



City of Chattanooga
Rainwater Management Guide (RMG) – Addendum # 1
Effective Date – 11/29/2017

This Addendum shall be used in conjunction with the December 1, 2014 edition of the City of Chattanooga's *Rainwater Management Guide* (RMG) to regulate stormwater control measure design, operation, and maintenance. The latest edition of the *Rainwater Management Guide* can be downloaded at the following web address: <http://chattanooga.gov/public-works/water-quality-program/resource-rain>. The addenda noted below are the City of Chattanooga's additions, clarifications, and exceptions based on the revised City Stormwater Ordinance, approved by Chattanooga City Council on November 21 and 28, 2017, and became effective upon signature by the Mayor and City Council Chairperson, as well as knowledge gained over the past three years of Stormwater Control Measures implementation.

This document shall have an effective date of November 29, 2017.



William C. Payne, PE
City Engineer – Engineering Department
Public Works – City of Chattanooga

11-29-17

Date



John T. Kinder, PE
Site Development Manager – Land Development Office
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11-29-17

Date

General Comments (Apply to the Entire RMG):

Overview

Below are some clarifications and changes to the Stay-On Volume (SOV) calculation method:

1. SOV is required when there is 1 acre or more of disturbed area.
2. Calculations for SOV may be based on impervious area only (not disturbed area, as before).
3. As before, SOV will be below perforated outlet pipes or Internal Water Storage (IWS). TSS only above these areas.
4. The entire City of Chattanooga will use 1.0" of rainfall for SOV. The South Chickamauga watershed no longer requires 1.6" for rainfall.
5. SOV may still be used to adjust Curve Numbers. However, only SOV may be used for this CN adjustment.
6. Impervious area disconnection may only be used for SOV calculations. All other stormwater calculations are not allowed to use disconnection.

Concept, preliminary, and final meetings/submittals are no longer required. One may voluntarily schedule any of the above with the City of Chattanooga as needed.

Disturbed/undisturbed areas are to be clearly delineated on the design documents. Drawings and calculations without undisturbed areas clearly labeled will be assumed to have disturbance for the entire property area. Measures describing how the undisturbed areas will be protected in the field must also be specified and installed prior to clearing, grading, or land disturbance.

A properly completed LDP checklist (in Excel) is required at the time of each LDP submittal and/or resubmittal.

Calculation Methodology

One may use the *Runoff Reduction Analysis Tool* (RRAT) and Tennessee *Permanent Stormwater Management and Design Guidance Manual* by TDEC, if desired (see: <http://tnpermanentstormwater.org/index.asp?vp=1>), instead of the City of Chattanooga's LID Calc Tool spreadsheet and *Rainwater Management Guide* or *WinSLAMM*. However, only one may be used for a project, and not a combination. When using RRAT or WinSLAMM, one is required to perform flood control calculations as there are currently no Curve Number adjustments in those tools (see Chattanooga Ordinance 31-313.7).

Worksheet 1 of the Chattanooga LID Calc Tool spreadsheet must be completed for all projects disturbing one acre or more and are located outside of the Chattanooga combined sewer area, including those using green infrastructure, modified green infrastructure, proprietary, man-made devices, or extended detention.

Site Infeasibilities and Procedures

Unless a site or portion of a site is documented and approved as “infeasible,” Stay-On Volume (SOV) is still required. That portion of the site that is not approved as “infeasible” will still be required to use SOV. Documentation shall include, but not be limited to, the City of Chattanooga’s *Stay-On Volume Infeasibility Application*.

Sites previously approved by the City of Chattanooga’s Land Development Office under the RMG will be deemed as being “feasible” and will not be changed to being “infeasible” unless new, documented field evidence indicates the previously approved plan is not able to be constructed as previously designed and approved. Any false information submitted to the City of Chattanooga may be referred to the appropriate Tennessee State Board for disciplinary action.

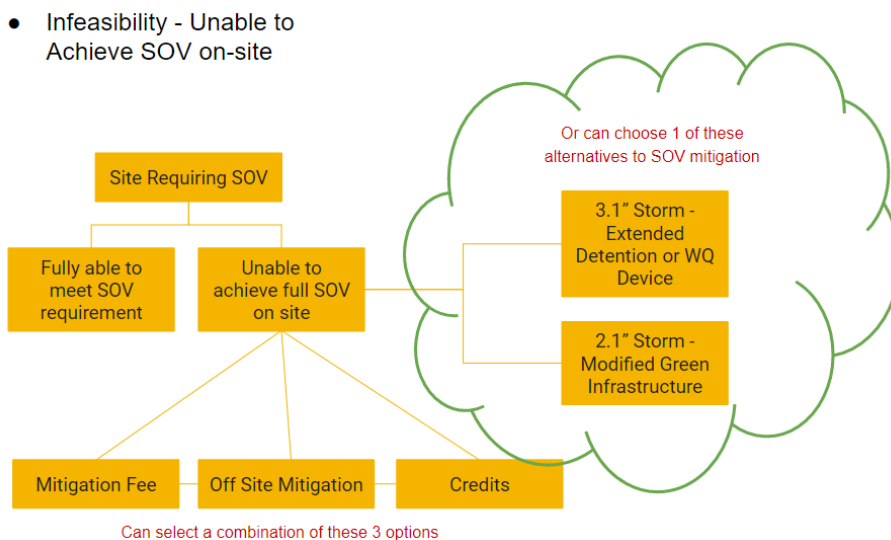
“Infeasibility Criteria” means documenting that a site or portion of a site is ineligible to implement some combination of Stay-On Volume (SOV) measures. Limitations to the installation of runoff reduction measures include, but are not limited to, physical site infeasibilities such as:

1. Groundwater pollution potential (hotspots)
2. Soil contamination (brownfields certified by TDEC)
3. Karst geology/sinkholes
4. Limited infiltration capacity (< 0.5 in./hr.)
5. High permanent groundwater table (< 2 feet to water table from bottom of proposed SCM)

On projects where conventional, onsite SCM’s are infeasible for SOV, offsite mitigation and/or use of coupons are still allowed. However, in-lieu of offsite mitigation or using coupons, one or a combination of the following methods may be used to remove a minimum of 80% TSS from the stormwater when “infeasibility criteria” has been met:

1. modified green infrastructure using 2.1” storm, and/or
2. extended detention pond using 3.1” storm, and/or
3. proprietary, man-made devices meeting NJCAT verification (www.njcat.org) and using 3.1” storm.

The following diagram below illustrates this process:



Modified green infrastructure is defined as green infrastructure SCM's that are unable to provide adequate SOV through infiltration, evapotranspiration, or rainwater harvesting, but having amended soil, stone, perforated pipe, orifice to reduce flows, and other features to allow a slow release of filtered stormwater.

Both green infrastructure and modified green infrastructure are required to have loading ratios at or below the target loading ratio shown on the Chattanooga LID Calc spreadsheet.

Extended detention ponds are defined as detention ponds that provide for the temporary storage of stormwater runoff for some minimum time (e.g., 24 to 72 hours) to allow suspended sediments and other associated pollutants to settle to the pond bottom, and therefore, not discharge to downstream channels. Extended detention ponds shall be designed in accord with the TDEC/UTK manual, *Tennessee Permanent Stormwater Management and Design Guidance Manual*. When using this method, TDEC/UTK's Treatment Volume (Tv) = Chattanooga's Stay-On Volume (SOV) using 3.1" of rainfall (or, SOV = 3.1" X R_v X A (in ft.²) X (1 ft./12 in.)). Peak flow attenuation for the 2-year, 5-year, 10-year, and 25-year storm events are still required, and check for the 100-year storm event. A forebay must be located at each major inlet to the pond. Low-flow orifices 3" or less shall have perforated pipes in stone with geo-wrap, or other acceptable means to prevent clogging. Low-flow orifices shall be sized using the following equation:

$$a = \frac{2A(H-H_0)^{0.5}}{3600CT(2g)^{0.5}}$$

Where:

a	=	Area of orifice (ft ²)
A	=	Average surface area of pond (ft ²)
C	=	Orifice coefficient, 0.66 for thin, 0.80 for materials thicker than the orifice dia.
T	=	Drawdown time of pond (hrs.), must be greater than 24 hours
g	=	Gravity (32.2 ft./sec. ²)
H	=	Elevation when pond is full to storage height (ft.)
H ₀	=	Final elevation when pond is empty (ft.)

"Grandfathering" Procedures

For sites seeking "grandfathering," written evidence must be provided that prior LDP approval from the City of Chattanooga was actually obtained before December 1, 2014, along with copies of all approved construction plans (i.e., drawings, hydrology report, etc...). Projects submitted without approved construction plans will be reviewed as if "grandfathering" was not requested, or, not accepted for review until said documentation is provided. "Grandfathered" sites will be considered exempted from certain permanent stormwater treatment requirements, such as SOV, but will not be exempted from other requirements of the City of Chattanooga that may currently be required (such as zoning, landscaping, detention, ADA, etc...). For subdivisions with a Preliminary Plat and approved construction documents before December 1, 2014, a new Preliminary Plat and new Land Disturbance Permit will still be required (since Preliminary Plat approval expires in two years).

Landscaping Criteria

For a listing of suggested bioretention and wetland plants, please refer to the *Tennessee Permanent Stormwater Management and Design Guidance Manual – Appendix D*, or Nashville's *Metro Stormwater Management Manual – Vol. 5 – Low Impact Development – Bioretention – GIP – 01* – pages 22-28, unless said plants are restricted by City of Chattanooga tree or landscaping ordinances. Additionally, bioretention and rain gardens plant placement may be in accord with templates found at: *Rain Gardens for Nashville: A Resource Guide for Planning, Designing, and Maintaining a Beautiful Rain Garden*. A Tennessee Professional Landscape Architect may also recommend other plants not on these lists.

For landscaping associated with new or existing construction of buildings 5,000 sf or more or greater than two stories, the use of a Tennessee State Board of Architectural and Engineering registrant (architect, engineer, or landscape architect) is required. For non-building /landscape related projects where site improvements are 5,000 sf or more in area, a registrant is also required (see *The Tennessee Board of Architectural and Engineering Examiners Reference Manual for Building Officials and Design Professionals*, Question # 26, Page 11, dated December 2015). A Tennessee Professional Landscape Architect is required to certify/stamp planting plans for rain gardens, bioretention, and constructed wetland areas (see *City of Chattanooga Policy Statement – Water Quality/Landscape Architecture*, dated January 4, 2011).

For bioretention, rain gardens, and constructed wetland areas, native plant species are preferred over non-native species. Invasive or exotic species are not allowed (see: <http://www.tnipc.org/invasive-plants/> for list of such plants in Tennessee). In general, the vegetative goal is to achieve surface area coverage of at least 75% in the first two years.

Construction Criteria

Observation wells/ports are required for each underground SCM. Observation wells/ports shall be tied into any T's or Y's in the underdrain system, or installed at one per 50 linear feet of practice. Also, a hook screw shall be installed a few inches from the top of the observation well/port to allow a data logger to measure the SCM drawdown rate. The drawdown rate should be measured at the observation well for three (3) days following a storm event in excess of 0.5 inches. If standing water is observed or measured after 72 hours, this will be considered a clear sign that the SCM is not functioning properly and will need to be repaired and/or replaced.

Chattanooga odor control structures (Chattanooga Standard # SD-310.01) are still required as needed on stormwater structures for combined sewer areas.

All Stormwater Control Measures (SCM's), including disconnection, require permanent stormwater easements and shall be recorded as part of the Inspection and Maintenance Agreement.

SCM's shall not be installed until the site is substantially stabilized. Exceptions may be made when other special construction measures are used to prevent sediment from damaging the SCM's during construction. Otherwise, damaged and/or SCM's not functioning as designed will need to be replaced before approval by the City of Chattanooga.

Individual Chapter Comments:

Chapter 1 – No changes.

Chapter 2 – No changes.

Chapter 3 –

p. 3-3 – Table 3-1 is no longer accurate. The Simple Method is not required and may be deleted. Additionally, sites between 5,000 sf and 1.0 acre are not required to use the Performance Method; therefore, SOV for sites less than one acre is not required.

p. 3-10 – As previously stated, the Simple Method is not required and may be deleted.

Chapter 4 –

pp. 4-1ff - As previously stated, Concept, Preliminary, and Final Meetings are no longer mandatory, but are voluntary only (though encouraged).

Chapter 5 –

p. 5-5 – Figure 5-1 should include a new reference to dry extended detention ponds, as referenced in the General Comments section of this Addendum.

p.5.3.4-18 – Perforated underdrains with Internal Water Storage (IWS) are required for all bioretention areas, as found in the *Tennessee Permanent Stormwater Management and Design Guidance Manual – Section 5.4.6 – Bioretention – pp. 149.*

p. 5.3.10-7 - For clarification, disconnection:

- a. Must be sheetflow (depths of 0.1' or less). Shallow, concentrated flow is not allowed.
- b. Pervious flow length must be at least twice as long as the impervious flow length.
- c. Receiving pervious area must be at least twice as large as the contributing impervious area.
- d. Permanent stormwater easements are required for the disconnection areas and shall be recorded as part of the Inspection and Maintenance Agreement.
- e. Disconnection not meeting (b) and (c) above may be prorated if a minimum of 50% of the required lengths and areas are provided. Other criteria listed in the RMG still apply, including maximum allowable impervious area per disconnection.
- f. Disconnection may only be used for SOV/green infrastructure calculations (not flood control calculations).

p. 5.3.12-1ff – As previously stated in the General Comments section of this Addendum, proprietary, man-made devices must have NJCAT verification (www.njcat.org) and use 3.1" of rainfall for design purposes. No SOV or detention allowances will be given for these devices. Proprietary, man-made SCM devices must be installed upstream (not downstream) of detention facilities. Inlet filter/bag systems are allowed for retrofit projects only and not for new construction projects.

Chapter 6 – No changes.

Chapter 7 –

p. 7-4 – Calculations may be made using either the Small Storm Hydrology Method (as per the Chattanooga LID Calc Tool spreadsheet), WinSLAMM, or TDEC Runoff Reduction Analysis Tool (RRAT). However, one may not use a combination of the above methodologies on any one project.

p. 7-4 – SOV calculations may be based on impervious areas only, not disturbed areas.

p. 7-17 – Update Table 7-2 to include the following TSS % Reduction Rates.

<u>Stormwater Control Measure (SCM)</u>	<u>TSS Removal % for SCM's</u>
Pervious Pavement	65
Infiltration Bed	80
Infiltration Trench	65
Bioretention	85
Vegetated Swales	25
Vegetated Filter Strips	30
Infiltration Berms	25
Green Roofs	N/A
Runoff Capture and Reuse	N/A
Disconnection of Impervious Areas	N/A
Stormwater Planter Box	15
Manufactured Devices	50 – 80
Naturalized Basins	80
Extended Detention (w/o perm. pool of water)	40
Extended Detention (w/ perm. pool and 24-hr. min. release rate)	60
Extended Detention (w/ perm. pool and 48-hr. min. release rate)	80

When using two or more SCM's as part of a "treatment train," the TSS % removed are not directly added together, but use a "treatment train" calculation of:

$$TSS_{train} = A + B - ((A \times B)/100)$$

where: TSS_{train} = total TSS removal for treatment train (%)
A = % TSS removal of the first (upstream) SCM (from the table above)
B = % TSS removal of the second (downstream) SCM (from the table above)

For development sites where the "treatment train" provides the only stormwater treatment on the site, TSS_{train} must be equal to or greater than 80%.

p. 7-26 – For clarification, in order for Curve Numbers to be adjusted, one must actually use SOV or green infrastructure (i.e., keep the stormwater onsite). Measures used to treat the stormwater with 80% TSS reduction, such as modified green infrastructure, man-made, proprietary devices, or extended detention, will not be allowed to use adjusted CN's.

Chapter 8 – No changes.

Appendices Comments:

Appendix A – No changes.

Appendix B – No changes.

Appendix C –

p. C-9 – Increase the pre-soak period from 1 – 2 hours, to a minimum of 24 hours. After the 24-hour pre-soak period, refill the percolation hole with 2 feet of clean water and measure the drop in water level after one hour. Repeat the procedure three (3) additional times by filling the percolation test hole with clean water and measuring the drop in water level after one hour. The infiltration rate of the underlying soil may be reported either as the average of the four readings or the value of the last observation. The infiltration rate should be reported in terms of inches per hour.

p. C-9 – Infiltration tests should be performed at the following minimum rates based on the area of the SCM:

< 1,000 sf – 2 tests

1,000 – 10,000 sf – 4 tests

>10,000 sf – 4 test, plus 1 additional test for every 5,000 sf or fraction thereof.

Additional tests may be required when infeasibility for infiltration is being sought for a project. Infiltration testing for infeasibility verification will be required at each proposed SCM natural point of discharge in order to confirm infeasibility. The “natural point of discharge” is defined as the invert of the SCM infiltration practice.

Appendix D – No changes.

Appendix E – No changes.

Appendix F –

p. F-3 – 5 – Bioretention and/or amended soil should generally be loamy sand with the following composition: 85% to 88% washed, coarse sand; 8% to 12% soil fines; and 3% to 5% organic matter from pine bark, with a P-Index between 10 to 30, a minimum infiltration rate of 0.5 inches per hour, and a clay content less than 6%. For additional information, refer to the bioretention soil requirements found in the *Tennessee Permanent Stormwater Management and Design Guidance Manual – Section 5.4.6 – Bioretention – pp. 147 – 148*.

Appendix G – No changes.

Appendix H – No changes.

Appendix I – No changes.

Appendix J – No changes.

Appendix K –

p. K -1 – 36 - As previously stated, South Chickamauga watershed no longer requires using 1.6", nor is SOV required for pervious areas. However, the rest of the information should still be accurate and useful for design purposes.

Credit and Incentives Manual Comments:

p. 12 – 5.2 – “Table of Discount Provisions” - delete the line regarding New Development in South Chickamauga.

p. 14 – 6.1(c)(1) – Delete this section since the timeframe has already passed.

p. 16 – 6.2 – “Table of Credit Provisions” - delete the line regarding New Development in South Chickamauga and all references to the Yr 1 through Yr 3 timeframes.

p. 19 – 7.2 – “Table of Fee Applicability” - delete the line regarding New Development in South Chickamauga and all references to the Yr 1 through Yr 3 timeframes.

Appendix A – “Credit and Incentives Summary Chart” - delete the line regarding New Development in South Chickamauga, as well as the footnote for Yr 1 through Yr 3.

Appendix C – The Inspection and Maintenance Agreement on this page is no longer current. Please use the ones found at the Chattanooga RMG website:
<http://chattanooga.gov/public-works/water-quality-program/resource-rain>.

References and Additional Resources:

City of Chattanooga Rainwater Management Guide and Resource: Rain Information.
<http://chattanooga.gov/public-works/water-quality-program/resource-rain>

City of Nashville's Metro Stormwater Management Manual.
<https://www.nashville.gov/Water-Services/Developers/Stormwater-Review/Stormwater-Management-Manual.aspx>

International Stormwater BMP Database.
<http://www.bmpdatabase.org/performance-summaries.html>

Knox County, TN Stormwater Management Manual, Volume 2.
<https://www.knoxcounty.org/stormwater/volume2.php>

National Pollutant Removal Performance Database.
<http://www.stormwaterok.net/CWP%20Documents/CWP-07%20Nat%20Pollutant%20Removal%20Perform%20Database.pdf>

NJCAT Stormwater Technologies: Laboratory Verified.
<http://njcat.org/verification-process/technology-verification-database.html>

Rain Gardens for Nashville: A Resource Guide for Planning, Designing, and Maintaining a Beautiful Rain Garden.
<https://ag.tennessee.edu/tnyards/Documents/Rain%20Garden%20Brochure%20Metro%20Nashville.pdf>

Tennessee Invasive Plant Council – Invasive Plant List.
<http://tnipc.org/invasive-plants/>

Tennessee Permanent Stormwater Management and Design Guidance Manual.
<http://tnpermanentstormwater.org/manual.asp>