Module 4: ESC Plan Components

Learning Objectives

At the end of this module, you will be able to:

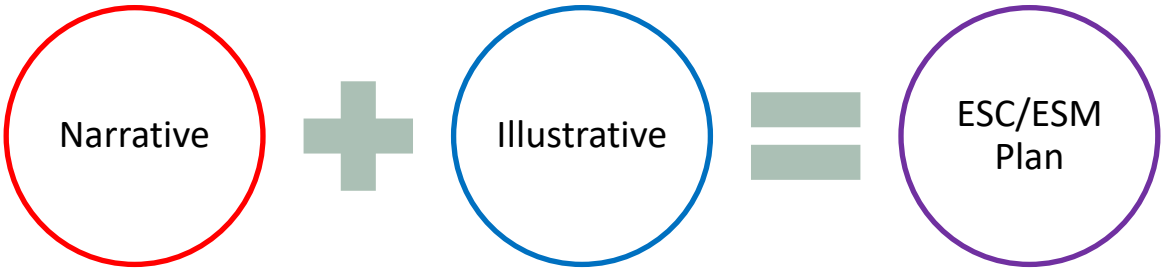
- Identify the two portions that make up an ESC or ESM plan
- Identify and explain the 19 Minimum Standards
- Compare and contrast similar contour line shapes of different topographic features

4a. Erosion and Sediment Control Plan Elements

The Erosion and Sediment Control (ESC) or the erosion portion of an Erosion Control and Stormwater Management Plan (ESM) plan shows how to develop the site and the sequencing, or phasing, of the construction. This material is presented in Chapter 4 of the Virginia Stormwater Management Handbook (VSWHB) (discussed more in Module 5). Plans should be separate from the building construction drawings and other information not related to erosion and sediment control requirements, so the plan reviewer, inspector, site supervisor, and/or RLD do not need to conduct time-consuming searches to find the relevant details.

The ESC plan or the erosion portion of an ESM plan consists of two parts:

- Narrative, which discusses the project description in paragraph form; and
- Illustrative, which shows the project development on map sheets.



An example of an Erosion and Sediment Control Plan Checklist is included on the next two pages as guidance and contains the different sections of consideration for both the narrative and illustrative portions of an ESC plan. Plan review checklists are encouraged for use as a job aid and as a guide for those preparing an ESC plan for submittal and approval. Inspectors should be familiar with the different items listed, in order to be better prepared to view their projects' site plans.

NOTES:

1. The stormwater components of an ESM plan are covered in the SWM certification courses.

2. DEQ's Office of Stormwater Management has an ESC/SWM Plan Submission Checklist required for plan submittal and approval. This checklist can be viewed at: https://www.deq.virginia.gov/permits/water/stormwater-construction/plan-review

EXAMPLE ESC PLAN REVIEW CHECKLIST

VSWHB, SECTION 4.3.2.6.1

CHECKLIST

FOR EROSION AND SEDIMENT CONTROL PLANS

_____ Minimum Standards - All applicable Minimum Standards must be addressed.

NARRATIVE

_____ Project description - Briefly describes the nature and purpose of the land-disturbing activity, and the area (acres) to be disturbed.

_____ Existing site conditions - A description of the existing topography, vegetation and drainage.

_____ Adjacent areas - A description of neighboring areas such as streams, lakes, residential areas, roads, etc., which might be affected by the land disturbance.

_____ Off-site areas - Describe any off-site land-disturbing activities that will occur (including borrow sites, waste or surplus areas, etc.). Will any other areas be disturbed?

_____ Soils - A brief description of the soils on the site giving such information as soil name, mapping unit, erodibility, permeability, depth, texture and soil structure.

_____ Critical areas - A description of areas on the site which have potentially serious erosion problems (e.g., steep slopes, channels, wet weather/ underground springs, etc.).

_____ Erosion and sediment control measures - A description of the methods which will be used to control erosion and sedimentation on the site. (Controls should meet the specifications in Chapter 3.)

_____ Permanent stabilization - A brief description, including specifications, of how the site will be stabilized after construction is completed.

_____ Stormwater runoff considerations - Will the development site cause an increase in peak runoff rates? Will the increase in runoff cause flooding or channel degradation downstream? Describe the strategy to control stormwater runoff.

_____ Calculations - Detailed calculations for the design of temporary sediment basins, permanent stormwater detention basins, diversions, channels, etc. Include calculations for pre- and post-development runoff.

Checklist (continued)

SITE PLAN

_____ Vicinity map - A small map locating the site in relation to the surrounding area. Include any landmarks which might assist in locating the site.

_____ Indicate north - The direction of north in relation to the site.

_____ Limits of clearing and grading - Areas which are to be cleared and graded.

_____ Existing contours - The existing contours of the site.

_____ Final contours - Changes to the existing contours, including final drainage patterns.

_____ Existing vegetation - The existing tree lines, grassed areas, or unique vegetation.

_____ Soils - The boundaries of different soil types.

_____ Existing drainage patterns - The dividing lines and the direction of flow for the different drainage areas. Include the size (acreage) of each drainage area.

_____ Critical erosion areas - Areas with potentially serious erosion problems. (See Chapter 6 for criteria.)

_____ Site Development - Show all improvements such as buildings, parking lots, access roads, utility construction, etc.

_____ Location of practices - The locations of erosion and sediment controls and stormwater management practices used on the site. Use the standard symbols and abbreviations in Chapter 3 of this handbook.

_____ Off-site areas - Identify any off-site land-disturbing activities (e.g., borrow sites, waste areas, etc.). Show location of erosion controls. (Is there sufficient information to assure adequate protection and stabilization?)

_____ Detail drawings - Any structural practices used that are not referenced to the E&S handbook or local handbooks should be explained and illustrated with detail drawings.

_____ Maintenance - A schedule of regular inspections and repair of erosion and sediment control structures should be set forth.

4b. Minimum Standards

(9VAC25-875-560)

The Minimum Standards (MS) are listed in Part V (Criteria and Requirements for Regulated Land-Disturbing Activities), Article 2 (Soil Erosion Requirements) of the Virginia Erosion and Stormwater Management (VESM) Regulation. The MSs state when and where Construction Best Management Practices-(C-BMPs) must be used for the effective control of soil erosion and sediment deposition. Every VESCP or VESMP authority must require compliance with the Minimum Standards, and an ESC plan consistent with the following criteria, techniques, and methods must be submitted to the VESMP or VESCP authority for review and approval.

The Minimum Standards should be mutually understood by the plan preparer, plan reviewer, developer (operator), and inspector. As such, they allow for consistent enforcement and compliance throughout the state.

The Minimum Standards can be divided into distinct groups:

- Erosion control and soil stabilization (MS-1, 2, 3, and 5)
- Sediment control (MS-4 and 6)
- Slope protection (MS-7, 8, and 9)
- Channels, culverts, and outlets (MS-10 and 11)
- Watercourses (MS-12, 13, 14, and 15)
- Underground utilities (MS-16)
- Construction entrances (MS-17)
- Project completion (MS-18)
- Water quantity stormwater management (MS-19)

Text in *italics* on the following pages indicates the language of the MS copied from the regulation.

MS-1: Stabilization

Permanent or temporary soil stabilization shall be applied to denuded areas within seven days after final grade is reached on any portion of the site. Temporary soil stabilization shall be applied within seven days to denuded areas that may not be at final grade but will remain dormant for longer than 14 days. Permanent stabilization shall be applied to areas that are to be left dormant for more than one year.

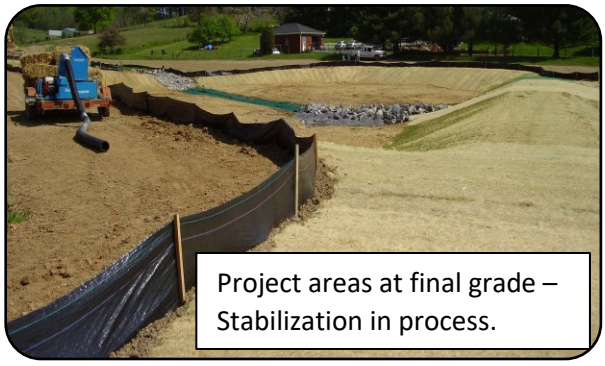
If final grade is reached on any portion of the site, vegetation must be established to prevent erosion. Temporary stabilization must be applied if any portion of the site will remain dormant for more than 14 days.

Remember, groundcover can reduce the erosion potential of an area by 90% to 99%.

Temporary sediment trap – To be removed at project completion.

Not at Final Grade

- Stabilize within 7 days if dormant >14 days
- Temporarily seed
- Mulch
- Permanently stabilize if dormant >1 year



Project areas at final grade – Stabilization in process.

At Final Grade

- Stabilize within 7 days
- Permanent seeding
- Mulch

MS-2: Stockpiles, Waste, and Borrow Areas

During construction of the project, soil stockpiles and borrow areas shall be stabilized or protected with sediment trapping measures. The applicant is responsible for the temporary protection and permanent stabilization of all soil stockpiles on site as well as borrow areas and soil intentionally transported from the project site.

Per MS-1, apply temporary soil stabilization (i.e. mulch or annual vegetation) to a stockpile within seven days if it will remain dormant for more than 14 days. If the stockpile will remain on-site for more than one year, stabilize it using permanent vegetation. This also applies to off-site borrow and spoil areas.

Mulch on stockpile and protected with silt fence
Purpose: Mulch prevents erosion by protecting the surface from raindrop impact, and silt fence intercepts and detains sediment from disturbed areas.

MS-3: Permanent Vegetation

A permanent vegetative cover shall be established on denuded areas not otherwise permanently stabilized. Permanent vegetation shall not be considered established until a ground cover is achieved that is uniform, mature enough to survive, and will inhibit erosion.

The inspector from the VESCP or VESMP authority may have the final say on when a site has reached final stabilization.

MS-3 is what the authority should use to verify that a site is ready for release of bonds or surety.

Permanent vegetation
Purpose: Reduce erosion and decrease sediment yield from disturbed areas

MS-4: First-Step Measures

Sediment basins and traps, perimeter dikes, sediment barriers, and other measures intended to trap sediment shall be constructed as a first step in any land-disturbing activity and shall be made functional before upslope land disturbance takes place.

This MS is meant to ensure that sediment does not leave the perimeter of the land-disturbing activity (LDA) once site clearing, grading, and construction commences.

Phasing of an LDA should include this Minimum Standard.

A certain amount of initial land disturbance may be required to provide access for equipment to install the initial C-BMPs required under MS-4, but site clearing and grading should be kept to a minimum until these practices are in place.

C-BMPs applicable to MS-4 include certain:

- Construction Erosion Control Measures (C-ECMs), like types of diversions
- Construction Perimeter Control Measures (C-PCMs), like silt fences
- Construction Sediment Control Measures (C-SCMs), like construction entrances, sediment traps, and sediment basins

Stabilized perimeter diversion dike (C-ECM-04)

Silt fence with wooden stakes (C-PCM-04)

Purpose: Intercept and detain small amounts of sediment from disturbed areas during construction operations to prevent sediment from leaving the site and decrease velocity of sheet flows and low-to-moderate level channel flow

MS-5: Earthen Structure Stabilization

Stabilization measures shall be applied to earthen structures such as dams, dikes, and diversions immediately after installation.

In this case, immediate stabilization is required, so the C-BMPs made of earthen materials do not become a source of sediment. Earthen practices are generally intended to impound, convey, or divert water, so immediate stabilization is needed to prevent damage or failure of earthen structures.

Earthen C-BMPs seeded and mulched immediately after construction
Purpose: Reduce erosion and sedimentation and reduce damage from sediment and runoff to downstream or off-site areas

MS-6: Traps and Basins

Sediment traps and sediment basins shall be designed and constructed based upon the total drainage area to be served by the trap or basin.

a) *The minimum storage capacity of a sediment trap shall be 134 cubic yards per acre of drainage area* (134 cubic yards per acre is equivalent to one inch of runoff) *and the trap shall only control drainage areas less than three acres.*

b) *Surface runoff from disturbed areas that is comprised of flow from drainage areas greater than or equal to three acres shall be controlled by a sediment basin. The minimum storage capacity of a sediment basin shall be 134 cubic yards per acre of drainage area. The outfall system shall, at a minimum, maintain the structural integrity of the basin during a 25-year storm of 24-hour duration. Runoff coefficients used in runoff calculations shall correspond to a bare earth condition or those conditions expected to exist while the sediment basin is utilized.*

Sediment trapping devices:

- Place near the lowest drainage points of a project
- Install as a first-step measure (MS-4)
- Stabilize immediately (MS-5)
- Must include outlet protection for basins (MS-11)
- VSWHB clearly requires MS-19 compliance as well

Sediment Trap
Drainage areas < 3 acres

Sediment Basin
Drainage areas ≥ 3 acres

MS-7: Cut and Fill Slopes

Cut and fill slopes shall be designed and constructed in a manner that will minimize erosion. Slopes that are found to be eroding excessively within one year of permanent stabilization shall be provided with additional slope stabilizing measures until the problem is corrected.

It is important that slopes are properly seeded and mulched to establish permanent vegetation, so erosion by concentrated flow does not occur.

While plants on a slope need water for germination and establishment, cut and fill slopes are inherently unstable, and any runoff from up-gradient areas must be conveyed down the slope in a non-erodible manner.

Remember, Module 2 discussed critical slopes. This minimum standard is reflexive of avoiding critical slope construction, if possible, and, where not possible, ensuring additional control measures are used to combat erosion occurring.

Roughening the surface of the slope decreases runoff by lowering the velocity and increasing water retention, which leads to better seed germination. This practice should generally be implemented unless the slope will require a high degree of maintenance mowing after vegetative establishment.

MS-8: Concentrated Runoff

Concentrated runoff shall not flow down cut or fill slopes unless contained within an adequate temporary or permanent channel, flume, or slope drain structure.

Concentrated runoff flowing down a cut or fill slope will cause erosion, so concentrated flow must be adequately controlled at the outlet and down the slope through a temporary or permanent channel, flume, or slope drain.

The ends of these slope drains need **outlet protection** to prevent erosion from concentrated flows.

Temporary slope drains
Purpose: Temporarily convey concentrated stormwater runoff safely down the face of a cut or fill slope without causing erosion on or below the slope

MS-9: Water Seeps

Whenever water seeps from a slope face, adequate drainage or other protection shall be provided.

Cut and fill operations may expose shallow aquifers, perched aquifers, or groundwater tables from which water may seep through the side of a slope. The water seeps can cause slopes to erode, or slough, from the soil's weight. When water seeps are known or discovered on sites, protections must be used to prevent erosion.

Slope failure from a water seep

Riprap installed to prevent further slope failure

MS-10: Inlet Protection

All storm sewer inlets that are made operable during construction shall be protected so that sediment-laden water cannot enter the conveyance system without first being filtered or otherwise treated to remove sediment.

The cost to clean out a site's stormwater infrastructure can be reduced with proper C-BMP control design, installation, and maintenance.

Storm sewers are designed to efficiently transport stormwater away from the site, so when sediment enters the storm sewer system, two negative effects can occur:

- When the velocity of flow is high, much of the sediment will be quickly transported to the nearest receiving channel **or**
- When the velocity of the flow is low, the sediment will deposit in the pipes, resulting in clogging and potential flooding of a site during storm events.

Silt fence drop inlet protection

Block and gravel drop inlet sediment filter

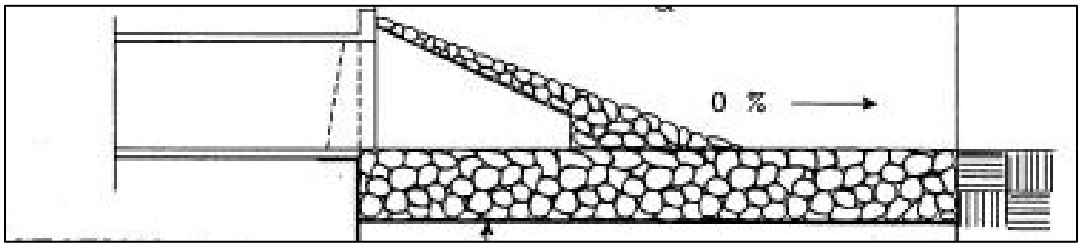
Purpose: Prevent sediment from entering storm drainage systems prior to permanent stabilization of the disturbed area

MS-11: Outlet Protection

Before newly constructed stormwater conveyance channels or pipes are made operational, adequate outlet protection and any required temporary or permanent channel lining shall be installed in both the conveyance channel and receiving channel.

Outlet protection provides energy dissipation of the concentrated discharge from a pipe or channel, in order to prevent erosion and provide a stable transition. Temporary or permanent channel lining helps to ensure that the channel itself will not erode once water is flowing through it.

Outlet protection must be constructed at 0% grade (see below).



Outlet protection
Purpose: Prevent scour at stormwater outlets, protect outlet structure, and minimize potential for downstream erosion by reducing the velocity and energy of concentrated stormwater flows

MS-12: Watercourse Construction

When work in a live watercourse is performed, precautions shall be taken to minimize encroachment, control sediment transport, and stabilize the work area to the greatest extent possible during construction. Nonerodible material shall be used for the construction of causeways and cofferdams. Earthen fill may be used for these structures if armored by nonerodible cover materials.

Note that the placing of fill in a wetland or stream as a work pad, as shown in the picture below, needs to be permitted by the U.S. Army Corp of Engineers, Virginia Marine Resource Commission (VMRC), and/or DEQ prior to the commencement of work (see MS-14).

In stream work
Purpose: Use of non-erodible materials prevents damage to the stream bed and sedimentation

MS-13: Temporary Vehicular Stream Crossing

When a live watercourse must be crossed by construction vehicles more than twice in any six-month period, a temporary vehicular stream crossing constructed of nonerodible material shall be provided.

When two different construction vehicles cross a stream one right after the other, the stream has now been crossed twice and can no longer be crossed within the next six months without violating this MS.

This minimum standard allows one construction vehicle to cross a stream then return within any six-month period.

Temporary stream crossing
Purpose: Provide a means for construction traffic to cross flowing streams without damaging the channel or banks and keep sediment generated by construction traffic out of the stream

MS-14: Other Watercourse Regulations

All applicable federal, state, and local requirements pertaining to working in or crossing live watercourses shall be met.

Activities in live watercourses usually fall under the jurisdiction of other agencies and/or regulations, including:

- U.S. Army Corps of Engineers (404 Permit)
- DEQ's Virginia Water Protection (VWP - 401 permitting regulations)
- Virginia Marine Resources Commission (VMRC)
- Virginia Department of Wildlife Resources (DWR) or
- Local wetland board time of year restrictions.

All applicable permits need to be obtained and need to be available on site before construction in live watercourses may start.

Water bodies may be identified through wetland delineation, followed by a jurisdictional determination by the U.S. Army Corps of Engineers. Wetlands, streams, and other water bodies and the impact on these water bodies are usually indicated on plans and sometimes include permit numbers.

> **NOTE**
>
> Jurisdiction of wetlands and shorelines in coastal areas and areas under the Chesapeake Bay Preservation Act may have complicated jurisdictional divisions.

MS-15: Bed and Bank Stabilization

The bed and banks of a watercourse shall be stabilized immediately after work in the watercourse is completed.

Stabilization at the end of each day or immediately after work is completed will ensure that sediment is not impacting other parts of the watercourse. Protective measures will be needed when work cannot be completed in a day.

When working in water, the safety of the workers and equipment is important. The weather also factors in heavily when deciding to continue working in a watercourse or not due to potentially high flows of water.

Vegetative streambank stabilization
Purpose: Protect streambanks from erosive forces of flowing water

MS-16: Utility Construction

Underground utility lines shall be installed in accordance with the following standards in addition to other applicable criteria:

a) No more than 500 linear feet of trench may be opened at one time.

b) Excavated material shall be placed on the uphill side of trenches.

c) Effluent from dewatering operations shall be filtered or passed through an approved sediment trapping device, or both and discharged in a manner that does not adversely affect flowing streams or off-site property.

d) Material used for backfilling trenches shall be properly compacted in order to minimize erosion and promote stabilization.

e) Re-stabilization shall be accomplished in accordance with this chapter (9VAC25-875-560).

f) Applicable safety requirements shall be complied with.

The basic principle of controlling erosion and sedimentation on utility projects is to get the trench backfilled and stabilized as soon as possible.

Section (f) refers to the safety requirements set forth by OSHA, in regard to trench depth and the requirement for shoring or trench boxes when workers are in the trench.

Backfilling a utility trench

MS-17: Vehicular Tracking and Construction Entrances

Where construction vehicle access routes intersect paved or public roads, provisions shall be made to minimize the transport of sediment by vehicular tracking onto the paved surface. Where sediment is transported onto a paved or public road surface, the road surface shall be cleaned thoroughly at the end of each day. Sediment shall be removed from the roads by shoveling or sweeping and transported to a sediment control disposal area. Street washing shall be allowed only after sediment is removed in this manner. This provision shall apply to individual development lots as well as to larger land-disturbing activities.

During wet weather, construction traffic can transport a significant amount of sediment (i.e. mud) onto paved public roads, creating not only a sedimentation problem but also a safety hazard and public nuisance.

The operator is responsible for keeping public roads adjacent to their project clean.

Mud should be swept or shoveled off the road and deposited on areas where it will not cause another sedimentation problem.

Sweeping and washing
Washing is only permitted after shoveling and sweeping of sediment

Temporary stone construction entrance (C-SCM-02)
Purpose: Reduce amount of mud transported onto paved public roads by motor vehicles or runoff

MS-18: Temporary Control Removal

All temporary erosion and sediment control measures shall be removed within 30 days after final site stabilization or after the temporary measures are no longer needed, unless otherwise authorized by the VESCP or VESMP authority. Trapped sediment and the disturbed soil areas resulting from the disposition of temporary measures shall be permanently stabilized to prevent further erosion and sedimentation.

Temporary C-BMPs can become a problem if left in place beyond their useful life.

- Sediment fences can trap wildlife and small animals.
- Sediment basins can become drowning hazards or sources of sediment in cases of failure, and they become unsightly.

ESC to SWM Practice?

Some sediment basins are designed to be converted to stormwater basins at the end of a project. This should only be done once final stabilization of the contributing drainage area has been achieved.

Temporary C-BMPs should be removed as soon as their function has been completed, and the area should be stabilized.

Frayed and weathered silt fence not removed at end of project.

Minimum Standard #	Summary Description & Purpose of Minimum Standards
MS 1	Addresses permanent and temporary soil stabilization within 7 days when site is at final grade and on sites that are not at final grade, but will remain dormant for more than 14 days.
MS 2	Soil Stockpiles and borrow areas must be stabilized or protected with sediment trapping measures. This includes off site/remote areas. According to MS-1, piles dormant more than 14 days should be temporary seeded.
MS 3	Permanent Stabilization must be applied to areas not otherwise permanently stabilized. Ground cover needs to be uniform, mature enough to survive and inhibit erosion.
MS 4	Perimeter controls (sediment barriers, sediment basins, traps, perimeter dikes, etc.) must be installed as first measures and shall be made functional before upslope activity occurs.
MS 5	Stabilization practice shall be applied immediately to earthen structures (i.e. dams, dikes & diversions) after installation.
MS 6	Sediment traps and basins shall be designed and constructed based on the total drainage area they serve.
MS 7	Cut and fill slopes shall be designed and constructed in a manner that will minimize erosion.
MS 8	Concentrated runoff shall not flow down a cut or fill slope unless contained in an adequate temporary or permanent channel, flume or slope drain structure.
MS 9	Where water seeps from a slope face, adequate drainage or other protection shall be provided.

MS 10	All storm sewer inlets made operable during construction must be protected so sediment laden water cannot enter without first being filtered.
MS 11	Before any newly constructed stormwater conveyance channel can be made operational, adequate outlet protection and any required temporary or permanent channel lining shall be installed in both the conveyance channel and receiving channel.
MS 12	Minimize encroachment to live water course. Non-erodible materials shall be used for constructing causeways and coffer dams; earthen material may be used if armored by non-erodible material.
MS 13	When construction vehicles must cross a live water course more than twice in a 6 month period, a temporary stream crossing of non-erodible material must be provided.
MS 14	When working in a live water course, all applicable Federal, State and local regulations pertaining to the activity must be met.
MS 15	The bed and banks of a watercourse shall be stabilized immediately after work in the watercourse has been completed.
MS 16	Underground utility lines can have no more than 500 feet open trench and need to be stabilized as soon as possible. All dewatering operations shall be filtered before water leaves the site.
MS 17	Provisions shall be made to minimize the transport of sediment from the site onto paved surfaces.
MS 18	All temporary ESC measures shall be removed within 30 days of achieving final stabilization or when the measures are no longer needed.
MS 19	Stormwater standard: Protect properties and waterways downstream of a land disturbing activity from erosion and sediment deposition due to increases in peak stormwater runoff.

MS-19: CHANNEL AND FLOOD PROTECTION CRITERIA

Minimum Standard 19 (MS-19) regulates how stormwater runoff leaving a site must be managed, both during construction and after construction is completed, in order to protect downslope waterways and properties.

Changes to MS-19 and the stormwater regulations have led to significant changes and overlaps between the erosion and sediment control and stormwater management programs. As of July 1, 2014, MS-19 (9VAC25-875-560) incorporated the post-construction water quantity technical criteria of 9VAC25-875-600. As a result, projects that meet the threshold for regulation under the erosion and sediment control program are required to demonstrate compliance with the water quantity regulations for post-construction stormwater management.

It should be noted that the definition of regulated land-disturbing activities (LDAs), or rather the trigger areas for erosion program and stormwater program requirements, may be different or the same in any given locality. The area threshold for erosion compliance within the state is 10,000 square feet, and the area threshold for stormwater compliance within the state is one acre, whether as one parcel of disturbance or as a common plan of development totaling an acre or more. A locality may have thresholds that are more stringent for either. The effective area thresholds must be reflected in a locality's ordinance.

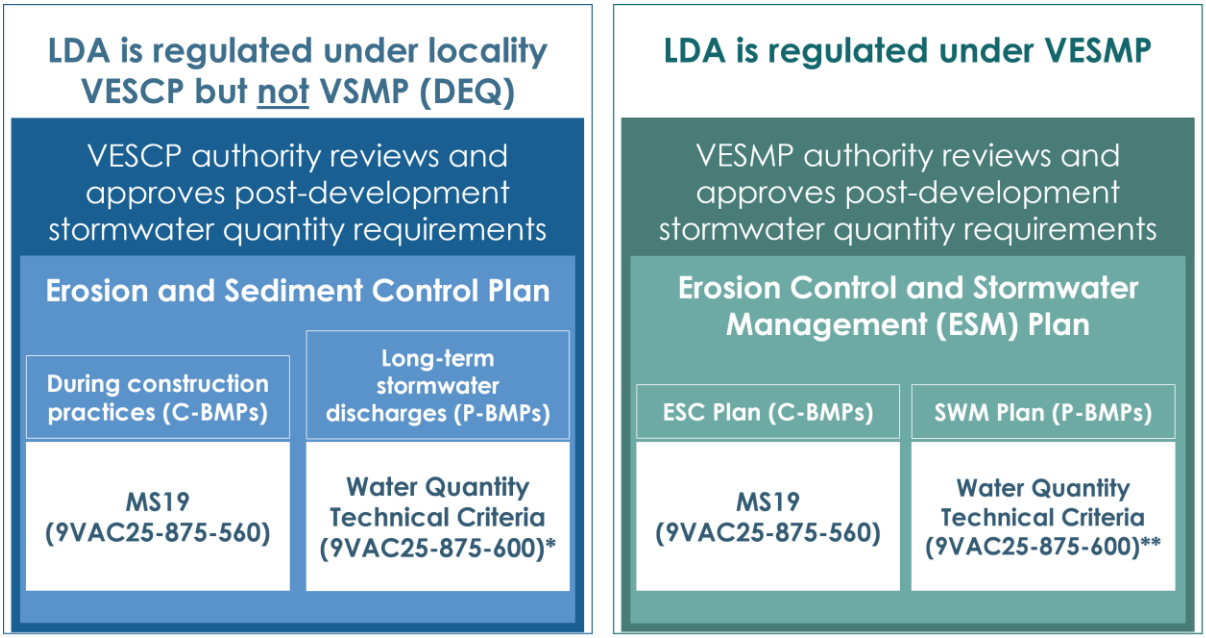
For a VESCP locality (left, blue side of graphic), for regulated LDAs over the erosion threshold of 10,000 square feet but less than an acre, at which DEQ would review a plan for stormwater compliance, the VESCP authority must review for post-construction stormwater quantity compliance, potentially with post-construction best management practices (P-BMPs). Practices used for compliance during construction (C-BMPs) must be evaluated for compliance with MS-19. Both C- and P-BMPs may or may not be included on the ESC plan specifically, but both types of practices must be reviewed for compliance.

For a VESMP locality (right, green side of graphic), for regulated LDAs over the authority's disturbance threshold, the locality must review both C- and P-BMPs for channel and flood protection compliance. As a reminder, Chesapeake Bay Preservation Area LDAs fall into this category and require compliance starting at 2,500 square feet of disturbance. These projects also have water quality compliance requirements discussed in our stormwater certification courses.

The graphic below shows these requirements. If an LDA is an exempt activity or is grandfathered, other requirements not discussed in the graphic may apply.

Additionally, according to 19.m and 19.n, a site design that satisfies the water quantity technical criteria of 875-600, will satisfy the requirements of MS-19.

Post-development channel and flood protection:



*Unless §62.1-44.15:55.F applies

**Unless 9VAC25-875-490 or §62.1-44.15:34.F-G apply

LDA: Land-disturbing activity
VESCP: Virginia Erosion and Sediment Control Program
VSMP: Virginia Stormwater Management Program
VESMP: Virginia Erosion and Stormwater Management Program

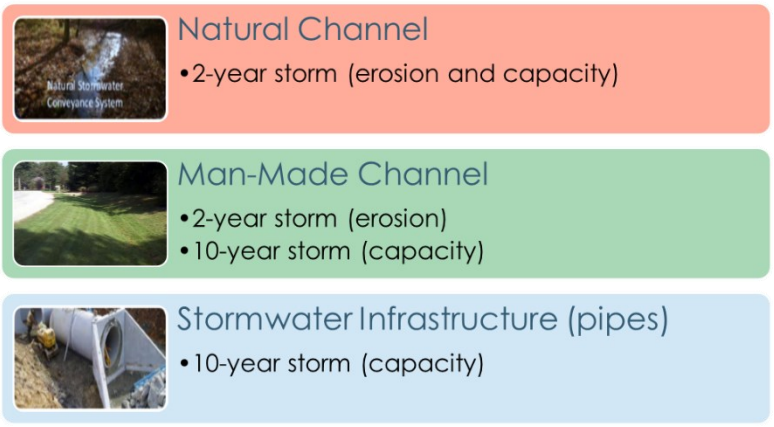
Managing water quantity during construction
& post-development plans approved prior to July 1, 2014

Plans must address runoff leaving the site both during construction and in the post-development condition. ESC plans must comply with the requirements listed below for runoff that is discharged from the site during construction, i.e. sediment basin discharges. These requirements also applied to the post-development condition for plans that were approved prior to July 1, 2014.

These requirements, as detailed in MS-19, and listed as Part V, Article 4 of the VESM Regulation (Water Quantity and Water Quality Technical Criteria for Grandfathered Projects and Time Limits of Applicability Projects), are as follows:

Concentrated runoff discharged from development sites must be directed to:

1. An adequate natural channel (a natural channel that will not erode nor flood during 2-year storms); ***or***
2. An adequate man-made channel (a man-made channel that will not erode during 2-year storms nor flood during 10-year storms); ***or***
3. An adequate pipe or storm sewer system with a stable outfall (an adequate pipe or storm sewer system will be able to contain 10-year storms).



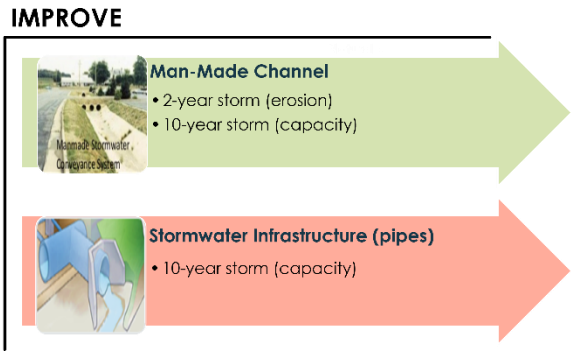
2-year storms?
Storms that have a moderate rainfall volume and occur on average once every 2 years or alternatively have a 50% chance of occurring in any given year.

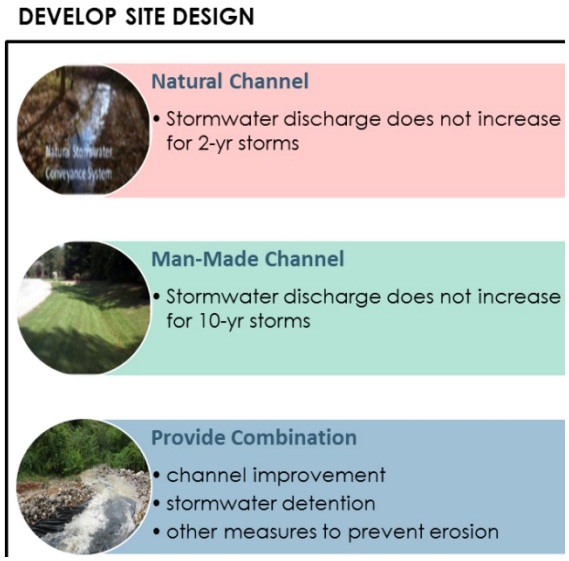
10-year storm?
Storms that have a large rainfall volume and occur on average once every 10 years or alternatively have a 10% chance of occurring in any given year.

If existing channels or pipes are NOT adequate, the requirement is to:

1. Improve channels so that:
   - the 10-year storm will not cause flooding, and
   - the 2-year storm will not cause channel erosion; **OR**
2. Improve the pipe or pipe system so that 10-year storms are contained;

   OR
3. Develop a site design:
   - For natural channels, the peak stormwater runoff discharge rate will not increase for the 2-year storm; or
   - For man-made channels, the peak stormwater runoff discharge rate will not increase for the 10-year storm; **OR**
4. Provide a combination of channel improvement, stormwater detention, or other measures satisfactory to the VESCP or VESMP authority to prevent downstream erosion.



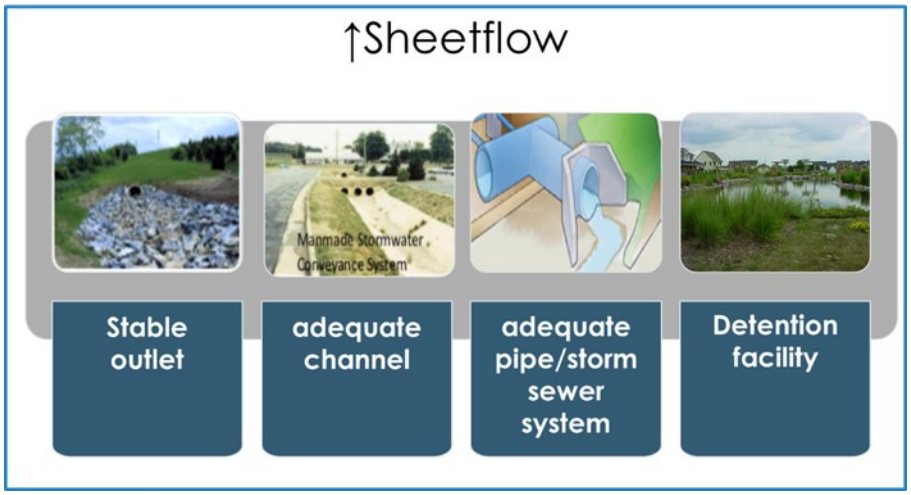


As an inspector…

It is important to ensure any channel or pipe/pipe system improvements called for on the approved plan are being followed in the field. Stormwater detention practices may also need to be inspected for compliance with the approved plan.

Sheet flow

Increased volumes of sheet flow that could cause erosion or sedimentation on downslope waterways or properties are required to be diverted to a stable outlet, adequate channel, pipe or pipe system, or detention facility. As an inspector, you should be looking for signs that sheet flow is becoming a problem – signs of erosion and/or flooding.



Post-development requirements for plans approved after July 1, 2014

For all ESC or ESM plans approved after July 1, 2014, compliance with MS-19 includes addressing runoff during construction using the requirements stated in the previous section.

Post-construction (or post-development) stormwater management for sites where plans were approved after July 1, 2014, must show compliance with the requirements listed in this section. If an LDA does not meet the threshold for requiring stormwater program compliance (≥ 1 acre or potentially lower in localities with more stringent thresholds, including in the CBPA), then post-construction stormwater management compliance must be satisfied and reviewed for approval by the erosion program authority. Remember, for VESCPs, DEQ does not review plans for post-development discharges unless the disturbance threshold reaches that which requires stormwater program compliance, as noted earlier.

Concentrated runoff discharged from the post-development site must be discharged into a stormwater conveyance system and must meet the water quantity requirements of 9VAC25-875-600.

9VAC25-875-600.B Channel Protection

1. **Energy Balance for natural conveyances**

   In order to balance the erosive potential of stormwater runoff before and after development, the post-development peak discharge rate and the runoff volume from the ***1-year storm*** must be managed so that they are similar to what they were before development. This can most effectively be achieved by reducing post-development runoff volume to close to what it was before development;

   OR

2. **For man-made channels**, another option is that the stormwater peak discharge rate from the 2-year storm may not cause erosion after development;

OR

3. **For restored channels**, another option is that the stormwater peak discharge rate after development is consistent with the design parameters of the restored system.

9VAC25- 875-600.C Flood Protection

The flood protection criterion is based on an assessment of the current condition of the downstream stormwater conveyance system during the 10-year storm. Compliance options may include channel/system improvements and/or detention of stormwater runoff.

9VAC25 875-600.D Sheet flow

Sheet flow discharged from the site must be managed:

- Increased volumes of sheet flow must be identified and evaluated for potential impacts on down-gradient properties or resources.
- Increased volumes of sheet flow that will cause or contribute to erosion, sedimentation, or flooding of down-gradient properties or resources must be diverted to a stormwater management facility or a stormwater conveyance system.

As an inspector, you should be looking for signs that:

- Sheet flow is becoming a problem – signs of erosion and/or flooding
- Outfalls are stable
- Downstream areas show evidence of erosion or flooding

When problems are detected, inspectors should consult with the plan reviewer and/or the plan reviewing authority to ensure that all requirements concerning downstream impacts have been met.

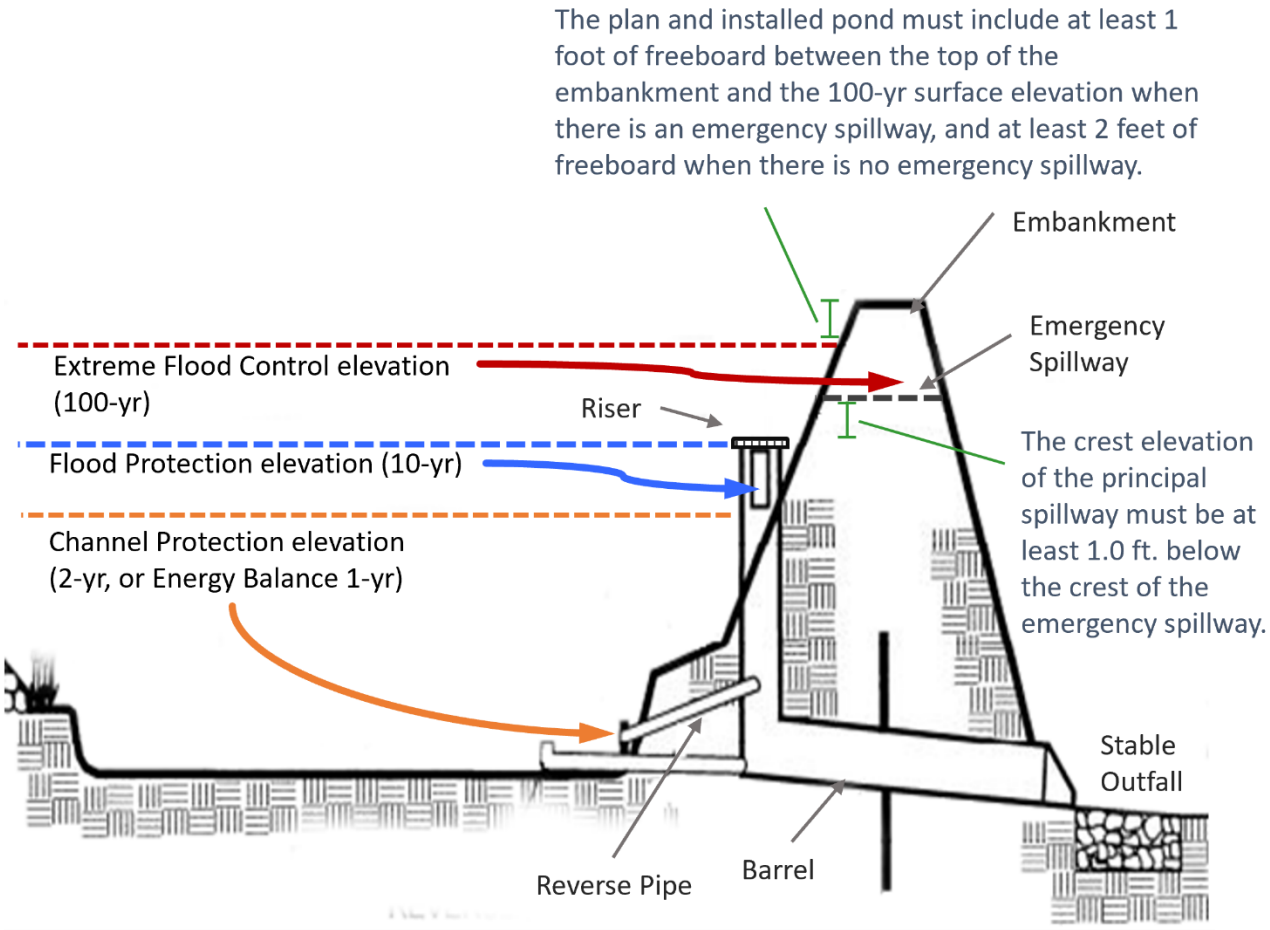
MS-19 Post-Development Stormwater Management

Minimum Standard 19 applies in its entirety during construction for plans submitted for approval. A guide through MS-19 for post-development requirements is provided:

Post-development requirements: supplanted by 9VAC-875-600 (grey italicized areas)

9VAC25-875-560.19.a	*Concentrated runoff leaving development site shall be discharged directly to adequate natural or manmade channel, pipe, or storm sewer system. Where runoff discharged into pipe/pipe system, downstream stability analyses at outfall of pipe or pipe system must be performed.*
9VAC25-875-560.19.b	*Requirements for verification for channel protection/flood protection adequacy of natural/manmade channels or 1% rule.*
9VAC25-875-560.19.c	*When existing natural or manmade channels/pipes not adequate: Requirements for channel/pipe(s) improvements or site design with non-erosive/non-flooding discharges. VESCP/VESMP approval required. Improvements to offsite areas need access permission.*
9VAC25-875-560.19.d	The applicant must provide evidence of permission to make improvements
9VAC25-875-560.19.e	All hydrologic analyses must be based on existing watershed characteristics and ultimate development condition.
9VAC25-875-560.19.f	Maintenance plan for stormwater detention options required: • Must be approved by VESCP/VESMP authority • Include maintenance requirements of facility and person responsible
9VAC25-875-560.19.g	*Outfall from a detention facility shall be discharged to a receiving channel, and* energy dissipaters shall be placed at the outfall of all detention facilities as necessary *to provide a stabilized transition from the facility to the receiving channel.*
9VAC25-875-560.19.h	All on-site channels must be verified to be adequate.
9VAC25-875.560.19.i	*Increased volumes of sheet flows ...*
9VAC25-875-560.19.j	Developments consisting of individual lots or parcels must be considered as a whole: • Residential, commercial, or industrial • Hydrologic parameters in engineering calculations must reflect ultimate development condition
9VAC25-875-560.19.k	Measures used to protect properties and waterways must be employed to minimize impacts on physical, chemical, and biological integrity of rivers, streams, and other waters of the state.
9VAC25-875-560.19.l	*Any plan approved prior to July 1, 2014,…*
9VAC25-875-560.19.m	Plans approved on and after 7/1/2014 must comply with flow rate capacity and velocity requirements of the ESC Law and MS-19 via compliance with water quantity requirements in VESMA and attendant regulations (9VAC25-875-600)…
9VAC25-875-560.19.n	Compliance with water quantity minimum standards in 9VAC25-875-600 satisfies the requirements of MS-19.

Stormwater Management Pond Schematic (Profile)

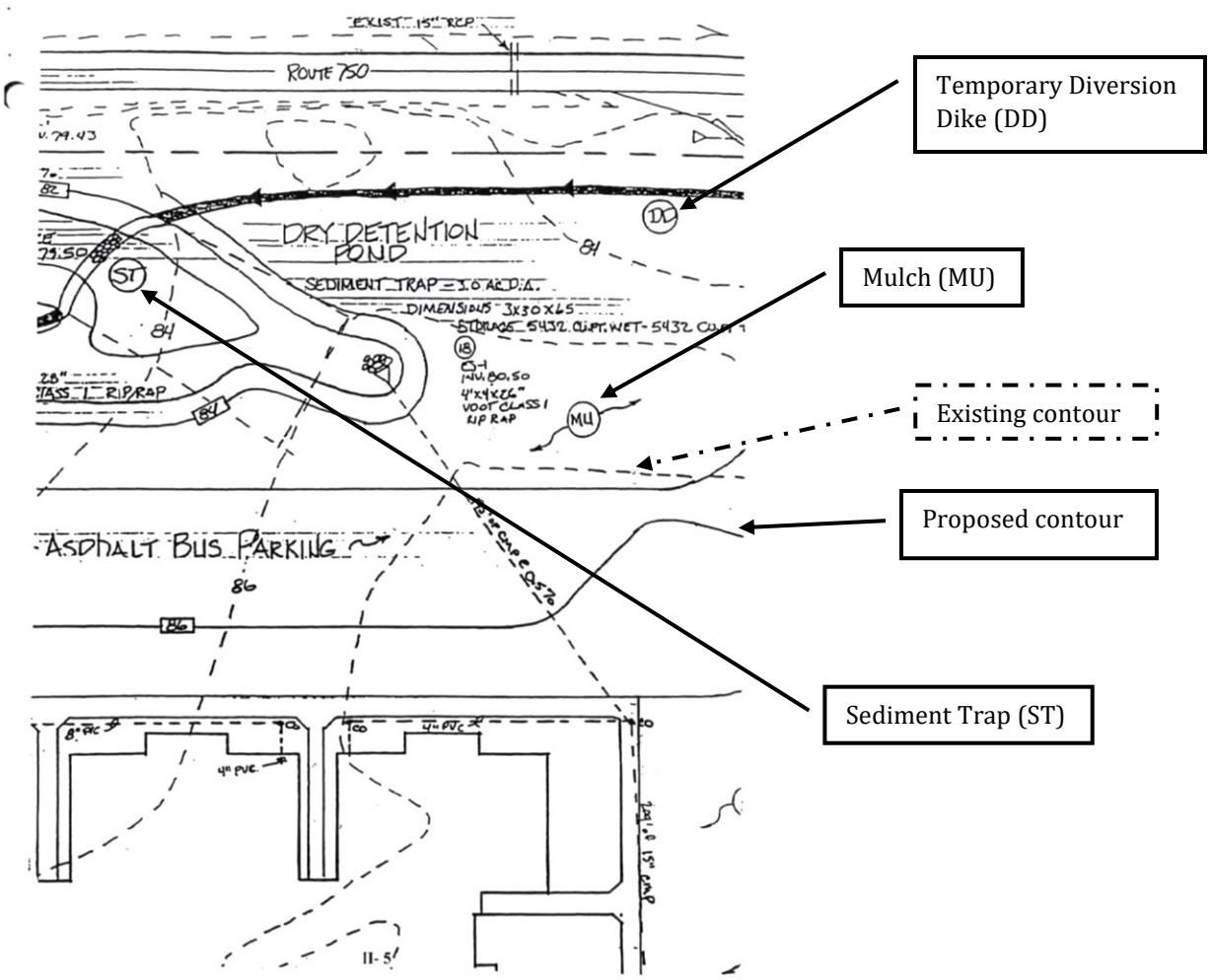


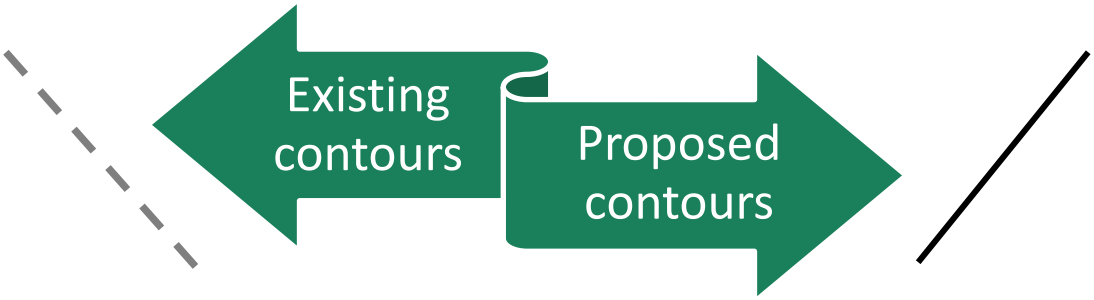
Stormwater ponds are often used to provide channel protection and/or volume protection. Ponds not regulated by the Impounding Structure Regulations (4VAC50-20) must be able to safely convey the 100-yr storm through the pond and emergency spillway per 9VAC25-875-650. Final construction specifications for all aspects of stormwater management structures should be included in the approved plans.

Water quantity compliance on the approved plan and installed pond is achieved via the size of riser pipe, size of riser orifice(s), size of outflow pipes, and barrel size. Pipe materials and specifications should be verified in accordance with the approved plan.

4c. Plan Reading Skills

In order to inspect your projects properly, you will need to be able to review the illustrative portion of the plan, so you need to understand some of the common elements of a plan and develop your plan reading skills.



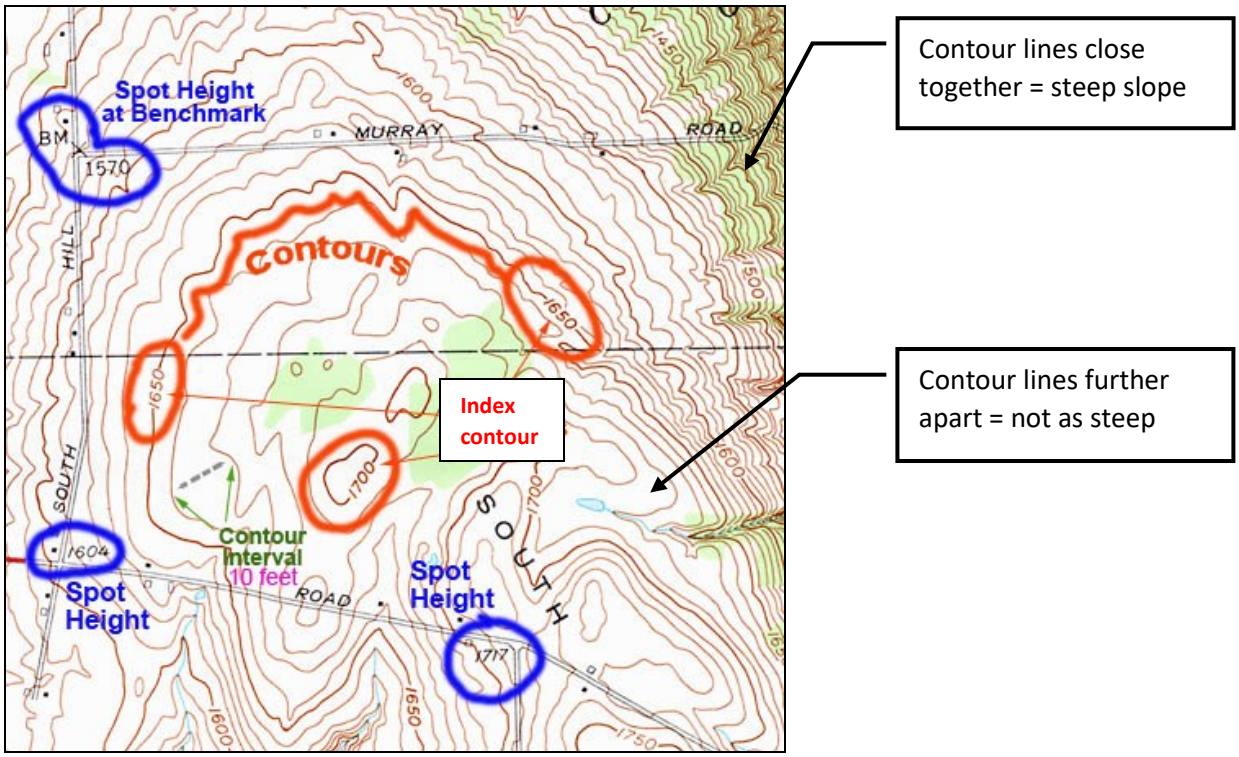


Contour line: a line on a map connecting points of equal elevation (height relative to sea level)

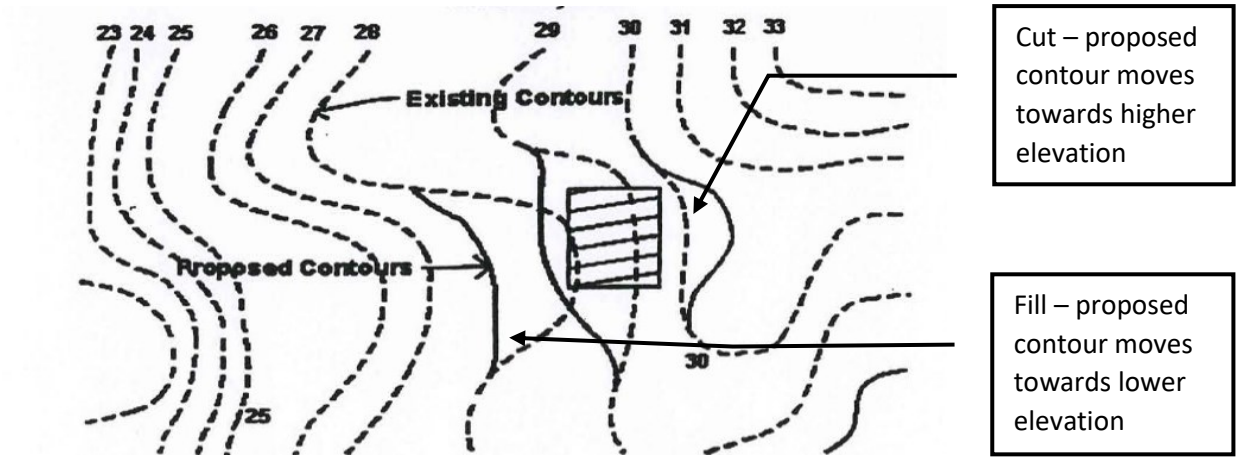
Contour interval: the difference in elevation between two adjacent contour lines

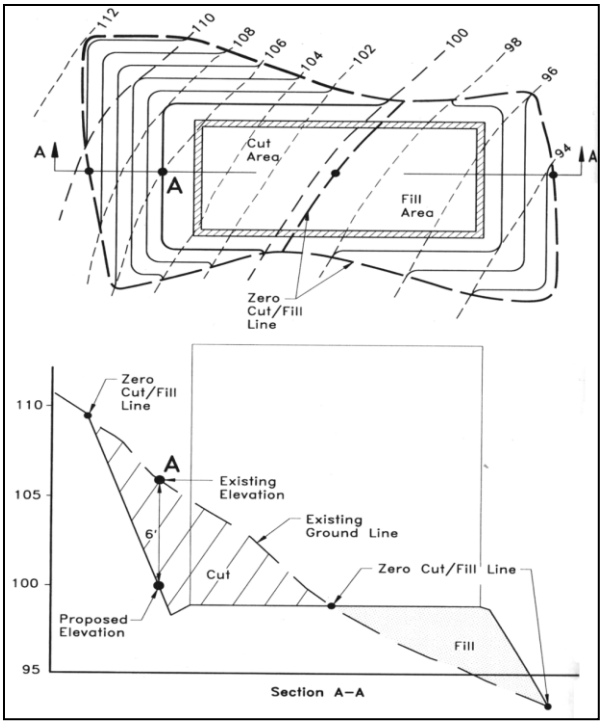
Index contour: contour lines that are labeled to help you find the contour interval

Benchmark: point of known elevation



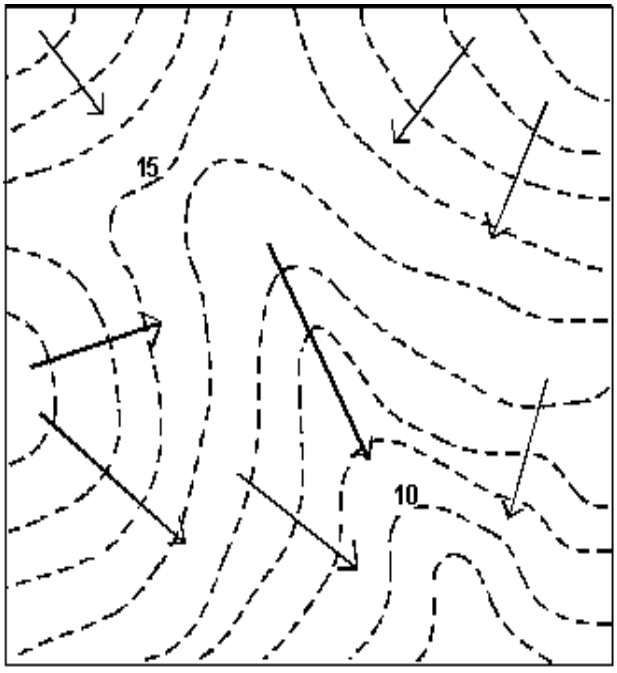
Cut and fill: the excavating of material in one place and the depositing of it nearby



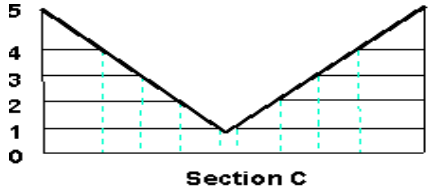


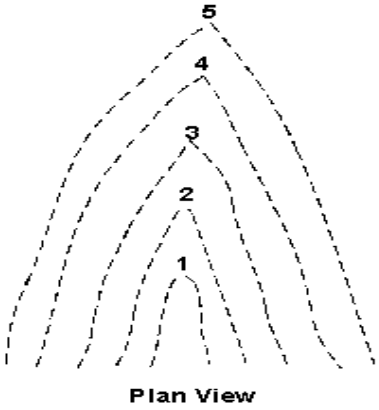
Cut and fill

Drainage: always flows perpendicular (at a right angle) to the contour, toward lower elevation



Valleys and swales: a long, low area of land, often with a drainage way, river, or stream running through it, which is surrounded by higher ground

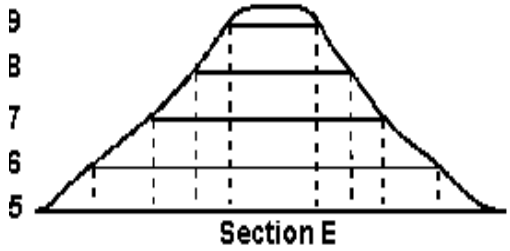


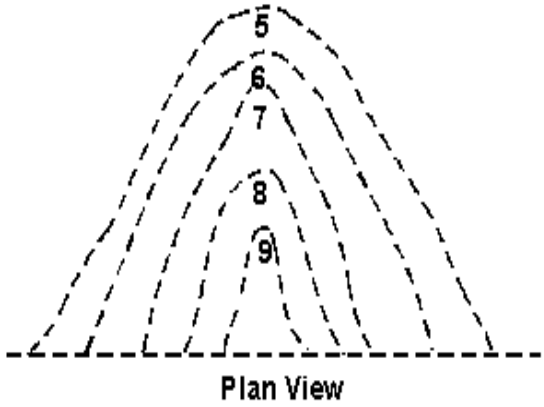


Stormwater runoff and, therefore, sediment leave sites through drainage ways in valleys or swales.

A valley or swale is represented by contours that point toward higher elevations.

Ridge: a long, narrow hilltop or range of hills

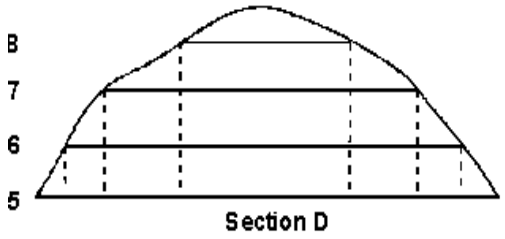


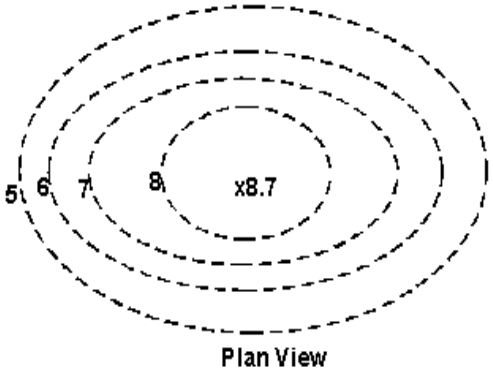


A ridge is represented by contours that point toward lower elevations.

Summit: the highest point or top of something, typically a mountain

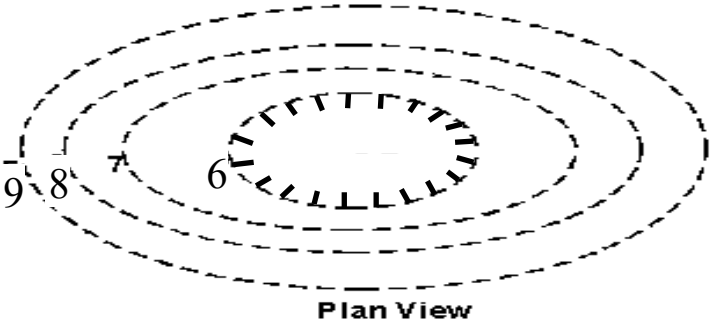
Summits usually have a spot elevation for the highest point; depressions may not have a spot elevation.



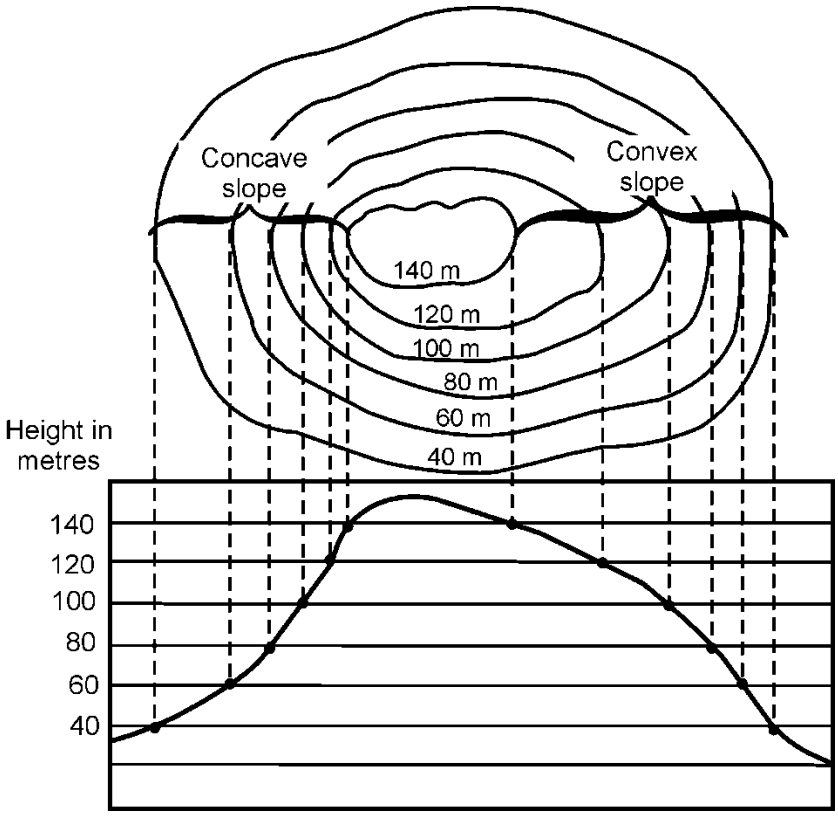


Depression/Sinkhole: a low area in a landscape without a clear drainage way. Sinkholes may drain through an underground system (karst topography).

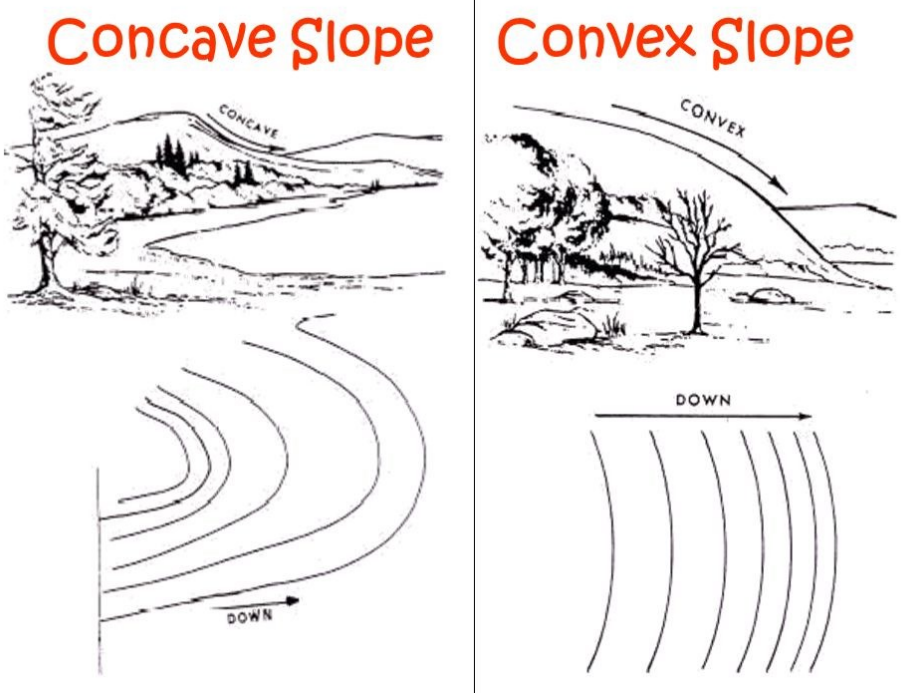
Hachure lines are used to indicate depressions.



SLOPES AND SLOPE CALCULATIONS



Contour profiles show a cross-section of a certain portion of a contour map, so you can envision what this portion looks like on the site.



Remember, concave slopes are steeper at the top then flatten out.

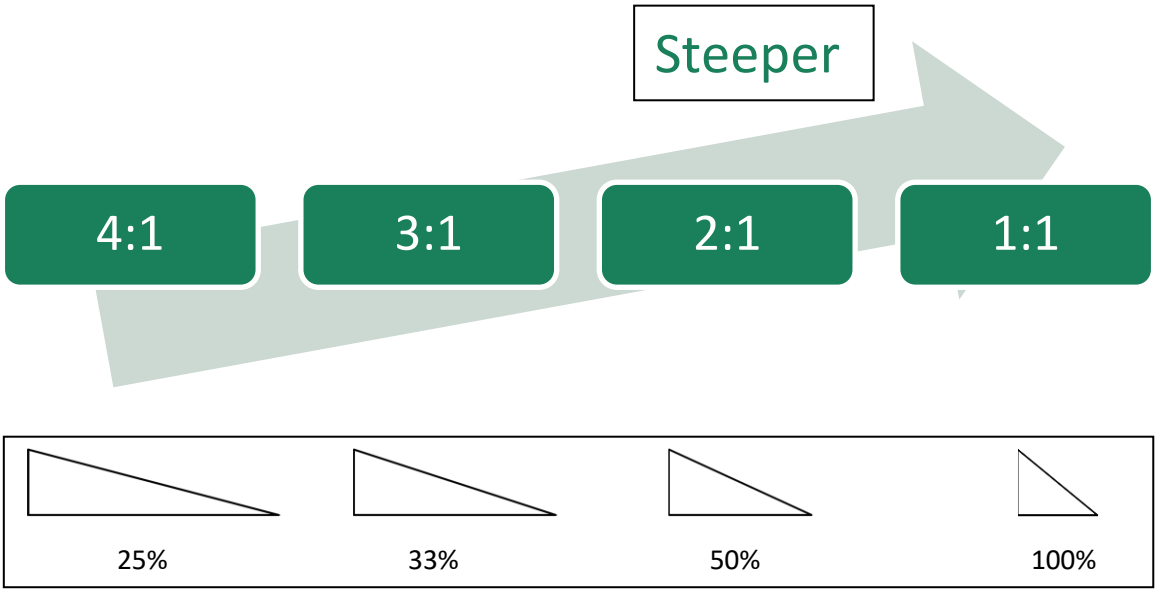
Convex slopes are steeper toward lower elevations.

Slope angle is often described as a ratio (2:1, 3:1, 4:1, etc.) or as percent (%) slope. The closer the first number is to 0, or the higher the percentage is, the steeper the slope.

A 3:1 slope indicates that for every 3 horizontal feet, the slope has 1 foot of vertical rise, while a 5:1 slope means 5 horizontal feet for every 1 foot of rise. Thus, a 3:1 slope is more steep than a 5:1 slope.

Slope percent is calculated by dividing vertical distance by the horizontal distance in the ratio and multiplying this by 100.

- A 4:1 slope becomes a $\frac{1}{4} \times 100 = 25\%$ slope.
- A 3:1 slope becomes a $\frac{1}{3} \times 100 = 33.3\%$ slope.



A slope that is 40 feet long and goes from elevation 110 to 125 is a 40:15 or a 2.67:1 slope.

Expressed as a percentage, this is a $\frac{(125-110)}{40} \times 100 = 37.5\%$ slope.

Summary

As an inspector, it is important to be able to:

- Identify and educate the regulated community on the major components within an ESC plan.
- Recall the Minimum Standards and identify which minimum standard applies to different parts of a site or site plan.
- Comprehend the overall goals of the post-development stormwater quantity criteria that form the basis for the regulatory compliance requirements that inspectors must check for on sites. A good understanding of these aspects will help inspectors ensure that post-development measures follow the approved ESC plan.
- Read a plan, so you can match plan specifics to the site. This enables an inspector to check for proper location and installation of practices.