A-1. Runoff Treatment and Volume Match

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Overview

High density developments are required to treat stormwater from all built-upon areas such as roads, roofs and driveways. The rules offer two options for treating that stormwater: Runoff Treatment and Runoff Volume Match. Runoff treatment involves treating the stormwater from the site in a Primary SCM. Runoff volume match typically sets a higher bar: not only is the stormwater treated, but the hydrology of the area is maintained by using SCMs that infiltrate and evapo-transpire the stormwater. Runoff volume match does provide more flexibility to under-treat some small areas of the project in exchange for over-treating other areas.

What do the Rules Say?

15A NCAC 02H .1003(3) DESIGN REQUIREMENTS FOR HIGH DENSITY PROJECTS.
. . . High density projects shall meet the following minimum design criteria:
(a) TREATMENT REQUIREMENTS. SCMs shall be designed, constructed, and maintained so that the project achieves either "runoff treatment" or "runoff volume match" as those terms are defined in Rule .1002 of this Section. . .

Runoff treatment and runoff volume match differ in the goals that the designer is seeking to attain. Here is a brief synopsis:

- Runoff treatment is the traditional way that stormwater has been managed in North Carolina, with each drainage area from a project equipped with one Primary SCM to treat the stormwater runoff. Under the runoff treatment approach, a project is equally compliant with state rules regardless of whether the SCM treats runoff and releases it as surface discharge or infiltrates and evapo-transpires stormwater.

- Runoff volume match is how DEQ defines “Low Impact Development.” The runoff volume match goal is to keep the volume of stormwater runoff on an annual basis similar both before and after development. This approach helps to protect the receiving stream’s hydrology, structure and use support. Under runoff volume match, the majority of the project must be treated by SCMs that infiltrate and evapo-transpire stormwater; however, a small portion of the project’s stormwater may typically be released without treatment (this helps to retain hydrology to the receiving waters).

Runoff Treatment

15A NCAC 02H .1002 (43) "Runoff treatment" means that the volume of stormwater runoff generated from all of the built upon area of a project at build-out during a storm of the required storm depth is treated in one or more primary SCMs or a combination of Primary and Secondary SCMs that provides equal or better treatment.

15A NCAC 02H .1002 (37) "Primary SCM" means 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.

15A NCAC 02H .1002 (46) "Secondary SCM" means 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.

The definition of runoff treatment allows stormwater from the site to be treated in one or more Primary SCMs, which are clearly defined in the stormwater “definitions” rule as shown above. The definition of runoff treatment allows the use of a combination of Primary and Secondary SCM that provides equal or better treatment. DEQ anticipates that the most likely pairings of Primary and Secondary SCMs on a single drainage area will be as follows:

- Installing a Disconnected Impervious Surface (DIS) upslope of any Primary SCM to infiltrate some of the stormwater and reduce the volume needed in the Primary SCM.

- Installing a Dry Pond either up or downslope of a Bioretention Cell or Sand Filter to provide flood control with water quality treatment, respectively.

Currently, DEQ is not aware of any combinations of only Secondary SCMs that provide equal or better treatment as a primary SCM. However, per 15A NCAC .1003(6)(a), applicants may propose a plan to use Secondary SCMs in series if they provide technical justification based on engineering calculations and the results of research studies showing that the proposed design provides equal or better stormwater control and equal or better protection of waters of the State than the Primary SCMs and that it shall function in perpetuity. The permitting authority shall have the option to require compliance with the MDC in the event that the alternative SCM design fails.

Runoff Volume Match

15A NCAC 02H .1003 (44) "Runoff volume match" means that the annual runoff volume after development shall not be more than ten percent higher than the annual runoff volume before development, except in areas subject to SA waters requirements per Rule .1019 of this Section where runoff volume match means that the annual runoff volume after development shall not be more than five percent higher than the annual runoff volume before development.

This definition may look a bit complicated but the purpose is actually simple; that is, to create development sites that disrupt the hydrology of the receiving stream as little as possible.

> When natural areas that infiltrate or evapo-transpire the majority of the annual rainfall are replaced with hard surfaces like pavement and roads, the result is a lot more surface stormwater runoff. Even when detention SCMs like wet ponds are provided, the additional surface runoff disrupts the hydrology of the receiving water and often causes issues with streambank stability and habitat destruction.
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> This disruption in hydrology can be addressed by directing runoff from hardened surfaces to SCMs that mimic the natural landscape's ability to infiltrate and evapo-transpire stormwater. Another option is to employ SCMs that store and use stormwater for other purposes. These SCMs that protect hydrology include infiltration systems, permeable pavement, bioretention cells, rainwater harvesting systems, green roofs and disconnected impervious surfaces.

The definition of "runoff volume match" was created in cooperation with a stakeholder team that included engineering consultants, local governments, NC University system, and environmental groups. The purpose of the definition is to expand upon the NC Low Impact Development (LID) Guidebook, which states that LID "maintains and restores the hydrologic regime by creating a landscape that mimics the natural hydrologic functions of infiltration, runoff, and evapotranspiration." This accurately describes the goal of LID, but it does not provide the public with a quantitative way to determine whether or not a given project implemented enough LID techniques to be considered an LID.

Often the development community perceives that LID requires the use of multiple smaller stormwater control measures (SCMs). While this is certainly a reasonable approach to LID, it is not required. For example, a single centralize infiltration system is a valid strategy for creating an LID development. On a particular project, the owner may select any combination of LID techniques and receive corresponding runoff volume-based credits.

Runoff volume match sites are equipped with "hydrology protecting" SCMs (infiltration systems, permeable pavement, bioretention cells, rainwater harvesting systems, green roofs and disconnected impervious surfaces). Currently, DEQ has a tool called "Storm-EZ" that designers can use to assess whether a project meets the runoff volume match definition. Storm-EZ is a spreadsheet that accepts data about a project's layout and SCMs. Then, Storm-EZ calculates how closely the project matches the pre-development runoff volumes.

Storm-EZ uses the NRCS Discrete Curve Number Method (based on USDA TR-55). "Discrete" means that the Curve Number Method is run twice: first, to yield runoff volume from the built-upon areas and second, to yield runoff volume from the remainder of the site. (The total runoff volume is the sum of the two results.) These calculations are automated in Storm-EZ tool. The Discrete Curve Number Method shall be run for both the pre- and post-development conditions to determine if runoff volume match is achieved.

Runoff volume match projects typically look different from runoff treatment projects. A runoff volume match site typically has more vegetated areas interspersed with roads, parking lots and buildings. These vegetated areas provide landscaping for the project while also treating stormwater. The rain garden shown in Figure 1 ponds immediately after a storm and then the

water soaks into the bioretention soils in less than one day. Runoff treatment projects often have stormwater piped to devices such as wet ponds for treatment.

Figure 1: Runoff Volume Match Project (left) and Runoff Treatment Projects (right)

Some of the potential benefits of runoff volume matching include:

- Reducing “hard” infrastructure costs such as pipes and rip rap.
- Increasing lot yields by eliminating the need for retention-based SCMs.
- Creating more vegetated areas interspersed with pavement and buildings.
- Reducing the need for flood control measures.
- Streamlining future maintenance on the site (regular vegetation management rather than major overhauls of aging piped systems).

Future Plans

During 2017, the DEQ Stormwater Program will be working with the Nonpoint Source Planning Program to develop the SNAP Tool that will be the “next generation” stormwater spreadsheet tool. This tool will calculate the runoff volume as well as the nutrient loading rates from new, redevelopment and retrofit projects. The DEQ Stormwater Program will make that tool available to designers as soon as it is ready.