

## **Chapter 1 - Introduction**

### **1.1 Manual Purpose**

As land is developed and woodlands and pastures are converted to more intensive commercial and residential uses, the increase in impervious surfaces (pavements, buildings, etc.) and managed turf, cause adverse effects including:

- Increased flooding
- Increased erosion and deposition of sediment in streams
- Less base flow in streams due to less groundwater recharge
- Increased runoff of pollutants (nutrients, sediment, bacteria, oil)
- Decreased stream biodiversity (e.g., aquatic insects and fish)
- Loss of recreational uses such as swimming and fishing

The County of Roanoke stormwater management goals are to minimize these adverse effects of land development by implementing effective stormwater management Best Management Practices (BMPs) as required by the County Code for new and redevelopment, and over time, by providing BMP measures to mitigate the adverse effects of past land development activities.

The County of Roanoke Stormwater Management Design Manual, hereafter called the Design Manual, contains local requirements that supplement local ordinances, state regulations and guidance, and federal regulations. In general, direction and guidance from these sources is not repeated in this Design Manual. Refer to the listing of Reference Sources at the end of this chapter.

### **1.2 Water Programs Regulatory Background**

The County of Roanoke implements, and is regulated by, several water programs as briefly described below.

Land Disturbing Activities are regulated under the erosion and sediment control, stormwater management, and floodplain management programs.

Existing Development is regulated by the illicit discharge detection and elimination program and, if the property contains a permanent BMP, by the stormwater management program.

The County of Roanoke itself is regulated by the MS4 Permit program. While the MS4 permit only directly regulates the County, it may indirectly impact anyone living in, owning property, or developing in the County of Roanoke through the impact of County actions that are required by its permit.

### **1.2.1 Erosion and Sediment Control Program**

The County is the local Erosion and Sediment Control (E&SC) authority. E&SC requirements are contained in the County of Roanoke Erosion and Sediment Control Ordinance and Virginia Erosion and Sediment Control Regulations. The County administers the program under the oversight of the Virginia Department of Environmental Quality (DEQ).

### **1.2.2 Stormwater Management Program**

The County is the local Virginia Stormwater Management Program (VSMP) authority. VSMP requirements are contained in the County of Roanoke Stormwater Management Ordinance and Virginia Stormwater Management Regulations. The County administers the program with oversight of the DEQ. The proper understanding of the meaning of “common plan of development or sale” is critical to understanding the applicability of stormwater management requirements for land disturbing activities. The County’s policy concerning common plan of development or sale is contained in Appendix 1A.

### **1.2.3 Floodplain Management Program**

The County regulates development in the floodplain through its Zoning Ordinance. This Program was developed and is administered to comply with Federal Emergency Management Agency requirements.

### **1.2.4 Illicit Discharge Detection and Elimination Program**

Except for specific limited exceptions, only uncontaminated stormwater may be discharged into stormwater systems. The County operates an Illicit Discharge Detection and Elimination Program in accordance with the County of Roanoke Illicit Discharge Ordinance, as required by its MS4 Permit. The DEQ provides oversight of this program.

### **1.2.5 Municipal Separate Storm Sewer System (MS4) Permit**

The County of Roanoke is regulated under a General Permit for Small Municipal Separate Storm Sewer Systems issued by the DEQ. MS4 permits generally impact urban areas and they require the locality to implement specific Minimum Control Measures (MCM) to protect local water quality. These MCM’s generally fall into six (6) categories:

1. Public Education and Outreach on Stormwater Impacts
2. Public Involvement and Participation
3. Illicit Discharge Detection and Elimination
4. Construction Site Stormwater Runoff Control
5. Post Construction Stormwater Management

## 6. Pollution Prevention and Good Housekeeping for Municipal Operations

The MS4 Permit also requires that the locality address water impairments that are identified by a Total Maximum Daily Load (TMDL) Study where the locality has been given a Waste Load Allocation (WLA). The County of Roanoke has WLA's for a number of its streams for impairments caused by sediment, bacteria, and PCBs.

See the Roanoke County website, Department of Community Development, Stormwater Management page for more information concerning the MS4 Permit and TMDLs.

### 1.3 Contents of the Manual

The Design Manual is divided into 15 chapters. An overview of each chapter is presented below.

Chapter 1 – Introduction. Chapter 1 presents the general background and purpose behind the Design Manual. The chapter documents the goals of the program, the applicable requirements for stormwater management, and the administration of the program.

Chapter 2 – Stormwater Management Plan Review and Approval. Chapter 2 presents the process that the applicant and the County of Roanoke follow to assure that the requirements of the stormwater management program and the Stormwater Management Ordinance are met.

Chapter 3 – Easements. Chapter 3 establishes the requirements for easements for BMPs and storm drainage systems.

Chapter 4 – Stormwater Hydrology. Chapter 4 documents the hydrologic design practices used to establish design flows necessary to design storm drainage systems and BMPs.

Chapter 5 – Open Channels. Chapter 5 presents the requirements for open channel hydraulics, including cross section requirements, side slopes, widths, slopes, channel linings, and calculation methods.

Chapter 6 – Culverts. Chapter 6 presents the requirements for culverts, including materials, slopes, headwater and tailwater limitations, and design calculation methods.

Chapter 7 – Storm Drains. Chapter 7 presents the requirements for storm drains, including storm drain piping sizes, and lengths, and storm drain inlet hydraulics.

Chapter 8 – Residential Lot Drainage. Chapter 8 presents the requirements for residential lot drainage by providing drainage and/or grading the land to direct surface drainage away from building and toward streets, drainage conveyance structures, or sheet flow.

**Chapter 9 – Stormwater Detention.** Chapter 9 presents requirements and design criteria for stormwater storage facilities. Design criteria include location, sizing, requirements, site access, release rates, and spillway requirements.

**Chapter 10 – Energy Dissipation.** Chapter 10 includes the requirements for velocity and energy reduction devices at the discharge from storm drains, culverts, open channels, and other stormwater management systems. Energy dissipation is required to prevent excessive velocities and erosion in downstream channels.

**Chapter 11 – RESERVED.**

**Chapter 12 – Environmentally Sensitive Areas.** Chapter 12 presents requirements for development of environmentally sensitive areas including floodplains, stream buffers, steep slopes, erodible soils, and stormwater pollutant hot spots.

**Chapter 13 – Geotechnical Studies. (RESERVED)**

**Chapter 14 – Maintenance of Stormwater Management Facilities.** Chapter 14 presents the requirements for establishing a maintenance program for stormwater management facilities, and the establishment of a maintenance agreement to assure that stormwater management facilities are properly maintained.

**Chapter 15 – Inspection and Enforcement.** Chapter 15 presents the inspection and enforcement procedures to ensure that construction of stormwater management facilities comply with the approved plans and are properly maintained post-construction. As-built requirements are also addressed in this chapter.

## **1.4 Authority**

The Design Manual provides supplemental information to implement the provisions of the County Code as they pertain to stormwater management, including storm drainage, and land development.

In the event that any part of this Design Manual is held to be illegal or void, this shall not have the effect of making illegal or void the Design Manual in its entirety, or any section thereof, which shall remain effective.

## **1.5 Applicability**

The requirements of this Design Manual apply to all land disturbance activities requiring permits.

Portions of this Design Manual apply to maintenance and repair of stormwater management facilities and other best management practices after construction is completed.

## **1.6 Administration**

### **1.6.1 General**

The policies and procedures contained within this Design Manual shall be administered by the County of Roanoke, Director of Community Development (Director), or designee.

### **1.6.2 Manual Amendments**

This Design Manual may be periodically amended, as recommended by the Director of Community Development, or designee, and approved by the Board of Supervisors.

Amendments to this Design Manual will be posted on the County website, and will become effective on the date listed on the website. **It is the manual user's responsibility to check the website and verify that they have the latest requirements.**

### **1.6.3 Exceptions**

Requests for exceptions of any provisions of this Design Manual shall be made in writing to the County of Roanoke, Director of Community Development. The exception request shall clearly identify the Design Manual provision that is desired to be modified; the justification to support the issuance of an exception, and the alternative measures that are proposed to meet the intent of the Design Manual. All requests for an exception will receive a written response outlining the reasons for approval, or denial, after receipt of all information requested by the Director. In reviewing the request, the Director shall closely examine the proposed development and evaluate the variance request based on the conditions set forth in the Design Manual, County of Roanoke Code, Stormwater Management Ordinance; and the requirements and recommendations of the VA SWM Handbook, VDOT Drainage Manual, VA BMP Clearinghouse, and other sources.

### **1.6.4 Appeal of Decisions**

Appeals of decisions may be filed in accordance with the procedures provided in the County of Roanoke Code, Stormwater Management Ordinance.

## **1.7 Approvals and Permits**

The applicant is responsible for acquiring all required approvals and permits.

### **1.7.1 Local Approvals and Permits**

The review and approval of stormwater management plans shall be an integral part of the overall review of site plans. Local permits and approvals include Erosion and

Sediment Control Approval, Virginia Stormwater Management Program Permit, Land Disturbance Permit, Zoning Permit, and Building Permit. Retaining walls with a height of 3' or greater require a building permit.

### **1.7.2 Water and Sewer Approvals and Permits**

Public water and sewer requires approval from either the Western Virginia Water Authority (WVWA) or the Town of Vinton, depending on the geographic location. If the site is located in the Town of Vinton or to the east of the Town of Vinton, within the Town of Vinton service area; then, Town of Vinton approval is required. If public water and/or sewer is located elsewhere in the County; then, WVWA approval is required.

For areas not served by public water and sewer, local health department approval is required for wells and onsite sanitary sewage disposal.

### **1.7.3. Joint Permit Application**

Wetlands and streams are protected under several Federal and State programs. Whenever jurisdictional wetlands or streams are impacted by land disturbing activities, a Joint Permit Application must be completed and filed with the Virginia Marine Resources Commission (VMRC). VMRC will distribute the joint permit application to The U.S. Army Corps of Engineers (USACE) and the Virginia Department of Environmental Quality (DEQ). The USACE and DEQ will consult with other Federal and State agencies in processing the permit application. Upon receipt of an acceptable application the following permits may be issued:

- USACE Federal Section 404 Permit
- DEQ Water Protection Permit (VWP)
- VMRC Permit

The Design Professional shall provide the County of Roanoke a copy of the required wetland permit; or with written documentation that a wetland permit is not required by the USACE, DEQ, or VMRC. The written documentation shall be prepared by a 3<sup>rd</sup> party professional experienced in wetland delineation. Plans shall show the surveyed wetland boundary delineation, provide geographic location of the wetland flags, provide acreage of wetlands, and linear footage of streams. Wetlands shall be numbered and flagged in the field. Wetland delineations shall be performed in accordance with the 1987 Corps of Engineers Wetland Delineation Manual and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region.

## **1.8 Reference Sources**

Managing stormwater runoff from land disturbing activities and prior developed land is a complex issue. There are a number of laws, ordinances and guidance sources that those that design land disturbance activities (land development) must follow.

The requirements and recommendations of the following sources, latest editions, are incorporated into this Design Manual by reference. All of the referenced sources are readily available on the internet.

### **1.8.1 County of Roanoke Code and Ordinances**

Design and construction of land disturbing activities shall comply with all relevant portions of the County of Roanoke Code including:

- Stormwater Management Ordinance
- Erosion and Sediment Control Ordinance
- Illicit Discharge Ordinance
- Zoning Ordinance
- Subdivision Ordinance

### **1.8.2 Virginia Law and Regulations**

Design and construction of land disturbing activities shall comply with all relevant Virginia law and regulations including:

- Virginia Stormwater Management Law
- Virginia Erosion and Sediment Control Law
- Virginia Stormwater Management Regulations
- Virginia Erosion and Sediment Control Regulations

### **1.8.3 Virginia Manuals, Handbooks, and Websites**

- Virginia Stormwater Management Handbook, Hereafter throughout this Design Manual referred to as the VA SWM Handbook.
- Virginia Department of Transportation Drainage Manual, Hereafter throughout this Design Manual referred to as the VDOT Drainage Manual.

- Virginia Department of Transportation Road and Bridge Standards. Hereafter throughout this Design Manual referred to as the VDOT Standards.
- Virginia Department of Transportation Road and Bridge Specifications. Hereafter throughout this Design Manual referred to as the VDOT Specifications.
- Virginia Erosion and Sediment Control Handbook. Hereafter throughout this Design Manual referred to as the VA E&SC Handbook.
- Virginia Stormwater Management BMP Clearinghouse website (<http://vwrcc.vt.edu/swc/>). Hereafter throughout this Design Manual referred to as the BMP Clearinghouse.

## 1.9 Acronyms and Abbreviations

For clarification, the following is a listing of abbreviations, and acronyms used in stormwater management and throughout this Design Manual.

A – Drainage area, acres (stormwater hydrology)  
 A – Cross section area, square feet (open channel or pipe hydraulics)  
 B – VDOT rainfall coefficient, no units (stormwater hydrology)  
 BMP – Best management practice  
 C – Runoff coefficient, no units (stormwater hydrology)  
 Cf – Saturation factor, no units (stormwater hydrology)  
 CMP – Corrugated metal pipe  
 CN – Curve Number (stormwater hydrology)  
 USACE – U.S. Army Corps of Engineers  
 D – VDOT rainfall coefficient, no units (stormwater hydrology)  
 DCR – Virginia Department of Conservation and Recreation  
 De – Critical duration, minutes (stormwater hydrology)  
 DEQ – Virginia Department of Environmental Quality  
 E – VDOT rainfall coefficient, no units (stormwater hydrology)  
 FEMA – Federal Emergency Management Agency  
 g – Gravity coefficient, 32.2 feet/s<sup>2</sup>  
 H – Height or depth of water, feet  
 H<sub>f</sub>, H<sub>i</sub>, H<sub>m</sub>, H<sub>o</sub>, H<sub>Δ</sub> – Head losses in piping and structures, feet (storm drain hydraulics)  
 HDPE – High density polyethylene  
 HGL – Hydraulic grade line  
 I – Rainfall intensity, inches per hour (stormwater hydrology)  
 I<sub>post</sub> – Post-development impervious cover, percentage (water quality Simple Method calculation)  
 I<sub>existing</sub> – Existing impervious cover, percentage (water quality Simple Method calculation)  
 K, K<sub>i</sub>, K<sub>o</sub> – Head loss coefficients for piping, no units  
 L<sub>pre</sub> – Pre-development pollutant loading, pounds per year (water quality Simple Method calculation)

$L_{post}$  – Post-development pollutant loading, pounds per year (water quality Simple Method calculation)

MS4 – Municipal Separate Storm Sewer System

n – Manning's equation roughness coefficient, no units (open channel and pipe hydraulics)

NFIP – National Flood Insurance Program

Q – Stormwater flow, cubic feet per second (cfs)

R – Hydraulic radius, feet (open channel hydraulics)

$r_c$  – Stream bend radius, center, feet (open channel hydraulics)

$r_i$  – Stream bend radius, inside bank, feet (open channel hydraulics)

$r_o$  – Stream bend radius, outside bank, feet (open channel hydraulics)

S – Slope, feet per feet (open channel or pipe hydraulics) or as a percentage (%)

SCS – Soil Conservation Service

$t_c$  – Time of concentration, minutes (stormwater hydrology)

$T_p$  – Time to peak flow, minutes (stormwater hydrology)

$T_r$  – Time to recede, minutes (stormwater hydrology)

$T_t$  – Travel time, minutes (stormwater hydrology)

$V, V_i, V_o$  – Velocity, feet per second (open channel and pipe hydraulics)

VA E&SC Handbook – Virginia Erosion and Sediment Control Handbook, latest version, as amended

VA SWM Handbook – Virginia Stormwater Management Handbook, latest version, as amended

VDOT – Virginia Department of Transportation

VDOT Drainage Manual – Virginia Department of Transportation, Drainage Manual, latest version, as amended

VDOT Specifications – Virginia Department of Transportation, Road and Bridge Specifications, latest version, as amended

VDOT Standards – Virginia Department of Transportation, Road and Bridge Standards, latest version, as amended

VMRC – Virginia Marine Resources Commission

VSMP – Virginia Stormwater Management Program, as administered by DEQ and Roanoke County

$\Delta Z$  = Difference in water surface elevation from the inside curve to the outside curve of an open channel, feet (open channel hydraulics)