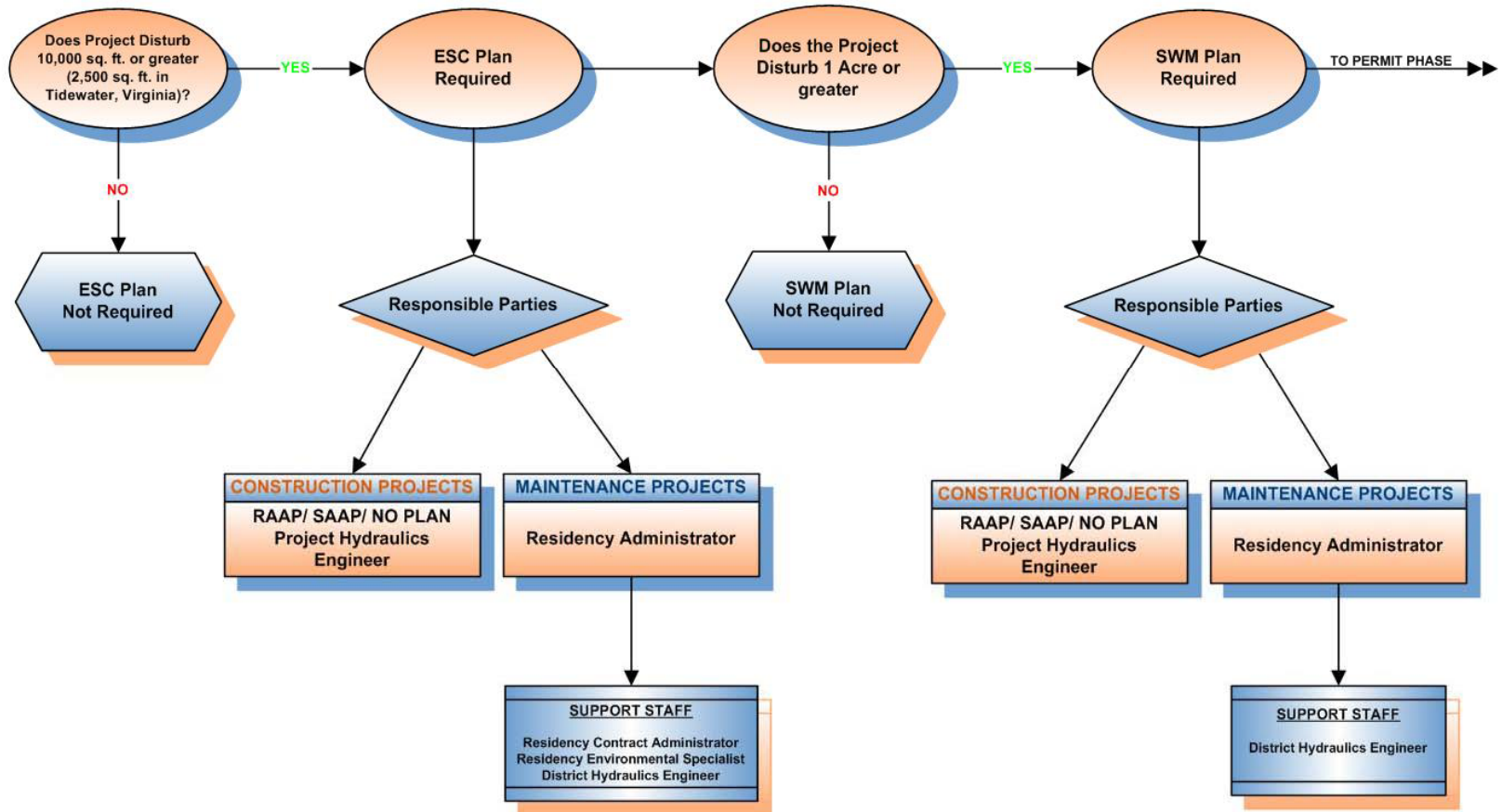


## **APPENDIX F**

### **Stormwater Program ESC, SWM, VSMP Construction Permit Requirements Flowchart**

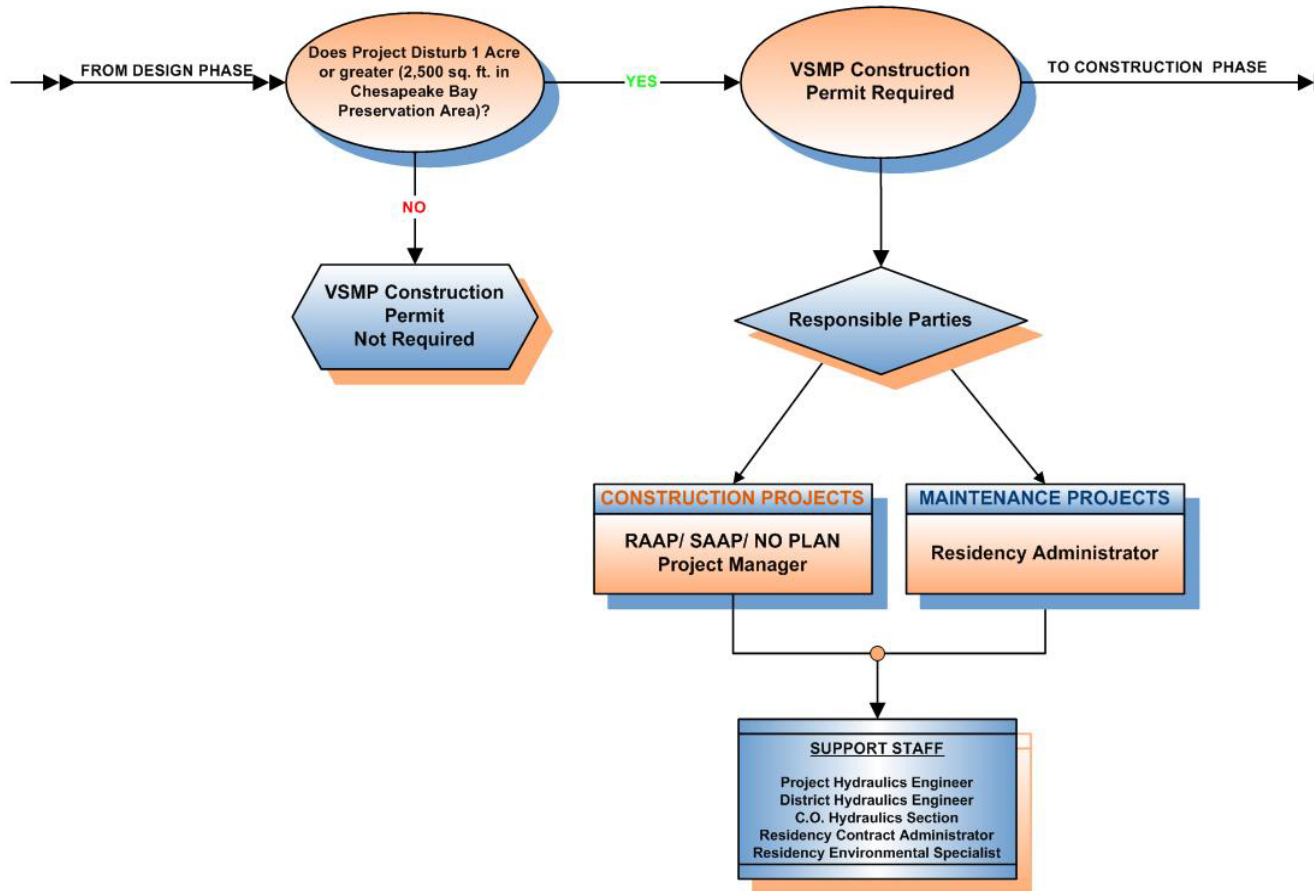
### **Instructional and Informational Memoranda**

## VDOT STORMWATER PROGRAM - ESC, SWM, VSMP CONSTRUCTION PERMIT REQUIREMENTS



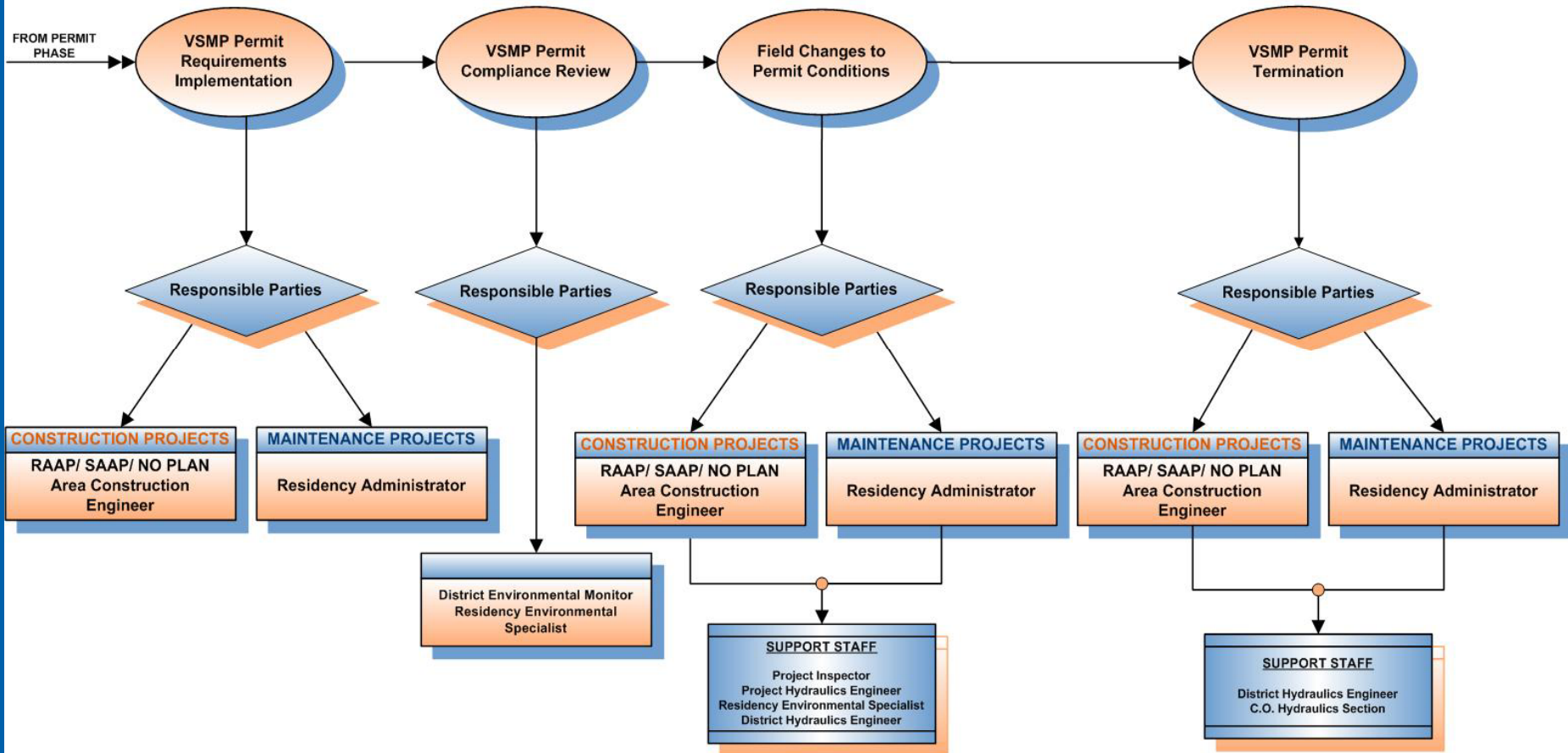
**PLAN DESIGN PHASE - For Construction and Maintenance Activities**

## VDOT STORMWATER PROGRAM - ESC, SWM, VSMP CONSTRUCTION PERMIT REQUIREMENTS



### VSMP CONSTRUCTION PERMIT PHASE - For Construction and Maintenance Activities

## VDOT STORMWATER PROGRAM - ESC, SWM, VSMP CONSTRUCTION PERMIT REQUIREMENTS



**CONSTRUCTION PHASE - For Construction and Maintenance RLD Activities**

VIRGINIA DEPARTMENT OF TRANSPORTATION

# LOCATION AND DESIGN DIVISION

## INSTRUCTIONAL AND INFORMATIONAL MEMORANDUM

GENERAL SUBJECT: EROSION AND SEDIMENT CONTROL	NUMBER: IIM-LD-11.23
SPECIFIC SUBJECT: TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES TO BE INCORPORATED INTO PLANS	DATE: JUNE 26, 2003
	SUPERSEDES: IIM-LD-11.22 LD-94 (D) 182.4
DIVISION ADMINISTRATOR APPROVAL: Mohammad Mirshahi, PE	

Changes are shaded.

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### CURRENT REVISION

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All references to the pay item for "Fabric Removal" have been deleted.

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### EFFECTIVE DATE

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This memorandum is effective upon receipt for all projects that have not progressed beyond the First Submission Stage (where right of way will not be affected by these instructions) or Right of Way Stage (where additional right of way or easements may be required to implement these instructions).

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### POLICY / GENERAL GUIDELINES

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- Requirements of the Virginia Erosion and Sediment Control (ESC) Regulations and the VDOT Erosion and Sediment Control Annual Plan (ESC Annual Plan), as approved by the Department of Conservation and Recreation (DCR) and described herein, shall be incorporated into all erosion and sediment control designs and shall be enforced on all regulated land disturbing activities managed by VDOT.

- Any maintenance or construction activity disturbing more than 2,500 square feet (232 m<sup>2</sup>) within the area of Tidewater, Virginia, as defined in the Virginia Chesapeake Bay Preservation Act, must have a project specific ESC Plan developed and implemented in accordance with the ESC Annual Plan. Tidewater, Virginia is defined as the counties of Accomack, Arlington, Caroline, Charles City, Chesterfield, Essex, Fairfax, Gloucester, Hanover, Henrico, Isle of Wight, James City, King George, King and Queen, King William, Lancaster, Matthews, Middlesex, New Kent, Northhampton, Northumberland, Prince George, Prince William, Richmond, Spotsylvania, Stafford, Surry, Westmoreland and York and the Cities of Alexandria, Chesapeake, Colonial Heights, Fairfax, Falls Church, Fredericksburg, Hampton, Hopewell, Newport News, Norfolk, Petersburg, Poquoson, Portsmouth, Richmond, Suffolk, Virginia Beach and Williamsburg.
- Any maintenance or construction activity disturbing more than 10,000 square feet (929 m<sup>2</sup>) in areas other than those within Tidewater, Virginia (as defined above) must have a project specific ESC Plan developed and implemented in accordance with the ESC Annual Plan.
- VDOT shall be responsible for ensuring compliance with the ESC Annual Plan by private entities (i.e., agents, contractors, subcontractors, consultants) conducting regulated land disturbing activities on projects managed by VDOT including those constructed under the Public/Private Transportation Act (PPTA) and Design/Build projects.
- Wherever practical, the disturbed areas of the project shall be isolated from the impacts of stormwater run-off originating beyond the project limits.
- The Hydraulics Engineer shall be responsible for developing the project specific ESC Plan and shall consult with the District Environmental Manager on application of non-standard items or when unusual conditions exist.
- The District Environmental Manager shall be responsible for reviewing each project specific ESC Plan at appropriate stages in the plan development process and providing suggestions as to additions and/or deletions to the plan.
- The details of the ESC Plan may be depicted on the same sheet as other construction details of the project (Single Phase Plan concept) or they may be depicted on one or more individual ESC plan sheets (Multiple Phase Plan concept). The decision as to which type of ESC Plan to develop for each construction project shall be determined by the Hydraulics Engineer and the appropriate District Environmental Manager during the initial stages of plan development.
- The ESC Plan shall depict locations where specific measures are needed in order to control erosion and siltation within the project limits. Specific erosion and sediment control measures include, but are not limited to, protective linings for ditches, pipe outlet protection, filter barrier, silt fence, check dams, silt traps, sediment traps, sediment basins, diversion berms and ditches, etc. The ESC Plan should be based on

the existing field conditions at the time of design and the anticipated sequence of construction.

- The planning for the sequence of construction should address all required erosion and sediment controls and should be used to eliminate or minimize the need for major erosion and sediment control facilities, such as sediment basins, by strategic planning of the timing and location of erosion and sediment control measures, grading operations, temporary and permanent channels and drainage facilities.
- Prior to the Public Hearing stage of the project, the plans should depict major erosion and sediment control items, i.e. sediment traps, sediment basins, etc., as well as any other erosion and sediment control items that may effect the required right of way.
- Prior to the Right of Way stage, the Hydraulics Engineer will finalize the ESC Plan and submit it to the appropriate District Construction Engineer and Environmental Manager for final review and comment. Erosion and sediment control items shall be detailed to scale on the plans where necessary to accurately determine the required right-of-way and/or easement. The proposed measures, means of access for maintenance and required right-of-way and/or easements shall be carefully reviewed and any changes, deletions or additions shall be incorporated into the plans prior to their submission for Right of Way acquisition.
- During the construction phase of the project, the Contractor, in conjunction with the Project Engineer and/or District Environmental Monitor, shall adjust the proposed location, quantity, and type of erosion and sediment control items as necessary in order to accommodate the selected sequence of construction and the actual field conditions encountered.
- Particular attention should be given to environmentally sensitive areas, such as reservoirs, lakes, ponds, streams, wetland areas, etc., that may require more protection than that provided by the standard application of erosion and sediment control items.
- In areas of karst terrain, where stormwater runoff will be ponded for long periods of time (e.g., in temporary sediment traps and basins), the District Geologist shall be consulted for recommendations for any special requirements needed to address the surface area below the permanent water pool elevation.
- The Contractor must provide an ESC Plan in accordance with Section 106 of the applicable VDOT Road and Bridge Specifications for borrow pit sites and disposal area sites utilized to obtain or dispose of project materials. When required, the Contractor must design, construct and maintain sediment basins at these sites. Supporting calculations for sediment basin design and those demonstrating compliance with the Virginia ESC Regulation MS-19 for adequate receiving channel will be required from the Contractor. This information should be reviewed by the District Hydraulics Engineer to ensure accuracy and the use of appropriate methodology.

- The ESC Plan must be fully and effectively implemented throughout the entire construction phase of the project.
  - Maintenance of the erosion and sediment control items must be continually provided during the duration of the land disturbing activity.
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## DESIGN GUIDELINES

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### References

- In addition to the information contained herein, the following references contain design and/or construction guidelines and details:
  - VDOT Road and Bridge Standards.
  - VDOT Road and Bridge Specifications.
  - DCR Virginia Erosion and Sediment Control Handbook.

### Diversion of Off-Site Stormwater Run-Off

- Stormwater run-off from areas outside the project limits shall, where practical, be diverted around the disturbed areas of the project.
- Erosion and sediment control measures such as diversion ditches, diversion dikes (VDOT Road and Bridge Standard EC-9) (Reference DCR Standard 3.09), stabilized channels, etc. shall be used to limit the stormwater run-off flowing across the disturbed areas of the project.
- Where diversion of runoff from offsite areas is impractical, the flow can be conveyed through the disturbed area in a culvert or a stabilized channel or ditch. Erosion and sediment control measures, such as temporary filter barrier or silt fence, shall be provided along the sides of the ditch or channel to prevent sediment from adjacent disturbed areas from entering the ditch or channel.

### Stabilized Construction Entrances - VDOT Road and Bridge Standard. ESC-INS (Reference DCR Standard 3.02)

Wherever construction traffic will enter or cross a public road, a stabilized construction entrance is required to minimize the transporting of sediment onto the adjoining surface. This entrance is to be constructed in accordance with the details shown on Standard Drawing ESC-INS on page 115.01 of the 2001 VDOT Road and Bridge Standards. In areas where clay or other soils that can be easily tracked onto a public roadway are encountered, a wash rack shall be provided to facilitate removal of sediment from vehicles using the entrance. Sediment laden runoff shall be directed to an approved sediment trapping device.



- Surface water shall be piped under the construction entrance. If piping is impractical, a mountable berm with 5:1 slopes will be permitted.
- Maintenance must be provided to assure continuous performance of the stabilized construction entrance.
- The need and potential locations for stabilized construction entrances should be discussed at the Field Inspection meeting or discussed with the appropriate District Environmental Manager or Construction Engineer.

Temporary Silt Fence - VDOT Road and Bridge Standard EC-5  
(Reference DCR Standard 3.05 & 3.08)

- Temporary Silt Fence is to be used to control sediment in non-concentrated (sheet) flow areas and around the inlet end of circular culverts with a diameter greater than 36" (900 mm) or other drainage structure shapes with an equivalent hydraulic opening.
- Temporary Silt Fence is to be used at the toe of embankments and culvert locations where the fill height is equal to or greater than 5' (1.5 m).
- Additional erosion and sediment control measures must be provided to supplement Temporary Silt Fences located along the toe of embankments where the area draining to Temporary Silt Fence exceeds 11,000 square feet (1020 m<sup>2</sup>) per 100 linear feet (30 m) of Silt Fence.

Temporary Filter Barrier - VDOT Road and Bridge Standard EC-5  
(Reference DCR Standard 3.05 & 3.08)

- Temporary Filter Barrier is to be used to control sediment in non-concentrated (sheet) flow areas and around the inlet end of circular culverts with a diameter that is equal to or less than 36" (900 mm) or other drainage structure shapes with an equivalent hydraulic opening.
- Temporary Filter Barrier is to be used at the toe of embankments and culvert locations where the height of fill is less than 5' (1.5 m).
- Additional erosion and sediment control measures must be provided to supplement Temporary Filter Barriers located along the toe of embankments where the area draining to Temporary Filter Barrier exceeds 11,000 square feet (1020 m<sup>2</sup>) per 100 linear feet (30 m) of Filter Barrier.
- Baled Straw Silt Barrier (Reference DCR Standard 3.04) may be substituted for Temporary Filter Barrier, with the approval of the Project Engineer and/or District Environmental Monitor, in non-critical areas, such as pavement locations, where geotextile type filter barrier cannot be installed in accordance with the Standard Drawings and Specifications.

### Brush Barriers - VDOT Road and Bridge Standard ESC-INS (Reference DCR Standard 3.06)

- Brush Barriers may to be used to control sediment in non-concentrated (sheet) flow areas.
- Additional erosion and sediment control measures must be provided to supplement Brush Barriers located parallel along the toe of embankments if the area draining to the Brush Barrier exceeds 11,000 square feet (1020 m<sup>2</sup>) per 100 linear feet (30 m) of Brush Barrier.
- It is desirable, where feasible, that Brush Barriers remain in place after completion of the project in order to provide an area for wildlife habit. Any Brush Barriers left in place must have any geotextile fabric removed.

### Drop Inlet Silt Trap - VDOT Road and Bridge Standard EC-6 (Reference DCR Standard 3.07)

- Provide Drop Inlet Silt Trap Type A at:
  - Grate inlets in graded median and roadside ditches.
  - Grate inlets in sump areas along embankment areas.
  - Grate inlets in other ditch locations or areas of concentrated flow.
- Provide Drop Inlet Silt Trap Type B at:
  - Curb opening inlets as needed.
- Sediment forebays shall be utilized at drop inlet locations where increased efficiency of sediment removal is desired or where drainage area/storage volume requirements dictate. The need for sediment forebays may be determined by the Hydraulics Engineer during the design phase of the project or by the Project Engineer or District Environmental Monitor during the construction phase of the project.

### Sediment Traps – VDOT Road and Bridge Standard EC-7 (Reference DCR Standard 3.13)

- Temporary Sediment Traps should be used to detain sediment-laden runoff from small disturbed areas. Use of Temporary Sediment Traps should be limited to those locations where the total contributing drainage area is less than 3 acres (1.2 hectares).
- Temporary Sediment Traps are normally located in areas of concentrated flow. The outflow from Temporary Sediment Traps is normally controlled by the use of a rock checkdam.
- Temporary Sediment Traps shall not be constructed in live streams.

- The storage volume for Temporary Sediment Traps shall be 134 cubic yards per acre (254 m<sup>3</sup> per hectare) of the total contributing drainage area and shall consist of 50% in the form of wet storage (excavated area) and 50% in the form of dry storage.
- The need and location for Temporary Sediment Traps is to be determined by the Hydraulics Engineer based on the anticipated sequence of construction.
- The general design for Temporary Sediment Traps is to be in accordance with the details shown on Standard Drawing EC-7 on page 114.08 of the 2001 VDOT Road and Bridge Standards. Specific dimensions for each Temporary Sediment Trap are to be determined by the Hydraulics Engineer and summarized on the Temporary Sediment Trap Detail Sheet (Imperial Insertable Sheet Number A6 or Metric Insertable Sheet Number MA6).
- The Resident Engineer, in conjunction with the District Environmental Monitor, shall determine the time schedule for the removal of the Temporary Sediment Traps.

#### Temporary Sediment Basins (Reference DCR Standard 3.14)

- Temporary Sediment Basins should be used to detain sediment laden runoff from disturbed areas where the total contributing drainage area is 3 acres (1.2 hectares) or greater. The maximum drainage area controlled by a Temporary Sediment Basin should not exceed 100 acres (40 hectares).
- The sediment storage volume for Temporary Sediment Basins shall be 134 cubic yards per acre (254 m<sup>3</sup> per hectare) of the total contributing drainage area. The storage volume shall consist of 50% in the form of wet storage (permanent pool) and 50% in the form of dry storage. The hydraulic performance of the Temporary Sediment Basin shall be predicated on the runoff from the entire watershed.
- The need and location for Temporary Sediment Basins is to be determined by the Hydraulics Engineer based on the anticipated sequence of construction.
- Specific details and dimensions for each Temporary Sediment Basin are to be determined by the Hydraulics Engineer and the design details (including wet and dry storage volumes) are to be included in the construction plans.
- Concentrated stormwater discharge from Temporary Sediment Basins shall be discharged directly into an adequate natural or man-made receiving channel as defined by Minimum Standard 19 (MS-19) of the Virginia Erosion and Sediment Control Regulations.
- The Hydraulics Engineer is referred to the Virginia Erosion and Sediment Control Handbook for further design parameters and construction details.
- The Resident Engineer, in conjunction with the District Environmental Monitor, shall determine the time schedule for removal of Temporary Sediment Basins.

- Permanent Stormwater Management (SWM) basins may be used as temporary sediment basins during the construction phase of the project by modifying the outflow control structure in order to provide the required wet and dry storage volumes. Typical details for modifying a standard riser structure are shown on Standard Drawing SWM-DR on page 116.04 of the 2001 VDOT Road and Bridge Standards.

Slope Drains - VDOT Standard EC-INS (Reference DCR Standard 3.15)

- Slope Drains are to be used in high (8' or greater) (2.4 m or greater), long fill situations to control slope erosion. Exceptions would be where the length of fill is less than 100' (30 meters) or at bridge locations where run-off is being handled by other means.
- The need for Slope Drains is to be determined by the Hydraulics Engineer.
- During the construction phase of the project, the Project Engineer and/or the District Environmental Monitor may require additional slope drains as dictated by field conditions.

Culvert Outlet Protection - VDOT Road and Bridge Standard EC-1  
(Reference DCR Standard 3.18)

- Stone for Erosion Control shall be provided at the outlet of each culvert where required in accordance with the guidelines set forth in the VDOT Drainage Manual.
- The placement of the stone shall be in accordance with Standard Drawing EC-1 on Page 114.01 of the 2001 VDOT Road and Bridge Standards.
- The Project Engineer and/or the District Environmental Monitor shall inspect the outlet ends of all culverts during the construction phase of the project. Where not specified on the plans, but warranted by field conditions, additional stone shall be added in order to ensure the stability of the area adjacent to the culvert outlet.

Rock Check Dams - VDOT Road and Bridge Standard EC-4 (Reference DCR Standard 3.20)

- Type I Rock Check Dams are to be used in trapezoidal ditches where the bottom width is greater than 2' (0.6 m).
- Type II Rock Check Dams are to be used in triangular (vee) ditches and trapezoidal ditches where the bottom width is 2' (0.6 m) or less.
- Rock Check Dams may be designated as permanent SWM structures that are to be left in place after completion of the project in order to function as a part of the overall SWM Plan for the project. Rock Check Dams designated as permanent structures, and located within the clear zone adjacent to a travelway, shall be designed so as not to present a hazard to traffic (see Standard Drawing EC-4 on page 114.05 of the 2001 VDOT Road and Bridge Standards).

- During the construction phase of the project, the Project Engineer and/or the District Environmental Monitor may approve the use of geosynthetic check dams in lieu of Rock Check Dams Type II provided that the check dams are not designated as permanent stormwater management structures and provided that there is no additional cost to the Department. The Environmental Division maintains a list of approved geosynthetic check dam manufacturers.

Temporary Diversion Channel - VDOT Road and Bridge Standard TD-CL  
(Reference DCR Standard 3.24 & 3.25)

- A Temporary Diversion Channel should be used where culvert installation is proposed in a live stream environment (perennial or intermittent) and where it will be necessary to divert the stream in order for the culvert to be installed in the dry.
- The Hydraulics Engineer, using USGS Topographical Maps and/or field observations, shall determine the need for a Temporary Diversion Channel and identify the most feasible location for the channel.
- When it is determined that a Temporary Diversion Channel is required, the Hydraulics Engineer shall determine the following:
  - The length of the Temporary Diversion Channel.
  - The bottom width of Temporary Diversion Channel necessary to essentially match that of the existing low water stream channel.
  - The depth of the Temporary Diversion Channel (average ground surface elevation minus average natural streambed elevation).
  - The class of lining required based on the following:
    - Specify Class A Lining where the Temporary Diversion Channel slope is less than 2 percent.
    - Specify Class B Lining where the Temporary Diversion Channel slope is equal to or greater than 2 percent.
- The location of the Temporary Diversion Channel should be shown on the appropriate ESC plan sheet, when using the Multiple Phase ESC Plan concept, or the Construction plan sheet, when using the Single Phase ESC Plan concept.
- Temporary Silt Fence shall be provided along both sides of the Temporary Diversion Channel.

### Dewatering Basins - VDOT Road and Bridge Standard EC-8 (Reference DCR Standard 3.26)

- Dewatering Basins are provided to receive sediment-laden water pumped from a construction site in order to allow for filtration before the water reenters a natural watercourse.
- Accumulated sediment in the Dewatering Basin shall be removed and disposed of in an approved disposal area outside of the 100-year flood plain, unless otherwise noted on the plans.
- Surface water flow shall be diverted around the Dewatering Basin.
- A stabilized conveyance shall be provided from the outlet of the Dewatering Basin to the receiving channel.
- The need for Dewatering Basins is to be determined by the Hydraulics Engineer during the design phase of the project.
- The field location of Dewatering Basins is to be determined by the Contractor during the construction phase of the project.
- During the construction phase of the project, the Project Engineer and/or the District Environmental Monitor may approve the use of a synthetic dewatering basin in lieu of the dewatering basin shown on Standard Drawing EC-8 on page 114.09 of the 2001 VDOT Road and Bridge Standards provided that there is no additional cost to the Department regardless of the number of synthetic dewatering basins required for each site.

### Turbidity Curtains (Reference DCR Standard 3.27)

- A Turbidity Curtain is used to provide sedimentation protection for a watercourse from up-grade land disturbance or from dredging or filling operations within the watercourse.
- A Turbidity Curtain may be used in both non-tidal and tidal watercourses where intrusion into the watercourse by construction activities or sediment movement is unavoidable.
- Turbidity Curtains should not be placed across the main flow of a significant body of moving water but instead should be located parallel to the direction of flow.
- The Turbidity Curtain should extend for the entire depth of the water to the bed (bottom) of the channel except in locations subject to tidal action and/or significant wind or wave forces.
- At locations subject to tidal action and/or significant wind and wave forces, the bottom of the Turbidity Curtain should extend no closer than 1.0' (0.3 m) above the bed (bottom) of the channel at mean low water.

- An impervious material should be used for the Turbidity Curtain for general applications.
- A pervious material should be used for the Turbidity Curtain for special applications in areas of tidal or moving water where there is a need to extend the curtain all the way to the bed (bottom) of the channel.
- The maximum depth (height) of the curtain shall be no greater than 10 feet (3.0 m) for all stages of water level anticipated during the duration of the curtain's installation.
- The Hydraulics Engineer is referred to the Virginia Erosion and Sediment Control Handbook for further design parameters and construction details.

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## DESIGN CONSIDERATIONS

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### Right of Way/Easement:

- Prior to the Public Hearing Stage of the project, the need for fee right-of-way, permanent easement or temporary easement to accommodate the construction and maintenance of temporary diversion channels, sediment traps, sediment basins or other perimeter erosion and sediment control devices should be addressed.
- All right of way or easements needed to accommodate the construction and maintenance of temporary diversion channels and erosion and sediment control measures shall be shown on the plans prior to their submission for right-of-way acquisition.

### Safety

- Guardrail or fencing around sediment traps or sediment basins should be specified where it is determined to be needed for the safety of pedestrians or vehicles.
- The need for guardrail or fencing should be determined by the District Construction Engineer or other person so designated.

### Maintenance Access

- The need to maintain erosion and sediment control control measures during construction shall be considered in the development of the ESC plan.

The plan design shall incorporate a means of access (e.g., sufficient right-of-way, easements, flattened slopes, etc.) for the maintenance of sediment traps, sediment basins and other erosion and sediment control measures.

## FIELD Revisions and Evaluations

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- During the construction phase of the project, the Project Engineer and the District Environmental Monitor shall continuously evaluate the project for areas that require immediate field engineering decisions for the need to construct or install additional erosion and sediment control measures not include on the construction plans. Additional erosion and sediment control measures may be needed due to unforeseen site conditions or changes in field conditions. When such engineering decisions require detailed hydrologic/hydraulic analysis/calculations, the Project Engineer or District Environmental Monitor will provide documentation (including digital photos, site sketches, additional field survey, inspection reports, etc.) to the Hydraulics Engineer for evaluation. The Hydraulics Engineer will then provide additional design details, as needed, for addressing the specific problem areas.
  - During the construction phase of the project, the Project Engineer and/or the District Environmental Monitor will periodically (or at the Hydraulics Engineer's request) provide the Hydraulics Engineer with detailed evaluation report that notes the success or failure of the proposed erosion and sediment control measures depicted in the construction plans and/or the implementation of different measures as a result of the advent of new design technologies.
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## Plan Development FOR SAAP AND NO PLAN PROJECTS

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### Definitions

- A "No Plan" project is an assembly of letter size sketches and narratives depicting the project's location, typical cross section, estimated quantities and any other specific details necessary for the construction of the project. A project developed under the "No Plan" concept is one that generally requires little or no survey, engineering or hydraulic analysis in order to produce the necessary contract documents. Any required right of way is generally acquired through donations in lieu of the purchase/condemnation process. See Appendix A of the VDOT Road Design Manual for additional information on the No Plan concept.
- SAAP Projects are those advertised under the Special Advertisement and Award Process. SAAP projects generally have one or more of the following characteristics:
  - They require little or no preliminary engineering.
  - They are standard maintenance repair contracts (for example: bridge, guardrail or concrete pavement repairs).



- They are standard incidental construction and/or improvement projects of limited scope.
- The work being performed involves a singular function or specialty work (for example: bridge painting, pavement markings or pipe installation).
- The “No Plan” concept is generally used to produce the required contract documents.

#### Plan Development Process

- During the early stages of the preparation of the contract assembly for any SAAP or No Plan Project, a field review should be made by appropriate members of the District Environmental Section and the District Hydraulics Section staff, accompanied by members of the Residency staff, to determine what is needed on the project in order to comply with all applicable ESC and SWM Regulations.
- The Contract Administrator (CA) will prepare a preliminary Straight Line Sketch (SLS) (see attached example) and Form LD-439 (Drainage Information Sheet) and provide a copy of this information to the appropriate personnel in the District Hydraulics Section and the District Environmental Section. Even though project specifics may not be totally complete at the time, it is recommended that the SLS and the Form LD-439 be provided to the District Hydraulics Section and the District Environmental Section at the same time that the Form EQ-429 Project Early Notification is submitted or as soon thereafter as possible.
- The CA will coordinate with the appropriate personnel in District Hydraulics Section and the District Environmental Section to schedule a Field Review of the proposed project. Appropriate person(s) from the Hydraulics Section and the Environmental Section (including those representing the areas of ESC, SERP, and Permits) should attend the Field Review. Attendees from the Hydraulics Section and the Environmental Section shall discuss pertinent issues during the Field Review and provide any follow-up information to the CA as soon, thereafter, as possible.
- The following data should be made available to the participants for the Field Review:
  - A completed Form EQ-429 and Form LD-439.
  - A Vicinity Map – USGS Topographical Map and County Road Map showing the location and limits of the proposed project.
  - A Straight Line Sketch (SLS) of the project showing the project limits and the approximate location of proposed drainage items and erosion and sediment control items. Information in Form LD-438 “Guidelines for Development of Straight Line Sketches” should be followed in preparation of the SLS.

- If during the Field Review it is found that such items as stormwater management facilities, temporary sediment basins or temporary sediment traps are required, the District Hydraulics Section will determine and request the survey data necessary to perform the required engineering studies.
- After the Field Review, and upon the completion of the design of any required stormwater management facilities or sediment trapping facilities, the District Environmental Section and the District Hydraulics Section will provide the CA with comments, recommendations and any pertinent design information or details.
- The CA will revise the SLS to incorporate the recommendations and design details provided by the District Hydraulics Section and the District Environmental Section.
- After all required revisions have been made by the CA, the final SLS will be incorporated into the contract assembly. This copy of the SLS should be identified as the final version and copies should be provided to the District Environmental Section and to the District Hydraulics Section for their review to ensure that all comments and issues have been addressed. Thereafter, any significant changes to the project that may impact environmental or drainage issues will require resubmission of the SLS to the Environmental and/or Hydraulics Section for additional review and comment.
- The final version of the SLS and associated Narrative will serve as the ESC and SWM Plan for the project. During the construction phase of the project, a copy of the ESC/SWM Plan should be kept on the project site and in the project file at the Residency Office as documentation that all policies and procedures have been addressed with regard to SWM and ESC requirements of the project.
- See Appendix A of the VDOT Road Design Manual for additional information and examples of the erosion and sediment control details required for these types of construction projects.

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## PLAN DEVELOPMENT FOR STATE FORCE CONSTRUCTION PROJECTS

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State Force Construction Projects include land-disturbing activities that are undertaken by state force equipment and/or hired equipment.

Residency personnel should contact the Residency Environmental Specialist or the District Environmental Section to review any State Force Construction Projects to determine if the proposed work is of a magnitude that would require stormwater management and/or erosion and sediment control measures. If it is determined that stormwater management and/or erosion and sediment control measures are needed, the same procedures outlined under the SAAP/No Plan Project Plan Development Process will be followed.

## PLAN DEVELOPMENT FOR MINIMUM PLAN & STANDARD PLAN CONSTRUCTION PROJECTS

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### Definitions

- Minimum Plan projects are those that require a limited amount of survey information in order to perform the necessary engineering studies and to provide the information required to secure the necessary rights of way. The minimum amount of details needed to address environmental requirements and to construct the project are provided in a standard plan assembly format. See Appendix A of the VDOT Road Design Manual for additional information on the Minimum Plan concept.
- Standard Plan Projects are those that require complete survey information in order to perform the necessary detailed engineering studies and to develop a complete and detailed construction plan assembly.

### PLAN DEVELOPMENT PROCESS

#### Single Phase Plan Concept

- The Single Phase ESC Plan concept may be used on simple construction projects where all of the erosion and sediment control measures can be clearly depicted on the construction plan sheet (e.g., rural secondary project, minor urban widening project, bridge and approach project, etc.)
- The ESC Plan shall address both those items requiring installation prior to the beginning of grubbing operations or the installation of major drainage structures and those items to be installed as grading operations and installation of minor drainage facilities progress.
- In addition to standard plan symbols, a narrative or additional notes may be used to clearly define the intent and purpose of the proposed erosion and sediment control measures and to define their installation sequencing. Some standard construction notes have been developed and are included as a part of the VDOT CADD Cell Library.
- Projects developed under the “Minimum Plan” concept must have an ESC Plan. See Appendix A of the Road Design Manual for additional information and examples of the erosion and sediment control details required for these types of construction projects.

#### Multiple Phase Plan Concept

- The Multiple Phase ESC Plan concept shall be used on construction projects where additional plan sheet(s) are needed in order to clearly depict the erosion and sediment

control measures required at the various stages of construction (e.g., rural multi-lane roadway projects, major urban roadway projects, roadway projects on new location, roadway projects through environmentally sensitive areas, etc.).

- In addition to standard plan symbols, a narrative or additional notes should be used to clearly define the intent and purpose of the proposed erosion and sediment control measures and to define their installation sequencing. Some standard construction notes have been developed and are included as a part of the VDOT CADD Cell Library.
- Some projects may be developed using the Multiple Phase concept on only those portions of the project that require greater detail and clarity than that provided by the Single Phase concept (e.g., construction in environmentally sensitive areas or major waterway areas, areas where plan clutter reduces the ability to clearly show the erosion and sediment control items, etc.).
- At a minimum, the ESC Plan should be developed in two phases:
  - Phase I for those items needed to be installed prior to the beginning of grubbing operations or the installation of major drainage structures.
  - Phase II for those items to be installed as grading operations and installation of minor drainage facilities progress.
- On most projects, the Phase I and the Phase II details (including associated narratives or notes) should each be depicted on a separate plan sheet following the applicable construction plan sheet (e.g., Construction Plan Sheet 5, Profile Sheet 5A, ESC Phase I Plan Sheet 5B, ESC Phase II Plan Sheet 5C).
- On some projects, the Phase I and Phase II details may be depicted on a single separate plan sheet following the applicable construction plan sheet (e.g., Construction Plan Sheet 5, Profile Sheet 5A, ESC Phase I & II Plan Sheet 5B).
- In general, when utilizing a separate plan sheet for both the Phase I and the Phase II details, erosion and sediment control items (including protective linings in permanent ditches and channel relocations) depicted on the Phase I Plan Sheet should not be duplicated on the Phase II Plan Sheet. Erosion and sediment control items depicted on the Phase I & II Plan Sheets should not be duplicated on the Construction Plan Sheet.
- The Phase I Plan Sheet shall, at a minimum, depict the following:
  - Existing contours.
  - Existing topography.
  - Proposed centerline, edges of pavement and construction limits.  
Permanent drainage culverts, temporary diversion channels and permanent channel relocations (including any protective linings required) involving natural

drainage ways that would be constructed or installed prior to the start of grading operations.

- Temporary Sediment Basins (including grading contours, if applicable).
- Stormwater Management Basins (including grading contours, if applicable) that will be utilized as temporary sediment basins during the construction phase of the project.
- Diversion dikes, berm ditches and other perimeter ditches (including any required protective linings) that need to be installed prior to the start of grubbing or other earth moving operations.
- Temporary sediment traps, filter barriers, silt fences, rock check dams, turbidity curtains and any other perimeter controls that need to be installed prior to the start of grubbing or other earth moving operations.
- Any necessary construction notes or narratives.

The Phase II Plan Sheet shall, at a minimum, depict the following:

- Existing topography.
  - Proposed centerline, edges of pavement and construction limits.
  - Any permanent drainage culverts and channel relocations involving natural drainage ways installed under the Phase I Plan.
  - Temporary Sediment Basins and Stormwater Management Basins installed under the Phase I Plan.
  - All culverts, storm sewer pipe, drop inlets and associated drainage structures that will be installed as grading operations progress.
  - All required protective ditch linings (e.g., Standard EC-2 or EC-3, concrete, riprap, etc.), paved flumes and associated structures that will be installed as grading operations progress.
  - Temporary sediment traps, slope drains, filter barriers, silt fences, rock check dams, drop inlet silt traps, and any other erosion and sediment control measures needed to be installed as grading operations progress.
  - Any necessary construction notes or narratives.
- The following drainage items from the Phase I and II Plan Sheets shall be depicted on the Construction Plan Sheet:
    - Permanent drainage culverts, storm sewer systems, drop inlets and associated structures.
    - Permanent channel relocations involving natural waterways.
    - Permanent Stormwater Management Basins.
    - Rock Check Dams that will be left in place after construction to serve as a permanent stormwater management structure.

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PLAN DETAILS

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## Symbols

- Standard symbols are to be used to depict erosion and sediment control items on the plans in accordance with General Note E-7 shown in the latest Location and Design Instructional and Informational Memorandum (D) 110 and in accordance with instructions in the VDOT CADD Manual.

## Check Dams

- Rock Check Dams that are to function as a part of the permanent SWM Plan for the project should be designated on the plans as follows:  
“Rock Check Dam Type (specify) - Permanent SWM Structure (to remain in place after project completion)”

## Dewatering Basins

- Do not show specific locations on the plans.
- The description of the applicable drainage structure (or a separate description note when utilizing individual sheets to depict a phased ESC Plan) should note the need for a Dewatering Basin(s) and specify the number required.

## Stabilized Construction Entrances

- The specific locations of Stabilized Construction Entrances will not be shown on the plans. A note should be included on the appropriate plan sheet(s) specifying the general location (station, lane, roadway, etc.) where it is anticipated that Stabilized Construction Entrances will be required.

## Filter Cloth

- Where existing fence is available for the attachment of the Filter Cloth, the plans are to specify the following: “Filter Cloth Req’d. (Attach to Exist. Fence)”.

## Slope Drains

- The specific locations of Slope Drains will not be shown on the plans. A note should be included on the appropriate plan sheet(s) specifying the general location (station to station, lane, roadway, etc.) and estimated quantity of Slope Drains and Erosion Control Stone Class 1, St’d. EC-1 required.

## Temporary Diversion Channel

- When the location is shown on an individual phased ESC Plan Sheet, the description for the Temporary Diversion Channel should specify the width of the channel required and the class of lining required (A or B). Temporary Silt Fence along both sides of the Temporary Diversion Channel should be specified.

- When the location is shown on the Construction plan sheet, the description for the Temporary Diversion Channel should be included in the description for the applicable drainage structure. The following information should be included in the drainage description:

Temporary Diversion Channel Req'd. Width = (specify)  
(specify) cu. yds. (m<sup>3</sup>) Temporary Diversion Channel Excavation  
(specify) sq. yds. (m<sup>2</sup>) Temporary Diversion Channel Lining, Class (specify)  
(specify) ft. (m) Temporary Silt Fence Req'd.

- The plan description calls attention to the need for a Temporary Diversion Channel and defines the width of the channel and the class of lining required.
- The Hydraulics Engineer should be liberal when estimating the length of Temporary Diversion Channel required in order to avoid significant cost overruns during construction.
- The Contractor, with approval of the District Environmental Monitor, will have the latitude to field locate the Temporary Diversion Channel where needed to best fit his planned construction sequencing. The Contractor is paid for the actual quantity of excavation and quantity of lining installed.
- Sufficient right of way and/or temporary/permanent easement should be provided in order to allow the contractor the latitude to locate the Temporary Diversion Channel on either side of the proposed structure. Location of wingwalls or other appurtenances that protrude beyond the neat lines of the culvert's barrel shall be considered when locating the Temporary Diversion Channel and establishing the required R/W or Easement.

#### General Notes

- See the latest Location and Design Instructional and Informational Memorandum (D) 110 for the applicable Erosion and Sediment Control Notes that are to be included on the General Notes Sheet of the plans.

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#### MAINTENANCE

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- Accumulated sediment shall, at a minimum, be removed from erosion and sediment control facilities as follows:
  - Sediment Traps & Basins - When the wet storage volume has been reduced by approximately 50%.
  - Temporary Silt Fence or Filter Barrier – When it retains sediment up to ½ of its height.

- Rock Check Dams – When the storage capacity behind the dam has been reduced by approximately 50%.
  - Dewatering Basins – When the excavated volume has been reduced by approximately 50%.
  - All other erosion and sediment control facilities – When the capacity, height or depth has been reduced by approximately 50%.
- 

## BASIS OF PAYMENT

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### Siltation Control Excavation

- All silt removal and sediment cleanout from erosion and sediment control items will be measured and paid for as “cubic yards (m<sup>3</sup>) of Siltation Control Excavation”.

### Rock Check Dams

- To be measured and paid for per each for the type specified.

### Temporary Filter Barrier and Silt Fence

- To be measured and paid for in linear feet (m).

### Temporary Sediment Basins and Sediment Traps

- Excavation for Temporary Sediment Basins or Sediment Traps will be measured and paid for as “cubic yards (m<sup>3</sup>) Temporary Sediment Basin Excavation.” If additional fill material is needed for dams or berms, it will be measured and paid for as “cubic yards (m<sup>3</sup>) of either Regular Excavation, Borrow Excavation or Embankment”.

### Dewatering Basins

- To be measured and paid for per each.

### Drop Inlet Silt Traps

- To be measured and paid for per each for the type specified.

### Temporary Diversion Dike

- Will not be measured for payment, but the cost shall be included in the price bid for other appropriate items.



### Stabilized Construction Entrance

- Will not be measured for payment but the cost shall be included in the price bid for other appropriate items.

### Slope Drains

- To be measured and paid for per each regardless of size or length.

### Brush Silt Barriers

- Will not be measured for payment but the cost shall be included in the price bid for other appropriate items.

### Geotextile Fabric

- When attached to brush barriers or an existing fence, payment will be made for square yards ( $m^2$ ) of Geotextile Fabric.

### Turbidity Curtains

- To be measured and paid for in linear feet (m) of the type specified, measured from edge of curtain to edge of curtain along the support cable.

### Temporary Diversion Channel

- To be measured and paid for in cubic yards ( $m^3$ ) Temporary Diversion Channel Excavation and square yards ( $m^2$ ) Temporary Diversion Channel Lining for the Class specified.

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## QUANTITY ESTIMATES

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### Summary Sheet

- All estimated quantities for erosion and sediment control items are to be summarized on the Erosion Control Summary Sheet (Imperial Insertable Sheet Number A5 or Metric Insertable Number MA5).
- Estimated quantities are to be shown for each phase of the ESC Plan.

### Rock Check Dams

- Summarize a quantity of 4.74 cubic yards ( $3.6 m^3$ ) of Siltation Control Excavation for each Rock Check Dam Type I specified. This should allow for two cleanouts.
- Summarize a quantity for 0.32 cubic yards ( $0.2 m^3$ ) of Siltation Control Excavation for each Rock Check Dam Type II specified. This should allow for two cleanouts.

### Temporary Filter Barrier

- The estimated quantity depicted on the plans is to be increased by a percentage factor of 100% and the adjusted quantity shown on the Erosion Control Summary Sheet.
- Summarize a quantity for cubic yards ( $m^3$ ) of Siltation Control Excavation as follows:

Metric - 0.25  $m^3$  of Siltation Control Excavation for each meter of Temporary Filter Barrier summarized on the Erosion Control Summary Sheet.

Imperial - 0.17 Cubic yards of Siltation Control Excavation for each linear foot of Temporary Filter Barrier summarized on the Erosion Control Summary Sheet.

### Temporary Silt Fence

- Summarize a quantity for cubic yards ( $m^3$ ) of Siltation Control Excavation as follows:

Metric - 0.25  $m^3$  of Siltation Control Excavation for each meter of Temporary Silt Fence specified.

Imperial - 0.17 Cubic yards of Siltation Control Excavation for each linear foot of Temporary Silt Fence specified.

### Brush Silt Barrier

- The estimated linear feet (m) is to be shown on the Erosion Control Summary Sheet.

### Temporary Sediment Basins and Traps

- Summarize the cubic yards ( $m^3$ ) of Temporary Sediment Basin Excavation on the Erosion Control Summary Sheet. If Borrow or Embankment is needed, it is to be included in roadway totals on the Grading Diagram and Summary Sheet.
- The Grading Diagram is to reflect how the cubic yards ( $m^3$ ) of Temporary Sediment Basin Excavation and cubic yards ( $m^3$ ) of Embankment is to be distributed.
- Temporary Sediment Basin control structure (riser pipe) – Summarize pay item as linear feet (meters) of Temporary Sediment Riser Pipe (size) on the Erosion Control Summary Sheet.

- Any culvert pipe necessary for a temporary sediment basin shall be included with other applicable pipe on the Drainage Summary Sheet.
- Summarize a quantity for cubic yards ( $m^3$ ) of Siltation Control Excavation that is equal to 50% of the total volume (wet storage volume plus dry storage volume) of the basin or trap. This will allow for two cleanouts.

#### Dewatering Basin

- The number of Dewatering Basins specified for each applicable site shall consider any potential phased construction of the proposed drainage structure. At a minimum, the following number of dewatering Basins shall be specified:
  - One Dewatering Basin for each pipe(s) or major structure that has a combined hydraulic opening of 12.6 square feet ( $1.17 m^2$ ) (48" (1200 mm) diameter pipe or equivalent) or greater including bridges 20' (6 m) or less in length.
  - Two Dewatering Basins for each bridge over 20' (6 m) in length.
- Summarize a quantity of 4 cubic yards ( $4 m^3$ ) of Siltation Control Excavation for each Dewatering Basin specified, based on a minimum Dewatering Basin size of 6' x 6' x 3' (2 m x 2 m x 1 m). This will allow for two cleanouts.

#### Drop Inlet Silt Trap

- Type A
  - Summarize a quantity of 15 cubic yards ( $11.5 m^3$ ) of Siltation Control Excavation for each Drop Inlet Silt Trap Type A specified at St'd DI-5, DI-7A,7B and DI-12,12A,12B,12C Drop Inlet locations. This should allow for two cleanouts.
  - Summarize a quantity of 5 cubic yards ( $3.8 m^3$ ) of Siltation Control Excavation for each Drop Inlet Silt Trap Type A specified at Standard DI-1 and DI-7 Drop Inlet locations. This should allow for two cleanouts.
- Type B
  - Summarize a quantity of 5 cubic yards ( $3.8 m^3$ ) of Siltation Control Excavation for each Drop Inlet Silt Trap Type B specified at curb drop inlet locations. This should allow for two cleanouts.

#### Stabilized Construction Entrance

- The estimated number of Stabilized Construction Entrances is to be shown on the Erosion Control Summary Sheet.

## Slope Drains

- Summarize the estimated number of Slope Drains and the quantity of Erosion Control Stone Class 1, St'd. EC-1 on the Erosion Control Summary Sheet.
- The number of Slope Drains required is to be estimated as follows:
  - One Slope Drain for each 250 linear feet (75 m), or portion thereof, for fills 8 feet (2.4 m) in height or greater, for each roadway baseline; e.g., 200' (60 m) of fill = 1 Slope Drain; 580' (175 m) of fill = 3 Slope Drains.

## Erosion Control Mulch

- Summarize a quantity on the Erosion Control Summary Sheet when recommended by the Environmental Division.
- This material is estimated at the rate of 50 square yards per 100 feet (135 m<sup>2</sup> per 100 meters) of roadway alignment.

## Turbidity Curtain

- Summarize as linear feet (meters) of Turbidity Curtain for the type specified (Pervious or Impervious) on the Erosion Control Summary Sheet.

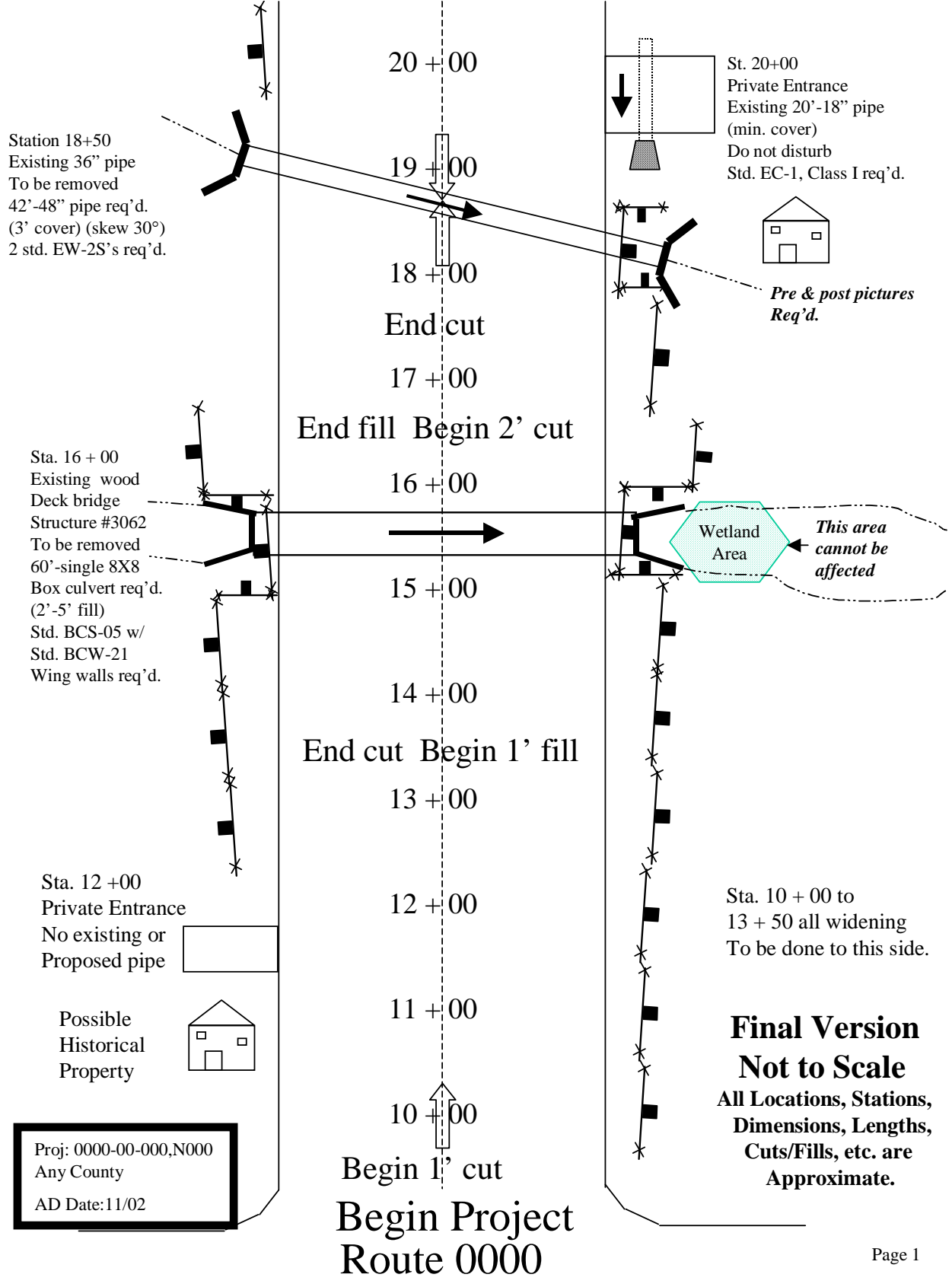
## Temporary Diversion Channel

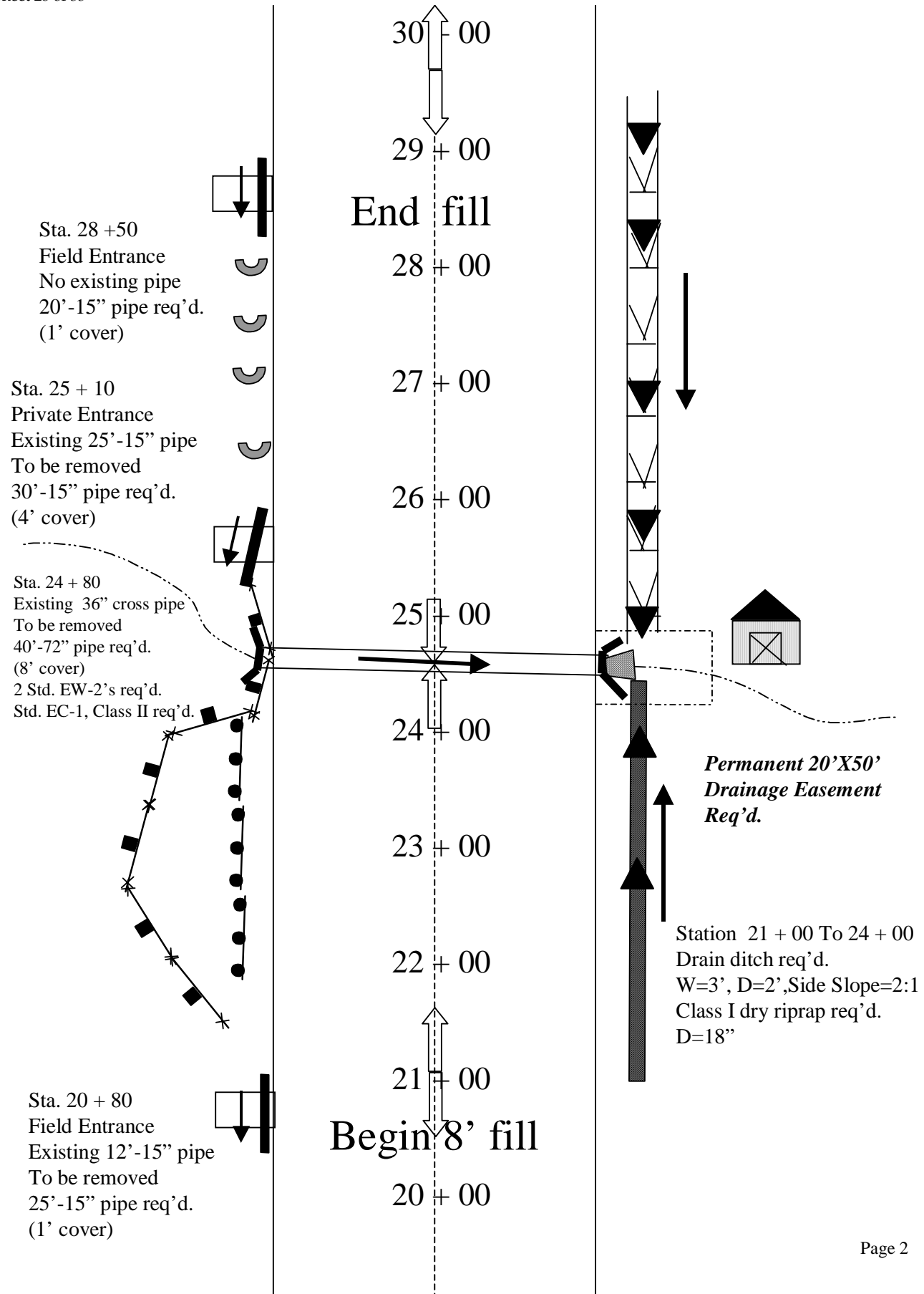
- An estimated quantity of Temporary Diversion Channel Excavation and Temporary Diversion Channel Lining for the Class specified (A or B) is to be shown on the Erosion Control Summary Sheet.
- Silt fence along both sides of channel is to be measured and paid for separately and summarized on the Erosion Control Summary Sheet.
- The Hydraulics Engineer shall estimate the cubic yards (m<sup>3</sup>) of temporary Diversion Channel Excavation and the square yards (m<sup>2</sup>) of Temporary Diversion Channel Lining based on the estimated width and depth of the channel using Table 1.

<b>TABLE 1 - TEMPORARY DIVERSION CHANNELS (IMPERIAL)</b>									
<b>S.Y. LINING / C.Y. EXCAVATION (PER LIN. FT.)</b>									
		<b>3' WIDTH</b>	<b>4' WIDTH</b>	<b>5' WIDTH</b>	<b>6' WIDTH</b>	<b>7' WIDTH</b>	<b>8' WIDTH</b>	<b>9' WIDTH</b>	<b>10' WIDTH</b>
<b>1' DEPTH</b>	<b>S.Y.</b>	<b>0.83</b>	<b>0.94</b>	<b>1.10</b>	<b>1.20</b>	<b>1.30</b>	<b>1.40</b>	<b>1.50</b>	<b>1.60</b>
<b>1' DEPTH</b>	<b>C.Y.</b>	<b>0.19</b>	<b>0.22</b>	<b>0.26</b>	<b>0.30</b>	<b>0.33</b>	<b>0.37</b>	<b>0.41</b>	<b>0.44</b>
<b>2' DEPTH</b>	<b>S.Y.</b>	<b>1.32</b>	<b>1.44</b>	<b>1.54</b>	<b>1.66</b>	<b>1.77</b>	<b>1.88</b>	<b>1.98</b>	<b>2.10</b>
<b>2' DEPTH</b>	<b>C.Y.</b>	<b>0.52</b>	<b>0.59</b>	<b>0.67</b>	<b>0.74</b>	<b>0.81</b>	<b>0.89</b>	<b>0.96</b>	<b>1.04</b>
<b>3' DEPTH</b>	<b>S.Y.</b>	<b>1.82</b>	<b>1.94</b>	<b>2.05</b>	<b>2.16</b>	<b>2.27</b>	<b>2.38</b>	<b>2.49</b>	<b>2.60</b>
<b>3' DEPTH</b>	<b>C.Y.</b>	<b>1.00</b>	<b>1.11</b>	<b>1.22</b>	<b>1.33</b>	<b>1.44</b>	<b>1.56</b>	<b>1.67</b>	<b>1.78</b>
<b>4' DEPTH</b>	<b>S.Y.</b>	<b>2.32</b>	<b>2.43</b>	<b>2.54</b>	<b>2.66</b>	<b>2.77</b>	<b>2.88</b>	<b>2.99</b>	<b>3.10</b>
<b>4' DEPTH</b>	<b>C.Y.</b>	<b>1.63</b>	<b>1.78</b>	<b>1.93</b>	<b>2.07</b>	<b>2.22</b>	<b>2.37</b>	<b>2.52</b>	<b>2.67</b>
<b>5' DEPTH</b>	<b>S.Y.</b>	<b>2.82</b>	<b>2.93</b>	<b>3.04</b>	<b>3.16</b>	<b>3.27</b>	<b>3.38</b>	<b>3.48</b>	<b>3.60</b>
<b>5' DEPTH</b>	<b>C.Y.</b>	<b>2.41</b>	<b>2.59</b>	<b>2.78</b>	<b>2.96</b>	<b>3.15</b>	<b>3.33</b>	<b>3.52</b>	<b>3.70</b>
<b>6' DEPTH</b>	<b>S.Y.</b>	<b>3.31</b>	<b>3.43</b>	<b>3.53</b>	<b>3.64</b>	<b>3.76</b>	<b>3.87</b>	<b>3.98</b>	<b>4.09</b>
<b>6' DEPTH</b>	<b>C.Y.</b>	<b>3.33</b>	<b>3.56</b>	<b>3.78</b>	<b>4.00</b>	<b>4.22</b>	<b>4.44</b>	<b>4.67</b>	<b>4.89</b>
<b>7' DEPTH</b>	<b>S.Y.</b>	<b>3.81</b>	<b>3.92</b>	<b>4.03</b>	<b>4.14</b>	<b>4.26</b>	<b>4.39</b>	<b>4.48</b>	<b>4.59</b>
<b>7' DEPTH</b>	<b>C.Y.</b>	<b>4.41</b>	<b>4.67</b>	<b>4.93</b>	<b>5.19</b>	<b>5.44</b>	<b>5.70</b>	<b>5.96</b>	<b>6.22</b>
<b>8' DEPTH</b>	<b>S.Y.</b>	<b>4.31</b>	<b>4.42</b>	<b>4.53</b>	<b>4.64</b>	<b>4.76</b>	<b>4.87</b>	<b>4.98</b>	<b>5.09</b>
<b>8' DEPTH</b>	<b>C.Y.</b>	<b>5.63</b>	<b>5.93</b>	<b>6.22</b>	<b>6.52</b>	<b>6.81</b>	<b>7.11</b>	<b>7.41</b>	<b>7.70</b>
<b>9' DEPTH</b>	<b>S.Y.</b>	<b>4.81</b>	<b>4.92</b>	<b>5.03</b>	<b>5.14</b>	<b>5.25</b>	<b>5.36</b>	<b>5.47</b>	<b>5.58</b>
<b>9' DEPTH</b>	<b>C.Y.</b>	<b>7.00</b>	<b>7.33</b>	<b>7.67</b>	<b>8.00</b>	<b>8.33</b>	<b>8.67</b>	<b>9.00</b>	<b>9.33</b>
<b>10' DEPTH</b>	<b>S.Y.</b>	<b>5.30</b>	<b>5.41</b>	<b>5.52</b>	<b>5.64</b>	<b>5.75</b>	<b>5.86</b>	<b>5.97</b>	<b>6.08</b>
<b>10' DEPTH</b>	<b>C.Y.</b>	<b>8.52</b>	<b>8.89</b>	<b>9.26</b>	<b>9.63</b>	<b>10.00</b>	<b>10.37</b>	<b>10.74</b>	<b>11.11</b>

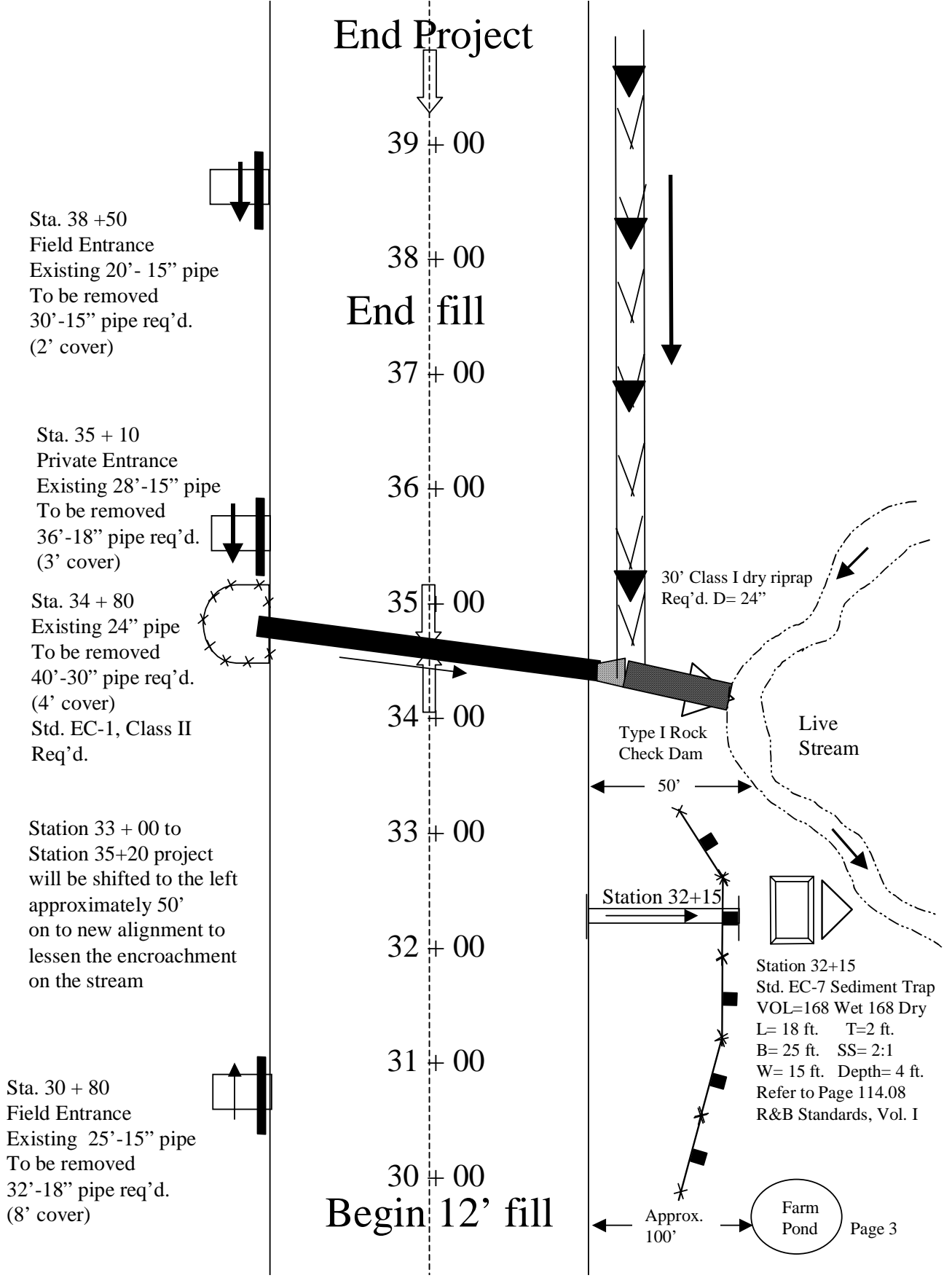
TABLE 1 - TEMPORARY DIVERSION CHANNELS (METRIC)						
M <sup>2</sup> LINING / M <sup>3</sup> EXCAVATION (PER METER)						
		1.00 m WIDTH	1.50 m WIDTH	2.00 m WIDTH	2.50 m WIDTH	3.00 m WIDTH
0.30mDepth	m <sup>2</sup>	2.34	2.84	3.34	3.84	4.34
0.30mDepth	m <sup>3</sup>	0.48	0.63	0.78	0.93	1.08
0.60mDepth	m <sup>2</sup>	3.68	4.18	4.68	5.18	5.68
0.60mDepth	m <sup>3</sup>	1.32	1.62	1.92	2.22	2.52
0.90mDepth	m <sup>2</sup>	5.02	5.52	6.02	6.52	7.02
0.90mDepth	m <sup>3</sup>	2.52	2.97	3.42	3.87	4.32
1.20mDepth	m <sup>2</sup>	6.37	6.87	7.37	7.87	8.37
1.20mDepth	m <sup>3</sup>	4.08	4.68	5.28	5.88	6.48
1.50mDepth	m <sup>2</sup>	7.71	8.21	8.71	9.21	9.71
1.50mDepth	m <sup>3</sup>	6.00	6.75	7.50	8.25	9.00
1.80mDepth	m <sup>2</sup>	9.05	9.55	10.05	10.55	11.05
1.80mDepth	m <sup>3</sup>	8.28	9.18	10.08	10.98	11.88
2.10mDepth	m <sup>2</sup>	10.39	10.89	11.39	11.89	12.39
2.10mDepth	m <sup>3</sup>	10.92	11.97	13.02	14.07	15.12
2.40mDepth	m <sup>2</sup>	11.73	12.23	12.73	13.23	13.73
2.40mDepth	m <sup>3</sup>	13.92	15.12	16.32	17.52	18.72
2.70mDepth	m <sup>2</sup>	13.07	13.57	14.07	14.57	15.07
2.70mDepth	m <sup>3</sup>	17.28	18.63	19.98	21.33	22.68
3.00mDepth	m <sup>2</sup>	14.42	14.92	15.42	15.92	16.42
3.00mDepth	m <sup>3</sup>	21.00	22.50	24.00	25.50	27.00

**EXAMPLE  
 NO PLAN PROJECT  
 EROSION AND SEDIMENT CONTROL PLAN**



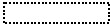



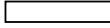

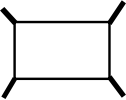

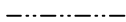
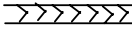


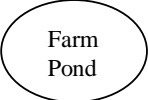
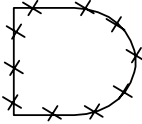






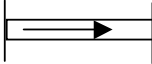






## KEY

### 0000-00-000,N000

	Pipe – Existing		Type II rock check dam
	Pipe – 42” or smaller		Type I rock check dam
	Pipe – 48” or larger		Filter check dam
	Box Culvert		Silt Fence
	Stream or edge of water		EC-2
	Guardrail		EC-3, Type B
	Pond		Inlet protection
	Potential wetland area		EC-1 Outlet protection
	House/dwelling		Dry riprap
	Barn		Sediment trap
			Temporary slope drain

**NOTE:**

- A temporary diversion channel may be required for work in live streams. Must be reviewed and approved by Environmental. (R&B Standard 113.01)
- All E&S controls need to be removed within 30 days after project is stabilized. (MS 18)
- All referenced standards and E&S controls should conform to the latest edition of the VDOT Road & Bridge Standards.
- Refer to contract documents for all quantities. (e.g.: minor structure excavation, bedding, backfill, etc.)
- For additional guidance on E&S controls, refer to I & IM LD-01(D)11.22.
- Dewatering devices may be required at live stream pipe installations.
- All disturbed areas will be stabilized with seed and mulch in accordance with the Roadside Development Sheet.

**FOR THE CURRENT VERSION OF THIS FORM SEE THE VDOT EXTRANET SITE:**

<http://www.extranet.vdot.state.va.us/forms/>

LD-438 Rev. 2-8-02

Page 1 of 2

**GUIDELINES FOR DEVELOPMENT  
OF EROSION & SEDIMENT CONTROL (E&S)  
AND STORMWATER MANAGEMENT (SWM) PLANS  
FOR PROJECTS  
WITH STRAIGHT LINE SKETCHES**

(When each item is satisfied or completed,  
the corresponding box  should be marked with an **X** or **✓**)

- Recommend a maximum of 1000 linear feet of roadway on each 8 ½ x 11 sheet. (Exceptions may be made and will be determined on a case-by-case basis depending on size and scope of project.)
- Site-specific E&S measures should be shown. E&S measures that will be installed consistently throughout the project or for a particular area may be addressed through a note or symbol. For example, "From station \_\_\_ to station \_\_\_, check dams will be placed every \_\_\_ feet" or "Silt Fence Inlet Protection will be installed for all pipe inlets".
- As noted in Instructional & Informational Memorandum LD-01(D) 110.13, sheet 14 of 15, uniform symbols should be used to depict E&S items in the Straight-Line Sketch. These symbols will be provided to the Contract Administrator in digital format.
- ▶ Show the following:
  - The location of any live streams, intermittent or dry channels, wetlands, or ponds to be **IMPACTED BY** the project. This includes pipe or bridge replacements, stream relocations, channel clean outs, etc.
  - The location of any live streams, intermittent or dry channels, wetlands, or ponds **IMMEDIATELY ADJACENT TO** the project. Even though these areas will not be affected or impacted by the project, they must be clearly identified and adequately protected from potential erosion and sediment damage.
  - The location of all existing and proposed culverts and bridges. Identify size (diameter, length, and skew) of new culverts and details of new bridge structures. Provide details on any proposed channel relocations and/or Temporary Detours within project limits associated with culvert placement or bridge construction. (NOTE: The Environmental Section will identify the type of permit needed during the Field Review, or shortly afterward. Be aware that if pipe lengths are increased or other adjustments are made after the Permit Determination has been done, a permit modification *may* be required.)
  - Identify any drainage structures to be left undisturbed.
  - The location of any proposed alignment changes. Specify the location of any areas of new alignment (shifting significantly off of the footprint of the old road). Identify these alignment changes on a Topographical Map.
  - The approximate location and heights of cuts and/or fills throughout the project.

- Specific size or gradation of erosion control treatment (for example, EC-1 Class I Dry Riprap, #1 Aggregate, etc.)
- Show direction of flow arrows for pipes, ditches, streams, etc.
- The approximate location of the discharge of any roadside ditches and cross-pipes. Indicate condition of receiving channel/swale, noting any visible erosion, flood-prone areas, etc. (Photographs of receiving channels are recommended. Documentation should be kept in the Residency's Project File.) Show any existing and proposed drainage easements. (NOTE: Dedicated drainage "easements" may be needed. This need should be determined at the Field Review.)
- The approximate location and size of any **known** borrow or disposal areas.
- Identify any buildings to be demolished, so that necessary asbestos inspection can be scheduled.

- ▶ The following information is required when requesting drainage replacement structures:
  - Specific location of study site on County Road Map or USGS Topographical Map
  - Size of existing drainage structure
  - Height of **existing** cover at study site
  - Proposed** height of fill at study site
  - Comment on existing flooding problems and frequency of flooding
  - Note whether or not there are existing dwellings, buildings, etc. upstream that could be flooded
  - Note whether or not the study site is a live stream
  - Note if existing drainage structure is a premature pipe failure
  - Proposed pipe skew
  - Show flow arrows for pipes
  - In accordance with Instructional and Informational (I&I) Memorandum Number LD-01(D) 223, an End Treatment will be required on culverts regardless of highway classification as noted:
    - All culverts conveying a live stream
    - All culverts with a diameter of 48" or greater
    - All culverts with arch or elliptical configuration and 48" or greater equivalent or accumulated end areas, in the case of multiple lines

*\*\* Please see the referenced memorandum for types of end treatments*
  - In accordance with I&I Memorandum Number LD-01(D) 121.14, a minimum 60" culvert is required for fills (not cover over pipe) that are greater than 20'. The 60" size is needed in high fills for inspection during and after construction and to facilitate future relining of the culvert where the open cut method is not usually a feasible option.
- ▶ For reference purposes, it is suggested that the Contract Administrator be familiar with the following I&I Memoranda:
  - Allowable Pipe Criteria for Culverts – LD-01(D) 121.14
  - Underdrains – LD-01 (D) 130.8
  - Drainage Instructions – LD-01(D) 223
  - Pipe Bedding and Backfill – LD-01 (D) 225
  - General Notes – LD-01 (D) 110.13

**FOR THE CURRENT VERSION OF THIS FORM SEE THE VDOT EXTRANET SITE:**  
<http://www.extranet.vdot.state.va.us/forms/>

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**DRAINAGE INFORMATION SHEET**

Page 1 of

PPMS #  
Route #  
County

Date

Scheduled Advertisement Date \_\_\_\_\_

Contract Administrator \_\_\_\_\_

Project #  
Limits:  
From:  
To:

Type of Facility  
Type of Financing \_\_\_\_\_  
Project Length  
State Forces or Contract \_\_\_\_\_

Description of work \_\_\_\_\_

**Geometrics:**

	Existing	Proposed		Existing	Proposed
No. of Lanes	_____	_____	Lane width	_____	_____
Cut Shoulder Width	_____	_____	Fill Shoulder Width	_____	_____
Ditch Width	_____	_____	R/W Width	_____	_____
Fill Slopes	_____	_____	Cut Slopes	_____	_____
Surface Treatment	_____	_____			

Are there existing Bridges or Live Streams? \_\_\_\_\_

Are there sections to be realigned? \_\_\_\_\_

Are there areas where the grade will be changed? \_\_\_\_\_

Utilities within project limits \_\_\_\_\_

Overall condition of existing Drainage Structures \_\_\_\_\_

Existing Erosion or Siltation Problems \_\_\_\_\_

History of flooding problems \_\_\_\_\_

Are Temporary detours required within project limits during Construction? \_\_\_\_\_

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## DRAINAGE INFORMATION SHEET

Page 2 of

(Please provide the following information for Drainage structures with  
36" or larger openings – Existing or Proposed.)

Location/Station:	Drainage Information	
	Existing	Proposed
Size/Diameter		
Type		
Length		
Cover Height		
Skew		
Live Stream? (Yes/No)	Yes	
Flooding Problems? (Yes/No)	Yes	
Existing dwellings or buildings in the immediate vicinity? (Yes/No)	Yes	

Location/Station:	Drainage Information	
	Existing	Proposed
Size/Diameter		
Type		
Length		
Cover Height		
Skew		
Live Stream? (Yes/No)	Yes	
Flooding Problems? (Yes/No)	Yes	
Existing dwellings or buildings in the immediate vicinity? (Yes/No)	Yes	

Location/Station:	Drainage Information	
	Existing	Proposed
Size/Diameter		
Type		
Length		
Cover Height		
Skew		
Live Stream? (Yes/No)	Yes	
Flooding Problems? (Yes/No)	Yes	
Existing dwellings or buildings in the immediate vicinity? (Yes/No)	Yes	

Location/Station:	Drainage Information	
	Existing	Proposed
Size/Diameter		
Type		
Length		
Cover Height		
Skew		
Live Stream? (Yes/No)	Yes	
Flooding Problems? (Yes/No)	Yes	
Existing dwellings or buildings in the immediate vicinity? (Yes/No)	Yes	

Additional Sheets may be added if necessary.



VIRGINIA DEPARTMENT OF TRANSPORTATION

# LOCATION AND DESIGN DIVISION

## INSTRUCTIONAL AND INFORMATIONAL MEMORANDUM

GENERAL SUBJECT: RIPRAP	NUMBER: IIM-LD-73.3
SPECIFIC SUBJECT: STONE DIMENSIONS SOIL SURVEY CONSTRUCTION PROCEDURE	DATE: JANUARY 24, 1991
	SUPERSEDES: LD-86 (D) 73.2
DIVISION ADMINISTRATOR APPROVAL: E. C. Cochran, Jr.	

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### CURRENT REVISION

- 
- All previous revisions and errata have been incorporated into this memorandum.
- 

### EFFECTIVE DATE

- 
- This memorandum will be effective on projects scheduled for the March 1991 advertisement and all subsequent projects.
- 

### POLICY

- 
- The Road and Bridge Specifications allows Riprap that is primarily placed by the dumped method to be measured by Square Yards or Tons.
  - Unless otherwise requested by the District Administrator at field inspection, the measurement should be in Tons to comply with the suppliers method of measurement and expedite final measurement for payment by field personnel.

## DIMENSIONS AND WEIGHTS

- The following table may be used as a guide for State personnel to correspond certain rock dimensions to equivalent weights. This table is not to be used for acceptance or rejection of Riprap material

APPROXIMATE ROCK DIMENSIONS AND EQUIVALENT WEIGHTS			
WEIGHT	MEAN SPHERICAL DIAMETER	RECTANGULAR SHAPE	
		LENGTH	HT./WIDTH
25 lbs.	0.7'	1.1'	0.4'
50 lbs.	0.8'	1.4'	0.5'
75 lbs.	1.0'	1.6'	0.5'
100 lbs.	1.1'	1.75'	0.6'
150 lbs.	1.3'	2.0'	0.67'
300 lbs.	1.6'	2.6'	0.9'
500 lbs.	1.9'	3.0'	1.0'
1000 lbs.	2.2'	3.7'	1.25'
1500 lbs	2.6'	4.7'	1.5'
2000 lbs.	2.75'	5.4'	1.8'
2 tons	3.6'	6.0'	2.0'
3 tons	4.0'	6.9'	2.3'
4 tons	4.5'	7.6'	2.5'
10 tons	6.1'	10.0'	3.3'

APPROXIMATE PERCENT OF VOIDS	
%	MATERIAL
25	DRY RIPRAP CL.AI
25	DRY RIPRAP CL.I
25	DRY RIPRAP CL.II
25	DRY RIPRAP CL.III
25	DUMPED RIPRAP TY.I
25	DUMPED RIPRAP TY.II
25	EROSION CONTROL STONE
25	GROUTED RIPRAP
25	STONE RIPRAP (CLASSIFICATION SHOWN ON PLANS)

## PROCEDURES

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- A soil survey is to be conducted through areas where a channel change is proposed and through embankment areas where riprap may be required. The plans or profile rolls for the regular soil survey will show the location of channel changes and the location where Riprap will be required on the fill section.
  - Borings along the proposed channel change are to be taken at sufficient intervals to determine the type of material encountered along the slopes and in the bottom of the channel.
  - The borings made in the cut sections or in the borrow pits for construction of the fills are adequate to determine the type of material used in the fills. The test results on the material used in embankments or along channel changes where Riprap is required should include the Plastic and Liquid Limits of the minus No. 40 sieve and the grading or particle size of the total sample. This information should be submitted in the regular soil survey report.
  - The Project Inspector will visually examine the slope upon which the plans designate Riprap to be placed. If the slope material appears coarser than the bedding aggregate specified, the Project Inspector is to notify the District Material Engineer, through normal channels, for a more detailed investigation to determine the actual need for the bedding. If the slope is comprised of solid rock or closely consolidated boulders with soundness, size and weight equal to or exceeding the specifications, for the proposed Riprap, then the riprap may be deleted by the District Construction Engineer.
- 

## PLANS

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- The designer shall specify on the plans the type of Riprap and the dimensions (length, width and depth) for placement. The quantity shall be computed using two (2) tons per cubic yard (148 lbs. per cu. ft.) for plan estimating purposes, unless otherwise specified by the District Administrator.
- The quantities will be field adjusted, utilizing the supplier's stone weight and the applicable Percent (%) of Voids for the Type or Class of material used, to obtain the actual quantity.

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## GENERAL NOTE

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- The applicable portion of the following general note is to be copied on the plans when riprap is specified. (See IIM-LD-110, Drainage Notes D-11 & D-12)

The proposed riprap may be omitted by the Engineer if the slope upon which the plans designate riprap to be placed is found to meet the following criteria: The slope designated for placement of riprap is comprised of solid rock or closely consolidated boulders with soundness, size and weight equal to or exceed the specifications for the proposed riprap. If the slope is found to be comprised of material, which is coarser than the bedding aggregate filter blanket specified on the plans, the aggregate filter blanket may be deleted by the Engineer.

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## PAY ITEMS

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- The Road and Bridge Specifications allow Erosion Control Stone to be measured by the Square Yard or Ton and to include Bedding for Riprap and Riprap Filter Cloth in the price bid for Riprap.

<u>ITEM CODE</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
09150	Erosion Control Stone Class I, Standard EC-1	Ton
09151	Erosion Control Stone Class I, Standard EC-1	Square Yards
09152	Erosion Control Stone Class II, Standard EC-1	Ton
09153	Erosion Control Stone Class II, Standard EC-1	Square Yards

VIRGINIA DEPARTMENT OF TRANSPORTATION

# LOCATION AND DESIGN DIVISION

## INSTRUCTIONAL AND INFORMATIONAL MEMORANDUM

GENERAL SUBJECT: GENERAL NOTES	NUMBER: IIM-LD-110.16
SPECIFIC SUBJECT:	DATE: NOVEMBER 21, 2003
	SUPERSEDES: IIM-LD-110.15
DIVISION ADMINISTRATOR APPROVAL: Mohammad Mirshahi, P.E. Approved November 12, 2003	

Changes are shaded.

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### CURRENT REVISION

- 
- Revisions have been made to the Title Sheet note regarding original Title Sheets.
  - All original, approved Title Sheets are filed in the VDOT Central Office Plan Library.
  - All scanned signatures (inserted into a .dgn file or attached as a reference file to any .dgn file title sheet) must be removed.
- 

### EFFECTIVE DATE

- 
- These instructions are effective upon receipt.
- 

### GENERAL INSTRUCTIONS

- 
- It is unlikely that any one project will need all of the available general notes. Designers should use only those notes that are applicable. It may be necessary to modify notes and/or supplement notes with additional information.
  - Notes referring to dated materials, such as Specifications or Standards, should be updated when new or revised Specifications or Standards take effect, as applicable.
  - The General Notes are available as CADD cells.

- The Drainage and Stormwater Management General Notes to be used on each project will be determined by the Drainage Designer.
  - Dual Units (Metric and Imperial) are shown for informational purposes.
- 

## TITLE SHEET

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- The following notes (available in the CADD Cell Library) shall be shown in the lower left portion of the Title Sheet prior to Field Inspection:
  - THE COMPLETE ELECTRONIC .TIF VERSION OF THE PLAN ASSEMBLY AS AWARDED, INCLUDING ALL SUBSEQUENT REVISIONS, WILL BE THE OFFICIAL CONSTRUCTION PLANS. FOR INFORMATION RELATIVE TO ELECTRONIC FILES AND LAYERED PLANS, SEE THE GENERAL NOTES.
  - DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT.
  - THIS PROJECT IS TO BE CONSTRUCTED IN ACCORDANCE WITH THE DEPARTMENT'S ROAD AND BRIDGE SPECIFICATIONS DATED 2002, ROAD AND BRIDGE STANDARDS DATED FEBRUARY 1, 2001, WORK AREA PROTECTION MANUAL DATED JANUARY 2003 AND AS AMENDED BY CONTRACT PROVISIONS AND THE COMPLETE ELECTRONIC .TIF VERSION OF THE PLAN ASSEMBLY.
  - ALL CURVES ARE TO BE SUPERELEVATED, TRANSITIONED AND WIDENED IN ACCORDANCE WITH STANDARD (see note below) EXCEPT WHERE OTHERWISE NOTED.  
  
Note: Show the appropriate designation: (TC-5.01U, TC-5.01R, TC-5.01ULS (Metric), TC-5.01U (Metric), or TC-5.01R (Metric).
  - THE ORIGINAL APPROVED TITLE SHEET(S), INCLUDING ORIGINAL SIGNATURES, ARE FILED IN THE VDOT CENTRAL OFFICE PLAN LIBRARY. ANY MISUSE OF ELECTRONIC FILES, INCLUDING SCANNED SIGNATURES, IS ILLEGAL AND ENFORCED TO THE FULL EXTENT OF THE LAW.
- For Metric Projects:
  - THIS PROJECT IS TO BE CONSTRUCTED IN ACCORDANCE WITH THE DEPARTMENT'S ROAD AND BRIDGE SPECIFICATIONS DATED JANUARY 1997, 1996 ROAD AND BRIDGE STANDARDS, WORK AREA PROTECTION MANUAL DATED JANUARY 2003 AND AS AMENDED BY CONTRACT PROVISIONS AND THE COMPLETE ELECTRONIC .TIF VERSION OF THE PLAN ASSEMBLY.

- The Classification, Design Traffic Volumes, etc., are to be placed directly under the project number block as shown in the following example:

<b>FUNCTIONAL CLASSIFICATION AND TRAFFIC DATA</b>			
a) MINOR ARTERIAL-DIVIDED-ROLLING-55 MPH MIN. DESIGN SPEED			
	Fr: Rte. 1	Fr: Rte. 640	Fr: Rte. 660
	To: Rte. 640	To: Rte. 660	To: Rte. 301
b)ADT 1996	1840	2700	4180
c)ADT 2018	5080	7320	11300
d)DHV	620	790	1140
e)D (%) (design hour)	55	58	58
f) T (%) (design hour)	5	5	5
g)V (MPH)	*	*	*

- See Plan and Profile Sheets for horizontal and vertical curve design speeds.

Explanations of the foregoing abbreviations:

- a) Road Functional Classification and Minimum Design Speed for this classification.
- b) ADT = Current (existing) Average Daily Traffic (for informational purposes and Maintenance of Traffic)
- c) ADT = Design Average Daily Traffic anticipated in the design year.  
Secondaries = Ad date + 11 years.  
All other systems and selected urban secondaries = Ad date + 22 years.
- d) DHV = Design Hour Volume
- e) D = Directional Distribution Factor (%) for design hour
- f) T = Percent of trucks (2 axles – 6 tires/3 axles or more) for design hour
- g) V = Design Speed (As shown on the plans by the Location and Design Division to determine the posted speed limit and/or the maximum safe speed.)

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### FIRST PROFILE SHEET

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- Levels based on \_\_\_\_\_ Datum.
- 

### GRADING GENERAL NOTES

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- G-1 The grade line denotes top of finished pavement unless shown otherwise on typical sections or plans.

The following applicable notes are for use where settlement is uncertain. (Omit notes G-2 and G-3 if project has both Excavation and Embankment set up as pay items.)

- Applicable when the contract is on plan quantity basis:

G-2 Earthwork quantities on this project are based on anticipated settlement and may require adjusting during construction.

- Applicable when the contract is not on plan quantity basis:

G-3 Earthwork quantities on this project are based on anticipated settlement and may require adjusting during construction. Payment will be made only for quantities actually moved.

- Non-significant masonry items (e.g. sidewalk, curb and gutter, paved ditch, small footings, small block or brick items, etc.) may be included in regular excavation and designated by the following note:

G-4 The cost of removal of all existing concrete items located in the area to be graded, including, but not limited to the following, shall be included in the price bid for regular excavation: \_\_\_\_\_

- When a project has excavation of unsuitable material shown on the plans for a specified depth and undercut excavation is not set up as a bid item, the following note will be used:

G-5 The excavation of unsuitable material as specified on these plans is based on previously conducted subsurface soil investigation. If, during construction, it is deemed necessary to change the depth more than 1 foot (0.3 m) or the limits of such excavation, such change shall be made at the direction of the Engineer and measurement and payment shall be made in accordance with Section 303 of the applicable VDOT Road and Bridge Specifications.

G-6 The borrow material for this project shall be a minimum CBR \_\_\_\_\_ or as approved by the Materials Engineer.

G-7 Material from regular excavation which is suitable for stabilization with hydraulic cement (lime) shall be placed in the top portion of the subgrade.

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## DRAINAGE GENERAL NOTES

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D-1 The locations of all drainage structures shown on these plans are approximate only, with the exception of structures showing specific stations, special design bridges and storm sewer. The "h" dimensions shown on the plans for drop inlets and junction boxes and the L.F. (m) dimensions shown for manholes are approximate.

D-2 If, during construction, the culvert invert elevations shown on the plans are found to differ significantly from the elevations of the stream or swale in which the culvert shall be placed, the Engineer will confer with the Project Drainage Designer before installing the culvert.



- The following note is to apply, only at specific locations that are designated on the District Administrator's Field Inspection Report. The portion regarding "Excavation For Minor Structures" will apply to single and multiple line culvert and arch installations with an overall span or diameter of 48" (1200 mm) or greater.
- D-3 At Station \_\_\_\_\_, the fill shall be placed, allowed to settle and displace all soft materials. Any necessary temporary drainage shall be installed. When directed by the Engineer, that part of the fill necessary for the installation of the permanent drainage structure shall be removed and the structure placed. The cost of installing and removing the temporary drainage facility, the cost of removing the fill for installation of permanent drainage (above the original ground) and the cost of backfill shall be included in the unit price bid for regular excavation. Excavation below the original ground necessary for the installation of the permanent drainage structure will be measured and paid for in accordance with Section 303 of the applicable VDOT Road and Bridge Specifications.
- If the cost of constructing fills is to be paid for as "embankment" make the appropriate change in the previous note.
  - The following note is to be included in the General Notes under "Drainage" for all projects that have locations that do not allow the use of uncoated Corrugated Steel pipe, if Structural Plate Steel pipe is required or allowed as an option:
- D-4 In locations where Galvanized Steel Pipe is allowed that require a paved invert, the paved invert shall be a factory applied asphalt paving or a field applied concrete invert. As an option, the plates along the bottom 25% (minimum) of the circumference of the Galvanized Structural Plate Steel Pipe or the bottom and corner plates of the Galvanized Structural Steel Pipe Arch shall be a minimum of two sheet thickness (gage) heavier than the sheet thickness (gage) indicated in the applicable VDOT Road and Bridge Standard PC-1 for applicable cover.
- Example: For a pipe with cover requiring 0.109" (2.8 mm) sheet thickness (12 gage) plates, the bottom plates shall be 0.168" (3.5 mm) sheet thickness (8 gage). The sheet thickness (gage) of the remainder of the pipe plates shall either conform to Standard PC-1 or to the heavier plates used in the bottom of the pipe.
  - The previous note addresses those locations where use of uncoated Corrugated Steel Pipe is not allowed. If there are locations on the project that allow the use of uncoated corrugated Steel pipe, and Structural Plate Steel Pipe is required or allowed as an option to Corrugated Steel Pipe the following note will be included in the General Notes under "Drainage":
- D-5 At locations on this project where uncoated Corrugated Steel Pipe is allowed, and where Structural Plate Steel Pipe is required or is allowable as an option to Corrugated Steel Pipe, no change in the sheet thickness (gage) of the structural plates, specified in the applicable VDOT Road and Bridge Standard PC-1, is required.
- Both of the previous notes will be shown in the General Notes if each of the conditions exists on a project.

- The following note is applicable when multiple types of pipes are allowed:
- D-6 Pipes shall conform to any of the allowable types shown on sheet number \_\_\_\_\_, within the applicable fill height limitations. For strength, sheet thickness, or class designation; available sizes; height of fill limitations; and method of bedding required for a particular height of cover, see Standard PC-1 and PB-1. Structural plate pipe may be substituted for corrugated pipe of the same size and a structural plate pipe arch may be substituted for a corrugated pipe arch of the same size, provided the substitution complies with the applicable VDOT Road and Bridge Standard PC-1 and PB-1.
- D-7 (Deleted)
- The following note is applicable when only one type of pipe is allowed (No Allowable Pipe Type Table is required):
- D-8 All pipe on this project shall be (Specify Type). For strength, sheet thickness, or class designation; available sizes; height of fill limitations; and method of bedding required for a particular height of cover, see applicable VDOT Road and Bridge Standards PC-1 and PB-1.
- The following notes (D-9 and D-10) are applicable when the plans specify that concrete pipe shall be laid on a radius.  
(See IIM LD- (D) 223).
- D-9 A pipe joint length different from that stated on the plans may be used. An adjustment in the percentage of open joint or amount of bevel shall be made that will obtain the radius stated on the plans. Extra payment for this adjustment will not be allowed. The proposed adjustment will be approved by the Engineer prior to installation of pipe line.
- D-10 Where open joint pipe is used, no joint shall be opened a distance exceeding 25% of the spigot length. Sealing of the pipe joint shall be in accordance with Section 302 of the applicable VDOT Road and Bridge Specifications.
- The following note is applicable when riprap is specified:
- D-11 The proposed riprap may be omitted by the Engineer if the slope is found to meet the following criteria: The slope designated for placement of riprap is comprised of solid rock or closely consolidated boulders with soundness, size and weight equal to, or exceeding, the specifications for the riprap.
- The following note is applicable when a granular filter blanket is used in lieu of geotextile fabric bedding. This does not apply to the aggregate cushion which is placed over the geotextile fabric in certain cases.

- D-12 The proposed riprap may be omitted by the Engineer if the slope is found to meet the following criteria: The slope designated for placement of riprap is comprised of solid rock or closely consolidated boulders with soundness, size and weight equal to or exceeding the specifications for the riprap. If the slope is found to be comprised of material which is coarser than the bedding aggregate filter blanket specified on the plans, the aggregate filter blanket may be omitted by the Engineer.
- D-13 All existing drainage facilities labeled "to be abandoned" shall be left in place, backfilled and plugged in accordance with Road and Bridge Standard PP-1. Payment will be in C.Y. (m<sup>2</sup>) of Flowable Backfill.

The previously mentioned sheet may be obtained from the CADD Insertable Sheet Directory.

- D-14 Existing drainage facilities being utilized as a part of the drainage system, and designated on the plans "To Be Cleaned Out", shall be cleaned as directed by the Engineer. The cost incidental to this shall be included in the contract price for other items.
- D-15 Drop inlets with "H" less than standard minimum shall be considered as standard and quantities adjusted accordingly. Where noted on the plans or as directed by the Engineer, concrete pipe with less than standard minimum cover shall have bedding material placed up to half the pipe diameter and shall be minimum of Class III.
- D-16 Where plans specify Standard Curb Drop Inlets adjacent to (Specify City of \_\_\_\_\_, etc.) standard curb and gutter, the drop inlets shall be modified in accordance with details shown on sheet\_\_\_\_. These drop inlets shall be considered Standard Drop Inlets and paid for as such.
- D-17 When CG-6 or CG-7 is specified on a radius (such as at an intersection), the Engineer may approve a decrease in the cross slope of the gutter to facilitate proper drainage.

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## PAVEMENT GENERAL NOTES

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- The following note applies to projects without bridge approach slabs.
- P-1 If any settlement occurs in concrete pavement adjacent to bridges prior to acceptance of the project by the Department, the contractor shall restore the pavement to the original grade either by the mud jack method or by replacing the pavement. In the event the pavement cracks or becomes damaged, it shall be replaced, if directed by the Engineer.
- P-2 The pavement materials on this project will be paid for on a tonnage basis. The weight will vary in accordance with the specific gravity of the aggregates and the asphaltic content of the mix actually used to secure the design depth. The weight of the asphalt concrete is based on 95% of theoretical maximum density. (See IIM LD-158)

P-3 Deleted

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## INCIDENTAL GENERAL NOTES

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- On Primary and Secondary projects involving grade crossings to remain in place, show the following notes in the General Notes, on applicable plan sheets and in the summary. Do not include the railroad crossbuck signs in the estimate.
- I-1 Two Reflectorized Railroad Grade Crossing Crossbuck Signs, complete with posts, SHALL BE FURNISHED AND ERECTED BY THE RAILROAD COMPANY.
- I-2 Two Reflectorized Railroad Advance Warning Signs W10-1 complete with two approved posts, WILL BE FURNISHED AND ERECTED BY STATE FORCES.
- The following note applies to all projects where access to private property will ultimately be by means of a service road. This note will be on the plans for all applicable projects when submitted for Right of Way Acquisition:
  - I-3 Service Roads are to be constructed, and private entrances connected thereto prior to the permanent severing of private entrances by other phases of the proposed construction.
- Principal-Minor Arterial Projects:
  - I-4 All trees located within the Clear Zone or within a minimum of 9 m (30 feet) of the edge of pavement, within the limits of the right of way or construction easement, unless otherwise noted on plans or directed by the Engineer, shall be removed, as provided for in Section 301 of the applicable VDOT Road and Bridge Specifications.
- Secondary – Collector – Local Projects:
  - I-5 That portion of the right of way lying within the Clear Zone or within a minimum of 10 feet (3 m), from the edge of pavement or surfacing or within the limits of the construction slopes beyond 10 feet (3 m), shall be cleared and grubbed in accordance with the applicable VDOT Road and Bridge Specifications, Section 301, where sufficient right of way or construction easement is provided.

### Exceptions:

- I-6 Certain trees shall be preserved as noted on plans or as directed by the Engineer.
- I-7 Where Standard slope roundoffs would damage trees, bushes or other desirable vegetation, they shall be omitted when so ordered by the Engineer.

- The following note shall be shown on all applicable plans when submitted for right of way acquisition:
  - I-8 All fruit trees between Station \_\_\_\_\_ and Station \_\_\_\_\_, lying within the right of way, shall be removed and destroyed. These trees shall be removed and destroyed as soon as possible after the contractor actually commences work. The cost of this work shall be included in the price bid for clearing and grubbing.
- When the following note applies to specific locations on a project, show Sta. \_\_\_\_\_ to Sta. \_\_\_\_\_.
  - I-8A Clearing and grubbing shall be confined to those areas needed for construction. No trees or shrubs in ungraded areas shall be cut without the permission of the Engineer. Station \_\_\_\_\_ to Station \_\_\_\_\_.
- I-9 When no centerline alignment is shown for a proposed entrance, the entrance shall be constructed in the same location as the existing entrance.
- The following note is to be used on all applicable projects as follows:
  - a) Projects using St'd. RM-2 Monuments only – select note I-11 or I-12.
  - b) Projects using both St'd. RM-1 and RM-2 Monuments – select notes I-10 and (I-11 or I-12)
  - c) Projects using Standard RM-1 only – select note I-10.
- I-10 St'd. RM-1 Right of Way monuments shall be set by the Contractor.
- I-11 St'd. RM-2 right of way monuments will be set by the State Survey Party at the time of stakeout or after construction is complete, if pin location is within construction limits.
- I-12 St'd. RM-2 right of way monuments shall be set by the Contractor.
- The following notes will be included in the General Notes when “Reuse Guardrail” is specified in the plans as follows:
  - a) Used when the District Administrator desires to retain the guardrail component materials not used by the Contractor in the new construction:
- I-13 Salvaged guardrail materials not used in the new construction shall become the property of the Department and the Contractor shall deliver and store, at no additional cost to the Department, the unused materials at the Department’s maintenance yard at (location) during the Department’s normal working hours.
  - b) Used when the District Administrator does not wish to retain the guardrail component parts not used by the Contractor in the new construction:
- I-14 Salvaged guardrail materials not used in the new construction shall become the property of the Contractor and shall be disposed of at a licensed landfill, recycled or be retained by the contractor.

- The following note may be used with note I-13 or I-14:
- I-15 Where Guardrail GR-2 or GR-8 is shown on the plans and in the summaries, either new guardrail or reused guardrail beam shall be used as provided elsewhere in these plans. The total quantities have been proportioned between new and reuse guardrail based on an estimate of the amount of existing beam that is reusable. The Contractor will be paid for the actual quantities of Guardrail, St'd GR-2 or St'd. GR-8, or Reuse Guardrail St'd. GR-2 or St'd GR-8, as determined by the Engineer.
- The following note will be included in the General Notes when the "Underground Utilities" survey data on a project has been provided by a consultant.  
 (See IIM LD - (D) 140)
- I-16 The "Underground Utilities" survey data on this project has been provided by consultant and copies are available from the Department.
- The following note is applicable in accordance with IIM LD - (D) 175):
- I-17 For method of constructing Straight-Line Taper Lanes in Curb and/or Curb and gutter sections, see typical details on Sheet \_\_\_\_\_.
- I-18 All pavement markings and traffic flow arrows shown on the roadway construction plans are schematic only. The actual location and application of pavement markings shall be in accordance with Section 704 of the applicable VDOT Road and Bridge Specifications, MUTCD, sequence of construction/traffic control plans, pavement marking plan sheets \_\_\_\_\_ thru \_\_\_\_\_ and as directed by the Engineer.
- The following note is applicable to projects having work performed by others:
- I-19 The following outside sources, under contract with VDOT, have provided information on this project.

Hydraulic Design	(Show Name of Source)			
Roadway Design	"	"	"	"
Utility Design	"	"	"	"
Utility Designation	"	"	"	"
Utility Location	"	"	"	"
Survey	"	"	"	"
Bridge Design	"	"	"	"

- If questions or problems arise during construction, please contact the Project Designer. DO NOT CONTACT THE OUTSIDE SOURCES. The following notes are applicable to all projects:
- I-20 The Official Electronic .tif Version of the plans will override the paper copies or prints of specific layers.

Portions of this plan assembly have been CADD generated. To assist in the construction of the project electronic files will be available to the prime contractor during bids and after award of the contract.

- I-21 All electronic plan assemblies will include the construction plans in two formats: .tif files and Microstation format (.dgn) files. Only the .tif files will be considered as part of the official plan assembly.

The Microstation format (.dgn) files are furnished only as information for the contractor. These plans are developed in layers (levels) to aid in readability. However, the construction items may or may not be in the proper layering scheme as described in the VDOT CADD Manual. The Microstation files will only match the scanned files if all required levels are turned on. A Microstation Software license is required to be able to read these files.

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## STORMWATER MANAGEMENT (SWM) GENERAL NOTES

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- S-1 CLEARING AND GRUBBING – The area where the dam is to be constructed and the area upstream of the dam, to an elevation equal to the crest of the dam (maximum ponded water elevation), shall be cleared and grubbed in accordance with Section 301 of the applicable VDOT Road and Bridge Specifications.

and shall be constructed in accordance with Section 303 of the applicable VDOT Road and Bridge Specifications. The native material on which the dam will set shall meet the specifications for AASHTO Type A-4 or finer material. Where the native material does not meet this requirement, the area beneath the dam is to be excavated a minimum of 4' (1.2 m) and backfilled with a material meeting the AASHTO Type A-4 or finer classification unless otherwise specified in the plans. The material used for the embankment of the dam shall be AASHTO Type A-4 or finer or otherwise specified in the plans. Dams with foundation and embankment material not meeting the above requirements or dams greater than 15' (4.6 m) in height shall incorporate a membrane-lined trench, a homogenous embankment with seepage controls, a zoned embankment or other such approved designs as specified in the plans.

- S-3 OUTLET PIPE – The pipe culvert under or through the dam shall be reinforced concrete pipe with rubber gaskets in accordance with Section 232 and 212 of the applicable VDOT Road and Bridge Specifications. A concrete cradle shall extend the full length of the pipe culvert in accordance with the Standard Drawings. The connection between the pipe culvert and the SWM Drainage Structure (or other control structure) shall be made watertight as approved by the Engineer and the cost shall be included in the price bid for the pipe.

- S-4 The SWM Drainage Structure (or other control structure) shall have 4" (100 mm) high numbers and 1" (25 mm) wide stripes painted at 1' (300 mm) intervals as shown on the Standard Drawings or detail sheets. Paint and application shall be in accordance with Section 231 and 411 of the applicable VDOT Road and Bridge Specifications and the cost is to be included in the price bid for the applicable structure.

- S-5 All SWM Basins designated for use as temporary sediment basins shall be constructed during the initial phase of earth moving activities. During project construction, the SWM Drainage Structure or other control structure shall be modified in accordance with the Standard Drawings or plan details in order to provide a temporary sediment basin with both a “wet” storage volume (permanent pool) and a “dry” storage volume. Sediment accumulated in the basin shall be removed when the volume of the “wet” storage (permanent pool) has been reduced by approximately 50%. Sediment shall be disposed of as approved or directed by the Engineer.
- S-6 When project construction is complete to a stage where no additional sediment from the project is expected to enter the basin, as determined by the Engineer, the basin shall be cleaned out and restored to the original design elevations, the area stabilized and all temporary modifications to the SWM Drainage Structure or other control structure removed.

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## EROSION AND SEDIMENT (E&S) CONTROL GENERAL NOTES

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- E-1 The temporary erosion and siltation control items shown on the E&S Control Plan are intended to provide a general plan for controlling erosion and siltation within the project limits. The E&S Control Plan is based on field conditions at the time of plan development and an assumed sequence of construction. The contractor, in conjunction with the Project Engineer and/or Environmental Monitor, shall adjust the location, quantity and type of erosion and siltation control items required based on the actual field conditions encountered at the time of construction and the selected sequence of construction.
- E-2 The areas beyond the project’s construction area are to be protected from siltation. Perimeter controls such as filter barrier, silt fence, diversion dikes, turbidity curtains, etc. shall be installed prior to any grubbing operations or other earth moving activities.
- E-3 All channel relocations are to be constructed during the earliest stage of construction and shall be constructed in the dry wherever possible. Stabilization or vegetation shall be established before flow is redirected through the constructed area as directed by the Engineer.
- E-4 If the removal of Brush Silt Barrier is required by the Engineer, the cost of removal and disposal of brush shall be in accordance with Section 109 of the applicable VDOT Road and Bridge Specifications.
- E-5 Rock for Check Dams, Drop Inlet Silt Traps, Erosion Control Stone and Riprap in channels shall be in accordance with Section 203 and Section 414 of the applicable VDOT Road and Bridge Specifications.
- E-6 Silt removal and sediment clean-out from erosion and siltation control items shall be performed in accordance with the following:



















Temporary Sediment Basins and Sediment Traps - When the “wet” storage volume (permanent pool) has been reduced by 50%.

- Dewatering Basins - When the excavated volume has been reduced by 50%.

All other Erosion and Siltation Control items - When the capacity, height or depth has been reduced by 50%.

E-7 The following symbols are used to depict Erosion Control items in the plan assembly:

		<b>Denotes Temporary Filter Barrier</b>
		<b>Denotes Temporary Silt Fence</b>
		<b>Denotes Temporary Diversion Channel</b>
		<b>Denotes Temporary Diversion Dike</b>
		<b>Denotes Temporary Silt Trap</b>
		<b>Denotes Rock Check Dam , Type I</b>
		<b>Denotes Rock Check Dam , Type II</b>
		<b>Denotes Culvert Inlet Protection</b>
		<b>Denotes Drop Inlet Silt Trap</b>
		<b>Denotes Existing Contours</b>
		<b>Denotes Proposed Contours</b>

- The previous symbols are to be used to denote erosion control items and are available as CADD cells. The following note is to be placed on level 63 of all applicable plan sheets (cell name: ESNOTE1):

**NOTE: SEE GENERAL NOTES FOR E&S LEGEND**

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**ELECTRONIC SELECTION OF GENERAL NOTES**

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Microstation has the capability of incorporating the necessary inserts in the General Notes (e.g. sheet number, station, etc.) and also incorporating any additional notes that are required for the project. The General Notes are to be shown for the applicable unit of measurement (Imperial or Metric). General Notes with metric units are denoted by the suffix “M”.

- A General Notes Sheet file is created as follows:
  - Create a file in MicroStation by using the **SEEDGEN.DGN** seed file.

- Ensure that the **LGNOTE.CEL** is part of the workspace search list for MicroStation cell library. (If you are using the **LD** workspace, then this is already set.)

Type **macro gnote** in the “Key-in Windows”. This will start a MicroStation macro command that will prompt you for information about the General Notes Sheet.

- Select the notes needed, or select the **Select All** button, then de-select the notes that are not needed. The **Add Sp** button will prompt you for additional spaces that you may need between each note header.

**EXAMPLE:**

**GENERAL NOTES SELECTION SCREEN**

**General Notes - Version 1.3**

**Pick The General Notes That You Need**

Grading	Drainage	Pavement	Incidentals	Stormwater	Erosion
<input type="checkbox"/> G - 1	<input type="checkbox"/> D - 1	<input type="checkbox"/> P - 1	<input type="checkbox"/> I - 1	<input type="checkbox"/> S - 1	<input type="checkbox"/> E - 1
<input type="checkbox"/> G - 2	<input type="checkbox"/> D - 1M	<input type="checkbox"/> P - 2	<input type="checkbox"/> I - 2	<input type="checkbox"/> S - 2	<input type="checkbox"/> E - 2
<input type="checkbox"/> G - 3	<input type="checkbox"/> D - 2	<input type="checkbox"/> Add Sp	<input type="checkbox"/> I - 3	<input type="checkbox"/> S - 3	<input type="checkbox"/> E - 3
<input type="checkbox"/> G - 4	<input type="checkbox"/> D - 3		<input type="checkbox"/> I - 4	<input type="checkbox"/> S - 4	<input type="checkbox"/> E - 4
<input type="checkbox"/> G - 5	<input type="checkbox"/> D - 4		<input type="checkbox"/> I - 4M	<input type="checkbox"/> S - 4M	<input type="checkbox"/> E - 5
<input type="checkbox"/> G - 5M	<input type="checkbox"/> D - 5		<input type="checkbox"/> I - 5	<input type="checkbox"/> S - 5	<input type="checkbox"/> E - 6
<input type="checkbox"/> G - 6	<input type="checkbox"/> D - 6		<input type="checkbox"/> I - 5M	<input type="checkbox"/> S - 6	<input type="checkbox"/> E - 7
<input type="checkbox"/> G - 7	<input type="checkbox"/> D - 8		<input type="checkbox"/> I - 6	<input type="checkbox"/> Add Sp	<input type="checkbox"/> Add Sp
<input type="checkbox"/> Add Sp	<input type="checkbox"/> D - 9		<input type="checkbox"/> I - 7		
	<input type="checkbox"/> Add Sp		<input type="checkbox"/> I - 8		
			<input type="checkbox"/> I - 8A		
			<input type="checkbox"/> I - 9		
			<input type="checkbox"/> Add Sp		

**Add Sp - Additional Spaces That Are Needed**

OK Cancel Select All

VIRGINIA DEPARTMENT OF TRANSPORTATION

# LOCATION AND DESIGN DIVISION

## INSTRUCTIONAL AND INFORMATIONAL MEMORANDUM

GENERAL SUBJECT: ROADSIDE DEVELOPMENT	NUMBER: IIM-LD-122.11
SPECIFIC SUBJECT: ROADSIDE DEVELOPMENT SHEET; COORDINATION; COMPUTING QUANTITIES/SUMMARIZATION	DATE: JANUARY 13, 2005
	SUPERSEDES: IIM-LD-122.10
DIVISION ADMINISTRATOR APPROVAL: Mohammad Mirshahi, PE Approved January 13, 2005	

Changes are shaded.

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### CURRENT REVISION

- 
- Updated primary points of contact.
  - Added Pay Item for Erosion Control Mulch in S.Y./m2.
- 

### EFFECTIVE DATE

- 
- These instructions are effective upon receipt.
- 

### POLICY

- 
- The Roadside Development Sheet and the Erosion Control Summary Sheet are to be included in project plan assemblies.
  - The Roadside Development Summary will indicate the Asset Management Division's recommended seed mixtures, and estimated quantities for Topsoil, Seeding (Regular and Legume), Fertilizer and Lime.
  - Seed additives (e.g. foxtail millet) are paid for as Regular Seeding except Crown Vetch, Sericea Lespedeza and Birdsfoot Trefoil
  - Seed mixture recommendations may at times deviate from the seed mixture guidelines on the Roadside Development Sheet. The District Roadside Manager will provide recommendations for the application of seed mixtures (core mix and additives), fertilizer, lime, etc.

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## SPECIAL INSTRUCTIONS

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- The approximate area (hectares or acres) to be disturbed will be shown under “Notes” on the Roadside Development Sheet. This area is not to be expanded for estimating purposes.
  - Notes on the Roadside Development Sheet marked by a star are for the use of field forces only. The Designer is not to use any percentages shown under “Notes” on the Roadside Development sheet when computing quantities.
- 

## MULCH

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- Roadside Development involves two categories of mulch as follows:
  - Seeding Mulch, Type I or II is applied in the field with the seed mixture. This mulch is included in the price for the regular seeding and is not summarized in the plans.
  - Erosion Control Mulch is summarized on the Erosion Control Summary Sheet when recommended by the Asset Management Division. This material is estimated at the rate of 0.25 acres (1,210 S.Y.) per 100 feet of alignment or 0.332 hectares (3,319 m<sup>2</sup>) per 100 meters of roadway alignment) and is to be paid for as follows:

<u>PAY ITEM</u>	<u>UNIT</u>	<u>ITEM CODE</u>
Erosion Control Mulch	Acres (Hectare)	27288
Erosion Control Mulch	S.Y. (m <sup>2</sup> )	27284

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## LEGUME SEEDING

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- The seed mixes available for roadside development include three “Legume” seeds, Crown Vetch, Sericea Lespedeza and Birdsfoot Trefoil specified as additives “E, F, and G” on the Roadside Development Sheet.
- These Legume seeds are used only on slopes 3:1 or greater and are not used on shoulders or other locations to be mowed.
- Legume Seed, and Legume Overseeding are to be summarized for separate payment.
- Whenever the Asset Management Division specifies any of these Legume seeds, the mowable areas on the project (slopes flatter than 3:1) and non-mowable areas (slopes 3:1 and greater) must be measured separately in order to accurately summarize the seeding requirements.

## ESTIMATING QUANTITIES

- If the lime application rate is not provided by the **Asset Management** Division, the Designer should estimate the Normal Lime Quantity based on 5 metric tons per hectare (2 tons per acre).
- If the fertilizer application rate is not provided by the **Asset Management** Division, the Designer should estimate the Normal Fertilizer Quantity based on 675 kilograms per hectare (600 pounds per acre).
- The seed mixtures (core mix plus additives) shown on the Roadside Development Sheet are weights per hectare (or acre) of disturbed area. These quantities may vary for each construction season.
- The Designer is advised to:
  1. Determine the disturbed area to be seeded.
  2. Determine the application rate for the sloped and mowed areas shown for each construction season.

Example for Seed Mix 2E:

100 lbs. Core Mix + 20 lbs. Additive = 120 lbs.

3. The greatest seeding rate is assumed to be the “Normal” Seeding rate.

Example for 10 acre area:

### MIX REQUIREMENTS ON THIS PROJECT

PROJECT NUMBERS	SLOPES	MOWED	SLOPES	MOWED	SLOPES	MOWED
	SPRING & FALL		SUMMER		LATE FALL & WINTER	
0123-123-103	2E	2B	3A	3A	4B	4B
	120 LBS.	120 LBS.	110 LBS	110 LBS.	120 LBS.	120 LBS.

The Normal Seeding rate = 120 lbs. per acre.

120 lbs. x 10 acres of disturbed area = 1200 lbs. “Normal” Seeding Quantity

- When a legume seed additive is specified (Crown Vetch, Sericea Lespedeza or Birdsfoot Trefoil) the sloped areas and mowed areas must be measured separately when summarizing seeding quantities.
  1. Determine the flat (less than 3:1) areas and sloped (3:1 and greater) areas to be seeded.
 

Example: 10 acres of mowed areas; 5 acres of sloped areas.
  2. Determine the application rate for the mowed areas.

Example for "Seed Mix 2B": 100 lbs. Core Mix + 20 lbs. Additive = 120 lbs.

- Determine the application rate for the sloped areas:

Example for Seed Mix 2E: Core Mix "2" = 100 lbs.; Additive E" = 20 lbs.

- Determine the quantities of Regular Seed and Legume Seed.

Example for mowed area (Seed Mix 2B):

Core Mix 100 lbs. + 20 lbs. = 120 lbs. x 10 acres = 1200 lbs. Regular Seed

Example for sloped areas (Seed Mix 2E):

100 lbs. x 5 acres = 500 lbs. Regular Seed

20 lbs. x 5 acres = 100 lbs. Legume Seed

- The "Normal" quantities for lime, fertilizer, and seeding are based on the actual area to be disturbed. The "Normal" quantities are to be increased by the following percentage factors to obtain the quantity to show in the summary:
  - Lime = Normal Quantity increased by 90%
  - Fertilizer (15-30-15)= Normal Quantity increased by 90%
  - Regular Seed = Normal Seeding Quantity increased by 60%
  - Overseeding=100% of Normal Seeding Quantity (no mulch or fertilizer)
  - Legume Seed = Normal Seeding Quantity increased by 60%
  - Legume Overseeding = 100% of Normal Seeding Quantity (no mulch or fertilizer)

Examples for determining quantities to summarize:

20 tons "normal" Lime x 1.90 (or 190%) = 38 tons Lime

3 tons "normal" Fertilizer x 1.90 (or 190%) = 5.7 or 6 tons Fertilizer

1700 lbs."normal" Seeding x 1.60 (or 160%) = 2720 lbs. Regular Seeding

1700 lbs. "normal" Seeding (@ 100%) = 1700 lbs. Overseeding

100 lbs. "normal" Legume Seeding x 1.60 (or 160%)= 160 lbs. Legume Seed

100 lbs. "normal" Legume Seeding (@ 100%) = 100 lbs. Legume Overseeding

## PAY ITEMS

• Lime	Metric Ton/Ton	27250
• Fertilizer	Metric Ton/Ton	27215
• Regular Seed	kg/lbs.	27102
• Overseeding	kg/lbs.	27103
• Legume Seed	kg/lbs.	27104
• Legume Overseeding	kg/lbs.	27105
• Topsoil Class A	ha/acres	27012
• Topsoil Class B	ha/acres	27022
• Erosion Control Mulch	ha/acres/m <sup>2</sup> /S.Y.	27288

## REVIEW BY ASSET MANAGEMENT DIVISION

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- The Roadside Development Sheet is to be reviewed by the Asset Management Division prior to submission of the plan assembly for construction.
  - Anytime the current Roadside Development Sheet is replaced by a revised Roadside Development Sheet, the District Roadside Manager should be requested to determine the need for any changes in seed mixes, quantities, etc.
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## INSERTABLE SHEETS

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- The Roadside Development Sheet may be obtained through the CADD Insertable Sheet Directory.
  - Special Design Section Drawing No. A-4 (Imperial)
  - Special Design Section Drawing No. MA-4 (Metric)
- The Erosion Control Summary Sheet may be obtained through the CADD Insertable Sheet Directory.
  - Special Design Section Drawing No. A-5 (Imperial)
  - Special Design Section Drawing No. MA-5 (Metric)

VIRGINIA DEPARTMENT OF TRANSPORTATION

# LOCATION AND DESIGN DIVISION

## INSTRUCTIONAL AND INFORMATIONAL MEMORANDUM

GENERAL SUBJECT: SOIL STABILIZATION MAT	NUMBER: IIM-LD-166.3
SPECIFIC SUBJECT: STANDARD EC-3	DATE: March 22, 1996
	SUPERSEDES: LD-94 (D) 166.2
DIVISION ADMINISTRATOR APPROVAL: J. T. Mills	

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### CURRENT REVISION

- 
- All previous revisions and errata have been incorporated into this memorandum.
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### EFFECTIVE DATE

- 
- These instructions are effective on all projects scheduled for the August 1996 advertisement and all subsequent projects.
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### POLICY

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#### Ditches

- Geotextile materials designated as Standard EC-3 (Type A and B) Soil Stabilization Mat are used for protective linings in ditches.
- Standard EC-3 Soil Stabilization Mat is intended to be used as a protective ditch lining material to be applied when the design velocity exceeds the allowable velocity for Standard EC-2 (i.e., jute mesh).
- When the design velocity exceeds the allowable velocity for Standard EC-3, a paved (or riprap) lining will be required.



## Slopes

- The Standard EC-3 (Type C) Soil Stabilization Mat may be used as a protective slope lining for dry cut or fill slopes and wet cut slopes to stabilize the slope on which vegetation is being established. (See Road and Bridge Standards)
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## TYPES AND APPLICATION

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### Ditches

- Type A is to be employed where the design (2 year) velocity in the ditch is within the range of 1.2 to 2.1 meters per second (m.p.s.) (4 to 7 f.p.s.)
  - Type B is to be employed where the design velocity is within the range of 2.1 to 3.0 m.p.s. (7 to 10 f.p.s.)
  - A Manning's "n" value of 0.05 should be used with Standard EC-3.
  - Typically, the use of Standard EC-3 Type A should begin at the point where flow velocity exceeds 1.2 m.p.s. (4 f.p.s.) (velocity is assumed to be for flow in an EC-2 lined channel) and continue changing to EC-3, Type B at the appropriate point, until the design velocity exceeds 3.0 m.p.s. (10 f.p.s.) or until such point as the use of a ditch lining can be discontinued.
  - Experience has shown that the installation of this material is particularly critical. It must be installed in strict accordance with the standard drawings and manufacturer's specifications.
  - It is requested that Standard EC-3 (Type A and B) installations be monitored very closely to determine the validity of the present design criteria. It is recommended that the District Drainage Engineer, in cooperation with appropriate District Environmental and/or maintenance personnel, visit these installations, particularly after significant or intense rainfall events, and prepare a report of their observations which would then be submitted to the Central Office Hydraulics Section on a regular basis until further notice.
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## PAY ITEMS AND SUMMRIZATION

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The following items are to be summarized, when applicable, in the Erosion & Sediment Control Summary:

<u>ITEM</u>	<u>UNIT</u>	<u>ITEM CODE</u>
Soil Stabilization Mat EC-3, Type A	m <sup>2</sup> (S.Y.)	27325
Soil Stabilization Mat EC-3, Type B	m <sup>2</sup> (S.Y.)	27326
Soil Stabilization Mat EC-3, Type C	m <sup>2</sup> (S.Y.)	27327

VIRGINIA DEPARTMENT OF TRANSPORTATION

# LOCATION AND DESIGN DIVISION

## INSTRUCTIONAL AND INFORMATIONAL MEMORANDUM

GENERAL SUBJECT: MANAGEMENT OF STORMWATER	NUMBER: IIM-LD-195.5
SPECIFIC SUBJECT: ENGINEERING AND PLAN PREPARATION	DATE: FEBRUARY 12, 2003
	SUPERSEDES: IIM-LD-195.4 DDM 2 (Drainage Manual)
DIVISION ADMINISTRATOR APPROVAL: Mohammad Mirshahi, PE	

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### CURRENT REVISION

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- Guidelines for water quality and quantity control have been clarified in accordance with the Virginia Department of Conservation and Recreation's annual plan review process..
  - Shading has been omitted from this memorandum.
- 

### EFFECTIVE DATE

- 
- This memo is effective upon receipt.
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### BACKGROUND

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- Acts of the General Assembly have resulted in the issuance of Virginia Stormwater Management (SWM) Regulations and Virginia Erosion and Sediment Control (ESC) Regulations. The general application to highway operations associated with these regulations is addressed in this memorandum. Additional information and instructions for the incorporation of the erosion and sediment details in plan assemblies are contained in the current version of IIM-LD-11.
  - Additional details and examples of the engineering application of the Virginia SWM Regulations in the design of VDOT projects can be obtained from the VDOT

Hydraulics Section in any of the various District offices or the Central Office in Richmond.

- Further information regarding the Virginia SWM Regulations or the Virginia ESC Regulations may be obtained from the Virginia Department of Conservation and Recreation (DCR) located at 203 Governor Street, Richmond, VA 23219 or at: <http://www.dcr.state.va.us/sw/index.htm>. Details may also be obtained from the Virginia SWM Handbook (Volume I and II) and the Virginia ESC Handbook published by DCR and available for reference in all VDOT Hydraulics Sections.
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## OBJECTIVE

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### Stormwater Management

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

- To effectively control soil erosion, sediment deposition, and post development runoff to minimize soil erosion and to prevent any sediment from escaping the project limits.
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## CRITERIA

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### General

- The runoff control provisions of both regulations are complementary and will be addressed under a single set of criteria. The information and instructions contained in this memorandum supersede all previous departmental documents. Where there are conflicts with previous instructions, this memorandum shall take precedence.
- For the applicability of the Virginia Erosion and Sediment Control Regulations see the latest version of IIM-LD-11.
- The Virginia Stormwater Management Regulations are applicable to all state agency projects.
- “State Agency Projects” are those land development activities wherein VDOT has funded any portion of the design, right of way acquisition, or construction including those constructed under the Public/Private Transportation Act (PPTA) and Design/Build projects. Projects, such as subdivision streets, industrial access roads, etc., which are designed and constructed by other parties and which are eligible for acceptance into the state roadway system for maintenance after completion of construction are not considered state agency projects and must conform to

appropriate local regulations. Land development activities occurring within existing VDOT right of way, which are allowed by permit and which are designed, constructed, and funded by other parties, are not considered state agency projects and must conform to appropriate local regulations.

- “Land Development Project” is defined as a manmade change to the land surface that potentially changes its runoff characteristics as a permanent condition. The permanent condition should consider the effects of mature vegetative cover and should not be concerned with temporary changes due to construction activities. The temporary changes are addressed by the ESC regulations.
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## Water Quantity Control

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- Water quantity control shall be governed by the Virginia ESC Regulation MS-19 that requires an adequate receiving channel for stormwater outflows.
- Receiving channels, pipes and storm sewers shall be reviewed for adequacy based upon the following criteria:
  - Natural channels shall be analyzed by the use of a 2-year storm to verify that stormwater will not overtop channel banks or cause erosion of the channel bed and banks.
  - All previously constructed manmade channels shall be analyzed by the use of a 10-year frequency storm to verify that the stormwater will not overtop the banks and analyzed by the use of a 2-year storm to verify that the stormwater will not cause erosion of the bed or banks.
  - Pipes and storm sewer systems shall be analyzed by the use of a 10-year frequency storm to verify that the stormwater will be contained within the pipe or storm sewer system. The receiving channel at the outlet of the pipe or storm sewer shall be analyzed for adequacy of the 2 year storm for natural channels or the 10 year storm for man made channels.
- Water quantity control for the 1 year storm (in lieu of the 2 year storm as required by ESC Regulation MS-19) may be needed if there are existing or anticipated erosion concerns downstream. Control of the 1 year storm requires detaining the volume of runoff from the entire drainage area and releasing that volume over a 24 hour period. The computations are similar to those used for detaining the Water Quality Volume

(WQV) and releasing over a 30 hour period. See the DCR SWM Handbook pages 1-23 and 5-38 thru 5-41 for additional information. When the 1 year storm is detained for 24 hours there will be no need to provide additional or separate storage for the WQV if it can be demonstrated that the WQV will be detained for approximately 24 hours. The control of the 1 year storm may require a basin size that is 1.5 to 2 times larger than a basin used to control the increase in the discharge from a 2 year or a 10 year storm.

- Pre-development conditions shall be considered that which exist (or is anticipated to exist) at the time the road plans are approved for right of way acquisition. All land cover shall be assumed to be in good condition regardless of actual conditions existing at the time the analysis is done.
- Impounding structures (dams) that are not covered by the Virginia Dam Safety Regulations shall be checked for structural integrity and floodplain impacts for the 100-year storm event.
- Outflows from stormwater management facilities shall be discharged into an adequate receiving channel as defined by the ESC Regulation MS-19.
- Existing swales being utilized as natural outfall conveyances for pre-development run-off will be considered as channels and, if the swale satisfactorily meets the criteria contained in the ESC Regulation MS-19 for post-development run-off, it will be considered as an adequate receiving channel.
- Construction of stormwater management facilities should be avoided in floodplains. When this is unavoidable, a special examination to determine the adequacy of the proposed stormwater management facilities during the passage of the 10-year flood will be required. The purpose of this analysis is to ensure that the stormwater management facility will operate effectively. The stormwater management facility shall also be examined for structural stability during the passage of the 100-year flood event on the floodplain and shall be examined for any possible impacts caused by the basin on the 100-year flood characteristics of the floodplain. The construction of stormwater management facilities shall be in compliance with all applicable regulations under FEMA's National Flood Insurance Program.
- If it can be demonstrated that the total drainage area to the point of analysis within the receiving channel is 100 times greater than the contributing drainage area within the project site, the receiving channel may be considered adequate, with respect to the channel capacity and stability requirements of the ESC Regulations, without further computations.
- Construction of stormwater management facilities within a sinkhole is prohibited. If stormwater management facilities are required along the periphery of a sinkhole, the design of such facilities shall comply with the guidelines in IIM-LD-228 (Sinkholes) and DCR's Technical Bulletin #2 (Hydrologic Modeling and Design in Karst) and applicable sections of the DCR's SWM Handbook.

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#### Water Quality Control

- A water quality control plan shall be developed for each outfall or watershed where one acre or more of land is disturbed and one acre or greater of impervious area is added.

- At outfalls or watersheds where one acre or more of land is disturbed but less than one acre of impervious area is added, an assessment based on specific site characteristics/limitations shall be made to determine what opportunities exist to enhance water quality.
- Where two or more outfalls flow directly into an adjacent natural or manmade receiving system, or where two or more outfalls converge into one system some distance downstream of the project, the combined additional impervious area of all affected outfalls shall be considered when determining the applicability of VDOT's Annual SWM Plan and the water quality requirements of the Virginia SWM Regulations. The presence of wetlands, perennial streams, natural channels, or other environmentally sensitive areas at the convergence of the outfalls will typically require that the outfall impervious areas be considered in total when assessing the project's water quality impacts. Multiple project outfalls can be considered individually only when the convergence (if applicable) of flows is sufficiently far from the outfalls so as to effectively disconnect the impact of the total combined project impervious area.
- The following comments represent the significant points of the current regulations (the page numbers referenced are those in the DCR SWM Handbook):
  1. BMP (Best Management Practice) requirements for quality control are "Technology Based" (4VAC-3-20-71). The type of BMP required is determined by the percent of area within the project site (right of way and permanent easement) with **new** impervious cover, per outfall. Table 1 shows the relationship of the new impervious cover to the type of BMP required.

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

\*Innovative or alternate BMPs not included in this table may be allowed at the discretion of DCR.

\*\*Percent Impervious Cover: Relationship of the area of new impervious cover within the project site (right of way and permanent easement) to the total area of the project site (right of way and permanent easement), per outfall.

2. BMP requirements for flooding or quantity control are determined by the ESC Regulation MS-19 for adequate receiving channels.
3. Extended Detention Basins and Extended Detention Basins Enhanced require a Water Quality Volume (WQV) of 2 x the standard WQV or 1" of runoff from the new impervious area.
4. Extended Detention Basins and Extended Detention Basins Enhanced require a 30 hour drawdown time for the required WQV. The 3" minimum size water quality orifice previously allowed has been eliminated. If the required orifice size is found to be significantly less than 3", an alternative water quality BMP should be investigated for use, such as a linear facility that treats the first flush and allows larger storms to bypass. The calculation procedure for drawdown time and orifice sizing is shown on Pages 5-33 through 5-38 (SWM Handbook) and also in example problems available from VDOT.
5. Sediment Forebays should be used on Extended Detention Basins and Extended Detention Basins Enhanced. The volume of the Forebay should be 0.1" – 0.25" x the new impervious area or 10% of the required detention volume. See Pages 3.04-1 through 5 (SWM Handbook) for details. The overflow spillway shall be stabilized utilizing rip rap, concrete or other non-erodible material.
6. Suggested details for the Extended Detention Basin are shown on Pages 3.07-4 and 5 (SWM Handbook). The riprap lined low flow channel through the basin is not recommended due to maintenance concerns.
7. Suggested details for the Extended Detention Basin Enhanced are shown on Pages 3.07-6 and 7 (SWM Handbook). The geometric design will probably need to be more symmetrical than that shown in order to construct the basin to the dimensions needed.
8. Non-structural practices including, but not limited to, minimization of impervious areas and curbing requirements, open space acquisition, floodplain management, and protection of wetlands may be utilized as appropriate in order to at least partially satisfy the water quality requirements. Approval of such non-structural measures will be secured in advance from the Department of Conservation and Recreation.

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## MULTI-USE SWM BASINS

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### Quantity Control – Quality Control – Temporary Sediment Storage

- SWM basins may function as both quantity control and quality control facilities. Some basins may only be needed for quality control. Most swm basins are needed to serve as temporary sediment basins during the construction phase of the project and the design will need to address this dual function. The design that is needed for a permanent swm basin may need to be altered to provide additional temporary sediment storage volume that is in excess of the required WQV. For design purposes the two volumes (WQV and temporary sediment storage volume) should not be added together but rather the larger of the two should govern the basin design.



The additional volume needed for temporary sediment storage may be provided by excavating the bottom of the basin lower than that required for the WQV. The basin's permanent outlet control structure can be temporarily altered to serve as the control structure for the temporary sediment basin (See Standard SWM-DR of VDOT's Road and Bridge Standards and the DCR ESC Handbook). When the project is nearing completion and the basin is no longer needed for temporary sediment control, the basin can be readily converted to the permanent SWM basin by regarding (excavating and/or filling) and removing any temporary control structure appurtenances.

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## IMPLEMENTATION

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### Plan Preparation

- Standard and minimum plan projects shall show stormwater management and erosion control measures on the plans as directed in the latest version of IIM-LD-11 and the Road Design Manual.
  - No-plan, SAAP and other types of projects (including maintenance) that do not have a "formal" plan assembly must conform to the requirements of the Virginia Stormwater Management Regulations. For the definition of these types of projects, and the procedures for addressing both the erosion and sediment control and stormwater management requirements on such projects, see the latest version of IIM-LD-11.
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### Foundation Data

- Foundation data (a soil boring) for the base of the dam should be requested for all stormwater management basins in order to determine if the native material will support the dam and not allow ponded water to seep under the dam. An additional boring near the center of the basin should also be requested if:
  1. Excavation from the basin may be used to construct the dam, or
  2. Rock may be encountered in the area of excavation, or
  3. A high water table is suspected that may alter the performance of the swm basin.

For large basins, more than one boring for the dam and one boring for the area of the basin may be needed. The number and locations of the borings are to be determined by the Hydraulics Engineer and/or the Materials Engineer.

- The foundation data for the swm basin should be requested by the Hydraulics Engineer at the same time that the request for culvert foundation data is initiated.

## Right of Way

- Permanent stormwater management facilities may be placed in fee right of way or in permanent easements. It is recommended that all permanent stormwater management facilities (dams, ponds, risers, etc.) be placed within fee right of way initially. Ditches and similar features may initially be placed in permanent easements. The final decision on right of way versus permanent easement should be made prior to the Right of Way Stage of the project development process based on information obtained at the Field Inspection meeting and/or the Design Public Hearing. The Department will generally be amenable to the desires of affected landowners in this matter. The multiple use of property for stormwater management and such features as utilities is permissible. The decision on the advisability of such actions must be made on an individual site basis.

## Design Details

- The following details are to be incorporated into the design of VDOT stormwater management basins in order to be in compliance with the Virginia SWM Regulation Revisions of 1998 and the DCR SWM Handbook. These details address concerns with seepage through the dam and along the culvert due to the ponding of water in the basins being of longer duration than previous designs that used a minimum 3" water quality orifice.
  1. Foundation data for the dam is to be secured by the Materials Division in order to determine if the native material will support the dam and not allow ponded water to seep under the dam.
  2. The foundation material under the dam and the material used for the embankment of the dam should be an AASHTO Type A-4 or finer and/or meet the approval of the Materials Division. If the native material is not adequate, the foundation of the dam is to be undercut a minimum of 4' or the amount recommended by the Materials Division. The backfill and embankment material must meet the above soil classification or the design of the dam may incorporate a trench lined with a membrane (such as bentonite penetrated fabric or an HDPE or LDPE liner) and be approved by the Materials Division.
  3. The pipe culvert under or through the dam is to be reinforced concrete pipe with rubber gaskets. Pipe: Specifications Section 232 (AASHTO M170), Gasket: Specification Section 212 (ASTM C443)
  4. A concrete cradle is to be used under the pipe to prevent seepage through the dam. The concrete cradle is to begin at the riser or inlet end of the pipe and extend the full length of the pipe.
  5. If the height of the dam is greater than 15' or if the basin includes a permanent water pool, the design of the dam is to include a homogenous embankment with seepage controls or zoned embankment or similar design in accordance with the DCR SWM Handbook and recommendations of the Materials Division.

6. The top width of the dam should be 10' (3m) minimum to facilitate both construction and maintenance.
  7. The side slopes of the basin should be no steeper than 3:1 to permit mowing and maintenance access.
  8. The longitudinal bottom slope through the basin should be no more than 2% nor less than 0.5%.
  9. The depth of the basin from bottom to the primary outflow point (top of riser, or invert of orifice or weir) should be no more than 3' (1m), if possible, in order to reduce the hazard potential. If the depth needs to be more than about 3' (1m), fencing of the basin site should be considered.
  10. The primary control structure (riser or weir) should be designed to operate in weir flow conditions for the full range of design flows. Where this is not possible or feasible and the control structure will operate in orifice flow conditions at some point within the design flow range, an anti-vortex device, consistent with the design recommendations in the DCR SWM Handbook, shall be utilized.
  11. The length to width ratio of the basin should be about 3:1 (wider at the outlet end). If the ratio is less than about 2:1, and if there is concern that the velocity of flow through the basin will be high, consideration should be given to using baffles within the basin to reduce velocity. Baffles should be constructed of "pervious" type material, such as snow fence, rather than earth berms that tend not to reduce the velocity.
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## Perimeter Controls

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

- Fencing of SWM Basins
  1. Fencing of stormwater management basins is normally not required and should not be considered for most basins due to:
    - Insignificant Hazard - Ponding of water in the basin should only occur with very heavy storms and be noticeable for only a few hours. The ponded depth will normally be no more than about 3' (1m). Ponds and lakes are almost never fenced, even though they may be located in subdivisions and have deep, permanent pools.
    - Limits Maintenance - Fencing will limit maintenance operations and could deter the frequency of maintenance. Fencing could become damaged during major maintenance operations.

2. Fencing of SWM basins may occasionally be needed and should be considered when:
- The basin is deep with ponded depth greater than about 3' (1m) and/or has steep side slopes with 2 or more sides steeper than 3:1, or
  - The basin is in close proximity to schools, playgrounds or similar areas where children may be expected to frequent, or
  - It is recommended on the Field Inspection Report, the Resident Engineer or the City/County (where City/County will take over maintenance responsibility.)

- Barricades

A chain barricade (See Standard CR-1 of VDOT's Road and Bridge Standards) or gate may be needed on some basins to prohibit vehicular access if there is concern with illegal dumping or other undesirable access.

- Signs

"No Trespassing" signs shall be considered for use on all basins, whether fenced or unfenced, and should be recommended, as needed, on the Field Inspection Report.

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## Regional Facilities

- There are many cases where it is more feasible to develop one major stormwater management facility to control a large watershed area rather than a number of small individual facilities controlling small drainage basins. The concept of regional stormwater management facilities is endorsed by VDOT provided that certain requirements are met.
- Development and use of regional stormwater management facilities must be a joint undertaking by VDOT and the local governing body. The site must be part of a master stormwater management plan developed and/or approved by the local governing body and any agreements related to these facilities must be consummated between VDOT and the local governing body. VDOT may enter into an agreement with a private individual or corporation provided the local governing body has a swm program that complies with the Virginia SWM Regulations and the proper agreements for maintenance and liability of the regional facility have been executed between the local governing body and the private individual or corporation.
- Where the roadway embankment serves as an impounding structure, the right of way line will normally be set at the inlet face of the drainage structure. The local government would be responsible for the maintenance and liabilities outside of the right of way and VDOT would accept the same responsibilities inside the right of way.
- Hydraulic design of regional stormwater management facilities must address any mitigation needed to meet the water quality and quantity requirements of the roadway project. Stormwater management facilities located upstream of the roadway project

shall provide sufficient mitigation for the water quality and quantity impacts of run-off from the roadway project which may bypass the facility.

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## Maintenance

- Requirements for maintenance of stormwater management facilities, the recommended schedule of inspection and maintenance, and the identification of persons responsible for the maintenance will be addressed in VDOT's "Stormwater Management Annual Plan" as approved by DCR.
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## Future Reconstruction

- If a stormwater management facility is constructed to address the water quality and quantity requirements of a current project and, at some time in the future, is displaced to accommodate future roadway construction, the new stormwater management facility constructed at that time must address the water quality and quantity requirements due to the future construction and the water quality and quantity requirements that were mitigated by the original stormwater management facility.
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## Reporting

- VDOT is required to submit an annual report to the Department of Conservation and Recreation (DCR) that identifies the location, number and type of stormwater management facilities installed during the preceding year, their storage capacities, the affected water body, and a summary of any water quality monitoring data associated with the facility. A database has been established on the Hydraulics Section's telecommunication file system to record this type of data for all projects. It shall be the responsibility of the district drainage engineer and the hydraulic design engineers in the Central office to ensure that the required information is logged on the database for all stormwater management facilities that are designed for roadway projects. In order for the database to reflect those facilities constructed during the preceding year, it is recommended that the required information be logged at the time of the first submission of plans to the Construction Division. The reporting period will be from July 1 to June 30.
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## PLAN DETAILS

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### Stormwater Management Drainage Structure Standard SWM-1

- To be used at all applicable locations where a riser type of control structure is desired.

### Stormwater Management Dam

- To be used at locations where a wall type control structure is desired (includes modifications to standard endwalls). Normally used for shallow depths of ponding.
  - Details to be provided for individual locations.
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Copies of the control structures other than those above shall be submitted to the office of the State Hydraulics Engineer to facilitate future development or modification of standard details.

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### Stormwater Management Details Standard SWM-DR

- Specify at each location requiring a water quality orifice and/or where modifications are required in order to provide for a temporary sediment basin during the construction phase of the project. The size opening for the water quality orifice or other required openings in the control structure shall be specified in the description for the control structure for each basin.
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### Access

- A means of access for inspection and maintenance personnel shall be provided at each SWM facility location. The Standard PE-1 details shown in VDOT's Road and Bridge Standards should be used for vehicular entrances.
  - A turnaround should be provided on each vehicular entrance.
  - Appropriate all weather surface material shall be provided for each vehicular entrance.
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### Method of Measurement – Basis of Payment

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#### Stormwater Management Drainage Structure (SWM-1):

- Basis of payment to be linear feet (meters) measured from invert of structure to top of concrete.

#### Stormwater Management Dam:

- Basis of payment to be cubic yards (m<sup>3</sup>) of Concrete Class A3 Miscellaneous and pounds (kilograms) of Reinforcing Steel.

**Grading:**

- Excavation for stormwater management basins will be measured and paid for as cubic yards (m<sup>3</sup>) of Stormwater Management Basin Excavation.
- Fill material needed for dams or berms will be measured and paid for as cubic yards (m<sup>3</sup>) of Regular Excavation, Borrow Excavation or Embankment.
- The Grading Diagram is to reflect how the cubic yards (m<sup>3</sup>) of Stormwater Management Basin Excavation and cubic yards (m<sup>3</sup>) of Embankment or Borrow is to be distributed.

**Stormwater Management Summary**

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

**PAY ITEMS**

The following pay items are established:

PAY ITEM	UNIT		ITEM CODE
	Metric	Imperial	
SWM Basin Excavation	m <sup>3</sup>	Cu. Yds.	27545
SWM Drainage Structure (SWM-1)	m	Lin. Ft.	27550
For SWM Dam:			
Conc. Cl. A3 Misc.	m <sup>3</sup>	Cu. Yds.	00525
Reinf. Steel	Kg.	Lbs.	00540

## SPECIAL PROVISIONS

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The current Special Provision/Copied Note for measurement and payment for stormwater management items is available for applicable projects as follows:

<http://www.virginiadot.org/business/manuals-default.asp>

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## INSERTABLE SHEETS

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The following insertable sheets (English and Metric) are available on Falcon DMS, under the PPMS# eng-ser, Division, minsert and insert, for insertion into applicable plan assemblies:

- SWM Details – SD/MSD # 2209.
- SWM Drainage Structure (SWM-1) – SD/MSD # 2216.
- SWM Trash Rack – SD/MSD # 2216A



VIRGINIA DEPARTMENT OF TRANSPORTATION

# LOCATION AND DESIGN DIVISION

## INSTRUCTIONAL AND INFORMATIONAL MEMORANDUM

GENERAL SUBJECT: SINKHOLES	NUMBER: IIM-LD-228 HM-2002-03
SPECIFIC SUBJECT: GUIDELINES FOR THE DISCHARGE OF STORMWATER AT SINKHOLES	DATE: AUGUST 15, 2002
	SUPERSEDES:
LOCATION AND DESIGN DIVISION APPROVAL: Mohammad Mirshahi, PE	
MATERIALS DIVISION APPROVAL: Andy Mergenmeier, PE	ENVIRONMENTAL DIVISION APPROVAL: Earl T. Robb

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### EFFECTIVE DATE

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- These instructions are effective upon receipt.
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### PURPOSE

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- The purpose of these guidelines is to:
  1. Increase awareness of the regulatory requirements for controlling stormwater runoff into sinkholes and identify the applicability of this guidance and the environmental regulations.
  2. Provide design guidance for the discharge of stormwater into sinkholes.
  3. Provide design details for addressing sinkholes directly impacted by the roadway embankment.
  4. Provide guidance to comply with the Environmental Protection Agency (EPA) regulatory requirements to complete an inventory of "improved" sinkholes.
- These guidelines are applicable to roadways and drainage outfall facilities that are constructed and maintained by VDOT and similar facilities that are constructed by others but which will be ultimately maintained by VDOT, such as subdivision streets and associated drainage outfalls.

## BACKGROUND

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- Sinkholes are found in areas of karst terrain. Karst terrain is generally formed over limestone and dolomite formations. Karst terrains primarily occur within the Valley and Ridge Physiographic Province of western Virginia. Karst type terrains are also known to occur in very limited areas of the Blue Ridge, Piedmont and Coastal Plain Physiographic Provinces of Virginia. While information contained in these guidelines is directed more to those sinkholes located in the Valley and Ridge Physiographic Province, the same considerations should be applied to sinkholes located in other areas of the state.
  - Karst terrain is characterized by closed depressions (sinkholes), caves, and underground drainage resulting from the solutions of the calcium and/or magnesium carbonates. Sinkholes may develop either by solution of the surficial rocks or collapse of underlying caves. The actual rock cavity may or may not be choked by residual soil and debris. It is the potential instability of the sinkhole infilling, most often associated with changes in the local hydrology, which traditionally has been the concern of the construction industry. Those concerns have now broadened to include the potential impacts of construction on the area's hydrology and water quality.
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## REGULATIONS

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- Pursuant to the Safe Drinking Water Act, the Environmental Protection Agency (EPA) regulates the discharge of stormwater runoff into "improved" sinkholes through their Underground Injection Control (UIC) Program. The improvement of sinkholes, and subsequent directing of water into the subsurface, is classified as underground injection. Improved sinkholes used for this purpose are classified as a Class V Underground Injection Wells and may require a permit to function as a recipient of stormwater runoff.
- The EPA classifies the following activities as sinkhole "improvements":
  - Cleaning out a sinkhole to facilitate drainage.
  - Cutting a ditch to the base or mouth of a sinkhole.
  - Piping stormwater runoff to a sinkhole.
  - Cutting brush to facilitate stormwater flow to a sinkhole.
- The EPA does not regulate (i.e., require a permit for) stormwater discharges that flow naturally into sinkholes without modification to the sinkhole.

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## CONCERNS

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- Both the EPA and VDOT have concerns with changes to the existing hydrology at sinkhole locations. These concerns include:
- Water Quality – Sinkholes are often direct links to underground sources of drinking water. Stormwater runoff from highways could potentially contain various constituents such as oil, grease, heavy metals and salt that could enter and impact these water supplies. The underground ecosystems could potentially be impacted by highway runoff containing sediment generated both during and following highway construction and material from potential spills resulting from traffic accidents once the highway is operational.
- Water Quantity – Directing additional stormwater flow to a sinkhole can result in the enlargement of the feature, create surface failures and erosion and cause flooding of adjacent property. Increasing the quantity of stormwater runoff flowing to a sinkhole can also cause the characteristics of the sinkhole opening to change in such a manner so as to restrict the flow into the subsurface, resulting in greater surface ponding in and around the area of the sinkhole.
- Instability – The area within and surrounding a sinkhole can settle or sink unexpectedly, resulting in loss of competent structural material and damage to overlying structures.

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## DESIGN CONSIDERATIONS

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- The following design considerations must be followed for any projects involving the construction of highways or drainage outfalls in areas where sinkholes are present:
  - Avoidance – Determine if there are any feasible alternatives that would avoid construction in the area of the sinkhole. Where the sinkhole is the natural outfall for the stormwater runoff from the roadway area, determine if the stormwater runoff can be diverted away from the sinkhole to an adequate surface water channel. It should be recognized that drainage facilities to accommodate the diversion of stormwater runoff may require significant additional grading and right of way. In addition, stormwater quantity management facilities may be required at the point where the diverted flow is released from the project right of way in order to avoid the liabilities inherent with stormwater runoff diversion.

- Minimization of Impacts from Direct Discharges – If avoidance is not possible, drainage outfalls from the roadway should include natural buffer zones between the outlet of the roadway drainage structure and the sinkhole in order to provide for a natural filtering process. Where stormwater runoff naturally terminates in sinkhole areas, vegetated flow areas (minimum 80' – 100' in length), runoff spreaders and vegetated swales should be used between the outlet of the roadway drainage structure and the bottom of the sinkhole in order to provide for filtering of the flow. If concentrated flow from the roadway pavement area is being directed into the bottom of the sinkhole, a stormwater management water quality basin or other type of water quality filtering device should be incorporated into the design. The water quality basin or filtering device should not be located in the bottom (throat) of the sinkhole (where the flow enters the ground) but rather should be located as close to the roadway or discharge point as practicable. Stormwater management basins constructed in these areas may require an impermeable lining in order to prevent impacts to the underlining soil and subsurface area. The District Materials Section should provide recommendations regarding this issue. A stormwater management basin may also be needed to provide attenuation of any increased flow quantity that may be directed toward the sinkhole.
  
- If stormwater runoff from a roadway project must be directed to a sinkhole, the area of the sinkhole should be investigated to determine if any existing ponding occurs during rainfall events. The drainage design for the project should reflect how the sinkhole is anticipated to function after completion of the construction activities. The project should be designed to avoid any flood damages resulting from potential blockage and ponding in the sinkhole area.

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## COORDINATION

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- During the Scoping Phase of the Plan Development Process, the District Materials Section should identify those projects where visible sinkholes are present along the project corridor. The presence of sinkholes should be noted on Form LD-430, Scoping Report and, if possible, the approximate location of observed sinkholes should be identified. The project survey shall provide an accurate and detailed location and description of all identifiable sinkholes located within the survey boundaries.
  
- During the hydraulic analysis phase of the project development process, the Hydraulics Engineer should coordinate with the District Materials Section and the District Environmental Section if the project Scoping Report or survey data indicates the presence of sinkholes and if it is anticipated that those sinkholes might be impacted by stormwater runoff from the project.

## PLAN DETAILS

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- Where the roadway traverses over or through a sinkhole area, the sinkhole should be treated in accordance with one of the typical details shown on Standard Insertable Sheet No. isd/msd 2944 unless otherwise directed by the District Materials Engineer.
  - Detail No. 1 should be used for sinkholes that receive stormwater runoff from relatively large areas and have a well-defined opening (throat). This treatment involves cleaning out soil and debris to expose the throat, installing a length of pipe to convey surface drainage into the sinkhole and backfilling with riprap and successive layers of smaller aggregate and a geotextile fabric prior to the placement of the regular roadway embankment material.
  - Detail No. 2 should be used for sinkholes with broad, flat depressions and which have no defined throat. These sinkholes typically receive stormwater runoff from relatively small areas. The width of the roadway embankment is generally less than the width of the depression. This treatment involves the placement of riprap in the bottom of the roadway embankment to allow for the continued infiltration of surface flows. The riprap is capped with successive layers of smaller aggregate and a geotextile fabric before placement of the regular roadway embankment material.
  - Detail No. 3 should be used for small shallow sinkholes that receive stormwater runoff from relatively small areas and where the roadway embankment will cover most or all of the depression. This treatment involves filling the depression with successive layers of smaller aggregate and a geotextile fabric before placement of the regular roadway embankment material. Since this treatment effectively “caps” the sinkhole and precludes the entry of surface water, a drainage ditch or other hydraulic conveyance is typically required along the edge of the roadway embankment to convey stormwater runoff to an adjacent outfall.
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## ROADSIDE DITCHES

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- In areas of karst topography, roadside ditches with a gradient of less than 5% may need to be lined to inhibit the infiltration of surface waters. The District Materials Section should make this determination during the preliminary soils investigation phase of the project and, where applicable, include their recommendations for ditch lining with those other recommendations requested on Form LD-252 - Request for Supporting Data. Where ditch lining is recommended, the roadside ditches should be lined with concrete using Standard PG-2A or PG-5 (as applicable) or similar details. When using Standard PG-2A or PG-5 concrete ditches in these areas, the standard detail drawings will need to be modified to include the following:
  - Add a 30-mil polyethylene film beneath all joints (to extend 4 feet longitudinally in each direction).

- Show the location of the curtain wall (normally placed adjacent to each expansion joint) 4 feet downgrade of the expansion joint (to coincide with the end of the 30-mil polyethylene film).
  - In areas where these modifications apply, the plan description should note "St'd. PG-2A Modified" or "St'd. PG-5 Modified", as applicable. The details for these modifications are included on the Sinkhole Insertable Sheet.
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## REPORTING REQUIREMENTS

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- If direct discharge of runoff into a sinkhole is the only feasible option available and improvements (modifications) such as cleaning, clearing, etc. are needed in the lowest section of the sinkhole (where water enters the ground), the details of such improvements (modifications) must be discussed with the District Environmental Section in order that they can determine what permits and/or reporting will be required. Typical sinkhole improvements (modifications) that would fit into this category are depicted in Detail 1 and Detail 2 on Standard Insertable Sheet No. isd/msd 2944. These "improved" sinkhole sites are brought to the attention of the District Environmental Section early in project development process in order to allow adequate time for coordination with the EPA and other applicable regulatory agencies. The Environmental Division's Form EQ-120 must be completed for those sites where it is determined necessary to "improve" a sinkhole and where it is determined such improvements would be regulated under the EPA's UIC Program. The Hydraulics Engineer shall be responsible for completing Form EQ-120 and submitting it to the District Environmental Hazardous Materials Manager for further processing.
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## SUBDIVISIONS AND FACILITIES BUILT BY OTHERS

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- These Guidelines shall apply to roadways that are designed and constructed by others and which will ultimately be maintained by VDOT. In addition, where a sinkhole is being utilized as a drainage outfall, an acceptable legal agreement shall be executed that absolves VDOT of any liability and maintenance responsibilities associated with the sinkhole. The agreement should identify the County as the responsible party in the event that the developer or homeowners association cannot (or will not) assume the responsibility for liability or maintenance. A sample legal agreement can be found in Secondary Roads Division's publication "GUIDE FOR ADDITIONS, ABANDONMENTS, AND DISCONTINUANCES – SECONDARY SYSTEM OF STATE HIGHWAYS". The sample agreement shown in this publication is for stormwater management facilities but it can be modified slightly to cover the use of a sinkhole as a drainage outfall. The development of the agreement for the use of a sinkhole as an outfall should be coordinated with and approved by the Secondary Roads Division in the Central Office.

## SUMMARIZATION

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- Quantities relative to sinkholes (Aggregate Material, Dry Rip Rap, etc.) are to be summarized in a separate summary.
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## PAY ITEMS

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- Standard PG-2A Modified, Paved Ditch, S.Y./m<sup>2</sup>
  - Standard PG-5 Modified, Paved Ditch, S.Y./m<sup>2</sup>
  - 30-mil Polyethylene Film is included in the bid price for Standard PG-2A Modified and/or Standard PG-5 Modified Paved Ditch.
  - Grate for EW-1 is included in the bid price for Standard EW-1 Endwall for Pipe Culverts.
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## INSERTABLE SHEET

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- The following insertable sheets are available on Falcon DMS under the PPMS# eng\_ser, Division, for applicable plan assemblies:
    - Sinkhole Details, Drawing No. [isd 2944](#) (Imperial), msd 2944 (Metric)
    - Paved Ditch PG-2A/ PG-5 Modified, Drawing No. [isd 2945](#) (Imperial), msd 2945 (Metric)
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## FORM EQ-120 SINK HOLE INVENTORY

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- The Environmental Division maintains Form EQ-120 at the following website:

<http://coweb/environmental/Forms/AllForms.htm>.