VirginiaTech

Annual Standards and Specifications

for

Erosion and Sediment Control

and

Stormwater Management

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INTRODUCTION

Virginia Polytechnic Institute and State University (VPI&SU), also referred to as Virginia Tech (VT), has incorporated Annual Standards and Specifications for Erosion and Sediment Control (ESC) and Stormwater Management (SWM) that are integral components of Virginia Tech's design, construction, maintenance, and management of the university's facilities and campuses. The Virginia Tech Annual Standards and Specifications for ESC and SWM submittal has been developed to provide information regarding VT's implementation in accordance with the Virginia Erosion and Sediment Control Law (§10.1-560 et. seq.), the Virginia Erosion and Sediment Control Regulations (4VAC50-30 et. seq.), the Virginia Erosion and Sediment Control Certification Regulations (4VAC50-50 et. seq.), the Virginia Stormwater Management Act (§10.1-603 et. seq.), and the Virginia Stormwater Management Program (VSMP) Permit Regulations (4VAC50-60 et. seq.) as related to municipal separate storm sewer systems (MS4) and regulated construction activities.

Virginia Tech Annual Standards and Specifications for ESC and SWM shall be administered by VT Site and Infrastructure Development and shall apply to all design, construction and maintenance activities undertaken by Virginia Tech, either by its internal workforce or contracted to external entities, where such activities are regulated by the Virginia ESC Law and Regulations or the Virginia SWM Act and VSMP Permit Regulations. During any inspections of Virginia Tech's land disturbing activities by DCR, EPA or other such environmental agencies, compliance with the approved Virginia Tech Annual Standards and Specifications for ESC and SWM (and all parts thereof), the Virginia ESC Law and Regulations, the Virginia SWM Act and the VSMP Permit Regulations will be expected.

Virginia Tech Annual Standards and Specifications for ESC and SWM are submitted to the Virginia Department of Conservation and Recreation (DCR) for review and approval on an annual basis. Virginia Tech shall ensure that project specific plans are developed and implemented in accordance with these Annual Standards and Specifications. This submittal constitutes Virginia Tech's commitment to execute all provisions contained herein on our regulated land disturbing activities and land development projects. As such, this submittal will be made available and utilized as an operational guidance by all appropriate Virginia Tech and DCR personnel. This submittal and errata information are available for download as PDF files at: http://www.facilities.vt.edu/stormwater.

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1.0 ANNUAL STANDARDS AND SPECIFICATIONS ADMINISTRATION

1.1 All projects involving land-disturbing activity subject to the Virginia Erosion and Sediment Control Law (§10.1-560 et seq. as amended) and the Virginia Erosion and Sediment Control Regulations (4VAC50-30 et seq. as amended) shall be bound by the Virginia Tech Annual Standards and Specifications for Erosion and Sediment Control and Stormwater Management as approved by DCR. All projects involving land-disturbing activity subject to the Virginia Stormwater Management Act (§10.1-603 et seq. as amended) and the VSMP Permit Regulations (4VAC50-60 et seq. as amended) shall be bound by the Virginia Tech Annual Standards and Specifications for Erosion and Sediment Control and Stormwater Management as approved by DCR.

1.2 The Virginia Tech Annual Standards and Specifications for ESC and SWM approved by DCR are composed of general specifications for ESC and SWM that apply to the land-disturbing activities listed in Section 1.1 above and include, by reference, the following:

1.2.1 Virginia Erosion and Sediment Control Law (§10.1-560 et seq. as amended);

1.2.2 Virginia Erosion and Sediment Control Regulations (4VAC50-30 et seq. as amended);

1.2.3 Virginia Erosion and Sediment Control Certification Regulations (4VAC50-50 et seq. as amended);

1.2.4 Virginia Erosion and Sediment Control Handbook, 1992, as amended;

1.2.5 Virginia Stormwater Management Act (§10.1-603 et seq. as amended);

1.2.6 Virginia Stormwater Management Permit Regulations (4VAC50-60 et seq. as amended);

1.2.7 Virginia Stormwater Management Handbook, 1999, as amended;

1.2.8 Technical Bulletins, as amended, on the Virginia DCR website at www.dcr.virginia.gov; and

1.2.9 Memos, as amended, on the Virginia DCR website at www.dcr.virginia.gov.

1.3 Any land-disturbing activity carried out in a locality with a local ESC program with more stringent regulations than those of the state program shall be consistent with the requirements of the local program. SWM projects shall, to the maximum extent practicable, meet the technical requirements of the local stormwater management program in addition to the technical requirements noted above.

1.4 Site-Specific ESC Plans shall be prepared for all projects involving a regulated land-disturbing activity as defined in §10.1-560. For all regulated land-disturbing projects, site-specific ESC Plans shall be submitted to the Virginia Tech Site & Infrastructure Development Department (VTSID) for review. Prior to starting the land-disturbing project, as defined in §10.1-560, the project must have written approval issued to the Virginia Tech project manager by the VTSID Department for the submitted Plan.

1.5 Site-Specific SWM Plans shall be prepared for all projects involving a regulated land-disturbing activity that requires a Virginia Stormwater Management General Permit for Discharges from Construction Activities (VSMP) or land-disturbing activity contained

within a watershed of a regional water quality stormwater management facility. Prior to starting a land-disturbing project requiring a SWM Plan, the project must submit site-specific SWM Plans and have written approval issued to the VT project manager by the VTSID Department for the Plan.

All land-disturbing activities requiring an ESC Plan, but not requiring a VSMP Permit for Construction Activities, shall clearly indicate in the narrative of the ESC Plan as to the reason a VSMP Permit for Construction Activities is not required.

1.6 The Virginia Tech Site & Infrastructure Development Department may request DCR to grant a project specific variance or exception to the approved Virginia Tech Annual Standards and Specifications for ESC and SWM. All requested variances and exceptions are to be considered unapproved until written approval from DCR is received. Refer to Section 0 for more information on variances and exceptions.

2.0 ANNUAL STANDARDS AND SPECIFICATIONS PERSONNEL

The Virginia Tech Site and Infrastructure Development Department (www.sid.vt.edu) shall be the plan approving authority for Virginia Tech Projects and the administrator of the Virginia Tech Annual Standards and Specifications for ESC and SWM. The following is a breakdown in responsibilities and titles in terms of the Virginia Tech Annual Standards and Specifications for ESC and SWM. The following personnel are assigned and/or delegated authority related to ensuring compliance with the Virginia Tech Annual Standards and Specifications for ESC and SWM. Responsibilities may be combined in terms of staffing resources only if the person responsible for the task(s) is qualified per Section 1.2.3.

2.1 Senior ESC and SWM Program Administrator shall have overall management and coordination responsibilities for the Virginia Tech Annual Standards and Specifications for ESC and SWM. This person shall be DCR certified as a combined administrator.

2.2 ESC Program Administrator shall have management and coordination responsibilities for the erosion and sediment control portion of the Virginia Tech Annual Standards and Specifications for ESC and SWM. This person shall be DCR certified as a combined administrator.

2.3 ESC Plan Reviewers shall be responsible for reviewing plans for compliance with the Virginia Tech Annual Standards and Specifications for ESC and SWM and applicable laws and regulations with an emphasis on ESC components. The assigned persons shall be DCR certified as a plan reviewer.

2.4 SWM Plan Reviewers shall be responsible for reviewing plans for compliance with the Virginia Tech Annual Standards and Specifications for ESC and SWM and applicable laws and regulations with an emphasis on stormwater management components. The assigned persons shall be DCR certified as a plan reviewer.

2.5 ESC and SWM Inspectors shall have the responsibility for inspecting erosion and sediment control, stormwater management, VSMP permits, SWPPP, and MS4 practices to ensure compliance with all applicable laws, regulations, as well as the Virginia Tech Annual Standards and Specifications for ESC and SWM. The assigned persons shall be DCR certified as an inspector.

2.5.1 All ESC and SWPPP Inspectors shall provide a certification statement located in Appendix C and Appendix D, respectively.

2.6 Responsible Land Disturber (RLD) shall hold a valid Responsible Land Disturber Certificate as issued by DCR and shall be accountable for assigned projects.

2.7 Certifications shall be in accordance with the Virginia Erosion and Sediment Control Certification Regulations (4VAC50-50 et seq. as amended).

3.0 ANNUAL STANDARDS AND SPECIFICATIONS IMPLEMENTATION

The Virginia Tech Site and Infrastructure Development Department (VTSID) is responsible for the administration, compliance, and enforcement of the Virginia Tech Annual Standards and Specifications for ESC and SWM. The VTSID Department reviews and inspects land-disturbing activities, including new and renovated projects for compliance with the Virginia Tech Annual Standards and Specifications for ESC and SWM.

Virginia Tech land-disturbing projects shall comply with the Virginia Tech Annual Standards and Specifications for Erosion and Sediment Control and Stormwater Management. Prior to commencement of a land-disturbing project, the project must have received written approval for the Plan from the VTSID Department.

3.1 Submittals

ESC and SWM Plans (includes ESC and SWM Narrative and Construction Drawings), reports, certifications, and record documents shall be submitted to the Virginia Tech Site & Infrastructure Development Department for review and approval. All submittals shall be in accordance with the approved Virginia Tech Annual Standards and Specifications for ESC and SWM. The submittal must include the appropriate information and data necessary to support the licensed professional's work. Please refer to Section 4.0 for more information on submittals to the VTSID Department.

3.2 Plan Reviews

Plan reviews shall be conducted by certified personnel, who are certified in accordance with the Virginia Erosion and Sediment Control Certification Regulations (4VAC50-50 et seq. as amended). Plan reviews shall ensure compliance with the Virginia Tech Annual Standards and Specifications for ESC and SWM.

3.3 Inspections

ESC and SWM Inspector(s) is responsible for enforcing the project ESC and SWM Plan and other environmental commitments. Refer to Section 5.0 for more information on inspections.

The Responsible Land Disturber (RLD) shall be in charge of and responsible for carrying out any regulated land-disturbing activities. The RLD shall attend the pre-construction ESC meeting and sign the approved ESC and SWM Plan.

The licensed professional is responsible for collecting, surveying, and documenting the stormwater management facility and/or stormwater conveyance channels ensuring the structures are constructed in accordance with the approved Plan.

3.4 Changes and Amendments to Approved Plans

An approved Plan may be changed by the Virginia Tech Site & Infrastructure Development Department in the following cases:

(i) Where inspection has revealed the plan is inadequate to satisfy applicable regulations; or

(ii) Where the person responsible for carrying out the approved Plan finds that because of changing circumstances, or for other reasons, the approved Plan cannot be effectively carried out, proposed amendments to the Plan, consistent with the requirements of this article, are agreed upon by the plan-approving authority and the person responsible for carrying out the Plan.

Amendments to an approved ESC and SWM Plan must be submitted in writing to the VTSID Department. Amendments shall not be considered approved until written notice is provided. The amendment must comply with the approved Virginia Tech Annual Standards and Specifications for ESC and SWM.

3.5 Land-Disturbing Activities

All regulated land-disturbing activities shall maintain a copy of the approved ESC and SWM Plan on site unless otherwise approved by the VTSID department.

All regulated land-disturbing activities shall be performed in accordance with the approved Virginia Tech Annual Standards and Specifications for ESC and SWM. In order to reduce the sediment load to the surrounding creeks, streams, and water bodies, at least 50% of the “total area to be disturbed” shall be stabilized at all times by either permanent or temporary means. The “total area to be disturbed” shall be defined in the narrative of the ESC and SWM Plan.

Exception: If constructability or environmental issues make the application of this section unreasonable then the responsible land disturber or design professional may submit a written request to the VTSID seeking to modify the percentage of area that must be stabilized at any one time. Please allow 10 working days to process the request. If approval has not been granted within 10 working days the request shall be considered denied.

4.0 ESC/SWM PLANS (DELIVERABLES)

4.1 Submittals

ESC and SWM Plans (includes ESC and SWM Narrative and Construction Drawings), reports, certifications, variances, exceptions, and record documents shall be submitted to the VTSID Department for review and approval. All submittals shall be in accordance with the approved Virginia Tech Annual Standards and Specifications for ESC and SWM. The submittal must include the appropriate information and data necessary to support the licensed professional's work.

4.1.1 Design Submittal and Plan Review Checklists

ESC and SWM Plans, to include narrative, calculations, design standard and specifications, plan sheets (construction drawings) and other supporting information, shall be submitted to the VTSID Department for review and approval prior to any land-disturbing activities. The submittal shall include a design that is in accordance with the Approved Virginia Tech Annual Standards and Specifications for ESC and SWM. The submittal must include the appropriate information, all calculations relevant to the Plan, checklists, and other appropriate information and documentation necessary to support the licensed professional's work.

Checklists are provided in the appendices of this document and the Stormwater Management Handbook. The designer shall include all appropriate checklists. Many items listed on the checklists may not apply to any given design and it is therefore up to the designer to indicate items as "not applicable" or "NA" as appropriate.

Profiles shall be included for storm sewer facilities and associated conveyance channels. The profile shall include the final surface, channel/pipe, and hydraulic grade line. Surcharges shall be clearly indicated on the profile.

4.1.2 Re-submittals

For all second and subsequent submittals, the submitting professional shall include a cover letter with explanations as to how each review comment is addressed that references the relevant drawing sheet or narrative location. In addition, significant changes in the Plan shall be listed as part of the cover letter. The cover letter may warrant additional comments/discussion depending upon the previous review comments or changes in the Plan.

4.1.3 Stormwater Final Report

A final report shall be submitted to the VTSID Department for review and approval prior to close-out of the project for any and all permanent BMPs associated with the project. Construction inspections and surveys, performed by a licensed professional, shall be required at each stage of installation (construction) as necessary by a licensed professional(s) to certify that the

stormwater management facility and associated conveyance systems have been built in accordance with the approved plan and design specifications. The final report shall be signed and sealed by the licensed professional(s) and include incremental surveys (drawings), a final survey (drawings), photographs, construction logs, inspection reports, geotechnical testing reports, soil reports, certification of materials, and all other applicable inspection reports and necessary documents to support and ensure the stormwater management facility and associated conveyance systems have been built in accordance with the approved Plan. The final report shall include the appropriate checklists provided in Stormwater Management Handbook. It shall be the licensed professional's responsibility to certify that as-built conditions of the system meet the quantitative and qualitative controls of the approved Plan.

If the stormwater management facility and/or associated conveyance system have not been constructed and installed in accordance with the approved Plan, then the licensed professional(s) responsible for certifying the as-built condition shall immediately notify the Virginia Tech Project Manager and the Manager for the VTSID Department. Generally, there are two potential options when the system(s) are not constructed in accordance with the approved Plan:

- Option 1: Re-construct the system(s) in accordance with the approved Plan. It will be necessary to repeat the inspections, surveys, and documentation process such that the licensed professional shall certify the system(s) are constructed in accordance with the approved Plan. It shall be the licensed professional's responsibility to certify that the as-built condition of the system(s) meet the quantitative and qualitative controls of the approved Plan.

- Option 2: Perform calculations and analysis, based on the licensed professional's surveys, data, inspections, and other applicable documentation necessary to verify the as-built conditions meet the approved Virginia Tech Annual Standards and Specifications for ESC and SWM. The licensed professional shall certify the as-built condition of the system(s) meet the quantitative and qualitative controls, as prescribed by the approved Virginia Tech Annual Standards and Specifications for ESC and SWM, and submit the final report as required in this section.

4.2 ESC/SWM Drawing Requirements (construction drawings)

The following information shall be placed on the ESC drawings (ESC sheets) and SWM drawings (SWM sheets) as indicated below. The requirements are separated into construction phase requirements and post-construction phase requirements. Both requirements are to be included on the ESC/SWM Drawings (ESC/SWM Sheets).

4.2.1 ESC Requirements

- Minimum Standards 1 through 19 (4VAC50-30-40) shall be listed on the construction drawings.
- General Erosion and Sediment Control Notes ES-1 through ES-16 shall be listed on the construction drawings.

- The total disturbed area and the amount of disturbed area per phase shall be listed on the construction drawings.
- The existing impervious area and the proposed impervious area shall be listed on the construction drawings.
- Construction sequence of operations shall be provided on the construction drawings with staged implementation of erosion and sediment control measures for each phase. The area which may be disturbed in each phase shall be set forth in the construction drawings.
- Construction drawings shall provide information on the maintenance of ESC measures.
- ESC measures shall have unique identifications and the identifications shall be referenced/used in all documentation, such as, but not limited to, SWPPP, narrative, calculations, and construction drawings.
- Construction drawings shall provide a profile of stormwater conveyance systems, including, but not limited to final surface, channel/pipe, and potential/approximate utility crossings.
- Existing features to be demolished or removed, but that will require ESC measures to prevent sediment from leaving the disturbed areas, shall be clearly indicated on the construction drawings.

4.2.2 SWM Requirements

- Construction drawings shall provide information on the post-construction maintenance of permanent BMPs (post-construction BMPs). The drawings shall contain a table as provided in Appendix – J with the applicable information listed.
- For manufactured permanent BMPs, the construction drawings shall include manufacturer's recommendation on maintenance and inspection or reference the section and page number in the narrative.
- Construction drawings shall provide information on the post-construction inspections required for each permanent BMP or reference the narrative section that contains the information.
- VTSID Department will provide the permanent BMP IDs. Please provide SID with the number of permanent BMPs used as part of the project prior to submitting the ESC/SWM Plan for review. The designer will need to add the BMP IDs provided by SID on the construction drawings, in the table provided in Appendix – J and in the narrative.

4.3 Digital Files Requirements

All digital files shall be included on a CD or DVD and submitted to the VTSID Department. Projections shall utilize the Virginia State Plane Coordinate System (U.S. Feet).

4.3.1 Treatment Areas

The area(s) directly and indirectly treated by post-construction stormwater management facilities (BMPs) shall be provided in an ESRI shapefile. Indirect areas are defined as areas being "treated" through credits, but do not directly

drain to the BMP. The shapefile shall be based on the example provided at http://www.facilities.vt.edu/pdc/stormwater/ldpp/escswm.asp.

4.3.2 Applicable Area

The applicable area(s) used to determine percent impervious and water quality calculations shall be provided in a shapefile as part of the ESC/SWM Plan approval process. The shapefile shall be based on the example provided at http://www.facilities.vt.edu/pdc/stormwater/ldpp/escswm.asp.

4.3.3 Disturbed Area

The disturbed area(s) shall be provided in a shapefile as part of the ESC/SWM Plan approval process. The shapefile shall be based on the example provided at http://www.facilities.vt.edu/pdc/stormwater/ldpp/escswm.asp.

4.3.4 Watersheds

The area(s) representing sub-watershed(s) shall be provided in a shapefile as part of the ESC/SWM Plan approval process. For projects in which the existing conditions and post conditions are the same, digital submission of the watersheds may not be required. Please check with SID to determine whether or not digital files of the watersheds are required. The shapefile shall be based on the example provided at http://www.facilities.vt.edu/pdc/stormwater/ldpp/escswm.asp.

4.3.5 Stormwater Final Report

A digital copy of the stormwater final report shall be provided as a PDF.

5.0 INSPECTIONS

Virginia Tech Site & Infrastructure Development Department shall perform periodic ESC inspections, at a minimum, every two weeks and within 48 hours of a runoff producing rainfall event. In addition, inspections shall be made during or immediately following initial installation of erosion and sediment controls and at the completion of the project. Virginia Tech is responsible for and shall ensure compliance with the approved Plan and the Virginia Tech Annual Standards and Specifications for ESC and SWM (§10.1-564.F and §10.1-603.5.B). Virginia Tech shall perform post-construction inspections for stormwater management facilities as indicated in the approved Plan.

Licensed professional(s) shall perform inspections and surveys as he or she deems necessary to support his or her certification that each permanent stormwater management facility and associated conveyance system are installed and constructed in accordance with the approved Plan.

DCR shall perform random site inspections to assure compliance with the Virginia Erosion and Sediment Control Law (§10.1-560 et. seq.), the Virginia Erosion and Sediment Control Regulations (4VAC50-30 et. seq.), the Virginia Stormwater Management Act (§10.1-603 et. seq.), and the Virginia Stormwater Management Program (VSMP) Permit Regulations (4VAC50-60 et. seq.). Reference: §10.1-603.5.B.

5.1 Erosion and Sediment Control Inspections

The inspection report provided in Appendix C shall be completed by Virginia Tech or an agent of Virginia Tech on each site inspection visit. All measures shown on the plan shall be inspected. All problems and violations shall be documented on the inspection report. Inspection reports shall specify a required corrective action for each problem or violation noted and a date the corrective action must be completed.

The Responsible Land Disturber (RLD) shall inspect, on projects larger than 1 acre, the erosion and sediment control measures periodically. The inspection reports shall be maintained on-site and shall be available for review by Virginia Tech, DCR, and other regulatory agencies.

5.2 Stormwater Pollution Prevention Plan (SWPPP) Inspections

The inspection report provided in Appendix D is designed to be customized according to the BMPs and conditions at each site and shall be completed on each site inspection visit. A number shall be assigned to all BMPs on the site plan and these numbers shall correspond to the BMP numbers listed on the inspection sheet. Specific areas that will require continuous inspections shall be numbered on the site plan and these numbers shall correspond to the numbers listed on the inspection sheet. A brief description of the BMP or area shall then be listed in the site-specific section of the inspection report. Specific structural BMPs such as construction site entrances, sediment ponds, or specific areas with silt fence (e.g., silt fence along Washington Street; silt fence along slope in NW corner, etc.) must be numbered and listed. Non-structural BMPs or areas that will be inspected (such as trash areas, material storage areas, temporary sanitary waste areas, etc) must also be numbered and listed

The Inspector shall walk the site by following the site map and numbered BMPs/areas for inspection and note whether the overall site issues have been addressed. Any required corrective actions and the completion date and responsible person for the correction shall be noted in the Corrective Action Log.

If there are no non-compliance issues/problems, then the inspector shall certify that the site is in compliance with the SWPPP, permit, regulations, and laws.

5.3 ESC Installations and Certification

Erosion and sediment control measures/practices that require calculations shall be identified on the ESC/SWM drawings and will require written certification by the design professional as to completeness and correctness of installation of the erosion. The design professional shall use the certification letter provided in Appendix K. The certification letter shall be provided to Site & Infrastructure Development within 10 business days of the erosion and sediment control measures/practices having been installed. Failure to provide certification or to properly install the erosion and sediment control measures/practices in accordance with the approved Plan will result in a violation and may require a “stop work order”.

5.4 Permanent BMP Inspections

Permanent BMPs (stormwater management facilities) shall be inspected, photographed, and surveyed throughout the construction process and at the completion of the project such that a licensed professional(s) shall lawfully certify the BMPs are constructed in accordance with the approved Plan. The licensed professional(s) shall assume full responsibility for the certification and the information on which the certification is based. A licensed professional shall prepare and submit a stormwater final report to the Virginia Tech Site & Infrastructure Development Department for approval (please refer to Section 4.0).

5.5 Post-construction Inspections

Post-construction (long-term) inspections shall be made in accordance with the Virginia Tech Annual Standards and Specifications for ESC and SWM, and manufacturer's recommendation, when applicable. These inspections shall be performed by a DCR certified inspector.

5.6 Notification of Repeat Violations

Notification in the event of a repeat violation will be the responsibility of the inspector. The inspector shall note the number of occurrences for each violation noted in the inspection report. At the time of the second inspection, if the noted violations have not been addressed from the previous inspection report the inspector shall notify Virginia Tech Site & Infrastructure Development by email or by phone depending on the significance of the violation. For repeat violations not requiring immediate attention, an email notification shall be sent to SID@vt.edu. The email notification shall include the following information:

(i) the project name

(ii) a brief explanation of the repeat violation(s)

(iii) the number of times the violation has been repeated

(iv) an explanation of how and when the contractor was notified of the violation(s)

(v) the date of initial recorded incident(s)

If the violation is critical in nature, the inspector shall immediately contact the following parties proceeding to the next party when the above party is inaccessible:

Party Name	Affiliation	Primary Number	Alternative Number
Whitney Blankenship	VT - ESC Program Admin.	(540) 231 – 2414	(540) 231 - 9097
Virginia Tech Project Manager		As listed in SWPPP	
Craig Moore	VT - Senior ECS Program Admin.	(540) 231 - 1788	(540) 231 - 9097
Lauren Grimes	VT - Water Resources Engineer	(540) 231-3716	(540) 231 - 9097
Ed Watson	VT - Director, Univ. Design & Constr.	(540) 231-7930	(540) 231 - 9097

Virginia Tech shall be responsible for notifying the local Virginia Department of Conservation and Recreation in the event of repeat violations. After the second inspection and subsequent inspections if the violations have not been corrected a notification shall be sent to the Director of Virginia Tech University Design and Construction and/or the permit holder of the project for each non-compliant inspection. At the time of the fourth inspection, or if the violation has existed for four (4) or more weeks, whichever is less, if previously noted violations have not been corrected Virginia Tech shall notify DCR. At this time, DCR shall determine the extent of the violations and may issue a Notice to Comply, Stop Work Order or other enforcement action dependent on the severity and length of the violation.

6.0 VARIANCES and EXCEPTIONS

Variances and Exceptions to regulations must ensure protection of off-site properties and resources from damage. Economic hardship is not sufficient reason to request a variance or an exception.

For a Variance to become part of a project specific ESC Plan, a written variance request must be submitted by the Virginia Tech Site & Infrastructure Development Department for review and approval by DCR. This request must include an explanation of the reasons for requesting the variance and describe the specific site conditions necessitating the request. The request must also include a detailed description of the alternative ESC practice and justification that the practice meets the intent of the Minimum Standard for which the variance is sought (Ref. 4VAC50-30-50).

For an Exception to become part of a specific SWM Plan, a written exception request must be submitted by the Virginia Tech Site & Infrastructure Development Department for review and approval by DCR. This request must include an explanation of the reasons for requesting the exception and describe the specific site conditions necessitating the request. The request must also include a detailed description of the alternative SWM practice and justification that the practice meets the intent of the minimum standard or technical criteria or both for which the exception is sought (Ref. 4VAC50-60-140).

6.1 ESC Variance Request Policy and Procedures:

- The Virginia Tech Site & Infrastructure Development Department shall coordinate the review and approval of all requested variances with DCR's ESC Program representative(s).
- All requests for project specific variances to the Virginia Tech Annual Standards and Specifications for ESC and SWM shall be sent by the design professional to Virginia Tech Site & Infrastructure Development and shall be accompanied by complete details and documentation, including justification for the requested variance and impacts associated with the variance request. The design professional shall complete the form included in Appendix G.

- The Virginia Tech ESC and SWM Administrator (or representative) will review the request and determine if the request should be sent to DCR for further consideration. If the Administrator determines the request should not be sent to DCR, then the request shall be considered denied.
- Variance requests will be sent by the Virginia Tech Site & Infrastructure Development Department to the DCR Christiansburg Regional Office and to the Virginia Erosion and Sediment Control Program Manager for review and approval, if determined to be appropriate.
- All requested variances shall be considered unapproved until written approval from DCR is received.
- All approved variances shall be listed in the General Notes section of the ESC & SWM construction drawings for land disturbing activities and included in the narrative.

6.2 SWM Exception Request Policy and Procedures:

- The Virginia Tech Site & Infrastructure Development Department will coordinate the review and approval of all requested exceptions with DCR's SWM Program representative(s).
- All requests for project specific exceptions to the Virginia Tech Annual Standards and Specifications for ESC and SWM shall be sent by the design professional to Virginia Tech Site & Infrastructure Development and shall be accompanied by complete details and documentation, including justification for the requested exception and impacts associated with the exception. The design professional shall complete the form included in Appendix H.
- The Virginia Tech ESC and SWM Administrator (or representative) will review the request and determine if the request should be sent to DCR for further consideration. If the Administrator determines the request should not be sent to DCR, then the request shall be considered denied.
- Exception requests will be sent by the Virginia Tech Site & Infrastructure Development Department to the DCR Christiansburg Regional Office and to the Virginia Stormwater Permitting Manager for review and approval, if determined to be appropriate.
- All requested exceptions shall be considered unapproved until written approval from DCR is received.
- All approved exceptions shall be listed in the General Notes section of the ESC and SWM plans for land disturbing activities and included in the Narrative.

6.3 Pre-approved variances:

The Virginia Tech Site & Infrastructure Development Department has included as part of the annual standards and specifications certain ESC measures (ESC controls) that are not included in the VESCH. As part of the approved annual standards and specifications, these ESC measures may be included as part of a project specific Plan. Appendix L includes a list of pre-approved variances for certain ESC measures that may be included as part of the ESC/SWM Plan.

In order for a project to utilize a pre-approved ESC measure, the ESC/SWM Plan must contain a detail sheet, inspection instructions, installation instructions, and maintenance instructions. ESC Measures not specifically included as part of the approved ESC/SWM

Plan shall not be used on the project unless the ESC/SWM Plan is amended to include the specific ESC Measure.

7.0 LAND-DISTURBING ACTIVITIES:

7.1 Proposed Land-disturbing activities:

A list of regulated land-disturbing activities expected to be under contract during the referenced time period are included in Appendix E. The list includes project location, estimated disturbed acreage by watershed, approximate start and completion date for each project, and a point of contact for each project. As additional land-disturbing activities not included on this list come under contract, information regarding such activities shall be submitted on separate lists on a quarterly basis to DCR. Information on specific land-disturbing activities not included on the list will be provided to DCR Christiansburg Regional Office no less than two weeks prior to the start of the activity. Estimated disturbed acreage for individual projects must be reported in the following manner:

(i) Linear Projects – beginning and ending coordinates, or
(ii) Site Development – central to polygon or point coordinates.

Note: *Coordinates may be reported by UTM (x, y, zone, datum) or state plane (x, y, zone, datum).*

7.2 Past and Current Land-disturbing activities:

A list of completed and actual regulated land-disturbing activities either under contract or terminated during the previously referenced time period or previous year, whichever is greater, is included in Appendix F. The list includes project location, project start and completion date, and actual disturbed area.

7.3 Project Tracking and Notification

- Virginia Tech shall use GIS to track regulated land-disturbing activities.
- The Virginia Tech Land-disturbing GIS will be updated monthly with project information as related to ESC and SWM.

7.4 Responsible Land Disturber:

- The Virginia Tech Site & Infrastructure Development Department shall notify DCR Christiansburg Regional Office of the Responsible Land Disturber (RLD) at least two weeks in advance of land-disturbing activities.
- The information to be provided shall include the name, contact information and certification number of the RLD.

8.0 LONG-TERM MAINTENANCE:

- Project Specific Plan (construction drawings/sheets and narrative) shall contain information on long-term maintenance of BMPs, which will be incorporated into the BMP O&M.
- Virginia Tech shall maintain a BMP GIS

  - Virginia Tech will use GIS to track stormwater management facilities, associated treatment areas/zones, and associated watersheds.
  - The Virginia Tech BMP GIS will be updated quarterly with information as related to the BMP.
- Stormwater Pollution Prevent Plans (SWPPPs) shall be made available over the internet.
- Virginia Tech shall inspect and maintain the BMPs in accordance with the approved Plans and VT Annual Standards and Specifications for ESC and SWM.

VirginiaTech

APPENDIX A

PART 1 – PLAN PREPARER'S CHECKLIST

PLAN PREPARER'S CHECKLIST

FOR EROSION AND SEDIMENT CONTROL PLANS

The Erosion and Sediment Control (ESC) Plan consists of the Narrative (including any supporting calculations) and the construction sheets (site plan), as noted below.

GENERAL

_____ Complete set of plans- Include all sheets pertaining to the site grading and stormwater and any activities impacting erosion and sediment control and drainage:

- ☐ Existing conditions
- ☐ Demolition
- ☐ Site grading
- ☐ Erosion and sediment control
- ☐ Storm sewer systems
- ☐ Stormwater management facilities
- ☐ Utility layout
- ☐ Landscaping
- ☐ On-site and off-site borrow and disposal areas that do not have separate approved ESC Plans

_____ Professional's seal - The designer's original seal, signature, and date are required on the *cover* sheet of each Narrative and each set of Plan Sheets. A facsimile is acceptable for subsequent Plan Sheets.

_____ Number of plan sets - Two sets of ESC Plans may be submitted initially. Four sets are required for approval. This office will retain one set of the approved ESC Plan.

_____ Variances - Variances requested at the time of plan submission are governed by Section 4VAC50-30-50 of the *Virginia Erosion and Sediment Control Regulations* and Virginia Tech Annual Standards and Specifications for ESC and SWM

_____ Certified Responsible Land Disturber (RLD) - A certified RLD is required during all stages of construction, from the initial land disturbance through final site stabilization**. The name of the project RLD must be provided to this office before any land disturbance may begin.** Notify this office in a timely manner if the RLD changes during the course of the project.

NARRATIVE

_____ Completed Plan Preparer's Checklists - Include a completed *Plan Preparer's Checklist for Erosion and Sediment Control Plans* and a completed *Plan Preparer's Minimum Standard Checklist for Erosion and Sediment Control Plans* in each Narrative.

_____ Project description - Briefly describe the nature and purpose of the land-disturbing activity. Provide the area (acres) to be disturbed. Identify the Owner of the development.

PROJECT NAME: _____ SUBMITTAL#: _____

PLANS DATED: _____ NARRATIVE DATED: _____

_____ Existing site conditions - A description of the existing topography (% slopes), ground cover, and drainage (on-site and receiving channels).

_____ Adjacent areas - A description of all neighboring areas such as residential developments, agricultural areas, streams, lakes, roads, etc., that might be affected by the land disturbance.

_____ Off-site areas - Describe any off-site land-disturbing activities that may occur (borrow sites, disposal areas, easements, etc.). Identify the Owner of the off-site area and the locality responsible for plan review. Include a statement that any off-site land-disturbing activity associated with the project must have an approved ESC Plan. Submit documentation of the approved ESC Plan for each of these sites.

_____ Soils - Provide a description of the soils on the site, giving such information as soil name, mapping unit, erodibility, permeability, surface runoff, and a *brief* description of depth, texture and soil structure. Show the site location on the Soil Survey, if it is available. Include a plan showing the boundaries of each soil type on the development site.

_____ Critical areas - A description of areas on the site that have potentially serious erosion problems or that are sensitive to sediment impacts (e.g., steep slopes, watercourses, wet weather / underground springs, etc.).

_____ Erosion and sediment control measures - A description of the structural and vegetative methods that will be used to control erosion and sedimentation on the site. Controls should satisfy applicable minimum standards and specifications in Chapter 3 of the 1992 *Virginia Erosion and Sediment Control Handbook* (VESCH).

_____ Management strategies / Sequence of construction - Address management strategies, the sequence of construction, and any phasing of installation of ESC measures.

_____ Permanent stabilization - A brief description, including specifications, of how the site will be stabilized after construction is completed.

_____ Maintenance of ESC measures - A schedule of regular inspections, maintenance, and repair of erosion and sediment control structures should be set forth.

_____ Calculations for temporary erosion and sediment control measures - For each temporary ESC measure, provide the calculations required by the standards and specifications.

_____ Stormwater management considerations - Will the development of the site cause an increase in peak runoff rates? Will the increase in runoff cause flooding or channel degradation downstream? Describe the strategy to control stormwater runoff:

- ☐ Provide exhibits showing the drainage divides, the direction of flow, and the size (acreage) of each of the site drainage areas that discharge runoff off-site, both existing and proposed.
- ☐ Provide calculations for pre- and post-development runoff from these drainage areas.
- ☐ Ensure that Minimum Standard 19 is satisfied for each off-site receiving channel, including those that receive runoff from stormwater management facilities.
- ☐ Provide calculations for the design of each permanent stormwater management facility.

PROJECT NAME: _____ SUBMITTAL#: _____

PLANS DATED: _____ NARRATIVE DATED: _____

☐ Ensure that increased volumes of sheet flows are diverted to a stable outlet, to an adequate channel, pipe or pipe system, or to a stormwater management facility.
☐ Provide adequacy calculations (capacity and erosion resistance) for all on-site stormwater conveyances in accordance with the next checklist item.

_____ Calculations for permanent stormwater conveyances - For each permanent stormwater conveyance or structure, provide the following design calculations, as applicable:

☐ Drainage area map with time of concentration (T_C) path shown
☐ T_C calculation/nomograph
☐ Locality IDF curve
☐ Composite runoff coefficient or RCN calculation
☐ Peak runoff calculations
☐ Stormwater conveyance channel design calculations
☐ Storm drain and storm sewer system design calculations
☐ Hydraulic Grade Line if any pipe in the system is more than 90% full for a 10-year storm
☐ Culvert design calculations
☐ Drop inlet backwater calculations
☐ Curb inlet length calculations

_____ Maintenance of SWM Facilities – Provide a table with following for each permanent stormwater management facility:

☐ A description of the requirements for maintenance of the facility and a recommended schedule of inspection and maintenance.
☐ The identification of the person or persons who will be responsible for maintenance.

_____ Water Quality – Is the plan in compliance with the water quality criteria (4VAC50-60-60)? Provide supporting calculations. For each best management practice with a checklist, include a completed Design and Plan Review Checklist from Appendix 3 of the *Virginia Stormwater Management Handbook*.

_____ Stream Channel Erosion – Is the plan in compliance with the stream channel erosion criteria (4VAC50-60-70)?

_____ Outfall Stability – Per MS-19, has the issue of outfall stability been appropriately addressed?

_____ Flooding – Is the plan in compliance with the flooding criteria (4VAC50-60-80)?

_____ Specifications for erosion and sediment control measures - For each erosion and sediment control measure employed in the plan, include in the Narrative at a minimum the following sections from the standard and specification in the VESCH: Construction Specifications, Installation, and Maintenance. Include any approved variances or revisions to the standards and specifications.

_____ Specifications for stormwater and stormwater management structures - Provide specifications for stormwater and stormwater management structures, i.e., pipe materials, pipe bedding, stormwater structures.

PROJECT NAME: _____ SUBMITTAL#: _____

PLANS DATED: _____ NARRATIVE DATED: _____

_____ Page numbers – Number the pages of the Narrative and the Calculations.

_____ General Information – Narrative contains project specific information, and where appropriate general information has been modified to represent the project specific information and situation.

SITE PLAN

_____ Vicinity map - A small map locating the site in relation to the surrounding area. Include any landmarks that might assist in locating the site.

_____ Indicate north - The direction of north in relation to the site.

_____ Off-site areas - Include any off-site land-disturbing activities (e.g., borrow sites, disposal areas, etc.) not covered by a separate approved ESC Plan.

_____ Erosion and sediment control notes - At a minimum, include the erosion and sediment control notes found in Table 6-1 on page VI-15 of the 1992 *Virginia Erosion and Sediment Control Handbook*. Note that the Virginia Erosion and Sediment Control Regulations are found in section "4VAC50-30" of the Code of Virginia. Ensure that all applicable Minimum Standards not covered elsewhere in the plan have been addressed. Include a note that any off-site land-disturbing activity associated with the project must have an approved ESC Plan.

_____ Minimum Standards – Minimum Standard 1 through Minimum Standard 19 shall be included in the plan set.

_____ Legend - Provide a complete listing of all ESC measures used, including the VESCH uniform code symbol and the standard and specification number. Include any other items necessary to identify pertinent features in the plan.

_____ Property lines and easements - Show all property and easement lines. For each adjacent property, list the deed book and page number and the property owner's name and address.

_____ Existing vegetation - The existing tree lines, grassed areas, or unique vegetation.

_____ Limits of clearing and grading – Delineate all areas that are to be cleared and graded.

_____ Protection of areas not being cleared - Fencing or other measures to protect areas that are not to be disturbed on the site.

_____ Critical areas – Note all critical areas on the plan.

_____ Existing contours - The existing contours of the site.

_____ Final contours and elevations - Changes to the existing contours, including final drainage patterns. Note the finished floor elevation (FFE) of all buildings on site, including basements.

PROJECT NAME: _____ SUBMITTAL#: _____

PLANS DATED: _____ NARRATIVE DATED: _____

VirginiaTech

APPENDIX A

PART 2 – PLAN PREPARER'S MINIMUM STANDARD CHECKLIST

PLAN PREPARER'S MINIMUM STANDARD CHECKLIST

FOR EROSION AND SEDIMENT CONTROL PLANS

Minimum Standards - All Minimum Standards must be addressed.

This project complies with the Virginia Tech Annual Standards and Specifications for ESC and SWM dated: _____

Yes	No	NA		
[]	[]	[]		All Minimum Standards have been listed on a construction sheet.
[]	[]	[]	MS-1	Have temporary and permanent stabilization been addressed in the narrative?
[]	[]	[]		Are practices shown on the plan?
[]	[]	[]		Temporary and permanent seed specifications?
[]	[]	[]		Lime and fertilizer?
[]	[]	[]		Mulching?
[]	[]	[]		Blankets/Matting?
[]	[]	[]		Pavement/Construction Road Stabilization?
[]	[]	[]	MS-2	Has stabilization of soil stockpiles, borrow areas, and disposal areas been addressed in the narrative and on the plan?
[]	[]	[]		Have sediment trapping measures been provided?
[]	[]	[]	MS-3	Has the establishment and maintenance of permanent vegetative stabilization been addressed?
[]	[]	[]	MS-4	Does the plan specifically state that sediment-trapping facilities shall be constructed as a first step in land-disturbing activities?
[]	[]	[]	MS-5	Does the plan specifically state that stabilization of earthen structures is required immediately after installation? Is this noted for each measure on the plan?
[]	[]	[]	MS-6	Are sediment traps and sediment basins specified where needed and designed to the standard and specification?
[]	[]	[]	MS-7	Have the design and temporary/permanent stabilization of cut and fill slopes been adequately addressed? Is Surface Roughening provided for slopes steeper than 3:1?
[]	[]	[]	MS-8	Have adequate temporary or permanent conveyances (paved flumes, channels, slope drains) been provided for concentrated stormwater runoff on cut and fill slopes?
[]	[]	[]	MS-9	Has water seeping from a slope face been addressed (e.g., subsurface drains)?

PROJECT NAME: _____ SUBMITTAL#: _____

PLANS DATED: _____ NARRATIVE DATED: _____

Yes No NA

[] [] [] MS-10 Is adequate inlet protection provided for all operational storm drain and culvert inlets?

[] [] [] MS-11 Are adequate outlet protection and/or channel linings provided for all stormwater conveyance channels and receiving channels? Is there a schedule indicating:
[] [] [] Dimensions of the outlet protection? Lining? Size of riprap?
[] [] [] Cross section and slope of the channels? Type of lining? Size of riprap, if used?

[] [] [] MS-12 Are in-stream protection measures required so that channel impacts are minimized?

[] [] [] MS-13 Are temporary stream crossings of non-erodible material required where applicable?

[] [] [] MS-14 Are all applicable federal, state and local regulations pertaining to working in or crossing live watercourses being followed?

[] [] [] MS-15 Has immediate restabilization of areas subject to in-stream construction (bed and banks) been adequately addressed?

[] [] [] MS-16 Have disturbances from underground utility line installations been addressed?
[] [] [] No more than 500 linear feet of trench open at one time?
[] [] [] Effluent from dewatering filtered or passed through a sediment-trapping device?
[] [] [] Proper backfill, compaction, and restabilization?

[] [] [] MS-17 Is the transport of soil and mud onto public roadways properly controlled? (i.e., Construction Entrances, wash racks, transport of sediment to a trapping facility, cleaning of roadways at the end of each day, no washing before sweeping and shoveling)

[] [] [] MS-18 Has the removal of temporary practices been addressed?
[] [] [] Have the removal of accumulated sediment and the final stabilization of the resulting disturbed areas been addressed?

[] [] [] MS-19 Are properties and waterways downstream from development adequately protected from sediment deposition, erosion, and damage due to increases in volume, velocity and peak flow rate of stormwater runoff? Have adequate channels been provided on-site? Has storm drain outfall stability been evaluated?

[] [] [] Variances requested at the time of plan submission are governed by Section 4VAC50-30-50 of the *Virginia Erosion and Sediment Control Regulations.*

[] [] [] Have variances been appropriately included in the narrative and construction sheets (drawings)?

Print	Professional's Signature	Date

PROJECT NAME: _____ SUBMITTAL#: _____

PLANS DATED: _____ NARRATIVE DATED: _____

_____ Site development - All improvements such as buildings, parking lots, access roads, utility construction, etc. Show all physical items that could affect or be affected by erosion, sediment, and drainage.

_____ Adequate Conveyances – Ensure that stormwater conveyances with adequate capacity and adequate erosion resistance have been for provided all on-site concentrated stormwater runoff. Off-site channels that receive runoff from the site, including those receiving runoff from stormwater management facilities, must be adequate. Increased volumes of sheet flows must be diverted to a stable outlet, adequate channel, pipe or pipe system, or a stormwater management facility.

_____ Location of practices - The locations of erosion and sediment control and stormwater management practices used on the site. Use the standard symbols and abbreviations in Chapter 3 of the VESCH.

_____ Direction of Flow for Conveyances - Indicate the direction of flow for all stormwater conveyances (storm drains, stormwater conveyance channels).

_____ Maintenance - A schedule of regular inspections, maintenance, and repair of temporary erosion and sediment control structures and permanent stormwater management facilities should be set forth.

_____ Storm Drain Profiles - Provide profiles of all storm drains except roof drains. If the type of pipe (RCP, CMP, HDPE, etc.) is not called out on the profiles, then the most conservative pipe material that may be specified for the project must be used in the adequacy calculations.

_____ Detail drawings - Any structural practices used that are not found in the VESCH or approved annual agency specifications should be described and illustrated with detail drawings.

_____ Details and Standards – The details and standards are modified to represent the project specific situation. Generalities have been removed, and project specific information has been included in the details and standards. Dimensions have been added to the details.

_____ Variances – The details and standards are modified to represent the project specific situation. Generalities have been removed, and project specific information has been included in the details and standards. Variances approved as part of the annual standards and specifications have been appropriately included in the Plan.

_____	_____	_____
Print	Professional's Signature	Date

PROJECT NAME: _____ SUBMITTAL#: _____

PLANS DATED: _____ NARRATIVE DATED: _____

VirginiaTech

APPENDIX B

PLAN PREPARER'S CHECKLIST
FOR
STORMWATER MANAGEMENT PLANS

PLAN PREPARER'S CHECKLIST

FOR STORMWATER MANAGEMENT PLANS

Y	N	N/A	
			A. Determination of flooding and channel erosion impacts to receiving streams due to land-disturbing activities shall be measured at each point of discharge from the land disturbance and such determination shall include any runoff from the balance of the watershed which also contributes to that point of discharge.
			B. The specified design storms shall be defined as either a 24-hour storm using the rainfall distribution recommended by the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) when using NRCS methods or as the storm of critical duration that produces the greatest required storage volume at the site when using a design method such as Modified Rational Method.
			C. For purposes of computing runoff, all pervious lands in the site shall be assumed prior to development to be in good condition (if the lands are pastures, lawns, or parks), with good cover (if the lands are woods), or with conservation treatment (if the lands are cultivated); regardless of conditions existing at the time of computation.
			D. Construction of stormwater management facilities or modifications to channels shall comply with all applicable laws and regulations. Evidence of approval of all necessary permits shall be presented.
			E. Impounding structures that are not covered by the Impounding Structure Regulations (4VAC50-20) shall be engineered for structural integrity during the 100-year storm event.
			F. Pre-development and post-development runoff rates shall be verified by calculations that are consistent with good engineering practices.
			G. Outflows from a stormwater management facility or stormwater conveyance system, shall be discharged to an adequate channel.
			H. Proposed residential, commercial, or industrial subdivisions shall apply these stormwater management criteria to the land disturbance as a whole. Individual lots in new subdivisions shall not be considered separate land-disturbing activities, but rather the entire subdivision shall be considered a single land development project. Hydrologic parameters shall reflect the ultimate land disturbance and shall be used in all engineering calculations.

Y	N	N/A	
			I. All stormwater management facilities shall have an inspection and maintenance plan that identifies the owner and the responsible party for carrying out the inspection and maintenance plan.
			J. Construction of stormwater management impoundment structures within a Federal Emergency Management Agency (FEMA) designated 100-year floodplain shall be avoided to the extent possible. When this is unavoidable, all stormwater management facility construction shall be in compliance with all applicable regulations under the National Flood Insurance Program, 44CFR Part 59.
			K. Natural channel characteristics shall be preserved to the maximum extent practicable.
			L. Land-disturbing activities shall comply with the Virginia Erosion and Sediment Control Law (10.1-560 et seq. of the Code of Virginia) and attendant regulations.
			M. Flood control and stormwater management facilities that drain or treat water from multiple development projects or from a significant portion of a watershed may be allowed in Resource Protection Areas defined in the Chesapeake Bay Preservation Act, provided that (i) the local government has conclusively established that the location of the facility within the Resource Protection Area is the optimum location; (ii) the size of the facility is the minimum necessary to provide necessary flood control, stormwater treatment, or both; and, (iii) the facility must be consistent with a stormwater management program that has been approved by the board.

Water Quality			
Y	N	N/A	
			A. Compliance with the water quality criteria may be achieved by applying the performance-based criteria or the technology-based criteria to either the site or a planning area.
			B. Performance-based criteria. For land-disturbing activities, the calculated post-development nonpoint source pollutant runoff load shall be compared to the calculated pre-development load based upon the average land cover condition or the existing site condition. A BMP shall be located, designed, and maintained to achieve the target pollutant removal efficiencies specified in Table 1 to effectively reduce the pollutant load to the required level based upon the following four applicable land development situations for which the performance criteria apply:
			1. Situation 1 consists of land-disturbing activities where the existing percent impervious cover is less than or equal to the average land cover condition and the proposed improvements will create a total percent impervious cover which is less than the average land cover condition. **Requirement:** No reduction in the after disturbance pollutant discharge is required
			2. Situation 2 consists of land-disturbing activities where the existing percent impervious cover is less than or equal to the average land cover condition and the proposed improvements will create a total percent impervious cover which is greater than the average land cover condition. **Requirement**: The pollutant discharge after disturbance shall not exceed the existing pollutant discharge based on the average land cover condition.
			3. Situation 3 consists of land disturbing activities where the existing percent impervious cover is greater than the average land cover condition. **Requirement:** The pollutant discharge after disturbance shall not exceed (i) the pollutant discharge based on existing conditions less 10% or (ii) the pollutant discharge based on the average land cover condition, whichever is greater.
			4. Situation 4 consists of land disturbing activities where the existing percent impervious cover is served by an existing stormwater management BMP that addresses water quality. **Requirement:** The pollutant discharge after disturbance shall not exceed the existing pollutant discharge based on the existing percent impervious cover while served by the existing BMP. The existing BMP shall be shown to have been designed and constructed in accordance with proper design standards and specifications, and to be in proper functioning condition.

Water Quality (con't)			
Y	N	N/A	
			C. Technology-based criteria. For land-disturbing activities, the post-developed stormwater runoff from the impervious cover shall be treated by an appropriate BMP as required by the post-developed condition percent impervious cover as specified in Table 1. The selected BMP shall be located, designed, and maintained to perform at the target pollutant removal efficiency specified in Table 1. Design standards and specifications for the BMPs in Table 1 that meet the required target pollutant removal efficiency will be available at the department.

Water Quality BMP*	**Target Phosphorus Removal Efficiency**	**Percent Impervious Cover**
Vegetated filter strip	10%	16-21%
Grassed swale	15%	16-21%
Constructed wetlands	20%	22-37%
Extended detention (2 x WQ Vol)	35%	22-37%
Retention basin I (3 x WQ Vol)	40%	22-37%
Bioretention basin	50%	38-66%
Bioretention filter	50%	38-66%
Extended detention-enhanced	50%	38-66%
Retention basin II (4 x WQ Vol)	50%	38-66%
Infiltration (1 x WQ Vol)	50%	38-66%
Sand filter	65%	67-100%
Infiltration (2 x WQ Vol)	65%	67-100%
Retention basin III (4 x WQ Vol with aquatic bench)	65%	67-100%

Stream Channel Erosion			
Y	N	N/A	
			A. Properties and receiving waterways downstream of any land-disturbing activity shall be protected from erosion and damage due to changes in runoff rate of flow and hydrologic characteristics, including but not limited to, changes in volume, velocity, frequency, duration, and peak flow rate of stormwater runoff in accordance with the minimum design standards set out in this section.
			B. In addition to subsections B and C of this section permit-issuing authorities, by local ordinance may, or the board by state regulation may, adopt more stringent channel analysis criteria or design standards to ensure that the natural level of channel erosion, to the maximum extent practicable, will not increase due to the land-disturbing activities. These criteria may include, but are not limited to, the following:
			1. Criteria and procedures for channel analysis and classification.
			3. Procedures for channel data collection.
			4. Criteria and procedures for the determination of the magnitude and frequency of natural sediment transport loads.
			5. Criteria for the selection of the proposed natural or man-made linings.

Flooding			
Y	N	N/A	
			A. Downstream properties and waterways shall be protected from damages from localized flooding due to changes in runoff rate of flow and hydrologic characteristics, including but not limited to, changes in volume, velocity, frequency, duration, and peak flow rate of stormwater runoff in accordance with the minimum design standards set out in this section.
			B. The 10-year post-developed peak rate of runoff from the development site shall not exceed the 10-year pre-developed peak rate of runoff.
			C. In lieu of subsection B of this section, localities may, by ordinance, adopt alternate design criteria based upon geographic, land use, topographic, geologic factors or other downstream conveyance factors as appropriate.
			D. Linear development projects shall not be required to control post-developed stormwater runoff for flooding, except in accordance with a watershed or regional stormwater management plan.

Print _____ Professional's Signature _____ Date _____

VirginiaTech

APPENDIX B

PART 2

PLAN PREPARER'S CHECKLIST
FOR
DETENTION, RETENTION, AND IMPOUNDMENT BMPS

VirginiaTech

Design and Plan Review Checklist

Applicant:_____ **Phone No.:**_____
Designer:_____ **Phone No.:**_____
Project Name: _____
Location:_____
Type of Facility and Identification No.:_____

Plan status:
_____ approved
_____ not approved

Legend:
_•_ - Complete
Inc. - Incomplete/Incorrect
N/A - Not Applicable

I. SUPPORTING DATA

_____ Narrative describing stormwater management strategy including all assumptions made in the design.

A. Drainage Area Map

_____ Site and drainage area boundaries
_____ Off-site drainage areas
_____ Pre- and post-developed land uses with corresponding acreage
_____ Pre- and post-developed time of concentration flow paths
_____ Existing and proposed topographic features
_____ Drainage area appropriate for BMP

B. Soils Investigation

_____ Soils map with site and drainage area outlined
_____ Geotechnical report with recommendations and earthwork specifications
_____ Boring locations
- _____ Borrow area
- _____ Basin pool area
- _____ Embankment area: centerline principal spillway, emergency spillway , abutments

_____ Boring logs with Unified Soils Classifications, soil descriptions, depth to seasonal high groundwater table, depth to bedrock, etc.
_____ Compaction requirements specified
_____ Additional geophysical investigation and recommendations in Karst environment

Design and Plan Review Checklist

II. COMPUTATIONS

A. Hydrology

_____ Runoff curve number determinations: pre- and post-developed conditions, with worksheets.

_____ Time of concentration: pre- and post-developed conditions, with worksheets.

_____ Hydrograph generation: pre- and post-developed condition for appropriate design and safety storms (SCS methods or modified rational-critical storm duration method)

B. Hydraulics

_____ Specify assumptions and coefficients used.

_____ Stage-storage table and curve

_____ Riser structure and barrel

- _____ Weir/orifice control analysis for riser structure discharge openings
- _____ Weir/orifice control analysis for riser crest
- _____ Barrel: inlet/outlet control analysis
- _____ Riser/Outlet Structure flotation analysis (factor of safety = 1.25 min.).
- _____ Anti-seep collar or filter diaphragm design.
- _____ Outlet protection per VE&SCH Std.. & Spec. 3.18.
- _____ Provisions for use as a temporary sediment basin riser with clean out schedule & instructions for conversion to a permanent facility.

_____ Emergency spillway adequacy/capacity analysis with required embankment freeboard.

_____ Stage - discharge table and curve (provide equations & cite references).

_____ Storm drainage & hydraulic grade line calculations.

_____ Reservoir routing of post-development hydrographs for appropriate design storms (2-yr., 10-yr., or as required by watershed conditions) & safety storms (100-yr. or as required).

C. Downstream impacts

_____ Danger reach study.

_____ 100 year floodplain impacts.

_____ "Adequate channel" calculations for receiving channel

_____ Provide downstream hydrographs at critical study points.

_____ Storm drainage plans for site areas not draining to BMP

- _____ Safe conveyance - MS-19
- _____ Areas compensated for in water quality performance-based criteria calculations

Design and Plan Review Checklist

D. Water Quality

_____ Impervious cover tabulation

_____ Technology-based criteria: proper selection of BMP based on impervious cover

_____ Performance-based criteria: pre- and post-developed pollutant load and pollutant removal requirement calculations (provide worksheets)

_____ Water quality volume for retention basin I, II, or III permanent pool

_____ Water quality volume for ext. detention and ext. detention enhanced with drawdown calculations

_____ Proper surface area/depth allocations for permanent pool/shallow marsh/constructed wetland

_____ Constructed stormwater wetland / shallow marsh

- _____ Adequate drainage area and/or base flow
- _____ Adequate pool volume
- _____ Adequate surface area
- _____ Allocation of surface area to depth zones
- _____ Maximum ponding depth over pool surface specified

III. PLAN REQUIREMENTS

A. General Items

_____ Plan view drawn at 1"=50' or less (40', 30', etc.)

_____ North arrow

_____ Legend

_____ Location plan and vicinity map

_____ Property lines

_____ Existing & proposed contours (2' contour interval min.)

_____ Existing features & proposed improvements (including utilities and protective measures)

_____ Locations of test borings

_____ Earthwork specifications

_____ Construction sequence for SWM basin and E&S controls

_____ Temporary erosion & sediment control measures

_____ Conveyance of base flow during construction

_____ Temporary and permanent stabilization requirements

- _____ Emergency spillway
- _____ Basin side slopes

_____ Basin bottom

_____ Delineation of FEMA 100 year floodplain

_____ Plans sealed by a qualified licensed professional

B. BMP Plan Views

_____ Dimensions of basin features: perm. Pool, sediment forebay, embankment, etc.

_____ Location of all conveyance system outfalls into basin

_____ Proper orientation to avoid short circuiting

_____ Outlet protection per VE&SCH

_____ Top of bank & basin bottom elevations

_____ Elevations of permanent pool, water quality volume and max. design water surface elevations for all appropriate design storms and safety storms

_____ Side slope (H:V) of basin storage area and embankment (upstream and downstream slopes)

_____ Proper length-to-width ratio as specified in BMP design criteria

_____ **Pervious** low flow channel

_____ Sediment forebay

_____ Basin bottom slope

_____ Maintenance access to sediment forebay, riser structure, and one side of the basin ponding area

_____ Peripheral ledge for safety

_____ Aquatic Bench

_____ Shoreline protection

_____ Safety fence

_____ Riser and barrel materials and dimensions labeled

_____ Constructed stormwater wetland / shallow marsh

_____ Basin liner specifications

_____ Pool depth zones identified on plan

_____ Pool geometry - wet/dry weather flow path

Design and Plan Review Checklist

C. BMP - Section Views & Related Details

1. Embankment (or dam) and Ponding Areas

_____ Elevations of permanent pool, water quality volume and max. design water surface elevations for all appropriate design storms and safety storms

_____ Top of dam elevations- constructed height and settled height (10% settlement).

_____ Adequate freeboard

_____ Top width labeled

_____ Elevation of crest of emergency spillway

_____ Emergency spillway w/ side slopes labeled.

_____ Emergency spillway inlet, level, and outlet sections labeled

_____ Existing ground and proposed improvements profile along center line of embankment

_____ Existing ground and proposed improvements profile along center line of principal spillway

_____ Typical grading section through pond including typical side slopes with aquatic bench, safety ledge, shoreline protection, etc.

_____ Existing ground and proposed improvements along center line of emergency spillway

_____ Dimensions of zones for zoned embankment

2. Seepage Control

_____ Impervious lining

_____ Phreatic line (4:1 slope measured from the principal spillway design high water).

a. Anti-seep Collar

_____ Anti-seep collar (detail reqd..).

_____ Size (based upon 15% increase in seepage length).

_____ Spacing & location on barrel (at least 2' from pipe joint).

b. Filter Diaphragm

_____ Design certified by a professional geotechnical engineer.

3. Foundation Cut Off Trench or Key Trench

_____ Materials labeled

_____ Bottom width (4' min. or greater per geotech. report).

_____ Side slopes labeled (1:1 max. steepness).

_____ Depth (4' min. or as specified in geotechnical report)

Design and Plan Review Checklist

4. Multi Stage Riser and Barrel System

_____ Materials labeled

_____ Bedding or cradle details provided

_____ Gauge & corrugation size for metal pipes specified

_____ Barrel diameter, inverts, and slope (%) labeled

_____ Outlet protection per VESCH, Std. & Spec. 3.18, 3.19 w/ filter cloth underlayment

_____ Crest elevation of riser structure shown

_____ Inverts and dimensions of control release orifices/weirs shown

_____ Structure dimensions shown

_____ Control orifice/weir dimensions shown

_____ Extended detention orifice protection (detail required for construction)

_____ Riser trash rack or screen (detail reqd.. for construction).

_____ Riser anti-vortex device (detail reqd.. for construction).

_____ Proper riser structure footing.

_____ Access to riser structure interior for maintenance.

_____ Basin drain pipe

D. Landscape Plan

_____ Planting schedule and specifications (transport / storage / installation / maintenance)

_____ Plant selection for planting zones 1thru 6

_____ Preservation measures for existing vegetation

_____ Top soil / planting soil included in final grading

E. Maintenance Items

_____ Person or organization responsible for maintenance.

_____ Maintenance narrative which describes the long-term maintenance requirements of the facility and all components.

_____ Facility access from public R/W or roadway.

_____ Maintenance easement.

Design and Plan Review Checklist

Comments

Print	*Signature*	*Date*

VirginiaTech

APPENDIX C

Erosion & Sediment Control and Stormwater Management Construction Site Inspection Form

University Design and Construction
Site & Infrastructure Development
69 Sterrett Facilities Complex (0129)
Blacksburg, Virginia 24061
540/231-9900 Fax: 540/231-5590

Erosion & Sediment Control and Stormwater Management
Construction Site Inspection Report

General Information			
Project Name & VT Work Order No.:		**Location:**	Blacksburg, Virginia
Date of Inspection:	**12/6/2011**	**Start/End Time:**	
Contact Information/Responsible Parties			
Responsible Land Disturber:		**RLD Phone #:**	
VT Project Manager:		**VT PM Phone #:**	
Inspector's Name(s):		**Inspector Phone #:**	**540-231-9097**
****All non-compliance issues to be resolved within 7 days from the date of the inspection unless otherwise noted.**** ****The RLD is responsible for the management and maintenance of all site erosion and stormwater controls.****			
Stage of Construction			
Pre-Construction Conference ☐ Clearing & Grubbing ☐ Construction ☐ Finish Grading ☐ Final Stabilization ☐ Construction of SWM Facilities ☐ Other _____ ☐			
Weather Information			
Type of Inspection: ❑ Regular ❑ Pre-storm event ❑ During storm event ❑ Post-storm event			
Has there been a storm event since the last inspection? ❑Yes* ❑No ***If yes, see rainfall data attached to this report.**			
Weather at time of this inspection? Temperature: ❑ Clear ❑Cloudy ❑ Rain ❑ Sleet ❑ Fog ❑ Snowing ❑ High Winds ❑ Other:			
Are there any indications of stormwater discharges prior to or at time of inspection? ❑Yes ❑No Are **there any indications of off-site damage?** ❑Yes ❑No **Is more than approximately 50% of the project site disturbed?** ❑Yes ❑No **If yes, describe:**			
Have previous violation(s) been corrected: ❑Yes ❑No ❑N/A			
❖ **No post-construction BMPs were inspected as part of this inspection.**	❖ **Certification of post-construction BMPs to be provided by others.**	❖ **No physical surveys have been conducted as part of this inspection report.**	

The required corrective action deadline date applies to all violations noted on this report. If listed violation(s) currently constitute non-compliance and/or required corrective actions are not completed by the deadline, a **NOTICE TO COMPLY**, **STOP WORK ORDER**, and/or other enforcement actions may be issued to the entity responsible for ensuring compliance on the above project.

Inspector's Name: _____

Signature: _____ **Date:** _____

Required Corrective Action Deadline Date: _____ **Re-inspection Date:** _____

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Blacksburg, Virginia 24061
540/231-9900 Fax: 540/231-5590

1. Refers to applicable regulation found in the most recent publication of the *Virginia Erosion and Sediment Control Regulations* (4VAC50-30), *Virginia Stormwater Management Permit Regulations* (4VAC50-60), or Annual Standards and Specifications for ESC & SWM
2. Non-compliance – number of times in which the item has been reported as a violation.

Revision: 10/21/2011

	Non-Compliance	BMP	BMP Installed	Maintenance Required	Description and Location of Problem/Violation[1], Required or Recommended Corrective Actions, and Other Comments/Notes
1			❑Y ❑N	❑Y ❑N	
Corrective Action Taken:					
2			❑Y ❑N	❑Y ❑N	
Corrective Action Taken:					
3			❑Y ❑N	❑Y ❑N	
Corrective Action Taken:					
4			❑Y ❑N	❑Y ❑N	
Corrective Action Taken:					
5			❑Y ❑N	❑Y ❑N	
Corrective Action Taken:					
6			❑Y ❑N	❑Y ❑N	
Corrective Action Taken:					
7			❑Y ❑N	❑Y ❑N	
Corrective Action Taken:					
8			❑Y ❑N	❑Y ❑N	

Date/Initials: _____

	Non-Compliance	BMP	BMP Installed	Maintenance Required	Description and Location of Problem/Violation[1], Required or Recommended Corrective Actions, and Other Comments/Notes
Corrective Action Taken:					
9			❑Y ❑N	❑Y ❑N	
Corrective Action Taken:					
10			❑Y ❑N	❑Y ❑N	
Corrective Action Taken:					
11			❑Y ❑N	❑Y ❑N	
Corrective Action Taken:					
10			❑Y ❑N	❑Y ❑N	
Corrective Action Taken:					

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69 Sterrett Facilities Complex (0129)
Blacksburg, Virginia 24061
540/231-9900 Fax: 540/231-5590

Date/Initials: _____

Overall Site Issues

	BMP/activity	Implemented?	Maintenance Required?	Description and Location of Problem/Violation[1], Required or Recommended Corrective Actions, and Other Comments/Notes
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	❑Yes ❑No ❑N/A	❑Yes ❑No	
2	Are natural resource areas (e.g., streams, wetlands, mature trees, etc.) protected with barriers or similar BMPs?	❑Yes ❑No ❑N/A	❑Yes ❑No	
3	Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	❑Yes ❑No ❑N/A	❑Yes ❑No	
4	Are discharge points and receiving waters free of any sediment deposits?	❑Yes ❑No ❑N/A	❑Yes ❑No	
5	Are storm drain inlets properly protected?	❑Yes ❑No ❑N/A	❑Yes ❑No	
6	Is the construction entrance/exit preventing sediment from being tracked into the street?	❑Yes ❑No ❑N/A	❑Yes ❑No	
7	Is trash/litter from work areas collected and placed in covered dumpsters?	❑Yes ❑No ❑N/A	❑Yes ❑No	
11	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	❑Yes ❑No ❑N/A	❑Yes ❑No	
12	Are public roads cleaned as required	❑Yes ❑No ❑N/A	❑Yes ❑No	
14	Is material leaving the site or being brought onto the site? If yes, explain.	❑Yes ❑No ❑N/A	❑Yes ❑No	

University Design and Construction
Site & Infrastructure Development
69 Sterrett Facilities Complex (0129)
Blacksburg, Virginia 24061
540/231-9900 Fax: 540/231-5590

Vault Webpage Access Information:

Web Address: http://198.82.142.212/AutodeskDM/webclient

User Name:	**VTProjects**
Password:	**Hokies (case sensitive)**
Server:	**198.82.142.212**
Database:	**SIDVault**

VirginiaTech

APPENDIX D

Stormwater Construction Site Inspection Report

University Design and Construction
Site & Infrastructure Development
69 Sterrett Facilities Complex (0129)
Blacksburg, Virginia 24061
540/231-9900 Fax: 540/231-5590

Stormwater Construction Site Inspection Report

General Information			
Project Name & VT Work Order No.:			
VAR10 Permit No.:		**Location:**	Blacksburg, VA
Date of Inspection:	**12/6/2011**	**Start/End Time:**	
Contact Information/Responsible Parties			
Contractor (GC/CM):		**GC Phone #:**	
Responsible Land Disturber:		**RLD Phone #:**	
VT Project Manager:		**VT PM Phone #:**	
Inspector's Name(s):		**Inspector Phone #.**	**(540) 231-9097**

****All non-compliance issues to be resolved within 7 days from the date of the inspection unless otherwise noted.****
****The Contractor is responsible for the management and maintenance of SWPPP.****
****The RLD is responsible for the management and maintenance of all site erosion and stormwater controls.****

Stage of Construction

Pre-Construction Conference ☐ Clearing & Grubbing ☐ Construction ☐ Finish Grading ☐ Final Stabilization ☐ Construction of SWM Facilities ☐ Other _____ ☐

Weather Information

Type of Inspection: ❑ Regular ❑ Pre-storm event ❑ During storm event ❑ Post-storm event

Has there been a storm event since the last inspection? ❑Yes* ❑No

***If yes, see rainfall data attached to this report.**

Weather at time of this inspection? Temperature:
❑ Clear ❑Cloudy ❑ Rain ❑ Sleet ❑ Fog ❑ Snowing ❑ High Winds ❑ Other:

Are there any indications of stormwater discharges prior to or at time of inspection? ❑Yes ❑No
Are there any indications of off-site damage? ❑Yes ❑No
Is more than approximately 50% of the project site disturbed? ❑Yes ❑No
If yes, describe:

Have previous violation(s) been corrected: ❑Yes ❑No ❑N/A

❖ **No post-construction BMPs were inspected as part of this inspection.**	❖ **Certification of post-construction BMPs to be provided by others.**	❖ **No physical surveys have been conducted as part of this inspection.**

CERTIFICATION STATEMENT

I certify under penalty of law that I performed the inspections and, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I have read and understand the SWPPP and the SWPPP portion of the General Permit for Discharge of Stormwater from Construction Activities. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations and falsifying inspections (reports).

Inspector's Name: _____

Signature: _____ **Date:** _____

VirginiaTech

University Design and Construction
Site & Infrastructure Development
69 Sterrett Facilities Complex (0129)
Blacksburg, Virginia 24061
540/231-9900 Fax: 540/231-5590

Date/Initials: _____

Refers to applicable regulation found in the most recent publication of the *Virginia Erosion and Sediment Control Regulations* (4VAC50-30), *Virginia Stormwater Management Permit Regulations* (4VAC50-60), or Annual Standards and Specifications for ESC & SWM

1. Non-compliance – number of times in which the item has been reported as a violation.

Revision: 10/21/2011

	Non-Compliance	BMP	BMP Installed	Maintenance Required	Description and Location of Problem/Violation[1], Required or Recommended Corrective Actions, and Other Comments/Notes
1			❑Y ❑N	❑Y ❑N	
Corrective Action Taken:					
2			❑Y ❑N	❑Y ❑N	
Corrective Action Taken:					
3			❑Y ❑N	❑Y ❑N	
Corrective Action Taken:					
4			❑Y ❑N	❑Y ❑N	
Corrective Action Taken:					
5			❑Y ❑N	❑Y ❑N	
Corrective Action Taken:					
6			❑Y ❑N	❑Y ❑N	
Corrective Action Taken:					
7			❑Y ❑N	❑Y ❑N	
Corrective Action Taken:					
8			❑Y ❑N	❑Y ❑N	
Corrective Action Taken:					

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	Non-Compliance	BMP	BMP Installed	Maintenance Required	Description and Location of Problem/Violation[1], Required or Recommended Corrective Actions, and Other Comments/Notes
9			❑Y ❑N	❑Y ❑N	
Corrective Action Taken:					
10			❑Y ❑N	❑Y ❑N	
Corrective Action Taken:					
11			❑Y ❑N	❑Y ❑N	
Corrective Action Taken:					
10			❑Y ❑N	❑Y ❑N	
Corrective Action Taken:					

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Site & Infrastructure Development
69 Sterrett Facilities Complex (0129)
Blacksburg, Virginia 24061
540/231-9900 Fax: 540/231-5590

Overall Site Issues

Below are some general site issues that should be assessed during inspections. Customize this list as needed for conditions at your site.

	BMP/activity	Implemented?	Maintenance Required?	Description and Location of Problem/Violation[1], Required or Recommended Corrective Actions, and Other Comments/Notes
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	❑Yes ❑No	❑Yes ❑No	
2	Are natural resource areas (e.g., streams, wetlands, mature trees, etc.) protected with barriers or similar BMPs?	❑Yes ❑No	❑Yes ❑No	
3	Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	❑Yes ❑No	❑Yes ❑No	
4	Are discharge points and receiving waters free of any sediment deposits?	❑Yes ❑No	❑Yes ❑No	
5	Are storm drain inlets properly protected?	❑Yes ❑No	❑Yes ❑No	
6	Is the construction entrance/exit preventing sediment from being tracked into the street?	❑Yes ❑No	❑Yes ❑No	
7	Is trash/litter from work areas collected and placed in covered dumpsters?	❑Yes ❑No	❑Yes ❑No	
8	Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	❑Yes ❑No	❑Yes ❑No	
9	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	❑Yes ❑No	❑Yes ❑No	
10	Are materials that are potential stormwater contaminants stored inside or under cover?	❑Yes ❑No	❑Yes ❑No	

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	BMP/activity	Implemented?	Maintenance Required?	Description and Location of Problem/Violation[1], Required or Recommended Corrective Actions, and Other Comments/Notes
11	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	❑Yes ❑No	❑Yes ❑No	
12	Are public roads cleaned as required	❑Yes ❑No	❑Yes ❑No	
13	Major grading log on site and maintained?	❑Yes ❑No	❑Yes ❑No	
14	Is material leaving the site or being brought onto the site? If yes, explain.	❑Yes ❑No	❑Yes ❑No	

	YES	NO
Copy of Permit on site		
Copy of permit coverage letter		
Approved ESC plan on site		

	YES	NO
SWPPP on site		
SWPPP signed		
Approved SWM plan on site		

	YES	NO	N/A
Has web address for SWPPP been displayed at entrance of site?			
Has Coverage Letter been displayed at entrance of site?			
Has the Amendment Log in SWPPP been updated since last report?			
Has the Grading Log in SWPPP been updated since last report?			
Has the Corrective Action Log in SWPPP been updated since last report?			
Has all SWPPP information been updated on the Vault webpage?			

Vault Webpage Access Information:

Web Address: http://198.82.142.212/AutodeskDM/webclient/

User Name: **VTProjects**
Password: **Hokies (case sensitive)**
Server: **198.82.142.212**
Database: **SIDVault**

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Blacksburg, Virginia 24061
540/231-9900 Fax: 540/231-5590

Date/Initials: _____

Additional Non-Compliance Violations

Describe any incidents of non-compliance not described above (write none if there are no additional incidents of non-compliance):

CERTIFICATION STATEMENT

I certify the site is in compliance or non-compliance (circle if correct) with the SWPPP and the General Permit for Discharge of Stormwater from Construction Activities.

"I certify under the penalty of law that I have read and understand this document and that this document and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name and title: _____

Signature: _____ **Date:** _____

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APPENDIX E

Proposed Land-disturbing Acitvities

VirginiaTech

APPENDIX F

Past and Current Land-disturbing Activities

VirginiaTech

APPENDIX G

Variance Request Form

VirginiaTech

University Planning, Design, and Construction
67 Sterrett Facilities Complex (0529)
Blacksburg, Virginia 24061
540/231-9097 Fax: 540/231-5590
www.facilities.vt.edu/pdc

VARIANCE REQUEST

Requested by: _____ **Date:** _____

Street Address: _____

City/Town/Zip: _____

Telephone #: _____ **Fax #:** _____

E-mail address: _____

Project Name/Location: _____

_____

Project Description: _____

_____

_____

Variance requested for (state appropriate minimum standard & requirement): _____

_____

_____

_____

Reasons/Justification for Variance Request and Specific Site Conditions Necessitating the Request: _____

_____

_____

_____

_____

Designers Signature: _____ **Date:** _____

Signature of applicant: _____ **Date:** _____

Providing supporting documentation (sketches, calculations, etc…) as necessary to support request
(NOTE: All approved Variance Requests will be considered part of the Erosion and Sediment Control Plan.

VirginiaTech

APPENDIX H

Exception Request Form

University Planning, Design, and Construction
67 Sterrett Facilities Complex (0529)
Blacksburg, Virginia 24061
540/231-9097 Fax: 540/231-5590
www.facilities.vt.edu/pdc

EXCEPTION REQUEST

Requested by: _____ **Date:** _____

Street Address: _____

City/Town/Zip: _____

Telephone #: _____ **Fax #:** _____

E-mail address: _____

Project Name/Location: _____

_____

Project Description: _____

_____

Exception requested for (state appropriate standard & requirement): _____

_____

_____

Reasons/Justification for Exception Request and Specific Site Conditions Necessitating the Request: _____

_____

_____

_____

Mitigating Measures: _____

_____

_____

Designers Signature: _____ **Date:** _____

Signature of applicant: _____ **Date:** _____

Providing supporting documentation (sketches, calculations, etc…) as necessary to support request
(NOTE: All approved Exception Requests will be considered part of the Stormwater Management Plan.)

VirginiaTech

APPENDIX I

Plan Reviewer Checklist

Site & Infrastructure Development
67 Sterrett Facilities Complex (0129)
Blacksburg, Virginia 24061
540/231-9097 Fax: 540/231-5590
www.facilities.vt.edu/stormwater

PLAN REVIEW CHECKLIST

_____ Annual Standards and Specifications – The ESC/SWM Plan clearly indicates the version of Virginia Tech Annual Standards and Specifications applicable.

- The coversheet of the narrative shall include the date of the Virginia Tech Annual Standards and Specifications ESC and SWM applicable.
- The coversheet of the construction drawings must contain Virginia Tech Annual Standards and Specifications for ESC and SWM applicable.
- What is the date of the annual stds and spec. applicable to this project:_____

_____ Minimum Standards - All applicable Minimum Standards must be addressed.

- All minimum Standards must be adhered to during the entire project regardless of the phasing.
- Request for a Variance should be addressed
- What is the version date of the most recent checklist: _____
- What is the version date of the checklist used:_____

_____ Plan Prepare Checklist – The ESC/SWM Plan must adhere to the approved Virginia Tech Annual Standards and Specifications listed on the coversheets of the narrative and construction drawings.

- What is the version date of the most recent checklist: _____
- What is the version date of the checklist used:_____

_____ Technical Criteria - All applicable technical criteria must be addressed.

- All technical criteria must be adhered to during the entire project regardless of the phasing.
- Request for an Exception should be addressed in the Plan.

_____ Areas – Shapefiles of the areas have been provided

- Treatment Areas
- Applicable Areas
- Disturbed Areas
- Watersheds

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Blacksburg, Virginia 24061
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www.facilities.vt.edu/stormwater

NARRATIVE

_____ Project description - Briefly describes the nature and purpose of the land-disturbing activity, and the area (acres) to be disturbed.

- What time of year will the project start and finish? (construction sequence)
- How long will it take to complete the project?
- How many acres will be disturbed for completion of this project?
- How much impervious area will the project have in post-developed conditions?
- What will be the ultimate developed conditions of the site?

_____ Existing site conditions - A description of the existing topography, vegetation and drainage.

- Should list percentages of slope on the site.
- Types of existing vegetation that can be used as erosion control, or areas to be left undisturbed.
- Discuss marking of areas where existing vegetation is to be preserved.
- Discuss size of drainage areas in pre-development and post-development conditions.
- Discuss any existing drainage or erosion problems and how they are to be corrected.
- Discuss orientation of slopes (north or south facing).
- Discuss how existing site conditions can be used to reduce the potential for erosion and how proposed E&S controls will be designed to "fit" the site.
- Photographs?

_____ Adjacent areas - A description of neighboring areas such as streams, lakes, residential areas, roads, etc., which might be affected by the land disturbance.

- The potential for off-site damages must be considered and discussed
- ANY environmentally sensitive areas should be mentioned.
- Other private or public lands adjacent to the site should be described and considered for possible problems during and after construction (traffic problems, dust control, increases in runoff etc.)
- Discuss perimeter controls to be used.

_____ Off-site areas - Describe any off-site land-disturbing activities that will occur (including borrow sites, waste or surplus areas, etc.). Will any other areas be disturbed?

- Any off-site borrow or spoil areas should have an approved plan to supplement the overall project plan.
- If off-site areas are under other permits, proof of permits should be provided.
- List specific locations of all off-site areas
- Discuss who will be responsible for final stabilization and maintenance of off-site areas.

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Blacksburg, Virginia 24061
540/231-9097 Fax: 540/231-5590
www.facilities.vt.edu/stormwater

_____ Soils - A brief description of the soils on the site giving such information as soil name, mapping unit, erodibility, permeability, depth, texture and soil structure.
- Indicate references for soil information
- Provide a copy of soil survey map
- Indicate what sheet of site plan soils are delineated
- Check for soils with a high K factor, or poor drainage, low pH etc.

_____ Critical areas - A description of areas on the site which have potentially serious erosion problems (e.g., steep slopes, channels, wet areas. streams, underground springs, etc.).
- Discuss any area of the project which may become critical during the project. Some areas of the site may have long or steep slopes during a certain phase of the grading.
- Indicate areas to be left alone until they can be graded and stabilized in favorable conditions.
- Discuss precautions to communicate limits of these areas to contractors and equipment operators.

_____ Erosion and sediment control measures - A description of the methods which will be used to control erosion and sedimentation on the site. (Controls should meet the specifications in Chapter 3.)
- List all controls used, list specification numbers (3.02) location of practice.
- Discuss why it was selected.
- Sequence of installation, maintenance and removal for each control.
- Discuss temporary seeding as a means of erosion control, list the types to be used

_____ Permanent stabilization - A brief description, including specifications, of how the site will be stabilized after construction is completed.
- Final stabilization needs careful review.
- Is the timing of seeding correct with the construction sequence?
- List soil testing requirements
- Provide seeding specifications (pure live seed minimums), fertilizer and liming specifications. Seeding tables and rates.
- Is the type of permanent vegetation appropriate for the site?
- Discuss all other areas to be stabilized other than vegetation (gravel, paved, etc.)

_____ Stormwater runoff considerations - Will the developed site cause an increase in peak runoff rates? Will the increase in runoff cause flooding or channel degradation downstream? Describe the strategy to control stormwater runoff.
- Discuss how downstream properties and waterways will be protected (basins, channel improvements, easements)
- Discuss how increased runoff will be managed during construction
- List or discuss all other references for design of permanent facilities.

Site & Infrastructure Development
67 Sterrett Facilities Complex (0129)
Blacksburg, Virginia 24061
540/231-9097 Fax: 540/231-5590
www.facilities.vt.edu/stormwater

_____ Calculations - Detailed calculations for the design of temporary sediment basins, permanent stormwater detention basins, diversions, channels, etc. Include calculations for pre- and post-development runoff.

- All calculations showing pre-development and post-development runoff should be provided. Worksheets, assumptions and engineering decisions should be clearly presented to assist the plan reviewer in his or her duties.
- Calculation methods should be clearly presented and organized.
- Have the calculations shown that adequate protection of down-stream properties and waterways are protected?

_____ Profiles – Storm pipe/channel profiles

- Is the Channel/pipe bottom shown?
- Are roughness coefficients and material type provided?
- Are surcharges shown or indicated that none acquire for a given storm?
- Is the hydraulic grade line shown for the required storm?
- Is the existing ground shown?
- Is the proposed ground/grade shown?

_____ WQ Calculations - Detailed calculations for the design of water quality BMPs

- Include calculations for pre- and post-development runoff.
- All calculations showing pre-development and post-development impervious surfaces impact should be provided. Worksheets, assumptions and engineering decisions should be clearly presented to assist the plan reviewer in his or her duties.
- Calculation methods should be clearly presented and organized.
- Have the calculations shown that the required WQ treatment is being attained?

_____ Maintenance - A schedule of maintenance for permanent stormwater management measures (BMPs) should be provided.

- Should list who is responsible during construction and who will be responsible once the project is complete
- Should provide a schedule of inspections to be conducted
- List maintenance items to check and perform as well as precautions for large storm events
- Is the table from Appendix – L provided in the Plan?_____
- Are the numbers provided by SID?

Site & Infrastructure Development
67 Sterrett Facilities Complex (0129)
Blacksburg, Virginia 24061
540/231-9097 Fax: 540/231-5590
www.facilities.vt.edu/stormwater

SITE PLAN

_____ Cover sheet – Contains the date of the Virginia Tech Annual Standards and Specifications for ESC and SWM applicable.

_____ Minimum Std Notes – Contains Minimum Standards 1 through 19 (4VAC50-30-40) listed on the construction drawings.

_____ General ESC Notes – Contains ES-1 through ES-16 notes listed on the construction drawings.

_____ Areas – Numerical values for areas are listed on the construction sheets.
- Contains the total area to be disturbed
- Contains the area to be disturbed per phase
- Contains the existing impervious area
- Contains the total impervious area after construction

_____ Vicinity map - A small map locating the site in relation to the surrounding area. Include any landmarks which might assist in locating the site.
- Provide a reproduction of a topographic map, road map etc.

_____ Indicate north - The direction of north in relation to the site.
- Useful tool for determining slope orientation
- Useful for communicating written inspection reports and plan review comments
- Useful in predicting areas off-site that might be effected by dust drift

_____ Limits of clearing and grading – Areas which are to be cleared and graded.
- Show all areas to be disturbed on the site plan
- Provide notes on how areas will be marked
- Provide notes and illustrations to clearly indicate areas NOT to be disturbed

_____ Existing contours - The existing contours of the site.
- Should be shown as dashed light lines in intervals from 1 to 5 feet.
- Represent pre-developed drainage areas (check these areas for accuracy)
- Show potential critical areas (slopes)
- Helps to determine cut or fill areas, low spots
- Helps to determine if E&S controls have been designed properly

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_____ Final contours - Changes to the existing contours, including final drainage patterns.
- Should be shown as heavy solid lines
- Determines final drainage areas
- Check to see if pre-developed drainage areas have increased
- Check final grade of slopes to see if they will become critical (may need diversions or flumes)
- Check vegetative specifications for final grade of slopes (low or high maintenance). Are erosion controls blankets needed?

_____ Existing vegetation - The existing tree lines, grassed areas, or unique vegetation.
- Clearly indicate existing tree lines, vegetation areas to remain
- Provide notes on the plan for areas to be undisturbed

_____ Soils - The boundaries of different soil types.
- Indicate soil boundaries of all soil types on the site. List K factor and soil survey classifications.
- Provide notes of soil properties (texture, etc.)

_____ Existing drainage patterns - The dividing lines and the direction of flow for the different drainage areas. Include the size (acreage) of each drainage area.
- Should be indicated by acres and show the direction of flow for all existing drainage areas.
- Indicates the need for basins, traps or other structural measures
- Helps to determine if controls are designed correctly
- Helps to determine if off-site drainage needs to be diverted
- Useful in planning to break up drainage areas into smaller more manageable areas during construction

_____ Profile of storm drainage systems – Proposed storm drainage components shall be provided in a profile.
- Pipe diameter, material, inverts, stationing, percent slope, proposed and existing grade, etc. should be included as part of the profile

_____ Critical erosion areas - Areas with potentially serious erosion problems.
- All critical, environmentally sensitive or prohibited areas should be denoted on the plan and notes provided to state reasons for critical nature
- Stream considerations; temporary crossings, other permits, location of stockpiles, trash & debris removal, fuel storage, etc.

_____ Site Development - Show all improvements such as buildings, parking lots, access roads, utility construction, etc.
- All improvements such as building, roads, temporary access roads, right-of-ways and temporary easements should be shown on the plan.
- Utility improvements on and off-site should be shown.

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_____ Location of practices - The locations of erosion and sediment controls and stormwater management practices used on the site. Use the standard symbols and abbreviations in Chapter 3 of the VESC handbook.

- The exact location of all practices including vegetation should be clearly shown on the plan.
- A legend denoting symbols, line uses and other special characters should be provided
-

_____ ESC BMPs – The ESC Measures (ESC BMPs) shall be clearly labeled.

- Are the ESC Measures (ESC BMPs) labeled with an ID that can be used in the SWPPP?

_____ Detail drawings - all structural practices used should be explained and illustrated with detail drawings.

- Details should be provided which are clearly dimensioned and reflected the ability to be "built" in the field according to the proper design criteria.
- Alternative E&S measures must have proper drawings to indicate how and where they are to be constructed.
- All plan drawings, elevations and cross section drawings should show scales used to prepare the drawings.
- Outlet protection schedules should be provided
- Sizes and materials should be shown for all pipes, flumes and slope drains.
- All details should list the specification number from the VESCH
- If more than one type of specification is being used, then details of all practices shall be provided
- See Variances below

_____ Variances - Any structural practices used that are not referenced to the E&S handbook or local handbooks should be explained and illustrated with detail drawings.

- Details should be provided which are clearly dimensioned and reflected the ability to be "built" in the field according to the proper design criteria.
- Alternative E&S measures must have proper drawings to indicate how and where they are to be constructed.
- All plan drawings, elevations and cross section drawings should show scales used to prepare the drawings.
- Installation instructions should be provided
- Maintenance instructions/schedule should be provided
- If more than one type of specification is being used, then details of all practices shall be provided

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_____ Off-site areas - Identify any off-site land-disturbing activities (e.g., borrow sites, waste areas, etc.). Show location of erosion controls. (Is there sufficient information to assure adequate protection and stabilization?)

- Are separate plans required for off-site borrow or disposal areas?
- How will off-site areas be stabilized?
- Are there any temporary easements to be disturbed during construction?
- Who has final responsibility for off-site areas?

_____ ESC Maintenance - A schedule of regular inspections and repair of erosion and sediment control structures should be set forth.

- Indicate who is responsible for maintenance and repair of all E&S measures on the project (RLD).
- Indicate who is the primary contact for emergencies, for notification of problems (owner), etc.
- Provide clean-out and maintenance specifications for all major structures such as basins, traps, silt fence etc.
- Require monitoring reports from the RLD if needed

_____ SWM Maintenance - A schedule of maintenance for permanent stormwater management measures (BMPs) should be provided.

- Should list who is responsible during construction and who will be responsible once the project is complete
- Should provide a schedule of inspections to be conducted
- List maintenance items to check and perform as well as precautions for large storm events
- Is the table from Appendix – L provided in the Plan?_____

_____ Permanent BMPs – The permanent BMPs (post-construction BMPs) shall be clearly labeled.

- Do the permanent BMP IDs match the SID requirements?

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APPENDIX J

Post-Construction BMPs

Site & Infrastructure Development
69 Sterrett Facilities Complex (0129)
Blacksburg, Virginia 24061
540/231-9097 Fax: 540/231-5590
www.facilities.vt.edu/stormwater

BMP Post-Construction Maintenance Responsibility

BMP ID	BMP Description	Name	Title	Department	Phone No.	Email
		Mark Helms	Director	Facilities Operations	540-231-7243	mahelms@vt.edu
		Mark Helms	Director	Facilities Operations	540-231-7243	mahelms@vt.edu
		Mark Helms	Director	Facilities Operations	540-231-7243	mahelms@vt.edu
		…	…	…	…	…

Note: Add additional rows as needed to account for all post-construction BMP's installed as part of this project.

Site & Infrastructure Development Department (SID) will provide the post-construction BMP IDs. Please provide SID with the number of post-construction BMPs used on the site prior to submit the ESC/SWM Plan for review. The designer will need to add the BMP IDs provided by SID on the construction drawings and in the table above.

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APPENDIX K

DESIGN PROFESSIONAL CERTIFICATION
OF
ESC MEASURES

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PROJECT NAME: _____ SUBMITTAL#: _____

Erosion and sediment control measures/practices that require calculations shall be identified on the ESC/SWM drawings and will require written certification by the design professional as to completeness and correctness of installation within 10 business days of the erosion and sediment control measures/practices being installed.

ESC Meas./Practice ID	ESC Measure/Practice Description	Comments

I, _____, certify the above erosion and sediment control measure(s)/practice(s) on the ESC/SWM Plan (Narrative dated: _____ and Construction Drawings dated :_____) approved on _____ has (have) been completely and correctly installed.

_____ _____

(Design Professional Signature) *(Date)*

Firm Name: _____

Address: _____

City, State, Zip Code _____

Phone Number _____

(Make additional copies as necessary) Sheet _____ of _____

Version: Dec. 20, 2010

VirginiaTech

APPENDIX L

PRE-APPROVED VARIANCES

Table of Contents

L.01 - Dewatering

- Dandy Dewatering Bag
- Dirtbag Dewatering Bag

L.02 - Diversion

- ACF Erosion Eel

L.03 - Inlet Protection

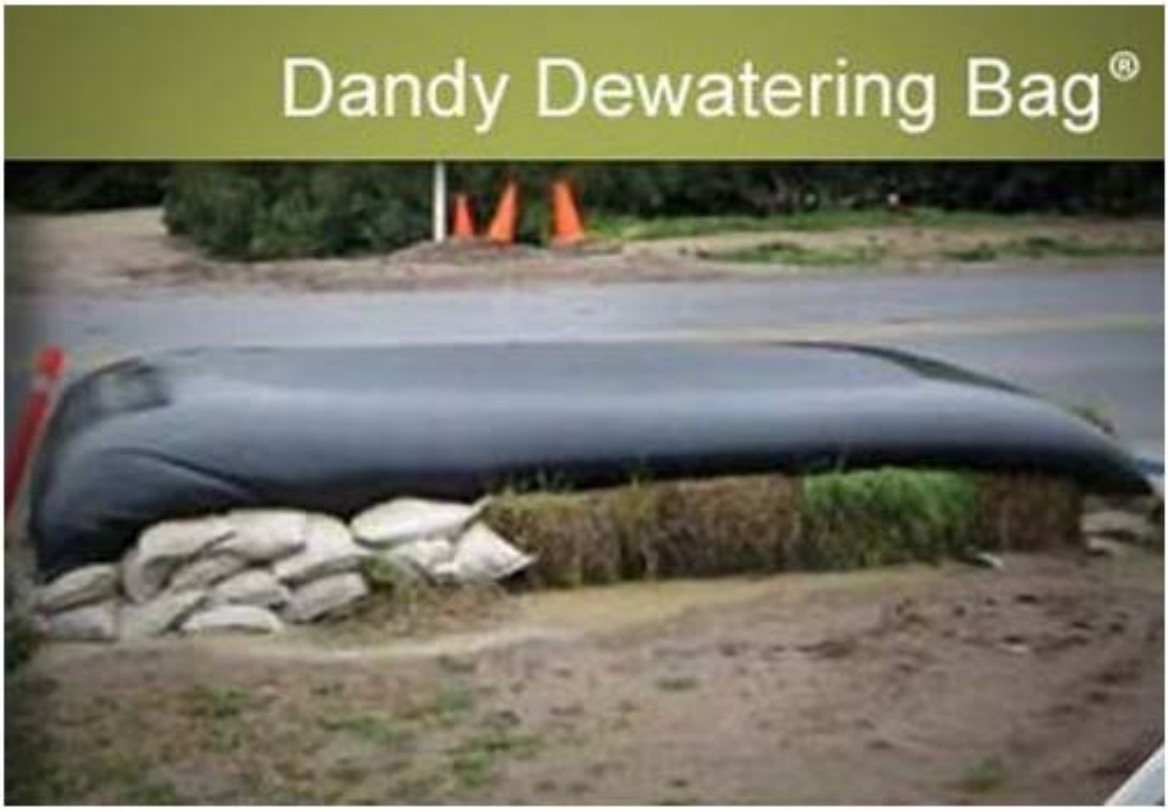
- ACF Grate Gator Sediment Containment
- ACF Gutterbuddy Curb Inlet Drain Filters
- ACF GutterEel Curb Inlet Drain Filters
- ACF SiltSack Sediment Capture Device
- Dandy Bag Inlet Protection System
- Dandy Curb Grateless Curb Inlet and Median Barrier Inlet Protection System
- Dandy Curb Bag Curb and Gutter Inlet/Grate Protection System
- Dandy Curb Sack Curb and Gutter Protection System
- Dandy Pop (Pop-up Dandy Bag) Inlet Protection System
- Dandy Sack Inlet Protection System
- Rapid Flow Drain Filter – Polystyrene Aggregate

L.04 - Silt Fence

- ACF Silt Fence

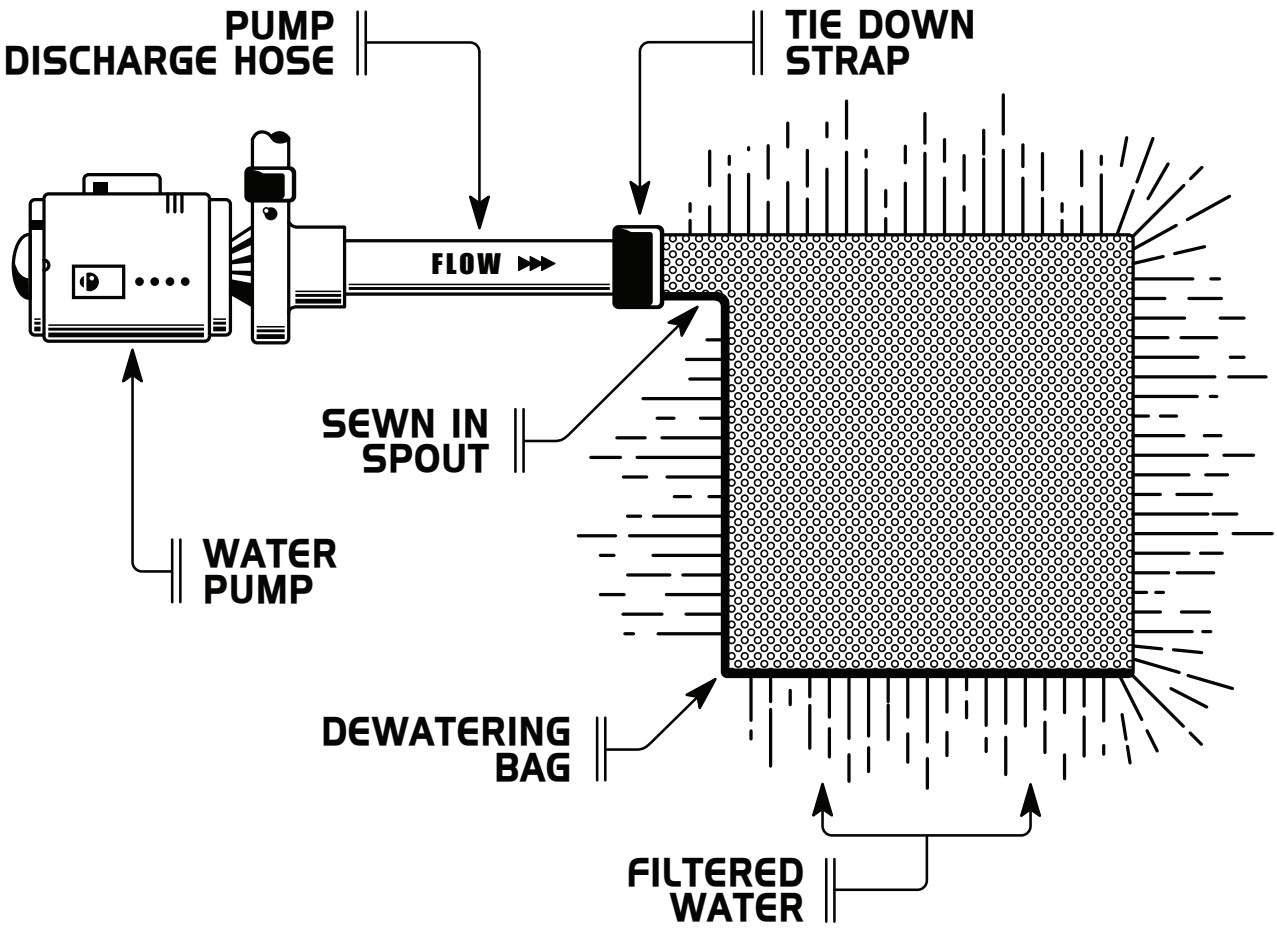
L.05 – Bio-soil Mixture

- Bio-soil Mixture

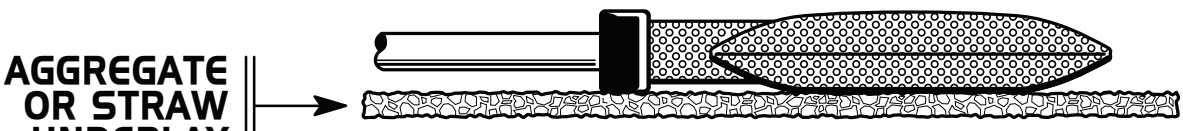

Dandy Dewatering Bag®

DANDY DEWATERING BAG™

TOP VIEW



SIDE VIEW



{For added flow}

DANDY DEWATERING BAG ™
PUMPED WATER SEDIMENT CONTROL SYSTEM GUIDE SPECIFICATIONS

PRODUCT:

DANDY DEWATERING BAG™

MANUFACTURER:

Dandy Products Inc.
P.O. Box 1980
Westerville, Ohio 43086
Phone: 800-591-2284
Fax: 740-881-2791
E Mail dlc@dandyproducts.com
Web www.dandyproducts.com

1.0 **Description:**

1.1 Work covered under this consists of furnishing, installing, maintaining, and removal of the Dandy Dewatering Bag ™ The purpose is to control sediment discharge in any dewatering or pumped water application.

2.0 **Material:**

2.1 The Dandy Dewatering Bag™ shall be a bag sewn of nonwoven fabric **in the U.S.A.** using a double needle machine and a high strength thread.

2.2 The Dandy Dewatering Bag™ shall have a spout opening large enough to accommodate at least a four (4) inch pump discharge hose with an attached strap to tie unit closed.

2.3 The Dandy Dewatering Bag™ Seams shall be a double stitched "J" type seam with an average wide width strength per ASTM D-4884 of 60lb/in for a 8 oz. fabric manufactured in the U.S.A. with the following characteristics:

PROPERTY	TEST METHOD	UNITS	MARV
Grab Tensile Strength	ASTM D 4632	kN (lbs)	0.9 (205)
Grab Tensile Elongation	ASTM D 4632	%	50
Puncture Strength	ASTM D 4833	kN (lbs)	0.58 (130)
Mullen Burst Strength	ASTM D 3786	kPa (psi)	2618 (380)
Trapezoid Tear Strength	ASTM D 4533	kN (lbs)	0.36 (80)
% Open Area	COE - 22125-86	%	N/A
Apparent Opening Size	ASTM D 4751	mm (US Std Sieve)	.0180 (80)

Permittivity	ASTM D 4491	sec^{1}	1.2
Permeability	ASTM 4491	cm/sec	0.21
Water Flow Rate	ASTM 4491	$l/min/m^2$ ($gal/min/ft^2$)	3866 (95)
Ultraviolet Resistance	ASTM D 4355	%	70
Color			Black

3.0 **Installation:**

3.1 Lifting straps (not included) should be placed under the unit to facilitate removal after use.

3.2 Unfold Dandy Dewatering Bag™ on a stabilized area over dense vegetation, straw, or gravel (if an increased drainage surface is needed) or as detailed in plans.

3.3 Insert discharge hose from pump into Dandy Dewatering Bag™ a minimum of six (6) inches and tightly secure with attached strap to prevent water from flowing out of the unit without being filtered.

4.0 **Maintenance:**

4.1 Replace the unit when ½ full of sediment or when sediment has reduced the flow rate of the pump discharge to an impractical rate.

4.2 Remove and dispose of the sediment in a manner satisfactory to the engineer/inspector or in one of the following ways:

A) Remove the unit and sediment from environmentally sensitive areas and waterways. At the approved disposal site, slit the unit; remove the sediment and grade smoothly into the existing topography. Dispose of unit no longer in use at an appropriate recycling or solid waste facility.

B) Bury unit on site; remove any visible fabric and seed.

5.0 **Method of Measurement:**

5.1 The quantity to be paid is for the actual number of Dandy Dewatering Bags ™.

6.0 **Basis of Payment:**

6.1 The unit price shall include labor, equipment, and materials necessary to install, maintain, and remove the Dandy Dewatering Bag™.
6.2 Payment for the completed work will be made at the contract prices for:

ITEM	UNIT	DESCRIPTION
Dandy Dewatering Bag™	EA	Pumped Water Sediment Control Unit (#_____UNITS)

DIRTBAG®

Pumped Sediment Removal System

Whenever accumulated water must be pumped!

Protect the environment effectively and economically with Dirtbag®! Collect sand, silt and fines. Avoid silting streams, surrounding property and storm sewers. As more and more emphasis is put on saving our wetlands, regulations are becoming more stringent regarding the pumping of dirty water from holes around construction sites-such as foundations, pipe line construction, repairing municipal water/sewer lines, marine construction, utility, highway and site development areas. Dirtbag® applications are endless.

Use Recommendations

ACF Environmental manufactures Dirtbag® using a variety of woven and nonwoven geotextile fabrics. The fabric properties on the Specifications page affirm the strength of Dirtbag® and are a result of tests conducted at on-site laboratories at the geotextile factory. All test methods are ASTM or industry standards.

Each standard Dirtbag® has a fill spout large enough to accommodate a 4" discharge hose. Straps are attached to secure the hose and prevent pumped water from escaping without being filtered.

Strap the neck of Dirtbag® tightly to the discharge hose. To increase the efficiency of filtration, place the bag on an aggregate or haybale bed to maximize water flow through the surface area of the bag.

Dirtbag® is full when it no longer can efficiently filter sediment or pass water at a reasonable rate. Flow rates will vary depending on the size of Dirtbag®, the type and amount of sediment discharged into Dirtbag, the type of ground, rock or other substance under the bag. Under most circumstances Dirtbag® will accommodate flow rates of 750 gallons per minute. Use of excessive flow rates or overfilling Dirtbag® with sediment will cause ruptures of the bags or failure of the hose attachment straps.

Dirtbag must be monitored during use.

Easy To Use

First, Dirtbag® is easy to transport to the site. To install, simply unfold and insert up to 4" pump discharge the hose into the hand-sewn spout and secure with the attached straps. Pump dirty water into Dirtbag®. The bag collects sediment silt as the clean water gently filters out from all sides.

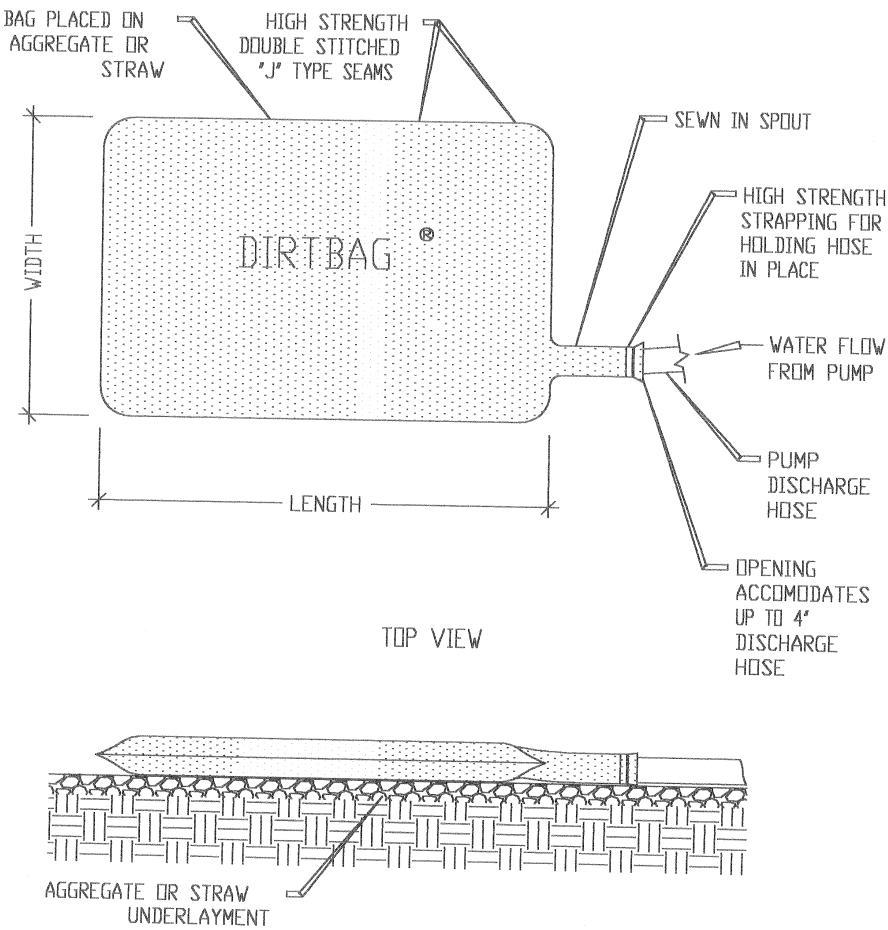
Compare Dirtbag® to the alternatives such as straw bale forts which are more cumbersome to transport, to build and to clean afterward. Best of all, Dirtbag® poses no threat to the environment when disposed properly.

Dirtbag® Features

- Designed and produced from a variety of fabrics to meet engineering specifications for flow rates, strength and permeability.
- Stabilized to provide resistance to ultra-violet degradation.
- Meets municipal, state and Corps of Engineers specifications.
- Available in 10'x15', 12 ½' x 15' and 15' x 15' sizes. Custom sizes available.

Hillside Installation on Straw Underlayment

Typical Dirtbag® Construction



Dirtbag® Specification
Control of Sediment In Pumped Water

1.0 Description

1.1 This work shall consist of furnishing, placing and removing Dirtbag® pumped sediment control device as directed by the design enginer or as shown on the contract drawings. Dirtbag® pumped-silt control system is marketed by:

ACF Environmental, Inc.
2831 Cardwell Road
Richmond, Virginia 23234
Phone: 800-448-3636 ● Fax: 804-743-7779
www.acfenvironmental.com

2.0 Materials

2.1 Dirtbag®

2.1.1 Dirtbag® shall be manufactured using a polypropylene nonwoven geotextile sewn into a bag with a double needle matching using a high strength thread.

2.1.2 Each standard Dirtbag® has a fill spout large enough to accommodate a 4" discharge hose. Straps are attached to secure the hose and prevent pumped water from escaping without being filtered.

2.1.3 Dirtbag® seams shall have an average wide width strength per ASTM D-4884 as follows:

Dirtbag® Style	Test Method	Test Method
Dirtbag® 53	ASTM D-4884	60 lbs./in
Dirtbag® 55	ASTM D-4884	100 lbs./in

Property	Test Method	Units	Test Results Style 53	Test Results Style 55
Weight	ASTM D-3776	oz/yd	8	10
Grab Tensile	ASTM D-4632	lbs.	205	250
Puncture	ASTM D-4833	lbs.	110	150
Flow Rate	ASTM D-4491	gal/min/ft^2	110	85
Permittivity	ASTM D-4491	sec.$^{-1}$	1.5	1.2
Mullen Burst	ASTM D-3786	lbs. ^{in2}	350	460
UV Resistant	ASTM D-4355	%	70	70
AOS % Retained	ASTM D-4751	US Sieve	80	100

All properties are Minimum Average Roll Value (MARV) except the weight of the fabric which is given for information only. Depending on soil conditions and filtration requirements, additional geotextile options are available. Please call our engineering staff for solutions.

3.0 Construction Sequence

3.1.1 To install Dirtbag® on a slope so incoming water flows downhill through Dirtbag® without creating more erosion. Strap the neck of Dirtbag® tightly to the discharge hose. To increase the efficiency of filtration, place the bag on an aggregate or haybale bed to maximize water flow through the surface area of the bag.

3.1.2 Dirtbag® is full when it no longer can efficiently filter sediment or allow water to pass at a reason able rate. Flow rates will vary depending on the size of Dirtbag®, the type and amount of sediment discharged into Dirtbag®, the type of ground, rock or other substance under the bag and the degree of the slope on which the bag lies. Under most circumstances Dirtbag® will accommodate flow rates of 750 gallons per minute. Use of excessive flow rates or overfilling Dirtbag® with sediment will cause the bag to rupture or failure of the hose attachment straps.

*Must be monitored during use.

3.1.3 Dispose Dirtbag® as directed by the site engineer. If allowed, Dirtbag® may be cut open and the contents seeded after removing visible fabric. Dirtbag® is strong enough to be lifted with optional straps if it must be hauled away. Off-site disposal may be facilitated by placing Dirtbag® in the back of a dump truck or flatbed prior to use and allowing the water to drain from the bag while in place, thereby eliminating the need to lift Dirtbag®.

4.0 Basis of Payment

4.1 The payment for any Dirtbag® used during construction is to be included in the bid of overall erosion and sediment control plan unless a unit price is requested.

*ACF Environmental is not liable for failures or misue of the Dirtbag.

Above: Dirtbag® installation shown on inclined hillside for maximum flow.

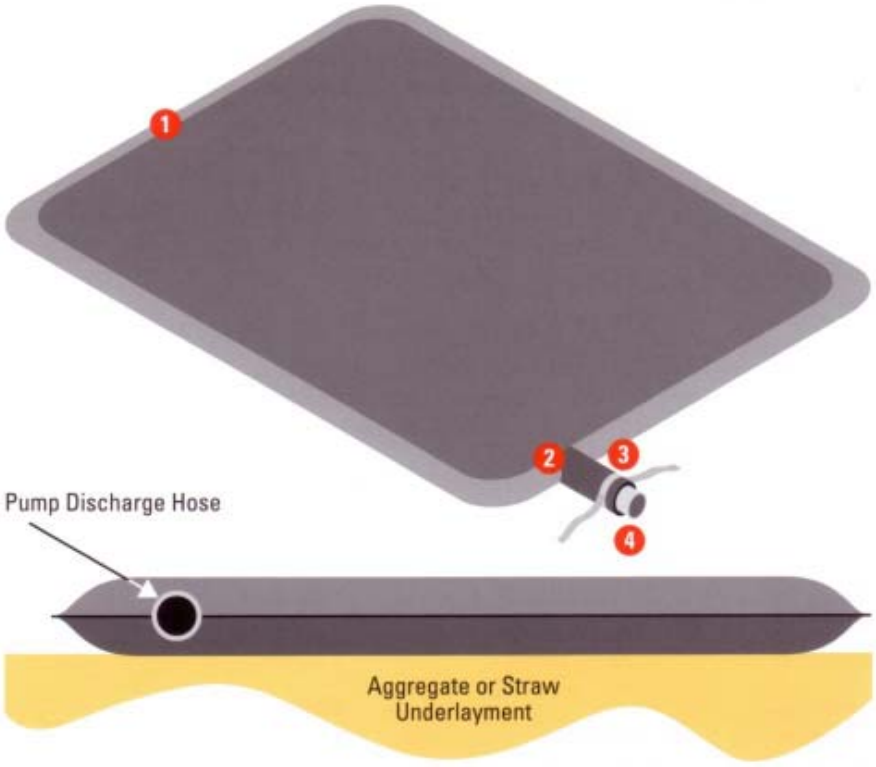
Disposal

Dispose of Dirtbag® as directed by the site engineer. If allowed, Dirtbag® may be cut open and the contents seeded after removing visible fabric. Dirtbag® is strong enough to be lifted with optional straps if it must be hauled away. Off-site disposal may be facilitated by placing Dirtbag® in the back of a dump truck or flatbed prior to use and allowing the water to drain from the bag while in place, thereby eliminating the need to lift Dirtbag®.

Dirtbag® Features:

1. High strength double stitched "J" type seams.
2. Sewn in spout.
3. High strength strapping for holding hose in place.
4. Hose opening accommodate up to 4" discharge hose.

For optimal flow, install over straw or aggregate.



ACF ENVIRONMENTAL
Customer Focused, Environmentally Committed
2831 Cardwell Road
Richmond, Virginia 23234
(800) 448-3636 • FAX (804) 743-7779
www.acfenvironmental.com

ACF Environmental

"Complete Source for Stormwater Solutions"

Distributed by:

EROSION EEL™

The Erosion EEL™, by its very nature, functions to help prevent physical degradation of the environment by enhancing water quality.

What Is The ErosionEEL™

The ErosionEEL™ is an environmentally friendly, low impact erosion and sediment control device.

Erosion EEL™ Advantages

- *Easy installation with no trenching required*
- *Replaces silt fence, rock check dams, temporary diversion berms, and storm/inlet drain protection*
- *May be placed over multiple surfaces including soil, asphalt, concrete, and surface rock*
- *DOT Approved in many states*
- *Durable, reusable, and easily moved, thereby making it very cost-effective compared to silt fence and other BMPs*
- *Increased flow rates through the filter material as compared to silt fence preventing localized flooding during storm events*

ErosionEEL™ is reusable within a project and can be moved to other project sites:

Minimizes the amount of new product manufacturing (involving extraction of natural resources, additional manufactured products into the environment).

At the end of EEL cycle, rubber material is cleaned and reused in new EELs that are produced.

Call ACF Environmental for more information.

Environmental ACF

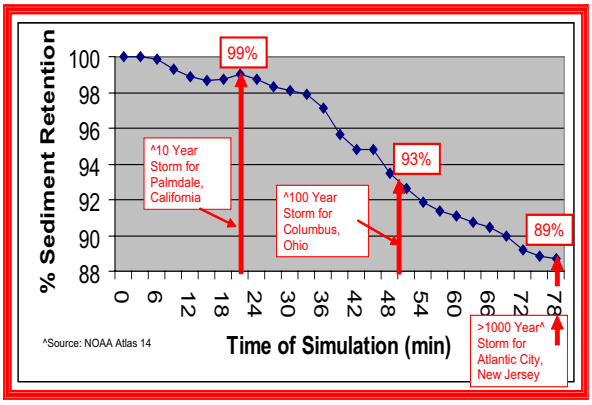
800-448-3636

Benefits and Features

- Three-dimensional Filter - Sediment retention roll/tube
  Function: Suspended particle capture; flow control
- Woven polypropylene geotextile exterior
- Nominal 9.5” diameter
- Manufactured lengths = Nominal 10ft and 4.5ft
- Internal fill Material Mixture
  Washed shredded rubber (metal removed) - Supplier: MTR AASHTO - specified hardwood chips (0.5” to 0.75” in size)

Performance

The test results for the ErosionEEL™ at the San Diego State University Soil Erosion Research Laboratory revealed that the EEL is very resilient under extreme rainfall intensities and slope conditions. The protocol used was designed to fail all BMPs in order to determine the performance limits. However, the ErosionEEL™ retained as high as 89% solids from a 33% barren slope under rainfall conditions at or exceeding the 1000 year storm event.



Environmental Compatibility

Synthetic Precipitation Leach Procedure (SPLP)

pH of 4.2 and pH 7.0 (modified SPLP)

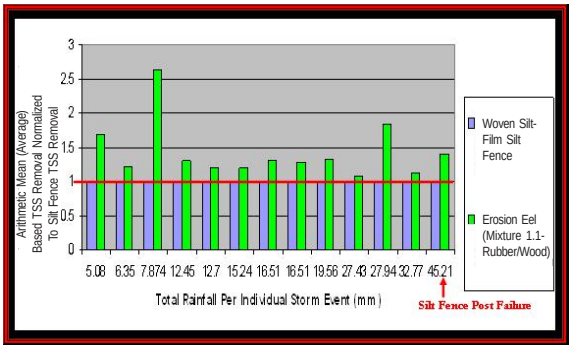
Testing for metals, volatiles, suffactants, base/neutral extractables, acid extractables

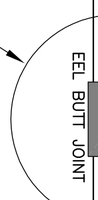
Rubber Fill Material Results

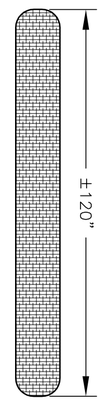
No adverse levels of any constituents have been extracted (relative to human exposure and aquatic toxicity)

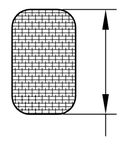
Synthetic Fibers (nylon, PP, PET)

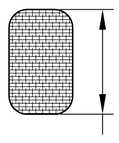
No adverse levels of any constituents have been extracted (relative to human exposure and aquatic toxicity)







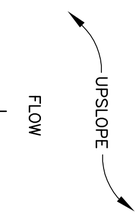


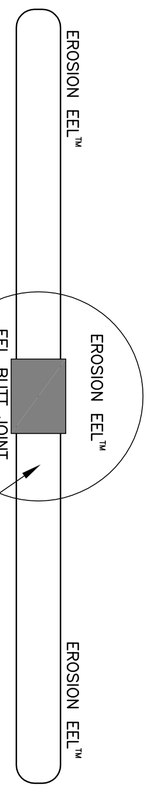


NOTE:
ALL EROSION EELS™ USED FOR PERIMETER CONTROL SHALL USE MIXTURE SPECIFICATIONS 1.1 AND 1.2.

DETAIL E1-A: EROSION EELS™
N.T.S.

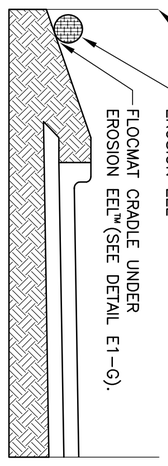
NOTE:
MINIMIZE THE PLACEMENT OF JOINTS AT THE INVERT OF THE MAIN DRAINAGE PATH FROM THE WATERSHED. POSITION JOINTS UPSLOPE OF THE MAIN INVERT AREA



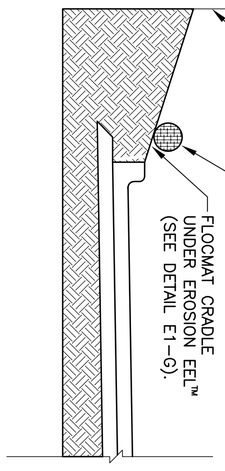


LAY EACH EEL AT JOINT LOCATION OVER FLOCMAT "CRADLE" (SEE "FLOCMAT" DETAIL E1-G). BUTT ENDS OF MAIN LINE OF EELS TOGETHER AND JOIN EELS WITH JOINT WRAP PER DETAIL E1-B1.

DETAIL E1-E: PLAN VIEW - OVERLAP/JOINT DETAIL NEAR DISCHARGE POINTS FROM WATERSHED
N.T.S.

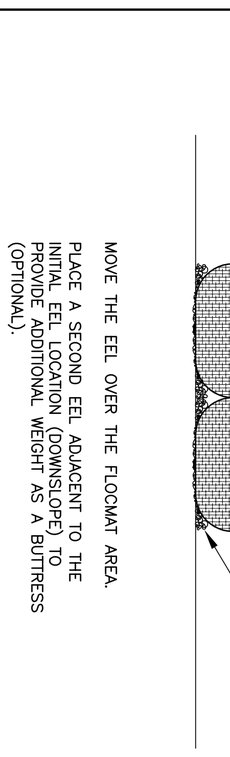


DETAIL E1-J: SECTION
N.T.S.



DETAIL E1-I: SECTION
N.T.S.

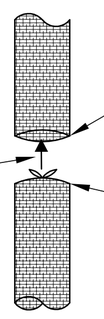
DETAIL E1-K: STABILIZING PROCEDURE FOR EROSION EEL PLACED OVER HARD SURFACE (PAVED, ROCK, ETC.)
N.T.S.



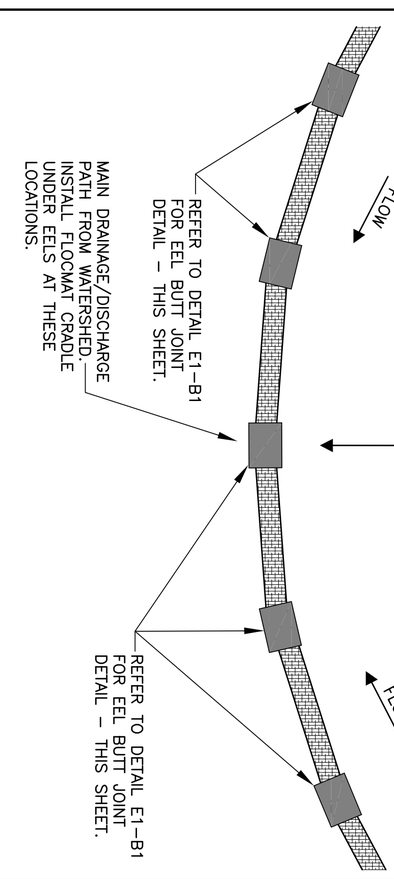
INSTALL EROSION EELS™ PARALLEL TO THE SLOPE CONTOURS. PLACE 100 ft. OF EROSION EELS™ FOR EVERY 0.25 ACRE DRAINAGE AREA.

BUTT ENDS OF EEL TOGETHER AND JOIN TIGHTLY WITH JUNCTION WRAP (PER DETAIL E1-B1 THIS SHEET).

DETAIL E1-B: INTERCEPTING SHEET FLOW PERPENDICULAR TO FLOW PATH - PLAN VIEW



DETAIL E1-B1



DETAIL E1-F: PLAN VIEW - TYPICAL ARRANGEMENT OF EELS USED FOR PERIMETER CONTROL
N.T.S.

INSTALL FLOCMAT AT MAIN DISCHARGE LOCATIONS FOR WATERSHED.

DETAIL E1-G: SECTION - FLOCMAT
N.T.S.

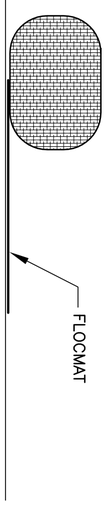
INSTALL EROSION EELS™ PARALLEL TO THE SLOPE CONTOURS. PLACE 100 ft. OF EROSION EELS™ FOR EVERY 0.25 ACRE DRAINAGE AREA.

BUTT ENDS OF EEL TOGETHER AND JOIN TIGHTLY WITH JUNCTION WRAP (PER DETAIL E1-B1 THIS SHEET).

DETAIL E1-B: INTERCEPTING SHEET FLOW PERPENDICULAR TO FLOW PATH - PLAN VIEW

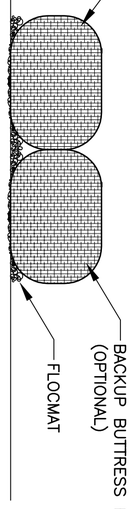
DETAIL E1-B1

STEP 1



PLACE EROSION EEL™ NEAR THE INTENDED SETUP LOCATION. PLACE FLOCMAT UNDER EEL (DETAIL E1-G).

STEP 2



MOVE THE EEL OVER THE FLOCMAT AREA.

PLACE A SECOND EEL ADJACENT TO THE INITIAL EEL LOCATION (DOWNSLOPE) TO PROVIDE ADDITIONAL WEIGHT AS A BUTTRESS (OPTIONAL).

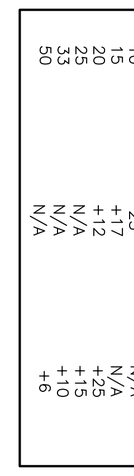
DETAIL E1-K: STABILIZING PROCEDURE FOR EROSION EEL PLACED OVER HARD SURFACE (PAVED, ROCK, ETC.)
N.T.S.

SPACING RECOMMENDATIONS FOR THE EROSION EEL™ FOR PERIMETER CONTROLS AND INTERCEPTING SHEET FLOW ON SLOPES

SLOPE(%)	SINGLE EEL SPACING(ft)	*STACKED DUAL EEL SPACING(ft)
0.5	300	N/A
1	200	N/A
2	160	N/A
3	80	N/A
4	50	N/A
5	40	N/A
6	35	N/A
8	30	N/A
10	25	N/A
15	+17	N/A
20	+12	+25
25	N/A	+15
33	N/A	+10
50	N/A	+6

* DUAL STACK REFERS TO TWO EELS STACKED ATOP ONE ANOTHER AND STABILIZED WITH T-POSTS. SEE DETAIL E2-E ON SHEET E-2.

+ PLACE STAKES BEHIND EELS @ 24" C/C SPACING. SEE SHEET E-2 FOR STAKING DETAILS.



INSTALL FLOCMAT AT MAIN DISCHARGE LOCATIONS FOR WATERSHED.

DETAIL E1-G: SECTION - FLOCMAT

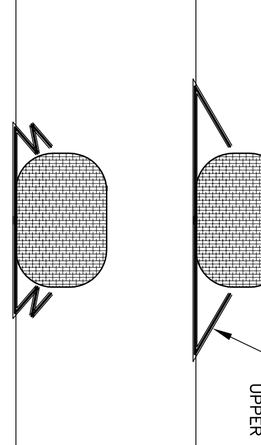
PLACE EEL ON GROUND SURFACE THAT HAS BEEN PREPARED BY REMOVING LARGE DEBRIS AND RAKING (OR DRAG HARROWING) SURFACE PRIOR TO EEL PLACEMENT (SEE DETAIL E1-D).

NOTE:
FOR AREAS WITH HIGH CONSTRUCTION TRAFFIC/ACTIVITY, DRIVE METAL POSTS THROUGH EEL HANDLES BEHIND EELS EVERY 6 FOOT TO PREVENT VEHICLES FROM DRIVING OVER EELS.

DETAIL E1-C: INTERCEPTING SHEET FLOW PERPENDICULAR TO FLOW PATH - PLAN VIEW

INSTALLATION OVER RILL/GULLEY AREAS

DETAIL E1-D: CROSS-SECTION VIEW
N.T.S.



PLAN VIEW

DETAIL E1-H: EROSION EEL™ PLACED AT EDGE OF ROADWAY RIGHT-OF-WAY
N.T.S.

GENERAL NOTES:

1. EROSION EELS™ USED IN PERIMETER CONTROL APPLICATIONS SHALL HAVE A SPECIFICATION MIXTURE 1.1 OR 1.2.
   a. MIXTURE SPECIFICATION 1.1: A FILTER MIXTURE COMPRISED OF 50% SHREDDED RUBBER AND 50% WOOD CHIP PARTICLES BY VOLUME. THE SHREDDED RUBBER SHALL BE WASHED AND PROCESSED TO REMOVE MOST, IF NOT ALL METAL COMPONENTS. THE RUBBER SHALL BE DERIVED FROM RECYCLED TIRES AND SHALL BE SHREDDED TO PRODUCE A MAXIMUM PARTICLE SIZE OF +/- 3/4 INCH. THE WOOD CHIPS SHALL BE PRODUCED FROM HARDWOOD TREES AND SHALL CONFIRM TO AASHTO CERTIFICATION SPECIFICATION MP 9-03. THE WOOD CHIPS SHALL BE 1/3 WOOD CHIPS, AND 1/3 RECYCLED SYNTHETIC FIBERS. THE SHREDDED RUBBER SHALL BE WASHED AND PROCESSED TO REMOVE MOST, IF NOT ALL, METAL COMPONENTS. THE RUBBER MIXTURE SPECIFICATION 1.2: A FILTER MIXTURE COMPRISED OF 1/3 SHREDDED RUBBER, 1/3 WOOD CHIPS, AND 1/3 RECYCLED SYNTHETIC FIBERS. THE SHREDDED RUBBER SHALL BE WASHED AND PROCESSED TO REMOVE MOST, IF NOT ALL, METAL COMPONENTS. THE RUBBER SHALL BE PRODUCED FROM HARDWOOD TREES AND SHALL CONFIRM TO AASHTO CERTIFICATION SPECIFICATION MP 9-03. THE WOOD CHIPS SHALL BE PRODUCED FROM RECYCLED, MANUFACTURED MATERIALS, SUCH AS, BUT NOT LIMITED TO, PRE-CONSUMER SCRAP CARPET, TIRE CHORD, AND TIRE FIBER MATERIALS.
   b. MIXTURE SPECIFICATION 1.1: A FILTER MIXTURE COMPRISED OF 50% SHREDDED RUBBER AND 50% WOOD CHIPS BY VOLUME. THE SHREDDED RUBBER SHALL BE WASHED AND PROCESSED TO REMOVE MOST, IF NOT ALL METAL COMPONENTS. THE RUBBER SHALL BE DERIVED FROM RECYCLED TIRES AND SHALL BE SHREDDED TO PRODUCE A MAXIMUM PARTICLE SIZE OF +/- 3/4 INCH. THE WOOD CHIPS SHALL BE PRODUCED FROM HARDWOOD TREES AND SHALL CONFIRM TO AASHTO CERTIFICATION SPECIFICATION MP 9-03. THE WOOD CHIPS SHALL BE 1/3 WOOD CHIPS, AND 1/3 RECYCLED SYNTHETIC FIBERS. THE SHREDDED RUBBER SHALL BE WASHED AND PROCESSED TO REMOVE MOST, IF NOT ALL, METAL COMPONENTS. THE RUBBER SHALL BE DERIVED FROM RECYCLED TIRES AND SHALL BE SHREDDED TO PRODUCE A MAXIMUM PARTICLE SIZE OF +/- 3/4 INCH. THE WOOD CHIPS SHALL BE PRODUCED FROM HARDWOOD TREES AND SHALL CONFIRM TO AASHTO CERTIFICATION SPECIFICATION MP 9-03. THE SYNTHETIC FIBERS SHALL BE PRODUCED FROM RECYCLED, MANUFACTURED MATERIALS, SUCH AS, BUT NOT LIMITED TO, PRE-CONSUMER SCRAP CARPET, TIRE CHORD, AND TIRE FIBER MATERIALS.
2. EROSION EELS™ SHALL BE MANUFACTURED FROM A WOVEN GEOTEXTILE COVERING WITH INTERIOR FILTER MATERIALS SUCH AS 100% SHREDDED RUBBER (MIXTURE SPECIFICATION 1.0, 50% SHREDDED RUBBER/50% AASHTO-CERTIFIED WOOD CHIPS (MIXTURE SPECIFICATION 1.1).
3. LENGTHS OF EROSION EELS™ CAN BE PLACED AT THE TOP, ON THE FACE, OR AT THE TOE OF SLOPES TO INTERCEPT RUNOFF, REDUCE FLOW VELOCITY, RELEASE THE RUNOFF AS SHEET FLOW AND PROVIDE REMOVAL OF SEDIMENT FROM THE RUNOFF.
4. EROSION EELS™ SHALL BE EITHER A NOMINAL +/-10 FT. OR +/- 4.5 FT. NOMINAL DIAMETER SHALL BE +/-9.5 INCHES.
5. EROSION EELS™ SHALL BE INSTALLED ALONG THE GROUND CONTOUR, AT THE TOE OF SLOPES, AT AN ANGLE TO THE CONTOUR TO DIRECT FLOW AS A DIVERSION BERM, AROUND INLET STRUCTURES, IN A DITCH AS A CHECK DAM TO HELP REDUCE SUSPENDED SOLIDS LOADING AND RETAIN SEDIMENT, OR AS A GENERAL FILTER FOR ANY DISTURBED SOIL AREA.
6. NO TRENCHING IS REQUIRED FOR INSTALLATION OF EROSION EELS™
7. PREPARE BED FOR EEL INSTALLATION BY REMOVING ANY LARGE DEBRIS INCLUDING ROCKS, SOIL CLODS, AND WOODY VEGETATION. EROSION EELS™ CAN ALSO BE PLACED OVER PAVED SURFACES INCLUDING CONCRETE AND ASPHALT WITH NO SURFACE PREPARATION REQUIRED.
8. RAKE BED AREA WITH A HAND RAKE OR BY DRAG HARROW.
9. DO NOT PLACE EEL DIRECTLY OVER RILL AND GULLIES UNTIL AREA HAS BEEN HAND-EXCAVATED AND RAKED TO PROVIDE A LEVEL BEDDING SURFACE. ALL SURFACES SHALL BE UNIFORMLY COMPACTED FOR MAXIMUM SEATING OF EELS IN PLACE.
10. FOR LOCATIONS WHERE EELS WILL BE PLACED IN CONCENTRATED FLOWS (SUCH AS CHECK DAMS, INLET PROTECTION) AND FOR PERIMETER CONTROLS AT PRIMARY DISCHARGE LOCATIONS, BED THE EELS IN A FLOCMAT CRADLE PER THE DETAILED DRAWINGS.
11. FOR DITCH APPLICATIONS, THE MAXIMUM DRAINAGE AREA SHALL BE 10 ACRES.
12. IF MORE THAN ONE EROSION EEL™ IS PLACED IN A ROW, THE EELS SHALL BE OVERLAPPED A MINIMUM OF 12 INCHES TO PREVENT FLOW AND SEDIMENT FROM PASSING THROUGH THE FIELD JOINT. COMPRESS THE TWO EELS OF THE OVERLAP TIGHTLY TOGETHER EITHER BY HAND OR MANUFACTURER-APPROVED MECHANIZED MEANS.
13. WHEN USED IN DITCHES AS A CHECK DAM, EROSION EELS™ SHALL BE INSTALLED PER MANUFACTURER'S DETAILS.
14. FOR CHECK DAM APPLICATIONS, EROSION EELS™ SHALL BE PLACED PERPENDICULAR TO THE FLOW OF THE WATER. EROSION EELS™ SHALL CONTINUE UP THE SIDES SLOPES A MINIMUM OF 3 FEET ABOVE THE DESIGN FLOW DEPTH.
15. EROSION EELS™ SHALL REMAIN IN PLACE UNTIL FULLY ESTABLISHED VEGETATION HAS COMPLETELY DEVELOPED OR UNTIL THE STORAGE CAPACITY/FUNCTIONAL LIFE OF THE EEL HAS BEEN EXHAUSTED (REQUIRING REPLACEMENT WITH NEW EELS).
16. ANCHORING POSTS FOR CHECK DAM APPLICATIONS SHALL HAVE A MINIMUM WEIGHT OF 1.25 LBS/FT STEEL T-POSTS (5 TO 7 FT. LENGTHS) ROLLED FROM HIGH CARBON STEEL. POSTS SHOULD BE HOT-DIP GALVANIZED OR COATED WITH A WEATHER-RESISTANT PAINT FOR STEEL APPLICATION. POSTS SHOULD BE EQUIPPED WITH A METAL ANCHOR PLATE. INSTALL PER DETAILS ON THIS SHEET.
17. PLACE T-POSTS THROUGH HANDLE OF BAGS. DO NOT DRIVE POSTS THROUGH EROSION EELS™. T-POSTS ARE TO BE EMBEDDED A MINIMUM OF 2 FT INTO GROUND.

NOTE: DRAWINGS SUBJECT TO REVISIONS AT DISCRETION OF MANUFACTURER

SHEET OF	LAST EDIT DATE: FEB. 25, 2008	DRAWN BY:	LM
DWG NO.: E-1	DWG SCALE: N.T.S.	CHECKED BY:	KW
	PROJECT NO: 060-925		
	QUALITY MANAGER APPROVAL:		

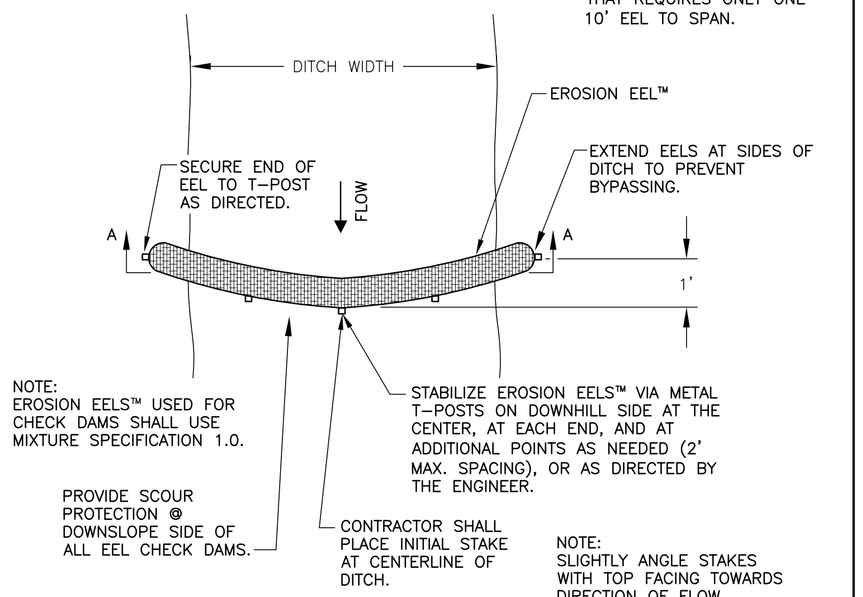
PERIMETER CONTROL AND SHEET (INTER-RILL) FLOW INTERCEPTION FOR THE EROSION EEL™

FRIENDLY ENVIRONMENT
100 PRINCE STREET
SHELBYVILLE, TENNESSEE 37160
1-931-607-5953

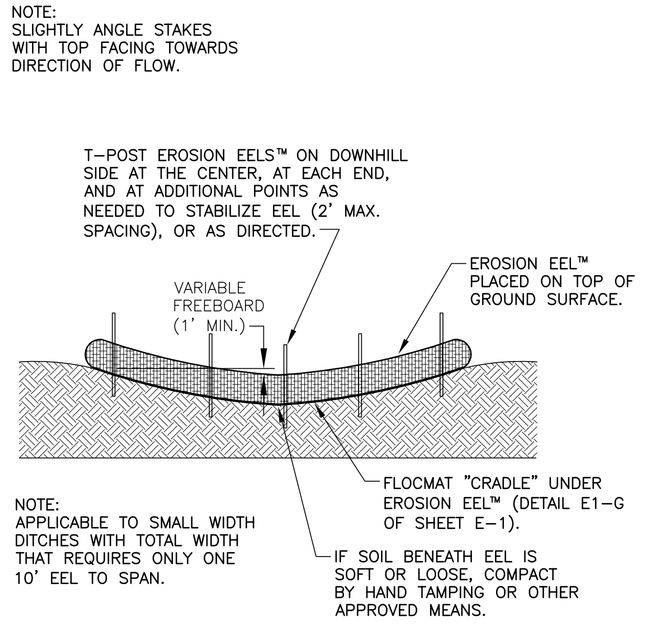
Authorized Use:
- ☐ Survey
- ☐ Design Dev.
- ☐ Permitting
- ☐ Bidding
- ☐ Construction
- ☐ -

SUBMITTAL & REVISION RECORD

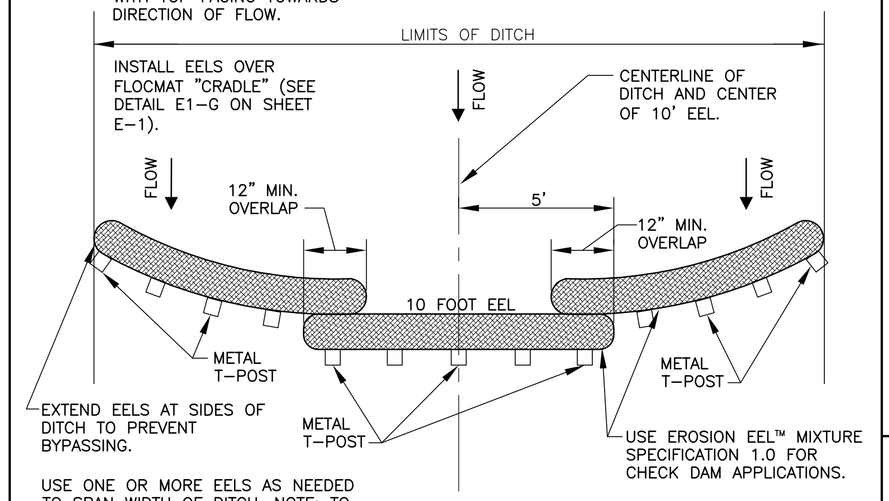
NO	DATE	DESCRIPTION
1		
2		
3		



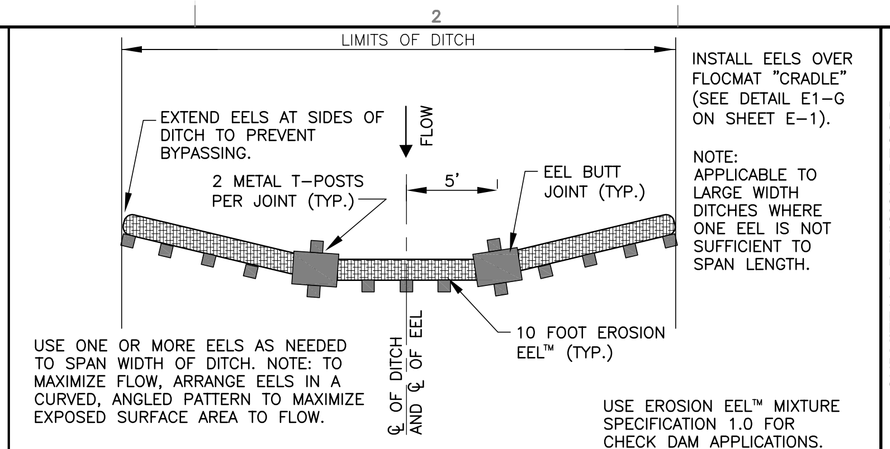
DETAIL E2–A: PLAN VIEW –
SMALL DITCH CHECKS SINGLE EEL (NO STACKING) FOR 9.5" AND 20"ø EELS
N.T.S.



DETAIL E2–B: SECTION – SMALL DITCH CHECKS FOR 9.5" AND 20"ø EELS
N.T.S.



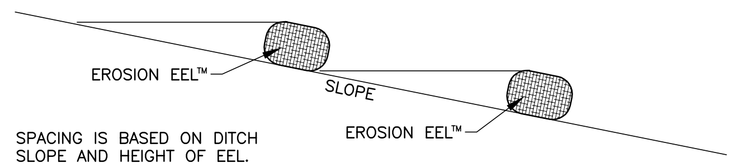
DETAIL E2–C: PLAN VIEW –
CHECK DAM ARRANGEMENT FOR LARGER WIDTH DITCHES FOR 9.5" AND 20"ø EELS
N.T.S.



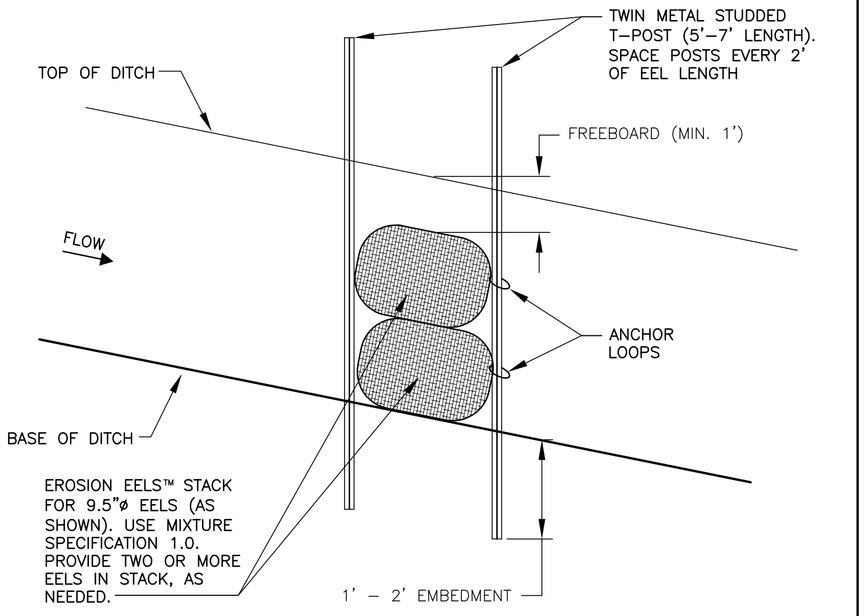
DETAIL E2–C1: PLAN VIEW – CHECK DAM
ARRANGEMENT FOR LARGER WIDTH DITCHES (WITH BUTT JOINT)
N.T.S.

SPACING RECOMMENDATIONS FOR THE
EROSION EEL™ FOR CHECK DAMS AND INTERCEPTION
OF CONCENTRATED FLOWS

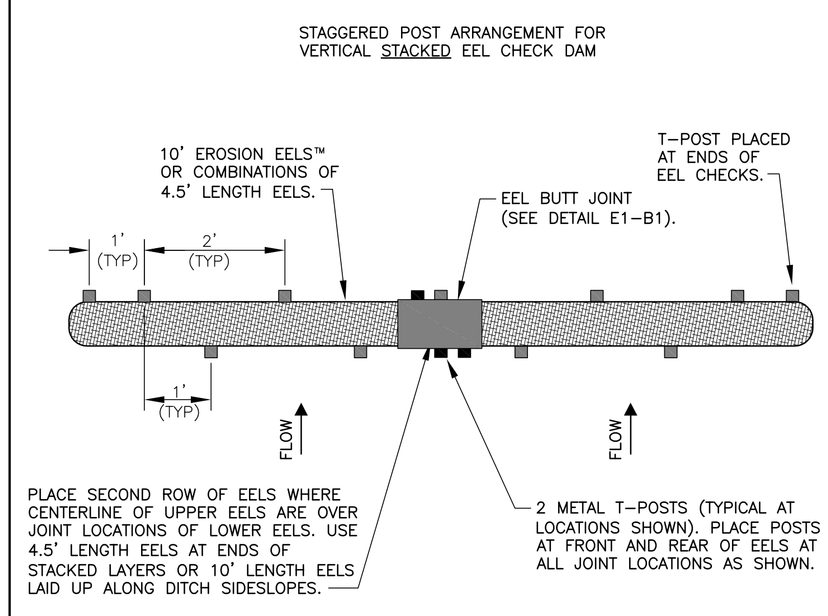
SLOPE(%)	9.5"ø SINGLE EEL SPACING(ft)	9.5"ø STACKED DUAL EEL SPACING(ft)	20"ø SINGLE EEL SPACING(ft)
0.5	115	233	333
1	55	115	167
2	29	58	84
3	19	38	56
4	14	29	42
5	12	23	33
10	6	12	17
15	N/A	8	11
20	N/A	6	8
25	N/A	N/A	7



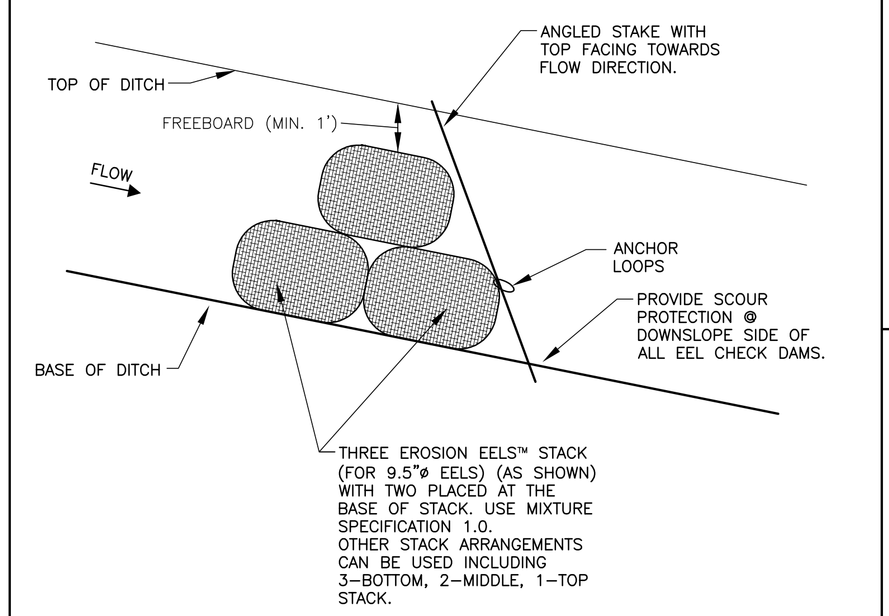
DETAIL E2–D: SECTION VIEW FOR 9.5" AND 20"ø EELS
N.T.S.



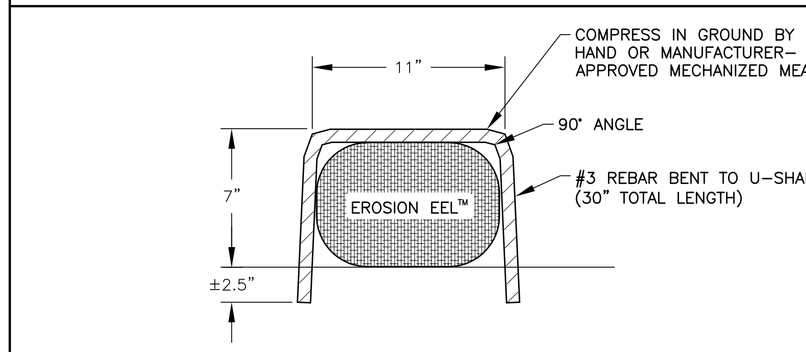
DETAIL E2–E: SECTION – TYPICAL DETAIL –
REINFORCED "VERTICAL STACK" CHECK DAM FOR HIGH FLOW APPLICATIONS FOR 9.5"ø EELS (OPTION A)
N.T.S.



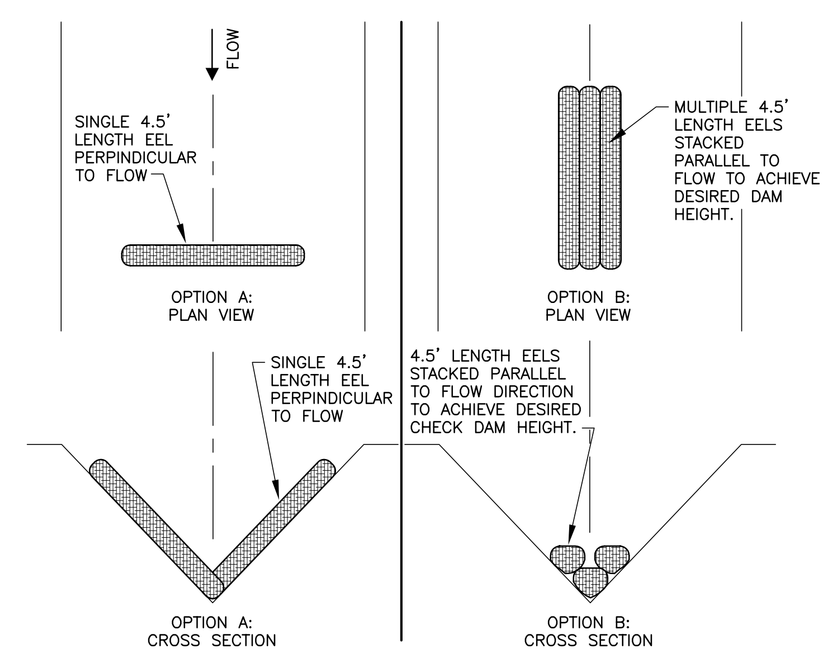
DETAIL E2–E(A): PLAN VIEW –
REINFORCED CHECK DAM FOR HIGH FLOW APPLICATIONS FOR 9.5"ø EELS (OPTION A)
N.T.S.



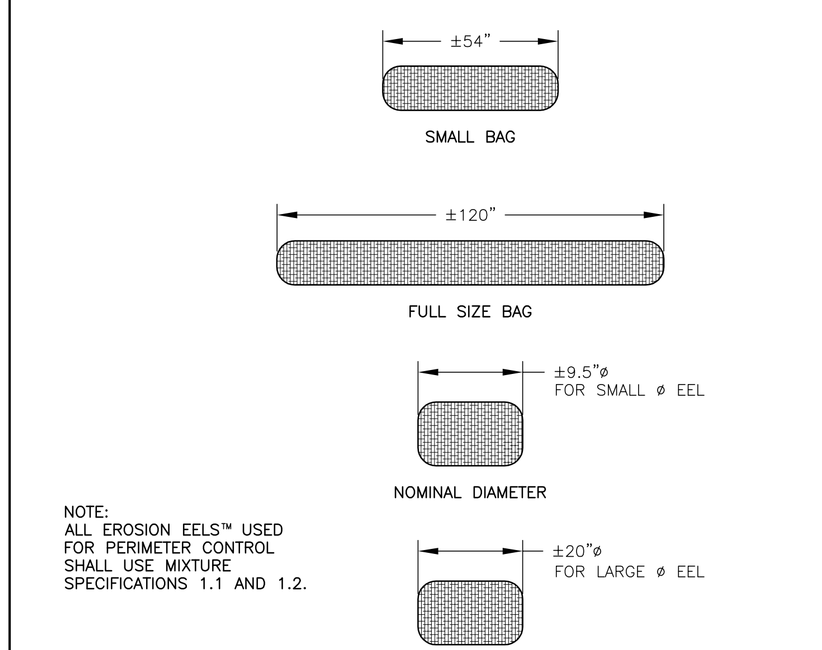
DETAIL E2–F: SECTION – TYPICAL DETAIL – REINFORCED
CHECK DAM FOR HIGH FLOW APPLICATIONS FOR LARGER DITCHES (OPTION B) FOR 9.5"ø EELS
N.T.S.



DETAIL E2–G: REBAR PIN DETAIL –
OPTIONAL/IN ADDITION TO T–POSTS FOR 9.5"ø EELS
N.T.S.



DETAIL E2–H: CHECK DAMS
FOR SHALLOW AND NARROW V–DITCHES
N.T.S.



DETAIL E2–I: EROSION EELs™
N.T.S.

GENERAL NOTES:

1. EROSION EELS™ USED IN PERIMETER CONTROL APPLICATIONS SHALL HAVE A SPECIFICATION MIXTURE 1.1 OR 1.2.
   a. MIXTURE SPECIFICATION 1.1. A FILTER MIXTURE COMPRISED OF 50% SHREDDED RUBBER AND 50% WOOD CHIP PARTICLES BY VOLUME. TH SHREDDED RUBBER SHALL BE WASHED AND PROCESSED TO REMOVE MOST, IF NOT ALL, METAL COMPONENTS. THE RUBBER SHALL BE DERIVED FROM RECYCLED TIRES AND SHALL BE SHREDDED TO PRODUCE A MAXIMUM PARTICLE SIZE OF +/– 3/4 INCH. THE WOOD CHIPS SHALL BE PRODUCED FROM HARDWOOD TREES AND SHALL CONFIRM TO AASHTO CERTIFICATION SPECIFICATION MP 9–03.
   b. MIXTURE SPECIFICATION 1.2. A FILTER MIXTURE COMPRISED OF 1/3 SHREDDED RUBBER, 1/3 WOOD CHIPS, AND 1/3 RECYCLED SYNTHET FIBERS. THE SHREDDED RUBBER SHALL BE WASHED AND PROCESSED TO REMOVE MOST, IF NOT ALL, METAL COMPONENTS. THE RUBBER SHALL BE DERIVED FROM RECYCLED TIRES AND SHALL BE SHREDDED TO PRODUCE A MAXIMUM PARTICLE SIZE OF +/– 3/4 INCH. THE W CHIPS SHALL BE PRODUCED FROM HARDWOOD TREES AND SHALL CONFIRM TO AASHTO CERTIFICATION SPECIFICATION MP 9–03. THE SYNT FIBERS SHALL BE PRODUCED FROM RECYCLED, MANUFACTURED MATERIALS, SUCH AS, BUT NOT LIMITED TO, PRE–CONSUMER SCRAP CARPE TIRE CHORD, AND TIRE FIBER MATERIALS.
2. EROSION EELS™ SHALL BE MANUFACTURED FROM A WOVEN GEOTEXTILE COVERING WITH INTERIOR FILTER MATERIALS SUCH AS 100% SHREDDED RUBBER (MIXTURE SPECIFICATION 1.0, 50% SHREDDED RUBBER/50% AASHTO–CERTIFIED WOOD CHIPS (MIXTURE SPECIFICATION 1.1).
3. LENGTHS OF EROSION EELS™ SHALL BE EITHER A NOMINAL +/–10 FT. OR +/– 4.5 FT. NOMINAL DIAMETER SHALL BE +/–9.5 INCHES.
4. EROSION EELS™ CAN BE PLACED AT THE TOP, ON THE FACE, OR AT THE TOE OF SLOPES TO INTERCEPT RUNOFF, REDUCE FLOW VELOCITY, RELEASE THE RUNOFF AS SHEET FLOW AND PROVIDE REMOVAL OF SEDIMENT FROM THE RUNOFF.
5. EROSION EELS™ SHALL BE INSTALLED ALONG THE GROUND CONTOUR, AT THE TOE OF SLOPES, AT AN ANGLE TO THE CONTOUR TO DIRECT FLO A DIVERSION BERM, AROUND INLET STRUCTURES, IN A DITCH AS A CHECK DAM TO HELP REDUCE SUSPENDED SOLIDS LOADING AND RETAIN SEDIMENT, OR AS A GENERAL FILTER FOR ANY DISTURBED SOIL AREA.
6. NO TRENCHING IS REQUIRED FOR INSTALLATION OF EROSION EELS™
7. PREPARE BED FOR EEL INSTALLATION BY REMOVING ANY LARGE DEBRIS INCLUDING ROCKS, SOIL CLODS, AND WOODY VEGETATION. EROSION E CAN ALSO BE PLACED OVER PAVED SURFACES INCLUDING CONCRETE AND ASPHALT WITH NO SURFACE PREPARATION REQUIRED.
8. RAKE BED AREA WITH A HAND RAKE OR BY DRAG HARROW.
9. DO NOT PLACE EEL DIRECTLY OVER RILL AND GULLIES UNTIL AREA HAS BEEN HAND–EXCAVATED AND RAKED TO PROVIDE A LEVEL BEDDING SURFACE. ALL SURFACES SHALL BE UNIFORMLY COMPACTED FOR MAXIMUM SEATING OF EELS IN PLACE.
10. FOR LOCATIONS WHERE EELS WILL BE PLACED IN CONCENTRATED FLOWS (SUCH AS CHECK DAMS, INLET PROTECTION) AND FOR PERIMETER CONTROLS AT PRIMARY DISCHARGE LOCATIONS, BED THE EELS IN A FLOCMAT CRADLE PER THE DETAILED DRAWINGS.
11. FOR DITCH APPLICATIONS, THE MAXIMUM DRAINAGE AREA SHALL BE 10 ACRES.
12. IF MORE THAN ONE EROSION EEL™ IS PLACED IN A ROW, THE EELS SHALL BE OVERLAPPED A MINIMUM OF 12 INCHES TO PREVENT FLOW AN SEDIMENT FROM PASSING THROUGH THE FIELD JOINT. COMPRESS THE TWO EELS OF THE OVERLAP TIGHTLY TOGETHER EITHER BY HAND OR MANUFACTURER–APPROVED MECHANIZED MEANS.
13. WHEN USED IN DITCHES AS A CHECK DAM, EROSION EELS™ SHALL BE INSTALLED PER MANUFACTURER'S DETAILS.
14. FOR CHECK DAM APPLICATIONS, EROSION EELS™ SHALL BE PLACED PERPENDICULAR TO THE FLOW OF THE WATER. EROSION EELS™ SHALL CONTINUE UP THE SIDES SLOPES A MINIMUM OF 3 FEET ABOVE THE DESIGN FLOW DEPTH.
15. EROSION EELS™ SHALL REMAIN IN PLACE UNTIL FULLY ESTABLISHED VEGETATION HAS COMPLETELY DEVELOPED OR UNTIL THE STORAGE CAPACITY/FUNCTIONAL LIFE OF THE EEL HAS BEEN EXHAUSTED (REQUIRING REPLACEMENT WITH NEW EELS).
16. ANCHORING POSTS FOR CHECK DAM APPLICATIONS SHALL HAVE A MINIMUM WEIGHT OF 1.25 LBS/FT STEEL T–POSTS (5 TO 7 FT. LENGTHS) ROLLED FROM HIGH CARBON STEEL. POSTS SHOULD BE HOT–DIP GALVANIZED OR COATED WITH A WEATHER–RESISTANT PAINT FOR STEEL APPLICATION. POSTS SHOULD BE EQUIPPED WITH A METAL ANCHOR PLATE. INSTALL PER DETAILS ON THIS SHEET.
17. PLACE T–POSTS THROUGH HANDLE OF BAGS. DO NOT DRIVE POSTS THROUGH EROSION EELS™. T–POSTS ARE TO BE EMBEDDED A MINIMUM FT INTO GROUND.

SUBMITTAL & REVISION RECORD

NO	DATE	DESCRIPTION

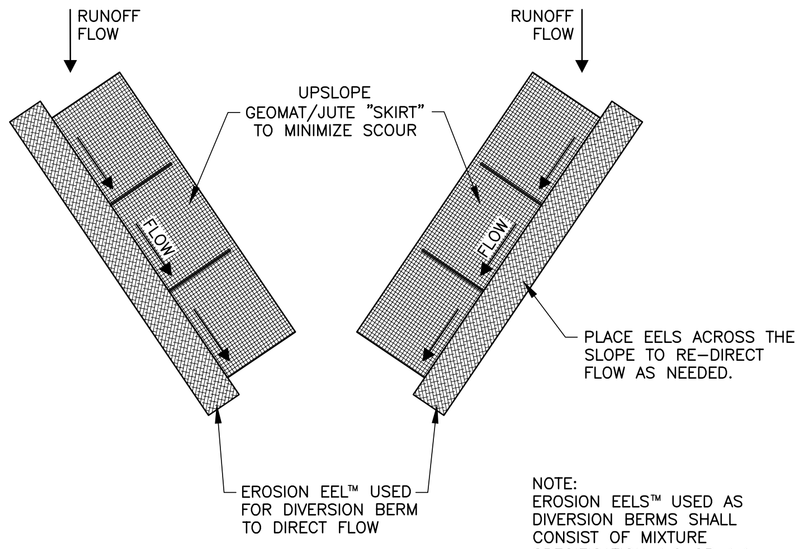
Authorized Use:

Survey	Design Dev.	Permitting	Bidding	Construction	-
☐	☐	☐	☐	☐	☐

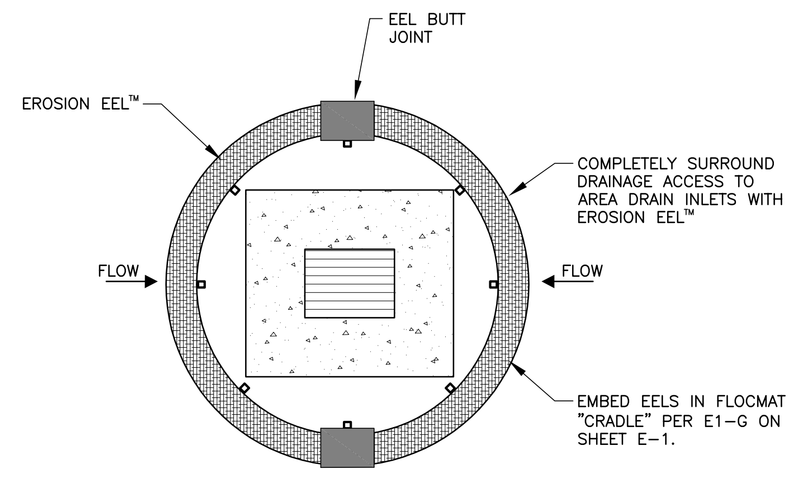
FRIENDLY ENVIRONMENT
100 PRINCE STREET
SHELBYVILLE, TENNESSEE 37160
1–931–607–5933

CHECK DAM DETAILS
FOR THE
EROSION EEL™

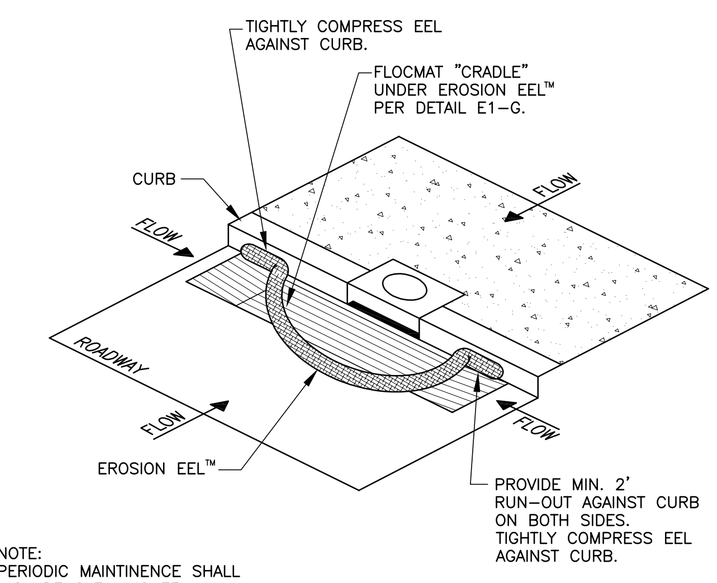
SHEET	OF	LAST EDIT DATE: FEB. 25, 2008	DRAWN BY: LM
DWG NO.:	E-2	DWG SCALE: N.T.S.	CHECKED BY: KW
		PROJECT NO: 060-925	
		QUALITY MANAGER APPROVAL:	



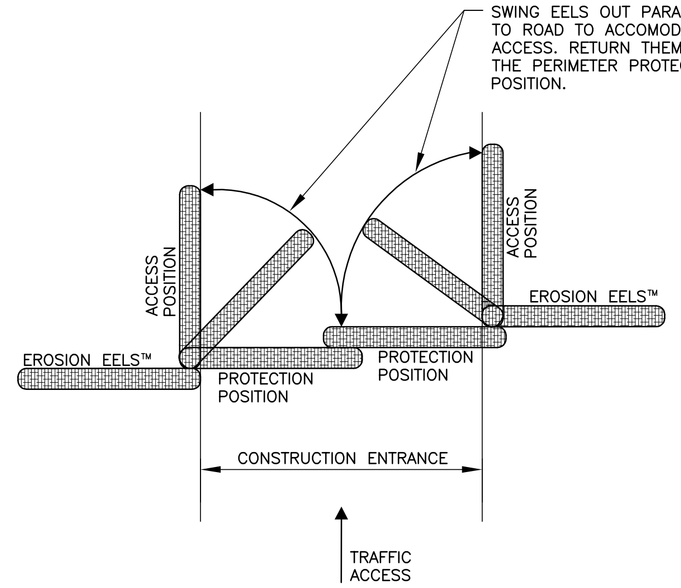
DETAIL E3-A: PLAN VIEW – EELS USED AS DIVERSION BERMS
N.T.S.



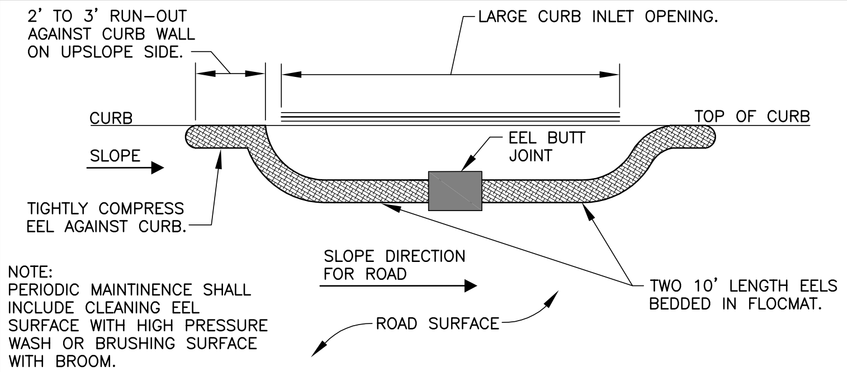
DETAIL E3-B: INLET SEDIMENT TRAP
N.T.S.



ISOMETRIC DETAIL E3-C: SMALL CURB INLET SEDIMENT TRAP
N.T.S.



DETAIL E3-D: PLAN VIEW – TEMPORARY CONSTRUCTION ACCESS
N.T.S.



DETAIL E3-E: PLAN VIEW – LARGE CURB INLET
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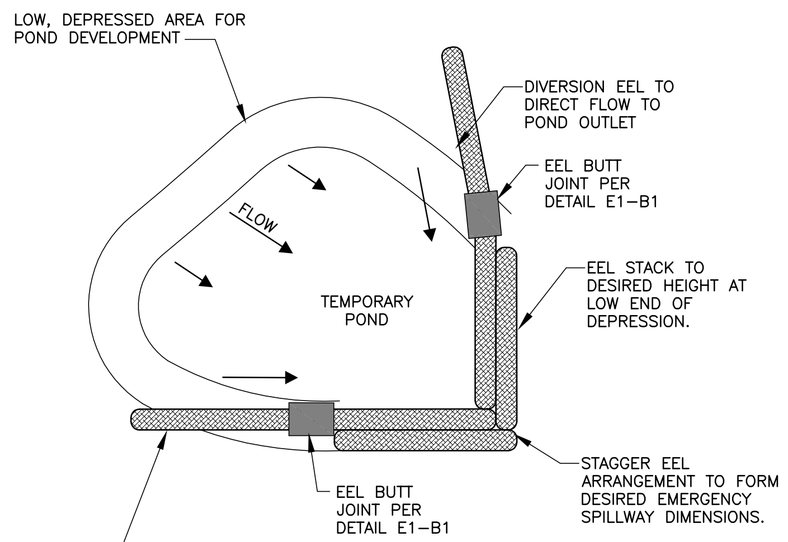
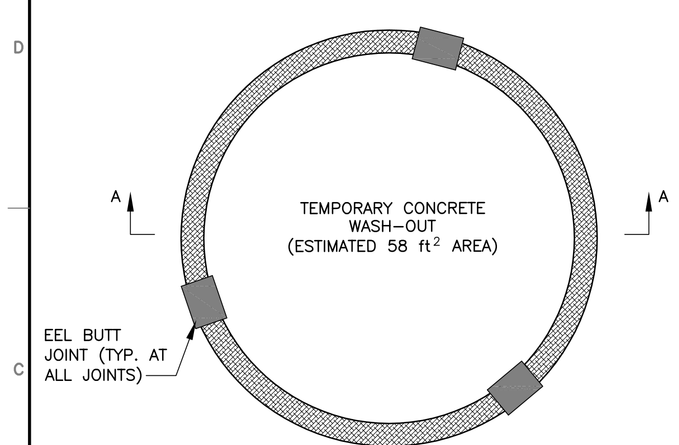
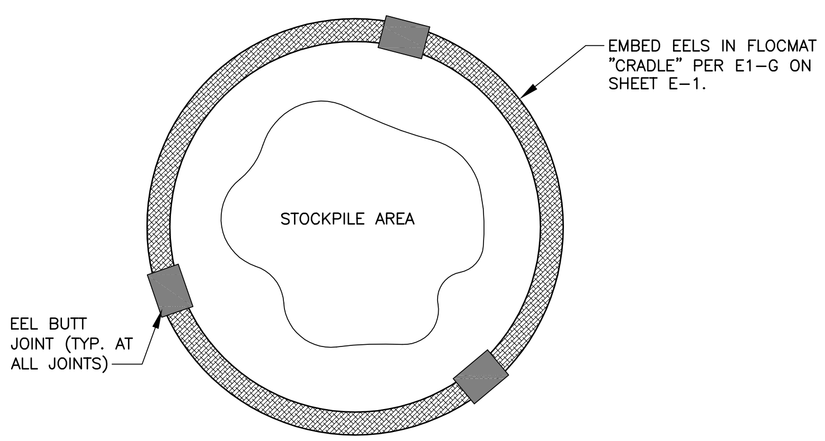


DETAIL E3-F: PLAN VIEW – TEMPORARY DETENTION POND
N.T.S.

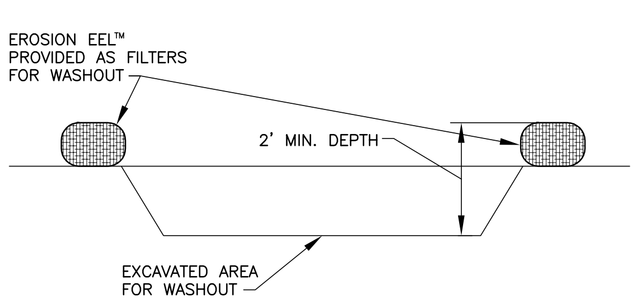
NOTE:
EELS USED FOR INLET CONTROL AS CULVERTS MUST BE STAKED OR ANCHORED VIA DETAIL E2-G.



DETAIL E3-G: PLAN VIEW – TEMPORARY CONCRETE WASH-OUT
N.T.S.



DETAIL E3-I: PLAN VIEW – TEMPORARY STOCKPILE AREAS
N.T.S.



SECTION A FOR DETAIL E3-H: TEMPORARY CONCRETE WASHOUT
N.T.S.

GENERAL NOTES:

1. EROSION EELS™ USED IN PERIMETER CONTROL APPLICATIONS SHALL HAVE A SPECIFICATION MIXTURE 1.1 OR 1.2.
   a. MIXTURE SPECIFICATION 1.1. A FILTER MIXTURE COMPRISED OF 50% SHREDDED RUBBER AND 50% WOOD CHIP PARTICLES BY VOLUME. TH SHREDDED RUBBER SHALL BE WASHED AND PROCESSED TO REMOVE MOST, IF NOT ALL, METAL COMPONENTS. THE RUBBER SHALL BE DERIVED FROM RECYCLED TIRES AND SHALL BE SHREDDED TO PRODUCE A MAXIMUM PARTICLE SIZE OF +/- 3/4 INCH. THE WOOD CHIPS SHALL BE PRODUCED FROM HARDWOOD TREES AND SHALL CONFIRM TO AASHTO CERTIFICATION SPECIFICATION MP 9-03.
   b. MIXTURE SPECIFICATION 1.2. A FILTER MIXTURE COMPRISED OF 1/3 SHREDDED RUBBER, 1/3 WOOD CHIPS, AND 1/3 RECYCLED SYNTHET FIBERS. THE SHREDDED RUBBER SHALL BE WASHED AND PROCESSED TO REMOVE MOST, IF NOT ALL, METAL COMPONENTS. THE RUBBER SHALL BE DERIVED FROM RECYCLED TIRES AND SHALL BE SHREDDED TO PRODUCE A MAXIMUM PARTICLE SIZE OF +/- 3/4 INCH. THE W CHIPS SHALL BE PRODUCED FROM HARDWOOD TREES AND SHALL CONFIRM TO AASHTO CERTIFICATION SPECIFICATION MP 9-03. THE SYNT FIBERS SHALL BE PRODUCED FROM RECYCLED, MANUFACTURED MATERIALS, SUCH AS, BUT NOT LIMITED TO, PRE-CONSUMER SCRAP CARPE TIRE CHORD, AND TIRE FIBER MATERIALS.
2. EROSION EELS™ SHALL BE MANUFACTURED FROM A WOVEN GEOTEXTILE COVERING WITH INTERIOR FILTER MATERIALS SUCH AS 100% SHREDDED RUBBER (MIXTURE SPECIFICATION 1.0, 50% SHREDDED RUBBER/50% AASHTO-CERTIFIED WOOD CHIPS (MIXTURE SPECIFICATION 1.1).
3. LENGTHS OF EROSION EELS™ SHALL BE EITHER A NOMINAL +/-10 FT. OR +/- 4.5 FT. NOMINAL DIAMETER SHALL BE +/-9.5 INCHES.
4. EROSION EELS™ CAN BE PLACED AT THE TOP, ON THE FACE, OR AT THE TOE OF SLOPES TO INTERCEPT RUNOFF, REDUCE FLOW VELOCITY, RELEASE THE RUNOFF AS SHEET FLOW AND PROVIDE REMOVAL OF SEDIMENT FROM THE RUNOFF.
5. EROSION EELS™ SHALL BE INSTALLED ALONG THE GROUND CONTOUR, AT THE TOE OF SLOPES, AT AN ANGLE TO THE CONTOUR TO DIRECT FLO A DIVERSION BERM, AROUND INLET STRUCTURES, IN A DITCH AS A CHECK DAM TO HELP REDUCE SUSPENDED SOLIDS LOADING AND RETAIN SEDIMENT, OR AS A GENERAL FILTER FOR ANY DISTURBED SOIL AREA.
6. NO TRENCHING IS REQUIRED FOR INSTALLATION OF EROSION EELS™
7. PREPARE BED FOR EEL INSTALLATION BY REMOVING ANY LARGE DEBRIS INCLUDING ROCKS, SOIL CLODS, AND WOODY VEGETATION. EROSION E CAN ALSO BE PLACED OVER PAVED SURFACES INCLUDING CONCRETE AND ASPHALT WITH NO SURFACE PREPARATION REQUIRED.
8. RAKE BED AREA WITH A HAND RAKE OR BY DRAG HARROW.
9. DO NOT PLACE EEL DIRECTLY OVER RILL AND GULLIES UNTIL AREA HAS BEEN HAND-EXCAVATED AND RAKED TO PROVIDE A LEVEL BEDDING SURFACE. ALL SURFACES SHALL BE UNIFORMLY COMPACTED FOR MAXIMUM SEATING OF EELS IN PLACE.
10. FOR LOCATIONS WHERE EELS WILL BE PLACED IN CONCENTRATED FLOWS (SUCH AS CHECK DAMS, INLET PROTECTION) AND FOR PERIMETER CONTROLS AT PRIMARY DISCHARGE LOCATIONS, BED THE EELS IN A FLOCMAT CRADLE PER THE DETAILED DRAWINGS.
11. FOR DITCH APPLICATIONS, THE MAXIMUM DRAINAGE AREA SHALL BE 10 ACRES.
12. IF MORE THAN ONE EROSION EEL™ IS PLACED IN A ROW, THE EELS SHALL BE OVERLAPPED A MINIMUM OF 12 INCHES TO PREVENT FLOW AN SEDIMENT FROM PASSING THROUGH THE FIELD JOINT. COMPRESS THE TWO EELS OF THE OVERLAP TIGHTLY TOGETHER EITHER BY HAND OR MANUFACTURER-APPROVED MECHANIZED MEANS.
13. WHEN USED IN DITCHES AS A CHECK DAM, EROSION EELS™ SHALL BE INSTALLED PER MANUFACTURER'S DETAILS.
14. FOR CHECK DAM APPLICATIONS, EROSION EELS™ SHALL BE PLACED PERPENDICULAR TO THE FLOW OF THE WATER. EROSION EELS™ SHALL CONTINUE UP THE SIDES SLOPES A MINIMUM OF 3 FEET ABOVE THE DESIGN FLOW DEPTH.
15. EROSION EELS™ SHALL REMAIN IN PLACE UNTIL FULLY ESTABLISHED VEGETATION HAS COMPLETELY DEVELOPED OR UNTIL THE STORAGE CAPACITY/FUNCTIONAL LIFE OF THE EEL HAS BEEN EXHAUSTED (REQUIRING REPLACEMENT WITH NEW EELS).
16. ANCHORING POSTS FOR CHECK DAM APPLICATIONS SHALL HAVE A MINIMUM WEIGHT OF 1.25 LBS/FT STEEL T-POSTS (5 TO 7 FT. LENGTHS) ROLLED FROM HIGH CARBON STEEL. POSTS SHOULD BE HOT-DIP GALVANIZED OR COATED WITH A WEATHER-RESISTANT PAINT FOR STEEL APPLICATION. POSTS SHOULD BE EQUIPPED WITH A METAL ANCHOR PLATE. INSTALL PER DETAILS ON THIS SHEET.
17. PLACE T-POSTS THROUGH HANDLE OF BAGS. DO NOT DRIVE POSTS THROUGH EROSION EELS™. T-POSTS ARE TO BE EMBEDDED A MINIMUM FT INTO GROUND.

NOTE: DRAWINGS SUBJECT TO REVISIONS AT DISCRETION OF MANUFACTURER

SUBMITTAL & REVISION RECORD

NO	DATE	DESCRIPTION

Authorized Use:
☐ Survey ☐ Design Dev. ☐ Permitting ☐ Bidding ☐ Construction ☐ -

FRIENDLY ENVIRONMENT
100 PRINCE STREET
SHELBYVILLE, TENNESSEE 37160
1-931-607-5933

CHECK DAMS (CONTINUED), DIVERSION BERM, INLET PROTECTION, PONDS, AND CONCRETE WASHOUT DETAILS FOR THE EROSION EEL™

LAST EDIT DATE:	FEB. 25, 2008
DRAWN BY:	LM
DWG SCALE:	N.T.S.
CHECKED BY:	KW
PROJECT NO:	060-925
QUALITY MANAGER APPROVAL:	

SHEET OF
DWG NO.: E-3

FRIENDLY ENVIRONMENT
100 Prince Street
Shelbyville, TN 37160
Phone: 1-866-H20-EELS
Alternate Phone: (931) 639-0729
E-Mail: info@friendlyenvironmentUS.com

Installation Instructions for the Erosion Eel™

1. Erosion Eels can be placed at the top, on the face, or at the toe of slopes to intercept runoff, reduce flow velocity, releasing the runoff as sheet flow, and provide reduction/removal of suspended solids from the runoff.
2. Erosion Eels shall be installed along the ground contour, at the toe of slopes, at an angle to the contour to direct flow as a diversion berm, around inlet structures, in a ditch as a check dam to help reduce suspended solids loading and retain sediment, or as a general filter for any disturbed soil area.
3. No trenching is required for installation of Erosion Eels.
4. Prepare the bed for Eel installation by removing any large debris including rocks, soil clods, and woody vegetation (>1 inch in size). Erosion Eels can also be placed over paved surfaces including concrete and asphalt with no surface preparation required.
5. Rake bed area with a hand rake or by drag harrow.
6. All surfaces shall be uniformly and well-compacted for maximum seating and stability of the Eels in place.
7. Do not place Eel directly over rills and gullies until area has been hand excavated and raked to provide a level bedding surface in order for the Eels to seat uniformly with no bridging effects that would allow flow to bypass under the bag.
8. For locations where Eels will be placed in concentrated flows (such as check dams, inlet protection) and for perimeter controls at primary discharge locations, bed the Eels in a jute mesh (or FlocMat™) cradle.
9. If more than one erosion Eel is placed in a row, install the Eels by firmly butting the sewn end against tied end of the Eels together to form a butt joint. No wraps are required around the joints locations.
10. Eels shall be installed where the handles will be positioned at the very top of the bag.

11. Place anchoring posts for check dam applications behind (downstream of) the Eels.
12. Posts should be metal t-posts with a minimum weight of 1.25 lbs/ft steel 5 to 7 ft. lengths rolled from high carbon steel. Post should be hot dipped galvanized or coated with a weather-resistant paint. Post should have a metal anchor plate.
13. Do not drive the post through the erosion Eels. Install the Eels by bedding them in a jute cradle and placing them in contact with (e.g., butted against) the anchoring post.
14. T-post are to be embedded a minimum of 2 ft on most moderately sloped applications. Embed posts a minimum of 3 ft. into ground on slopes greater than 25%.

GRATE GATOR

Sediment Containment

GrateGator Catch Basin

GrateGator Advantages

- *Lightweight*
- *Easy to use and reuse*
- *No stone or sand needed*
- *Flip top allows for easy maintenance*

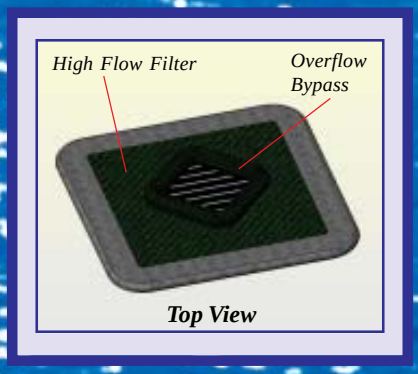
GrateGator

GrateGator is an innovative new "above the grate" storm water filter designed to remove sediment and debris from storm water as it enters the catch basin. Manufactured with a durable, high flow multidimensional filter, the GrateGator has superior flow rates to alternative methods or products used in this application. With built in overflow protection, the GrateGator is efficient at filtering out contaminents while allowing bypass during exteme wet weather events. GrateGator can be cleaned and reused over and over for the life of the project.

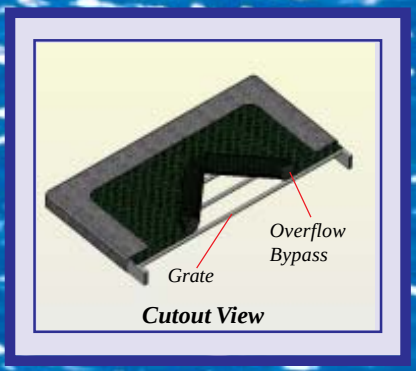
The unit easily slides over the grate edges and has a low profile to prevent damage. The GrateGator eliminates the need for sand bags or stone bundles which create a source for storm water contamination if and when they fail or burst from vehicle damage.

Call ACF Environmental for more information.

ACF ENVIRONMENTAL
Customer Focused, Environmentally Committed
800-448-3636



Top View



Cutout View

Bottom View

GrateGator Specification:

1.0 Description

1.1 This work shall consist of furnishing, placing, maintaining and removing the GrateGator sediment control device as directed by the engineer and as shown on the contract drawings. The GrateGator sediment control system manufactured by:

ACF Environmental, Inc.
2831 Cardwell Road
Richmond, Virginia 23234
Phone: 800-448-3636 • Fax: 804-743-7779
www.acfenvironmental.com

2.0 Materials

2.1 GrateGator

2.1.1 The GrateGator will be manufactured so the high flow filter portion of the unit covers the inlet grate. The installation sleeve is then tucked under the grate and the unit is held in place by the grate.

3.0 Construction Sequence

3.1 General

3.1.1 Install GrateGator so the green filter material covers the surface area of the grate and the installation sleeve is not visible at the surface.

3.1.2 The GrateGator should be cleaned if a visual inspection shows sediment and debris build up around the GrateGator.

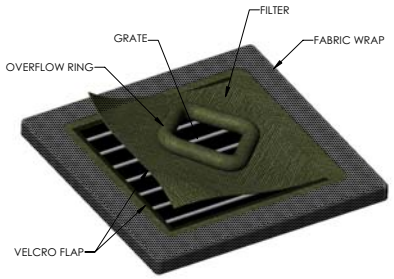
3.1.3 To remove GrateGator, lift grate unit by access through GrateGator overflow bypass.

3.1.4 Clean as needed. Store out of direct sunlight.

3.1.5 Ponding is likely if sediment is not removed regularly. Inspection of GrateGator should be on a regular basis and immediately after wet weather events.

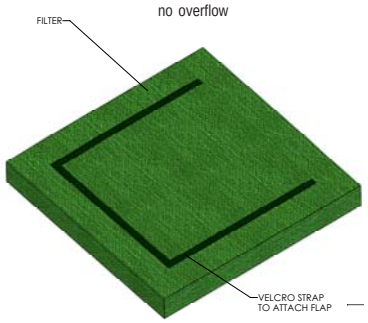
GrateGator Installation and Maintenance:

- Remove grate.
- Place grate on its side.
- Slide installation sleeve over one side of the grate.
- Place grate on the opposite edge and slide GrateGator over remaining surface.
- Replace grate.
- Inspection after each wet weather event is recommended.
- Remove all sediment and debris from surface after each wet weather event.
- Remove GrateGator, clean out and replace.



GrateGator Jr.

no overflow



GUTTERBUDDY™

Curb Inlet Drain Filters

88.2% Reduction in Total Suspended Solids
87.4% Reduction in Hydrocarbons

Gutterbuddy™ Curb Inlet and Ditch Pavement Filters

Gutterbuddy™ Advantages

- *Easy to transport, install and maintain*
- *Keeps out sand, asphalt millings and other fine sediment*
- *Available in regular and super flow*
- *Washable*
- *Reusable*

Gutterbuddy™ Curb Inlet Filters

effectively prevent sediment, debris and other pollutants from entering storm water systems. The filtering action lets water freely flow through the fiberous material while stopping sediment and debris. Built-in overflows drain water even more quickly during extreme events.

Long lasting Gutterbuddy™ Curb Inlet Filters are 9" in diameter and can be purchased in 4', 6', 8', 10', 12', 14' and 16' lengths. These inlet filters are flexible enough to conform to any curb radius, allowing for quick and easy installation.

Gutterbuddy™ Ditch Pavement Filters

effectively prevent sediment, debris and other pollutants from entering storm water systems or other areas that ditch pavement is used to channel water runoff. Their filtering action lets water freely flow through the fiberous material while stopping sediment and debris. Each ditch pavement filter comes with a stake hole at each end and has bendable steel in the middle of the fabric that allows it to conform to all types of ditch pavement.

For more information about Gutterbuddy™ Curb Inlet and Drainage Ditch Filters, call your ACF Environmental or SI Geosolutions distributor.

PROBLEM:

Failed Inlet Protection

SOLUTION:

Gutterbuddy™ Curb Inlet Drain Filter

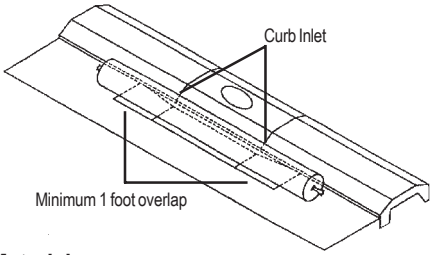
Gutterbuddy™ Specification

For Curb Gutter Storm Drains

1.0 Description

1.1 This work shall consist of furnishing, placing, maintaining and removing the Gutterbuddy™ sediment control device as directed by the engineer and as shown on the contract drawings. The Gutterbuddy™ sediment control system distributed by:

ACF Environmental, Inc.
2831 Cardwell Road
Richmond, Virginia 23234
Phone: 800-448-3636 • Fax: 804-743-7779
www.acfenvironmental.com



2.0 Materials

2.1 GUTTERBUDDY™

The Gutterbuddy™ shall be synthetic filter manufactured from recycled synthetic fibers.

2.1.1 The Gutterbuddy™ will be manufactured to be 9" in diameter and are available in 4', 6', 8', 10', 12', 14' and 16' lengths and a minimum of twenty-four (24) inches longer than the curb inlet opening. This will allow for sufficient length to cover the inlet with twelve (12) inches beyond the inlet on both ends.

3.0 Construction Sequence

3.1 General

3.1.1 Install the Gutterbuddy™ in front of the curb inlet opening. Each end of the Gutterbuddy™ should overlap the curb inlet approximately 12".

3.1.2 The Gutterbuddy™ should be cleaned if a visual inspection shows silt and debris build up around the Gutterbuddy™.

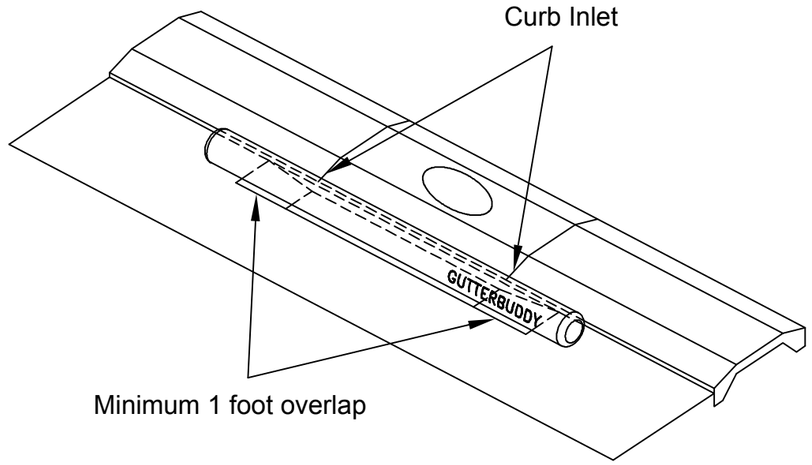
3.1.3 To remove the Gutterbuddy™, lift out of the opening.

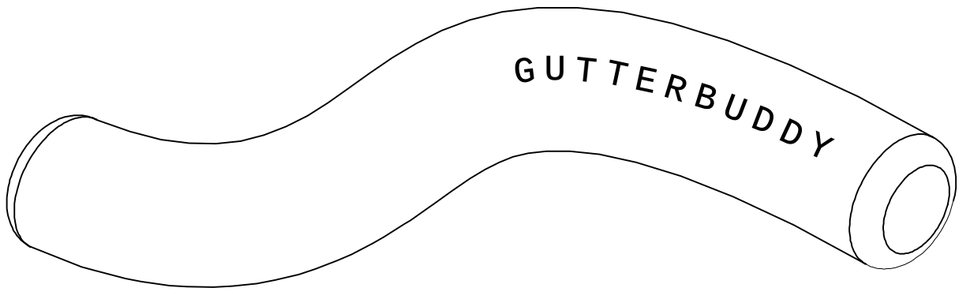
3.1.4 The Gutterbuddy™ is reusable. Once the construc tion project is complete and it is no longer needed for sediment control, remove, clean and store out of the sunlight until needed on the next project.

3.1.5 Ponding is likely if sediment is not removed regularly. Inspection of Gutterbuddy™ should be on a regular basis and immediately after major rain events.

4.0 Basis of Payment

4.1 The payment for any Gutterbuddy™ used during the construction is to be included in the bid of the overall erosion and sediment control plan and priced by the linear foot.





GUTTERBUDDY® Curb Inlet Drain Filters

PROJECT:		
CITY:		*DR. BY:*
STATE:	*DATE:*	*DR. NO:*

GutterEEL™

NEW from ACF!

The GutterEEL™, is used on any active construction site where soils have been disturbed. It is used to filter runoff from construction sites at stormwater inlets.

What Is The GutterEEL™

The GutterEEL™ is a higly effective curb inlet sediment control filter used to remove suspended soils, trash and debris from stormwater runoff. Gutter EEL™ is manufactured with a high flow/ high strength outer filter sleeve encasing 100% shredded tire filter media.

The GutterEEL™ is designed with a built in overflow weir to prevent ponding during heavy storm events. The weight of the unit holds it firmly in place close to the curb face and it's durability allows the unit to be cleaned and reused from job to job.

GutterEEL™ Advantages

- *Designed with high flow overflow weir for extreme wet weather events*
- *High flow/high strength outer filter*
- *Filter media composed of 100% recycled, shredded tires*
- *Easy to install, use, and reuse*
- *Weight of unit holds it securely to curb surface*

GutterEEL™ is easily cleaned and is reusable. This advanced technology provided by ACF Environmental is superior to traditional inlet protection methods such as stone or hay bales.

Call ACF Environmental or your local representative for more information.

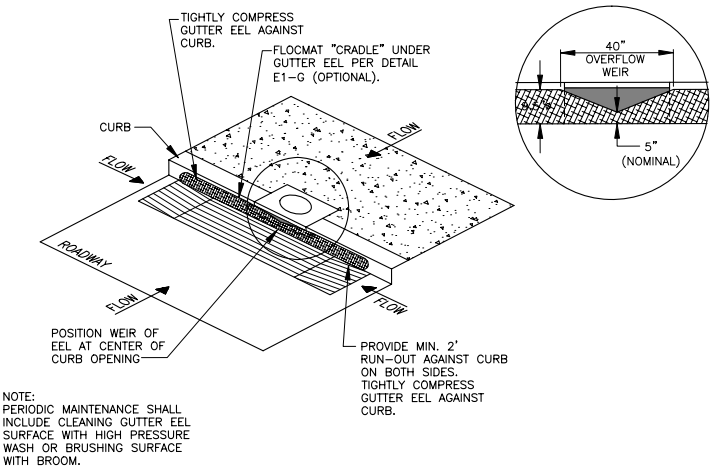
ACF ENVIRONMENTAL
Customer Focused, Environmentally Committed
800-448-3636

GutterEEL™ Specification

1.0 Description

1.1 This work shall consist of furnishing, placing, maintaining and removing the GutterEEL™ sediment control device as directed by the engineer and as shown on the contract drawings. The GutterEEL™ sediment control system is distributed by:

ACF Environmental, Inc.
2831 Cardwell Road
Richmond, Virginia 23234
Phone: 800-448-3636 • Fax: 804-743-7779
www.acfenvironmental.com



NOTE:
PERIODIC MAINTENANCE SHALL INCLUDE CLEANING GUTTER EEL SURFACE WITH HIGH PRESSURE WASH OR BRUSHING SURFACE WITH BROOM.

2.0 Materials

2.1 GutterEEL™

The GutterEEL™ shall be a synthetic filter manufactured from recycled shredded tires.

2.1.1 The GutterEEL™ will be manufactured to be 9" diameter with overflow weir in the center of the unit and is available in 6' and 9' lengths.

3.0 Construction Sequence

3.1 General

3.1.1 Install the GutterEEL™ in front of the curb inlet opening. Each end of the GutterEEL™ should overlap the curb inlet approximately 12".

3.1.2 Overflow weir should be centered on curb inlet. If more than 1 unit is required, units should be placed with each end flush against each other.

3.1.3 The GutterEEL™ should be cleaned if a visual inspection shows silt and debris build up in front of the unit.

3.1.4 The GutterEEL™ is reusable. Once the construction project is complete and it is no longer needed for sediment control, remove, clean and store out of the sunlight.

3.1.5 Ponding is possible if sediment is not removed regularly. Inspection of GutterEEL™ should be on a regular basis and immediately after major storm events.

Fabric Properties

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value	
			MD	CD
Wide Width Tensile Strength	ASTM D 4595	kN/m (lbs/in)	40.273 (230)	39.398 (225)
Grab Tensile Strength	ASTM D 4632	kN (lbs)	1.78 (400)	1.491 (335)
Grab Tensile Elongation	ASTM D 4632	%	20	15
Trapezoid Tear Strength	ASTM D 4533	kN (lbs)	0.645 (145)	0.556 (125)
Mullen Burst Strength	ASTM D 3786	kPa (psi)	4478.5 (650)	
Puncture Strength	ASTM D 4833	kN (lbs)	0.556 (125)	
Apparent Opening Size (AOS)	ASTM D 4751	mm (U.S. Sieve)	0.60 (30)	
Percent Open Area	COE-22125	%	8	
Permittivity	ASTM D 4491	sec^{-1}	1.5	
Permeability	ASTM D 4491	cm/sec	0.13	
Flow Rate	ASTM D 4491	$l/min/m^2$ ($gal/min/ft^2$)	4685.1 (115)	
UV Resistance (at 500 hours)	ASTM D 4355	% strength retained	90	

Physical Properties	Test Method	Unit	Typical Value
Mass/Unit Area	ASTM D 5261	g/m^2 (oz/yd^2)	271.2 (8.0)
Thickness	ASTM D 5199	mm (mils)	0.889 (35)
Roll Dimensions (width x length)	--	m (ft)	3.8 (12.5) x 91 (300)
Roll Area	--	m^2 (yd^2)	348 (417)
Estimated Roll Weight	---	kg (lbs)	100 (221)

Clean Water Hydraulic Flow Rates

Flow through tube at maximum head at the invert of the overflow weir is 14 gpm/ft (53 liters per minute) length.

Flow through the trapezoidal weir is given as follows:

Flow Depth (inches)	Approximate Flow Through Weir Only (in gallons per minute for single weir opening)	Approximate Total Flow Range (in gallons per minute) for single weir plus flow through 9ft long Gutter EEL bag
1	10	135
2	50	175
3	135	260
4	250	375
5	500	625

ACF Environmental
2831 Cardwell Road
Richmond, VA 23234
Sales: 1-800-448-3636
Corporate: 1-800-223-9021
Fax: 1-804-271-3074
www.acfenvironmental.com

Specification Sheet for the Gutter Eel

Product Description:

The Gutter Eel is a highly effective sediment-control product used at construction sites to prevent suspended soils from contaminating area streams and wetlands during storm events. It is sediment tube filled with an effective filter ballast material, consisting of 100% shredded, recycled tire rubber.

Applications:

The Gutter Eel is used on any active construction site where soils have been disturbed. The Eel is used to filter runoff from construction sites at stormwater inlets.

Product Dimensions and Weights:

The Gutter Eel comes as a weighted sediment tube filter with a diameter of 9.5-inches (24-cm) on the ends, tapering to 5 inches (12.7-cm) diameter at the center. Manufactured lengths for the Gutter Eel are 6 feet (1.8 m) and 9 feet (2.7 m). The Gutter Eel has a built-in triangular overflow weir to evacuate excess flow during high-intensity storm events.

The unit weight per ft for the Gutter Eel is approximately 13 lbs/ft (19.4 kg/m).

Interior Filter Material:

Shredded, recycled used tire rubber particles. Greater than 98% of metal is removed from shredded rubber filtrate material. The rubber is washed during manufacturing.

Interior Filter Material Particle Size Gradation:

½ inch to ¾ inch particle size for the Gutter Eel.

Geotextile Bag Specifications:

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value	
			MD	CD
Wide Width Tensile Strength	ASTM D 4595	kN/m (lbs/in)	40.273 (230)	39.398 (225)
Grab Tensile Strength	ASTM D 4632	kN (lbs)	1.78 (400)	1.491 (335)
Grab Tensile Elongation	ASTM D 4632	%	20	15
Trapezoid Tear Strength	ASTM D 4533	kN (lbs)	0.645 (145)	0.556 (125)
Mullen Burst Strength	ASTM D 3786	kPa (psi)	4478.5 (650)	
Puncture Strength	ASTM D 4833	kN (lbs)	0.556 (125)	
Apparent Opening Size (AOS)	ASTM D 4751	mm (U.S. Sieve)	0.60 (30)	
Percent Open Area	COE-22125	%	8	
Permittivity	ASTM D 4491	sec^{-1}	1.5	
Permeability	ASTM D 4491	cm/sec	0.13	
Flow Rate	ASTM D 4491	$l/min/m^2$ ($gal/min/ft^2$)	4685.1 (115)	
UV Resistance (at 500 hours)	ASTM D 4355	% strength retained	90	

Physical Properties	Test Method	Unit	Typical Value
Mass/Unit Area	ASTM D 5261	g/m^2 (oz/yd^2)	271.2 (8.0)
Thickness	ASTM D 5199	mm (mils)	0.889 (35)
Roll Dimensions (width x length)	--	m (ft)	3.8 (12.5) x 91 (300)
Roll Area	--	m^2 (yd^2)	348 (417)
Estimated Roll Weight	---	kg (lbs)	100 (221)

Clean Water Hydraulic Flow Rates:

Flow through tube at maximum head at the invert of the overflow weir is 14 gpm/ft (53 liters per minute) length.

Flow through the trapezoidal weir is give as follows:

Flow Depth (inches)	Approximate Flow Through Weir Only (in gallons per minute for single weir opening)	Approximate Total Flow Range (in gallons per minute) for single weir plus flow through 9 ft long Gutter Eel bag
1	10	135
2	50	175
3	135	260
4	250	375
5	500	625

Installation Requirements:

Each Eel is designed with high-strength handles. One can move the Eels either manually (e.g., two individuals holding onto the handles at either ends of the Eel, or one person dragging the Eel by one of the end handles) or it can be moved mechanically using any number of different types of construction equipment. **Place the Gutter Eel along the opening of the inlet, maintaining open freeboard for the overflow weir. A minimum 12 inches of overlap on each end of the curb opening is required.**

Refer to the installation drawings provided by the distributor for more detailed installation requirements.

Storage Requirements:

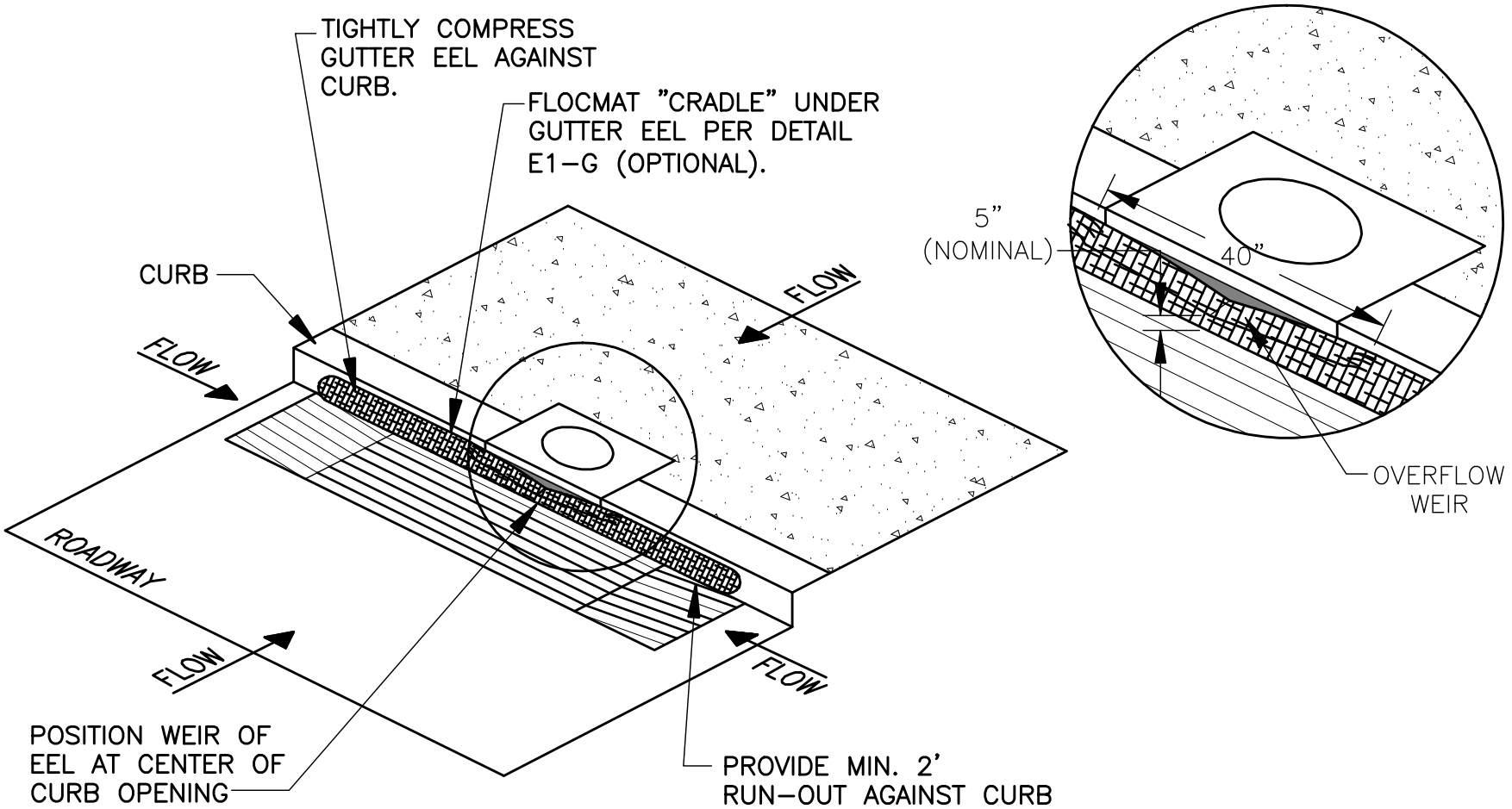
It is recommended to keep the Eels stored either indoors or, if stored outside, keep the Eels covered to minimize UV exposure to prolong the geotextile life.

Expected Life:

Assuming there is no physical damage inflicted on the Eel from construction activities or vandalism, the service life of the Eel is estimated to be, on the average, approximately 2 years. This is based on the internal pore storage space within the Eel to trap particles under varied construction conditions. The overall maximum life is anticipated to be around 3 years.

Disclaimer/Warranty

Seller makes no warranty, expressed or implied, concerning the product furnished hereunder other than at the time of delivery it shall be of the quality and specification stated herein. Any implied warranty of fitness for a particular purpose is expressly excluded, and, to the extent that it is contrary to the foregoing sentence, any implied warranty of merchantability is expressly excluded. Any recommendations made by the Manufacturer/Seller concerning the use or application of said product are believed reliable and the Manufacturer /Seller makes no warranty of results to be obtained. If the product does not meet current Manufacturer-published specifications, and the customer gives notice to the Manufacturer/Seller before installing the product, then the Manufacturer/Seller will replace the product without charge or refund the purchase price.



NOTE:
PERIODIC MAINTENANCE SHALL INCLUDE CLEANING GUTTER EEL SURFACE WITH HIGH PRESSURE WASH OR BRUSHING SURFACE WITH BROOM.

ISOMETRIC DETAIL E3–C: SMALL CURB INLET SEDIMENT TRAP – GUTTER EEL
N.T.S.

Silt Sack

SILTSACK®

(U.S. Patent #5,575,925)

Catch Basin Sediment Capture Device

Keeping catch basins free of silt!

Now Available in High Visibility Yellow

Versatile

Available in 2 styles to meet your needs:

- High flow
- Regular flow

And It's Simple

- Remove drain grate
- Insert Siltsack
- Replace grate to hold Siltsack in position
- Siltsack traps silt
- Remove filled Siltsack easily
- Clean and reuse or simply discard and replace

Are you looking for a cost-effective, easy way to stop silt and sediment from entering catch basins on construction site? Siltsack is the simple and economical solution to prevent clogging of catch basins.

Siltsack is a sediment control device used to prevent silt and sediment from entering your drainage system by catching the silt and sediment while allowing water to pass through freely. Siltsack can be used as a primary or secondary sediment control device to prevent failure of your drainage system due to clogging. It must be maintained on a regular basis to function properly.

Siltsack is available in both high-flow or regular flow. A modified Siltsack is also available with a curb opening deflector attached to prevent sediment and debris from entering through curb openings. Constructed with properties shown on the Specifications page, Siltsack is a quality product designed to save time and money.

Routine inspection of a Siltsack's collected sediment level is important to prevent "ponding" around storm drains. We recommend the following maintenance schedule:

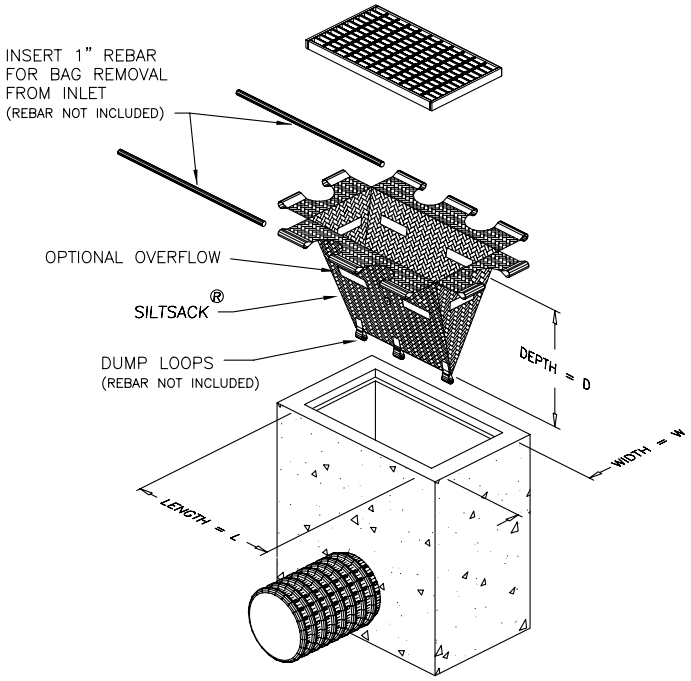
- Each Siltsack should be inspected after every major rain event.
- If there have been no major events, Siltsack should be inspected every 2-3 weeks.
- The yellow restraint cord should be visible at all times. If the cord is covered with sediment, the Siltsack should be emptied.

Typical Siltsack® Construction

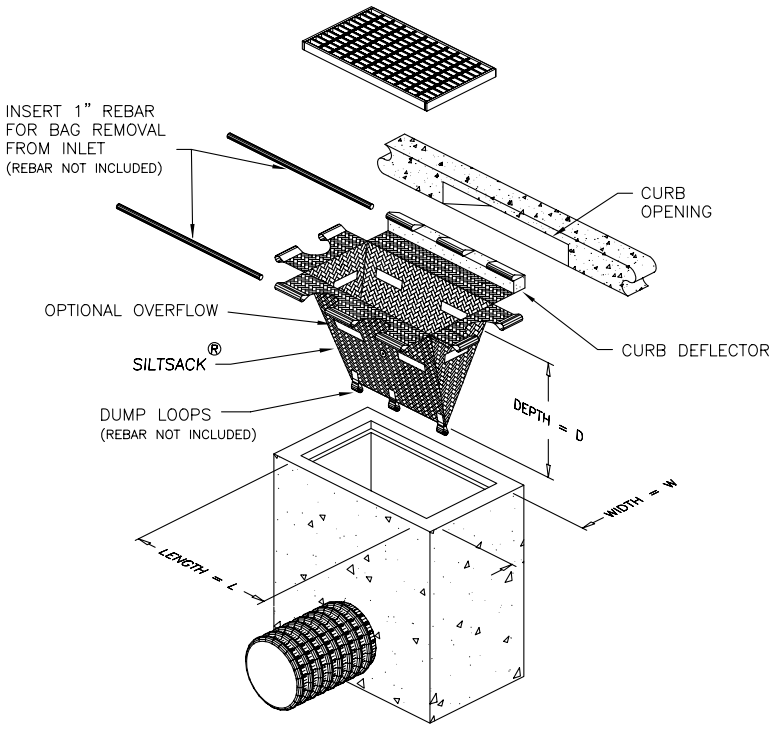
installed Siltsack held in place by grate.

Sediment captured by Siltsack® can easily be removed from the site.

Type A



Type B



Siltsack® Specification
Control of Sediment Entering Catch Basins
(Storm Water Management)

1.0 Description

1.1 This work shall consist of furnishing, installing, maintaining, and removing Siltsack sediment control device as directed by the engineer or as shown on the site drawings. Siltsack sediment control device is manufactured by:

ACF Environmental, Inc.
2831 Cardwell Road, Richmond, Virginia 23234
Phone: 800-448-3636 • Fax: 804-743-7779
www.acfenvironmental.com

2.0 Materials

2.1 Siltsack®

2.1.1 Siltsack shall be manufactured from a specially designed woven polypropylene geotextile and sewn by a double needle machine, using a high strength nylon thread.

2.1.2 Siltsack will be manufactured to fit the opening of the catch basin or drop inlet. Siltsack will have the following features: two dump straps attached at the bottom to facilitate the emptying of Siltsack; Siltsack shall have lifting loops as an integral part of the system to be used to lift Siltsack from the basin; Siltsack shall have a restraint cord approximately halfway up the sack to keep the sides away from the catch basin walls, this yellow cord is also a visual means of indicating when the sack should be emptied. Once the cord is covered with sediment, Siltsack should be emptied, cleaned and placed back into the basin.

2.1.3 Siltsack seams shall have a certified average wide width strength per ASTM D-4884 standards as follows:

Siltsack Style	Test Method	Test Method
Regular Flow	ASTM D-4884	165.0 lbs./in
Hi-Flow	ASTM D-4884	114.6 lbs./in

Siltsack Regular Flow

Property	Test Method	Units	Test Results
Grab Tensile	ASTM D-4632	lbs.	315x300
Grab Elongation	ASTM D-4632	%	15x15
Puncture	ASTM D-4833	lbs.	125
Mullen Burst	ASTM D-3786	P.S.I.	650
Trapezoid Tear	ASTM D-4533	lbs.	120x150
UV Resistance	ASTM D-4355	%	90
Apparent Opening	ASTM D-4751	US Sieve	40
Flow Rate	ASTM D-4491	Gal/Min/Ft^2	40
Permittivity	ASTM D-4491	sec $^{-1}$	0.55

or SILTSACK® High Flow

Property	Specification	Units	Test Results
Material	Polypropylene		
Weight	5.6 oz/sq yd		
Color	Black		
Grab Tensile Strength	390lbs (530N)	lbs.	255x275
Grab Elongation (Max %)	30%	%	20x15
Traezoid Tear	120 lbs (250N) Min	lbs.	40x50
Puncture	140 lbs (250N) Min	lbs.	135
Mullen Burst	600 psi	P.S.I.	420
Coefficinet of Permeability	0.04 in/sec		
Permittivity	0.3 gal/min/sq ft	sec $^{-1}$	1.5
Water Flow Rate	152 gal/min/sq ft	gal/min/ft ^{2}	200
AOS	0.212mm	US Seive	40
UV Resistance Strength	90%		
Fabric Width	72”		

All properties are Minimum Average Roll Values (MARV)

3.0 Construction Sequence

3.1 General

3.1.1 To install Siltsack in the catch basin, remove the grate and place the sack in the opening. Hold approximately six inches of the sack outside the frame. This is the area of the lifting straps. Replace the grate to hold the sack in place.

3.1.2 When the restraint cord is no longer visible, Siltsack is full and should be emptied.

3.1.3 To remove Siltsack, take two pieces of 1” diameter rebar and place through the lifting loops on each side of the sack to facilitate the lifting of Siltsack.

3.1.4 To empty Siltsack, place unit where the contents will be collected. Place the rebar through the lift straps (connected to the bottom of the sack) and lift. This will lift Siltsack from the bottom and empty the contents. Clean out and rinse. Return Siltsack to its original shape and place back in the basin.

3.1.5 Siltsack is reusable. Once the construction cycle is complete, remove Siltsack from the basin and clean. Siltsack should be stored out of sunlight until next use.

4.0 Basis of Payment

4.1 Payment for all Siltsacks used during construction is to be included in the bid price for the overall erosion and sediment control plan unless unit price is requested. Maintenance of Siltsack also to be included in this price.

**Silt sack is covered by U.S. Patent No. 5,575,925.*

Installation and Maintenance

Remove grate from catch basin.

Slide Siltsack® over one side of grate.

Slide Siltsack® over opposite side of grate.

Replace Siltsack® and grate inlet into recess.

Installed Siltsack®.

To remove Siltsack®, clean area around grate and slide rebar through Siltsack® pockets.

Slowly remove Siltsack® from inlet.

Removed Siltsack® is now ready for cleanout.

To clean Siltsack® attach rebar through empty loops at bottom and lift to empty.

ACF Environmental

"Complete Source for Stormwater Solutions"

ENVIRONMENTAL

2831 Cardwell Road
Richmond, Virginia 23234
(800) 448-3636 • FAX (804) 743-7779
www.acfenvironmental.com

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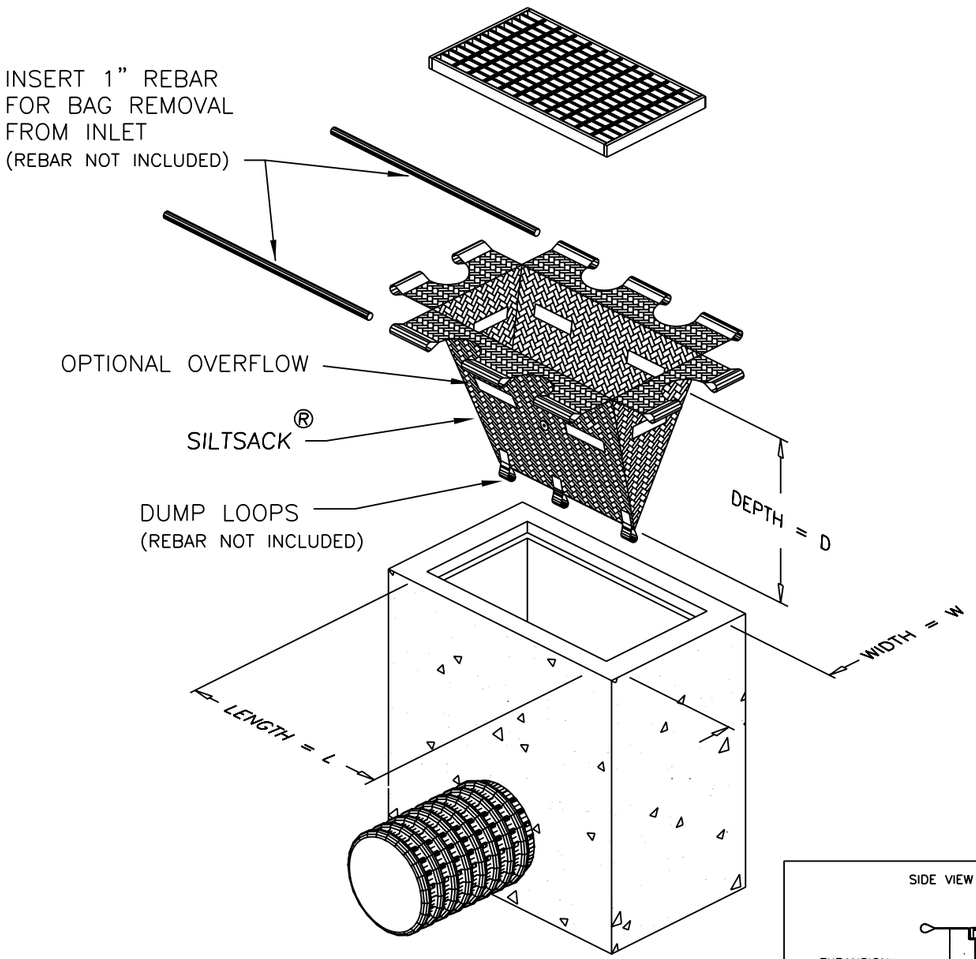

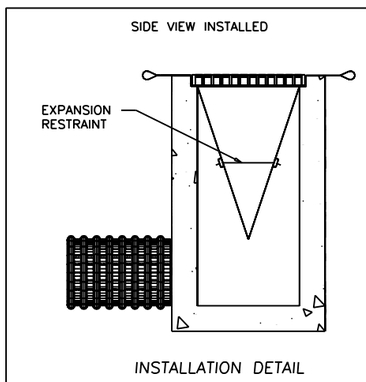

INSTALLATION DETAIL

DETAIL OF INLET SEDIMENT CONTROL DEVICE
TYPE A – WITHOUT CURB DEFLECTOR

Environmental
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Geosynthetic Solutions

ACF Environmental, Inc.
2831 Cardwell Rd.
Richmond, Virginia 23234
(800) 448-3636

SILTSACK®
SPECIFICATIONS

NOTE: THE SILTSACK® WILL BE MANUFACTURED FROM A WOVEN POLYPROPYLENE FABRIC THAT MEETS OR EXCEEDS THE FOLLOWING SPECIFICATIONS.

REGULAR FLOW SILTSACK®

(FOR AREAS OF LOW TO MODERATE PRECIPITATION AND RUN-OFF)

PROPERTIES	TEST METHOD	UNITS
GRAB TENSILE STRENGTH	ASTM D-4632	300 LBS
GRAB TENSILE ELONGATION	ASTM D-4632	20 %
PUNCTURE	ASTM D-4833	120 LBS
MULLEN BURST	ASTM D-3786	800 PSI
TRAPEZOID TEAR	ASTM D-4533	120 LBS
UV RESISTANCE	ASTM D-4355	80 %
APPARENT OPENING SIZE	ASTM D-4751	40 US SIEVE
FLOW RATE	ASTM D-4491	40 GAL/MIN/SQ FT
PERMITTIVITY	ASTM D-4491	0.55 SEC -1

HI-FLOW SILTSACK®

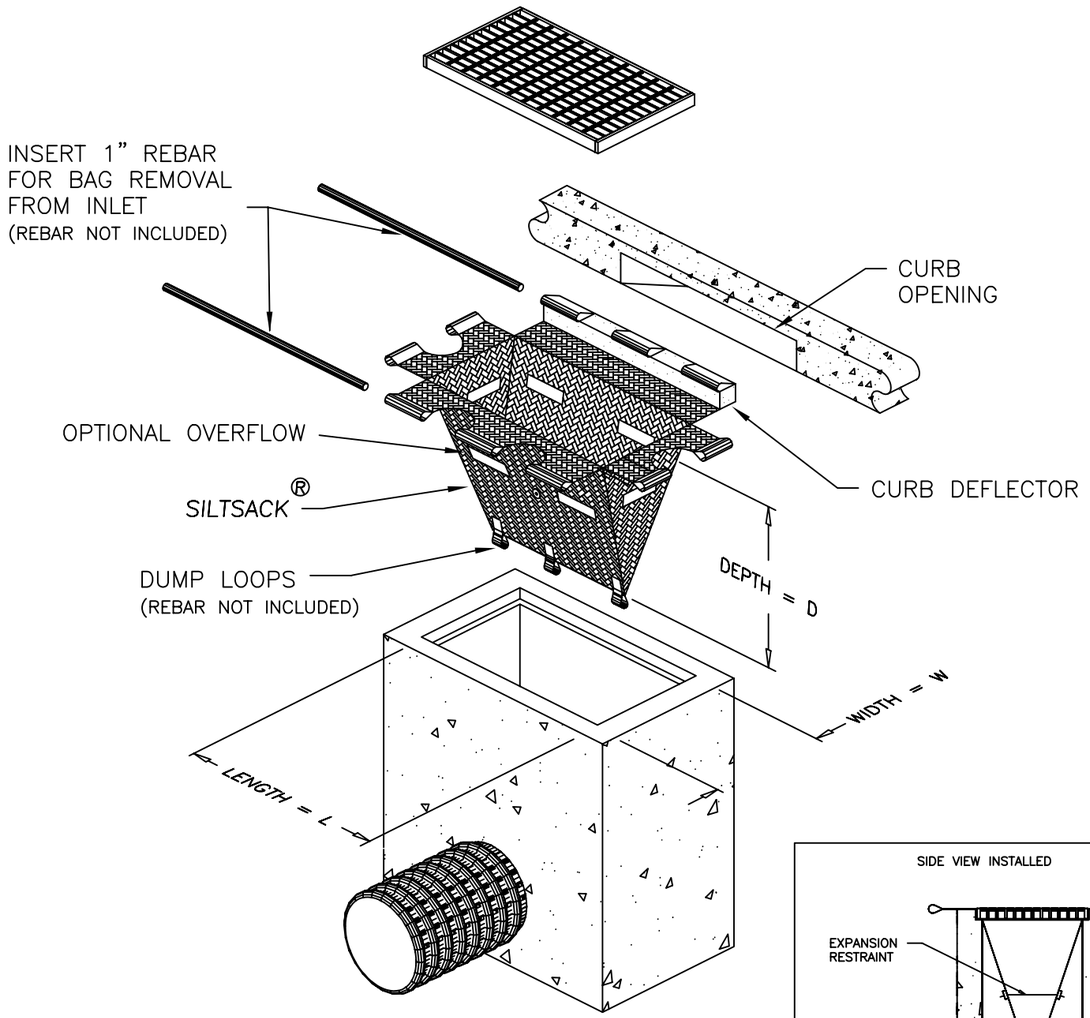
(FOR AREAS OF MODERATE TO HEAVY PRECIPITATION AND RUN-OFF)

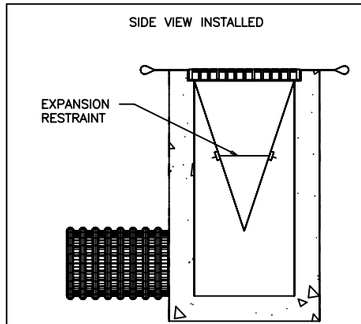
PROPERTIES	TEST METHOD	UNITS
GRAB TENSILE STRENGTH	ASTM D-4632	265 LBS
GRAB TENSILE ELONGATION	ASTM D-4632	20 %
PUNCTURE	ASTM D-4833	135 LBS
MULLEN BURST	ASTM D-3786	420 PSI
TRAPEZOID TEAR	ASTM D-4533	45 LBS
UV RESISTANCE	ASTM D-4355	90 %
APPARENT OPENING SIZE	ASTM D-4751	20 US SIEVE
FLOW RATE	ASTM D-4491	200 GAL/MIN/SQ FT
PERMITTIVITY	ASTM D-4491	1.5 SEC -1

OIL-ABSORBANT SILTSACK®

(FOR AREAS WHERE THERE IS A CONCERN FOR OIL RUN-OFF OR SPILLS)

DEPENDING ON YOUR PARTICULAR APPLICATION, THE SILTSACK® CAN BE MADE FROM EITHER ONE OF THE ABOVE FABRICS WITH AN OIL-ABSORBANT PILLOW INSERT OR, MADE COMPLETELY FROM AN OIL-ABSORBANT SILTSACK® WITH A WOVEN PILLOW INSERT.





INSTALLATION DETAIL

DETAIL OF INLET SEDIMENT CONTROL DEVICE TYPE B – WITH CURB DEFLECTOR

Environmental
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ACF Environmental, Inc.
2831 Cardwell Rd.
Richmond, Virginia 23234
(800) 448-3636

SILTSACK®
SPECIFICATIONS

NOTE: THE SILTSACK ® WILL BE MANUFACTURED FROM A WOVEN POLYPROPYLENE FABRIC THAT MEETS OR EXCEEDS THE FOLLOWING SPECIFICATIONS.

REGULAR FLOW SILTSACK®

(FOR AREAS OF LOW TO MODERATE PRECIPITATION AND RUN-OFF)

PROPERTIES	TEST METHOD	UNITS
GRAB TENSILE STRENGTH	ASTM D-4632	300 LBS
GRAB TENSILE ELONGATION	ASTM D-4632	20 %
PUNCTURE	ASTM D-4833	120 LBS
MULLEN BURST	ASTM D-3786	800 PSI
TRAPEZOID TEAR	ASTM D-4533	120 LBS
UV RESISTANCE	ASTM D-4355	80 %
APPARENT OPENING SIZE	ASTM D-4751	40 US SIEVE
FLOW RATE	ASTM D-4491	40 GAL/MIN/SQ FT
PERMITTIVITY	ASTM D-4491	0.55 SEC -1

HI-FLOW SILTSACK®

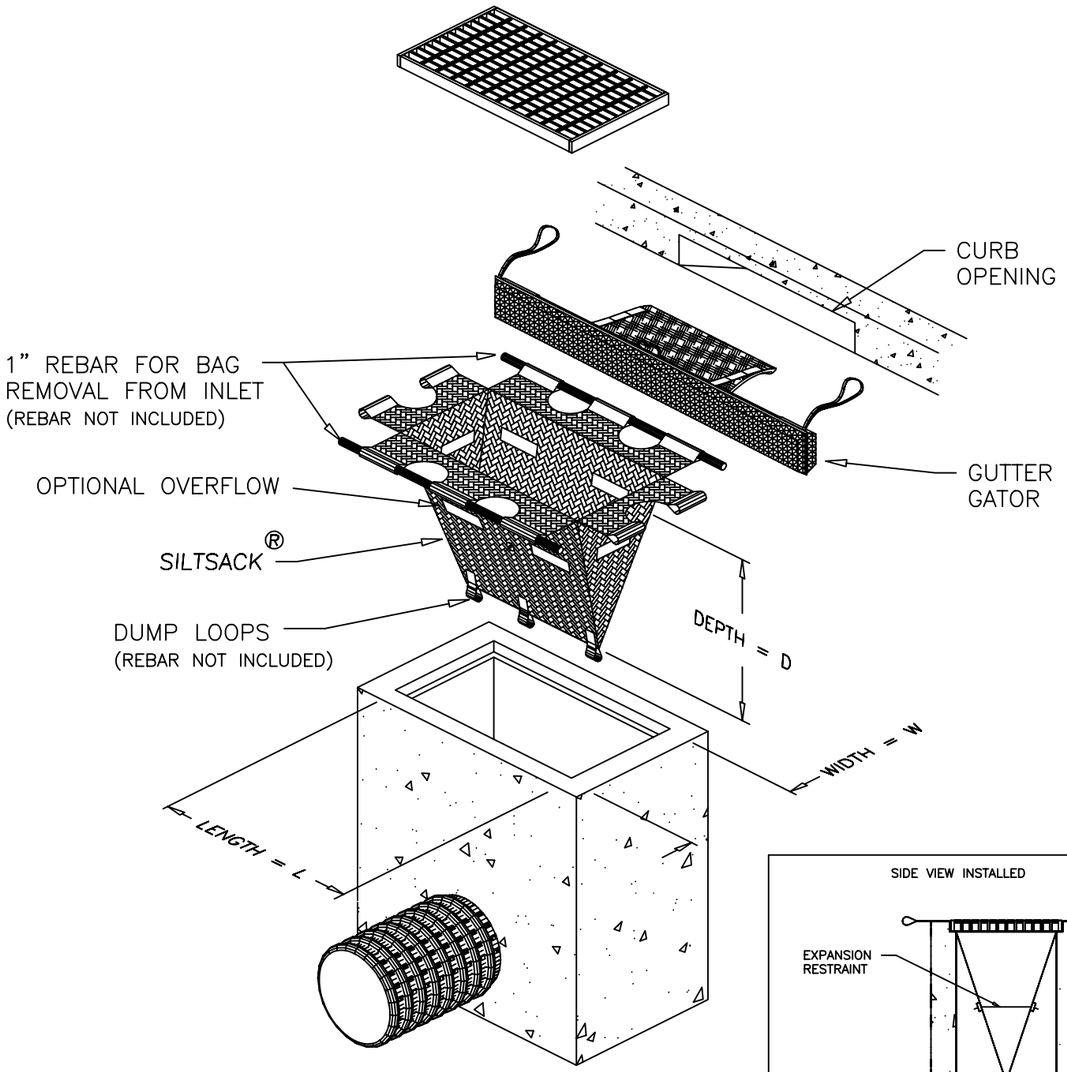
(FOR AREAS OF MODERATE TO HEAVY PRECIPITATION AND RUN-OFF)

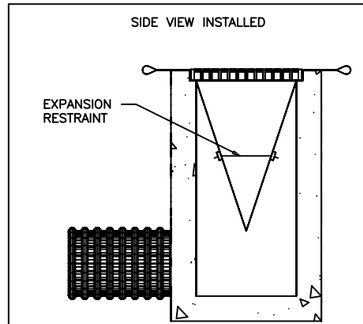
PROPERTIES	TEST METHOD	UNITS
GRAB TENSILE STRENGTH	ASTM D-4632	265 LBS
GRAB TENSILE ELONGATION	ASTM D-4632	20 %
PUNCTURE	ASTM D-4833	135 LBS
MULLEN BURST	ASTM D-3786	420 PSI
TRAPEZOID TEAR	ASTM D-4533	45 LBS
UV RESISTANCE	ASTM D-4355	90 %
APPARENT OPENING SIZE	ASTM D-4751	20 US SIEVE
FLOW RATE	ASTM D-4491	200 GAL/MIN/SQ FT
PERMITTIVITY	ASTM D-4491	1.5 SEC -1

OIL-ABSORBANT SILTSACK®

(FOR AREAS WHERE THERE IS A CONCERN FOR OIL RUN-OFF OR SPILLS)

DEPENDING ON YOUR PARTICULAR APPLICATION, THE SILTSACK® CAN BE MADE FROM EITHER ONE OF THE ABOVE FABRICS WITH AN OIL-ABSORBANT PILLOW INSERT OR, MADE COMPLETELY FROM AN OIL-ABSORBANT SILTSACK ,®WITH A WOVEN PILLOW INSERT.





INSTALLATION DETAIL

DETAIL OF INLET SEDIMENT CONTROL DEVICE WITH GUTTER GATOR

Environmental
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Geosynthetic Solutions

ACF Environmental, Inc.
2831 Cardwell Rd.
Richmond, Virginia 23234
(800) 448-3636

SILTSACK® GUTTER GATOR® COMBINATION
SPECIFICATIONS

NOTE: THE SILTSACK® WILL BE MANUFACTURED FROM A WOVEN POLYPROPYLENE FABRIC THAT MEETS OR EXCEEDS THE FOLLOWING SPECIFICATIONS.

REGULAR FLOW SILTSACK®

(FOR AREAS OF LOW TO MODERATE PRECIPITATION AND RUN-OFF)

PROPERTIES	TEST METHOD	UNITS
GRAB TENSILE STRENGTH	ASTM D-4632	300 LBS
GRAB TENSILE ELONGATION	ASTM D-4632	20 %
PUNCTURE	ASTM D-4833	120 LBS
MULLEN BURST	ASTM D-3786	800 PSI
TRAPEZOID TEAR	ASTM D-4533	120 LBS
UV RESISTANCE	ASTM D-4355	80 %
APPARENT OPENING SIZE	ASTM D-4751	40 US SIEVE
FLOW RATE	ASTM D-4491	40 GAL/MIN/SQ FT
PERMITTIVITY	ASTM D-4491	0.55 SEC -1

HI-FLOW SILTSACK®

(FOR AREAS OF MODERATE TO HEAVY PRECIPITATION AND RUN-OFF)

PROPERTIES	TEST METHOD	UNITS
GRAB TENSILE STRENGTH	ASTM D-4632	265 LBS
GRAB TENSILE ELONGATION	ASTM D-4632	20 %
PUNCTURE	ASTM D-4833	135 LBS
MULLEN BURST	ASTM D-3786	420 PSI
TRAPEZOID TEAR	ASTM D-4533	45 LBS
UV RESISTANCE	ASTM D-4355	90 %
APPARENT OPENING SIZE	ASTM D-4751	20 US SIEVE
FLOW RATE	ASTM D-4491	200 GAL/MIN/SQ FT
PERMITTIVITY	ASTM D-4491	1.5 SEC -1

OIL-ABSORBANT SILTSACK®

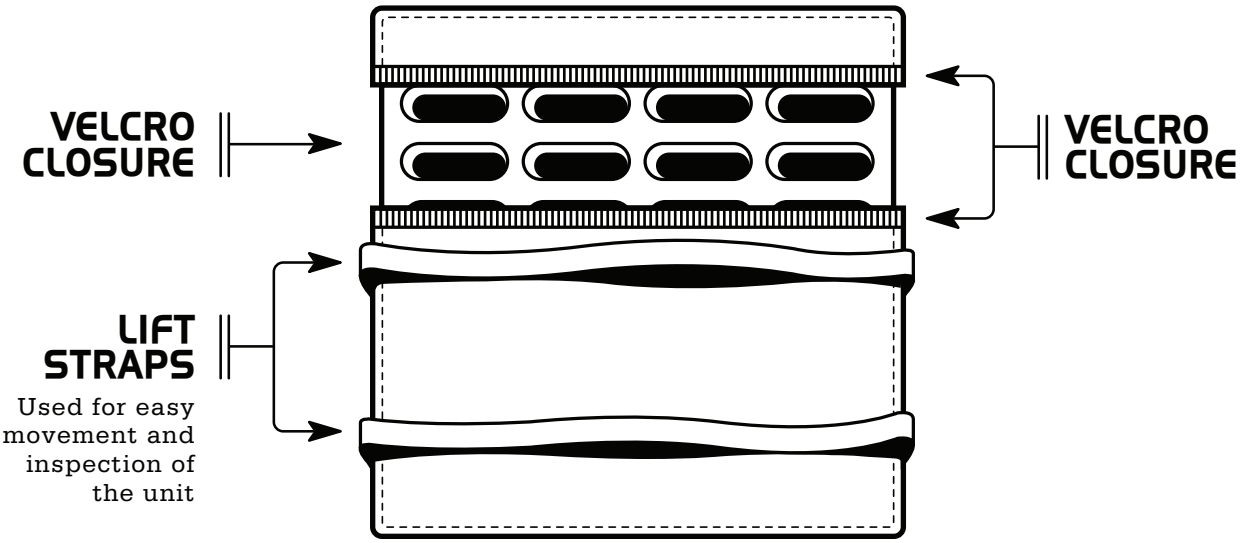
(FOR AREAS WHERE THERE IS A CONCERN FOR OIL RUN-OFF OR SPILLS)

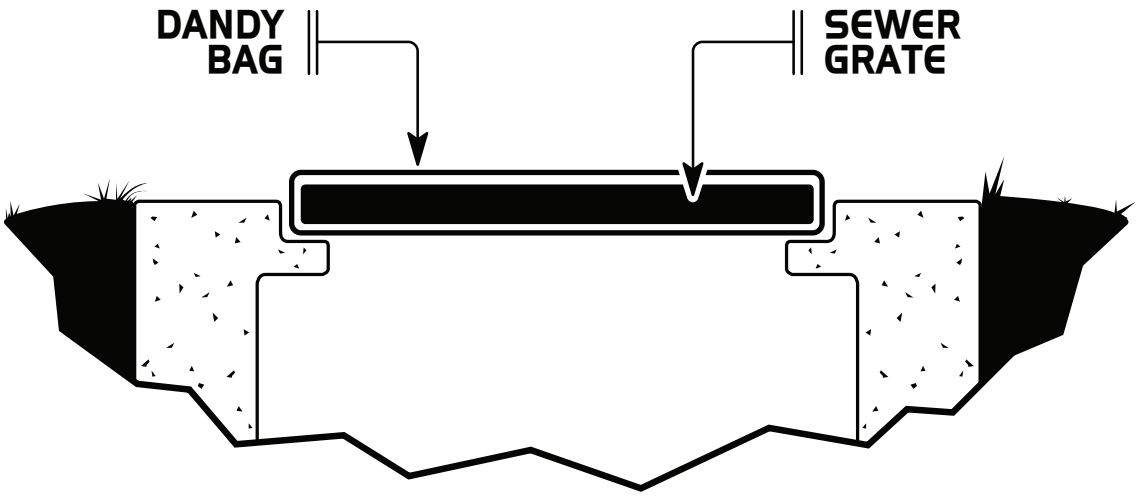
DEPENDING ON YOUR PARTICULAR APPLICATION, THE SILTSACK® CAN BE MADE FROM EITHER ONE OF THE ABOVE FABRICS WITH AN OIL-ABSORBANT PILLOW INSERT OR, MADE COMPLETELY FROM AN OIL-ABSORBANT SILTSACK,® WITH A WOVEN PILLOW INSERT.

Dandy Bag


Stormwater Filtration Sediment Control - The Dandy Bag
Dandy Bag®
DANDY
PRODUCTS

DANDY BAG®


VELCRO CLOSURE
VELCRO CLOSURE
LIFT STRAPS
Used for easy movement and inspection of the unit


DANDY BAG
SEWER GRATE

DANDY BAG®
INLET PROTECTION SYSTEM GUIDE SPECIFICATION

PRODUCT:

DANDY BAG®

MANUFACTURER:

Dandy Products Inc.
P.O. Box 1980
Westerville, Ohio 43086
Phone: 800-591-2284
Fax: 740-881-2791
E mail dlc@dandyproducts.com
Web www.dandyproducts.com

1.0 **Description:**

1.1 Work covered under this item consists of installing a Dandy Bag® inlet protection system. The purpose is to keep silt, sediment and construction debris out of the storm water system.

2.0 **Material:**

2.1 The Dandy Bag® inlet protection unit shall be a **sewn in the U.S.A**. geotextile fabric unit fitted to the individual grate(s) and completely enclosing the grate(s).

2.2 The Dandy Bag® shall have lifting devises to allow manual inspection of the storm water system.

2.3 The Dandy Bag® unit shall utilize an orange monofilament fabric manufactured in the U.S.A. with the following characteristics:

PROPERTY	TEST METHOD	UNITS	TEST RESULTS
Grab Tensile Strength	ASTM D 4632	lbs	450 X 300
Elongation	ASTM D 4632	%	40% X 25%
Puncture Strength	ASTM D 4833	lbs	130
Mullen Burst Strength	ASTM D 3786	psi	600
Trapezoid Tear Strength	ASTM D 4533	lbs	165 x 150
% Open Area (POA)	COE - 22125-86	%	28
Apparent Opening Size	ASTM D 4751	US Std Sieve	30
Permittivity	ASTM D 4491	sec[1]	3.5
Permeability	ASTM 4491	cm/sec	0.25
Water Flow Rate	ASTM 4491	gal/min/ft^2	250
Ultraviolet Resistance	ASTM D 4355	%	70
Color			Orange[1]

[1]The color orange is a trademark of Dandy Products, Inc.
The property values listed above are effective October 2010 and are subject to change without notice.

3.**0 Installation:**

3.1 Place the empty Dandy Bag® over the grate as the grate stands on end.

3.2 For oil and sediment model; to install or replace absorbent, place absorbent pillow in pouch, on the bottom (below-grade side) of the unit.

3.3 Tuck the enclosure flap inside to completely enclose the grate.

3.4 Holding the lifting devises, insert the grate into the inlet being careful not to damage the Dandy Bag® unit.

4.0 **Maintenance:**

4.1 The contractor shall remove all accumulated sediment and debris from surface and vicinity of unit after each rain event or as directed by engineer/inspector. Dispose of unit no longer in use at an appropriate recycling or solid waste facility.

4.2 *For oil and sediment model; remove and replace absorbent when near saturation.*

5.0 **Method of Measurement:**

5.1 The quantity to be paid is for the actual number of Dandy Bag® inlet protection units installed

6.0 **Basis of Payment:**

6.1 The unit price shall include labor, equipment, and materials necessary to complete the work and maintain the Dandy Bag® inlet protection units.

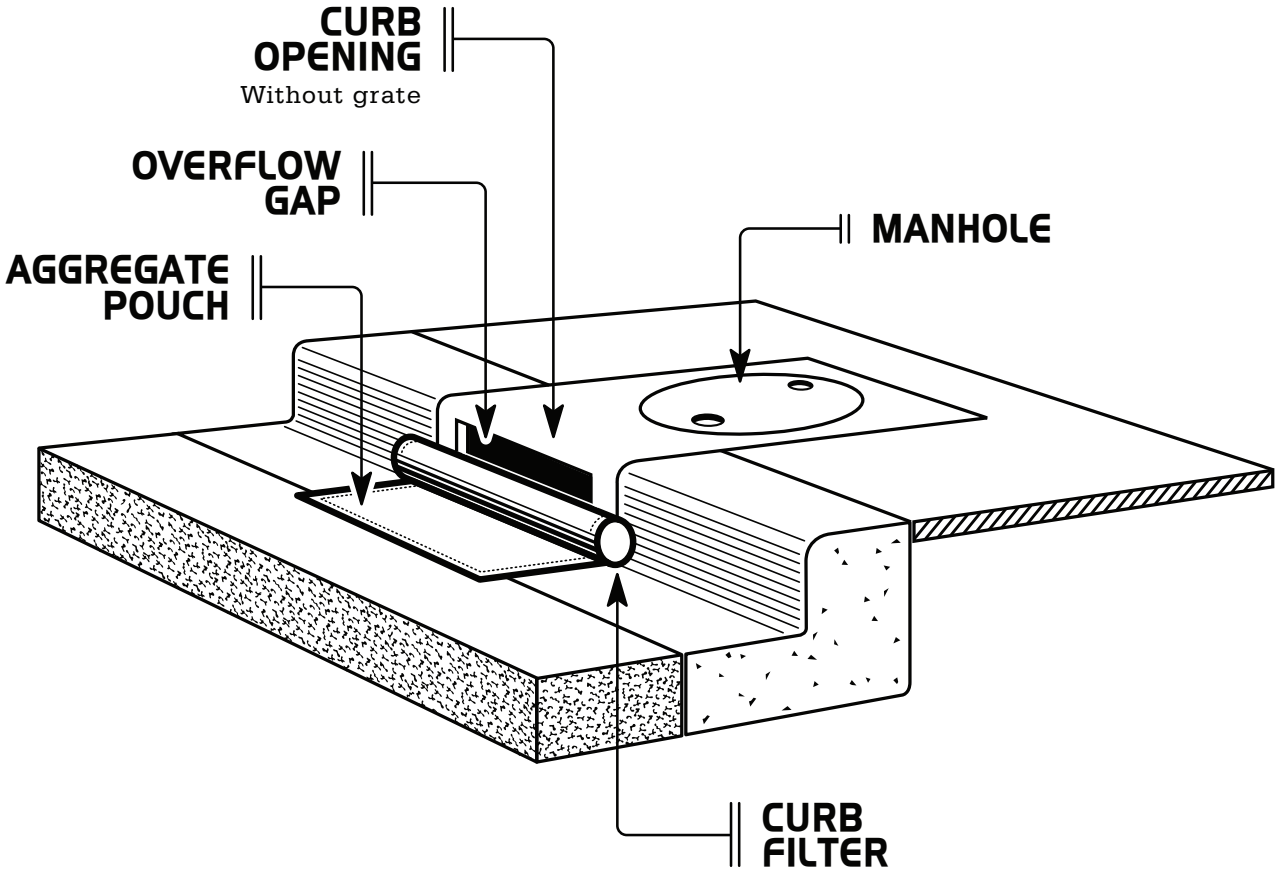
6.2 Payment for the completed work will be made at the contract prices for:

ITEM	UNIT	DESCRIPTION
Dandy Bag®	EA	Inlet Protection Unit (#_____Inlet)

Dandy Curb


Inlet Protection Video | Curb Inlet Filtration | Dandy Curb
Dandy Curb®
DANDY
PRODUCTS

DANDY CURB™


CURB OPENING
Without grate
OVERFLOW GAP
AGGREGATE POUCH
MANHOLE
CURB FILTER

DANDY CURB®
GRATELESS CURB INLET AND MEDIAN BARRIER INLET PROTECTION SYSTEM GUIDE SPECIFICATION

PRODUCT:

DANDY CURB®

MANUFACTURER:

Dandy Products Inc.
P.O. Box 1980
Westerville, Ohio 43086
Phone: 800-591-2284
Fax: 740-881-2791
E mail dlc@dandyproducts.com
Web www.dandyproducts.com

1.0 **Description:**

1.1 Work covered under this item consists of installing a Dandy Curb® inlet protection system for inlets and median barrier inlets without grates. The purpose is to keep silt, sediment and construction debris out of the storm system.

2.0 **Material:**

2.1 The Dandy Curb® inlet protection system shall be a **sewn in the U.S.A**. fabric unit enclosing a porous structure in the form of a cylindrical tube placed in front of and extending beyond the inlet opening on both sides.

2.2 The Dandy Curb® inlet protection system shall have a pouch on the street side of the sewn unit for aggregate or other material to hold the unit in place.

2.3 The Dandy Curb® unit shall utilize an orange monofilament fabric that is manufactured in the U.S.A. with the following characteristics:

PROPERTY	TEST METHOD	UNITS	TEST RESULTS
Grab Tensile Strength	ASTM D 4632	lbs	450 x 300
Grab Tensile Elongation	ASTM D 4632	%	40 x 25
Puncture Strength	ASTM D 4833	lbs	130
Mullen Burst Strength	ASTM D 3786	psi	600
Trapezoid Tear Strength	ASTM D 4533	lbs	165 x 150
% Open Area (POA)	COE - 22125-86	%	28
Apparent Opening Size	ASTM D 4751	US Std Sieve	30
Permittivity	ASTM D 4491	sec^{1}	3.5
Permeability	ASTM 4491	cm/sec	0.25
Water Flow Rate	ASTM 4491	$gal/min/ft^{2}$	250
Ultraviolet Resistance	ASTM D 4355	%	70

Color			Orange[1]

[1]The color orange is a trademark of Dandy Products, Inc.
The property values listed above are effective October 2010 and are subject to change without notice.

3.0 Installation:

3.1 Place Dandy Curb® inlet protection unit on ground with aggregate pouch on street side near inlet it will be installed on.

3.2 For oil and sediment model, to install or replace absorbent, place absorbent sock in pouch.

3.3 Fill pouch with aggregate such as #5-7, 8's or similar to a level (at least ½ full) that will keep unit in place during a rain event and create a seal between the Dandy Curb® and the surface of the street. Reseal Velcro access.

3.4 Center the unit against curb or median inlet opening so that the curb side of the unit creates a seal with the curb or median barrier and inlet structure. There will be approximately twelve (12) inches of the inlet protection unit overhanging on each side of the opening. If the unit is not installed in this manner, it will not function properly.

4.0 Maintenance:

4.1 The contractor shall remove all accumulated sediment and debris from surface and vicinity of unit after each rain event or as directed by engineer/inspector. Dispose of unit no longer in use at an appropriate recycling or solid waste facility.

4.2 *For oil and sediment model; remove and replace absorbent when near saturation.*

5.0 Method of Measurement:

5.1 The quantity to be paid is for the actual number of Dandy Curb® inlet protection units installed.

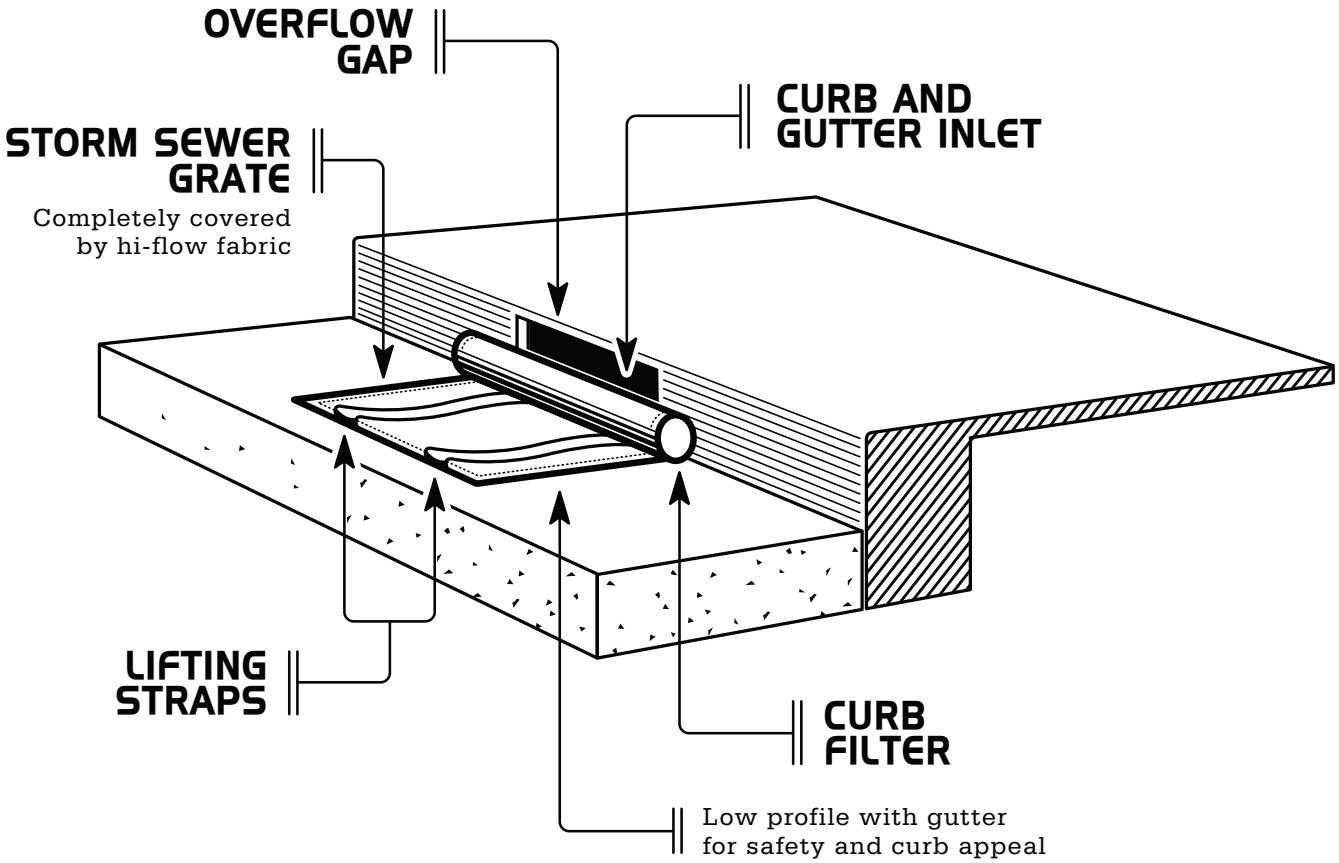
6.0 Basis of payment:

6.1 The unit price shall include labor, equipment, and materials necessary to complete the work and maintain the True Dam® inlet protection units.
6.2 Payment for the completed work will be made at the contract prices for:

ITEM	UNIT	DESCRIPTION
Dandy Curb®	EA	Inlet Protection Unit (#_____Inlet)


Dandy Curb Bag®

DANDY CURB BAG™



DANDY CURB BAG®
CURB AND GUTTER INLET/GRATE PROTECTION SYSTEM
GUIDE SPECIFICATION

PRODUCT:

DANDY CURB BAG®

MANUFACTURER:

Dandy Products, Inc.
P.O. Box 1980
Westerville, Ohio 43086
Phone: 800-591-2284
Fax: 740-881-2791
E-mail dlc@dandyproducts.com
Web www.dandyproducts.com

1.0 **Description:**

1.1 Work covered under this item consists of installing a Dandy Curb Bag® curb and gutter inlet protection system. The purpose is to keep silt, sediment and construction debris out of the storm water system.

2.0 **Material:**

2.1 The Dandy Curb Bag® curb and gutter inlet protection unit shall be a **sewn in the U.S.A.** geotextile fabric unit enclosing a porous structure in the form of a cylindrical tube placed in front of and extending beyond the inlet opening on both sides and have a geotextile fabric envelope fitted to the individual grate(s)on the street side of the sewn unit for grate(s) to be inserted and to completely enclose the grate(s).

2.2 The Dandy Curb Bag® shall have lifting devices to allow manual inspection of the storm water system.

2.3 The Dandy Curb Bag® unit shall utilize an orange monofilament fabric that is manufactured in the U.S.A. with the following characteristics:

PROPERTY	TEST METHOD	UNITS	TEST RESULTS
Grab Tensile Strength	ASTM D 4632	lbs	450 x 300
Grab Tensile Elongation	ASTM D 4632	%	40 x 25
Puncture Strength	ASTM D 4833	lbs	130
Mullen Burst Strength	ASTM D 3786	psi	600
Trapezoid Tear Strength	ASTM D 4533	lbs	165 x 150
% Open Area (POA)	COE - 22125-86	%	28
Apparent Opening Size	ASTM D 4751	US Std Sieve	30
Permittivity	ASTM D 4491	sec^{1}	3.5

Permeability	ASTM 4491	cm/sec	0.25
Water Flow Rate	ASTM 4491	gal/min/ft^2	250
Ultraviolet Resistance	ASTM D 4355	%	70
Color			Orange[1]

[1]The color orange is a trademark of Dandy Products, Inc.
The property values listed above are effective October 2010 and are subject to change without notice.

3.0 **Installation:**

3.1 Place the empty Dandy Curb Bag® unit over the grate as the grate stands on end.

3.2 *For oil and sediment model; to install or replace absorbent, place absorbent pillow in pouch, on the bottom (below-grade side) of the unit.*

3.3 Tuck the enclosure flap inside to completely enclose the grate.

3.4 Holding the lifting devices, being careful not to damage the sewn fabric unit, insert the grate into its frame, street side edge first, then lower back edge with cylindrical tube into place. The cylindrical tube should be partially blocking the curb hood opening when installed properly.

4.0 **Maintenance:**

4.1 The contractor shall remove all accumulated sediment and debris from surface and vicinity of unit after each rain event or as directed by engineer/inspector. Dispose of unit no longer in use at an appropriate recycling or solid waste facility.

4.2 *For oil and sediment model; remove and replace absorbent when near saturation.*

5.0 **Method of Measurement:**

5.1 The quantity to be paid is for the actual number of Dandy Curb Bag® inlet protection units installed

6.0 **Basis of payment:**

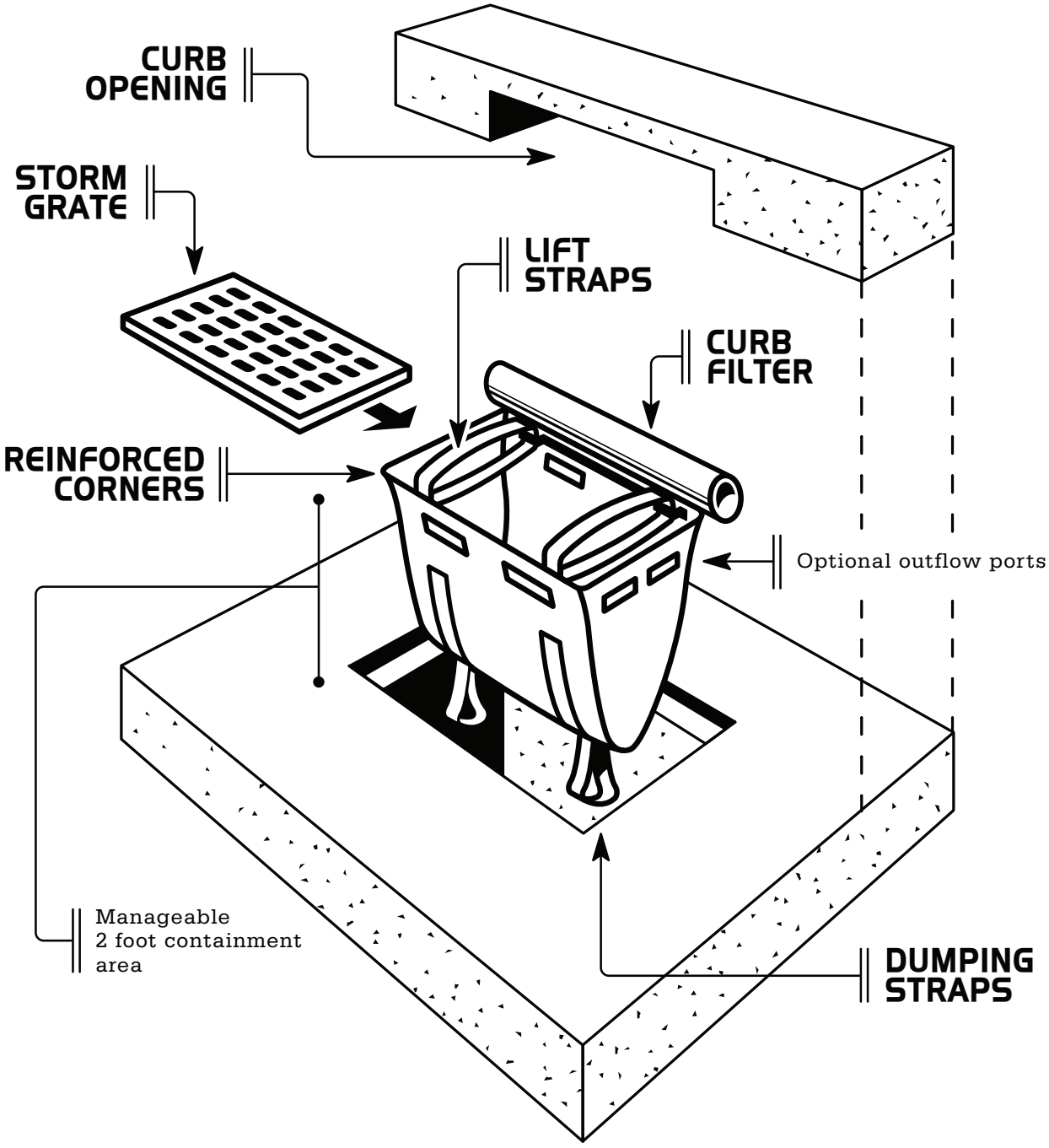
6.1 The unit price shall include labor, equipment, and materials necessary to complete the work and maintain the Dandy Curb Bag® inlet protection units.

6.2 Payment for the completed work will be made at the contract prices for:

ITEM	UNIT	DESCRIPTION
Dandy Curb Bag®	EA	Curb Inlet Protection Unit (#_____Inlet)

Dandy Curb Sack

DANDY CURB SACK™



DANDY CURB SACK®
CURB AND GUTTER INLET PROTECTION SYSTEM GUIDE SPECIFICATION

PRODUCT:

DANDY CURB SACK®

MANUFACTURER:

Dandy Products Inc.
P.O. Box 1980
Westerville, Ohio 43086
Phone: 800-591-2284
Fax: 740-881-2791
E mail dlc@dandyproducts.com
Web www.dandyproducts.com

1.0 **Description:**

1.1 Work covered under this item consists of installing a Dandy Curb Sack® curb and gutter inlet protection system. The purpose is to keep silt, sediment and construction debris out of the storm water system.

2.0 **Material:**

2.1 The Dandy Curb Sack® curb and gutter inlet protection unit shall be a sewn geotextile fabric unit **made in the U.S.A.** enclosing a porous structure in the form of a cylindrical tub placed in front and extending beyond the inlet opening on both sides and have a geotextile fabric sack attached designed to fit the opening of the catch basin or drop inlet and to hang underneath the grate and into the catch basin.

2.2 The Dandy Curb Sack® shall have lifting straps to allow removal of the unit and manual inspection of the storm water system.

2.3 The Dandy Curb Sack® unit shall utilize an orange monofilament fabric that is manufactured in the U.S.A with the following characteristics:

PROPERTY	TEST METHOD	UNITS	TEST RESULTS
Grab Tensile Strength	ASTM D 4632	lbs	450 x 300
Grab Tensile Elongation	ASTM D 4632	%	40 x 25
Puncture Strength	ASTM D 4833	lbs	130
Mullen Burst Strength	ASTM D 3786	psi	600
Trapezoid Tear Strength	ASTM D 4533	lbs	165 x 150
% Open Area (POA)	COE - 22125-86	%	28
Apparent Opening Size	ASTM D 4751	US Std Sieve	30
Permittivity	ASTM D 4491	sec^{1}	3.5
Permeability	ASTM 4491	cm/sec	0.25

Water Flow Rate	ASTM 4491	gal/min/ft^2	250
Ultraviolet Resistance	ASTM D 4355	%	70
Color			Orange[1]

[1]The color orange is a trademark of Dandy Products, Inc.
The property values listed above are effective October 2010 and are subject to change without notice.

3.0 **Installation:**

3.1 Remove the grate from the catch basin.

3.2 For Oil and Sediment Model; to install or replace absorbent, place absorbent pillow in unit, on the bottom (below-grade side) of the unit.

3.3 Stand the grate on end. Move the top lifting straps out of the way and place the grate into the Dandy Curb Sack® unit so that the grate is below the top straps and above the lower straps. The grate should be cradled between the upper and lower straps.

3.4 Holding the lifting devices, insert the grate into the inlet, then lower back edge with cylindrical tube into place, being careful that the grate remains in place and being careful not to damage the Dandy Curb Sack® unit. The cylindrical tube should partially block the curb hood opening when installed properly.

4.0 **Maintenance:**

4.1 Remove all accumulated sediment and debris from vicinity of unit after each storm event.

4.2 After each storm event and at regular intervals, look into the Dandy Curb Sack® unit. If the unit is more than 1/3 full of accumulated sediment, the unit must be emptied.

4.3 To empty the unit, using the lifting straps lift the unit out of the inlet and remove the grate. Transport the unit to an appropriate location for removal of the contents. Holding the dumping straps on the outside at the bottom of the unit, turn the unit upside down, emptying the contents. Reinstall unit as above.

4.4 *For Oil and Sediment Model; remove and replace absorbent when near saturation.*

4.5 Dispose of unit and/or absorbent in accord with applicable Federal, state and local environmental laws and regulations.

5.0 **Method of Measurement**:

5.1 The quantity to be paid is for the actual number of Dandy Curb Sack® inlet protection units installed

6.0 **Basis of payment:**

6.1 The unit price shall include labor, equipment, and materials necessary to complete the work and maintain the Dandy Curb Sack® inlet protection units.

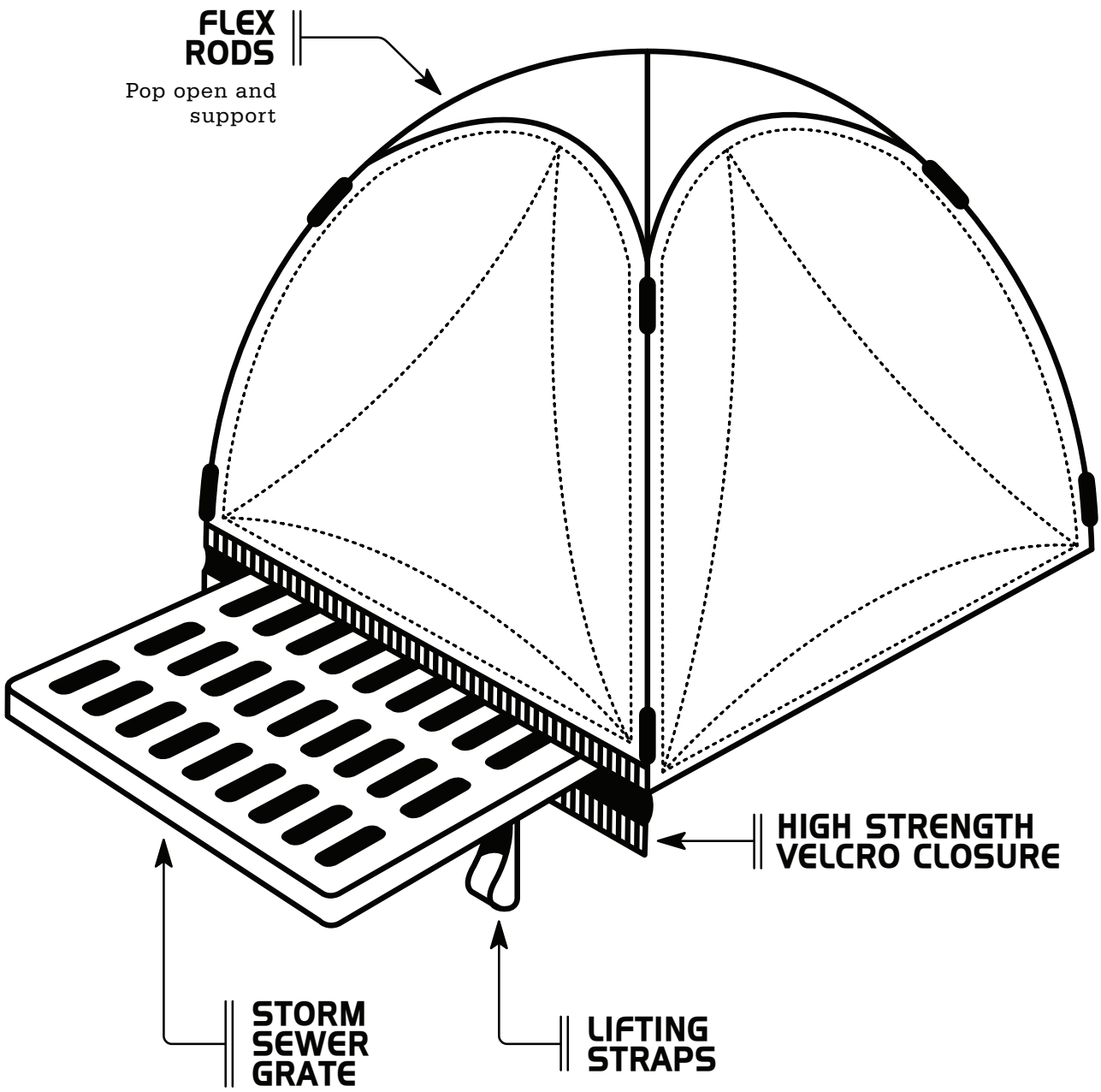
6.2 Payment for the completed work will be made at the contract prices for:

ITEM	UNIT	DESCRIPTION
Dandy Curb Sack®	EA	Inlet Protection Unit (#_____Inlet)

Dandy Pop


Stormwater and Sediment Filtration Video | Curb Inlet Filtration | The Dandy Pop
Dandy Pop®
DANDY
PRODUCTS

DANDY POP™


FLEX RODS
Pop open and support
HIGH STRENGTH VELCRO CLOSURE
STORM SEWER GRATE
LIFTING STRAPS

DANDY POP® (POP-UP DANDY BAG®)
INLET PROTECTION SYSTEM GUIDE SPECIFICATION

PRODUCT: DANDY POP®

MANUFACTURER:

Dandy Products Inc.
P.O. Box 1980
Westerville, Ohio 43086
Phone: 800-591-2284
Fax: 740-881-2791
E mail dlc@dandyproducts.com
Web www.dandyproducts.com

1.0 **Description:**

1.1 Work covered under this item consists of installing a Dandy Pop® inlet protection system. The purpose is to keep silt, sediment and construction debris out of the storm water system.

2.0 **Material:**

2.1 The Dandy Pop® inlet protection unit shall be a **sewn in the U.S.A**. geotextile fabric dome unit with a fully-covered support frame. The unit shall enclose the grate.

2.2 The Dandy Pop® shall unfold for installation to a height of approximately 24" (twenty-four inches).

2.3 The Dandy Pop® shall have lifting devises sewn to the bottom of the unit to assist in installation and to allow manual inspection of the storm water system.

2.4 The Dandy Pop® shall utilize an orange monofilament fabric that is manufactured in the U.S.A. with the following characteristics:

PROPERTY	TEST METHOD	UNITS	TEST RESULTS
Grab Tensile Strength	ASTM D 4632	lbs	450 x300
Grab Tensile Elongation	ASTM D 4632	%	40 x 25
Puncture Strength	ASTM D 4833	lbs	130
Mullen Burst Strength	ASTM D 3786	psi	600
Trapezoid Tear Strength	ASTM D 4533	lbs	165 x 150
% Open Area (POA)	COE - 22125-86	%	28
Apparent Opening Size	ASTM D 4751	US Std Sieve	30
Permittivity	ASTM D 4491	sec^{1}	3.5
Permeability	ASTM 4491	cm/sec	0.25
Water Flow Rate	ASTM 4491	$gal/min/ft^{2}$	250

Ultraviolet Resistance	ASTM D 4355	%	70
Color			Orange[1]

[1]The color orange is a trademark of Dandy Products, Inc.
The property values listed above are effective October 2010 and are subject to change without notice.

3.0 **Installation:**

3.1 Pop open the Dandy Pop® near the inlet.

3.2 Stand the grate on end and slide the Dandy Pop® over the grate.

3.3 For oil and sediment model; to install or replace absorbent, place absorbent pillow in pouch, on the bottom (below-grade side) of the unit. As desired, or required, attach absorbent pillow to provided tether loop.

3.4 Turn the grate 180° on end (turn twice) so that the opening is facing up.

3.5 Pull up slack and seal velcro® to enclose the grate.

3.6 Lay the grate flat, and holding the lifting devises, insert the grate into the inlet making sure that the grate seats completely in the frame.

4.0 **Maintenance:**

4.1 The contractor shall remove all accumulated sediment and debris from panels and surface and vicinity of unit after each rain event or as directed by engineer/inspector. Dispose of unit no longer in use at an appropriate recycling or solid waste facility.

4.2 For oil and sediment model; remove and replace absorbent when near saturation.

5.0 **Method of Measurement:**

5.1 The quantity to be paid is for the actual number of Dandy Pop® inlet protection units installed

6.0 **Basis of payment:**

6.1 The unit price shall include labor, equipment, and materials necessary to complete the work and maintain the Dandy Pop® inlet protection units.

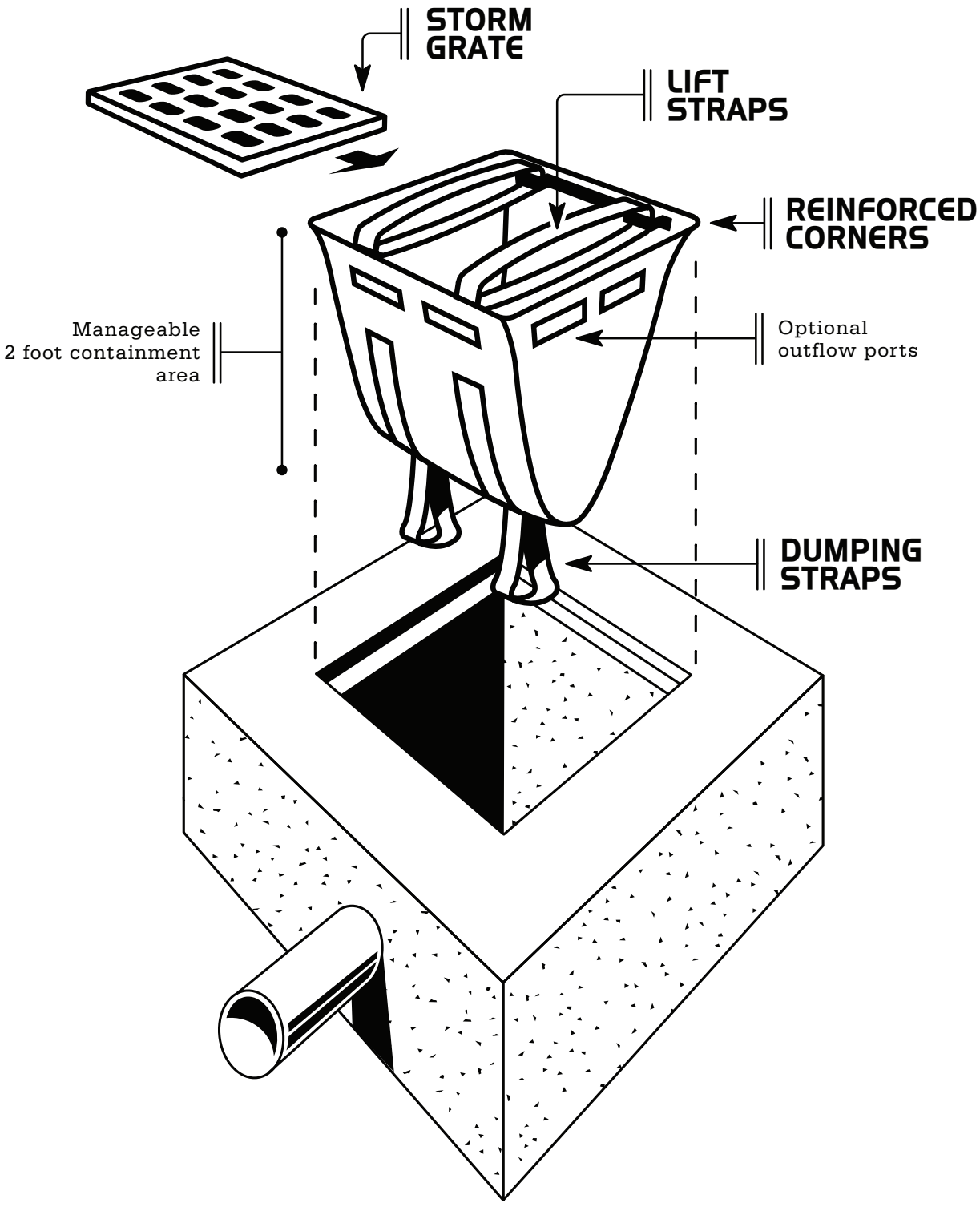
6.2 Payment for the completed work will be made at the contract prices for:

ITEM	UNIT	DESCRIPTION
Dandy Pop®	EA	Inlet Protection Units (#_____INLET)

Dandy Sack


Stormwater Control Video - The Dandy Sack
Dandy Sack®
IN USA
DANDY
PRODUCTS

DANDY SACK™


STORM GRATE
LIFT STRAPS
REINFORCED CORNERS
Manageable 2 foot containment area
Optional outflow ports
DUMPING STRAPS

DANDY SACK®
INLET PROTECTION SYSTEM GUIDE SPECIFICATION

PRODUCT:

DANDY SACK®

MANUFACTURER:

Dandy Products Inc.
P.O. Box 1980
Westerville, Ohio 43086
Phone: 800-591-2284
Fax: 740-881-2791
E mail dlc@dandyproducts.com
Web www.dandyproducts.com

1.0 **Description:**

1.1 Work covered under this item consists of installing a Dandy Sack® inlet protection system. The purpose is to keep silt, sediment and construction debris out of the storm water system.

2.0 **Material:**

2.1 The Dandy Sack® inlet protection unit shall be a **sewn in the U.S.A.** geotextile fabric unit.

2.2 The Dandy Sack® shall have lifting straps to allow removal of the unit and manual inspection of the storm water system.

2.3 The Dandy Sack® unit shall utilize an orange monofilament fabric that is manufactured in the U.S.A. with the following characteristics:

PROPERTY	TEST METHOD	UNITS	TEST RESULTS
Grab Tensile Strength	ASTM D 4632	lbs	450 x 300
Grab Tensile Elongation	ASTM D 4632	%	40 x 25
Puncture Strength	ASTM D 4833	lbs	130
Mullen Burst Strength	ASTM D 3786	psi	600
Trapezoid Tear Strength	ASTM D 4533	lbs	165 x 150
% Open Area (POA)	COE - 22125-86	%	28
Apparent Opening Size	ASTM D 4751	US Std Sieve	30
Permittivity	ASTM D 4491	sec[1]	3.5
Permeability	ASTM 4491	cm/sec	0.25
Water Flow Rate	ASTM 4491	gal/min/ft[2]	250
Ultraviolet Resistance	ASTM D 4355	%	70
Color			Orange[1]

[1]The color orange is a trademark of Dandy Products, Inc.
The property values listed above are effective October 2010 and are subject to change without notice.

3.0 **Installation:**

3.1 Remove the grate from the catch basin.

3.2 For Oil and Sediment Model; to install or replace absorbent, place absorbent pillow in unit, on the bottom (below-grade side) of the unit.

3.3 Stand the grate on end. Move the top lifting straps out of the way and place the grate into the Dandy Sack® unit so that the grate is below the top straps and above the lower straps. The grate should be cradled between the upper and lower straps.

3.4 Holding the lifting devices, insert the grate into the inlet, being careful that the grate remains in place and being careful not to damage the Dandy Sack® unit.

4.0 **Maintenance:**

4.1 Remove all accumulated sediment and debris from vicinity of unit after each storm event.

4.2 After each storm event and at regular intervals, look into the Dandy Sack® unit. If the unit is more than 1/3 full of accumulated sediment, the unit must be emptied.

4.3 To empty the unit, using the lifting straps lift the unit out of the inlet and remove the grate. Transport the unit to an appropriate location for removal of the contents. Holding the dumping straps on the outside at the bottom of the unit, turn the unit upside down, emptying the contents. Reinstall unit as above.

4.4 *For Oil and Sediment Model; remove and replace absorbent when near saturation.*

4.5 Dispose of unit and/or absorbent in accord with applicable Federal, state and local environmental laws and regulations.

5.0 **Method of Measurement:**

5.1 The quantity to be paid is for the actual number of Dandy Sack® inlet protection units installed

6.0 **Basis of Payment:**

6.1 The unit price shall include labor, equipment, and materials necessary to complete the work and maintain the Dandy Sack® inlet protection units.

6.2 Payment for the completed work will be made at the contract prices for:

ITEM	UNIT	DESCRIPTION
Dandy Sack®	EA	Inlet Protection

Rapid Flow Curb Inlet Protection
with Polystyrene Aggregate

Product Specifications
For
Polystyrene Aggregate

Manufacturer for: Rapid Flow

Product Item Number: AG21

Product Description: Polystyrene Drainage Aggregate, Recycled

Physical Properties:

Color: Varying Light Colors including, but not limited to gray, beige, pink, and green.

Cell Structure: Fine to Medium

Density of Finished Product: .40 to .65 pounds per cubic foot.

Shape: Cubical in form, with annotated protuberances for increased surface area and increased flow characteristics. **See Picture below.**

Standards Testing:

ASTM C127-88
Law Engineering,
Proj. No. 50161-8-2142-01-831.

ASTM D2221-84
Gh Packaging & Product Testing and Consulting
Project No. J#08189C4

ASTM C29-91a
ASTM C127-88

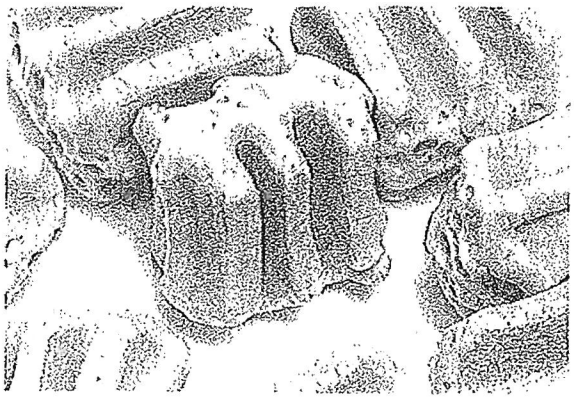
Void Space: 50.0 %

Bulk Dry Specific Gravity: .025

Flow Rate:
3.53 GPM PS Bead
2.61 GPM Gravel

Permanent Set

Load	Deformation (inches)
2psi	.0365
3psi	.542
4psi	.948
5psi	1.051

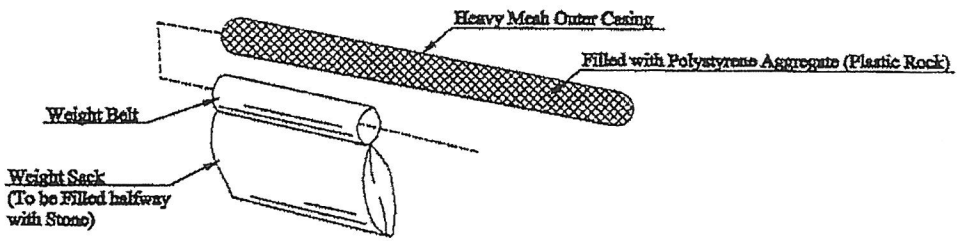


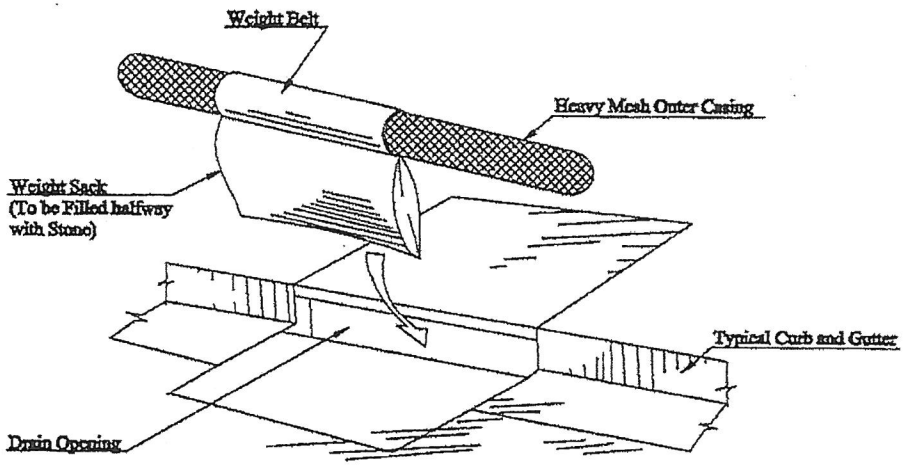
Polystyrene Drainage Beads **Figure 1.**

RAPID-FLOW DRAIN FILTER

(N.T.S.)

U.S. Patent No.7,300,574





Installation Instructions

1. Fill provided weight belt sacks half way with gravel.
2. Place filled weight belt sleeves over the Rapid Flow log, spacing them according to size of drain.
3. Place Rapid Flow log with weight belts in front of drain opening, allowing the white weight sacks to drop into the back of the drain opening.
4. Adjust Rapid Flow log so that the weight belts are evenly spaced, and that you have at least 6" of Rapid Flow log bypassing the drains opening on each side.
5. If you are in a low-flow area, stake ends to add an Over Flow Pillow in the the middle of the Rapid Flow log.
6. After storm event, simply remove the Rapid Flow log, remove sediment that has built up around the outside of the drain, clean out the Rapid Flow log and replace.

Maintenance Instructions

1. After a major rain event, remove sediment or debris build-up from area around the Rapid Flow log and surrounding area.
2. Periodically, or after a major rain event, remove Rapid Flow Drain Filter from drain and hose-off with water to remove sediment built-up into plastic rocks. Place back into drain for repeated use.

Limited Warranty

EROSION CONTROL PRODUCTS, INC
4001 Van Dyke Ct.
Monroe, NC 28110
Contact: Matt Hulett (National Sales Manager)
Phone: 704-821-3042
Fax: 704-821-5239
Email: erosioncontrolproducts.biz

C:\Documents and Settings\woody\Desktop\Rapid Flow Details\Double.dwg, 1/16/2008 3:02:43 PM, woody, 1:65.9686

Bio-soil Mixture (BSM-1)

Rockydale Quarries Bioretention Soil Mix Submittal of November 5, 2010
Analysis performed by A&L Eastern Laboratories, Inc.; Date of Report – November 4, 2010

Report of three soil samples submitted for two Virginia Tech Projects: ICTAS II and Materials Management.

Of the three samples, BIOMIX 2 most closely adheres to BMP Clearinghouse Guidelines. DCR has approved BIOMIX 2 for use at the above named projects.

SUMMARY OF BIOMIX 2:

Parameter	Required (units) [BMP Clearinghouse]	Actual (Soil Mixture)	% Different	Notes/Comments
Sand	85% - 88%	88.4%	0.4% Over	Silica Sand
Soil Fines	8% - 12%	11.6% (Silt=5.6%; Clay=6.0%)	Within Range	Sandy Loam Texture
Mix Organic Matter	3% - 5%	2.7%	0.3% below	
P-Index	Recommended Range 10 - 30 (7-23 ppm)	30 ppm	7 ppm over	
Cation exchange capacity (CEC)	>10 preferred	11.7 (meq/100g)	> 10 as preferred	
Topsoil Clay Content	NA	NA	NA	
Topsoil pH	NA	Entire Mix pH = 7.9	NA	Entire Mix
Topsoil Organic Content	NA	NA	NA	

ROCKYDALE QUARRIES CORPORATION

P.O. BOX 8425 • ROANOKE, VIRGINIA 24014-0425 • TELEPHONE (540) 774-1696 • FAX (540) 774-9114

November 5, 2010

Mr. Shane Hubbard

Hubbard Excavating & Hauling

2805 Blacksburg Road

Troutville, VA 24175

Re: Bioretention Soil for the Virginia Tech Materials Management Facility

Dear Shane,

Please review the soil chemical and soil texture analyses that have been submitted to you. A & L Eastern Laboratories have tested our sand and compost blends to find the correct ratio that will meet the VA DCR Stormwater Design Specification # 9. Please note that the sample Bio-Mix # 3 is the correct blend needed to meet the Virginia BMP Clearinghouse Standard.

Rockydale will blend in our bioretention soil, quartz silica concrete sand that is certified to be ASTMC-33 specification. This sand is shipped from the B. V. Hedrick Gravel and Sand Company in Lilesville, NC.

Rockydale will blend leaf compost into our bioretention soil. Rockydale has been composting leaves since August, 2003, with the approval of the Virginia Department of Environmental Quality. Rockydale is certifying that we will blend the sand and leaf compost to the ratios as required in the "VA Stormwater Management Handbook, Option B." This design specification # 9 is an acceptable BMP Clearinghouse Standard.

If you are in need of any additional information, please contact me.

Sincerely,

John Basham

Sales Manager

www.aleastern.com

A&L Eastern Laboratories, Inc.

7621 Whitepine Road Richmond, Virginia 23237 (804) 743-9401 Fax (804) 271-8446

TEXTURE ANALYSIS

Client :
ROCKYDALE QUARRIES CORP
POB 8425

ROANOKE , VA 24014-0425

Grower :
BIOMIX 1,2,3

Farm:

Report No : 10-307-0625
Cust No : 71708
Date Printed : 11/05/2010
Page : 1 of 1
Submitted By : JOHN BASHAM
Date Received : 11/03/2010

Lab No	Field ID	Sample Identification	Percent Sand	Percent Silt	Percent Clay	Textural Classification
15706		1 BIOMIX	86.4	5.6	8.0	Loamy Sand
15707		2 BIOMIX	88.4	5.6	6.0	Loamy Sand
15708		3 BIOMIX	88.4	5.6	6.0	Loamy Sand

Analysis prepared by: A&L Eastern Laboratories, Inc.

Report Number: 10-307-0625
Account Number: 71708

www.aleastern.com

A&L Eastern Laboratories, Inc.
7621 Whitepine Road Richmond, Virginia 23237 (804) 743-9401 Fax (804) 271-6446

Send To: ROCKYDALE QUARRIES CORP
POB 8425
ROANOKE VA 24014-0425

Grower:
BIOMIX 1,2,3

Submitted By: JOHN BASHAM
Farm ID:

SOIL ANALYSIS REPORT

Analytical Method(s):
Mehlich 3

Date Received: 11/03/2010 Date Of Analysis: 11/04/2010 Date Of Report: 11/05/2010

Sample ID / Field ID	Lab Number	Organic Matter %	Organic Matter Rate	Organic Matter ENR lbs/A	Phosphorus Mehlich 3 ppm	Phosphorus Mehlich 3 Rate	Phosphorus Reserve ppm	Phosphorus Reserve Rate	Potassium K ppm	Potassium K Rate	Magnesium Mg ppm	Magnesium Mg Rate	Calcium Ca ppm	Calcium Ca Rate	Sodium Na ppm	Sodium Na Rate	pH Soil pH	Buffer Index	Acidity H meq/100g	C.E.C meq/100g
1 BIOMIX	15706	2.6	M	91	21	L			72	L	261	H	1051	M			7.6		0.0	7.6
2 BIOMIX	15707	2.7	M	87	30	L			112	M	407	H	1613	M			7.9		0.0	11.7
3 BIOMIX	5708	4.4	M	117	39	M			163	H	494	H	2001	M			7.7		0.0	14.5

Sample ID / Field ID	Percent Base Saturation K %	Mg %	Ca %	Na %	H %	Nitrate NO_3N ppm	Nitrate Rate	Sulfur S ppm	Sulfur Rate	Zinc Zn ppm	Zinc Rate	Manganese Mn ppm	Manganese Rate	Iron Fe ppm	Iron Rate	Copper Cu ppm	Copper Rate	Boron B ppm	Boron Rate	Soluble Salts SS ms/cm	Soluble Salts Rate	Chloride Cl ppm	Chloride Rate	Aluminum Al ppm
1 BIOMIX	2.4	28.6	69.1		0.0															0.14	VL			
2 BIOMIX	2.5	29.0	68.9		0.0															0.14	VL			
3 BIOMIX	2.9	28.4	69.0		0.0															0.34	VL			

Values on this report represent the plant available nutrients in the soil. Rating after each value: VL (Very Low), L (Low), M (Medium), H (High), VH (Very High). ENR - Estimated Nitrogen Release. C.E.C. - Cation Exchange Capacity.

Explanation of symbols: % (percent), ppm (parts per million), lbs/A (pounds per acre), ms/cm (milli-mhos per centimeter), meq/100g (milli-equivalent per 100 grams). Conversions: ppm x 2 = lbs/A, Soluble Salts ms/cm x 640 = ppm.

This report applies to sample(s) tested. Samples are retained a maximum of thirty days after testing.

Analysis prepared by: A&L Eastern Laboratories, Inc.

by:

Paulic McGroary

(Portions of Spec. No. 9)

VIRGINIA DCR STORMWATER DESIGN SPECIFICATION No. 9

BIORETENTION

VERSION 1.8
April 13, 2010

SECTION 1: DESCRIPTION

Individual bioretention areas can serve highly impervious drainage areas less than two (2) acres in size. Surface runoff is directed into a shallow landscaped depression that incorporates many of the pollutant removal mechanisms that operate in forested ecosystems. The primary component of a bioretention practice is the filter bed, which has a mixture of sand, soil, and organic material as the filtering media with a surface mulch layer. During storms, runoff temporarily ponds 6 to 12 inches above the mulch layer and then rapidly filters through the bed. Normally, the filtered runoff is collected in an underdrain and returned to the storm drain system. The underdrain consists of a perforated pipe in a gravel layer installed along the bottom of the filter bed. A bioretention facility with an underdrain system is commonly referred to as a *Bioretention Filter*.

Bioretention can also be designed to infiltrate runoff into native soils. This can be done at sites with permeable soils, a low groundwater table, and a low risk of groundwater contamination. This design features the use of a "partial exfiltration" system that promotes greater groundwater recharge. Underdrains are only installed beneath a portion of the filter bed, above a stone "sump" layer, or eliminated altogether, thereby increasing stormwater infiltration. A bioretention facility without an underdrain system, or with a storage sump in the bottom is commonly referred to as a *Bioretention Basin*.

Small-scale or Micro-Bioretention used on an individual residential lot is commonly referred to as a *Rain Garden*.

Maximum Ponding Depth = 6 inches	
Filter Media Depth minimum = 18 inches; Recommended maximum = 36 inches	Filter Media Depth minimum = 24 inches; Recommended maximum = 36 inches
Media: mixed on-site or supplied by vendor	Media: supplied by vendor
All Designs: Media mix tested for an acceptable phosphorus index (P-Index) of between 10 and 30, ***OR*** Between 7 and 21 mg/kg of P in the soil media	
Sub-soil testing: not needed if an underdrain is used; Min infiltration rate > 1 inch/hour in order to remove the underdrain requirement.	Sub-soil testing: one per practice; Min infiltration rate > 1/2 inch/hour; Min infiltration rate > 1 inch/hour in order to remove the underdrain requirement.
Underdrain: corrugated HDPE or equivalent.	Underdrain: corrugated HDPE or equivalent, with a minimum 6-inch stone sump below the invert; ***OR*** none, if soil infiltration requirements are met
Clean-outs: not needed	
Inflow: sheetflow or roof leader	
Pretreatment: external (leaf screens, grass filter strip, energy dissipater, etc.).	Pretreatment: external *plus* a grass filter strip
Vegetation: turf, herbaceous, or shrubs (min = 1 out of those 3 choices).	Vegetation: turf, herbaceous, shrubs, or trees (min = 2 out of those 4 choices).
Building setbacks: 10 feet down-gradient; 25 feet up-gradient	
[1] Consult **Appendix 9-A** for design criteria for Urban Bioretention Practices. [2] Micro-Bioretention (Rain Gardens) can be located at individual downspout locations to treat up to 1,000 sq. ft. of impervious cover (100% IC); the surface area is sized as 5% of the roof area (Level 1) or 6% of the roof area (Level 2), with the remaining Level 1 and Level 2 design criteria as provided in **Table 9.2**. If the Rain Garden is located so as to capture multiple rooftops, driveways, and adjacent pervious areas, the sizing rules within **Table 9.2** should apply.	

Table 9.3. Bioretention Filter and Basin Design Criteria

Level 1 Design (RR 40 TP: 25)	**Level 2 Design (RR: 80 TP: 50)**
Sizing (**Section 6.1**): Surface Area (sq. ft.) = (T_V - the volume reduced by an upstream BMP) / Storage Depth [1]	Sizing (**Section 6.1**): Surface Area (sq. ft.) = [(1.25)(T_V) - the volume reduced by an upstream BMP] /Storage Depth [1]
Recommended maximum contributing drainage area = 2.5 acres	
Maximum Ponding Depth = 6 to 12 inches [2]	Maximum Ponding Depth = 6 to 12 inches [2]
Filter Media Depth minimum = 24 inches; recommended maximum = 6 feet	Filter Media Depth minimum = 36 inches; recommended maximum = 6 feet
Media & Surface Cover (**Section 6.6**) = supplied by vendor; tested for acceptable phosphorus index (P-Index) of between 10 and 30, ***OR*** Between 7 and 21 mg/kg of P in the soil media	
Sub-soil Testing (**Section 6.2**): not needed if an underdrain used; Min infiltration rate > 1/2 inch/hour in order to remove the underdrain requirement.	Sub-soil Testing (**Section 6.2**): one per 1,000 sq. ft. of filter surface; Min infiltration rate > 1/2 inch/hour in order to remove the underdrain requirement.
Underdrain (**Section 6.7**) = Schedule 40 PVC with clean-outs	Underdrain & Underground Storage Layer (**Section 6.7**) = Schedule 40 PVC with clean outs, and a minimum 12-inch stone sump below the invert; ***OR***, none, if soil infiltration requirements are met (**Section 6.2**)
Inflow: sheetflow, curb cuts, trench drains, concentrated flow, or the equivalent	
Geometry (**Section 6.3**): Length of shortest flow path/Overall length = 0.3; ***OR***, other design methods used to prevent short-circuiting; a one-cell design (not including the pre-treatment cell).	Geometry (**Section 6.3**): Length of shortest flow path/Overall length = 0.8; ***OR***, other design methods used to prevent short-circuiting; a two-cell design (not including the pretreatment cell).

Pre-treatment (**Section 6.4**): a pretreatment cell, grass filter strip, gravel diaphragm, gravel flow spreader, or another approved (manufactured) pre-treatment structure.	Pre-treatment (**Section 6.4**): a pretreatment cell *plus* one of the following: a grass filter strip, gravel diaphragm, gravel flow spreader, or another approved (manufactured) pre-treatment structure.
Conveyance & Overflow (**Section 6.5**)	Conveyance & Overflow (**Section 6.5**)
Planting Plan (**Section 6.8**): a planting template to include turf, herbaceous vegetation, shrubs, and/or trees to achieve surface area coverage of at least 75% within 2 years.	Planting Plan (**Section 6.8**): a planting template to include turf, herbaceous vegetation, shrubs, and/or trees to achieve surface area coverage of at least 90% within 2 years. If using turf, must combine with other types of vegetation [1].
Building Setbacks [3] (**Section 5**): 0 to 0.5 acre CDA = 10 feet if down-gradient from building or level (coastal plain); 50 feet if up-gradient. 0.5 to 2.5 acre CDA = 25 feet if down-gradient from building or level (coastal plain); 100 feet if up-gradient. (Refer to additional setback criteria in **Section 5**)	
Deeded Maintenance O&M Plan (**Section 8**)	

[1] Storage depth is the sum of the Void Ratio (V_r) of the soil media and gravel layers multiplied by their respective depths, plus the surface ponding depth. Refer to **Section 6.1**.

[2] A ponding depth of 6 inches is preferred. Ponding depths greater than 6 inches will require a specific planting plan to ensure appropriate plant selection (**Section 6.8**).

[3] These are recommendations for simple building foundations. If an in-ground basement or other special conditions exist, the design should be reviewed by a licensed engineer. Also, a special footing or drainage design may be used to justify a reduction of the setbacks noted above.

SECTION 3: TYPICAL DETAILS

Figures 9.2 through 9.5 provide some typical details for several bioretention configurations. Also see additional details in **Appendix 9-B** of this design specification.

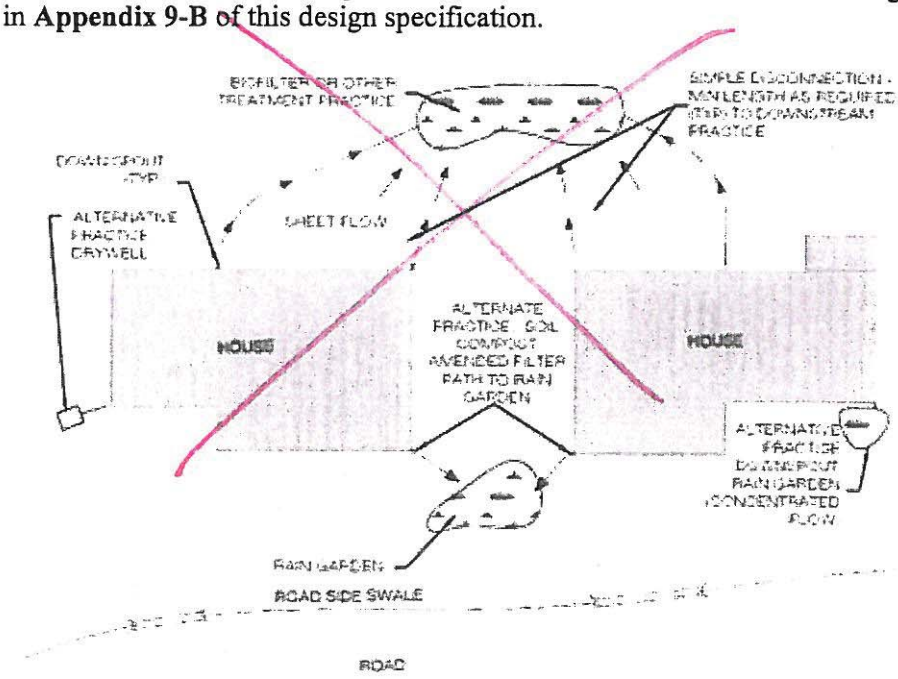


Figure 9.2. Residential Rooftop Treatment - Plan View:
(a) Simple Disconnection to downstream Raingarden;
(b) Disconnection - Alternative Practice: Raingarden;
(c) Disconnection - Alternative Practice: Compost

6.6. Filter Media and Surface Cover

The filter media and surface cover are the two most important elements of a bioretention facility in terms of long-term performance. The following are key factors to consider in determining an acceptable soil media mixture.

- ***General Filter Media Composition.*** The recommended bioretention soil mixture is generally classified as a loamy sand on the USDA Texture Triangle, with the following composition:
    - 85% to 88% sand;
    - 8% to 12% soil fines; and
    - 3% to 5% organic matter.

It may be advisable to start with an open-graded coarse sand material and proportionately mix in topsoil that will likely contain anywhere from 30% to 50% soil fines (sandy loam, loamy sand) to achieve the desired ratio of sand and fines. An additional 3% to 5% organic matter can then be added. (The exact composition of organic matter and topsoil material will vary, making particle size distribution and recipe for the total soil media mixture difficult to define in advance of evaluating the available material.)

- ***P-Index.*** The P-Index provides a measure of soil phosphorus content and the risk of that phosphorus moving through the soil media. The risk of phosphorus movement through a soil is influenced by several soil physical properties: texture, structure, total pore space, pore-size, pore distribution, and organic matter. A soil with a lot of fines will hold phosphorus while also limiting the movement of water. A soil that is sandy will have a high permeability, and will therefore be less likely to hold phosphorus within the soil matrix.

  A primary factor in interpreting the desired P-Index of a soil is the bulk density. Saxton et. al. (1986) estimated generalized bulk densities and soil-water characteristics from soil texture. The expected bulk density of the loamy sand soil composition described above should be in the range of 1.6 to 1.7 g/cu. cm. Therefore, ***the recommended range for bioretention soil P-index of between 10 and 30*** corresponds to a ***phosphorus content range (mg of P to kg of soil) within the soil media of 7 mg/kg to 23 mg/kg***.

- ***Cation Exchange Capacity (CEC).*** The CEC of a soil refers to the total amount of positively charged elements that a soil can hold; it is expressed in milliequivalents per 100 grams (meq/100g) of soil. For agricultural purposes, these elements are the basic cations of calcium (Ca^{+2}), magnesium (Mg^{+2}), potassium (K^{+1}) and sodium (Na^{+1}) and the acidic cations of hydrogen (H^{+1}) and aluminum (Al^{+3}). The CEC of the soil is determined in part by the amount of clay and/or humus or organic matter present. ***Soils with CECs exceeding 10 are preferred for pollutant removal***. Increasing the organic matter content of any soil will help to increase the CEC, since it also holds cations like the clays.

- ***Infiltration Rate.*** The bioretention soil media should have a minimum infiltration rate of 1 to 2 inches per hour (a proper soil mix will have an initial infiltration rate that is significantly higher).

- ***Depth.*** The standard minimum filter bed depth ranges from 24 and 36 inches for Level 1 and Level 2 designs, respectively, (18 to 24 inches for rain gardens or micro-bioretention). If trees are included in the bioretention planting plan, tree planting holes in the filter bed must be at least 4 feet deep to provide enough soil volume for the root structure of mature trees. Use turf, perennials or shrubs instead of trees to landscape shallower filter beds.

- ***Filter Media for Tree Planting Areas.*** A more organic filter media is recommended within the planting holes for trees, with a ratio of 50% sand, 30% toposoil and 20% acceptable leaf compost.

- ***Mulch.*** A 2 to 3 inch layer of mulch on the surface of the filter bed enhances plant survival, suppresses weed growth, and pre-treats runoff before it reaches the filter media. Shredded, aged hardwood bark mulch makes a very good surface cover, as it retains a significant amount of nitrogen and typically will not float away.

- ***Alternative to Mulch Cover.*** In some situations, designers may consider alternative surface covers such as turf, native groundcover, erosion control matting (coir or jute matting), river stone, or pea gravel. The decision regarding the type of surface cover to use should be based on function, cost and maintenance. Stone or gravel are not recommended in parking lot applications, since they increase soil temperature and have low water holding capacity.

- ***Media for Turf Cover.*** One adaptation is to design the filter media primarily as a sand filter with organic content only at the top. Leaf compost tilled into the top layers will provide organic content for the vegetative cover. If grass is the only vegetation, the ratio of compost may be reduced.

- Designers should also remember that planting holes for trees need must be at least 4 feet deep to provide enough soil volume for the root structure of mature trees. This applies even if the remaining soil media layer is shallower than 4 feet.

- If trees are used, plant shade-tolerant ground covers within the drip line.

- Maintenance is an important consideration in selecting plant species. Plant selection differs if the area will be frequently mowed, pruned, and weeded, in contrast to a site which will receive minimum annual maintenance.

- If the bioretention area is to be used for snow storage or is to accept snowmelt runoff, it should be planted with salt-tolerant, herbaceous perennials.

6.9. Bioretention Material Specifications

Table 9.6 outlines the standard material specifications used to construct bioretention areas.

Table 9.6. Bioretention Material Specifications

Material	Specification	Notes
Filter Media Composition	Filter Media to contain: • 85%-88% sand • 8%-12% soil fines • 3%-5% organic matter in the form of leaf compost	The volume of filter media based on 110% of the plan volume, to account for settling or compaction.
Filter Media Testing	P-Index range = 10-30, ***OR*** Between 7 and 21 mg/kg of P in the soil media. CECs greater than 10	The media must be procured from approved filter media vendors.
Mulch Layer	Use aged, shredded hardwood bark mulch	Lay a 2 to 3 inch layer on the surface of the filter bed.
Alternative Surface Cover	Use river stone or pea gravel, coir and jute matting, or turf cover.	Lay a 2 to 3 inch layer of to suppress weed growth.
Top Soil For Turf Cover	Loamy sand or sandy loam texture, with less than 5% clay content, pH corrected to between 6 and 7, and an organic matter content of at least 2%.	3 inch surface depth. ADJACENT to Biofilter (TURF Not in Cell)
Geotextile/Liner	Use a non-woven geotextile fabric with a flow rate of > 110 gal./min./sq. ft. (e.g., Geotex 351 or equivalent)	Apply only to the sides and above the underdrain. For hotspots and certain karst sites only, use an appropriate liner on bottom.
Choking Layer	Lay a 2 to 4 inch layer of sand over a 2 inch layer of choker stone (typically #8 or #89 washed gravel), which is laid over the underdrain stone.	
Stone Jacket for Underdrain and/or Storage Layer	1 inch stone should be double-washed and clean and free of all fines (e.g., VDOT #57 stone).	12 inches for the underdrain; 12 to 18 inches for the stone storage layer, if needed
Underdrains, Cleanouts, and Observation Wells	Use 6 inch rigid schedule 40 PVC pipe (or equivalent corrugated HDPE for micro-bioretention), with 3/8-inch perforations at 6 inches on center; position each underdrain on a 1% or 2% slope located nor more than 20 feet from the next pipe.	Lay the perforated pipe under the length of the bioretention cell, and install non-perforated pipe as needed to connect with the storm drain system. Install T's and Y's as needed, depending on the underdrain configuration. Extend cleanout pipes to the surface with vented caps at the Ts and Ys.
Plant Materials	Plant one tree per 250 square feet (15 feet on-center, minimum 1 inch caliper).	Establish plant materials as specified in the landscaping plan and the recommended plant list.

	Shrubs a minimum of 30 inches high planted a minimum of 10 feet on-center. Plant ground cover plugs at 12 to 18 inches on-center; Plant container-grown plants at 18 to 24 inches on-center, depending on the initial plant size and how large it will grow.	In general, plant spacing must be sufficient to ensure the plant material achieves 80% cover in the proposed planting areas within a 3-year period. If seed mixes are used, they should be from a qualified supplier, should be appropriate for stormwater basin applications, and should consist of native species (unless the seeding is to establish maintained turf).

SECTION 7: REGIONAL & SPECIAL CASE DESIGN ADAPTATIONS

7.1 Karst Terrain

Karst regions are found in much of the Ridge and Valley province of Virginia, which complicates both land development and stormwater design. While bioretention areas produce less deep ponding than conventional stormwater practices (e.g., ponds and wetlands), Level 2 bioretention designs (i.e., infiltration) are not recommended in any area with a moderate or high risk of sinkhole formation (Hyland, 2005). On the other hand, Level 1 designs that meet separation distance requirements (3 feet) and possess an impermeable bottom liner and an underdrain should work well. In general, micro-bioretention and bioretention basins with contributing drainage areas not exceeding 20,000 square feet are preferred (compared to bioretention with larger drainage areas), in order to prevent possible sinkhole formation. However, it may be advisable to increase standard setbacks to buildings.

7.2 Coastal Plain

The flat terrain, low hydraulic head, and high water table of many coastal plain sites can constrain the application of deeper bioretention areas (particularly Level 2 designs). In such settings, the following design adaptations may be helpful:

- A linear approach to bioretention, using multiple cells leading to the ditch system, helps conserve hydraulic head.
- The minimum depth of the filter bed may be 18 to 24 inches. It is useful to limit surface ponding to 6 to 9 inches and avoid the need for additional depth by establishing a turf cover rather than using mulch. The shallower media depth and the turf cover generally comply with the Dry Swale specification, and therefore will be credited with a slightly lower pollutant removal (See Stormwater Design Specification No. 10: Dry Swales).
- The minimum depth to the seasonally high water table from the invert of the system can be 1 foot, as long as the bioretention area is equipped with a large-diameter underdrain (e.g., 6 inches) that is only partially efficient at dewatering the bed.
- It is important to maintain at least a 0.5% slope in the underdrain to ensure positive drainage.
- The underdrain should be tied into the ditch or conveyance system.
- The mix of plant species selected should reflect coastal plain plant communities and should be more wet-footed and salt-tolerant than those used in typical Piedmont applications.

While these design criteria permit bioretention to be used on a wider range of coastal plain sites, it is important not to avoid using bioretention on marginal sites. Other stormwater practices, such as wet swales, ditch wetland restoration, and smaller linear wetlands, are often preferred alternatives for coastal plain sites.