



**CARROLL COUNTY
SUPPLEMENT TO THE
2000 MARYLAND
STORMWATER DESIGN
MANUAL VOLUMES I & II**

Carroll County Bureau of Resource Management

May 2010

Adopted by Resolution July 2010

Preamble

This document is a collection of Carroll County's current applicable, locally developed, administrative policies and standard designs used in implementation of Chapter 191 of the Code of Public Local Laws and Ordinances in Carroll County.

In accordance with my conversation with Steward Comstock at MDE¹ this is a supplement to the 2000 Maryland Stormwater Design Manual Volumes I & II, rather than an appendix.

This supplement organizes our local information into a whole that should help streamline the design, review and approval process.

A handwritten signature in black ink, appearing to read 'MBC', with a horizontal line extending to the right across the signature.

Martin B. Covington III, P.E., CFM
Stormwater Management Engineer

¹ Comstock, Stewart, Maryland Department of the Environment, Program Compliance, September 26, 2005, Personal Communication

RESOLUTION NO. 786-10

Stormwater Management Supplement

WHEREAS, The County Commissioners of Carroll County, Maryland, a body corporate and politic of the State of Maryland, are authorized to adopt, and from time to time amend, revise, rescind or change provisions of ordinances and resolutions; and

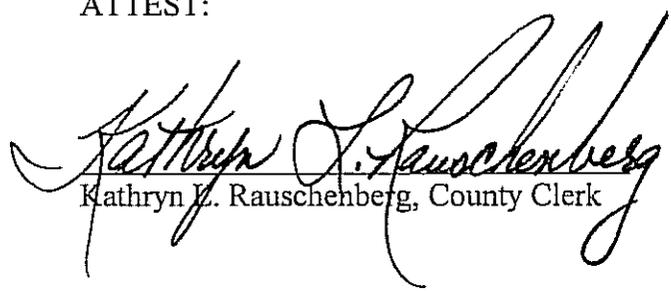
WHEREAS, by Ordinance No. 2010-05, the County Commissioners adopted certain revisions to Chapter 191, Stormwater Management, of the Code of Public Local Laws and Ordinances of Carroll County which has resulted in the need to amend the corresponding Supplement to the 2000 Maryland Stormwater Design Manual Volumes I & II.

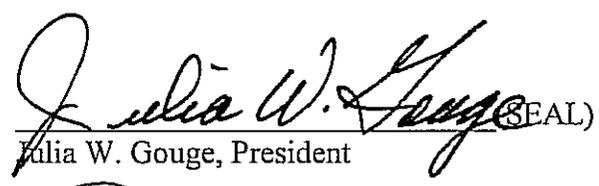
NOW, THEREFORE, IT IS HEREBY RESOLVED that effective immediately the Supplement to the 2000 Maryland Stormwater Design Manual Volumes I & II, dated July 2010 is approved and adopted and shall be applicable to all pending projects and plans unless such application is waived by the Carroll County Bureau of Resource Management for good cause.

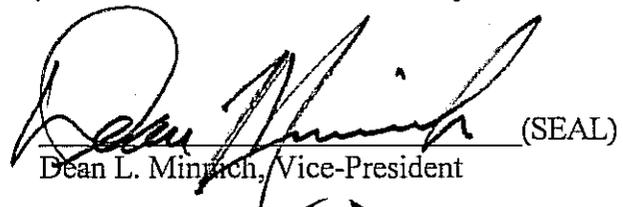
RESOLVED this 29th day of July, 2010.

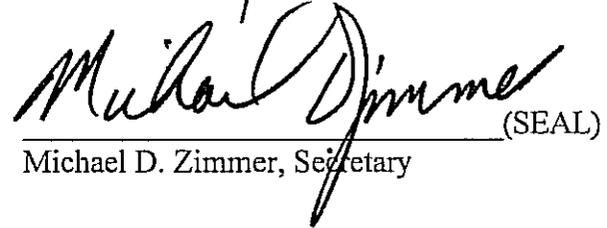
THE COUNTY COMMISSIONERS OF
CARROLL COUNTY, MARYLAND
a body corporate and politic
of the State of Maryland

ATTEST:

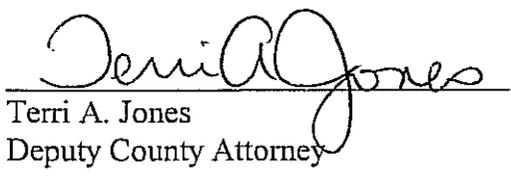

Kathryn L. Rauschenberg, County Clerk

 (SEAL)
Julia W. Gouge, President

 (SEAL)
Dean L. Minnich, Vice-President

 (SEAL)
Michael D. Zimmer, Secretary

Approved for legal sufficiency:


Terri A. Jones
Deputy County Attorney

STORMWATER MANAGEMENT PLAN REVIEW CHECKLIST

NOTES:

1. All page numbers referenced are in the Carroll County Supplement to the 2000 Maryland Stormwater Management Design Manual May 4, 2010 as amended (the Supplement).
2. Check each blank or place N/A as appropriate.
3. Submit completed checklist, signed by the responsible professional engineer or land surveyor with each phase.
4. A narrative responding point by point to each comment is required with each re-submission of the plans during each phase.

ENVIRONMENTAL SITE DELINEATION (ALL PLANS)

- _____ 1. Environmental Site Delineation completed in accordance with Chapter 103, Article IV of the Code.
- _____ 2. Environmental Site Delineation Requirements Checklist filled out and submitted. (Current copies are available at Carroll County Government website. See “Bureau of Development Review, Checklists and Forms”.)

Signature and date by responsible professional engineer or land surveyor as appropriate

Note to responsible professional: You are certifying that the Environmental Site Delineation matches the field conditions.

CHAPTER 191 CONCEPT PLAN PHASE. APPLIES TO ALL PLANS

- _____ 1. Approved Environmental Site Delineation and approval letter included.
- _____ 2. Features Shown on Concept Plan
 - a. From Environmental Site Delineation
 - _____ 100-year floodplain (FEMA and ultimate development county floodplains)
 - _____ Wetlands
 - _____ Streams and watercourses on or adjacent to the property
 - _____ Forest Boundaries
 - _____ 25% Slopes
 - _____ Existing water impoundments on or adjacent to the property and any associated dam breach inundation areas
 - _____ Erodeable soils
 - _____ Sensitive Areas to be protected
 - b. From Field Work
 - _____ The location of infiltratable areas using the soils testing procedure on pages 43 and 44
 - c. From Concept Design
 - _____ All proposed impervious areas (buildings, roadways, parking, sidewalks, etc.) utilities and other site improvements
 - _____ Proposed limits of disturbance
 - _____ Location of all points of stormwater discharge into natural watercourses or off-site (see pages 42a and 42b)
 - _____ Location and site of ESD techniques and practices. Preliminary sizing must be done using the curve number reduction method in Chapter 5 of the Manual

- _____ 3. Stormwater Management narrative (not on the plan sheets) that supports the conceptual design and outlines how Chapter 191 of the Code of Public Laws will be addressed by the use of planning techniques, ESD and nonstructural practices to the maximum extend practical (MEP) thus reducing or eliminating the need for structural SWM facilities. In order of priority, either explain how the following techniques and ESD and non-structural practices will be employed to meet SWM requirements or why they cannot be used on the project.
 - a. Planning Techniques
 - _____ Preserving and protecting natural resources
 - _____ Conserving natural drainage patterns
 - _____ Minimizing impervious areas
 - _____ Reducing runoff volume
 - _____ Limiting soil disturbance, mass grading and compaction
 - _____ Clustering development
 - _____ Maintaining 100% of the predevelopment groundwater recharge volume.
 - _____ Other – Specify _____
 - b. ESD Practices
 - _____ All houses disconnected by use of rooftop runoff credits (grading or drywells) see pages 24-31
 - _____ Open section roadways disconnected by use of non rooftop runoff credits or sheet flow to conservation areas (wide shoulders) see pages 32-36
 - c. Micro scale (non-structural) practices
 - _____ Grass swales (see pages 42i-42p)
 - _____ Landscape infiltration
 - _____ Other – Specify _____
 - d. Conceptual phased erosion and sediment controls.
 - _____ Integrated into the SWM strategy.
- _____ 4. Certifications
 - a. Narrative plans supporting documentation and filled out Environmental Site Delineation and concept portions of the checklist signed and sealed by the licensed professional engineer or land surveyor that is in charge of the work.
 - b. All items in 4a included in submission

Signature and date by responsible professional engineer or land surveyor as appropriate

CHAPTER 191 PRELIMINARY PLAN PHASE. APPLIES TO: PRELIMINARY PLAN(SUBDIVISION PLANS), FINAL PLAN (SITE PLANS)

- 1. Concept Plan Approvals
 - _____ Concept Plan SWM approval letter included
 - _____ Concept Plan Sediment Control approval letter included
 - _____ All information from concept phase included
- 2. Construction Plans
 - _____ Final site layout with exact impervious areas
 - _____ Existing and proposed topography (2 ft. contours minimum) including the area necessary to perform the downstream analysis for proposed SWM facilities.
 - _____ Easements for stream and forest buffers and floodplains
 - _____ Plan view with proposed grading for all ESD planning techniques, treatments, and non-standard and standard practices

- _____ Publicly maintained facilities
 - _____ No slopes greater than 4:1
 - _____ Stormwater parcels
 - _____ Access road, in fee, to public road, paved and graded to use-in-common driveway standards 12' wide, 4:1 side slopes, 17% maximum grade. Strip at least 20 ft. wide.
- 3. Phased erosion and sediment control plan
 - _____ Overlay plan showing all temporary erosion and sediment control measures and permanent ESD and structural stormwater management measures.
 - _____ An overall sequence of construction phased to match the plan. If SWM facilities are used for sediment control the sequence must reference but not duplicate the sequence for the SWM facility.
 - _____ Limits on earth disturbance.
 - _____ Protection of natural resources
- 4. Report
 - a. Hydrologic Mapping for Erosion & Sediment (E&S) Control and Stormwater Management
 - _____ Vicinity Map
 - _____ Drainage Area Maps
 - _____ Existing (Pre-development) conditions with time of concentration (tc) paths shown
 - _____ Interim (Phased sediment control) conditions with time of concentration (tc) paths shown
 - _____ Proposed (Post-development) conditions with time of concentration (tc) paths shown
 - _____ Topography (two foot contours)
 - _____ Soil types
 - _____ Land use
 - _____ Location of geotechnical testing
 - _____ Clearly delineated drainage areas to each planning technique, ESD non-structural and structural practice and to each sediment control practice at each phase of construction as well as all discharge points.
 - b. Hydrology, Hydraulics and Interim (E & S) and Permanent SWM volumes.
 - _____ Use TR-55 and TR-20
 - _____ SWM volume Calculations for all planning techniques, ESD and nonstructural practices performed in accordance with the Curve Number Reduction Method in Chapter 5 of the Manual
 - _____ Interim SWM (E&S) volume calculations for each phase of construction.
 - _____ Quantity Control (Q_{10}) provided at all discharge points
 - _____ Stable outlets at all discharge points at all phases
 - _____ SWM Volume calculations for structural practices
 - _____ Recharge (Re_v)
 - _____ Water Quality (WQ_v)
 - _____ Channel Protection (CP_v)
 - _____ Quantity Control (Q_{10}) achieved at all discharge points (TR-55 & TR-20)

- c. Geotechnical Investigation
 - _____ Soil Investigation – Infiltration/Recharge facilities must have a double-ring infiltrometer test and sieve analyses performed at a proposed bottom elevation and a sieve analysis performed four feet below the proposed bottom elevation of the technique, practice or facility
 - _____ Soil Investigation performed and certified in accordance with the Carroll County Soils Testing policy for Proposed Infiltration/Recharge Facilities (pages 43 & 44)
 - d. Stormwater Management Narrative (part of the report and not on the plan sheets) that supports the preliminary design, describes how ESD has been used to the MEP and justifies any proposed interim (E & S) or permanent structural stormwater management measures necessary to meet the requirements of Chapter 191 or protect public health and safety, the environment or downstream properties from flooding.
5. Certifications
- _____ a. Narrative, plans, supporting documentation and filled out Environmental Site Delineation, Concept and Preliminary portions of this checklist signed and sealed by the licensed professional engineer or land surveyor that is in charge of the work
 - _____ b. All items in 5a included in the submission.

Signature and date by responsible professional engineer or land surveyor.

CHAPTER 191 FINAL PLAN PHASE. APPLIES TO: FINAL PLAN(SUBDIVISION PLANS), MYLAR APPROVAL(SITE PLANS)

- 1. Preliminary Plan Approvals
 - _____ a. Preliminary (Subdivision) or Final (Site) Plan SWM approval letter included
 - _____ b. Preliminary (Subdivision) or Final (Site) Plan Sediment Control approval letter included.
 - _____ c. All information from Preliminary phase included.
- 2. Finalized phased (E&S) plans from Preliminary according to COMAR 26.17.01.05
- 3. Finalized Stormwater Management Plans as follows:
 - _____ a. All proposed improvements including locations of buildings, structures, impervious surfaces, storm drainage facilities and all grading.
 - _____ b. All easements and rights-of-way
 - _____ c. Structural and construction details including representative cross-sections for all components of the proposed drainage system or systems and SWM facilities.
 - _____ d. An overall sediment control sequence of construction and detailed individual sequence for each interim or permanent ESD practice, technique or nonstructural or structural SWM facility.
 - _____ e. An overall site table with total site area, total disturbed area, new impervious and total impervious area.
- 4. **Vicinity Map:**
 - _____ Bench mark described and location shown.
- 5. **Drainage area map:**
 - _____ a. Shown on plans, conforms to approved map(s), submitted with hydrology meeting applicable standards.
 - _____ b. Storm drainage design **must** correspond to the Drainage Area Map.

- _____ c. One hundred percent (100%) pick up and conveyance of the SCS method 10-year storm runoff to the facilities must be demonstrated at each drainage area boundary shown on the Drainage Area Map. Note: 150% pick up of the rational method runoff is equivalent to 100% pick up of the SCS method. (See pages 53-54)
- _____ d. Commercial Entrances designed per pages 51 and 52
- 6. Stormwater management plan:**
 - _____ a. Coordinates for all stormwater management ESD practices and facilities shall be based upon the Maryland Coordinate System, North American Datum of 1983/99.
 - _____ b. Elevations and topographic information shall be based upon the North American Vertical Datum of 1988 (NAD 88).
 - _____ c. Existing and proposed ground (two-foot contours):
 - _____ Proposed contours on pond embankments are uniformly spaced at indicated slope.
 - _____ Emergency spillway.
 - _____ d. Soil Investigation locations shown (minimum of two required. See SCS MD-378 for pond requirements and this Checklist, Section H for infiltration requirements.
 - _____ e. Stabilization indicated.
 - _____ f. Barrel outlet and outlet protection (plunge pool is preferred). See pages 42b, c & d and 76.
 - _____ g. Property lines, property owner's name and lot number or liber/folio.
 - _____ h. Slopes and elevations.
 - _____ i. Stationing along embankment.
 - _____ j. Scale.
 - _____ k. Forty-two inch fence and gate (may be required).
 - _____ l. Access road – swing gate required (if fenced).
 - _____ m. Existing and proposed easements shown (see “Standard Language for Floodplain and Stormwater Easements,” pages 2-6).
 - _____ n. Publicly maintained facilities:
 - _____ No loose rip-rap exposed.
 - _____ Access road, in fee, to public road, paved, and graded to use-in-common driveway standards (12 feet wide – 17% slope maximum, 3% cross slope and 4:1 grading – 20' strip minimum)
- 7. Principal Spillway Profile:**
 - _____ a. Existing ground.
 - _____ b. Proposed ground (slopes, top width) [378.4].
 - _____ c. Cutoff trench (minimum 4-foot bottom; 1:1 slopes, 4-foot depth).
 - _____ d. Impervious core (top width, top elevation) –up to 10-year storm.
 - _____ e. Concrete riser:
 - _____ No barrel pipe exposed.
 - _____ Riser set back into the embankment to the first major opening.
 - _____ 15-inch minimum barrel.
 - _____ 12-inch minimum low-flow pipe with orifices located inside riser.
 - _____ f. Trash rack – anti-vortex device shown [378-8].
 - _____ g. Riser base shown.
 - _____ h. Low flow structure (diameter class, type, trash rack, filter).

- _____ i. Concrete barrel (diameter: ASTM C-361, length, slope, saturated length – specify ASTM C361 and class).
- _____ j. Phreatic line at 4:1.
- _____ k. Anti seep collars [378.7] must be a minimum two-foot projection beyond concrete bedding:
 - _____ Minimum – maximum spacing.
 - _____ Size (design computations submitted).
 - _____ Located primarily within saturated zone.
 - _____ Note indicating location two-foot from pipe joint.
 - _____ Prefomed joint filler specified.
- _____ l. Publicly maintained facilities:
 - _____ Embankment and pond side slopes no greater than 4:1.
- _____ m. Outlet protection shown – details cross referenced.
- _____ n. Elevations:
 - _____ Emergency spillway (dotted line at crest).
 - _____ 1.0 feet of freeboard below settled top of dam, built with emergency spillway, to 100-year WSEL.
 - _____ 2.0 feet of freeboard below settled top of dam, without emergency spillway, to 100-year WSEL.
 - _____ 3.0 feet of freeboard below sump in road, where a County road serves as the embankment, to 100-year WSEL.
 - _____ Riser crest.
 - _____ Design storms water surfaces shown.
 - _____ Inlet and outlet pipe elevations (low-flow, barrel).
 - _____ Embankment side slopes specified.
- 8. Emergency Spillway Profile [378-5-14]:**
 - _____ a. Existing ground (spillway in cut) – level section stabilization (armor: gabions, riprap, etc.) required for spillways which will carry storms more frequent than 10-year storm.
 - _____ b. Disturbed ground (spillway in fill) – entire spillway armored (gabions or riprap).
 - _____ c. Inlet, control, and outlet sections (lengths, elevations).
 - _____ d. Slopes.
 - _____ e. Flow quantity and velocity.
 - _____ f. Limits of channel protection.
 - _____ g. Adequate outfall.
 - _____ h. Minimum one-foot of freeboard between settled top of dam and emergency spillway design storm (usually 100-year).
- 9. Profile of Dam Along Centerline (as stationed on plan):**
 - _____ a. Top of dam (constructed and settled shown with elevations).
 - _____ b. Emergency and principal spillways stationed.
 - _____ c. Existing ground – top of dam must extend to existing ground.
 - _____ d. Proposed ground line within pond.
 - _____ e. Impervious core to 10-year storm.
 - _____ f. Cutoff trench.
 - _____ g. Horizontal control.
- 10. Soil Investigation:**

A minimum of one (1) soil test in the centerline of the embankment and one (1) soil test in the pond area. The soil test in the centerline of the embankment must extend

to the bottom of the core trench. The soil classification must be determined and a standard penetration test performed. Infiltration facilities must have double-ring infiltrometer tests and sieve analyses performed at a proposed bottom elevation and a sieve analysis performed four feet below the proposed bottom elevation of the facility.

_____ Soil investigation performed and certified in accordance with the “Carroll County Soils Testing Policy for Proposed Infiltration/Recharge Facilities” (pages 43 and 44).

11. **Details to be Shown on Plan:**

a. Riser:

_____ Riser base (length, width, thickness shown).

_____ Dimensions from riser crest to barrel & low-flow pipe shown.

_____ Vertical angles between barrel & riser, low-flow pipe & riser specified.

_____ Horizontal angle between barrel & low-flow pipe specified.

_____ Standard notes and dimensions.

_____ Reinforcing steel details.

_____ All holes in riser or weir wall to be framed with additional reinforcing steel.

_____ b. Anti-seep collar.

_____ c. All flows enter stormwater management ponds through drop structures and pipes. (See pages 69-78)

_____ d. Storm drain pipes entering ponds must be rigid with sealed joints up to the elevation of the higher of the emergency spillway or top of riser.(see pages 69-78)

_____ e. Pipes outfall at bottom of stilling basin, plunge pool or forebay. End treatment is concrete headwalls (DPW Roads and Storm Drains 6-13).(see pages 69-78)

_____ f. Underdrained plunge pools/forebays at all pipe outfalls.(see pages 69-78)

_____ g. Conveyance channels designed with minimum 4:1 side slopes, profiles, and cross sections shown (DPW Road and Storm Drains 6-16, 17).

_____ h. Pipe bedding for concrete pipes. See NRCS Technical Release 46

_____ i. Dewatering device detail. See page 77.

_____ j. Fence crossing detail.

_____ k. Trash rack & anti-vortex device:

_____ 1:1 slope.

_____ Minimum #4 rebar at 6-inches on center.

_____ Five foot span or greater – double center bar or use #6 rebar throughout.

_____ Welding detail/trash rack detail.

_____ Trash racks hot dipped galvanized after fabrication & prior to installation

_____ Trash racks anchored to riser

_____ Access provided through trash rock

_____ l. Emergency spillway typical cross-sections.

_____ Rip-rap armor from centerline of dam to back of level section if 10 year storm discharges through. If on fill armor to existing ground (adequate outfall)

_____ All rip-rap choked with topsoil and seeded and mulched.

12. **Construction Specifications [378-15-19]:**

_____ a. Site preparation.

_____ b. Earth fill (embankment, core/cutoff):

_____ Compaction: 95% of AASHTO T-99 or equivalent.

_____ Core & cutoff trench: use type GC, SC, CH, or CL material.

- _____ c. Structural backfill.
 - _____ d. Pipe conduit.
 - _____ e. Concrete – meets minimum MD SHA requirements, mix #6.
 - _____ f. Stabilization.
 - _____ g. Fence.
 - _____ h. Filter cloth.
 - _____ i. Gabions (PVC coated).
 - _____ j. Stormwater management sequence of construction:
(located on Plan sheet showing the facility.)
 - _____ Give the certifying professional engineer’s or land surveyor’s name and telephone number.
 - _____ State all steps of construction and when the engineer must be contacted and inspection performed prior to further work.
 - _____ No water may be allowed into the facility until: all buildings are constructed, the entire drainage area to the facility is paved or supporting a 2” stand of grass and the certifying engineer has inspected and given his approval.
 - _____ Broken into two phases; sediment control and stormwater management.
 - _____ k. Inspection table:
 - _____ Give the certifying professional’s name and telephone number.
 - _____ Include all steps that must be inspected in accordance with Chapter 191 of the Code of Public Local Laws and Ordinances of Carroll County.
 - _____ Include blocks for signature and date at each inspection step.
 - _____ Table corresponds to stormwater management sequence of construction.
 - _____ Broken into two phases, sediment control and stormwater management.
13. **Stormwater Management Table for each ESD Practice, Non-structural and Structural SWM Facility:**
- _____ a. Facility ownership and maintenance responsibility.
 - _____ b. Structure classification, MD-378 dam Type A, B, or C or non MD-378 dam or ESD technique or non-structural practice. Is the area in the danger reach protected from future development? Will it remain the same structure classification?
 - _____ c. Drainage area to the ESD practice, non-structural or structural SWM facility (in acres). Small scale drainage area map (with coordinates) shown next to table.
 - _____ d. Impervious area to the ESD technique or non-structural or structural SWM facility (in acres)
 - _____ e. Height and top width of any embankment.
 - _____ f. Watershed name and receiving stream classification.
 - _____ g. Levels of stormwater management required and provided along with associated storage volumes and water surface elevations (Re_v , WQ_v , CP_v , Q_{10} , Q_{100}).
 - _____ h. North and east coordinates of the centroid of the ESD practice, non-structural or structural SWM facility.
14. **Certifications: (page 21)**
- _____ a. Plans, signed and sealed by the licensed professional engineer or surveyor as appropriate that is in responsible charge of the work.
 - _____ b. Developer certification signed.
 - _____ c. As-built certification block on the plans.

- 15. **Pond Summary Sheet (MD-14)**
- 16. **Right-of-Way Plats**
- 17. **Maintenance Schedule (owner responsibility or public ownership)
(see pages 11-20)**
- 18. **Computations Required as Part of Plan Submission:**
 - _____ a. Hydrology
 - _____ 10-year management provided.
 - _____ 100-year storm for dam/breach/emergency spillway.
 - _____ Storm drain systems "pick up" and convey the 10-year storm to the facilities. (see pages 47-53)
 - _____ b. Hydraulics
 - _____ Hydraulic Performance Table:
 - _____ 1. Riser hydraulics must be "balanced."
 - _____ 2. Barrel must control before riser orifice controls.
 - _____ Elevation – discharge curve or table.
 - _____ c. Channel Protection if required – 1-year storm:
 - _____ Off-site: Allowable discharge computed.
 - _____ Class I and II Waters- extended detention over 24 hours.
 - _____ Class III and IV Waters – extended detention 12 hours.
 - _____ Size orifice in accordance with Appendix D.11 of the 2000 Maryland Stormwater Design Manual.
 - _____ d. Infiltration (see Checklist, Section Q):
 - _____ Required volume computations (In accordance with Appendix D.13 of the 2000 Maryland Stormwater Design Manual or Infiltration Practices, Maryland Department of the Environment publication No. 21).
 - _____ 100% of predevelopment groundwater recharge provided (see pages 82-84)
 - _____ Required size of structure.
 - _____ Both relief drain and emergency spillway to safe outfall.
 - _____ e. Emergency Spillway – Becomes Token Spillway if Principal Spillway Accepts 100-Year Discharge:
 - _____ Capacity sized by 378 criteria [378.4] (Not applicable for token spillways).
 - _____ Design by Engineering Field Manual.
 - _____ f. Routings:
 - _____ TR-20 (including schematic).
 - _____ Elevation – storage curve and/or table.
 - _____ Inflow hydrographs.
 - _____ 1-year, 10-year, 100-year routing (pass safely).
 - _____ g. Outfall Study:
 - _____ Existing and proposed channel velocity.
 - _____ V_{10} less than or equal to 2 ft/sec. (see page 42b)
 - _____ Dam breach analysis in accordance with MD-378 Peak Breach Discharge and Criteria (see page 45):
 - _____ Narrative.
 - _____ Danger reach and cross-sections including all downstream structures and roadways, and potential development. Reach and sections shown on plan view.
 - _____ Reach Length Calculated per SCS-TSC-UD-16

- _____ Hydraulic computations.
- _____ Pond classification statement.
- _____ Danger reach shown on **plats** - no new structures in danger reach.
- _____ Easements obtained from off-site property owners in the danger reach.
- _____ h. Riser Flotation Computations
- _____ i. Anti-Seep Collar Design
- _____ j. Estimate of Stormwater Management Construction Costs
- _____ k. Estimate of Stormwater Management Engineering Costs During Construction Including Inspections During Construction and As-built Plan Preparation
- 19. **Carroll County Standard Design Details:**
 - _____ a. Surface Designed Facilities (see pages 69-78):
 - (must be underdrained to prevent surface ponding)
 - _____ Eighteen inch layer 4 parts sand (ASTM C-33), 1 part loam soil, 1 part green untreated wood chips engineer inspected and approved.
 - _____ Ten inch layer of No. 8 stone.
 - _____ Six inch or four inch slitted PVC pipe or HDPE Type SP to adequate outfall.(see page 87)
 - _____ Two feet or greater layer of No.57 stone under perforated PVC or HDPE Type SP pipe to provide recharge requirements.
 - _____ No filter fabric.
 - _____ Start principal spillway profile at drop structure of largest incoming storm drain, extend across pond bottom, through principal spillway and down to receiving water course. (Show stream buffer edge)
 - _____ Underdrains discharging onto dense grass not plowed fields or forest duff.
 - _____ b. Underground Facilities (see pages 63-68):
 - _____ Manifold fed from inlet through PVC or HDPE Type SP slitted pipe. (see page 87)
 - _____ Filter fabric sides and top only.
 - _____ Located in virgin ground.
 - _____ No. 2 or No. 57 stone reservoir.
 - _____ Twelve inches of sand below stone (ASTM C-33).
 - _____ Inlet (concrete):
 - _____ Minimum three feet of depth below invert of PVC or HPDE Type SP manifold pipes.
 - _____ An emergency PVC pipe installed in bottom with a cap to allow dewatering (if necessary).
 - _____ Ninety degree elbow turn down on PVC or HPDE Type SP manifold pipe. Screw on cap to temporarily block water from entering facility.
 - _____ Carroll County standard details, easements, sequence of construction, inspection, and bonds.
 - _____ c. Dry Wells:
 - _____ Carroll County standard details, easements, sequence of construction, inspection, and bonds.
- 20. **Finalized Stormwater Management Report**
 - _____ a. Updated/Finalized Preliminary SWM report (Tables, Calculations, Figures)

- _____ b. Description of all watercourses, impoundments and wetlands on or adjacent to the site or into which stormwater discharges
- _____ c. Data for total site area, disturbed area, new impervious and total impervious areas
- _____ d. Data for total ESD and unified sizing criteria at all points of discharge. The sum of all discharge points must equal (c).
- _____ e. Hydrologic & Hydraulic Study at all final and interim points of discharge into streams, stream buffers, watercourses and adjoining properties showing effects.(Pre and post construction flow rates and velocities and a determination that adequate outfalls exist.) ($V_{10} \leq 2$ feet per second)
- _____ f. Final narrative that supports the final integrated stormwater management and sediment control designs, provides information to evaluate the effectiveness of the design, and demonstrates that ESD will be achieved to the MEP.

21. Certifications

- _____ a. Narrative, plans, supporting documentation and entirely filled out checklist signed and sealed by the licensed professional engineer or land surveyor that is in charge of the work.
- _____ b. All items in (21a) included in the submission

Signature and date by responsible professional engineer or land surveyor

M.B. Covington III, P.E.
SWM Program Engineer
Originally effective June 21, 2006
Revised to include ESD to the MEP.
Distributed for comment May 3, 2010.
Comments received at the Carroll County Surveyor's Meeting on May 19, 2010
Effective Date: July 29, 2010

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Administrative

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Easement Comment 1

Proposed, Platted, Residential, Commercial, or Institutional Subdivisions (including those subdivisions known as off-conveyances) with Private Stormwater (SWM) Facilities both structural and non-structural (i.e. ponds, drywells, roadway wide shoulders, etc.)

Lots (give lot or off-conveyance numbers) contain private Stormwater Management Facilities. A “Stormwater Management Easement and Maintenance Agreement” is to be granted to the County Commissioners of Carroll County as an easement of access to the County Commissioners or authorized representatives by a deed intended to be recorded simultaneously herewith.

For subdivisions, the above language must be placed on the plat. For off-conveyances, the facilities must be described in a meets and bounds description accompanied by an 8 ½” x 11” or 8 1/2” x 14” exhibit drawing to be recorded, with the easement, in the Land Records of Carroll County. The lots or off-conveyances containing the facilities and subject to the easements must be noted. Do not show drywell locations on the plat or exhibit. They are subject to change when buildings are constructed. All other SWM facilities that are outside of the right-of-way and on private lots or off-conveyances must be located and labeled as “Stormwater Management Facility”. The easement of access and maintenance agreement must be executed and recorded simultaneously with recordation or execution of the PWA. Specific easement language must be acceptable to the County Attorney’s Office.

Easement Comment 2

Proposed Residential Subdivision with Public Stormwater Facilities.

The area shown as Parcel (s)_____, containing _____acres, is/are to be conveyed to the County Commissioners of Carroll County upon acceptance of the Stormwater Management Facility.

The above language must be placed on the plat.

Issued August 20, 2003

Revised December 6, 2006

Distributed at Carroll County Surveyors Mtg. December 20, 2006

Revised & Distributed for Comment at Carroll County Surveyor’s Meeting on September 16, 2009

Revised per Comments, Redistributed at Carroll County Surveyors Meeting on November 18, 2009

Effective Date December 1, 2009

Easement Comment 3

Stormwater Management Access across a Common Use Drive.

A “Stormwater Management Easement” is to be granted to the County Commissioners of Carroll County as an easement of access to provide access to parcel (give parcel designation) for the County Commissioners or authorized representatives by a deed intended to be recorded simultaneously herewith.

Access from a Stormwater facility to a public road must be provided. If the access route includes a use-in-common driveway the above language must be placed on the plat. The easement of access across the use-in-common must be executed and recorded simultaneously with recordation or execution of the PWA. Specific easement language must be acceptable to the County Attorney’s Office.

Please note: Carroll County Government cannot be included in the declaration of maintenance obligation with respect to maintenance obligations.

Easement Comment 4

Renovations and additions to Residential, Commercial or Institutional Lots requiring Private Stormwater Facilities (both structural and non-structural ie ponds, drywells, roadway wide shoulders, etc.)

A “Stormwater Management Easement and Maintenance Agreement” is to be granted to the County Commissioners of Carroll County as an easement of access to the County Commissioners or authorized representatives by a deed intended to be recorded simultaneously herewith.

The above language must be placed on the plans. The lots containing the facilities must be noted. The easement of access and maintenance agreement must be executed and recorded simultaneously with execution of the Public Works Agreement. Specific easement language must be acceptable to the County Attorney’s Office.

One of the conditions for release of the SWM construction bond will be proof of the execution and recordation of the SWM easement.

Easement Comment 5

General Note – Floodplain Easement

Any area identified hereon as "Floodplain Easement" is to be granted to the County Commissioners of Carroll County as an easement to provide permanent preservation of the floodplain by a deed intended to be recorded simultaneously herewith.

The above language must be placed on the plat.

Easement Comment 6

For Platted Subdivisions That Achieve Stormwater Management Through Grading

Lots (give lot numbers) were intended to achieve stormwater management through grading. A grading plan will be required for each individual lot with the building permit application.

* The above language must appear on the plat and the subdivision plan. *

Please be aware that the rooftop disconnection credit assumes a level spreading effect on the lawn. The entire lawn **must** be graded to provide at least the required 5% for 75 ft. minimum disconnection distance. Achieving the slopes and distances by ditching produces concentrated flows and this is not acceptable for disconnection credit.

Issued August 20, 2003

Revised December 6, 2006

Distributed at Carroll County Surveyors Mtg. December 20, 2006

Pages 6-10 contained a reference copy of the Standard Stormwater Management Deed of Easement and Maintenance Agreement.

This document has been updated. It is available in the Department of the County Attorney Office, Room 301, 225 North Center Street, Westminster, MD 21157 or by calling 410-386-2030.

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Stormwater Managements Easements in the Incorporated Towns/Cities

When located within an incorporated town/city, the stormwater management easements may be granted to the municipality and recorded in the Land Records of Carroll County. To modify the easement language on the plat or plan to reference the incorporated town/city, the following language may be substituted for: County Commissioners of Carroll County, County Commissioners, or Carroll County Government:

Manchester:	“Town of Manchester”
Mount Airy:	“Town of Mount Airy”
New Windsor:	“Town of New Windsor”
Sykesville:	“Town of Sykesville”
City of Westminster:	“The Mayor and Common Council of Westminster”

Please note: In June 2006, the Town of Hampstead elected to have all stormwater management and floodplain easements conveyed to the Commissioners of Carroll County.

Effective Date: June 21, 2006
Distributed at the Carroll County Surveyor’s and Engineer’s Meeting
Revised to Eliminate Union Bridge
Distributed at the Carroll County Surveyors Mtg. December 20, 2006
Revised after Carroll County Surveyor’s Meeting May 19, 2010
Effective Date: July 29, 2010

CARROLL COUNTY-PUBLIC FACILITY

STORMWATER MANAGEMENT MAINTENANCE AGREEMENT **SCHEDULE**

1. The Stormwater Management Facility/Facilities shown on these plans shall be constructed by the developer.
2. The developer shall be responsible for continuing maintenance of the facility/facilities which shall include such items as mowing, cleaning, removing debris and repairing any structural damage until it is accepted by Carroll County.
3. The developer shall be responsible for any structural damage or failure which may occur as a result of negligence, accident or misuse. In the event of structural damage, the developer is responsible to make repairs as quickly as possible (30 day maximum). If after 30 days, Carroll County Government performs the necessary work to place the facility in proper working condition, the developer of the facility shall be assessed the cost of the work and any penalties. These monies shall first be collected from a bond, which the developer is required to post with the County to cover such expenses. Should the bond be insufficient, the remaining monies may be collected by placing a lien on the property or by including the costs and penalties on the property tax bill and collecting them as ordinary taxes. The bond and/or lien and/or tax bill will be used until such time as the County takes the facility into its system.
4. Maintenance of the facility shall be until accepted for maintenance by the County which will be no sooner than two years after completion of the facility at which time the Carroll County Bureau of Resource Management shall certify that the facility is in proper working condition. "After completion of the facility" is construed to mean that all contributory drainage areas are paved or supporting a 2" stand of grass and that all buildings are constructed and that the Carroll County Bureau of Resource Management has inspected construction and a registered professional engineer has certified that the "As-Built" plans meet the plans and specifications for construction.
5. The developer shall provide in a deed, an in-fee parcel for the site of the facilities and an in-fee access from the facility to a public right-of-way.

First Effective January 21, 2004
Revised after Carroll County Surveyor's Meeting May 19, 2010
Effective Date: July 29, 2010

TOWN OF SYKESVILLE – PUBLIC FACILITY

STORMWATER MANAGEMENT MAINTENANCE AGREEMENT **SCHEDULE**

1. The Stormwater Management Facility/Facilities shown on these plans shall be constructed by the developer.
2. The developer shall be responsible for continuing maintenance of the facility/facilities which shall include such items as mowing, cleaning, removing sediment, trees, shrubs and debris and repairing any structural damage until it is accepted by the Town of Sykesville.
3. The developer shall be responsible for any structural damage or failure which may occur as a result of negligence, accident or misuse. In the event of structural damage, the developer is responsible to make repairs as quickly as possible (30 day maximum). If after 30 days, the Town of Sykesville performs the necessary work to place the facility in proper working condition, the developer of the facility shall be assessed the cost of the work and any penalties. These monies shall first be collected from a bond, which the developer is required to post with the Town to cover such expenses. Should the bond be insufficient, the remaining monies may be collected by placing a lien on the property or by including the costs and penalties on the property tax bill and collecting them as ordinary taxes. This bond will be used until such time as the County takes the facility into its system. The bond and/or lien and/or tax bill will be used until such time as the Town takes the facility into its system.
4. Maintenance of the facility shall be until accepted for maintenance by the Town which will be no sooner than two years after completion of the facility at which time the Carroll County Bureau of Resource Management shall certify that the facility is in proper working conditions. “After completion of the facility” is construed to mean that all contributory drainage areas are paved or supporting a 2" stand of grass and all buildings are constructed and that the Carroll County Bureau of Resource Management has inspected construction and a registered professional engineer has certified that the “As-Built” plans meet the plans and specifications for construction.
5. The developer shall provide in a deed, an in-fee parcel for the site of the facilities and an in-fee access from the facility to a public right-of –way.

First effective January 21, 2004
Revised after Carroll County Surveyor’s Meeting May 19, 2010
Effective Date: July 29, 2010

TOWN OF NEW WINDSOR – PUBLIC FACILITY

STORMWATER MANAGEMENT MAINTENANCE AGREEMENT **SCHEDULE**

1. The Stormwater Management Facility/Facilities shown on these plans shall be constructed by the developer.
2. The developer shall be responsible for continuing maintenance of the facility/facilities which shall include such items as mowing, cleaning, removing sediment, trees, shrubs and debris and repairing any structural damage until it is accepted by the Town of New Windsor.
3. The developer shall be responsible for any structural damage or failure which may occur as a result of negligence, accident or misuse. In the event of structural damage, the developer is responsible to make repairs as quickly as possible (30 day maximum). If after 30 days, the Town of New Windsor performs the necessary work to place the facility in proper working condition, the developer of the facility shall be assessed the cost of the work and any penalties. These monies shall first be collected from a bond, which the developer is required to post with the Town to cover such expenses. Should the bond be insufficient, the remaining monies may be collected by placing a lien on the property or by including the costs and penalties on the property tax bill and collecting them as ordinary taxes. The bond and/or lien and/or tax bill will be used until such time as the Town takes the facility into its system.
4. Maintenance of the facility shall be until accepted for maintenance by the Town which will be no sooner than two years after completion of the facility at which time the Carroll County Bureau of Resource Management shall certify that the facility is in proper working conditions. “After completion of the facility” is construed to mean that all contributory drainage areas are paved or supporting a 2" stand of grass and all buildings are constructed and that the Carroll County Bureau of Resource Management has inspected construction and a registered professional engineer has certified that the “As-Built” plans meet the plans and specifications for construction.
5. The developer shall provide in a deed, an in-fee parcel for the site of the facilities and an in-fee access from the facility to a public right-of-way.

First effective January 21, 2004

Revised after Carroll County Surveyor's Meeting May 19, 2010

Effective Date: July 29, 2010

TOWN OF MOUNT AIRY – PUBLIC FACILITY

STORMWATER MANAGEMENT MAINTENANCE AGREEMENT SCHEDULE

1. The Stormwater Management Facility/Facilities shown on these plans shall be constructed by the developer.
2. The developer shall be responsible for continuing maintenance of the facility/facilities which shall include such items as mowing, cleaning, removing sediment, trees, shrubs and debris and repairing any structural damage until it is accepted by the Town of Mount Airy.
3. The developer shall be responsible for any structural damage or failure which may occur as a result of negligence, accident or misuse. In the event of structural damage, the developer is responsible to make repairs as quickly as possible (30 day maximum). If after 30 days, the Town of Mount Airy performs the necessary work to place the facility in proper working condition, the developer of the facility shall be assessed the cost of the work and any penalties. These monies shall first be collected from a bond, which the developer is required to post with the Town to cover such expenses. Should the bond be insufficient, the remaining monies may be collected by placing a lien on the property or by including the costs and penalties on the property tax bill and collecting them as ordinary taxes. The bond and/or lien and/or tax bill will be used until such time as the Town takes the facility into its system.
4. Maintenance of the facility shall be until accepted for maintenance by the Town which will be no sooner than two years after completion of the facility at which time the Carroll County Bureau of Resource Management shall certify that the facility is in proper working condition. “After completion of the facility” is construed to mean that all contributory drainage areas are paved or supporting a 2” stand of grass and that all buildings are constructed and that the Carroll County Bureau of Resource Management has inspected construction and a registered professional engineer has certified the “As-Built” plans meet the plans and specifications for construction.
5. The developer shall provide in a deed, an in-fee parcel for the site of the facilities and an in-fee access from the facility to a public right-of-way.

Effective January 21, 2004
Revised after Carroll County Surveyor’s Meeting May 19, 2010
Effective Date: July 29, 2010

TOWN OF MANCHESTER – PUBLIC FACILITY

STORMWATER MANAGEMENT MAINTENANCE AGREEMENT **SCHEDULE**

1. The Stormwater Management Facility/Facilities shown on these plans shall be constructed by the developer.
2. The developer shall be responsible for continuing maintenance of the facility/facilities which shall include such items as mowing, cleaning, removing debris and repairing any structural damage until it is accepted by the Town of Manchester.
3. The developer shall be responsible for any structural damage or failure which may occur as a result of negligence, accident or misuse. In the event of structural damage, the developer is responsible to make repairs as quickly as possible (30 day maximum). If after 30 days, the Town of Manchester performs the necessary work to place the facility in proper working condition, the developer of the facility shall be assessed the cost of the work and any penalties. These monies shall first be collected from a bond, which the developer is required to post with the Town to cover such expenses. Should the bond be insufficient, the remaining monies may be collected by placing a lien on the property or by including the costs and penalties on the property tax bill and collecting them as ordinary taxes. The bond and/or lien and/or tax bill will be used until such time as the Town takes the facility into its system.
4. Maintenance of the facility shall be until accepted for maintenance by the Town which will be one year after 80% of the houses in the development are completed, but no sooner than two years after completion of the facility at which time the Carroll County Bureau of Resource Management shall certify that the facility is in proper working condition. “After completion of the facility” is construed to mean that the Carroll County Bureau of Resource Management has inspected construction and a registered professional engineer has certified the “As-Built” plans meet the plans and specifications for construction.
5. The developer shall provide in a deed, an in-fee parcel for the site of the facilities and an in-fee access from the facility to a public right-of-way.

First effective April 15, 2003
Revised after Carroll County Surveyor’s Meeting May 19, 2010
Effective Date: July 29, 2010

TOWN OF HAMPSTEAD- PUBLIC FACILITY

STORMWATER MANAGEMENT MAINTENANCE AGREEMENT **SCHEDULE**

1. The Stormwater Management Facility/Facilities shown on these plans shall be constructed by the developer.
2. The developer shall be responsible for continuing maintenance of the facility/facilities which shall include such items as mowing, cleaning, removing sediment, trees, shrubs, and debris and repairing any structural damage until it is accepted by the Town of Hampstead.
3. The developer shall be responsible for any structural damage or failure which may occur as a result of negligence, accident or misuse. In the event of structural damage, the developer is responsible to make repairs as quickly as possible (30 day maximum). If after 30 days, the Town of Hampstead performs the necessary work to place the facility in proper working condition, the developer of the facility shall be assessed the cost of the work and any penalties. These monies shall first be collected from a bond, which the developer is required to post with the Town to cover such expenses. Should the bond be insufficient, the remaining monies may be collected by placing a lien on the property or by including the costs and penalties on the property tax bill and collecting them as ordinary taxes. The bond and/or lien and/or tax bill will be used until such time as the Town takes the facility into its system.
4. Maintenance of the facility shall be until accepted for maintenance by the Town which will be no sooner than two years after completion of the facility at which time the Carroll County Bureau of Resource Management shall certify that the facility is in proper working condition. "After completion of the facility" is construed to mean that all contributory drainage areas are paved or supporting a 2" stand of grass and that all buildings are constructed and that the Carroll County Bureau of Resource Management has inspected construction and a registered professional engineer has certified that the "As-Built" plans meet the plans and specifications for construction.
5. The developer shall provide in a deed, an in-fee parcel for the site of the facilities and an in-fee access from the facility to a public right-of-way.

First effective January 21, 2004
Revised after Carroll County Surveyor's Meeting May 19, 2010
Effective Date: July 29, 2010

CITY OF WESTMINSTER - PUBLIC FACILITY

STORMWATER MANAGEMENT MAINTENANCE AGREEMENT **SCHEDULE**

1. The Stormwater Management Facility/Facilities shown on these plans shall be constructed by the developer.
2. The developer shall be responsible for continuing maintenance of the facility/facilities which shall include such items as mowing, cleaning, removing sediment, trees, shrubs, and debris and repairing any structural damage until it is accepted by the City of Westminster.
3. The developer shall be responsible for any structural damage or failure which may occur as a result of negligence, accident or misuse. In the event of structural damage, the developer is responsible to make repairs as quickly as possible (30 day maximum). If after 30 days, the City of Westminster performs the necessary work to place the facility in proper working condition, the developer of the facility shall be assessed the cost of the work and any penalties. These monies shall first be collected from a bond, which the developer is required to post with the City to cover such expenses. Should the bond be insufficient, the remaining monies may be collected by placing a lien on the property or by including the costs and penalties on the property tax bill and collecting them as ordinary taxes. The bond and/or lien and/or tax bill will be used until such time as the City takes the facility into its system.
4. Maintenance of the facility shall be until accepted for maintenance by the City which will be no sooner than two years after completion of the facility at which time the Carroll County Bureau of Resource Management shall certify that the facility is in proper working condition. "After completion of the facility" is construed to mean that all contributory drainage areas are paved or supporting a 2" stand of grass and all buildings are constructed and that the Carroll County Bureau of Resource Management has inspected construction and a registered professional engineer has certified that the "As-Built" plans meet the plans and specifications for construction.
5. The developer shall provide in a deed, an in-fee parcel for the site of the facilities and an in-fee access from the facility to a public right-of-way.

First effective January 21, 2004
Revised after Carroll County Surveyor's Meeting May 19, 2010
Effective Date: July 29, 2010

**CARROLL COUNTY, HAMPSTEAD,
WESTMINSTER, MT AIRY, NEW WINDSOR,
SYKESVILLE, MANCHESTER
PRIVATE FACILITIES**

STORMWATER MANAGEMENT MAINTENANCE AGREEMENT SCHEDULE

1. The Stormwater Management Facility/Facilities shown on these plans shall be constructed and maintained by the owner(s).
2. Owner/his heirs or assigns shall be responsible for continuing maintenance of the facility/facilities, which shall include such items as mowing, cleaning and removing sediment, trees, shrubs and debris. The time period for this continuing maintenance shall be on “as-needed” basis but shall not be delayed longer than thirty (30) days.
3. Owner, his heirs or assigns shall be responsible for any structural damages or failure which may occur as a result of negligence, accident or misuse. In the event of structural damage, owner shall be responsible to make the necessary repairs as quickly as possible but in any case within thirty (30) days.
4. If after notice by the County/Town/City to correct a violation requiring maintenance work, satisfactory corrections are not made by the owner(s) within (30) days the County/Town/City may perform all necessary work to place the facility in proper working condition. The owners of the facility shall be assessed the cost of the work and any penalties. These monies shall be collected from a bond, which the developer is required to post with the County/Town/City to cover such expenses until “completion of the facility”. “Completion of the facility” is construed to mean that all contributory drainage areas are paved or supporting a 2” stand of grass and that the Carroll County Bureau of Resource Management has inspected construction and a registered professional engineer has certified that the “As-Built” plans meet the plans and specifications for construction. After “completion of the facility” the moneys may be collected by placing a lien on the property, or by including the costs and penalties on the property tax bill and collecting them as ordinary taxes by the County/Town/City.

5. Owner(s) shall grant right of entry to authorized County/Town/City personnel for purposes of inspection monitoring and/or repair. Site visits for inspection and/or monitoring shall be conducted only during normal County working hours (8:00 a.m. to 5:00 p.m. Monday – Friday).
6. This agreement including right-of entry for inspection/maintenance and repair shall be recorded in the Land Records of the County.

Updated April 15, 2003

Revised and distributed at the Carroll County Surveyors Meeting on December 20, 2006

Revised after Carroll County Surveyor's Meeting May 19, 2010

Effective Date: July 29, 2010

CARROLL COUNTY, MT AIRY, NEW WINDSOR, SYKESVILLE, MANCHESTER, HAMPSTEAD

REQUIRED PLAN CERTIFICATIONS

Note: Only Professional Engineers may design and certify MD-378 structures.

Engineer's Design Certification

I hereby certify that these plans have been designed according to Chapter 191 of the Code of Public Local Laws and Ordinances of Carroll County and I hereby certify that these documents were prepared or approved by me, and I am a duly licensed Professional Engineer or Professional Land Surveyor, as appropriate, under the laws of the State of Maryland.

Signed _____ Date _____
License No. _____ Expiration Date _____

Developer's / Landowner's Certification

I/We hereby certify that all proposed work shown on these construction drawing(s) will be conducted in strict accordance with these plans. I/We also understand that it is my/our responsibility to have the construction supervised and certified, including the submittal of "as-Built" plans certified by a registered Professional Engineer or Professional Land Surveyor, as appropriate, within thirty (30) days of completion of work on the stormwater management facility/facilities. I/we also certify that this/these stormwater management facility/facilities will be inspected during construction by a registered Professional Engineer or Professional Land Surveyor, as appropriate, in accordance with Article VII of Chapter 191 of the Code of Public Local Laws and Ordinances of Carroll County.

Signed _____ Date _____

Engineer's "As-Built" Certification

I/We hereby certify that the facility/facilities shown on this/these plan(s) was constructed as shown on the "As-Built" plans and meets the approved plans and specifications. I also certify that this/these facilities were inspected in accordance with Article VII of Chapter 191 of the Code of Public Local Laws and Ordinances of Carroll County and I hereby certify that these documents were prepared or approved by me, and I am a duly licensed Professional Engineer or Professional Land Surveyor, as appropriate, under the laws of the State of Maryland.

Signed _____ Date _____
License No. _____ Expiration Date _____

Effective November 1, 2001

Updated on 4/22/03 & 06/20/05

Revised and distributed at the Carroll County Surveyors Meeting on December 20, 2006

Engineer's Design and As-Built Certification revised in accordance with COMAR changes July 2007, distributed at the Carroll County Surveyors Meeting August 15, 2007

Revised to add Professional Land Surveyors

Distributed for comment May 3, 2010

Comments received at the Carroll County Surveyors Meeting on May 19, 2010.

Effective Date: July 29, 2010

**Carroll County Bureau of Resource Management
Stormwater Management
REVIEW FEE COMPUTATION SHEET**

Project Name: _____ **File No.:** _____ **Receipt No.:** _____

Applicant: _____

Choose one of the following options:

_____ 1. Plan Review (**Total Plan Review Fee \$**_____)

$\$1,000 + (\$160 \times \text{_____ Acres} \times \text{_____} \% \text{ Weighted Average Impervious Area}) = \text{_____}$
Total

PERCENT IMPERVIOUS AREA

Land Use	Average % Impervious
Impervious Area	100
Commercial / Business	85
Industrial / School	72
Residential	
1/8 acre or less lots	65
1/6 acre lots *	56
1/4 acre lots	38
1/3 acre lots	30
1/2 acre lots	25
1 acre lots	20
2 acre lots	12

From: USDA Soil Conservation Service Technical Release 55 (*interpolated)

2. Residential Subdivision with Stormwater management entirely provided by ESD treatment practices in accordance with Chapter 191, the Manual and County Policies.

_____ **2a-** Minor Residential Subdivision (3 lots or less, not including remainder) \$500

_____ **2b-** Previously recorded lot or single off conveyance \$125

_____ 3. Variance Request \$50

Enter the review fee amount on the Bureau of Development Review's Review Fee Deposit Form. Please not that one check made payable to the Carroll County Commissioners is to be submitted for all plan review fees.

Martin B. Covington, III, P.E. – First effective April 5, 2005
 Revised to add ESD Treatment Practices.
 Distributed for comment May 3, 2010
 Comments received at the Carroll County Surveyors Meeting on May 19, 2010.
 Effective Date: July 29, 2010

Carroll County Stormwater Management Fee-In-Lieu Computation Sheet

Fee in lieu of providing on-site management of stormwater runoff for Variances and Redevelopment Projects when no other alternative is available. *

FEE:

$$\frac{\text{Square Footage of Impervious Within the Limits of Disturbance}}{\text{Square Foot}} \times \frac{\$0.76}{\text{Fee / Ft}^2} = \text{Stormwater Management Fee-In-Lieu **}$$

FEE DERIVATION:

Carroll County Stormwater Management Retrofit Projects that are comparable to redevelopment projects:

1. Treating small to medium (less than 5-acres) amounts of impervious surfaces.
2. Constructed since January 1, 2009. ***

	Construction Costs	Engineering	Impervious Area Treated
Totals:	\$533,921.96	\$117,999.50	19.63 acres= 855,082 Ft ²

$$\frac{\text{Fee}}{\text{Square Foot}} = \frac{\$651,921.00}{855,082 \text{ Ft}^2} = \$0.76 / \text{Ft}^2$$

* See Section §191-8 and §191-9 of the Carroll County Code.

** Fees paid into the Stormwater Management Fund established in §191-17.1 for the exclusive purpose of providing management of stormwater.

*** This fee will be updated annually to include all applicable County retrofit projects.

Martin B. Covington, III, P.E.
 Distributed for comment May 3, 2010
 Comments received at the Carroll County Surveyors Meeting on May 19, 2010.
 Effective Date: July 29, 2010

Mandatory Carroll County Stormwater Runoff Disconnections

Introduction

In accordance with Section 191-10 of the Carroll County Code of Public Local Laws and Ordinances-

“(1) The County shall require that the planning techniques, non-structural practices, and design methods specified in the Design Manual be used to implement ESD to the MEP. The use of ESD planning techniques and treatment practices shall be exhausted before any structural BMP is implemented. Stormwater management plans for development projects subject to this chapter shall be designed using ESD sizing criteria, recharge volume, water quality volume, and channel protection storage volume criteria according to the Design Manual and the Supplement. The MEP standard is met when channel stability is maintained, predevelopment groundwater recharge is replicated, non point source pollution is minimized and structural stormwater management practices are used only if determined to be absolutely necessary.”

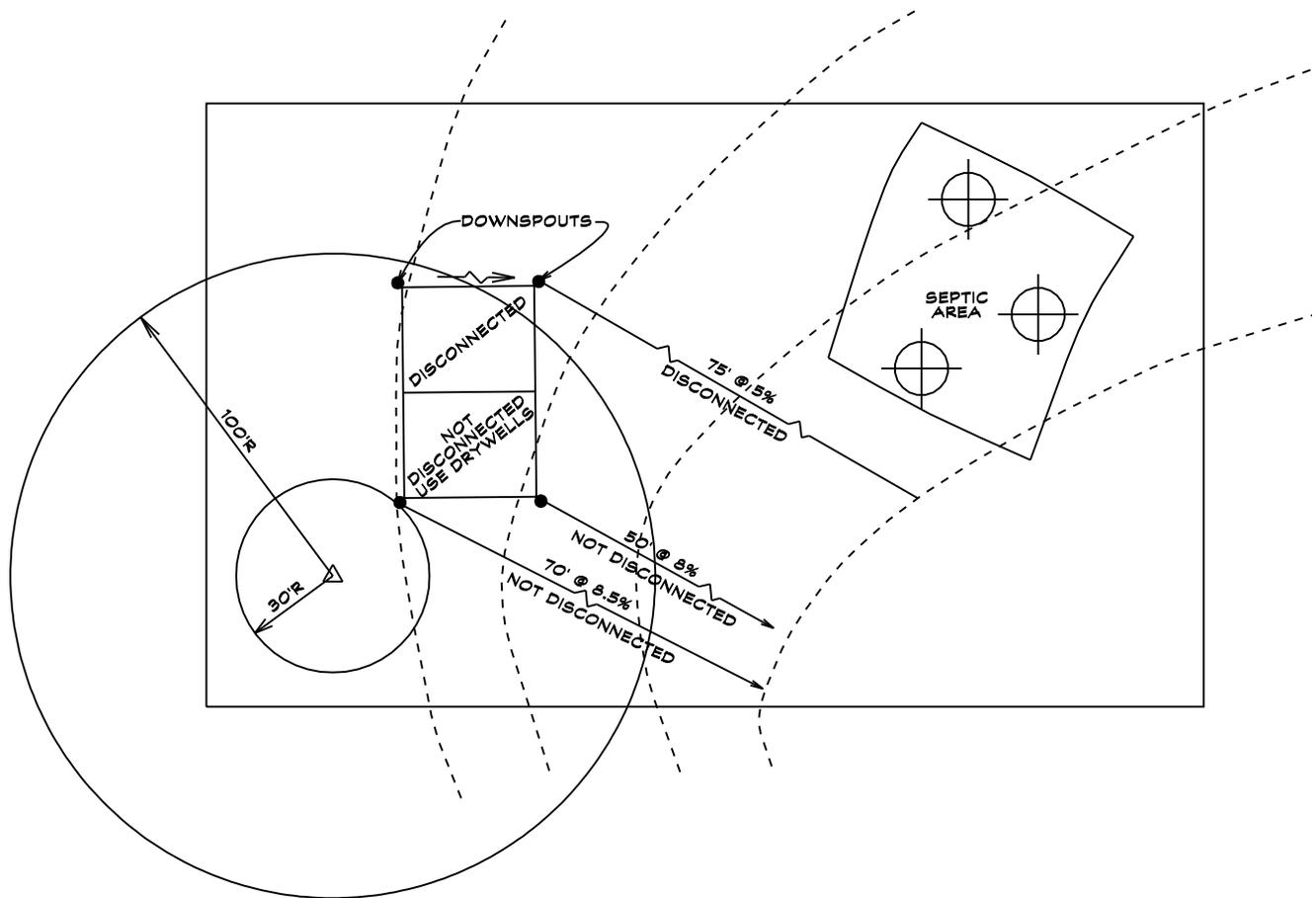
The purpose of these requirements is to minimize increases of new development runoff thus reducing the number and volume of structural surface facilities.

General Requirements

1. All new houses must be “disconnected” either by grading or by use of standard drywells in accordance with the details on pages 25-31.
2. All new open section roadways or use-in-common drives must be disconnected by use of the “wide shoulder” technique. This requires that subdivision roadways and use-in-common drives have acceptable grades to achieve disconnection credit in accordance with the details on pages 32-36. This may necessitate the realignment of planned subdivision roads and common-use-driveways. If sidewalks are required along subdivision roadways the wide shoulder must be extended by twice the width of the sidewalk.
3. Other ESD, nonstructural and structural stormwater management practices may be considered on a case by case basis if rooftop and non runoff disconnection credits are proven not to be feasible due to site specific conditions.

Martin B. Covington, III, P.E. , Carroll County Stormwater Management Program Engineer
First Effective October 19, 2005
Revised to provide “ESD to MEP”
Distributed for comment May 3, 2010
Comments received at the Carroll County Surveyors Meeting on May 19, 2010.
Effective Date: July 29, 2010

CARROLL COUNTY POLICY ON ROOFTOP DISCONNECTION THROUGH GRADING



NOTE:

PLEASE BE AWARE THAT THE ROOFTOP DISCONNECTION CREDIT ASSUMES A LEVEL SPREADING EFFECT ON THE LAWN. THE ENTIRE LAWN MUST BE GRADED EVENLY TO PROVIDE AT LEAST THE REQUIRED MINIMUM DISCONNECTION DISTANCE ON THE LOT ITSELF. ACHIEVING THE REQUIRED 75 FT. @ 5% BY DITCHING PRODUCES CONCENTRATED FLOWS. THIS IS NOT ACCEPTABLE FOR DISCONNECTION CREDIT.

PLEASE SEE APPROVED EASEMENT LANGUAGE
"EASEMENT COMMENT #6"

Martin B. Covington III, PE
C.C. SWM Program Engineer
FIRST EFFECTIVE OCTOBER 19, 2005
REVISED AND DISTRIBUTED FOR
COMMENT MAY 3, 2010
COMMENTS RECEIVED AT C.C.
SURVEYORS MEETING MAY 19, 2010
EFFECTIVE DATE: JULY 29, 2010

**CARROLL COUNTY HEALTH DEPARTMENT
BUREAU OF ENVIRONMENTAL HEALTH**

Larry L. Leitch, M.A., M.P.A.
Health Officer, Carroll County

Elizabeth M. Ruff, M.D.
Deputy Health Officer



290 South Center Street
P.O. Box 845
Westminster, Maryland 21158

Telephones: 410-857-5009
410-876-1886
410-875-3395
800-966-3877
TTY: 410-876-4779
Fax: 410-876-4430

TO: Surveyors, Engineers, Etc.
FROM: Leigh T. Broderick
DATE: December 10, 2002
RE: Well and septic setbacks from storm water devices and water quality facilities

In response to requests for guidance on setback requirements from storm water management devices and water quality facilities, the following summary is given:

**SEWAGE DISPOSAL AREA AND WELL SEPARATION DISTANCES
FROM STORMWATER MANAGEMENT DEVICES**

STORM WATER DEVICE	Sewage disposal areas/systems	Wells
Infiltration facilities (including by not limited to infiltration pond/trench, sand-filter trench, downspout drywell (“box of rocks”), and rain gardens)	25-foot minimum ¹	100 feet ²
Wet Pond	100 feet	No specified setback ¹
Dry Pond	50 feet from high water level	No specified setback ¹
Combination/Wet marsh	50 feet from high water level or 100 feet from edge of marsh, whichever is greater	No specified setback ¹

¹ These will be evaluated on a case-by-case basis.

² MDE’s Storm Water Management Manual states that “Infiltration facilities should be located a minimum of 100 feet horizontally from any water supply well.”

STORMWATER MANAGEMENT STANDARD DRYWELL INSTALLATION

MARTIN BRYAN COVINGTON, III. P.E. 1

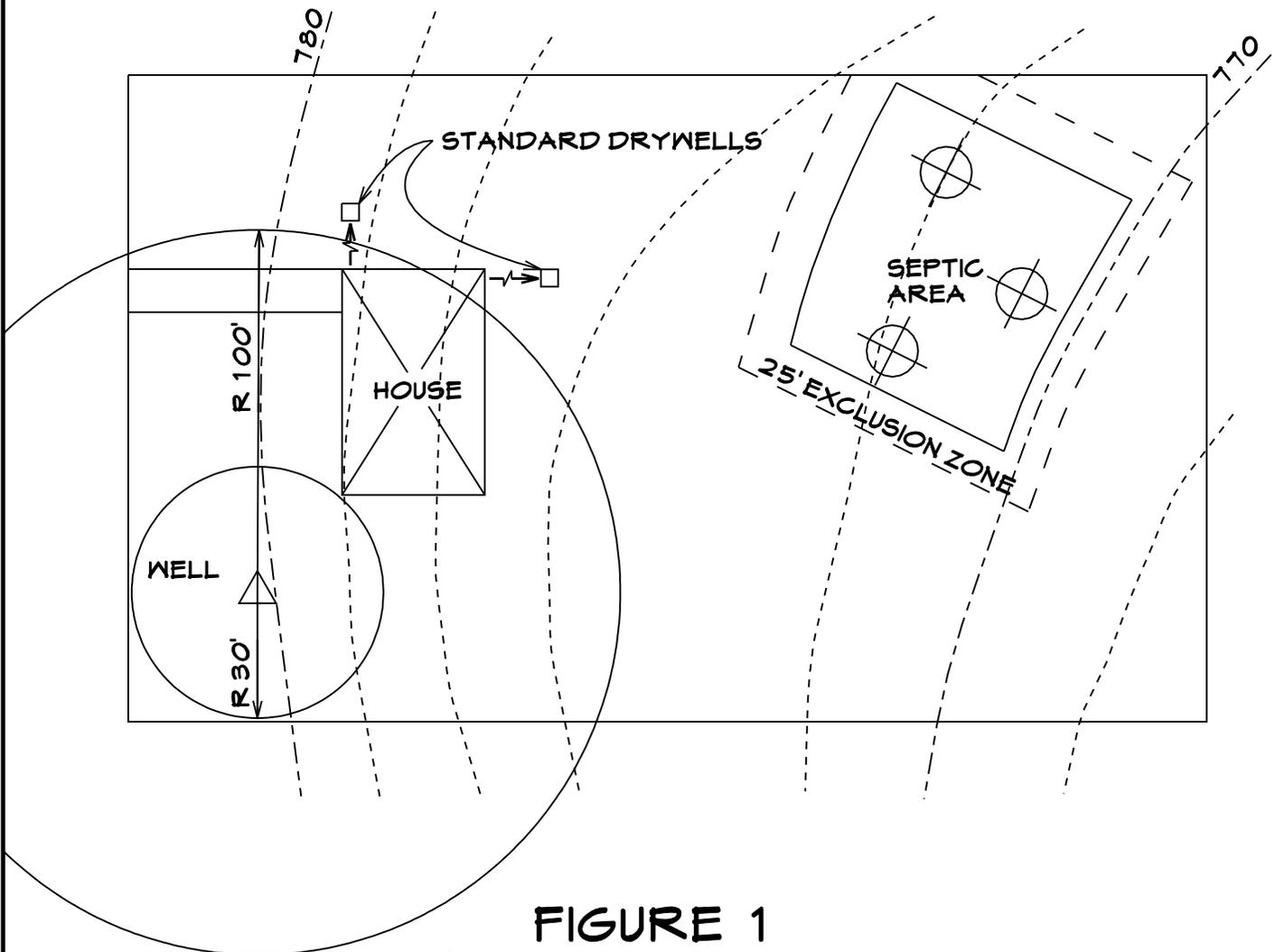


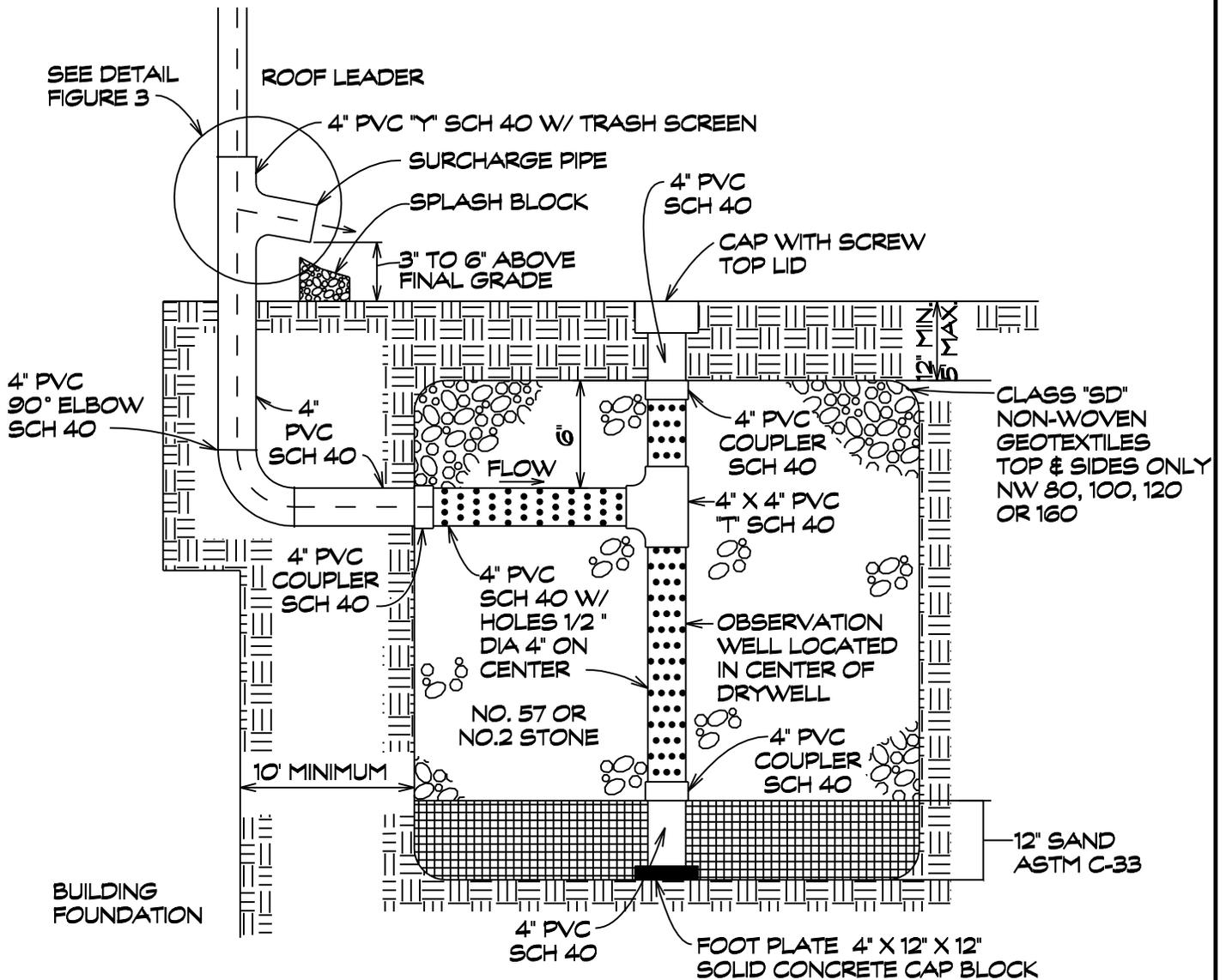
FIGURE 1
TYPICAL LOT LAYOUT

NOTES:

1. STANDARD CARROLL COUNTY DRYWELLS ARE NORMALLY 11'x10'x5' WITH SAND FILLING THE BOTTOM FOOT. THIS PROVIDES MINIMUM ESD STORMWATER CONTROL AND GROUNDWATER RECHARGE FOR 2000 SQAURE FEET OF ROOFTOP.
2. STANDARD DRYWELLS MUST BE LOCATED AT LEAST 100 FEET FROM ANY WELL AND AT LEAST 25 FEET FROM THE SEPTIC AREA.
3. DRY WELLS ARE TO BE INSTALLED AT OR AFTER FINAL GRADING. (WHEN DOWNSPOUTS ARE INSTALLED)

¹MARTIN BRYAN COVINGTON, III. P.E., PROGRAM ENGINEER, CARROLL COUNTY GOVERNMENT, MD 225 NORTH CENTER STREET, WESTMINSTER, MD 21157-2194 MCOVINGTON@CCG.CARR.ORG

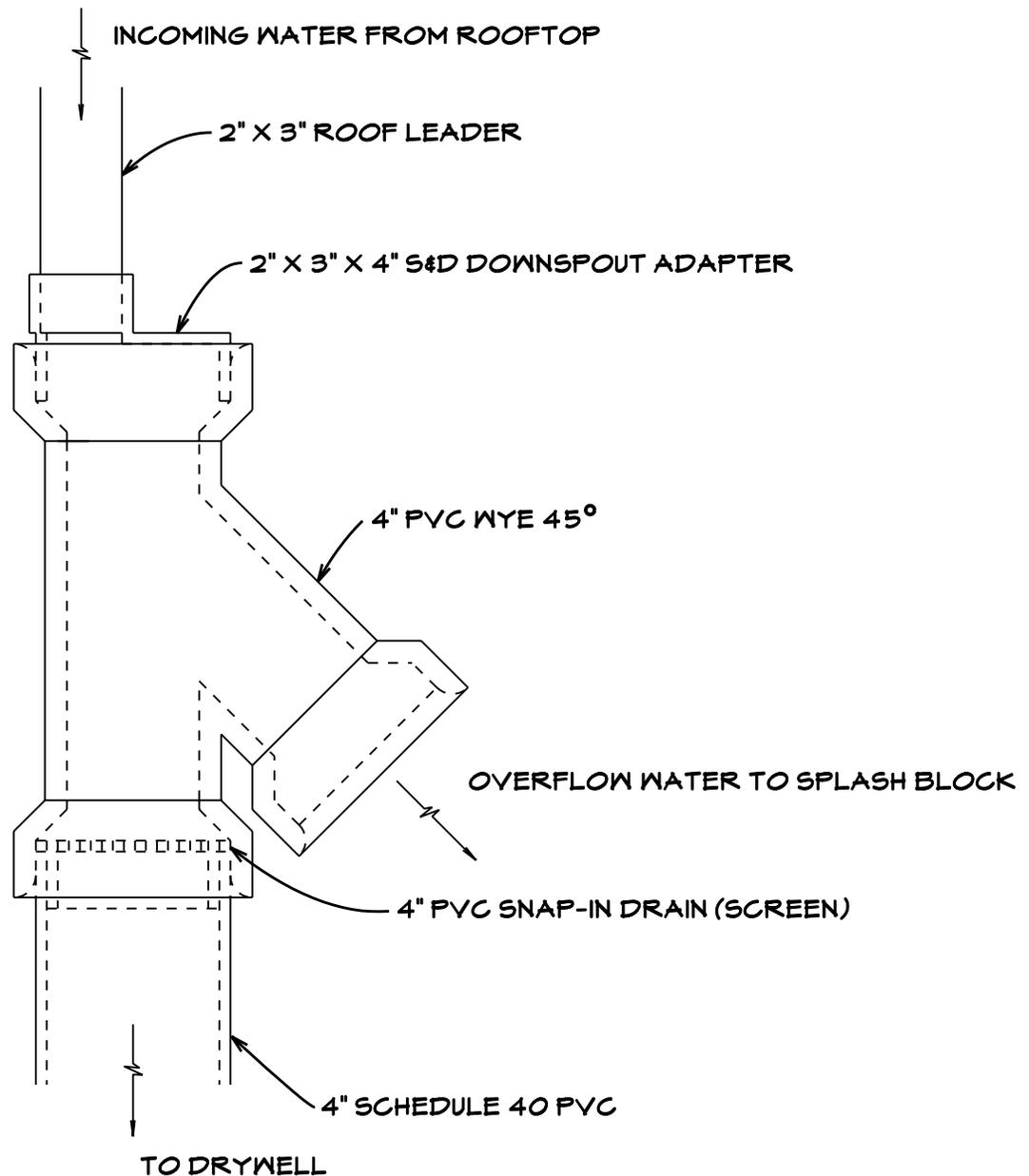
FIGURE 2 STANDARD DRYWELL



NOTES:

1. IF USING ONE DRYWELL FOR THE ENTIRE HOUSE THE STANDARD DRYWELL IS 11' X 10' X 5' WITH SAND FILLING THE BOTTOM FOOT. THIS PROVIDES MINIMUM ESD (1") STORMWATER CONTROL FOR 2000 SQUARE FEET OF ROOFTOP. IF ADDITIONAL CONTROL IS REQUIRED TO PROVIDE TOTAL ESD TO MEP (UP TO 2.6") MULTIPLE PRACTICES MAY BE USED. DRYWELLS LARGER THAN 300 FT² OF STORAGE VOLUME MUST BE DESIGNED AS INFILTRATION FACILITIES.
2. MINIMUM SETBACKS:
 - A. 100 FT FROM WELLS
 - B. 25 FT FROM SEPTIC AREAS
 - C. 10 FT FROM BUILDINGS
3. FROM THE DOWNSPOUT TO THE DRYWELL THE DRAIN PIPE MUST BE AT LEAST 6" BELOW GRADE.
4. THE LOCATIONS AND SIZE OF ALL DRYWELLS MUST BE SHOWN ON THE GRADING PLOT PLAN.
5. THESE GEOTEXTILES ARE AVAILABLE IN FINKSBURG @ ES&G DISTRIBUTORS 2601 EMORY RD. BLDG 8. 866-744-5001, ANY EQUIVALENT GEOTEXTILE IS ACCEPTABLE.

FIGURE 3 STANDARD DRYWELL DOWNSPOUT FITTINGS



NOTES:

1. THE SNAP IN SCREEN IS REQUIRED TO PREVENT CLOGGING OF THE DRYWELL WITH DEBRIS.
2. SEE FIGURE 3a "LIST OF POTENTIAL SUPPLIERS TO ACCOMPANY FIGURE 3 STANDARD DRYWELL DOWNSPOUT FITTINGS" FOR INFORMATION ON SOME LOCAL RETAILERS THAT SUPPLY COMPONENTS FOR THIS SYSTEM.

Martin B. Covington III, PE
 ORIGINALLY EFFECTIVE APRIL, 2006
 REVISED MARCH 19, 2008
 DISTRIBUTED AT C.C. SURVEYORS MTG.

Figure 3a
List of Potential Suppliers to Accompany Figure 3
Standard Drywell Downspout Fittings
March 2008

2" x 3" x 4" S&D Downspout Adapter

BT Plumbing Supply, Inc., 486 Lucabaugh Mill Road, Westminster, MD 21157; 410-876-2118-
Part No. PSDDSA234

Ferguson Enterprises, Inc., 900 Wakefield Valley Road, New Windsor, MD 21776; 410-635-6682-
Part No. PSDAKMP

Lowes Home Improvement Warehouse of Westminster, 777 Market Street, Westminster, MD 21157;
410-857-7445- Part No. NDS L9P04

The Plumbery Home Center (two locations), 15 N. Main Street, Mt Airy, MD 21771; 301-829-1770 or
410-0331; or 418 E. Baltimore Street, Taneytown, MD 21787; 410-751-1113 – Part No.- requires bushing

4" PVC WYE 45°

BT Plumbing Supply, Inc., 486 Lucabaugh Mill Road, Westminster, MD 21157; 410-876-2118-
Part No. PY4

Ferguson Enterprises, Inc., 900 Wakefield Valley Road, New Windsor, MD 21776; 410-635-6682-
Part No. PDWVYP

Lowes Home Improvement Warehouse of Westminster, 777 Market Street, Westminster, MD 21157;
410-857-7445- Part No. Charlotte CPF600 1400

4" PVC Snap-in Drain Screen

BT Plumbing Supply, Inc., 486 Lucabaugh Mill Road, Westminster, MD 21157; 410-876-2118-
Part No. JSD42004

Jones-Stephens Corp.; www.plumbest.com; 800-355-6637 – Part No. D42-004

Lowes Home Improvement Warehouse of Westminster, 777 Market Street, Westminster, MD 21157;
410-857-7445- Part No. Oatey 435693

The Plumbery Home Center (two locations), 15 N. Main Street, Mt Airy, MD 21771; 301-829-1770 or
410-0331; or 418 E. Baltimore Street, Taneytown, MD 21787; 410-751-1113 – Part No.- requires cutting
to fit

Note: The Carroll County Bureau of Resource Management obtained this part information after sending out a letter to known local plumbing supply companies and after receiving information from each respective company. The suppliers listed above are provided for reference purposes only. Any equivalent schedule 40 PVC fittings from any vendor may be used.

Martin B. Covington, III, P.E. , Carroll County Stormwater Management Program Engineer
First Effective March 19, 2008
Revised to provide 1" of ESD.
Distributed for comment May 3, 2010.
Comments received at the Carroll County Surveyors Meeting on May 19, 2010.
Effective Date: July 29, 2010

**Use of Drywells to Achieve SWM When Creating
New Lots When No Other BMPs Are Needed**

Required Items April 2006

Off Conveyances Only

1. Drywell Detail and Sequence on Plan (Specify Drywell Dimensions)
2. Engineer's, Developer's/Landowner's and Engineer's As-Built Certifications on Plan.
3. Bonding at time of Building Permit.

Subdivision Lots Only

1. Drywell Detail and Sequence on Plan (Specify Drywell Dimensions)
2. Engineer's, Developer's/Landowner's and Engineer's As-Built Certifications on Plan.
3. Appropriate **Private Facility** Maintenance Schedule on Plan. (Replace County / Town / City with correct jurisdiction).
4. Copy of record plat with easement language (Give lot numbers of lots containing drywells).
5. Bonding at time of Building Permit.

Martin B. Covington, III, P.E., Carroll County Stormwater Management Program Engineer
First Effective April 19, 2006
Revised and Distributed for comment May 3, 2010.
Comments received at the Carroll County Surveyors Meeting on May 19, 2010.
Effective Date: July 29, 2010

FOR PLATTED SUBDIVISIONS WITH DRY WELLS

The following language must be placed on the final plat:

Lots (give lot numbers) contain private stormwater management facilities.

A “Stormwater Management Easement and Maintenance Agreement” is to be granted to the Commissioners of Carroll County as an easement of access to the County Commissioners or authorized representatives by a deed intended to be recorded simultaneously herewith.

Please be aware that specific easement language must be acceptable to the County Attorney’s Office.

Standard Bonding Amounts/Drywell (11’ X 10’ X 5’)

<u>Construction Costs</u>	<u>P.E. or P.L.S. Certification</u>	<u>Total Bond</u>
\$4,000.00	\$1,000.00	\$5,000.00

Please be aware that revisions to these amounts on site specific projects can be made with justification.

Sequence of Construction (to go on plan)

1. Once the individual house has been constructed and the final lot grading is complete, contact the certifying professional engineer / professional land surveyor (give name and phone number). Once the certifying professional has given his/her approval, proceed as follows.
2. Construct drywell and connect to downspout per standard details under supervision of certifying professional.
3. Submit as-built certifications for bond release.

Martin B. Covington, III, P.E., Carroll County Stormwater Management Program Engineer
Originally Effective August 20, 2003
Revised to provide 11’ ESD.
Distributed for comment May 3, 2010
Comments received at the Carroll County Surveyors Meeting on May 19, 2010.
Effective Date: July 29, 2010

Carroll County Supplement to the 2000 Maryland Stormwater Design Manual
Volumes I & II
Policy Change

Effective Date: January 28, 2009

Issue: Non Rooftop Carroll County Disconnection "Wide Shoulder" Technique for Use-in-Common Driveways and Open Section Public Roads (Page 32)

Policy:

The wide shoulder technique must be applied to use-in-common driveways and open section public roadways wherever feasible. See page 24.

The wide shoulders are stormwater management facilities; therefore:

- 1) Standard easement notes must appear on the plats or site plans as appropriate.
- 2) Standard engineer's design certification, owner/developer certification, and as-built certification blocks must be placed on the plans.
- 3) Construction cost estimates must be provided and bonding will be required.

See pages 32(a), 32(b), 32(c), 33, 34, 35, and 36 which provide specific guidance.

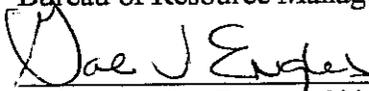
ESD to the MEP (2010)

All guidance on these pages is based upon treatment of the minimum ESD Stormwater Volume (1"). If additional control is required to provide total ESD to the MEP (up to 2.6"), multiple practices may be used or the width of the grass shoulder may be increased proportionally to the next even number.



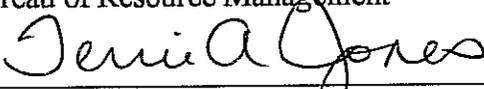
Martin B. Covington, III, P.E., Stormwater Program Engineer
Bureau of Resource Management

3 August 2010
Date



Gale J. Engles, Bureau Chief
Bureau of Resource Management

8-3-10
Date

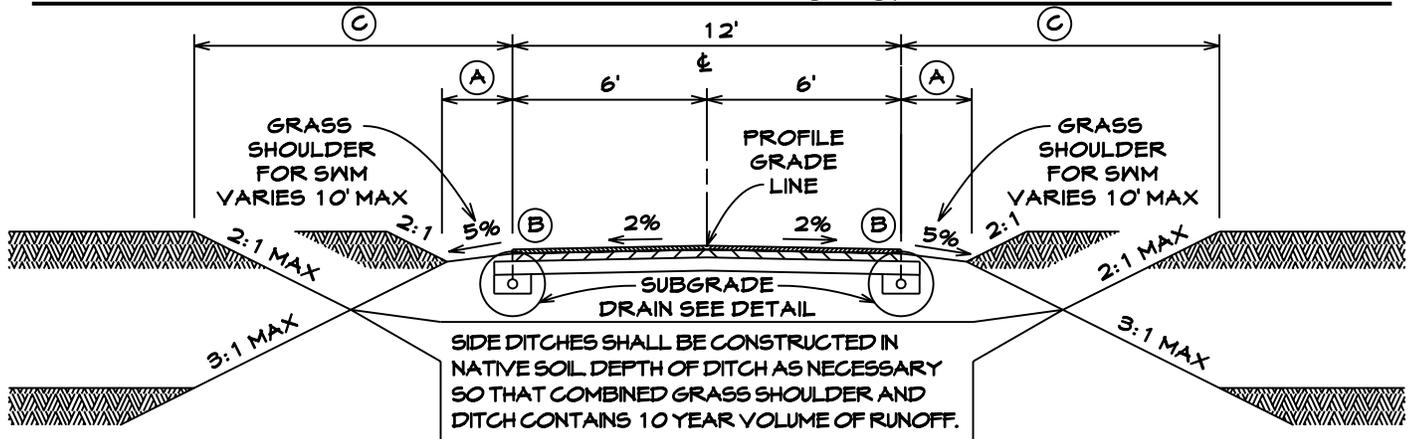


Terri A. Jones, Deputy County Attorney
Department of the County Attorney

8/3/10
Date

This policy was originally distributed at the Carroll County Surveyor's Meeting held on October 19, 2005; and subsequently revised and re-distributed September 17, 2008, for comment. Effective January 28, 2009. This policy was revised to include the section on ESD to the MEP. Distributed for comment on May 3, 2010. Comments received at the Carroll County Surveyors Meeting on May 19, 2010. Effective date: July 29, 2010. Per M.B. Covington, III, P.E.

Non Rooftop Carroll County Disconnection "Wide Shoulder" Technique 12' Paved Use-In-Common Driveway Typical Crowned Section



INSPECTION CHART FOR (INSERT ROAD NAME HERE) ROADWAY OR (INSERT USE-IN-COMMON DRIVE NAME HERE) USE-IN-COMMON DRIVE	INSPECTOR'S APPROVAL	
	INITIALS	DATE
1. TRAVEL LANE(S) AND WIDE SHOULDER(S) GRADED PER PLAN.		
2. SUBGRADE DRAIN(S) AND OUTFALL(S) CONSTRUCTED PER PLAN.		
3. GRADED AGGREGATE BASE EXTENDED OVER SUBGRADE DRAIN PER PLAN.		
4. TRAVEL LANES CONSTRUCTED.		
5. FINE GRADING, TOPSOILING, SEEDING AND MULCHING OF WIDE SHOULDERS AND SUPPORTING SLOPES. FINISH WIDE SHOULDER ELEVATION 2 1/2 INCHES BELOW EDGE OF TRAVEL LANE.		
6. ALL UTILITIES AND DRIVEWAYS ALONG TRAVEL LANES COMPLETED, ANY DAMAGED AREAS REPAIRED AND 2 INCH STAND OF DENSE GRASS ESTABLISHED OVER ALL DISTURBED AREAS.		
7. SIGNED AND CERTIFIED AS-BUILT SUBMITTED TO C.C. BUREAU OF RESOURCE MANAGEMENT WITHIN 30 DAYS OF STEP 6.		

CARROLL COUNTY WIDE SHOULDER TECHNIQUE SEQUENCE OF CONSTRUCTION FOR PUBLIC ROADS & USE-IN-COMMON DRIVES

1. CONTACT THE CERTIFYING PROFESSIONAL ENGINEER OR PROFESSIONAL LAND SURVEYOR 24 HOURS PRIOR TO START OF CONSTRUCTION OF (INSERT ROADWAY NAME HERE) ROADWAY OR (INSERT USE-IN-COMMON DRIVE NAME HERE) USE-IN-COMMON DRIVE. (INSERT NAME AND PHONE NUMBER OF CERTIFYING PROFESSIONAL ENGINEER OR LAND SURVEYOR HERE).
2. GRADE TRAVEL LANES AND WIDE GRASS SHOULDER PER PLAN.
3. INSTALL SUBGRADE DRAINS AND OUTFALLS PER PLAN.
4. INSTALL GRADED AGGREGATE BASE, EXTENDING OVER THE SUBGRADE DRAIN.
5. CONSTRUCT TRAVEL LANES.
6. FINE GRADE, TOPSOIL, SEED AND MULCH WIDE SHOULDERS AND SUPPORTING SLOPES. FINISH WIDE SHOULDER ELEVATION 2 1/2 INCHES BELOW EDGE OF TRAVEL LANE.
7. WITHIN 30 DAYS OF THE COMPLETION OF ALL DRIVEWAYS (TO EASEMENT LINE (C)), AND ALL UTILITIES ALONG THE TRAVEL LANES, WITH ALL DAMAGED AREAS REPAIRED AND THE ESTABLISHMENT OF A 2 INCH STAND OF DENSE GRASS OVER ALL DISTURBED AREAS, SUBMIT A SIGNED AND CERTIFIED AS BUILT (INCLUDING THE INSPECTION CHART) TO THE C.C. BUREAU OF RESOURCE MANAGEMENT.

CROWNED DRIVEWAY WITH 6 FOOT LANES DRAINING TO BOTH SIDES

DRIVEWAY GRADE	REQUIRED SHOULDER WIDTH (A)
0	6
1	6
2	7
3	7
4	8
5	9
6	9
7	10

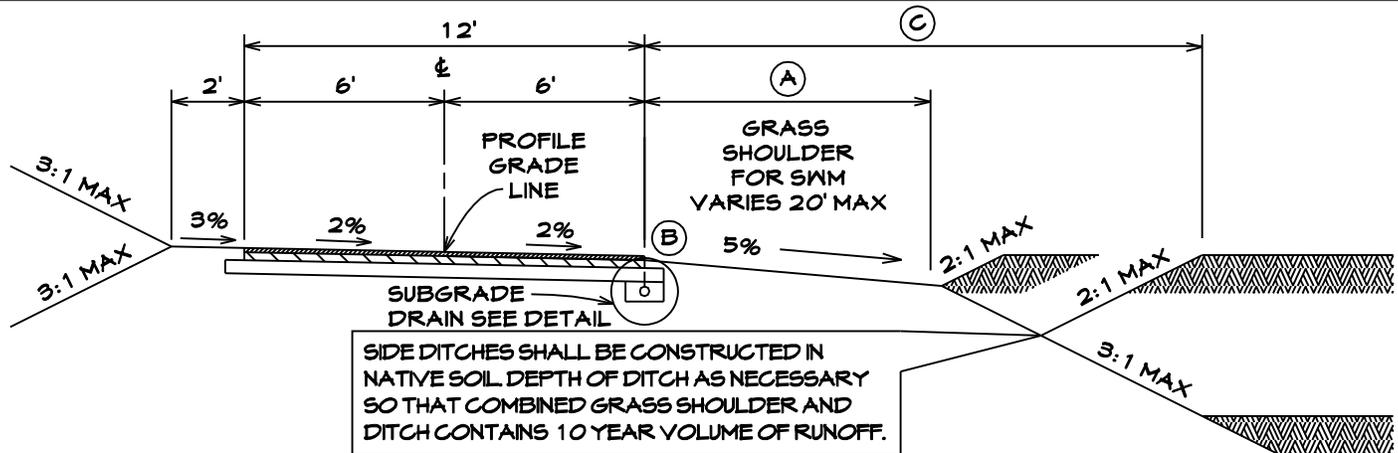
(C)

THE ENTIRE WIDE SHOULDER, OUTSIDE OF THE DRIVEWAY PAVEMENT AND ANY SUBGRADE DRAIN OUTFALLS MUST BE PROTECTED BY EASEMENT AND MUST BE NOTED AS "STORMWATER MANAGEMENT FACILITY" ON THE PLAT. SEE EASEMENT COMMENT 1, PAGE 3.

THIS SHEET ORIGINALLY DISTRIBUTED AT THE CARROLL COUNTY SURVEYOR'S MEETING OCTOBER 19, 2005. REVISED AND RE-DISTRIBUTED SEPT. 17, 2008 FOR COMMENT EFFECTIVE NOV. 19, 2008
M.B. COVINGTON III, P.E.

Non Rooftop Carroll County Disconnection "Wide Shoulder" Technique

12' Paved Use-In-Common Driveway Typical Super Left Elevated Section



INSPECTION CHART FOR (INSERT ROAD NAME HERE) ROADWAY OR (INSERT USE-IN-COMMON DRIVE NAME HERE) USE-IN-COMMON DRIVE	INSPECTOR'S APPROVAL	
	INITIALS	DATE
1. TRAVEL LANE(S) AND WIDE SHOULDER(S) GRADED PER PLAN.		
2. SUBGRADE DRAIN(S) AND OUTFALL(S) CONSTRUCTED PER PLAN.		
3. GRADED AGGREGATE BASE EXTENDED OVER SUBGRADE DRAIN PER PLAN.		
4. TRAVEL LANES CONSTRUCTED.		
5. FINE GRADING, TOPSOILING, SEEDING AND MULCHING OF WIDE SHOULDERS AND SUPPORTING SLOPES. FINISH WIDE SHOULDER ELEVATION 2 1/2 INCHES BELOW EDGE OF TRAVEL LANE.		
6. ALL UTILITIES AND DRIVEWAYS ALONG TRAVEL LANES COMPLETED, ANY DAMAGED AREAS REPAIRED AND 2 INCH STAND OF DENSE GRASS ESTABLISHED OVER ALL DISTURBED AREAS.		
7. SIGNED AND CERTIFIED AS-BUILT SUBMITTED TO C.C. BUREAU OF RESOURCE MANAGEMENT WITHIN 30 DAYS OF STEP 6.		

CARROLL COUNTY WIDE SHOULDER TECHNIQUE SEQUENCE OF CONSTRUCTION FOR PUBLIC ROADS & USE-IN-COMMON DRIVES

- CONTACT THE CERTIFYING PROFESSIONAL ENGINEER OR PROFESSIONAL LAND SURVEYOR 24 HOURS PRIOR TO START OF CONSTRUCTION OF (INSERT ROADWAY NAME HERE) ROADWAY OR (INSERT USE-IN-COMMON DRIVE NAME HERE) USE-IN-COMMON DRIVE. (INSERT NAME AND PHONE NUMBER OF CERTIFYING PROFESSIONAL ENGINEER OR LAND SURVEYOR HERE).
- GRADE TRAVEL LANES AND WIDE GRASS SHOULDER PER PLAN.
- INSTALL SUBGRADE DRAINS AND OUTFALLS PER PLAN.
- INSTALL GRADED AGGREGATE BASE, EXTENDING OVER THE SUBGRADE DRAIN.
- CONSTRUCT TRAVEL LANES.
- FINE GRADE, TOPSOIL, SEED AND MULCH WIDE SHOULDERS AND SUPPORTING SLOPES. FINISH WIDE SHOULDER ELEVATION 2 1/2 INCHES BELOW EDGE OF TRAVEL LANE.
- WITHIN 30 DAYS OF THE COMPLETION OF ALL DRIVEWAYS (TO EASEMENT LINE (C)), AND ALL UTILITIES ALONG THE TRAVEL LANES, WITH ALL DAMAGED AREAS REPAIRED AND THE ESTABLISHMENT OF A 2 INCH STAND OF DENSE GRASS OVER ALL DISTURBED AREAS, SUBMIT A SIGNED AND CERTIFIED AS BUILT (INCLUDING THE INSPECTION CHART) TO THE C.C. BUREAU OF RESOURCE MANAGEMENT.

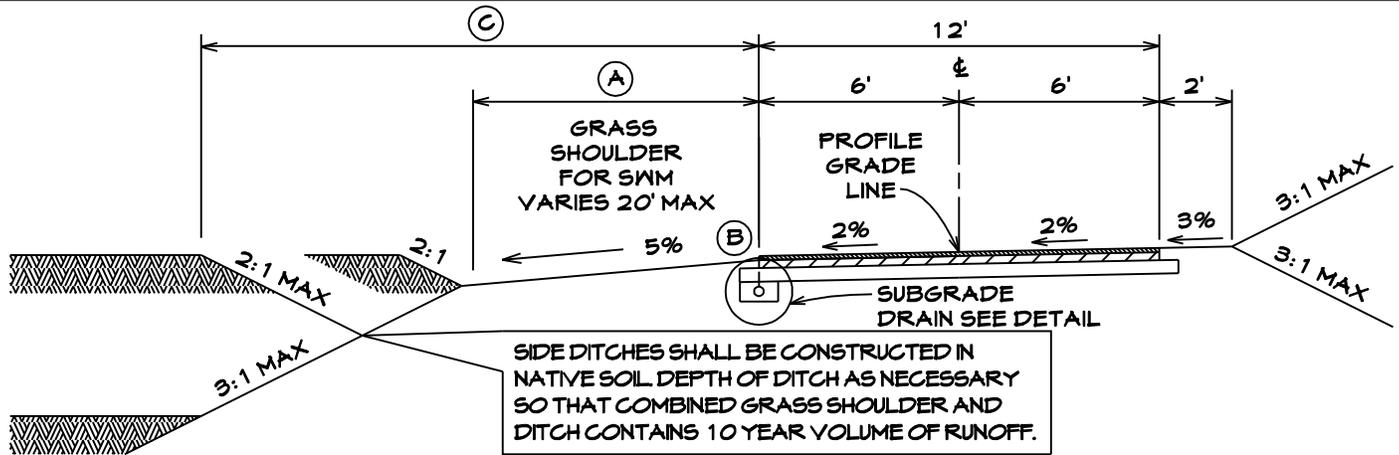
DRIVEWAY GRADE	REQUIRED SHOULDER WIDTH (A)
0	12
1	12
2	13
3	15
4	16
5	17
6	19
7	20

(C)
THE ENTIRE WIDE SHOULDER, OUTSIDE OF THE DRIVEWAY PAVEMENT AND ANY SUBGRADE DRAIN OUTFALLS MUST BE PROTECTED BY EASEMENT AND MUST BE NOTED AS "STORMWATER MANAGEMENT FACILITY" ON THE PLAT. SEE EASEMENT COMMENT 1, PAGE 3.

THIS SHEET ORIGINALLY DISTRIBUTED AT THE CARROLL COUNTY SURVEYOR'S MEETING OCTOBER 19, 2005. REVISED AND RE-DISTRIBUTED SEPT. 17, 2008 FOR COMMENT EFFECTIVE NOV. 19, 2008
M.B. COVINGTON III, P.E.

Non Rooftop Carroll County Disconnection "Wide Shoulder" Technique

1 2' Paved Use-In-Common Driveway Typical Super Right Elevated Section



INSPECTION CHART FOR (INSERT ROAD NAME HERE) ROADWAY OR (INSERT USE-IN-COMMON DRIVE NAME HERE) USE-IN-COMMON DRIVE	INSPECTOR'S APPROVAL	
	INITIALS	DATE
1. TRAVEL LANE(S) AND WIDE SHOULDER(S) GRADED PER PLAN.		
2. SUBGRADE DRAIN(S) AND OUTFALL(S) CONSTRUCTED PER PLAN.		
3. GRADED AGGREGATE BASE EXTENDED OVER SUBGRADE DRAIN PER PLAN.		
4. TRAVEL LANES CONSTRUCTED.		
5. FINE GRADING, TOPSOILING, SEEDING AND MULCHING OF WIDE SHOULDERS AND SUPPORTING SLOPES. FINISH WIDE SHOULDER ELEVATION 2 1/2 INCHES BELOW EDGE OF TRAVEL LANE.		
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CARROLL COUNTY WIDE SHOULDER TECHNIQUE SEQUENCE OF CONSTRUCTION FOR PUBLIC ROADS & USE-IN-COMMON DRIVES

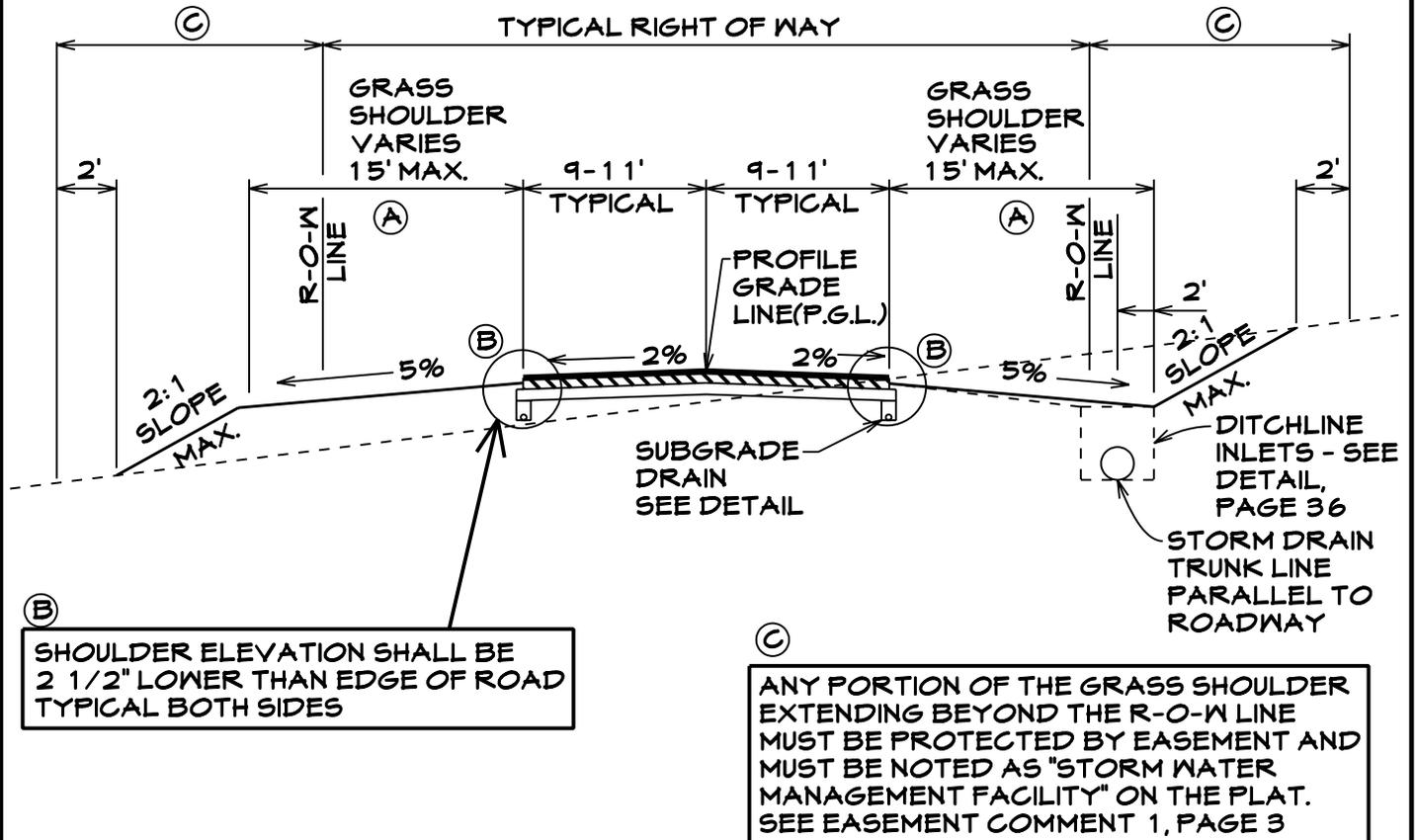
- CONTACT THE CERTIFYING PROFESSIONAL ENGINEER OR PROFESSIONAL LAND SURVEYOR 24 HOURS PRIOR TO START OF CONSTRUCTION OF (INSERT ROADWAY NAME HERE) ROADWAY OR (INSERT USE-IN-COMMON DRIVE NAME HERE) USE-IN-COMMON DRIVE. (INSERT NAME AND PHONE NUMBER OF CERTIFYING PROFESSIONAL ENGINEER OR LAND SURVEYOR HERE).
- GRADE TRAVEL LANES AND WIDE GRASS SHOULDER PER PLAN.
- INSTALL SUBGRADE DRAINS AND OUTFALLS PER PLAN.
- INSTALL GRADED AGGREGATE BASE, EXTENDING OVER THE SUBGRADE DRAIN.
- CONSTRUCT TRAVEL LANES.
- FINE GRADE, TOPSOIL, SEED AND MULCH WIDE SHOULDERS AND SUPPORTING SLOPES. FINISH WIDE SHOULDER ELEVATION 2 1/2 INCHES BELOW EDGE OF TRAVEL LANE.
- WITHIN 30 DAYS OF THE COMPLETION OF ALL DRIVEWAYS (TO EASEMENT LINE (C)), AND ALL UTILITIES ALONG THE TRAVEL LANES, WITH ALL DAMAGED AREAS REPAIRED AND THE ESTABLISHMENT OF A 2 INCH STAND OF DENSE GRASS OVER ALL DISTURBED AREAS, SUBMIT A SIGNED AND CERTIFIED AS BUILT (INCLUDING THE INSPECTION CHART) TO THE C.C. BUREAU OF RESOURCE MANAGEMENT.

DRIVEWAY GRADE	REQUIRED SHOULDER WIDTH (A)
0	12
1	12
2	13
3	15
4	16
5	17
6	19
7	20

(C) THE ENTIRE WIDE SHOULDER, OUTSIDE OF THE DRIVEWAY PAVEMENT AND ANY SUBGRADE DRAIN OUTFALLS MUST BE PROTECTED BY EASEMENT AND MUST BE NOTED AS "STORMWATER MANAGEMENT FACILITY" ON THE PLAT. SEE EASEMENT COMMENT 1, PAGE 3.

THIS SHEET ORIGINALLY DISTRIBUTED AT THE CARROLL COUNTY SURVEYOR'S MEETING OCTOBER 19, 2005. REVISED AND RE-DISTRIBUTED SEPT. 17, 2008 FOR COMMENT EFFECTIVE NOV. 19, 2008
M.B. COVINGTON III, P.E.

Non Rooftop Disconnection for Carroll County Public Roads The "Wide Shoulder" Technique



The "Wide Shoulder" Technique must be applied to subdivision streets wherever feasible. The shoulder slope is set at 5% and the shoulder width is proportional to the maximum road grade. (See Table 1) Once the maximum required shoulder width is determined the typical section must be constant along the street. Any areas that are too steep to qualify for credits must still have the constant shoulder width.

This technique satisfies the water quality and recharge requirements of the 2000 MD stormwater management manual and allows the roadway to be counted as grass when calculating the channel protection and quantity control requirements.

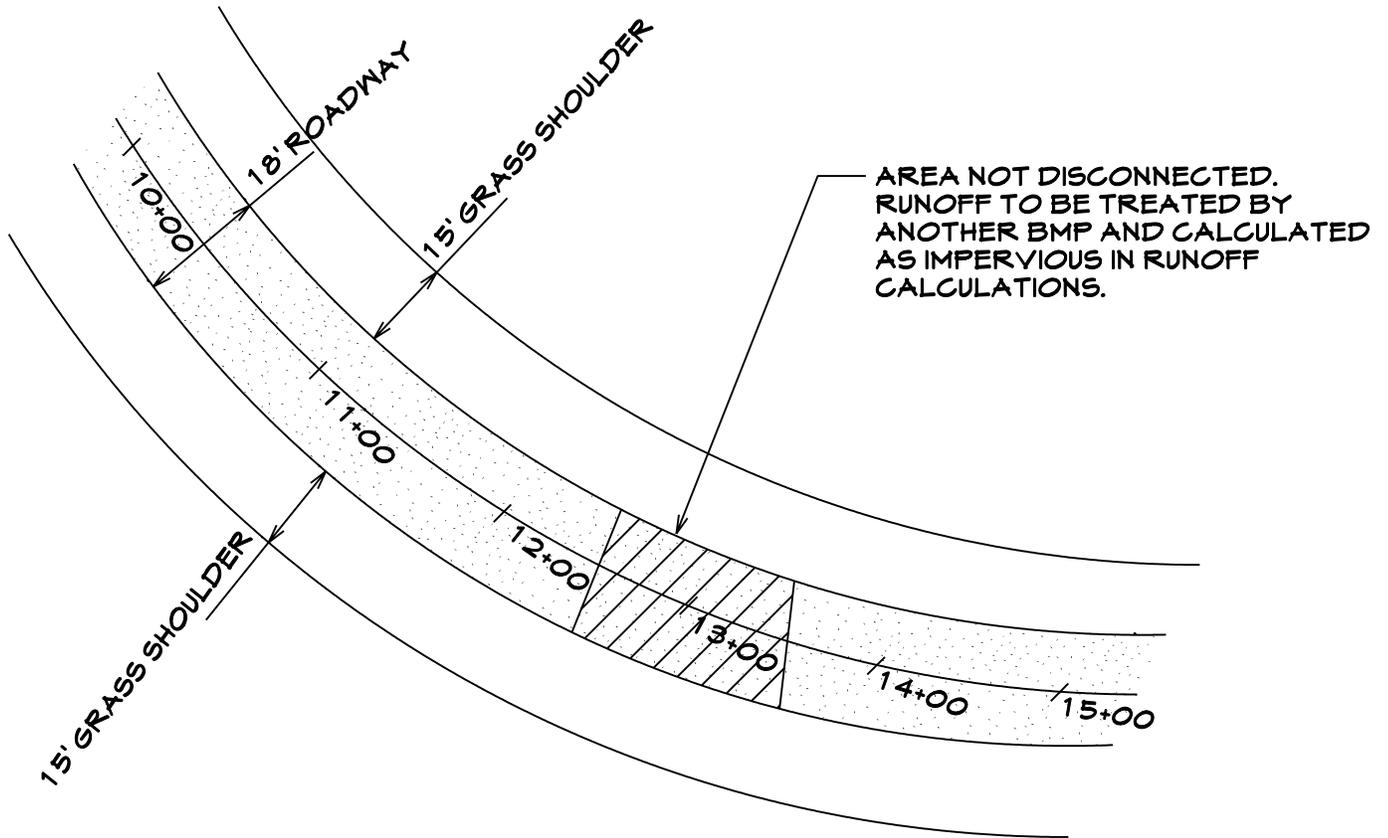
ROAD GRADE	REQUIRED (A) SHOULDER WIDTH
0	9
1	9
2	10
3	11
4	12
5	13
6	14
7	15

THIS SHEET REVISED AND DISTRIBUTED AT THE CARROLL COUNTY SURVEYOR'S MEETING TO INCLUDE STANDARD LOCATION OF STORM DRAIN TRUNK LINE. MAY 21, 2008

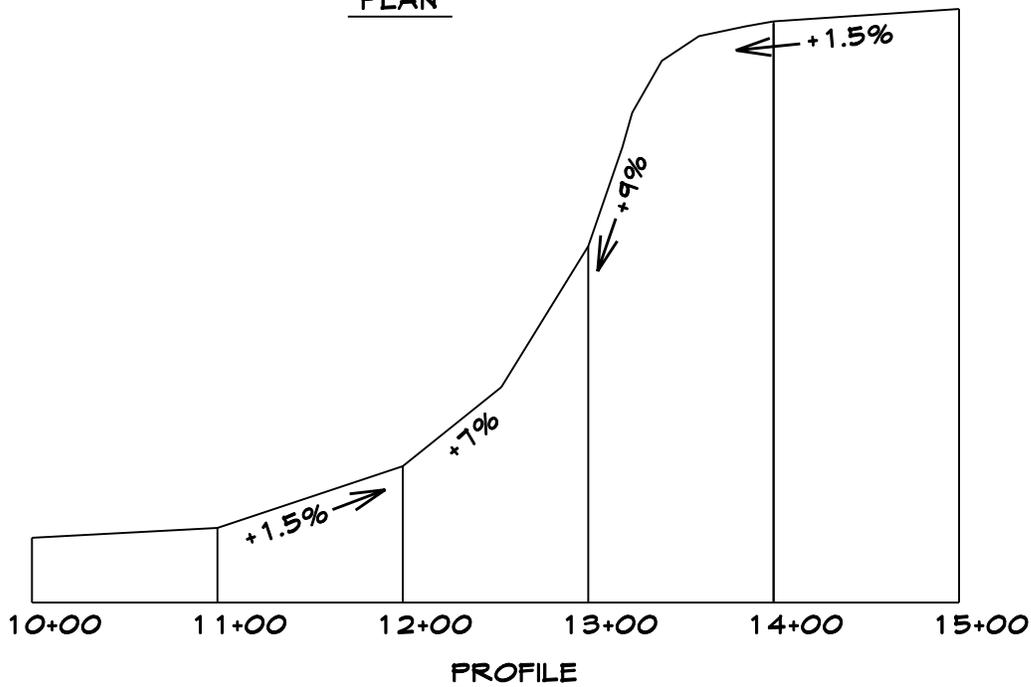
M.B. COVINGTON III, P.E.
4 APRIL 2008

SCHEMATIC OF ROADWAY WITH WIDE SHOULDER TECHNIQUE

To be shown on Drainage Area Maps and used to identify undisconnected impervious areas.



PLAN



SUBGRADE DRAINS

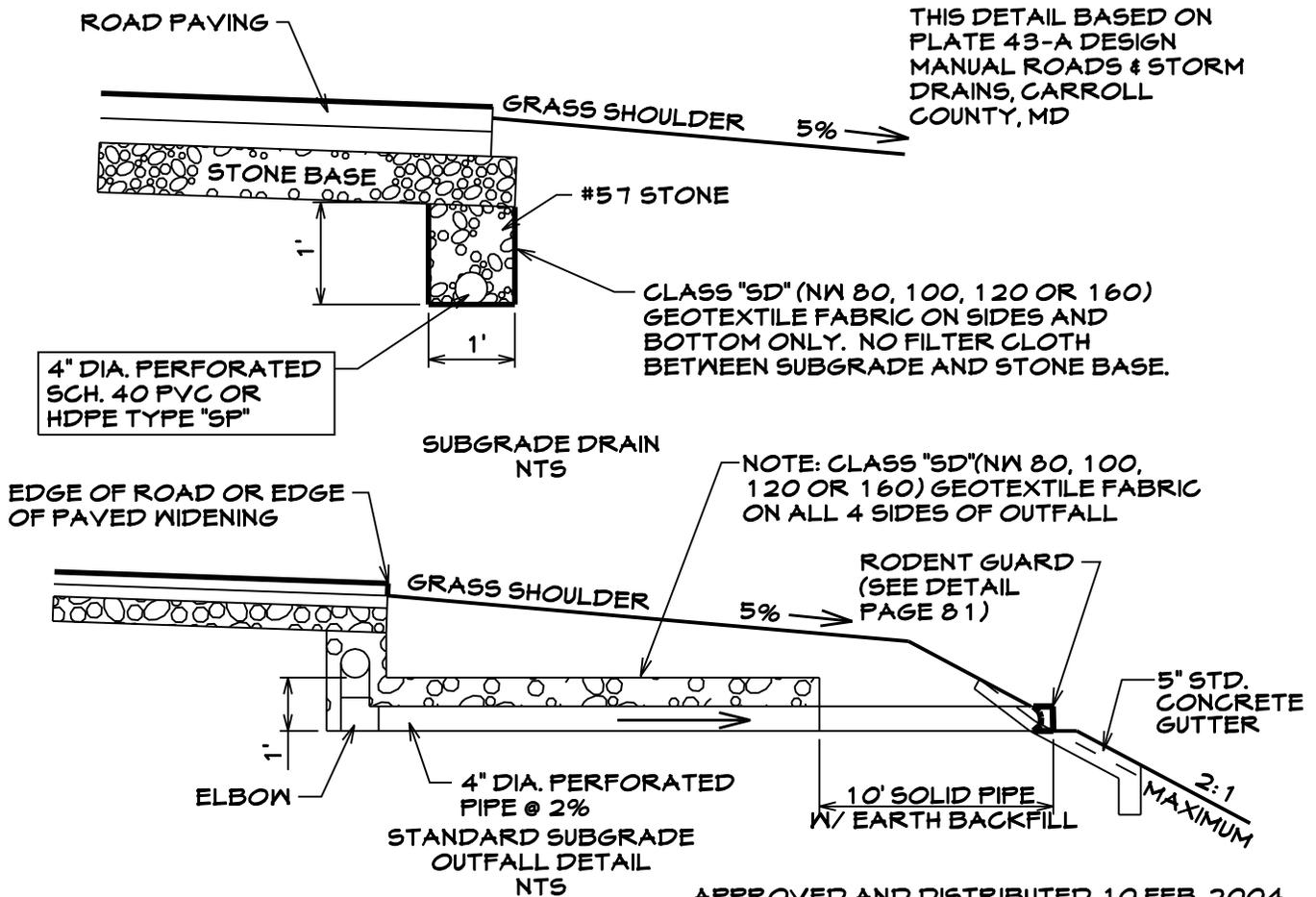
GENERAL: SUBGRADE DRAINS SHALL RUN CONTINUOUSLY WITH BOTH EDGES OF CROWNED ROADS AND COMMON-USE-DRIVEWAYS AND ALONG LOW EDGE OF SUPERELEVATED ROADS AND USE-IN-COMMON DRIVEWAYS AT EDGE OF PAVEMENT.

PIPE FOR DRAINS SHALL BE 4" I.D. PERFORATED SCHEDULE 40 PVC OR HDPE (TYPE "SP"). STONE SHALL BE CLEAN #57 AGGREGATE. TRENCH SHALL BE LINED ON BOTH SIDES AND THE BOTTOM WITH PERMEABLE GEOTEXTILE FABRIC. NO GEOTEXTILE FABRIC IS TO BE PLACED ON THE TOP BETWEEN THE TRENCH AND THE STONE BASE. PIPES CROSSING BENEATH THE ROAD SHALL BE SOLID (NON-PERFORATED). TRENCH UNDER ROADWAY SHALL BE BACKFILLED WITH EARTH OR ROAD BASE MATERIAL. PREFABRICATED FITTINGS SHALL BE USED FOR ABRUPT CHANGES IN DIRECTION OR WHEN JOINING PIPE SYSTEMS. FITTINGS WILL NOT BE REQUIRED FOR NORMAL UNDULATIONS IN ROAD PROFILE.

GEOTEXTILE FABRIC SHALL CONFORM TO CLASS "SD" SPECIFICATIONS.

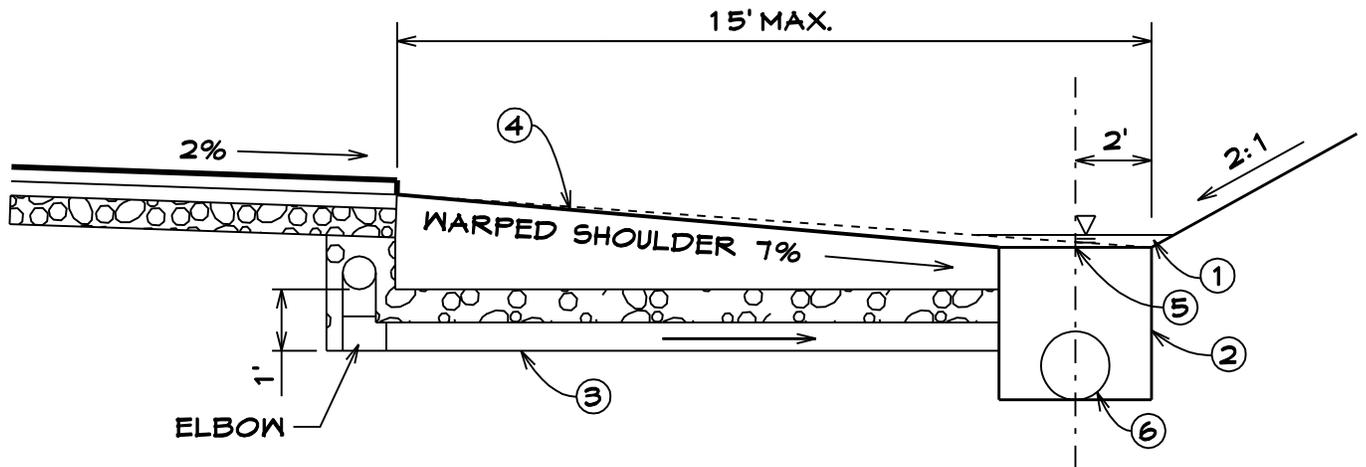
OUTFALL: OUTFALLS SHALL BE CONSTRUCTED AT DOWNGRADE ENDS OF SUBGRADE DRAINS AND AT SUMPS IN ROAD PROFILE USING SAME MATERIALS AND SPECIFICATIONS AS FOR DRAINS EXCEPT THAT THE PERMEABLE GEOTEXTILE FABRIC MUST SURROUND THE TRENCH ON ALL 4 FACES (TOP, BOTTOM, AND BOTH SIDES). OUTFALLS MUST DAYLIGHT. OUTFALL MAY RUN WITH/BENEATH CENTERLINE OF DITCH IF NECESSARY TO DAYLIGHT.

WHERE OUTFALL WILL BE PLACED IN UPLAND AREAS, A STANDARD 5" CONCRETE GUTTER WILL BE USED. SEE C.C. PLATE 44. FINAL 10' SECTION OF PIPE SHALL BE NON-PERFORATED WITH A RODENT GUARD INSTALLED. TRENCH FOR FINAL 10' SECTION SHALL BE BACKFILLED WITH EARTH.



APPROVED AND DISTRIBUTED 10 FEB. 2004
BY C.C.D.P.W. REVISED TO CORRECT
BACKFILL, GEOTEXTILE AND GUTTER.
DISTRIBUTED FOR COMMENT ON MAY 3, 2010
COMMENTS RECIEVED AT C.C. SURVEYORS MTG.
MAY 19, 2010
EFFECTIVE DATE: JULY 29, 2010

Ditchline Inlet Type & Spacing for Carroll County Public Roads when The "Wide Shoulder" Technique is Used



- ① DITCHLINE INLET TO BE PLACED SO THAT THE 10 YEAR STORM FLOW DEPTH DOES NOT EXCEED A DEPTH OF 6 INCHES OR A FLOW OF 2.25 CFS.

REQUIRED INLET SPACING DESIGN CHART				
ROAD GRADE %	DEPTH OF FLOW INCHES	MANNING'S (N)*	DITCH FLOW (Q ₁₀) FT ³ /SEC	DITCHLINE VELOCITY FT/SEC
1	6	.12	1.18	.48
2	6	.12	1.68	.67
3	6	.12	2.06	.82
4	5.9	.12	2.25	.94
5	5.6	.12	2.25	1.02
6	5.4	.12	2.25	1.09
7	5.3	.12	2.25	1.16
8	5.2	.12	2.25	1.21
9	5.2	.13	2.25	1.20
10	5.1	.13	2.25	1.25

*MANNING'S "N" PER FIGURE 7.5 "VARIABLE MANNINGS "N" WITH VARYING FLOW DEPTHS" GRASS CHANNEL DESIGN PROCEDURE

- ② STANDARD TYPE K INLET - MD 378.05 MODIFIED TO INCLUDE A TRAFFIC BEARING GRATE. INCLUDE 10 FT CONCRETE FLUME UPSTREAM OF INLET.
- ③ 4" PERFORATED PIPE AND 57 STONE @ 2% TO INLET PER DETAIL, PAGE 35.
- ④ WARP SHOULDER TO MEET INLET AND CONCRETE FLUME (APPROXIMATELY 7% SHOULDER).
- ⑤ CONCRETE GUTTER & INLET WEIR TO MATCH DITCHLINE INVERT.
- ⑥ MINIMUM PIPE SIZES PER SECTION 6.4.6 OF THE C.C. DESIGN MANUAL, ROADS & STORM DRAINS.

ISSUED 4 APRIL 2008
REVISED TO INCLUDE SPECIFICATIONS
FOR DITCHLINE INLET. DISTRIBUTED
AT THE CARROLL COUNTY SURVEYORS
MEETING 21 MAY 2008

Carroll County Policy on Use of the Percent Area and Percent Volume Methods for Calculating Stormwater Management (SWM) Requirements

Page 2.6 of the 2000 Maryland Stormwater Design Manual states that:

“The percent volume method is used... when structural practices are used.”

“The percent area method is used when non-structural practices are used.”

Structural Practices include; infiltration trenches and basins, wet and dry ponds, sand filters etc. Non-Structural Practices include; disconnection of impervious surfaces (including drywells) as well as sheet flows to buffers, and adequate grass channels.

Conclusions/Policy

When non structural methods provide the SWM for the entire site the Percent Area Method may be used. If any structural methods are used anywhere on site the Percent Volume Method must be used.

Practical Application

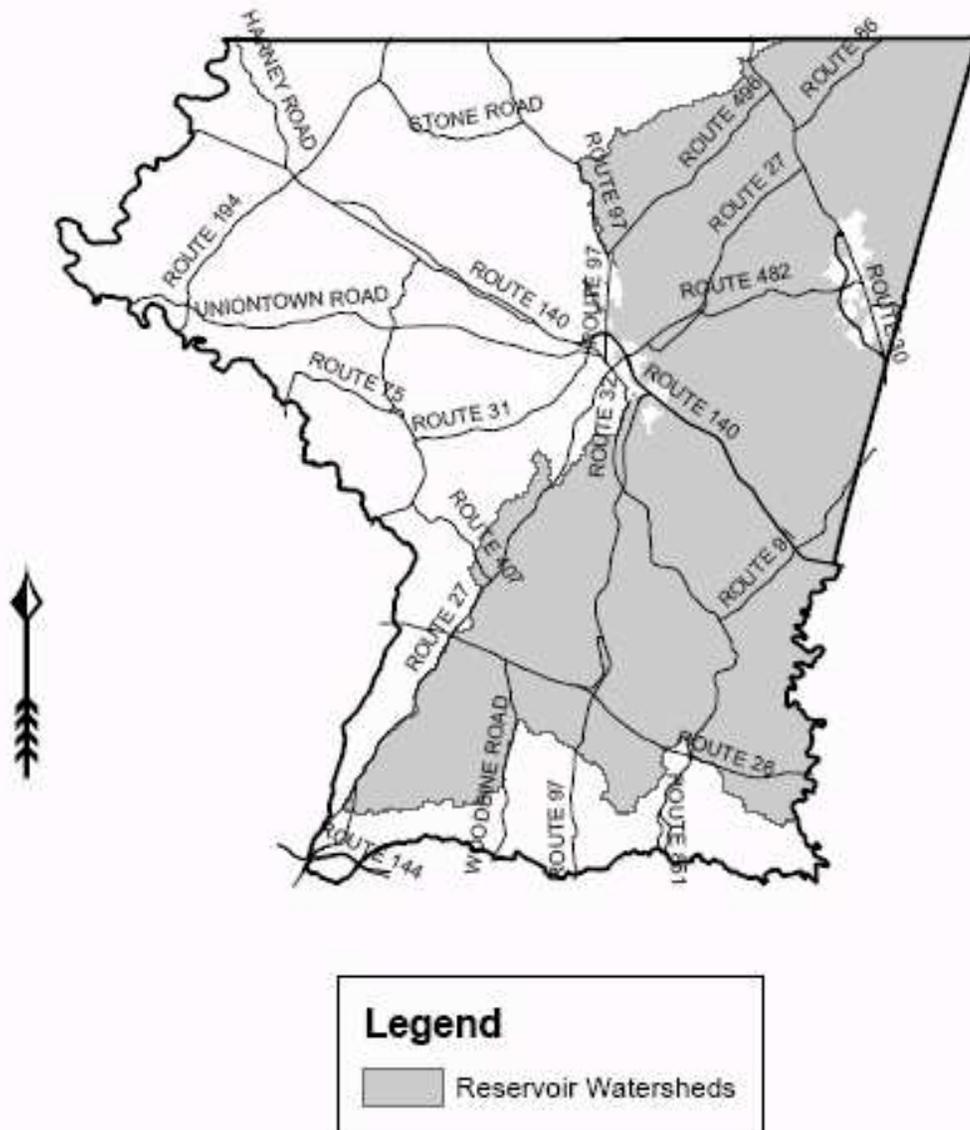
In practice only complete disconnection of impervious surfaces can eliminate structural SWM practices. Thus only completely disconnected sites can use the Percent Area Method to calculate SWM requirements.

Martin B. Covington, III P.E.
Stormwater Management Program Engineer
Distributed @ C.C. Surveyor's Meeting
Effective Date: December 20, 2006

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Carroll County, Maryland

Reservoir Watersheds



This map is solely for guidance. It is not to be used as a substitute for a site specific plan.

Additional Stormwater Management Requirements for Commercial & Industrial Development in the Reservoir Watersheds in Carroll County, Maryland

2. Commercial and industrial development within Surface Watershed Areas shall adhere to the following:
- a. The storage, use, and transfer of regulated substances shall be performed under roof so that exposure to rainfall is eliminated and the contamination of stormwater runoff prevented.
 - b. Pollutants shall be removed from runoff as close to the source of exposure as possible.
 - c. Stormwater flows should be designed to be dispersed rather than concentrated. Stormwater flows should be directed to areas containing permeable soils, hydrologic soil groups A or B, where site design allows.
 - d. A minimum of 90% of the annual, total runoff from all impervious surfaces shall be recharged to the ground within the site property.
Note: Provisions of the Stormwater Management Act of 2007 require that 100% of the average annual predevelopment groundwater recharge volume over the entire site be recharged into the ground within the site (parcel or group of parcels). See pages 82-84 for calculation procedure.
 - e. Stormwater management shall be achieved through the use of a series of connected practices (i.e. a treatment train approach). Water quality management and recharge shall be distributed throughout the site.
 - f. Landscape islands and other vegetated areas shall be utilized within the building envelope for stormwater management (see page 85).
 - g. The 10-year quantity volume and channel protection volumes, as well as any additional water quality and recharge required shall be provided in a perimeter, modified recharge/sand filter facility. *
 - h. Distributed outflows onto the surface from the perimeter facilities are required. *
 - i. Between any parking area or structure and the perimeter facility, the following minimum grass filter strip shall be installed: *

Filter Strip Requirements	
Slope of Strip (%)	Minimum Length (ft)
1	25
2	25
3	29
4	33
5	37
6	41
7	45
8	49
9	53
10	57
11	61
12	65
13	69
14	73
15	77

* See pages 42i-42p for approved alternate techniques to meet these requirements.

Martin B. Covington, III, P.E. – First distributed June 21, 2005
 Revised to include groundwater recharge requirement.
 Distributed for comment May 3, 2010.
 Comments received at the Carroll County Surveyors Meeting on May 19, 2010.
 Effective Date: July 29, 2010

Tom Devilbiss, C.P.G., Deputy Director
Bureau of Resource Management
410-386-2321, Fax: 410-386-2924
Environmental Inspection Services
410-386-2210



Department of Planning
Carroll County Government
225 North Center Street
Westminster, MD 21157
1-888-302-8978; TT 410-848-9747

Carroll County Code Implementation Policy Chapter 218, Water Resource Management

Effective Date: 19 December 2007

Issue: Clarification to the Exemptions Section (§218-4.B(1) and (2))

- B. Modifications to businesses which do not involve an increase in:
- (1) Impervious cover of more than 10% or 40,000 square feet, whichever is less, and
 - (2) the storage or handling of a regulated substance.

Policy:

To determine if a modification to an existing business meets the exemption B (1), apply the following criteria:

- 1) Calculate the impervious area associated with operating the business. The impervious area should include, but not be limited to existing structures, parking and storage areas used for the business.
- 2) If the proposed impervious area is greater than 10% of the impervious area associated with operating the business, then the proposed modification is not exempt from the requirements of Chapter 218.
- 3) If the modification to the business creates additional impervious area of more than 40,000 square feet, then the modification is not exempt from the requirements of Chapter 218.

If a modification to a business involves an increase in the storage or handling of a regulated substance (§218-4.B(2)) then, regardless of the amount of impervious area added, the modification to the business is not exempt from the requirements of Chapter 218.

**Additional Stormwater Management Requirements for Commercial and Industrial
Redevelopment in the Reservoir Watersheds in Carroll County, Maryland**

If the proposed development meets the redevelopment criteria listed in the attached “Project Decision Chart” and the onsite impervious surfaces were constructed prior to **July 1, 1984** or as **part of an approved site plan** then:

“2.d. A minimum of 90% of the annual, total runoff from all impervious surfaces shall be recharged to the ground within the site property.”¹

191-8.A “. . . provide ESD to the MEP. Overbank flood protection volumes do not apply . . .”²

191.8.B “. . . shall reduce those existing site impervious areas within the limits of disturbance (LOD) . . .”³

Together this means that the Impervious Area Reduction and ESD to the MEP provisions of Chapter 191 (SWM) apply only within the LOD.

However, Groundwater Recharge is different.

Please see page 40a. Unless a project is exempt from the provisions of Chapter 218 (Water Resources), one inch of runoff from all impervious surfaces on the site (parcel or group of parcels) must be captured, conveyed and recharged into the ground.

and:

Please also be aware that due to the Stormwater Management Act of 2007, 100% of the average annual pre-development groundwater recharge volume over the “entire site” (parcel or group of parcels) must be captured, conveyed and recharged into the ground.⁴ Please see the calculation procedures on pages 82-84.

Footnotes

¹ Carroll County Water Resource Management Manual (May 2004), pages 17 and 18

² §191-8A of the Code of Public Local Laws and Ordinances of Carroll County

³ §191-8B of the Code of Public Local Laws and Ordinances of Carroll County

⁴ COMAR 26.17.02.06 “Minimum Control Requirements”

Martin B. Covington, III, P.E. – First distributed at the Carroll County Surveyors Meeting on June 15, 2005
Revised to include 2010 Chapter 191 revisions.

Distributed for comment May 3, 2010.

Comments received at the Carroll County Surveyors Meeting on May 19, 2010.

Effective Date: July 29, 2010

Project Decision Chart
Redevelopment vs. New Development

Measuring Impervious Cover: The measured area of a site plan that “effectively prevents stormwater from infiltrating into the ground.” The area that “does not have vegetative or permeable cover shall be considered total impervious cover.”² (i.e. buildings, pavement, crusher run gravel, millings, etc.)

The “site” is the “entire parcel or combination of parcels where development is to be performed.”³

Is the existing Land Use on the “site” commercial, industrial or multi-family residential?⁴
and

Do the existing impervious surfaces cover 40% or more of the site (parcel)?⁵
and

Were the impervious surfaces constructed before July 1, 1984 or with an approved stormwater management plan after that date?⁶

YES to All Questions	NO to Any Questions
This is a redevelopment project.	This is a new development project.
The stormwater management requirements apply to the impervious areas within the limits of disturbance only (L.O.D.) only.	The stormwater management requirements apply to the entire site (all of the impervious surfaces on the parcel or parcels).
See §191-8 for requirements.	See §191-10 for requirements.

Footnotes

¹ §191-3- Definition of “Impervious Area”

² 2000 Maryland Stormwater Design Manual, Pages 2-4

³ §191-3- Definition of “Site”

⁴ §191-3- Definition of “Redevelopment”

⁵ §191-3- Definition of “Redevelopment”

⁶ §191-8B- Redevelopment

Martin B. Covington, III, P.E. – First distributed at the Carroll County Surveyors Meeting on April 20, 2005

Revised to include 2010 Chapter 191 Revisions.

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DESIGN PROCEDURE FOR SATISFYING CARROLL COUNTY WATER RESOURCE MANAGEMENT MANUAL SECTION IV C3b2

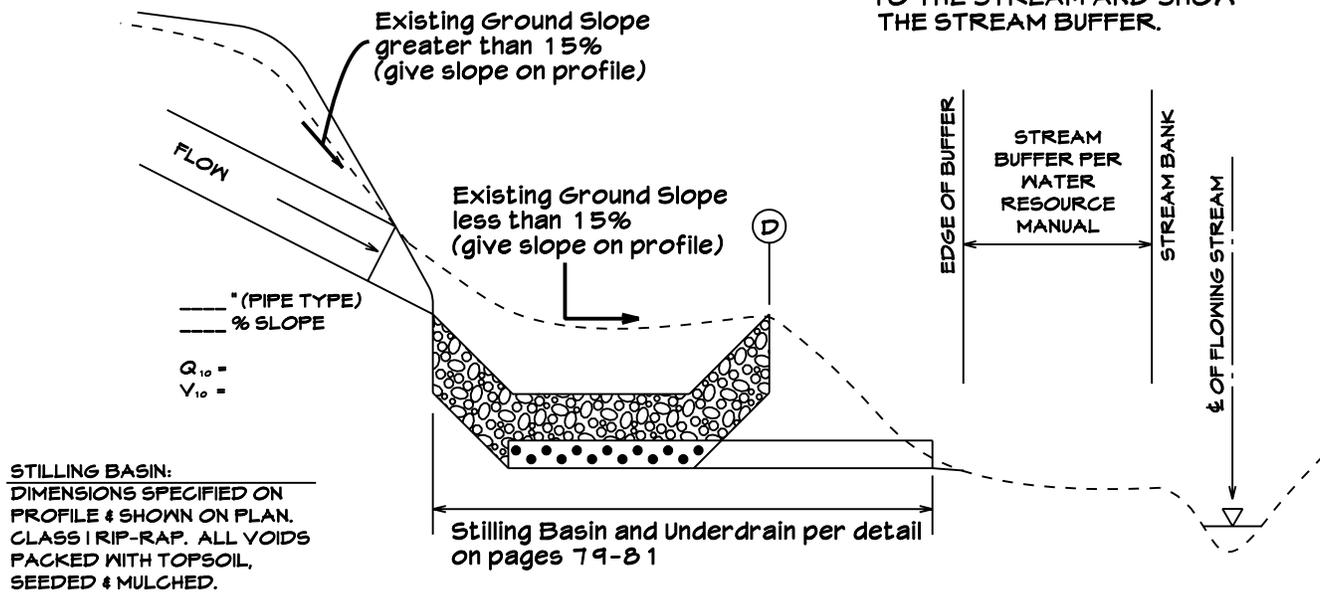
"STORM DRAINAGE UP TO AND INCLUDING THE 10 YEAR DESIGN STORM SHALL NOT PRODUCE DISCHARGE VELOCITIES EXCEEDING 2 FEET PER SECOND PRIOR TO ENTERING THE BUFFER"

Carroll County Stilling Basin Technique

OPTION 1: (WHERE A FULL SIZED STILLING BASIN AND UNDERDRAIN CAN BE CUT INTO AND DISCHARGED ONTO THE EXISTING GROUND OUTSIDE OF THE STREAM BUFFER)

Note : If any portion of the stilling basin or underdrain encroaches on the stream buffer option 2 (page 42b) must be used.

NOTE: ALL PROFILES MUST EXTEND TO THE STREAM AND SHOW THE STREAM BUFFER.



IF THE STILLING BASIN AND UNDERDRAIN:

1. ARE SIZED AND CONSTRUCTED IN ACCORDANCE WITH THE DETAILS ON SHEETS 79-81
2. ARE CUT ENTIRELY INTO EXISTING GROUND
3. ARE ENTIRELY OUTSIDE OF THE STREAM BUFFER
4. ARE DESIGNED WITH THE DOWNSTREAM LIP (D) COMPLETELY FLAT (GRADING IS REQUIRED TO SHOW PLACEMENT ON THE LANDSCAPE)

THEN: THE OUTFALL MEETS THE 2 FT/SEC. CRITERIA FOR DISCHARGES UP TO THOSE FOUND IN TABLE 1

FOR LARGER DISCHARGES, OPTION 2 (PAGE 42b) MUST BE USED.

PIPE DIAMETER (in)	MAXIMUM Q_{10}^* (cfs)
15"	6.28
18"	7.50
21"	8.78
24"	10.00
27"	11.28
30"	12.50
36"	15.00
42"	17.50
48"	20.00
54"	22.50
60"	25.00

*BASED UPON 6" OF FLOW OUT OF BASIN

MARTIN B. COYINGTON III, P.E.
 STORMWATER MANAGEMENT
 PROGRAM ENGINEER
 EFFECTIVE DATE: JAN. 21, 2009
 REVISED AND DISTRIBUTED
 FOR COMMENT AT CARROLL COUNTY
 SURVEYOR'S MEETING: JAN 20, 2010
 EFFECTIVE DATE: MARCH 17, 2010

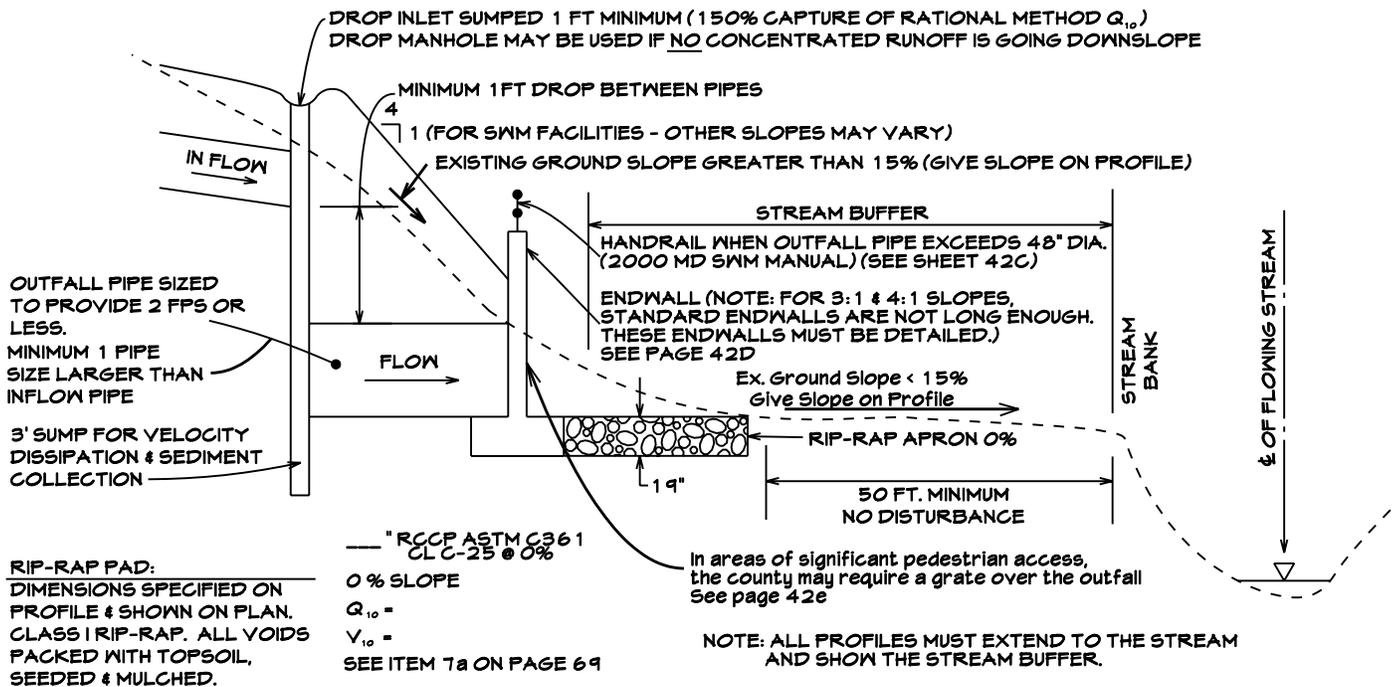
DESIGN PROCEDURE FOR SATISFYING CARROLL COUNTY WATER RESOURCE MANAGEMENT MANUAL SECTION IV C3b2

"STORM DRAINAGE UP TO AND INCLUDING THE 10 YEAR DESIGN STORM SHALL NOT PRODUCE DISCHARGE VELOCITIES EXCEEDING 2 FEET PER SECOND PRIOR TO ENTERING THE BUFFER"

Carroll County Drop Structure and Oversized Outfall Pipe Technique

Option 2 is used in the following situations:

1. When a full sized stilling basin and underdrain cannot be cut into and discharge onto the existing ground outside of the stream buffer.
2. When the Q_{10} is too large for table 1 on 42a
3. Outfalls are not allowed on existing steep slopes. When steep slopes intersect the edge of the buffer and no area can be found to discharge outside the buffer area, the riprap apron is allowed in the buffer for the minimum distance to tie into the flood plain. In extreme situations, with prior permission of the C.C. Water Resources Reviewer, the outfall may be allowed in the buffer.



IF: THE DROP STRUCTURE AND OUTFALL PIPE ARE CONSTRUCTED AS SHOWN ABOVE, THEN: THE OUTFALL MEETS THE 2 FT/SECOND CRITERIA FOR DISCHARGES UP TO THOSE FOUND IN TABLE 2

PIPE DIAMETER (in)	MAXIMUM Q_{10} (cfs)
15"	2.0
18"	3.0
24"	6.0
27"	8.0
30"	10.0
36"	14.0
42"	19.0
48"	25.0
54"	32.0
60"	40.0
72"	55.0
84"	75.0
96"	100.0
108"	125.0
120"	155.0

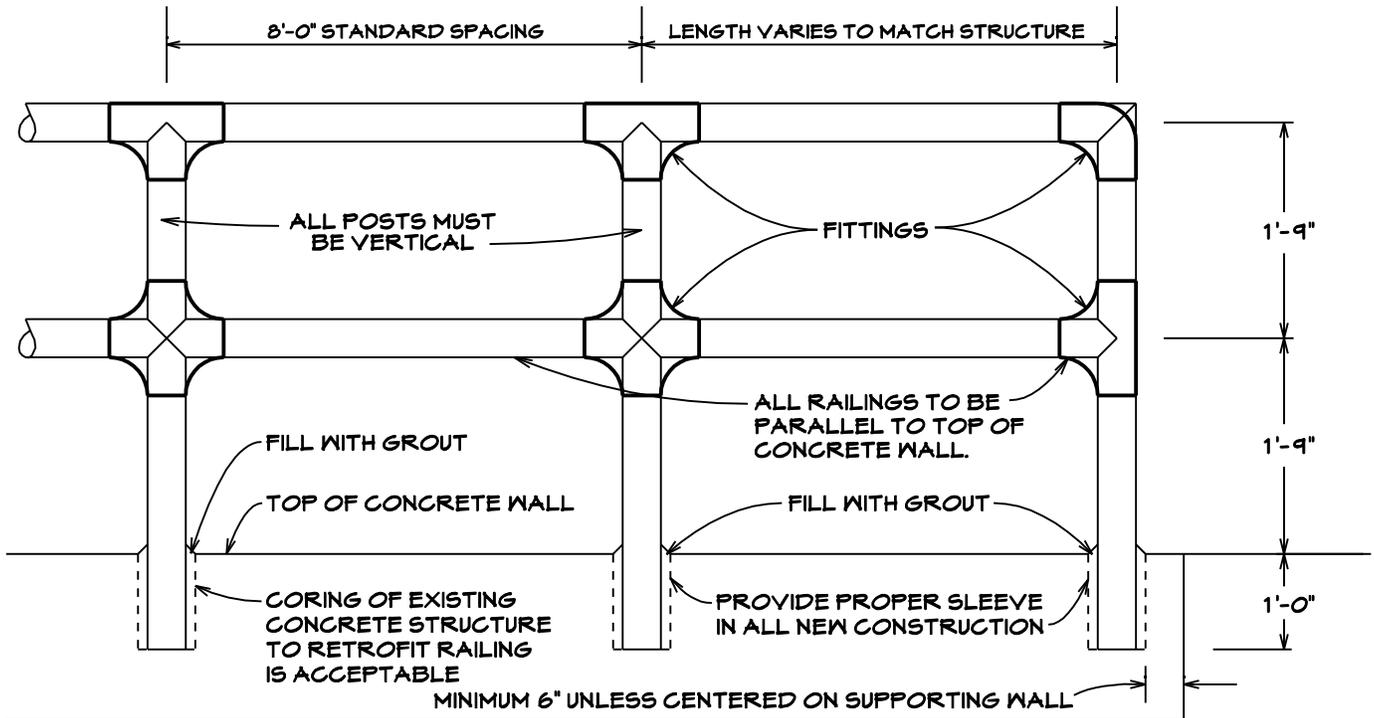
MINIMUM SIZE OF FLAT GRADE OUTFALL PIPES SHALL BE 30" FOR MAINTENANCE (C.C.D.P.W.)

THEREFORE, THE MINIMUM STRUCTURES ARE:
 60" MANHOLE MD-384.03 OR STD TYPE-S INLET DOUBLE GRATE TANDEM MD 374.70 & BAR GRATE MD 379.05 (NON TRAFFIC) OR MD 374.70 & RETICULAR GRATE MD 374.02 (TRAFFIC AREAS)

* BEYOND 155 cfs A CUSTOM DESIGN IS REQUIRED. CONTACT APPROVING AUTHORITY.

MARTIN B. COYINGTON III, P.E.
 STORMWATER MANAGEMENT PROGRAM ENGINEER
 EFFECTIVE DATE: JAN. 21, 2009
 REVISED AND DISTRIBUTED FOR COMMENT AT CARROLL COUNTY SURVEYOR'S MEETING: JAN 20, 2010
 EFFECTIVE DATE: MARCH 17, 2010

CARROLL COUNTY FIELD WELDED PIPE RAILING FOR HEADWALLS, ENDWALLS & RISER BOXES USED IN STORMWATER MANAGEMENT FACILITIES WITH VEHICLE ACCESS AND LOW VOLUMES OF FOOT TRAFFIC ANTICIPATED



General Notes for Field Welded Pipe Railings

MATERIAL - Pipe Posts, Railing & Welded Fittings to be Standard Steel Pipe, 2 1/2" ϕ inside diameter. ASTM A-53, Schedule 40. Grout to be a commercially prepared 5,000 psi nonshrink product per section 902.11(c)

JOINTS - No Pipe Joints are allowed except at corners or tees. Corners and tees may be formed by field cutting and welding or use of standard fittings. If field formed they must approximate the fitting geometry.

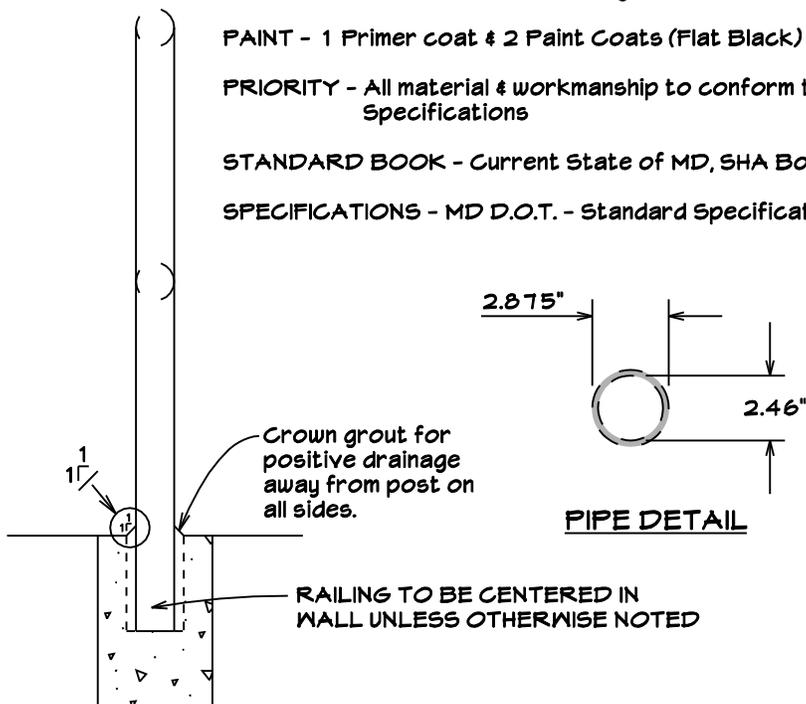
WELDING - Full penetration of metal. Welds to be free of holes, gaps or defects and ground off smooth to the touch. All welding to be in accordance with section 430.03.19.

PAINT - 1 Primer coat & 2 Paint Coats (Flat Black) in accordance with section 435

PRIORITY - All material & workmanship to conform to: the plans, then this detail, then the latest SHA Specifications

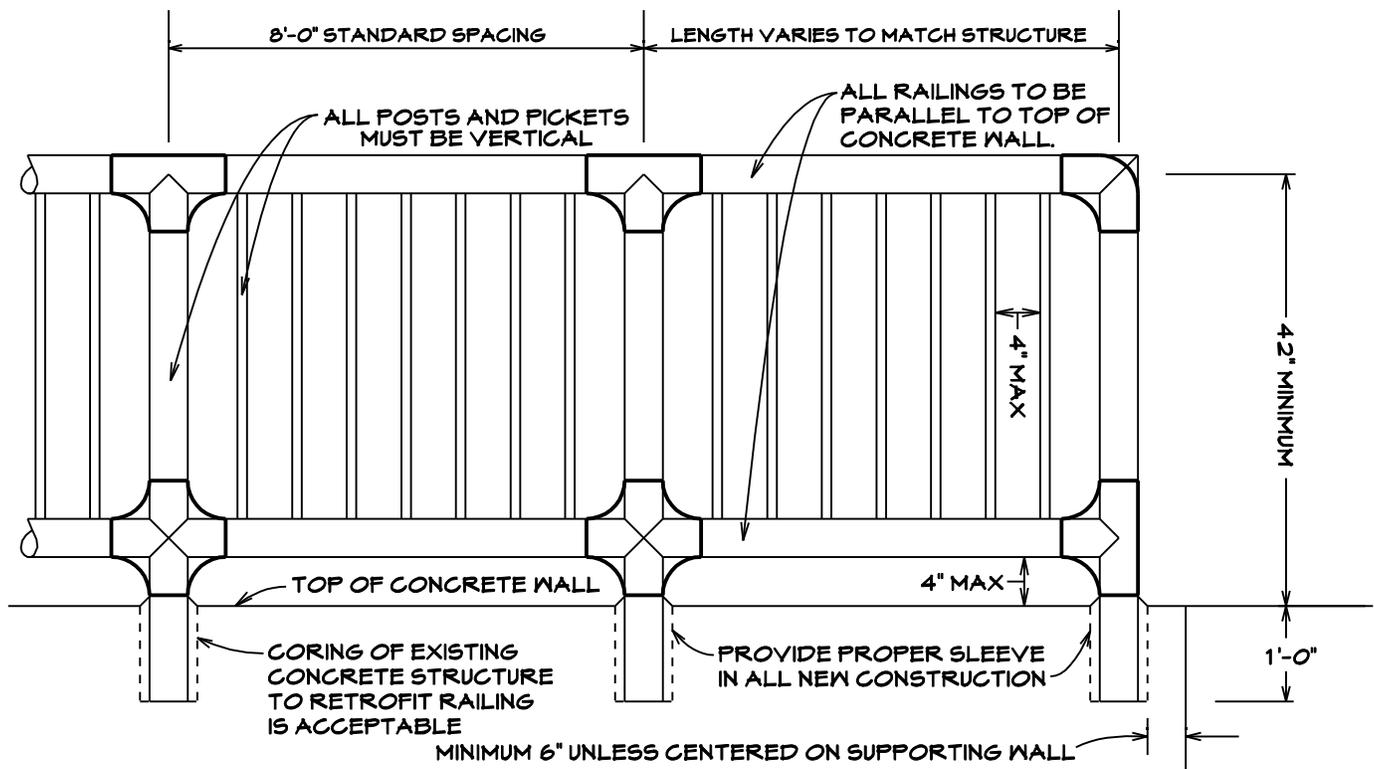
STANDARD BOOK - Current State of MD, SHA Book of Standards

SPECIFICATIONS - MD D.O.T. - Standard Specifications for Construction and Materials, July 2008



FIRST DISTRIBUTED FOR COMMENT
AT THE C.C. SURVEYOR'S MEETING:
NOV. 19, 2008. REVISED TO
CORRECT SPECIFICATIONS
DISTRIBUTED FOR COMMENT
MAY 3, 2010
COMMENTS RECEIVED AT C.C.
SURVEYORS MTG. MAY 19, 2010
EFFECTIVE DATE: JULY 29, 2010

CARROLL COUNTY FIELD WELDED PIPE RAILING FOR HEADWALLS, ENDWALLS & RISER BOXES USED IN STORMWATER MANAGEMENT FACILITIES WITH VEHICLE ACCESS AND HIGH VOLUMES OF FOOT TRAFFIC AND SMALL CHILDREN ANTICIPATED



General Notes for Field Welded Pipe Railings

MATERIAL - Pipe Posts, Railing & Welded Fittings to be Standard Steel Pipe, 2 1/2" ϕ inside diameter. ASTM A-53, Schedule 40. Grout to be a commercially prepared 5,000 psi nonshrink product per section 902.11 (c)
Pickets to be AISI 1018 cold finished steel square bars 1" x 1"

JOINTS - No Pipe Joints are allowed except at corners or tees. Corners and tees may be formed by field cutting and welding or use of standard fittings. If field formed they must approximate the fitting geometry.

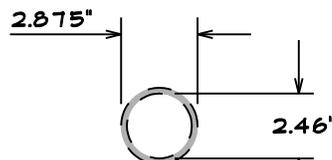
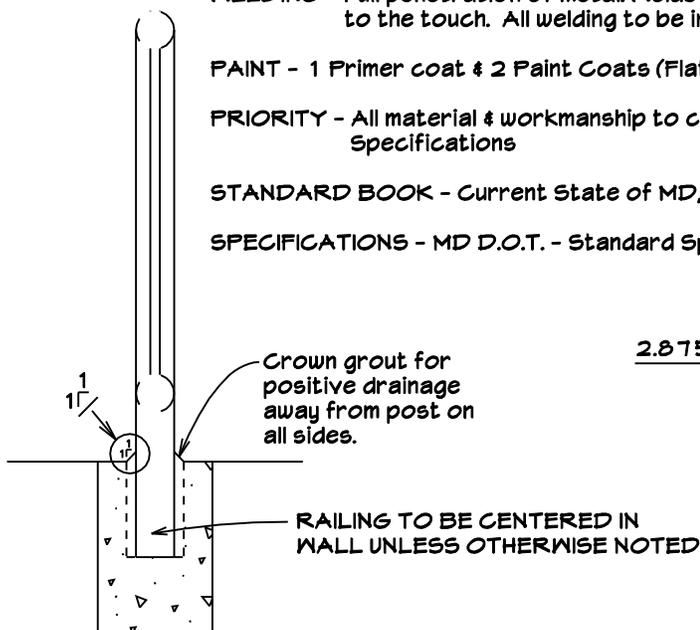
WELDING - Full penetration of metal. Welds to be free of holes, gaps or defects and ground off smooth to the touch. All welding to be in accordance with section 430.03.19.

PAINT - 1 Primer coat & 2 Paint Coats (Flat Black) in accordance with section 435

PRIORITY - All material & workmanship to conform to: the plans, then this detail, then the latest SHA Specifications

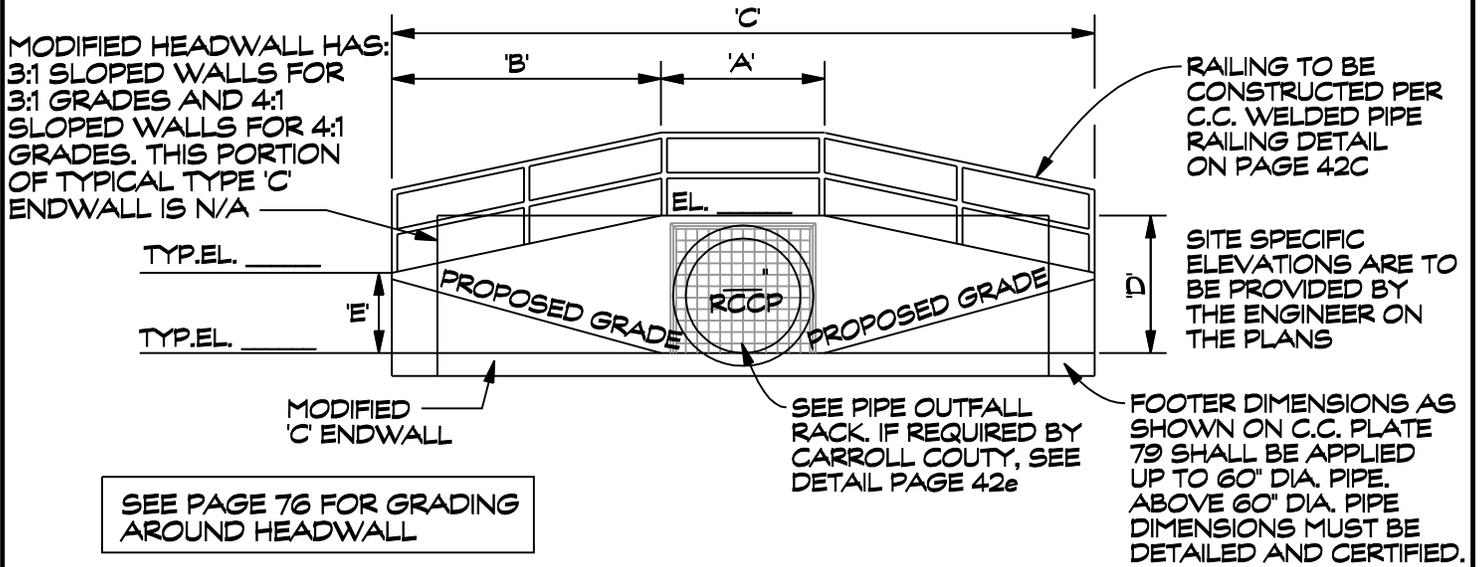
STANDARD BOOK - Current State of MD, SHA Book of Standards

SPECIFICATIONS - MD D.O.T. - Standard Specifications for Construction and Materials, July 2008



PIPE DETAIL
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EFFECTIVE DATE: JULY 29, 2010

CARROLL COUNTY MODIFIED TYPE "C" ENDWALLS FOR USE IN STORMWATER MANAGEMENT FACILITIES WITH 3:1 OR 4:1 SLOPES



THE MODIFICATIONS TO THIS ENDWALL ARE MINIMAL. STANDARD TYPE 'C' SPECIFICATIONS REGARDING REINFORCING, STEEL, CONCRETE, AND CHAMFERS AS SHOWN ON C.C. PLATE 79 SHALL BE APPLIED.

FOR CIRCULAR CONCRETE PIPES

3:1 GROUND SLOPES					
OUTFALL PIPE DIA.	ENDWALL DIMENSIONS				
	"A"	"B"	"C"	"D"	"E"
(IN.)	(FT.)	(FT.)	(FT.)	(FT.)	(FT.)
15"	2.5	2.625	7.75	2.0	1.13
18"	3.0	3.0	9.00	2.25	1.25
24"	4.0	3.75	11.50	2.75	1.50
30"	5.0	4.875	14.75	3.5	1.875
36"	6.0	5.625	17.25	4.0	2.125
42"	7.0	6.375	19.75	4.5	2.375
48"	8.0	7.125	22.25	5.0	2.625
54"	9.0	8.25	25.25	5.75	3.00
60"	10.0	9.00	28.00	6.25	3.25
72"	12.0	10.50	33.00	7.25	3.75
84"	14.0	12.0	38.00	8.25	4.25
96"	16.0	13.875	43.75	9.5	4.875
108"	18.0	15.375	48.75	10.5	5.375
120"	20.0	16.875	53.75	11.5	5.875

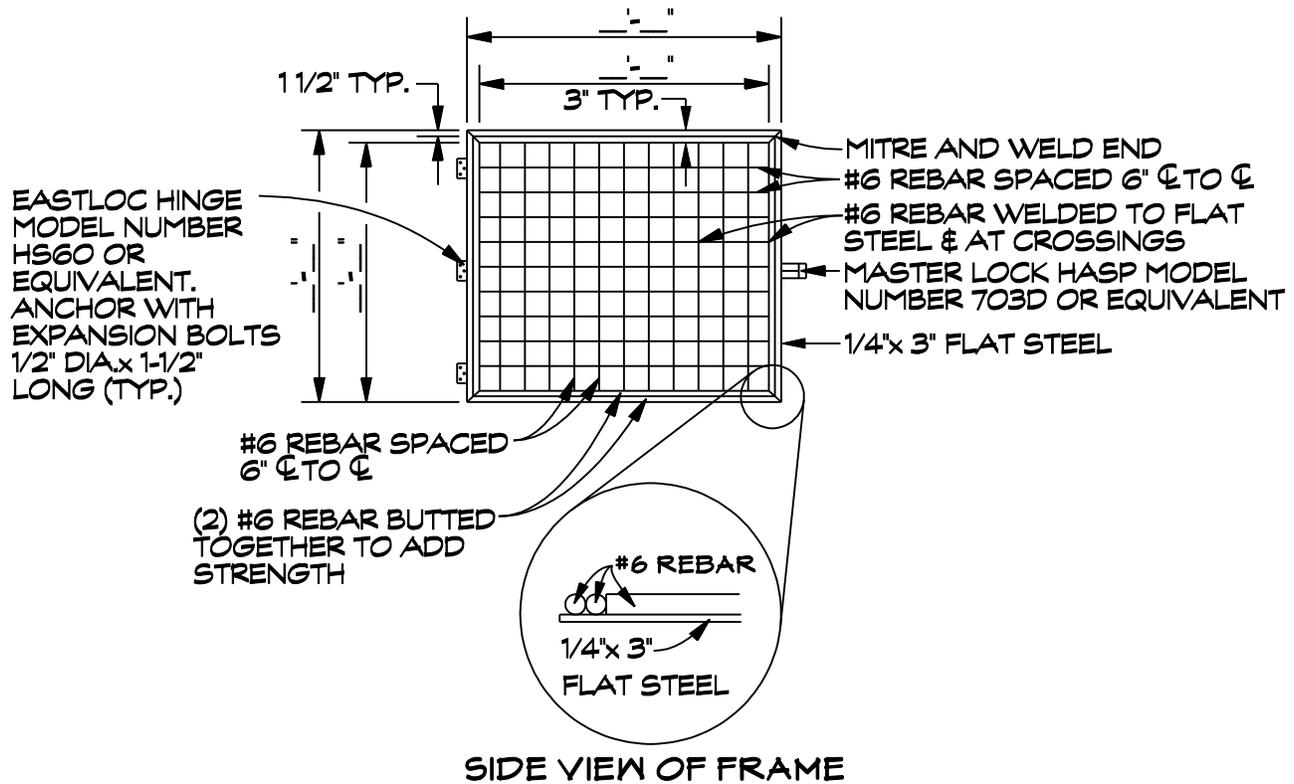
4:1 GROUND SLOPES					
OUTFALL PIPE DIA.	ENDWALL DIMENSIONS				
	"A"	"B"	"C"	"D"	"E"
(IN.)	(FT.)	(FT.)	(FT.)	(FT.)	(FT.)
15"	2.5	3.5	9.5	2.0	1.13
18"	3.0	4.0	11.0	2.25	1.25
24"	4.0	5.0	14.0	2.75	1.50
30"	5.0	6.5	18.0	3.50	1.875
36"	6.0	7.5	21.0	4.00	2.125
42"	7.0	8.5	24.0	4.50	2.375
48"	8.0	9.5	27.0	5.00	2.625
54"	9.0	11.0	31.0	5.75	3.00
60"	10.0	12.0	34.0	6.25	3.25
72"	12.0	14.0	40.0	7.25	3.75
84"	14.0	16.0	46.0	8.25	4.25
96"	16.0	18.5	53.0	9.50	4.875
108"	18.0	20.5	59.0	10.50	5.375
120"	20.0	22.5	65.0	11.50	5.875

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DISTRIBUTED FOR COMMENT MAY 3, 2010
COMMENTS RECEIVED AT C.C. SURVEYORS
MEETING MAY 19, 2010
EFFECTIVE DATE: JULY 29, 2010

PIPE OUTFALL RACK

NOTE: CONTRACTOR TO PROVIDE LARGEST MASTER LOCK TO FIT HASP & 2 KEYS TO COUNTY ENGINEER WITH AS-BUILT DRAWINGS

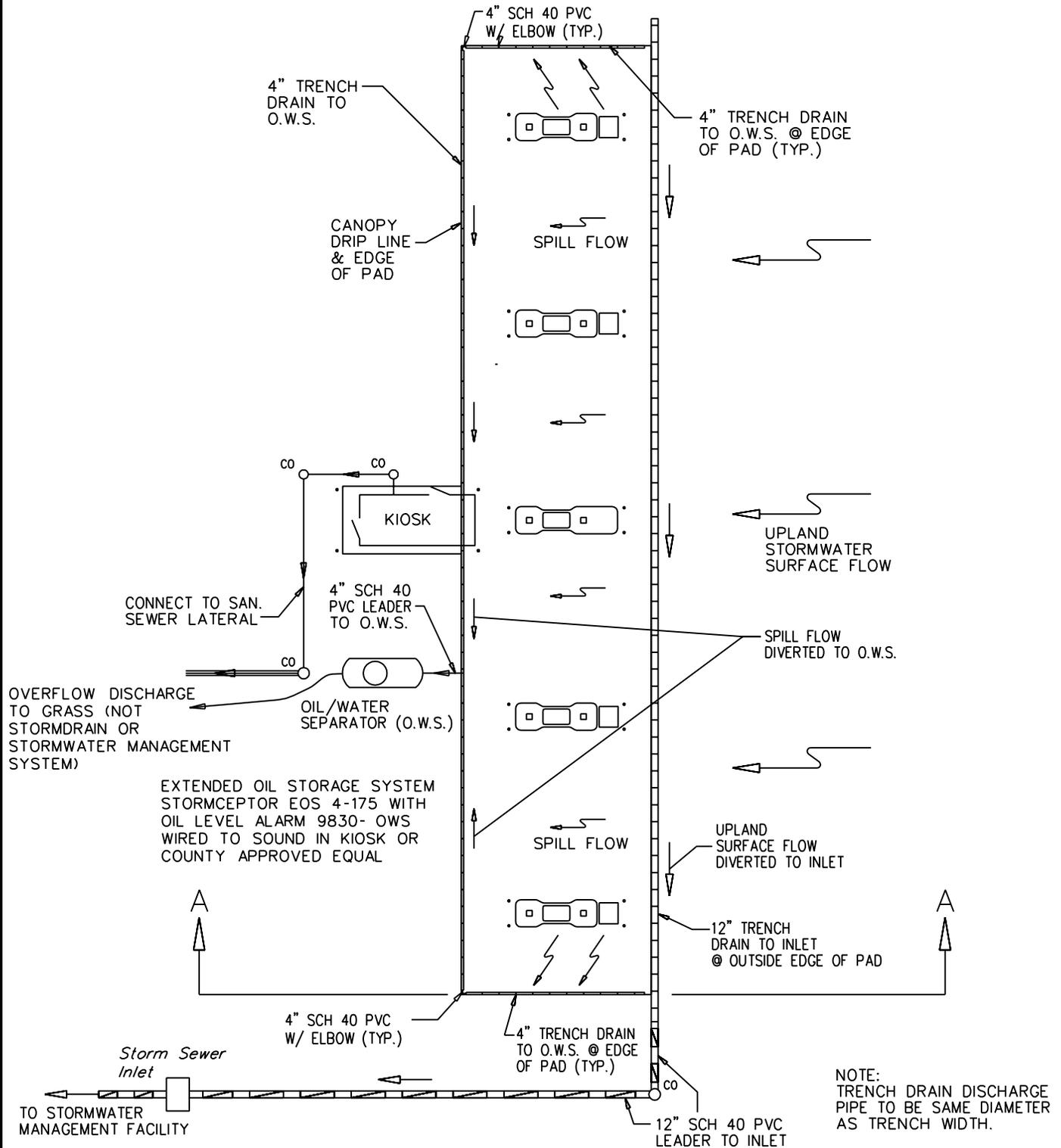
NOTE: PIPE OUTFALL RACK TO BE HOT DIPPED GALVANIZED. NO PAINTED FIELD MODIFICATIONS.



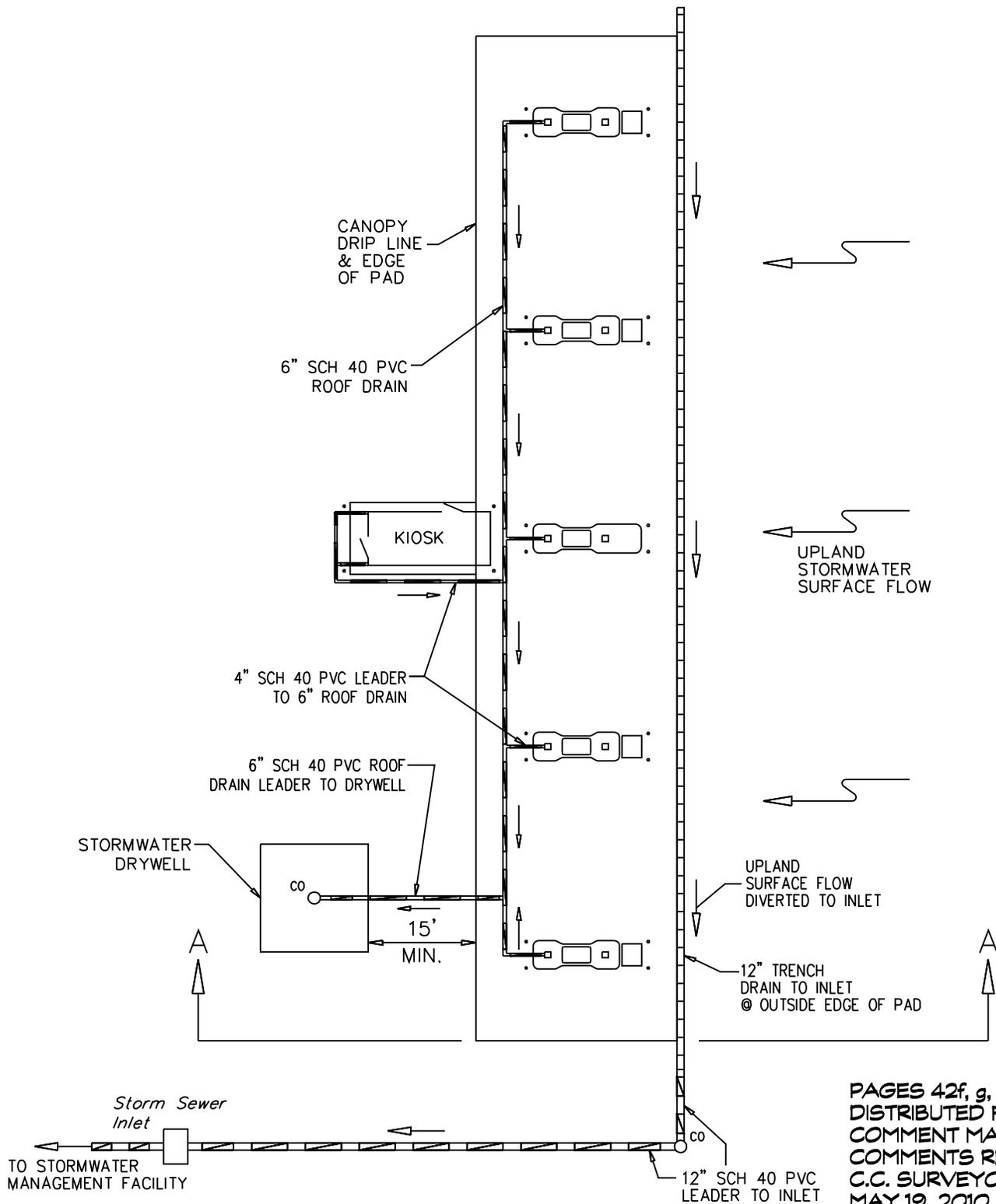
NOTE: DIMENSIONS TO BE SPECIFIED ON PLAN. OVERALL DIMENSIONS SHALL BE 6" LARGER THAN PIPE OUTSIDE DIAMETER.

Martin B. Covington III, PE
 SWM Program Engineer
 DISTRIBUTED FOR COMMENT MAY 3, 2010
 COMMENTS RECEIVED AT C.C. SURVEYORS
 MEETING MAY 19, 2010
 EFFECTIVE DATE: JULY 29, 2010

THIS IS AN APPROVED METHOD TO MEET THE REQUIREMENTS OF WRM MANUAL SECTION IVA2 AND IVC2A FOR GAS ISLANDS

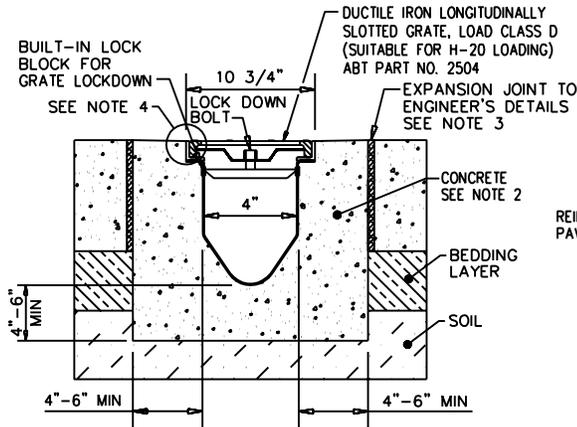


THIS IS AN APPROVED METHOD TO MEET THE REQUIREMENTS OF WRM MANUAL SECTION IVA2 AND IVC2A FOR GAS ISLANDS



PAGES 42f, g, & h
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MAY 19, 2010
EFFECTIVE DATE:
JULY 29, 2010

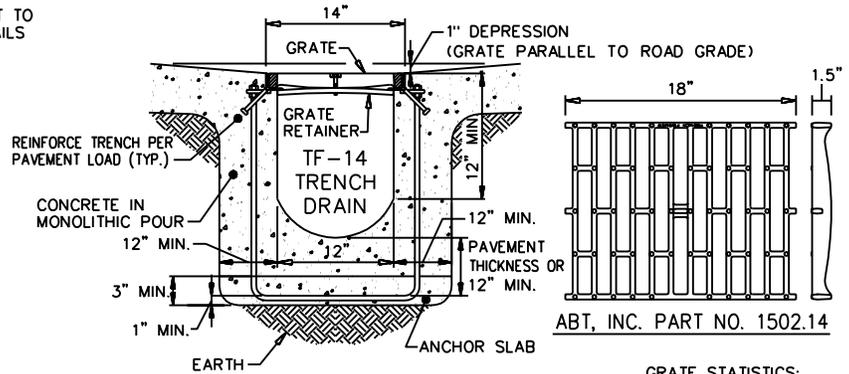
THIS IS AN APPROVED METHOD TO MEET THE REQUIREMENTS OF WRM MANUAL SECTION IVA2 AND IVC2A FOR GAS ISLANDS



1. IT IS NECESSARY TO ENSURE THE MINIMUM DIMENSIONS SHOWN ARE SUITABLE FOR THE EXISTING GROUND CONDITIONS, NOTIFY ENGINEERING TO THE CONTRARY.
2. A MINIMUM CONCRETE STRENGTH OF 3000 PSI IS RECOMMENDED. THE CONCRETE SHOULD BE VIBRATED TO ELIMINATE AIR POCKETS.
3. EXPANSION AND CRACK CONTROL JOINTS ARE RECOMMENDED TO PROTECT THE CHANNEL AND THE CONCRETE SURROUND. ENGINEERING ADVICE MAY BE REQUIRED
4. THE FINISHED LEVEL OF THE CONCRETE SURROUND MUST BE APPROX. 1/8" ABOVE THE TOP OF THE CHANNEL EDGE.
5. REFER TO ABT'S LATEST INSTALLATION INSTRUCTIONS FOR COMPLETE DETAILS.

4" TRENCH DRAIN DETAIL

N.T.S.



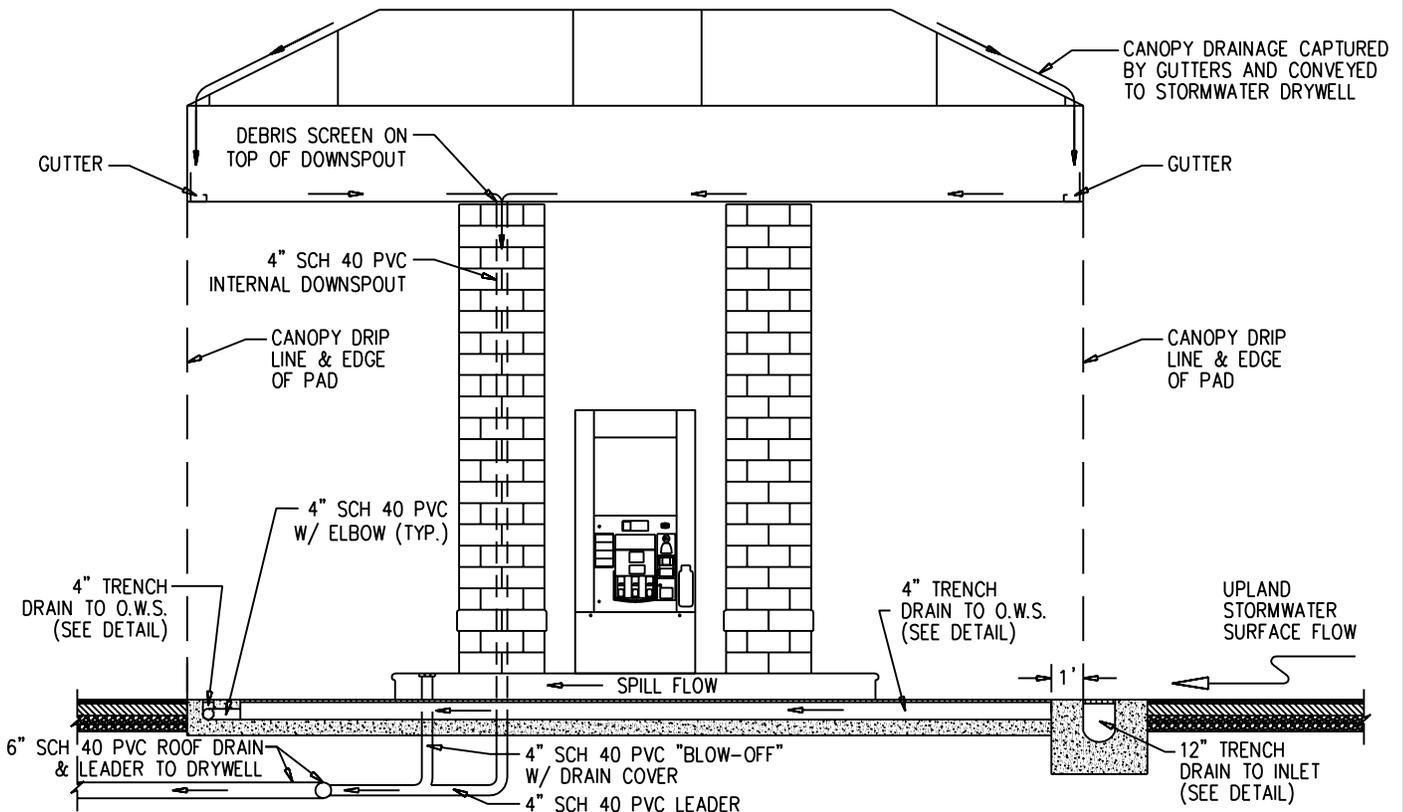
1. TRENCH DRAIN SHALL BE TRENCH FORMER (TF-14) BY ABT, INC.
2. CONCRETE SHALL BE AT LEAST MDSA MIX NO. 3.
3. DRAIN COVER SHALL BE HEAVY DUTY, RATED TO H-20 LOADING BICYCLE SAFE GRATE. GRATE SHALL BE ABT, INC. PART NO. 1502.14.
4. GRATE SHALL BE SEATED ON ANGLE STEEL. CONCRETE TO BE REINFORCED PER MANUFACTURER'S SPECIFICATIONS.
5. ALL GRATES SHALL BE LOCKED DOWN PER MANUFACTURER'S SPECIFICATIONS.

GRATE STATISTICS:

LOAD CLASS:	31.2
AASHTO RATING:	H-25
MATERIAL:	GR-80 D.I.
OPEN AREA:	65%
WEIGHT:	26 LBS.

12" TRENCH DRAIN DETAIL

N.T.S.



THIS IS AN APPROVED ALTERNATE WAY OF MEETING THE REQUIREMENTS OF NRM MANUAL SECTION IV C2 g,h,i

PERIMETER AND ISLAND GRASS SWALES, DITCHES AND INLETS SET IN GRASS ARE REQUIRED PRE-TREATMENT FOR STORMWATER MANAGEMENT FACILITIES.

PERIMETER AND ISLAND GRASS SWALE AND DITCHES

WATER QUALITY PRE-TREATMENT IS PROVIDED FOR IMPERVIOUS AREAS DRAINING TO GRASS SWALES AND DITCHES WHEN THE RUNOFF FROM THE 1 YEAR STORM IS CONVEYED AT $V_1 = 1 \text{ FT/SEC}$ OR LESS. THE RUNOFF FROM THE 10 YEAR STORM IS CONVEYED IN THE DITCH AT $V_{10} = 4 \text{ FT/ SEC}$ OR LESS, ADEQUATE STORM DRAINAGE CONVEYANCE IS PROVIDED TO OUTFALL INTO THE DITCH AT $V_{10} = 2 \text{ FT/ SEC}$ OR LESS, AND THE ONE YEAR STORM WETTED CONTACT AREA IN THE DITCH IS EQUAL TO OR GREATER THAN 2.5% OF THE IMPERVIOUS AREA DRAINING TO IT.

INLETS SET IN GRASS

WATER QUALITY PRE-TREATMENT IS PROVIDED FOR IMPERVIOUS AREAS SHEET FLOWING THROUGH AT LEAST 5 FEET OF GRASS TO INLETS WHERE THE RUNOFF FROM THE 1 YEAR STORM IS CONVEYED THROUGH THE CURB OPENING AND SHEET FLOWED THROUGH THE GRASS AT $V_1 = 1 \text{ FT/ SEC}$ OR LESS, THE OPENING AND GRASS CAN CONVEY THE 10 YEAR STORM RUNOFF AT $V_{10} = 4 \text{ FT/ SEC}$ OR LESS AND THE WETTED CONTACT AREA IN THE GRASS IS EQUAL TO OR GREATER THAN 2.5% OF THE IMPERVIOUS AREA DRAINING TO IT.

PARTIAL PRETREATMENT (GRASS DITCHES AND INLETS)

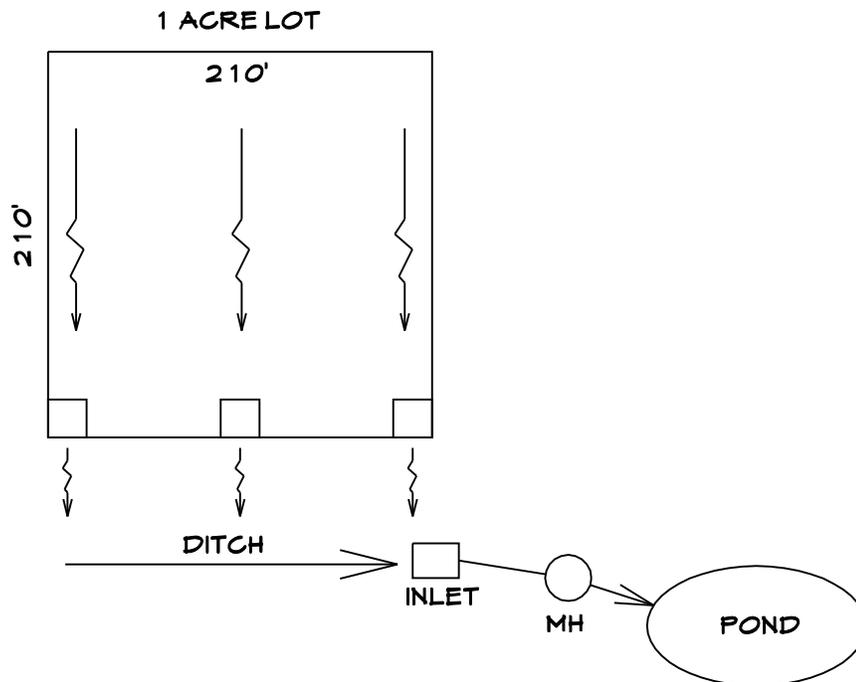
WHEN THE WETTED CONTACT AREA CANNOT BE ACHIEVED TO THE SATISFACTION OF THE COUNTY, PROPORTIONALLY DISTRIBUTED STRUCTURAL PRETREATMENT MUST BE PROVIDED FOR THE REMAINDER OF THE PRETREATMENT VOLUME (25% NQ_v). PROCEDURES FOR CALCULATING DITCH AND SHEET FLOW VELOCITIES, PARTIAL PRETREATMENT, REQUIRED VOLUMES AND REQUIRED DESIGN FEATURES ARE FOUND ON PAGES 42; THROUGH 42p.

NOTE:

ALL SWALES AND DITCHES MUST BE FLAT BOTTOMED, AT LEAST 2 FEET WIDE, WITH 3:1 OR FLATTER SIDE SLOPES.

Martin B. Covington III, PE
SWM Program Engineer
DISTRIBUTED FOR COMMENT MAY 3, 2010
COMMENTS RECEIVED AT C.C. SURVEYORS
MEETING MAY 19, 2010
EFFECTIVE DATE: JULY 29, 2010

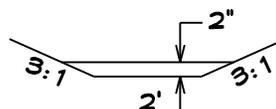
PERIMETER AND ISLAND DITCHES/ SWALES



$43560 \text{ FT}^2 \times 1"/12 = 3630 \text{ FT}^3 \text{ WQ}$ 907 FT^3 PRETREATMENT (25% OF WQ VOLUME)

PRETREATMENT BY DITCH 2.5% OF SURFACE AREA

$(.025)43560 = 1089 \text{ FT}^2 \rightarrow$ ASSUME 3' NETTED



DITCH NEEDS TO BE 363 FT LONG. NOTE: $363 \text{ FT} @ 1 \text{ FT/ SEC} = 363 \text{ SEC}$ OR 6 MIN CONTACT TIME

ACTUAL DITCH LENGTH $\rightarrow 210 \cdot .58 = 58\%$ OF PRETREATMENT. \therefore 42% REMAINS
 REQUIRED DITCH LENGTH $\rightarrow 363$

$.42(907) = 381$ CUBIC FEET TO BE SATISFIED

4'x4' INLETS PRODUCE $16 \text{ FT}^3 / \text{FT}$ OF SUMP DEPTH

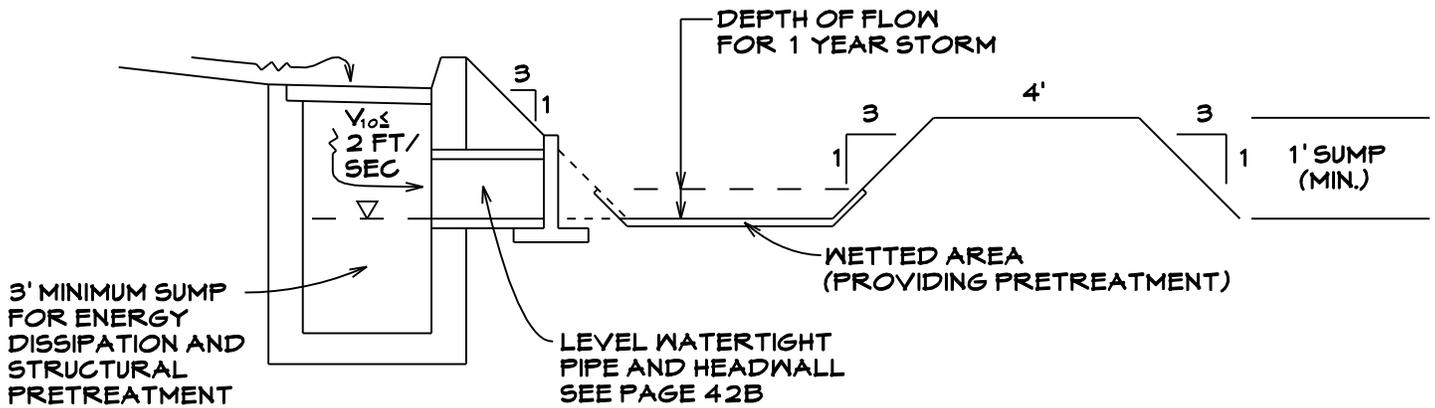
10' DIA. MANHOLES PRODUCE $78 \text{ FT}^3 / \text{FT}$ OF SUMP DEPTH

(1) 5' SUMP MANHOLE WILL PRODUCE ALL REQUIRED ADDITIONAL WQ PRETREATMENT VOLUME

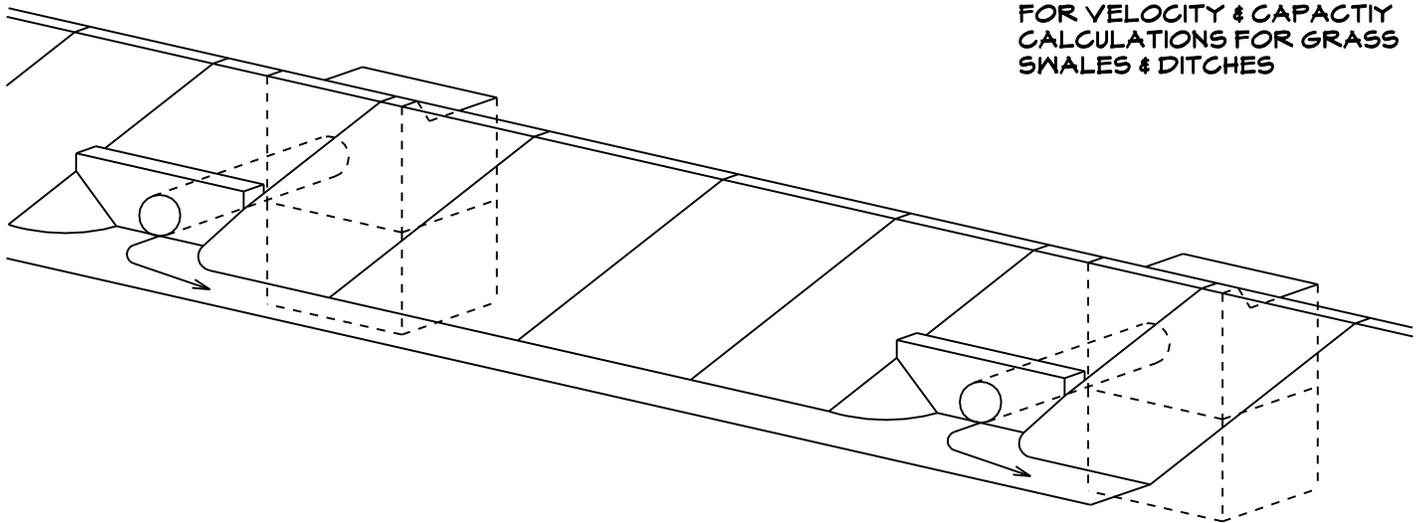
WITH DEEP SUMP MANHOLES THE PIPE OUTFALL INTO THE POND SHOULD HAVE PIPE OUTFALL RACK FOR SAFETY. SEE PAGE 42e

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PERIMETER AND ISLAND GRASS SWALES/ DITCHES GRADING OPTION



SEE PAGES 88A & 88B
FOR VELOCITY & CAPACITY
CALCULATIONS FOR GRASS
SWALES & DITCHES

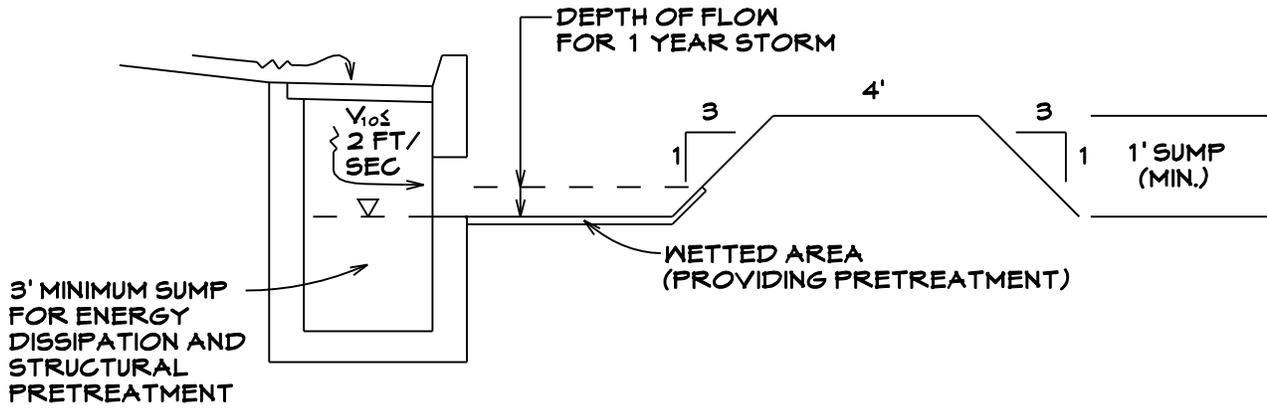


NOTES:

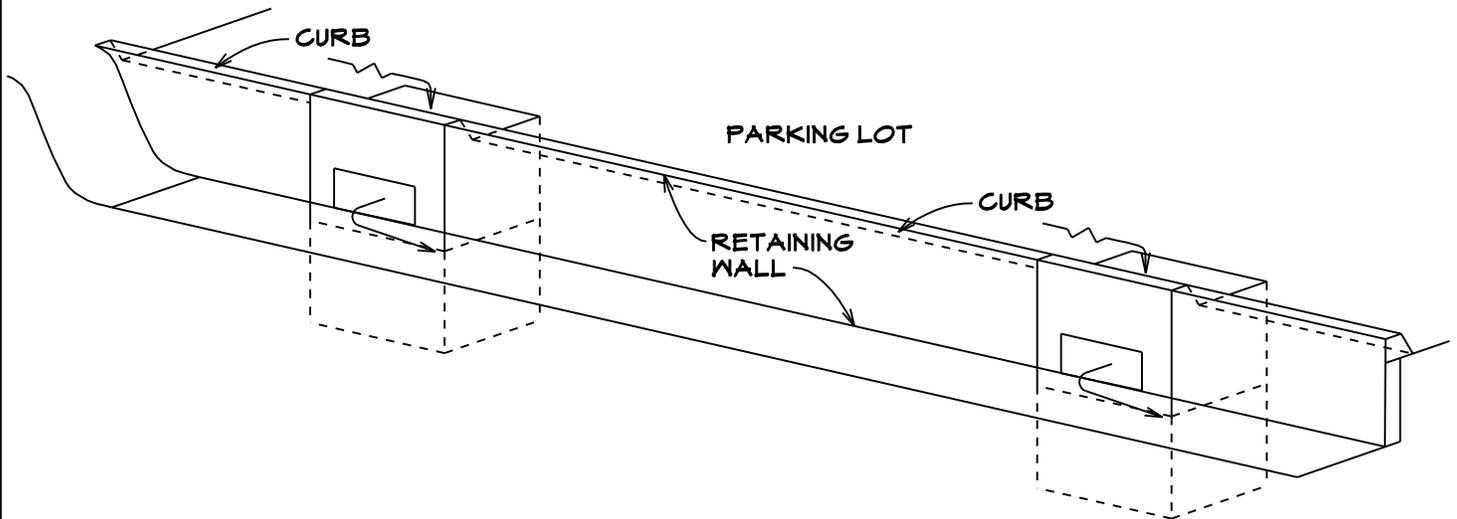
1. ALL INLETS, MANHOLES, CURB OPENINGS, GRASS CHANNELS, SWALES AND DITCHES USED FOR PRETREATMENT (WQ) MUST BE BONDED, INSPECTED AND CERTIFIED. THEY MUST BE PART OF THE SEQUENCE OF CONSTRUCTION AND THE INSPECTION CHART AND SHOWN ON THE AS-BUILT PLAN.
2. THE SEQUENCE AND INSPECTION CHARTS FOR ALL GRASSED DITCH, SWALE AND SHEET FLOW AREAS MUST INCLUDE ESTABLISHMENT OF 2" OF DENSE GRASS.
3. PER SECTION 191-25C(6), ALL SUMPED INLETS AND MANHOLES USED FOR STRUCTURAL PRETREATMENT (WQ_s) MUST BE PUMPED OUT AND ALL ACCUMULATED DEBRIS REMOVED AT LEAST ANNUALLY. PLEASE LIST ALL SUCH STRUCTURES AND THIS REQUIREMENT IN BOLD ON THE SWM AS-BUILT CERTIFICATION SHEET.

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PERIMETER AND ISLAND GRASS SWALES/ DITCHES RETAINING WALL OPTION

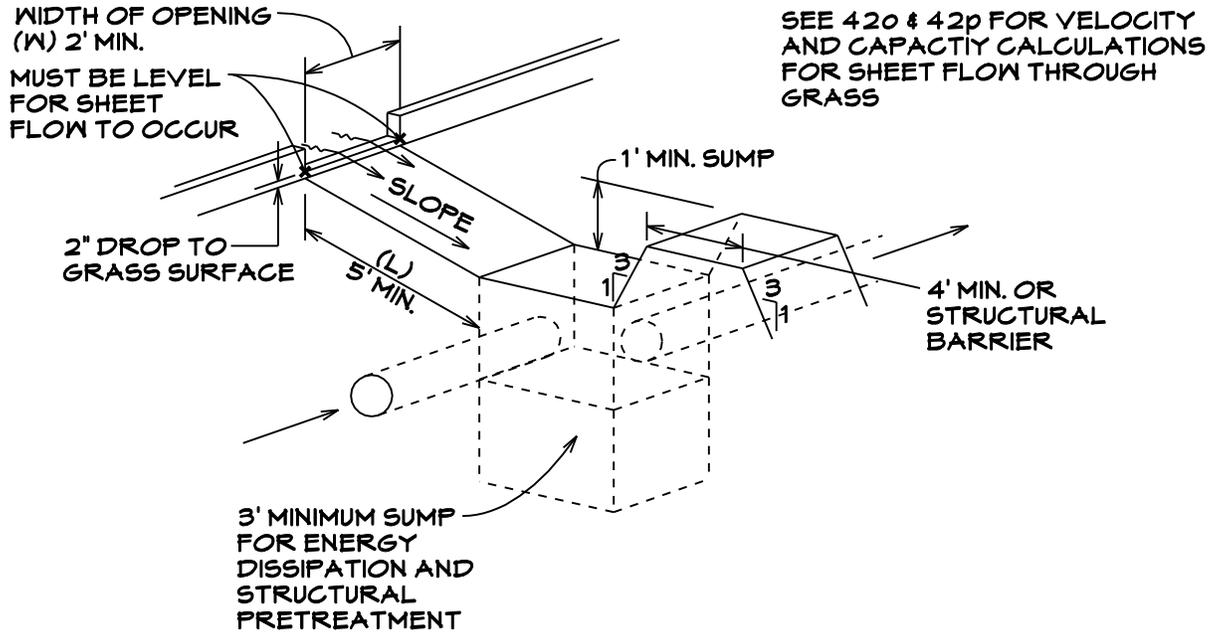


SEE PAGES 88A & 88B
FOR VELOCITY & CAPACITY
CALCULATIONS FOR GRASS
SWALES & DITCHES



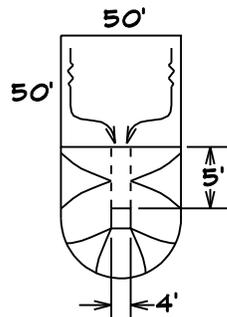
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INLETS SET IN GRASS CURB OPENING OPTION (INLET DIRECTLY BEHIND CURB INLET)



NOTE: BELOW A 4% SLOPE THE DISTANCE BETWEEN THE CURB OPENING AND INLET MUST BE INCREASED TO PRODUCE A 1 FT. SUMP. (I.E. 1% SLOPE, 17 FT.; 2% SLOPE, 9 FT.; 3% SLOPE, 6 FT.)

WETTED AREA = (L) x (W)



EXAMPLE CALCULATION FOR PARTIAL TREATMENT

$$\text{IMPERVIOUS AREA} = 50' \times 50' = 2500 \text{ FT}^2$$

$$\text{WQ}_v = 2500 \times 1''/12 = 208 \text{ FT}^3$$

$$\text{PRETREATMENT} = .25 \text{ WQ}_v = 52 \text{ FT}^3$$

$$\text{WETTED AREA} = 5 \times 4 = 20 \text{ FT}^2$$

$$\text{IMPERVIOUS AREA TREATED @ 2.5\%} = \frac{20}{.025} = 800 \text{ FT}^2$$

$$\frac{\text{TREATED IMPERVIOUS AREA}}{\text{IMPERVIOUS DRAINAGE AREA}} = \frac{800}{2500} = .32 = 32\% \text{ PRETREATMENT PROVIDED}$$

THEREFORE 68% OF PRETREATMENT MUST BE PROVIDED STRUCTURALLY.

.68(52) = 35 FT³ OF TREATMENT TO BE SATISFIED STRUCTURALLY

4x4 INLETS PROVIDE 16 FT³ / FT OF SUMP DEPTH

A STANDARD 3' SUMP INLET PROVIDES 48 FT³ OF ADDITIONAL

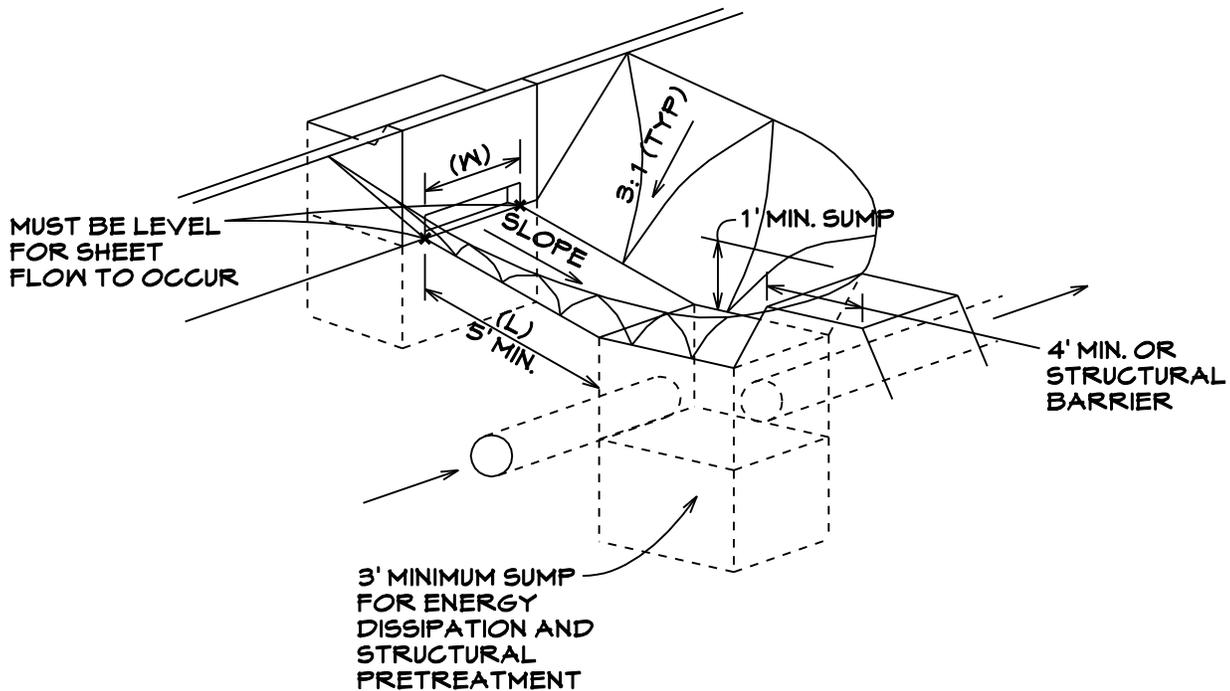
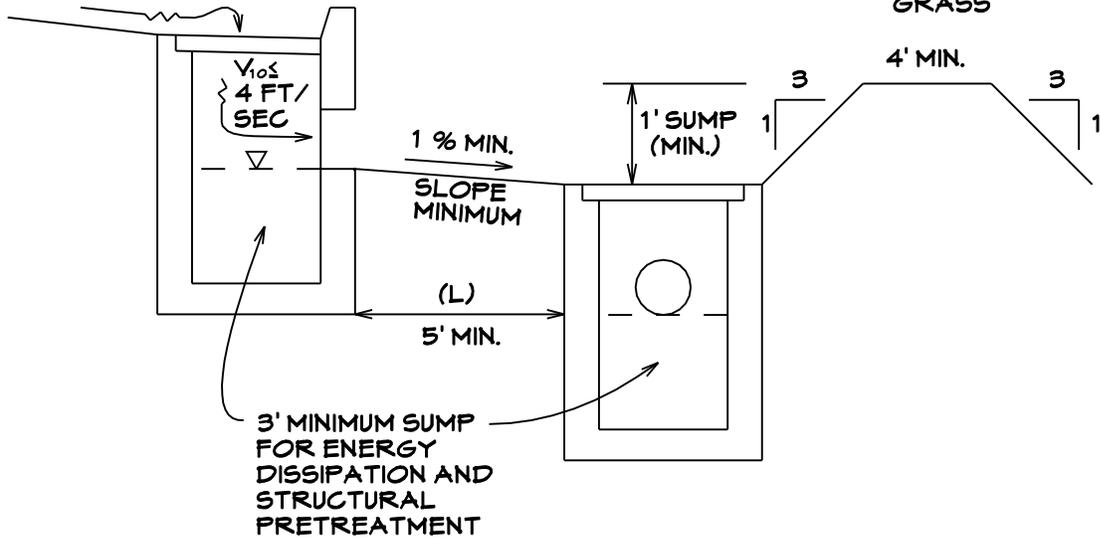
WQ PRETREATMENT VOLUME.

48 FT³ > 35 FT³. ALL REQUIRED VOLUME IS PROVIDED.

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INLETS SET IN GRASS RETAINING WALL OPTION (INLET DIRECTLY BEHIND CURB INLET)

SEE 42o & 42p FOR VELOCITY
AND CAPACITY CALCULATIONS
FOR SHEET FLOW THROUGH
GRASS



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VELOCITY AND CAPACITY CALCULATIONS FOR INLETS SET IN GRASS (SHEET FLOW)

SHEET FLOW SLOPE

2 FT. CURB OPENING		1%		2%		3%		4%		5%	
DEPTH OF FLOW - IN. (FT.)	MANNINGS * "n"	VELOCITY FT./SEC	DISCHARGE** (Q) C.F.S.	VELOCITY FT./SEC.	DISCHARGE** (Q) C.F.S.						
1 (.08)	0.15	0.17	0.03	0.25	0.04	0.30	0.05	0.35	0.06	0.39	0.06
2 (.17)	0.15	0.27	0.09	0.39	0.13	0.47	0.16	0.55	0.19	0.61	0.21
3 (.25)	0.15	0.33	0.17	0.48	0.24	0.59	0.29	0.68	0.34	0.76	0.38
4 (.33)	0.15	0.39	0.26	0.55	0.37	0.68	0.45	0.78	0.52	0.87	0.58
5 (.42)	0.135	0.49	0.41	0.69	0.58	0.85	0.71	0.98	0.82	1.09	0.92
6 (.50)	0.12	0.60	0.60	0.84	0.84	1.03	1.03	1.19	1.19	1.33	1.33
7 (.58)	0.105	0.73	0.84	1.03	1.19	1.26	1.46	1.45	1.68	1.62	1.88
8 (.67)	0.09	0.90	1.20	1.27	1.70	1.56	2.08	1.80	2.41	2.01	2.69
2 FT. CURB OPENING		6%		7%		8%		9%		10%	
DEPTH OF FLOW - IN. (FT.)	MANNINGS * "n"	VELOCITY FT./SEC	DISCHARGE** (Q) C.F.S.	VELOCITY FT./SEC.	DISCHARGE** (Q) C.F.S.						
1 (.08)	0.15	0.43	0.07	0.46	0.07	0.49	0.08	0.52	0.08	0.55	0.09
2 (.17)	0.15	0.67	0.23	0.72	0.25	0.77	0.26	0.82	0.28	0.87	0.29
3 (.25)	0.15	0.83	0.41	0.90	0.45	0.96	0.48	1.02	0.51	1.07	0.53
4 (.33)	0.15	0.96	0.63	1.03	0.68	1.10	0.73	1.17	0.77	1.24	0.82
5 (.42)	0.135	1.20	1.00	1.29	1.09	1.38	1.16	1.47	1.23	1.55	1.30
6 (.50)	0.12	1.46	1.46	1.58	1.58	1.68	1.68	1.79	1.79	1.88	1.88
7 (.58)	0.105	1.78	2.06	1.92	2.22	2.05	2.38	2.18	2.52	2.29	2.66
8 (.67)	0.09	2.20	2.95	2.38	3.18	2.54	3.40	2.69	3.61	2.84	3.80

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VELOCITY AND CAPACITY CALCULATIONS FOR INLETS SET IN GRASS (SHEET FLOW)

SHEET FLOW SLOPE

4 FT. CURB OPENING		1%		2%		3%		4%		5%	
DEPTH OF FLOW - IN. (FT.)	MANNINGS * "n"	VELOCITY FT./SEC	DISCHARGE** (Q) C.F.S.	VELOCITY FT./SEC.	DISCHARGE** (Q) C.F.S.						
1 (.08)	0.15	0.18	0.06	0.25	0.08	0.31	0.10	0.56	0.11	0.40	0.13
2 (.17)	0.15	0.29	0.20	0.41	0.28	0.50	0.34	0.58	0.39	0.64	0.44
3 (.25)	0.15	0.36	0.36	0.51	0.51	0.63	0.63	0.73	0.73	0.81	0.81
4 (.33)	0.15	0.43	0.56	0.60	0.80	0.74	0.98	0.85	1.13	0.96	1.26
5 (.42)	0.135	0.54	0.91	0.77	1.29	0.94	1.58	1.09	1.83	1.22	2.04
6 (.50)	0.12	0.67	1.34	0.95	1.90	1.16	2.33	1.34	2.69	1.50	3.01
7 (.58)	0.105	0.83	1.93	1.17	2.73	1.44	3.34	1.66	3.85	1.86	4.31
8 (.67)	0.09	1.04	2.79	1.47	3.95	1.81	4.84	2.09	5.59	2.33	6.25
4 FT. CURB OPENING		6%		7%		8%		9%		10%	
DEPTH OF FLOW - IN. (FT.)	MANNINGS * "n"	VELOCITY FT./SEC	DISCHARGE** (Q) C.F.S.	VELOCITY FT./SEC.	DISCHARGE** (Q) C.F.S.						
1 (.08)	0.15	0.44	0.14	0.47	0.15	0.51	0.16	0.54	0.17	0.57	0.18
2 (.17)	0.15	0.71	0.48	0.76	0.52	0.81	0.55	0.86	0.59	0.91	0.62
3 (.25)	0.15	0.89	0.89	0.96	0.96	1.03	1.03	1.09	1.09	1.15	1.15
4 (.33)	0.15	1.05	1.38	1.13	1.49	1.21	1.60	1.28	1.69	1.35	1.78
5 (.42)	0.135	1.33	2.24	1.44	2.42	1.54	2.58	1.63	2.74	1.72	2.89
6 (.50)	0.12	1.65	3.29	1.78	3.56	1.80	3.80	2.02	4.03	2.13	4.25
7 (.58)	0.105	2.03	4.72	2.20	5.10	2.35	5.45	2.49	5.78	2.63	6.09
8 (.67)	0.09	2.55	6.84	2.76	7.39	2.95	7.80	3.13	8.38	3.30	8.84

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42p

CARROLL COUNTY SOILS TESTING POLICY FOR PROPOSED INFILTRATION/RECHARGE FACILITIES

Soils classifications and field infiltration rate testing must be performed for all proposed structural infiltration/recharge facilities.

Testing is to be conducted by a qualified professional. This professional shall either be a registered professional engineer, or soils scientist or geologist and licensed by the State of Maryland.¹

Follow Test Pit/Boring Requirements per Appendix D.1, Pages 2 and 3 of the “Manual”.

TEST PITS:

Test pits must be used where the bottom of the proposed facility can be within 16 feet of the existing ground elevation. Infiltration/recharge must be accomplished, if possible. Facilities may not arbitrarily be designed greater than 16 feet below grade to avoid test pit requirements.

Proposed infiltration facilities must have double-ring infiltrometer tests and sieve analyses performed at the proposed bottom elevation. Then the test pits must be extended 4 feet below the proposed bottom elevation of the facility with additional sieve analyses performed.² The double-ring infiltrometer tests must be performed in accordance with ASTM-D 3385 “Standard Test Method for Infiltration Rate of Soils in Field Using Double Ring Infiltrometer”.

SOIL BORINGS:

When the bottom of the proposed facility must be 16 feet or greater below the existing ground elevation, you may use soil borings and the “Falling Head Infiltration Rate Test” at your own risk. If the soil borings produce disputed information, the County reserves the right to require test pits.

Follow Infiltration Testing Requirements per Appendix D.1, Pages 3 and 4 of the “Manual” with the following exceptions:

1. A 6” solid casing may be used in place of the specified 5” casing. A 5” casing is the minimum diameter casing that Carroll County will accept.
2. Two inches of No. 8 stone (pea gravel) must be placed in the bottom of the casing to protect the soil from scouring and sedimentation.
3. Only 24” of water is to be used in the pre-soak and the infiltration testing. It is the registered professional engineer, soils scientist or geologist’s responsibility to have the necessary equipment to accurately measure water levels in the casing.

GENERAL:

1. All test pits or borings must be backfilled immediately, labeled and staked.³ If the area is to be developed, the backfill should be adequately compacted to support the intended use,
2. Reports must be certified by the registered professional on site during testing. The attached certification block must be completed and on the cover page of the report. Uncertified reports will not be accepted.

1 2000 MD Stormwater Design Manual, Volumes I and II, Appendix D.1, Page 1.

2 Carroll County Stormwater Management Plan Review Checklist, pages vi-vii.

3 2000 MD Stormwater Design Manual, Volumes I and II, Appendix D.1, Page 3.

Infiltration Testing Certification

I was on site and either I or personnel under my direct supervision conducted the field infiltration testing described in this report. I certify that the testing met the requirements of the current Carroll County Soils Testing Policy for Proposed Infiltration/Recharge Facilities and all referenced standards.

*Signature of Registered Professional
Engineer, Soils Scientist or Geologist*

Date

Maryland License Number

Seal

Originally issued March 16, 2005
Revision effective October 18, 2006
Distributed at C.C. Surveyor's Meeting
Revised after Carroll County Surveyors Meeting on May 19, 2010.
Effective Date: July 29, 2010

Martin B. Covington, III, P.E.
Myron R. Frock

- 1 2000 MD Stormwater Design Manual, Volumes I and II, Appendix D.1, Page 1.
- 2 Carroll County Stormwater Management Plan Review Checklist, effective June 8, 2004, Page 5.
- 3 2000 MD Stormwater Design Manual, Volumes I and II, Appendix D.1, Page 3.

Carroll County Floodplain and Stormwater Management
Policy on Dam Breach Inundation Areas

The definition in Chapters 114 and 191 is “Dam Breach Inundation Area – The area potentially inundated by a sudden dam failure.” Chapter 191 incorporates USDA Natural Resources Conservation Service Maryland Conservation Practice Standard Pond Code 378 (January 2000) by reference.

The words are defined exactly the same way there.

“The breach hydrograph is the outflow hydrograph attributed to the sudden release of water in reservoir storage. This is due to a dam breach during non-storm conditions. ...The minimum peak discharge of the breach hydrograph, regardless of the techniques used to analyze the downstream inundation areas, is as follows:

Hw= depth of water at the dam at the time of failure, feet. This is measured to the crest of the emergency spillway or to design high water, if no emergency spillway exists. Use non-storm conditions downstream of the dam.”

Our definition corresponds to MD-378. The “potential” for inundation after a storm is based upon the pond being full to at least the emergency spillway elevation and breaking in a catastrophic failure.

This corresponds to the design policies for emergency spillways that assumes “the release has failed” and thus the pond is sitting full.

For the above reasons, we are going to enforce delineation and protection of dam breach inundation areas on all MD-378 ponds.

Martin B. Covington, III, P.E. – Effective August 26, 2004
Revised to correct misspellings and distributed for comment May 3, 2010.
Comments received at the Carroll County Surveyors Meeting on May 19, 2010.
Effective Date: July 29, 2010

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Carroll County Policy on Storm Drain Design and Diversions into Stormwater Management Facilities

Introduction

The main purposes of stormwater management laws are to protect public health and safety and downstream properties from flooding.

When subdivisions are constructed, it is common practice to locate stormwater quantity management ponds along the entrance roadways with storm drain systems gathering the flow and diverting it into ponds (surge tanks) to be released at a lower rate over a long period of time.

Likewise, it is also common practice to locate ponds adjacent to streams where subdivision roads cross with storm drains gathering the flow and diverting it into the ponds.

If the storm drain system is unable to completely capture the stormwater management design flow, the peak flows will not be managed in accordance with state or local laws and ordinances no matter how well the stormwater management ponds are designed and constructed. The bypass water may significantly impact downstream properties.

Analysis has shown that in densely developed subdivisions or sites capture of 150 percent of the rational method 10 year storm peak is required to capture 100 percent of the SCS TR-55 10 year peak.

The professional engineer or land surveyor certifying the plans is responsible to achieve specified levels of stormwater management regardless of SHA or DPW storm drain criteria.

Therefore,

Storm Drain Capture Criteria

One Hundred Fifty percent capture of the rational method 10-year storm runoff, including all bypass flows from upstream inlets is required. This must occur in sumps and at all drainage area divides for stormwater management to be achieved in accordance with design calculations and plans.

Minimum Inlet Spacing

Please refer to the attached detail “Spacing Hydraulically Independent Inlets.” The Standard design charts and capacity calculations only apply if inlets are spaced far enough apart that they do not effect each other. To automatically be considered hydraulically independent inlets on grade must be at least 20 feet apart center to center.

Diversion Design Criteria (See Pages 63-68)

Introduction

Many Underground Stone Reservoirs are being constructed adjacent to storm drain systems. The required volume of runoff to be managed must be diverted into the stone reservoir or peak flows will not be managed no matter how well the reservoir is designed and constructed.

Peak Flow

To determine a required peak flow to size the diversion pipe, please divide the total storage volume (in cubic feet) in the reservoir by 1800 sec. This will produce a peak flow in cfs.

Pipe Size

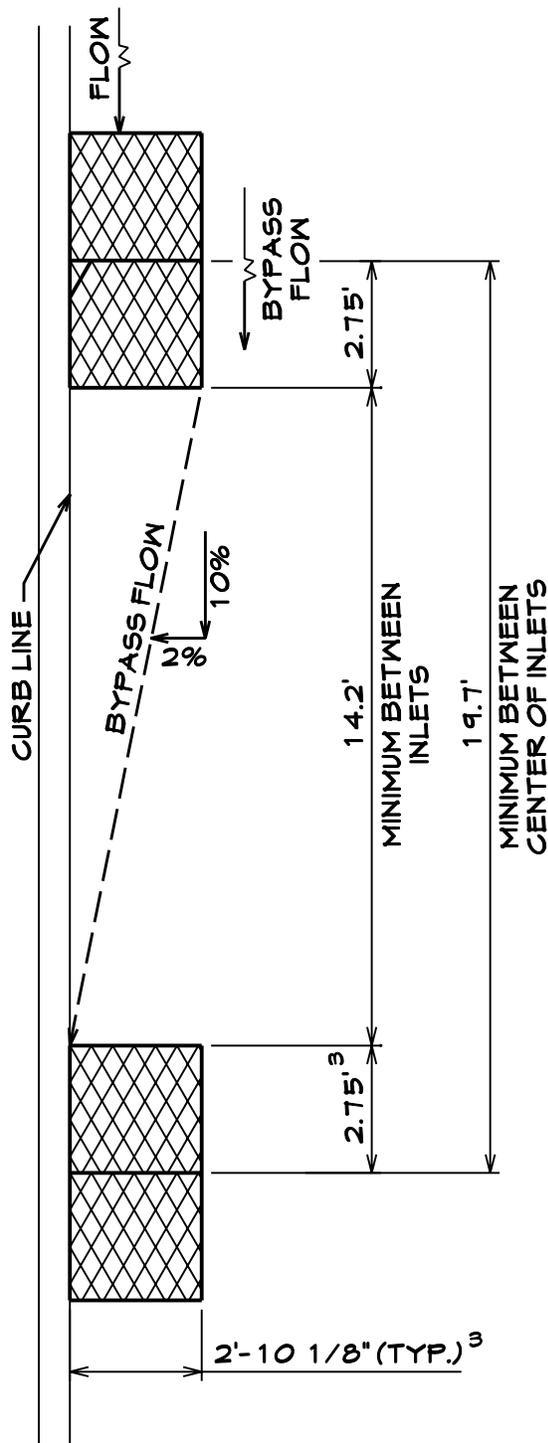
To determine a required pipe size, measure the head from the center of the diversion pipe to the invert of the outlet storm drain. Check the capacity using the orifice equation. For long diversion pipes more complete analysis may be required.

Diversion Manhole/Inlet

Diversion walls will not be allowed. The diversion pipe must be placed at least one foot below the invert of the outlet storm drain.

Martin B. Covington, III, P.E. – Originally Issued October 19, 2005
Revised August 16, 2006
Revised and distributed for comment May 3, 2010.
Comments received at the Carroll County Surveyors Meeting on May 19, 2010.
Effective Date: July 29, 2010

SPACING HYDRAULICALLY INDEPENDENT INLETS ON GRADE



CRITERIA

1. 10% MAXIMUM ROADWAY GRADE PER § 2.6.11, C.C. DESIGN MANUAL ROADS & STORM DRAINS
2. 2% MINIMUM CROSS SLOPE PER PLATES 15-27, C.C. DESIGN MANUAL ROADS & STORM DRAINS
3. PLATE 71, C.C. DESIGN MANUAL ROADS & STORM DRAINS

POLICY

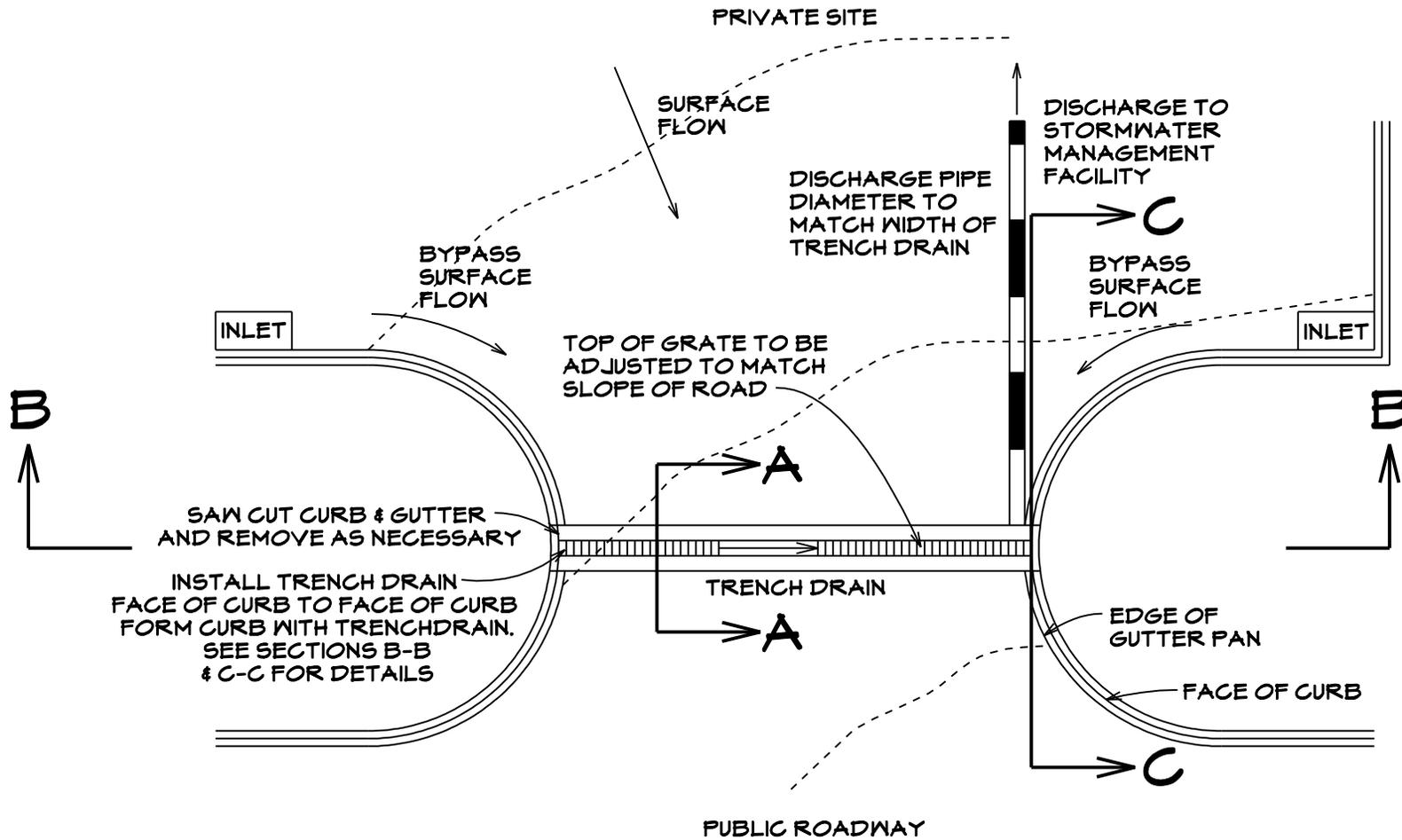
TO BE CONSIDERED HYDRAULICALLY INDEPENDENT INLETS ON GRADE MUST BE AT LEAST 20 FEET APART CENTER TO CENTER.

MARTIN B. COVINGTON III, P.E.
SWM PROGRAM ENGINEER
C.C. GOVERNMENT

DISTRIBUTED AT THE C.C. SURVEYORS MEETING AUGUST 16, 2006

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TRENCH DRAIN ENTRANCE DETAIL PRIVATE SITE DRAINING ONTO PUBLIC ROAD

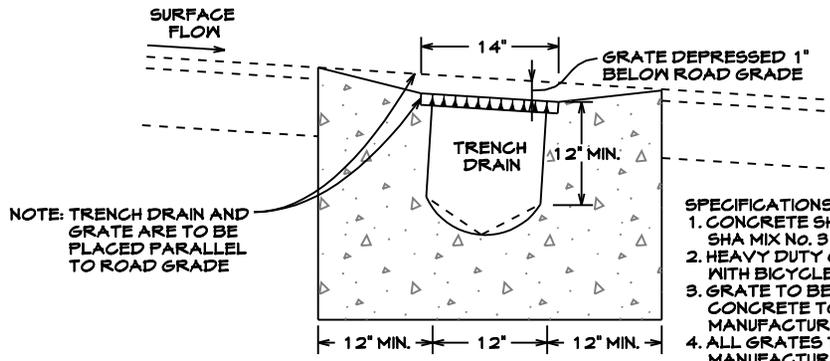


NOTE: THE GRATE MUST
EXTEND TO THE FACE OF CURB
NOT TO THE GUTTER PAN

MARTIN B. COVINGTON III, PE
ISSUED OCTOBER 18, 2006
REVISED MAY 19, 2010 TO ADD
EXPANSION JOINTS
EFFECTIVE DATE: MAY 19, 2010
CARROLL COUNTY SURVEYOR'S MEETING

51

TRENCH DRAIN ENTRANCE DETAIL PRIVATE SITE DRAINING ONTO PUBLIC ROAD



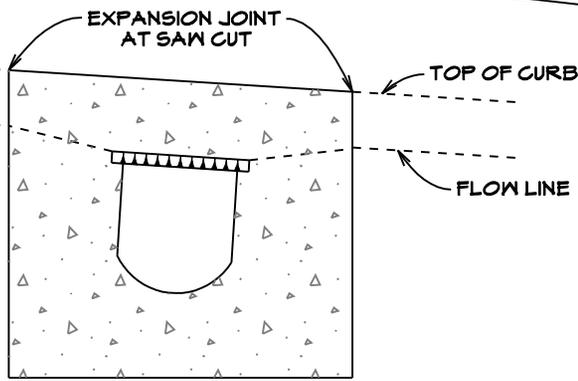
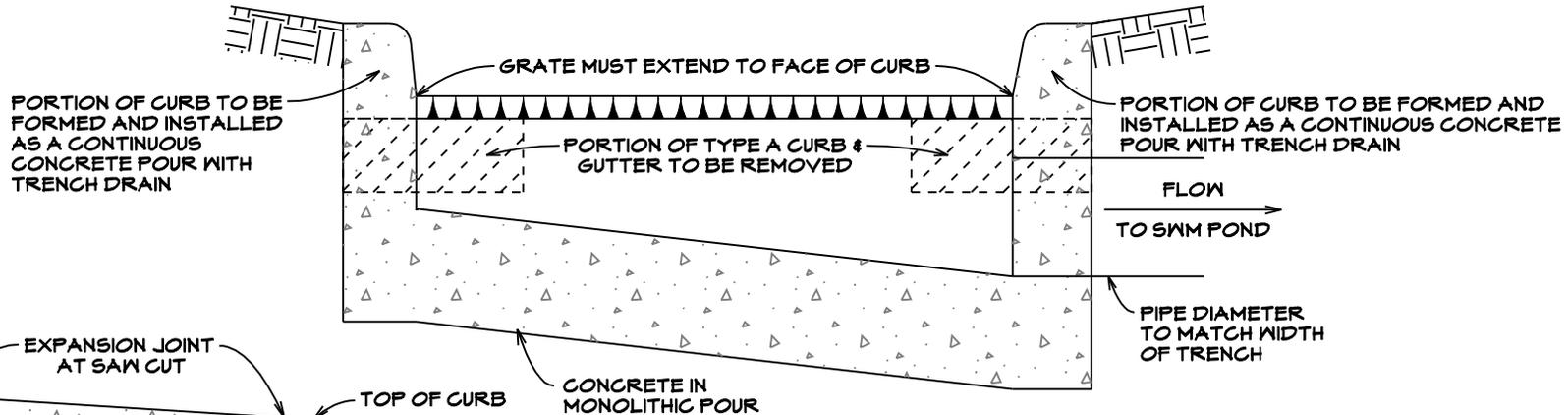
NOTE: TRENCH DRAIN AND GRATE ARE TO BE PLACED PARALLEL TO ROAD GRADE

- SPECIFICATIONS:**
1. CONCRETE SHALL BE AT LEAST MD SHA MIX No. 3
 2. HEAVY DUTY GRATE H-20 LOADING WITH BICYCLE SAFE GRATE
 3. GRATE TO BE SEATED ON ANGLE STEEL CONCRETE TO BE REINFORCED PER MANUFACTURER'S SPECIFICATIONS
 4. ALL GRATES TO BE LOCKED DOWN PER MANUFACTURER'S SPECIFICATIONS

APPROVED SUPPLIER*	TRENCH	GRATE
COMMERCIAL APPLICATIONS		
ABT, INC P.O. BOX 837 259 MURDOCK ROAD TROUTMAN, NC 28166 (704) 528-9806	TF-14	1502.14
ACO POLYMER PRODUCTS, INC 12080 RAVENNA RD. P.O. BOX 245 SEARDON, OHIO 44024 (800) 543-4764	FF300	97449-E
EXTRA HEAVY DUTY INDUSTRIAL APPLICATIONS		
ABT, INC	HD-300	INCLUDED WITH TRENCH
ACO POLYMER PRODUCTS, INC	POWER DRAIN S300K	SLOTTED DUCTILE IRON-F

* THESE SUPPLIERS ARE PROVIDED FOR CONVENIENCE. ANY APPROVED EQUAL MAY BE SUBSTITUTED

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SECTION B-B
SCALE: 1" = 1' VERTICAL
NTS HORIZONTAL

NOTE: CONNECTION TO BE MADE PER MANUFACTURER'S RECOMENDATIONS

MARTIN B. COVINGTON III, PE
ISSUED OCTOBER 18, 2006
REVISED MAY 19, 2010 TO ADD EXPANSION JOINTS
EFFECTIVE DATE: MAY 19, 2010
CARROLL COUNTY SURVEYOR'S MEETING

BUREAU OF ENGINEERING – ENGINEERING REVIEW DIVISION
225 NORTH CENTER STREET, ROOM 221 – WESTMINSTER, MARYLAND 21157
410.386.2157 FAX: 410.876.2431

DATE: March 9, 2006

TO: Engineers and surveyors practicing in Carroll County

FROM: Ronald A. Church, Mgr.

RE: Design of storm drainage systems which convey runoff to a storm water management facility

The purpose of this memorandum is to clarify the position of the Department of Public Works (DPW) with respect to the design of storm drainage systems which capture and convey runoff to a storm water management facility. Although the information and procedures presented here will apply primarily to the design of drainage systems in or along closed section roads, they shall apply also to the design of drainage systems for open section roads.

The DPW Design manual presently requires that the Rational Formula (RF) method of determining quantities of runoff be used for the design of public storm drainage systems. The Office of Storm Water Management (SWM) requires the use of the SCS TR-55 (TR-55) method for determination of quantities used in designing storm water management facilities. It has been demonstrated that analysis of the same drainage area using both computational methods can yield significantly different results. In order for management facilities to function as intended, it is necessary that the drainage systems conveying runoff to them be designed so that the management facility and drainage systems are hydraulically compatible. Since the 10 year frequency event is the basis for design of both storm water management facilities and drainage systems it shall be the design frequency used for this procedure. Unless otherwise noted any quantities referred to shall be understood as being on the 10 year frequency.

Information provided by the Office of Storm Water Management indicates that when drainage areas are within SCS hydrologic soil groups B, C, or D runoff quantities determined using the TR-55 method range on average approximately 50% greater than when determined using the RF method. In instances where the entire drainage area is in group A, quantities determined by both methodologies are approximately equal. Therefore, wherever the drainage area(s) are within groups B, C, and D, a factor of 1.5 applied to RF quantities shall be recognized and accepted as the proper conversion from RF quantities to TR-55 quantities. Where the entire drainage area, or group of drainage areas, contributing to the storm drain system are completely within soil group A, RF quantities shall be considered as being equal to TR-55 quantities.

To convert flows, the following general procedure will be used

1. Starting at the highest inlets, convert RF Q₂ to RF Q₁₀. Apply the 1.5 factor to obtain TR-55 Q₁₀.
2. Using TR-55 Q₁₀ calculate inlet capture and note the remainder as flow-by.
3. Repeat the procedure for each subsequent downgrade inlet, adding in the flow-by from upgrade structures.

4. When the lowest pick-up point* is reached, calculate TR-55 Q_{10} and add in accumulated flow-by from upstream structures.
5. Using standard design methods provide additional inlets as necessary to capture 100% of the TR-55 Q_{10} runoff.

IMPORTANT DESIGN NOTE: The provision of additional inlets are noted here in not to be construed as meaning that those inlets must be located at or near the lowest pick-up point. The primary function of a drainage system is to remove water from the road surface. Additional inlets, if they are necessary, should be placed at locations on the road where they will be the most effective in removing runoff from the surface. If this procedure would result in more than two inlet structures on each side of the road, at the lowest pick-up point, those structures should be placed at critical locations farther upgrade.

6. Check the carrying capacity of the pipe from the last pick-up point to the management facility. This pipe must be able to convey the total TR-55 Q_{10} quantity to the management facility.

It is acknowledged that use of this design procedure will result in construction of drainage systems which are more efficient than those designed using current minimum acceptable standards of the DPW. Therefore this procedure may be used without prior approval of the DPW. When used, the following note must appear on the first page of the storm drain computation booklet and on the storm drain tabulation sheet in the final construction plans:

**Design of the storm drainage system for this project utilizes a
1.5 conversion factor for pick-up and conveyance of 100% of the
10 year runoff to the storm water management facility.**

If there are any questions please be in touch at the numbers above or e-mail rchurch@ccg.carr.org.

Thank you

* the lowest pick up point is that point on a road or in a development beyond which any runoff not captured by the drain system will flow offsite possibly impacting an existing public road, drainage facility, off-site properties or other facilities.

Attachment: none

Cc: project file
rac file

Ronald A. Church, Manager, Engineering Review Division
Carroll County Government
Distributed through Surveyor/Engineer Pick Up Bins March 9, 2006

SWM APPROVAL LETTER LANGUAGE

EFFECTIVE JUNE 1, 2005

Drywells Only

This plan contains private stormwater facilities (dry wells). Drywell bonding will be required with the building permit application.

ESD Techniques and Practices / Non Structural and Structural BMPs

This plan contains ESD techniques and/or practices and/or non structural and/or structural BMPs. A stormwater management bond will be required for the ESD techniques and/or practices and/or non structural and / or structural BMPs.

Martin B. Covington, III, P.E., Carroll County Stormwater Management Program Engineer
First Distributed at the Carroll County Surveyor's Meeting June 15, 2005
Revised to include ESD techniques and practices.
Distributed for comment May 3, 2010.
Comments received at the Carroll County Surveyors Meeting on May 19, 2010.
Effective Date: July 29, 2010

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**Policy on Stormwater Management Plan
Preparation**

RE: § 191-15 of the Carroll County Code

Each submission of site and subdivision plans as well as supporting calculations and documentation must be signed and sealed by the licensed professional engineer or land surveyor (as appropriate) that was in responsible charge of work.

That responsible professional must be available for questions and meetings.

The county reserves the right to refuse to meet with design technicians unless the responsible professional is in attendance.

Distributed at the Carroll County Surveyor's and Engineer's Meeting 21, June 2006

Bureau of Resource Management
Stormwater Management
Effective Date 21, June 2006

Martin B. Covington, III, P.E.
Myron R. Frock

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Design Guidelines and Aids

Carroll County, Maryland Design Storms

Effective 24 hour rainfall amounts to be used for the following _____ year (design) storm.

Year Storm Event	Percent % Chance of Being Equaled or Exceeded in any given year	Effective 24 Hour Rainfall Amount for Design
1 Year	99%	2.5 in.
2 Year	50%	3.1 in.
5 Year	20%	3.9 in.
10 Year	10%	4.7 in.
25 Year	4%	5.8 in.
50 Year	2%	6.9 in.
100 Year	1%	8.0 in.

* Source: Point Precipitation Frequency Estimates from NOAA Atlas 14, Westminster, MD 39.55N 76.9667 W.

Martin B. Covington, III, P.E., Carroll County Stormwater Management Program Engineer
Distributed for comment May 3, 2010
Comments received at the Carroll County Surveyors Meeting on May 19, 2010.
Effective Date: July 29, 2010

Frederick, MD Rainfall Frequency

Analysis

<u>Rainfall (inches)</u> ¹	<u>Percentage of Annual Total</u> ²
.2	22.5
.3	40.7
.4	55.3
.5	64.6
.6	73.0
.7	79.1
.8	84.1
.9	88.4
1.0	90.6
1.1	92.8
1.2	94.6
1.3	96.3
1.4	97.5
1.5	98.5
1.6	99.0
1.7	99.4
1.8	99.7
1.9	99.9
2.0	100.0

¹ No runoff is observed up to .1 inches of rainfall. Events below .1 inches are eliminated.

² The percentage of the annual total at each precipitation level is increased by the portion of larger events up to that level.

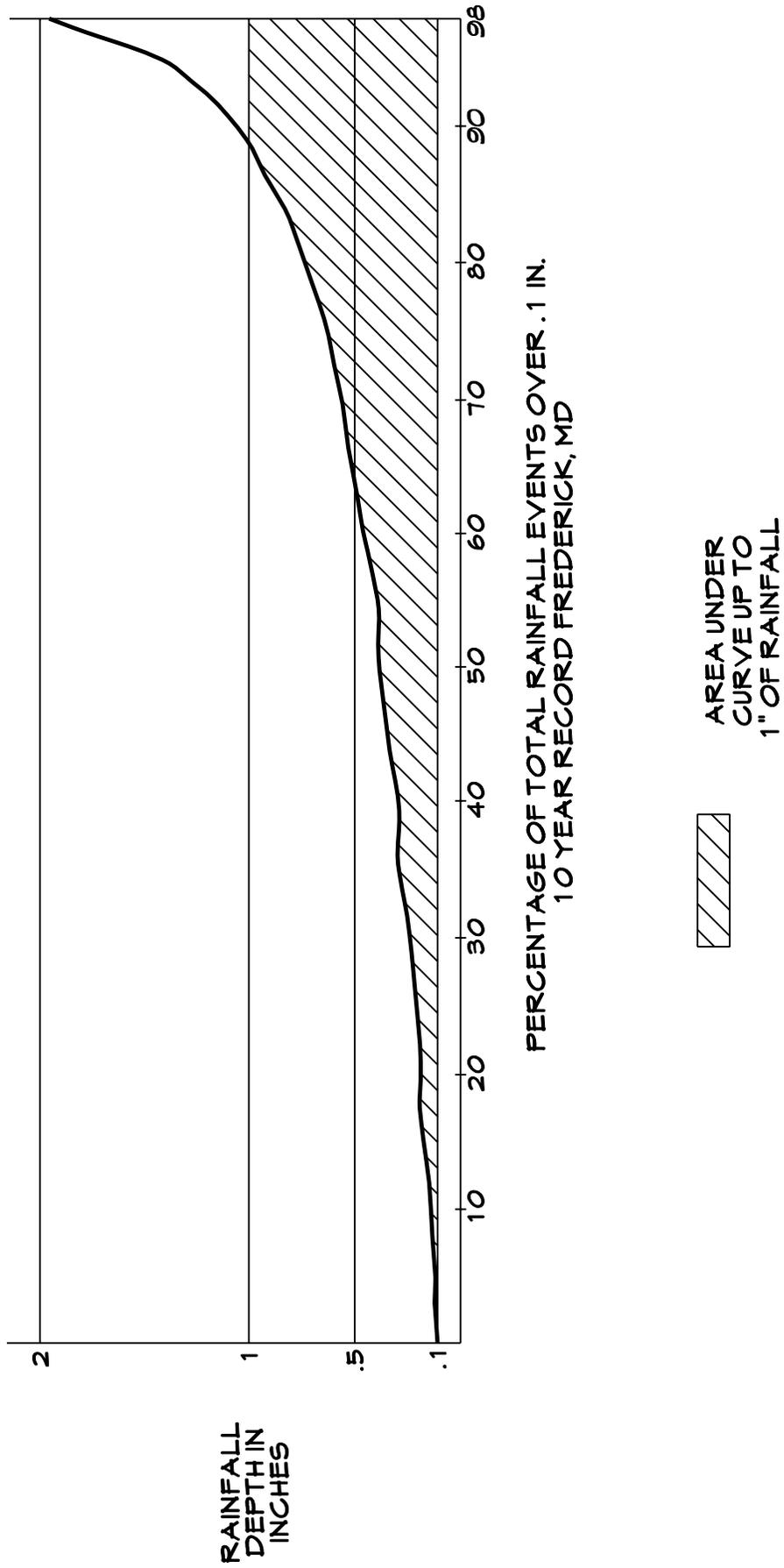
Example: The area under the curve up to 1 inch of rainfall is 3.58 square inches. The total area up to 98% of all rainfall events is 3.98 square inches.

$$\frac{3.58}{3.95} = 90.6\%$$

Therefore, in Frederick, during the 10-year period studied, 90.6% of the total runoff occurred during the first 1 inch of rainfall.

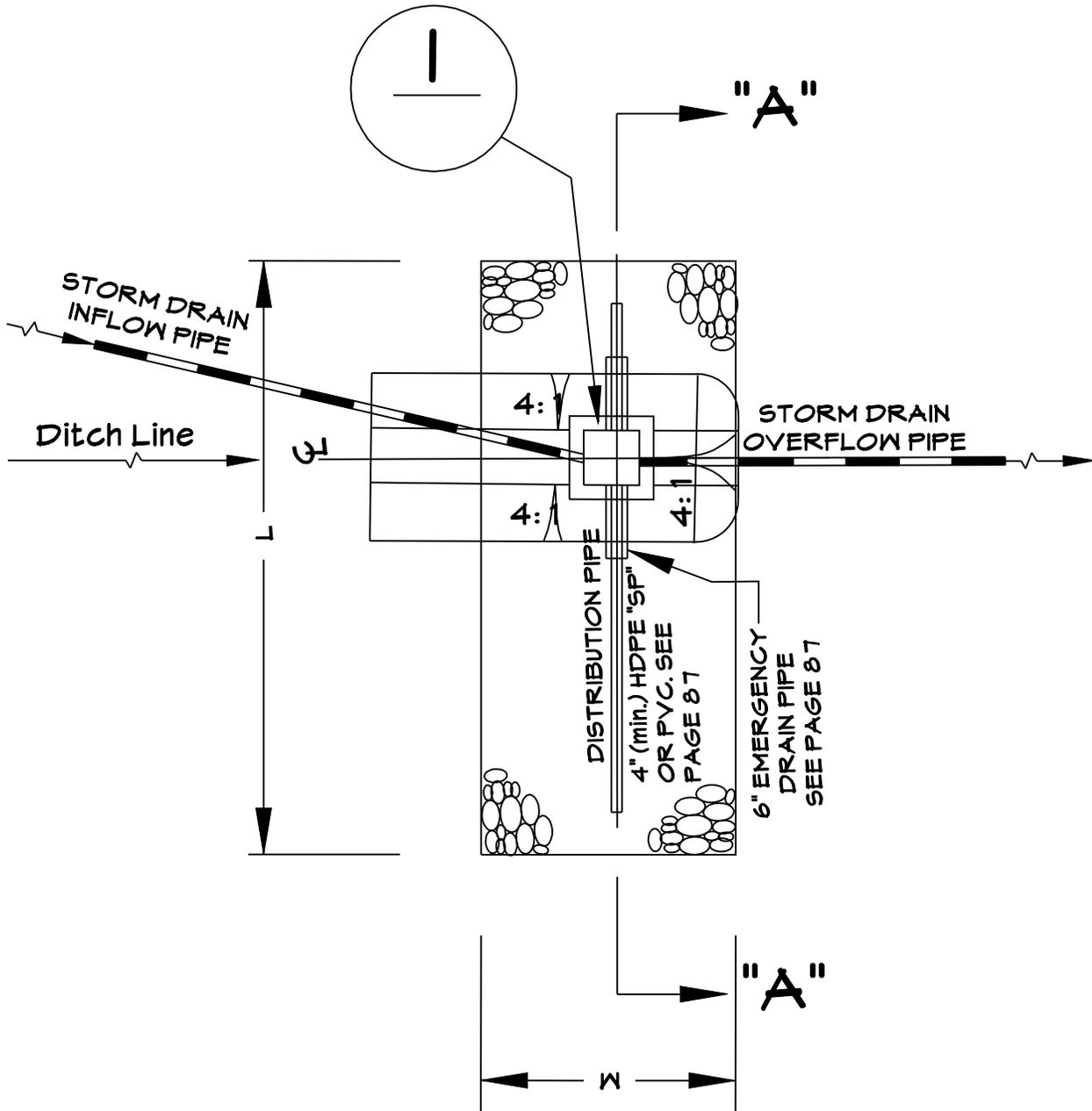
Martin B. Covington, III, P.E., Carroll County Stormwater Management Program Engineer
First Effective March 15, 2005
Revised to add higher rainfall amounts.
Distributed for comment May 3, 2010
Comments received at the Carroll County Surveyors Meeting on May 19, 2010.
Effective Date: July 29, 2010

RAINFALL FREQUENCY SPECTRUM FREDERICK, MARYLAND

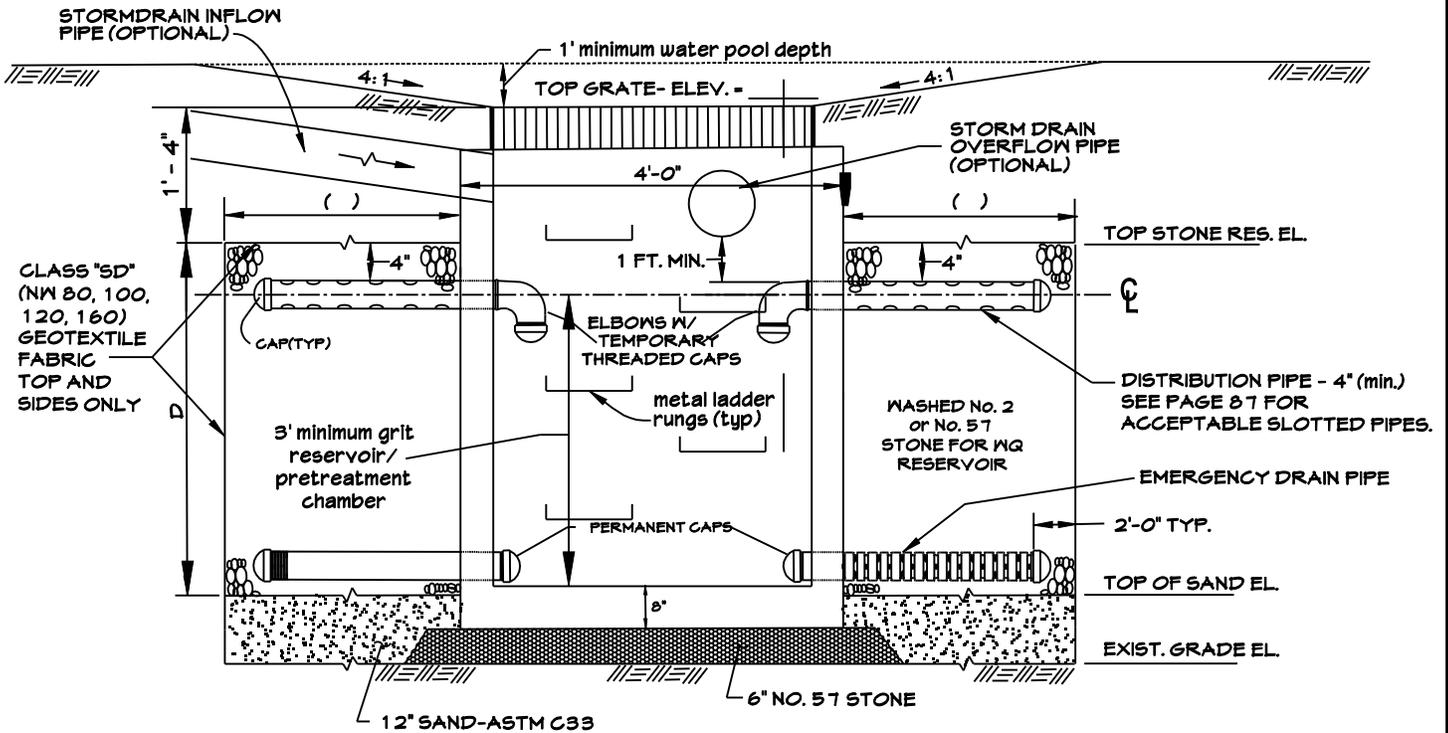


FROM: PAGE 2.2 1(a) OF THE 2000
MD STORMWATER DESIGN MANUAL
TECHNICAL SUPPORT MANUAL 1996

**UNDERGROUND STONE RESERVOIRS
(FOR USE IN PERMEABLE SOILS)**



UNDERGROUND STONE RESERVOIRS (FOR USE IN PERMEABLE SOILS)



SECTION "A - A" @ I-()

NOTES:

1. THIS STRUCTURE IS A STANDARD BOX INLET MODIFIED AS A WATER QUALITY DEVICE. ACCEPTABLE INLETS ARE LISTED ON PAGE 89. SEE CARROLL COUNTY PLATE STANDARD INLET PLATE(S) FOR STRUCTURAL AND OTHER PERTINENT INFO.
2. LABEL AND PROVIDE DETAILS OF SPECIFIC STRUCTURES TO SCALE ON THE CONSTRUCTION PLANS. ALL PIPE TYPES AND INVERTS AS WELL AS TOP OF GRATE AND INVERT OF STRUCTURE MUST BE SHOWN AND LABELED ON THE PROFILES.
3. ALL INLETS MUST HAVE TRAVERSABLE GRATES. YARD INLETS ARE NOT ACCEPTABLE. ACCEPTABLE INLETS ARE LISTED ON PAGE 89.
4. INSTALL STANDARD METAL LADDER RUNGS IN ACCORDANCE WITH CARROLL COUNTY PLATE No. 89
5. INLET MUST BE ABLE TO CAPTURE 150% OF THE RATIONAL METHOD 10 YEAR STORM

It is the intent of the Stormwater Management Act of 2007 to provide: 1. Sufficient groundwater recharge to maintain 100% of the average annual predevelopment recharge volume (Re_v), 2. Treatment of one inch of runoff from all impervious surfaces (WQ_v) and 3. Extended detention of the runoff from the 1 year storm as receiving stream channel protection (CP_v). These are to be provided by the use of ESD techniques, practices and non-structural methods to the MEP. Once Carroll County agrees that ESD to the MEP has been achieved, any remaining WQ , Re and CP volumes must be provided as follows:

WQ_v & Re_v STORAGE VOLUME CALCULATION

A soils

(Ai) Impervious Area draining to inlet = _____ SQ. FT.

(Vr) Volume Required = $Ai \times \frac{1.38 \text{ in.}}{12 \text{ in./ft.}}$ = _____ CU. FT.

B soils

(Ai) Impervious Area draining to inlet = _____ SQ. FT.

(Vr) Volume Required = $Ai \times \frac{1.26 \text{ in.}}{12 \text{ in./ft.}}$ = _____ CU. FT.

C soils

(Ai) Impervious Area draining to inlet = _____ SQ. FT.

(Vr) Volume Required = $Ai \times \frac{1.13 \text{ in.}}{12 \text{ in./ft.}}$ = _____ CU. FT.

D soils

(Ai) Impervious Area draining to inlet = _____ SQ. FT.

(Vr) Volume Required = $Ai \times \frac{1.06 \text{ in.}}{12 \text{ in./ft.}}$ = _____ CU. FT.

(Vr) Total Volume Required= _____ CU. FT.

(Vp) Volume Provided = $L \times W \times D (0.40)$ = _____ CU. FT.

- Notes: 1. Vp must be greater than Vr
 2. L, W, and D must be specified on the plans.
 3. The drainage area to the inlet must be shown on the plans.
 The pre and post development groundwater recharge rates must be calculated using the procedure on pages 82-84 with any necessary adjustments made to meet the 100% target.

UNDERGROUND STONE RESERVOIRS
 (FOR USE IN PERMEABLE SOILS)

SIZE CALCULATION PROCEDURE FOR COMBINATION WQ_v , Re_v , CP_v , & Q_{10}
FACILITIES

1. Determine the difference between the on-site 10-year pre & post development TR-55 direct runoff $Q(in)$. Pre-development land used can only be woods, meadow, and impervious surfaces.
2. Multiply the difference in direct runoff by the site area in square feet (ft^2) and convert units to obtain required volume in cubic feet (ft^3).
3. Determine the required CP_v using the procedure in Appendix D.11 of the 2000 MD Stormwater Design Manual.
4. Carroll County will accept the greater of the Q_{10} or the sum of the Re_v , WQ_v , & CP_v volumes. This is the total required storage up to the top of the stone reservoir.
(NOTE: If an overflow pipe is provided in the reservoir, storage may be calculated from the top of the sand to the invert of the overflow pipe or top of the stone which ever is less. Use 40% voids to calculate the storage volume.)
5. Sizing the distribution pipes:
 - a. The required distribution pipe flow (cfs) is determined by dividing the storage volume (ft^3) by 1800 sec.
 - b. Use the orifice equation to check the distribution pipe capacity. Head (H) must be from the centerline of the distribution pipe to the invert of the storm drain overflow pipe or top of grate if no overflow is provided. All pipes must be at least 4" in diameter. The crown of the distribution pipes must be at least 1 Ft below the invert of the overflow pipe.

UNDERGROUND STONE RESERVOIRS
(FOR USE IN PERMEABLE SOILS)

**UNDERGROUND STONE RESERVOIRS
INSTALLATION INSPECTION CHART**

STAGE*	INSPECTOR'S APPROVAL	
	INITIALS	DATE
1. EXCAVATION TO SUBGRADE		
2. CONSTRUCTION OF THE INLET STRUCTURE		
3. PLACEMENT OF FILTER MEDIA ON THE BOTTOM		
4. PLACEMENT OF No. 57 or No. 2 STONE AND PERFORATED PVC OR HDPE DISTRIBUTION AND DRAIN PIPES		
5. ALL PIPES CAPPED INSIDE THE INLET		
6. GEOTEXTILE INSTALLATION		
7. COMPLETION OF FINAL GRADING, PAVING, CONSTRUCTION OR STRUCTURES AND ESTABLISHMENT OF 2" STAND OF DENSE GRASS		
8. REMOVE SEDIMENTS AND UNCAP ONLY THE DISTRIBUTION PIPES		
9. SUBMIT AS-BUILT PLANS TO CARROLL COUNTY WITHIN 60 DAYS OF COMPLETION OF CONSTRUCTION		

* Please notify certifying engineer 48 hours prior to commencing construction.*

Engineer's Name: _____

Phone Number: _____

Note: The name and phone number of the certifying Professional Engineer or Land Surveyor must be listed here. The inspections may be performed by any qualified person under the supervision of the certifying Professional. Per Section 191 – 21 of the code, the certifying Professional must be the same Professional Engineer or Surveyor that certified the design plans. If the County's prior written permission is obtained, an equally qualified Professional Engineer or Surveyor may be substituted.

**UNDERGROUND STONE RESERVOIRS
SEQUENCE OF CONSTRUCTION**

1. Contact the certifying professional engineer/professional land surveyor (give name and phone number). Once the certifying professional has given his/her approval proceed as follows:
2. Excavate for inlet and stone reservoir. Install stone base and inlet. Install sand, stone and perforated pipes under supervision of certifying professional. Place geotextile and backfill. Cap all perforated pipes with either temporary or permanent caps inside the inlet as shown on the detail.
3. Once the entire drainage area to the inlet is paved or supporting a 2" stand of dense grass (all houses built), with the approval of the certifying professional, remove all accumulated sediments and uncap the distribution pipes.
4. Submit as-built certification for bond release.

* Note: The above sequence must be referenced on the general sequence of construction at the appropriate step.

Proposed Residential Subdivision with Public Stormwater Facilities

The area shown as Parcel(s) _____, containing _____ acres, is/are to be conveyed to the County Commissioners of Carroll County upon acceptance of the Stormwater Management Facility.

Stormwater Management Access across a Use-in-Common Drive

A “Stormwater Management Easement” is to be granted to the County Commissioners of Carroll County as an easement of access to the County Commissioners or authorized Representatives by a deed intended to be recorded simultaneously herewith, or upon execution of the PWA.

*Access from a Stormwater facility to a public road must be provided. If the access route includes a use-in common driveway the above language must be placed on the plat. The easement of access across the use-in-common must be executed and recorded simultaneously with recordation or execution of the PWA. Specific easement language must be acceptable to the County Attorney’s Office.

*Please note: Carroll County Government cannot be included in the Declaration of Maintenance Obligation with respect to maintenance obligations.

*Please not: If the facility is located in one of the incorporated Towns/Cities the above notes must be Modified to include the municipality and satisfy the Town/City attorney. See Page 11 For modified language.

Martin B. Covington, III, P.E., Carroll County Stormwater Management Program Engineer
Pages 63-68 Revised to update specifications and to incorporate ESD.
Distributed for comment May 3, 2010
Comments received at the Carroll County Surveyors Meeting on May 19, 2010.
Effective Date: July 29, 2010

Carroll County Stormwater Management Pre-Approval Materials for Underground Detention, Filtration and Infiltration Structures.

Pipes

The engineer must design all pipes for H-20 live load (minimum).

- A. HDPE Smooth Core (double wall) corrugated pipe with integral bell and gasketed joint.
 - 1. 4" – 10" diameter pipe (Virgin Polyethylene Material) must meet requirements of AASHTO M252 (see details on page 87).
 - 2. 12" – 60" diameter pipe
 - a. If the pipe is not entirely surrounded by free draining (no. 57) stone bedding of sufficient thickness to itself, support the H-20 loading then Virgin Polyethylene Material meeting the requirements of AASHTO M294 is required.
 - b. If the pipe is entirely surrounded by free draining (no. 57) stone bedding of sufficient thickness to itself support the H-20 loading then blended Virgin and Recycled Polyethylene Material meeting the requirements of ASTM F2648 may be substituted for AASHTO M294.
- B. PVC Smooth Core (double wall) Corrugated pipe with integral bell and gasketed joints.
 - 1. 4" – 12" must meet requirements of AASHTO M278 (see details on page 87.)
 - 2. 12" – 36" must meet requirements of AASHTO M304.
- C. 3" x 1" or 5" x 1" Corrugated Steel Aluminized Type II Pipe (AL-T2CMP). All must meet the requirements of AASHTO M36 and AASHTO M274 and be completely surrounded by free draining (No. 57) stone.
 - 1. 60" – 96" (Minimum thickness 12 gauge) (.109")
 - 2. 96" – 120" (Minimum thickness 10 gauge) (.138")
 - 3. 120" – 144" (Minimum thickness 8 gauge) (.168")

Notes:

- 1. In special conditions additional criteria for water tightness, deflection, etc. may eliminate some of these choices.
- 2. The above list is not all inclusive. Other types of pipes, materials and structures may be added at a later date.
- 3. Other types of pipe, materials and structures may be considered, at the discretion of the County, on a case by case basis, for special circumstances.

Martin B. Covington, III, P.E., Carroll County Stormwater Management Program Engineer
Distributed for comment May 3, 2010
Comments received at the Carroll County Surveyors Meeting on May 19, 2010.
Effective Date: July 29, 2010

Guidance for Surface Sand Filter Designs in Carroll County

Details (See Pages 73-78)

1. Geotextile is **not** allowed between the stone recharge reservoir and the sand/soil mixture.
2. The recharge reservoir must be made of No. 57 stone (per Stuart Comstock, Maryland Department of the Environment meeting on January 16, 2004).
3. The sand/soil/wood chips layer must be made of four parts sand (ASTM C-33); one part loam (engineer certified) and one part green untreated woodchips.
4. The sand/soil layer must be at least 18” deep.
5. A 4” underdrain pipe is the minimum size to be used as the trunk and lateral lines. HDPE type “SP” is recommended. Slitted pipe must be used (see page 87).
6. Lateral underdrain lines must extend to the edges of the sand filter at least every 50’ along the trunk line. Do **not** put cleanouts in the system.
- 7a. All storm drain outfalls into the filter must discharge at the stilling basin bottom elevation through sumped drop structures and flat (0%) watertight, rigid pipes. Reinforced concrete low-head pressure pipe is the only commonly used storm drain pipe that meets this requirement. It is classified by hydrostatic head to the center line of the pipe in 25 ft. increments and by height of cover in 5 ft. increments (A, B, C, D) etc. A typical designation would be 30” RCCP ASTM C-361 CL B-25 with water tight joints. This is 30” diameter reinforced concrete culvert pipe rated for 10 feet of earth cover and water tight to 25 feet of hydrostatic head. (See page 73)
- 7b. Storm drains must discharge through concrete end walls (per Carroll County Roads and Storm Drains, Section 6.4.6.), into underdrained stilling basins with the underdrains connected to the trunk line. The stilling basins must be packed with the sand/soil/wood chip filter material (see pages 73 & 76).
8. The ends of the trunk and lateral underdrains must be capped to prevent stone from entering them (see page 73).
9. The underdrains must be at 0% grade. If the trunk line exceeds 200’, a 6” line must be used.
10. Access roads must be paved per Appendix B.3.A.3., 2000 Maryland Stormwater Design Manual.
11. At a minimum, the top 10” of the recharge reservoir must be a No. 8 stone choker course. The choker course layer must extend to 6” above the underdrain trunk line.

Guidance for Surface Sand Filter Designs in Carroll County

Page 2

12. If underdrains discharge to the surface, they must be protected by rodent guards and discharge onto a splash block (see pages 73 & 80).
13. The entire bottom of the facility must be covered by the sand/soil/wood chip filter.
14. The riser must be buried in the dam to the maximum extent possible. Since there is a sand filter underdrain connection, but no other holes in the sides of the riser, only the riser top needs to be exposed. Lockable, vented, access through the riser top must be provided with manhole rungs to the bottom. Flat-topped risers must have railings. (See page 42c.)
15. Trash racks must cover all exposed openings in the riser. Trash racks must be anchored to the riser. Trash racks must be hot dipped galvanized after fabrication and prior to the installation (two coats).

Calculations

1. It is the intent of the Stormwater Management Act of 2007 to provide: 1. Sufficient groundwater recharge to maintain 100% of the average annual predevelopment recharge volume (Re_v), 2. Treatment of one inch of runoff from all impervious surfaces (WQ_v), 3. Extended detention of the runoff from the 1 year storm as receiving stream channel protection (CP_v). These are to be provided by the use of ESD techniques, practices and non-structural methods to the MEP. Once Carroll County agrees that ESD to the MEP has been achieved, any remaining WQ, Re and CP volumes must be provided as follows:
 - a. Any remaining recharge (Re) volume must be provided in the No. 57 stone reservoir below the invert of the underdrain pipe. Forty percent voids may be used in the recharge reservoir calculation. At least 0.38, 0.26, 0.13 or 0.06 inches of recharge volume must be provided for all impervious surfaces on A, B, C and D soils respectively. The pre and post development groundwater recharge rates must be calculated using the procedure on pages 82-84 and any necessary adjustments made to meet the 100% target.
 - b. Any remaining Water Quality (WQ) must be provided above the sand/soil/wood chip layer.
 - c. Any remaining Channel Protection (CP) volume must be calculated per Appendix D.11 of the manual. It must be “stacked” on the WQ volume. The first opening in the riser, weir wall or open channel spillway must be at or above the level of the top of the stacked WQ and CP volumes. No separate channel protection orifice is allowed. The water will discharge through the sand layer.
2. Unless the sand filter forebay is capturing runoff from at least 10 acres of **impervious**, it will drain too quickly to be effective. In these situations, forebays are not allowed. Anytime they are used, draw down time must be approximately 24-hours.

3. The discharge through the sand layer can be calculated by multiplying the sand surface area by 1.75" per hour and converting the result to cubic feet per second.
4. Generally, the 10-year storm can be routed through the facility. All of the water quality and channel protection storage may be counted as active storage by using the discharge rate through the sand/soil mixture and increasing it by .01 cubic feet per second for each storage interval in the stage discharge relationship (TR-20 input). In locations where there is no acceptable outfall, the County **may** require that the water quality and channel protection volumes not be included in the 10-year hydraulic routing. In this special case, assume that the water quality and channel protection volumes are full when the 10-year storm begins. If the facility safely discharges into an adequate protected floodplain, 10-year management and routings are **not** required.

5. **Spillway Design**

a. **Pond without Riser (Simplified Design)**

Configure the open channel spillway with a 25 ft. level section and 4:1 side slopes. Use the SCS Engineering Field Manual design chart 1140 procedure to size the spillway. Retardance factor C-D must be used. Using the chart demonstrate that the 100 year storm runoff, for the entire watershed drainage to the facility, can pass through the level section with 1 ft. of freeboard between the water surface and the settled crest of the dam. (Note: do not use the data from the stippled area in the charts). The spillway must either be cut into undisturbed soil, or rip-rap armored to the (centerline) top of the dam down to undisturbed ground and along the outlet channel to an adequate outfall (see page 74). All exposed rip-rap must be covered with topsoil and seeded and mulched.

b. **Pond with Riser**

If a riser is used to discharge the 100 year storm event without an open channel spillway, the runoff must be routed through the facility. For each flow the water surface elevation inside the riser and in the outfall channel must be calculated. The riser must be "balanced". A stage/discharge chart, including all necessary calculations and formulas to check the balancing must be provided.

The routed 100 year storm runoff for the entire watershed draining to the facility must pass through the riser with 2 feet of freeboard between the water surface and the settled top of the dam.

c. **Pond with Riser and Emergency Spillway**

If an open channel emergency spillway is included in combination with the riser, the stage/discharge chart must be modified to include the emergency spillway flows per design chart 1140. The riser must be rebalanced to include the changed water surface elevations in the outlet channel.

Guidance for Surface Sand Filter Designs in Carroll County

Page 4

Plans

1. The sediment control sequence of construction must reference, but not duplicate the specific sequence of construction.
2. The specific sequence of construction for the facility must be located on the plan sheet showing the facility.
3. The specific sequence must be broken into two phases, sediment control and stormwater management.
4. An inspection checklist must be located on the same sheet. It must list all steps of facility inspection. It must be broken into two phases, sediment control and stormwater management. Spaces for the inspector's signature and date must be provided at each step of construction (see page 78).
5. Under the chart, the name and telephone number of the professional engineer or land surveyor who will perform the inspections and certify the plans must be stated. With prior written permission, an equivalently qualified professional engineer or land surveyor may be substituted for the one listed on the plans (see page 78).
6. See "Maintenance Schedules (pages 12 – 21)." The appropriate one must be used.
7. Items 2 through 6 **must** correspond exactly.

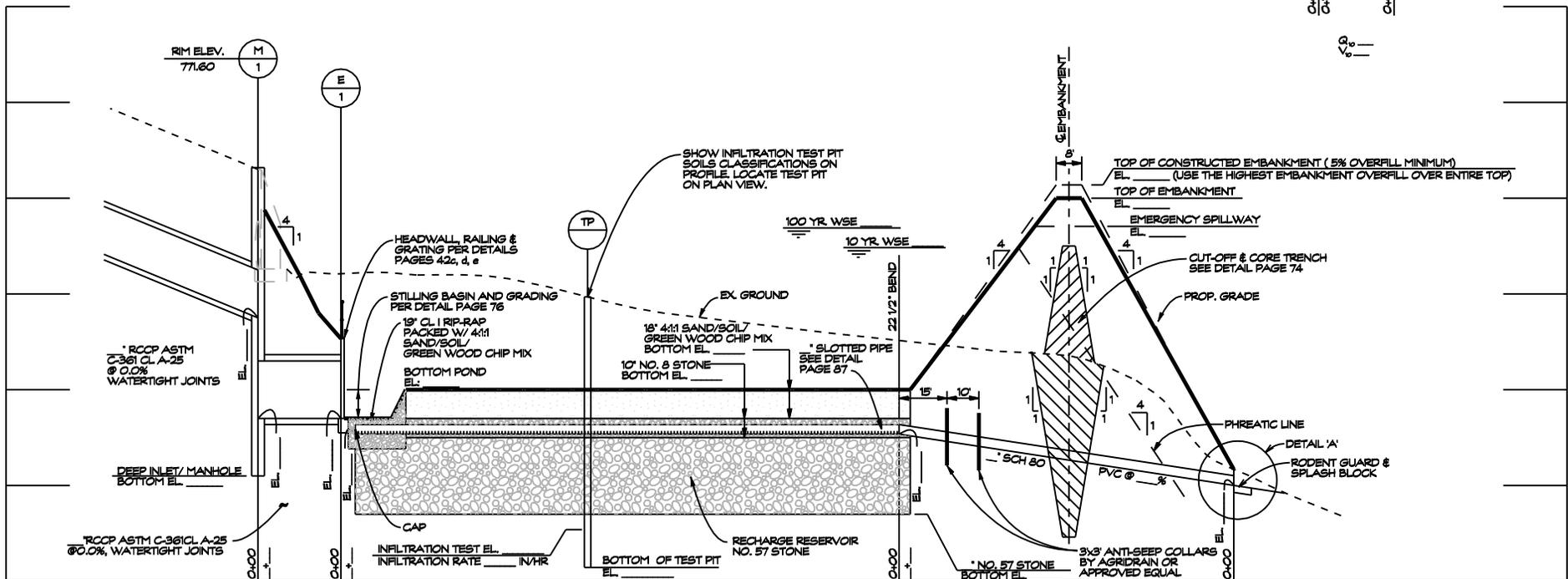
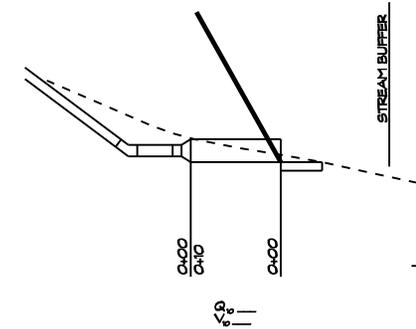
Martin B. Covington, III, P.E., Carroll County Stormwater Management Program Engineer
Pages 69-72 Effective January 21, 2008
Revised to update specifications and incorporate ESD.
Distributed for comment May 3, 2010
Comments received at the Carroll County Surveyors Meeting on May 19, 2010.
Effective Date: July 29, 2010

CARROLL COUNTY POND- SAND FILTER POND WITHOUT RISER PRINCIPAL SPILLWAY PROFILE

VERY IMPORTANT:

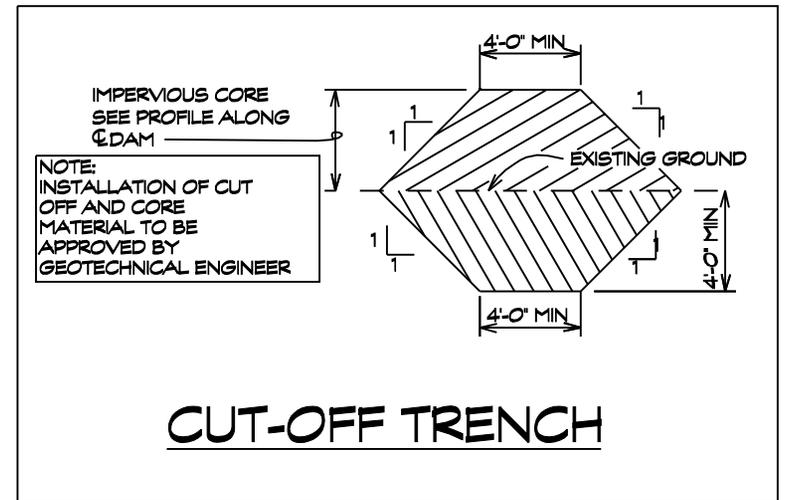
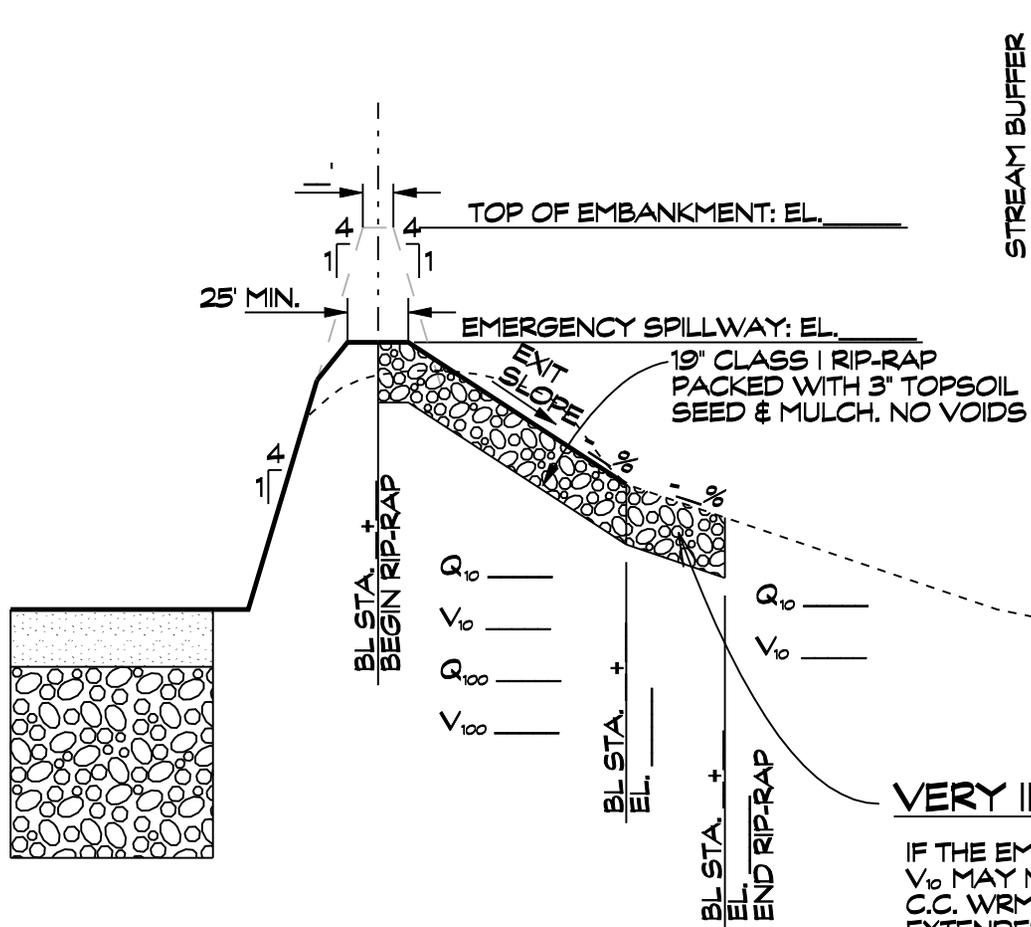
IF THE UNDERDRAIN DISCHARGES INTO THE STREAM BUFFER V_0 MAY NOT EXCEED 2 FT/SEC. AT THE EDGE OF THE BUFFER PER C.C. WRM IV C382. A 10 FT. FLAT SECTION OF OVERSIZED UNDERDRAIN, STANDARD REDUCER AND BEND CAN BE USED TO MEET THIS REQUIREMENT.

DETAIL 'A'



Martin B. Covington III, PE
SWM Program Engineer
DISTRIBUTED FOR COMMENT MAY 3, 2010
COMMENTS RECEIVED AT C.C. SURVEYORS
MTG. MAY 19, 2010
EFFECTIVE DATE: JULY 29, 2010

CARROLL COUNTY POND- SAND FILTER POND WITHOUT RISER EMERGENCY SPILLWAY PROFILE & CUT-OFF TRENCH

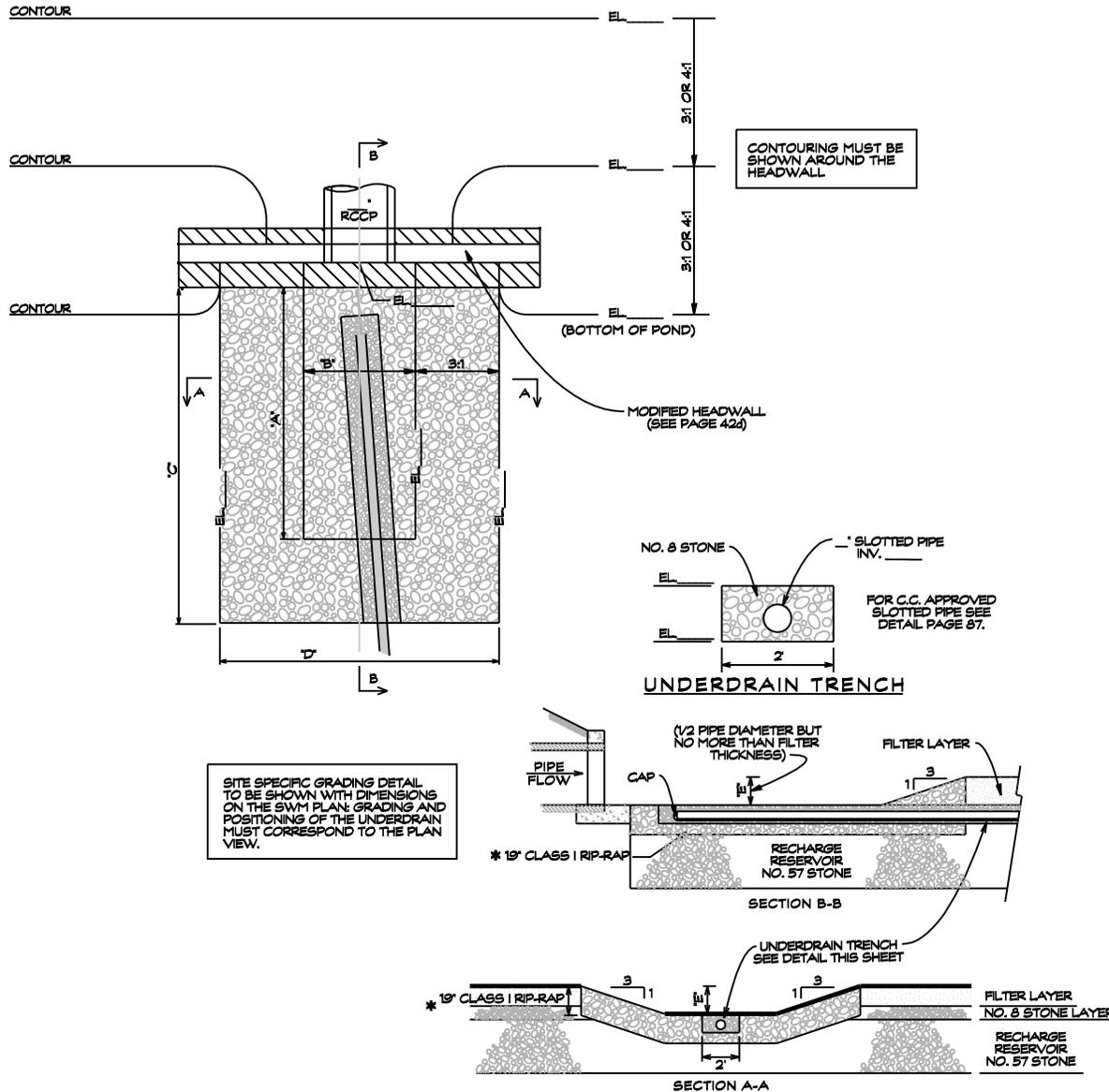


VERY IMPORTANT

IF THE EMERGENCY SPILLWAY DISCHARGES INTO THE STREAM BUFFER
 V_{10} MAY NOT EXCEED 2 FT./SEC. AT THE EDGE OF THE BUFFER PER
C.C. WRM IV C3B2. THE EMERGENCY SPILLWAY MAY NEED TO BE
EXTENDED ONTO THE EXISTING GROUND TO MEET THIS CRITERIA.

Martin B. Covington III, PE
SWM Program Engineer
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COMMENTS RECEIVED AT C.C. SURVEYORS
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CARROLL COUNTY POND- SAND FILTER STILLING BASIN CUT INTO POND BOTTOM



STILLING BASIN DIMENSIONS

LEGEND

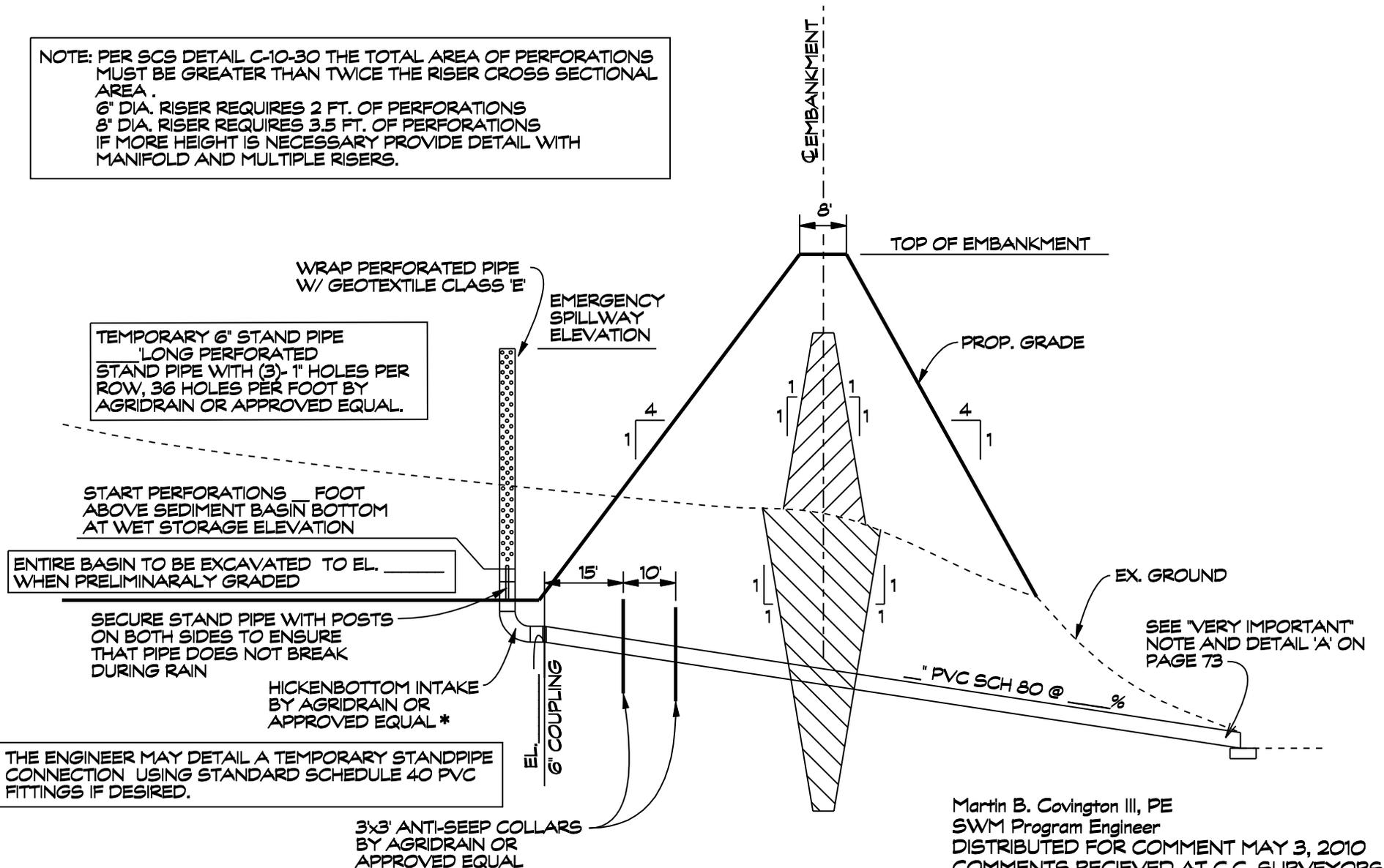
PIPE DIA. (IN.)	"A" (FT.)	"B" (FT.)	"C" (FT.)	"D" (FT.)	"E" (FT.)
15"	5.64	2.50	7.50	6.28	0.63
18"	6.75	3.00	9.00	7.50	0.75
21"	7.89	3.50	10.50	8.78	0.88
24"	9.00	4.00	12.00	10.00	1.00
27"	10.14	4.50	13.50	11.28	1.13
30"	11.25	5.00	15.00	12.50	1.25
36"	13.50	6.00	18.00	15.00	1.50
42"	15.00	7.00	19.50	16.00	1.50
48"	16.50	8.00	21.00	17.00	1.50
54"	18.00	9.00	22.50	18.00	1.50
60"	19.50	10.00	24.00	19.00	1.50
72"	22.50	12.00	27.00	21.00	1.50
84"	25.50	14.00	30.00	23.00	1.50
96"	28.50	16.00	33.00	25.00	1.50
108"	31.50	18.00	36.00	27.00	1.50
120"	34.50	20.00	39.00	29.00	1.50

NOTES: DEPTH OF STILLING BASIN IS 1/2 PIPE DIAMETER UP TO THICKNESS OF FILTER LAYER. THIS TABLE IS BASED ON A 18" LAYER.

Martin B. Covington III, PE
SWM Program Engineer
DISTRIBUTED FOR COMMENT MAY 3, 2010
COMMENTS RECEIVED AT C.C. SURVEYORS
MTG. MAY 19, 2010
EFFECTIVE DATE: JULY 29, 2010

CARROLL COUNTY POND- SAND FILTER POND WITHOUT RISER TEMPORARY STAND PIPE DETAIL

NOTE: PER SCS DETAIL C-10-30 THE TOTAL AREA OF PERFORATIONS MUST BE GREATER THAN TWICE THE RISER CROSS SECTIONAL AREA.
6" DIA. RISER REQUIRES 2 FT. OF PERFORATIONS
8" DIA. RISER REQUIRES 3.5 FT. OF PERFORATIONS
IF MORE HEIGHT IS NECESSARY PROVIDE DETAIL WITH MANIFOLD AND MULTIPLE RISERS.



Martin B. Covington III, PE
SWM Program Engineer
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MTG. MAY 19, 2010
EFFECTIVE DATE: JULY 29, 2010

CARROLL COUNTY POND- SAND FILTER POND WITHOUT RISER EXAMPLE INSPECTION CHART

INSPECTION CHART FOR SWM/WQ FACILITY NO. _____

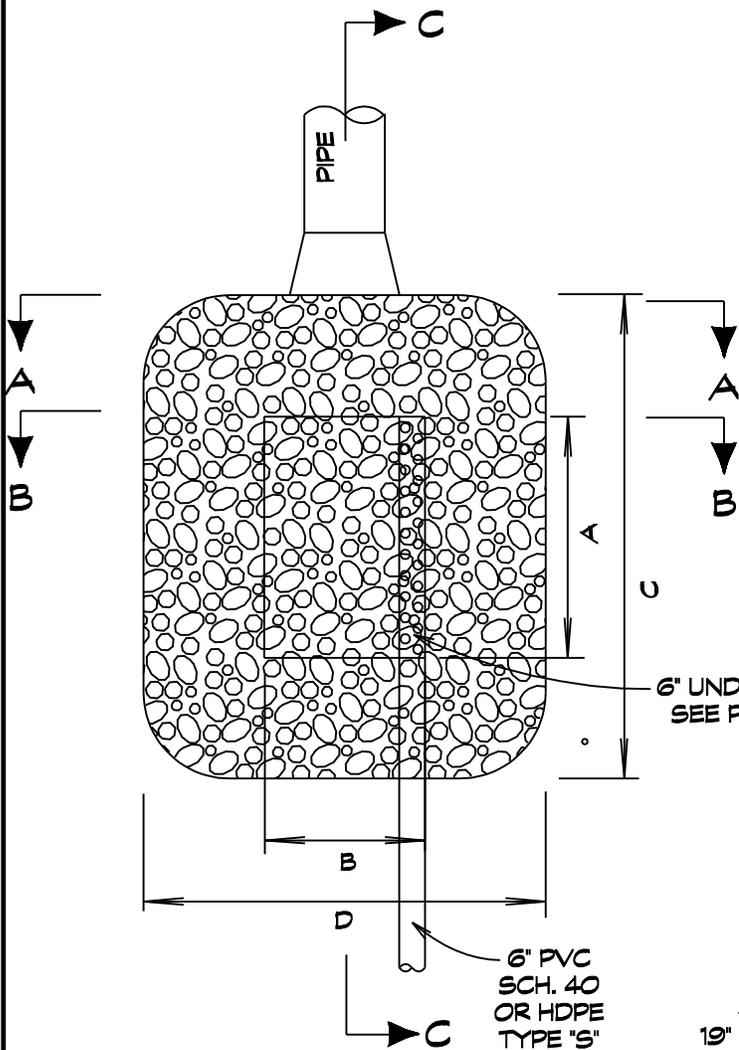
STAGE	ENGINEER'S APPROVAL	
	INITIALS	DATE
SEDIMENT CONTROL PHASE		
1. INSTALL STABILIZED CONSTRUCTION ENTRANCE AND ALL PERIMETER SEDIMENT CONTROLS AS SHOWN ON SEDIMENT CONTROL PLAN SHEETS ___ & ___		
2. ALL ITEMS ON PRE-CONSTRUCTION SEQUENCE OF CONSTRUCTION AS SHOWN ON SHEET ___ ARE COMPLETED		
3. CONSTRUCT STORMDRAIN SYSTEM (GIVE SPECIFICS). ATTACH TEMP. ___" FLEX HDPEP TO END OF ___" RCCP & RUN AROUND THE PERIMETER OF THE PROPOSED FACILITY TYING INTO EX. DITCH. TEMPORARILY BLOCK ___" OPENING @ ___ TO ENSURE ALL WATER ENTERS ___" RCCP.		
4. EXCAVATE AND CONSTRUCT CUT-OFF TRENCH FROM BL. STA. ___+___ TO BL. STA. ___+___ AS DIRECTED BY GEOTECHNICAL ENGINEER.		
5. INSTALL ___" SCH 80 PVC THROUGH CUT-OFF TRENCH AT BL EMBANKMENT STA. ___+___ ± APPROXIMATELY ___' TO TOE OF EMBANKMENT, THEN CONTINUE 80' WITH SCH 40 PVC TO BL. STA. ___+___ . STUB OFF BOTH ENDS.		
6. CONSTRUCT EMBANKMENT/CORE TRENCH AS DIRECTED BY GEOTECHNICAL ENGINEER. EXCAVATE BOTTOM OF POND TO EL. _____ AND CONSTRUCT 4:1 SLOPES OF PROPOSED FACILITY. OBTAIN SUITABLE CLAY MATERIAL FOR EMBANKMENT.		
7. ADD TEMPORARY STAND PIPE INSIDE POND.		
8. CONSTRUCT ___' EMERGENCY SPILLWAY AND PLACE RIP-RAP AS SHOWN ON PLANS. PACK RIP-RAP WITH TOPSOIL, SEED, AND MULCH.		
9. CONSTRUCT MODIFIED ENDWALL & REMOVE TEMPORARY BLOCKAGE OF ___" OPENING AT _____ AND INSTALL ___" RCCP ASTM C-361 CLA-25 FROM MODIFIED ENDWALL @ ___ TO _____. REMOVE TEMP ___" FLEX HDPEP FROM END OF ___" RCCP.		
10. GRADE ACCESS ROAD INTO FACILITY, FINE GRADE SIDE SLOPES, TOP OF DAM, ETC...		
11. ENTIRE CONTRIBUTING DRAINAGE AREA TO THE POND IS PAVED ALL HOUSES AND BUILDINGS ARE CONSTRUCTED AND A MINIMUM 2" STAND OF DENSE GRASS IS ESTABLISHED ON ALL DISTURBED AREAS, INCLUDING THE POND SLOPES AND TOP.		
STORMWATER MANAGEMENT PHASE		
1. REMOVE ACCUMULATED SEDIMENTS AND STANDING WATER FROM THE ENTIRE STORMDRAIN SYSTEM INCLUDING SUMP INLETS AND MANHOLES AND THEN EXCAVATE TO THE BOTTOM OF RECHARGE RESERVOIR EL. _____ AND REMOVE TEMPORARY STAND PIPE.		
2. INSTALL NO. 57 STONE, NO. 8 STONE, STILLING BASIN AT _____ AND ___" SLOTTED PIPE UNDER SUPERVISION OF GEOTECHNICAL ENGINEER.		
3. ADD ENGINEER APPROVED 4:1:1 SAND/SOIL/GREEN WOOD CHIP MIXTURE.		
4. STABILIZE ANY DISTURBED AREAS AND REMOVE PERIMETER SEDIMENT CONTROLS AND ANY REMNANTS OF CONSTRUCTION INCLUDING STAKES.		
5. A MINIMUM OF 2" STAND OF DENSE GRASS IS ESTABLISHED.		
6. SUBMIT AS-BUILT MYLARS TO CARROLL COUNTY BUREAU OF RESOURCE MANAGEMENT WITHIN 30 DAYS OF COMPLETION.		

* PLEASE NOTIFY CERTIFYING ENGINEER 48 HOURS PRIOR TO COMMENCING CONSTRUCTION *

ENGINEER'S NAME: _____ (PLACE DESIGN ENGINEERS NAME HERE)
 PHONE NUMBER: _____ (PLACE DESIGN ENGINEERS PHONE NUMBER HERE)

Martin B. Covington III, PE
 SWM Program Engineer
 DISTRIBUTED FOR COMMENT MAY 3, 2010
 COMMENTS RECEIVED AT C.C. SURVEYORS
 MTG. MAY 19, 2010
 EFFECTIVE DATE: JULY 29, 2010

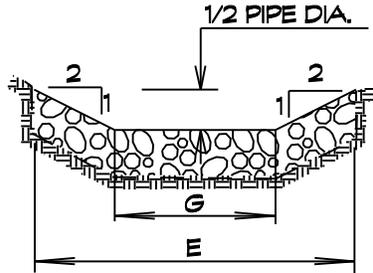
STILLING BASIN DETAIL



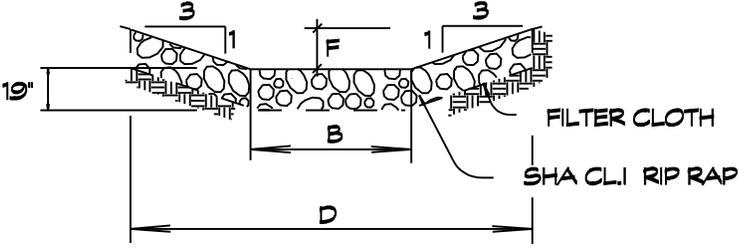
NOTE: VOIDS IN STONE ARE TO BE PACKED WITH 4:1:1 SAND/ SOIL/ WOOD CHIPS MIXTURE. SURFACE IS SEED AND MULCH. "SAND" IS ASTM C-33. "SOIL" IS ENGINEER APPROVED "LOAM". WOOD CHIPS ARE GREEN UNTREATED WOOD CHIPS TYPICALLY FROM ONSITE LAND CLEARING.

6" UNDERDRAIN SEE PAGE 87

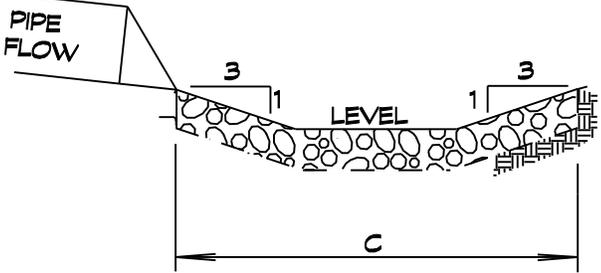
6" PVC SCH. 40 OR HDPE TYPE "S"



Section "A-A"



Section "B-B"



Section "C-C"

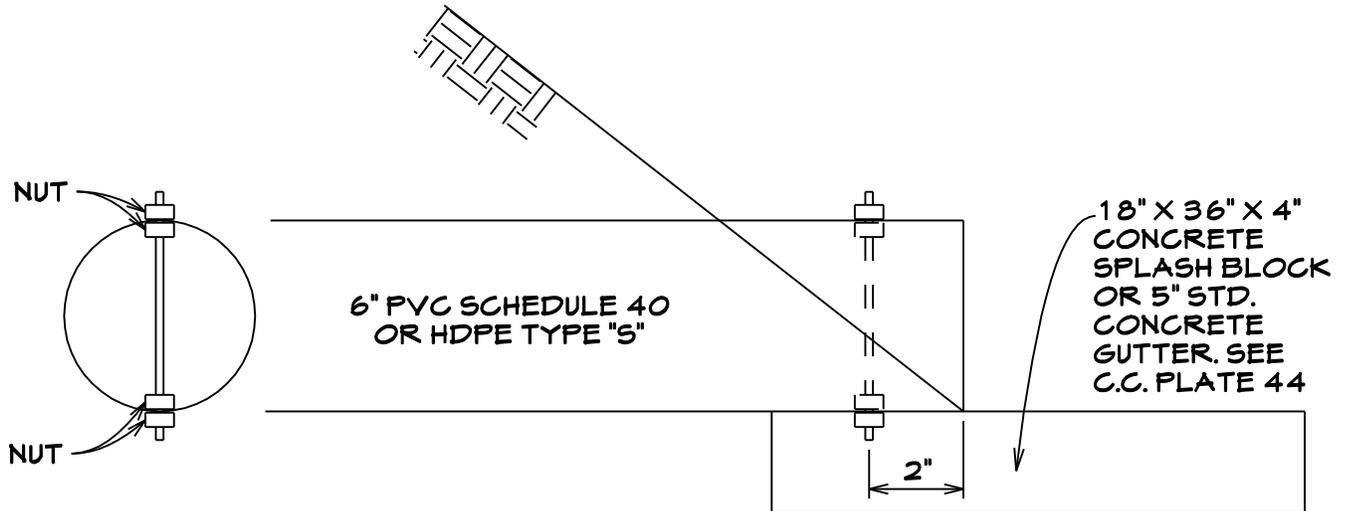
Martin B. Covington III, PE
 SWM Program Engineer
 REVISED TO INCLUDE WOODCHIPS
 DISTRIBUTED FOR COMMENT MAY 3, 2010
 COMMENTS RECEIVED AT C.C. SURVEYORS
 MTG. MAY 19, 2010
 EFFECTIVE DATE: JULY 29, 2010

STILLING BASIN DETAIL

BASIN DIMENSIONS

LEGEND							
PIPE DIA.	"A"	"B"	"C"	"D"	"E"	"F"	"G"
15"	3.75'	2.50'	7.53'	6.28'	4.75'	0.63'	2.25'
18"	4.50'	3.00'	9.00'	7.50'	5.50'	0.75'	2.50'
21"	5.25'	3.50'	10.50'	8.78'	6.25'	0.88'	2.75'
24"	6.00'	4.00'	12.00'	10.00'	7.00'	1.00'	3.00'
27"	6.75'	4.50'	13.50'	11.28'	7.75'	1.13'	3.25'
30"	7.50'	5.00'	15.00'	12.50'	8.50'	1.25'	3.50'
36"	9.00'	6.00'	18.00'	15.00'	10.00'	1.50'	4.00'
42"	10.50'	7.00'	21.00'	17.50'	11.50'	1.75'	4.50'
48"	12.00'	8.00'	24.00'	20.00'	13.00'	2.00'	5.00'
54"	13.50'	9.00'	27.00'	22.50'	14.50'	2.25'	5.50'
60"	15.00'	10.00'	30.00'	25.00'	16.00'	2.50'	6.00'

DETAIL A - RODENT GUARD



NOTES:

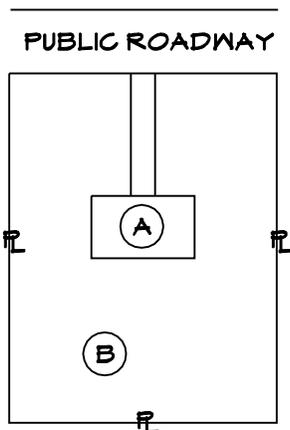
1. THE UNDERDRAIN, WHERE IT DISCHARGES ONTO THE GROUND, MUST HAVE A RODENT GUARD AND A SPLASH BLOCK TO PROTECT THE OUTFALL.

Martin B. Covington III, PE
 SWM Program Engineer
 REVISED TO INCLUDE SPLASH BLOCK
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 MTG. MAY 19, 2010
 EFFECTIVE DATE: JULY 29, 2010

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PROCEDURE FOR CALCULATING PRE AND POST DEVELOPMENT GROUNDWATER RECHARGE RATES

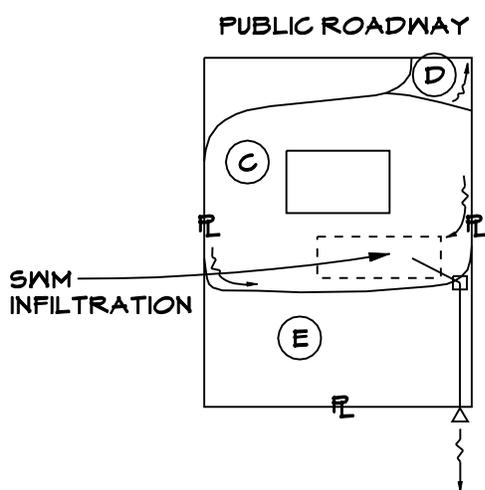
PRE DEVELOPMENT (B SOIL)



TOTAL SITE- 1 ACRE

- (A) IMPERVIOUS AREA
HOUSE & DRIVEWAY- 0.20 ACRES
- (B) PERVIOUS AREA
 $1.00 - 0.20 = 0.80$ ACRES

POST DEVELOPMENT (B SOIL)



TOTAL SITE- 1 ACRE

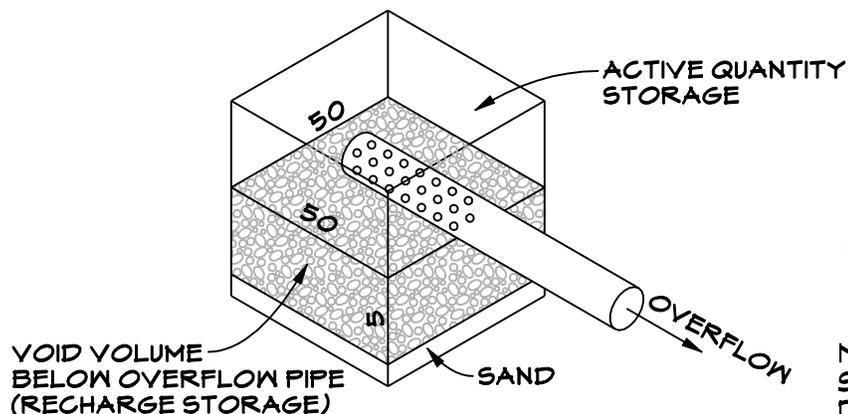
IMPERVIOUS AREA

- (C) DRAINAGE TO FACILITY- 0.50 ACRES
- (D) BYPASSING THE FACILITY- 0.20 ACRES

PERVIOUS AREA

- (E) $1 - 0.50 - 0.20 = 0.30$ ACRES

SWM INFILTRATION PRACTICE



5,000 FT³ OF VOIDS

Martin B. Covington III, PE
SWM Program Engineer
DISTRIBUTED FOR COMMENT MAY 3, 2010
COMMENTS RECEIVED AT C.C. SURVEYORS
MTG. MAY 19, 2010
EFFECTIVE DATE: JULY 29, 2010

TABLE 1 - RECHARGE BY SOIL TYPE

SOIL TYPES	PERVIOUS AREAS		IMPERVIOUS AREAS	
	* PRE- DEVELOPMENT	* POST- DEVELOPMENT	PRE- DEVELOPMENT	POST- DEVELOPMENT
A	98%	98%	2%	2%
B	98%	95%	2%	2%
C	85%	79%	2%	2%
D	70%	65%	2%	2%

* BASED UPON MEADOW AND LAWN, INITIAL ABSTRACTION AND THE RAINFALL FREQUENCY ANALYSIS FOUND ON PAGE 6 1. IF PRE AND POST DEVELOPMENT PERVIOUS AREAS ARE NOT MEADOW AND LAWN RESPECTIVELY, ADJUSTMENTS MAY BE MADE.

TABLE 2 - RECHARGE PERCENTAGES BY RAINFALL AMOUNT

RAINFALL CAPTURE (IN.)	RECHARGE PERCENTAGES %
.2	22.5
.3	40.7
.4	55.3
.5	64.6
.6	73.0
.7	79.1
.8	84.1
.9	88.4
1.0	90.6
1.1	92.8
1.2	94.6
1.3	96.3
1.4	97.5
1.5	98.5
1.6	99.0
1.7	99.4
1.8	99.7
1.9	99.9
2.0	100.0

Martin B. Covington III, PE
 SWM Program Engineer
 DISTRIBUTED FOR COMMENT MAY 3, 2010
 COMMENTS RECEIVED AT C.C. SURVEYORS
 MTG. MAY 19, 2010
 EFFECTIVE DATE: JULY 29, 2010

EXAMPLE CALCULATIONS

STEP 1: DETERMINE WEIGHTED PRE DEVELOPMENT RECHARGE PERCENTAGE

IMPERVIOUS AREA (A)	0.20 AC. x 2% = 0.40%AC.	
PERVIOUS AREA (B)	0.80AC. x 98% = 78.4%AC.	
TOTALS	1.0 AC.	78.8%AC.

$$\text{WEIGHTED RECHARGE} = \frac{78.8\%AC.}{1.0 AC.} = 78.8\%$$

STEP 2: DETERMINE WEIGHTED POST DEVELOPMENT RECHARGE PERCENTAGE

A. DETERMINE AFFECTIVE RECHARGE IN INCHES FOR IMPERVIOUS AREA DRAINING TO THE SWM INFILTRATION FACILITY. (150% CAPTURE OF THE 10 YEAR STORM RUNOFF BY STORMDRAIN IS REQUIRED PER PAGES 47,53 & 54.)

$$\begin{aligned} \text{DEPTH OF RAINFALL EFFECTIVLY INFILTRATED} &= \frac{\text{VOLUME OF INFILTRATION STORAGE}}{\text{IMPERVIOUS AREA DRAINING TO IT}} \\ &= \frac{5000 \text{ FT}^3 (12 \text{ in.})}{0.5 \text{ AC.} \times 43560 \text{ FT}^2} = 2.75 \text{ in.} \end{aligned}$$

B. DETERMINE EFFECTIVE RECHARGE PERCENTAGE FROM TABLE 2 FOR IMPERVIOUS AREAS DRAINING TO THE FACILITY.

2.75 in. > 2.0 in. THEREFORE RECHARGE IS 100.0%

C. CALCULATION

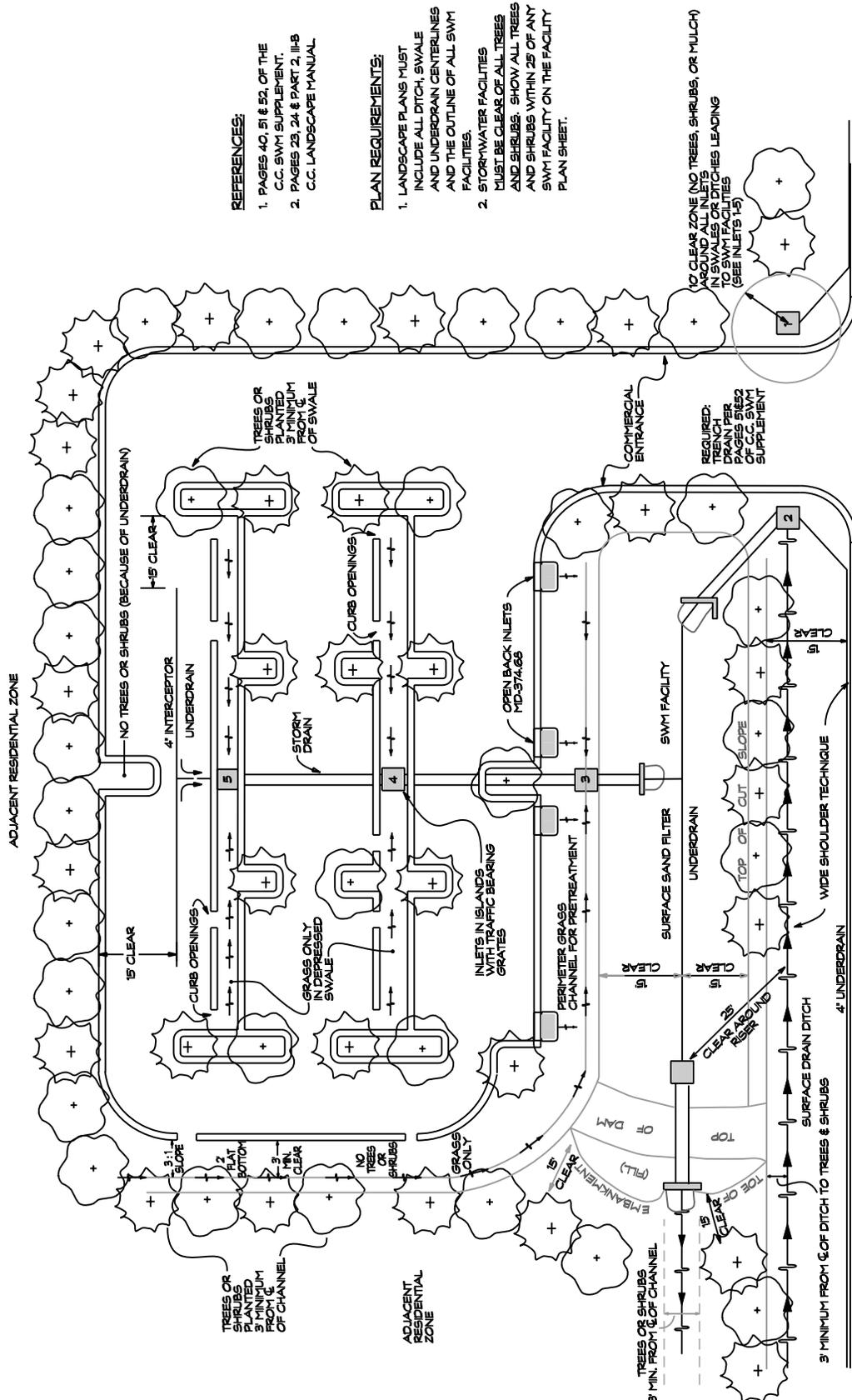
IMPERVIOUS AREA DRAINING TO FACILITY (C)	0.50AC. x 100.0% = 50.0%AC.	
IMPERVIOUS AREA BYPASSING FACILITY (D)	0.20AC. x 2% = 0.4%AC.	
ALL PERVIOUS AREAS (E)	0.30AC x 95% = 28.5%AC.	
TOTALS	1 AC.	78.9%AC.

$$\text{WEIGHTED RECHARGE} = \frac{78.9\% AC.}{1 AC.} = 78.9\%$$

STEP 3: COMPARE PRE AND POST DEVELOPMENT RECHARGE PERCENTAGES

78.9 > 78.8 THEREFORE 100% OF THE PRE DEVELOPMENT GROUND WATER RECHARGE HAS BEEN PRESERVED IN ACCORDANCE WITH THE REQUIREMENTS OF CODE OF MARYLAND 26.17.02.06 (THE SWM ACT OF 2007)

Martin B. Covington III, PE
SWM Program Engineer
DISTRIBUTED FOR COMMENT
C.C. SURVEYORS MTG. MAY 3, 2010
COMMENTS RECIEVED AT C.C.
SURVEYORS MTG. MAY 19, 2010
EFFECTIVE DATE: JULY 29, 2010



REFERENCES:

1. PAGES 40, 51 & 52, OF THE C.C. SWM SUPPLEMENT.
2. PAGES 23, 24 & PART 2, IIS C.C. LANDSCAPE MANUAL.

PLAN REQUIREMENTS:

1. LANDSCAPE PLANS MUST INCLUDE ALL DITCH, SWALE AND UNDERDRAIN CENTERLINES AND THE OUTLINE OF ALL SWM FACILITIES.
2. STORM-WATER FACILITIES MUST BE CLEAR OF ALL TREES AND SHRUBS. SHOW ALL TREES AND SHRUBS WITHIN 25' OF ANY SWM FACILITY ON THE FACILITY PLAN SHEET.

10' CLEAR ZONE (NO TREES, SHRUBS, OR MULCH) AROUND ALL INLETS IN SWALES OR DITCHES LEADING TO SWM FACILITIES (SEE INLETS 1-5)

REQUIRED: TRENCH PER DRAIN PER PAGES 51&52 OF C.C. SWM SUPPLEMENT

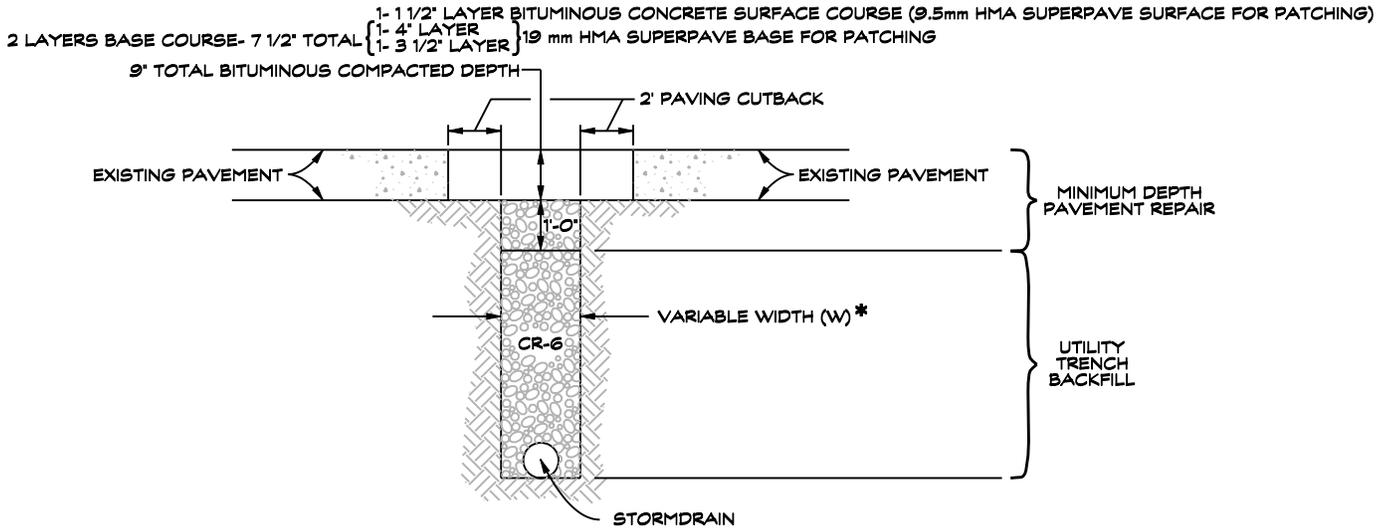
CARROLL COUNTY CRITERIA
 LANDSCAPING LOCATED AROUND STORM-WATER MANAGEMENT FACILITIES AND CONVEYANCES

ORIGINAL DISTRIBUTED AT:
 CARROLL COUNTY SURVEYORS MEETING
 DECEMBER 15, 2007
 M.B. COVINGTON III, PE
 DRAWING NOT TO SCALE

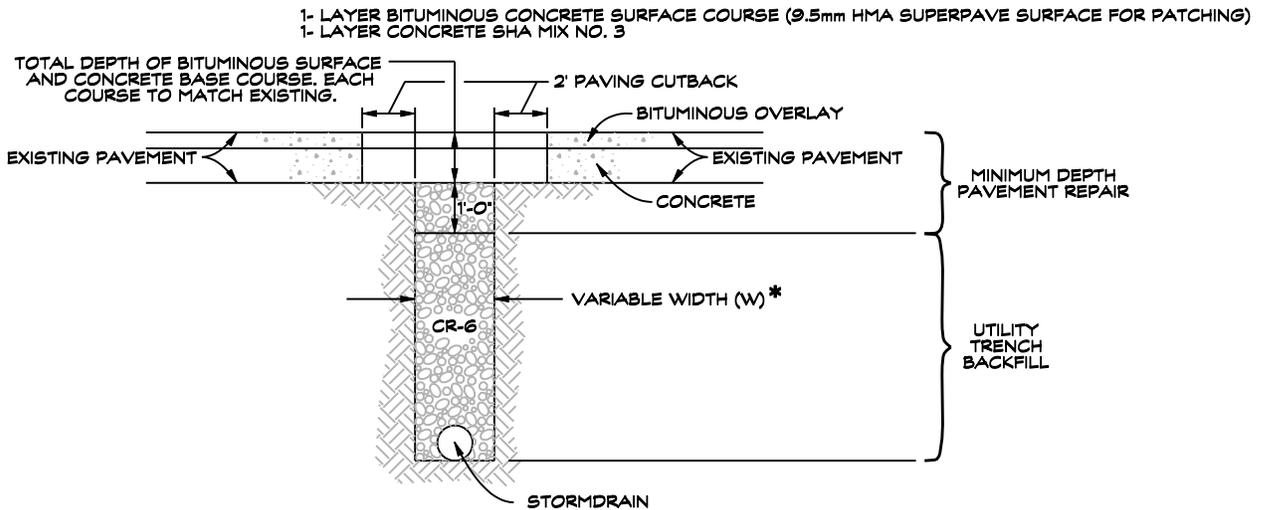
CAD DETAIL DISTRIBUTED AT C.C. SURVEYORS MTG.
 EFFECTIVE DATE: MAY 21, 2008

MODIFIED METHOD OF CUTTING AND REPAIRING ROADWAYS FOR STORMWATER MANAGEMENT RETRO-FIT PROJECTS

BASED ON C.C.D.P.W. ROADS AND STORM DRAINS MANUAL PLATE 47



FOR EXISTING BITUMINOUS PAVED ROADWAYS



FOR EXISTING CONCRETE PAVED ROADWAYS WITH BITUMINOUS OVERLAYS

NOTE: CUTTING & REMOVING PAVEMENT, STONE & SOIL REMOVAL AND DISPOSAL, CR-6 BACKFILL AND PAVEMENT PATCH ALL INCLUDED IN LUMP SUM BID PRICE.

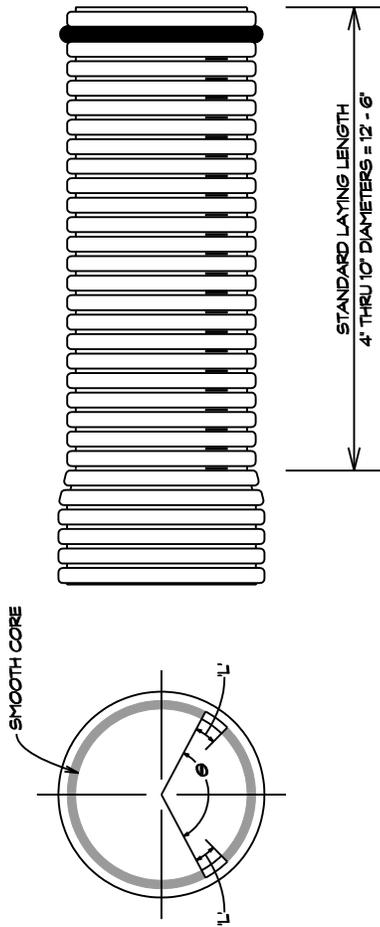
* TRENCH WIDTH FOR STORM DRAIN INSTALLATION SHALL BE EITHER TWICE THE OUTSIDE DIAMETER OF THE PIPE, OR OUTSIDE DIAMETER PLUS 3 FEET, WHICHEVER IS LESS.

Martin B. Covington III, PE
 SWM Program Engineer
 DISTRIBUTED FOR COMMENT
 C.C. SURVEYORS MTG. SEPT. 16, 2009
 EFFECTIVE DATE: NOVEMBER 18, 2009

APPROVED UNDERDRAIN PIPES FOR CARROLL COUNTY STORMWATER MANAGEMENT FACILITIES

CONTECH A-2000 SLOTTED PVC UNDERDRAIN PIPE

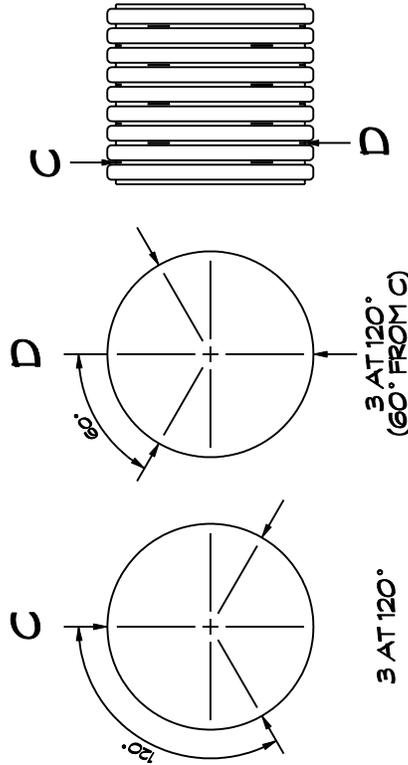
NOMINAL SIZE	DEGREES	ROW OF SLOTS	SLOT SIZE			PERFORATION OPEN AREA (SQ. IN./FT. OF PIPE)
			WIDTH	L'	SLOT SPACING	
4"	152	2	.032	1-1/16"	0.416	1.92'
6"	134	2	.032	1-3/8"	0.516	1.99'
8"	152	2	.032	1-3/4"	0.689	1.90'
10"	114	2	.032	2-3/16"	0.826	1.98'
12"	122	2	.051	1-1/16"	1.033	2.00'
15"	124	2	.051	2-1/4"	1.377	2.00'
18"	120	2	.051	2-1/4"	1.377	2.00'



PLAN & PROFILE NOTATION:
" SLOTTED PIPE
SEE DETAIL SHEET ____

ADS N-12 SLOTTED HDPE TYPE 'SP' UNDERDRAIN PIPE

NOMINAL I.D.	PERFORATION TYPE	SLOT SIZE				MINIMUM INLET AREA PER FT. OF PIPE
		MAXIMUM SLOT LENGTH		MAXIMUM SLOT WIDTH		
		IN.	MM.	IN.	MM.	
4"	SLOT	0.875	22	0.125	3	1.0
6"	SLOT	0.875	22	0.125	3	1.0
8"	SLOT	1.18	30	0.125	3	1.0
10"	SLOT	1.18	30	0.125	3	1.0

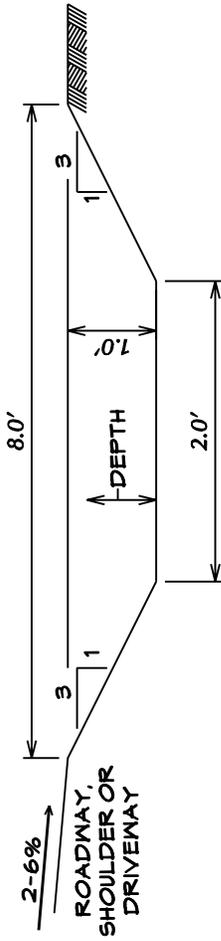


SLOTTED HDPE PIPE DETAIL
NOT TO SCALE

- NOTES:
1. ALL PIPES MUST BE CORRUGATED DOUBLE WALLED (SMOOTH CORE)
 2. ALL PIPES MUST BE SLOTTED (NO CIRCULAR HOLES)
 3. ENGINEER APPROVED EQUIVALENTS MAY BE SUBSTITUTED WITH PRIOR CARROLL COUNTY BUREAU OF RESOURCE MANAGEMENT PERMISSION

Martin B. Covington III, PE
SWM Program Engineer
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C.C. SURVEYORS MTG. SEPT. 16, 2009
EFFECTIVE DATE: NOVEMBER 18, 2009

DESIGN AID FOR GRASS CHANNEL CREDIT



CHANNEL SLOPE

DEPTH OF FLOW - IN.	MANNINGS * "n"	1%		2%		3%		4%	
		VELOCITY FT./SEC.	DISCHARGE** (Q) C.F.S.						
1	0.15	0.17	0.03	0.24	0.04	0.30	0.05	0.34	0.06
2	0.15	0.26	0.10	0.37	0.15	0.45	0.18	0.52	0.21
3	0.15	0.32	0.22	0.46	0.32	0.57	0.39	0.65	0.45
4	0.15	0.38	0.37	0.54	0.53	0.66	0.65	0.76	0.75
5	0.135	0.49	0.66	0.68	0.94	0.84	1.15	0.97	1.33
6	0.12	0.60	1.05	0.85	1.49	1.04	1.82	1.20	2.10
7	0.105	0.74	1.61	1.05	2.28	1.29	2.80	1.49	3.23
8	0.09	0.93	2.45	1.32	3.46	1.61	4.24	1.86	4.90
9	0.075	1.20	3.83	1.70	5.41	2.08	6.63	2.40	7.66
10	0.06	1.58	5.92	2.24	8.37	2.75	10.25	3.17	11.84
11	0.045	2.24	9.82	3.17	13.89	3.88	17.02	4.48	19.65
12	0.03	3.52	17.63	4.98	24.93	6.10	30.54	7.05	35.26

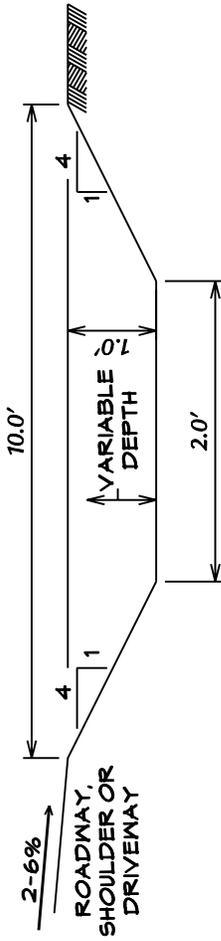
WATER QUALITY STORM LIMIT V < 1 ft./sec.

NON-EROSIVE 10 YEAR STORM LIMIT V < 4 ft./sec.

* VARIABLE MANNINGS "n" WITH VARYING FLOW DEPTH
 FIGURE 7.5, PAGE 7-12, "DESIGN OF STORMWATER FILTERING SYSTEMS"
 (CLAYTON & SCHULER 1996)

MARTIN B. COVINGTON III, P.E.
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 AT THE CARROLL COUNTY
 SURVEYOR'S MEETING:
 SEPTEMBER 16, 2009
 EFFECTIVE DATE: NOV. 18, 2009

DESIGN AID FOR GRASS CHANNEL CREDIT



CHANNEL SLOPE

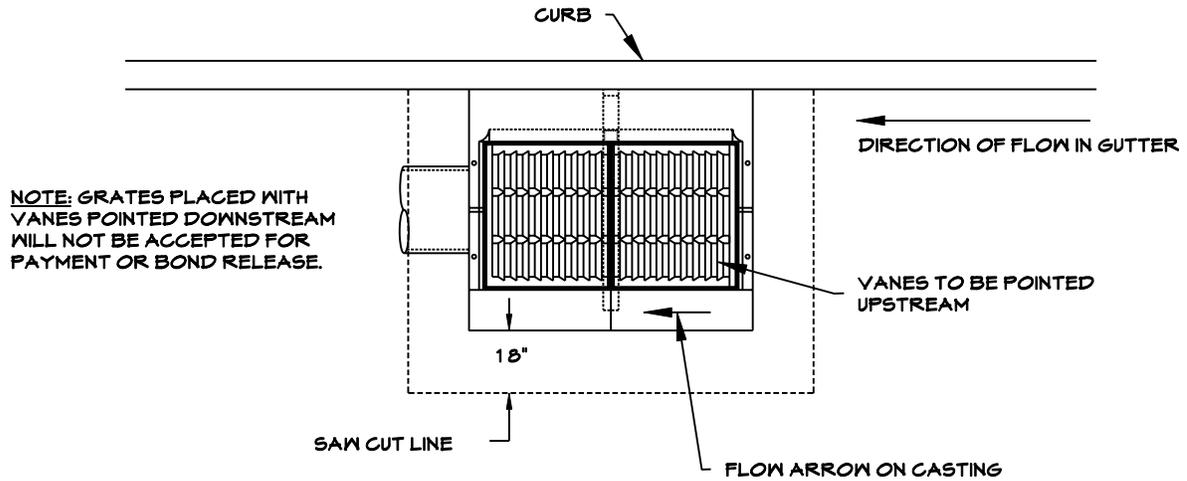
DEPTH OF FLOW - IN.	MANNINGS * "n"	1%		2%		3%		4%	
		VELOCITY FT./SEC.	DISCHARGE** (Q) C.F.S.						
1	0.15	0.16	0.03	0.24	0.04	0.29	0.05	0.34	0.06
2	0.15	0.25	0.11	0.35	0.15	0.43	0.18	0.50	0.21
3	0.15	0.32	0.24	0.45	0.34	0.56	0.42	0.64	0.48
4	0.15	0.37	0.41	0.53	0.58	0.71	0.65	0.75	0.82
5	0.135	0.47	0.70	0.66	0.99	0.81	1.21	0.93	1.39
6	0.12	0.59	1.17	0.83	1.66	1.02	2.03	1.17	2.35
7	0.105	0.73	1.83	1.03	2.58	1.26	3.16	1.46	3.65
8	0.09	0.91	2.80	1.29	3.96	1.58	4.85	1.82	5.59
9	0.075	1.17	4.41	1.66	6.24	2.04	7.65	2.35	8.83
10	0.06	1.55	6.88	2.20	9.73	2.70	11.92	3.12	13.76
11	0.045	2.20	11.51	3.11	16.28	3.82	19.94	4.40	23.03
12	0.03	3.47	20.80	4.90	29.41	6.00	36.03	6.93	41.60

WATER QUALITY STORM LIMIT
V < 1 ft./sec.

NON-EROSIVE 10 YEAR STORM LIMIT
V < 4 ft./sec.

** COMPUTE 10 YEAR STORM DISCHARGE USING THE PROCEDURES IN APPENDIX D.10 OF THE 2000 MARYLAND STORMWATER DESIGN MANUAL
COMPUTE 10 YEAR STORM DISCHARGE USING PROCEDURES IN SHA HIGHWAY DRAINAGE MANUAL OR CARROLL COUNTY DPW DESIGN MANUAL ROADS & STORM DRAINS.

MARTIN B. COVINGTON III, P.E.
DISTRIBUTED FOR COMMENT
AT THE CARROLL COUNTY
SURVEYOR'S MEETING:
SEPTEMBER 16, 2009
EFFECTIVE DATE: NOV. 18, 2009



PLAN

NOTES:

1. INSTALL M.O.T. PER SECTION 104 OF THE BOOK OF STANDARDS
2. REMOVE EXISTING GRATES
3. SAW CUT
4. REMOVE EXISTING FRAME
5. PLACE REPLACEMENT INLET FRAME
6. DRILL BOLT HOLES
7. ATTACH FRAME WITH ANCHOR BOLTS & GROUT PER "FRAME ANCHORAGE DETAIL" MD 374.02
8. INSTALL VANE GRATE OR GRATES
9. REPAIR ROADWAY PER DETAIL ON PAGE 86
10. REMOVE M.O.T.

REFERENCES:

(USE LATEST EDITION/REVISIONS)

. DESIGN MANUAL
ROADS & STORM DRAINS
CARROLL COUNTY, MD

. BOOK OF STANDARDS
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

NOTE:

THIS DETAIL DISTRIBUTED AT CARROLL COUNTY SURVEYORS MEETING SEPTEMBER 16, 2009 FOR COMMENT. EFFECTIVE NOVEMBER 18, 2009.

<u>INLET DESCRIPTION</u>	<u>MARYLAND SHA STANDARD No.</u>	<u>CARROLL COUNTY STANDARD PLATE</u>	<u>REPLACEMENT VANE GRATE & FRAME</u>
PRECAST STANDARD TYPE-"S" INLET DOUBLE GRATE TANDEM	INLET MD 374.70 FRAME & GRATE MD 374.05	INLET PLATE 66	NEENAH R-3540-2 EAST JORDAN 541812, 541640
PRECAST SINGLE "WR" INLET	INLET MD 374.23 FRAME & GRATE MD 374.02 & 374.03	INLET PLATE 68	NEENAH R-3540 EAST JORDAN 54610, 541640
PRECAST "WR" COMBINATION INLET	INLET MD 374.71 FRAME & GRATE MD 374.02 & 374.03	INLET PLATE 70	NEENAH R-3540-2 EAST JORDAN 5418412, 541813 541640, 2905079

* ALL CASTINGS TO COMPLY WITH AASHTO M306-04 (MINIMUM)

NOTES:

1. IN 2004 MD SHA ISSUED MD 374.02-D 1. THIS DETAILS A REPLACEMENT VANE GRATE FOR WR & WRM INLETS USING EXISTING FRAMES. AS OF 2008 NO VENDOR HAS PRODUCED THESE.

2. THIS CHART LISTS AVAILABLE REPLACEMENT VANE GRATES AND FRAME ASSEMBLIES FROM NEENAH FOUNDRY COMPANY (DALE MCGINITY 410-592-2505) OR EAST JORDAN IRON WORKS, INC. (MARK BAUM 800-418-3549). ANY EQUIVALENT VANE GRATE AND FRAME ASSEMBLY IS ACCEPTABLE.

REPLACEMENT OF RETICULAR OR BAR GRATE & FRAME WITH VANE GRATE AND FRAME

Guidance for Dam Safety Review in Carroll County, Maryland

Area of Responsibility

Carroll County Government¹ (Martin B. Covington, III, P.E.)

Hazard Classification	A
Diameter of Barrel Pipe	30-inches or less
Fill Height of Dam	less than 15 feet
Surface Area of Pond	less than 12 acres
Drainage Area	less than 100 acres
Height of Weir Wall	5 feet or less

Carroll Soil Conservation District² (Warren Johnson, P.E.)

Hazard Classification	A
Fill Height of Dam	20 feet or less
Drainage Area	640 acres or less (1 sq. Mile)

Maryland Department of the Environment Dam Safety³ (Charles Wallis, P.E. or Cas Taherion)

Hazard Classification	B or C
Fill Height of Dam	greater than 20 feet
Drainage Area - All dams in Use III watersheds with wet ponds, stream, or spring capture regardless of size.	greater than 640 acres (1 sq. Mile)

Remember, if a wet pond exists in a Use III watershed and the surface area is being reduced, dam safety approval may be deferred to the Carroll Soil Conservation District (SCD). Maryland Department of the Environment briefly reviews and issues an exemption letter deferring to the Carroll SCD unless other concerns are raised.

Martin B. Covington, III, P.E.
Carroll County Government
Distributed for Comment at the
Carroll County Surveyor's
Meeting: September 16, 2009
Effective Date: November 18, 2009

¹ 28 January, 1994 Agreement Carroll Soil Conservation District and Carroll County Government as Revised on 15 May 1997.

² Appendix B.1.2 Small Pond Approval Criteria, 2000 Maryland Stormwater Design Manual

³ Small Pond Maintenance and Repair Flow Chart, Maryland Department of the Environment, 19 March, 2009