Chapter 5 Construction Site Runoff Control

5.0 Introduction

During construction activities, soil is typically moved or disturbed in a way that affects stormwater drainage. The use of Best Management Practices (BMPs) during construction is crucial in controlling erosion and sedimentation of soil from a site, see Figure 5-0.1. These practices can be physical in nature or can be related to site management. Erosion and sediment control devices can be used alone or in combination to control and minimize impacts.

The proper use of erosion and sediment controls will allow the following objectives to be met:

1. Minimizing or eliminating off-site effects of erosion and sedimentation.
2. Facilitating project construction and minimizing overall costs.
3. Complying with Federal, State and local regulations.

This section will guide homeowners, designers, and contractors in implementing proper erosion and sediment control practices. Each project will have unique and site-specific conditions that will need to be addressed. It is very important that those involved in a project become familiar with the concepts outlined in this chapter.

Temporary erosion and sediment controls are required when reshaping site topography and exposing soil during construction. Temporary erosion and sediment controls are required for all soil disturbances. The temporary erosion and sediment controls in this Chapter are divided into three major groups:

- Vegetative soil stabilization.
- Water conveyance/energy dissipation.
- Limiting the deposition of sediment off-site and/or into surface waters.

Figure 5-0.1
Protecting Riparian Area

5.1 Development of a Storm Water Pollution Protection Plan (SWPPP)

A mandatory requirement of all construction projects over one (1) acre or any commercial or industrial project over one half (½) acre will require development of a SWPPP for use by the Owner and the selected contractor during construction. The SWPPP will address requirements of the most current version of the General National Pollutant Discharge Elimination System (NPDES) Permit for stormwater associated with construction activities. The EPA and WVDEP provides a guide for construction sites "Developing Your Storm Water Pollution Prevention Plan." This plan can be accessed at: http://www.dep.wv.gov/WWE/Programs/stormwater/MS4/guidance/Documents/Developing%20your%20SWPPP%20A%20Guide%20for%20Construction%20Sites.pdf

Key components of any SWPPP developed for work within the City of Charleston include but are not limited to:

- Protection of downstream landowners from uncontrolled runoff and other potential consequences of earth disturbing activities.
- Prevention of tracking dirt and mud onto public roadways.
- Minimizing dust generation.
- Good housekeeping of construction materials.
- Proper disposal of construction materials.
- Proper installation and routine maintenance of temporary construction and permanent BMP's.

It is the intent of this section that the Developer/Owner of the property can utilize a SWPPP document generated for the City permit to also meet the WVDEP submittal requirements for a SWPPP.

Developers and Owners shall also realize that larger projects will require more effort in developing a SWPPP. The generic version presented in this manual is based upon the typical historical project size of 10 acres or less. Large developments (e.g. box stores, commercial strip malls, etc.) will require a larger document to adequately describe and address the controls necessary to meet Stormwater Pollution Prevention requirements.

The SWPPP must be submitted with the permit application to the City and once approved must be maintained on-site during construction and available for review.

The requirement for temporary stormwater BMP's will be considered fulfilled when a WVDEP approved Notice of Termination is presented by the Developer/Owner to the City for projects over 1 acre. The Owner/Developer must also execute a Stormwater Management Facilities Maintenance Agreement with the City prior to termination of the City Stormwater Permit. or projects less than 1 acre the Owner/Developer shall request an inspection by the City and request issuance of a City Stormwater Permit Notice of Termination.

5.2 Groundwater Pollution Protection Plan (GPP)

The City of Charleston has adopted the WVDEP's generic GPP document and guidance as the standard to be used within City limits. The Owner may combine the GPP into the SWPPP if desired. The WVDEP Groundwater Protection Plan Guidance document can be accessed at: http://www.dep.wv.gov/WWE/permit/individual/Documents/367_gppguide.pdf

The GPP must be kept maintained on-site during construction at all times and available for review during normal work hours.

5.3 Alternative and Dual Use Measures

5.3.1 Dual Use of BMP's

It has become more common for contractors to use permanent stormwater BMP's as temporary erosion and sediment controls illustrated in Figure 5-3.1. The City acknowledges the benefits and cost savings of this approach provided the permanent BMP is properly cleaned and maintained at completion of its temporary use and put into Permanent Service in good and functional condition.

For example it is common to use the excavated portion of proposed infiltration areas (e.g. rain gardens or bio-retention areas) as a temporary sediment trap or pond prior to installation of the engineered soil mix and plantings. If a developer or contractor wishes to use this approach they will be required to demonstrate that sediments are cleaned out once the site is stabilized, underdrains and outlet pipes are not clogged and functioning as designed and any potentially restrictive layers (e.g. filter fabric or gravel blinded off by sediment) are replaced.

Figure 5-3.1
Pond with check dam during construction, check dam removed at end of construction.

5.3.2 Alternative BMP's

The intent of this Chapter is to provide examples of locally common and readily available options for BMP's. Projects are not limited to the technologies presented in this document. The reader is referred to the following resources for additional detailed information regarding temporary erosion and sediment control practices.

- West Virginia Department of Environmental Protection – Erosion and Sediment Control Best Practices Management Manual: http://www.dep.wv.gov/WWE/Programs/stormwater/csw/Pages/ESC_BMP.aspx
- West Virginia Department of Transportation, Division of Highways – Erosion and Sediment Control Manual: http://www.transportation.wv.gov/highways/engineering/files/EROSION/Erosion2003.pdf
- National Center for Watershed Protection - http://www.cwp.org/
- West Virginia Stormwater Management and Design Guidance Manual - http://www.dep.wv.gov/WWE/Programs/stormwater/MS4/Pages/StormwaterManagementDesignandGuidanceManual.aspx

Multiple other resources are available to complement this manual.

5.4 Vegetative Soil Stabilization

5.4.1 Control Description

Surfaces with a vegetative cover help in reducing the amount of sediment runoff that collects in other erosion and sediment devices. Re-vegetative practices reduce the amount of maintenance necessary to control erosion throughout the life of the project. Seeding and mulching (illustrated in Figure 5-4.1) assists with soil stabilization and erosion, and shall be performed on all areas where the vegetation has been removed or is not present due to construction activities.

Figure 5-4.1
Properly Mulch Site

5.4.2 Control Uses and Applicability

Temporary seeding shall be used for sites that remain idle for more than 21 days (e.g. soil stockpiles, waste areas) illustrated in Figure 5-4.2. Steep slope areas should be temporarily seeded immediately upon completion to maintain and reduce sediment runoff.

Permanent seeding shall be used for sites that require permanent vegetative cover after completion of a project or areas that lay idle for six (6) month or longer.

Figure 5-4.2
Topsoil Stockpile Seeded Against Erosion

5.4.3 Design Criteria

Prior to the seeding and mulching, whether temporary or permanent, the following steps shall be used to properly re-vegetate the project area.

1. Select the appropriate seeding mixture based on the seasonal and site conditions. Tables 5-4.1 and 5-4.2 (page 5-6) provide a list of potential mixture selections.
2. Seedbed preparation shall be performed by tilling, discing or tracking to ensure soil surface is loose and free of hardened areas prior to planting and mulching (see Figure 5-4.3).
3. Mulching is required for all seeding whether it is paper mulch, straw or hay. Refer to Table 5-4.3 (page 6-7) for mulching materials and application rates.

Figure 5-4.3
Preparing Soil for Seeding

4. All seeding requires nitrogen fertilization along with phosphorus, lime and potassium. The key is to properly determine the soil quality to avoid under-fertilization, which will lead to poor seed growth while avoiding over-fertilization, which can lead to elevated concentration of nitrogen and phosphorus runoff which can be detrimental to water quality.
5. The lime and fertilizer shall be incorporated into the top four (4) to six (6) inches of the soil by discing or other means whenever possible. When application is performed using a hydroseeder (illustrated in Figure 5-4.4) the lime and fertilizer shall be applied to a rough and loose surface.
6. To maintain proper conditions for vegetative growth, testing soils prior to seeding is crucial. Limiting the amount of additives used will help eliminate the contamination of streams and maintain stream health.

Figure 5-4.4
Hydroseeding

Figure 5-4.5
Seeded Area Versus Unseeded Area
**Note the erosion*

5.4.4 Materials

The following tables provide a guide to the selection and application for temporary and permanent seeding and mulching required in order to re-vegetate the project area.

Table 5-4.1: Temporary Seeding

Common Name	Scientific Name	Planting Dates	Application Rate
Annual Ryegrass	Lolium multiflorum	2/16 - 5/15 8/1 - 11/1	40 lbs/acre
Winter Rye	Secale cereale	8/15 - 2/28	170 lbs/acre
Foxtail Millet	Setaria italic	5/1 - 8/1	40 lbs/acre

Courtesy of WVDEP

Note: Other seed mixtures may be considered on a case-by-case basis.

Table 5-4.2: Permanent Seeding

Seed Mix	Common Name	Scientific Name	Planting Dates	Application Rate lbs/acre	pH Range	Planting Type	Shade Tolerance	Notes
A	Kentucky 31 Fescue Red Fescue Birdsfoot Trefoil	*Festuca arundinacea* *Festuca rubra* *Lotus corniculatus*	3/1 - 6/15 8/15 - 9/15	65 20 5	6.0-7.5	Low Maintenance	Full Sun	Use Temporary Seeding Mix for out- of-date planting
B	Switchgrass Perennial Reygrass Redtop Birdsfoot	*Panicum Virgatum* *Lolium perenne* *Agrostis alba* *Lotus corniculatus*	3/1 - 6/15 8/15 - 9/15	15 20 5 15	5.0-7.5	No Maintenance	Full Sun	Use Temporary Seeding Mix for out- of-date planting
C	Red Fescue Kentucky Bluegrass Merion Bluegrass	*Festuca rubra* *Poa Pratensis* *Poa pratensis*	3/1 - 6/15 8/15 - 9/15	20 40 30	6.0-7.5	Fine Lawn	Full Sun	-
D	Kentucky 31 Fescue Red Fescue Kentucky Blue Grass White Dutch Clover	*Festuca arundinacea* *Festuca rubra* *Poa Pratensis* *Trifolium repens*	3/1 - 6/15 8/15 - 9/15	45 20 25 5	6.0-7.5	Coarse Lawn	Full Sun	-
F	Orchardgrass Ladino Clover Redtop	*Dactylis glomerata* *Trifolium repens* *Agrostis alba*	3/1 - 6/15 8/15 - 9/15	20 5 5	5.5-7.5	Low Maintenance - Pasture	Tolerant	Use Temporary Seeding Mix for out- of-date planting
J	Perennial Pea Orchardgrass	*Lathyrus latifolius* *Dactylis glomerata*	3/1 - 6/15 8/15 - 9/15	30 30	4.0-8.0	Low Maintenance - Pasture	Tolerant	Use Temporary Seeding Mix for out- of-date planting

Courtesy of WVDEP

Note: Other seed mixtures may be considered on a case-by-case basis. For more information check out West Virginia Department of Environment Protection's Erosion and Sediment Control Best Management Practices Manual at: https://apps.dep.wv.gov/dwwm/stormwater/BMP/index.html

Table 5-4.3: Mulch Materials and Application Rates

Common Name	Rates		Application Rate
	Per Acre	Per 1,000 ft2	
Straw or Hay	1 ½ - 2 tons (minimum 2 tons for winter cover)	70 -90 lbs	Free from weeds and coarse matter. Must be anchored. Spread with mulch blower or by hand
Fiber Mulch	Minimum 1,500 lbs.	35 lbs	Do not use as mulch for winter cover or during hot, dry periods.* Apply as slurry.
Cornstalks	4 -6 tons	185 – 275 lbs	Cut or Shred in 4-6" lengths. Air dried. Do not use on fine turf areas. Apply with mulch blower or by hand.
Wood Chips	4 -6 tons	185 – 275 lbs	Free of coarse matter. Air dried. Treat with 12 lbs nitrogen per ton. Do not use on fine turf areas. Apply with mulch blower, chip handler or by hand.
Bark Chips or Shredded Bark	50 – 70 cu yds	1 – 2 cu yds	Free of coarse matter. Air dried. Do not use in fine turf areas. Apply with mulch blower, chip handler or by hand.

*When fiber mulch is the only available mulch during periods when straw should be used and only fiber mulch is available, apply mulch at a minimum rate of 2,000 lbs/acre or 45 lbs/1,000 sf.

Courtesy of WVDEP

Vegetative Soil Stabilization

The fertilizer rates to be used are as follows*:

- Mixed grasses and legumes: 1,000 lbs/acre (23 lbs/1000 sf) 10-20-10 or equivalent.
- Legume stands only: 1,000 lbs/acre nutrients (23 lbs/1000 sf) 5-20-10 is preferred; however, 1,000 lbs/acre (23 lbs/1000 ft^2) 10-20-10 or equivalent may be used.
- Grass Stands Only: 1,000 lbs/acre (23 lbs/1000 sf) 10-20-10 or equivalent.

The lime rate to be used on the project areas is as follows:

- Two tons/acre (90 lbs/1,000 sf) pulverized agricultural grade limestone.

5.4.5 Maintenance

All areas of the project site are to be maintained based on the following criteria:

- Grasses and pastures shall be maintained during their growing cycle in accordance with their final use and industry accepted practices.
- Lawn grasses shall be kept watered to establish good growth. These grasses should be mowed to a height of 2.5 to 3 inches when their height exceeds four (4) inches until a full lawn is established.
- Low maintenance and/or slope areas shall be seeded and mulched as soon as possible after exposure to reduce the sediment runoff and maintained throughout the construction of the project.

Any area that fails to establish vegetation must be re-seeded as soon as possible with multiple step seedings until sufficient vegetation is established. High acidity or low nutrient areas shall have topsoil added to establish a vegetative cover prior to the placement of seed and mulch.

5.5 Construction Entrance Stabilization

5.5.1 Control Description

A stabilized construction entrance shall be required to reduce the amount of soil transferred onto paved surfaces during construction. Soil can be removed from construction sites in large quantities on the tires of traffic leaving the disturbed project area causing dangerous driving conditions and creating sediment runoff during rain events.

5.5.2 Control Uses and Applicability

Construction entrance stabilization shall be used and installed at every point where vehicles leaves project area to prevent sedimentation of adjacent roadways. Entrances should be minimized to only those necessary for proper and safe construction to minimize sedimentation potential (see Figure 5-5.1).

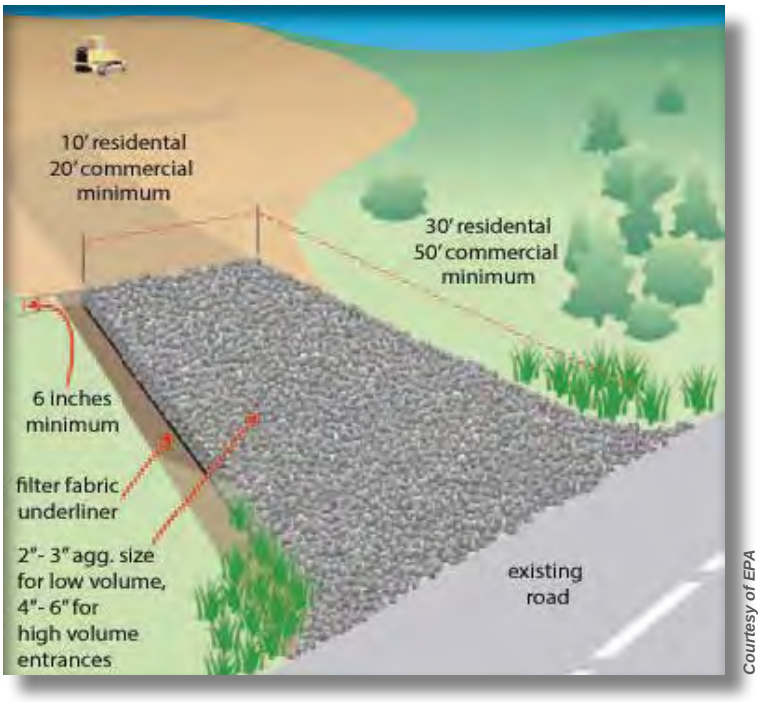


Figure 5-5.1
Construction Entrance Detail for Proper Installation

5.5.3 Design Criteria

Prior to the initiation of work on a project site, construction entrance stabilization areas shall be constructed to eliminate sedimentation runoff. The following steps must be used to properly install a construction entrance to a project site, see Detail 5-5.1 (page 5-9).

1. Entrance lengths for residential sites are to be 30 feet minimum and commercial sites are to be 50 feet minimum. Longer lengths shall be used for large projects as necessary.
2. Entrance thicknesses shall be no less than six (6) inches.
3. The entrance width shall be a minimum of 10 feet, 20 feet for commercial.

4. Geotextile fabric must be used under the stone entrance.
5. All surface water flowing toward the construction entrance shall be diverted away from or piped across the entrance.

5.5.4 Materials

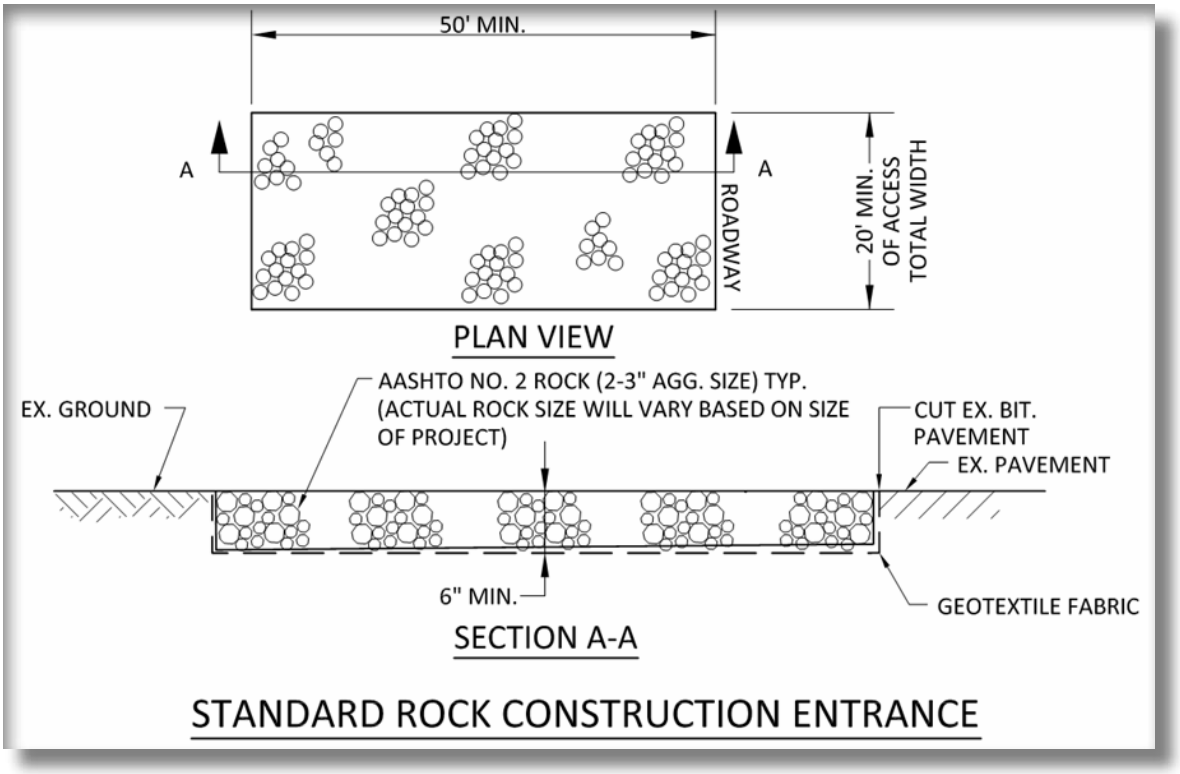
A stabilized layer of aggregate shall be used for a construction entrance based on the following project sites.

1. For low volume residential projects greater than one (1) acres, one (1) to (2) inch stone (e.g. AASHTO 4) shall be used.
2. For most construction entrances on projects of one (1) to three (3) acres, two (2) to four (4) inch stone (e.g. AASHTO No. 2) shall be used.
3. For major construction, larger rock choked with a smaller gradation (e.g. AASHTO No. 1 Stone or four (4) to six (6) inch rock shall be used.

5.5.5 Maintenance

To ensure the sedimentation is prevented to the best degree possible, all vehicles leaving the site must clean and remove sediment and debris prior to entering the public roadway. If any of these materials are tracked onto roadway, the sediment, debris, and/or gravel must be cleaned immediately and precautions taken to prevent any sediment-laden water from entering storm systems or streams.

The entrance shall be inspected everyday and immediately after a rainfall event of 0.5 inches or greater to ensure the prevention of transporting soils off the project site. This will require additional stone being added when needed as well as repair and cleanout of adjacent sediment trap, sumps or silt fence.



Detail 5-5.1
Typical Construction Entrance

5.6 Temporary Berms

5.6.1 Control Description

Temporary berms are used to divert stormwater flow and are typically a constructed ridge of compacted soil, with or without a shallow ditch. These berms can be found around the perimeter of a project or at various locations within the project.

5.6.2 Control Uses and Applicability

Temporary berms, illustrated in Figures 5-6.1, shall be used on a project site to convey stormwater into sediment control structures or permanent ditches with established sediment controls. Another use of a temporary berm shall be to divert stormwater away from steep slopes and keep stormwater from running onto disturbed area, see Figure 5-6.2.

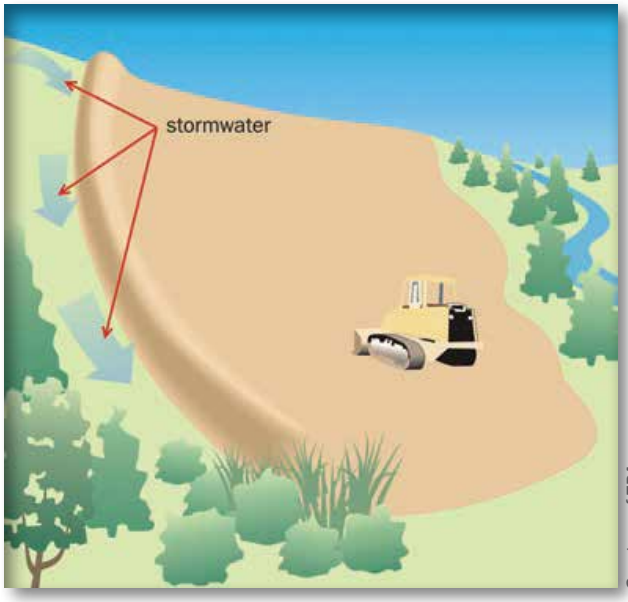
Figure 5-6.1
Temporary Berm

5.6.3 Design Criteria

During construction of a project, temporary berms shall be constructed, as required, at a minimum of 12 inches in height with six (6) inches of freeboard and a two (2) foot width (see Detail 5-6.1 provided at the end of this section for additional information). Each berm shall be machine compacted with a minimum of one pass of a bull dozer or similar equipment over the entire length of the berm. Temporary berms shall be installed so that gentle positive drainage, i.e. continuous downhill slope, is created to convey the water away from the protected areas.

Erosive stormwater velocities shall be avoided unless adequate erosion protection is installed.

Larger berms may be specified as drainage areas increase and will require a Professional Engineered designed.



Courtesy of EPA

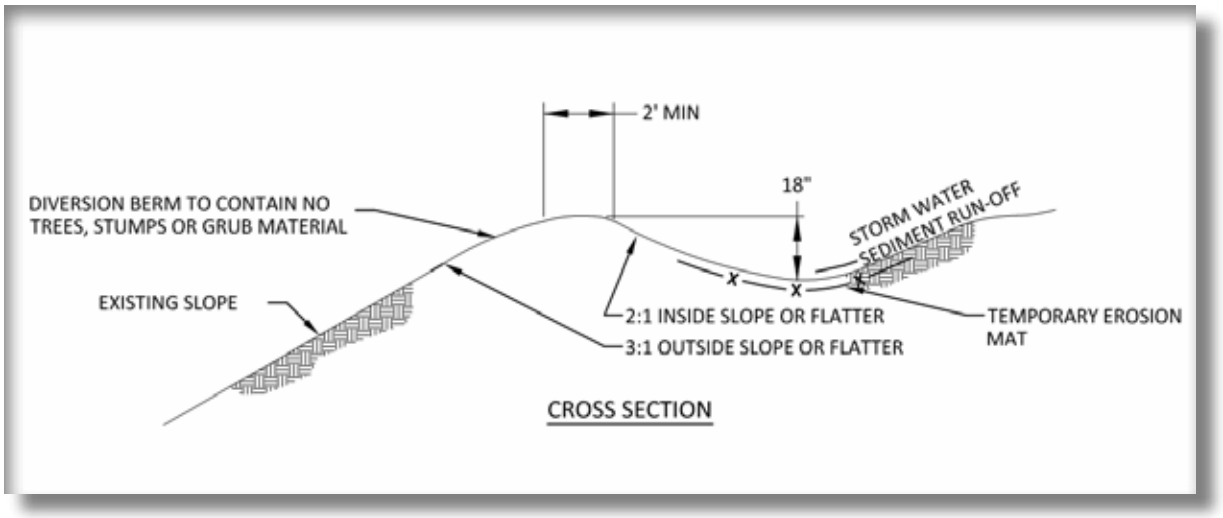
Figure 5-6.2
Proper Construction of a Temporary Berm around the Exterior Perimeter of a Project. Vegetation requires Second Step Seeding.

5.6.4 Materials

In order to effectively and efficiently construct temporary berms throughout the project, the use of appropriate soils from the existing site that provide cohesion and are easily compacted shall be used whenever available. The use of sand, stone, or soils with high sand or rock content are prohibited due to excessive porosity and compaction characteristics of such soils.

5.6.5 Maintenance

All temporary berms shall be inspected on a daily basis and should any part of the berm be visibly damaged it must be repaired immediately.



Detail 5-6.1
Typical Berm Cross Section

5.7 Contour Ditches

5.7.1 Control Description

Contour ditches are used in projects to divert stormwater runoff from a recently constructed erodible surface to a controlled and stabilized release point at low velocity. These ditches are typically excavated in natural ground.

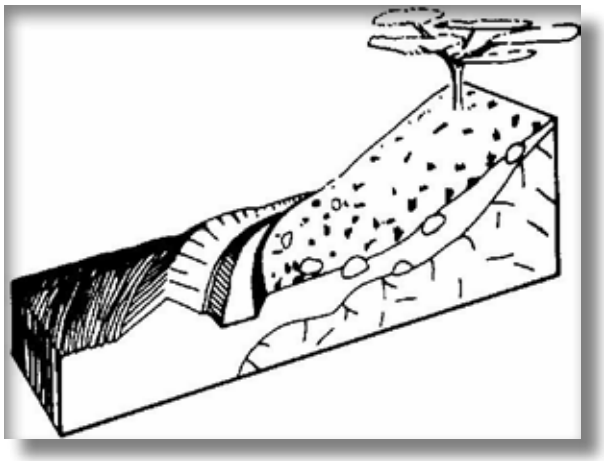


Figure 5-7.1
Contour Ditch

5.7.2 Control Uses and Applicability

Contour ditches, illustrated in Figure 5-7.1 and Figure 5-7.2, are generally used to minimize earthwork and drain slopes by following the general topography of the site. These ditches are similar to temporary or diversion berms with the exception of being constructed by excavation or partial excavation into original ground as opposed to a compacted embankment or fill berm.

The contour ditches should be constructed below disturbed areas to convey the sediment laden stormwater to a sediment trapping structure. Ditches should be constructed above disturbed areas to move stormwater away from stabilized areas to reduce erosion and control or decrease the size of sediment structures.

Figure 5-7.2
Contour Ditch

5.7.3 Design Criteria

The following steps shall be used to properly construct contour ditches throughout a project area. See Detail 5-7.1 (page 5-13) provided at the end of this section for additional information.

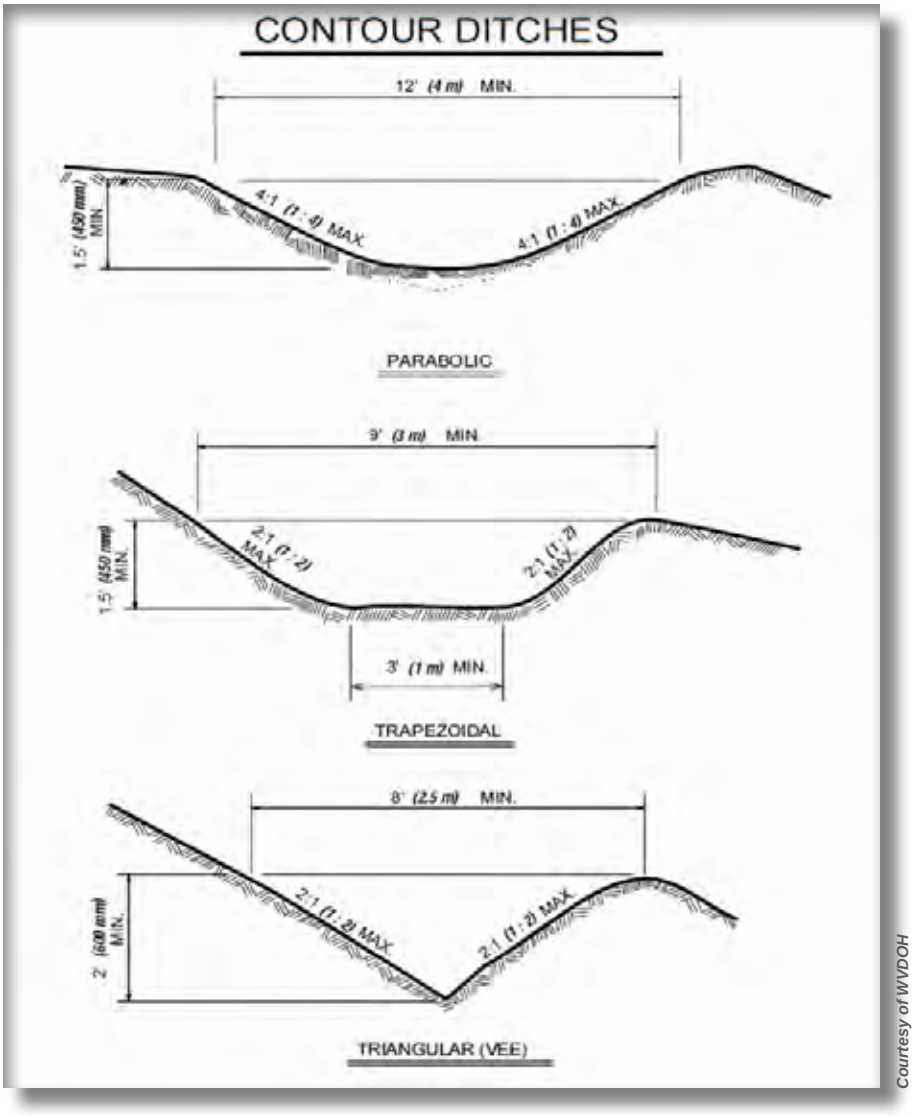
1. The ditch size shall be designed based on hydraulic analysis of the area to be drained and provide adequate freeboard. A minimum of a one (1) year-24 hour storm event shall be considered for any ditch design. Should the project construction and site stabilization be longer than one (1) year, the design of a two (2) year-24 hour storm event shall be considered.
2. Select the geometry of the contour ditch, three types are typically used:
   - Parabolic with maximum side slopes of 4:1
   - Trapezoidal with maximum side slopes of 2:1
   - Triangular with maximum side slopes of 2:1
3. Contour ditches constructed to divert stormwater from upslope areas shall be stabilized with seeding and erosion mat immediately after installation.

5.7.4 Materials

In order to effectively and efficiently construct temporary contour ditches throughout the project, they should be located in appropriate soils on the existing site that provide cohesion and are easily compacted. Contour ditches should not be used across existing slip areas, or slopes with a high probability of slippage. The erosion matting shall be selected based upon the expected length of construction and required durability.

5.8.5 Maintenance

All contour ditches shall be inspected after every rainfall event during the duration of the project and should any part of the ditch be damaged it should be replaced immediately. The accumulated sediment must be removed once the capacity of the contour ditch is reduced by more than 40%.



Detail 5-7.1
Contour Ditch Cross Sections

5.8 Check Dams

5.8.1 Control Description

Check dams are barriers constructed of clean, non-erosive rock or manufactured devices used to reduce stormwater velocities to a non-erosive level in a ditch or open channel, see Figure 5-8.1.

5.8.2 Control Uses and Applicability

Check dams, illustrated in Figures 5-8.2 and 5-8.3, shall be used in all ditches throughout the project until vegetative cover has been established or non-erosive ditch linings such as riprap have been installed.

In addition, check dams can be located in natural drains or established ditches in disturbed areas of the project to supplement erosion control devices.

5.8.3 Design Criteria

The following steps shall be used to properly construct ditch checks throughout a project area.

1. During construction of check dams, no erosion around the side of the ditch slope is permitted to occur. This is accomplished by designing the lowest overflow point located in the middle of the ditch line.
2. The overflow shall be six (6) inches lower than the tie-in points located on each side of the ditch.
3. Stone check dams shall be constructed with a maximum slope of 2:1 for both the front and back slope.
4. The distance between check dams shall be as follows:

   a) For slopes greater than 3%, the West Virginia Division of Highways method shall be used:

   - L = 160/Slope (maximum distance between check dams shall be 50 feet)
   - Slope = Rise/Run x 100

   b) For slopes less than 3%, the West Virginia Department of Environmental Protection method shall be used:

Figure 5-8.1
Proper Construction of a Check Dam

Figure 5-8.2
Proper Construction of Check Dam System

Figure 5-8.3
Proper Placement of Manufactured Check Dams

- The toe of the up-gradient check dam cannot be lower than the bottom of the preceding check dam which will create a series of shallow step pools that catch a significant amount of sediment.

5. Check dam height shall be between one (1) to three (3) feet, based on channel size and desired pool depth. See Detail 5-8.1 (page 5-16) at the end of this section for additional information.
6. The spacing of a prefabricated check dam shall be the same as a stone check dam, provided manufacturer's recommendations do not specify closer spacing.
7. Prefabricated check dams, illustrated in Detail 5-8.2, (page 5-17), must be installed and secured per manufacturer specifications and recommendations.

5.8.4 Materials

The following materials shall be used to provide effective and efficient check dams throughout a project area.

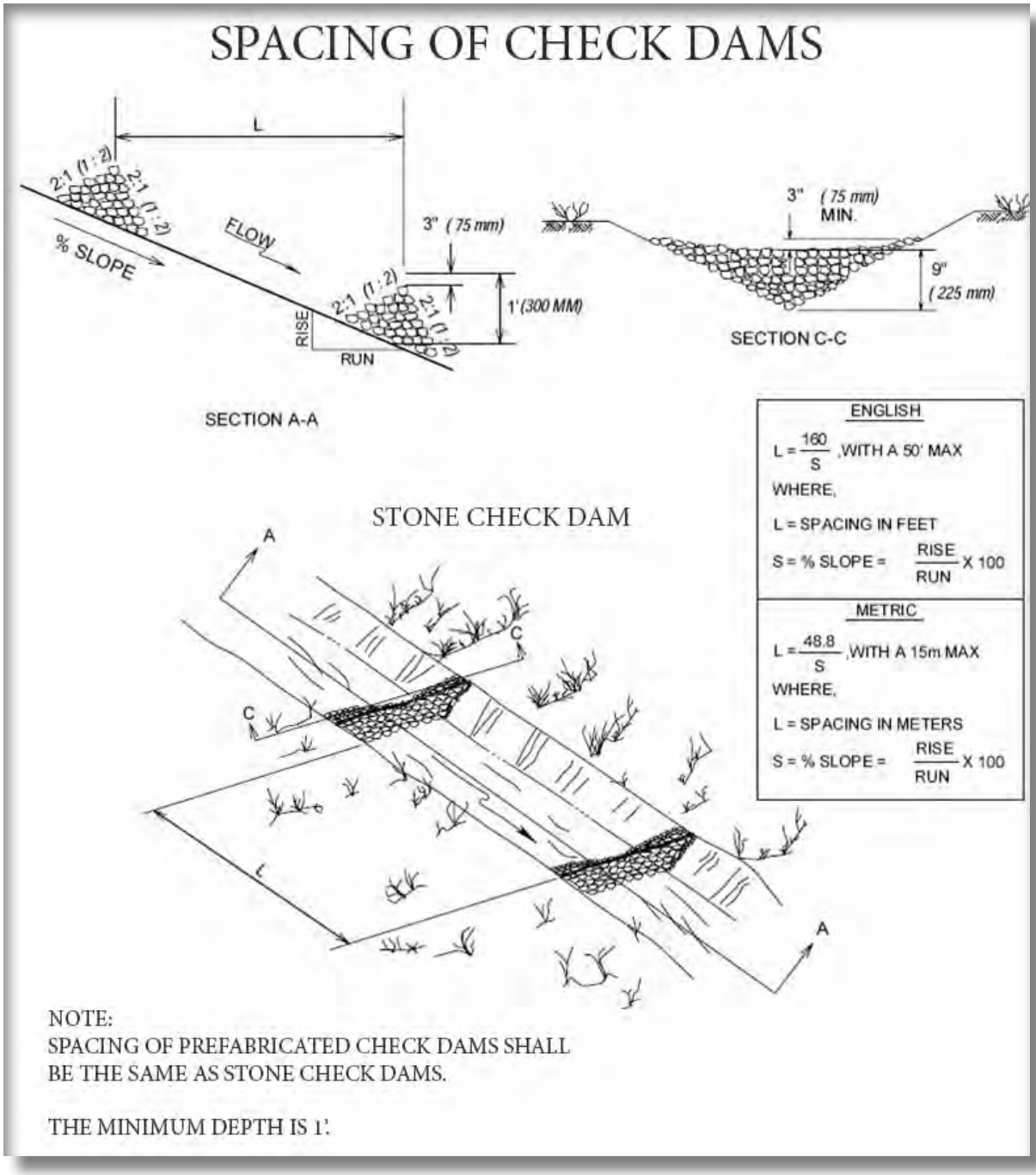
1. For drainage areas up to two (2) acres, two (2) to four (4) inch aggregate (AASHTO No. 1 or No. 2 Stone) shall be used to construct the check dam.
2. For drainage areas between two (2) and five (5) acres, four (4) to eight (8) inch aggregate (Riprap Gradation) shall be used to construct the check dam.
3. A layer of finer aggregate on the upstream face can be used to improve filtering capacity where appropriate.
4. No materials that contain leachable chemical additives shall be used.
5. Products may contain wood fibers and/or man-made fibers, illustrated in Figure 5-8.4.
6. A variety of manufactured check dams exist, as seen in Figure 5-8.5. The City will review proposed products on a case-by-case basis.
7. Straw bales are not allowed for use as check dam.

Figure 5-8.4
Check Dams using Wattles and Riprap

Figure 5-8.5
Check Dams in Ditch-line

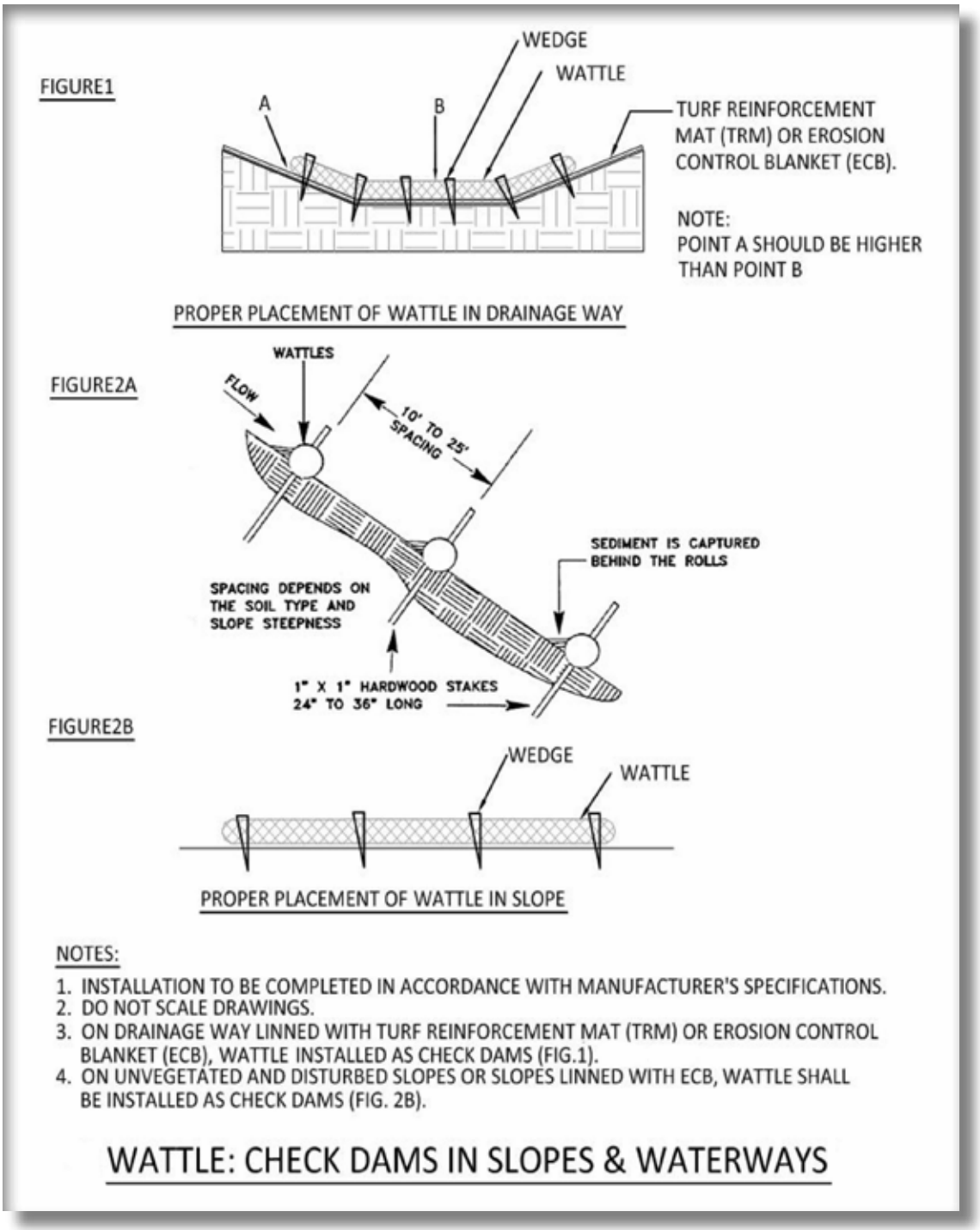
5.8.5 Maintenance

All check dams shall be inspected at least once per week and after any rain event of 0.5 inches or greater during the duration of the project. Should any part of the ditch be damaged, the check dam must be repaired or replaced immediately. Any sediment accumulations that are greater than ½ the height of the check dam shall be removed.



Courtesy of WVDOH

Detail 5-8.1
Check Dam Cross Sections



Detail 5-8.2
Wattle Cross Sections

5.9 Silt Fence and Other Temporary Stormwater Sediment Barriers

5.9.1 Control Description

Temporary stormwater sediment barriers are used to reduce the velocity of stormwater and to capture sediment before it leaves the primary project area. These devices include silt fencing, wattles (fiber rolls), inlet filters and a variety of other devices that can be easily placed at numerous locations to remove sediment.

5.9.2 Control Uses and Applicability

To provide effective stormwater sediment barriers, the devices should be used down slope of a disturbed area, along the perimeter of a project site, around temporary soil stockpiles to prevent sediment runoff, and as special inlet filters at storm drains to prevent sediment from entering storm sewer systems.

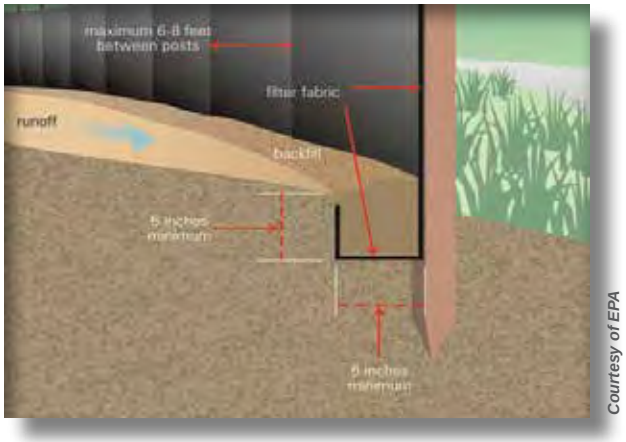
The use of silt fence, illustrated in Figures 5-9.1 is the most prevalent sediment barriers used in the Charleston area due to the relatively inexpensive cost and ease of installation. Proper installation is imperative for the device to be effective. Over the last several years, a large variety of innovative devices have become available that may be more advantageous in specific applications.

5.9.3 Design Criteria

An efficient and effective stormwater sediment barrier can be provided for the project using the following design criteria.

1. Silt fence and wattles, shall be installed perpendicular to the flow direction and with the slope's contour.
2. Wattles must be staked down to prevent movement. See Figure 5-9.3 for an example of a wattle and Detail 5-9.3 (page 5-21) for installation guidelines .
3. Silt fence, illustrated in Figure 5-9.2 and Detail 5-9.1 (page 20) must be installed into a trench that is at least six (6) inches deep, positioned at the back edge of the trench, and the trench backfilled with material for the device to be acceptable for use.
4. Silt fence must be installed with the fabric facing the direction of flow.
5. When multiple rolls of silt fence are required, the

Figure 5-9.1
Proper installation of Silt Fence



Courtesy of EPA

Figure 5-9.2
Silt Fence Installation illustration

Figure 5-9.3
Properly Installing Wattle

junction of each roll of silt fence must be placed so that the last post of the first run and the first post of the second run overlap and are tied together.

6. Wattles must be installed using a trench that is a minimum of two (2) to four (4) inches deep, see Figure 5-9.4.
7. Wattles shall be installed either end to end with no overlap of the ends, Figure 5-9.4 or overlapped with a minimum of 12 inches, see Detail 5-9.3 (page 5-21).
8. Stakes installed along the wattle shall be at a maximum of four (4) foot intervals and at each end. The stakes shall be a minimum of 24 inches in length and installed in the middle of the wattles with two (2) to three (3) inches remaining above the surface of the wattle.
9. Properly protecting drop inlets is a key to keeping silt on the job site and out of the storm sewer system. There are two primary methods of preventing erosion sediment from entering storm drain system, Above ground Stormwater BMPs are illustrated in Figures 5-9.5 and 5-9.6 show examples of good installation practices and Detail 5-9.2 silt fence inlet protection (page 5-21), (page 5-20), wattle inlet protection in Detail 5-9.4 (page 5-21), and curb inlet protection using concrete block and gravel in Detail 5-9.5 (page 5-22). Below surface BMP include the use of ingrate filter bags illustrated in Detail 5-9.6 on page 5-23.

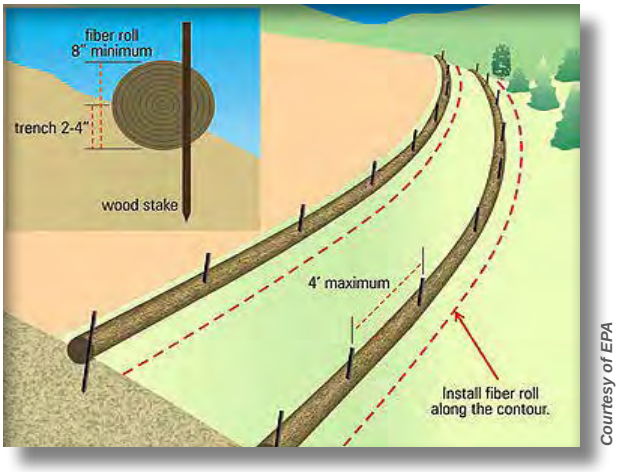
5.9.4 Materials

The stormwater sediment barrier shall not contain chemical additives unless approved during the permitting process. The devices may contain wood fibers and/or man-made fibers.

5.9.5 Maintenance

All devices shall be inspected at least once per week and after any rain event of 0.5 inches or greater during the duration of the project. Should any device be damaged, a repair or replacement of that particular device must occur immediately. The sediment accumulations that are greater than ½ the height of the wattle or six (6) inches in height above the base of the silt fence shall be removed.

Many of the storm sewer protection devices, such as ingrate-filters or curb drain filters, must be inspected and cleaned on a case-by-case basis or based on manufacturer recommendations.

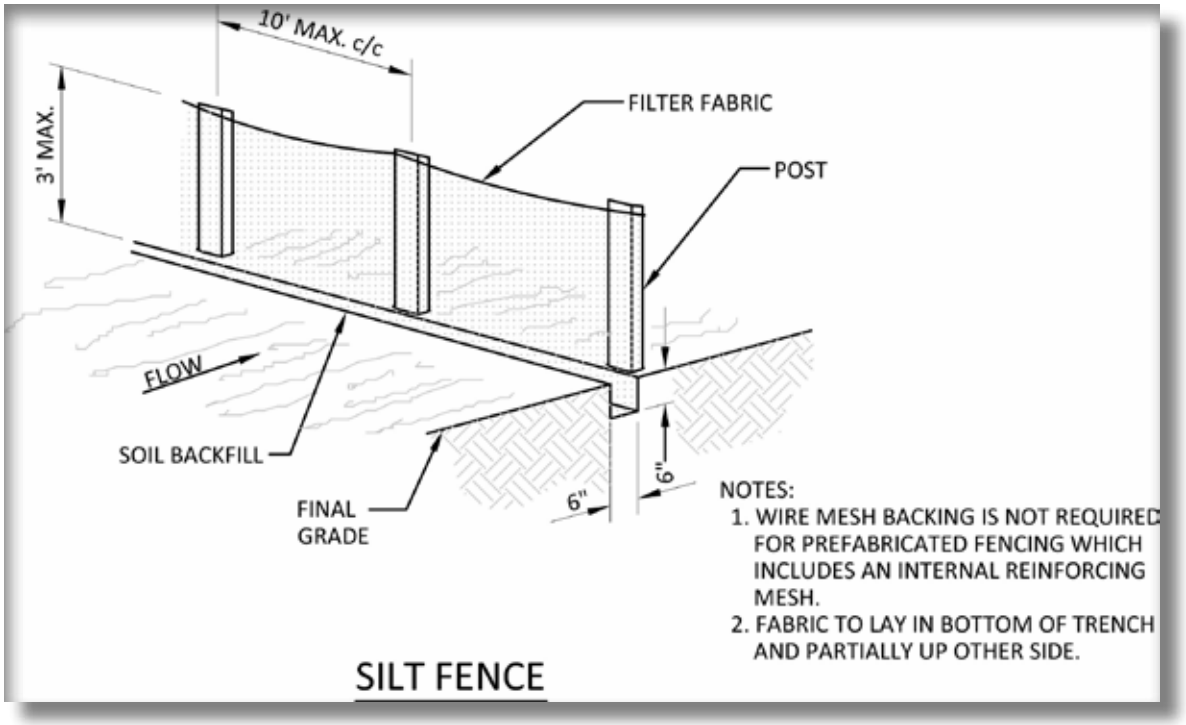


Courtesy of EPA

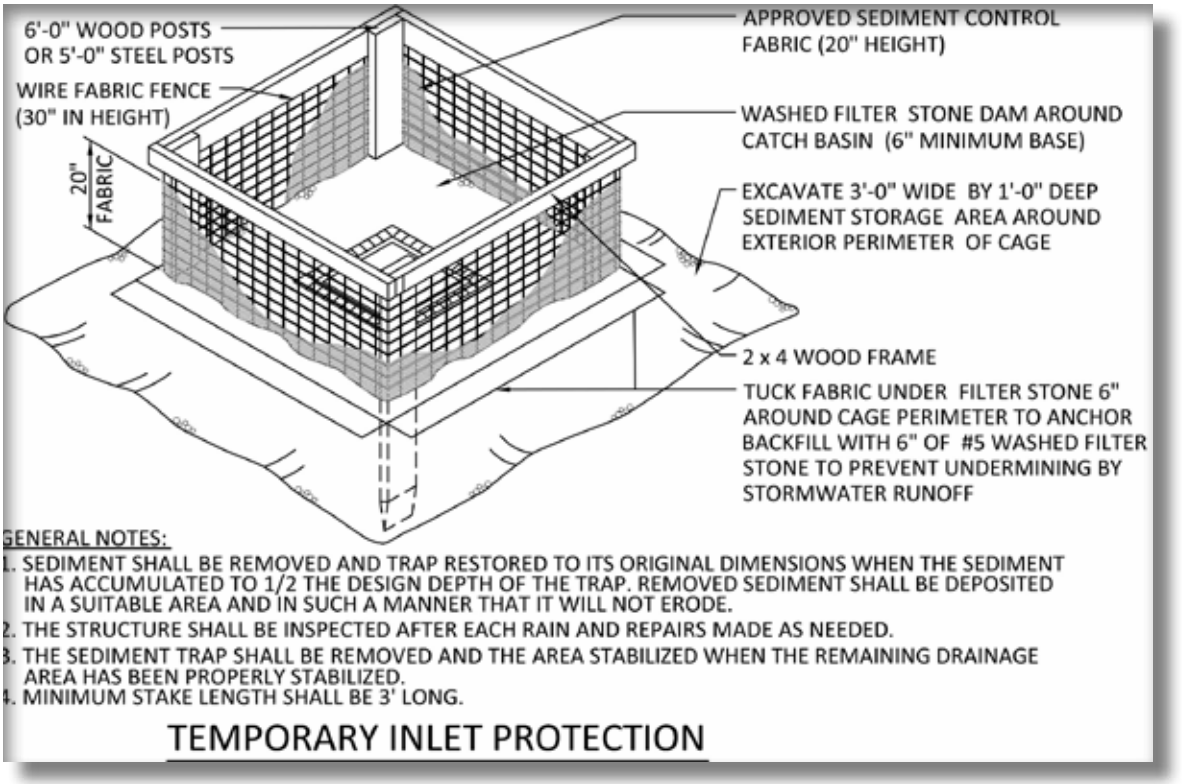
Figure 5-9.4.
Wattle installation illustration

Figure 5-9.5
Good Application of Silt Fence used to protect Drop Inlet

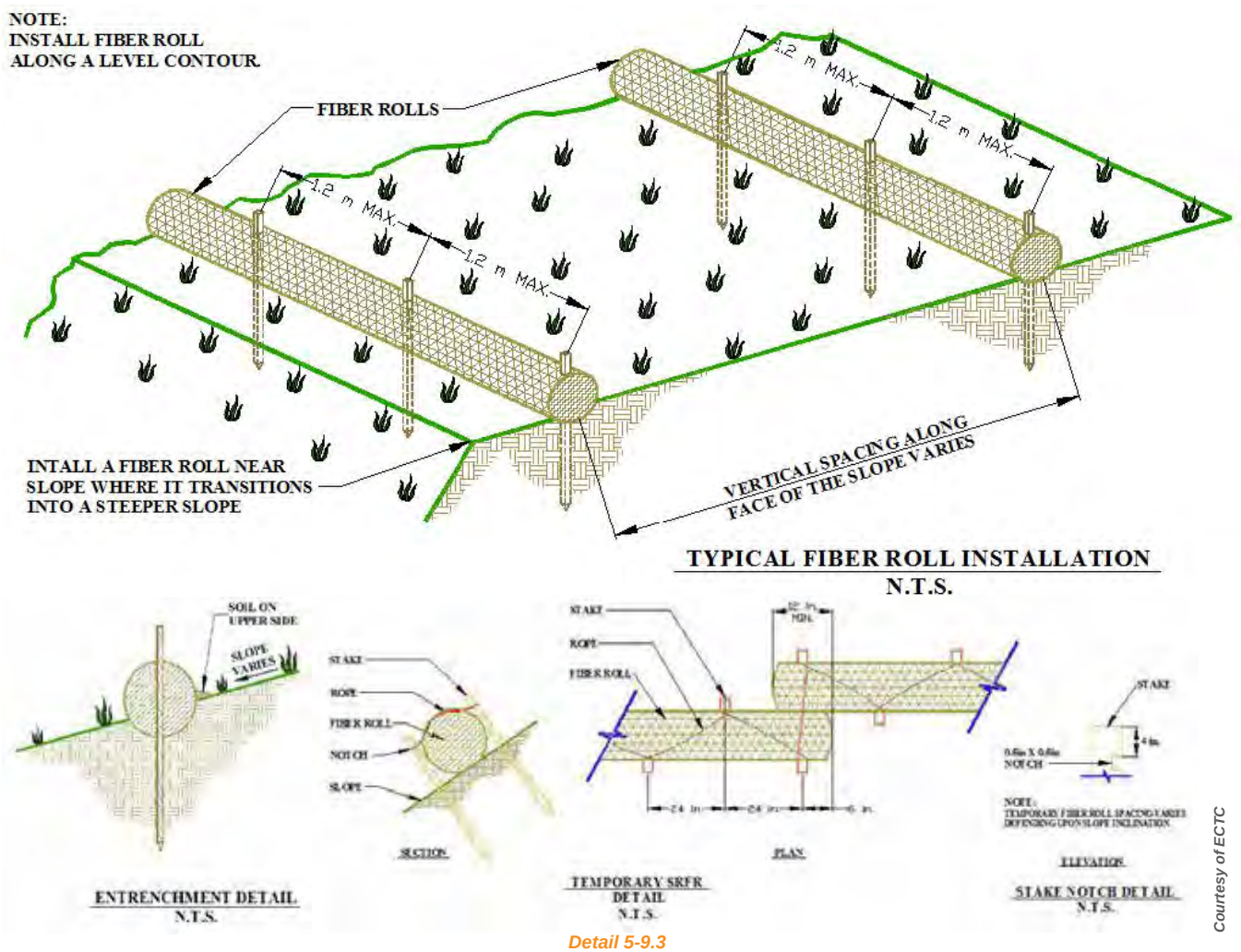
Figure 5-9.6
Good example of Inlet Protection



Detail 5-9.1
Silt Fence Installation

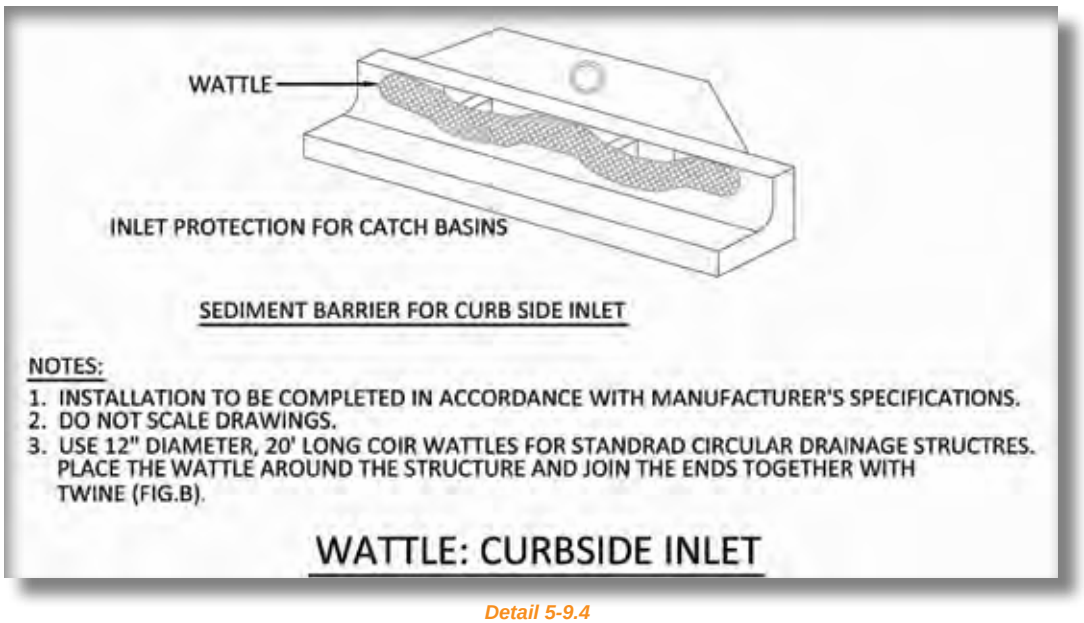


Detail 5-9.2
Inlet Protection with Silt Fence



Courtesy of ECTC

Detail 5-9.3
Wattle Installation Cross Sections



Detail 5-9.4
Curb inlet Protection with a Wattle

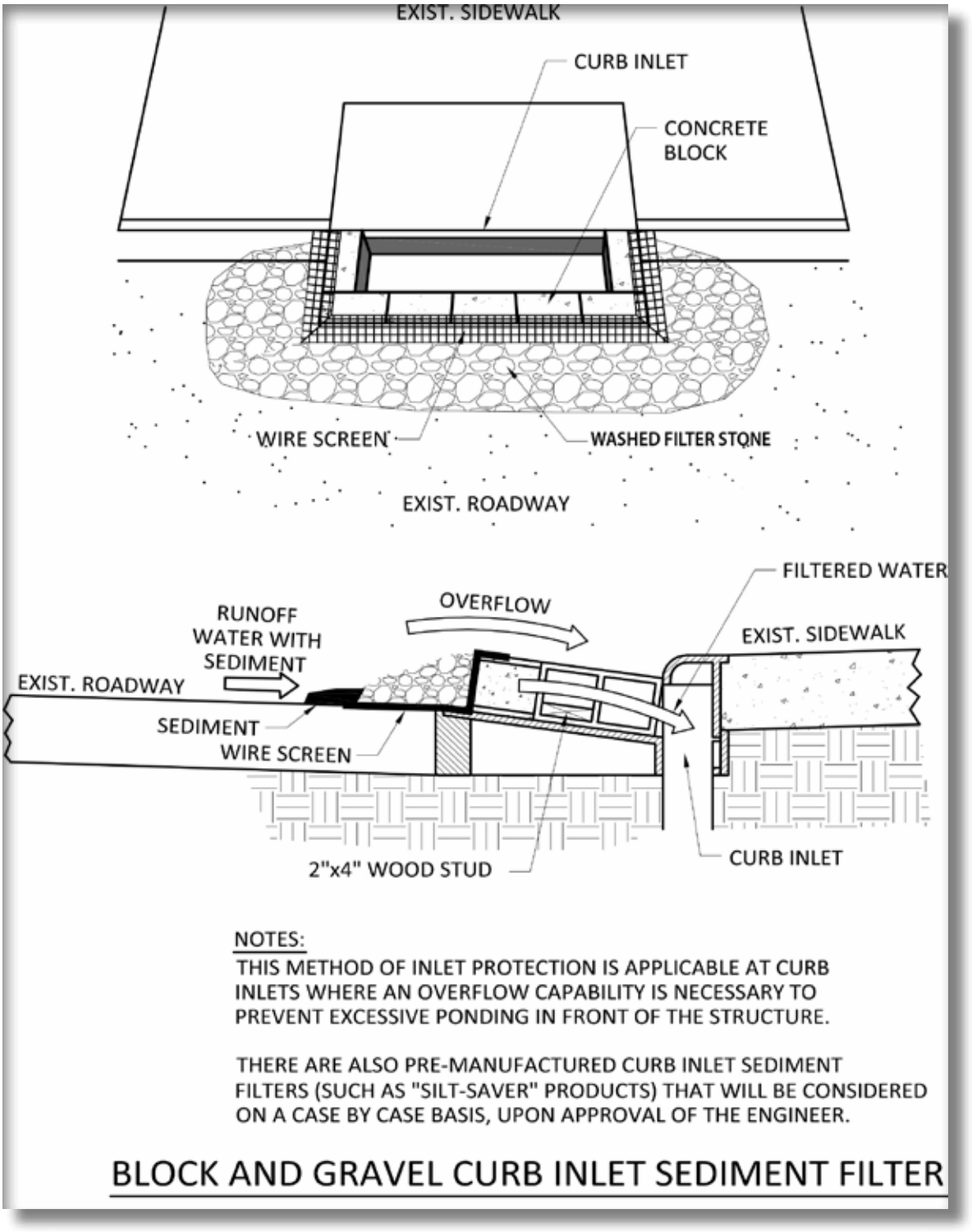


Diagram 5-9.5
Curb inlet protection using Block and Gravel

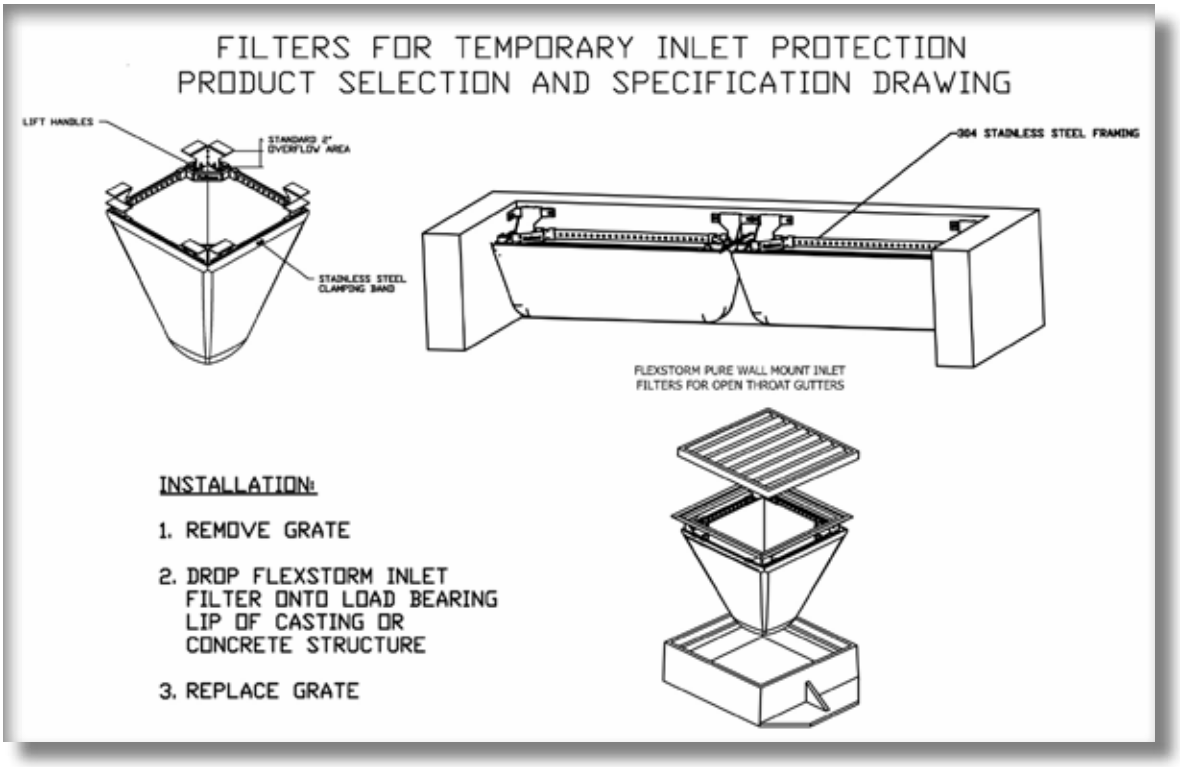


Diagram 5-9.6
Inlet Filter Cross sections