



**City of Virginia Beach
Planning and Community Development Department
Public Works Department**



**Consultants, Builders and Developers
Informational Meeting
Stormwater Design Requirements**

Monday, December 4, 2017
9:00 AM – 11:00 AM
Public Utilities Operations Multipurpose Rooms
3500 Dam Neck Road
Virginia Beach, VA 23453

Meeting Handout

This handout contains general processes and requirements for Stormwater Management Design in the City of Virginia Beach. It is not intended to replace or replicate all applicable City Codes or Policies. Design professionals must comply with all applicable Codes and Policies, even if not included in this document.

Planning and Community Development/Development Services Center – (757) 385-4621 - dsc@vbgov.com
Public Works/Stormwater Engineering Center - (757) 385-4131 – stormpics@vbgov.com

Preliminary Stormwater Engineering Analysis FAQs

1. When is this needed?
 - Projects requiring discretionary approval from City Council (ie. rezonings, conditional use permits),
AND
 - Located in the Southern Rivers Watershed (all projects in Southern Rivers), or
 - Located in other watersheds in areas identified as possibly having or creating drainage concerns (case by case in other watersheds)

2. Why is it needed?
 - Concern of potential impacts to the new development, surrounding neighborhoods and streets
 - City Council needs information on possible impacts, and whether staff believes an approvable final stormwater design is achievable, prior to public hearing

3. What information is needed?
 - List begins next page (page 3)

4. Is this required or just recommended?
 - Required in order to receive staff recommendation of approval to Planning Commission and City Council

5. What is the Submittal/Review Process?
 - Submitted to staff planner handling the Planning Commission application
 - Preliminary Stormwater Analysis is distributed to DSC Engineer and PW SWEC engineer for review
 - Review engineers provide comments to staff planner, usually within 2 weeks
 - Meetings to discuss submittal, additional information, etc. coordinated by staff planner
 - Analysis should be revised and resubmitted to obtain staff support for the preliminary design
 - Staff planner includes stormwater concerns, support, etc. in staff report

6. Why are two engineering teams reviewing the preliminary analysis?
 - PW SWEC reviews boundary conditions (tailwater)
 - PW SWEC reviews projects with complex modeling design or in areas of special stormwater concerns
 - DSC reviews for all other stormwater requirements

Preliminary Storm Water Engineering Analysis Required in the Southern Rivers Watershed

Revised: 9/28/2017

Projects located in the Southern Rivers Watershed that require discretionary approval such as a re-zoning, conditional re-zoning and/or conditional use permit now also require that a Preliminary Stormwater Engineering Analysis be prepared by the developer's engineer and submitted to Planning staff. Planning staff will review and use the analysis to determine if there is a strong likelihood that the project is viable from a stormwater design perspective. This requirement is communicated to the developer at the time of application or during pre-submittal meetings. When the submittal is made, the review is tasked to various staff members, including the DSC Civil/Stormwater Engineering Supervisor, who will respond in writing to the Planner managing the application. Any unresolved issues are communicated to the developer and the engineer. The DSC Engineers will seek assistance from Public Works Stormwater Engineering Center on all projects that may require complex modeling or may affect Public Works studies or projects. When and if the development project moves forward to Planning Commission, staff will identify in the staff report if the project appears viable from a stormwater design perspective.

The following list contains the general information required in the Stormwater Engineering Analysis. Depending on the location, topography and proposed development, more or less information may be required as necessary to support the project. The analysis generally needs to be presented as a combination of maps, drawings, narrative and calculations. The Preliminary Stormwater Engineering Analysis does not guarantee that the final design will meet stormwater requirements and be approved.

Preliminary Stormwater Engineering Analysis submittal requirements

1. Stormwater Management narrative to include:
 - a. Description of the existing and proposed nature of the site
 - b. Description of the existing drainage patterns and the intended stormwater design
 - c. Methods used to meet water quality and quantity requirements

2. Proposed preliminary plan:
 - a. Storm system layout, stormwater management facilities (SWMF), outfall
 - b. Drainage area maps/delineations. Drainage area maps shall depict on-site and off-site drainage area, land use and soil conditions. Maps should include all areas contributing to the point of analysis.
 - c. Existing and proposed impervious area tabulations per drainage area
 - d. FEMA flood zone delineation per the Flood Insurance Rate Map (FIRM) and also based on existing topography using the FEMA Base Flood Elevation

Preliminary Stormwater Engineering Analysis submittal requirements, cont.

- e. Estimated or known tidal and non-tidal wetlands locations
- f. Average existing elevations and proposed elevations of the lots, dwellings and streets
- g. Proposed estimated height and volume of fill needed for the project.
- h. Location of the SWMF
- i. SWMF cross-section with estimated volumes and calculations to show that it can be adequately sized for the given location and seasonal high groundwater elevation

3. Supporting information:

- a. Soil analysis - seasonal high groundwater elevation; soil types; existing ground cover (field, forest, etc.) based on actual soil borings or available USGS data, Aerials, field reconnaissance, adjoining projects, etc.
- b. Any on-site ponding should be noted and approximate detention estimated.
- c. A contributing base flow from groundwater, where BMP facilities intercept seasonal high groundwater elevation, shall be included in the analysis.
- d. VRRM spreadsheet to show what assumptions are being used for water quality compliance
- e. Water quantity calculations that demonstrate how requirements for channel protection, flood protection, and safe conveyance of the 100-year storm will be met.
- f. An analysis of either a static hydraulic grade line or dynamic modeling of the system should be included.
- g. Design must analyze the effects of tailwater on the proposed development, and other contributing drainage areas, for the 10- and 100-year return frequency storm events (and/or other return frequencies as the drainage area size may necessitate). Tailwater elevations must be approved by the City prior to beginning analysis.
- h. The site and proposed stormwater management system must be evaluated for a 1.5-foot rise in the tailwater condition (to account for sea level rise and its related consequences).
- i. The City of Virginia Beach recognizes that rainfall patterns are changing and is in the process of updating the requirements in the Public Works Standards and Specifications. Developer's engineer shall perform all analysis using the following inches of rain for the design storms:

1-year storm -	3.60 inches
2-year storm -	4.38 inches
10-year storm -	6.77 inches
25-year storm -	8.39 inches
50-year storm -	9.91 inches
100-year storm-	11.34 inches

Final Stormwater Management Plan Submittal and Review FAQs

1. When is a Stormwater Management Plan required?
 - Land Disturbance equal to or greater than 2,500 square feet in Chesapeake Bay watershed
 - Land disturbance equal to or greater than 1 acre in other watersheds (Southern Rivers, Atlantic Ocean)
 - Individual Single Family plans – agreement in lieu of a plan (BMPs must be shown for inspection and record purposes only; not reviewed)

2. When is an Erosion & Sediment Control Plan and MS 19 compliance (downstream capacity and erosion) required?
 - All projects with land disturbance equal to or greater than 2,500 square feet
 - Stormwater Management Plan requirements cover the MS19 requirements
 - Projects without a Stormwater Management Plan must meet the MS 19 requirements
 - Individual Single Family plans – agreement in lieu of a plan

3. Who reviews the stormwater management plan and supporting calculations, reports, maps, etc.?
 - DSC Civil/Stormwater engineers – always
 - PW SWEC engineers -
 - ❖ Projects involving complex stormwater modeling
 - ❖ Projects located within pw stormwater CIP design areas
 - ❖ When using the pw study modeling (inputting project modeling into PW SWMM model)
 - ❖ Projects located in flood-prone areas

4. Who has the existing drainage system and watershed information needed for design?
 - Contact the DSC Civil/Stormwater Engineer or DSC Project Team Leader to obtain needed information – they will obtain it from PW SWEC and share with the consultant (the DSC engineer also needs the information)
 - This information is typically provided at the Presubmittal Meetings held on Thursdays

5. What does each Department review?
 - PW SWEC generally reviews modeling and the assumptions and conditions used in the modeling
 - DSC Engineers review all other components such as hydrology and hydraulic calculations, HGL, inlet spread, maps, soil reports, Runoff Reduction spreadsheets, BMP designs, infiltration rates, seasonal high groundwater, plans and details

Final Stormwater Management Plan Submittal and Review FAQs, cont.

6. How long does the review take?
 - No changes to review times
 - ❖ 4 weeks for initial submittal
 - ❖ 3 weeks for subsequent submittals

7. Who do I contact if I disagree with the stormwater comments, have questions, or want to meet?
 - Contact DSC Project Team Leader who will coordinate and facilitate discussions and meetings

8. Who approves the final stormwater management plan?
 - The DSC is ultimately responsible for the final approval of the plan
 - Design variances or waivers may be granted by either DSC or PW, depending on type
 - ❖ PW SWEC grants approval of variances to the Public Works Specifications and Standards
 - ❖ DSC grants variances to DEQ BMP Clearinghouse specifications
 - Stormwater Appeals Board (not appointed yet)

9. When is a Stormwater Management Facilities Maintenance Agreement (SWMA) required?
 - Almost every project, even when no SWMF is proposed on-site
 - 11 standard forms on line; each dependent on situation
 - Staff will determine which form to use during plan review
 - Most projects require recordation of the SWMA prior to site permitting

Final Stormwater Design Components

- **Erosion and Sediment Control - Minimum Standard 19**
- **Minimum Technical Criteria:**
 - ❖ **Grandfathered (IIC Design Criteria)**
 - ❖ **Not Grandfathered (IIB Design Criteria)**
- **City Design Requirements for All Projects**

Erosion and Sediment Control - Minimum Standard 19 *(from 9VAC25-840)*

19. Properties and waterways downstream from development sites shall be protected from sediment deposition, erosion and damage due to increases in volume, velocity and peak flow rate of stormwater runoff for the stated frequency storm of 24-hour duration in accordance with the following standards and criteria. Stream restoration and relocation projects that incorporate natural channel design concepts are not man-made channels and shall be exempt from any flow rate capacity and velocity requirements for natural or man-made channels:

- a. Concentrated stormwater runoff leaving a development site shall be discharged directly into an adequate natural or man-made receiving channel, pipe or storm sewer system. For those sites where runoff is discharged into a pipe or pipe system, downstream stability analyses at the outfall of the pipe or pipe system shall be performed.
- b. Adequacy of all channels and pipes shall be verified in the following manner:
 - (1) The applicant shall demonstrate that the total drainage area to the point of analysis within the channel is 100 times greater than the contributing drainage area of the project in question;
 - (2) (a) Natural channels shall be analyzed by the use of a two-year storm to verify that stormwater will not overtop channel banks nor cause erosion of channel bed or banks.
(b) All previously constructed man-made channels shall be analyzed by the use of a 10-year storm to verify that stormwater will not overtop its banks and by the use of a two-year storm to demonstrate that stormwater will not cause erosion of channel bed or banks; and
 - (c) Pipes and storm sewer systems shall be analyzed by the use of a 10-year storm to verify that stormwater will be contained within the pipe or system.
- c. If existing natural receiving channels or previously constructed man-made channels or pipes are not adequate, the applicant shall:
 - (1) Improve the channels to a condition where a 10-year storm will not overtop the banks and a two-year storm will not cause erosion to the channel, the bed, or the banks;
 - (2) Improve the pipe or pipe system to a condition where the 10-year storm is contained within the appurtenances;
 - (3) Develop a site design that will not cause the pre-development peak runoff rate from a two-year storm to increase when runoff outfalls into a natural channel or will not cause the pre-development peak runoff rate from a 10-year storm to increase when runoff outfalls into a man-made channel; or
 - (4) Provide a combination of channel improvement, stormwater detention or other
- d. The applicant shall provide evidence of permission to make the improvements.
- e. All hydrologic analyses shall be based on the existing watershed characteristics and the ultimate development condition of the subject project.

Erosion and Sediment Control - Minimum Standard 19 (from 9VAC25-840) cont.

f. If the applicant chooses an option that includes stormwater detention, he shall obtain approval from the VESCP of a plan for maintenance of the detention facilities. The plan shall set forth the maintenance requirements of the facility and the person responsible for performing the maintenance.

g. Outfall from a detention facility shall be discharged to a receiving channel, and energy dissipators shall be placed at the outfall of all detention facilities as necessary to provide a stabilized transition from the facility to the receiving channel.

h. All on-site channels must be verified to be adequate.

i. Increased volumes of sheet flows that may cause erosion or sedimentation on adjacent property shall be diverted to a stable outlet, adequate channel, pipe or pipe system, or to a detention facility.

j. In applying these stormwater management criteria, individual lots or parcels in a residential, commercial or industrial development shall not be considered to be separate development projects. Instead, the development, as a whole, shall be considered to be a single development project. Hydrologic parameters that reflect the ultimate development condition shall be used in all engineering calculations.

k. All measures used to protect properties and waterways shall be employed in a manner which minimizes impacts on the physical, chemical and biological integrity of rivers, streams and other waters of the state.

l. Any plan approved prior to July 1, 2014, that provides for stormwater management that addresses any flow rate capacity and velocity requirements for natural or man-made channels shall satisfy the flow rate capacity and velocity requirements for natural or man-made channels if the practices are designed to (i) detain the water quality volume and to release it over 48 hours; (ii) detain and release over a 24-hour period the expected rainfall resulting from the one year, 24-hour storm; and (iii) reduce the allowable peak flow rate resulting from the 1.5, 2, and 10-year, 24-hour storms to a level that is less than or equal to the peak flow rate from the site assuming it was in a good forested condition, achieved through multiplication of the forested peak flow rate by a reduction factor that is equal to the runoff volume from the site when it was in a good forested condition divided by the runoff volume from the site in its proposed condition, and shall be exempt from any flow rate capacity and velocity requirements for natural or man-made channels as defined in any regulations promulgated pursuant to § 62.1-44.15:54 or 62.1-44.15:65 of the Act.

m. For plans approved on and after July 1, 2014, the flow rate capacity and velocity requirements of § 62.1-44.15:52 A of the Act and this subsection shall be satisfied by compliance with water quantity requirements in the Stormwater Management Act (§ 62.1-44.15:24 et seq. of the Code of Virginia) and attendant regulations, unless such land-disturbing activities (i) are in accordance with provisions for time limits on applicability of approved design criteria in 9VAC25-870-47 or grandfathering in 9VAC25-870-48 of the Virginia Stormwater Management Program (VSMP) Regulation, in which case the flow rate capacity and velocity requirements of § 62.1-44.15:52 A of the Act shall apply, or (ii) are exempt pursuant to § 62.1-44.15:34 C 7 of the Act.

n. Compliance with the water quantity minimum standards set out in 9VAC25-870-66 of the Virginia Stormwater Management Program (VSMP) Regulation shall be deemed to satisfy the requirements of this subdivision 19.

Stormwater Management Ordinance - City Code, Appendix D

“Grandfathered” Projects – may use Part II C technical criteria (may also use Part IIB technical criteria)

- Grandfathered for one permit cycle (until June 30, 2019) if preliminary or final plan approved by City prior to July 1, 2012 and
 - ❖ Plan layout included SWM facilities
 - ❖ Complies with Type IIC criteria
 - ❖ Has not been modified to increase pollutant load, total runoff volume, or peak flow rate
 - ❖ State permit was not issued prior to July 1, 2014
 - ❖ Land Disturbance did not start prior to July 1, 2014

- Grandfathered for two permit cycles (until June 30, 2024) if
 - ❖ Project obtained initial state permit or began land disturbance prior to July 1, 2014, **or**
 - ❖ Project area is served by existing SWMF that was designed and implemented in accordance with Type IIC criteria
 - Impervious cover on site shall not increase from assumption used in original SWMF design
 - SWMF shall not be modified to account for additional impervious

- Basic Grandfathered Design criteria:
 - ❖ Water Quality
 - Performance Based Criteria (old calculation forms - 4 “situations”)
 - SWMF designs must conform with:
 - a. VA Stormwater Management Handbook (“Blue Book”) and
 - b. Public Works Specifications and Standards and
 - c. DSC policies and practices (typically documented in DSC and PCD Notices)

 - ❖ Water Quantity – stream channel erosion and flooding
 - Compliance with MS-19

NON- “Grandfathered” Projects – must use Part II B technical criteria

- For any project not meeting the “grandfathering” conditions
 - ❖ Water Quality – VRRM Spreadsheet
 - New development shall not exceed 0.41 lb/acre/yr phosphorous load
 - Redevelopment < 1 acre, 10% reduction in phosphorous load from existing
 - Redevelopment ≥ 1 acre, 20% reduction in phosphorous load from existing
 - SWMF designs must conform with:
 - ✓ BMP Clearinghouse and
 - ✓ Public Works Specifications and Standards and
 - ✓ DSC policies and practices (typically documented in DSC and PCD Notices)
 - Offsite Nutrient credits can be used if available in same or adjacent HUC and:
 - Less than 5 acres of LDA **or**
 - Less than 10 lb/yr phosphorous load reduction required **or**
 - At least 75% of required treatment is provided onsite
 - ❖ Water Quantity: Channel Protection
 - Natural conveyance system: Use Energy balance equation (1-year 24-hour storm): $Q_{\text{Developed}} \leq I.F. * (Q_{\text{Pre-developed}} * RV_{\text{Pre-Developed}}) / RV_{\text{Developed}}$
 - Manmade conveyance system: Use Energy balance equation (1-year 24-hour storm) or show that the system can convey the 2-year 24-hour storm event without causing erosion of the system (concrete pipe or channel ok; grass channels comply with VA ESC specifications)
 - Limits of analysis: Extends to where either the site’s drainage area is ≤ 1% of the total watershed area or the site’s peak flow rate is ≤ 1% of the total watershed peak flow rate
 - If area of analysis reaches a natural conveyance system before the 1% limit of analysis is reached, then channel protection must be met through the energy balance equation
 - The entire conveyance system must be analyzed to the limits of analysis for adequacy based on the 2-year 24-hour storm event

NON- “Grandfathered” Projects – must use Part II B technical criteria, cont.

❖ Water Quantity: Flood Protection

- Discharge to a system that does not experience localized flooding during 10-year 24-hour storm
 - Confines post-development peak flow rate from the 10-year 24-hour storm event within the stormwater conveyance system
- Discharge to a system that does experience localized flooding during 10-year 24-hour storm
 - Confines post-development peak flow rate from the 10-year 24-hour storm event within the stormwater conveyance system or
 - 10-year post development peak flow rate does not exceed the pre-development peak flow rate
- Limits of analysis: Extends to where either the site’s drainage area is \leq 1% of the total watershed area, or the site’s peak flow rate is \leq 1% of the total watershed peak flow rate, or the stormwater conveyance system enters a mapped floodplain or other flood-prone area
 - The entire conveyance system must be analyzed for adequacy based on the 10-year 24-hour storm event to the limits of analysis

City Design Requirements/Considerations for All Projects

- **Tailwater**

- ❖ Tailwater elevation must be the higher of:
 - 0.8d of the existing receiving pipe or
 - calculated HGL based on the most recent approved City SWM study
 - City will provide nearest available elevation
 - Tailwater elevation will vary based on the design-year storm
 - Design engineer must calculate HGL at site outfall
- ❖ Tailwater must be applied as static elevation throughout SWM system at start of storm event
- ❖ Onsite HGL must be based on full rise in SWMF (NOT ½ rise)

- **Design methods**

- ❖ SCS Method, TR-55, SWMM type modeling, routing, etc. is required for volumetric (storage SWMF) design and to demonstrate compliance with MS-19, Type IIB or Type IIC regulations
- ❖ Rational / Modified Rational Method is NOT acceptable for volumetric calculations or to demonstrate compliance with MS-19, Type IIB or Type IIC regulations
- ❖ Rational method is acceptable for onsite H&H calculations
 - gutter spread
 - pipe HGLs
 - ditch capacity
 - pipe capacity

- **100-year 24-hour storm event**

- ❖ SWMF design/routing must provide the following for the 100-yr 24 hour storm:
 - Top of curb or crown of road remains visible
 - Overflow safely passes to right-of-way or other public drainage system
 - Overflow does not impact or drain directly onto adjacent properties
 - Provides required freeboard per BMP Clearinghouse and PWSS (detention and retention facilities)

City Design Requirements/Considerations for All Projects, cont.

- **Site Conditions Input Data**
 - ❖ Site conditions (groundcover, impervious areas, etc.)
 - ❖ Soils types (based on USGS soil survey or site specific soils report)
 - ❖ Seasonal High Groundwater level
 - PWSS seasonal adjustment chart or
 - an evaluation performed and sealed by a qualified certified or licensed professional
 - Seasonal high evaluation should be performed in conformance with the 2013 Draft VA DEQ Stormwater Design Specification No.8, Appendix 8-A, Infiltration and Soil Testing
 - ❖ Groundwater base flow recommended to be included in design of any SWMF that intersects the seasonal high groundwater table
 - ❖ Infiltration rates must be based on ½ maximum measured field rate

- **Various other local design requirements**
 - ❖ Private perimeter interceptor drainage system to prevent surface runoff from entering neighboring properties and to collect runoff that may enter site from adjoining properties
 - ❖ Adequate maintenance access and areas surrounding private SWMFs
 - ❖ No SWMFs in residential back yards
 - ❖ A SWMF that serves multiple residential lots must be placed on a separate HOA-owned parcel
 - ❖ SWMFs cannot be in required landscape buffers (exception for acceptable combined bioretention/buffer designs)
 - ❖ Private drainage systems cannot be in required landscape buffers
 - ❖ Trees cannot be planted over or very close to drainage systems

- **What is included in a typical SW Design submittal?**
 - ❖ Narrative (must include how water quality, channel protection and flood protection requirements will be met)
 - ❖ Soils report (including boring logs, seasonal high groundwater and infiltration rates)
 - ❖ VRRM spreadsheet
 - ❖ Pre and post drainage area maps
 - ❖ Tailwater elevations and how they were determined
 - ❖ Times of concentration and how they were determined
 - ❖ SWMF routing calculations
 - ❖ Pipe and channel calculations
 - ❖ Inlet spread calculations