2010 Maryland Standards and Specifications for Soil Erosion and Sediment Control

DRAFT

OCTOBER 2009

Maryland Department of the Environment

Water Management Administration

in association with

Natural Resources Conservation Service

and

Maryland Association of Soil Conservation Districts

MARYLAND

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Department of the Environment

MDE

Martin O'Malley, Governor
Anthony G. Brown, Lt. Governor
Shari T. Wilson, Secretary
Robert M. Summers, Deputy Secretary

1800 Washington Blvd.
Baltimore, MD 21230
410-537-3000
www.mde.state.md.us

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Allan Stahl (Natural Resources Conservation Service)
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Bill Tharpe (Harford County)
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David Bourdon (Prince George's County SCD)
James Whisonant (Prince George's County SCD)
Lance Gardner (Prince George's County SCD)
David Kuykendall (Montgomery County)
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Dee Price (Washington County SCD)
Karuna Pujara (SHA)
Steve Buckley (SHA)
Kate Meade (MES)
Kerri Martin (MES)
Michael Herzberger (MES)
James Tracy (MDE)
Amanda Malcolm (MDE)
Richard Trickett (MDE)
Maria Warburton (MDE)
Ken Pensyl (MDE)

The consultant Project Team members included the following individuals:

Brian Noll, Project Manager (WBCM)
James Kramperth (WBCM)
Jason Reinhardt (WBCM)
Mike Moore (WBCM)
Phil Carroll (WBCM)
Dennis Santeufemio, E.I.T. (WBCM)
Melisa Keimig (WBCM)
Charlene Osborne (WBCM)
Saada Russell (WBCM)
Tristram Madden. (Michael Baker)
Vic Siaurusaitus (Michael Baker)

ABSTRACT/EXECUTIVE SUMMARY

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The draft ***"2010 Maryland Standards and Specifications for Soil Erosion and Sediment Control"*** provides guidance for applicants, designers, plan reviewers, developers, contractors, and inspectors to control sediment laden runoff from construction sites and ensure the protection of Maryland's stream, rivers, and the Atlantic Coastal and Chesapeake Bays.

The document consists of an introduction, a planning and design section, seven sections of erosion and sediment control practices, and appendices. Planning (e.g., Section A) is an important element for today's site design measures, especially when required to meet "Environmental Site Design (ESD) to the maximum extent practicable (MEP)." A brief description of each section is outlined below:

Introduction
This section describes the purpose of the manual, results of sediment damage, and factors that influence soil erosion.

Section A ***Planning and Design***
This section includes the design and review process as it relates to ESD. It outlines design principles that should be applied throughout the process from planning through design, review, inspection and enforcement. A design methodology is presented with tools for selecting practices under certain conditions. An erosion and sediment control table (Table A-3) is provided as a quick reference summarizing the practices, their primary purpose, design criteria, and associated practices. Also provided is a flow chart (Turbidity Control System; Figure A-2) that uses soil type and drainage area to determine whether standard practices are acceptable or advanced practices are required.

Section B ***Grading and Stabilization***
This section describes stabilization and grading requirements to minimize potential for erosion during construction. Proper utilization of these practices controls erosion at the source and assists in complying with ESD requirements.

Section C ***Water Conveyance***
Practices in this section are primarily used to convey water around the active construction area (clear-water diversions) or to a sediment control practice. The conveyance practices can be used to divide drainage areas into manageable segments. The practice is selected based on design criteria such as conveying clear-water versus sediment-laden water, slope, and drainage area.

Section D ***Erosion Control***
This section uses structural practices to reduce erosion from concentrated flow. Erosion control practices can be used for inflow or outlet protection, velocity checks in ditches, or to convey water down a slope in non-erosive manner. The design of these practices is based on drainage area, flow rate, location, slope and velocity.

Section E ***Filtering***
This section describes practices that trap and filter sediment for relatively small drainage areas. Some of these practices are used in sheet flow conditions and work with ESD principles. These are designed based on upstream slope and the length of upstream runoff (slope-length). Other filtering practices trap and filter water in concentrated flow conditions.

Section F ***Dewatering***

Dewatering practices are used to remove the water from areas such as foundations for buildings and bridges, utilities, and sediment traps and basins while filtering sediment. Critical elements for dewatering practices are the location and clarity of the discharge. As such, turbidity control may be required.

Section G ***Sediment Trapping***

Sediment trapping practices are used to detain and settle sediment laden runoff from larger drainage areas and include sediment traps and sediment basins. Sediment traps can be used for drainage areas up to 10 acres. A sediment basin that is going to remain as a permanent structure requires an engineering design. Also included are associated practices to be used with the design and construction of sediment traps and basins.

Section H ***Miscellaneous***

This section includes material specifications, temporary channel crossing practices, dust control, etc. Additionally, guidelines are provided to assist in developing a turbidity control system that uses coagulants in either a passive or active application.

Glossary

Definitions can be found in the Glossary.

Appendices

Various appendices further assist those involved in designing, reviewing, constructing, and inspecting erosion and sediment controls. Appendix A contains sediment and erosion controls for forest harvest operations are included for those endeavors. Erosion and sediment control certifications as well as a sediment control checklist can be found in Appendix B. ESD design examples with erosion and sediment control measures are provided in Appendix C. Appendix D contains photographs of properly installed erosion and sediment control measures.

2010 MARYLAND EROSION AND SEDIMENT CONTROL

DESIGN AND CONSTRUCTION MANUAL

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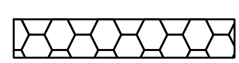
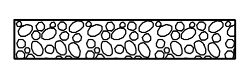
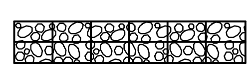
STANDARD SYMBOLS

STABILIZED CONSTRUCTION ENTRANCE	SCE
STABILIZED CONSTRUCTION ENTRANCE WITH WASH RACK	SCE-WR
EARTH DIKE	A-I
TEMPORARY SWALE	A-I
PERIMETER DIKE/SWALE	PDS-I
TEMPORARY ASPHALT BERM	TAB
CLEAR WATER DIVERSION PIPE	CWD - 12
TEMPORARY BARRIER DIVERSION	TBD
MOUNTABLE BERM	MB
DIVERSION FENCE	DF
PIPE SLOPE DRAIN	PSD - 12
STONE CHECK DAM	CD
RIPRAP INFLOW PROTECTION	RRP
GABION INFLOW PROTECTION	GP

STANDARD SYMBOLS

ROCK OUTLET PROTECTION I	ROPI
ROCK OUTLET PROTECTION II	ROPII
ROCK OUTLET PROTECTION III	ROPIII
LEVEL SPREADER	LS
SILT FENCE	SF
SILT FENCE ON PAVEMENT	SFOP
SUPER SILT FENCE	SSF
WOODCHIP BERM	A-WCB B-WCB
TEMPORARY STONE OUTLET STRUCTURE	TSOS
TEMPORARY GABION OUTLET STRUCTURE	TGOS
STANDARD INLET PROTECTION	SIP
AT-GRADE INLET PROTECTION	AGIP
CURB INLET PROTECTION (COG OR COS INLETS)	CIP
MEDIAN SUMP INLET PROTECTION	MSIP

STANDARD SYMBOLS

MEDIAN INLET PROTECTION	MIP
COMBINATION INLET PROTECTION	COIP
CATCH BASIN INSERT	CBI
GABION INLET PROTECTION	GIP
REMOVABLE PUMPING STATION	RPS
SUMP PIT	SP
PORTABLE SEDIMENT TANK	PST
FILTER BAG	FB
SUBSURFACE DRAIN	SSD
WATTLES	WTL
STRAW BALES	SB
SOIL STABILIZATION MATTING	
PLACED RIPRAP DITCH	
GABIONS	

STANDARD SYMBOLS

RIPRAP OUTLET SEDIMENT TRAP	ROST
STONE/RIPRAP OUTLET SEDIMENT TRAP	SROST
PIPE OUTLET SEDIMENT TRAP	POST
LIMIT OF DISTURBANCE	——LOD——
EXISTING CONTOURS	-- ——100-- -- --
PROPOSED CONTOURS	——100——
SEDIMENT BASIN BAFFLES	BB

SECTION A – PLANNING AND DESIGN

A-1 ENVIRONMENTAL SITE DESIGN (ESD)

The Stormwater Management Act of 2007 (Act) requires that the Code of Maryland Regulations (COMAR) be modified and a model ordinance developed for the purpose of implementing environmental site design (ESD) to the maximum extent practicable (MEP). Significant changes to COMAR and the 2000 Maryland Stormwater Design Manual, Volumes I & II (Design Manual), were adopted in May 2009. These changes specify how ESD is to be implemented, how the MEP standard is to be met, and how the review of erosion and sediment control and stormwater management plans is to be integrated.

The Act defines ESD as "using small-scale stormwater management practices, nonstructural techniques, and better site planning to mimic natural hydrologic runoff characteristics and minimize the impact of land development on water resources." ESD also emphasizes conserving natural features, drainage patterns, and vegetation; minimizing impervious surfaces; slowing down runoff; and increasing infiltration. This definition, the modifications to COMAR, and the procedures and practices presented herein will guide developers and designers submitting plans for approval. The changes required to implement the Act are significant and will compel consideration of runoff control from the start of the land development process. As a result, erosion and sediment control and stormwater management for new development and redevelopment will be conceived, designed, reviewed, and built differently than prior to passage of the Act.

A-2 DESIGN AND REVIEW PROCESS

The Act requires the establishment of a comprehensive process for the review and approval of sediment control, and stormwater management plans. Planning for erosion and sediment control needs to start early and be integrated with stormwater management practices. Additionally, acceptable plans must be designed to prevent soil erosion from developing, prevent increases in stormwater runoff, and minimize pollutants in nonpoint discharges. A coordinated, comprehensive review process includes the submittal and review of erosion and sediment control and stormwater management plans for each of the following three phases of plan development:

1. **CONCEPT PLAN**

2. **SITE DEVELOPMENT PLAN**

3. **FINAL PLAN**

This process is outlined and described in more detail in Figure A.1.

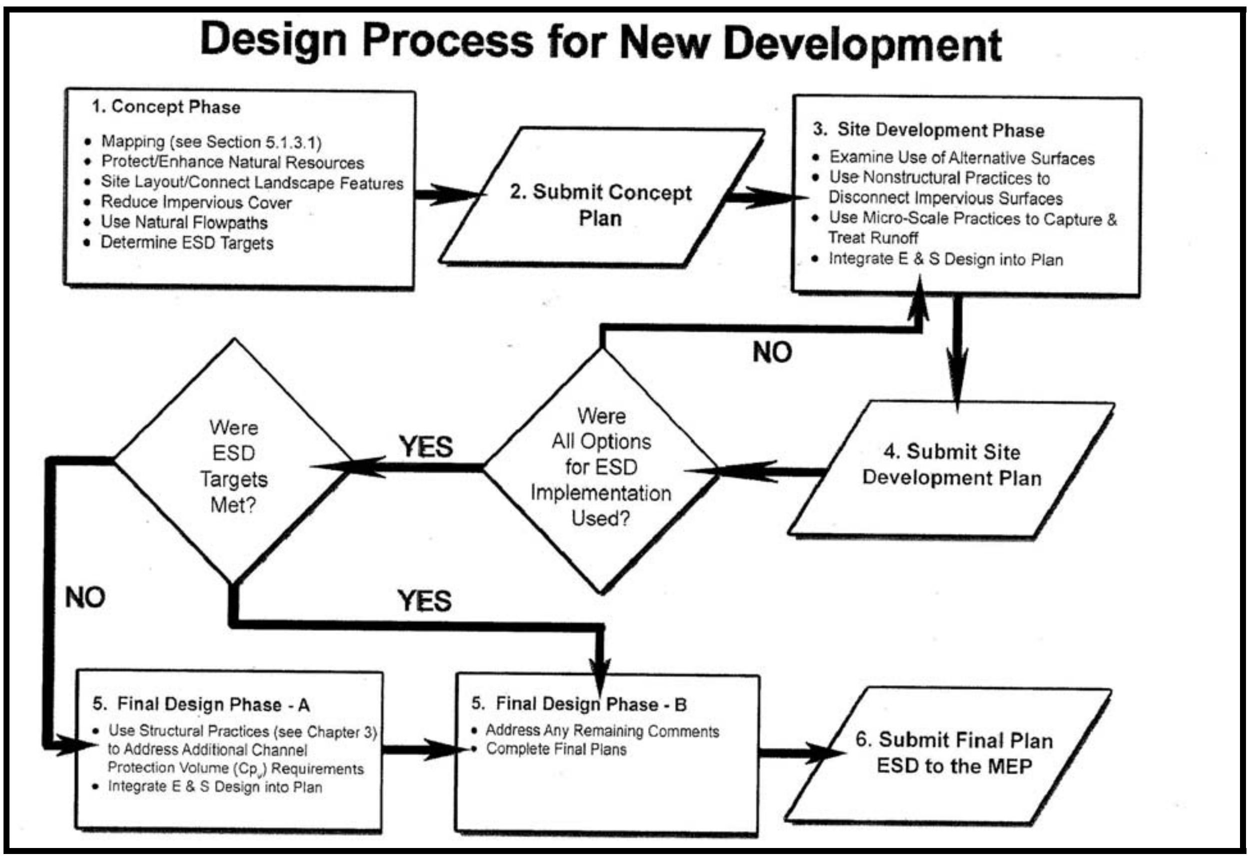


Figure A.1: Design Process for New Development
(Source: New Chapter 5 of 2000 Stormwater Design Manual)

Concept Plan
Developing a site plan begins with gathering, mapping, and analyzing information about the physical characteristics of the site. Designers should visit the proposed development site in order to clearly understand its topographic, vegetative, drainage and soil characteristics. Relying exclusively on topographic maps, soils maps, and other materials found in the office without field verification is not an acceptable planning technique.

The topography of the site, mapped at suitable contour intervals, will allow the identification of drainage patterns, slopes, and natural resources such as wetlands, seeps, streams, forests, critical areas, and buffers. Mapping the flow of water onto, through, and off the site enables the delineation of drainage areas and flow patterns. Downstream wetlands, lakes, streams, structures, or other areas particularly sensitive to damage from erosion and sedimentation should also be investigated, mapped, and incorporated into the design to afford these areas additional protection. The design should never allow sediment to flow through a sensitive area.

Investigating the site soil characteristics by geotechnical testing and referring to local soil surveys enables the designer to identify highly erodible soil areas that if possible should remain undisturbed. Long or steep slopes **(steeper than 15%)**, highly erodible soils, and vegetative buffer strips along water bodies should be mapped and designated to remain undisturbed.

As plans are developed using ESD per the new Chapter 5 of the *Maryland Stormwater Design Manual,* the concept plan at a minimum requires a narrative describing how erosion and sediment control will be integrated into the stormwater management strategy.

Site Development Plan

After concept plan approval, the designer should use comments, suggestions, and feedback received during the concept phase in preparing site development plans. The site development plan will establish the footprint of the proposed project and demonstrate the relationship between proposed impervious surface and the existing natural conditions identified during concept plan design. This will better protect natural resources and buffers and allow for using ESD practices throughout the site. Included in this step are the preparation of detailed designs, computations, and grading plans for a second comprehensive review and approval. After approval from the review agencies, the applicant will then proceed with final plan preparation including the design of any structural practices needed to address remaining channel protection requirements. Final plans will go to both the stormwater and erosion and sediment control review agencies for approval.

An overlay plan showing stormwater and erosion and sediment control practices are required as part of the site development submittal.

Final Plan

Comments from the site development plan approval should be incorporate into developing final phase design plans. Existing site topography as well as proposed contours must be shown at the appropriate interval for the limit of disturbance (LOD), including contours for sediment controls such as sediment traps and sediment basins. Final erosion and sediment control plans should include the location of each sediment control practice and associated construction notes. Details and representative cross-sections, as appropriate, should also be included on the final plans. Drainage areas must be delineated for sediment control practices whose sizing is based on drainage area. These should include not only proposed, but initial phase and interim phase practices and drainage areas. The sequence of construction and associated narrative must be detailed enough to guide the contractor through the process of construction, maintenance, and removal of the erosion and sediment controls.

A-3 DESIGN PRINCIPLES

This section offers design strategies and planning guidance. The principles listed in Table A.1 should be followed in developing erosion and sediment control plans that protect against downstream erosion, capture sediment on-site, and meet all applicable guidelines and requirements.

Table A.1: Principles of Land Development

Design Principles
Plan the development to fit the site
Minimize disturbed areas - duration (phasing) and extent (limits of disturbance)
Protect and avoid natural resources
Protect and avoid steep slopes and highly erodible soils
Stabilize exposed soils as soon as practicable
Control and/or manage on-site and off-site runoff
Use perimeter controls
Retain sediment on-site through settling, dewatering, and filtering
Inspect and maintain sediment controls

Plan the development to fit the site

A primary goal of ESD is the conservation of natural features (e.g. drainage patterns, soil, vegetation) to the maximum extent practicable. Working with a site's natural features when designing improvements minimizes the amount of necessary clearing and grading. Using the existing contours as much as possible reduces cuts and fills. Roads should be designed parallel to the contours rather than perpendicular to them. In this way, steep slopes are minimized and the earthwork can be kept to a minimum. Developing flatter slopes decreases the area that needs to be cleared compared to development in steeper terrain. Fitting the development to the site results in less erosion and saves costs by limiting the amount of cut and fill as well as the need for structural components such as retaining walls.

Minimize disturbance - duration and extent

When soil disturbances occur and the natural vegetation is removed, the potential for erosion increases thereby requiring more sediment controls to keep sediment on-site. To reduce the need for sediment controls, the extent and duration of soil exposure should be minimized. This is best achieved by phasing and sequencing. When a project is phased the active work area is limited to a portion of the site. A well designed plan will include phases or stages of development that ensure only areas under active development are exposed. All other areas should have a good cover of vegetation or mulch. Also, grading should be completed and stabilized as soon as possible after it is initiated.

The project should be phased such that no more than one grading unit of land is disturbed at a time. A grading unit is a contiguous area of disturbed earth on a site at any given time and is limited to 20 acres, or as determined by the appropriate approval authority. Unless otherwise specified or approved, clearing and grubbing shall be limited to a single grading unit. Work may proceed to a second grading unit only when the fifty percent of the first grading unit has been stabilized and approved by the appropriate enforcement authority.

The sequencing of activities also enables the project to be completed in an efficient way that balances earth work. For example, a proposed roadway with large sections of cut and fill should be sequenced so that the areas in cut are graded first, followed by the areas in fill. A detailed sequence of construction will coordinate the timing of grading and construction activities with the installation of erosion and sediment control measures.

Protect and avoid natural resources

Special attention should be paid to disturbed areas adjacent to natural resources, steep slopes, and erodible soils. A site's natural resource areas, such as wetlands, springheads, floodplains and stream buffers, are to be mapped during the concept plan stage.

The approach for protection of natural resources is as follows:

- **AVOIDANCE**
- **MINIMIZATION**
- **MITIGATION**

Impacts to natural resources should be avoided as much as practicable. If avoidance is not feasible, every effort should be made to minimize impacts. Permanent impacts to resources require mitigation, often at a 2:1 or more replacement rate or in the form of compensation. Construction of erosion and sediment controls resulting in temporary impacts to resources may require re-establishing or creating vegetative buffers within the project limits or enhancing existing resources outside the project limits.

If a project has a direct discharge into a Tier II water body or an impaired water body with a Total Maximum Daily Load (TMDL) for sediment, an additional level of control(s) may be needed. This includes but is not limited to accelerated stabilization, passive or active chemical treatment systems (see Figure A.2.), redundant sediment controls, or a reduction in the size of the grading unit.

Protect and avoid steep slopes and highly erodible soils

Protection of steep slopes is imperative to reducing erosion, and therefore these areas should be identified in the concept plan. Slopes steeper than 15% shall be avoided to the maximum extent practicable. If steep slopes must be developed, protection strategies include accelerated vegetative stabilization, structural stabilization, (e.g., mechanically stabilized slopes), diverting runoff around or over (e.g., pipe slope drains) steep slopes, benching, and incremental stabilization. Other stabilization methods include soil stabilization matting and turf reinforcement mats.

Soil erodibility is a measure of a soil's resistance to the erosive powers of rainfall energy and runoff. Highly erodible soils have less resistance to erosion. Additionally, soils with fine silts and clay particles, once eroded, remain suspended for an extended time period. Turbidity control measures, as outlined in Figure A.2, are required when disturbing soils with high clay content. Information regarding highly erodible soils is provided in the Appendix.

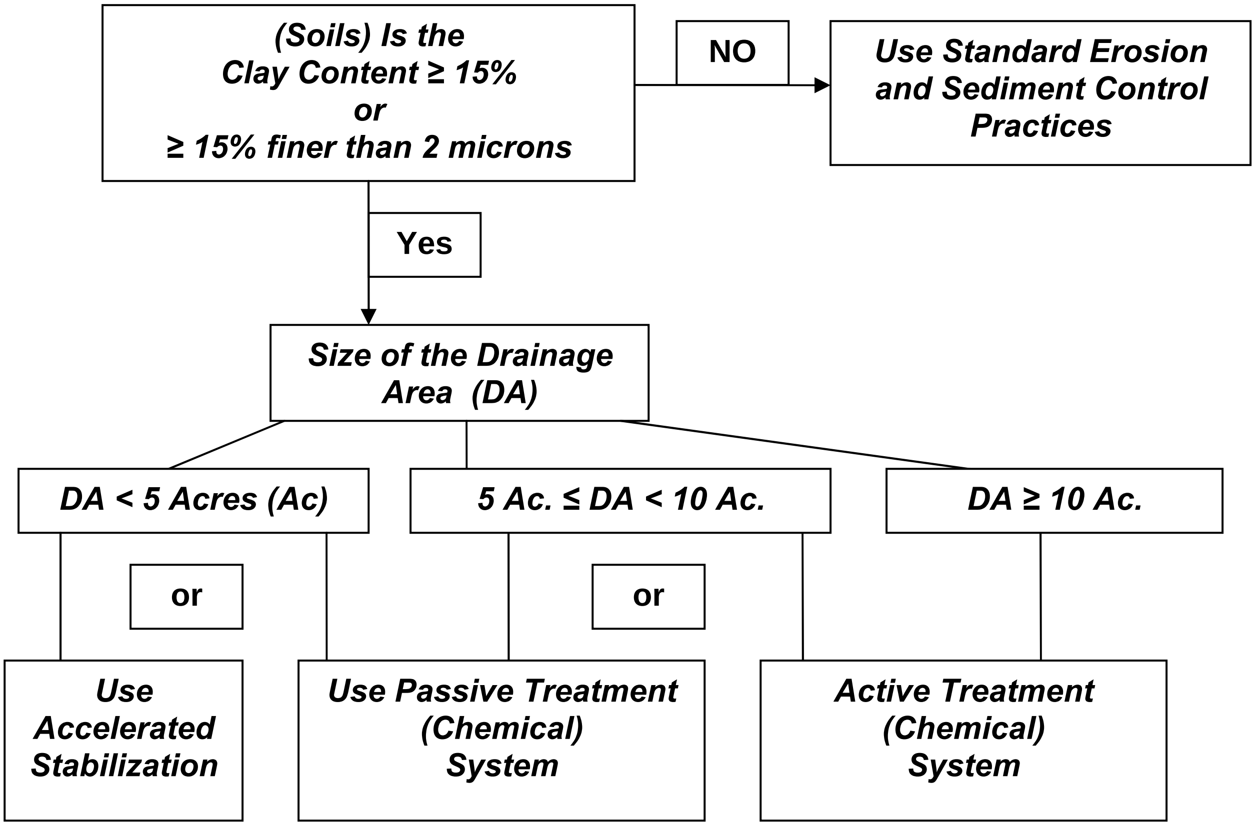


Figure A.2: Turbidity Control System (TCS) Flow Chart

Stabilize exposed soils as soon as practicable

Minimizing disturbed areas, both in size and duration, is critical for preventing erosion and sediment runoff. Areas that must be disturbed should be stabilized as soon as possible. At a minimum, permanent or temporary stabilization is to occur within three calendar days following soil disturbance on all perimeter controls (e.g., earth berms, sediment traps) and slopes greater than 3:1 and seven days for all other disturbed areas. Only areas under active grading, or on certain sites such as surface mines, are exempt from these requirements. Accelerated stabilization may be required based on site characteristics or at the request of the appropriate approval authority.

See Section B-4 for specifics on stabilization, including types of seeding, timeframes, and alternative stabilization methods. All stabilization requirements should be included on the erosion and sediment control plan.

Control and/or manage runoff

Flows onto, through, and off of the site must be evaluated. Consideration should be given to the type of flow (sheet versus concentrated) and the slope, land use, and size of the contributory drainage area. Peak discharges and velocities, as well as the volume of flow through and discharging from the site, need to be controlled to minimize soil erosion.

Most sediment controls are sized for the drainage area discharging to the control. This includes off-site as well as on-site runoff, from undisturbed as well as disturbed areas. Reducing the drainage area may allow the use of a simpler, alternative practice (e.g. a sediment trap instead of a sediment basin).

Typically water conveyances (see Section C) are used to divert runoff around the project site. These include earth dikes, temporary swales, perimeter dike swales, diversion pipes, and permanent ditches which are often constructed early in the project. On-site runoff volumes and velocities can be controlled with erosion control devices such as check dams, pipe slope drains, outlet protection and other similar measures, as well as by establishing vegetation promptly and maintaining it vigilantly.

Use perimeter controls

The main objective of a sediment control plan is to prevent sediment laden water from leaving the project site. Generally, this is achieved by installing sediment control practices along the perimeter of the disturbed area. Although perimeter controls tend to be linear in nature, sediment traps and basins can also be perimeter controls. Earth dikes, temporary swales, diversion fence, berms, silt fence, and super silt fence are other examples of perimeter controls. Sediment controls designed along the perimeter of a site typically need to be installed before clearing and grading operations begin. Prior to installing perimeter controls, the limits of disturbance (LOD) should be clearly marked in the field. This will help to ensure that no construction takes place outside the approved limits of disturbance.

Retain sediment on-site through trapping, filtering, and/or dewatering

Sediment can be retained by either trapping or filtering or a combination. Practices such as sediment traps and basins impound sediment-laden runoff for a period of time sufficient for soil particles to settle out. Filtering practices include silt fence, temporary outlet structures, and inlet protection. When a sump or trapping area needs to be drained, the sediment laden water is pumped through a dewatering device, such as a portable sediment tank or a filter bag, where the sediment is separated from the effluent and retained for disposal.

Perimeter controls are the last line of defense on a construction site. These controls must be installed prior to any clearing and grubbing for the remainder of the project and they must be stabilized as soon as possible after they are constructed, preferably within 24 hours, but no more than 3 days after their construction. The designer should use a combination of controls to convey runoff non-erosively, divert clear water flow around the construction site, and to intercept and treat sediment-laden water through the appropriate sediment control.

Inspect and maintain sediment controls

Proper implementation of the erosion and sediment control plan is as important as good planning and design. Erosion and sediment controls are ineffective without proper installation and maintenance. Thorough, periodic maintenance checks of erosion and sediment control measures are necessary to ensure proper operation. Although enforcement is beyond the control of the designer and reviewer, the plans and specifications need to be clear and concise so they can serve as an effective enforcement tool. Inspection requirements should be provided on the plans and depending on the approval authority may be stated in the approval or permit. The owner/developer and contractor are responsible for conducting routine inspections and required maintenance. At a minimum, the site and all controls should be inspected weekly and after each rain event. However, the approval authority may require more frequent inspections, especially adjacent to sensitive areas or in impaired watersheds. Inspections may be required on a weekly or even daily basis or prior to or during a precipitation event. A written inspection report should be part of every inspection. The inspection report should include:

- Inspection date
- Type of inspection (regular, pre-storm event, post-storm event, inspection during rain event)
- Name and title of inspector
- Weather information (current conditions as well as time and amount of last recorded precipitation
- Brief description of project's status(e.g., percent complete) and/or current activities
- Evidence of sediment discharges
- Identification of sediment controls that require maintenance
- Identification of missing or improperly installed sediment controls

- Compliance status regarding the sequence of construction and stabilization requirements
- Photographs
- Maintenance performed
- Installation or re-installation of sediment controls

The appropriate enforcement authority should be notified and the following meetings/inspections of the site should be requested:

1. Pre-construction meeting;
2. After installation of sediment controls for each phase; and
3. After stabilization and prior to removal of the final-phase sediment controls.

Implementation of the approved erosion and sediment control plan is required. The appropriate approval authority must be consulted of any desired modifications to the approved plan. Modifications may be implemented only upon written approval from the approving authority or in accordance with an MDE-approved minor field modification policy.

A-4 DESIGN METHODOLOGY

Design Methodology

The process of designing erosion and sediment control is step-wise and iterative. Table A.2 summarizes the steps in designing an erosion and sediment control plan. A more detailed description of each step follows the table.

Table A.2: Design Steps

No.	Design Step
1.	Identify existing drainage patterns, drainage area boundaries, and slopes (concept plan)
2.	Identify natural resources (concept plan)
3.	Visit project site and take photographs (concept plan)
4.	Develop phasing and determine the limits of clearing and grading (concept and site development plans)
5.	Select initial phase erosion and sediment controls (site development plan)
6.	Identify interim and proposed drainage patterns, drainage area boundaries, slopes, and stormwater management practices (site development plan)
7.	Select interim and final phase erosion and sediment controls (site development plan)
8.	Prepare the sequence of construction (final plan)

1. **Identify drainage patterns, drainage area boundaries, and slopes**. Current land use information for the project site as well as off-site should be obtained and confirmed by a site visit and/or survey. Evaluate flow onto, through, and off of the site for existing conditions. Determine areas of sheet flow and concentrated flow and how off-site flow can be diverted around the disturbed area. When evaluating drainage areas, determine the slope, slope length, and for areas with concentrated flow, the discharge. Determine if the diversion of off-site flow is desirable to reduce the number and size of sediment controls, to increase their efficiency, or to maintain sheet flow on-site. Using ESD principles maintain or mimic the exiting drainage patterns that give preference to sheet flow and small drainage areas.

   During concept plan design consider the impact erosion and sediment control practices will have on the existing hydrology. For example, a clear-water diversion may convert sheet flow to concentrated flow and increase velocities. Evaluate how this will affect the downstream flow patterns and if the discharge needs to be returned to sheet flow.

2. **Identify natural resources.** Areas of particular environmental concern, such as wetlands, streams, buffers, wooded areas, steep slopes, and highly erodible soils, need to be identified both within the project site and adjacent areas and shown on the plan. Other considerations include the Atlantic Coast and Chesapeake Bay Critical Area, National Wetland Inventory, soil survey, Natural Heritage, and mapped rare, threatened, and endangered species, as well as Tier II watersheds and those with a TMDL for sediment.

3. **Visit the project site and take photographs**. Field check drainage patterns, drainage boundaries, vegetation, and land use. Look for existing storm drains, culverts, underground utilities, and other drainage features. Verify the locations of wetlands, streams, trees and identify those features that are not already mapped. Note any erosion, lack of vegetation, drainage problems, and other features that may be pertinent to the design. (If an unmapped resource is found, contact the appropriate authority to determine possible permit requirements). As part of the site visit, visualize access onto and through the site for the various phases of construction.

4. **Determine the limits of clearing and grading**. The initial assessment on the limits of clearing, grubbing, and grading should be based on existing site features and proposed construction, striving to minimize the project's footprint and the encroachment on natural resources in accordance with ESD principles. The site development plan, typical sections, cross-sections, and profiles determine which areas need to be disturbed. The proposed limits of disturbance (LOD) may need to be adjusted based on existing site conditions. The LOD is that area required to be cleared and grubbed for the construction of the project, including associated work and storage areas.

5. **Select initial phase erosion and sediment control practices.** When possible, the choice of initial sediment controls should be based on the final phase controls. However, initial controls need to consider existing topography, drainage areas, ground cover, and access throughout the site. The selection of controls may need to take into account limited initial access due to wooded areas, stream crossings, and areas of cuts and fills. These restrictions, as well as changing drainage areas, may require additional phases of sediment control installation.

Example 1 – Conveyance of clear water around a site

An offsite drainage area is 5 acres, and the slope along the proposed conveyance practice is 4%. Referring to Table A.3, there are a number of practices that may be used to convey clear water. However, based on site conditions, the most likely choices are an earth dike, temporary swale, or diversion fence. The final choice may be dependent on the amount of right-of-way available to construct the practice, the accessibility to equipment and labor, or the selection of other sediment controls.

For example, if space is limited or trees need to be saved, a diversion fence might be the best choice. However, if the area is readily accessible and relatively clear, then a temporary swale might be the better option. An earth dike might be selected if an earth berm and sediment trap are to be used to control the disturbed area, with one side the berm directing clear-water around the site and the other side directing the disturbed area to a trap. For any of the choices, a level spreader or outlet protection may also be required.

Example 2 – Sediment trap or basin as an initial control

It is important to know both the existing and proposed site conditions when designing and locating sediment trapping devices. A sediment trap should not be located in an area where a stormwater infiltration practice is proposed. It should ideally be located in an area where it can be kept in place for the longest period of time, taking into consideration the phasing and location of road or house construction.

The phasing of a site must also take into account the length of time and access needed to install the initial sediment controls. If earth dikes and a sediment basin are designed as the initial controls, these must be completed before beginning other grading. This could require stockpiling the excavated material from the basin rather than using it immediately for fill on the site. Sequencing is also important to ensure that the basin is completed prior to the construction of the berms. Additional sediment controls may be required if extensive clearing is needed to reach the proposed basin location.

<u>Example 3 – Concentrated flow</u>
A 1.2 acre project site is located at the bottom of a 5 acre drainage area. The clear water runoff from the 3.8 acres off-site area is going to be diverted around the project site. Because of site constraints, the entire site needs to be opened for active grading, and the flow leaving the site will be concentrated. There are a number of options for trapping and treating the sediment prior to discharging it from the site. Refer to Table A.3 for a list of acceptable practices for trapping sediment.

Potential practices include storm drain inlet protection, sediment traps, sediment basins, temporary stone outlet structures (TSOS), and temporary gabion outlet structures (TGOS). The table indicates that silt fence, super silt fence, filter berms, and similar practices are not acceptable since these are limited to sheet flow. If the discharge point is not into a storm drain, inlet protection can be eliminated. Because the drainage area is more than 0.5 acres, a TSOS would be eliminated unless the drainage area is being divided into multiple subareas of less than 0.5 acre. Since the drainage area is less than 5 acres, a sediment trap rather than a sediment basin is the more logical choice (unless the proposed drainage area exceeds 5 acres or a stormwater management pond is designed for this location). Alternatively, a TGOS may be the best choice for this particular area, especially if the soils do not require a turbidity control system.

Note that Table A.3 also cites associated practices. This column alerts the designer to practices that are typically used in conjunction with the chosen practice. Earth dikes are listed for TGOS because earth dikes are required to direct flow toward a TGOS. If erosion in the channel downstream of this TGOS is a concern, the designer may elect to use check dams or an outlet protection practice. Each application needs to be evaluated case-by-case.

In choosing erosion and sediment controls, consider possible locations for staging and stockpile areas and access or haul roads. If staging/stockpile areas are within the project's LOD, the proposed perimeter controls may suffice. However, if a soil stockpile creates a longer slope length or steeper slope, perimeter controls must be adjusted accordingly. Additionally, an access road may be required down a steep slope thereby concentrating flow that was previously sheet flow. Considerations must be made for handling this concentrated flow and stabilizing and maintaining the access road.

The best designs incorporate erosion controls (structural and non-structural), sediment controls, and careful phasing and sequencing into the overall erosion and sediment control plan and construction strategy

6. **Identify interim and proposed drainage patterns, drainage area boundaries, and slopes**. Interim conditions are often overlooked yet are important considerations for erosion and sediment control design. Typically, evaluating interim conditions is more difficult than evaluating initial phase or final phase. Project plans always include existing and proposed site conditions. Unlike the initial or final phases, interim conditions are not definitive; they represent the in-between. Due to shifts in drainage areas and changes in slope, drainage patterns for an interim phase may be entirely different from initial or final phase, and therefore the sediment controls may also need to be different. Unless the proposed grading is producing only minor changes, an interim phase sediment control plan will be necessary.

<u>Example 4 – Interim Plan</u>
A roadway is being constructed in hilly terrain and will require various amounts of cut, some as large as 20 feet. Drainage patterns will change significantly between existing and proposed conditions. CADD or other technology can be used to generate interim contours, cross-sections, and/or profiles for assessing how the drainage will change and how sediment laden runoff will be controlled during interim conditions.

7. **Select interim and final phase erosion and sediment controls**. Follow the same procedures used to select initial phase sediment controls. Initial phase controls may need to be adjusted or modified to better correlate with the interim and/or final phase plans. As construction progresses consider impacts to staging and stockpile areas and access roads. Also, consideration should be given to how the controls selected for final phase will be removed.

   <u>Example 5 – Interim or final phase</u>
   A 14 acre housing development is originally controlled by three sediment traps and associated earth berms. Off-site drainage is not an issue. As roads are installed and house lots brought to grade, some of the drainage will be cut off to the traps, necessitating the design of additional controls. The plans should be sequenced to ensure that these controls are installed before or as the drainage patterns changes. Super silt fence may be needed along the perimeter of some of the house lots as yards are graded. TSOSs may be required in roadside swales if these swales are no longer directed to a trap. Temporary diversions might be required to stay within the maximum drainage area allowed to a particular control. Considering all phases of a project during the initial erosion and sediment control design enables the development of the most efficient plan.

8. **Prepare the sequence(s) of construction**. The sequence of construction describes how the plan will progress. It directs the contractor when to install and remove the different erosion and sediment controls shown on the plan. Sequencing of the project should be considered in steps 1 through 7. As each sequential design step is completed, the designer must continually be thinking of how the sequence of construction should proceed from clearing and grubbing through final stabilization. When selecting erosion and sediment controls, consider whether special directions coinciding with the proposed site improvements will be helpful to ensure that the controls are installed correctly and in the proper sequence to minimize erosion and off-site sedimentation

   Writing a sequence of construction is probably the most difficult step (and certainly the most tedious) in designing an erosion and sediment control plan. It requires visualizing the progression and connection of various site development activities (clearing, grubbing, grading, maintenance of traffic, drainage systems, building systems, road systems, stream diversions, erosion and sediment control, stormwater management, etc.) to assure that the erosion and sediment control practices will be installed and removed at the proper times, and function as intended. Depending on the project's complexity, the sequence can be relatively simple or it can involve many small steps. Sometimes, multiple steps can occur concurrently, while others must be sequential. A sequence of construction should be neither too specific nor too broad, allowing flexibility where possible. However, there will be instances where flexibility must be sacrificed for the assurance that the erosion and sediment controls will be installed, maintained, and removed as intended. Narratives are helpful in allowing reviewers, contractors, and inspectors to understand why a certain sediment control was selected or why following the sequence is imperative to the progression of the construction.

   At a minimum, the sequence of construction should contain the following steps:

   1. Notify the appropriate enforcement authority to set up a pre-construction meeting.
   2. Clear and grub to install perimeter controls
   3. Install and stabilize perimeter controls
   4. Clear and grub other areas needed to construct project (preferably, staged construction)
   5. Stabilize areas per requirements
   6. Maintain sediment controls
   7. Remove sediment controls and stabilize these areas
   8. Convert sediment controls to stormwater management facilities where applicable

Most sequences of construction will be more detailed, especially for plans requiring a stream diversion or the coordination between the removal of controls in one phase and the installation of different controls in a subsequent phase. If traffic control is an issue, then the erosion and sediment control should coordinate with the maintenance of traffic plan. Each project is unique and the level of detail in the sequence of construction needs to be tailored to each specific project.

Table A.3: Erosion and Sediment Control Practices

Practice	Primary Purpose	Design Criteria	Associated Practices	Remarks
Stabilized Construction Entrance	Stabilize Soil	Access points	Mountable berms, silt fence	All Ingress/Egress Points
Stabilized Construction Entrance with Wash Rack	Stabilize Soil; prevent excessive tracking of mud	Access points	Sediment traps, mountable berms	All Ingress/Egress Points
Serrated Slopes	Stabilize ripable rock	Site specific	Topsoiling, Soil Stabilization Matting	Divert overland flow from top of slope
Benching	Minimize erosion	20 ft cut/fill- 2:1 slopes 30 ft cut/fill- 3:1 slopes 40 ft cut/fill- 4:1 slopes	Temporary, Permanent Stabilization	
Temporary Stabilization	Stabilize soil	Site specific	Soil Stabilization Matting	
Permanent Stabilization	Stabilize soil	Site specific	Soil Stabilization Matting	
Heavy Use Area Protection	Stabilize Soil	All construction routes	Dust Control, Temporary Swales, Temporary or Permanent Seeding	SCE, Soil Stabilization
Earth Dike	Convey runoff	Drainage area ≤ 10 Ac.; slope ≤ 10%	Sediment Trap, TSOS, TGOS, Outlet Protection	Engineering Design if > 10 ac or slope > 10%.
Temporary Swale	Convey runoff	Drainage area ≤ 10 Ac.; slope ≤ 10%	Sediment Trap, TSOS, TGOS; Outlet Protection	Engineering Design if > 10 ac or slope > 10%.
Perimeter Dike/Swale	Convey runoff	Drainage area ≤ 2 Ac.	Sediment Trap, Level Spreader, Temporary Stabilization	Smaller footprint than ED and TS
Temporary Asphalt Berm	Convey runoff on paved areas	Site specific	Earth Dikes, TSOS, TGOS, Outlet Protection	
Clear Water Diversion Pipe	Convey stream flow around construction	Design storm = Q_2; 1 ft freeboard at inlet	Sandbags, Dewatering Practices, Outlet Protection	Reviewed by Wetlands and Waterways Division
Temporary Barrier Diversion	Convey clear water flow around construction	Design storm = Q_2; 1 ft freeboard at inlet	Dewatering Practices; Outlet Protection	

Practice	Primary Purpose	Design Criteria	Associated Practices	Remarks
Mountable Berm	Convey Runoff	Side slopes ≤ 5:1, Min height 18 in.	Earth Dikes, SCE, Heavy Use Area Protection	Requires regular maintenance
Diversion Fence	Convey Runoff	Drainage area ≤ 2 ac.	Sediment Trap, TSOS, TGOS, Outlet Protection	Smaller footprint than other diversions; may not be applicable in areas with high bedrock.
Pipe Slope Drain	Convey runoff down steep slopes	Drainage area ≤ 5 Ac.	Earth Dike, Rock Outlet Protection, Sediment Traps, TSOS, TGOS	Typically used for cut/fill slopes.
Stone Check Dam	Minimize Erosion, reduce velocities	Slope ≤ 10%	Soil Stabilization Matting, Sediment Trap, TSOS, TGOS	Velocity check, not a sediment control
Riprap Inflow Protection	Convey runoff non-erosively	Inflow slopes between 4:1 and 10:1	Sediment Traps/Basins, Temporary Swales	
Gabion Inflow Protection	Convey runoff non-erosively	Inflow slopes steeper than 4:1	Sediment Traps/Basins, Temporary Swales	
Outlet Protection	Prevent erosion at outlets	Site specific	Earth Dikes, Temporary Swales, Sediment Basins, Sediment Traps	
Silt Fence	Trap sediment	Sheet flow, 2:1 slopes maximum, 20 ft. slope-length, 5% max longitudinal slope for 50 ft.	Filter Berms/Logs, Super Silt Fence	
Silt Fence on Pavement	Trap sediment	Sheet flow, 3:1 slopes maximum, 60 ft. slope-length	Silt Fence, Super Silt Fence	Used on pavement
Super Silt Fence	Trap sediment	Sheet flow, 2:1 slopes maximum, 50 ft. slope-length, 5% max longitudinal slope for 100 ft.	Filter Berms/Logs, Silt Fence	
Clear Water Pipe through Silt Fence/Super Silt Fence	Trap sediment; convey clear-water runoff through SF/SSF	Site specific	Silt Fence, Super Silt Fence, Pipe Slope Drain	
Filter Berms & Logs	Trap sediment	Site specific	Silt Fence, Super Silt Fence	Green practice

Practice	Primary Purpose	Design Criteria	Associated Practices	Remarks
Temporary Stone Outlet Structure	Trap sediment	Drainage area ≤ 0.5 Ac.	Earth Dike, Stone Check Dam; Outlet Protection	
Temporary Gabion Outlet Structure	Trap sediment	Drainage area ≤ 1.5 Ac.	Earth Dike, Stone Check Dam; Outlet Protection	
Storm Drain Inlet Protection	Trap sediment	Site specific	Sediment Trap/Basin, Temporary Storm Drain Diversion	Should be used as a secondary measure
Removable Pumping Station	Dewatering	Site specific	Sediment Trap/Basin	Used for dewatering, pumping required, may require Turbidity Control Systems
Sump Pit	Dewatering	Site specific	Sediment Trap/Basin	Used for dewatering, pumping required, may require Turbidity Control Systems
Portable Sediment Tank	Dewatering	Storage = 1 cu. Ft./gpm of pump capacity	Sediment Trap/Basin	Used for dewatering, pumping required, may require Turbidity Control Systems
Filter Bag	Dewatering	Site specific	Sediment Trap/Basin	Used for dewatering, pumping required, may require Turbidity Control Systems
Sediment Traps:				
I. Pipe Outlet	Trap Sediment	Drainage area ≤ 5 Ac.	Earth Dike, Temporary Swale	
II. Stone/Riprap Outlet	Trap Sediment	Drainage area ≤ 10 Ac.	Rock Outlet Protection	
III. Riprap Outlet	Trap Sediment	Drainage area ≤ 10 Ac.	Rock Outlet Protection	
Sediment Basin	Trap Sediment	Drainage area ≤ 100 Ac.,	Turbidity Control System; Outlet Protection	Requires Active Treatment System
Subsurface Drains	Intercept and convey drainage water	Site specific	Rock Outlet Protection; Land Grading,	

Practice	**Primary Purpose**	**Design Criteria**	**Associated Practices**	**Remarks**
Temporary Access Waterway Crossing:				
I. Temp. Access Bridge	Protect Stream	At or above stream bank; 8 ft. centerline piers, curbs/fenders	Heavy Use Area Protection, Stabilized Access Road	Most preferred method
II. Temp. Access Culvert	Protect Stream	Time-of-year restrictions; Must pass Q2; 40 ft maximum length	Heavy Use Area Protection, Stabilized Access Road, Outlet Protection	
III. Temp. Access Ford	Protect Stream	Time-of-year restrictions	Heavy Use Area Protection, Stabilized Access Road, Stream Bank Height ≤ 4 Ft., Approach Roads ≤ 5:1	Least preferred method
Dust Control	Reduce Wind erosion	Access points, construction roads	Temporary and Permanent Stabilization	
Sand Filter	Filter Sediment		Sediment Trap/Basin, Turbidity Control System	Used with Turbidity Control System
Turbidity Control System	Reduce turbidity	Site specific, must have MDE Industrial Discharge Permit approval	Sediment Basin/Trap	See Figure A-2

A-5 EROSION AND SEDIMENT CONTROL PLAN

I. DEVELOPING EROSION AND SEDIMENT CONTROL PLANS

A. Content of the Erosion and Sediment Control Plans

Applicants are responsible for submitting erosion and sediment control plans that meets the requirements provided by these Standards. The plan shall include sufficient information to evaluate the site conditions, environmental characteristics of the affected areas, potential impacts of the proposed grading on water resources, and effectiveness and acceptability of measures proposed to minimize soil erosion and off-site sedimentation.

Applicants shall submit the following information, as required:

1. A letter of transmittal and application form;

2. Name, address, and telephone number of:
   a). The owner of the property where the grading is proposed;
   b). The developer; and
   c). The applicant.

3. A vicinity sketch indicating north arrow, scale, site location, and other information necessary to easily locate the property;

4. Drainage area map at a minimum 1"=200' scale showing existing and proposed topography, proposed improvements, pertinent drainage information, schematic sediment control features, and any relevant stormwater management practices;

5. Concept, site development, and final plans, as required by the appropriate approval authority;

6. A final plan indicating:

   a. North arrow.

   b. The existing topography and improvements as well as proposed topography and improvements on 1"=50' scale with 2 foot contours or other approved scale and contour interval. For projects with more than minor grading interim topography will also be required.

   c. The proposed grading and earth disturbance including:
      1) Total disturbed area
      2) Volume of cut and fill quantities
      3) Volume of borrow and spoil quantities including locations;
      4) Limits of grading including limitation of mass clearing and grading whenever possible.

   d. Storm drainage features, including:
      1) Existing and proposed bridges, storm drains, culverts, outfalls, etc.;
      2) Velocities (v_2 and v_{10}) and rates (Q_2 and Q_{10}) of flow at outfalls; and
      3) Downstream conditions and provisions to protect downstream areas from erosion.

e. Erosion and sediment control measures to minimize on-site and off-site erosion and prevent off-site sedimentation including:
   1) The salvage and reuse of topsoil
   2) Phased construction and grading to limit disturbances, both in extent and duration;
   3) Location and type of all proposed sediment control measures;
   4) Design details and design tables for all erosion and sediment control measures; and
   5) Specifications for temporary and permanent stabilization measures including, at a minimum, the placement of the following statement on the plan:

      Following initial soil disturbance or re-disturbance, permanent or temporary stabilization shall be completed within:
      a.) Three calendar days as to the surface of all perimeter dikes, swales, ditches, perimeter slopes, and all slopes greater than 3 horizontal to 1 vertical (3:1); and
      b.) Seven days as to all other disturbed or graded areas on the project site not under active grading.

      Additional notes may be necessary if acceleration stabilization is required.

f. Delineated drainage areas and contours for initial, interim, and final phase sediment control practices, as applicable, at a minimum 1"=200' scale. Delineations may be made on the erosion and sediment control plan or on separate drainage area map(s).

g. Sequence of construction describing the relationship between the implementation and maintenance of controls, including permanent and temporary stabilization, and the various stages or phases of earth disturbance and construction. The sequence of construction, at a minimum, shall include the following activities (and time frame):
   1) Request for a pre-construction meeting with the appropriate enforcement authority;
   2) Clearing and grubbing of those areas necessary for installation of perimeter sediment controls;
   3) Construction and stabilization of perimeter controls for contributory disturbed areas;
   4) Remaining clearing and grubbing of controlled area;
   5) Grading;
   6) Staging the sediment control measures for grading the remainder of the site;
   7) Utility installation and whether storm drains will be temporarily diverted, used, or blocked during construction;
   8) Final grading, landscaping, and stabilization; and
   9) Removal of controls.

   A revised sequence of construction may be submitted for review and approval by the contractor constructing the project. The revised sequence of construction must be approved by appropriate plan review authority before construction may proceed.

h. A statement requiring the owner/developer or representative to contact the appropriate enforcement authority at the following stages of the project or in accordance with the approved erosion and sediment control plan, grading or building permit:
   1) Prior to starting the project, for a preconstruction meeting.
   2) Upon completion of the installation of perimeter erosion and sediment controls and prior to start of other clearing and grubbing.
   3) Prior to the start of another phase of construction or opening of another grading unit.
   4) Upon establishment of final stabilization and prior to removal of erosion and sediment control measures.

i. Certification by the owner or developer that any clearing, grading, construction, or development will be done pursuant to the approved erosion and sediment control plan, including inspecting and maintaining controls, and that the responsible personnel involved in the construction project will have a Certificate of Training at a Maryland Department of the Environment (MDE) approved training program for the control of erosion and sediment prior to beginning the project. Additionally, the owner or developer shall certify right of entry for periodic on-site evaluation by the appropriate enforcement authority and/or MDE.

j. As required by the appropriate approval authority or MDE, certification by a professional engineer, land surveyor, landscape architect, architect, or forester registered in the State that the plans have been designed in accordance with erosion and sediment control laws, regulations, and standards.

k. A general description of the predominant soil types on the site. The soil survey information may be plotted on the drainage area map to help identify environmentally sensitive areas. Alternatively results from on-site soils testing may be used.

7. Any additional information or data deemed appropriate by the approval authority.

B. <u>Format of the Erosion and Sediment Control Submittals</u>

The format of erosion and sediment control reports and plans submitted to the appropriate approval authority should be as follows:

1. Report: A discussion/narrative with supporting technical documentation of the overall strategy of the proposed erosion and sediment control plan and documentation of environmental site design (ESD) to the maximum extent practicable (MEP).

2. The erosion and sediment control report should be on 8 ½" by 11" paper. The report should be typed; however certain computational sheets may be handwritten. The report should be bound in an acceptable cover binder. Any maps, diagrams, or figures (except computer printouts) that are larger than 8 ½" by 11" should be folded to a size of 8 ½" by 11" or smaller and should be placed in a pocket within the report binder. All maps, diagrams, and figures should be clearly labeled.
At a minimum each report should contain the following:
   a. Project identification;
   b. Title sheet;
   c. Table of contents;
   d. List of figures or tables; and
   e. Body of the report including:
      1) Introduction;
      2) Analysis; and
      3) Conclusions.
   f. Appendices should include all the background information used in the erosion and sediment control analysis. Examples of background information include:
      1) Drainage area maps;
      2) Soils maps;
      3) Design computations for engineered sediment control devices;
      4) Computations of flow rates (Q_2 and Q_{10}) and velocities (v_2 and v_{10}) at outfalls: and
      5) Other computations deemed necessary by the approval authority.

2. Computer printouts, when required, should include all input data, output data, hydrographs at critical sections where appropriate, and summary output.

3. Plans, special provisions, and other contract documents should be submitted, if applicable.

4. Appropriate Tracking Information (e.g., file numbers) - All reports, computer printouts, plans, special provisions, and other contract documents should be accompanied by a transmittal letter. The transmittal letter should list the contents of the submittal, the purpose of the submittal, and should include the appropriate tracking information.

II. APPROVALS

A. Approval Requirements

An erosion and sediment control plan may be approved by the appropriate approval authority once all requirements of these Standards have been met.

B. Approval Conditions

In granting the plan approval, the approval authority may impose additional conditions and criteria as deemed necessary to ensure compliance with the provisions of these Standards and the preservation of the State's natural assets, resources, public health, and safety. Generally, additional controls will be required in environmentally sensitive areas, areas with highly erodible soils, or other facilities that require protection.

C. Suspension or Revocation

Any erosion and sediment control approval issued may be suspended or revoked after written notice is given for any of the following reasons or as determined by appropriate approval authority:

1. Terms or conditions of the approved erosion and sediment control plans violated;
2. Violation notice(s) or stop work order(s) ignored;
3. Site characteristics upon which plan approval was based changed; or
4. Construction standards as required by the approved plan were disregarded.

D. Modification of Approved Erosion and Sediment Control Plans

Modifications of an approved erosion and sediment control plan shall be made in accordance with the erosion and sediment control criteria contained in these Standards and/or as directed by the appropriate enforcement authority. The modification request should include a transmittal form (e.g., minor modification form), a written statement explaining the change(s), all revised plan sheets, and any necessary revisions to the report.

<u>SECTION B – GRADING AND STABILIZATION</u>

B-1 STANDARDS AND SPECIFICATIONS

FOR

STABILIZED CONSTRUCTION ENTRANCE

Definition

A Stabilized Construction Entrance (SCE) is a stabilized layer of aggregate that is underlain with Geotextile Class SE. Stabilized construction entrances are located where traffic enters or leaves a construction site.

Purpose

Stabilized construction entrances reduce tracking of sediment and provides a stable area for entrance or exit from the construction site.

Conditions Where Practice Applies

1. Stabilized construction entrances must be located at all points of construction ingress and egress.

2. For single family residences, the entrance should be located at the permanent driveway.

3. Stabilized construction entrances can not be used on existing pavement.

Construction Specifications

1. Minimum length of 50 feet (30 feet for single residence lot).

2. Minimum width of 10 feet. Flare SCE 10 feet minimum at the existing road to provide a turning radius.

3. Place Geotextile Class SE over the existing ground prior to placing stone. (The plan approval authority may not require single family residence to use geotextile.)

4. Place crushed aggregate (2 to 3 inches in size) or reclaimed or equivalent recycled concrete (without rebar) at least 6 inches deep over the length and width of the SCE.

5. Pipe all surface water flowing to or diverted toward the SCE under the entrance, maintaining positive drainage. 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 will not be necessary. Size pipe (six inch minimum diameter) to convey the runoff generated by a 2-year frequency storm. A mountable berm is required on all SCEs not located at a high spot.

6. Locate SCE at every point where construction traffic enters or leaves a construction site. Vehicles leaving this site must travel over the entire length of the SCE. The orientation of the SCE may vary from a straight line and be curved or 'T' shaped depending on the topography and right of way. Avoid locating entrances along the low point of work area where possible.

Maintenance

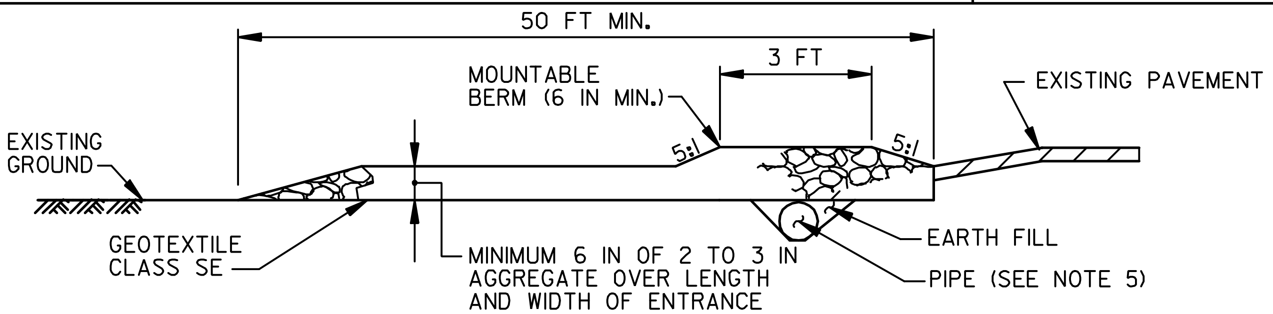
Maintain SCE in a condition which will minimize tracking of sediment. This may require adding stone or other repairs as conditions demand. Stone must be added to maintain the specified dimensions. All sediment spilled, dropped, or tracked must be removed immediately by vacuum sweeping, scraping, or sweeping. Washing the roadway to remove mud tracked onto pavement is not acceptable.

Removal

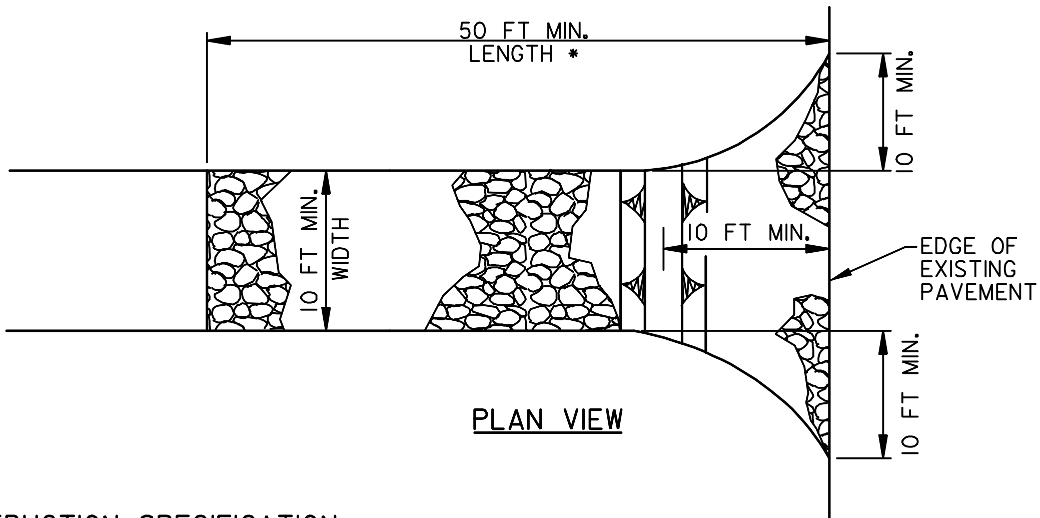
After construction is complete and the site is stabilized, remove the stabilized construction entrance and stabilize the area, unless it will be used as an underlayment for a driveway.

DETAIL B-1 STABILIZED CONSTRUCTION ENTRANCE

STANDARD SYMBOL



PROFILE



PLAN VIEW

CONSTRUCTION SPECIFICATION

1. MINIMUM LENGTH OF 50 FEET (30 FEET FOR SINGLE RESIDENCE LOT).
2. MINIMUM WIDTH OF 10 FEET. FLARE SCE 10 FEET MINIMUM AT THE EXISTING PAVEMENT TO PROVIDE A TURNING RADIUS.
3. PLACE GEOTEXTILE CLASS SE OVER THE EXISTING GROUND PRIOR TO PLACING STONE. (THE PLAN APPROVAL AUTHORITY MAY NOT REQUIRE SINGLE FAMILY RESIDENCE TO USE GEOTEXTILE.)
4. PLACE CRUSHED AGGREGATE (2 TO 3 INCHES IN SIZE) OR EQUIVALENT RECYCLED CONCRETE (WITHOUT REBAR) AT LEAST 6 INCHES DEEP OVER THE LENGTH AND WIDTH OF THE SCE.
5. PIPE ALL SURFACE WATER FLOWING TO OR DIVERTED TOWARD THE SCE UNDER THE ENTRANCE, MAINTAINING POSITIVE DRAINAGE. 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 ON THE LIMIT OF DISTURBANCE (LOD) AND HAS NO DRAINAGE TO CONVEY, A PIPE WILL NOT BE NECESSARY. SIZE PIPE (SIX INCH MINIMUM DIAMETER) TO CONVEY THE RUNOFF GENERATED BY A 2-YEAR FREQUENCY STORM. A MOUNTABLE BERM IS REQUIRED ON ALL SCEs NOT LOCATED AT A HIGH SPOT.
6. LOCATE SCE AT EVERY POINT WHERE CONSTRUCTION TRAFFIC ENTERS OR LEAVES A CONSTRUCTION SITE. VEHICLES LEAVING THE SITE MUST TRAVEL OVER THE ENTIRE LENGTH OF THE SCE. THE ORIENTATION OF THE SCE MAY VARY FROM A STRAIGHT LINE AND BE CURVED OR 'T' SHAPED DEPENDING ON THE TOPOGRAPHY AND RIGHT OF WAY. AVOID LOCATING ENTRANCES ALONG THE LOW POINT OF THE WORK AREA WHERE POSSIBLE.

B-2 STANDARDS AND SPECIFICATIONS

FOR

WASH RACK OPTION

Definition

A stabilized layer of aggregate that is underlain with Geotextile Class SE with a system for washing mud off construction vehicles wheels. Stabilized construction entrances are located at any point where traffic enters or leaves a construction site.

Purpose

Stabilized Construction Entrances with wash racks should be considered wherever soil and/or traffic conditions on site require washing the construction vehicle wheels prior to exiting the site to avoid excessive tracking of mud and sediment.

Conditions Where Practice Applies

1. Stabilized construction entrances with wash racks located at all points of construction ingress and egress where tracking of sediment cannot be removed.

2. Stabilized construction entrance with wash racks must drain to an approved sediment trapping measure.

3. Stabilized construction entrances with wash racks can not be used on existing pavement.

Materials

Provide a wash rack designed of material that is constructed and manufactured to withstand the anticipated traffic loads. Wash Racks may be of concrete, steel plates with ribs or other materials. Wash racks may be of a design that contains the washed mud/sediments or they must drain to an approved sediment trapping device.

Construction Specifications

1. Minimum length of 50 feet (30 feet for single residence lot).

2. Minimum width of 10 feet. Flare 10 feet minimum at the existing road to provide a turning radius.

3. Place Geotextile Class SE over the existing ground prior to placing stone. (The plan approval authority may not require single family residence to use geotextile.)

4. Place crushed aggregate (2 to 3 inches in size) or reclaimed or equivalent recycled concrete (without rebar) at least 6 inches deep over the length and width of the SCE.

5. Provide a wash rack designed and constructed/manufactured for the anticipated traffic loads.

6. Provide a drainage ditch/swale that conveys the runoff from the wash area (if not contained) to an approved sediment trapping device.

7. Pipe all surface water flowing to or diverted toward the SCE under the entrance, maintaining positive drainage. 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 will not be necessary. Size pipe to convey the runoff generated by a 2-year frequency storm. A six inch diameter (minimum) pipe will be required. The mountable berm is required on all SCEs not located at a high spot.

8. Locate SCE pervious surface at every point where construction traffic enters or leaves a construction site. Minimize the number of SCEs for a site. Vehicles leaving the site must travel over the entire length of the SCE. The orientation of the SCE may vary from a straight line and be curved or ‘T’ shaped depending on the topography and right of way. Avoid locating entrances along the low side of the work area where possible.

Maintenance

Maintain the SCE with wash racks in a condition which will prevent tracking or flow of mud onto pavement. This may require periodic top dressing with 2-3 inch stone, or other repairs as conditions demand. The wash rack may need to be cleaned and excess sediment removed. Remove spilled, dropped, washed or tracked sediments from vehicles onto roadways immediately. Repair wash rack if damaged.

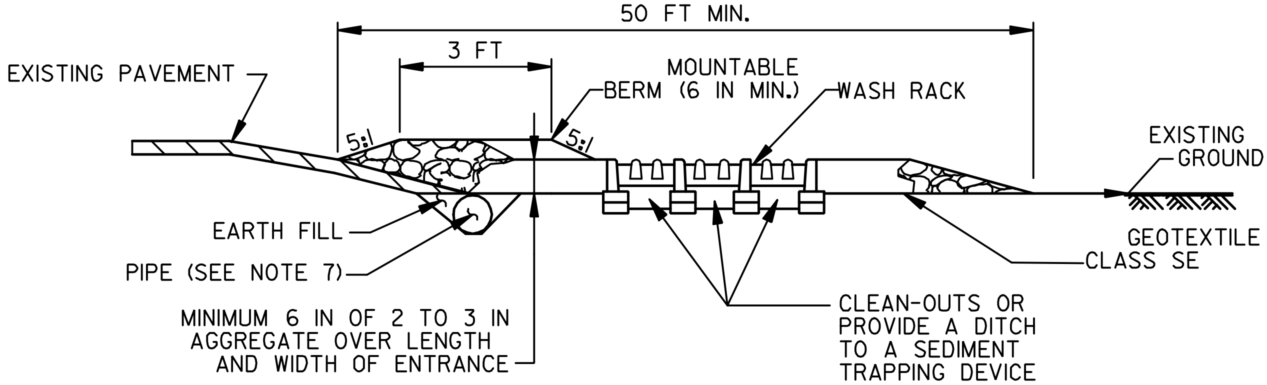
Removal

After construction is complete and the site is stabilized, remove the stabilized construction entrance and wash rack and stabilize the area.

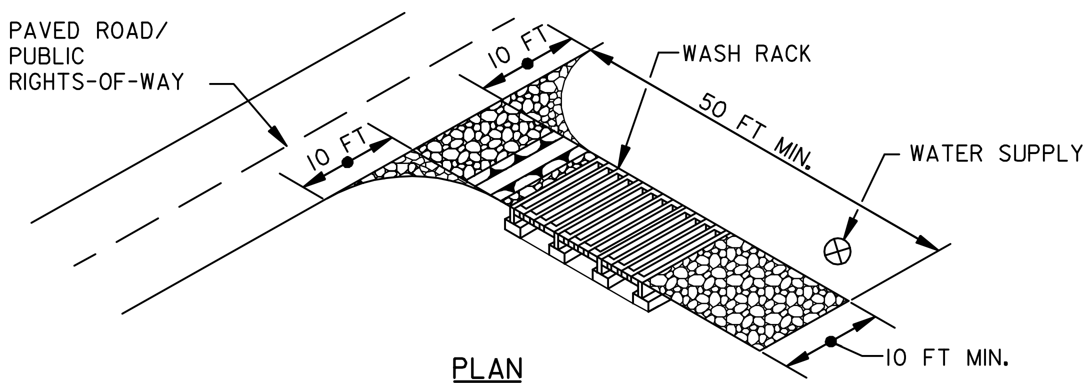
DETAIL B-2 WASH RACK OPTION

STANDARD SYMBOL

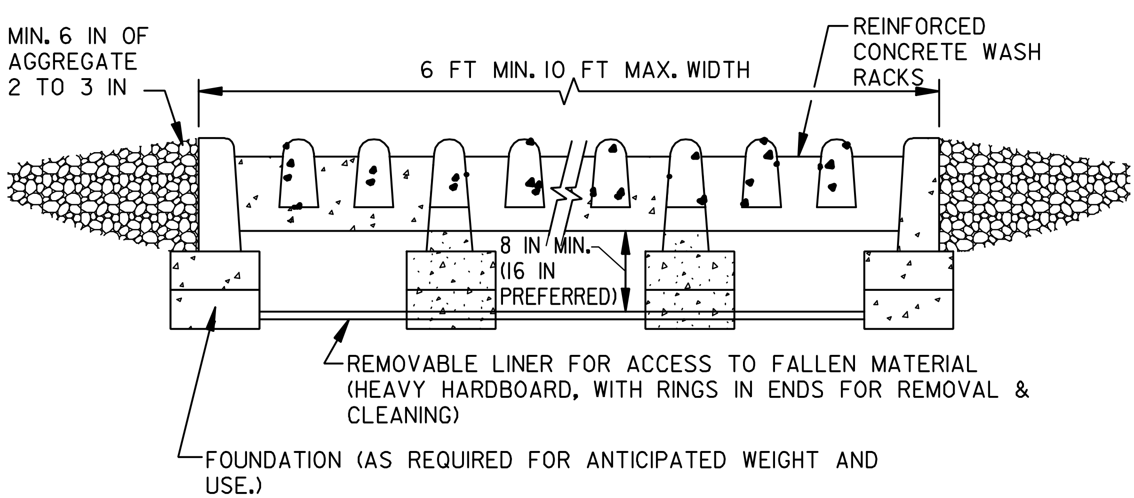
WR



PROFILE



PLAN



SECTION

NOTE: WASH RACK DESIGN MAY CONSIST OF OTHER MATERIALS SUITABLE FOR ANTICIPATED TRUCK TRAFFIC.

1 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL B-2 WASH RACK OPTION

STANDARD SYMBOL

WR

CONSTRUCTION SPECIFICATIONS

1. MINIMUM LENGTH OF 50 FEET (30 FEET FOR SINGLE RESIDENCE LOT).
2. MINIMUM WIDTH OF 10 FEET. FLARE 10 FEET MINIMUM AT THE EXISTING PAVEMENT TO PROVIDE A TURNING RADIUS.
3. PLACE GEOTEXTILE CLASS SE OVER THE EXISTING GROUND PRIOR TO PLACING STONE. (THE PLAN APPROVAL AUTHORITY MAY NOT REQUIRE SINGLE FAMILY RESIDENCE TO USE GEOTEXTILE.)
4. PLACE CRUSHED AGGREGATE (2 TO 3 INCHES IN SIZE) OR EQUIVALENT RECYCLED CONCRETE (WITHOUT REBAR) AT LEAST 6 INCHES DEEP OVER THE LENGTH AND WIDTH OF THE SCE.
5. PROVIDE A WASH RACK DESIGNED AND CONSTRUCTED/MANUFACTURED FOR ANTICIPATED TRAFFIC LOADS.
6. PROVIDE A DRAINAGE DITCH THAT WILL CONVEY THE RUNOFF FROM THE WASH AREA (IF NOT CONTAINED) TO A SEDIMENT TRAPPING DEVICE.
7. PIPE ALL SURFACE WATER FLOWING TO OR DIVERTED TOWARD THE SCE UNDER THE ENTRANCE, MAINTAINING POSITIVE DRAINAGE. 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 ON THE LIMIT OF DISTURBANCE (LOD) AND HAS NO DRAINAGE TO CONVEY, A PIPE WILL NOT BE NECESSARY. SIZE PIPE (SIX INCH MINIMUM DIAMETER) TO CONVEY THE RUNOFF GENERATED BY A 2-YEAR FREQUENCY STORM. A MOUNTABLE BERM IS REQUIRED ON ALL SCEs NOT LOCATED AT A HIGH SPOT.
8. LOCATE SCE WITH WASH RACK AT EVERY POINT WHERE CONSTRUCTION TRAFFIC ENTERS OR LEAVES A CONSTRUCTION SITE. VEHICLES LEAVING THE SITE MUST TRAVEL OVER THE ENTIRE LENGTH OF THE SCE. THE ORIENTATION OF THE SCE MAY VARY FROM A STRAIGHT LINE AND BE CURVED OR 'T' SHAPED DEPENDING ON THE TOPOGRAPHY AND RIGHT OF WAY. AVOID LOCATING ENTRANCES ALONG THE LOW POINT OF THE WORK AREA WHERE POSSIBLE.

2 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

B-3 STANDARDS AND SPECIFICATIONS

FOR

LAND GRADING

Definition

Reshaping of the existing land surface in accordance with a plan to provide suitable topography for building facilities and other site improvements.

Purpose

In this context, land grading provides erosion control and vegetative establishment on those areas where the existing land surface is to be reshaped by grading according to site plans.

Design Criteria

The grading plan should be based upon the incorporation of building designs and street layouts that fit and utilize existing topography and desirable natural surroundings to avoid extreme grade modifications. Information submitted must provide sufficient topographic surveys and soil investigations to determine limitations that must be imposed on the grading operation related to slope stability, effect on adjacent properties and drainage patterns, measures for drainage and water removal and vegetative treatment, etc.

Many counties have regulations and design procedures already established for land grading and cut and fill slopes that must be followed. The plan must show existing and proposed contours for the area(s) to be graded and include practices for erosion control; slope stabilization; safe disposal of runoff water and drainage such as: waterways, lined ditches, reverse slope benches (include grade and cross section), grade stabilization structures, retaining walls, surface drains, and subsurface drains. The grading/construction plans are to include the phasing of these practices and the following:

1. Provisions to safely convey surface runoff to storm drains, protected outlets or to stable water courses to insure that surface runoff will not damage slopes or other graded areas.

2. Cut and fill slopes that will be stabilized with grasses not to exceed 2:l slopes. (Where the slope is to be mowed the slope should be no steeper than 3:l; 4:l is preferred because of safety factors related to mowing steep slopes.) Slopes exceeding 2:l requires special design and stabilization considerations shown on the plans.

3. Reverse benches per Detail B-3-1 whenever the vertical interval (height) of any 2:l slope exceeds 20 feet; for 3:l slope every 30 feet, and for 4:l every 40 feet. Locate benches to divide the slope face as equally as possible and to convey the water to a stable outlet. Soils, seeps, rock outcrops, etc., are to be taken into consideration when designing benches.

    a. Provide benches a minimum of six feet in width for ease of maintenance.

    b. Design benches with a reverse slope of 6:l or flatter to the toe of the upper slope and with a minimum of one foot in depth. Grade the slope of the bench between 2 percent and 3 percent, unless accompanied by appropriate design and computations.

c. The maximum allowable flow length within a bench is 800 feet unless accompanied by appropriate design and computations. For flow channel stabilization see temporary swale.

4. Divert surface water from the face of all cut and fill slopes using earth dikes, ditches, or swales. Convey surface water downslope using a designed structure, and:

   a. Protect the face of all graded slopes from surface runoff until they are stabilized.

   b. Do not subject the face of the slope to any concentrated flows of surface water such as from natural drainageways, graded swales, downspouts, etc.

   c. Protect the face of the slope by special erosion control materials, to include, but not limited to: approved vegetative stabilization practices, riprap or other approved stabilization methods.

5. Serrate cut slopes occurring in ripable rock as shown in the Detail B-3-2. Make serrations with conventional equipment as the excavation progresses. Construct each step or serration on the contour and cut steps at nominal two foot vertical intervals with nominal three foot horizontal shelves. These steps will vary depending on the slope ratio or the cut slope. The maximum allowable slope for ripable rock is 1.5:1. For non rock surfaces, the slopes are to be 2:1 or flatter. These steps will weather and act to hold moisture, lime, fertilizer and seed thus producing a much quicker and longer lived vegetative cover and better slope stabilization. Divert overland flow from the top of all serrated cut slopes and carried to a suitable outlet.

6. Provide subsurface drainage where necessary to intercept seepage that would otherwise adversely affect slope stability or create excessively wet site conditions.

7. Do not create slopes close to property lines as to endanger adjoining properties without adequately protecting such properties against sedimentation, erosion, slippage, settlement, subsidence, or other related damages.

8. Keep fill material free of brush, rubbish, rocks, logs, stumps, building debris, and other objectionable material. No stones over two (2) inches in diameter will be allowed where compacted by hand or mechanical tampers or over eight (8) inches in diameter where compacted by rollers or other equipment. Do not place frozen materials in the fill nor place the fill material on a frozen foundation.

9. Show stockpiles, borrow areas and spoil areas on the plans and provide protection and stabilization according to the Standard and Specifications.

10. Stabilize all disturbed areas structurally or vegetatively in compliance with Section B-4 Standards and Specifications for Stabilization Practices.

B-3-1 STANDARDS AND SPECIFICATIONS

FOR

BENCHING

Construction Specifications

1. Compact all fills as required to reduce erosion, slippage, settlement, subsidence or other related problems. Compact fill intended to support buildings, structures, conduits, etc., in accordance with local requirements or codes.

2. Place all fill in loose lifts not to exceed 8 inches and then compact.

3. Except for approved landfills or nonstructural fills, keep fill material free of brush, rubbish, rocks, logs, stumps, building debris, and other objectionable materials that would interfere with or prevent construction of satisfactory fills.

4. Do not incorporate frozen, soft, mucky, or highly compressible materials into fill slopes or structural fills. Do not place fill on a frozen foundation.

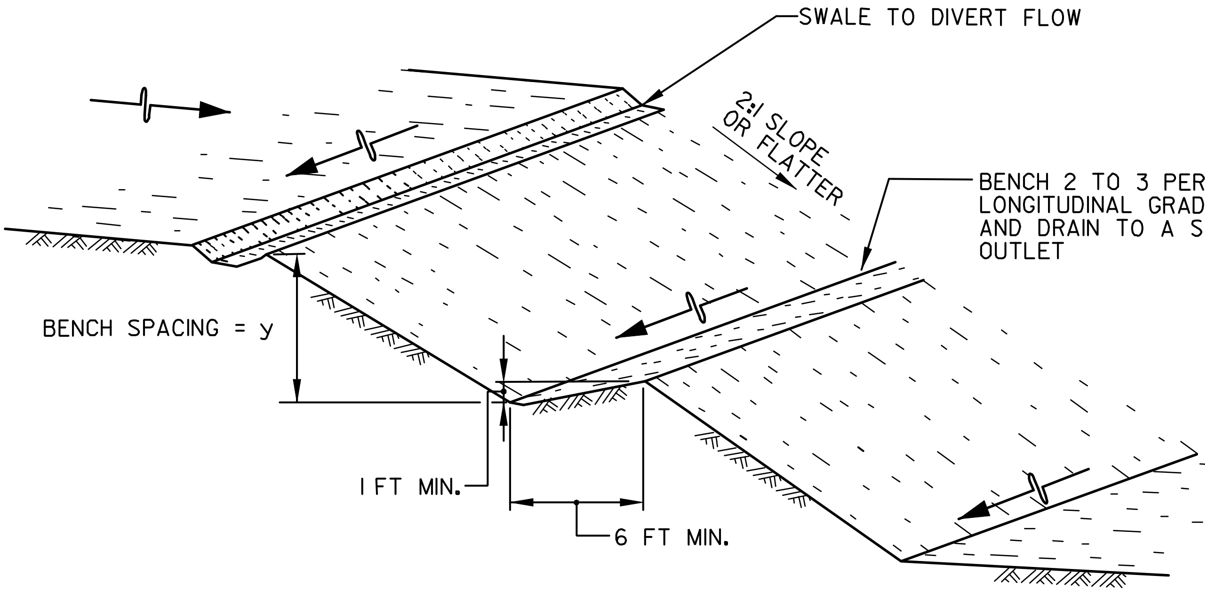
5. Keep all benches free of sediment during all phases of development.

6. Handle seeps or springs encountered during construction in accordance with the standard and specification for subsurface drains or other approved methods.

7. Stabilize in accordance with the 3/7 day stabilization criteria or as specified in the approved erosion and sediment control plan. Installation of erosion control matting may be necessary in bench/swale inverts.

DETAIL B-3-1 BENCHING

STANDARD SYMBOL



SLOPE	y (MAX.)
2:1	20 FT
3:1	30 FT
4:1	40 FT

CONSTRUCTION SPECIFICATIONS

1. COMPACT ALL FILLS AS REQUIRED TO REDUCE EROSION, SLIPPAGE, SETTLEMENT, OR OTHER RELATED PROBLEMS. COMPACT FILL INTENDED TO SUPPORT BUILDINGS, STRUCTURES, CONDUITS, ETC. IN ACCORDANCE WITH LOCAL REQUIREMENTS OR CODES.
2. PLACE ALL FILL IN LOOSE LIFTS NOT TO EXCEED 8 INCHES AND THEN COMPACT.
3. EXCEPT FOR APPROVED LANDFILLS OR NONSTRUCTURAL FILLS, USE FILL MATERIAL FREE OF BRUSH, RUBBISH, ROCKS, LOGS, STUMPS, BUILDING DEBRIS, AND OTHER OBJECTIONABLE MATERIALS THAT WOULD INTERFERE WITH OR PREVENT CONSTRUCTION OF SATISFACTORY FILLS.
4. DO NOT INCORPORATE FROZEN, SOFT, MUCKY, OR HIGHLY COMPRESSIBLE MATERIALS INTO FILL SLOPES OR STRUCTURAL FILLS. DO NOT PLACE FILL ON A FROZEN FOUNDATION.
5. KEEP ALL BENCHES FREE OF SEDIMENT DURING ALL PHASES OF DEVELOPMENT.
6. HANDLE SEEPS OR SPRINGS ENCOUNTERED DURING CONSTRUCTION IN ACCORDANCE WITH THE STANDARD AND SPECIFICATION FOR SUBSURFACE DRAINS OR OTHER APPROVED METHODS.
7. STABILIZE IN ACCORDANCE WITH THE 3/7 DAY STABILIZATION CRITERIA OR AS SPECIFIED IN THE APPROVED EROSION AND SEDIMENT CONTROL PLAN. INSTALLATION OF EROSION CONTROL MATTING MAY BE NECESSARY IN BENCH/SWALE INVERTS.

B-3-2 STANDARDS AND SPECIFICATIONS

FOR

SERRATED SLOPE

Construction Specifications

1. Serrate cut slopes occurring in ripable rock as shown. Make serrations with conventional equipment as the excavation progresses.

2. Construct each step or serration on the contour and cut steps. Rise & run dimensions will vary depending on the final slope ratio or the cut slope. For ripable rock surfaces, make two foot vertical (rise) and three foot horizontal (run) serrations at a maximum slope ratio of 1.5:1 for non rock surfaces. Make two foot vertical (rise) and four foot horizontal (run) serrations at a maximum slope ratio of 2:1.

3. Divert overland flow from the top of all serrated cut slopes and carry to a suitable outlet.

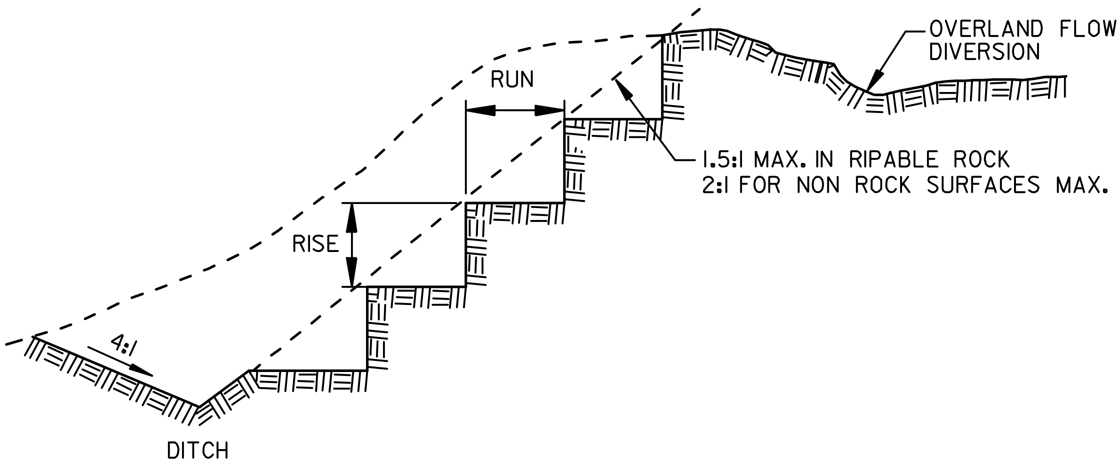
4. Keep all benches free of sediment during all phases of development.

5. Handle seeps or springs encountered during construction in accordance with the standard and specification for subsurface drain or other approved methods.

6. Temporarily or permanently stabilize all graded, non rock surfaces in accordance with the 3/7 day stabilization requirements.

DETAIL B-3-2 SERRATED SLOPE

STANDARD SYMBOL



TYPICAL SECTION

CONSTRUCTION SPECIFICATIONS

1. SERRATE CUT SLOPES OCCURRING IN RIPABLE ROCK AS SHOWN. MAKE SERRATIONS WITH CONVENTIONAL EQUIPMENT AS THE EXCAVATION PROGRESSES.
2. CONSTRUCT EACH STEP OR SERRATION ON THE CONTOUR AND CUT STEPS. RISE & RUN DIMENSIONS WILL VARY DEPENDING ON THE FINAL SLOPE RATIO. FOR RIPABLE ROCK SURFACES, MAKE TWO FOOT VERTICAL (RISE) AND THREE FOOT HORIZONTAL (RUN) SERRATIONS AT A MAXIMUM SLOPE RATIO OF 1.5:1. FOR NON ROCK SURFACES. MAKE TWO FOOT VERTICAL (RISE) AND FOUR FOOT HORIZONTAL (RUN) SERRATIONS AT A MAXIMUM SLOPE RATIO OF 2:1.
3. DIVERT OVERLAND FLOW FROM THE TOP OF ALL SERRATED CUT SLOPES AND CARRY TO A SUITABLE OUTLET.
4. KEEP ALL BENCHES FREE OF SEDIMENT DURING ALL PHASES OF DEVELOPMENT.
5. HANDLE SEEPS OR SPRINGS ENCOUNTERED DURING CONSTRUCTION IN ACCORDANCE WITH THE STANDARD AND SPECIFICATION FOR SUBSURFACE DRAIN OR OTHER APPROVED METHODS.
6. TEMPORARILY OR PERMANENTLY STABILIZE ALL GRADED, NON ROCK SLOPES IN ACCORDANCE WITH THE 3/7 DAY STABILIZATION REQUIREMENTS.

B-4 STANDARDS AND SPECIFICATIONS

FOR

STABILIZATION PRACTICES

Definition

Using vegetation as cover for barren soil to protect it from forces that cause erosion.

Purpose

Stabilization practices are used to promote the establishment of vegetation on exposed soil. When soil is stabilized with vegetation, the soil is less likely to erode and more likely to allow infiltration of rainfall, thereby reducing sediment loads and runoff to downstream areas, and improving wildlife habitat and visual resources.

Conditions Where Practice Applies

This practice is used on denuded areas as specified on the plans and may be used on highly erodible or critically eroding areas. This specification is divided into several sections: Soil Preparation, to get the site and soils ready to receive the stabilization practice; Soil Amendments or Topsoiling, with fertilizer, lime, seeding and mulches; Temporary Stabilization, to quickly establish vegetative cover for short duration (between two months but less than one year), and Permanent Stabilization, for long term vegetative cover. Examples of applicable areas for Temporary Stabilization are temporary soil stockpiles, cleared areas being left idle between construction phases, earth dikes, etc. and for Permanent Stabilization are lawns, dams, cut and fill slopes and other areas at final grade, former stockpile and staging areas, etc.

Effects on Water Quality and Quantity

Planting vegetation in disturbed areas will have an effect on the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, percolation, and groundwater recharge. Vegetation, over time, will increase organic matter content and improve the water holding capacity of the soil and subsequent plant growth.

Vegetation will help reduce the movement of sediment, nutrients, and other chemicals carried by runoff to receiving waters. Plants will also help protect groundwater supplies by assimilating those substances present within the root zone.

Sediment control devices must remain in place during grading, seedbed preparation, seeding, mulching and vegetative establishment to prevent large quantities of sediment and associated chemicals and nutrients from washing into surface waters.

Repairs and Maintenance

Inspect all seeded areas for failures and make necessary repairs, replacements, and reseedings within the planting season.

1. Once the vegetation is established, the site shall have 95 percent groundcover to be considered adequately stabilized.

2. If the stand provides less than 40 percent ground coverage, reestablish following original lime, fertilizer, seedbed preparation and seeding recommendations.

3. If the stand provides between 40 percent and 94 percent ground coverage, overseeding and fertilizing using half of the rates originally applied may be necessary.

4. Maintenance fertilizer rates for permanent seedings are shown in Table B.1. For lawns and other medium to high maintenance turfgrass areas, refer to the University of Maryland publication "Lawn Care in Maryland" Bulletin No. 171.

A. Incremental Stabilization - Cut Slopes

i. Dress, prepare, seed and mulch all cut slopes as the work progresses. Excavate and stabilize cut slopes in equal increments not to exceed 15 feet.

ii. Construction sequence (Refer to Figure B.1):

a. Excavate and stabilize all temporary swales, side ditches, or berms that will be used to convey runoff from the excavation.

b. Perform Phase 1 excavation, dress, and stabilize.

c. Perform Phase 2 excavation, dress, and stabilize. Overseed Phase 1 areas as necessary.

d. Perform final phase excavation, dress, and stabilize. Overseed previously seeded areas as necessary.

Note: Once excavation has begun the operation should be continuous from grubbing through the completion of grading and placement of topsoil (if required) and permanent seed and mulch. Any interruptions in the operation or completing the operation out of the seeding season will necessitate the application of temporary stabilization.

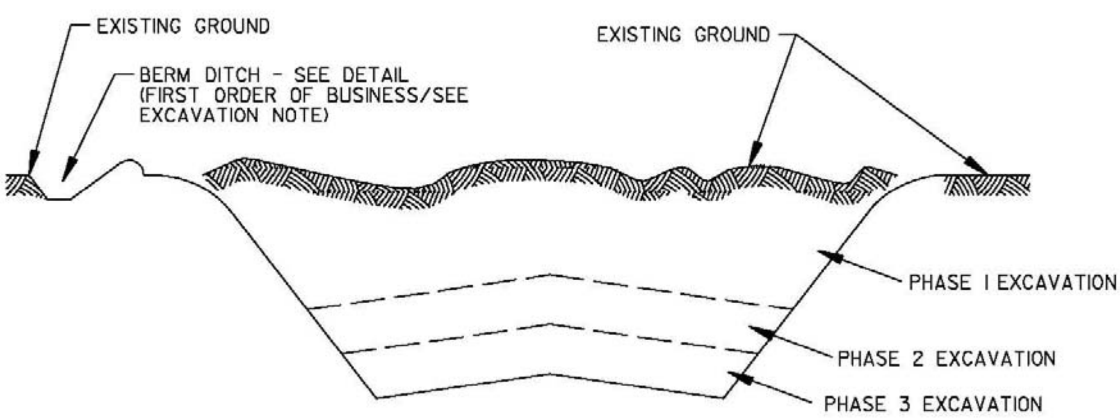


Figure B.1: Incremental Stabilization – Cut

B. Incremental Stabilization of Embankments - Fill Slopes

i. Construct embankments in lifts as prescribed on the plans.

ii. Stabilize slopes immediately when the vertical height of the multiple lifts reaches 15 feet, or when the grading operation ceases as prescribed in the plans.

iii. At the end of each day, temporary berms and pipe slope drains should be constructed along the top edge of the embankment to intercept surface runoff and convey it down the slope in a non-erosive manner to a sediment trapping device.

iv. Construction Sequence: (Refer to Figure B.2 below).

a. Excavate and stabilize all temporary swales, side ditches, or berms that will be used to divert runoff around the fill. Construct Slope Silt Fence on low side of fill as shown in Figure B.3, unless other methods shown on the plans address this area.

b. Place Phase 1 embankment, dress and stabilize.

c. Place Phase 2 embankment, dress and stabilize.

d. Place final phase embankment, dress and stabilize. Overseed previously seeded areas as necessary.

Note: Once the placement of fill has begun the operation should be continuous from grubbing through the completion of grading and placement of topsoil (if required) and permanent seed and mulch. Any interruptions in the operation or completing the operation out of the seeding season will necessitate the application of temporary stabilization.

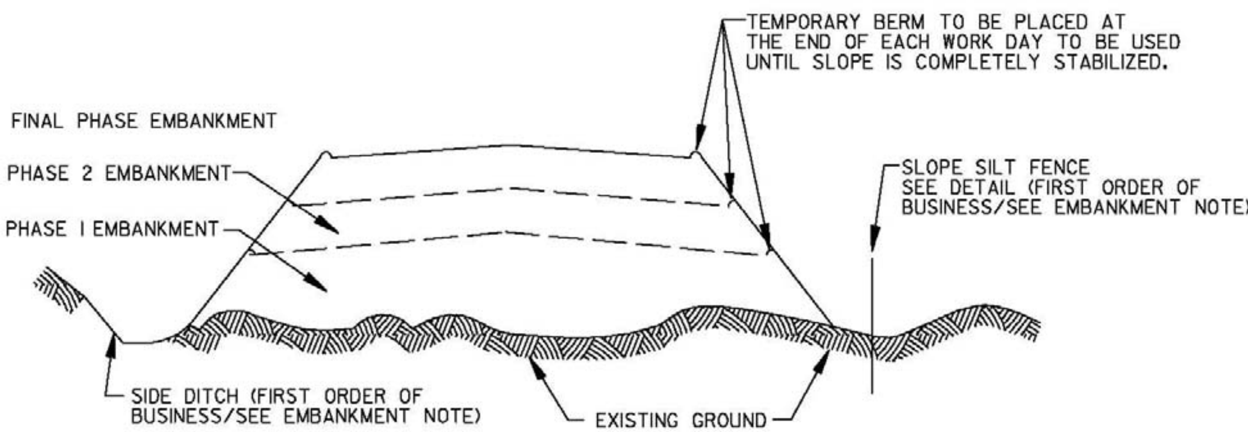


Figure B.2: Incremental Stabilization – Fill

B-4-1 STANDARDS AND SPECIFICATIONS

FOR

SOIL PREPARATION

A. Site Preparation

i. Install erosion and sediment control structures (either temporary or permanent) such as diversions, grade stabilization structures, berms, waterways, or sediment control basins.

ii. Perform all grading operations at right angles to the slope. Final grading and shaping is not usually necessary for temporary stabilization.

iii. Schedule required soil tests to determine soil amendment composition and application rates for sites having disturbed area over 5 acres.

B. Soil Preparation

i. Temporary Stabilization

a. Seedbed preparation shall 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 it shall not be rolled or dragged smooth but left in the roughened condition. Sloped areas (greater than 3:1) shall be tracked leaving the surface in an irregular condition with ridges running parallel to the contour of the slope.

b. Apply fertilizer and lime as prescribed on the plans.

c. Incorporate lime and fertilizer into the top 3 to 5 inches of soil by disking or other suitable means.

ii. Permanent Stabilization

a. Minimum soil conditions required for permanent vegetative establishment:

1. Soil pH shall be between 6.0 and 7.0.

2. Soluble salts shall be less than 500 parts per million (ppm).

3. The soil shall contain less than 40 percent clay but enough fine grained material (greater than 30 percent silt plus clay) to provide the capacity to hold a moderate amount of moisture. An exception: if lovegrass will be planted, then a sandy soil (less than 30 percent silt plus clay) would be acceptable.

4. Soil shall contain 1.5 percent minimum organic matter by weight.

5. Soil must contain sufficient pore space to permit adequate root penetration.

6. Addition of topsoil is required in accordance with Section B-4-2 Soil Amendments, Seeding, Mulching and Topsoiling if the above conditions cannot be met by on site soils.

b. Areas previously graded in conformance with the drawings shall be maintained 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.

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

d. 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. Loosen surface soil by dragging with a heavy chain or other equipment to roughen the surface where site conditions will not permit normal seedbed preparation. Track steep slopes (steeper than 3:1) with 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 be unnecessary on newly disturbed areas.

B-4-2 STANDARDS AND SPECIFICATIONS

FOR

SOIL AMENDMENTS, SEEDING, MULCHING AND TOPSOILING

A. Soil Amendments (Fertilizer and Lime Specifications)

i. Soil tests must be performed to determine the exact ratios and application rates for both lime and fertilizer on sites having disturbed areas over 5 acres. Soil analysis may be performed by a recognized private or commercial laboratory. Soil samples taken for engineering purposes may also be used for chemical analyses.

ii. Fertilizers shall be uniform in composition, free flowing and suitable for accurate application by approved equipment. Manure may be substituted for fertilizer with prior approval from the appropriate approval authority. Fertilizers shall all be delivered to the site fully labeled according to the applicable state fertilizer laws and shall bear the name, trade name or trademark and warranty of the producer.

iii. Lime materials shall be ground limestone (hydrated or burnt lime may be substituted) which contains at least 50 percent total oxides (calcium oxide plus magnesium oxide). Limestone shall be ground to such fineness that at least 50 percent will pass through a #100 mesh sieve and 98 to 100 percent will pass through a #20 mesh sieve.

iv. Incorporate lime and fertilizer into the top 3 to 5 inches of soil by disking or other suitable means.

B. Seed Specifications

i. All seed must meet the requirements of the Maryland State Seed Law. All seed shall be subject to re-testing by a recognized seed laboratory. All seed used shall have been tested within the 6 months immediately preceding the date of sowing such material on any project. **Note: Seed tags shall be made available to the inspector to verify type and rate of seed used.**

ii. Inoculant: The inoculant for treating legume seed in the seed mixtures shall be a pure culture of nitrogen fixing bacteria prepared specifically for the species. Inoculants shall not be used later than the date indicated on the container. Add fresh inoculant as directed on package. Use four times the recommended rate when hydroseeding. **Note: It is very important to keep inoculant as cool as possible until used. Temperatures above 75 to 80 degrees Fahrenheit can weaken bacteria and make the inoculant less effective.**

C. Methods of Seeding

i. Hydroseeding: Apply seed uniformly with hydroseeder (slurry includes seed and fertilizer), broadcast or drop seeder, or a cultipacker seeder.

a. If fertilizer is being applied at the time of seeding, the application rates amounts will not exceed the following: nitrogen; maximum of 100 pounds per acre total of soluble nitrogen; P_2O5 (phosphorous): 200 pounds per acre; K_2O (potassium): 200 pounds per acre.

b. Lime: Use only ground agricultural limestone, (Up to 3 tons per acre may be applied by hydroseeding). Normally, not more than 2 tons are applied by hydroseeding at any one time. Do not use burnt or hydrated lime when hydroseeding.

c. Mix seed and fertilizer on site and seed immediately and without interruption.

ii. Dry Seeding: This includes use of conventional drop or broadcast spreaders.

a. Seed spread dry shall be incorporated into the subsoil at the rates prescribed on the Temporary or Permanent Seeding Summaries or Tables. Roll the seeded area with a weighted roller to provide good seed to soil contact.

b. Where practical, seed should be applied in two directions perpendicular to each other. Apply half the seeding rate in each direction.

iii. Drill or Cultipacker Seeding: Mechanized seeders that apply and cover seed with soil.

a. Cultipacking seeders are required to bury the seed in such a fashion as to provide at least 1/4 inch of soil covering. Seedbed must be firm after planting.

b. Where practical, seed should be applied in two directions perpendicular to each other. Apply half the seeding rate in each direction.

D. Mulch Specifications (In order of preference)

i. Straw shall consist of thoroughly threshed wheat, rye, or oat straw- reasonably bright in color. Straw shall be free of noxious weed seeds as specified in the Maryland Seed Law and shall not be musty, moldy, caked, decayed, or excessively dusty. **Note: Only Sterile straw mulch should be used in areas where one species of grass is desired.**

ii. Wood Cellulose Fiber Mulch (WCFM)

a. WCFM shall consist of specially prepared wood cellulose processed into a uniform fibrous physical state.

b. WCFM shall be dyed green or contain a green dye in the package that will provide an appropriate color to facilitate visual inspection of the uniformly spread slurry.

c. WCFM, including dye, shall contain no germination or growth inhibiting factors.

d. WCFM materials shall be manufactured and processed in such a manner that the wood cellulose fiber mulch will remain in uniform suspension in water under agitation and will blend with seed, fertilizer and other additives to form a homogeneous slurry. The mulch material shall form a blotter-like ground cover, on application, having moisture absorption and percolation properties and shall cover and hold grass seed in contact with the soil without inhibiting the growth of the grass seedlings.

e. WCFM material shall contain no elements or compounds at concentration levels that will be phyto-toxic.

f. WCFM must conform to the following physical requirements: fiber length of approximately 10 millimeters, diameter approximately 1 millimeter, pH range of 4.0 to 8.5, ash content of 1.6 percent maximum and water holding capacity of 90 percent minimum.

E. Mulching Seeded Areas: Apply mulch to all seeded areas immediately after seeding.

i. If grading is completed outside of the seeding season, apply mulch alone as prescribed in this section and maintain until the seeding season returns and then perform seeding in accordance with these specifications.
ii. When straw mulch is used, spread it over all seeded areas at the rate of 2 tons per acre to a uniform loose depth of 1 to 2 inches. Apply mulch to achieve a uniform distribution and depth so that the soil surface is not exposed. When using a mulch anchoring tool, increase the rate to 2.5 tons per acre.
iii. Wood cellulose fiber used as mulch shall be applied at a net dry weight of 1,500 pounds per acre. Mix the wood cellulose fiber with water, to attain a mixture with a maximum of 50 pounds of wood cellulose fiber per 100 gallons of water.

F. Securing Straw Mulch (Mulch Anchoring): Perform mulch anchoring immediately following application to minimize loss by wind or water. This may be done by one of the following methods (listed by preference), depending upon size of area and erosion hazard:

i. A mulch anchoring tool is a tractor drawn implement designed to punch and anchor mulch into the soil surface a minimum of 2 inches. This practice is most effective on large areas, but is limited to flatter slopes where equipment can operate safely. If used on sloping land, this practice should be used on the contour if possible.
ii. Wood cellulose fiber may be used for anchoring straw. Apply the fiber binder at a net dry weight of 750 pounds per acre. Mix the wood cellulose fiber with water at a maximum of 50 pounds of wood cellulose fiber per 100 gallons of water.
iii. Application of liquid binders should be heavier at the edges where wind catches mulch, such as in valleys and on crests of banks. The remainder of area should appear uniform after binder application. Synthetic binders - such as Acrylic DLR (Agro-Tack), DCA-70, Petroset, Terra Tax II, Terra Tack AR or other approved equal may be used at rates recommended by the manufacturer to anchor mulch. Use of asphalt binders is strictly prohibited.
iv. Lightweight plastic netting may be stapled over the mulch according to manufacturer recommendations. Netting is usually available in rolls 4 to 15 feet wide and 300 to 3,000 feet long.

G. Topsoiling: Placement of topsoil over prepared subsoil prior to establishment of permanent vegetation. The purpose is to provide a suitable soil medium for vegetative growth. Soils of concern have low moisture content, low nutrient levels, low pH, materials toxic to plants, and/or unacceptable soil gradation.

Conditions Where Practice Applies

1. This practice is limited to areas having 2:1 or flatter slopes where:

a. The texture of the exposed subsoil/parent material is not adequate to produce vegetative growth.

b. The soil material is so shallow that the rooting zone is not deep enough to support plants or furnish continuing supplies of moisture and plant nutrients.

c. The original soil to be vegetated contains material toxic to plant growth.
d. The soil is so acidic that treatment with limestone is not feasible.

2. For the purpose of these Standards and Specifications, areas having slopes steeper than 2:1 require special consideration and design for adequate stabilization. Areas having slopes steeper than 2:1 shall have the appropriate stabilization shown on the plans.

Construction and Material Specifications

1. Topsoil salvaged from the existing site may be used provided that it meets the standards as set forth in these specifications. Typically, the depth of topsoil to be salvaged for a given soil type can be found in the representative soil profile section in the Soil Survey published by USDA-SCS in cooperation with Maryland Agricultural Experimental Station.

2. Topsoil Specifications: Soil to be used as topsoil must meet the following:

   a. Topsoil shall be a loam, sandy loam, clay loam, silt loam, sandy clay loam, loamy sand. Other soils may be used if recommended by an agronomist or soil scientist and approved by the appropriate approval authority. Regardless, topsoil shall not be a mixture of contrasting textured subsoils and shall contain less than 5% by volume of cinders, stones, slag, coarse fragments, gravel, sticks, roots, trash, or other materials larger than 1½" in diameter.

   b. Topsoil must be free of plants or plant parts such as bermuda grass, quackgrass, Johnsongrass, nutsedge, poison ivy, thistle, or others as specified.

   c. Where the subsoil is either highly acidic or composed of heavy clays, ground limestone shall be spread at the rate of 4-8 tons/acre (200-400 pounds per 1,000 square feet) prior to the placement of topsoil. Lime shall be distributed uniformly over designated areas and worked into the soil in conjunction with tillage operations as described in the following procedures.

3. For sites having disturbed areas under 5 acres:

   a. Place topsoil (if required) and apply soil amendments as specified Section B-4 Stabilization Practices.

4. For sites having disturbed areas over 5 acres:

   a. On soil meeting Topsoil specifications, obtain test results dictating fertilizer and lime amendments required to bring the soil into compliance with the following:

      i. pH for topsoil shall be between 6.0 and 7.5. If the tested soil demonstrates a pH of less than 6.0, sufficient lime shall be perscribed to raise the pH to 6.5 or higher.

      ii. Organic content of topsoil shall be not less than 1.5 percent by weight.

      iii. Topsoil having soluble salt content greater than 500 parts per million shall not be used.

iv. No sod or seed shall be placed on soil which has been treated with soil sterilants or chemicals used for weed control until sufficient time has elapsed (14 days min.) to permit dissipation of phyto-toxic materials.

Note: Topsoil substitutes or amendments, as recommended by a qualified agronomist or soil scientist and approved by the appropriate approval authority, may be used in lieu of natural topsoil.

b. Place topsoil (if required) and apply soil amendments as specified in Section B-4, Stabilization Practices. .

5. Topsoil Application

a. When topsoiling, maintain needed erosion and sediment control practices such as diversions, Grade Stabilization Structures, Earth Dikes, Slope Silt Fence and Sediment Traps and Basins.

i. Grades on the areas to be topsoiled, which have been previously established, shall be maintained, albeit 4-8 inches higher in elevation.
ii. Topsoil shall be uniformly distributed in a 4-8 inch layer and lightly compacted to a minimum thickness of 4inches. Spreading shall be performed in such a manner that sodding or seeding can proceed with a minimum of additional soil preparation and tillage. Any irregularities in the surface resulting from topsoiling or other operations shall be corrected in order to prevent the formation of depressions or water pockets.
iii. Topsoil shall not be placed while the topsoil or subsoil is in a frozen or muddy condition, when the subsoil is excessively wet or in a condition that may otherwise be detrimental to proper grading and seedbed preparation.

6. Alternative for Permanent Seeding: Instead of applying the full amounts of lime and commercial fertilizer, composted sludge and amendments may be applied as specified below:

a. Composted Sludge Material for use as a soil conditioner for sites having disturbed areas over 5 acres shall be tested to prescribe amendments and for sites having disturbed areas under 5 acres shall conform to the following requirements:

i. Composted sludge shall be supplied by, or originate from, a person or persons that are permitted (at the time of acquisition of the compost) by the Maryland Department of the Environment under COMAR 26.04.06.
ii. Composted sludge shall contain at least 1 percent nitrogen, 1.5 percent phosphorus, and 0.2 percent potassium and have a Ph of 7.0 to 8.0. If compost does not meet these requirements, the appropriate constituents must be added to meet the requirements prior to use.
iii. Composted sludge shall be applied at a rate of 1 ton/1,000 square feet.
iv. Composted sludge shall be amended with a potassium fertilizer applied at the rate of 4 lb/1,000 square feet, and 1/3 the normal lime application rate.

Table B.1: Maintenance Fertilization for Permanent Seedings

Use Soil Test Results or Rates Shown Below

Seeding Mixture	Type	lb/ac	lb/1000 sf	Time	Mowing
Tall fescue makes up 70 percent or more of cover.	10-10-10 or 30-10-10	500 400	11.5 9.2	Yearly or as needed. Fall	Not closer than 3 inches, if occasional mowing is desired.
Birdsfoot Trefoil.	0-20-0	400	9.2	Spring, the year following establishment, and every 4 to 5 years, thereafter.	Do not mow crownvetch.
Fairly uniform stand of tall fescue or birdsfoot trefoil.	5-10-10	500	11.5	Fall, the year following establishment, and every 4 to 5 years, thereafter.	Not required, no closer than 4 inches in the fall after seed has matured.
Weeping lovegrass fairly uniform plant distribution.	5-10-10	500	11.5	Spring, the year following establishment, and every 3 to 4 years, thereafter.	Not required, not closer than 4 inches in fall after seed has matured.
Red & chewings fescue, Kentucky bluegrass, hard fescue mixtures.	20-10-10	250 100	5.8 2.3	September, 30 days later. December, May 20, June 30, if needed.	Mow no closer than 2 inches for red fescue and Kentucky bluegrass, 3 inches for fescue.

B-4-3 STANDARDS AND SPECIFICATIONS

FOR

TEMPORARY STABILIZATION

Definition

To stabilize a disturbed area with vegetation for a temporary period of time up to 6 months to protect it from the forces of erosion.

Purpose

To use annual grass or grains to provide cover on disturbed areas for up to 6 months. For longer duration of time, permanent stabilization practices are required.

Design

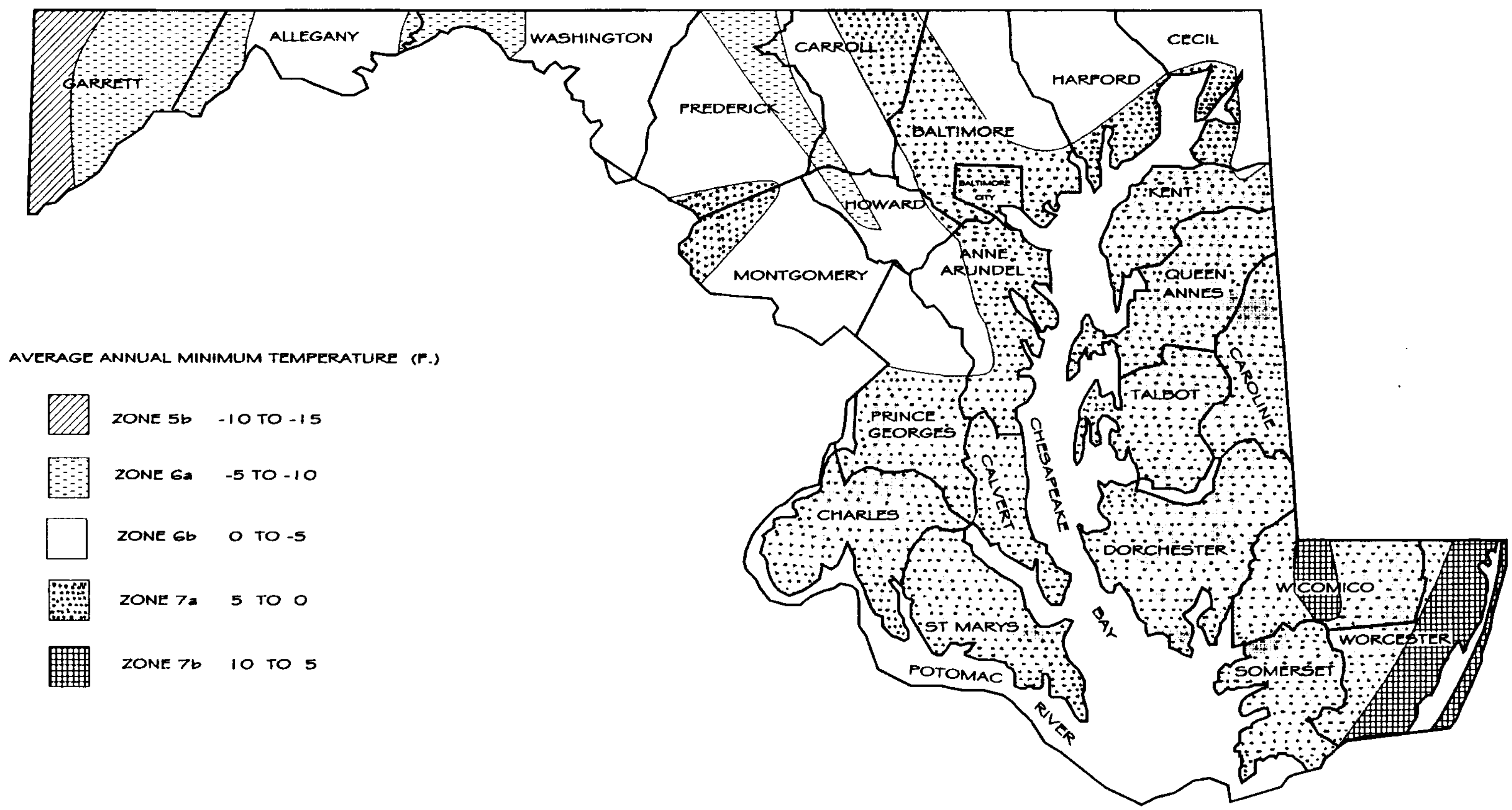
Seed Mixtures - Temporary Seeding

i. Select one or more of the species or mixtures listed in Table B.2 for the appropriate Plant Hardiness Zone (from Figure B.3) and enter them in the Temporary Seeding Summary below, along with application rates, seeding dates and seeding depths. If this Summary is not put on the plans and completed, then Table B.2, plus fertilizer and lime rates, must be put on the plans.

ii. For sites having soil tests performed, use and show the recommended rates by the testing agency. Soil tests are not required for Temporary Seeding.

Temporary Seeding Summary

<table>
<tr><th colspan="5">Seed Mixture (Hardiness Zone: _________)
(From Table B.2)</th><th rowspan="2">Fertilizer Rate
(10-10-10)</th><th rowspan="2">Lime Rate</th></tr>
<tr><th>No.</th><th>Species</th><th>Application Rate (lb/ac)</th><th>Seeding Dates</th><th>Seeding Depths</th></tr>
<tr><td rowspan="4"></td><td></td><td></td><td></td><td>¼ inch minimum
2 inch max.</td><td rowspan="4">600 lb/ac
(14 lb/1000 sf)</td><td rowspan="4">2 tons/ac
(100 lb/1000 sf)</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>



Plant Hardiness Zones delineate areas where a species can be successfully established based on average annual minimum temperatures.

Figure B.3: U.S.D.A. Plant Hardiness Zones

Table B.2: Temporary Seeding for Site Stabilization

	Plant Hardiness Zones		
Type of Plant Material	**5b and 6a**	**6b**	**7a and 7b**
Seeds - Cool-Season Grasses (includes mixes with forbs and/or legumes)	Mar 15 to May 31 Aug 1 to Sep 30	Mar 1 to May 15 Aug 1 to Oct 15	Feb 15 to Apr 30 Aug 15 to Oct 31 Nov 1 to Nov 30♦
Seeds - Warm-Season/Cool-Season Grass Mixes (includes mixes with forbs and/or legumes)	Mar 15 to May 31♦♦ Jun 1 to Jun 15*	Mar 1 to May 15♦♦ May 16 to Jun 15*	Feb 15 to Apr 30♦♦ May 1 to May 31*
Sod - Cool-Season	Mar 15 to May 31 Jun 1 to Aug 31* Sep 1 to Nov 1*✦	Mar 1 to May 15 May 16 to Sep 14* Sep 15 to Nov 15*✦	Feb 15 to Apr 30 May 1 to Sep 30* Oct 1 to Dec 1*✦
Unrooted Woody Materials; Bare-Root Plants; Bulbs, Rhizomes, Corms, and Tubers [2/]	Mar 15 to May 31 Jun 1 to Jun 30*	Mar 1 to May 15 May 16 to Jun 30*	Feb 15 to Apr 30 May 1 to Jun 30*
Containerized Stock; Balled-and-Burlapped Stock	Mar 15 to May 31 Jun 1 to Jun 30* Sep 1 to Nov 15*✦	Mar 1 to May 15 May 16 to Jun 30* Sep 15 to Nov 30*✦	Feb 15 to Apr 30 May 1 to Jun 30* Oct 1 to Dec 15*✦

Table B.2 Notes:

1. **The planting dates listed are averages for each zone. These dates may require adjustment to reflect local conditions, especially near the boundaries of the zones. When seeding toward the end of the listed planting dates, or when conditions are expected to be less than optimal, select an appropriate nurse crop from Table 1 and plant with the permanent seeding mix.**

2. **When planted during the growing season, most of these materials must be purchased and kept in a dormant condition until planting. Bare-root grasses are the exception—they may be supplied as growing (non-dormant) plants.**

♦ **Additional planting dates for the lower Coastal Plain, dependent on annual rainfall and temperature trends. Recommend adding a nurse crop, as noted above, if planting during this period.**

♦♦ **Warm-season grasses need a soil temperature of at least 50 degrees F in order to germinate. If soil temperatures are colder than 50 degrees, or moisture is not adequate, the seeds will remain dormant until conditions are favorable. In general, planting during the latter portion of this period allows more time for weed emergence and weed control prior to planting. When selecting a planting date, consider the need for weed control vs. the likelihood of having sufficient moisture for later plantings, especially on droughty sites.**

* **Additional planting dates during which supplemental watering may be needed to ensure plant establishment.**

✦ **Frequent freezing and thawing of wet soils may result in frost-heaving of materials planted in late fall, if plants have not sufficiently rooted in place. Sod usually needs 4 to 6 weeks to become sufficiently rooted. Large containerized and balled-and-burlapped stock may be planted into the winter months as long as the ground is not frozen and soil moisture is adequate.**

B-4-4 STANDARDS AND SPECIFICATIONS

FOR

PERMANENT STABILIZATION

Definition

To stabilize a disturbed area with vegetation for a period of 6 months or more or permanently.

Purpose

To use seeding grasses and legumes to establish ground cover for period more than 6 months or permanently on disturbed areas generally receiving low maintenance.

Design

1. Permanent Seeding: Seeding grass and legumes to establish ground cover for a minimum period of 6 months or more or permanently on disturbed areas generally receiving low maintenance.

   A. Seed Mixtures: Permanent Seeding

      i. Select one or more of the species or mixtures listed in Table B.6 for the appropriate Plant Hardiness Zone (from Figure B.1) and enter them in the Permanent Seeding Summary below, along with application rates and seeding dates. Seeding depths can be estimated using Table B.6. If this Summary is not put on the construction plans and completed, then Table B.6 must be put on the plans. Additional planting specifications for exceptional sites such as shorelines, streambanks, or dunes or for special purposes such as wildlife or aesthetic treatment may be found in USDA-NRCS Technical Field Office Guide, Section 342 - Critical Area Planting.

      ii. For sites having disturbed area over 5 acres, use and show the rates recommended by the soil testing agency.

      iii. For areas receiving low maintenance, apply ureaform fertilizer (46-0-0) at 3 and 1/2 pounds per 1000 square feet (150 pounds per acre), in addition to the above soil amendments shown in the table below, to be performed at the time of seeding.

Permanent Seeding Summary

<table>
<tr><th colspan="5">Seed Mixture (For Hardiness Zone: ________)
(From Table B.6)</th><th colspan="3">Fertilizer Rate
(10-20-20)</th><th rowspan="2">Lime Rate</th></tr>
<tr><th>No.</th><th>Species</th><th>Application Rate (lb/ac)</th><th>Seeding Dates</th><th>Seeding Depths</th><th>N</th><th>P_2O_5</th><th>K_20</th></tr>
<tr><td rowspan="3"></td><td></td><td></td><td></td><td></td><td rowspan="3">90 pounds per acre (2.0 lb/ 1000 sf)</td><td rowspan="3">175 lb/ac (4 lb/ 1000 sf)</td><td rowspan="3">175 lb/ac (4 lb/ 1000 sf)</td><td rowspan="3">2 tons/ac (92 lb/ 1000 sf)</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>

2. Sod: To provide quick cover on disturbed areas (2:1 grade or flatter).

A. General Specifications

i. Class of turfgrass sod shall be Maryland or Virginia State Certified or Approved. Sod labels shall be made available to the job foreman and inspector.

ii. Sod shall be machine cut at a uniform soil thickness of ¾ inch, plus or minus ¼ inch, at the time of cutting. Measurement for thickness shall exclude top growth and thatch. Individual pieces of sod shall be cut to the supplier width and length. Maximum allowable deviation from standard widths and lengths shall be 5 percent. Broken pads and torn or uneven ends will not be acceptable.

iii. Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape when suspended vertically with a firm grasp on the upper 10 percent of the section.

iv. Sod shall not be harvested or transplanted when moisture content (excessively dry or wet) may adversely affect its survival.

v. Sod shall be harvested, delivered, and installed within a period of 36 hours. Sod not transplanted within this period shall be approved by an agronomist or soil scientist prior to its installation.

B. Sod Installation

i. During periods of excessively high temperature or in areas having dry subsoil, lightly irrigate the subsoil immediately prior to laying the sod.

ii. Lay the first row of sod in a straight line with subsequent rows placed parallel to it and tightly wedged against each other. Stagger lateral joints 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.

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

iv. Water the sod immediately 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.

C. Sod Maintenance

i. In the absence of adequate rainfall, perform daily watering or as often as necessary during the first week and in sufficient quantities to maintain moist soil to a depth of 4 inches. Watering should be done during the heat of the day to prevent wilting.

ii. After the first week, sod watering is required as necessary to maintain adequate moisture content.

iii. The first mowing of sod should not be attempted until the sod is firmly rooted. No more than 1/3 of the grass leaf shall be removed by the initial cutting or subsequent cuttings. Maintain grass height between 2 and 3 inches unless otherwise specified.

3. Turfgrass Establishment: Areas where turfgrass may be desired include lawns, parks, playgrounds, and commercial sites which will receive a medium to high level of maintenance. Till areas to receive seed by disking or other approved methods to a depth of 2 to 4 inches, level and rake the areas to prepare a proper seedbed. Remove stones and debris over 1 and 1/2 inches in diameter. The resulting seedbed shall be in such condition that future mowing of grasses will pose no difficulty.
Note: Choose certified material. Certified material is the best guarantee of cultivar purity. The certification program of the Maryland Department of Agriculture, Turf and Seed Section, provides a reliable means of consumer protection and assures a pure genetic line.

A. Turfgrass Mixtures

i. <u>Kentucky Bluegrass</u>: Full Sun Mixture: For use in areas that receive intensive management. Irrigation required in the areas of central Maryland and eastern shore. Recommended Certified Kentucky Bluegrass Cultivars Seeding Rate: 1.5 to 2.0 pounds per 1000 square feet. A minimum of three bluegrass cultivars should be chosen ranging from a minimum of 10 percent to a maximum of 35 percent of the mixture by weight.

ii. <u>Kentucky Bluegrass/Perennial Rye</u>: Full Sun Mixture: For use in full sun areas where rapid establishment is necessary and when turf will receive medium to intensive management. Certified Perennial Ryegrass Cultivars/Certified Kentucky Bluegrass Seeding Rate: 2 pounds mixture per 1000 square feet. A minimum of 3 Kentucky Bluegrass Cultivars must be chosen, with each cultivar ranging from 10 percent to 35 percent of the mixture by weight.

iii. <u>Tall Fescue/Kentucky Bluegrass</u>: Full Sun Mixture: For use in drought prone areas and/or for areas receiving low to medium management in full sun to medium shade. Recommended mixture includes; certified Tall Fescue Cultivars 95 to 100 percent, certified Kentucky Bluegrass Cultivars 0 to 5 percent. Seeding Rate: 5 to 8 pounds per 1000 square feet. One or more cultivars may be blended.

iv. <u>Kentucky Bluegrass/Fine Fescue: Shade Mixture</u>: For use in areas with shade in Bluegrass lawns. For establishment in high quality, intensively managed turf area. Mixture includes; certified Kentucky Bluegrass Cultivars 30 to 40 percent and certified Fine Fescue and 60 to 70 percent. Seeding Rate: 1 and 1/2 to 3 pounds per 1000 square feet. A minimum of 3 Kentucky bluegrass cultivars must be chosen, with each cultivar ranging from a minimum of 10 percent to a maximum of 35 percent of the mixture by weight.
Note: Turfgrass varieties should be selected from those listed in the most current University of Maryland Publication, Agronomy Memo #77, "Turfgrass Cultivar Recommendations for Maryland".

B. Ideal Times of Seeding

Western MD: March 15 to June 1, August 1 to October 1 (Hardiness Zones: 5b, 6a)

Central MD: March 1 to May 15, August 15 to October 15 (Hardiness Zone: 6b)

Southern MD, Eastern Shore: March 1 to May 15, August 15 to October 15 (Hardiness Zones: 7a, 7b)

C. Irrigation

If soil moisture is deficient, supply new seedings with adequate water for plant growth (1/2 to 1 inch every 3 to 4 days depending on soil texture) until they are firmly established. This is especially true when seedings are made late in the planting season, in abnormally dry or hot seasons, or on adverse sites.

Table B.3: Recommended Planting Dates for Permanent Cover in Maryland [1/]

Type of Plant Material	Plant Hardiness Zones		
	5b and 6a	6b	7a and 7b
Seeds - Cool-Season Grasses (includes mixes with forbs and/or legumes)	Mar 15 to May 31 Aug 1 to Sep 30	Mar 1 to May 15 Aug 1 to Oct 15	Feb 15 to Apr 30 Aug 15 to Oct 31 Nov 1 to Nov 30♦
Seeds - Warm-Season/Cool-Season Grass Mixes (includes mixes with forbs and/or legumes)	Mar 15 to May 31♦♦ Jun 1 to Jun 15*	Mar 1 to May 15♦♦ May 16 to Jun 15*	Feb 15 to Apr 30♦♦ May 1 to May 31*
Sod - Cool-Season	Mar 15 to May 31 Jun 1 to Aug 31* Sep 1 to Nov 1*✦	Mar 1 to May 15 May 16 to Sep 14* Sep 15 to Nov 15*✦	Feb 15 to Apr 30 May 1 to Sep 30* Oct 1 to Dec 1*✦
Unrooted Woody Materials; Bare-Root Plants; Bulbs, Rhizomes, Corms, and Tubers [2/]	Mar 15 to May 31 Jun 1 to Jun 30*	Mar 1 to May 15 May 16 to Jun 30*	Feb 15 to Apr 30 May 1 to Jun 30*
Containerized Stock; Balled-and-Burlapped Stock	Mar 15 to May 31 Jun 1 to Jun 30* Sep 1 to Nov 15*✦	Mar 1 to May 15 May 16 to Jun 30* Sep 15 to Nov 30*✦	Feb 15 to Apr 30 May 1 to Jun 30* Oct 1 to Dec 15*✦

Table B.3 Notes:

1. **The planting dates listed are averages for each zone. These dates may require adjustment to reflect local conditions, especially near the boundaries of the zones. When seeding toward the end of the listed planting dates, or when conditions are expected to be less than optimal, select an appropriate nurse crop from Table 1 and plant with the permanent seeding mix. (See Table B.2, Note 1, for more information.)**

2. **When planted during the growing season, most of these materials must be purchased and kept in a dormant condition until planting. Bare-root grasses are the exception—they may be supplied as growing (non-dormant) plants.**

♦ **Additional planting dates for the lower Coastal Plain, dependent on annual rainfall and temperature trends. Recommend adding a nurse crop, as noted above, if planting during this period.**

♦♦ **Warm-season grasses need a soil temperature of at least 50 degrees F in order to germinate. If soil temperatures are colder than 50 degrees, or moisture is not adequate, the seeds will remain dormant until conditions are favorable. In general, planting during the latter portion of this period allows more time for weed emergence and weed control prior to planting. When selecting a planting date, consider the need for weed control vs. the likelihood of having sufficient moisture for later plantings, especially on droughty sites.**

* **Additional planting dates during which supplemental watering may be needed to ensure plant establishment.**

✦ **Frequent freezing and thawing of wet soils may result in frost-heaving of materials planted in late fall, if plants have not sufficiently rooted in place. Sod usually needs 4 to 6 weeks to become sufficiently rooted. Large containerized and balled-and-burlapped stock may be planted into the winter months as long as the ground is not frozen and soil moisture is adequate.**

Table B.4: Recommended Permanent Seeding Mixtures by Site Condition or Purpose

Site Condition or Purpose of the Planting	Recommended Mix (see Table B.6)												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Steep Slopes, Roadsides	4	4	4	υ	4	υ				υ	υ	4	4
Sand and Gravel Pits, Sanitary Landfills	4	4	4	υ	4	υ				υ	υ	4	
Salt-Damaged Areas	υ												4
Mine Spoil, Dredged Material, and Spoil Banks	υ		4	υ	υ								
Utility Rights-of-Way	4	4	4	4	4	4	υ			4	4	4	
Dikes and Dams	υ	υ	4	υ		4	4	υ		4	4	4	
Berms, Low Embankments (not on Ponds)	4	4	4	4	4	4	υ	υ		4	4	4	υ
Pond and Channel Banks, Streambanks	4	4	4	4	υ	υ	υ			υ	υ		
Grassed Waterways, Diversions, Terraces, Spillways	υ				υ	4	4	υ	4		4		υ
Bottom of Drainage Ditches, Swales, Detention Basins				υ		4	υ			υ	4		4
Field Borders, Filter Strips, Contour Buffer Strips	4	4	4	υ	υ	4	υ	4	4	4	4	4	υ
Wastewater Treatment Strips and Areas								4	υ	υ			
Heavy Use Areas (Grass Loafing Paddocks for Livestock)								4					
Athletic Fields, Residential and Commercial Lawns							υ	4	4		4		
Recreation Areas							4	4	4		4		

Table B.4 Notes:

4 **Recommended mix for this site condition or purpose.**

υ **Alternative mix, depending on site conditions**

Table B.5: Quality of Seed

Species	Minimum Seed Purity (%)	Minimum Seed Germination (%)	Species	Minimum Seed Purity (%)	Minimum Seed Germination (%)
COOL-SEASON GRASSES			**WARM-SEASON GRASSES**		
Barley	98	85	Bluestem, Big	60	60
Bentgrass, Creeping	95	85	Bluestem, Little	55	60
Bluegrass, Canada	90	80	Deertongue	95	75
Bluegrass, Kentucky	97	80	Indiangrass	60	60
Bluegrass, Rough	96	80	Millet, Foxtail or Pearl	98	80
Fescue, Chewings	97	85	Panicgrass, Coastal	95	70
Fescue, Creeping Red	97	85	Switchgrass	95	75
Fescue, Hard	97	85	**LEGUMES/FORBS**		
Fescue, Sheep	97	85	Clover, Alsike	99	85
Fescue, Tall	97	85	Clover, Bush	--	--
Meadowgrass, Fowl	--	--	Clover, Red	99	85
Oats	98	85	Clover, White	98	90
Orchardgrass	90	80	Flatpea	98	75
Redtop	92	80	Indigo, Wild	--	--
Rye, Cereal	98	85	Lespedeza, Common	98	80
Ryegrass, Annual or Perennial	97	85	Lespedeza, Korean	98	80
Saltgrass, Alkali	85	80	Pea, Partridge	98	70
Wheat	98	85	Tick-Trefoil, Showy	--	--
Wild Rye, Canada	85	70	Trefoil, Birdsfoot	98	85
Wild Rye, Virginia	--	--	Wildflowers	--	--

TABLE B.5 NOTE:

1. **All seed shall comply with the Maryland State Seed Law. Seed shall be free of prohibited or restricted noxious weeds, as currently listed by the Maryland Department of Agriculture, Turf and Seed Section.**

Table B.6: Selected List of Permanent Herbaceous Seeding Mixtures

Mix	Recommended Cultivar	Seeding Rate [1/] lbs./ac.	Seeding Rate [1/] lbs./ 1000 sq .ft.	Soil Drainage Class [2/]	Max. Height (feet)	Maint. Level [3/]	Remarks
WARM-SEASON/COOL-SEASON GRASS MIXES							
1. SELECT ONE WARM-SEASON GRASS:				E - P	4 - 7	C - D	All species are native to Maryland. Plant this mix with a regular grass drill. Coastal panicgrass is best adapted to Zones 7a and 7b. Creeping red fescue is a cool-season grass that will provide erosion protection while the warm-season grass (switchgrass or coastal panicgrass) is becoming established. Switchgrass, coastal panicgrass, the 'Dawson' variety of creeping red fescue, and partridge pea are moderately salt-tolerant. Do not use bush clover or wild indigo on wet sites.
Switchgrass *Panicum virgatum* **OR**	Blackwell, Carthage, Cave-in-Rock, or Shelter	10	0.23				
Coastal Panicgrass *Panicum amarum var. amarulum*	Atlantic	10	0.23				
AND ADD:							
Creeping Red Fescue *Festuca rubra var. rubra*	Dawson, Pennlawn, Flyer, Fortess, Ruby, or Salem	15	0.34				
PLUS ONE OF THE FOLLOWING LEGUMES:							
Partridge Pea *Chamaecrista fasciculata*	Common	4	0.09				
Bush Clover *Lespedeza capitata*	Common	2	0.05				
Wild Indigo *Baptisia tinctoria*	Common	2	0.05				
2. Big Bluestem *Andropogon gerardii*	Niagara or Rountree	6	0.14	E - MW	6 - 8	C - D	All species are native to Maryland. The indiangrass and bluestems have fluffy seeds. Plant with a specialized native seed drill. Creeping red fescue is a cool-season grass that will provide erosion protection while the warm-season grasses are becoming established.
Indiangrass *Sorghastrum nutans*	Rumsey	6	0.14				
Little Bluestem *Schizachyrium scoparium*	Aldous or Blaze	4	0.09				
Creeping Red Fescue *Festuca rubra var. rubra*	Dawson, Pennlawn, Flyer, Fortess, Ruby, or Salem	15	0.34				
PLUS ONE OF THE FOLLOWING LEGUMES:							
Partridge Pea *Chamaecrista fasciculata*	Common	4	0.09				
Bush Clover *Lespedeza capitata*	Common	2	0.05				
Wild Indigo *Baptisia tinctoria*	Common	2	0.05				
Showy Tick-Trefoil *Desmodium canadense*	Common	1	0.02				

Mix	Recommended Cultivar	Seeding Rate [1/]		Soil Drainage Class [2/]	Max. Height (feet)	Maint. Level [3/]	Remarks
		lbs./ac.	lbs./ 1000 sq .ft.				
WARM-SEASON/COOL-SEASON GRASS MIXES							
3. SELECT THREE GRASSES:				E - MW	4 - 6	C - D	
Deertongue Dichanthelium clandestinum	Tioga	20	0.46				Excellent for excessively droughty, low pH (acidic) soils.
Sheep Fescue Festuca ovina **OR**	Common or Bighorn	20	0.46				Sheep fescue, Canada wild rye, and redtop are cool-season grasses that will provide erosion protection while the warm-season grass (deertongue) is becoming established.
Canada Wild Rye Elymus canadensis	Common	3	0.07				
Redtop Agrostis gigantea	Streaker	1	0.02				
PLUS ONE OF THE FOLLOWING LEGUMES:							
Common Lespedeza Lespedeza striata	Kobe	10	0.23				Common lespedeza ('Kobe' variety) is more tolerant of low acidity and high manganese concentrations than Korean lespedeza. These lespedezas are reseeding annuals.
Korean Lespedeza Lespedeza stipulacea	Climax or Rowan	10	0.23				
4. Deertongue Dichanthelium clandestinum	Tioga	15	0.34	W - P	2 - 3	C - D	
Creeping Red Fescue Festuca rubra var. rubra	Dawson, Pennlawn, Flyer, Fortess, Ruby, or Salem	20	0.46				
Virginia Wild Rye Elymus virginicus **OR**	Common	5	0.11				Use Virginia wild rye on moist, shady sites.
Canada Wild Rye Elymus canadensis	Common	5	0.11				Use Canada wild rye on droughty sites.

Mix	Recommended Cultivar	Seeding Rate [1/]		Soil Drainage Class [2/]	Max. Height (feet)	Maint. Level [3/]	Remarks
		lbs./ac.	lbs./ 1000 sq .ft.				
COOL-SEASON GRASS MIXES							
5. SELECT <u>TWO</u> GRASSES:							
Creeping Red Fescue Festuca rubra var. rubra **<u>OR</u>**	Dawson, Pennlawn, Flyer, Fortess, Ruby, or Salem	20	0.46	E - SP	2 - 3	B - D	Use creeping red fescue in heavy shade and on moist sites.
Hard Fescue Festuca trachyphylla	Attila or Aurora	20	0.46				Perennial ryegrass and redtop will establish more rapidly than either fescue. Redtop tolerates wet sites better than ryegrass.
Perennial Ryegrass Lolium perenne **<u>OR</u>**	Blazer (II), Pennfine	10	0.23				
Redtop Agrostis gigantea	Streaker	1	0.02				Flatpea will suppress woody vegetation. It should be planted in the spring, or as a dormant seeding in late fall or winter. It must be incorporated into the soil or covered with mulch. It may not be winter-hardy if planted late summer - fall. <u>Caution</u>: Flatpea can spread aggressively, and can be toxic to livestock.
AND ADD THE FOLLOWING LEGUME:							
Flatpea Lathyrus sylvestris	Lathco	15	0.34				
6. Tall Fescue Lolium arundinaceum (formerly Festuca arundinacea)	Recommended MD turf-types [4/]	40	0.93	W - SP	2 - 3	C - D	
Perennial Ryegrass Lolium perenne	Blazer (II), Pennfine	25	0.57				
PLUS <u>ONE</u> OF THE FOLLOWING LEGUMES:							
Birdsfoot Trefoil Lotus corniculatus	Empire, Viking, Norcen, Leo	8	0.18				Birdsfoot trefoil is suitable for use only in Zones 5b and 6a.
White Clover Trifolium repens	Common	5	0.11				
7. Creeping Red Fescue Festuca rubra var. rubra	Dawson, Pennlawn, Flyer, Fortess, Ruby, or Salem	60	1.38	W - MW	1 - 2	C - D	This mix has good shade tolerance.
Kentucky Bluegrass Poa pratensis	Recommended MD turf-types [4/]	15	0.34				

Mix	Recommended Cultivar	Seeding Rate [1/]		Soil Drainage Class [2/]	Max. Height (feet)	Maint. Level [3/]	Remarks
		lbs./ac.	lbs./ 1000 sq .ft.				
8. Tall Fescue Lolium arundinaceum (formerly Festuca arundinacea)	Recommended MD turf-types [4/]	100	2.3	E - SP	2 - 3	A - D	Tall fescue produces a dense turf if frequently mowed, but tends to be clumpy if mowed only occasionally. For best results, recommend using a blend of 3 cultivars. Use low-endophyte cultivars in areas where livestock may graze.
9. SELECT <u>ONE</u> SPECIES OF FESCUE:				W - SP	2 - 3	A - B	Good for highly managed athletic fields. Tall fescue is more suitable for compacted, high use areas and on moist sites. Hard fescue produces finer-textured turf with more shade tolerance. Use tall fescue instead of hard fescue for wastewater treatment strips and areas. For best results, recommend using a blend of 3 cultivars each for tall fescue and Kentucky bluegrass.
Tall Fescue Lolium arundinaceum (formerly Festuca arundinacea) **<u>OR</u>**	Recommended MD turf-types [4/]	60	1.38				
Hard Fescue Festuca trachyphylla	Attila or Aurora	40	0.92				
AND ADD:							
Kentucky Bluegrass Poa pratensis	Recommended MD turf-types [4/]	40	0.92				
Perennial Ryegrass Lolium perenne	Blazer (II), Pennfine	20	0.46				
10. Orchardgrass Dactylis glomerata	Any	25	0.57	W - SP	2 - 3	C - D	Low maintenance mix that is easy to establish.
Creeping Red Fescue Festuca rubra var. rubra	Dawson, Pennlawn, Flyer, Fortess, Ruby, or Salem	10	0.23				
Redtop Agrostis gigantea	Streaker	1	0.02				
Alsike Clover Trifolium hybridum	Common	3	0.07				Alsike clover can be toxic to horses.
White Clover Trifolium repens	Common	3	0.07				Omit the clovers if using this mix for wastewater treatment strips and areas.

Mix	Recommended Cultivar	Seeding Rate [1/] lbs./ac.	Seeding Rate [1/] lbs./ 1000 sq .ft.	Soil Drainage Class [2/]	Max. Height (feet)	Maint. Level [3/]	Remarks
11. Creeping Red Fescue Festuca rubra var. rubra	Dawson, Pennlawn, Flyer, Fortess, Ruby, or Salem	30	0.69	E - MW	2 - 3	B - D	
Chewings Fescue Festuca rubra ssp.commutata	Common	30	0.69				
Kentucky Bluegrass Poa pratensis	Recommended MD turf-types [4/]	20	0.46				
OPTIONAL ADDITION							
Rough Bluegrass Poa trivialis	Common	15	0.34				Add rough bluegrass in moist, shady conditions.
12. Creeping Red Fescue Festuca rubra var. rubra	Dawson, Pennlawn, Flyer, Fortess, Ruby, or Salem	25	0.57	E - MW	2 - 3	C - D	Attractive mix of fine fescues and wildflowers for low maintenance conditions. Once well-established, the grasses may tend to outcompete the wildflowers. Wildflowers are best established by broadcasting and cultipacking on a prepared seedbed. Drilling can be also used, but care must be taken so that seeds are not drilled too deep. Hydroseeding is not recommended for this mix if wildflowers are used. (They have very small seeds.)
Hard Fescue Festuca trachyphylla	Attila or Aurora	25	0.57				
Sheep Fescue Festuca ovina	Common or Bighorn	25	0.57				
PLUS WILDFLOWER MIX:							
Black-eyed Susan Rudbeckia hirta	Common	2	0.05				
Lance-leaved Coreopsis Coreopsis lanceolata	Common	2	0.05				
Purple Coneflower Echinacea purpurea	Common	2	0.05				
Partridge Pea Chamaecrista fasciculata	Common	5	0.11				
OR ADD CLOVER MIX:							
White Clover Trifolium repens	Common	3	0.07				
Red Clover Trifolium pratense	Any	3	0.07				

Mix	Recommended Cultivar	Seeding Rate [1/]		Soil Drainage Class [2/]	Max. Height (feet)	Maint. Level [3/]	Remarks
		lbs./ac.	lbs./ 1000 sq .ft.				
13. Alkali Saltgrass Puccinellia distans	Fults or Salty	20	0.46	W - P	2 - 3	B - D	This is the recommended mix for saline sites. Saltgrass will persist only under saline conditions.
Creeping Red Fescue Festuca rubra var. rubra	Dawson	15	0.34				For best results, use only the 'Dawson' variety of creeping red fescue. It is a salt-tolerant variety.
Fowl Meadowgrass Poa palustris	Common	2	0.05				
<u>**OPTIONAL ADDITION**</u>							
Creeping Bentgrass Agrostis stolonifera	Seaside	2	0.05				Add bentgrass for wetter conditions.

Table B.6 Notes:

1. Seeding Rates: Seeding rates for the warm-season grasses are in pounds of Pure Live Seed (PLS). Actual planting rates shall be adjusted to reflect percent seed germination and purity, as tested. Adjustments are usually not needed for the cool-season grasses, legumes, or wildflowers. All legume seeds shall be inoculated before planting with the appropriate Rhizobium bacteria. When feasible, hard-seeded legumes should be scarified to improve germination.

2 Soil Drainage Class (refer to the county soil survey for further information):
E - Excessively Drained; W - Well Drained; MW - Moderately Well Drained; SP - Somewhat Poorly Drained; P - Poorly Drained.

3. Maintenance Level:

A - Intensive mowing (every 2 - 4 days), fertilization, lime, insect and weed control, and watering (examples: high maintenance lawns and athletic fields).
B - Frequent mowing (every 4 - 7 days), occasional fertilization, lime, pest control, and watering (examples: residential, school, and commercial lawns).
C - Periodic mowing (every 7 - 14 days), occasional fertilization and lime (examples: residential lawns, parks).
D - Infrequent or no mowing, fertilization, or lime after the first year of establishment (examples: wildlife areas, roadsides, steep banks)

4. Turf-type cultivars of Tall Fescue and Kentucky Bluegrass shall be selected based on recommendations of the University of Maryland Cooperative Extension Service, Agronomy Mimeo 77. (See the "References" section of this standard.) Recommendations in the April, 2000 publication are as follows:

A. <u>Kentucky Bluegrass</u> –

1. The following Kentucky bluegrass cultivars are suitable for general use, and are also noted for shade tolerance:

America	**Coventry**	**Quantum Leap**
Ascot	**Liberator**	**Showcase**
Brilliant	**Moonlight**	**SR 2000**
Champagne	**Nuglade**	**Unique**
Compact	**Princeton 105**	

2. The following Kentucky bluegrass cultivars are suitable for general use, and are also noted for tolerance of low maintenance conditions:

Barirus	**Haga**	**Monopoly**
Caliber	**Livingston**	**Washington**
Eagleton	**Merit**	
Freedom	**Midnight**	

B. <u>Tall Fescue</u> - The following turf-type cultivars are suitable for general use:

Alamo E	**Bulldawg**	**Debutante**	**Good-En**	**Micro DD**	**Rebel 3D***	**Scorpio**	**Titan 2**
Apache II	**Chapel Hill**	**Dominion**	**Grande**	**Millennium**	**Rebel III***	**Shenandoah**	**Tomahawk***
Avanti*	**Chieftain II***	**Duke**	**Guardian**	**Olympic Gold**	**Rebel Jr.**	**Shenandoah II**	**Trailblazer II***
Axiom	**Chinook**	**Duster***	**Heritage**	**Oncue**	**Rebel Sentry**	**Southern Choice***	**Twilight II**
Bandana	**Cochise II**	**Eldorado***	**Houndog 5**	**Pixie**	**Red Coat**	**SR 8200**	**Virtue***
Barlexus	**Comstock**	**Empress**	**Jaguar III**	**Pixie E+**	**Regiment***	**SR 8300**	**Watchdog**
Barrington	**Coyote**	**Falcon II***	**Lancer**	**Plantation**	**Rembrandt**	**Stetson**	**Wolfpack**
Bonanza*	**Crossfire***	**Finelawn Petite***	**Leprechaun**	**Pyramid**	**Renegade**	**Tarheel**	**WPEZE**
Bonanza II	**Crossfire II**	**Genesis**	**Masterpiece**	**Rebel 2000**	**Reserve**	**TF6**	**Wyatt**

Tall fescue cultivar names that are followed by an asterisk (*) have low endophyte levels (20% or lower, based on seed analysis). To avoid livestock health problems due to endophyte toxicity, use low-endophyte cultivars for critical area plantings where livestock may be allowed to graze (e.g., heavy use grass loafing paddocks). Please note that endophyte levels in plantings can vary between varieties, between fields of the same variety, and with the time of year. For areas where livestock will not have access, cultivars with higher endophyte levels are desirable because they tend to be more drought tolerant and more resistant to disease and insect damage.

B-4-5 STANDARDS AND SPECIFICATIONS

FOR

SOIL STABILIZATION MATTING

Definition

Soil stabilization matting is used to temporarily stabilize channels or steep slopes until vegetation is established and/or to permanently stabilize an area. There are many types of matting available. The soil stabilization matting that is used must withstand the flow velocities determined for the area.

Conditions Where Practice Applies

Mattings are used to stabilize the flow channels of dikes and channels and on steep slopes. They may also be used on tidal or stream banks where moving water is likely to wash out new vegetative plantings.

Materials

Temporary soil stabilization matting is a machine produced, temporary mat of degradable (lasts 6 months minimum, 12 months maximum) natural or manmade fibers (mostly organic) of uniform thickness and distribution of fibers throughout and is smolder resistant.

Permanent soil stabilization matting is an open weave synthetic machine produced, temporary mat consisting of synthetic non degradable fibers or elements of uniform thickness and distribution of weave throughout.

Any chemicals used shall be non leaching, non toxic to vegetation and seed germination, and non injurious to the skin. If present, netting shall be extruded plastic having a maximum mesh opening size of 2 inch by 2 inch, sufficiently bonded or sewn on 2 inch centers along the longitudinal axis of the material to prevent separation of the net from the parent material for the life of the product.

Staples for the matting can be steel U or T shaped steel wire having minimum gauges of No. 11 (3.061 mm) and No. 8 (4.115 mm) respectively, or wood in a wedge shape. The U shape staples shall average 1 to 1 and 1/2 inches wide and be a minimum of 6 inches long. T shaped staples shall have an 8 inch main leg, a 1 inch secondary leg and a 4 inch head. The wood staples shall be rough sawn hardwood, wedged shaped, 1 inch by 3 inches at the top, and 12 to 24 inches in length.

Ditch or Channel Installation

1. Perform final grading, topsoil application seedbed preparation, and permanent seeding in accordance with specifications. Place matting within 48 hours of completing seeding operations unless end of workday stabilization is specified on the approved erosion and sediment control plan.

2. Unroll matting in direction of water flow, centering the first roll on the ditch centerline. Lay mat smoothly and firmly on the seeded surface and avoid stretching the matting.

3. Key in upstream end of each mat roll by digging a 6 inch (minimum) trench at the upstream end of the matting, placing the roll end in the trench, stapling the mat in place, replacing the excavated material and tamping to secure the mat end.

4. Overlap the roll edges 6 inches (minimum), and roll ends by 6 inches (minimum), with the upstream mat overlapping on top of the next downstream mat. Work from center of channel outward when placing rolls.

5. Staple/stake mat in a staggered pattern on 4 foot (maximum) centers throughout and 2 foot (maximum) centers along seams, joints and roll ends.

Slope Installation

1. Perform final grading, topsoil application seedbed preparation, and permanent seeding in accordance with specifications. Place matting within 48 hours of completing seeding operations unless end of workday stabilization is specified on the approved erosion and sediment control plans.

2. Unroll matting downslope. Lay mat smoothly and firmly upon the seeded surface. Avoid stretching the matting.

3. Overlap roll edges by 6 inches (minimum) and roll ends by 6 inches (minimum), with the upslope mat overlapping on top of the downslope mat.

4. Key in the upslope end of mat 6 inches (minimum) by digging a trench, placing the matting roll end in the trench, stapling the mat in place, replacing the excavated material and tamping to secure the mat end in the key.

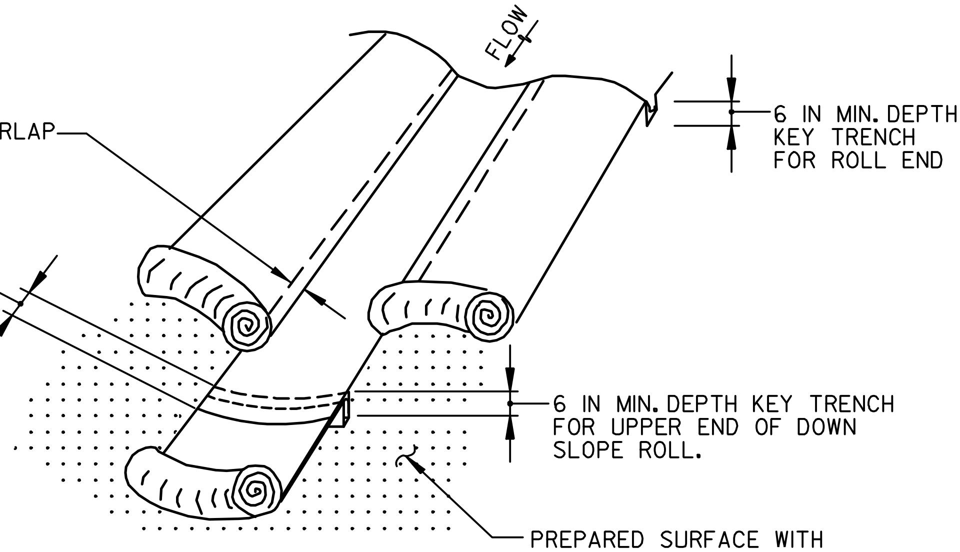
5. Staple/stake mat in a staggered pattern on 4 foot (maximum) centers throughout and 2 foot (maximum) centers along seams.

Installation – Other Applications

Install matting per manufacturer recommendations if slope or ditch and channel installation instructions do not pertain to the site conditions.

DETAIL B-4-5-A TEMPORARY SOIL STABILIZATION MATTING DITCH OR CHANNEL APPLICATION

STANDARD SYMBOL



PERSPECTIVE VIEW

MATERIALS

TEMPORARY SOIL STABILIZATION MATTING SHALL CONSIST OF A MACHINE PRODUCED, TEMPORARY MAT OF DEGRADABLE (LASTS 6 MONTHS MINIMUM, 12 MONTHS MAXIMUM) NATURAL OR MANMADE FIBERS (MOSTLY ORGANIC) OF UNIFORM THICKNESS AND DISTRIBUTION OF FIBERS THROUGHOUT, AND IS SMOLDER RESISTANT. ANY CHEMICALS USED SHALL BE NON LEACHING, NONTOXIC TO VEGETATION AND SEED GERMINATION, AND NON INJURIOUS TO THE SKIN. IF PRESENT, NETTING SHALL BE EXTRUDED PLASTIC HAVING A MAXIMUM MESH OPENING SIZE 2x2 INCH, SHALL BE SUFFICIENTLY BONDED OR SEWN ON 2 INCH CENTERS ALONG THE LONGITUDINAL AXIS OF THE MATERIAL TO PREVENT SEPARATION OF THE NET FROM THE PARENT MATERIAL FOR THE LIFE OF THE PRODUCT.

STAPLES SHALL BE STEEL "U" OR "T" SHAPED STEEL WIRE HAVING MINIMUM GAUGES OF NO. 11 (3.061 MM) AND NO. 8 (4.115 MM) RESPECTIVELY OR WOOD IN A WEDGE SHAPE. THE "U" SHAPE STAPLES SHALL AVERAGE 1 TO 1½ INCHES WIDE AND BE A MINIMUM OF 6 INCHES LONG. "T" SHAPED STAPLES SHALL HAVE AN 8 INCH MAIN LEG, A 1 INCH SECONDARY LEG AND A 4 INCH HEAD. THE WOOD STAPLES SHALL BE ROUGH SAWN HARDWOOD, WEDGE SHAPE, 1x3 INCHES AT THE TOP, AND 12 TO 24 INCHES IN LENGTH.

INSTALLATION

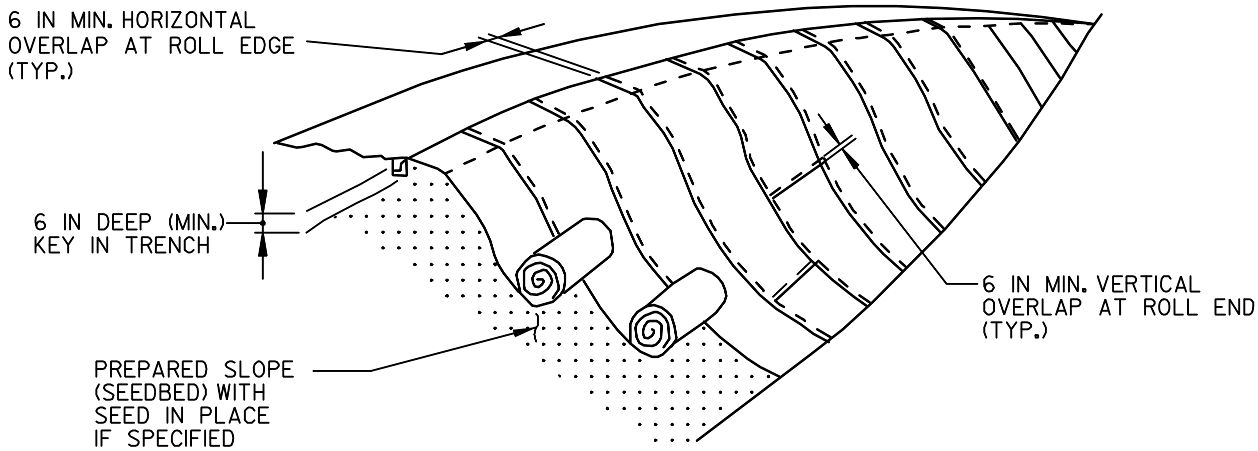
1. PERFORM FINAL GRADING, TOPSOIL APPLICATION SEEDBED PREPARATION, AND PERMANENT SEEDING IN ACCORDANCE WITH SPECIFICATIONS. MATTING SHALL BE PLACED WITHIN 48 HOURS OF COMPLETING SEEDING OPERATIONS UNLESS END OF WORKDAY STABILIZATION IS SPECIFIED ON THE APPROVED EROSION AND SEDIMENT CONTROL PLAN.
2. UNROLL MATTING IN DIRECTION OF WATER FLOW, CENTERING THE FIRST ROLL ON THE DITCH CENTERLINE. MAT SHALL BE LAID SMOOTHLY AND FIRMLY ON THE SEEDED SURFACE. AVOID STRETCHING THE MATTING.
3. KEY-IN UPSTREAM END OF EACH MAT ROLL BY DIGGING A 6 INCH (MINIMUM) TRENCH AT THE UPSTREAM END OF THE MATTING, PLACING THE ROLL END IN THE TRENCH, STAPLING THE MAT IN PLACE, REPLACING THE EXCAVATED MATERIAL AND TAMPING TO SECURE THE MAT END.
4. OVERLAP THE ROLL EDGES 6 INCHES (MINIMUM), AND ROLL ENDS BY 6 INCHES (MINIMUM), WITH THE UPSTREAM MAT OVERLAPPING ON TOP OF THE NEXT DOWNSTREAM MAT. WORK FROM CENTER OF CHANNEL OUTWARD WHEN PLACING ROLLS.
5. STAPLE/STAKE MAT IN A STAGGERED PATTERN ON 4 FOOT (MAXIMUM) CENTERS THROUGHOUT AND 2 FOOT (MAXIMUM) CENTERS ALONG SEAMS, JOINTS AND ROLL ENDS.

INSTALLATION - OTHER APPLICATIONS

INSTALL MATTING PER MANUFACTURERS RECOMMENDATIONS WHERE DITCH OR CHANNEL INSTALLATION INSTRUCTIONS ARE NOT APPROPRIATE FOR THE SITE CONDITIONS.

DETAIL B-4-5-B TEMPORARY SOIL STABILIZATION MATTING SLOPE APPLICATION

STANDARD SYMBOL



PERSPECTIVE VIEW

MATERIALS

TEMPORARY SOIL STABILIZATION MATTING SHALL CONSIST OF A MACHINE PRODUCED, TEMPORARY MAT OF DEGRADABLE (LASTS 6 MONTHS MINIMUM, 12 MONTHS MAXIMUM) NATURAL OR MANMADE FIBERS (MOSTLY ORGANIC) OF UNIFORM THICKNESS AND DISTRIBUTION OF FIBERS THROUGHOUT AND IS SMOLDER RESISTANT. ANY CHEMICALS USED SHALL BE NON-LEACHING, NONTOXIC TO VEGETATION AND SEED GERMINATION, AND NON-INJURIOUS TO THE SKIN. IF PRESENT, NETTING SHALL BE EXTRUDED PLASTIC HAVING A MAXIMUM OPENING SIZE OF 2x2 INCH AND SHALL BE SUFFICIENTLY BONDED OR SEWN ON 2 INCH CENTERS ALONG THE LONGITUDINAL AXIS OF THE MATERIAL TO PREVENT SEPARATION OF THE NET FROM THE PARENT MATERIAL FOR THE LIFE OF THE PRODUCT.

STAPLES SHALL BE STEEL "U" OR "T" SHAPED STEEL WIRE HAVING MINIMUM GAUGES OF NO. 11 (3.06 MM) AND NO. 8 (4.115 MM) RESPECTIVELY OR WOOD IN A WEDGE SHAPE. THE "U" SHAPED STAPLES SHALL AVERAGE 1 TO 1½ INCHES WIDE AND BE A MINIMUM OF 6 INCHES LONG. "T" SHAPED STAPLES SHALL HAVE AN 8 INCH MAIN LEG, A 1 INCH SECONDARY LEG AND A 4 INCH HEAD. THE WOOD STAPLES SHALL BE ROUGH SAWN HARDWOOD, WEDGE SHAPED, 1x3 INCHES AT THE TOP, AND 12 TO 24 INCHES IN LENGTH.

INSTALLATION

1. PERFORM FINAL GRADING, TOPSOIL APPLICATION, SEEDBED PREPARATION, AND PERMANENT SEEDING IN ACCORDANCE WITH SPECIFICATIONS. MATTING SHALL BE PLACED WITHIN 48 HOURS OF COMPLETING SEEDING OPERATIONS UNLESS END OF WORKDAY STABILIZATION IS SPECIFIED ON THE APPROVED EROSION & SEDIMENT CONTROL PLANS.

2. UNROLL MATTING DOWNSLOPE. LAY MAT SMOOTHLY AND FIRMLY UPON THE SEEDED SURFACE. AVOID STRETCHING THE MATTING.

3. OVERLAP ROLL EDGES BY 6 INCHES (MINIMUM) AND ROLL ENDS BY 6 INCHES (MINIMUM), WITH THE UPSLOPE MAT OVERLAPPING ON TOP OF THE DOWNSLOPE MAT.

4. KEY IN THE UPSLOPE END OF MAT 6 INCHES (MINIMUM) BY DIGGING A TRENCH, PLACING THE MATTING ROLL END IN THE TRENCH, STAPLING THE MAT IN PLACE, REPLACING THE EXCAVATED MATERIAL AND TAMPING TO SECURE THE MAT END IN THE KEY.

5. STAPLE/STAKE MAT IN A STAGGERED PATTERN ON 4 FOOT (MAXIMUM) CENTERS THROUGHOUT AND 2 FOOT (MAXIMUM) CENTERS ALONG SEAMS.

INSTALLATION – OTHER APPLICATIONS

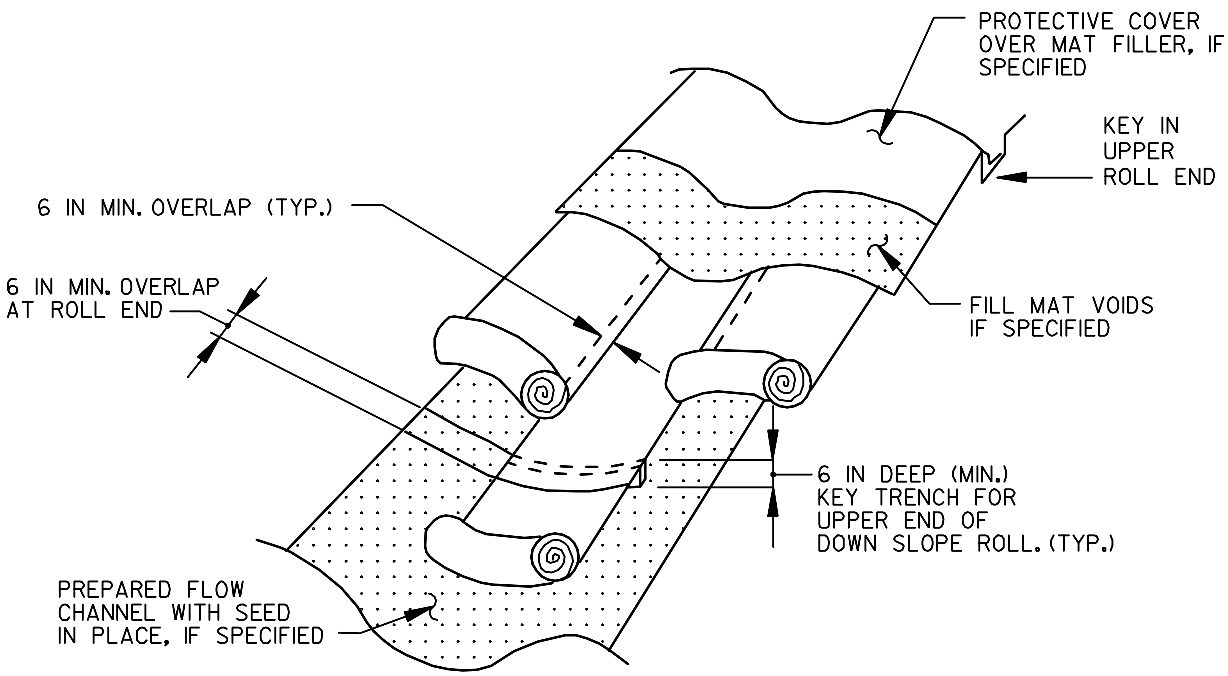
INSTALL MATTING PER MANUFACTURERS RECOMMENDATIONS WHERE SLOPE INSTALLATION INSTRUCTIONS ARE NOT APPROPRIATE FOR THE SITE CONDITIONS.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL B-4-5-C PERMANENT SOIL STABILIZATION MATTING DITCH OR CHANNEL APPLICATION

STANDARD SYMBOL



PERSPECTIVE VIEW

SPECIFICATIONS:

MATERIALS

PERMANENT SOIL STABILIZATION MATTING IS AN OPEN WEAVE SYNTHETIC MACHINE PRODUCED MAT CONSISTING OF SYNTHETIC NON DEGRADABLE FIBERS OR ELEMENTS OF UNIFORM THICKNESS AND DISTRIBUTION OF WEAVE THROUGHOUT. ANY CHEMICALS USED SHALL BE NON LEACHING, NONTOXIC TO VEGETATION AND SEED GERMINATION, AND NON INJURIOUS TO THE SKIN. IF PRESENT, NETTING SHALL BE EXTRUDED PLASTIC HAVING A MAXIMUM MESH OPENING SIZE OF 2x2 INCH, SUFFICIENTLY BONDED OR SEWN ON 2 INCH CENTERS ALONG THE LONGITUDINAL AXIS OF THE MATERIAL TO PREVENT SEPARATION OF THE NET FROM THE PARENT MATERIAL FOR THE LIFE OF THE PRODUCT.

STAPLES SHALL BE STEEL "U" OR "T" SHAPED STEEL WIRE HAVING MINIMUM GAUGES OF NO. 11 (3.061 MM) AND 'NO. 8 (4.115 MM) RESPECTIVELY OR WOOD IN A WEDGE SHAPE. THE "U" SHAPED STAPLES SHALL AVERAGE 1 TO 1½ INCHES WIDE AND BE A MINIMUM OF 6 INCHES LONG. "T" SHAPED STAPLES SHALL HAVE AN 8 INCH MAIN LEG, A 1 INCH SECONDARY LEG AND A 4 INCH HEAD. THE WOOD STAPLES SHALL BE ROUGH SAWN HARDWOOD, WEDGE SHAPED, 1x3 INCHES AT THE TOP, AND 12 TO 24 INCHES IN LENGTH.

NOTE: ONCE IN PLACE, AREAS WHERE SOME TYPES OF PERMANENT SOIL STABILIZATION MATTING HAVE BEEN INSTALLED MUST BE TEMPORARILY PROTECTED FROM SURFACE EROSION IF SPECIFIED.

1 OF 2

DETAIL B-4-5-C PERMANENT SOIL STABILIZATION MATTING DITCH OR CHANNEL APPLICATION

STANDARD SYMBOL

SPECIFICATIONS (CONTINUED)

INSTALLATION

1. PERFORM FINAL GRADING, TOPSOIL APPLICATION, SEEDBED PREPARATION, AND PERMANENT SEEDING IN ACCORDANCE WITH SPECIFICATIONS. PLACE MATTING WITHIN 48 HOURS OF COMPLETING SEEDING OPERATIONS, UNLESS END OF WORKDAY STABILIZATION IS SPECIFIED ON THE APPROVED EROSION AND SEDIMENT CONTROL PLANS.

2. UNROLL MATTING IN DIRECTION OF WATER FLOW. WORK FROM CENTER OF CHANNEL OUTWARD WHEN PLACING ROLLS. LAY MATTING SMOOTHLY AND FIRMLY UPON THE SEEDED SURFACE. AVOID STRETCHING THE MATTING.

3. OVERLAP EDGES OF MATTING ROLLS BY 6 INCHES (MINIMUM) AND ROLL ENDS BY 6 INCHES (MINIMUM), WITH THE UPSTREAM MAT OVERLAPPING ON TOP OF THE NEXT DOWNSTREAM MAT.

4. KEY IN THE TOP OF SLOPE END OF MAT 6 INCHES (MINIMUM) BY DIGGING A TRENCH, PLACING THE MATTING ROLL END IN THE TRENCH, STAPLING THE MAT IN PLACE, REPLACING THE EXCAVATED MATERIAL AND TAMPING TO SECURE THE MAT END IN THE KEY.

5. STAPLE/STAKE MAT IN A STAGGERED PATTERN ON 4 FOOT (MAXIMUM) CENTERS THROUGHOUT AND 2 FOOT (MAXIMUM) CENTERS ALONG SEAMS, JOINTS AND ROLL ENDS.

6. IF SPECIFIED BY THE DESIGNER OR MANUFACTURER AND DEPENDING ON THE TYPE OF MAT BEING INSTALLED, ONCE THE MATTING IS KEYED AND STAPLED IN PLACE, FILL THE MAT VOIDS WITH TOP SOIL OR GRANULAR MATERIAL AND LIGHTLY COMPACT OR ROLL TO MAXIMIZE SOIL/MAT CONTACT WITHOUT CRUSHING MAT.

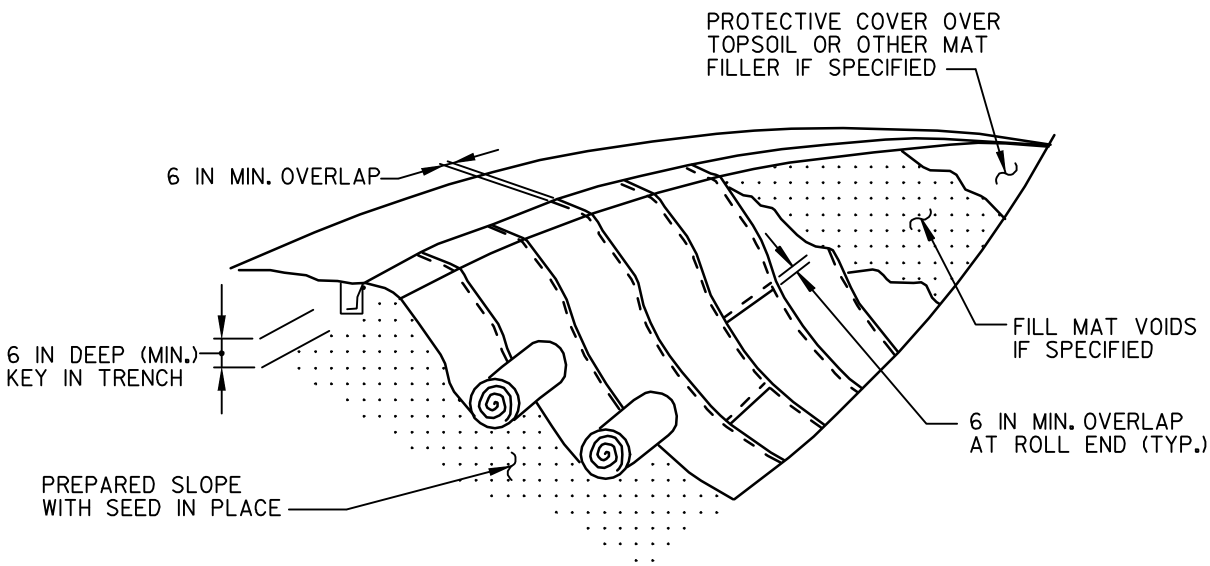
7. IF SPECIFIED AND DEPENDING ON THE TYPE OF MAT BEING INSTALLED, UPON INSTALLATION COVER THE AREA WITH TEMPORARY EROSION PROTECTION BY MULCH AND TACK, NON ASPHALTIC LIQUID MULCH BINDER, OR TEMPORARY SOIL STABILIZATION MATTING.

INSTALLATION - OTHER APPLICATIONS

INSTALL MATTING PER MANUFACTURERS RECOMMENDATIONS WHERE DITCH OR CHANNEL INSTALLATION INSTRUCTIONS ARE NOT APPROPRIATE FOR THE SITE CONDITIONS.

DETAIL B-4-5-D PERMANENT SOIL STABILIZATION MATTING SLOPE APPLICATION

STANDARD SYMBOL



PERSPECTIVE VIEW

SPECIFICATIONS:

MATERIALS

PERMANENT SOIL STABILIZATION MATTING IS AN OPEN WEAVE SYNTHETIC MACHINE PRODUCED MAT CONSISTING OF SYNTHETIC NON DEGRADABLE FIBERS OR ELEMENTS OF UNIFORM THICKNESS AND DISTRIBUTION OF WEAVE THROUGHOUT. ANY CHEMICALS USED SHALL BE NON LEACHING, NONTOXIC TO VEGETATION AND SEED GERMINATION, AND NON INJURIOUS TO THE SKIN. IF PRESENT, NETTING SHALL BE EXTRUDED PLASTIC HAVING A MAXIMUM MESH OPENING SIZE OF 2x2 INCH, SUFFICIENTLY BONDED OR SEWN ON 2 INCH CENTERS ALONG THE LONGITUDINAL AXIS OF THE MATERIAL TO PREVENT SEPARATION OF THE NET FROM THE PARENT MATERIAL FOR THE LIFE OF THE PRODUCT.

STAPLES SHALL BE STEEL "U" OR "T" SHAPED STEEL WIRE HAVING MINIMUM GAUGES OF NO. 11(3.061 MM) AND NO. 8 (4.115 MM) RESPECTIVELY OR WOOD IN A WEDGE SHAPE. THE 'U" SHAPED STAPLES SHALL AVERAGE 1 TO 1½ INCHES WIDE AND BE A MINIMUM OF 6 INCHES LONG. "T" SHAPE STAPLES SHALL HAVE AN 8 INCH MAIN LEG, A 1 INCH SECONDARY LEG AND 4 INCH HEAD. THE WOOD STAPLES SHALL BE ROUGH SAWN HARDWOOD, WEDGE SHAPED, 1x3 INCHES AT THE TOP, AND 12 TO 24 INCHES IN LENGTH.

NOTE - ONCE IN PLACE, AREAS WHERE SOME TYPES OF PERMANENT SOIL STABILIZATION MATTING HAVE BEEN INSTALLED MUST BE TEMPORARILY PROTECTED FROM SURFACE EROSION BY MEANS OF NON ASPHALTIC LIQUID MULCH BINDERS, STRAW MULCH AND TACK, OR TEMPORARY STABILIZATION MATTING UNLESS THE SPECIFIED PERMANENT SOIL STABILIZATION MAT FILLER IS GRANULAR FOR THE PURPOSE OF IMITATING NATURAL STREAM BED. STRAW OR WOOD CELLULOSE FIBER MULCH AND TACK, AND SOME LIQUID MULCH BINDERS ARE UNACCEPTABLE FOR AREAS RECEIVING CONCENTRATED FLOW. CHECK WITH MANUFACTURER FOR LIQUID MULCH BINDER APPLICATION IN CONCENTRATED FLOW AREAS.

1 OF 2

DETAIL B-4-5-D PERMANENT SOIL STABILIZATION MATTING SLOPE APPLICATION

STANDARD SYMBOL

SPECIFICATIONS (CONTINUED)

INSTALLATION

1. PERFORM FINAL GRADING, TOPSOIL APPLICATION, SEEDBED PREPARATION, AND PERMANENT SEEDING IN ACCORDANCE WITH SPECIFICATIONS. PLACE MATTING WITHIN 48 HOURS OF COMPLETING SEEDING OPERATIONS, UNLESS END OF WORKDAY STABILIZATION IS SPECIFIED ON THE EROSION AND SEDIMENT CONTROL PLANS.
2. UNROLL MATTING DOWN SLOPE. LAY MAT SMOOTHLY AND FIRMLY UPON THE SEEDED SURFACE. AVOID STRETCHING THE MATTING.
3. OVERLAP EDGES OF MATTING ROLLS BY 6 INCHES (MINIMUM) AND ROLL ENDS BY 6 INCHES (MINIMUM), WITH THE UPSLOPE MAT OVERLAPPING ON TOP OF THE DOWNSLOPE MAT.
4. KEY IN THE UPSLOPE END OF THE MAT 6 INCHES (MINIMUM) BY DIGGING A TRENCH, PLACING THE MATTING ROLL END IN THE TRENCH, STAPLING THE MAT IN PLACE, REPLACING THE EXCAVATED MATERIAL AND TAMPING TO SECURE THE MAT END IN THE KEY.
5. STAPLE/STAKE MAT IN A STAGGERED PATTERN ON 4 FOOT (MAXIMUM) CENTERS THROUGHOUT AND 2 FOOT (MAXIMUM) CENTERS ALONG SEAMS.
6. IF SPECIFIED BY THE DESIGNER OR MANUFACTURER AND DEPENDING ON THE TYPE OF MAT BEING INSTALLED, ONCE THE MATTING IS KEYED AND STAPLED IN PLACE, FILL THE MAT VOIDS WITH TOPSOIL OR GRANULAR MATERIAL AND LIGHTLY COMPACT OR ROLL TO MAXIMIZE SOIL/MAT CONTACT WITHOUT CRUSHING MAT.
7. IF SPECIFIED AND DEPENDING ON THE TYPE OF MAT BEING INSTALLED, UPON INSTALLATION COVER THE AREA WITH TEMPORARY EROSION PROTECTION BY MULCH AND TACK, NON ASPHALTIC LIQUID MULCH BINDER, OR TEMPORARY SOIL STABILIZATION MATTING.

INSTALLATION - OTHER APPLICATIONS

INSTALL MATTING PER MANUFACTURERS RECOMMENDATIONS WHERE SLOPE INSTALLATION INSTRUCTIONS ARE NOT APPROPRIATE FOR THE SITE CONDITIONS.

B-4-6 STANDARDS AND SPECIFICATIONS

FOR

HEAVY USE AREA PROTECTION

Definition

The stabilization of areas frequently and intensively used by people and vehicles by establishing vegetative cover, surfacing with suitable materials and/or installing structures.

Purpose

To provide a stable, non-eroding surface for area frequently used by people and vehicles and to improve the water quality from the runoff of these areas.

Conditions Where Practice Applies

This practice applies to urban, recreational and other frequently and intensively used areas requiring treatment to address one or more of the resource concerns. Refer to NRCS Code 561, "Heavy Use Area Protection" for other heavy use areas such as agricultural areas or areas used by animals.

General Considerations

When stabilizing heavily used areas consider the adjoining land uses and the proximity of residences, utilities, cultural resource areas, wetlands or other environmentally sensitive areas, and areas of special scenic value.

For heavy use areas conducive to protection by vegetation, consideration must be given to the effect(s) of treading and/or miring. The vegetative species selected should tolerate and persist under heavy use conditions. If practicable, consider increasing the size of the area and/or establishing a rest/non-use period to allow plant recovery and increase vigor.

Heavy use area protection effects on the water budget, especially on volumes and rates of runoff, infiltration, and transpiration due to the installation of less pervious surfaces, should be considered in the selection of surfacing materials.

The transport of sediments, nutrients, oils, chemicals and particulate matter associated with vehicular traffic, and soluble and sediment-attached substances carried by runoff should be considered in selection of companion conservation practices.

Consider using additional air quality conservation practices such as Windbreak/Shelterbelt Establishment (NRCS Code 380) to impede transport of particulate matter between the source (i.e., heavy use area) and nearby sensitive areas.

To reduce the negative water quality impact of heavy use areas, consider locating them as far as possible from waterbodies or water courses. In some cases this may require relocating the heavily used area rather than just armoring an area which is already in use.

For areas with aggregate surfaces that will be frequently scraped, consideration should be given to the use of concrete or cementitious materials to lessen the recurring cost of aggregate replacement.

Consider the location of the site, distance, and gradient relative to streams, sinkholes, drainage ways, and wellheads; depth to bedrock; depth to water table; aquifer flow characteristics; traffic patterns and density; type of maintenance equipment; proximity to neighbors; prevailing winds; visual effects; and operation and maintenance costs.

Surface erosion can be a problem on large heavy use areas that do not use a hard surface such as concrete. In these cases the designer may need to include measures on the area that reduce the flow length of runoff to reduce erosion problems.

Consider constructing travel lanes on the contour.

For structural design measures, consider all items that will influence the performance of the structure, including loading assumptions, material properties, and construction quality.

Select the stabilizing material based on the intended use, desired maintenance frequency, and runoff control.

Byproducts from coal fired power plants such as fly ash and sludge from scrubbers can vary significantly. Therefore, their toxicity and cementation characteristics should be known to ensure they are compatible with the intended use.

General Criteria

Plan and design heavy use areas to comply with Federal, state, and local laws and regulations. Any work performed in and/or discharges near streams, wetlands or waterbodies may require a permit from the US Army Corps of Engineers, the Maryland Department of the Environment (MDE) or local authority.

Take measures to limit the generation of particulate matter during construction.

Incorporate safety measures for the users into the design of the heavy use area protection.

Design Load: Base the design load on the type of traffic, (vehicular or human) anticipated on the heavy use area. The minimum design load for areas that support vehicular traffic will be a wheel load of 4000 lbs.

Foundation: Evaluate all site foundations for soil moisture, permeability, texture and bearing strength in combination with the design load and anticipated frequency of use.

Use a base course of gravel, crushed stone, other suitable material and/or geotextile on all sites that need increased load bearing strength, drainage, separation of material and soil reinforcement.

Provide a minimum 3-inch base course of gravel, crushed stone, or other suitable materials under all concrete areas. Provide a minimum 4-inch base course of gravel, crushed stone, or other suitable material under all asphalt areas. The material in place may be used if it has adequate drainage and bearing capacity. Use geotextile for soil separation when foundation is soft or poorly drained.

Provide an impervious barrier on sites with porous foundations (high permeability rate), and a need to protect ground water from contamination.

Prepare the foundation by removal and disposal of materials that are not adequate to support the design loads.

Surface Treatment: Select a surface treatment that is safe and appropriate to the purpose of the heavy use area. Surface treatments must meet the following requirements according to the material.

1. Concrete: Design the thickness and compressive strength of concrete according to the expected loading and use.

2. Bituminous Concrete Pavement: Refer to AASHTO Guide for Design of Pavement Structures for design criteria for bituminous concrete paving.

   In lieu of a site specific design for areas that will be subject to light use, pave with a minimum of 4 inches of compacted bituminous concrete over a subgrade of at least 4 inches of well compacted gravel. Use bituminous concrete mixtures commonly used for road paving in the area. Compact the surface with a heavy steel wheel roller until the bituminous concrete is thoroughly compacted and roller marks are eliminated.

3. Other Cementitious Materials: Soil cement, roller compacted concrete, and coal combustion by-products (flue gas desulphurization sludge and fly ash) may be used as surface material if designed and installed to withstand the anticipated loads and surface abrasion.

4. Aggregate: Design fine or coarse aggregate surfaces at least 4-inches thick. If the surface will be compacted, choose a well graded aggregate.

5. Sprays and Artificial Mulches: When utilizing sprays of asphalt, oil, plastic, manufactured mulches, and similar materials, follow the manufacturer's recommendations for design requirements.

6. Other: Surfacing materials, such as lime stone screenings, cinders, tanbark, bark mulch, brick chips, shredded rubber and/or sawdust, shall have a minimum layer thickness of 4 inches.

Structures: Design any structures associated with the heavy use area including roofs, according to appropriate NRCS standards. Where NRCS standards do not exist, design structures according to accepted engineering practice. Base design loads for buildings associated with heavy use areas on criteria in Minimum Design Loads for Buildings and Other Structures: ASCE/SEI 705.

If the heavy use area is to serve as part of a foundation or support for a building, use the total load in the structural design.

Drainage and Erosion Control: Include provisions in the design for surface and subsurface drainage, as needed. Include provisions for disposal of runoff without causing erosion or water quality impairment. To the extent possible, exclude runoff from entering the heavy use area. Shape treatment areas to prevent ponding of water.

Vegetative Measures: Where appropriate, stabilize all area disturbed by construction with vegetation as soon as possible after construction. If vegetation is not appropriate for the site, use other measures to stabilize the area.

Access Control: Provide fencing or other measures as needed for containment, direction control, and management of people, or vehicles. Follow the Maryland conservation practice standards for Fence (NRCS Code 382) and/or Access Control (NRCS Code 472), as appropriate.

Additional Criteria for Areas Utilized for Recreation: The treated area shall be conducive to the overall recreation area and aesthetically blend with the general landscape and surroundings.

Plants, landscaping timbers, traffic control measures, wooden walkways, etc. shall be evaluated for effectiveness, aesthetics and accessibility as covered by the Americans with Disabilities Act.

<u>SECTION C - WATER CONVEYANCE</u>

C-1 STANDARDS AND SPECIFICATIONS

FOR

EARTH DIKE

Definition

A temporary berm or ridge of soil, compacted, stabilized and located in such a manner as to direct water to a desired location.

Purpose

The purpose of the earth dike is to direct sediment laden runoff to a sediment trapping device or to intercept and divert clear water away from disturbed areas. Both usages reduce the potential for erosion and sedimentation.

Conditions Where Practice Applies

Earth dikes are constructed along the limit of disturbance (LOD) or across disturbed areas. Generally, earth dikes remain in place until the disturbed areas are permanently stabilized.

Appropriate uses of earth dikes include the following:

1. To divert sediment laden runoff from a disturbed area to a sediment trapping practice.

2. To segment drainage areas to reduce acreage to sediment control devices.

3. To divert clear water from an undisturbed area to a stabilized outlet at non-erosive velocity.

There are two standard sizes of earth dikes and three types of flow channel stabilization.

Table C.1: Earth Dike Criteria

	Dike A	**Dike B**
Drainage Area	(See Table C.2)	(See Table C.2)
Slope (of dike)	(See Table C.2)	(See Table C.2)
Dike Height (a)	18 inches	30 inches
Dike Width (b)	24 inches	36 inches
Flow Width (c)	4 feet	6 feet
Flow Depth in Channel (d)	12 inches	24 inches
Side Slopes	2:1 or flatter	2:1 or flatter

Flow Channel Stabilization

1	Seed with straw mulch and tack.
2	Seed with soil stabilization matting or sod.
3	Four (4) to seven (7) inch stone or equivalent recycled concrete pressed flush a minimum of seven (7) inches into the soil.

Design Criteria

1. Determine the longitudinal slopes of the earth dike. Determine the drainage area to various design points along the proposed earth dike alignment.

2. Design points are located where changes in slope and/or increases in drainage area may alter the type and stabilization of earth dike.

3. Use Table C.2 to select the appropriate earth dike type (A or B) and lining (1, 2, or 3) for the earth dike alignment between the design points.

4. Review the slopes along the earth dike alignment between the design points to insure that the slope/drainage area relationship does not exceed the selected lining.

5. Maintain positive drainage along the entire length of the earth dike.

6. For slopes or drainage areas other than specified on Table C.2, an engineering design is required**.**

7. Show earth dike type (A or B) and stabilization (1, 2, or 3) on the plans using the standard symbol and A-1, or B-3, etc. Place designation (e.g., A-1) on flow channel side of dike. Earth dike type and stabilization may vary along its length.

8. In highly erodible soils, as defined by the local approval agency, use the next higher slope grade for the dike stabilization.

9. Discharge velocities from an earth dike shall be non-erosive.

10. Where an earth dike is used to convey runoff from disturbed areas, the discharge shall be to a sediment control practice suitable for concentrated flow. Silt fence and super silt fence are unacceptable for receiving discharges from earth dikes.

11. Where an earth dike is used to convey clear water runoff, the discharge should be to an undisturbed stable area at a non-erosive velocity; otherwise, provide outlet protection.

Table C.2: Earth Dike Selection

	Drainage Area (acres)									
Slope % **	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1			4					B-2		
2	A-1	4								
3								6	6	6
4	4*		A-2				6			
5					6	6			B-3	
6				6						
7			6							
8						**A-3**				
9										
10		6								

"B" Dike

"A" Dike

*Velocity of discharge in feet per second
** For slopes steeper than 10 percent refer to Section D – Erosion Control

Notes:

1. **If the slope of the earth dike or drainage area to the dikes falls between values on Table C.2, round to the next higher slope or drainage area.**

2. **A-1 Earth Dike not allowed for clear water diversions**

Stabilization

A-1: Seed with mulch and tack

A-2/B-2: Seed and soil stabilization matting

A-3/B-3: 4 to 7 inch diameter compacted stone in a minimum 7 inch layer

Engineering Design Criteria

Engineering design may be required in lieu of Table C.2. Use the two year frequency storm with NRCS criteria, assuming the worst soil cover conditions to prevail in the contributing drainage area over the life of the earth dike. Use Manning's Equation to determine earth dike flow channel velocities associated with the developed discharges. The Manning's Roughness coefficients to be used in the equation are 0.025 for seed and mulch, 0.03 for soil stabilization matting or sod, and for 4 to 7 inch stone use 0.045 for flow depths up to 1 foot (Dike A) and 0.038 for flow depths between 1 and 2 feet (Dike B). The allowable flow channel velocities are < 4 fps for Seed and Mulch, < 6 fps for Stabilization Matting or sod, and < 8 fps for 4 to 7 inch stone.

Construction Specifications

3. Construct flow channel on an uninterrupted, continuous grade, adjusting the location due to field conditions as necessary to maintain positive drainage.

4. Provide outlet protection as required on plan.

5. Remove and dispose of all trees, brush, stumps, obstructions, and other objectionable material so as not to interfere with proper function of earth dike.

6. Excavate or shape earth dike to line, grade, and cross section as specified. Bank projections or other irregularities that impede flow are not allowed.

7. Compact fill.

8. Stabilize earth dike within three days of installation. Stabilize flow channel for clear water dike within 24 hours of installation.

9. Inspect and provide necessary maintenance periodically and after each rain event.

10. Upon removal of earth dike, grade area flush with existing ground and stabilize disturbed area with topsoil, seed, and mulch, or as specified within 24 hours of said removal.

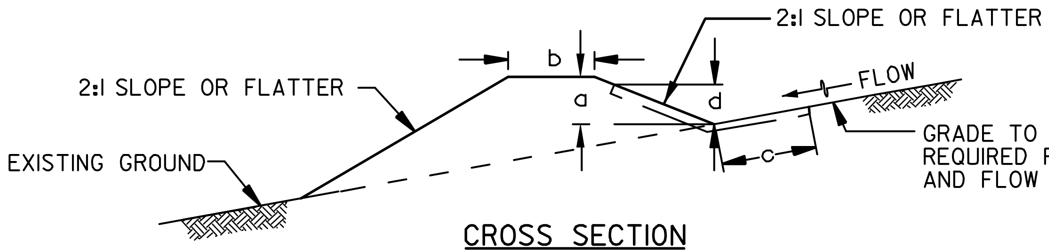
Removal

Following completion of all construction and stabilization at a site with established vegetation, remove all temporary earth dikes and grade the areas occupied by the dikes and stabilize.

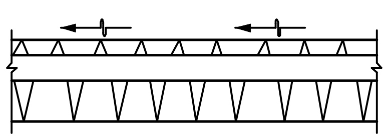
DETAIL C-1 EARTH DIKE

STANDARD SYMBOL
A-1

PLACE DESIGNATION (A-1, B-2, etc.) ON FLOW CHANNEL SIDE OF DIKE.



CROSS SECTION



PLAN VIEW

DIKE TYPE

	A	B
a - DIKE HEIGHT	18 IN MIN.	30 IN MIN.
b - DIKE WIDTH	24 IN MIN.	36 IN MIN.
c - FLOW WIDTH	4 FT MIN.	6 FT MIN.
d - FLOW DEPTH	12 IN MIN.	24 IN MIN.

FLOW CHANNEL STABILIZATION

A-1 SEED WITH STRAW MULCH AND TACK.

A-2/B-2 SEED WITH SOIL STABILIZATION MATTING OR LINE WITH SOD.

A-3/B-3 4 TO 7 INCH STONE OR RECYCLED CONCRETE EQUIVALENT PRESSED INTO SOIL FLUSH WITH GROUND 7 INCHES MINIMUM.

CONSTRUCTION SPECIFICATIONS

1. CONSTRUCT FLOW CHANNEL ON AN UNINTERRUPTED, CONTINUOUS GRADE, ADJUSTING THE LOCATION DUE TO FIELD CONDITIONS NECESSARY FOR POSITIVE DRAINAGE.
2. PROVIDE OUTLET PROTECTION AS REQUIRED ON PLAN.
3. REMOVE AND DISPOSE OF ALL TREES, BRUSH, STUMPS, OBSTRUCTIONS, AND OTHER OBJECTIONABLE MATERIAL SO AS NOT TO INTERFERE WITH PROPER FUNCTION OF EARTH DIKE.
4. EXCAVATE OR SHAPE EARTH DIKE TO LINE, GRADE, AND CROSS SECTION AS SPECIFIED. BANK PROJECTIONS OR OTHER IRREGULARITIES THAT IMPEDE FLOW ARE NOT ALLOWED.
5. COMPACT FILL.
6. STABILIZE EARTH DIKE WITHIN THREE DAYS OF INSTALLATION. STABILIZE FLOW CHANNEL FOR WITH CLEAR WATER WITHIN 24 HOURS.
7. INSPECT AND PROVIDE NECESSARY MAINTENANCE PERIODICALLY AND AFTER EACH RAIN EVENT.
8. UPON REMOVAL OF EARTH DIKE, GRADE AREA FLUSH WITH EXISTING GROUND AND STABILIZE DISTURBED AREA WITH TOPSOIL, SEED, AND MULCH, OR AS SPECIFIED WITHIN 24 HOURS OF SAID REMOVAL.

C-2 STANDARDS AND SPECIFICATIONS

FOR

TEMPORARY SWALE

Definition

A temporary excavated flow channel constructed and located to convey runoff to a desired location.

Purpose

The purpose of a temporary swale is to prevent clear water runoff from entering disturbed areas by intercepting and diverting it to a stabilized outlet or to intercept sediment laden water and divert it to a sediment trapping device.

Conditions Where Practice Applies

Appropriate uses of temporary swales when DA = 5.0 acres or less include the following:

1. To divert sediment laden runoff from a disturbed area to a sediment trapping practice.

2. To segment drainage areas to reduce acreage to sediment control devices.

3. To divert clear water from an undisturbed area a to a stabilized outlet at a non-erosive velocity.

Table C.3: Temporary Swale Design Criteria

	Swale A	Swale B
Drainage Area	(See Table C.4)	(See Table C.5)
Slope of swale	(See Table C.4)	(See Table C.5)
Bottom Width of Flow Channel	4 foot minimum	6 foot minimum
Depth of Flow Channel	1 foot minimum	1 foot minimum
Side Slopes	2:1 or flatter	2:1 or flatter

Flow Channel Stabilization

1	Seed with straw mulch and tack.
2	Seed with soil stabilization matting or sod.
3	Four (4) to seven (7) inch stone or equivalent recycled concrete pressed flush a minimum of seven (7) inches into the soil.

Notes:

1. **For slopes or drainage areas other than specified on Table C.4 or C.5, an engineering design is required. (See Design Criteria in this section). If the slope of the swale or the drainage area contributing to the swale falls between values on Table C.4 or C.5, round up to the next higher slope or drainage area.**

2. **Complete stabilization of the swale within three days of installation.**

<u>Design Criteria</u>

1. Determine the longitudinal slopes of temporary swale. Determine the drainage area to various design points along the proposed temporary swale alignments.

2. Design points are located where changes in slopes and/or increases in drainage area may alter the type and stabilization of earth dike.

3. Use Table C.5 to select the appropriate temporary swale type (A or B) and lining (1, 2, or 3) for the earth dike alignment between the design points.

4. Review the slopes along the temporary swale alignment between the design points to insure that the slope/drainage area relationship does not exceed the selected lining.

5. Maintain positive drainage along the entire length of the temporary swale.

6. For slopes or drainage areas other than specified on Table C.4 or C.5, an engineering design is required**.**

7. Show temporary swale type (A or B) and stabilization (1, 2, or 3) on the plans using the standard symbol and A-1, or B-3, etc. Temporary swale type and stabilization may vary along its length.

8. In highly erodible soils, as defined by the local approval agency, use the next higher slope grade for the dike stabilization.

9. Discharge velocities from an temporary shall be non-erosive.

10. Where a temporary swale is used to convey runoff from disturbed areas, the discharge shall be a sediment control practice suitable for concentrated flow. Silt fence and super silt fence are unacceptable for receiving discharges from temporary swale.

11. Where temporary swale is used to convey clear water runoff, the discharge should be to an undisturbed stable area at a non-erosive velocity; otherwise, provide outlet protection.

Table C.4: Temporary Swale Selection

Swale A: Drainage Area ≤ to 5 acres

4 Foot Flat Bottom

Type 'A'

SLOPE %	DRAINAGE AREA (ACRES)				
	1	2	3	4	5
1	SEED	AND			
2	MULCH A-1	AND TACK	4	4	4
3		4		SEED	AND
4					MATTING
5	4*				
6			A-2		
7					6
8				6	
9					
10			6		

*Velocity of flow in feet/second

Note: A-1 Temporary Swale <u>not</u> allowed for clean water diversions.

Stabilization

A-1: Seed with mulch and tack

A-2: Seed and soil stabilization matting

A-3: 4 to 7 inch diameter compacted stone in a minimum 7 inch layer

Table C.5: Temporary Swale Selection

Swale B: 5 ac.< Drainage Area ≤10 ac.

6 Foot Flat Bottom

Type 'B'

SLOPE %	DRAINAGE AREA (ACRES)				
	6	7	8	9	10
1	4				
2					
3	SOIL	STABILI	ZATION	6	6
4			6		
5		6			
6	6			B-3	
7			4"-7"	STONE	PRESSED
8			7" (MIN)	INTO	GROUND
9					
10					

* Velocity of flow in feet/second

Stabilization

B-1: Seed with mulch and tack

B-2: Seed and soil stabilization matting

B-3: 4 to 7 inch diameter compacted stone in a minimum 7 inch layer

Engineering Design Criteria

Engineering design may be required in lieu of Table C.4 or C.5. Use the two year frequency storm with NRCS criteria, assuming the worst soil cover conditions to prevail in the contributing drainage area over the life of the temporary swale. Use the Manning's Equation to determine temporary swale flow channel velocities associated with the developed discharges. The Manning's Roughness coefficients to be used in the equation are 0.025 for seed and mulch, 0.03 for soil stabilization matting or sod, and for 4 to 7 inch stone use 0.045 for flow depths up to 1 foot. The allowable flow channel velocities are < 4 fps for Seed and Mulch, < 6 fps for Stabilization Matting or sod, and < 8 fps for 4 to 7 inch stone. For site conditions exceeding those where Temporary Swale criteria apply, refer to Section H-3, Lined Channel.

Construction Specifications

1. Construct flow channel on an uninterrupted, continuous grade, adjusting the location due to field conditions as necessary to maintain positive drainage.

2. Provide outlet protection as required on plan.

3. Remove and dispose of all trees, brush, stamps, obstructions, and other objectionable material so as not to interfere with proper function of earth dike.

4. Excavate or shape temporary swale to line, grade, and cross section as specified. Bank projections or other irregularities that impede flow are not allowed.

5. Compact fill.

6. Stabilize temporary swale within three days of installation. Stabilize flow channel for clear water dike within 24 hours of installation.

7. Inspect and provide necessary maintenance periodically and after each rain even.

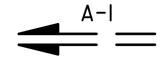
8. Upon removal of temporary swale, grade area with flush existing ground and stabilize disturbed area with topsoil, seed, and mulch, or as specified within 24 hours of said removal.

Removal

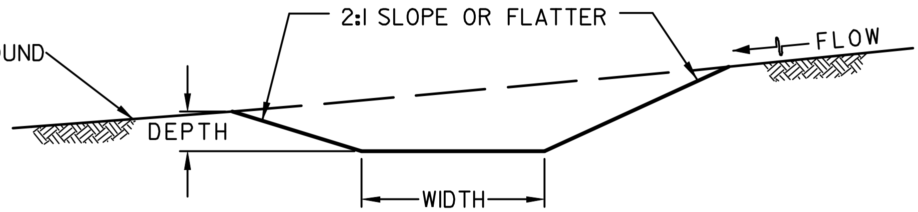
Following completion of all construction and stabilization at a site with established vegetation, remove all temporary swales and grade the areas occupied by the swales and stabilize.

DETAIL C-2 TEMPORARY SWALE

STANDARD SYMBOL
A-1

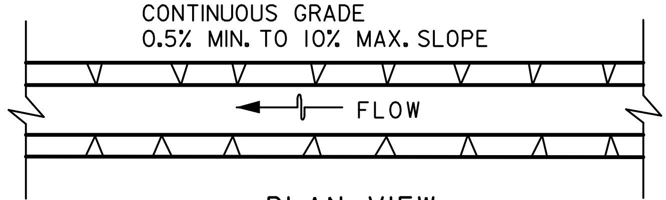


PLACE DESIGNATION (A-1, B-2, etc.) ON FLOW CHANNEL SIDE OF SWALE.



CROSS SECTION

	SWALE TYPE A	SWALE TYPE B
MIN. DEPTH	1 FT MIN.	1 FT MIN.
BOTTOM WIDTH	4 FT MIN.	6 FT MIN.



PLAN VIEW

FLOW CHANNEL STABILIZATION

A-1 / SEED WITH STRAW MULCH AND TACK.

A-2 / B-2 SEED WITH SOIL STABILIZATION MATTING OR LINE WITH SOD.

A-3 / B-3 4 TO 7 INCH STONE OR EQUIVALENT RECYCLED CONCRETE PRESSED INTO SOIL FLUSH WITH GROUND 7 INCHES MINIMUM.

CONSTRUCTION SPECIFICATIONS

1. CONSTRUCT TEMPORARY SWALE ON AN UNINTERRUPTED, CONTINUOUS GRADE, ADJUSTING THE LOCATION DUE TO FIELD CONDITIONS NECESSARY FOR POSITIVE DRAINAGE.
2. PROVIDE OUTLET PROTECTION AS REQUIRED ON PLAN.
3. REMOVE AND DISPOSE OF ALL TREES, BRUSH, STUMPS, OBSTRUCTIONS, AND OTHER OBJECTIONABLE MATERIAL SO AS NOT TO INTERFERE WITH PROPER FUNCTION OF SWALE.
4. EXCAVATE OR SHAPE SWALE TO LINE, GRADE, AND CROSS SECTION AS SPECIFIED. BANK PROJECTIONS OR OTHER IRREGULARITIES THAT IMPEDE FLOW ARE NOT ALLOWED.
5. STABILIZE SWALE WITHIN THREE DAYS OF INSTALLATION. STABILIZE SURFACES IN CONTACT WITH CLEAR WATER WITHIN 24 HOURS.
6. INSPECT AND PROVIDE NECESSARY MAINTENANCE PERIODICALLY AND AFTER EACH RAIN EVENT.
7. UPON REMOVAL OF SWALE, GRADE AREA FLUSH WITH EXISTING GROUND AND STABILIZE DISTURBED AREA WITH TOPSOIL, SEED, AND MULCH, OR AS SPECIFIED WITHIN 24 HOURS OF SAID REMOVAL.

C-3 STANDARDS AND SPECIFICATIONS

FOR

PERIMETER DIKE/SWALE

Definition

A temporary berm of soil created from excavated material used to form an adjoining channel located along the perimeter of the site or disturbed area.

Purpose

The purpose of a temporary perimeter dike/swale is to prevent clear water runoff from entering disturbed areas by intercepting and diverting it to a stabilized outlet or to intercept sediment laden water and divert it to a sediment trapping device.

Conditions Where Practice Applies

A perimeter dike/swale is constructed to divert flows around disturbed areas, or along tops of slopes to prevent flows from eroding the slope, or along the toe of slopes to direct sediment laden flows to a trapping device.

Appropriate uses of perimeter dike/swale:

1. To divert clean water flow around unstable areas.

2. To prevent flows from eroding unstable slopes.

3. To direct sediment laden water to stabilized outlet at non-erosive velocity.

PD/S Type	**Drainage Area**	**Stabilization**
PD/S - 1	1 acre or less	Seed and Mulch
PD/S - 2	1 to 2 acres	Seed and cover with soil stabilization matting or line with sod

Note: Perimeter Dike/Swale (PD/S -1) not allowed for clean water diversions.

Design Criteria

An engineering design is not required for perimeter dike/swale. Use the following criteria:

Drainage Area: The maximum drainage area for this practice is 2 acres (for drainage areas larger than 2 acres see Earth Dike or Temporary Swale).

Height: 12 inches minimum from bottom of swale to top of dike evenly divided between dike height and swale depth. Bottom width of dike: 3 feet minimum. Width of swale: 3 feet minimum (see Detail C-3 Perimeter Dike/Swale Detail).

Dike/Swale: Dike/Swale should have positive drainage (sufficient grade to drain). The grade will be dependent upon the topography and shall not exceed 10 percent.

Stabilization: Use one of the following methods to stabilize within 7 days of installation:

Construction Specifications

1. Construct dike/swale on an uninterrupted, continuous grade.

2. Where dike/swale is used to convey runoff from disturbed areas, discharge to a control practice suitable for concentrated flow. Silt fence and super silt fence are unsuitable for receiving discharges from dike/swale.

3. Where dike/swale is used to convey runoff from stable area, discharge directly into an undisturbed stable area at a non-erosive velocity. Provide outlet protection as required.

4. Remove and dispose of all trees, brush, stumps, obstructions, and other objectionable material so as not to interfere with proper function of dike/swale.

5. Excavate or shape dike/swale to line, grade, and cross section as specified. Bank projections or other irregularities that impede flow are not allowed.

6. Compact fill.

7. Stabilize dike/swale within 3 days of installation, stabilize surfaces in contact with clear water within 24 hours.

8. Inspect and provide necessary maintenance periodically and after each rain event.

9. Upon removal of dike/swale, grade area flush with existing ground and stabilize disturbed area with topsoil, seed, mulch, or as specified within 24 hours of said removal.

Note: The maximum drainage area for this practice is 2 acres.

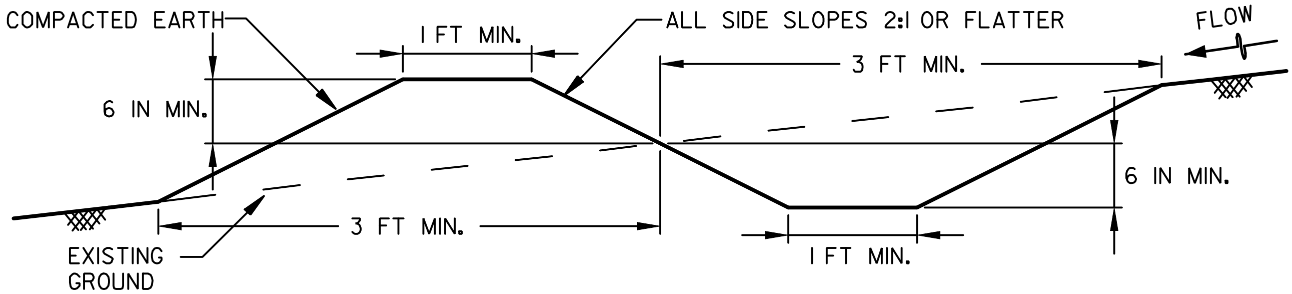
Removal

Following completion of all construction and stabilization at a site with established vegetation, remove all perimeter dike/swales and grade the areas occupied by the dike/swale and stabilize.

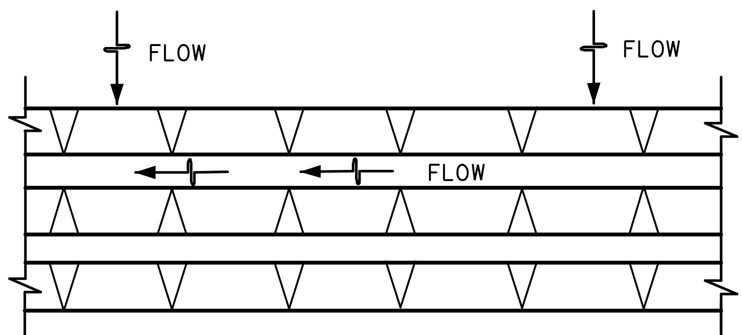
DETAIL C-3 PERIMETER DIKE/SWALE

STANDARD SYMBOL
PDS-1

PLACE DESIGNATION (PDS-1 OR 2) ON FLOW CHANNEL SIDE OF DIKE-SWALE.



CROSS SECTION



CONTINUOUS GRADE
0.5% MIN. TO 10% MAX.
SLOPE

PLAN VIEW

FLOW CHANNEL STABILIZATION

PDS-1	SEED AND MULCH AND TACK (DRAINING < 1 ACRE)
PDS-2	SEED WITH SOIL STABILIZATION MATTING OR LINE WITH SOD (DRAINING BETWEEN 1 AND 2 ACRES)

CONSTRUCTION SPECIFICATIONS

1. CONSTRUCT DIKE/SWALE ON AN UNINTERRUPTED, CONTINUOUS GRADE, ADJUSTING THE LOCATION DUE TO FIELD CONDITIONS NECESSARY FOR POSITIVE DRAINAGE.
2. PROVIDE OUTLET PROTECTION AS REQUIRED ON PLAN.
3. REMOVE AND DISPOSE OF ALL TREES, BRUSH, STUMPS, OBSTRUCTIONS, AND OTHER OBJECTIONABLE MATERIAL SO AS NOT TO INTERFERE WITH PROPER FUNCTION OF DIKE/SWALE.
4. EXCAVATE OR SHAPE DIKE/SWALE TO LINE, GRADE, AND CROSS SECTION AS SPECIFIED. BANK PROJECTIONS OR OTHER IRREGULARITIES THAT IMPEDE FLOW ARE NOT ALLOWED.
5. COMPACT FILL.
6. STABILIZE DIKE/SWALE WITHIN THREE DAYS OF INSTALLATION, STABILIZE FLOW CHANNEL FOR CLEAR WATER WITHIN 24 HOURS OF INSTALLATION.
7. INSPECT AND PROVIDE NECESSARY MAINTENANCE PERIODICALLY AND AFTER EACH RAIN EVENT.
8. UPON REMOVAL OF TEMPORARY SWALE, GRADE AREA FLUSH WITH EXISTING GROUND AND STABILIZE DISTURBED AREA WITH TOPSOIL, SEED, AND MULCH, OR AS SPECIFIED WITHIN 24 HOURS OF SAID REMOVAL.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

C-4 STANDARDS AND SPECIFICATIONS

FOR

TEMPORARY ASPHALT BERM

Definition

Temporary macadam mound used to intercept and redirect sheet flow across pavement.

Purpose

The purpose of a temporary asphalt berm is to direct sediment laden sheet flow runoff to a sediment control device or to intercept and divert clean water runoff away from disturbed areas.

Conditions Where Practice Applies

Asphalt berms are constructed across paved areas where other diversion devices are not appropriate. Asphalt berms can also be used to direct runoff into an inlet or in conjunction with inlet protection. The asphalt berm shall remain in place until the disturbed areas are stabilized.

Appropriate uses of temporary asphalt berms include the following:

1. To divert sediment laden runoff in a sheet flow condition from an disturbed area to a sediment control device.
2. To segment drainage areas.
3. To direct clear water from an undisturbed area at non-erosive rates to a stabilized outlet.

Design Criteria

1. Maximum drainage area to an asphalt berm is 1 acre.
2. Maximum slope of contributory surface is 10%.
3. Maximum slope along the berm is 10%.
4. Where an asphalt berm is used to convey the runoff diverted from disturbed areas, the discharge must be to a sediment control device suitable for concentrated flow.
5. When used on an entrance in conjunction with silt fence on pavement, place berm in a “V” configuration with the apex pointing upgrade.
6. Where an asphalt berm is used to convey runoff from a stable area, discharge directly into a stable area at a non erosive velocity. Provide outlet protection as required.

Construction Specifications

1. Construct flow channel on an uninterrupted, continuous grade.

2. Install berm to conform to cross section dimensions of a uniform height of 4 inches minimum and approximate width of 3.5 feet.

3. Provide outlet protection as required on plan.

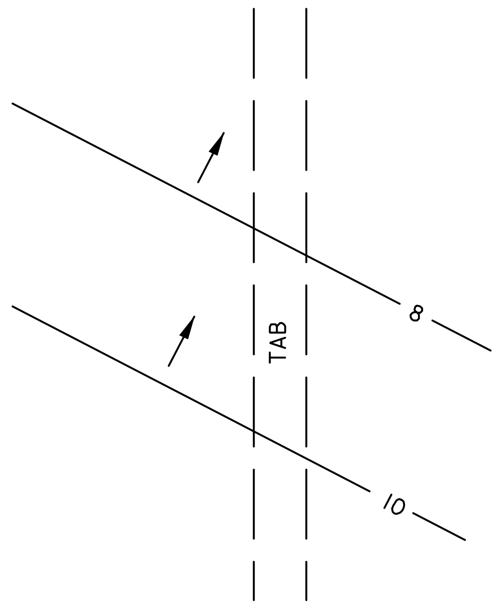
4. Compact asphalt berm.

5. Inspect and provide necessary maintenance.

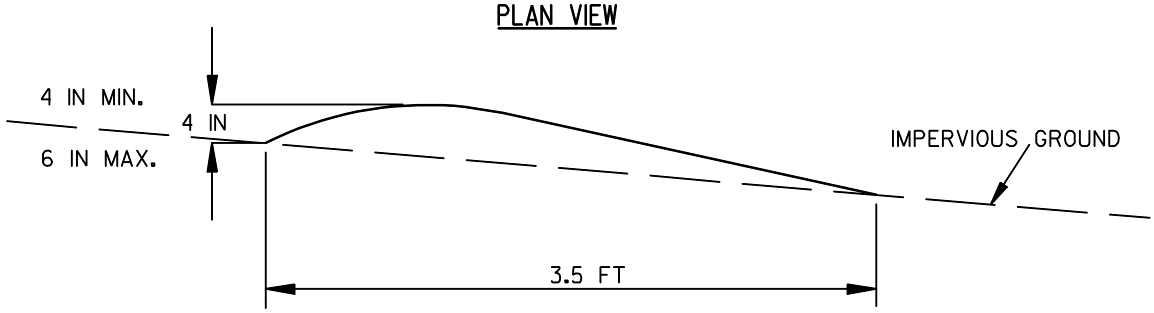
6. Upon removal of asphalt berm, return original conditions or as specified.

DETAIL C-4 TEMPORARY ASPHALT BERM

STANDARD SYMBOL



PLAN VIEW



CROSS SECTION

CONSTRUCTION SPECIFICATIONS

1. CONSTRUCT FLOW CHANNEL ON AN UNINTERRUPTED, CONTINUOUS GRADE.
2. INSTALL BERM TO CONFORM TO CROSS SECTION DIMENSIONS OF A UNIFORM MINIMUM HEIGHT OF 4 INCHES MINIMUM AND APPROXIMATE WIDTH OF 3.5 FEET.
3. PROVIDE OUTLET PROTECTION AS REQUIRED ON PLAN.
4. COMPACT ASPHALT BERM.
5. INSPECT AND PROVIDE NECESSARY MAINTENANCE.
6. UPON REMOVAL OF ASPHALT BERM, RETURN TO ORIGINAL CONDITION OR AS SPECIFIED.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

C-5 STANDARDS AND SPECIFICATIONS

FOR

CLEAR WATER DIVERSION PIPE

Definition

A temporary pipe installed in conjunction with sandbag dikes . Use of flexible pipe is preferred.

Purpose

The purpose of a clear water diversion pipe is to convey channel or pipe flow around a work area.

Conditions Where Practice Applies

This practice is used when the proposed work is located in a drainage way. .

Table C.6: Clear Water Diversion Pipe Design Criteria

Pipe Maximum Drainage Area (Acres)	Diameter (inches)
0.5	12
1.5	18
2.5	21
3.5	24
5.0	Twin 24

Design Criteria

Height of barrier (H) is twice the size of diameter of the diversion pipe.

The diversion pipe shall outlet onto a stable area at a non erosive velocity. Provide outlet protection if necessary.

Construction Specifications

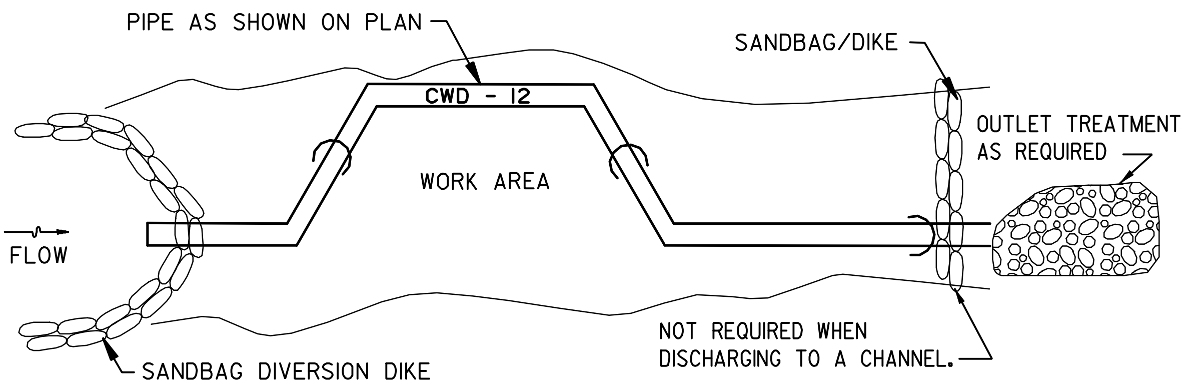
1. Set height (H) of sandbag diversion dike at twice the pipe diameter.
2. Flexible pipe is preferred. However, corrugated metal pipe or equivalent PVC pipe can be used. Make all joints watertight.
3. Set outlet end of diversion pipe lower than inlet end.
4. Anchor diversion pipe at each downgrade joint.
5. Provide outlet protection as required on plan.
6. Inspect and provide necessary maintenance periodically and after each rain event.

DETAIL C-5 CLEAR WATER DIVERSION PIPE

STANDARD SYMBOL

CWD - 12

NOTE: DESIGNATION CWD-12 REFERS TO CLEAR WATER DIVERSION WITH 12 INCH PIPE.



PIPE DIVERSION FOR EROSION AND SEDIMENT CONTROL

CONSTRUCTION SPECIFICATIONS

1. SET HEIGHT (H) OF SANDBAG DIVERSION DIKE AT TWICE THE PIPE DIAMETER.
2. FLEXIBLE PIPE IS PREFERRED. HOWEVER, CORRUGATED METAL PIPE OR EQUIVALENT PVC PIPE CAN BE USED. MAKE ALL JOINTS WATERTIGHT.
3. SET OUTLET END OF DIVERSION PIPE LOWER THAN INLET END.
4. ANCHOR DIVERSION PIPE AT EACH DOWNGRADE JOINT.
5. PROVIDE OUTLET PROTECTION AS REQUIRED ON PLAN.
6. INSPECT AND PROVIDE NECESSARY MAINTENANCE PERIODICALLY AND AFTER EACH RAIN EVENT.

C-6 STANDARDS AND SPECIFICATIONS

FOR

TEMPORARY BARRIER DIVERSION

Definition

A temporary structural conveyance consisting of traffic control barriers, sand bags, and a liner.

Purpose

The purpose of the temporary barrier diversion is to direct clear water channel flow around a work area.

Conditions Where Practice Applies

A temporary barrier is used when proposed work area is located in or around water..

Design Criteria

1. H is equal to height of channel bank.

2. Top elevation shall be H/2 + 1 foot for project duration of less than two weeks. Otherwise, use two year frequency storm elevation plus 1 foot freeboard.

3. The width of the diversion must be 45 percent of the channel being diverted.

Construction Specifications

1. Establish top elevation at H/2 + 1 foot for project of duration less than 2 weeks or as specified on plan.

2. Use sand bag base for leveling and to establish minimum top elevation of the barrier.

3. For sandbags use materials that are resistant to ultra-violet radiation, tearing and puncture and woven tightly enough to prevent leakage of fill material.

4. Use barrier made of concrete or other approved material.

5. Use polyethylene liner or other material which is impermeable and resistant to puncturing and tearing.

6. Install diversion structure from upgrade to downgrade.

7. Dispose of all excavated materials in an approved disposal area outside of the 100-year floodplain.

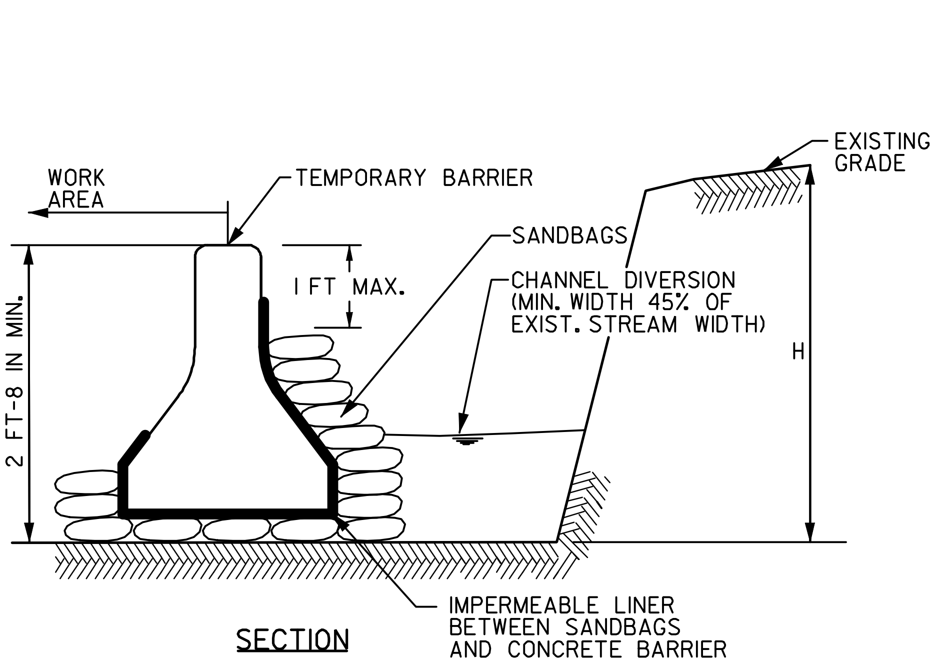
8. Dewater the work area to an approved erosion and sediment practice as specified on plan.

9. Place impermeable liner such that upgrade portion overlaps downgrade portion by a minimum of 18 inches overlap.

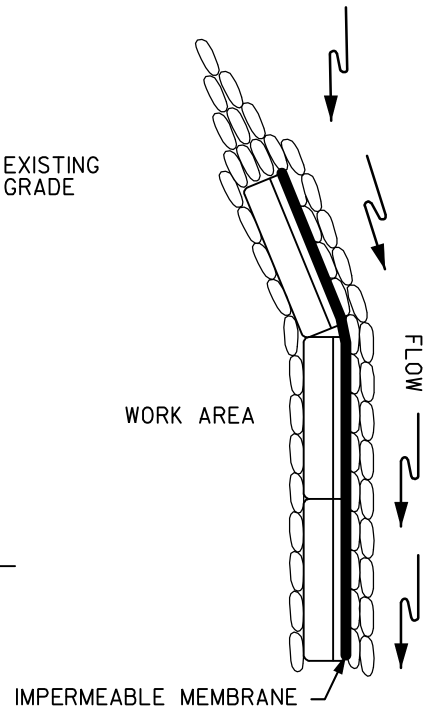
DETAIL C-6 TEMPORARY BARRIER DIVERSION

STANDARD SYMBOL

TBD



SECTION



PLAN

CONSTRUCTION SPECIFICATIONS

1. ESTABLISH TOP ELEVATION AT H/2 + 1 FOOT FOR PROJECT OF DURATION LESS THAN 2 WEEKS OR AS SPECIFIED ON PLAN.
2. USE SANDBAG FOR LEVELING AND TO ESTABLISH MINIMUM TOP ELEVATION OF THE BARRIER.
3. FOR SANDBAG USE MATERIALS THAT ARE RESISTANT TO ULTRA-VIOLET RADIATION, TEARING AND PUNCTURE AND WOVEN TIGHTLY ENOUGH TO PREVENT LEAKAGE OF FILL MATERIAL.
4. USE BARRIER MADE OF CONCRETE OR OTHER APPROVED MATERIAL.
5. USE POLYETHYLENE LINER OR OTHER MATERIAL WHICH IS IMPERMEABLE AND RESISTANT TO PUNCTURING AND TEARING.
6. INSTALL DIVERSION STRUCTURE FROM UPGRADE TO DOWNGRADE.
7. DISPOSE OF ALL EXCAVATED MATERIALS IN AN APPROVED DISPOSAL AREA OUTSIDE OF THE 100-YEAR FLOODPLAIN.
8. DEWATER THE WORK AREA TO AN APPROVED EROSION AND SEDIMENT PRACTICE AS SPECIFIED ON PLAN.
9. PLACE IMPERMEABLE LINER SUCH THAT UPGRADE PORTION OVERLAPS DOWNGRADE PORTION BY A MINIMUM OF 18 INCHES OVERLAP.

C-7 STANDARDS AND SPECIFICATIONS

FOR

MOUNTABLE BERM

Definition

A trapezoidal earth mound 18 inches in height which is covered with Geotextile Class SE and capped with 2 to 3 inch stone.

Purpose

Mountable berms are used as an extension of an earth dike to allow construction vehicles to traverse the site where water diversions are in use.

Conditions Where Practice Applies

Mountable berms are used to help divert flows from unstable areas to sediment trapping practices usually in conjunction with earth dikes.

Construction Specifications

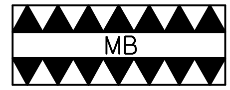
1. Use minimum width of 10 feet to allow for vehicular passage.

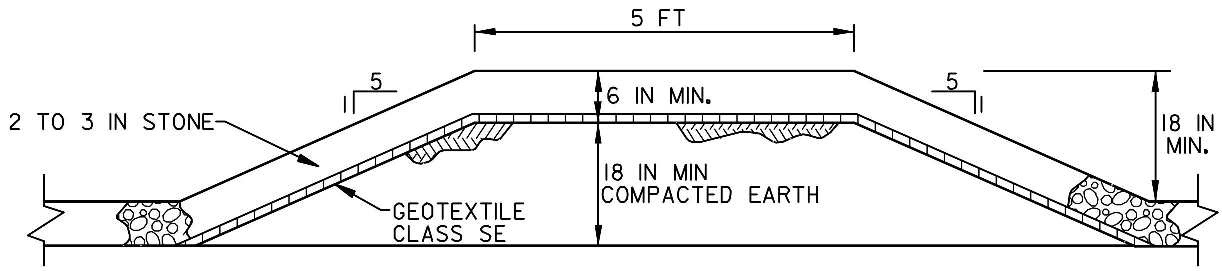
2. Place Geotextile Class SE over the earth mound prior to placing stone.

3. Place stone (2 to 3 inch) or equivalent recycled concrete at least 6 inches deep over the length and width of the mountable berm.

DETAIL C-7 MOUNTABLE BERM

STANDARD SYMBOL





SECTION

CONSTRUCTION SPECIFICATIONS

1. USE MINIMUM WIDTH OF 10 FEET TO ALLOW FOR VEHICULAR PASSAGE.
2. PLACE GEOTEXTILE CLASS SE OVER THE EARTH MOUND PRIOR TO PLACING STONE.
3. PLACE STONE (2 TO 3 INCH) OR EQUIVALENT RECYCLED CONCRETE AT LEAST 6 INCHES DEEP OVER THE LENGTH AND WIDTH OF THE MOUNTABLE BERM.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

C-8 STANDARDS AND SPECIFICATIONS

FOR

DIVERSION FENCE

Definition

A temporary barrier of polyethylene sheeting located in such a manner as to direct water to a desired location.

Purpose

The purpose of diversion fence is to direct sediment laden runoff to a sediment trapping device or to intercept and divert clean water away from disturbed areas. Both usages reduce erosion and sedimentation.

Conditions Where Practice Applies

Diversion fence is constructed along the limit of disturbance (LOD) or across disturbed areas. Diversion fence shall be used only when there is insufficient space to construct an earth dike, temporary swale, or perimeter dike swale.

Appropriate uses of diversion fences include the following:

1. To divert sediment laden runoff from a disturbed area to sediment trapping practice.
2. To segment drainage areas for reducing acreage to sediment control devices.
3. To divert clear water from an undisturbed area to a stable outlet at non erosive velocities.
4. When other water conveyance practices cannot be used due to space limitations. The designer must demonstrates that there is insufficient room to construct an earth dike, temporary swale, or perimeter dike swale.

Construction Specifications

1. Use 42 inch high, nine gauge or heavier chain link fencing.
2. Post spacing not to exceed 10 feet. The posts do not need to be set in concrete.
3. Fasten chain link fence securely to the fence posts with wire ties. The lower tension wire, braces, truss rods, drive anchors, and post caps are not required except on the end posts.
4. Secure a double layer of 6 MIL UV resistant (black) polyethylene sheeting to chain link fence with ties spaced every 24 inches at top and mid section.
5. Embed 6 MIL sheeting a minimum of 8 inches into ground.

6. When two sections of 6 MIL sheeting adjoin each other, overlap by 6 inches and fold with seam facing downgrade.

7. Perform maintenance as needed.

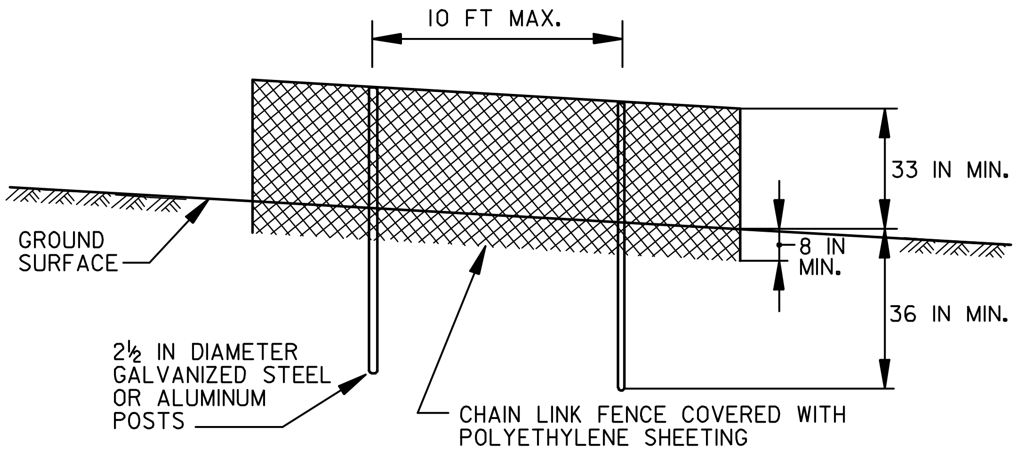
8. Maximum slope along fence 10%.

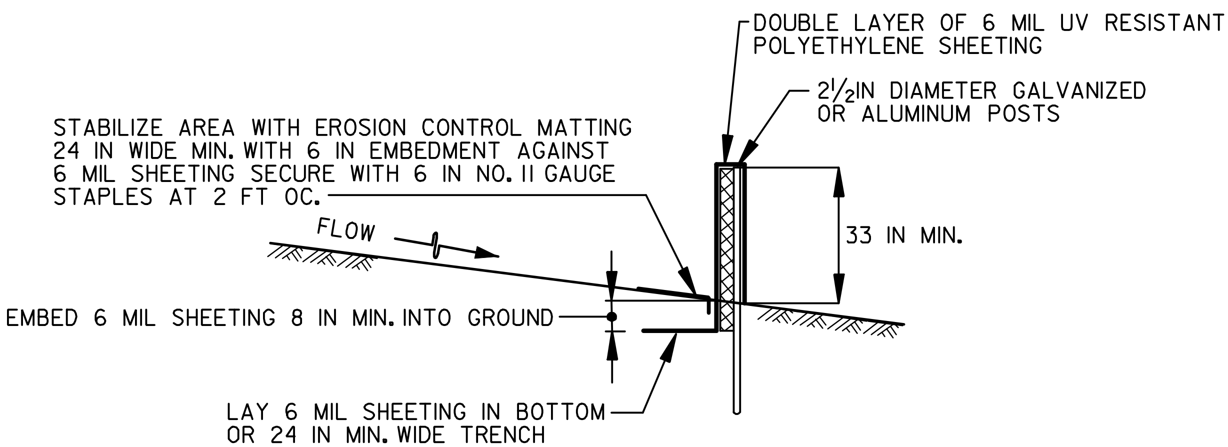
9. Maximum drainage area 2 acres.

DETAIL C-8 DIVERSION FENCE

STANDARD SYMBOL

|—— DF ——|





CONSTRUCTION SPECIFICATIONS

1. USE 42 INCHES HIGH, NINE GAUGE OR HEAVIER CHAIN LINK FENCING.
2. POST SPACING NOT TO EXCEED 10 FEET. THE POSTS DO NOT NEED TO BE SET IN CONCRETE.
3. FASTEN CHAN LINK FENCE SECURELY TO THE FENCE POSTS WITH WIRE TIES. THE LOWER TENSION WIRE, BRACES, TRUSS RODS, DRIVE ANCHORS, AND POST CAPS ARE NOT REQUIRED EXCEPT ON THE END POSTS.
4. SECURE A DOUBLE LAYER OF 6 MIL UV RESISTANT (BLACK) POLYETHYLENE SHEETING TO CHAIN LINK FENCE WITH TIES SPACED EVERY 24 INCHES AT THE TOP AND MID SECTION.
5. EMBED 6 MIL SHEETING A MINIMUM OF 8 INCHES INTO GROUND.
6. WHEN TWO SECTIONS OF 6 MIL SHEETING ADJOIN EACH OTHER, OVERLAP BY 6 INCHES AND FOLD WITH SEAM FACING DOWNGRADE.
7. PERFORM MAINTENANCE AS NEEDED.
8. MAXIMUM SLOPE ALONG FENCE 10%.
9. MAXIMUM DRAINAGE AREA 2 ACRES.

<u>SECTION D – EROSION CONTROL</u>

D-1 STANDARDS AND SPECIFICATIONS

FOR

PIPE SLOPE DRAIN

Description of Practice

A pipe slope drain is a pipe that is installed to convey surface runoff down the face of un-stabilized slopes. It is used to minimize erosion on the slope face. Use of flexible piping is preferred.

Conditions Where Practice Applies

Pipe slope drains are used in conjunction with earth dikes. The dikes direct surface runoff to the slope drain which conveys concentrated flow down the face of a slope. When used to convey water down an unstable fill slope on a road construction project the drainage area to the pipe slope drain will be limited to 2 acres. When used as an inflow protection device the drainage area will be 5 acres.

Table D.1: Pipe Slope Drain Design Criteria

Size	Diameter (inches)	Pipe Maximum Drainage Area (Acres)
PSD-12	12	0.5
PSD-18	18	1.5
PSD-21	21	2.5
PSD-24	24	3.5
PSD-(2) (24)[1]	24	5.0

Inlet End

At the inlet of the pipe slope drain, provide an earth dike at least two times the pipe diameter and measured from the invert of the pipe. Install a standard flared entrance and secure it to the pipe slope drain with a watertight connection. To prevent erosion, place geotextile under the inlet and extend it 5 feet in front of the inlet and key in all sides 6 inches.

Outlet End

For disturbed drainage areas, outlet the pipe slope drain into a sediment trap or basin, or a stable conveyance that leads to a trap or basin. Locate the exit point of discharge as far away from the trap or basin outlet structure as possible at a non-erosive velocity. For stable drainage areas, outlet the pipe slope drain onto a stabilized area at a non-erosive velocity. Protect the point of discharge with rock outlet protection.

[1] Due to the height limitations on earth dikes, the maximum pipe diameter for pipe slope drain is 24 inches. For drainage areas over 3 1/2 acres two 24 inch pipes shall be used. A minimum spacing of 2D (4 feet) is required between pipes.

Construction Specifications

1. Slope the Pipe Slope Drain (PSD) at 3 percent or steeper.

2. The height of the top of the earth dike must be at least 2 times the pipe diameter measured from the invert of the pipe. Extend the top of the dike level until it intersects the standard dike height.

3. Flexible pipe is preferred. However, corrugated metal pipe or equivalent PVC pipe can be used. All connections must be watertight.

4. Attach a flared end section to the inlet end of pipe with a watertight connection. Provide a 12 inch stone apron of 4 to 7 inch stone on Geotextile Class SE at the inlet of the pipe slope drain and extend out 5 feet from the inlet in all directions. Key-in the geotextile on all sides a minimum of 6 inches.

5. Securely anchor the Pipe Slope Drain (PSD) to the slope. Space the anchors every 10 feet.

6. Hand tamp the soil around and under the pipe and end section in 4 inch lifts to the top of the earth dike.

7. Outlet whenever possible where a PSD drains an un-stabilized area into a sediment trap or basin. If this is not possible then discharge the pipe slope into a stable conveyance that leads to a sediment trap or basin. Discharge PSD into a trap or basin at the same elevation as the wet pool elevation. The discharge from the PSD must be as far away from the sediment control outlet as possible.

8. When the drainage area is stabilized, discharge PSD onto a stabilized area at a non-erosive velocity. Provide Rock Outlet Protection as necessary.

9. Upon completing installation of the PSD, stabilize associated disturbances with seed, mulch, and tack.

10. Perform inspection and any required maintenance periodically and after each rain event.

11. The inlet must be kept open at all times.

DETAIL D-1 PIPE SLOPE DRAIN

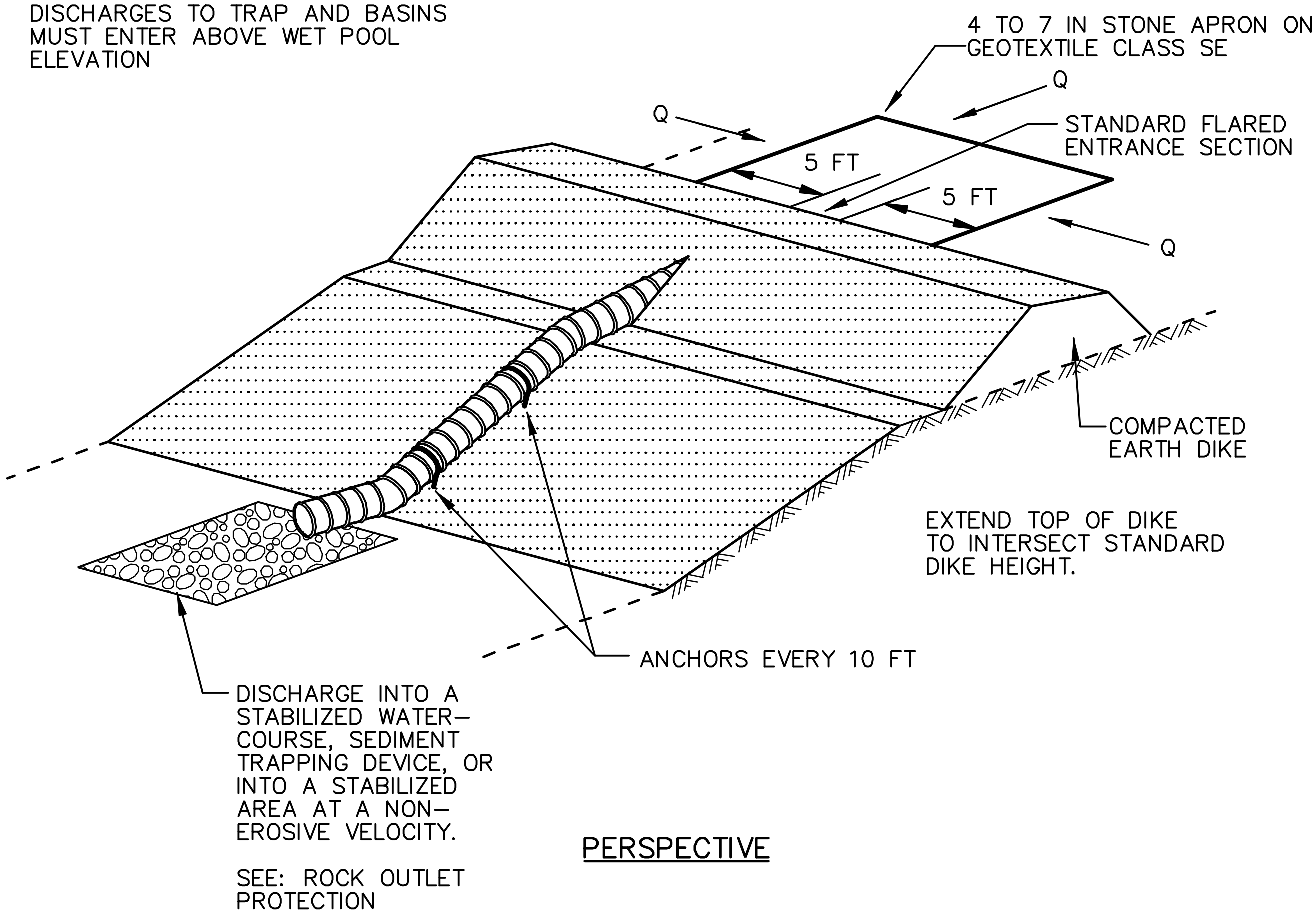
STANDARD SYMBOL

PSD – 12

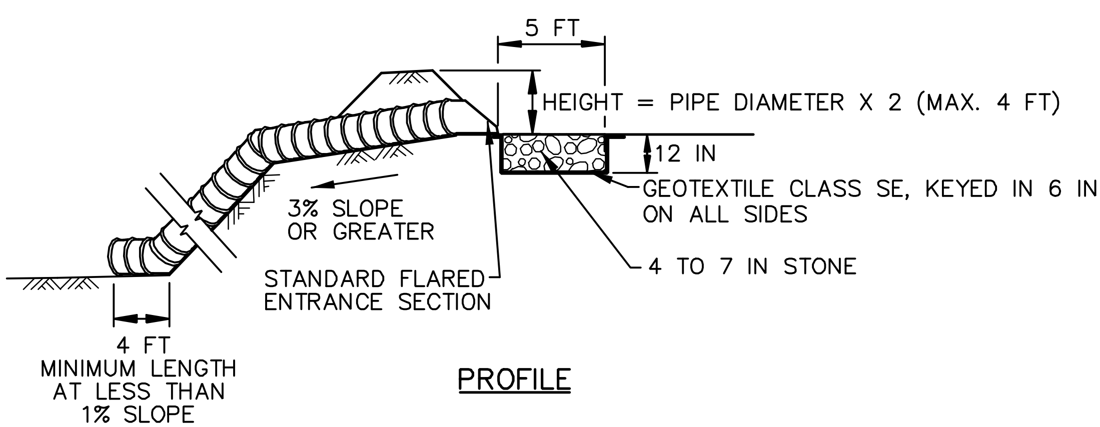
NOTE: DESIGNATION PSD-12 REFERS TO PIPE SLOPE DRAIN WITH 12 IN PIPE

NOTE:

DISCHARGES TO TRAP AND BASINS MUST ENTER ABOVE WET POOL ELEVATION



PERSPECTIVE



PROFILE

1 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL D-1 PIPE SLOPE DRAIN

STANDARD SYMBOL

PSD - 12

NOTE: DESIGNATION PSD-12 REFERS TO PIPE SLOPE DRAIN WITH 12 IN PIPE

CONSTRUCTION SPECIFICATIONS

1. SLOPE THE PIPE SLOPE DRAIN (PSD) AT 3 PERCENT OR STEEPER.
2. THE HEIGHT OF THE TOP OF THE EARTH DIKE MUST BE AT LEAST 2 TIMES THE PIPE DIAMETER MEASURED FROM THE INVERT OF THE PIPE. EXTEND THE TOP OF THE DIKE LEVEL UNTIL IT INTERSECTS THE STANDARD DIKE HEIGHT.
3. FLEXIBLE PIPE IS THE PREFERRED. HOWEVER, CORRUGATED METAL PIPE OR EQUIVALENT PVC PIPE CAN BE USED. ALL CONNECTIONS MUST BE WATERTIGHT.
4. ATTACH A FLARED END SECTION TO THE INLET END OF PIPE WITH A WATERTIGHT CONNECTION. PLACE GEOTEXTILE CLASS SE UNDER THE INLET OF THE PIPE SLOPE DRAIN AND EXTEND OUT 5 FEET FROM THE INLET. KEY-IN THE GEOTEXTILE ON ALL SIDES A MINIMUM OF 6 INCHES.
5. SECURELY ANCHOR THE PIPE SLOPE DRAIN TO THE SLOPE. SPACE THE ANCHORS EVERY 10 FEET.
6. HAND TAMP SOIL AROUND AND UNDER THE PIPE AND END SECTION IN 4 INCH LIFTS TO THE TOP OF THE EARTH DIKE.
7. OUTLET WHENEVER POSSIBLE WHERE A PSD DRAINS AN UN-STABILIZED AREA INTO A SEDIMENT TRAP OR BASIN. IF THIS IS NOT POSSIBLE THEN DISCHARGE THE PIPE SLOPE INTO A STABLE CONVEYANCE THAT LEADS TO A SEDIMENT TRAP OR BASIN. DISCHARGE PSD INTO A TRAP OR BASIN AT THE SAME ELEVATION AS THE WET POOL ELEVATION. THE DISCHARGE FROM THE PSD MUST BE AS FAR AWAY FROM THE SEDIMENT CONTROL OUTLET AS POSSIBLE.
8. WHEN THE DRAINAGE AREA IS STABILIZED, DISCHARGE PSD ONTO A STABILIZED AREA AT A NON-EROSIVE VELOCITY. PROVIDE ROCK OUTLET PROTECTION AS NECESSARY.
9. UPON COMPLETING INSTALLATION OF THE PSD, STABILIZE ASSOCIATED DISTURBANCES WITH SEED, MULCH, AND TACK.
10. PERFORM INSPECTION AND ANY REQUIRED MAINTENANCE PERIODICALLY AND AFTER EACH RAIN EVENT.
11. THE INLET MUST BE KEPT OPEN AT ALL TIMES.

2 OF 2

D-2 STANDARDS AND SPECIFICATIONS

FOR

STONE CHECK DAM

Description of Practice

Stone Check Dams are stone weirs placed in series in swales or ditches.

Purpose

Stone Check Dams are constructed to reduce runoff velocities to non-erosive rates and to prevent channel erosion in drainage courses.

Design Criteria

1. Locate stone check dam to provide maximum velocity reduction. This may be achieved by considering the volume of runoff, the drainage area and the slope. The check dam should be placed in reasonably straight ditch sections to minimize the potential for erosion in the channel bend. All stone check dams should be keyed into the sides and bottom of the channel. This practice is not to be used as a sediment trapping device. Sediment laden runoff must pass through a sediment trapping device prior to being discharged from the site.

2. The distance between the Stone Check Dams will vary with the longitudinal ditch slope. Construct Stone Check Dam using 4 to 7 inch stone[2] or recycled concrete equivalent (without rebar) and place to form a weir. The outlet crest or the top of the stone weir shall be approximately 6 inches lower than the outer edges. Line the inside or upstream side of the weir shall with a 1 foot thick layer of washed (3/4 to 1 ½ inch) crushed aggregate. Geotextile Class E[3] or better under the bottom and sides of the dam prior to placement of stone is optional.

3. The height of the stone outlet weir should not exceed one-half the depth of the ditch or swale. Additionally, the maximum height of the weir must not exceed 2.0 feet to prevent scour of the toe of the dam. If the check dam exceeds this, these provisions do not apply and an engineering analysis should be conducted. The stone check dam should be wide enough to reach from bank to bank of the ditch or swale with the weir section length in the center of the dam.

4. The number of check dams will depend on the length and slope of the ditch or swale.

5. The required spacing is determined as:

$$x = \frac{y}{S}$$

where:
x = Check dam spacing (ft)
y = Check dam height (ft)
S = Natural channel slope (ft/ft)

[2] Refer to Table H.1
[3] Refer to Table H.2

Figure D.1 may be used to determine the check dam spacing. The spacing requirements do not change significantly with varying ditch cross sections, but are most sensitive to the channel slope and height of the check dam.

Construction Specifications

1. Prepare swales and ditches in accordance with the construction specifications described in Section C-2, Standards and Specifications for Temporary Swale.

2. Construct the check dam of 4 to 7 inch stone with minimum side slopes of 2:1 and a minimum top width of 12 inches. 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 height of the stone outlet weir should not exceed one-half the depth of the ditch or swale. Additionally, the maximum height of the weir must not exceed 2.0 feet to prevent scour of the toe of the dam. If the check dam exceeds this, these provisions do not apply and an engineering analysis should be conducted.

5. Extend geotextile 12 inches beyond downstream face of check dam. Provide a 20 inch long by 8 inches deep apron of 4 to 7 inch stone embedded under and along the downstream side of the dam.

6. Remove accumulated sediment when it has built up to ½ of the original height of the weir crest.

Sediment Removal

This practice is not intended to be used for sediment trapping; however, some sediment will accumulate behind the check dam. Check dam should be inspected periodically and after each significant rainfall. Accumulated sediment should be removed when it has reached ½ of the original height of the weir crest.

Check Dam Removal

In temporary swales and channels, check dams should be removed and the ditch filled in when it is no longer needed. In permanent channel structures, check dams may be removed when a permanent lining can be installed. In the case of grass-lined ditches, check dam may be removed when the grass has matured sufficiently to protect the swale or channel. The area beneath the check dam should be seeded and mulched immediately after they are removed.

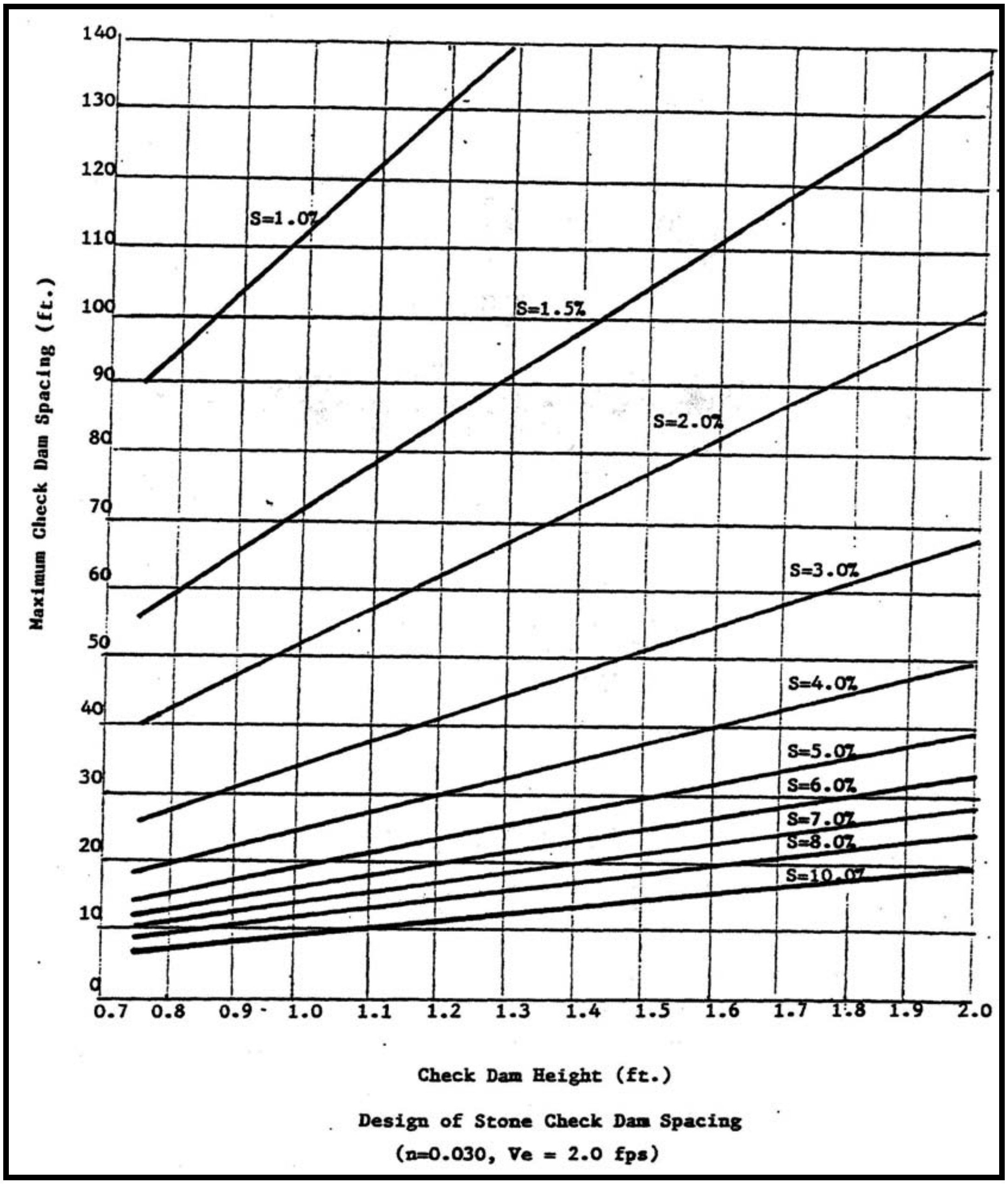
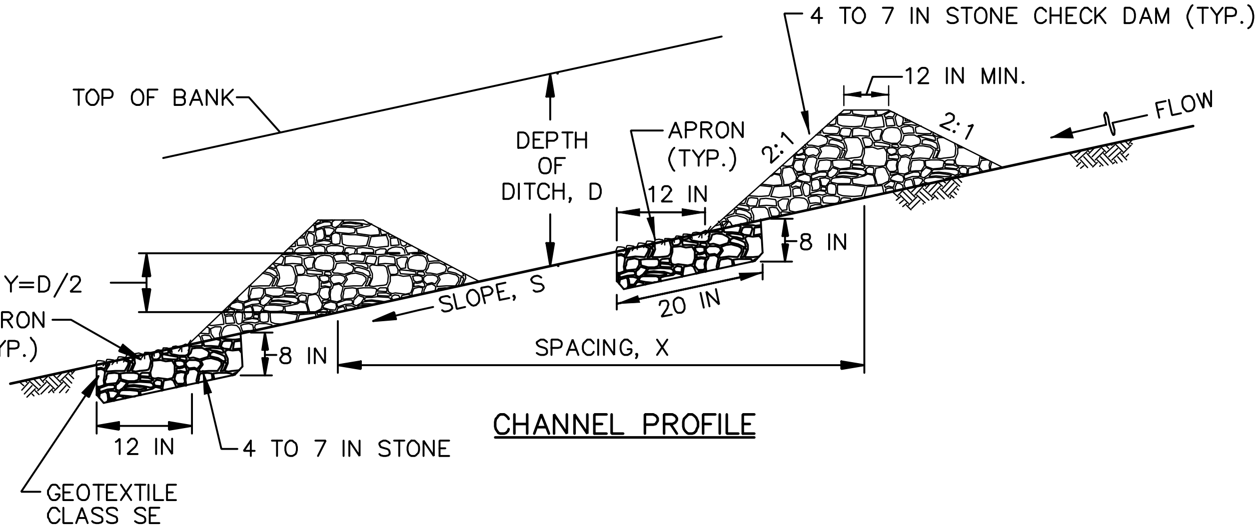


Figure D.1: Check Dam Spacing and Height

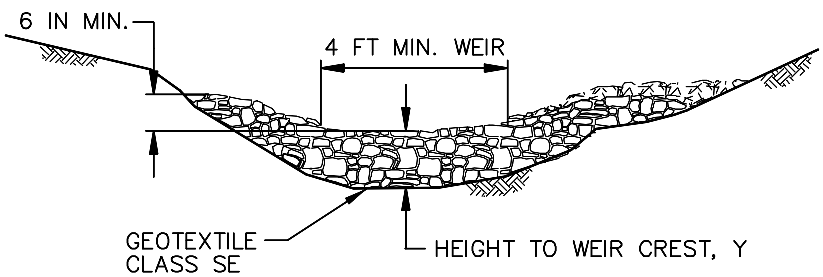
DETAIL D-2 STONE CHECK DAM

STANDARD SYMBOL

CD



CHANNEL PROFILE



CROSS SECTION

CONSTRUCTION SPECIFICATIONS

1. PREPARE SWALES AND DITCHES IN ACCORDANCE WITH THE CONSTRUCTION SPECIFICATIONS DESCRIBED IN SECTION C–2, STANDARDS AND SPECIFICATIONS FOR TEMPORARY SWALE.

2. CONSTRUCT THE CHECK DAM OF 4 TO 7 INCH STONE WITH MINIMUM SIDE SLOPES OF 2:1 AND A MINIMUM TOP WIDTH OF 12 INCHES. 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 HEIGHT OF THE STONE OUTLET WEIR SHOULD NOT EXCEED ONE–HALF THE DEPTH OF THE DITCH OR SWALE. ADDITIONALLY, THE MAXIMUM HEIGHT OF THE WEIR MUST NOT EXCEED 2.0 FEET TO PREVENT SCOUR OF THE TOE OF THE DAM. IF THE CHECK DAM EXCEEDS THIS, THESE PROVISIONS DO NOT APPLY AND AN ENGINEERING ANALYSIS SHOULD BE CONDUCTED.

5. EXTEND GEOTEXTILE 12 INCHES BEYOND DOWNSTREAM FACE OF CHECK DAM. PROVIDE A 20 INCH LONG BY 8 INCHES DEEP APRON OF 4 TO 7 INCH STONE EMBEDDED UNDER AND ALONG THE DOWNSTREAM SIDE OF THE DAM.

6. REMOVE ACCUMULATED SEDIMENT WHEN IT HAS BUILT UP TO 1/2 OF THE ORIGINAL HEIGHT OF THE WEIR CREST.

D-3 STANDARDS AND SPECIFICATIONS

FOR

INFLOW PROTECTION

D-3-1 RIPRAP INFLOW PROTECTION

Definition

A temporary or permanent, lined drainage way installed to convey concentrated runoff into sediment traps and basins or down steep slopes as applicable. Riprap Inflow Protection consists of the installation of rock or recycled concrete equivalent in a flow channel for stabilization.

Purpose

The purpose of Riprap Inflow Protection is to provide stable conveyance of concentrated runoff down steep slopes, (i.e. into temporary sediment traps and basins) thereby preventing erosion of the flow channel.

Conditions Where Practice Applies

Riprap Inflow Protection is required where the slope of a drainage way contributing to a sediment trap or basin exceeds 10:1 but is less than 4:1. Runoff may be directed to the inflow device by means of dikes or swales.

Design Criteria

Use 4 to 12 inch riprap (minimum), underlain with Geotextile Class SE and place from the ditch outfall elevation to the bottom of the trap or basin when the inflow slope is between 4:1 and 10:1. Stabilize slopes flatter than 10:1 in accordance with Temporary Swale or Earth Dike criteria as applicable. For slopes steeper than 4:1, use Gabion Inflow Protection.

Construction Specifications

1. The Riprap Inflow Protection channel must be 1 foot in depth minimum, have a trapezoidal cross section with 2:1 or flatter side slopes and a 3 foot minimum bottom width. Line channel with Class I riprap to a depth of 19 inches.

2. Provide Geotextile Class SE under all riprap.

3. Install entrance and exit sections as shown on the cross section.

4. The slope of the riprap inflow protection must be between 4:1 to 10:1.

5. Riprap used for the lining may be cleaned and recycled for permanent outlet protection if the basin is to be converted to a stormwater management facility.

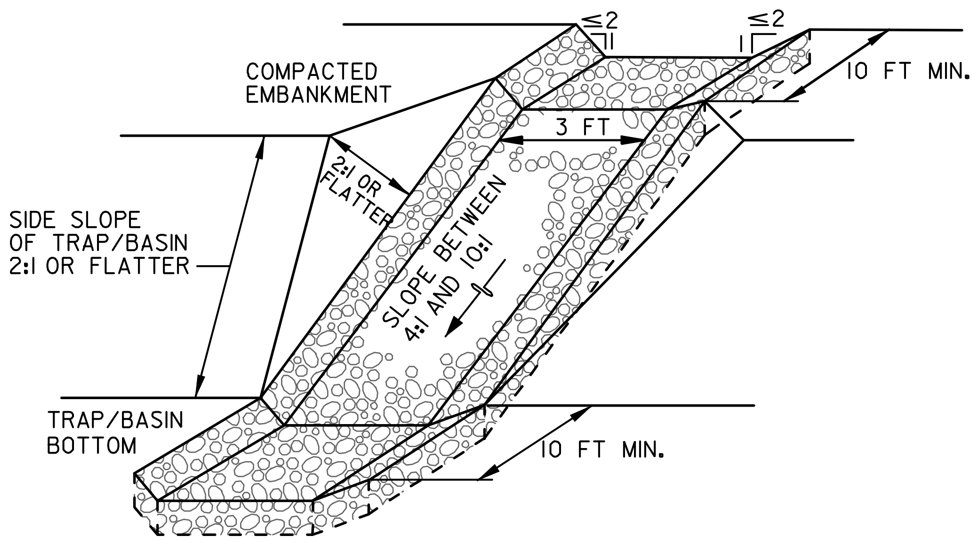
6. Riprap should blend into existing ground.

7. Use riprap inflow protection where the slope is between 4:1 and 10:1. For slopes flatter than 10:1 use earth dike/temporary swale lining criteria. For slopes steeper than 2:1 use gabion inflow protection.

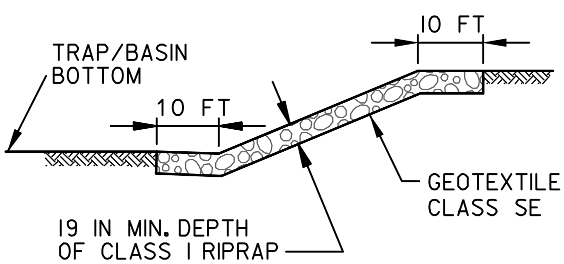
DETAIL D-3-1 RIPRAP INFLOW PROTECTION

STANDARD SYMBOL

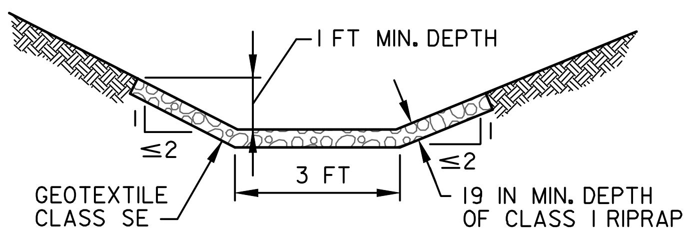
RRP



PERSPECTIVE VIEW



PROFILE ALONG CENTERLINE



CROSS SECTION

CONSTRUCTION SPECIFICATIONS

1. THE RIPRAP INFLOW PROTECTION CHANNEL MUST BE 1 FOOT IN DEPTH MINIMUM, HAVE A TRAPEZOIDAL CROSS SECTION WITH 2:1 OR FLATTER SIDE SLOPES AND A 3 FOOT MINIMUM BOTTOM WIDTH. LINE CHANNEL WITH CLASS I RIPRAP TO A DEPTH OF 19 INCHES.
2. PROVIDE GEOTEXTILE CLASS SE UNDER ALL RIPRAP.
3. INSTALL ENTRANCE AND EXIT SECTIONS AS SHOWN ON THE CROSS SECTION.
4. THE SLOPE OF THE RIPRAP INFLOW PROTECTION MUST BE BETWEEN 4:1 TO 10:1.
5. RIPRAP USED FOR THE LINING MAY BE CLEANED AND RECYCLED FOR PERMANENT OUTLET PROTECTION IF THE BASIN IS TO BE CONVERTED TO A STORMWATER MANAGEMENT FACILITY.
6. RIPRAP SHOULD BLEND INTO EXISTING GROUND.
7. USE RIPRAP INFLOW PROTECTION WHERE THE SLOPE IS BETWEEN 4:1 AND 10:1. FOR SLOPES FLATTER THAN 10:1 USE EARTH DIKE / TEMPORARY SWALE LINING CRITERIA. FOR SLOPES STEEPER THAN 2:1 USE GABION INFLOW PROTECTION.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

D-3-2 STANDARDS AND SPECIFICATIONS

FOR

GABION INFLOW PROTECTION

Definition

A temporary or permanent, lined drainage way installed to convey concentrated runoff into sediment traps and basins or down steep slopes as applicable. Gabion Inflow Protection consists of the installation of wire baskets (Gabions) filled with rock or recycled concrete equivalent in a flow channel for stabilization.

Purpose

The purpose of Gabion Inflow Protection is to provide stable conveyance of concentrated runoff down steep slopes, (i.e. into temporary sediment traps and basins) thereby preventing erosion of the flow channel.

Conditions Where Practice Applies

Gabion Inflow Protection is required where the slope of a drainage way contributing to a sediment trap or basin, or other steep area as applicable, exceeds 4:1 (25 percent). Surface runoff may be directed to the inflow device by means of dikes or swales.

Design Criteria

Place 4 to 7 inch stone[4] (min.) within manufactured wire baskets, underlain with Geotextile Class SE and place from the ditch outfall elevation to the bottom of the trap or basin when the inflow slope is between 2:1 and 4:1. Stabilize slopes flatter than 10:1 in accordance with Temporary Swale or Earth Dike criteria as applicable. For slopes between 4:1 and 10:1, see Riprap Inflow Protection.

Construction Specifications

1. Construct Gabion Inflow Protection by arranging 9 foot by 3 foot by 1 foot gabion baskets to form a trapezoidal section with a 3 foot bottom width, 1 foot minimum depth, 3 foot side walls, and 2:1 flatter side slopes.

2. Provide Geotextile Class SE under all gabion baskets.

3. Use 4 to 7 inch stone to fill the gabion baskets.

4. Install gabions in accordance with manufacturer recommendations.

5. Use Gabion Inflow Protection where concentrated flow is present on slopes steeper than 4:1.

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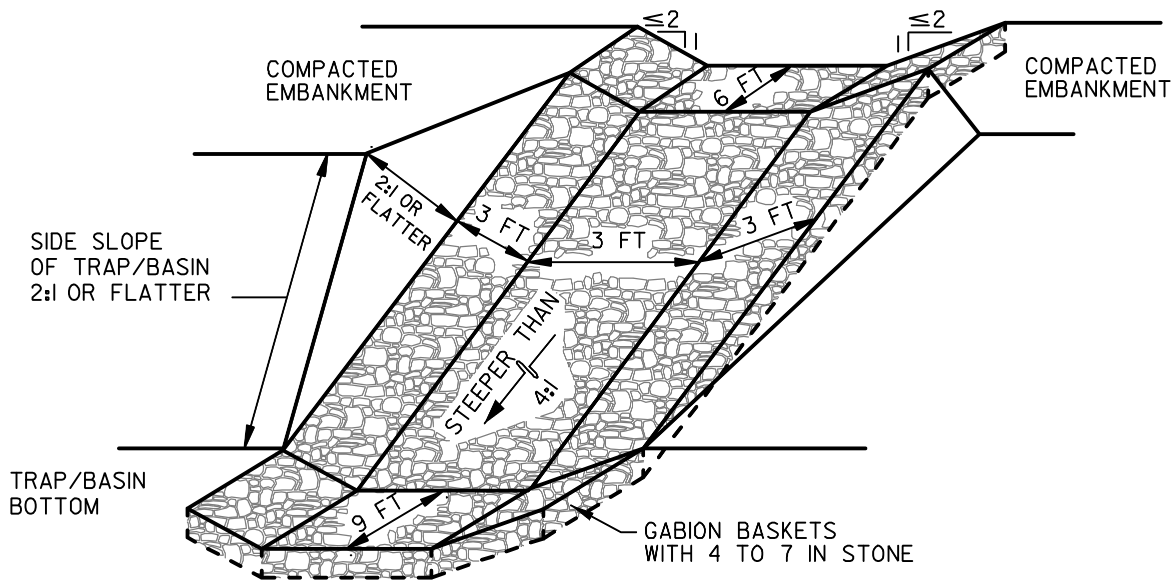
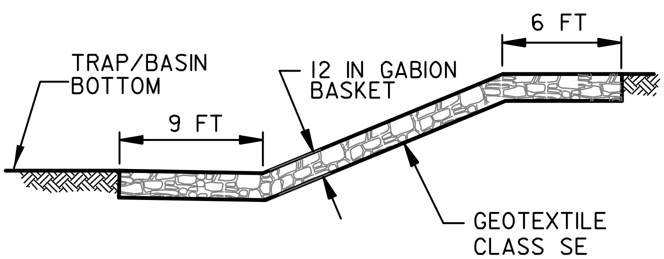
[4] See Table H.2

DETAIL D-3-2 GABION INFLOW PROTECTION

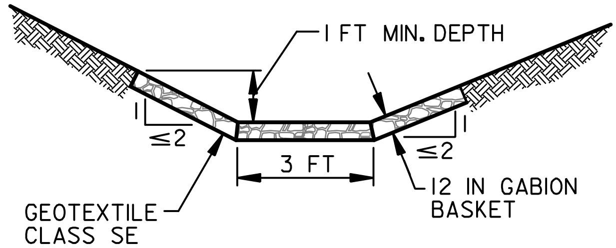
STANDARD SYMBOL

GP





PROFILE ALONG CENTERLINE



CROSS SECTION

CONSTRUCTION SPECIFICATIONS

1. CONSTRUCT GABION INFLOW PROTECTION BY ARRANGING 9 FOOT x 3 FOOT x 1 FOOT GABION BASKETS TO FORM A TRAPEZOIDAL SECTION WITH A 3 FOOT BOTTOM WIDTH, 1 FOOT MINIMUM DEPTH, 3 FOOT SIDE WALLS, AND 2:1 OR FLATTER SIDE SLOPES.
2. PROVIDE GEOTEXTILE CLASS SE UNDER ALL GABION BASKETS.
3. USE 4 TO 7 INCH STONE TO FILL THE GABION BASKETS.
4. INSTALL GABIONS IN ACCORDANCE WITH MANUFACTURER RECOMMENDATIONS.
5. USE GABION INFLOW PROTECTION WHERE CONCENTRATED FLOW IS PRESENT ON SLOPES STEEPER THAN 4:1.

D-4 STANDARDS AND SPECIFICATIONS

FOR

OUTLET PROTECTION

D-4-1 ROCK OUTLET PROTECTION

Definition

Rock placed at the outfall of channels or culverts.

Purpose

The purpose of rock outlet protection is to reduce the velocity of flow in the receiving channel to non erosive rates.

Conditions Where Practice Applies

This practice applies where discharge velocities and energies at the outlets of culverts are sufficient to erode the next downstream reach. This applies to outlets of all types such as sediment basins, stormwater management ponds, and road culverts. Rock outlet protection may be temporary or permanent. The rock outlet protection is to be designed for the same design storm as the facility it is out letting with the 10-year 24-hour storm being the minimum.

Design Criteria

The design method presented here applies to sizing rock riprap to protect a downstream area. It does not apply to rock lining of channels or streams. The design of rock outlet protection depends entirely on the location. Pipe outlets at the top of cuts or on slopes steeper than ten percent cannot be protected by rock aprons or riprap sections due to re-concentration of flows and high velocities encountered after the flow leaves the apron.

Be aware that many counties and state agencies have regulations and design procedures established for dimensions, type and size of materials, and locations where outlet protection is required.

1. Tailwater Depth

   The depth of tailwater immediately below the pipe outlet must be determined for the design capacity of the pipe. If the tailwater depth is less than half the diameter of the outlet pipe and the receiving stream is wide enough to accept divergence of the flow, it shall be classified as a Minimum Tailwater Condition. If the tailwater depth is greater than half the pipe diameter and the receiving stream will continue to confine the flow, it shall be classified as a Maximum Tailwater Condition. Pipes which outlet onto flat areas with no defined channel may be assumed to have Minimum Tailwater Condition.

2. Apron Size

   A. Determine the apron length and width from the curves according to the tailwater condition:

Minimum Tailwater	Use Figure D.2
Maximum Tailwater	Use Figure D.3

B. Determine the apron type based on the outlet channel conditions. Where the pipe discharges directly into a well defined channel, extend the apron across the channel bottom and up the channel banks to an elevation one foot above the maximum tailwater depth or to the top of the bank, whichever is less. Use Rock Outlet Protection II. When the discharge is to a semi-confined section, use Rock Outlet Protection I. Where the discharge is to an undefined channel or flat area, use Rock Outlet Protection III. Where no headwall is used, construct the upstream end of the apron adjacent to the pipe so that the width is two times the diameter of the outlet pipe. Where an end section is used, the upstream end of the apron shall conform to the end section.

3. Bottom Grade

Construct the outlet protection apron with no slope along its length and with no obstruction at the end of the apron. Tie the elevation of the downstream end of the apron to the elevation of the receiving channel or adjacent ground.

4. Alignment

Locate the outlet protection apron so that there are no bends in the horizontal alignment.

5. Materials

Riprap must be composed of a well graded mixture of stone sized so that fifty (50) percent of the pieces, by weight, are larger than the size determined by using the charts. The minimum d_{50} size to be used must be 9.5 inches. A well graded mixture, as used herein, is defined as a mixture composed primarily of larger stone sizes but with a sufficient mixture of other sizes to fill the smaller voids between the stones. The diameter of the largest stone in such a mixture must be two (2) times the size selected from Table D.2.

6. Thickness

For SHA riprap specifications the following values are used:

Table D.2: Riprap Sizes and Thicknesses

Class	**D_{50}**	**D_{100}**	**Thickness**
Class I	9.5 inches	15 inches	19 inches
Class II	16 inches	24 inches	32 inches
Class III	23 inches	34 inches	46 inches

7. Stone Quality

Stone for riprap must consist of field stone or rough and hewn quarry stone. The stone must be hard and angular and of a quality that will not disintegrate on exposure to water or weathering. The specific gravity of the individual stones must be at least 2.5.

Recycled concrete equivalent may be used provided it has a density of at least 150 pounds per cubic foot and does not have any exposed steel or reinforcing bars.

8. Filter

A filter is a layer of material placed between the riprap and the underlying soil surface to prevent soil movement into and through the riprap to prevent piping, reduce uplift pressure, and collect water. Riprap must have a filter placed under it in all cases. A filter may be of two general forms; a gravel layer or a Geotextile Class SE.

Maintenance

Once a riprap outlet has been installed, the maintenance needs are very low. It should be inspected after high flows to see if scour beneath the riprap has occurred or if any stones have been dislodged. Repairs must be made immediately.

Design Procedure

1. Investigate the downstream channel to assure that non erosive velocities can be maintained.

2. Determine the tailwater condition at the outlet to establish which curve to use.

3. Enter the appropriate chart with the depth of flow and discharge velocity to determine the riprap size and apron length required. References to pipe diameters in the charts are based on full flow. For other than full pipe flow, the parameters of depth of flow and velocity must be used.

4. Calculate apron width at the downstream end if a flared section is to be employed.

5. Determine the Rock Outlet Protection type based on the discharge channel conditions.

Examples

Example 1: Pipe Flow (Full) with Discharge to Unconfined Section:

Q = 280 cfs, diameter = 66 inches, tailwater is 2 feet above pipe invert (min. tailwater condition).

Read d_{50} = 1.2 feet (14 inches), and apron length = 38 feet.

Apron width = diameter + L a = 5.5 + 38 = 43.5 feet.

Use Rock Outlet Protection III.

Use Class II Riprap width a d_{50} = 16 inches.

Example 2: Box Flow (Partial) with High Tailwater:

A box culvert is flowing under partial flow conditions:

A concrete box 5.5 feet x 10 feet is flowing 5feet deep; Q = 600 cfs, and tailwater (surface) is 5 feet above invert (maximum tailwater condition);

V = Q/A = 600/(5 x 10) = 12 fps

At the intersection of the curve, d = 60 inches, V = 12 fps, read d_{50} = 0.4 foot.

Since d_{50} 9 inches, use d_{50} = 9.5 inches, Class I riprap.

Then reading to the d = 60 inches curve, read apron length = 40 feet.

Apron width, W = conduit width + 0.04 L a = 10 + (0.4)(40) = 26 feet.

Use Rock Outlet Protection II.

Example 3: Open Channel Flow with Discharge to Unconfined Section:

A trapezoidal concrete channel 5 feet wide with 2:1 side slopes is flowing 2 feet deep;

Q = 180 cfs (velocity = 10 fps); and the tailwater (surface) downstream is 0.8 foot (minimum tail water condition).

At the intersection of the curve, d = 24 inches, V = 10 fps, read d_{50} = 0.7 foot.

Since d_{50} 9 inches, use d_{50} = 9.5 inches, Class I riprap.

Then reading to the d = 24 inches curve, read apron length = 22 feet.

Apron width, W = bottom of width of channel + L a = 5 + 22 = 27 feet.

Use Rock Outlet Protection III.

Example 4: Pipe Flow (Partial) with Discharge to a Confined Section:

A 48 inch pipe is discharging with a depth of 3 feet;

Q = 100 cfs and the discharge velocity of 10 fps (established from partial flow analysis) to a confined trapezoidal channel with a 2 foot bottom width, 2:1 side slopes, n =.04, and a grade of 0.6 percent.

Calculation of the downstream channel (Manning's Equation) indicates a normal depth of 3.1 feet and a normal velocity of 3 fps. Since the receiving channel is confined, the maximum tailwater condition controls.

At the intersection of the curve, d = 36 inches, and V = 10 fps, read d_{50} = 0.3 foot.

Since d_{50} 9 inches, use d_{50} = 9.5 inches, Class I riprap.

Then reading to the d = 36 inch curve, read apron length = 30 feet.

Since the maximum flow depth in this reach is 3.1 feet, the minimum depth of the riprap must be 4.1 feet.

Use Rock Outlet Protection I.

<u>Construction Specifications</u>

1. Prepare the subgrade for the filter, riprap, or gabion 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. The rock or gravel must conform to the specified grading limits when installed respectively in the riprap or filter.

3. Use Geotextile Class SE or better protected from puncturing, cutting, or tearing. Repair any damage other than an occasional small hole by placing another piece of geotextile over the damaged part or by completely replacing the geotextile. Provide a minimum of one foot overlap for all repairs and for joining two pieces of geotextile together.

4. Stone for the riprap or gabion outlets may be placed by equipment. Construct to the full course thickness in one operation and in such a manner as to avoid displacement of underlying materials. Deliver and place the stone for riprap or gabion outlets 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 to prevent damage to the filter blanket or geotextile. Hand place 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.

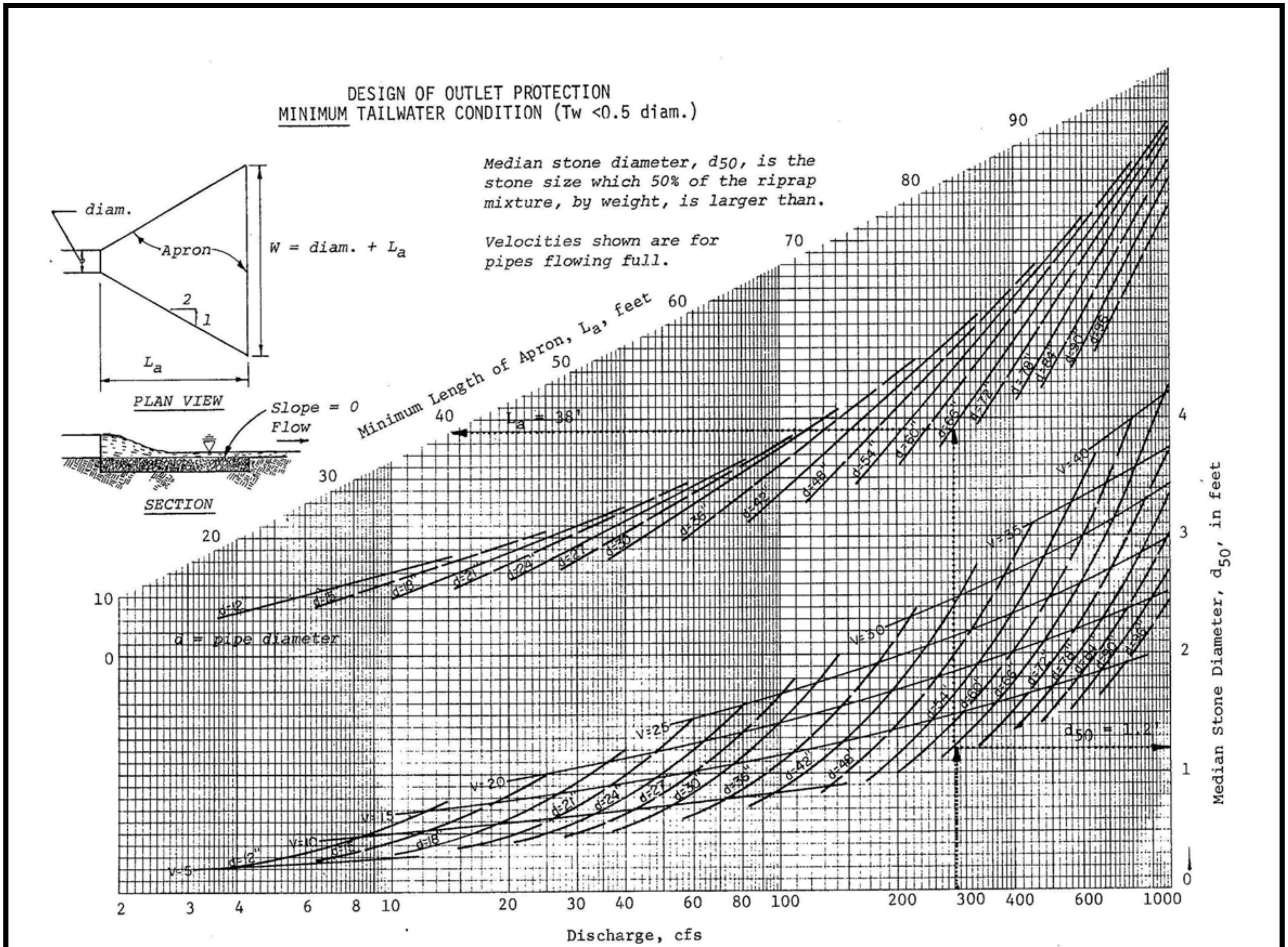


Figure D.2: Design of Outlet Protection – Minimum Tailwater Condition

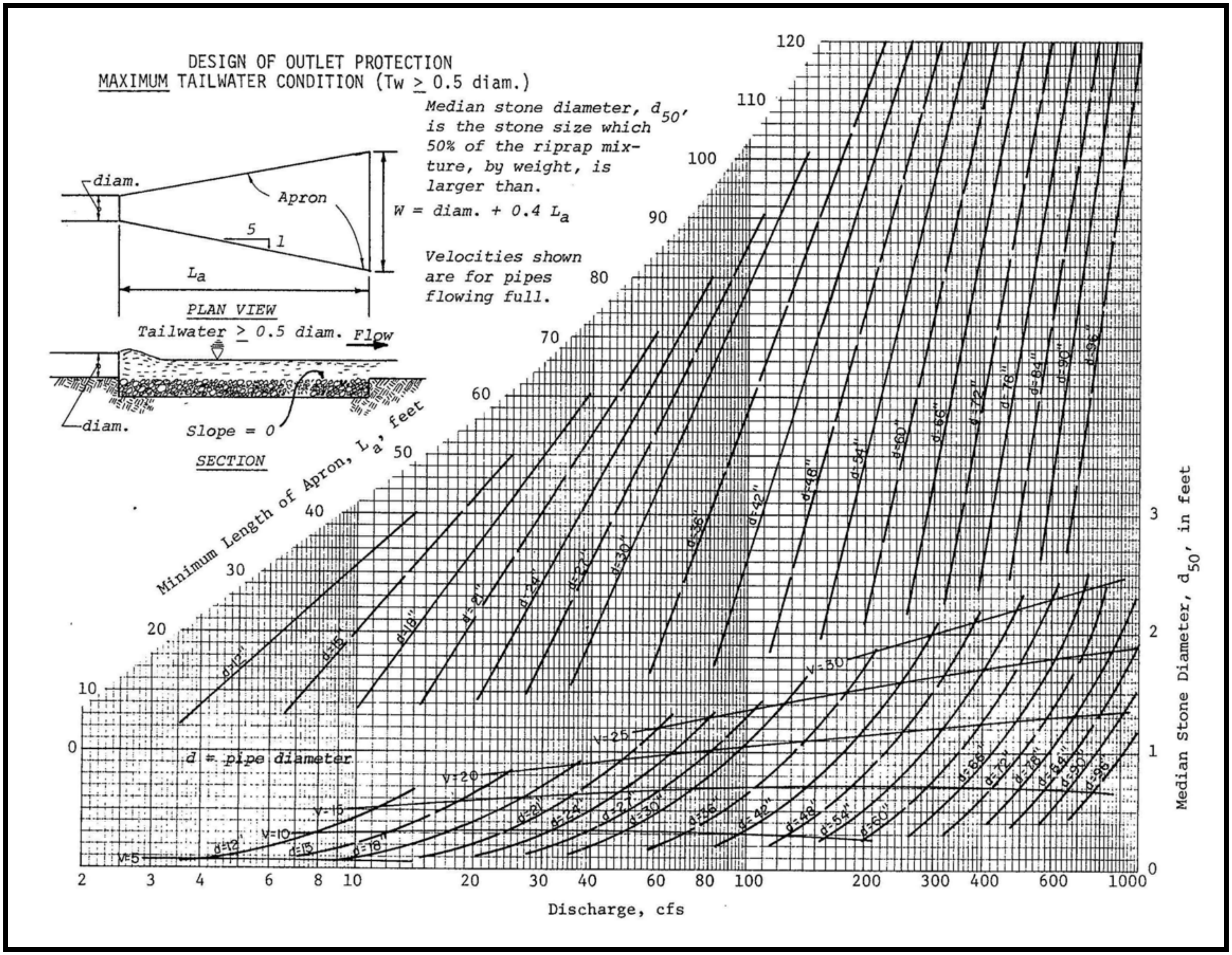


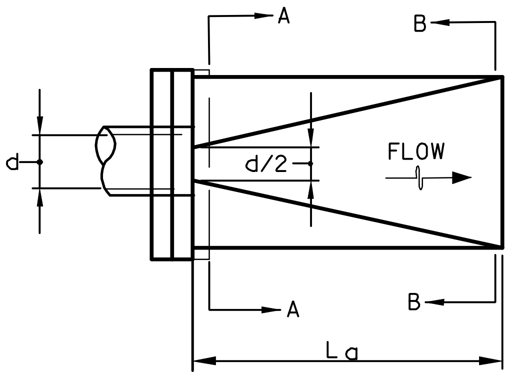
Figure D.3: Design of Outlet Protection – Maximum Tailwater Condition

DETAIL D-4-I-A ROCK OUTLET PROTECTION I

STANDARD SYMBOL

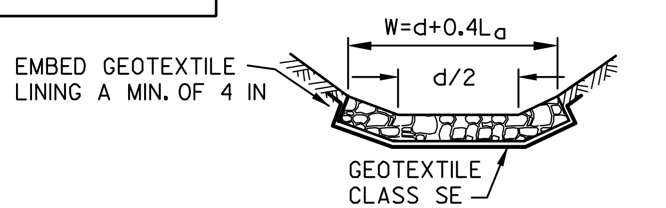
ROPI

DISCHARGE TO SEMI CONFINED SECTION (MAX. TAILWATER CONDITION)

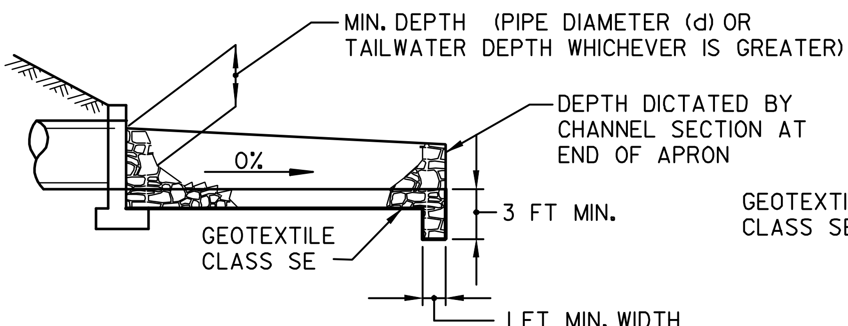


PLAN VIEW

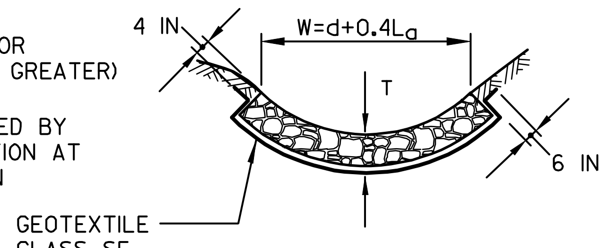
CHANNEL CROSS SECTION WILL TRANSITION FROM A-A TO B-B



SECTION A-A



PROFILE



SECTION B-B

NOTE:
GEOTEXTILE CLASS SE MUST EXTEND AT LEAST 6 IN FROM EDGE OF RIPRAP AND BE EMBEDDED AT LEAST 4 IN AT SIDES OF THE RIPRAP.

RIPRAP	
CLASS	THICKNESS (T)
I	19 IN
II	32 IN
III	46 IN

CONSTRUCTION SPECIFICATIONS

1. PREPARE SUBGRADE FOR THE FILTER, RIPRAP, OR GABION, 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. THE ROCK OR GRAVEL MUST CONFORM TO THE SPECIFIED GRADING LIMITS WHEN INSTALLED RESPECTIVELY IN THE RIPRAP OR FILTER,

3. USE GEOTEXTILE CLASS SE OR BETTER PROTECTED FROM PUNCTURING, CUTTING, OR TEARING. REPAIR ANY DAMAGE OTHER THAN AN OCCASIONAL SMALL HOLE BY PLACING ANOTHER PIECE OF GEOTEXTILE OVER THE DAMAGED PART OR BY COMPLETELY REPLACING THE GEOTEXTILE. PROVIDE A MINIMUM OF ONE FOOT OVERLAP FOR ALL REPAIRS AND FOR JOINING TWO PIECES OF GEOTEXTILE TOGETHER.

4. STONE FOR THE RIPRAP OR GABION OUTLETS MAY BE PLACED BY EQUIPMENT. CONSTRUCT TO THE FULL COURSE THICKNESS IN ONE OPERATION AND IN SUCH A MANNER AS TO AVOID DISPLACEMENT OF UNDERLYING MATERIALS. DELIVER AND PLACE THE STONE FOR RIPRAP OR GABION OUTLETS 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 TO PREVENT DAMAGE TO THE FILTER BLANKET OR GEOTEXTILE. HAND PLACE 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.

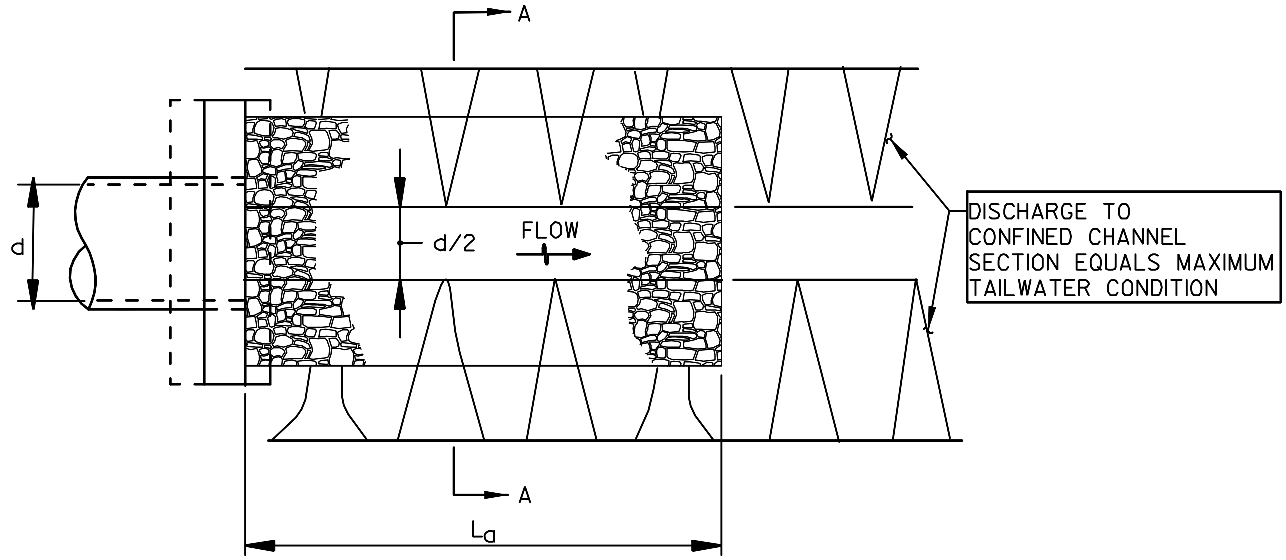
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION		U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE

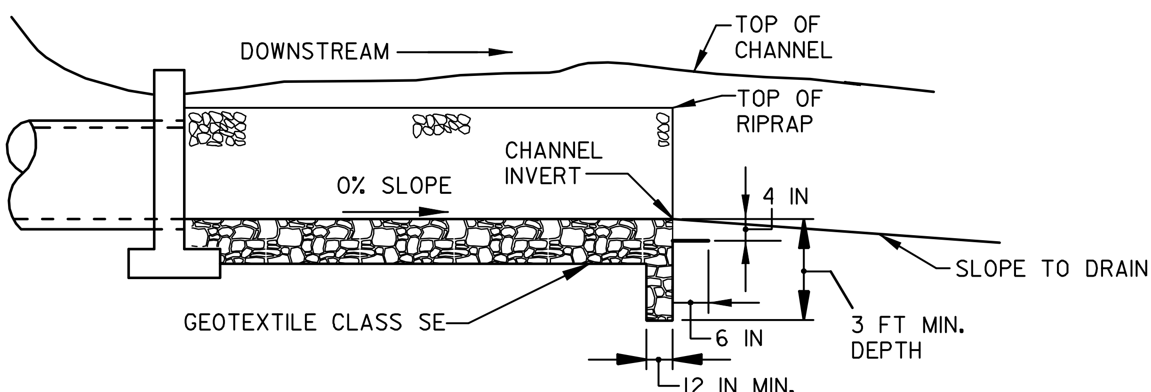
DETAIL D-4-1-B ROCK OUTLET PROTECTION II

STANDARD SYMBOL

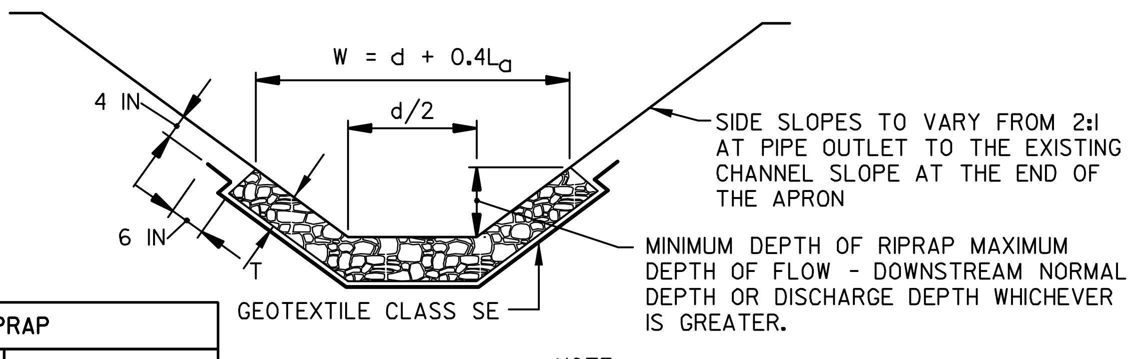
ROPII



PLAN VIEW



PROFILE



RIPRAP	
CLASS	THICKNESS (T)
I	19 IN
II	32 IN
III	46 IN

SECTION A-A

NOTE:
GEOTEXTILE CLASS SE MUST EXTEND AT LEAST 6 IN FROM EDGE OF RIPRAP AND BE EMBEDDED AT LEAST 4 IN AT SIDES OF THE RIPRAP.

1 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

MARYLAND DEPARTMENT OF ENVIRONMENT
WATER MANAGEMENT ADMINISTRATION

DETAIL D-4-1-B ROCK OUTLET PROTECTION II

STANDARD SYMBOL

ROPII

CONSTRUCTION SPECIFICATIONS

1. PREPARE SUBGRADE FOR THE FILTER, RIPRAP, OR GABION, 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. THE ROCK OR GRAVEL MUST CONFORM TO THE SPECIFIED GRADING LIMITS WHEN INSTALLED RESPECTIVELY IN THE RIPRAP OR FILTER,

3. USE GEOTEXTILE CLASS SE OR BETTER PROTECTED FROM PUNCTURING, CUTTING, OR TEARING. REPAIR ANY DAMAGE OTHER THAN AN OCCASIONAL SMALL HOLE BY PLACING ANOTHER PIECE OF GEOTEXTILE OVER THE DAMAGED PART OR BY COMPLETELY REPLACING THE GEOTEXTILE. PROVIDE A MINIMUM OF ONE FOOT OVERLAP FOR ALL REPAIRS AND FOR JOINING TWO PIECES OF GEOTEXTILE TOGETHER.

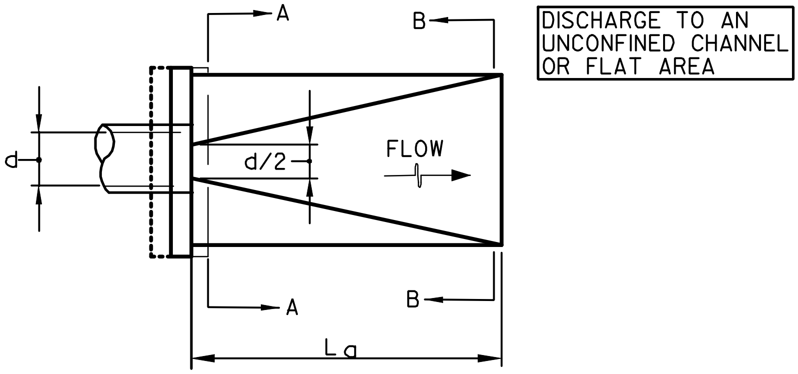
4. STONE FOR THE RIPRAP OR GABION OUTLETS MAY BE PLACED BY EQUIPMENT. CONSTRUCT TO THE FULL COURSE THICKNESS IN ONE OPERATION AND IN SUCH A MANNER AS TO AVOID DISPLACEMENT OF UNDERLYING MATERIALS. DELIVER AND PLACE THE STONE FOR RIPRAP OR GABION OUTLETS IN A MANNER THAT WILL ENSURE THAT IT IS REASONABLY HOMOGENOUS WITH THE SMALLER STONES AND SPALLS FILLING THE VOIDS BETWEEN THE LARGER STONES. PLACE RIPRAP IN A MANNER TO PREVENT DAMAGE TO THE FILTER BLANKET OR GEOTEXTILE. HAND PLACE 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.

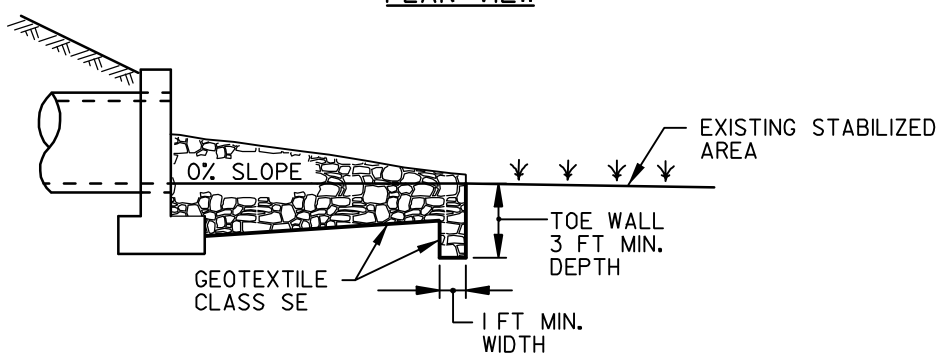
DETAIL D-4-1-C ROCK OUTLET PROTECTION III

STANDARD SYMBOL

ROPIII

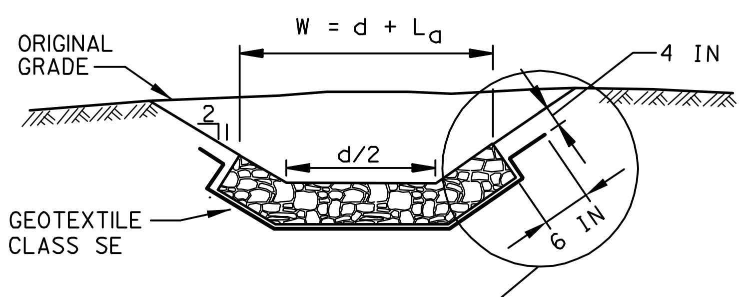


PLAN VIEW



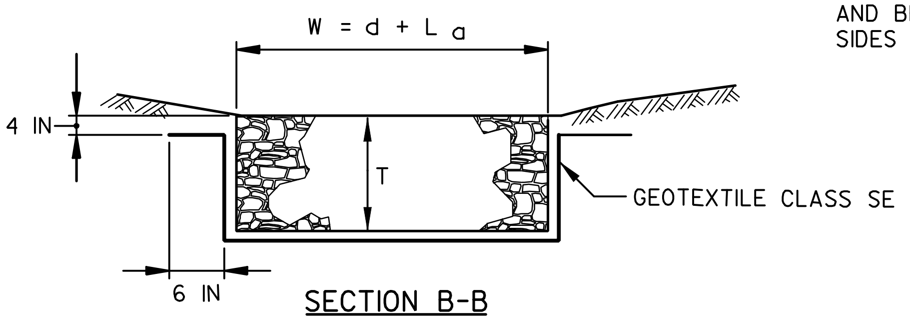
PROFILE

RIPRAP	
CLASS	THICKNESS (T)
I	19 IN
II	32 IN
III	46 IN



SECTION A-A

NOTE:
GEOTEXTILE CLASS SE MUST EXTEND AT LEAST 6 IN FROM EDGE OF RIPRAP AND BE EMBEDDED AT LEAST 4 IN AT SIDES OF THE RIPRAP.



SECTION B-B

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL D-4-1-C ROCK OUTLET PROTECTION III

STANDARD SYMBOL

ROPIII

CONSTRUCTION SPECIFICATIONS

1. PREPARE SUBGRADE FOR THE FILTER, RIPRAP, OR GABION, 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. THE ROCK OR GRAVEL MUST CONFORM TO THE SPECIFIED GRADING LIMITS WHEN INSTALLED RESPECTIVELY IN THE RIPRAP OR FILTER,

3. USE GEOTEXTILE CLASS SE OR BETTER PROTECTED FROM PUNCTURING, CUTTING, OR TEARING. REPAIR ANY DAMAGE OTHER THAN AN OCCASIONAL SMALL HOLE BY PLACING ANOTHER PIECE OF GEOTEXTILE OVER THE DAMAGED PART OR BY COMPLETELY REPLACING THE GEOTEXTILE. PROVIDE A MINIMUM OF ONE FOOT OVERLAP FOR ALL REPAIRS AND FOR JOINING TWO PIECES OF GEOTEXTILE TOGETHER.

4. STONE FOR THE RIPRAP OR GABION OUTLETS MAY BE PLACED BY EQUIPMENT. CONSTRUCT TO THE FULL COURSE THICKNESS IN ONE OPERATION AND IN SUCH A MANNER AS TO AVOID DISPLACEMENT OF UNDERLYING MATERIALS. DELIVER AND PLACE THE STONE FOR RIPRAP OR GABION OUTLETS 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 TO PREVENT DAMAGE TO THE FILTER BLANKET OR GEOTEXTILE. HAND PLACE 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.

D-4-2 STANDARDS AND SPECIFICATIONS

FOR

LEVEL SPREADER

Definition

A device used to disperse concentrated clear water runoff uniformly over the ground surface as sheet flow.

Purpose

The purpose of this practice is to take concentrated clear water flow and convert it to sheet flow and disperse it uniformly over a stabilized area in a non-erosive manner.

Conditions Where Practice Applies

This practice applies at the outlet of diversion and drainage structures.

Design Criteria

1. The level spreader can be constructed of pretreated lumber, concrete or other materials.

2. The runoff to the spreader must be sediment free.

3. Construct the lip of the level spreader in undisturbed soil (not fill) at a zero grade on the contour.

4. No traffic is allowed over the spreader.

5. The runoff from the spreader can not re-concentrate after release until it reaches an outlet designed for concentrated flow.

6. Outfall the level spreader to an existing stabilized area.

7. The minimum length of the level spreader will be determined from the 10-year storm flow.

10-Year Q (cfs)	Minimum Length – L (feet)
Up to 10	10
10 to 20	20
20 to 30	30
30 to 40	40
40 to 50	50

Construction Specifications

1. Construct the level spreader of pretreated lumber, concrete or other structural materials.

2. Construct the lip of the level spreader in undisturbed soil (not fill) at a zero percent grade on the contour.

3. Outfall the level spreader to an existing undisturbed stabilized area.

4. The minimum width will be 6 feet and the depth will be 6 inches minimum measured from the lip of the spreader and be uniform across the entire length.

5. The minimum length will be determined based on the 10-year, 24-hour storm flow.

Q10-Year (cfs)	Minimum Length (feet)
Up to 10	10
10 to 20	20
20 to 30	30
30 to 40	40
40 to 50	50

6. Provide a slope of 2:1 or flatter on the backside of the spreader.

7. The runoff to the spreader must be sediment free.

8. The runoff from the spreader can not concentrate after release until it reaches an outlet designed for concentrated flow.

9. The grade of the channel coming into the spreader must have a slope of 1 percent or less for the last 15 feet. Grade the entrance from the channel to direct the runoff into the zero percent graded channel of the spreader.

Maintenance

Inspect the level spreader after each rainfall event and make repairs immediately if needed. Inspect the spreader for levelness and any debris or vegetation that may be on it. The downstream area from the spreader should not show signs of erosion as this will indicate that sheet flow is not occurring over the spreader.

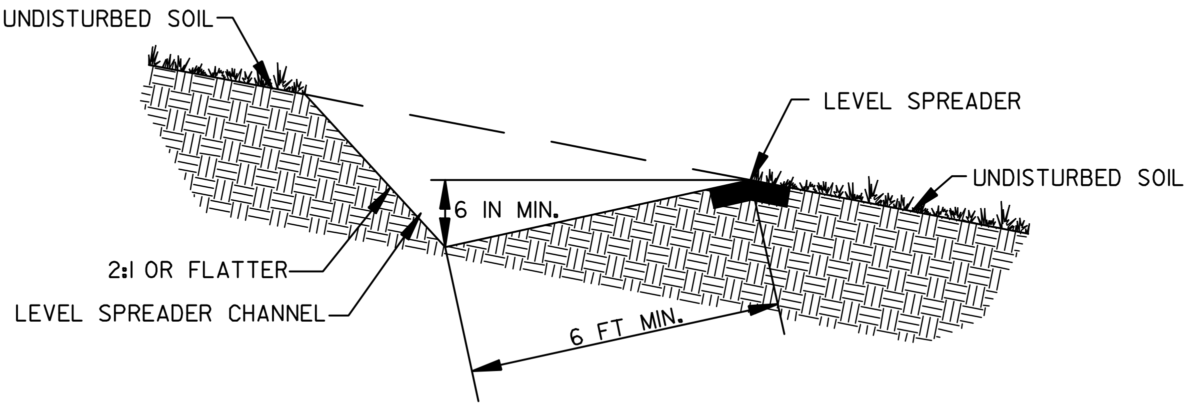
Removal

If the level spreader is a temporary device, remove the device during a non-rain event period and stabilize all areas disturbed by its removal.

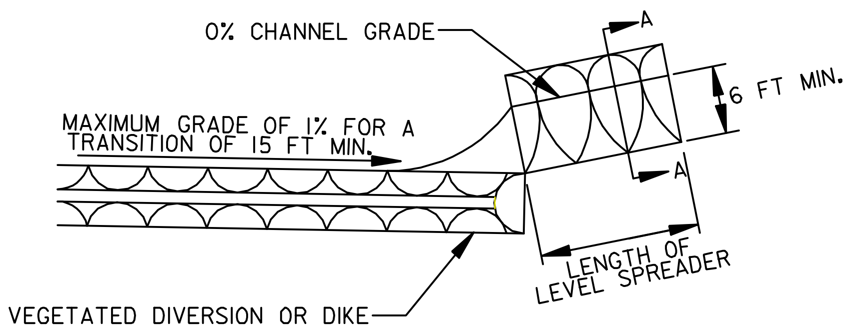
DETAIL D-4-2 LEVEL SPREADER

STANDARD SYMBOL

LS



SECTION A-A



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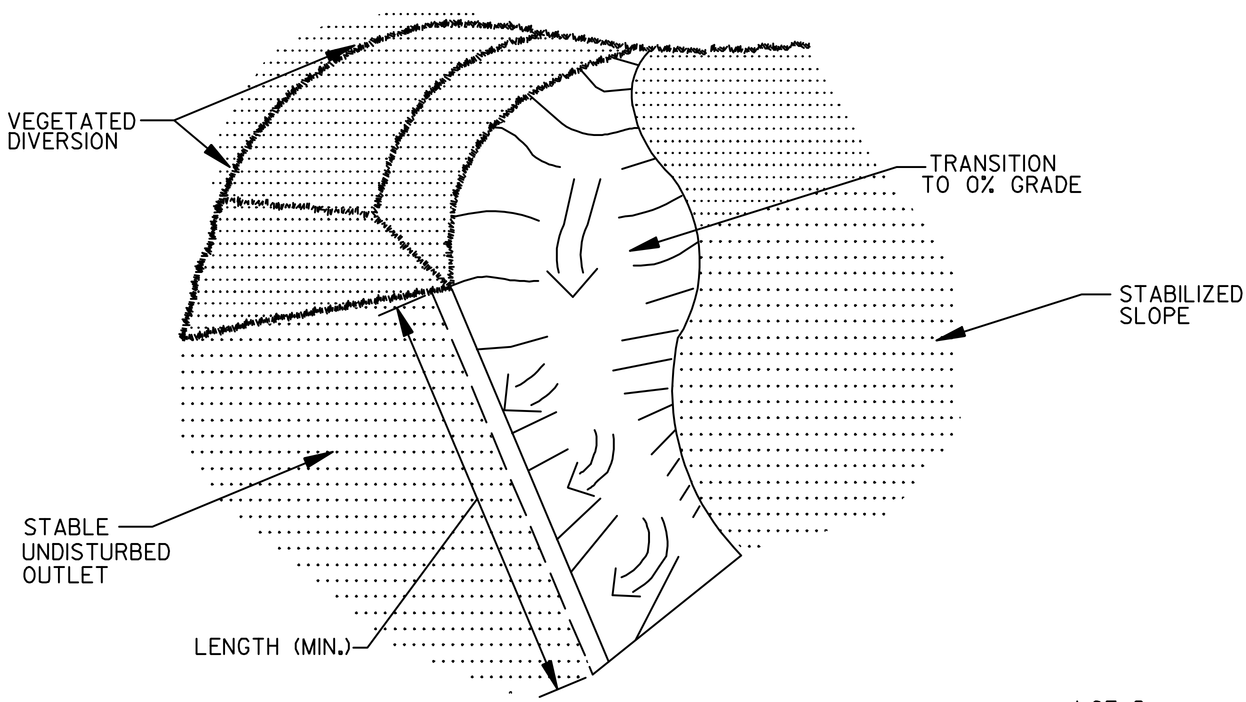


ISOMETRIC VIEW

1 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL D-4-2 LEVEL SPREADER

STANDARD SYMBOL

LS

CONSTRUCTION SPECIFICATIONS

1. CONSTRUCT THE LEVEL SPREADER OF PRETREATED LUMBER, CONCRETE OR OTHER STRUCTURAL MATERIALS.
2. CONSTRUCT THE LIP OF THE LEVEL SPREADER IN UNDISTURBED SOIL (NOT FILL) AT A ZERO PERCENT GRADE ON THE CONTOUR.
3. OUTFALL THE LEVEL SPREADER TO AN EXISTING UNDISTURBED STABILIZED AREA.
4. THE MINIMUM WIDTH WILL BE 6 FEET AND THE DEPTH WILL BE 6 INCHES MINIMUM MEASURED FROM THE LIP OF THE SPREADER AND BE UNIFORM ACROSS THE ENTIRE LENGTH.
5. THE MINIMUM LENGTH WILL BE DETERMINED BASED ON THE 10-YEAR, 24-HOUR STORM FLOW.

Q10-YEAR (CFS)	MINIMUM LENGTH (FEET)
UP TO 10	10
10 TO 20	20
20 TO 30	30
30 TO 40	40
40 TO 50	50

6. PROVIDE A SLOPE OF 2:1 OR FLATTER ON THE BACKSIDE OF THE SPREADER.
7. THE RUNOFF TO THE SPREADER MUST BE SEDIMENT FREE.
8. THE RUNOFF FROM THE SPREADER CAN NOT CONCENTRATE AFTER RELEASE UNTIL IT REACHES AN OUTLET DESIGNED FOR CONCENTRATED FLOW.
9. THE GRADE OF THE CHANNEL COMING INTO THE SPREADER MUST HAVE A SLOPE OF 1 PERCENT OR LESS FOR THE LAST 15 FEET. GRADE THE ENTRANCE FROM THE CHANNEL TO DIRECT THE RUNOFF INTO THE ZERO PERCENT GRADED CHANNEL OF THE SPREADER.

D-4-3 STANDARDS AND SPECIFICATIONS

FOR

STEP POOLS

Definition

A series of alternating steps and pools at the outfall of a discharge that conveys the runoff down a steeply sloped channel.

Purpose

To safely convey the discharge down a steeply sloped outfall by dissipating the energy in the pools and the steps and preventing the outfall channel from erosion.

Conditions Where Practice Applies

This practice applies where the steepness of the outfall channel prevents standard riprap outfall protection and is usually a permanent design.

Design Criteria

The step pool is defined by the step height, H, and the step length, L. The steepness of the step pool system is equal to the value of H/L. The step length is typically spaced from 1 to 4 times the channel width. The step height is then chosen so that the ratio of the mean steepness to the channel slope (S) lies between the range from 1 to 2. (i.e. $1 \leq (H/L)_{ave} / S \leq 2$)

All steps are to be firmly anchored into the stream bank and bottom with stones called the footer stones.

The steps are usually made from boulders and sized to resist the design storm event. A weir is designed in the step to pass the flow down the center of the pool. Design the weir to pass the 2-year storm flow and the pool to contain the 10-year storm flow without overflowing the edges of the step pool.

Construction Specifications

1. Determine a step length, L, based on the channel width. (1 to 4 times the width.)
2. Determine a step height, H, that satisfies the equation ($1 < (H/L)ave /S < 2$).
3. Construct the step pool in the dry. (Divert any existing flow in channel or based flow if any via an approved temporary stream diversion method and construct during a period of 3 day or more dry weather forecast.)
4. Install Geotextile Class SE under footer stones buried below the stream invert.
5. Construct weir steps on the footer stones with the low point in the center of the step. Abut stones close together so that there are no gaps between the stones.

6. Provide stone on the channel banks to complete the stone pool.

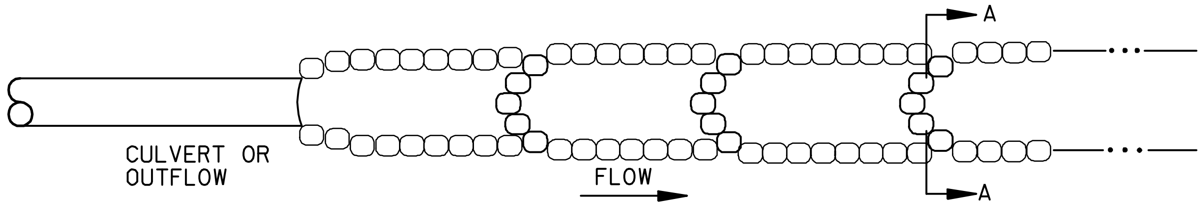
7. The water depth behind the weir should be half the step depth.

Inspection

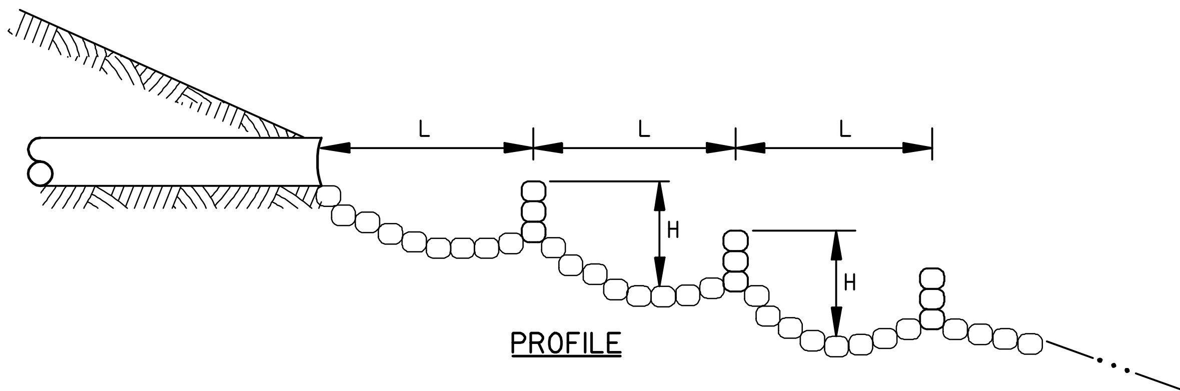
Step pool systems are to be inspected annually and after every major storm event. Look for stones that are out of place or that have been dislodged. Check pool depths for sedimentation. Make repairs immediately.

DETAIL D-4-3 STEP POOLS

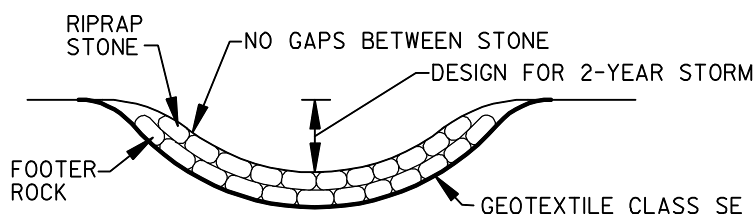
STANDARD SYMBOL



PLAN VIEW



PROFILE



SECTION A-A

CONSTRUCTION SPECIFICATIONS

1. DETERMINE A STEP LENGTH, L, BASED ON THE CHANNEL WIDTH. (1 TO 4 TIMES THE WIDTH.)
2. DETERMINE A STEP HEIGHT, H, THAT SATISFIES THE EQUATION $(1<(H/L)_{AVE} \div S < 2)$.
3. CONSTRUCT THE STEP POOL IN THE DRY. (DIVERT ANY EXISTING FLOW IS CHANNEL OR BASED FLOW IF ANY VIA AN APPROVED TEMPORARY STREAM DIVERSION METHOD AND CONSTRUCT DURING A PERIOD OF 3 DAY OR MORE DRY WEATHER FORECAST.)
4. INSTALL GEOTEXTILE CLASS SE UNDER FOOTER STONES BURIED BELOW THE STREAM INVERT.
5. CONSTRUCT WEIR STEPS ON THE FOOTER STONES WITH THE LOW POINT IN THE CENTER OF THE STEP. ABUT STONES CLOSE TOGETHER SO THAT THERE ARE NO GAPS BETWEEN THE STONES.
6. PROVIDE STONE ON THE CHANNEL BANKS TO COMPLETE THE STONE POOL.
7. THE WATER DEPTH BEHIND THE WEIR SHOULD BE HALF THE STEP DEPTH.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

D-4-4 STANDARDS AND SPECIFICATIONS

FOR

PREFORMED SCOUR HOLE

Definition

Rock placed at the outfall of culverts in the form of a depression (hole).

Purpose

The purpose of this practice is to reduce the velocity of the flow in the receiving channel to non erosive rates.

Conditions Where Practice Applies

This practice applies where discharge velocities and energies at the outlet of culverts are sufficient to erode the downstream channel reach. This applies to outlets of all types such as road culverts and from stormwater management facilities. The preformed scour hole may be a temporary or permanent device.

Design Criteria

1. Determine the type of scour hole type based on the topography and site conditions:

   Type I: The preformed scour hole is depressed ½ the size of the culvert rise.
   Type II: The preformed scour hole is depressed the full height of the culvert rise.

2. Determine the riprap (d_{50}) stone size for the scour hole type and design storm flow.

   Type I: $D_{50} = (0.0125d^2/TW) \times (Q/d^{2.5})^{4/3} - 0.5d$
   Type II: $D_{50} = (0.0082d^2/TW) \times (Q/d^{2.5})^{4/3} - d$

3. Determine the scour hole dimensions.

   C = (3 x d) + (6 x F)
   A = (2 x d) + (6 x F)
   B = (2 x d) + (6 x F)
   D = 2 x D_{50} = to scour hole stone thickness in Feet
   E = to the culvert diameter or span in Feet
   F = d or 0.5 d = to scour hole depth in Feet

   Where: D_{50} = to the median stone size in Feet
   d = to the culvert diameter or span in Feet
   TW = to the tailwater depth in Feet
   Q = to the design flow for the culvert, minimum 10-year, 24-hour storm, in CFS
   C = to the scour hole length in Feet
   A = to the scour hole inlet width in Feet
   B = to the scour hole outlet width in Feet
   3E = to the scour hole bottom length in Feet
   2E = to the scour hole width in Feet

4. For permanent uses, provide a toewall at the downstream end at a depth twice the (D) dimension and at a width equal to the (D) dimension, on Geotextile Class SE. Provide a similar toewall under the outlet pipe if the outlet does not have a footer or headwall.

5. Provide an underdrain to a suitable outfall if standing water in the scour hole is an issue or as required by the local district.

Construction Specifications

1. Prepare the subgrade for the filter and scour hole 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. The rock must conform to the specified grading limits when installed in the scour hole and filter.

3. Use Geotextile Class SE or better protected from punching, cutting, or tearing. Repair any damage other than an occasional small hole by placing another piece of geotextile over the damaged part or by completely replacing the geotextile. Provide a minimum of one foot overlap for all repairs and for joining two pieces of geotextile. Embed the geotextile a minimum of 4 inches and extend the geotextile a minimum of 6 inches beyond the edge of the scour hole.

4. Stone for the scour hole may be placed by equipment. Construct to the full course thickness in one operation and in such a manner as to avoid displacement of underlying materials. Deliver and place the stone for the scour hole 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 stone for the scour hole in a manner to prevent damage to the filter blanket or geotextile. Hand place to the extent necessary to prevent damage to the permanent works.

5. Place the stone for the scour hole 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.

6. For permanent uses, provide a toewall wrapped in Geotextile Class SE, 2 x D in depth and D in width at the downstream end. Provide a similar toewall under the outlet pipe if the outlet pipe does not have a footer or headwall.

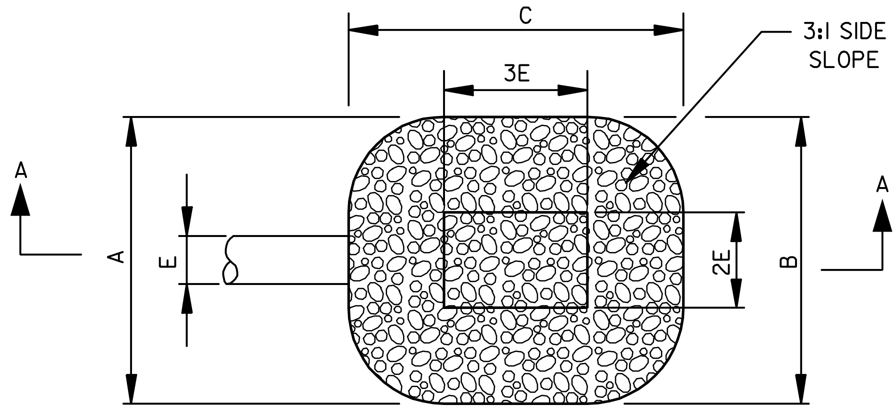
7. Provide an underdrain to a suitable outfall if standing water in the scour hole is an issue or as required by the local District.

Maintenance

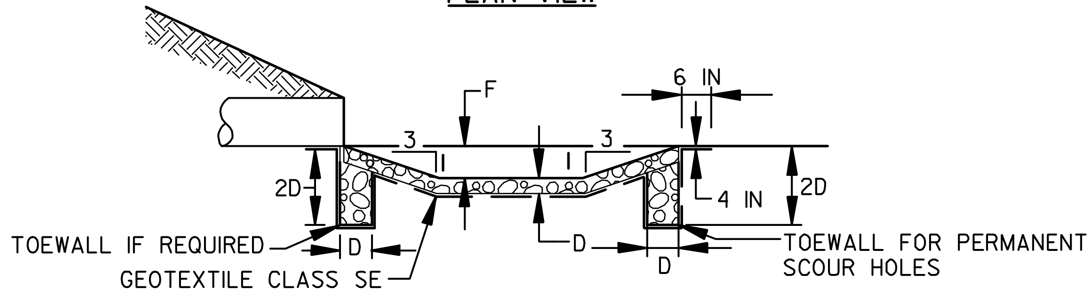
Inspect the preformed scour hole after significant rainfall events and repair immediately as needed.

DETAIL D-4-4 PREFORMED SCOUR HOLE

STANDARD SYMBOL



PLAN VIEW



SECTION A-A

CONSTRUCTION SPECIFICATIONS

1. PREPARE THE SUBGRADE FOR THE FILTER AND SCOUR HOLE 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. THE ROCK MUST CONFORM TO THE SPECIFIED GRADING LIMITS WHEN INSTALLED IN THE SCOUR HOLE AND FILTER.

3. USE GEOTEXTILE CLASS SE OR BETTER PROTECTED FROM PUNCHING, CUTTING, OR TEARING. REPAIR ANY DAMAGE OTHER THAN AN OCCASIONAL SMALL HOLE BY PLACING ANOTHER PIECE OF GEOTEXTILE OVER THE DAMAGED PART OR BY COMPLETELY REPLACING THE GEOTEXTILE. PROVIDE A MINIMUM OF ONE FOOT OVERLAP FOR ALL REPAIRS AND FOR JOINING TWO PIECES OF GEOTEXTILE. EMBED THE GEOTEXTILE A MINIMUM OF 4 INCHES AND EXTEND THE GEOTEXTILE A MINIMUM OF 6 INCHES BEYOND THE EDGE OF THE SCOUR HOLE.

4. STONE FOR THE SCOUR HOLE MAY BE PLACED BY EQUIPMENT. CONSTRUCT TO THE FULL COURSE THICKNESS IN ONE OPERATION AND IN SUCH A MANNER AS TO AVOID DISPLACEMENT OF UNDERLYING MATERIALS. DELIVER AND PLACE THE STONE FOR THE SCOUR HOLE 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 STONE FOR THE SCOUR HOLE IN A MANNER TO PREVENT DAMAGE TO THE FILTER BLANKET OR GEOTEXTILE. HAND PLACE TO THE EXTENT NECESSARY TO PREVENT DAMAGE TO THE PERMANENT WORKS.

5. PLACE THE STONE FOR THE SCOUR HOLE 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.

6. FOR PERMANENT USES, PROVIDE A TOEWALL WRAPPED IN GEOTEXTILE CLASS SE, 2 X D IN DEPTH AND D IN WIDTH AT THE DOWNSTREAM END. PROVIDE A SIMILAR TOEWALL UNDER THE OUTLET PIPE IF THE OUTLET PIPE DOES NOT HAVE A FOOTER OR HEADWALL.

7. PROVIDE AN UNDERDRAIN TO A SUITABLE OUTFALL IF STANDING WATER IN THE SCOUR HOLE IS AN ISSUE OR AS REQUIRED BY THE LOCAL DISTRICT.

SECTION E – FILTERING

E-1 STANDARDS AND SPECIFICATIONS

FOR

SILT FENCE

Definition

Temporary barrier of woven geotextile used to intercept, reduce velocity and filter surface runoff from disturbed areas.

Purpose

Silt fences intercept sediment laden sheet flow runoff so that deposition of sediment transported from upstream can occur and can be used to intercept sheet flow only. Silt fence shall not be used as velocity checks in ditches or swales, or placed where it will intercept concentrated flow.

Conditions Where Practice Applies

Silt fence is limited to intercepting sheet flow runoff from small disturbed areas. The use of silt fence is based on slope and slope length. Silt fence works primarily by velocity dissipation to promote gravity settling of sediments and provides some filtering.

Table E.1: Silt Fence Design Constraints

Slope Steepness	(Maximum) Slope Length	(Maximum) Silt Fence Length
Flatter than 50:1 (2%)	Unlimited	Unlimited
>50:1 to 10:1 (2-10%)	125 feet	1,000 feet
>10:1 to 5:1 (10-20%)	100 feet	750 feet

1. 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.

2. Downslope from the silt fence should be undisturbed ground.

Design Criteria

1. Silt fence shall be used to treat small, disturbed areas of sheet flow.

2. Silt fence should be placed as close to the contour as possible. No section of silt fence should exceed a grade of 5 percent for a distance of more than 50 feet.

3. Silt fence shall not be used as velocity checks in ditches or swales or placed where it will intercept concentrated flow.

4. Silt fence should be used with caution in areas of rocky soils that may prevent trenching.

5. The length of silt fence must conform to the design constraints listed in Table E.1 below.

Construction Specifications

1. Use 36 inch minimum fence post and drive 16 inch minimum into ground. Use wood posts 2 x 2 inch (minimum) square cut, or 1 ¾ inch (minimum) diameter round and of sound quality hardwood. Use standard T or U section steel posts 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 and meet the requirements for Geotextile Class F as described in Section H-1 Material Specifications in these standards and specifications.

3. Where two sections of geotextile adjoin each other; overlap, fold, and staple. Twist joining posts 180^{o} prior to driving posts into the ground.

4. Perform maintenance as needed and remove silt buildups when "bulges" develop in the silt fence, or when silt reaches 25% of the fence height.

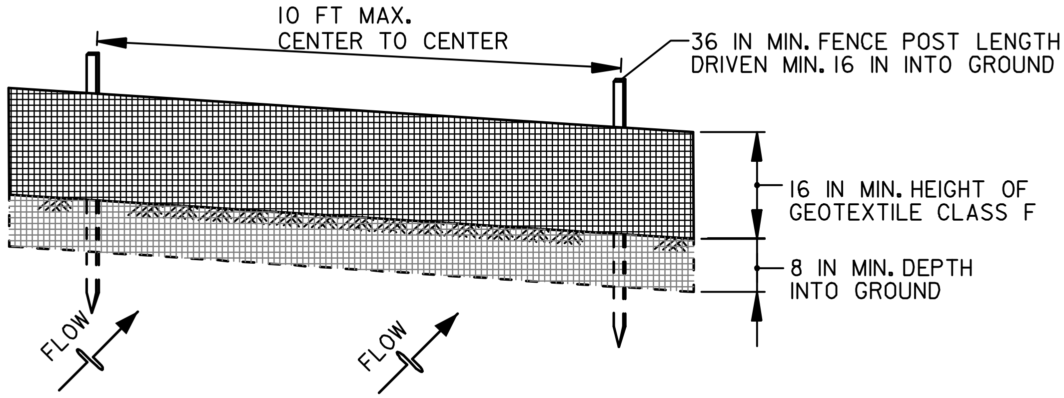
5. Provide the manufacturer certification at the site for inspection by an authorized representative of the approval authority showing that the silt fence used meets the requirements set forth in this specification.

6. Extend both ends of the silt fence at least five feet upslope at 45 degrees to the main fence alignment to prevent runoff from going around the ends of the silt fence.

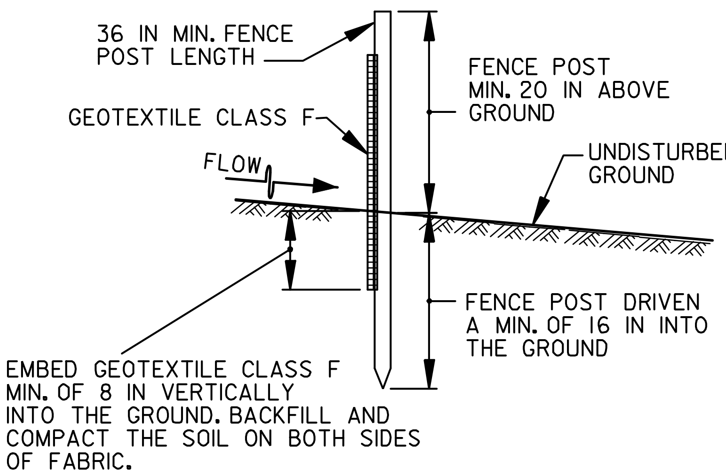
DETAIL E-1 SILT FENCE

STANDARD SYMBOL

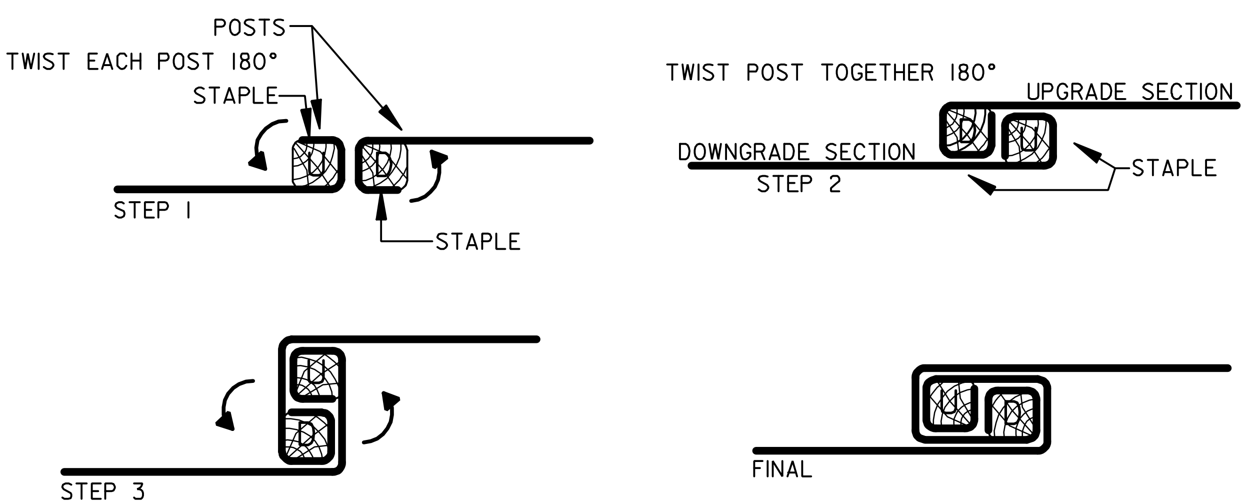
—SF—



PERSPECTIVE VIEW



CROSS SECTION



JOINING TWO ADJACENT SILT
FENCE SECTIONS (TOP VIEW)

1 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL E-1 SILT FENCE

STANDARD SYMBOL

|——SF——|

CONSTRUCTION SPECIFICATIONS

1. USE 36 INCH MINIMUM FENCE POST AND DRIVE 16 INCH MINIMUM INTO GROUND. USE WOOD POSTS 2x2 INCH (MINIMUM) SQUARE CUT, OR 1¾ INCH (MINIMUM) DIAMETER ROUND AND OF SOUND QUALITY HARDWOOD. USE STANDARD T OR U SECTION STEEL POSTS WEIGHING NOT LESS THAN 1.00 POUND PER LINEAR FOOT.

2. FASTEN GEOTEXTILE SECURELY TO EACH FENCE POST WITH WIRE TIES OR STAPLES AT TOP AND MID-SECTION AND MEET THE REQUIREMENTS FOR GEOTEXTILE CLASS F AS DESCRIBED IN SECTION H-1 MATERIAL SPECIFICATIONS IN THESE STANDARDS AND SPECIFICATIONS.

3. WHEN TWO SECTIONS OF GEOTEXTILE ADJOIN EACH OTHER, OVERLAP, FOLD, AND STAPLE. TWIST JOINING POSTS 180° PRIOR TO DRIVING POSTS INTO THE GROUND.

4. PERFORM MAINTENANCE AS NEEDED AND REMOVE SILT BUILDUPS WHEN "BULGES" DEVELOP IN THE SILT FENCE, OR WHEN SILT REACHES 25% OF THE FENCE HEIGHT.

5. PROVIDE THE MANUFACTURE CERTIFICATION AT THE SITE FOR INSPECTION BY AN AUTHORIZED REPRESENTATIVE OF THE APPROVAL AUTHORITY SHOWING THAT THE SILT FENCE USED MEETS THE REQUIREMENTS SET FORTH IN THIS SPECIFICATION.

6. EXTEND BOTH ENDS OF THE SILT FENCE AT LEAST FIVE FEET UPSLOPE AT 45 DEGREES TO THE MAIN FENCE ALIGNMENT TO PREVENT RUNOFF FROM GOING AROUND THE ENDS OF THE SILT FENCE.

E-2 STANDARDS AND SPECIFICATIONS

FOR

SILT FENCE ON PAVEMENT

Definition

Temporary barrier of woven geotextile used to intercept, reduce velocity and filter surface runoff from disturbed areas with paved areas (i.e. work in parking lots, etc.).

Purpose

Silt fences intercept sediment laden sheet flow runoff so that deposition of sediment transported from upstream can occur and can be used to intercept sheet flow only. Silt fence shall not be used as velocity checks in ditches or swales, or placed where it will intercept concentrated flow.

Conditions Where Practice Applies

Silt fence is limited to intercepting sheet flow runoff from small disturbed areas. The use of silt fence is based on slope and slope length. Silt fence works primarily by velocity dissipation to promote gravity settling of sediments and provides some filtering.

Table E.2: Silt Fence on Pavement Design Constraints

Slope Steepness	(Maximum) Slope Length	(Maximum) Silt Fence Length
Flatter than 50:1 (2%)	Unlimited	Unlimited
50:1 to 10:1 (2-10%)	125 feet	1,000 feet
10:1 to 5:1 (10-20%)	100 feet	750 feet
5:1 to 3:1 (20 - 33%)	60 feet	500 feet

1. 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.

2. Downslope from the silt fence should be undisturbed ground.

Design Criteria

1. Silt fence provides a barrier that can collect soil, preventing the material from entering critical areas, streams, streets, etc.

2. Silt fence should be placed as close to the contour as possible. No section of silt fence should exceed a grade of 5 percent for a distance of more than 50 feet.

3. Do not use silt fence as velocity checks in paved swales or placed where it will intercept concentrated flow.

4. The length of silt fence must conform to the design constraints listed in Table E.2 below.

Construction Specifications

1. Use finished lumber 2 x 4 inch minimum.

2. Provide a mastic seal as shown in Detail E-2 to prevent sediment-laden water from escaping untreated beneath silt fence installation.

3. Keep silt fence taut and securely staple to the face of upright supports.

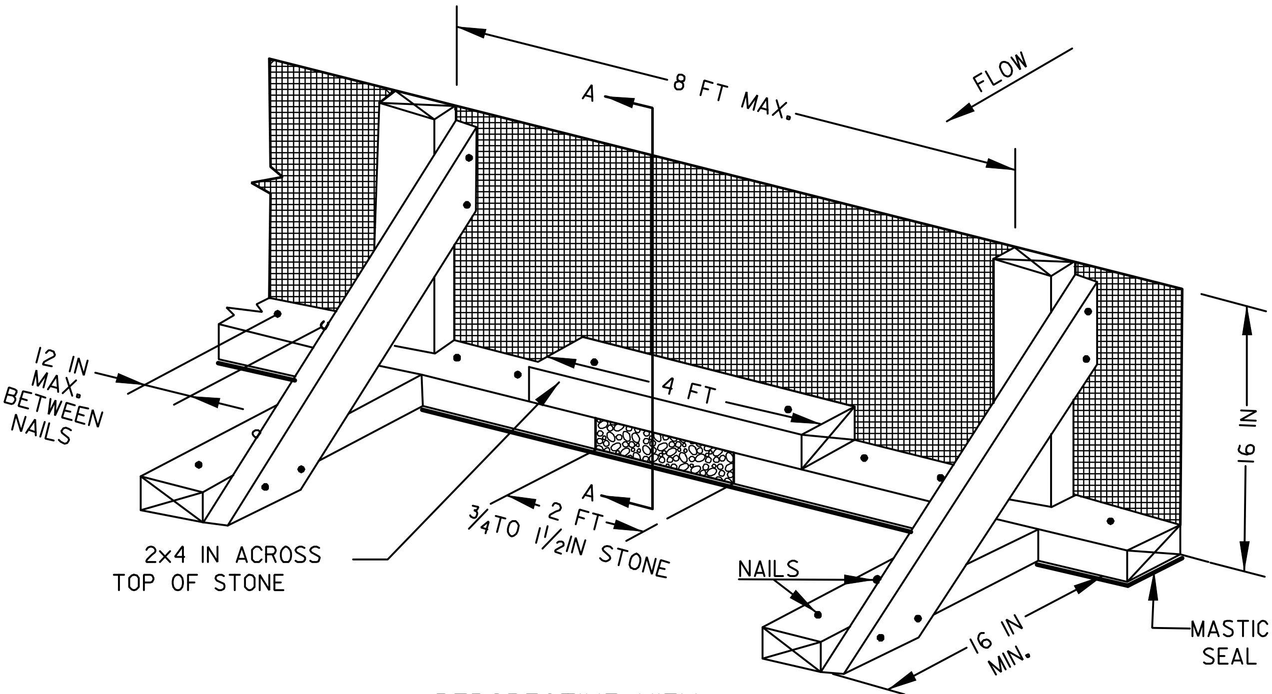
4. Secure boards to pavement with type 20d nails 4 inch minimum in length.

5. Use the requirements of Class F Geotextile as described in Section H-1 Material Specifications in these standards and specifications.

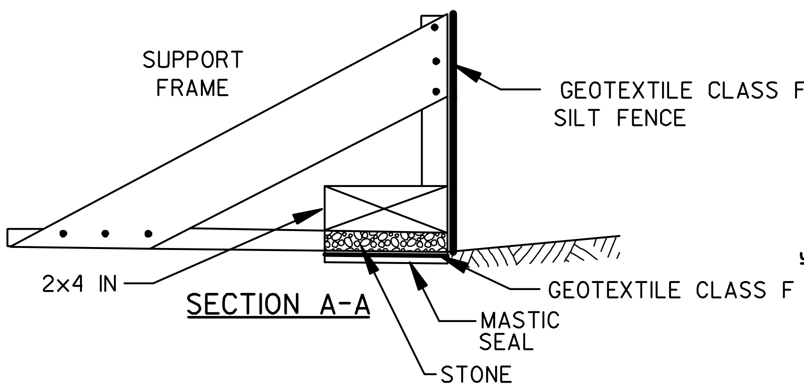
DETAIL E-2 SILT FENCE ON PAVEMENT

STANDARD SYMBOL

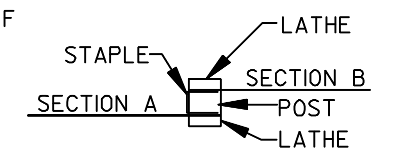
|——SFOP——|



PERSPECTIVE VIEW



SECTION A-A



JOINING ADJACENT SECTIONS OF GEOTEXTILE

CONSTRUCTION SPECIFICATIONS

1. USE FINISHED LUMBER 2x4 INCH MINIMUM.
2. PROVIDE A MASTIC SEAL TO PREVENT SEDIMENT-LADEN WATER FROM ESCAPING UNTREATED BENEATH SILT FENCE INSTALLATION.
3. KEEP SILT FENCE TAUT AND SECURELY STAPLED TO FACE OF UPRIGHT SUPPORTS.
4. SECURE BOARDS TO PAVEMENT WITH 20d NAILS 4 INCH MINIMUM IN LENGTH.
5. MEET THE REQUIREMENTS FOR GEOTEXTILE CLASS F AS DESCRIBED IN SECTION H-1 MATERIAL SPECIFICATIONS IN THESE STANDARDS AND SPECIFICATIONS.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

E-3 STANDARDS AND SPECIFICATIONS

FOR

SUPER SILT FENCE

Definition

A temporary barrier of woven geotextile over chain link fence used to intercept sediment laden sheet flow runoff from small drainage areas.

Purpose

Super silt fence intercepts sediment laden sheet flow runoff so that deposition of sediment transported from upstream can occur and can be used to intercept sheet flow only. Super silt fence can be used where the slope or slope length criterion for silt fence cannot be met or where additional protection is warranted such as adjacent to wetlands, streams, or other sensitive areas.

Table E.3: Super Silt Fence Design Constraints

Slope	Slope Steepness	Slope Length (maximum)	Super Silt Fence Length (maximum)
0 - 10%	0 - 10:1	Unlimited	Unlimited
>10 - 20%	>10:1 - 5:1	200 feet	1,500 feet
>20 - 33%	>5:1 - 3:1	100 feet	1,000 feet
>33 - 50%	>3:1 - 2:1	100 feet	500 feet
>50% +	>2:1 +	50 feet	250 feet

Where ends of the geotextile come together, the ends shall be overlapped, folded, and stapled to prevent sediment bypass.

Design Criteria

1. Super silt fence provides a barrier that can collect and hold debris and soil, preventing the material from entering critical areas, streams, streets, etc.

2. Super silt fence should be placed as close to the contour as possible. No section of silt fence should exceed a grade of 5% for a distance of more than 50 feet.

3. Super silt fence shall not be used as velocity checks in ditches or swales or placed where it will intercept concentrated flow.

4. Super silt fence should be used with caution in areas of rocky soils that may prevent trenching.

5. The length of super silt fence must conform to the design constraints listed in Table E.3 below

Construction Specifications

1. Place minimum 9 gauge fencing 42 inches in height Chain Link Fencing. When 6 foot fence is specified use SHA specifications for a 6 foot fence, substituting 42 inches of geotextile and 6 foot length posts. Posts do not need to be set in concrete. Drive 2 ½ inch diameter fence post 36 inches into the ground.

2. Fasten chain link fence securely to the fence posts with wire ties or staples. The lower tension wire, brace and truss rods, drive anchors, and post caps are not required except on the ends of the fence.

3. Fasten Geotextile securely to the chain link fence with ties spaced every 24 inches at the top and mid section. Embed geotextile a minimum of 8 inches into the ground.

4. When two sections of geotextile adjoin each other, overlap by 6 inches and fold.

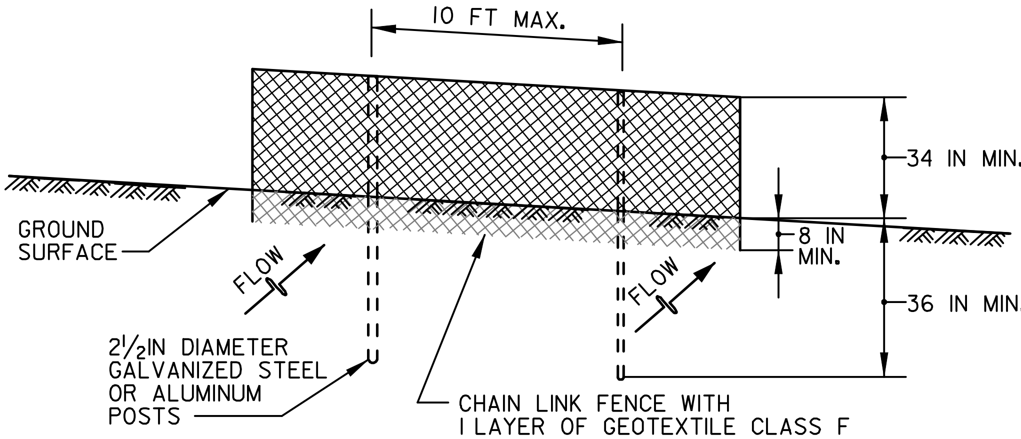
5. Perform maintenance as needed and remove silt buildups when "bulges" develop in the silt fence, or when silt reaches 50% of the fence height.

6. Use Geotextile Class F as described in section H-1 material specification in these standards and specifications.

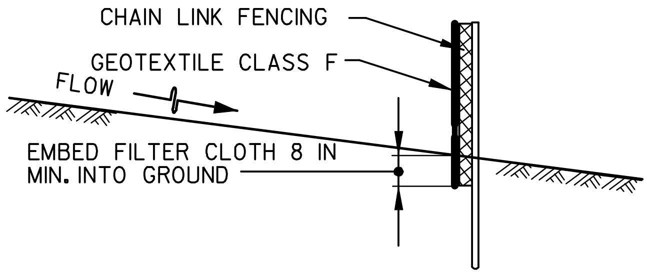
DETAIL E-3 SUPER SILT FENCE

STANDARD SYMBOL

SSF



PERSPECTIVE VIEW



CROSS SECTION

CONSTRUCTION SPECIFICATIONS

1. PLACE MINIMUM 9 GAUGE FENCING 42 INCHES IN HEIGHT CHAIN LINK FENCING. WHEN 6 FOOT FENCE IS SPECIFIED USE SHA SPECIFICATIONS FOR A 6 FOOT FENCE, SUBSTITUTING 42 INCHES OF GEOTEXTILE AND 6 FOOT LENGTH POSTS. POSTS DO NOT NEED TO BE SET IN CONCRETE. DRIVE 2½ INCH DIAMETER FENCE POST 36 INCHES INTO THE GROUND.

2. FASTEN CHAIN LINK FENCE SECURELY TO THE FENCE POSTS WITH WIRE TIES OR STAPLES. THE LOWER TENSION WIRE, BRACE AND TRUSS RODS, DRIVE ANCHORS, AND POST CAPS ARE NOT REQUIRED EXCEPT ON THE ENDS OF THE FENCE.

3. FASTEN GEOTEXTILE SECURELY TO THE CHAIN LINK FENCE WITH TIES SPACED EVERY 24 INCHES AT THE TOP AND MID SECTION. EMBED GEOTEXTILE A MINIMUM OF 8 INCHES INTO THE GROUND.

4. WHEN TWO SECTIONS OF GEOTEXTILE ADJOIN EACH OTHER, OVERLAP BY 6 INCHES AND FOLD.

5. PERFORM MAINTENANCE AS NEEDED AND REMOVE SILT BUILDUPS WHEN "BULGES" DEVELOP IN THE SILT FENCE, OR WHEN SILT REACHES 50% OF THE FENCE HEIGHT.

6. MEET THE REQUIREMENTS FOR GEOTEXTILE CLASS F AS DESCRIBED IN SECTION H-1 MATERIAL SPECIFICATIONS IN THESE STANDARDS AND SPECIFICATIONS.

E-4 STANDARDS AND SPECIFICATIONS

FOR

CLEAR WATER PIPE THROUGH SILT FENCE OR SUPER SILT FENCE

Definition

A pipe extension through silt fence or super silt fence installed to convey channel or pipe flow around an unstable area. Use of flexible piping is preferred.

Conditions Where Practice Applies

Clean water pipe through silt fences or super silt fence are used for pipe slope drains or where a drainage pipe outfalls at the toe of fill and silt fence is the primary erosion and sediment control in this area.

Design Criteria

1. Clean water pipe transports clean water away from disturbed areas reducing the amount of erosion and sediment control requirements.

2. The plywood baffle should be placed parallel to the silt fence. The baffle should be placed on a grade of 0 percent. Use ½ inch plywood baffle in equal or greater height then the silt fence being impacted by the pipe.

3. The outfall of the clean water pipe shall be stable and able to handle the 2-year discharge.

4. Plywood baffle should be used with caution in areas of rocky soils that may prevent trenching.

Construction Specifications

1. Cut and pull back 8 linear feet maximum section of silt fence.

2. Install Pipe Slope Drain and securely anchor to the slope.

3. Install ½ inch plywood baffle and attach silt fence (SF) stakes or super silt fence (SSF) chain link. Reset Silt fence geotextile behind the plywood.

4. Add #4 stone behind the plywood baffle to a height of 4 inches above the top of pipe slope drain.

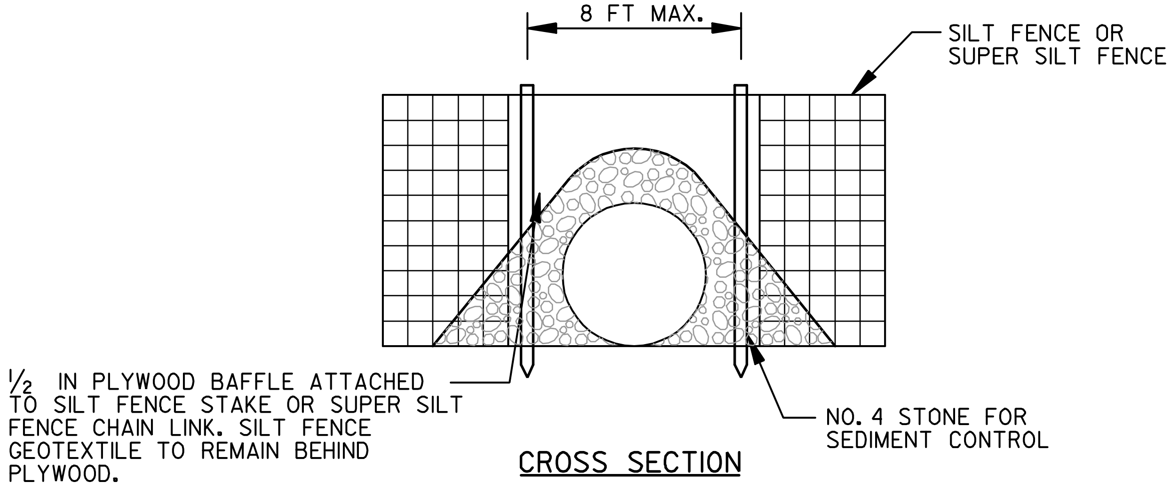
5. Outlet whenever possible where a PSD drains an un-stabilized area into a sediment trap or basin. If this is not possible then the slope drain will discharge into a stable conveyance that leads to a sediment trap or basin. Discharge PSD into a trap or basin at the same elevation as the wet pool elevation. The discharge from the PSD must be as far away from the sediment control outlet as possible.

6. When the drainage area is stable, discharge PSD onto a stable area at a non-erosive velocity. Place 4 to 7 inch stone overtop of Geotextile Class F as necessary.

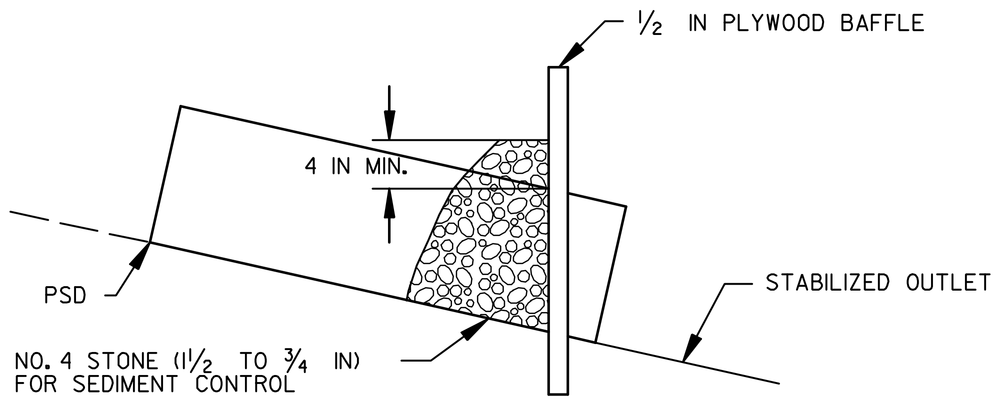
7. Perform inspection and any required maintenance periodically and after each rain event.

DETAIL E-4 CLEAR WATER PIPE THROUGH SILT FENCE OR SUPER SILT FENCE

STANDARD SYMBOL



CROSS SECTION



PROFILE

CONSTRUCTION SPECIFICATIONS

1. CUT AND PULL 8 LINEAR FOOT MAXIMUM SECTION OF SILT FENCE.
2. INSTALL PIPE SLOPE DRAIN AND SECURELY ANCHOR TO THE SLOPE.
3. INSTALL ½ INCH PLYWOOD BAFFLE AND ATTACH SILT FENCE (SF) STAKES OR SUPER SILT FENCE (SSF) CHAIN LINK. RESET SILT FENCE GEOTEXTILE BEHIND THE PLYWOOD.
4. PLACE NO. 4 STONE BEHIND THE PLYWOOD BAFFLE TO HEIGHT OF 4 INCHES ABOVE THE TOP OF PIPE SLOPE DRAIN.
5. OUTLET WHENEVER POSSIBLE WHERE A PSD DRAINS AN UN-STABILIZED AREA INTO A SEDIMENT TRAP OR BASIN. IF THIS IS NOT POSSIBLE THEN THE SLOPE DRAIN WILL DISCHARGE INTO A STABLE CONVEYANCE THAT LEADS TO A SEDIMENT TRAP OR BASIN. DISCHARGE PSD INTO A TRAP OR BASIN AT THE SAME ELEVATION AS THE WET POOL ELEVATION. THE DISCHARGE FROM THE PSD MUST BE AS FAR AWAY FROM THE SEDIMENT CONTROL OUTLET AS POSSIBLE.
6. WHEN THE DRAINAGE AREA IS STABLE, DISCHARGE PSD ONTO A STABLE AREA AT A NON-EROSIVE VELOCITY. PLACE 4 TO 7 INCH STONE OVERTOP OF GEOTEXTILE CLASS F AS NECESSARY.
7. PERFORM INSPECTION AND ANY REQUIRED MAINTENANCE PERIODICALLY AND AFTER EACH RAIN EVENT.

E-5 STANDARDS AND SPECIFICATIONS

FOR

FILTER BERMS AND LOGS

Definition

A temporary ridge made of loose gravel, stone, or crushed rock. Filter logs are in the form of log made of sterile and seedless straw or coconut fiber filtering material that will decompose over time allowing for regrowth of native vegetation that will help stabilize the site.

Purpose

The purpose is to slow velocity of water, filter sediment, and divert flow from open traffic areas and act as an efficient form of sediment control.

Conditions Where Practice Applies

These berms and logs are most suitable in areas where vehicular traffic needs to be rerouted because roads are under construction, in traffic areas within a construction site, or other disturbances along long slope areas.

BERM A and BERM B Design Constraints

Sheet Flow Slope	(Maximum) Length along Slope (Feet)
Flatter than 10:1	Unlimited
10:1 to < 5:1	200
5:1 to < 3:1	100
3:1 to 2:1	50

Table E.4: Filter Berm Design Criteria

	BERM A/LOG	BERM B/LOG
Drainage Area	3 Acres	5 Acres
Berm Height (a)	30 in./14in.	42 in./20in.
Berm Top Width (b)	36 in./14in.	48 in./20in.
Side Slopes	2:1 or flatter	2:1 or flatter

Design Criteria

1. Determine the sheet flow slopes to the filter berm. Determine the drainage area to various design points along the proposed filter berm alignment.

2. Design points are located where changes in slope and/or drainage area may alter the type of berm to be used.

3. Use Table E.4 to select the appropriate filter berm type (A or B) for the filter berm alignment between the design points.

4. Review the slopes along the filter berm alignment between the design points to insure that the slope/drainage area relationship does not exceed the selected berm type.

5. Show filter berm type (A or B) on the plans using the standard symbol A-WCB or B-WCB. Place designation on the upstream side of the filter berm. Filter berm type may vary along its length.

<u>Construction Specifications</u>

1. Construct berm of well graded gravel or crushed rock. If logs are used use sterile and seedless straw or coconut fiber.

2. Do not place trees, bushes, and/or stumps in a location that would interfere with the function of the berm.

3. Shape and grade berm as required by the cross section making sure the flow line is free of bank projections or other irregularities which would impede normal flow.

4. If logs are used, straw installation requires the placement and secure staking of the roll in a trench, 3 to 5 inch deep, dug along the contour. Runoff must not be allowed to run under or around the roll. Abut adjacent rolls tightly. Use 1 inch by 1 inch stakes to secure the logs.

5. Provide inspections and maintenance periodically and after each rain event.

6. Place berms or logs parallel to contours. Grades along the berm exceeding 5 percent for a distance greater than 50-feet are <u>not</u> allowed.

E-5-1 STANDARDS AND SPECIFICATIONS

FOR

WOODCHIP BERM

Definition

A temporary berm of compacted wood chips.

Purpose

The purpose of the woodchip berm is to trap/filter sediment laden runoff, maintain sheet flow and allow the disturbed area behind the berm to dewater.

Conditions Where Practice Applies

Woodchip berms are constructed in areas where penetration of the ground is not desirable, such as where unexploded ordinance, archeological artifacts or contaminated material may be encountered.

BERM A

Sheet Flow	Length along Slope (Feet)
Flatter than 10:1	Unlimited
10:1 to < 5:1	200
5:1 to < 2:1	100

BERM B

Sheet Flow	Length along Slope (Feet)
Flatter than 10:1	Unlimited
10:1 to < 5:1	400
5:1 to < 2:1	200

Note: Woodchip berms shall be placed on the contour to intercept and discharge sheet flow and prevent diversion and concentration of runoff.

Design Criteria

	BERM A	BERM B
Berm Height (a)	30 in.	42 in.
Berm Top Width (b)	36 in.	48 in.
Side Slopes	2:1 or flatter	2:1 or flatter

Construction Specifications

1. Construct berm of clean, ground chips or compost with a minimum size of 1 inch by 2 inch and a maximum of 2 inch by 2 inch.

2. Place all woodchip material on site to the standards specified and compact by earth moving equipment.

3. Do not place un-chipped tree pieces, brushes, and/or stumps in the berm.

4. Shape berm as specified by the cross section on the plan, place on contour and free of bank projections or other irregularities.

5. Provide inspections and maintenance after each rain event.

6. Place woodchip berms parallel to contours. Grades along the berm exceeding 5 percent for a distance greater than 50 feet are not allowed.

Removal

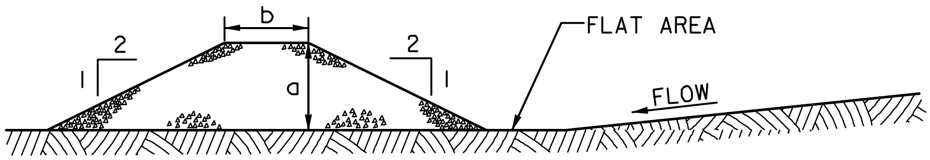
Following completion of all construction and stabilization of the contributing drainage area with established vegetative cover, the woodchip berm shall be removed and the area occupied by the berm shall be stabilized with vegetation. With approval, in lieu of complete removal, the woodchips may be spread on site leaving enough material to stabilize the footprint of the berm.

DETAIL E-5-1 WOODCHIP BERM

STANDARD SYMBOL

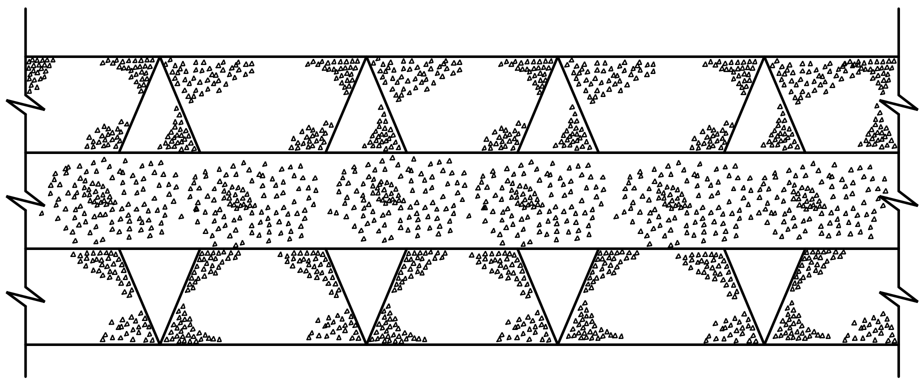
|--- A-WCB---|

|--- B-WCB---|



	BERM A	BERM B
a - BERM HEIGHT	30 IN	42 IN
b - BERM WIDTH	36 IN	48 IN

CROSS SECTION



PLAN VIEW

CONSTRUCTION OF WOODCHIP
BERM REQUIRES NO STABILIZATION

CONSTRUCTION SPECIFICATIONS

1. CONSTRUCT BERM OF CLEAN, GROUND CHIPS WITH A MINIMUM SIZE OF 1x2 INCH AND A MAXIMUM OF 2x2 INCH.

2. PLACE ALL WOODCHIP MATERIAL ON SITE TO THE STANDARDS SPECIFIED AND COMPACT BY EARTH MOVING EQUIPMENT.

3. DO NOT PLACE UN-CHIPPED TREE PIECES, BRUSHES, AND/OR STUMPS IN THE BERM.

4. SHAPE BERM AS SPECIFIED BY THE CROSS SECTION ON THE PLAN, PLACE ON CONTOUR AND FREE OF BANK PROJECTIONS OR OTHER IRREGULARITIES.

5. PROVIDE INSPECTIONS AND MAINTENANCE AFTER EACH RAIN EVENT.

6. PLACE WOODCHIP BERMS PARALLEL TO CONTOURS. GRADES ALONG THE BERM EXCEEDING 5 PERCENT FOR A DISTANCE GREATER THAN 50 FEET ARE NOT ALLOWED.

E-6 STANDARDS AND SPECIFICATIONS

FOR

TEMPORARY STONE OUTLET STRUCTURE

Definition

A temporary stone dike installed in conjunction with and as a part of an earth dike.

Purpose

The purpose of the Stone Outlet Structure is to filter sediment laden runoff, provide a protected outlet for an earth dike, provide for diffusion of concentrated flow, and allow the area behind the dike to dewater.

Conditions Where Practice Applies

Stone outlet structures apply to any point of discharge where there is a need to dispose of runoff at a protected outlet or to diffuse concentrated flow for the duration of the period of construction. The drainage area to this practice shall be 1/2 acre or less.

Construction Specifications

1. Use crushed stone or gravel if crushed stone is not available. Use stone size 2 to 3 inches.

2. Embed baffle board a minimum of 4 inches into ground, and replace stone when structure ceases to function and ponding results.

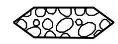
3. Set level crest of stone at least 6 inches lower than lowest elevation of the top of earth dike. Use minimum length of 6 feet for crest.

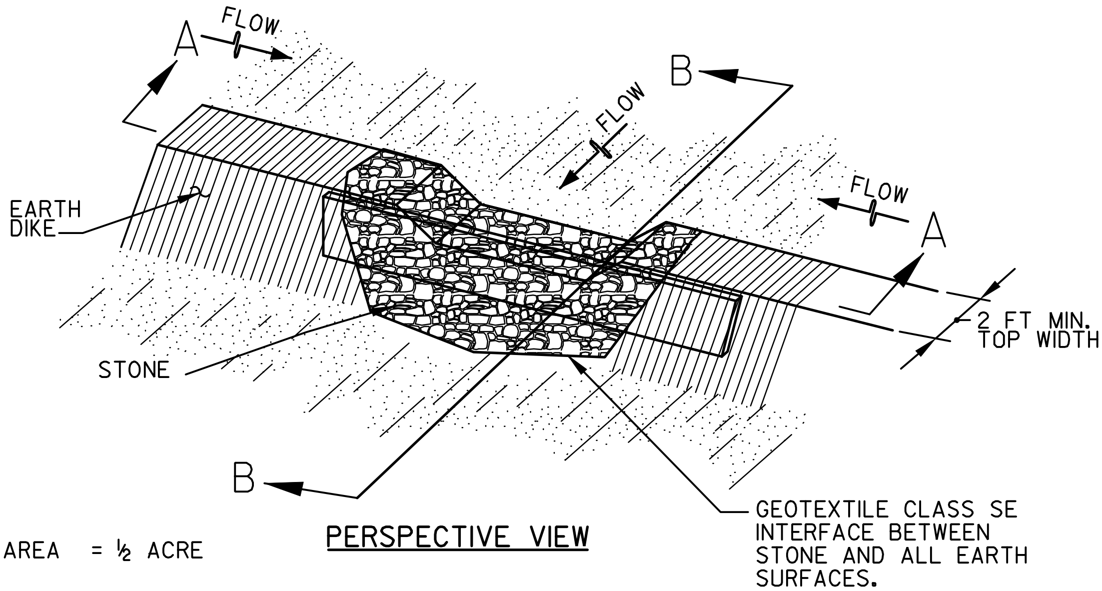
4. Inspect and provide necessary maintenance periodically and after each rain event. Remove sediment when it has accumulated to within 6 inches of the weir crest. Replace stone when structure ceases to function and ponding results.

5. Upon removal of stone outlet structure, grade area flush with existing ground and stabilize disturbed area with topsoil, seed, and mulch, or as specified, within 24 hours of said removal.

DETAIL E-6 TEMPORARY STONE OUTLET STRUCTURE

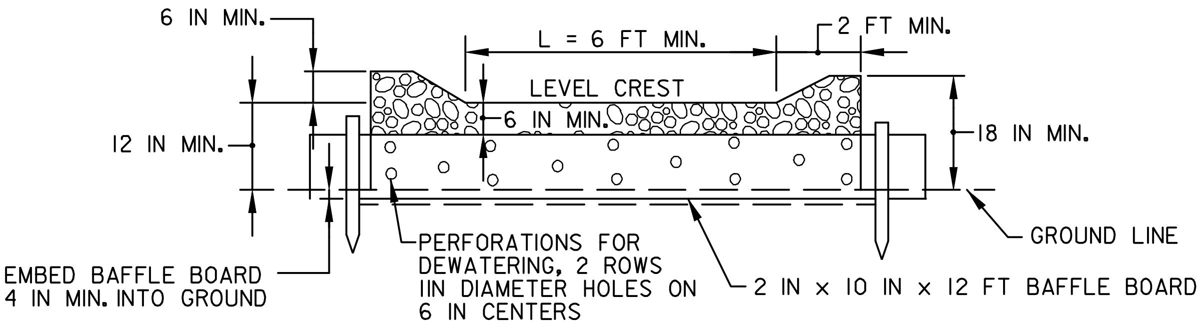
STANDARD SYMBOL



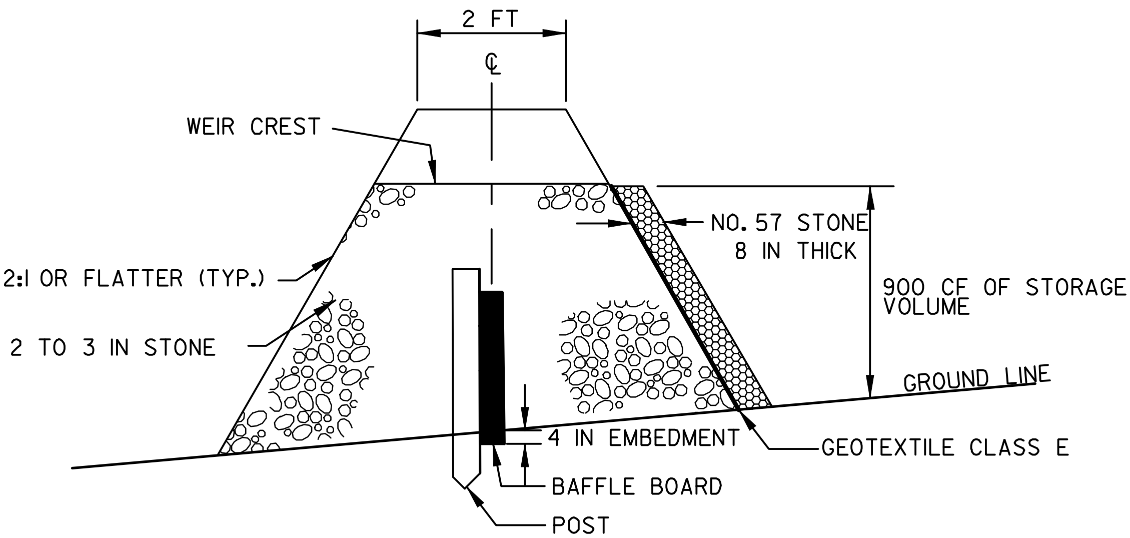


PERSPECTIVE VIEW

MAX. DRAINAGE AREA = ½ ACRE



SECTION A-A



SECTION B-B

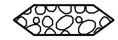
1 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL E-6 TEMPORARY STONE OUTLET STRUCTURE

STANDARD SYMBOL

 TSOS

CONSTRUCTION SPECIFICATIONS

1. USE CRUSHED STONE OR GRAVEL IF CRUSHED STONE IS NOT AVAILABLE. USE STONE SIZE 2 TO 3 INCHES.
2. EMBED BAFFLE BOARD A MINIMUM OF 4 INCHES INTO GROUND, AND REPLACE STONE WHEN STRUCTURE CEASES TO FUNCTION AND PONDING RESULTS.
3. SET LEVEL CREST OF STONE AT LEAST 6 INCHES LOWER THAN LOWEST ELEVATION OF THE TOP OF EARTH DIKE. USE MINIMUM LENGTH OF 6 FEET FOR CREST.
4. INSPECT AND PROVIDE NECESSARY MAINTENANCE PERIODICALLY AND AFTER EACH RAIN EVENT. REMOVE SEDIMENT WHEN IT HAS ACCUMULATED TO WITHIN 6 INCHES OF THE WEIR CREST. REPLACE STONE WHEN STRUCTURE CEASES TO FUNCTION AND PONDING RESULTS.
5. UPON REMOVAL OF STONE OUTLET STRUCTURE, GRADE AREA FLUSH WITH EXISTING GROUND AND STABILIZE DISTURBED AREA WITH TOPSOIL, SEED, AND MULCH, OR AS SPECIFIED, WITHIN 24 HOURS OF SAID REMOVAL.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

MARYLAND DEPARTMENT OF ENVIRONMENT
WATER MANAGEMENT ADMINISTRATION

E-7 STANDARDS AND SPECIFICATIONS

FOR

TEMPORARY GABION OUTLET STRUCTURE (TGOS)

Definition

A temporary dike consisting of Wire Baskets (Gabions) filled with rock or recycled concrete equivalent installed at points of concentrated flow to reduce velocity and filter surface runoff from disturbed areas of less than 1.5 acres.

Purpose

The purpose of the TGOS is to filter sediment laden runoff, provide a protected outlet for an earth dike, provide for diffusion of concentrated flow, and allow the area behind a dike to dewater.

Conditions Where Practice Applies

TGOSs apply to any point of concentrated discharge whose contributing drainage area does not exceed 1.5 acres.

Construction Specifications

1. Use 4 inch to 7 inch stone or equivalent recycled concrete without rebar mesh may be used if stone is not available.

2. Make the crest of the lowest gabion basket at least 9 inches lower than the elevation of the top of the adjacent gabion basket or earth dike and shall be level.

3. Embed the gabion outlet structure into the soil a minimum of 9 inches.

4. Make the minimum length of the crest of the gabion outlet structure be 3 feet.

5. Attach Geotextile Class E to the upstream face of all gabion baskets.

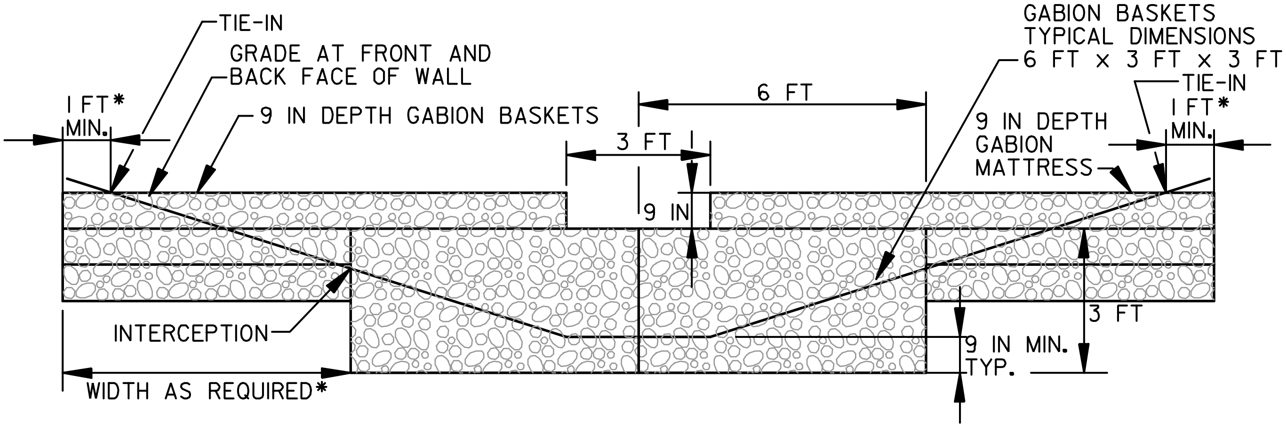
6. Inspect periodically and after each rain event.

7. Remove sediment when it has built up to a maximum depth of one (1) foot.

DETAIL E-7 TEMPORARY GABION OUTLET STRUCTURE

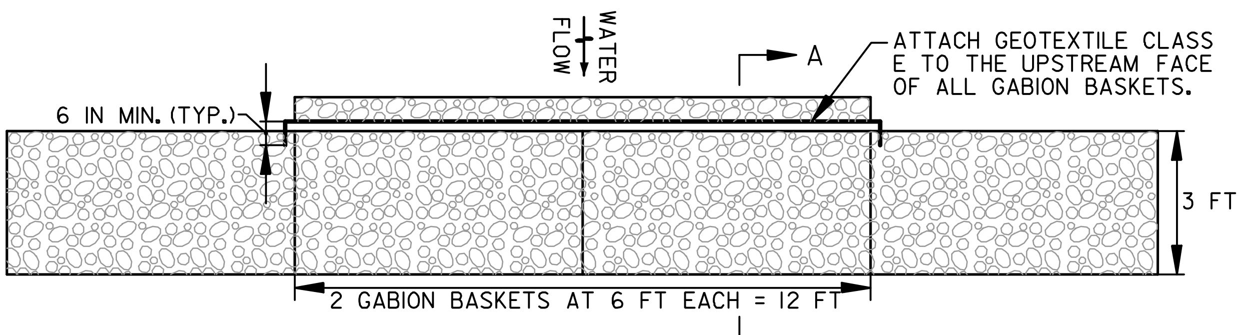
STANDARD SYMBOL

TGOS



*ONE MATTRESS OR MULTIPLE MATTRESS NEED TO EXTEND FROM THE INTERCEPTION TO A MINIMUM I FOOT BEYOND THE TIE IN

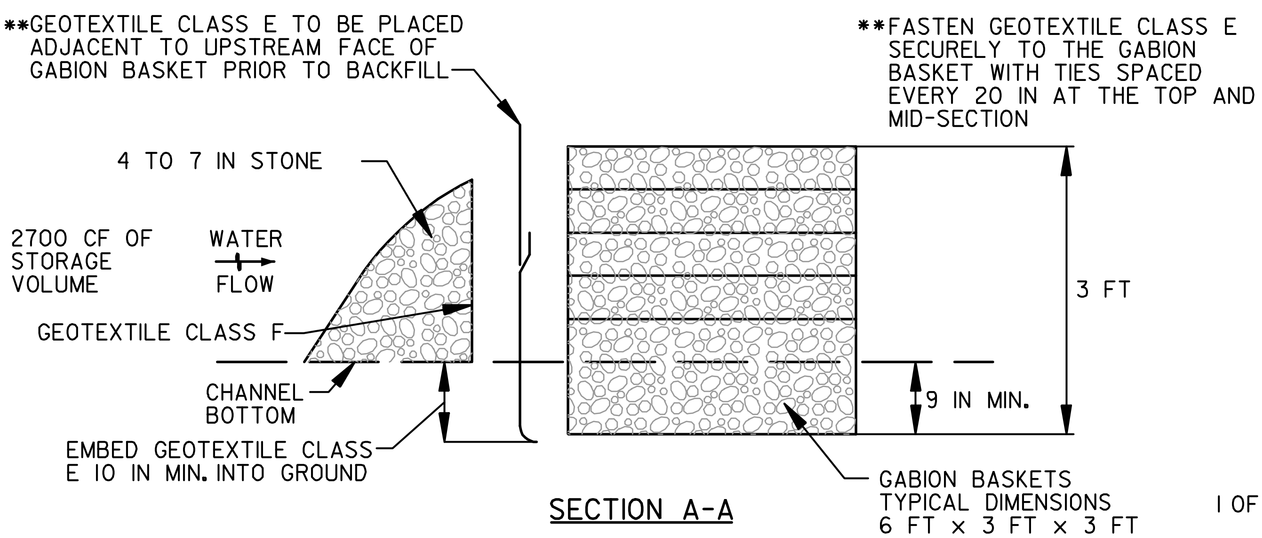
ELEVATION



PLAN

NOTES:

1. MAXIMUM DRAINAGE AREA = 1.5 ACRES.
2. PROVIDE A MINIMUM HEIGHT OF 40 IN FOR CONNECTING EARTH DIKES.



SECTION A-A

I OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL E-7 TEMPORARY GABION OUTLET STRUCTURE

STANDARD SYMBOL

TGOS

CONSTRUCTION SPECIFICATIONS

1. USE 4 TO 7 INCH STONE OR EQUIVALENT RECYCLED CONCRETE WITHOUT REBAR MESH.
2. MAKE THE CREST OF THE LOWEST GABION BASKET AT LEAST 9 INCHES LOWER THAN THE ELEVATION OF THE TOP OF THE ADJACENT GABION BASKET OR EARTH DIKE AND SHALL BE LEVEL.
3. EMBED THE GABION OUTLET STRUCTURE INTO THE SOIL A MINIMUM OF 9 INCHES.
4. MAKE THE MINIMUM LENGTH OF THE CREST OF THE GABION OUTLET STRUCTURE BE 3 FEET.
5. ATTACH GEOTEXTILE CLASS E TO THE UPSTREAM FACE OF ALL GABION BASKETS.
6. INSPECT PERIODICALLY AND AFTER EACH RAIN EVENT.
7. REMOVE SEDIMENT WHEN IT HAS BUILT UP TO A MAXIMUM DEPTH OF ONE FOOT.

E-7-1 STANDARDS AND SPECIFICATIONS

FOR

EARTH DIKE/TGOS TRANSITION

Definition

A temporary berm or ridge of soil, compacted, stabilized, and located in such a manner as to direct water to a temporary gabion outlet structure.

Purpose

The purpose of the transition is to change the characteristic shape of a standard earth dike to the standard section of a gabion outlet structure in order to ensure continuity of the directed flow and maintain the required storage behind the outlet.

Conditions Where Practice Applies

Earth dike/TGOS transition is constructed wherever an earth dike is directed to a temporary gabion outlet structure.

Design Criteria

1. Construct earth dike to a height of 4 inches above the top of the gabion basket and a minimum of 1 foot past the beginning of the basket.

2. Make the top of the earth dike provide positive drainage away from the top of the gabion basket.

Construction Specifications

1. Provide positive drainage along earth dike to outlet.

2. Compact fill with earth moving equipment.

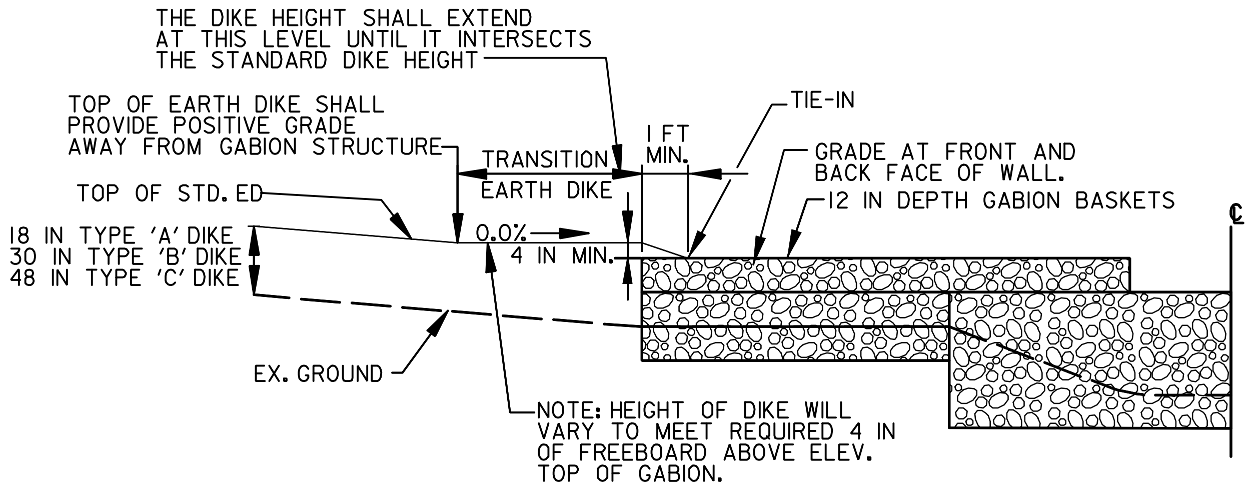
3. Place all earth removed and not needed for construction so that it will not interfere with the functioning of the earth dike or gabion basket outlet.

4. Shape the earth dike to line, grade, and cross-section, as required to direct flow to the gabion basket outlet, free of bank projections or irregularities which will impede normal flow

5. Inspect and maintain periodically and after each rain event.

DETAIL E-7-1 EARTH DIKE/TGOS TRANSITION

STANDARD SYMBOL



CONSTRUCTION SPECIFICATIONS

1. PROVIDE POSITIVE DRAINAGE ALONG EARTH DIKE TO OUTLET.
2. COMPACT FILL WITH EARTH MOVING EQUIPMENT.
3. PLACE ALL EARTH REMOVED AND NOT FOR CONSTRUCTION SO THAT IT WILL NOT INTERFERE WITH THE FUNCTIONING OF THE EARTH DIKE OR GABION BASKET OUTLET.
4. SHAPE THE EARTH DIKE LINE, GRADE, AND CROSS SECTION, AS REQUIRED TO DIRECT FLOW TO THE GABION BASKET OUTLET, FREE OF BANK PROJECTIONS OR IRREGULARITIES WHICH WILL IMPEDE NORMAL FLOW.
5. INSPECT AND MAINTAIN PERIODICALLY AND AFTER EACH RAIN EVENT.

E-8 STANDARDS AND SPECIFICATIONS

FOR

STORM DRAIN INLET PROTECTION

Definition

A filter constructed around a storm drain inlet.

Purpose

Storm Drain Inlet Protection is used to filter sediment laden runoff before it enters the storm drain system.

Conditions Where Practices Applies

Storm drain inlet protection is a secondary sediment control device and is not to be used in place of a sediment trapping device unless approved by the appropriate approval authority.

1. When flow carrying sediment is directed to an inlet.

2. When it is not possible to temporarily divert the storm drain outfall into a sediment-trapping device.

3. When watertight blocking of inlets is not advisable.

Maintenance

Maintenance requirements for storm drain inlet protection are intense, due to the susceptibility to clogging. When the structure does not drain completely within 48 hours after a storm event, it is clogged. When this occurs, accumulated sediment must be removed and the geotextile and stone must be cleaned or replaced.

Design Criteria

1. Determine drainage area for all inlet locations. If drainage area to an inlet is less than 1/4 acre select curb or standard inlet protections.

2. If drainage area equals 1 acre or less use elevated or at grade inlet protections.

3. For at grade inlets, the total for inlets in series must be 1 acre or less and the contributing drainage area must have slopes flatter than 5%.

E-8-1 STANDARDS AND SPECIFICATIONS

FOR

STANDARD INLET PROTECTION

Construction Specifications

1. Excavate completely around the inlet to a depth of 18 inches below the notch elevation.

2. Drive 2 x 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 x 4 inch frame using the overlap joint shown on Detail E-9-1. The top of the frame (weir) must be 6 inches below adjacent roadways where flooding and safety issues may arise.

3. Stretch the chain link fencing tightly around the frame and fasten securely. The ends must meet and overlap at a post.

4. Stretch the Geotextile Class F tightly over the chain link fencing 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 or chain link fence. The ends of the geotextile must meet at a post, be overlapped and folded, then fastened to the post.

5. Backfill around the inlet in loose 4 inch lifts and compact 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.

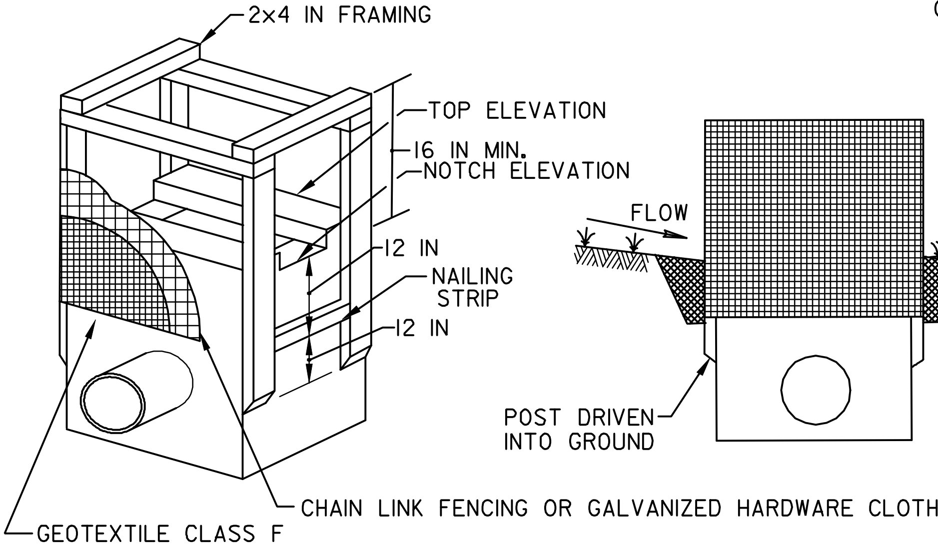
7. The structure must be inspected periodically and after each rain and the geotextile replaced when it becomes clogged.

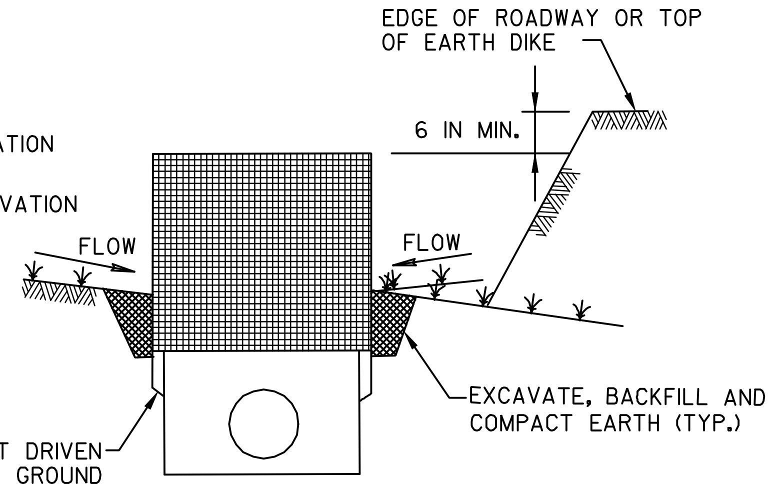
8. When the contributing drainage area is stabilized with established vegetation, remove the inlet protection.

DETAIL E-8-1
STANDARD INLET PROTECTION

STANDARD SYMBOL

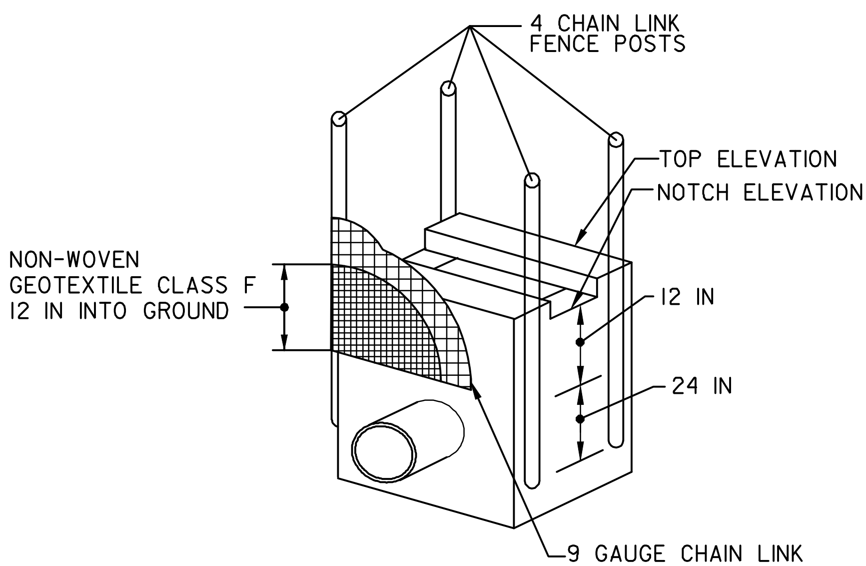
SIP

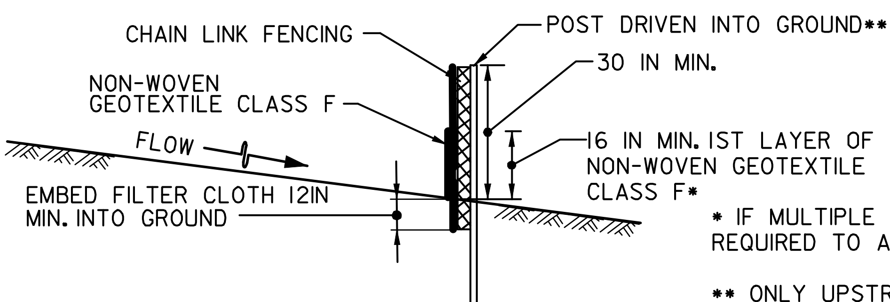




TYPE A MAX. DRAINAGE AREA = 0.25 ACRE FOR GALVANIZED HARDWARE CLOTH

TYPE B MAX. DRAINAGE AREA = 1.0 ACRE FOR CHAIN LINK FENCE





* IF MULTIPLE LAYERS ARE REQUIRED TO ATTAIN 42 IN

** ONLY UPSTREAM SIDE OF INLET PROTECTION SHOWN FOR CLARITY

MAX. DRAINAGE AREA ≤ 1 ACRE

DETAIL E-8-1
STANDARD INLET PROTECTION

STANDARD SYMBOL

SIP

CONSTRUCTION SPECIFICATIONS

1. EXCAVATE COMPLETELY AROUND THE INLET TO A DEPTH OF 18 INCHES BELOW THE NOTCH ELEVATION.

2. DRIVE THE 2x4 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 2x4 INCH FRAME USING THE OVERLAP JOINT SHOWN ON DETAIL E-9-1. THE TOP OF THE FRAME (WEIR) MUST BE 6 INCHES BELOW ADJACENT ROADWAYS WHERE FLOODING AND SAFETY ISSUES MAY ARISE.

3. STRETCH THE CHAIN LINK FENCE TIGHTLY AROUND THE FRAME AND FASTEN SECURELY. THE ENDS MUST MEET AND OVERLAP AT A POST.

4. STRETCH THE GEOTEXTILE CLASS F TIGHTLY OVER THE CHAIN LINK FENCE 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 OR CHAIN LINK FENCE. THE ENDS OF THE GEOTEXTILE MUST MEET AT A POST, BE OVERLAPPED AND FOLDED, THEN FASTENED TO THE POST.

5. BACKFILL AROUND THE INLET IN LOOSE 4 INCH LIFTS AND COMPACT 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.

8. WHEN THE CONTRIBUTING DRAINAGE AREA IS STABILIZED WITH ESTABLISHED VEGETATION, REMOVE THE INLET PROTECTION.

E-8-2 STANDARDS AND SPECIFICATIONS

FOR

AT-GRADE INLET PROTECTION

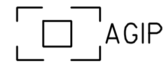
Construction Specifications

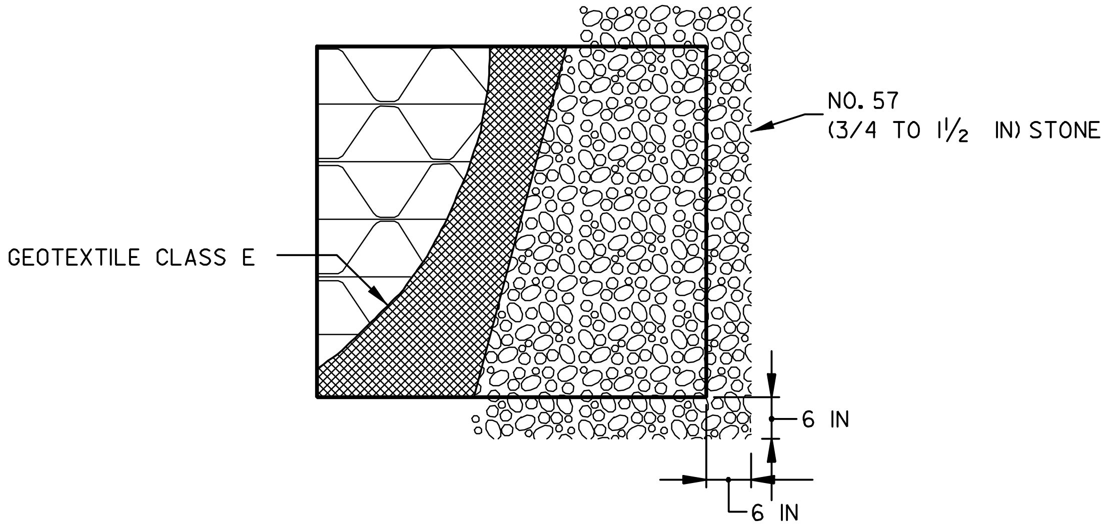
1. Lift grate and wrap with Geotextile Class E to completely cover all openings. Secure with wire ties and set grate back in place.

2. Place ¾ to 1 ½ inch stone 6 inches thick on the grate to secure the geotextile and provide additional filtration.

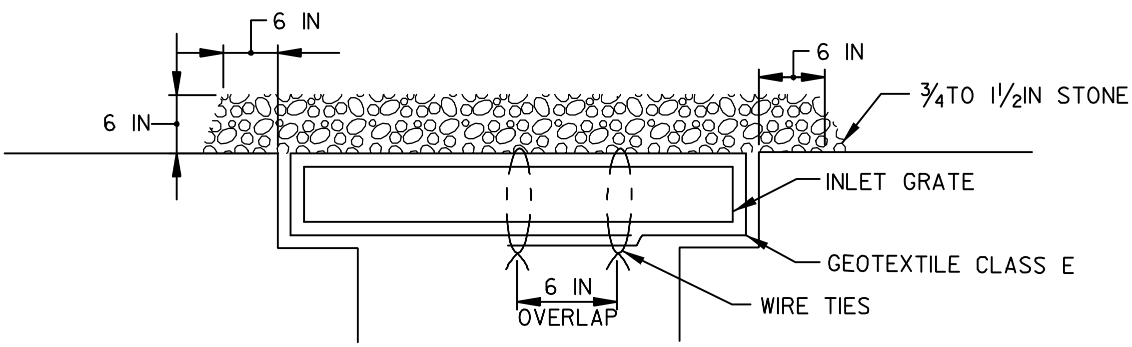
DETAIL E-8-2 AT-GRADE INLET PROTECTION

STANDARD SYMBOL





PLAN / CUT AWAY VIEW



CROSS SECTION

CONSTRUCTION SPECIFICATIONS

1. LIFT GRATE AND WRAP WITH GEOTEXTILE CLASS E TO COMPLETELY COVER ALL OPENINGS. SECURE WITH WIRE TIES AND SET GRATE BACK IN PLACE.

2. PLACE ¾ TO 1 ½ INCH STONE, 6 INCHES THICK ON THE GRATE TO SECURE THE GEOTEXTILE AND PROVIDE ADDITIONAL FILTRATION.

E-8-3 STANDARDS AND SPECIFICATIONS

FOR

CURB INLET PROTECTION (COG OR COS INLETS)

Construction Specifications

1. Attach a continuous piece of ½ x ½ inch galvanized hardware cloth (30 inches minimum width by throat length, plus 4 feet) to the 2 x 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 hardware cloth over the hardware cloth and securely attach it to the 2 x 4 inch weir.

3. Securely nail the 2 x 4 inch weir to a 9 inch long vertical spacer to be located between the weir and the inlet face (maximum 6 feet apart).

4. Place the assembly against the inlet throat and nail (minimum 2 feet lengths of 2 x 4 inch to the top of the weir at spacer locations). Extend the 2 x 4 inch anchors across the inlet top and hold in place by sandbags or alternate weight.

5. Place the assembly so that the end spacers are a minimum 1 foot beyond both ends of the throat opening.

6. Form the ½ x ½ inch galvanized hardware cloth and the geotextile to the concrete gutter and against the face of the curb on both sides of the inlet. Place clean 3/4 to 1 ½ inch sized stone over the galvanized hardware cloth and geotextile in such a manner to prevent water from entering the inlet under or around the geotextile.

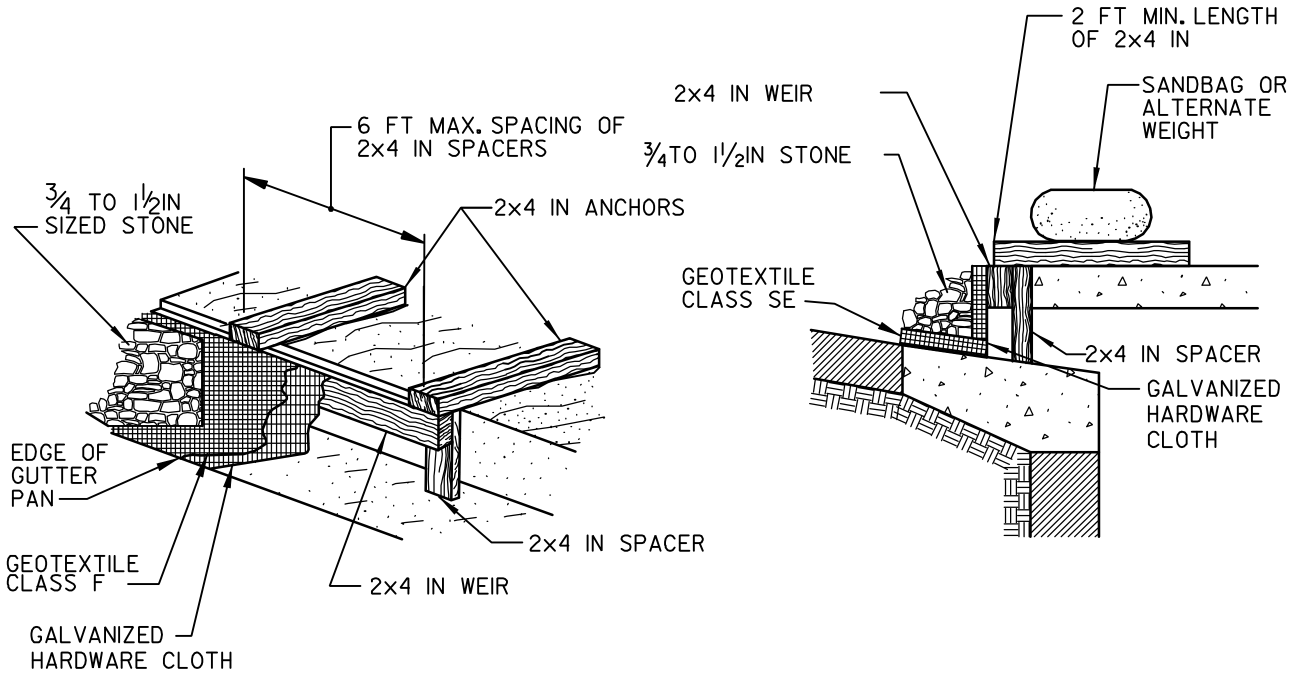
7. This type of protection must be inspected frequently and the geotextile and stone replaced when clogged with sediment.

8. At non-sump locations, install a temporary sandbag or asphalt berm to prevent inlet bypass.

DETAIL E-8-3 CURB INLET PROTECTION (COG OR COS INLETS)

STANDARD SYMBOL

CIP



MAX. DRAINAGE AREA = ¼ ACRE

CONSTRUCTION SPECIFICATIONS

1. ATTACH A CONTINUOUS PIECE OF 1/2x1/2 INCH GALVANIZED HARDWARE CLOTH (30 INCH MINIMUM WIDTH BY THROAT LENGTH PLUS 4 FEET) TO THE 2x4 INCH WEIR (MEASURING THROAT LENGTH PLUS 2 FEET) AS SHOWN ON THE STANDARD DRAWING.

2. PLACE A CONTINUOUS PIECE OF GEOTEXTILE CLASS SE THE SAME DIMENSIONS AS THE GALVANIZED HARDWARE CLOTH OVER THE GALVANIZED HARDWARE CLOTH AND SECURELY ATTACH IT TO THE 2x4 INCH WEIR.

3. SECURELY NAIL THE 2x4 INCH WEIR TO A 9 INCH LONG VERTICAL SPACER TO BE LOCATED BETWEEN THE WEIR AND THE INLET FACE (MAXIMUM 6 FEET APART).

4. PLACE THE ASSEMBLY AGAINST THE INLET THROAT AND NAIL (MINIMUM 2 FOOT LENGTHS OF 2x4 INCH TO THE TOP OF THE WEIR AT SPACER LOCATIONS). EXTEND THE 2x4 INCH ANCHORS ACROSS THE INLET TOP AND HOLD IN PLACE BY SANDBAGS OR ALTERNATE WEIGHT.

5. PLACE THE ASSEMBLY SO THAT THE END SPACERS ARE A MINIMUM 1 FOOT BEYOND BOTH ENDS OF THE THROAT OPENING.

6. FORM THE 1/2x1/2 INCH GALVANIZED HARDWARE CLOTH AND THE GEOTEXTILE TO THE CONCRETE GUTTER AND AGAINST THE FACE OF THE CURB ON BOTH SIDES OF THE INLET. PLACE CLEAN ¾ TO 1½ INCH SIZED STONE OVER THE GALVANIZED HARDWARE CLOTH AND GEOTEXTILE IN SUCH A MANNER TO PREVENT WATER FROM ENTERING THE INLET UNDER OR AROUND THE GEOTEXTILE.

7. THIS TYPE OF PROTECTION MUST BE INSPECTED FREQUENTLY AND THE GEOTEXTILE AND STONE REPLACED WHEN CLOGGED WITH SEDIMENT.

8. AT NON-SUMP LOCATIONS, INSTALL A TEMPORARY SANDBAG OR ASPHALT BERM TO PREVENT INLET BYPASS.

E-8-4 STANDARDS AND SPECIFICATIONS

FOR

MEDIAN INLET PROTECTION

Construction Specifications

1. Drive 36 inches (minimum) long fence posts, 6 inches into the ground and spaced 5 feet (maximum) apart. Use wood posts of sound quality hardwood 2x2 inch (minimum) square cut or 1 3/4 inch (minimum) diameter round. Use steel posts standard T or U section weighing not less than 1.0 lb/linear foot.

2. Embed geotextile Class F, 8 inches (minimum) vertical into the ground and fastened securely to each post with wire ties or staples at top and mid-section.

3. Overlap, fold, and staple geotextile where ends come together. Geotextile sections must end at posts.

4. Inspect median inlet protection after each rain and maintain when bulges occur in the geotextile or when the stone becomes clogged.

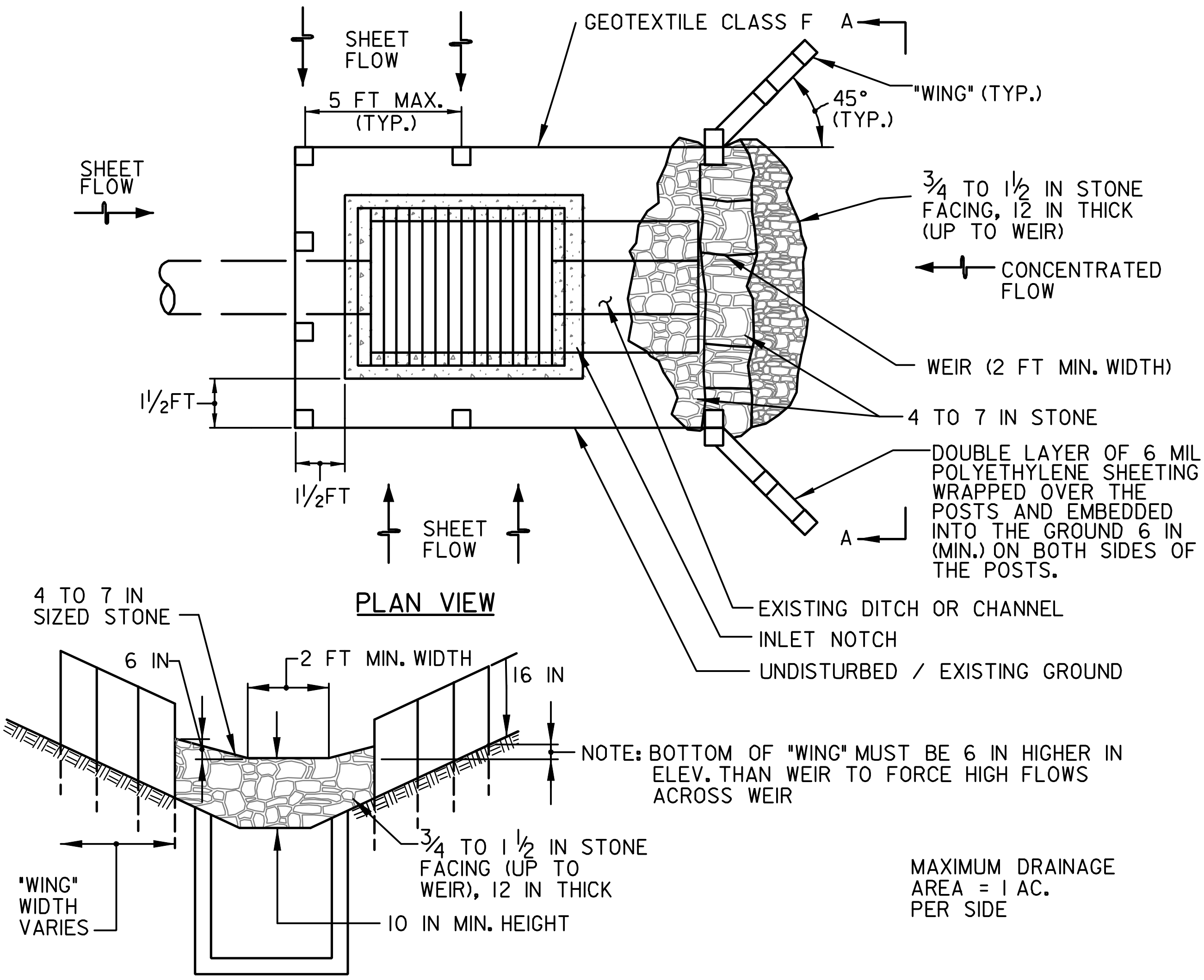
5. Construct stone weir with stone 4 to7 inches in size with a 2 inch thick layer of ¾ to 1 ½ inch sized stone on the upstream face.

6. Construct 6 inch high stone check dam with the weir 10 inches above the invert of the ditch or channel and the weir opening the same width as the ditch or channel bottom or 2 feet minimum.

DETAIL E-8-4 MEDIAN INLET PROTECTION

STANDARD SYMBOL

MIP



MAXIMUM DRAINAGE AREA = 1 AC. PER SIDE

CONSTRUCTION SPECIFICATIONS

1. DRIVE 36 INCHES (MINIMUM) LONG FENCE POSTS, 6 INCHES INTO THE GROUND AND SPACED 5 FEET (MAXIMUM) APART. USE WOOD POSTS OF SOUND QUALITY HARDWOOD 2×2 INCH (MINIMUM) SQUARE CUT OR 1¾ INCH (MINIMUM) DIAMETER ROUND. USE STEEL POSTS STANDARD T OR U SECTIONS WEIGHING NOT LESS THAN 1.0 LB/LINEAR FOOT.

2. EMBED GEOTEXTILE CLASS F, 8 INCHES (MINIMUM) VERTICAL INTO THE GROUND AND FASTEN SECURELY TO EACH POST WITH WIRE TIES OR STAPLES AT TOP AND MID-SECTION.

3. OVERLAP, FOLD, AND STAPLE GEOTEXTILE WHERE ENDS COME TOGETHER. GEOTEXTILE SECTIONS MUST END AT POSTS.

4. INSPECT MEDIAN INLET PROTECTION AFTER EACH RAIN AND MAINTAIN WHEN BULGES OCCUR IN THE GEOTEXTILE OR WHEN THE STONE BECOMES CLOGGED.

5. CONSTRUCT STONE WEIR WITH STONE 4 TO 7 INCHES IN SIZE WITH A 2 INCH THICK LAYER OF ¾ TO 1½ INCH SIZED STONE ON THE UPSTREAM FACE.

6. CONSTRUCT 6 INCH HIGH STONE CHECK DAM WITH THE WEIR 10 INCHES ABOVE THE INVERT OF THE DITCH OR CHANNEL AND THE WEIR OPENING THE SAME WIDTH AS THE DITCH OR CHANNEL BOTTOM OR 2 FEET MINIMUM.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

E-8-5 STANDARDS AND SPECIFICATIONS

FOR

MEDIAN SUMP INLET PROTECTION

Construction Specifications

1. Drive 36 inches (minimum) long fence posts, 6 inches into the ground and spaced 5 feet (maximum) apart. Use wood posts of sound quality hardwood 2 x 2 inch (minimum) square cut or 1 3/4 inch (minimum) diameter round. Use steel posts standard T or U section weighing not less than 1.0 lb/linear foot.

2. Embed geotextile Class F, 8 inches (minimum) vertical into the ground and fastened securely to each post with wire ties or staples at top and mid-section.

3. Overlap, fold, and staple geotextile where ends come together. Geotextile sections must end at posts.

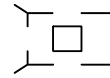
4. Inspect median inlet protection after each rain and maintain when bulges occur in the geotextile or when the stone becomes clogged.

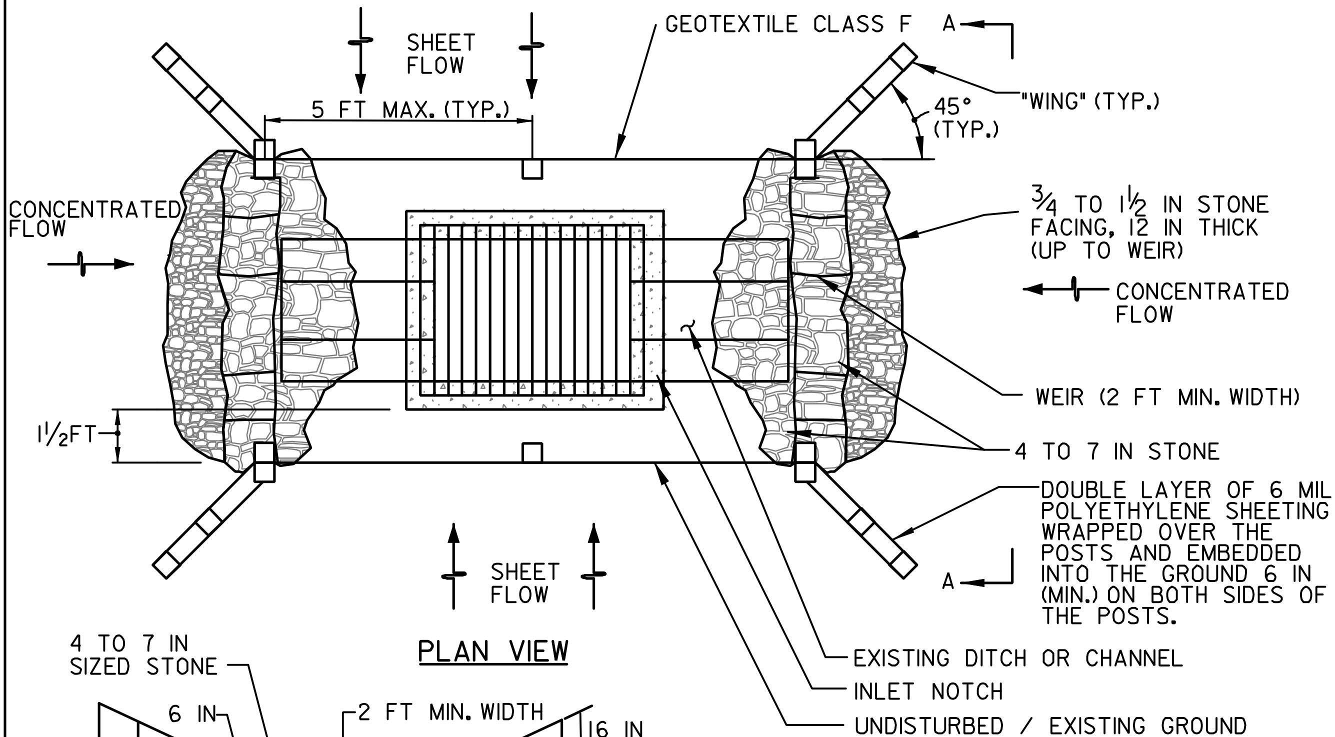
5. Construct two (2) stone weirs with stone 4 to7 inches in size with a 2 inch thick layer of ¾ to 1 ½ inch sized stone on the upstream faces.

6. Construct two (2) 16 inch high stone check dams with the weirs 10 inches above the invert of the ditch or channel and the weir opening the same width as the ditch or channel bottom or 2 feet minimum.

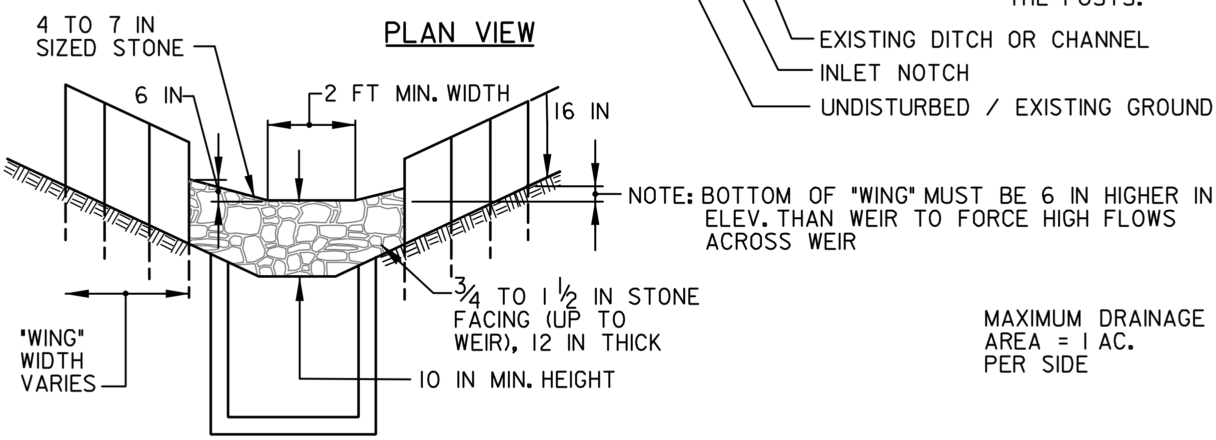
DETAIL E-8-5 MEDIAN SUMP INLET PROTECTION

STANDARD SYMBOL





PLAN VIEW



SECTION A-A

MAXIMUM DRAINAGE AREA = 1 AC. PER SIDE

CONSTRUCTION SPECIFICATIONS

1. DRIVE 36 INCHES (MINIMUM) LONG FENCE POSTS, 6 INCHES INTO THE GROUND AND SPACED 5 FEET (MAXIMUM) APART. USE WOOD POSTS OF SOUND QUALITY HARDWOOD 2x2 INCH (MINIMUM) SQUARE CUT OR 1 3/4 INCH (MINIMUM) DIAMETER ROUND. USE STEEL POSTS STANDARD T OR U SECTIONS WEIGHING NOT LESS THAN 1.0 LB/LINEAR FOOT.

2. EMBED GEOTEXTILE CLASS F, 8 INCHES (MINIMUM) VERTICAL INTO THE GROUND AND FASTEN SECURELY TO EACH POST WITH WIRE TIES OR STAPLES AT TOP AND MID-SECTION.

3. OVERLAP, FOLD, AND STAPLE GEOTEXTILE WHERE ENDS COME TOGETHER. GEOTEXTILE SECTIONS MUST END AT POSTS.

4. INSPECT MEDIAN INLET PROTECTION AFTER EACH RAIN AND MAINTAIN WHEN BULGES OCCUR IN THE GEOTEXTILE OR WHEN THE STONE BECOMES CLOGGED.

5. CONSTRUCT TWO (2) STONE WEIRS WITH STONE 4 TO 7 INCHES IN SIZE WITH A 2 INCH THICK LAYER OF 3/4 TO 1 1/2 INCH SIZED STONE ON THE UPSTREAM FACES.

6. CONSTRUCT TWO (2) 16 INCH HIGH STONE CHECK DAMS WITH WEIRS 10 INCHES ABOVE THE INVERT OF THE DITCH OR CHANNEL AND THE WEIR OPENING THE SAME WIDTH AS THE DITCH OR CHANNEL BOTTOM OR 2 FEET MINIMUM.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

E-8-6 STANDARDS AND SPECIFICATIONS

FOR

COMBINATION INLET PROTECTION

Construction Specifications

1. Lift grate and wrap with Geotextile Class E to completely cover all openings, then set grate back in place.

2. Place ¾ to 1 ½ inch stone, 4 to 6 inches thick on the grate to secure the geotextile and provide additional filtration.

3. Attach a continuous piece of hardware cloth (30 inch minimum width by throat length plus 4 feet) to the 2 x 4 inch weir (measuring throat length plus 2 feet) as shown on the standard drawing.

4. Place a continuous piece of Geotextile Class E the same dimensions as the hardware cloth over the hardware cloth and securely attach it to the 2 x 4 inch weir.

5. Securely nail the 2 x 4 inch weir to the top of a 9 inch long vertical spacer to be located between the weir and the inlet face (max. 4 feet apart).

6. Place the assembly against the inlet throat and nail (minimum 2 feet lengths of 2 x 4 inch to the top of the weir at spacer locations). Extend 2 x 4 inch anchors across the inlet top and hold in place by sandbags or alternate weight.

7. Place the assembly so that the end spacers are a minimum 1 foot beyond both ends of the throat opening.

8. Form the ½ x ½ inch hardware cloth and the geotextile to the concrete gutter and against the face of the curb on both sides of the inlet. Place clean ¾ to 1 ½ inch stone over the hardware cloth and geotextile in such a manner to prevent water from entering the inlet under or around the geotextile.

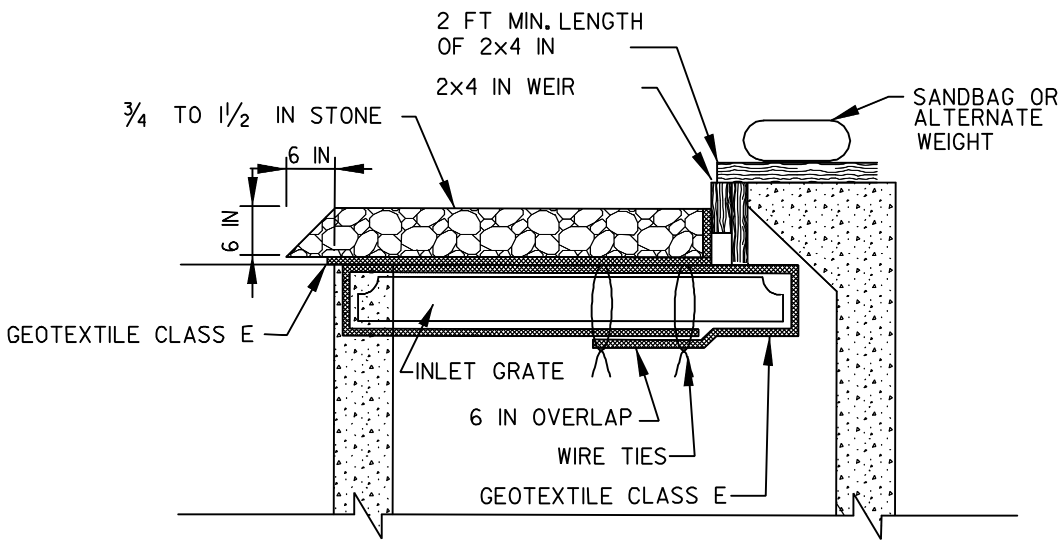
9. This type of protection must be inspected frequently and the filter cloth and stone replaced when clogged with sediment.

10. Assure that storm flow does not bypass the inlet by installing a temporary earth or asphalt dike to direct the flow to the inlet.

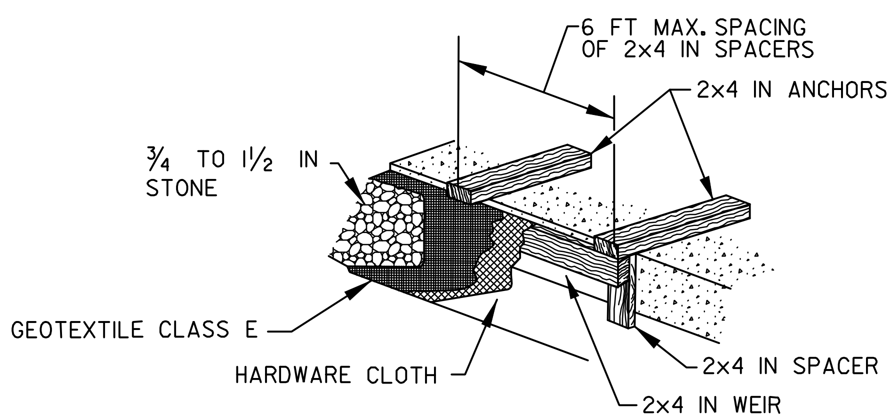
DETAIL E-8-6 COMBINATION INLET PROTECTION

STANDARD SYMBOL

COIP



SECTION



MAX. DRAINAGE AREA = 1/4 ACRE

ISOMETRIC

DETAIL E-8-6 COMBINATION INLET PROTECTION

STANDARD SYMBOL

COIP

CONSTRUCTION SPECIFICATIONS

1. LIFT GRATE WRAP WITH GEOTEXTILE CLASS E TO COMPLETELY COVER ALL OPENINGS, THEN SET GRATE BACK IN PLACE.
2. PLACE ¾ TO 1½ INCH STONE, 4 TO 6 INCHES THICK ON THE GRATE TO SECURE THE GEOTEXTILE AND POVIDE ADDITIONAL FILTRATION.
3. ATTACH A CONTINUOUS PIECE OF GALVANIZED HARDWARE CLOTH (30 INCH MINIMUM WIDTH BY THROAT LENGTH PLUS 4 FEET) TO THE 2x4 INCH WEIR (MEASURING THROAT LENGTH PLUS 2 FEET) AS SHOWN ON THE STANDARD DRAWING.
4. PLACE A CONTINUOUS PIECE OF GEOTEXTILE CLASS E THE SAME DIMENSIONS AS THE GALVANIZED HARDWARE CLOTH OVER THE GALVANIZED HARDWARE CLOTH AND SECURELY ATTACH IT TO THE 2x4 INCH WEIR.
5. SECURELY NAIL THE 2x4 INCH WEIR TO THE TOP OF A 9 INCH LONG VERTICAL SPACER TO BE LOCATED BETWEEN THE WEIR AND THE INLET FACE (MAXIMUM 4 FEET APART).
6. PLACE THE ASSEMBLY AGAINST THE INLET THROAT AND NAIL (MINIMUM 2 FEET LENGTHS OF 2x4 INCH TO THE TOP OF THE WEIR AT SPACER LOCATIONS). EXTEND 2x4 INCH ANCHORS ACROSS THE INLET TOP AND HOLD IN PLACE BY SANDBAGS OR ALTERNATE WEIGHT.
7. PLACE ASSEMBLY SO THAT THE END SPACERS ARE A MINIMUM 1 FOOT BEYOND BOTH ENDS OF THE THROAT OPENING.
8. FORM THE 1/2x1/2 INCH GALVANIZED HARDWARE CLOTH AND THE GEOTEXTILE TO THE CONCRETE GUTTER AND AGAINST THE FACE OF THE CURB ON BOTH SIDES OF THE INLET. PLACE ¾ TO 1½ INCH STONE OVER THE GALVANIZED HARDWARE CLOTH AND GEOTEXTILE IN SUCH A MANNER TO PREVENT WATER FROM ENTERING THE INLET UNDER OR AROUND THE GEOTEXTILE.
9. THIS TYPE OF PROTECTION MUST BE INSPECTED FREQUENTLY AND THE FILTER CLOTH AND STONE REPLACED WHEN CLOGGED WITH SEDIMENT.
10. ASSURE THAT STORM FLOW DOES NOT BYPASS THE INLET BY INSTALLING A TEMPORARY EARTH OR ASPHALT DIKE TO DIRECT THE FLOW TO THE INLET.

E-8-7 STANDARDS AND SPECIFICATIONS

FOR

CATCH BASIN INSERT

Construction Specifications

1. Lift grate and place woven polypropylene geotextile insert in position so that the geotextile forms a basket shape within the inlet. Hold out approximately 6 inches of the sack outside the frame.

2. For combination inlets, also tuck foam assembly against the inlet throat making sure that the woven polypropylene geotextile encompasses the foam and the top edge of the geotextile is held in place with the 1 inch rebar for ease of removal.

3. This type of protection must be inspected frequently and the geotextile insert replaced or cleaned when clogged with sediment.

4. Assure that storm flow does not bypass the inlet by installing a temporary earth or asphalt berm to direct the flow to the inlet.

5. To remove catch basin insert, take two pieces of 1 inch diameter rebar and place through the lifting loops on each side of the sack to facilitate the lifting.

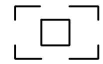
6. For areas where there is a concern for oil run-off or spills an oil-absorbent pillow insert can be used or the geotextile can be made completely from an oil-absorbent geotextile, with a woven pillow insert.

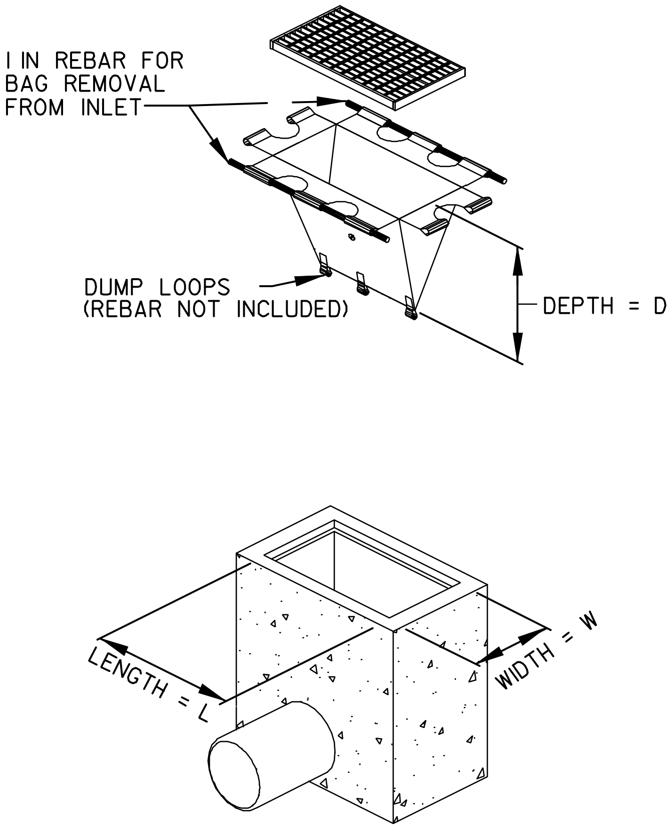
7. The geotextile will be manufactured from a woven polypropylene geotextile that meets or exceeds the following specifications:

Properties	Test Method	Units
Grab Tensile Strength	ASTM D-4632	300 lbs
Grab Tensile Elongation	ASTM D-4632	20 %
Puncture	ASTM D-4833	120 lbs
Mullen Burst	ASTM D-3786	800 psi
Trapezoidal Tear	ASTM D-4533	120 lbs
UV Resistance	ASTM D-4355	80%
Apparent Opening Size	ASTM D-4751	40 US Sieve
Flow Rate	ASTM D-4491	40 Gal/min/sq. ft.
Permittivity	ASTM D-4491	0.55 Sec^{-1}

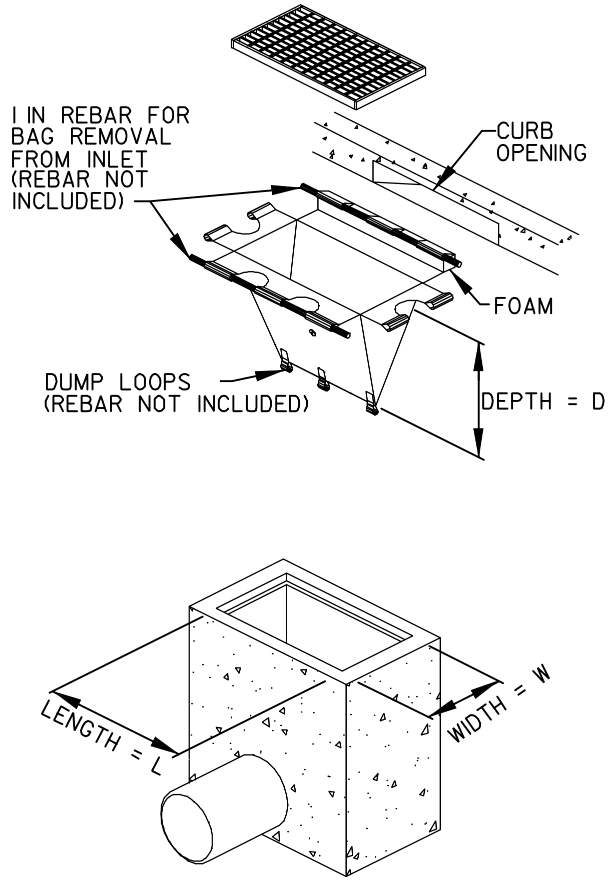
DETAIL E-8-7 CATCH BASIN INSERT

STANDARD SYMBOL





STD INSTALLATION DETAIL
NTS



CURB OPENING INSTALLATION DETAIL
NTS

1 OF 2

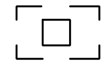
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

MARYLAND DEPARTMENT OF ENVIRONMENT
WATER MANAGEMENT ADMINISTRATION

DETAIL E-8-7 CATCH BASIN INSERT

STANDARD SYMBOL



CBI

CONSTRUCTION SPECIFICATIONS

1. LIFT GRATE AND PLACE WOVEN POLYPROPYLENE GEOTEXTILE IN POSITION SO THAT THE GEOTEXTILE FORMS A BASKET SHAPE WITHIN THE INLET. HOLD OUT APPROXIMATELY 6 INCHES OF THE SACK OUTSIDE THE FRAME. MAKE SURE ENDS OF DUMP STRAPS ARE FULLY EXTENDED SO THAT THE ENDS ARE OUTSIDE OF THE INLET, THEN SET GRATE BACK IN PLACE.

2. FOR COMBINATION INLETS, ALSO TUCK FOAM ASSEMBLY AGAINST THE INLET THROAT MAKING SURE THAT THE WOVEN POLYPROPYLENE GEOTEXTILE ENCOMPASSES THE FOAM AND THE TOP EDGE OF THE GEOTEXTILE IS HELD IN PLACE WITH THE 1 INCH REBAR FOR EASE OF REMOVAL.

3. THIS TYPE OF PROTECTION MUST BE INSPECTED FREQUENTLY AND THE GEOTEXTILE INSERT REPLACED OR CLEANED WHEN CLOGGED WITH SEDIMENT.

4. ASSURE THAT STORM FLOW DOES NOT BYPASS THE INLET BY INSTALLING A TEMPORARY EARTH OR ASPHALT DIKE TO DIRECT THE FLOW TO THE INLET.

5. TO REMOVE CATCH BASIN INSERT, TAKE TWO PIECES OF 1 INCH DIAMETER REBAR AND PLACE THROUGH THE LIFTING LOOPS ON EACH SIDE OF THE SACK TO FACILITATE THE LIFTING.

6. FOR AREAS WHERE THERE IS A CONCERN FOR OIL RUN-OFF OR SPILLS AN OIL-ABSORBENT PILLOW INSERT CAN BE USED OR THE GEOTEXTILE CAN BE MADE COMPLETELY FROM AN OIL-ABSORBENT GEOTEXTILE, WITH A WOVEN PILLOW INSERT.

7. THE GEOTEXTILE WILL BE MANUFACTURED FROM A WOVEN POLYPROPYLENE GEOTEXTILE THAT MEETS OR EXCEEDS THE FOLLOWING SPECIFICATIONS:

PROPERTIES	TEST METHOD	UNITS
GRAB TENSILE STRENGTH	ASTM D-4632	300 LBS
GRAB TENSILE ELONGATION	ASTM D-4632	20 %
PUNCTURE	ASTM D-4833	120 LBS
MULLEN BURST	ASTM D-3786	800 PSI
TRAPEZOIDAL TEAR	ASTM D-4533	120 LBS
UV RESISTANCE	ASTM D-4355	80%
APPARENT OPENING SIZE	ASTM D-4751	40 US SIEVE
FLOW RATE	ASTM D-4491	40 GAL/MIN./SQ. FT.
PERMITTIVITY	ASTM D-4491	0.55 SEC^{-1}

E-8-8 STANDARDS AND SPECIFICATIONS

FOR

GABION INLET PROTECTION

Construction Specifications

1. Wrap 3 x 3 feet Gabion basket with Class E Geotextile overlapping at the top and fasten the geotextile to the hardware cloth at the top of the basket with wire fasteners (hog rings) at a maximum of 1 foot intervals along the seam.

2. Precautions are to be made by the contractor not to tear or damage geotextile.

3. Interlock and continue gabion baskets with no gaps.

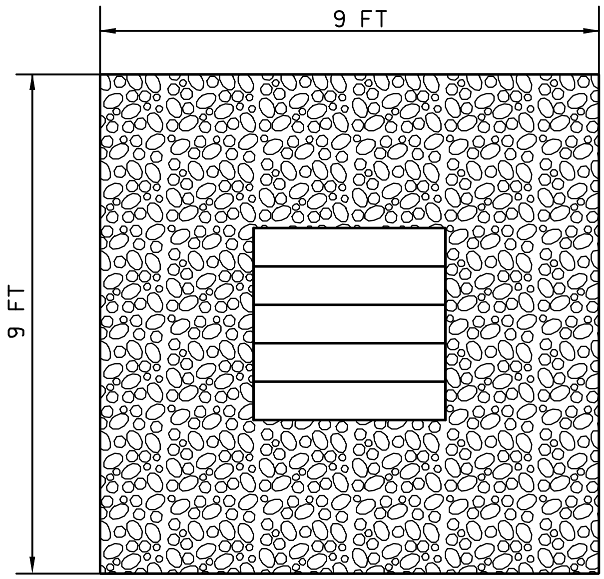
4. Contractor to inspect gabion inlet protection following each storm event and remove all accumulated sediment and repair any damage.

5. Partially bury gabion baskets on the bottom to a depth of 6 inches.

DETAIL E-8-8 GABION INLET PROTECTION

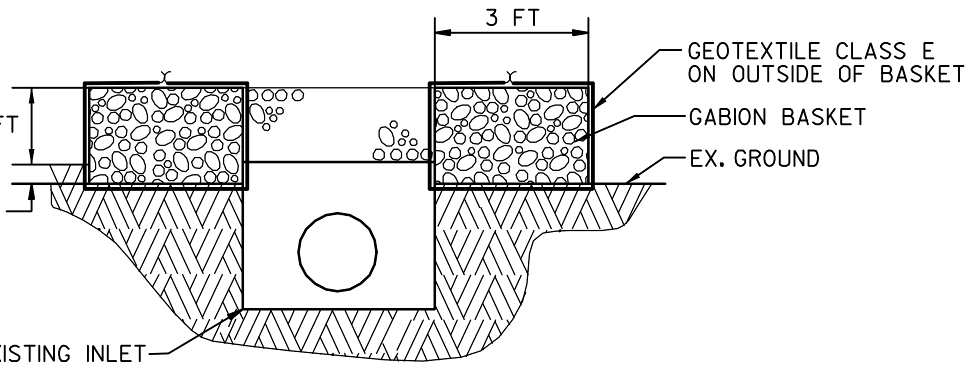
STANDARD SYMBOL

GIP



PLAN VIEW

MAX. DA = 1.5 ACRES



SECTION

CONSTRUCTION SPECIFICATIONS

1. WRAP 3x3 FEET GABION BASKET WITH GEOTEXTILE CLASS E OVERLAPPING AT THE TOP AND FASTEN THE GEOTEXTILE TO THE GALVANIZED HARDWARE CLOTH AT THE TOP OF THE BASKET WITH WIRE FASTENERS (HOG RINGS) AT A MAXIMUM OF 1-FOOT INTERVALS ALONG SEAM.
2. PRECAUTIONS ARE TO BE MADE BY THE CONTRACTOR NOT TO TEAR OR DAMAGE GEOTEXTILE.
3. INTERLOCK AND CONTINUE GABION BASKETS WITH NO GAPS.
4. CONTRACTOR TO INSPECT GABION INLET PROTECTION FOLLOWING EACH STORM EVENT AND REMOVE ALL ACCUMULATED SEDIMENT AND REPAIR ANY DAMAGE.
5. PARTIALLY BURY GABION BASKETS ON THE BOTTOM TO A DEPTH OF 6 INCHES.

SECTION F - DEWATERING

DEWATERING STRATEGY

Dewatering refers to the act of removing and discharging water from excavated areas on construction sites or from sediment traps or basins on construction sites. Standards and specifications for dewatering practices follow.

Dewatering during dry weather may change the clarity of the receiving waters, even after being pumped through an approved dewatering practice. As such, additional treatment beyond an approved dewatering practice may be needed to reduce turbidity in the discharged water prior to releasing to receiving waters. Additional treatment may include, but is not limited to: discharging to a vegetative filter, using coagulants to increase setting and filtering, pumping to a sediment trap or basin, or a combination of the above.

These standards apply to removal and discharge of water from any excavated area or sediment trap or basin at any construction site. Given the unique conditions at any particular construction site, any or all of the practices may apply. Regardless of the applicability of the practices listed herein, operators are required to use acceptable procedures for maintenance and dewatering. In all cases, every effort shall be made to eliminate sediment pollution associated with dewatering.

Designers shall specify the preferred procedures for dewatering on plans. In particular, designers should identify procedures for dewatering sediment traps and basins prior to elimination of the last sediment control facility on the site or prior to conversion of sediment control facilities to stormwater management facilities. Recommended procedures shall be consistent with these standards. Atypical site conditions may require innovative dewatering designs. Dewatering measures not referenced in this standard may be used with the consent of the approval authority.

DEWATERING OF EXCAVATED AREAS

A. Designers shall specify on plans, and in sequences of construction included on plans, practices for dewatering of excavated areas. Plan reviewers shall check to see that procedures for dewatering are included on plans.

B. In all cases, water removed from excavated areas shall be discharged such that it shall pass through a sediment control device prior to entering receiving waters. Sediment control devices include sediment traps and basins, in addition to the practices in this section.

APPROVED PRACTICES FOR DEWATERING OF EXCAVATED AREAS

1. Pumping of water to an existing sediment basin or trap in which the entire volume of water from the area to be dewatered can be contained without discharge to receiving waters.

2. Pumping of water to an existing sediment basin or trap such that the entire volume of water from the area to be dewatered can be managed without exceeding the design outflow from the sediment control structure.

3. <u>Removable Pumping Station</u>: Standards and specifications for Removable Pumping Station are on Detail F-1.

4. <u>Sump Pit</u>: Standards and specifications for a sump pit are on Detail F-2.

5. Portable Sediment Tank: Standards and specifications for a sediment tank are on Detail F-3.

6. Filter Bag: Standards and specifications for a Filter Bag are on Detail F-4.

DEWATERING OF SEDIMENT TRAPS AND SEDIMENT BASINS

Designers shall specify on plans, and in sequences of construction included on plans, the practices for dewatering of traps and basins. Plan reviewers shall check to see that procedures for dewatering to be used are included on plans. In all cases, water removed from traps and basins must discharge through an MDE-approved sediment control device prior to entering receiving waters.

APPROVED PRACTICES FOR DEWATERING OF SEDIMENT TRAPS AND SEDIMENT BASINS

1. Removable Pumping Station.

2. Sump Pit.

3. Use of a floating suction hose to pump the cleaner water from the top of the pond. As the cleaner water is pumped the suction hose will lower and eventually encounter sediment laden water. When this happens the pumping operation will cease. Provisions shall be made to filter water prior to discharge to receiving waters. When floating suction hoses are used, personnel shall be assigned to monitor pumping operations to ensure that sediment pollution is abated. **Pumping sediment laden water into the waters of the State without filtration is strictly forbidden.**

4. Filter Bag.

5. Vegetative Buffers: The maintenance of areas of existing vegetation adjacent to wetlands, streams, and other areas of significant natural resource value in connection with sediment control practices noted in this manual can ensure that such areas are not adversely affected by grading and construction or by stormwater runoff once construction is completed. The maintenance of such areas adjacent to streams is particularly important because they lessen the impact of sedimentation on fish and spawning to keep streams at water temperatures favorable to fish and other aquatic species, and provide food such as leaves and twigs for aquatic organisms, particularly in headwater streams.

   The width needed for such areas in order to provide adequate protection is dependent on the type of area to be protected, the type of vegetation in the buffer, the slope present, the ability of the soils in the buffer to absorb water, the size distribution of the incoming sediment, and the rate of runoff. However, research studies have shown that the maintenance of a buffer of 100 feet in width in areas with low to moderate slopes should generally provide adequate protection.

F-1 DEWATERING SPECIFICATIONS

FOR

REMOVABLE PUMPING STATION

Definition

A temporary structure which is used to remove water from excavated areas, sediment traps and basins.

Purpose

The Removable Pumping Station is an easily maintained device that filters sediment laden water at a pump intake, prior to discharging to a suitable area.

Conditions Where Practice Applies

Removable Pumping Stations are constructed where water collects and must be pumped away during excavation, cofferdam dewatering, maintenance or removal of sediment traps and basins or for other uses as applicable. These are preferred over Sump Pits on projects where a long duration of pumping is expected.

Design Criteria

The number of Removable Pumping Stations and their locations shall be determined by the designer and included on the plans. Contractors may relocate sump pits to optimize use but discharge location changes must be coordinated with MDE inspectors. A design is not required but construction must conform to the general criteria outlined on Detail F-1.

A perforated, vertical standpipe wrapped with hardware cloth and geotextile is placed inside a larger perforated pipe. The outside pipe is then enveloped by a cone of washed stone. Water is then pumped from the center of the inside pipe to a suitable discharge area.

Water pumped from the standpipe should discharge into a sediment trap, sediment basin or stable area.

Construction Specifications

1. Use a 48 inch diameter outer pipe or in any case, at least 6 inches greater in diameter than the inner pipe. Wrap the perforated CMP or PVC Pipe outer pipe with ½ inch galvanized hardware cloth to prevent backfill material from entering the perforations. Use perforations of ½ x 6 inch slots or 1 inch diameter holes at 6 inches on center.

2. After installing the outer pipe, backfill around the outer pipe with ¾ to 1 ½ inch (No. 57) clean stone.

3. Use a perforated 12 to 36 inch diameter CMP of PVC inner pipe with perforations of ½ x 6 inch slots or 1 inch diameter holes at 6 inches on center. Wrap the inner pipe first with ½ inch galvanized hardware cloth, and then again with Geotextile Class SE.

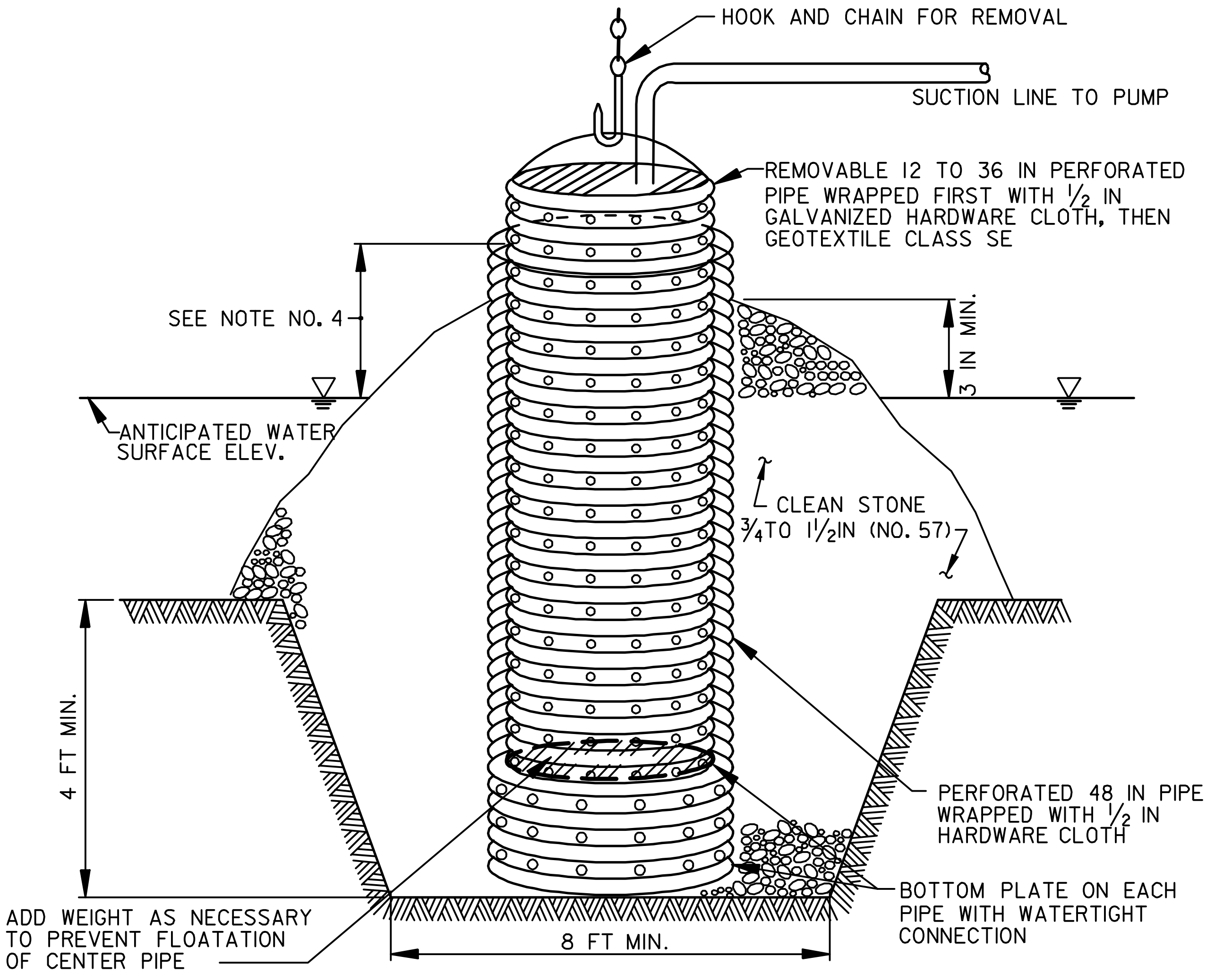
4. Extend both the inner and outer pipes 12 to 18 inches above the anticipated water surface elevation (or riser crest elevation when dewatering a basin).

5. Perform Maintenance when water is prevalent within the pumping station during pump operation but nothing is discharged from the suction line.

DETAIL F-1 REMOVABLE PUMPING STATION

STANDARD SYMBOL

☒RPS



ELEVATION (CUT AWAY)

CONSTRUCTION SPECIFICATIONS

1. USE A 48 INCH DIAMETER OUTER PIPE OR IN ANY CASE, AT LEAST 6 INCHES GREATER IN DIAMETER THAN THE INNER PIPE. WRAP THE PERFORATED CMP OR PVC PIPE OUTER PIPE WITH ½ INCH GALVANIZED HARDWARE CLOTH TO PREVENT THE STONE FROM ENTERING THE PERFORATIONS. USE PERFORATIONS OF ½×6 INCH SLOTS OR 1 INCH DIAMETER HOLES AT 6 INCHES ON CENTER.
2. AFTER INSTALLING THE OUTER PIPE, BACKFILL AROUND THE OUTER PIPE WITH ¾ TO 1½ INCH (NO. 57) CLEAN STONE.
3. USE A PERFORATED 12 TO 36 INCH DIAMETER CMP OF PVC INNER PIPE WITH PERFORATIONS OF 1/2×6 INCH SLOTS OR 1 INCH DIAMETER HOLES AT 6 INCHES ON CENTER. WRAP THE INNER PIPE FIRST WITH ½ INCH GALVANIZED HARDWARE CLOTH, AND THEN AGAIN WITH GEOTEXTILE CLASS SE.
4. EXTEND BOTH THE INNER AND OUTER PIPES 12 TO 18 INCHES ABOVE THE ANTICIPATED WATER SURFACE ELEVATION (OR RISER CREST ELEVATION WHEN DEWATERING A BASIN).
5. PERFORM MAINTENANCE WHEN WATER IS PREVALENT WITHIN THE PUMPING STATION DURING PUMP OPERATION BUT NOTHING IS DISCHARGED FROM THE SUCTION LINE.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

F-2 STANDARDS AND SPECIFICATIONS

FOR

SUMP PIT

Description of Practice

A temporary pit from which pumping is conducted to remove excess water while minimizing sedimentation.

Purpose

The sump pit filters water being pumped to reduce sedimentation to receiving streams.

Conditions Where Practice Applies

Sump Pits are constructed when water collects and must be pumped away during excavating, cofferdam dewatering, maintenance or removal of sediment traps and basins or other uses as applicable.

Design Criteria

The number of sump pits and their locations shall be determined by the designer and included on the plans. Contractors may relocate sump pits to optimize use but discharge location changes must be coordinated with inspectors. A design is not required but construction must conform to the general criteria outlined on Detail F-2.

A perforated vertical standpipe is wrapped with ½ inch hardware cloth and Geotextile Class E, then placed in the center of an excavated pit which is then backfilled with filter material consisting of clean No. 57 stone. Water is then pumped from the center of the standpipe to a suitable discharge area such as into a sediment trap, sediment basin or stable area.

Construction Specifications

1. Pit dimensions are variable, with the minimum diameter being two times the standpipe diameter.

2. Construct the standpipe by using perforated 12 to 36 inch diameter pipe and wrap it with ½ inch galvanized hardware cloth and Geotextile Class E. Use perforations ½ x 6 inch slots or 1 inch diameter holes 6 inch on center, 4 rows minimum.

3. Place a base of filter material consisting of anything from clean gravel (minimal fines) to No. 4 stone should be placed in the pit to a depth of 12 inches. After installing the standpipe, the pit surrounding it should then be backfilled with the same filter material.

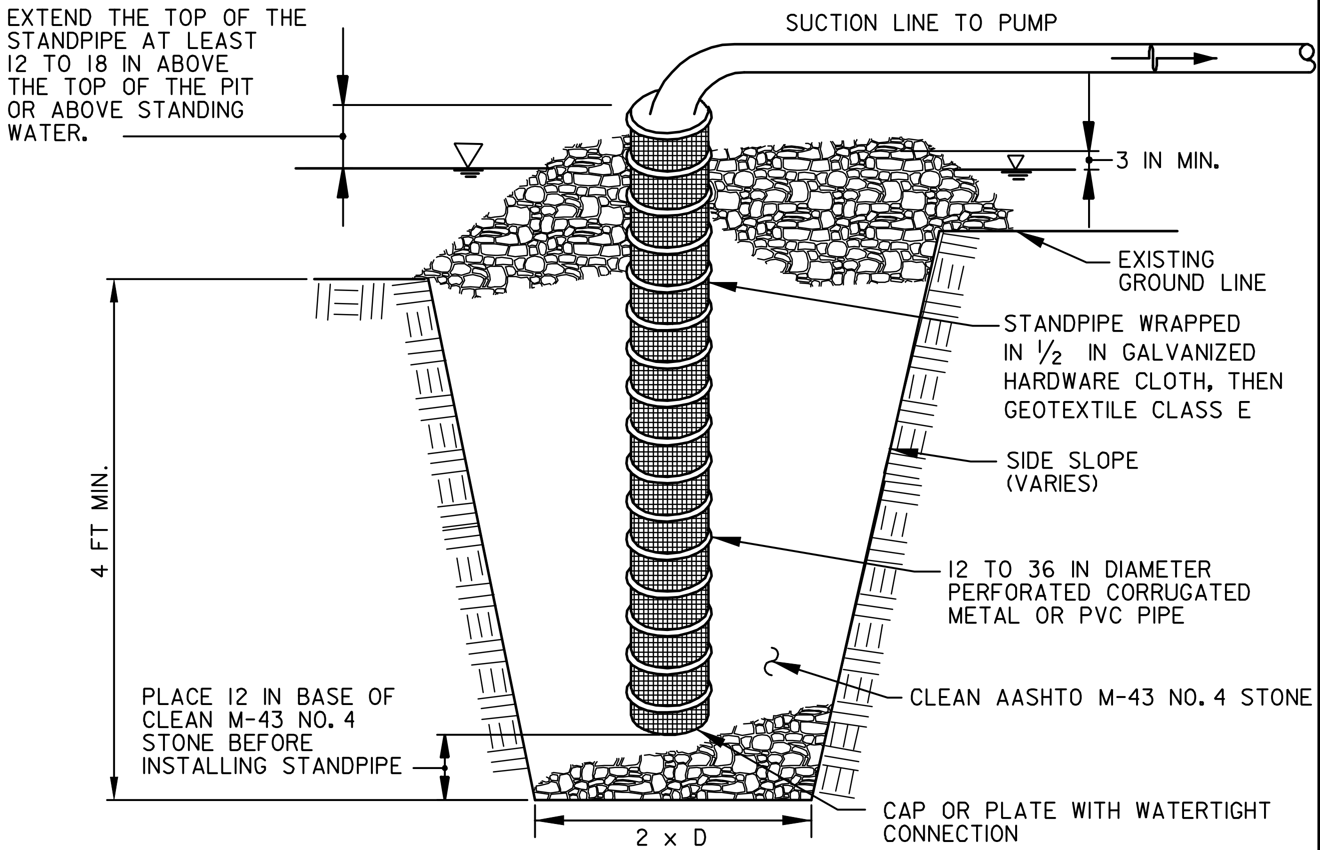
4. Extend the standpipe 12 to 18 inches above the lip of the pit (or riser crest elevation basin dewatering only) and extend the filter material a minimum of 3 inches above the anticipated standing water level.

5. Remove and reconstruct sump pits for maintenance when nothing discharges from the suction line during pump operation.

DETAIL F-2 SUMP PIT

STANDARD SYMBOL

☒SP



ELEVATION (CUT AWAY)

NOTE: THIS MEASURE MUST BE LOCATED WHERE IT WILL BE READILY ACCESSIBLE TO ALLOW FOR ITS PRACTICAL USAGE.

CONSTRUCTION SPECIFICATIONS

1. PIT DIMENSIONS ARE VARIABLE, WITH THE MINIMUM DIAMETER BEING TWO TIMES THE STANDPIPE DIAMETER.

2. CONSTRUCT THE STANDPIPE BY USING PERFORATED 12 TO 36 INCH DIAMETER PIPE AND WRAP IT WITH 1/2 INCH GALVANIZED HARDWARE CLOTH AND GEOTEXTILE CLASS E. USE PERFORATIONS 1/2x6 INCH SLOTS OR 1 INCH DIAMETER HOLES AT 6 INCH ON CENTER, 4 ROWS MINIMUM.

3. PLACE A BASE OF FILTER MATERIAL CONSISTING OF ANYTHING FROM CLEAN GRAVEL (MINIMAL FINES) TO NO. 4 STONE SHOULD BE PLACED IN THE PIT TO A DEPTH OF 12 INCHES. AFTER INSTALLING THE STANDPIPE THE PIT SURROUNDING IT SHOULD THEN BE BACKFILLED WITH THE SAME FILTER MATERIAL.

4. EXTEND THE STANDPIPE 12 TO 18 INCHES ABOVE THE LIP OF THE PIT (OR THE RISER CREST ELEVATION BASIN DEWATERING ONLY) AND EXTEND THE FILTER MATERIAL A MINIMUM OF 3 INCHES ABOVE THE ANTICIPATED STANDING WATER ELEVATION.

5. REMOVE AND RECONSTRUCT SUMP PITS FOR MAINTENANCE WHEN NOTHING DISCHARGES FROM THE SUCTION LINE DURING PUMP OPERATION.

F-3 STANDARDS AND SPECIFICATIONS

FOR

PORTABLE SEDIMENT TANK

Definition

A sediment tank is a compartmented tank container through which sediment laden water is pumped to trap and retain the sediment.

Purpose

To trap and retain sediment prior to pumping the water to drainageways, adjoining properties, and rights-of-way below the sediment tank site.

Conditions Where Practice Applies

A sediment tank is to be used on sites where excavations are deep, and space is limited, such as urban construction, where direct discharge of sediment laden water to stream and storm drainage systems is to be avoided.

Design Criteria

1. Location: The sediment tank shall be located for ease of clean-out and disposal of the trapped sediment and to minimize interference with construction activities and pedestrian traffic.

2. Tank Size: The following formula should be used in determining the storage volume of the sediment tank: 1 cubic foot of storage for each gallon per minute of pump discharge capacity.

3. Do not connect tanks in series.

4. Overtopping of the 60 inch CMP is not permitted.

An example of a typical sediment tank is shown below. Other container designs can be used if the storage volume is adequate and approval is obtained from the local approving agency.

Tanks may be connected in series. Geotextile shall be Class SE or better.

Construction Specifications

1. Use the following formula to determine the storage volume of the sediment tank: 1 cubic foot of storage within the 60 in CMP for each gallon per minute of pump discharge capacity.

2. See detail for typical sediment tank. Other container designs may be used if the storage volume is adequate and approval is obtained from the approving agency.

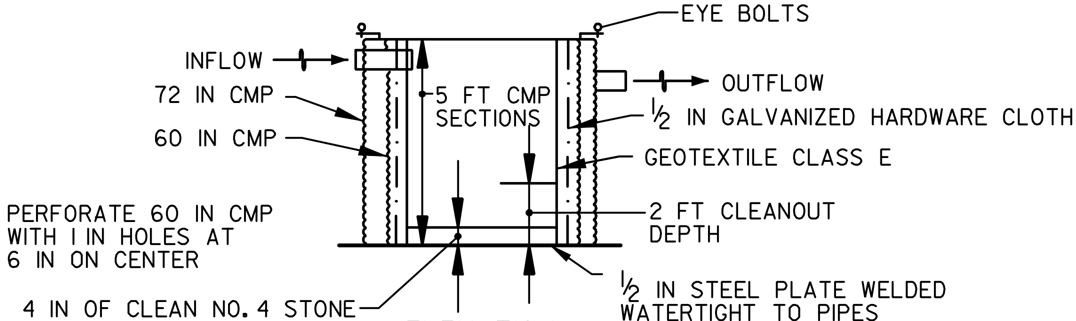
3. Overlap geotextile 6 inches minimum at vertical seam and at the bottom plate.

4. Anchor geotextile at bottom of tank with 4 inches of clean No. 4 stone.

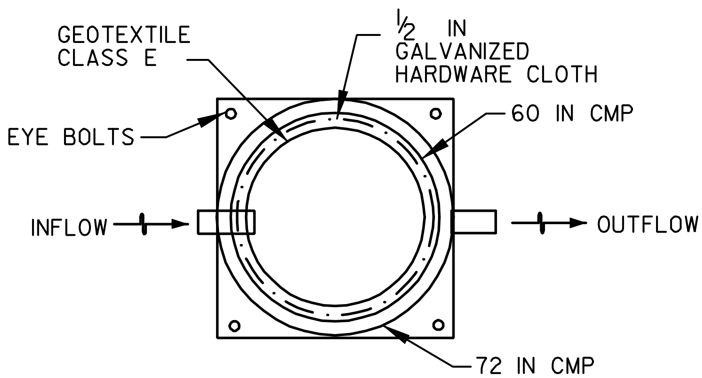
DETAIL F-3 PORTABLE SEDIMENT TANK

STANDARD SYMBOL

☒PST



ELEVATION



PLAN VIEW

CONSTRUCTION SPECIFICATIONS

1. USE THE FOLLOWING FORMULA TO DETERMINE THE STORAGE VOLUME OF THE SEDIMENT TANK: 1 CUBIC FOOT OF STORAGE WITHIN THE 60 IN CMP FOR EACH GALLON PER MINUTE OF PUMP DISCHARGE CAPACITY.
2. AN EXAMPLE OF A TYPICAL SEDIMENT TANK IS SHOWN ABOVE. OTHER CONTAINER DESIGNS MAY BE USED IF THE STORAGE VOLUME IS ADEQUATE AND APPROVAL IS OBTAINED FROM THE APPROVING AGENCY.
3. OVERLAP GEOTEXTILE 6 INCHES MINIMUM AT VERTICAL SEAM AND AT THE BOTTOM PLATE.
4. ANCHOR GEOTEXTILE AT BOTTOM OF TANK WITH 4 INCHES OF CLEAN NO. 4 STONE.

F-4 STANDARDS AND SPECIFICATIONS

FOR

FILTER BAG

Definition

A filter bag is a geotextile bag through which sediment laden water is pumped to trap and retain the sediment.

Purpose

To trap and retain sediment prior to pumping the water to drainage-ways, adjoining properties, and rights-of-way below the filter bag location.

Conditions Where Practice Applies

A filter bag is to be used on excavation sites where direct discharge of sediment laden water to stream and storm drainage systems is to be avoided. Bags should be located in well-vegetated grassy areas.

Design Criteria

1. Location: The filter bag shall be located for ease of disposal of the trapped sediment and to minimize interference with construction activities outside of excavation area and pedestrian traffic.

2. Bag Size: The bag shall be square or rectangular with a minimum surface area of 225 square feet per side.

Construction Specifications

1. Material: Non-woven geotextile with a minimum surface area of 225 square feet per side.

2. Seam Strength: Withstand 100 pounds/inch using ASTM D-4884 test method. Double stitch sewn using a double needle machine with high strength thread.

3. Sleeve size to accommodate a 4 inch diameter pump discharge hose.

4. Tightly seal sleeve around the pump discharge hose with a strap or similar device.

5. Place filter bag upon stones located on a level or gently sloping (5% maximum) stabilized area.

6. Control pumping rate to prevent excessive pressure within the filter bag. As the bag fills with sediment, reduce pumping rate.

7. Dewater, remove and dispose 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 by the end of the work day. Restore the surface area beneath the bag to original condition upon removal of the device.

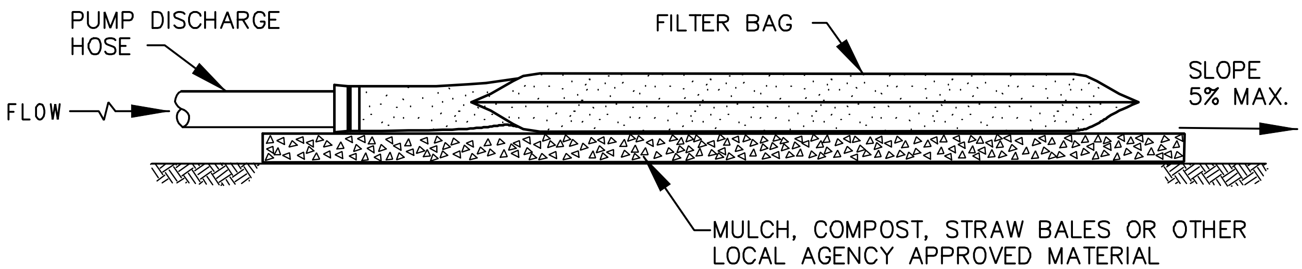
8. Minimum geotextile requirements and specifications:

GRAB TENSILE	210 lb	ASTM D-4632
PUNCTURE	150 lb	ASTM D-4833
FLOW RATE	70 gal/min/ft2	ASTM D-4491
PERMITTIVITY (SEC-1)	1.3 sec-1	ASTM D-4491
UV RESISTANCE	70% strength @ 500 hours	ASTM D-4355
APPARENT OPENING SIZE (AOS)	0.15-0.18 mm	ASTM D-4751

DETAIL F-4 FILTER BAG

STANDARD SYMBOL

☒FB



CONSTRUCTION SPECIFICATIONS

1. MATERIAL: NON-WOVEN GEOTEXTILE WITH A MINIMUM SURFACE AREA OF 225 SQUARE FEET PER SIDE.

2. SEAM STRENGTH: WITHSTAND 100 POUNDS/INCH USING ASTM D-4884 TEST METHOD. DOUBLE STITCH SEWN USING A DOUBLE NEEDLE MACHINE WITH HIGH STRENGTH THREAD.

3. SLEEVE SIZE TO ACCOMMODATE A 4 INCH DIAMETER PUMP DISCHARGE HOSE.

4. TIGHTLY SEAL SLEEVE AROUND THE PUMP DISCHARGE HOSE WITH A STRAP OR SIMILAR DEVICE.

5. PLACE FILTER BAG UPON MULCH, COMPOST, STRAW BALES OR OTHER LOCAL AGENCY APPROVED MATERIAL, LOCATED ON LEVEL OR GENTLY SLOPING (5% MAXIMUM) STABILIZED AREA.

6. CONTROL PUMPING RATE TO PREVENT EXCESSIVE PRESSURE WITHIN THE FILTERBAG. AS THE BAG FILLS WITH SEDIMENT, REDUCE PUMPING RATE.

7. DEWATER, REMOVE AND DISPOSE FILTER BAG UPON COMPLETION OF PUMPING OPERATIONS OR AFTER BAG HAS REACHED CAPACITY, WHICHEVER OCCURS FIRST. SPREAD THE DEWATERED SEDIMENT FROM BAG IN AN APPROVED UPLAND AREA AND STABILIZED BY THE END OF THE WORK DAY. RESTORE SURFACE AREA BENEATH BAG TO ORIGINAL CONDITION UPON REMOVAL OF THE DEVICE.

8. MINIMUM GEOTEXTILE REQUIREMENTS AND SPECIFICATIONS:

GRAB TENSILE STRENGTH	210 LB	ASTM D-4632
PUNCTURE	150 LB	ASTM D-4833
FLOW RATE	70 GAL/MIN/SF	ASTM D-4491
PERMITTIVITY	1.3 SEC-1	ASTM D-4491
UV RESISTANCE	70% STRENGTH AT 500 HOURS	ASTM D-4355
APPARENT OPENING SIZE (AOS)	0.15-0.18 MM	ASTM D-4751

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

MARYLAND DEPARTMENT OF ENVIRONMENT
WATER MANAGEMENT ADMINISTRATION

SECTION G – SEDIMENT TRAPPING

G-1 STANDARDS AND SPECIFICATIONS

FOR

SEDIMENT TRAPS

Definition

A temporary sediment control device formed by excavation and/or an embankment with an approved outlet used to intercept sediment-laden runoff and to retain the sediment.

Purpose

The purpose of a sediment trap is to intercept sediment-laden runoff and trap the sediment in order to protect drainage ways, properties, and rights-of-way downstream of the sediment trap from sedimentation.

Conditions Where Practice Applies

A sediment trap is installed at points of discharge from a disturbed area.

Wet and Dry Storage

The storage requirement for Sediment Traps I and II is 3600 cubic feet per acre of contributory drainage area. The sediment traps storage volume of 3600 cubic feet minimum per acre is to be divided equally into "dry" or dewatered storage and "wet" or retention storage. The will be dewatered to the wet pool elevation corresponding to 1800 cubic feet of storage per acre of drainage. Sediment trap III consists of only "wet" storage and the volume required is 5400 cubic feet per acre of drainage area.

Design Criteria

1. The maximum drainage area for each type sediment trap are as follows:

Practice #	**Practice Type**	**Max. Drainage Area**
ST-I	Pipe Outlet	5.0 ac.
ST-II	Stone Outlet/Riprap Outlet	10.0 ac.
ST-III	Riprap Outlet	10.0 ac.

2. The volume of a natural (unexcavated) sediment trap may be approximated by the equation:

   Volume (ft^3) = 0.4 x surface area (ft^2) x maximum depth (ft).

3. Locate sediment traps so that they can be installed prior to grading or filling. Do not locate traps any closer than 20 feet from an existing building foundation. Care must be taken when placing sediment traps in structural fill areas (i.e. proposed roadways and building foundations). When these traps are removed the wet soil around the traps must also be removed to facilitate compaction. Trap bottoms should be generally level. Indicate bottom dimensions on Plan View. Show contours/grading of traps on plans to ensure constructability.

   Locate traps to:

   a. Obtain maximum storage benefit from the terrain with a 2:1 length to width ratio desired.
   b. Facilitate cleanout.

c. Facilitate disposal of the trapped sediment.

4. Remove sediment and restore the trap to the original dimensions when the sediment has accumulated to one half of the wet storage depth of the trap. Deposit sediment removed from the trap in a protected area and in such a manner that it will not erode.

5. **For sediment traps, embankments do not exceed 4 feet in height as measured at the low point of the original ground along the centerline of the embankment.** Construct embankments to have a minimum 4 feet wide top and side slopes of 2:1 or flatter. Compact the embankment by traversing with equipment while it is being constructed. Once constructed, stabilize with seed and mulch. Protect the points of concentrated inflow in accordance with Inflow Protection criteria. Monitor and maintain the embankment during the life of the trap.

6. Make the elevation of the top of any dike directing water to any sediment trap equal to or exceeding the maximum elevation of the embankment along the entire length of the trap.

7. Carry out all excavation operations in such a manner that erosion and water pollution is minimized. Grade sediment traps to have 2:1 or flatter side slopes.

8. Locate inflow points to maximize the flow distance to the outlet. Where this is not feasible, install baffles.

9. Design, construct and maintain the outlet according to the standards set forth herein, and in such a manner that sediment does not leave the trap and that erosion at or below the outlet does not occur. Discharge sediment traps onto stable ground, into a stable watercourse, stable channel, or into a storm drain system.

10. Following completion of all construction and stabilization at a site, remove all temporary sediment traps and grade and stabilize the areas occupied by the traps. Silt Fence or other sediment control devices may be required during trap removal.

If any of the design criteria presented here cannot be met, see Standard and Specifications for Sediment Basin.

TRAP DETAILS NEEDED ON SOIL EROSION AND SEDIMENT CONTROL PLANS

There is no standard symbol for a sediment trap. Delineate each trap on the plans in such a manner that it will not be confused with any other features. Include on the plan all the information necessary to properly construct and maintain the trap. If tabular form is used to present the numbered information below, then consecutively number each trap on the plan. Please use caution in sitting sediment traps. Plot contours as necessary to ensure constructability. Show the following information, at a minimum, for each trap on the plans:

1. Trap number.
2. Type of trap (ST-I, ST-II, etc.).
3. Drainage area (5 acres max. for ST-I and 10 acres max. for ST-II and ST-III).
4. Storage required: (wet, dry, total).
5. Storage provided: (wet, dry, total).
6. Weir length or pipe size, outfall length (for ST-II) and channel depth (for ST-III).
7. Storage depth below outlet and cleanout elevation.
8. Embankment height, width, and elevation (if applicable).
9. Typical detail of each trap used.
10. Elevations at bottom, wet storage, dry storage and crest.
11. Existing elevation at centerline of embankment.
12. Bottom Dimensions.

G-1-1 STANDARDS AND SPECIFICATIONS

FOR

PIPE OUTLET SEDIMENT TRAP ST-I

This practice consists of a trap formed by an embankment or excavation. The outlet for the trap is through a perforated riser and a barrel pipe through the embankment. Construct the barrel pipe and riser of corrugated metal, PVC, or CPP pipe. Make all pipes circular and watertight. Set the top of the embankment at least 1 foot above the crest of the riser.

Perforate the riser above the wet pool elevation. Perforate slots ½ inch wide by 6 inches in length or 1 inch diameter holes spaced six (6) inches both vertically and horizontally.

Do not perforate the riser within six (6) inches of the top of the horizontal barrel. Make all pipe connections watertight. Wrap the riser with ½ inch galvanized hardware cloth then wrap with Geotextile Class SE and secure with strapping or connecting bands at the top and bottom of the geotextile. Extend the hardware cloth and geotextile at least six (6) inches above the highest perforation and six (6) inches below the lowest perforation. Provide a trash rack/anti-vortex device (the top of the riser pip) that meets the requirements of Detail G-2-6

Provide a base to the riser with sufficient weight to prevent flotation of the riser. An approved base is:

1. A concrete base twice the diameter of the riser, 12 inches thick with the riser embedded 9 inches into the concrete base (see Detail G-2-5).

Note: Limit pipe outlet sediment traps to five (5) acres maximum drainage area.

Table G.1: Pipe Outlet Diameter Selection

Minimum Sizes	**Minimum Sizes**	**Minimum Sizes**	**Minimum Sizes**
Barrel Diam. (Inches)	**Riser Diam. (Inches)**	**Trash Rack Diam. (Inches)**	**Drainage Area (Acres)**
12	15	21	1
15	18	27	2
18	21	30	3
21	24	36	4
24	27	42	5

Construction Specifications

1. Clear, grub and strip any vegetation and root mat from the area under the embankment. Clear the pool area.

2. Use fill material free of roots or other woody vegetation as well as oversized stones, rocks, organic material, or other objectionable material for the embankment. Compact the embankment by traversing with equipment while it is being constructed.

3. Provide a total trap volume of 3600 cubic feet/acre of contributory drainage area (see Table G.2.) Construct the top of the embankment greater than 1 foot above the crest of the riser.

4. Remove sediment and restore the trap to its original dimensions when the sediment has accumulated to one half of the wet storage depth of the trap. Deposit the sediment in a suitable

area and in such a manner that it will not erode.

5. Inspect the structure periodically as required and after each rain and make repairs as needed.

6. Carry out construction operations in such a manner that erosion and water pollution are abated. Once constructed, stabilize with seed and mulch, the top and outside face of the embankment. Protect points of concentrated inflow in accordance with Inflow Protection criteria (see Section D). 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.

7. Remove the structure and stabilize the area when the contributory drainage area has been permanently stabilized.

8. Make all cut and fill slopes 2:1 or flatter.

9. Make all pipe connections watertight.

10. Above the wet storage elevation, perforate the riser with ½ inch wide by 6 inches long slots or 1 inch diameter holes spaced 6 inches vertically and horizontally. Do not perforate the riser within 6 inches of the horizontal barrel.

11. Wrap the riser with ½ inch galvanized hardware cloth then wrap with Geotextile Class SE. Extend the geotextile 6 inches above the highest slot/holes and six 6 inches below the lowest slot/hole. Overlap, fold and fasten where ends of geotextile come together to prevent bypass. Replace geotextile as necessary to prevent clogging.

12. Use straps or connecting bands at the top and bottom of the geotextile to hold the geotextile and hardware cloth in place.

13. Hand compact in 4 inch layers fill material around the pipe spillway. Place a minimum of 2 feet of hand compacted backfill over the pipe spillway before crossing it with construction equipment.

14. Anchor the riser with either a concrete base or steel plate base to prevent flotation. Make concrete bases at least twice the riser diameter and 12 inches thick with the riser embedded 9 inches.

15. Design anti-seep collars in accordance with Table G.9 and Details G-2-3 and G-2-4.

16. Concentric trash rack and anti-vortex device design details are on Detail G-2-6.

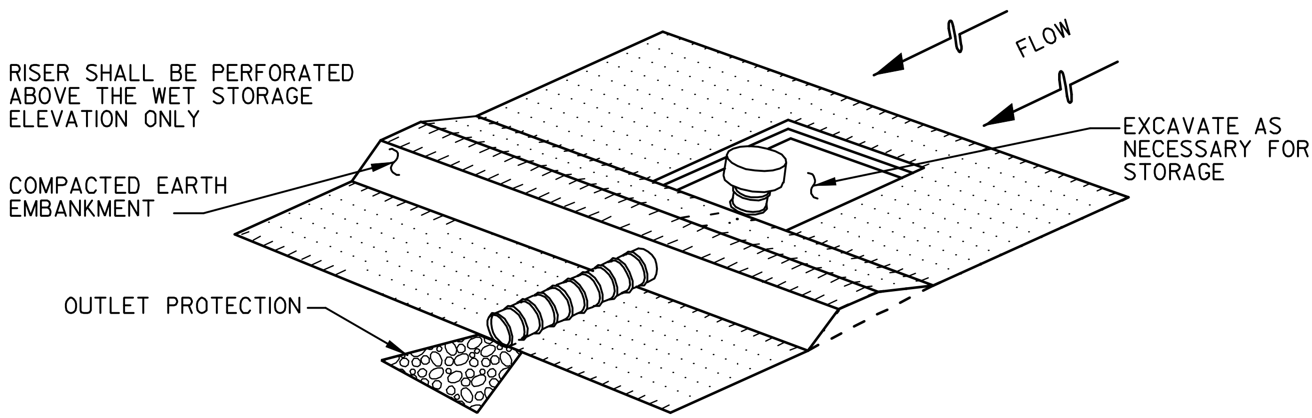
17. Refer to Section F for dewatering requirements of sediment traps.

18. Outlet: Provide an outlet including a means of conveying the discharge in a non-erosive manner to an existing stable channel. Protect against scour at the discharge end of the pipe spillway in accordance with the Standards and Specifications for Outlet Protection (Section D).

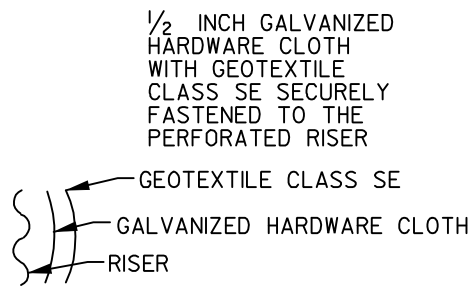
19. Where discharge occurs at the property line, comply with local ordinances and drainage easement requirements.

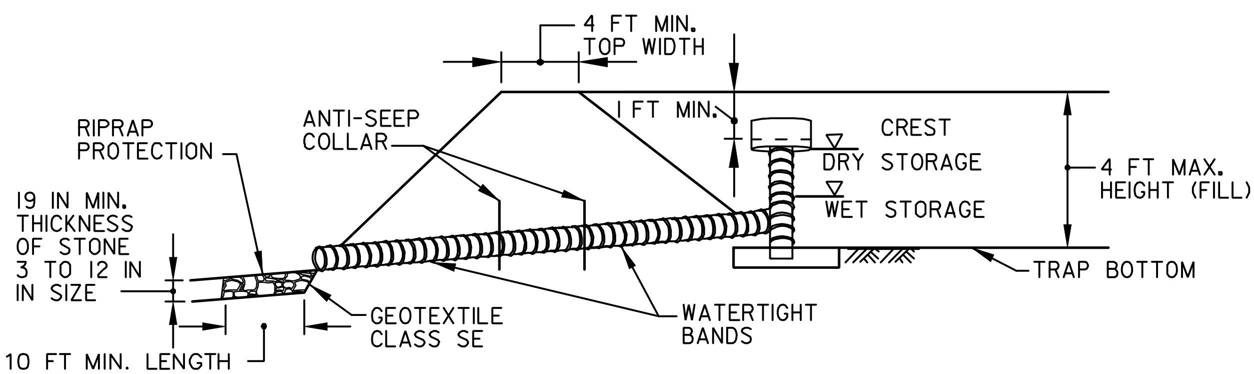
DETAIL G-1-1 - PIPE OUTLET SEDIMENT TRAP - ST 1

STANDARD SYMBOL



PERSPECTIVE VIEW





EMBANKMENT SECTION THROUGH RISER

NOTE ANCHOR RISER:
EMBED RISER 9 IN INTO A CONCRETE BASE TWICE THE RISER DIAMETER, MIN.

1 OF 3

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL G-1-1 - PIPE OUTLET SEDIMENT TRAP - ST I

STANDARD SYMBOL

CONSTRUCTION SPECIFICATIONS

1. CLEAR, GRUB AND STRIP ANY VEGETATION AND ROOT MAT FROM THE AREA UNDER THE EMBANKMENT. CLEAR THE POOL AREA.
2. USE FILL MATERIAL FREE OF ROOTS OR OTHER WOODY VEGETATION AS WELL AS OVERSIZED STONES, ROCKS, ORGANIC MATERIAL, OR OTHER OBJECTIONABLE MATERIAL FOR THE EMBANKMENT. COMPACT THE EMBANKMENT BY TRAVERSING WITH EQUIPMENT WHILE IT IS BEING CONSTRUCTED.
3. PROVIDE A TOTAL TRAP VOLUME OF 3600 CUBIC FEET/ACRE OF CONTRIBUTORY DRAINAGE AREA (SEE TABLE G.2). CONSTRUCT THE TOP OF THE EMBANKMENT GREATER THAN 1 FOOT MINIMUM ABOVE THE CREST OF THE RISER.
4. REMOVE SEDIMENT AND RESTORE THE TRAP TO ITS ORIGINAL DIMENSIONS WHEN THE SEDIMENT HAS ACCUMULATED TO ONE HALF OF THE WET STORAGE DEPTH OF THE TRAP. DEPOSIT THE SEDIMENT IN A SUITABLE AREA AND IN SUCH A MANNER THAT IT WILL NOT ERODE.
5. INSPECT THE STRUCTURE PERIODICALLY AS REQUIRED AND AFTER EACH RAIN AND MAKE REPAIRS AS NEEDED.
6. CARRY OUT CONSTRUCTION OPERATIONS IN SUCH A MANNER THAT EROSION AND WATER POLLUTION ARE ABATED. ONCE CONSTRUCTED, STABILIZE WITH SEED AND MULCH. PROTECT POINTS OF CONCENTRATED INFLOW IN ACCORDANCE WITH INFLOW PROTECTION CRITERIA (SECTION D). MONITOR AND MAINTAIN EROSION FREE DURING THE LIFE OF THE TRAP.
7. REMOVE THE STRUCTURE AND STABILIZE THE AREA WHEN THE CONTRIBUTORY DRAINAGE AREA HAS BEEN PERMANENTLY STABILIZED.
8. MAKE ALL CUT AND FILL SLOPES 2:1 OR FLATTER.
9. MAKE ALL PIPE CONNECTIONS WATERTIGHT.
10. ABOVE THE WET STORAGE ELEVATION, PERFORATE THE RISER WITH ½ INCH WIDE BY 6 INCHES LONG SLOTS OR 1 INCH DIAMETER HOLES SPACED 6 INCHES VERTICALLY AND HORIZONTALLY. DO NOT PERFORATE THE RISER WITHIN 6 INCHES OF THE HORIZONTAL BARREL.
11. WRAP THE RISER WITH ½ INCH GALVANIZED HARDWARE CLOTH THEN WRAP WITH GEOTEXTILE CLASS SE. EXTEND THE GEOTEXTILE 6 INCHES ABOVE THE HIGHEST SLOT/HOLE AND SIX 6 INCHES BELOW THE LOWEST SLOT/HOLE. OVERLAP, FOLD AND FASTEN WHERE ENDS OF GEOTEXTILE COME TOGETHER TO PREVENT BYPASS. REPLACE GEOTEXTILE AS NECESSARY TO PREVENT CLOGGING.
12. USE STRAPS OR CONNECTING BANDS AT THE TOP AND BOTTOM OF THE GEOTEXTILE TO HOLD THE GEOTEXTILE AND HARDWARE CLOTH IN PLACE.
13. HAND COMPACT IN 4 INCH LAYERS FILL MATERIAL AROUND THE PIPE SPILLWAY. PLACE A MINIMUM OF 2 FEET OF HAND COMPACTED BACKFILL OVER THE PIPE SPILLWAY BEFORE CROSSING IT WITH CONSTRUCTION EQUIPMENT.
14. ANCHOR THE RISER WITH A CONCRETE BASE TO PREVENT FLOTATION. MAKE CONCRETE BASES AT LEAST TWICE THE RISER DIAMETER AND 12 INCHES THICK WITH THE RISER EMBEDDED 9 INCHES.
15. DESIGN ANTISEEP COLLARS IN ACCORDANCE WITH TABLE G.9 AND DETAILS G-2-3 AND G-2-4.
16. CONCENTRIC TRASH RACK AND ANTI-VORTEX DEVICE DESIGN DETAILS ARE ON DETAIL G-2-6.
17. REFER TO SECTION F FOR DEWATERING REQUIREMENTS OF SEDIMENT TRAPS.
18. OUTLET - PROVIDE AN OUTLET INCLUDING A MEANS OF CONVEYING THE DISCHARGE IN A NON-EROSIVE MANNER TO AN EXISTING STABLE CHANNEL. PROTECT AGAINST SCOUR AT THE DISCHARGE END OF THE PIPE SPILLWAY IN ACCORDANCE WITH THE STANDARDS AND SPECIFICATIONS FOR OUTLET PROTECTION (SECTION D).
19. WHERE DISCHARGE OCCURS AT THE PROPERTY LINE, COMPLY WITH LOCAL ORDINANCES AND DRAINAGE EASEMENT REQUIREMENTS.

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DETAIL G-1-1 - PIPE OUTLET SEDIMENT TRAP - ST 1

STANDARD SYMBOL

PIPE OUTLET SEDIMENT TRAP ST-1

PROPOSED DRAINAGE AREA	_.__ ACRES
EXISTING DRAINAGE AREA	_.__ ACRES
STORAGE REQUIRED	__,___ $FT.^3$
TRAP BOTTOM ELEVATION	___.__
TRAP BOTTOM DIMENSIONS	__FTx__FT(MIN.)
STORAGE PROVIDED	__,___ FT^3
RISER CREST (DRY STORAGE) ELEVATION	___.__
OUTLET (WET STORAGE) ELEVATION	___.__
CLEANOUT ELEVATION	___.__
EMBANKMENT HEIGHT ELEVATION	___.__
SIDE SLOPE	_:_
DRY STORAGE ZONE (ELEV.)	___.__-___.__
WET STORAGE ZONE (ELEV.)	___.__-___.__
RISER INVERT (ELEV.)	___.__
RISER DIAMETER	___.__

3 OF 3

G-1-2 STANDARDS AND SPECIFICATIONS

FOR

STONE/RIPRAP OUTLET SEDIMENT TRAP ST-II

This practice consists of a trap formed by an excavation and embankment. Outlet this trap through a partially excavated channel lined with riprap and containing a stone or recycled concrete equivalent. Discharge the outlet onto a stable area or to a stable watercourse. Use the stone outlet/riprap outlet sediment trap for drainage areas up to a maximum of 10 acres. Make the minimum length of the weir of the stone section equal to four (4) times the drainage area (acres).

Construct the outlet crest (top of stone in weir section) level, at least 1 foot below top of embankment and no more than 3 feet above ground beneath the outlet. Use 4 to 7 inch stone in the weir and 4 to 12 inch (Class I riprap) to construct the outlet. Place a 1 foot thick layer of ¾ to 1 ½ inch washed aggregate on the upstream face of the outlet. Geotextile Class SE placed on the upstream face of the outlet may be substituted for the ¾ to 1 ½ inch stone.

Construction Specifications

1. Clear, grub and strip any vegetation and root mat from the area under embankment. Clear the pool area.

2. Use fill material free of roots or other woody vegetation as well as oversized stones, rocks, organic material or other objectionable material for the embankment. Compact the embankment by traversing with equipment while it is being constructed.

3. Make all cut and fill slopes 2:1 or flatter.

4. Make the elevation of the top of any dike directing water into trap equal to or exceeding the height of trap embankment.

5. Compute the storage volume provided measuring from top of weir. (For storage requirements see Table G.2.)

6. Place Geotextile Class SE over the bottom and sides of the outlet channel prior to placement of stone. Overlap sections of geotextile at least 1 foot with the section nearest to the trap placed on top. Embed geotextile at least 6 inches into existing ground at entrance of outlet channel.

7. Use 4 to 7 inch stone to construct the weir and 4 to 12 inch (Class I riprap) stone to construct the outlet channel. Place 1 foot of ¾ to 1 ½ inch stone on the upstream face of the weir.

8. Outlet: Include a means of conveying the discharge in a non-erosive manner to an existing stable channel. Protect against scour at the discharge point in accordance with the Standards and Specifications for Outlet Protection (see Section D).

9. Construct the outlet channel with positive drainage away from the trap.

10. Remove sediment and restore trap to its original dimensions when the sediment has accumulated to 1/2 of the wet storage depth of the trap. Deposit removed sediment in a suitable area and in such a manner that it will not erode.

11. Inspect the trap periodically as required and after each rain and repair as needed.

12. Carry out construction of traps in such a manner that sediment pollution is abated. Once constructed, stabilize the top and outside face of the embankment with seed and mulch. Protect points of concentrated inflow in accordance with Inflow Protection criteria (see Section D). Stabilize (one time) the remainder of the interior slopes with seed and mulch upon trap completion and monitor and maintain erosion free during the life of the trap.

13. Remove the trap and stabilize the area when the contributory drainage area has been properly stabilized.

Table G.2: Sediment Trap Design Criteria

ST-I and ST-II

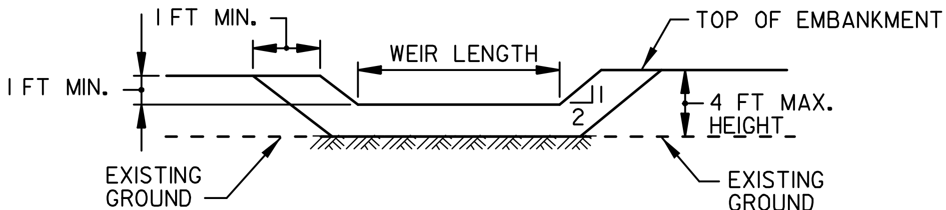
DRAINAGE AREA (AC.)	TRAP TYPE*	TOTAL VOLUME (CF)	WET VOLUME (CF)	DRY VOLUME (CF)	MINIMUM DEPTH (FT)	MINIMUM LENGTH (FT)	MINIMUM WIDTH (FT)
1	I/II	3600	1800	1800	2.5	46	23
2	I/II	7200	3600	3600	2.5	68	34
3	I/II	10800	5400	5400	2.5	86	42
4	I/II	14400	7200	7200	3.0	90	43
5	I/II	18000	9000	9000	3.0	101	50
6	III	21600	10800	10800	4.0	90	46
7	II	25200	12600	12600	4.0	100	50
8	II	28800	14400	14400	4.0	105	55
9	II	32400	16200	16200	4.0	110	60
10	II	36000	18000	18000	4.0	123	60

*I - PIPE OUTLET (POST), II - STONE/RIPRAP OUTLET (SROST)

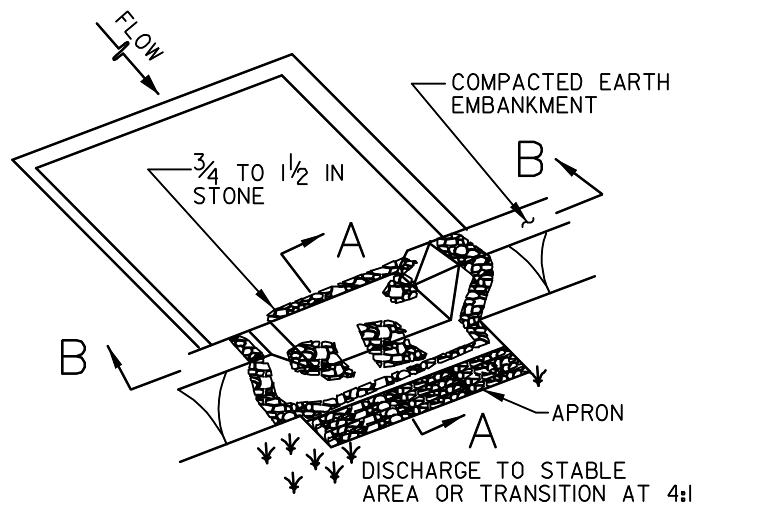
1. Make the length to width ratio be 2:1 or greater.
2. Minimum length and width dimensions apply to the bottom of the traps.
3. Make the side slopes 2:1 or flatter.

DETAIL G-1-2 - STONE RIPRAP OUTLET SEDIMENT TRAP - ST II

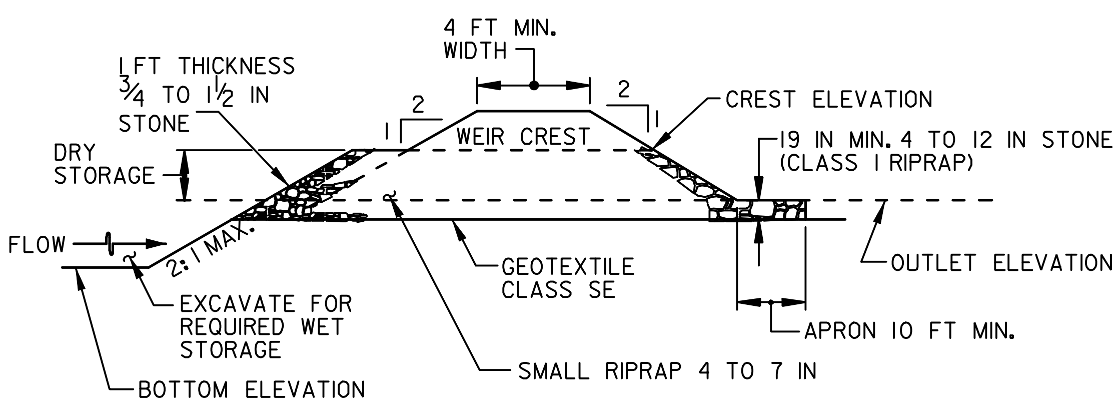
STANDARD SYMBOL



SECTION B-B



PERSPECTIVE VIEW



SECTION A-A

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MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL G-1-2 - STONE RIPRAP OUTLET SEDIMENT TRAP - ST II

STANDARD SYMBOL

CONSTRUCTION SPECIFICATIONS

1. CLEAR, GRUB AND STRIP ANY VEGETATION AND ROOT MAT FROM THE AREA UNDER EMBANKMENT. CLEAR THE POOL AREA.

2. USE FILL MATERIAL FREE OF ROOTS OR OTHER WOODY VEGETATION AS WELL AS OVER SIZED STONES, ROCKS, ORGANIC MATERIAL OR OTHER OBJECTIONABLE MATERIAL FOR THE EMBANKMENT. COMPACT THE EMBANKMENT BY TRAVERSING WITH EQUIPMENT WHILE IT IS BEING CONSTRUCTED.

3. MAKE ALL CUT AND FILL SLOPES 2:1 OR FLATTER.

4. MAKE THE ELEVATION OF THE TOP OF ANY DIKE DIRECTING WATER INTO TRAP EQUAL TO OR EXCEEDING THE HEIGHT OF TRAP EMBANKMENT.

5. COMPUTE THE STORAGE VOLUME PROVIDED MEASURING FROM TOP OF WEIR. (FOR STORAGE REQUIREMENTS SEE TABLE G.2).

6. PLACE GEOTEXTILE CLASS SE OVER THE BOTTOM AND SIDES OF THE OUTLET CHANNEL PRIOR TO PLACEMENT OF STONE. OVERLAP SECTIONS OF GEOTEXTILE AT LEAST 1 FOOT WITH THE SECTION NEAREST TO THE TRAP PLACED ON TOP. EMBED GEOTEXTILE AT LEAST 6 INCHES INTO EXISTING GROUND AT ENTRANCE OF OUTLET CHANNEL.

7. USE 4 TO 7 INCH STONE TO CONSTRUCT THE WEIR AND 4 TO 12 INCH (CLASS I RIPRAP) STONE TO CONSTRUCT THE OUTLET CHANNEL.

8. OUTLET - INCLUDE A MEANS OF CONVEYING THE DISCHARGE IN A NON-EROSIVE MANNER TO AN EXISTING STABLE CHANNEL. PROTECT AGAINST SCOUR AT THE DISCHARGE POINT IN ACCORDANCE WITH THE STANDARDS AND SPECIFICATIONS FOR OUTLET PROTECTION (SECTION D).

9. CONSTRUCT THE OUTLET CHANNEL WITH POSITIVE DRAINAGE AWAY FROM THE TRAP.

10. REMOVE SEDIMENT AND RESTORE TRAP TO ITS ORIGINAL DIMENSIONS WHEN THE SEDIMENT HAS ACCUMULATED TO $\frac{1}{2}$ OF THE WET STORAGE VOLUME OF THE TRAP. DEPOSIT REMOVED SEDIMENT IN A SUITABLE AREA AND IN SUCH A MANNER THAT IT WILL NOT ERODE.

11. INSPECT THE TRAP PERIODICALLY AS REQUIRED AND AFTER EACH RAIN AND REPAIR AS NEEDED.

12. CARRY OUT CONSTRUCTION OF TRAPS IN SUCH A MANNER THAT SEDIMENT POLLUTION IS ABATED. ONCE CONSTRUCTED, STABILIZE THE TOP AND OUTSIDE FACE OF THE EMBANKMENT WITH SEED AND MULCH. PROTECT POINTS OF CONCENTRATED INFLOW IN ACCORDANCE WITH INFLOW PROTECTION CRITERIA (SECTION D). STABILIZE (ONE TIME) THE REMAINDER OF THE INTERIOR SLOPES WITH SEED AND MULCH UPON TRAP COMPLETION AND MONITOR AND MAINTAIN EROSION FREE DURING THE LIFE OF THE TRAP.

13. REMOVE THE TRAP AND STABILIZE THE AREA WHEN THE CONTRIBUTORY DRAINAGE AREA HAS BEEN PROPERLY STABILIZED.

DETAIL G-1-2 - STONE RIPRAP OUTLET SEDIMENT TRAP - ST II

STANDARD SYMBOL

STONE/RIPRAP OUTLET SEDIMENT TRAP ST-II

PROPOSED DRAINAGE AREA	_.__ ACRES
EXISTING DRAINAGE AREA	_.__ ACRES
WET STORAGE REQUIRED	__,___ FT^3.
WET STORAGE PROVIDED	__,___ FT^3.
DRY STORAGE REQUIRED	___,___ FT^3.
DRY STORAGE PROVIDED	__,___ FT^3.
EXISTING GROUND ELEVATION AT OUTLET	___.__
TRAP BOTTOM ELEVATION	___.__
TRAP BOTTOM DIMENSIONS	__FTx__FT(MIN.)
WEIR CREST (DRY STORAGE) ELEVATION	___.__
OUTLET (WET STORAGE) ELEVATION	___.__
CLEANOUT ELEVATION	___.__
EMBANKMENT HEIGHT ELEVATION	___.__
SIDE SLOPE	_:_
WEIR LENGTH	__FT
DRY STORAGE ZONE (ELEV.)	___.__-___.__
WET STORAGE ZONE (ELEV.)	___.__-___.__

G-1-3 STANDARDS AND SPECIFICATIONS

FOR

RIPRAP OUTLET SEDIMENT TRAP ST-III

This practice consists of a trap formed by an excavation and embankment. Outlet this trap through a partially excavated channel lined with riprap or recycled concrete equivalent. Discharge the outlet channel onto a stable area or to a stable watercourse. **Use the Riprap Outlet Sediment Trap for drainage areas of up to a maximum of 10 acres.**

Dry storage is not required in the Riprap Outlet Sediment Trap, only excavation for wet storage. The storage required is 5400 cubic feet per acre of drainage area for Riprap Outlet Sediment Traps.

Construction Specifications

1. Clear, grub and strip any vegetation and root mat from the area under the embankment. Clear the pool area.

2. Use fill material free of roots or other woody vegetation as well as over-sized stones, rocks, organic material or other objectionable material for the embankment. Compact the embankment by traversing with equipment while it is being constructed.

3. Make all cut and fill slopes 2:1 or flatter.

4. Make the elevation of the top of any dike directing water into trap equal to or exceeding the height of trap embankment.

5. Place Geotextile Class SE over the bottom and sides of the outlet channel prior to placement of stone. Overlap sections of fabric at least 1 foot with the section nearest to the trap placed on top. Embed fabric at least 6 inches into existing ground at entrance of outlet channel.

6. Construct the outlet channel using 4 to 12 inch stone, placed 19 inches thick.

7. Outlet: Convey the discharge in a non-erosive manner to an existing stable channel. Protect against scour at the discharge point in accordance with the Standards and Specifications for Outlet Protection (see Section D).

8. Construct the Outlet channel with positive drainage away from the trap.

9. Remove sediment and restore trap to its original dimensions when the sediment has accumulated to 1/4 of the wet storage volume of the trap. Deposit removed sediment in a suitable area and in such a manner that it will not erode.

13. Inspect the trap periodically as required and after each rain and repair as needed.

14. Carry out construction of traps in such a manner that sediment pollution is abated. Once constructed, stabilize the top and outside face of the embankment with seed and mulch. Protect points of concentrated inflow in accordance with Inflow Protection criteria (see Section D). Stabilize (one time) the remainder of the interior slopes with seed and mulch upon trap completion and monitor and maintain erosion free during the life of the trap.

15. When the contributory drainage area has been properly stabilized, dewater the trap by approved methods (see Section F). Remove the trap and stabilize the area.

16. For storage requirements see Table G.4.

Table G.3: Riprap Outlet Sediment Trap

ST-III (for Stone Lined Weir)

Contributing Drainage Area (Acres)	Depth of Weir (a) (Feet)	Width of Weir (b) (Feet)
1	1.5	4.0
2	1.5	5.0
3	1.5	6.0
4	1.5	10.0
5	1.5	12.0
6	1.5	14.0
7	1.5	16.0
8	2.0	10.0
9	2.0	10.0
10	2.0	12.0

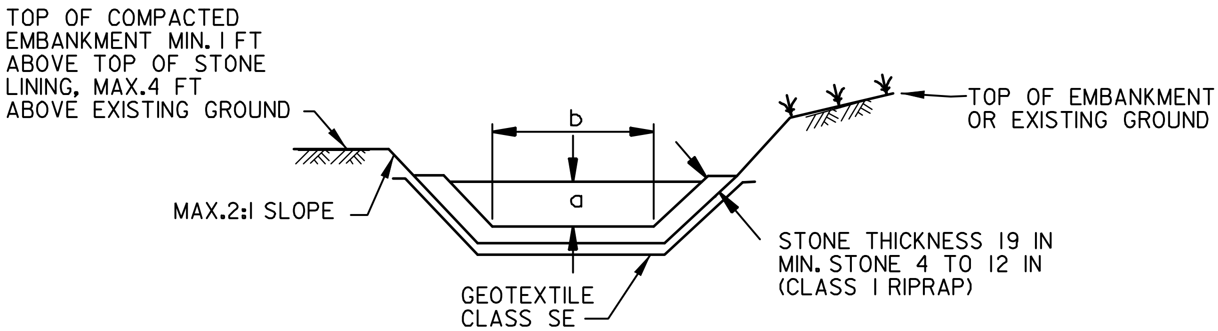
Table G.4: Sediment Trap Design Criteria

ST-III

Drainage Area (Acres)	Total Volume (CF)	Minimum Depth (Feet)	Minimum Length (Feet)	Minimum Width (Feet)
1	5400	3.0	68	34
2	10800	3.0	102	51
3	16200	3.5	116	58
4	21600	3.5	136	68
5	27000	4.0	141	70
6	32400	4.5	156	78
7	37800	4.5	157	78
8	43200	4.5	169	85
9	48600	5.0	168	84
10	54000	5.0	178	89

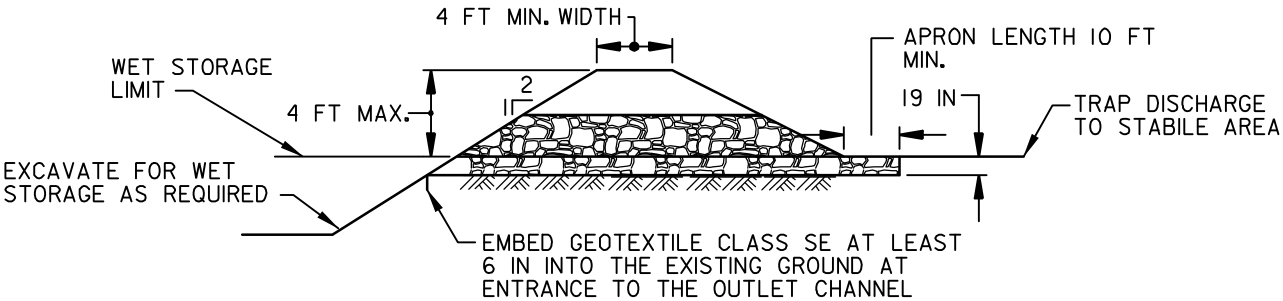
DETAIL G-1-3 - RIPRAP OUTLET SEDIMENT TRAP - ST III

STANDARD SYMBOL

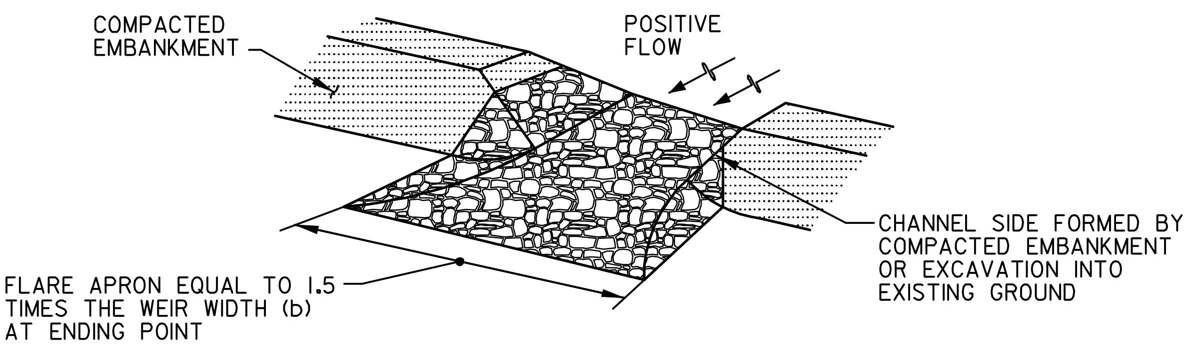


CROSS SECTION

a	MIN. DEPTH OF WEIR
b	BOTTOM WIDTH OF WEIR



PROFILE



PERSPECTIVE VIEW

NOTE: MAXIMUM DRAINAGE AREA= 10 ac.

1 OF 3

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL G-1-3 – RIPRAP OUTLET SEDIMENT TRAP – ST III

STANDARD SYMBOL

CONSTRUCTION SPECIFICATIONS

1. CLEAR, GRUB AND STRIP ANY VEGETATION AND ROOT MAT FROM THE AREA UNDER THE EMBANKMENT. CLEAR THE POOL AREA.
2. USE FILL MATERIAL FREE OF ROOTS OR OTHER WOODY VEGETATION AS WELL AS OVER SIZED STONES, ROCKS, ORGANIC MATERIAL OR OTHER OBJECTIONABLE MATERIAL FOR THE EMBANKMENT. COMPACT THE EMBANKMENT BY TRAVERSING WITH EQUIPMENT WHILE IT IS BEING CONSTRUCTED.
3. MAKE ALL CUT AND FILL SLOPES 2:1 OR FLATTER.
4. MAKE THE ELEVATION OF THE TOP OF ANY DIKE DIRECTING WATER INTO TRAP EQUAL TO OR EXCEEDING THE HEIGHT OF TRAP EMBANKMENT.
5. PLACE GEOTEXTILE CLASS SE OVER THE BOTTOM AND SIDES OF THE OUTLET CHANNEL PRIOR TO PLACEMENT OF STONE. OVERLAP SECTIONS OF FABRIC AT LEAST 1 FOOT WITH THE SECTION NEAREST TO THE TRAP PLACED ON TOP. EMBED FABRIC AT LEAST 6 INCHES INTO EXISTING GROUND AT ENTRANCE OF OUTLET CHANNEL.
6. CONSTRUCT THE OUTLET WEIR USING 4 TO 12 INCH STONE, PLACED 19 INCHES THICK.
7. OUTLET – CONVEY THE DISCHARGE IN A NON-EROSIVE MANNER TO AN EXISTING STABLE CHANNEL. PROTECT AGAINST SCOUR AT THE DISCHARGE POINT IN ACCORDANCE WITH THE STANDARDS AND SPECIFICATIONS FOR OUTLET PROTECTION (SECTION D).
8. CONSTRUCT THE OUTLET WEIR WITH POSITIVE DRAINAGE AWAY FROM THE TRAP.
9. REMOVE SEDIMENT AND RESTORE TRAP TO ITS ORIGINAL DIMENSIONS WHEN THE SEDIMENT HAS ACCUMULATED TO $\frac{1}{4}$ OF THE WET STORAGE VOLUME OF THE TRAP. DEPOSIT REMOVED SEDIMENT IN A SUITABLE AREA AND IN SUCH A MANNER THAT IT WILL NOT ERODE.
10. INSPECT THE TRAP PERIODICALLY AS REQUIRED AND AFTER EACH RAIN AND REPAIR AS NEEDED.
11. CARRY OUT CONSTRUCTION OF TRAPS IN SUCH A MANNER THAT SEDIMENT POLLUTION IS ABATED. ONCE CONSTRUCTED, STABILIZE THE TOP AND OUTSIDE FACE OF THE EMBANKMENT WITH SEED AND MULCH. PROTECT POINTS OF CONCENTRATED INFLOW IN ACCORDANCE WITH INFLOW PROTECTION CRITERIA (SECTION D). STABILIZE (ONE TIME) THE REMAINDER OF THE INTERIOR SLOPES WITH SEED AND MULCH UPON TRAP COMPLETION AND MONITOR AND MAINTAIN EROSION FREE DURING THE LIFE OF THE TRAP.
12. WHEN THE CONTRIBUTORY DRAINAGE AREA HAS BEEN PROPERLY STABILIZED, DEWATER THE TRAP BY APPROVED METHODS (SECTION F). REMOVE THE TRAP AND STABILIZE THE AREA.
13. FOR STORAGE REQUIREMENTS SEE TABLE G.4.

DETAIL G-1-3 - RIPRAP OUTLET SEDIMENT TRAP - ST III

STANDARD SYMBOL

RIPRAP OUTLET SEDIMENT TRAP ST-III

PROPOSED DRAINAGE AREA	_.__ ACRES
EXISTING DRAINAGE AREA	_.__ ACRES
WET STORAGE REQUIRED	__,___ FT.
EXISTING GROUND ELEVATION AT OUTLET	___.__
TRAP BOTTOM ELEVATION	___.__
TRAP BOTTOM DIMENSIONS	__FTx__FT(MIN.)
WEIR CREST (WET STORAGE) ELEVATION	___.__
CLEANOUT ELEVATION	___.__
EMBANKMENT HEIGHT ELEVATION	___.__
SIDE SLOPE	_:_
WEIR LENGTH	__FT

3 OF 3

G-2 STANDARD AND SPECIFICATIONS

FOR

SEDIMENT BASINS

Definition

A temporary barrier or dam constructed across a drainage way or at other suitable locations to intercept sediment laden runoff. This barrier may be combined with excavation to achieve the required storage.

Purpose

Sediment basins protect downstream properties and drainage ways by trapping sediment and controlling the release of stormwater runoff.

Wet and Dry Storage

The minimum storage volume requirement for sediment basins is 3600 cubic feet per acre of contributory drainage area. Divide the basin storage volume of 3600 cubic feet per acre equally into "dry" or dewatered storage and "wet" or retention storage. Dewater basins to the wet pool elevation corresponding to 1800 cubic feet of storage per acre of drainage area.

Conditions Where Practice Applies

A sediment basin is required to control runoff and sediment from large areas where sediment traps are not appropriate. Stormwater management ponds may be used as sediment basins provided that they meet the requirements of this section and that the construction sequence addresses converting the sediment basin to the permanent stormwater management pond.

Conditions of Use

This standard applies to the installation of temporary sediment basins on sites where: (a) failure of the structure would not result in loss of life, damage to homes or buildings, or interruption of use or service of public roads or utilities; (b) the drainage area does not exceed 100 acres; (c) the maximum embankment height does not exceed 15 feet measured from the natural ground to the embankment top along the centerline of embankment; and (d) the basin is to be removed within 36 months after the beginning of construction of the basin. Where these criteria cannot be met, design the structure in accordance with Environmental Article, Title 5, Subtitle 5, Annotated Code of Maryland or Maryland NRCS Standards and Specifications No. 378 for Ponds. Design the total volume of permanent sediment basins to be equal to or exceed the capacity requirements for temporary basins contained herein.

Design Criteria

Comply with state and local laws, ordinances, rules and regulations for design and construction

1. Location: Locate the sediment basin to obtain the maximum storage benefit from the terrain and for ease of cleanout of the trapped sediment. Locate the basin to minimize interference with construction activities and construction of utilities. Whenever possible, locate the sediment basins so that storm drains may outfall or be diverted into the basin.

2. Volume of the Basin: Provide a volume of at least 3600 cubic feet per acre of total contributory drainage area in the sediment basin, as measured from the bottom of the basin to the elevation of the principal spillway crest. The 3600 cubic feet of storage is approximately equal to 1 inch of runoff per acre of drainage area. Divide the sediment basin storage volume of 3600 cubic feet minimum per acre and be divided equally into "dry" or dewatered storage and "wet" or retention storage.

   Clean out sediment basins when the basin is filled with sediment to ½ of the wet storage volume. Restore the original design volume to the basin. Determine and state the elevation corresponding to the maximum allowable sediment level in the design data on the plans as a distance below the top of the riser. Clearly show the distance between the top of the riser and the cleanout elevation on the riser, above the wet pool elevation.

3. Surface Area: Design basins so that the ratio of acres of surface area to cubic feet/second of discharge (from a 10 year storm) is greater than or equal to 0.0035. Measure the surface area at the design high water elevation.

4. Shape of the Basin: It is recommended that the designer of a sediment basin strive to incorporate the following features:

   a. Length to width ratio greater than 2:1, where length is the distance between the inlet and outlet. For basins with skimmer dewatering devices, make the length to width ration greater than 4:1.

   b. A wedge shape with the inlet located at the narrow end.

   c. Baffles designed to maximize detention time are require in situations where the above conditions cannot be met,

   d. Clearly show on the plans the dimensions necessary to obtain the required basin volume and surface area to facilitate plan review, construction, and inspection.

5. Inflow Protection: Whenever the inflow to the basin is not stabilized, or where concentrated runoff enters the basin, refer to the inflow protection specifications. Inflow protection provides safe conveyance of concentrated runoff into temporary sediment basins to prevent erosion. Meet or exceed the practices found in Section D of these Standards and Specifications for Inflow Protection. Locate points of runoff entry as far away from the riser as possible, to maximize travel time in conjunction with dikes, swales, or other water control devices, as warranted by site conditions.

6. Embankment: Include elevations of the top of earth fill at constructed and settled height on the plans.

7. Side Slopes: Design the combined upstream and downstream side slopes of the settled embankment to be not less than five horizontal to one vertical (5:1) with neither slope steeper than 2:1. Design slopes to be stable in all cases.

8. Top Width: For dam embankments up to ten (10) feet, make the top level width a minimum of eight (8) feet. For embankments between ten (10) feet and fifteen (15) feet, make the top level width (10) feet.

9. Spillway Design: Compute runoff by the method outlined in Chapter 2, Estimating Runoff, "Engineering Field Manual for Conservation Practices," available in the Natural Resource Conservation Service offices, or by TR-55, Urban Hydrology. Base runoff computations upon the worst soil cover conditions expected to prevail in the contributing drainage area during the anticipated effective life of the structure. Ensure that the combined capacities of the principal and emergency spillways are sufficient to pass the "routed" peak rate of runoff from a 10-year frequency storm.

10. Riser Type Principal Spillway: Provide a spillway which consists of a vertical pipe or box type riser joined (watertight connection) to a pipe (barrel) that extends through the embankment and discharges beyond the downstream toe of the fill. Measure the storage volume required from the riser crest elevation to the bottom of the basin. The minimum size of the barrel should be what is required to pass 10% of the 10 year storm or 8 inches in diameter whichever is larger. Where an emergency spillway is not provided, provide a minimum cross-sectional area of the principal spillway of three (3) square feet and with the capacity to pass the 10-year frequency storm.

    a. Crest Elevation: Design the crest elevation of the riser to be a minimum of one foot below the elevation of the control section of the emergency spillway.

    b. Watertight Riser and Barrel Assembly: Design the riser and all pipe connections to be completely watertight except for the inlet opening at the top or dewatering openings and should not have any other holes, leaks, rips or perforations.

    c. Basin Draw-Down: Draw down the water in the basin from the riser crest to the permanent pool over a 10 hour period through an internal orifice in a draw-down device. Include a draw-down device in the sediment basin plans submitted for approval and install during construction of the basin. Design a draw-down device if an orifice size other than those provided in Table G.4 is to be used. Design perforations in the horizontal or vertical dewatering device. Draw-down the water in such a manner as to remove the clean water without removing sediment that has settled out or floating debris. This should be done by constructing a perforated horizontal or vertical draw-down device with an internal orifice to control discharge. Other methods may be used with the approval of the local authority as long as detailed drawings are provided on the approved sediment control plans.

NOTE: If PVC pipe is used for the principal spillway then the concrete pipe chart will be used for hydraulic design. Use manufacturer specification for loading.

    d. Anti-Vortex Device and Trash Rack: Securely install on top of the riser an anti-vortex device and trash rack (concentric type) meeting these specifications for corrugated metal pipe risers and meeting MD 378 for all others.

    e. Base: Attach the riser to a base with a watertight connection of sufficient weight to prevent flotation of the riser. Concrete riser bases should be twice the diameter of the riser, a minimum of 18 inches thick, contain steel reinforcement as shown in Detail G-2-5, and have the riser embedded 9 inch minimum. Risers over 10 feet in height require that anti-floatation calculations be performed and be based on the following:

        1. Analyze the riser for floatation assuming all orifices and pipes are plugged.
        2. Provide the factor of safety against floatation of 1.2 or greater.

f. Precast Riser Connector: For risers constructed from precast concrete containing multiple sections, provide a mechanical connection at each joint as shown on Detail G-2-12 to prevent joint separation that may be caused by differential earth pressures in the embankment.

g. Anti-Seep Collars: When a filter diaphragm is not being used install anti-seep collars around all conduits through earth fills of impoundment structures according to the following criteria:

1. Place collars to increase the seepage length along the barrel by a minimum of 15 percent of the pipe length located within the saturation zone.

2. Space collar between 5 and 14 times the vertical projection of each collar.

3. Place collars within the saturation zone. In cases where spacing limit will not allow this, place at least one in the saturation zone.

4. **Make all anti-seep collars and their connections watertight.**

5. Place anti-seep collars a minimum of two feet from pipe joints.

6. Design anti-seep collars to a 2 foot minimum projection measured from the outside wall of the barrel.

h. Outlet: Provide an outlet including a means of conveying the discharge in an non-erosive manner to an existing stable channel. **Where discharge occurs at the property line, obtain drainage easements in accordance with local ordinances. Show adequate notes and references concerning the easements on the erosion and sediment control plan.** Provide protection against scour at the discharge end of the pipe spillway in accordance with the Standards and Specifications of Section D.

11. Weir Wall Spillway: Provide a spillway which consists of a concrete wall that is embedded in an embankment a minimum of five (5) feet. A weir in the wall is to be sized to pass the "routed" peak rate of runoff from a 10-year frequency storm event. The top of the weir wall is to be set a minimum of six inches below the top of embankment. Design the difference between the design high water elevation and the top of the weir wall to be at least a minimum of one (1) foot (see Detail G-2-13).

12. Emergency Spillways: Construct the entire flow area of the emergency spillway in undisturbed ground (not fill). Design the emergency spillway cross-section to be trapezoidal with a minimum bottom width of eight feet. Design the spillway channel with a straight, level control section of at least 25 feet in length. The exit channel section should have sufficient slope such that the discharge capacity of the spillway is not hindered in any way and allows the discharge to be released at a non-erosive velocity.

a. Capacity: Make the minimum capacity of the emergency spillway required to pass the peak rate of runoff from the 10-year 24-hour duration storm, less any reduction due to flow in the principal spillway. Determine the emergency spillway dimensions by using the method in Detail G-2-2 and Table G.7 or Figure G-2-2.

b. Velocities: Do not allow the velocity of flow in the exit channel to exceed 5 feet per second for vegetated channels. For channels with erosion protection other than vegetation, ensure velocities are within the non-erosive range for the type of protection used.

c. Freeboard: Freeboard is the difference between the design high water elevation in the emergency spillway and the top of the settled embankment. Design Freeboard to be at least a minimum of one (1) foot. Where no emergency spillway is provided, design the minimum freeboard to a minimum of two (2) feet.

13. Sediment Disposal: Indicate the method(s) of disposing of the sediment removed from the basin on the plans. Place the sediment in such a manner that it shall not erode from the site. Do not deposit the sediment downstream from the basin or adjacent to a stream or floodplain. **Disposal sites must be considered in an approved sediment control plan**. Indicate the method of disposal of the sediment after the contributory drainage area is stabilized and include the stabilization of the sediment basin site on the sediment basin plans. **Do not allow sediment to be flushed into a stream or drainage way.**

14. Dewatering: For dewatering basins, use the methods in Section F.

Construction Specifications

1. Site Preparation: Install perimeter sediment control practices necessary to install the basin prior to clearing and grubbing. Clear, grub, and strip topsoil to remove trees, vegetation, roots or other objectionable material from the areas where the embankment is to be placed. 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 all brush, trees, and other objectionable materials from the pool area (measured at the top of the pipe spillway).

2. Cut-off Trench: Excavate a cut-off trench along the centerline of earth fill embankments. Make the minimum depth four feet. Extend the cut-off trench up both abutments to the riser crest elevation. Make the minimum bottom two feet; wide enough to permit operation of excavation and compaction equipment. Make the side slopes no steeper than 1:1. Compaction requirements are the same as those for the embankment. Dewater the trench during the backfilling compaction operations. For dewatering, see Section F.

3. Embankment: Take the fill material from approved sources. Use clean mineral soil free of roots, woody vegetation, oversized stones, rocks, or other objectionable material. Do not use relatively pervious materials such as sand or gravel (Unified Soil Classes GW, GP, SW & 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. Use fill material containing 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 six-inch to eight inch thick continuous lifts over the entire length of the fill. Obtain compaction by passing 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 by the use of a compactor. Construct the embankment to an elevation 10 percent higher than the design height to allow for settlement.

4. Principal Spillway: Securely attach steel risers to the barrel or barrel stub by welding the full circumference making a watertight structural connection. Pour concrete risers with the principal spillway in place or pre-cast with voids around the principal spillway filled with concrete or shrink proof grout for watertight connection. Attach the barrel stub to the riser at the same percent (angle) of grade as the outlet conduit. Make the connection between the riser and the riser base watertight. Make all

connections between barrel sections by use of approved watertight band assemblies. Place the barrel and riser on a firm, smooth foundation of impervious soil as the embankment is constructed. **Do not breach the embankment to install the barrel.** Do not use pervious materials such as sand, gravel, or crushed stone as backfill around the pipe or anti-seep collars. Place the fill material around the pipe spillway in four (4) inch lifts and hand compact under and around the pipe to at least the same density as the adjacent embankment. Backfill over the principal spillway to a depth of 1.5 times the pipe diameter (minimum) and hand compact before crossing it with construction equipment.

5. Emergency Spillway: **Install the emergency spillway in undisturbed ground.** The achievement of planned elevations, grades, design width, entrance and exit channel slopes are critical to the successful operation of the emergency spillway. Construct the emergency spillway within a tolerance of $\pm$ 0.2 feet.

6. Vegetative Treatment: Stabilize the embankment in accordance with the appropriate vegetative Standard and Specifications immediately following construction. Do not allow the embankment to remain unstabilized for more than three (3) days. Once constructed, stabilize the top and outside face of the embankment with seed and mulch. Stabilize the remainder of the interior slopes with seed and mulch upon basin completion and monitor and maintain erosion free during the life of the basin.

7. Safety: Meet local requirements concerning fencing and signs, warning the public of hazards of soft sediment and floodwater.

8. Maintenance: Repair all damage caused by soil erosion and construction equipment at or before the end of each working day. Remove sediment from the basin when it reaches the specified distance below the top of the riser as shown on the riser. Place this sediment in such a manner that it will not erode from the site. Do not deposit the sediment downstream from the embankment, adjacent to a stream or floodplain. Stabilize disposal areas.

9. Final Disposal: When temporary structures have served their intended purpose and the contributing drainage area has been properly stabilized, the embankment and resulting sediment deposits are to be leveled or otherwise disposed of in accordance with the approved sediment control plan. The proposed use of a sediment basin site will often dictate final disposition of the basin and any sediment contained therein. If the site is scheduled for future construction, remove and safely dispose of the basin material and trapped sediments. Backfill the basin with a structural fill. When the basin area is to remain open space, Pump the pond dry (using methods in Section F - Dewatering). Backfill and grade the area and permanently stabilize.

10. Conversion to Stormwater Management Structure: After permanent stabilization of all disturbed contributory drainage areas, convert temporary sediment basins, if initially built and certified to meet permanent standards, to permanent stormwater management structures. To convert the basin from temporary to permanent use, modify the outlet structure in accordance with approved stormwater management design plans. Perform additional grading as necessary. Provide the required storage volume in the basin. Conversion can only take place after all contributory disturbed areas have been stabilized to the satisfaction of the inspection authority and storm drains have been flushed.

INFORMATION TO BE SUBMITTED

When sediment basin designs and construction plans are submitted for review to the Approval Authority, include the following:

1. Sediment controls necessary for the installation of the basin.

2. Specific location of the basin.

3. Plan view of the basin and emergency spillway showing existing and proposed contours.

4. Cross section of dam, including elevations at the top of earth fill at constructed and settled height, principal spillway and emergency spillway; profile of emergency spillway.

5. Details of pipe connections, riser to pipe connections, riser base, filter diaphragm, anti-seep collars, trash rack, cleanout elevation, and anti-vortex device.

6. Runoff calculations for the 10-year frequency storm assuming worst soil conditions.

7. Storage Computation:

   a. Total volume required including volumes of "wet" and "dry" storage.

   b. Total volume provided including volumes of "wet" and "dry" storage.

   c. Level of sediment at which cleanout shall be required, stated as a distance from the riser crest to the sediment surface.

8. Calculations showing design of pipe and emergency spillways.

9. Maintenance equipment access points.

10. Dewatering method (sump pit, etc.).

11. Bottom dimensions of basin.

12. Drainage Area Map clearly showing the maximum contributory drainage area to reach the basin.

13. Other information is required by the approval agency.

TEMPORARY SEDIMENT BASIN DESIGN DATA SHEET
INSTRUCTIONS FOR USE OF FORM

1. The minimum required volume of storage is 3600 cubic feet per acre (ft^3/ac) of drainage area. Compute the volume of basin storage using the entire contributory drainage area. Do not estimate storage based only on disturbed area.

2. The volume of a naturally shaped basin (no excavation) may be approximated by the formula Volume = 0.4 Ad, where Volume is in ft^3, A is the surface area of the basin in square feet (ft^2), and d is the maximum depth of the basin in feet (ft.). Compute volume from contour information or other suitable methods.

3. If the volume of the basin is not adequate for the required storage, excavate to obtain the required volume.

4. The volume of the basin for a permanent pool is 1800 ft^3/ac from each acre of drainage area. The basin is dewatered to this permanent pool elevation and volume through the draw-down device.

5. The volume of the basin for cleanout of settled sediment is ½ the wet storage volume. As the basin fills with sediment to this volume, remove the sediment to restore the original design volume.

6. Determine the design elevation for the minimum required storage volume of the basin. The design elevation is set at the riser crest to provide the required 3600 ft^3/ac of drainage area.

7. Determine the design elevation of the permanent pool level. Dewater the basin to this elevation using a draw-down device or perforations in the riser. The design elevation of the permanent pool corresponds to 1800 ft^3/ac of volume. The size of the internal orifice governs the discharges between the riser crest and permanent pool elevations, with the draw-down time being 10 hours (minimum).

8. Subtract the permanent pool elevation from the riser crest elevation.

9. Determine the elevation of basin cleanout, storage corresponding to ½ of the wet storage volume.

10. Subtract the cleanout elevation from the riser crest elevation. Clearly show on the riser the distance (ft.) between the riser crest elevation and cleanout elevation.

11. Compute the peak discharge rate for a 10-year, 24-hour storm event using approved NRCS methods (Q_{10}) assuming worst soil cover conditions.

12. Design the minimum principal spillway discharge capacity (Q_{ps}) under H(ft) head to be through an 8" pipe or 10 percent of Q_{10}, whichever is greater.

NOTE: If there is no emergency spillway then $Q_{ps} = Q_{10}$.

13. "H" is the distance in feet between the centerline of the outlet pipe and the emergency spillway crest. Determine the length of the barrel.

14. Determine the barrel diameter for Q_{ps} using Tables G.6 and G.7.

15. Determine the riser diameter, length, and "h" to release the principal spillway discharge using the solid lines on Table G.9. Set the riser crest 1 foot (minimum) below the emergency spillway (See Detail G-2-2).

16. Determine the trash rack and anti-vortex device size using Detail G-2-6.

17. Compute the capacity required for the emergency spillway (Qes) by subtracting the actual flow carried by the principal spillway from Q_{10}.

18. Using Table G.9 or Figure G-2-2 and Detail G-2-2, determine values of Hp and bottom width for the emergency spillway.

19. Determine the entrance channel slope.

20. Determine the exit channel slope.

21. Determine the anti-seep collar design. (See Table G.10 and Details G-2-3 and G-2-4).

22. Determine the number of anti-seep collars to use.

23. Determine the design elevation of the riser crest.

24. Design high water is the elevation of the emergency spillway crest plus the value of Hp.

25. Determine the design elevation of the emergency spillway.

26. The settled top of dam elevation requires 1.0 ft. minimum of freeboard above design high water. Design the minimum constructed top of dam elevation to include a 10% increase in height to allow for settlement.

27. Determine the elevation where 1/2 of the total storage volume is attained. This elevation, known as the permanent pool elevation, is also the invert elevation of the basin draw-down device.

28. Fill in the basin bottom elevation.

29. Fill in the draw-down orifice invert. For a horizontal draw-down device this elevation should be the same as the permanent pool elevation.

30. Compute the minimum basin surface area using the equation given on the Sediment Basin Design Data Sheet and Q_{10}.

31. Choose a basin draw-down orifice size from the Table G.5 or design one using the parameters given.

32. Using orifice area from Table G.5 or calculations, and a maximum perforation diameter of 1 inch (0.0055 ft^2 area), determine the length of pipe required to provide sufficient perforations so that the area of perforations (total) is greater than or equal to four times the internal orifice area.

Figure G.1: Temporary Sediment Basin Design Data Sheet

Computed by:__________________ Date: _______ Checked by: ___ Date:____________________________
Project name:_____________________ Basin #: ____
Location:____
____

Total area draining to basin: ______________ acres (ac)

Basin Volume Design

Note: 1. Also see Surface Area Design #30, this form.

2. To convert ft^3 to yd^3, divide ft^3 by 27. To convert ft^2 to yd^2, divide ft^2 by 9.

1. Min. required vol. = 3600 ft^3/ac x _______ ac. drainage = _______ ft^3
2. Actual Volume of basin =___________ft^3
3. Excavate ___________ft^3 (__________yd^3) to obtain required capacity.
4. Vol. at dewatering elev. = 1800 ft^3/ac x _______ ac. = _________ ft^3
5. Vol. of basin at cleanout = ½ x _______ ft^3. = _________ ft^3
6. Elev. corresponding to min. required volume of basin (**at or below** riser crest elev.) ____________ ft.
7. Permanent pool elevation _________ ft.
8. Distance from riser crest elevation to permanent pool elevation __________ ft.
9. Basin cleanout elevation _________ ft.
10. Distance from riser crest elevation to cleanout elevation__________ ft.

Spillway Design (See Detail G-2-1)

11. Q_{10} = __________cfs (peak discharge from 10-yr, 24-hr storm event, attach computations)

Principal Spillway (Qps) (See Detail G-2-1)

12. Design Principal Spillway (Barrel) discharge, Design Q_{ps} = __________ cfs (min. 10% of 10 year peak or 8 inch Diameter Pipe)
13. H = __________ ft.; Barrel length = __________ ft.
14. Barrel Diam. _____ in. **Note: Q_{ps} must equal or exceed Design Q_{ps}**
Q_{ps} = Q _____ x (length correction factor) _____ = _____ cfs.
15. Riser Diameter _____ in.; Riser Height _____ ft.; Riser Head (h) = _____ ft.
16. Trash Rack Diam. _____ in.; Trash Rack Height = _____ in.

NOTE: Include a table showing design data on the plan for each basin.

Emergency Spillway (Qes) (See Detail G-2-2)

17. Emergency spillway cap., $Q_{es} = Q_{10} - Q_{ps}$ =_____ -_____ =_____cfs
18. Width _____ ft; Hp _____ft
19. Entrance channel slope __________%.
20. Exit channel slope __________%

Anti-Seep Collar Design (If Required) (See Detail G-2-3)

21. y = _____ ft.; z =_____:1; pipe slope = _____ %; Ls = _____ ft
22. Use _____ collars, _____ ft. - _____ in. square; projection = _____ ft.

Design Elevations

23. Riser Crest =__________ ft.
24. Design High Water =__________ft.
25. Emergency Spillway Crest =__________ ft.
26. Min. settled top of dam =__________ ft.
27. Permanent pool =__________ ft.
28. Bottom of Basin =__________ ft.
29. Draw-down orifice invert =__________ ft.

Surface Area Design

30. Min. basin surface area; SA $\geq$ 0.0035 x Q_{10} = 0.0035 x _____ cfs $\leq$ =______ ac. $\leq$________ac.
required **provided**

Draw-Down Device

31. Draw-down device orifice diameter = __________ in. (From Table G.5)
32. A_t = Total area of perforations $\geq 4A_o$

A_t= (# of perforation/foot)(perforation area ft^2)(perforated section length ft.)

A_t= _______ft^2

A_o = Internal orifice area (from Table G.5 or computed)

Table G.5: Draw-Down Device Orifice Area and Diameter

Drainage Area (acres)	Maximum Orifice Diameter (d_o)	Maximum Orifice Area (A_o)
5-10	4 IN	0.087 ft^2
10-20	6 IN	0.20 ft^2
20-40	8 IN	0.34 ft^2
40-60	10 IN	0.55 ft^2
60-80	12 IN	0.79 ft^2
80-100	15 IN	1.07 ft^2

Draw-Down Device Equations

$$Q_{d\text{-}d}\ (\text{cfs}) = \frac{(1800\ \text{cf/acre})(\text{number of acres})}{(10\ \text{hours})(3600\ \text{seconds/hour})}$$

$$A_o = \frac{Q_{d-d}}{C\sqrt{2gh_{d-d}}} \qquad\qquad d_o = \frac{4A_o}{\pi}$$

$h_{d\text{-}d}$ = 2/3 (Riser Crest Elevation - Wet Storage Elevation)
C = Constant = 0.6
A_o = Internal Orifice Area ($ft.^2$)
π = Constant = 3.142
d_o = Maximum Orifice Diameter
g = Gravitational Constant = 32.166 ft/s^2

Table G.6: Corrugated Metal Pipe Inlet Flow Chart

70 Feet of Corrugated Metal Pipe Conduit $K_m = K_e + K_b = 1.00$
(Full Flow Assumed, n=0.025,,Flow in cubic feet per second)

H/D	6"	8"	10"	12"	15"	18"	21"	24"	30"	36"	42"	48"	54"	60"	66"	72"
1'	0.33	0.70	1.25	1.98	3.48	5.47	7.99	11.0	18.8	28.8	41.1	55.7	72.6	91.8	113	137
2'	0.47	0.99	1.76	2.80	4.92	7.74	11.3	15.6	26.6	40.8	58.2	78.8	103	130	160	194
3'	0.58	1.22	2.16	3.43	6.02	9.48	13.8	19.1	32.6	49.9	71.2	96.5	126	159	196	237
4'	0.67	1.40	2.49	3.97	6.96	10.9	16.0	22.1	37.6	57.7	82.3	111	145	184	226	274
5'	0.74	1.57	2.79	4.43	7.78	12.2	17.9	24.7	42.1	64.5	92.0	125	162	205	253	306
6'	0.82	1.72	3.05	4.86	8.52	13.4	19.6	27.0	46.1	70.6	101	136	178	225	277	336
7'	0.88	1.86	3.30	5.25	9.20	14.5	21.1	29.2	49.8	76.3	109	147	192	243	300	362
8'	0.94	1.99	3.53	5.61	9.84	15.5	22.6	31.2	53.2	81.5	116	158	205	260	320	388
9'	1.00	2.11	3.74	5.95	10.4	16.4	24.0	33.1	56.4	86.5	123	167	218	275	340	411
10'	1.05	2.22	3.94	6.27	11.0	17.3	25.3	34.9	59.5	91.2	130	176	230	290	358	433
11'	1.10	2.33	4.13	6.58	11.5	18.2	26.5	36.6	62.4	95.6	136	185	241	304	376	454
12'	1.15	2.43	4.32	6.87	12.1	19.0	27.7	38.2	65.2	99.9	142	193	252	318	392	475
13'	1.20	2.53	4.49	7.15	12.6	19.7	28.8	39.8	67.8	104	148	201	262	331	408	494
14'	1.25	2.63	4.66	7.42	13.0	20.5	29.9	41.3	70.4	108	154	208	272	343	424	513
15'	1.29	2.72	4.83	7.68	13.5	21.2	30.9	42.8	72.8	112	159	216	281	355	439	531

L (FT) — CORRECTION FACTORS FOR OTHER PIPE LENGTHS

20	1.69	1.63	1.58	1.53	1.47	1.42	1.37	1.34	1.28	1.24	1.20	1.18	1.16	1.14	1.13	1.11
30	1.44	1.41	1.39	1.36	1.32	1.29	1.27	1.24	1.21	1.18	1.15	1.13	1.12	1.11	1.10	1.09
40	1.28	1.27	1.25	1.23	1.21	1.20	1.18	1.17	1.14	1.12	1.11	1.10	1.09	1.08	1.07	1.06
50	1.16	1.16	1.15	1.14	1.13	1.12	1.11	1.10	1.09	1.08	1.07	1.06	1.06	1.05	1.05	1.04
60	1.07	1.07	1.07	1.06	1.06	1.05	1.05	1.05	1.04	1.04	1.03	1.03	1.03	1.02	1.02	1.02
70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
80	.94	.94	.95	.95	.95	.95	.96	.96	.96	.97	.97	.97	.98	.98	.98	.98
90	.89	.89	.90	.90	.91	.91	.92	.92	.93	.94	.94	.95	.95	.96	.96	.96
100	.85	.85	.86	.86	.87	.88	.89	.89	.90	.91	.92	.93	.93	.94	.94	.95
120	.78	.79	.79	.80	.81	.82	.83	.83	.85	.86	.87	.89	.89	.90	.91	.92
140	.72	.73	.74	.75	.76	.77	.78	.79	.81	.82	.84	.85	.86	.87	.88	.89
160	.68	.69	.69	.70	.71	.73	.74	.75	.77	.79	.80	.82	.83	.84	.85	.86

Table G.7: Reinforced Concrete Pipe Inlet Flow Chart

70 Feet of Reinforced Concrete Pipe Conduit $K_m = K_e + K_b = 1.00$
(Full Flow Assumed, n=0.013, Diameter of Pipe in Inches,
H in Feet, Flow in cubic feet per second)

H\D	12"	15"	18"	21"	24"	30"	36"	42"	48"	54"	60"	66"	72"	78"	84"	90"	96"	102"
1'	3.08	5.17	7.83	11.1	14.9	24.2	35.8	49.7	65.8	84.2	105	128	153	180	210	242	276	312
2'	4.35	7.31	11.1	15.7	21.0	34.2	50.6	70.3	93.1	119	148	181	216	255	297	342	390	441
3'	5.33	8.95	13.6	19.2	25.8	41.9	62.0	86.1	114	146	182	221	265	312	363	419	478	541
4'	6.15	10.3	15.7	22.1	29.8	48.4	71.6	99.4	132	168	210	255	306	360	420	483	552	624
5'	6.88	11.6	17.5	24.7	33.3	54.1	80.1	111	147	188	234	286	342	403	469	540	617	698
6'	7.54	12.7	19.2	27.1	36.4	59.3	87.7	122	161	206	257	313	374	441	514	592	676	765
7'	8.14	13.7	20.7	29.3	39.4	64.0	94.8	131	174	223	277	338	404	477	555	640	730	826
8'	8.70	14.6	22.2	31.3	42.1	68.5	101	141	186	238	297	361	432	510	594	684	780	883
9'	9.23	15.5	23.5	33.2	44.6	72.6	107	149	197	253	315	383	459	541	630	725	827	936
10'	9.73	16.3	24.8	35.0	47.0	76.5	113	157	208	266	332	404	483	570	664	764	872	987
11'	10.2	17.1	26.0	36.7	49.3	80.3	119	165	218	279	348	424	507	598	696	802	915	1035
12'	10.7	17.9	27.1	38.3	51.5	83.9	124	172	228	292	363	442	530	624	727	837	955	1081
13'	11.1	18.6	28.2	39.9	53.6	87.3	129	179	237	304	378	461	551	650	757	872	994	1125
14'	11.5	19.3	29.3	41.4	55.7	90.6	134	186	246	315	392	478	572	674	785	904	103	1168
15'	11.9	20.0	30.3	42.9	57.6	93.8	139	192	255	326	406	495	592	698	813	936	106	1209

L (ft) CORRECTION FACTORS FOR OTHER PIPE LENGTHS

20	1.30	1.24	1.21	1.18	1.15	1.12	1.10	1.08	1.07	1.06	1.05	1.05	1.04	1.04	1.03	1.03	1.03	1.03
30	1.22	1.18	1.15	1.13	1.12	1.09	1.08	1.07	1.05	1.05	1.04	1.04	1.03	1.03	1.03	1.02	1.02	1.02
40	1.15	1.13	1.11	1.10	1.08	1.07	1.05	1.05	1.04	1.03	1.03	1.03	1.02	1.02	1.02	1.02	1.02	1.02
50	1.09	1.08	1.07	1.06	1.05	1.04	1.04	1.03	1.03	1.02	1.02	1.02	1.02	1.01	1.01	1.01	1.01	1.01
60	1.04	1.04	1.03	1.03	1.03	1.02	1.02	1.02	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
80	.96	.97	.97	.97	.98	.98	.98	.99	.99	.99	.99	.99	.99	.99	.99	.99	.99	.99
90	.93	.94	.94	.95	.95	.96	.97	.97	.98	.98	.98	.98	.98	.99	.99	.99	.99	.99
100	.90	.91	.92	.93	.93	.95	.95	.96	.97	.97	.97	.98	.98	.98	.98	.98	.98	.99
120	.84	.86	.87	.89	.90	.91	.93	.94	.94	.95	.96	.96	.96	.97	.97	.97	.97	.98
140	.80	.82	.83	.85	.86	.88	.90	.91	.92	.93	.94	.94	.95	.95	.96	.96	.96	.97
160	.76	.78	.80	.82	.83	.86	.88	.89	.90	.91	.92	.93	.94	.94	.95	.95	.95	.96

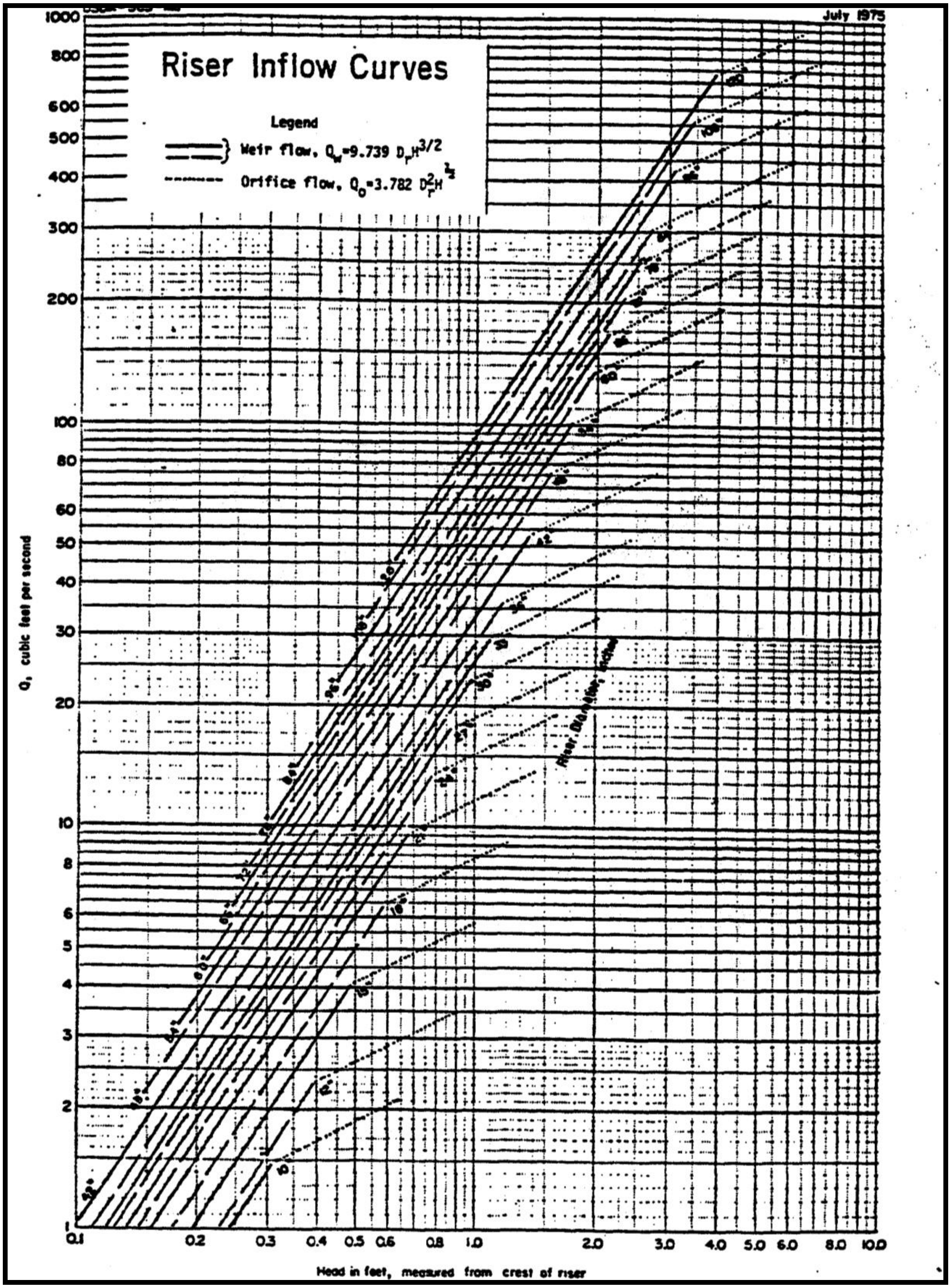
Table G.8: Design Data for Earth Spillways

STAGE (Hp) IN FEET	SPILLWAY VARIABLES	BOTTOM WIDTH (b) IN FEET																
		8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
0.5	Q	6	7	8	10	11	13	14	15	17	18	20	21	22	24	25	27	28
	V	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
	S	3.9	3.9	3.9	3.9	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
0.6	Q	8	10	12	14	16	18	20	22	24	26	28	30	32	34	35	37	39
	V	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	S	3.7	3.7	3.7	3.7	3.6	3.7	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
0.7	Q	11	13	16	18	20	23	25	28	30	33	35	38	41	43	44	46	48
	V	3.2	3.2	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
	S	3.5	3.5	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
0.8	Q	13	16	19	22	26	29	32	35	38	42	45	46	48	51	54	57	60
	V	3.5	3.5	3.5	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
	S	3.3	3.3	3.3	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
0.9	Q	17	20	24	28	32	35	39	43	47	51	53	57	60	64	68	71	75
	V	3.7	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
	S	3.2	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
1.0	Q	20	24	29	33	38	42	47	51	56	61	63	68	72	77	81	86	90
	V	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	S	3.1	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
1.1	Q	23	28	34	39	44	49	54	60	65	70	74	79	84	89	95	100	105
	V	4.2	4.2	4.2	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
	S	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
1.2	Q	28	33	40	45	51	58	64	69	76	80	86	92	98	104	110	116	122
	V	4.4	4.4	4.4	4.4	4.4	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
	S	2.9	2.9	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
1.3	Q	32	38	46	53	58	65	73	80	86	91	99	106	112	119	125	133	140
	V	4.5	4.6	4.6	4.6	4.6	4.6	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7
	S	2.8	2.8	2.8	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
1.4	Q	37	44	51	59	66	74	82	90	96	103	111	119	127	134	142	150	158
	V	4.7	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
	S	2.8	2.7	2.7	2.7	2.7	2.7	2.7	2.6	2.5	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
1.5	Q	41	50	58	66	75	85	92	101	108	116	125	133	142	150	160	169	178
	V	4.8	4.9	4.9	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.1	5.1	5.1
	S	2.7	2.7	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5	2.5	2.5
1.6	Q	46	56	65	75	84	94	104	112	122	132	142	149	158	168	178	187	197
	V	5.0	5.1	5.1	5.1	5.1	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
	S	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
1.7	Q	52	62	72	83	94	105	115	126	135	146	156	167	175	187	196	206	217
	V	5.2	5.2	5.2	5.3	5.3	5.3	5.3	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4
	S	2.6	2.6	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
1.8	Q	58	69	81	93	104	116	127	139	150	160	171	182	194	204	214	226	233
	V	5.3	5.4	5.4	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.6	5.6	5.6	5.6	5.6	5.6
	S	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
1.9	Q	64	76	88	102	114	127	140	152	164	175	188	201	213	225	235	248	260
	V	5.5	5.5	5.5	5.6	5.6	5.6	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7
	S	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
2.0	Q	71	83	97	111	125	138	153	164	178	193	204	218	232	245	256	269	283
	V	5.6	5.7	5.7	5.7	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.9	5.9	5.9	5.9	5.9	5.9
	S	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
2.1	Q	77	91	107	122	135	149	162	177	192	207	220	234	250	267	276	291	305
	V	5.7	5.8	5.9	5.9	5.9	5.9	5.9	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	S	2.4	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3

DATA TO RIGHT OF HEAVY VERTICAL LINES SHOULD BE USED WITH CAUTION, AS THE RESULTING SECTIONS WILL BE EITHER POORLY PROPORTIONED, OR HAVE VELOCITIES IN EXCESS OF 6 FEET PER SECOND.

Source: USDA-SCS

Table G.9: Riser Inflow Curves



DESIGNING ANTI-SEEP COLLARS

(REFER TO DETAIL G-2-3)

1. Determine the length of pipe within the saturation zone of the embankment (L_S) either graphically or by using the following equation, assuming that the upstream slope of the embankment intersects the invert of the pipe at its upstream end and that the slope of the pipe (S_o) is constant.

$$L_S = \frac{Y(Z+4)}{(1-4\,S_o)}$$

2. Determine the vertical projection (P_1) required to increase L_s by 15% either graphically as shown on Table G.9 or by using the equation:

$$P_1 = 0.075\ L_S$$

3. Choose the actual vertical projection (2 foot minimum) of each anti-seep collar (P) by rounding up P_1 or rounding down P_1 and using multiple collars.

4. Determine the number of anti-seep collars (N) required of the chosen vertical projection (P) using equation:

$$\frac{P_1}{P} = N$$

5. Either round up N or repeat steps 3 and 4 to determine optimum P/N relationship.

6. Provide construction specifications relative to the materials to be used and method for anchoring the anti-seep collar(s) to the pipe in a watertight manner.

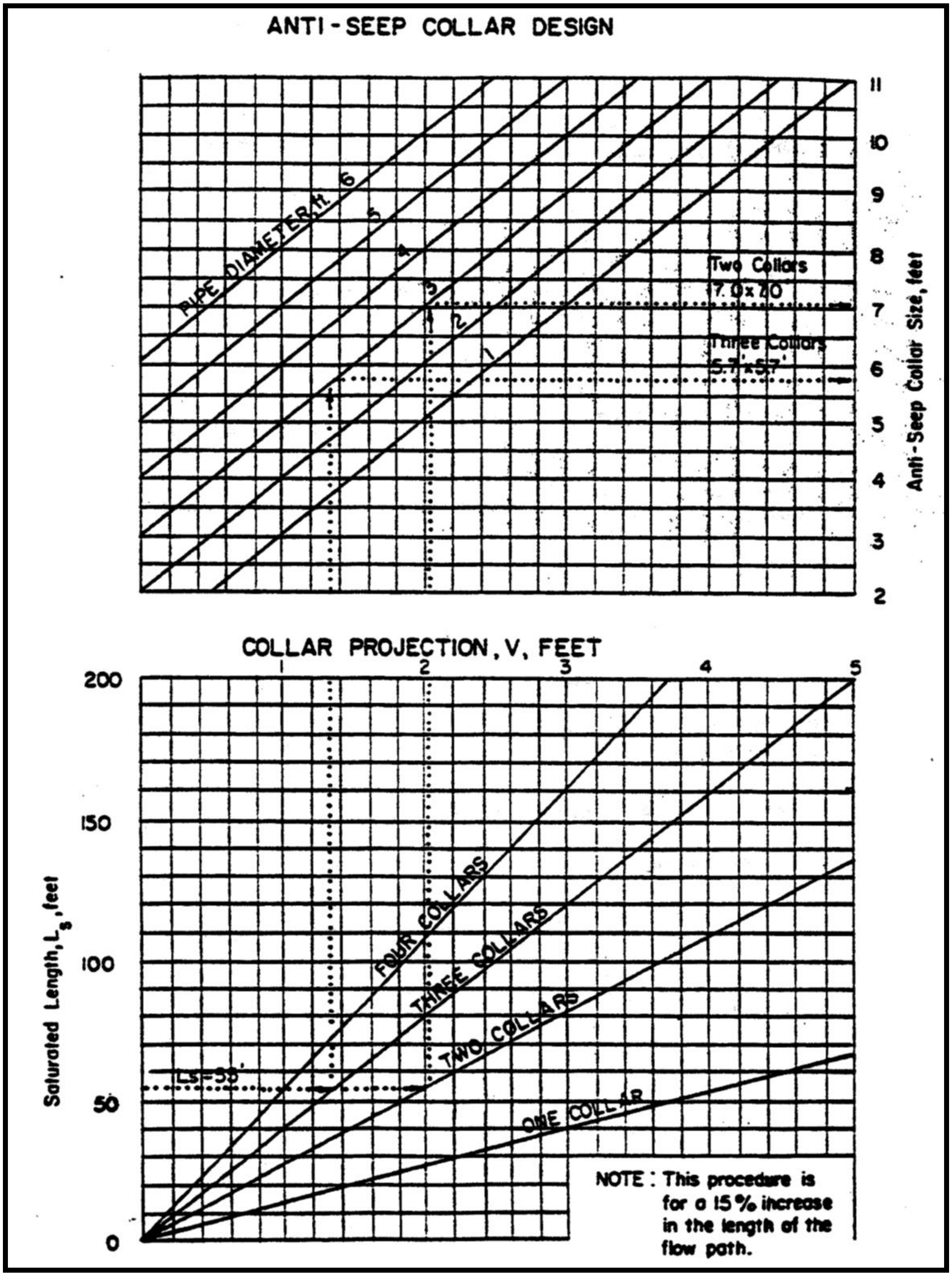
7. Space anti-seep collar(s) between 5 and 14 times the vertical projection of each collar.

8. Extend anti-seep collar dimensions a minimum of 2 feet in all directions around the pipe.

9. Place anti-seep collars a minimum of two feet from pipe joints.

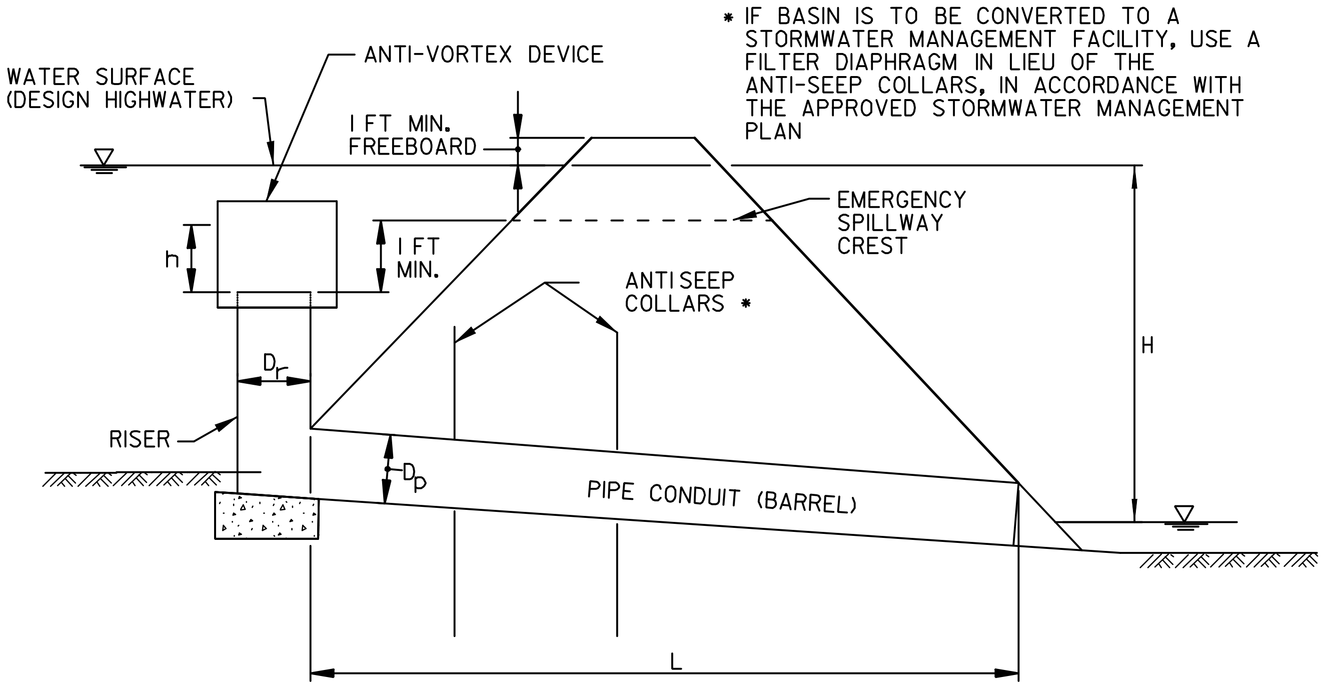
10. Place anti-seep collars within the saturation zone. In cases where the spacing limit will not allow this, place at least one collar in the saturation zone.

Table G.10: Anti-Seep Collar Design



DETAIL G-2-1 - PIPE SPILLWAY DESIGN

STANDARD SYMBOL



LEGEND

H	=	HEAD ON PIPE SPILLWAY (PIPE FLOW), IN FEET (MEASURED FROM THE CENTERLINE OF OUTLET OR TAILWATER ELEVATION, WHICHEVER IS GREATER, TO EMERGENCY SPILLWAY CREST OR TO DESIGN HIGH WATER, WHICHEVER IS GREATER.
h	=	HEAD OVER RISER CREST, IN FEET (INSIDE THE ANTI-VORTEX DEVICE).
L	=	LENGTH OF PIPE IN FEET.
D_p	=	DIAMETER OF PIPE CONDUIT (BARREL).
D_r	=	DIAMETER OF RISER.

FIGURE G.2 - EMERGENCY SPILLWAY

LEGEND

n = MANNING'S ROUGHNESS COEFFICIENT.
Hp = DIFFERENCE IN ELEVATION BETWEEN THE CREST OF THE EMERGENCY SPILLWAY IN THE CONTROL SECTION AND WATER SURFACE OF THE RESERVOIR, IN FEET.
b = BOTTOM WIDTH OF EMERGENCY SPILLWAY AT THE CONTROL SECTION, IN FEET. (8 FT MINIMUM)
Qc = TOTAL DISCHARGE, IN CUBIC FEET PER SECOND.
Vc = VELOCITY, IN FEET PER SECOND, THAT WILL EXIST IN THE CHANNEL BELOW THE CONTROL SECTION, AT DESIGN Qc, IF CONSTRUCTED TO SLOPE (Sc) THAT IS SHOWN. (Vmax. = 5 FPS.)
Sc = FLATTEST SLOPE (Sc), 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 = 2
Yc= CRITICAL DEPTH AT THE CONTROL SECTION.
Ac= FLOW AREA AT CRITICAL DEPTH
T = TOP WIDTH OF FLOW AT CRITICAL DEPTH
Hec= ENERGY AT CRITICAL DEPTH
a= CORRECTION FACTOR
Hp= HEAD ON EMERGENCY SPILLWAY
R= HYDRAULIC RADIUS AT CRITICAL DEPTH

NOTES

1. FOR A GIVEN Hp A DECREASE IN THE EXIT SLOPE FROM Sc, DECREASES THE SPILLWAY DISCHARGE BUT INCREASING THE EXIT SLOPE FROM Sc DOES NOT INCREASE THE DISCHARGE. IF AN EXIT SLOPE (Se) STEEPER THAN Sc IS USED, THEN THE VELOCITY (Ve) IN THE EXIT CHANNEL WILL INCREASE ACCORDING TO THE FOLLOWING RELATIONSHIP:

$$V_e = V_c \left(\frac{S_e}{S_c} \right)^{0.3}$$

(1) $Ac = (b + ZYc)\,Yc$,

(2) $T = b + 2ZYc$

(3) $Qc = \mathrm{SQRT}\,(gA^3/T)$

(4) $Vc = \mathrm{SQRT}\,(gA/T)$,

(5) $Hec = Yc + Vc^2/2g$,

(6) $a = (4.32n^2)/Hec^{1.33}$,

(7) $Hp = Hec\,(1 + aL)$,

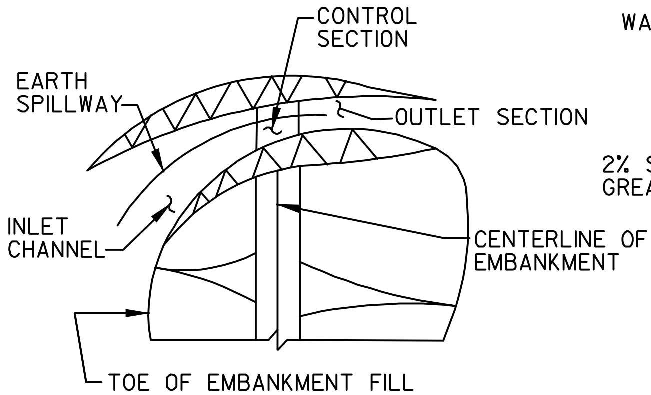
(8) $R = (b + ZYc)\,Yc/\,(b + 2Yc\,\mathrm{SQRT}(1 + Z^2))$,

(9) $Sc = 14.56n^2A/\,(R^{1.33})\,T$,

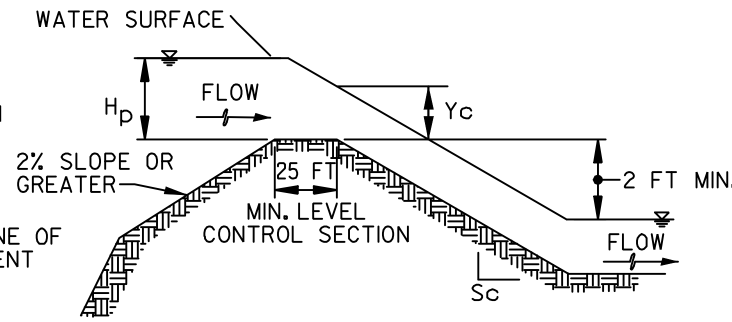
SELECTED Yc (ft)	Ac (ft²)	T (ft)	Qc (cfs)	Vc (fps)	Hec (ft)	a	Hp (ft)	R (ft)	Sc (ft/ft)		ELEV
0.00			0.00								0.00

DETAIL G-2-2 - EMERGENCY SPILLWAY

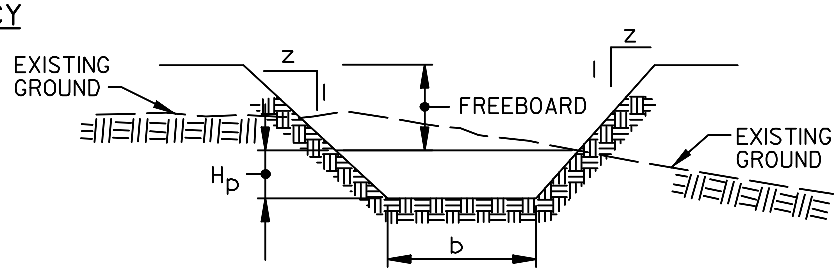
STANDARD SYMBOL



PLAN VIEW OF EMERGENCY SPILLWAY



PROFILE ALONG CENTERLINE OF EMERGENCY SPILLWAY



CROSS SECTION OF EMERGENCY SPILLWAY AT CONTROL SECTION

LEGEND

Hp = DIFFERENCE IN ELEVATION BETWEEN THE CREST OF THE EMERGENCY SPILLWAY IN 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)

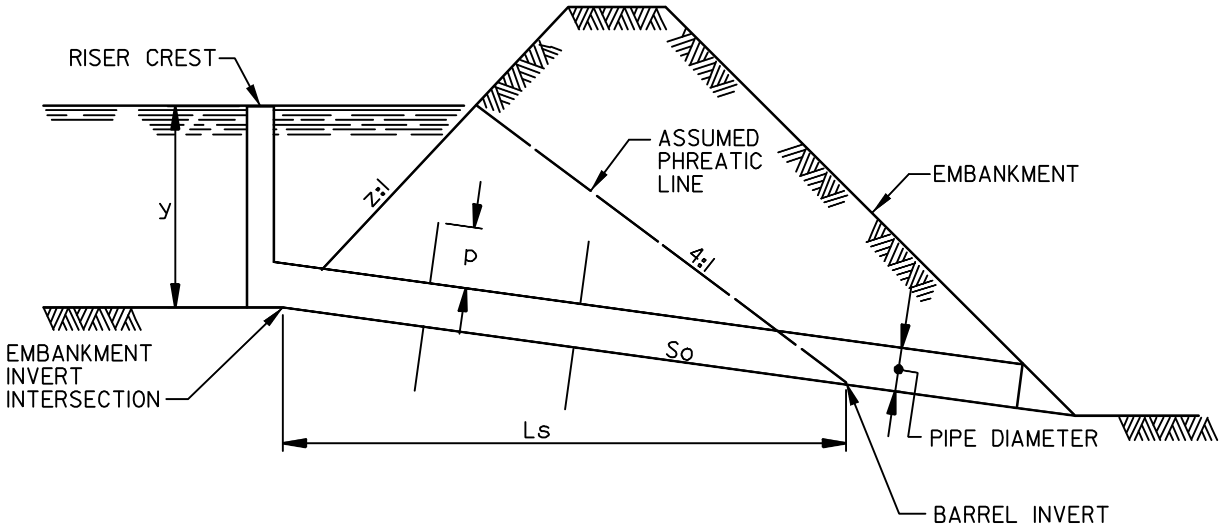
Sc = FLATTEST SLOPE (Sc), IN PERCENT, ALLOWABLE FOR THE CHANNEL BELOW THE CONTROL SECTION.

z = SIDE SLOPE RATIO. MINIMUM z = 2

Yc = CRITICAL DEPTH AT THE CONTROL SECTION.

DETAIL G-2-3 - ANTI-SEEP COLLAR DESIGN

STANDARD SYMBOL



ANTI-SEEP COLLAR DESIGN

LEGEND

p = PERPENDICULAR PROJECTION OF ANTI-SEEP COLLAR (FEET). (2 FEET MINIMUM)

Ls = LENGTH OF PIPE IN THE SATURATED ZONE (FEET)

y = DISTANCE IN FEET FROM UPSTREAM INVERT OF PIPE TO THE CREST OF THE RISER.

z = SLOPE OF UPSTREAM EMBANKMENT AS A RATIO OF z FEET HORIZONTAL TO ONE FOOT VERTICAL.

So = SLOPE OF PIPE IN FEET PER FOOT.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

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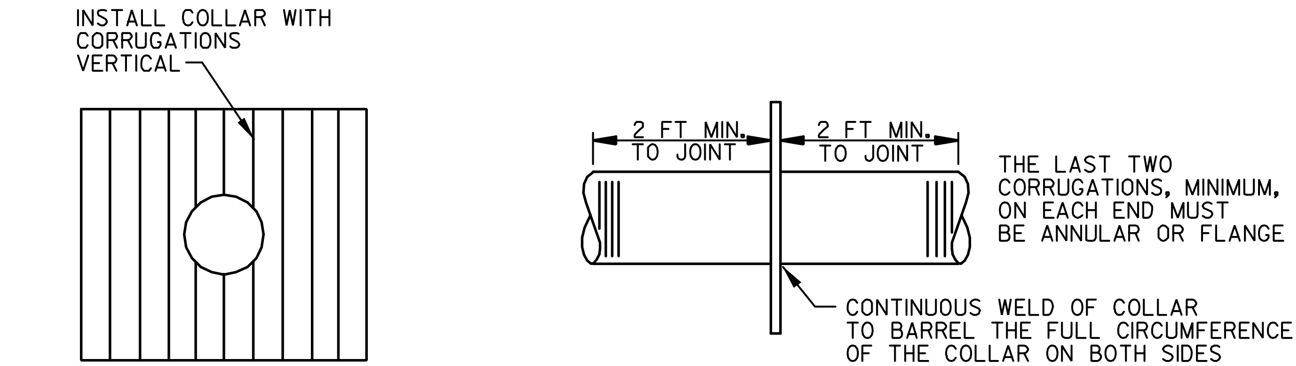
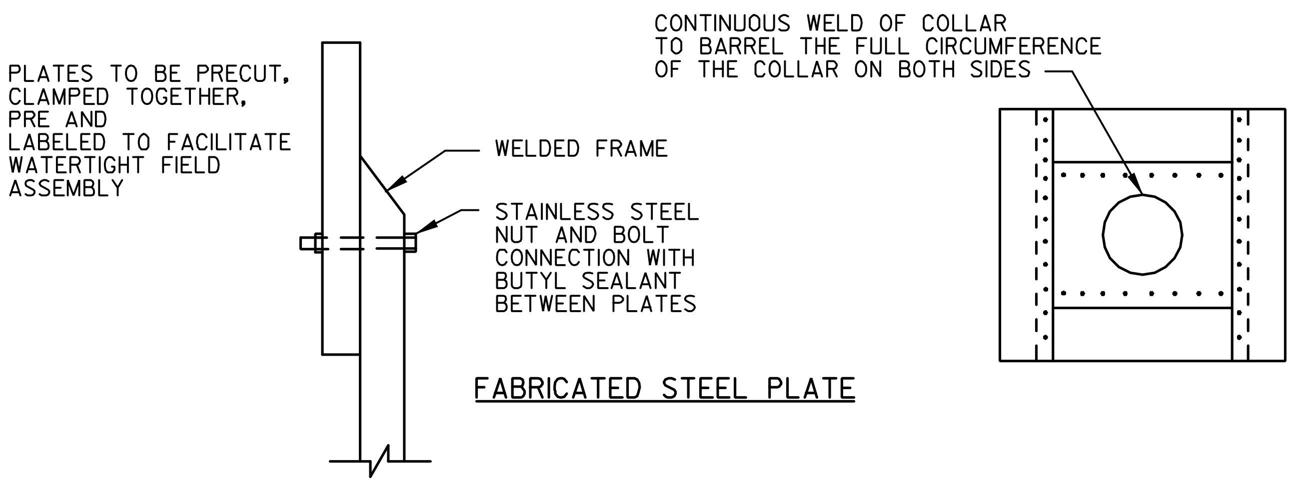
DETAIL G-2-4 - TYPICAL METAL ANTI-SEEP COLLARS

STANDARD SYMBOL



CORRUGATED COLLAR WELDED IN PLACE ON BARREL SECTION



FABRICATED STEEL PLATE

COLLAR FOR FLANGE JOINT PIPE

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

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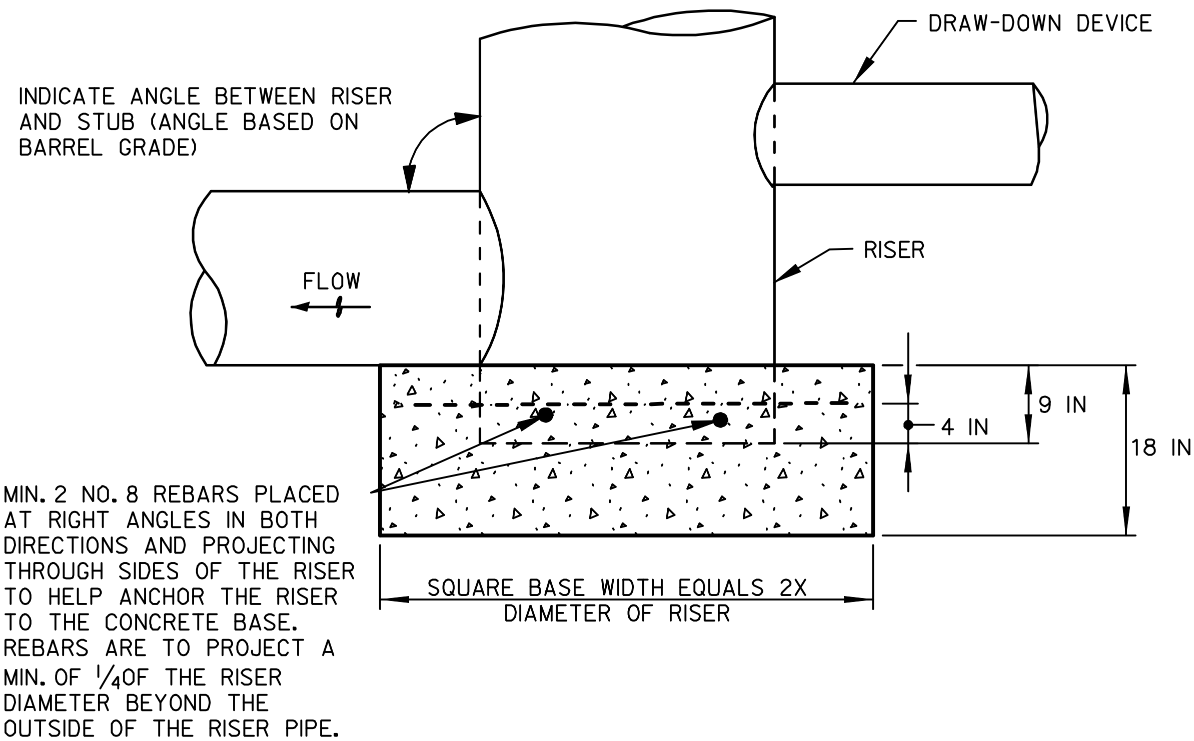
DETAIL G-2-5 - RISER BASE

STANDARD SYMBOL



CONSTRUCTION SPECIFICATIONS

ATTACH BASE TO RISER WITH A WATERTIGHT CONNECTION AND SUFFICIENT WEIGHT TO PREVENT FLOTATION OF THE RISER. AN APPROVED BASE FOR RISER 10 FEET OR LESS IN HEIGHT IS:

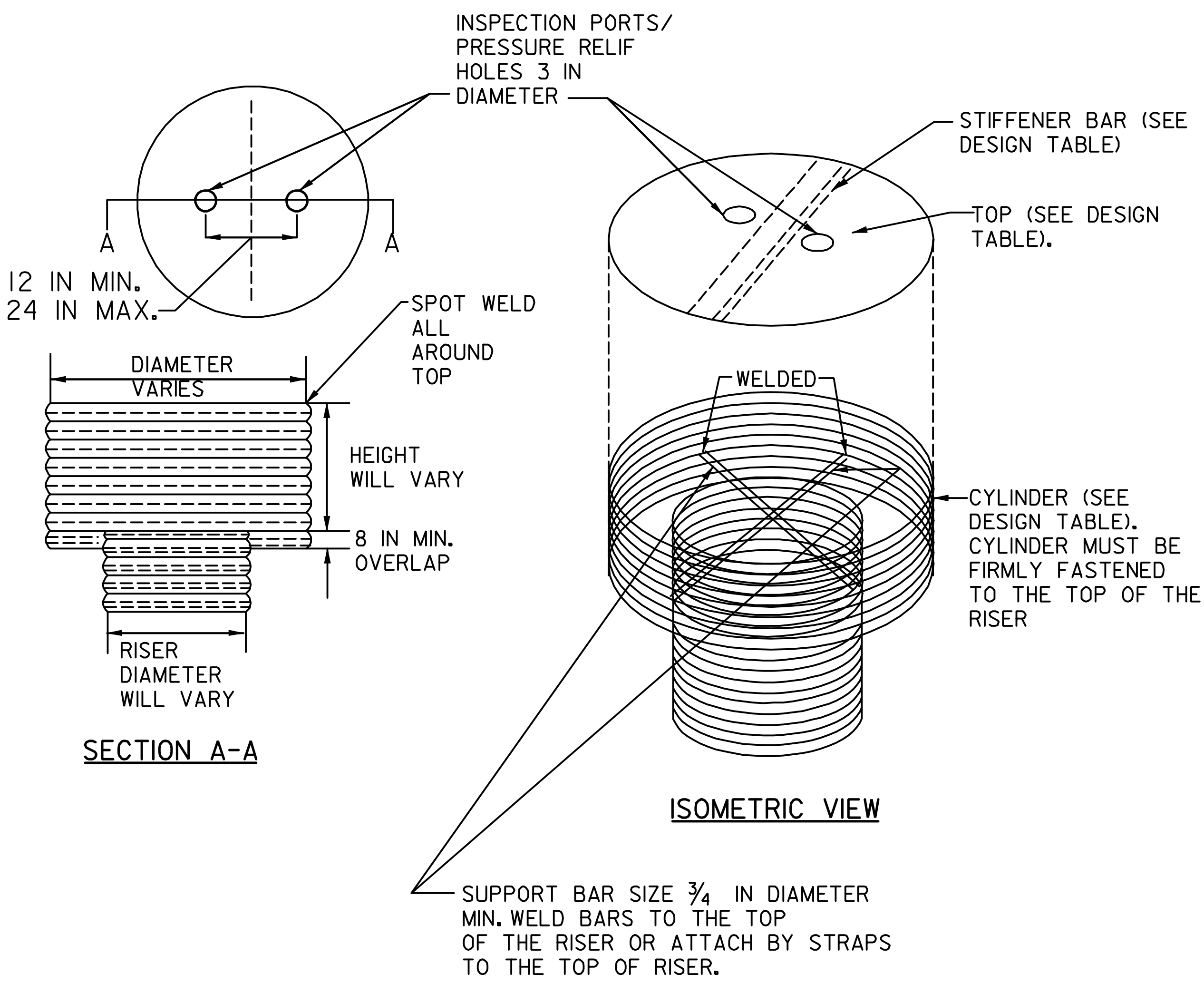
1. A CONCRETE BASE 18 INCHES THICK MINIMUM WITH THE RISER EMBEDDED 9 INCHES IN THE BASE, OR

2. MAKE EACH SIDE OF THE SQUARE BASE TWICE THE RISER DIAMETER.

NOTE: FOR RISERS GREATER THAN TEN FEET HIGH, PROVIDE COMPUTATIONS FOR THE DESIGN OF A BASE WHICH WILL PREVENT FLOATATION WITH A MINIMUM FACTOR OF SAFETY OF 1.20 (DOWNWARD FORCES = 1.20 X UPWARD FORCES).

DETAIL G-2-6 - CONCENTRIC TRASH RACK AND ANTI-VORTEX DEVICE

STANDARD SYMBOL



1 OF 2

DETAIL G-2-6 - CONCENTRIC TRASH RACK AND ANTI-VORTEX DEVICE SECOND PANEL

STANDARD SYMBOL

RISER DIAM. IN	TRASH ROCK CYLINDER DIAM. IN.	TRASH ROCK CYLINDER THICK GAGE	H. IN	MINIMUM SIZE SUPPORT BAR	MINIMUM TOP THICKNESS	MINIMUM TOP STIFFENER
12	18	16	6	#6 REBAR	16 GA.	N/A
15	21	16	7	#6 REBAR	16 GA.	N/A
18	27	16	8	#6 REBAR	16 GA.	N/A
21	30	16	11	#6 REBAR	16 GA.	N/A
24	36	16	13	#6 REBAR	14 GA.	N/A
27	42	16	13	#6 REBAR	14 GA.	N/A
36	54	14	17	#8 REBAR	12 GA.	N/A
42	60	14	19	#8 REBAR	12 GA.	N/A
48	72	12	21	1-1/4 IN PIPE OR 1-1/4 x 1-1/4 x $^1/_4$ ANGLE	10 GA.	N/A
54	78	12	25	1-1/4 IN PIPE OR 1-1/4 x 1-1/4 x $^1/_4$ ANGLE	10 GA.	N/A
60	90	12	29	1-1/2 IN PIPE OR 1-1/2 x 1-1/2 x $^1/_4$ ANGLE	8 GA.	N/A
66	96	10	33	2 IN PIPE OR 2 x 2 x $^3/_{16}$ ANGLE	8 GA. W/STIFFENER	2x2x1/4 ANGLE
72	102	10	36	2 IN PIPE OR 2 x 2 x $^3/_{16}$ ANGLE	8 GA. W/STIFFENER	2-1/2x2-1/2x1/4 ANGLE
78	114	10	39	2-1/2 IN PIPE OR	8 GA.	2-1/2x2-1/2x1/4 ANGLE
84	120	10	42	2-1/2 IN PIPE OR 2-1/2 x 2-1/2 x 5/6 ANGLE	8 GA. W/STIFFENER	2-1/2x2-1/2x5/16 ANGLE

NOTE: THE ABOVE TRASH RACK AND ANTI-VORTEX DEVICE INFORMATION IS FOR CORRUGATED METAL PIPE ONLY. CONCRETE RISERS MUST MEET THE REQUIREMENTS OF MD 378.

2 OF 2

DETAIL G-2-7 - SEDIMENT BASIN BAFFLES

STANDARD SYMBOL
BB

D= DISTANCE BETWEEN INFLOW AND OUTFLOW

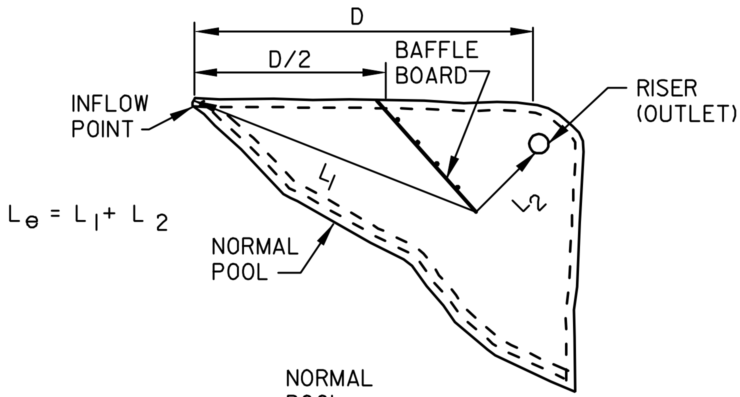
A= AREA OF NORMAL POOL

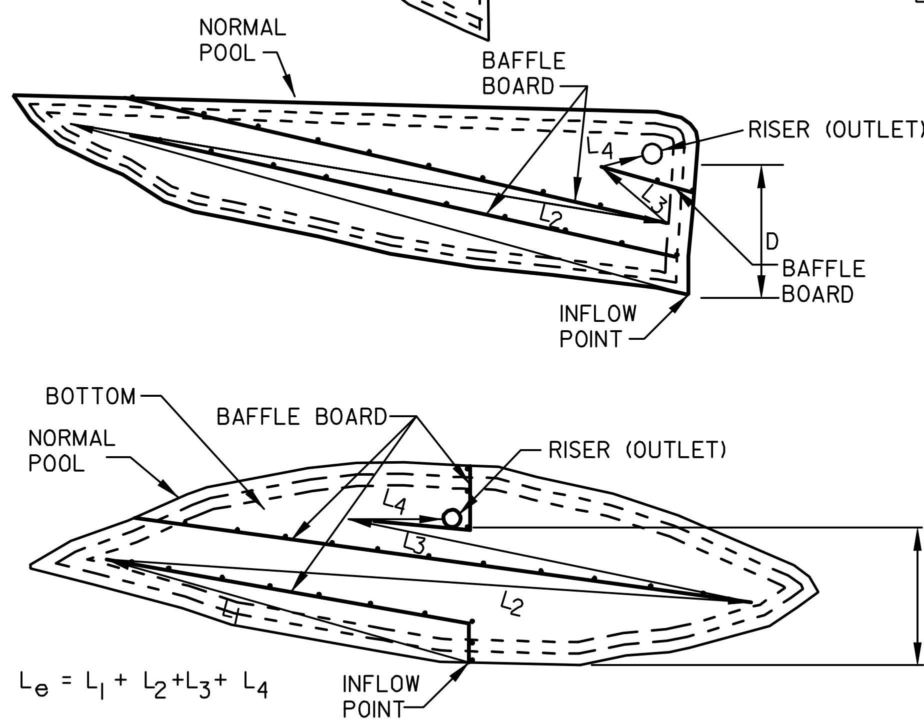
W_e= EFFECTIVE WIDTH = A/D

L_e= TOTAL DISTANCE FROM THE INFLOW POINT AROUND THE BAFFLES TO THE RISER

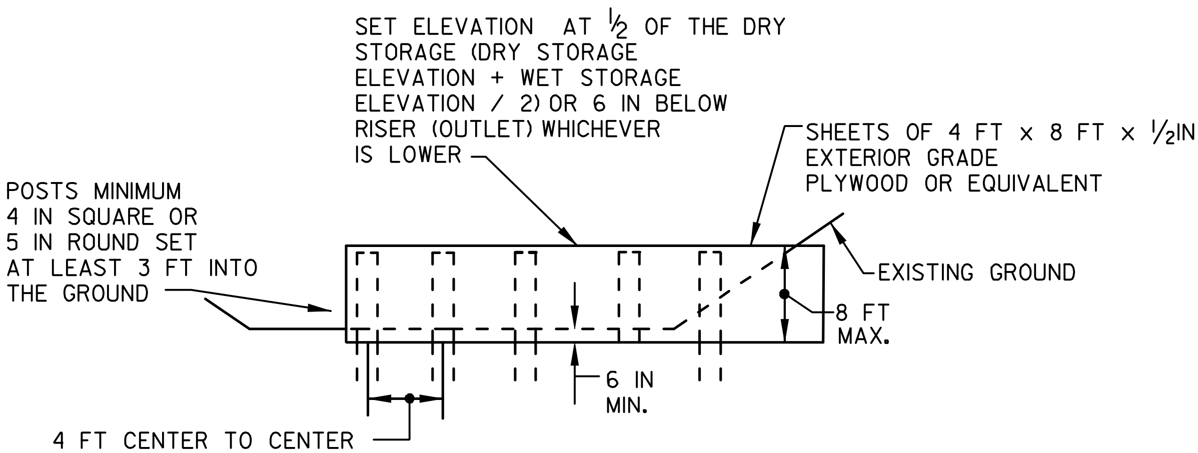
FORMULAS: $W_e = (A\ /\ 2)^{1/2}$

$L_e \geq W_e \times 2$





PLAN VIEWS



BAFFLE DETAIL

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

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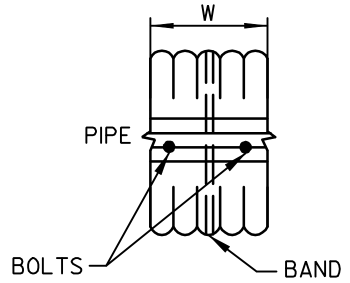
MARYLAND DEPARTMENT OF ENVIRONMENT
WATER MANAGEMENT ADMINISTRATION

DETAIL G-2-8 - TYPES OF COUPLERS FOR CORRUGATED STEEL PIPE

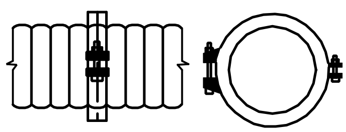
STANDARD SYMBOL

ANNULAR BAND



SIDE VIEW

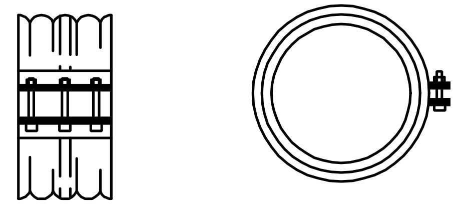
BAR AND STRAP CONNECTOR
CHANNEL COUPLING BAND
FOR FLANGED END
CORRUGATED STEEL PIPE



SIDE VIEW END VIEW

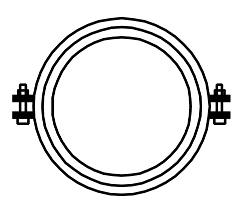
GASKET

STANDARD LAP-TYPE



SIDE VIEW END VIEW

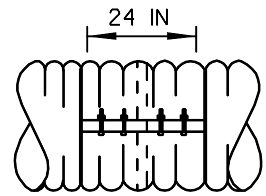
ONE PIECE LAP-TYPE COUPLING FOR ANNULAR OR HELICAL PIPE 12 TO 24 IN IN DIAMETER

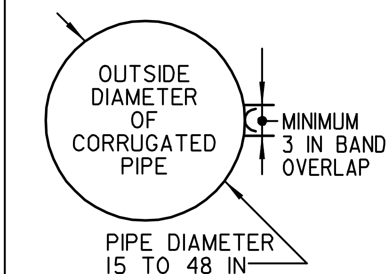


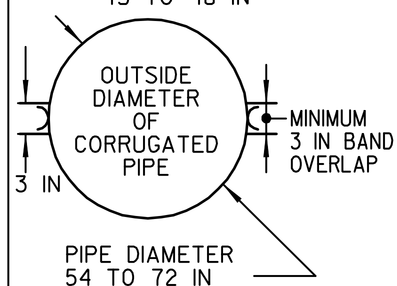
SIDE VIEW END VIEW

TWO PIECE LAP-TYPE COUPLING FOR ANNULAR OR HELICAL PIPE 12 TO 24 IN IN DIAMETER

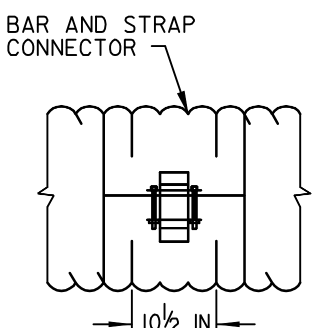
ROD AND LUG TYPE

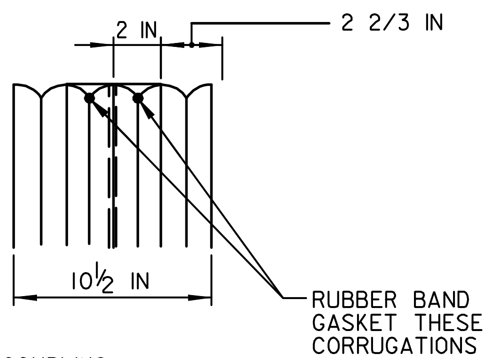






CONTINUOUS CORRUGATION ANNULAR BAND





HUGGER TYPE COUPLING BAND FOR REFORMED END H.C.S.P. OR ANNULAR C.S.P.

(ALL CONNECTOR BANDS REQUIRE NEOPRENE GASKETS)

NOTE: UNDER NO CIRCUMSTANCES WILL THE DIMPLE (UNIVERSAL) CONNECTOR BAND BE ACCEPTABLE FOR USE IN ANY SEDIMENT CONTROL OR STORMWATER MANAGEMENT STRUCTURE

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

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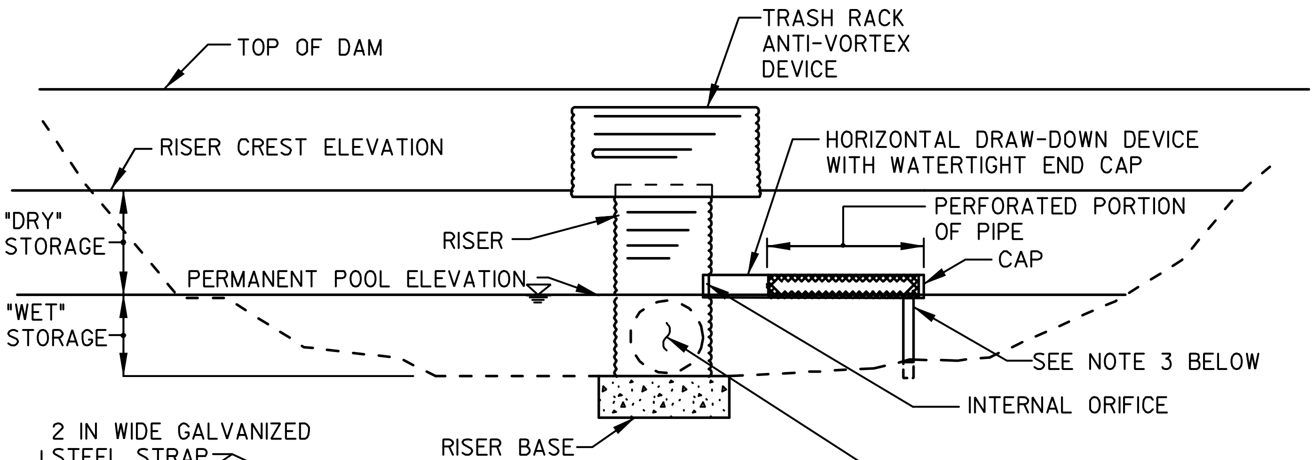
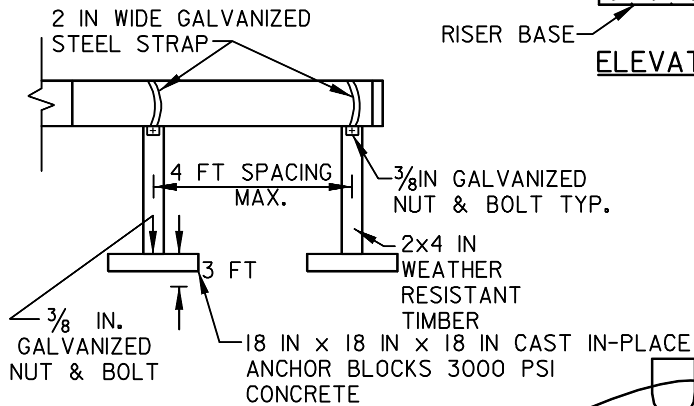
DETAIL G-2-9 - SEDIMENT BASIN SCHEMATIC HORIZONTAL DRAW-DOWN DEVICE

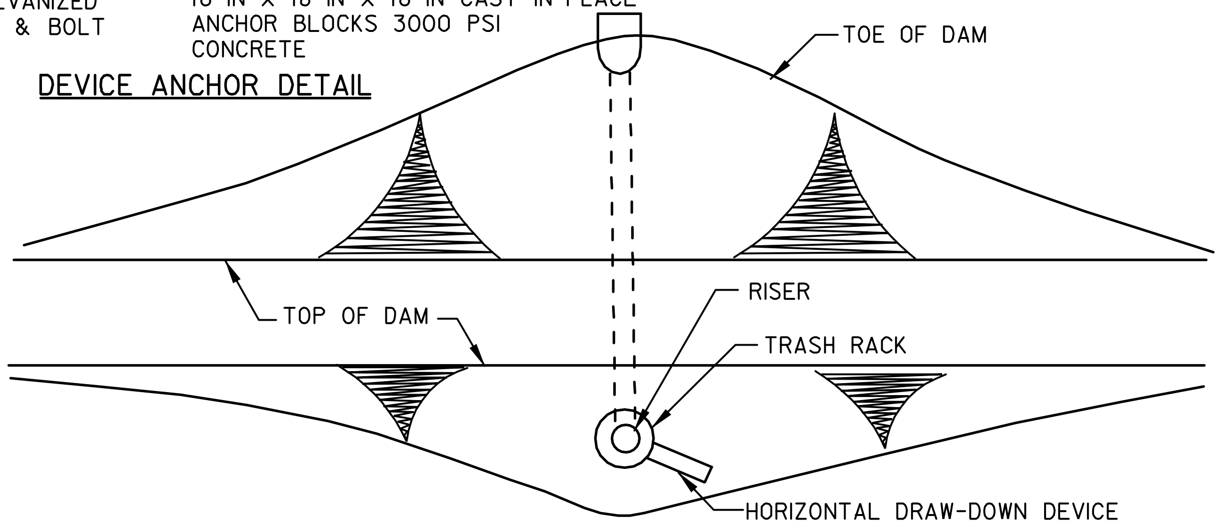
STANDARD SYMBOL



ELEVATION



DEVICE ANCHOR DETAIL



PLAN VIEW

CONSTRUCTION SPECIFICATIONS

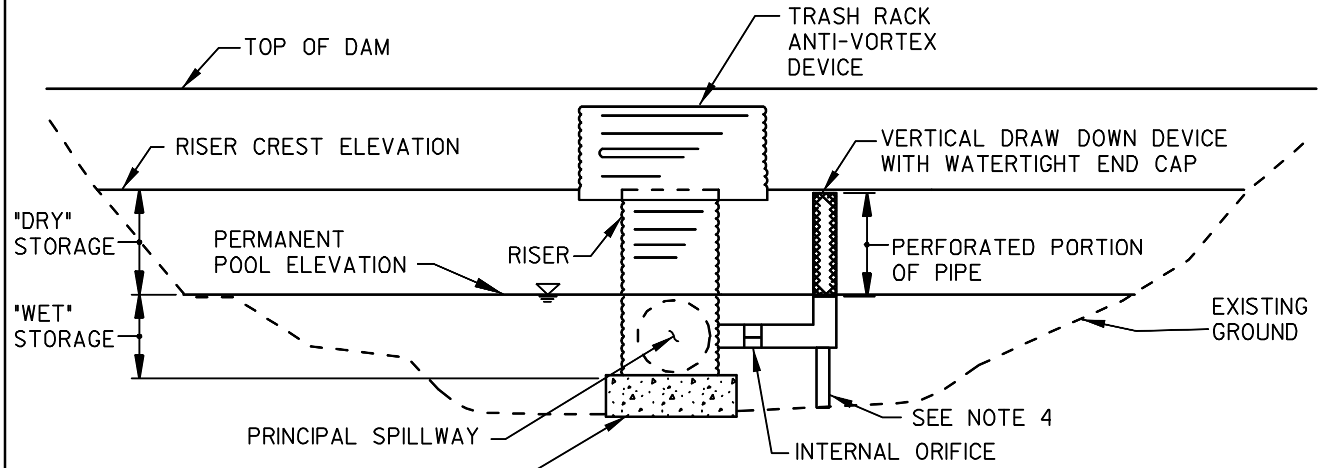
1. DESIGN THE TOTAL AREA OF THE PERFORATIONS TO BE GREATER THAN 4 TIMES THE AREA OF THE INTERNAL ORIFICE.

2. WRAP THE PERFORATED PORTION OF THE DRAW DOWN DEVICE FIRST WITH ½ INCH GALVANIZED HARDWARE CLOTH, THEN GEOTEXTILE CLASS SE.

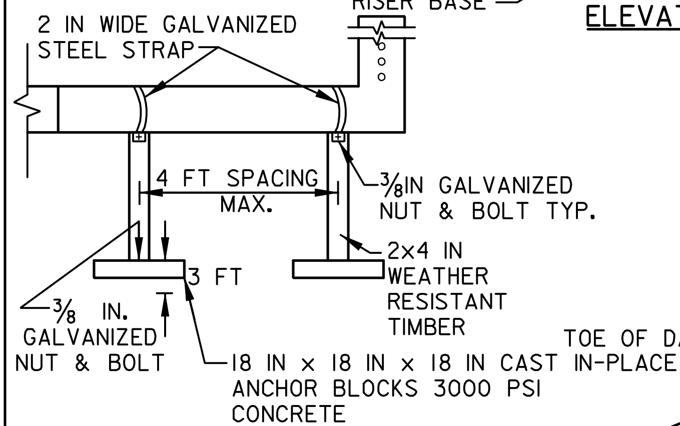
3. AN ACCEPTABLE DESIGN IS TO STAKE THE DRAW DOWN DEVICE WITH 2x4 INCH PRESSURE TREATED TIMBER ATTACHED TO THE DRAW DOWN DEVICE BY A 2 INCH WIDE GALVANIZED STEEL STRAP. TIMBER SHALL BE ATTACHED TO A CONCRETE FOUNDATION BLOCK CAST INTO THE BOTTOM OF THE BASIN.

DETAIL G-2-10 - SEDIMENT BASIN SCHEMATIC VERTICAL DRAWDOWN DEVICE

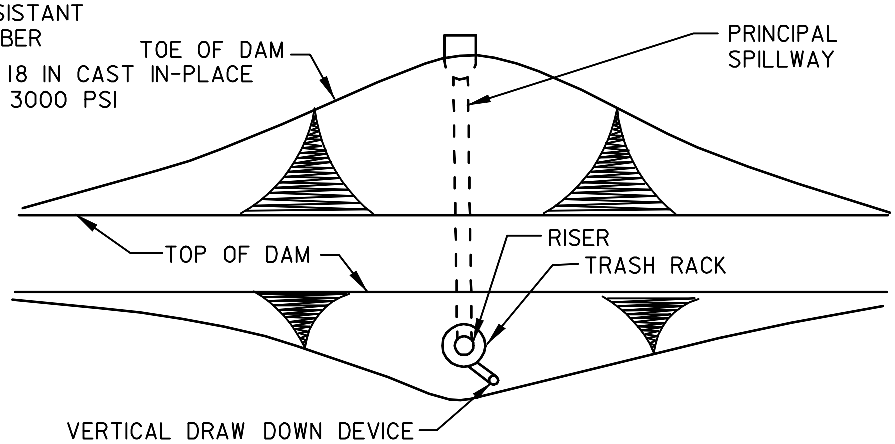
STANDARD SYMBOL



ELEVATION



DEVICE ANCHOR DETAIL



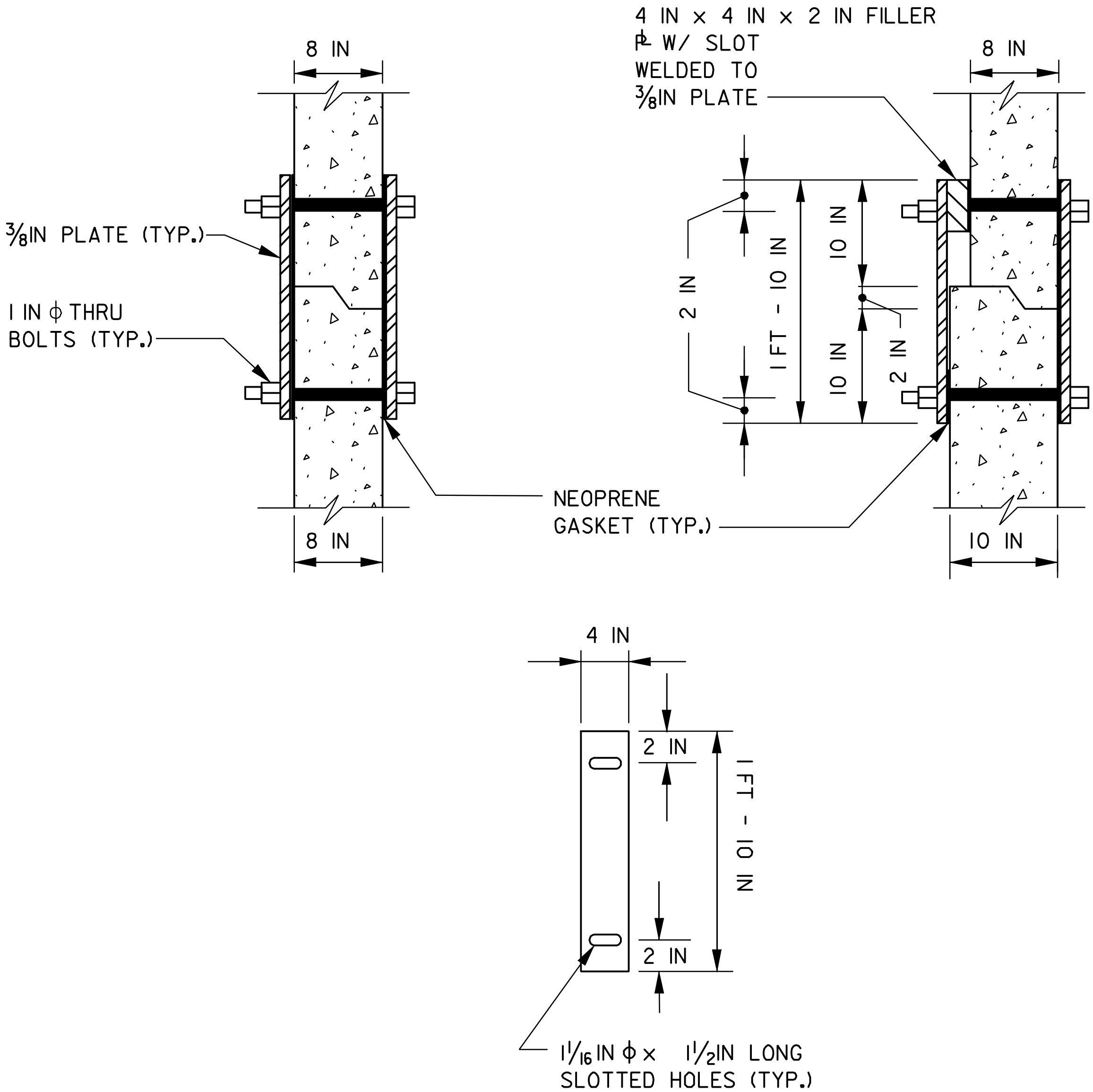
PLAN VIEW

CONSTRUCTION SPECIFICATIONS

1. DO NOT EXTEND THE PERFORATIONS IN THE DRAW DOWNDEVICE INTO THE WET STORAGE.
2. DESIGN THE TOTAL AREA OF THE PERFORATIONS TO BE GREATER THAN 4 TIMES THE AREA OF THE INTERNAL ORIFICE.
3. WRAP THE PERFORATED PORTION OF THE DRAWDOWN DEVICE FIRST WITH ½ INCH GALVANIZED HARDWARE CLOTH, THEN GEOTEXTILE CLASS SE.
4. AN ACCEPTABLE DESIGN IS TO STAKE THE DRAWDOWN DEVICE WITH 2x4 INCH PRESSURE TREATED TIMBER ATTACHED TO THE DRAWDOWN DEVICE BY A 2 INCH WIDE GALVANIZED STEEL STRAP. TIMBER SHALL BE ATTACHED TO A CONCRETE FOUNDATION BLOCK CAST INTO THE BOTTOM OF THE BASIN.

DETAIL G-2-11 - PRECAST RISER CONNECTOR

STANDARD SYMBOL



NOTES:

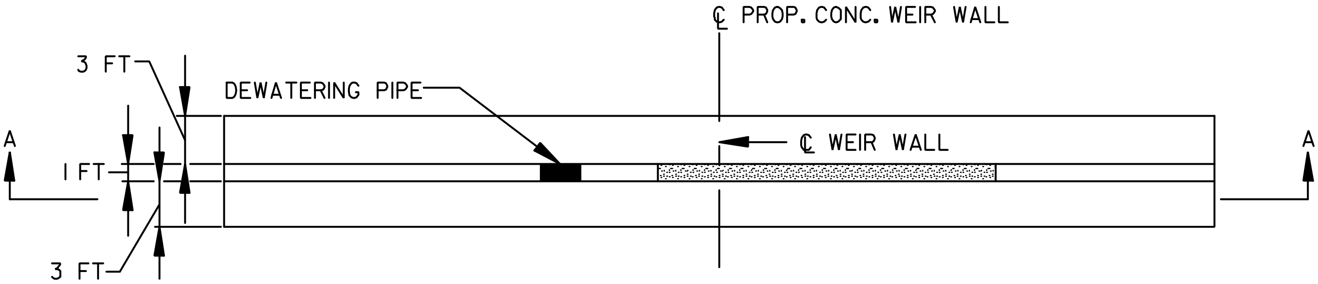
1. FABRICATE PLATE CONNECTIONS FROM STAINLESS STEEL CONFORMING TO ASTM A666-72, GRADE A OR B.

2. USE TYPE 304 STAINLESS STEEL FOR BOLTS.

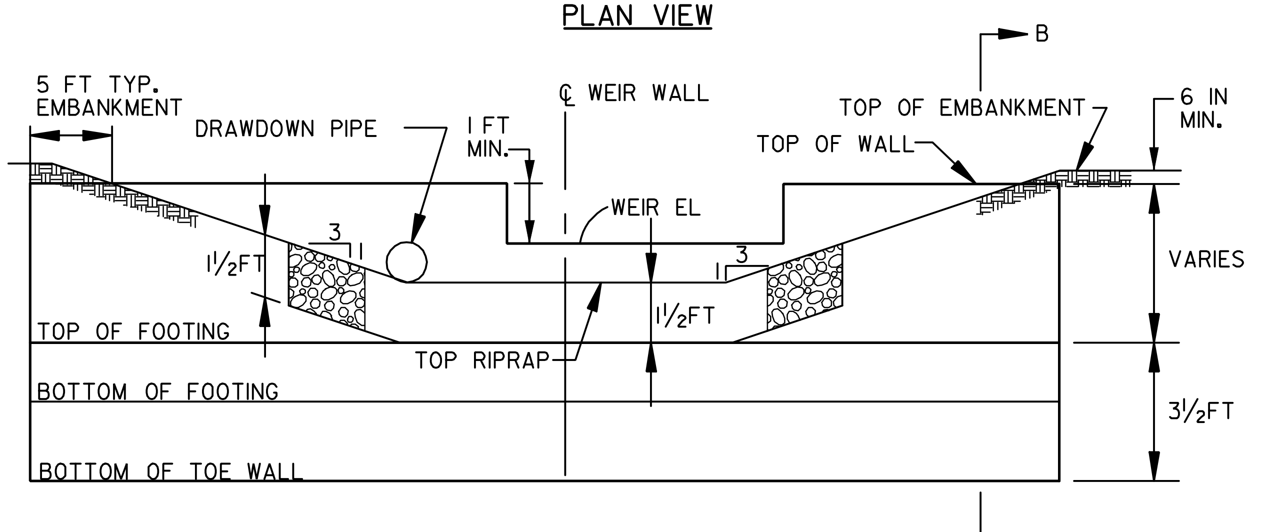
3. PROVIDE ONE PLATE ON CENTERLINE OF EACH PRECAST BOX FACE (4 PLATES PER BOX SECTIONS).

DETAIL G-2-12 - CONCRETE WEIR WALL

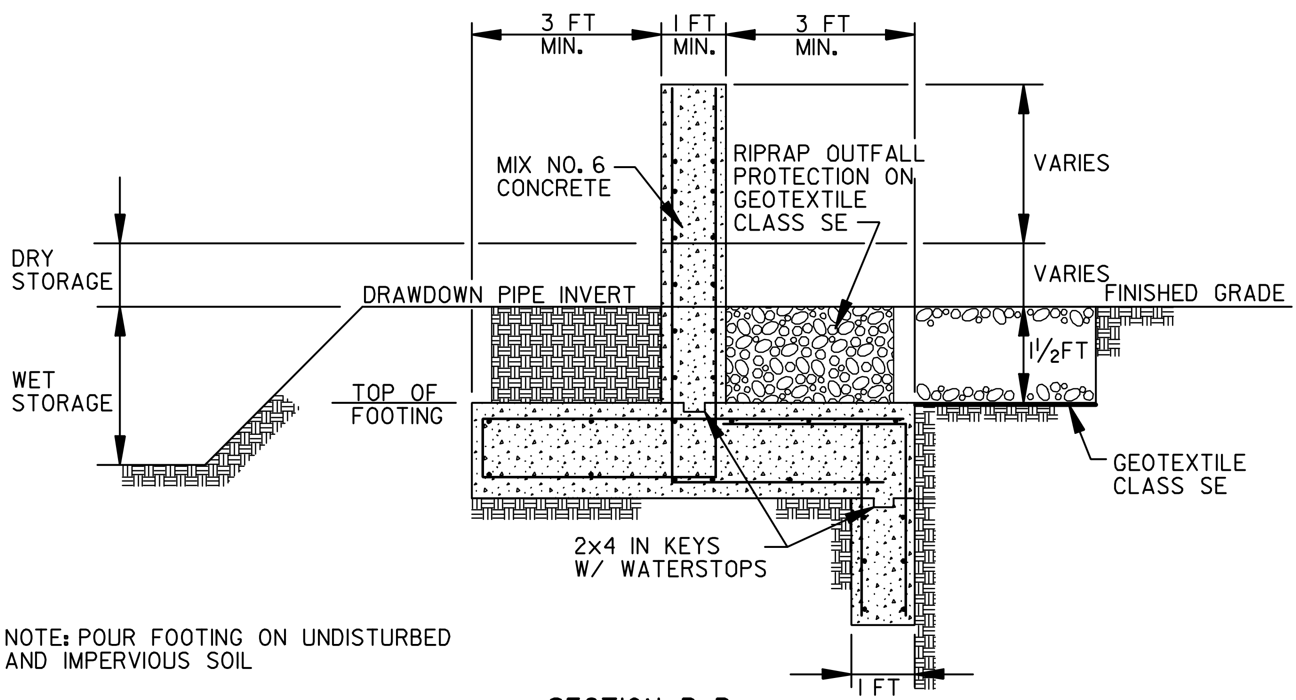
STANDARD SYMBOL



PLAN VIEW



SECTION A-A: ELEVATION



NOTE: POUR FOOTING ON UNDISTURBED AND IMPERVIOUS SOIL

SECTION B-B

1 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

SECTION H – MISCELLANEOUS

H-1 STANDARDS AND SPECIFICATIONS

FOR

MATERIALS

Table H.1: Geotextile Fabrics

MARYLAND APPLICATION CLASS		TYPE OF GEOTEXTILE	GRAB STRENGTH lb D 4632	PUNCTURE STRENGTH lb D 6241	PERMITTIVITY sec^{-1} D 4491	APPARENT OPENING SIZE, max mm D 4751	TRAPEZOID TEAR STRENGTH lb D 4533
SD	TYPE I	NONWOVEN	160	56	0.50	0.43	55
		WOVEN, MONOFILAMENT	250	90	0.50	0.43	90
	TYPE II	NONWOVEN	160	56	0.20	0.25	55
		WOVEN, MONOFILAMENT	250	90	0.20	0.25	90
PE	TYPE I	NONWOVEN	200	80	0.70	0.43	80
		WOVEN, MONOFILAMENT	250	90	0.70	0.43	90
	TYPE II	NONWOVEN	200	80	0.20	0.25	80
		WOVEN, MONOFILAMENT	250	90	0.20	0.25	90
	TYPE III	NONWOVEN	200	80	0.10	0.22	80
		WOVEN, MONOFILAMENT	250	90	0.10	0.22	90
SE		NONWOVEN	200	80	0.20	0.30	80
		WOVEN	250	90	0.20	0.30	90
ST		WOVEN	300*	110	0.05	0.15**	110
F		WOVEN	100	–	0.05	0.60	–
E		NONWOVEN	90	30	0.50	0.30	30

Note 1: All property values are based on minimum average roll values in the weakest principle direction, except for apparent opening size.
Note 2: The ultraviolet stability shall be 50 percent after 500 hours of exposure for all classes, except Class F, which shall be 70 percent (D 4355).
* Minimum 15 percent elongation.
** This is a MINIMUM apparent opening size, not a maximum.

Determine the properties in accordance with the following procedures:

Apparent Opening Size: ASTM D-4751

Grab Tensile Strength: ASTM D-4632 D: 4 inch x 8 inch specimen, 1inch x 2 inch clamps, 12 inches per minute strain rate in both principal directions of geotextile.

Puncture Resistance: ASTM D-4833

The geotextile shall be inert to commonly encountered chemicals and hydrocarbons, and shall be rot and mildew resistant. Manufacture the geotextile from fibers consisting of long chain synthetic polymers, and composed of a minimum of 85% by weight of polyolephins, polyesters, or polyamides. The geotextile shall resist deterioration from ultraviolet exposure. In addition, the geotextile shall have a 0.01 cm./sec. minimum permeability when tested in accordance with ASTM D-4491, and an apparent minimum elongation of 20 percent (20%) when tested in accordance with the grab tensile strength requirements listed above.

SILT FENCE

Class F Geotextile for silt fence shall have a 50 lb./in. minimum tensile strength and a 20 lb./in. minimum tensile modules when tested in accordance with ASTM D-4595. The material shall also have a maximum flow rate of less than 0.3 gallons per square foot, per minute, minimum and seventy-five percent (75%) minimum filtering efficiency when tested in accordance with ASTM D-5141.

Geotextile used in the construction of silt fence shall resist deterioration from ultraviolet exposure. The geotextile shall contain sufficient amounts of ultraviolet ray inhibitors and stabilizers to provide a minimum of 12 months of expected usable construction life at a temperature range of 0 to 120 degrees F.

Table H.2: Stone Size

TYPE	SIZE RANGE	D_{50}	D_{100}	AASHTO	WEIGHT
NUMBER 57*	3/8 to 1 ½ inch	½ inch	1 ½ inch	M-43	N/A
NUMBER 1	2 to 3 inch	2 ½ inch	3 inch	M-43	N/A
RIPRAP**	4 to 7 inch	5 ½ inch	7 inch	N/A	N/A
CLASS I	N/A	9.5 inch	15 inch	N/A	150 lb. max
CLASS II	N/A	16 inch	24 inch	N/A	700 lb. max
CLASS III	N/A	23 inch	34 inch	N/A	2000 lb. max

* This classification is to be used on the inside face of stone outlets and check dams.

** This classification is to be used for gabions.

Table H.3: Stone for Gabion Baskets

BASKET THICKNESS		SIZE OF INDIVIDUAL STONES	
INCHES	MILLIMETERS	INCHES	MILLIMETERS
6	150	3 to 5	75 to 125
9	225	4 to 7	100 to 175
12	300	4 to 7	100 to 175
18	460	4 to 7	100 to 175
36	910	4 to 12	100 to 300

Note: Equivalent recycled concrete may be substituted for all stone classifications. Concrete broken into the sizes meeting the appropriate classification, containing no steel reinforcement, and with a density of 150 pounds per cubic foot can be used as an equivalent for temporary control measures only.

H-2 STANDARDS AND SPECIFICATIONS

FOR

SUBSURFACE DRAINS

Definition

A conduit, such as tile, pipe, or tubing, installed beneath the ground surface which intercepts, collects, and/or conveys drainage water.

Purpose

A subsurface drain may serve one or more of the following purposes:

1. Improve the environment for vegetative growth by regulating the water table and groundwater flow.
2. Intercept and prevent water movement into a wet area.
3. Relieve artisan pressures.
4. Remove surface runoff.
5. Provide internal drainage of slopes to improve their stability and reduce erosion.
6. Provide internal drainage behind bulkheads, retaining walls, etc.
7. Replace existing subsurface drains that are interrupted or destroyed by construction operations.
8. Provide subsurface drainage for dry stormwater management structures.
9. Improve dewatering of sediment in sediment basins. (See Section G-2 - Standard and Specifications for Sediment Basin.)

Conditions Where Practice Applies

Subsurface drains are used in areas having a high water table or where subsurface drainage is required. The soil shall have enough depth and permeability to permit installation of an effective system. This standard does not apply to storm drainage systems or foundation drains. An outlet for the drainage system shall be available, either by gravity flow or by pumping. The outlet shall be adequate for the quantity of water to be discharged without causing damage above or below the point of discharge and shall comply with state and local laws.

Design Criteria

Base the design and installation on adequate surveys and on site soils investigations.

1. Required Capacity of Drains

   Determine the required capacity by one or more of the following:

   a. Where subsurface drainage is to be uniform over an area through a systematic pattern of drains, use a Drainage Coefficient (d_c) of 1 inch to be removed in 24 hours.

b. Where subsurface drainage is to be by a random interceptor system, use a minimum inflow rate of 0.5 cfs per 1,000 feet of line to determine the required capacity. If actual field tests and measurements of flow amounts are available, they may be used for determining capacity. For interceptor subsurface drains on sloping land, increase the inflow rate as follows:

Land Slopes	**Increase Inflow Rate By**
2 to 5 percent	10 percent
5 to 12 percent	20 percent
Over 12 percent	30 percent

c. Additional design capacity must be provided if surface water is allowed to enter the system.

2. Size of Subsurface Drain

Determine the size of subsurface drains from Figure H.1 – Drain Chart – Corrugated Plastic Drain Tubing. The minimum subsurface drains size is 4 inches.

3. Depth and Spacing

a. Provide a minimum depth of cover on the subsurface drains of 24 inches where possible. The minimum depth of cover may be reduced to 15 inches where it is not possible to attain the 24 inch depth and where the drain is not subject to equipment loading or frost action. Roots from some types of vegetation can plug drains as the drains get closer to the surface.

b. The spacing of drain laterals will be dependent on the permeability of the soil, the depth of installation of the drain and degree of drainage required. Generally, drains installed 36 inches deep and spaced 50 feet center-to-center will be adequate.

4. Minimum Velocity and Grade

The minimum grade for subsurface drains is 0.10 percent. Where surface water enters the system, use a velocity of not less than 2 feet per second to establish the minimum grades. Prevent debris or sediment from entering the system by means of filters or collection and periodic removal of sediment from installed traps.

5. Materials for Subsurface Drains

a. Acceptable subsurface drain materials include perforated, continuous closed joint conduits of polyethylene plastic, concrete, corrugated metal, asbestos-cement, bituminized fiber, and polyvinyl chloride.

b. Meet the strength and durability requirements of the site.

6. Loading

Base the allowable loads on subsurface drain conduits on the trench and bedding conditions specified for the job. Use a factor of safety of not less than 1.5 in computing the maximum allowable depth of cover for a particular type of conduit.

7. Envelopes and Envelope Materials

a. Use envelopes around subsurface drains for proper bedding and to provide better flow into the conduit. Use a minimum of 3 inches of envelope material for the sand-gravel envelopes. Where necessary to improve the characteristics of flow of groundwater into the conduit, more envelope material may be required.

b. Where county regulations do not allow sand-gravel envelopes, follow the county's design for type and size of envelope material:

1. Place envelope material to the height of the uppermost seepage strata. Behind bulkheads and retaining walls, go to within 12 inches of the top of the structure. This standard does not cover the design of filter materials where needed.

2. Use materials for the envelopes that contain no materials which will cause an accumulation of sediment in the conduit or render the envelope unsuitable for bedding of the conduit. Provide envelope materials consisting of either geotextile or sand-gravel material passing a 1 ½ inch sieve, 90 to 100 percent passing a ¾ inch sieve, and not more than 10 percent passing a No. 60 sieve.

3. Geotextile envelopes can be either woven or nonwoven monofilament yarns and with a sieve opening ranging from 40-80. Place the envelope in such a manner that once the conduit is installed, it will be completely encased.

4. Place and bed the conduit in a sand-gravel envelope. Place a minimum of 3 inches of envelope materials on the bottom of a conventional trench. Place the conduit on this and fill the trench completely with envelope material to a minimum depth of 3 inches above the conduit.

5. Stabilize soft or yielding soils under the drain where required and protect lines from settlement by adding gravel or other suitable material to the trench, by placing the conduit on plank or other rigid support, or by using long sections of perforated or watertight pipe with adequate strength to insure satisfactory subsurface drain performance.

8. Use of Heavy Duty Corrugated Plastic Drainage Tubing

Specify heavy duty corrugated drainage tubing where rocky or gravelly soils are expected to be encountered during installation operations. The quality of tubing will also be specified when cover over this tubing is expected to exceed 24 inches for 4, 5, 6, or 8 inch tubing. Larger size tubing designs will be handled on an individual job basis.

9. Auxiliary Structure and Subsurface Drain Protection

   a. Protect the outlet against erosion and undermining of the conduit, against damaging periods of submergence, and against entry of rodents or other animals into the subsurface drain. Install an animal guard on the outlet end of the pipe. Use a continuous 10 foot section of corrugated metal, cast iron, or steel pipe without perforations at the outlet end of the line and outlet 1.0 foot above the normal elevation of low flow in the outlet ditch or above mean high tide in tidal areas. Do not provide envelope material around this 10 foot section of pipe. Bury two-thirds of the pipe in the ditch bank and extend the cantilevered section to a point above the toe of the ditch side slope. If this is not possible, protect the side slope from erosion.

   b. Design conduits under roadways and embankments to be watertight and to withstand the expected loads.

   c. Where surface water is to be admitted to subsurface drains, design the inlets to exclude debris and prevent sediment from entering the conduit. Design lines flowing under pressure to withstand the resulting pressures and velocity of flow. Use surface waterways where feasible.

   d. Cap the upper end of each subsurface drain line with a tight fitting cap of the same material as the conduit or other durable material unless connected to a structure.

Construction Specifications

1. Do not use deformed, warped, or otherwise damaged pipe or tubing.

2. Lay all subsurface drains to a uniform line and cover with envelope material. Lay the pipe or tubing with the perforations down and oriented symmetrically about the vertical center line. Make connections with manufactured functions comparable in strength with the specified pipe or tubing unless otherwise specified. Specify the method of placement and bedding on the drawing.

3. Provide envelope material consisting of geotextile or a sand/gravel mixture passing the 1 ½ inch sieve, 90 to 100 percent passing the ¾ inch sieve, and not more than 10 percent passing the No. 60 sieve.

4. Cap the upper end of each subsurface drain line with a tight fitting cap of the same material as the conduit or other durable material unless connected to a structure.

5. Use a continuous 10 foot section of corrugated metal, cast iron, or steel pipe without perforations at the outlet end of the line with no envelope material around the 10 foot section of pipe. Install an animal guard on the outlet end of the pipe.

6. Place earth backfill material in the trench in such a manner that displacement of the drain will not occur.

7. Where surface water is entering the system, provide a swing type trash and animal guard at the pipe outlet section of the system.

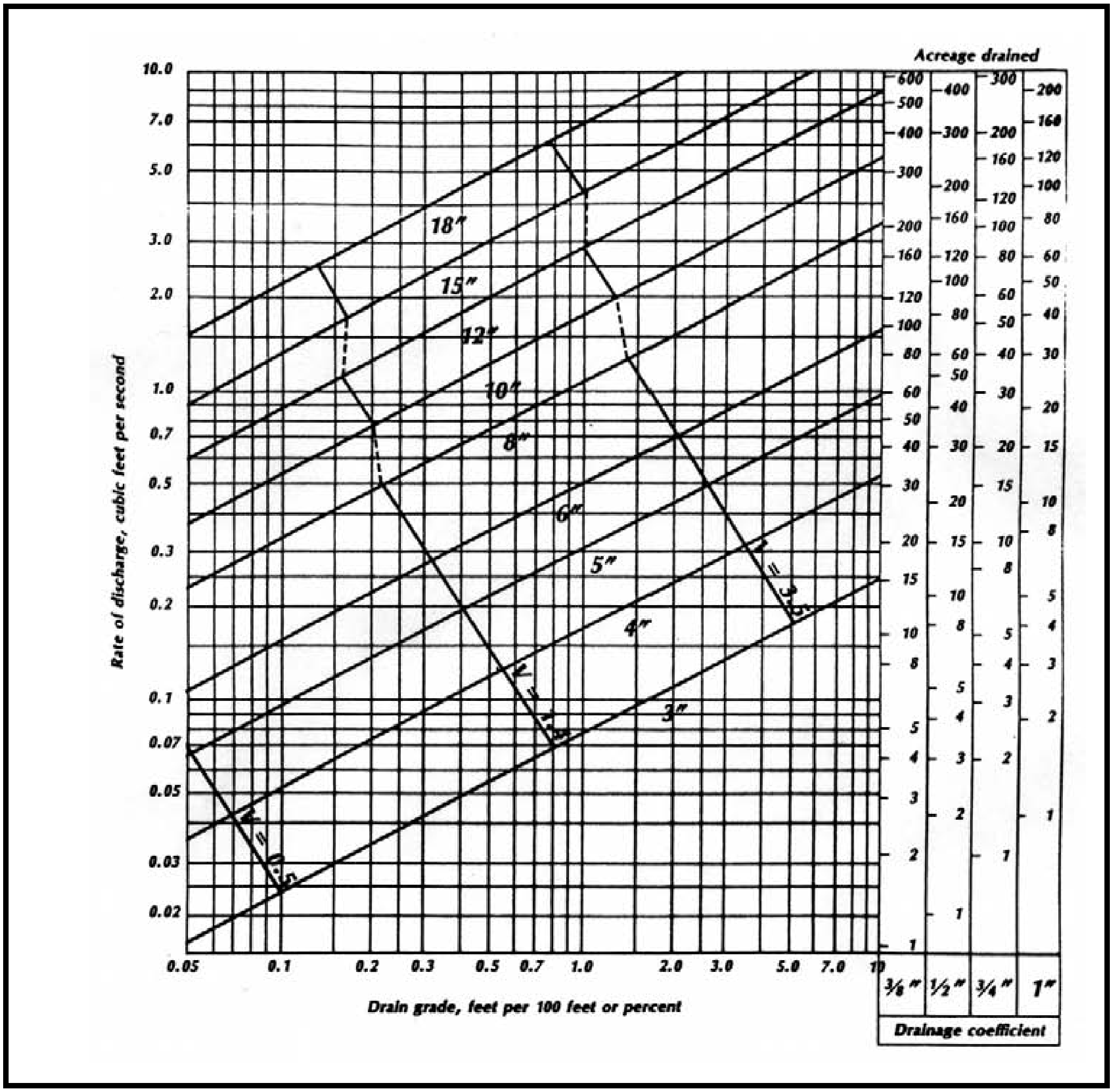
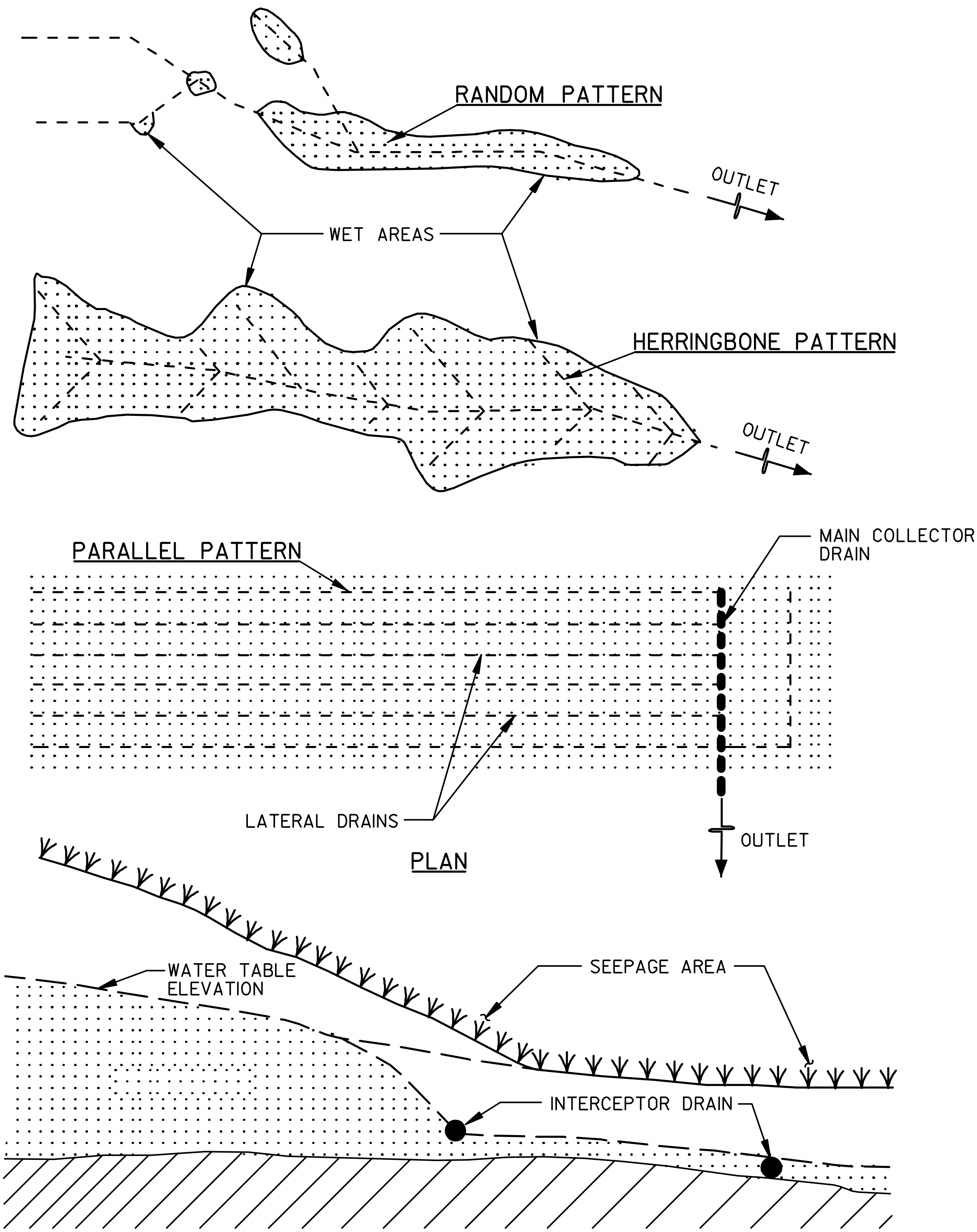


Figure H.1: Drain Chart – Corrugated Plastic Drain Tubing

DETAIL H-2 - SUBSURFACE DRAIN

STANDARD SYMBOL



NOTE: AN MDE WETLANDS AND WATERWAYS PERMIT MAY BE REQUIRED

I OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL H-2 - SUBSURFACE DRAIN

STANDARD SYMBOL

├— — SSD —— —┤

CONSTRUCTION SPECIFICATIONS

1. DO NOT USE DEFORMED, WARPED, OR OTHERWISE DAMAGED PIPE OR TUBING.

2. LAY ALL SUBSURFACE DRAINS TO A UNIFORM LINE AND COVER WITH ENVELOPE MATERIAL. LAY THE PIPE TUBING WITH PERFORATIONS DOWN AND ORIENTED SYMMETRICALLY ABOUT THE VERTICAL CENTER LINE. MAKE CONNECTIONS WITH MANUFACTURED FUNCTIONS COMPARABLE IN STRENGTH WITH SPECIFIED PIPE OR TUBING UNLESS OTHERWISE SPECIFIED. SPECIFY THE METHOD OF PLACEMENT AND BEDDING ON THE DRAWING.

3. PROVIDE ENVELOPE MATERIAL CONSISTING OF GEOTEXTILE OR A SAND/GRAVEL MIXTURE PASSING THE 1½ IN SIEVE, 90 TO 100 PERCENT PASSING THE ¾ IN SIEVE, AND NOT MORE THAN 10 PERCENT PASSING THE NO. 60 SIEVE.

4. CAP THE UPPER END OF EACH SUBSURFACE DRAINLINE WITH A TIGHT FITTING CAP OF THE SAME MATERIAL AS THE CONDUIT OR OTHER DURABLE MATERIAL UNLESS CONNECTED TO A STRUCTURE.

5. USE A CONTINUOUS 10 FOOT SECTION OF CORRUGATED METAL, CAST IRON, OR STEEL PIPE WITHOUT PERFORATIONS AT THE OUTLET END OF THE LINE WITH NO ENVELOPE MATERIAL AROUND THE 10 FOOT SECTION PIPE. INSTALL AN ANIMAL GUARD ON THE OUTLET END OF THE PIPE.

6. PLACE EARTH BACKFILL MATERIAL IN THE TRENCH IN SUCH A MANNER THAT DISPLACEMENT OF THE DRAIN WILL NOT OCCUR.

7. WHERE SURFACE WATER IS ENTERING THE SYSTEM, PROVIDE A SWING TYPE TRASH AND ANIMAL GUARD AT THE PIPE OUTLET SECTION OF THE SYSTEM.

2 OF 2

H-3 STANDARDS AND SPECIFICATIONS

FOR

LINED CHANNEL

Definition

A channel or outlet with a lining of concrete, stone, or other permanent material. The lined section extends up the side slopes to the designed depth. The earth above the permanent lining may be vegetated or otherwise protected.

Purpose

To provide for the disposal of concentrated runoff without damage from erosion or flooding where grassed waterways would be inadequate due to high velocities.

Scope

This standard applies to waterways or outlets with linings of cast-in-place concrete, flagstone mortared in place, rock riprap, gabions, or similar permanent linings. It does not apply to irrigation ditch and canal linings, grassed waterways with stone centers, or small lined sections to carry prolonged low flows, or to reinforced concrete channels. The capacity of the lined channel flowing at design depth cannot exceed 100 cubic feet per second.

Conditions Where Practice applies

This practice applies where the following or similar conditions exist:

1. Concentrated runoff is such that a lining is required to control erosion.

2. Steep grades, wetness, prolonged base flow, seepage, or piping would cause erosion.

3. The location is such that damage from use by people or animals precludes use of vegetated waterways or outlets.

4. Soils are highly erosive or other soil and climate conditions preclude using vegetation.

5. High-value property or adjacent facilities warrant the extra cost to contain design runoff in a limited space.

Design Criteria

1. Capacity:

    a. Design the channel to carry the peak rate of runoff from a 10-year, 24-hour storm.

Compute the velocity using Manning's equation with a coefficient of roughness "n" as follows:

Lined Material	"n"
Concrete (Type):	
Trowel Finish	0.015
Float Finish	0.019
Gunite	0.019
Flagstone	0.022
Riprap	Determine from Table H.4
Gabion	0.030
Permanent Soil Stabilization Matting	0.030

b. Design the riprap and filter (bedding) in accordance with criteria set forth in the National Cooperative Highway Research Program Report 108, available from the University Microfilm International, 300 N. Ree Road, Ann Arbor, Michigan 48016, Publication No. PB-00839; or Publication No. FHWA-IP-89-016, dated March 1989, available from Federal Highway Admin, 4009 7th Street, S.W., Washington, Engineering Field Manual, Chapter 16.

2. Velocity:

a. The maximum design velocity is a function of the design flow depth shown below. Except for short transition sections, flow with a channel gradient within the range of 0.7 to 1.3 of this flow's critical slope must be avoided unless the channel is straight. Velocities exceeding critical will be restricted to straight reaches.

Design Flow Depth (ft.)	Maximum Velocity* (ft./sec.)
0.0 to 0.5	25
0.5 to 1.0	15
Greater than 1.0	10

*** Maximum permissible velocity for permanent soil stabilization matting is 8.5 fps.**

b. Discharge waterways or outlets with velocities exceeding critical velocity into an energy dissipater to reduce velocity to less than critical, or to a velocity that the downstream soil and vegetative conditions will allow.

3. Cross Section:

Cross sections may be triangular, parabolic, or trapezoidal in shape. Monolithic concrete or gabions may be rectangular.

4. Freeboard:

The minimum freeboard for lined waterways or outlets is 0.25 foot above the design high water in areas where erosion resistant vegetation cannot be grown adjacent to the paved side slopes. No freeboard is required where good vegetation can be grown and maintained.

5. Side Slope:

Steepest permissible side slopes, horizontal to vertical, will be as follows:

a. Non-Reinforced Concrete

i. Hand-placed, formed concrete

Height of lining, 1.5 feet or less ....Vertical

ii. Hand-placed screened concrete or mortared in place flagstone

Height of lining, less than 2 feet.........1 to 1
Height of lining, more than 2 feet.......2 to 1

b. Slip Form Concrete:

Height of lining, less than 3 feet................1 to 1

c. Rock:

i. riprap..2 to 1
ii. gabions................Per specifications for gabions

d. Permanent soil stabilization matting… ……………2 to 1

6. Lining Thickness:

a. Concrete.............4 inches.
(In most problem areas, provide a minimum thickness of 5 inches with welded wire reinforcing.)

b. Rock

i. riprap...........1.5 x maximum stone size plus thickness of filter or bedding
ii. gabions……..Per manufacturer specifications

c. Permanent soil stabilization matting… Per manufacturer specifications

7. Related Structures: Design side inlets, drop structures, and energy dissipaters to meet the hydraulic and structural requirements of the site.

8. Filters or Bedding: Filters or bedding to prevent piping, reduce uplift pressure, and collect water will be used as required and will be designed in accordance with sound engineering principles. Weep holes and drains will be provided as needed.

9. Concrete:

   a. Proportion the concrete used for lining so that it is plastic enough for thorough consolidation and stiff enough to stay in place on side slopes. A dense durable product will be required. A mix that can be certified as suitable to produce a minimum strength of at least 3,000 pounds per square inch will be required. Use Portland Cement, Type I, II, IV, or V with an aggregate having a maximum diameter of one and one half inches.

   b. Weep holes should be provided in concrete footings and retaining walls to allow free drainage of water. Use non-corrosive pipe for the weep holes.

10. Mortar: Use mortar for mortared in-place flagstone consisting of a mix of cement, sand, and water with a water-cement ratio of not more than 6 gallons of water per bag of cement.

11. Contraction Joints: Form contraction joints in concrete linings, where required, transversely to a depth of about one-third the thickness of the lining at a uniform spacing in the range of 10 to 15 feet.

12. Rock Riprap: Provide stone used for rip-rap or gabions of a density and hardness to withstand exposure to air, water, freezing, and thawing.

13. Cutoff Walls: Use cutoff walls at the beginning and ending of concrete lining, and for rock rip-rap lining, key into the channel bottom at both ends of the lining.

14. Gabion Baskets: Fabricate gabions in such a manner that the sides, ends, and lid can be assembled at the site into a rectangular basket of similar size. Install gabion baskets according to the manufacturer specifications.

15. Place Geotextile Class SE beneath all rip-rap and gabions.

Construction Specifications

1. Clear the foundation area of trees, stumps, roots, sod, loose rock, or other objectionable material.

2. Excavate the cross-section to the neat lines and grades as shown on the plans. Backfill over-excavated areas with moist soil compacted to the density of the surrounding material.

3. Construct the grade or horizontal alignment of the lined channel as per the plans.

4. Place concrete linings to the thickness shown on the plans and finish in a workmanlike manner. Protect freshly-placed concrete from freezing or extremely high temperatures, to ensure proper curing.

5. Place filter, bedding, and rock rip-rap to line and grade, and in the manner specified.

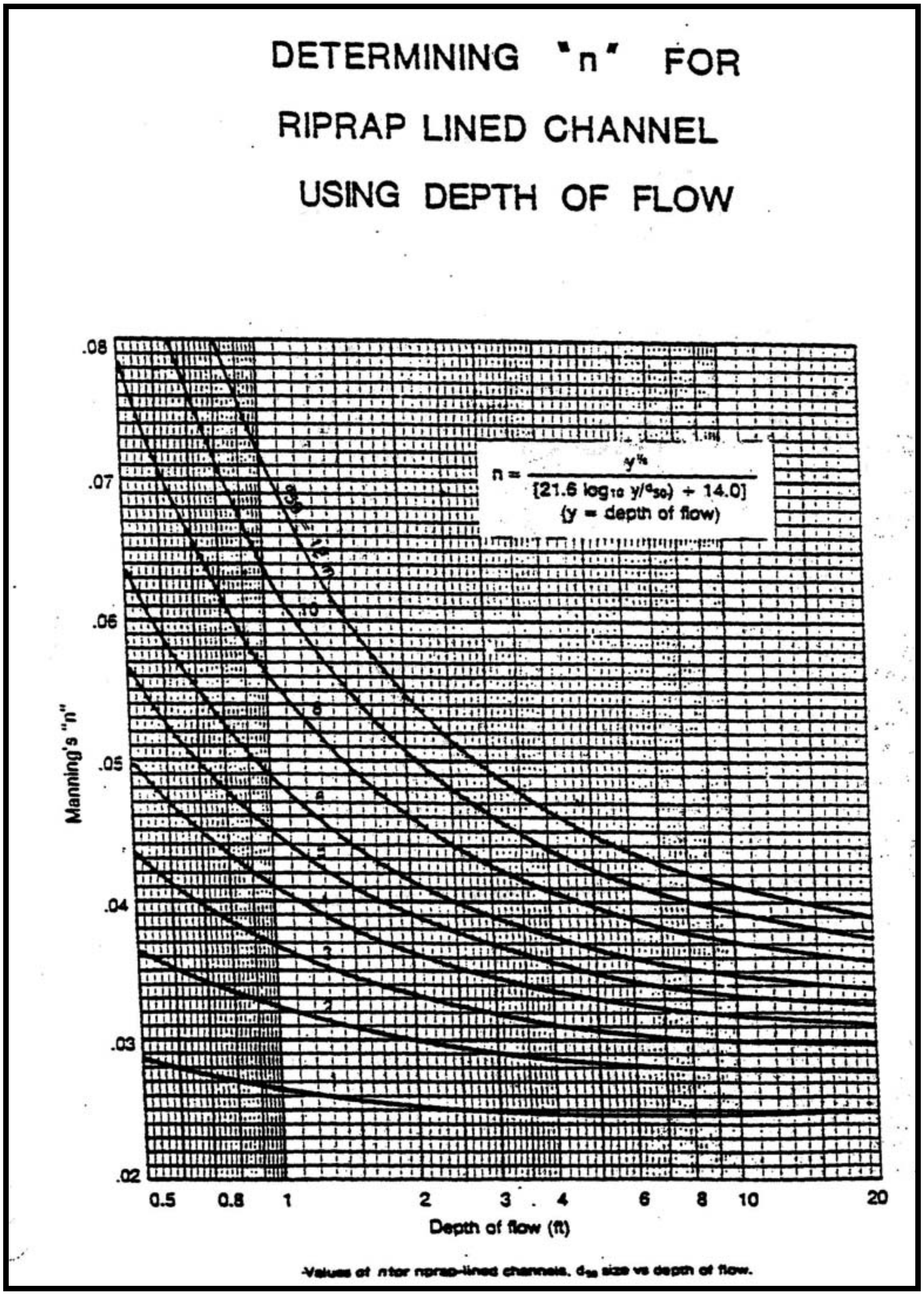
6. Construct channels in such a manner that erosion, air, and water pollution will be minimized and held within legal limits. The completed job will have a workmanlike appearance. Vegetate all disturbed areas or otherwise protected against soil erosion.

Maintenance

1. Pavement or lining should be maintained as built to prevent undermining and deterioration. Trees should be removed next to pavements, as roots can cause uplift damage.

2. Vegetation next to pavement should be maintained in good condition to prevent scouring if the pavement is overtopped.

Table H.4: Determining "n" for Riprap Lined Channel using Depth of Flow



H-4 STANDARDS AND SPECIFICATIONS

FOR

TEMPORARY ACCESS WATERWAY CROSSINGS

Definition

A temporary access waterway crossing is a structure placed across a waterway to provide access for construction purposes for a period of less than one year. Temporary access crossings are not to be utilized to maintain traffic for the general public.

Purpose

The purpose of the temporary access waterway crossing is to provide safe, pollution free access across a waterway for construction equipment by establishing minimum standards and specifications for the design, construction, maintenance, and removal of the structure. Temporary access waterway crossings are necessary to prevent construction equipment from damaging the waterway, blocking fish migration, and tracking sediment and other pollutants into the waterway. These standards and specifications may represent a channel constriction thus the **temporary** nature of waterway access crossings must be stressed. They should be planned to be in service for the shortest practical period of time and removed as soon as their function is completed.

Conditions Where Practice Applies

Any temporary access crossing shall conform to the technical requirements of these Standards and Specifications as well as any specific requirements imposed by the MDE Wetlands and Waterways Program. The following standards and specifications for temporary access waterway crossings are applicable in non-tidal waterways. These Standards and Specifications provide designs based on waterway geometry rather than the drainage area contributing to the point of crossing. The principal consideration for development of these Standards and Specifications is concern for soil erosion and sediment control. Structural integrity and safety must also be considered when designing temporary access waterway crossings to withstand expected loads. The three types of standard temporary access waterway crossings are fords, bridges, and culverts.

General Requirements

1. In-stream Excavation

   Limit in-stream excavation to only that necessary to allow installation and removal of the standard methods as presented below in the individual practices section and within the restricted time periods.

2. Elimination of Fish Migration Barriers

   Of the three basic methods presented below in the individual practices section, bridges pose the least potential for creating barriers to aquatic migration. The construction of any specific crossing method cannot cause a significant water level difference between the upstream and downstream water surface elevations.

Stream closure dates for fish spawning or migration within waterways are as follows:

Use I and IP	March 1 - June 15
Use II	June 1 - September 30 and December 16 - March 14
Use III and IIIP	October 1 - April 30
Use IV	March 1 - May 31
SAV* (All flowing streams)	April 15 - October 15

*** Submerged Aquatic Vegetation**

Therefore, the stream channel must not be disturbed during these periods. For more information about the closures based on stream uses and SAV contact MDE Wetlands and Waterways Program.

3. Crossing Alignment

Construct the temporary waterway crossing at right angles to the stream. Where approach conditions dictate, the crossing may vary 15 degrees from a line drawn perpendicular to the centerline of the stream at the intended crossing location.

4. Road Approaches

Match the centerline of both roadway approaches with the crossing alignment centerline for a minimum distance of 50 feet from each bank of the waterway being crossed. If physical or right-of-way restraints preclude the 50 feet minimum, a shorter distance may be provided. Limit all fill materials associated with the roadway approach to a maximum height of 2 feet above the existing floodplain elevation. Limit to the extent possible, the grading work on the approaches primarily within the floodplain to keep the road close to the existing grades.

5. Surface Water Diverting Structure

Construct a water diverting structure such as a swale (across the roadway on both roadway approaches) 50 feet (maximum) on either side of the waterway crossing. This will prevent roadway surface runoff from directly entering the waterway. The 50 feet is measured from the top of the waterway bank. Design this diverting structure in accordance with the Standards and Specifications for the individual design standard of choice. If the roadway approach is constructed with a reverse grade away from the waterway, a separate diverting structure is not required.

6. Road Width

Provide one traffic lane with a minimum width of 12 feet and a maximum width of 20 feet depending on the size of the vehicles that will use the crossing.

7. Time of Operation

Remove all temporary crossings within 14 calendar days after the structure is no longer needed.

Unless prior written approval is obtained from the MDE Wetland and Waterways Program, remove all structures within one year from the date of the installation. Do not remove the structure during the spawning periods for the stream as stated above.

8. Materials

   a. Aggregate: Earth or soil materials may not be used for construction within the waterway channel. Use 3/4 inch to 4 inch as the minimum acceptable aggregate size for temporary crossings. Larger aggregates will be allowed.

   b. Geotextile: Geotextile is a fabric consisting of either woven or nonwoven plastic, polypropylene, or nylon used to distribute the load, retain fines, allow increased drainage of the aggregate, and reduce mixing of the aggregate with the subgrade soil. Use approved geotextile as required by the specific method.

9. Bridge Anchors

   Anchor bridges securely at only one end using steel cable or chain. Anchoring at only one end will prevent channel obstruction in the event that floodwaters float the bridge. Acceptable anchors are large trees, large boulders, or driven steel anchors. Provide sufficient anchoring to prevent the bridge from floating downstream and possibly causing an obstruction to the flow.

10. Stabilization

   Stabilize all areas disturbed during installation within 24 hours of the disturbance in accordance with the Standards for "Section B-4-4, Permanent Stabilization."

BRIDGE MAINTENANCE REQUIREMENTS

1. Inspection: The user will perform periodic inspection to ensure that the bridge, streambed, and stream banks are maintained and not damaged.

2. Maintenance: Perform maintenance as needed to ensure that the structure complies with the standard and specifications. Remove and dispose of any trapped sediment or debris. Dispose sediment outside of the flood plain and stabilize.

BRIDGE REMOVAL AND CLEAN-UP REQUIREMENTS

1. Removal: When the temporary bridge is no longer needed, all structures including abutments and other bridging materials will be removed within 14 calendar days. In all cases, remove the bridge materials within one year of installation.

2. Final Clean Up: For final clean up, remove the temporary bridge from the waterway, protect the banks from erosion, and remove all construction materials. Store all removed materials outside the waterway floodplain.

3. Method: Accomplish removal of the bridge and clean up of the area without construction equipment working in the waterway channel.

4. Final Stabilization: Stabilize all areas disturbed during removal within 24 hours of that disturbance in accordance with the Standards for "Permanent Stabilization, Section B-4-4."

TEMPORARY ACCESS WATERWAYS CROSSING METHODS

1. Considerations for Choosing a Specific Method

   Consider the following criteria for soil erosion and sediment control when selecting a specific temporary access waterway crossing standard method:

   a. Site Aesthetics: Select standard design methods that will least disrupt the existing terrain of the stream reach. Consider the effort that will be required to restore the area after the temporary crossing is removed.

   b. Site Location: Locate the temporary crossing where there will be the least disturbance to the soils of the existing waterway banks. When possible, locate the crossing at a point receiving minimal surface runoff.

   c. Physical Site Constraints: The physical constraints of a site may preclude the selection of some of the standard methods.

   d. Time of Year: The time of year may preclude the selection of one or more of the standard methods due to fish spawning or migration restrictions.

   e. Vehicular Loads and Traffic Patterns: Vehicular loads, traffic patterns, and frequency of crossings should be considered in choosing a specific method.

   f. Maintenance of Crossing: The standard methods will require various amounts of maintenance. The bridge method should require the least maintenance, whereas the ford method will probably require more intensive maintenance.

   g. Removal of the Structure: Ease of removal and subsequent damage to the waterway should be primary factors in considering the choice of a standard method.

H-4-1 STANDARDS AND SPECIFICATIONS

FOR

TEMPORARY ACCESS FORD

A temporary access ford is a shallow structure placed in the bottom of the waterway over which the water flows while still allowing traffic to cross the waterway.

Considerations

Temporary fords may be used when bridge or culvert crossings are not possible and the streambed is armored with naturally occurring bedrock, or can be protected with an aggregate layer conforming to these specifications.

Construction Specifications

1. Restrictions: Use or removal of a temporary access will not be permitted between - Class III, October 1 through April 30 and Class IV, March 1 through May 31. For other streams, use or removal of a temporary ford will be prohibited from March 1 through June 15 of each year because fish are spawning during this period.

2. Use stone pads for the approaches to the structure. Cover the entire ford approach (where banks were cut) with geotextile and protect with aggregate to a depth of 4 inches.

3. Fords may not be used when the stream banks are 4 feet or more in height above the invert of the stream and when a bridge or culvert crossing can be easily constructed.

4. The approach roads at the cut banks can be no steeper than 5:1. Store spoil material from the banks out of the flood plain and stabilize.

5. Place one layer of geotextile on the streambed, streambanks, and road approaches prior to placing the bedding material on the stream channel or approaches. Extend the geotextile a minimum of 6 inches and a maximum one foot beyond the bedding material.

6. Use bedding material of coarse aggregate or gabion mattresses filled with coarse aggregate. Use Class 1 stone for the aggregate.

7. Construct all fords to minimize the blockage of stream flow and to allow free flow over the ford. The placing of any material in the waterway bed will cause some upstream ponding. The depth of this ponding will be equivalent to the depth of the material placed within the stream and therefore should be kept to a minimum height. However, in no case will the bedding material be placed deeper than 12 inches or one half (1/2) the height of the existing banks, whichever is smaller.

8. Stabilize all areas disturbed during the ford installation within 24 hours of that disturbance in accordance with the Standards for "Permanent Stabilization, Section B-4-4," or "Temporary Stabilization, Section B-4-3," as applicable.

FORD REMOVAL AND CLEAN-UP REQUIREMENTS

Removal and Final Clean-Up

Remove the temporary structure after it has served its purpose. Care should be taken so that any aggregate left does not create an impoundment or restrict fish passage. For final clean-up remove all of temporary ford materials from the waterway. Store all materials outside the waterway floodplain.

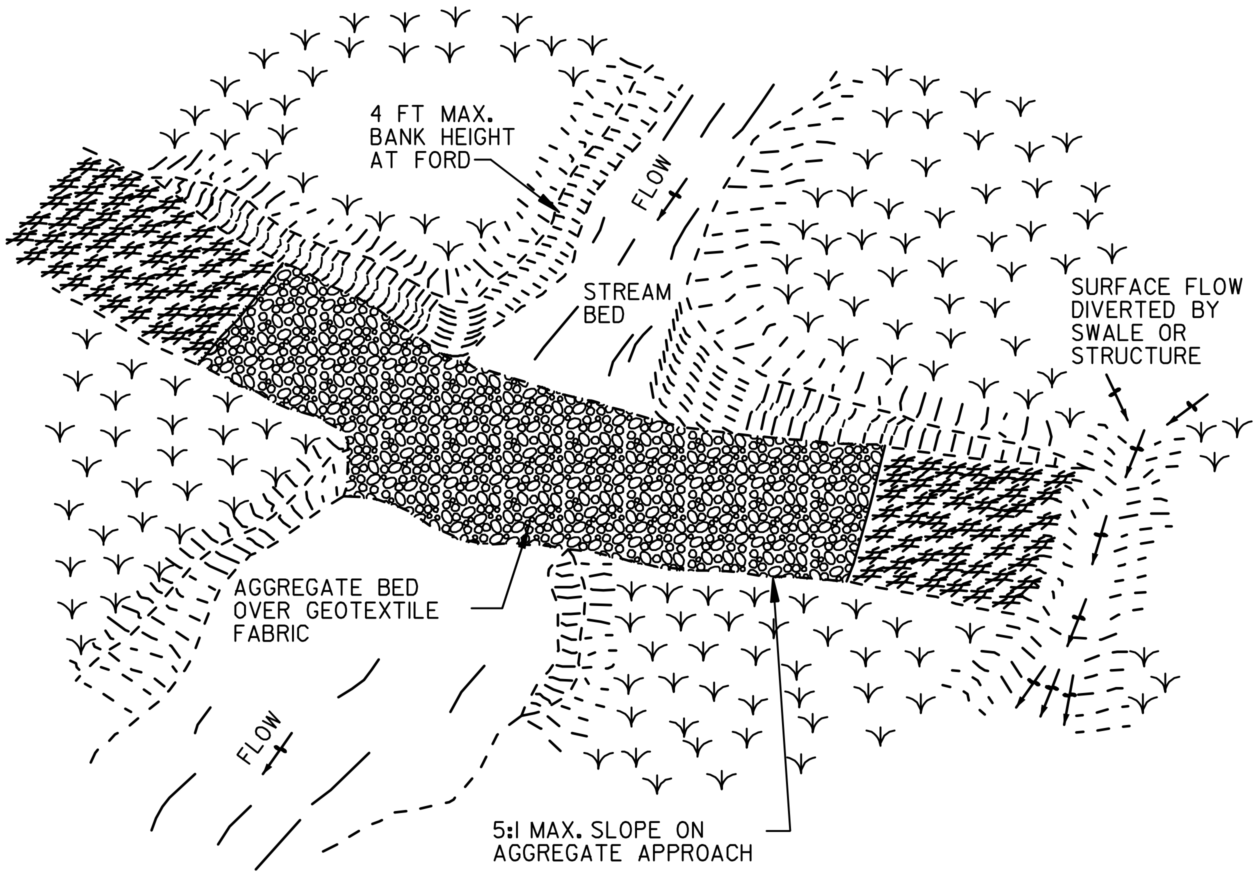
1. Method: Perform clean up without construction equipment working in the stream channel.

2. Approach Disposition: Do not backfill the approach slopes of the cut banks.

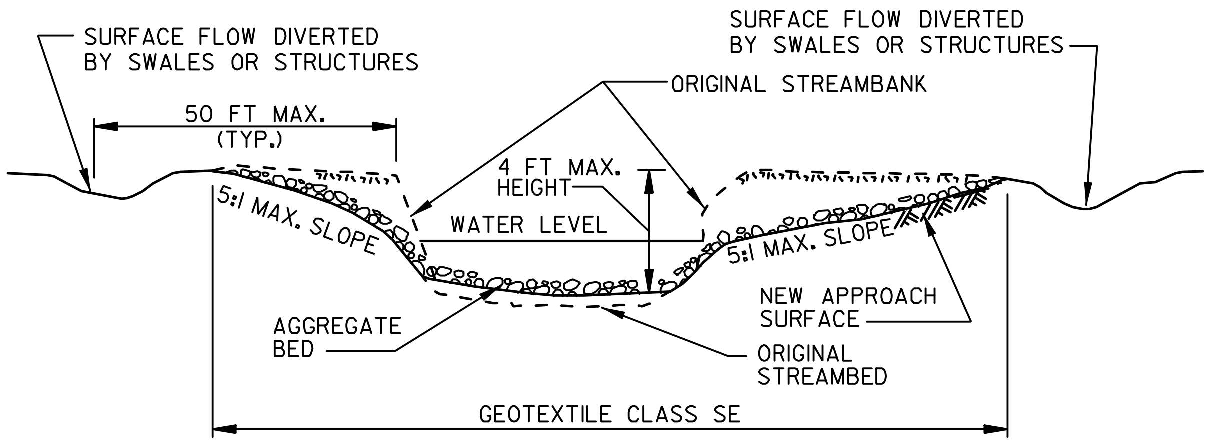
3. Final Stabilization: Stabilize all areas disturbed during ford removal within 24 hours of that disturbance in accordance with the Standard for "Permanent Stabilization, Section B-4-4".

DETAIL H-4-1 - TEMPORARY ACCESS FORD

STANDARD SYMBOL



PLAN



CROSS SECTION

1 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL H-4-1 - TEMPORARY ACCESS FORD

STANDARD SYMBOL

CONSTRUCTION SPECIFICATIONS

1. RESTRICTIONS - USE OR REMOVAL OF A TEMPORARY ACCESS WILL NOT BE PERMITTED BETWEEN - CLASS III, OCTOBER 1 THROUGH APRIL 30 AND CLASS IV, MARCH 1 THROUGH MAY 31. FOR OTHER STREAMS, USE OR REMOVAL OF A TEMPORARY FORD WILL BE PROHIBITED FROM MARCH 1 THROUGH JUNE 15 OF EACH YEAR BECAUSE FISH ARE SPAWNING DURING THIS PERIOD.

2. USE STONE PADS FOR THE APPROACHES TO THE STRUCTURE. COVER THE ENTIRE FORD APPROACH (WHERE BANKS WERE CUT) WITH GEOTEXTILE AND PROTECT WITH AGGREGATE TO A DEPTH OF 4 INCHES.

3. FORDS MAY NOT BE USED WHEN THE STREAM BANKS ARE 4 FEET OR MORE IN HEIGHT ABOVE THE INVERT OF THE STREAM AND WHEN A BRIDGE OR CULVERT CROSSING CAN BE EASILY CONSTRUCTED.

4. THE APPROACH ROADS AT THE CUT BANKS CAN BE NO STEEPER THAN 5:1. STORE SPOIL MATERIAL FROM THE BANKS OUT OF THE FLOOD PLAIN AND STABILIZE.

5. PLACE ONE LAYER OF GEOTEXTILE ON THE STREAMBED, STREAMBANKS, AND ROAD APPROACHES PRIOR TO PLACING THE BEDDING MATERIAL ON THE STREAM CHANNEL OR APPROACHES. EXTEND THE GEOTEXTILE A MINIMUM OF 6 INCHES AND A MAXIMUM ONE FOOT BEYOND THE BEDDING MATERIAL.

6. USE BEDDING MATERIAL OF COARSE AGGREGATE OR GABION MATTRESSES FILLED WITH COARSE AGGREGATE. USE CLASS I STONE FOR THE AGGREGATE.

7. CONSTRUCT ALL FORDS TO MINIMIZE THE BLOCKAGE OF STREAM FLOW AND TO ALLOW FREE FLOW OVER THE FORD. THE PLACING OF ANY MATERIAL IN THE WATERWAY BED WILL CAUSE SOME UPSTREAM PONDING. THE DEPTH OF THIS PONDING WILL BE EQUIVALENT TO THE DEPTH OF THE MATERIAL PLACED WITHIN THE STREAM AND THEREFORE SHOULD BE KEPT TO A MINIMUM HEIGHT. HOWEVER, IN NO CASE WILL THE BEDDING MATERIAL BE PLACED DEEPER THAN 12 INCHES OR ONE HALF (1/2) THE HEIGHT OF THE EXISTING BANKS, WHICHEVER IS SMALLER.

8. STABILIZE ALL AREAS DISTURBED DURING THE FORD INSTALLATION WITHIN 24 HOURS OF THAT DISTURBANCE IN ACCORDANCE WITH THE STANDARDS FOR "PERMANENT STABILIZATION, SECTION B-4-4," OR "TEMPORARY STABILIZATION, SECTION B-4-3," AS APPLICABLE.

2 OF 2

H-4-2 STANDARDS AND SPECIFICATIONS

FOR

TEMPORARY ACCESS BRIDGE

A temporary access bridge is a structure made of wood, metal, or other materials which provides access across a stream or waterway.

Considerations

1. Preferred Method: This is the preferred method for temporary access waterway crossings. Normally, bridge construction causes the least disturbance to the waterway bed and banks when compared to the other access waterway crossings. Keep the disturbance to the stream banks to a minimum.

2. Most bridges can be quickly removed and reused.

3. Temporary access bridges pose the least chance for interference with fish migration when compared to the other temporary access waterway crossings.

Construction Specifications

1. Restriction: Construction, use, or removal of a temporary access bridge will not normally have any time of year restrictions since construction, use, or removal should not affect the stream or its banks, unless the bridge is built with a pier(s) in the water.

2. Bridge Placement: Construct temporary bridge structure at or above the bank elevation to prevent the entrapment of floating materials and debris.

3. Abutments: Place abutments parallel to, and on, stable banks.

4. Bridge Span: Construct bridges to span the entire channel. If the channel width exceeds 8 feet, (as measured from top-of-bank to top-of-bank), then a footing, pier, or bridge support may be constructed within the waterway. One additional footing, pier, or bridge support will be permitted for each additional 8 foot width of the channel. However, no footing, pier, or bridge support will be permitted within the channel for waterways less than 8 feet wide.

5. Stringers: Use stringers consisting of logs, sawn timber, prestressed concrete beams, metal beams, or other approved materials.

6. Deck Material: Choose decking materials to provide sufficient strength to support the anticipated load. Place all decking members perpendicular to the stringers, butted tightly, and securely fastened to the stringers. Decking materials must be butted tightly to prevent any soil material tracked onto the bridge from falling into the waterway below.

7. Run Planks (optional): Securely fasten run planking to the length of the span. Provide one run plank for each track of the equipment wheels. Although run planks are optional, they may be necessary to properly distribute loads.

8. Curbs or Fenders: Curbs or fenders may be installed along the outer sides of the deck. Curbs or fenders are an option which will provide additional safety.

9. Bridge Anchors: Anchor bridges securely at only one end using steel cable or chain. Anchoring at only one end will prevent channel obstruction in the event that floodwaters float the bridge. Acceptable anchors are large trees, large boulders, or driven steel anchors. Provide sufficient anchoring to prevent the bridge from floating downstream and possibly causing an obstruction to the flow.

10. Stabilization: Stabilize all areas disturbed during installation within 24 hours of the disturbance in accordance with the Standard for "Permanent Stabilization, Section B-4-4," or "Temporary Stabilization, Section B-4-3," as applicable.

Bridge Maintenance Requirements

1. Inspection: The user will perform periodic inspection to ensure that the bridge, streambed, and stream banks are maintained and not damaged.

2. Maintenance: Perform maintenance as needed to ensure that the structure complies with the standard and specifications. Remove and dispose of any trapped sediment or debris. Dispose sediment outside of the flood plain and stabilize.

Bridge Removal and Clean-Up Requirements

1. Removal: When the temporary bridge is no longer needed, all structures including abutments and other bridging materials will be removed within 14 calendar days. In all cases, remove the bridge materials within one year of installation.

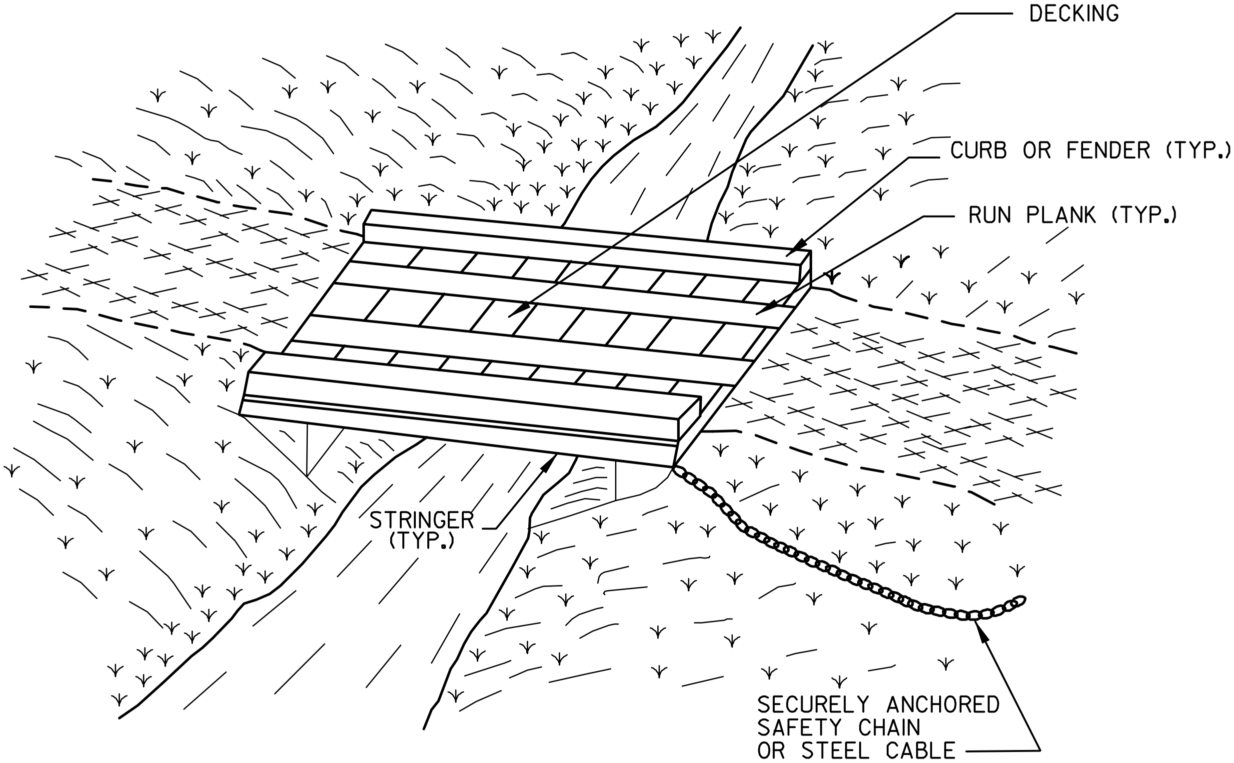
2. Final Clean-Up: For final clean-up remove the temporary bridge from the waterway, protect the banks from erosion, and remove all construction materials. Store all removed materials outside the waterway floodplain.

3. Method: Accomplish removal of the bridge and clean up of the area without construction equipment working in the waterway channel.

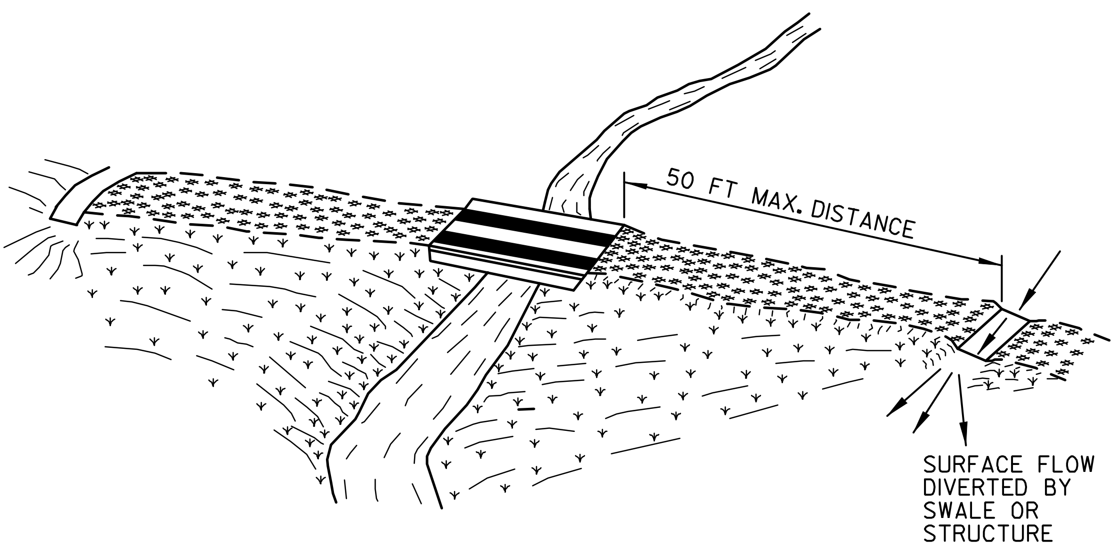
4. Final Stabilization: Stabilize all areas disturbed during removal within 24 hours of that disturbance in accordance with the Standards for "Permanent Stabilization, Section B-4-4."

DETAIL H-4-2 - TEMPORARY ACCESS BRIDGE

STANDARD SYMBOL



LOCATION PLAN



PLAN

1 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

MARYLAND DEPARTMENT OF ENVIRONMENT
WATER MANAGEMENT ADMINISTRATION

DETAIL H-4-2 - TEMPORARY ACCESS BRIDGE

STANDARD SYMBOL

CONSTRUCTION SPECIFICATIONS

1. RESTRICTION - CONSTRUCTION, USE OR REMOVAL OF A TEMPORARY ACCESS BRIDGE WILL NOT NORMALLY HAVE ANY TIME OF YEAR RESTRICTIONS SINCE CONSTRUCTION, USE, OR REMOVAL SHOULD NOT AFFECT THE STREAM OR ITS BANKS, UNLESS THE BRIDGE IS BUILT WITH A PIER(S) IN THE WATER.

2. BRIDGE PLACEMENT - CONSTRUCT TEMPORARY BRIDGE STRUCTURE AT OR ABOVE THE BANK ELEVATION TO PREVENT THE ENTRAPMENT OF FLOATING MATERIALS AND DEBRIS.

3. ABUTMENTS - PLACE ABUTMENTS PARALLEL TO, AND ON, STABLE BANKS.

4. BRIDGE SPAN - CONSTRUCT BRIDGES TO SPAN THE ENTIRE CHANNEL. IF THE CHANNEL WIDTH EXCEEDS 8 FEET, (AS MEASURED FROM TOP-OF-BANK TO TOP-OF-BANK), THEN A FOOTING, PIER, OR BRIDGE SUPPORT MAY BE CONSTRUCTED WITHIN THE WATERWAY. NO ADDITIONAL FOOTING, PIER, OR BRIDGE SUPPORT WILL BE PERMITTED WITHIN THE CHANNEL FOR WATERWAYS LESS THAN 8 FEET WIDE.

5. STRINGERS - USE STRINGERS CONSISTING OF LOGS, SAWN TIMBER, PRESTRESSED CONCRETE BEAMS, METAL BEAMS, OR OTHER APPROVED MATERIALS.

6. DECK MATERIAL - CHOOSE DECKING MATERIALS TO PROVIDE SUFFICIENT STRENGTH TO SUPPORT THE ANTICIPATED LOAD. PLACE ALL DECKING MEMBERS PERPENDICULAR TO THE STRINGERS, BUTTED TIGHTLY, AND SECURELY FASTENED TO THE STRINGERS. DECKING MATERIALS MUST BE BUTTED TIGHTLY TO PREVENT ANY SOIL MATERIAL TRACKED ONTO THE BRIDGE FROM FALLING INTO THE WATERWAY BELOW.

7. RUN PLANKS (OPTIONAL) - SECURELY FASTEN RUN PLANKING TO THE LENGTH OF THE SPAN. PROVIDE ONE RUN PLANK FOR EACH TRACK OF THE EQUIPMENT WHEELS. ALTHOUGH RUN PLANKS ARE OPTIONAL, THEY MAY BE NECESSARY TO PROPERLY DISTRIBUTE LOADS.

8. CURBS OR FENDERS - CURBS OR FENDERS MAY BE INSTALLED ALONG THE OUTER SIDES OF THE DECK. CURBS OR FENDERS ARE AN OPTION WHICH WILL PROVIDE ADDITIONAL SAFETY.

9. BRIDGE ANCHORS - ANCHOR BRIDGES SECURELY AT ONLY ONE END USING STEEL CABLE OR CHAIN. ANCHORING AT ONLY ONE END WILL PREVENT CHANNEL OBSTRUCTION IN THE EVENT THAT FLOODWATERS FLOAT THE BRIDGE. ACCEPTABLE ANCHORS ARE LARGE TREES, LARGE BOULDERS, OR DRIVEN STEEL ANCHORS. PROVIDE SUFFICIENT ANCHORING TO PREVENT THE BRIDGE FROM FLOATING DOWNSTREAM AND POSSIBLY CAUSING AN OBSTRUCTION TO THE FLOW.

10. STABILIZATION - STABILIZE ALL AREAS DISTURBED DURING INSTALLATION WITHIN 24 HOURS OF THE DISTURBANCE IN ACCORDANCE WITH THE STANDARDS FOR "PERMANENT STABILIZATION, SECTION B-4-4," OR "TEMPORARY STABILIZATION, SECTION B-4-3," AS APPLICABLE.

H-4-3 STANDARDS AND SPECIFICATIONS

FOR

TEMPORARY ACCESS CULVERT

Definition

A temporary access culvert is a structure consisting of a section(s) of circular pipe, pipe arches, or oval pipes of reinforced concrete, corrugated metal, or structural plate, which is used to convey flowing water through the crossing.

Considerations

1. Temporary culverts are used where (1) the channel is too wide for normal bridge construction, (2) anticipated loading may prove unsafe for single span bridges, or (3) access is not needed from bank to bank.

2. This temporary waterway crossing method is normally preferred over a ford type of crossing, since disturbance to the waterway is only during construction and removal of the culvert.

3. Temporary culverts can be salvaged and reused.

Construction Specifications

1. Restrictions: Construction or removal of a temporary access culvert will not be permitted during the following periods:

Use I and IP	March 1 - June 15
Use II	June 1 - September 30 and December 16 - March 14
Use III and IIIP	October 1 - April 30
Use IV	March 1 - May 31
SAV* (All flowing streams)	April 15 - October 15

***Submerged Aquatic Vegetation**

2. Culvert Strength: Select culvert type to be strong enough to support their cross sectional area under maximum expected loads.

3. Culvert Size: Size the culvert pipe for the largest pipe diameter that will fit into the existing channel without major excavation of the waterway channel or without major approach fills. If a channel width exceeds 3 feet, additional pipes may be used until the cross sectional area of the pipes is greater than 60 percent of the cross sectional area of the existing channel. The minimum size culvert that may be used is a 12 inch diameter pipe. Size the pipe(s) to convey the normal stream flows.

4. Culvert Length: Extend the culvert(s) a minimum of one foot beyond the upstream and downstream toe to the aggregate placed around the culvert.

5. Geotextile: Place geotextile on the streambed and streambanks prior to placement of the pipe culvert(s) and aggregate. Cover the streambed and extend it a minimum of six inches and a maximum of one foot beyond the end of the culvert and bedding material. Geotextile reduces settlement and improves crossing stability.

6. Culvert Placement: Place the invert elevation of the culvert(s) on the natural streambed grade to minimize interference with fish migration (free passage of fish).

7. Culvert Protection: Cover the culvert(s) with a minimum of one foot of aggregate. For multiple culverts provide at least 12 inches of compacted aggregate fill between culverts.

8. Stabilization: Stabilize all areas disturbed during culvert installation within 24 hours of the disturbance in accordance with the standards for "Permanent Stabilization, Section B-4-4," or "Temporary Stabilization, Section B-4-3," as applicable.

Culvert Maintenance Requirements

1. Inspection: Perform periodic inspection to ensure that the culverts, streambed, and streambanks are not damaged, and that sediment is not entering the stream or blocking fish passage or migration.

2. Maintenance: Perform maintenance, as needed in a timely manner to ensure that structures are in compliance with this standard and specifications. Remove and dispose of any trapped sediment or debris. Dispose and stabilize sediment outside the waterway floodplain.

Culvert Removal and Clean-Up Requirements

1. Removal: After the crossing has served its purpose, all structures including culverts, bedding and geotextile materials are to be removed within 14 calendar days. In all cases, remove the culvert materials within one year of installation. Structure may not be removed during restriction closure periods.

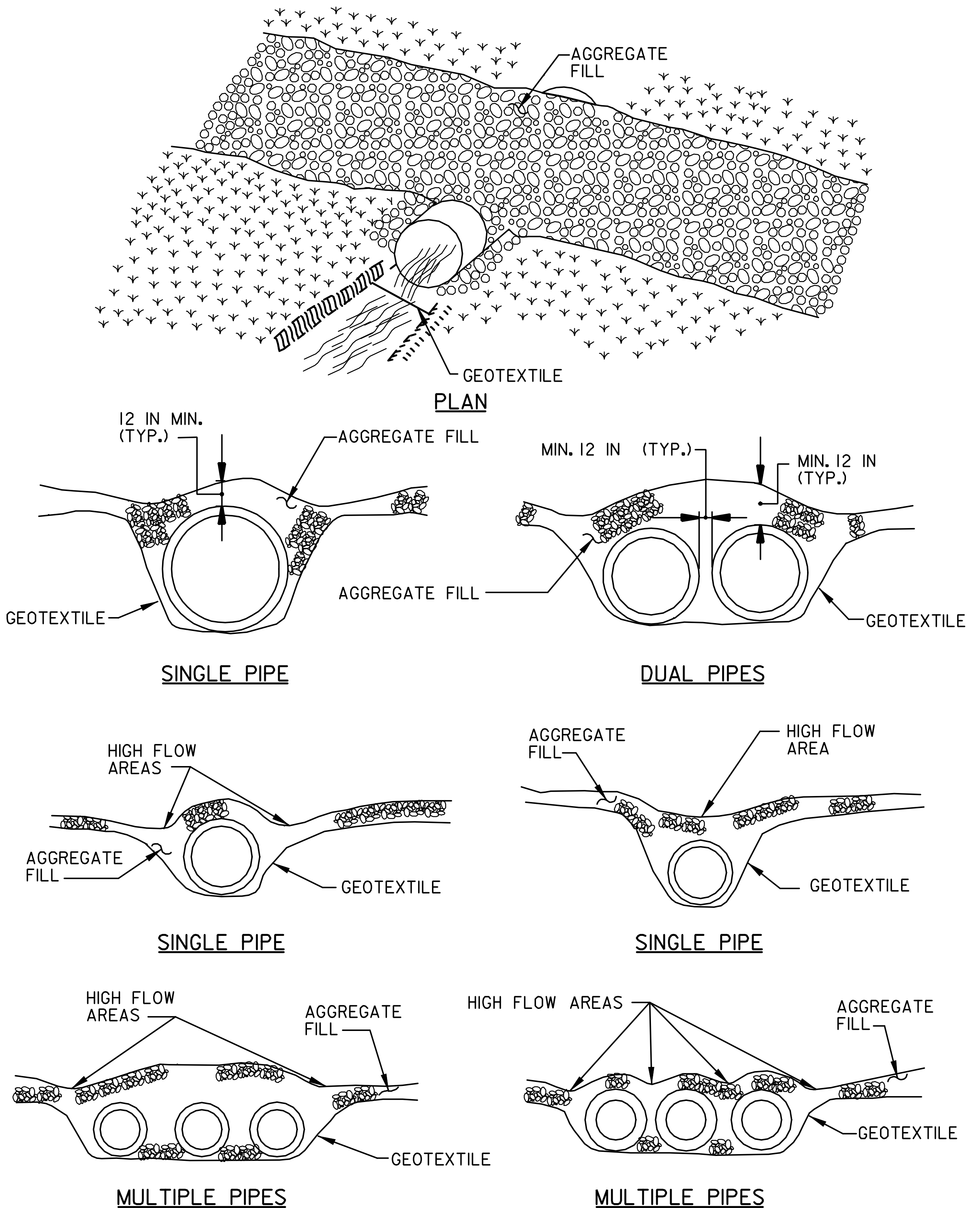
2. Final Clean-up: Remove the temporary structure from the waterway, remove all construction materials, restore the original stream channel cross section, and protect the stream banks from erosion. Store removed material outside of the waterway floodplain.

3. Method: Construction equipment will not be allowed in the waterway channel during the removal of the structure and clean up of the area.

4. Final Stabilization: Stabilize all areas disturbed during culvert removal within 24 hours of that disturbance in accordance with the standards for "Permanent Stabilization, Section B-4-4."

DETAIL H-4-3 – TEMPORARY ACCESS CULVERT

STANDARD SYMBOL



1 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL H-4-3 - TEMPORARY ACCESS CULVERT

STANDARD SYMBOL

CONSTRUCTION SPECIFICATIONS

1. RESTRICTIONS - CONSTRUCTION OR REMOVAL OF A TEMPORARY ACCESS CULVERT WILL NOT BE PERMITTED DURING THE FOLLOWING PERIODS:

USE I AND IP	MARCH 1 - JUNE 15
USE II	JUNE 1 - SEPTEMBER 30 AND DECEMBER 16 - MARCH 14
USE III AND IIIP	OCTOBER 1 - APRIL 30
USE IV	MARCH 1 - MAY 31
SAV* (ALL FLOWING STREAMS)	APRIL 15 - OCTOBER 15

*SUBMERGED AQUATIC VEGETATION

2. CULVERT STRENGTH - SELECT CULVERT TYPE TO BE STRONG ENOUGH TO SUPPORT THEIR CROSS SECTIONAL AREA UNDER MAXIMUM EXPECTED LOADS.
3. CULVERT SIZE - SIZE THE CULVERT PIPE FOR THE LARGEST PIPE DIAMETER THAT WILL FIT INTO THE EXISTING CHANNEL WITHOUT MAJOR EXCAVATION OF THE WATERWAY CHANNEL OR WITHOUT MAJOR APPROACH FILLS. IF A CHANNEL WIDTH EXCEEDS 3 FEET, ADDITIONAL PIPES MAY BE USED UNTIL THE CROSS SECTIONAL AREA OF THE PIPES IS GREATER THAN 60 PERCENT OF THE CROSS SECTIONAL AREA OF THE EXISTING CHANNEL. THE MINIMUM SIZE CULVERT THAT MAY BE USED IS A 12 INCH DIAMETER PIPE. SIZE THE PIPE(S) TO CONVEY THE NORMAL STREAM FLOWS.
4. CULVERT LENGTH - EXTEND THE CULVERT(S) A MINIMUM OF ONE FOOT BEYOND THE UPSTREAM AND DOWNSTREAM TOE TO THE AGGREGATE PLACED AROUND THE CULVERT.
5. GEOTEXTILE - PLACE GEOTEXTILE ON THE STREAMBED AND STREAMBANKS PRIOR TO PLACEMENT OF THE PIPE CULVERT(S) AND AGGREGATE. COVER THE STREAMBED WITH THE GEOTEXTILE AND EXTEND IT A MINIMUM SIX INCHES AND A MAXIMUM OF ONE FOOT BEYOND THE END OF THE CULVERT AND BEDDING MATERIAL. GEOTEXTILE REDUCES SETTLEMENT AND IMPROVES CROSSING STABILITY.
6. CULVERT PLACEMENT - PLACE THE INVERT ELEVATION OF THE CULVERT(S) ON THE NATURAL STREAMBED GRADE TO MINIMIZE INTERFERENCE WITH FISH MIGRATION (FREE PASSAGE OF FISH).
7. CULVERT PROTECTION - COVER THE CULVERT WITH A MINIMUM OF ONE FOOT OF AGGREGATE. FOR MULTIPLE CULVERTS PROVIDE AT LEAST 12 INCHES OF COMPACTED AGGREGATE FILL BETWEEN CULVERTS.
8. STABILIZATION - STABILIZE ALL AREAS DISTURBED DURING CULVERT INSTALLATION WITHIN 24 HOURS OF THE DISTURBANCE IN ACCORDANCE WITH STANDARDS FOR "PERMANENT STABILIZATION, SECTION B-4-4," OR "TEMPORARY STABILIZATION, SECTION B-4-3," AS APPLICABLE.

H-5 STANDARD AND SPECIFICATIONS

FOR

DUST CONTROL

Definition

Controlling dust blowing and movement on construction sites and roads.

Purpose

To prevent blowing and movement of dust from exposed soil surfaces, reduce on and off-site damage, health hazards, and improve traffic safety.

Conditions Where Practice Applies

This practice is applicable to areas subject to dust blowing and movement where on and off-site damage is likely without treatment.

Specifications

Temporary Methods:

1. Mulches: See standards and specifications Section B-4-2, Soil Amendments, Seeding, Mulching and Topsoiling and Section B-4-3, Temporary Stabilization. Mulch should be crimped or tacked to prevent blowing.

2. Vegetative Cover: See standards and specifications Section B-4-3, Temporary Stabilization.

3. Tillage: To roughen surface and bring clods to the surface. This is an emergency measure which should be used before soil blowing starts. Begin plowing on windward side of site. Chisel-type plows spaced about 12 inches apart, spring-toothed harrows, and similar plows are examples of equipment which may produce the desired effect.

4. Irrigation: This is generally done as an emergency treatment. Site is sprinkled with water until the surface is moist. Repeat as needed. At no time should the site be irrigated to the point that runoff begins to flow.

5. Barriers: Solid board fences, silt fences, snow fences, burlap fences, straw bales, and similar material can be used to control air currents and soil blowing. Barriers placed at right angles to prevailing currents at intervals of about 10 times their height are effective in controlling soil blowing.

6. Calcium Chloride: Apply at rates that will keep surface moist and may need retreatment.

Permanent Methods:

1. Permanent Vegetation: See standard and specifications section B-4-4, Permanent Stabilization. Existing trees or large shrubs may afford valuable protection if left in place.

2. Topsoiling: Covering with less erosive soil materials. See standards and specifications Section B-4-2, Soil Amendments, Seeding, Mulching and Topsoiling.

3. Stone: Cover surface with crushed stone or coarse gravel.

H-6 STANDARD AND SPECIFICATIONS

FOR

SAND FILTER

Definition

A device used to filter the discharge from traps and basins.

Purpose

To filter the dewatered discharge from traps and basins as a secondary treatment prior to discharge to a stable outfall.

Conditions Where Practice Applies

This practice is used where further removal of sediments is needed for the dewatering of the discharge from traps and basins prior to discharge into:

1. Streams or bodies of water.
2. Wetlands and Waters of the U.S.
3. Critical and sensitive areas.

Design Criteria

The sand filter consists of a layered system. The upper layer is composed of sand to filter the discharge from a pipe distribution system sitting on top of the sand layer. The lower layer is composed of gravel with a pipe collecting system to collect the filtered discharge and to outlet it to a stable outfall. A stone layer is in between these two layers to keep them from clogging each other.

The sand layer is a minimum of 12 inches thick consisting of clean washed sand. The pipe distribution and collecting systems consist of perforated 6 inch minimum PVC or HDPE pipes. The distribution pipes will consist of two parallel rows minimum sitting level on top of the sand layer with the end of the pipes capped. Several cross connecting pipes are to be provided to connect the two parallel rows. The discharge hose/pipe from the traps or basins will be securely connected to the distribution pipes. Similarly, the collection system will also be two parallel rows of pipe minimum with connecting cross pipes within a clean washed gravel layer. The collection pipes must have a minimum slope of ½ percent towards the outlet. A minimum cover of 6 inches is to be provided on top of the pipes. The one end of the system will be capped and the other end will be connected to a non-perforated length of PVC or HDPE pipe for the outlet of the sand filter. A 4 inch stone layer (#7 stone) will separate the sand and gravel layers. The minimum width of the filter will be 5 feet. The length will be equal to 5 times the drainage area to the trap/basin with the minimum width being 10 feet. The topography of the land may require the minimum dimensions to be altered, but the total surface area provided must be the same. The location of the sand filter must be beyond the phreatic line of the trap/basin.

Construction Specifications

1. Excavate the trench for the sand filter and place materials on downstream side of trench to form a berm.

2. Line the sides of the trench and berm with Class 'SE' geotextile.

3. Construct the 6 inch PVC or HDPE pipe collection system and outlet pipe to a stable outfall with minimum slope of 0.5 percent.

4. Cover collection pipes with 6 inches of clean washed gravel.

5. Provide a 4 inch layer of # 7 stone on the gravel.

6. Provide 12 inches minimum of clean washed sand over the gravel.

7. Construct 6 inch PVC or HDPE collection system on top of sand layer at zero grade (level) and connect to discharge from trap/basin.

8. Discharge sediment laden water from the trap/basin at a rate that does not scour the sand layer.

Inspection

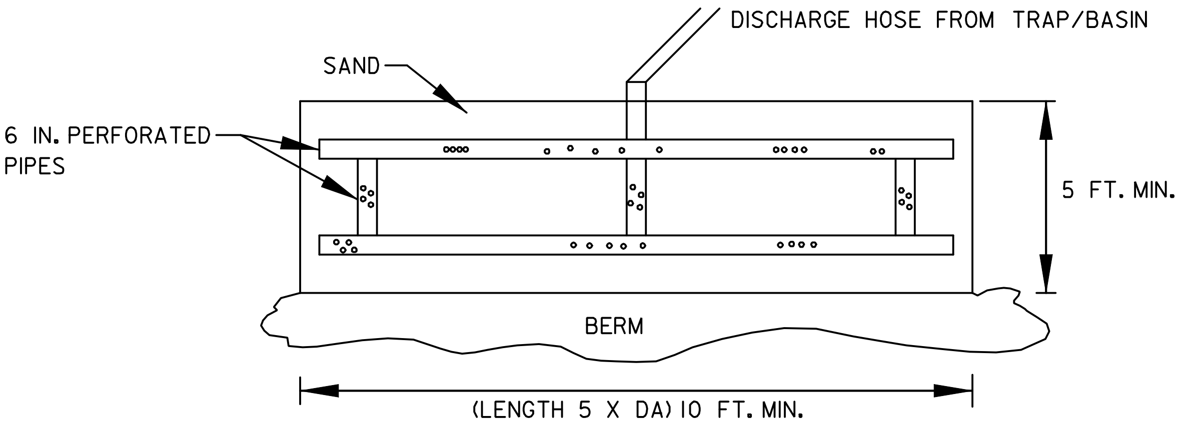
Constant inspection of the sand filter is required during the filtering operation. The sand layer will need to be cleaned and or replaced when the discharge ponds on the sand layer due to clogging of the sand and there is no discharge at the outlet pipe.

Removal

When the filtering operations are completed and the sand filter is no longer needed, remove the sand filter. Remove the sand, gravel PVC pipes and geotextile. Fill the trench back up with the material from the berm. Stabilize all area disturbed due to the removal.

DETAIL H-6 - SANDFILTER

STANDARD SYMBOL



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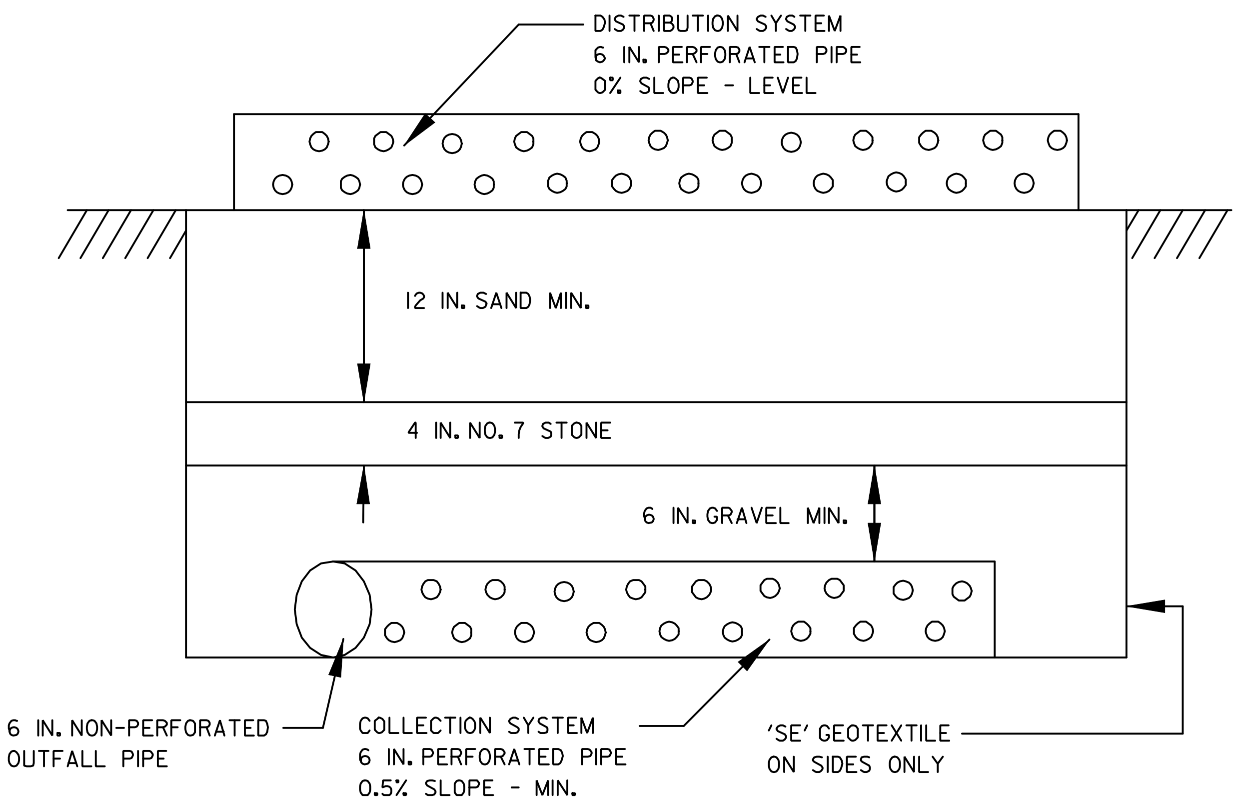


PROFILE

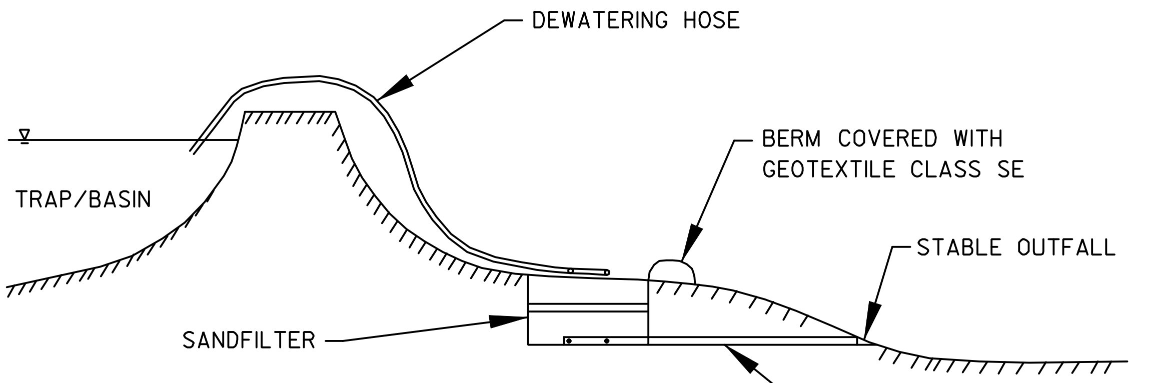
1 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL H-6 - SANDFILTER

STANDARD SYMBOL



SECTION

CONSTRUCTION SPECIFICATIONS

1. EXCAVATE THE TRENCH FOR THE SAND FILTER AND PLACE MATERIALS ON DOWNSTREAM SIDE OF TRENCH TO FORM A BERM.
2. LINE THE SIDES OF THE TRENCH AND BERM WITH GEOTEXTILE CLASS SE.
3. CONSTRUCT THE 6 INCH PVC OR HDPE PIPE COLLECTION SYSTEM AND OUTLET PIPE TO A STABLE OUTFALL WITH MINIMUM SLOPE OF 0.5 PERCENT.
4. COVER COLLECTION PIPES WITH 6 INCHES MINIMUM OF CLEAN WASHED GRAVEL.
5. PROVIDE A 4 INCH LAYER OF NO. 7 STONE ON THE GRAVEL.
6. PROVIDE 12 INCHES MINIMUM OF CLEAN WASHED SAND OVER THE GRAVEL.
7. CONSTRUCT 6 INCH PVC OR HDPE COLLECTION SYSTEM ON TOP OF SAND LAYER AT ZERO GRADE (LEVEL).
8. DISCHARGE SEDIMENT LADEN WATER FROM THE TRAP/BASIN AT A RATE THAT DOES NOT SCOUR THE SAND LAYER.

2 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

H-7 STANDARD AND SPECIFICATIONS

FOR

TURBIDITY CONTROL SYSTEMS

Turbidity control systems improve the water quality of construction site runoff that cannot otherwise be improved by conventional sediment and erosion controls. Properly designed, constructed, and maintained sediment control practices detailed in this manual are effective at removing sediment from construction site runoff. Many of these sediment control practices typically remove sands and medium to coarse silts but are less effective in removing fine silts and clays. For sites containing soils with a high clay content a turbidity control system is required. See Figure A-2.

Typically, treatment with chemicals is referred to as coagulation or flocculation. Coagulation uses a chemical additive to reduce the net repulsive forces at the surface of individual particles in water, thereby causing them to adhere to each other.. Flocculation is the agitation of the water after chemicals are added to the water in order to agglomerate the individual particles into aggregates or “flocs”, thus allowing faster settling and more efficient filtration. For the purpose of this manual, coagulants are defined as chemicals treating sediment-laden runoff in either a passive or active system. The effectiveness of chemical treatment is dependent on a number of variables including water temperature, soil types (particle size distribution), turbidity of inflow water, pH, and flow rate. .

Chemical additives used in treatment systems include gypsum, aluminum sulfate (alum), ferric iron (sulfate or chloride salt), and polymers. These chemicals are routinely used in municipal water treatment systems but are relatively new to the erosion and sediment control industry. All of these chemical additives can be used with either passive and active treatment systems. Currently, MDE supports the use of polyacrylamides (PAM) as the preferred choice for a chemical additive. PAM is a water soluble polymer. Polymers are long-chain molecules that bind soil particles together by reducing the intermolecular chemical forces.

H-7-1 STANDARD AND SPECIFICATIONS

FOR

PASSIVE CHEMICAL TREATMENT SYSTEMS (PTS)

Definition

A process where a coagulant is applied directly to the soil surface or in conjunction with sediment control practices.

Purpose

Passive chemical treatment systems utilize chemical coagulants to bind soil particles together and reduce sediment pollution through the application of a coagulant over disturbed areas.

Conditions Where Practice Applies

1. As determined by Figure A-2 Turbidity Control System.

2. To reduce turbidity and improve water clarity.

3. Disturbed soil areas that discharge to a sediment control practice.

Design Criteria

1. Areas where coagulant is to be applied should be designated on the plan and upgrade of a sediment control practice.

2. Specify whether the application of coagulant will be wet or dry.

3. Application rate of coagulant (e.g., 2/3 pound PAM/1000 gallons of water/acre) must be provided.

4. Provide manufacturer's information regarding the application of a coagulant.

5. Provide the Material Safety Data Sheet (MSDS) for each coagulant.

6. Coagulants must be non-combustible.

7. Additives to coagulants must be non-toxic.

Construction Specifications

1. Apply the coagulant in accordance with the manufacturer's recommendations and all Material Safety Data Sheet (MSDS) requirements.

2. Use application rate specified on the plan.

3. Apply coagulant uniformly to the targeted area and avoid drift to non-targeted areas.

4. All coagulants must be approved by MDE or appropriate approval authority prior to use.

5. Only apply coagulant where runoff is to a sediment control practice.

6. Do not apply coagulant directly to surface waters of the State.

7. Follow safety precautions for handling all coagulants and additives.

H-7-2 STANDARD AND SPECIFICATIONS

FOR

ACTIVE TREATMENT SYSTEMS (ATS)

The main components of an active treatment system (ATS) include a storage facility to temporarily detain water, a coagulation unit, a mixing/flocculation area, and either clarifying basin/tank, media filtration, or a combination. After coagulation/flocculation, the resulting "floc" can be filtered, skimmed, or settled by gravity.

Two modes of operation for ATS are currently used to treat construction site runoff; batch treatment or continuous (flow-through) systems. Batch treatment systems detain the sediment-laden water for a specific amount of time after coagulation, treating the runoff in "batches" prior to discharge. Continuous treatment allows for a continuous discharge while the incoming flow is treated. Batch treatment allows for better control of the water to be discharged. Batch treatment works well for low volumes and low discharge rates and during dry-weather pumping operations such as dewatering excavated areas. Dosing in batch treatment can be automated or manual. Continuous systems are typically automated and are more suitable for wet-weather flow and higher volumes and peak discharge rates. Dosing is applied throughout the pumping operation and can be controlled to start once a certain rainfall depth is reached and stopped at the cessation of rainfall.

In batch treatment systems, storage facilities typically consist of a sediment trap or basin. Continuous systems do not require a storage facility, but water needs to be collected in a storm drain or an open channel system. Gypsum, alum, PAMs, and chitosan-based polymers have been used successfully in ATS. After the addition of coagulants, proper mixing/flocculation must take place. In continuous systems, a filter media is used to filter the resultant floc prior to discharge. Batch treatment systems may use a filter media (such as sand filter (see section H-7), a skimmer device, or gravity settling. A sediment basin or tank is required to allow the floc to settle or if using a skimmer to siphon the water prior to discharge.

Definition

A mechanized system in which coagulation is achieved by the addition of chemicals at a known dosage or the use of electrocoagulation to sediment-laden runoff followed by gravity settling, and/or filtration to reduce turbidity prior to discharging from the site.

Purpose

To reduce the turbidity of concentrated discharge water from construction sites by using pumps and other mechanized equipment .

Conditions Where Practice Applies

1. As determined by Figure A-2 Turbidity Control System.

2. To reduce turbidity and improve water clarity.

3. Disturbed soil areas that discharge to a sediment control practice.

Design Criteria

1. Chemicals used in an ATS must be approved by MDE. Petroleum-based emulsions or carriers are prohibited.

2. Provide the manufacturer's instructions on the chemical selected for the system, specific to the type of system, if applicable.

3. Provide the Material Safety Data Sheet(MSDS) for the selected chemical.

4. Determine the appropriate dosage rates based on site-specific soil and water conditions.

5. The maximum dosage must be at least 50% of the no observed effects concentration (NOEC).

6. Jar testing must be in compliance with ASTM D2035-08 Standard Practice for Coagulation-Flocculation Jar Test of Water.

7. The ATS design must be approved by MDE or the appropriate approval authority.

8. The ATS design must include safeguards to preclude the accidental discharge of settled or floating floc during pumping or related operations.

9. The design should ensure proper flocculation/mixing after coagulation.

10. Develop an ATS Plan that includes site-specific data and necessary information for the safe and efficient operation of the selected treatment system . At a minimum, include:
    a) ATS Operation and Maintenance Manual for All Equipment
    b) ATS Monitoring, Sampling & Reporting Plan, including Quality Assurance / Quality Control (QA/QC)
    c) ATS Health and Safety Plan
    d) ATS Spill Prevention Plan
    e) Site information such as soil type, flow rate, discharge location. etc.

11. Submit the ATS Plan to MDE or the appropriate approval authority for approval.

12. A copy of the approved ATS Plan is to be on site when the ATS is operating.

Construction Specifications

1. All required approvals and specifications must be on site during the operation of an ATS, including:
    a. Material Data Safety Sheet (MSDS) for each chemical additive used in the ATS.
    b. Manufacturer's specifications and instructions for each chemical additive, specific to the on-site ATS.
    c. A site-specific ATS Plan approved by MDE or the appropriate approval authority.

2. Install the ATS as specified on the approved erosion and sediment control plan and ATS Plan.

3. Implement all health and safety precautions as required by the chemical manufacturer's instructions and OSHA.

4. Adhere to the proper dosage rates for the chemical additives.

5. If dosage rates are not provided in the approved ATS Plan, approval must be obtained prior to beginning operation of the ATS.

6. Operation of the ATS must be conducted in accordance with the ATS Plan and all operation and maintenance manuals specific to the on-site ATS.

7. Continuous monitoring of the ATS is required when in operation.

8. A written daily log is required when the ATS is operational. At a minimum, include the following information:
   a) pH conductivity (as a surrogate for alkalinity), turbidity, and temperature of the untreated stormwater;
   b) pH and turbidity of the treated water;
   c) pH and turbidity of the receiving water;
   d) Type and amount of chemical coagulant used
   e) Type and amount of chemical used for pH adjustment;
   f) Rainfall (amount and duration);
   g) Total volume treated and discharged from the ATS;
   h) Discharge duration and flow rate;
   i) Settling time (applies to batch treatments);
   j) Maintenance performed;
   k) Name of operator;
   l) Name of person conducting the monitoring (if different);
   m) Date and time of monitoring;
   n) Any issues, problems, and concerns with the ATS.

9. Operation of the ATS shall not cause a change in pH of the receiving water of more than 0.2 standard units.

H-8 STANDARDS AND SPECIFICATIONS

FOR

ONSITE CONCRETE DISPOSAL AREA

Definition

An area designated for washing out ready-mix trucks, drums, pumps and for rinsing off chutes, equipment and concrete truck exteriors.

Purpose

Concrete wash areas are used to capture the concrete and wash water to prevent contamination of waterways, groundwater and storm drains.

Conditions Where Practice Applies

When concrete is used as a construction material and it is not possible to dispose of all concrete wastewater and washout offsite at the ready mix plant or facility.

Design Criteria

The washout area can be a prefabricated concrete washout container that is delivered to the site or can be an onsite constructed facility located below grade or above-grade. Locate all washout areas a minimum of 50 feet from sensitive areas such as storm drains, open ditches, water bodies, streams and wetlands. Provide convenient access for the concrete trucks to the washout areas. Install a sign adjacent to each washout area to inform the concrete equipment operator to utilize the proper facilities. Size the washout area to contain all liquid and solid wastes that are expected to be generate between washings. Approximately 7 gallons are used to wash out a chute and 50 gallons to wash out the hopper of the concrete pump truck. Also consider rainfall in sizing of the facility. The onsite constructed washout areas will have a minimum dimension of 10 feet by 10 feet. Provide 12 inches of freeboard above the required computed depth for the onsite constructed washout areas with the minimum depth of the facility being 3 feet. Line the bottom of the constructed washout area with plastic sheeting at least 10-mil thick with no holes or tears to prevent leaching of liquids into the ground. Prefabricated containers will follow manufacturers design criteria and operations.

Construction Specifications

1. Locate washout area a minimum of 50 feet away from open channels, storm drain inlets, sensitive areas, wetlands, buffers or water courses and away from construction traffic.

2. Size washout area for required computed volume considering wash water, solids and rainfall. Minimum dimensions are 10 feet by 10 feet and 3 feet deep.

3. Provide polyethylene plastic liner a minimum of 10-mils thick free of holes and tears or other defect that compromise impermeability of the material. Prepare soil base free of rocks or other debris that may cause tears or holes in the liner.

4. Provide a sign for the washout in close proximity to the facility.

Maintenance

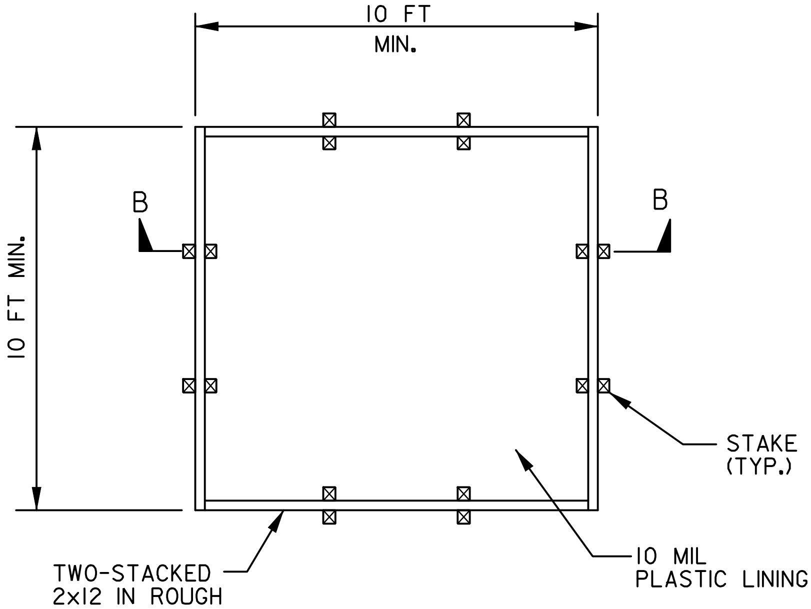
Inspect washout area daily and prior to each use. Clean facility or provide a new facility when washout is 75 percent full or when minimum freeboard is no longer achieved. Check for leaks, holes and tears in the liner and repair or replace immediately. Cover area with a non-collapsing, non-water collecting cover prior to predicted wet weather events to prevent overtopping with rainwater if not sized to handle rain events.

Removal

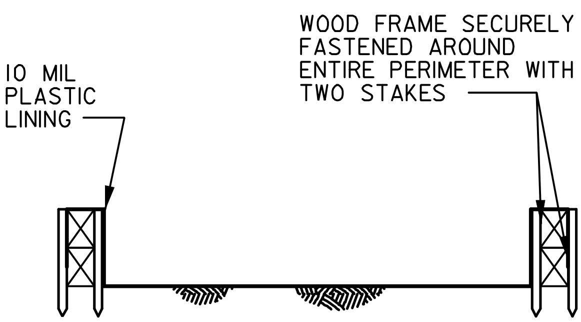
When washout facility is no longer required, remove hardened concrete, slurries and liquids and dispose of them properly. Remove materials used to build the washout and recycle if possible. Backfill and repair depressions or holes in the ground after removal and stabilize area of washout per the standard stabilization methods.

DETAIL H-8-2 - ONSITE CONCRETE DISPOSAL AREA - ABOVE GRADE WITH WOOD PLANKS

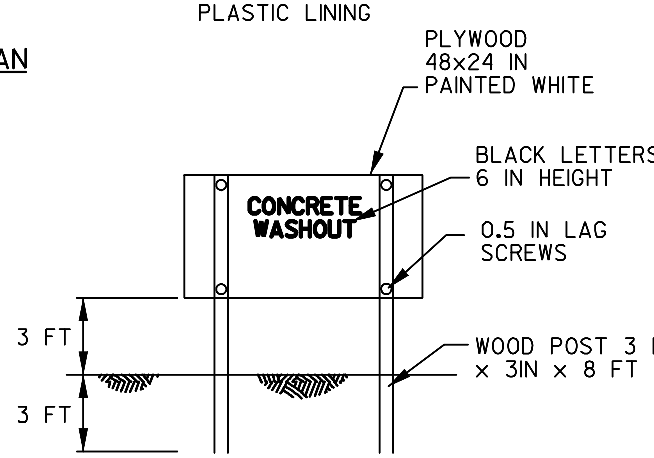
STANDARD SYMBOL



PLAN



SECTION B-B



SIGN DETAIL

CONSTRUCTION SPECIFICATIONS

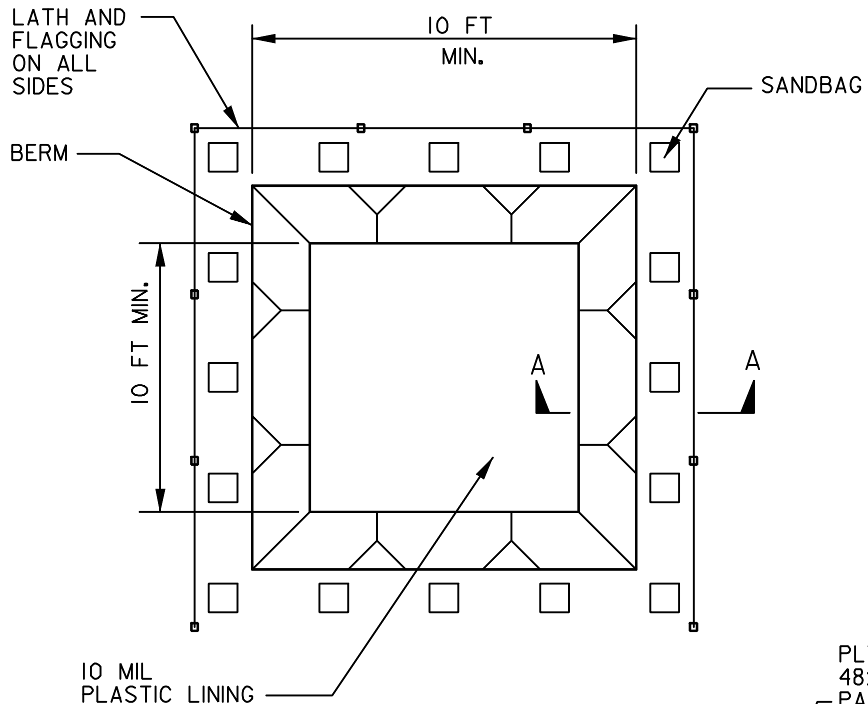
1. LOCATE WASHOUT AREA A MINIMUM OF 50 FEET AWAY FROM OPEN CHANNELS, STORM DRAIN INLETS, SENSITIVE AREAS, WETLANDS, BUFFERS OR WATER COURSES AND AWAY FROM CONSTRUCTION TRAFFIC.
2. SIZE WASHOUT AREA FOR REQUIRED COMPUTED VOLUME CONSIDERING WASH WATER, SOLIDS AND RAINFALL. MINIMUM DIMENSIONS ARE 10 FEET BY 10 FEET AND 3 FEET DEEP.
3. PROVIDE POLYETHYLENE PLASTIC LINER A MINIMUM OF 10-MILS THICK FREE OF HOLES AND TEARS OR OTHER DEFECT THAT COMPROMISE IMPERMEABILITY OF THE MATERIAL. PREPARE SOIL BASE FREE OF ROCKS OR OTHER DEBRIS THAT MAY CAUSE TEARS OR HOLES IN THE LINER.
4. PROVIDE A SIGN FOR THE WASHOUT IN CLOSE PROXIMITY TO THE FACILITY.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL H-8-1 - ONSITE CONCRETE DISPOSAL AREA - BELOW GRADE WASHOUT

STANDARD SYMBOL



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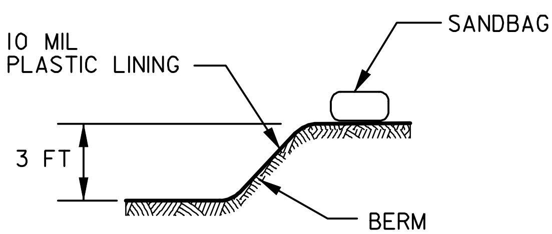
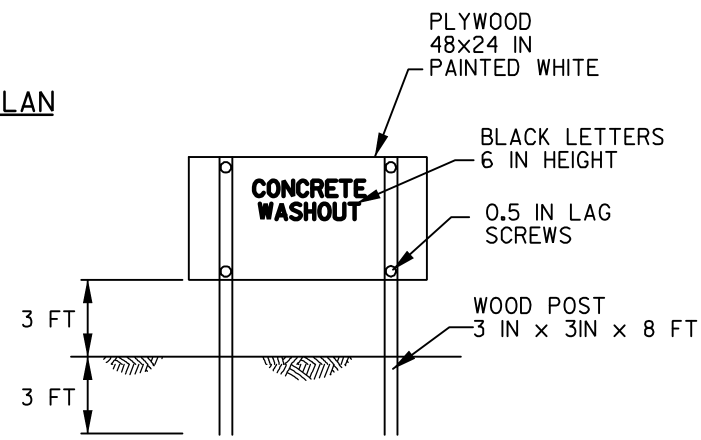


SECTION A-A



SIGN DETAIL

CONSTRUCTION SPECIFICATIONS

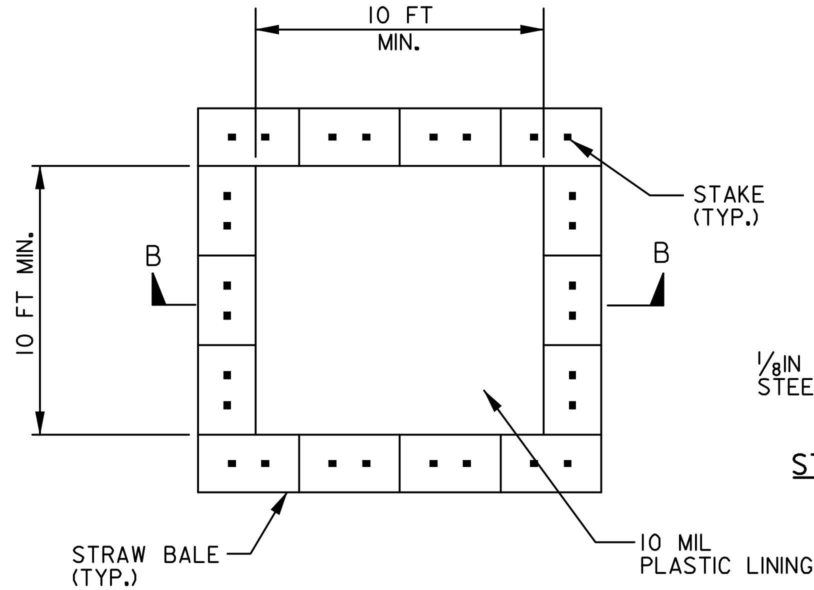
1. LOCATE WASHOUT AREA A MINIMUM OF 50 FEET AWAY FROM OPEN CHANNELS, STORM DRAIN INLETS, SENSITIVE AREAS, WETLANDS, BUFFERS OR WATER COURSES AND AWAY FROM CONSTRUCTION TRAFFIC.
2. SIZE WASHOUT AREA FOR REQUIRED COMPUTED VOLUME CONSIDERING WASH WATER, SOLIDS AND RAINFALL. MINIMUM DIMENSIONS ARE 10 FEET BY 10 FEET AND 3 FEET DEEP.
3. PROVIDE POLYETHYLENE PLASTIC LINER A MINIMUM OF 10-MILS THICK FREE OF HOLES AND TEARS OR OTHER DEFECT THAT COMPROMISE IMPERMEABILITY OF THE MATERIAL. PREPARE SOIL BASE FREE OF ROCKS OR OTHER DEBRIS THAT MAY CAUSE TEARS OR HOLES IN THE LINER.
4. PROVIDE A SIGN FOR THE WASHOUT IN CLOSE PROXIMITY TO THE FACILITY.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

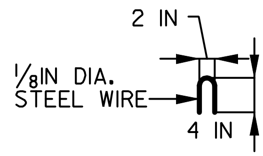
U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL H-8-3 - ONSITE CONCRETE DISPOSAL AREA - ABOVE GRADE WITH STRAW BALES

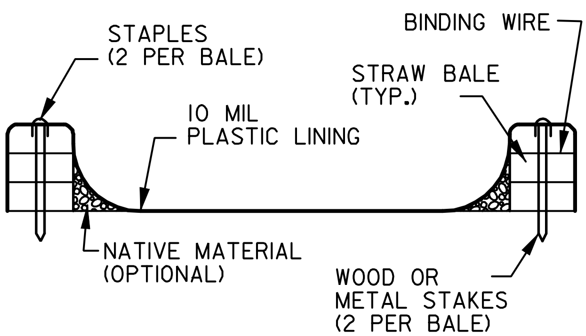
STANDARD SYMBOL



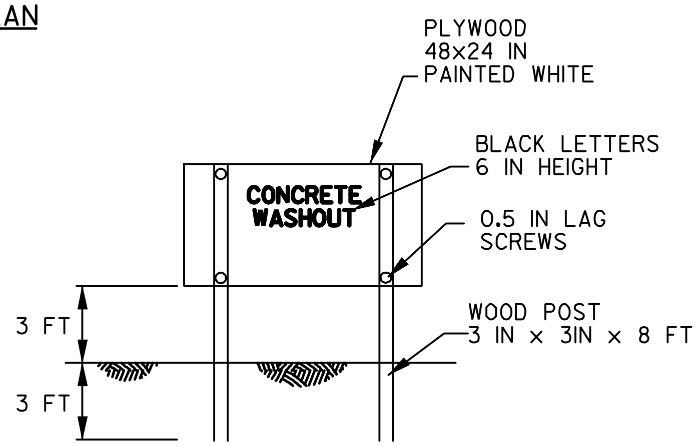
PLAN



STAPLE DETAIL



SECTION B-B



SIGN DETAIL

CONSTRUCTION SPECIFICATIONS

1. LOCATE WASHOUT AREA A MINIMUM OF 50 FEET AWAY FROM OPEN CHANNELS, STORM DRAIN INLETS, SENSITIVE AREAS, WETLANDS, BUFFERS OR WATER COURSES AND AWAY FROM CONSTRUCTION TRAFFIC.

2. SIZE WASHOUT AREA FOR REQUIRED COMPUTED VOLUME CONSIDERING WASH WATER, SOLIDS AND RAINFALL. MINIMUM DIMENSIONS ARE 10 FEET BY 10 FEET AND 3 FEET DEEP.

3. PROVIDE POLYETHYLENE PLASTIC LINER A MINIMUM OF 10-MILS THICK FREE OF HOLES AND TEARS OR OTHER DEFECT THAT COMPROMISE IMPERMEABILITY OF THE MATERIAL. PREPARE SOIL BASE FREE OF ROCKS OR OTHER DEBRIS THAT MAY CAUSE TEARS OR HOLES IN THE LINER.

4. PROVIDE A SIGN FOR THE WASHOUT IN CLOSE PROXIMITY TO THE FACILITY.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE		MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

GLOSSARY

GLOSSARY

AASHTO - American Association of State Highway & Transportation Officials
(Formerly AASHO.)

ACCEPTABLE OUTLET - That point where storm water runoff can be released into a watercourse or drainage way of adequate capacity without causing scour or erosion.

ACID SOIL - A soil giving an acid reaction throughout most or all of the portion occupied by roots. (Precisely, below a pH of 7.0; practically, below a pH of 6.6.)

ALLUVIAL FAN - A sloping, fan shaped mass of sediment deposited by a stream where it emerges from an upland onto a plain.

ALLUVIUM - A general term for all detrital material deposited or in transit by streams, including gravel, sand, silt, clay and all variations and mixtures of these. Unless otherwise noted, alluvium is unconsolidated.

ANGLE OF REPOSE - The stable angle between the horizontal and the maximum slope that a soil assumes through natural processes which will not slough.

ANTI-SEEP COLLAR - An impermeable diaphragm usually of sheet metal or concrete constructed at intervals within the zone of saturation along the conduit of a principal spillway to increase the seepage length along the conduit and thereby prevent piping or seepage along the conduit.

ANTI-VORTEX DEVICE - A device designed and placed on the top of a riser or at the entrance of a pipe to prevent the formation of a vortex in the water at the entrance.

APRON - A floor or lining to protect a surface from erosion, for example, the pavement below chutes, spillways, or at the toes of dams.

ASPECT - The direction a slope faces - a physiographic feature of steep slopes which influences plant growth and adaptation.

ATTERBERG LIMITS - Atterberg limits are soil properties measured for soil materials passing the No. 40 sieve.

> Liquid Limit (LL) - the liquid limit is the water content corresponding to the arbitrary limit between the liquid & plastic states of consistency of a soil.
>
> Plastic Limit (PL) - The plastic limit is the water content corresponding to an arbitrary limit between the plastic and semisolid states of consistency of a soil.
>
> Plasticity Index (PI) - The plasticity index is the numerical difference between the liquid limit and plastic limit.

BAFFLES - Vanes, guides, grids, grating or similar devices placed in a conduit to deflect or regulate flow and effect a more uniform distribution of velocities.

BARREL - The usually mild sloping closed conduit used to convey water under or through a dam; part of a principal spillway.
BASE FLOW - The stream discharge from ground water accretion.

BEDLOAD - The sediment that moves by sliding, rolling or bounding on or very near the streambed; sediment moved mainly by tractive or gravitational forces or both, but at velocities less than the surrounding flow.

BERM - A shelf that breaks the continuity of a slope.

BIODEGRADABLE - Capable of being broken down (degraded) by common soil organisms.

BLIND DRAIN - A type of drain consisting of an excavated trench refilled with pervious material, such as coarse sand, gravel or crushed stone, through whose voids water percolates and flows to an outlet. Often referred to as a French drain because of its initial development and widespread use in France.

BRACKISH (WATER) - Slightly to moderately salty water.

BULKHEAD - A wall made from wood, steel, concrete, etc. for protection of shoreline from waves or currents.

CALCIUM SULFATE - Gypsum. A hydrated form used to treat high sodium soils.
$CaSO_4$

CHANNEL - A natural stream that conveys water; a ditch or channel excavated for the flow of water.

CHANNEL IMPROVEMENT - The improvement of the flow characteristics of a channel by clearing, excavation, realignment, lining, or other means in order to increase its water carrying capacity.

CHANNEL STABILIZATION - Erosion prevention and stabilization of velocity distribution in a channel using jetties, drops, revetments, structural linings, vegetation and other measures.

CHANNEL STORAGE - Water temporarily stored in channels while enroute to an outlet.

CHECK DAM - A small dam construction in a gully or other small watercourse to decrease the stream flow velocity (by reducing the channel gradient), minimize channel scour, and promote deposition of sediment.

CHUTE - A high velocity, open channel for conveying water to a lower level without erosion.

CLAY (SOILS) - 1. A mineral soil separate consisting of particles less than 0.002 millimeter in equivalent diameter. 2. A soil texture class. 3. (Engineering) A fine grained soil (more than 50 percent passing the No. 200 sieve) that has a high plasticity index in relation to the liquid limit. (Unified Soil Classification System)

COMPACTION - To unite firmly. With respect to construction work with soils, engineering compaction is any process by which the soil grains are rearranged to decrease void space and bring them into closer contact with one another, thereby increasing the weight of solid material per unit of volume, increasing the shear and bearing strength and reducing permeability.

CONCENTRATED FLOW – Water, usually stormwater runoff that converges in well-defined channels, ditches, gullies, streams, or pipes.

CONDUIT - Any channel intended for the conveyance of water, whether open or closed.

CONTOUR - 1. An imaginary line on the surface of the earth connecting points of the same elevation. 2. A line drawn on a map connecting points of the same elevation.

COOL (SLOPE, EXPOSURE) - A slope facing north or east, or a slope shaded during the hot part of the day.

CORDGRASS - Grasses of genus Spartina which are so named because of seed heads which have the appearance of coarse cord. These grasses are important soil binders along saltwater shorelines and marshes.

CORE TRENCH - A trench, filled with relatively impervious material intended to reduce seepage of water through porous strata.

CRADLE (ENGINEERING) - A structure usually of concrete shaped to fit around the bottom and sides of a conduit to support the conduit, increase its strength and in dams, to fill all voids between the underside of the conduit and the soil.

CREST - 1. the top of a dam, dike, spillway or weir, frequently restricted to the overflow portion. 2. The summit of a wave or peak of a flood.

CRITICAL AREA OR SITE - Sediment producing, highly erodible or severely eroded areas.

CRITICAL DEPTH (HYDRAULICS) - Depth of flow in a channel of specified dimensions at which specific energy is a minimum for a given discharge.

CRITICAL FLOW – The dividing point between sub critical (tranquil) and super critical (rapid) flow.

CROWN (OF SLOPE) - Top of slope; apex.

CRUSHED STONE - Aggregate consisting of angular particles produced by mechanically crushing rock.

CULM - The stem of grasses, sedges and rushes which is jointed and usually hollow in grasses and usually solid in sedges and rushes.

CULTIPACKER SEEDER - A farm tool equipped with a seedbox which drops the seed between cultipacker rollers to place the seed on firm soil where they will be pressed into soil by the second corrugated roller.

CUT - Portion of land surface or area from which earth has been removed or will be removed by excavation; the depth below original ground surface to excavated surface.

CUT-AND-FILL - Process of earth moving by excavating part of an area and using the excavated material for adjacent embankments or fill areas.

CUTOFF - A wall or other structure, such as a trench, filled with relatively impervious material intended to reduce seepage of water through porous strata.

CUTTINGS - A small shoot cut from a plant to start a new plant.

CYCLONE (SEEDER) - A hand turned or tractor drawn seeder that broadcasts seed onto the seedbed by a rotary motion that slings the seed outward from the seeder.

DAM - A barrier to confine or raise water for storage or diversion, to create a hydraulic head, to prevent gully erosion, or for retention of soil, sediment or other debris.

DEBRIS - Broken remains of plants, objects and rocks that form trash or remains.

DECIDUOUS - Plants that shed their leaves annually as opposed to evergreen.

DEPOSITION - The accumulation of material dropped because of a slackening movement of the transporting agent, water or wind.

DESICCATION - Drying out as of root systems of plants before they are planted.

DESILTING AREA - An area of grass, shrubs or other vegetation used for inducing deposition of silt and other debris from slowing water, located above a pond, field or other area needing protection from sediment accumulation. (See filter strip.)

DETENTION DAM - A dam constructed for the purpose of temporary storage of stream flow or surface runoff which releases the stored water at controlled rates.

DIKE (ENGINEERING) - An embankment to confine or control water, for example, one built along the banks of a river to prevent overflow or lowlands; a levee.

DISTURBED AREA - An area in which the natural vegetative soil cover has been removed or altered and, therefore, is susceptible to erosion.

DIVERSION - A channel with a supporting ridge on the lower side constructed across the slope to divert water from areas where it is in excess to sites where it can be used or disposed of safely. Diversions differ from terraces in that they are individually designed.

DOLOMITIC (LIMESTONE) - Liming materials that contain more than 6 percent magnesium (mg); high magnesium lime.

DRAIN (NOUN) - 1. A buried pipe or other conduit (subsurface drain). 2. A ditch or channel (open drain) for carrying off surplus surface water or groundwater.

DRAIN (VERB) - 1. To provide channels, such as open ditches or closed drains, so that excess water can be removed by surface flow or internal flow. 2. To lose water (from the soil) by percolation.

DRAINAGE - 1. The removal of excess surface water or ground water from land by means of surface or subsurface drains. 2. Soils characteristics that affect natural drainage.

DRAINAGE AREA (WATERSHED) - All land and water area from which runoff may run to a common (design) point.

DRAUGHTY (SOIL OR SLOPE) - Lacking moisture during part of the growing season during a typical year.

DROP INLET SPILLWAY - An outfall structure in which the water drops through a vertical riser connected to a discharge conduit.

DROP SPILLWAY - An outfall structure in which the water drops over a vertical wall onto an apron at a lower elevation.

DROP STRUCTURE - A structure for dropping water to a lower level and dissipating surplus energy; a fall. The drop may be vertical or inclined.

DRY STORAGE - The 1800 cubic feet of storage in a trap or basin that is dewatered after rain events.

EMERGENCY SPILLWAY - A dam spillway designed and constructed to discharge flow in excess of the principal spillway design discharge.

ENERGY DISSIPATOR - A designed device such as an apron of riprap or a concrete structure placed at the end of a water transmitting apparatus such as pipe, paved ditch or paved chute for the purpose of reducing the velocity, energy and turbulence of the discharged water.

ENTRANCE HEAD - The head required to cause flow into a conduit or other structure, including both entrance loss and velocity head.

EROSION - 1. The wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep. 2. Detachment and movement of soil or rock fragments by water, wind, ice or gravity. The following terms are used to describe different types of water erosion:

> Accelerated erosion - Erosion much more rapid than normal, natural or geological erosion, primarily as a result of the influence of the activities of man or, in some cases, of other animals or natural catastrophes that expose base surfaces, for example, fires.
>
> Gully erosion - The erosion process whereby water accumulates in narrow channels and, over short periods, removes the soil from this narrow area to considerable depths, ranging from 1 or 2 feet to as much as 75 to 100 feet.
>
> Rill erosion - An erosion process in which numerous small channels only several inches deep are formed. See rill.
>
> Sheet erosion - The spattering of small soil particles caused by the impact of raindrops on wet soils. The loosened and spattered particles may or may not subsequently be removed by surface runoff.

EROSIVE VELOCITIES - Velocities of water that are high enough to wear away the land surface. Exposed soil will generally erode faster than stabilized soils. Erosive velocities will vary according to the soil type, slope, structural or vegetative stabilization used to protect the soil.

ESTHETIC (AESTHETIC) - Pleasing in appearance; showing good taste.

EVERGREEN - Plants which have leaves or needles yearlong as opposed to those that lose their leaves during part of the year.

EXCELSIOR BLANKET - An erosion retardant material made from excelsior strands held together with net-like stands of plastic or other material.

EXPOSURE (SLOPE) -

> North - Slopes facing in any compass direction clockwise between N45W and S45E.
>
> South - Those slopes which face in any compass direction clockwise between S45E and N45W.

FILTER STRIP - A strip of permanent vegetation above ponds, diversions and other structures to retard flow of runoff water, causing deposition of transported material, thereby reducing sediment flow.

FINES (SOIL) - Generally refers to the silt and clay size particles in soil.

FREEBOARD (HYDRAULICS) - The distance between the maximum water surface elevation anticipated in design and the top of retaining banks or structures. Freeboard is provided to prevent overtopping due to unforeseen conditions.

GABION - A flexible woven-wire basket composed of two to six rectangular cells filled with small stones. Gabions may be assembled into many types of structures such as revetments, retaining walls, channel liners, drop structures and groins.

GABION MATTRESS - A thin gabion, usually six or nine inches thick, used to line channels for erosion control.

GRADE - 1. The slope of a road, channel or natural ground. 2. The finished surface of a canal bed, roadbed, top of embankment, or bottom of excavation; any surface prepared for the support of construction, like paving or laying a conduit. 3. To finish the surface of a canal bed, roadbed, top of embankment or bottom of excavation.

GRAFTING - A method of propagating plants by joining wood from one plant to another plant to get more desirable growth on the second plant.

GRASSED WATERWAY - A natural or constructed waterway, usually broad and shallow covered with erosion resistant grasses, to convey surface water down the slope.

GRAVEL - 1. Aggregate consisting of mixed sizes of 1/4 inch to 3 inch particles which normally occur in or near old streambeds and have been worn smooth by the action of water. 2. A soil having particle sizes, according to the Unified Soil Classification System, ranging from the No. 4 sieve size angular in shape as produced by mechanical crushing.

GRAVEL FILTER - Washed and graded sand and gravel aggregate placed around a drain or well screen to prevent the movement of fine materials from the aquifer into the drain or well.

GROIN - A shore protection structure built (usually perpendicular to the shoreline) to trap littoral drift or retard erosion of the shoreline.

GROUND COVER - Plants which are low-growing and provide a thick growth which protects the soil as well as providing some beautification of the area occupied.

GULLY - A channel or miniature valley cut by concentrated runoff through which water commonly flows only during and immediately after heavy rains or during the melting of snow. The distinction between gully and rill is one of depth. A gully is sufficiently deep that it would not be obliterated by normal tillage operations, whereas a rill is of lesser depth and would be smoothed by ordinary farm tillage.

HEAD (HYDRAULICS) - 1. The height of water above any plane of reference. 2. The energy, either kinetic or potential, possessed by each unit weight of a liquid expressed as the vertical height through which a unit weight would have to fall to release the average energy possessed. Used in various terms such as pressure head, velocity head, and head loss.

HERBACEOUS PERENNIAL (PLANTS) - A plant whose stems die back to the ground each year.

HERBICIDE - Chemical formulation used to control weeds or brush.

HULLED (SEED) - Hulless seed, such as sericea lespedeza. Seed are usually processed after threshing to take off outer hull to facilitate scarification and quicken germination.

HYDRAULIC GRADE LINE - In a closed conduit a line joining the elevations to which water could stand in risers or vertical pipes connected to the conduit at their lower end and open at their upper end. In open channel flow, the hydraulic grade line is the free water surface.

HYDRAULIC GRADIENT - The slope of the hydraulic grade line. The slope of the free surface of water flowing in an open channel.

HYDRAULIC JUMP - The sudden turbulent rise in water level from a flow stage below critical depth to flow stage above critical depth, during which the velocity passes from super critical to subcritical.

HYDROGRAPH - A graph showing variation in stage (depth) or discharge of a stream of water over a period of time.

HYDROSEEDER - A machine designed to apply seed, fertilizer, lime and short fiber wood or paper mulch to the soil surface.

HYDRO-SEEDING - Seeding with a hydroseeder.

INFLOW PROTECTION - A water handling device used to protect the transition area between any water conveyance (dike, swale, or swale dike) and a sediment trapping device.

INTERCEPTOR DRAIN - A surface or subsurface drain, or a combination of both, designed and installed to intercept flowing water.

LIME - Basic calcareous materials used to raise pH of acid soils for benefit of plants being grown. May be either ground limestone or hydrated lime.

LITTORAL DRIFT - The sedimentary material moved in the littoral zone under the influence of waves and currents.

MANNING'S FORMULA (HYDRAULICS) - A formula used to predict the velocity of water flow in an open channel or pipeline:

$$V = \frac{1.486}{n} R^{2/3} S^{1/2}$$

Where V is the mean velocity of flow in feet per second; R is the hydraulic radius; S is the slope of the energy gradient or for assumed uniform flow the slope of the channel, in feet per foot; and n is the roughness coefficient or retardance factor of the channel lining.

MULCH - Covering on surface of soil to protect and enhance certain characteristics, such as water retention qualities.

MULCH ANCHORING TOOL - A tool that looks like a dull disk designed to press straw and similar mulches into the soil to prevent loss due to wind, water or gravity.

NETTING (MULCH) – Paper, plastic, or cotton material used to hold mulch material on the soil surface.

NITROGEN - FIXING (BACTERIA) - Bacteria having the ability to fix atmospheric nitrogen, making it available for use by plants. Inoculation of legume seeds is one way to insure a source of these bacteria for specified legumes.

NON-EROSIVE VELOCITY - Controlling the velocity of water to prevent detachment and movement of soil or rock. Erosive velocity will vary according to the soil type, slope, structural or vegetative stabilization used to protect the soil.

NORMAL DEPTH - Depth of flow in an open conduit during uniform flow for the given conditions. (See uniform flow.)

NOXIOUS WEEDS - Harmful; undesirable; hard to control.

a. Restricted - May be sold in the trade but are limited to very small amounts as undesirable contaminates.

b. Prohibited - Prohibited from sale.

NRCS - Natural Resources Conservation Service.

OUTFALL - The point where water flows from a conduit, stream or drain.

OUTLET - The point at which water discharges from such things as a stream, river, lake, tidal basin, pipe, channel or drainage area.

OUTLET CHANNEL - A waterway constructed or altered primarily to carry water form man-made structures such as terraces, subsurface drains, diversions and impoundments.

OVERFALL - Abrupt change in stream channel elevation; the part of a dam or weir notch over which the water flows.

PAPER FIBER - A short fiber mulch material usually applied by hydroseeder along with fertilizer and seed.

PARENT MATERIAL - The unconsolidated rock material from which the soil profile develops.

PENDULOUS - More or less hanging or inclined downward.

PERMANENT SEEDING - Results in establishing perennial vegetation which may remain on the area for many years.

PERMISSIBLE VELOCITY (HYDRAULICS) - The highest average velocity at which water may be carried safely in a channel or other conduit. The highest velocity that can exist through a substantial length of a conduit and not cause scour of the channel. A safe, non-eroding or allowable velocity.

pH - A number denoting the common logarithm of the reciprocal of the hydrogen ion concentration. A pH of 7.0 denotes neutrality, higher values indicate alkalinity, and lower values indicate acidity.

PHASING – Stabilizing one part of a site before disturbing another.

PHREATIC LINE - The upper surface of the zone of saturation in an embankment is the phreatic (zero pressure) surface; in cross-section, this is called the phreatic line.

PIPING - Removal of soil material through subsurface flow channels or "pipes" developed by seepage water.

PLUGS - Pieces of turf or sod, usually cut with a round tube, which can be used to propagate the turf or sod by vegetative means.

PROJECTION - In sediment basins or other dams the perpendicular distance that the anti-seep collar extends from the outside surface of the pipe or pipe cradle.

RECYCLED CONCRETE EQUIVALENT - May be substituted for stone or riprap as called for in these specifications except where stone must be "washed". Concrete used in place of stone shall be broken into the stone sizes required for the application, shall be angular, resist crumbling and shall contain no steel reinforcement.

RETENTION - The amount of precipitation on a drainage area that does not escape as runoff. It is the difference between total precipitation and total runoff.

REVETMENT - Facing of stone or other material, either permanent or temporary, placed along the edge of a stream or shoreline to stabilize the bank and to protect it from the erosive action of water.

RHIZOME - Any prostrate, more or less elongated stem growing partly or completely beneath the surface of the ground; usually rooting at the nodes and becoming upcurved at the apex.

RIGHT-OF-WAY - Right of passage, as over another's property. A route that is lawful to use. A strip of land acquired for transport or utility construction.

RILL - A small channel cut by concentrated runoff but through which water commonly flows only during and immediately after rains or during the melting of snow. A rill is usually only a few inches deep (but no more than a foot) and, hence, no obstacle to tillage operations.

RIPRAP - Broken rock, cobbles, or boulders placed on earth surfaces, such as the face of a dam or the bank of a stream, for protection against the action of water (waves); also applies to brush or pole mattresses, or brush and stone, or similar materials used for soil erosion control.

ROUGHNESS COEFFICIENT (HYDRAULICS) - A factor in velocity and discharge formulas representing the effect of channel roughness on energy losses in flowing water. Manning's "n" is a commonly used roughness coefficient.

RUNOFF (HYDRAULICS) - That portion of the precipitation on a drainage area that is discharged from the area in the stream channels. Types include surface runoff, ground water runoff or seepage.

SALINE SOIL - A non-alkali soil containing sufficient soluble salts to impair plant growth.

SAND - 1. (Agronomy) A soil particle between 0.05 and 2.0 millimeters in diameter. 2. A soil textural class. 3. (Engineering) According to the Unified Soil Classification System, a soil particle larger than the No. 200 sieve (0.074mm) and passing the No. 4 sieve (approximately 1/4 inch).

SEDIMENT - Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice and has come to rest on the earth's surface either above or below sea level.

SEDIMENTATION - Deposition of detached soil particles.

SEDIMENT DISCHARGE (SEDIMENT LOAD) - The quantity of sediment, measured in dry weight or by volume, transported through a stream cross-section in a given time. Sediment discharge consists of both suspended load and bedload.

SEEPAGE - 1. Water escaping through or emerging from the ground. 2. The process by which water percolates through the soil.

SEEPAGE LENGTH - In sediment basins or ponds, the length along the pipe and around the anti-seep collars that is within the seepage zone through an embankment. (See "phreatic line".)

SHA - Maryland State Highway Administration.

SHEET FLOW - Water, usually stormwater runoff, flowing in a thin layer over the ground surface.

SIDE SLOPES (ENGINEERING) - The slope of the sides of a canal, dam or embankment. It is customary to name the horizontal distance first, as 1.5 to 1, or frequently, 1 1/2 : 1, meaning a horizontal distance of 1.5 feet to 1 foot vertical.

SILT - 1. (Agronomy) A soil separate consisting of particles between 0.05 and 0.002 millimeter in equivalent diameter. 2. A soil textural class. 3. (Engineering) According to the Unified Soil Classification System a fine grained soil (more than 50 percent passing the No. 200 sieve) that has a low plasticity index in relation to the liquid limit.

SLURRY - A thickened, aqueous mixture of such things as seed, fertilizer, short fiber mulch or soil.

SMALL GRAIN MULCH MATERIAL - Straw material from oats, barley, wheat, or rye.

SOD - A piece of earth containing grass plants with their matted roots. Turf.

SOIL - 1. (Agronomy) the unconsolidated mineral and organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants. 2. (Engineering) Earth and rock particles resulting from the physical and chemical disintegration of rocks, which may or may not contain organic matter. It includes fine material (silts and clays), sand and gravel.

SOIL TEST - Chemical analysis of soil to determine needs for fertilizers or amendments for species of plant being grown.

SPECIFIC ENERGY - The average energy per unit weight of water at a channel section as expressed with respect to the channel bottom.

SPILLWAY - An open or closed channel, or both, used to convey excess water from a reservoir. It may contain gates, either manually or automatically controlled to regulate the discharge of excess water.

SPREADER (HYDRAULICS) - A device for distributing water uniformly in or from a channel.

STABLE AREA - An area sufficiently covered by erosion resistant material such as a good cover of grass, or paving by asphalt, concrete, or stone, in order that erosion of the underlying soil does not occur.

STABILIZED GRADE - The slope of a channel at which neither erosion nor deposition occurs.

STABLE (STREAM OR CHANNEL) - The condition of a stream, channel or other water course in which no erosion or deposition occurs; adequately protected from erosion.

STAGE (HYDRAULICS) - The variable water surface or the water surface elevation above any chosen datum.

STATIC HEAD - Head resulting from elevation differences, for example, the difference in elevation in headwater and tailwater in a hydroelectric plant.

STILLING BASIN - An open structure or excavation at the foot of an outfall, conduit, chute, drop, or spillway to reduce the energy of the descending stream of water.

STOLON - A trailing or reclining above ground stem capable of rooting and/or sending up new shoots from the nodes.

STRUCTURAL - Relating to something constructed or built by man.

STRUCTURAL (SOIL) - The combination or arrangement of primary soil particles into secondary particles, units or peds. (Dune sand is structureless)

SUBCRITICAL FLOW - Flow at velocities less than critical velocity.

SUBGRADE - The soil prepared and compacted to support a structure or a pavement system.

TAILWATER (HYDRAULICS) - Water, in a river or channel, immediately downstream from a structure.

TEMPORARY SEEDING - A seeding which is made to provide temporary cover for the soil while waiting for further construction or other activity to take place.

TERRACE - An embankment or combination of an embankment and channel constructed across a slope at a suitable spacing to control erosion by diverting or storing surface runoff instead of permitting it to flow uninterrupted down the slope. Normally used only on cropland.

TEXTURE (SOIL) - The relative proportions of various soil separates in a soil material.

THATCH - A tightly intermingled layer of living and dead stems, leaves and roots of grasses.

TIDAL BANKS - Vertical or sloping banks adjoining oceans, rivers, bays, estuaries, etc. which are affected by fluctuations of daily tides.

TIME OF CONCENTRATION - Time required for water to flow from the most remote point of a watershed, in a hydraulic sense, to the outlet.

TOE (OF SLOPE) - Where the slope stops or levels out. Bottom of the slope.

TOE WALL - Downstream wall of a structure, usually to prevent flowing water from eroding under the structure.
TOPSOIL - Fertile or desirable soil material used to top dress roadbanks, subsoils, parent material, etc.

TRAP EFFICIENCY - The capability of a reservoir to trap sediment. The ratio of sediment trapped to the sediment delivered, usually expressed in percent.

TRASH RACK - Grill, grate or other device at the intake of a channel, pipe, drain or spillway for the purpose of preventing oversize debris from entering the structure.

UNHULLED (SEED) - Seed still encased with a hull. Example: Sericea lespedeza before it is rendered hulless by mechanically removing the hull.

UNIFIED SOIL CLASSIFICATION SYSTEM (ENGINEERING) - A classification system based on the identification of soils according to their particle size, gradation, plasticity index and liquid limit.

UNIFORM FLOW - A state of steady flow when the mean velocity and cross-sectional area are equal at all sections of a reach.

UNIVERSAL SOIL LOSS EQUATION - An equation used for the design of water erosion control system: A=RKLSCP where A is average annual soil loss in tons per acre per year; R is rainfall factor; K is soil erodibility factor; L is length of slope; S is percent of slope; C is cropping and management factor; and P is conservation practice factor.

UPLIFT (HYDRAULICS) - The upward force of water on the base or underside of a structure.

VARIETY - A variant within a species which reproduces true by seed or vegetative propagation.

VELOCITY HEAD (HYDRAULICS) - Head due to the velocity of a moving fluid, equal to the square of the mean velocity divided by twice the acceleration due to gravity (32.16 feet per second per second).

WATER SURFACE PROFILE (HYDRAULICS) - The longitudinal profile assumed by the surface of a stream flowing in an open channel; the hydraulic grade line.

WEEP-HOLES (ENGINEERING) - Openings left in retaining walls, aprons, linings or foundations to permit drainage and reduce pressure.

WET STORAGE - The wet storage area is the 1800 cubic feet in the permanent pool of water in a sediment trap or basin.

WETTED PERIMETER (HYDRAULICS) - The length of the line of intersection of the plane or the hydraulic cross-section with the wetted surface of the channel.

WING WALL - Side wall extensions of a structure used to prevent sloughing of banks or channels and to direct and confine overfall.

WOOD FIBER - A short fiber mulch material, usually applied with a hydro-seeder in an aqueous mixture.

REFERENCES

REFERENCES

Bibliography

Hoan, CT., Tapp, J.S. "Design of Sedimentation Basins," NCHRP Synthesis of Highway Practices (1980) Ware, A.D.,

Institute of Mining and Minerals Research, The Deposits Sedimentation Pond Design Manual, Lexington 1979, University of Kentucky.

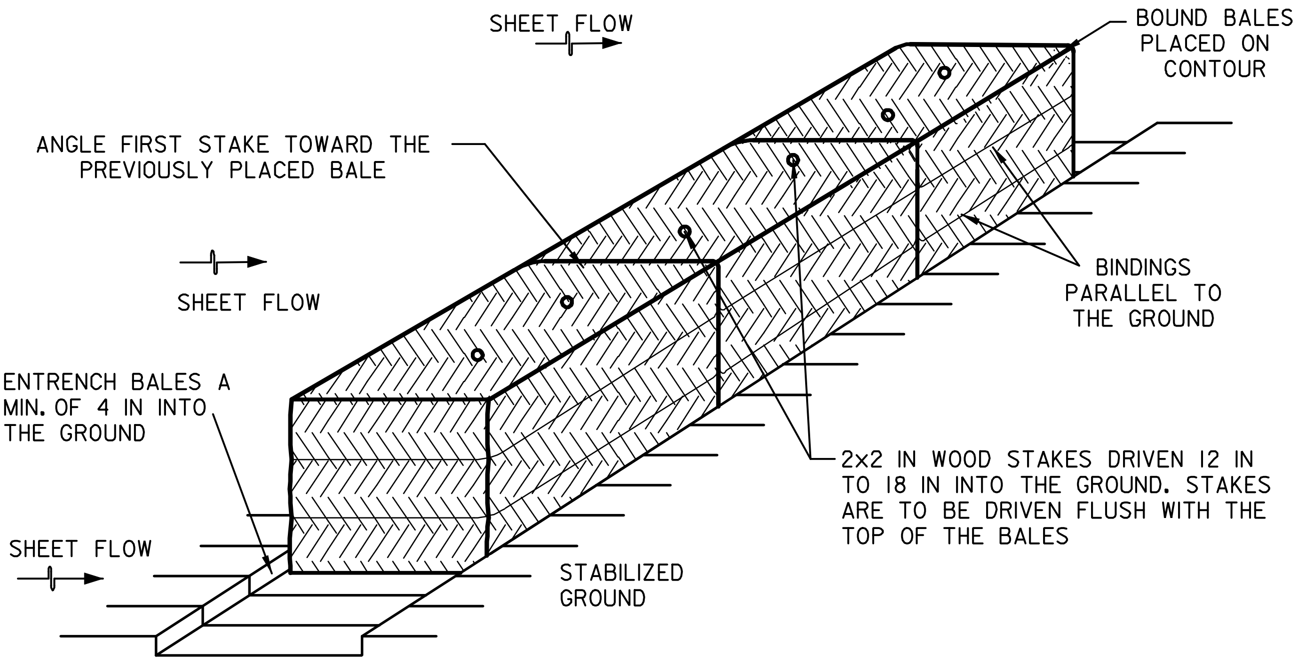
Barfield, Billy J. and Clar, Michael L., Development of New Design Criteria for Sediment Traps and Basins. 1985.

APPENDIX A – FOREST HARVEST PRACTICES AND STANDARDS

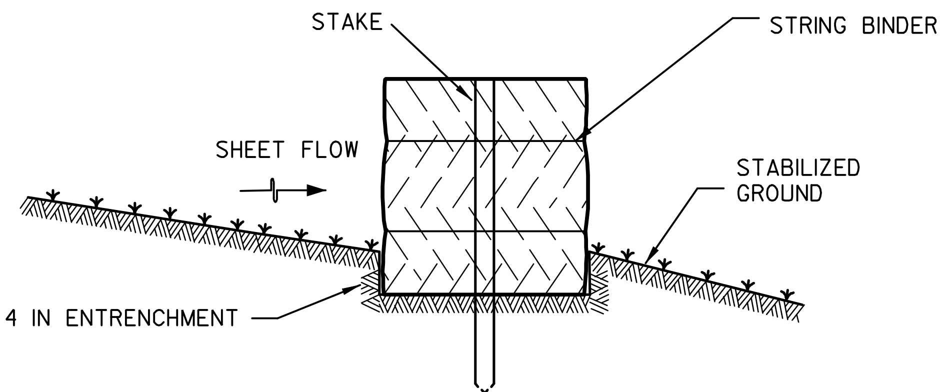
STRAW BALE DIKE

STANDARD SYMBOL

|— — — — —|
SBD



ANCHORING DETAIL



BEDDING DETAIL

CONSTRUCTION SPECIFICATIONS

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 IN MIN. INTO THE SOIL WITH BINDINGS HORIZONTALLY PLACED.

3. SECURELY ANCHORE BALES IN PLACE BY DRIVING TWO WOODEN STAKES THROUGH THE BALE 12 IN TO 18 IN INTO THE GROUND. DRIVE THE FIRST STAKE IN EACH BALE TOWARDS THE PREVIOUSLY LAID BALE AT AN ANGLE TO FORCE THE BALES TOGETHER. DRIVE STAKES FLUSH WITH TOP OF THE BALE.

4. INSPECT STRAW BALE DIKES FREQUENTLY AND AFTER EACH RAIN EVENT AND PERFORM MAINTENANCE AS NECESSARY.

5. REMOVE ALL BALES WHEN THE SITE HAS BEEN STABILIZED. GRADE FLUSH AND STABILIZE THE TRENCH WHERE THE BALES WERE LOCATED.

APPENDIX B – E&SC CHECKLIST AND CERTIFICATIONS

EROSION AND SEDIMENT CONTROL

PLAN REVIEW CHECKLIST

Approval No. _______________________ ___ acceptable ___ unacceptable
Project: _______________________ INC incomplete R required
Contract No. ____________________ N/A not applicable NR not reviewed

NOTE: Project is exempt from ero & sed control if disturbed area is < 5000 s.f. & 100 c.y.

Notice of Intent (NOI) is required if disturbed area >= 1 acre.

1st	**2nd**	**3rd**	
_______	_______	_______	***Review Date***
_______	_______	_______	***Application Form with applicant information***
_______	_______	_______	***Met the ESD to the MEP Requirement (Concept Approval Phase)***
			GENERAL PLAN REQUIREMENTS
_______	_______	_______	Location Map (sufficient that inspector can locate facility)
_______	_______	_______	Owner's/Developer's Certification with signature
_______	_______	_______	Design Certification with signature
_______	_______	_______	Standard Stabilization Note
_______	_______	_______	Note to Contractor: "Erosion and Sediment Control Shall Be Strictly Enforced."
_______	_______	_______	Legend including sediment control items
_______	_______	_______	North arrow
_______	_______	_______	Scale (1"=50' max.)
_______	_______	_______	Topography - existing and proposed contours
_______	_______	_______	Property lines
_______	_______	_______	Existing and proposed treelines
_______	_______	_______	Proposed buffer and conservation areas
_______	_______	_______	Limits of wetlands
_______	_______	_______	Limits of 100 Year Floodplain
_______	_______	_______	Storm drain system shown – existing and proposed
_______	_______	_______	Adequate Outfall(s)
_______	_______	_______	Q_{10} and V_{10}
_______	_______	_______	Outfalls to toe of slope
_______	_______	_______	Topo extends 75' downgrade of outfall
_______	_______	_______	Proposed slopes 2:1 max and 3:1 max in lawn maintenance areas
_______	_______	_______	Standard Erosion and Sediment Control Notes (1 through 27)
_______	_______	_______	Completed Note 27 Site Information
_______	_______	_______	Vegetative Stabilization Specifications (text)
_______	_______	_______	Temporary and Permanent Seeding Summary Tables
_______	_______	_______	MDE/SSCC Standard Details for proposed controls (i.e., 2010)
_______	_______	_______	Other details

SITE SPECIFIC REVIEW

			Initial Phase Sediment Control
________	________	________	Sequence of Construction
________	________	________	Notification to compliance
________	________	________	Installation of controls
________	________	________	Phasing considerations
________	________	________	Construction of improvements
________	________	________	Stabilization
________	________	________	Removal of controls
________	________	________	Conversion of E&SC structures to SWM structures
________	________	________	Remaining stabilization
________	________	________	Limits of Disturbance (LOD) delineated
________	________	________	Stabilized Construction Entrance (SCE)
________	________	________	Controls labeled using MDE standard symbol
________	________	________	Controls meet design parameters (DA, slopes, etc)
________	________	________	All disturbed areas drain to an approved sediment control device
________	________	________	Immediate stabilization note in designated areas
________	________	________	Dewatering addressed
________	________	________	Designated staging/stockpile area with sediment controls
			Final Phase Sediment Controls
________	________	________	Sequence of Construction
________	________	________	Notification to compliance
________	________	________	Installation of controls
________	________	________	Phasing considerations
________	________	________	Construction of improvements
________	________	________	Stabilization
________	________	________	Removal of controls
________	________	________	Conversion of E&SC structures to SWM structures
________	________	________	Remaining stabilization
________	________	________	Limits of Disturbance (LOD) delineated
________	________	________	Stabilized Construction Entrance (SCE)
________	________	________	Controls labeled using MDE standard symbol
________	________	________	Controls meet design parameters (DA, slopes, etc)
________	________	________	All disturbed areas drain to an approved sediment control device
________	________	________	Immediate stabilization note in designated areas
________	________	________	Dewatering addressed
________	________	________	Designated staging/stockpile area with sediment controls

COMMENTS:____
____
____
____

CERTIFICATIONS

OWNER'S / DEVELOPER'S CERTIFICATION

I / We hereby certify that all clearing, grading, construction, and/or development will be done pursuant to this plan and that any responsible personnel involved in the construction project will have a certificate of attendance at a Maryland Department of the Environment approved training program for the control of erosion and sediment before beginning the project. I hereby authorize the right of entry for periodic on-site evaluation by appropriate inspection and enforcement authority or the State of Maryland, Department of the Environment.

____________________________ Date

____________________________ Owner / Developer Signature

____________________________ Card No.

____________________________ Printed Name and Title

DESIGN CERTIFICATION

I hereby certify that this plan has been designed in accordance with the 2010 Maryland Standards and Specifications for Soil Erosion and Sediment Control, the 2000 Maryland Stormwater Design Manual, Volumes I & II including Supplements, the Environment Article Section ' 4-101 through 116 and ' 4-201 and 215 and the Code of Maryland Regulations (COMAR) 26.17.01 and COMAR 26.17.02 for erosion and sediment control and stormwater management, respectfully.

______________________ Date

___________________________________ Designer's Signature

Md. Registration No.___________
P.E., R.L.S., RLA, or R.A. (circle one)

___________________________________ Printed Name

REVISING THE MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL MANUAL

The Maryland Standards and Specifications for Soil Erosion and Sediment Control Manual establishes a minimum performance criteria that should be met by all techniques and devices used for erosion and sediment control in Maryland. On occasion, variations or new erosion and sediment control measures may be found to function better or be more desirable for erosion and sediment control by plan approval authorities. If after several tests the approval authority decides it would like to utilize this revised standard or specification on a regular basis, it needs to prepare a standard and the accompanying specifications, with a cover letter, to be submitted to the Maryland Department of the Environment, Water Management Administration.

A subcommittee consisting of: Natural Resources Conservation Service (NRCS), Maryland Association of Soil Conservation Districts (MASCD) and Maryland Department of the Environment (MDE) technical personnel will review the revised erosion and sediment control measure. When the revised erosion and sediment control measure is approved by the technical subcommittee, an approved Standard will be posted on MDE's web page for use.

APPENDIX C – DESIGN EXAMPLES

APPENDIX C

DESIGN EXAMPLES

APPENDIX D – E&SC PHOTOGRAPHS