# APPENDIX D

## EROSION AND SEDIMENT CONTROL STANDARDS

**KING COUNTY, WASHINGTON**

# SURFACE WATER DESIGN MANUAL

King County
Department of Natural Resources
Department of Development and Environmental Services

September 1998

# APPENDIX D

## EROSION AND SEDIMENT CONTROL STANDARDS

### KING COUNTY, WASHINGTON

# SURFACE WATER DESIGN MANUAL


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# EROSION AND SEDIMENT CONTROL STANDARDS

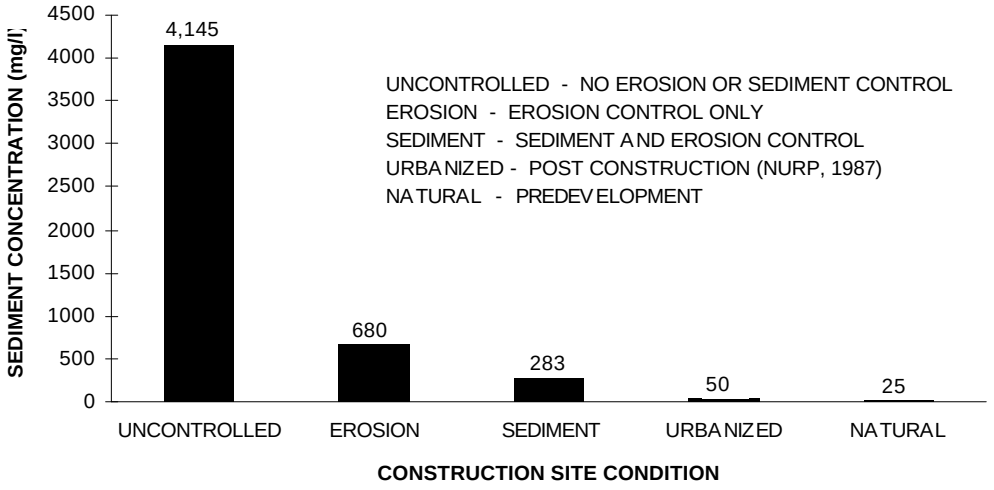
## D.1 PURPOSE AND OVERVIEW

The purpose of erosion and sediment control (ESC) is to prevent the transport of sediment to streams, wetlands, lakes, drainage systems, and adjacent properties. In most circumstances, however, it is impossible to completely prevent the transport of sediment to these features, either because of the difficulty in removing silt and clay-sized particles from runoff or because of large storms that overwhelm the ESC facilities. Due to the inherent difficulties in entirely preventing the transport of sediment, it is the responsibility of those involved in the design and construction of any project to utilize a variety of strategies to minimize erosion and the transport of sediment to the greatest extent possible. These strategies shall include overall project planning that reduces the risk of erosion through appropriate design and scheduling (see Section D.2) and traditional structural and cover measures, such as those described in Section D.4.

Erosion and sediment control is necessary because erosion rates associated with uncontrolled construction sites are much higher than normal rates—often a thousand or more times that of undeveloped land. The erosion rates increase during construction due to the removal of soil cover, alteration of soil characteristics, and changes in site topography. These vastly accelerated erosion rates, together with the higher rates typical of urbanized areas, result in excessive deposition of sediment in water resources and drainage facilities. This excessive erosion and consequent sediment deposition can result in devastating impacts to surface waters such as smothering of salmonid spawning beds, algal blooms in lakes, and flooding due to obstruction of drainage ways.

Applying erosion and sediment controls to construction sites can greatly reduce the delivery of sediment to surface waters. Figure D.1.A demonstrates how controls can significantly reduce the concentration of sediment leaving the site. Even with good controls, the concentration of sediment leaving the site will still be significantly higher than either undeveloped or developed conditions and this may result in significant adverse impacts; however, the likelihood of such impacts are dramatically less than if no controls are used.

**FIGURE D.1.A MEDIAN STORM SEDIMENT CONCENTRATIONS (METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS, 1990)**



# D.2 EROSION AND SEDIMENT CONTROL PRINCIPLES

This section provides basic information on the principles of erosion and sediment control that shall be applied to all projects in King County. This section is intended to highlight certain principles that are particularly critical to achieving effective control and that are the basis for the *Surface Water Design Manual's* Core Requirement #5: Erosion and Sediment Control Requirements (see Section D.10.1, p. D-63). Projects that are consistent with these principles will generally meet the intent of the Core Requirement and this appendix, even if the details of the project are not entirely consistent with County standards. If a more complete treatment of ESC is needed, there are a number of useful references available (for example, Goldman et al., 1986). Additionally, information on permanent erosion control in natural channels is available in the *Guidelines for Bank Stabilization Projects* (King County, 1993).

- **Design the project to fit the natural topography, soils, and drainage patterns.** Through such practices as limiting disturbance of steeper slopes, avoiding disturbance of natural drainage ways, or using soils with a high infiltration rate to treat polluted runoff, the characteristics of the site can be used to minimize erosion and sediment transport.

- **Emphasize erosion control rather than sediment control.** Erosion control minimizes the entrainment of sediment by runoff, while sediment control removes entrained sediment from runoff. Erosion control is more efficient and cost-effective because it is impossible to entirely remove sediment from runoff once it is entrained. Examples of erosion control include covering disturbed soils and controlling surface runoff using measures such as dikes and lined ditches. One illustration of the relative effectiveness of erosion control is straw mulch, which can reduce sediment concentrations in runoff over 90%.

  Since it is nearly impossible to entirely prevent erosion, it will also be necessary to incorporate sediment control facilities such as sedimentation ponds and silt fences. Sediment controls vary in their effectiveness, but typically reduce sediment concentrations 50 to 75%. However, sediment controls have little effect on the very fine sediment that causes turbidity, whereas cover measures, such as straw mulch, can be highly effective in reducing turbidity.

- **Minimize the extent and duration of area exposed.** Restricting clearing to only those areas necessary for construction is probably the single most effective form of erosion control. Additionally, exposing areas only as long as necessary reduces the risk of erosion substantially. This can be accomplished by planning the project so that areas are disturbed only when construction is imminent, and by mulching or seeding disturbed areas as soon as grading is completed.

- **Keep runoff velocities low.** While erosion of exposed soil begins with a single raindrop, the largest volumes of eroded materials are typically associated with concentrated runoff forming rills and gullies. One of the best ways to minimize erosion, therefore, is to reduce the possibility of concentrated runoff by intercepting runoff and conveying it in a non-erosive manner to a sediment pond or trap. This can include the use of dikes, swales, and benches to intercept runoff on slopes and ditches or drains to convey the intercepted runoff.

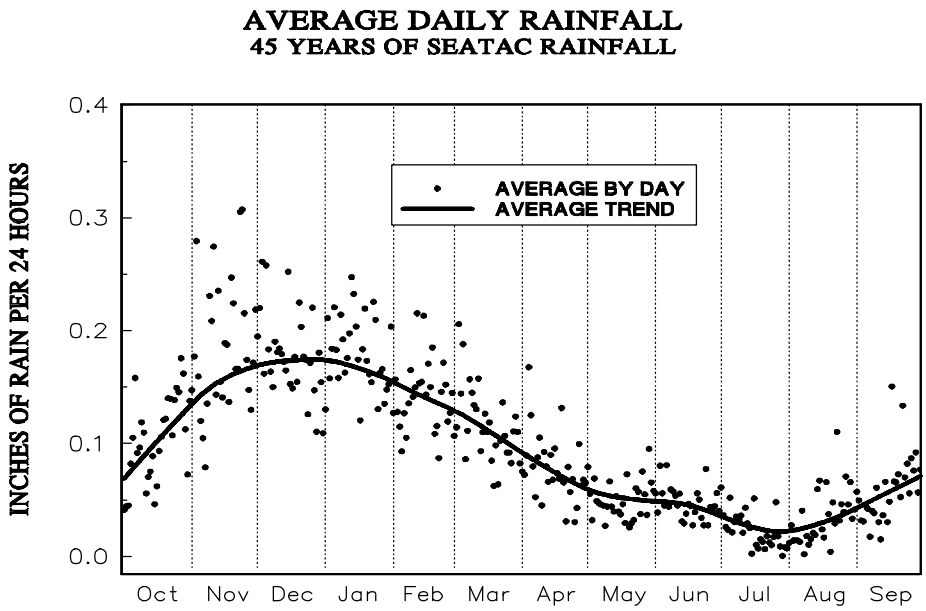
- **Retain sediment on site.** Sediment retention is less effective than erosion control measures, such as cover, but it is nevertheless a vital part of most projects because it is impossible to completely prevent erosion and the entrainment of sediment by runoff. Sediment can be retained by allowing it to settle out in ponds and traps or by filtering runoff from small areas through vegetation or a silt fence. Note that settling and filtration typically only remove sand-sized and coarse silt particles. Fine silts and clays cannot be removed in these ways, unless the runoff is released to vegetated areas or if chemical flocculents, such as alum, are used.

- **Thoroughly monitor the site and maintain all ESC measures.** Maintenance and vigilance are the most vital components of effective ESC management. All measures require regular maintenance. The overall site also needs to be constantly examined to ensure that all areas are protected, that the measures

are working together to provide maximum protection, and that all areas are mulched and/or vegetated as soon as possible.

- **Schedule major earthwork during the dry season.** The climate in the Puget Sound region is unique in that there are generally well-defined wet and dry seasons (see Figure D.2.A) and the wet season is characterized by a large number of low-intensity, but frequent and long-lasting, storms. As a result, construction in the dry season is a very effective form of erosion control. If construction does occur in the wet season, the need for regular maintenance is even more imperative.

**FIGURE D.2.A YEARLY RAINFALL PATTERN**



# D.3 GENERAL ESC REQUIREMENTS

To satisfy the King County requirements for ESC, the following steps are required of all construction projects:

1. In accordance with Sections 2.3.1 and 2.3.3 of the *Surface Water Design Manual* (*SWDM*), prepare and submit a technical information report (TIR) and an ESC plan for King County review. Incorporate any King County review comments as necessary to comply with Core Requirement #5 of the *SWDM* (see Section D.10.1, p. D-63) and the Erosion and Sediment Control Standards in this appendix.
2. Construct initial ESC measures on site according to the approved ESC plan.
3. Inspect and maintain all ESC measures throughout construction in accordance with the inspection and maintenance standards of Section D.5.4 (p. D-43).
4. Make any changes or additions necessary during construction to ensure that ESC measures perform in accordance with Core Requirement #5 and Sections D.4 and D.5.
5. Prior to final construction approval, meet all the conditions in Section D.5.5 (p. D-44) for final stabilization.

Proposed projects that add less than 10,000 square feet of impervious surface can satisfy the King County requirements by meeting all the conditions for Small Site ESC in Section D.7 (p. D-50).

# D.4 ESC MEASURES

This section details the ESC measures that are required to minimize erosion and sediment transport off a construction site. These ESC measures represent Best Management Practices (BMPs) for the control of erosion and entrained sediment. The measures and practices are grouped into seven sections corresponding to each of the ESC measures in Core Requirement #5 (see Section D.10.1, p. D-63). The introductory paragraphs at the beginning of most sections present the purpose of the measures, installation requirements relative to construction activity, guidelines for the conditions of use for each measure, and other information relevant to all BMPs in the section. Compliance with each of the seven sections of the ESC measures and the implementation requirements in Section D.5 ensures compliance with the ESC requirements. *Note: Additional measures shall be required by the County if the existing standards are insufficient to protect adjacent properties, drainage facilities, or water resources.*

The standards for each individual ESC measure are divided into four sections:

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

A code and symbol for each measure have also been included for ease of use on ESC plans. Note that the "Conditions of Use" always refers to site conditions. As site conditions change, ESC measures must be changed to remain in compliance with the requirements of this appendix.

# D.4.1 CLEARING LIMITS

**ESC Requirement 1:** Prior to any site clearing or grading, those areas that are to remain undisturbed during project construction shall be delineated. At a minimum, clearing limits shall be installed at the edges of all sensitive area buffers and any other areas required to be left uncleared such as portions of the site subject to clearing limits under KCC 16.82.150, areas around significant trees identified to be retained, and other areas identified to be left undisturbed to protect sensitive features.

**Purpose:** The purpose of clearing limits is to prevent disturbance of those areas of the project site that are not designated for clearing or grading. This is important because limiting site disturbance is the single most effective method for reducing erosion. Clearing limits may also be used to control construction traffic, thus reducing the disturbance of soil and limiting the amount of sediment tracked off site.

**When to Install:** Clearing limits shall be installed prior to the clearing and/or grading of the site.

**Measures to Use:** Marking clearing limits by delineating the site with a continuous length of brightly colored survey tape is sometimes sufficient. The tape can be supported by vegetation or stakes, and it shall be 3 to 6 feet high and highly visible. Sensitive areas and their buffers require more substantial protection and shall be delineated with plastic or metal safety fences (also referred to as Sensitive Area Setback Area or SASA fences) or stake and wire fences. Fencing may be required at the County's discretion to control construction traffic or at any location where greater protection is warranted. Permanent fencing may also be used if desired by the applicant. Silt fence, in combination with survey flagging, is also an acceptable method of marking sensitive areas and their buffers.

## D.4.1.1 PLASTIC OR METAL FENCE

Code: FE Symbol:


### 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:

1. At the boundary of sensitive areas, their buffers, and other areas required to be left uncleared
2. As necessary to control vehicle access to and on the site (see Sections D.4.4.1 and D.4.4.2).

### Design and Installation Specifications

1. The fence shall be designed and installed according to the manufacturer's specifications.
2. The fence shall be at least 3 feet high and must be highly visible.
3. The fence shall not be wired or stapled to trees.

### Maintenance Requirements

1. If the fence has been damaged or visibility reduced, it shall be repaired or replaced immediately and visibility restored.
2. Disturbance of a sensitive area, sensitive area buffer, native growth retention area, or any other area required to be left undisturbed shall be reported to the County for resolution.

## D.4.1.2 STAKE AND WIRE FENCE

Code: SWF Symbol:


### 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:

1. At the boundary of sensitive areas, their buffers, and other areas required to be left uncleared
2. As necessary, to control vehicle access to and on the site (see Sections D.4.4.1 and D.4.4.2).

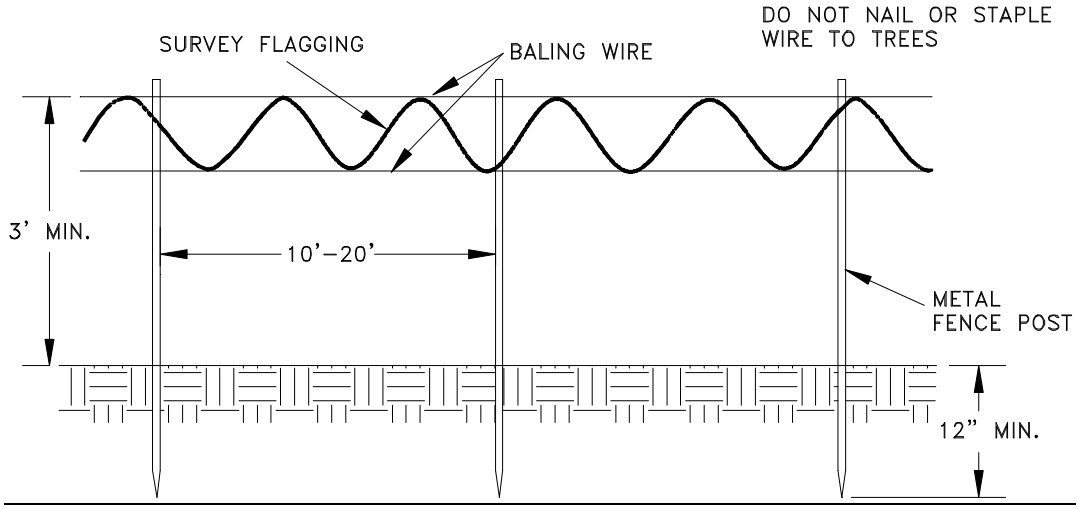
### Design and Installation Specifications

See Figure D.4.A for details.

### Maintenance Requirements

1. If the fence has been damaged or visibility reduced, it shall be repaired or replaced immediately and visibility restored.
2. Disturbance of a sensitive area, sensitive area buffer, native growth retention area, or other area required to be left undisturbed shall be reported to the County for resolution.
3. More substantial fencing shall be required by the County if the fence does not prevent encroachment into those areas that are not to be disturbed.

**FIGURE D.4.A STAKE AND WIRE FENCE**



# D.4.2 COVER MEASURES

**ESC Requirement 2:** Temporary and permanent cover measures shall be provided to protect disturbed areas. Temporary cover shall be installed if an area is to remain unworked for more than seven days during the dry season (May 1 to September 30) or for more than two days during the wet season (October 1 to April 30). These time limits may be relaxed if an area poses a low risk of erosion due to soil type, slope gradient, anticipated weather conditions, or other factors. Conversely, the County may reduce these time limits if site conditions warrant greater protection (e.g., adjacent to significant aquatic resources or highly erosive soils) or if significant precipitation (see Section D.5.2) is expected. Any area to remain unworked for more than 30 days shall be seeded or sodded, unless the County determines that winter weather makes vegetation establishment infeasible. During the wet season, slopes and stockpiles 3H:1V or steeper and with more than ten feet of vertical relief shall be covered if they are to remain unworked for more than 12 hours. Also during the wet season, the material necessary to cover all disturbed areas must be stockpiled on site. The intent of these cover requirements is to have as much area as possible covered during any period of precipitation.

**Purpose:** The purpose of covering exposed soils is to prevent erosion, thus reducing reliance on less effective methods that remove sediment after it is entrained in runoff. Cover is the only practical method of reducing turbidity in runoff. Structural measures, such as silt fences and sediment ponds, are only capable of removing coarse particles and in most circumstances have little to no effect on turbidity.

**When to Install:** Any exposed soils that will remain unworked for more than the time limit set in ESC Requirement 2 shall be covered by the end of the working day. If the exposed area is to remain unworked for more than 30 days, the area shall be seeded with the temporary seed mix or an equivalent mix that will provide rapid protection (see Section 0). If the disturbed area is to remain unworked for a year or more or if the area has reached final grade, permanent seed mix or an equivalent mix shall be applied.

**Measures to Use:** Cover methods include the use of mulch, erosion control nets and blankets, plastic covering, seeding, and sodding. Mulch and plastic sheeting are primarily intended to protect disturbed areas for a short period of time, typically days to a few months. Seeding and sodding are measures for areas that are to remain unworked for months. Erosion nets and blankets are to be used in conjunction with seeding steep slopes. The choice of measures is left to the designer; however, there are restrictions on the use of these methods, which are listed in the "Conditions of Use" and the "Design and Installation Specifications" sections for each measure.

The methods listed are by no means exhaustive. Variations on the standards presented here are encouraged if other cost-effective products or methods provide substantially equivalent or superior performance. Also, the details of installation can, and should, vary with the site conditions. A useful reference on the application of cover measures in the Puget Sound area is Horner, Guedrey, and Kortenhof (1990).

## D.4.2.1 MULCHING

Code: MU Symbol:


### 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:

1. On disturbed areas that require cover measures for less than 30 days

2. As a cover for seed during the wet season and during the hot summer months
3. During the wet season on slopes steeper than 3H:1V with more than 10 feet of vertical relief.

## Design and Installation Specifications

For mulch materials, application rates, and specifications, see Table D.4.A. *Note: Thicknesses may be increased for disturbed areas in or near sensitive areas or other areas highly susceptible to erosion.*

**TABLE D.4.A MULCH STANDARDS AND GUIDELINES**

| Mulch Material | Quality Standards | Application Rates | Remarks |
|---|---|---|---|
| Straw | Air-dried; free from undesirable seed and coarse material | 2"-3" thick; 2-3 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. Straw should be crimped to avoid wind blow. The thickness of straw may be reduced by half when used in conjunction with seeding. |
| Wood Fiber Cellulose | No growth inhibiting factors | Approx. 25-30 lbs per 1000 sf or 1000-1500 lbs per acre | Shall be applied with hydromulcher. Shall not be used without seed and tackifier unless the application rate is at least doubled. Some wood fiber with very long fibers can be effective at lower application rates and without seed or tackifier. |
| Compost | No visible water or dust during handling. Must be purchased from supplier with Solid Waste Handling Permit. | 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. Sources for compost are available from the King County Commission for Marketing Recyclable Materials at (206) 296-4439. |
| Chipped Site Vegetation | Average size shall be several inches. | 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. |

## Maintenance Standards

1. The thickness of the cover must be maintained.
2. 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.

## D.4.2.2 NETS AND BLANKETS

Code: NE Symbol:


### 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 are strands of material woven into an open, but high-tensile strength net (for example, jute 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:

1. For permanent stabilization of slopes 2H:1V or greater and with more than 10 feet of vertical relief.
2. In conjunction with seed for final stabilization of a slope, not for temporary cover. However, they can be used for temporary applications as long as the product is not damaged by repeated handling. In fact, this method of slope protection is superior to plastic sheeting, which generates high-velocity runoff (see Section D.4.2.3).
3. 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.

### Design and Installation Specifications

1. See Figure D.4.B and Figure D.4.C for **typical orientation and installation** of nettings and blankets. *Note: 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.*
2. 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 thoroughly consults the **manufacturer's information** and that a site visit takes place in order to insure that the product specified is appropriate.
3. Jute matting must be used in conjunction with mulch (Section D.4.2.1). 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 (though not authorized here) that may be appropriate in certain circumstances. Other types of products will have to be evaluated individually. 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.
4. Purely synthetic blankets are allowed but shall only be used for long-term stabilization of waterways. The organic blankets authorized above are better for slope protection and short-term waterway protection because they retain moisture and provide organic matter to the soil, substantially improving the speed and success of revegetation.

### Maintenance Standards

1. Good contact with the ground must be maintained, and there must not be erosion beneath the net or blanket.

2. Any areas of the net or blanket that are damaged or not in close contact with the ground shall be repaired and stapled.
3. If erosion occurs due to poorly controlled drainage, the problem shall be fixed and the eroded area protected.

**FIGURE D.4.B WATERWAY INSTALLATION**

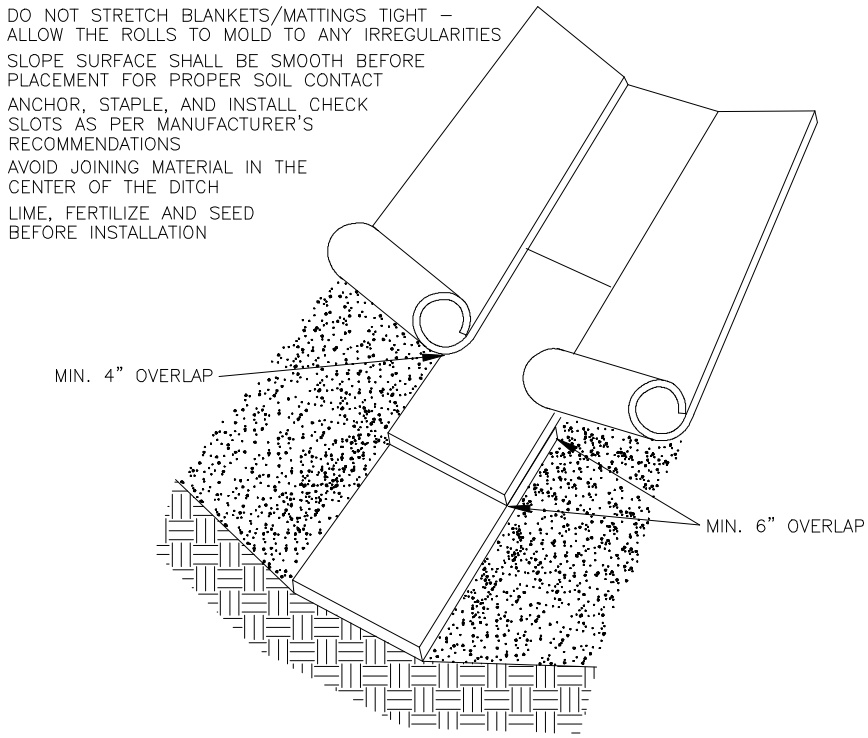
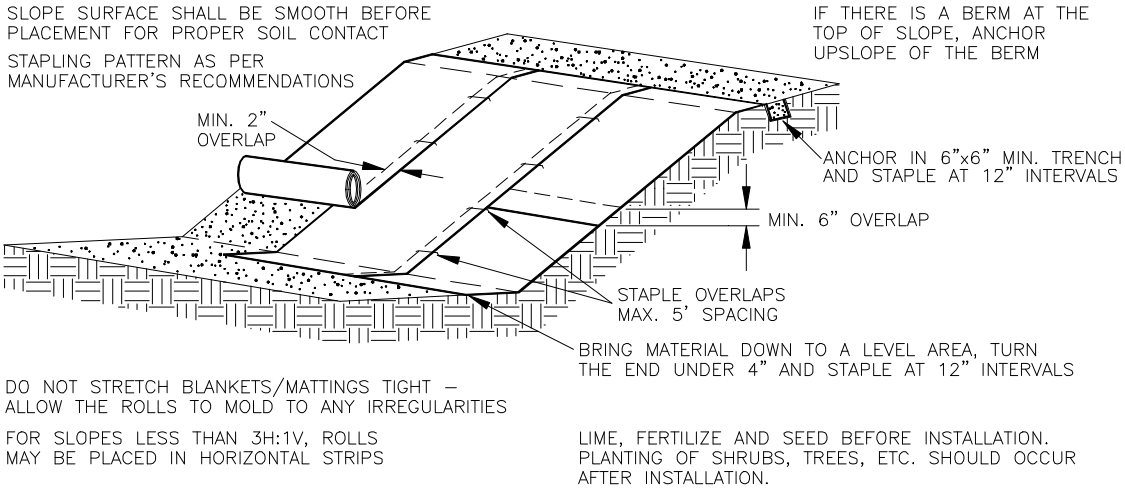



**FIGURE D.4.C SLOPE INSTALLATION**



## D.4.2.3 PLASTIC COVERING

Code: PC Symbol: PC

### Purpose

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

### Conditions of Use

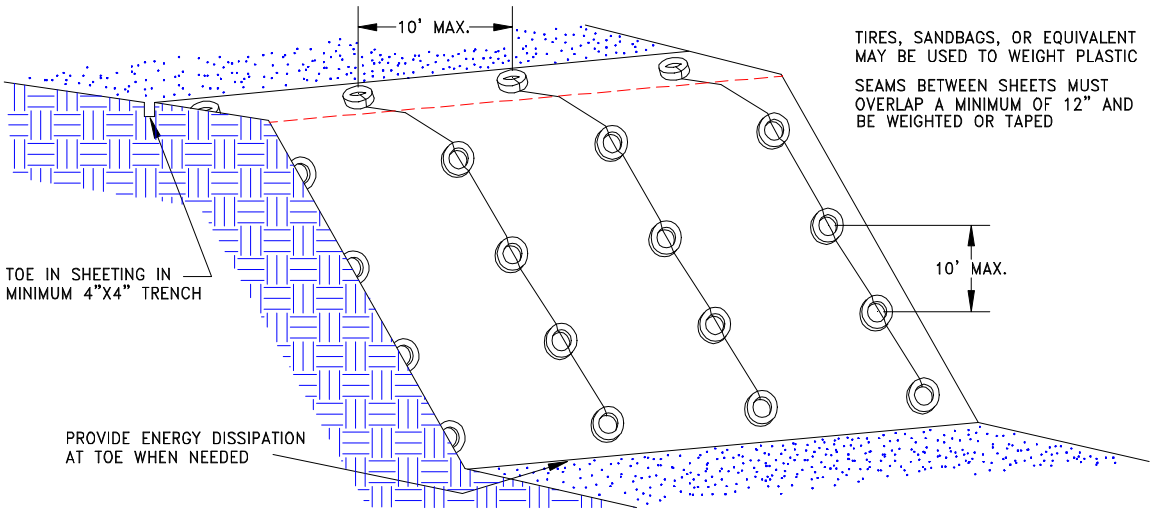
1. Plastic covering may be used on disturbed areas that require cover measures for less than 30 days.
2. Plastic is particularly useful for protecting cut and fill slopes and stockpiles. *Note: The relatively rapid breakdown of most polyethylene sheeting makes it unsuitable for long-term applications.*
3. Clear plastic sheeting can be used over newly-seeded areas to create a greenhouse effect and encourage grass growth. Clear plastic should not be used for this purpose during the summer months because the resulting high temperatures can kill the grass.
4. 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.

*Note: There have been many problems with plastic, usually attributable to poor installation and maintenance. However, the material itself can cause problems, even when correctly installed and maintained, because it generates high-velocity runoff and breaks down quickly due to ultraviolet radiation. In addition, if the plastic is not completely removed, it can clog drainage system inlets and outlets. It is highly recommended that alternatives to plastic sheeting be used whenever possible and that its use be limited.*

### Design and Installation Specifications

1. See Figure D.4.D for details.
2. Plastic sheeting shall have a minimum thickness of 0.06 millimeters.
3. 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.

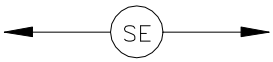
**FIGURE D.4.D PLASTIC COVERING**



### Maintenance Standards for Plastic Covering

1. Torn sheets must be replaced and open seams repaired.
2. If the plastic begins to deteriorate due to ultraviolet radiation, it must be completely removed and replaced.
3. When the plastic is no longer needed, it shall be completely removed.

## D.4.2.4 TEMPORARY AND PERMANENT SEEDING

Code: SE Symbol: 


### 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

1. Seeding shall be used throughout the project on **disturbed areas** that have reached final grade or that will remain unworked for more than 30 days.
2. **Vegetation-lined channels** shall be seeded.
3. **Retention/detention ponds** shall be seeded as required.
4. At the County's discretion, seeding without mulch during the **dry season** is allowed even though it will take more than seven days to develop an effective cover. Mulch is, however, recommended at all times because it protects seeds from heat, moisture loss, and transport due to runoff.
5. At the beginning of the **wet season**, all disturbed areas shall be reviewed to identify which ones can be seeded in preparation for the winter rains (see Section D.5.2). Disturbed areas shall be seeded within one week of the beginning of the wet season. A sketch map of those areas to be seeded and those areas to remain uncovered shall be submitted to the DDES inspector. The DDES inspector may require seeding of additional areas in order to protect surface waters, adjacent properties, or drainage facilities.
6. At final site stabilization, all disturbed areas not otherwise vegetated or stabilized shall be seeded and mulched (see Section D.5.5).

### Design and Installation Specifications

1. The best **time to seed** is April 1 through June 30, and September 1 through October 15. Areas may be seeded between July 1 and August 31, but irrigation may be required in order to grow adequate cover. Areas may also be seeded during the winter months, but it may take several months to develop a dense groundcover due to cold temperatures. The application and maintenance of mulch is critical for winter seeding.
2. To prevent seed from being washed away, confirm that **all required surface water control measures** have been installed.
3. The **seedbed** should be firm but not compacted because soils that are well-compacted will not vegetate as quickly or thoroughly. Slopes steeper than 3H:1V shall be surface roughened. Roughening can be accomplished in a variety of ways, but the typical method is track-walking, or driving a crawling tractor up and down the slope, leaving cleat imprints parallel to the slope contours.
4. In general, 10-20-20 N-P-K (nitrogen-phosphorus-potassium) **fertilizer** can be used at a rate of 90 pounds per acre. Slow-release fertilizers are preferred 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. Disturbed areas within 200 feet of water bodies and wetlands must use slow-release low-phosphorus fertilizer (typical proportions 3-1-2 N-P-K).

5. The following requirements apply to **mulching**:
   A. Mulch is always required for seeding slopes greater than 3H:1V (see Section D.4.2.1).
   B. If seeding during the wet season, mulch is required.
   C. The use of mulch may be required during the dry season at the County's discretion if grass growth is expected to be slow, the soils are highly erodible due to soil type or gradient, there is a water body close to the disturbed area, or significant precipitation (see Section D.5.2) is anticipated before the grass will provide effective cover.
   D. Mulch can be applied on top of the seed or simultaneously by hydroseeding.
6. **Hydroseeding** is allowed as long as tackifier is included. Hydroseeding with wood fiber mulch is adequate during the dry season. During the wet season, the application rate shall be doubled because the mulch and tackifier used in hydroseeding break down fairly rapidly. It may be necessary in some applications to include straw with the wood fiber, but this can be detrimental to germination.
7. Areas to be permanently landscaped shall use **soil amendments**. Good quality topsoil shall be tilled into the top six inches to reduce the need for fertilizer and improve the overall soil quality. Most native soils will require the addition of four inches of well-rotted compost to be tilled into the soil to provide a good quality topsoil. Compost used should meet Ecology publication 98-38 specifications for Grade A quality compost.
8. 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 should be consulted for their recommendations because the appropriate mix depends on a variety of factors, including exposure, soil type, slope, and expected foot traffic. Alternative seed mixes approved by the County may be used.

Table D.4.B presents the standard mix for those areas where just a temporary vegetative cover is required.

**TABLE D.4.B TEMPORARY EROSION CONTROL SEED MIX**

| | % Weight | % Purity | % Germination |
|---|---|---|---|
| Chewings or red fescue<br>*Festuca rubra var. commutata* or *Festuca rubra* | 40 | 98 | 90 |
| Annual or perennial rye<br>*Lolium multiflorum* or *Lolium perenne* | 40 | 98 | 90 |
| Redtop or colonial bentgrass<br>*Agrostis alba* or *Agrostis tenuis* | 10 | 92 | 85 |
| White dutch clover<br>*Trifolium repens* | 10 | 98 | 90 |

Table D.4.C provides just one recommended possibility for landscaping seed.

| TABLE D.4.C LANDSCAPING SEED MIX | | | |
|---|---|---|---|
| | **% Weight** | **% Purity** | **% Germination** |
| Perennial rye blend<br>*Lolium perenne* | 70 | 98 | 90 |
| Chewings and red fescue blend<br>*Festuca rubra var. commutata* or<br>*Festuca rubra* | 30 | 98 | 90 |

This turf seed mix in Table D.4.D is for dry situations where there is no need for much water. The advantage is that this mix requires very little maintenance.

| TABLE D.4.D LOW-GROWING TURF SEED MIX | | | |
|---|---|---|---|
| | **% Weight** | **% Purity** | **% Germination** |
| Dwarf tall fescue (several varieties)<br>*Festuca arundinacea var.* | 45 | 98 | 90 |
| Dwarf perennial rye (Barclay)<br>*Lolium perenne var. barclay* | 30 | 98 | 90 |
| Red fescue<br>*Festuca rubra* | 20 | 98 | 90 |
| Colonial bentgrass<br>*Agrostis tenuis* | 5 | 98 | 90 |

Table D.4.E presents a mix recommended for bioswales and other intermittently wet areas. Sod shall generally not be used for bioswales because the seed mix is inappropriate for this application. Sod can be used for lining ditches to prevent erosion, but it will provide little water quality benefit during the wet season.

| TABLE D.4.E BIOSWALE SEED MIX* | | | |
|---|---|---|---|
| | **% Weight** | **% Purity** | **% Germination** |
| Tall or meadow fescue<br>*Festuca arundinacea* or<br>*Festuca elatior* | 75-80 | 98 | 90 |
| Seaside/Creeping bentgrass<br>*Agrostis palustris* | 10-15 | 92 | 85 |
| Redtop bentgrass<br>*Agrostis alba* or *Agrostis gigantea* | 5-10 | 90 | 80 |
| * Modified Briargreen, Inc. Hydroseeding Guide Wetlands Seed Mix | | | |

The seed mix shown in Table D.4.F is a recommended low-growing, relatively non-invasive seed mix appropriate for very wet areas which are not regulated wetlands (if planting in wetland areas, see Section 6.3.1 of the *Surface Water Design Manual*). Other mixes may be appropriate, depending on the soil type and hydrology of the area. Apply this mixture at a rate of 60 pounds per acre.

**TABLE D.4.F WET AREA SEED MIX***

| | % Weight | % Purity | % Germination |
|---|---|---|---|
| Tall or meadow fescue<br>*Festuca arundinacea* or<br>*Festuca elatior* | 60-70 | 98 | 90 |
| Seaside/Creeping bentgrass<br>*Agrostis palustris* | 10-15 | 98 | 85 |
| Meadow foxtail<br>*Alepocurus pratensis* | 10-15 | 90 | 80 |
| Alsike clover<br>*Trifolium hybridum* | 1-6 | 98 | 90 |
| Redtop bentgrass<br>*Agrostis alba* | 1-6 | 92 | 85 |

* Modified Briargreen, Inc. Hydroseeding Guide Wetlands Seed Mix

The meadow seed mix in Table D.4.G 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.

**TABLE D.4.G MEADOW SEED MIX**

| | % Weight | % Purity | % Germination |
|---|---|---|---|
| Redtop or Oregon bentgrass<br>*Agrostis alba* or *Agrostis oregonensis* | 40 | 92 | 85 |
| Red fescue<br>*Festuca rubra* | 40 | 98 | 90 |
| White dutch clover<br>*Trifolium repens* | 20 | 98 | 90 |

## Maintenance Standards for Temporary and Permanent Seeding

1. Any seeded areas that fail to establish at least 80 percent cover within one month shall be reseeded. If reseeding is ineffective, an alternate method, such as sodding or nets/blankets, shall be used. If winter weather prevents adequate grass growth, this time limit may be relaxed at the discretion of the County when sensitive areas would otherwise be protected.

2. 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.
3. Seeded areas shall be supplied with adequate moisture, but not watered to the extent that it causes runoff.

## D.4.2.5 SODDING

Code: SO Symbol:


### Purpose

The purpose of sodding is to establish permanent turf for immediate erosion protection and to stabilize drainage ways where concentrated overland flow will occur.

### Conditions of Use

Sodding may be used in the following areas:

1. Disturbed areas that require short-term or long-term cover
2. Disturbed areas that require immediate vegetative cover
3. All waterways that require vegetative lining (except biofiltration swales—the seed mix used in most sod is not appropriate for biofiltration swales). Waterways may also be seeded rather than sodded, and protected with a net or blanket (see Section D.4.2.2).

### Design and Installation Specifications

Sod shall be free of weeds, of uniform thickness (approximately 1-inch thick), and shall have a dense root mat for mechanical strength.

The following steps are recommended for sod installation:

1. Shape and smooth the surface to final grade in accordance with the approved grading plan.
2. Amend two inches (minimum) of well-rotted compost into the top six inches of the soil if the organic content of the soil is less than ten percent. Compost used should meet Ecology publication 98-38 specifications for Grade A quality compost.
3. Fertilize according to the supplier's recommendations. Disturbed areas within 200 feet of water bodies and wetlands must use non-phosphorus fertilizer.
4. Work lime and fertilizer 1 to 2 inches into the soil, and smooth the surface.
5. 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.
6. Roll the sodded area and irrigate.
7. When sodding is carried out in alternating strips or other patterns, seed the areas between the sod immediately after sodding.

### Maintenance Standards

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.

# D.4.3 PERIMETER PROTECTION

**ESC Requirement 3:** Perimeter protection to filter sediment from sheetwash shall be located downslope of all disturbed areas and shall be installed prior to upslope grading. Perimeter protection includes the use of vegetated strips as well as more conventional, constructed measures, such as silt fences. During the wet season, 50 linear feet of silt fence (and the necessary stakes) per acre of disturbed area must be stockpiled on site.

**Purpose:** The purpose of perimeter protection is to reduce the amount of sediment transported beyond the disturbed areas of the construction site. Perimeter protection is primarily a backup means of sediment control. Most, if not all, sediment-laden water is to be treated in a sediment trap or pond. The only circumstances in which perimeter control is to be used as a primary means of sediment removal is when the catchment is very small (see below).

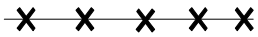
**When to Install:** Perimeter protection is to be installed prior to any upslope clearing and grading.

**Measures to Use:** There are three perimeter protection measures in this section that can be used to satisfy ESC Requirement 3: silt fence, brush barriers, and vegetated strips. These measures can be used interchangeably. If surface water is collected by an interceptor dike or swale and routed to a sediment pond or trap, there is no need for the perimeter protection measures specified in this section.

**Criteria for Use as Primary Treatment:** At the boundary of a site, perimeter protection may be used as the sole form of treatment when the flowpath meets the criteria listed below. If these criteria are not met, perimeter protection shall only be used as a backup to a sediment trap or pond.

| Average Slope | Slope Percent | Flowpath Length |
|---|---|---|
| 1.5H:1V or less | 67% or less | 100 feet |
| 2H:1V or less | 50% or less | 115 feet |
| 4H:1V or less | 25% or less | 150 feet |
| 6H:1V or less | 16.7% or less | 200 feet |
| 10H:1V or less | 10% or less | 250 feet |

## D.4.3.1 SILT FENCE

Code: SF Symbol: 

### Purpose

Use of a silt fence reduces the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

### Conditions of Use

1. Silt fence may be used downslope of all disturbed areas.
2. Silt fence is not intended to treat concentrated flows, nor is it intended to treat substantial amounts of overland flow. Any concentrated flows must be conveyed through the drainage system to a sediment trap or pond. The only circumstance in which overland flow can be treated solely by a silt fence, rather than by a sediment trap or pond, is when the area draining to the fence is small (see "Criteria for Use as Primary Treatment" on page D-18).

### Design and Installation Specifications

1. See Figure D.4.E for details.

2. The geotextile used must meet the standards listed below. A copy of the manufacturer's fabric specifications must be available on site.

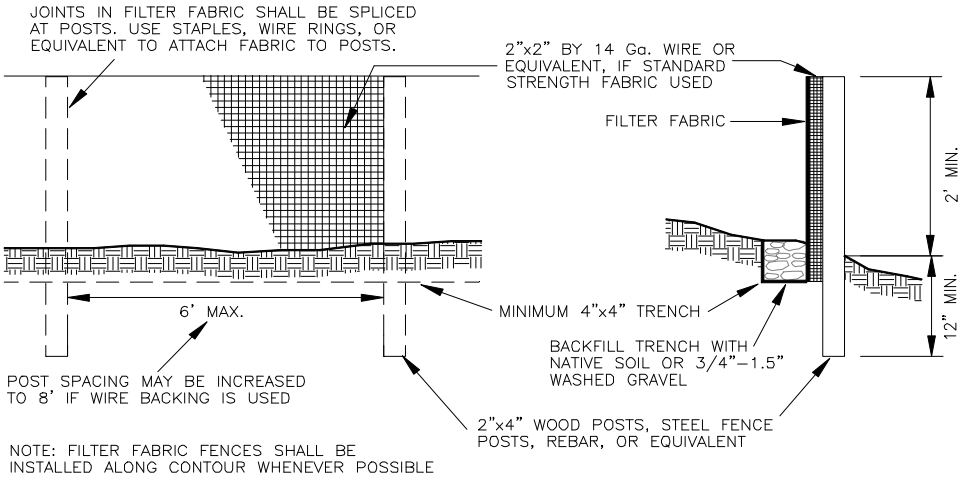
| | |
|---|---|
| AOS (ASTM D4751) | 30-100 sieve size (0.60-0.15 mm) for slit film<br>50-100 sieve size (0.30-0.15 mm) for other fabrics |
| Water Permittivity (ASTM D4491) | 0.02 $sec^{-1}$ minimum |
| Grab Tensile Strength (ASTM D4632) | 180 lbs. min. for extra strength fabric<br>100 lbs. min. for standard strength fabric |
| Grab Tensile Elongation(ASTM D4632) | 30% max. |
| Ultraviolet resistance (ASTM D4355) | 70% min. |

3. Standard strength fabric requires wire backing to increase the strength of the fence. Wire backing or closer post spacing may be required for extra strength fabric if field performance warrants a stronger fence.
4. Where the fence is installed, the slope shall be no steeper than 2H:1V.

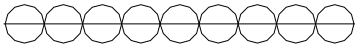
## Maintenance Standards

1. Any damage shall be repaired immediately.
2. If concentrated flows are evident uphill of the fence, they must be intercepted and conveyed to a sediment trap or pond.
3. It is important to check the uphill side of the fence for signs of the fence clogging and acting as a barrier to flow and then causing channelization of flows parallel to the fence. If this occurs, replace the fence or remove the trapped sediment.
4. Sediment must be removed when the sediment is 6 inches high.
5. If the filter fabric (geotextile) has deteriorated due to ultraviolet breakdown, it shall be replaced.

**FIGURE D.4.E SILT FENCE**



## D.4.3.2 BRUSH BARRIER

Code: BB Symbol: 

### Purpose

The purpose of brush barriers is to reduce the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

### Conditions of Use

1. Brush barriers may be used downslope of all disturbed areas.
2. Brush barriers are not intended to treat concentrated flows, nor are they intended to treat substantial amounts of overland flow. Any concentrated flows must be conveyed through the drainage system to a sediment trap or pond. The only circumstance in which overland flow can be treated solely by a barrier, rather than by a sediment trap or pond, is when the area draining to the barrier is small (see "Criteria for Use as Primary Treatment" on page D-18).

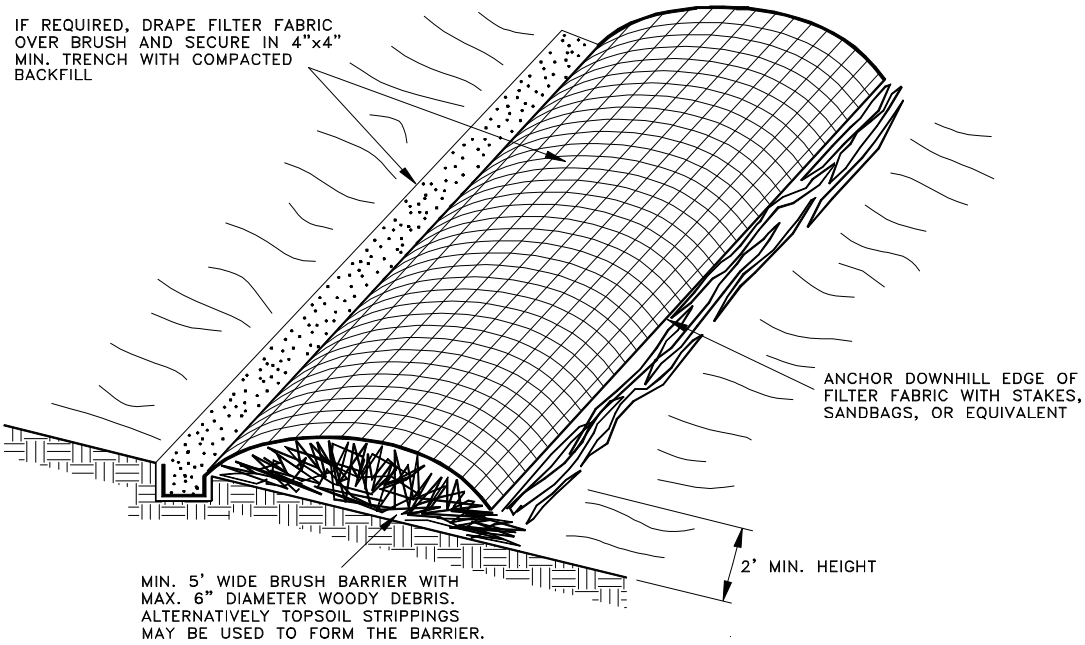
### Design and Installation Specifications

1. See Figure D.4.F for details.
2. King County may require filter fabric (geotextile) anchored over the brush berm to enhance the filtration ability of the barrier.

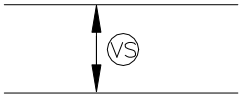
### Maintenance Standards

1. There shall be no signs of erosion or concentrated runoff under or around the barrier. If concentrated flows are bypassing the barrier, it must be expanded or augmented by toed-in filter fabric.
2. The dimensions of the barrier must be maintained.

**FIGURE D.4.F BRUSH BARRIER**



# D.4.3.3 VEGETATED STRIP

Code: VS Symbol: 


## Purpose

Vegetated strips reduce the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

## Conditions of Use

1. Vegetated strips may be used downslope of all disturbed areas.
2. Vegetated strips are not intended to treat concentrated flows, nor are they intended to treat substantial amounts of overland flow. Any concentrated flows must be conveyed through the drainage system to a sediment trap or pond. The only circumstance in which overland flow can be treated solely by a strip, rather than by a sediment trap or pond, is when the area draining to the strip is small (see "Criteria for Use as Primary Treatment" on page D-18).

## Design and Installation Specifications

1. The vegetated strip shall consist of a 25-foot wide continuous strip of dense vegetation with a permeable topsoil. Grass-covered, landscaped areas are generally not adequate because the volume of sediment overwhelms the grass. Ideally, vegetated strips shall consist of undisturbed native growth with a well-developed soil that allows for infiltration of runoff.
2. The slope within the strip shall not exceed 4H:1V.
3. The uphill boundary of the vegetated strip shall be delineated with clearing limits as specified in Section D.4.1 (p. D-6).

## Maintenance Standards

1. Any areas damaged by erosion or construction activity shall be seeded immediately and protected by mulch.
2. If more than 5 feet of the original vegetated strip width has had vegetation removed or is being eroded, sod must be installed.
3. If there are indications that concentrated flows are traveling across the buffer, surface water controls must be installed to reduce the flows entering the buffer, or additional perimeter protection must be installed.

# D.4.4 TRAFFIC AREA STABILIZATION

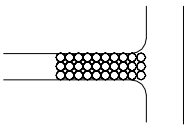
**ESC Requirement 4:** Unsurfaced entrances, roads, and parking areas used by construction traffic shall be stabilized to minimize erosion and tracking of sediment off site. Stabilized construction entrances shall be installed as the first step in clearing and grading. At the County's discretion, road and parking area stabilization is not required during the dry season (unless dust is a concern) or if the site is underlain by coarse-grained soils. Roads and parking areas shall be stabilized immediately after initial grading.

**Purpose:** The purpose of traffic area stabilization is to reduce the amount of sediment transported off site by construction vehicles and to reduce the erosion of areas disturbed by vehicle traffic. Sediment transported off site onto paved streets is a significant problem because it is difficult to effectively remove, and any sediment not removed ends up in the drainage system. Additionally, sediment on public right-of-way can pose a serious traffic hazard. Construction road and parking area stabilization is important because the combination of wet soil and heavy equipment traffic typically forms a slurry of easily erodible mud. Finally, stabilization also is an excellent form of dust control in the summer months.

**When to Install:** The construction entrance is to be installed as the first step in clearing and grading. Construction road stabilization shall occur immediately after initial grading of the construction roads and parking areas.

**Measures to Use:** There are two types of traffic area stabilization: (1) a stabilized construction entrance and (2) construction road/parking area stabilization. Both measures must be used as specified under "Conditions of Use" for each measure.

## D.4.4.1 STABILIZED CONSTRUCTION ENTRANCE

Code: CE Symbol: 

### Purpose

Construction entrances are stabilized to reduce the amount of sediment transported onto paved roads by motor vehicles or runoff 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.

### Design and Installation Specifications

1. See Figure D.4.G for details.
2. 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) |

3. Hog fuel may be substituted for or combined with quarry spalls in areas that will not be used for permanent roads. The effectiveness of hog fuel is highly variable, but it has been used successfully on many sites. It generally requires more maintenance than quarry spalls. The inspector may at any time

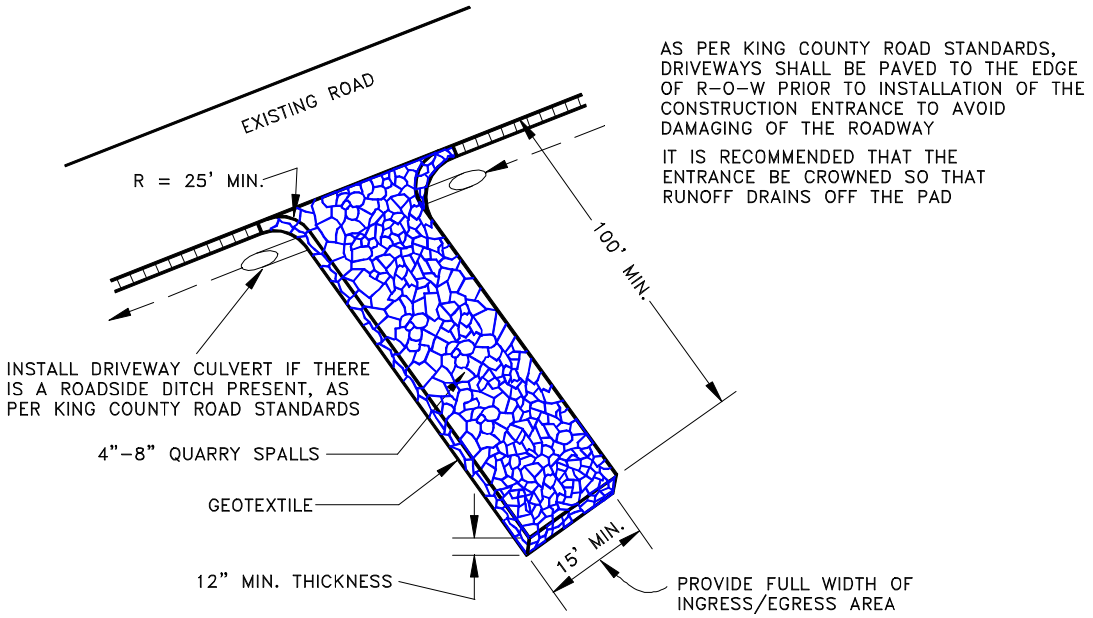
require the use of quarry spalls if the hog fuel is not preventing sediment from being tracked onto pavement or if the hog fuel is being carried onto pavement. Hog fuel is prohibited in permanent roadbeds because organics in the subgrade soils cause difficulties with compaction.

4. Fencing (see Section D.4.1) shall be installed as necessary to restrict traffic to the construction entrance.
5. 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.

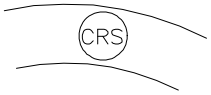
## Maintenance Standards

1. Quarry spalls (or hog fuel) shall be added if the pad is no longer in accordance with the specifications.
2. 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. If washing is used, it shall be done on an area covered with crushed rock, and wash water shall drain to a sediment trap or pond.
3. Any sediment that is tracked onto pavement shall be removed immediately by 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.
4. Any quarry spalls that are loosened from the pad and end up on the roadway shall be removed immediately.
5. If vehicles are entering or exiting the site at points other than the construction entrance(s), fencing (see Section D.4.1) shall be installed to control traffic.

**FIGURE D.4.G STABILIZED CONSTRUCTION ENTRANCE**



# D.4.4.2 CONSTRUCTION ROAD/PARKING AREA STABILIZATION

Code: CRS Symbol: 


## 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

1. Roads or parking areas shall be stabilized wherever they are constructed, whether permanent or temporary, for use by construction traffic.
2. Fencing (see Section D.4.1) 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

1. 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 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. *Note: If the area will be used for permanent road or parking installation later in the project, the subgrade will be subject to inspection.*
2. **Temporary road gradients** shall not exceed 15 percent. Roadways shall be carefully graded to drain transversely. 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 designed in accordance with the standards given in Section D.4.6.3 (p. D-37) and directed to a sediment pond or trap.
3. 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 vegetated 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.
4. In order to control construction traffic, the County can require that **signs** be erected on site informing construction personnel that vehicles, other than those performing clearing and grading, are restricted to stabilized areas.

## Maintenance Standards

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.

# D.4.5 SEDIMENT RETENTION

**ESC Requirement 5:** Surface water collected from disturbed areas of the site shall be routed through a sediment pond or trap prior to release from the site. An exception is for areas at the perimeter of the site with drainage areas small enough to be treated solely with perimeter protection (see Section D.4.3, p. D-18). Also, if the soils and topography are such that no offsite discharge of surface water is anticipated up to and including the developed 2-year runoff event, sediment ponds and traps are not required. A 10-year peak flow shall be used for sediment pond/trap sizing if the project size, expected timing and duration of construction, or downstream conditions warrant a higher level of protection (see below). At the County's discretion, sites may be worked during the dry season without sediment ponds and traps if there is some other form of protection of surface waters, such as a 100-foot forested buffer between the disturbed areas and adjacent surface waters. Protection of catch basins is required for inlets that are likely to be impacted by sediment generated by the project and that do not drain to an onsite sediment pond or trap. Sediment retention facilities shall be installed prior to grading of any contributing area.

**Purpose:** The purpose of sediment retention facilities is to remove sediment from runoff generated from disturbed areas.

**When to Install:** The facilities shall be constructed as the first step in the clearing and grading of the site. The surface water conveyances can then be connected to the facilities as site development proceeds.

**Measures to Use:** There are three sediment retention measures in this section. The first two, sediment traps and ponds, serve the same function but for different size catchments. All runoff from disturbed areas must be routed through a trap or pond except for very small areas as specified in Section D.4.3. The third measure is for catch basin protection. It is only to be used in limited circumstances and is not a primary sediment treatment facility. It is only intended as a backup in the event of failure of other onsite systems.

**Use of Permanent Drainage Facilities:** All projects that are constructing permanent facilities for runoff quantity control are strongly encouraged to use the rough-graded or final-graded permanent facilities for ponds and traps. This includes combined facilities and infiltration facilities. When permanent facilities are used as temporary sedimentation facilities, the surface area requirements of sediment traps (for drainages less than 3 acres) or sediment ponds (more than 3 acres) must be met. If the surface area requirements are larger than the surface area of the permanent facility, then the pond shall be enlarged to comply with the surface area requirement. The permanent pond shall also be divided into two cells as required for sediment ponds. Either a permanent control structure or the temporary control structure described in Section D.4.5.2 can be used. If a permanent control structure is used, it may be advisable to partially restrict the lower orifice with gravel to increase residence time while still allowing dewatering of the pond.

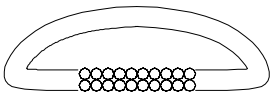
If infiltration facilities are to be used, the sides and bottom of the facility must only be rough excavated to a minimum of three feet above final grade. Excavation should be done with a backhoe working at "arms length" to minimize disturbance and compaction of the infiltration surface. Additionally, any required pretreatment facilities shall be fully constructed prior to any release of sediment-laden water to the facility. Pretreatment and shallow excavation are intended to prevent the clogging of soil with fines. Final grading of the infiltration facility shall occur only when all contributing drainage areas are fully stabilized (see Section D.5.5, p. D-44).

**Selection of the Design Storm:** In most circumstances, the use of the developed 2-year runoff event is sufficient for calculating surface area for ponds and traps and for determining exemptions to ESC Requirements 5 and 6 (Sections D.4.5 and 0, respectively). In some circumstances, however, the 10-year peak flow should be used. Examples of such circumstances include the following:

- Sites that are within ¼ mile of salmonid streams, Class 1 wetlands, and designated sensitive lakes such as Lake Sammamish
- Sites where significant clearing and grading is likely to occur during the wet season
- Sites with downstream erosion or sedimentation problems.

**Natural Vegetation:** Whenever possible, sediment-laden water shall be discharged into onsite, relatively level, vegetated areas. This is the only way to effectively remove fine particles from runoff. This can be particularly useful after initial treatment in a sediment retention facility. The areas of release must be evaluated on a site-by-site basis in order to determine appropriate locations for and methods of releasing runoff. Vegetated wetlands shall not be used for this purpose. Frequently, it may be possible to pump water from the collection point at the downhill end of the site to an upslope vegetated area. Pumping shall only augment the treatment system, not replace it because of the possibility of pump failure or runoff volume in excess of pump capacity.

## D.4.5.1 SEDIMENT TRAP

Code: ST Symbol: 

### Purpose

Sediment traps remove sediment from runoff originating from disturbed areas of the site. Sediment traps are typically designed to only remove sediment as small as medium silt (0.02 mm). As a consequence, they usually only result in a small reduction in turbidity.

### Conditions of Use

A sediment trap shall be used where the contributing drainage area is 3 acres or less.

### Design and Installation Specifications

1. See Figure D.4.H for details.
2. If permanent runoff control facilities are part of the project, they should be used for sediment retention (see "Use of Permanent Drainage Facilities" on page D-25).
3. To determine the trap geometry, first calculate the design surface area (*SA*) of the trap, measured at the invert of the weir. Use the following equation:

$$SA = FS(Q_2/V_S)$$

where $Q_2$ = Design inflow based on the peak discharge from the developed 2-year runoff event from the contributing drainage area as computed in the hydrologic analysis. The 10-year peak flow shall be used if the project size, expected timing and duration of construction, or downstream conditions warrant a higher level of protection. If no hydrologic analysis is required, the Rational Method may be used (Section 3.2.1 of the *Surface Water Design Manual*).

$V_S$ = The settling velocity of the soil particle of interest. The 0.02 mm (medium silt) particle with an assumed density of 2.65 g/cm$^3$ has been selected as the particle of interest and has a settling velocity ($V_S$) of 0.00096 ft/sec.

$FS$ = A safety factor of 2 to account for non-ideal settling.

Therefore, the equation for computing surface area becomes:

$$SA = 2 \times Q_2/0.00096 \quad \text{or} \quad 2080 \text{ square feet per cfs of inflow}$$

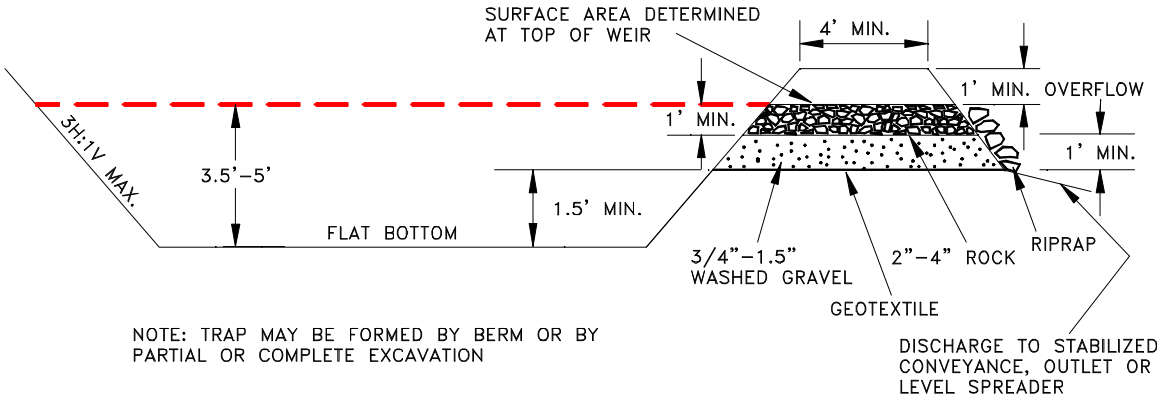
*Note: Even if permanent facilities are used, they must still have a surface area that is at least as large as that derived from the above formula. If they do not, the pond must be enlarged.*

4. To aid in determining sediment depth, all traps shall have a staff gage with a prominent mark one foot above the bottom of the trap.

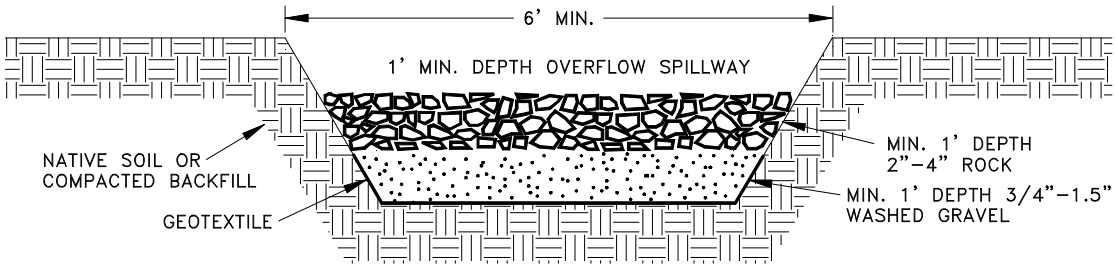
## Maintenance Standards

1. Sediment shall be removed from the trap when it reaches 1 foot in depth.
2. Any damage to the trap embankments or slopes shall be repaired.

**FIGURE D.4.H SEDIMENT TRAP**

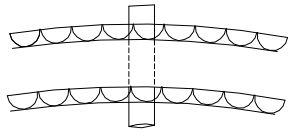



**CROSS-SECTION**




**TRAP OUTLET**

## D.4.5.2 SEDIMENT POND

Code: SP Symbol: 

### Purpose

Sediment ponds remove sediment from runoff originating from disturbed areas of the site. Sediment ponds are typically designed to only remove sediment as small as medium silt (0.02 mm). As a consequence, they usually reduce turbidity only slightly.

### Conditions of Use

A sediment pond shall be used where the contributing drainage area is 3 acres or more.

### Design and Installation Specifications

1. See Figure D.4.I, Figure D.4.J, and Figure D.4.K for details.
2. If permanent runoff control facilities are part of the project, they should be used for sediment retention (see "Use of Permanent Drainage Facilities" on page D-25).

### Determining Pond Geometry

1. Obtain the discharge from the hydrologic calculations of the peak flow for the 2-year runoff event ($Q_2$). The 10-year peak flow shall be used if the project size, expected timing and duration of construction, or downstream conditions warrant a higher level of protection. If no hydrologic analysis is required, the Rational Method may be used (Section 3.2.1 of the *Surface Water Design Manual*).
2. Determine the required surface area at the top of the riser pipe with the equation:

   $$SA = 2 \times Q_2/0.00096 \quad \text{or} \quad 2080 \text{ square feet per cfs of inflow}$$

   See Section D.4.5.1 (p. D-26) for more information on the derivation of the surface area calculation.
3. The basic geometry of the pond can now be determined using the following design criteria:
   - Required surface area *SA* (from Step 2 above) at top of riser
   - Minimum 3.5-foot depth from top of riser to bottom of pond
   - Maximum 3:1 interior side slopes and maximum 2:1 exterior slopes. The interior slopes can be increased to a maximum of 2:1 if fencing is provided at or above the maximum water surface
   - One foot of freeboard between the top of the riser and the crest of the emergency spillway
   - Flat bottom
   - Minimum one foot deep spillway
   - Length-to-width ratio between 3:1 and 6:1.

### Sizing of Discharge Mechanisms

**Principal Spillway:** Determine the required diameter for the principal spillway (riser pipe). The diameter shall be the minimum necessary to pass the pre-developed 10-year peak flow ($Q_{10}$). Use Figure 5.3.4.H (*SWDM* Chapter 5) to determine this diameter (*h* = one foot). *Note: A permanent control structure may be used instead of a temporary riser.*

**Emergency Overflow Spillway:** Determine the required size and design of the emergency overflow spillway for the developed 100-year peak flow using the procedure in Section 5.3.1 ("Emergency Overflow Spillway" subsection) of the *Surface Water Design Manual*.

**Dewatering Orifice:** Determine the size of the dewatering orifice(s) (minimum 1-inch diameter) using a modified version of the discharge equation for a vertical orifice and a basic equation for the area of a circular orifice.

1. Determine the required area of the orifice with the following equation:

$$A_o = \frac{A_s (2h)^{0.5}}{0.6\text{x}3600Tg^{0.5}}$$

where $A_O$ = orifice area (square feet)
$A_S$ = pond surface area (square feet)
$h$ = head of water above orifice (height of riser in feet)
$T$ = dewatering time (24 hours)
$g$ = acceleration of gravity (32.2 feet/second$^2$)

2. Convert the required surface area to the required diameter *D* of the orifice:

$$D = 24\text{x}\sqrt{\frac{A_o}{p}} = 13.54\text{x}\sqrt{A_o}$$

3. The vertical, perforated tubing connected to the dewatering orifice must be at least 2 inches larger in diameter than the orifice to improve flow characteristics. The size and number of perforations in the tubing should be large enough so that the tubing does not restrict flow. The flow rate should be controlled by the orifice.

## Additional Design Specifications

- The **pond shall be divided** into two roughly equal volume cells by a permeable divider that will reduce turbulence while allowing movement of water between cells. The divider shall be at least one-half the height of the riser and a minimum of one foot below the top of the riser. Wire-backed, 2- to 3-foot high, extra strength filter fabric (see Section D.4.3.1) supported by treated 4"x4"s can be used as a divider. Alternatively, staked straw bales wrapped with filter fabric (geotextile) may be used.

  If the pond is more than 6 feet deep, a different mechanism must be proposed. A riprap embankment is one acceptable method of separation for deeper ponds. Other designs that satisfy the intent of this provision are allowed as long as the divider is permeable, structurally sound, and designed to prevent erosion under or around the barrier.

- To aid in determining sediment depth, **one-foot intervals** shall be prominently marked on the riser.

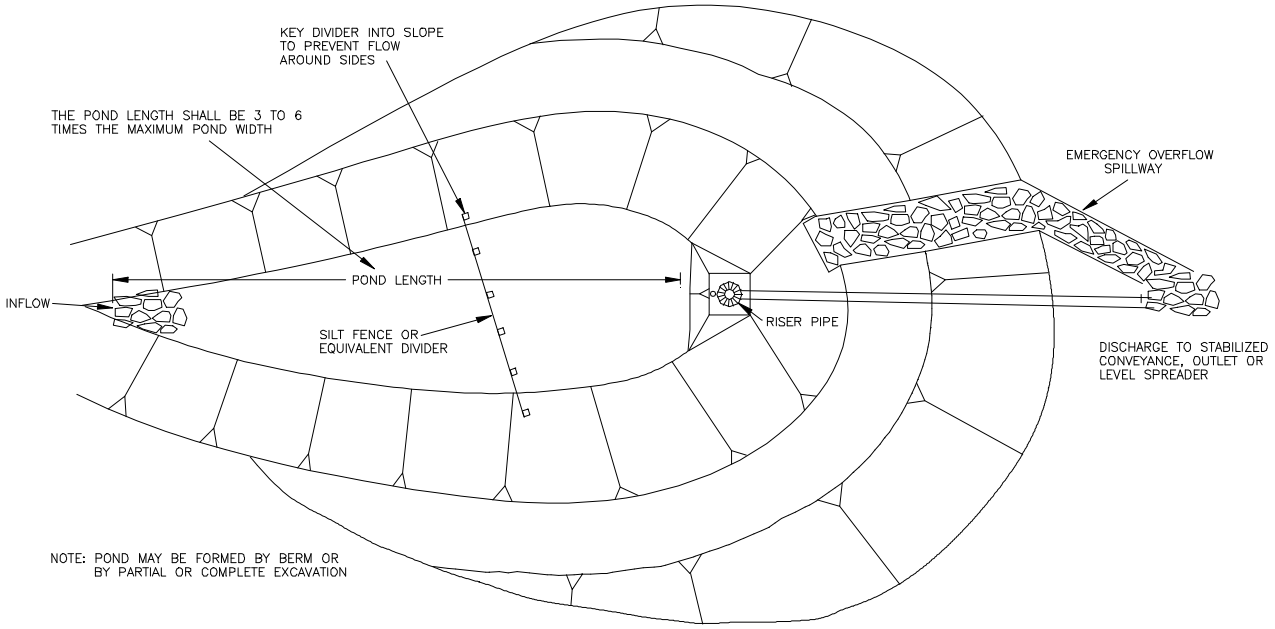
- If an **embankment** of more than 6 feet is proposed, the pond must comply with the criteria under "Embankments" in Section 5.3.1 of the *Surface Water Design Manual*.

## Maintenance Standards

1. Sediment shall be removed from the pond when it reaches 1 foot in depth.

2. Any damage to the pond embankments or slopes shall be repaired.

## FIGURE D.4.I SEDIMENT POND PLAN VIEW




## FIGURE D.4.J SEDIMENT POND CROSS SECTION

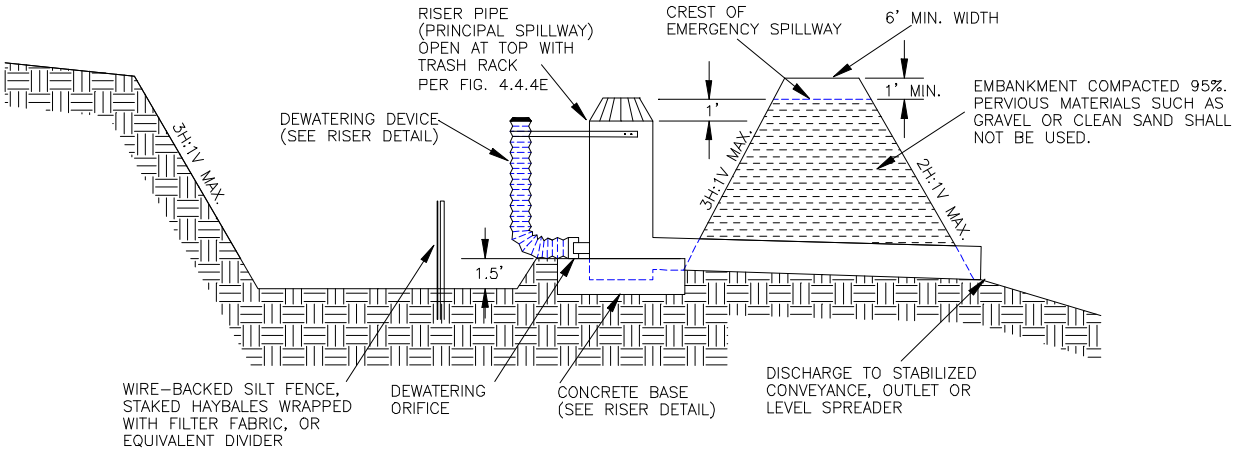
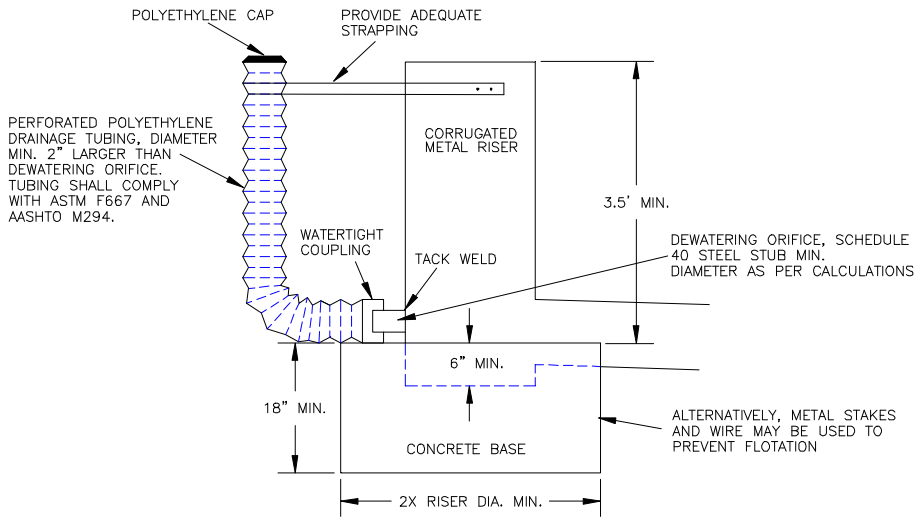


**FIGURE D.4.K SEDIMENT POND RISER DETAIL**




## D.4.5.3 STORM DRAIN INLET PROTECTION

Code: FFP or CBI Symbol: or

### Purpose

Storm drain inlets are protected to prevent coarse sediment from entering storm drainage systems.

### Conditions of Use

1. Protection shall be provided for all storm drain inlets downslope and within 500 feet of a disturbed or construction area, unless the runoff that enters the catch basin will be conveyed to a sediment pond or trap.
2. Inlet protection may be used anywhere at the applicant's discretion to protect the drainage system. This will, however, require more maintenance, and it is highly likely that the drainage system will still require some cleaning.

### Design and Installation Specifications

1. There are **two options for protecting storm drain inlets**: filter fabric protection and catch basin inserts. *Filter fabric protection* (see Figure D.4.L) is filter fabric (geotextile) placed *over* the grate. *Catch basin inserts* (see Figure D.4.M) are manufactured devices that nest inside a catch basin. Both options are much simpler to maintain than many other methods of storm drain inlet protection and are not a hazard to traffic. Both options provide adequate protection, but filter fabric is likely to result in ponding of water above the catch basin, while the insert will not. Thus, filter fabric is only allowed where ponding will not be a traffic concern and where slope erosion will not result if the curb is overtopped by ponded water.

   Trapping sediment in the catch basins is unlikely to improve the water quality of runoff if it is treated in a pond or trap because the coarse particles that are trapped at the catch basin settle out very quickly in the pond or trap. **Catch basin protection normally only improves water quality where there is no treatment facility downstream**. In these circumstances, catch basin protection is an important last line of defense. It is not, however, a substitute for preventing erosion.

In addition, the use of catch basin protection has been severely scaled back and revised from previous versions of the *Surface Water Design Manual* due to field observations. The traditional method of protection has been placement of filter fabric under the grate of the catch basin. This method is very difficult to maintain, leads to ponding, and can cause substantial erosion because curbs can be overtopped, and concentrated runoff then erodes slopes. The placement of filter fabric *under* grates is therefore prohibited and the use of filter fabric over grates is strictly limited and discouraged.

2. It is sometimes possible to construct a small sump around the catch basin before final surfacing of the road. This is allowed because it can be a very effective method of sediment control.

## Maintenance Standards

1. Any accumulated sediment on or around the filter fabric protection shall be removed immediately. Sediment shall not be removed with water, and all sediment must be disposed of as fill on site or hauled off site.
2. Any sediment in the catch basin insert shall be removed when the sediment has filled one-third of the available storage. The filter media for the insert shall be cleaned or replaced at least monthly.
3. Regular maintenance is critical for both forms of catch basin protection. Unlike many forms of protection that fail gradually, catch basin protection will fail suddenly and completely if not maintained properly.

**FIGURE D.4.L FILTER FABRIC PROTECTION**

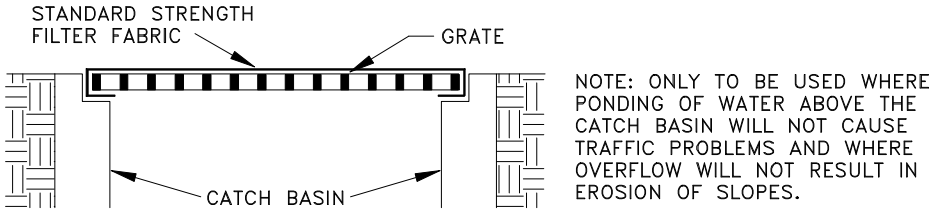
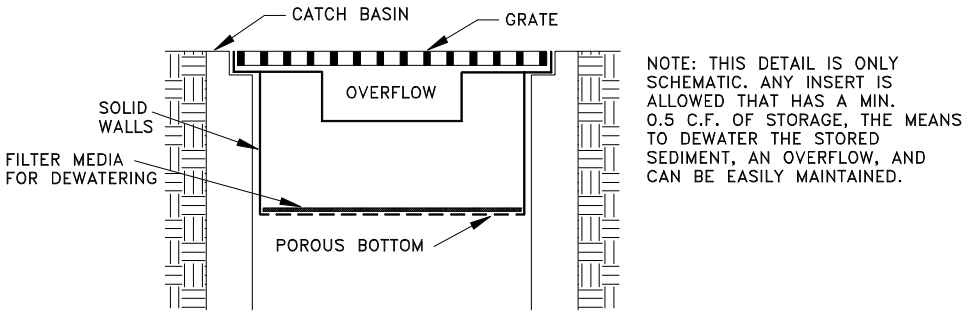



**FIGURE D.4.M CATCH BASIN INSERT**



# D.4.6 SURFACE WATER CONTROL

**ESC Requirement 6:** All surface water from disturbed areas shall be intercepted, conveyed to a sediment pond or trap, and discharged downslope of any disturbed areas. An exception is for areas at the perimeter of the site with drainage areas small enough to be treated solely with perimeter protection (see Section D.4.3). Also, if the soils and topography are such that no offsite discharge of surface water is anticipated up to and including the developed 2-year runoff event, surface water controls are not required. A 10-year peak flow shall be used for sizing surface water controls if the project size, expected timing and duration of construction, or downstream conditions warrant a higher level of protection (see the introduction to Section D.4.5). At the County's discretion, sites may be worked during the dry season without surface water controls, if there is some other form of protection of surface waters, such as a 100-foot forested buffer between the disturbed areas and adjacent surface waters. Significant sources of upslope surface water that drain onto disturbed areas shall be intercepted and conveyed to a stabilized discharge point downslope of the disturbed areas. Surface water controls shall be installed concurrently with rough grading.

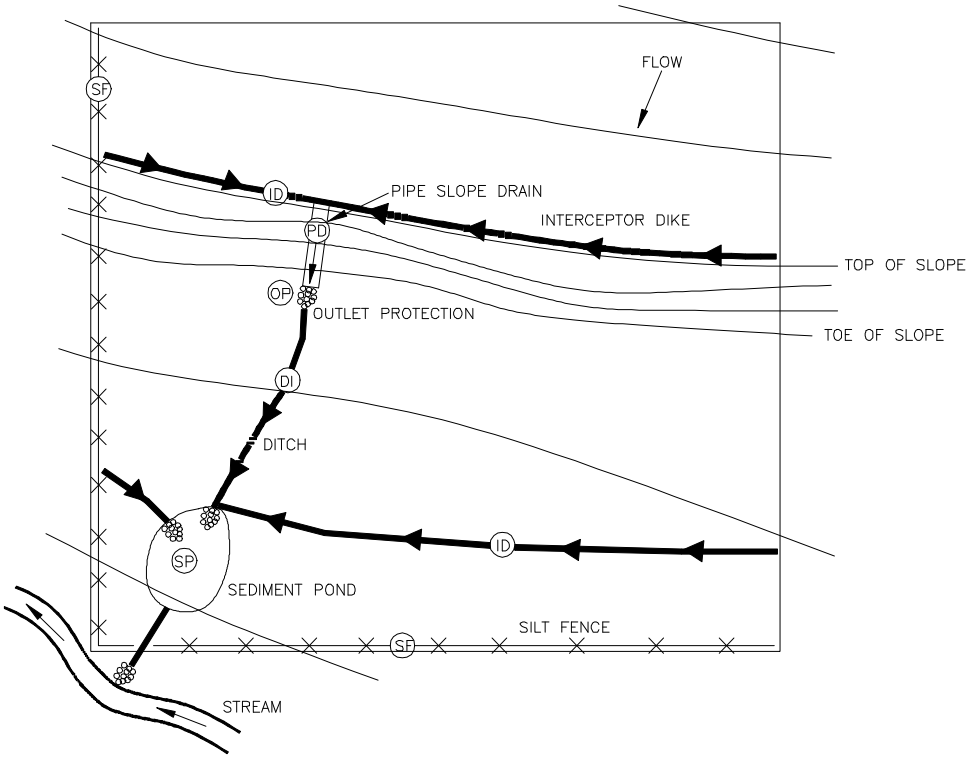
**Purpose:** The purpose of surface water control is to collect and convey surface water so that erosion is minimized, and runoff from disturbed areas is treated by a sediment pond or trap. Surface water control essentially consists of three elements:

1. Interception of runoff on and above slopes
2. Conveyance of the runoff to a sediment pond or trap (if the runoff was collected from a disturbed area)
3. Release of the runoff downslope of any disturbed areas.

**When to Install:** Surface water controls shall be constructed during the initial grading of an area and must be in place before there is any opportunity for storm runoff to cause erosion.

**Measures to Install:** Interceptor dikes/swales intercept runoff, ditches and pipe slope drains convey the runoff, and riprap or level spreaders help release the runoff in a non-erosive manner. Each measure is to be used under different circumstances so there is very little overlap. However, the two options for releasing water in a non-erosive manner, outlet protection and level spreaders, can be somewhat interchangeable. See Figure D.4.N for a schematic drawing demonstrating the use of these measures.

**FIGURE D.4.N SKETCH PLAN OF SURFACE WATER CONTROLS**




## D.4.6.1 INTERCEPTOR DIKE AND SWALE

Code: ID or IS Symbol: ID or IS

### Purpose

Interceptor dikes and swales intercept storm runoff from drainage areas on or above disturbed slopes and convey it to a sediment pond or trap. They can also be used to intercept runoff from undisturbed areas and convey the runoff to a point below any exposed soils. Interception of surface water reduces the possibility of slope erosion. Interceptor dikes and swales differ from ditches (see Section D.4.6.3) in that they are intended to convey smaller flows along low-gradient drainage ways to larger conveyance systems such as ditches or pipe slope drains.

### Conditions of Use

Interceptor dikes and swales are required in the following situations:

1. At the top of all slopes in excess of 3H:1V and with more than 20 feet of vertical relief.
2. At intervals on any slope that exceeds the dimensions specified in this section for the horizontal spacing of dikes and swales.

### Design and Installation Specifications

1. See Figure D.4.O for details of an interceptor dike and Figure D.4.P for an interceptor swale.

2. Interceptor dikes and swales shall be **spaced horizontally** as follows:

| Average Slope | Slope Percent | Flowpath Length |
|---|---|---|
| 20H:1V or less | 3-5% | 300 feet |
| (10 to 20)H:1V | 5-10% | 200 feet |
| (4 to 10)H:1V | 10-25% | 100 feet |
| (2 to 4)H:1V | 25-50% | 50 feet |

3. For slopes steeper than 2H:1V with more than 10 feet of vertical relief, **benches** may be constructed or closer spaced interceptor dikes or swales can be used. Whichever measure is chosen, the spacing and capacity of the measures must be designed by the engineer and the design must include provisions for effectively intercepting the high velocity runoff associated with steep slopes.
4. If the dike or swale intercepts runoff from **disturbed areas**, it shall discharge to a stable conveyance system that routes the runoff to a sediment pond or trap (see Section D.4.5). If the dike or swale intercepts runoff that originates from **undisturbed areas**, it shall discharge to a stable conveyance system that routes the runoff downslope of any disturbed areas and releases the water at a stabilized outlet.
5. **Construction traffic** over temporary dikes and swales shall be minimized.

## Maintenance Standards

1. Damage resulting from runoff or construction activity shall be repaired immediately.
2. If the facilities do not regularly retain storm runoff, the capacity and/or frequency of the dikes/swales shall be increased.

**FIGURE D.4.O INTERCEPTOR DIKE**

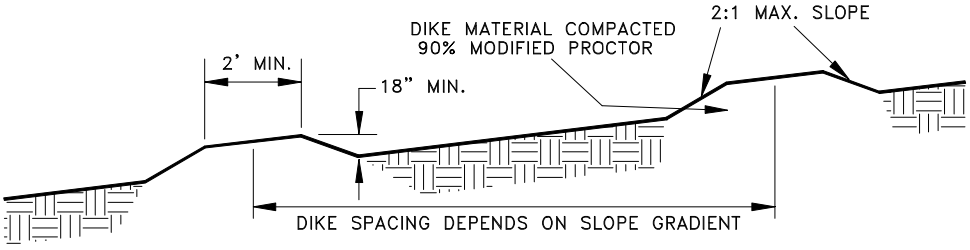
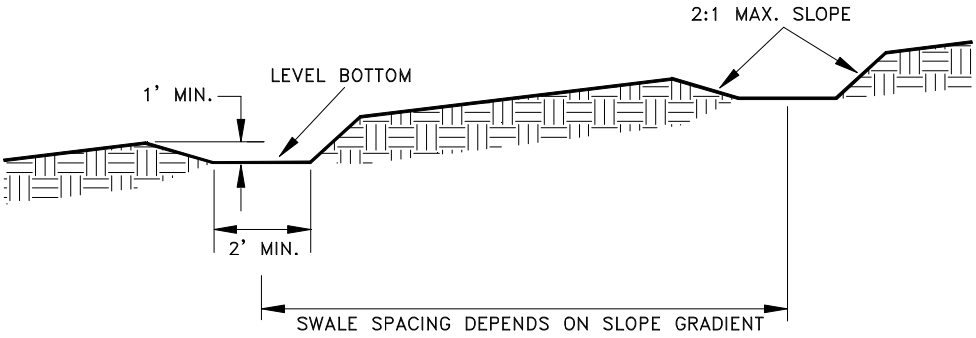
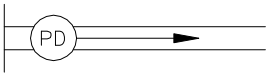



**FIGURE D.4.P INTERCEPTOR SWALE**



# D.4.6.2 PIPE SLOPE DRAINS

Code: PD Symbol: 


## Purpose

Pipe slope drains are designed to carry concentrated runoff down steep slopes without causing erosion, or saturation of slide-prone soils.

## Conditions of Use

1. Pipe slope drains may be used on any slope with a gradient of 2H:1V or greater and with at least 10 feet of vertical relief.
2. Rock-lined ditches or other permanent, non-erosive conveyances may also be used to convey runoff down steep slopes that are not steep slope hazard areas.

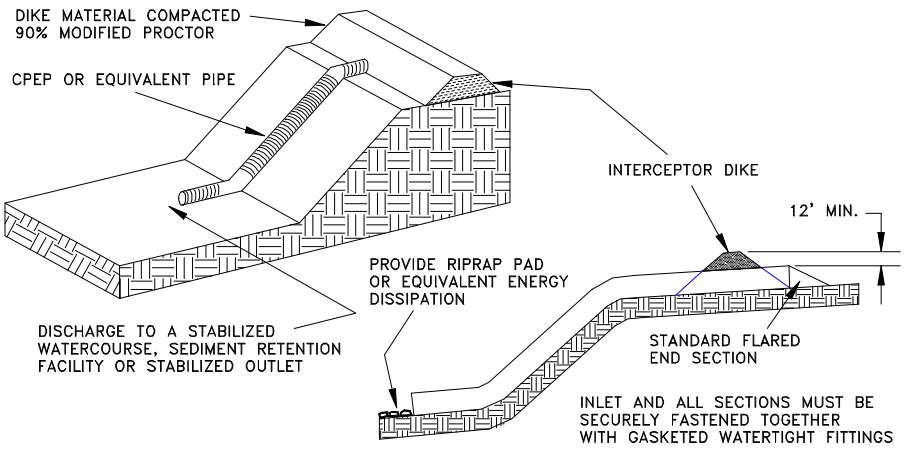
## Design and Installation Specifications

1. See Figure D.4.Q for details.
2. The **capacity** for temporary drains shall be sufficient to handle the peak flow from a developed 10-year runoff event. Up to 30,000 square feet may be drained by each 6-inch minimum diameter pipe without computation of the peak flow. Up to 2 acres may be drained by each 12-inch minimum diameter pipe. Otherwise, the peak flow will need to be computed using the Rational Method described in Section 3.2.1 of the *Surface Water Design Manual* (*SWDM*).
3. The **maximum drainage area** allowed for any sized pipe is 10 acres. For larger areas, more than one pipe shall be used or a rock-lined channel shall be installed (see *SWDM* Section 4.4.1, "Open Channels").
4. The **soil** around and under the pipe and entrance section shall be thoroughly compacted.
5. The **flared inlet section** shall be securely connected to the slope drain and be fused or welded, or have flange-bolted mechanical joints to ensure a watertight seal.
6. Slope drains shall be continuously fused, welded, or flange-bolted mechanical joint pipe systems with proper anchoring to the soil.
7. Where slope drains cross steep **slope hazard areas** or their associated buffers, the installation shall be on the ground surface, accomplished with minimum alteration. In most circumstances, this requires that slope drains be constructed of corrugated metal, CPE, or equivalent pipe and installed by hand (see *SWDM* Section 4.2.1). Any area disturbed during installation or maintenance must be immediately stabilized.
8. If the pipe slope drain will convey **sediment-laden runoff**, the runoff must be directed to a sediment retention facility (see Section D.4.5). If the runoff is not from a disturbed area or is conveyed from a sediment trap or pond, it must be conveyed to a stabilized discharge point (see Section D.4.6.4).

## Maintenance Standards

1. The inlet shall not be undercut or bypassed by water. If there are problems, the head wall shall be appropriately reinforced.
2. No erosion shall occur at the outlet point. If erosion occurs, additional protection shall be added.

**FIGURE D.4.Q PIPE SLOPE DRAIN**




## D.4.6.3 DITCHES

Code: DI Symbol:


### Purpose

Ditches convey intercepted runoff from disturbed areas to and from sediment ponds or traps. They also convey runoff intercepted from undisturbed areas around the site to a non-erosive discharge point.

### Conditions of Use

Ditches may be used anywhere that concentrated runoff is to be conveyed on or around the construction site. Temporary pipe systems can also be used to convey runoff.

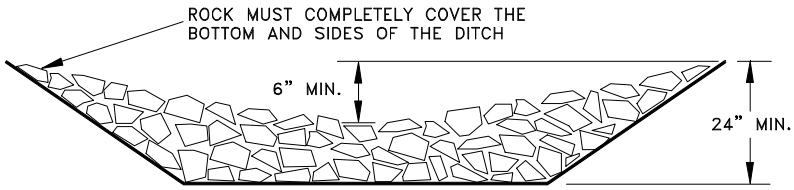
### Design and Installation Specifications

1. Channels and ditches shall be sized to accommodate the peak flow from the developed 10-year runoff event with 0.5 feet of freeboard . If no hydrologic analysis is required for the site, the Rational Method may be used [see Section 3.2.1 of the *Surface Water Design Manual* (*SWDM*)].
2. See *SWDM* Section 4.4.1 for open-channel design requirements.
3. The only exception to the requirements of *SWDM* Section 4.4.1 is the use of check dams, rather than grass lining, for channels in which the design flow velocity does not exceed 5 fps. See Figure D.4.R for details on check dam installation.

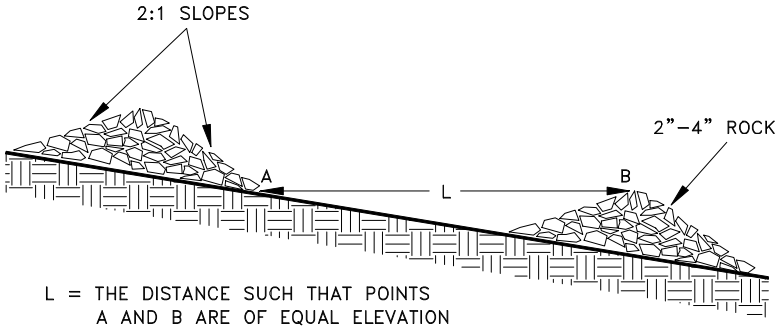
### Maintenance Standards

1. Any sediment deposition of more than 0.5 feet shall be removed so that the channel is restored to its design capacity.
2. If the channel capacity is insufficient for the design flow, it must be determined whether the problem is local (e.g., a constriction or bend) or the channel is under-designed. If the problem is local, the channel capacity must be increased through construction of a berm(s) or by excavation. If the problem is under-design, the design engineer shall be notified and the channel redesigned to a more conservative standard to be approved by King County.
3. The channel shall be examined for signs of scouring and erosion of the bed and banks. If scouring or erosion has occurred, affected areas shall be protected by riprap or an erosion control blanket or net.

**FIGURE D.4.R CHECK DAMS**

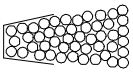



**CROSS SECTION**




**CHECK DAM SPACING**

## D.4.6.4 OUTLET PROTECTION

Code: OP Symbol: 

### Purpose

Outlet protection prevents scour at conveyance outlets.

### Conditions of Use

Outlet protection is required at the outlets of all ponds, pipes, ditches, or other approved conveyances, and where runoff is conveyed to a natural or manmade drainage feature such as a stream, wetland, lake, or ditch.

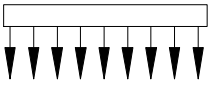
### Design and Installation Specifications

For the standard pipe slope drains in Section D.4.6.2 and other smaller conveyance systems, the standard rock pad (6 feet by 8 feet) made of 1-foot thick quarry spall is adequate. For all other outlets, the outlet protection shall meet the requirements of the "Outfalls" section of Core Requirement #4 and Section 4.2.2 of the *Surface Water Design Manual*.

### Maintenance Standards for Outlet Protection

If there is scour at the outlet, the eroded area shall be protected with more conservative measures proposed by the design engineer and approved by King County.

# D.4.6.5 LEVEL SPREADER

Code: LS Symbol: 

## Purpose

Level spreaders convert concentrated runoff to sheet flow and release it onto areas stabilized by existing vegetation.

## Conditions of Use

Level spreaders may be used where runoff from undisturbed areas or sediment retention facilities is discharged. This practice applies only where the spreader can be constructed on undisturbed soil and the area below the level lip is vegetated and low gradient (see below).

*Note: Level spreaders are conceptually an ideal way to release stormwater since the vegetation and soil allow for the removal of fines from runoff that cannot be removed by settling or filtration. Unfortunately, the performance record of spreaders in the field is dismal. They are frequently under-designed and, despite the best installations, are rarely perfectly level, which results in the release of stormwater at a particular point. This concentrated runoff can result in catastrophic erosion downslope. Given such design failures,* ***the use of spreaders is not encouraged****. However, where slopes are gentle and the water volume is relatively low, spreaders may still be the best method. When proposing their use, the designer shall carefully evaluate the site for possible concerns.*

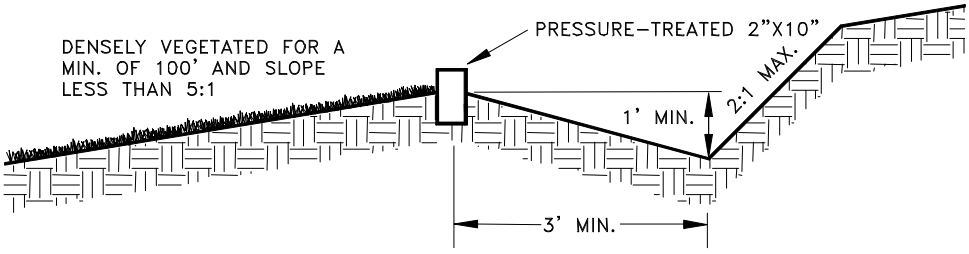
## Design and Installation Specifications

1. See Figure D.4.S for detail. Other designs may be used subject to County approval.
2. If runoff velocity as it enters the level spreader is more than 4 fps for the developed 10-year peak flow, a **riprap apron** must be provided to dissipate energy before the runoff enters the spreader (Section D.4.6.4).
3. The **total spreader length** shall be at least the square root of the catchment area. The maximum length for an individual spreader is 50 feet, limiting the catchment area that a single spreader may serve to 2500 square feet. Although this is very small, four 50-foot level spreaders next to one another could serve nearly an acre (40,000 square feet). Multiple spreaders shall not be placed uphill or downhill from one another in a configuration that would allow water released from one spreader to enter a downslope spreader.
4. The area below the spreader for a horizontal distance of 100 feet shall not exceed 20 percent and shall be completely vegetated with no areas of instability or erosion. The topography for a horizontal distance of 50 feet below the spreader shall be uniform so that runoff is not funneled into a swale or channel immediately after its release.
5. The level spreader shall be **seeded and mulched** in accordance with Section D.4.2 (p. D-8).

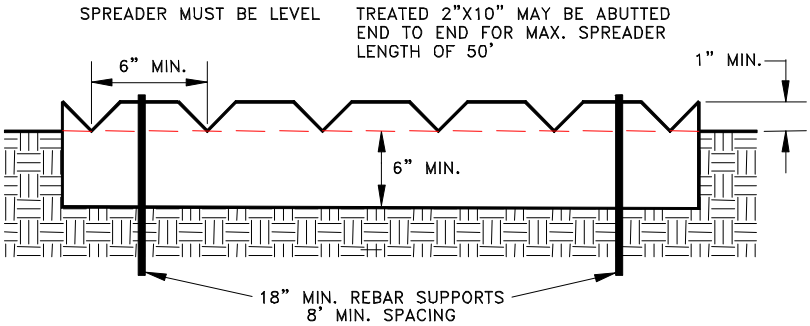
## Maintenance Standards

1. Any damage to the spreader shall be immediately repaired.
2. The downslope area shall be checked for signs of erosion and to verify that the spreader is not functioning as a point discharge. Any eroded areas shall be immediately stabilized, and the cause determined and eliminated if possible. If the erosion is recurrent and the design, even when properly installed and maintained, is not adequate to prevent erosion, a new method of releasing runoff shall be installed in accordance with the standards of this appendix. Any new design must be approved by King County.

**FIGURE D.4.S LEVEL SPREADER**




**CROSS SECTION**




**DETAIL OF SPREADER**

# D.4.7 DUST CONTROL

**ESC Requirement 7:** Preventative measures to minimize the wind transport of soil shall be taken when a traffic hazard may be created or when sediment transported by wind is likely to be deposited in water resources or adjacent properties.

**Purpose:** To prevent wind transport of dust from exposed soil surfaces onto roadways, drainage ways, and surface waters.

**When to Install:** Dust control shall be implemented when exposed soils are dry to the point that wind transport is possible and roadways, drainage ways, or surface waters are likely to be impacted.

**Measures to Install:** Water is the most common dust control (or palliative) used in the area. When using water for dust control, the exposed soils shall be sprayed until wet, but runoff shall not be generated by spraying. Calcium chloride may also be used for dust control. Exposed areas shall be resprayed as needed. Oil shall not be used for dust control.

# D.5 ESC IMPLEMENTATION REQUIREMENTS

This section describes the ESC implementation requirements that are required at each construction site. The measures and practices correspond to the implementation requirements in Core Requirement #5. Three of the sections [the ESC report (Section D.5.1, below), ESC maintenance requirements (Section D.5.4, p. D-43), and final site stabilization (Section D.5.5, p. D-44)] are required of every project. The rest of the sections are special requirements that may apply to the project depending on site conditions and project type. The introductory paragraphs at the beginning of most sections present the purpose of the measures and when they should be applied to the site. Compliance with the implementation requirements (as appropriate for the site) ensures compliance with the ESC Requirements. Note, however, that additional measures shall be required by the County if the existing standards are insufficient to protect adjacent properties, drainage facilities, or water resources.

## D.5.1 ESC REPORT

For all proposed projects, an ESC report, including the ESC plan and supporting information for providing ESC measures and meeting implementation requirements as specified in Section D.6 (p. D-47) shall be submitted to DDES for review. A copy of this report shall be kept at the project site throughout all phases of construction. All of the materials required for the report are standard parts of engineering plan submittals for projects requiring drainage review. The simplest approach to preparing this report is to compile the pieces during preparation for submittal and include the report as a separate part of the submittal package. The ESC report shall include the following:

1. A detailed **construction sequence**, as proposed by the design engineer or erosion control specialist, identifying required ESC measures and implementation requirements;
2. A **technical information report** (TIR) and ESC plan for King County review in accordance with Sections 2.3.1 and 2.3.3 of the *Surface Water Design Manual*. Incorporate any King County review comments as necessary to comply with Core Requirement #5 of the *SWDM* (see Section D.10.1, p. D-63) and the Erosion and Sediment Control Standards in this appendix;
3. Any **calculations** or information necessary to size ESC measures and demonstrate compliance with Core Requirement #5;
4. An **inspection and maintenance program** in accordance with Section D.5.4 (p. D-43) that includes the designation of an ESC supervisor as point of contact; and
5. **Anticipated changes or additions** necessary during construction to ensure that ESC measures perform in accordance with Core Requirement #5 and Sections D.4 (p. D-5) and D.5 (p. D-41).

While the ESC plan focuses on the initial measures to be applied to the site, any changes or additions necessary during construction to ensure that ESC measures perform in accordance with Core Requirement #5 and Sections D.4 and D.5 must be identified in the ESC report. The County may require large, complex projects to phase construction and submit multiple ESC plans for different stages of construction. Development of new ESC plans is not required for changes that are necessary during construction.

## D.5.2 WET SEASON REQUIREMENTS

Any site with exposed soils during the wet season (October 1 to April 30) shall be subject to the special provisions below. In addition to the ESC cover measures (see Section D.4.2, p. D-8), these provisions include covering any newly seeded areas with mulch and identifying and seeding as much disturbed area as possible prior to September 23 in order to provide grass cover for the wet season.

### Wet Season Special Provisions

All of the following provisions for wet season construction are detailed in the referenced sections. These requirements are listed here for the convenience of the designer and the reviewer.

1. The allowed time that a disturbed area can remain unworked without cover measures is reduced to two days, rather than seven (Section D.4.2).
2. Stockpiles and steep cut and fill slopes are to be protected if unworked for more than 12 hours (Section D.4.2).
3. Cover materials sufficient to cover all disturbed areas shall be stockpiled on site (Section D.4.2).
4. All areas that are to be unworked during the wet season shall be seeded within one week of the beginning of the wet season (Section 0).
5. Mulch is required to protect all seeded areas (Section 0).
6. Fifty linear feet of silt fence (and the necessary stakes) per acre of disturbance must be stockpiled on site (Section D.4.3.1).
7. Construction road and parking lot stabilization are required for all sites unless the site is underlain by coarse-grained soil (Section D.4.4.2).
8. Sediment retention is required unless no offsite discharge is anticipated for the specified design flow (Section D.4.5).
9. Surface water controls are required unless no offsite discharge is anticipated for the specified design flow (Section 0).
10. Phasing and more conservative BMPs must be evaluated for construction activity near surface waters (Section D.5.3).
11. Any runoff generated by dewatering shall be treated through construction of a sediment trap (Section D.4.5.1) when there is sufficient space or by releasing the water to a well-vegetated, gently sloping area. Since pumps are used for dewatering, it may be possible to pump the sediment-laden water well away from the surface water so that vegetation can be more effectively utilized for treatment. A straw bale filter shall be placed around the discharge from the dewatering pump. If there is not space for a sediment trap or 25 feet of suitable vegetation, other filtration methods shall be required consistent with KCC 9.12.
12. The frequency of maintenance review increases from monthly to weekly (Section D.5.4).

## D.5.3 SENSITIVE AREAS RESTRICTIONS

Any construction that will result in disturbed areas on or within a stream or associated buffer, a Class 1 or 2 wetland or associated buffer, or within 50 feet of a lake shall be subject to the special provisions below. These provisions include, whenever possible, phasing the project so that construction in these areas is limited to the dry season. The County may require more conservative BMPs, including more stringent cover requirements, in order to protect surface water quality. Any project proposing work within 50 feet of a steep slope hazard area shall evaluate the need for diverting runoff that might flow over the top of the slope.

### Sensitive Areas Special Provisions

Any project that disturbs areas on or within a stream or associated buffer, a Class 1 or 2 wetland or associated buffer, or within 50 feet of a lake has the potential to seriously damage water resources, even if the project is relatively small. While it is difficult to require specific measures for such projects because the ESC plan must be very site specific, the following recommendations shall be incorporated into the plan where appropriate:

1. Whenever possible, phase all or part of the project so that it occurs during the dry season. If this is impossible, November through February shall be avoided since this is the most likely period for large, high-intensity storms.
2. All projects shall be completed and stabilized as quickly as possible. Limiting the size and duration of a project is probably the most effective form of erosion control.
3. Where appropriate, sandbags or an equivalent barrier shall be constructed between the project area and the surface water in order to isolate the construction area from high water that might result due to precipitation.
4. Additional perimeter protection shall be considered to reduce the likelihood of sediment entering the surface waters. Such protection might include multiple silt fences, silt fences with a higher AOS, construction of a berm, or a thick layer of organic mulch upslope of a silt fence.
5. If work is to occur within the ordinary high water mark of a stream, most projects must isolate the work area from the stream by diverting the stream or constructing a coffer dam. Certain small projects that propose only a small amount of grading may not require isolation since diversions typically result in disturbance and the release of some sediment to the stream. For such small projects, the potential impacts from construction with and without a diversion must be weighed.
6. If a stream must be crossed, a temporary bridge shall be considered rather than allowing equipment to utilize the streambed for a crossing.
7. Any runoff generated by dewatering shall be treated through construction of a sediment trap (see Section D.4.5.1) when there is sufficient space, or by releasing the water to a well-vegetated, gently sloping area. Since pumps are used for dewatering, it may be possible to pump the sediment-laden water well away from the surface water so that vegetation can be more effectively utilized for treatment. A straw bale filter shall be placed around the discharge from the dewatering pump. If there is not space for a sediment trap or 25 feet of suitable vegetation, other filtration methods shall be required consistent with KCC 9.12.

For projects in or near a salmonid stream, it may be appropriate to monitor the composition of any spawning gravels within a quarter-mile of the site with a McNeil sampler before, during, and after construction. The purpose of such monitoring would be to determine if the fine content of the gravels increases as a result of construction impacts. Monitoring results could be used to guide erosion control efforts during construction and as a threshold for replacing spawning gravels if the fine content rises significantly.

## D.5.4 MAINTENANCE REQUIREMENTS

All ESC measures shall be maintained and reviewed on a regular basis as prescribed in the maintenance requirements for each BMP and in this section. The applicant shall designate an **ESC supervisor** who shall be responsible for maintenance and review of ESC and for compliance with all permit conditions relating to ESC. The ESC supervisor must be available for rapid response to ESC problems.

The ESC supervisor shall review the site at least once a month during the dry season, weekly during the wet season, and within 24 hours of significant storms. The County can require that a written record of these reviews be kept on site with copies submitted to DDES within 48 hours. The County can also require that the applicant designate an ESC supervisor with demonstrated experience in ESC to perform these reviews and to be responsible for ESC.

### ESC Supervisor

For minor projects, the applicant may serve as the ESC supervisor. The name, address, and phone number of the ESC supervisor shall be supplied to the County prior to the start of construction. A sign shall be posted at all primary entrances to the site identifying the ESC supervisor and his/her phone number. The requirement for an ESC supervisor does not relieve the applicant of ultimate responsibility for the project and compliance with King County Code.

For **highly sensitive sites**, the County can require that the applicant designate an ESC supervisor with demonstrated expertise in erosion and sediment control. The qualifications of such a person shall include at least several years of construction supervision or inspection and a background in geology, soil science, or agronomy. Typically, if a geotechnical consultant is already working on the project, the consultant can also be the designated ESC supervisor. The design engineer may also be qualified for this position. This requirement shall only be used for sensitive sites that pose an unusually high risk of impact to surface waters. At a minimum, the project site shall meet all of the following conditions in order to require the applicant to designate an ESC supervisor with demonstrated expertise in ESC:

- Alderwood soils or other soils of Hydrologic Group C or D
- Five acres of disturbance
- Large areas with slopes in excess of 10 percent

Proximity to Class 1 or 2 streams or wetlands or phosphorus-sensitive lakes, such as Lake Sammamish, shall also be a factor in determining if a site warrants an ESC specialist. However, proximity alone shall not be a determining factor because even projects that are a considerable distance from surface waters can result in significant impacts if there is a natural or constructed drainage system with direct connections to surface waters.

If DDES determines that the onsite ESC measures are inadequately installed, located, or maintained, DDES can require the appointment of an ESC supervisor with expertise in erosion and sediment control.

### Documentation

If DDES requires that a written record be maintained, a standard ESC Maintenance Report, included in Section D.10.2 (p. D-66), may be used. A copy of all the required maintenance reports shall be kept on site throughout the duration of construction. Detailed maintenance requirements for each ESC measure are provided in Sections D.4.1 through D.4.7.

### Review Timing

During the wet season, weekly reviews shall be carried out every 6 to 8 calendar days. During the dry season, monthly reviews shall be carried out within 3 days of the calendar day for the last inspection (e.g., if an inspection occurred on June 6, then the next inspection must occur between July 3 and July 9). Reviews shall also take place within 24 hours of significant storms. In general, a significant storm is one with more than 0.5 inches of rain in 24 hours or less. Other indications that a storm is "significant" are if the sediment ponds or traps are filled with water, or if gullies form as a result of the runoff.

*Note: The site is to be in compliance with the regulations of this appendix at all times. The requirement for periodic reviews does not remove the applicant's responsibility for having the site constantly in compliance with Core Requirement #5 and the requirements of this appendix. The reviews are a mechanism to ensure that all measures are thoroughly checked on a regular basis and that there is documentation of compliance. The requirement for these reviews does not mean that ESC is to be ignored in between.*

## D.5.5 FINAL STABILIZATION

Prior to obtaining final construction approval, the site shall be stabilized, the structural ESC measures, such as silt fences and sediment traps, removed, and drainage facilities cleaned. The removal of ESC measures is not required for those projects, such as plats, that will be followed by additional construction under a different permit. In these circumstances, the need for removing or retaining the measures must be evaluated on a site-specific basis.

To obtain final construction approval, the following conditions must be met:

1. All disturbed areas of the site shall be **vegetated or otherwise permanently stabilized**. At a minimum, disturbed areas shall be seeded and mulched (see Section 0) with a high likelihood that

sufficient cover will develop shortly after final approval. Mulch without seeding is not adequate to allow final approval of the permit, except for small areas of mulch used for landscaping. The only exceptions to these requirements are lots within a plat that are to be developed under an approved residential permit immediately following plat approval. In these cases, mulch and/or temporary seeding are adequate for cover.

2. **Structural measures** such as, but not limited to, silt fences, pipe slope drains, construction entrances, storm drain inlet protection, and sediment traps and ponds **shall be removed** from the site. Measures that will quickly decompose, such as brush barriers and organic mulches, may be left in place. In the case of silt fences, it may be best to remove fences in conjunction with the seeding, since it may be necessary to bring machinery back in to remove them. This will result in disturbed soils that will again require protection. The DDES inspector must approve an applicant's proposal to remove fencing prior to the establishment of vegetation. In some cases, such as residential building following plat development, it may be appropriate to leave some or all ESC measures for use during subsequent development. This shall be determined on a site-specific basis.

3. All **permanent surface water facilities**, including catch basins, manholes, pipes, ditches, channels, R/D facilities, and water quality facilities, **shall be cleaned**. Any offsite catch basin that required protection during construction (see Section D.4.5.3) shall also be cleaned.

4. If only the infrastructure of the site has been developed (e.g., subdivisions and short plats) with building construction to occur under a different permit, then the sensitive area buffers, Sensitive Area Tracts, or Sensitive Area Setback Area shall be clearly marked as described in Section D.4.1 (p. D-6) in order to alert future buyers and builders.

## D.5.6 ROADS AND UTILITIES

Road and utility projects often pose difficult erosion control challenges because they frequently cross surface waters and because narrow right-of-way constrains areas available to store and treat sediment-laden water. In most cases, the standards of this appendix can be applied to such linear projects without modification. For instance, the ability to use perimeter control rather than a sediment retention facility for small drainage areas (see Section D.4.3) will apply to many of these projects.

However, there may be some projects that cannot reasonably meet the standards of Core Requirement #5 and this appendix. In these cases, other measures may be proposed that will provide reasonable protection. An adjustment is not required for such projects, unless the County determines that measures proposed by the applicant fail to meet the intent of Core Requirement #5 and this appendix, and that significant adverse impacts to surface water may result. Examples of other measures that may be taken in lieu of the standards of this appendix are:

1. Phasing the project so that the site is worked progressively from end to end, rather than clearing and grubbing the entire length of the project. This results in smaller exposed areas for shorter durations, thus reducing the erosion risk.

2. Mulching and vegetating cut and fill slopes as soon as they are graded. Frequently, this is done at the end of construction when paving or utility installation is complete. Vegetating these areas at the start of the project stabilizes those areas most susceptible to erosion.

3. Protecting all catch basin inlets with catch basin inserts when these do not drain to ponds or traps. This will not provide the same level of protection as a sediment pond or trap, but can remove most of the sand-sized material entrained in the runoff.

4. Phasing the project so that all clearing and grading in sensitive area buffers occurs in the dry season. This substantially reduces the chance of erosion and allows for rapid revegetation in the late summer and early fall.

5. Using flocculents to reduce the turbidity of water released from sediment ponds.

6. Hiring a private consultant with expertise in ESC to review and monitor the site.

If alternatives are used, it may be appropriate to develop a monitoring program that would monitor compliance with the performance standard of Core Requirement #5 and/or impacts to nearby water resources. Of particular concern are impacts to salmonid spawning gravels. McNeil sampling is a possible method of sampling to determine impacts to spawning gravels (see Section D.5.3).

## D.5.7 NPDES REQUIREMENTS

As part of the implementation of the National Pollutant Discharge Elimination System (NPDES), projects that will disturb more than five acres of total area must apply for coverage under the Washington State Department of Ecology's Baseline General Permit for Stormwater. The five-acre threshold applies even if the five acres are to be disturbed in phases, as long as the construction is "part of a larger common plan of development or sale." In general, the erosion control plan required by the *Surface Water Design Manual* is equivalent to that required by the State through the *Stormwater Management Manual for the Puget Sound Basin* (DOE, 1982). The DOE stormwater permit application requires the filing of a Notice of Intent (NOI) at least 30 days prior to the start of construction. The only major requirement of the stormwater permit that is not included in the *SWDM* is a public notice requirement. Note that this public notice for Ecology's stormwater permit can be published concurrently with other public notices required for permits or SEPA. Contact the Department of Ecology at (360) 407-7156 for complete information on permit thresholds, applications, and requirements.

## D.5.8 FOREST PRACTICE PERMIT REQUIREMENTS

Projects that will clear more that two acres of forest or 5,000 board feet of timber must apply for a Class IV Special Forest Practice permit from the Washington State Department of Natural Resources (WSDNR). All such clearing is also subject to the State Environmental Policy Act (RCW 43.21C) and will require SEPA review. King County assumes lead agency status for Class IV permits and the application can be consolidated with the associated King County development permit or approval. The permit must be initiated with WSDNR, but will then be transferred over to King County to conduct the SEPA review and grant the permit. Contact the WSDNR for complete information on permit thresholds, applications, and requirements.

## D.5.9 ALTERNATIVE AND EXPERIMENTAL MEASURES

In general, the *Surface Water Design Manual* only contains those BMPs that are standards of the local industry. There are a variety of other BMPs available that can also be used, even though they are not included in this appendix. Such alternatives may be approved without an adjustment if the alternative will produce a compensating or comparable result with the measures in this appendix. Variations on or modifications of the BMPs in this appendix can also be granted based on the same criteria. Technical support will be provided by WLRD when requested by DDES.

An adjustment is only required for those products or techniques that are so new and untested as to be experimental. If the County determines that a proposed alternative is experimental, then an experimental adjustment must be obtained (see Section 1.4.4 of the *SWDM*). The intent of this requirement is not to discourage new techniques, but to insure that new techniques are monitored and documented for adequacy and possible inclusion in subsequent versions of the *SWDM*. An example of a product that would have required an experimental adjustment prior to this version of the manual is the catch basin insert (see Section D.4.5.3) because it was not equivalent to any existing measure.

# D.6 EROSION AND SEDIMENT CONTROL PLANS

This section details the specifications and contents for erosion and sediment control (ESC) plans. An ESC plan and any supporting information must be submitted as part of a complete engineering plan to facilitate proper drainage review. An ESC plan and its supporting information is also an important part of the ESC Report required to be submitted to DDES and a copy kept on the project site (see Section D.5.1, p. D-41).

## ESC Plan Specifications

The **site improvement plan** shall be used as the base of the ESC plan. Certain detailed information (e.g., pipe catch basin size, stub-out locations, etc.) that is not relevant may be omitted to make the ESC plan easier to comprehend. At a minimum, the ESC plan shall include all of the information required for the **base map of a site improvement plan** (see Table 2.3.1A of the *Surface Water Design Manual*), as well as existing and proposed roads, driveways, parking areas, buildings and drainage facilities, utility corridors not associated with roadways, all sensitive areas and buffers, and proposed final topography. A smaller scale may be used to provide better comprehension and understanding.

The ESC plan shall generally be designed for proposed topography, not existing topography, since rough grading is usually the first step in site disturbance. The ESC plan focuses on the initial measures to be applied to the site. The County may require large, complex projects to phase construction and submit multiple ESC plans for different stages of construction.

The following list provides the basic information requirements for the ESC plan. Note that the ESC plan may be simplified by the use of the symbols and codes provided for each ESC measure in Section D.4 (p. D-5). In general, the ESC plan shall be submitted as a separate plan sheet(s). However, there may be some relatively simple projects where providing a separate grading and ESC plan is unnecessary.

### General

1. Identify areas with a high susceptibility to erosion.
2. Provide all details necessary to clearly illustrate the intent of the ESC design.
3. Provide information consistent with that in Section 8 of the technical information report (TIR) required in the engineering plan submittal (see Section 2.3.1 of the *SWDM*).
4. Include ESC measures for all on- and offsite utility construction included in the permit.
5. Include standard ESC Notes and specify the construction sequence. ESC Notes and a sample construction sequence are provided in the Reference Section.
6. Identify the designated ESC supervisor (if required) and provide phone numbers for 24-hour contact.

### Clearing Limits

1. Delineate clearing limits (areas to remain uncleared).
2. Provide details sufficient for installation of markings for maintenance of clearing limits.

### Cover Measures

1. Specify the type and location of temporary cover measures to be used on site.
2. If more than one type of cover is to be used on site, indicate the areas where the different measures shall be used, including steep cut and fill slopes.
3. If the type of cover measures to be used will vary depending on the time of year, soil type, gradient, or some other factor, specify the conditions that control the use of the different measures.
4. Specify the nature and location of permanent cover measures. If a landscaping plan is prepared, this may not be necessary.

5. Specify the approximate amount of cover measures necessary to cover all disturbed areas.
6. If erosion netting or blankets are specified, provide typical details sufficient for installation and maintenance.
7. Specify the seed mixes, fertilizers, and soil amendments to be used, as well as the application rate for each item.

**Perimeter Protection**

1. Specify the location and type of perimeter protection to be used.
2. Provide typical details sufficient for installation and maintenance of perimeter protection.
3. If a silt fence is to be used, specify the type of fabric.

**Traffic Area Stabilization**

1. Locate the construction entrance(s).
2. Provide typical details sufficient for installation and maintenance of the construction entrance.
3. Locate the construction roads and parking areas.
4. Specify the measure(s) that will be used to create stabilized construction roads and parking areas. Provide sufficient detail to install and maintain.

**Sediment Retention**

1. Show the locations of all sedimentation ponds and traps.
2. Dimension pond berm widths and all inside and outside pond slopes.
3. Indicate the trap/pond storage required and the depth, length, and width dimensions.
4. Provide typical section views throughout the pond and outlet structure.
5. Provide typical details of the control structure and dewatering mechanism.
6. Detail stabilization techniques for the outlet/inlet.
7. Provide details sufficient to install a cell divider.
8. Specify mulch and/or recommended cover of berms and slopes.
9. Indicate the requirement to provide a depth gage with a prominent mark at 1 foot depth for sediment removal.
10. Indicate catch basins that are to be protected.
11. Provide details of the catch basin protection sufficient to install and maintain.

**Surface Water Control**

1. Locate all pipes, ditches, and interceptor ditches and swales that will be used to convey stormwater.
2. Provide details sufficient to install and maintain all conveyance systems.
3. Indicate locations of outlet protection and provide detail of protections.
4. Indicate locations and outlets of any possible dewatering systems.
5. Indicate the location of any level spreaders and provide details sufficient to install and maintain.
6. Provide all temporary pipe inverts.
7. Provide location and specifications for the interception of runoff from disturbed areas and the conveyance of the runoff to a non-erosive discharge point.
8. Provide location and details of rock check dams.

9. Provide front and side sections of typical rock check dams.

### Wet Season Requirements

Provide a list of all applicable wet season requirements.

### Sensitive Areas Restrictions

1. Specify the type, locations, and details of any measures necessary to comply with requirements to protect surface waters.
2. Specify the type, locations, and details of any measures necessary to comply with any additional protection required for steep slopes.

# D.7 SMALL SITE ESC

Smaller sites tend to have similar erosion and sediment control (ESC) needs. This section provides a simplified process to apply effective erosion and sediment controls to smaller sites and guides the user through the preparation and submittal of a Small Site ESC Plan with the permit application.

## D.7.1 INTRODUCTION TO SMALL SITE ESC

### What is ESC and Why is it Required for My Site?

**applies to all projects in King County**. All sites, including small sites, are required to use erosion and sediment control (ESC) Best Management Practices (BMPs). ESC BMPs prevent soil erosion during development of the site. The types of BMPs required through the small site process are generally simple to construct and easy to maintain, and with few exceptions do not require engineering or formal design. Examples of such BMPs include phasing or minimizing clearing, terracing exposed slopes, routing water around exposed soils, and placing straw or other mulching materials on exposed soils.

ESC is required because soils eroded from the site are *always* deposited downstream in pipes, streams, or lakes. Soils deposited in a pipe or channel reduce its capacity to convey flows and can increase the likelihood of flooding. Soils in streams can also clog the gravels that salmon use for spawning. Nutrients associated with soils that reach lakes can upset the chemical balance of the lake, causing excessive growth of algae and decreasing recreational uses such as swimming, boating, and fishing.

### Which Projects Can Use Small Site Erosion and Sediment Control Requirements?

All proposed projects that disturb soil and add less than 5,000 square feet of impervious surface can use the Small Site ESC requirements contained in this section. These projects must apply erosion and sediment control even though they may not be subject to drainage review under the *Surface Water Design Manual*.

In addition, all proposed projects that qualify for Small Site Drainage Review can use the Small Site ESC requirements contained in this section. The Small Site Drainage Review is detailed in Appendix C of the *Surface Water Design Manual* and applies to single family residential or subdivision projects that add between 5,000 and 10,000 square feet of impervious surface per threshold discharge area[1] and clear less than 2 acres or less than 35% of the site, whichever is greater.

### What Will I Be Required To Do?

It is the responsibility of both the applicant and the contractor to minimize erosion and the transport of sediment to the greatest extent possible. Erosion and sediment control is a two step process that (1) minimizes the amount of sediment mobilized, and (2) traps any mobilized sediment before it leaves the site.

Examples of erosion controls include use of mulches or other cover materials, marked/minimized clearing, and routing of water around exposed soils. Installation and maintenance of silt fencing is an example of sediment trapping. ESC techniques that are particularly suitable for small sites are described below (Section D.7.2).

[1] A threshold discharge area is an onsite area draining to a single natural discharge location or multiple natural discharge locations that combine within one-quarter-mile downstream. Small sites typically have only one threshold discharge area.

# D.7.2 SMALL SITE ESC REQUIREMENTS

One or more of the following measures will be required on small sites in order to minimize onsite erosion and prevent mobilized sediment from leaving the site:

1. Rock construction entrance
2. Mulching
3. Minimized clearing
4. Silt fencing
5. Winter (or wet season) stabilization
6. Final stabilization.

Other measures may be allowed or required if these are inappropriate for the project or fail to contain sediment on the project site. A description of other measures which may be needed for successful ESC on some sites, and a more detailed description of those included here, can be found in ESC Measures Section D.4, "ESC Measures" (p. D-5).

The placement and type of proposed ESC BMPs are shown on an **ESC plan**. Required features of this plan are outlined in Section D.7.3, "Submittal Requirements" (p. D-56).

## D.7.2.1 ROCK CONSTRUCTION ENTRANCE

### Purpose

Rock construction entrances help prevent transport of sediment away from the site on the tires or undercarriages of vehicles.

### Application

Rock construction entrances shall be provided at all entranceways to cleared construction sites.

### Design Specifications

The rock pad should measure approximately 10 feet by 25 feet, and be about 1 foot deep (see Figure D.7.A). Rocks used for pad construction will be 4 to 6 inches in diameter. Geotextile will be placed beneath the rock to prevent fine sediments from being "pumped" up through the rock by heavy vehicles. The geotextile shall meet the following standards:

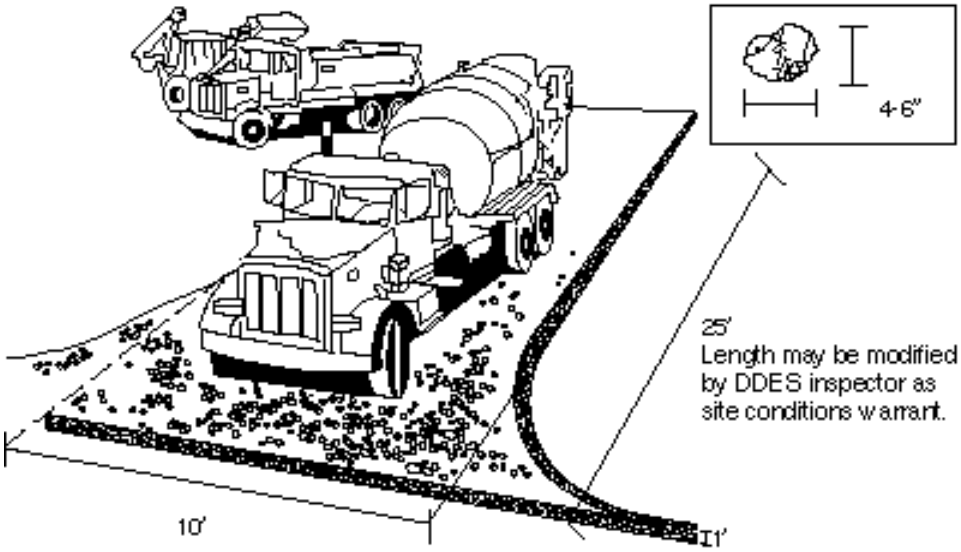
| | |
|---|---|
| Grab Tensile Strength (ASTM D4751) | 200 psi min. |
| Grab Tensile Elongation (ASTM D4632) | 30% max. |
| Mullen Burst Strength (ASTM D3786-80a) | 400 psi min. |

All vehicles must use the rock pad to leave the site.

### Maintenance

Construction entrances must be inspected regularly, and rock must be replaced as needed.

**FIGURE D.7.A ROCK CONSTRUCTION ENTRANCE**




## D.7.2.2 MULCHING

### Purpose

Mulching prevents erosion by dissipating the energy of and absorbing water. Mulch prevents raindrops from falling directly on exposed soils, reducing the likelihood that soils will be dislodged and washed away. Mulch also enhances plant establishment by conserving moisture, holding fertilizer, seed, and topsoils in place, and moderating soil temperatures.

### Application

1. On disturbed areas that are to remain unworked for more than 7 days. Mulch is to be used for areas that need cover measures for less than 30 days. Permanent seeding is required for areas that need cover for longer than 30 days.
2. As a cover for seed during the wet season and during the hot summer months.
3. During the wet season, on slopes steeper than 3H:1V with more than 10 feet of vertical relief.

### Design Specifications

The amount of mulch applied per acre (application rate) depends on the type of material used. Table D.7.A provides application rates for a variety of common mulches. Plastic can be used as a surrogate for mulch, with the following cautions:

1. If erosion at the toe of the covered slope is likely, a gravel berm, riprap, or other suitable protection shall be installed at the toe to reduce the velocity of runoff.
2. Seams between sheets must overlap and must be weighted and taped.
3. Toe in sheeting at the top of slope with a minimum 4"x4" trench running the length of the top of slope.

### Maintenance

Mulch must be inspected regularly and more mulch added as needed to maintain the suggested application rate. All rips or tears in plastic sheeting shall be repaired. Sheeting shall be checked to ensure it is properly overlapped and weighted in place; sheeting shall be re-lapped and weights replaced as needed.

| TABLE D.7.A MULCH STANDARDS AND APPLICATION RATES | | |
|---|---|---|
| **Mulch Material** | **Quality Standards** | **Application Rates** |
| Straw | Air-Dried; free from undesirable seed and coarse material | 2"-3" thick; 2-3 bales per 1000 SF or 2-3 tons per acre |
| Wood Fiber Cellulose | No growth inhibiting factors | Approx. 25-30 lbs. per 1000 SF or 1000 to 1500 lbs. per acre |
| Compost | No visible water or dust during handling. Must be purchased from supplier with Solid Waste Handling Permit | 2" thick min.; approx. 100 tons per acre (approx. 800 lbs. per yard) |
| Chipped Site Vegetation | Average size shall be several inches | 2" minimum thickness |

## D.7.2.3 MARK CLEARING LIMITS / MINIMIZE CLEARING

### Purpose

Minimizing clearing is the most effective method of erosion control. Undisturbed vegetation intercepts and slows rainwater. Plant roots hold soil in place, and dead vegetation on the ground acts as a mulch.

### Applications

Clearing limits shall be marked and clearing minimized on any site where significant areas of undisturbed vegetation will be retained.

### Design Specifications

Minimizing clearing should be incorporated into the site design. Clearing limits must be marked on both the site plan and the erosion control plan. On the ground, clearing limits must be clearly marked with brightly colored tape or plastic or metal safety fencing (also referred to as Sensitive Areas Setback Area fencing, or SASA fencing). If tape is used, it should be supported by vegetation or stakes, and should be about 3 to 6 feet high and highly visible. Equipment operators should be informed of areas of vegetation that are to be left undisturbed.

### Maintenance

Fencing shall be inspected regularly and repaired or replaced as needed.

## D.7.2.4 SILT FENCING

### Purpose

Silt fencing catches sediment that has been mobilized by water flowing over the site. Fabric used in the construction of silt fencing has openings specifically sized to allow water to flow through while retaining the majority of particle sizes.

### Application

Silt fencing shall be used to protect the perimeter of the site. It can be placed parallel to topographic contours. Silt fencing is not suitable for placement in drainage channels or for other concentrated flows.

## Design Specifications

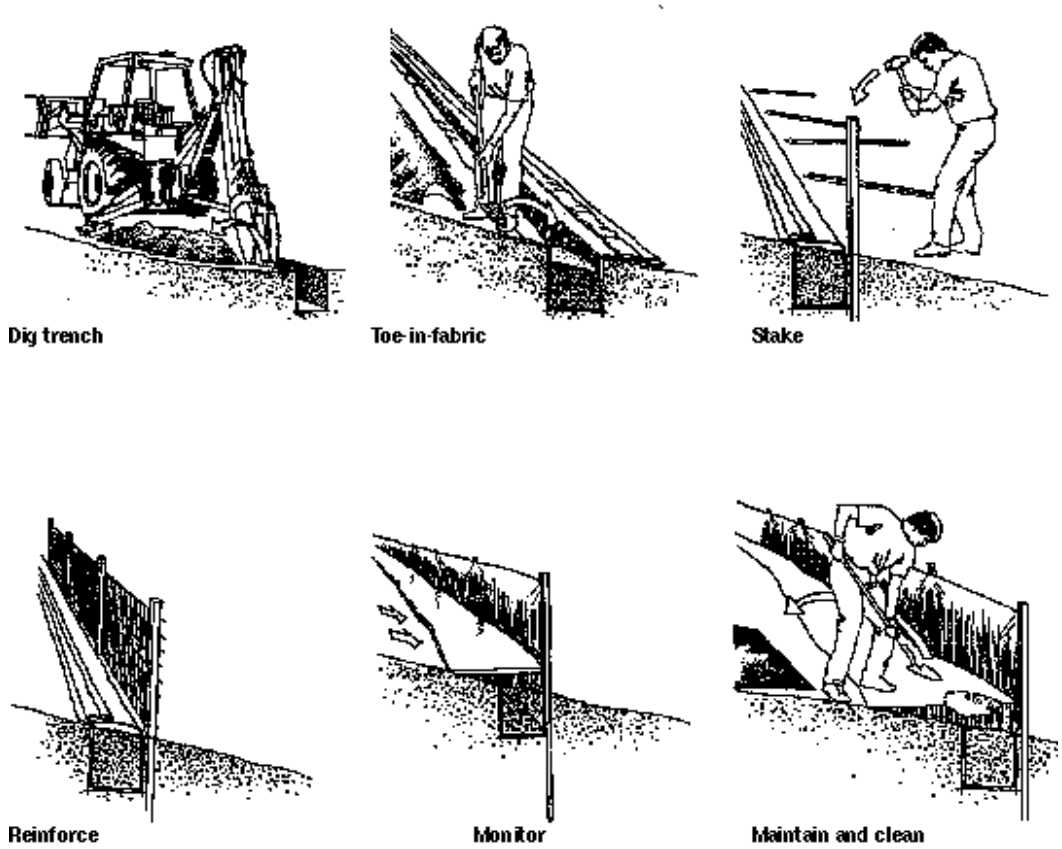
As shown in Figure D.7.B, silt fence must be towed-in to a shallow trench, and then staked and reinforced to function properly. The silt fence, which can be found at many construction supply stores, must meet the following standard specifications:

| | |
|---|---|
| AOS (ASTM D4751) | 30-100 sieve size (0.60-0.15 mm) for slit film<br>50-100 sieve size (0.30-0.15 mm) for other fabrics |
| Water Permittivity (ASTM D4491) | 0.02 $sec^{-1}$ min. |
| Grab Tensile Strength (ASTM D4632) | 180 lbs. min. (called extra strength fabric) |
| Grab Tensile Elongation(ASTM D4632) | 30% max. |
| Ultraviolet resistance (ASTM D4355) | 70% min. |

## Maintenance

Fencing must be inspected regularly for damage. Silt fencing does break down under UV light. Sediment collected behind the fence must be removed so that this material does not push the fence over.

**FIGURE D.7.B SILT FENCE INSTALLATION AND MAINTENANCE**



## D.7.2.5 WINTER STABILIZATION

### Purpose

In order to minimize sediment-laden runoff, as much of the bare and disturbed portions of the site as possible should be covered during any period of precipitation. Once sediment is mobilized, it is much more difficult to effectively control.

### Application

All sites require winter stabilization between October 1 and April 30 (the wet season).

### Design Specifications

During the above time frame, slopes and stockpiles 3H:1V or steeper and with more than 10 feet of vertical rise shall be covered if they are to remain unworked for more than 12 hours. Other disturbed areas shall be covered or mulched according to Table D.7.A (p. D-53) if they are to remain unworked for more than two days. Cover material sufficient to cover all disturbed areas shall be stockpiled on site at the beginning of the wet season. Areas that are to be left unworked during the winter shall be seeded prior to September 23.

### Maintenance

The site should be inspected weekly and immediately before, during, and after storms. Cover and other erosion control measures shall be repaired and enhanced as necessary to prevent or minimize sediment runoff and transport.

## D.7.2.6 FINAL STABILIZATION

### Purpose

Final stabilization minimizes sediment-laden runoff from the site after construction has been completed.

### Application

All sites require final stabilization prior to final construction approval.

### Design Specifications

Prior to final construction approval, the site shall be stabilized to prevent sediment-laden water from leaving the site after project completion. All disturbed areas of the site shall be vegetated or otherwise permanently stabilized. At a minimum, disturbed areas must be seeded and mulched to ensure that sufficient cover will develop shortly after final approval. Mulch without seeding is adequate for small areas to be landscaped before October 1.

All permanent surface water facilities (including catch basins, manholes, pipes, ditches, channels, flow control facilities, and water quality facilities) impacted by sedimentation during construction must be cleaned.

### Maintenance

Permanent erosion control is the responsibility of the owner. The site must be kept stabilized using landscaping, mulch, or other measures to prevent sediment-laden water from leaving the site and to prevent sediment from being transported onto adjacent properties and roads.

# D.7.3 SUBMITTAL REQUIREMENTS

*A Small Site ESC Plan* must be submitted for all projects that are eligible to use the Small Site ESC requirements in this section. This plan is part of a Small Site Drainage Plan described in *Small Site Drainage Requirements* (Appendix C of the *Surface Water Design Manual*). Directions for preparing a Small Site ESC Plan are provided below, and a sample plan is presented in Section D.7.3.3 (p. D-57).

## D.7.3.1 SMALL SITE ESC PLAN MAP

The Small Site ESC Plan includes information that is routinely collected for a **single family residence site plan or a short plat plot plan** already required to be submitted with a permit application. One copy of the site plan or plot plan shall be used to show how ESC BMPs are to be applied to the site to comply with the Small Site ESC requirements. The approximate location and size of clearing limits, rock construction entrance, flow paths, silt fences, etc., should be indicated on the ESC Plan. Any plan must contain at a minimum the features listed in Section D.7.3.2.

**Single family residential projects** that qualify for Small Site ESC requirements should use the Residential Site Plan (see DDES Bulletin No. 9, "Obtaining a Residential Building Permit") as the base map for the ESC plan.

**Proposed short plats** that qualify for Small Site Drainage Review should use the Small Site Drainage Plan (see *Small Site Drainage Requirements*, detached Appendix C of the *Surface Water Design Manual*) as a base plan for the ESC plan. All projects subject to Small Site Drainage Review are required to submit these plans and a drainage assessment. If engineering plans are required for a short plat application, they may be used as a base plan for Small Site ESC plans. How the ESC BMPs are to be applied on the site are added directly to the base map. For more complicated sites, an erosion control professional should be readily able to add Small Site ESC BMPs to the base map with minimal additional effort or expense.

The ESC plans for short plats usually apply only to the site development, since siting of homes on lots created by short plats is done after the short plat is approved (when the home applies for a residential building permit). It is the responsibility of the proposed single family residence to show in detail how ESC requirements are met.

## D.7.3.2 FEATURES REQUIRED ON SMALL SITE ESC PLANS

The Small Site ESC Plan should be drawn on 8-1/2" x 11", 8-1/2" x 14", or 11" x 17" paper (see the sample plan in Figure D.7.C, p. D-59), and must include the following information.

### Identification

1. Name, address, and phone number of the applicant
2. Scale—use a scale that clearly illustrates drainage features and flow controls (1"=20' is standard engineering scale; minimum acceptable scale is 1"=50')
3. Parcel number
4. North arrow
5. Dimension of all property lines, easements, and building setback lines
6. Street names and existing or proposed property address
7. Section, township, and range of proposal.

**Topography**

1. Corner elevations
2. Benchmark (a permanent mark indicating elevation and serving as a reference in the topographic survey)
3. Datum (assumed datum is acceptable in many cases, i.e., fire hydrant base = 100'; datum for projects in or near FEMA floodplains should be NGVD 1929)
4. If over 15% slope: 5-foot contours, top of slope, toe of slope, and any erosion or landslide areas.

**Proposed ESC**

1. Delineation of proposed clearing limits
2. Type and location of erosion control facilities
3. Location of any significant offsite drainage features within 200 feet of the discharge point(s) for the lot, including streams, lakes, roadside ditches.

**Topography/Drainage Features**

1. Outline of any stream, wetland, lake, closed depression, or other water feature (including any required buffer width)
2. Location of all steep slopes, landslide hazard areas, and coal mine hazard areas (including buffers)
3. Location of all existing and proposed drainage easements, ditches, swales, pipes, etc.
4. Location of all sensitive areas as shown on any recorded Sensitive Areas Notice on Title (SANT).

## D.7.3.3 SAMPLE SMALL SITE ESC PLAN

All sites are required to control erosion and contain sediment. The planning and use of ESC BMPs will be illustrated for a single family residence. Although the specifics of any lot will differ from those shown here, the process will be similar. The first step in the process is to determine whether the site is eligible to use the Small Site ESC requirements. This evaluation and the following materials are usually included in the drainage assessment that accompanies the Small Site ESC Plan.

The proposed house is to be placed on an existing 1.69-acre lot (see Figure D.7.C). Impervious surfaces are the roof, a driveway, and a parking area. The total proposed impervious surface is 6,950 square feet as determined from the residential site plan layout of residence and driveway (the site plan provides the base map for the Small Site ESC Plan). The amount exceeds 5,000 square feet but falls below the 10,000-square-foot limit for Small Site Drainage Review. Therefore, a Small Site ESC Plan is applicable.

The proposal is not in a basin plan area or critical drainage area that might contain clearing limits. However, a portion of a wetland and an erosion hazard area have been identified on the site, and their approximate locations are shown in Figure D.7.C. While neither the wetland and its buffer, nor the erosion hazard area and its buffer would be disturbed during construction, the locations of these sensitive areas must be verified. This review will likely be minimal if the locations shown are accurate, and will be concurrent with Small Site Drainage Review.

Approximately the southern 2/3 of the site will be cleared. Trees and other native vegetation will be left intact along the northern edge, near the street. Buffers will be maintained around the wetland and erosion hazard areas, respectively. The site slopes towards the street.

In order to best prevent erosion and to encourage sedimentation, the following **BMPs** are used:

1. **Clearing will be minimized** to the extent possible, and **clearing limits marked** by fencing or other means on the ground.

2. Water will be **routed** around the erosion hazard area and around the steep section of the driveway by constructing an interceptor dike or ditch that will intersect and direct water away to the east of the site.
3. Water will be **filtered** before it reaches the wetland. Silt fencing will be placed along slope contours at the limits of clearing in the vicinity of both the wetland and the erosion hazard area.
4. A rocked construction entrance will be placed at the end of the driveway.
5. **Mulch** will be spread over all cleared areas of the site when they are not being worked. Mulch will consist of air-dried straw and chipped site vegetation.

The BMPs shown in Figure D.7.C must be installed as clearing progresses. For example, the rock construction entrance must be installed as soon as the path for the driveway has been cleared. Additional ESC measures must be installed if the ones proposed above prove insufficient.

**FIGURE D.7.C SAMPLE SMALL SITE ESC PLAN**

# D.8 FOREST PRACTICES ESC

(This section reserved for erosion and sediment control requirements that will specifically apply to forest practices and clearing regulated by King County)

# D.9 MINING AND EXTRACTION ESC

(This section reserved for erosion and sediment control requirements that will specifically apply to extraction operations requiring a grading permit from King County)

# D.10 REFERENCE SECTION

This reference section provides materials useful in developing erosion and sediment control plans and for effectively implementing erosion control measures in the field. In order to make the Erosion and Sediment Control Standards a stand alone booklet, several key components relating to erosion and sediment control found in the *Surface Water Design Manual* are repeated in this section.

1. Core Requirement #5: Erosion and Sediment Control Requirements
2. ESC maintenance report
3. Standard ESC plan notes
4. Recommended construction sequence
5. References.

*Note: The administrative rule adopting the Erosion and Sediment Control Standards has not formally adopted any of the materials in this section. All of the forms, notes, and other material are provided for reference only. King County assumes no responsibility for the completeness or current status of the materials contained in this section. It is the sole responsibility of each applicant to use the most current materials in the preparation and implementation of the erosion and sediment control requirements. Copies of the current versions of these materials are available at DDES.*

# D.10.1 CORE REQUIREMENT #5: EROSION AND SEDIMENT CONTROL

REQMT

All proposed projects that will clear, grade, or otherwise disturb the site must provide erosion and sediment controls to prevent, to the maximum extent possible, the transport of sediment from the project site to downstream drainage facilities, water resources, and adjacent properties. To prevent sediment transport, **Erosion and Sediment Control (ESC)** measures are required and shall perform as described in Section 1.2.5.2. Both temporary and permanent erosion and sediment controls shall be implemented as described in Section 1.2.5.3.

**Intent:** To prevent the transport of sediment to streams, wetlands, lakes, drainage systems, and adjacent properties. Erosion on construction sites can result in excessive sediment transport to adjacent properties and to surface waters. Sediment transport can result in major adverse impacts, such as flooding due to obstructed drainage ways, smothering of salmonid spawning beds, and creation of algal blooms in lakes.

## D.10.1.1 ESC MEASURES

The following ESC measures shall be provided as specified below and as further detailed in Section D.4, (p. D-5):

1. **Clearing Limits:** Prior to any site clearing or grading, areas to remain undisturbed during project construction shall be delineated. At a minimum, clearing limit delineation flagging shall be provided at the edges of all sensitive area buffers.
2. **Cover Measures:** Temporary and permanent cover measures shall be provided when necessary to protect disturbed areas. Temporary cover shall be installed if an area is to remain unworked for more than seven days during the dry season (May 1 to September 30) or for more than two days during the wet season (October 1 to April 30), unless otherwise determined by the County. Any area to remain unworked for more than 30 days shall be seeded or sodded, unless the County determines that winter weather makes vegetation establishment unfeasible. **During the wet season**, **slopes and stockpiles 3H:1V or steeper with more than 10 feet of vertical relief** shall be covered if they are to remain unworked for more than 12 hours. The intent of these measures is to prevent erosion by having as much area as possible covered during any period of precipitation.
3. **Perimeter Protection:** When necessary, perimeter protection to filter sediment from sheet flow shall be provided downstream of all disturbed areas. Perimeter protection includes the use of vegetated strips, as well as more conventional constructed measures such as silt fences. Such protection shall be installed prior to upstream grading.
4. **Traffic Area Stabilization:** Unsurfaced entrances, roads, and parking areas used by construction traffic shall be stabilized to minimize erosion and tracking of sediment offsite.
5. **Sediment Retention:** Surface water collected from disturbed areas of the site shall be routed through a sediment pond or trap prior to release from the site. This does not apply to areas at the perimeter of the site small enough to be treated solely with perimeter protection. Sediment retention facilities shall be installed prior to grading any contributing area.
6. **Surface Water Controls:** Surface water controls shall be installed to intercept all surface water from disturbed areas, convey it to a sediment pond or trap, and discharge it downstream of any disturbed areas. However, areas at the perimeter of the site that are small enough to be treated solely with perimeter protection do not require surface water controls. Significant sources of upstream surface water that drain onto disturbed areas shall be intercepted and conveyed to a stabilized discharge point downstream of the disturbed areas. Surface water controls shall be installed concurrently with or immediately following rough grading.

7. **Dust Control:** Preventative measures to minimize wind transport of soil shall be implemented when a traffic hazard may be created or when sediment transported by wind is likely to be deposited in water resources.

## D.10.1.2 ESC PERFORMANCE

The above ESC measures shall be applied and maintained so as to prevent, to the maximum extent possible, the transport of sediment from the project site or into onsite wetlands, streams, or lakes. This performance is intended to be achieved through proper selection, installation, and operation of the above ESC measures as detailed in the *ESC Standards* (detached Appendix D) and approved by the County. However, the County may determine at any time during construction that such approved measures are not sufficient and additional action is required based on one of the following criteria:

1. IF a **sieve test** of storm and surface water discharges indicates that sand-sized sediment (soil particles coarser than the #200 sieve, 0.075 mm) is leaving the project site or entering onsite wetlands, streams, or lakes, THEN corrective actions and/or additional measures beyond those specified in Section 1.2.5.1 shall be implemented as deemed necessary by the County. *Note: The County can require that the ESC supervisor have a #200 sieve on site. Also, "leaving the project site" will be interpreted liberally. For example, if this criterion is applied to individual lots within a subdivision, it may, depending on the site, be appropriate to conduct the sieve test at the outlet of the drainage system rather than at the edge of the lot.*
2. IF the County determines that the condition of the construction site poses a **hazard to adjacent property** or may **adversely impact drainage facilities or water resources**, THEN additional measures beyond those specified in Section 1.2.5.1 can be required by the County.

## D.10.1.3 IMPLEMENTATION REQUIREMENTS

### ESC Plan

As specified in Chapter 2, all proposed projects must submit a plan for providing ESC measures. The ESC plan shall include a detailed construction sequence as proposed by the design engineer and shall identify required ESC measures. All ESC measures shall conform to the details and specifications in the *ESC Standards* unless an alternative is approved by King County (see "Alternative and Experimental Measures" in the *ESC Standards*, detached Appendix D). The ESC plan shall be accompanied by any calculations or information necessary to size ESC measures and demonstrate compliance with Core Requirement #5. The County may require large, complex projects to phase construction and to submit multiple ESC plans for the different stages of construction. Development of new ESC plans is not required for changes that are necessary during construction.

### Wet Season Construction

During the wet season (October 1 to April 30) any site with exposed soils shall be subject to the "Wet Season Provisions" contained in Section D.5.2. In addition to the ESC cover measures, these provisions include covering any newly-seeded areas with mulch and seeding as much disturbed area as possible during the first week of October in order to provide grass cover for the wet season.

### Construction within Sensitive Areas and Buffers

Any construction that will result in disturbed areas on or within a stream or associated buffer, within a Class 1 or 2 wetland or associated buffer, or within 50 feet of a lake shall be subject to the "Sensitive Area Restrictions" contained in Section D.5.3. These provisions include phasing the project whenever possible so that construction in these areas is limited to the dry season.

## Maintenance

All ESC measures shall be maintained and reviewed on a regular basis as prescribed in Section D.5.4. The applicant shall designate an ESC supervisor who shall be responsible for maintenance and review of ESC measures and for compliance with all permit conditions relating to ESC as described in the *ESC Standards*.

## Final Stabilization

Prior to obtaining final construction approval, the site shall be stabilized, structural ESC measures (such as silt fences and sediment traps) shall be removed, and drainage facilities shall be cleaned as specified in the *ESC Standards*.

## Flexible Compliance

Some projects may meet the intent of Core Requirement #5 while varying from specific ESC requirements contained here. If a project is designed and constructed such that it meets the intent of this core requirement, the County may determine that strict adherence to a specific ESC requirement is unnecessary; an approved adjustment (see Section 1.4) is not required in these circumstances. Certain types of projects are particularly likely to warrant this greater level of flexibility; for instance, projects on relatively flat, well drained soils, projects that are constructed in closed depressions, or projects that only disturb a small percentage of a forested site may meet the intent of this requirement with very few ESC measures. More information on intent and general ESC principles is contained in the *ESC Standards*.

## Roads and Utilities

Road and utility projects often pose difficult erosion control challenges because they frequently cross surface waters and are long and narrow with limited area available to treat and store sediment-laden water. Because of these factors, road and utility projects are allowed greater flexibility in meeting the intent of Core Requirement #5 as described in the *ESC Standards*. Projects that pose a very low risk of erosion or sediment transport due to site conditions or project scope may also warrant greater flexibility.

## Consideration of Other Required Permits

Consideration should be given to the requirements and conditions that may be applied by other agencies as part of other permits required for land-disturbing activities. In particular, the following permits may be required and should be considered when implementing ESC measures:

- A **Class IV Special Forest Practices Permit** is required by the Washington State Department of Natural Resources for projects that will clear more than two acres of forest or 5,000 board feet of timber. All such clearing is also subject to the State Environmental Policy Act (RCW 43.21C) and will require SEPA review. King County assumes lead agency status for Class IV permits, and the application can be consolidated with the associated King County development permit or approval.
- A **NPDES**[2] **General Permit for Construction** (pursuant to the Washington State Department of Ecology's Baseline General Permit for Stormwater) is required for projects that will disturb more than five acres. The five-acre threshold applies even where the five acres are to be disturbed in phases, as long as the construction is "part of a larger common plan of development or sale."

[2] *NPDES* stands for National Pollutant Discharge Elimination System.

## D.10.2 ESC MAINTENANCE REPORT

DDES may require a written record of all maintenance activities to be kept to demonstrate compliance with the Maintenance Requirements (Section D.5.4). A standard ESC Maintenance Report is provided on the next page. Copies of the ESC Maintenance Report must be kept on site throughout the duration of construction.

# ESC MAINTENANCE REPORT

Performed By: _____
Date: _____
Project Name: _____
DDES Permit #: _____

**Clearing Limits**

| | | |
|---|---|---|
| Damage | OK ____ | Problem |
| Visible | OK ____ | Problem |
| Intrusions | OK ____ | Problem |
| Other | OK ____ | Problem |

**Mulch**

| | | |
|---|---|---|
| Rills/Gullies | OK ____ | Problem |
| Thickness | OK ____ | Problem |
| Other | OK ____ | Problem |

**Nets/Blankets**

| | | |
|---|---|---|
| Rills/Gullies | OK ____ | Problem |
| Ground Contact | OK ____ | Problem |
| Other | OK ____ | Problem |

**Plastic**

| | | |
|---|---|---|
| Tears/Gaps | OK ____ | Problem |
| Other | OK ____ | Problem |

**Seeding**

| | | |
|---|---|---|
| Percent Cover | OK ____ | Problem |
| Rills/Gullies | OK ____ | Problem |
| Mulch | OK ____ | Problem |
| Other | OK ____ | Problem |

**Sodding**

| | | |
|---|---|---|
| Grass Health | OK ____ | Problem |
| Rills/Gullies | OK ____ | Problem |
| Other | OK ____ | Problem |

**Silt Fence**

| | | |
|---|---|---|
| Damage | OK ____ | Problem |
| Sediment Build-up | OK ____ | Problem |
| Concentrated Flow | OK ____ | Problem |
| Other | OK ____ | Problem |

**Brush Barrier**

| | | |
|---|---|---|
| Damage | OK ____ | Problem |
| Sediment Build-up | OK ____ | Problem |
| Concentrated Flow | OK ____ | Problem |
| Other | OK ____ | Problem |

**Vegetated Strip**

| | | |
|---|---|---|
| Damage | OK ____ | Problem |
| Sediment Build-up | OK ____ | Problem |
| Concentrated Flow | OK ____ | Problem |
| Other | OK ____ | Problem |

**Construction Entrance**

| | | |
|---|---|---|
| Dimensions | OK ____ | Problem |
| Sediment Tracking | OK ____ | Problem |
| Vehicle Avoidance | OK ____ | Problem |
| Other | OK ____ | Problem |

**Construction Road**

| | | |
|---|---|---|
| Stable Driving Surf. | OK ____ | Problem |
| Vehicle Avoidance | OK ____ | Problem |
| Other | OK ____ | Problem |

**Sediment Trap/Pond**

| | | |
|---|---|---|
| Sed. Accumulation | OK ____ | Problem |
| Overtopping | OK ____ | Problem |
| Inlet/Outlet Erosion | OK ____ | Problem |
| Other | OK ____ | Problem |

**Catch Basin Protection**

| | | |
|---|---|---|
| Sed. Accumulation | OK ____ | Problem |
| Damage | OK ____ | Problem |
| Clogged Filter | OK ____ | Problem |
| Other | OK ____ | Problem |

**Interceptor Dike/Swale**

| | | |
|---|---|---|
| Damage | OK ____ | Problem |
| Sed. Accumulation | OK ____ | Problem |
| Overtopping | OK ____ | Problem |
| Other | OK ____ | Problem |

**Pipe Slope Drain**

| | | |
|---|---|---|
| Damage | OK ____ | Problem |
| Inlet/Outlet | OK ____ | Problem |
| Secure Fittings | OK ____ | Problem |
| Other | OK ____ | Problem |

**Ditches**

| | | |
|---|---|---|
| Damage | OK ____ | Problem |
| Sed. Accumulation | OK ____ | Problem |
| Overtopping | OK ____ | Problem |
| Other | OK ____ | Problem |

**Outlet Protection**

| | | |
|---|---|---|
| Scour | OK ____ | Problem |
| Other | OK ____ | Problem |

**Level Spreader**

| | | |
|---|---|---|
| Damage | OK ____ | Problem |
| Concentrated Flow | OK ____ | Problem |
| Rills/Gullies | OK ____ | Problem |
| Sed. Accumulation | OK ____ | Problem |
| Other | OK ____ | Problem |

**Miscellaneous**

| | | |
|---|---|---|
| Wet Season Stockpile | OK ____ | Problem |
| Other | OK ____ | Problem |

**Comments:**

**Actions Taken:**

**Problems Unresolved:**

# D.10.3 STANDARD ESC PLAN NOTES

The standard ESC plan notes must be included on all ESC plans. At the applicant's discretion, notes that in no way apply to the project may be omitted; however, the remaining notes must not be renumbered. For example, if ESC Note #3 were omitted, the remaining notes should be numbered 1, 2, 4, 5, 6, etc.

1. Approval of this erosion and sedimentation control (ESC) plan does not constitute an approval of permanent road or drainage design (e.g., size and location of roads, pipes, restrictors, channels, retention facilities, utilities, etc.).
2. The implementation of these ESC plans and the construction, maintenance, replacement, and upgrading of these ESC facilities is the responsibility of the applicant/ESC supervisor until all construction is approved.
3. The boundaries of the clearing limits shown on this plan shall be clearly flagged by a continuous length of survey tape (or fencing, if required) prior to construction. During the construction period, no disturbance beyond the clearing limits shall be permitted. The clearing limits shall be maintained by the applicant/ESC supervisor for the duration of construction.
4. The ESC facilities shown on this plan must be constructed prior to or in conjunction with all clearing and grading so as to ensure that the transport of sediment to surface waters, drainage systems, and adjacent properties is minimized.
5. The ESC facilities shown on this plan are the minimum requirements for anticipated site conditions. During the construction period, these ESC facilities shall be upgraded as needed for unexpected storm events and modified to account for changing site conditions (e.g., additional sump pumps, relocation of ditches and silt fences, etc.).
6. The ESC facilities shall be inspected daily by the applicant/ESC supervisor and maintained to ensure continued proper functioning. Written records shall be kept of weekly reviews of the ESC facilities during the wet season (Oct. 1 to April 30) and of monthly reviews during the dry season (May 1 to Sept. 30).
7. Any areas of exposed soils, including roadway embankments, that will not be disturbed for two days during the wet season or seven days during the dry season shall be immediately stabilized with the approved ESC methods (e.g., seeding, mulching, plastic covering, etc.).
8. Any area needing ESC measures that do not require immediate attention shall be addressed within fifteen (15) days.
9. The ESC facilities on inactive sites shall be inspected and maintained a minimum of once a month or within forty eight (48) hours following a storm event.
10. At no time shall more than one (1) foot of sediment be allowed to accumulate within a catch basin. All catch basins and conveyance lines shall be cleaned prior to paving. The cleaning operation shall not flush sediment-laden water into the downstream system.
11. Stabilized construction entrances and roads shall be installed at the beginning of construction and maintained for the duration of the project. Additional measures, such as wash pads, may be required to ensure that all paved areas are kept clean for the duration of the project.
12. Any permanent flow control facility used as a temporary settling basin shall be modified with the necessary erosion control measures and shall provide adequate storage capacity. If the facility is to function ultimately as an infiltration system, the temporary facility must be graded so that the bottom and sides are at least three feet above the final grade of the permanent facility.
13. Where straw mulch for temporary erosion control is required, it shall be applied at a minimum thickness of 2 to 3 inches.
14. Prior to the beginning of the wet season (Oct. 1), all disturbed areas shall be reviewed to identify which ones can be seeded in preparation for the winter rains. Disturbed areas shall be seeded within one week

of the beginning of the wet season. A sketch map of those areas to be seeded and those areas to remain uncovered shall be submitted to the DDES inspector. The DDES inspector can require seeding of additional areas in order to protect surface waters, adjacent properties, or drainage facilities.

## D.10.4 CONSTRUCTION SEQUENCE

A detailed construction sequence is needed to ensure that erosion and sediment control measures are applied at the appropriate times. A recommended construction sequence is provided below:

1. Hold the pre-construction meeting.
2. Flag or fence clearing limits.
3. Post a sign with the name and phone number of the ESC supervisor.
4. Install catch basin protection, if required.
5. Grade and install construction entrance(s).
6. Install perimeter protection (silt fence, brush barrier, etc.).
7. Construct sediment ponds and traps.
8. Grade and stabilize construction roads.
9. Construct surface water controls (interceptor dikes, pipe slope drains, etc.) simultaneously with clearing and grading for project development.
10. Maintain erosion control measures in accordance with King County standards and manufacturer's recommendations.
11. Relocate surface water controls or erosion control measures, or install new measures so that as site conditions change, the erosion and sediment control is always in accordance with the *King County Erosion and Sediment Control Standards*.
12. Cover all areas that will be unworked for more than seven days during the dry season or two days during the wet season with straw, wood fiber mulch, compost, plastic sheeting, or equivalent.
13. Stabilize all areas within seven days of reaching final grade.
14. Seed or sod any areas to remain unworked for more than 30 days.
15. Upon completion of the project, stabilize all disturbed areas and remove BMPs if appropriate.

# D.10.5 REFERENCES

Goldman, S.J., Jackson, K., and Bursztynsky, T.A. 1986. Erosion and Sediment Control Handbook. McGraw-Hill Book Company, New York, New York.

King County Dept. of Public Works. 1993. Guidelines for Bank Stabilization Projects. Surface Water Management Division, Seattle, Wash.

Metropolitan Washington Council of Governments. 1990. Performance of Current Sediment Control Measures at Maryland Construction Sites. Washington, D.C. Prepared by T.R. Schueler and J. Lugbill.

Horner, R.R., Guedry, J., and Kortenhof, M.H. 1990. Highway Construction Site Erosion and Pollution Control Manual. Washington State Transportation Center, Seattle, Wash. and Washington State Dept. of Transportation, Olympia, Wash. Report No. WA-RD 200.2.