

Chapter 7

Construction BMPs

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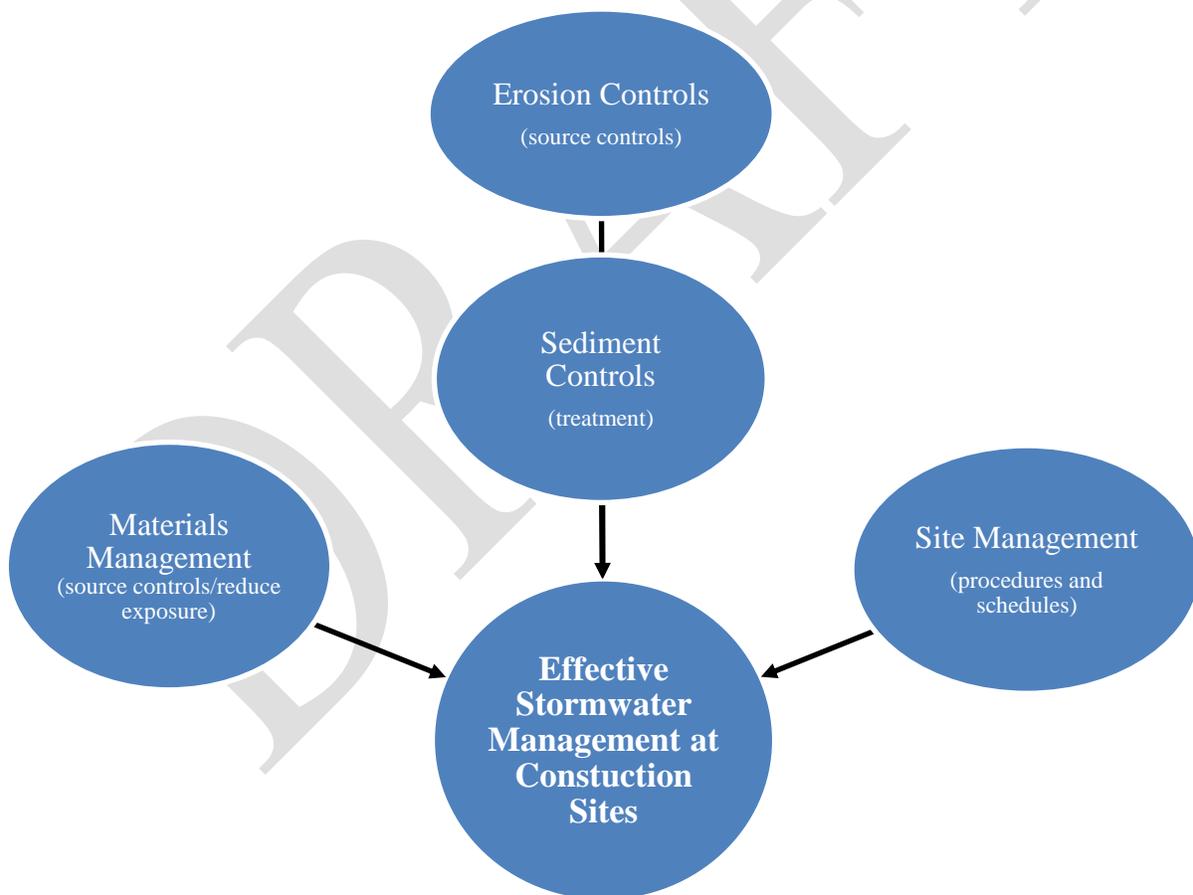
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1.0 Introduction

Effective management of stormwater runoff during construction activities is critical to the protection of water resources. The Federal Clean Water Act and the Colorado Water Quality Control Act require stormwater discharge permits during construction at development and redevelopment sites that disturb one or more acres of land. Both erosion and sediment controls are necessary for effective construction site management as well as effective material management and site management practices (Figure 7-1). Protection of waterways from construction-related pollution is the ultimate objective of these practices.

This chapter provides an overview of erosion and sediment control principles and information on construction best management practices (BMPs). Also provided are procedures and policies regarding construction site inspection and enforcement. This chapter hereby incorporates by reference all criteria presented in the current version of the Urban Storm Drainage Criteria Manual (USDCM), Volume 3, Best Management Practices, Chapter 7 Construction BMPs for purposes of design and implementation. Detailed descriptions, sizing and design criteria, and design procedures for these BMPs are provided in the USDCM, V3 Construction BMP Fact Sheets.

Figure 7-1. Components of Effective Stormwater Management at Construction Sites



2.0 Fundamental Erosion and Sediment Control Principles

2.1 Erosion

Soil erosion can generally be defined as the removal of soil by wind and water. Although soil erosion is a natural process, accelerated soil erosion occurs on construction sites due to activities that disturb the natural soil and vegetation.

Water erosion has five primary mechanisms: raindrop erosion, sheet erosion, rill erosion, gully erosion, and channel erosion. Raindrops dislodge soil particles, making them more susceptible to movement by overland water flow. Shallow surface flows on soil rarely move as a uniform sheet for more than several feet before concentrating in surface irregularities, known as rills. As the flow changes from a shallow sheet to a deeper rill flow, the flow velocity and shear stresses increase, which detach and transport soil particles. This action begins to cut into the soil mantle and form small channels. Rills are small, well-defined channels that are only a few inches deep. Gullies occur as the flows in rills come together into larger channels. The major difference between rill and gully erosion is size. Rills caused by erosion can be smoothed out by standard surface treatments such as harrowing. Gully erosion, however, typically requires heavy equipment to regrade and stabilize the land surface.

Wind erosion occurs when winds of sufficient velocity create movement of soil particles. The potential for wind erosion is dependent upon soil cover, soil particle size, wind velocity, duration of wind and unsheltered distance.

Erodibility of soils is affected by multiple factors including physical soil characteristics, slope steepness, slope lengths, vegetative cover, and rainfall characteristics. Physical properties of soils such as particle size, cohesiveness, and density affect erodibility. Loose silt and sand-sized particles typically are more susceptible to erosion than "sticky" clay soils. Rocky soils are less susceptible to wind erosion, but are often found on steep slopes that are subject to water erosion. Most of the soils in Colorado are susceptible to wind or water erosion, or both. When surface vegetative cover and soil structure are disturbed during construction, the soil is more susceptible to erosion. Vegetation plays a critical role in controlling erosion. Roots bind soil together and the leaves or blades of grass reduce raindrop impact forces on the soil. Grass, tree litter and other ground cover not only intercept precipitation and allow infiltration, but also reduce runoff velocity and shear stress at the surface. Vegetation reduces wind velocity at the ground surface, and provides a rougher surface that can trap particles moving along the ground. Once vegetation is removed, soils become more susceptible to erosion.



Photograph 7-2. Erosion is a common occurrence during construction activities, which can result in sediment movement off site and deposition in waterways when not properly managed. (Photo courtesy of Douglas County)

2.2 Sedimentation

Sedimentation occurs when eroded soil transported in wind or water is deposited from its suspended state. During a typical rainstorm in Colorado, runoff normally builds up rapidly to a peak and then diminishes. Because the amount of sediment a watercourse can carry is dependent upon the velocity and volume of runoff, sediment is eventually deposited as runoff decreases. The deposited sediments may be resuspended when future runoff events occur. In this way, sediments are moved progressively downstream in the waterway system.

2.3 Effective Erosion and Sediment Control

It is better to minimize erosion than to rely solely on sedimentation removal from construction site runoff. Erosion control BMPs limit the amount and rate of erosion occurring on disturbed areas. Sediment control BMPs attempt to capture the soil that has been eroded before it leaves the construction site. Despite the use of both erosion control and sediment control BMPs, some amount of sediment will remain in runoff leaving a construction site, but the use of a "treatment train" of practices can help to minimize offsite transport of sediment. The last line of treatment such as inlet protection and sediment basins should be viewed as "polishing" BMPs, as opposed to the only treatment on the site. USDCM, V3 BMP Fact Sheets provide design details and guidance for effective use of various erosion and sediment control practices. BMPs should be combined and selected to meet these objectives:

- Conduct land-disturbing activities in a manner that effectively reduces accelerated soil erosion and reduces sediment movement and deposition off site.
- Schedule construction activities to minimize the total amount of soil exposed at any given time.
- Establish temporary or permanent cover on areas that have been disturbed as soon as practical after grading is completed.
- Design and construct temporary or permanent facilities to limit the flow of water to non-erosive velocities for the conveyance of water around, through, or from the disturbed area.
- Remove sediment caused by accelerated soil erosion from surface runoff water before it leaves the site.
- Stabilize disturbed areas with permanent vegetative cover and provide permanent stormwater quality control measures for the post-construction condition.

State Construction Phase Permitting

Stormwater runoff controls from construction sites are mandated by the Federal Water Pollution Control Act (Clean Water Act). In Colorado, the EPA has delegated authority to the Colorado Department of Public Health and Environment (CDPHE). CDPHE, specifically the Water Quality Control Division, issues stormwater and wastewater discharge permits under the Colorado Discharge Permit System (CDPS) Regulation promulgated by the Water Quality Control Commission.

3.0 Local and State Construction Stormwater Discharge Permits

Development or redevelopment projects with one or more acres of potential disturbance are required to obtain both local and state permits related to construction-phase stormwater discharges. The local permit in Colorado Springs consists of an approved Erosion and Stormwater Quality Control Plan (see Section 3.1). The state permit is the CDPS General Permit for stormwater discharges associated with construction activities. For both the local and state permit, the area of disturbance is the total area at the site where any construction activity is expected to result in disturbance of the ground surface. This includes any activity that could increase the rate of erosion, including but not limited to, clearing, grading, excavation, and demolition activities, installation of new or improved haul roads and access roads, staging areas, vehicle traffic areas, storage of materials, stockpiling of fill materials, and borrow areas and other construction related activities. Construction does not include routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of the facility.

The local MS4 permittee may require an Erosion and Stormwater Quality Control Plan for specific minor land disturbing areas that are less than one acre. Within Colorado Springs, the City Engineer is authorized by City Code to implement stormwater requirements and when warranted may require an Erosion and Stormwater Quality Control Plan for specific minor land disturbing areas that are less than one acre.

The Erosion and Stormwater Quality Control Plan has been structured to meet the requirements of the CDPS General Permit for stormwater discharges associated with construction activities, in addition to local requirements. It is anticipated that a single plan could meet both state and local requirements. However, local requirements for the Erosion and Stormwater Quality Control Plan are more inclusive than state requirements for the Stormwater Management Plan (SWMP). In addition, the developer should note that compliance with one program does not fill the need to comply with the other. Also note that although CDPHE does not require that the SWMP be submitted for approval, the Erosion and Stormwater Quality Control Plan is required to be submitted and reviewed by the MS4 permittee and must be approved prior to construction activities.

Local Erosion and Stormwater Quality Control Plans and state SWMPs are "living documents" that must be updated and maintained as the phases of construction progress. Ideally, one master document could be developed that is inclusive of both the local (Erosion and Stormwater Quality Control Plans) and state (SWMPs) requirements, as opposed to maintaining duplicate records. Compliance with all other local, state and federal regulations is the responsibility of the owner, developer, contractor and engineer as it relates to the development and implementation of the Erosion and Stormwater Quality Control Plan.

Common Plan of Development or Sale

US EPA defines a "larger common plan of development or sale" as a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under one plan. For example, if a developer buys a 20-acre lot and builds roads, installs pipes, and runs electricity with the intention of constructing homes or other structures sometime in the future, this would be considered a larger common plan of development or sale. If the land is parceled off or sold, and construction occurs on plots that are less than one acre by separate, independent builders, this activity still would be subject to stormwater permitting requirements if the smaller plots were included on the original site plan.

If the project is part of a common plan of development or sale, the disturbed area of the entire plan must be used in determining permit requirements.

Table 7-1. Comparison of State and Local Construction-Phase Stormwater Permits in Colorado

	State	Local Government (<u>programs vary, not inclusive</u>)
Nomenclature	<ul style="list-style-type: none"> ▪ Colorado Discharge Permit System (CDPS) General Permit for Stormwater Discharges Associated with Construction Activities ▪ CDPS Individual Permit for Stormwater Discharges Associated with Construction Activities 	<ul style="list-style-type: none"> ▪ Erosion and Stormwater Quality Control Plan
Triggers	<ul style="list-style-type: none"> ▪ Area of potential disturbance is greater than one acre (This area includes construction activities that are part of a larger common plan of development or sale. Areas used for staging, materials storage, temporary construction site access, off-site borrow areas and other construction related activities should also be included.) 	<ul style="list-style-type: none"> ▪ State Construction Phase Stormwater Permit required ▪ Potential for erosion based on site characteristics (i.e. hillside areas, steep topography, highly erodible soils) ▪ Contaminated soils on site ▪ Sites within a designated 100-year floodplain, stream overlay, and/or proximity to active waterway
Required Items	<ul style="list-style-type: none"> ▪ Application ▪ Stormwater Management Plan (SWMP). In other parts of the country, this may be referred to as a Stormwater Pollution Prevention Plan (SWPPP) ▪ Annual Fee 	<ul style="list-style-type: none"> ▪ Erosion and Stormwater Quality Control Plan ▪ Fee

3.1 Preparing an Erosion and Stormwater Quality Control Plan

An Erosion and Stormwater Quality Control Plan must be developed prior to construction and kept current for the duration of construction. No clearing, grading, excavation, filling or other land disturbing activities described in Section 3.1.1 shall be permitted until sign off and acceptance of the Erosion and Stormwater Quality Control Plan is approved by the MS4 permittee. Reviews and

approvals required by this manual for projects within the City of Colorado Springs will be completed by the City Engineer and/or his or her designee.

Planning for erosion and stormwater quality control shall begin with the Preliminary Drainage Report preparation, and shall include first-hand knowledge of the site by the engineer. Plan approval for the Erosion and Stormwater Quality Control Plan shall be concurrent with review of the Preliminary/Final Drainage Report and approval of the Grading Plan. The Erosion and Stormwater Quality Control Plan may be combined with the Grading Plan if all information can be clearly presented. Plan signoff and acceptance of both the Grading Plan and the Erosion and Stormwater Quality Control Plan, or a combined plan, by the MS4 permittee constitutes a grading permit authorizing the approved land disturbance and implementation of the approved erosion and stormwater quality control measures. The Erosion and Stormwater Quality Control Plan should be consistent with the Final Drainage Report for a development and other plans including Grading Plans, Development Plans, and utility facility plans.

3.1.1 Applicability

At a minimum, an Erosion and Stormwater Quality Control Plan is required in Colorado Springs whenever a Grading Plan is required or when one (1) acre or more of land will be disturbed (disturbance includes construction activities that are part of a larger common plan of development or sale). Requirements for land disturbance in Hillside Overlay areas are incorporated into Section 504 of Part 5 of Article 3 of Chapter 7 of the Colorado Springs City Code (Erosion and Stormwater Quality Control Plan required with Development Plan, Development Plan amendment, plat or replat, whichever is applicable, in designated hillside areas).

Typical activities for which an Erosion and Stormwater Quality Control Plan is generally not required are designated as minor land disturbing activities and include:

1. Any project involving earth disturbing activity of less than 1 acre, unless deemed necessary by the MS4 permittee and allowed by code.
2. Individual home landscaping, gardening, maintenance and repair work.
3. Agriculture and related activities.

The Erosion and Stormwater Quality Control Plan shall require the design, implementation and maintenance of BMPs as set forth in this Manual and shall include the plan elements as set forth in this Manual.

3.1.2 Basic Grading, Erosion and Stormwater Quality Requirements and General Prohibitions

Grading, construction, and land development activities must control erosion and prevent the transport of sediment onto adjacent properties, public rights-of-ways, streets, storm drainage facilities, channels or any other public or private facilities. Land disturbance by any owner, developer, builder, contractor, or other person shall comply with the general grading, erosion and stormwater quality requirements and general prohibitions, including the 22 plan notes, as noted below. In many cases, this will require the design, implementation and maintenance of BMPs as specified in the Manual, even if an Erosion and Stormwater Quality Control Plan is not required. A typical example for this requirement would be a home building contractor constructing one or more homes in an area on individual lots less than an acre and not part of a larger common plan of development or sale.

3.1.3 General Erosion and Stormwater Quality Control Plan Requirements

- An Erosion and Stormwater Quality Control Plan shall communicate and satisfy the following:
 - Identify all potential sources of pollution which may affect the quality of stormwater discharges associated with construction activity;
 - Describe the practices to be used to reduce the pollutants in stormwater discharges associated with construction activity including the installation, implementation and maintenance requirements; and
 - Be prepared in accordance with good engineering, hydrologic, and pollution control practices and be updated throughout construction and stabilization of the site.
- Implement the provisions of the Erosion and Stormwater Quality Control Plan as written and updated, from commencement of construction activity until final stabilization is complete. The Erosion and Stormwater Quality Control Plan may require additions or other modifications once construction commences, and documentation of all modifications and amendments is required. The contractor shall maintain written records of all inspections, BMP maintenance, and communications with the owner and/or engineer. This shall be kept at the construction site with the Erosion and Stormwater Quality Control Plan.
- The Erosion and Stormwater Quality Control Plan shall include additional discussion or plans for any special requirements of the site. Special requirements include Spill Prevention Control and Countermeasure (SPCC) plans under Section 311 of the Clean Water Act, or BMP programs otherwise required by another CDPS permit.

3.1.4 Erosion and Stormwater Quality Control Elements

An Erosion and Stormwater Quality Control Plan shall be developed that consists of 1) a narrative description of the construction project and 2) appropriate construction documents (plans/maps). The Erosion and Stormwater Quality Control Plan shall consist of the most appropriate or best selection of erosion control practices and sediment trapping facilities in conjunction with an appropriate schedule in order to accomplish adequate control. Adequate erosion control measures shall be constructed prior to land disturbing activities such that no adverse affect of site alternatives will impact the surrounding properties. Particular attention shall be given to concentrated flows of water either to prevent their occurrence or to provide appropriate conveyance devices to prevent erosion. Sediment trapping devices shall be required at all points where sediment laden water might leave the site.

The Erosion and Stormwater Quality Control Plan shall include permanent structures for conveying and treating storm runoff (when required per Chapter 4), how the site will be graded, final site stabilization, temporary sediment control features including sediment basins and finally, stabilization of the site where temporary features have been removed. Plans showing improvements or construction outside the property line of the site will not be approved unless the plan is accompanied by an appropriate legal easement, written acceptance by the adjacent property owner, or other acceptable form of correspondence for the area in which such work is required.

The Erosion and Stormwater Quality Control shall include the following as a minimum. When some sections are not applicable, include a statement to that effect.

- **Narrative Report:** The narrative report must contain, at the minimum, the following:

- Name, address, and telephone number of the owner/developer and, the name, address, and telephone number of the professional engineer preparing the *Erosion and Stormwater Quality Control Plan*.
- Subdivision Name – The name as it appears on the Final Subdivision Plat.
- Project description - A brief description of the nature and purpose of the land disturbing activity, and project location.
- Existing site conditions - A description of the existing topography, vegetation, drainage, and wetlands on the site to include estimate of percent existing vegetation cover. Also include non-stormwater discharges (e.g. springs, landscape irrigation return flow, etc.)
- Receiving waters – name of receiving water and the size, type, and location of any outfalls. Indicate if discharge to existing storm sewer system and name of ultimate receiving waters.
- Adjacent areas - A description of neighboring areas such as streams, residential areas, roads, etc., which may be affected by the land disturbance.
- Soils - A brief description of the soils on the site including information on soil type and character.
- Description of potential pollutants – sources such as vehicle fueling, chemical/ fertilizer storage, construction dewatering, concrete washout area, etc.
- Soil Borings/Tests and Groundwater – Soil borings and tests, including groundwater analysis and plan for safe discharge must be included if appropriate.
- Areas and Volume Statement - The total area of the site and the area of disturbance (e.g. cleared, excavated, or graded) involved.
- Narrative description of appropriate controls and measures that will be implemented before and during construction activities at the facility and address phased BMP implementation. It shall clearly describe the relationship between the phases of construction the proposed sequencing of major activities, BMP's installed under each phase, and the implementation and maintenance of control measures. For example, what BMP's will be implemented during each of the following stages of construction:
 - Clearing and grubbing necessary for perimeter controls
 - Initiation of perimeter controls
 - Remaining clearing and grubbing
 - Road grading
 - Drainage facility installation
 - Utilities installation
 - Vertical construction
 - Final grading
 - Stabilization
 - Removal of temporary control measures

The description of controls shall address the following areas:

- Erosion and Sediment Control. This includes:

1. Structural Practices – A description of structural site management practices that will minimize erosion and sediment transport, including vehicle tracking control.
 2. Non-Structural Practices – A description of interim and permanent stabilization practices, including site-specific scheduling of the implementation of the practices.
 - Potential pollutant sources - The plan shall identify and describe those sources determined to have the potential to contribute pollutants to stormwater discharges, and how the sources will be controlled through BMP selection and implementation.
 - Materials Handling, and Spill Prevention and Response. The plan shall identify any procedures of materials handled at the site that could contribute pollutants to runoff. Areas where potential spills can occur shall have spill prevention and response procedures identified. Materials of interest could include: exposed storage of building materials; paints and solvents; fertilizers or chemicals; waste material; and equipment maintenance or fueling procedures.
 - Waste Management and Disposal, including Concrete Washout. The plan shall clearly describe and locate the practices implemented at the site to control stormwater pollution from all construction site wastes (liquid and solid), including concrete washout activities. The practices used for concrete washout must ensure that these activities do not result in the contribution of pollutants associated with the washing activity to stormwater runoff. The plan shall clearly describe and locate the practices used that will ensure that no washout water from concrete washout activities is discharged from the site as surface runoff or to surface waters.
- Erosion and Stormwater Quality Control Plan Administrator - Identify a specific individual(s), position, or title that is responsible for developing, implementing, maintaining, and revising the Erosion and Stormwater Quality Control Plan. This designated individual(s) or position(s) should address all aspects of the facility's Erosion and Stormwater Quality Control Plan. If this is unknown with plan submittal, then leave a blank for this information to be filled in once a contractor is selected. This individual(s) must be a registered PE in Colorado or certified in a City approved erosion control inspection class. The City can be contacted for approved classes.
 - Timing schedule - Indicate the anticipated starting and completion time periods of the site grading
 - Permanent stabilization - A description, including specifications, of how the site will be stabilized after construction is completed and any planned practices to control pollutants in stormwater discharges that will occur after construction operations have been completed at the site.
 - Owner inspections and maintenance of construction BMP's – A description of procedures and a schedule of regular inspections during construction for vegetation, erosion and sediment control measure repair, and other protective measures identified in the plan. A detailed description of the maintenance program for sediment control facilities, including inspection programs, vegetative establishment on exposed soils, method and frequency of removal and disposal of waste materials from control facilities, and disposition of temporary structural measures shall be included.

- Groundwater and Stormwater Dewatering - These activities often require a separate state dewatering permit that includes sampling of processed waters. However, in some cases, these activities can be conducted without a separate state permit when processed water is not discharged from the site as surface runoff or discharged into surface waters. The Erosion and Stormwater Quality Control Plan shall describe how these waters will be used (i.e., land application, infiltration, evaporation) and how the specific practices at the site will ensure that these waters are not discharged via runoff.
- **Construction Plan/Site Map.** The information listed below shall be included on one or multiple legible site maps. The map shall use one of the following scales; 1"=20' up to 1"=100'. The scale selected must be suitable for practical use and readability. The contour interval for these plans shall be 2 feet or closer.
 - General vicinity map Showing relationship of the site to existing and planned roadways, jurisdictional boundaries, major creeks, and streams.
 - Subdivision name – The name as it appears on the Final Subdivision Plat.
 - General Notes - See Plan Notes (see below)
 - Cost Estimate of the temporary and permanent BMP's including installation and maintenance until final stabilization is achieved. A unit price list may be obtained from the City Engineering office.
 - Signature blocks - See Signature Block discussion below.
 - North Arrow and Scale
 - Property lines for the site on which the work will be performed.
 - Areas of soil disturbance – total area of the site where any construction activity is expected to result in disturbance of the ground surface.
 - Cut and fill demarcation line
 - Construction site boundaries – area of soil disturbance and staging areas.
 - Existing topography at one or two foot contour intervals. The map should extend a minimum of 50-feet beyond the property line or beyond the project's soil disturbance limits, whichever is larger.
 - Proposed topography at one or two foot contour intervals. The map should show elevations and extent and the slope of all proposed grading, including building site and driveway grades.
 - Location of any proposed features and structures on this site.
 - Location of all natural features which affect the site specific water quality or adjacent to the site. To include wetlands, highly permeable soils, etc...
 - Adjacent existing and proposed development affected by the construction
 - Location of soil stockpiles - Areas designated for topsoil and subsoil storage.

- Location of critical erosion areas – areas of highly erodible soils.
 - Location of existing or proposed water courses – to include, but not limited to, groundwater springs, streams, wetland, or other surface waters.
 - Location and plans for all drainage features, paved areas, retaining walls, cribbing, and plantings constructed as part of this proposed site.
 - Location of temporary or permanent soil erosion and sediment control measures or other features to be constructed in connection with, or as a part of, the proposed work.
 - Depict all erosion control measures using the standard map symbols given in the Drainage Criteria Manual, Volume 2. The symbols should be bold and tend to “stand out” on the plans.
 - Location and description of any potential natural pollutant sources –practices implemented at the site to control stormwater pollution from the dewatering of uncontaminated groundwater or stormwater from excavations, wells, etc....
 - Location of storage equipment maintenance and temporary disposal areas – for example, areas designated for equipment, building materials, fuel storage, fueling, lubricants, chemical, concrete truck washout, and all temporary construction waste storage.
 - Vegetation – existing vegetation to remain and proposed seeding areas
 - Location of any dedicated asphalt or concrete batch plants
 - Boundaries of the 100-yr floodplain
 - Is the site in the City’s Streamside Zone? - show Streamside zone boundaries
 - Soil Types
 - Emergency overflow swales - located at all sump inlet locations and be sized for the 100-yr storm event.
 - Flow route – flow through and overflow of permanent BMP’s and temporary sediment basins.
 - Existing utility locations and easements - grading over existing utilities or within dedicated easements is restricted
 - Detail Drawings of Temporary BMP’s including installation and maintenance. Provide enough detail for each BMP to ensure proper installation and maintenance.
 - Detail Drawings of Permanent BMP’s - provide enough site specific detail for each BMP to ensure proper installation/construction.
- **Plan Notes.** The below twenty two (22) plan notes shall be included on the Erosion and Stormwater Quality Control Plan. Per the Engineering Criteria Manual, the summary 8 notes found in that document may be listed on the plan and reference the 22 notes.

1. Stormwater discharges from construction sites shall not cause or threaten to cause pollution, contamination, or degradation of State Waters.
2. Concrete wash water shall not be discharged to or allowed to runoff to the Municipal Separate Storm Sewer System (MS4).
3. Building, construction, excavation, or other waste materials shall not be temporarily placed or stored in the street, alley, or other public way, unless in accordance with an approved Traffic Control Plan. BMPs may be required by the MS4 permittee if deemed necessary, based on specific conditions and circumstances (e.g., estimated time of exposure, season of the year, etc.).
4. Vehicle tracking of soils off-site shall be minimized.
5. All wastes composed of building materials must be removed from the construction site for disposal in accordance with local and state regulatory requirements. No building material wastes or unused building materials shall be buried, dumped, or discharged at the site.
6. No chemicals are to be added to the discharge unless permission for the use of a specific chemical is granted by the state. In granting the use of such chemicals, special conditions and monitoring may be required.
7. Bulk storage structures for petroleum products and other chemicals shall have secondary containment or equivalent adequate protection so as to contain all spills and prevent any spilled material from entering the MS4, including any surface or subsurface storm drainage system or facilities.
8. All persons engaged in earth disturbance shall implement and maintain acceptable soil erosion and sediment control measures including BMPs in conformance with the erosion control technical standards of the Drainage Criteria Manual, Volume 2 and in accordance with the approved Erosion and Stormwater Quality Control Plan approved by the MS4 permittee, if required.
9. All temporary erosion control facilities including BMPs and all permanent facilities intended to control erosion of any earth disturbance operations, shall be installed as defined in the approved Erosion and Stormwater Quality Control Plan and the Drainage Criteria Manual, Volume 2 and maintained throughout the duration of the earth disturbance operation. The installation of the first level of temporary erosion control facilities and BMPs shall be installed and inspected prior to any earth disturbance operations taking place.
10. Any earth disturbance shall be conducted in such a manner so as to effectively reduce accelerated soil erosion and resulting sedimentation.
11. All earth disturbances shall be designed, constructed, and completed in such a manner so that the exposed area of any disturbed land shall be limited to the shortest practical period of time.
12. All work and earth disturbance shall be done in a manner that minimizes pollution of any on-site or off-site waters, including wetlands.
13. Suspended sediment caused by accelerated soil erosion shall be minimized in runoff water before it leaves the site of the earth disturbance.

14. Any temporary or permanent facility designed and constructed for the conveyance of stormwater around, through, or from the earth disturbance area shall be designed to limit the discharge to a non-erosive velocity.
15. Temporary soil erosion control facilities shall be removed and earth disturbance areas graded and stabilized with permanent soil erosion control measures pursuant to the standards and specifications prescribed in the Drainage Criteria Manual, Volume 2, and in accordance with the permanent erosion control features shown on the approved Erosion and Stormwater Quality Control Plans, if required.
16. Soil erosion control measures for all slopes, channels, ditches, or any disturbed land area shall be completed within twenty-one (21) calendar days after final grading, or final earth disturbance, has been completed. Disturbed areas and stockpiles which are not at final grade but will remain dormant for longer than 30 days shall also be mulched within 21 days after interim grading. An area that is going to remain in an interim state for more than 60 days shall also be seeded. On a case-by-case basis, the MS4 permittee may allow another appropriate BMP to be in place that prevents sediment from leaving the site. All temporary soil erosion control measures and BMPs shall be maintained until permanent soil erosion control measures are implemented.
17. No person shall cause, permit, or contribute to the discharge into the municipal separate storm sewer pollutants that could cause the MS4 permittee to be in violation of its Colorado Discharge Permit System MS4 Permit.
18. The owner, site developer, contractor, and/or their authorized agents shall be responsible for the removal of all construction debris, dirt, trash, rock, sediment, and sand that may accumulate in the storm sewer or other drainage conveyance system and stormwater appurtenances as a result of site development.
19. No person shall cause the impediment of stormwater flow in the flow line of the curb and gutter, including the temporary or permanent ramping with materials for vehicle access.
20. Individuals shall comply with the “Colorado Water Quality Control Act” (Title 25, Article 8, CRS), and the “Clean Water Act” (33 USC 1344), regulations promulgated, certifications or permits issued, in addition to the requirements included in the Drainage Criteria Manual, Volume 2. In the event of conflicts between these requirements and water quality control laws, rules, or regulations of other Federal or State agencies, the more restrictive laws, rules, or regulations shall apply.
21. The quantity of materials stored on the project site shall be limited, as much as practical, to that quantity required to perform the work in an orderly sequence. All materials stored on-site shall be stored in a neat, orderly manner, in their original containers, with original manufacturer’s labels. Materials shall not be stored in a location where they may be carried by stormwater runoff into the MS4 at any time.
22. Spill prevention and containment measures shall be used at storage, and equipment fueling and servicing areas to prevent pollution from discharging to the MS4. All spills shall be cleaned up immediately after discovery, or contained until appropriate cleanup methods can be employed. Manufacturer’s recommended methods for spill cleanup shall be followed, along with proper disposal methods.

- **Final Stabilization and Long-Term Stormwater Management**

- The Erosion and Stormwater Quality Control Plan **narrative report** should describe the practices used to achieve final stabilization of all disturbed areas at the site and any planned practices to control pollutants in stormwater discharges that will occur after construction operations have been completed at the site.
- Final stabilization practices for obtaining a vegetative cover should include, as appropriate: seed mix selection and application methods; soil preparation and amendments; soil stabilization practices (e.g., crimped straw, hydro mulch or rolled erosion control products); and appropriate sediment control BMPs as needed until final stabilization is achieved; etc.
- Final stabilization is reached when all ground surface disturbing activities at the site have been completed, and uniform vegetative cover has been established with an individual plant density of at least 70 percent of pre-disturbance levels plant density, or equivalent permanent, physical erosion reduction methods have been employed, as determined by the MS4 permittee. Re-seeding alone does not qualify. Documentation of pre-disturbance conditions assists in making this determination. The developer/owner will be responsible for providing documentation to make this comparison. Upon good cause, the MS4 permittee may amend the final stabilization criteria for specific operations.

- **Inspection and Maintenance**

The Erosion and Stormwater Quality Control Plan **narrative report** shall describe the self inspection and maintenance procedures implemented at the site to maintain all erosion and sediment control practices and other protective practices identified in the Erosion and Stormwater Quality Control Plan in good and effective operating condition. Proactive maintenance is fundamental to effective BMP performance. Rather than maintaining the BMP in a reactive manner following failure, provide proactive maintenance that may help to reduce the likelihood of failure. The types and frequencies of maintenance are BMP-specific. The USDCM, V3 BMP Fact Sheets describe the maintenance needs for each BMP, with some BMP types requiring more attention.

All temporary and permanent erosion and sediment control practices shall be maintained and repaired by the owner during the construction phase as needed to assure continued performance of their intended function. All facilities must be inspected and then cleaned, repaired or replaced if necessary, following each precipitation or snowmelt event that results in runoff.

- **Plan Preparation by a Colorado Professional Engineer**

The State Board of Licensure for Architects, Professional Engineers, and Professional Land Surveyors (Board) does not consider erosion and sediment control plans that do not contain engineering information or engineering features as the practice of engineering. However, **grading** and erosion control plans are considered the practice of engineering. **Grading**, Erosion and Stormwater Quality Control Plan (a combined plan) being submitted for approval must be prepared by or under the direction of a Colorado Professional Engineer's (P.E.) and include the P.E.'s number and signature and the required owner's compliance statement and signature. In addition, Erosion and Stormwater Quality Control Plans that include **permanent, treatment best management practices** must also be submitted for approval must be prepared by or under the direction of a Colorado P.E.. Prints of the approved plan must bear the professional seal of the P.E. in accordance with City Code Section 7.7.1504 and State Law.

- **Signature Blocks**

Engineer's Statement - The following statement is required on all plans along with the Engineer's signature: "This Erosion and Stormwater Quality Control/Grading Plan was prepared under my direction and supervision and is correct to the best of my knowledge and belief. If such work is performed in accordance with the grading and erosion control plan, the work will not become a hazard to life and limb, endanger property, or adversely affect the safety, use, or stability of a public way, drainage channel, or other property."

Developer's/Owner's Statement - The following statement is required on all Erosion and Stormwater Quality Control/Grading Plans prepared for new development and redevelopment (non-public project) along with the Developer's/Owner's signature: "The owner will comply with the requirements of the Erosion and Stormwater Quality Control Plan including temporary BMP inspection requirements and final stabilization requirements. I acknowledge the responsibility to determine whether the construction activities on these plans require Colorado Discharge Permit System (CDPS) permitting for Stormwater discharges associated with Construction Activity."

City Engineering Review Statement - The following statement is required on all plans along with the City's Review Engineer's signature: "This grading plan is filed in accordance with section 7.7.1503 (enacted as ord. 82-56) of the code of the City of Colorado Springs, 2001, as amended. Erosion control is reviewed in accordance with the Drainage Criteria Manual, Vol. I (2012) and Vol. II (2012), latest revisions"

Public Project Contractor Statement - The following statement is required on all Erosion and Stormwater Quality Control/Grading Plans prepared by Contractors for Public Projects along with the Public Project Contractor's signature: "The Public Project Contractor will comply with the requirements of the Erosion and Stormwater Quality Control Plan including temporary BMP inspection requirements and final stabilization requirements. I acknowledge the responsibility to determine whether the construction activities on these plans require Colorado Discharge Permit System (CDPS) permitting for Stormwater discharges associated with Construction Activity."

- **Transfer of Plan/Permit**

The Erosion and Stormwater Quality Control permit (approved Erosion and Stormwater Quality Control Plan) may be transferred from one party to another upon submittal of a transfer form (available from the MS4 permittee). Transfer forms must be approved by the MS4 permittee prior to the transfer taking effect. Both parties must consent to the transfer with the new responsible party accepting the plan responsibilities and liabilities. The transfer may also require authorization by the Engineer that developed and signed the Erosion and Stormwater Quality Control Plan.

Financial assurances (see Section 3.2) must be in place for the Erosion and Stormwater Quality Control Plan before and after the permit transfer.

- **Sale of Residence to Homeowner**

For residential construction only and similar to state requirements, when a residential lot **has been conveyed to a homeowner** and all criteria in paragraphs a through e, below, are met, coverage under the approved Erosion and Stormwater Quality Control Plan and permit is no longer required. At such time, the builder is no longer responsible for meeting the terms and conditions of the plan for the conveyed lot.

- a) The lot has been sold to the homeowner(s) for private residential use;

- b) the lot is less than one acre of disturbed area;
- c) all construction activity conducted by the builder on the lot is completed;
- d) a certificate of occupancy (or equivalent) has been awarded to the homeowner; and
- e) the Erosion and Stormwater Quality Control Plan has been amended to indicate the lot is no longer covered by the approved plan.

Lots not meeting all of the above criteria require continued plan and permit coverage. However, the plan and permit may be transferred to a new owner or operator.

▪ **Plan Expiration/Resubmittal Requirements**

Erosion and Stormwater Quality Control Plans expire if site construction or land disturbance has not commenced within twelve (12) months of plan approval. The plans must then be resubmitted for re-approval. Previously approved plans must also be resubmitted for re-approval when any of the following occur:

- Change in ownership of the property to be disturbed, including ownership by a bank through foreclosure proceedings, excluding if the plan/permit has been transferred,
- Major BMP changes (see Section 3.4),
- Major development design changes to the site, or
- Major grading design revisions to the site.

3.2 Guarantee

A financial assurance of all temporary and permanent treatment BMPs included on the Erosion and Stormwater Quality Control Plan shall be provided, subject to current policies, which exclude enterprises of the City of Colorado Springs from this requirement. The Erosion and Stormwater Quality Control Plan must also include a cost estimate for any temporary and permanent erosion control measures to include, but not limited to, silt fence, sediment basins, vehicle tracking controls, check dam, erosion control blanket, inlet protection, permanent treatment water quality ponds, porous pavement surfaces, re-vegetation, and maintenance costs. The plan must separately delineate the financial assurance for the permanent BMPs and the temporary BMPs. Financial assurances shall be posted by the owner/developer for all erosion control measures prior to approval of any land disturbance activities. The owner/ developer shall provide the financial assurances prior to plan sign off, and will be released when the disturbed areas are stabilized, treatment BMPs constructed, inspection and maintenance requirements for treatment BMPs met, or established to the satisfaction of the MS4 permittee in accordance with the Drainage Criteria Manual, Volume 2 and a written letter requesting release has been submitted to the MS4 permittee. The owner/developer may also make arrangements with the builder to require the builder to post financial assurances so that the owner/developers assurances can be released. Financial assurances will not be released to the owner/developer until the builder as posted financial assurances.

Enforcement actions may require the use of the financial assurance currently on file for the project site (regardless of ownership) to address non-compliance issues. If the enforcement process results in the use of the financial assurances and work is contracted by the MS4 permittee to address the non-compliance issues, the MS4 permittee or the MS4 permittee's contractor will update the Erosion and Stormwater

Quality Control Plans to show activities performed with the financial assurance. The owner/developer must update and resubmit the Erosion and Stormwater Quality Control Plan and repost assurances prior to continuing work on the site.

3.3 Erosion and Stormwater Quality Control Plan Implementation

3.3.1 Plan Acceptance

No clearing, grading, excavation, filling, or other land-disturbing activities shall be permitted until signoff and acceptance of the Grading Plan and Erosion and Stormwater Quality Control Plan (or the combined plan) is received from the MS4 permittee.

3.3.2 Installation of BMPs

Once signoff and acceptance is received, the approved erosion and sediment control measures must be installed before land-disturbing activities are initiated so that no adverse effect of site alteration will impact surrounding property. These measures shall apply to all features of the construction site including, but not limited to, street and utility installations, as well as to the protection of individual lots. During all phases of construction, it shall be the responsibility of those initiating such land disturbing activities to maintain all erosion control features in a functional manner.

3.4 Modifications to the Erosion and Stormwater Quality Control Plan

3.4.1 City Requested

Additional information may be required for projects where soil erosion, sedimentation, or stormwater quality control problems will not be adequately handled by the submitted plan. Such data may include, but not be limited to, other engineering studies, computations, schedules, and supportive data such as product design information and specifications.

It shall be understood that additional or revised BMPs may be required should construction site observation indicate the BMPs are not adequately controlling erosion, sedimentation or stormwater runoff from equipment fueling/maintenance and materials storage areas.

3.4.2 Owner/Contractor/Engineer Proposed

Minor field modifications to erosion and sediment control and treatment BMPs may be approved by the MS4 permittee inspector. Such modifications would include minor adjustments to BMP field locations or a change to a similar erosion and sediment control BMP to better correspond to actual site conditions or to improve BMP performance. No formal written approval will be required, except the inspector shall initial the changes on the updated Erosion and Stormwater Quality Control Plan (on-site copy).

All other requested major modifications shall be in writing and submitted to the MS4 permittee. Examples of major modifications to temporary BMPs that require re-submittal include change to pipe sizes or pipe strength (could be used with temporary stream crossings) and changes to peak discharges or hydraulic calculations. Changes of temporary BMP types or locations on the site are not considered major modifications.

Examples of major modifications to permanent treatment BMPs include change in BMP type, change to volume of BMP, change to drain times (e.g., changes to size or number of orifices), additional hardening,

elimination of any significant features, change in location or drainage patterns, and change in media.

Major modifications, including revised calculations and plans, shall be submitted for re-approval.

3.5 Erosion Control Inspections

Routine and post-storm inspections of BMPs are essential to identify maintenance necessary for the BMPs to remain in effective operating conditions. **Inspections are performed by MS4 permittee inspectors and also required of the owner or owner's representative.** In Colorado Springs, the City Engineering Inspections' staff performs site inspections and also provides educational information to the owners/owner's representatives, developers, and contractors on minimizing the stormwater quality impacts from site operations. Ultimately, it is the responsibility of the owner to take all necessary measures to ensure that the site is in compliance with local and state requirements and the Erosion and Stormwater Quality Control Plan.

The MS4 permittee's review of an Erosion and Stormwater Quality Control Plan is the first step in determining the type of inspections needed and the relative priority of the site for inspections.

3.5.1 Types of Inspections

The following are inspections performed at construction sites *within the City of Colorado Springs*. The City shall have the right to enter the construction site at any time to determine if the site is in compliance with the plan. Not all inspection types will be performed at all sites.

Self-Inspections

The owner or his representative conducts self-inspections. The purpose of these inspections is to ensure that all BMPs are installed according to approved plans and that the BMPs are being properly maintained. The person performing the inspections must be a registered professional engineer in Colorado, a certified erosion control specialist, or certified in a City-approved inspection training program.

The owner or his representative will record the results of the self-inspections by completing a copy of the City of Colorado Springs Inspection Checklist (Appendix C). Completed Inspection Checklists will be submitted electronically to the assigned City Engineering inspector within 5 business days of the self-inspection. The self-inspections must also be kept on-site.

Initial Inspections

Initial inspections are to confirm that the approved plan is being implemented. The City Engineering Inspector must be contacted by the owner/owner's representative/contractor at least 48 hours prior to scheduling the Initial Inspection. It is expected that at the time of the initial inspection, the first level of BMPs will have been implemented according to those plans and that no land disturbing activity will have occurred prior to the Initial Inspection. This inspection also serves to establish contact between inspectors and the site personnel responsible for implementing the approved plans. This is especially important for those sites that have a long construction period or the potential to have a significant impact. Initial inspections are only conducted on sites that require an Erosion and Stormwater Quality Control Permit. These inspections are documented on the Inspection Checklist.

Compliance Inspections

Compliance inspections are performed by City Engineering Inspectors. The inspector verifies that the latest self-inspection report is accurate and that BMPs are functioning according to design and only

allowable discharges are occurring. The inspector also verifies that the Erosion and Stormwater Quality Control Plan is updated to reflect current BMP activity. Compliance inspections may also occur during or immediately after a precipitation event. Compliance inspections are only conducted for sites that require an Erosion and Stormwater Quality Control Permit. The City uses the Inspection Checklist to document these inspections.

Reconnaissance Inspections

Reconnaissance inspections are conducted by a City Engineering Inspector for the general purpose of determining conditions at the site, particularly if the site has contributed sediment to drainageways or other drainage facilities, or if material has runoff the site. These inspections are generally performed from off-site on adjacent streets or property, and may occur during or immediately after a significant precipitation event. This type of inspection is normally aimed at potential problem sites or sites that typically do not require an Erosion and Stormwater Quality Control Permit. The results of a reconnaissance inspection could require a site that previously was not required to develop an Erosion and Stormwater Quality Control Plan to develop one. The inspection will be documented using the Inspection Checklist.

Complaint Response Inspections

These City inspections will occur in response to either a citizen complaint or a complaint from another City agency. The inspector will inform the contractor and owner/owner's representative of the complaint, determine the validity of the complaint, and if necessary, advise on the necessary repair, maintenance or cleanup. The inspector may also require the implementation of specific measures or additional BMPs to prevent the recurrence of the problems that gave rise to the complaint. All construction sites are subject to complaint response inspections. The inspection will be documented using the Inspection Checklist.

Follow-up Inspections

Follow-up inspections are conducted to ensure that measures or requirements from a previous City inspection have been performed or complied with. These requirements may involve the cleanup of a discharge, implementing additional or revised BMPs, repairing, reinstalling, or maintaining damaged or non-functioning BMPs. All construction sites are subject to follow-up inspections. The inspection will be documented using the Inspection Checklist.

Final Inspections

A final inspection of the site is conducted by the City Engineering Inspector to determine overall compliance with the Erosion and Stormwater Quality Control Plan, to determine if measures have been taken to stabilize the site prior to final approval, and prior to release of any financial assurances. The City Engineering Inspector must be contacted by the owner/owner's representative/contractor at least 48 hours prior to scheduling the Final Inspection. The inspection will focus on whether the following have occurred and if sediment from erosion is leaving the site or entering into drainageways or other drainage facilities.

1. All work is in compliance with the approved Erosion and Stormwater Quality Control Plan, and all stabilization is completed, including vegetation, retaining walls or other approved measures.
2. Final stabilization is reached when all ground surface disturbing activities at the site have been completed, and uniform vegetative cover has been established with an individual plant density of at least 70 percent of pre-disturbance plant density levels, or equivalent permanent, physical erosion reduction methods have been employed, as determined by the City Engineering Inspector. Documentation of pre-disturbance conditions assists in making this determination.
3. Removal of all temporary erosion and sediment control measures.

4. Installation of all approved permanent treatment stormwater quality BMPs, if required.
5. Removal of all stockpiles of soil, construction material/debris, construction equipment, etc.
6. Streets, parking lots and other paved surfaces (on-site and off-site) are clean.
7. Removal of sediment and debris from drainage facilities (on-site and off-site) and other off-site property caused by the construction activity, including proper restoration of any damaged property.

Final inspections are only conducted for those sites that are required to have an Erosion and Stormwater Quality Control Permit. The inspection will be documented using the Inspection Checklist.

Correction of Deficiencies

Where self inspections note the need for BMP maintenance activities, BMPs must be maintained by the owner or his representative. A specific timeline for implementing maintenance procedures is not included because BMP maintenance is expected to be proactive, not responsive. Where BMPs have failed, resulting in noncompliance, they must be addressed as soon as possible, immediately in most cases, to minimize the discharge of pollutants.

Where city inspections identify the need for BMP maintenance, the City Engineering Inspector will notify the owner or his representative of the required actions. The City Engineering Inspector will perform a follow-up inspection within 5 business days. The date of non-compliance is established as the date that the BMP violation was identified. The 5 day timeframe for the follow-up inspection is not a grace period from enforcement actions.

3.5.2 Inspection Frequency

Self-Inspection Frequency

The owner or his representative shall, at a minimum, make a thorough inspection at least once every 14 calendar days. Also, post-storm event inspections must be conducted within 24 hours after the end of any precipitation or snowmelt event that causes surface erosion. Provided the timing is appropriate, the post-storm inspections may be used to fulfill the 14-day routine inspection requirement. A more frequent inspection schedule than the minimum inspections described may be necessary to ensure that BMPs continue to operate as needed to comply with the plan. **Self-inspection forms must be submitted electronically to the assigned City Engineering Inspector within 5 business days of the self-inspection.**

For sites or portions of sites that have construction activities completed and final stabilization measures installed, but final stabilization has not been achieved due to a vegetative cover that has not become established, the owner or his representative shall make a thorough inspection of their stormwater management system at least once every month, and post-storm event inspections are not required. The Erosion and Stormwater Quality Control Plan must be amended to indicate those areas that will be inspected in accordance with the reduced schedule.

Inspections are not required at sites where construction activities are temporarily halted, snow cover exists over the entire site for an extended period, and melting conditions posing a risk of surface erosion do not exist. This exception is applicable only during the period where melting conditions do not exist, and applies to the routine 14-day and monthly inspections, as well as the post-storm event inspections. The following information must be documented in the inspection record for use of this exclusion: dates when snow cover occurred, date when construction activities ceased, and date melting conditions began.

When site conditions make this schedule impractical, the owner/developer may petition the City to grant an alternative inspection schedule.

The inspection frequency is typically reasonable to achieve and can help to ensure that the BMPs remain in good working condition. For example, vehicle tracking of sediment onto the roadway is a common problem that often requires maintenance more frequently than weekly. Curb socks, inlet protection and silt fence are other BMPs that are prone to damage and displacement, also benefiting from more frequent inspections.

City Engineering Inspection Frequency

Compliance inspections are performed by City Engineering Inspectors and may occur randomly but at least once every 30 to 60 days. The City Engineering Inspector also performs an initial and final inspection of the project site. For construction sites operating less than 30 days, the City engineering Inspector performs an initial and final inspection, as well as at least once midway through the estimated duration of the project. Chronic and recalcitrant violators of control measures will be inspected more frequently as needed to ensure compliance.

3.6 Record Keeping

The owner or developer (permittee) shall retain all copies of the approved plan, all reports and inspections required by the permit and records of all data used to complete the plan for three years.

The owner or developer shall retain a copy of the plan and all required reports and inspections at the construction site from the date of project initiation to the date of final stabilization, unless the City approves another location, specified by the owner or developer.

3.7 Disposition of Temporary Measures

With only a few exceptions, most temporary erosion and sediment control measures must be removed prior to a final inspection and final approval and prior to release of any financial assurances. The BMP Fact Sheets provide guidance for final disposition of temporary measures. This may be as simple as removing silt fence, or more complex such as removing accumulated sediment from a construction phase sedimentation basin that will be used as a post-construction extended detention basin. Some biodegradable BMPs, such as erosion control blankets, are designed to remain in place and would create new areas of disturbance if removed. See the BMP Fact Sheets for guidance on BMPs that may be left in place as a part of final stabilization. For some BMPs such as sediment control logs/straw wattles, some materials may be biodegradable (straw), but there may be components of the BMP that biodegrade slowly (stakes) or not at all (plastic netting) and these must be removed.

Temporary erosion control measures should not be removed until all areas tributary to the temporary controls have achieved final stabilization. It may be necessary to maintain some of the control measures for an extended period of time, until the upgradient areas have been fully stabilized, and vegetation has sufficiently matured to provide adequate cover. Trapped sediment and disturbed soil areas resulting from the disposal of temporary measures must be returned to final plan grades and permanently stabilized to prevent further soil erosion.

Whenever post-construction BMPs are used for sediment controls during construction, the Erosion and Stormwater Quality Control Plan shall include the steps and actions needed to refurbish these facilities to a fully operational form as post-construction BMPs. As discussed in Chapter 4, the final site work will not be accepted until these BMPs are in final and acceptable form as the original design calls for, which includes lines and grades, volumes, outlet structures, trash racks, landscaping and other measures specified in the plans prepared by the design engineer.

3.8 Construction Enforcement Strategy

The following strategy will be used to ensure compliance with the City of Colorado Spring's Erosion and Stormwater Quality Control Plans.

3.8.1 Goal of Strategy

To encourage owners, developers, and contractors to take the necessary measures to ensure that their construction sites do not create negative impacts to public safety, property, or water resources.

3.8.2 Policies

The following policies apply to enforcement at construction sites in the City of Colorado Springs.

1. It will be the policy of the City of Colorado Springs to encourage compliance with grading, erosion and stormwater quality control requirements by working with engineers and developers during the design and implementation phases of a project to incorporate proper construction BMPs.
2. The City will take enforcement action on a site as necessary to ensure proactive compliance with BMP implementation and maintenance. The intent will be to initiate the enforcement process to correct deficiencies and to motivate construction site violators.
3. The owner of the land is the ultimate responsible party for all construction activities. It is the responsibility of the owner to take all necessary measures to ensure that the site is in compliance with City ordinances and the Erosion and Stormwater Quality Control Plan.
4. The City has made every effort to make its requirements consistent with State requirements for construction activities (CDPS General Permit – Stormwater Discharges Associated with Construction Activities). Should requirements conflict, it will be the responsibility of the owner to bring these conflicts to the City's attention and propose how to address them.
5. Whenever a Stop Work Order is issued, it will be the City's policy to stop any or all City activities or further approvals relative to the site until the necessary measures are taken to address the concerns, as stipulated in the Stop Work Order. The City Engineer may also use partial Stop Work Orders, when deemed appropriate.

An important element of the City's enforcement program is inspections. The City encourages compliance by requiring self-inspections by the owner. A good program for monitoring the compliance status of sites with their plans may be sufficient encouragement to ensure compliance with their Erosion and Stormwater Quality Control Permits. The self-inspections require the owner to identify areas of noncompliance and take corrective actions.

When the City performs inspections at construction sites, it notes those areas that need to be addressed to bring the site into compliance with the Erosion and Stormwater Control Plan. Based on a review of the site, the City Engineering Inspector will list the actions that are needed. A follow-up inspection occurs within 5-business days.

There are several situations where the City may determine that more aggressive action is necessary to get the site into compliance with its permit. The first situation is when there are impacts on public safety, property or water resources. This could include, but is not limited to, the deposition of sediment on a roadway that has the potential to cause accidents, the wash out of channels, spills of toxic materials, deposition of sediment that causes or has the potential to cause property damage, or the deposition of

materials into water ways. The magnitude of the impacts will determine what action is appropriate. Another instance that may result in more aggressive action involves chronic and recalcitrant behavior by the owner/developer/contractor. Problems that may warrant such action include:

- Where the same problem is reoccurring at the site.
- Where the site appears to be having frequent minor problems.
- The individuals involved have a history of noncompliance.

There are several options for formal action that are available to the City. Table 7-2 summarizes some of the more common options. The City may take other action as deemed appropriate. Enforcement steps will only reset if the site passes two consecutive City Engineering Inspections following the final follow-up inspection for the most recent violation.

Table 7-2 Possible Enforcement Options		
Enforcement Option	Description	Typical Applications
Verbal Notice During Compliance Inspections	Violations found at the time of the inspection. Give the site representative a copy of the inspection report along with verbal communication of the violations that need immediate repair.	No immediate danger to public safety, property or water resources.
Verbal Notice During Follow Up Inspections	Complete an inspection report following up on the deficiencies that were in need of repair from the prior compliance inspection. These follow up inspections shall be done within five business days from the time of the compliance inspection. Verbally communicate with the site representative at the time of the follow up inspection, giving them a copy of the inspection report.	No immediate danger to public safety, property or water resources.
Letter of Non Compliance	The letter of non compliance shall be issued when the deficiencies were not repaired as identified during the compliance and first follow up inspection. The items need to be repaired immediately from the time of receipt of the non compliance letter with the city inspector returning to the site for a second follow up inspection within five business days.	No immediate danger to public safety, property or water resources. Compliance has not been achieved while working with the owner/representative or contractor. When the City wants to document ongoing problems and agreed upon follow-up.
Stop Work Order/Cease and Desist	The stop work order shall be issued when the deficiencies listed in the letter of non compliance have not been completed. The stop work order is hand delivered to the owner of the site with signatures from the owner and the inspector issuing it; or sent by certified mail if owner is unavailable for hand delivery. The stop work order is posted on site. If the deficiencies are not	Used when there is an immediate threat to the public safety, property or water resources. Used when the site has failed to comply with the Letter of Non Compliance. Used when unauthorized grading, stockpiling, or discharge is observed or

	<p>completed during the stop work order and within the timeframe allowed, a demand of the financial assurance may be done so the City of Colorado Springs can contract to complete the work. The timeframe between the stop work order and the demand of the financial assurance is on a case by case basis.</p> <p>If deficiencies are resolved then the stop work order is lifted and construction activities can resume.</p>	reported on a site.
Permit Revocation.	The permit revocation is used when the site has failed to comply with the Stop Work Order. The City may revoke the Grading Permit and/or the Erosion Control Permit if the requirements of the plan are not implemented. Revocation of the permit has the same effect as a Stop Work Order, except the owner will need to resubmit an Erosion and Stormwater Quality Control Plan	<p>Used when the site has failed to comply with the Stop Work Order.</p> <p>Used when the current plan has been judged to be inadequate, and the owner or contractor has failed to take the necessary measures to improve the plan.</p>
Notice and Order	A notice and order is issued whenever the City will need to collect funds (beyond the financial assurances) for abating the violation. The notice and order is issued by certified mail or hand delivered to the owner of the site	This action may be taken whenever the City will need to collect funds (beyond the financial assurances) for abating the violation.
Municipal Summons	A municipal summons is used when the site has failed to comply with the Stop Work Order or Notice and Order. This is the issuance of a summons to appear before a judge in Municipal Court.	Used when the site has failed to comply with the Stop Work Order or Notice and Order.

It is expected that under normal conditions the progression of enforcement actions is a Verbal Notice, Letter of Noncompliance, then a Stop Work Order, then a revocation of the Grading and/or Erosion and Stormwater Control Permit and then a Notice and Order. The City may also use financial assurances when a Stop Work Order has been issued to address non-compliance issues. Once a stop work order has been issued and a permit has been revoked, it will be necessary to resubmit an Erosion and Stormwater Quality Control Plan to the City. A Municipal Summons may be issued for noncompliance with a Stop Work Order, a Notice and Order or other situations as outlined in the City Code.

4.0 Overview of Construction BMPs

This chapter hereby incorporates by reference all criteria presented in the current version of the Urban Storm Drainage Criteria Manual (USDCM), Volume 3, Best Management Practices, Chapter 7 Construction BMPs for purposes of design and implementation. This includes sediment control measures, erosion control measures, site management, and materials management. Detailed descriptions, sizing and design criteria, and design procedures for these BMPs are provided in the USDCM, V3 Construction BMP Fact Sheets. Related practices include dewatering and construction in waterways,

which are discussed in Sections 6 and 7.

A key to effective stormwater management at construction sites is to understand how construction stormwater management requirements change over the course of a construction project, as summarized in Figure 7-2. Additionally, BMPs vary with regard to the functions they provide.

Figure 7-2. Construction Stormwater Management



Table 7-3 provides a qualitative characterization of the roles that various BMPs provide with regard to serving erosion control functions, sediment control functions, or site/materials management roles. In particular, it is important to understand whether the primary role of the BMP is erosion control or sediment control. Effectively managed construction sites will provide a combination of BMPs that provide both functions.

Table 7-3. Overview of Construction BMPs

Functions	Erosion Control	Sediment Control	Site/Material Management
Erosion Control BMPs			
Surface Roughening	Yes	No	No
Temporary/Permanent Seeding	Yes	No	No
Soil Binders	Yes	No	Moderate
Mulching	Yes	Moderate	No
Compost Blankets and Filter Berms	Yes	Moderate	No
Rolled Erosion Control Products	Yes	No	No
Temporary Slope Drains	Yes	No	No
Temporary Outlet Protection	Yes	Moderate	No
Rough Cut Street Control	Yes	Moderate	No
Earth Dikes / Drainage Swales	Yes	Moderate	No
Terracing	Yes	Moderate	No
Check Dams	Yes	Moderate	No
Streambank Stabilization	Yes	No	No
Wind Erosion / Dust Control	Yes	No	Moderate
Sediment Control BMPs			
Silt Fence	No	Yes	No
Sediment Control Log	Moderate	Yes	No
Straw Bale Barrier	No	Moderate	No
Brush Barrier	Moderate	Moderate	No
Rock Sock (perimeter control)	No	Yes	No
Inlet Protection (various forms)	No	Yes	No
Sediment Basins	No	Yes	No
Sediment Traps	No	Yes	No
Vegetative Buffers	Moderate	Yes	Yes
Chemical Treatment	Moderate	Yes	No
Materials Management			
Concrete Washout Area	No	No	Yes
Stockpile Management	Yes	Yes	Yes
Good Housekeeping (multiple practices)	No	No	Yes
Site Management and Other Specific Practices			
Construction Phasing	Moderate	Moderate	Yes
Protection of Existing Vegetation	Yes	Moderate	Yes
Construction Fence	No	No	Yes
Vehicle Tracking Control	Moderate	Yes	Yes
Stabilized Construction Roadway	Yes	Moderate	Yes
Stabilized Staging Area	Yes	Moderate	Yes
Street Sweeping / Vacuuming	No	Yes	Yes
Temporary Diversion Channel	Yes	No	No
Dewatering Operations	Moderate	Yes	Yes
Temporary Stream Crossing	Yes	Yes	No
Temporary Batch Plants	No	No	Yes
Paving and Grinding Operations	No	No	Yes

4.1 Erosion Control Measures

Erosion control measures are source controls used to limit erosion of soil. These are typically surface treatments that stabilize soil that has been exposed by excavation or grading, although some limit erosion by redirecting flows or reducing velocities of concentrated flow. Fact Sheets for erosion control (EC) practices are provided in USDCM, V3, Chapter 7. Examples of erosion control practices include surface roughening, seeding, soil binders, mulching, rolled erosion control products, slope drains, and many more.

4.2 Sediment Control Measures

Sediment control measures limit transport of sediment off-site to downstream properties and receiving waters. Sediment controls are the second line of defense, capturing soil that has been eroded. Sediment controls generally rely on treatment processes that either provide filtration through a permeable media or that slow runoff to allow settling of suspended particles. A third treatment process that is used in some parts of the country includes advanced treatment systems employing chemical addition (flocculent) to promote coagulation and settling of sediment particles. CDPHE does not currently allow use of chemicals. Fact Sheets for sediment control (ES) practices are provided in USDCM, V3, Chapter 7. Examples of sediment control practices include silt fence, sediment control log, straw bale barrier, rock sock, as well as many others.

4.3 Site Management

Site management is often ultimately the deciding factor in how effective BMPs are at a particular site. BMPs implemented at the site must not only be properly selected and installed, but also must be inspected, maintained and properly repaired for the duration of the construction project. In addition to general site management, there are a number of specific site management practices that affect construction site management. For example, effective construction scheduling (phasing and sequencing) helps minimize the duration of exposed soils. Protection of existing vegetation also minimizes exposed areas and can reduce the cost of final site stabilization. Stabilized construction entrances (vehicle tracking controls) and street sweeping are critical source control measures to minimize the amount of sediment that leaves a site. Additionally, there are several miscellaneous activities that must be carefully conducted to protect water quality such as dewatering operations, temporary batch plants, temporary stream crossings and other practices.

As part of the construction kick-off meeting for the project (or for major phases of construction), an effective strategy is to include a training component related to construction site stormwater management. Such training should provide basic education to site personnel regarding the requirements of the state and local construction stormwater permits and the serious fines and penalties that can result from failure to comply with permit requirements. The individual or individuals responsible for inspection and maintenance of construction BMPs should have a practical understanding of how to maintain construction

Resources for Construction Stormwater Management/Erosion and Sediment Control Training

Certified Professional in Erosion and Sediment Control Program
(<http://www.cpsc.org/>)

Certified Inspector of Sediment and Erosion Control Program
(<http://www.cisecinc.org/>)

Rocky Mountain Education Center
(<http://www.rccc.edu/rmec/cetc.html>)

International Erosion Control Association (<http://www.ieca.org/>)

Associated General Contractors of Colorado (www.agccolorado.org/)

The City of Colorado Springs often hosts training sessions. Check with the City's website for more information.

BMPs proactively in effective operating condition and to identify conditions where failure is eminent or has already occurred. The individual performing the inspections must be a registered professional engineer in Colorado, a certified erosion control specialist, or certified in a City-approved inspection training program. Several training courses are available in Colorado Springs and the metro Denver area regarding construction site stormwater management.

Fact Sheets for site management (SM) practices are provided in USDCM, V3, Chapter 7. Examples of site management practices include construction phasing/sequencing, vehicle tracking control, protection of existing vegetation, temporary diversion channel, as well as others.

4.4 Materials Management

Materials management BMPs are source control practices intended to limit contact of runoff with pollutants commonly found at construction sites such as construction materials and equipment-related fluids. By intentionally controlling and managing areas where chemicals are handled, the likelihood of these materials being transported to waterways is reduced. Materials management (MM) BMPs Fact Sheets are provided in USDCM, V3, Chapter 7. Examples of materials management include concrete washout area, stockpile management, and good housekeeping.

4.5 Use of Alternative, Proprietary or Innovative Sediment and Erosion Control (Temporary) BMPs

The toolbox of sediment and erosion control BMPs continues to expand with alternative and innovative BMPs that become available. Many of these temporary BMPs may prove to be effective and potentially even exceed the performance of the City approved BMPs. In recognition of this, the MS4 permittee may allow the implementation of temporary erosion and sediment BMPs beyond those available in the DCM, V2. Alternative or innovative temporary BMPs will be used on a limited scale and be evaluated as a pilot program.

Requests to use alternative or innovative temporary BMPs must be submitted with the Erosion and Stormwater Quality Control Plan. To facilitate discussions and expedite the process, it would be helpful for the project proponent and MS4 permittee to have initial discussions on the proposed temporary BMP prior to submitting the Erosion and Stormwater Quality Control Plan. The proposed BMP(s) must be clearly identified as a proposed pilot BMP on the plan and adequate evidence must be given that demonstrates that the BMP will effectively control sediment and/or erosion. The plan must include complete design details, comprehensive installation and maintenance details, and cost estimates for financial assurance calculations. The MS4 permittee may request additional information to evaluate the use of this BMP. The information submitted will be used to determine if a pilot program will be allowed. The City of Colorado Springs reserves the right to deny the use of any proposed BMP. Pilot programs will not exceed 12 months in duration. Financial assurances are required for the pilot BMPs and maintenance of the BMPs.

Removal of alternative or innovative temporary BMPs may be required if the BMPs fail to perform adequately in the field. In this situation, installation of other recommended BMPs found in the Drainage Criteria Manual, Volume 2 will be required to control erosion and sediment on the site and the Erosion and Stormwater Quality Control Plan must be updated to reflect the BMP changes. Modifications to correct deficiencies shall be made immediately with the inspector verifying the changes at the follow-up inspection.

Successfully implemented alternative or innovative BMPs will be considered after thorough evaluation for possible inclusion in the list of recommended BMPs with future revisions to the Drainage Criteria

Manual, Volume 2. The City of Colorado Springs also reserves the right to remove recommended BMPs if in the future it is determined that they are not providing adequate protection.

5.0 BMP Selection and Planning

Construction BMPs should be selected, designed, installed, and maintained based on site-specific conditions. BMPs should be selected based on the physical layout and site conditions that will exist during each stage of construction, because site conditions change through the various stages of construction. The number of stages that must be addressed in the Erosion and Stormwater Quality Control Plan depends on the type of construction activity and local jurisdiction requirements, but in general, three stages of erosion and sediment control plans can be considered. These stages include initial clearing and grading; utility, infrastructure and building construction; and final stabilization.

Effective construction site stormwater management planning involves the following:

- Collecting and analyzing site-specific information to identify needed erosion and sediment controls,
- Preparing a Erosion and Stormwater Quality Control Plan that specifies needed BMPs appropriate to each phase of construction, and
- Following the Erosion and Stormwater Quality Control Plan, maintaining BMPs and updating the Erosion and Stormwater Quality Control Plan as construction progresses.

This section focuses on important factors to consider in the development of an Erosion and Stormwater Quality Control Plan, including site-specific conditions, BMP functions, and other site-related plans.

5.1 Site Assessment

Early awareness of site-specific factors that make a site particularly prone to erosion problems can prevent serious problems later during the construction process. A site assessment should include attention to these factors, prior to selection of BMPs:

- **Slopes/Topography and Topographic Changes Due to Grading:** Slope length and steepness are two key factors in identifying the types and placement of both erosion and sediment control BMPs. Slopes will change throughout the phases of construction as grading is conducted. See Sections 5.2 and 5.3 for additional guidance.
- **Tributary Area/Catchment Size:** The overall size of sub-catchment areas prior to and following grading is a key factor in determining the types, sizes, spacing and other design requirements for sediment controls appropriate for each drainage area. The allowable tributary area for sediment controls varies, depending on the practice selected, as described in the BMP Fact Sheets.
- **Soils:** Regardless of soil type, all disturbed soils require erosion controls; however, NRCS soil maps and geotechnical reports for the development can be used to identify soil conditions where erosion may be particularly difficult to control. In such settings, additional layers of protection for both erosion and sediment controls may be needed and planned for proactively in the Erosion and Stormwater Quality Control Plan.
- **Vegetation:** Onsite vegetation that is to be left undisturbed must be clearly identified in the Erosion and Stormwater Quality Control Plan and/or the construction plans. Construction fence should be installed to avoid disturbance and compaction of these areas. This is particularly important for

protection of mature trees, natural riparian buffers and wetlands, natural open space, or other areas specifically identified to be protected from compaction as part of Low Impact Development (LID) designs. Maintaining a vegetative buffer, in combination with other perimeter control BMPs, can be effective for minimizing transport of sediment off-site.

- **Drainage Infrastructure:** Understanding the hydrology of a site is important in the design of sediment controls. Offsite run-on as well as drainage patterns within the site should be thoroughly assessed. The configuration of hill slope areas and waterways, in the context of planned roads and buildings, will determine which erosion and sediment controls will be needed at each phase of construction.
- **Sensitive Site Conditions:** In cases where construction is occurring in areas of sensitive aquatic habitat, upstream of drinking water supplies, or near areas where threatened and endangered species are a concern, additional layers of protection may be specified by the local, state or federal government. These may include redundant BMPs or restrictions on times that construction activities are allowed.

5.2 Slope-Length and Runoff Considerations

Cut-and-fill slopes should be designed and constructed to minimize erosion. This requires consideration of the length and steepness of the slope, the soil type, upslope drainage area, groundwater conditions and other applicable factors. Slopes found to be eroding excessively will require additional slope stabilization until the problem is corrected. The following guidelines should assist site planners and plan reviewers in developing an adequate design:



Photograph 7-2. Diverting the upland slope drainage area may have avoided the rilling shown in this picture.

- Rough soil surfaces enhance infiltration and/or lengthen the travel path or runoff, reducing runoff velocity. See the Surface Roughening BMP Fact Sheet.
- Temporary diversion dikes should be constructed at the top of long or steep slopes. Diversion dikes or terraces reduce slope length within the disturbed area. See the Earth Dikes and Drainage Swales BMP Fact Sheet.
- Temporary diversion dikes should be provided whenever:

$$S^2L > 2.5 \quad \text{for } \mathbf{undisturbed} \text{ tributary areas;} \quad \text{Equation 7-1}$$

$$S^2L > 1.0 \quad \text{for disturbed tributary areas;} \quad \text{Equation 7-2}$$

$$S^2L > 0.25 \quad \text{for paved tributary areas;} \quad \text{Equation 7-3}$$

where:

S = slope of the upstream tributary area (feet/foot)

L = length of the upstream slope (feet)

As an example, runoff from a developed area runs on to an area that will be disturbed. A diversion dike would be required if, for example, the length of the flow path was greater than 625 feet and the slope of the flow path was 2%.

- Concentrated stormwater (e.g., pipe outflow, channel, swale) should not be allowed to flow down cut or fill slopes unless contained within an adequately-sized temporary channel diversion, a permanent channel, or temporary slope drain. See the Temporary Slope Drain and Diversion Ditches/Channels BMP Fact Sheets.
- Wherever a slope face crosses a water seepage plane that endangers the stability of the slope, adequate drainage should be provided.
- Provide sediment basins or barriers (silt fence) at or near the toe of slopes to trap sediment or to reduce slope lengths. When flows are concentrated and conveyed down a slope using a slope drain or channel, energy dissipation measures will be required at the conveyance outlet at the toe of the slope. See the Sediment Control BMP Fact Sheets for several options for controlling sediment at the base of slopes.

5.3 Using the Revised Universal Soil Loss Equation

The Revised Universal Soil Loss Equation (RUSLE) is an erosion prediction method that has evolved over time, resulting from data collection and analysis efforts extending from the 1930s through the 1970s, ultimately published in *Agriculture Handbook 282* (Wischmeier and Smith, 1965), then *Agriculture Handbook 537* (Wischmeier and Smith, 1978) and *Agriculture Handbook 703* (Renard et al., 1997). Although originally developed for agricultural land use, it is also a useful method for estimating erosion potential on construction sites and adjusting BMPs to reduce the estimated erosion. The RUSLE is also incorporated into several modern erosion prediction models. The Modified Universal Soil Loss Equation (MUSLE) is similar to the RUSLE, but is differentiated by the fact that MUSLE is event-based while RUSLE is an annual method (with the option to calculate monthly or seasonal erosion). This section provides a brief overview of RUSLE and describes how it can be used to help select erosion control practices at construction sites.

$$A = RKLSCP \quad \text{Equation 7-4}$$

where:

A = Computed spatial average soil loss and temporal average soil loss per unit of area, expressed in the units selected for K and for the period selected for R . Typically, A is expressed in tons per acre per year.

R = Rainfall-runoff erosivity factor – the rainfall erosion index plus a factor for any significant runoff from snowmelt.

K = Soil erodibility factor – the soil-loss rate per erosion index unit for a specified soil.

L = Slope length factor – the ratio of soil loss from the field slope length to soil loss from a 72.6 ft length under identical conditions.

S = Slope steepness factor – the ratio of soil loss from the field slope gradient to soil loss from a 9 percent slope under otherwise identical conditions.

C = Cover-management factor – the ratio of soil loss from an area with specified cover and management to soil loss from an identical area in a bare condition. Values range from 0.01 to 1.

P = Erosion control practice factor – the ratio of soil loss with a certain conservation practice (erosion control BMP) to that of no practice. Values range from 0.8 to 1.2.

The slope length, L , and steepness factor, S , are commonly combined as one variable, LS . Values for LS are quantified relative to a 72.6 ft slope length with a 9 percent slope. A slope with these two values will have an LS factor of 1.

A detailed discussion of RUSLE factors is beyond the scope of this manual; however, *Agriculture Handbook 703* can be obtained at no charge from the USDA publications website and used to develop or obtain values for the factors in the equation. Construction managers can use the RUSLE, either by hand or by using a variety of different software programs based on the equation, to evaluate how implementing various BMPs can help reduce surface erosion. Highly erosive sites or sites with sensitive receiving waters may benefit from more rigorous analysis using the RUSLE.

Although construction managers have no control over the A and R factors, factors L , S , C and P can be altered by implementing practices that reduce sediment loading. One technique to reduce the slope length and steepness is to terrace. For example, if a portion of a construction area has a slope length of 500 feet, it can be terraced into three or four equal sections to reduce the erosivity of the water coming down the slope. This factor can also be used to guide placement distances for silt fence, wattles and other practices that serve to break up the slope length. As another example, construction managers can vary cover management practices to decrease the C factor and reduce sediment loading. C values vary, depending on the type of cover implemented. Using the reference table for the C value, managers can select cover approaches to help reduce sediment loading. Finally, the practice factor (P) serves as an index of anticipated erosion reduction associated with various erosion control BMPs.

5.4 BMP Functions

Understanding the intended function of a BMP is critical to proper BMP selection. BMPs should be selected based on both the intended function of the BMP and consideration of whether the BMP can provide the desired function based on the site-specific conditions. It is also important to understand how BMP functions are related to maintenance. For example, when silt fence is initially installed, it provides a filtration function, but over time, the fabric can become clogged, leading to ponding and sedimentation behind the fence as the primary function rather than filtration.

Sediment control BMPs such as sediment basins can provide some settling of sediment from runoff, but must be combined with **erosion** controls throughout the site in order to be effective. Sediment basins, inlet protection, and other sediment control BMPs should not be solely relied upon as "end-of-pipe" treatment systems.

5.5 Consistency with Other Plans

Prior to selection of BMPs for the Erosion and Stormwater Quality Control Plan, it is important to cross-check other construction planning documents for consistency and/or opportunities for increased efficiencies and effectiveness. As an example, landscaping plans for a site should be consistent with final stabilization measures in the Erosion and Stormwater Quality Control Plan.

5.5.1 Drainage Plans

The Erosion and Stormwater Quality Control Plan should be prepared with due consideration of the final drainage plan for a development. As permanent drainage features are constructed, temporary sediment controls should be located and designed to both protect and complement these final drainage features. Temporary controls should be staged and removed at the appropriate time relative to the completion of permanent drainage features. Special care is necessary for permanent BMPs that rely on infiltration such as bioretention, permeable pavements, sand filters and others. These BMPs will clog if they are not adequately protected during construction (or constructed after tributary areas have been stabilized).

5.5.2 Post Construction Stormwater Management

Coordination of temporary and post-construction BMPs is important for several reasons. In some cases, post construction BMPs such as extended detention basins can be modified to serve as sedimentation basins during construction. In other cases, such as in the case of rain gardens or infiltration-oriented post-construction BMPs, it is critically important to protect the post-construction facilities from sediment loading during construction. Also, as previously noted, if an area is targeted for preservation in an uncompacted, natural condition under a LID design, it is critical to keep heavy equipment and staging out of this area.

5.5.3 Air Quality Plans

Properly implemented erosion and sediment control BMPs are beneficial in minimizing wind erosion. For example, surface stabilization measures that help to reduce precipitation-induced erosion help to reduce windborne dust and sediment. Additional controls, such as road watering (to moisten roads but not to the extent that runoff results) and/or soil binders may be necessary to fully comply with fugitive dust regulations at a construction site.

5.6 Integrating Site Conditions and BMPs into an Erosion and Stormwater Quality Control Plan

The following guidelines are recommended when combining BMPs into an effective Erosion and Stormwater Quality Control Plan:

- **Determine the limits of clearing and grading:** If the entire site will not undergo excavation and grading, or excavation and grading will occur in stages, the boundaries of each cut-and-fill operation should be defined. Buffer strips of natural vegetation may be utilized as a control measure. Adequate protection of both tree limbs and root systems is important when specifying limits of construction activity. Use construction fence or other barriers to protect areas that should not be compacted or disturbed.
- **Define the layout of buildings and roads:** Typically, this will have been decided previously as a part of the general development plan. If building layout is not final, the road areas stabilized with pavement and the drainage features related to roads should be defined as they relate to the plan.
- **Determine permanent drainage features:** The location of permanent channels, storm sewers, roadside swales and stormwater quality controls such as ponds, wetlands, grassed-lined swales, buffer strips and areas of porous pavement, if known, should be defined.
- **Determine extent of temporary channel diversions and crossings:** If permanent channel improvements are a part of the plan, the route, sizing and lining needed for temporary channel

diversions should be determined. Location and type of temporary channel crossings can be assessed.

- **Determine the boundaries of watersheds:** The size of drainage catchments will determine the types of sediment controls to be used. Areas located offsite that contribute runoff must be assessed. Measures to limit the size of upland drainage areas, such as diversion dikes, should be considered at this stage. Routing offsite "clean" runoff around areas of disturbance in stabilized conveyances reduces the burden on onsite measures and can reduce liability of the owner/developer—once offsite runoff enters the permitted construction area, the owner/developer is responsible for erosion and sediment transport resulting from the offsite runoff.
- **Select erosion controls:** All areas of exposed soil will require erosion control measures based on factors including the duration of exposure, soil erosivity, slope steepness, and length, and others.
- **Select sediment controls:** Select the controls needed for each stage of the construction project. Each stage will have different demands for the control of erosion and sedimentation. For example, over-lot grading will require controls that may require different BMPs than when individual homes are being built and lots are disturbed after the streets and drainage systems are in place. Sediment basins are an essential part of the total plan when the tributary area exceeds one acre.
- **Determine sequencing of construction:** The schedule of construction will determine what areas must be disturbed at various stages throughout the development plan. The opportunity for phasing cut-and-fill operations to minimize the period of exposure of soils needs to be assessed and then incorporated into the Erosion and Stormwater Quality Control Plan.
- **Identify planned locations of topsoil stockpiles:** Areas for storing topsoil should be determined and proper measures to control erosion and sediment movement should be specified.
- **Identify planned location of temporary construction roads, vehicle tracking controls, portable toilets, waste disposal areas, and material storage areas:** These elements can be determined in the context of previously defined parts of the site construction management plan.

6.0 Construction Dewatering

Dewatering is typically necessary during construction activities that involve deep excavations, instream work, pumped surface diversions, and open trench operations in some cases. In Colorado, construction dewatering frequently requires a separate state permit along with sample collection and the completion of Discharge Monitoring Reports (DMRs). When dewatering can be conducted without discharging surface runoff from the site, it may be possible to conduct such activities under the state Construction-phase Stormwater Permit. Some commonly used methods to handle the pumped water without surface discharge include land application to vegetated areas through a perforated discharge hose (i.e., the "sprinkler method") or dispersal from a water truck for dust control. Carefully check state permit requirements to determine when dewatering can be conducted without additional permitting.

Construction dewatering BMPs generally include practices to minimize turbidity in the pumped water. Representative practices that may help to reduce turbidity in various types of dewatering applications include:

- Using perimeter well points outside of the excavated area to draw down the water table rather than dewatering directly from the excavation;
- Placing a submersible pump in a perforated bucket filled with gravel for short-term pumping;

- Constructing a filtering sump pit for pumping groundwater below the excavation grade for multiple-day operations; or
- Using a flotation collar or other flotation device to pump from the surface of a sediment basin to avoid the silt that can accumulate on the bottom of the basin.

Guidance on BMPs for construction dewatering is provided on the Dewatering Operations Fact Sheet.

7.0 Construction in Waterways

Construction in waterways is often required for projects including bridge construction, utility construction, streambank stabilization and grade control, and temporary or permanent stream crossings. Construction in waterways requires a high standard of care in order to avoid and minimize damage to waterways, habitat, and aquatic life. In addition to the construction phase permits already discussed, this work can also require a Clean Water Act Section 404 Permit from USACE, U.S. Fish and Wildlife Service (USFWS) threatened and endangered species permitting, and/or other state and local permits. Some required permits may restrict construction to certain times of the year.

Many of the BMPs described in Section 4 of this chapter are used in waterway construction. This section provides guidance on factors to consider and plan for during construction in waterways, as well as guidance on specific BMPs that should be implemented, depending on site-specific conditions. Other criteria and guidance that are closely related to in-stream work should also be referenced including:

- Drainage Criteria, Volume 1 Major Drainage Chapter
- Drainage Criteria, Volume 1 Revegetation Chapter
- Drainage Criteria, Volume 1 Hydraulic Structures Chapter
- *Stormwater Management During Construction: Best Management Practices for Construction in Waterways Training Program Student Manual* (Altitude Training Associates 2008). This document is available for download on www.udfcd.org.

BMPs provided in this chapter that are commonly used when construction occurs in waterways include surface roughening, soil binders, mulching, earth dikes, temporary channel diversion channel; temporary stream crossing, as well as many others.

In addition to criteria specified for these BMPs, the following general principles should be followed:

- Construction vehicles should be kept out of a waterway to the maximum extent practicable.
- Where in-channel work is necessary, steps such as temporary channel diversions must be taken to stabilize the work area and control erosion during construction.
- When in-stream work has been completed, the channel must be stabilized using revegetation practices (often, including use of erosion control matting or turf reinforced mats), riprap, or other permanent stabilization measures as required by the Erosion and Stormwater Quality Control Plan.
- Where an actively-flowing watercourse must be crossed regularly by construction vehicles, a temporary crossing should be provided. Three primary methods are available: (1) a culvert crossing, (2) temporary bridge, and (3) a stream ford. See the Temporary Stream Crossing Fact Sheets.

- A permit is required for placement of fill in a waterway under Section 404 of the Clean Water Act. The local office of the USACE should be contacted concerning the requirements for obtaining a 404 permit. In addition, a permit from USFWS may be needed if threatened or endangered species are of concern in the work area. Typically, the USFWS issues are addressed in conjunction with the 404 permit if one is required. A floodplain development permit and other local permits may also be required.
- When work takes place within a channel, a temporary water diversion to bypass the work area is typically required. See the Diversion Channel/Ditch BMP Fact Sheet for criteria and design details.
- To the extent practical, construction in a waterway should be sequenced to begin at the most downstream point and work progressively upstream installing required channel and grade control facilities.
- Complete work in small segments, exposing as little of the channel at a time as practical. Keep equipment operators contained in immediate work area and avoid excessive compacting of the soil surface because it inhibits revegetation.
- Where feasible, it is best to perform in-channel work between October 1 and March 31 in Colorado. This is the period when the chances of flash floods and flows higher than the 2-year flood peak flows are less likely.
- During the process of cut and fill, avoid letting side-cast or waste material enter waterways or placing it on unstable areas. Instead, efficiently move excavated material to areas needing fill or to a stockpile. For stream restoration/stabilization projects, consulting with a fluvial geomorphologist on stream stability issues may be prudent.

404 Permit Basics

Section 404 of the Federal Clean Water Act established a program to regulate the discharge of dredged and fill material into waters of the United States, including wetlands. Responsibility for administering and enforcing Section 404 is shared by the U.S. Army Corps of Engineers (USACE) and EPA. USACE administers the day-to-day program, including individual permit decisions and jurisdictional determinations; develops policy and guidance; and enforces Section 404 provisions. EPA develops and interprets environmental criteria used in evaluating permit applications, identifies activities that are exempt from permitting, reviews/comments on individual permit applications, enforces Section 404 provisions, and has authority to veto USACE permit decisions.

A Section 404 permit is typically required when the following activities are conducted in waters of the U.S., including wetlands:

- Construction of roads or paths
- Foundations or amenities for residential, commercial, or recreational developments
- Construction of ponds, dams, dikes or weirs
- Placement of riprap and channel protection
- Laying utility pipes or lines

When selecting BMPs for in-stream construction, a variety of factors should be considered such as:

- Hydrologic factors (tributary watershed size, length of the overland flow, roughness and slope characteristics, precipitation characteristics, imperviousness, etc.)
- Baseflow conditions
- Pollutants that may be delivered to the waterway from the surrounding area
- Extent of existing erosion, headcutting or bank sloughing
- Condition/type of vegetation and percent cover
- Sources of surface runoff
- Drainage pattern
- Historic events
- Flow regulation (ditch diversions, reservoir releases)

8.0 Considerations for Linear Construction Projects

Linear projects involving utilities, streets, highways, railways, and other transportation-related projects can pose some unique stormwater management challenges during construction. Section 8.1 identifies special considerations and approaches that may be beneficial to linear projects, and Section 8.2 provides criteria for trenching for underground utility lines.

8.1 General Considerations

General considerations for linear construction projects include:

- **Standard Details for Typical Activities:** Development of a set of standard BMP details for typical construction activities can promote consistent implementation of erosion and sediment control measures and more efficient Erosion and Stormwater Quality Control Plan preparation. For example, if a utility company frequently installs light poles, it may be beneficial to develop a standard detail showing the typical construction of a light pole and the associated BMPs. Typical details for construction activities can be used by contractors allowing them to know what BMPs must be used for specific construction activities. BMP details shall be shown on the Erosion and Stormwater Quality Control Plans. BMPs must be indicated on the site map if site-specific conditions vary from the conditions assumed for development of the typical construction activity BMP detail.
- **Construction Phasing:** By nature, linear construction activities are typically phased. Phasing often will be dictated by the extent of allowable traffic closures and typical requirements for closing trenches at the end of the workday in the right-of-way. For linear construction projects in the public right-of-way, stabilization often can be achieved rapidly as each segment or phase of the project is completed, often by paving or repairing and/or installing sod. For areas where revegetation is from seed, reaching final stabilization (and inactivating stormwater permit coverage) will be a lengthier process.
- **Weather and Climate:** Linear projects such as roadwork may need to consider seasonal weather patterns when scheduling construction. Bridgework over waterbodies should be planned during traditionally low water levels, October 1 to March 31 when possible. Utility projects should attempt to close trenches prior to inclement weather, if feasible, and at the end of each day.

- **Space Constraints:** Select BMPs that work best under the space constraints of the project. Many utility and road construction projects in urban areas have BMPs that are located in active streets.
- **Durability:** Particularly in active traffic areas, durability of BMPs (i.e., ability to continue to function properly, even when run over by a vehicle) is an important consideration for BMP selection.
- **Potential for Ponding:** Creation of ponded water on roadways may also be a concern. It is important to keep in mind that inlet protection can function in two different ways: filtration and/or ponding. While both of these mechanisms can play a role in sediment removal, typically, inlet protection methods that encourage filtration and limit the amount of ponding are favorable, since ponding typically does not provide enough storage for significant residence time/settling and because ponding can impede travel in streets and highways. Ponding, which occurs to at least some degree with most types of inlet protection, can typically be addressed by selection of the appropriate type of inlet protection, frequent maintenance/sediment removal, and providing an overflow path that will not cause flooding in the event that excessive ponding occurs.
- **Temporary Access:** Unlike a typical residential or commercial development where there are access points that will be used throughout the duration of the project, for linear construction projects, it is often necessary to access the work area for limited periods of time at multiple locations throughout the corridor. For utility projects where access through vegetated areas is necessary at multiple locations, but generally only for a limited amount of time at each location, consider alternatives to standard geotextile and rock-lined vehicle tracking control pads such as construction mats or turf reinforced mats for temporary access to avoid disturbance to vegetation and soil that is typically associated with traditional vehicle tracking control pads.
- **Jurisdictional Considerations:** Linear projects are often multijurisdictional. In these cases, it is important to have upfront coordination with the municipalities that are involved to reduce the burden of permitting and Erosion and Stormwater Quality Control Plan preparation to the extent practical. For example, it may be possible to prepare a single Erosion and Stormwater Quality Control Plan that will satisfy the requirements of multiple municipalities rather than preparing separate Erosion and Stormwater Quality Control Plans for work in each municipality.

8.2 Underground Utility Trenching Criteria

Specific criteria for trenching activities include:

- Minimize the length of trench open at one time to the extent practical. For most trenching projects, it should be feasible to phase construction so that no more than a few hundred feet of trench are open at any given time.
- Where consistent with safety and space considerations, place excavated material on the upgradient side of trenches.
- Trench dewatering devices must discharge in a manner that will not cause erosion or adversely affect flowing streams, wetlands, drainage systems, or off-site property. See the Dewatering Operations BMP Fact Sheet and Section 6 of this chapter for additional guidance.
- Provide storm sewer inlet protection whenever soil erosion from the excavated material has the potential to enter the storm drainage system. See Inlet Protection BMP Fact Sheet for specific guidance.

- Evaluate potential for sediment contributions to inlets or receiving waters that are not in the immediate vicinity of the work area and implement inlet protection and/or other BMPs as necessary. For example, if vehicles access the construction area to remove excavated material or to deliver materials, evaluate the potential for offsite sediment tracking and implement measures such as street sweeping, inlet protection, stabilized access to the construction area, and other BMPs to protect inlets or receiving waters that could be affected by tracked sediment. As another example, perimeter controls on the upgradient side of stockpiles and inlet protection on the opposite side of the crown of the street may be necessary if stockpile height or tracking from accessing stockpiles has the potential to contribute sediment to the opposite side of the street.

9.0 Construction BMP Fact Sheets

The Construction BMP Fact Sheets included in the UDFCD Manual, Volume 3 are applicable.

10.0 Map Symbols

The map symbols shown at the back of this chapter shall be used to represent the construction BMP features.

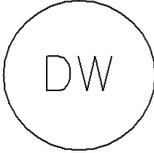
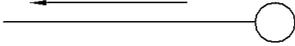
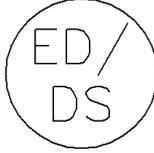
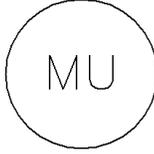
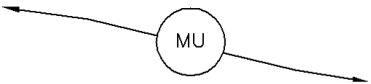
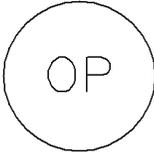
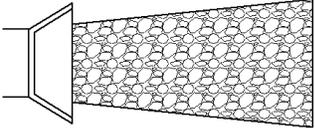
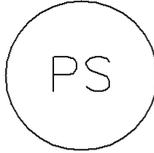
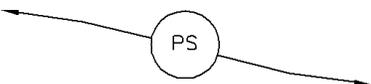
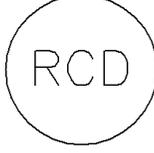
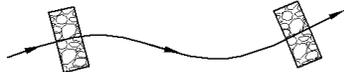
11.0 References

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Map Symbols

<u>TITLE</u>	<u>KEY</u>	<u>SYMBOL</u>
BRUSH BARRIER	BB	— BB — BB — BB —
CHECK DAM	CD	
COMPOST BLANKET AND BERMS	CB	
CONSTRUCTION FENCE	CF	— CF — CF — CF —
CULVERT INLET PROTECTION	CIP	
STABILIZED CONSTRUCTION ROADWAY	SCR	
CONCRETE WASHOUT AREA	CWA	
DIVERSION DITCHES/CHANNELS	DD/ DC	

Map Symbols (cont'd)

<u>TITLE</u>	<u>KEY</u>	<u>SYMBOL</u>
DEWATERING OPERATIONS		
EARTH DIKES AND DRAINAGE SWALES		
EROSION CONTROL BLANKET		
INLET PROTECTION		
MULCHING		
OUTLET PROTECTION		
PERMANENT SEEDING		
REINFORCED CHECK DAM		

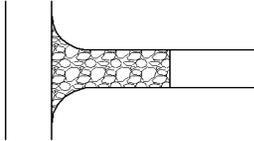
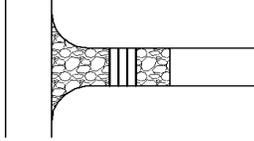
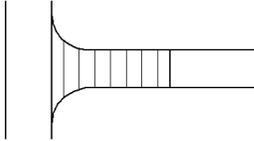
Map Symbols (cont'd)

<u>TITLE</u>	<u>KEY</u>	<u>SYMBOL</u>
ROCK SOCKS	RS	
ROUGH CUT STREET CONTROL	RCS	
SEDIMENT BASIN	SB	
SEDIMENT CONTROL LOG	SCL	
SILT FENCE	SF	
SURFACE ROUGHENING	SR	
STABILIZED STAGING AREA	SSA	
STOCKPILE MANAGEMENT W/ PROTECTION	SP	

Map Symbols (cont'd)

<u>TITLE</u>	<u>KEY</u>	<u>SYMBOL</u>
STOCKPILE MANAGEMENT W/ PROTECTION IN ROADWAY	SPR	
STRAW BALE BARRIER	SBB	
SEDIMENT TRAP	ST	
TEMPORARY SEEDING	TS	
TERRACING	TER	
TEMPORARY STREAM CROSSING W/CULVERT	TSCC	
TEMPORARY STREAM CROSSING W/FORD	TSCF	
TEMPORARY SLOPE DRAIN	TSD	

Map Symbols (cont'd)

<u>TITLE</u>	<u>KEY</u>	<u>SYMBOL</u>
VEHICLE TRACKING CONTROL		
VEHICLE TRACKING CONTROL W/ WHEEL WASH		
VEHICLE TRACKING CONTROL W/ CONSTRUCTION MAT		
VEHICLE TRACKING CONTROL W/ TRM		