

1. Other States Using the 90th Percentile Storm for Water Quality

- Maryland
- Pennsylvania (although only a recommendation at this point, not yet regulatory)
- New York
- New Jersey
- North Carolina (higher 1.5 inches of rainfall treated in coastal counties)
- South Carolina (treat 1/2 inch of runoff from the entire site)
- Georgia
- Vermont
- Ontario
- Minnesota
- Portland, Oregon

2. City of Chicago's Stormwater Management Regulations (2010)

NOTE: The City of Chicago has recently revised its SWM code to require control and on-site storage of much larger storms in order to avoid further stresses on its combined sewers. The City Council concluded that this will be a less expensive and more immediate way to deal with the CSO problem than continuing to pour mega-millions of dollars into sewer separation and upgrades.

3.1 DESIGN REQUIREMENTS

All Regulated Developments must be designed to manage the 100-year storm event and to provide means to manage and direct overflows to the public right-of-way. The maximum allowable rates of discharge are discussed in Sections 3.3 and 3.4 of this chapter. The number, size, and locations of sewer connections are also regulated. Applicants may need to provide detention as part of a Plan to accommodate the allowable size of a stormwater connection to the City sewer system.

A minimum of 0.1 feet of freeboard from the high-water level within any detention facility to the overflow to the right-of-way must be provided. An additional 0.1 feet (minimum) freeboard must be provided from the lowest overflow elevation leading to an adjacent property. No more than 400 square feet of impervious surface area can sheet flow to the public right-of-way without detention. This sheet flow requirement shall not apply to fueling stations.

3.1.1 LOT-TO-LOT BUILDINGS

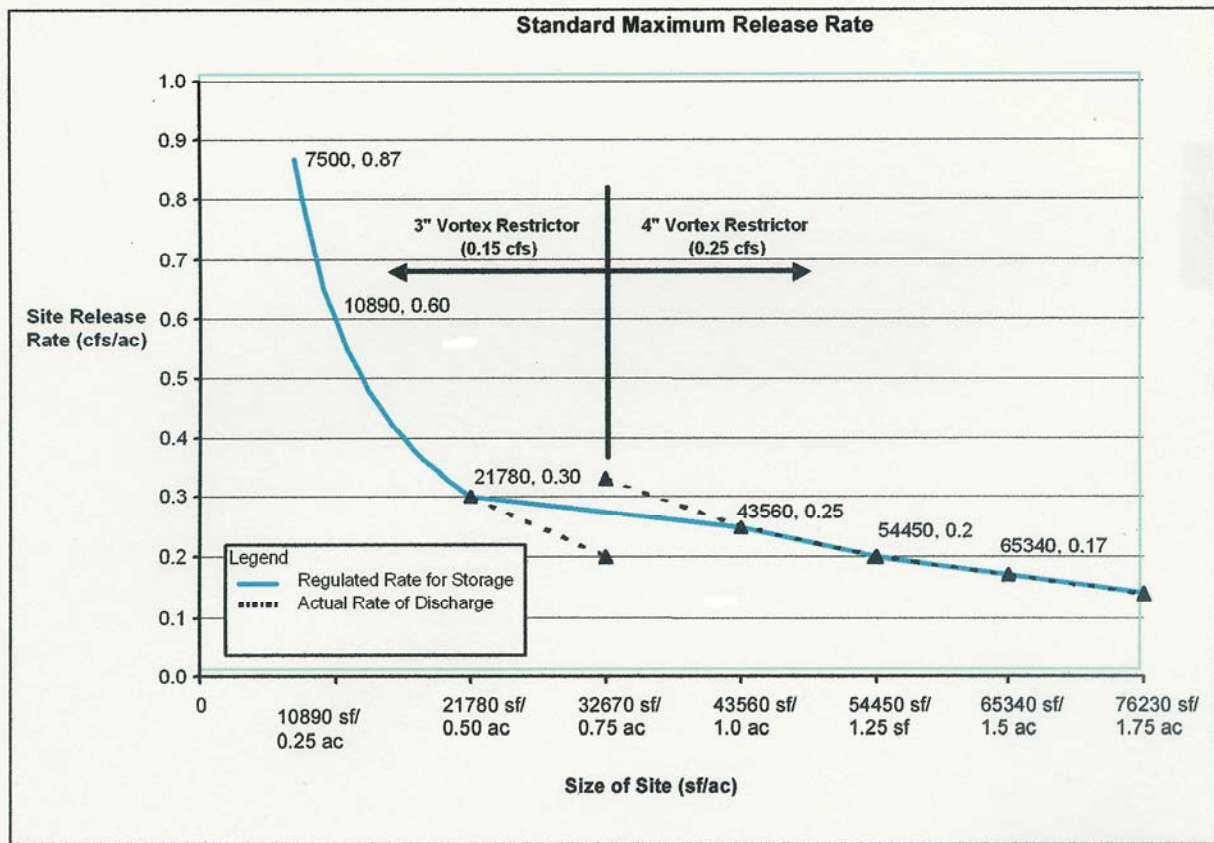
With respect to Developments that are totally or almost totally (more than 85%) occupied by structures, including basements, the required storage shall be based on a minimum 10-year magnitude storm event for structures subject to Chapter II, Section 3.1.2- Buildings With Tributary Sidewalls or Significant DWF. For any remaining open space, the required storage shall be based on a 100-year magnitude storm. Means to safely accommodate all storm events up to a 100-year magnitude, via overflows to the right-of-way, must also be provided. Buildings with underground storage vaults must have plans (with backup calculations) sealed by a licensed architect or structural engineer to safeguard against structural failure of floor foundations and downspouts due to maximum hydrostatic pressures during sewer surcharges.

3.3 STANDARD MAXIMUM RELEASE RATE

All Regulated Developments must control the 100-year storm event. *Regulated Developments of 7,500 square feet to 1.75 acres in size have the option to accept a standard maximum release rate for the site, as shown below in the Maximum Release Rate Control Chart, or to calculate their own maximum release rate, using the procedures in Section 3.4 of this chapter. The standard maximum release rate is as follows.*

- For sites between 7,500 square feet and 21,780 square feet (one-half acre), the maximum allowable release rate is 0.15 cfs, the maximum release rate from a 3-inch vortex restrictor. The required storage is based on 0.15 cfs, subject to Chapter II, Section 3.5- Dry Weather Flows.
- For sites between 21,780 square feet (one-half acre) and 43,560 square feet (one acre), the maximum regulated release rate is a linear interpolation between 0.15 cfs (equivalent to use of 3-inch vortex restrictor on a one-half-acre site) and 0.25 cfs (equivalent to use of 4-inch vortex restrictor with 0.25 cfs release rate on a one-acre site), respectively. The required storage is based on the linear interpolation of the two release rates, subject to Chapter II, Section 3.5- Dry Weather Flows.
- For sites between 43,560 square feet up to 76,230 square feet, the maximum allowable release rate is 0.25 cfs, the maximum release rate from a 4-inch vortex restrictor. The required storage is based on 0.25 cfs, subject to Chapter II, Section 3.5- Dry Weather Flows.
- For sites larger than 76,230 square feet (1.75 acres), Applicants must compute their own maximum release rate using the procedures in Section 3.4 of this chapter.

The above requirements are illustrated in the following chart.



3.4 COMPUTED MAXIMUM RELEASE RATE

In lieu of utilizing the Standard Maximum Release Rate, the Applicant may submit documentation in support of a computed maximum release rate. The 5-year capacity of a sewer line (in cfs/acre) shall be based on the ratio of its full flow segment capacity (in cfs) to its corresponding tributary area (in acres). The computed maximum release rate shall be the lesser of the "Outlet Sewer Capacity" at the downstream end of the system and the critical "Local Sewer Capacity" as defined by sewer sizes 3.5 feet in diameter or smaller. The following subsections describe the computation to be followed in determining the computed maximum release rate for the Regulated Development.



Green alley in Chicago



Chicago Green Alley (Before)



Chicago Green Alley (After)



Pave block parking with reservoir storage beneath (at U.S. Cellular Field in Chicago)

3. Maryland Stormwater Management Program

Since 2000, Maryland has been applying the following stormwater management criteria **statewide**, in addition to what Virginia has been doing:

- Maintain 100% of the pre-development groundwater recharge after development
- Use of the 90th percentile storm event (0.9-inch rainfall in the western part of the state, or 1 inch rainfall in the eastern part of the state) as the basis for the water quality treatment volume
- Prescriptive requirements for management of the extreme storm event (100-year design storm)

In 2007, Maryland's Stormwater Management Law was amended to require the use of Environmental Site Design (ESD) techniques in the planning and execution of land development projects. The Maryland Stormwater Management Regulations were amended earlier this year (2010) to provide specific criteria regarding how ESD is to be incorporated.

ESD is defined as using small-scale stormwater management practices, nonstructural techniques, and better site planning to mimic natural hydrologic runoff characteristics and minimize the impact of land development on water resources. ESD includes:

- Optimizing conservation of natural features, such as drainage patterns, soils, and vegetation;
- Minimizing use of impervious surfaces, such as pavement, concrete channels, roofs, and pipes;
- Slowing down and holding runoff to maintain discharge timing, increase infiltration, and allow evapotranspiration; and
- Other nonstructural practices and innovative technologies (e.g., impervious surface disconnections, rain barrels, green roofs, rain gardens) as approved by MDE.
- Employ BMPs only when ESD techniques will not achieve compliance with the regulatory criteria, preferring LID-type BMPs as the first resort.

4. Washington, DC Stormwater Management Program

The District of Columbia is currently revising its stormwater management criteria to ensure they can meet the requirements of the new Chesapeake Bay TMDL. The District's criteria include the following:

- Any site disturbing more than 5,000 square feet must comply with the SWM regulations
- Any site disturbing more than 50 square feet must comply with the E&S Control regulations
- The water quality volume is still 1/2-inch of runoff from parking/pavement kinds of impervious surfaces, and 1/3-inch of runoff from rooftops and walkways, etc.
- Local overbank flood protection is based on channels that can convey the 15-year storm (larger than Virginia's 10-year design storm for channel protection)
- Every site must conduct a downstream analysis of discharge from a 100-year design storm to ensure downstream protection from extreme floods
- The criteria emphasize incorporating functional landscaping in site designs
- The criteria emphasize incorporating LID practices into site designs

5. North Carolina Stormwater Management Program

North Carolina has varying stormwater management requirements across the state. Sensitive or impaired watersheds have more strict criteria than the default statewide criteria, and MS-4 communities have criteria that are more customized to their conditions. The following are key criteria:

- Treat the first 1-inch of rainfall (1.5-inches in coastal counties)
- Implement BMPs to remove 85% of TSS from runoff
- The treatment volume must drawdown in 2 to 5 days (48 to 120 hours)
- The amount of impervious cover that triggers the regulations is 12% for shellfish waters
- North Carolina communities incentivize/emphasize the use of LID practices
- Sites must discharge the post-development 1 year storm at the pre-development peak rate
- Sensitive and nutrient impaired watersheds have extensive buffer requirements (100 to 200 feet wide)

6. Delaware Stormwater Management Program

- Water quality criteria require capture and treatment of 2 inches of rainfall volume (89th to 93rd percentile storm event)
- For channel protection, post-development peak flows of 2.0 inches of rainfall must match pre-development peak flows. Also, there must be no increase in the peak rate of the 2-year runoff event. Stricter criteria using forest cover with 10% Effective Impervious Area (EIA) for pre-development conditions and a 50% reduction in the peak flows for the 2.0 inch event may apply to pristine Piedmont watersheds.
- Flood protection design storms are the 10-year storm for conveyance design and the 100-year storm for protection from extreme events.

7. Philadelphia Stormwater Management Program

The City of Philadelphia revised its SWM regulations in 2006 and its SWM Handbook in 2007. The city's criteria include the following:

- Any new development site disturbing more than 15,000 square feet and any redevelopment site disturbing more than an acre must comply with the SWM regulations (however, criteria may be applied to smaller sites if they are determined to exceed stormwater system capacity, cause a combined sewer overflow, or degrade receiving waters)
- If a redevelopment project is subject to the regulations but reduces the directly connected impervious area (DCIA) by at least 20%, then the site does *not* have to comply with channel protection and flood control requirements.
- The water quality volume is 1-inch of rainfall
- The water quality volume must be infiltrated on-site to recharge the groundwater table
- Any portion of the water quality volume that cannot be infiltrated on-site must be treated by BMPs
- The City provides a sequencing process to determine the kinds of practices that may be used in the site design, with initial preference given to non-structural approaches and graduating to structural measures.
- Channel/flood protection peak runoff rates vary from one "management district" to another, to meet the specific conditions of the management district (varies from the 1-year storm to the 100-year storm)

8. Stafford County, Virginia Stormwater Management Program

Stafford County implements all the various Virginia stormwater management requirements, including requirements of the Chesapeake Bay Preservation Act program and MS-4 permit requirements. However, they have gone even further by adopting code requirements that site developers *must* use LID practices and may only use more traditional BMPs if the LID practices are unable to achieve total compliance with the pollutant reduction requirements.

9. Fairfax County, Virginia (Tyson's Corner Redevelopment Stormwater Management Plan)

?????? (mentioned at the subcommittee meeting – can any member provide more details?)