

# Drainage Design Manual

City of Statesville

Updated January 2026



# TABLE OF CONTENTS

---

<b>CHAPTER 1: INTRODUCTION</b> .....	<b>2</b>
1.1 Background.....	2
1.2 Role of Stormwater Management.....	2
1.3 Role of Key Personnel.....	3
1.4 Objectives of this Manual .....	3
<b>CHAPTER 2: PLAN SUBMITTAL + REVIEW PROCESS</b> .....	<b>5</b>
2.1 Projects Requiring A Stormwater Management Plan .....	5
2.2 Stormwater Plan Review Process Chart.....	6
2.3 Concept Plan .....	7
2.4 Stormwater Management Plan .....	9
2.5 As-Built Certification And Final Approval .....	11
<b>CHAPTER 3: HYDROLOGIC CALCULATIONS</b> .....	<b>12</b>
3.1 Hydrologic Methods .....	12
3.2 Rational Method.....	13
3.3 Simple Method .....	14
3.4 NRCS Curve Method .....	15
4.1 Inlets and Catch Basins.....	18
4.2 Pipes and Culverts.....	20
4.3 Pipe Specifications and Installation.....	21
4.4 Channels .....	22
4.5 Drainage Easements .....	23
5.1 Vegetated Buffers .....	24
5.2 Calculating Project Density.....	25
5.3 Low Density Requirements .....	25
5.4 High Density Requirements.....	26
5.5 Common SCMs .....	27
<b>CHAPTER 6: SCM MAINTENANCE</b> .....	<b>28</b>
6.1 Operation And Maintenance Plan and Agreement .....	29
6.2 Annual Maintenance Inspection and Report .....	30
6.3 City Inspection .....	31
6.4 Scm Maintenance Schedules .....	31
<b>CHAPTER 7: GLOSSARY</b> .....	<b>36</b>
<b>REFERENCES</b> .....	<b>41</b>

# CHAPTER 1: INTRODUCTION

---

This chapter provides some background information and describes the roles of both stormwater management and key personnel with the City of Statesville (City) and Iredell County (County). It also discusses the objectives of this manual.

## 1.1 BACKGROUND

The passage of the Clean Water Act in 1972, and later the Water Quality Act in 1987, granted the EPA authority to regulate stormwater runoff through state administered programs using the National Pollutant Discharge and Elimination System (NPDES) permit program. Phase I communities (cities with populations of 100,000 or greater) were first required to establish stormwater management programs and apply for discharge permits from the state. More recent legislation has expanded stormwater programs to include smaller communities like the City of Statesville. These Phase II rules require programs that include the development and implementation of six specified measures to reduce stormwater pollution. The “six minimum measures” are as follows:

1. Public education and outreach.
2. Public involvement and participation.
3. Illicit discharge detection and elimination.
4. Construction site stormwater runoff control.
5. Post-construction stormwater management for new development and redevelopment.
6. Pollution prevention/good housekeeping for municipal operations.

## 1.2 ROLE OF STORMWATER MANAGEMENT

To comply with the Phase II permit requirements, Statesville maintains a stormwater management program modeled around EPA’s six minimum measures and upholds the City’s long-standing efforts to provide sound drainage policy and practices for publicly maintained rights-of-way and areas proposed for development or redevelopment. The program includes best management practices put in place by the City to manage the quantity and quality of stormwater runoff. The objectives of the program are to:

1. Protect human life and health.
2. Minimize private and public property damage resulting from flooding, erosion, and sedimentation.
3. Improve the quality of stormwater runoff discharge to surface waters and groundwater.
4. Prevent new development and redevelopment from creating a demand for public investment in flood-control and water quality improvement works.
5. Provide an effective stormwater management system that will not result in

excessive public or private monies being used for maintenance and replacement of existing portions of the stormwater system.

6. Facilitate the design of drainage systems that are consistent with good engineering practice and design and in accordance with the City’s overall planning efforts and stormwater management planning.
7. Provide a mechanism that allows development with minimum adverse effects to the natural environment.
8. Encourage preservation of the natural drainage systems in an aesthetically pleasing condition as best possible.

### 1.3 ROLE OF KEY PERSONNEL

Statesville City Council designated a Stormwater Program Manager position to administer and enforce the requirements of Section 8.05 of the UDO. Duties include issuance of stormwater plan approvals for new development and subsequent field inspections for final approvals (post-construction stormwater management). The Stormwater Program Manager as part of the City’s Engineering Department will also oversee the administration of the NPDES Phase II permit by developing and managing programs for the following: public education and involvement, illicit discharge detection and elimination, and pollution prevention/good housekeeping for City operations.

The Iredell County Planning Department manages construction site runoff control (sediment/erosion control) for the entire county. Erosion control plans and questions should be submitted to Iredell County. Contacts for both offices can be found in Table 1-1.

*Table 1-1. City and County Contacts*

	City Stormwater Program Manager	Iredell County Erosion Control
Mailing Address	PO Box 1111 Statesville, NC 28687	PO Box 788 Statesville, NC 28687
Physical Address	301 S. Center Street Statesville, NC 28687	349 N. Center Street Statesville, NC 28687
Phone Number	(704)-761-2385	(704)-832-2352

### 1.4 OBJECTIVES OF THIS MANUAL

This manual is developed to aid the public in understanding the requirements in Statesville for managing stormwater runoff. It is intended for use by developers and design professionals in planning and designing new developments detailed site design which considers stormwater impacts and incorporates best stormwater practices into the site development to the greatest extent possible. It may also be used by the public to become more familiar with stormwater management and surface water protection around homes, businesses, and existing development. The manual is divided into the following chapters:

## CHAPTER 1: INTRODUCTION

- Chapter 1 – Introduction
- Chapter 2 – Plan Submittal and Review Process
- Chapter 3 – Hydrologic Calculations
- Chapter 4 – Drainage Design Requirements
- Chapter 5 – Treatment and Attenuation Requirements
- Chapter 6 – SCM Maintenance
- Chapter 7 – Glossary
- References

Statesville, with the assistance of the Stormwater Advisory Commission composed of public citizens, significantly revised Section 8.05 of the City’s Unified Development Ordinance (UDO) in accordance with NPDES Phase II requirements. The updated UDO Section 8.05 was adopted in 2019 and has since undergone another update in 2026. Refer to the UDO for additional information regarding stormwater rules in Statesville.



*Figure 1-1. Statesville City Hall*

## CHAPTER 2: PLAN SUBMITTAL + REVIEW PROCESS

This chapter describes the process of submitting and receiving approval for a stormwater management plan. A stormwater plan covers the design, construction, and maintenance of stormwater practices on the site including stormwater control measures (SCMs). Stormwater management approvals are reviewed by the Stormwater Program Manager or designee and may be reviewed concurrently with the City of Statesville Planning Department Technical Review Committee (TRC) review and approval process.

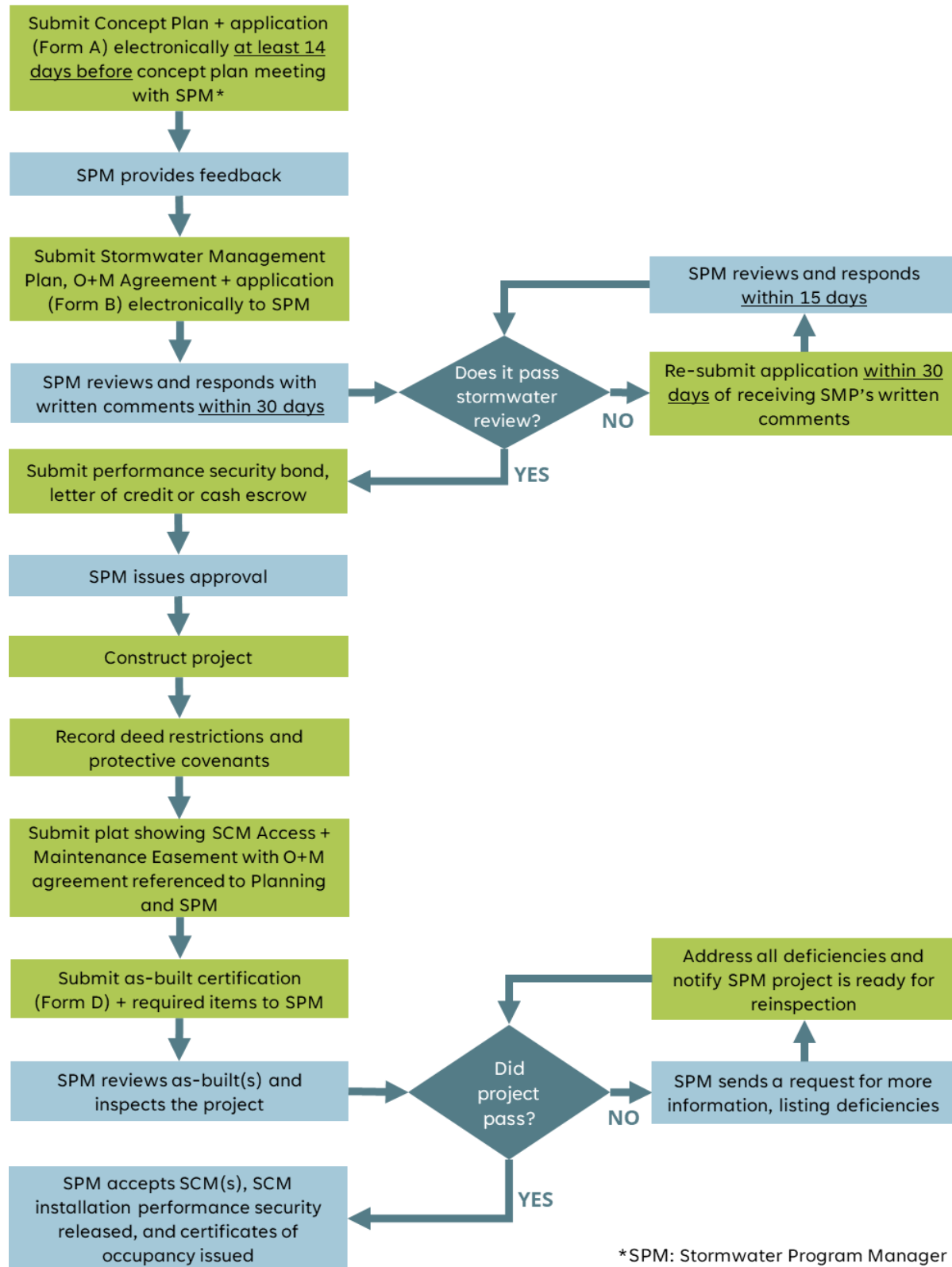
### 2.1 PROJECTS REQUIRING A STORMWATER MANAGEMENT PLAN

Development and redevelopment projects require a stormwater management plan if they cumulatively disturb one acre or more or add 20,000 square feet or more of BUA. The stormwater management plan requirement also applies to projects that are part of a larger common plan of development or sale that, in total, disturb one acre or more or add 20,000 square feet or more of BUA. For redevelopment projects, increased stormwater controls are required only for the amount of BUA being created that exceeds the pre-existing BUA.



Figure 2-1. Statesville Stormwater Division Vehicle

2.2 STORMWATER PLAN REVIEW PROCESS CHART



\*SPM: Stormwater Program Manager

### 2.3 CONCEPT PLAN

A concept plan and consultation meeting are required prior to submitting the stormwater management plan application and detailed engineering drawings. Table 2-1 details when a concept plan and meeting are required.

*Table 2-1. Conditions Requiring a Concept Plan and Meeting*

	Project Type
1	High density projects
2	Projects disturbing five or more acres of land
3	Major subdivisions
4	Conditional rezoning projects
5	Any site whose complexity or proximity to natural resources is deemed necessary by the Stormwater Program Manager

The concept meeting offers significant value by facilitating early alignment between the applicant and the Stormwater Program Manager. The goal of this consultation is to ensure both parties agree on the proposed approach prior to the applicant submitting a full stormwater management plan and to streamline subsequent steps.

The concept plan application packet must be submitted electronically at least 14 days before the meeting by emailing all required documents to the Stormwater Program Manager. This allows the Stormwater Program Manager the opportunity to review the packet prior to the consultation meeting. Contact information can be obtained on the City of Statesville’s Stormwater page by visiting <https://www.statesvillenc.net/statesville-stormwater-management>.

The concept plan does not require the seal or signature of a registered, North Carolina Professional Engineer and there are no fees associated with reviewing the concept plan. The applicant must provide existing conditions based only on publicly available topography, hydrography, soils, land cover, and flood zones that can be obtained from government websites or observed from aerial photography. Applicants are encouraged to incorporate other information as may be available from their own records or upon request from NCDOT, adjacent property owners, or other public records. Table 2-2 lists the items that must be included in the concept plan application packet.

The stormwater concept plan meeting may be held as part of a Planning Department/TRC Pre-Application Conference. Topics to be covered in the consultation meeting include the SCMs that are proposed for the project and the preliminary stormwater drainage, and constraints, opportunities and potential approaches to stormwater management designs.

Local watershed plans, Statesville’s Unified Development Ordinance, and other relevant resource protection plans should be consulted in the development of the concept plan.

The Stormwater Program Manager provides feedback during the meeting and may provide additional written feedback after the meeting.

*Table 2-2. Required Items in a Concept Plan*

	Required Item Description
1	Completed Form A, Stormwater Application – Concept Plan.
2	Location and boundaries of perennial and intermittent streams, lakes, ponds, stream buffers, and wetlands.
3	Soil survey map (if available).
4	Location of floodplain/floodway limits.
5	Relationship of site to upstream and downstream properties and drainages.
6	Proposed limits of clearing and grading.
7	Existing and preliminary proposed topography and flow paths.
8	Location of existing and proposed roads, buildings, parking areas and other impervious surfaces, as well as any known existing utilities on the site.
9	Other setbacks (e.g., drinking water well setbacks, septic setbacks, etc.) – to the extent this information is publicly available or can be observed from general site reconnaissance.
10	Preliminary locations of any proposed stream channel modifications, such as bridge or culvert crossings.
11	A written or graphic concept plan of the proposed post-development stormwater management system, including preliminary selection and location of proposed SCMs and associated access corridors; low-impact design elements; location of existing and proposed conveyance systems.

## 2.4 STORMWATER MANAGEMENT PLAN

After the concept plan is approved by the Stormwater Program Manager, the applicant may submit a stormwater management plan. The plan must detail how post-development stormwater runoff will be controlled and managed and it must be prepared by a qualified registered North Carolina professional engineer performing services in their area of competence. Stormwater management plans must be submitted electronically through email to the Stormwater Program Manager.

Plans will be reviewed and a response with written comments will be provided within 30 days from the submittal date. The applicant is required to re-submit updated plans within 30 working days to be considered part of the original submittal or the plan may be subject to additional application fees. Subsequent submittals will be reviewed within 15 days.

The stormwater management plan application should include other environmental permits applicable to the project, such as the Erosion and Sediment Control permit, 404 wetlands permit and 404 water quality certification, and buffer authorization certificate (after the implementation of the High Rock Lake buffer rule). Table 2-3 lists the required items to be included in the submittal of the stormwater management plan application packet.

Upon approval of the SCM(s) cost estimate, the applicant must submit a performance security or bond with surety, cash escrow, letter of credit or other acceptable legal arrangement. The amount for the installation performance security will be the total estimated cost of construction of the SCM(s), plus 50 percent, plus \$2,500 for mobilization per SCM.

Before building may occur on any lots, the final plat must be approved. The Stormwater Program Manager will not approve the final plat until the association is formed, and the association bylaws are submitted to the City prior to the conveyance or transfer of any lot, unit, or building site. Approval will also require an enforceable restriction on property usage that runs with the land, such as a recorded deed restriction or protective covenants, to ensure that future development and redevelopment maintain the site consistently with the approved plans.

The stormwater management approval allows for periodic inspections of the development by the City to ensure compliance with proposed designs.

Table 2-3. Required Items in a Stormwater Management Plan

	Required Item Description
1	Completed Form B, Stormwater Application, Stormwater Management Plan.
2	A narrative detailing how post-development stormwater runoff will be controlled and managed. The narrative should verify that the design of all stormwater management facilities and practices meets the submittal requirements for complete applications, that the design complies with Section 8.05 of the UDO and policies found in this Design Manual.
3	<p>Signed and sealed engineering drawings that contain the following items:</p> <ul style="list-style-type: none"> <li>• Perennial and intermittent streams;</li> <li>• Mapping of predominant soils from soil surveys (if available);</li> <li>• Locations of floodplain/floodway limits;</li> <li>• Relationship of site to upstream and downstream properties and drainages;</li> <li>• Proposed limits of clearing and grading;</li> <li>• Existing and proposed topography and proposed flow paths;</li> <li>• Location of existing and proposed roads, buildings, parking areas and other impervious surfaces, as well as any known existing utilities on the site;</li> <li>• All notes, plans, calculations and details pertinent to stormwater construction. It is recommended that plans are developed with coordinate geometry referenced to the NC Grid System, since electronic as-builts will later be required in this format;</li> <li>• Clear delineations and accounting for all existing and proposed BUA, specifying areas to be removed and any additional BUA requiring stormwater treatment;</li> <li>• Storm drainage easements are to be shown on the plan sheets and labeled “Storm Drainage Easement” for all stormwater pipes and open conveyances which convey runoff from public rights-of-way; and</li> <li>• The locations of any jurisdictional wetlands and vegetated buffers.</li> </ul>
4	A construction cost estimate for each SCM. The cost estimate must be signed and sealed.
5	An operation and maintenance agreement that includes all SCMs on the development and has been signed and executed by the responsible party (Form E). The O&M agreement must be referenced on the final plat.
6	The stormwater plan review fee. The fee schedule can be found on Statesville’s Stormwater Plan Review website.

## 2.5 AS-BUILT CERTIFICATION AND FINAL APPROVAL

Upon completion of a project, and before a certificate of occupancy is granted and/or installation bonds released, the applicant must certify that the completed project is in accordance with the approved stormwater management plans and designs and submit actual as-built plans for all stormwater management facilities or practices after final construction is completed.

As-built plans should be submitted electronically with units in feet and based on NC State Plane coordinates. Table 2-4 lists the required items that must be included when submitting the as-built certification to the Stormwater Program Manager.

*Table 2-4. Required Items for As-Built Submittal*

	Required Item Description
1	Completed Form D, Engineer SCM As-Built Certification.
2	Final grading and location of all BUA on the site as well as the total area of BUA installed.
3	The final design for all SCMs and stormwater drainage system components that includes field location, size, depth, and planted vegetation as installed.
4	Updated calculations based on the installed topography, BUA, SCMs, and stormwater drainage system.
5	A signed and sealed certification from the designer that the as-built, SCMs, and stormwater drainage system complies with the approved stormwater management plans and designs.

A final inspection and approval by the Stormwater Program Manager will occur before the release of any performance securities.

No certificate of compliance or occupancy will be issued by Iredell County without all aspects of Section 8.05 of the UDO met and approval by the Stormwater Program Manager. Exception will be made where multiple units are served by the SCM(s), or where SCMs required by this section are being used for erosion control and a bond is in place for their conversion. In this case, Iredell County will withhold a percentage of permits or certificates of occupancy until as-built plans are submitted and final inspection and approval has occurred.

# CHAPTER 3: HYDROLOGIC CALCULATIONS

Numerous manuals, guidance documents, and software resources are available to support the design of stormwater drainage systems and SCMs. The City of Statesville encourages design professionals to use appropriate references and software to conduct the required analysis and prepare design documents. This Manual does not offer step-by-step instructional guidance; instead, it references other manuals that are considered sufficient for providing the methodologies necessary to perform engineering analysis.

## 3.1 HYDROLOGIC METHODS

Accurately defining the drainage area is the initial step in conducting hydrologic calculations. Several important factors should be considered during this process. Land use conditions must be represented based on future land use as outlined in the County and City Land Use Plans and Zoning Maps, unless the current land use produces higher runoff rates. In this case, existing conditions should be used. When delineating watersheds, they should have fairly uniform land cover to minimize errors associated with averaging runoff characteristics. If a watershed has a significant variation in land uses, then it should be broken into smaller watersheds to more accurately assess the hydrology.

Typical calculations include peak discharge, water quality volumes, and bank full capacities for channels and swales. The following outlines standards for performing commonly used estimation techniques. The Rational Method or the NRCS Method may be applied as described in Table 3-1 below. When using hydrologic software, the designer should submit the inputs and outputs from the system to the reviewer. The reviewer may verify the results using their software. Should any discrepancies arise between the designer’s and the reviewer’s results, the reviewer may raise concerns about the submitted results.

Table 3-1. Hydrologic Methods and Watershed Sizes

Method	Watershed Size	Typical Use
Rational	0 – 20 acres	Estimates peak flow
Simple	0 – 20 acres	Estimates runoff volume
NRCS	0 – 2,000 acres	Estimates runoff volume + peak flow



### 3.2 RATIONAL METHOD

Peak flow is commonly determined using the Rational Method. The composite runoff coefficient C represents the runoff potential of the drainage area and typically ranges from 0.35 to 0.95, with higher values indicating greater runoff potential. It is calculated as the weighted average of all land uses within the drainage area.

$$Q_p = CIA$$

- Where:  $Q_p$  = Peak Flow (cfs)  
 C = Runoff Coefficient (unitless) – see Table 3-2  
 I = Rainfall Intensity (in/hr) – see Table 3-3  
 A = Watershed Area (ac) – ensure watershed is fairly uniform

Table 3-2. Runoff Coefficient (C) Values

Type of Area	Description of Area	Runoff Coefficient "C"
Lawns	Sandy soil, flat, 2%	0.10
	Sandy soil, average, 2 - 7%	0.15
	Sandy soil, steep, > 7%	0.20
	Clay soil, flat, 2%	0.17
	Clay soil, average, 2 - 7%	0.22
	Clay soil, steep, > 7%	0.35
Business	Downtown city areas	0.95
	Neighborhood areas	0.70
Residential	Single-family areas	0.50
	Multi-units, detached	0.60
	Multi-units, attached	0.70
	Suburban	0.40
Industrial	Apartment dwelling areas	0.70
	Light areas	0.70
Industrial	Heavy areas	0.80
	Miscellaneous	
Miscellaneous	Parks and cemeteries	0.25
	Playgrounds	0.35
	Railroad yard areas	0.40
	Unimproved areas (forest)	0.30
Streets, Gravel, Soil	Asphalt and concrete	1.00
	Brick	1.00
	Drives, walks, and roofs	1.00
	Gravel areas	0.50
Graded or no plant cover	Sandy soil, flat, 0 - 5%	0.30
	Sandy soil, flat, 5 - 10%	0.40
	Clayey soil, flat, 0 - 5%	0.50
	Clayey soil, average, 5 - 10%	0.60

Rainfall intensities used for the application of the Rational Method should be based on storm duration equal to the watershed time of concentration ( $T_c$ ), referencing Precipitation Intensity tables available from NOAA. The minimum  $T_c$  is five minutes.

Table 3-3. Storm Intensities (NOAA Atlas 14, Precipitation Frequency Data Server, 2025)

Storm event (return period with a 24-hour duration)	Intensity (inches/hour)
1-year	0.118
2-year	0.143
5-year	0.182
10-year	0.212
25-year	0.253
50-year	0.286
100-year	0.320

### 3.3 SIMPLE METHOD

The Simple Method (Schueler 1987) was developed by measuring the runoff from many watersheds with known impervious areas and extrapolating a relationship between percent imperviousness and the fraction of rainfall converted to runoff (the runoff coefficient). It is often used to size SCMs.

$$R_V = 0.05 + 0.9 * I_A$$

Where:  $R_V$  = Runoff coefficient (unitless)  
 $I_A$  = Impervious portion (unitless)

$$D_V = 3,630 * R_D * R_V * A$$

Where:  $D_V$  = Design volume (cu ft)  
 $R_D$  = Design storm depth (in)  
 $A$  = Drainage area (ac)

A few important notes about the variables listed above:

- The impervious fraction,  $I_A$ , is the impervious portion of drainage area in acres divided by the drainage area in acres.
- The design storm depth,  $R_D$ , is 1.0” for SCM treatment volume.
- The drainage area,  $A$ , must include all of the surfaces that drain to the SCM regardless of whether they are on-site or off-site.
- The design volume,  $D_V$ , is the required volume of the SCM.

### 3.4 NRCS CURVE METHOD

The Natural Resources Conservation Service (NRCS) method estimates the runoff depth from the drainage area in inches and is required for any drainage area of 20 acres or more. The runoff volume is then determined by multiplying the accumulated runoff depth by the drainage area. This method is more sophisticated than the Simple Method because it considers the time distribution of the rainfall, the initial rainfall losses to infiltration and depression storage, and an infiltration rate that decreases during the course of a storm.

Table 3-5 provides curve numbers that must be used in Statesville. Soils data is available in hard copy format from NRCS soil surveys and electronically at no cost from the NRCS Web Soil Survey website included in the References. Curve numbers shall be based on build out of the entire drainage area even if the area is not currently fully developed.

The following assumptions are required in Statesville when using the NRCS Method:

- Average antecedent runoff condition and  $Ia = 0.2S^2$
- BUA is directly connected to the drainage system. For BUA that is not connected, the NRCS method has an adjustment to reduce the effect.
- Pervious areas are equivalent to open space in good hydrologic condition.
- The rainfall event duration should be 24 hours and use the NRCS Type II rainfall distribution with a maximum 2-minute time increment.
- The minimum time of concentration is five minutes.

$$Q = \frac{(P-0.2S)^2}{(P+0.8S)} \quad S = \frac{1,000}{CN} - 10$$

- Where: Q = Accumulated runoff depth (in)  
 P = Accumulated precipitation depth (in) – see Table 3-4  
 S = Potential maximum retention (in)  
 CN = Curve number (unitless) – see Table 3-5

Table 3-4. Storm Depths (NOAA Atlas 14, Precipitation Frequency Data Server, 2025)

Storm event (return period with a 24-hour duration)	Depth (inches)
1-year	2.84
2-year	3.45
5-year	4.37
10-year	5.09
25-year	6.08
50-year	6.88
100-year	7.69

Table 3-5. Runoff Curve Numbers (NRCS, TR-55, second Edition, June 1986)

Cover Description Cover Type and Hydrologic Condition	Average % BUA	CN for HSG			
		A	B	C	D
<b>Open space (lawns, parks, golf courses, cemeteries, etc.)</b>					
Poor Condition (<50% ground cover)		68	79	86	89
Fair Condition (50% to 75% ground cover)		49	69	79	84
Good Condition (>75% ground cover)		39	61	74	80
<b>Impervious areas:</b>					
Paved parking lots, roofs, driveways (excluding right-of-way)		98	98	98	98
<b>Streets and roads:</b>					
Paved: curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved: open ditches (including right-of-way)		83	89	92	93
Gravel: including right-of-way		76	85	89	91
Dirt: including right-of-way		72	82	87	89
<b>Urban districts:</b>					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
<b>Residential districts by average lot size:</b>					
1/8 acre or less (City houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
<b>Newly graded areas:</b>					
Pervious areas only, no vegetation		77	86	91	94
<b>Pasture, grassland, or range: continuous forage for grazing</b>					
Poor Condition (<50% ground cover or heavily grazed, no mulch)		68	79	86	89
Fair Condition (50% to 75% ground cover and not heavily grazed)		49	69	79	84
Good Condition (>75% ground cover and lightly grazed)		39	61	74	80
<b>Meadow:</b>					
Continuous grass, no grazing and generally mowed for hay		30	58	71	78
<b>Brush-brush, weed, grass mixture with brush the major element</b>					
Poor Condition (<50% ground cover)		48	67	77	83
Fair Condition (50% to 75% ground cover)		35	56	70	77
Good Condition (>75% ground cover)		30	48	65	73
<b>Woods</b>					
Poor Condition (Forest litter, small trees, and brush destroyed by heavy grazing or regular burning)		45	66	77	83
Fair Condition (Woods are grazed but not burned, and some forest litter)		36	60	73	79
Good Condition (Woods are protected from grazing, and litter and brush cover the soil)		30	55	70	77



# CHAPTER 4: DRAINAGE SYSTEM STANDARDS

This chapter outlines design standards, material specifications, and installation specifications for the stormwater conveyance system. A stormwater drainage system shall be provided for public streets and adjoining properties requiring adequate drainage. The design professional must observe the design standards provided in this section as well as the City of Statesville’s Land Development Standards Manual (LDSM) when designing and constructing stormwater drainage systems in Statesville.

The design professional is encouraged to keep in mind that the stormwater management program objectives include development with minimum adverse effects to the natural environment and encouraging preservation of the natural drainage systems in an aesthetically pleasing condition as best possible.

Storm drainage pipe and structure information shall be listed on each plan sheet for the stormwater system. The following information should be presented in a table format with corresponding pipe or structure numbers shown in plan view:

*Table 4-1 Required Stormwater System Information on Plan Sheets*

For Each Pipe	For Each Inlet
Diameter	Drainage area
Material	Grate type
Slope	Rim elevation
Length	Invert elevation



*Figure 4-1. Stormwater pipes*



*Figure 4-2. Storm drain inlet*

### 4.1 INLETS AND CATCH BASINS

Inlets and catch basins are the initial point of collection for stormwater drainage systems. They intercept the runoff and transmit it to an underground storm sewer system or route it to a system of surface swales or channels. Typical inlet and catch basin calculations include spread width and depth for street, and curb sections, capacity and overflow calculations for inlets. See Table 4-2 for standards to observe when analyzing and designing inlets and catch basins.

*Table 4-2. Design Standard for Inlets and Catch Basins*

Topic	Requirement
Design Intensity	<ul style="list-style-type: none"> <li>4 in/hr</li> </ul>
Spread	<ul style="list-style-type: none"> <li>For local and single-lane collectors: Spread in a travel lane should not exceed 6 ft at any given section, or 8 ft with a standard curb and gutter section</li> <li>For thoroughfares and multi-lane collectors: Spread should not exceed one-half of a travel lane on a two-lane roadway. May encroach a full travel lane on a four-lane roadway</li> <li>Spread depth may not exceed 6 inches or overtop the curb</li> </ul>
Sags	<ul style="list-style-type: none"> <li>Flow shall not overtop the curb in sags</li> </ul>
Inlet spacing along curb and gutter	<ul style="list-style-type: none"> <li>Should not exceed 500 feet</li> </ul>
Catch basin placement	<ul style="list-style-type: none"> <li>Place at lot lines to avoid conflict with driveways when feasible</li> </ul>
Yard inlets or catch basins within dedicated right-of-way or easements	<ul style="list-style-type: none"> <li>Shall meet NCDOT/City standards detailed in the Public Works Department <a href="#">Street Construction Specifications &amp; Details</a></li> </ul>
Curb and gutter catch basins	<ul style="list-style-type: none"> <li>Shall be designed to City of Statesville details and specifications set forth in Chapter 3 of the City’s Land Development Standards Manual (LDSM)</li> </ul>

## 4.2 PIPES AND CULVERTS

Pipes and culverts convey stormwater runoff from inlet and catch basin systems to detention structures, SCMs, or major drainage ways. Typical pipe and culvert calculations include flow capacity, velocity, erosion, scour, and internal pressure analysis. See Table 4-3 for design standards for stormwater pipes and culverts.

*Table 4-3. Design Standards for Pipes and Culverts*

Topic	Requirement
Design storm for pipes	<ul style="list-style-type: none"> <li>10-year storm</li> <li>Analyze 25-year storm to ensure the drainage system does not project property damage, public access or safety concerns</li> </ul>
Minimum pipe diameter	<ul style="list-style-type: none"> <li>15 inches</li> </ul>
Minimum pipe slope	<ul style="list-style-type: none"> <li>The minimum slope on all 15" pipe shall be 0.5%.</li> <li>Pipes larger than 15" should be sloped to allow a velocity of at least 2.5 feet per second for the 2-year storm</li> </ul>
Maximum pipe velocity	<ul style="list-style-type: none"> <li>20 feet per second</li> </ul>
Hydraulic grade line (HGL)	<ul style="list-style-type: none"> <li>The HGL should not be above the top of the pipe during the 10-year storm</li> </ul>
Design storm for culverts	<ul style="list-style-type: none"> <li>25-year storm for local and collector</li> <li>50-year storm for thoroughfares</li> </ul>
HW/D ratio for culverts in public easements	<ul style="list-style-type: none"> <li>Less than 1.5 for culverts that have cross sectional area less than or equal to 30 square feet</li> <li>Less than 1.2 for culverts that have a cross-sectional area greater than 30 square feet</li> <li>Design must avoid any inundation of public streets from headwater depths at culvert entrance or junctions</li> </ul>
Freeboard	<ul style="list-style-type: none"> <li>18 inches of freeboard shall be maintained for all roads and finished floor elevations of habitable structures on design storms other than the 100-year</li> <li>The 100-year design storm shall be routed through the pipe or culvert system to determine that the finished floor of residential dwellings, public, commercial, and industrial buildings will not be inundated by the 100-year floodwater surface elevation</li> </ul>

### 4.3 PIPE SPECIFICATIONS AND INSTALLATION

Table 4-4 outlines allowable storm sewer pipe materials and installation standards.

*Table 4-4. Pipe Specifications and Installation*

Material/Size	Specification
Reinforced Concrete Pipe (RCP)	<ul style="list-style-type: none"> <li>• Minimum Class III</li> <li>• Must meet AASHTO M170 or ASTM C76</li> <li>• Type II installation per ASTM C1479</li> <li>• Under public roads, rubber gasketed connections must meet ASTM C443 or ASTM C1628</li> </ul>
Polypropylene (PP)	<ul style="list-style-type: none"> <li>• Dual wall pipe meeting AASHTO M330, ASTM F2881, and ASTM F2764</li> <li>• Smooth interior and rubber gaskets meeting ASTM F477</li> <li>• Class III backfill compacted to 95% SPD to top of pipe</li> <li>• installation per ASTM D2321</li> <li>• Pipe joints shall pass lab performance testing per ASTM D3212</li> </ul>
Polyethylene (HDPE)	<ul style="list-style-type: none"> <li>• Dual wall pipe meeting AASHTO M294 or ASTM F2306</li> <li>• Smooth interior and rubber gaskets meeting ASTM F477.</li> <li>• Class II backfill compacted to 95% SPD to top of pipe</li> <li>• installation per ASTM D2321</li> </ul>
Pipe connections	<ul style="list-style-type: none"> <li>• Connections to structures may be grouted in place when HW/D in structures is less than 1.2</li> <li>• A resilient connection with long-term pressure rating that meets or exceeds design pressure head depths must be used when the energy grade line exceeds HW/D values</li> </ul>
Pipe horizontal distances	<ul style="list-style-type: none"> <li>• At least 5 feet from water and sanitary sewer mains</li> </ul>
Pipe vertical clearances	<ul style="list-style-type: none"> <li>• Minimum of 24 inches below sub-grade</li> <li>• Deep enough to accommodate drainage structures</li> <li>• Deeper than water mains</li> <li>• Minimum of 24" from sanitary sewer mains</li> <li>• Vertical clearances shall meet North Carolina standards (15A NCAC 18C .0906 and 15A NCAC 18A .1900)</li> <li>• Vertical information for pipes shall be clearly detailed on the construction plan/profile sheets</li> </ul>

### 4.4 CHANNELS

Channels provide an opportunity for surface water conveyance rather than an underground piped storm sewer system. Using channels can enhance water quality and reduce flooding by slowing the velocity and promoting infiltration into the soil. When maintained properly, they can also assist in capturing stormwater pollutants and infiltrating stormwater runoff. Typical channel calculations include flow capacity and velocity and erosion and scour analysis. Chapter 3 of the Charlotte-Mecklenburg Stormwater Design Manual provides additional design guidance on channel design.



Figure 4-3. Vegetated channel (USGS)

Often the term channel has been used interchangeably with the term swale. However, the City now considers them to be two different types of measures. Channels are designed solely for the safe conveyance of stormwater runoff. However, swales are designed to have a larger cross-section, lower velocities, and longer residence times. For guidance on swales as engineered SCMs, please refer to the [NCDEQ Stormwater Design Manual](#).

When designing channels, use Table 4-5 to determine design standards.

Table 4-5. Channel Design Standards

Topic	Design Requirement
Design Storm	<ul style="list-style-type: none"> <li>• 10-year storm must be below freeboard height</li> <li>• 25-year storm must be contained within the channel</li> <li>• 100-year design storm must be routed through the channel system to determine no finished floor of residential dwellings, public, commercial, and industrial buildings will be inundated by floodwater surface elevation</li> </ul>
Minimum Freeboard	<ul style="list-style-type: none"> <li>• Channels 3 feet or less in depth, 6 inches of freeboard shall be provided</li> <li>• Channels deeper than 5 feet shall maintain a freeboard of 18 inches</li> </ul>
Side Slopes	<ul style="list-style-type: none"> <li>• Side slopes shall be stable for the entire length and not exceed a slope of 3:1 (H:V)</li> </ul>
Longitudinal slopes	<ul style="list-style-type: none"> <li>• 2% is the preferred minimum</li> <li>• 7% is the maximum slope</li> </ul>

Topic	Design Requirement
Minimum easement requirements	<ul style="list-style-type: none"> <li>For private drainage outside the ROW, a 10ft easement is required</li> </ul>
Channel lining	<ul style="list-style-type: none"> <li>Vegetated linings should be used to the maximum extent practicable</li> </ul>
Velocity	<ul style="list-style-type: none"> <li>Permissible velocities shall be consistent with surface linings used</li> </ul>

#### 4.5 DRAINAGE EASEMENTS

Publicly maintained drainage pipes shall be located within the right-of-way at intersections and under pavement/curb elsewhere in street cross-section. Storm drainage easements are required for all portions of a storm system which convey runoff from public rights-of-way. All storm drainage easements must be shown on the plan sheet and labeled, “Storm Drainage Easement.” The applicant must declare who will maintain easements outside of the ROW (e.g., HOA, or property owner).

Plan and profile drawings are required for all portions of the stormwater system that will be within storm drainage easements developed for conveyance.

Minimum easement width for pipes with an inside diameter less than 24 inches and buried at depths less than 9 feet shall be 20 feet. For pipes with an inside diameter 24 inches or greater and/or buried at depths of 9 feet or greater, the minimum easement width shall be 30 feet, or as directed by the Stormwater Program Manager.



Figure 4-4. Pipe installation

# CHAPTER 5: TREATMENT + ATTENUATION REQUIREMENTS

## 5.1 VEGETATED BUFFERS

A vegetated buffer is an undisturbed area of natural or established vegetation adjacent to surface waters, through which stormwater runoff flows in a diffuse manner to protect surface waters from degradation due to development activities. Statesville requires a 30-foot vegetated buffer from all perennial and intermittent surface waters that is protected from land disturbance and the addition of BUA. The purpose of the vegetated buffer is to protect the streambank, support aquatic life, filter pollution, and provide some protection from flooding.

Currently, NCDEQ is in the process of developing state-mandated buffers for the High Rock Lake watershed. After this rule goes into effect, it will take the place of the City’s current ordinance provisions for vegetated buffers. Table 5-1 displays current requirements and the draft High Rock Lake rules for protection of vegetated buffers.

*Table 5-1. Buffer Requirements Before / After High Rock Lake Buffer Rule Implementation*

Feature	Before High Rock buffers	After High Rock buffers
Width	30 feet – undisturbed, no BUA	Total width is 50 feet: <ul style="list-style-type: none"> <li>• Zone 1: 30 feet – undisturbed, no BUA</li> <li>• Zone 2: 20 additional feet landward, may be disturbed and revegetated if Zone 1 vegetation is not compromised</li> </ul>
Location	<ul style="list-style-type: none"> <li>• For streams, measure from the top of bank</li> <li>• For impounded structures, measure from the normal pool elevation</li> </ul>	<ul style="list-style-type: none"> <li>• For streams, measure from the most landward limit of the top of bank or the rooted herbaceous vegetation</li> <li>• When the stream enters or exits a culvert or wetland, measure the buffer as a radius around the beginning and end</li> <li>• For ponds, lakes and reservoirs, measure from the normal water level</li> </ul>
Allowed uses	<ul style="list-style-type: none"> <li>• Required streets, facilities, utility mains and easements, and greenways</li> <li>• Roads and golf courses may cross at an angle of less than 60 degrees</li> </ul>	Allowed uses are provided in 15A NCAC 02B .0764



## CHAPTER 5: TREATMENT + ATTENUATION REQUIREMENTS

Currently in the City, the top of bank determination is usually consistent with the US Army Corps of Engineers “Ordinary High Water Mark” used in delineation of jurisdictional waters. In cases of conflicting interpretations by the Stormwater Program Manager and the applicant, the applicant will have the option of providing a jurisdictional determination, including tops of stream banks, from an individual certified by NCDEQ as qualified for Surface Water Identification.

### 5.2 CALCULATING PROJECT DENSITY

Project density influences whether a site will require SCMs for water quality and detention structures for water quantity. The density of a project is calculated by dividing the total BUA by the total project area. For projects with existing development, density can be determined either by this standard calculation or, alternatively, by subtracting the existing BUA from the total BUA and dividing that value by the total project area minus the existing BUA.

During application review, the City may, on a case-by-case basis, determine that a project contains both high- and low-density areas. This determination can be based on natural drainage area boundaries or variations in land use across the site.

### 5.3 LOW DENSITY REQUIREMENTS

A project is classified as low density when the drainage area contains less than 24 percent BUA. Low density projects should maximize dispersed flow through vegetated areas and minimize the channelization of stormwater. Any runoff that cannot be released as dispersed flow must be conveyed from the site using vegetated channels to the maximum extent practicable. The City will permit a minimal amount of non-vegetated channels, such as those needed for erosion protection or piping under driveways and roads, only when these features are unavoidable.

Vegetated conveyances must adhere to the following requirements:

- Side slopes must not be steeper than 3:1 horizontal to vertical unless it can be demonstrated to the City, through engineering calculations and on-site soil investigation, that the soils and vegetation will remain stable over time.
- The conveyance must be designed to prevent erosion during the peak flow from the 10-year storm event, as demonstrated by engineering calculations.

For low density projects, curb and gutter systems with outlets may be used to direct stormwater to grassed swales or vegetated areas if they meet the following requirements:

- Curb outlets must be designed so that the swale or vegetated area can convey the peak flow from a 10-year storm at a velocity that does not cause erosion.
- The longitudinal slope of the swale or vegetated area should not exceed five percent, unless physical constraints make this impractical. In such cases, measures

## CHAPTER 5: TREATMENT + ATTENUATION REQUIREMENTS

must be implemented to slow runoff and promote infiltration, helping to reduce pollutant transport.

- The swale cross-section should be trapezoidal, with a minimum bottom width of two feet.
- Side slopes for the swale or vegetated area should be no steeper than 3:1 (horizontal to vertical).
- The swale or vegetated area should have a minimum length of 100 feet.

### 5.4 HIGH DENSITY REQUIREMENTS

A new development project is classified as high density when the BUA is 24 percent or more of the total project area. High density projects are required to incorporate primary SCMs that:

- Manage and treat runoff from a 1-inch rainfall event.
- Comply with the Minimum Design Criteria (MDC) for SCMs as specified in [15A NCAC 02H .1050 through .1062](#) and the [NCDEQ Stormwater Design Manual](#).
- Regulate flooding so that the peak flow rate from the new development does not exceed the pre-development peak flow rate for the 2-year, 10-year, and 25-year, 24-hour storm events.
- Are located at least 30 feet from all perennial and intermittent surface waters, including the SCM itself, any fill slopes, and outlet structures related to the SCM.
- Provide an emergency overflow shall be adequately designed and constructed to convey the 50-year discharge.
- Discharge flows at non-erosive velocities for the 10-year storm via an energy dissipation device.

The NCDEQ Stormwater Design Manual provides siting guidance, design procedures, and maintenance steps and schedules for a range of SCMs. Primary SCMs (with links to NCDEQ design standards) that are well suited to Statesville's soil and topography include:

- [Bioretention cells](#)
- [Stormwater wetlands](#)
- [Wet ponds](#)
- [Permeable pavement](#)
- [Sand filters](#)
- [Infiltration systems](#) (where the soil is suitable)
- [Green roofs](#)

It is also acceptable to use underground detention or a dry pond to manage the 2-year, 10-year, and 25-year storm events, while providing a smaller primary SCM for water quality treatment of the 1-inch storm. This would be an especially helpful approach if the primary SCM were a green roof or a small bioretention cell that does not have enough capacity to control a larger storm event.

5.5 COMMON SCMS



Figure 5-1. Wet pond



Figure 5-2. Grassed bioretention cell



Figure 5-3. Stormwater wetland



Figure 5-4. Permeable pavers



Figure 5-5. Dry detention pond



Figure 5-6. Sand filter

## CHAPTER 6: SCM MAINTENANCE

---

This chapter details the requirements for regular inspections, operation, and maintenance of SCMs. Once a development is completed and the SCM has passed the final inspection, it will become the responsibility of the owner or association to maintain. Neglecting routine maintenance can compromise SCM effectiveness, increasing the risk of flooding, erosion, and property damage.

Failing to conduct routine maintenance can become costly when major structural failures occur. Suggested maintenance schedules for the most common types of SCMs can be found at the end of this chapter and additional guidance can be found in the NCDEQ Stormwater Design Manual as well as information on SCMs not covered in this chapter.

To ensure proper upkeep and annual compliance, the City requires developers and SCM owners to enter into an Operation and Maintenance Agreement.



*Figure 6-1. SCM outlet and dam failure*

### 6.1 OPERATION AND MAINTENANCE PLAN AND AGREEMENT

A signed operation and maintenance agreement must be received by the Stormwater Program Manager prior to plan approval. The agreement outlines the owner's responsibilities for operating and properly maintaining the SCMs. The owner must keep the SCMs in good working condition, to the City's satisfaction, and follow the long-term maintenance schedule provided in Section 6.4. The SCM maintenance plan must address both maintenance and monitoring procedures intended to prevent:

- Conditions of blocking, hindering or obstructing the natural or intended flow of surface waters;
- Improper operation of stormwater retention or impoundment device or any structure or device used for the improvement of the quality of surface runoff;
- Any condition that would damage the City's stormwater collection system or that would harm the quality of the City's waters; and
- Any conditions specifically declared to be dangerous to the public health, safety, and general welfare of the City's inhabitants.

Failure to properly operate and maintain stormwater facilities and SCMs in accordance with the approved Stormwater Plan is a violation of the City's UDO. This agreement will require annual inspections and timely maintenance, repair, and, in extreme cases, replacement of the SCM or major components. To see the full details of the operation and maintenance agreement, see Form E – Operation and Maintenance Agreement on the City's Stormwater Division web page.



*Figure 6-2. Well maintained sand filter in Statesville*

## 6.2 ANNUAL MAINTENANCE INSPECTION AND REPORT

As a requirement of the NPDES Phase II permit, the owner must have an annual inspection performed by a professional engineer or an individual certified in the state of North Carolina for maintenance and inspections of SCMs. A report detailing the findings of the inspection must be submitted to the Stormwater Program Manager. Inspection forms can be found on the City’s Stormwater Division website.

The report shall be submitted annually prior to the anniversary date of the final construction inspection and as-built certification. The report at a minimum must include the items listed in Table 6-1.

*Table 6-1. Required Items in the SCM Annual Maintenance Report*

	Required Item Description
1	The name and address of the landowner
2	The recorded book and page number of the lot of each SCM
3	A statement of completion of the inspection of the SCM(s) and the date the inspection was made
4	A statement that all inspected SCMs are performing properly and comply with the terms and conditions of the approved Operation and Maintenance Agreement required by this Ordinance
5	An action plan for restoring any SCM that is found to be out of compliance
6	The original signature and seal of the engineer inspecting the SCMs, or signature and certification number of the individual certified in the state of North Carolina for maintenance and inspections of SCMs
7	Digital photographs of the SCMs and pertinent components integral to its operation, including but not limited to inlet/outlet control structures, downstream receiving channel/area, embankments and spillways, safety features, and vegetation
8	It is also recommended that the owner have quarterly inspections performed and include these in the annual report to the City

Pursuant to the Statesville UDO Section 8.05, the property owner of the SCM(s) is required to maintain copies of inspection forms at least five (5) years from the date of creation of the record and shall submit the same upon reasonable request to the Stormwater Program Manager.

### 6.3 CITY INSPECTION

The City may conduct inspections or develop an inspection program on any reasonable basis. The nature of these inspections may include but are not limited to routine inspections; random inspections; inspections based upon complaints or other notice of possible violations; and joint inspections with other agencies inspecting under environmental or safety laws. Inspection activities may include, but are not limited to, reviewing maintenance and repair records; sampling discharges, surface water, groundwater and material or water in SCMs; and evaluating the condition of the SCM(s). If the owner or occupant of any property refuses to permit such inspection, the Stormwater Program Manager shall proceed to obtain an administrative search warrant pursuant to G.S. 15-27.2 or its successor. No person shall obstruct, hamper or interfere with the Stormwater Program Manager while carrying out the official duties of the City.

### 6.4 SCM MAINTENANCE SCHEDULES

The following tables outline the specific maintenance tasks and frequency for most types of SCMs. These tables represent a minimum set of tasks and prescribed schedules to perform maintenance. Routine and annual inspections may provide evidence to perform routine maintenance at a higher frequency than indicated in the tables.

*Table 6-2. Wet Pond Maintenance and Task Schedule*

Task	Frequency
Remove excess sediment if less than 2ft depth in forebay	Yearly
Measure main pool depth. Depth should be greater than or equal to the required design depth.	Yearly
Bank mowing and inspection/stabilization of eroded areas	Monthly
Outlet/inlet inspection and cleanout	Monthly
Unwanted vegetation and trash removal	Monthly
Visual inspection of water quality	Monthly
Inspect/exercise all mechanical devices, valves, etc.	Yearly
Inspect for structural damage, leaks, etc.	Yearly
Rodent management	As needed

Table 6-3. Dry Pond Maintenance and Task Schedule

Task	Frequency
Remove excess sediment if less than 2ft depth in forebay	Monthly
Bank mowing and inspection/ stabilization of eroded areas	Monthly
Outlet/inlet inspection and cleanout	Monthly
Unwanted vegetation and trash removal	Monthly
Inspect/exercise all mechanical devices, valves, etc.	Yearly
Inspect for structural damage, leaks, etc.	Yearly
Evaluate sediment level (remove as needed)	Yearly

Table 6-4. Stormwater Wetland Maintenance and Task Schedule

Task	Frequency
Remove excess sediment if less than 2ft depth in forebay	Monthly
Invasive species control/vegetation management and replanting to maintain design densities	Semi-annual
Bank mowing and inspection/stabilization of eroded areas	Monthly
Outlet/inlet inspection and cleanout	Monthly
Trash removal	Monthly
Visual inspection of water quality	Monthly
Rodent and mosquito management	As needed
Inspect/exercise all mechanical devices, valves, etc.	Yearly
Inspect for structural damage, leaks, etc.	Yearly
Evaluate sediment level (remove 20 years, or when plants are being impacted)	Yearly

Table 6-5. Bioretention Maintenance and Task Schedule

Task	Frequency
Sedimentation prevention: inspect surrounding drainage areas such as out parcels and parking lots	Monthly
Sediment removal	As needed
Inspect for proper drawdown/evidence of clogging (should drain within 24 hours)	Monthly
Perimeter mowing and inspection/stabilization of eroded areas	Monthly
Outlet/inlet inspection and cleanout	Monthly
Drop inlet inspection and cleanout	Monthly
Trash removal	Monthly
Pruning (if applicable)	Yearly
Mulch renewal (if applicable)	Yearly
Inspect plants and replace diseased or dead plants as needed	Semi-annual (spring and fall)

Table 6-6. Infiltration Trench Maintenance and Task Schedule

Task	Frequency
Remove trash and debris	Monthly
Inspect grass filter strip/pretreatment areas and repair/reseed as needed	Monthly
Inspect for proper drawdown/evidence of clogging (should drain within 24 hours)	Monthly
Remove weeds from filter stone: do not pull (may pull out media) Wipe with herbicide such as glyphosate and then return in a week to remove by hand	Monthly
Inspect observation wells following precipitation events to ensure proper infiltration	Monthly
Replace filter stone top layer	As needed

Table 6-7. Sand Filter Maintenance and Task Schedule

Task	Frequency
Forebay/sediment chamber inspection and cleanout: remove sediment when it exceeds 50% of storage volume	Monthly
Sedimentation prevention: inspection of surrounding drainage areas such as out parcels and parking lots	Monthly
Inspect for proper drawdown/evidence of clogging (should drain within 48 hours)	Monthly
Hand-pull weeds from sand media	As needed
Bank mowing and inspection/stabilization of eroded areas	Monthly
Drop inlet inspection and cleanout	Monthly
Outlet/inlet inspection and cleanout	Monthly
Trash removal	Monthly
Skim sand media	Yearly
Replace sand media	As needed (expect 3 years)

Table 6-8. Treatment Swales Maintenance and Task Schedule

Task	Frequency
Remove trash and debris	Monthly
Mowing (maintain approximately 3-6" height)	Monthly
Inspect for areas of bare soil/erosive gullies and repair/seed as needed	Monthly
Inspect condition of dispersion devices and check dams	Monthly
Remove unwanted vegetation (woody vegetation or invasives)	Monthly
Removal of sediment	Yearly

Table 6-9. Level Spreader-Filter Strip Maintenance and Task Schedule

Task	Frequency
Remove trash and debris	Monthly
Mowing (maintain approximately 3-6" height)	Monthly
Stabilization of eroded areas throughout the filter strip and below the flow dispersion device	Monthly
Remove unwanted vegetation (woody vegetation or invasives)	Monthly
Inspect flow splitter device (if applicable) and remove any sediment or blockages	Monthly
Inspect gravel diaphragm (if present) and remove sediment	Yearly
Repair or replace level spreader lip if it is cracked, undercut, eroded or damaged	As needed

Additional SCMs may be used, including those considered to be new stormwater technologies or proprietary systems. These include StormFilter by Contech, Silva Cell suspended pavement with bioretention by DeepRoot Green Infrastructure, Filterra by Contech, and BayFilter by ADS. Maintenance of these devices should be followed per the manufacturer’s recommendations.



Figure 6-3. Filterra plaque on catch



Figure 6-4. Filterra system in Statesville

# CHAPTER 7: GLOSSARY

---

Definitions marked with an asterisk (\*) are as defined in [15A NCAC 02H .1000 – Stormwater Management](#).

## **Built-upon area (BUA)**

As defined in G.S. 143-214.7D, BUA is impervious surface and partially impervious surface to the extent that the partially impervious surface does not allow water to infiltrate through the surface and into the subsoil. For the purposes of implementing State or local government stormwater programs, none of the following surfaces shall be considered "built-upon area" or an impervious or partially impervious surface:

- a slatted deck;
- the water area of a swimming pool;
- a surface of number 57 stone, as designated by the American Society for Testing and Materials, laid at least four inches thick over a geotextile fabric;
- a trail as defined in G.S. 113A 85 that is either unpaved or paved as long as the pavement is porous with a hydraulic conductivity greater than 0.001 centimeters per second (1.41 inches per hour); or
- landscaping material, including, but not limited to, gravel, mulch, sand, and vegetation, placed on areas that receive pedestrian or bicycle traffic or on portions of driveways and parking areas that will not be compacted by the weight of a vehicle, such as the area between sections of pavement that support the weight of a vehicle.
- Artificial turf, manufactured to allow water to drain through the backing of the turf, and installed according to the manufacturer's specifications over a pervious surface.

## **Development**

Any land-disturbing activity that increases the amount of BUA or that otherwise decreases the infiltration of precipitation into the subsoil. When additional development occurs at a site that has existing development, the BUA of the existing development shall not be included in the density calculations for additional stormwater control requirements, and stormwater control requirements cannot be applied retroactively to existing development, unless otherwise required by federal law.

## **Dispersed flow\***

Uniform shallow flow that is conveyed to a vegetated filter strip as defined in 15A NCAC 2H .1059, another vegetated area, or SCM. The purpose of "dispersed flow" is to remove pollutants through infiltration and settling, as well as to reduce erosion prior to stormwater reaching surface waters.

**High density project\***

A development project that exceeds the low density threshold for BUA.

**Instrument of title**

Any recorded instrument that affects title or constitutes the chain of title to real property, including, but not limited to, all deeds, wills, estate documents evidencing transfer of title, plats, surveys, easements, rights-of-way, outstanding mortgages and deeds of trust, judicial orders or decrees, and documents evidencing intestate succession.

**Larger common plan of development or sale**

Any area where multiple separate and distinct construction or land-disturbing activities will occur under one plan. A plan is any announcement or piece of documentation (including but not limited to a sign, public notice or hearing, sales pitch, advertisement, loan application, drawing, permit application, zoning request, or computer design) or physical demarcation (including but not limited to boundary signs, lot stakes, or surveyor markings) indicating that construction activities may occur on a specific plot.

**Low density project\***

A development project that has less than 24 percent BUA for all residential and non-residential development

**Minimum design criteria (MDC)\***

The requirements set forth in 15A NCAC 02H .1050 for siting, site preparation, design and construction, and post-construction monitoring and evaluation necessary for the City of Statesville to issue stormwater permits that comply with State water quality standards adopted pursuant to G.S. 143-214.1

**Municipal Separate Storm Sewer System (MS4)**

A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains):

1. Owned and operated by a state, city, borough, county, parish, district, association, or other public body (created by or pursuant to state law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under state law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the Clean Water Act (CWA) that discharges to waters of the United States;
2. Designed or used for collecting or conveying stormwater;
3. Which is not a combined sewer; and
4. Which is not part of a publicly owned treatment works (POTW).

### **Non-erosive velocity\***

The flow rate of water, usually measured in feet per second, that does not exceed the maximum permissible velocity for the condition and type of soil and groundcover over which the water is flowing. Erosion occurs when the maximum permissible velocity is exceeded.

### **n-year, 24-hour storm\***

A storm of a 24-hour duration with a precipitation total expected to be equaled or exceeded, on average, 1 in n chances in 12 months.

### **NPDES**

National Pollutant Discharge and Elimination System, a provision of the Clean Water Act which prohibits discharge of pollutants into waters of the United States unless a special permit is issued by EPA, a state, or, where delegated, a tribal government on an Indian reservation.

### **NRCS Soil Survey**

A soil survey is a detailed report on the soils of an area with maps with soil boundaries and photos, descriptions, and tables of soil properties and features. Soil surveys are used by farmers, real estate agents, land use planners, engineers and others who desire information about the soil resource. The survey is produced and published by the National Resources Conservation Service.

### **Owner**

The legal or beneficial owner of land, including but not limited to a mortgagee or vendee in possession, receiver, executor, trustee, or long-term or commercial lessee, or any other person or entity holding proprietary rights in the property or having legal power of management and control of the property. "Owner" shall include long-term commercial tenants; management entities, such as those charged with or engaged in the management of properties for profit; and every person or entity having joint ownership of the property. A secured lender not in possession of the property does not constitute an owner, unless the secured lender is included within the meaning of "owner" under another description in this definition, such as a management entity.

### **Primary SCM\***

A wet pond, stormwater wetland, infiltration system, sand filter, bioretention cell, permeable pavement, green roof, rainwater harvesting, or an approved new stormwater technology that is designed, constructed and maintained in accordance with the MDC.

### **Project\***

The proposed development activity for which an applicant is seeking a stormwater permit from the City. "Project" shall exclude any land adjacent to the area disturbed by the project that has been counted as pervious by any other development regulated under a federal, State, or local stormwater regulation. Owners and developers of large developments consisting of many linked projects may consider developing a master plan that illustrates how each project fits into the design of the large development.

### **Receiving Waters**

All natural water bodies, including oceans, salt and freshwater marsh areas, lakes, rivers, streams, ponds, wetlands, and groundwater. Stormwater management ponds, wetlands, ditches, and swales constructed for the sole purpose of controlling and treating stormwater are excluded.

### **Redevelopment**

Any development on previously developed land. For purposes of Statesville UDO Section 8.05, a rebuilding activity that results in no net increase in BUA and provides equal or greater stormwater control than the previous development is exempt from requirements related to redevelopment.

### **Secondary SCM\***

An SCM that does not achieve the annual reduction of Total Suspended Solids (TSS) of a "Primary SCM" but may be used in a treatment train with a primary SCM or other Secondary SCMs to provide pre-treatment, hydraulic benefits, or a portion of the required TSS removal.

### **Sheet Flow**

Conveyance of surface water or runoff at a depth significantly less than the width of the flow path on which it flows. Sheet flow is maintained until the flow begins to concentrate into rills or micro- channels. The purpose for sheet flow in regards to this Ordinance is that sheet flow maintains a lower energy and higher surface area of contact with the flow path than concentrated flow.

### **Stormwater Management Plan**

Stormwater management plan or SWMP means the set of drawings and other documents that comprise all the information and specifications for the programs, drainage systems, structures, SCMs, concepts, and techniques for the control and treatment of stormwater pursuant to Statesville UDO Section 8.05.

### **Stormwater Approval**

An approval issued by the Stormwater Program Manager to the Applicant to issue a site plan or subdivision approval or for Iredell County to issue a grading permit. The approval grants permittee the right to discharge stormwater to the City's MS4 or receiving waters where compliance with the requirements and conditions of the Statesville UDO Section 8.05 are achieved through planning and engineering and maintained by operation and maintenance of post-construction stormwater management system.

### **Stormwater Control Measure (SCM)\***

A permanent structural device designed, constructed, and maintained to remove pollutants from stormwater runoff by promoting settling or filtration; or to mimic the natural hydrologic cycle by promoting infiltration, evapo-transpiration, post-filtration discharge, reuse of stormwater, or a combination thereof; to approximate the pre-development hydrology on a developed site; or to achieve any combination of these goals. SCMs include physical practices such as constructed wetlands, vegetative practices, filter strips, grassed swales, and other methods installed or created on real property. "SCM" is synonymous with "structural practice," "stormwater control facility," "stormwater control practice," "stormwater treatment practice," "stormwater management practice," "structural stormwater treatment systems," and similar terms used in this manual.

### **USGS Maps**

A series of topographic maps developed and published by the United States Geological Survey. The maps, also known as quadrangle maps, depict 7.5-minutes of the Earth's surface at 1:24,000 scale.

### **Vegetated Buffer**

An undisturbed area of natural or established vegetation adjacent to surface waters, through which stormwater runoff flows in a diffuse manner to protect surface waters from degradation due to development activities.

### **Vegetated Conveyance\***

A permanent, designed waterway lined with vegetation that is used to convey stormwater runoff at a non-erosive velocity within or away from a developed area.

## REFERENCES

---

City of Charlotte. (2014). [\*Storm Water Design Manual\*](#).

City of Statesville. (2024). *Unified Development Ordinance*. [\*Section 8.05, Stormwater Management\*](#).

City of Statesville. (2023). [\*Street Construction Specifications & Details\*](#).

Kuichling, E. (1889). “[\*The relation between the rainfall and the discharge of sewers in populous areas\*](#).” Trans. ASCE, 20, 1–56

NOAA Hydrometeorological Design Studies Center. (2025). [\*Precipitation Frequency Data Server \(PFDS\)\*](#).

North Carolina Department of Environmental Quality. (2010). [\*Methodology for Identification of Intermittent and Perennial Streams and Their Origins\*](#).

North Carolina Department of Environmental Quality. (2017a). [\*Stormwater Design Manual\*](#).

North Carolina Department of Environmental Quality. (2017b). [\*Stormwater Rules and Regulations\*](#).

Schueler, T. 1987. [\*The Simple Method to Calculate Urban Pollutant Loads\*](#).

United States Department of Agriculture. (2025). [\*Web Soil Survey\*](#).

United States Department of Agriculture, Natural Resources Conservation Service. (2020). Title 210, [\*National Engineering Handbook, Part 630\*](#).