|---|
| < 1 Acre | 100 feet | 15 feet | 20 feet |
| < 5 Acres | 200 feet | 20 feet | 30 feet |
| < 10 Acres | > 200 feet | 20 feet | 40 feet |
| > 10 Acres | > 200 feet | 25 feet | 50 feet |

**LIMITATIONS**

Selection of the construction entrance location is critical in that to be effective, it must be used exclusively.

Stabilized entrances are rather expensive considering that it must be installed in combination with one or more other sediment control techniques, but it may be cost effective compared to labor intensive street cleaning.

**MAINTENANCE REQUIREMENTS**

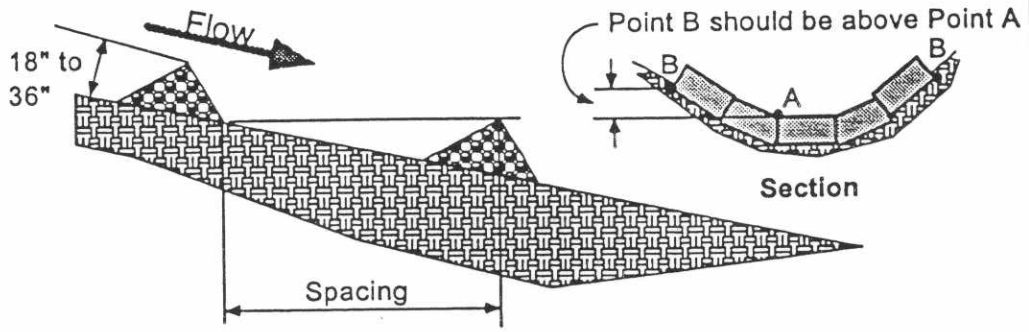
Inspections should be made on a regular basis and after large storm events in order to ascertain whether or not sediment and pollution are being effectively detained on site.

When sediment has substantially clogged the void area between the rocks, the aggregate mat must be washed down or replaced.

Periodic re-grading and top dressing with additional stone must be done to keep the efficiency of the entrance from diminishing.

BMP
9

# Check Dams




**DESCRIPTION**
Check dams are small barriers consisting of straw bales, rock, or earth berms placed across a drainage swale or ditch. They reduce the velocity of small concentrated flows, provide a limited barrier for sediment and help disperse concentrated flows, reducing potential erosion.

**PRIMARY USE**
Check dams are used for long drainage swales or ditches in which permanent vegetation may not be established and erosive velocities are present. They are typically used in conjunction with other techniques such as inlet protection, rip rap or other sediment reduction techniques. Check dams provide limited treatment. They are more useful in reducing flow to acceptable levels for other techniques.

**APPLICATIONS**
Check dams are typically used early in construction in swales for long linear projects such as roadways. They can also be used in short swales with a steep slope to reduce unacceptable velocities.

**DESIGN CRITERIA**

- Check dams should be placed at a distance and height to allow small pools to form between each one. Typically, dam height should be between 18" and 36". Dams should be spaced such that the top of the downstream dam should be at the same elevation as the toe of the upstream dam.
- See design criteria for straw bales, sand bag berms, etc. for specific de- sign criteria. Maximum allowable flow shall be based on the specific technique utilized and the velocity of flow.
- Major flows (greater than 2 year design storm) must pass the check dam without causing excessive upstream flooding.
- Check dams should be used in conjunction with other sediment reduction techniques prior to releasing flow offsite.

**Applications**

- Perimeter Control
- Slope Protection
- **Sediment Trapping**
- **Channel Protection**
- Temporary Stabilization
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**Targeted Constituents**

- ◒ Sediment
- ○ Nutrients
- ○ Toxic Materials
- ○ Oil & Grease
- ◒ Floatable Materials
- ○ Other Construction Wastes

**Implementation Requirements**

- ◒ Capital Costs
- ● Maintenance
- ○ Training
- ◒ Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**
10

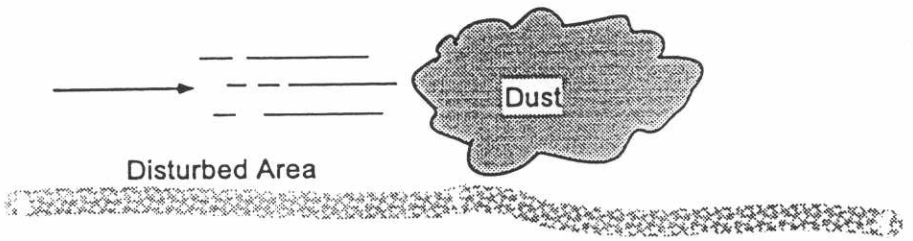
**LIMITATIONS**
Minor ponding will occur upstream of the check dams.

For heavy flows or high velocity flows, extensive maintenance or replacement of the dams will be required.

Check dams are not a total treatment technique.

**MAINTENANCE REQUIREMENTS**
Maintenance of the dams should adhere to the maintenance requirements of the management practice used for the dam.

# Dust Control BMP




**Applications**

- Perimeter Control
- Slope Protection
- Sediment Trapping
- Channel Protection
- Temporary Stabilization
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**Targeted Constituents**

- ◒ Sediment
- ◒ Nutrients
- ◒ Toxic Materials
- ○ Oil & Grease
- ◒ Floatable Materials
- ◒ Other Construction Wastes

**Implementation Requirements**

- ◒ Capital Costs
- ◒ Maintenance
- ◒ Training
- Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**

**11**

## DESCRIPTION

Dust control measures are used to stabilize soil from wind erosion, and reduce dust generated by construction activities. Dust which settles on surfaces both on-site and off-site may be washed by storm water into waterways.

## APPLICATIONS

- Clearing and grading activities
- Construction vehicles traffic on unpaved roads
- Drilling and blasting activities
- Sediment tracking onto paved roads
- Soil and debris storage piles
- Batch drop from front end loaders
- Areas with unstabilized soil

## DESIGN CRITERIA

- Schedule construction activities to minimize the area where, and time period when soils are exposed.
- Quickly stabilize exposed soils using vegetation, mulching, spray-on adhesives, calcium chloride, sprinkling, and stone/gravel layering.
- Identify and stabilize key access points prior to commencement of construction.
- Minimizing the impact of dust by anticipating the direction of prevailing winds.
- Direct most construction traffic to stabilize roadways within the project site.

## LIMITATIONS

- Watering prevents dust only for a short period and should be applied daily (or more often) to be effective. Overwatering may cause a contaminated erosion.
- Oils should not be used for dust control because it may migrate into drainageway and/or seep into the soil.
- Certain chemically-treated subgrades may make soil water repellent, increasing runoff.

**MAINTENANCE REQUIREMENTS**
Most dust control measures require frequent, often daily, attention.

**ADDITIONAL INFORMATION**
Dust control BMP's generally stabilize expose surfaces and minimize activities that suspend or track dust particles. For heavily traveled and disturbed areas, wet suppression (watering), chemical dust suppression, gravel or asphalt surfacing, temporary gravel construction entrances, equipment wash-out areas, and haul truck covers can be employed as dust control applications. Permanent or temporary vegetation and mulching and sand fences can be employed for areas of occasional or no construction traffic. Preventive measures would include minimizing surface areas to be disturbed.

Many of the reasonably available control measures for controlling dust from construction sites can also be implemented as BMPs for storm water pollution prevention. Those BMPs include:

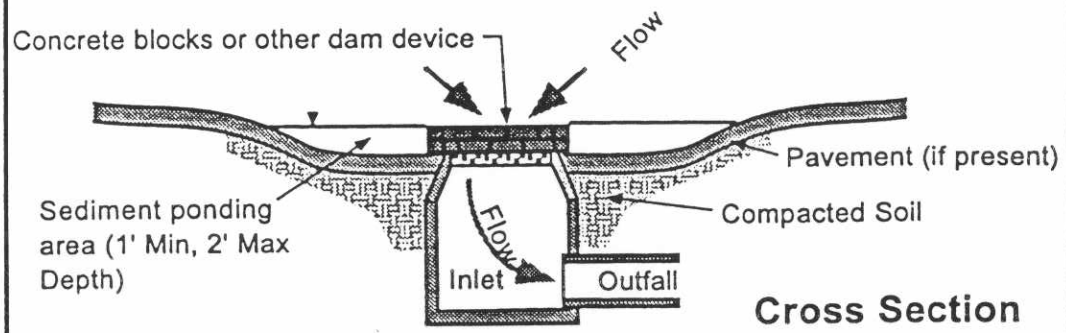
- Pave, vegetate, or chemically stabilize access points where unpaved traffic surfaces adjoin paved roads.
- Provide covers for haul truck transporting materials that contribute to dust.
- Provide suppression or chemical stabilization of exposed soils.
- Provide for rapid clean-up of sediments deposited on paved roads. Furnish stabilized construction road entrances and vehicle wash down areas.
- Stabilize unpaved haul roads, parking and staging areas. Reduce speed and trips on unpaved roads.
- Implement dust control measures for material stockpiles.
- Prevent drainage of sediment laden storm water onto paved surfaces.
- Stabilize abandoned construction sites using vegetation or chemical stabilization methods.
- Limit the amount of areas disturbed by clearing and earth moving operations by scheduling these activities in phases.

For the chemical stabilization, there are many products available as dust palliatives for chemically stabilizing gravel roadways and stockpiles.

In addition, there are many other BMPs identified in this handbook that provide dust control including:

- Seeding and Plantings
- Stabilized Construction Entrances
- Construction Road Stabilization
- Mulching

# Inlet Protection




**Cross Section**

**Applications**

- Perimeter Control
- Slope Protection
- **Sediment Trapping**
- Channel Protection
- Temporary Stabilization
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**DESCRIPTION**

Inlet protection consists of a variety of methods of intercepting sediment at low point inlets through the use of stone, filter fabric and other materials. This is normally located at the inlet, providing either detention or filtration to reduce sediment and floatable materials in storm water.

**PRIMARY USE**

Inlet protection is normally used as a secondary defense in site erosion control . It is normally used in new developments that include new inlets or roads with new curb inlets or during major repairs to existing roadways. Inlet protection has limited use in developed areas due to the potential for flooding, traffic safety and pedestrian safety and maintenance problems. Inlet protection can reduce sediment in storm sewer system by serving as a back up system to onsite controls or by reducing sediment loads from controls with limited effectiveness such as straw bale dikes.

**APPLICATIONS**

Different variations are used for different conditions as follows:

- Filter barrier protection (similar to a silt fence barrier around the inlet) is appropriate when the drainage area is less than one acre and the basin slope is less than five (5) percent. This type of protection is not applicable in paved areas. (See details, Section 9)
- Block and gravel (crushed stone, recycled concrete is also appropriate) protection is used when flows exceed 0.5 c.f.s. and it is necessary to allow for overtopping to prevent flooding (See sketch at top of fact sheet).
- Wire mesh and gravel protection (crushed stone, recycled concrete is also appropriate) is used when flows exceed 0.5 c.f.s. and construction traffic may occur over the inlet. This form of protection may be used with both curb and drop inlets (See details Section 9).

**Targeted Constituents**

- ◒ Sediment
- ○ Nutrients
  Toxic Materials
- ◒ Oil & Grease
- ◒ Floatable Materials
- ◒ Other Construction Wastes

**Implementation Requirements**

- ◒ Capital Costs
- ◒ Maintenance
- ◒ Training
- ○ Suitability for Slopes >5%

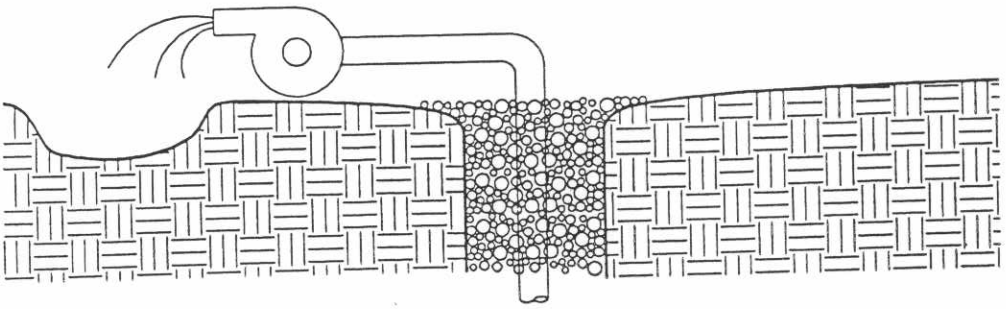
**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**

**12**

# Dewatering Operations



**Applications**

- Perimeter Control
- Slope Protection
- **Sediment Trapping**
- Channel Protection
- Temporary Stabilization
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**Targeted Constituents**

- ○ Sediment
- ○ Nutrients
  Toxic Materials
- ◒ Oil & Grease
- ○ Floatable Materials
- ● Other Construction Wastes

**Implementation Requirements**

- ◒ Capital Costs
- ○ Maintenance
- ◒ Training
- ○ Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**

13

## DESCRIPTION

Prevent or reduce the discharge of pollutants to storm water from dewatering operations by using sediment controls and by testing the water for contamination.

## APPLICATIONS

There are two general classes or pollutants that may result from dewatering operations: sediment, and toxics and petroleum products. A high sediment content in dewatering discharges is common because of the nature of the operation. On the other hand, toxics and petroleum products are not commonly found in dewatering discharges unless, the site or surrounding area has been used for light or heavy industrial activities, or the area has a history of groundwater contamination.

## DESIGN CRITERIA

- Use sediment controls to remove sediment from water generated from dewatering.
- Use filtration to remove sediment from a sediment trap or basin. Filtration can be achieved with:
  - Sump pit and a standpipe in the center with holes and wapped in filter fabric. The standpipe is surrounded by stones which filters the water as it collects in the pit before being pumped out;
  - Floating suction hose allowing cleaner surface water to be pumped out; or
  - Standpipe in the sediment basin with slits and wrapped in filter fabric to remove sediments.
- Toxics and Petroleum Products:
  - In areas suspected of having groundwater contamination, protect yourself early in the excavation process by sampling and having the water tested at a certified laboratory. Check with the Louisiana Department of Environmental Quality and the PROGRAM MANAGER for their requirements, including additional water quality tests and disposal options.

- Contaminated water can be expensive to treat and/or dispose of properly. However, addressing the problem before construction is much less expensive than after the structures are in place.

**LIMITATIONS**

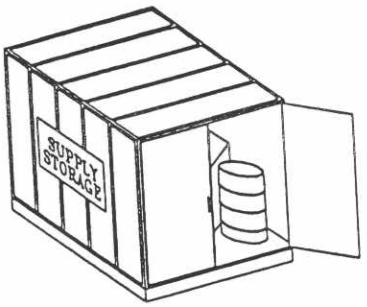
The presence of contaminated water may indicate contaminated soil as well. If contaminated water is discovered or suspected, the CONTRACTOR shall stop dewatering and immediately notify the PROGRAM MANAGER.

**MAINTENANCE REQUIREMENTS**

Maintain sediment controls and filters in good working order.

Inspect excavated areas daily for signs or contaminated water as evidenced by discoloration, oily sheet, or odors.

# Material Delivery And Storage




**Applications**

- Perimeter Control
- Slope Protection
- Sediment Trapping
- Channel Protection
- Temporary Stabilization
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**DESCRIPTION**

Prevent or reduce the discharge or pollutants to storm water from material delivery and storage by minimizing the storage of hazardous materials on-site, storing materials in a designated area, installing secondary containment, conducting regular inspection, and training employees and subcontractors.

This best management practice covers only material delivery and storage. For information on wastes, see the waste management BMPs.

**APPLICATIONS**

The following materials are commonly stored on construction sites:

- Pesticides and herbicides.
- Fertilizers.
- Detergents.
- Petroleum products such as fuel, oil, and grease, and
- Other hazardous chemicals such as acids, lime, glues, paints, solvents, and curing compounds.

Storage of these materials on-site can pose the following risks:

- Storm water contamination.
- Injury to workers or visitors.
- Groundwater contamination, and
- Soil contamination.

**DESIGN CRITERIA**

- Designate an area of the construction site for material delivery and storage.
  - Place near the construction entrance, away from waterways
  - Avoid transport near drainage paths or waterways
  - Surround with earth berms (see DRI, Earth Dike)
  - Place in an area which will be used to stabilize any residential materials

**Targeted Constituents**

- ○ Sediment
- ○ Nutrients
- ○ Toxic Materials
- ◒ Oil & Grease
- ○ Floatable Materials
- ● Other Construction Wastes

**Implementation Requirements**

- ◒ Capital Costs
- ○ Maintenance
- ◒ Training
- ○ Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**

**14**

# Material Delivery And Storage

- Storage of reactive, ignitible, or flammable liquids must comply with the local fire codes

  See the Flammable and Combustible Liquid Code NFPA30.
- Keep an accurate, up-to-date inventory in your SWPPP of the materials delivered and stored on-site.
- Keep your inventory down. Store only the amount you need, for only as long as you need it.
- Store as few hazardous materials on-site as possible.
- Handle hazardous materials as infrequently as possible.
- Designate a secure material storage area away from drainage courses and near the site entrance.
- Whenever possible, store materials in a covered area with secondary containment such as an earthen dike, horse trough, or even kid's wading pool for non-reactive materials such as detergents, oil, grease and paints. Small amounts of material may be secondarily contained in "busboy" trays or concrete mixing trays.
- Do not store chemicals, drums, or bagged materials directly on the ground. Place these items in secondary containment.
- If drums must be kept uncovered, store them at a slight angle to reduce ponding or rainwater on the lids and to reduce corrosion.
- Try to keep chemicals in their original containers, and keep them well labeled.
- Train employees and subcontractors.
- Employees trained in emergency spill cleanup procedures should be present when dangerous materials or liquid chemicals are unloaded.

**LIMITATIONS**

Storage sheds often must meet building and fire code requirements.

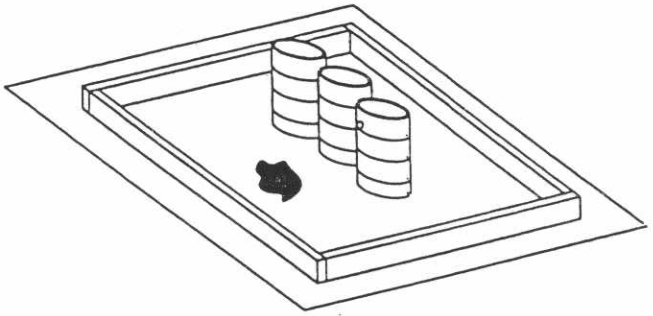
**MAINTENANCE REQUIREMENTS**

Keep the designated storage area clean and well organized.
Conduct routine weekly inspections and check for external corrosion of material containers.
Keep an ample supply of spill cleanup materials near the storage area.

**BMP**

14

# Spill Prevention And Control



**Applications**

Perimeter Control

Slope Protection

Sediment Trapping

Channel Protection

Temporary Stabilization

Permanent Stabilization

Waste Management

Housekeeping Practices

**Targeted Constituents**

- ○ Sediment
- ○ Nutrients
- ○ Toxic Materials
- ◒ Oil & Grease
- ○ Floatable Materials
- ● Other Construction Wastes

**Implementation Requirements**

- ○ Capital Costs
- ○ Maintenance
- ◒ Training
- ○ Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**

**15**

## DESCRIPTION

Prevent or reduce the discharge of pollutants to storm water from leaks and spills by reducing the chance for spills, stopping the source of spills, containing and cleaning up spills, properly disposing of spill materials, and training employees.

This best management practice covers only spill prevention and control. However, Material Delivery and Storage and Material Use, also contain useful information, particularly on spill prevention. For information on wastes, see the waste management BMPs.

## APPLICATIONS

The following steps will help reduce the storm water impacts of leaks and spills:

### General Measures

- Hazardous materials and wastes should be stored in covered containers and protected from vandalism.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Train employees in spill prevention and cleanup.

### Cleanup

- Clean up leaks and spills immediately.
- On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a dam mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to either a certified laundry (rags) or disposed of as hazardous waste.
- Never nose down or bury dry materials spills. Sweep up or excavate the material and dispose of properly. See the waste management BMPs in this chapter for specific information.

# Spill Prevention And Control

**Reporting**

- Immediately report spills to the BTR Airport Rescue & Fire Fighting Unit (504-355-2068). Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response center (NRC) at 800-424-8802 (24 hour).

**Vehicle and Equipment Maintenance**

- If maintenance must occur on-site, use a designated area, located away from drainage courses, toprevent the runon of storm water and the runoff of spills.
- Regularly inspect on-site vehicles and equipment for leaks, and repair immediately.
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment on-site.
- Always use secondary containment, such as a drain pan or deep cloth, to catch spills or leaks when removing or changing fluids.
- Place drip pans or absorbent materials under pacing equipment when not in use.
- Use adsorbent materials on small spills rather than hosing down or burying the spill. Remove the adsorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.
- Oil filters disposed of in trash cans or dumpsters can leak oil and contaminate storm water. Place the oil filter in a funnel over a water oil recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.
- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries. Even if you think all the acid has drained out. If you drop a battery, treat it as if is cracked. Put in into the containment area until you are sure it is not leaking.

**Vehicle and Equipment Fueling**

- If fueling must occur on-site, use designated areas, located away from drainage courses, to prevent the runon of storm water and the runoff of spills.
- Discourage "topping-off" of fuel tanks.
- Always use secondary containment, such as a drain pan, when fueling to catch spills/leaks.

**LIMITATIONS**

If necessary, use a private spill cleanup company.

**MAINTENANCE REQUIREMENTS**

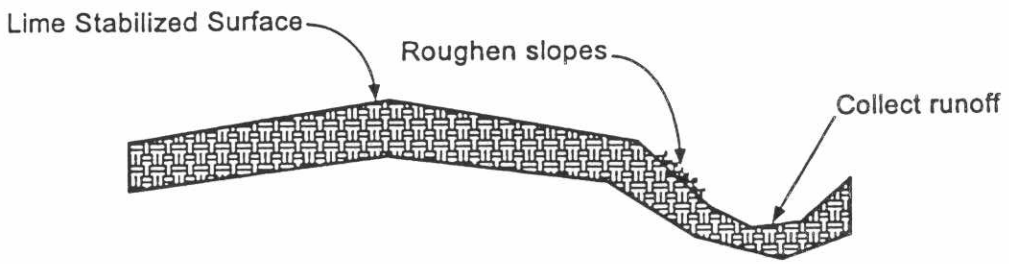
Keep ample supplies or spill control and cleanup materials on-site, near storage, unloading, and maintenance areas.

Update your spill cleanup materials as changes occur in the types of chemicals on-site.

**BMP**

15

# Lime Stabilization BMP




**Applications**

- Perimeter Control
- Slope Protection
- Sediment Trapping
- Channel Protection
- Temporary Stabilization
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**DESCRIPTION**

Lime stabilization is used extensively in some areas to stabilize pavement subbases for roadways, parking lots and other paved surfaces. Hydrated lime is applied to the soil and mixed through disking and other techniques, then allowed to cure. This practice will reduce the potential for runoff to carry lime offsite, where it may impact aquatic life through changing the pH balance of streams, ponds and other water bodies.

**PRIMARY USE**

This BMP consists of a series of techniques that should be implemented when lime is required for soil stabilization.

**APPLICATIONS**

Each of the techniques listed can be used under a variety of conditions. The engineer should determine the applicability of the technique based on site conditions such as available open space, quantity of area to be stabilized, proximity of nearby water courses and other BMPs employed at the site. The use of diversion dikes and interceptor swales (see appropriate fact sheets) to divert runoff away from areas to be stabilized can be used in conjunction with these techniques to reduce the impact of the lime.

**DESIGN CRITERIA**

- The contractor shall limit lime operations to that which can be thoroughly mixed and compacted by the end of each work day.
- No traffic other than water trucks and mixing equipment shall be allowed to pass over the spread lime until after completion of mixing.
- Areas adjacent and downstream of stabilized areas shall be roughened to intercept lime from runoff and reduce runoff velocity.
- Geotextile fabrics such as those used for silt fence should not be used to address lime since the grain size of lime is significantly smaller than the equivalent opening size of the fabric.
- For areas which phasing of lime operations is impractical, use of a curing seal such as Liquid Asphalt, Grade MC-250 or MC-800 applied at a rate of 0.15 gallons per square yard of surface can be used to protect the base.

**Targeted Constituents**

- ○ Sediment
- ○ Nutrients
- ○ Toxic Materials
- ○ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Wastes

**Implementation Requirements**

- ○ Capital Costs
- ○ Maintenance
- ○ Training
- ○ Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**

16

- Use of sediment basins with a significant (>36 hour) drawdown time is encouraged for large stabilized areas (see Sediment Basin BMP).

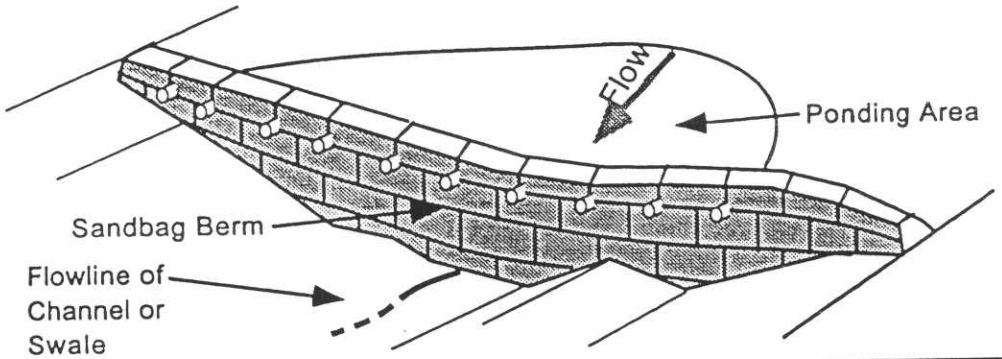
**LIMITATIONS**

These techniques are part of an overall plan to reduce pollutants from an active construction site. In the case of pollution due to lime, prevention of contamination is the only effective method to address this pollutant. Proper application and mixing along with avoiding applications when there is a significant probability of rain will reduce lime runoff.

**MAINTENANCE REQUIREMENTS**

None.

# Sand Bag Berm




**Applications**

Perimeter Control

Slope Protection

Sediment Trapping

Channel Protection

Temporary Stabilization

Permanent Stabilization

Waste Management

Housekeeping Practices

**Targeted Constituents**

- O Sediment
- O Nutrients Toxic Materials
- O Oil & Grease
- O Floatable Materials
- O Other Construction Wastes

**Implementation Requirements**

- ● Capital Costs
- O Maintenance
- O Training
- ● Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- O Low Impact
- ? Unknown or Questionable Impact

**BMP**

**17**

## DESCRIPTION

Sandbag berms consist of stacked sandbags installed across a watercourse to direct flow around construction or to allow sedimentation to occur for flows downstream of disturbed areas. There are overflow pipes located in the top of the berm to allow controlled outflow of water after sedimentation has occurred.

## PRIMARY USE

A sandbag berm is a temporary sediment control method that addresses the problem of construction in creeks, channels and other watercourses which carry a constant flow and is subjected to high, concentrated flows. A sandbag berm can also be used to create a small sedimentation pond prior to the completion of a permanent detention basin.

Sandbag berms can be used as check dams in temporary swales or borrow ditches.

Sandbag berms are not recommended for typical perimeter controls where sheet flow is prevalent.

## APPLICATIONS

During utility or any type of construction in channels or stream beds, sandbag berms can be used as check dams across channels, serve as a barrier for utility trenches or even provide a temporary channel crossing for construction equipment without seriously affecting stream conditions. Sandbag berms can also be installed parallel to a roadway, providing a corridor of sediment control similar to that provided by a silt fence or hay bales with the exception that a sand bag dike is capable of controlling much higher flows and is much more durable. For site construction sandbag berms can be used to divert or direct flow or create a temporary sediment basin with the added dimension of being able to be moved to accommodate changes in construction much more easily than compacted earth berms.

# Sand Bag Berm

DESIGN CRITERIA

- Berms are to be constructed along a line of constant elevation (a contour line) for use as perimeter control devices.
- Maximum flow through rate shall be 0.1 CFS per square foot of berm surface.
- Minimum height shall be 18 inches.
- Minimum width of the berm shall be 18 inches at the top and 54 inches measured at the bottom.
- Maximum side slopes shall be 2:1.
- Maximum design freeboard shall be 0.3 feet
- Sandbags shall be consist of jute, polypropylene, polyethylene or polyamide woven fabric. Jute shall be composed of a uniform weave of undyed and unbleached single jute jarn weighing an average of 1.2 pounds per linear uard of cloth with approximately 78 warp ends per width of cloth. Polypropylene, polyethylene or polyamide woven fabric shall have a minimum unit weight of 4 ounces per square yard, a mullen burst strength of 300 psi minimum and ultraviolet stability exceeding 70 percent, and shall be filled with coarse sand or pea gravel.
- 4" diameter Schedule 40 or greater PVC pipe segments approximately 24 inches in length shall be used immediately below the top layer of sandbags to allow for flow through the berm.
- For severe velocities or high flows, woven wire mesh can be used to maintain the integrity of the berm.
- Sufficient room for the operation of sediment removal equipment shall be provided between the berm and other obstructions in order to properly remove sediment.
- The ends of the berm shall be turned upgrade or shall tie into natural grades to prevent bypass of stormwater.
- In channel applications, the center of the berm must be lower than the outside ends to prevent bypass around the berm.

LIMITATIONS

Sandbag berms are a costly, labor intensive technique which is suitable only for areas subjected to high concentrated flows. The permeability of the berms makes it unsuitable for low flow, perimeter conditions.

Ponding will occur directly upstream from the berm creating the possibility of a flooding concern which should be considered prior to its placement.

For sandbag berms located in high flow areas such as creeks, the potential for berm damage during high flows increases the requirement for maintenance.

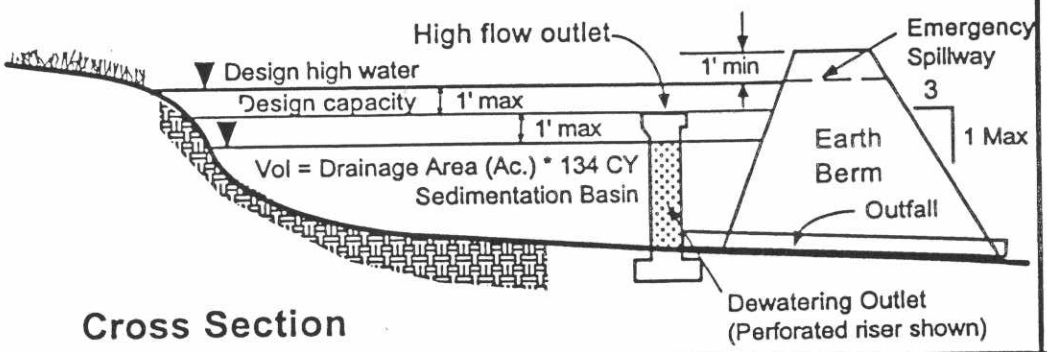
MAINTENANCE REQUIREMENTS

Inspections should be made on a daily basis and after each significant (>0.5 inches) rain event. The sandbags shall be reshaped or replaced as need during the inspection. Silt should be removed when it reaches a depth of six (6) inches. In addition, weekly inspections should be made on the PVC pipe segments to assure clear flow.

BMP

17

# Sediment Basin




Cross Section

**Applications**

- Perimeter Control
- Slope Protection
- Sediment Trapping
- Channel Protection
- Temporary Stabilization
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**Targeted Constituents**

- ● Sediment
- ◒ Nutrients
- ◒ Toxic Materials
- ○ Oil & Grease
- ◒ Floatable Materials
- ○ Other Construction Wastes

**Implementation Requirements**

- ● Capital Costs
- ◒ Maintenance
- ○ Training
- ● Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**

18

## DESCRIPTION

A sediment basin is a pond area with a controlled outlet in which sediment-laden runoff is directed to allow settling of suspended sediment from the runoff. It provides treatment for the runoff as well as detention and controlled release of runoff, minimizing flood impacts downstream.

## PRIMARY USE

Sediment basins should be used for all sites with adequate open space to site the basin and the ability to direct a majority of the site drainage into the basin. For sites with disturbed areas of 10 acres and larger that are part of a common drainage area, sediment basins are required as either temporary or permanent controls unless specific site conditions limit their use.

## APPLICATIONS

Sediment basins serve as treatment devices which can be used on a variety of project types. It is normally used in site development projects in which large areas of land are available for the basin, a stream or drainage way crosses the site, or a specific water feature is planned for the site. Sediment basins are highly effective at reducing sediment and other pollutants for design storm conditions. It also reduces maintenance requirements due to the central location of the sediment and minimal structural requirements of the basin.

## DESIGN CRITERIA

- Maximum drainage area contributing to the basin should be 10 acres or less. Larger sediment basins will require specific measures to address the potential for overtopping of the basin and possible failure of the berm.
- Minimum capacity of the basin shall be 3600 cubic feet per disturbed acre of contributing drainage area.
- Deposited sediment shall be removed when the storage capacity of the basin has been depleted by 20%.
- Minimum width of the embankment at the top shall be 8 feet.
- Minimum embankment slope shall be 3:1.
- Maximum embankment height shall be 6 feet as measured from

the toe of slope on the downstream side.

- The basin outlet shall be designed to accommodate a 10 year design storm without causing damage to the containment structure.
- Minimum outlet capacity shall be 0.2 CFS per acre of contributing drainage area.
- The sediment basin shall have a minimum design dewatering time of 36 hours.
- The basin must be laid out such that the effective flow length of the basin should be at least twice the effective flow width.
- The outlet of the outfall pipe shall be stabilized with rip rap or other form of stabilization with design flows and velocities based on 25 year design storm peak flows. For velocities in excess of 5 feet per second, velocity dissipation measures should be used to reduce outfall velocities.

**LIMITATIONS**

Sediment basins can be rather large depending on site conditions, requiring the use of expensive development area and comprehensive planning for construction phasing prior to implementation.

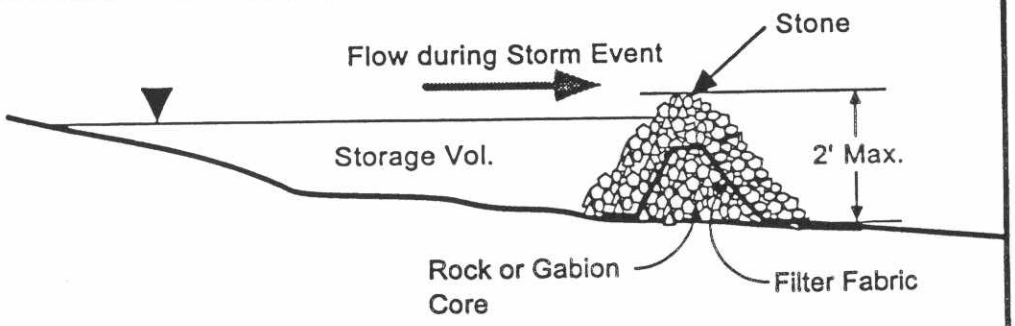
Storm events which exceed the design storm event can cause damage to the spillway structure of the basin and may impact downstream concerns.

**MAINTENANCE REQUIREMENTS**

Sediment shall be removed and the basin shall be regraded to its original dimensions at such point that the capacity of the impoundment has been reduced to 20% of its original storage capacity. The removed sediment shall be stockpiled or redistributed in areas which are protected from erosion.

The basin outlet structure and emergency spillway (if present) should be checked frequently and after each major rain event to check for damage and to insure that obstructions are not diminishing the effectiveness of the structures.

# Stone Outlet Sediment Trap




**Applications**

- Perimeter Control
- Slope Protection
- **Sediment Trapping**
- Channel Protection
- Temporary Stabilization
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**Targeted Constituents**

- ● Sediment
- ○ Nutrients Toxic Materials
- ○ Oil & Grease
- ◒ Floatable Materials
- ○ Other Construction Wastes

**Implementation Requirements**

- ● Capital Costs
- ◒ Maintenance
- ○ Training
- ● Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**

19

## DESCRIPTION

A stone outlet sediment trap is a small ponding area formed by placing a stone embankment or gabion core with an integral stone filter outlet across a drainage swale for the purpose of detaining sediment-laden runoff generated by construction activities. The sediment trap detains runoff long enough to allow most of the suspended sediment to settle while still allowing for diffused flow of runoff.

## PRIMARY USE

A sediment trap is used in situations where flows are concentrated in a drainage swale or channel. The sediment trap reduces velocities and allows for settling of sediment while allowing the area behind the trap to de-water. This is normally used for long term (18 months or less) applications in which a sediment basin is not feasible due to site or construction method restrictions. The use of a gabion core as opposed to an compacted earth core provides additional filtration and aids in dewatering the area as necessary.

## APPLICATIONS

Temporary stone outlet sediment traps are installed at locations where concentrated flows require a protected outlet to contain sediment or spread flow prior to discharge.

## DESIGN CRITERIA

- Maximum drainage area contributing to the trap shall be 3 acres. For larger drainage areas, a sediment basin should be used.
- The minimum length of the crest, in feet, of the stone outlet shall be equal to 6 times the size (acres) of the contributing drainage area.
- Deposited sediment shall be removed when the depth of sediment is equal to one-third of the height of the outlet structure as measured from the original toe of slope to the crest of the outlet, or has reached a depth of one foot, whichever is less.
- Minimum width of the embankment at the top shall be 3 feet.
- Minimum embankment slope shall be 3:1.

- Maximum embankment height shall be 2 feet as measured from the toe of slope to the crest of the stone outlet. The height of the compacted earth embankment shall be one foot higher than the crest of the outlet.
- The maximum allowable flow-through rate shall be 0.1 CFS per square foot of the frontal area of the outlet structure.
- The effective life of the stone outlet sediment trap is approximately 18 months.

**LIMITATIONS**

Limited applications due to cost of construction, availability of materials, and the amount of land required.

Can cause minor flooding upstream of dam, impacting construction operations.

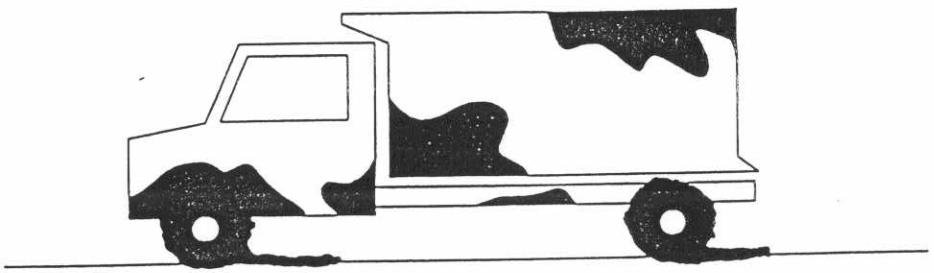
This technique serves as a temporary measure during construction. It should not be used for more than 18 months due to reduced efficiency.

**MAINTENANCE REQUIREMENTS**

Sediment shall be removed and the area directly behind the berm shall be regraded to its original dimensions at such point when the capacity of the impoundment has been reduced to one-half of its original storage capacity. The removed sediment shall be stockpiled or redistributed in areas which are protected from erosion.

The stone outlet structure should be inspected frequently and after each major rain event to check for clogging of the void spaces between stones. If the aggregate appears to be silted in such that efficiency is diminished, the stone should be replaced.

# Vehicle And Equipment Cleaning



**Applications**

- Perimeter Control
- Slope Protection
- Sediment Trapping
- Channel Protection
- Temporary Stabilization
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**Targeted Constituents**

- ◒ Sediment
- ○ Nutrients
- ○ Toxic Materials
- ◒ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Wastes

**Implementation Requirements**

- ○ Capital Costs
- ◒ Maintenance
- ◒ Training
- ○ Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**

**20**

## DESCRIPTION

Prevent or reduce the discharge of pollutants to storm water from vehicle and equipment cleaning by using off-site facilities, washing in designated areas only, eliminated discharges to the storm drain by infiltrating or recycling the wash water and training employees and subcontractors.

## APPLICATIONS

Washing vehicles and equipment outdoors or in areas where wash water flow onto the ground can pollute storm water.

## DESIGN CRITERIA

- Use off-site commercial washing businesses as much as possible. For operations involving a large number of vehicles or pieces of equipment, consider conducting this work at an off-site commercial business equipped to handle and dispose of the wash waters properly. Performing this work off-site can also be economical by eliminating the need for a separate washing operation at your site.
- If washing must occur on-site, use designated, bermed wash areas to prevent wash water contact with storm water, creeks, rivers, and other water bodies. These wash area can be sloped for wash water collection and subsequent infiltration into the ground.
- Use as little water as possible to avoid having to install erosion and sediment controls for the wash area.
- Use phosphate-free, biodegradable soaps.
- Educate employees and subcontractors on pollution prevention measures.
- Do not permit steam cleaning on-site. Steam cleaning can generate significant pollutant concentrations leading to potential storm water and groundwater contamination.
- In construction areas where trucks tires collect mud, provide a cleaning areas for removing soil before truck leaves site. Truck tires cleaning area should not be directly acjacent to drainage conveyances. A vegetated buffer area should be located downstream of the tire wash. For heavy use of tire wash area, silt fencing, or sediment trapping may be necessary.

**LIMITATIONS**

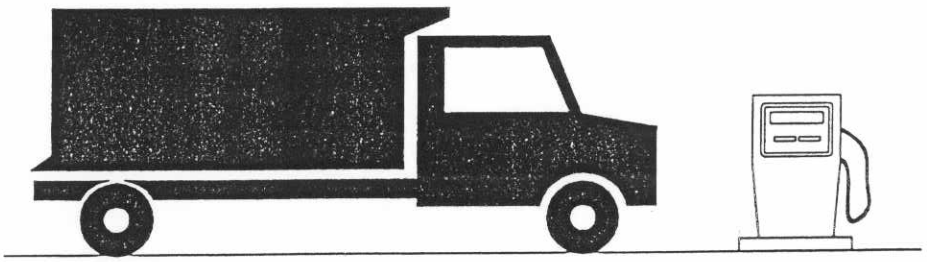
Even phosphate-free, biodegradable soaps have been shown to toxic to fish before the soap degrades.

Sending vehicles/equipment off-site should be done in conjunction with PS7 (Stabilized Construction Entrance).

**MAINTENANCE REQUIREMENTS**

Minimal.

# Vehicle And Equipment Fueling



**Applications**

- Perimeter Control
- Slope Protection
- Sediment Trapping
- Channel Protection
- Temporary Stabilization
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**DESCRIPTION**

Prevent fuel spills and leaks, and reduce their impacts to storm water by using off-site facilities, fueling in designated areas only, enclosing or covering stored fuel, implementing spill controls, and training employees and subcontractors.

**APPLICATIONS**

Fueling vehicles and equipment outdoors or in areas where wash water flows onto the ground can pollute storm water.

**DESIGN CRITERIA**

- Use of off-site fueling stations as much as possible. If you fuel a large number of vehicles or pieces of equipment, consider using an off-site fueling station equipped to handle fuel and spills properly. Performing this work off-site can also be economical by eliminating the need for a separate fueling area at your site.
- If fueling must occur on-site, use designated areas, located away from drainage course,s to prevent the runon of storm water and the runoff of spills.
- Discourage "topping-off" of fuel tanks.
- Always use secondary containment, such as a drain pan, when fueling to catch spills/leaks.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Use adsorbent materials on small spills rather than hosing down or burying the spill. Remove the adsorbent materials promptly and dispose of properly.
- Carry out all Federal and State requirements regarding stationary above ground storage tanks.
- Do not use mobile fueling of mobile construction equipment around the site; rather, transport the equipment to designated fueling areas. With the exception of tracked equipment such as bulldozers and perhaps small forklifts, most vehicles should be able to travel to a designated area with little lost time.

**Targeted Constituents**

- ○ Sediment
- ○ Nutrients
- ○ Toxic Materials
- ◒ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Wastes

**Implementation Requirements**

- ◒ Capital Costs
- ○ Maintenance
- ◒ Training
- ○ Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**

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- Train employees and subcontractors in proper fueling and cleanup procedures.

**LIMITATIONS**
Sending vehicles/equipment off-site should be done in conjunction with Stabilized Construction Entrance BMP.

**MAINTENANCE REQUIREMENTS**
Keep ample supplies of spill cleanup materials on-site.
inspect fueling areas and storage tanks on a regular schedule.

# Solid Waste Management

**DESCRIPTION**
Large volumes of solid waste are often generated at construction sites including: packaging, pallets, wood waste, concrete waste, soil, electrical wiring, cuttings, and a variety of other materials. The solid waste management practice lists techniques to minimize the potential of storm water contamination from solid waste through appropriate storage and disposal practices.

**PRIMARY USE**
These practices should be a part of all construction practices. By limiting the trash and debris on site, storm water quality is improved along with reduced clean up requirements at the completion of the project.

**APPLICATIONS**
The solid waste management practice for construction sites is based on proper storage and disposal practices by construction workers and supervisors. Key elements of the program are education and modification of improper disposal habits. Cooperation and vigilance is required on the part of supervisors and workers to ensure that the recommendations and procedures are followed. Following are lists describing the targeted materials and recommended procedures:

- Targeted Solid Waste Materials
  - Paper and cardboard containers
  - Plastic packaging
  - Styrofoam packing and forms
  - Insulation materials (non-hazardous)
  - Wood pallets
  - Wood cuttings
  - Pipe and electrical cuttings
  - Concrete, brick, and mortar waste
  - Shingle cuttings and waste
  - Roofing tar
  - Steel (cuttings, nails, rust residue)
  - Gypsum board cuttings and waste
  - Sheathing cuttings and waste
  - Miscellaneous cutting and waste
  - Food waste
  - Demolition waste

*Storage Procedures*
- Wherever possible, minimize production of solid waste materials.
- Designate a foreman or supervisor to oversee and enforce proper solid waste procedures.
- Instruct construction workers in proper solid waste procedures.
- Segregate potentially hazardous waste from non-hazardous construction site debris.

**Applications**
- Perimeter Control
- Slope Protection
- Sediment Trapping
- Channel Protection
- Temporary Stabilization
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**Targeted Constituents**
- ○ Sediment
- ● Nutrients
  Toxic Materials
- ○ Oil & Grease
- ● Floatable Materials
- ● Other Construction Wastes

**Implementation Requirements**
- ◒ Capital Costs
- ◒ Maintenance
- ◒ Training
- ○ Suitability for Slopes >5%

**Legend**
- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**
22

- Keep solid waste materials under cover in either a closed dumpster or other enclosed trash container that limits contact with rain and runoff.
- Store waste materials away from drainage ditches, swales and catch basins.
- Do not allow trash containers to overflow.
- Do not allow waste materials to accumulate on the ground.
- Prohibit littering by workers and visitors.
- Police site daily for litter and debris.
- Enforce solid waste handling and storage procedures.

*Disposal Procedures*

- If feasible, segregate recyclable wastes from non-recyclable waste materials and dispose of properly.
- General construction debris may be hauled to a licensed construction debris landfill (typically less expensive than a sanitary landfill).
- Use waste facilities approved by local jurisdiction.
- Runoff which comes into contact with unprotected waste shall be directed into structural treatment such as silt fence to remove debris.

*Education*

- Educate all workers on solid waste storage and disposal procedures.
- Instruct workers in identification of solid waste and hazardous waste.
- Have regular meetings to discuss and reinforce disposal procedures (incorporate in regular safety seminars).
- Clearly mark on all solid waste containers which materials are acceptable.

*Quality Control*

- Foreman and/or construction supervisor shall monitor on-site solid waste storage and disposal procedures.
- Discipline workers who repeatedly violate procedures.

*Requirements*

- Job-site waste handling and disposal education and awareness program.
- Commitment by management to implement and enforce Solid Waste Management Program.
- Compliance by workers.
- Sufficient and appropriate waste storage containers.
- Timely removal of stored solid waste materials.
- Possible modest cost impact for additional waste storage containers.
- Small cost impact for training and monitoring
- Minimal overall cost impact.

**LIMITATIONS**

Only addresses non-hazardous solid waste.
One part of a comprehensive construction site management program.

BMP
22

# Hazardous Waste Management

**DESCRIPTION**

The hazardous waste management BMP addresses the problem of storm water polluted with hazardous waste through spills or other forms of contact. The objective of the Management Program is to minimize the potential of stormwater contamination from common construction site hazardous wastes through appropriate recognition, handling, storage and disposal practices.

It is not the intent of this Management Program to supersede or replace normal site assessment and remediation procedures. Significant spills and/or contamination warrant immediate response by trained professionals. Suspected job-site contamination should be immediately reported to regulatory authorities and protective actions taken. The General Permit requires reporting of significant spills to the National Response Center (NRC) at (800) 424-8802.

**PRIMARY USE**

These management practices along with applicable OSHA and EPA guidelines should be incorporated at all construction sites which use or generate hazardous wastes. Many wastes such as fuel, oil, grease, fertilizer and pesticide are present at most construction sites.

**INSTALLATION, APPLICATION AND DISPOSAL CRITERIA**

The hazardous waste management techniques presented here are based on proper recognition, handling, and disposal practices by construction workers and supervisors. Key elements of the management program are education, proper disposal practices, as well as provisions for safe storage and disposal. Following are lists describing the targeted materials and recommended procedures:

- Targeted Hazardous Waste Materials
  - Paints
  - Solvents
  - Stains
  - Wood preservatives
  - Cutting oils
  - Greases
  - Roofing tar
  - Pesticides
  - Fuels & lube oils
  - Lead based paints (Demolition)

*Storage Procedures*

- Wherever possible, minimize use of hazardous materials.
- Minimize generation of hazardous wastes on the job-site.
- Segregate potentially hazardous waste from non-hazardous construction site debris.

**Applications**

- Perimeter Control
- Slope Protection
- Sediment Trapping
- Channel Protection
- Temporary Stabilization
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**Targeted Constituents**

- ○ Sediment
- ● Nutrients
- ● Toxic Materials
- ● Oil & Grease
- ○ Floatable Materials
- ● Other Construction Wastes

**Implementation Requirements**

- ◒ Capital Costs
- ◒ Maintenance
- ◒ Training
- ○ Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**

**23**

# Hazardous Waste Management

- Designate a foreman or supervisor to oversee hazardous materials handling procedures.
- Keep liquid or semi-liquid hazardous waste in appropriate containers (closed drums or similar) and under cover.

- Store waste materials away from drainage ditches, swales and catch basins.
- Use containment berms in fueling and maintenance areas and where the potential for spills is high.
- Ensure that adequate hazardous waste storage volume is available.
- Ensure that hazardous waste collection containers are conveniently located.
- Do not allow potentially hazardous waste materials to accumulate on the ground.
- Enforce hazardous waste handling and disposal procedures.
- Clearly mark on all hazardous waste containers which materials are acceptable for the container.

*Disposal Procedures*
- Regularly schedule hazardous waste removal to minimize on-site storage.
- Use only reputable, licensed hazardous waste haulers.

*Education*
- Instruct workers in identification of hazardous waste
- Educate workers of potential dangers to humans and the environment from hazardous wastes
- Instruct workers on safety procedures for common construction site hazardous wastes
- Educate all workers on hazardous waste storage and disposal procedures
- Have regular meetings to discuss and reinforce identification, handling and disposal procedures (incorporate in regular safety seminars)
- Establish a continuing education program to indoctrinate new employees.

*Quality Assurance*
- Foreman and/or construction supervisor shall monitor on-site hazardous waste storage and disposal procedures.
- Educate and if necessary, discipline workers who violate procedures.
- Ensure that the hazardous waste disposal contractor is reputable and licensed.

*Requirements*
- Job-site hazardous waste handling and disposal education and awareness program.
- Commitment by management to implement hazardous waste management practices.
- Compliance by workers.
- Sufficient and appropriate hazardous waste storage containers.
- Timely removal of stored hazardous waste materials.

*Costs*
- Possible modest cost impact for additional hazardous storage containers.
- Small cost impact for training and monitoring.
- Potential cost impact for hazardous waste collection and disposal by licensed hauler - actual cost depends on type of material and

BMP
23

# Concrete Waste Management

**DESCRIPTION**
Concrete waste at construction sites comes in two forms; 1) excess fresh concrete mix including truck and equipment washing, and 2) concrete dust and concrete debris resulting from demolition. Both forms have the potential to impact water quality through storm water runoff contact with the waste.

**PRIMARY USE**
Concrete waste is present at most construction sites. This BMP should be utilized at sites in which concrete waste is present.

**APPLICATIONS**
A number of water quality parameters can be affected by introduction of concrete - especially fresh concrete. Concrete affects the pH of runoff, causing significant chemical changes in water bodies and harming aquatic life. Suspended solids in the form of both cement and aggregate dust are also generated from both fresh and demolished concrete waste.

*Current Unacceptable Waste Concrete Disposal Practices*
- Dumping in vacant areas on the job-site
- Illicit dumping off-jobsite
- Dumping into ditches or drainage facilities

*Recommended Disposal Practices*
- Avoid unacceptable disposal practices listed above.
- Develop pre-determined, safe concrete disposal areas.
- Provide a washout area with a minimum of 6 cubic feet of containment area volume for every 10 cubic yards of concrete poured.
- Never dump waste concrete illicitly or without property owners knowledge and consent.
- Treat runoff from storage areas through the use of structural controls as required.

*Education*
- Drivers and equipment operators should be instructed on proper disposal and equipment washing practices (see above).
- Supervisors must be made aware of the potential environmental consequences of improperly handled concrete waste.

*Enforcement*
- The construction site manager or foreman must ensure that employees and pre-mix companies follow proper procedures for concrete disposal and equipment washing.
- Employees violating disposal or equipment cleaning directives must be re-educated or disciplined if necessary.

**Applications**
- Perimeter Control
- Slope Protection
- Sediment Trapping
- Channel Protection
- Temporary Stabilization
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**Targeted Constituents**
- ○ Sediment
- ○ Nutrients
- ○ Toxic Materials
- ○ Oil & Grease
- ○ Floatable Materials
- ● Other Construction Wastes

**Implementation Requirements**
- ◒ Capital Costs
- ◒ Maintenance
- ◒ Training
- ○ Suitability for Slopes >5%

**Legend**
- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**
24

*Demolition Practices*

- Monitor weather and wind direction to ensure concrete dust is not entering drainage structures and surface waters.
- Where appropriate, construct sediment traps or other types of sediment detention devices downstream of demolition activities.

*Requirements*

- Use a pre-determined disposal site(s) approved by LADEQ for waste concrete (See BMP 22 Solid Waste Management). Inform PROGRAM MANAGER of selected disposal site(s).
- Prohibit dumping waste concrete anywhere but pre-determined areas.
- Assign pre-determined truck and equipment washing areas.
- Educate drivers and operators on proper disposal and equipment cleaning procedures.

*Costs*

- Minimal cost impact for training and monitoring.
- Concrete disposal cost depends on availability and distance to suitable disposal areas
- Additional costs involved in equipment washing could be significant.

**LIMITATIONS**

This concrete waste management program is one part of a comprehensive construction site waste management program.

# Sandblasting Waste Management

## DESCRIPTION

The objective of the this management program is to minimize the potential of storm water quality degradation from sandblasting activities at construction sites. The key issues in this program are prudent handling and storage of sandblast media, dust suppression, and proper collection and disposal of spent media. It is not the intent of this program to outline all of the worker safety issues pertinent to this practice. Safety issues should be addressed by construction safety programs as well as local, state, and federal regulations.

## INSTALLATION/APPLICATION CRITERIA

Since the media consists of fine abrasive granules, it can be easily transported by air and running water. Sandblasting activities typically create a significant dust problem which must be contained and collected to prevent off-site migration of fines.

*Operational Procedures*

- Use only inert, non-degradable sandblast media.
- Use appropriate equipment for the job, do not over-blast.
- Wherever possible, blast in a downward direction.
- Install a wind sock or other wind direction instrument.
- Cease blasting activities in high winds or if wind direction could transport grit to drainage facilities.
- Install dust shielding around sandblasting areas.
- Collect and dispose of all spent sandblast grit, use dust containment fabrics and dust collection hoppers and barrels.
- Non-hazardous sandblast grit may be disposed in permitted construction debris landfills or permitted sanitary landfills.
- If sandblast media cannot be fully contained, construct sediment traps downstream from blasting area where appropriate.
- Use sand fencing where appropriate in areas where blast media - cannot be fully contained.
- If necessary, install misting equipment to remove sandblast grit from the air - prevent runoff from misting operations from entering drainage systems.
- Use vacuum grit collection systems where possible.
- Keep records of sandblasting materials, procedures, and weather conditions on a daily basis.
- Take all reasonable precautions to ensure that sandblasting grit is contained and kept away from drainage structures.

*Educational Issues*

- Educate all on-site employees of potential dangers to humans and the environment from sandblast grit.

**Applications**

- Perimeter Control
- Slope Protection
- Sediment Trapping
- Channel Protection
- Temporary Stabilization
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**Targeted Constituents**

- ○ Sediment
- ● Nutrients
- Toxic Materials
- ○ Oil & Grease
- ○ Floatable Materials
- ● Other Construction Wastes

**Implementation Requirements**

- ● Capital Costs
- ● Maintenance
- ● Training
- ○ Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

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- Instruct all on-site employees of the potential hazardous nature of sandblast grit and the possible symptoms of over-exposure to sandblast grit.
- Instruct operators of sandblasting equipment on safety procedures and personal protection equipment.
- Instruct operators on proper procedures regarding storage, handling and containment of sandblast grit.
- Instruct operators to recognize unfavorable weather conditions regarding sandblasting activities.
- Instruct operators and supervisors on current local, state and federal regulations regarding fugitive dust and hazardous waste from sandblast grit.
- Have weekly meetings with operators to discuss and reinforce proper operational procedures.
- Establish a continuing education program to indoctrinate new employees.

*Materials Handling Recommendations*

- Sandblast media should always be stored under cover away from drainage structures.
- Ensure that stored media or grit is not subject to transport by wind.
- Ensure that all sandblasting equipment as well as storage containers comply with current local, state and federal regulations.
- Refer to Hazardous Waste BMP fact sheet if sandblast grit is known or suspected to contain hazardous components.
- Capture and treat runoff which comes into contact with sandblasting material or waste.

*Quality Assurance*

- Foremen and/or construction supervisor should monitor all sandblasting activities and safety procedures.
- Educate and if necessary, discipline workers who violate procedures.
- Take all reasonable precautions to ensure that sandblast grit is not transported off-site or into drainage facilities.

*Requirements*

- Education and awareness program for all employees regarding control of sandblasting and potential dangers to humans and the environment.
- Operator and supervisor education program for those directly involved in sandblasting activities
- instructions on material handling, proper equipment operation, personal protective equipment, fugitive dust control, record keeping and reporting.
- Proper sandblast equipment for the job.
- Site-specific fugitive dust control and containment equipment.
- Site-specific fugitive dust control procedures.
- Compliance by supervisors and workers.

*Costs*

- Minimal cost for training and monitoring.
- Potential for significant cost for containment procedures on large jobs.
- Potential for significant costs associated with cleanup, correction and remediation if contamination occurs.

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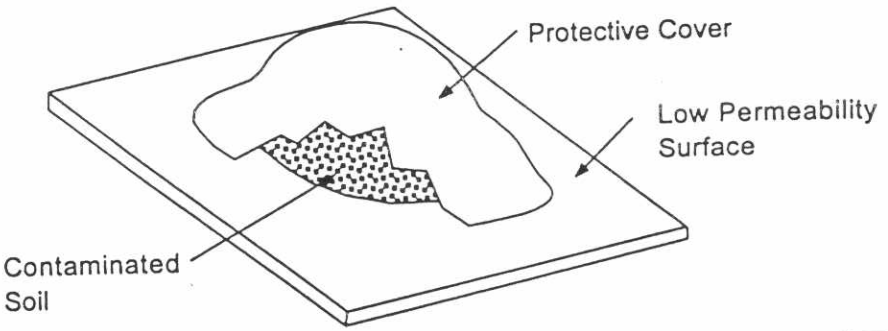
# Contaminated Soil Management




**Applications**

- Perimeter Control
- Slope Protection
- Sediment Trapping
- Channel Protection
- Temporary Stabilization
- Permanent Stabilization
- **Waste Management**
- Housekeeping Practices

**Targeted Constituents**

- ○ Sediment
- ◒ Nutrients
- Toxic Materials
- ○ Oil & Grease
- ○ Floatable Materials
- ◒ Other Construction Wastes

**Implementation Requirements**

- ● Capital Costs
- ○ Maintenance
- ◒ Training
- ○ Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**

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## DESCRIPTION

Prevent or reduce the discharge of pollutants to storm water from contaminated soil and highly acidic or alkaline soils by conducting pre-construction surveys, inspecting excavations regularly, and remediating contaminated soil promptly.

## APPLICATIONS

Contaminated soils may occur on your site for several reasons including:

Past site uses and activities;
Detected or undetected spills and leaks; and

## DESIGN CRITERIA

- Conduct thorough site planning including pre-construction geologic surveys.
- Look for contaminated soil as evidence by discoloration, odors, or differences in soil properties.
- Seal bedrock fractures with grout or bentonite to reduce seepage from excavation.
- Prevent leaks and spills to the maximum extent practicable. Contaminated soil can be expensive to treat and/or dispose of properly. However, addressing the problem before building construction is much less expensive than after the buildings are in place.
- Test suspected soils at a certified laboratory.
- If the soil is contaminated, work with the local regulatory agencies to develop options for treatment and/or disposal.

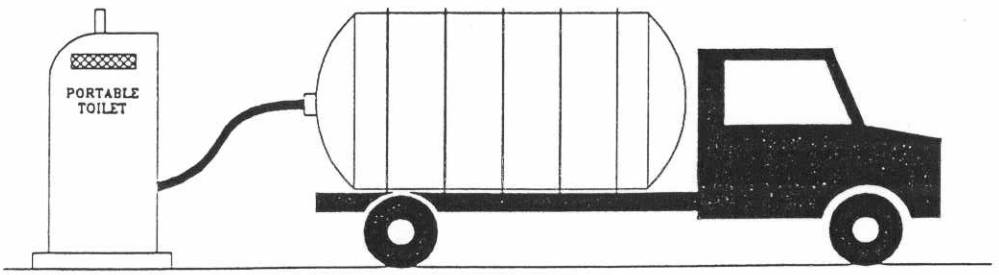
## LIMITATIONS

If necessary, use a private spill cleanup company.

## MAINTENANCE REQUIREMENTS

Contaminated soils that cannot be treated on-site must be disposed of off-site by a licensed hazardous waste hauler.
The presence of contaminated soil may indicate contaminated water as well.

# Sanitary/Septic Waste Management




**DESCRIPTION**
Prevent or reduce the discharge off pollutants to storm water from sanitary/septic waste by providing convenient, well-maintained facilities, and arranging for regular service and disposal.

**APPLICATIONS**
This BMP is nearly all construction projects.

**DESIGN CRITERIA**
- Sanitary or septic wastes should be treated or disposed of in accordance with State and local requirements.
- Locate sanitary facilities in a convenient location.
- Untreated raw sewage should never be discharged or buried.
- Temporary septic systems should treat wastes to appropriate levels before discharging.
- If using an on-site disposal system (OSDS), such as a septic system, contact the loca health agency for their requirements.
- If discharging to the sanitary sewer, contact the local sewage treatment plant for their requirements.
- Sanitary/septic facilities should be maintained in good working order by a licensed service.
- Arrange for regular waste collection by a licensed hauler before facilities overflow.

**LIMITATIONS**
There are no major limitations to this best management practice.

**MAINTENANCE REQUIREMENTS**
Inspect facilities regularly. Arrange for regular waste collection.

**Applications**
- Perimeter Control
- Slope Protection
- Sediment Trapping
- Channel Protection
- Temporary Stabilization
- Permanent Stabilization
- **Waste Management**
- Housekeeping Practices

**Targeted Constituents**
- ○ Sediment
- ● Nutrients
- Toxic Materials
- ○ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Wastes

**Implementation Requirements**
- ○ Capital Costs
- ◒ Maintenance
- ◒ Training
- ○ Suitability for Slopes >5%

**Legend**
- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

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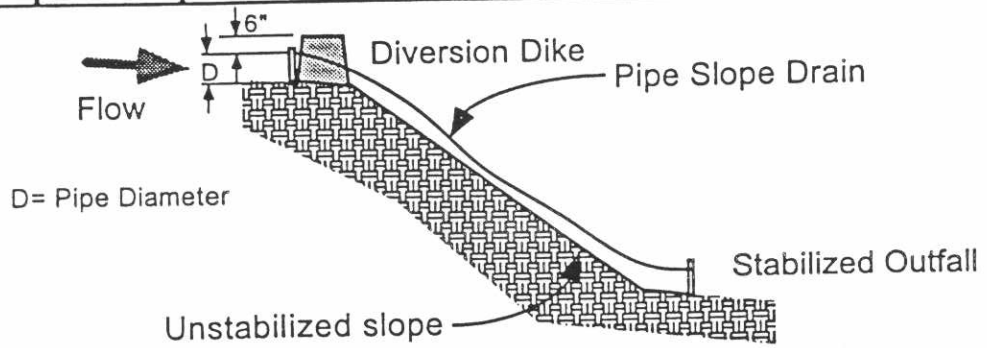
# Pipe Slope Drain




**Applications**

- Perimeter Control
- **Slope Protection**
- Sediment Trapping
- Channel Protection
- Temporary Stabilization
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**Targeted Constituents**

- ◒ Sediment
- ○ Nutrients
  Toxic Materials
- ○ Oil & Grease
- ◒ Floatable Materials
- ○ Other Construction Wastes

**Implementation Requirements**

- ● Capital Costs
- ● Maintenance
- ○ Training
- ● Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**

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## DESCRIPTION

A pipe slope drain is a temporary pipe line typically utilizing flexible pipe that conveys runoff down unstabilized slopes. The drain is anchored on the upstream end with some form of headwall to limit erosion and secure the pipe.

## PRIMARY USE

A pipe slope drain is used on sites with a long, unstabilized, steep slope area which is subject to erosion from overland flow. It is normally used in combination with interceptor swales or diversion dikes to direct the flow into the pipe area. The pipe slope drain can provide service for a relatively large area. It does not treat the runoff, therefore if the runoff contains sediment, treatment through a controlled outlet will be required before the flow is released offsite.

## APPLICATIONS

Sites with large berms or grade changes such as roadway embankments are candidates for a pipe slope drain. Since provisions must be made to direct the flow into the pipe drain, some grading is normally required upstream of the pipe slope drain. Installed properly, slope erosion can be greatly reduced (but not entirely eliminated) through the use of the drain.

Pipe slope drains also require a stabilized outlet. This is critical since the velocities at the outfall are normally high. Velocity dissipators as well as stone or concrete rip rap are typically required to reduce the velocity and spread the flow, reducing erosion. Flow from a pipe slope drain should be routed to a sediment reduction practice through interceptor swales, diversion dikes or other suitable methods.

## DESIGN CRITERIA

- The entrance to the pipe slope drain may be a standard corrugated metal pre-fabricated flared end section with an integral toe plate extending a minimum of 6 inches from the bottom of the end section. The grade of the entrance shall be 3 percent maximum.
- The berm at the entrance shall have a minimum height of the pipe diameter + 6" and a minimum width of 3 times the pipe diameter.
- All sections of the pipe slope drain shall be connected using watertight collars or gasketed watertight fittings.
- All sediment-laden runoff conveyed by the pipe slope drain shall be directed to a sediment trapping facility.
- Temporary pipe slope drains are to be sized to accommodate runoff flows equivalent to a 10 year storm as calculated using the Rational Method and

Manning's equation, but in no case shall pipes be sized smaller than is shown in the following table:

| Minimum Pipe Size | Maximum Contributing Drainage Area |
|---|---|
| 12" | 0.5 Acres |
| 18" | 1.5 Acres |
| 21" | 2.5 Acres |
| 24" | 3.5 Acres |
| 30" | 5.0 Acres |

- Maximum drainage area for individual pipe slope drains shall be 5 acres. For areas larger than 5 acres, additional drains shall be added.
- Both the entrance and outfall of the pipe slope drain should be properly stabilized. Grass can normally be used at the entrance, but armor type stabilization such as stone or concrete rip rap is normally required to address the high velocities of the outfall.
- An effectiveness rating is based on the ratio of storm water routed away from the slope and into the pipe drain versus the total area of the drainage basin. A minimum value of 0.40 and a maximum value of 0.85 is used for the rating.

**LIMITATIONS**

- Drains must be located away from construction areas since the drain can easily be damaged by construction traffic.
- Securing the pipe to the slope can be difficult and require significant maintenance during the life of the system.
- In situations where pipe slope drains convey sediment-laden runoff, pipes can become clogged during large rain events causing water to overtop the diversion dike thereby creating a serious erosion condition.
- Grading is normally required upstream of the pipe slope drain in order to direct flow into the system. This can cause additional cost and maintenance.
- A pipe slope drain reduces erosion but does not prevent it or reduce the amount of sediment in runoff. Additional measures should be used in conjunction with the pipe slope drain to treat the flow.

**MAINTENANCE REQUIREMENTS**

Inspection must be made of the pipe after each significant (>0.5 inch) rain event to locate and repair any damage to joints or clogging of the pipe. In cases where the diversion dike has deteriorated from around the entrance of the pipe, it may be necessary to reinforce the dike with sandbags or to install a concrete collar to prevent failure. Signs of erosion around the pipe drain should be addressed in a timely manner by stabilizing the area with erosion control mats, crushed stone, concrete or other acceptable method.

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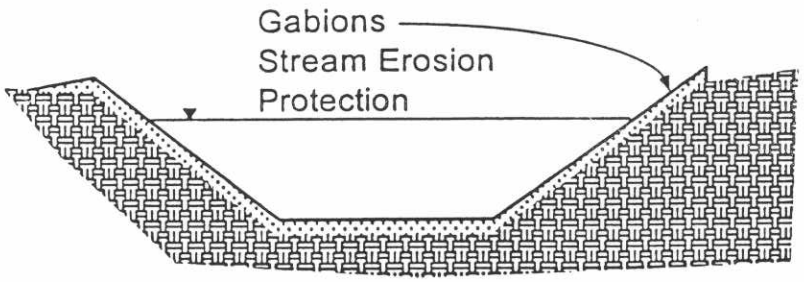
# Permanent Structural Controls




**Applications**

- Perimeter Control
- Slope Protection
- Sediment Trapping
- Channel Protection
- Temporary Stabilization
- Permanent Stabilization
- Waste Management
- Housekeeping Practices

**DESCRIPTION**

Permanent erosion techniques consist of a wide variety of erosion prevention methods including gabions, retaining walls, and rip rap. These are not included as individual BMPs since they go beyond construction phase measures and due to the fact that their use is widespread in the region and the variety of design factors influencing design.

**PRIMARY USE**

Permanent erosion control is required at the completion of the construction phase of the project. This includes permanent structural methods as well as non-structural methods such as vegetation.

**APPLICATIONS**

Due to high installation cost and long term maintenance, permanent structural methods should be used only when necessary to address severe erosive conditions. In certain instances however, retaining walls are an effective method to reduce site slopes, reducing runoff velocity. Gabions and concrete rip-rap are effective in reducing stream bank erosion under severe concentrated flow conditions and at pipe outfalls.

**DESIGN CRITERIA**

Most structural controls such as gabions and rip-rap are designed based on the velocity of flow and the size of the stone used. Project plans will address this as part of standard details. Specifications for rip rap will be provided in design specifications for stone size based on the design velocity of flow across the structure. Manufacturers' information addresses stone size along with basket dimensions for gabions.

Design of retaining walls is based on a variety of structural conditions including soil compressive strength, wall height and water table influence. Tables of dimensions for retaining walls based on site conditions are available from a variety of sources including the Concrete Reinforcing Steel Institute (CRSI).

A critical aspect with regards to the design of many permanent controls is adequate anchoring of the structure to prevent undermining of the

**Targeted Constituents**

- ● Sediment
- ○ Nutrients
- ○ Toxic Materials
- ○ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Wastes

**Implementation Requirements**

- ● Capital Costs
- ◒ Maintenance
- ○ Training
- ● Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**

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foundation and washout of sediment at the edges of the structure. Where applicable, proper anchoring in the form of embedment or 'toe in' of the structure is required.

**LIMITATIONS**

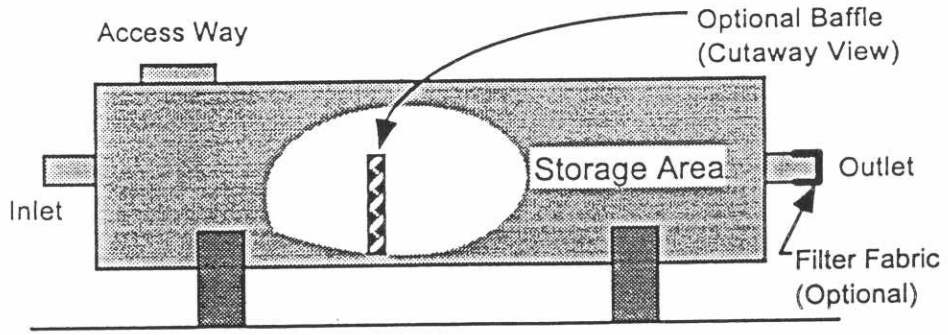
The initial cost is an important consideration in selection of permanent structural controls.

Stream bank erosion protection such as rip rap provides limited protection unless used extensively due to the potential for erosion at the edges of the rip rap.

**MAINTENANCE REQUIREMENTS**

Most stone or concrete structures require little maintenance, but may be subject to vandalism. As mentioned above, erosion around the structure may undermine the integrity of the structure. When maintenance is required, it is typically very extensive and costly.

# Temporary Sediment Tank




**Applications**

- Perimeter Control
- Slope Protection
- **Sediment Trapping**
- Channel Protection
- Temporary Stabilization
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**Targeted Constituents**

- ◒ Sediment
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- ○ Floatable Materials
- ○ Other Construction Wastes

**Implementation Requirements**

- ● Capital Costs
- ● Maintenance
- ◒ Training
- ○ Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

**BMP**

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## DESCRIPTION

A temporary sediment tank (TST) is a large truck mounted tank used to hold sediment laden water to provide for sedimentation and filtration. For smaller applications, 55 gallon drums or other water tight container can be used for storage. Water is pumped into the tank where it is detained. If desired an outlet with a geofabric filter can be provided to release the flow after a period of detention.

## PRIMARY USE

A TST is typically used at construction sites in urban areas where conventional methods of sediment removal (e. g., sediment traps, sediment basins) are not practical.

## APPLICATIONS

Applications for a TST include utility construction in confined areas (such as a business district or large developed area) or localized construction in which other BMPs are not required such as small, depressed construction (tank farms). This includes pumpage from excavation in heavily developed areas, such as a central business district, with flows due to groundwater or runoff entering the trench or excavated area.

## DESIGN CRITERIA

- A TST can be used as either a sedimentation or filtration device. If an oil sheen is present in the runoff, additional treatment will be required before release of runoff.

- For use as a small scale sedimentation basin, de-watering discharge is directed into the TST to a level below the tank midpoint and held for a minimum of 2 hours to allow settlement of a majority of the suspended particles. The tank should be designed for a controlled release when the contents of the tank reach a level higher than the midpoint. When sediment occupies 1/3 the capacity of the TST, it should be removed from the tank.

- As a filtration device, a TST is used for collecting de-watering discharge and flowing it through a filtered opening at the outlet of

the tank to reduce suspended sediment volume. The filter opening in the TST should have an EOS (see silt fence BMP) of 70 or smaller.

**LIMITATIONS**

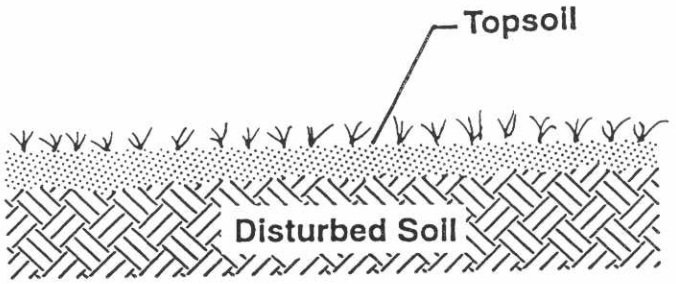
This is a specialized technique for the situations listed. It is not cost effective for normal sediment removal conditions.

The use of a temporary sediment tank is limited by the capacity of the tank, the time required for settlement of suspended material, and disposal of the water and the sediment.

**MAINTENANCE REQUIREMENTS**

The temporary sediment tank should be inspected periodically during and after use. A tank should be cleaned out when it becomes 1/3 full of sediment.

# Topsoiling




**Applications**

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**Implementation Requirements**

- ◒ Capital Costs
- ◒ Maintenance
- ○ Training
- ◒ Suitability for Slopes >5%

**Legend**

- ● Significant Impact
- ◒ Medium Impact
- ○ Low Impact
- ? Unknown or Questionable Impact

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## STANDARD FOR TOPSOILING[1]

### TOPSOILING

**Definitions:** Topsoiling is the stripping, storing and spreading of fertile topsoil over disturbed areas.

**Purpose:** Topsoiling will provide a more suitable soil medium if the existing or constructed surface is unfavorable for plant growth. Topsoiling will greatly increase the success of establishing good vegetations, help reduce soil erosion, and enhance the beauty of the development.

**Conditions Where Practices Applies:**

**Topsoiling is Used Where:**

- The texture and quality of the exposed subsoil or parent material are not suitable for producing adequate vegetative growth.
- The soil material is so shallow that the rooting zone is not deep enough to support plants with continuing supplies of moisture and plant nutrients.
- The soil is extremely acidic or contains material toxic to plant growth.

**Design Criteria**

- **Topsoil Materials**
  The site should be explored to determine if there is sufficient surface soil of good quality to justify stripping. If

[1]From "Erosion & Sedimentation Control Guide for Developing Areas in Louisiana", Soil Conservation Service.

additional off-site topsoil is needed, it should meet the following standards as well:

- Topsoil should be friable and loamy (loam, sandy loam, silt loam, sandy clay loam, clay loam).
- Topsoil should be free of debris, objectionable weeds and stones, and contain no toxic substances that may be harmful to plant growth.
- Organic matter content should not be less than 0.75 percent by weight; pH range should be from 5.0 - 7.5.

- **Stripping and Stockpiling**
  Stripping should be confined to the immediate construction area. A 4-6 inch stripping depth is common, but may vary depending on the particular soil.

  Topsoil should be stockpiled so that natural drainage is not obstructed and off-site sediment damage does not occur. stockpile sideslopes should not exceed 2:1. A perimeter dike with a grave outlet or straw bale barriers should surround the stockpiles. Temporary seeding should be completed within 15 days of stockpile formation.

- **Site Preparation**
  When topsoiling, maintain needed erosion control practices such as diversion, dikes, sediment basins, waterways, etc.

  Grading - Grades on the areas to be topsoiled, which have been previously established, should be maintained.

  Liming - Where the pH of the subsoil is 6.0 or less or the soil is composed of heavy clays, agricultural limestone should be spread in accordance with the soil test on the vegetative establishment practice being used.

Bonding - After gradient and immediately prior to dumping and spreading the topsoil, the subgrade should be loosened by disking and scarifying to a depth of at least two inches to insure bonding of the topsoil and subsoil.

- **Applying Topsoil**
  Topsoil should be handled when it is dry enough to work without damaging soil structure. A uniform application of 4 to 6 inches unsettled should be made.

  No sod or seed should be placed on soil which has been treated with soil sterilants until sufficient time has elapsed to permit dissipation of toxic materials.

**General Notes**

There are advantages and disadvantages in topsoiling:

- Stripping, stockpiling, reapplying or importing topsoil may not always be cost-effective. Topsoiling can delay seeding or sodding operations and increase the exposure time of denuded areas. Also, most topsoils contain weed seeds, and weeds may compete with desirable species.

- On the other hand, the advantages of topsoil include its high organic matter content, friable nature, water-holding capacity, and nutrient content, which makes it an excellent medium for growth and greatly reduces chances of failure.

Further, preparing a seedbed in subsoil may be considered instead of topsoiling, as some subsoils may provide a good growth medium which is generally free of weed seeds.

If topsoiling is to be done, it should be determined if an adequate volume of topsoil exists on the site. The stockpile should be located for proper non-erosive drainage and such that it does not interfere with work on the site. Sufficient time should be allowed for spreading and bonding topsoil

prior to seeding, sodding or planting; topsoil and subsoil should be properly bonded. Topsoil should not be applied to a subsoil with contrasting texture (as a clay) unless the surface of the subsoil is scarified to provide a good bond with the topsoil.