# GWRC Coastal Technical Assistance Program Report, FY2013

NA12NOS4190168, Task 47
9/30/2014

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# Product #1: Training and Coordination Summary

*Description:* Consolidation of meeting minutes and program recommendations, and training materials from periodic training sessions.

## Training & Coordination Events:

### A. Regional Stormwater Managers Committee Meetings

These meetings helped define the direction of consultant and regional staff efforts to continue to develop a useful regional model ordinance template used by localities to construct specific local stormwater ordinances, define local stormwater programs and amend other affected local ordinances to comply with State stormwater management regulations. The meetings also provided opportunities to coordinate with Caroline County and the University of Mary Washington in the development of the County's BMP database and GIS layer.

1. Meeting Minutes Summary (see Attachment 1.A)

### B. Training Events

1 VSMP Educational Forum for Public and Private Sector Stakeholders (4/2/14) (Attachment 1.B.1)

### C. Other Coordination Activities

GWRC staff and their consultants participated in the following CZM-related meetings.

1 Kickoff Meeting with GWRC, Caroline County, University Mary Washington (UMW) staffs (October 1, 2013)
2 CZM TA Project Coordination Meeting with Conservation Concepts and Caroline County staff (November 14, 2013)
3 Presentation of CZM TA Project to UMW Geography 355 class (February 13, 2014)
4 Field Work Presentation and Inspections with UMW Geography class (March 13, 2014)
5 Coordination meeting with summer interns for summer work in Caroline County (May 22, 2014)
6 CZM TA Project Coordination Meeting with Conservation Concepts, Caroline County, UMW staffs and interns (July 1, 2014)
7 VAPDC Annual Meeting (July 24, 2014)
8 CZM TA Project Field visit to recon BMP sites with Conservation Concepts, Caroline County and interns (July 31, 2014)
9 CZM TA Project Field visit to conduct measurements for proposed BMP retrofit with Conservation Concepts, Caroline County and interns (August 14, 2014)
10 Final review of CZM TA Project deliverables from interns with Conservation Concepts, Caroline County UMW staffs (September 16, 2014)
11 Quarterly CZM Coordination Meeting (June 12, 2014)
12 Quarterly CZM Coordination Meeting (September 30, 2014)

## Product #2: Enhancement of Caroline County BMP Assessment, Tracking and Monitoring System

***Description:*** An Access database[1] containing information about development sites with urban BMPs, including map coordinates of the site and BMP locations, site and property owner contact address information, the corresponding BMP maintenance agreement for the development, approved site plans and schematic drawings of the BMPs, and the latest inspection/assessment report on the installed BMPs. The resulting database will better enable the County to record and track the status of BMP inspections required under the Virginia Stormwater Management regulations and Chesapeake Bay Preservation Act to ensure that these water quality protection devices are functioning as intended.

**Report Components:**

## A. Regional CZM Technical Assistance Program Summary

Kickoff meeting was held October 1, in attendance were Kevin Byrnes, GWRC, David Nunnally, Caroline County, Jacqueline Gallagher and Steve Hanna, University of Mary Washington (UMW), Doug and Ross Pickford, Conservation Concepts. The primary purpose of the meeting was to introduce the Conservation Concepts team to the University of Mary Washington team, as Kevin Byrnes is slated for retirement and Conservation Concepts was taking on the management of the project. Mr. Byrnes distributed copies of a preliminary Excel spreadsheet of County BMPs that had been previously developed by GWRC. Mr. Byrnes then discussed the timeline. It was agreed by all parties that the timeline seemed reasonable and doable, even with Mr. Byrne's impending departure. Conservation Concepts agreed to meet with Caroline County to develop a more detailed scope of work and timeline for UMW implementation during the winter/spring months of the project.

On November 14th Dave Nunnally, Caroline County staff, Doug and Ross Pickford, of Conservation Concepts, met to discuss next steps in coordinating the scope of work for implementing the development of a GPS based database of BMPs. A preliminary list of BMP sites was identified by County staff (approximately 80 BMPs). Caroline County staff and the consultants then discussed the development of some information gathering protocols that could be utilized by Mary Washington (MWU) faculty to help with the direction of the student's work in the field. An instructional sheet and an information gathering template will be produced by the consultants with input from County staff. It was determined that at the very least, the following information would be collected during field work: Location of inflows and outflows; size of facility; a qualitative assessment of condition and comments supporting such evaluation; identification of any clogging or structural failures; and date stamped pictures of each site.

Conservation Concepts and Caroline County staff met with the MWU class (*GEO 355*) on February 13, 2014 to discuss the project specifics. Conservation Concepts provided an overview of the CZM program, explaining its purpose, objectives and goals. The consultants also provided an overview of BMPs, their purpose, how they function, and usefulness in managing stormwater. Caroline County staff

discussed the specific sites that would be included in the survey and explained how to read site plans for stormwater management purposes. An attribute table was developed based on the previous assessments and class participation. On March 13, 2014 County staff, the consultant, and the entire Geo 355 class and faculty conducted fieldwork at Maury Heights subdivision in Caroline County. Seventeen students participated in conducting assessments on 3 BMP sites.

In April, the Consultant (Conservation Concepts, LLC) worked with Mary Washington (MWU) students and faculty to develop a database metadata file and construct the database based on input from Caroline County staff needs and uses. The GPS data collected during field work conducted in March by the MWU class (*GEO 355*) was incorporated into an Excel Spreadsheet for eventual incorporation into the finished database. A call for summer interns resulted in the hiring of three students who would continue working with Caroline County staff and the consultants over the summer months. These summer interns completed all of the GPS field work, documenting the location of all 86 BMP sites, taking pictures and recording qualitative observations of the condition of the facilities. The interns also developed the Microsoft Access database based on the metadata. The interns also scanned all of the existing site plans the Caroline County had in its files that pertained to any of the BMP sites. These pdf files will be hyperlinked to the Access database, along with photographs of the BMP facilities and GPS data. The interns also reviewed the site plans to gather stormwater facility related data (i.e., drainage area of each BMP, type of facility, maintenance agreement, etc.) and transferred this information into the Access database. Caroline County staff, the consultants and MWU faculty worked with Caroline County's GIS consultants to insure that all of the new BMP data and database were incorporated into the County's existing GIS. At the conclusion of the project, the intern team, with assistance from the consultants and MWU faculty, prepared a presentation for Caroline County staff on the project and how to use the information.

On April 2, GWRC co-sponsored with the Virginia Association of Environmental Professionals, a regional educational conference that examined the details of the impending implementation of Virginia's Stormwater Management Program (VSMP). The seminar was attended by approximately 160 private and public sector engineers, planners, landscape architects and other professionals who would be impacted by the impending VSMP implementation. Joan Salvati and other DEQ staff made presentations, as well as presentations from private sector consultants providing their insights on the impending changes to Virginia's stormwater program.

Conservation Concepts staff presented lessons learned and discussed GWRC's VSMP regional process at the Annual VAPDC conference on July 24th. The panel included the Secretary of Natural Resources and examined some other issues, such as water supply planning.

## B. Subsequent Deliverables

1. **Microsoft Access Database of BMPs w/geo-references for GIS usage (Separate File - Attachment 2.B.1)**
2. **Sample of Plans Scanned into the Caroline County GIS database (Attachment 2.B.2)**
3. **Sample of field photographs gathered during inspection of County BMPs (Attachment 2.B.3)**

## Product #3: BMP Facility Design for Property Retrofit to Meet New Stormwater Runoff Requirements

***Description:*** GWRC's on-call environmental engineering/planning contractor (Conservation Concepts, L.L.C.) will receive a Task Order sub-contract to visit County-specified development sites where a remedial action plan is needed (and produced by Consultant) to restore dilapidated BMP installations.

## A. Project Summary:

As part of the Coastal Zone Management Grant, Conservation Concepts and GWRC were tasked with developing a bmp retrofit design for Caroline County. In discussions with Mr. David Nunnally, Senior Environmental Planner for Caroline County, we decided upon retrofitting stormwater management bmp's into the County Department of Planning and Community Development. Other than disconnected downspouts on the building, the site lacks any other stormwater management. The department building also houses zoning, plan review and building permits. As such, Mr. Nunnally suggested that this would be an ideal location to raise awareness of current stormwater management bmp design for the County's development and engineering community. The location of the retrofit bmp's is adjacent to the general parking lot and will be highly visible to all who visit the County building. The County DPCD building is located at 233 W. Broaddus Avenue, at the corner of N. Main Street (Rt. 2), on the northern side of the town of Bowling Green. Stormwater management along W. Broaddus Ave. consists of grass swales that discharge into a stormwater detention pond serving an adjacent property.

The bmp retrofit location is currently a mostly shaded, grassy area between the general parking lot and W. Broaddus Ave. The area is shaded by four large, well established, White Pine trees. Due to the pine trees and shaded nature of the area beneath, much of this open area lacks well established grass and is experiencing minor erosion problems. Through discussions with Mr. Nunnally, it was determined that any bmp option selected for this area would not impact the existing trees. As such, a proposal to develop stormwater bmp planter boxes, in association with an infiltration swale, was deemed an appropriate alternative. In order to have only a minimal impact on the existing trees, the design of the planter boxes would be above the existing grade. Discussions with the Virginia Department of Transportation determined that an infiltration swale would be acceptable so long as the existing swale topography would not be affected. In addition, Mr. Nunnally expressed the desire that reducing the amount of grass area would also reduce current maintenance efforts.

The design of the stormwater bmp's initially consisted of detailing the current topography of the open area. This effort would determine the size and general layout for the planter boxes. Topographic measurements were collected at five foot intervals throughout the area using a laser level. This information was used to determine planter box heights and material depths. The planter boxes were then laid out to maximize the capture of stormwater runoff from adjacent impervious surfaces (building, parking lot and roadway). Care was also taken to align the planter box retaining walls such that they would have little effect on the existing trees. With the exception of excavating small areas to tie the retaining walls into the existing slope, the plan for the planter boxes is to build them up on top of the existing topography. Infiltration tests were conducted at two locations within the proposed planter box areas and infiltration rates were determined to be in excess of 2.75 inches per hour.

Once the general layouts for the planter boxes and infiltration swale were determined, the contributing impervious surface areas were identified. The contributing impervious surface area of the building was determined to be approximately 4,430 square feet. The contributing impervious surface area of the parking lot was determined to be approximately 9,360 square feet, and the contributing impervious surface area of W. Broaddus Ave. was determined to be approximately 3,354 square feet.

Planter Box A (A1 to D1 on the drawings) is designed with a surface area of 2,115 square feet and with a depth of 6 inches, it will contain 7,910 gallons of stormwater. The engineered soil layer in Planter Box A has an average surface area of 740 square feet and an average depth of 12 inches, providing 1,384 gallons of storage. The gravel layer has an average surface area of 148 square feet and an average depth of 12 inches, providing 443 gallons of storage.

Planter Box B (E1 to F1 on the drawings) is designed with a surface area of 490 square feet and with a depth of 6 inches, this will contain 1,833 gallons of stormwater. The engineered soil layer of Planter Box B has an average surface area of 245 square feet and an average depth of 12 inches providing 61 gallons of storage. The gravel layer has an average surface area of 49 square feet and an average depth of 12 inches providing 20 gallons of storage.

The Infiltration Swale is designed with a surface area of 591 square feet and with a ponding depth of 1 inch, it will contain 368 gallons of stormwater. The engineered soil layer has a surface area of 591 square feet and at a depth of 12 inches, will provide 1,105 gallons of storage. The gravel layer has a surface area of 591 square feet and at a depth of 22 inches, will provide 3,242 gallons of storage.

The 16,366 gallons of combined stormwater storage for all three bmp's will retain approximately 1.61 inches of rain falling onto the 17,144 square feet of impervious surface at the County DPCD site.

## B. Information Products:

1. **BMP Design Drawings (Attachment 3.1)**
   These designs meet the Commonwealth's newly adopted stormwater regulations for nutrient, sediment and flow requirements. The designs are "construction ready" and have been reviewed by a certified engineer for state construction compliance.

# Attachments

# Attachment 1.A: GWRC Stormwater Managers Committee Meeting Summaries

## A. Attendance Record

**GWRC Stormwater Managers Committee Meeting Attendance Summary - CZM FY2013**

| Committee Members | 11/12/13 | 12/14/13 | 2/20/14 | 3/9/14 | 5/15/14 | 6/12/14 | 8/14/14 | 9/11/14 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Caroline County** | | | | | | | | | |
| Dave Nunnally | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | 7 |
| **King George County** | | | | | | | | | |
| Jack Green | | | | 1 | | | | | 1 |
| **City of Fredericksburg** | | | | | | | | | |
| Kevin Utt | | 1 | 1 | 1 | 1 | | | | 4 |
| **Spotsylvania County** | | | | | | | | | |
| Troy Tignor | | | 1 | 1 | 1 | 1 | 1 | | 5 |
| Craig Pennington | | | | | | | | | 0 |
| Richard Street | | | | | | | | | 0 |
| John Euson | | | | | | | | | 0 |
| Rick Roberson | | | | | | | | | 0 |
| **Stafford County** | | | | | | | | | |
| Steve Hubble | 1 | | | | | | | | 1 |
| Paul Santay | | | | | | 1 | | 1 | 2 |
| Rishi Baral | | | | | | | | | 0 |
| **Town of Bowling Green** | | | | | | | | | |
| Steve Manster | 1 | | | | 1 | | 1 | | 3 |
| **Town of Port Royal** | | | | | | | | | |
| Nancy Long | | | | | | | | | 0 |
| Alex Long | | | | | | | | | 0 |
| **GWRC** | | | | | | | | | |
| Tim Ware | 1 | 1 | 1 | 1 | 1 | 1 | | 1 | 7 |
| **Friends of the Rappahannock** | | | | | | | | | |
| Kathy Harrigan | | | | | | | | | 0 |
| **Northern Virginia Conservation Trust** | | | | | | | | | |
| Patrick Coady | 1 | 1 | | | | 1 | 1 | 1 | 5 |
| Ryan Stewart | | | | | | 1 | 1 | 1 | 3 |
| **Hanover – Caroline SWCD** | | | | | | | | | |
| Peggy Stevens | | | | 1 | | | | | 1 |
| Sharon Conner | | | | | | | | | 0 |
| **Tri-County SWCD** | | | | | | | | | |
| Charles Lively | | | | | | | | | 0 |
| **Virginia DEQ** | | | | | | | | | |
| Mike Lee | 1 | 1 | 1 | 1 | | | | | 4 |
| May Sligh | 1 | 1 | | 1 | | 1 | | | 4 |
| **Other Participants** | | | | | | | | | |
| Eldon James - Eldon James & Assoc. | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 7 |
| Doug Pickford - Conservation Concepts | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 7 |
| Ross Pickford - Conservation Concepts | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 |
| Chris Pomeroy - AquaLaw, Inc. | 1 | | | 1 | | | | | 2 |
| Mike Collins - Center for Natural Capital | | | | | | 1 | 1 | | 2 |
| **Total** | **11** | **8** | **8** | **12** | **7** | **11** | **9** | **7** | **73** |

## B. GWRC Stormwater Managers Committee Meeting Topics

11/14/2013:

1. Local Program Development Update - LG staff representatives
   a. Ordinance and VSMP Development Work Update – Local Reps
   b. DEQ Revised Schedule and VSMP Regulation Amendments
   c. Accounting for Local Govt In-Kind Match of DCR VSMP Grant Please bring breakdown of staff time effort in Sept. & Oct. – Tim Ware
2. AquaLaw Review of Ordinances - Needs, updates, concerns, insights
3. VSMP Program Funding Discussion
   a. Discussion of NFWF and DEQ Funding Requirements – Doug Pickford & Eldon James
4. Nutrient Trading Update – Eldon James
5. VSMP Workshop Update – Eldon James

12/18/2013:

1. Local Program Development Update
   a. Ordinance and VSMP Development Work Update – Local Reps
   b. Accounting for Local Govt In-Kind Match of DCR VSMP Grant Please bring breakdown of staff time effort in Sept. & Oct. – Tim Ware
2. VSMP Regulation Application By Type of Project Matrix – Review/Discussion
3. Natural Watershed Protection – Patrick Coady
4. VSMP Workshop – Eldon James

2/20/2014:

1. Accounting for Local Govt In-Kind Match of DCR VSMP Grant Please bring breakdown of staff time effort Nov. - Jan. – Tim Ware
2. HB 1173 – Local Implications/Discussion
3. VSMP Workshop – Eldon James
4. Updates on Local VSMP Submittals/Comments Received from DEQ
5. Fee Structures – Spotsylvania
6. Revised VSMP Regulation Application By Type of Project Matrix – Review/Discussion
7. NFWF Technical Grants

3/19/2014:

1. Accounting for Local Govt In-Kind Match of DCR VSMP Grant Please bring breakdown of staff time effort Jan - March – Tim Ware

2. VSMP Workshop – Eldon James
   a. Agenda – Attached for discussion and final revisions/note new local presentations at lunch
   b. Speakers – See Agenda/Confirm Welcoming Speakers
   c. Handouts – What will be included day of/deadline for inclusion/what will be circulated electronically
   d. Site Details – Registration desk/AV Support/Other?
   e. Status of Registrations – VAEPO/FABA/Local Governments (Elected Officials?)
   f. Other Items
3. Latest Status of HB 1173 – Eldon James

5/15/2014:

1. Accounting for Local Govt In-Kind Match of DCR VSMP Grant Please bring breakdown of staff time effort March - May – Tim Ware
2. VSMP Workshop Follow Up/Comments
3. Local VSMP Implementation Status/Updates – Local Government Reps
4. Nutrient Trading – Ross Pickford, Patrick Coady

6/12/2014:

1. Accounting for Local Govt In-Kind Match of DCR VSMP Grant Please bring breakdown of staff time effort May - June – Tim Ware
2. Local VSMP Implementation Status/Updates, Summary of 6/10/14 Spotsylvania Meeting – Local Government Reps
3. Regional Nutrient Reduction Strategy Feasibility Study – All
4. DEQ VSMP Grant Wrap Up

8/14/2014:

1. Accounting for Local Govt In-Kind Match of DCR VSMP Grant Please bring breakdown of staff time effort June - August – Tim Ware
2. Nutrient Trading Proposal
3. Ideas for Legislative Items for 2015 GA Session – General Discussion
4. Update on VSMP Implementation – Local Governments

9/11/14:

1. Accounting for Local Govt In-Kind Match of DCR VSMP Grant Please bring breakdown of staff time effort for August – Tim Ware
2. Nutrient Trading Program Proposal and October Workshop
3. Update on VSMP Implementation – Local Governments

## Attachment 1.A.1 – Coordination – GWRC Stormwater Managers Committee Meeting Summaries

GWRC Stormwater/Coastal Zone Management
Managers Committee Meeting
November 14, 2013

**Meeting Summary**

The meeting was called to order at 1:00 p.m. In attendance were Tim Ware, GWRC, Steve Hubble, Stafford County, David Nunnally, Caroline County, Eldon James, Eldon James & Associates, Steve Manster, Town of Bowling Green, and Doug and Ross Pickford, Conservation Concepts. Calling in were Chris Pomeroy, AquaLaw, May Sligh, Nancy Miller and Michael Lee, DEQ, and Patrick Coady, No. Va. Conservation Trust.

Tim Ware reminded Committee members to continue to track your in-kind hours of commitment to the project so that GWRC can allocate these to the Grant. Doug Pickford suggested an amendment to the existing agenda, adding a discussion topic related to the email that was distributed the day before from DEQ that addressed a change in the schedule for completing the VSMP ordinance development and suggested amendments to the VSMP regulations.

<u>Local VSMP Ordinance Development Updates</u>

Stafford County – Rough draft finished. Will be presented to the Board next Tuesday (November 19th). Based on the Model Ordinance, the county ordinance is very close to being completed, but still working out some of the details on the maintenance aspects/requirements. Staff met with FABO (Fredericksburg Area Business Organization?) to discuss the draft ordinance and ascertain their concerns/issues. Staff is also working on revising the county design manual to incorporate the runoff reduction methodology for facility calculations. Steve mentioned that the County is tentatively planning a training session for early next year to familiarize staff with the runoff reduction methodology, modeling and other changes that have been made to stormwater maintenance and implementation of the VSMP. More information will follow as details are determined.

Lastly, Steve mentioned that the SW Technical Committee discussed a number of issues that relate to the implementation of the ePermitting system. Originally, it was the understanding of local staff that DEQ would be entering most of the permit data, however, recent conversations seem to indicate that the responsibility for most of the data input would fall on the local staff. As such, getting training on the ePermitting system and developing new "accounting" methodologies to track the permit fees would be necessary at the local level. Tasks that had not been originally anticipated.

Caroline County – A draft stormwater ordinance has been completed, and represents a little more "basic" ordinance than what was originally drafted by

Conservation Concepts and provided to Caroline staff. The draft ordinance will become additional chapters to the existing county code. The draft ordinance is still being reviewed and revised internally by staff. Bowling Green has received the draft ordinance as well and is prepared to present it to the Town Council soon. Town staff continues to work with Caroline County staff to work out the protocols that will be developed between the Town and County. Bowling Green anticipates using Caroline County for VSMP implementation.

Revised Schedule and VSMP Regulation Amendments

The committee reviewed and discussed the revised schedule – which essentially pushes all deadlines back one month (except for the final implementation) – therefore draft VSMP ordinances are now due to DEQ regional offices by January 15, 2014. Final adopted (though probably provisionally adopted by localities) due to DEQ regional office by May 15, 2014. DEQ approval (not SWCB) of final VSMP's will be concluded by June 13, 2014. Local implementation will still commence on July 1, 2014.

A revised VSMP ordinance checklist was also distributed that reflects some of the proposed amendments to the VSMP regulations. Most of the amendments address/change the grandfathering requirements in the regulations. However, David Nunnally raised some issues associate with the VSMP requirements that address common plan submittals, particularly if a developer abandons a project prior to completion (for instance, they go bankrupt or out of business). David has asked who then becomes responsible for insuring the implementation of the VSMP Construction General Permit requirements if, in fact, an individual parcels falls under the minimum acreage threshold but is still part of a common plan of development?

Eldon James also mentioned that there were considerable negative rumblings about the VSMP regulations from attendees at the recent VACO meeting. In particular, he noted that many local elected officials felt there should be no DEQ role in setting fee schedules for local government SW programs. Eldon indicated that it would be highly likely this issue may be addressed legislatively in the upcoming General Assembly session.

Doug Pickford distributed copies of WSSI's latest newsletter that also addressed many issues associated with the proposed amendments to the VSMP regulations. WSSI summarized the issues (at least from their perspective) associated with Inspection Frequencies, SWPP requirements (they must now be submitted prior to registration, not before land disturbance activities), grandfathering, and, importantly, changes to what constitutes a "storm event" for E&S inspections. Dave Nunnally indicated that he believed the existing inspection schedule would provide better results than the proposed schedule.

Steve Hubble had a copy of the recently developed SWPP template. A copy was given to Doug Pickford to distributed to the Committee members. However, we believe most have already obtained copies from Kevin Utt (Fredericksburg), who circulated an email to the group with an electronic version attached.

Chris Pomeroy then briefed the committee on a number of issues. He mentioned that they had completed their review of the King George County ordinance and had supplied County staff with their comments/feedback. Chris also mentioned that he was working with local staff in developing some language that addresses the "formal hearing" procedures. DEQ has acknowledged that the current language in the VSMP regulations is not ideal, and that further guidance and changes would be forthcoming. Chris mentioned that they were assisting in developing some base language that could be used for legislation in the upcoming GA session.

Similar to Eldon's comments, Chris indicated widespread, and intense, local dissatisfaction from local elected government officials concerning the VSMP. In particular, local officials are concerned about the local hearing requirements, state involvement in setting local fee structures, common plan review, post construction requirements in the General Construction Permits. There is also considerable consternation among local officials on the single home plan review and construction regulations. Chris predicted that some legislative fixes would be offered by local government officials in the upcoming GA session.

Both Eldon and Chris also mentioned that local officials were not pleased with DEQ incorporating general construction standards in with the VSMP, as well as DEQ's role in approving staffing and fee structures. Again, legislative fixes are probably in order to address these issues.

VSMP Implementation

Local staff were asked to summarize where they were in developing their programs for implementing the VSMP, particularly those who are not MS4 localities. Caroline indicated that they would simply rely on existing staff resources, leaning on their experiences in enforcing the Chesapeake Bay ordinance in the past. David did express some concern over managing the ePermitting system, something they would like to have some additional training to get up to speed with the program.

Stafford indicated that program implementation would parallel past program implementation, however, they were planning to conduct some internal training (as previously mentioned) to get staff up to speed on the new modeling methodologies, ePermitting, SWPP implementation, maintenance inspections, etc.

Funding

Doug Pickford mentioned recent efforts to secure funding for GWRC and some of the local governments through applications to the National Fish and Wildlife

Foundation (the primary distributor of federal funds for the Chesapeake Bay TMDL initiative). All of the technical assistance applications (3 in total) and a proposal for implementation were denied by NFWF. While there is recognition that these are competitive grant programs, this lack of success and DEQ's recent announcement of state funding only being available on a 50/50 match basis, raises some troubling concerns about the ability of more rural locality's ability to find funding to assist in implementing programs to meet the Chesapeake Bay TMDL objectives. There was some discussion about seeking some legislative initiatives to seek more favorable matching requirements for more rural localities. In the long run, since there seems to be little or no consequences facing rural jurisdictions for compliance, the lack of funding for implementation may be inconsequential anyway.

Nutrient Trading

Eldon James mentioned that the draft regulations were currently out for public comment. The SWCB is to review comments and vote on the regulations on December 17, 2014.

Local VSMP Workshop

It is still the intention of the Conservation Concepts Team to hold a workshop for local stakeholders (developers, staff, etc) in the spring of next year (either March or April). Steve Manster asked whether we intended to hold more than one workshop, noting the difficulty in getting all stakeholders to attend a single event, and also the difference that exists in issues that need to be addressed between the MS4 and the smaller, more rural jurisdictions. Eldon indicated that a second workshop is not out of the question, but that funding of the forums may dictate the number that we hold, more so than logistics. It was agreed that the next meeting of the Technical Committee would focus on some of the details of these workshops, with roles, responsibilities and tasks clearly defined among the organizers.

**Next meeting: Tentatively set for December 19, 2014 at GWRC**

With no further business, the meeting was adjourned at 2:45 p.m.

GWRC Stormwater/Coastal Zone Management
Managers Committee Meeting
December 18, 2013

**Meeting Summary**

The meeting was called to order at 1:00 p.m. In attendance were Tim Ware, GWRC, David Nunnally, Caroline County, Eldon James, Eldon James & Associates, Kevin Utt, City of Fredericksburg, Patrick Coady, Northern Virginia Conservation Trust, May Sligh and Mike Lee, DEQ, and Doug and Ross Pickford, Conservation Concepts.

Tim Ware reminded Committee members to continue to track your in-kind hours of commitment to the project so that GWRC can allocate these to the Grant. Doug Pickford suggested an amendment to the existing agenda, adding a discussion topic on a *Natural Watershed Protection* study that Patrick Coady of the Northern Virginia Conservation Trust wanted to present.

Local VSMP Ordinance Development Updates

City of Fredericksburg – Draft ordinance is finished. Was presented to City Council, with no action taken on the draft. Ordinance is being updated in accordance to the new checklist that was recently circulated by DEQ. The revised draft will be taken back to City Council on January 14. It is anticipated that the Council will approve staff submittal of the draft ordinance to DEQ.

Caroline County – Staff continues work on developing an "Environmental Chapter" that combines the County's Chesapeake Bay, E&S and Stormwater programs into a single, comprehensive ordinance. Staff is was prepared for the December submittal, but with the revised DEQ schedule, they continue to tweak the ordinance language and anticipate taking a draft back before the Board of Supervisors in January.

VSMP Regulation Application By Type of Project Matrix

Committee members reviewed and commented on the draft matrix that Conservation Concepts constructed that identifies the applicability of various VSMP regulations on development projects. For the most part the matrix seemed to accurately identify when certain regulations were triggered under the new VSMP regulations. However, committee members felt that the order in which the matrix identified certain regulations should be revised to identify the "priority" in which certain regulations were initiated. Conservation Concepts agreed to revise and re-circulate the matrix to the committee members prior to the next meeting (tentatively scheduled for February). Overall, the committee felt that the matrix did provide a very good overview of the VSMP regulations and would be a valuable handout for the planned VSMP workshop this spring.

Natural Watershed Protection

Patrick Coady, Chair of NVCT, discussed a recent study released by the World Resources Initiative (WRI) that presented a number of case studies that focused on Natural Watershed Protection initiatives across the United States. He mentioned that NVCT was interested in organizing a workshop in Northern Virginia that would revolve around the many concepts discussed in the WRI report. He offered to possibly pursue a similar workshop in the GWRC region should there be local interest. He did mention that NVCT has been collaborating with Mary Washington University on conducting some GIS analysis in the GWRC region, so a forum on this may present a good opportunity to present some of these preliminary findings, etc. for the region. Eldon James mentioned that the RRBC is very interested in similar analysis and they are looking at a number of opportunities for natural land preservation, for instance utility corridors, as mechanisms for preserving the Rappahannock watershed. Overall, the committee members seemed interested in the topic and would follow up with NVCT on the details of conducting such a forum.

Local VSMP Workshop

Eldon led the discussion on organizing the local VSMP "training" workshop. To clarify the objectives of the workshop, the committee reconfirmed the following questions:

1. Who is the audience?
   **Answer: Private/public sector engineers, designers, developers, and other stakeholder who are involved in mostly technical aspects of stormwater.**
2. Timing: March – April?
   **Answer: April 2, 2014. Richard Street has generously offered to use Spotsylvania County's education and outreach portion of VAEPO's program to host the forum. Committee members present agreed this was a good opportunity to hold the training session.**
3. Location(s)
   **Answer: Spotsylvania's Public School training center.**
4. Who are the subject matter experts for each topic area? (This becomes more challenging as frequency increases)
   **Answer: One forum to be held April 2nd, 8 a.m. to 1 p.m. at the Spotsylvania Public School Training Center. Potential speakers have been preliminarily identified below.**

Eldon distributed a draft outline for the forum. Committee members then brainstormed on potential speakers for each of the sessions. In the coming weeks, GWRC will formally invite a number of the DEQ staff to participate in the forum, as well as some of the other recommended speakers.

Eldon and Conservation Concepts will continue to refine and reach out to potential speakers between now and the next meeting of the Committee. Kevin Utt agreed to contact FASA to gain there support and interest in the program. Dave Nunnally mentioned that a couple of speakers at a prior forum hosted by McQuireWoods would be good additions to the list as well. Patrick Coady agreed to address Nutrient Trading. Doug Pickford suggested that maybe over lunch, local government reps could divide up and have informal discussions with interested participants, giving a little local slant to some of the information. Overall, the schedule, timing and presentation (as well as handouts, etc.) need to be further refined in order to ensure that we cover topics within a 4-5 hour timeframe.

The draft outline is included below as well as a preliminary list of potential speakers. For those who were not in attendance, the Committee would like to hear from you on any additional speaker suggestions.

<u>Outline of Proposed Training/Education Program for External Technical Stakeholders</u>

Program Elements:

- High-Level View of the Changes to VSMP
  - Overview of VSMP - Minimum requirements of all local programs
  - General description of the application process: state and local
  - Statewide Fee Schedule and the Impact on Local Fee Schedules
  - Interrelations with other local program responsibilities (this is intended to remind participants of the related programs and not to go into the programmatic details of each) -
    - Construction General Permit
    - Chesapeake Bay Program
    - MS4
    - E&S
    - Local and Chesapeake Bay TMDLs
    - Nutrient trading
  - Overview of the different requirements across the region
- Technical Requirements
  - SWPPP Requirements
  - Runoff Reduction Methodology and Calculations
  - Stormwater Management Plan
  - Long-term maintenance responsibilities
  - Monitoring and Inspection Requirements
  - *Other Topics to be determined*

<u>Preliminary List of Potential Presenters:</u>

**Next meeting: Tentatively set for February 13, 2014 at GWRC - if issues arise that need to be addressed beforehand, the Committee may meet in January.**

With no further business, the meeting was adjourned at 3:00 p.m.

**GWRC Regional Stormwater Managers Committee**
**Wednesday, 2/20/14, 1:00 pm**
**GWRC Conference Room**

**Meeting Summary**

In attendance were: Tim Ware, GWRC; Ross and Doug Pickford, Conservation Concepts; Kevin Utt, City of Fredericksburg; David Nunnally, Caroline County; Troy Tignor, Spotsylvania County; and attending via conference call were Eldon James, James & Associates; and Mike Lee, Va DEQ.

The committee discussed the potential implications of HB 1173/SB 423 on the local government's implementation and development of the VSMPs. The whole discussion revolved around the perceived positive and negative implications of those non MS4 localities that would have the ability to opt out of the VSMP and have DEQ run their stormwater programs for them. At this time, there is no deadline for indicating whether you would opt in or out. Most staff have been in contact with their respective elected officials to discuss some of these implications. One major concern is how DEQ's involvement in the program might slow down the development processes in each of the respective jurisdictions. Others seemed to be concerned about giving up their oversight of the program, while some were actually relieved to have DEQ take control of their program. At this juncture there doesn't seem to be any overriding consensus among the elected officials in most of those affected jurisdictions. Eldon mentioned that the law should probably be signed by the end of March.

The committee then discussed the logistics for the upcoming stakeholders workshop scheduled for April 2nd at the Spotsylvania Public Schools Training Facility. It was noted that the facility has been reserved, but that we need to vacate by 2 due to another meeting being held at the facility. Joan Salavati has agreed to present, as well as some of her staff. The Timmons representative and the Stantec representative have both been contacted and have also agreed to present. Eldon and Doug had a conference call with both to detail what topics we wanted each to address. A mailing list will be put together by local staff, and the VAEPO list will also be utilized for invitational purposes. A public notice for the forum will also be posted. The group agreed that the next steps are to put together a more specific agenda and to attach a timeline for presentations to ensure that we have enough time to cover the extensive list of topics to be covered.

Eldon and Tim have have also arranged to make a presentation to the CAOs on the VSMP. This will be a "30,000 foot" overview of where we are in the process and a chance for questions and answers.

Some committee members mentioned an interest in having local Board of Supervisor/City Council briefings lined up by DEQ so that their elected officials would have a chance to ask questions about the process and eventual implementation of the program. Eldon

mentioned that at the next RRBC Technical Committee meeting (3/26) that DEQ was on the agenda to provide an update on how they see how the program would be implemented.

A quick roundtable discussion ensued on the respective VSMP submittals and updates from each locality. There was a bit of frustration on some local governments that DEQ had not acknowledged receipt of their draft ordinances and that they were never give the checklist that was apparently circulated previously by DEQ. There was also some discussion about the fee schedules and how these would interact with existing local fees.

With no further topics to discuss, the meeting was adjourned at 3:00 p.m.

# VSMP Educational Workshop for External Technical Stakeholders
# April 2, 2014
# 8 A.M. – 12 P.M.

## Agenda

7:30 - 8:00 **Check-In/Registration**

8:00 – 8:10 **Welcome**
*Dr. Scott Baker, Superintendent, Spotsylvania County Public Schools*
*Richard Street, VAEPO*
*Eldon James, James & Associates - Moderator*

8:10 – 9:15 ➢ **High-Level View of the Changes to VSMP**
*Joan Salvati and Drew Hammond – Virginia Department of Environmental Quality*

**Overview of VSMP - Minimum requirements of all local programs**
**Overview on Grandfathering (IIB or Not IIB)**
Continuation of Permit Coverage
True Grandfathering
**General description of the application process: State perspective**
**Statewide Fee Schedule and the Impact on Local Fee Schedules**
**Overview from Virginia DEQ on Program Management – Consequences of Opting In/Opting Out of VSMP**

9:15 – 10:30 ➢ **Interrelations with other local program responsibilities**
*Andrew Gould, Timmons*
*Patrick Coady, Northern Virginia Conservation Trust*

**Chesapeake Bay Program**
**Local and Chesapeake Bay TMDLs**
**E & S Control Program**
**Construction General Permit and SWPPP**
- Enhanced Inspection Frequencies for Operators
- More rigorous P2 requirements (9 requirements presumptively satisfied)

**Nutrient Trading**

10:30 - 10:45 ➢ **Break**

10:45 - Noon ➢ **Overall Requirements for Plans and Approvals (OVERVIEW)**
*Doug Beisch, Stantec*

**Requirements for Approval of SWM ESC for future projects**

*Content Requirements*

- *SWM Plan*
- *ESC Plan*
- *P2 Plan*
- *Other things necessary to satisfy TMDL*

➢ **Technical Requirements**

**Runoff Reduction Methodology and Calculations**

Overview of RRM Methodology
Emphasis on Volume
Addition of Turf as a Loading metric
Water Quality
Treatment Requirements
BMP Performance
New technologies/specifications
Runoff Reduction versus Pollutant Removal
Channel Protection and Flooding Requirements
Energy Balance
Channel protection options
Flood control requirements

**Inspection, Acceptance and Maintenance**

Monitoring and Inspection Requirements
Authorities must hold certification of competence
Periodic Inspection by VSMPA (SWM/ESC/P2)
BMP Record Drawings and Certification
Implied QC Program

**Long-term maintenance responsibilities**

Agreements approved prior to plan approval
Recorded prior to NOT/Bond release
Responsibilities laid out in agreements
Authority required to inspect every 5 yrs

Noon - 1:00 ➢ **Lunch**

**GWRC Regional Stormwater Managers Committee**
**Wednesday, 3/19/14, 1:00 pm**
**GWRC Conference Room**

**Meeting Summary**

In attendance were: Tim Ware, GWRC; Eldon James, James & Associates; Kevin Utt, City of Fredericksburg; David Nunnally, Caroline County; Troy Tignor, Spotsylvania County; Steve Hubble, Stafford County; Patrick Coady, Northern Virginia Conservation Trust; Jack Green, King George County; Peggy Stevens, Hanover/Caroline County SWCD; and attending via conference call were May Sligh and Mike Lee, Va DEQ; Ross and Doug Pickford, Conservation Concepts; and Chris Pomeroy, AquaLaw.

The meeting focused on finalizing the agenda and logistics for the planned educational forum for the Virginia Stormwater Management Program to be held on April 2, 2014. Eldon James facilitated the discussion and indicated that all speakers had been confirmed and briefed on what each was to be prepared to discuss.

Troy Trignor indicated that Richard Street (not in attendance) had secured the facility, sent out invitations, was in the process of receiving registrations/rsvps and had made arrangements for food. As of today, we had approximately 110 reservations confirmed, and were approaching the maximum capacity of the room at 140. It was decided that we would not conduct another round of invitations to leave room for potential elected official walk ups, etc.

The committee discussed the agenda. It was noted that DEQ wanted to handle some of the topics assigned to our private sector participants, and those changes were made. It was also noted that we were covering a lot of material in a very short period of time, therefore it would be imperative that the moderator keep the discussions and presentations moving along. May Sligh suggested having index cards available at each table for participants to write down questions and have them collected for the moderator to ask. The Committee liked this idea, if we can't get to all the questions, they could be answered via email subsequent to the session.

The committee also discussed the idea of whether we wanted to make the local government representatives "available" during lunch to answer specific questions relating to the respective local stormwater programs. It was determined that most of the localities would not have formally adopted their programs by the workshop date, therefore most of the local representatives would not be in a position to answer specific questions concerning their programs. As such, this element in the program was dropped. It was suggested that maybe we have follow up forums in each of the localities to discuss their programs once they were adopted. Possibly DEQ could help offset costs of such an initiative.

With no further discussion on the agenda, it was agreed that the attached agenda would be the final workshop agenda.

The committee briefly discussed handouts. In recognizing the desire to limit the amount of paper produced for 120 attendees, it was agreed that we would not distribute all of the presentations at the forum, but would instead ask participants to provide electronic copies that would then be posted on the VAEPO and GWRC websites subsequent to the workshop. The committee did want to have the VSMP Matrix available at the forum, as well as any brochures or "one-pagers" that the speakers thought might be appropriate for participants to have.

With no further topics to discuss, the meeting was adjourned at 2:30 p.m.

# VSMP Educational Workshop for External Technical Stakeholders
# April 2, 2014
# 8 A.M. – 12 P.M.

## Agenda

7:30 - 8:00 **Check-In/Registration**

8:00 – 8:10 **Welcome**
*Dr. Scott Baker, Superintendent, Spotsylvania County Public Schools*
*Richard Street, VAEPO*
*Eldon James, James & Associates - Moderator*

8:10 – 9:15 ➢ **High-Level View of the Changes to VSMP**
*Joan Salvati and Drew Hammond – Virginia Department of Environmental Quality*

**Overview of VSMP - Minimum requirements of all local programs**
**Overview on Grandfathering (IIB or Not IIB)**
Continuation of Permit Coverage
True Grandfathering
**General description of the application process: State perspective**
**Statewide Fee Schedule and the Impact on Local Fee Schedules**
**Overview from Virginia DEQ on Program Management – Consequences of Opting In/Opting Out of VSMP**

9:15 – 10:30 ➢ **Interrelations with other local program responsibilities**
*Andrew Gould, Timmons*
*Patrick Coady, Northern Virginia Conservation Trust*

**Chesapeake Bay Program**
**Local and Chesapeake Bay TMDLs**
**E & S Control Program**
**Construction General Permit and SWPPP**
- Enhanced Inspection Frequencies for Operators
- More rigorous P2 requirements (9 requirements presumptively satisfied)

**Nutrient Trading**

10:30 - 10:45 ➢ **Break**

10:45 - Noon ➢ **Overall Requirements for Plans and Approvals (OVERVIEW)**
*Doug Beisch, Stantec*

**Requirements for Approval of SWM ESC for future projects**

*Content Requirements*

- *SWM Plan*
- *ESC Plan*
- *P2 Plan*
- *Other things necessary to satisfy TMDL*

➢ **Technical Requirements**

**Runoff Reduction Methodology and Calculations**

Overview of RRM Methodology
Emphasis on Volume
Addition of Turf as a Loading metric
Water Quality
Treatment Requirements
BMP Performance
New technologies/specifications
Runoff Reduction versus Pollutant Removal
Channel Protection and Flooding Requirements
Energy Balance
Channel protection options
Flood control requirements

**Inspection, Acceptance and Maintenance**

Monitoring and Inspection Requirements
Authorities must hold certification of competence
Periodic Inspection by VSMPA (SWM/ESC/P2)
BMP Record Drawings and Certification
Implied QC Program

**Long-term maintenance responsibilities**

Agreements approved prior to plan approval
Recorded prior to NOT/Bond release
Responsibilities laid out in agreements
Authority required to inspect every 5 yrs

Noon - 1:00 ➢ **Lunch**

**GWRC Regional Stormwater Managers Committee**
**Wednesday, 5/15/14, 1:00 pm**
**GWRC Conference Room**

**Meeting Summary**

In attendance were: Tim Ware, GWRC; Ross Pickford, Conservation Concepts; Kevin Utt, City of Fredericksburg; David Nunnally, Caroline County; Troy Tignor, Spotsylvania County; Steve Manster, Bowling Green; and attending via conference call were Eldon James, James & Associates.

The Committee discussed the April 2nd VSMP Educational session. Troy Tignor mentioned that his staff had received some very favorable feedback from participants and the general consensus seemed tto be that the forum was very beneficial to those who attended. The presentations were to be posted on both the VAEPO and GWRC websites.

Troy Tignor mentioned that he was getting feedback that there were still problems with the State e-permitting system. He also mentioned that Mike Lee was scheduled to conduct a presentation of the Runoff Reduction Method for Spotsylvania County on June 10th. Troy was going to send an invite for this to all of our group. He also mentioned that he would open the presentation to anyone interested in attending.

Steve Manster commented that he had serious reservations over the support that Bowling Green had received from DEQ throughout the VSMP process. He suggested that we submit a formal protest to DEQ outlining the various deficiencies that we had encountered. Dave Nunnally mentioned that the local governments would be the face of the VSMP program and would face the brunt of complaints if things broke down. Kevin Utt did not believe that the DEQ would be ready by July 1st for full implementation of the VSMP, particularly in localities where they were assuming responsibility for the stormwater program. He mentioned that DEQ still hadn't worked out the bugs in the e-permitting system and that it may be scaled back considerably in its initial usage. Troy felt we should specifically define what we were protesting and not submit something that says we are disappointed overall with DEQ's support. Some items suggested were e-permitting, fee payments, plan review process as it concerns other reviews, and the single-family SWPPP.

Committee members then summarized where each of their respective localities were in the implementation of their VSMP:

Troy Tignor mentioned that Spotsylvania had adopted the new ordinance and had recieved an approval letter from DEQ. They were planning to submit their VSMP by July 1.

Kevin Utt indicated that Fredericksburg's city Council would review and act on the new ordinance on June 15th.

The committee then discussed how each may achieve reductions on existing development. The conversation then turned to whether the region should pursue development of a regional Nutrient Trading Program. Kevin Utt mentioned that he understood that there were draft regulations in place for a state wide trading program, but that they have yet to be formally adopted by the Secretary of Natural Resources. It was also mentioned that a point to point source trading program was in place and active. All present expressed interest in exploring how nutrient trading might benefit them and how it might work for the region and agreed to pursue this issue further.

With no further business, the meeting was adjourned at 2:30 p.m. The next meeting of the Committee was scheduled for June 12th.

**GWRC Regional Stormwater Managers Committee**
**Wednesday, 6/12/14, 1:00 pm**
**GWRC Conference Room**

**Meeting Summary**

In attendance were: Tim Ware, GWRC; Ross and Doug Pickford, Conservation Concepts; David Nunnally, Caroline County; Troy Tignor, Spotsylvania County; Paul Santay, Stafford County; Pat Coady, Northern Virginia Conservation Trust; Eldon James, James & Associates and attending via conference call were May Sligh, DEQ; Ryan Stewart, Northern Virginia Conservation Trust; and Mike Collins, Center for Natural Capital.

**VSMP Implementation Updates**
Committee members provided updates on their respective progress in either adopting their VSMP ordinances or in the assumption of the programs under DEQ. Tim Ware mentioned that GWRC had been granted an extension on the regional stormwater grant from DEQ. The remaining funds would be used to provide training opportunities to Dave Nunnally, who would be serving as stormwater staff to the Town of Bowling Green as the town implements the VSMP. Caroline County has chosen to opt out, and will have DEQ undertake their stormwater program.

Paul Santay mentioned that the Stafford County Board of Supervisors (BOS) had deferred consideration of their ordinance until next Tuesday. Stafford staff had met with Mike Lee on implementation and he had provided some answers that the BOS had raised during preliminary discussions. He mentioned that a continuing issue is the ePermitting program and how it is to be used during the VSMP implementation process. DEQ is attempting to clarify this issue with all those who have assumed VSMP responsibilities and hopes to have this resolved by July 1.

Caroline County, which opted out of the VSMP, is looking for some clarifications from DEQ on the process(es) that will be used as it pertains to Erosion and Sediment Control and their Chesapeake Bay ordinances (both of which local staff will still have control and responsibility over). Dave Nunnaly mentioned that Mike Lee (DEQ) has been quite helpful and is in the process of clarifying how he believes the process will unfold. Dave did mention that he would like to be more in the loop on the general discussions that are evolving around the VSMP implementation, and that if all committee members could be "cc'd" on correspondence, that it would be helpful to see and hear what issues are being raised and what some of the proposed resolutions are being discussed. Dave also mentioned that he believes that Bowling Green will opt in to the VSMP and would be responsible for managing their stormwater program.

**Nutrient Reduction Strategy**
At the last meeting of the SW Managers Committee meeting, there was a discussion on how the local governments would address nutrient reduction on existing developments. The Committee agreed that one of the tools that might be useful would be to establish a pilot

nutrient trading program, and asked GWRC to look into this matter in more detail.

Mike Collins mentioned that his organization, the Center for Natural Capital, has been working for the past couple years realizing and investing private sector participation in the establishment of stormwater BMPs throughout the Rappahannock River basin. He mentioned that he would be eager to apply his knowledge and expertise to a regional initiative should the localities of the GWRC be interested in developing a pilot program. There was some discussion among Committee members about the proposed framework that DEQ is currently considering to adopt, and some of the issues that are evident in this proposed framework, specifically the proposed fees and the establishment of nutrient baselines for participation in the program. According to Committee members, both of these issues serve more as impediments than incentives for a program. The Committee members then discussed what a framework for a regional program might look like. May Sligh (DEQ) suggested that the Committee should probably speak with Alan Brockenbough, of DEQ, before we move to far forward in developing a program. She indicated that Alan has been the lead person at DEQ for developing the existing, proposed program regulations and that his insights might be very beneficial. It was also mentioned that Chris Pomeroy, who helped establish the point to point source trading program, should also be brought into the discussion.

Committee members discussed some of the elements that may need consideration under a pilot nutrient trading program. All agreed that the program must demonstrate that it was very good for economic development in the region. Pat Coady mentioned that we need to develop a business agreement and that a regional program would be very useful for all facets of stormwater management and water quality programs. Ross Pickford circulated an outline of a draft proposal and explained the various elements that were included in the proposal. Afterwards, the Committee agreed on some common concepts that needed to be addressed: 1) transaction costs need to be low; 2) innovation and creativity needs to be promoted; 3) creation of competition will drive costs down, private sector involvement is critical; and 4) we don't necessarily need to get "everything right" to get a program up and running, we can tweak it down the road as we run into issues or concerns.

Paul Santay mentioned that now is a good time to put a framework and program in place, however, most localities believe some of the next milestones (i.e., 2017, 2019) are probably going to be met. This may hinder the program's early "successes". Just something to keep in mind as we move forward.

Next steps were discussed as well. First, set up meeting with DEQ to determine if a pilot will fly, or not. Maybe even see if a meeting with EPA Chesapeake Bay Program leadership is warranted. Second, refine the proposal and scope out more issues that may arise. Third, develop a more specific budget, identify other partners or participants and identify funding sources.

With no further business, the meeting was adjourned at 3:00 p.m. The next meeting of the Committee was scheduled for August 14th. Pat Coady asked if the meeting might be scheduled

for the morning instead of the afternoon.  With no objections, it was decided that future meetings would be held at 10 a.m. instead of in the afternoon.

**GWRC Regional Stormwater Managers Committee**
**Thursday, 8/14/14, 10:00 am**
**GWRC Conference Room**

**Draft Meeting Summary**

In attendance were: David Nunnally, Caroline County; Troy Tignor, Spotsylvania County; Steve Manster, Town of Bowling Green; Patrick Coady, Northern Virginia Conservation Trust; Ross and Doug Pickford, Conservation Concepts; and attending via conference call were Eldon James, James & Associates; and Mike Collins, Center for Natural Capital, and Ryan Stewart Northern Virginia Conservation Trust.

## Nutrient Trading

The meeting focused on reviewing the Pilot Nutrient Trading Program Proposal that Conservation Concepts had put together and circulated to Committee members. A brief summary of the actions that led to developing this proposal were summarized by Conservation Concepts. Ross Pickford explained the general concepts that were put together in developing the Proposal. With an understanding that the local jurisdictions are facing an extremely difficult task in meeting the 2025 Phase II WIP milestone goals for nutrient and sediment reductions, Conservation Concepts believes that a nutrient trading program developed to encourage construction of stormwater BMPs on existing, non-regulated properties, could be a significant mechanism to meeting these goals. The current proposal identifies 8 specific tasks beginning with having the local jurisdictions deciding on an overall program management organization. Several deficiencies with the current nutrient trading program proposal put forward by the DEQ were discussed and how these would actually discourage stormwater management efforts on existing non-regulated properties.

It was discussed that the proposal put forth for the Regional Pilot Nutrient Trading Program would seek to remove these impediments in a responsible manner starting with the fees assessed for inclusion of nutrient credits into the trading program. Such fees should be based on program management needs for plan review and inspections. Further, the requirement for establishing a baseline of stormwater management would mean that no existing non-regulated property would agree to participate thus eliminating this potential source for nutrient and sediment reductions.

It was further discussed that such a program might include a nutrient trading ratio greater than 1:1 (ie, 1:1.1 or 1:1.2), so that runoff reductions are realized over the 2009 baseline levels. In addition, the jurisdictions could consider allowing trading only within subwatersheds so that gains in one subwatershed do not offset increased pollution loads in another. The jurisdictions could also consider whether or not to allow for an “in-lieu fee” or simply require that an applicant for nutrient runoff credits find available credits or they cannot participate and must achieve full runoff compliance. Another example of a potential program element could be urban or development credit off-sets realized by upstream

agricultural BMPs, thus using development funds to provide for agricultural runoff reductions.

Mr. Pickford also mentioned that there are several successful nutrient or stormwater trading programs that currently exist and one of the first tasks identified in the proposal is to research these existing programs. Such research should include an analysis of what program elements are successful and what might be modified to produce a better trading program.

Pat Coady explained NVCT's interest in participating in the program, noting that NVCT is currently working in the region on a green infrastructure project that has many possible synergies with the trading proposal, not the least of which is developing priorities for conservation and the protection of the region's water resources.

Troy Trignor noted that Spotsylvania County would be interested in the program but that the economic aspects (i.e., feasibility and positive impacts on economic development) need to be demonstrated in some sort of scenario example. If the project could demonstrate how a potential project(s) might benefit from this program, those types of scenarios would help him make the case to the County's leadership. He also noted that the cross use of these types of credits (say between suburban development and agriculture) is very interesting and could be extremely beneficial in meeting the future Chesapeake Bay TMDL nutrient/sediment reduction objectives.

Based on the feedback from the committee, Conservation Concepts agreed to continue to refine the proposal and to begin putting a budget together. They also agreed to contact the local government committee members who were not present (King George, Fredericksburg and Stafford County) to ascertain their feedback and gather additional input.

**Legislative Issues**

The committee discussed whether there were any issues that they might have that need to be addressed in the upcoming General Assembly session. Eldon James indicated that the Governor would be addressing the Joint GA committee this coming Friday and that by all indications the Commonwealth's projected revenue streams were looking very bleak (subsequently the Governor did announce a $2.4 billion project budget shortfall) and would probably dominate the upcoming session. As such, anything seeking new revenues is probably going nowhere. Eldon thought there may be some policy oriented legislation that may be of interest, particularly some that may be related to hydro-fracturing (fracking) in Virginia.

**VSMP Implementation**

The local government representatives were asked to provide summaries of their efforts at VSMP implementation. Troy indicated that things were going smoothly in Spotsylvania County, that the state's proportion of fees were being collected, but no invoices have been received from DEQ. He also noted no problems thus far with ePermiting either.

Dave Nunnally indicated that he and Mike Lee were still working through some of the processes in how Caroline County and DEQ were interacting in some of the E&S review and VSMP reviews. Apparently DEQ is contracting out much of their review processes and the consultants are now working with County staff. Dave did express some confusion over the process, and enquired whether there was a "flowchart" of how applications (particularly single family residential projects) move through the process and when certain elements of a proposal might trigger certain actions.

Steve Manster indicated that Bowling Green and Caroline County were working with Conservation Concepts to develop procedures and protocols to have the County assist the town in implementing their VSMP. A set of draft documents had been produced and each of the locality's staff were in the process of reviewing them.

**Next meeting is scheduled for Thursday, September 11th at 9:30 a.m. at GWRC's offices.**

With no further topics to discuss, the meeting was adjourned at 12 p.m.

**GWRC Regional Stormwater Managers Committee**
**Thursday, 9/11/14, 9:30 am**
**GWRC Conference Room**

**Meeting Summary**

In attendance were: Tim Ware, GWRC; Ross and Doug Pickford, Conservation Concepts; Paul Santay, Stafford County; Pat Coady, Northern Virginia Conservation Trust; Eldon James, James & Associates and attending via conference call was Ryan Stewart, Northern Virginia Conservation Trust.

Pilot Nutrient Trading Program Proposal
At the last meeting of the SW Managers Committee meeting, there was a discussion on how the local governments would address nutrient reduction on existing developments and there was consensus among those in attendance that the group would put together a proposal that would promote the development of a regional Pilot Nutrient Trading Program. Doug Pickford mentioned that based on a conference call between himself, Eldon James, Mike Collins, Pat Coady, Tim Ware and Ross Pickford, the proposal was futher refined and the proposed tasks were re-ordered to better reflect the natural progression of steps that needed to be undertaken as well as making it easier to divide the proposal into discreet steps that could attract individual (smaller) sources of funding.

Eldon James mentioned that those on the conference call also discussed the feasibility of holding a regional educational workshop at the end of October that would provide a forum in which we could simulate some actual trades and look into the specific actions that the group might need to take to put a larger simulation of a program in place. The RRBC has a grant to cover the costs of this workshop and this type of program would fall under DEQ's grant criteria. The larger simulation initiative was added to the Pilot Program proposal as another task.

Eldon also mentioned that the Virginia Department of Forestry and the Chesapeake Bay Commission have been discussing nutrient trading as a viable mechanism to enhance reforestation efforts in the Commonwealth and may be potential partners in our initiative. The Committee then discussed what geographic area we should focus on during this initiative. There are pros and cons to both keeping the geographic area confined to political boundaries of the GWRC region, and also expanding it to the entire Rappahannock River watershed. The Committee agreed that this issues needs to be resolved sooner, rather than later as we seek out funding partners and make the case for the need of a pilot program.

Pat Coady added that NVCT is willing to help identify and contact potential funding partners. He indicated that he has had some preliminary discussions with Joe Maroon at VEE, and that they have expressed some interest in this initiative. Conservation Concepts agreed to continue to work on the existing proposal to further refine the budget. Ross asked the Committee members to think about what they would like their individual roles to be in this effort to

facilitate our development of the budget.

**VSMP Implementation**

Committee members were asked to provide updates on their respective VSMP implementation. Paul Santay indicated that things were going smoothly thus far. Ross suggested that maybe we need to begin tracking the region's progress in the WIP II milestones to ensure that we are on track to meet the two year objectives. In general, most committee members believe that the region is on track to meet the 2017 and probably 2019 goals. Eldon mentioned that this topic was discussed in some detail at a recent RRBC Technical Committee meeting. Among those present at the Technical Committee meeting, he mentioned that there was some real nervousness about meeting the milestones after 2019 and what the consequences for local governments will be if they do not achieve these milestones. It was noted that the Pilot Nutrient Trading Program could be a very valuable tool for local implementation and the meeting of future milestones.

With no further business, the meeting was adjourned at 12:00 p.m. The next meeting of the Committee was scheduled at 10 am on October 9th.

## Attachment 1.B.1 - Training Events - Presentations

## VSMP Regulation Application By Type of Project

| TYPE OF PROJECT | E&S Plan and Inspections (Y/N) | Construction General Permit (Y/N) | VSMP Permit (from DEQ) Required (Y/N) | Local Land Disturbance/Local VSMP Authority Permit Required (Y/N) | Water Quality Required(Y/N) | Water Quantity Required (Y/N) | Storm Water Pollution Prevention Plan Required (Y/N) |
|---|---|---|---|---|---|---|---|
| **Common Plan** | Y | Y | Y | Y | Y | Y | Y |
| **Single Lot (In Common Plan with VSMP permit)** | Y[3] | Y[3] | N[1] | Y[2] | N[1] | N[1] | N[1] |
| **Single Lot (Outside of Common Plan)** | | | | | | | |
| Lot Size Less Than 1 acre | Y[3] | N | N | Y[2] | Y | N | Y[2] |
| Lot Size Greater Than 1 acre | Y | Y | Y | Y | Y | Y | Y |
| **Single Lot (In common plan no VSMP permit)** | Y[3] | Y[3] | N[4] | N | Y | N | N |
| **Chesapeake Bay Preservation Area** | | | | | | | |
| Lot Size Less Than 2,500 sq. ft. | N[6] | N | N | N | N[5] | N | N |
| Lot Size Greater Than 2,500 sq. ft. | Y | N | Y | Y | Y | Y | Y |
| **Development on Prior Developed Land (less than 1 acre)** | Y[3] | N | N | Y[2] | Y[7] | Y[8] | Y[2] |

1) Considered required as a component under the Common Plan. The common plan should provide SWM for entire site, or for each individual site within plan.

2) Where a Local Land Disturbance /Local VSMP Authority Permit is required under local codes. Not necessary if locality only adopts State requirements.

3) Any disturbance greater than 10,000 square feet.

4) Unless the lot size is greater than 1 acre. A VSMP permit will then be required.

5) Unless there is an increase in impervious cover on a predeveloped site.

6) Unless required by local E&S code.

7) Total phosphorus load shall be reduced at least 10% below the predevelopment total phosphorus load.

8) For peak discharge rates.

# Virginia Stormwater Management Program Overview & Status

## VAEPO VSMP Training/Information Session

Joan Salvati, Manager
Office of Local Government Stormwater Programs
DEQ Water Division

# Local VSMP Program Administrative Requirements

9 VAC 25-870-148

A VSMP shall provide for the:

1. Identification of the authority:
   - Accepting registration statements
   - Completing plan review & approval, inspection and enforcement
2. Submission and approval of ESC plans
3. Requirements to ensure compliance with Stormwater Pollution Prevention, Stormwater Management, and Pollution Prevention Plans
4. Requirements for the inspection and monitoring of construction activities by the VSMP operator

# Local VSMP Administrative Requirements (continued)

9 VAC 25-870-148

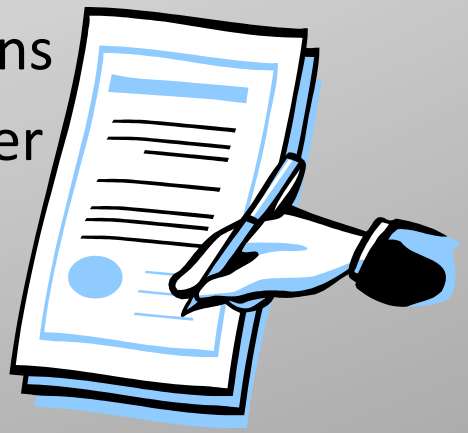
5. Requirements for long-term inspection and maintenance of SWM facilities
6. Collection and use of fees
7. Enforcement procedures and penalties
8. Policies and procedures to obtain and release bonds
9. Procedures for reporting and record keeping

DEQ
Virginia Department of Environmental Quality

# Local SW Ordinance Development

Required Elements:

1. Identification of authority for receipt of registration statements, plan review, inspection and enforcement
2. Provisions for review and approval of ESC plans
3. Requirements for compliance with stormwater management and pollution prevention plans
4. Inspection & monitoring of construction activities
5. Long-term inspection & maintenance of SWM facilities
6. Enforcement procedures and penalties



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# Final VSMP Submittal Package

4VAC50-60-150

1. Final adopted SW Ordinance

2. Funding and Staffing Plan

3. Policies and Procedures
   - Partnerships
   - Administration of Program
   - Plan Review
   - Inspection
   - Long term BMP maintenance requirements
   - Enforcement
   - Procedures for record keeping & reporting

4. Existing, more stringent ordinances adopted prior to January 1, 2013

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# HB1173/SB423 Highlights

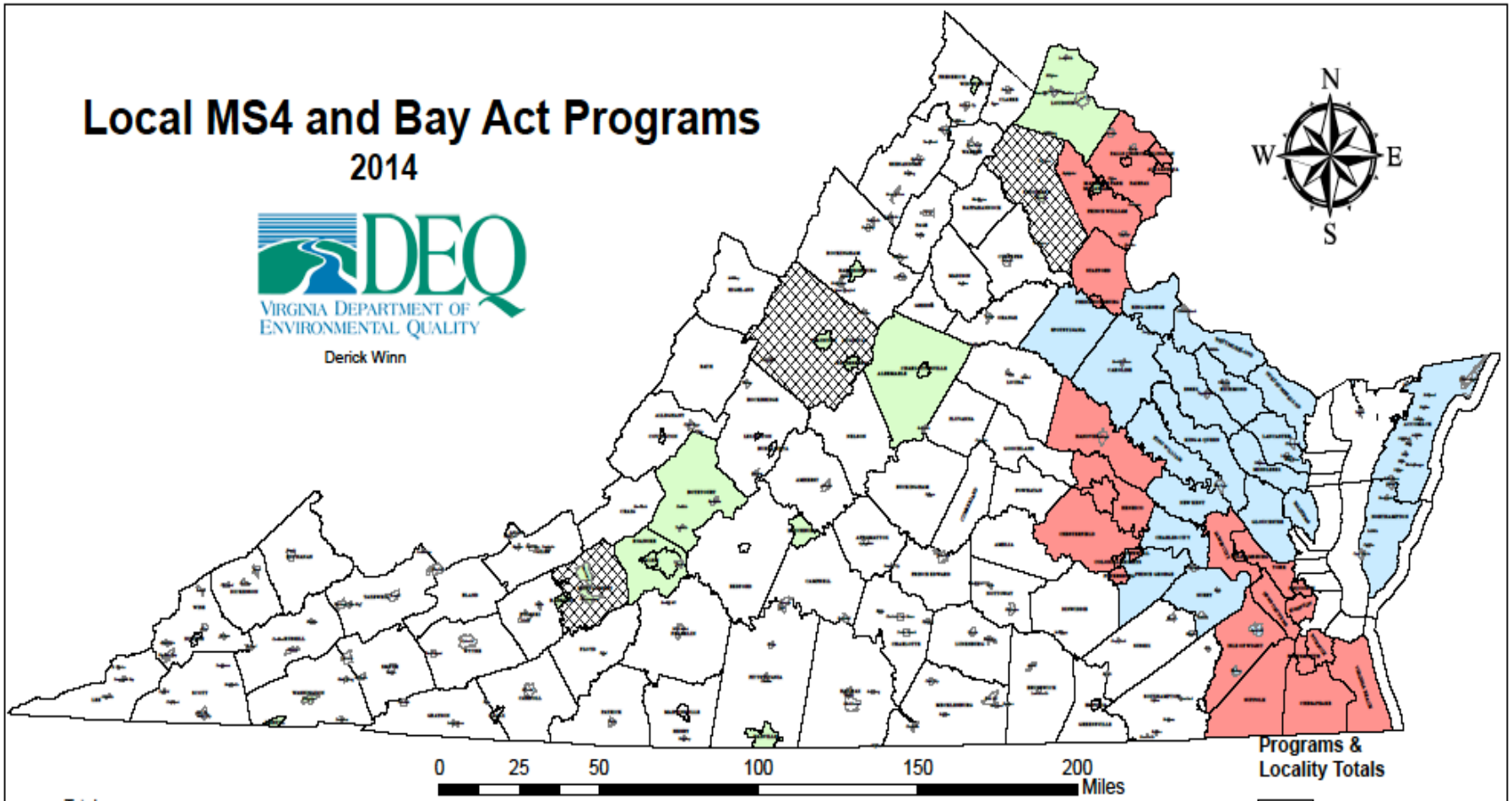
- Limits VSMP required adoption to MS4 localities and allows other localities to “opt in” to the program.
- Allows newly designated (after January 1, 2014) MS4 *counties* to defer adoption of a VSMP to no later than January 1, 2015.
- Allows for agreements in lieu of a stormwater management plan for single family lots.
- Localities not choosing to adopt a VSMP must still administer the flow rate capacity and velocity requirements of the Erosion and Sediment Control law.

# Local MS4 and Bay Act Programs

## 2014

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Derick Winn




Programs & Locality Totals

| | |
|---|---|
| 67 | N/A |
| 24 | MS4 Only |
| 19 | Bay Act Only |
| 31 | MS4 & Bay Act |
| 3 | New MS4 Counties |

Totals:

* White localities include 67 cities and counties outside the purview of the Bay Act that do not own or operate a MS4. These localities are not required to adopt a VSMP but may "opt-in" to the program.
* Green localities include 24 cities, counties, and towns outside the purview of the Bay Act that have a permitted MS4.
* Red localities include 31 cities, counties, and towns that have both a permitted MS4 and a Bay Act program.
* The 55 red and green localities are required to adopt a VSMP by July 1, 2014.
* Blue localities include the 19 counties with Bay Act programs that do not own or operate a MS4.
* Blue localities are not required to adopt a VSMP, but must administer the requirements for Chesapeake Bay Land Disturbing Activities contained in the VSMP regulations.
* Hash-marked localities include 3 counties with newly regulated MS4s that may defer VSMP adoption to January 1, 2015.

# HB1173/SB423 Highlights

- Clarification as to how local VSMPs are to conduct hearings and appeals.
- Requires  DEQ to amend fees schedule to reduce fee for all single family lots.
- Directs DEQ to establish procedures for not requiring registration under the construction general permit for single family residences

# Opt out considerations

- Localities not electing to adopt a VSMP remain responsible for:
  - Compliance with stormwater quantity requirements of Erosion & Sediment Control Law
  - Issue local land disturbing permits only after there is evidence of Construction General Permit coverage (existing requirement)
  - Bay Act localities only: must regulate "Chesapeake Bay Land Disturbing Activities" through local ordinances
  - Localities cannot maintain existing SWM ordinances

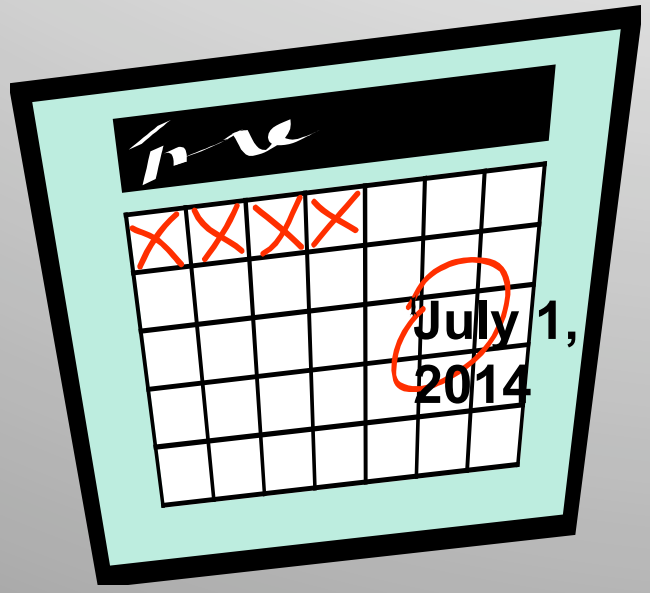
# Current Status

- Number of submitted VSMP packages = 144
- Number of non-mandatory localities that submitted packages = 5
- Number of mandatory localities that submitted packages = 139
- Regional & central office reviewing submitted packages
- Most localities are going through the local adoption process
- All RRBC localities have submitted programs
- Campbell and Hanover Counties and the City of Newport News have adopted programs

# DEQ Activities & Next Steps

- 3-15-14 - Revise VSMP Adoption Schedule (May 15? “fa-get-about it!”)
- 3-31-14 – Communicate revised schedule and needed amendments to ordinances based on legislation to localities
- 4-3-14 - Opt-in letters to localities & grantees
- Jan. 15 through April 15 - Continue to review VSMP packages

# Timeline: VSMP Adoption Schedule




- January 15, 2014 – Localities submit preliminary local VSMP application packages for review by DEQ
- June 15, 2014 – Final VSMP application packages submitted for review by DEQ
- July 1, 2014 – Deadline for implementation of Final VSMPs

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Virginia Department of Environmental Quality

# Training Status

- Stormwater Basic classes

Daleville: March 12-13
Henrico: April 2-3 (course filled)
Fairfax: May 5-6 (course filled)

- Inspector Classes: 1/14/14 – May 22, 2014
  - role of the inspector;
  - applicable laws/regulations;
  - best practices;
- inspection during both the construction & post-construction phases;
  - overview of the 15 Stormwater Clearinghouse BMP's ; and
  - safety.

Fairfax: March 18, 2014
Chesapeake: March 21, 2014
Chesapeake: March 28, 2014
Henrico: Apr. 24, 2014
Gloucester: May 13, 2014
Fairfax: May 20, 2014
Leesburg: May 22, 2014

- Plan Review training under development

# Questions?

**Joan Salvati, Manager**
**Office of Local Government**
**Stormwater Programs**
(804) 698-4230
Joan.salvati@deq.virginia.gov

DEQ
Virginia Department of Environmental Quality

# Stormwater Regulations: Fun, Fun, Fun!

April 2, 2014

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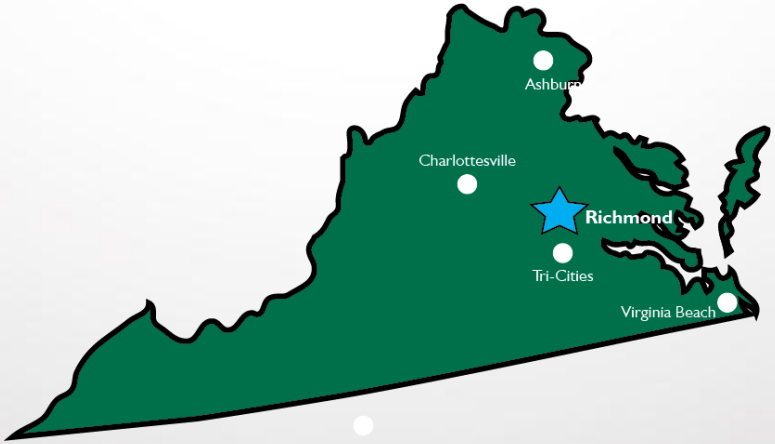
# Firm Overview

- ✓ Over 60 years in business
- ✓ 300-person full-service engineering firm
- ✓ Headquartered in Richmond
- ✓ Branch offices throughout VA and NC
- ✓ Engineering News-Record's "Top 500 Design Firms" for over ten years
- ✓ Stormwater regulatory compliance expertise

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# Professional Services

- ✓ Storm Sewer Analysis & Design
- ✓ Stormwater Regulatory Compliance
- ✓ Floodplain Analysis & Mapping
- ✓ Low Impact Development
- ✓ Stream Restoration
- ✓ Dam Inspection & Certification
- ✓ Environmental Investigations & Permitting
- ✓ GIS & Technology Applications
- ✓ Surveying
- ✓ Roadway & Street Design
- ✓ Traffic Control Devices
- ✓ Utilities Engineering
- ✓ Landscaping, Streetscaping & Irrigation Design
- ✓ Construction Management & Inspection

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# Presentation Outline

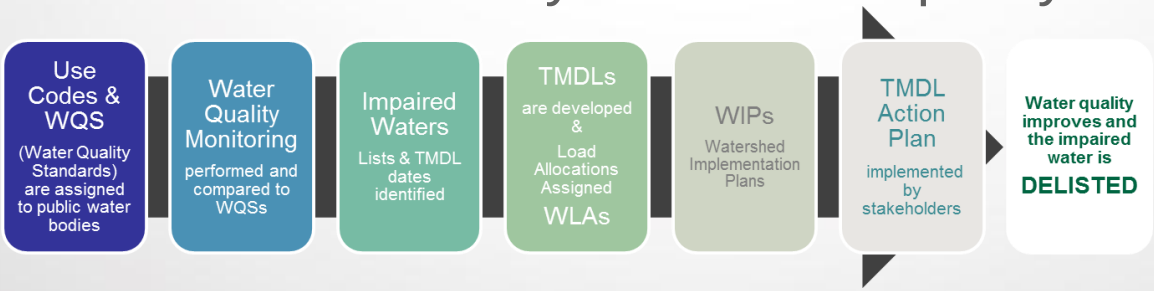
- Chesapeake Bay Program
- Chesapeake Bay (and other) TMDLs
  - VSMP
  - MS4
  - Erosion / Sediment Control Program
- Construction General Permit / SWPPP

# MS4 = Municipal Separate Storm Sewer Systems

- Once a local government exceeds a population threshold or density, it is required to have a permit to own and operate an MS4.

# TMDL = Total Maximum Daily Load

- The maximum amount of a pollutant that a waterbody can receive and still safely meet water quality standards



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## DEQ or VADEQ = Virginia Department of Environmental Quality

- State agency that currently regulates stormwater activity in Virginia

## VSMP = Virginia Stormwater Management Program

- State regulations governing stormwater related to development and redevelopment process



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## VSMP GCP = Virginia Stormwater Management Program General Construction Permit

- State general permit under which a land disturbing project must register for permit coverage

## SWPPP or SWP3 = Stormwater Pollution Prevention Plan

- Required GCP document that demonstrates how a land disturbing activity complies with all applicable stormwater requirements



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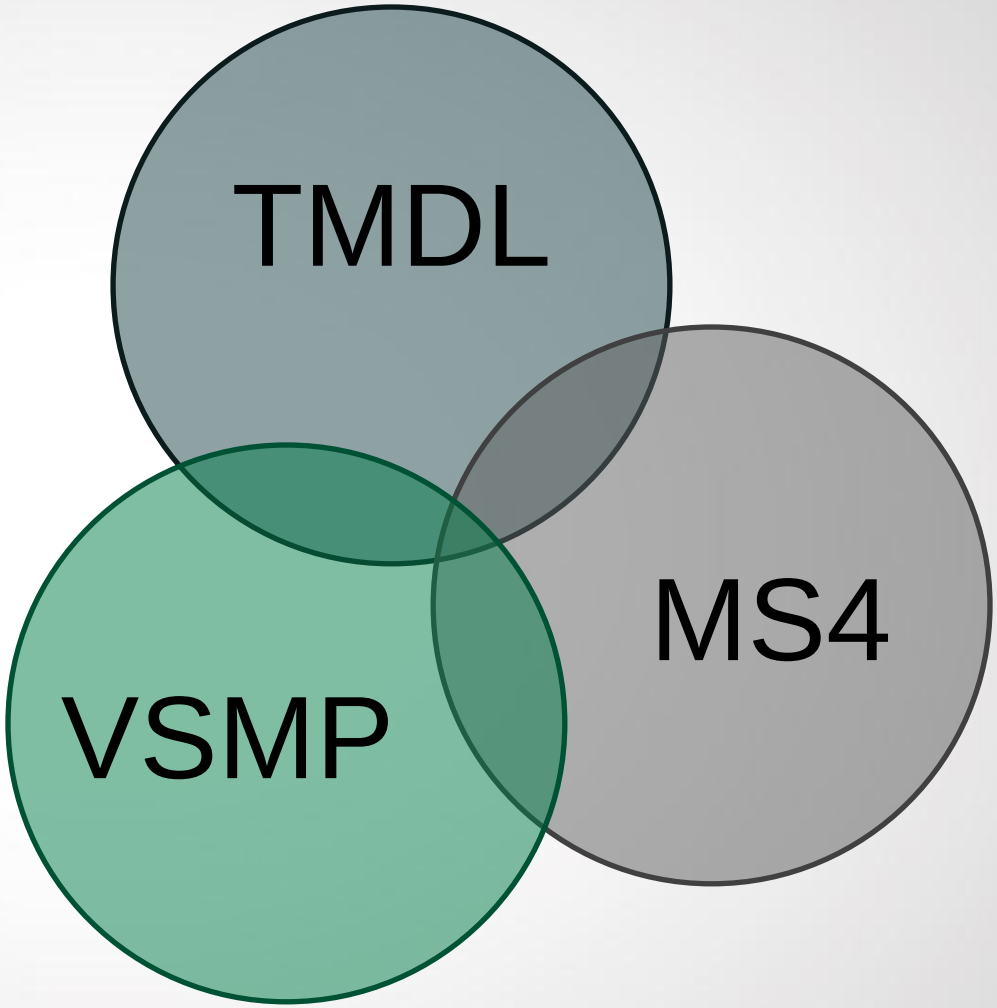
# Road Map to Compliance

- **V**irginia **S**tormwater **M**anagement **P**rograms
- **M**unicipal **S**eparate **S**torm **S**ewer **S**ystem
- Chesapeake Bay **T**otal **M**aximum **D**aily **L**oad



# Chesapeake Bay and Watershed

## A Brief History

1970

- Watershed is 64,000 square miles
- First dead zone identified in 1970s
- Chesapeake Bay Agreement in 1983, 1987
  - VA, MD, PA, DC, EPA
  - Amended to develop Tributary Strategies in 1992
- First listed as impaired water in 1999
- Chesapeake 2000
  - VA, MD, PA, DC, EPA, Ches. Bay Commission
- New Tributary Strategies in 2005
- Executive Order in 2009
  - Recognizes Chesapeake Bay as a National Treasure
  - Annual Chesapeake Bay Action Plan allocating federal funding
- Bay TMDL Adopted 2010

2010

Source: Chesapeake Bay TMDL Fact Sheet, US EPA and the Chesapeake Bay Program

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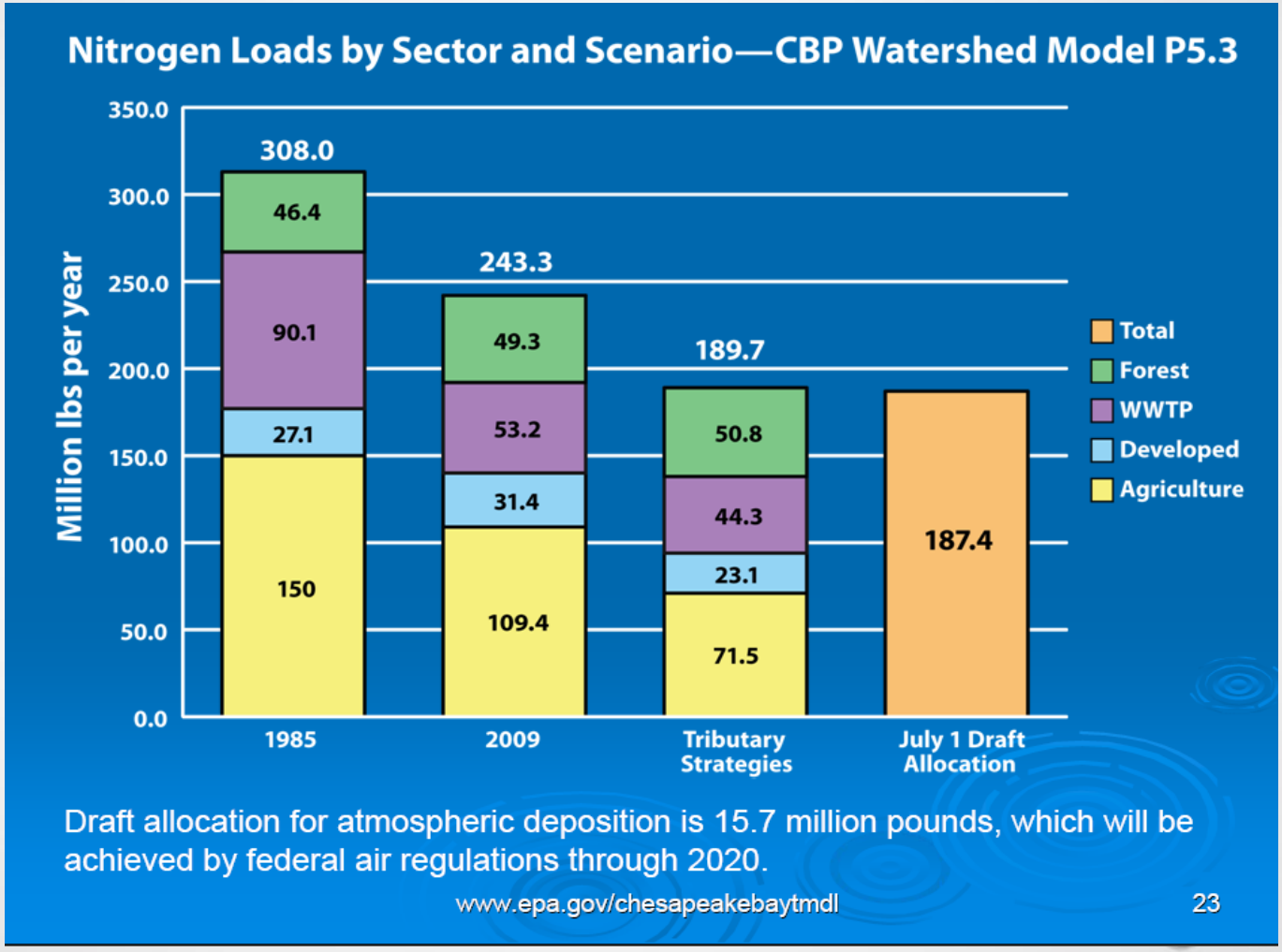
# Bay Nitrogen Loads



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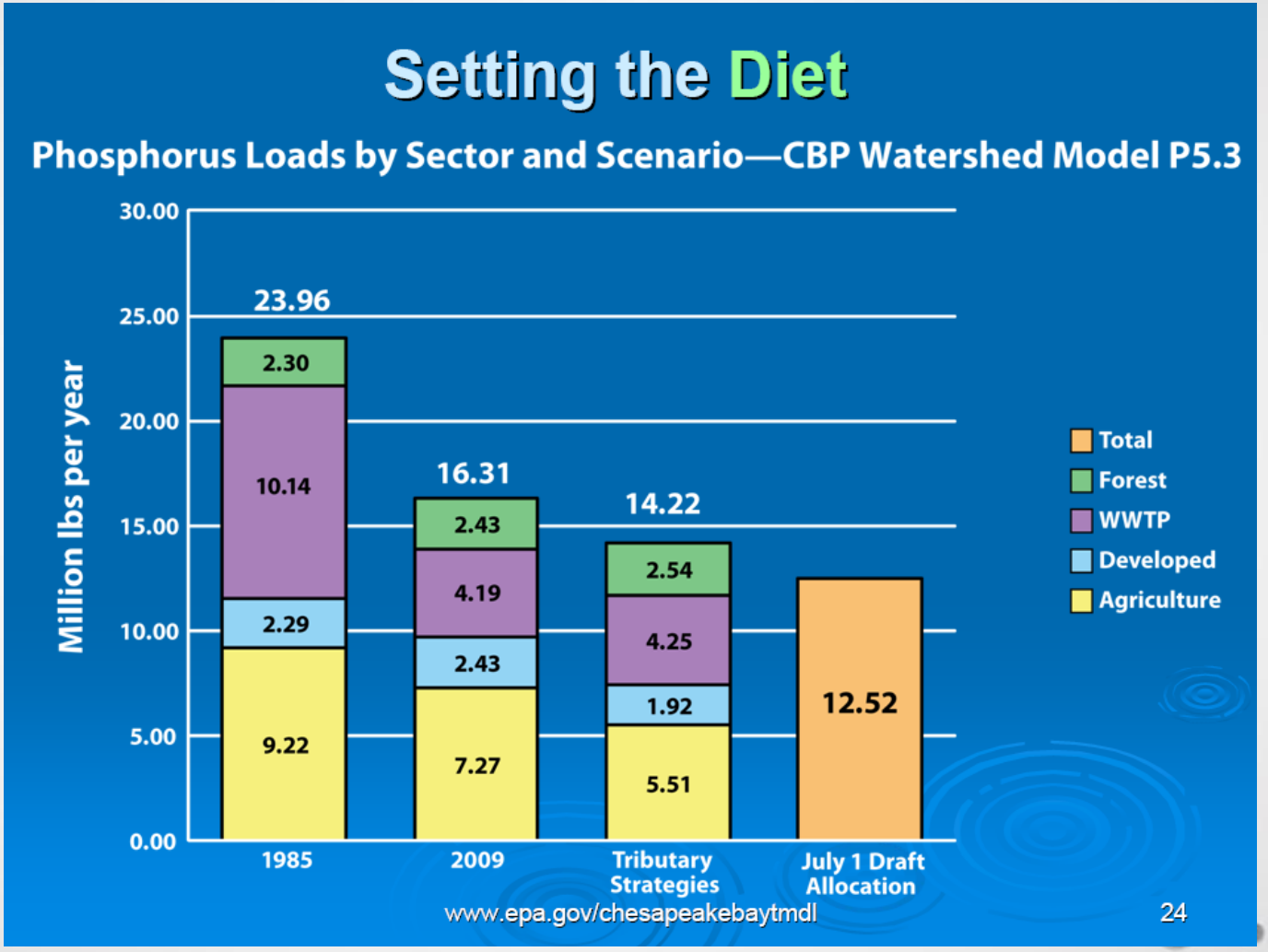
# Bay Phosphorous Loads



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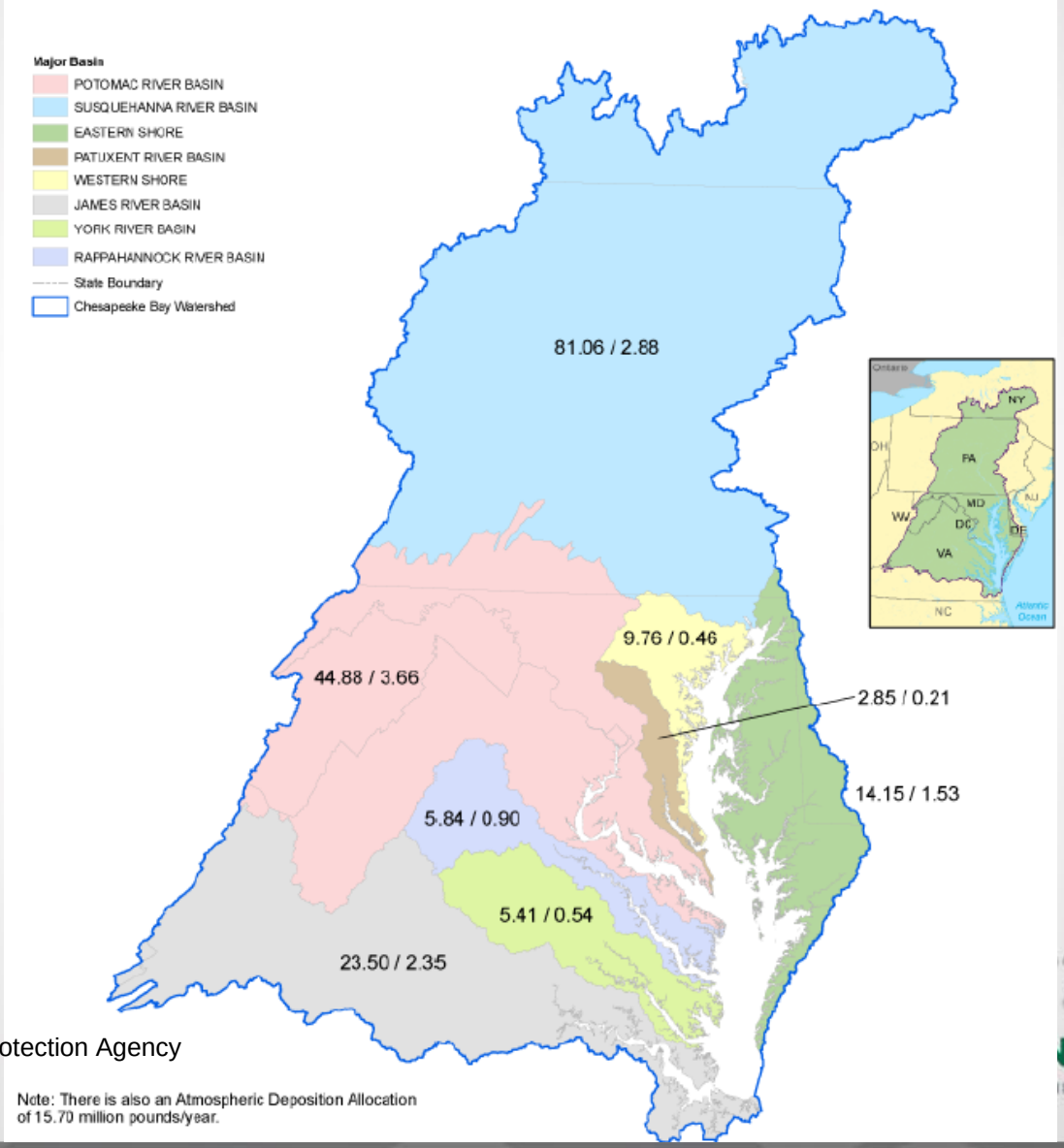
# Pollution Diet




Source: US Environmental Protection Agency



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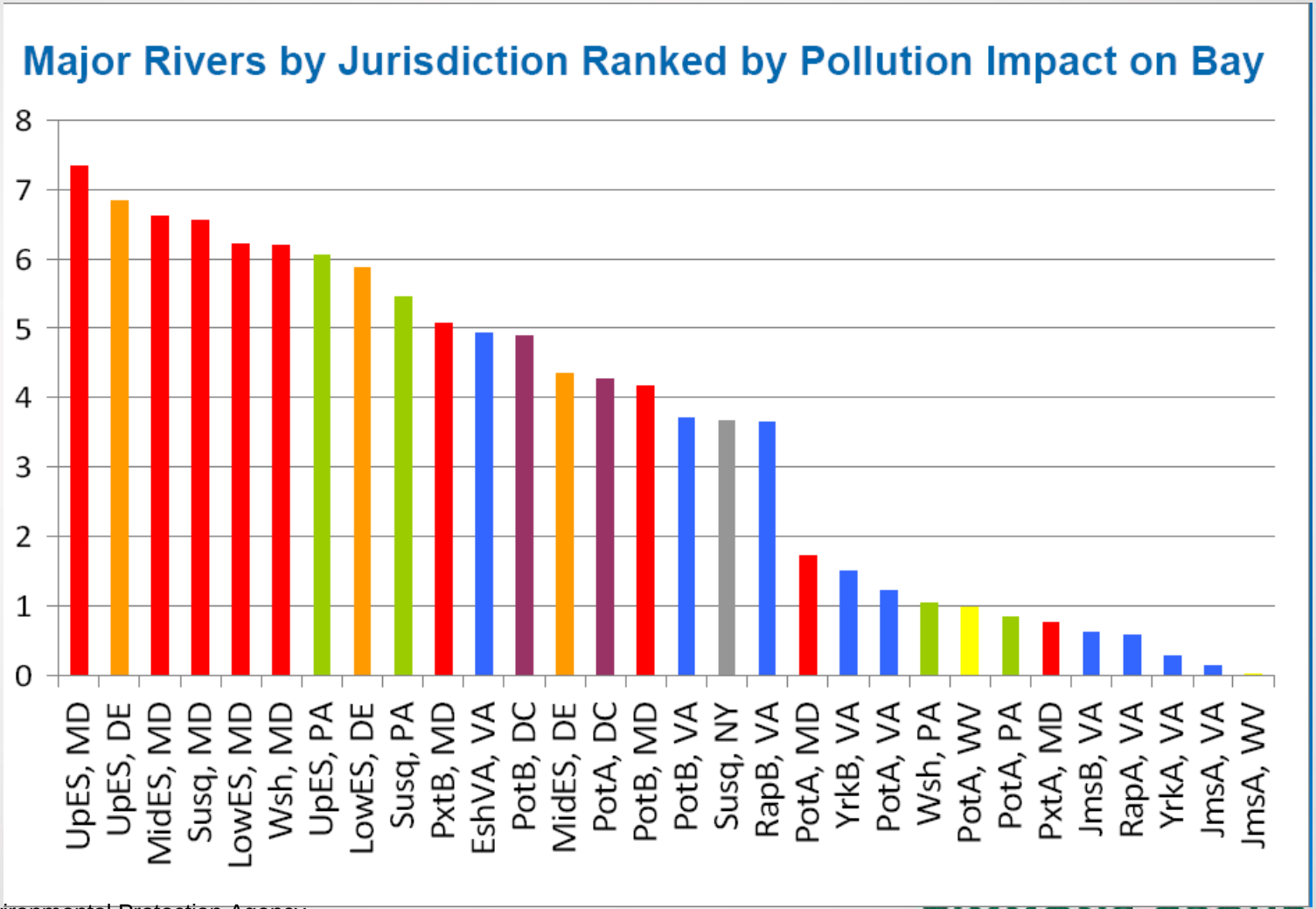
# Bay Pollution by River Segment




Source: US Environmental Protection Agency



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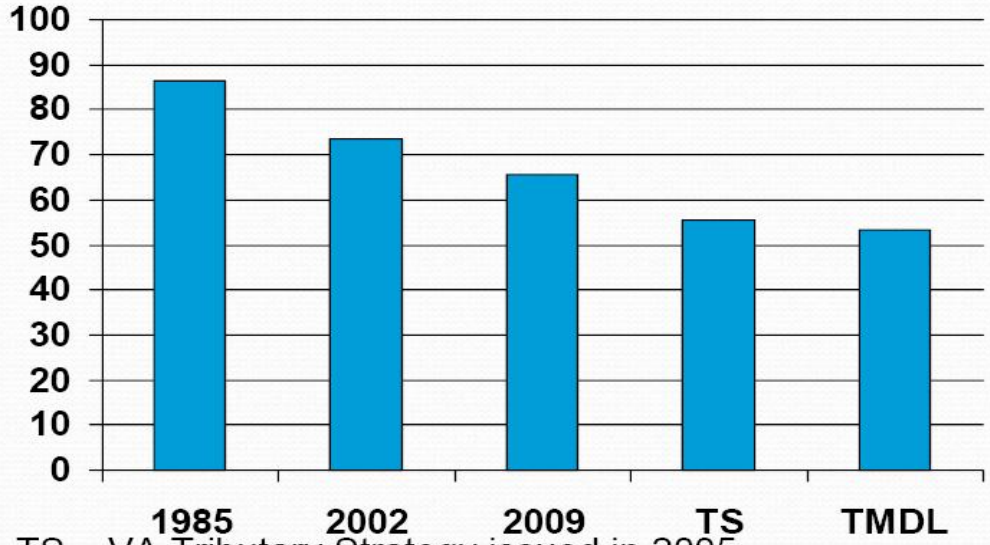
# Virginia Nitrogen Loads

[million lbs/yr]




TS – VA Tributary Strategy issued in 2005

Source: Virginia Department of Conservation and Recreation



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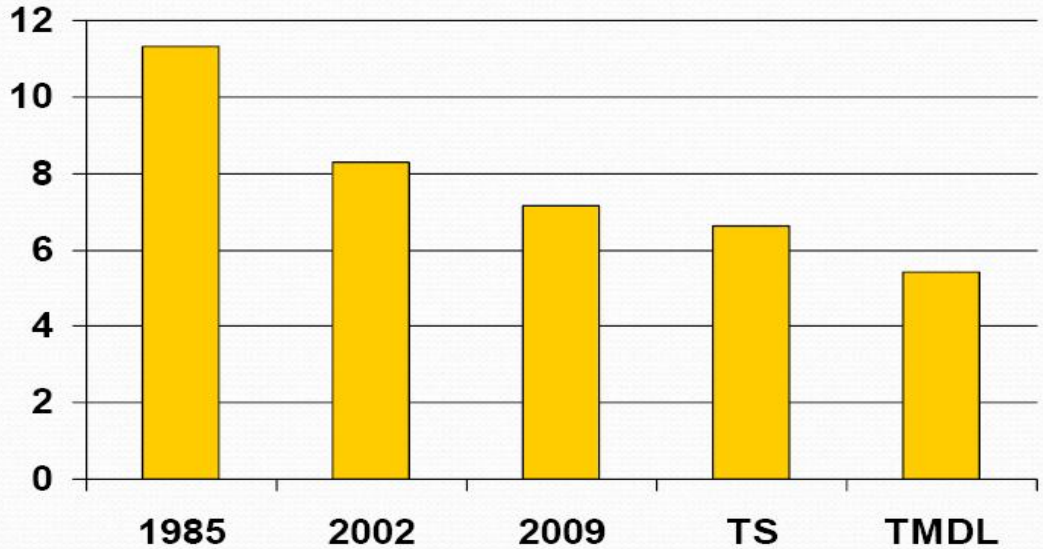
# Virginia Phosphorus Loads

[million lbs/yr]




TS – VA Tributary Strategy issued in 2005

Source: Virginia Department of Conservation and Recreation



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# Chesapeake Bay TMDL

Chesapeake Bay Total Maximum Daily Load

- December 29, 2010
- Combination of 92 Chesapeake Bay tidal segment TMDLs
- “Pollution diet” for nitrogen, phosphorus, and sediment
  - Nitrogen = 25% (185.9 million pounds)
  - Phosphorus = 24% (12.5 million pounds)
  - Sediment = 20% (6.45 billion pounds)
- All pollution control measures in place by **2025**
  - 60% completed by 2017
- WIPs, 2-yr milestones, EPA oversight, threat of federal action
- Designed to meet WQSs for DO, clarity, SAV, & chlorophyll *a*

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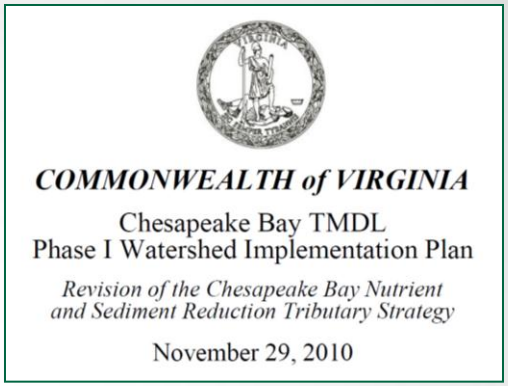
# Virginia's Watershed Implementation Plans


COMMONWEALTH of VIRGINIA

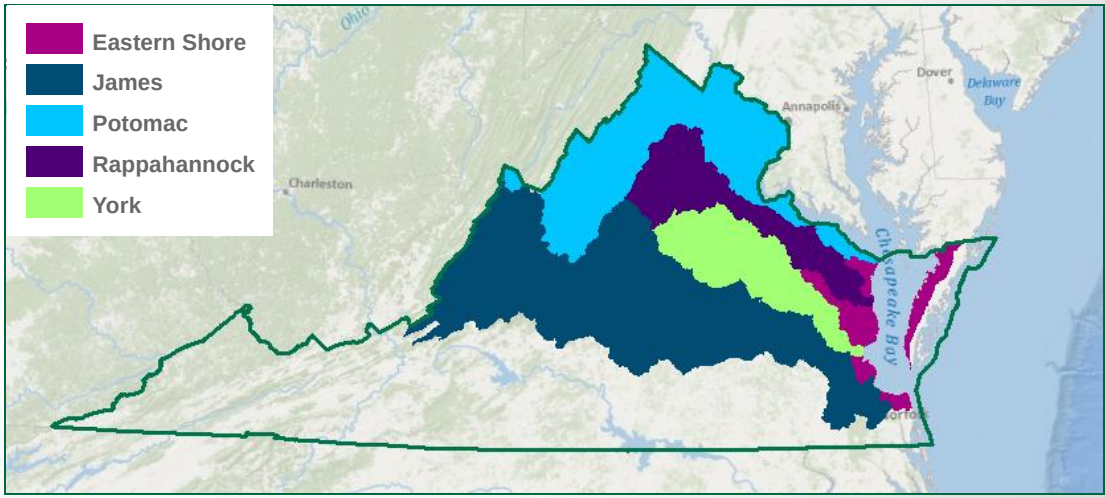
Chesapeake Bay TMDL
Phase I Watershed Implementation Plan

*Revision of the Chesapeake Bay Nutrient and Sediment Reduction Tributary Strategy*

November 29, 2010

## Phase 1

- Embrace adaptive management
- Expand nutrient credit exchange
- Identified key strategies/initiatives
  - *Source sector*
    - *Agriculture/Forestry*
    - *Onsite/Septic*
    - ***Urban Stormwater***
    - *Wastewater*
  - *Basin*

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# Virginia's Watershed Implementation Plans

## Phase 1 - Urban Stormwater Key Initiatives → Strategies

| | |
|---|---|
| Urban nutrient management plans on all municipally owned lands → | MS4 Permits |
| Ban the use of fertilizers containing phosphorus → | MS4 Permits |
| 20% phosphorus reduction standard for redevelopment aka "development on prior developed lands" → | Stormwater Regulations |
| Loads from new development not to exceed allowable loads for previous land use → | Stormwater Regulations |
| Stormwater retrofits on existing developed land → | MS4 Permits |

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# Virginia's Watershed Implementation Plans

## Phase 1 – Stormwater Retrofits on Existing Developed Land

| Land Use Category | Practice Description | Level 2 Practice % Coverage | Effective Net Reduction Prorated Over Entire Land Use Category Acreage | | |
|---|---|---|---|---|---|
| | | | N | P | Sediment |
| Impervious Urban High and Low Intensity | | | | | |
| | Impervious Cover Reduction | 7.5% | 0% | 5% | 6% |
| | Filtration Practices | 7.5% | 3% | 4% | 6% |
| | Infiltration Practices | 8.0% | 6% | 7% | 8% |
| | **Total** | | **9%** | **16%** | **20%** |
| Pervious Urban High and Low Intensity | | | | | |
| | Impervious Cover Reduction | - | | | |
| | Filtration Practices | 5% | 2% | 3% | 4% |
| | Infiltration Practices | 5% | 4% | 4.25% | 4.75% |
| | **Total** | | **6%** | **7.25%** | **8.75%** |

***Nutrient Reduction Efficiencies:***

*Impervious Cover Reduction: 2% N, 65% P, 85% Sediment (based on differences in Phase 5.3 Watershed Model no BMP loads for pervious/impervious average Virginia loads)*

*Filtration Practices: 40% N, 60% P, 85% Sediment*

*Infiltration Practices: 80% N, 85% P, 95% Sediment*

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# Virginia's Watershed Implementation Plans

## Phase 2

- Divide the Bay TMDL allocations into local target areas
- Work with local partners
- Describe how local partners are going to reduce loads
- Identify resources, authorities, assistance needed to implement actions to achieve allocations

**2009 Progress - VA**
**Summary Results**

**Description:** 2009 Progress scenario entered with county percent implementations as calculated by the CBP
**Source Year:** 2010
**Date Created:** 10/10/2011 9:35:58 PM

**Total Loads**

| Sector | Lbs Nitrogen Edge of Stream | Lbs Nitrogen Delivered | Lbs Phosphorus Edge of Stream | Lbs Del | | |
|---|---|---|---|---|---|---|
| Landuse | 107,727,440.1 | 43,420,472.5 | 11,387,587.5 | 7,30 | | |
| Septic | 4,500,393.4 | 2,494,928.6 | 0.0 | 0.0 | | |
| Waste Water | 18,505,840.9 | 14,295,889.3 | 1,403,006.6 | 1,128,244.1 | 150,446,587.1 | 138,871,509.6 |
| Total: | 130,733,674.4 | 60,211,290.4 | 12,790,594.1 | 8,428,812.5 | 4,356,683,372.2 | 3,848,643,293.8 |

**Landuse Loads**

| Landuse | Pre-BMP Acres | Post-BMP Acres | Lbs Nitrogen Edge of Stream | Lbs Nitrogen Delivered | Lbs Phosphorus Edge of Stream | Lbs Phosphorus Delivered | Lbs Sediment Edge of Stream | Lbs Sediment Delivered |
|---|---|---|---|---|---|---|---|---|
| Sector: Agriculture | | | | | | | | |
| | 2,812,904.5 | 2,786,173.8 | 57,616,760.3 | 19,990,012.1 | 8,308,871.2 | 5,184,955.2 | 2,680,506,592.8 | 2,387,005,646.0 |
| Sector: Forest | | | | | | | | |
| | 9,290,777.5 | 9,318,015.1 | 30,536,471.7 | 12,536,211.8 | 1,178,250.2 | 782,152.2 | 663,312,778.2 | 588,790,062.3 |
| Sector: Urban | | | | | | | | |
| | 1,693,936.0 | 1,693,429.0 | 18,567,591.8 | 10,316,247.8 | 1,820,610.5 | 1,277,087.5 | 862,417,414.1 | 733,976,075.9 |
| Sector: Water | | | | | | | | |
| | 130,064.1 | 130,064.1 | 1,006,616.3 | 578,000.8 | 79,855.6 | 56,373.5 | 0.0 | 0.0 |
| Total: | 13,927,682.1 | 13,927,682.0 | 107,727,440.1 | 43,420,472.5 | 11,387,587.5 | 7,300,568.4 | 4,206,236,785.1 | 3,709,771,784.2 |

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# Virginia's Watershed Implementation Plans

## Summary – Phase 1 and Phase 2 WIPs: Urban Stormwater

- Stormwater Regulations – effective July 1, 2014
  - New technical criteria → runoff reduction method
  - Local programs to administer VSMP construction permits
- MS4 Permits
  - 11 Phase I (Large) MS4s
    - All have been administratively continued for years
    - DCR has verbalized an aggressive schedule
  - 89 Phase 2 (Small) MS4s
    - New General Permit effective July 1, 2013
    - 5 year permit cycle
    - Compliance with Ches Bay (and other) TMDLs regulatory



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# Determine the Required Reduction and the 5% Adequate Progress for the First Permit Cycle

| | Subsource | Pollutant | Total Existing Acres Served by MS4 (6/30/13) | 2009 EOS Loading Rate (lbs/ac) | MS4 Required Chesapeake Bay Total Loading Rate Reduction | Difference 2009 Progress - Final Target (lbs/ac) | MS4 Final Target (lbs/ac) | First Permit Cycle Required Reduction in Loading Rate (lb/ac) | Total Reduction Required First Permit Cycle (lbs) | Total Reduction Required (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| James River Basin: James River, Lynnhaven and Poquoson Coastal Basins | Regulated Urban Impervious | Nitrogen | 1,087 | 9.39 | 9% | 0.85 | 8.54 | **0.04** | 336.07 | 6,721.44 |
| | Regulated Urban Pervious | | 13,836 | 6.99 | 6% | 0.42 | 6.57 | **0.02** | | |
| | Regulated Urban Impervious | Phosphorus | 1,087 | 1.76 | 16% | 0.28 | 1.48 | **0.01** | 40.38 | 807.65 |
| | Regulated Urban Pervious | | 13,836 | 0.5 | 7.25% | 0.04 | 0.46 | **0.002** | | |
| | Regulated Urban Impervious | Sediment | 1,087 | 676.94 | 20% | 135.39 | 541.55 | **6.77** | 13,476.96 | 269,539.26 |
| | Regulated Urban Pervious | | 13,836 | 101.08 | 8.75% | 8.84 | 92.24 | **0.44** | | |

Source: Small MS4 General Permit Regulatory Advisory Panel Meeting Materials (presented July 25, 2012), "Chesapeake Bay TMDL Language – Addressing Existing Sources.

# New VSMP Regulations

- ✓ (Virginia Stormwater Management Program) regulations
  - Promulgated in 2011
  - Become effective July, 2014
    - Requires updated County stormwater program/ordinance
    - Requires County administration of VSMP General Construction Permit
    - Mandates new stormwater BMP design guidelines
    - Mandates new stormwater calculation method



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# Site Plan Review Application

- ✓ Changes coming
  - Statement of applicable Technical Criteria
  - Digital submission standards
  - SWM Plan
    - Runoff Reduction Compliance
    - Energy Balance
    - Part IIC
  - BMP summary

Revised March 16, 2012

**Site Plan Review Application**

Town of Ashland

Please ensure that all of the checklist information attached has been completed. Plans will not be accepted for review if the information on the following pages is not submitted with this application.

Deliver plans to: Town of Ashland, 101 Thompson Street, Ashland, VA 23005

Any questions? Contact the Planning Department at (804)798-1073 or fax (804)798-4892

See our website for application fee schedule.

www.town.ashland.va.us

Name of Project

Site address, or description of location

GPIN (Parcel Number) for all subject parcels

Total Acreage of Site

**CONTACT INFORMATION:** All correspondence will be sent to the consultant who prepared the plans.

DEVELOPER/APPLICANT

Contact Name

Company

Address

City, State Zip

Work Phone#

Fax #

Cell Phone #

Email address

CONSULTANT/ENGINEER

Contact Name

Company

Address

City, State Zip

Work Phone#

Fax #

Cell Phone #

Email address

DRAFT



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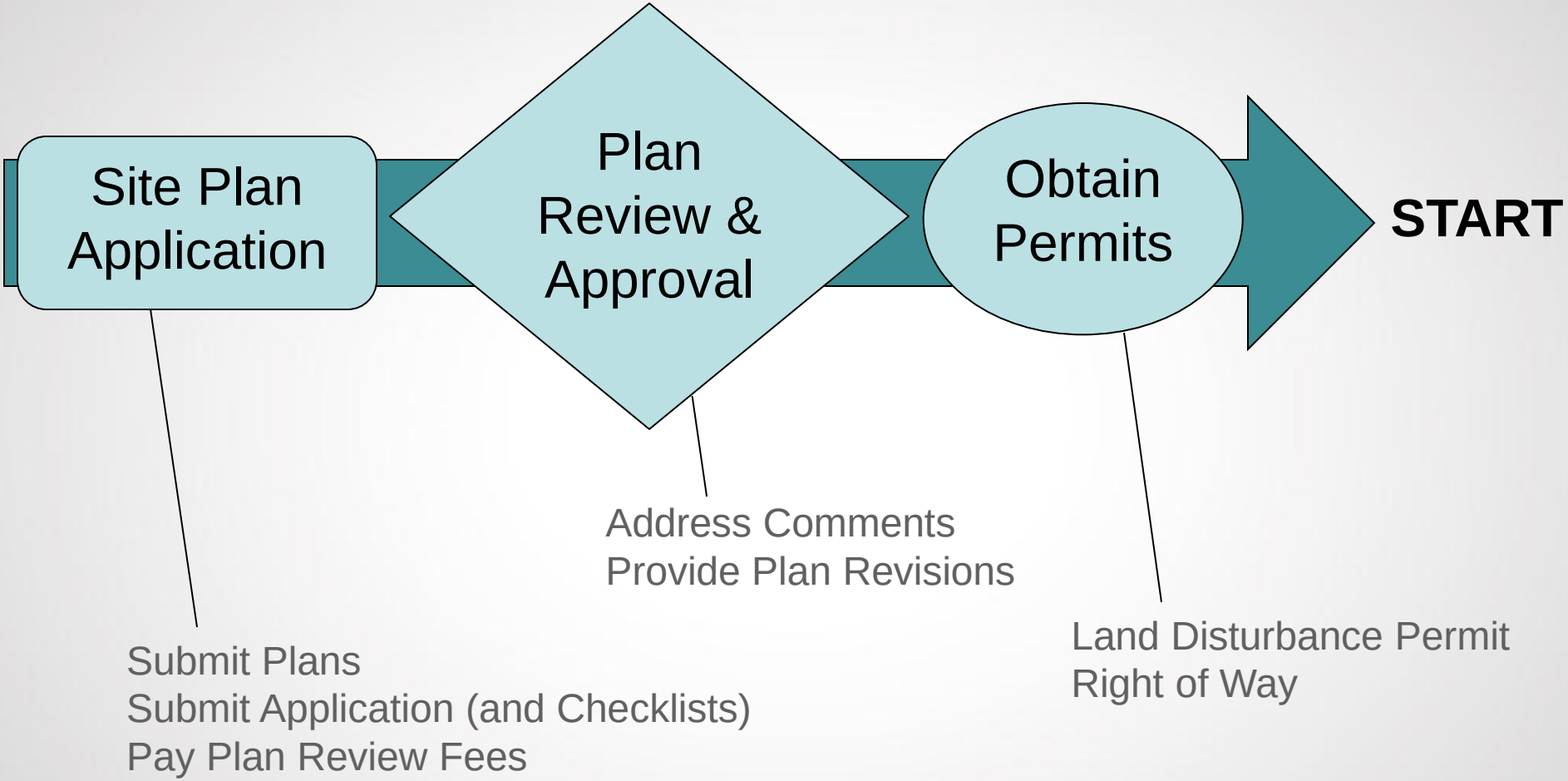
# Land Disturbance Permits

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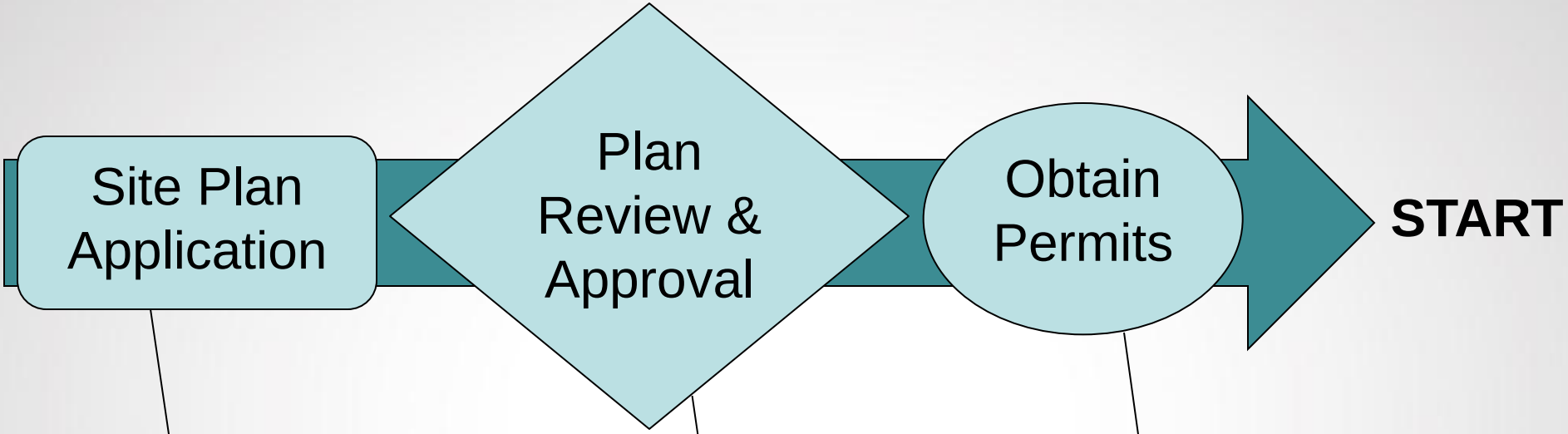
# Land Disturbance Permits




Submit Plans
Submit Application (and Checklists)
Pay Plan Review Fees
Submit VSMP Registration Statement
Pay 50% VSMP Fee

Address Comments
Provide Plan Revisions

Land Disturbance Permit
Right of Way
VSMP GP Coverage
Pay Remaining VSMP Fee

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# Presentation Outline

- Chesapeake Bay Program
- Chesapeake Bay (and other) TMDLs
  - VSMP
  - MS4
  - Erosion / Sediment Control Program
- Construction General Permit / SWPPP

# Which technical criteria to use?

Apply the Technical Criteria specified in Part IIB (runoff reduction and energy balance) unless your project meets one of the following clauses:

- ✓ Time limits on applicability of approved design criteria
- ✓ Grandfathering



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# Which technical criteria to use?

Time limits on applicability of approved design criteria:

- If have approved E and S and SWM Plan by June 30, 2014 (or August 30th)
- And have obtained 2009 CGP and maintain continuous GCP permit coverage
- Then use Part IIC Technical Criteria for any work constructed within subsequent 2 GCP permit terms (10 years, 2024)



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# Which technical criteria to use?

Grandfathering:

- If any of the following approvals prior to July 1, 2012
  - Zoning plan
  - Subdivision plan
  - Site plan
  - Funding for public project
- And have <u>not</u> obtain 2009 CGP coverage
- Then use Part IIC Technical Criteria for any work constructed within subsequent 1 GCP permit terms (5 years, 2019)



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# BMP Design Standards and Specifications

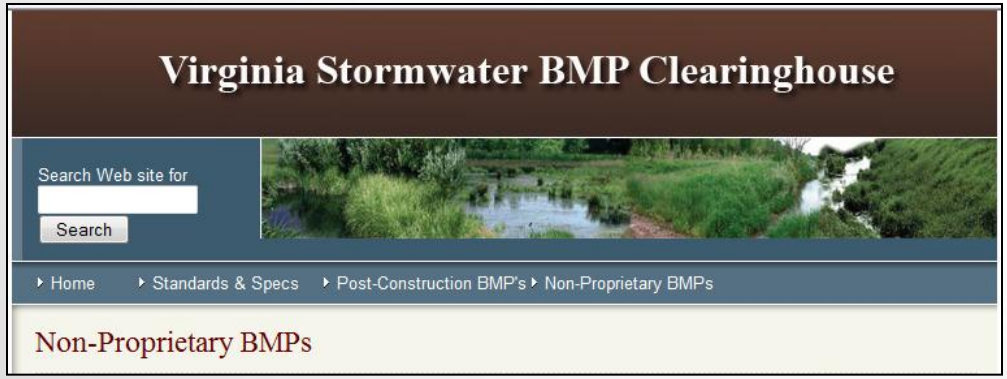
## Part IIB

- ✓ Runoff Reduction Method

http://www.deq.virginia.gov/404Error.aspx?aspxerrorpath=/Programs/Water/LawsRegulationsGuidance/Guidance.aspx

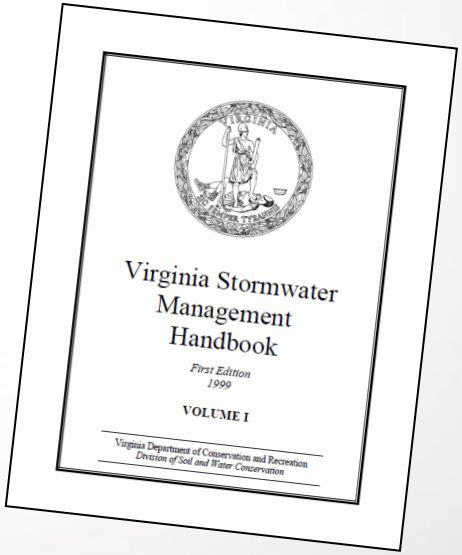
- ✓ BMP Clearinghouse

http://vwrrc.vt.edu/SWC/PostConstructionBMPs.html




## Part IIC

- ✓ Performance Based Criteria
- ✓ 1999 Standards



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# Construction Oversight

- ✓ SWPPP on-site
- ✓ Completed Contractor certification forms
- ✓ Completed Contractor self inspection forms
- ✓ Trash cans/dumpsters
- ✓ Portable toilets
- ✓ Fueling tanks / spill clean-up
- ✓ Equipment maintenance areas
- ✓ Material storage areas
- ✓ Erosion and sediment control measures
- ✓ Concrete washout



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# THANK YOU

Andrew Gould, PE
andrew.gould@timmons.com
804.334.9284

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# Stormwater Management Update – Requirements for Plans and Approvals

Doug Beisch (WEG, now Stantec)

Stantec

April 2, 2014

# Introduction and overview

Why are we here?

Stantec

# About Stantec

- Williamsburg Environmental Group (WEG) is now part of the Stantec family!
- More than 13,000 people providing services in the US, Canada and Internationally.
- WEG staff are now part of Stantec's Mid-Atlantic Environmental Services practice.

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# Goals and Objectives

- Administrative Requirements/Approvals
- Overall Technical Requirements
  - Runoff Reduction
  - Energy Balance
- Final Completion and Acceptance
- Long Term O&M

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# Background Questions

- How many of you have completed the **SWM Basic Training provided by DEQ**?
- How many of you have completed the **Inspector Training provided by DEQ**?
- How many of you have been **closely following the development of the new Stormwater Regulations** and technical criteria?

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# IIB or not IIB?

- Two Possible Avenues:
  - Continuation of Coverage
  - True "Grandfathering"

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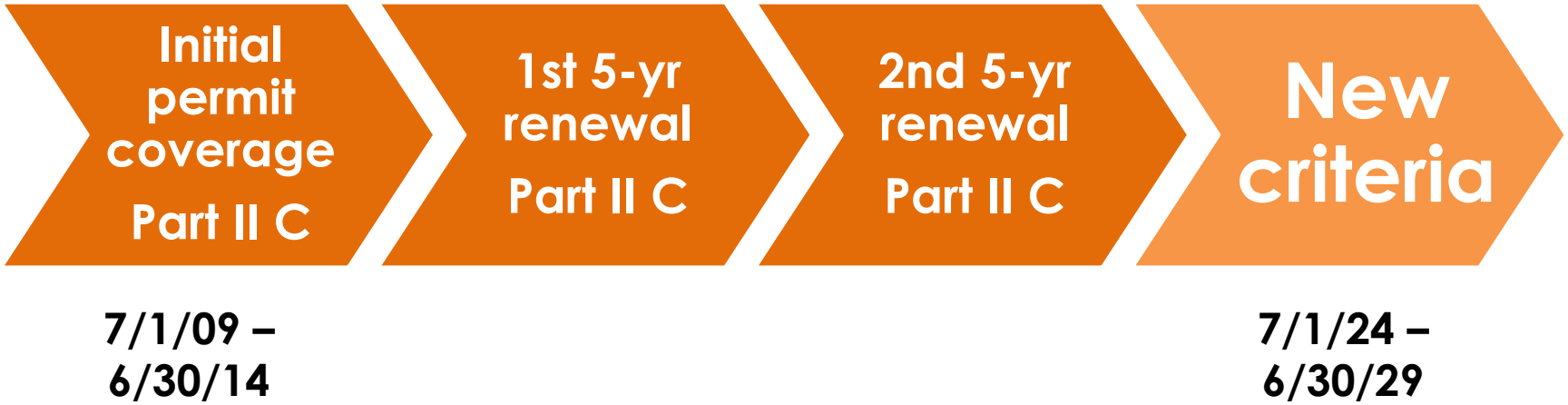
# Time Limits of Approved Design Criteria (9VAC25-870-47B)




SOURCE: DEQ

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# Grandfathering (9VAC25-870-48)

**Construction GP issued after June 30, 2014**

**Local approval before July 1, 2012**

SOURCE: DEQ

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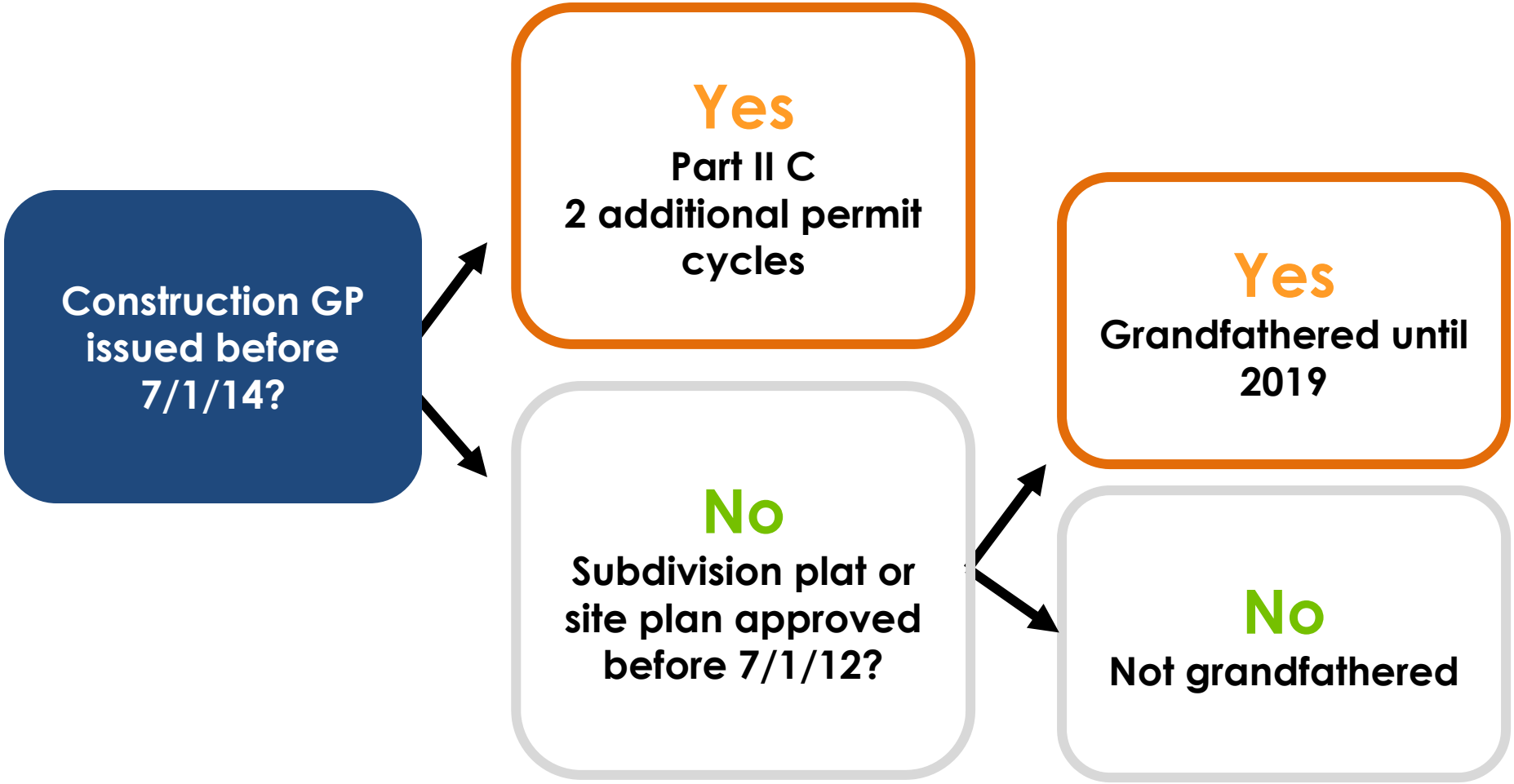
# Private LDA




SOURCE: DEQ

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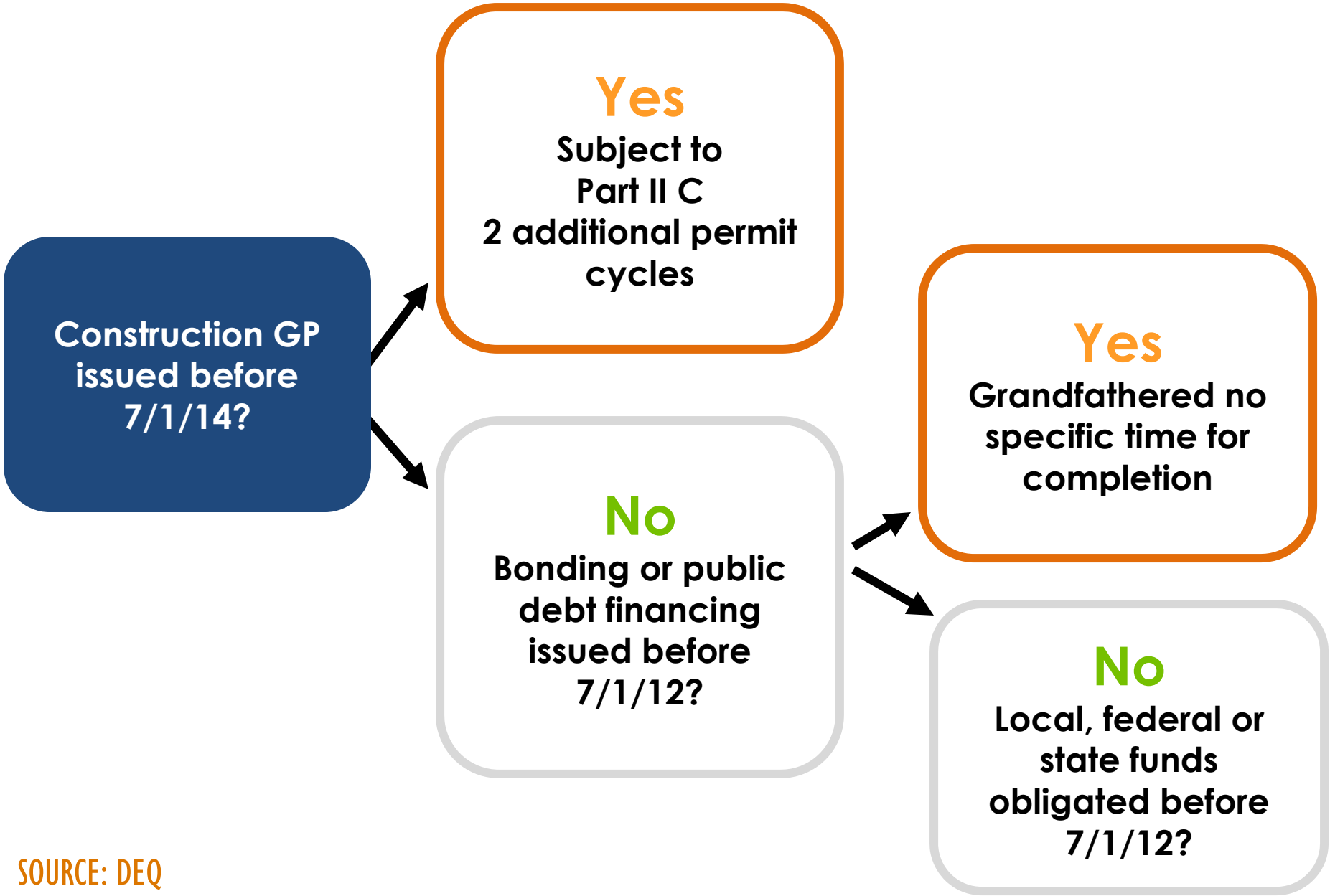
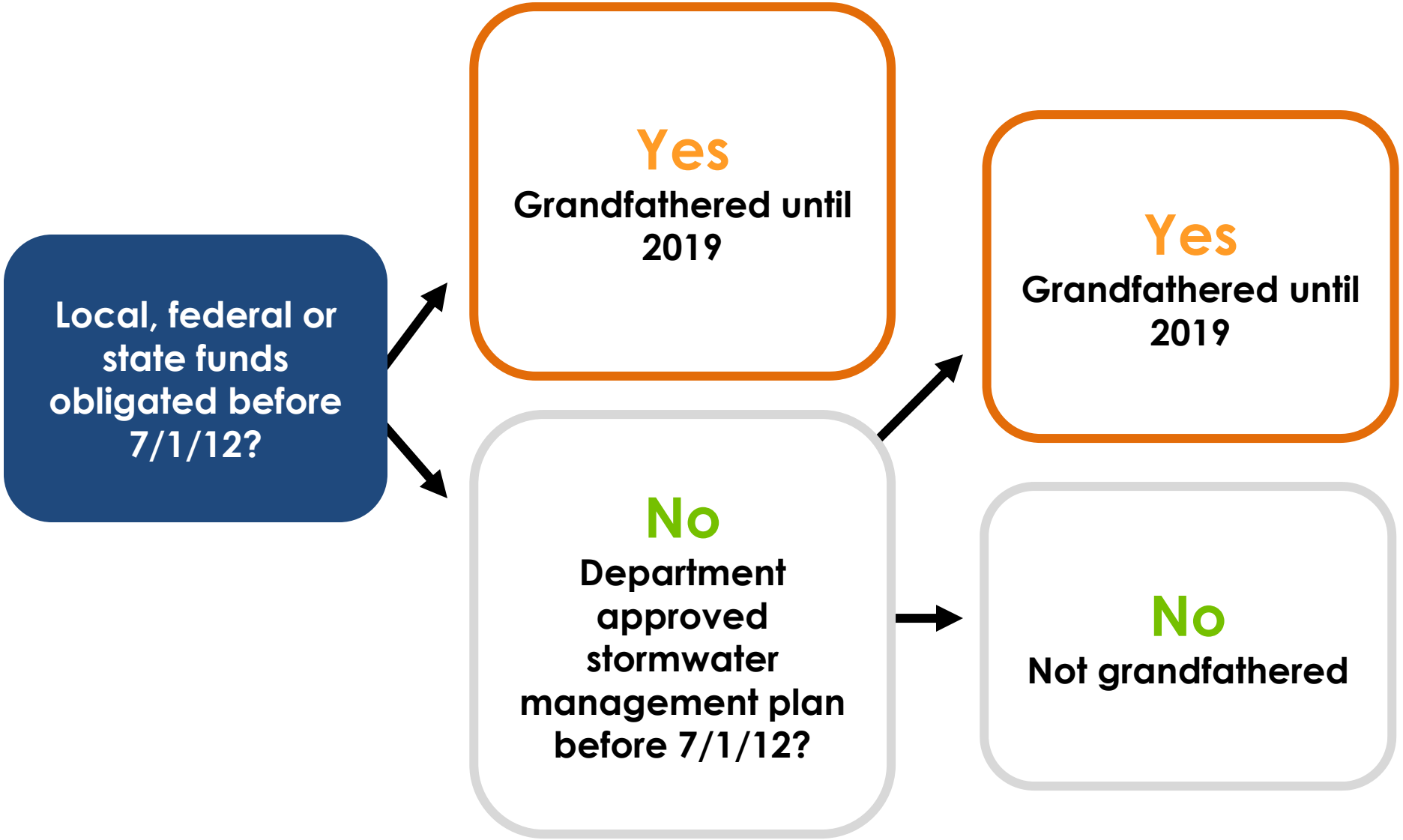
# Local, State, Federal LDA




SOURCE: DEQ

# Local, State, Federal LDA




SOURCE: DEQ

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# Other Submittal Requirements

- Maintenance Agreement
  - Submitted and approved prior to permit issuance
  - Recorded prior to NOT
- Bonds and Performance Securities
  - May be Required by Authorities
- P2 Plan – Some localities will review
- Registration Statement and Fees

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# Requirements for a SWPPP

- Prepared by Operator
  - Prior to signing registration statement
- SWM Plan/ ESC Plan
- Pollution Prevention (P2) Plan
- Other Control Measures Necessary for a TMDL

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# Technical Topic #1

## VIRGINIA RUNOFF REDUCTION METHOD

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# Virginia Runoff Reduction Method

1. Overview of the Methodology
2. Spreadsheet Review
3. BMP Types/Categories

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# Overview of the Virginia Runoff Reduction Method

- Inclusion of land cover type in loading factors (not just impervious cover);
- Treatment Volume (Tv) based on 90th Percentile Rain event (1-inch);
- New site based TP load limit;
- New treatment options; and
- Updated BMP performance metrics
  - Volume and concentration

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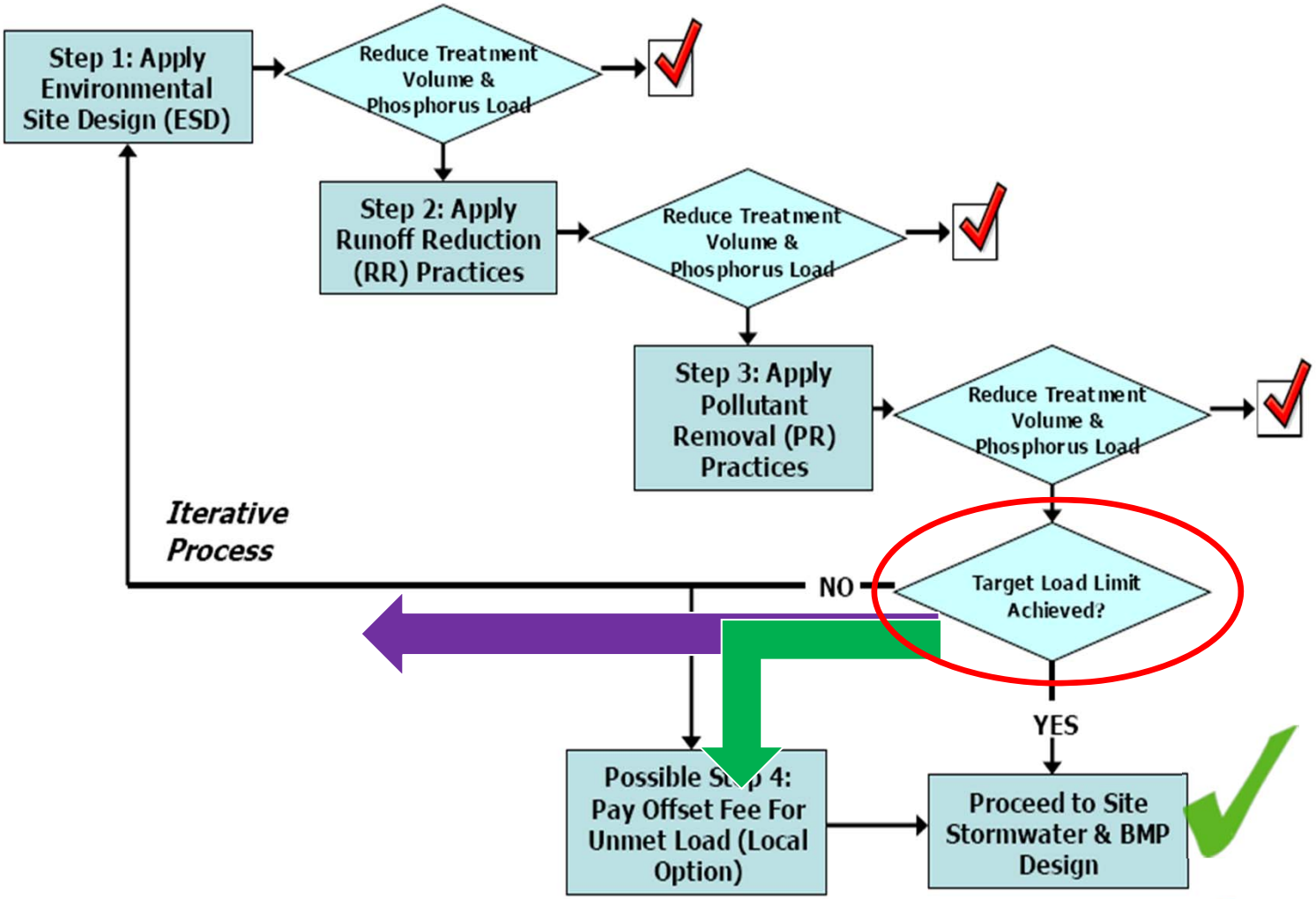
# Virginia Runoff Reduction Method: 3 Step Compliance

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# Virginia Runoff Reduction Method

- Codifies & incentivizes minimization and avoidance;
- Goes beyond impervious cover as a water quality indicator;
- Utilizes latest science & research for nutrient reductions;
- Credits total BMP performance; New Specifications with Level 1 and Level 2

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# Managed Turf

- Documented impacts from turf management activities:
  - Fertilization;
  - Pest management;

# Treatment Volume: Site Runoff Coefficients (Rv)[1]

| Cover | HSG A | HSG B | HSG C | HSG D |
|---|---|---|---|---|
| Forest/Open | **0.02** | **0.03** | **0.04** | **0.05** |
| Managed Turf / Disturbed Soil | **0.15** | **0.20** | **0.22** | **0.25** |
| Impervious Cover | **0.95** | **0.95** | **0.95** | **0.95** |

[1] *Center for Watershed Protection – Technical Memorandum: The Runoff Reduction Method; 4/18/08*

*Pitt et al (2005), Lichter and Lindsey (1994), Schueler (2001a, 2001b, 1987), Legg et al (1996), Pitt et al (1999), and Cappiella et al (2005)*

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# Stormwater Quality

## New Development:

- Current Rqmt.: 0.45 lb/ac/yr TP
- Original Proposal: 0.28 lb/ac/yr TP
- Final Adopted: **0.41 lb/ac/yr TP**

## Re-Development:

- Current Requirement: 10% Reduction in exist annual TP load
- Proposed Requirement: 20% reduction in exist annual TP load (LDA > 1 Ac)

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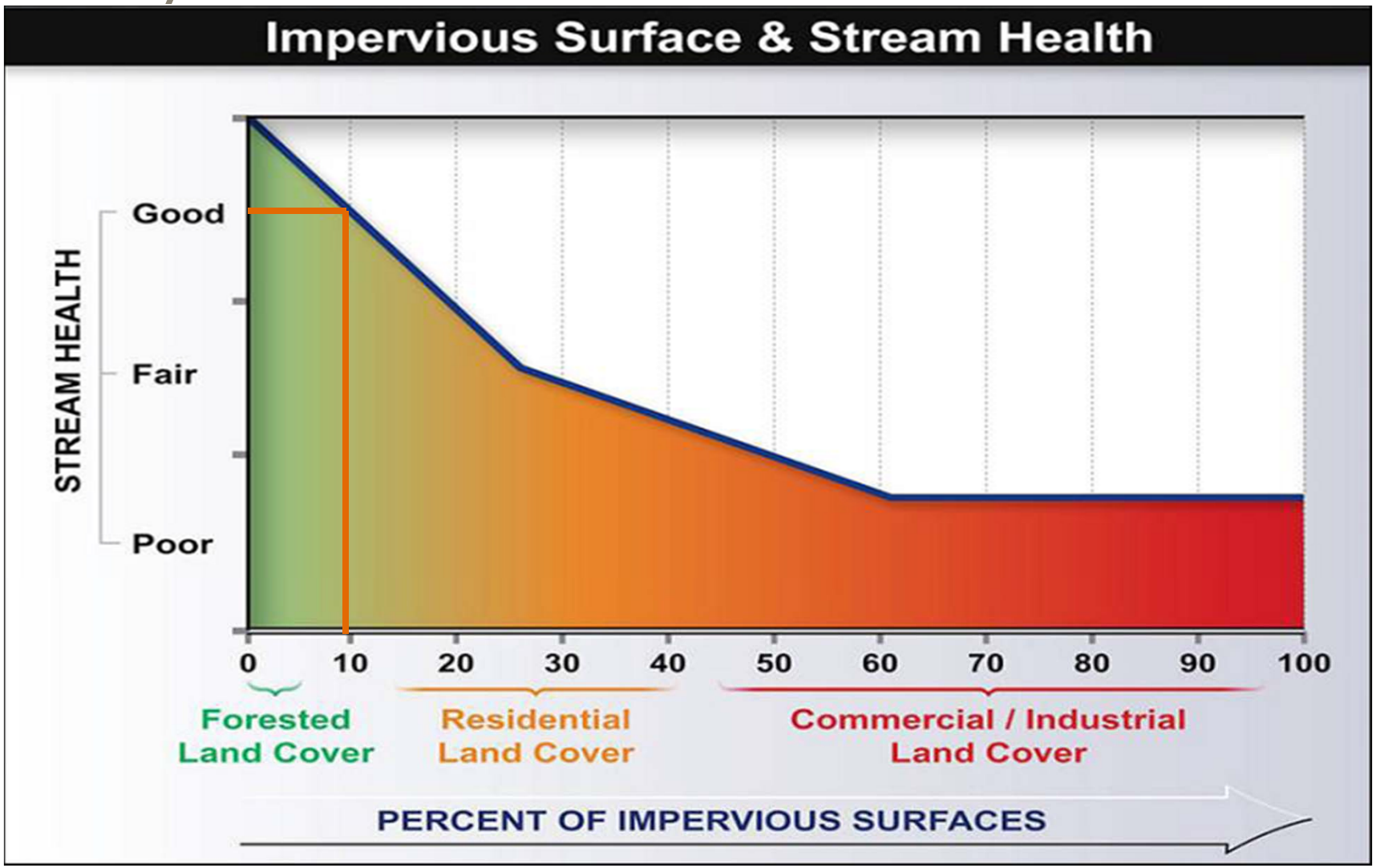
# Why 10% IC?

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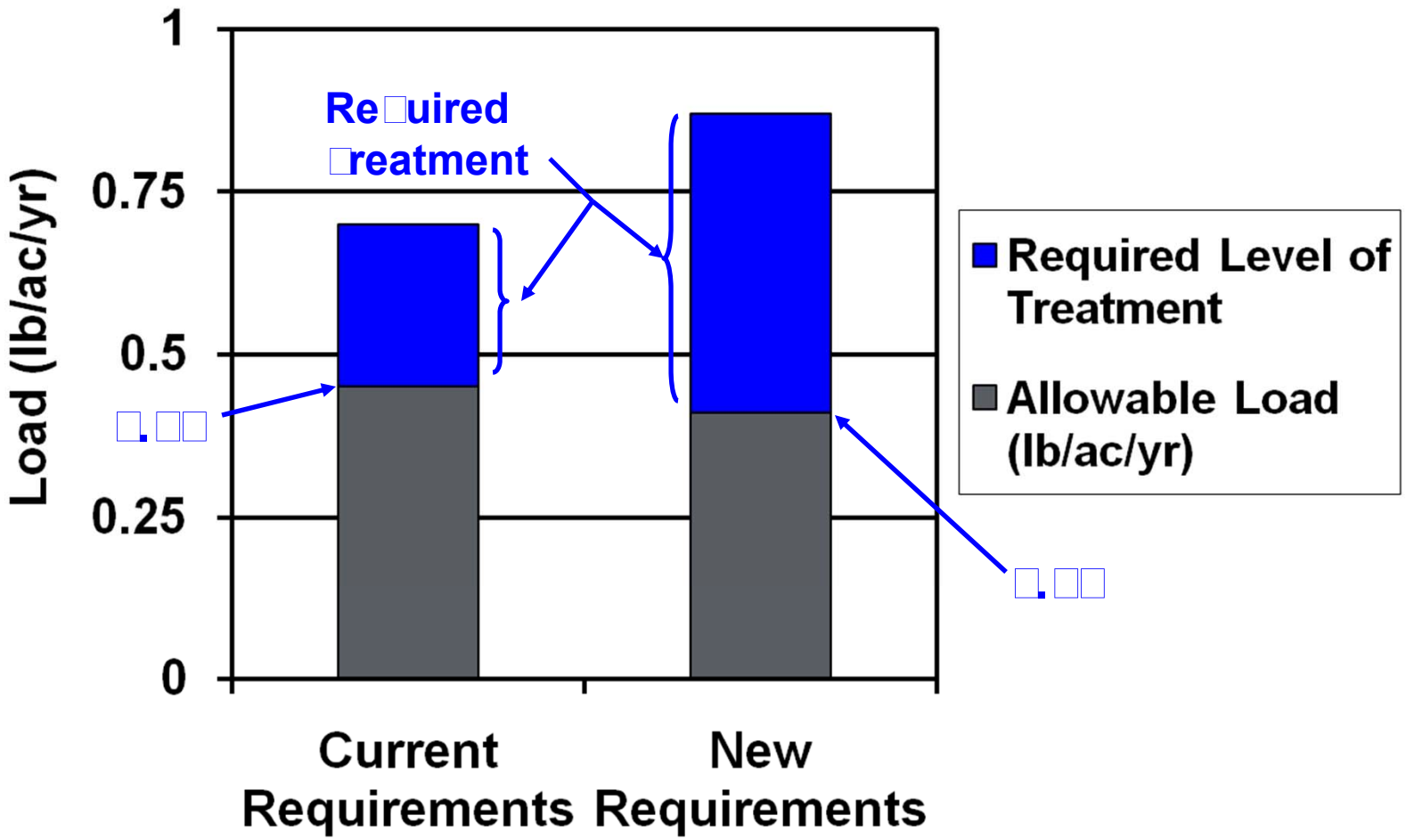
# Water Quality - Treatment

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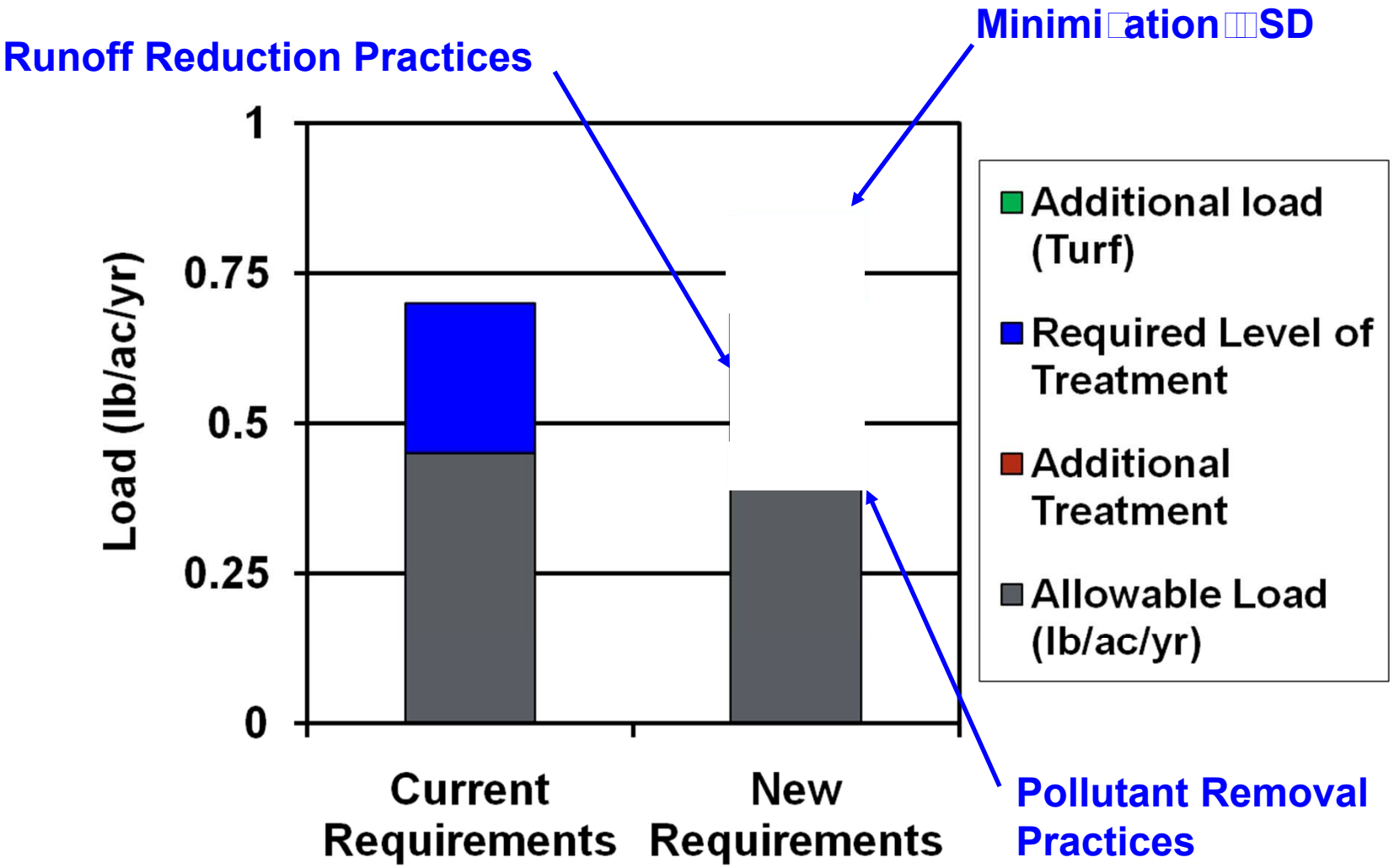
# Treatment Options

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# Virginia Runoff Reduction Spreadsheet

**Virginia Runoff Reduction Method New Development Worksheet -- v2.7 Revised Feb 2014**

**Site Data**

**Project Name:**

**Date:**

data input cells
calculation cells
constant values

**1. Post-Development Project & Land Cover Information**

**Constants**

| | |
|---|---|
| Annual Rainfall (inches) | 43 |
| Target Rainfall Event (inches) | 1.00 |
| Phosphorus EMC (mg/L) | 0.26 |
| Nitrogen EMC (mg/L) | 1.86 |
| Target Phosphorus Target Load (lb/acre/yr) | 0.41 |
| Pj | 0.90 |

**Land Cover (acres)**

| | A soils | B Soils | C Soils | D Soils | Totals |
|---|---|---|---|---|---|
| Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land | 0.00 | | 0.00 | 0.00 | 0.00 |
| Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed | 0.00 | | 0.00 | 0.00 | 0.00 |
| Impervious Cover (acres) | 0.00 | | 0.00 | 0.00 | 0.00 |
| | | | | Total | 0.00 |

**Rv Coefficients**

| | A soils | B Soils | C Soils | D Soils |
|---|---|---|---|---|
| Forest/Open Space | 0.02 | 0.03 | 0.04 | 0.05 |
| Managed Turf | 0.15 | 0.20 | 0.22 | 0.25 |
| Impervious Cover | 0.95 | 0.95 | 0.95 | 0.95 |

**Land Cover Summary**

| | |
|---|---|
| Forest/Open Space Cover (acres) | 0.00 |
| Weighted Rv(forest) | 0.00 |
| % Forest | 0% |
| Managed Turf Cover (acres) | 0.00 |

Site Data | D.A. A | D.A. B | D.A. C | D.A. D | D.A. E | Water Quality Compliance | Channel and Flood Protection | Summary

Ready

1. Site Data Input

2. Drainage Area Inputs

3. Water Quality Check

4. Channel/Flood Protection Check

5. Summary Print-out

## 1. Site Data Input:

- Site Land cover
- Site level Treatment Volume (Tv)
- Site level pollutant loads and Removal Requirement

## 2. Drainage Area Inputs:

- DA Land Cover
- $Tv_{BMP}$ (used for BMP sizing)
- Area treated check
- DA pollutant removal

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# Virginia Runoff Reduction Spreadsheet

**Virginia Runoff Reduction Method Worksheet -- Revised 1/25/12**

**Site Data**

**Project Name:**

**Date:**

data input cells
calculation cells
constant values

**1. Post-Development Project & Land Cover Information**

**Constants**

| | |
|---|---|
| Annual Rainfall (inches) | 43 |
| Target Rainfall Event (inches) | 1.00 |
| Phosphorus EMC (mg/L) | 0.26 |
| Target Phosphorus Target Load (lb/acre/yr) | 0.41 |
| Pj | 0.90 |

Nitrogen EMC (mg/L)

**Land Cover (acres)**

| | A soils | B Soils | C Soils | D Soils | Totals |
|---|---|---|---|---|---|
| Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Impervious Cover (acres) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | | Total | 0.00 |

**Rv Coefficients**

| | A soils | B Soils | C Soils | D Soils |
|---|---|---|---|---|
| Forest/Open Space | 0.02 | 0.03 | 0.04 | 0.05 |
| Managed Turf | 0.15 | 0.20 | 0.22 | 0.25 |
| Impervious Cover | 0.95 | 0.95 | 0.95 | 0.95 |

**Land Cover Summary**

| | |
|---|---|
| Forest/Open Space Cover (acres) | 0.00 |
| Weighted Rv(forest) | 0.00 |
| % Forest | 0% |
| Managed Turf Cover (acres) | 0.00 |
| Weighted Rv(turf) | 0.00 |
| % Managed Turf | 0% |
| Impervious Cover (acres) | 0.00 |
| Rv(impervious) | 0.95 |
| % Impervious | 0% |
| **Total Site Area (acres)** | 0.00 |
| **Site Rv** | 0.00 |
| Post-Development Treatment Volume (acre-ft) | 0.00 |
| Post-Development Treatment Volume (cubic feet) | 0 |
| Post_Development Load (TP) (lb/yr) | 0.00 |
| Total Load (TP) Reduction Required (lb/yr) | 0.00 |

Post_Development Load (TN) (lb/yr) 0.00

Site Data | D.A. A | D.A. B | D.A. C | D.A. D | D.A. E | Water Quality Compliance

- Land Cover (acres) by HSG
- Definitions Provided in Guidance

Volumetric Runoff Coefficients

Weighted (by HSG) Rv for Forest, Trf, & Imp

Composite Site Rv

**Post-Dev Tv**

**Pollutant Load (TP & TN)**

**Total Load Reduction Reqd.**

# Permeable Surface Management Conditions

VIRGINIA STORMWATER MANAGEMENT HANDBOOK
CHAPTER 12:
Table 12.1. Land cover guidance for VRRM compliance spreadsheet

**Managed Turf**: Areas **intended to be mowed and maintained** as turf within residential, commercial, industrial, and institutional settings

**Forest & Open Space:**

- Portions of residential lots **that will NOT be disturbed** during construction
- Portions of roadway rights-of-way that, following construction, will be used as **filter strips**, **grass channels**, or **stormwater treatment** areas; MUST include soil restoration or placement of engineered soil mix as per the design specifications
- **Community open space** areas that will not be mowed routinely, but **left in a natural vegetated state** (can include areas that will be bush hogged no more than **four times per year**)

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# Latest Science and Research

## Total BMP Performance:

Pollutant Removal Reported Performance:

- **$EMC_{in}$ vs $EMC_{out}$**

plus:

Runoff Reduction Reported Performance:

- **$Vol_{in}$ vs $Vol_{out}$**

equals:

Total BMP Performance (reported as Load Reduction):

- $(Vol_{in})*(EMC_{in})$ vs $(Vol_{out})*(EMC_{out})$

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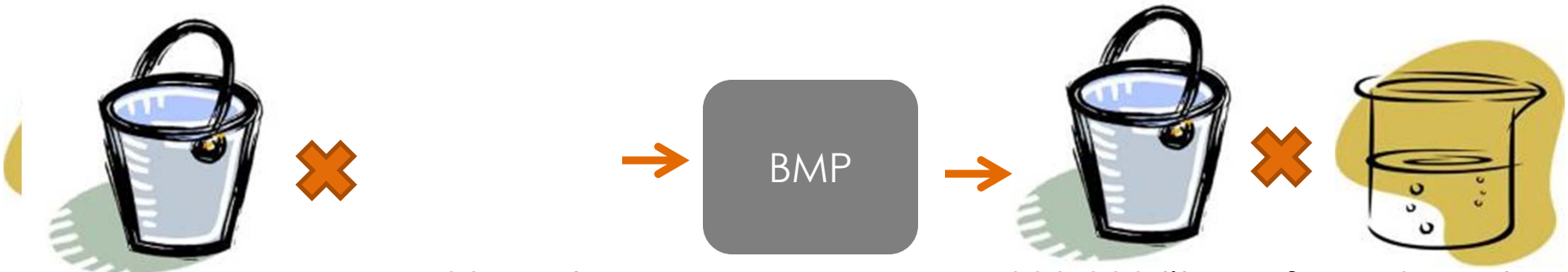
# Traditional BMPs



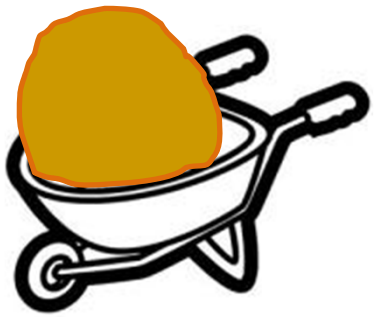

1,000,000 liters of stormwater (multiple storm events)

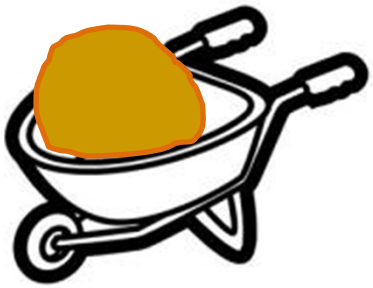
100 mg/L pollutant (average)

1,000,000 liters of stormwater (multiple storm events)

50 mg/L of pollutant (average)

**100 kg**
Total pollutant load





**50 kg**
Total pollutant load discharged over time

No volume reduction, only load reduction

SOURCE: VA DEQ, 2013

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# RRM, "New" BMPs

1,000,000 liters of stormwater (multiple storm events)

100 mg/L of pollutant (average)

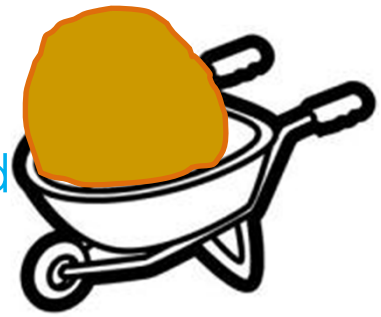
**BMP**

**50% volume reduction**

500,000 liters of stormwater (multiple storm events)

50 mg/L pollutants (average)

**100 kg**
Total load of pollutant



**25 kg**
Total load of pollutant discharged over time

**Volume and load reduction!**

SOURCE: VA DEQ, 2013 (CORRECTED)

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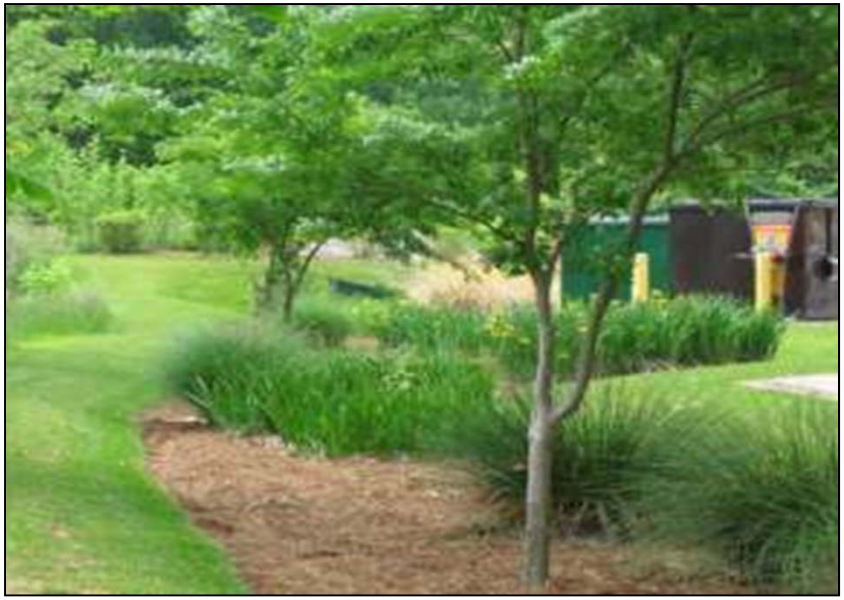
# Stormwater Practices Differ Sharply in Ability to Reduce Runoff Volume

Wet Ponds, ED Ponds and Constructed Wetlands and Filters Reduce Runoff Volumes by zero to 10%



Bioretention, Infiltration, Dry Swales, Soil Amendments, disconnection, and Related Practices Reduce Runoff Volumes by 50 to 90%

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# Multi-Function Practices

| | Site Design | Runoff Reduction | Pollutant Removal |
|---|---|---|---|
| 1. Rooftop Disconnection | ✓ | ✓ | |
| 2. Filter Strip | ✓ | ✓ | |
| 3. Grass Channel | | ✓ | ✓ |
| 4. Soil Amendments | ✓* | ✓ | |
| 5. Green Roof | | ✓ | |
| 6. Rain Tanks & Cisterns | | ✓ | |
| 7. Permeable Pavement | | ✓ | ✓ |
| 8. Infiltration | | ✓ | ✓ |
| 9. Bioretention | | ✓ | ✓ |
| 10. Dry Swales | | ✓ | ✓ |
| 12. Filtering Practices | | | ✓ |
| 13. Constructed Wetlands | | | ✓ |
| 14. Wet Ponds | | | ✓ |
| 15. ED Ponds | | ✓ | ✓ |

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# Limitations of Spreadsheet

- Not a routing model
- Some BMPs can be customized for additional volumetric storage not reflected
- Does not include "other approved" practices
- Multiple treatment trains are difficult to deal with

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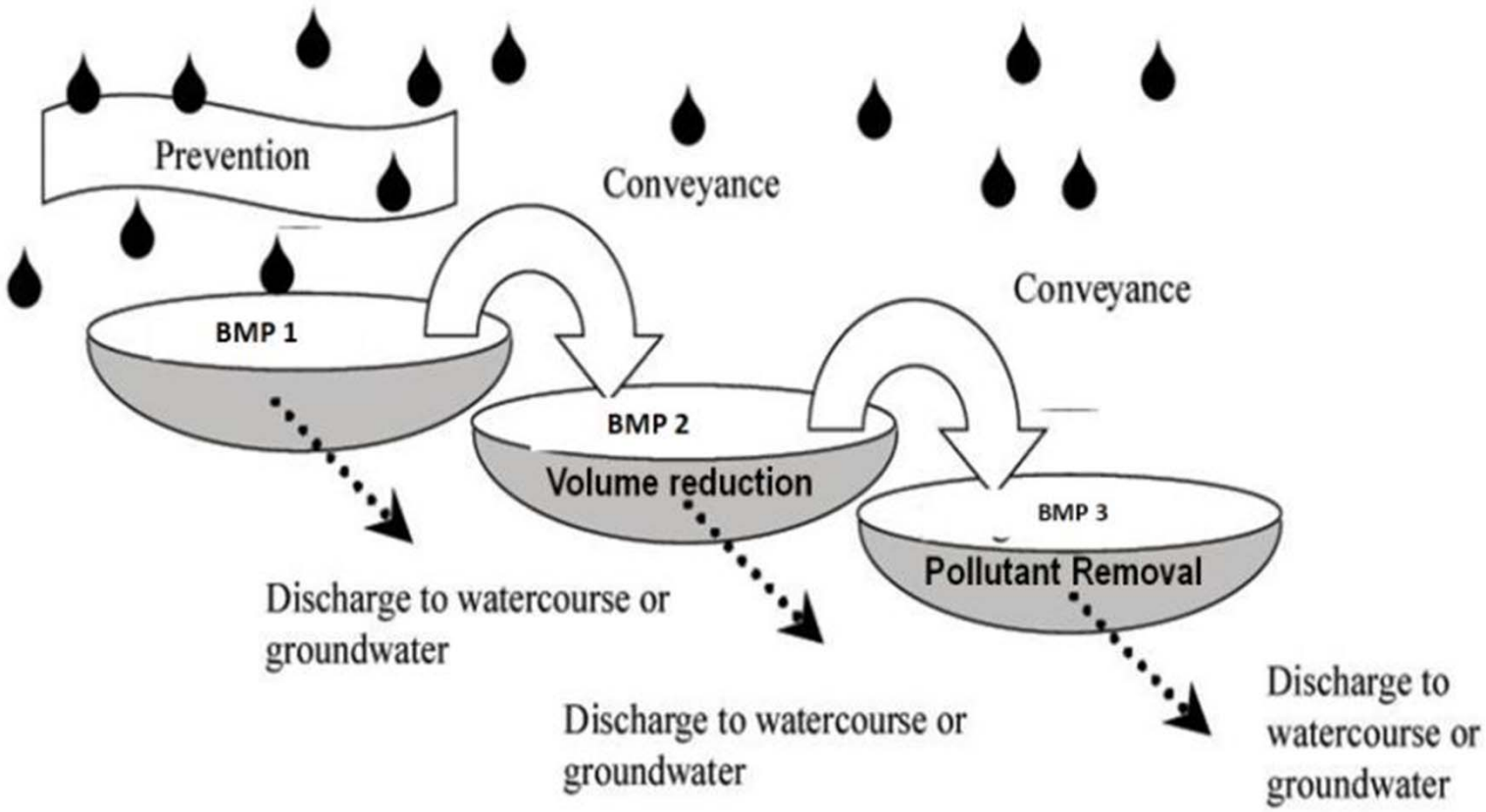
# BMP Treatment Train

Consider guidance to standardize *Process Diagrams* to track volume and load through complex treatment trains

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# Non-Proprietary BMPs in the Clearinghouse

1. **Impervious Disconnection**
2. **Sheetflow to Conservation Area/Filter Strip**
3. **Grass Channels**
4. **Soils Compost Amendments**
5. Vegetated Roofs
6. Rainwater Harvesting
7. Permeable Pavement
8. Infiltration
9. Bioretention (including Urban Bioretention)
10. Dry Swales
11. Wet Swales
12. Filtering Practices
13. Constructed Wetlands
14. Wet Ponds
15. Dry Extended Detention Ponds

**Site Design BMPs**

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# Rooftop/Impervious Area Disconnection

## VIRGINIA DEQ STORMWATER DESIGN SPECIFICATION No. 1

### Simple Rooftop Disconnection Design Criteria

| DESIGN FACTOR | SIMPLE DISCONNECTION |
|---|---|
| Maximum impervious (rooftop or residential impervious) area treated | 1,000 sq. ft. per disconnection |
| Longest flow path (roof/gutter or small residential impervious area) | 75 feet |
| Disconnection Geometry | Width ≥ 10 feet; Length equal to longest flow path, but no less than 40 feet [2] |
| Disconnection slope | < 2%, or < 5% with turf reinforcement [3] |
| Distance from buildings or foundations | Extend downspouts 5 ft. [4] (15 ft. in karst areas) away from building *if grade is less than 1%*. |
| Type of Pretreatment | External (leaf screens, etc) |

[1] For alternate disconnection runoff reduction practices, see the applicable specification for design criteria. See Table 1 in this specification for eligible practices and associated specification numbers.

[2] An alternate disconnection runoff reduction practice must be used when the disconnection length is less than 40 feet.

[3] Turf reinforcement may include EC-3, or other appropriate reinforcing materials that are confirmed by the designer to be non-erosive for the specific characteristics and flow rates anticipated at each individual application, and acceptable to the plan approving authority.

[4] Note that the downspout extension of 5 feet is intended for simple foundations. Any dry well or french drain adjacent to an in-ground basement or finished floor area should be carefully designed and coordinated with the design of the structure's water-proofing system (foundation drains, etc.), or avoided altogether.

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# Rooftop/Impervious Area Disconnection

VIRGINIA DEQ STORMWATER DESIGN SPECIFICATION No. 1

**Alternate Disconnection**:

Rainwater Harvesting & Cisterns;

Micro-Infiltration (dry wells);

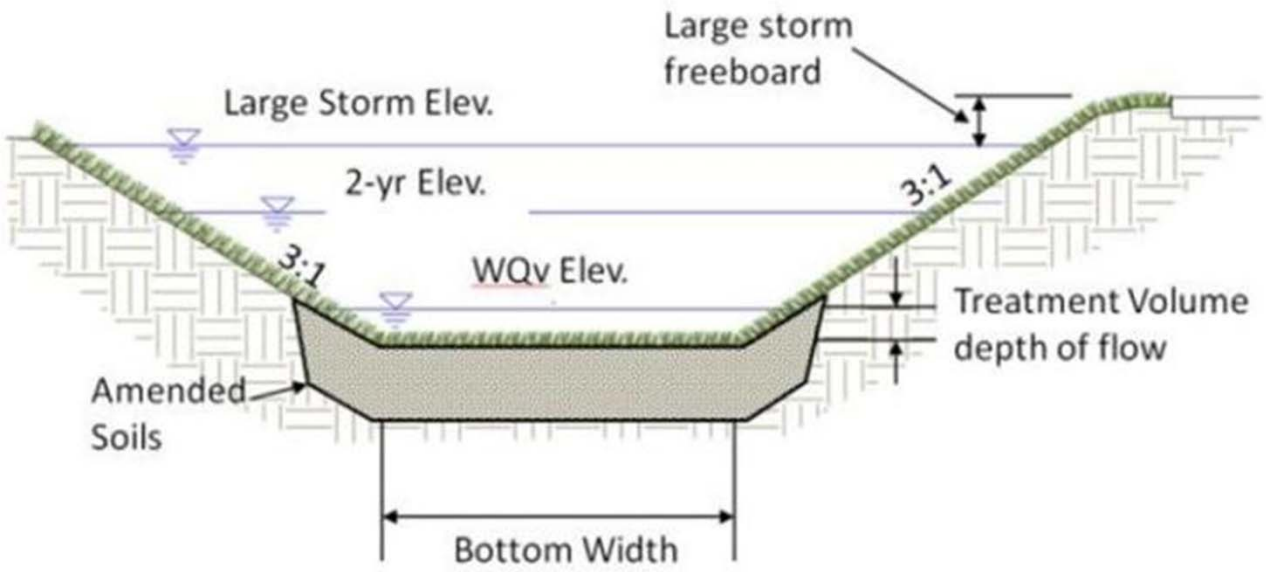
Rain Gardens Urban Planter

# Grass Channels

VIRGINIA DEQ STORMWATER DESIGN SPECIFICATION No. 3

## Key Design Consideration: Soils

- Runoff reduction (RR) capacity is greatest in HSG A soils;
- RR gradually decreases in HSG B, C and D soils;
- HSG C and D soils lining the bottom of the Grass Channel can be amended to improve RR performance

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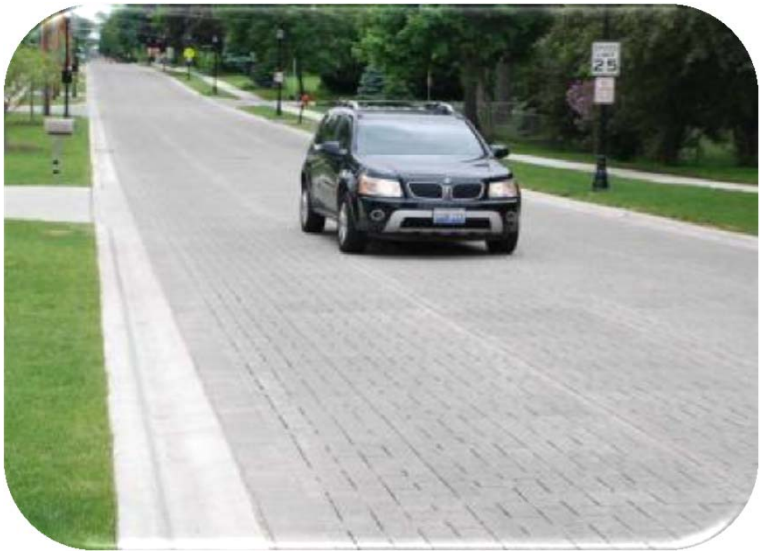
# Permeable Pavement

## VIRGINIA DEQ STORMWATER DESIGN SPECIFICATION No. 7



### Summary of Stormwater Functions [1]

| Stormwater Function | Level 1 Design | Level 2 Design |
|---|---|---|
| Annual Runoff Volume Reduction (RR) | 45% | 75% |
| Total Phosphorus (TP) EMC Reduction[1] by BMP Treatment Process | 25% | 25% |
| Total Phosphorus (TP) Mass Load Removal | 59% | 81% |
| Total Nitrogen (TN) EMC Reduction[1] | 25% | 25% |
| Total Nitrogen (TN) Mass Load Removal | 59% | 81% |
| Channel Protection | • Use VRRM Compliance spreadsheet to calculate a Curve Number (CN) adjustment[2]; ***OR***<br>• Design extra storage in the stone underdrain layer and peak rate control structure (optional, as needed) to accommodate detention of larger storm volumes. | |
| Flood Mitigation | Partial. May be able to design additional storage into the reservoir layer by adding perforated storage pipe or chambers. | |

[1] Change in event mean concentration (EMC) through the practice. Actual nutrient mass load removed is the product of the removal rate and the runoff reduction rate (see Table 1 in the *Introduction to the New Virginia Stormwater Design Specifications*).

[2] NRCS TR-55 Runoff Equations 2-1 thru 2-5 and Figure 2-1 can be used to compute a curve number adjustment for larger storm events based on the retention storage provided by the practice(s).

**Sources:** CWP and CSN (2008) and CWP (2007)

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# Bioretention

## VIRGINIA DEQ STORMWATER DESIGN SPECIFICATION No. 9

### Summary of Stormwater Functions [1]

| Stormwater Function | Level 1 Design | Level 2 Design |
|---|---|---|
| Annual Runoff Volume Reduction (RR) | 40% | 80% |
| Total Phosphorus (TP) EMC Reduction[1] by BMP Treatment Process | 25% | 50% |
| Total Phosphorus (TP) Mass Load Removal | 55% | 90% |
| Total Nitrogen (TN) EMC Reduction[1] by BMP Treatment Process | 40% | 60% |
| Total Nitrogen (TN) Mass Load Removal | 64% | 90% |
| Channel and Flood Protection | • Use the Virginia Runoff Reduction Method (VRRM) Compliance Spreadsheet to calculate the Curve Number (CN) Adjustment<br>***OR***<br>• Design extra storage (optional; as needed) on the surface, in the engineered soil matrix, and in the stone/underdrain layer to accommodate a larger storm, and use NRCS TR-55 Runoff Equations[2] to compute the CN Adjustment. | |

[1] Change in event mean concentration (EMC) through the practice. Actual nutrient mass load removed is the product of the removal rate and the runoff reduction rate(see Table 1 in the *Introduction to the New Virginia Stormwater Design Specifications*).

[2] NRCS TR-55 Runoff Equations 2-1 thru 2-5 and Figure 2-1 can be used to compute a curve number adjustment for larger storm events based on the retention storage provided by the practice(s).

Sources: CWP and CSN (2008) and CWP (2007)

Stantec

# Offsite Compliance Options
(9VAC25-870-69)

**Can be used under any of the following conditions:**

- < 5-acres land disturbed
- Post-construction P control requirement is < 10 lbs/year
- 75% required P reductions achieved onsite

SOURCE: DEQ

Stantec

# Technical Topic #2

## ENERGY BALANCE

*What Happened to the MS-19 I Used to Know and Love?*

Stantec

# MS-19 (as amended)

Meet the new boss . . .

. . . Same as the old boss?

§ 62.1-44.15:28. Development of regulations.

7. Require that VSMPs:

- **replicate**, as nearly as practicable, the existing predevelopment runoff characteristics and site hydrology, or
- **improve upon** the contributing share of the predevelopment stream channel erosion or localized flooding.

Stantec

# MS-19 (as amended)

§ 62.1-44.15:28. Development of regulations.

7. Require that VSMPs (continued):

- Except where TMDL or exceptional waters require more stringent control the following shall satisfy any regulatory requirements for natural channel capacity (**Safe Harbor Provision**):
  - (i) 48 hour ED of the WQv (0.5”);
  - (ii) 24-hour ED of the 1-yr storm runoff; and
  - (iii) proportional reduction of the 1.5, 2, and 10-yr storms peak flow rate using forested condition energy balance.

Stantec

# MS-19 (as amended)

§ 62.1-44.15:52. Virginia ESC Program.

- After July 1, 2014, the flow rate capacity requirements shall be satisfied by compliance with **SWM water quantity requirements** (§ 62.1-44.15:24 et seq.) and attendant regulations (9VAC25-870-66) unless grandfathering provisions apply.

Stantec

# MS-19 (as amended)

SWM Regulations 9VAC25-870-66.

Water quantity.

A. Channel protection and flood protection **minimum standards** are established pursuant to the requirements of **subdivision 7** of § 62.1-44.15:28 of the Code of Virginia.

Compliance with the minimum standards set out in this section **shall be deemed to satisfy** the requirements of **subdivision 19** of 9VAC25-840-40 (Minimum standards; Virginia Erosion and Sediment Control Regulations).

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# System Capacity

Concentrated stormwater flow shall be released in to a stormwater conveyance system:

- "***Manmade stormwater conveyance system***" *means a pipe, ditch, vegetated swale, or other stormwater conveyance system constructed by man except for restored stormwater conveyance systems;*

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# System Capacity

Manmade stormwater conveyance system:

- Non-erosive capacity for **2-yr peak** flow & **1% Rule** analysis; or
- Energy Balance (Natural Stormwater Conveyance)

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# System Capacity

Concentrated stormwater flow shall be released in to a stormwater conveyance system:

- "***Restored stormwater conveyance system***" *means a stormwater conveyance system that has been designed and constructed using natural channel design concepts. Restored stormwater conveyance systems include the main channel and the flood-prone area adjacent to the main channel.*

Stantec

# System Capacity

Restored stormwater conveyance system:

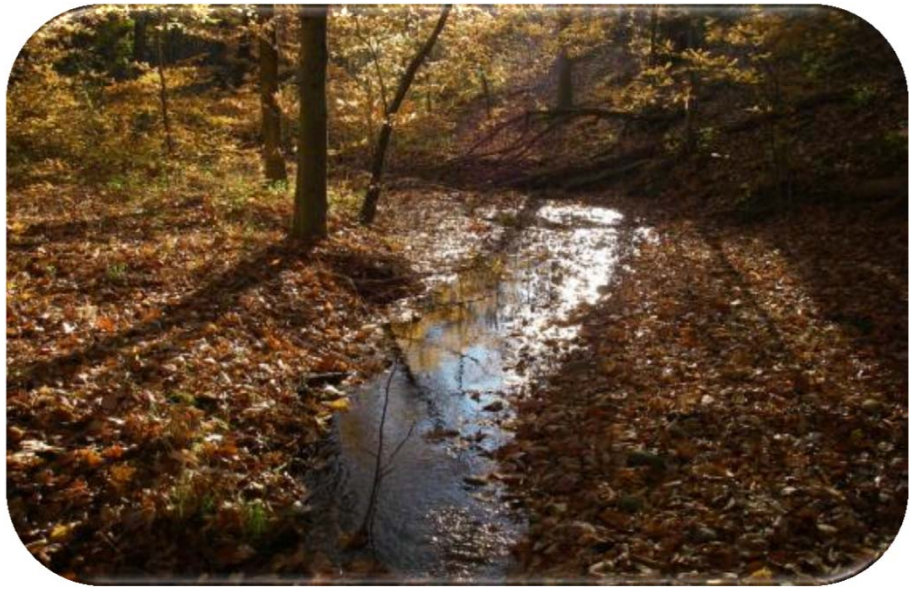
- Development (density, scale, etc.) and peak flow rate consistent with the design parameters of the restored system & **1% Rule** analysis; or
- Energy Balance (Natural Stormwater Conveyance).

Stantec

# System Capacity

Concentrated stormwater flow shall be released in to a stormwater conveyance system:

- "***Natural stormwater conveyance system***" *means the main channel of a natural stream and the flood-prone area adjacent to the main channel.*



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# Criteria for the Protection of Natural Channels

Protection of natural stream channels

- Restore them using natural channel design
- Protect them using the Energy Balance Method (1-yr event)
- Safe Harbor Provision (from SWM Law § 62.1-44.15:28.7)

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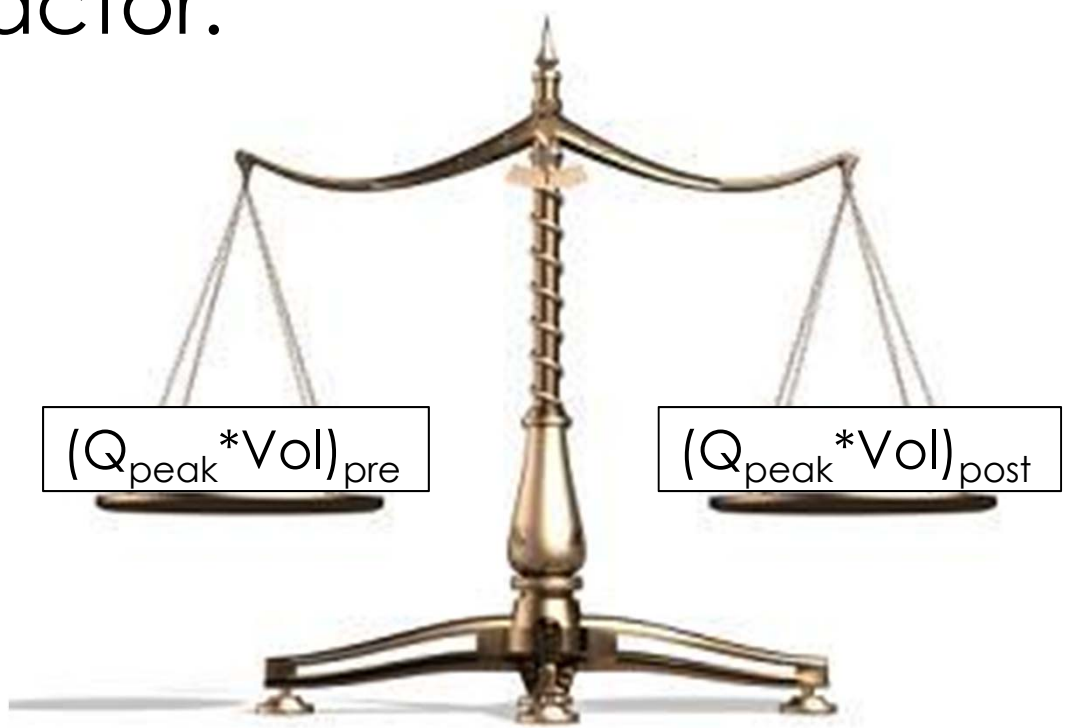
# Energy Balance

Goal is to establish a "balance" exerted by the pre- and post-developed stormwater discharge: ($Q_{peak}$*Vol) with a 10% improvement factor.

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# Stormwater Quantity
# Channel Protection

9VAC25-870-66.A

## Energy Balance

**Post** ($Vol_{1\text{-}yr}$ * Peak $Q_{1\text{-}yr}$) **≤ Pre** ($Vol_{1\text{-}yr}$ * Peak $Q_{1\text{-}yr}$)

$$Q_{1post} \leq Q_{1pre}\left(\frac{Pre\ Vol_1}{Post\ Vol_1}\right)(IF)$$

IF = Improvement Factor:
0.8 for sites > 1 acre;
0.9 for sites ≤ 1 acre

# Water Quantity Criteria
# Flood Control

9VAC25-870-66. localized flooding:

- Demonstrate: **no 10-yr flooding now**; and **no 10-yr flooding after development** and a **1% Rule** analysis; or
- If there **is local flooding**, provide on-site detention, system improvements, or a combination thereof, to eliminate flooding and a **1% Rule** analysis; or
- **Detention** of 10-year peak flow to **less than existing** and **no further** (1% rule) **analysis** is required.

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# Water Quantity Control Compliance

1% Rule Analysis:

- Downstream capacity analysis is carried to a point where:
  - The sites contributing DA is < 1% of the total watershed area; or
  - The sites 1-yr contributing peak flow rate is < 1% of that of the total watershed area (before implementation of any quantity detention).

# Sheet Flow

9VAC25-870-66. Water quantity.

D. Increased volumes of sheet flow resulting from pervious or disconnected impervious areas, or from physical spreading of concentrated flow through level spreaders, must be identified and evaluated for potential impacts on down-gradient properties or resources.

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# Technical Topic #3

## COMPLETION AND ACCEPTANCE

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# Construction Record Drawings

VSMP Regulations requires the permittee to submit **construction record drawings** to the VSMP authority (9VAC25-870-55)

- Construction record drawings certify that the stormwater management facilities have been constructed in accordance with the approved plans
- Construction record drawings must be "appropriately sealed and signed by a professional registered in the Commonwealth of Virginia"

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# Recordation of Maintenance Agreement

Maintenance Agreement needs to be recorded prior to permit termination and bond release.

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# Notice of Termination

Construction GP coverage may be terminated by the applicant after one or more of the following conditions are met (9VAC25-880-60):

- Necessary permanent control measures are in place and functioning, and final stabilization has been achieved
- Another operator has assumed control over all areas of the site that have not been finally stabilized and obtained coverage for the ongoing discharge
- Coverage under an alternative VPDES or state permit has been obtained
- For residential construction only, temporary soil stabilization has been completed and the residence has been transferred to the homeowner.

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# Notice of Termination

- DEQ provides a Notice of Termination (NOT) form for the permittee to use that includes the information required for termination, including the items in Table 10-1 on page 6 of Module 10
- NOT must be submitted within 30 days of one of the above conditions
- NOT is submitted to the VSMP authority, with final termination of coverage under the GP by the DEQ

Stantec

# Notice of Termination

NOT documentation includes, where applicable:

- List of the on-site and off-site permanent control measures
- Information related to participation in a regional stormwater management plan
- Information related to perpetual nutrient credits

Information is important for the VSMP authority, U.S. EPA, DEQ, and MS4 to document compliance with federal, state, and local programs

Stantec

# Release of Security for Performance

- VSMP authority may take action on the security if the applicant/permittee fails to perform
- VSMP authority may collect from the applicant/permittee the difference should the amount of the reasonable cost of such action exceed the amount of the security held
- The security or any unexpended portion must be refunded to the applicant or terminated within **60 days** of the completion of the requirements of the permit conditions

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# Technical Topic #4

## LONG TERM OPERATION AND MAINTENANCE

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# Inspections (9VAC25-870-114)

VSMP authority must establish a **post-construction** inspection program:

- Be approved by Board
- Ensure each facility is inspected at least once every 5 years
- Be document by records

SOURCE: DEQ

# Inspections (9VAC25-870-114)

Post-construction inspection reports

- Licensed
  - Professional engineer
  - Architect
  - Landscape architect
  - Land surveyor
- Person under the direction and oversight of those listed above
- Person with an Inspector Certificate of Competence

SOURCE: DEQ

# Reports and Record Keeping
(9VAC25-870-126)

## Fiscal year reporting

- # of permanent stormwater management facilities completed
- # of enforcement actions
- # of exceptions granted

SOURCE, DEQ

# Reports and Record Keeping

(9VAC25-870-126)

## 3 yrs

- Project records
- Registration statements

## 5 yrs

- Stormwater management facility inspection records

## Until facility is removed

- Construction record drawings

SOURCE: DEQ

# Questions?

Doug Beisch - Principal
Doug.Beisch@Stantec.com
757-810-2687

Special Thanks to **Joe Battiata** with the **Center for Watershed Protection** for helping to organize training materials for Stantec, the DEQ and Fredericksburg Area Municipalities

Stantec

## Attachment 2.A.1 - Field Work/BMP Inspection Photographs

# Field Work - BMP Facility Educational Trip and Facility Inspections
# March 13, 2014

**Participants: University of Mary Washington Geography 355 Students, Faculty, Conservation Concepts, Caroline County and Hanover/Caroline Soil and Water Conservation District Staff**

## Attachment 2.A.2 - Module Attribute Metadata

## General Information Module

| Attribute | Description | Field Type | Field Size | Comment |
|---|---|---|---|---|
| Structure ID | Unique ID for each BMP | Numeric | 25 | |
| Date | Date Record was last modified. | Date | NA | Should be an automatically generated date |
| BMP Type (General Description) | Type of structure | Text | 50 | Should probably be based on DEQ BMP Clearinghouse more detailed descriptions listed below might rely on VAST descriptions |
| Inspector | Name, title, affiliation | Text | 120 | |
| Location – Lattitude | Coordinates | Alphanumeric | 10 w/6 decimals | Example: '38.008415 |
| Location – Longitude | Coordinates | Alphanumeric | 10 w/6 decimals | Example: '-77.501951 |
| Location Description | Address, name of development or nearest address. | Text | 200 | |
| Residential | Yes/No | Checkmark | NA | Checkmark indicator |
| Commercial | Yes/No | Checkmark | NA | Checkmark indicator |
| Bonded | Yes/No | Checkmark | NA | Checkmark indicator |
| Tax Map | Location by tax map number | Alphanumeric | 50 | |
| Parcel ID | Location by parcel number on tax map | Alphanumeric | 50 | Taken from site design plans |
| Discharges To | Name of tributary | Text | 100 | |
| As-built Plans | Yes/No | Checkmark | NA | Checkmark indicator with hyperlink to pdf of SW plans |
| Maintenance Agreement | Yes/No | Checkmark | NA | Checkmark indicator with hyperlink to pdf of agreement |
| Maintenance Schedule | Frequency of maintenance | Text | 100 | As indicated in agreement |
| Acres Treated | From plan submittal | Numeric | 10 | Taken from site design plan |

## Facility Inventory Module

| Attribute | Description | Field Type | Field Size | Comment |
|---|---|---|---|---|
| Structure ID | Unique ID for each BMP | Numeric | 25 | Derived from info in general module |
| Date | Date Record was last modified. | Date | NA | Derived from info in general module |
| BMP Type (General Description) | Type of structure | Text | 50 | Derived from info in general module |
| BMP Type – Specific | Checkmark or pull down | Checkmark | Self Assigned | Need to determine what descriptions you want to track (i.e., ponds, filtration, infiltration, manufactured, LID, etc.) |

## Property Owner Module (Based on Existing BMP Spreadsheet)

| Attribute | Description | Field Type | Field Size | Comment |
|---|---|---|---|---|
| Structure ID | Unique ID for each BMP | Numeric | 25 | Derived from info in general module |
| Date | Date Record was last modified. | Date | NA | Derived from info in general module |
| BMP Type (General Description) | Type of structure | Text | 50 | Derived from info in general module |
| Project Name | | Text | 120 | Derived from Existing Caroline BMP Spreadsheet |
| BMP # | | Text | 25 | Derived from Existing Caroline BMP Spreadsheet |
| Project Address | | Text | 150 | Derived from Existing Caroline BMP Spreadsheet |
| Project City | | Text | 50 | Derived from Existing Caroline BMP Spreadsheet |
| Project Zip | | Alphanumeric | 10 | Derived from Existing Caroline BMP Spreadsheet |
| Owner Name | | Text | 75 | Derived from Existing Caroline BMP Spreadsheet |
| Owner Company | | Text | 75 | Derived from Existing Caroline BMP Spreadsheet |
| Owner Street Address | | Text | 150 | Derived from Existing Caroline BMP Spreadsheet |
| Owner PO Address | | Text | 25 | Derived from Existing Caroline BMP Spreadsheet |
| Owner City | | Text | 50 | Derived from Existing Caroline BMP Spreadsheet |
| Owner State | | Text | 25 | Derived from Existing Caroline BMP Spreadsheet |
| Owner Zip | | Alphanumeric | 10 | Derived from Existing Caroline BMP Spreadsheet |
| Status | | Text | 25 | Derived from Existing Caroline BMP Spreadsheet |
| Year | | Numeric | 4 | Derived from Existing Caroline BMP Spreadsheet |
| BMP Type | | Text | 50 | Derived from Existing Caroline BMP Spreadsheet |
| Outlet Type | | Text | 25 | Derived from Existing Caroline BMP Spreadsheet |
| Drainage Area | | Text | 100 | Derived from Existing Caroline BMP Spreadsheet |
| Outfall Into Area Near | | Text | 100 | Derived from Existing Caroline BMP Spreadsheet |
| Sheet # on Plan | | Alphanumeric | 20 | Derived from Existing Caroline BMP Spreadsheet |
| Comments/Notes | | Text | 300 | Derived from Existing Caroline BMP Spreadsheet |

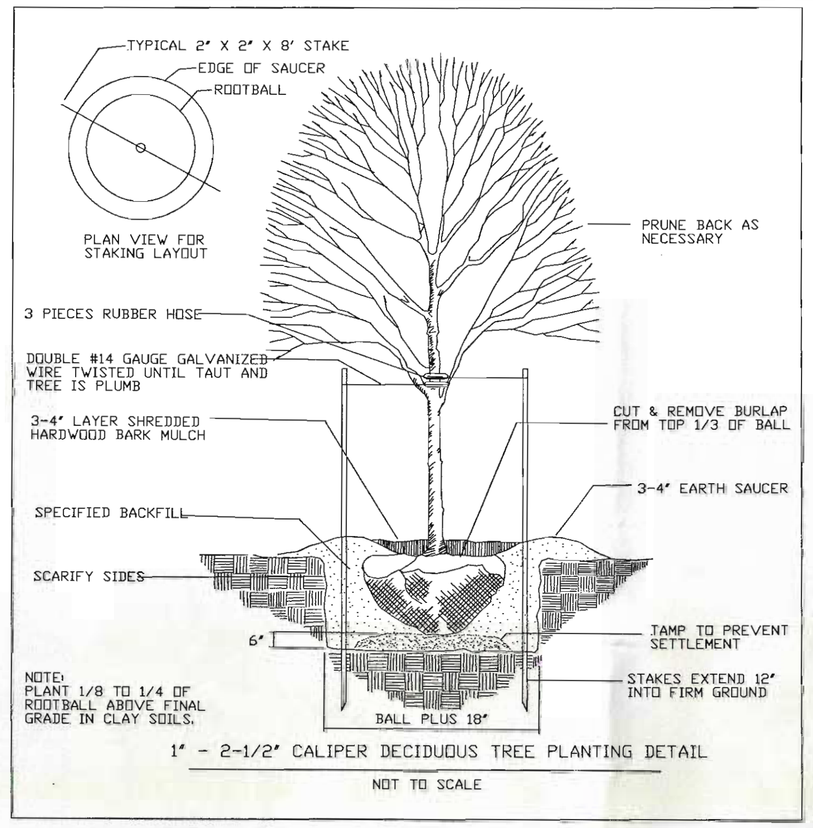
## Inspection Module

| Attribute | Description | Field Type | Field Size | Comment |
|---|---|---|---|---|
| Structure ID | Unique ID for each BMP | Numeric | 25 | Derived from info in general module |
| Date | Date Record was last modified. | Date | NA | Derived from info in general module |
| BMP Type (General Description) | Type of structure | Text | 50 | Derived from info in general module |
| Inspector | Name, title, affiliation | Text | 120 | Derived from info in general module |
| Date of Inspection | Date | Date | NA | Date of last inspection |
| Condition | Drop down menu? | Text | Self Assigned | Need to come up with general condition criteria |
| Photographs | Yes/No | Media | NA | Hyperlink to photographs of the facility, all date stamped. |
| Comments/Notes | | Text | 300 | |

## Attachment 2.B.1 (Separate File on DVD) - Microsoft Access Database of BMPs w/geo-references for GIS Usage

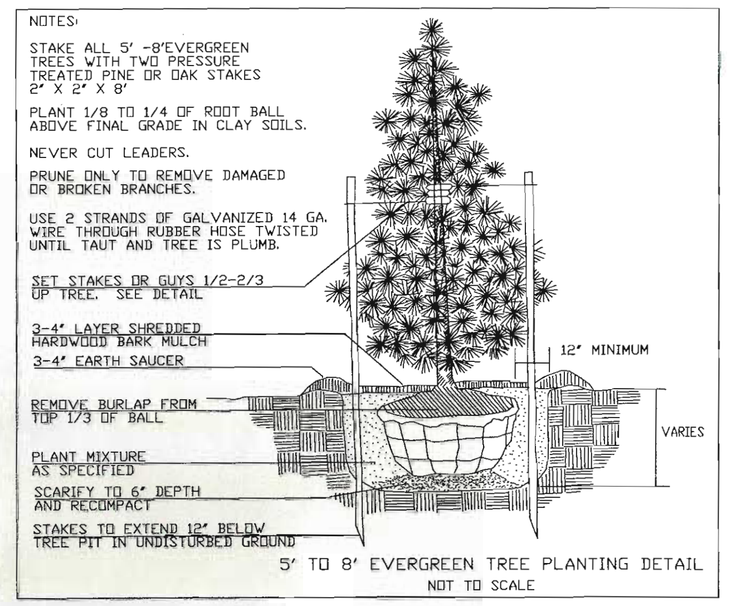
## Attachment 2.B.2 - Sample of Plans Scanned into the Caroline County GIS Database

| | LANDSCAPE PLAN TREE COUNTS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | SYMBOL | BOTANICAL NAME | COMMON NAME | TYPE | QUANTITY | SIZE | coverage/tree | TOTAL COVERAGE (SF) | REMARKS |
| | AB | | Autumn Blaze | Large Deciduous | 10 | 2.5" Caliper | 300 | 3000 | B&B |
| | PS | Pinus strobus | White Pine | Large Evergreen | 10 | 6' Height | 175 | 1750 | B&B |
| | CP | Chamaecyparis pisifera 'Plumosa' | Plume Sawara False Cypress | Medium Shrub | 22 | 5 GAL. | 50 | 1100 | Container |
| | | | | | | | | | |
| | TOTAL CANOPY PROVIDED | | | | | | | 5850 | |



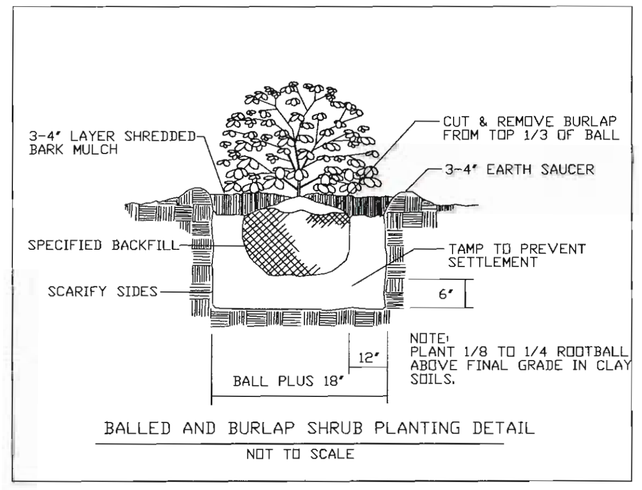

1" - 2-1/2" CALIPER DECIDUOUS TREE PLANTING DETAIL

NOT TO SCALE




5' TO 8' EVERGREEN TREE PLANTING DETAIL

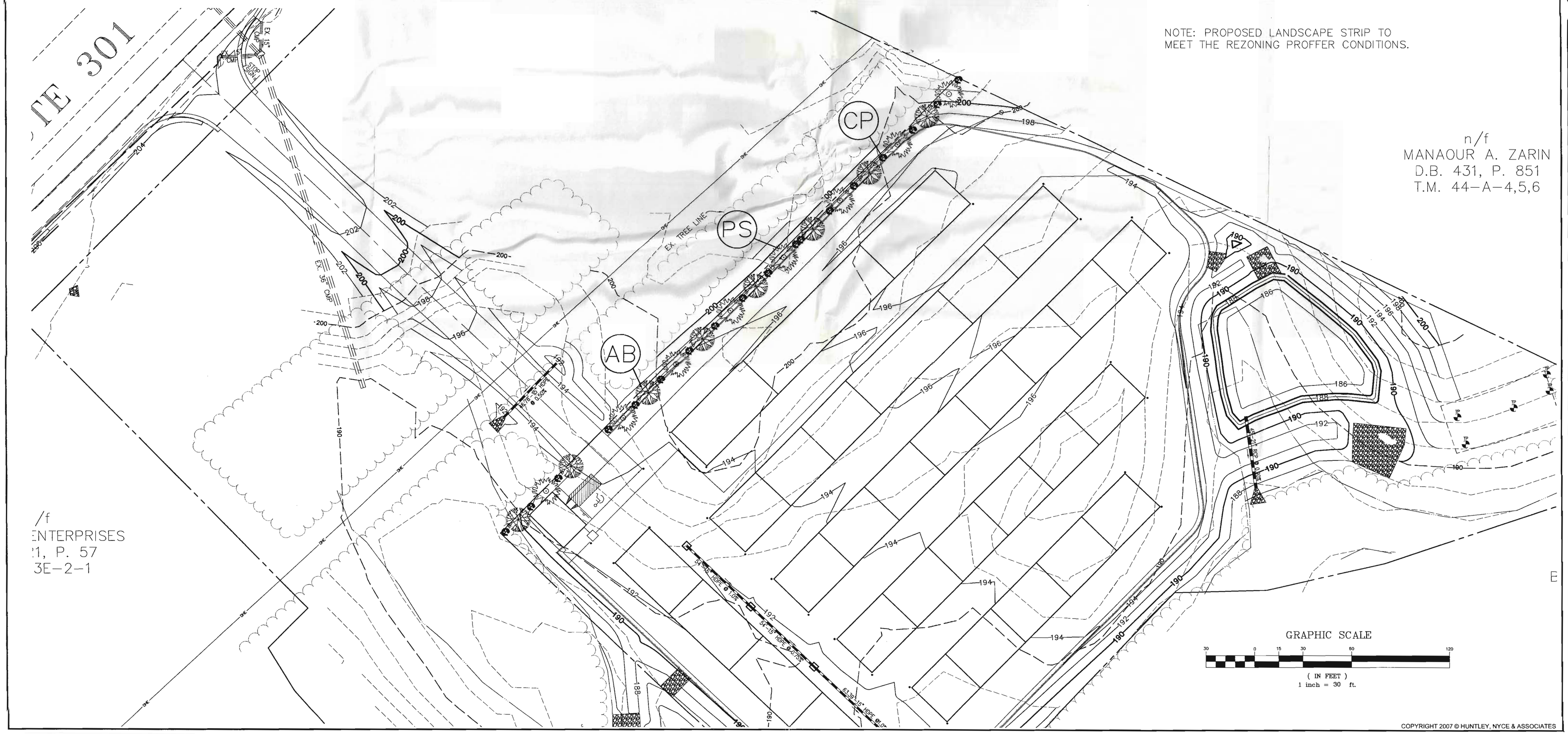
NOT TO SCALE




BALLED AND BURLAP SHRUB PLANTING DETAIL

NOT TO SCALE

NOTE: PROPOSED LANDSCAPE STRIP TO MEET THE REZONING PROFFER CONDITIONS.

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COMMONWEALTH OF VIRGINIA
MARVIN T. HINCHEY
NO. 017596
8-30-07
PROFESSIONAL ENGINEER

# VILLAGE SELF STORAGE

TOWN OF BOWLING GREEN - CAROLINE COUNTY, VA

## LANDSCAPING PLAN

SCALE: 1"=30'

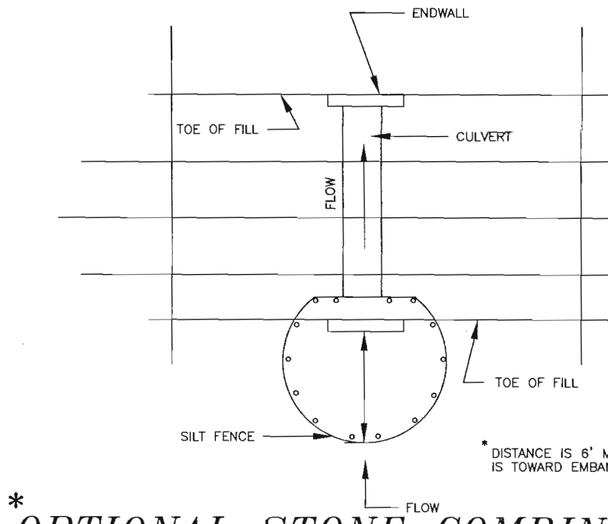
DATE: 05-18-2007

REVISIONS: 8-30-07

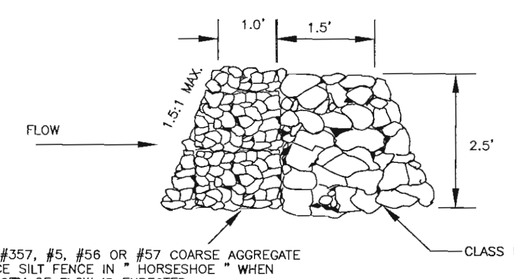
SHEET 11 OF 11

FILE NO. 7388

## SILT FENCE CULVERT INLET PROTECTION




## * OPTIONAL STONE COMBINATION

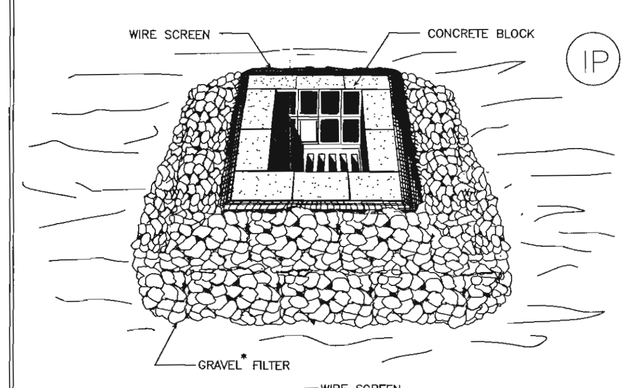


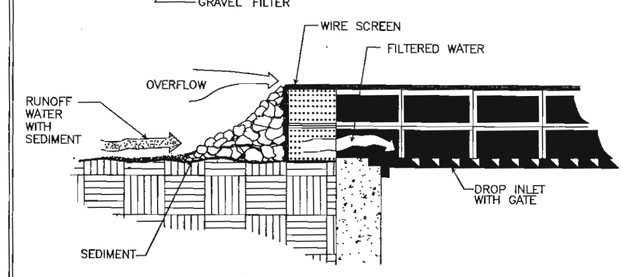

*VDOT #3, #357, #5, #56 OR #57 COARSE AGGREGATE TO REPLACE SILT FENCE IN * HORSESHOE * WHEN HIGH VELOCITY OF FLOW IS EXPECTED

SOURCE: ADAPTED from VDOT Standard Sheets and Va. DSWC

PLATE. 3.08-1

## BLOCK AND GRAVEL DROP INLET SEDIMENT FILTER




SPECIFIC APPLICATION

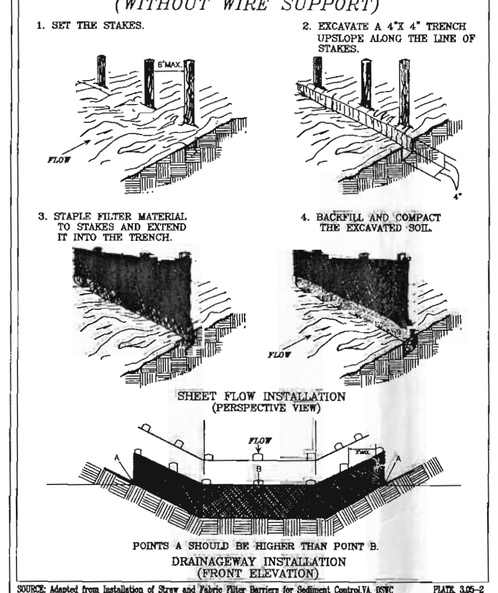
THIS METHOD OF INLET PROTECTION IS APPLICABLE WHERE HEAVY FLOWS ARE EXPECTED AND WHERE AN OVERFLOW CAPACITY IS NECESSARY TO PREVENT EXCESSIVE PONDING AROUND THE STRUCTURE.

* GRAVEL SHALL BE VDOT #3, #357 OR #5 COARSE AGGREGATE.

SOURCE: VA. DSWC

PLATE. 3.07-3

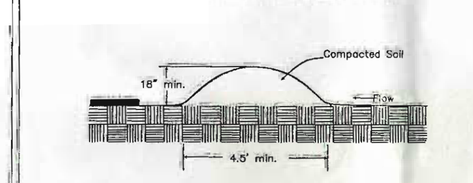
## CONSTRUCTION OF A SILT FENCE (WITHOUT WIRE SUPPORT)




SOURCE: Adapted from Installation of Straw and Fabric Filter Barriers for Sediment Control, Va. DSWC Sherwood and Byard

PLATE. 3.05-2

## TEMPORARY DIVERSION DIKE



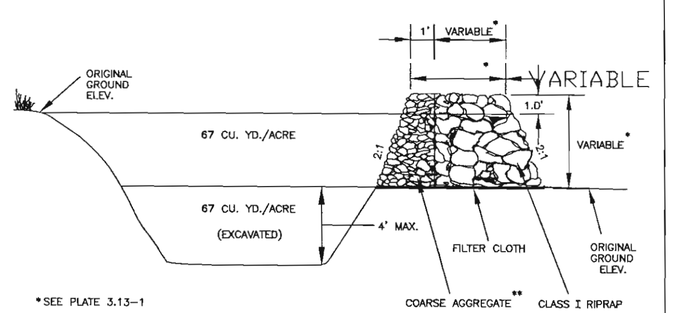

SOURCE: Va. DSWC

PLATE 3.09-1

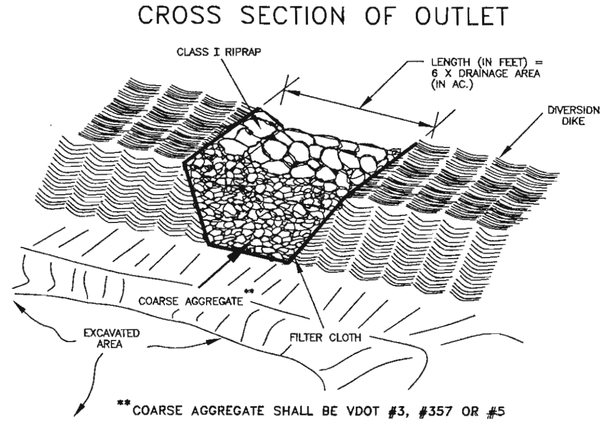
## VESCH MINIMUM STANDARDS

1. PERMANENT OR TEMPORARY SOIL STABILIZATION SHALL BE APPLIED TO DENUDED AREAS WITHIN SEVEN DAYS AFTER FINAL GRADE IS REACHED ON ANY PORTION OF THE SITE. TEMPORARAY SOIL STABILIZATION SHALL BE APPLIED WITHIN SEVEN DAYS TO DENUDED ARE AS THAT MAY NOT BE AT FINAL GRADE BUT WILL REMAIN DORMANT FOR LONGER THAN 30 DAYS. PERMANENT STABILIZATION SHALL BE APPLIED TO AREAS THAT ARE TO BE LEFT DORMANT FOR MORE THAN ONE YEAR.
2. DURING CONSTRUCTION OF THE PROJECT, SOIL STOCKPILES AND BORROW AREAS SHALL BE STABILIZED OR PROTECTED WITH SEDIMENT TRAPPING MEASURES. THE APPLICANT IS RESPONSIBLE FOR THE TEMPORARY PROTECTION AND PERMANENT STABILIZATION OF ALL SOIL STOCKPILES ON SITE AS WELL AS BORROW AREAS AND SOIL INTENTIONALLY TRANSPORTED FROM THE PROJECT SITE.
3. A PERMANENT VEGETATIVE COVER SHALL BE ESTABLISHED ON DENUDED AREAS NOT OTHERWISE PERMANENTLY STABILIZED. PERMANENT VEGETATION SHALL NOT BE CONSIDERED ESTABLISHED UNTIL A GROUND COVER IS ACHIEVED THAT, IS UNIFORM, MATURE ENOUGH TO SURVIVE AND WILL INHIBIT EROSION.
4. SEDIMENT BASINS AND TRAPS, PERIMETER DIKES, SEDIMENT BARRIERS AND OTHER MEASURES INTENDED TO TRAP SEDIMENT SHALL BE CONSTRUCTED AS A FIRST STEP IN ANY LAND – DISTURBING ACTIVITY AND SHALL BE MADE FUNCTIONAL BEFORE UPSLOPE LAND DISTURBANCE TAKES PLACE.
5. STABILIZATION MEASURES SHALL BE APPLIED TO EARTHEN STRUCTURES SUCH AS DAMS, DIKES, AND DIVERSIONS IMMEDIATELY AFTER INSTALLATION.
6. SEDIMENT TRAPS AND SEDIMENT BASINS SHALL BE DESIGNED AND CONSTRUCTED BASED UPON THE TOTAL DRAINAGE AREA TO BE SERVED BY THE TRAP OR BASIN.
   a. The minimum storage capacity of a sediment trap shall be 134 cy per acre of drainage area and the trap shall only control drainage areas less than three acres.
   b. Surface runoff from disturbed areas that is comprised of flow from drainage areas greater than or equal to three acres shall be controlled by a sediment basin. The minimum storage capacity of a sediment basin shall be 134 cy per acre of drainage area. The outfall system shall, at a minimum, maintain the structural integrity of the basin during a twenty five year storm of 24 hour duration.
7. CUT AND FILL SLOPES SHALL BE DESIGNED AND CONSTRUCTED IN A MANNER THAT WILL MINIMIZE EROSION. SLOPES THAT ARE FOUND TO BE ERODING EXCESSIVELY WITHIN ONE YEAR OF PERMANENT STABILIZATION SHALL BE PROVIDED WITH ADDITIONAL SLOPE STABILIZING MEASURES UNTIL THE PROBLEM IS CORRECTED.
8. CONCENTRATED RUNOFF SHALL NOT FLOW DOWN CUT OR FILL SLOPES UNLESS CONTAINED WITHIN AN ADEQUATE TEMPORARY OR PERMANENT CHANNEL, FLUME OR SLOPE DRAIN STRUCTURE.
9. WHENEVER WATER SEEPS FROM A SLOPE FACE, ADEQUATE DRAINAGE OR OTHER PROTECTION SHALL BE PROVIDED.
10. ALL STORM SEWER INLETS THAT ARE MADE OPERABLE DURING CONSTRUCTION SHALL BE PROTECTED SO THAT SEDIMENT-LADEN WATER CANNOT ENTER THE CONVEYANCE SYSTEM WITHOUT FRIST BEING FILTERED OR OTHERWISE TREATED TO REMOVE SEDIMENT.
11. BEFORE NEWLY CONSTRUCTED STORMWATER CONVEYANCE CHANNELS OR PIPES ARE MADE OPERATIONAL, ADEQUATE OUTLET PROTECTION AND ANY REQUIRED TEMPORARY OR PERMANENT CHANNEL LINING SHALL BE INSTALLED IN BOTH THE CONVEYANCE CHANNEL AND RECEIVING CHANNEL.
12. WHEN SORK IN A LIVE WATERCOURSE IS PERFORMED, PRECAUTIONS SHALL BE TAKEN TO MINIMIZE ENCROACHMENT, CONTROL SEDIMENT TRANSPORT AND STABILIZE THE WORK AREA TO THE GREATEST EXTENT POSSIBLE DURING CONSTRUCTION. NONERODIBLE MATERIAL SHALL BE USED FOR THE CONSTRUCTION OF CAUSEWAYS AND COFFERDAMS. EARTHEN FILL MAY BE USED FOR THESE STRUCTURES IF ARMORED BY NONERODIBLE COVER MATERIALS.
13. WHEN A LIVE WATERCOURSE MUST BE CROSSED BY CONSTRUCTION VEHICLES MORE THAN TWICE IN ANY SIX YEAR PERIOD, A TEMPORARY VEHICULAR STREAM CROSSING CONSTRUCTED OF NON ERODIBLE MATERIAL SHALL BE PROVIDED.
14. ALL APPLICABLE FEDERAL, STATE AND LOCAL REGULATIONS PERTAINING TO WORKING IN OR CROSSING LIVE WATERCOURSES SHALL BE MET.
15. THE BED AND BANKS OF A WATERCOURSE SHALL BE STABILIZED IMMEDIATELY AFTER WORK IN THE WATERCOURSE IS COMPLETED.
16. UNDERGROUND UTILITY LINES SHALL BE INSTALLED IN ACCORDANCE WITH THE STANDARDS SET FORTH IN THE VESCH, CHAPTER 8, PG.22.
17. WHERE CONSTRUCTION VEHICLE ACCESS ROUTES INTERSECT PAVED OR PUBLIC ROADS, PROVISIONS SHALL BE MADE TO MINIMIZE THE TRANSPORT OF SEDIMENT BY VEHICULAR TRACKING ONTO THE PAVED SURFACE. WHERE SEDIMENT IS TRANSPORTED ONTO A PAVED OR PUBLIC ROAD SURFACE, THE ROAD SURFACE SHALL BE CLEANED THOROUGHLY AT THE END OF EACH DAY. SEDIMENT SHALL BE REMOVED FROM THE ROADS BY SHOVELING OR SWEEPING AND TRANSPORTED TO A SEDIMENT CONTROL DISPOSAL AREA.
18. ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES SHALL BE REMOVED WITHIN 30 DAYS AFTER FINAL SITE STABILIZATION OR AFTER THE TEMPORARY MEASURES ARE NO LONGER NEEDED, UNLESS OTHERWISE AUTHORIZED BY THE LOCAL PROGRAM AUTHORITY. TRAPPED SEDIMENT AND THE DISTRUBED SOIL AREAS RESULTING FROM THE DISPOSITION OF TEMPORARY MESURES SHALL BE PERMANENTLY STABILIZED TO PREVENT FURTHER EROSION AND SEDIMENTATION.
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 STANDARDS SET FORTH IN THE VESCH, CHAPTER 8 (MINIMUM STANDARDS) PG. 23.

## TEMPORARY SEDIMENT TRAP




CROSS SECTION OF OUTLET



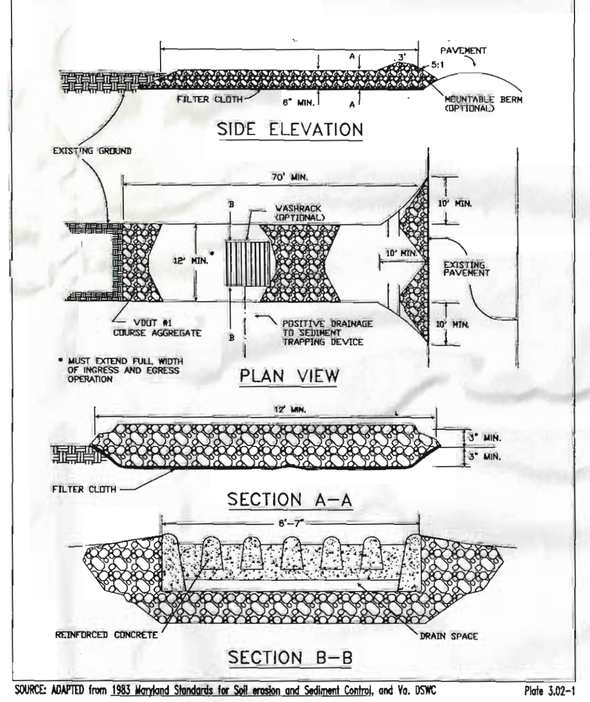

**COARSE AGGREGATE SHALL BE VDOT #3, #357 OR #5

OUTLET (PERSPECTIVE VIEW)

SOURCE: VA. DSWC

PLATE. 3.13-2

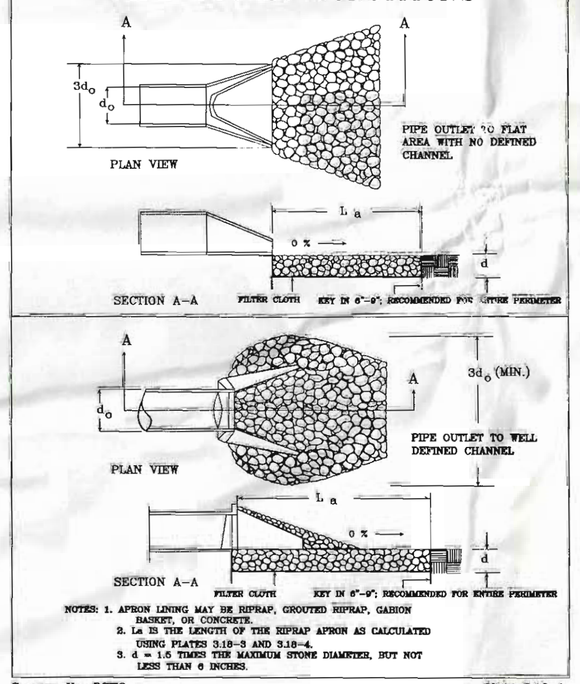
## STONE CONSTRUCTION ENTRANCE




SOURCE: ADAPTED from 1983 Maryland Standards for Soil erosion and Sediment Control, and Va. DSWC

Plate 3.02-1

## PIPE OUTLET CONDITIONS



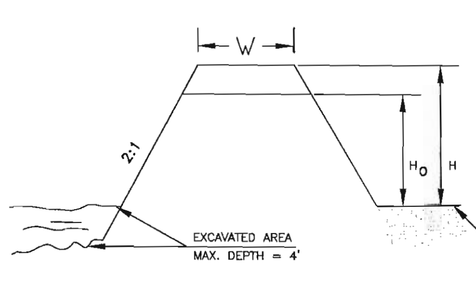

Source: Va. DSWC

Plate 3.18-1

## SILT LEGEND

| NO. | TITLE | KEY | SYMBOL |
|---|---|---|---|
| 3.02 | TEMPORARY STONE CONSTRUCTION ENTRANCE | CE | |
| 3.05 | SILT FENCE | SF | |
| 3.07 | STORM DRAIN INLET PROTECTION | IP | |
| 3.09 | TEMPORARY DIVERSION DIKE | DD | DD |
| 3.11 | TEMPORARY RIGHT-OF-WAY DIVERSION | RWD | RWD |
| 3.13 | TEMPORARY SEDIMENT TRAP | ST | |
| 3.18 | OUTLET PROTECTION | OP | |
| 3.19 | RIPRAP | RR | |
| 3.31 | TEMPORARY SEEDING | TS | TS |
| 3.32 | PERMANENT SEEDING | PS | PS |
| 3.38 | TREE PRESERVATION AND PROTECTION | TP | TP |

## MINIMUM TOP WIDTH (W) REQUIRED FOR SEDIMENT TRAP EMBANKMENTS ACCORDING TO HEIGHT OF EMBANKMENT (FEET)

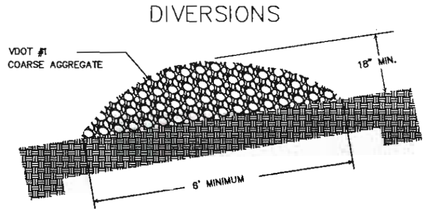



| H | HO | W |
|---|---|---|
| 1.5 | 0.5 | 2.0 |
| 2.0 | 1.0 | 2.0 |
| 2.5 | 1.5 | 2.5 |
| 3.0 | 2.0 | 2.5 |
| 3.5 | 2.5 | 3.0 |
| 4.0 | 3.0 | 3.0 |
| 4.5 | 3.5 | 4.0 |
| 5.0 | 4.0 | 4.5 |

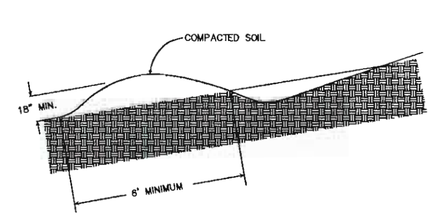
SOURCE: VA. DSWC

PLATE. 3.13-1

## TEMPORARY RIGHT-OF-WAY DIVERSIONS




TYPICAL GRAVEL STRUCTURE




TYPICAL EARTHEN STRUCTURE

Source: Va. SWCC

Plate 3.11-1

## EROSION & SEDIMENT CONTROL NARRATIVE

THE VILLAGE SELF STORAGE PROJECT CONSISTS OF 6 STEEL FRAME SELF STORAGE BUILDINGS TOTALLING 44,639 SF. THE SITE AREA IS 3.82 ACRES AND IS LOCATED APROXIMATELY 350 FEET BACK FROM A.P. HILL BLVD (ROUTE 301) APROXIMATELY 1500 FEET SOUTH OF THE INTERSECTION OF A.P. HILL BLVD AND LAKEWOOD ROAD (RTE 608). THE HYDROLOGIC UNIT CODE (HUC) FOR THIS PROJECT IS 02080105.

EXISTING SITE CONDITIONS: THE SITE IS PREDOMINANTLY WOODED. DRAINAGE ON THE PROPERTY IS DIVIDED ALONG A LINE RUNNING ROUGHLY NORTHWEST TO SOUTHEAST ACROSS THE APROXIMATE CENTER OF THE SITE. WETLANDS HAVE BEEN LOCATED ON THE SOUTHWESTERN EDGE OF THE SITE AND CROSSING THE PROPERTY NEAR THE NORTHEASTERN TIP. THE SITE IS BOUNDED ON THE SOUTHEAST SIDE BY LARGE ACREAGE UNDEVELOPED PROPERTY. THE SITE IS MOSTLY WOODED. SLOPES ARE SLIGHT TO MODERATE.

ADJACENT PROPERTY: THE SITE IS BOUNDED BY ROUTE 301 ON THE NORTHWEST, ON THE SOUTHEAST, NORTHEAST, AND SOUTHWEST SIDES BY AGRICULTURAL USES AND ZONING.

CRITICAL EROSION AREAS: CRITICAL EROSION AREAS ON THIS SITE CONSIST OF THE AREAS IMMEDIATELY ABOVE THE WETLANDS AREAS.

EROSION AND SEDIMENT CONTROL MEASURES: SUITABLE EROSION CONTROL MEASURES WILL BE EXERCISED DURING THE COURSE OF CONSTRUCTION AS SPECIFIED HEREON. SOIL STOCKPILES ESTABLISHED IN THE FIELD DURING CONSTRUCTION SHALL BE STABILIZED AND PROTECTED BY SILT FENCE. NO OFFSITE DISTURBANCE AREAS ARE NECESSARY FOR THIS PROJECT.

TEMPORARY AND PERMANENT SOIL STABILIZATION: ALL EARTHEN STRUCTURES SUCH AS DAMS, DIKES AND DIVERSIONS ARE TO BE STABILIZED IMMEDIATELY UPON INSTALLATION IN ACCORDANCE WITH MINIMUM STANDARD NO. 5. STABILIZATION IN THE PROPOSED PAVED AREA SHALL CONSIST OF APPLYING THE BASE STONE AND THE AREAS NOT TO BE PAVED SHALL RECEIVE PERMANENT SEEDING AND MULCHING IN ACCORDANCE WITH SPEC 3.32. DISTURBED AREAS THAT WILL NOT BE BROUGHT TO FINAL GRADE FOR A PERIOD OF MORE THAN 30 DAYS SHALL RECEIVE TEMPORARY SEEDING AND MULCHING IN ACCORDANCE WITH SPEC 3.31. SEE SEEDING REQUIREMENTS, THIS SHEET.

### PHASING OF LAND DISTURBING ACTIVITIES:

1. INSTALL CONSTRUCTION ENTRANCES.

2. THE PERIMETER DIVERSION DIKES, SILT FENCES, AND SEDIMENT TRAPS SHALL BE INSTALLED PRIOR TO BEGINNING EARTHMOVING ACTIVITIES.

3. STRIP TOPSOIL AND ROUGH GRADE SITE.

4. ANY SOIL STOCKPILES THAT ARE ESTABLISHED SHALL HAVE SILT FENCES INSTALLED AS A PERIMETER MEASURE AND BE MULCHED AND SEEDED IN ACCORDANCE WITH SPEC. 3.31.

5. INSTALL STORM SEWERS, CULVERTS, AND INLET/OUTLET PROTECTION.

6. APPLY PERMANENT SEEDING AND MULCH TO ALL DENUDED AREAS THAT ARE NOT TO BE PAVED.

7. BEGIN PAVING AND BUILDING CONSTRUCTION.

ALL CONTROLS SHALL REMAIN IN PLACE UNTIL ALL DISTURBED AREAS ARE STABILIZED. UPON COMPLETION OF ALL GRADING ACTIVITIES, THE ESTABLISHMENT OF VEGETATION, AND WITH THE APPROVAL OF THE LOCAL APPROVING AUTHORITY THE EROSION AND SEDIMENT CONTROL MEASURES SHALL BE REMOVED.

MAINTENANCE PROGRAM: ALL MEASURES ARE TO BE INSPECTED DAILY BY THE SITE SUPERINTENDENT. ANY DAMAGED STRUCTURAL MEASURE SHALL BE REPAIRED BY THE CLOSE OF DAY. THE DIVERSION DIKES SHALL BE CHECKED FOR EROSION AND THE MODIFIED INLET PROTECTIONS CLEANED OUT WHENEVER SEDIMENT DEPTH REACHES 8 INCHES. THE SEEDED AREAS SHALL BE CHECKED REGULARLY TO ENSURE THAT A GOOD STAND IS MAINTAINED. AREAS SHALL BE SEEDED AND REFERTILIZED AS NEEDED.

### TEMPORARY SEEDING REQUIREMENTS

50/50 MIX OF ANNUAL RYEGRASS AND CEREAL (WINTER) RYE
@ 50–100 LBS/ACRE (SEPT. 1 – FEB. 15)
OR
ANNUAL RYEGRASS
@ 60–100 LBS/ACRE ( FEB. 15 – APR. 30)
OR
GERMAN MILLET
@ 50 LBS/ACRE (MAY 1 – AUG. 31)
FERTILIZER: 10/20/10 MIX @ 600 LBS/ACRE
LIME: AGRICULTURAL LIMESTONE @ 2 TONS/ACRE
STRAW MULCH: APPLIED @ 1.5–2.0 TONS/ACRE

### PERMANENT SEEDING REQUIREMENTS

COMMERCIAL/RESIDENTIAL MIXTURE @ 175–200 LBS/ACRE
KENTUCKY 31 OR TURF TYPE TALL FESCUE (95–100%)
IMPROVED PERENNIAL RYEGRASS (0–5%)
KENTUCKY BLUEGRASS (0–5%)
FERTILIZER: 10/20/10 MIX @ 600 LBS/ACRE
LIME: AGRICULTURAL LIMESTONE @ 2 TONS/ACRE
STRAW MULCH: APPLIED @ 1.5–2.0 TONS/ACRE

### EROSION & SEDIMENT CONTROL NOTE

1. ALL APPROPRIATE EROSION AND SEDIMENT CONTROLS ARE TO BE PLACED PRIOR TO OR AS THE FIRST STEP IN CLEARING AND GRADING.
2. SEDIMENT BASINS AND TRAPS, DIVERSION DIKES, SEDIMENT BARRIERS AND OTHER MEASURES INTENDED TO TRAP SEDIMENT SHALL BE CONSTRUCTED AS A FIRST STEP IN ANY LAND DISTURBING ACTIVITY AND SHALL BE MADE FUNCTIONAL BEFORE ANY UPSLOPE LAND DISTURBANCE TAKES PLACE.
3. ALL TEMPORARY EARTH BERMS, DAMS, DIVERSIONS AND SEDIMENT CONTROLS ARE TO BE MULCHED AND SEEDED IMMEDIATELY AFTER GRADING. HAY, STRAW OR COMPARABLE MULCH IS REQUIRED.
4. ALL LAND, ON OR OFF SITE, WHICH IS DISTURBED BY CONSTRUCTION AND WHICH IS NOT BUILT UPON OR SURFACED SHALL BE ADEQUATELY STABILIZED TO CONTROL EROSION AND SEDIMENTATION.
5. ALL EROSION AND SEDIMENT CONTROL, INCLUDING SEEDING AND MULCHING, SHALL BE IN ACCORDANCE WITH THE STANDARDS AND SPECIFICATIONS CONTAINED IN THE TOWN OF BOWLING GREEN EROSION AND SEDIMENT CONTROL ORDINANCE AND THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK (VESCH), THIRD EDITION 1992, AS AMENDED.
6. ADDITIONAL EROSION AND SEDIMENT CONTROLS SHALL BE INSTALLED IF ON SITE INSPECTIONS REVEAL PROBLEMS.
7. STOCKPILED TOPSOIL WILL BE SURROUNDED BY APPROVED EROSION AND SEDIMENT CONTROLS.
8. ALL MEASURES ARE TO BE INSPECTED DAILY BY THE SITE SUPERINTENDENT. ANY DAMAGED STRUCTURAL MEASURES SHALL BE REPAIRED BY THE CLOSE OF THE FOLLOWING DAY. EROSION AND SEDIMENT CONTROLS SHALL BE REMOVED AFTER AREAS HAVE BEEN STABILIZED, BUT NOT BEFORE APPROVAL BY A CAROLINE COUNTY INSPECTOR.
9. THE AREAS USED FOR BURNING DEBRIS SHALL BE SEEDED USING APPROPRIATE SEEDING MIXTURE RECOMMENDED IN PLAN AFTER DEBRIS REMOVAL IS COMPLETED.
10. PERMANENT OR TEMPORARY SEEDING SHALL BE APPLIED TO DENUDED AREAS WITHIN 7 DAYS AFTER FINAL GRADE IS REACHED ON ANY PORTION OF THIS SITE. TEMPORARY SEEDING SHALL BE APPLIED WITHIN 7 DAYS TO DENUDED AREAS THAT MAY NOT BE AT FINAL GRADE BUT WILL REMAIN DORMANT (UNDISTURBED) FOR LONGER THAN 30 DAYS. PERMANENT SEEDING SHALL BE APPLIED TO AREAS THAT ARE TO BE LEFT DORMANT FOR MORE THAN ONE YEAR.
11. BEFORE NEWLY CONSTRUCTED STORMWATER CONVEYANCE CHANNELS ARE MADE OPERATIONS, ADEQUATE OUTLET PROTECTION AND ANY TEMPORARY OR PERMANENT CHANNEL LINING SHALL BE INSTALLED IN BOTH THE CONVEYANCE CHANNEL AND THE RECEIVING CHANNEL.
12. ALL DRAINAGE CALCULATIONS ARE BASED ON THE METHODS SET FORTH IN THE VIRGINIA DEPARTMENT OF HIGHWAYS (V.D.O.T.) DRAINAGE MANUAL AND VESCH 1992, AS AMENDED. ALL DRAINAGE CULVERTS AND OUTLET DITCHED SHALL BE DESIGNED FOR A 10 YEAR FREQUENCY STORM AND DONE IN ACCORDANCE WITH MS-19.
13. THESE EROSION AND SEDIMENT CONTROL NOTES APPLY TO ALL LAND DISTURBING ACTIVITY ASSOCIATED WITH THIS PROJECT, INCLUDING ROAD, SEWER LINE AND WATER LINE CONSTRUCTION.

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540-825-6055

COMMONWEALTH OF VIRGINIA
MARVIN T. HINCHEY
NO. 017596
8-30-07
PROFESSIONAL ENGINEER

# VILLAGE SELF STORAGE

TOWN OF BOWLING GREEN - CAROLINE COUNTY, VA

EROSION AND SEDIMENT NOTES AND DETAILS

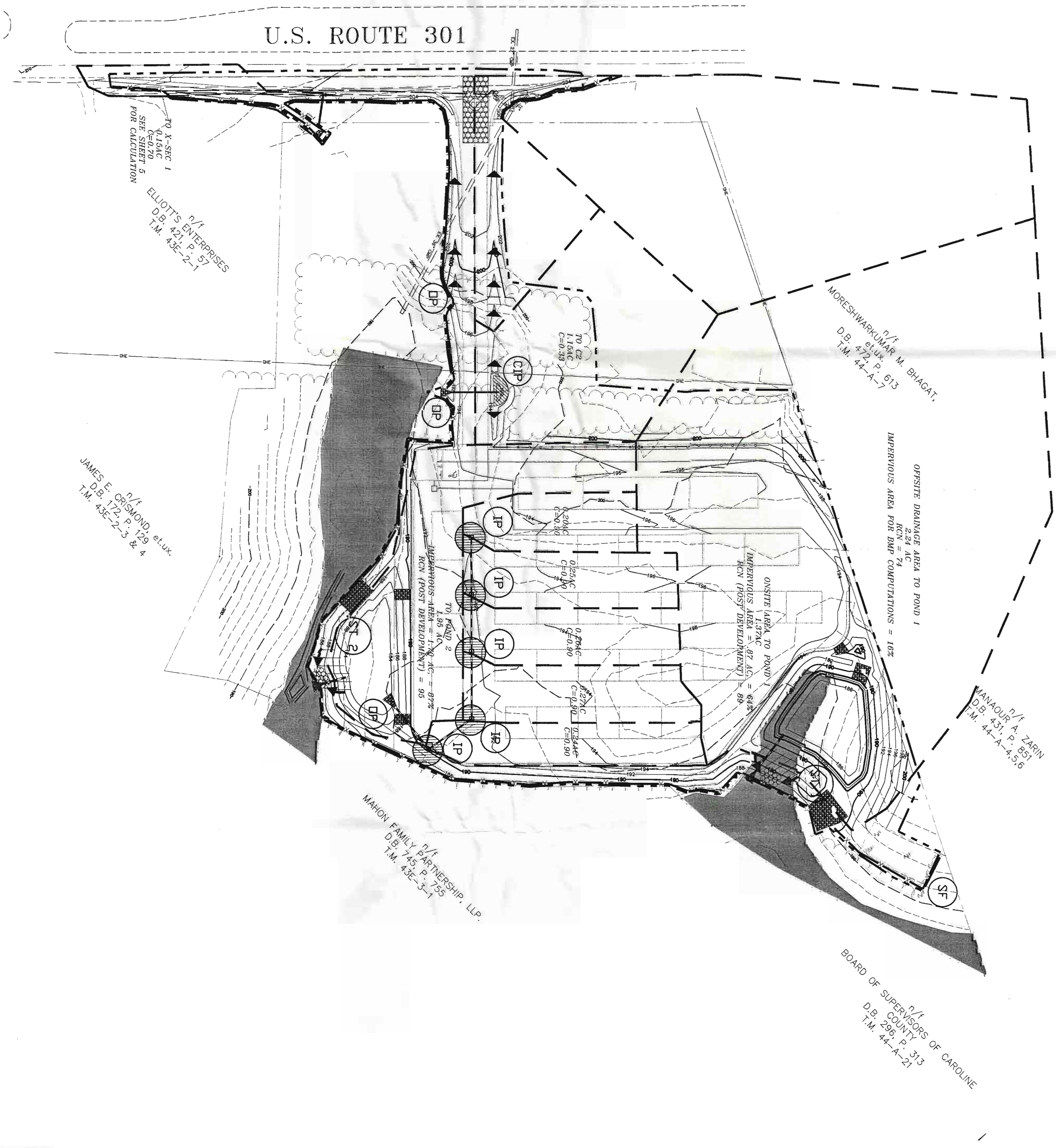
SCALE: N/A

DATE: 05-18-2007

REVISIONS: 8-30-07

SHEET 10 OF 11

FILE NO. 7388

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SHEET 9 OF 11
FILE NO. 7388

SCALE: 1"=50'
DATE: 05-18-2007
REVISIONS: 8-23-07

# VILLAGE SELF STORAGE

TOWN OF BOWLING GREEN – CAROLINE COUNTY, VA

EROSION AND SEDIMENT CONTROL PLAN – PHASE II

COMMONWEALTH OF VIRGINIA
MARVIN T. HINCHEY
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COMMONWEALTH OF VIRGINIA
MARVIN T. HINCHEY
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8-23-07
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# VILLAGE SELF STORAGE

TOWN OF BOWLING GREEN - CAROLINE COUNTY, VA

EROSION AND SEDIMENT CONTROL PLAN - PHASE I

SCALE: 1'=50'

DATE: 05-18-2007

REVISIONS:
8-23-07

SHEET 8 OF 11

FILE NO. 7388

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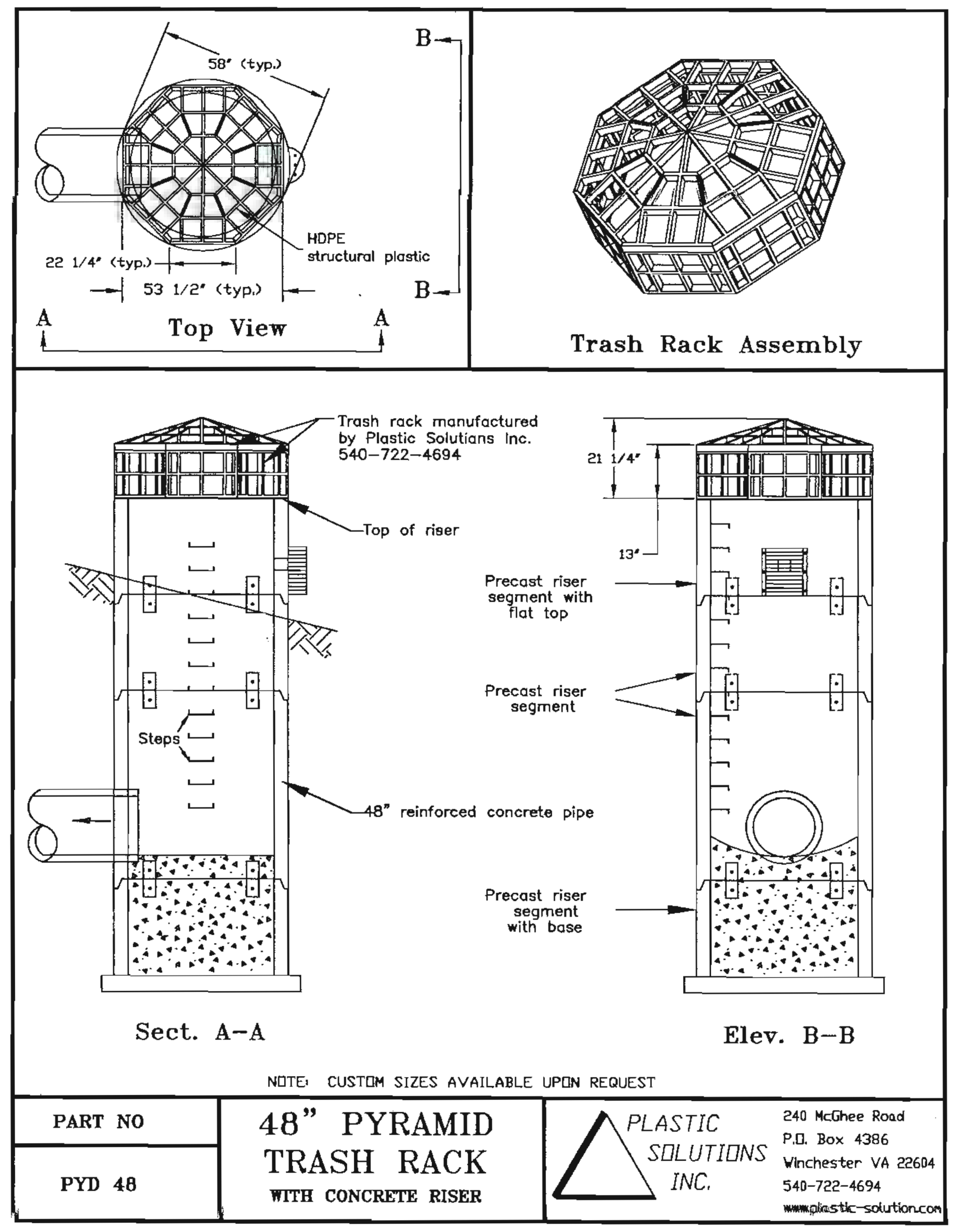
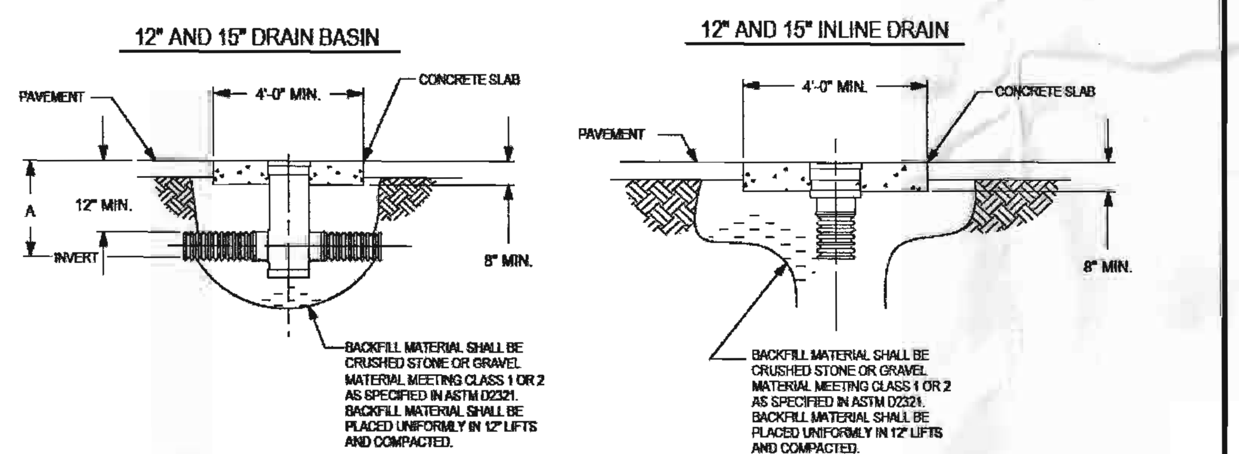
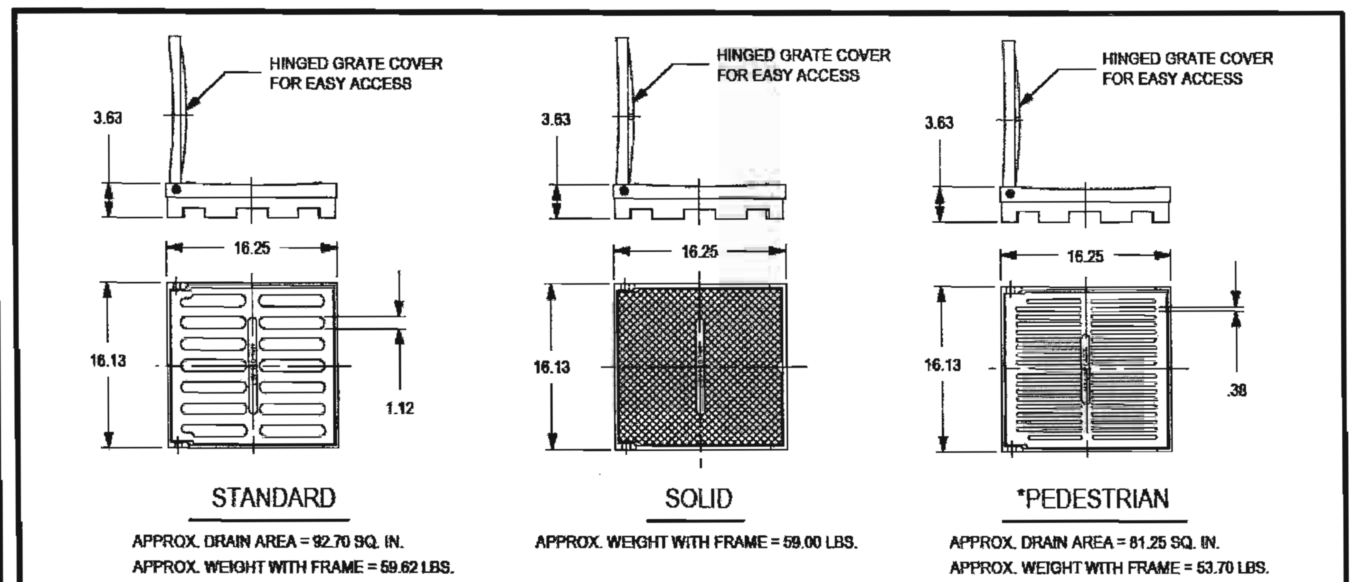



| PIPE SIZE | A (ADS N-12 PIPE) |
|---|---|
| 4" | 17.00" |
| 6" | 19.00" |
| 8" | 21.00" |
| 10" | 24.00" |
| 12" | 26.00" |
| 15" | 29.00" |

Nyloplast — 12" & 15" H-25 (HEAVY TRAFFIC) INSTALLATION




APPROX. DRAIN AREA = 92.70 SQ. IN.
APPROX. WEIGHT WITH FRAME = 59.62 LBS.

APPROX. WEIGHT WITH FRAME = 59.00 LBS.

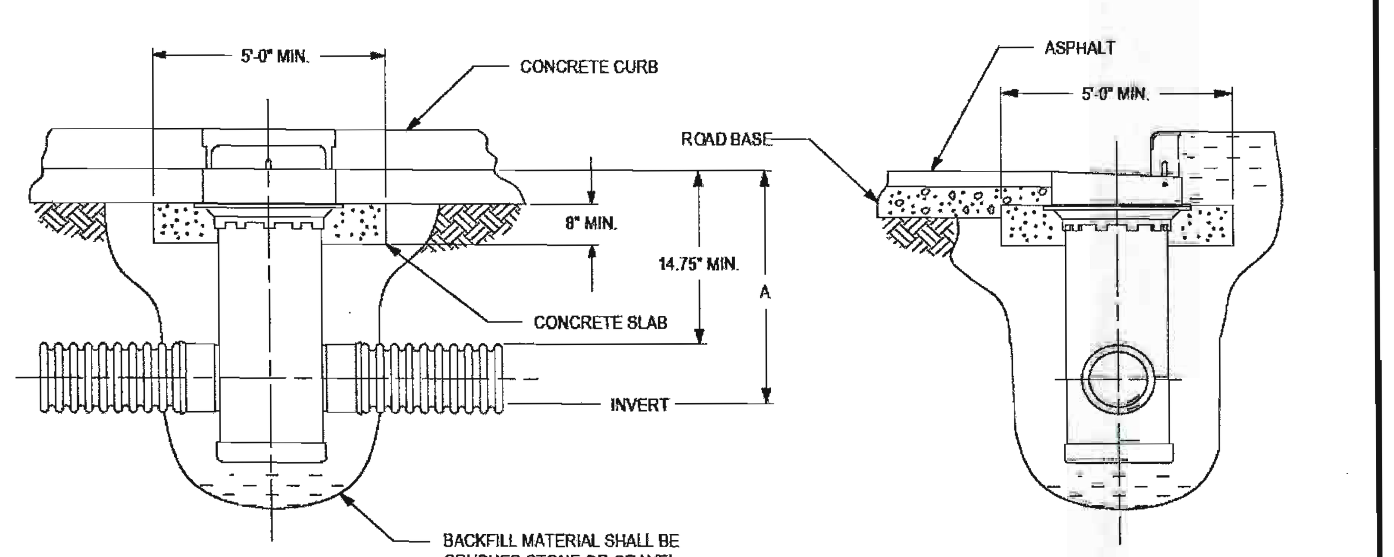
APPROX. DRAIN AREA = 81.25 SQ. IN.
APPROX. WEIGHT WITH FRAME = 53.70 LBS.

**NYLOPLAST 15" GRATES/COVERS**

STANDARD GRATE HAS H-25 HEAVY DUTY RATING
SOLID COVER HAS H-25 HEAVY DUTY RATING
PEDESTRIAN GRATE HAS H-10 MEDIUM DUTY RATING
QUALITY: MATERIALS SHALL CONFORM TO ASTM A536 GRADE 70-50-05 & A48-CLASS 30B
MATERIAL: DUCTILE IRON GRATE W/CAST IRON FRAME
PAINT: CASTINGS ARE FURNISHED WITH A BLACK PAINT
LOCKING DEVICE AVAILABLE UPON REQUEST
PRICE INCLUDES FRAME & GRATE/COVER

* SIZE OF OPENING MEETS REQUIREMENTS OF AMERICAN DISABILITY ACT AS STATED IN FEDERAL REGISTER PART III, DEPARTMENT OF JUSTICE, 28 CFR PART 36. NONDISCRIMINATION ON THE BASIS OF DISABILITY BY PUBLIC ACCOMMODATIONS AND IN COMMERCIAL FACILITIES; FINAL RULE.

Nyloplast — 15" STANDARD, SOLID & PEDESTRIAN




BACKFILL MATERIAL SHALL BE CRUSHED STONE OR GRAVEL MATERIAL MEETING CLASS 1 OR 2 AS SPECIFIED IN ASTM D2321. BACKFILL MATERIAL SHALL BE PLACED UNIFORMLY IN 12" LIFTS AND COMPACTED

| PIPE SIZE | A (ADS N-12 PIPE) |
|---|---|
| 4" | 20.00" |
| 6" | 22.00" |
| 8" | 24.00" |
| 10" | 26.00" |
| 12" | 29.00" |
| 15" | 32.00" |
| 18" | 35.00" |
| 24" | 42.00" |

Nyloplast — 2'X2' INSTALLATION

## STORMWATER MANAGEMENT FACILITY MAINTENANCE PLAN

1. GENERAL DESCRIPTION. ONE DRY DETENTION FACILITY WILL PROVIDE STORMWATER MANAGEMENT FOR THIS SITE. STORMWATER RUNOFF GENERATED BY THE ASSOCIATED DRAINAGE AREA INCLUDING PORTIONS OF THE SITE, WILL BE STORED IN THE FACILITY AND RELEASED AT A RATE EQUAL TO OR LESS THAN THE PRE-DEVELOPMENT RATE AT THAT PARTICULAR OUTFALL LOCATION.

2. DESIGN. THE POND IS DESIGNED TO PROVIDE STORMWATER VOLUME, PEAK RATE AND QUALITY CONTROL VIA GRADED STORAGE AND A CONCRETE RISER/OUTFALL STRUCTURE. THE RISER/OUTFALL STRUCTURE CONSISTS OF A SQUARE (4'x4'x5') RISER AND 30" CONCRETE OUTLET BARREL. DEWATERING IS ACCOMPLISHED VIA A 3" ORIFICE, 4, 30"X4" ORIFICES (2 YEAR STORM), A 4' LONG RECTANGULAR WEIR (10 YEAR STORM), AND A 50' LONG RIP-RAP EMERGENCY SPILLWAY (100 YEAR STORM).

3. MOWING. ALL GRASSES SHALL BE MOWED AT LEAST TWICE EACH YEAR. COOL SEASON GRASSES SUCH AS TALL FESCUE SHOULD BE MOWED IN EARLY SUMMER AFTER EMERGENCE OF THE HEADS AND AGAIN IN EARLY FALL TO PREVENT SEEDS OF ANNUAL WEEDS FROM MATURING. LEGUMES SUCH AS SERICEA LESPEDEZA AND CROWN VETCH CAN BE MOWED LESS FREQUENTLY. TREES AND SHRUBS SHOULD NOT BE PERMITTED TO GROW ON THE DAM.

4. LIMING AND FERTILIZING. THE SOIL SHOULD BE SAMPLED ACCORDING TO RECOMMENDED PROCEDURES AT LEAST ONCE EVERY 4 YEARS. TESTING OF THE SAMPLE SHOULD BE PERFORMED BY A QUALIFIED SOIL TESTING LABORATORY (SUCH AS VPI&SU). LIME AND FERTILIZER SHOULD BE APPLIED IN ACCORDANCE WITH RECOMMENDATIONS BASED ON THESE TESTS.

5. REPLANTING AND OVERSEEDING. IF VEGETATION COVERS LESS THAN 40% OF THE SOIL SURFACE, THE APPLICATION OF LIME, FERTILIZER, AND SEED SHALL BE IN ACCORDANCE WITH CURRENT RECOMMENDATIONS FOR NEW SEEDINGS. IF VEGETATION COVERS MORE THAN 40% BUT LESS THAN 70% OF THE SOIL SURFACE, THE APPLICATION OF LIME, FERTILIZER AND SEEDING SHALL BE IN ACCORDANCE WITH CURRENT OVERSEEDING RECOMMENDATIONS.

6. REMOVING TRASH AND DEBRIS. TRASH, LITTER AND VEGETATION WILL BE REMOVED AS NEEDED TO PREVENT OBSTRUCTION TO THE FLOW OF WATER AND MOVEMENT OF TRASH AND LITTER TO DOWNSTREAM PROPERTIES; TO MAINTAIN THE INTEGRITY OF THE STRUCTURE; TO PROVIDE AN ATTRAVTIVE APPEARANCE; AND TO MINIMIZE WATER POLLUTION.

7. REMOVING SEDIMENT. SOIL MATERIALS (INCLUDING CLAY, SILT, SAND, AND GRAVEL) WILL BE REMOVED AND DESIGN CAPACITY OF THE POND SHALL BE RESTORED WHEN THE DETENTION POOL OR THE BMP POOL STORAGE CAPACITY HAS BEEN REDUCED BY 10%.

8. SEDIMENT DISPOSAL. SEDIMENT DISPOSAL SHOULD BE IN ACCORDANCE WITH CURRENT PROCEDURES FOR DISPOSAL OF SEDIMENT. WHERE DEEMED NECESSARY OR DESIRABLE, SEDIMENT WILL BE TESTED FOR APPROPRIATE POLLUTANTS PRIOR TO ITS DISPOSAL.

9. REPAIRS. REPAIR SLIDES, SLUMPS, AND ERODED AREAS PROMPTLY AND IN A WORKMAN-LIKE MANNER. TRASH RACKS, PIPES, HEADWALLS, ETC. WILL BE MAINTAINED, REPAIRED, AND/OR REPLACED AS NEEDED TO MAINTAIN THE INTERGRITY OF THE STRUCTURE.EXPOSED METAL SURFACES WILL BE PAINTED TO MINIMIZE DAMAGE DUE TO RUST.

10. MAINTENANCE INSPECTIONS. THE OWNER OR OWNER'S RESPRESENTATIVE SHALL INSPECT THE STORMWATER MANAGEMENT POND AND OUTFALL STRUCTURE WITHIN 24 HOURS AFTER EACH RAINFALL EVENT OF ONE INCH OR MORE. ADDITIONALLY, THE OWNER OR THE OWNER'S RESPRESENTATIVE AND A TOWN OR COUNTY REPRESENTATIVE SHALL JOINTLY INSPECT THE STRUCTURE ONCE EACH YEAR. APPROPRIATE ACTION SHALL BE TAKEN TO ENSURE NECESSARY REPAIRS ARE PERFORMED IN A TIMELY MANNER. MAINTENANCE COSTS SHALL BE BORNE SOLELY BY THE OWNER(S). KEYS FOR LOCKED ACCESS POINTS SHALL BE AVAILABLE TO TOWN OR COUNTY PERSONNEL UPON REQUEST.

11. MAINTENANCE RECORDS. THE OWNER OR OWNER'S DESIGNEE SHALL KEEP WRITTEN RECORDS OF ALL INSPECTIONS. COPIES OF WRITTEN RECORDS SHALL BE PROVIDED TO THE TOWN OR THE COUNTY UPON REQUEST.

12. MODIFICATIONS. THE DETENTION POND SHALL NOT BE MODIFIED WITHOUT PRIOR APPROVAL BY THE TOWN AND THE COUNTY.

## STORMWATER MANAGEMENT NARRATIVE

PROJECT DESCRIPTION. THE VILLAGE SELF STORAGE PROJECT CONSISTS OF 6 STEEL FRAME SELF STORAGE BUILDINGS TOTALLING 44,639 SF. THE SITE AREA IS 3.82 ACRES AND IS LOCATED APROXIMATELY 350 FEET BACK FROM A.P. HILL BLVD (ROUTE 301) APROXIMATELY 1500 FEET SOUTH OF THE INTERSECTION OF A.P. HILL BLVD AND LAKEWOOD ROAD (RTE 608). THE SITE IS PREDOMINANTLY WOODED. DRAINAGE ON THE PROPERTY IS DIVIDED ALONG A LINE RUNNING ROUGHLY NORTHWEST TO SOUTHEAST ACROSS THE APROXIMATE CENTER OF THE SITE. WETLANDS HAVE BEEN LOCATED ON THE SOUTHWESTERN EDGE OF THE SITE AND CROSSING THE PROPERTY NEAR THE NORTHEASTERN TIP. THE SITE IS BOUNDED ON THE SOUTHEAST SIDE BY LARGE ACREAGE UNDEVELOPED PROPERTY.

HYDROLOGIC ANALYSIS. HYDROLOGIC ANALYIS FOR THIS PROJECT HAVE BEEN PREPARED USING THE SCS METHOD. 2 DRAINAGE AREAS WERE ANALYSED FOR THE 2, 10, AND 100 YEAR STORM EVENTS.

AREA 1 INCLUDES A SIGNIFICANT AREA OF OFFSITE DRAINAGE TO THE NORTHEAST THROUGH NORTHWEST OF THE SITE AND CURRENTLY FLOWS INTO THE WETLANDS AREA TO THE NORTHEAST OF THE SITE. THE AREA IS 3.61 ACRES IN TOTAL WITH A PRE-DEVELOPMENT RCN OF 74 AND A TIME OF CONCENTRATION OF 10 MINUTES PREDEVELOPMENT.

AREA 2 CONSISTS EXCLUSIVELY OF ONSITE DRAINAGE, AND DISCHARGES EITHER INTO THE WETLANDS TO THE SOUTHWEST OF THE SITE OR BY OVERLAND SHEET FLOW TO SOUTHEAST. THE AREA IS 1.95 ACRES IN TOTAL WITH A PRE-DEVELOPMENT RCN OF 74 AND A TIME OF CONCENTRATION OF 7 MINUTES PREDEVELOPMENT.

THE INTENSITIES USED FOR THIS ANALYSIS PER THE SCS 24 HOUR RAINFALL EVENT CHARTS FOR CAROLINE COUNTY VA TAKEN FROM VDOT HYDRAULIC DESIGN ADVISORY 05-04 DATED AUGUST 24, 2005.

TIME OF CONCENTRATION. PRE-DEVELOPMENT TIME OF CONCENTRATION WAS CALCULATED USING TR-55 METHODOLOGIES ALONG THE LONGEST FLOW PATH AND THEN CONSERVATIVELY ROUNDED DOWN TO 10 MINUTES AND 7 MINUTES RESPECTIVELY. POST DEVELOPMENT TIMES OF CONCENTRATION WERE CALCULATED AT 5 MINUTES.

HYDRAULIC ANALYSIS. A COMPARISON OF THE PRE- AND POST-DEVELOPMENT RUNOFF VOLUMES AND PEAK RATES WAS MADE USING HYDROFLOW 2004. CALCULATIONS GENERATED BY HYDROFLOW 2004 HAVE BEEN PROVIDED HEREON. THE STORMWATER MANAGEMENT STSTEMS WERE DESIGNED TO DETAIN THE INCREASED VOLUME OF RUNOFF AND TREAT THE WATER FOR WATER QUALITY. THE RISER/OUTFALL STRUCTURES WERE DESIGNED TO RELEASE THE EXCESS RUNOFF AT A RATE EQUAL TO OR LESS THAN PRE-DEVELOPMENT RATES FOR THE 2 AND 10 YEAR DESIGN STORM, AND TO SAFELY PASS THE 100 YEAR STORM.

THE PROPOSED WET POND AND EXTENDED DETENTION POND PROPOSED HEREON PROVIDE ADEQUATE STORAGE AND WATER QUALITY TREATMENT FOR SITE RUNOFF.

FOR POND 1 A VOLUME OF 5,390 CF OF STORAGE WAS REQUIRED FOR THE 2-YEAR STORM. A VOLUME OF 8,189 CF WAS REQUIRED FOR THE 10-YEAR STORM. VOLUMES USED HERE ARE EXCLUSIVE OF THE 4X WATER QUALITY VOLUME WET STORAGE.

A COMBINATION OF A 4' RECTANGULAR WIER (ELEV 188.10, FOR THE 2 YEAR STORM), AND THE CREST OF THE 3' DIAMETER RISER (ELEV 188.80, FOR THE 10 YEAR STORM) (SEE DETAIL FOR STRUCTURE #11) WAS UTILIZED TO CONTROL PEAK RATE. A PEAK RATE OF 6.15 CFS (MAX REQUIREMENT 6.31 CFS) WAS PROVIDED FOR THE 2 YEAR STORM. A PEAK RATE OF 13.60 CFS (MAX REQUIREMENT 13.69 CFS) WAS PROVIDED FOR THE 10 YEAR STORM. (SEE HYDROGRAPH #3).

A TOTAL USABLE VOLUME OF 35,599 CF WAS PROVIDED

FOR POND 2 A VOLUME OF 9,124 CF OF STORAGE WAS REQUIRED FOR THE 2-YEAR STORM. A VOLUME OF 12,534 CF WAS REQUIRED FOR THE 10-YEAR STORM.

A COMBINATION OF A 3" ORIFICE (ELEV 184.00, FOR THE BMP STORM), 2, 4"X20.25" RECTANGULAR ORIFICES (ELEV 185.40, FOR THE 2 YEAR STORM), 2, 4"X24" RECTANGULAR ORIFICES (ELEV 186.00, FOR THE 10 YEAR STORM) (SEE DETAIL FOR STRUCTURE #21) WAS UTILIZED TO CONTROL PEAK RATE. A PEAK RATE OF 3.56 CFS (MAX REQUIREMENT 3.58 CFS) WAS PROVIDED FOR THE 2 YEAR STORM. A PEAK RATE OF 7.70 CFS (MAX REQUIREMENT 7.72 CFS) WAS PROVIDED FOR THE 10 YEAR STORM. (SEE HYDROGRAPH #7).

A TOTAL USABLE VOLUME OF 22,969 CF WAS PROVIDED

WATER QUALITY ANALYSIS. WATER QUALITY TREATMENT IS BEING PERFORMED UTILIZING 1 4X WATER QUALITY VOLUME WET POND W/ AQUATIC BENCH, 1 EXTENDED DETENTION BASIN, AND 5 "STORMPURE" INLET FILTERS.

THE WET POND IS AN IMPOUNDMENT AREA WHEREIN 4X THE WATER QUALITY VOLUME IS ALLOWED TO POND REMAIN INDEFINITELY, THERE IS AN AQUATIC BENCH NEAR THE WATER SURFACE ELEVATION TO PROMOTE THE GROWTH OF AQUATIC PLANT SPECIES THAT ARE BENEFICIAL IN REMOVING POLUTANTS AND NUTRIENTS FRROM THE WATER, THE PRIMARY METHOD OF POLLUTANT REMOVAL IN THESE STRUCTURES IS HOWEVER SETTLEMENT. THE WET POND IS EQUIPPED WITH A SEDIMENT FOREBAY DUE TO THE LARGE AREA OF PERVIOUS SURFACE THAT COMES TO THIS POND AND THE RELATIVELY HIGH SEDIMENT LOADING LIKELY. 4X WATER QUALITY VOLUME WET PONDS W/ AQUATIC BENCH HAVE A GENERALLY ACCEPTED PHOSPHOROUS REMOVAL RATE OF 65%

THE EXTENDED DETENTION BASIN IS AN IMPOUNDMENT AREA WHEREIN 2X THE WATER QUALITY VOLUME IS DETAINED AND RELEASED OVER APROXIMATELY 30 HOURS, THE PRIMARY METHOD OF POLLUTANT REMOVAL IN THESE STRUCTURES IS SETTLEMENT AND FILTRATION THROUGH THE VEGETATION ON THE BOTTOM OF THE POND. EXTENDED DETENTION BASINS HAVE A GENERALLY ACCEPTED PHOSPHOROUS REMOVAL RATE OF 35%

THE STORMPURE INLET FILTERS ARE A SYSTEM WHERE WATER THAT ENTERS A STORM SEWER INLET IS FILTERS THROUGH AN ENGINEERED FILTER MEDIA BEFORE BEING PERMITTED TO ENTER THE STORM SEWER SYSTEM. STORMPURE FILTERS HAVE A MANUFACTURERS ESTIMATED POLLUTANT REMOVAL RATE OF GREATER THAT 90%, HOWEVER, ONLY 65% REMOVAL WAS CREDITED HERE. DETAILS ARE PROVIDED ON THIS SHEET.

FOR FURTHER DETAIL OF THE WATER QUALITY CALCULATIONS, SEE SHEET 6.

ADEQUATE OUTFALL ANALYSIS. POST-DEVELOPMENT RELEASE RATES FROM THE STORMWATER MANAGEMENT FACILITY ARE LESS THAN PRE-DEVELOPMENT RATES.

## DAM CONSTRUCTION NOTES

1. STAKE OUT THE ENTIRE AREA TO BE COVERED BY THE DAM AND RELATED STRUCTURES.

2. REMOVE ALL TOPSOIL, ORGANIC MATERIAL AND STONES FROM THE AREA. INSTALL A COFFER DAM OR SOME OTHER APPROPRIATE STRUCTURE TO FACILITATE PUMPING OF WATER DURING CONSTRUCTION, IF NEEDED.

3. EXCAVATE THE CORE TRENCH UNDER THE ENTIRE LENGTH OF THE DAM. MINIMUM DEPTH SHALL BE 5 FEET WITH A BOTTOM WIDTH OF 4 FEET. ACTUAL DEPTH SHALL BE DETERMINED BY A QUALIFIED SOILS SPECIALIST DURING EXCAVATION.

4. THE CORE TRENCH SHALL BE FILLED WITH MATERIAL OF VERY LOW PERMEABILITY. THE FILL MATERIAL FOR THE CORE TRENCH AND THE REMAINDER OF THE DAM SHALL CONSIST OF SOILS MEETING THE UNIFIED SOIL CLASSIFICATION CRITERIA FOR SC AND CL SOILS. THIS DAM IS DESIGNED WITH HOMOGENEOUS SECTION AND IT IS EXPECTED THAT THE SC AND CL SOILS WILL BE AVAILABLE FROM THE POND EXCAVATION. FILL SHALL BE PLACED IN HORIZONTAL LIFTS OF NO MORE THAT 8 INCHES. THE FILL WILL BE FREE OF TOPSOIL, ORGANIC MATERIAL, AND STONES LARGER THAN 6 INCHES. MINIMUM COMPACTION OF FILL UNDER PIPE AND RELATED STRUCTURES SHALL BE 95%. COMPACTION OF FILL NOT UNDER THESE STRUCTURES MAY BE 90%, HOWEVER, ADDITIONAL SETTLING ALLOWANCE IS REQUIRED.

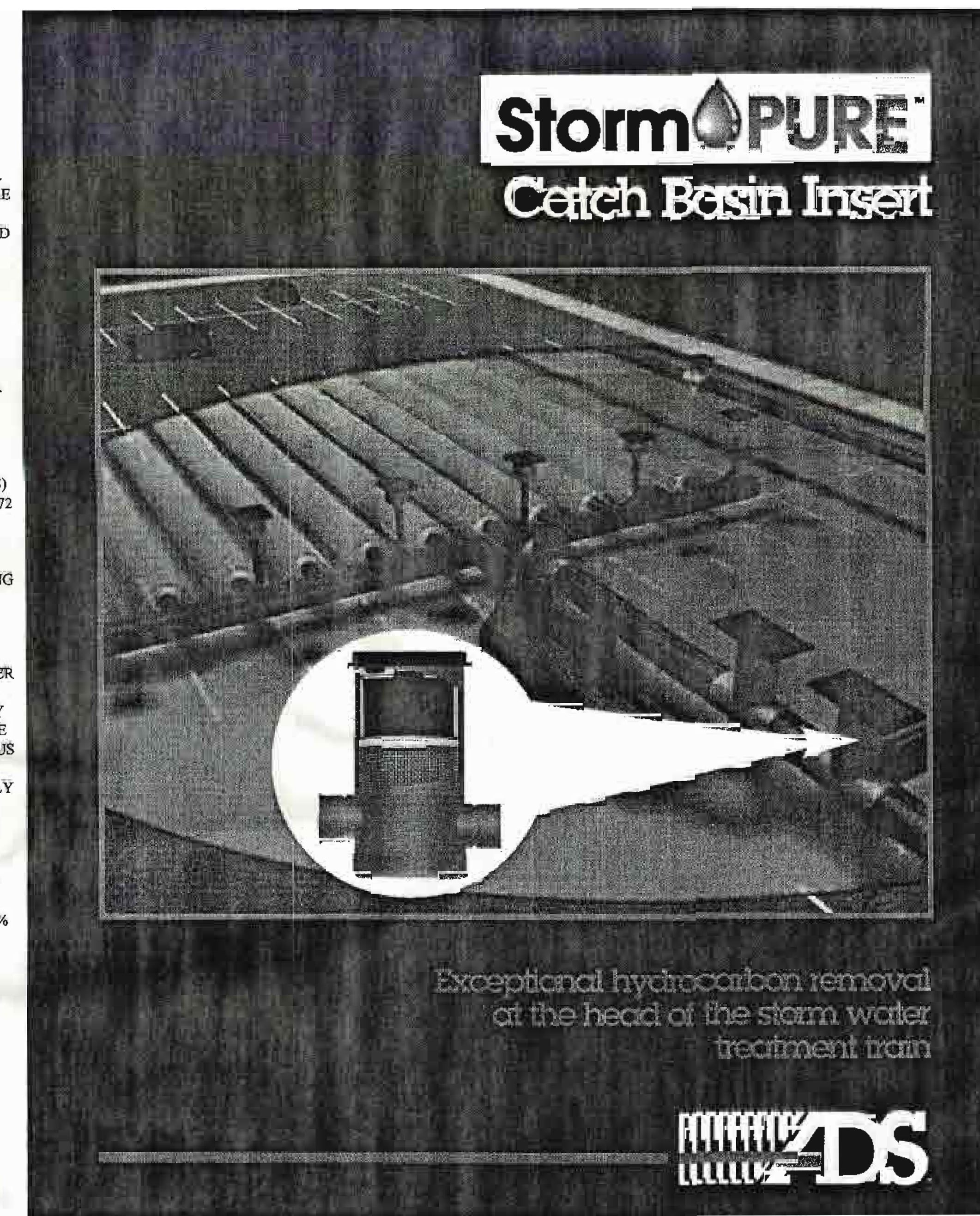
5. INSTALL THE PIPE BARREL AND ANTI-SEEP COLLAR, IF REQUIRED. THE BARREL SHALL BE REINFORCED CONCRETE WITH RUBBER GASKET JOINTS AND BEDDED IN APPROVED, COMPACTED FILL SHAPED TO FIT THE BOTTOM HALF OF THE PIPE. THE BEDDING SHALL BE IMPERMEABLE SUCH AS SOILS MEETING THE SC AND CL CLASSIFICATIONS. THE BOTTOM PORTION OF THE ANTI-SEEP COLLAR MAY BE FORMED BY EXCAVATING TRENCHES.

6. ALL METERIALS INCLUDING TRASH RACKS, ANTI-VORTEX DEVICES AND OUTLET PROTECTION WILL BE IN ACCORDANCE WITH THE APPROVED PLAN AND APPROPRIATE A.S.T.M. SPECIFICATIONS. PIPE FITTINGS SHALL BE WATER TIGHT AND IN ACCORDANCE WITH THE APPROVED PLANS. ALL WORK SHALL BE PERFORMED IN A TIMELY AND WORKMAN-LIKE MANNER.

7. SIDE SLOPES SHALL BE A MAXIMUM OF 3:1. FLATTER SLOPES ARE ACCEPTABLE PROVIDED THERE IS NO ENCROACHMENT IN THE FLOODPLAIN OF REQUIRED STORAGE AREA.

8. A SETTLING ALLOWANCE OF AT LEAST 5% IS REQUIRED. THE ELEVATION OF THE TOP OF THE DAM SHOULD BE HIGHEST WHERE THE DEPTH OF FILL IS GREATEST.

9. APPLY LIME, FERTILIZER AND SEED IN ACCORDANCE WITH THE APPROVED PLAN. LIME AND FERTILIZER SHALL BE WORKED INTO THE TOP 6 INCHES OF SOIL.




### Unmatched pollutant removal

The Storm-PURE water quality basin stands apart from competitive units in its ability to remove suspended solids, hydrocarbons and other pollutants. In a laboratory test, polluted storm water was processed through the unit, and samples of the influent and effluent were analyzed by Energy Laboratories Inc. to determine removal efficiency.

The results are shown in the table below, which also includes the published analysis of similar tests conducted at the University of Arkansas on four competitive catch basin inserts. As can be seen, the Storm-Pure basin has **more than double the pollutant removal efficiency than any of the competing brands.**

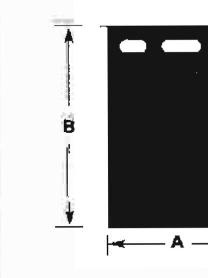
#### Pollution Removal Performance

| Analyzed Components | Storm-PURE Basin Influent | Effluent | Removal Rate | Competitive Catch Basin Inserts Removal Rate A | B | C | D |
|---|---|---|---|---|---|---|---|
| Total Suspended Solids | 295 mg/L | 9 mg/L | **96.95%** | 45% | 10% | 40% | 21% |
| Total Petroleum Hydrocarbons | 320 mg/L (at 150 gpm flow rate) | 16 mg/L | **95.00%** | 16% | 18% | 18% | 16% |
| Zinc | 0.45 mg/L | 0.06 mg/L | **86.67%** | NA | NA | NA | NA |
| Oxygen Demand, Biochemical (BOD) | 250 mg/L | 26 mg/L | **89.60%** | NA | NA | NA | NA |
| Oxygen Demand, Chemical (COD) | 650 mg/L | 130 mg/L | **80.00%** | NA | NA | NA | NA |
| Nitrogen, Total | 54.4 mg/L | 17.7 mg/L | **67.46%** | NA | NA | NA | NA |
| Phosphorus, Total as P | 28.9 mg/L | 7.39 mg/L | **74.43%** | NA | NA | NA | NA |
| Sediment and Debris | – | – | **98.00%** | NA | NA | NA | NA |

#### Storm-Pure Specifications

| | | |
|---|---|---|
| Max. Flow Rate of Filter (at 0 ft. of head weir flow) | 230 gpm | (0.51 cfs) |
| Max. Flow Rate of Bypass (at 0.5 ft. of head orifice flow) | 1189 gpm | (2.65 cfs) |
| Max. Flow Rate of Filter & Bypass (at 0.5 ft. of head orifice flow) | 1419 gpm | (3.16 cfs) |
| Primary Filter (Upper Section) Sediment/Debris Storage Capacity | 1.42 cu ft | (170 lbs) |
| Sediment/Debris Particle Size Captured by Primary Filter | >0.033 in | (838 micron) |
| Sediment/Debris Particle Size Captured by Secondary (Micelx) Filter | >0.012 in | (300 micron) |
| Secondary Filter Hydrocarbon Removal Storage Capacity | 15 lbs | (2.04 gal) |
| Secondary Filter Media Volume | 1.60 cu ft | – |

#### Dimensions *




| Nom. Diameter | A | B |
|---|---|---|
| 24" | 21.38" | 30.00" |

* Additional sizes to be developed as dictated by demand.

### Recommended Maintenance Schedule and Procedure

(Personnel should wear protective gear on hands and proper eye protection.)

**Monthly, or following 6" of accumulated rainfall:**

1. Remove grate.
2. Lift out the catch basket (upper chamber) by hand or mechanical lifting device.
3. Remove the gasket material and lift out the geotextile filter bag from the basket.
4. Dispose of sediment and debris. If sediment has dried or caked, it may be necessary to wash the bag.
5. Inspect the filter bag. If too much sediment has dried and cannot be washed out, or if any tears or holes are discovered, the bag should be replaced.
6. Re-position the bag in the catch basket and re-install the basket into the top of the Storm-Pure unit.
7. Replace the grate.

**Every 6 months, or after oil/fuel or other hazmat spill event:**

1. Clean and inspect the filter bag as outlined at left.
2. The Mycelx hydrocarbon adsorption bag is located in the lower chamber of the Storm-Pure assembly.
3. Obtain a replacement Mycelx filter by calling 800-821-6710.
4. Prior to removing filter, consult with local waste management authorities to determine proper disposal procedure.
5. Remove Mycelx filter bag and dispose of in accordance with local requirements.
6. Install a fresh Mycelx filter into the lower chamber, making sure it is lying flat and is equally displaced.
7. Re-assemble the unit and replace the grate.

### ADS Sales and Service Locations

**Zone Offices**

- **MIDWEST/NORTHEAST** LONDON, OH 1-800-733-9554
- **SOUTHERN** FRANKLIN, TN 1-800-733-9987
- **WESTERN** WASHOUGAL, WA 1-800-733-8523
- **MANUFACTURING FACILITY LOCATIONS**

**To learn more about the Storm-Pure Catch Basin Insert and the full line of ADS water quality and drainage products, call 1-800-821-6710.**

ADVANCED DRAINAGE SYSTEMS, INC.
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800-821-6710 www.ads-pipe.com

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### Treating storm water at the source

Phase II of EPA's National Pollution Discharge Elimination System requires all but the smallest municipal and industrial storm sewer systems to treat storm water discharge to the "maximum extent practicable." The regulations are not clear on the allowable concentration of specific pollutants, but it is generally agreed that significant removal of suspended solids, hydrocarbons, sediment, metals and nutrients is required.

The EPA lists a variety of best management practices (BMPs) for treating storm water, and local jurisdictions are free to choose the ones they believe will provide the most effective and economical compliance. One important factor is the ease with which the BMP can be adapted to the existing storm sewer system.

#### Catch Basin Inserts

Storm water treatment is especially important in locations with higher pollutant concentrations, such as roadways, parking lots, and maintenance and loading areas. Catch basin inserts are increasingly being selected for these applications because of their adaptability to existing drainage systems, fast installation, high flow volume, relatively low cost, and pollutant removal performance.

#### Storm-PURE™

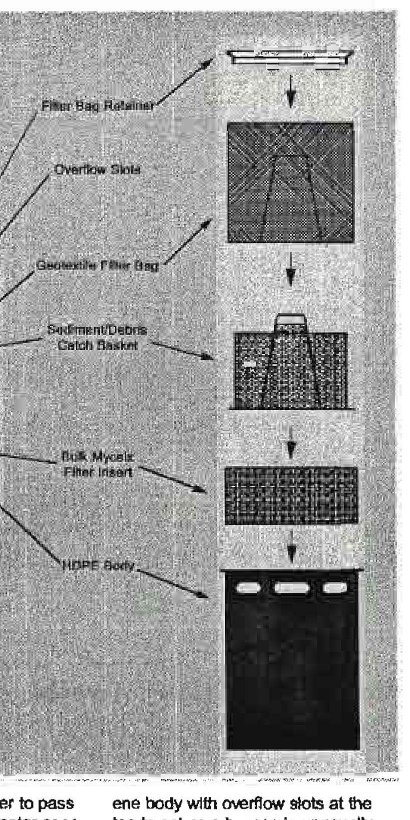
The Nyloplast Division of Advanced Drainage Systems has developed a catch basin insert that provides all of the above benefits, and is particularly efficient at removing pollutants. The Storm-PURE catch basin insert is a two-stage unit that will fit into 24" nominal diameter catch basins (additional sizes to be developed as demand dictates).

The upper section consists of a perforated metal catch basket covered by a geotextile filter bag. This assembly captures sediment and debris while allowing filtered water to pass freely down through the center cone.

The lower stage contains a patented Mycelx® filter insert that attracts and holds tiny particles of hydrocarbons and oil-bound pollutants. The specially treated adsorbent material instantly bonds contaminant particles, resulting in a 95.0% removal rate of total petroleum hydrocarbons.

Both stages are housed in a corrosion-resistant high density polyethylene body with overflow slots at the top to act as a bypass in unusually high flow conditions. The complete assembly will pass 230 gpm without bypassing the flow.

The Storm-PURE catch basin insert fits readily into standard 24" Nyloplast catch basins (including curb inlets and road and highway basins), providing a highly engineered solution for treating storm water. A kit is available for retrofitting standard concrete basins.

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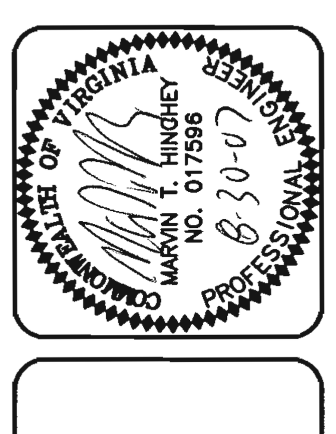



# VILLAGE SELF STORAGE

TOWN OF BOWLING GREEN – CAROLINE COUNTY, VA

STORM SEWER AND STORM PURE DETAILS

SCALE: AS NOTED
DATE: 05-18-2007
REVISIONS: 8-30-07

SHEET 7 OF 11
FILE NO. 7388

Hydraflow Hydrographs by Intelisolve — Tuesday, May 22 2007, 5:10 PM

## Hyd. No. 1

pond 1 pre

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 6.31 cfs |
| Storm frequency | = 2 yrs | Time interval | = 1 min |
| Drainage area | = 3.61 ac | Curve number | = 74 |
| Basin Slope | = 10.0 % | Hydraulic length | = 0 ft |
| Tc method | = USER | Time of conc. (Tc) | = 10.0 min |
| Total precip. | = 3.30 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 14,488 cuft (Printed values >= 50% of Qp.)

### Hydrograph Discharge Table

| Time – (min | Outflow cfs) |
|---|---|
| 713 | 3.26 |
| 714 | 3.79 |
| 715 | 4.39 |
| 716 | 4.98 |
| 717 | 5.52 |
| 718 | 5.96 |
| 719 | 6.24 |
| 720 | 6.31 << |

Hydraflow Hydrographs by Intelisolve — Tuesday, May 22 2007, 5:10 PM

## Hyd. No. 2

pond 1 post

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 9.38 cfs |
| Storm frequency | = 2 yrs | Time interval | = 1 min |
| Drainage area | = 3.61 ac | Curve number | = 82 |
| Basin Slope | = 7.0 % | Hydraulic length | = 0 ft |
| Tc method | = USER | Time of conc. (Tc) | = 10.0 min |
| Total precip. | = 3.30 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 21,214 cuft (Printed values >= 50% of Qp.)

### Hydrograph Discharge Table

| Time – (min | Outflow cfs) |
|---|---|
| 712 | 4.89 |
| 713 | 5.55 |
| 714 | 6.29 |
| 715 | 7.10 |
| 716 | 7.87 |
| 717 | 8.56 |
| 718 | 9.08 |
| 719 | 9.38 << |

Hydraflow Hydrographs by Intelisolve — Tuesday, May 22 2007, 5:10 PM

## Hyd. No. 3

pond 1

| | | | |
|---|---|---|---|
| Hydrograph type | = Reservoir | Peak discharge | = 6.15 cfs |
| Storm frequency | = 2 yrs | Time interval | = 1 min |
| Inflow hyd. No. | = 2 | Reservoir name | = New Pond1 |
| Max. Elevation | = 188.70 ft | Max. Storage | = 14,758 cuft |

Storage Indication method used. Wet pond routing start elevation = 188.01 ft. Outflow hydrograph volume = 20,721 cuft (Printed values >= 50% of Qp.)

### Hydrograph Discharge Table

| Time (min) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | Clv D cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 717 | 8.56 | 188.50 | 3.48 | — | — | — | — | 3.42 | — | — | — | 3.42 |
| 718 | 9.08 | 188.54 | 4.02 | — | — | — | — | 3.97 | — | — | — | 3.97 |
| 719 | 9.38 << | 188.58 | 4.55 | — | — | — | — | 4.51 | — | — | — | 4.51 |
| 720 | 9.36 | 188.62 | 5.04 | — | — | — | — | 5.01 | — | — | — | 5.01 |
| 721 | 8.97 | 188.65 | 5.45 | — | — | — | — | 5.44 | — | — | — | 5.44 |
| 722 | 8.37 | 188.67 | 5.78 | — | — | — | — | 5.77 | — | — | — | 5.77 |
| 723 | 7.59 | 188.69 | 6.00 | — | — | — | — | 5.99 | — | — | — | 5.99 |
| 724 | 6.68 | 188.70 | 6.14 | — | — | — | 0.01 | 6.12 | — | — | — | 6.13 |
| 725 | 5.74 | 188.70 | 6.15 | — | — | — | 0.02 | 6.13 | — | — | — | 6.15 << |

Hydraflow Hydrographs by Intelisolve — Tuesday, May 22 2007, 5:10 PM

## Hyd. No. 5

pond 2 post

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 3.58 cfs |
| Storm frequency | = 2 yrs | Time interval | = 1 min |
| Drainage area | = 1.95 ac | Curve number | = 74 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = USER | Time of conc. (Tc) | = 7.0 min |
| Total precip. | = 3.30 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 7,619 cuft (Printed values >= 50% of Qp.)

### Hydrograph Discharge Table

| Time – (min | Outflow cfs) |
|---|---|
| 713 | 2.02 |
| 714 | 2.35 |
| 715 | 2.72 |
| 716 | 3.06 |
| 717 | 3.34 |
| 718 | 3.53 |
| 719 | 3.58 << |

Hydraflow Hydrographs by Intelisolve — Tuesday, May 22 2007, 5:10 PM

## Hyd. No. 6

pond 2 post

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 9.00 cfs |
| Storm frequency | = 2 yrs | Time interval | = 1 min |
| Drainage area | = 1.95 ac | Curve number | = 95 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = USER | Time of conc. (Tc) | = 5.0 min |
| Total precip. | = 3.30 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 20,022 cuft (Printed values >= 50% of Qp.)

### Hydrograph Discharge Table

| Time – (min | Outflow cfs) |
|---|---|
| 710 | 4.96 |
| 711 | 5.52 |
| 712 | 6.14 |
| 713 | 6.80 |
| 714 | 7.49 |
| 715 | 8.21 |
| 716 | 8.73 |
| 717 | 9.00 << |

Hydraflow Hydrographs by Intelisolve — Tuesday, May 22 2007, 5:10 PM

## Hyd. No. 7

pond 2 route

| | | | |
|---|---|---|---|
| Hydrograph type | = Reservoir | Peak discharge | = 3.56 cfs |
| Storm frequency | = 2 yrs | Time interval | = 1 min |
| Inflow hyd. No. | = 6 | Reservoir name | = pond2 |
| Max. Elevation | = 185.95 ft | Max. Storage | = 9,124 cuft |

Storage Indication method used. Outflow hydrograph volume = 20,007 cuft (Printed values >= 50% of Qp.)

### Hydrograph Discharge Table

| Time (min) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | Clv D cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 718 | 8.90 | 185.72 | 2.20 | 0.23 | 1.94 | — | — | — | — | — | — | 2.18 |
| 719 | 8.32 | 185.79 | 2.81 | 0.22 | 2.57 | — | — | — | — | — | — | 2.79 |
| 720 | 7.50 | 185.86 | 3.13 | 0.22 | 2.89 | — | — | — | — | — | — | 3.11 |
| 721 | 6.44 | 185.91 | 3.35 | 0.22 | 3.12 | — | — | — | — | — | — | 3.34 |
| 722 | 5.27 | 185.94 | 3.50 | 0.22 | 3.27 | — | — | — | — | — | — | 3.49 |
| 723 | 4.13 | 185.95 | 3.57 | 0.22 | 3.34 | — | — | — | — | — | — | 3.56 |
| 724 | 3.14 | 185.95 | 3.58 | 0.22 | 3.34 | — | — | — | — | — | — | 3.56 << |

Hydraflow Hydrographs by Intelisolve — Tuesday, May 22 2007, 5:30 PM

## Hyd. No. 1

pond 1 pre

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 13.69 cfs |
| Storm frequency | = 10 yrs | Time interval | = 1 min |
| Drainage area | = 3.61 ac | Curve number | = 74 |
| Basin Slope | = 10.0 % | Hydraulic length | = 0 ft |
| Tc method | = USER | Time of conc. (Tc) | = 10.0 min |
| Total precip. | = 5.00 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 30,982 cuft (Printed values >= 50% of Qp.)

### Hydrograph Discharge Table

| Time – (min | Outflow cfs) |
|---|---|
| 712 | 7.05 |
| 713 | 8.02 |
| 714 | 9.11 |
| 715 | 10.31 |
| 716 | 11.45 |
| 717 | 12.46 |
| 718 | 13.25 |
| 719 | 13.69 << |

Hydraflow Hydrographs by Intelisolve — Tuesday, May 22 2007, 5:30 PM

## Hyd. No. 2

pond 1 post

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 17.62 cfs |
| Storm frequency | = 10 yrs | Time interval | = 1 min |
| Drainage area | = 3.61 ac | Curve number | = 82 |
| Basin Slope | = 7.0 % | Hydraulic length | = 0 ft |
| Tc method | = USER | Time of conc. (Tc) | = 10.0 min |
| Total precip. | = 5.00 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 40,349 cuft (Printed values >= 50% of Qp.)

### Hydrograph Discharge Table

| Time – (min | Outflow cfs) |
|---|---|
| 711 | 8.82 |
| 712 | 9.88 |
| 713 | 11.09 |
| 714 | 12.41 |
| 715 | 13.85 |
| 716 | 15.19 |
| 717 | 16.35 |
| 718 | 17.20 |
| 719 | 17.62 << |

Hydraflow Hydrographs by Intelisolve — Tuesday, May 22 2007, 5:30 PM

## Hyd. No. 3

pond 1

| | | | |
|---|---|---|---|
| Hydrograph type | = Reservoir | Peak discharge | = 13.60 cfs |
| Storm frequency | = 10 yrs | Time interval | = 1 min |
| Inflow hyd. No. | = 2 | Reservoir name | = New Pond1 |
| Max. Elevation | = 189.05 ft | Max. Storage | = 17,557 cuft |

Storage Indication method used. Wet pond routing start elevation = 188.01 ft. Outflow hydrograph volume = 39,855 cuft (Printed values >= 50% of Qp.)

### Hydrograph Discharge Table

| Time (min) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | Clv D cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 716 | 15.19 | 188.78 | 7.77 | — | — | — | 0.30 | 7.47 | — | — | — | 7.77 |
| 717 | 16.35 | 188.83 | 8.91 | — | — | — | 0.50 | 8.41 | — | — | — | 8.91 |
| 718 | 17.20 | 188.89 | 10.05 | — | — | — | 0.89 | 9.16 | — | — | — | 10.05 |
| 719 | 17.62 << | 188.94 | 11.18 | — | — | — | 1.84 | 9.34 | — | — | — | 11.18 |
| 720 | 17.47 | 188.99 | 12.16 | — | — | — | 2.67 | 9.49 | — | — | — | 12.16 |
| 721 | 16.65 | 189.02 | 12.92 | — | — | — | 3.31 | 9.61 | — | — | — | 12.92 |
| 722 | 15.46 | 189.05 | 13.40 | — | — | — | 3.72 | 9.68 | — | — | — | 13.40 |
| 723 | 13.94 | 189.05 | 13.60 | — | — | — | 3.89 | 9.71 | — | — | — | 13.60 << |

Hydraflow Hydrographs by Intelisolve — Tuesday, May 22 2007, 5:30 PM

## Hyd. No. 5

pond 2 post

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 7.72 cfs |
| Storm frequency | = 10 yrs | Time interval | = 1 min |
| Drainage area | = 1.95 ac | Curve number | = 74 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = USER | Time of conc. (Tc) | = 7.0 min |
| Total precip. | = 5.00 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 16,317 cuft (Printed values >= 50% of Qp.)

### Hydrograph Discharge Table

| Time – (min | Outflow cfs) |
|---|---|
| 712 | 4.27 |
| 713 | 4.87 |
| 714 | 5.53 |
| 715 | 6.26 |
| 716 | 6.90 |
| 717 | 7.41 |
| 718 | 7.72 |
| 719 | 7.72 << |

Hydraflow Hydrographs by Intelisolve — Tuesday, May 22 2007, 5:30 PM

## Hyd. No. 6

pond 2 post

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 14.06 cfs |
| Storm frequency | = 10 yrs | Time interval | = 1 min |
| Drainage area | = 1.95 ac | Curve number | = 95 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = USER | Time of conc. (Tc) | = 5.0 min |
| Total precip. | = 5.00 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 32,261 cuft (Printed values >= 50% of Qp.)

### Hydrograph Discharge Table

| Time – (min | Outflow cfs) |
|---|---|
| 709 | 7.12 |
| 710 | 7.88 |
| 711 | 8.75 |
| 712 | 9.70 |
| 713 | 10.72 |
| 714 | 11.79 |
| 715 | 12.89 |
| 716 | 13.68 |
| 717 | 14.06 << |

Hydraflow Hydrographs by Intelisolve — Tuesday, May 22 2007, 5:30 PM

## Hyd. No. 7

pond 2 route

| | | | |
|---|---|---|---|
| Hydrograph type | = Reservoir | Peak discharge | = 7.70 cfs |
| Storm frequency | = 10 yrs | Time interval | = 1 min |
| Inflow hyd. No. | = 6 | Reservoir name | = pond2 |
| Max. Elevation | = 186.47 ft | Max. Storage | = 12,534 cuft |

Storage Indication method used. Outflow hydrograph volume = 32,246 cuft (Printed values >= 50% of Qp.)

### Hydrograph Discharge Table

| Time (min) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | Clv D cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 714 | 11.79 | 186.04 | 4.09 | 0.21 | 3.64 | 0.23 | — | — | — | — | — | 4.08 |
| 715 | 12.89 | 186.11 | 4.64 | 0.20 | 3.79 | 0.65 | — | — | — | — | — | 4.64 |
| 716 | 13.68 | 186.18 | 5.22 | 0.18 | 3.94 | 1.10 | — | — | — | — | — | 5.22 |
| 717 | 14.06 << | 186.25 | 5.87 | 0.17 | 3.97 | 1.73 | — | — | — | — | — | 5.87 |
| 718 | 13.88 | 186.32 | 6.50 | 0.17 | 3.95 | 2.37 | — | — | — | — | — | 6.50 |
| 719 | 12.97 | 186.38 | 7.04 | 0.17 | 3.94 | 2.93 | — | — | — | — | — | 7.04 |
| 720 | 11.67 | 186.43 | 7.40 | 0.17 | 3.98 | 3.25 | — | — | — | — | — | 7.40 |
| 721 | 10.01 | 186.46 | 7.61 | 0.18 | 4.02 | 3.41 | — | — | — | — | — | 7.61 |
| 722 | 8.18 | 186.47 | 7.70 | 0.18 | 4.04 | 3.49 | — | — | — | — | — | 7.70 << |

Hydraflow Hydrographs by Intelisolve — Tuesday, May 22 2007, 5:30 PM

## Hyd. No. 1

pond 1 pre

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 31.16 cfs |
| Storm frequency | = 100 yrs | Time interval | = 1 min |
| Drainage area | = 3.61 ac | Curve number | = 74 |
| Basin Slope | = 10.0 % | Hydraulic length | = 0 ft |
| Tc method | = USER | Time of conc. (Tc) | = 10.0 min |
| Total precip. | = 8.60 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 71,623 cuft (Printed values >= 50% of Qp.)

### Hydrograph Discharge Table

| Time – (min | Outflow cfs) |
|---|---|
| 711 | 15.76 |
| 712 | 17.65 |
| 713 | 19.76 |
| 714 | 22.09 |
| 715 | 24.62 |
| 716 | 26.96 |
| 717 | 28.98 |
| 718 | 30.46 |
| 719 | 31.16 << |

Hydraflow Hydrographs by Intelisolve — Tuesday, May 22 2007, 5:30 PM

## Hyd. No. 2

pond 1 post

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 35.55 cfs |
| Storm frequency | = 100 yrs | Time interval | = 1 min |
| Drainage area | = 3.61 ac | Curve number | = 82 |
| Basin Slope | = 7.0 % | Hydraulic length | = 0 ft |
| Tc method | = USER | Time of conc. (Tc) | = 10.0 min |
| Total precip. | = 8.60 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 84,276 cuft (Printed values >= 50% of Qp.)

### Hydrograph Discharge Table

| Time – (min | Outflow cfs) |
|---|---|
| 711 | 19.02 |
| 712 | 21.13 |
| 713 | 23.47 |
| 714 | 26.03 |
| 715 | 28.79 |
| 716 | 31.30 |
| 717 | 33.42 |
| 718 | 34.92 |
| 719 | 35.55 << |

Hydraflow Hydrographs by Intelisolve — Tuesday, May 22 2007, 5:30 PM

## Hyd. No. 3

pond 1

| | | | |
|---|---|---|---|
| Hydrograph type | = Reservoir | Peak discharge | = 29.58 cfs |
| Storm frequency | = 100 yrs | Time interval | = 1 min |
| Inflow hyd. No. | = 2 | Reservoir name | = New Pond1 |
| Max. Elevation | = 189.76 ft | Max. Storage | = 23,061 cuft |

Storage Indication method used. Wet pond routing start elevation = 188.01 ft. Outflow hydrograph volume = 83,782 cuft (Printed values >= 50% of Qp.)

### Hydrograph Discharge Table

| Time (min) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | Clv D cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 714 | 26.03 | 189.15 | 14.81 | — | — | — | 5.40 | 9.42 | — | 0.14 | — | 14.95 |
| 715 | 28.79 | 189.24 | 15.86 | — | — | — | 6.80 | 9.06 | — | 0.29 | — | 16.15 |
| 716 | 31.30 | 189.34 | 16.58 | — | — | — | 7.70 | 8.88 | — | 1.59 | — | 18.17 |
| 717 | 33.42 | 189.44 | 17.25 | — | — | — | 8.53 | 8.71 | — | 3.08 | — | 20.32 |
| 718 | 34.92 | 189.54 | 17.69 | — | — | — | 9.09 | 8.59 | — | 5.24 | — | 22.92 |
| 719 | 35.55 << | 189.62 | 18.07 | — | — | — | 9.58 | 8.49 | — | 7.16 | — | 25.23 |
| 720 | 35.05 | 189.69 | 18.35 | — | — | — | 9.90 | 8.44 | — | 9.08 | — | 27.42 |
| 721 | 33.25 | 189.74 | 18.53 | — | — | — | 10.11 | 8.41 | — | 10.37 | — | 28.90 |
| 722 | 30.74 | 189.76 | 18.62 | — | — | — | 10.21 | 8.40 | — | 10.96 | — | 29.58 << |

Hydraflow Hydrographs by Intelisolve — Tuesday, May 22 2007, 5:30 PM

## Hyd. No. 5

pond 2 post

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 17.49 cfs |
| Storm frequency | = 100 yrs | Time interval | = 1 min |
| Drainage area | = 1.95 ac | Curve number | = 74 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = USER | Time of conc. (Tc) | = 7.0 min |
| Total precip. | = 8.60 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 37,721 cuft (Printed values >= 50% of Qp.)

### Hydrograph Discharge Table

| Time – (min | Outflow cfs) |
|---|---|
| 711 | 9.38 |
| 712 | 10.54 |
| 713 | 11.83 |
| 714 | 13.23 |
| 715 | 14.73 |
| 716 | 16.02 |
| 717 | 17.00 |
| 718 | 17.49 << |

Hydraflow Hydrographs by Intelisolve — Tuesday, May 22 2007, 5:30 PM

## Hyd. No. 6

pond 2 post

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 24.64 cfs |
| Storm frequency | = 100 yrs | Time interval | = 1 min |
| Drainage area | = 1.95 ac | Curve number | = 95 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = USER | Time of conc. (Tc) | = 5.0 min |
| Total precip. | = 8.60 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

Hydrograph Volume = 58,391 cuft (Printed values >= 50% of Qp.)

### Hydrograph Discharge Table

| Time – (min | Outflow cfs) |
|---|---|
| 709 | 12.63 |
| 710 | 13.97 |
| 711 | 15.48 |
| 712 | 17.13 |
| 713 | 18.90 |
| 714 | 20.74 |
| 715 | 22.64 |
| 716 | 24.00 |
| 717 | 24.64 << |

Hydraflow Hydrographs by Intelisolve — Tuesday, May 22 2007, 5:30 PM

## Hyd. No. 7

pond 2 route

| | | | |
|---|---|---|---|
| Hydrograph type | = Reservoir | Peak discharge | = 21.20 cfs |
| Storm frequency | = 100 yrs | Time interval | = 1 min |
| Inflow hyd. No. | = 6 | Reservoir name | = pond2 |
| Max. Elevation | = 186.96 ft | Max. Storage | = 15,887 cuft |

Storage Indication method used. Outflow hydrograph volume = 58,366 cuft (Printed values >= 50% of Qp.)

### Hydrograph Discharge Table

| Time (min) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | Clv D cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 715 | 22.64 | 186.73 | 10.75 | 0.17 | 3.89 | 4.34 | 2.35 | — | — | 1.84 | — | 12.59 |
| 716 | 24.00 | 186.81 | 12.07 | 0.16 | 3.63 | 4.30 | 3.97 | — | — | 3.16 | — | 15.23 |
| 717 | 24.64 << | 186.88 | 13.11 | 0.14 | 3.27 | 3.88 | 5.82 | — | — | 4.89 | — | 18.01 |
| 718 | 24.30 | 186.93 | 13.86 | 0.13 | 3.02 | 3.57 | 7.13 | — | — | 6.12 | — | 19.98 |
| 719 | 22.68 | 186.96 | 14.26 | 0.13 | 2.88 | 3.41 | 7.85 | — | — | 6.79 | — | 21.05 |
| 720 | 20.40 | 186.96 | 14.32 | 0.12 | 2.86 | 3.39 | 7.95 | — | — | 6.89 | — | 21.20 << |

Hydraflow Hydrographs by Intelisolve — Tuesday, May 22 2007, 5:30 PM

## Hyd. No. 11

pond 1 spillway route

| | | | |
|---|---|---|---|
| Hydrograph type | = Reservoir | Peak discharge | = 30.70 cfs |
| Storm frequency | = 100 yrs | Time interval | = 1 min |
| Inflow hyd. No. | = 2 | Reservoir name | = pond 1 spillway r |
| Max. Elevation | = 190.32 ft | Max. Storage | = 28,254 cuft |

Storage Indication method used. Wet pond routing start elevation = 188.01 ft. Outflow hydrograph volume = 76,202 cuft (Printed values >= 50% of Qp.)

### Hydrograph Discharge Table

| Time (min) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | Clv D cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 713 | 23.47 | 189.93 | — | — | — | — | — | — | — | 16.18 | — | 16.18 |
| 714 | 26.03 | 189.98 | — | — | — | — | — | — | — | 18.09 | — | 18.09 |
| 715 | 28.79 | 190.04 | — | — | — | — | — | — | — | 19.95 | — | 19.95 |
| 716 | 31.30 | 190.09 | — | — | — | — | — | — | — | 21.88 | — | 21.88 |
| 717 | 33.42 | 190.14 | — | — | — | — | — | — | — | 23.88 | — | 23.88 |
| 718 | 34.92 | 190.20 | — | — | — | — | — | — | — | 25.84 | — | 25.84 |
| 719 | 35.55 << | 190.24 | — | — | — | — | — | — | — | 27.79 | — | 27.79 |
| 720 | 35.05 | 190.28 | — | — | — | — | — | — | — | 29.36 | — | 29.36 |
| 721 | 33.25 | 190.31 | — | — | — | — | — | — | — | 30.36 | — | 30.36 |
| 722 | 30.74 | 190.32 | — | — | — | — | — | — | — | 30.70 | — | 30.70 << |

Hydraflow Hydrographs by Intelisolve — Tuesday, May 22 2007, 5:30 PM

## Hyd. No. 10

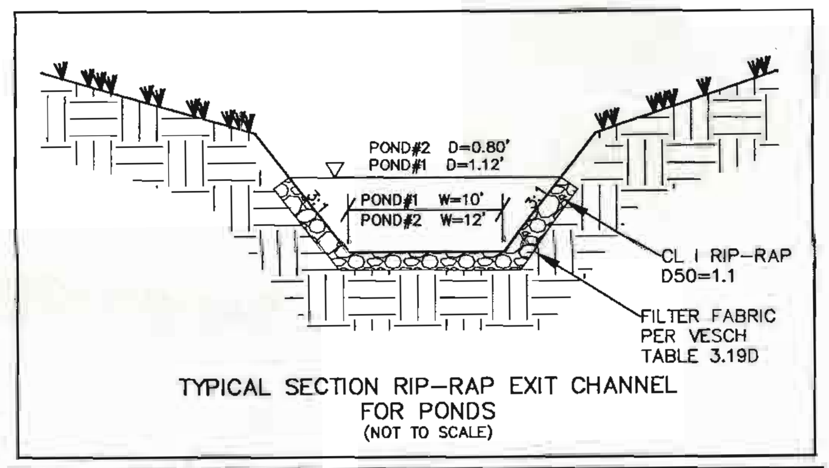
pond 2 spillway route

| | | | |
|---|---|---|---|
| Hydrograph type | = Reservoir | Peak discharge | = 22.28 cfs |
| Storm frequency | = 100 yrs | Time interval | = 1 min |
| Inflow hyd. No. | = 6 | Reservoir name | = pond2 spillway |
| Max. Elevation | = 187.40 ft | Max. Storage | = 18,874 cuft |

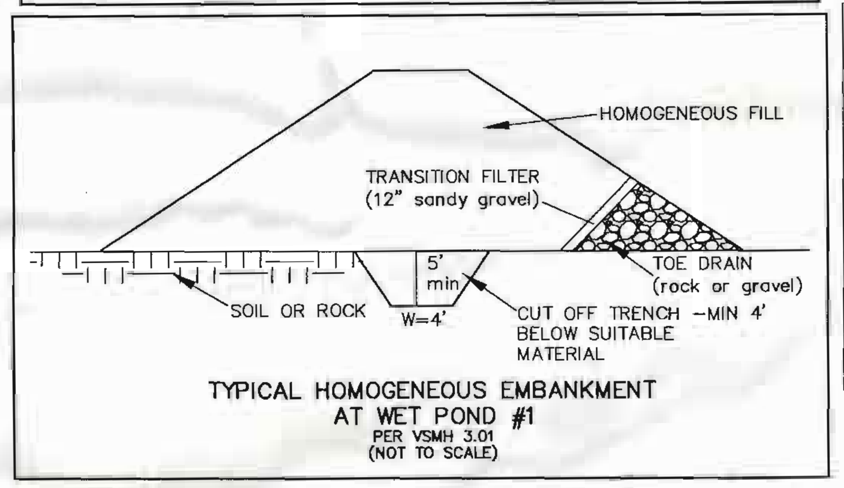
Storage Indication method used. Outflow hydrograph volume = 44,960 cuft (Printed values >= 50% of Qp.)

### Hydrograph Discharge Table

| Time (min) | Inflow cfs | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | Clv D cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Outflow cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 711 | 15.48 | 187.10 | — | — | — | — | — | — | — | 11.35 | — | 11.35 |
| 712 | 17.13 | 187.14 | — | — | — | — | — | — | — | 12.61 | — | 12.61 |
| 713 | 18.90 | 187.18 | — | — | — | — | — | — | — | 13.98 | — | 13.98 |
| 714 | 20.74 | 187.23 | — | — | — | — | — | — | — | 15.61 | — | 15.61 |
| 715 | 22.64 | 187.27 | — | — | — | — | — | — | — | 17.40 | — | 17.40 |
| 716 | 24.00 | 187.32 | — | — | — | — | — | — | — | 19.14 | — | 19.14 |
| 717 | 24.64 << | 187.36 | — | — | — | — | — | — | — | 20.66 | — | 20.66 |
| 718 | 24.30 | 187.39 | — | — | — | — | — | — | — | 21.78 | — | 21.78 |
| 719 | 22.68 | 187.40 | — | — | — | — | — | — | — | 22.28 | — | 22.28 << |




TYPICAL SECTION RIP-RAP EXIT CHANNEL
FOR PONDS
(NOT TO SCALE)




TYPICAL HOMOGENEOUS EMBANKMENT
AT WET POND #1
PER VSMH 3.01
(NOT TO SCALE)

# Pond Report

Hydraflow Hydrographs by Intelisolve — Tuesday, May 22 2007, 5:10 PM

## Pond No. 1 - New Pond1

### Pond Data

Pond storage is based on known contour areas. Average end area method used.

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|---|---|---|---|---|
| 0.00 | 186.00 | 3,856 | 0 | 0 |
| 1.88 | 187.88 | 5,512 | 8,806 | 8,806 |
| 2.13 | 188.13 | 6,757 | 1,534 | 10,340 |
| 4.00 | 190.00 | 8,862 | 14,604 | 24,943 |
| 6.00 | 192.00 | 12,162 | 21,024 | 45,967 |

### Culvert / Orifice Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| Rise (in) | = 21.00 | 0.00 | 0.00 | 0.00 |
| Span (in) | = 21.00 | 0.00 | 0.00 | 0.00 |
| No. Barrels | = 1 | 0 | 0 | 0 |
| Invert El. (ft) | = 186.25 | 0.00 | 0.00 | 0.00 |
| Length (ft) | = 50.00 | 0.00 | 0.00 | 0.00 |
| Slope (%) | = 0.90 | 0.00 | 0.00 | 0.00 |
| N-Value | = .013 | .013 | .000 | .000 |
| Orif. Coeff. | = 0.60 | 0.60 | 0.00 | 0.00 |
| Multi-Stage | = n/a | No | No | No |

### Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| Crest Len (ft) | = 9.00 | 4.00 | 0.00 | 10.00 |
| Crest El. (ft) | = 188.80 | 188.10 | 0.00 | 189.20 |
| Weir Coeff. | = 3.33 | 3.33 | 0.00 | 2.60 |
| Weir Type | = Riser | Rect | — | Broad |
| Multi-Stage | = Yes | Yes | No | No |

Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control. Weir riser checked for orifice conditions.

### Stage / Storage / Discharge Table

| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | Clv D cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Total cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 186.00 | 0.00 | — | — | — | 0.00 | 0.00 | — | 0.00 | — | 0.00 |
| 1.88 | 8,806 | 187.88 | 0.00 | — | — | — | 0.00 | 0.00 | — | 0.00 | — | 0.00 |
| 2.13 | 10,340 | 188.13 | 0.08 | — | — | — | 0.00 | 0.07 | — | 0.00 | — | 0.07 |
| 4.00 | 24,943 | 190.00 | 19.52 | — | — | — | 11.01 | 8.49 | — | 18.60 | — | 38.11 |
| 6.00 | 45,967 | 192.00 | 25.52 | — | — | — | 10.06 | 15.42 | — | 121.82 | — | 147.30 |

Hydraflow Hydrographs by Intelisolve — Tuesday, May 22 2007, 5:10 PM

## Pond No. 4 - pond2

### Pond Data

Pond storage is based on known contour areas. Average end area method used.

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|---|---|---|---|---|
| 0.00 | 184.00 | 3,670 | 0 | 0 |
| 2.00 | 186.00 | 5,673 | 9,343 | 9,343 |
| 4.00 | 188.00 | 7,953 | 13,626 | 22,969 |

### Culvert / Orifice Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| Rise (in) | = 21.00 | 3.00 | 4.00 | 4.00 |
| Span (in) | = 21.00 | 3.00 | 20.25 | 24.00 |
| No. Barrels | = 1 | 1 | 2 | 2 |
| Invert El. (ft) | = 184.00 | 184.00 | 185.40 | 186.00 |
| Length (ft) | = 30.00 | 0.00 | 0.00 | 0.00 |
| Slope (%) | = 0.50 | 0.00 | 0.00 | 0.00 |
| N-Value | = .013 | .013 | .013 | .013 |
| Orif. Coeff. | = 0.60 | 0.60 | 0.60 | 0.60 |
| Multi-Stage | = n/a | Yes | Yes | Yes |

### Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| Crest Len (ft) | = 12.00 | 0.00 | 0.00 | 12.00 |
| Crest El. (ft) | = 186.60 | 0.00 | 0.00 | 186.60 |
| Weir Coeff. | = 3.33 | 3.33 | 0.00 | 2.60 |
| Weir Type | = Riser | — | — | Broad |
| Multi-Stage | = Yes | No | No | No |

Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

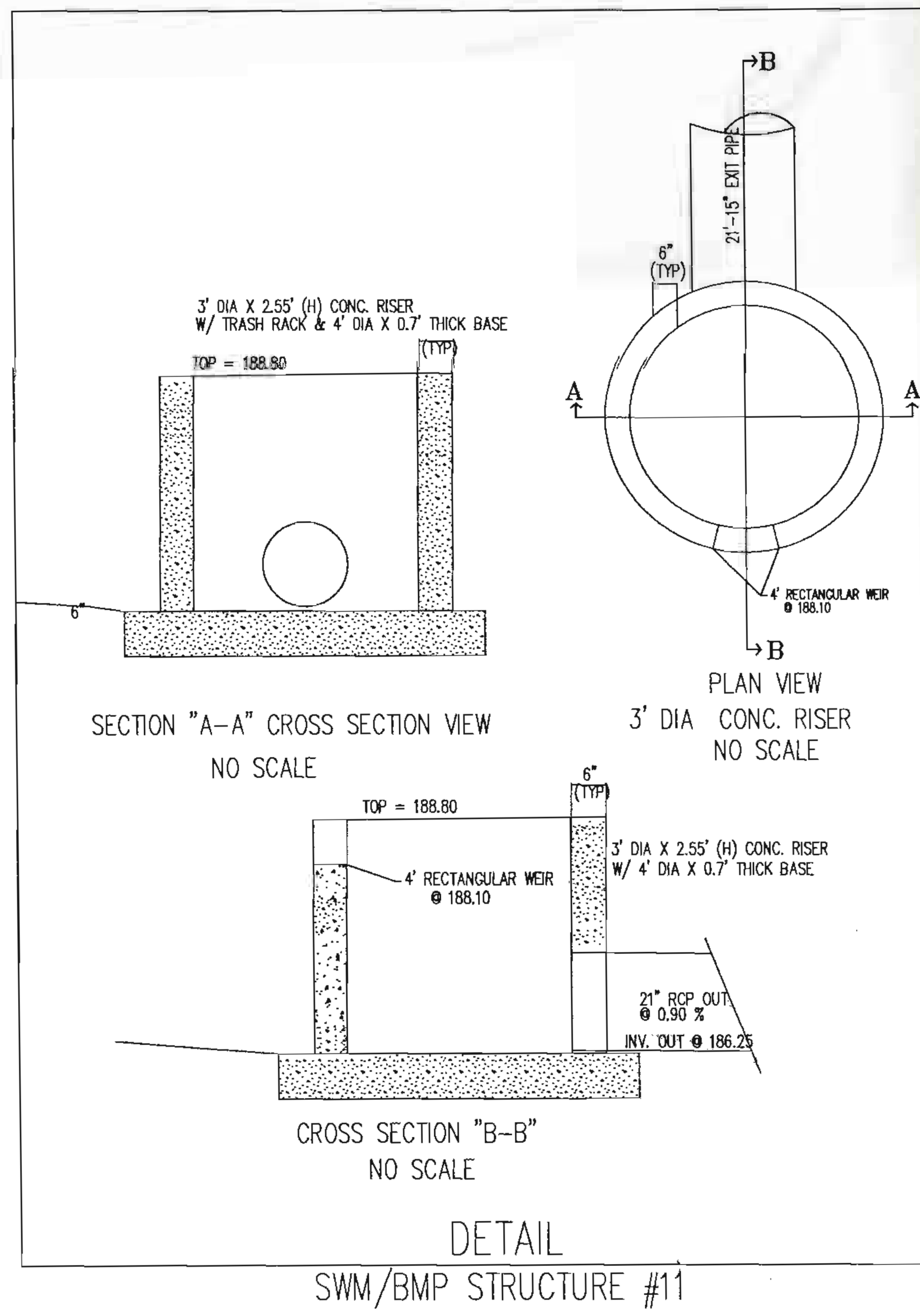
Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control. Weir riser checked for orifice conditions.

### Stage / Storage / Discharge Table

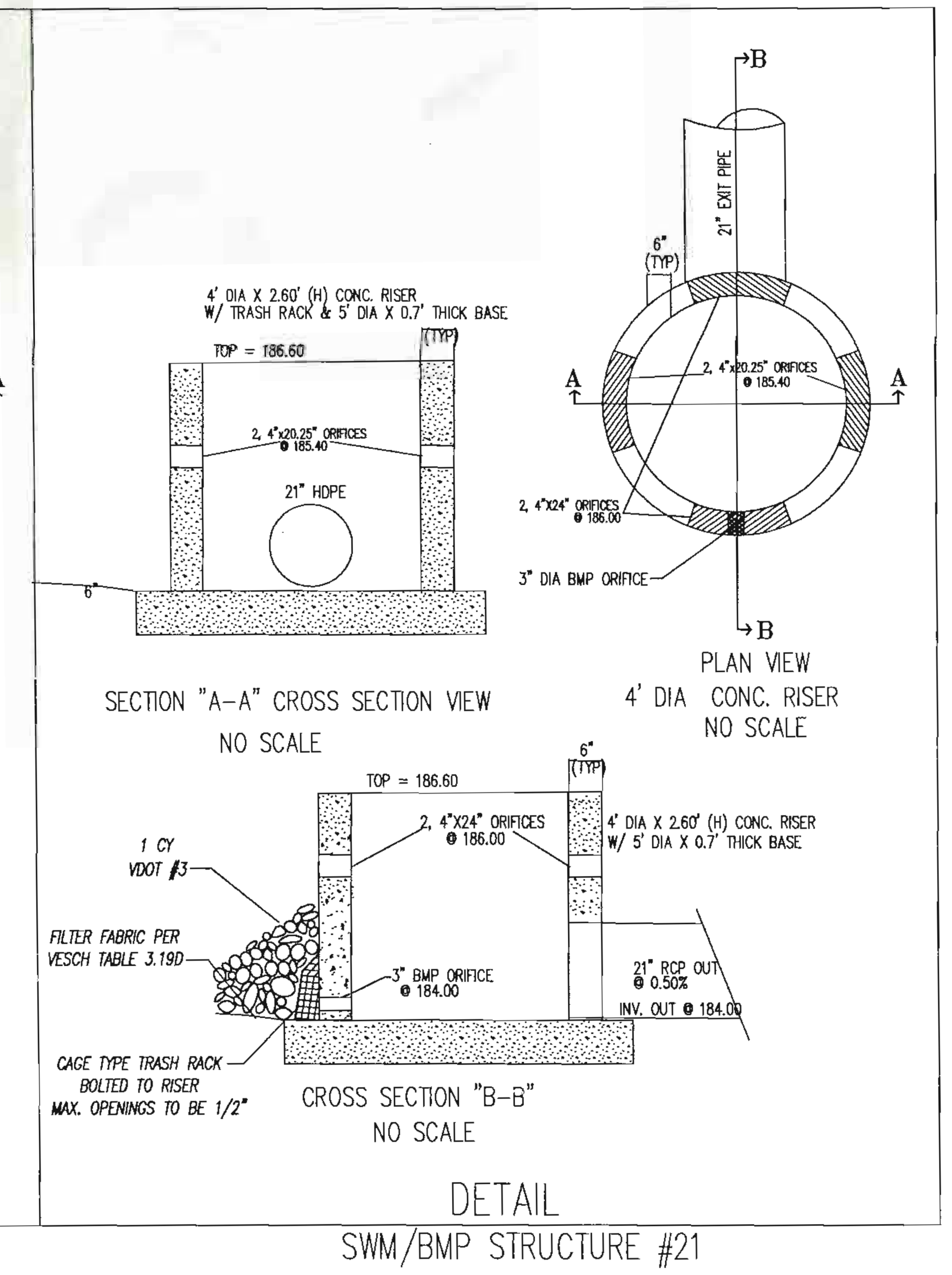
| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | Clv D cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | Total cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 184.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | — | — | 0.00 | — | 0.00 |
| 2.00 | 9,343 | 186.00 | 3.80 | 0.22 | 3.57 | 0.00 | 0.00 | — | — | 0.00 | — | 3.79 |
| 4.00 | 22,969 | 188.00 | 20.36 | 0.04 | 0.98 | 1.16 | 18.18 | — | — | 51.68 | — | 72.05 |

# Hydrograph Return Period Recap

| Hyd. No. | Hydrograph type (origin) | Inflow Hyd(s) | Peak Outflow (cfs) 1-Yr | 2-Yr | 3-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr | Hydrograph description |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SCS Runoff | — | — | 6.31 | — | — | 13.69 | — | — | 31.16 | pond 1 pre |
| 2 | SCS Runoff | — | — | 9.38 | — | — | 17.62 | — | — | 35.55 | pond 1 post |
| 3 | Reservoir | 2 | — | 6.15 | — | — | 13.60 | — | — | 29.58 | pond 1 |
| 5 | SCS Runoff | — | — | 3.58 | — | — | 7.72 | — | — | 17.49 | pond 2 post |
| 6 | SCS Runoff | — | — | 9.00 | — | — | 14.06 | — | — | 24.64 | pond 2 post |
| 7 | Reservoir | 6 | — | 3.56 | — | — | 7.70 | — | — | 21.20 | pond 2 route |
| 10 | Reservoir | 6 | — | 0.51 | — | — | 9.22 | — | — | 22.28 | pond 2 spillway route |
| 11 | Reservoir | 2 | — | 1.53 | — | — | 13.25 | — | — | 30.70 | pond 1 spillway route |




DETAIL
SWM/BMP STRUCTURE #11




DETAIL
SWM/BMP STRUCTURE #21

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COMMONWEALTH OF VIRGINIA
MARVIN T. HINCHEY
NO. 017596
8-23-07
PROFESSIONAL ENGINEER

# VILLAGE SELF STORAGE

TOWN OF BOWLING GREEN – CAROLINE COUNTY, VA

STORMWATER MANAGEMENT COMPUTATIONS

SCALE: AS NOTED

DATE: 05-18-2007

REVISIONS:
8-23-07

SHEET 6 OF 11

FILE NO. 7388

Channel Calculator
2-YR STORM A=0.15AC. C=0.70

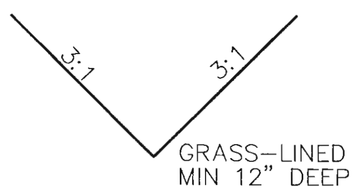
Given Input Data:
- Shape ..... Trapezoidal
- Solving for ..... Depth of Flow
- Flowrate ..... 0.6100 cfs
- Slope ..... 0.0100 ft/ft
- Manning's n ..... 0.0300
- Height ..... 10000.0000 ft
- Bottom width ..... 0.0000 ft
- Left slope ..... 0.3330 ft/ft (V/H)
- Right slope ..... 0.3330 ft/ft (V/H)

Computed Results:
- Depth ..... 0.3637 ft
- Velocity ..... 1.5353 fps
- Full Flowrate ..... 0.6100 cfs
- Flow area ..... 0.3973 ft2
- Flow perimeter ..... 2.3026 ft
- Hydraulic radius ..... 0.1726 ft
- Top width ..... 2.1846 ft
- Area ..... 0.3973 ft2
- Perimeter ..... 2.3026 ft
- Percent full ..... 100.0000 %

Channel Calculator
10YR STORM A=0.15AC. C=0.70

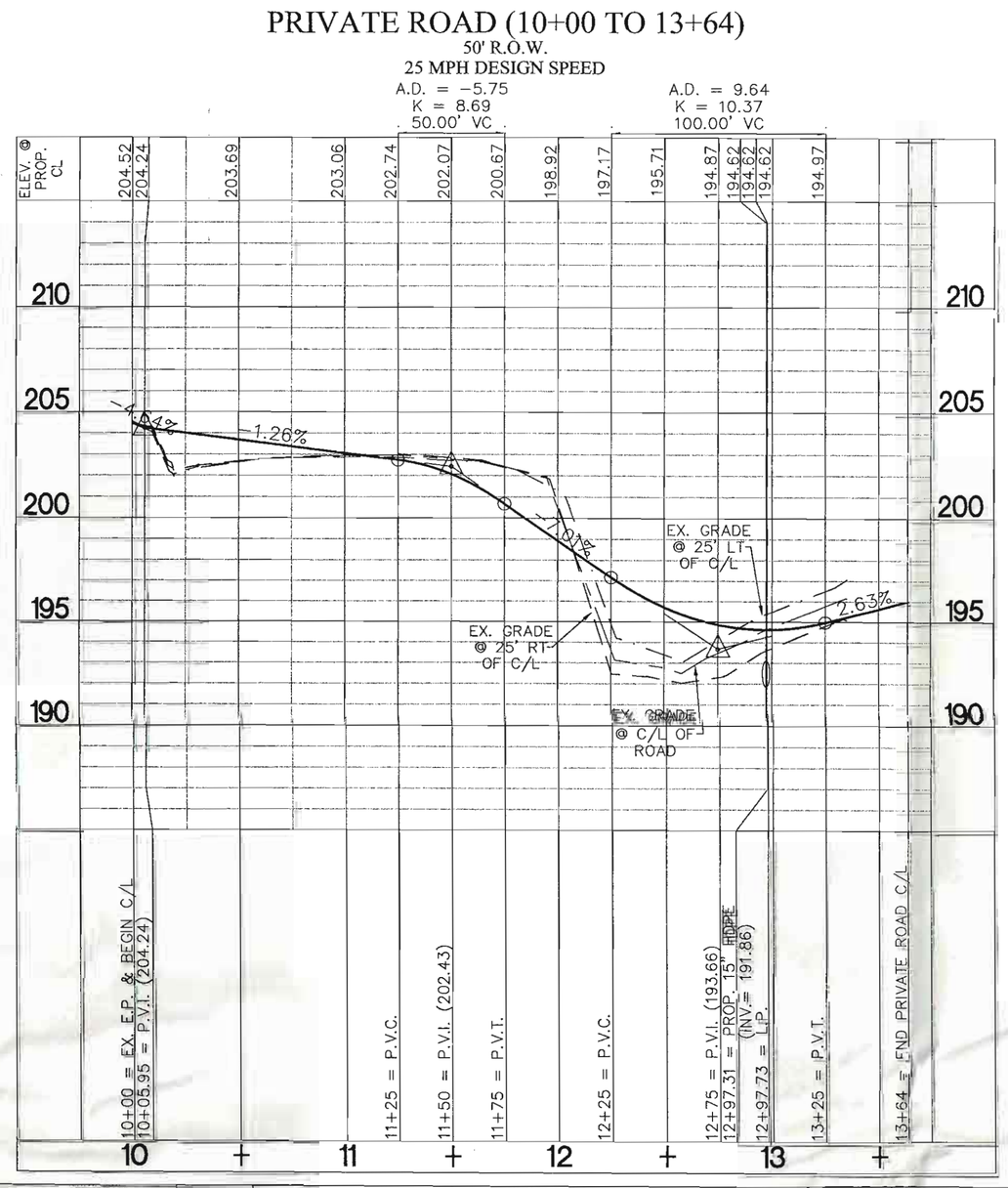
Given Input Data:
- Shape ..... Trapezoidal
- Solving for ..... Depth of Flow
- Flowrate ..... 0.7500 cfs
- Slope ..... 0.0100 ft/ft
- Manning's n ..... 0.0300
- Height ..... 10000.0000 ft
- Bottom width ..... 0.0000 ft
- Left slope ..... 0.3330 ft/ft (V/H)
- Right slope ..... 0.3330 ft/ft (V/H)

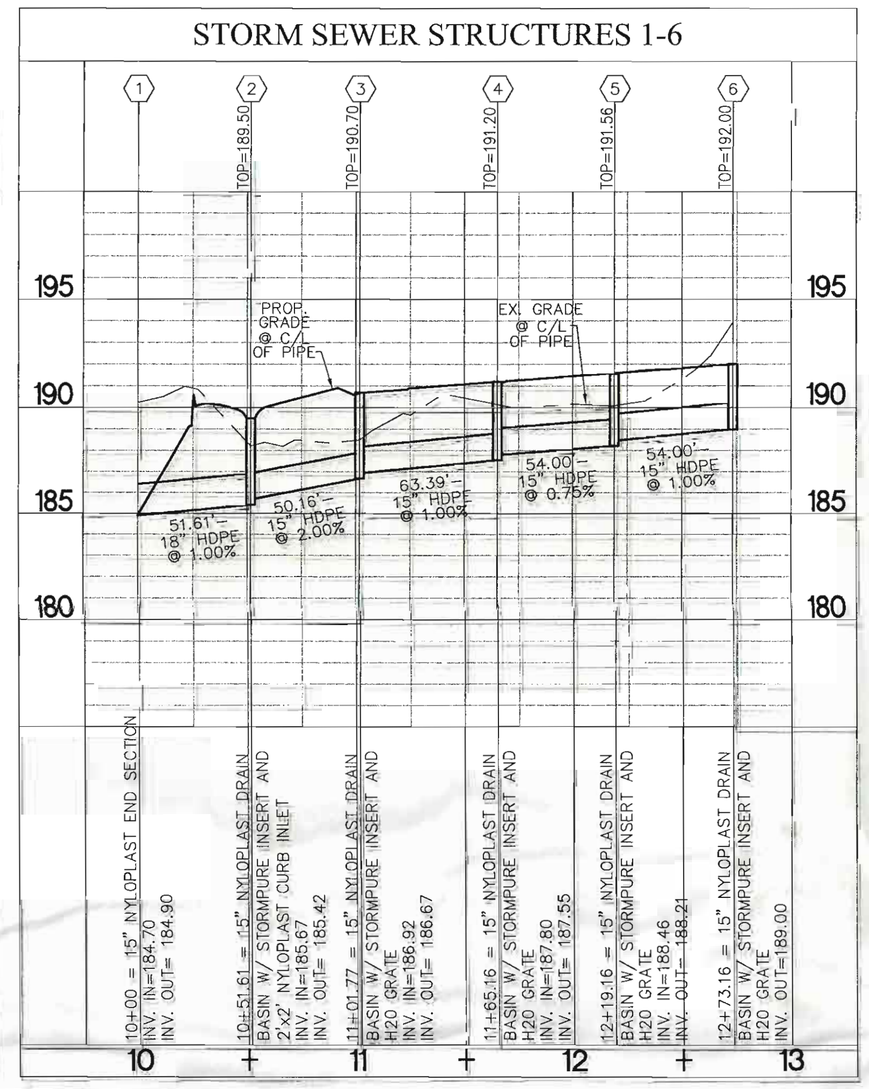
Computed Results:
- Depth ..... 0.3930 ft
- Velocity ..... 1.6167 fps
- Full Flowrate ..... 0.7500 cfs
- Flow area ..... 0.4639 ft2
- Flow perimeter ..... 2.4881 ft
- Hydraulic radius ..... 0.1865 ft
- Top width ..... 2.3606 ft
- Area ..... 0.4639 ft2
- Perimeter ..... 2.4881 ft
- Percent full ..... 100.0000 %

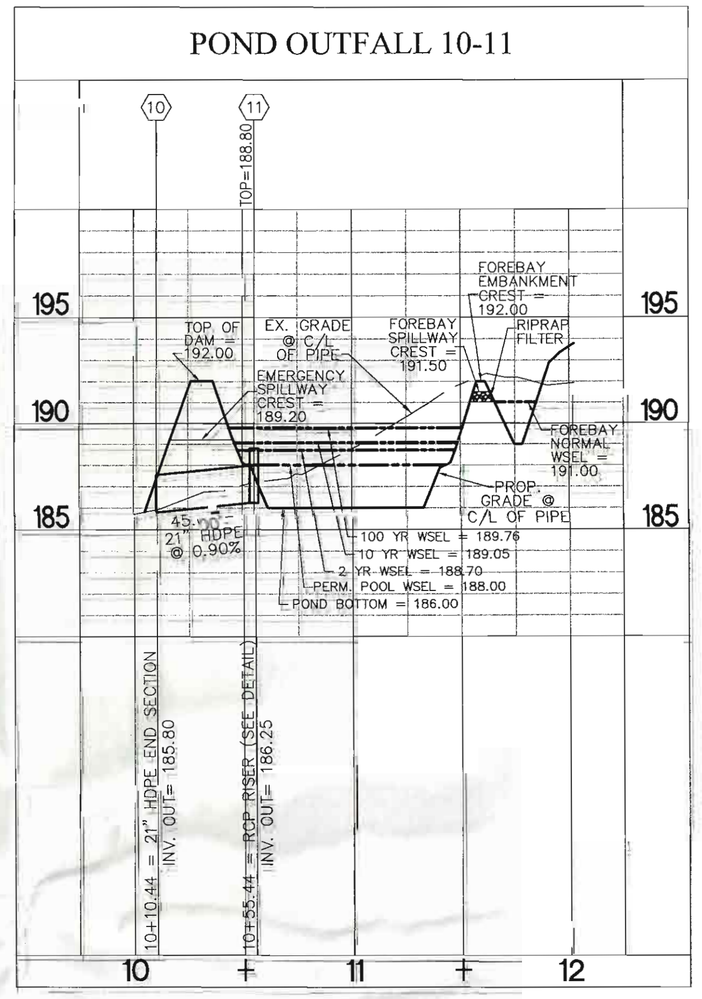



OUTLET RIPRAP SHALL BE 5'X5' VDOT CLASS 1A

CHANNEL 1
TYPICAL SECTION




## CULVERT CALCULATIONS

| CULV # | Tc | I (10 YR) (IN/HR) | C | A (ACRES) | Q(total) (CFS) (10 YR) | Number of Barrels | FLOW PER BARREL Q/N | BARREL SIZE (inches) | BARREL Slope (ft/ft) | BARREL Length (ft) | Barrel Inverts Upper | Barrel Inverts Lower | Tailwater depth | Max HWd | INLET CONTROL crit. depth | INLET CONTROL crit vel | INLET CONTROL HWi/D | INLET CONTROL HWi | INLET CONTROL Fall | INLET CONTROL ELhi | OUTLET CONTROL dc | OUTLET CONTROL (dc+D)/2 | OUTLET CONTROL ho | OUTLET CONTROL ke | OUTLET CONTROL H | OUTLET CONTROL ELho | HW ELEV | REMARKS | 2 YR Q (CFS) | 2 YR VELOCITY (F/S) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C2 | 5 | 6.87 | 0.33 | 1.15 | 2.598 | 1 | 2.60 | 15 | 0.0050 | 47.00 | 191.20 | 190.97 | 1.00 | 193.08 | 0.65 | 4.11 | 0.76 | 0.95 | - | 192.15 | 0.50 | 0.88 | 0.88 | 0.50 | | 191.84 | 192.15 | OK INLET CONTROL | 1.99 | 3.7090575 |

## STORM SEWER CALCULATIONS

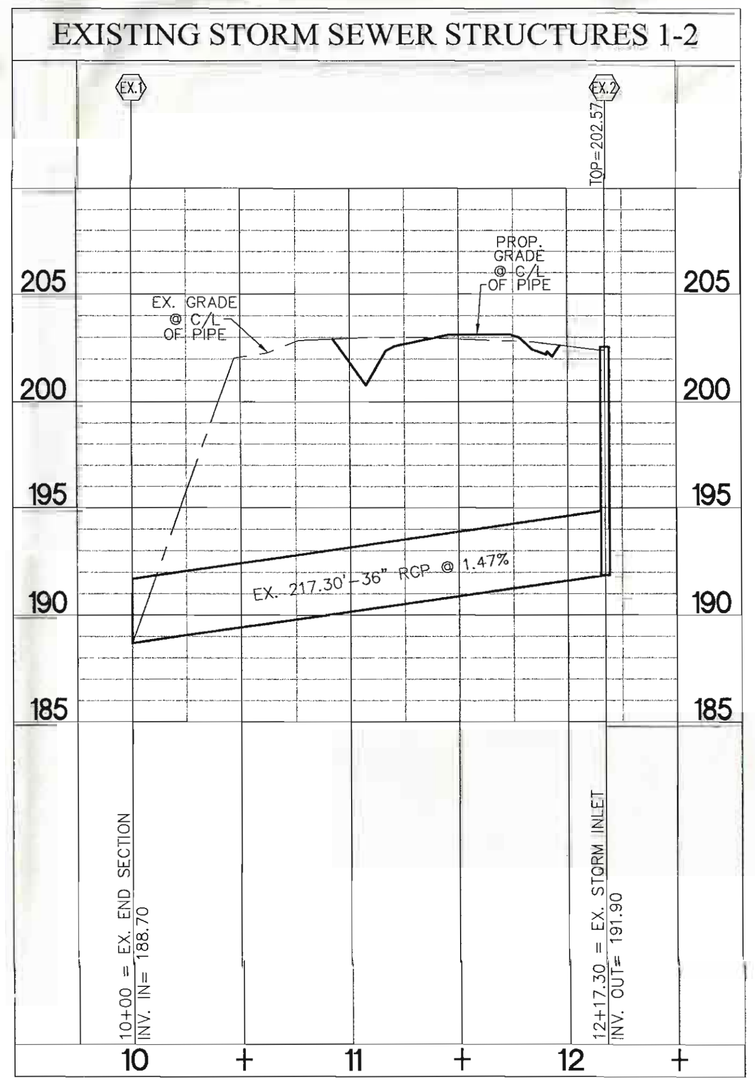
| FROM POINT | TO POINT | DRAIN. AREA "A" ACRES | RUNOFF COEFF. C | CA INCRE-MENT | INLET TIME MINUTES | RAIN FALL IN./HR. | RUNOFF Q, cfs INCRE-MENT | RUNOFF Q, cfs ACCUMU-LATED | INVERT ELEVATIONS UPPER END | INVERT ELEVATIONS LOWER END | LENGTH FT. | SLOPE FT/FT | DIA. IN. | CAPA-CITY C.F.S. | VEL-OCITY F.P.S. | FLOW TIME SEC. | TOP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 5 | 0.20 | 0.90 | 0.18 | 5 | 6.87 | 1.24 | 1.24 | 189.00 | 188.46 | 54 | 0.0100 | 15.00 | 6.46 | 4.07 | 13.28 | 192.19 |
| 5 | 4 | 0.20 | 0.90 | 0.18 | 5 | 6.87 | 1.24 | 2.47 | 188.21 | 187.80 | 54 | 0.0075 | 15.00 | 5.59 | 4.43 | 12.20 | 191.76 |
| 4 | 3 | 0.26 | 0.90 | 0.23 | 5 | 6.87 | 1.61 | 4.08 | 187.55 | 186.92 | 63 | 0.0100 | 15.00 | 6.46 | 5.58 | 11.36 | 191.40 |
| 3 | 2 | 0.27 | 0.90 | 0.24 | 5 | 6.87 | 1.67 | 5.75 | 186.67 | 185.67 | 50 | 0.0200 | 15.00 | 9.13 | 7.88 | 6.36 | 190.88 |
| 2 | 1 | 0.24 | 0.90 | 0.22 | 5 | 6.87 | 1.48 | 7.24 | 185.42 | 184.90 | 52 | 0.0100 | 18.00 | 10.50 | 6.42 | 8.03 | 189.69 |

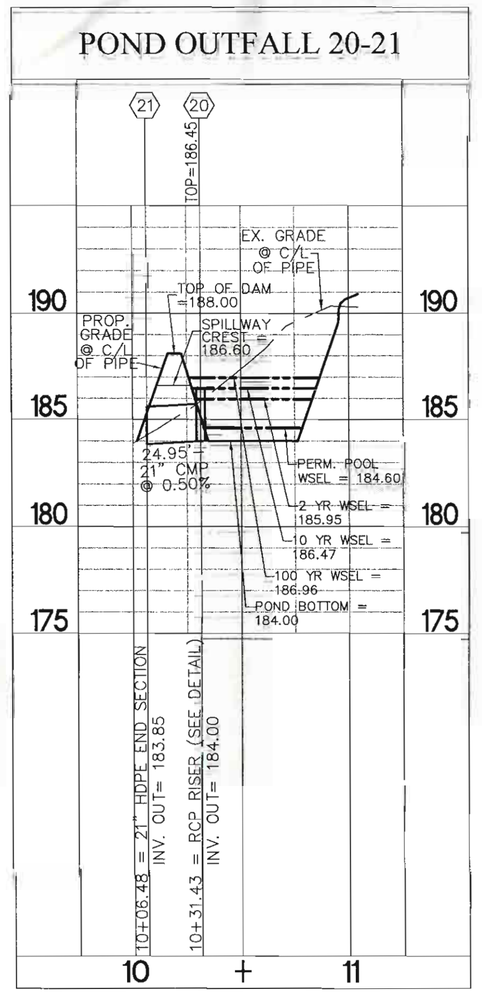
## HGL CALCULATIONS

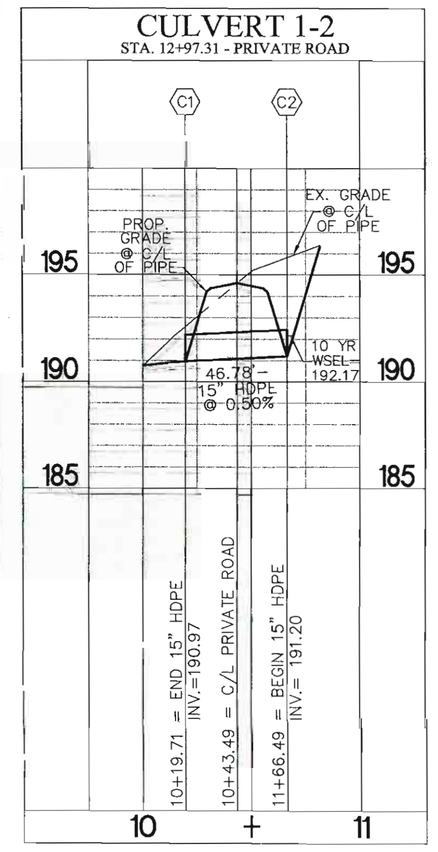
| INLET STA. | OUTLET WATER SURFACE ELEV. | DO | QO | LO | F OUT (FT/FT) | HF | | VO | Ho OUT | Q I | V I | Q IV I | V2I/2G | Hi IN | | Hd ANGLE | HT | 1.3*HT | OR 0.5*1.3*HT .5HT | FINAL H | INLET WATER SURFACE ELEV. | RIM/ THROAT ELEV. | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 189.47 | 15 | 1.24 | 54.0 | 0.0101 | 0.54 | | 4.07 | 0.06 | | | | | 0.00 | | 0.00 | 0.06 | 0.08 | 0.04 | 0.58 | 190.06 | 192.19 | OK-2.14 |
| 5 | 188.96 | 15 | 2.47 | 54.0 | 0.0075 | 0.41 | | 4.43 | 0.08 | | | | | 0.09 | | 0.00 | 0.17 | 0.22 | 0.11 | 0.52 | 189.47 | 191.76 | OK-2.29 |
| | | | | | | | | FROM | 6 | 1.24 | 4.07 | 5.03 | 0.26 | | 0.00 | | | | | | | | |
| 4 | 188.17 | 15 | 4.08 | 63.4 | 0.0101 | 0.64 | | 5.58 | 0.12 | | | | | 0.11 | | 0.00 | 0.23 | 0.30 | 0.15 | 0.79 | 188.96 | 191.40 | OK-2.44 |
| | | | | | | | | FROM | 5 | 2.47 | 4.43 | 10.95 | 0.30 | | 0.00 | | | | | | | | |
| 3 | 187.36 | 15 | 5.75 | 50.2 | 0.0079 | 0.40 | | 7.88 | 0.24 | | | | | 0.17 | | 0.23 | 0.64 | 0.83 | 0.41 | 0.81 | 188.17 | 190.88 | OK-2.71 |
| | | | | | | | | FROM | 4 | 4.08 | 5.58 | 22.78 | 0.48 | | 55.57 | | | | | | | | |
| 2 | 186.10 | 18 | 7.24 | 51.6 | 0.0101 | 0.52 | | 6.42 | 0.16 | | | | | 0.34 | | 0.64 | 1.14 | 1.48 | 0.74 | 1.26 | 187.36 | 189.69 | OK-2.34 |
| | | | | | | | | FROM | 3 | 5.75 | 7.88 | 45.35 | 0.97 | | 85.72 | | | | | | | | |

## INLET CALCULATIONS

| Inlet # | GRATE TYPE | TOP ELEV. | Drain. Area | C | CA | I in/hr | Q cfs | AREA | PERIM L | h WIER (INCHES) | H ORIF (INCHES) | H (INCHES) | WSEL (50%CLOGGED) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | ADS 15 H25 | 192.19 | 0.20 | 0.90 | 0.18 | 7.27 | 1.31 | 0.6 | 5.4 | 2.24 | 3.43 | 2.24 | 193.34 | WEIR |
| 5 | ADS 15 H25 | 191.76 | 0.20 | 0.90 | 0.18 | 7.27 | 1.31 | 0.6 | 5.4 | 2.24 | 3.43 | 2.24 | 192.90 | WEIR |
| 4 | ADS 15 H25 | 191.40 | 0.26 | 0.90 | 0.23 | 7.27 | 1.70 | 0.6 | 5.4 | 2.67 | 5.80 | 2.67 | 193.33 | WEIR |
| 3 | ADS 15 H25 | 190.88 | 0.27 | 0.90 | 0.24 | 7.27 | 1.77 | 0.6 | 5.4 | 2.73 | 6.25 | 2.73 | 192.97 | WEIR |
| 2 | ADS 15 H25 | 189.19 | 0.24 | 0.90 | 0.22 | 7.27 | 1.57 | 0.6 | 5.4 | 2.53 | 4.94 | 2.53 | 190.84 | WEIR |





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CHANTILLY, VIRGINIA 703-750-1460
LEESBURG, VIRGINIA 703-779-4464
400 SOUTH MAIN STREET SUITE 302 CULPEPER, VIRGINIA 22701 540-825-6055


COMMONWEALTH OF VIRGINIA
MARVIN T. HINCHEY NO. 017596
8-23-07
PROFESSIONAL ENGINEER

# VILLAGE SELF STORAGE

TOWN OF BOWLING GREEN – CAROLINE COUNTY, VA

STORM SEWER AND FORCE MAIN PROFILES

SCALE: H: 1"=50' V: 1"=5'

DATE: 05-18-2007

REVISIONS:
8-23-07

SHEET 5 OF 11

FILE NO. 7388

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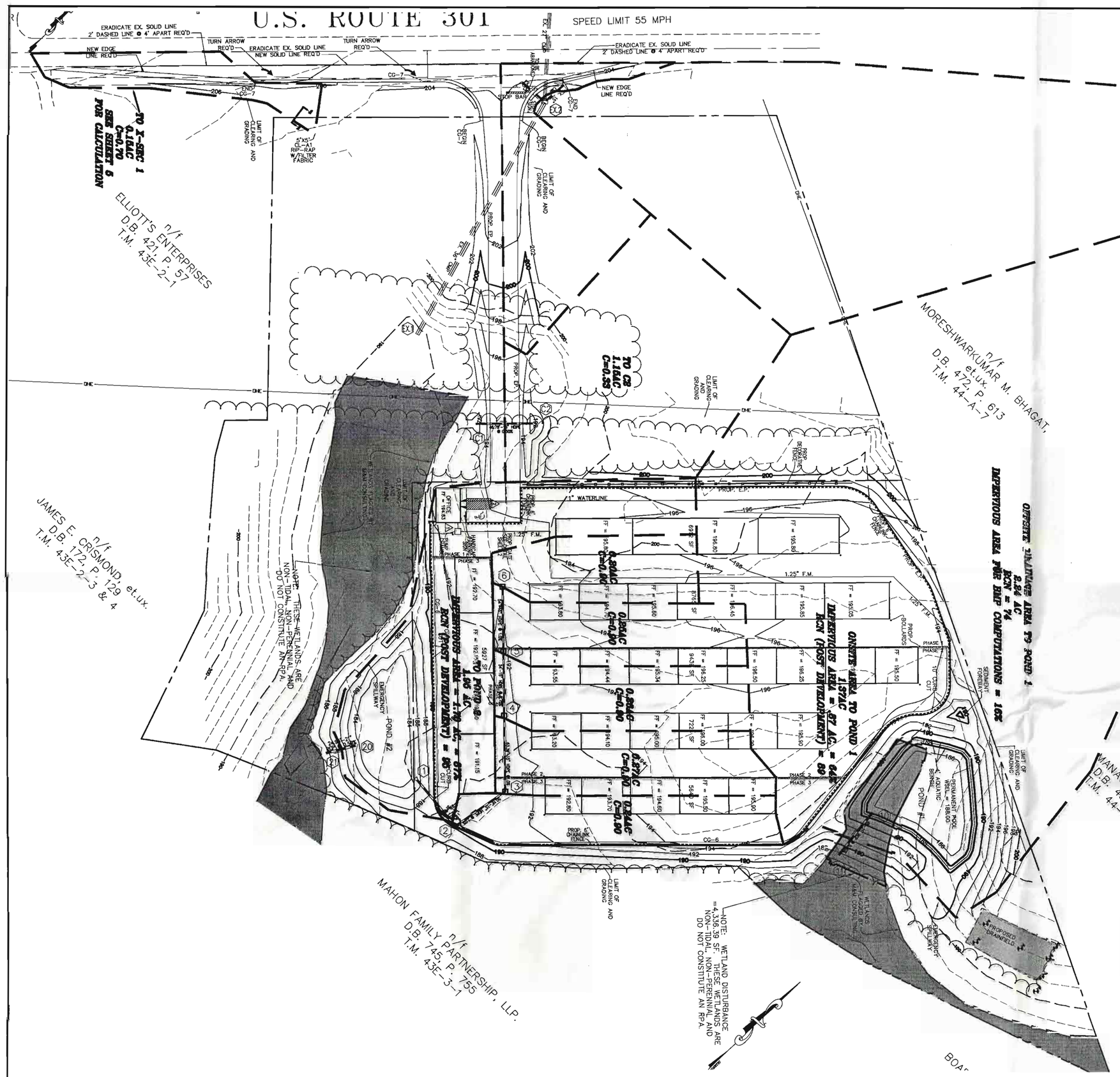
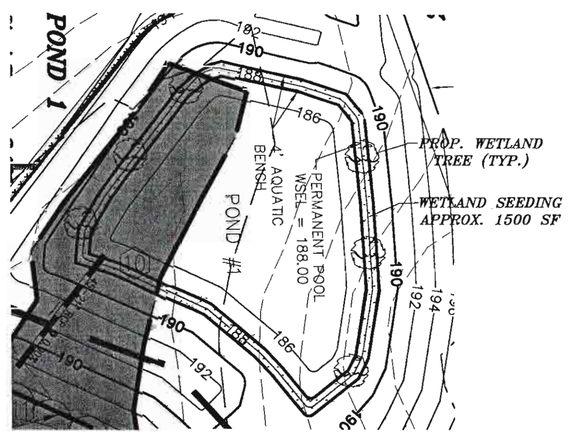



*AQUATIC BENCH PLANTING SPECIFICATIONS*

*SEEDING REQUIREMENTS*

| | |
|---|---|
| *30% FOX SEDGE* | *SEED* |
| *30% ARROW ARUM* | *SEED* |
| *30% SOFT STEM BULRUSH* | *SEED* |
| *10% CARDINAL FLOWER* | *SEED* |

*CONTRACTOR SHALL HYDROSEED MIX AT 40 LBS/ACRE.*
*GREEN DYED MULCH SHALL BE APPLIED AT 1200 LBS/ACRE.*

*PLANT REQUIREMENTS*

| | | |
|---|---|---|
| *3 EA* | *BUTTON BUSH* | *GAL* |
| *3 EA* | *BLACK WILLOW* | *GAL* |

*DISTRIBUTION SHALL BE RANDOM AMONG SPECIES. PLANTS SHALL BE LOCATED IN AREAS WITH LESS THAN 3" INUNDATION.*

## POND 1 BMP CALCULATIONS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| OFFSITE UNTREATED TO POND | 78.08 | 17.00% | 2.24 | 1.8592 | 0.83 lb/yr | 11 | no filter |
| ONSITE UNTREATED TO POND | 82.7591241 | 36.50% | 1.37 | 0.87 | 1.06 lb/yr | 12 | no filter |

| pond 1 area | tot imp | tot perv |
|---|---|---|
| 1.37 ac | 0.50 ac | 0.87 ac |
| percent impervious | 36.50% | |

| | predev | postdev |
|---|---|---|
| phosphorous | 0.61 lb/yr | 1.18 lb/yr |
| total removal rates | pond | 1.24 lb/yr |
| total | | 1.24 lb/yr |

| pond 1removal | |
|---|---|
| load to pond | 1.91 lb/yr |
| removed by pond | 1.24 lb/yr |

| bmp volume calculation | | forebay calculation | |
|---|---|---|---|
| total impervious | 0.88 ac | total impervious | 0.88 ac |
| bmp volume | 1598.65 cf | forebay volume | 319.73 cf |
| wet storage required (4x wqv) | 6394.61 cf | | |
| wet storage provided | 9368.00 cf | wet storage prov | 748.00 cf |
| wet storage wsel | 188.00 cf | | |

## POND 2 BMP CALCULATIONS

| | str.# | imp % | area tot | area perv | load in | load removed |
|---|---|---|---|---|---|---|
| stormpure filter | 6 | 100.00% | 0.20 | | 0.46 | 0.23 |
| stormpure filter | 5 | 100.00% | 0.20 | | 0.46 | 0.23 |
| stormpure filter | 4 | 100.00% | 0.26 | | 0.58 | 0.29 |
| stormpure filter | 3 | 100.00% | 0.27 | | 0.60 | 0.30 |
| stormpure filter | 2 | 100.00% | 0.24 | | 0.54 | 0.27 |
| ONSITE UNTREATED TO POND | | 67.95% | 0.78 | 0.25 | 1.14 lb/yr | no filter |

| pond 2 area | tot imp | tot perv |
|---|---|---|
| 1.95 ac | 1.70 ac | 0.25 ac |
| percent impervious | 87.18% | |

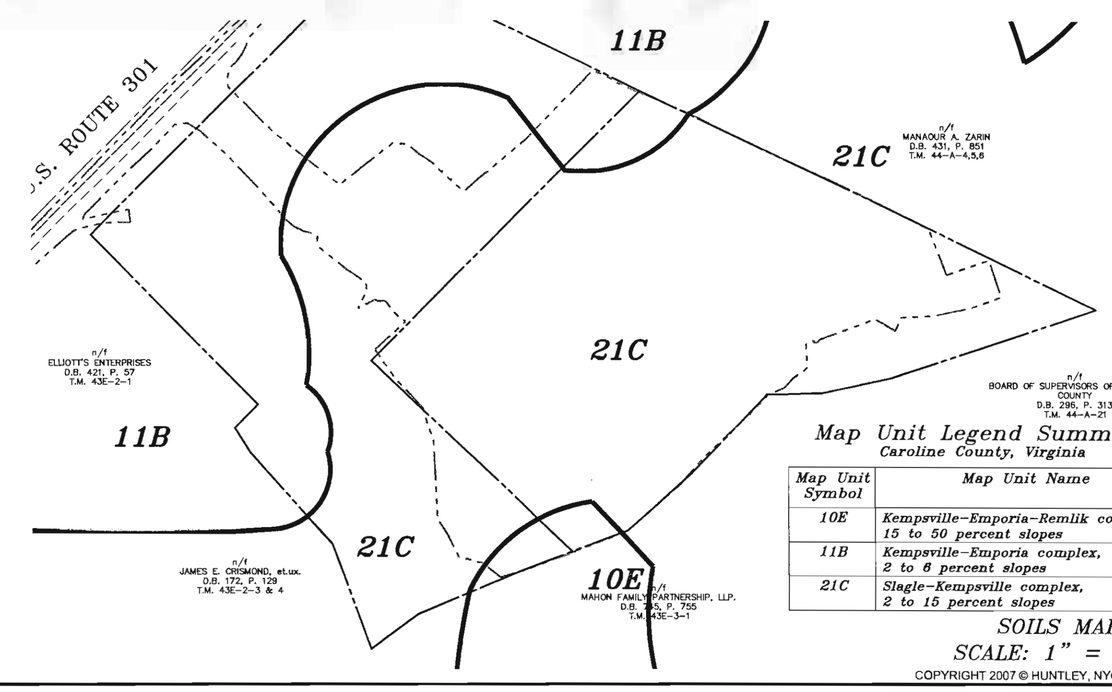
| | predev | postdev |
|---|---|---|
| phosphorous | 0.86 lb/yr | 3.71 lb/yr |
| total removal rates | | |
| | stormpure | 1.33 lb/yr |
| | pond | 0.86 lb/yr |
| total | | 2.19 lb/yr |

| pond 2 removal | |
|---|---|
| load | 3.79 lb/yr |
| phosphorous removed by filters | 1.33 lb/yr |
| load to pond | 2.46 lb/yr |
| removed by pond | 0.86 lb/yr |

| bmp volume calculation | |
|---|---|
| total impervious | 1.70 ac |
| water quality volume | 3085.50 cf |
| ext. det. vol. required (2x wqv) | 6171.00 cf |
| ext. det. vol. provided | 6540.00 cf |
| ext. det. vol. wsel | 185.20 |

## COMPLIANCE

| | predev | postdev |
|---|---|---|
| phosphorous | 1.47 lb/yr | 4.89 lb/yr |
| required removal | | 3.42 lb/yr |
| | stormpure | 1.72 lb/yr |
| | ponds | 1.96 lb/yr |
| total removed | | 3.69 lb/yr |
| compliance | | 3.69>3.42 SITE IS IN COMPLIANCE |




*Map Unit Legend Summary*
*Caroline County, Virginia*

| *Map Unit Symbol* | *Map Unit Name* |
|---|---|
| *10E* | *Kempsville–Emporia–Remlik complex, 15 to 50 percent slopes* |
| *11B* | *Kempsville–Emporia complex, 2 to 6 percent slopes* |
| *21C* | *Slagle–Kempsville complex, 2 to 15 percent slopes* |

*SOILS MAP*
*SCALE: 1" = 100'*

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540-825-6055

COMMONWEALTH OF VIRGINIA
MARVIN T. HINCHEY
NO. 017596
8-23-07
PROFESSIONAL ENGINEER

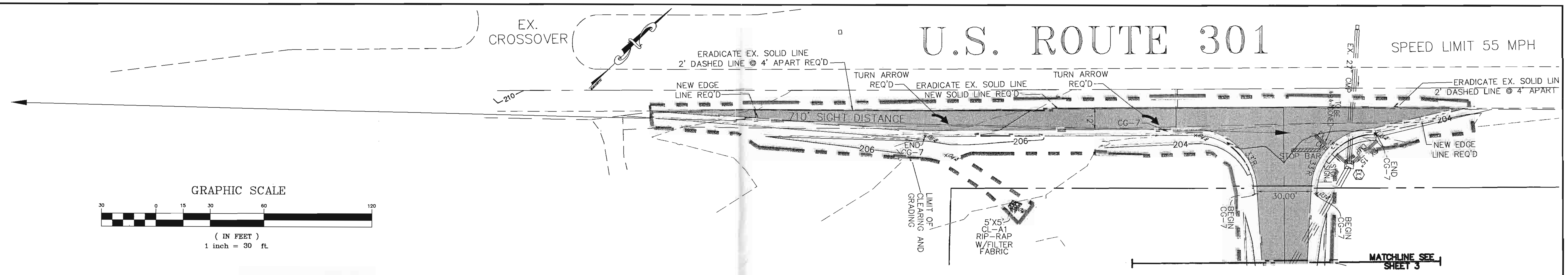
# VILLAGE SELF STORAGE

TOWN OF BOWLING GREEN - CAROLINE COUNTY, VA

BMP PLAN

SCALE: 1"=50'
DATE: 05-18-2007
REVISIONS: 8-23-07

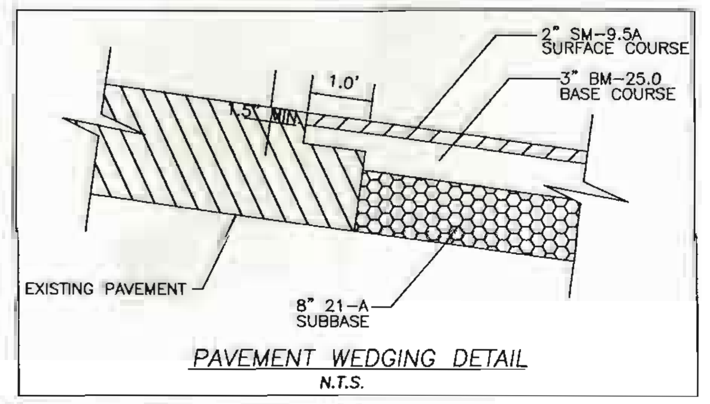
SHEET 4 OF 11
FILE NO. 7388



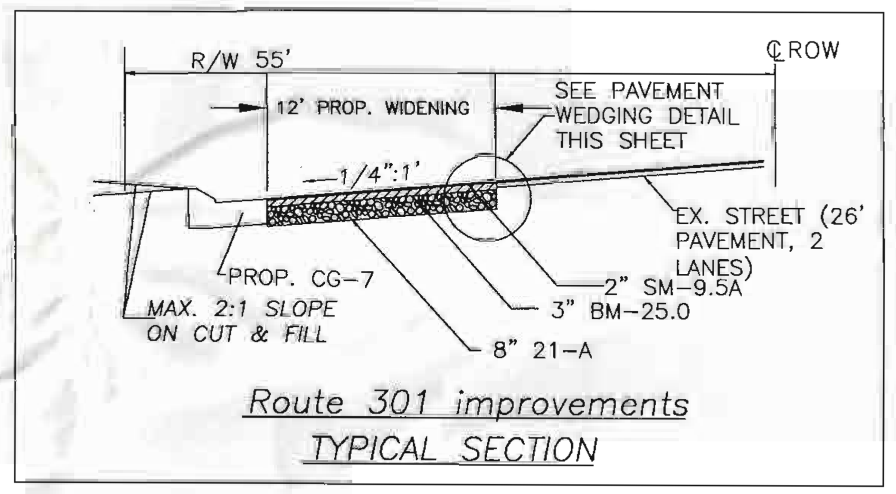

## CONSTRUCTION NOTES FOR VDOT

(REVISED MARCH 15, 2005)

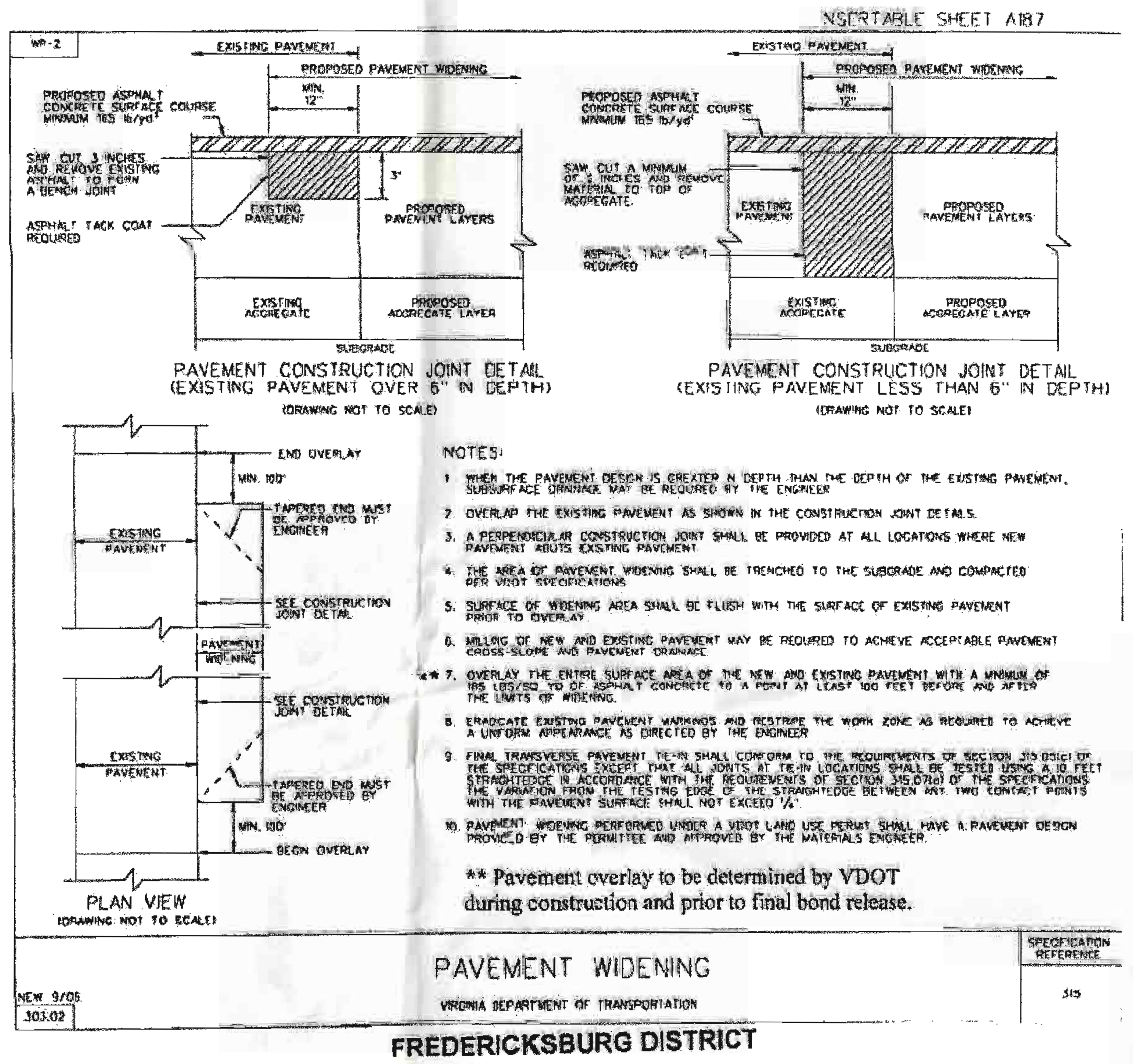
1. All work hereon shall be in strict accordance with the Standards and Specifications of the Virginia Department of Transportation (VDOT), Caroline County, and Town of Bowling Green Ordinances.
2. It is the intent of these drawings to show all necessary work. Any item of work not specifically shown, but necessary to eligibility for acceptance, is hereby implied.
3. A permit must be obtained from VDOT prior to starting any construction within the State Right–of–way.
4. The Contractor/owner shall perform CBR testing on the subgrade in accordance with VDOT Specifications by a certified geotechnical engineer to determine base and pavement designs and this information must be forwarded to VDOT and reviewed prior to placement of stone base.
5. The Contractor/owner must specify in writing to VDOT prior to construction the type of subbase, base, and pavement to be utilized on each street for each traffic group.
6. The Contractor shall notify VDOT 72 hours prior to placement of base materials and prior to the placement of asphalt material to ensure VDOT's ability to perform testing such as proof rolling, depth checks, compaction & contamination. Option: A certified analysis from a private engineer/testing firm maybe submitted within 7 work days of the required tests. 72 hours notice to VDOT is still required prior to each activity.
7. All culvert pipes shall be of a type approved by the Virginia Department of Transportation.
8. All entrance pipes for driveways shall be a minimum of 12" in diameter, unless otherwise specified by the plans. All private entrance (driveway) pipes shall be 30 foot in length for corrugated metal pipe and 28 feet for concrete pipes unless otherwise approved by VDOT. See road construction plans for proper size culvert.
9. Contractor to verify all dimensions and elevations in the field before starting construction and notify the design engineer and VDOT of any differences.
10. The contractor erected street signs shall conform to VDOT and Tonw of Bowling Green standards.
11. A minimum 25' pavement fillet radii is recammended. A pavement cross slope of 1/4":1' recommended.
12. Contractar shall do overlot grading as necessary to preclude the ponding of water adjacent to the roadway.
13. Slope easements will be required at all locations where the top of the cut or the toe of the fill exceeds the proposed dedication of right–of–way. See plat for exact location.
14. If running water is present in outlet channel during construction where ditch protection is required, the bottom of the channel shall be lined with rip–rap stone per the EC–1 standard further, EC–2 or EC–3 must have a minimum width of 4' fill sections and 5' cut sections.
15. Contractor shall be responsible to see that all erosion and sediment control standards are met and the Contractor to seed and mulch all disturbed areas along with all graded areas with the proposed right–of–way in accordance with VDOT specifications.
16. Final location of manholes, valves, fire hydrants, and other appurtenances shall not conflict with or constrict roadside drainage. Contractor shall adjust manholes and/or ditch alignment to insure proper roadside drainage compatible with existing field conditions.
17. VDOT will require density tests from a certified engineer for all culvert installations 36" or larger.
18. Video inspection on all storm sewer systems may be required prior to final construction approval. VDOT inspector must be present during video taping process.
19. The contractor must contact VDOT Traffic Engineering Department at (540)899–4540 prior to construction within 1000' of a signalized intersection.
20. The final footage and location for VDOT standard guardrail to be established prior to completion of the fine grading by joint inspection with contractor, VDOT and the owner representative.
21. Whenever tying into existing roadway a1–foot milled joint and overlay of surface material is required.
22. Overlay may be required in order to obtain desirable cross–slope.
23. All storm structures shall have IS–1 invert shaping and SL–1's will be placed in structures at appropriate locations.



PAVEMENT WEDGING DETAIL
N.T.S.



Route 301 improvements
TYPICAL SECTION




**SUBDIVISION & COMMERCIAL ENTRANCE WORKSHEET FOR FOUR-LANE DIVIDED HIGHWAYS**

ENTRANCE LOCATION: Village Self-Storage off Rt. 301 in Bowling Green

ENTER / SELECT ALL KNOWN CRITERIA:

- HIGHWAY POSTED SPEED (MPH): 55
- HIGHWAY TRAFFIC VOLUME (VPD): 3,000
- HIGHWAY FUNCTIONAL CLASSIFICATION: PRINCIPAL ARTERIAL HIGHWAY
- TRAFFIC GENERATED BY SITE (VPD): 112
- IS THERE AN EXISTING OR PROPOSED CROSSOVER AT THIS LOCATION? (YES OR NO): NO
- NO DATA ENTRY REQUIRED (Box Should Be Empty)

MINIMUM CROSSOVER SPACING = N/A

LEFT TURN LANES
MINIMUM LEFT TURN STORAGE LANE = N/A
MINIMUM LEFT TURN TAPER = N/A

Remarks (Optional):

SITE ACCESS GUIDELINES CATEGORY = C

MIN. ENTR. RADIUS = 25'
MIN. CONN. RADIUS = 50'
MIN. INT. SIGHT DIST. = 775'
(Design Speed = Posted Speed plus 5 MPH)

RIGHT TURN LANE*
MIN. TAPER = 150'
MIN. DECEL = 100'

* See "Min. St'ds. of Entrs. to State Highways" for additional Entrance Requirements

FULL FRONTAGE DEVELOP. REQ'D.? NO

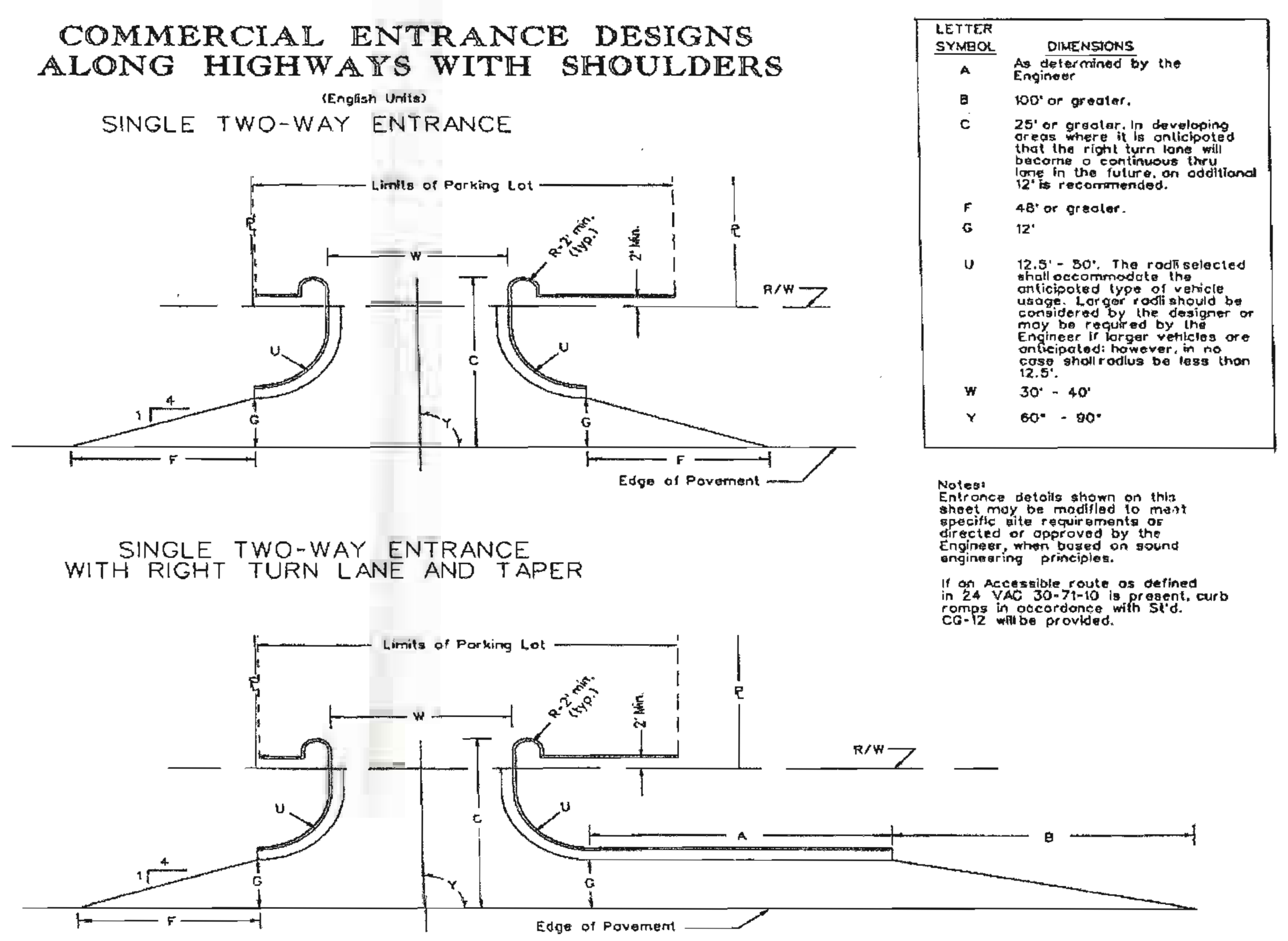
Click Here for Traffic Engineering Data

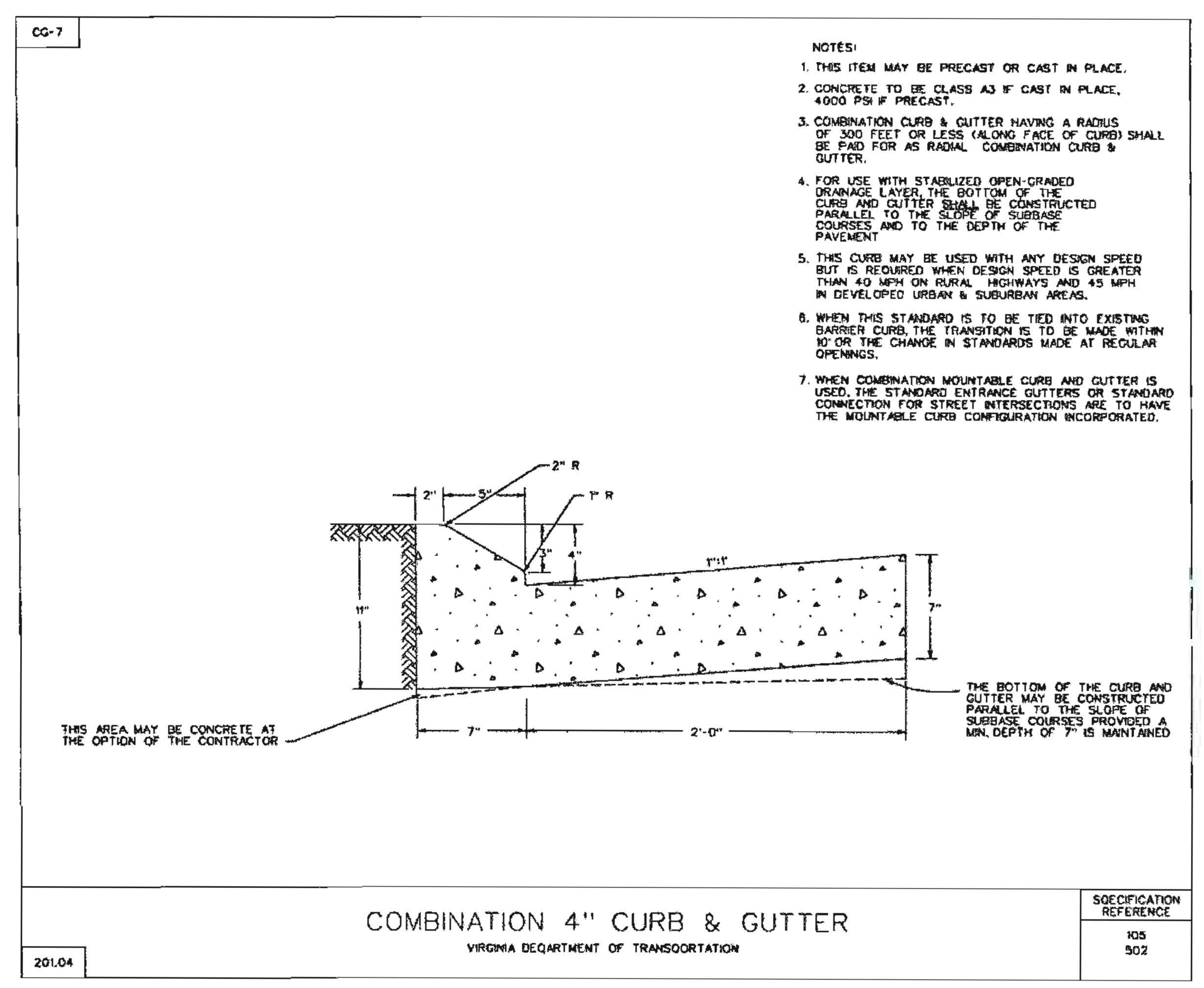
NOTES:
1. Data MUST be entered in ALL Applicable "KNOWN CRITERIA" Cells ("Boxes")
2. Use "Tab" Key to move to next Cell
3. Select Printer Icon to Print

© VDOT SPH 12/01/04 Release 3.1

*Virginia Department of Transportation*

*Minimum Standards of Entrances to State Highways*




Huntley, Nyce & Associates, Ltd.
SURVEYING – CIVIL ENGINEERING – LAND PLANNING
400 SOUTH MAIN STREET
SUITE 302
CULPEPER, VIRGINIA 22701
540–825–6055
ARLINGTON, VIRGINIA 703–532–4924
CHANTILLY, VIRGINIA 703–750–3490
LEESBURG, VIRGINIA 703–779–4905

COMMONWEALTH OF VIRGINIA
MARVIN T. HINCHEY
NO. 017596
8-30-07
PROFESSIONAL ENGINEER

# VILLAGE SELF STORAGE

TOWN OF BOWLING GREEN – CAROLINE COUNTY, VA

RT. 301 IMPROVEMENTS PLAN

SCALE: 1"=30'
DATE: 05–18–2007
REVISIONS: 8–2–07, 8–30–07
SHEET 3A OF 11
FILE NO. 7388

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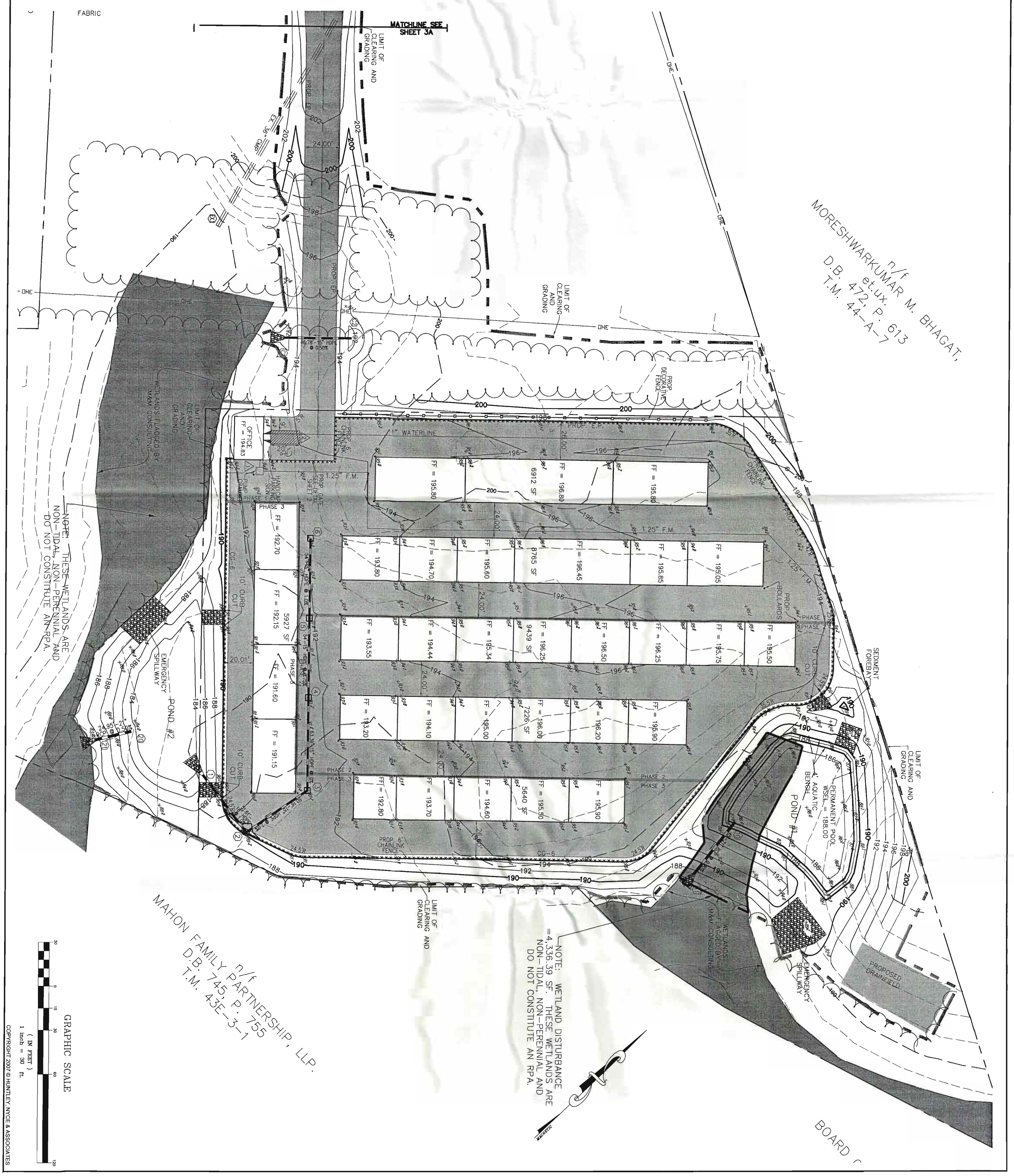


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SCALE: 1"=30'
DATE: 05-18-2007
REVISIONS:
8-2-07
8-23-07

SHEET 3 OF 11
FILE NO. 7388

# VILLAGE SELF STORAGE

TOWN OF BOWLING GREEN – CAROLINE COUNTY, VA

## GRADING PLAN

COMMONWEALTH OF VIRGINIA
MARVIN T. HINCHEY
NO. 017596
8-23-07
PROFESSIONAL ENGINEER

*Huntley, Nyce & Associates, Ltd.*
SURVEYING – CIVIL ENGINEERING – LAND PLANNING

400 SOUTH MAIN STREET
SUITE 302
CULPEPER, VIRGINIA 22701
540-825-6055

ARLINGTON, VIRGINIA
703-532-4924

CHANTILLY, VIRGINIA
703-750-3490

LEESBURG, VIRGINIA
703-779-4905

**CONSTRUCTION NOTES FOR VDOT** (REVISED MARCH 15, 2005)

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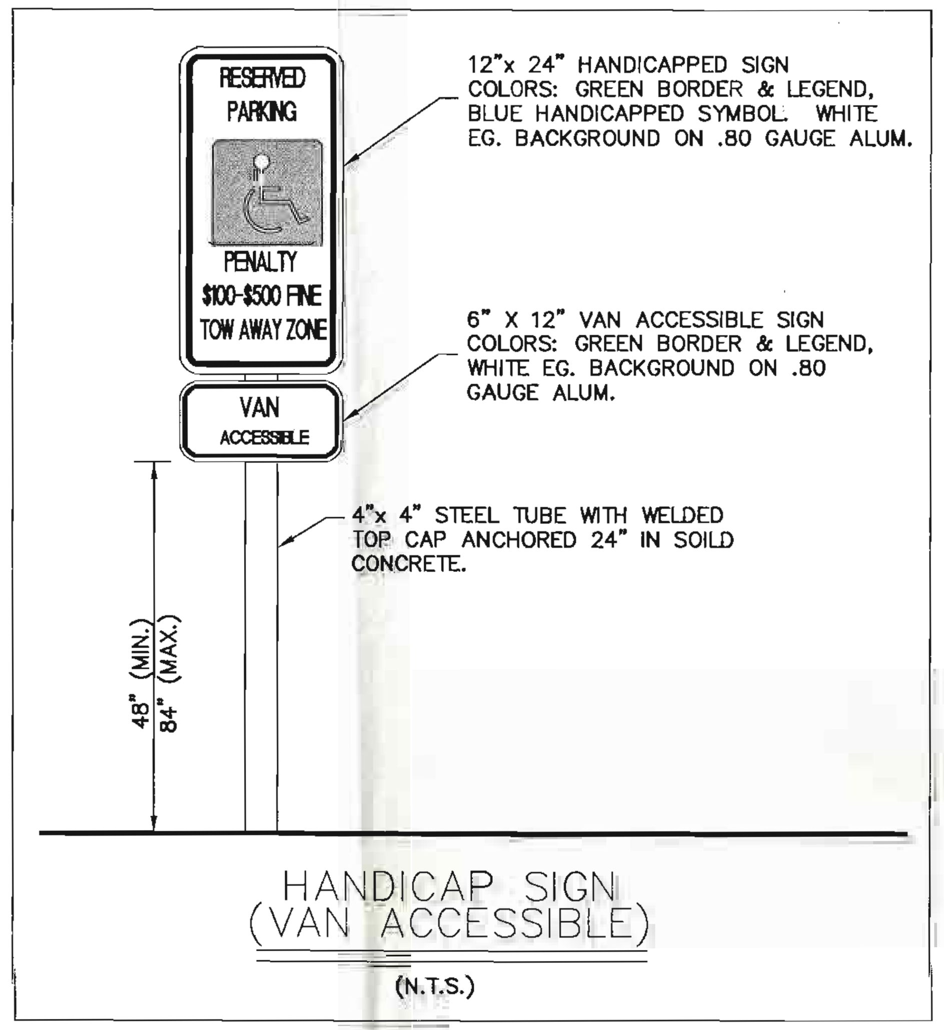
23. All storm structures shall have IS-1 invert shaping and SL-1's will be placed in structures at appropriate locations.

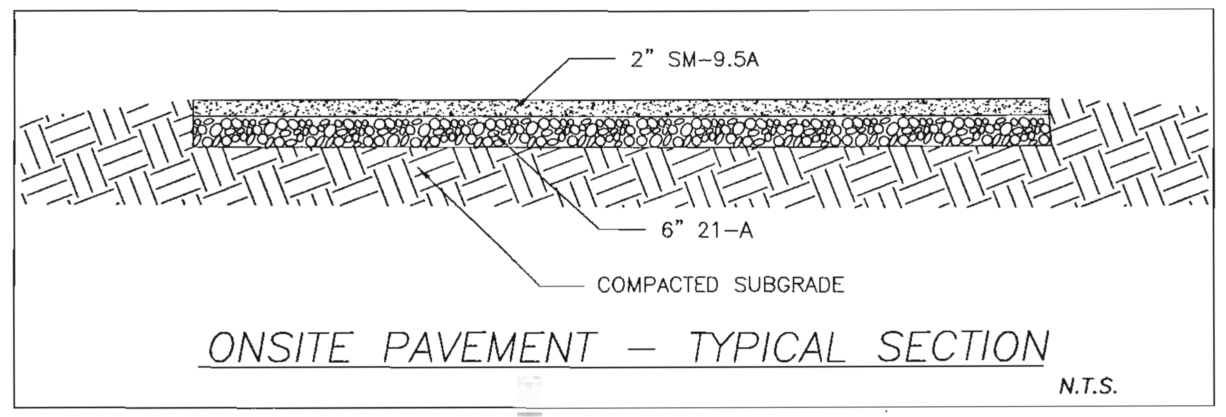
## ABBREVIATION LIST

| | |
|---|---|
| ABP | ANGLE OF BULK PLANE |
| BM | BENCHMARK |
| CO | CLEAN OUT |
| CONC. | CONCRETE |
| D.B. | DEED BOOK |
| D.I.P. | DUCTILE IRON PIPE |
| DWG | DRAWING |
| ELEC. | ELECTRICAL |
| ELEV. | ELEVATION |
| EP | EDGE OF PAVEMENT |
| ESMT. | EASEMENT |
| EX., EXIST. | EXISTING |
| FCCD | FAUQUIER COUNTY COMMUNITY DEVELOPMENT |
| FCDPR | FAUQUIER COUNTY DEPARTMENT OF PARKS AND RECREATION |
| FCWSA | FAUQUIER COUNTY WATER AND SANITATION AUTHORITY |
| FH | FIRE HYDRANT |
| G | GAS |
| HP | HIGH POINT |
| INV | INVERT |
| IPF | IRON PIPE FOUND |
| IPS | IRON PIPE SET |
| JB | JUNCTION BOX |
| LP | LIGHT POLE, LOW POINT |
| MH | MANHOLE |
| MUTCD | MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES |
| OHE | OVERHEAD ELECTRICAL |
| P/P | POWER POLE |
| PFM | PUBLIC FACILITIES MANUAL |
| PG | PAGE |
| PKNF | PK NAIL FOUND |
| PVC | POLYVINYL CHLORIDE |
| R/W, R.O.W. | RIGHT OF WAY |
| RCP | REINFORCED CONCRETE PIPE |
| RPA | RESOURCE PROTECTION AREA |
| RTE. | ROUTE |
| S/W | SIDEWALK |
| SAN. SEW. | SANITARY SEWER |
| SF | SQUARE FEET |
| STD. | STANDARD |
| STM. DRN., STM. SEW. | STORM DRAIN |
| SWM | STORMWATER MANAGEMENT |
| TC | TOP OF CURB |
| TRANS. | TRANSFORMER, TRANSITION |
| UGE | UNDERGROUND ELECTRICAL |
| USGS | UNITED STATES GEOLOGICAL SURVEY |
| VDOT | VIRGINIA DEPARTMENT OF TRANSPORTATION |
| VEPCO | VIRGINIA ELECTRIC POWER COMPANY |
| W/L, W/M | WATER LINE, WATER MAIN |
| WTP | WATER TREATMENT PLANT |
| ZO | ZONING ORDINANCE |




HANDICAP SIGN (VAN ACCESSIBLE)

(N.T.S.)




ONSITE PAVEMENT – TYPICAL SECTION

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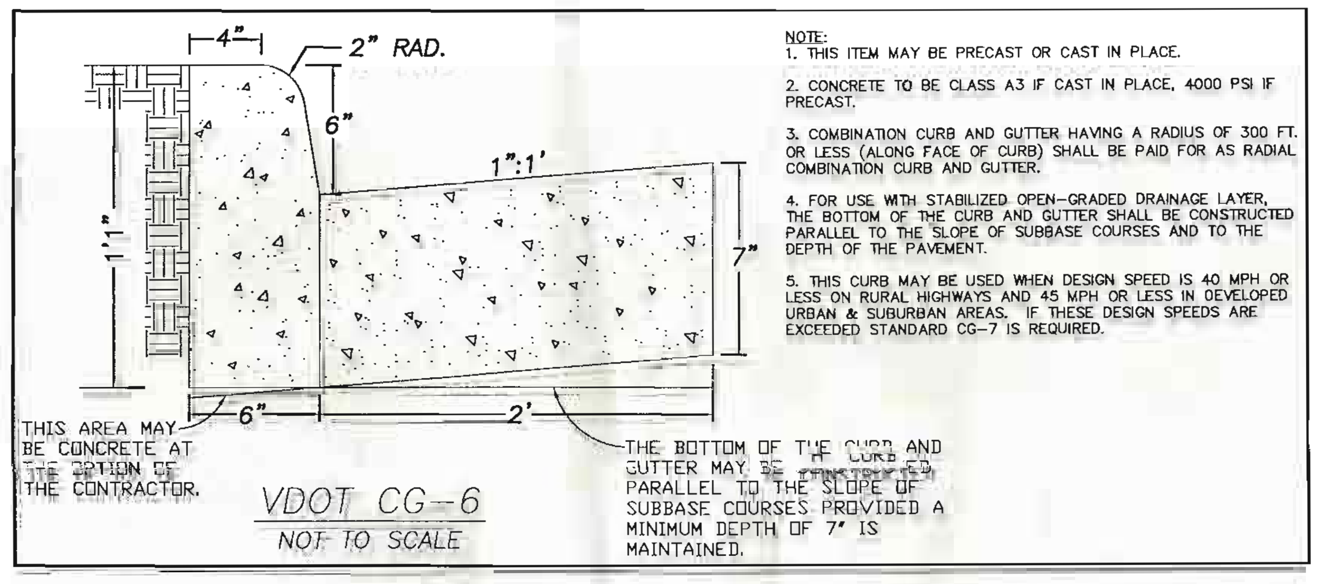
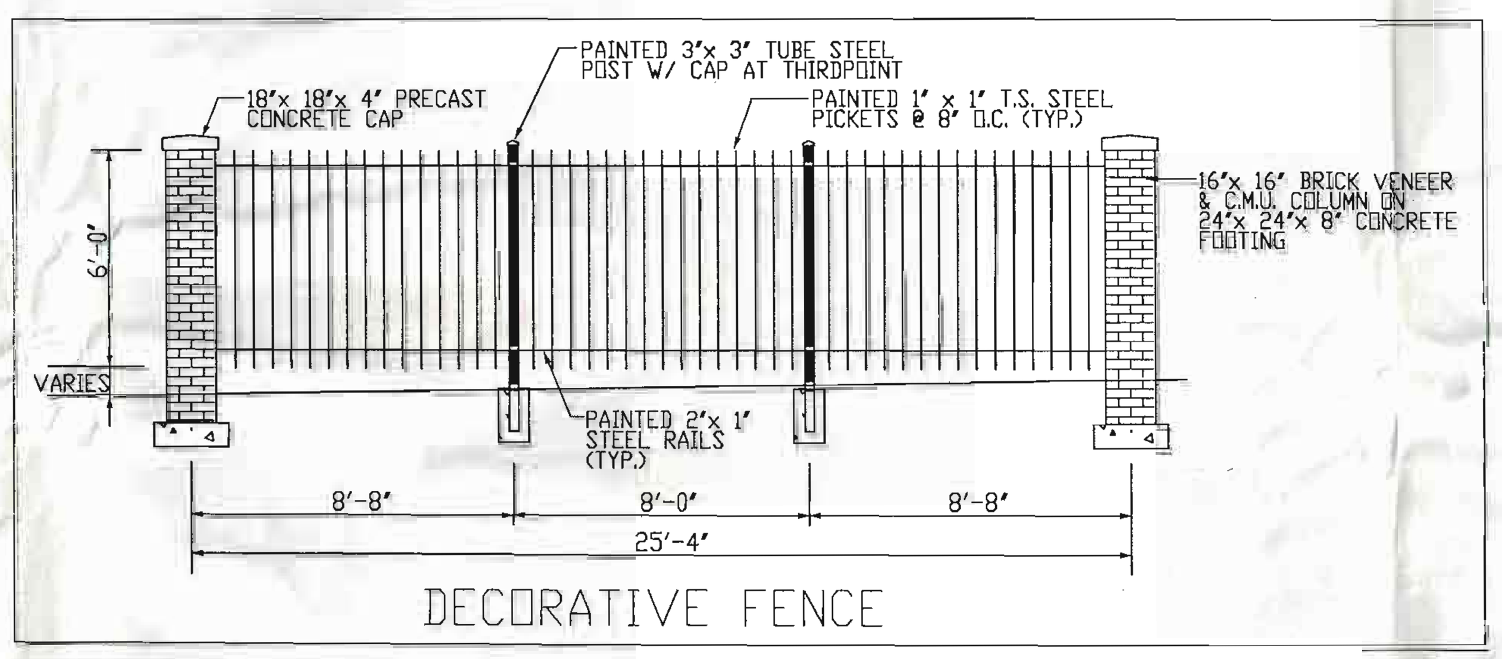
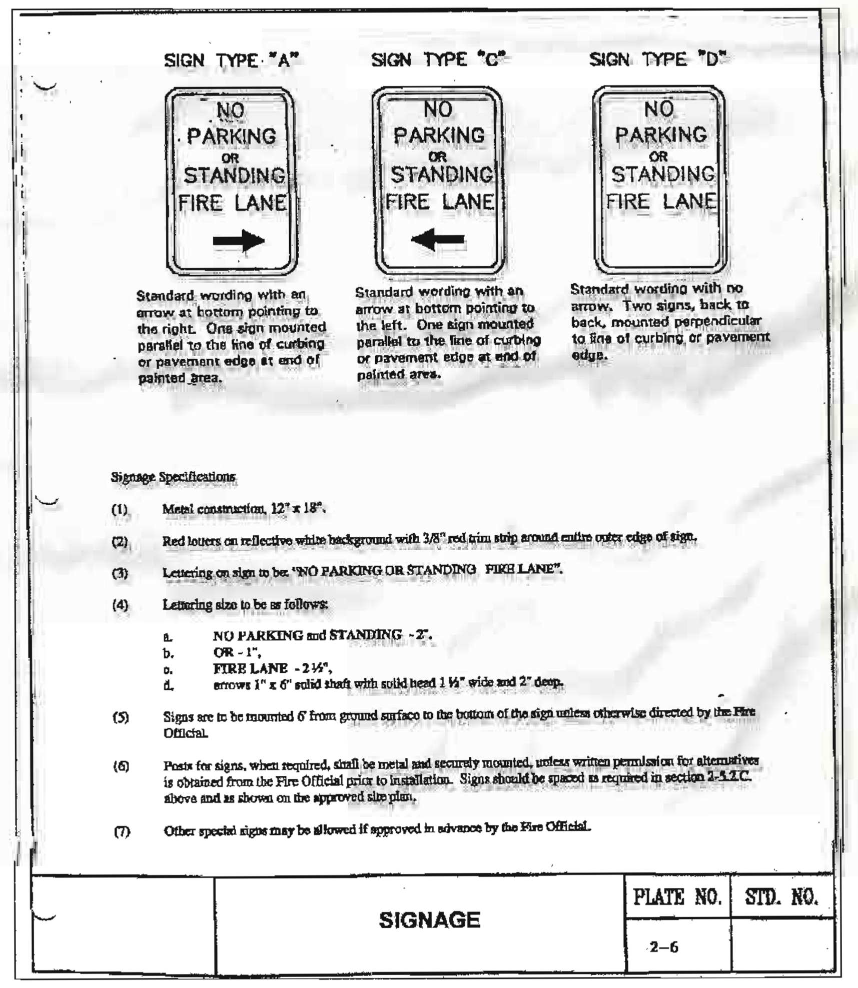


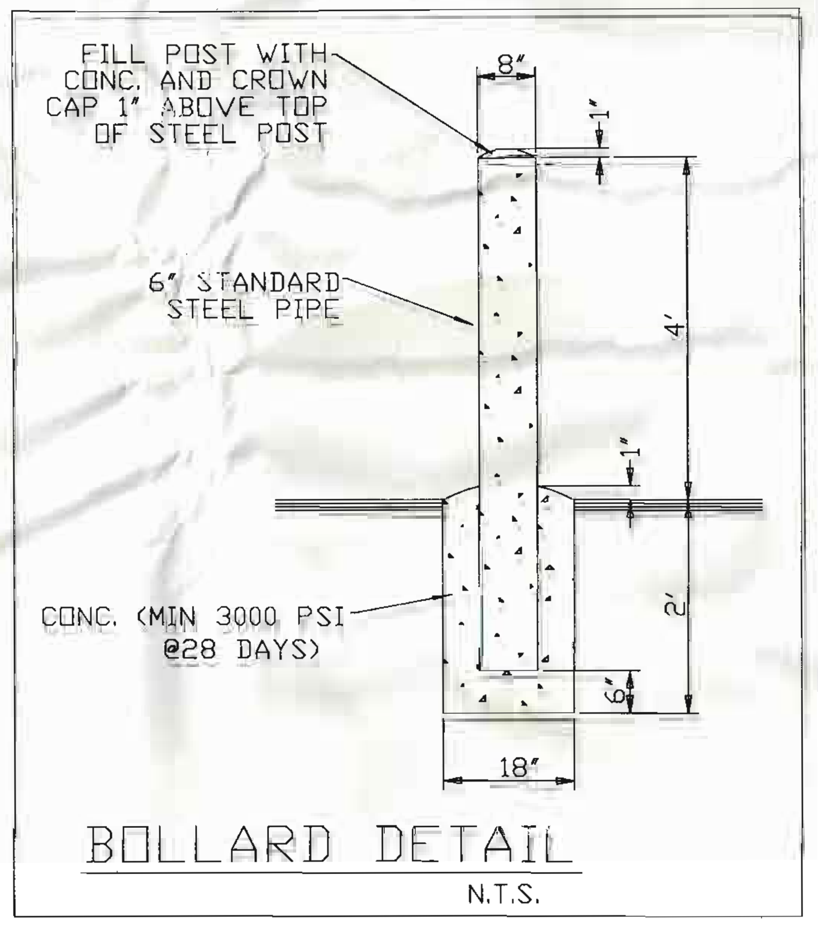

VDOT CG-6

NOT TO SCALE



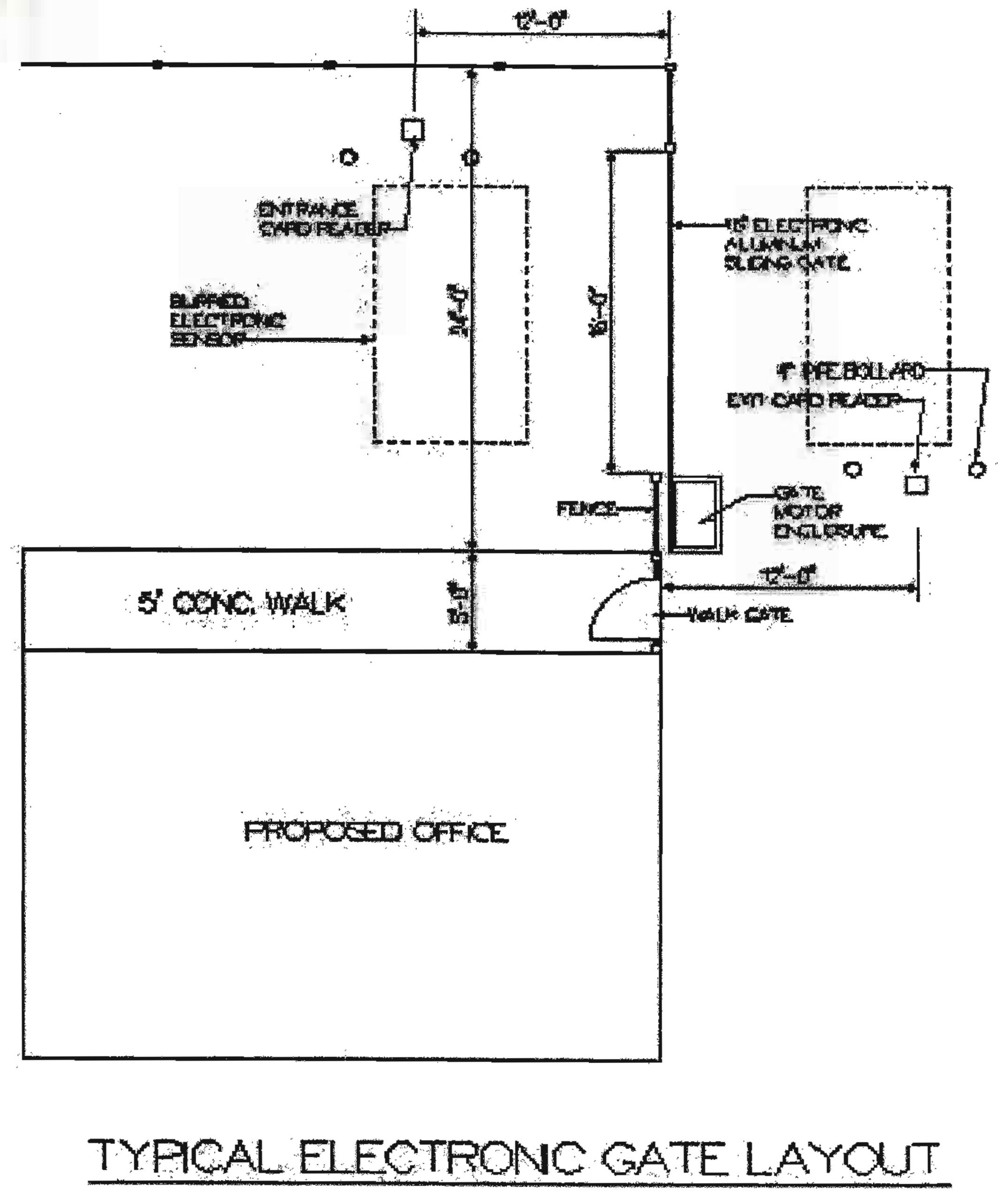

DECORATIVE FENCE



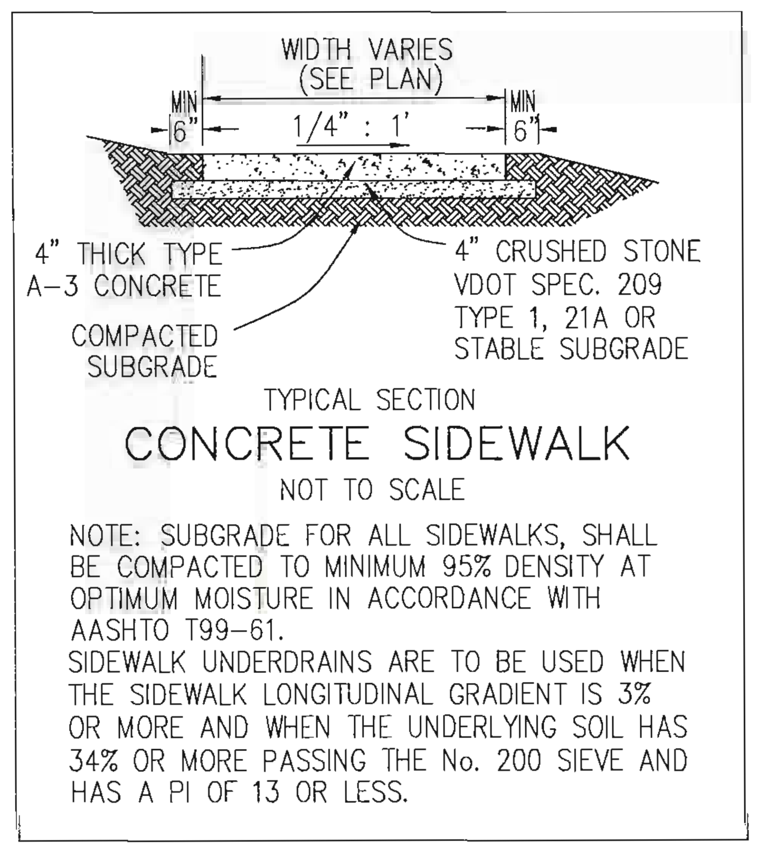




BOLLARD DETAIL

N.T.S.




TYPICAL ELECTRONIC GATE LAYOUT




TYPICAL SECTION

CONCRETE SIDEWALK

NOT TO SCALE

NOTE: SUBGRADE FOR ALL SIDEWALKS, SHALL BE COMPACTED TO MINIMUM 95% DENSITY AT OPTIMUM MOISTURE IN ACCORDANCE WITH AASHTO T99-61.
SIDEWALK UNDERDRAINS ARE TO BE USED WHEN THE SIDEWALK LONGITUDINAL GRADIENT IS 3% OR MORE AND WHEN THE UNDERLYING SOIL HAS 34% OR MORE PASSING THE No. 200 SIEVE AND HAS A PI OF 13 OR LESS.


Huntley, Nyce & Associates, Ltd.
SURVEYING – CIVIL ENGINEERING – LAND PLANNING
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SUITE 302
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ARLINGTON, VIRGINIA 703-532-4924
CHANTILLY, VIRGINIA 703-750-3490
LEESBURG, VIRGINIA 703-779-4905

# VILLAGE SELF STORAGE

TOWN OF BOWLING GREEN – CAROLINE COUNTY, VA

NOTES AND DETAILS

SCALE: N/A

DATE: 05-18-2007

REVISIONS:
8-2-07
8-30-07

SHEET 2 OF 11

FILE NO. 7388

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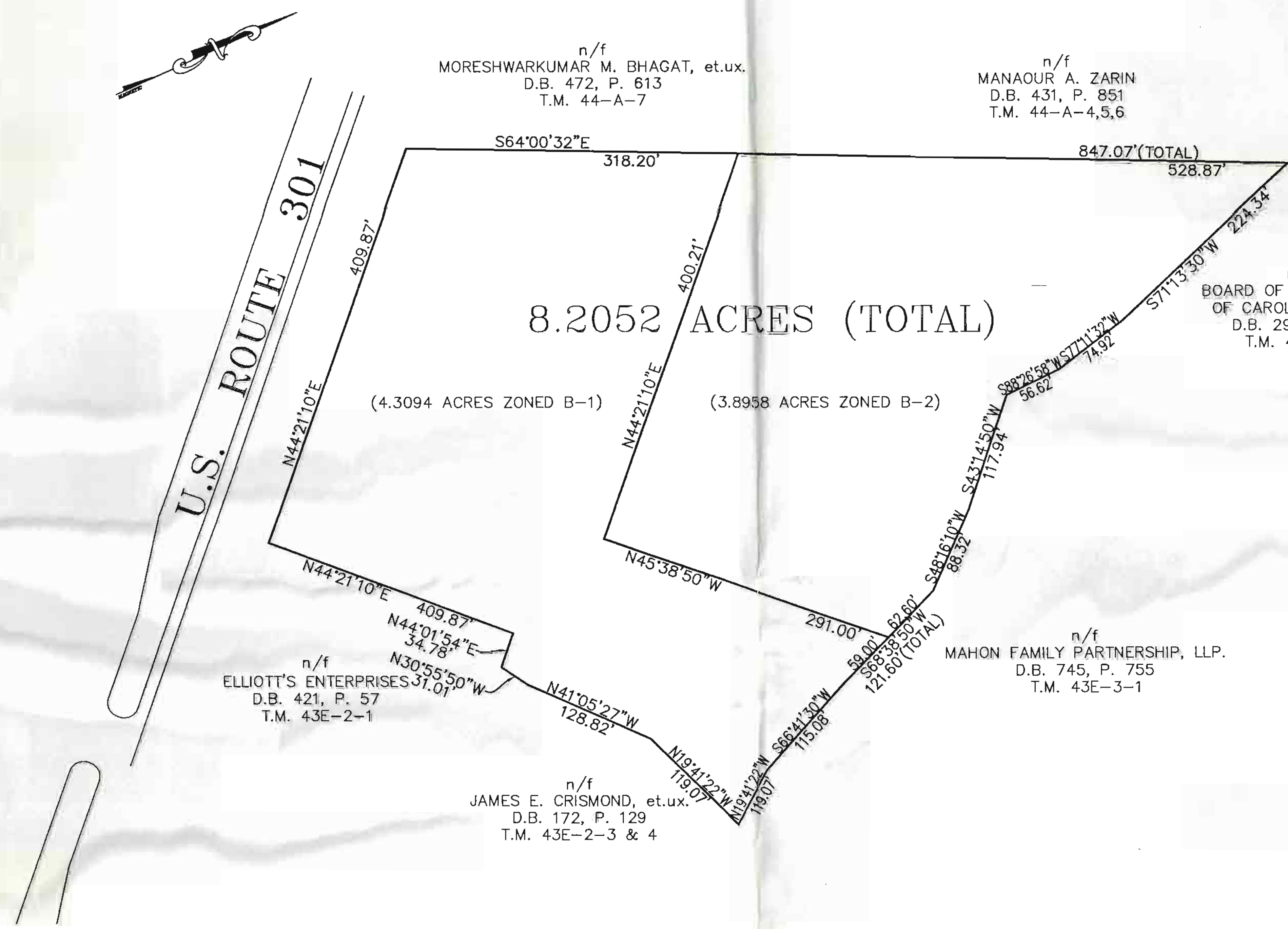
# SITE PLAN FOR
# VILLAGE SELF STORAGE
## TOWN OF BOWLING GREEN
## CAROLINE COUNTY, VIRGINIA

## GENERAL NOTES

1. All construction shall conform to existing State and County building codes. It is the contractor's responsibility to be aware of all applicable standards and specifications as well as required methods of construction. The contractor shall furnish all materials, labor, and equipment to perform all work, including restoration, for the completed installation of all improvements shown hereon or implied as necessary to complete the proposed improvements.
2. Miss Utility of Virginia (800-552-2001) shall be contacted by the contactor at lest 48 hours prior to beginning excavation. The contractor or his agent shall be responsible for digging test pits to determine the exact location of any existing underground utilities prior to the beginning of construction. In particular, test pits adjacent to existing high pressure gas mains shall be performed in the presence of a gas company representative and shall be hand dug according to their instruction. Utilities shown hereon are based on available information.
3. No title report was furnished. However, this property is subject to any existing easements, covenants and servitudes of record.
4. All erosion and sediment control practices shall be constructed and maintained in accordance with the minimum standards and specifications of the 1992 Virginia Erosion and Sediment Control Handbook and County ordinances, as amended. Removal of said controls shall be authorized by County inspector but, at least, shall not be removed until permanent vegetative cover is established on all denuded areas.
5. Construction should be sequenced so that grading operations can begin and end as quickly as possible. Sediment trapping measures, such as silt fences, shall be installed and made functional before any land disturbing activity begins.
6. Prior to development, the limits of clearing shall be clearly marked on the property and suitable protective barriers shall be erected five (5) feet outside the dripline of any tree or stand of trees to be preserved within 100 feet of the construction footprint. The barriers shall remain erected throughout all phases of construction. The storage of equipment, materials, debris or fill shall not be allowed with the area protected by the barrier.
7. No subsurface investigation has been performed by Huntley, Nyce & Associates Ltd. to attest to the soil conditions or the presence of toxic or contaminated waste.
8. It shall be the responsibility of the contractor or developer to have sufficient soils and foundation testing performed to determine that the support values and C.B.R.'s are adequate for the standards shown on this plan.
9. All construction involving problem soils must be performed under the full-time inspection of a professional geotechnical engineer.
10. The proposed project shall be served by private well and septic.
11. Stormwater Management and Best Management Practices for this project are addressed on this plan.
12. The contractor shall perform necessary grading to preclude the ponding of water on roadways and buildable areas.
13. There are no known gravesites on this site. In the event gravesites are discovered during construction, the Town Planning Office should be notified immediately. All activities must cease and shall not resume until authorization to proceed is granted by the Town Planning Office. Gravesites shall be protected in accordance with state law.
14. Prior to clearing and grading on slopes 25% or greater, all surface drainage will be routed away from the area to be graded.
15. All fill materials and their subgrade will be approved by the soils engineer for this site.
16. All wetland permits required by federal, state, and local laws and regulations shall have been obtained prior to initiating grading or any other on-site land disturbing activity.
17. The developer shall be responsible for the relocation of any utilities which is required as a result of this project. The relocation should be done prior to construction.
18. The developer shall be responsible for any damage to the existing streets and utilities which occurs as a result of this project within or contiguous to the existing right-of-way.
19. Site lighting meeting standards of the Town of Bowling Green shall be provided on each building.
20. Road improvements shall be in conformance with standards and specifications of the Virginia Department of Transportation.
21. Water service to be provided by private onsite well and sanitary sewerage to be provided by private onsite drainfield.
22. All refuse must be disposed of at County or Town-approved disposal sites.
23. Prior to the issuance of a Certificate of Occupancy, all stockpiled materials, including but not limited to stumps, brush, and construction debris shall be removed from the property and disposed of in accordance with any state or federal regulations.
24. Contractor shall seed or mulch all denuded or disturbed areas in accordance with Virginia Erosion & Sediment Control Regulations Standards MS-1, MS-2, and MS-3.
25. No burning of construction or demolition materials on site.
26. There are no known RPAs on site.
27. There are no known historic buildings or features on site.
28. On-site storage of flammable, hazardous or noxious materials is prohibited.
29. No portion of the land hereon is located in the F.I.R.M. 100-year special floodplain area zone "A", as indicated on Flood Insurance Rate Map (FIRM) number 510249-0100B, effective date: August 18, 1989. However, this land is located in zone "X" (areas outside of the 500-year floodplain).
30. The site will be served by a private trash collection.



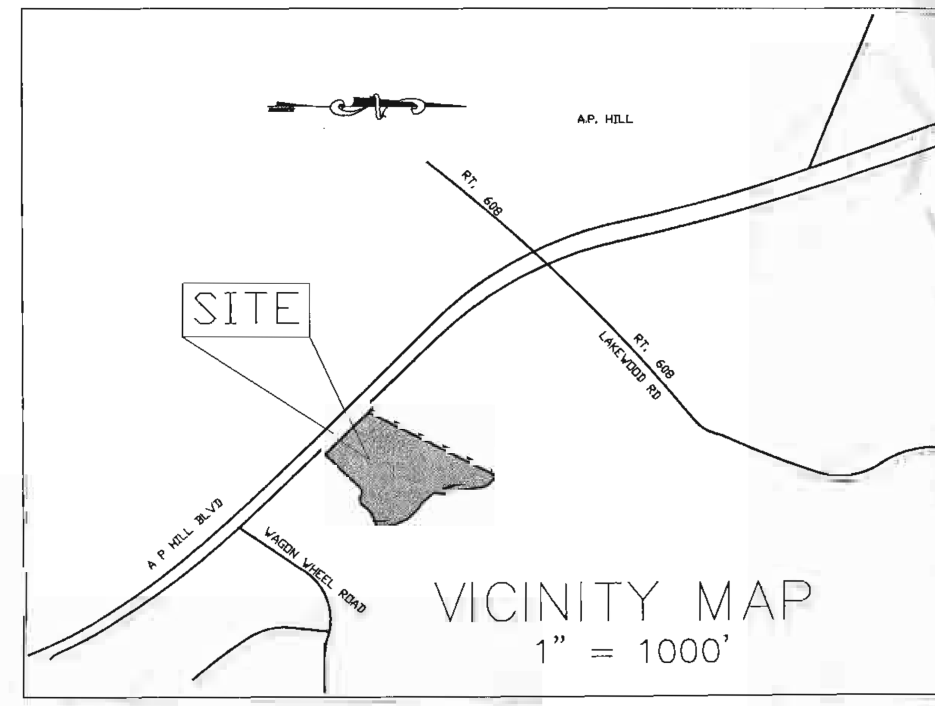

*BOUNDARY DATA*
*1" = 100'*

**TOWN OF BOWLING GREEN SIGNATURE BLOCK**

PLANNING COMMISSION CHAIRMAN ________ DATE

**RESPONSIBLE LAND DISTURBER**
(RLD)

NAME:
ADDRESS:
TELEPHONE:
CERTIFICATE: #
VALID THROUGH:




*VICINITY MAP*
*1" = 1,000'*

**SITE PLAN NOTES**

1. SITE IDENTIFICATION - TAX MAP NUMBER 43-A-45
2. SITE AREA = 3.89 ACRES
3. THIS SITE PLAN WILL DISTURB APPROXIMATELY 3.02 ACRES
4. OWNER/APPLICANT: VILLAGE SELF STORAGE II, L.L.C. P.O. BOX 356 LADYSMITH, VA 22501
5. PROPOSED DEVELOPMENT: 1 OFFICE BUILDING AND 6 STEEL-FRAME SELF STORAGE BUILDINGS. BUILDING 'A' SHALL HAVE A BRICK VENEER FACADE PER REZONING CONDITIONS. GROSS FLOOR AREA STORAGE = 43,908 SF GROSS FLOOR AREA OFFICE = 580 SF FLOOR AREA RATIO - 44,488 SF/169,699 SF = .26
6. TOPOGRAPHICAL INFORMATION BY HUNTLEY NYCE & ASSOCIATES.
7. BOUNDARY INFORMATION WAS TAKEN FROM PLAT OF RECORD (SEE PLAT FILE 1 PAGE 443).
8. ZONING: B-2 PROPOSED USE: COMMERCIAL SETBACKS: FRONT 50' FROM RIGHT-OF-WAY REAR N/A SIDE N/A
9. PARKING: REQUIRED = 1 SPACE PER EMPLOYEE, PLUS 1 SPACE PROVIDED = 2 SPACES INCLUDING 1 HANDICAPPED ACCESSIBLE SPACE.
10. AN ILLUMINATED MONUMENT MEETING TOWN OF BOWLING GREEN ZONING ORDINANCES SHALL BE LOCATED AT THE ENTRANCE OF PROPERTY. A SEPARATE PERMIT IS REQUIRED.
11. THIS DEVELOPMENT WILL BE SERVED BY PRIVATE TRASH SERVICE, NO DUMPSTER IS PROPOSED.
12. TRAFFIC GENERATION: FROM I.T.E. 7TH EDITION CODE 151 2.50 TRIPS/DAY/1000 SF GFA * 44,488 SF = 112 TRIPS/DAY
13. PRIVATE WELL AND SEPTIC WILL BE PROVIDED FOR THIS DEVELOPMENT.
14. 155,357 SF (3.57ACRES) OF IMPERVIOUS AREA ARE PROPOSED WITH THIS DEVELOPMENT.
15. THIS DEVELOPMENT WILL HAVE AN IMPERVIOUS SURFACE RATIO OF 100*155,357 SF/169,699 SF = 91.55%
16. THIS DEVELOPMENT WILL HAVE OTHER IMPERVIOUS AREAS NOT INCLUDING THE BUILDINGS OF 100*110,720 SF/169,699 SF = 65.25%
17. THIS DEVELOPMENT WAS REZONED WITH THE TOWN OF BOWLING GREEN UNDER CASE ZP-2006-08.

**PREPARED FOR:**
VILLAGE SELF STORAGE II, INC.
P.O. BOX 356
LADYSMITH, VA 22501
(804) 448-8500

RECEIVED
AUG 31 2007
TOWN OF BOWLING GREEN

## SHEET INDEX

1. COVER SHEET
2. NOTES AND DETAILS
3. SITE PLAN
3A. RT. 301 IMPROVEMENTS PLAN
4. BMP PLAN AND SOILS MAP
5. STORM SEWER AND FORCE MAIN PROFILES
6. STORM WATER MANAGEMENT COMPUTATIONS
7. STORM SEWER AND STORM PURE DETAILS
8. EROSION AND SEDIMENT CONTROL PLAN - PHASE I
9. EROSION AND SEDIMENT CONTROL PLAN - PHASE II
10. EROSION AND SEDIMENT NOTES AND DETAILS
11. LANDSCAPE PLAN

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CULPEPER, VIRGINIA 22701
540-825-6055
ARLINGTON, VIRGINIA 703-532-4924
CHANTILLY, VIRGINIA 703-750-3490
LEESBURG, VIRGINIA 703-779-4905

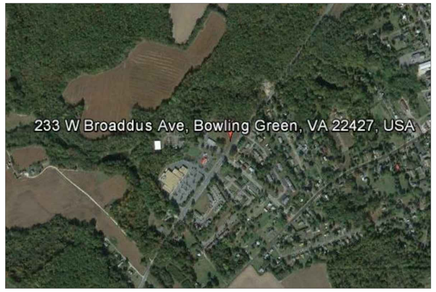
COMMONWEALTH OF VIRGINIA
MARVIN T. HINCHEY
NO. 017596
8-30-07
PROFESSIONAL ENGINEER

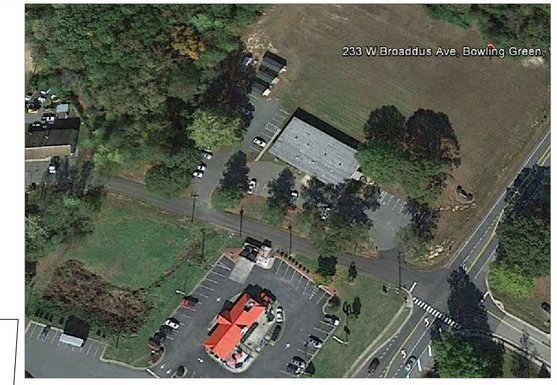
**VILLAGE SELF STORAGE**
TOWN BOWLING GREEN - CAROLINE COUNTY, VA
COVER SHEET

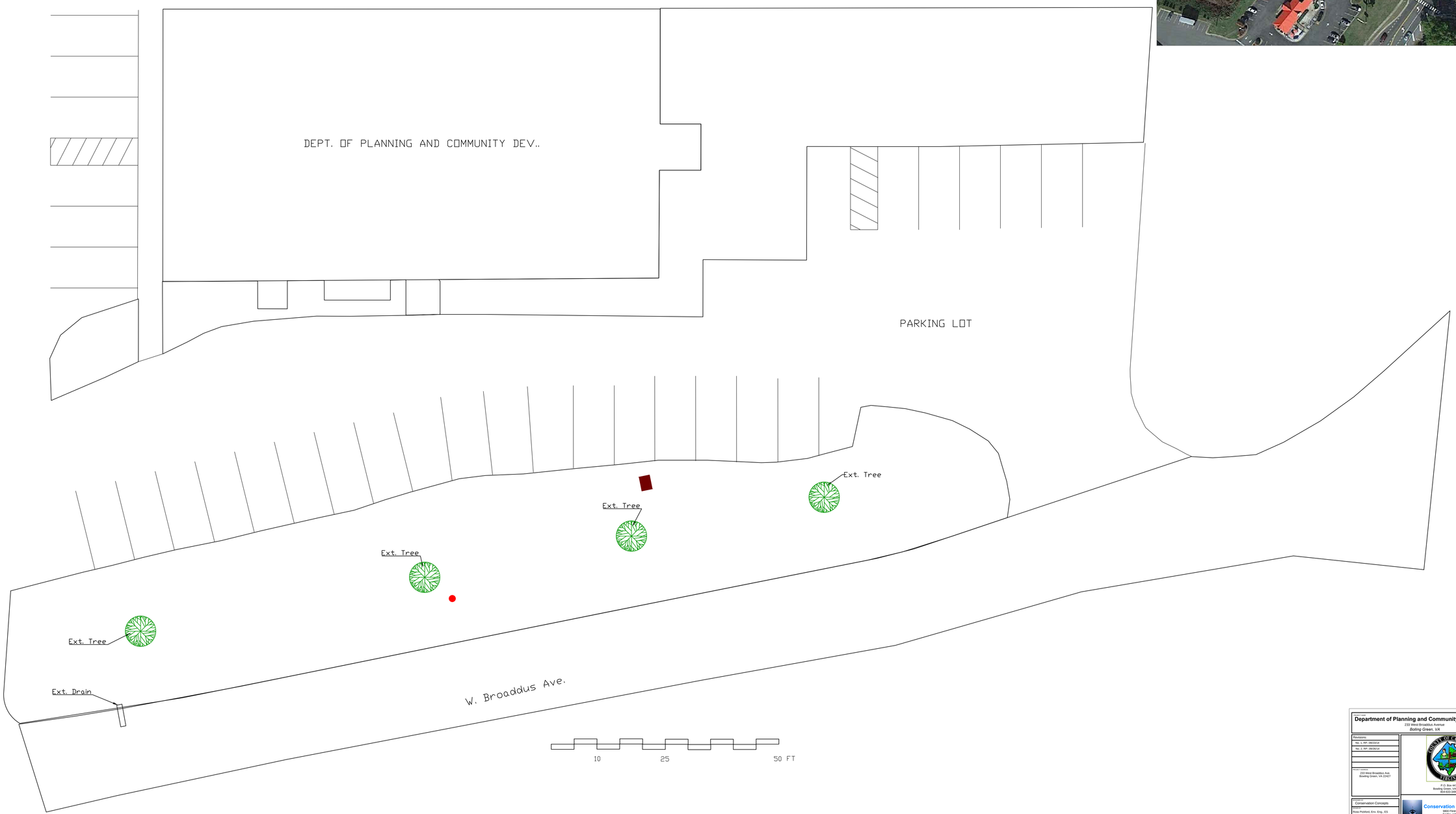
SCALE: AS NOTED
DATE: 5-18-2007
REVISIONS:
8-2-07
8-30-07
SHEET 1 OF 11
FILE NO. 7388

## Attachment 2.B.3 - Sample of field photographs gathered during inspection of County BMPs

## Attachment 3.1 - Design Drawings for BMP Facility




Sheet: 1 of 6

Location of Site and General Layout

Department of Planning and Community Development
233 West Broaddus Avenue
Bowling Green, VA

Revisions:
No. 1. RP. 09/29/14
No. 2. RP. 09/29/14

Project Location:
233 West Broaddus Ave.
Bowling Green, VA 22427

County of Caroline
Virginia

P.O. Box 447
Bowling Green, VA 22427
804-633-3499

Conservation Concepts

Project Engineer:
Ross Pickford, Env. Eng., ES

Project Manager:
Rick Stanford, PE, BCEE

Project Planner:
Dave Nunnally, S. Env. Planner

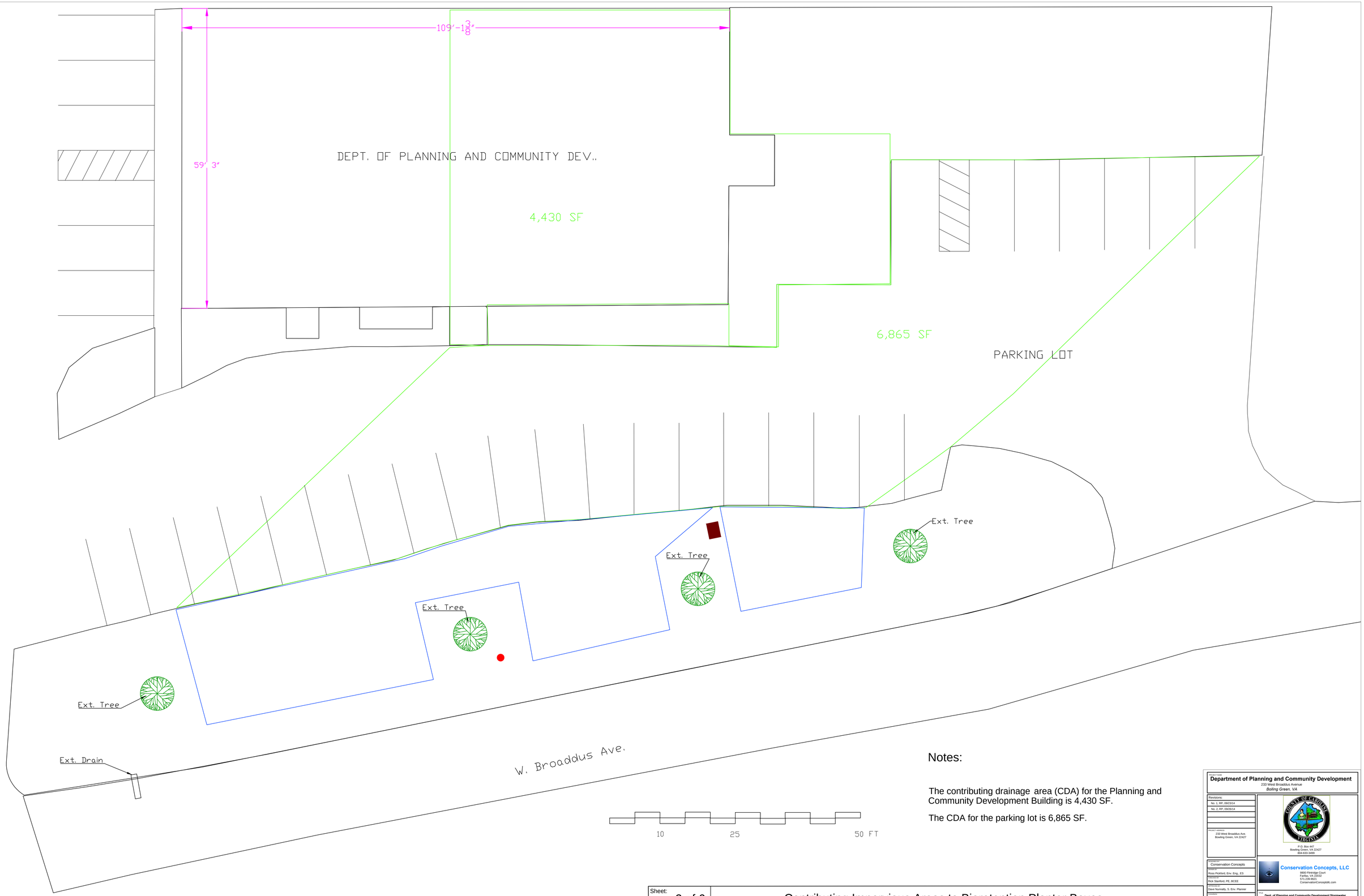
Project Number:
Conservation Concepts, LLC
9800 Flintridge Court
Fairfax, VA 22032
571.239.9623
ConservationConceptsllc.com

Project Name:
Dept. of Planning and Community Development Stormwater Management Retrofit Project

Project Location:
Caroline County Building BMP 09/01/14

Project Number: 0001

Date: 09/29/14




Notes:

The contributing drainage area (CDA) for the Planning and Community Development Building is 4,430 SF.

The CDA for the parking lot is 6,865 SF.

PROJECT NAME
**Department of Planning and Community Development**
233 West Broaddus Avenue
*Bolling Green, VA*

Revisions:
No. 1, RP, 09/23/14
No. 2, RP, 09/26/14

PROJECT ADDRESS
233 West Broaddus Ave.
Bowling Green, VA 22427

COUNTY OF CAROLINE VIRGINIA
P.O. Box 447
Bowling Green, VA 22427
804-633-3499

PREPARED BY
Conservation Concepts


Conservation Concepts, LLC
9800 Fleetridge Court
Fairfax, VA 22032
571.239.9621
ConservationConceptsllc.com


PROJECT TO
Ross Pickford, Env. Eng., ES

PROJECT TO
Rick Stanford, PE, BCEE

PROJECT TO
Dave Nunnally, S. Env. Planner

TITLE
**Dept. of Planning and Community Development Stormwater Management Retrofit Project**

CAD FILE NAME
CarolineCity Building BMP 090514

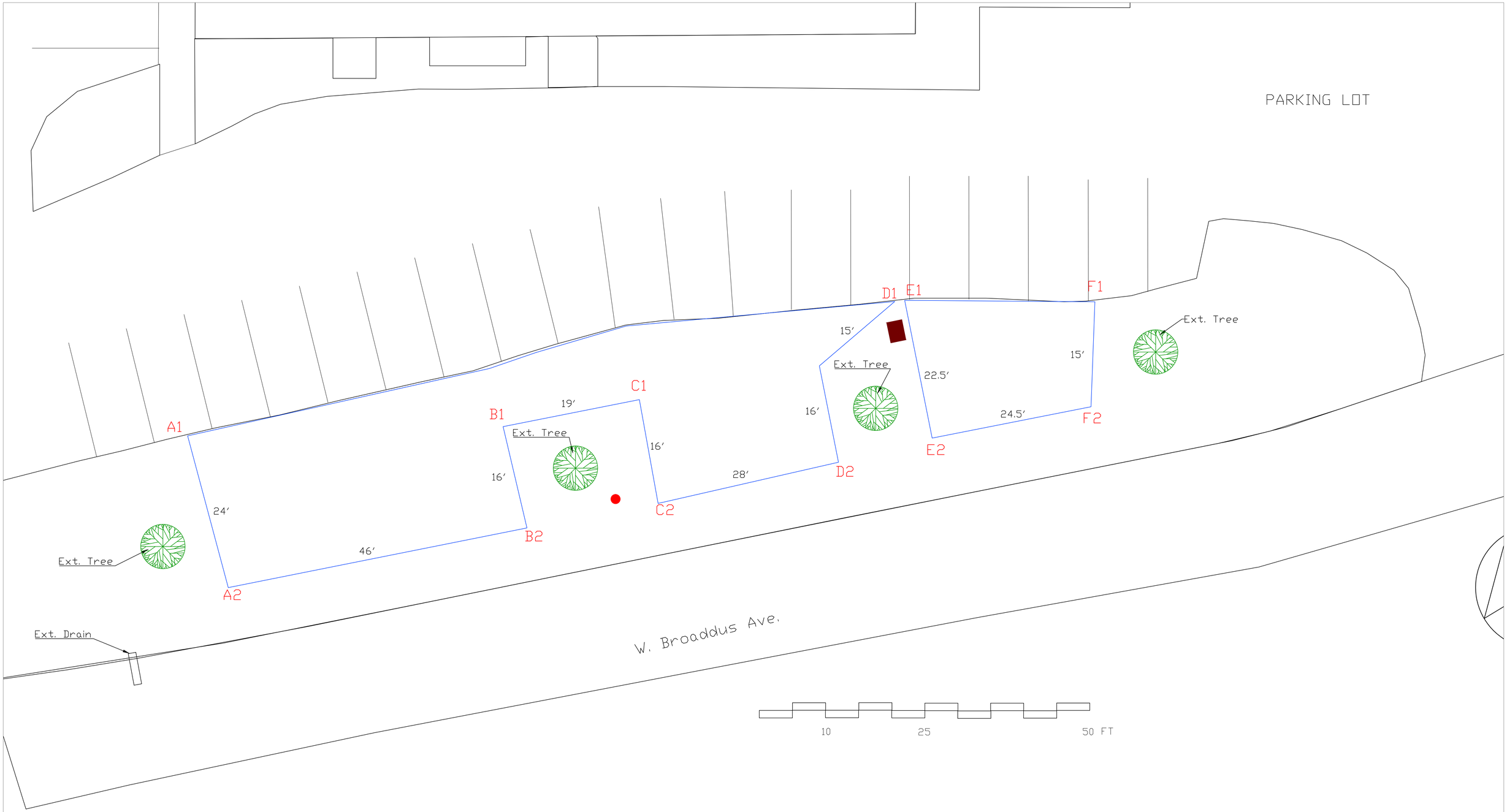
CAD FILE NAME
Bioretention

PROJECT NUMBER
0001

DATE
09/26/14

Sheet: 2 of 6

Contributing Impervious Areas to Bioretention Planter Boxes




Notes:

The A1 to D1 planter box has a surface area of 2,115 SF and with a depth of 6 in. this will contain 7,910 gallons of stormwater. The engineered soil layer has an average surface area of 740 SF and an average depth of 12 in. providing 1,384 gallons of storage. The gravel layer has an average surface area of 148 SF and an average depth of 12 in. providing 443 gallons of storage.

The E1 to F1 planter box has a surface area of 490 SF and with a depth of 6 in. this will contain 1,833 gallons of stormwater. The engineered soil layer has an average surface area of 245 SF and an average depth of 12 in. providing 61 gallons of storage. The gravel layer has an average surface area of 49 SF and an average depth of 12 in. providing 20 gallons of storage.

The 11,651 gal. of storage for the two BMP Planter Boxes is designed to capture approximately 1.74 inches of stormwater falling on the 11,295 SF of impervious surface contributing drainage area.

Sheet: 3 of 6

Location and Layout of Bioretention Planter Boxes

PROJECT NAME
**Department of Planning and Community Development**
233 West Broaddus Avenue
*Bolling Green, VA*

Revisions:
No. 1, RP, 09/23/14
No. 2, RP, 09/25/14

PROJECT ADDRESS
233 West Broaddus Ave.
Bowling Green, VA 22427

COUNTY OF CAROLINE VIRGINIA
P.O. Box 447
Bowling Green, VA 22427
804-633-3499

DESIGNED BY
Conservation Concepts

DRAWN BY
Ross Pickford, Env. Eng., ES

CHECKED BY
Rick Stanford, PE, BCEE

APPROVED BY
Dave Nunnally, S. Env. Planner

COMMENTS
CarolineCity Building BMP 09/25/14

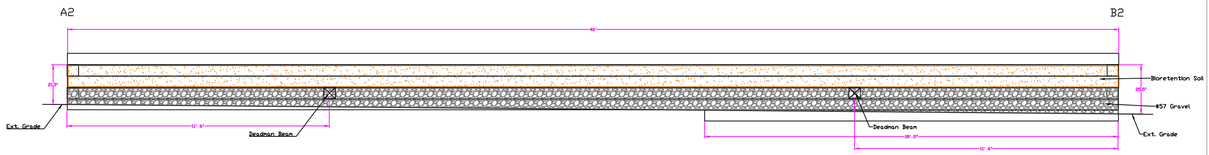
**Conservation Concepts, LLC**
9800 Fleetridge Court
Fairfax, VA 22032
571.239.9621
ConservationConceptsllc.com

TITLE
**Dept. of Planning and Community Development Stormwater Management Retrofit Project**

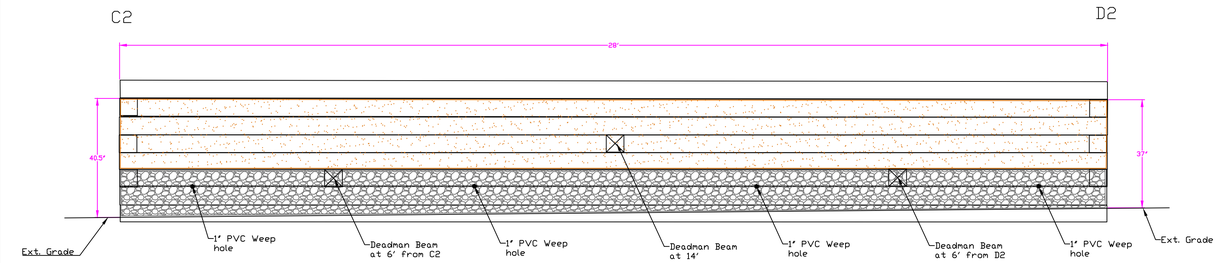
CAD FILE NAME
CarolineCity Building BMP 09/25/14

PROJECT NUMBER
0001

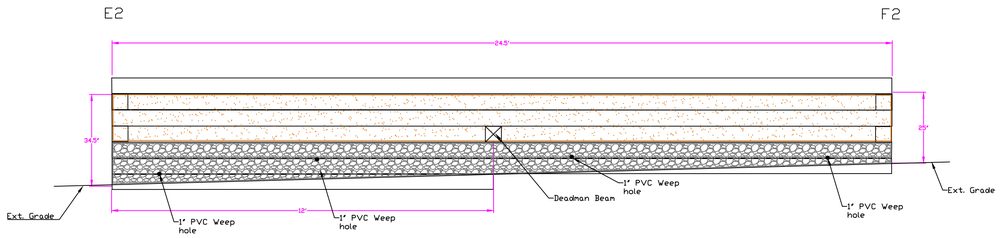
DATE
09/26/14



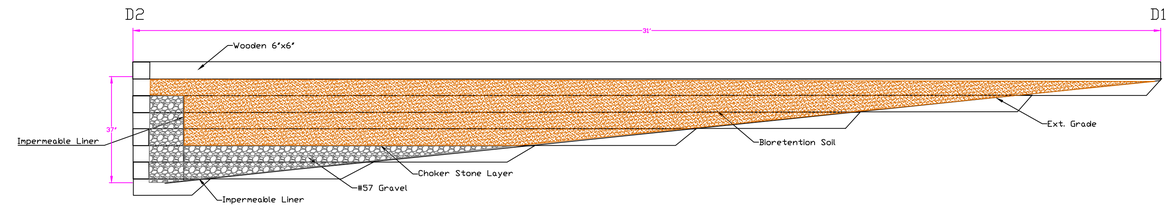

A2-B2 CROSS SECTION BMP PLANTER BOX



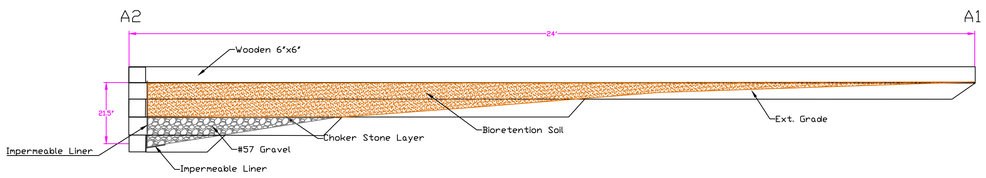

C2-D2 CROSS SECTION BMP PLANTER BOX



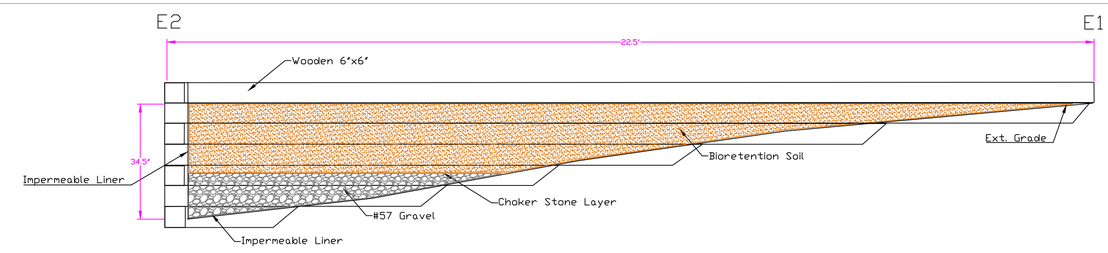

E2-F2 CROSS SECTION BMP PLANTER BOX



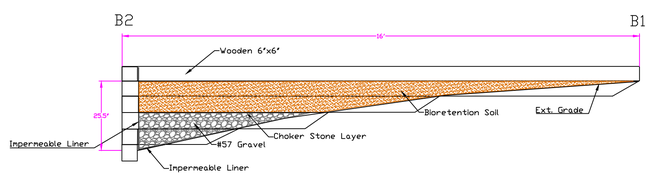

D1-D2 CROSS SECTION BMP PLANTER BOX



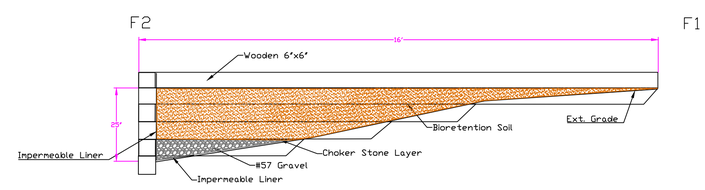

A1-A2 CROSS SECTION BMP PLANTER BOX



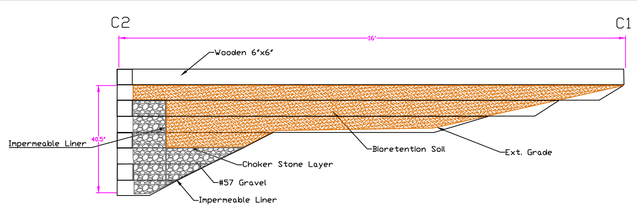

E1-E2 CROSS SECTION BMP PLANTER BOX




B1-B2 CROSS SECTION BMP PLANTER BOX




F1-F2 CROSS SECTION BMP PLANTER BOX




C1-C2 CROSS SECTION BMP PLANTER BOX

PROJECT NAME
**Department of Planning and Community Development**
210 West Broadbus Avenue
*Boiling Green, VA*

| Revisions: |
|---|
| No. 1, RP, 09/23/14 |
| No. 2, RP, 09/26/14 |
| |
| |
| |
| |

PROJECT ADDRESS
210 West Broadbus Ave.
Bowling Green, VA 22427

COUNTY OF GLOUCESTER VIRGINIA

P.O. Box 447
Bowling Green, VA 22427
804-633-3484

DESIGNED BY
Conservation Concepts

DRAWN BY
Ross Pickford, Env. Eng., ES

REVIEWED BY
Rick Stanford, PE, BCEE

APPROVED BY
Greer Nunnally, S. Env. Planner

DATE

SCALE FOR PLOT
Landscaping Building BMP 09012d

**Conservation Concepts, LLC**
9802 Flintridge Court
Richmond, VA 23233
571.239.9622
ConservationConceptsllc.com

TITLE
**Dept. of Planning and Community Development Stormwater Management Retrofit Project**

| DRAWING | DRAWING NUMBER | DATE |
|---|---|---|
| Bioretention | 0001 | 09/26/14 |

| Sheet: | |
|---|---|
| 4 of 6 | Cross Sectional Diagrams of Bioretention Planter Boxes |

Notes:

| Common Name | Latin Name | Number | Size |
|---|---|---|---|
| Witch Hazel | Hamamelis virginiana | 1 | 36" cont. |
| Virginia Sweetspire | Itea virginica | 2 | 3-gal. |
| Flowering Dogwood | Comus florida | 1 | 36" cont. |
| Wild Blue Indigo | Baptisia australis | 12 | 1-qt. |
| Bay-scented Fern | Dennstaedtia punctilobula | 15 | 1-qt. |
| Silky Dogwood | Comus amomium | 1 | 36" cont. |
| Cinnamon Fern | Osmunda cinnamomea | 12 | 1-qt. |
| Wild Hydrangea | Hydrangea arborescens | 2 | 1-gal. |
| Slate Walking Stones | | 9 | 3'x3' |
| Picnic Table | | 1 | 6 foot |

Sheet: 5 of 6

Planting Plan for Bioretention Planter Boxes

**Department of Planning and Community Development**
233 West Broaddus Avenue
*Boiling Green, VA*

Revisions:
No. 1, RP, 09/23/14
No. 2, RP, 09/26/14

Project Location:
233 West Broaddus Ave.
Boiling Green, VA 23427

P.O. Box 447
Boiling Green, VA 23427
804-633-3499

Consultant:
Conservation Concepts

Designed by:
Ross Pickford, Env. Eng., ES

Checked by:
Rick Stanford, PE, BCEE

Drawn by:
Dave Nunnally, S. Env. Planner

Contractor:
Contractor to Bidding WIP Notice

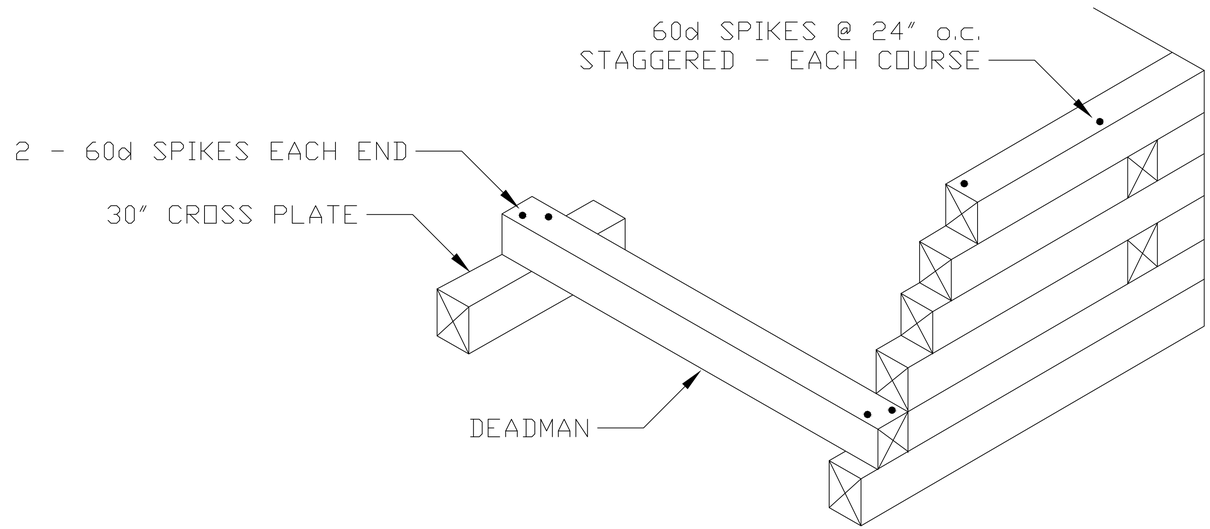
**Conservation Concepts, LLC**
9900 Flintridge Court
Richmond, VA 23233
171.239.0612
ConservationConceptsllc.com

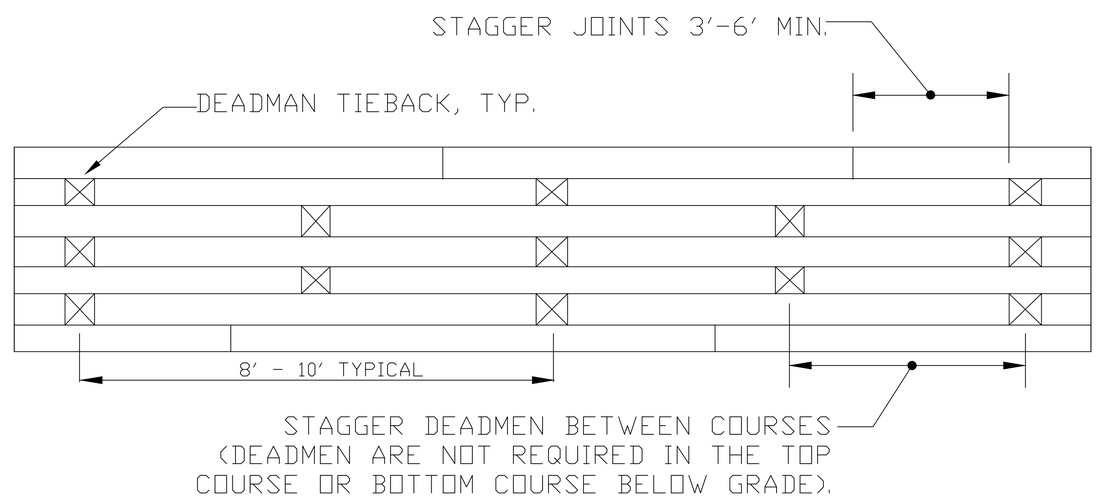
Title:
**Dept. of Planning and Community Development Stormwater Management Retrofit Project**

Drawing Number: 0001

Date: 09/26/14

Revisions:




Department of Planning and Community Development
233 West Broadbus Avenue
Boiling Green, VA

Revisions:
No. 1, RP, 09/25/14
No. 2, RP, 09/26/14

Project Address:
233 West Broadbus Ave.,
Boiling Green, VA 22427

P.O. Box 447
Boiling Green, VA 22427
804 633-3498

Conservation Concepts

Conservation Concepts, LLC
9800 Flemings Court
Fairfax, VA 22032
571.239.9621
ConservationConceptsllc.com

Project Engineer:
Sam Kuzmaly, S. Env. Planner

Project Title:
Dept. of Planning and Community Development Stormwater Management Retrofit Project

Drawing Number: 0001 Date: 09/26/14

Sheet: 6 of 6 | Retaining Wall Detail from 2012 International Residential Code