# Section 3
# Temporary Construction Site Runoff Management Practices (TCPs)

# Section 3 – Temporary Construction Site Runoff Management Practices (TCPs)

## 3.1 Introduction

The erosion and sedimentation of soil are natural processes that occur daily. Erosion can occur due to wind, the impact of a raindrop, or the force of water flowing across the soil surface. Clearing and grubbing or other land disturbance activities during construction can increase the rate and amount of sediment loss from a site due to erosion. Thus, erosion and sedimentation are one of the most significant sources of pollution occurring in stormwater run-off from a typical construction site. Therefore, proper Erosion Prevention and Sediment Control (EP&SC) Best Management Practices (BMPs) are essential for effective water quality protection and also to ensure compliance with the State of Tennessee's General NPDES Permit for Stormwater Discharges Associated with Construction Activities (http://www.tn.gov/environment/permits/conststrm.shtml).

There are two types of EP&SC BMPs. The first type, erosion prevention practices, includes ground covers that prevent different types of erosion from occurring. These ground covers include vegetation, mulch, and blankets that absorb the energy of a raindrop's impact and reduce the possibility for sheet erosion to occur. Diversions, check dams, slope drains, and storm drain protection, while they may also trap sediment, are primarily used to prevent rill and gully erosion from starting. The second type, sediment control practices, attempts to prevent soil particles that are already being carried in stormwater from leaving the site and entering waterways. Silt fence, sediment traps, sediment basins, check dams, and even vegetative cover are common types of sediment control practices.

The BMPs presented in this section are intended to serve as Temporary Construction Site Runoff Management Practices (TCPs), lasting only as long as the construction activities themselves. Details regarding Post Construction Erosion Prevention and Sediment Control (PESC) and Permanent Storm Water Treatment Controls (PTPs), which are intended to function on a long-term basis, are provided in Section 4 and Section 5, respectively.

## 3.2 Management Practice Fact Sheets

TDEC's Erosion and Sediment Control (E&SC) Handbook has been designed to provide standardized and comprehensive erosion prevention and sediment control BMPs for use throughout Tennessee. The handbook is designed to provide information to planners, developers, engineers and contractors on the proper selection, installation and maintenance of the BMPs. The handbook should be used during the design and construction phases of projects and is available for download through the Tennessee Erosion and Prevention Control (TNEPSC) website (http://www.tnepsc.org/handbook.asp).

The City of Franklin has adopted the criteria listed within TDEC's E&SC Handbook for the selection, design, implementation and maintenance of TCPs. These management practices should be selected and utilized as a comprehensive set of controls rather than individual, standalone practices. The management practices approved for use by the City of Franklin as presented within TDEC's E&SC Handbook are listed in Table 3-1 below.

| Table 3-1<br>TDEC E&SC Handbook<br>Temporary Construction Site Runoff Management Practices |
|---|
| **Site Preparation** |
| Identifying sensitive areas or critical areas |
| Construction sequencing |
| Topsoiling |
| Tree preservation |
| Surface roughening and tracking |
| **Stabilization Practices** |
| Stabilization with straw mulch |
| Stabilization with other mulch materials |
| Temporary vegetation |
| Permanent vegetation |
| Sod |
| Rolled erosion control products |
| Hydro applications |
| Soil binders |
| Emergency stabilization with plastic |
| Soil enhancement |
| **Pollution Prevention** |
| Concrete washout |
| Vehicle maintenance |
| Chemical storage |
| Trash and debris management |
| **Runoff Control and Management** |
| Check dam |
| Dewatering treatment practice |
| Diversion |
| Outlet protection |
| Slope drain |
| Tubes and wattles |
| Level spreader |
| Channels (stable channel design) |
| **Sediment Control Practices** |
| Construction exit* |
| Tire washing facility |
| Filter ring |
| Sediment basin |
| Sediment trap |
| Baffles |
| Silt fence* |
| Inlet protection |
| Construction road stabilization |

| Table 3-1<br>TDEC E&SC Handbook<br>Temporary Construction Site Runoff Management Practices |
|---|
| **Sediment Control Practices (cont'd)** |
| Tubes and wattles |
| Filter berm |
| Turbidity curtain |
| Flocculants |
| **Stream Protection Practices** |
| Stream buffers |
| Stream diversion |
| Temporary stream crossing |
| Bioengineered streambank stabilization |

***City of Franklin Fact Sheet required (see Table 3-2)**

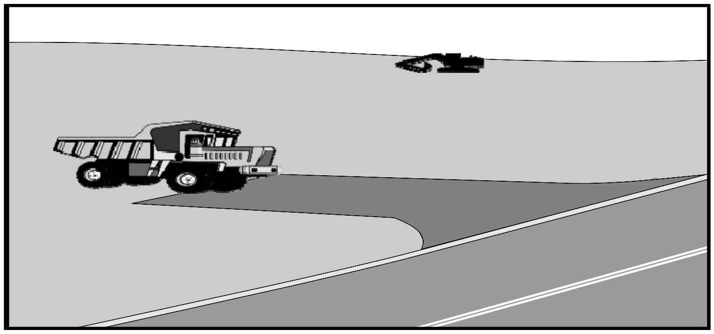
For the TCPs listed in Table 3-2 below, the City of Franklin has implemented requirements that differ from those presented in TDEC's E&SC Handbook. The fact sheets provided on the following pages within this Section must be adhered to for the management practices listed below.

**Table 3-2**
**City of Franklin**
**Temporary Construction Site Runoff Management Practices**

| Fact Sheet ID | Description |
|---|---|
| **TCP – 01** | Stabilized Construction Entrance |
| **TCP – 02** | Silt Fence |
| **TCP – 03** | Terracing |

Each fact sheet contains information regarding specific pollutants of concern, a description of the control measure, suitable applications, implementation procedures, and maintenance requirements. Each fact sheet also contains an "Inspection Checklist" to ensure that each EP&SC measure is managed properly. The inspection checklist provides a list of critical items for each of the BMPs. It is not intended to limit the inspection process, but is intended to guide and strengthen the inspection process and maintenance procedures. There may be additional inspection points made by City inspectors.

| ACTIVITY: Stabilized Construction Entrance | TCP – 01 |
|---|---|



**Targeted Constituents**

● **Significant Benefit** ◉ **Partial Benefit** ○ **Low or Unknown Benefit**

| | | | | |
|---|---|---|---|---|
| ◉ Sediment | ○ Heavy | ○ Floatable Materials | | ○ Oxygen Demanding Substances |
| ◉ Nutrients | ◉ Toxic Materials | ◉ Oil & Grease | ○ Bacteria & Viruses | ○ Construction Wastes |

**Implementation Requirements**

● **High** ◉ **Medium** ○ **Low**

| | | | | |
|---|---|---|---|---|
| ◉ Capital Costs | ○ O & M | ○ Maintenance | ○ Suitability for Slopes >5% | ○ Training |

## Description

The construction entrance practice is a stabilized pad of aggregate underlain with filter cloth located at any point where traffic will be entering or leaving a construction site to or from a public right-of-way, street, alley, sidewalk or parking area. Stabilizing the construction entrance significantly reduces the amount of sediment (dust, mud) tracked off-site, especially if a wash rack is incorporated for removing caked on sediment. If soil and stormwater runoff conditions warrant removal of mud from construction vehicles, see the Tire Washing Facility Sediment Control Practice within TDEC's current E&SC Handbook. This management practice is likely to create a significant reduction in sediment, nutrients, toxic materials, and oil and grease.

## Suitable Applications

- All points of construction ingress and egress.
- Unpaved areas where sediment tracking occurs from site onto paved or public roads.

**Approach**

- Construct on level ground where possible.
- Stones should be 2-3 in (5.1-7.6 cm) crushed, washed, and well graded rock to at least a 6 in (15.2 cm) depth.
- Length should be 100 ft (30.5 m) minimum, and 20 ft (6.1 m) minimum width.
- Provide ample turning radii as part of entrance.
- Should be used in conjunction with street sweeping on adjacent public right-of-way.
- It is strongly suggested that perimeter fencing be installed proximate to the construction entrance that will limit egress to the designated construction exit(s).

**Maintenance**

- Inspect weekly and after each rainfall.
- Requires periodic top dressing with additional stones; add gravel material when soil subgrade becomes visible.
- Remove all sediment deposited on paved roadways at the end of the work day.
- Remove gravel and filter fabric at completion of construction.

**Limitations**

Stabilized construction entrances are rather expensive to construct, especially when a wash rack is included. Most construction sites will already require some measure of sediment trap. A sediment trap of some kind must also be provided to collect wash water runoff. The cost of a sediment trap for a construction entrance should be incremental or much less expensive than other BMPs to control sediment from a construction entrance.

**Additional Information**

A stabilized construction entrance is a pad of aggregate that may be enhanced with an underlain filter cloth, located at any point where traffic will be entering or leaving a construction site to or from a public right-of-way, street, alley, sidewalk or parking area. The purpose of a stabilized construction entrance is to reduce or eliminate the tracking of sediment onto public rights-of-way or streets. Reducing trackout of sediments and other pollutants onto paved roads helps prevent deposition of sediments into local storm drains and production of airborne dust.

A stabilized construction entrance should be used at all points of construction ingress and egress. The NPDES permits administered by TDEC require that appropriate measures be implemented to prevent trackout of sediments onto paved roadways, which is a significant source of sediments derived from mud and dirt carryout from the unpaved roads and construction sites.

Stabilized construction entrances are moderately effective in removing sediment from equipment leaving a construction site. Advantages of the Stabilized Construction Entrance is that it does remove some sediment from equipment and serves to channel construction traffic in and out of the site at specified locations. Efficiency is greatly increased when a wash rack is included as part of a stabilized construction entrance (See Tire Washing Facility Sediment Control Practice within TDEC's current E&SC Handbook).

The entrance must be properly graded to prevent runoff from leaving the construction site. When wash areas are provided, washing is done on a reinforced concrete pad (if significant washing is necessary) or in an area stabilized with crushed stone which drains into a properly constructed sediment trap or basin. Sediment barriers, such as swales with check dams, must be provided to prevent sediments from entering into the stormwater sewer system, ditch, or waterway.

**Primary References**

*California Storm Water Best Management Practice Handbooks*, CDM et. al. for the California SWQTF, 1993.

*Caltrans Storm Water Quality Handbooks*, CDM et.al. for the California Department of Transportation, 1997.

*Tennessee Erosion and Sediment Control Handbook*, Tennessee Department of Environment and Conservation, July 1992.

**Additional References**

*Best Management Practices and Erosion Control Manual for Construction Sites*, Flood Control District of Maricopa County, Arizona, September 1992.

*Manual of Standards of Erosion and Sediment Control Measures*, Association of Bay Area Governments, June 1981.

*Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*, Work Group Working Paper, USEPA, April, 1992.

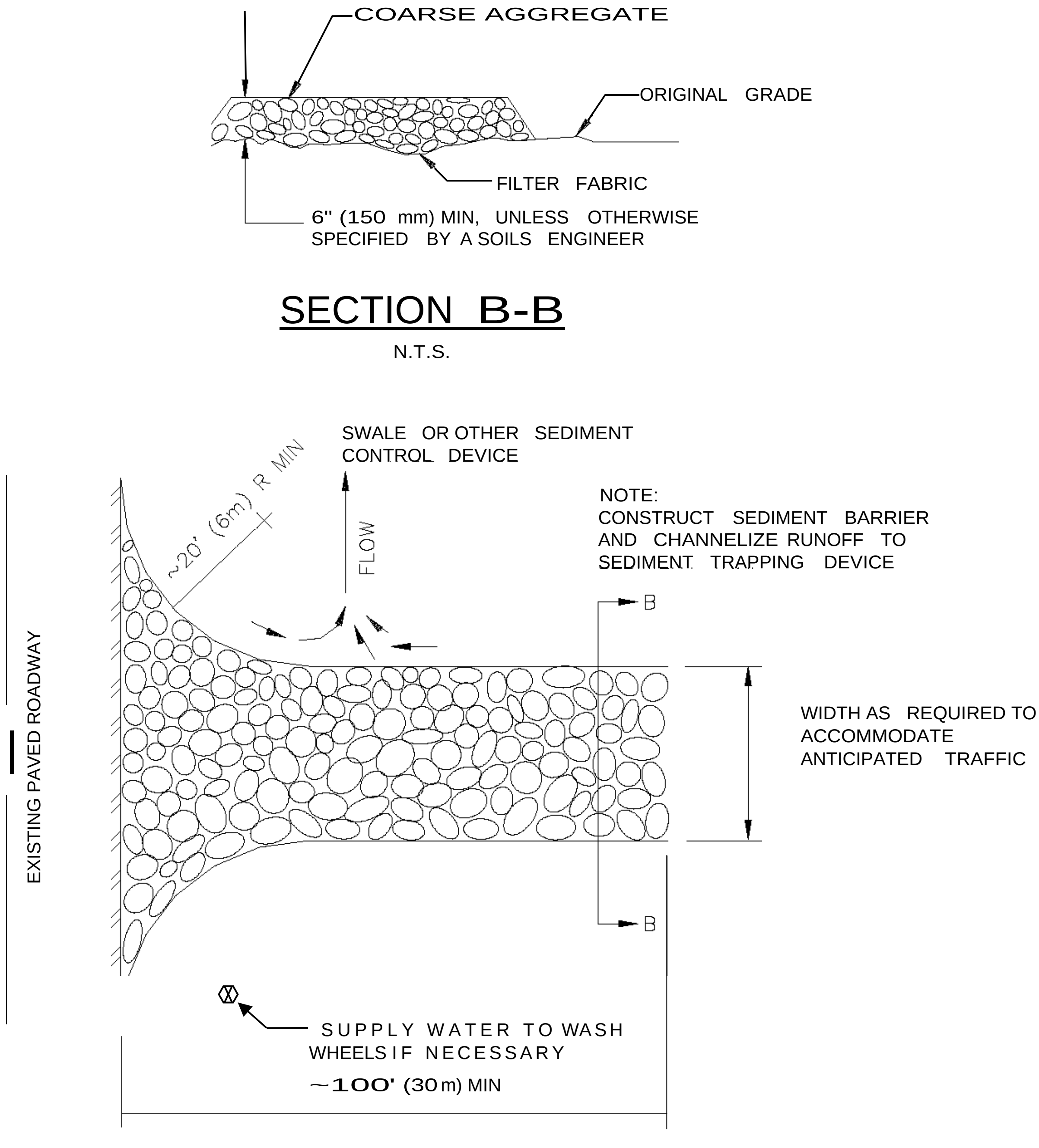
*Stormwater Management Water for the Puget Sound Basin*, Washington State Department of Ecology, The Technical Manual – February 1992, Publication # 91-75.

*Virginia Erosion and Sedimentation Control Handbook*, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, 1991.

*Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices*, Tahoe Regional Planning Agency – November 1988.

**Inspection Checklist**

- ☐ Are there indications that vehicles are leaving the site in areas other than the designated construction exit(s)?
- ☐ Are there indications that mud, dust or dirt is tracked onto the adjacent road via the construction exit(s)?
- ☐ Is the construction exit sufficiently maintained to prevent mud, dirt, and dust from being tracked off-site?




PLAN VIEW

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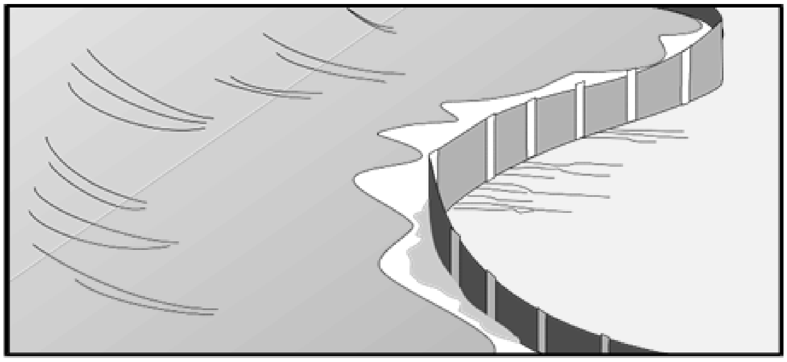
Figure TCP-01-1
Stabilized Construction Entrance

# ACTIVITY: Silt Fence

# TCP – 02



CITY OF FRANKLIN
STORMWATER
MANAGEMENT

**Targeted Constituents**

● **Significant Benefit** ⦿ **Partial Benefit** ○ **Low or Unknown Benefit**

| | | | | |
|---|---|---|---|---|
| ● Sediment | ○ Heavy Metals | ○ Floatable Materials | ○ Oxygen Demanding Substances | |
| ○ Nutrients | ○ Toxic Materials | ○ Oil & Grease | ○ Bacteria & Viruses | ○ Construction Wastes |

**Implementation Requirements**

● **High** ⦿ **Medium** ○ **Low**

| | | | | |
|---|---|---|---|---|
| ⦿ Capital Costs | ⦿ O & M Costs | ⦿ Maintenance | ○ Suitability for Slopes > 5% | ⦿ Training |

## Description

A silt fence is made of a filter fabric which has been entrenched, attached to supporting poles, and sometimes backed by a wire fence for support. The silt fence detains sediment-laden water, promoting sedimentation behind the fence.

A silt fence is a temporary sediment barrier consisting of filter fabric stretched across and attached to supporting posts, entrenched, and depending upon the strength of the fabric used, supported with wire fence. Silt fences trap sediment in two ways: (1) by intercepting and detaining small amounts of sediment from disturbed areas during construction operations in order to promote sedimentation behind the fence; and (2) by decreasing the velocity of low flows (up to 0.5 cfs (1.4 x $10^{-2}$ $m^3$/s)) in swales. In simpler terms, a silt fence does not filter the water - it slows it down enough for the sediment to settle out of the runoff water. This management practice is likely to create a significant reduction in sediment.

Silt fences, while much more effective than straw bales and brush barriers, are not as effective as sand bag barriers or rock filters (especially continuous berms). The difference in effectiveness is due to the durability and maintenance requirements.

## Suitable Applications

- Along the downstream perimeter of the phase construction.
- Below the toe of a cleared slope.
- Upstream of sediment traps or basins.
- Along streams and channels (not across).
- Around temporary spoil areas.
- Across swales with catchments less than 1 acre (0.4 ha) (per 400 ft (125.7 m) of fence) and below other small cleared areas.

**Installation/ Application Criteria**

- Silt fences are typically installed with ¼ acre draining to every 100 ft (31.4 m) of silt fence. They are designed to function under a 10-year storm event and may be operated for as long as 5 to 8 months. Silt fences are designed to pond water behind them, so it is crucial that they are sufficiently anchored and follow contours. Silt fences that are not entrenched and follow contours can result in worsened erosion.

- Silt fences may be used for downstream perimeter control, placed upstream of the point(s) of discharge of sheet flow from a site. They may also be used as interior controls below disturbed areas where runoff may occur in the form of sheet and rill erosion, and perpendicular to minor swales or ditch lines for up to one acre contributing drainage areas. Silt fences are generally ineffective in locations where the flow is concentrated and are only applicable for sheet or overland flows.

- Use principally in areas where sheet flow occurs.

- Install along a level contour, so water does not pond more than 1.5 ft (0.5 m) at any point.

- The maximum slope perpendicular to the fence line should be 1:1.

- No more than 0.25 acre (0.1 ha) per 100 ft (31.4 m), or 0.5 cfs (1.4 x $10^{-2}$ $m^3/s$) of concentrated flow should drain to any point along the silt fence.

- Turn ends of fence uphill to prevent scour from wash around.

- Provide area behind the fence for runoff to pond and sediment to settle (Approx. 1200 sq.ft. (111.5 $m^2$) per acre (0.4 ha) draining to the silt fence).

- Select filter fabric which retains 85% of the soil, by weight, based on sieve analysis, but is not finer than an equivalent opening size of 70.

- Select standard duty or heavy duty prefabricated silt fence based on criteria shown below:

  ***Standard Duty Silt Fence***
  - Slope of area draining to fence is 4:1 (H:V) or less.
  - Use is generally limited to less than five months.
  - Area draining to fence produces low sediment loads.
  - Use prefabricated standard duty silt fence.

  ***Heavy Duty Silt Fence***
  - Slope of area draining to fence is 1:1 (H:V) or less.
  - Use generally limited to eight months. Longer periods may require fabric replacement.
  - Area draining to fence produces moderate sediment loads.

- Use prefabricated heavy-duty silt fence. Heavy duty silt fences typically have the following physical characteristics:

  (1) Fence fabric has greater tensile strength than other fabric types available from manufacturer.
  (2) Fence fabric has a greater permittivity than other fabric types available from manufacturer.
  (3) Fence fabric may be reinforced with a backing or additional support to increase fabric strength.
  (4) Posts may be spaced closer together than other premanufactured silt fence types available from manufacturer.

- Most manufactured silt fencing has a colored band that indicates the depth of trenching required. If the lower colored band is visible then the silt fence is not trenched deep enough.

- Install silt fence along a level contour, with the last 6 ft (1.9 m) of fence turned up slope. Except for the ends, the difference in elevation between the highest and lowest point along the top of the silt fence shall not exceed one-third the fence height.

- Posts should be spaced a maximum of 6 ft (1.9 m) apart and driven securely into the ground a minimum of 30 inches (0.8 m).

- A trench should be excavated approximately 8 inches (20.3 cm) wide and 12 inches (30.5 cm) deep along the line of posts and upslope from the barrier.

- When standard strength filter fabric is used, a wire mesh support fence should be fastened securely to the upslope side of the posts using heavy-duty wire staples at least 1 inch (2.5 cm) long, tie wires or hog rings. The wire should extend into the trench a minimum of 4 inches (10.2 cm).

- The standard strength filter fabric should be stapled or wired to the fence, and 40 inches (102 cm) of the fabric should extend into the trench. When extra-strength filter fabric and closer post spacing are used, the wire mesh support fence may be eliminated and the filter fabric stapled or wired directly to the posts.

- Avoid the use of joints. The filter fabric should be purchased in a continuous roll, then cut to the length of the barrier. When joints are necessary, filter cloth should be spliced together only at a support post, with a minimum 6-inch (15.2-cm) overlap, and both ends securely fastened to the post.

- The trench should be backfilled with compacted native material.

- Generally, silt fencing should be used in conjunction with erosion source controls up slope to provide effective control.

**Maintenance**

- Inspect weekly and after each rainfall.

- Repair wherever fence is damaged.

- Remove sediment when it reaches 1/3 the height of the fence.
- Inspect silt fence when rain is forecast. Perform required maintenance before the storm event.
- Remove silt fence when no longer needed. Fill and compact post holes and anchorage trench, remove sediment accumulation, and grade alignment to blend with adjacent ground.

**Limitations**

- Do not place fence on a slope, or across any contour line. This may result in worse erosion than not installing the fence at all.
- Do not use in streams, channels, or anywhere flow has concentrated.
- Do not use in locations where ponded water may cause flooding.
- Limit the length of slope draining to any point along the silt fence to 100 ft (30 m) or less.
- Limit length of any single run of silt fence to 500 ft (150 m).
- Must be placed along a level contour.
- Don't use below slopes subject to creep, slumping, or landslides.
- Don't use silt fences to divert flow.

**Additional Information**

Silt fences are preferable to straw barriers in many cases. Laboratory work at the Virginia Highway and Transportation Research Council has shown that silt fences can trap a much higher percentage of suspended sediments than can straw bales. While the failure rate of silt fences is lower than that of straw barriers, there are many instances where silt fences have been improperly installed.

Selection of a filter fabric is based on soil conditions at the construction site (which affect the equivalent opening size (EOS) fabric specifications) and characteristics of the support fence (which affect the choice of tensile strength). The designer should specify a filter fabric that retains the soil found on the construction site yet will have openings large enough to permit drainage and prevent clogging. The following criteria is recommended for selection of the equivalent opening size:

1. If 50 percent or less of the soil, by weight, will pass the U.S. standard sieve No. 200, select the EOS to retain 85 percent of the soil. The EOS should not be finer than EOS 70.
2. For all other soil types, the EOS should be no larger than the openings in the U.S. Standard Sieve No. 70 [0.0083 in. (0.21 mm.)] except where direct discharge to a stream, lake, or wetland will occur, then the EOS should be no larger than Standard Sieve No. 100.

To reduce the chance of clogging, it is preferable to specify a fabric with openings as large as allowed by the criteria. No fabric should be specified with an EOS smaller than U.S. Standard Sieve No. 100 [0.0059 in. (0.15 mm)]. If 85 percent or more of a soil, by weight, passes through the openings in a No. 200 sieve [0.0029 in. (0.074 mm)], filter fabric should not be used. Most of the particles in such a soil would not be retained if the EOS was too large, and they would clog the fabric quickly if the EOS was small enough to capture the soil.

The fence should be supported by a wire mesh if the fabric selected does not have sufficient strength and bursting strength characteristics for the planned application (as recommended by the fabric manufacturer). Filter fabric material should contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0°F to 120°F.

**Primary References**

*California Storm Water Best Management Practice Handbooks*, CDM et.al. for the California SWQTF, 1993.

*Caltrans Storm Water Quality Handbooks*, CDM et.al. for the California Department of Transportation, 1997.

**Additional References**

*Best Management Practices and Erosion Control Manual for Construction Sites*, Flood Control District of Maricopa County, Arizona, September 1992.

*Environmental Action Manual*, City of Austin, Texas, 1989.

*Manual of Standards of Erosion and Sediment Control Measures*, Association of Bay Area Governments, June 1981.

*Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*, Work Group Working Paper, USEPA, April, 1992.

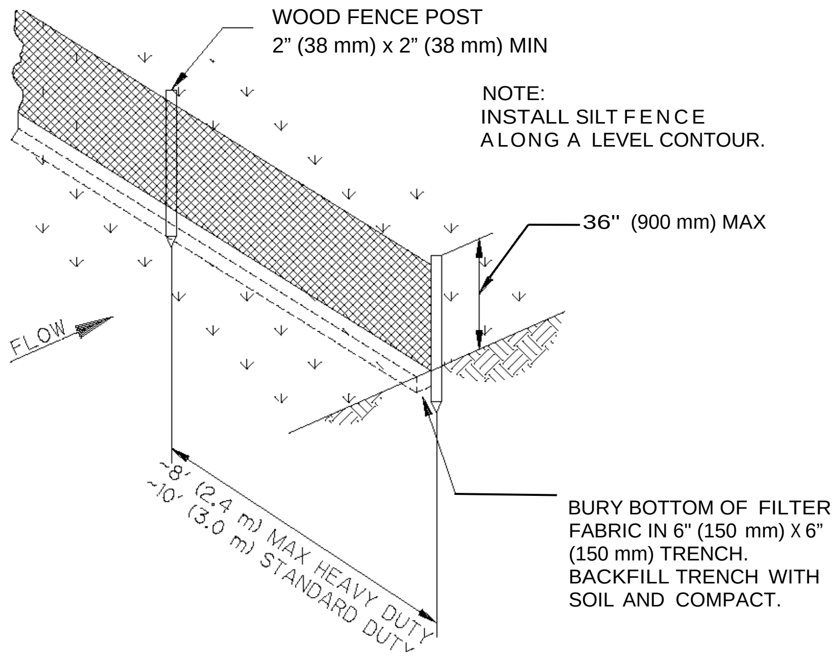
*Sedimentation and Erosion Control Practices*, An Introductory of Current Practices (Draft), USEPA, 1990.

*Stormwater Management Manual for the Puget Sound Basin*, Washington State Department of Ecology, Public Review Draft, 1991.

*Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices*, Tahoe Regional Planning Agency – November 1988.

**Inspection Checklist**

- ☐ Does the silt fence follow a contour?
- ☐ Are the ends of the silt fence turned uphill for the last 6 ft (1.8 m)?
- ☐ Is the anchor trench depth color band visible?
- ☐ Is the silt fence secure to the posts?
- ☐ Has sediment accumulated behind the fence by more than 1/3 the height of the fence? If yes, then clear it.
- ☐ Does any 100-foot (30.5 m) of silt fence serve more than ¼ acre (0.1 ha) of exposed area?
- ☐ Is there any indication of washaround or underwash? If yes, then reset the fence and determine if it is overloaded (i.e. another fence should be installed upstream).




TYPICAL PREFABRICATED
SILT FENCE INSTALLATION
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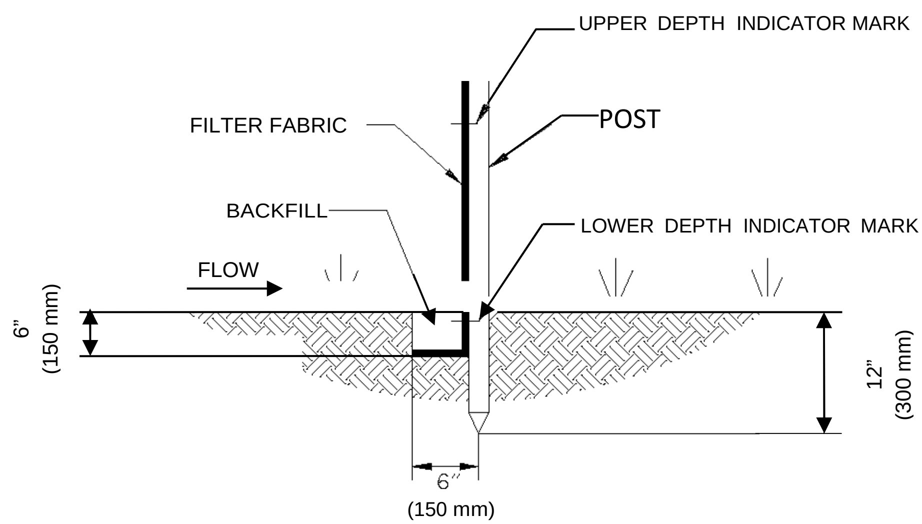


SECTION
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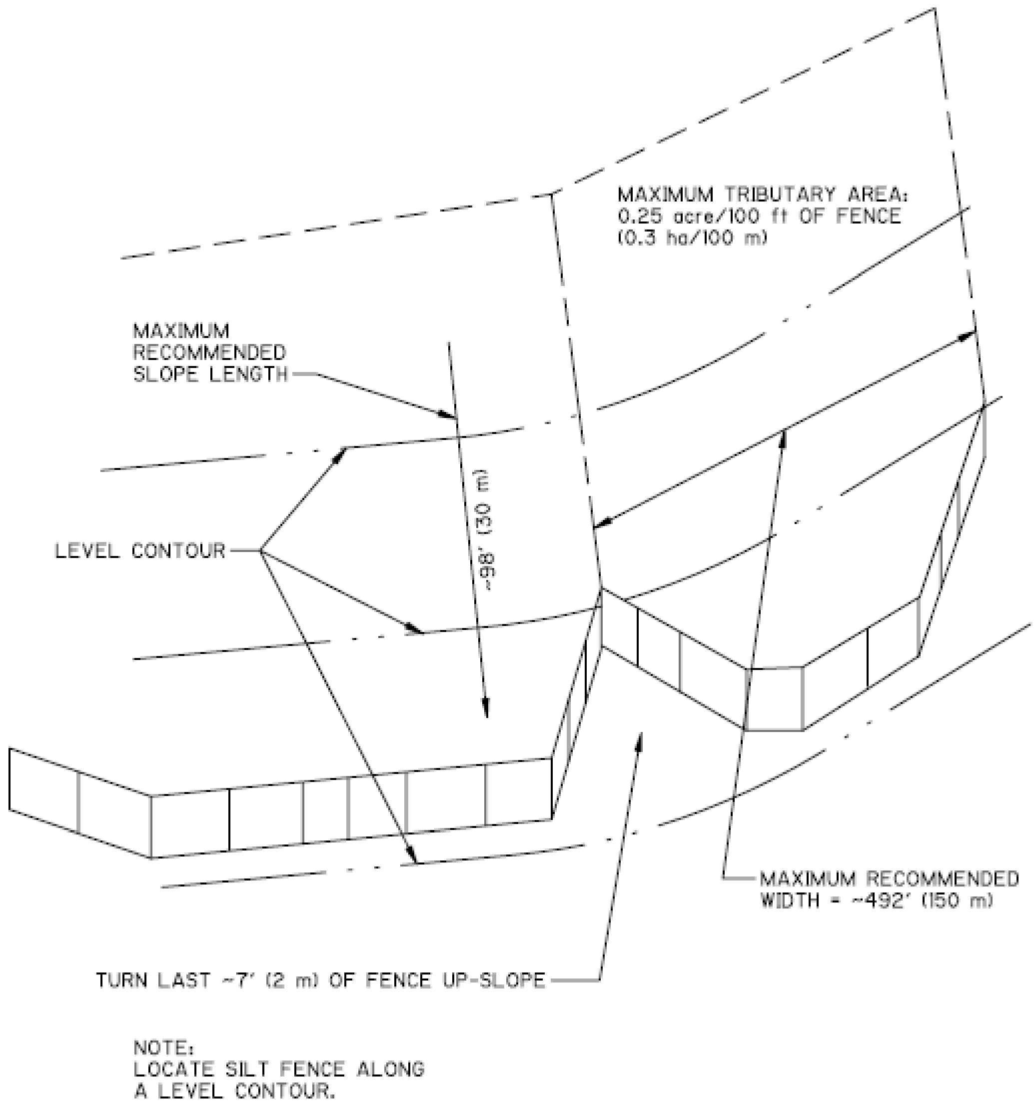
Figure TCP-02-1
Silt Fence Anchoring




PLAN VIEW
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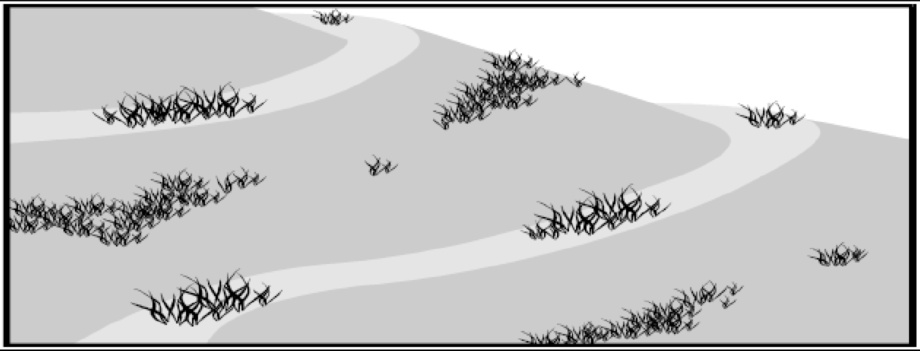
Figure TCP-02-2
Silt Fence End Layout

**ACTIVITY:** Terracing

# TCP-03



| Targeted Constituents | | |
|---|---|---|
| ● Significant Benefit | ◉ Partial Benefit | ○ Low or Unknown Benefit |

| | | | |
|---|---|---|---|
| ● Sediment | ○ Heavy Metals | ○ Floatable Materials | ○ Oxygen Demanding Substances |

| | | | | |
|---|---|---|---|---|
| ○ Nutrients | ○ Toxic Materials | ○ Oil & Grease | ○ Bacteria & Viruses | ○ Construction Wastes |

| Implementation Requirements | | |
|---|---|---|
| ● High | ◉ Medium | ○ Low |

| | | | | |
|---|---|---|---|---|
| ○ Capital Costs | ○ O & M Costs | ○ Maintenance | ● Suitability for Slopes >5% | ○ Training |

## Description

Terracing creates small but widespread areas for establishing vegetation that reduces runoff velocity, increases infiltration, and provides small depressions for trapping sediment, thereby reducing sediment from leaving the site. This management practice is likely to create a significant reduction in sediment.

## Suitable Applications

- Any cleared area prior to temporary or permanent seeding and planting.
- Required for cleared, erodible slopes steeper than 3:1 (H:V) and higher than 5 feet (1.5 m) prior to seeding and planting.
- Graded areas with smooth, hard surfaces.
- Where length of slopes needs to be shortened by terracing. Note, terracing is usually permanent, and should be designed under the direction of and approved by a licensed professional civil engineer based on site conditions. Terraces must be designed with adequate drainage and stabilized outlets.
- Terracing can be enhanced by surface roughening as explained in TDEC’s E&SC Handbook.

## Application Methods

Slope roughening/terracing is performed in several ways:

- Stair-step grading.
- Grooving.
- Furrowing.

- Tracking.
- Rough grading.
- No grading.

**Installation/ Application Criteria**

Graded areas with smooth, hard surfaces give a false impression of "finished grading" and a job well done. It is difficult to establish vegetation on such surfaces due to reduced water infiltration and the potential for erosion. Rough slope surfaces with uneven soil and rocks left in place may appear unattractive or unfinished at first, but they encourage water infiltration, speed the establishment of vegetation, and decrease runoff velocity. Rough, loose soil surfaces give lime, fertilizer, and seed some natural coverage. Niches in the surface provide microclimates which generally provide a more favorable moisture level that aids seed germination.

There are different methods for achieving a roughened soil surface on a slope, and the selection of an appropriate method depends upon the type of slope. Roughening methods include stair-step grading, grooving, and tracking. Factors to be considered in choosing a method are slope steepness, mowing requirements, and whether the slope is formed by cutting or filling.

1. Disturbed areas which will not require mowing may be stair-step graded, grooved, or left rough after filling.
2. Graded areas steeper than 3:1 (H:V) should be stair-stepped with benches (See figure TCP-03-1). The stair-stepping will help vegetation become attached and also trap soil eroded from the slopes above. Stair-step grading is particularly appropriate in soils containing large amounts of soft rock. Each "step" catches material which sloughs from above, and provides a level site where vegetation can become established. Stairs should be wide enough to work with standard earth moving equipment.
3. Make the vertical cut distance less than the horizontal distance, and slightly slope the horizontal position of the step in towards the slope.
4. Do not make individual vertical cuts more than 24 in. (600 mm) high in soft materials or more than 3 ft. (1 m) high in rocky materials.
5. Groove the slope using machinery to create a series of ridges and depressions that run across the slope and on the contour.

***Fill Slope Roughening***

- Place fill slopes with a gradient steeper than 3:1 (H:V) in lifts not to exceed 8 in. (200 mm), and make sure each lift is properly compacted.
- Ensure that the face of the slope consists of loose, uncompacted fill 4 in. (100 mm) to 6 in. (150 mm). This is not to be confused with proper compaction necessary for

slope stabilization.

- Use grooving or tracking to roughen the face of the slopes, if necessary.
- Apply seed, fertilizer, and mulch and then track or crimp in the mulch. See TDEC's E&SC Handbook for temporary vegetation practices.
- Do not blade or scrape the final slope face.

***Cuts, Fills, and Graded Areas***

- Slopes that will be maintained by mowing should be no steeper than 3:1 (H:V).
- To roughen these areas, create shallow grooves by normal tilling, disking, harrowing, or use a mechanical seeder. Make the final pass of any such tillage on the contour.
- Make grooves formed by such implements close together, less than 10 in. (250mm), and not less than 1 in. (25 mm) deep.
- Excessive roughness is undesirable where mowing is planned.

## Maintenance Limitations

Periodically check the seeded or planted slopes for rills and washes, particularly after significant storm events greater than 0.5 in. (12 mm). Fill these areas slightly above the original grade, then reseed and mulch as soon as possible.

- Inspect roughened slopes weekly and after rainfall for excessive erosion.
- Roughening may increase grading costs and result in sloughing in certain soil types.
- Stair-step grading may not be practical for sandy soils, very steep, or shallow slopes.
- Roughening alone as a temporary erosion prevention measure is of limited effectiveness in intense rainfall events. If roughening effects are washed away in a heavy storm, the surface will have to be re-roughened and new seed and mulch applied.

## Primary References

*California Storm Water Best Management Practice Handbooks*, CDM et.al. for the California SWQTF, 1993.

*Caltrans Storm Water Quality Handbooks*, CDM et.al. for the California Department of Transportation, 1997.

## Subordinate References

*Best Management Practices and Erosion Control Manual for Construction Sites*, Flood Control District of Maricopa County, Arizona, September 1992.

*Handbook of Steel, Drainage & Highway Construction*, American Iron and Steel Institute, 1983.

*Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*, Work Group Working Paper, USEPA, April, 1992.

*Stormwater Management Water for the Puget Sound Basin*, Washington State Department of Ecology, The Technical Manual – February 1992, Publication #91-75.

## Inspection Checklist

- Are furrows at least 6-inches (15.2 cm) deep?
- Are furrows spaced no more than 50-feet (15.2 m) apart?
- What are the groove slopes in serrated slopes?
- Are stepped slopes cut so that the horizontal distance is greater than the vertical?
- Are stepped or terraced slopes cut so that the steps drain in on themselves?

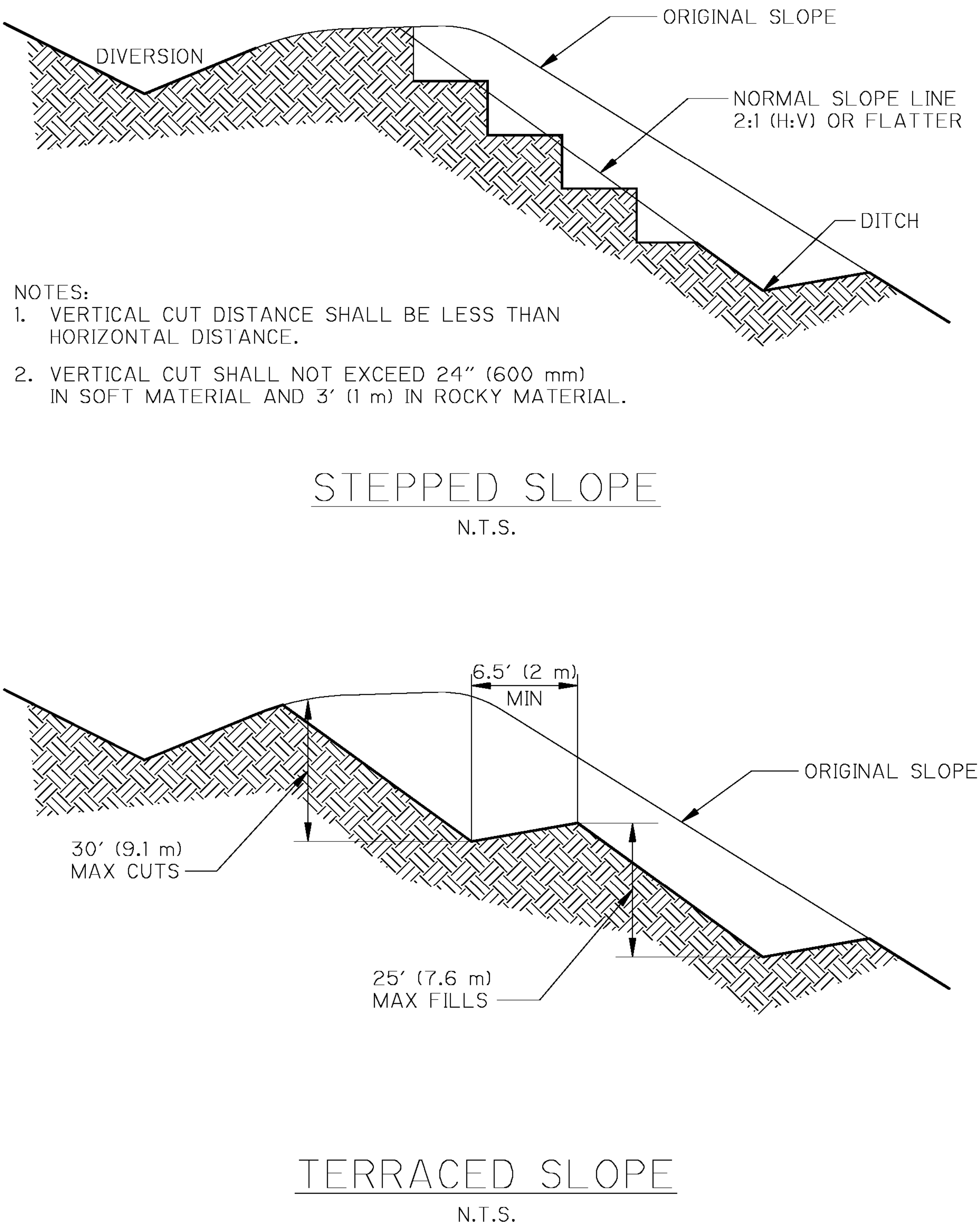



Figure TCP-03-1
Stepped and Terraced Slope Construction