

VIRGINIA DEPARTMENT OF TRANSPORTATION

LOCATION AND DESIGN DIVISION

INSTRUCTIONAL AND INFORMATIONAL MEMORANDUM

GENERAL SUBJECT: POST DEVELOPMENT STORMWATER MANAGEMENT	NUMBER: IIM-LD-195.7
SPECIFIC SUBJECT: MINIMUM REQUIREMENTS FOR THE ENGINEERING, PLAN PREPARATION AND IMPLEMENTATION OF POST DEVELOPMENT STORMWATER MANAGEMENT PLANS	DATE: NOVEMBER 12, 2010
	SUPERSEDES: IIM-LD-195.6
DIVISION ADMINISTRATOR APPROVAL: Mohammad Mirshahi, P.E. State Location and Design Engineer Approved November 12, 2010	

CURRENT REVISION

- Guidelines for water quality and quantity control have been clarified in accordance with the Virginia Department of Conservation and Recreation's annual plan review of the VDOT's Erosion and Sediment Control and Stormwater Management Standards and Specifications and the Virginia Erosion and Sediment Control and Stormwater Management Program Law and Regulations.
 - **Shading** has been omitted due to the number of changes in this memorandum.
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EFFECTIVE DATE

- With the exception of the water quality volume requirements noted in Section 5.4.4.2, the information contained in this IIM is effective upon receipt. The water quality volume requirements in Section 5.4.4.2 shall be implemented in accordance with Section 19.0 of this IIM.

ACRONYMS

- BMP – Best Management Practice
- CBPA – Chesapeake Bay Preservation Area
- DCR – Department of Conservation and Recreation
- ESC – Erosion and Sediment Control
- EPA – Environmental Protection Agency
- FEMA – Federal Emergency Management Agency
- HUC - Hydrologic Unit Code
- IIM – Instructional and Informational Memorandum
- MS – Minimum Standard
- MS4 – Municipal Separate Storm Sewer System
- PAC – Pre-Advertisement Conference
- R&B – Road and Bridge
- RFP – Request for Proposal
- SWM – Stormwater Management
- SWCB – Soil and Water Conservation Board
- TMDL – Total Maximum Daily Load
- SWPPP – Stormwater Pollution Prevention Plan
- VDOT – Virginia Department of Transportation
- VSMP – Virginia Stormwater Management Program
- WQV – Water Quality Volume

DEFINITIONS

- Adequate Channel – A channel that meets the technical criteria contained in Section 5.2 and 5.3 of this IIM.
- Average Land Cover Condition – A measure (in percent) of the average amount of impervious area within a watershed. For regulatory purposes, this value is assumed to be 16% statewide. A locality may opt to calculate actual watershed-specific values for the average land cover condition based upon Section 4VAC50-60-110 of the VSMP Regulations.
- Channel – A natural or manmade waterway (includes culverts and storm sewer systems).
- Discharge Point – The point at which stormwater and/or a pollutant leaves the site.
- Department – The Virginia Department of Transportation.
- Hydrologic Unit Code - A watershed unit established in the most recent version of Virginia's 6th Order National Watershed Boundary Dataset.
- Impervious Cover or Area - A surface or area composed of any material that significantly impedes or prevents natural infiltration of water into soil. Impervious surfaces include, but are not limited to, roofs, buildings, streets, parking areas, and any concrete, asphalt, or compacted gravel surface.
- Land Disturbing Activity” or “Land Disturbance” - A manmade change to the land surface that potentially changes its runoff characteristics including any clearing, grading or excavation associated with a land disturbing activity.

- Linear Development Projects – Those land disturbing activities linear in nature such as, but not limited to, highway construction/maintenance projects/activities, construction/maintenance of stormwater channels and stream restoration projects.
- MS4 General Permit - General Permit For Discharges Of Stormwater From Small Municipal Separate Storm Sewer Systems.
- Non-Linear Projects – Those land disturbing activities not considered linear in nature such as, but not limited to, parking lots, rest areas and District/Residency/Area Headquarter complexes.
- Outfall – See Discharge Point.
- Receiving Channel – The off site drainage facility that the proposed land disturbing activity discharges into.
- Regulated Land Disturbance Activities – Those activities that disturb one acre or greater except in those areas designated as a Chesapeake Bay Preservation Area in which case the land disturbance threshold is 2500 square feet or greater (unless the activity is specifically exempted by the VSMP Law and/or Regulations).
- Roadway Section – The traveled way and associated shoulders, ditches, sidewalks, multi-use/shared use paths, back (cut) slopes and fore (fill) slopes
- Site – The total area of land on which the project or land disturbing activity is located.
 - For linear projects, this is typically the area of the right of way on which the roadway section exists or is constructed. When analyzing individual outfalls, the site area would be the right of way area draining to each specific outfall.
 - For non-linear projects, it is typically the total area of the property within which the proposed development is occurring.
 - Permanent easements and/or other property acquired through the right of way acquisition process may be considered a part of the site and utilized in determining the post construction stormwater management requirements for the project providing such property is intended to remain under the ownership/control of the Department for the life of the project and providing such property is so identified/designated on the plans and legally encumbered for the purpose of SWM.
- Traveled Way – That portion of the roadway section, exclusive of shoulders, designated for vehicular use.
- Water Quality Offsets – The process of overachieving water quality requirements at one location to compensate for another location where water quality requirements are unable to be fully or partially achieved.
- Watershed – The surface area, measured in a horizontal plane, draining to a specific point in a channel, stream, river or other such watercourse. Also referred to as Drainage Area or Drainage Basin.

REFERENCES

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- Virginia SWM Handbook – First Edition (1999) Volume I and II.
 - Virginia ESC Handbook – Third Edition (1992).

1.0 PROGRAM BACKGROUND

- 1.1 Acts of the General Assembly and the SWCB have resulted in the issuance of Virginia Stormwater Management Program Law and Regulations and Virginia Erosion and Sediment Control Law and Regulations. The general application of the VSMP Law and Regulations to VDOT operations is addressed in this IIM. The general application of the ESC Law and Regulations to VDOT operations is addressed in the current version of IIM-LD-11.

Further information regarding the VSMP Law and Regulations or the Virginia ESC Law and Regulations may be obtained from the Virginia Department of Conservation and Recreation at: http://www.dcr.virginia.gov/soil_and_water/

- 1.2 Additional information may also be obtained from the Virginia SWM Handbook and the Virginia ESC Handbook published by DCR and available at the web site noted in Section 1.1.

2.0 PROGRAM OBJECTIVE

2.1 Post Development Stormwater Management

To inhibit the deterioration of the aquatic environment by instituting a post development stormwater management program that maintains both water quantity and quality post development run-off characteristics, as nearly as practicable, equal to or better than pre-development run-off characteristics.

2.2 Erosion and Sediment Control

To effectively control soil erosion, sediment deposition, and post development run-off in order to protect downstream properties from erosion and flooding and to minimize on site soil erosion and transportation of sediment off the project site.

3.0 PROGRAM ADMINISTRATION

- 3.1 VDOT requests an annual approval of its ESC and SWM Standards and Specifications from DCR. By its annual approval of VDOT's ESC and SWM Standards and Specifications, DCR authorizes VDOT to administer its ESC and SWM Program in accordance with the approved ESC and SWM Standards and Specifications on all regulated land disturbance activities undertaken by the Department.

- 3.2 VDOT's Approved ESC and SWM Standards and Specifications shall apply to all plan design, construction and maintenance activities undertaken by VDOT, either by its internal workforce or contracted to external entities, where such activities are regulated by the Virginia ESC and VSMP Law and Regulations. During any inspections of VDOT land disturbing activities by DCR, EPA and other such environmental agencies, compliance with the VDOT Approved ESC and SWM Standards and Specifications (and all parts thereof) will be expected.
- 3.3 Any revisions to the VDOT's approved ESC and SWM Standards and Specifications shall be reviewed and approved by the DCR prior to implementation. Such review and approval shall be coordinated by the VDOT ESC Program Administrator (State Hydraulics Engineer).

4.0 POLICY/GENERAL GUIDELINES

- 4.1 The VSMP Regulations are applicable to all land disturbing activities where one acre or greater (2,500 square feet or greater in a designated CBPA) of land is disturbed except as noted in Section 4.8 of this IIM.
- 4.2 The VSMP Regulations are applicable to all State Agency Projects and shall apply to all regulated land disturbing activities, both construction and maintenance, undertaken by the VDOT, either by its internal workforce or contracted to external entities, including those constructed/developed under the Public/Private Transportation Act (PPTA), the Design/Build process and the Capital Outlay Program.
- 4.3 Projects, such as subdivision streets, industrial access roads, etc., which are designed and constructed by other parties and which are eligible for acceptance into the state roadway system for operations and/or maintenance after completion of construction are not considered state agency projects and must, typically, conform to appropriate local SWM regulations (see exception in Section 4.5 of this IIM).
- 4.4 Land disturbing activities occurring within the existing right of way of VDOT owned and/or operated roadway facilities that are a part of an off site development and which are allowed by the issuance of a VDOT Land Use Permit and which are designed and constructed by other parties, are not considered state agency projects and must, typically, conform to the appropriate local SWM Regulations (see exception in Section 4.5 of this IIM).

- 4.5 Prior to the issuance of a VDOT Land Use Permit for land disturbance activities occurring on the right of way of VDOT owned and/or operated roadway facilities or the acceptance of a roadway facility into the state roadway system for VDOT operations and/or maintenance, those activities identified in Section 4.3 and 4.4 of this IIM, and which occur in a designated MS4 area or a watershed with an approved TMDL plan, shall be reviewed by the appropriate VDOT personnel for compliance with the conditions of the MS4 General Permit and/or the approved TMDL plan and the requirements of the VDOT Implementation Plan for the MS4 General Permit conditions. Those activities found not to comply with the conditions of the MS4 General Permit or an approved TMDL plan or the VDOT MS4 Implementation Plan requirements and responsibilities shall not be issued a Land Use Permit nor be accepted into the state system of roadways until such compliance is demonstrated.
- 4.6 With regards to changes to the land surface, the impact of any such changes should be based on the proposed post development condition of the site and should consider the effects of a mature vegetative cover and should not be based on the temporary surface changes that occur during construction activities. The temporary surface changes occurring during construction activities are addressed by the Virginia ESC Regulations.
- 4.7 Milling and/or overlaying/reconstructing an existing impervious surface is not considered a land disturbance activity but any associated shoulder or ditch grading would be considered in the calculation of the total land disturbance quantity for the proposed activity.
- 4.8 The following land disturbance activities are exempt from the VSMP Regulations:
- Linear development projects (e.g., highway construction projects) where less than one acre will be disturbed per outfall or watershed and where there will be insignificant increases in peak flow rates and where there is no existing or anticipated flooding or erosion problems downstream of the discharge (outfall) point. For projects with multiple outfalls, this exemption shall be applied to each outfall meeting the noted criteria.
 - Routine maintenance activities that are performed to maintain the original line and grade, hydraulic capacity or original construction of the project and which disturb less than five acres of land.
- 4.9 When requested by the DCR prior to the public participation phase of a project (or other such phase where no public participation process is required), VDOT projects located in jurisdictions with more stringent SWM technical criteria than that required by the VSMP Regulations (as identified in this IIM) shall be designed, to the maximum extent practicable, to meet those more stringent criteria. The local criteria may be part of a locally adopted DCR approved SWM program or may be part of a watershed initiative related to the protection of a water supply, a TMDL implementation plan, or a Tributary Strategy plan. It will be the responsibility of the SWM Plan Designer to demonstrate to DCR that the more stringent local requirements are not practicable for the project under consideration. Early coordination should occur between the SWM Plan Designer and the local program authority in order to identify any such potential requirements.

5.0 TECHNICAL CRITERIA

5.1 The VSMP Regulations provide technical criteria to address three specific areas:

- Stream Channel Erosion
- Flooding
- Water Quality

The requirements for each of these areas are addressed in this IIM.

5.2 Stream Channel Erosion

5.2.1 Properties and receiving waterways downstream of any land-disturbing activity shall be protected from erosion and damage due to changes in stormwater flows and hydrologic characteristics, including but not limited to, changes in run-off volume, velocity, frequency, duration, and peak flow rate.

5.2.2 Requirements for stream channel erosion control shall be governed by the Virginia ESC Regulation MS 19 for an adequate receiving channel for stormwater discharges.

5.2.3 Receiving channels shall be reviewed for adequacy based upon the following criteria:

1. Natural channels shall be analyzed by the use of a post development peak discharge from a 2 year storm to verify that stormwater will not cause erosion of the channel bed and banks.
2. All previously constructed man-made channels shall be analyzed by the use of a post development peak discharge from a 2 year storm to verify that the stormwater will not cause erosion of the channel bed or banks.

5.2.4 When utilizing an existing culvert or storm sewer pipe as the outfall for stormwater run-off from the development site, the receiving channel at the outlet end of the existing culvert or storm sewer pipe shall be analyzed for adequacy in accordance with Section 5.2.3 based on the type of receiving channel (natural or man-made).

5.2.5 If existing natural or previously constructed man-made receiving channels are not adequate, then one of the following measures must be implemented:

1. Improve the receiving channel to a condition where the post development peak run-off rate from a two year storm will not cause erosion to the channel bed or banks or the drainage area within the channel complies with the requirements of Section 5.2.9 of this IIM, or

2. Develop a site design that will not cause the pre-development peak run-off rate from a two year storm to increase when run-off discharges into a natural channel or will not cause the pre-development peak run-off rate from a ten year storm to increase when run-off discharges into a man-made channel, or
3. Provide a combination of channel improvements, stormwater detention or other measures to prevent downstream erosion.

5.2.6 Where determined necessary by the SWM Plan Designer or requested by DCR, water quantity control for the 1 year storm may be required if there are existing or anticipated erosion concerns downstream. Such determination or request shall be made prior to the public participation phase of the project (or other such phase when no public participation process is required). Control of the 1 year storm requires detaining the volume of runoff from the entire drainage area and releasing that volume over a 24 hour period. See the Virginia SWM Handbook, Volume I, Page 1-23 and Volume II, Pages 5-38 thru 5-41 for additional information.

5.2.7 Pre-development conditions for both off site and on site areas shall be those that exist at the time when the final receiving channel analysis is performed. All land cover shall be assumed to be in good condition regardless of actual conditions existing at the time the analysis is done.

5.2.8 Post development conditions for off site areas shall be determined the same as in Section 5.2.7 of this IIM. Post development conditions for the project site shall be determined based on the proposed ultimate development for the site.

5.2.9 One Percent (1%) Rule - If it can be demonstrated that the total drainage area to the point of analysis within the receiving channel is 100 times greater than the contributing drainage area from within the project site, the receiving channel may be considered adequate, with respect to the stability (erosion) requirements, without further analysis.

5.3 Flooding

5.3.1 Properties and receiving waterways downstream of any land disturbing activity shall be protected from localized flooding due to changes in stormwater flows and hydrologic characteristics including, but not limited to, changes in run-off volume, velocity, frequency, duration, and peak flow rate.

5.3.2 For non-linear projects, the 10 year post development peak rate of run-off from the site shall not exceed the 10 year pre-developed peak rate of run-off.

5.3.3 For linear projects, requirements for downstream flooding control shall be governed by the Virginia ESC Regulation MS 19 for adequate receiving channel for stormwater discharges.

5.3.3.1 Receiving channels shall be reviewed for adequacy based upon the following criteria:

1. Natural channels shall be analyzed by the use of a post development peak discharge rate from 2 year storm to verify that stormwater will not overtop the channel banks.
2. All previously constructed man-made channels shall be analyzed by the use of a post development peak discharge rate from a 10 year storm to verify that the stormwater will not overtop the channel banks.
3. Existing culvert and storm sewer systems utilized as stormwater outfalls for the development site shall be analyzed by the use of a post development peak discharge rate from a 10 year frequency storm to verify that the stormwater will be contained within the pipe or storm sewer system.

5.3.3.2 When utilizing an existing culvert or storm sewer pipe as the outfall for stormwater run-off from the development site, the receiving channel at the outlet end of the existing culvert or storm sewer pipe shall be analyzed for adequacy in accordance with Section 5.3.3.1 based on the type of receiving channel (natural or man-made).

5.3.3.3 If existing natural or previously constructed man-made receiving channels or existing culvert or storm sewer pipe systems are not adequate, then one of the following measures must be implemented:

1. Improve the channel to a condition where the post development peak run-off rate from a ten year storm will not overtop the channel banks or the drainage area within the channel complies with the requirements of Section 5.3.3.4 of this IIM, or
2. Improve the culvert or storm sewer system to a condition where the post development peak run-off rate from a ten year storm is contained within the appurtenances, or
3. Develop a site design that will not cause the pre-development peak run-off rate from a two year storm to increase when runoff from the site discharges into a natural channel or will not cause the pre-development peak run-off rate from a ten year storm to increase when run-off from the site discharges into a man-made channel or a culvert/storm sewer system, or
4. Provide a combination of channel/culvert/storm sewer system improvements, stormwater detention or other measures in order to prevent downstream flooding.

5.3.3.4 One Percent (1%) Rule - If it can be demonstrated that the total drainage area to the point of analysis within the receiving channel is 100 times greater than the contributing drainage area from within the project site, the receiving channel may be considered adequate, with respect to the flooding requirements, without further analysis.

5.3.3.5 Pre-development conditions for both the off site and on site areas shall be those that exist at the time when the final receiving channel analysis is performed. All land cover shall be assumed to be in good condition regardless of actual conditions existing at the time the analysis is done.

5.3.3.6 Post development conditions for off site areas shall be determined the same as in Section 5.3.3.5 of this IIM. Post development conditions for the project site shall be determined based on the proposed ultimate development for the site.

5.4 Water Quality Control

5.4.1 With the exception of those land disturbing activities noted as exempt in Section 4.8 of this IIM, a water quality control plan shall be developed for each land disturbing activity exceeding the land disturbance thresholds noted in Section 4.1 of this IIM.

5.4.2 Compliance with the water quality criteria may be achieved by applying the performance based criteria or the technology based criteria methodology. Discussion and application of each of these methodologies, as they relate to VDOT land disturbing activities, is found in Sections 5.4.3 and 5.4.4 of this IIM. Additional discussion and application of these methodologies can be found in Volumes I and II of the Virginia SWM Handbook.

5.4.3 Performance Based Criteria

5.4.3.1 The calculated post development non-point source pollutant runoff load from the site shall be compared to the calculated pre-development pollutant load from the site based upon the average land cover condition or the existing site condition as related to the site's percent impervious.

5.4.3.2 The site's percent impervious shall be determined as follows:

- For pre-development conditions -The total pre-development impervious area of the site divided by the total post development area of the site.
- For post development conditions -The total post development impervious area of the site divided by the total post development area of the site.

5.4.3.3 A BMP shall be located, designed, and maintained to achieve the target pollutant removal efficiencies specified in Table 1 in order to effectively reduce the post development pollutant load from the site to the required level based upon the following four applicable land development situations for which the performance criteria apply:

1. Situation 1 consists of land disturbing activities where the pre-development percent impervious cover of the site is less than or equal to the average land cover condition (16%) and the proposed improvements will create a total post development percent impervious cover of the site which is less than the average land cover condition (16%).

- Water Quality Requirement: No reduction in the post development pollutant discharge from the site is required.
2. Situation 2 consists of land disturbing activities where the pre-development percent impervious cover of the site is less than or equal to the average land cover condition (16%) and the proposed improvements will create a total post development percent impervious cover of the site which is greater than the average land cover condition (16%).
 - Water Quality Requirement: The post development pollutant discharge from the site shall not exceed the pre-development pollutant discharge from the site based on the average land cover condition (16%).
 3. Situation 3 consists of land disturbing activities where the pre-development percent impervious cover of the site is greater than the average land cover condition (16%).
 - Water Quality Requirement: The post development pollutant discharge from the site shall not exceed (a) the pre-development pollutant discharge from the site less 10% or (b) the pollutant discharge based on the average land cover condition (16%), whichever is greater.
 4. Situation 4 consists of land disturbing activities where the pre-development impervious cover of the site is served by an existing stormwater management BMP that addresses water quality.
 - Water Quality Requirement: The post development pollutant discharge from the site shall not exceed the pre-development pollutant discharge from the site based on the existing percent impervious cover of the area being served by the existing BMP. The existing BMP shall be shown to have been designed and constructed in accordance with proper design standards and specifications, and to be in proper functioning condition.

5.4.4 Technology Based Criteria

- The stormwater run-off from the impervious cover of the land disturbing activity shall be treated by an appropriate BMP as specified in Table 1 based on the applicable post construction percent impervious cover of the site.
- When the applicable percent impervious cover of the site is less than the statewide “average land cover condition” of 16%, no water quality BMPs are required. Exception - Where a locality has established a lower “average land cover condition” than the statewide average, the provisions of Section 4.9 of this IIM shall govern.

5.4.4.1 The applicable post construction percent impervious cover of the site shall be as follows:

- For linear development projects – The net increase in impervious area of the site (total post development impervious area of the site minus the total pre-development impervious area of the site) divided by the total post development area of the site.
- For Non- Linear Projects – See Section 5.4.3.2 of this IIM.

5.4.4.2 The water quality volume for any required BMP shall be based on the total post development impervious area within the site draining to the BMP.

TABLE 1 BMP SELECTION TABLE		
Water Quality BMP	Target Phosphorus Removal Efficiency	Applicable Percent Impervious Cover of Site
Vegetated filter strip Grassed swale	10% 15%	16-21%
Constructed wetlands Extended detention (2xWQV) Retention basin I (3xWQV)	30% 35% 40%	22-37%
Bioretention basin Bioretention filter Extended detention-enhanced Retention basin II (4xWQV) Infiltration (1xWQV)	50% 50% 50% 50% 50%	38-66%
Sand filter Infiltration (2xWQV) Retention basin III (4xWQV with aquatic bench)	65% 65% 65%	67-100%

5.4.5 Innovative or alternative BMPs not included in Table 1 may be allowed at the discretion and approval of the DCR. Approval to use such is to be coordinated between the VDOT State Hydraulics Engineer and the DCR VSMP Manager.

5.4.6 When the 1 year storm is detained for 24 hours (in accordance with Section 5.2.6 of this IIM) there will be no need to provide additional or separate storage for the WQV if it can be demonstrated that the WQV will be detained for approximately 24 hours.

5.4.7 Water Quality Offsets

Where the water quality requirements for the land development activity can not be met on-site or, in the case of a linear development project, at a specific outfall/discharge point from the site, water quality offsets can be used to achieve compliance with the water quality requirements of the VSMP Regulations. Water quality offsets are to be provided within the same HUC watershed as where originally required.

- 5.4.8 The following information is taken from the the current VSMP Regulations and the Virginia SWM Handbook.
- 5.4.8.1 The selected BMP shall be located, designed, and maintained to perform at the target pollutant removal efficiency specified in Table 1. Design standards and specifications for the BMPs in Table 1 that meet the required target pollutant removal efficiency are available in the Virginia SWM Handbook. Additional information can also be found on the Virginia Stormwater BMP Clearing House website <http://www.vwrrc.vt.edu/swc/> .
 - 5.4.8.2 Extended Detention Basins and Extended Detention Basins Enhanced require a WQV of two times the standard WQV or 1 inch of run-off from the post development impervious area of the site draining to the BMP.
 - 5.4.8.3 Extended Detention Basins and Extended Detention Basins Enhanced require a 30 hour drawdown time for the required WQV. If the required orifice size to achieve the 30 hour draw down time is found to be significantly less than 3 inches, an alternative water quality BMP should be investigated for use, such as a linear facility that treats the WQV and allows larger storms to bypass. The calculation procedure for the drawdown time and orifice sizing can be found in the Virginia SWM Handbook Volume II, Pages 5-33 through 5-38.
 - 5.4.8.4 In order to facilitate maintenance, sediment forebays are to be incorporated into the design of Extended Detention Basins and Extended Detention Basins Enhanced. The volume of the forebay should be 0.1 inch – 0.25 inches times the impervious area treated by the facility or 10 percent of the required detention volume. Additional information can be found in the Virginia SWM Handbook Volume I, Pages 3.04-1 through 5.
 - 5.4.8.5 The overflow spillway shall be stabilized utilizing rip rap, concrete or other non-erodible material.
 - 5.4.8.6 Suggested details for the Extended Detention Basin can be found in the Virginia SWM Handbook Volume I, Pages 3.07-4 and 5. The riprap lined low flow channel through the basin is not recommended due to maintenance considerations.
 - 5.4.8.7 Suggested details for the Extended Detention Basin Enhanced can be found in the Virginia SWM Handbook Volume I, Pages 3.07-6 and 7. The geometric shape of the facility may need to be more symmetrical than that shown in order to facilitate construction of the basin to the dimensions needed.
 - 5.4.8.8 Non-structural practices including, but not limited to, minimization of impervious areas and curbing requirements, open space acquisition, floodplain management, and protection of wetlands may be utilized as appropriate in order to at least partially satisfy the water quality requirements. Approval to use such non-structural measures is to be secured in advance from the DCR and is to be coordinated between the VDOT State Hydraulics Engineer and the DCR VSMP Manager.

6.0 OTHER DESIGN CRITERIA / CONSIDERATIONS

- 6.1 The analysis to demonstrate compliance with the requirements of Section 5.2 and 5.3 of this IIM (MS 19 of the Virginia ESC Regulations) shall be performed in accordance with the procedures noted in the DCR Technical Bulletin No. 1 (Stream Channel Erosion Control Policy Guidance).
- 6.2 Increased volumes of sheet flow due to the proposed development that may cause erosion and sedimentation on adjacent property shall be diverted to a stable outfall, an adequate channel, pipe or storm sewer system or to an appropriate SWM facility.
- 6.3 All on site channels (including culverts and storm sewer systems) must be designed/verified to be adequate in accordance with Sections 5.2 and 5.3 of this IIM (MS 19 of the Virginia ESC Regulations).
- 6.4 Impounding structures (dams) that are not covered by the Virginia Dam Safety Regulations shall be designed in accordance with Section 12.0 of this IIM and reviewed for floodplain impacts during the passage of the 100 year storm event.
- 6.5 Outflows from stormwater management facilities shall be discharged into an adequate receiving channel as defined in Section 5.2 and 5.3 of this IIM (MS 19 of the Virginia ESC Regulations).
- 6.6 Existing swales being utilized as natural or man-made outfall conveyances for pre-development run-off will be considered as channels and, if the swale satisfactorily meets the criteria contained in Section 5.2 and 5.3 of this IIM (MS 19 of the Virginia ESC Regulations) for the post development run-off, it will be considered an adequate receiving channel.
- 6.7 Construction of stormwater management impoundment structures within a FEMA designated 100 year flood plain shall be avoided whenever possible. When this is unavoidable, a thorough review shall be made to ensure that the stormwater management facility will operate effectively for its intended purpose during the passage of the 10 year flood event on the flood plain. All stormwater management facility construction within a designated 100 year flood plain shall be in compliance with all applicable regulations under the FEMA's National Flood Insurance Program. The stormwater management facility shall be reviewed for any potential impacts to the 100 year flood event characteristics of the floodplain and designed for structural stability during the passage of the 100 year flood event on the flood plain.
- 6.8 Construction of stormwater management facilities within a sinkhole is prohibited. If stormwater management facilities are required along the periphery of a sinkhole, the design of such facilities shall comply with the guidelines in the latest IIM-LD-228 (Sinkholes) and the DCR's Technical Bulletin No. 2 (Hydrologic Modeling and Design in Karst) and applicable sections of the Virginia SWM Handbook.

- 6.9 Design of any stormwater management facilities with permanent water features (proposed or potential) located within five (5) miles of a public use or military airport is to be reviewed and coordinated in accordance with Section A-6 of the VDOT Road Design Manual.
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7.0 REGIONAL FACILITIES

- 7.1 There are many cases where it is more feasible to develop one major stormwater management facility to control a large watershed area rather than a number of small individual facilities controlling small drainage areas within the large watershed. The concept of regional stormwater management facilities is endorsed by the VDOT provided that certain requirements are met.
- 7.1.1 Development and use of regional stormwater management facilities must be a joint undertaking by the VDOT and the local governing body. The site must be part of a master stormwater management plan developed and/or approved by the local governing body and any agreements related to the VDOT use of these facilities must be consummated between the VDOT and the local governing body. The VDOT may enter into an agreement with a private individual or corporation provided the local governing body has a SWM program that complies with the VSMP Regulations and the proper agreements for maintenance and liability of the regional facility have been executed between the local governing body and the private individual or corporation.
- 7.1.2 Where an existing or potential VDOT roadway embankment will serve as an impounding structure for a regional facility, the right of way line will normally be set at the inlet face of the main drainage structure. The local government would be responsible for the maintenance and liabilities outside of the right of way and the VDOT would accept the same responsibilities inside the right of way.
- 7.1.3 The design of regional stormwater management facilities must address any mitigation needed to meet the water quality and quantity requirements of proposed or future roadway projects within the contributing watershed. Regional SWM facilities located upstream of a roadway project shall provide sufficient mitigation for any water quality and quantity impacts of run-off from the roadway project which may bypass the facility.
- 7.2 Any questions or concerns related to the the use of an off site regional SWM facility to satisfy the VDOT post construction swm requirements should be discussed with the DCR prior to entering into any agreements with either private or public entities.

8.0 MULTI-USE SWM BASINS

- 8.1 SWM basins may function as both quantity control and quality control facilities. Some basins may only be needed for quality control.
- 8.2 SWM basins are typically utilized as temporary sediment basins during the construction phase of the project and the design of the SWM basin will need to address this dual function. The design that is needed for a permanent SWM basin may need to be altered to provide additional temporary sediment storage volume that is in excess of the required WQV. For design purposes, the two volumes (WQV and temporary sediment storage volume) should not be added together but rather the larger of the two should govern the basin's design.
- 8.2.1 The additional volume needed for temporary sediment storage may be provided by excavating the bottom of the basin lower than that required for the WQV. The basin's permanent outlet control structure can be temporarily altered to serve as the control structure for the temporary sediment basin (see Standard SWM-DR of VDOT's R&B Standards and the Virginia ESC Handbook). When the project is nearing completion and the basin is no longer needed for temporary sediment control, the basin can be converted to satisfy the permanent SWM basin requirements by regrading (excavating and/or filling) and removing any temporary control structure appurtenances.

9.0 PLAN PREPARATION

- 9.1 Complete (C) and Minimum (M) plan projects shall show stormwater management and erosion control measures in the plan assembly as directed in the latest version of IIM-LD-11, the VDOT Drainage Manual and the VDOT Road Design Manual.
- 9.2 No-plan (N) and other types of projects (including maintenance activities) that have an abbreviated plan assembly must conform to the requirements of the ESC and VSMP Regulations where the land disturbance value exceeds the land disturbance thresholds for such. For the definition of these types of projects, and the procedures for addressing both the erosion and sediment control and stormwater management plan details for such projects, see the latest version of IIM-LD-11, the VDOT Drainage Manual and the VDOT Road Design Manual.

10.0 FOUNDATION DATA

- 10.1 Foundation data (a soil boring) for the base of the dam should be requested for all stormwater management basins in order to determine if the native material will support the dam and prevent ponded water from seeping under the dam. An additional boring near the center of the basin should also be requested if:
1. Excavation from the basin may, potentially, be used to construct the dam, or
 2. There is potential for rock to be encountered in the area of excavation, or
 3. A high water table is suspected that may alter the performance of the SWM basin.
- 10.2 For large basins, more than one boring for the dam and one boring for the area of the basin may be needed. The number and locations of the borings are to be determined by the VDOT SWM Plan Designer/Hydraulics Engineer and/or the VDOT Materials Engineer.
- 10.3 The foundation data for the swm basin should be requested by the VDOT SWM Plan Designer/Hydraulics Engineer at the same time that the request for culvert foundation data is initiated.

11.0 RIGHT OF WAY/PERMANENT EASEMENTS

- 11.1 Permanent stormwater management facilities may be placed in fee right of way or in permanent easements.
- 11.1.1 It is recommended that all permanent stormwater management features (dams, risers, storage area etc.) be placed within fee right of way initially. Outfall ditches and similar features may initially be placed in permanent easements.
 - 11.1.2 The final decision on right of way versus permanent easement should be made prior to the Right of Way (or similar) phase of the project development process based on information obtained at the Field Inspection, Design Public Hearing and/or other such plan review milestones.
- 11.2 The Department will generally be amenable to the desires of the affected landowners regarding the fee right of way/permanent easement issue.
- 11.3 The multiple use of property for stormwater management facilities and other features, such as utilities, is permissible. The decision on the advisability of such actions must be made on an individual case basis.

11.4 Permanent easements and/or other property acquired through the right of way acquisition process, and which are considered a part of the “site” in determining the post construction stormwater management requirements for the project, are to remain under the ownership/control of the Department for the life of the project and such property is to be identified/designated on the plans and legally encumbered for the purpose of SWM.

12.0 DESIGN DETAILS

12.1 The following details are to be incorporated into the design of VDOT stormwater management basins in order to be in compliance with the VSMP Regulations and the Virginia SWM Handbook. These details address concerns with seepage through the dam and along the culvert due to the ponding of water in the basins for durations greater than that associated with typical culvert installations.

12.1.1 The foundation material under the dam and the material used for the embankment of the dam shall be an AASHTO Type A-4 or finer and/or meet the approval of the VDOT Materials Division. If the native material is not adequate, the foundation of the dam is to be excavated and backfilled a minimum of 4 feet or the amount recommended by the VDOT Materials Division. The backfill and embankment material must meet the soil classification requirements identified herein or the design of the dam may incorporate a trench lined with a membrane (such as bentonite penetrated fabric or an HDPE or LDPE liner). Such designs shall be reviewed and approved by the VDOT Materials Division before use.

12.1.2 The pipe culvert under or through the dam is to be reinforced concrete pipe with rubber gaskets. The pipe and gaskets are to comply with the following VDOT Road and Bridge Specifications:

- Pipe - Section 232 (AASHTO M170)
- Gasket - Section 212 (ASTM C443)

12.1.3 A concrete cradle is to be used under the pipe through the dam in order to prevent seepage. The concrete cradle is to begin at the riser or inlet end of the pipe and extend the full length of the pipe (see Standard SWM-DR of VDOT’s R&B Standards).

12.1.4 If the height of the dam is greater than 15’ or if the basin includes a permanent water pool, the design of the dam is to include a homogenous embankment with seepage controls or zoned embankment or similar design in accordance with the Virginia SWM Handbook and recommendations of the VDOT Materials Division.

12.1.5 The top width of the dam is to be 10’ minimum in order to facilitate both construction and maintenance operations.

- 12.1.6 The side slopes of the basin should be no steeper than 3:1 to facilitate mowing and maintenance inspections/operations.
- 12.1.7 The longitudinal slope along the bottom of the basin should be no greater than 2% nor less than 0.5%.
- 12.1.8 The depth of the basin from the lowest bottom elevation to the primary outflow point (top of riser or invert of orifice or weir) should be no more than 3 feet in order to reduce the hazard potential. If the depth needs to be more than 3 feet, fencing (or other means to limit access) of the basin site should be considered.
- 12.1.9 The primary control structure (riser or weir) should be designed to operate in weir flow conditions for the full range of design flows. Where this is not possible or feasible and the control structure will operate in orifice flow conditions at some point within the design flow range, an anti-vortex device, consistent with the design recommendations in the Virginia SWM Handbook, shall be utilized.
- 12.1.10 The length to width ratio of the basin should be about 3:1, with the widest part of the basin at the outlet end. If the ratio is less than about 2:1, and if there is concern that the velocity of flow through the basin will be high, consideration should be given to using baffles within the basin to reduce velocity and increase flow time through the basin.

13.0 PERIMETER CONTROLS

All SWM basins should be reviewed for the needs of fencing, barricades and no trespassing signs in accordance with the following guidelines.

13.1 Fencing

- 13.1.1 Fencing of stormwater management basins is normally not required and should not be considered for most basins due to:
- Insignificant Hazard – For detention basins (no permanent water pool), significant ponding of water in the basin should only occur with very heavy rainfall events and the maximum ponded depth should typically be no more than about 3 feet. Ponds and lakes are almost never fenced, even though they may be located in subdivisions and have deep, permanent water pools.
 - Limits Maintenance – Fencing could hinder the performance of both routine and long term maintenance operations. Fencing could become damaged during major maintenance operations and have to be repaired or replaced.
- 13.1.2 Fencing of SWM basins may be needed and should be considered when:

1. The basin is deep with a maximum ponded depth greater than about 3' and/or has steep side slopes with 2 or more sides steeper than 3:1, or
2. The basin is in close proximity to schools, playgrounds or similar areas where children may be expected to frequent, or
3. It is recommended by the VDOT Field Inspection Review Team (or other such plan reviewing group), the VDOT Residency Administrator or the City/County (where the City/County will assume maintenance responsibility).

13.1.3 Where fencing is proposed, access gate(s) of sufficient size to accommodate maintenance equipment are to be provided. Appropriate security mechanisms for the gates are to be provided to prevent/deter unauthorized entry.

13.2 Barricades

For non-fenced basins, a chain barricade (see Standard CR-1 of VDOT's R&B Standards) or gate may be needed across the vehicular entrance to prohibit non-authorized access if there is a concern with illegal dumping or other undesirable activities at the site.

13.3 Signs

"No Trespassing" signs shall be considered for use on all basins, whether fenced or unfenced, and should be recommended, as needed, by the VDOT Field Inspection Review Team or other such plan reviewing group.

14.0 MAINTENANCE

- Requirements for maintenance of stormwater management facilities, the schedule for inspection and maintenance operations, and the identification of persons responsible for the maintenance will be addressed in the VDOT's ESC and SWM Standards and Specifications, as approved annually by the DCR.

15.0 REPORTING

15.1 The VDOT is required to submit an annual report to the DCR that identifies the location, number and type of stormwater management facilities installed during the preceding year, their storage capacities, the affected water body, and a summary of any water quality monitoring data associated with the facility. The reporting period is from July 1 to June 30.

15.2 A database has been established on the VDOT Central Office Hydraulics Section's web system to record the required data for all VDOT projects.

15.2.1 It shall be the responsibility of the VDOT District Hydraulics Engineer or VSMP Construction Permit Coordinator to ensure that the required information is logged into the database for all post construction stormwater management facilities that are installed on VDOT projects in their respective areas.

15.2.2 Information is to be logged into the data base when the VSMP Permit Termination Notice Form (LD-445D) is submitted with the as built BMP information (see the latest version of IIM-LD-242 and IIM-LD-246).

16.0 PLAN DETAILS

16.1 Stormwater Management Drainage Structure – R&B Standard SWM-1

- To be used at all applicable locations where a riser type of control structure is desired.
- At locations where a riser type structure is desired but a Standard SWM-1 structure will not satisfy site specific characteristics, a special design structure is to be utilized with appropriate details developed and included in the plan assembly or other such construction documents.

16.2 Stormwater Management Dam

- To be used at locations where a wall type control structure is desired (includes modifications to standard endwalls). Normally used where shallow depths of ponding are desired/required.
- Appropriate details are to be developed and included in the plan assembly or other such construction documents for individual locations to fit site specific conditions.

16.3 Stormwater Management Details – Road and Bridge Standard SWM-DR

- Includes details for debris rack, trash rack, concrete cradle, water quality orifice and modifications for use of SWM facility as a temporary sediment basin.
- Specify at each SWM facility location requiring any of the noted items.
- The size opening for the water quality orifice or other required openings in the control structure shall be specified in the description for the control structure for each SWM facility.

16.4 Access

- A means of access for inspection and maintenance personnel shall be provided at each SWM facility location. The Standard PE-1 details shown in VDOT's Road and Bridge Standards should be used for vehicular entrances.
 - A turnaround area is to be provided at or near the terminus of each vehicular entrance.
 - An appropriate all weather surface material shall be provided for each vehicular entrance.
 - See Section 13.0 of this IIM for requirements for access control.
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17.0 METHOD OF MEASUREMENT – BASIS OF PAYMENT

17.1 Stormwater Management Drainage Structure – Road and Bridge Standard SWM-1 and other similar types of control structures.

- Basis of payment to be linear feet measured from invert of structure to top of concrete. Price bid includes cost of trash rack, debris rack and holder, temporary dewatering device and temporary metal plates.

17.2 Stormwater Management Dam

- Basis of payment to be cubic yards of Concrete Class A3 Miscellaneous and pounds of Reinforcing Steel.

17.3 Concrete Cradle

- Basis of payment to be cubic yards of Concrete Class A3 Miscellaneous.

17.4 Excavation for stormwater management facilities will be measured and paid for as cubic yards of Stormwater Management Basin Excavation.

17.5 Fill material needed for dams or berms will be measured and paid for as cubic yards of Regular Excavation, Borrow Excavation or Embankment, as appropriate.

17.6 The Grading Diagram and/or the Grading Summary is to reflect how the cubic yards of Stormwater Management Basin Excavation and cubic yards of Embankment or Borrow, if needed, are to be distributed.

18.0 STORMWATER MANAGEMENT SUMMARY

- 18.1 All drainage items related to the construction of stormwater management facilities shall be summarized, by location, in the Drainage Summary for the project.
- 18.2 All incidental items related to the construction of stormwater management facilities shall be summarized, by location, in the Incidental Summary for the project.
- 18.3 Stormwater Management Excavation and Borrow or Embankment, if needed, are to be included in the totals on the Grading Diagram and/or Summary.
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19.0 EFFECTIVE DATE

- The effective date for implementing the guidelines and criteria contained in Section 5.4.4.2 of this IIM regarding water quality volume shall be based on the date of this IIM and as follows.

19.1 Design/Bid/Build Projects

- 19.1.1 For projects that **have not** been advertised for a Public Hearing/Willingness or progressed beyond a similar phase (where no Public Hearing/Willingness is required):

- **Full Implementation.**

- 19.1.2 For projects that **have** been advertised for a Public Hearing/Willingness or progressed beyond a similar phase (where no Public Hearing/Willingness is required) but which must **repeat** that process because of reasons other than changes related to this IIM:

- **Full Implementation**

- 19.1.3 For projects that **have** been advertised for a Public Hearing/Willingness or progressed beyond a similar phase (where no Public Hearing/Willingness is required) but which **have not** progressed to the PAC or similar phase (based on the normal time schedule for such):

- **Implementation to the extent practicable within the identified right of way requirements except where the project construction schedule will be compromised in doing so.**

19.1.4 For projects that **are** at the PAC or similar phase (based on the normal time schedule for such):

- **Exempt from any type of implementation**

19.2 PPTA Projects

19.2.1 For projects that **have not** been advertised for a Public Hearing/Willingness and where a contract **has not** been executed with the selected Concessionaire:

- **Full Implementation**

19.2.2 For projects where a contract **has not** been executed with the selected Concessionaire and the project **has** been advertised for a Public Hearing/Willingness but which must **repeat** that process because of reasons other than changes related to this IIM:

- **Full Implementation**

19.2.3 For projects that **have** been advertised for a Public Hearing/Willingness but where a contract with the selected Concessionaire **has not** been executed:

- **Implementation to the extent practicable within the identified right of way requirements except where the project construction schedule will be compromised in doing so.**

19.2.4 For projects where a contract **has been** executed with the selected Concessionaire:

- **Exempt from any type of implementation**

19.3 Design Build Projects

19.3.1 For projects that **have not** been advertised for a Public Hearing/Willingness and where an RFP **has not** been advertised:

- **Full Implementation**

19.3.2 For projects where an RFP **has not** been advertised and the project **has** been advertised for a Public Hearing/Willingness but which must **repeat** that process because of reasons other than changes related to this IIM:

- **Full Implementation.**

19.3.3 For projects that **have** been advertised for a Public Hearing/Willingness but where an RFP **has not** been advertised:

- **Implementation to the extent practicable within the identified right of way requirements except where the project construction schedule will be compromised in doing so.**

19.3.4 For projects where an RFP **has** been advertised:

- **Exempt from any type of implementation.**

19.4 There may be projects that will not exactly fit into any one of the scenarios identified in Sections 19.1, 19.2 or 19.3. In those situations, a project by project decision on implementation of the water quality volume requirements contained in Section 5.4.4.2 of this IIM will have to be made. The State Hydraulics Engineer or the respective District Hydraulics Engineer should be consulted for assistance, as needed. The expectation is that VDOT will implement the revised water quality volume requirements contained in this IIM on all projects where it is reasonable and feasible to do so.