

# Erosion and Sediment Control Field Handbook

September 2017



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Stabilized Construction Entrance

- Place the stabilized construction entrance in accordance with the approved plan. Vehicles must travel over the entire length of the SCE. Use a minimum length of 50 feet (30 feet for single-family residence lot) and a minimum width of 10 feet. Flare the SCE at the existing road to provide a turning radius.
- 2. Pipe all surface water flowing to or diverted toward the SCE under the entrance maintaining positive drainage. Provide pipe as specified on approved plan. Protect pipe installed through the SCE with a mountable berm with 5:1 slopes and a minimum of 12 inches of stone over the pipe. When the SCE is located at a high spot and has no drainage to convey, a pipe is not necessary. A mountable berm is required when the SCE is not located at a high spot.
- 3. Prepare subgrade and place nonwoven geotextile.
- 4. Place crushed aggregate (2 inches to 3 inches in size) or equivalent recycled concrete (without rebar) at least 6 inches deep over the length and width of the SCE.



- 1. Use a wash rack designed and constructed/manufactured for the anticipated traffic loads. Concrete, steel, or other materials are acceptable. Prefabricated units such as cattle guards are acceptable. Use a minimum dimension of 6 feet by 10 feet. Orient the direction of ribs as shown on the detail. Approaches to the wash rack should be a minimum of 25 feet on both sides.
- 2. Install prior to, alongside of, or as part of the SCE.
- Direct wash water to an approved sediment trapping device.



### ISOMETRIC VIEW - WASH RACK ALONG SCE



### ISOMETRIC VIEW

- 1. Prepare soil before installing matting, including application of lime, fertilizer, and seed. For soil-filled RECPs, the planting bed may be installed after the product is installed.
- 2. Start laying the protective covering from the top of slope and unroll downgrade.
- 3. Bury the up-slope ends of the protective covering in an anchor slot no less than 6 inches deep. Tamp earth firmly over the material. Staple the material at a minimum of every 12 inches across the top end.
- 4. Install edges of parallel mats with a minimum of 2-inch overlap.
- 5. When mats need to be spliced down the slope, install them end over end, with a minimum 4-inch overlap, and staple every 12 inches. The manufacturers' specifications will indicate the density of staples.

STANDARD

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- 1. Prepare soil before installing matting, including application of lime, fertilizer, and seed. For soil-filled RECPs, the planting bed may be installed after the product is installed.
- 2. Start laying the protective covering at the channel inlet (i.e., highest elevation) along the bottom of the channel. Unroll in the direction of flow.
- 3. At the channel inlet, bury the first mats placed in an anchor slot no less than 6 inches deep. Tamp earth firmly over the material. Staple the material at a minimum of every 12 inches across the top end.
- 4. Lay mats end over end with a 6-inch overlap and secure with a double row of staggered staples 4 inches apart.
- 5. In high flow applications, install a staple check dam (a double row of staggered staples 4 inches apart across the entire channel width), at 30-foot to 40-foot intervals.
- 6. Anchor the terminal end of each mat in a 6-inch by 6-inch trench. Backfill and compact after stapling.
- 7. Mats installed along the side slopes should overlap the center mat by 4 inches. Install with a staple density or spacing per manufacturers' recommendations.

### Site Preparation

- 1. Install erosion and sediment control structures (either temporary or permanent) such as diversions, grade stabilization structures, berms, waterways, or sediment control basins.
- 2. Perform all grading operations at right angles to the slope. Final grading and shaping is not usually necessary for temporary seeding.
- 3. Schedule required soil tests to determine soil amendment composition and application rates for sites having disturbed area over 5 acres.
- 4. Distribute lime and fertilizer evenly and incorporate them into the top 3 to 5 inches of soil by disking or other suitable means.
- 5. Where the subsoil is either highly acidic or composed of heavy clays, spread ground limestone at the rate of 4 to 8 tons per acre (200 to 400 pounds per 1,000 square feet) prior to the placement of topsoil.

### Seedbed Preparation

- Temporary Seeding Seedbed preparation must consist of loosening soil to a depth of 3 to 5 inches by means of suitable agricultural or construction equipment, such as disc harrows or chisel plows or rippers mounted on construction equipment. After the soil is loosened, do not roll or drag smooth but leave in the roughened condition. Track sloped areas (greater than 3:1) leaving the surface in an irregular condition with ridges running parallel to the contour of the slope.
  - a) Apply fertilizer and lime as prescribed on the plans.
  - b) Incorporate lime and fertilizer into the top 3 to 5 inches of soil by disking or other suitable means.

2. Permanent Seeding – Maintain areas previously graded in conformance with the drawings in a true and even grade, then scarified or otherwise loosened to a depth of 3 to 5 inches to permit bonding of the topsoil to the surface area and to create horizontal erosion check slots to prevent topsoil from sliding down a slope.

Apply soil amendments as per soil test or as included on the plans.

Mix soil amendments into the top 3 to 5 inches of topsoil by disking or other suitable means. Rake lawn areas to smooth the surface, remove large objects like stones and branches, and ready the area for seed application. Where site conditions will not permit normal seedbed preparation, loosen surface soil by dragging with a heavy chain or other equipment to roughen the surface. Track steep slopes (steeper than 3:1) by a dozer leaving the soil in an irregular condition with ridges running parallel to the contour of the slope. The top 1 to 3 inches of soil should be loose and friable. Seedbed loosening may not be necessary on newly disturbed areas.

- 3. Methods of Seeding Apply seed uniformly with hydroseeder (slurry includes seed, fertilizer and mulch), broadcast or drop seeder, or a cultipacker seeder.
  - a) Hydroseeding
    - i. If fertilizer is being applied at the time of seeding, the application rates will not exceed the following: nitrogen, maximum of 100 pounds per acre total of soluble nitrogen;  $P_2O_5$  (phosphorous), 200 pounds per acre;  $K_2O$  (potassium), 200 pounds per acre.
    - Lime Use only ground agricultural limestone, (up to 3 tons per acre may be applied by hydroseeding). Normally, not more than 2 tons per acre are applied by hydroseeding at any one time. Do not use burnt or hydrated lime when hydroseeding.

- iii. Seed and fertilizer must be mixed on site and seeding must be done immediately and without interruption.
- iv. Fiber mulch may be incorporated into the hydroseeding mixture. Consult Section 2.7 Mulching for standards and specifications for mulch materials.
- b) Dry Seeding This includes use of conventional drop or broadcast spreaders.
  - i. Incorporate seed spread dry into the subsoil at the rates prescribed on the Temporary or Permanent Seeding Summaries or Tables 2.4 or 2.7. The seeded area must then be rolled with a weighted roller to provide good seed to soil contact.
  - ii. Where practical, apply seed in two directions perpendicular to each other. Apply half the seeding rate in each direction.
- c) Drill or Cultipacker Seeding Mechanized seeders that apply and cover seed with soil.
  - i. Cultipacking seeders are required to bury the seed in such a fashion as to provide at least ¼ inches of soil covering. Seedbed must be firm after planting.
  - ii. Where practical, apply seed in two directions perpendicular to each other. Apply half the seeding rate in each direction.
- 4. Sod Installation During periods of excessively high temperature or in areas having dry subsoil, the subsoil must be lightly irrigated immediately prior to laying the sod.

The first row of sod must be laid in a straight line with subsequent rows placed parallel to and tightly wedged against each other. Lateral joints must be staggered to promote more uniform growth and strength. Ensure that sod is not stretched or overlapped and that all joints are butted tight in order to prevent voids, which would cause air drying of the roots.

Wherever possible, lay sod with the long edges parallel to the contour and with staggering joints. Roll and tamp, peg, or otherwise secure sod to prevent slippage on slopes and to ensure solid contact between sod roots and the underlying soil surface.

Immediately water sod following rolling or tamping until the underside of the new sod pad and soil surface below the sod are thoroughly wet. Complete the operations of laying, tamping and irrigating for any piece of sod within eight hours.



### Application Conditions

Polyacrylamide (PAM) must always be applied above a preconstructed sediment trap or basin inflow structure and never be applied directly to slopes that flow directly into a wetland or waters of the District.

### **General Considerations**

- PAM may be applied in dissolved form with water, or it may be applied in dry, granular, or powered form.
- PAM may not be applied within 25 feet of any natural waterbodies.
- PAM will work when applied to saturated soil but is not as effective as applications to dry or damp soil. PAM is not recommended for application on surfaces of pure sand or gravels with no fines or on snow-covered surfaces.
- Keep the granular PAM supply out of the sun. Granular PAM loses its effectiveness in three months after exposure to sunlight and air.
- PAM, combined with water, is very slippery and can be a safety hazard. Care must be taken to prevent spills of PAM powder onto paved surfaces. During an application of PAM, prevent over spray from reaching pavement, as pavement will become slippery. If PAM powder gets on skin or clothing, wipe it off with a rough towel rather than washing with water.

### Preferred Application Method

- 1. The specific PAM formulation and rate of application is unique to each site depending upon the soil types present. Prior to the commencement of site grading, take soil samples and forward to an experienced PAM consultant for laboratory analysis. The PAM consultant should recommend the type of PAM to be utilized, and the application rate and methodologies to be employed. Higher concentrations of PAM than those recommended by the PAM consultant do not provide any additional effectiveness. Forward the PAM recommendations to DOEE for approval.
- 2. Keep a record of the application, including the date of application, product type, weather conditions, method of application, and the name of the applicator, on site.
- 3. Do not add water to powdered PAM. Add PAM powder slowly to water to the desired concentration and mix for 3 to 5 minutes. If water is added to PAM, globs may form that can clog dispensers—this indicates incomplete dissolving of the PAM and, therefore, increases the risk of under-application.
- 4. The application method used should provide uniform coverage to the target area while avoiding drift to non-target areas, especially paved areas.

- 5. Including tackifiers, mulch, seed, and fertilizer in the final PAM mixture is recommended to improve performance and provide additional permanent protection beyond the useful life of the PAM. However, PAM must always be the final additive to the mixture.
- 6. Immediately prepare the PAM mixture prior to application as effectiveness decreases if too much time passes between mixing and application.
- 7. Marking with tracer or colorant to visually track application is recommended.
- 8. Procedures for application must ensure uniform coverage to the target area and avoid drift to non-target areas.
- 9. Confirm that the area where PAM is applied is above a preconstructed sediment trap or basin inflow structure.



### Table 3.1 Silt Fence Slope Length and Fence Length Constraints

Slope Steepness	Slope Length (maximum) (feet)	Silt Fence Length (maximum) (feet)
Flatter than 50:1 (2 %)	unlimited	unlimited
> 50:1 to 10:1 (2% to 10%)	125	1,000
> 10:1 to 5:1 (10% to 20%)	100	750
> 5:1 to 3:1 (20% to 33%)	60	500
> 3:1 to 2:1 (33% to 50%)	40	250
> 2:1 (> 50%)	20	125

### Note:

- In areas of less than 2% slope and sandy soils (USDA general classification system, soil class A), maximum slope length and silt fence length will be unlimited. In these areas, a silt fence may be the only perimeter control required.
- To avoid circumvention, extend the ends of the silt fence upslope to prevent water and sediment from flowing around the ends of the fence.

Silt Fence

- Fence posts must be a minimum of 36 inches long driven 16 inches minimum into the ground. Wood posts must be of sound quality hardwood with 1½ inches minimum width when square cut or 1¾ inches minimum diameter when round. Steel posts must be standard T or U section weighing not less than 1 pound per linear foot.
- 2. Fasten geotextile securely to each fence post with wire ties or staples at top and mid-section. Geotextile must meet the following requirements (Geotextile Class F):

Property	Value	Test Method
Tension Strength	50 lb/in. (minimum)	ASTM D-4595
Tensile Modulus	20 lb/in. (minimum)	ASTM D-4595
Flow Rate	0.3 gal/ft <sup>2</sup> /minute (maximum)	ASTM D-5141
Filtering Efficiency	75% (minimum)	ASTM D-5141

### Table 3.2 Physical Properties of Silt Fence Geotextile

3. Where ends of geotextile fabric come together, overlap, fold, and staple them to prevent sediment bypass.



- Fencing must be at least 42 inches in height and constructed in accordance with the latest District Department of Transportation (DDOT) Details for Chain Link Fencing. The DDOT specification for a 6-foot fence must be used, substituting minimum 42-inch fabric and 6foot length posts. Posts do not need to be set in concrete.
- 2. Securely fasten chain link fence to the fence posts with wire ties. The lower tension wire, brace and truss rods, drive anchors and post caps are not required except on the ends of the fence.
- 3. Securely fasten geotextile to the chain link fence with ties spaced every 24 inches at the top and mid-section.
- 4. Embed geotextile a minimum of 8 inches into the ground.
- 5. When two sections of geotextile fabric adjoin each other, fold and overlap by 6 inches.
- 6. Geotextile must meet the following requirements for Geotextile Class F (from Table 3.2):

Property	Value	Test Method
Tension Strength	50 lb/in. (minimum)	ASTM D-4595
Tensile Modulus	20 lb/in. (minimum)	ASTM D-4595
Flow Rate	0.3 gal/ft²/minute (maximum)	ASTM D-5141
Filtering Efficiency	75% (minimum)	ASTM D-5141

### Table 3.3 Super Silt Fence Slope Length and Fence Length Constraints

Slope Steepness	Maximum Slope Length (feet)	Maximum Silt Fence Length (feet)
Flatter than 10:1 (10%)	unlimited	unlimited
> 10:1 to 5:1 (10% to 20%)	200	1,500
> 5:1 to 3:1 (20% to 33%)	150	1,000
> 3:1 to 2:1 (33% to 50%)	100	500
> 2:1 (> 50%)	50	250

### Note:

• To avoid circumvention, extend the ends of the silt fence 5 horizontal feet upslope at a 45-degree angle relative to the main fence alignment to prevent sediment accumulation.





- Before installing, clear all obstructions including rocks, clods, and debris greater than 1-inch that may interfere with proper function of the filter sock.
- 2. Fill sock uniformly with compost or alternate filter media to desired length, with enough material that the socks do not deform.
- Place socks along contours, with the ends turned upslope at 30 to 45 degrees for a length of at least 5 feet to prevent runoff bypass.
- 4. For entrenched installation, backfill mulch or compost on the upstream side of the sock and tamp to prevent undercutting and piping.
- Anchoring stakes must conform to the following list (a) Minimum 2-inch square cross section hardwood; (b) Driven at least 12 inches below grade, or 8 inches if in dense clay soils; (c) Protrude above filter socks at least 3 inches; (d) Driven in at 45-degree angle upslope; (e) Spaced at no more than 4 feet apart, or 8 feet apart if the filter sock is entrenched 4 inches in to the ground

- 6. Do not use entrenched installation on filter socks smaller than 12 inches in diameter.
- For hard surface installation, such as on pavement, anchoring may be necessary where straight sections exceed 4 feet. When no anchoring is used, the practice must be checked daily, regardless of whether rainfall occurs. Anchored installation is always preferred to non-anchored installation, if possible.
- 8. For at-grade inlet protection, filter socks must completely enclose the drain (Figure 3.1). If used as curb inlet protection, the effective height of the filter sock must not be higher than the height of the curb (Figure 3.2); use 8inch diameter filter sock for standard highway applications.
- 9. If multiple sections of filter sock are needed for a continuous run, overlap ends of separate sections a minimum 2 feet and stake ends.
- 10. To reach taller heights, it is possible to stack filter socks. If using filter socks of multiple sizes, larger socks go beneath smaller socks.



Straw Bale Dike

- 1. Place bales in a row on the contour with the ends of each bale tightly abutting the adjacent bales.
- 2. Entrench each bale 4 inches minimum into the soil and place so the bindings are horizontal. Some of the excavated soil must be built up and compacted at the upstream edge of the dike to prevent piping and undercutting.
- 3. Securely anchor bales in place by either two stakes or rebars driven through the bale 12 inches to 18 inches into the ground. Drive the first stake in each bale toward the previously laid bale at an angle to force the bales together. Drive the stakes flush with the top of the bale.
- 4. Remove all bales when the site has been stabilized. Grade flush and stabilize the trench where the bales were located.



Protection Standard Inlet

- 1. Excavate completely around the inlet to a depth of 18 inches below the notch elevation.
- 2. Drive 2-inch × 4-inch construction grade lumber posts 1 foot into the ground at each corner of the inlet. Place nail strips between the posts on the ends of the inlet. Assemble the top portion of the 2-inch × 4-inch frame using the overlap joint shown on Detail 307.1. The top of the frame (weir) must be 6 inches below adjacent roadways where flooding and safety issues may arise.
- 3. Stretch ½-inch × ½-inch wire mesh tightly around the frame and fasten securely. The ends must meet and overlap at a post.
- 4. Stretch the Geotextile Class E (refer to Appendix A, Table A.2) tightly over the wire mesh with the geotextile extending from the top of the frame to 18 inches below the inlet notch elevation. Fasten the geotextile firmly to the frame. The ends of the geotextile must meet at a post, be overlapped and folded, then fastened down.
- 5. Backfill around the inlet in compacted 6-inch layers until the layer of earth is level with the notch elevation on the ends and top elevation on the sides.
- 6. If the inlet is not in a sump, construct a compacted earth dike across the ditch line directly below it. The top of the earth dike should be at least 6 inches higher than the top of the frame.
- 7. The structure must be inspected periodically and after each rain and the geotextile replaced when it becomes clogged.



STANDARD SYMBOL

### **Construction Specifications**

- 1. Lift grate and wrap with Geotextile Class E to completely cover all openings, secure with wire ties, then set grate back in place.
- 2. Place ¾-inch to 1½-inch stone or equivalent recycled concrete, 4 to 6 inches thick on the grate to secure the fabric.
- 3. If there are any signs of street flooding or water ponding, this structure must be cleaned or replaced, or redesigned with a viable alternative.

At Grade Inlet Protection


Curb Inlet Protection

- 1. Attach a continuous piece of ½-inch × ½-inch wire mesh (30 inches minimum width by throat length, plus 4 feet) to the 2-inch × 4-inch weir (measuring throat length plus 2 feet) as shown on the standard drawing.
- 2. Place a continuous piece of approved Geotextile Class E of the same dimensions as the wire mesh over the wire mesh and securely attach it to the 2-inch × 4-inch weir.
- 3. Securely nail the 2-inch by 4-inch weir to a 9-inch long vertical spacer to be located between the weir and the inlet face (maximum 4 feet apart).
- 4. Place the assembly against the inlet throat and nail (minimum 2-foot lengths of 2 inches by 4 inches to the top of the weir at spacer locations). Extend these 2-inch by 4-inch anchors across the inlet top and be held in place by sandbags or alternate weight.
- 5. Place the assembly so that the end spacers are 1 foot beyond both ends of the throat opening.
- 6. Form the ½-inch by ½-inch wire mesh and the geotextile fabric to the concrete gutter and against the face of the curb on both sides of the inlet. Place clean ¾-inch to 1½-inch stone over the wire mesh and geotextile in such a manner as to prevent water from entering the inlet under or around the geotextile.
- 7. This type of protection must be inspected frequently and the geotextile fabric and stone replaced when clogged with sediment.
- 8. Assure that storm flows do not bypass the inlet by installing a temporary earth or asphalt dike to direct the flow to the inlet.
- 9. If there are any signs of street flooding or water ponding, this structure must be cleaned or replaced, or redesigned with a viable alternative such as Section 3.3 Filter Sock.

Note: Filter Sock is an alternative which is easier to install and maintain than this standard design.



Standard Inlet Guaro

- 1. Position guard sections to cover inlet with at least 2 inches of overlap on each end of inlet.
- 2. Overlap guards at least 2 inches at their intersections.
- 3. Position the desired filter cloth around guard so that it can be tucked in at the bottom.
- 4. Position the cloth so that the horizontal metal strip can hold the cloth in place.
- 5. Do not cover the 2-inch overflow holes with cloth.
- 6. Attach horizontal strip with sheet metal screws.
- 7. Place end clips into position so that the triangular end gap is covered and bend covers the face.
- 8. Place 2-inch attaching clips at the ends and intersections of the guards.
- 9. Insert the attaching bolt, nail, or screw as shown in Detail 307.5.
- 10. Make a watertight connection along the sides and bottom of the inlet guard with the street and curb.
- 11. If there are any signs of street flooding or water ponding, this structure must be cleaned or replaced or redesigned with a viable alternative.



- 1. Prepare swales and ditches in accordance with the construction specifications described in Temporary Swales.
- 2. Construct the check dam of 4 to 7-inch stone. Place the stone so that it completely covers the width of the channel and is keyed into the channel banks.
- 3. Construct the top of the check dam so that the center is approximately 6 inches lower than the outer edges, forming a weir that water can flow across.
- 4. The maximum height of the check dam at the center must not exceed 2 feet or half the height of the channel.
- 5. Line the upstream side of the check dam with approximately 1 foot of ¾ to 1½-inch aggregate.
- 6. Remove accumulated sediment when it has built up to half of the original height of the weir crest.



Silt Fence on Pavement

- 1. Use nominal 2-inch by 4-inch lumber.
- 2. Use woven slit film geotextile, as specified in Appendix A.
- 3. Space upright supports nor more than 10 feet apart.
- 4. Provide a 2-foot opening between every set of supports and place stone in the opening over geotextile.
- 5. Keep silt fence taut and securely staple to the upslope side of upright supports. Extend geotextile under 2 × 4.
- 6. Where two sections of geotextile adjoin overlap, fold, and staple to post in accordance with this detail. Attach lathe.
- 7. Provide a mastic seal between pavement, geotextile, and 2 × 4 to prevent sedimentladen water from escaping beneath silt fence installation.
- 8. Secure boards to pavement with 40D 5-inch minimum length nails.
- 9. Remove accumulated sediment and debris when bulges develop in silt fence or when sediment reaches 25% of fence height. Replace geotextile if torn. Maintain water tight seal along bottom. Replace stone if displaced.



**Diversion** Fence

- 1. Use 42-inch high, 9 gauge or thicker chain link fencing  $(2^{3}/_{8})$ -inch maximum opening).
- 2. Use 2  $\frac{3}{8}$ -inch diameter galvanized steel posts of 0.095-inch wall thickness and 6-foot length spaced no further than 10 feet apart. The posts do not need to be set in concrete.
- 3. Fasten chain link fence securely to the fence posts with wire ties.
- 4. Secure 10-mil or thicker UV-resistant, impermeable sheeting to chain link fence with ties spaced every 24 inches at top, mid-section, and below ground surface.
- 5. Extend sheeting a minimum of 4 feet along flow surface and embed end a minimum of 8 inches into ground. Soil stabilization matting may be used in lieu of impermeable sheeting along flow surface.
- 6. When two sections of sheeting adjoin each other, overlap by 6 inches and fold with seam facing downgrade.



Dike/Swale

- 1. Excavate or shape the swale to line, grade, and cross section as required to meet the criteria specified in the standard.
- 2. Compact the fill by earth moving equipment in maximum 6-inch lifts, where the height of the fill is greater than 6 inches.
- 3. Complete the stabilization of the area disturbed by the dike and swale within 7 days and in accordance with the stabilization specifications on the plans (see Vegetative Stabilization).
- 4. A perimeter dike/swale must have an outlet that functions without causing erosion.
- 5. Outlet runoff diverted from a protected or stabilized upland area directly onto an undisturbed stabilized area.
- 6. Convey runoff diverted from a disturbed or exposed upland area to a sediment trapping device such as a sediment trap or sediment basin.
- 7. The location of a dike/swale may need to be adjusted in the field in order to provide positive drainage to a trapping device and to utilize the most suitable outlet.





3. 4 TO 7-INCH STONE OR RECYCLED CONCRETE EQUIVALENT PRESSED INTO SOIL USING CONSTRUCTION EQUIPMENT IN A MINIMUM 7-INCH LAYER.

# Earth Dike



- 1. All temporary earth dikes must have uninterrupted positive grade to an outlet. Earth dikes having longitudinal slopes flatter than 1% should have spot elevations along the flow line.
- 2. Direct diverted runoff from disturbed areas to a sediment trapping device.
- 3. Outlet diverted runoff from undisturbed areas directly onto an undisturbed, stabilized area at a non-erosive velocity (≤ 4 feet per second for well-established turfgrass).
- 4. Remove and dispose of all trees, brush, stumps, obstructions, and other objectionable material so as not to interfere with the proper functioning of the earth dike berm and flow channel.
- 5. Excavate or shape the dike to line, grade, and cross section as required to meet the criteria specified herein and be free of bank projections or other irregularities which will impede normal flow.
- 6. Compact the fill by earth moving equipment in maximum 12-inch lifts.
- 7. Place all earth removed and not needed for construction so that it will not interfere with the functioning of the earth dike berm and flow channel.
- 8. Stabilize flow channel as required by design selection using Table 4.3 or Table 4.4. Stone lining must have geotextile underlayment of Class SD Type I non-woven or PE Type I non-woven fabric.



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- 1. Use minimum width of 10 feet to allow for vehicular passage.
- 2. Place non-woven geotextile of Class SD Type I non-woven or PE Type I non-woven fabric over the earth mound prior to placing stone. If the flow channel lining necessary according to Table 4.3 and the channel characteristics is 4 to 7-inch stone, install this as the base layer, and apply the 2 to 3-inch stone for the mountable berm on top of the 4 to 7-inch stone for the vehicle crossing surface maintaining a smooth flow path line. The geotextile underlayment is only necessary where there is not already a stone base.
- 3. Place 2 to 3-inch stone or equivalent recycled concrete at least 6 inches deep over the length and width of the mountable berm. Ensure a smooth transition to and from the flow channel above and below the mountable berm section.
- 4. Maintain line, grade, and cross section. Add stone or make other repairs as conditions demand to maintain specified dimensions. Remove accumulated sediment and debris. Maintain positive drainage.



morary Swales

CROSS SECTION

- 1. All temporary swales must have uninterrupted positive grade to an outlet. Swales having longitudinal slopes flatter than 1% should have spot elevations along the flow line.
- 2. Convey diverted runoff from disturbed areas to a sediment trapping device.
- 3. Outlet diverted runoff from an undisturbed area directly into an undisturbed stabilized area at a non-erosive velocity (≤ 4 feet per second for well-established turfgrass).
- 4. Remove and dispose of all trees, brush, stumps, obstructions, and other objectionable material so as not to interfere with the proper functioning of the swale flow channel.
- 5. Excavate or shape the swale to line, grade, and cross section as required to meet the criteria specified herein and be free of bank projections or other irregularities that will impede normal flow.
- 6. Compact fill, if necessary, by earth moving equipment in maximum 12-inch lifts.
- 7. Place all earth removed and not needed for construction so that it will not interfere with the functioning of the swale flow channel.
- 8. For vehicle or machine crossings, reduce the side slopes of the swale to 5:1 horizontal to vertical, and 2 to 3-inch stone must be placed at least 6 inches deep over a layer of Class SD Type I or PE Type I non-woven geotextile. If the flow channel lining material is type 3 (4 to 7-inch stone), the geotextile is not required, and the 2 to 3-inch stone can be laid directly on top of the 4 to 7-inch stone lining. Flow channel depth of 1 foot minimum must be maintained through cross section.



Bd

PROFILE

THE R

Rock Outlet Protection

TANDARD

SYMBO





Rock Outlet Protection

- 1. Prepare the subgrade for the riprap to the required lines and grades. Compact any fill required in the subgrade to a density of approximately that of the surrounding undisturbed material.
- 2. Conform the rock or gravel to the specified grading limits when installed in the riprap.
- 3. Use filter stone or nonwoven geotextile as specified and protect from punching, cutting, or tearing. Repair any damage other than an occasional small hole by placing another piece of geotextile fabric over the damaged part or by completely replacing the geotextile fabric. All overlaps whether for repairs or for joining two pieces of geotextile fabric must be a minimum of 1 foot. Extend geotextile at least 6 inches beyond edges of riprap and embed at least 4 inches at sides of the riprap.
- 4. Stone for the riprap outlets may be placed by equipment. Construct the outlets to the full course thickness in one operation and in such a manner as to avoid displacement of underlying materials. Deliver and place the riprap in a manner that will ensure that it is reasonably homogenous with the smaller stones and spalls filling the voids between the larger stones. Place riprap in a manner that prevents damage to the filter blanket or geotextile fabric. Hand placement will be required to the extent necessary to prevent damage to the permanent works.
- 5. Place the stone so that it blends in with the existing ground. If the stone is placed too high, then the flow will be forced out of the channel and scour adjacent to the stone will occur.



<u>Se</u>diment Trap Pipe Outlet

- Clear, grub, and strip the area under the embankment of any vegetation and root mat. Clear the pool area.
- The fill material for the embankment must be free of roots or other woody vegetation as well as oversized stones, rocks, organic material, or other objectionable material. Place the fill in lifts not to exceed 9 inches, and machine compact it. Overfill the embankment 6 inches to allow for settlement.
- 3. All cut and fill slopes must be 2:1 or flatter.
- 4. All pipe connections must be watertight.
- 5. Carry out construction operations in such a manner that erosion and water pollution are abated. Once constructed, stabilize the top and outside face of the embankment with seed and mulch. Protect points of concentrated inflow in accordance with Chapter 4 Conveyance or Chapter 5 Water Control criteria. Stabilize the remainder of the interior slopes (one time) with seed and mulch upon trap completion and monitor and maintain erosion free during the life of the trap.

- 6. Remove the structure and stabilize that area when the drainage area has been permanently stabilized.
- Above the wet storage elevation, perforate the riser with ½-inch wide by 6-inch long slits or 1-inch diameter holes spaced 6 inches vertically and horizontally. No perforations will be allowed within 6 inches of the horizontal barrel.
- Wrap the riser with ½-inch hardware cloth (wire) then wrap with Geotextile Class E.
  Extend the geotextile fabric 6 inches above the highest slit and 6 inches below the lowest slit.
  Where ends of geotextile fabric come together, overlap, fold, and fasten them to prevent bypass. Replace geotextile fabric as necessary to prevent clogging.
- 9. Use straps or connecting bands to hold the geotextile fabric and wire fabric in place and place them at the top and bottom of the cloth.
- 10. Hand compact the fill material around the pipe spillway in 4-inch layers. Place a minimum of 2 feet of hand-compacted backfill over the pipe spillway before crossing it with construction equipment.



### SECTION B-B

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- 1. Clear, grub, and strip the area under the embankment of any vegetation and root mat. Remove all surface soil containing high amounts of organic matter, and stockpile or dispose of it properly. Haul all objectionable material to the designated disposal area.
- 2. The fill material for the embankment must be free of roots and other woody vegetation, as well as over-sized stones, rocks, organic material, or other objectionable material. Place the fill in lifts not to exceed 9 inches, and machine compact it. Overfill the embankment 6 inches to allow for settlement.
- 3. Construct the outlet section in the embankment. Protect the connection between the riprap and the soil from piping by using geotextile or a keyway cutoff trench between the riprap structure and soil. (a) Place geotextile Class SE over the bottom and sides of the outlet channel prior to the placement of stone. Sections of geotextile fabric must overlap at least I foot with the section nearest the entrance placed on top. Embed the geotextile fabric at least 6 inches into existing ground at the entrance of the outlet channel; or (b) Excavate a cutoff trench along the centerline of the spillway foundation extending up the sides to the height of the dam. The trench must be at least 2 feet deep by 2 feet wide with 1:1 side slopes.
- 4. Clear the pond area below the elevation of the crest of the spillway to facilitate sediment cleanout.
- 5. All cut and fill slopes must be 2:l or flatter.
- 6. Ensure that the stone (drainage) section of the embankment has a minimum top width of 4 feet and maximum side slopes of 2:1 that extend to the bottom of the spillway section.
- 7. Construct the minimum finished stone spillway bottom width, as shown on the plans, with 2:1 side slopes extending to the top of the over filled embankment. Keep the thickness of the sides of the spillway outlet structure at a minimum of 21 inches. The weir must be level and constructed to grade to assure design capacity.

### **Construction Specifications Continued**

- 8. Material used in the stone section must be a well-graded mixture of stone with a d<sub>50</sub> size of 9 inches and a maximum stone size of 14 inches. The stone may be machine placed and the smaller stones worked into the voids of the larger stones. The stone should be hard, angular, and highly weather-resistant.
- 9. Discharge inlet water into the basin in a manner to prevent erosion. Use temporary slope drains or diversions with outlet protection to divert sediment-laden water to the upper end of the pool area to improve basin trap efficiency.
- 10. Ensure that the stone spillway outlet section extends downstream past the toe of the embankment until stable conditions are reached and the outlet velocity is acceptable for the receiving stream. Keep the edges of the stone outlet section flush with the surrounding ground, and shape the center to confine the outflow stream.
- 11. Direct emergency bypass to natural, stable areas. Locate bypass outlets so that flow will not damage the embankment.
- 12. Stabilize the embankment and all disturbed areas above the sediment pool and downstream from the trap immediately after construction and maintain erosion free during the life of the trap.
- 13. Show the distance from the top of the spillway to the sediment cleanout level (half the design depth) on the plans and mark it in the field.



### PERSPECTIVE VIEW



Sediment Β asin Skimmer





Sediment Basin Anti-Seep Collar



Legend

- n = Manning's coefficient of roughness
- Hp = difference in elevation between the crest of the emergency spillway and the control section and water surface of the reservoir, in feet
- b = bottom width of emergency spillway at the control section, in feet (8 feet minimum)
- Q = total discharge, in cfs
- V = velocity, in feet per second, that will exist in the channel below the control section, at design Q, if constructed to slope (S) that is shown (Vmax = 5 fps)
- S = flattest slope, in %, allowable for the channel below the control section
- X = minimum length of the channel below the control section, in feet
- Z = side slope ratio (minimum Z = 3)

Note: For a given Hp a decrease in the exit slope from S as given in the table decreases the spillway discharge but increasing the exit slope from S does not increase the discharge. If an exit slope (Se) steeper than S is used, then the velocity (Ve) in the exit channel will increase according to the following relationship:

$$Ve = V\left(\frac{Se\ 0.3}{S}\right)$$

### Notes:

- 1. Adding a sediment basin after ESC plan approval requires a revised plan.
- 2. See Chapter 7 Dewatering for dewatering strategies when sediment basin is no longer needed.

### **Construction Specifications**

- <u>Site Preparation</u> Install perimeter sediment control devices prior to clearing and grubbing. Clear, grub, and strip areas of topsoil where the embankment is to be placed to remove trees, vegetation, roots, or other objectionable material. Do not clear the pool area until completion of the dam embankment unless the pool area is to be used for borrow. In order to facilitate clean-out and restoration, clear the pool area (measured at the top of the pipe spillway) of all brush, trees, and other objectionable materials.
- <u>Cutoff Trench</u> Excavate a cutoff trench along the centerline of earth fill embankments. The minimum depth must be 4 feet. Extend the trench up both abutments to the riser crest elevation. The minimum bottom width must be 2 feet, but wide enough to permit operation of excavation and compaction equipment. The side slopes must be no steeper than 1:1. Compaction requirements must be the same as those for the embankment. Dewater the trench during the backfilling-compaction operations. See Chapter 7 Dewatering.

### **Construction Specifications Continued**

- 3. Embankment Take the fill material from approved areas shown on the plans, and clear mineral soil of roots, woody vegetation, oversized stones, rocks, or other objectionable material. Do not place relatively pervious materials such as sand or gravel (Unified Soil Classes GW, GP, SW, and SP) or organic materials (Unified Soil Classes OL and OH) in the embankment. Scarify areas on which fill is to be placed prior to placement of fill. The fill material must contain sufficient moisture so that it can be formed by hand into a ball without crumbling. If water can be squeezed out of the ball, it is too wet for proper compaction. Place fill material in 6-inch to 8-inch thick continuous lifts over the entire length of the fill. Obtain compaction by routing and hauling the construction equipment over the fill so that the entire surface of each layer of the fill is traversed by at least one wheel or tread track of the equipment or using a compactor. Construct the embankment to an elevation 10% higher than the design height to allow for settlement.
- 4. <u>Vegetative Treatment</u> Stabilize the embankment in accordance with Vegetative Stabilization immediately following construction. The embankment must not remain unstabilized for more than 7 days. Once constructed, stabilize the top and outside face of the embankment with seed and mulch. Stabilize the remainder of the interior slopes (one time) with seed and mulch. Upon basin completion, monitor and maintain erosion free during the life of the basin.

# **Construction Specifications Continued**

- Principal Spillway Securely attach steel risers to the barrel or barrel stub by welding the 6. full circumference and making a watertight structural connection. Pour concrete risers with the principal spillway in place or precast with voids around the principal spillway and fill with concrete or shrink proof grout for watertight connection. The barrel stub must be attached to the riser at the same percent (angle) of grade as the outlet conduit. The connection between the riser and the riser base must be watertight. All connections between barrel sections must be achieved by approved watertight band assemblies. Place the barrel and riser on a firm, smooth foundation of impervious soil as the embankment is constructed. Breaching the embankment to install the barrel is unacceptable. Do not use pervious materials such as sand, gravel, or crushed stone as backfill around the pipe or antiseep collars. Place the fill material around the pipe spillway in 4-inch lifts and hand compact under and around the pipe to at least the same density as the adjacent embankment. Backfill a depth of 1.5 times the pipe diameter (minimum) over the principal spillway and hand compact before crossing it with construction equipment.
- <u>Emergency Spillway</u> Install the emergency spillway in undisturbed ground. The achievement of planned elevations, grades, design width, and entrance and exit channel slopes are critical to the successful operation of the emergency spillway and must be constructed within a tolerance of + 0.2 feet.
- 8. <u>Safety</u> Meet local requirements concerning fencing and signs, warning the public of hazards of soft sediment and floodwater.


- 1. Wrap the inner pipe with ¼-inch hardware cloth and then geotextile over the hardware cloth. Wrap the outer pipe with ¼-inch hardware cloth.
- Excavate 8 feet by 8 feet by 4 feet deep pit for pipe placement. Place clean ¾ -inch to 1½-inch stone or equivalent recycled concrete, 6 inches in depth prior to pipe placement.
- 3. Both the inner and outer pipes must extend a minimum of 12 inches above the anticipated water surface elevation (or riser crest elevation when dewatering a basin).
- 4. Backfill pit around the outer pipe with ¾-inch to 1½-inch clean stone or equivalent recycled concrete and extend stone a minimum of 6 inches above anticipated water surface elevation.
- 5. Place the suction hose from the pump inside the inner pipe to begin dewatering. Place the discharge hose in a stabilized area downslope of unstabilized areas to prevent erosion. Meadow or wooded areas are preferred discharge locations but storm drains and paved areas are acceptable.



- 1. Wrap the pipe with ¼-inch galvanized hardware cloth and then geotextile over the hardware cloth.
- 2. Excavate the pit to 3 times the pipe diameter and 4 feet in depth. Place clean ¾-inch to 1½-inch stone or equivalent recycled concrete, 6 inches in depth prior to pipe placement.
- 3. Set the top of pipe a minimum of 12 inches above the anticipated water surface elevation.
- 4. Backfill pit around the outer pipe with <sup>3</sup>/<sub>4</sub>-inch to 1<sup>1</sup>/<sub>2</sub>-inch clean stone or equivalent recycled concrete and extend stone a minimum of 6 inches above anticipated water surface elevation.
- 5. Place the suction hose from the pump inside the pipe to begin dewatering. Place the discharge hose in a stabilized area downslope of unstabilized areas to prevent erosion. Meadow or wooded areas are preferred discharge locations but storm drains and paved areas are acceptable.

STANDARD

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ELEVATION

- 1. Construct the structure with steel drums, sturdy wood, or other material suitable for handling the pressure exerted by the volume of water.
- 2. Sediment tanks have a minimum depth of 2 feet.
- 3. Once the water level nears the top of the tank, shut off the pump while the tank drains and additional capacity is made available.
- 4. Design the tank to allow for emergency flow over top of the tank.

Horizontal Tank **Portable Sediment** 

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<del>symbol</del> PST

STANDARD



- 1. Use 60-inch corrugated metal or plastic pipe with 1-inch diameter perforations, 6 inches on center for the inner pipe. Line pipe with nonwoven geotextile sandwiched between, and attached to, ¼-inch hardware cloth.
- 2. Overlap geotextile 8 inches minimum at vertical seam and at the bottom plate.
- 3. Anchor geotextile at bottom of tank with 4 inches of 2-inch to 3-inch clean stone or equivalent recycled concrete.
- 4. Use 72-inch corrugated metal or plastic outer pipe with permanent outflow pipe with invert lower than inflow pipe.
- 5. Inflow pipe must discharge into inner pipe and be removable.
- 6. Place tank on level surface and discharge to a stable area at a non-erosive rate.

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PLAN VIEW



- 1. Tightly seal sleeve around the pump discharge hose with a strap or similar device.
- 2. Place filter bag on 8 inches suitable base located on a level or 5% maximum sloping surface, and discharge to a stabilized area. Extend base a minimum of 12 inches from the edges of the bag.
- 3. Control pumping rate to prevent excessive pressure within the filter bag in accordance with the manufacturer recommendations. As the bag fills with sediment, reduce pumping rate.
- 4. Remove and properly dispose of filter bag upon completion of pumping operations or after bag has reached capacity, whichever occurs first. Spread the dewatered sediment from the bag in an approved upland area and stabilize with seed and mulch by the end of the work day. Restore the surface area beneath the bag to original condition upon removal of the device.

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STANDARD SYMBOL

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- 1. The contractor must conduct operations and maintain the project site so as to minimize the creation and dispersion of dust. Use dust control throughout the work at the site.
- 2. The contractor must provide clean water, free from salt, oil, and other deleterious material to be used for on-site dust control.
- 3. The contractor shall supply water-spraying equipment capable of accessing all work areas.
- 4. The contractor shall implement strict dust control measures during active construction periods onsite. These control measures shall generally consist of water applications that shall be applied a minimum of once per day during dry weather or more often as required to prevent dust emissions.
- 5. For water application to undisturbed soil surfaces, the contractor shall:
  - a) Apply water with equipment consisting of tank, spray bar, and pump with discharge pressure gauge.
  - b) Arrange spray bar height, nozzle spacing and spray pattern to provide complete coverage of ground with water.
  - c) Disperse water through nozzles on spray bar at 20 psi (137.8 kPa) minimum. Keep areas damp without creating nuisance conditions such as ponding.
- 6. For water application to soil surfaces during demolition and/or excavation, the contractor shall:
  - a) Apply water with equipment consisting of a tank, pump with discharge gauge, hoses and mist nozzles.
  - b) Locate tank and spraying equipment so that the entire excavation area can be misted without interfering with demolition and/or excavation equipment or operations. Keep areas damp without creating nuisance conditions such as ponding.
  - c) Apply water spray in a manner to prevent movement of spray beyond the site boundaries.

#### EXCAVATED WITHOUT STRUCTURE



### WASHOUT STRUCTURE WITH STRAW BALES OR FILTER SOCK



On-Site Concrete Washout Structure

- 1. Locate the washout structure a minimum of 50 feet away from open channels, storm drain inlets, sensitive areas, wetlands, buffers, and water courses and away from construction traffic.
- 2. Size the washout structure for the volume necessary to contain wash water and solids and maintain at least 4 inches of freeboard.
- 3. Prepare the soil base to be free of rocks or other debris that may cause tears or holes in the liner. For the liner use UV resistant, impermeable sheeting, free of holes and tears or other defects that compromise impermeability of the material.
- 4. Provide a sign for the washout near the BMP.
- 5. Apply a new liner before reusing the station for additional washouts after maintenance has occurred.

SECTION VIEW



**Free Protection** 



**Tree Protection** 

- 1. Groups of trees and individual trees selected for retention must be accurately located on the plan and designated as "tree(s) to be saved." Individual specimens that are not part of a tree group must also have their species and diameter noted on the plan.
- 2. Prior to construction and before the preconstruction meeting, mark individual trees and stands of trees to be retained within the limits of clearing at a height visible to equipment operators.
- 3. During any preconstruction meeting, review tree preservation and protection measures with the contractor as they apply to that specific project.
- 4. Define the critical root zone.
- 5. Construct the tree protection zone.
- 6. Tree branches that interfere with the construction may be tied back or pruned only to the point necessary to complete the work. Tying back or trimming of all branches must be in accordance with accepted arboricultural practices (ANSI A300, part 8) and be performed under supervision of an arborist.
- 7. Mechanical boring is required to tunnel under the CRZ. The boring must be at a minimum depth of 30 inches. Excavations must proceed with care by use of hand tools.
- 8. Do not cut roots larger than 2 inches in diameter without DOEE's permission.
- 9. Wrap exposed roots 2 inches and larger in diameter in burlap or other approved material and keep moist at all times.

- 10. Heavy equipment, vehicular traffic, or stockpiles of any construction materials (including topsoil) are not permitted within the CRZ of any tree to be retained unless the specifications shown on page 84 are followed per arborist's direction. Silt fencing must not be trenched.
- 11. Trees to be removed must be removed in a controlled manner and not felled, pushed, or pulled into trees being retained. Do not damage tree trunks and limbs by construction equipment. Do not nail boards to trees during building operations.

