

**APPENDIX A2**  
**Construction Stormwater Pollution Prevention Standards and  
Specifications for Best Management Practices**

This appendix contains standards and specifications for construction stormwater pollution prevention best management practices consistent with Chapter 4 of Volume II of the Washington State Department of Ecology Stormwater Management Manual for Western Washington

## Chapter 4 - Standards and Specifications for Best Management Practices

Best Management Practices (BMPs) are defined as schedules of activities, prohibitions of practices, maintenance procedures, and structural and/or managerial practices, that when used singly or in combination, prevent or reduce the release of pollutants to waters of Washington State. This chapter contains standards and specifications for temporary BMPs to be used as applicable during the construction phase of a project.

**Section 4.1** contains the standards and specifications for Source Control BMPs.

**Section 4.2** contains the standards and specifications for Runoff Conveyance and Treatment BMPs.

The standards for each individual BMP are divided into four sections:

1. Purpose
2. Conditions of Use
3. Design and Installation Specifications
4. Maintenance Standards

Note that the “Conditions of Use” always refers to site conditions. As site conditions change, BMPs must be changed to remain in compliance.

Information on streambank stabilization is available in the *Integrated Streambank Protection Guidelines*, Washington State Department of Fish and Wildlife, 2000.

## 4.1 Source Control BMPs

### BMP C101: Preserving Natural Vegetation

#### *Purpose*

The purpose of preserving natural vegetation is to reduce erosion wherever practicable. Limiting site disturbance is the single most effective method for reducing erosion. For example, conifers can hold up to about 50 percent of all rain that falls during a storm. Up to 20-30 percent of this rain may never reach the ground but is taken up by the tree or evaporates. Another benefit is that the rain held in the tree can be released slowly to the ground after the storm.

#### *Conditions of Use*

- Natural vegetation should be preserved on steep slopes, near perennial and intermittent watercourses or swales, and on building sites in wooded areas.
- As required by plat conditions, land use code, or land use approvals.

#### *Design and Installation Specifications*

Natural vegetation can be preserved in natural clumps or as individual trees, shrubs and vines.

The preservation of individual plants is more difficult because heavy equipment is generally used to remove unwanted vegetation. The points to remember when attempting to save individual plants are:

- Is the plant worth saving? Consider the location, species, size, age, vigor, and the work involved. Plat conditions or land use regulations may also require that natural vegetation and trees be saved.
- Fence or clearly mark areas around trees that are to be saved. It is preferable to keep ground disturbance away from the trees at least as far out as the dripline.

Plants need protection from three kinds of injuries:

- *Construction Equipment* - This injury can be above or below the ground level. Damage results from scarring, cutting of roots, and compaction of the soil. Placing a fenced buffer zone around plants to be saved prior to construction can prevent construction equipment injuries.
- *Grade Changes* - Changing the natural ground level will alter grades, which affects the plant's ability to obtain the necessary air, water, and minerals. Minor fills usually do not cause problems although sensitivity between species does vary and should be checked. Trees can tolerate fill of 6 inches or less. For shrubs and other plants, the fill should be less.

When there are major changes in grade, it may become necessary to supply air to the roots of plants. This can be done by placing a layer of gravel and a tile system over the roots before the fill is made. A tile

system protects a tree from a raised grade. The tile system should be laid out on the original grade leading from a dry well around the tree trunk. The system should then be covered with small stones to allow air to circulate over the root area.

Lowering the natural ground level can seriously damage trees and shrubs. The highest percentage of the plant roots are in the upper 12 inches of the soil and cuts of only 2-3 inches can cause serious injury. To protect the roots it may be necessary to terrace the immediate area around the plants to be saved. If roots are exposed, construction of retaining walls may be needed to keep the soil in place. Plants can also be preserved by leaving them on an undisturbed, gently sloping mound. To increase the chances for survival, it is best to limit grade changes and other soil disturbances to areas outside the dripline of the plant.

- *Excavations* - Protect trees and other plants when excavating for drainfields, power, water, and sewer lines. Where possible, the trenches should be routed around trees and large shrubs. When this is not possible, it is best to tunnel under them. This can be done with hand tools or with power augers. If it is not possible to route the trench around plants to be saved, then the following should be observed:

Cut as few roots as possible. When you have to cut, cut clean. Paint cut root ends with a wood dressing like asphalt base paint.

Backfill the trench as soon as possible.

Tunnel beneath root systems as close to the center of the main trunk to preserve most of the important feeder roots.

Some problems that can be encountered with a few specific trees are:

- Maple, Dogwood, Red alder, Western hemlock, Western red cedar, and Douglas fir do not readily adjust to changes in environment and special care should be taken to protect these trees.
- The windthrow hazard of Pacific silver fir and madronna is high, while that of Western hemlock is moderate. The danger of windthrow increases where dense stands have been thinned. Other species (unless they are on shallow, wet soils less than 20 inches deep) have a low windthrow hazard.
- Cottonwoods, maples, and willows have water-seeking roots. These can cause trouble in sewer lines and infiltration fields. On the other hand, they thrive in high moisture conditions that other trees would not.
- Thinning operations in pure or mixed stands of Grand fir, Pacific silver fir, Noble fir, Sitka spruce, Western red cedar, Western hemlock,

Pacific dogwood, and Red alder can cause serious disease problems. Disease can become established through damaged limbs, trunks, roots, and freshly cut stumps. Diseased and weakened trees are also susceptible to insect attack.

***Maintenance  
Standards***

- Inspect flagged and/or fenced areas regularly to make sure flagging or fencing has not been removed or damaged. If the flagging or fencing has been damaged or visibility reduced, it shall be repaired or replaced immediately and visibility restored.
- If tree roots have been exposed or injured, “prune” cleanly with an appropriate pruning saw or loppers directly above the damaged roots and recover with native soils. Treatment of sap flowing trees (fir, hemlock, pine, soft maples) is not advised as sap forms a natural healing barrier.

## **BMP C102: Buffer Zones**

- Purpose*** An undisturbed area or strip of natural vegetation or an established suitable planting that will provide a living filter to reduce soil erosion and runoff velocities.
- Conditions of Use*** Natural buffer zones are used along streams, wetlands and other bodies of water that need protection from erosion and sedimentation. Vegetative buffer zones can be used to protect natural swales and can be incorporated into the natural landscaping of an area.
- Critical-areas buffer zones should not be used as sediment treatment areas. These areas shall remain completely undisturbed. The City may expand the buffer widths temporarily to allow the use of the expanded area for removal of sediment.
- Design and Installation Specifications***
- Preserving natural vegetation or plantings in clumps, blocks, or strips is generally the easiest and most successful method.
  - Leave all unstable steep slopes in natural vegetation.
  - Mark clearing limits and keep all equipment and construction debris out of the natural areas. Steel construction fencing is the most effective method in protecting sensitive areas and buffers. Alternatively, wire-backed silt fence on steel posts is marginally effective. Flagging alone is typically not effective.
  - Keep all excavations outside the dripline of trees and shrubs.
  - Do not push debris or extra soil into the buffer zone area because it will cause damage from burying and smothering.
  - Vegetative buffer zones for streams, lakes or other waterways shall be established by the City or other state or federal permits or approvals.
- Maintenance Standards***
- Inspect the area frequently to make sure flagging remains in place and the area remains undisturbed.

## **BMP C103: High Visibility Plastic or Metal Fence**

### ***Purpose***

Fencing is intended to: (1) restrict clearing to approved limits; (2) prevent disturbance of sensitive areas, their buffers, and other areas required to be left undisturbed; (3) limit construction traffic to designated construction entrances or roads; and, (4) protect areas where marking with survey tape may not provide adequate protection.

### ***Conditions of Use***

To establish clearing limits, plastic or metal fence may be used:

- At the boundary of sensitive areas, their buffers, and other areas required to be left uncleared.
- As necessary to control vehicle access to and on the site.

### ***Design and Installation Specifications***

- High visibility plastic fence shall be composed of a high-density polyethylene material and shall be at least four feet in height. Posts for the fencing shall be steel or wood and placed every 6 feet on center (maximum) or as needed to ensure rigidity. The fencing shall be fastened to the post every six inches with a polyethylene tie. On long continuous lengths of fencing, a tension wire or rope shall be used as a top stringer to prevent sagging between posts. The fence color shall be high visibility orange. The fence tensile strength shall be 360 lbs./ft. using the ASTM D4595 testing method.
- Metal fences shall be designed and installed according to the manufacturer's specifications.
- Metal fences shall be at least 3 feet high and must be highly visible.
- Fences shall not be wired or stapled to trees.

### ***Maintenance Standards***

- If the fence has been damaged or visibility reduced, it shall be repaired or replaced immediately and visibility restored.

## BMP C104: Stake and Wire Fence

**Purpose** Fencing is intended to: (1) restrict clearing to approved limits; (2) prevent disturbance of sensitive areas, their buffers, and other areas required to be left undisturbed; (3) limit construction traffic to designated construction entrances or roads; and, (4) protect any areas where marking with survey tape may not provide adequate protection.

**Conditions of Use** To establish clearing limits, stake or wire fence may be used:

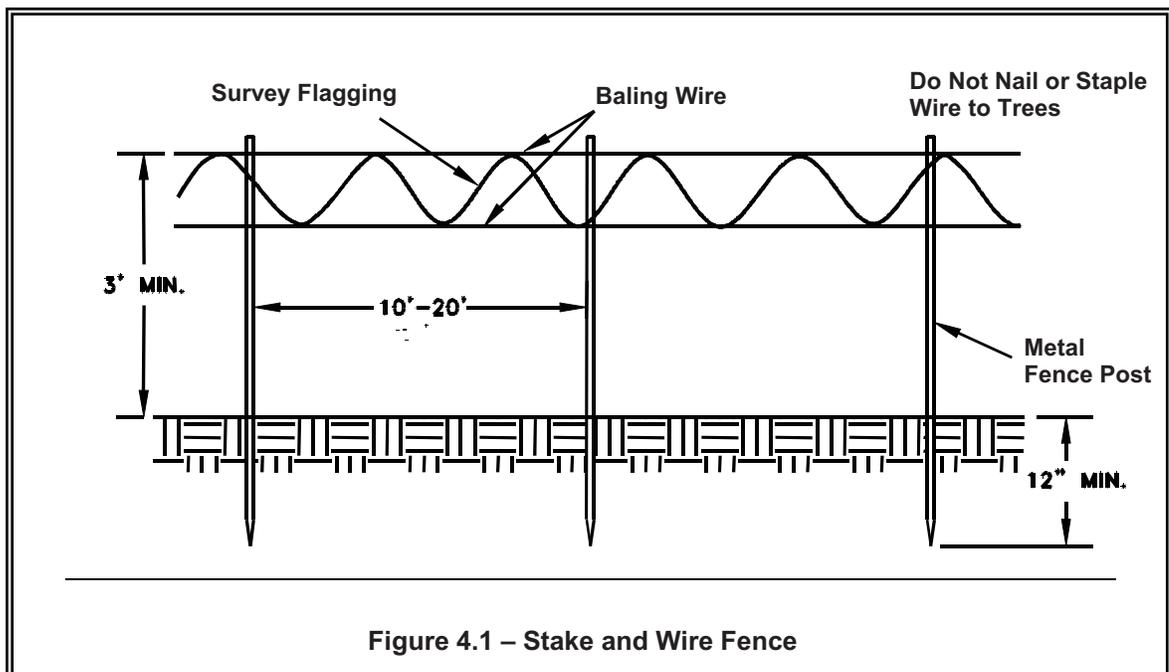
- At the boundary of sensitive areas, their buffers, and other areas required to be left uncleared.
- As necessary, to control vehicle access to and on the site.

**Design and Installation Specifications**

- See Figure 4.1 for details.
- More substantial fencing shall be used if the fence does not prevent encroachment into those areas that are not to be disturbed.

**Maintenance Standards**

- If the fence has been damaged or visibility reduced, it shall be repaired or replaced immediately and visibility restored.



## **BMP C105: Stabilized Construction Entrance**

### ***Purpose***

Construction entrances are stabilized to reduce the amount of sediment transported onto paved roads by vehicles or equipment by constructing a stabilized pad of quarry spalls at entrances to construction sites.

### ***Conditions of Use***

Construction entrances shall be stabilized wherever traffic will be leaving a construction site and traveling on paved roads or other paved areas within 1,000 feet of the site.

On large commercial, highway, and road projects, the designer should include enough extra materials in the contract to allow for additional stabilized entrances not shown in the initial CSWPPP. It is difficult to determine exactly where access to these projects will take place; additional materials will enable the contractor to install them where needed.

### ***Design and Installation Specifications***

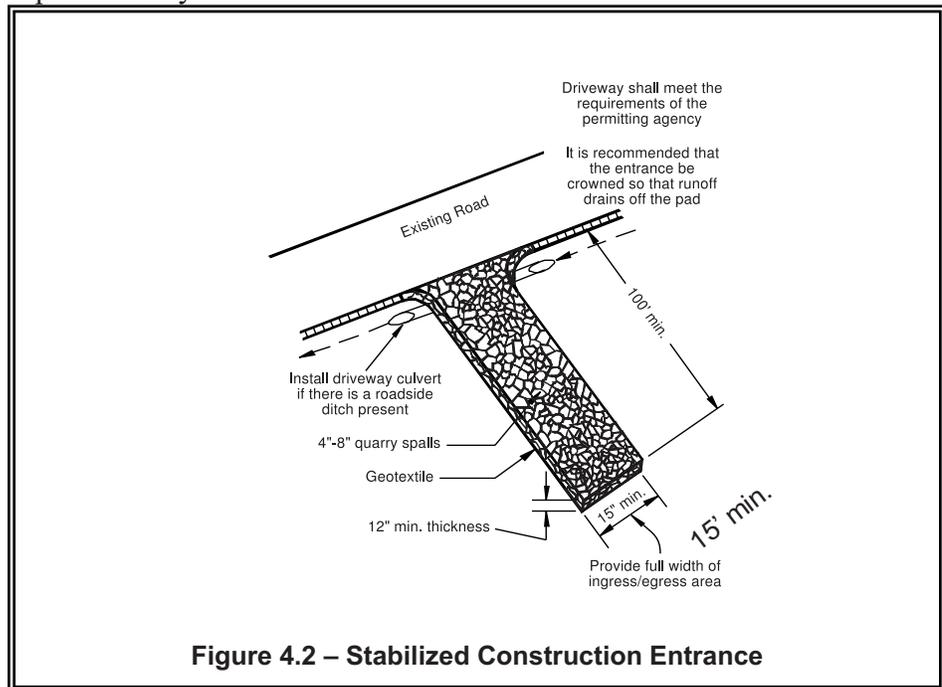
- See Figure 4.2 for details. Note: the 100' minimum length of the entrance shall be reduced to the maximum practicable size when the size or configuration of the site does not allow the full length (100').
- A separation geotextile shall be placed under the spalls to prevent fine sediment from pumping up into the rock pad. The geotextile shall meet the following standards:

Grab Tensile Strength (ASTM D4751)	200 psi min.
Grab Tensile Elongation (ASTM D4632)	30% max.
Mullen Burst Strength (ASTM D3786-80a)	400 psi min.
AOS (ASTM D4751)	20-45 (U.S. standard sieve size)

- Consider early installation of the first lift of asphalt in areas that will paved; this can be used as a stabilized entrance. Also consider the installation of excess concrete as a stabilized entrance. During large concrete pours, excess concrete is often available for this purpose.
- Hog fuel (wood-based mulch) may be substituted for or combined with quarry spalls in areas that will not be used for permanent roads. Hog fuel is generally less effective at stabilizing construction entrances and should be used only at sites where the amount of traffic is very limited. Hog fuel is not recommended for entrance stabilization in urban areas. The effectiveness of hog fuel is highly variable and it generally requires more maintenance than quarry spalls. The inspector may at any time require the use of quarry spalls if the hog fuel is not preventing sediment from being tracked onto pavement or if the hog fuel is being carried onto pavement. Hog fuel is prohibited in permanent roadbeds because organics in the subgrade soils cause degradation of the subgrade support over time.
- Fencing (see BMPs C103 and C104) shall be installed as necessary to restrict traffic to the construction entrance.

**Maintenance Standards**

- Whenever possible, the entrance shall be constructed on a firm, compacted subgrade. This can substantially increase the effectiveness of the pad and reduce the need for maintenance.
- Quarry spalls (or hog fuel) shall be added if the pad is no longer in accordance with the specifications.
- If the entrance is not preventing sediment from being tracked onto pavement, then alternative measures to keep the streets free of sediment shall be used. This may include street sweeping, an increase in the dimensions of the entrance, or the installation of a wheel wash.
- Any sediment that is tracked onto pavement shall be removed by shoveling or street sweeping. The sediment collected by sweeping shall be removed or stabilized on site. The pavement shall not be cleaned by washing down the street, except when sweeping is ineffective and there is a threat to public safety. If it is necessary to wash the streets, the construction of a small sump shall be considered. The sediment would then be washed into the sump where it can be controlled.
- Any quarry spalls that are loosened from the pad, which end up on the roadway shall be removed immediately.
- If vehicles are entering or exiting the site at points other than the construction entrance(s), fencing (see BMPs C103 and C104) shall be installed to control traffic.
- Upon project completion and site stabilization, all construction accesses intended as permanent access for maintenance shall be permanently stabilized.



**Figure 4.2 – Stabilized Construction Entrance**

## **BMP C106: Wheel Wash**

### ***Purpose***

Wheel washes reduce the amount of sediment transported onto paved roads by motor vehicles.

### ***Conditions of Use***

When a stabilized construction entrance (see BMP C105) is not preventing sediment from being tracked onto pavement.

- Wheel washing is generally an effective BMP when installed with careful attention to topography. For example, a wheel wash can be detrimental if installed at the top of a slope abutting a right-of-way where the water from the dripping truck can run unimpeded into the street.
- Pressure washing combined with an adequately sized and surfaced pad with direct drainage to a large 10-foot x 10-foot sump can be very effective.

### ***Design and Installation Specifications***

Suggested details are shown in Figure 4.3. The City may allow other designs. A minimum of 6 inches of asphalt treated base (ATB) over crushed base material or 8 inches over a good subgrade is recommended to pave the wheel wash.

Use a low clearance truck to test the wheel wash before paving. Either a belly dump or lowboy will work well to test clearance.

Keep the water level from 12 to 14 inches deep to avoid damage to truck hubs and filling the truck tongues with water.

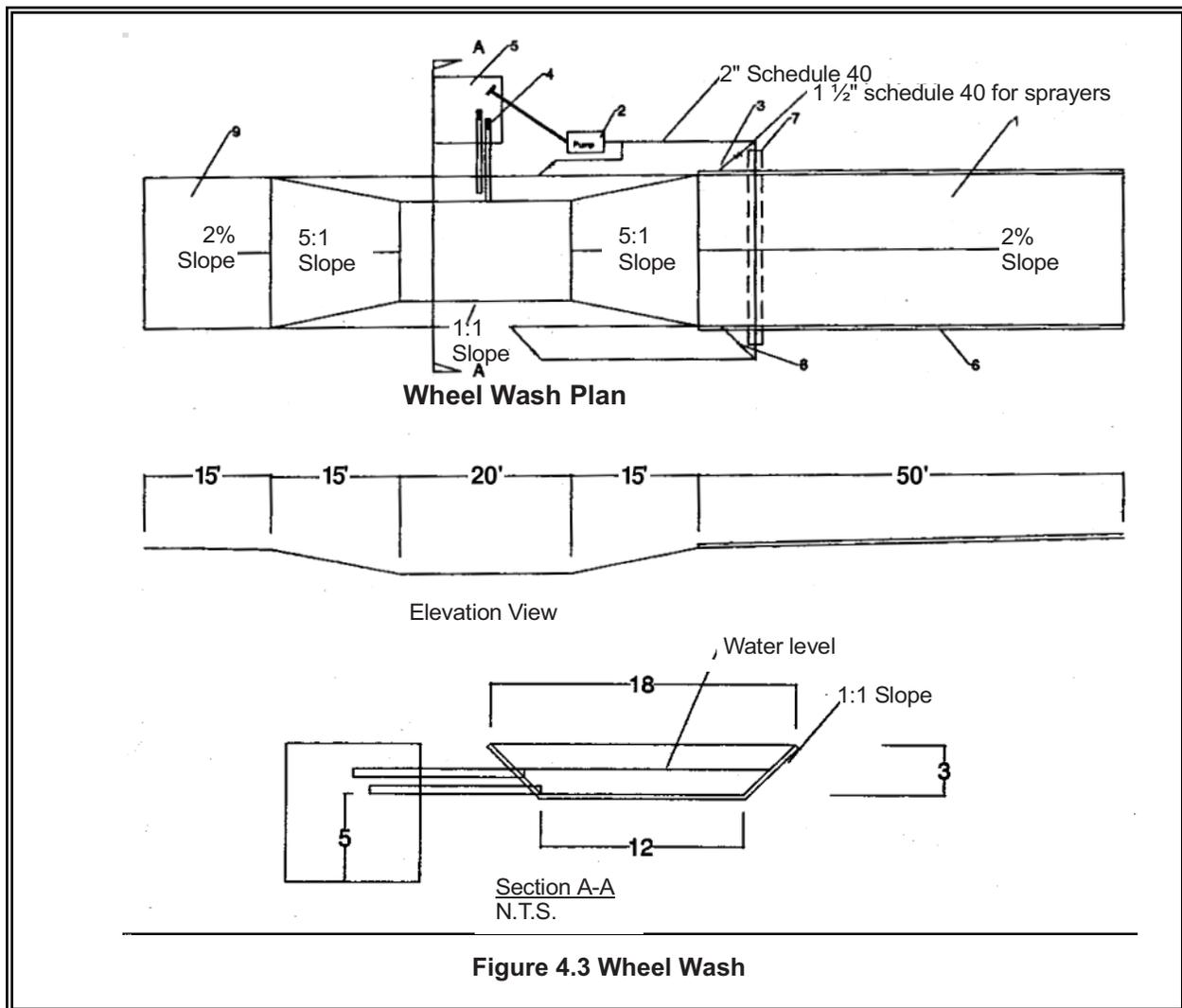
Midpoint spray nozzles are only needed in extremely muddy conditions. Wheel wash systems should be designed with a small grade change, 6 to 12 inches for a 10-foot-wide pond, to allow sediment to flow to the low side of pond to help prevent re-suspension of sediment. A drainpipe with a 2- to 3-foot riser should be installed on the low side of the pond to allow for easy cleaning and refilling. Polymers may be used to promote coagulation and flocculation in a closed-loop system. Polyacrylamide (PAM) added to the wheel wash water at a rate of 0.25 - 0.5 pounds per 1,000 gallons of water increases effectiveness and reduces cleanup time. If PAM is already being used for dust or erosion control and is being applied by a water truck, the same truck can be used to change the wash water.

### ***Maintenance Standards***

The wheel wash should start out the day with fresh water.

The wash water should be changed a minimum of once per day. On large earthwork jobs where more than 10-20 trucks per hour are expected, the wash water will need to be changed more often.

Wheel wash or tire bath wastewater shall be discharged to a separate on-site treatment system, such as closed-loop recirculation or land application, or to the sanitary sewer with proper local sewer district approval.



Notes:

1. Asphalt construction entrance 6 in. asphalt treated base (ATB).
2. 3-inch trash pump with floats on the suction hose.
3. Midpoint spray nozzles, if needed.
4. 6-inch sewer pipe with butterfly valves. Bottom one is a drain. Locate top pipe's invert 1 foot above bottom of wheel wash.
5. 8 foot x 8 foot sump with 5 feet of catch. Build so can be cleaned with trackhoe.
6. Asphalt curb on the low road side to direct water back to pond.
7. 6-inch sleeve under road.
8. Ball valves.
9. 15 foot. ATB apron to protect ground from splashing water.

## **BMP C107: Construction Road/Parking Area Stabilization**

### ***Purpose***

Stabilizing subdivision roads, parking areas, and other onsite vehicle transportation routes immediately after grading reduces erosion caused by construction traffic or runoff.

### ***Conditions of Use***

- Roads or parking areas shall be stabilized wherever they are constructed, whether permanent or temporary, for use by construction traffic.
- Fencing (see BMPs C103 and C104) shall be installed, if necessary, to limit the access of vehicles to only those roads and parking areas that are stabilized.

### ***Design and***

### ***Installation***

### ***Specifications***

- On areas that will receive asphalt as part of the project, install the first lift as soon as possible.
- A 6-inch depth of 2- to 4-inch crushed rock, gravel base, or crushed surfacing base course shall be applied immediately after grading or utility installation. A 4-inch course of asphalt treated base (ATB) may also be used, or the road/parking area may be paved. It may also be possible to use cement or calcium chloride for soil stabilization. If cement or cement kiln dust is used for roadbase stabilization, pH monitoring and BMPs are necessary to evaluate and minimize the effects on stormwater. If the area will not be used for permanent roads, parking areas, or structures, a 6-inch depth of hog fuel may also be used, but this is likely to require more maintenance. Whenever possible, construction roads and parking areas shall be placed on a firm, compacted subgrade.
- Temporary road gradients shall not exceed 15 percent. Roadways shall be carefully graded to drain. Drainage ditches shall be provided on each side of the roadway in the case of a crowned section, or on one side in the case of a super-elevated section. Drainage ditches shall be directed to a sediment control BMP.
- Rather than relying on ditches, it may also be possible to grade the road so that runoff sheet-flows into a heavily vegetated area with a well-developed topsoil. Landscaped areas are not adequate. If this area has at least 50 feet of vegetation, then it is generally preferable to use the vegetation to treat runoff, rather than a sediment pond or trap. The 50 feet shall not include wetlands. If runoff is allowed to sheetflow through adjacent vegetated areas, it is vital to design the roadways and parking areas so that no concentrated runoff is created.
- Storm drain inlets shall be protected to prevent sediment-laden water entering the storm drain system (see BMP C220).

### ***Maintenance***

### ***Standards***

- Inspect stabilized areas regularly, especially after large storm events.
- Crushed rock, gravel base, hog fuel, etc. shall be added as required to maintain a stable driving surface and to stabilize any areas that have eroded.

- Following construction, these areas shall be restored to pre-construction condition or better to prevent future erosion.

## **BMP C120: Temporary and Permanent Seeding**

### ***Purpose***

Seeding is intended to reduce erosion by stabilizing exposed soils. A well-established vegetative cover is one of the most effective methods of reducing erosion.

### ***Conditions of Use***

- Seeding may be used throughout the project on disturbed areas that have reached final grade or that will remain unworked for more than 30 days.
- Channels that will be vegetated should be installed before major earthwork and hydroseeded with a Bonded Fiber Matrix. The vegetation should be well established (i.e., 75 percent cover) before water is allowed to flow in the ditch. With channels that will have high flows, erosion control blankets should be installed over the hydroseed. If vegetation cannot be established from seed before water is allowed in the ditch, sod should be installed in the bottom of the ditch over hydromulch and blankets.
- Retention/detention ponds should be seeded as required.
- Mulch is required at all times because it protects seeds from heat, moisture loss, and transport due to runoff.
- All disturbed areas shall be reviewed in late August to early September and all seeding should be completed by the end of September. Otherwise, vegetation will not establish itself enough to provide more than average protection.
- At final site stabilization, all disturbed areas not otherwise vegetated or stabilized shall be seeded and mulched. Final stabilization means the completion of all soil disturbing activities at the site and the establishment of a permanent vegetative cover, or equivalent permanent stabilization measures (such as pavement, riprap, gabions or geotextiles) which will prevent erosion.
- Seeding should be done during those seasons most conducive to growth and will vary with the climate conditions of the region. Local experience should be used to determine the appropriate seeding periods.
- The optimum seeding windows for western Washington are April 1 through June 30 and September 1 through October 1. Seeding that occurs between July 1 and August 30 will require irrigation until 75 percent grass cover is established. Seeding that occurs between October 1 and March 30 will require a mulch or plastic cover until 75 percent grass cover is established.
- To prevent seed from being washed away, confirm that all required surface water control measures have been installed.

### ***Design and Installation Specifications***

- The seedbed should be firm and rough. All soil should be roughened no matter what the slope. If compaction is required for engineering purposes, slopes must be track walked before seeding. Backblading or smoothing of slopes greater than 4:1 is not allowed if they are to be seeded.
- New and more effective restoration-based landscape practices rely on deeper incorporation than that provided by a simple single-pass rototilling treatment. Wherever practical the subgrade should be initially ripped to improve long-term permeability, infiltration, and water inflow qualities. At a minimum, permanent areas shall use soil amendments to achieve organic matter and permeability performance defined in engineered soil/landscape systems. For systems that are deeper than 8 inches the rototilling process should be done in multiple lifts, or the prepared soil system shall be prepared properly and then placed to achieve the specified depth.
- Organic matter is the most appropriate form of “fertilizer” because it provides nutrients (including nitrogen, phosphorus, and potassium) in the least water-soluble form. A natural system typically releases 2-10 percent of its nutrients annually. Chemical fertilizers have since been formulated to simulate what organic matter does naturally.
- In general, 10-4-6 N-P-K (nitrogen-phosphorus-potassium) fertilizer can be used at a rate of 90 pounds per acre. Slow-release fertilizers should always be used because they are more efficient and have fewer environmental impacts. It is recommended that areas being seeded for final landscaping conduct soil tests to determine the exact type and quantity of fertilizer needed. This will prevent the over-application of fertilizer. Fertilizer should not be added to the hydromulch machine and agitated more than 20 minutes before it is to be used. If agitated too much, the slow-release coating is destroyed.
- There are numerous products available on the market that take the place of chemical fertilizers. These include several with seaweed extracts that are beneficial to soil microbes and organisms. If 100 percent cottonseed meal is used as the mulch in hydroseed, chemical fertilizer may not be necessary. Cottonseed meal is a good source of long-term, slow-release, available nitrogen.
- Hydroseed applications shall include a minimum of 1,500 pounds per acre of mulch with 3 percent tackifier. Mulch may be made up of 100 percent: cottonseed meal; fibers made of wood, recycled cellulose, hemp, and kenaf; compost; or blends of these. Tackifier shall be plant-based, such as guar or alpha plantago, or chemical-based such as polyacrylamide or polymers. Any mulch or tackifier product used shall be installed per manufacturer’s instructions. Generally, mulches come in 40-50 pound bags. Seed and fertilizer are added at time of application.

- Mulch is always required for seeding. Mulch can be applied on top of the seed or simultaneously by hydroseeding.
- On steep slopes, Bonded Fiber Matrix (BFM) or Mechanically Bonded Fiber Matrix (MBFM) products should be used. BFM/MBFM products are applied at a minimum rate of 3,000 pounds per acre of mulch with approximately 10 percent tackifier. Application is made so that a minimum of 95 percent soil coverage is achieved. Numerous products are available commercially and should be installed per manufacturer's instructions. Most products require 24-36 hours to cure before a rainfall and cannot be installed on wet or saturated soils. Generally, these products come in 40-50 pound bags and include all necessary ingredients except for seed and fertilizer.

BFMs and MBFMs have some advantages over blankets:

- No surface preparation required;
- Can be installed via helicopter in remote areas;
- On slopes steeper than 2.5:1, blanket installers may need to be roped and harnessed for safety;
- They are at least \$1,000 per acre cheaper installed.

In most cases, the shear strength of blankets is not a factor when used on slopes, only when used in channels. BFMs and MBFMs are good alternatives to blankets in most situations where vegetation establishment is the goal.

- When installing seed via hydroseeding operations, only about 1/3 of the seed actually ends up in contact with the soil surface. This reduces the ability to establish a good stand of grass quickly. One way to overcome this is to increase seed quantities by up to 50 percent.
- Vegetation establishment can also be enhanced by dividing the hydromulch operation into two phases:
  1. Phase 1- Install all seed and fertilizer with 25-30 percent mulch and tackifier onto soil in the first lift;
  2. Phase 2- Install the rest of the mulch and tackifier over the first lift.

An alternative is to install the mulch, seed, fertilizer, and tackifier in one lift. Then, spread or blow straw over the top of the hydromulch at a rate of about 800-1000 pounds per acre. Hold straw in place with a standard tackifier. Both of these approaches will increase cost moderately but will greatly improve and enhance vegetative establishment. The increased cost may be offset by the reduced need for:

1. Irrigation
2. Reapplication of mulch
3. Repair of failed slope surfaces

This technique works with standard hydromulch (1,500 pounds per acre minimum) and BFM/MBFMs (3,000 pounds per acre minimum).

- Areas to be permanently landscaped shall provide a healthy topsoil that reduces the need for fertilizers, improves overall topsoil quality, provides for better vegetal health and vitality, improves hydrologic characteristics, and reduces the need for irrigation. This can be accomplished in a number of ways:

Recent research has shown that the best method to improve till soils is to amend these soils with compost. The optimum mixture is approximately two parts soil to one part compost. This equates to 4 inches of compost mixed to a depth of 12 inches in till soils. Increasing the concentration of compost beyond this level can have negative effects on vegetal health, while decreasing the concentrations can reduce the benefits of amended soils. Please note: The compost should meet specifications for Grade A quality compost in Ecology Publication 94-038.

Other soils, such as gravel or cobble outwash soils, may require different approaches. Organics and fines easily migrate through the loose structure of these soils. Therefore, the importation of at least 6 inches of quality topsoil, underlain by some type of filter fabric to prevent the migration of fines, may be more appropriate for these soils.

Areas that already have good topsoil, such as undisturbed areas, do not require soil amendments.

- Areas that will be seeded only and not landscaped may need compost or meal-based mulch included in the hydroseed in order to establish vegetation. Native topsoil should be re-installed on the disturbed soil surface before application.
- Seed that is installed as a temporary measure may be installed by hand if it will be covered by straw, mulch, or topsoil. Seed that is installed as a permanent measure may be installed by hand on small areas (usually less than 1 acre) that will be covered with mulch, topsoil, or erosion blankets. The seed mixes listed below include recommended mixes for both temporary and permanent seeding. These mixes, with the exception of the wetland mix, shall be applied at a rate of 120 pounds per acre. This rate can be reduced if soil amendments or slow-release fertilizers are used. Local suppliers or the local conservation district should be consulted for their recommendations because the appropriate mix depends on a variety of factors, including location, exposure, soil type, slope, and expected foot traffic. Alternative seed mixes approved by the local authority may be used.

Table 4.1 represents the standard mix for those areas where just a temporary vegetative cover is required.

<b>Table 4.1 Temporary Erosion Control Seed Mix</b>			
	<b>% Weight</b>	<b>% Purity</b>	<b>% Germination</b>
Chewings or annual blue grass <i>Festuca rubra var. commutata</i> or <i>Poa annua</i>	40	98	90
Perennial rye - <i>Lolium perenne</i>	50	98	90
Redtop or colonial bentgrass <i>Agrostis alba</i> or <i>Agrostis tenuis</i>	5	92	85
White dutch clover <i>Trifolium repens</i>	5	98	90

Table 4.2 provides just one recommended possibility for landscaping seed.

<b>Table 4.2 Landscaping Seed Mix</b>			
	<b>% Weight</b>	<b>% Purity</b>	<b>% Germination</b>
Perennial rye blend <i>Lolium perenne</i>	70	98	90
Chewings and red fescue blend <i>Festuca rubra var. commutata</i> or <i>Festuca rubra</i>	30	98	90

This turf seed mix in Table 4.3 is for dry situations where there is no need for much water. The advantage is that this mix requires very little maintenance.

<b>Table 4.3 Low-Growing Turf Seed Mix</b>			
	<b>% Weight</b>	<b>% Purity</b>	<b>% Germination</b>
Dwarf tall fescue (several varieties) <i>Festuca arundinacea var.</i>	45	98	90
Dwarf perennial rye (Barclay) <i>Lolium perenne var. barclay</i>	30	98	90
Red fescue <i>Festuca rubra</i>	20	98	90
Colonial bentgrass <i>Agrostis tenuis</i>	5	98	90

Table 4.4 presents a mix recommended for bioswales and other intermittently wet areas.

<b>Table 4.4 Bioswale Seed Mix*</b>			
	<b>% Weight</b>	<b>% Purity</b>	<b>% Germination</b>
Tall or meadow fescue <i>Festuca arundinacea</i> or <i>Festuca elatior</i>	75-80	98	90
Seaside/Creeping bentgrass <i>Agrostis palustris</i>	10-15	92	85
Redtop bentgrass <i>Agrostis alba</i> or <i>Agrostis gigantea</i>	5-10	90	80

\* Modified Briargreen, Inc. Hydroseeding Guide Wetlands Seed Mix

The seed mix shown in Table 4.5 is a recommended low-growing, relatively non-invasive seed mix appropriate for very wet areas that are not regulated wetlands. Other mixes may be appropriate, depending on the soil type and hydrology of the area. Recent research suggests that bentgrass (agrostis sp.) should be emphasized in wet-area seed mixes. Apply this mixture at a rate of 60 pounds per acre.

<b>Table 4.5 Wet Area Seed Mix*</b>			
	<b>% Weight</b>	<b>% Purity</b>	<b>% Germination</b>
Tall or meadow fescue <i>Festuca arundinacea</i> or <i>Festuca elatior</i>	60-70	98	90
Seaside/Creeping bentgrass <i>Agrostis palustris</i>	10-15	98	85
Meadow foxtail <i>Alepcurus pratensis</i>	10-15	90	80
Alsike clover <i>Trifolium hybridum</i>	1-6	98	90
Redtop bentgrass <i>Agrostis alba</i>	1-6	92	85

\* Modified Briargreen, Inc. Hydroseeding Guide Wetlands Seed Mix

The meadow seed mix in Table 4.6 is recommended for areas that will be maintained infrequently or not at all and where colonization by native plants is desirable. Likely applications include rural road and utility right-of-way. Seeding should take place in September or very early October in order to obtain adequate establishment prior to the winter months. The appropriateness of clover in the mix may need to be considered, as this can be a fairly invasive species. If the soil is amended, the addition of clover may not be necessary.

<b>Table 4.6 Meadow Seed Mix</b>			
	<b>% Weight</b>	<b>% Purity</b>	<b>% Germination</b>
Redtop or Oregon bentgrass <i>Agrostis alba</i> or <i>Agrostis oregonensis</i>	20	92	85
Red fescue <i>Festuca rubra</i>	70	98	90
White dutch clover <i>Trifolium repens</i>	10	98	90

**Maintenance Standards**

- Any seeded areas that fail to establish at least 80 percent cover (100 percent cover for areas that receive sheet or concentrated flows) shall be reseeded. If reseeding is ineffective, an alternate method, such as sodding, mulching, or nets/blankets, shall be used. If winter weather prevents adequate grass growth, this time limit may be relaxed at the discretion of the local authority when sensitive areas would otherwise be protected.

- After adequate cover is achieved, any areas that experience erosion shall be reseeded and protected by mulch. If the erosion problem is drainage related, the problem shall be fixed and the eroded area reseeded and protected by mulch.
- Seeded areas shall be supplied with adequate moisture, but not watered to the extent that it causes runoff.

## **BMP C121: Mulching**

### ***Purpose***

The purpose of mulching soils is to provide immediate temporary protection from erosion. Mulch also enhances plant establishment by conserving moisture, holding fertilizer, seed, and topsoil in place, and moderating soil temperatures. There is an enormous variety of mulches that can be used. Only the most common types are discussed in this section.

### ***Conditions of Use***

As a temporary cover measure, mulch should be used:

- On disturbed areas that require cover measures for less than 30 days.
- As a cover for seed during the wet season and during the hot summer months.
- During the wet season on slopes steeper than 3H:1V with more than 10 feet of vertical relief.
- Mulch may be applied at any time of the year and must be refreshed periodically.

### ***Design and Installation Specifications***

For mulch materials, application rates, and specifications, see Table 4.7. Note: Thicknesses may be increased for disturbed areas in or near sensitive areas or other areas highly susceptible to erosion.

Mulch used within the ordinary high-water mark of surface waters should be selected to minimize potential flotation of organic matter. Composted organic materials have higher specific gravities (densities) than straw, wood, or chipped material.

### ***Maintenance Standards***

- The thickness of the cover must be maintained.
- Any areas that experience erosion shall be remulched and/or protected with a net or blanket. If the erosion problem is drainage related, then the problem shall be fixed and the eroded area remulched.

**Table 4.7  
Mulch Standards and Guidelines**

<b>Mulch Material</b>	<b>Quality Standards</b>	<b>Application Rates</b>	<b>Remarks</b>
Straw	Air-dried; free from undesirable seed and coarse material.	2"-3" thick; 5 bales per 1000 sf or 2-3 tons per acre	Cost-effective protection when applied with adequate thickness. Hand-application generally requires greater thickness than blown straw. The thickness of straw may be reduced by half when used in conjunction with seeding. In windy areas straw must be held in place by crimping, using a tackifier, or covering with netting. Blown straw always has to be held in place with a tackifier as even light winds will blow it away. Straw, however, has several deficiencies that should be considered when selecting mulch materials. It often introduces and/or encourages the propagation of weed species and it has no significant long-term benefits. Straw should be used only if mulches with long-term benefits are unavailable locally. It should also not be used within the ordinary high-water elevation of surface waters (due to flotation).
Hydromulch	No growth inhibiting factors.	Approx. 25-30 lbs per 1000 sf or 1500 - 2000 lbs per acre	Shall be applied with hydromulcher. Shall not be used without seed and tackifier unless the application rate is at least doubled. Fibers longer than about ¾-1 inch clog hydromulch equipment. Fibers should be kept to less than ¾ inch.
Composted Mulch and Compost	No visible water or dust during handling. Must be purchased from supplier with Solid Waste Handling Permit (unless exempt).	2" thick min.; approx. 100 tons per acre (approx. 800 lbs per yard)	More effective control can be obtained by increasing thickness to 3". Excellent mulch for protecting final grades until landscaping because it can be directly seeded or tilled into soil as an amendment. Composted mulch has a coarser size gradation than compost. It is more stable and practical to use in wet areas and during rainy weather conditions.
Chipped Site Vegetation	Average size shall be several inches. Gradations from fines to 6 inches in length for texture, variation, and interlocking properties.	2" minimum thickness	This is a cost-effective way to dispose of debris from clearing and grubbing, and it eliminates the problems associated with burning. Generally, it should not be used on slopes above approx. 10% because of its tendency to be transported by runoff. It is not recommended within 200 feet of surface waters. If seeding is expected shortly after mulch, the decomposition of the chipped vegetation may tie up nutrients important to grass establishment.
Wood-based Mulch	No visible water or dust during handling. Must be purchased from a supplier with a Solid Waste Handling Permit or one exempt from solid waste regulations.	2" thick; approx. 100 tons per acre (approx. 800 lbs. per cubic yard)	This material is often called "hog or hogged fuel." It is usable as a material for Stabilized Construction Entrances (BMP C105) and as a mulch. The use of mulch ultimately improves the organic matter in the soil. Special caution is advised regarding the source and composition of wood-based mulches. Its preparation typically does not provide any weed seed control, so evidence of residual vegetation in its composition or known inclusion of weed plants or seeds should be monitored and prevented (or minimized).

## **BMP C122: Nets and Blankets**

### ***Purpose***

Erosion control nets and blankets are intended to prevent erosion and hold seed and mulch in place on steep slopes and in channels so that vegetation can become well established. In addition, some nets and blankets can be used to permanently reinforce turf to protect drainage ways during high flows. Nets (commonly called matting) are strands of material woven into an open, but high-tensile strength net (for example, coconut fiber matting). Blankets are strands of material that are not tightly woven, but instead form a layer of interlocking fibers, typically held together by a biodegradable or photodegradable netting (for example, excelsior or straw blankets). They generally have lower tensile strength than nets, but cover the ground more completely. Coir (coconut fiber) fabric comes as both nets and blankets.

### ***Conditions of Use***

Erosion control nets and blankets should be used:

- To aid permanent vegetated stabilization of slopes 2H:1V or greater and with more than 10 feet of vertical relief.
- For drainage ditches and swales (highly recommended). The application of appropriate netting or blanket to drainage ditches and swales can protect bare soil from channelized runoff while vegetation is established. Nets and blankets also can capture a great deal of sediment due to their open, porous structure. Synthetic nets and blankets can be used to permanently stabilize channels and may provide a cost-effective, environmentally preferable alternative to riprap. 100 percent synthetic blankets manufactured for use in ditches may be easily reused as temporary ditch liners.

Disadvantages of blankets include:

- Surface preparation required;
- On slopes steeper than 2.5:1, blanket installers may need to be roped and harnessed for safety;
- They cost at least \$4,000-6,000 per acre installed.

Advantages of blankets include:

- Can be installed without mobilizing special equipment;
- Can be installed by anyone with minimal training;
- Can be installed in stages or phases as the project progresses;
- Seed and fertilizer can be hand-placed by the installers as they progress down the slope;
- Can be installed in any weather;
- There are numerous types of blankets that can be designed with various parameters in mind. Those parameters include: fiber blend, mesh strength, longevity, biodegradability, cost, and availability.

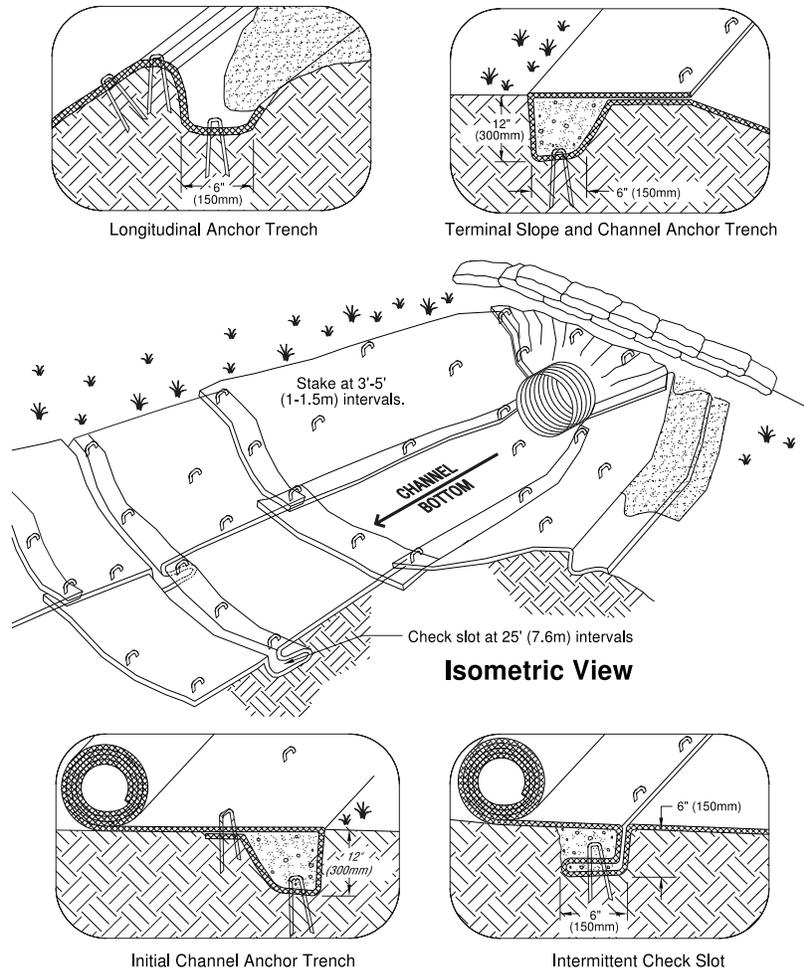
***Design and  
Installation  
Specifications***

- See Figure 4.4 and Figure 4.5 for typical orientation and installation of blankets used in channels and as slope protection. Note: these are typical only; all blankets must be installed per manufacturer's installation instructions.
- Installation is critical to the effectiveness of these products. If good ground contact is not achieved, runoff can concentrate under the product, resulting in significant erosion.
- Installation of Blankets on Slopes:
  1. Complete final grade and track walk up and down the slope.
  2. Install hydromulch with seed and fertilizer.
  3. Dig a small trench, approximately 12 inches wide by 6 inches deep along the top of the slope.
  4. Install the leading edge of the blanket into the small trench and staple approximately every 18 inches. NOTE: Staples are metal,"U"-shaped, and a minimum of 6 inches long. Longer staples are used in sandy soils. Biodegradable stakes are also available.
  5. Roll the blanket slowly down the slope as installer walks backwards. NOTE: The blanket rests against the installer's legs. Staples are installed as the blanket is unrolled. It is critical that the proper staple pattern is used for the blanket being installed. The blanket is not to be allowed to roll down the slope on its own as this stretches the blanket making it impossible to maintain soil contact. In addition, no one is allowed to walk on the blanket after it is in place.
  6. If the blanket is not long enough to cover the entire slope length, the trailing edge of the upper blanket should overlap the leading edge of the lower blanket and be stapled. On steeper slopes, this overlap should be installed in a small trench, stapled, and covered with soil.
- With the variety of products available, it is impossible to cover all the details of appropriate use and installation. Therefore, it is critical that the design engineer consults the manufacturer's information and that a site visit takes place in order to insure that the product specified is appropriate. Information is also available at the following web sites:
  1. WSDOT: <http://www.wsdot.wa.gov/eesc/environmental/>
  2. Texas Transportation Institute:  
<http://www.dot.state.tx.us/insdot/orgchart/cmd/erosion/contents.htm>
- Jute matting must be used in conjunction with mulch (BMP C121). Excelsior, woven straw blankets and coir (coconut fiber) blankets may

be installed without mulch. There are many other types of erosion control nets and blankets on the market that may be appropriate in certain circumstances.

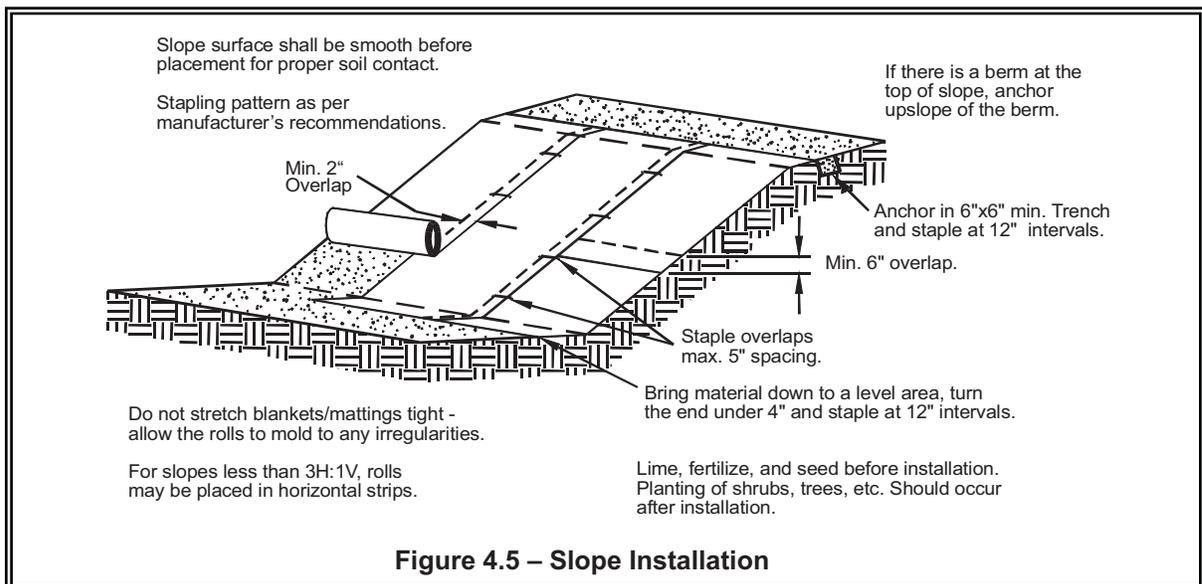
- In general, most nets (e.g., jute matting) require mulch in order to prevent erosion because they have a fairly open structure. Blankets typically do not require mulch because they usually provide complete protection of the surface.
- Extremely steep, unstable, wet, or rocky slopes are often appropriate candidates for use of synthetic blankets, as are riverbanks, beaches and other high-energy environments. If synthetic blankets are used, the soil should be hydromulched first.
- 100 percent biodegradable blankets are available for use in sensitive areas. These organic blankets are usually held together with a paper or fiber mesh and stitching which may last up to a year.
- Most netting used with blankets is photodegradable, meaning they break down under sunlight (not UV stabilized). However, this process can take months or years even under bright sun. Once vegetation is established, sunlight does not reach the mesh. It is not uncommon to find non-degraded netting still in place several years after installation. This can be a problem if maintenance requires the use of mowers or ditch cleaning equipment. In addition, birds and small animals can become trapped in the netting.
- Good contact with the ground must be maintained, and erosion must not occur beneath the net or blanket.
- Any areas of the net or blanket that are damaged or not in close contact with the ground shall be repaired and stapled.
- If erosion occurs due to poorly controlled drainage, the problem shall be fixed and the eroded area protected.

***Maintenance  
Standards***



- NOTES:
1. Check slots to be constructed per manufacturers specifications.
  2. Staking or stapling layout per manufacturers specifications.

**Figure 4.4 – Channel Installation**



**Figure 4.5 – Slope Installation**

## **BMP C123: Plastic Covering**

***Purpose*** Plastic covering provides immediate, short-term erosion protection to slopes and disturbed areas.

- Conditions of Use***
- Plastic covering may be used on disturbed areas that require cover measures for less than 30 days, except as stated below.
  - Plastic is particularly useful for protecting cut and fill slopes and stockpiles. Note: The relatively rapid breakdown of most polyethylene sheeting makes it unsuitable for long-term (greater than six months) applications.
  - Clear plastic sheeting can be used over newly-seeded areas to create a greenhouse effect and encourage grass growth if the hydroseed was installed too late in the season to establish 75 percent grass cover, or if the wet season started earlier than normal. Clear plastic should not be used for this purpose during the summer months because the resulting high temperatures can kill the grass.
  - Due to rapid runoff caused by plastic sheeting, this method shall not be used upslope of areas that might be adversely impacted by concentrated runoff. Such areas include steep and/or unstable slopes.
  - While plastic is inexpensive to purchase, the added cost of installation, maintenance, removal, and disposal make this an expensive material, up to \$1.50-2.00 per square yard.
  - Whenever plastic is used to protect slopes, water collection measures must be installed at the base of the slope. These measures include plastic-covered berms, channels, and pipes used to convey clean rainwater away from bare soil and disturbed areas. At no time is clean runoff from a plastic covered slope to be mixed with dirty runoff from a project.
  - Other uses for plastic include:
    1. Temporary ditch liner;
    2. Pond liner in temporary sediment pond;
    3. Liner for bermed temporary fuel storage area if plastic is not reactive to the type of fuel being stored;
    4. Emergency slope protection during heavy rains; and,
    5. Temporary drainpipe (“elephant trunk”) used to direct water.

***Design and  
Installation  
Specifications***

- Plastic slope cover must be installed as follows:
  1. Run plastic up and down slope, not across slope;
  2. Plastic may be installed perpendicular to a slope if the slope length is less than 10 feet;
  3. Minimum of 8-inch overlap at seams;
  4. On long or wide slopes, or slopes subject to wind, all seams should be taped;
  5. Place plastic into a small (12-inch wide by 6-inch deep) slot trench at the top of the slope and backfill with soil to keep water from flowing underneath;
  6. Place sand filled burlap or geotextile bags every 3 to 6 feet along seams and pound a wooden stake through each to hold them in place;
  7. Inspect plastic for rips, tears, and open seams regularly and repair immediately. This prevents high velocity runoff from contacting bare soil which causes extreme erosion;
  8. Sandbags may be lowered into place tied to ropes. However, all sandbags must be staked in place.
- Plastic sheeting shall have a minimum thickness of 0.06 millimeters.
- If erosion at the toe of a slope is likely, a gravel berm, riprap, or other suitable protection shall be installed at the toe of the slope in order to reduce the velocity of runoff.

***Maintenance  
Standards***

- Torn sheets must be replaced and open seams repaired.
- If the plastic begins to deteriorate due to ultraviolet radiation, it must be completely removed and replaced.
- When the plastic is no longer needed, it shall be completely removed.
- Dispose of old tires appropriately.

## **BMP C124: Sodding**

<b><i>Purpose</i></b>	The purpose of sodding is to establish permanent turf for immediate erosion protection and to stabilize drainage ways where concentrated overland flow will occur.
<b><i>Conditions of Use</i></b>	Sodding may be used in the following areas: <ul style="list-style-type: none"><li>• Disturbed areas that require short-term or long-term cover.</li><li>• Disturbed areas that require immediate vegetative cover.</li><li>• All waterways that require vegetative lining. Waterways may also be seeded rather than sodded, and protected with a net or blanket.</li></ul>
<b><i>Design and Installation Specifications</i></b>	<p>Sod shall be free of weeds, of uniform thickness (approximately 1-inch thick), and shall have a dense root mat for mechanical strength.</p> <p>The following steps are recommended for sod installation:</p> <ul style="list-style-type: none"><li>• Shape and smooth the surface to final grade in accordance with the approved grading plan. The swale needs to be overexcavated 4 to 6 inches below design elevation to allow room for placing soil amendment and sod.</li><li>• Amend 4 inches (minimum) of compost into the top 8 inches of the soil if the organic content of the soil is less than ten percent or the permeability is less than 0.6 inches per hour. Compost used should meet Ecology publication 94-038 specifications for Grade A quality compost.</li><li>• Fertilize according to the supplier's recommendations.</li><li>• Work lime and fertilizer 1 to 2 inches into the soil, and smooth the surface.</li><li>• Lay strips of sod beginning at the lowest area to be sodded and perpendicular to the direction of water flow. Wedge strips securely into place. Square the ends of each strip to provide for a close, tight fit. Stagger joints at least 12 inches. Staple on slopes steeper than 3H:1V. Staple the upstream edge of each sod strip.</li><li>• Roll the sodded area and irrigate.</li><li>• When sodding is carried out in alternating strips or other patterns, seed the areas between the sod immediately after sodding.</li></ul>
<b><i>Maintenance Standards</i></b>	If the grass is unhealthy, the cause shall be determined and appropriate action taken to reestablish a healthy groundcover. If it is impossible to establish a healthy groundcover due to frequent saturation, instability, or some other cause, the sod shall be removed, the area seeded with an appropriate mix, and protected with a net or blanket.

## **BMP C125: Topsoiling**

### ***Purpose***

To provide a suitable growth medium for final site stabilization with vegetation. While not a permanent cover practice in itself, topsoiling is an integral component of providing permanent cover in those areas where there is an unsuitable soil surface for plant growth. Native soils and disturbed soils that have been organically amended not only retain much more stormwater, but they also serve as effective biofilters for urban pollutants and, by supporting more vigorous plant growth, reduce the water, fertilizer and pesticides needed to support installed landscapes. Topsoil does not include any subsoils but only the material from the top several inches including organic debris.

### ***Conditions of Use***

- Native soils should be left undisturbed to the maximum extent practicable. Native soils disturbed during clearing and grading should be restored, to the maximum extent practicable, to a condition where moisture-holding capacity is equal to or better than the original site conditions. This criterion can be met by using on-site native topsoil, incorporating amendments into on-site soil, or importing blended topsoil.
- Topsoiling is a required procedure when establishing vegetation on shallow soils, and soils of critically low pH (high acid) levels.
- Stripping of existing, properly functioning soil system and vegetation for the purpose of topsoiling during construction is not acceptable. If an existing soil system is functioning properly it shall be preserved in its undisturbed and uncompacted condition.
- Depending on where the topsoil comes from, or what vegetation was on site before disturbance, invasive plant seeds may be included and could cause problems for establishing native plants, landscaped areas, or grasses.
- Topsoil from the site will contain mycorrhizal bacteria that are necessary for healthy root growth and nutrient transfer. These native mycorrhiza are acclimated to the site and will provide optimum conditions for establishing grasses. Commercially available mycorrhiza products should be used when topsoil is brought in from off-site.

### ***Design and Installation Specifications***

If topsoiling is to be done, the following items should be considered:

- Maximize the depth of the topsoil wherever possible to provide the maximum possible infiltration capacity and beneficial growth medium. Topsoil depth shall be at least 8 inches with a minimum organic content of 10 percent dry weight and pH between 6.0 and 8.0 or matching the pH of the undisturbed soil. This can be accomplished either by returning native topsoil to the site and/or incorporating organic amendments. Organic amendments should be incorporated to

a minimum 8-inch depth except where tree roots or other natural features limit the depth of incorporation. Subsoils below the 12-inch depth should be scarified at least 2 inches to avoid stratified layers, where feasible. The decision to either layer topsoil over a subgrade or incorporate topsoil into the underlying layer may vary depending on the planting specified.

- If blended topsoil is imported, then fines should be limited to 25 percent passing through a 200 sieve.
- The final composition and construction of the soil system will result in a natural selection or favoring of certain plant species over time. For example, recent practices have shown that incorporation of topsoil may favor grasses, while layering with mildly acidic, high-carbon amendments may favor more woody vegetation.
- Locate the topsoil stockpile so that it meets specifications and does not interfere with work on the site. It may be possible to locate more than one pile in proximity to areas where topsoil will be used.
- Allow sufficient time in scheduling for topsoil to be spread prior to seeding, sodding, or planting.
- Care must be taken not to apply to subsoil if the two soils have contrasting textures. Sandy topsoil over clayey subsoil is a particularly poor combination, as water creeps along the junction between the soil layers and causes the topsoil to slough.
- If topsoil and subsoil are not properly bonded, water will not infiltrate the soil profile evenly and it will be difficult to establish vegetation. The best method to prevent a lack of bonding is to actually work the topsoil into the layer below for a depth of at least 6 inches.
- Ripping or re-structuring the subgrade may also provide additional benefits regarding the overall infiltration and interflow dynamics of the soil system.
- Field exploration of the site shall be made to determine if there is surface soil of sufficient quantity and quality to justify stripping. Topsoil shall be friable and loamy (loam, sandy loam, silt loam, sandy clay loam, clay loam). Areas of natural ground water recharge should be avoided.
- Stripping shall be confined to the immediate construction area. A 4- to 6- inch stripping depth is common, but depth may vary depending on the particular soil. All surface runoff control structures shall be in place prior to stripping.

Stockpiling of topsoil shall occur in the following manner:

- Side slopes of the stockpile shall not exceed 2:1.

- An interceptor dike with gravel outlet and silt fence shall surround all topsoil stockpiles between October 1 and April 30. Between May 1 and September 30, an interceptor dike with gravel outlet and silt fence shall be installed if the stockpile will remain in place for a longer period of time than active construction grading.
- Erosion control seeding or covering with clear plastic or other mulching materials of stockpiles shall be completed within 2 days (October 1 through April 30) or 7 days (May 1 through September 30) of the formation of the stockpile. Native topsoil stockpiles shall not be covered with plastic.
- Topsoil shall not be placed while in a frozen or muddy condition, when the subgrade is excessively wet, or when conditions exist that may otherwise be detrimental to proper grading or proposed sodding or seeding.
- Previously established grades on the areas to be topsoiled shall be maintained according to the approved plan.
- When native topsoil is to be stockpiled and reused the following should apply to ensure that the mycorrhizal bacterial, earthworms, and other beneficial organisms will not be destroyed:
  1. Topsoil is to be re-installed within 4 to 6 weeks;
  2. Topsoil is not to become saturated with water;
  3. Plastic cover is not allowed.
- Inspect stockpiles regularly, especially after large storm events. Stabilize any areas that have eroded.

***Maintenance  
Standards***

## BMP C126: Polyacrylamide for Soil Erosion Protection

### *Purpose*

Polyacrylamide (PAM) is used on construction sites to prevent soil erosion.

Applying PAM to bare soil in advance of a rain event significantly reduces erosion and controls sediment in two ways. First, PAM increases the soil's available pore volume, thus increasing infiltration through flocculation and reducing the quantity of stormwater runoff. Second, it increases flocculation of suspended particles and aids in their deposition, thus reducing stormwater runoff turbidity and improving water quality.

### *Conditions of Use*

PAM shall not be directly applied to water or allowed to enter a water body.

In areas that drain to a sediment pond, PAM can be applied to bare soil under the following conditions:

- During rough grading operations.
- Staging areas.
- Balanced cut and fill earthwork.
- Haul roads prior to placement of crushed rock surfacing.
- Compacted soil roadbase.
- Stockpiles.
- After final grade and before paving or final seeding and planting.
- Pit sites.
- Sites having a winter shut down. In the case of winter shut down, or where soil will remain unworked for several months, PAM should be used together with mulch.

### *Design and Installation Specifications*

PAM may be applied in dissolved form with water, or it may be applied in dry, granular or powdered form. The preferred application method is the dissolved form.

PAM is to be applied at a maximum rate of 2/3 pound PAM per 1000 gallons water (80 mg/L) per 1 acre of bare soil. Table 4.8 can be used to determine the PAM and water application rate for a disturbed soil area. Higher concentrations of PAM **do not** provide any additional effectiveness.

<b>Disturbed Area (ac)</b>	<b>PAM (lbs)</b>	<b>Water (gal)</b>
0.50	0.33	500
1.00	0.66	1,000
1.50	1.00	1,500
2.00	1.32	2,000
2.50	1.65	2,500
3.00	2.00	3,000
3.50	2.33	3,500
4.00	2.65	4,000
4.50	3.00	4,500
5.00	3.33	5,000

The Preferred Method:

- Pre-measure the area where PAM is to be applied and calculate the amount of product and water necessary to provide coverage at the specified application rate (2/3 pound PAM/1000 gallons/acre).
- PAM has infinite solubility in water, but dissolves very slowly. Dissolve pre-measured dry granular PAM with a known quantity of clean water in a bucket several hours or overnight. Mechanical mixing will help dissolve the PAM. Always add PAM to water - not water to PAM.
- Pre-fill the water truck about 1/8 full with water. The water does not have to be potable, but it must have relatively low turbidity – in the range of 20 NTU or less.
- Add PAM /Water mixture to the truck
- Completely fill the water truck to specified volume.
- Spray PAM/Water mixture onto dry soil until the soil surface is uniformly and completely wetted.

An Alternate Method:

PAM may also be applied as a powder at the rate of 5 lbs. per acre. This must be applied on a day that is dry. For areas less than 5-10 acres, a hand-held “organ grinder” fertilizer spreader set to the smallest setting will work. Tractor-mounted spreaders will work for larger areas.

The following shall be used for application of PAM:

- PAM shall be used in conjunction with other BMPs and not in place of other BMPs.
- Do not use PAM on a slope that flows directly into a stream or wetland. The stormwater runoff shall pass through a sediment control BMP prior to discharging to surface waters.
- Do not add PAM to water discharging from site.
- When the total drainage area is greater than or equal to 5 acres, PAM treated areas shall drain to a sediment pond.
- Areas less than 5 acres shall drain to sediment control BMPs, such as a minimum of 3 check dams per acre. The total number of check dams used shall be maximized to achieve the greatest amount of settlement of sediment prior to discharging from the site. Each check dam shall be spaced evenly in the drainage channel through which stormwater flows are discharged off-site.
- On all sites, the use of silt fence shall be maximized to limit the discharges of sediment from the site.
- All areas not being actively worked shall be covered and protected from rainfall. PAM shall not be the only cover BMP used.

- PAM can be applied to wet soil, but dry soil is preferred due to less sediment loss.
- PAM will work when applied to saturated soil but is not as effective as applications to dry or damp soil.
- Keep the granular PAM supply out of the sun. Granular PAM loses its effectiveness in three months after exposure to sunlight and air.
- Proper application and re-application plans are necessary to ensure total effectiveness of PAM usage.
- PAM, combined with water, is very slippery and can be a safety hazard. Care must be taken to prevent spills of PAM powder onto paved surfaces. During an application of PAM, prevent over-spray from reaching pavement as pavement will become slippery. If PAM powder gets on skin or clothing, wipe it off with a rough towel rather than washing with water-this only makes cleanup messier and take longer.
- Some PAMs are more toxic and carcinogenic than others. Only the most environmentally safe PAM products should be used.

The specific PAM copolymer formulation must be anionic. **Cationic PAM shall not be used in any application because of known aquatic toxicity problems.** Only the highest drinking water grade PAM, certified for compliance with ANSI/NSF Standard 60 for drinking water treatment, will be used for soil applications. Recent media attention and high interest in PAM has resulted in some entrepreneurial exploitation of the term "polymer." All PAM are polymers, but not all polymers are PAM, and not all PAM products comply with ANSI/NSF Standard 60. PAM use shall be reviewed and approved by the City. The Washington State Department of Transportation (WSDOT) has listed approved PAM products on their web page.

- PAM designated for these uses should be "water soluble" or "linear" or "non-crosslinked". Cross-linked or water absorbent PAM, polymerized in highly acidic (pH<2) conditions, are used to maintain soil moisture content.
- The PAM anionic charge density may vary from 2-30 percent; a value of 18 percent is typical. Studies conducted by the United States Department of Agriculture (USDA)/ARS demonstrated that soil stabilization was optimized by using very high molecular weight (12-15 mg/mole), highly anionic (>20% hydrolysis) PAM.
- PAM tackifiers are available and being used in place of guar and alpha plantago. Typically, PAM tackifiers should be used at a rate of no more than 0.5-1 lb. per 1000 gallons of water in a hydromulch machine. Some tackifier product instructions say to use at a rate of 3 –

5 lbs. per acre, which can be too much. In addition, pump problems can occur at higher rates due to increased viscosity.

***Maintenance  
Standards***

- PAM may be reapplied on actively worked areas after a 48-hour period.
- Reapplication is not required unless PAM treated soil is disturbed or unless turbidity levels show the need for an additional application. If PAM treated soil is left undisturbed a reapplication may be necessary after two months. More PAM applications may be required for steep slopes, silty and clayey soils (USDA Classification Type "C" and "D" soils), long grades, and high precipitation areas. When PAM is applied first to bare soil and then covered with straw, a reapplication may not be necessary for several months.
- Loss of sediment and PAM may be a basis for penalties per RCW 90.48.080.

## **BMP C130: Surface Roughening**

### ***Purpose***

Surface roughening aids in the establishment of vegetative cover, reduces runoff velocity, increases infiltration, and provides for sediment trapping through the provision of a rough soil surface. Horizontal depressions are created by operating a tiller or other suitable equipment on the contour or by leaving slopes in a roughened condition by not fine grading them.

### ***Conditions for Use***

- All slopes steeper than 3:1 and greater than 5 vertical feet require surface roughening.
- Areas with grades steeper than 3:1 should be roughened to a depth of 2 to 4 inches prior to seeding.
- Areas that will not be stabilized immediately may be roughened to reduce runoff velocity until seeding takes place.
- Slopes with a stable rock face do not require roughening.
- Slopes where mowing is planned should not be excessively roughened.

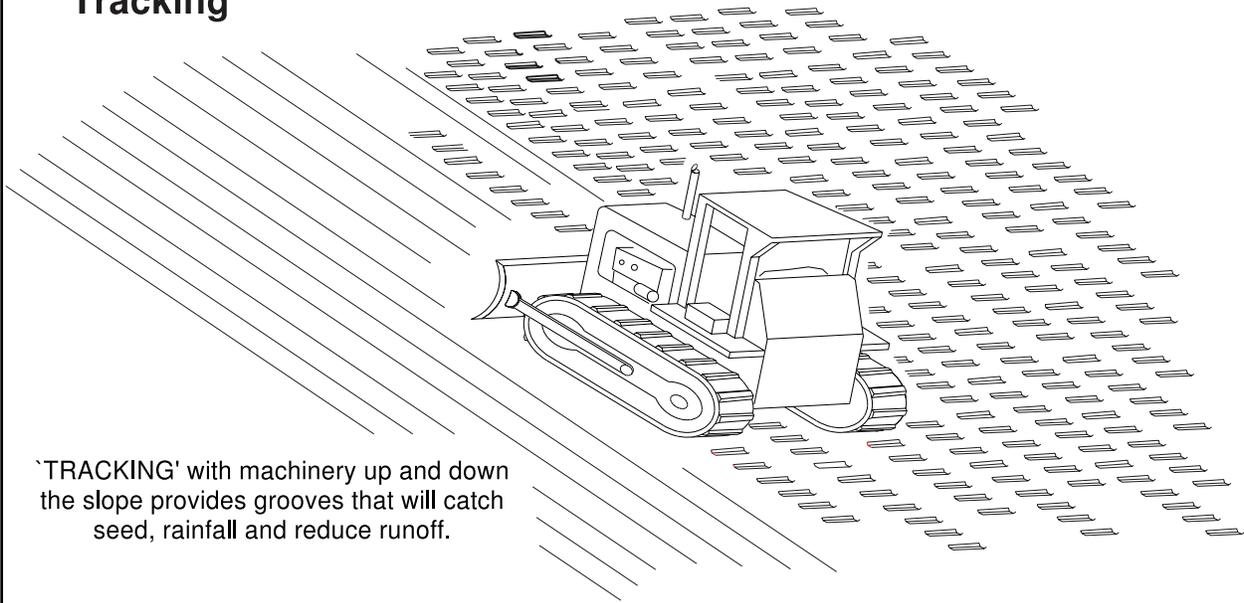
### ***Design and Installation Specifications***

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, contour furrows, and tracking. See Figure 4.6 for tracking and contour furrows. Factors to be considered in choosing a method are slope steepness, mowing requirements, and whether the slope is formed by cutting or filling.

- Disturbed areas that will not require mowing may be stair-step graded, grooved, or left rough after filling.
- Stair-step grading is particularly appropriate in soils containing large amounts of soft rock. Each "step" catches material that 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. Stair steps must be on contour or gullies will form on the slope.
- Areas that will be mowed (these areas should have slopes less steep than 3:1) may have small furrows left by disking, harrowing, raking, or seed-planting machinery operated on the contour.
- Graded areas with slopes greater than 3:1 but less than 2:1 should be roughened before seeding. This can be accomplished in a variety of ways, including "track walking," or driving a crawler tractor up and down the slope, leaving a pattern of cleat imprints parallel to slope contours.
- Tracking is done by operating equipment up and down the slope to leave horizontal depressions in the soil.
- Areas that are graded in this manner should be seeded as quickly as possible.
- Regular inspections should be made of the area. If rills appear, they should be re-graded and re-seeded immediately.

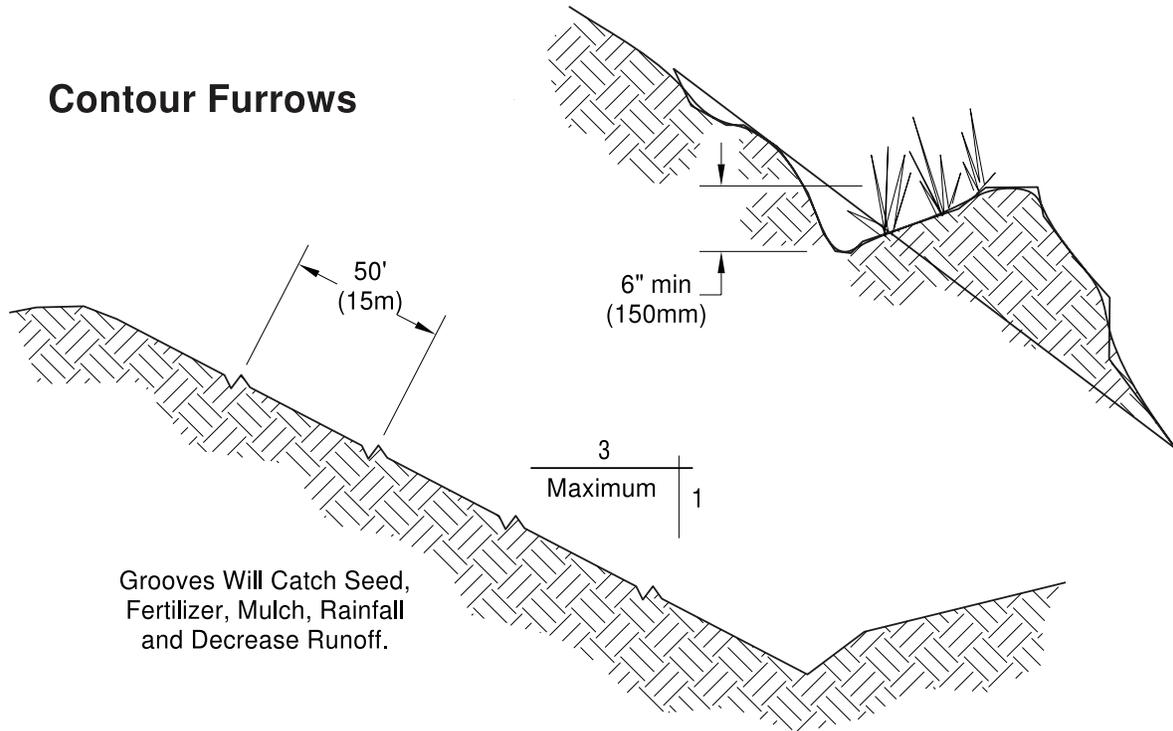
### ***Maintenance Standards***

## Tracking



'TRACKING' with machinery up and down the slope provides grooves that will catch seed, rainfall and reduce runoff.

## Contour Furrows



Grooves Will Catch Seed, Fertilizer, Mulch, Rainfall and Decrease Runoff.

**Figure 4.6 – Surface Roughening by Tracking and Contour Furrows**

## BMP C131: Gradient Terraces

**Purpose** Gradient terraces reduce erosion damage by intercepting surface runoff and conducting it to a stable outlet at a non-erosive velocity.

**Conditions of Use**

- Gradient terraces normally are limited to denuded land having a water erosion problem. They should not be constructed on deep sands or on soils that are too stony, steep, or shallow to permit practical and economical installation and maintenance. Gradient terraces may be used only where suitable outlets are or will be made available. See Figure 4.7 for gradient terraces.

**Design and  
Installation  
Specifications**

- The maximum spacing of gradient terraces should be determined by the following method:

$$VI = (0.8)s + y$$

Where: VI = vertical interval in feet

s = land rise per 100 feet, expressed in feet

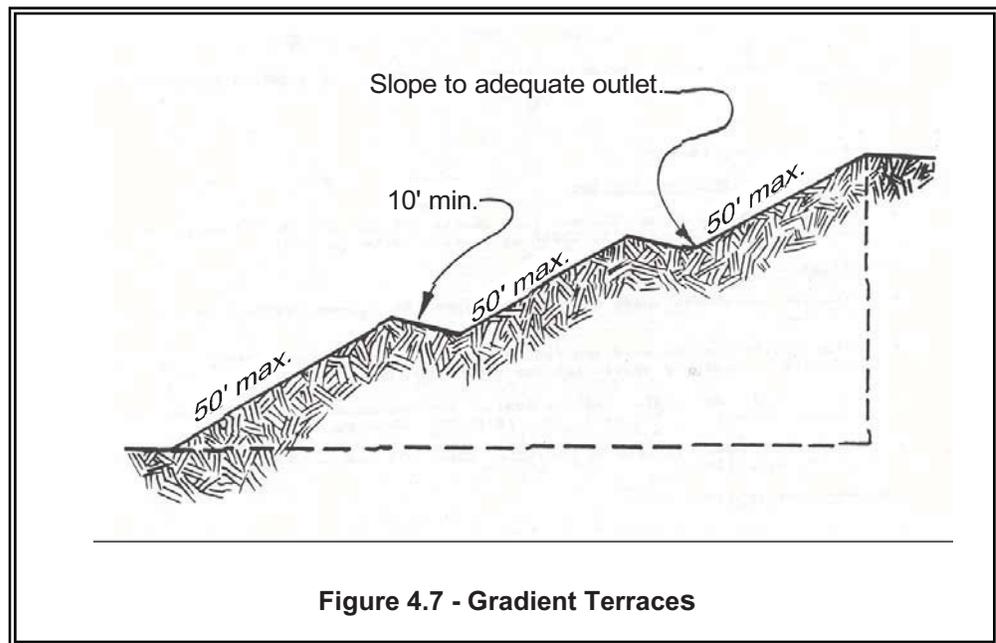
y = a soil and cover variable with values from 1.0 to 4.0

Values of “y” are influenced by soil erodibility and cover practices. The lower values are applicable to erosive soils where little to no residue is left on the surface. The higher value is applicable only to erosion-resistant soils where a large amount of residue (1½ tons of straw/acre equivalent) is on the surface.

- The minimum constructed cross-section should meet the design dimensions.
- The top of the constructed ridge should not be lower at any point than the design elevation plus the specified overfill for settlement. The opening at the outlet end of the terrace should have a cross section equal to that specified for the terrace channel.
- Channel grades may be either uniform or variable with a maximum grade of 0.6 feet per 100 feet length. For short distances, terrace grades may be increased to improve alignment. The channel velocity should not exceed that which is nonerosive for the soil type with the planned treatment.
- All gradient terraces should have adequate outlets. Such an outlet may be a grassed waterway, vegetated area, or tile outlet. In all cases the outlet must convey runoff from the terrace or terrace system to a point where the outflow will not cause damage. Vegetative cover should be used in the outlet channel.
- The design elevation of the water surface of the terrace should not be lower than the design elevation of the water surface in the outlet at their junction, when both are operating at design flow.

- Vertical spacing determined by the above methods may be increased as much as 0.5 feet or 10 percent, whichever is greater, to provide better alignment or location, to avoid obstacles, to adjust for equipment size, or to reach a satisfactory outlet.
- The drainage area above the top should not exceed the area that would be drained by a terrace with normal spacing.
- The terrace should have enough capacity to handle the peak runoff expected from a 2-year, 24-hour design storm without overtopping.
- The terrace cross-section should be proportioned to fit the land slope. The ridge height should include a reasonable settlement factor. The ridge should have a minimum top width of 3 feet at the design height. The minimum cross-sectional area of the terrace channel should be 8 square feet for land slopes of 5 percent or less, 7 square feet for slopes from 5 to 8 percent, and 6 square feet for slopes steeper than 8 percent. The terrace can be constructed wide enough to be maintained using a small cat.
- Maintenance should be performed as needed. Terraces should be inspected regularly; at least once a year, and after large storm events.

***Maintenance Standards***



## **BMP C140: Dust Control**

- Purpose*** Dust control prevents wind transport of dust from disturbed soil surfaces onto roadways, drainage ways, and surface waters.
- Conditions of Use***
- In areas (including roadways) subject to surface and air movement of dust where on-site and off-site impacts to roadways, drainage ways, or surface waters are likely.
- Design and Installation Specifications***
- Vegetate or mulch areas that will not receive vehicle traffic. In areas where planting, mulching, or paving is impractical, apply gravel or landscaping rock.
  - Limit dust generation by clearing only those areas where immediate activity will take place, leaving the remaining area(s) in the original condition, if stable. Maintain the original ground cover as long as practical.
  - Construct natural or artificial windbreaks or windscreens. These may be designed as enclosures for small dust sources.
  - Sprinkle the site with water until surface is wet. Repeat as needed. To prevent carryout of mud onto street, refer to Stabilized Construction Entrance (BMP C105).
  - Irrigation water can be used for dust control. Irrigation systems should be installed as a first step on sites where dust control is a concern.
  - Spray exposed soil areas with a dust palliative, following the manufacturer's instructions and cautions regarding handling and application. Used oil is prohibited from use as a dust suppressant. Local governments may approve other dust palliatives such as calcium chloride or PAM.
  - PAM (BMP C126) added to water at a rate of 0.5 lbs. per 1,000 gallons of water per acre and applied from a water truck is more effective than water alone. This is due to the increased infiltration of water into the soil and reduced evaporation. In addition, small soil particles are bonded together and are not as easily transported by wind. Adding PAM may actually reduce the quantity of water needed for dust control, especially in eastern Washington. Since the wholesale cost of PAM is about \$ 4.00 per pound, this is an extremely cost-effective dust control method.
- Techniques that can be used for unpaved roads and lots include:
- Lower speed limits. High vehicle speed increases the amount of dust stirred up from unpaved roads and lots.
  - Upgrade the road surface strength by improving particle size, shape, and mineral types that make up the surface and base materials.

- Add surface gravel to reduce the source of dust emission. Limit the amount of fine particles (those smaller than .075 mm) to 10 to 20 percent.
- Use geotextile fabrics to increase the strength of new roads or roads undergoing reconstruction.
- Encourage the use of alternate, paved routes, if available.
- Restrict use by tracked vehicles and heavy trucks to prevent damage to road surface and base.
- Apply chemical dust suppressants using the admix method, blending the product with the top few inches of surface material. Suppressants may also be applied as surface treatments.
- Pave unpaved permanent roads and other trafficked areas.
- Use vacuum street sweepers.
- Remove mud and other dirt promptly so it does not dry and then turn into dust.
- Limit dust-causing work on windy days.
- Contact your local Air Pollution Control Authority for guidance and training on other dust control measures. Compliance with the local Air Pollution Control Authority constitutes compliance with this BMP.

***Maintenance  
Standards***

Respray area as necessary to keep dust to a minimum.

## BMP C150: Materials On Hand

### *Purpose*

Quantities of erosion prevention and sediment control materials can be kept on the project site at all times to be used for emergency situations such as unexpected heavy summer rains. Having these materials on-site reduces the time needed to implement BMPs when inspections indicate that existing BMPs are not meeting the CSWPPP requirements. In addition, contractors can save money by buying some materials in bulk and storing them at their office or yard.

### *Conditions of Use*

- Construction projects of any size or type can benefit from having materials on hand. A small commercial development project could have a roll of plastic and some gravel available for immediate protection of bare soil and temporary berm construction. A large earthwork project, such as highway construction, might have several tons of straw, several rolls of plastic, flexible pipe, sandbags, geotextile fabric and steel “T” posts.
- Materials are stockpiled and readily available before any site clearing, grubbing, or earthwork begins. A large contractor or developer could keep a stockpile of materials that are available to be used on several projects.
- If storage space at the project site is at a premium, the contractor could maintain the materials at their office or yard. The office or yard must be less than an hour from the project site.

### *Design and Installation Specifications*

Depending on project type, size, complexity, and length, materials and quantities will vary. A good minimum that will cover numerous situations includes:

<b>Material</b>	<b>Measure</b>	<b>Quantity</b>
Clear Plastic, 6 mil	100 foot roll	1-2
Drainpipe, 6 or 8 inch diameter	25 foot section	4-6
Sandbags, filled	each	25-50
Straw Bales for mulching,	approx. 50# each	10-20
Quarry Spalls	ton	2-4
Washed Gravel	cubic yard	2-4
Geotextile Fabric	100 foot roll	1-2
Catch Basin Inserts	each	2-4
Steel “T” Posts	each	12-24

### *Maintenance Standards*

- All materials with the exception of the quarry spalls, steel “T” posts, and gravel should be kept covered and out of both sun and rain.
- Re-stock materials used as needed.

## **BMP C151: Concrete Handling**

***Purpose*** Concrete work can generate process water and slurry that contain fine particles and high pH, both of which can violate water quality standards in the receiving water. This BMP is intended to minimize and eliminate concrete process water and slurry from entering waters of the state.

***Conditions of Use*** Any time concrete is used, these management practices shall be utilized. Concrete construction projects include, but are not limited to, the following:

- Curbs
- Sidewalks
- Roads
- Bridges
- Foundations
- Floors
- Runways
- Concrete truck chutes, pumps, and internals shall be washed out only into formed areas awaiting installation of concrete or asphalt.
- Unused concrete remaining in the truck and pump shall be returned to the originating batch plant for recycling.
- Hand tools including, but not limited to, screeds, shovels, rakes, floats, and trowels shall be washed off only into formed areas awaiting installation of concrete or asphalt.
- Equipment that cannot be easily moved, such as concrete pavers, shall only be washed in areas that do not directly drain to natural or constructed stormwater conveyances.
- Washdown from areas such as concrete aggregate driveways shall not drain directly to natural or constructed stormwater conveyances.
- When no formed areas are available, washwater and leftover product shall be contained in a lined container. Contained concrete shall be disposed of in a manner that does not violate groundwater or surface water quality standards.

***Maintenance Standards*** Containers shall be checked for holes in the liner daily during concrete pours and repaired the same day.

## **BMP C152: Sawcutting and Surfacing Pollution Prevention**

<b><i>Purpose</i></b>	Sawcutting and surfacing operations generate slurry and process water that contains fine particles and high pH (concrete cutting), both of which can violate the water quality standards in the receiving water. This BMP is intended to minimize and eliminate process water and slurry from entering waters of the State.
<b><i>Conditions of Use</i></b>	Anytime sawcutting or surfacing operations take place, these management practices shall be utilized. Sawcutting and surfacing operations include, but are not limited to, the following: <ul style="list-style-type: none"><li>• Sawing</li><li>• Coring</li><li>• Grinding</li><li>• Roughening</li><li>• Hydro-demolition</li><li>• Bridge and road surfacing</li></ul>
<b><i>Design and Installation Specifications</i></b>	<ul style="list-style-type: none"><li>• Slurry and cuttings shall be vacuumed during cutting and surfacing operations.</li><li>• Slurry and cuttings shall not remain on permanent concrete or asphalt pavement overnight.</li><li>• Slurry and cuttings shall not drain to any natural or constructed drainage conveyance.</li><li>• Collected slurry and cuttings shall be disposed of in a manner that does not violate groundwater or surface water quality standards.</li><li>• Process water that is generated during hydro-demolition, surface roughening or similar operations shall not drain to any natural or constructed drainage conveyance and shall be disposed of in a manner that does not violate groundwater or surface water quality standards.</li><li>• Cleaning waste material and demolition debris shall be handled and disposed of in a manner that does not cause contamination of water. If the area is swept with a pick-up sweeper, the material must be hauled out of the area to an appropriate disposal site.</li></ul>
<b><i>Maintenance Standards</i></b>	Continually monitor operations to determine whether slurry, cuttings, or process water could enter waters of the state. If inspections show that a violation of water quality standards could occur, stop operations and immediately implement preventive measures such as berms, barriers, secondary containment, and vacuum trucks.

## **BMP C153: Material Delivery, Storage and Containment**

### ***Purpose***

Prevent, reduce, or eliminate the discharge of pollutants from material delivery and storage to the stormwater system or watercourses by minimizing the storage of hazardous materials onsite, storing materials in a designated area, and installing secondary containment.

### ***Conditions of Use***

**These procedures are suitable for use at all construction sites with delivery and storage of the following materials:**

- Petroleum products such as fuel, oil and grease
- Soil stabilizers and binders (e.g. Polyacrylamide)
- Fertilizers, pesticides and herbicides
- Detergents
- Asphalt and concrete compounds
- Hazardous chemicals such as acids, lime, adhesives, paints, solvents and curing compounds
- Any other material that may be detrimental if released to the environment

### ***Design and Installation Specifications***

**The following steps should be taken to minimize risk:**

- Temporary storage area should be located away from vehicular traffic, near the construction entrance(s), and away from waterways or storm drains.
- Material Safety Data Sheets (MSDS) should be supplied for all materials stored. Chemicals should be kept in their original labeled containers.
- Hazardous material storage on-site should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- During the wet weather season (Oct 1 – April 30), consider storing materials in a covered area.
- Materials should be stored in secondary containments, such as earthen dike, horse trough, or even a children’s wading pool for non-reactive materials such as detergents, oil, grease, and paints. Small amounts of material may be secondarily contained in “bus boy” trays or concrete mixing trays.
- Do not store chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and, when possible, in secondary containment.

- If drums must be kept uncovered, store them at a slight angle to reduce ponding of rainwater on the lids to reduce corrosion. Domed plastic covers are inexpensive and snap to the top of drums, preventing water from collecting.

**Material Storage Areas and Secondary Containment Practices:**

- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 shall be stored in approved containers and drums and shall not be overfilled. Containers and drums shall be stored in temporary secondary containment facilities.
- Temporary secondary containment facilities shall provide for a spill containment volume able to contain precipitation from a 25 year, 24 hour storm event, plus 10% of the total enclosed container volume of all containers, or 110% of the capacity of the largest container within its boundary, whichever is greater.
- Secondary containment facilities shall be impervious to the materials stored therein for a minimum contact time of 72 hours.
- Secondary containment facilities shall be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills shall be collected and placed into drums. These liquids shall be handled as hazardous waste unless testing determines them to be non-hazardous.
- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- During the wet weather season (Oct 1 – April 30), each secondary containment facility shall be covered during non-working days, prior to and during rain events.
- Keep material storage areas clean, organized and equipped with an ample supply of appropriate spill clean-up material (spill kit).
- The spill kit should include, at a minimum:
  - 1-Water Resistant Nylon Bag
  - 3-Oil Absorbent Socks 3”x 4’
  - 2-Oil Absorbent Socks 3”x 10’
  - 12-Oil Absorbent Pads 17”x19”
  - 1-Pair Splash Resistant Goggles
  - 3-Pair Nitrile Gloves
  - 10-Disposable Bags with Ties
  - Instructions

## **BMP C160: Certified Erosion and Sediment Control Lead**

### ***Purpose***

The project proponent designates at least one person as the responsible representative in charge of erosion and sediment control (ESC), and water quality protection. The designated person shall be the Certified Erosion and Sediment Control Lead (CESCL) who is responsible for ensuring compliance with all local, state, and federal erosion and sediment control and water quality requirements.

### ***Conditions of Use***

A CESCL shall be made available on projects one acre or larger that discharge stormwater to surface waters of the state

- The CESCL shall:
  - Have a current certificate proving attendance in an erosion and sediment control training course that meets the minimum ESC training and certification requirements established by Ecology (see details below).

Ecology will maintain a list of ESC training and certification providers at: [www.ecy.wa.gov/programs/wq/stormwater](http://www.ecy.wa.gov/programs/wq/stormwater).

### **OR**

- Be a Certified Professional in Erosion and Sediment Control (CPESC); for additional information go to: [www.cpesc.net](http://www.cpesc.net)

### ***Specifications***

- Certification shall remain valid for three years.
- The CESCL shall have authority to act on behalf of the contractor or developer and shall be available, on call, 24 hours per day throughout the period of construction.
- The CSWPPP shall include the name, telephone number, fax number, and address of the designated CESCL.
- A CESCL may provide inspection and compliance services for multiple construction projects in the same geographic region.

Duties and responsibilities of the CESCL shall include, but are not limited to the following:

- Maintaining permit file on site at all times which includes the SWPPP and any associated permits and plans.
- Directing BMP installation, inspection, maintenance, modification, and removal.
- Updating all project drawings and the CSWPPP with changes made.
- Keeping daily logs, and inspection reports. Inspection reports should include:
  - Inspection date/time.

- Weather information; general conditions during inspection and approximate amount of precipitation since the last inspection.
- A summary or list of all BMPs implemented, including observations of all erosion/sediment control structures or practices. The following shall be noted:
  - 1) Locations of BMPs inspected,
  - 2) Locations of BMPs that need maintenance,
  - 3) Locations of BMPs that failed to operate as designed or intended, and
  - 4) Locations of where additional or different BMPs are required.
- Visual monitoring results, including a description of discharged stormwater. The presence of suspended sediment, turbid water, discoloration, and oil sheen shall be noted, as applicable.
- Any water quality monitoring performed during inspection.
- General comments and notes, including a brief description of any BMP repairs, maintenance or installations made as a result of the inspection.
- Facilitate, participate in, and take corrective actions resulting from inspections performed by outside agencies or the owner.

## Minimum Requirements for ESC Training and Certification Courses

### General Requirements

1. The course shall teach the construction stormwater pollution prevention guidance provided in the most recent version of:
  - a. The Washington State Dept. of Ecology Stormwater Management Manual for Western Washington,
  - b. Other equivalent stormwater management manuals approved by Ecology.
2. Upon completion of course, each attendee shall receive documentation of certification, including, at a minimum, a wallet-sized card that certifies completion of the course. Certification shall remain valid for three years. Recertification may be obtained by completing the 8-hour refresher course or by taking the initial 16-hour training course again.
3. The initial certification course shall be a minimum of 16 hours (with a reasonable time allowance for lunch, breaks, and travel to and from field) and include a field element and test.
  - a. The field element must familiarize students with the proper installation, maintenance and inspection of common erosion and sediment control BMPs including, but not limited to, blankets, check dams, silt fence, straw mulch, plastic, and seeding.
  - b. The test shall be open book and a passing score is not required for certification. Upon completion of the test, the correct answers shall be provided and discussed.
4. The refresher course shall be a minimum of 8 hours and include a test.
  - a. The refresher course shall include:
    - i. Applicable updates to the Stormwater Management Manual that is used to teach the course, including new or updated BMPs; and
    - ii. Applicable changes to the NPDES General Permit for Construction Activities.
  - b. The refresher course test shall be open book and a passing score is not required for certification. Upon completion of the test, the correct answers shall be provided and discussed.
  - c. The refresher course may be taught using an alternative format (e.g. internet, CD ROM, etc.) if the module is approved by Ecology.

### Required Course Elements

1. Erosion and Sedimentation Impacts
  - a. Examples/Case studies

2. Erosion and Sedimentation Processes
  - a. Definitions
  - b. Types of erosion
  - c. Sedimentation
    - i. Basic settling concepts
    - ii. Problems with clays/turbidity
3. Factors Influencing Erosion Potential
  - a. Soil
  - b. Vegetation
  - c. Topography
  - d. Climate
4. Regulatory Requirements
  - a. NPDES - Construction Stormwater General Permit
  - b. Local requirements and permits
  - c. Other regulatory requirements
5. Stormwater Pollution Prevention Plan (SWPPP)
  - a. SWPPP is a living document – should be revised as necessary
  - b. 12 Elements of a SWPPP; discuss suggested BMPs (with examples)
    1. Mark Clearing Limits
    2. Establish Construction Access
    3. Control Flow Rates
    4. Install Sediment Controls
    5. Stabilize Soils
    6. Protect Slopes
    7. Protect Drain Inlets
    8. Stabilize Channels and Outlets
    9. Control Pollutants
    10. Control De-watering
    11. Maintain BMPs
    12. Manage the Project
6. Monitoring/Reporting/Recordkeeping
  - a. Site inspections/visual monitoring
    - i. Disturbed areas
    - ii. BMPs
    - iii. Stormwater discharge points
  - b. Water quality sampling/analysis
    - i. Turbidity
    - ii. pH
  - c. Monitoring frequency
    - i. Set by NPDES permit
    - ii. Inactive sites - reduced frequency

- d. Adaptive Management
  - i. When monitoring indicates problem, take appropriate action (e.g. install/maintain BMPs)
  - ii. Document the corrective action(s) in SWPPP
- e. Reporting
  - i. Inspection reports/checklists
  - ii. Discharge Monitoring Reports (DMR)
  - iii. Non-compliance notification

### **Instructor Qualifications**

1. Instructors must be qualified to effectively teach the required course elements.
2. At a minimum, instructors must have:
  - a. Current certification as a Certified Professional in Erosion and Sediment Control (CPESC), or
  - b. Completed a training program for teaching the required course elements, or
  - c. The academic credentials and instructional experience necessary for teaching the required course elements.
3. Instructors must demonstrate competent instructional skills and knowledge of the applicable subject matter.

## **BMP C161: Payment of Erosion Control Work**

### ***Purpose***

As with any construction operation, the contractor should be paid for erosion control work. Payment for erosion control must be addressed during project development and design. Method of payment should be identified in the SWPPP.

### ***Conditions of Use***

Erosion control work should never be “incidental” to the contract as it is extremely difficult for the contractor to bid the work. Work that is incidental to the contract is work where no separate measurement or payment is made. The cost for incidental work is included in payments made for applicable bid items in the Schedule of Unit Prices. For example, any erosion control work associated with an item called “Clearing and Grubbing” is bid and paid for as part of that item, not separately.

Several effective means for payment of erosion control work are described below. These include:

- Temporary Erosion and Sediment Control (TESC) Lump Sum.
- TESC-Force Account.
- Unit Prices.
- Lump Sum.

### **TESC Lump Sum**

One good method for achieving effective erosion and sediment control is to set up a Progress Payment system whereby the contract spells out exactly what is expected and allows for monthly payments over the life of the contract.

For example, an Item called “TESC Lump Sum” is listed in the Bid Schedule of Unit Prices. An amount, such as \$10,000, is written in both the Unit Price and Amount columns. This requires all bidders to bid \$10,000 for the item. If \$10,000 is not shown in the Amount column, each contractor bids the amount. Often this is under-bid, which can cause compliance difficulties later. In this example, the contractor is required to revise the project CSWPPP by developing a Contractor’s Erosion and Sediment Control Plan (CESCP) that is specific to their operations.

Next, the following language is included in the TESC specification Payment section:

Based upon lump sum Bid Item “TESC Lump Sum”, payments will be made as follows:

- A. Upon receipt of the Contractor’s CESCP, 25 percent.
- B. After Notice To Proceed and before Substantial Completion, 50 percent will be pro rated and paid monthly for compliance with the

CESCP. Non-compliance will result in withholding of payment for the month of non-compliance.

C. At Final Payment, 25 percent for a clean site.

Payment for “TESC Lump Sum” will be full compensation for furnishing all labor, equipment, materials and tools to implement the CESCP, install, inspect, maintain, and remove temporary erosion and sediment controls as detailed in the drawings and specified herein, with the exception of those items measured and paid for separately.

### ***TESC Force Account***

One good method for ensuring that contingency money is available to address unforeseen erosion and sediment control problems is to set up an item called “TESC-Force Account”. For example, an amount such as \$15,000 is written in both the Unit Price and Amount columns for the item. This requires all bidders to bid \$15,000 for the item.

The Force Account is used only at the discretion of the contracting agency or developer. If there are no unforeseen erosion problems, the money is not used. If there are unforeseen erosion problems, the contracting agency would direct the work to be done and pay an agreed upon amount for the work (such as predetermined rates under a Time and Materials setting).

Contract language for this item could look like this:

Measurement and Payment for “TESC-Force Account” will be on a Force Account basis in accordance with \_\_\_\_\_ (include appropriate section of the Contract Specifications). The amount entered in the Schedule of Unit Prices is an estimate.

### *Unit Prices*

When the material or work can be quantified, it can be paid by Unit Prices. For example, the project designer knows that 2 acres will need to be hydroseeded and sets up an Item of Work for Hydroseed, with a Bid Quantity of 2, and a Unit for Acre. The bidder writes in the unit Prices and Amount.

Unit Price items can be used in conjunction with TESC-Force Account and TESC-Lump Sum.

### *Lump Sum*

In contracts where all the work in a project is paid as a Lump Sum, erosion control is usually not paid as a separate item. In order to ensure that appropriate amounts are bid into the contract, the contracting agency can request a Schedule of Values and require that all erosion control costs be identified.

## **BMP C162: Scheduling**

<i><b>Purpose</b></i>	Sequencing a construction project reduces the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking.
<i><b>Conditions of Use</b></i>	<p>The construction sequence schedule is an orderly listing of all major land-disturbing activities together with the necessary erosion and sedimentation control measures planned for the project. This type of schedule guides the contractor on work to be done before other work is started so that serious erosion and sedimentation problems can be avoided.</p> <p>Following a specified work schedule that coordinates the timing of land-disturbing activities and the installation of control measures is perhaps the most cost-effective way of controlling erosion during construction. The removal of surface ground cover leaves a site vulnerable to accelerated erosion. Construction procedures that limit land clearing, provide timely installation of erosion and sedimentation controls, and restore protective cover quickly can significantly reduce the erosion potential of a site.</p>
<i><b>Design Considerations</b></i>	<ul style="list-style-type: none"><li>• Avoid rainy periods.</li><li>• Schedule projects to disturb only small portions of the site at any one time. Complete grading as soon as possible. Immediately stabilize the disturbed portion before grading the next portion. Practice staged seeding in order to revegetate cut and fill slopes as the work progresses.</li></ul>

## **BMP C180: Small Project Construction Stormwater Pollution Prevention**

**Purpose** To prevent the discharge of sediment and other pollutants to the maximum extent practicable from small construction projects.

**Conditions of Use** On small construction projects, those adding or replacing less than 2,000 square feet of impervious surface or clearing less than 7,000 square feet.

### ***Design and Installation Specifications***

- Plan and implement proper clearing and grading of the site. It is most important only to clear the areas needed, thus keeping exposed areas to a minimum. Phase clearing so that only those areas that are actively being worked are uncovered.

*Note: Clearing limits should be flagged in the lot or area prior to initiating clearing.*

- Soil shall be managed in a manner that does not permanently compact or deteriorate the final soil and landscape system. If disturbance and/or compaction occur the impact must be corrected at the end of the construction activity. This shall include restoration of soil depth, soil quality, permeability, and percent organic matter. Construction practices must not cause damage to or compromise the design of permanent landscape or infiltration areas.
- Locate excavated basement soil a reasonable distance behind the curb, such as in the backyard or side yard area. This will increase the distance eroded soil must travel to reach the storm sewer system. Soil piles should be covered until the soil is either used or removed. Piles should be situated so that sediment does not run into the street or adjoining yards.
- Backfill basement walls as soon as possible and rough grade the lot. This will eliminate large soil mounds, which are highly erodible, and prepares the lot for temporary cover, which will further reduce erosion potential.
- Remove excess soil from the site as soon as possible after backfilling. This will eliminate any sediment loss from surplus fill.
- If a lot has a soil bank higher than the curb, a trench or berm should be installed moving the bank several feet behind the curb. This will reduce the occurrence of gully and rill erosion while providing a storage and settling area for stormwater.
- The construction entrance should be stabilized where traffic will be leaving the construction site and traveling on paved roads or other paved areas within 1,000 feet of the site.

- Provide for periodic street cleaning to remove any sediment that may have been tracked out. Sediment should be removed by shoveling or sweeping and carefully removed to a suitable disposal area where it will not be re-eroded.
- Utility trenches that run up and down slopes must be backfilled within seven days. Cross-slope trenches may remain open throughout construction to provide runoff interception and sediment trapping, provided that they do not convey turbid runoff off site.