

Module 6: Virginia Stormwater Management Handbook Specifications

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Learning Objectives

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

- Correlate the major C-BMP specifications with the applicable minimum standards.
- Identify under which circumstances the different C-BMP specifications would best be applied.
- Evaluate the use of the C-BMP specifications as they apply to the transition from existing to proposed site conditions.

6a. Handbook Specifications and the Minimum Standards

The Virginia Stormwater Management Handbook (VSWHB) is a technical guide used for design, plan review, and inspection of Construction Best Management Practices (C-BMPs) on construction sites. The C-BMPs are listed in Chapter 7. Other practices can be used on construction sites that are not listed in the Handbook.

The practices can be broadly grouped as either vegetative controls or structural controls. Vegetative controls (groundcover) should be considered the first line of defense against erosion. Structural controls can be considered the second line of defense.

The practices in the Handbook are grouped similarly to the Minimum Standards. The following boxes show the practices usually used to achieve the Minimum Standards:

Soil Stabilization for Erosion Control MS-1, 2, 3, and 5

C-ENV-15 Seeding, Mulching, and Soil Stabilization (Wetlands/Streams) (MS-1, 3)

C-SCM-01 Dust Control (MS-2)

C-SCM-13 Concrete Washout Pit (MS-2)

C-SSM-01 Tree Preservation and Protection (MS-1)

C-SSM-02 Topsoiling (MS-1, 2)

C-SSM-03 Surface Roughening (MS-1, 7)

C-SSM-04 Compost Blankets (MS-1)

C-SSM-05 Soil Stabilization Blankets and Matting (MS-1, 3)

C-SSM-06 Sodding (MS-1, 3)

C-SSM-07 Bermudagrass and Zoysiagrass Establishment (MS-1) Note: MS-3 is not listed in the VSWHB.

C-SSM-08 Trees, Shrubs, Vines, and Ground Cover (MS-1, 5, 7)

C-SSM-09 Temporary Seeding (MS-1, 2)

C-SSM-10 Permanent Seeding (MS-1, 3)

C-SSM-11 Mulching (MS-1)

Underground Utilities MS-16

C-ECM-10 Subsurface Drain (MS-9, 16)

C-SCM-10 Dewatering Structure (MS-4, 6)
Note: MS-16 is not listed in the VSWHB.

Sediment Control MS-4 and 6

C-ECM-01 Straw Wattles (MS-4)

C-ECM-02 Impermeable Diversion Fence (MS-4)

C-ECM-04 Temporary Diversion Dike (MS-4, 8)

C-ECM-05 Diversion (MS-4, 5, 8, 9, 19)

C-ENV-10 Trenchless Silt Fence (MS-4)

C-ENV-11 Wetland Berm (MS-4)

C-ENV-12 Wetland Weir Outlet (MS-4)

C-ENV-13 Wetland Cell Sediment Trap (MS-4, 6)

C-PCM-01 Safety Fence (MS-4)

C-PCM-02 Straw Bale Barrier (MS-4)

C-PCM-03 Brush Barrier (MS-4)

C-PCM-04 Silt Fence (MS-4)

C-PCM-05 Compost Filter Sock (MS-4)

C-SCM-02 Construction Road Stabilization (MS-4, 17)

C-SCM-03 Temporary Stone Construction Entrance (MS-4, 17)

C-SCM-04 Inlet Protection (MS-4) Note: MS-10 is not listed in the VSWHB.

C-SCM-06 Wood Chip Filter Berm (MS-4)

C-SCM-08 Rock Filter Outlet (MS-4)

C-SCM-09 Turbidity Curtain (MS-4, 12, 14)

C-SCM-10 Dewatering Structure (MS-4, 6)
Note: MS-16 is not listed in the VSWHB.

C-SCM-11 Temporary Sediment Trap (MS-4, 6)

C-SCM-12 Temporary Sediment Basin (MS-4, 6, 19)

Slope Protection MS-7, 8, and 9

C-ECM-03 Slope Interruption Device (MS-7)
 C-ECM-04 Temporary Diversion Dike (MS-4, 8)
 C-ECM-05 Diversion (MS-4, 5, 8, 9, 19)
 C-ECM-06 Temporary Fill Diversion (MS-8)
 C-ECM-07 Temporary Right-of-Way Diversion (MS-8)
 C-ECM-08 Waterbars and Sheet Flow Breakers (MS-8)
 C-ECM-09 Stormwater Conveyance Channel (MS-8)
 C-ECM-10 Subsurface Drain (MS-9, 16)
 C-ECM-11 Paved Flume (MS-8, 11)
 C-ECM-12 Temporary Slope Drain (MS-8,)
 C-ECM-14 Temporary Level Spreader (MS-8, 11)
 C-SSM-03 Surface Roughening (MS-1, 7)
 C-SSM-08 Trees, Shrubs, Vines, and Ground Cover (MS-1, 5, 7)

Construction Entrances MS-17

C-SCM-02 Construction Road Stabilization (MS-4, 17)
 C-SCM-03 Temporary Stone Construction Entrance (MS-4, 17)

Stormwater Quantity MS-19

C-ECM-05 Diversion (MS-4, 5, 8, 9, 19)
 C-SCM-12 Temporary Sediment Basin (MS-4, 6, 19)

Channels, Culverts, and Outlets MS-10 and 11

C-ECM-05 Diversion (MS-4, 5, 8, 9, 19)
 C-ECM-11 Paved Flume (MS-8, 11)
 C-ECM-13 Riprap (MS-11)
 C-ECM-14 Temporary Level Spreader (MS-8, 11)
 C-ECM-15 Outlet Protection (MS-11)
 C-ECM-16 Flexible Transition Mat (MS-11)
 C-ENV-07 Gabions (MS-11, 15)
 C-SCM-04 Inlet Protection (MS-4) Note: MS-10 is not listed in the VSWHB.
 C-SCM-05 Culvert Inlet Protection (MS-10)
 C-SCM-07 Rock Check Dams (MS-11)

Watercourses MS-12, 13, 14, and 15

C-ENV-01 Vegetative Streambank Stabilization (MS-15)
 C-ENV-02 Structural Streambank Stabilization (MS-15)
 C-ENV-03 Temporary Vehicular Stream Crossing (MS-13, 15)
 C-ENV-04 Utility Stream Crossing (MS-12, 14)
 C-ENV-05 Cofferdam Crossing (MS-12, 14)
 C-ENV-06 Stable Wetland Crossing (MS-12, 14)
 C-ENV-07 Gabions (MS-11, 15)
 C-ENV-08 Pump Around Diversion (MS-12, 14)
 C-ENV-09 Overnight Channel Protection (MS-12, 14)
 C-ENV-14 Modified Turbidity Curtain for Streams (MS-4, 12, 14)
 C-SCM-09 Turbidity Curtain (MS-4, 12, 14)

6b. Structural Control Practices

Structural controls are meant to filter sediment-laden water before it leaves a construction site. In most cases, these types of controls are no more than 60% – 75% effective in filtering sediment, and the smaller particles, such as clay, are very difficult to filter. Structural controls are generally more expensive than vegetative methods.

The VSWHB Chapter 7 will be used for this portion of the module.

COMMONLY USED STONE SIZES

All have angular edges:

Class I Riprap: 8" – 15", 13"x9" average

Used to protect the soil from erosive forces and slow the velocity of concentrated runoff (outlet protection), stabilize slopes, sediment trap outlet and check dam backing, stormwater conveyance channels, structural streambank stabilization, temporary culvert crossing, and utility stream diversions.



Figure 1: Class I Riprap

#1 stone: 1.5" – 3.5", 2.5" average

Used for construction entrances, check dams, temporary culvert stream crossings, and right-of-way diversions.



Figure 2: #1 stone

#3 stone: 1" – 2", 1.5" average

#357 stone: 0.19" – 2", 1" average

Used for inlet protection and sediment trap outlets as filtering stones.



Figure 3: #357 stone

#57 stone: 0.19" – 1", 0.5" average

Typical "gravel" for driveways, etc.



Figure 4: #57 stone

#21 stone: 0.28" average to stone dust

Used in road stabilization and sidewalk bedding.



Figure 5: #21 stone

Photo credit (all): DEQ

6c. Vegetative Control Practices

Chapter 7 of the Handbook classifies C-BMPs Construction Surface Stabilization Measures (C-SSM) as vegetative (or erosion) control practices. These specifications will be covered using the VSWHB Chapter 7.

Remember, vegetative controls should be used as a first line of defense to break up the raindrop impact and are less expensive to install than structural practices.

HELPFUL INFORMATION FOR ESTABLISHING VEGETATION

Virginia Turfgrass Variety Recommendations: <https://www.pubs.ext.vt.edu/SPES/spes-518/spes-518.html>

Agronomy Handbook: <https://pubs.ext.vt.edu/424/424-100/424-100.html>

Spring Planting Considerations for Warm-Season Turfgrasses in Virginia Lawns:
<https://ext.vt.edu/lawn-garden/turfandgardentips/tips/warm-season-planting.html>

“Fall” Into Your Lawn: Establishing Cool-Season Turfgrasses: <https://ext.vt.edu/lawn-garden/turfandgardentips/tips/Establishing-Cool-season-Turfgrasses.html>

Virginia Native Plant Marketing Partnership: <https://www.plantvirginianatives.org/>

Native vs. Invasive Plant Species (below 1992 ESC Handbook, near end):
<https://www.deq.virginia.gov/our-programs/water/stormwater/stormwater-construction/handbooks>

Also included on the following pages:



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FREQUENTLY ASKED QUESTIONS (FAQ)

NATIVE VS. INVASIVE PLANT SPECIES FOR EROSION & SEDIMENT CONTROL

DCR's Natural Heritage Program and other conservation agencies and organizations recognize as "invasive non-natives" certain plant species referenced by DEQ in the *Virginia Erosion and Sediment Control Handbook*. This FAQ provides information regarding Virginia native and invasive non-native plant species and guidance for using natives in lieu of invasive Non-natives for vegetative stabilization of land-disturbing activities regulated by the Virginia Erosion and Sediment Control Law and Regulations. This document promotes sound ecological stewardship, while ensuring erosion control and compliance with the law and regulations. Visit DCR's website for further information about [native and invasive plant species](#) and for information about [erosion and sediment control](#) visit DEQ's website.

What is a Native Species?

Native species are those that naturally occur in the region in which they evolved. Plants evolve in specific habitats over extended periods of time in response to physical and biotic habitats processes that are characteristic of that place: the climate; the soils; the seasonal rainfall, drought, and frost; and interactions with other species occupying those habitats. Native species thus possess certain traits that enable them to thrive under local conditions.

What Are Invasive Non-Native Species and Why Are They of Concern?

Non-native plants, also known as exotic or non-native, are species that have been introduced intentionally or accidentally by human activity into a region in which they did not evolve. Many non-native species are well known and economically important in agriculture and horticulture, such as wheat, soybeans, and tulips. However, while some non-native plants are beneficial and have little capacity to spread in the natural environment, a few are *invasive* and pose serious threats to both natural communities and rare species. Because of a lack of natural controls like insect pests and competitors, some invasive non-native plants may escape cultivation, displace native plant species, reduce wildlife habitats, and alter ecosystem processes. The majority of invasive non-native plants are problematic due to their ability to easily and rapidly disperse across the landscape. Given this possibility of colonization, use of these species for erosion and sediment control should be avoided when possible.

How Many Invasive Non-Native Plant Species Have Been Identified in Virginia?

DCR's Natural Heritage Program and the Virginia Native Plant Society, in cooperation with land managers and agencies, nurserymen, landscape architects, horticulturalists, and other partners, have identified 90 (DCR 2014) invasive non-native plant species that threaten natural areas, forests, parks, and other conservation areas in Virginia. A complete [list of invasive non-native plants for Virginia](#) is available on DCR's website.

Why is Vegetative Stabilization of Land-Disturbing Activities Required?

Virginia Erosion and Sediment Control Law defines a land-disturbing activity as any land change of 10,000 sq. ft. or greater that involves clearing, grading, excavating, transporting, and filling of land. The Virginia Erosion and Sediment Control Regulations and local ordinances that implement the Law delineate strict requirements for timely temporary or permanent stabilization of land-disturbing activities, including denuded areas, soil stockpiles, earthen structures, cut and fill slopes, and watercourses, to prevent soil erosion from occurring in the first place. Planting vegetation, namely grasses or other herbaceous plants, is an effective and economic method for achieving expedient site stabilization. A copy of the Law and Regulations are available on DEQ's website.

Should Invasive Plants Referenced in the DCR Handbook Be Avoided?

Yes. DCR strongly discourages the use of the highly invasive **Common Reed** and **Chinese Lespedeza**. There are equally effective alternatives that are less problematic. It is especially important to avoid using these species in stormwater channels and on streambanks, as planting in these habitats may facilitate their wider distribution. Eight plant species considered invasive non-natives are referenced within the following sections of the *E&S Handbook*: Temporary Seeding (STD&SPEC 3.31), Permanent Seeding (STD&SPEC 3.32), Stormwater Conveyance Channels (STD&SPEC 3.17), Vegetative Streambank Stabilization (STD&SPEC 3.22), and Sodding (STD&SPEC 3.33). However, DCR encourages using native plants whenever feasible as described in the remainder of this FAQ.

What Criteria Should Be Met For Native Species To Be Used for Stabilization?

The plant species chosen for stabilization must always be matched to the characteristics (climate, soils, etc.) of the site/region and must be commercially available in that region. Further, because interest in using native species for erosion and sediment control is relatively recent, alternative native species may not have been thoroughly field-tested to document their efficacy for erosion and sediment control. DCR recommends native plants for vegetative stabilization if the following criteria are met:

- Slopes < 15% slope gradient
- Soils with K factors < 0.36 (soils are not highly erodible)
- For use along roadways, species height must comply with Virginia Department of Transportation visibility requirements and not have characteristics that are highly attractive to birds and mammals
- For use on stormwater conveyance channels and streambanks, species must have proven effectiveness at the expected maximum stormwater flow volume and velocity

Generally, flat to gently sloping, open areas where there is little traffic are appropriate locales for planting most of the alternatives species suggested below. Utility easements or rights-of-way, park like areas, greenways, and other open tracks of land are excellent places to propagate native plants. However, natives may be considered even if one of these criteria is not met if there is sufficient evidence that the species is effective for erosion control.

What are Some Alternative Native Species to the Invasive Plants in the Handbook?

The table below provides a list of alternative Virginia native plants with similar attributes to the invasive non-native plants. These alternatives are offered as suggestions if the criteria listed above are met. Fact sheets for [30 invasive plant species](#) and five brochures on using [native plants for restoration and landscaping](#) are available on DCR's website.

Invasive Non-Native Species	Alternative Virginia Native	
Common Name	Common Name	Scientific Name
Common Reed	Great bulrush	<i>Schoenoplectus tabernaemontani</i>
	Common Cattail	<i>Typha latifolia</i>
Chinese Lespedeza Birdsfoot Trefoil Orchard Grass Redtop Weeping Lovegrass	Roundheaded bushclover	<i>Lespedeza capitata</i>
	Patridge pea	<i>Chamaecrista fasciculata</i>
	Butterflyweed	<i>Asclepias tuberosa</i>
	Joe-pye weed	<i>Eutrochium dubium</i>
	Black-eyed Susan	<i>Rudbeckia fulgida</i>
	Big blue stem	<i>Andropogon gerardii</i>
	Indian grass	<i>Sorghastrum nutans</i>
	Side oats grama	<i>Bouteloua curtipendula</i>
Crownvetch	Roundheaded bushclover	<i>Lespedeza capitata</i>
	Patridge pea	<i>Chamaecrista fasciculata</i>
	Big blue stem	<i>Andropogon gerardii</i>
	Little blue stem	<i>Schizachyrium scoparium</i>
	Indian grass	<i>Sorghastrum nutans</i>
	Switchgrass	<i>Panicum virgatum</i>
Tall Fescue	Big blue stem	<i>Andropogon gerardii</i>
	Little blue stem	<i>Schizachyrium scoparium</i>
	Indian grass	<i>Sorghastrum nutans</i>
	Switchgrass	<i>Panicum virgatum</i>
	Broomsedge	<i>Andropogon virginicus</i>
	Deertongue	<i>Dichanthelium clandestinum</i>
	Side oats grama	<i>Bouteloua curtipendula</i>
	Canadian wildrye	<i>Elymus canadensis</i>
	Bottlebrush grass	<i>Elymus hystrix</i>
	Virginia wildrye	<i>Elymus virginicus</i>

Are There Other Considerations When Employing Alternative Native Plants? Yes. The following potential issues should also be considered when employing alternative native plants:

- Always using a native seed mix is desirable for two reasons:
 - Some natives take several seasons to fully establish, so a seed mix including some non-competing annual plant species is recommended
 - To prevent establishing a “monoculture” and encourage biodiversity, multiple natives species should be established on site when possible
- Some natives have new/unique maintenance requirements (weeding, mowing, herbicides, etc.)
- Adding compost to raise the organic content of the soil will greatly enhance the success of vegetation
- Always coordinate with and educate local government officials, property owners, and the citizenry about the benefits of natives – many natives don’t produce lush green lawns, and are perceived as weeds

Who Must Approve Use of Alternative Native Plants?

Users should work with the local [Native Plant Society chapter](#) or equivalent and the erosion and sediment control program authority to select appropriate native plant species. Note that the selection of plant species for vegetative stabilization **must always** be approved by the program authority as a part of the erosion and sediment control plan.

Summary

As a plan reviewer, it is important to:

- Match the major C-BMP specifications with the applicable minimum standards.
- Convey to the regulated community how the regulatory standards can and should be applied on-site.
- Identify the different C-BMP specifications and the conditions under which they are best suited.
- Provide technical assistance to plan preparers and help inspectors achieve and maintain site compliance.