



**ANNUAL STANDARDS AND SPECIFICATIONS
FOR
EROSION AND SEDIMENT CONTROL
AND
STORMWATER MANAGEMENT**

2012 Update

**Subject: GEORGE MASON UNIVERSITY ANNUAL STANDARDS AND SPECIFICATIONS FOR EROSION AND
SEDIMENT CONTROL AND STORMWATER MANAGEMENT**

Dated: December 3, 2012

I certify under penalty of law that all documents and all attachments related to the submission and updating of the GEORGE MASON UNIVERSITY ANNUAL STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL AND STORMWATER MANAGEMENT are prepared under my direction or supervision in a system designed to assure that qualified personnel properly gather and evaluate 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 a fine and imprisonment for knowing violations.

Sincerely,

A handwritten signature in blue ink, appearing to read "Bradley D. Glatfelter", with a stylized flourish at the end.

Bradley D. Glatfelter
University Erosion and Sediment Control Combined Administrator

INTRODUCTION

George Mason University Erosion and Sediment Control and Stormwater Management Programs are integral components of George Mason University's design, construction, maintenance, and management of the University's facilities and campuses. George Mason University's Erosion and Sediment Control and Stormwater Management (ESC & SWM) Annual Standards and Specifications submittal has been developed to provide information regarding George Mason University's implementation of these programs in accordance with 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 and regulated construction activities.

George Mason University Annual Standards and Specifications for ESC & SWM shall apply to all plan design, construction, and maintenance activities undertaken by George Mason University, either by its internal workforce or contracted to external entities, where such activities are regulated by the Virginia Erosion and Sediment Control Law and Regulations (VESCL&R) or the Virginia Stormwater Management Act and VSMP Permit Regulations. During any inspections of George Mason University's land disturbing activities by DCR, EPA, and other applicable environmental agencies, compliance with the approved George Mason University Annual Standards and Specifications for ESC & SWM (and all parts thereof), the VESCL&R, the Virginia Stormwater Management Act and the VSMP Permit Regulations will be required.

George Mason University Annual Standards and Specifications for ESC & SWM are submitted to the Virginia Department of Conservation and Recreation for review and approval on an annual basis. George Mason University shall ensure that project specific plans are developed and implemented in accordance with these Annual Standards and Specifications. This submittal constitutes George Mason University'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 George Mason University and DCR personnel. This submittal and errata information are available for download as PDF files at: <http://facilities.gmu.edu/>

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1.0 ABBREVIATIONS and ACRONYMS

Abbreviation/ Acronym	Term
BMP	Best Management Practice
Board	Virginia Soil and Water Conservation Board
DCR	Virginia Department of Conservation and Recreation
ESC	Erosion and Sediment Control
LID	Low-Impact Development
Mason LD	George Mason University Land Development
MS4	Municipal Small Storm Sewer System
NLDPP	Mason LD How-To Guide: Navigating the Land Disturbance Permitting Process
SWM	Stormwater Management
SWPPP	Storm Water Pollution Protection Plan
VESCL&R	Virginia Erosion and Sediment Control Law and Regulations
VSMP	Virginia Stormwater Management Program
VSMPP	Virginia Stormwater Management Program Permit for discharges from construction activities

2.0 ANNUAL STANDARDS AND SPECIFICATIONS ADMINISTRATION

- 2.1** George Mason University follows the policies and procedures described in the *Virginia Erosion and Sediment Control Handbook* and the *Virginia Stormwater Management Handbook*. *George Mason University Annual Standards and Specifications for ESC & SWM* approved by DCR are composed of general specifications. The general specifications for erosion and sediment control and storm water management that apply to the land-disturbing activities include by reference the following:
- 2.1.1** *Virginia Erosion and Sediment Control Law* (§10.1-560 et seq. as amended);
 - 2.1.2** *Virginia Erosion and Sediment Control Regulations* (4VAC50-30 et seq. as amended);
 - 2.1.3** *Virginia Erosion and Sediment Control Certification Regulations* (4VAC50-50 et seq. as amended);
 - 2.1.4** *Virginia Erosion and Sediment Control Handbook*, 1992, as amended;
 - 2.1.5** *Virginia Stormwater Management Act* (§10.1-603 et seq. as amended);
 - 2.1.6** *Virginia Stormwater Management Program Permit Regulations* (4VAC50-60 et seq. as amended);
 - 2.1.7** *Virginia Stormwater Management Handbook*, 1999, as amended.
 - 2.1.8** Technical Bulletins, as amended, on DCR web site at www.dcr.virginia.gov.
 - 2.1.9** *Mason LD How-To Guide: Navigating the Land Disturbance Permitting Process (NLDPP)*
- 2.2** Any land-disturbing activity, as defined by carried out by George Mason University shall comply with *George Mason University Annual Standards and Specifications for ESC & SWM*.
- 2.3** Any land disturbing work, as defined by *VESCL&R*, must be vetted through Mason LD. A Land Disturbance Application (See NLDPP- Appendix B) must always be completed and submitted with a construction schematic and location of the proposed work. Prior to starting a land-disturbing project, the project must have an approval issued by Mason LD for the plan by way of a Land Disturbance Permit (See NLDPP- Appendix F).
- 2.4** Site-Specific ESC Plans shall be prepared for all projects involving a regulated land-disturbing activity as defined in §10.1-560 or when deemed necessary by Mason LD if development is outside the purview of the *VESCL&R* and poses potential environmental implications. Site-specific ESC plans shall be submitted to Mason LD for review. Prior to starting a land-disturbing project, as defined in §10.1-560, the project must have an approval issued by Mason LD for the plan by way of a Land Disturbance Permit. In addition, if the addition of impervious surfaces is part of the scope, a SWM narrative and/or schematic must be submitted concurrently to explain/show how the run-off will be treated.
- 2.5** Site-Specific SWM plans shall be prepared for all projects involving a regulated land-disturbing activity that requires:
- (a)** A Virginia Stormwater Management Program General Permit for Discharges from Construction Activities (VSMPP)

- (b) land-disturbing activity contained within a watershed of a regional water quality stormwater management facility
- (c) incorporates the use of an LID and/or BMP.
- (d) changes the University MS4

Site-specific SWM plans shall be submitted to Mason LD for review. Prior to starting a land-disturbing project requiring a SWM plan, the project must have an approval issued by Mason LD for the plan by way of a Land Disturbance Permit.

- 2.6 Mason LD may request DCR to grant a project specific variance or exception, in terms of ESC and SWM, respectively, to the approved George Mason University 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 7.0 for more information on variances and exceptions.

3.0 ANNUAL STANDARDS AND SPECIFICATIONS PERSONNEL

Mason LD shall be the plan approving authority for George Mason University projects. The following is a breakdown in responsibilities and titles in regard to *George Mason University Annual 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 2.1.3. The following titles are designated to ensure compliance with erosion and sediment control and stormwater management regulations on all George Mason University projects.

- 3.1 **“Certified Inspector”** means an employee or agent of Mason LD who: (i) holds a certificate of competence from the Board in the area of project inspection; or, (ii) is enrolled in the Board’s training program for project inspection and successfully completes such program within one year after enrollment; and, (iii) shall be responsible to inspect as mandated by the VESCL&R erosion and sediment control measures to ensure proper installation in accordance with the permitted plan and record the state and effectiveness of such measures in an effort maximize site erosion and sediment control; and, (iv) shall be responsible to inspect the construction and effectiveness of permanent stormwater management controls; and, (v) shall be responsible to verify that all required documents are available on-site for view/review, including but not limited to, land disturbance permit, permitted plans, inspections log, VSMP permits, SWPPP, etc.
- 3.2 **“Inspection Certified Program Administrator”** means an employee or agent of Mason LD who: (i) holds a certificate of competence from the Board in the area of program administration and project inspection; or, (ii) is enrolled in the Board’s training programs for the program administrator and project inspector and successfully completes such programs within one year after enrollment; and (iii) is currently a Certified Inspector; and, (iv) shall oversee all of the project inspectors; and, (v) shall assign inspection duties; and, (vi) shall ensure all inspections are completed as mandated by the VESCL&R; and, (vii) shall review and post completed inspection reports; (viii) shall assist in the certification/re-certification process of inspectors; and (ix) shall update the *George Mason University Annual Standards and Specifications for Erosion and*

Sediment Control and Stormwater Management yearly.

- 3.3 “Certified Plan Reviewer”** means an employee or agent of Mason LD who: (i) holds a certificate of competence from the Board in the area of plan review; or, (ii) is enrolled in the Board’s training program for project inspection and successfully completes such program within one year after enrollment; or, (iii) is licensed as a professional engineer, architect, certified landscape architect, or land surveyor pursuant to Article 1 (§54.1-400 et seq.) of Chapter 4 or Title 54.1 of the Code of Virginia; and, (iv) shall be responsible to review and permit erosion and sediment control and stormwater management plans; and, (v) shall be responsible to review and approve SWPPPs; and, (vi) can assume the role of inspector or assist with inspections when needed.
- 3.4 “Plan Review Certified Program Administrator”** means an employee or agent of Mason LD who: (i) holds a certificate of competence from the Board in the area of program administration and plan review; or, (ii) is enrolled in the Board’s training programs for the program administrator and plan reviewer and successfully completes such programs within one year after enrollment; and (iii) is currently a Certified Plan Reviewer; and, (iv) shall oversee all of the plan reviewers; and, (v) shall designate plan review assignments; and, (vi) shall ensure all reviews are completed in a timely manner; (vii) shall assist in the certification/re-certification process of plan reviewers; and, (viii) shall update the *George Mason University Annual Standards and Specifications for Erosion and Sediment Control and Stormwater Management* yearly.
- 3.5 “Senior Combined Program Administrator”** means an employee or agent of Mason LD who: (i) holds a certificate of competence from the Board in the combined areas of program authority, plan review, and project inspection; or, (ii) is enrolled in the Board’s training program for the program administrator, plan reviewer, and project inspection and successfully completes such program within one year after enrollment; and (iii) shall oversee all of the inspection and plan review personnel; and, (iv) shall designate the Inspection Administrator and Plan Review Administrator; and, (v) shall directly communicate with the Contractor and DCR when circumstances require enforcement actions; and, (vi) shall oversee update of the *George Mason University Annual Standards and Specifications for Erosion and Sediment Control and Stormwater Management* yearly; and, (vii) is DCR’s delegated permitting authority.
- 3.6** Certifications shall be in accordance with the *Virginia Erosion and Sediment Control Certification Regulations* (4VAC50-50 et seq. as amended).

4.0 ANNUAL STANDARDS AND SPECIFICATIONS IMPLEMENTATION

ESC and SWM plans shall comply with *George Mason University Annual Standards and Specifications for Erosion and Sediment Control and Stormwater Management*, the *Virginia Erosion and Sediment Control Law* (§10.1-560 et. seq.), the *Virginia Stormwater Management Act* (§10.1-603 et. seq.), associated ESC and SWM regulations, and the *Virginia Stormwater Management Program Permit regulations* (4VAC50-60 et. seq.). Refer to Section 2.1 for more information on general specifications.

- 4.1 Submittals** ESC and SWM application, plans, narratives, and necessary attachments shall be

submitted to the Mason LD for review and approval prior to any land-disturbing activities. Below are the typical submittals expected to be completed for each project, however, exact composition of submittals is project specific.

- Land Disturbance Application
 - Any application submitted after October 1st must comply with the Annual Standards and Specifications submitted to DCR for approval.
- Stamped/Signed (by a licensed Professional Engineer) Civil Plans and Profiles
- Plan Review Checklist
- SWPPP
- Copy of Completed VSMP Permit Application
- SWM Narrative/Schematic
- Vicinity Map
- Construction Schematic
- Dig Permit

The Mason LD shall have 30 days to review the plan and provide written comments. Prior to commencement of a land-disturbing project, the project must have received approval for the plan(s) from Mason LD.

4.2 Plan Reviews Plan reviews shall be conducted by qualified personnel. Plan reviews shall ensure compliance with the *George Mason University Annual Specifications for ESC and SWM*. Plan reviewers shall use the *Plan Review Checklist* provided in the NLDPP guide, Appendix E for ESC plans. Re-submission should include (1) red-lined plan set of the first submission showing all to-date revisions and at least (1) clean, updated plan set. When approved, at least (5) unmarked, updated plan sets must be submitted and stamped by a licensed Professional Engineer. These plan sets are allocated as follows: (1) for Record, (1) for the Engineer, (1) for the Project Inspector and (1) for the Contractor. Additional copies may be requested as needed. Plan Reviews are not to be used to vet designs. Pre-design concept meetings are strongly encouraged.

4.3 Inspections The Certified Inspector(s) is responsible for ensuring that the construction and installation of all structural and non-structural controls are in accordance with the project's ESC and SWM plans and intention. In addition, if circumstances arise where the current plan is proven inadequate, the inspector is responsible to take the necessary steps to address and resolve the issue in cooperation with the Contractor and Engineer. Inspectors are responsible to complete and submit Inspection Reports as required by VESCL&R. Inspection Reports will eventually be posted on a website for public view. Refer to Section 6.0 for more information on inspections.

4.4 Changes and Amendments to Approved Plans An approved plan may be changed by Mason LD in the following cases (§10.1-563(C)):

- (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 such plan is no longer effective due to field conditions and/or changes to the overall project scope. In such case, an amended plan, consistent with the requirements of this article, must be promptly proposed.

Revisions to an approved ESC and SWM plan must be submitted in writing to the Mason LD. Revisions shall not be considered approved until written notice is provided. All revisions must be clouded in red. Revisions must comply with the George Mason University Annual Standards and Specifications for ESC and SWM. Exceptions maybe allowed in the event of an emergency.

The contractor is responsible for the performance of the ESC measures. If the designated ESC proves to be inadequate, the contractor is responsible to reassess, design, and submit a plan amendment at no cost to the University.

5.0 **ESC AND SWM PLAN REQUIREMENTS**

Detailed requirements of specific items to be included in the ESC and SWM plans are located in the Plan Preparer's Checklist (Appendix C) of the NLDPP.

5.1 **Construction Plans**

- Complete/Approved ESC and SWM plans shall be provided in the construction plans.
- Plans shall include the amount of disturbed area listed per phase and proposed net increase in impervious area.
- Minimum Standards 1 through 19 (4VAC50-30-40) shall be listed in the construction plans.
- Construction sequence of operations shall be provided on the construction plans 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 plans.
- Plans shall provide information on the maintenance of BMPs or reference the narrative section that contains the information.
- Permanent SWM BMPs shall have unique identifications and the identifications shall be referenced/used in all documentation, such as, but not limited to, SWPPP, narrative, construction plans, and calculations. Identifications should correspond with University BMP Identification System and MS-4 reporting. Identification should adhere to the following format: Campus Code (FX, PW, A, L) – Grid Number – Feature Number. For example, FX – 01 - 001. Coordinate with Mason LD.
- Drainage areas to ESC measures must be provided in each phase.
- Profiles shall be included for all closed and open storm systems. The profile shall include the existing surface, final surface, proposed water elevations, pipes, pipe crossings, and hydraulic grade line. Surcharges shall be clearly indicated on the profile.
- SWM calculations include but are not limited to: ditch computations, stormwater routing, storm inlet computations, pipe capacity computations, BMP computations, pond routings and computations, etc.
- Proof of adequate outfall and adequacy of the receiving channel to the SWM treatment facility needs to be provided to Mason LD.
- Plans should also include a detailed landscape plan with a planting schedule. Landscape plans should adhere to George Mason University Landscape Guidelines.
- Stockpile/lay-down areas and trailer locations shall be provided on the erosion and sediment control plans for both phases and must be approved by Mason LD prior to mobilization.
- Signage must be provided for all stormwater treatment measures. Coordinate with Mason LD.

5.2 Sheet Index

Suggested Sheets (actual sheets may vary accordingly):

- Cover Sheet (General Notes, Vicinity Map, Soils Map)
- General Construction Details (handicap ramp, cross-sections, sidewalk, etc.)
- Existing Conditions and Grading (2' contours)
 - Existing Drainage Divides (include calculated areas, impervious areas, and C-values)
 - Proposed Site Plan
 - Proposed Grading Plan (1-2' contours; spot elevations @ high/low points and entrances)
 - Proposed Drainage Divides (include calculated areas, impervious areas, and C-values)
 - E&S Narrative (Narrative Template)
 - Phase 1 E&S w/ Drainage Divides
 - Phase 2 E&S w/ Drainage Divides
 - E&S/BMP/SWM Details
 - Stormwater Pipe Profiles (include dimensioned utility crossings; V=1:5 H=1:25)
 - Stormwater Calculations (ditch comps, pipe comps, inlet comps, pond routings, etc.)
 - Detailed Landscaping plan (include planting schedule)

6.0 INSPECTIONS

Periodic inspections shall be conducted, at a minimum, every two weeks and within 48 hours of a significant rainfall event producing runoff. Inspectors shall be notified 24 hours prior to installation of BMPs and shall be present for installation of BMPS. In addition, inspections shall be made during or immediately following initial installation of erosion and sediment controls and at the completion of the project. Completion of the project is defined as the achievement of final stabilization, not completion of construction.

6.1 Erosion and Sediment Control Inspections *The Land Disturbance Inspection Report*, provided in Appendix I shall be used on each site inspection visit. All measures shown on the plan shall be inspected. All issues and violations shall be photographed and documented in the report. Critical Areas that require continuous inspections shall also be identified on the site plan. LD Inspection Reports shall specify the required corrective action for each issue or violation noted and a date by which all corrective actions must be completed. A copy of the LD Inspection Report will be emailed to the project Contractor and archived by Mason LD.

6.2 Stormwater Management Inspections *The Land Disturbance Inspection Report* provided in Appendix I is also used to record SWM inspections and shall be filled out on each site inspection. All stormwater BMPs must be identified on the site plan. As previously addressed, identification of permanent BMPs shall be coordinated with the University BMP Identification System. Refer to 5.1 for further information. Critical areas that require continuous inspections shall also be identified on the site plan. Photographs will be taken during the inspection and referenced within the report.

6.3 Project Close-Out As previously stated, project completion is defined as the achievement of

final stabilization, verification of final product according to approved plans and completion of TV inspection (Refer to Appendix C.3) of the installed storm sewer system. The Inspector will recommend to Mason LD that final stabilization has been achieved. Once Mason LD concurs and final project as-builts are received in the required formats (Civil 3D, PDF, BIM, Hard Copy, etc.), the permit will be closed-out and a Permit Notice of Termination will be issued. After which, Mason LD may recommend that full retainage be released. If deemed appropriate, retainage may be withheld as a performance guarantee for up to 60 days after achievement of final stabilization unless otherwise directed by the Contract. Full retainage may not be released without recommendation by the Mason LD.

6.4 Post-construction Inspections Post-construction (long-term) inspections shall be made in accordance with the manufacture's and/or engineer's recommendation, the provisions of these standards and specifications, and the general specifications provided in Section 2.1. Complete campus inspections shall be conducted at least quarterly.

6.5 Violations and Documentation Violations shall be documented in the *Land Disturbance Inspection Report*, including photographs, descriptions, and necessary corrective actions. If a violation continues to be repeated, then a formal Notice of Non-Compliance will be issued, and DCR notified. At the discretion of Mason LD, the Land Disturbance Permit may be suspended and/or revoked; at which time all land disturbing activity must cease until the violation(s) of the plan or permit has ceased, corrective action completed, and any related environmental or property damages abated. Alternatively, Mason LD also has the option to contract with a 3rd party to install and maintain the Erosion and Sediment Control and/or Stormwater Management measures in accordance with the approved plan, complete any necessary corrective actions, and abate any related damages. Once the site is stabilized to the satisfaction of the Mason LD, site work may resume. All associated costs will be back-charged to the Contractor.

7.0 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 from *VESCL&R* or *George Mason University Annual Specifications for ESC and SWM*. Variances and exceptions are considered to be project specific.

For a variance or exception to become part of the project ESC and SWM plans, a written request must be submitted to Mason LD for review and approval. This request must include an explanation and description of the specific condition necessitating the request. The request must also include a detailed description of the alternative practice and justification that the practice meets the intent of the regulation for which the variance is sought. (Ref. 4VAC50-30-50)

7.1 Variance or Exception Request Policy and Procedures:

- The design professional shall draft a letter of request to Mason LD and shall be accompanied by complete details and documentation, including justification and impacts associated with the request.

- All requests shall be considered unapproved until written approval from Mason LD is received.
- All approved variances or exceptions shall be listed in the General Notes section of the ESC & SWM plans for land disturbing activities and included in the Narrative.
- Typically, variations and exceptions must be submitted to DCR for final approval.

8.0 **LAND-DISTURBING ACTIVITIES**

- 8.1 Future Land-disturbing Activities** A list of regulated land-disturbing activities expected to soon be under contract is included in Appendix A. The list includes project location, estimated disturbed acreage, and approximate start and completion date for each project.
- 8.2 Current Land-disturbing Activities** A list of current permitted land-disturbing activities during the referenced time period is included in Appendix A. The list includes project location, project start and completion date, and actual disturbed area.
- 8.3 Project Tracking and Notification**
- Mason LD shall use GIS to track regulated land-disturbing activities.
 - Mason LD will update the GIS map quarterly with project information as related to ESC and SWM.
 - The GIS will be accessible through Microsoft Windows Explorer to DCR. Mason LD shall send an email notification to DCR each time the website is updated.
- 8.4 Responsible Land Disturber**
- Mason LD shall notify the DCR Warrenton 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.
 - Unless otherwise specified in the narrative, land disturbing activities shall be completed under the supervision of: Bradley D. Glatfelter, #34017, (571)-265-1977, bglatfel@gmu.edu

9.0 **CONSTRUCTION REQUIREMENTS**

- 9.1 Top Soil** All area that is disturbed shall require a minimum top soil depth of 2" in grassed areas and 4" in landscaped areas. Refer to Appendix C.1 for additional requirements on top soil.
- 9.2 Construction Area Maintenance** All grassed perimeter areas shall be mowed at least once a month during construction in order to maintain the aesthetics of the University.
- 9.3 Stabilization** Turf and grasses shall comply with the requirements in Appendix C.2. In the event that approved seeding does not establish stabilization within 90 days of installation, sod shall be installed at no expense to the University.

10.0 PERFORMANCE WARRANTY

- Upon termination of the permit, the Contractor shall warranty all work, including but not limited to, installations, landscaping, turf, etc. for one year from the date of permit termination.
- In the event that such feature does not meet its designed and approved intent, the Contractor shall repair/replace said feature in kind per the Standards and Specifications outlined in this document.
- The repair/replacement shall be guaranteed to perform as designed for one year from the date of repair acceptance.

11.0 LONG-TERM MAINTENANCE

- Project plans shall contain information on long-term maintenance of BMPs.
- Mason LD shall use GIS to track stormwater management facilities and associated watersheds.
- The Mason LD BMP GIS will be updated quarterly with information as related BMPs.
- The GIS will be accessible through a web browser to DCR.
- Inspections will be conducted in accordance with section 6.0.

12.0 PLAN REVIEW and EVALUATION

12.1 DCR'S RESPONSIBILITIES

- DCR shall have sixty days in which to comment on any erosion and sediment control specifications submitted to it for review, and its comments shall be binding on Mason LD and any private business hired by Mason LD (§10.1564.D).
- DCR shall perform random site inspections to assure compliance with this article, the Erosion and Sediment Control Law and Regulations adopted there under (§10.1-603.5.B)

12.2 GEORGE MASON UNIVERSITY'S RESPONSIBILITIES

- Mason LD shall ensure compliance with the approved plan and annual standards and specifications (§10.1-564.F and §10.1-603.5.B).
- Mason LD shall provide DCR with the appropriate information, in a timely manner, when requested.

Note: Due to technology and budget constraints, George Mason does not currently have GIS capabilities. However, recent funds have been allocated to develop such technologies. It is the goal of Mason Facilities to implement such measures by October 2013.

APPENDIX A:

Current and Future Land Disturbing Activities

Current & Future Land Disturbing Projects						
Project Name	Total Disturbed Area (ac)	Projected Timeline		Location	On-Site Project Manager	Project Description
		Start	Finish			
Projects Currently Under Construction						
Science & Tech II Addition	3.6	November-12	May-13	Fairfax	Alex Iszard (703) 993-9220	Academic Science Addn.
Roanoke River Road	1.9	August-12	December-12	Fairfax	Brad Glatfelter (571) 265-1977	Campus Entrance
Discovery Hall II	5.2	July-12	August-13	Prince William	Micky Boeckl (703) 993-3726	Academic Laboratory Building
Graduate Student Housing	8	October-12	November-12	Prince William	Micky Boeckl (703) 993-3726	Student Housing
2013 Proposed/Potential Future Construction Projects						
ICAR/POV	1.20 (?)	December-12	August-13	Mason Neck	Nancy Pickens (571) 296-1137	Conference Center and Housing
Fenwick Library	2.3 (?)	December-12	August-14	Fairfax	Brian Snyder (703) 993-5041	Academic Library
Baseball Stadium	3(?)	April-13	December-13	Fairfax	Alex Iszard (703) 993-9220	Baseball Stadium
Sandy Creek Transit Center	2.8 (?)	May-13	September-13	Fairfax	Brad Glatfelter (571) 265-1977	Transit Center Upgrades

2013 Proposed/Potential Future Construction Projects (cont'd)

West Campus Connector Road	15(?)	December-12	July-14	Fairfax	Brad Glatfelter (571) 265-1977	Road and Grade Separated Crossing
Bull Run Hall Addition	3.5(?)	October-13	October-15	Prince William	Micky Boeckl (703) 993-3726	Academic Addition
Graduate Housing	20(?)	August-13	August-15	Fairfax	Nancy Pickens (571) 296-1137	Student Housing
Academic VII	8	October-13	October-16	Fairfax	Brian Snyder (703) 993-5041	Academic Building
Potomac Science Center	2	January-13	June-14	Belmont Bay	Alex Iszard (703) 993-9220	Academic Building
Plant Expansion	0.25	March-13	October-13	Fairfax	Brian Snyder (703) 993-5041	Facilities Building
Shenandoah Housing	1.5	October-13	October-15	Fairfax	Nancy Pickens (571) 296-1137	Student Housing
Shenandoah Dining	0.5	May-12	February-14	Fairfax	Nancy Pickens (571) 296-1137	Dining Building
Rappahannock Housing	1	May-13	September-15	Fairfax	Nancy Pickens (571) 296-1137	Student Housing
Field House Renovation	1.33	May-13	June-14	Fairfax	Alex Iszard (703) 993-9220	Athletic Building Renovation

APPENDIX B:

Erosion and Sediment Control Structures

APPENDIX B.1:

SILTSACK® Specification

Control of Sediment Entering Catch Basins or equal substitute

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 contract drawings. Siltsack sediment control device is manufactured by:

ACF Environmental, Inc.
2831 Cardwell Drive
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 manufactured by SI® Geosolutions and sewn by a double needle machine, using a high strength nylon thread.

SI Geosolutions:
www.sigeosolutions.com (800) 621-0444

- 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 strap 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

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/Ft2	40
Permittivity	ASTM D-4491	sec -1	0.55
<i>All properties are Minimum Average Roll Values (MARV)</i>			

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 out 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 it where the contents will be collected. Place the rebar through the lift straps (connected to the bottom of the sack) and lift. This will turn Siltsack inside out 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 the sunlight until needed on another project.
- 4.0 Basis of Payment**
- 4.1** Payment for all Siltsack used during the construction is to be included in the bid price for the overall erosion and sediment control plan unless unit price is requested.

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

Available in Texas from:

EcoSupplies

6719 Theall Rd., Suite C, Houston, Texas
281-537-8657 Voice
281-537-1146 Fax
www.ecosupplies.com

INSERT 1" REBAR
FOR BAG REMOVAL
FROM INLET
(REBAR NOT INCLUDED)

OPTIONAL OVERFLOW

SILTSACK[®]

DUMP LOOPS
(REBAR NOT INCLUDED)

DEPTH = D

WIDTH = W

LENGTH = L

SIDE VIEW INSTALLED

EXPANSION
RESTRAINT

INSTALLATION DETAIL

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



Environmental
Your Complete Source for
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®

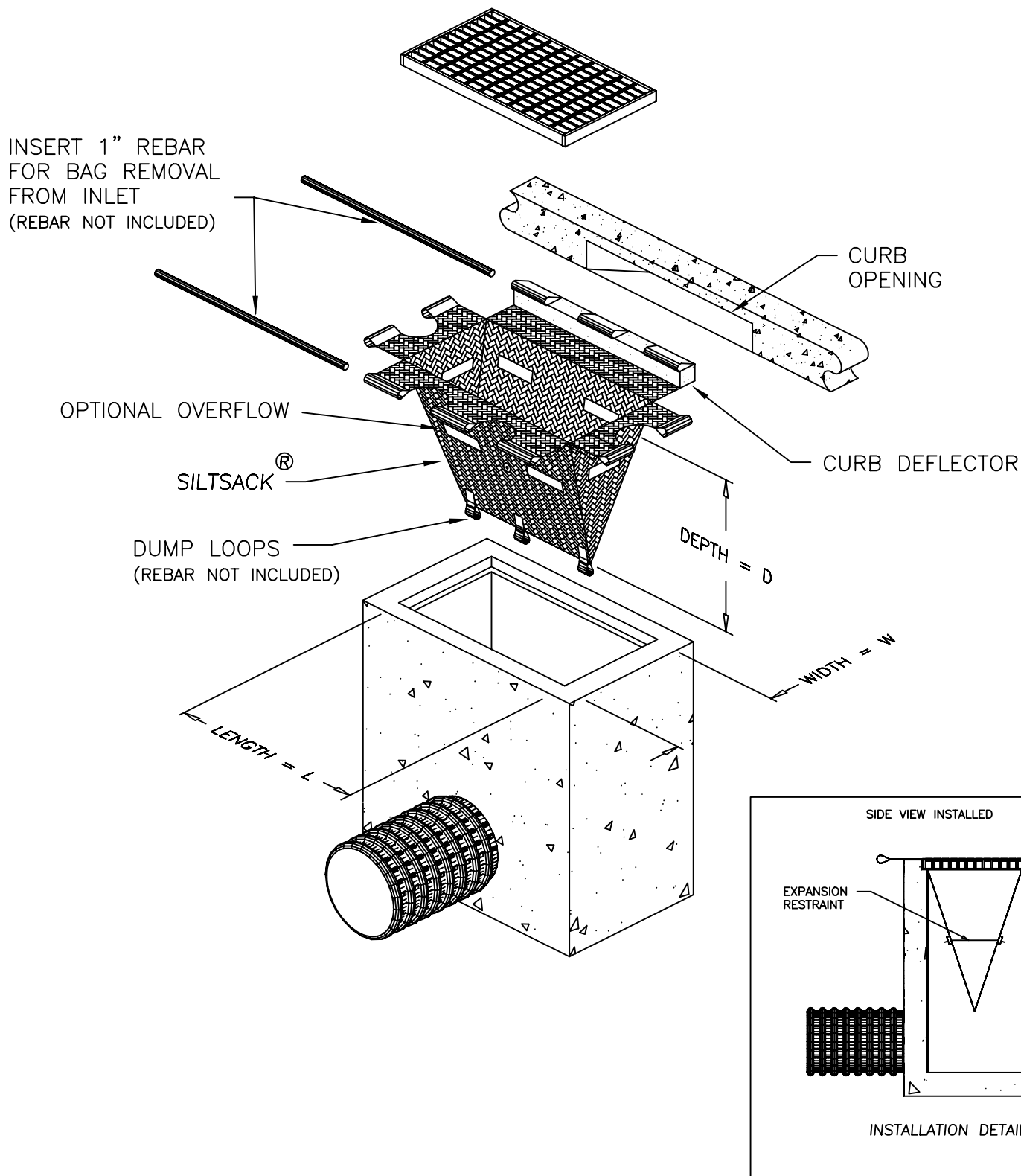
(FOR AREAS OF MODERATE TO HEAVY PRECIPITATION AND RUN-OFF)

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.



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



Environmental
Your Complete Source for
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®

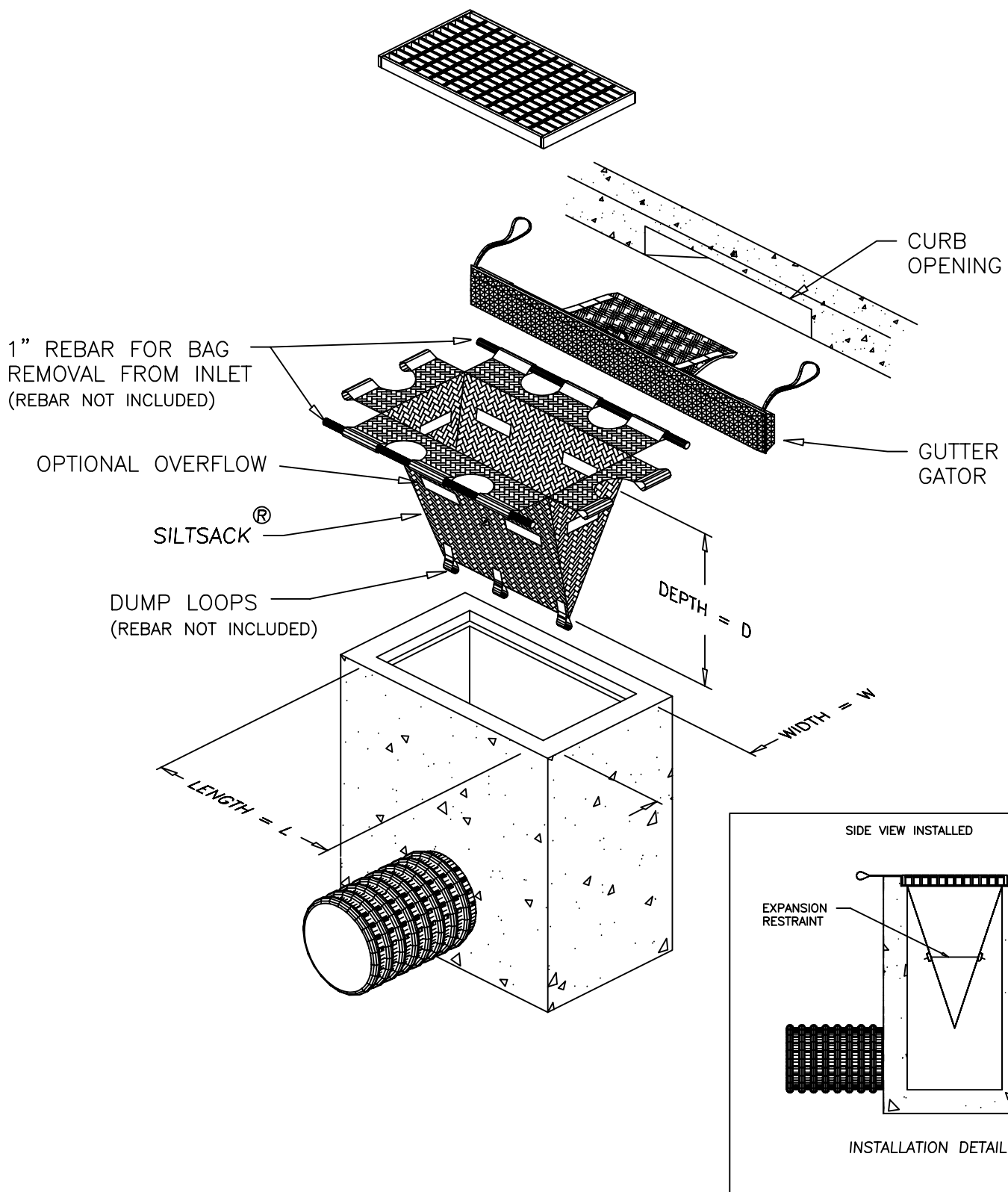
(FOR AREAS OF MODERATE TO HEAVY PRECIPITATION AND RUN-OFF)

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.



DETAIL OF INLET SEDIMENT CONTROL DEVICE WITH GUTTER GATOR



Environmental
Your Complete Source for
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.

APPENDIX B.2:

GUTTERBUDDY® Specification For Curb Gutter Storm Drains or equal substitute

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 nationally by:

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

2.0 Materials

2.1 GUTTERBUDDY®

The Gutterbuddy® shall be a 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 are to be sized 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

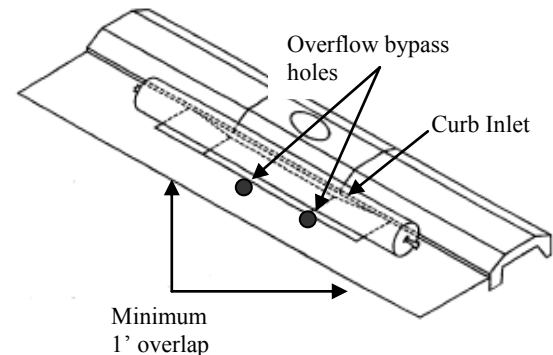
- 3.1.1 Install the Gutterbuddy® in front of the curb inlet opening. Each end of the Gutterbuddy® should overlap the curb inlet approximately 12".
- 3.1.2 When installed, the overflow bypass holes drilled through the Gutterbuddy® should be oriented to be parallel with the surface of the pavement. This will minimize ponding.
- 3.1.3 The Gutterbuddy® should be cleaned if a visual inspection shows silt and debris buildup around the Gutterbuddy®.
- 3.1.4 To remove the Gutterbuddy®, lift out of the opening.

- 3.1.5 The Gutterbuddy® 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 until needed on the next project.

- 3.1.6 Ponding is likely if sediment is not removed regularly, or if the overflow bypass holes are not oriented properly. 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, or per unit based on length.



Available in Texas from:

EcoSupplies
6719 Theall Rd., Suite C
Houston, TX 77066
281-537-8657 Voice
281-537-1146 Fax
www.ecosupplies.com

APPENDIX B.3:

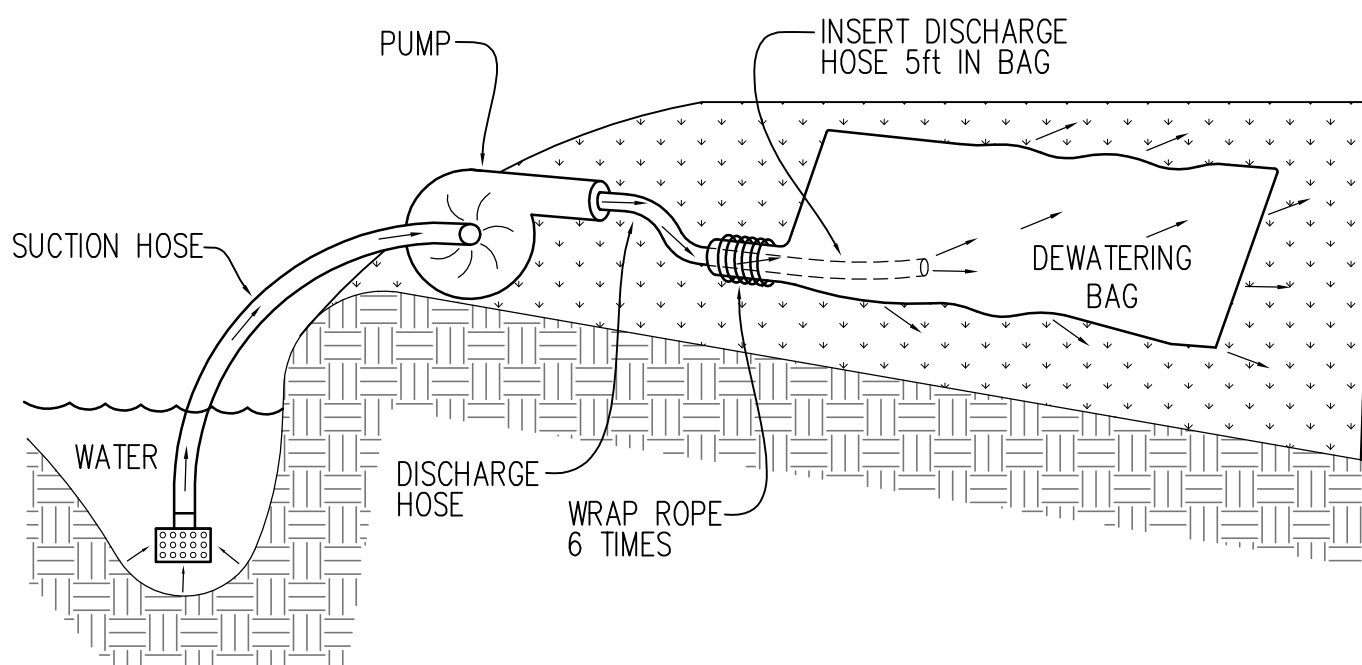
Dewatering Bag Standard Drawing

The purpose of a Dewatering Bag is to collect sediment contained in the discharged water, to prevent the scour and erosion from water exiting a pipe at high velocity, to defuse the water over a wider area to minimize erosion as the water drains away, and to retain oil contained within effluent.

A SedCatch® dewatering bag or approved equal should be used anytime water is pumped on the site.

SedCatch® Dewatering Bag Or equal substitute

www.SedCatch.com



Installation and Use:

1. Place SedCatch® Dewatering Bag on the ground or on a trailer over a relatively level, stabilized area.
2. Insert discharge pipe a minimum of 5ft. inside SedCatch® dewatering bag and secure with a rope (included) wrapped 6 times around the snout over a 6 inch width of the bag.
3. Replace SedCatch® Dewatering Bag when half full of sediment or when the sediment has reduced the flow rate of the pump discharge to an impractical amount.

Maintenance and Disposal:

1. Remove and dispose of accumulated sediment away from waterways or environmentally sensitive areas. Slit open Sediment Bag and remove accumulated sediment. Dispose of bag at an appropriate recycling or solid waste facility. OR; as directed by engineer or inspector.

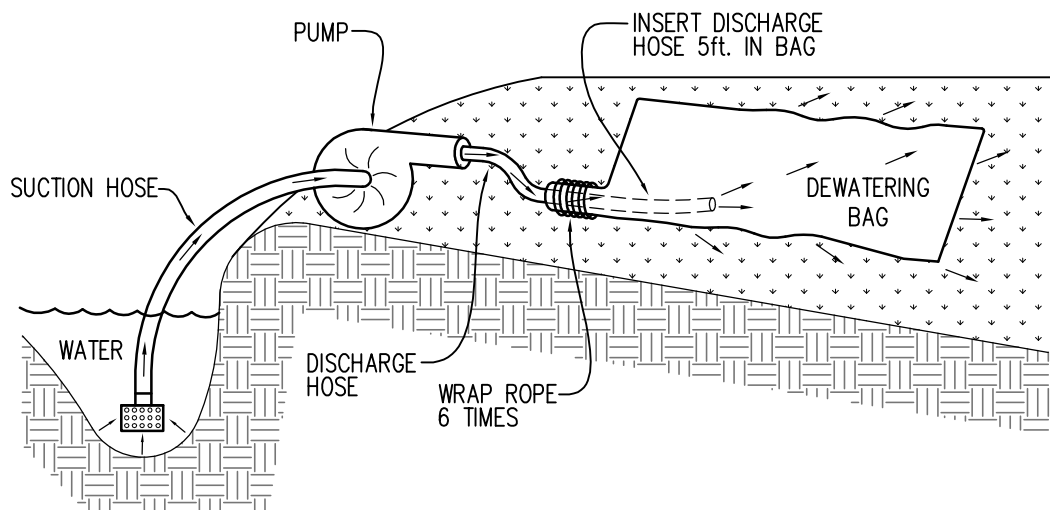
Dewatering Bag/Tube™ Standard Drawing

The purpose of a Dewatering Bag/Tube™ is to collect sediment contained in the discharged water, to prevent the scour and erosion from water exiting a pipe at high velocity, to defuse the water over a wider area to minimize erosion as the water drains away, and to retain oil contained within effluent.

A SedCatch® Dewatering Bag/Tube™ or approved equal should be used anytime water is pumped on the site.

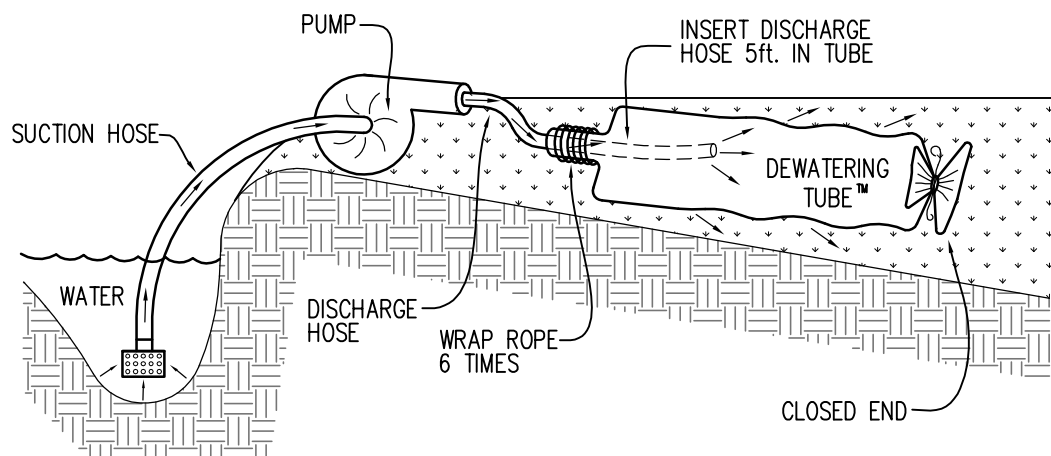
SedCatch® Dewatering Bag

www.SedCatch.com



SedCatch® Dewatering Tube™

www.SedCatch.com



Installation and Use:

1. Place SedCatch® Dewatering Bag/Tube™ on the ground or on a trailer over a relatively level, stabilized area.
2. Insert discharge pipe a minimum of 5ft. inside SedCatch® Dewatering Bag/Tube™ and secure with a rope (included) wrapped 6 times around the snout over a 6 inch width of the bag. To close Open end of the Dewatering Tube™: Overlap the tube 2 ft. from the end. Gather the center of the doubled-up portion forming a bow tie. Secure with a rope wrapped multiple times.
3. Replace SedCatch® Dewatering Bag when half full of sediment or when the sediment has reduced the flow rate of the pump discharge to an impractical amount, OR; empty SedCatch® Sediment Tube™ when half full of sediment or when the sediment has reduced the flow rate of the pump discharge to an impractical rate.

Maintenance and Disposal:

1. Remove and dispose of accumulated sediment away from waterways or environmentally sensitive areas. Slit open Dewatering Bag and remove accumulated sediment. Dispose of bag at an appropriate recycling or solid waste facility, OR: open both ends of the SedCatch® Dewatering Tube™, pick it up in the center and dump accumulated sediment out of both ends. Allow to dry and store for re-use, OR; as directed by engineer or inspector.

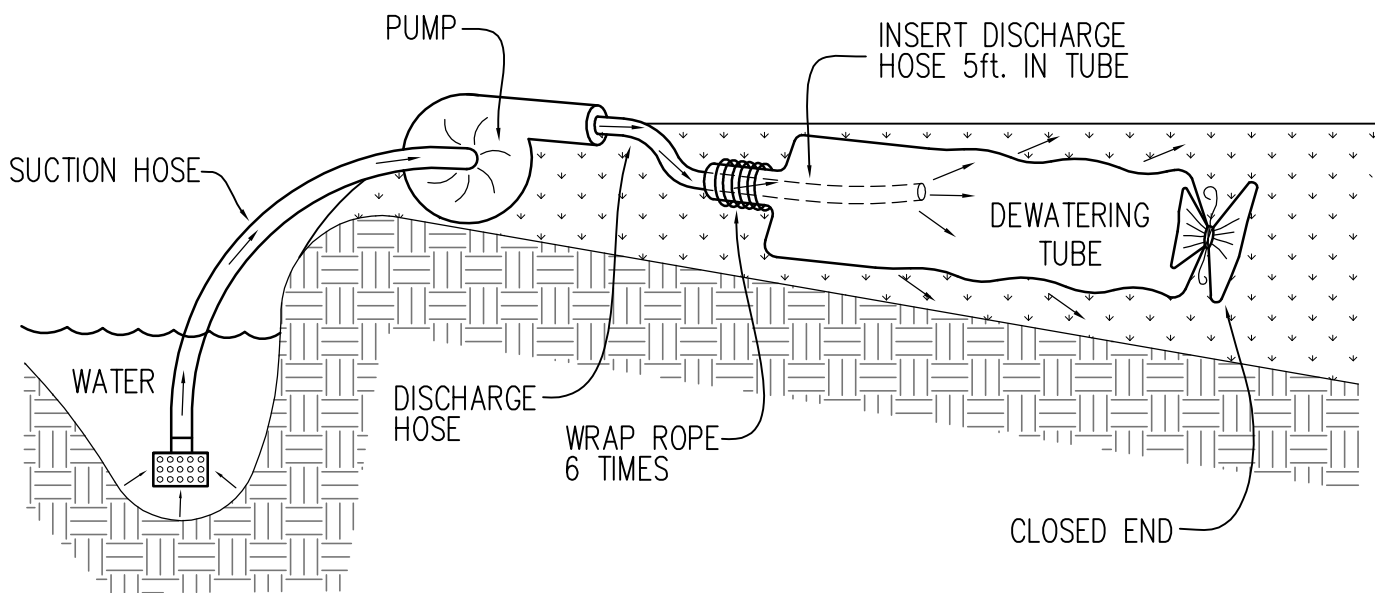
Dewatering Tube™ Standard Drawing

The purpose of a Dewatering Tube™ is to collect sediment contained in the discharged water, to prevent the scour and erosion from water exiting a pipe at high velocity, to defuse the water over a wider area to minimize erosion as the water drains away, and to retain oil contained within effluent.

A SedCatch® Dewatering Tube™ or approved equal should be used anytime water is pumped on the site.

SedCatch® Dewatering Tube™

www.SedCatch.com



Installation and Use:

1. Place SedCatch® Dewatering Tube™ on the ground or on a trailer over a relatively level, stabilized area.
2. Insert discharge pipe a minimum of 5ft. inside SedCatch® Dewatering Tube™ and secure with a rope (included) wrapped 6 times around the snout over a 6 inch width of the bag. To close and open end of the Dewatering Tube™: Overlap the tube 2 ft. from the end. Gather the center of the doubled-up portion forming a bow tie. Secure with a rope wrapped multiple times.
3. Empty SedCatch® Dewatering Tube™ when half full of sediment or when the sediment has reduced the flow rate of the pump discharge to an impractical amount.

Maintenance and Disposal:

1. Remove and dispose of accumulated sediment away from waterways or environmentally sensitive areas. Open both ends of the SedCatch® Dewatering Tube™, pick it up in the center and dump accumulated sediment out of both ends. Allow to dry and store for re-use OR; as directed by engineer or inspector.

ITEM SPECIFICATION
for
SedCatch® Dewatering Bag/Tube™

SedCatch® Dewatering Bag/Tube™, as manufactured by:
www.SedCatch.com

1.0 Description:

- 1.1 Work covered under this item consists of furnishing, installing, maintaining, and removal of the SedCatch Dewatering Bag/Tube. The purpose is to collect sediment that is contained in the water that is being pumped, to prevent scour and erosion from water exiting a pipe at high velocity, to defuse the water over a wider area to minimize erosion as the water drains away, and to retain oil contained within effluent.

2.0 Material:

- 2.1 The above geotextile seams shall be double stitched with a high strength thread.
- 2.2 The SedCatch Dewatering Bag/Tube shall be made of a nonwoven, needle punched geotextile with the following characteristics:

Material	Polypropylene
Weight	8 oz.
Construction	Needle Punched

Property	Test Method	MARV
Tensile Strength (Grab)	ASTM D-4632	205 lbs
Elongation	ASTM D-4632	50%
Puncture	ASTM D-4833	110 lbs
Mullen Burst	ASTM D-3786	350 psi
Trapezoidal Tear	ASTM D-4533	80 lbs
UV Resistance	ASTM D-4355	70%
Apparent Opening Size	ASTM D-4751	80 Sieve = .18mm
Permittivity	ASTM D-4491	1.5 sec ⁻¹
Water Flow Rate	ASTM D-4491	110 gpm/ft ²

3.0 Installation and Use:

- 3.1 Place SedCatch Dewatering Bag/Tube on the ground or on a trailer over a relatively level, stabilized area.
- 3.2 Insert discharge hose a minimum of 5 ft inside SedCatch Dewatering Bag/Tube and secure with a rope (included wrapped 6 times around the snout over a 6 inch width of the bag.
- 3.3 Insert discharge pipe a minimum of 5 ft inside SedCatch Dewatering Bag/Tube and secure with a rope wrapped 6 times around the snout over a

6 inch width of the bag. To close the open end of the tube; overlap the tube 2 ft from the end, gather the center of the doubled up portion forming a bow tie, secure with a rope wrapped multiple times.

4.0 Maintenance:

- 4.1 Replace SedCatch Dewatering Bag when half full of sediment or when the sediment has reduced the flow rate of the pump discharge to an impractical rate,
OR; Empty SedCatch Sediment Tube when half full of sediment or when the sediment has reduced the flow rate of the pump discharge to an impractical rate,
OR; As directed by engineer or inspector.

5.0 Method of Measurement:

- 5.1 The quantity to be paid for the actual number of SedCatch Dewatering Bags/Tubes that are actually used.

6.0 Basis of Payment:

- 6.1 The unit price shall include labor, equipment, and materials necessary to install, maintain, and dispose of SedCatch Dewatering Bags/Tubes
6.2 Payment for completed work will be made at the contract price for:

UNITS	DESCRIPTION	EA
Quan	Size of Bag/Tube	Unit price

GEOTEXTILE SPECIFICATION

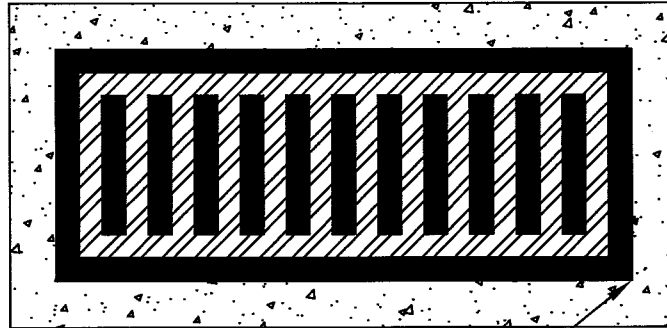
SedCatch® Dewatering Bags and Dewatering Tubes™ are manufactured with geotextile with the following properties:

Material	Polypropylene
Weight	8 oz.
Construction	Needle Punched

Property	Test Method	MARV
Tensile Strength (Grab)	ASTM D-4632	205 lbs
Elongation	ASTM D-4632	50%
Puncture	ASTM D-4833	110 lbs
Mullen Burst	ASTM D-3786	350 psi
Trapezoidal Tear	ASTM D-4533	80 lbs
UV Resistance	ASTM D-4355	70%
Apparent Opening Size	ASTM D-4751	80 Sieve = .18mm
Permittivity	ASTM D-4491	1.5 sec ⁻¹
Water Flow Rate	ASTM D-4491	110 gpm/ft ²

APPENDIX B.4:

PLAN



FILTER FABRIC

CROSS SECTION



NOTE:

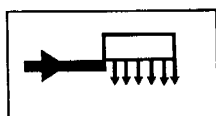
- 1) CLEAN OUT AND CHANGE FABRIC AT A MINIMUM BI-WEEKLY.

NOT TO SCALE

MASON LAND DEVELOPMENT	GEORGE MASON UNIVERSITY	DETAIL NO: LD-003
APPROVED		
9-29-2011	FILTER FABRIC INLET PROTECTION	
DATE		

APPENDIX B.5:

STD & SPEC 3.21



LEVEL SPREADER



Definition

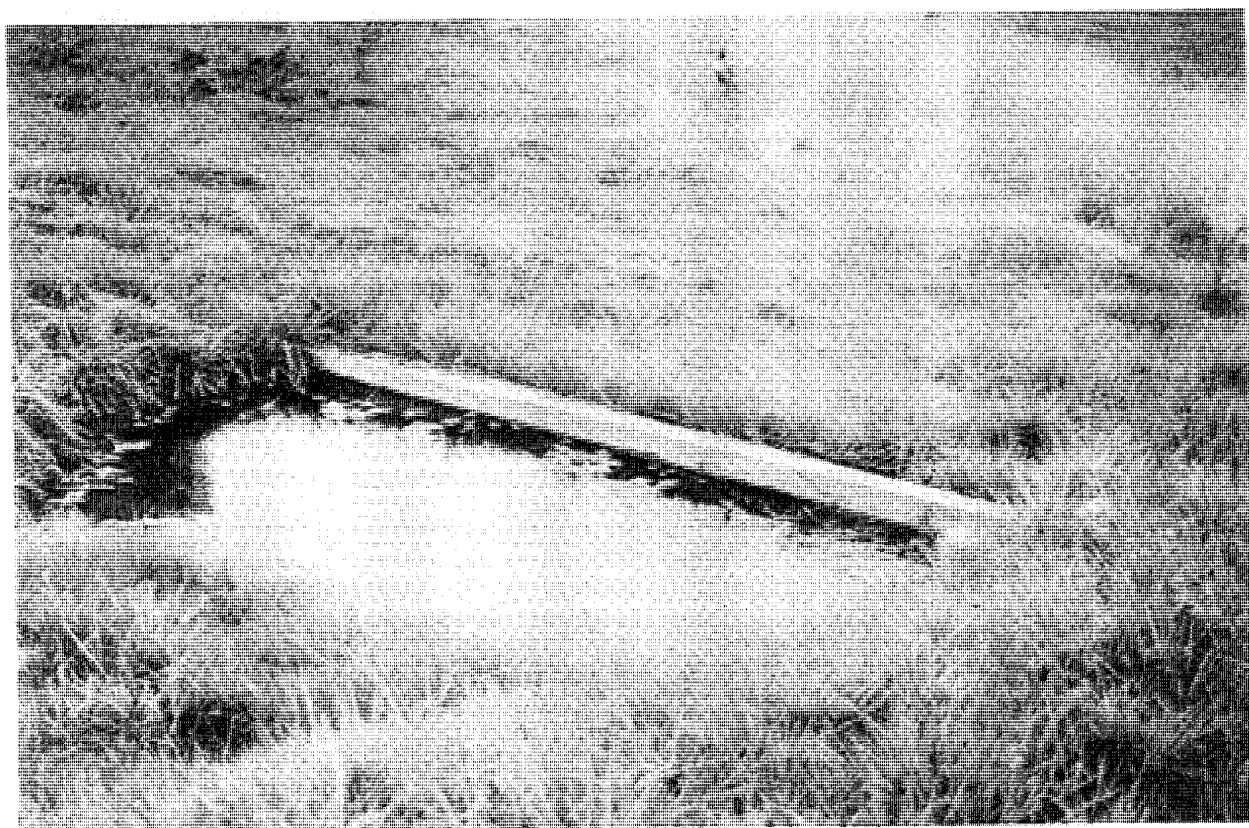
An outlet for dikes and diversions consisting of an excavated depression constructed at zero grade across a slope.

Purpose

To convert concentrated runoff to sheet flow and release it uniformly onto areas stabilized by existing vegetation.

Conditions Where Practice Applies

Where there is a need to divert stormwater away from disturbed areas to avoid overstressing erosion control measures; where sediment-free storm runoff can be released in sheet flow down a stabilized slope without causing erosion.



This practice applies only in those situations where the spreader can be constructed on undisturbed soil and the area below the level lip is uniform with a slope of 10% or less and is stabilized by natural vegetation. The runoff water should not be allowed to reconcentrate after release unless it occurs during interception by another measure (such as a permanent pond or detention basin) located below the level spreader.

Planning Considerations

The TEMPORARY DIVERSION DIKE, (Std.& Spec. 3.09) and the TEMPORARY RIGHT-OF-WAY DIVERSION, (Std. & Spec. 3.11) each call for a stable outlet for concentrated stormwater flows. The level spreader is a relatively low-cost structure to release small volumes of concentrated flow where site conditions are suitable (see Plate 3.21-1).

The outlet area must be uniform and well-vegetated with slopes 10% or less. Particular care must be taken to construct the outlet lip completely level in a stable, undisturbed soil. Any depressions in the lip will concentrate the flow, resulting in erosion. Under higher design flow conditions, a rigid outlet lip design should be used to create the desired sheet flow conditions. Runoff water containing high sediment loads must be treated in a sediment trapping device before being released to a level spreader.

Design Criteria

No formal design is required. The following criteria must be met:

Spreader Dimensions

Determine the capacity of the spreader by estimating the peak flow expected from a 10-year storm (Q_{10}).

Select the appropriate length, width and depth of the spreader from Table 3.21-A.

For design flows greater than 20 cfs, the measure should be designed by a qualified engineer.

A 20-foot transition section should be formed in the diversion channel so that the width of the diversion will smoothly tie in with the width of the spreader to ensure more uniform outflow.

The depth of the level spreader, as measured from the lip, shall be at least 6 inches. The depth may be made greater to increase temporary storage capacity, improve trapping of debris and to enhance settling of any suspended solids.

TABLE 3.21-A

MINIMUM DIMENSIONS FOR LEVEL SPREADER

<u>Design Flow,</u> <u>Q₁₀ (cfs)</u>	<u>Depth</u> <u>(ft.)</u>	<u>Width of Lower</u> <u>Side Slope of</u> <u>Spreader (ft.)</u>	<u>Length</u> <u>(ft.)</u>
0-10	0.5	6	10
10-20	0.6	6	20

Source: Va. DSWC

Grade

1. The grade of the channel for the last 20 feet of the dike or diversion entering the level spreader shall be less than or equal to 1% (see Plate 3.21-1).
2. The grade of the level spreader channel shall be 0%.

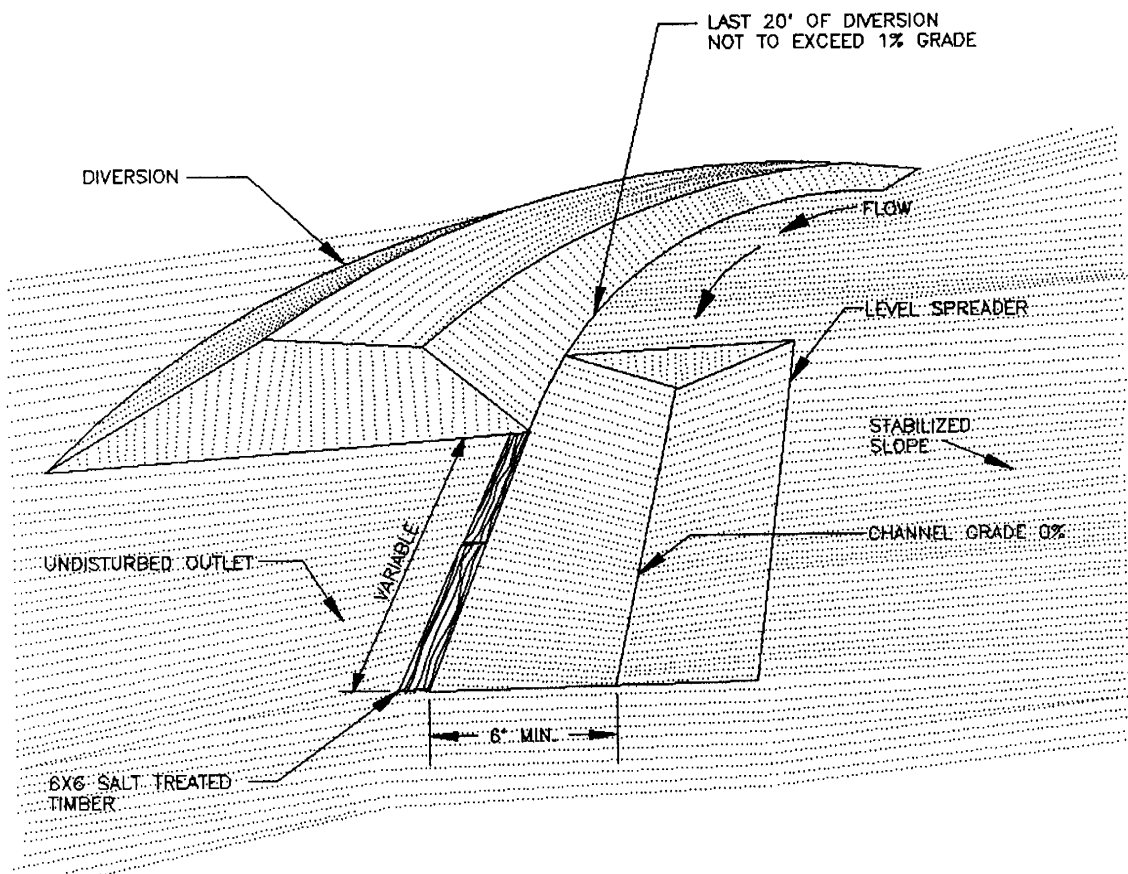
Spreader Lip

The release of the stormwater will be over the level lip onto an undisturbed well-vegetated area with a maximum slope of 10%. The level lip should be of uniform height and zero grade over the length of the spreader.

The level spreader lip may be stabilized by vegetation or may be of a rigid non-erodible material depending on the expected design flow:

<u>Spreader Lip</u>	<u>Design Flow</u> <u>(cfs)</u>
Vegetated	0 - 4
Rigid	5 - 20

LEVEL SPREADER



PERSPECTIVE VIEW

NOTE: ALL TEMPORARY BERMS, SWALES AND LEVEL SPREADER DITCH MUST RECEIVE TEMPORARY SEEDING IMMEDIATELY AFTER INSTALLATION

Source: Adapted from N.C. Erosion and Sediment Control Planning and Design Manual

Plate 3.21-1

A vegetated level lip must be constructed with an erosion-resistant material, such as jute or excelsior blankets, to inhibit erosion and allow vegetation to become established (see Plate 3.21-2).

For higher design flows and permanent installations, a rigid lip of non-erodible material, such as pressure-treated timbers or concrete curbing, should be used (see Plate 3.21-2).

Construction Specifications

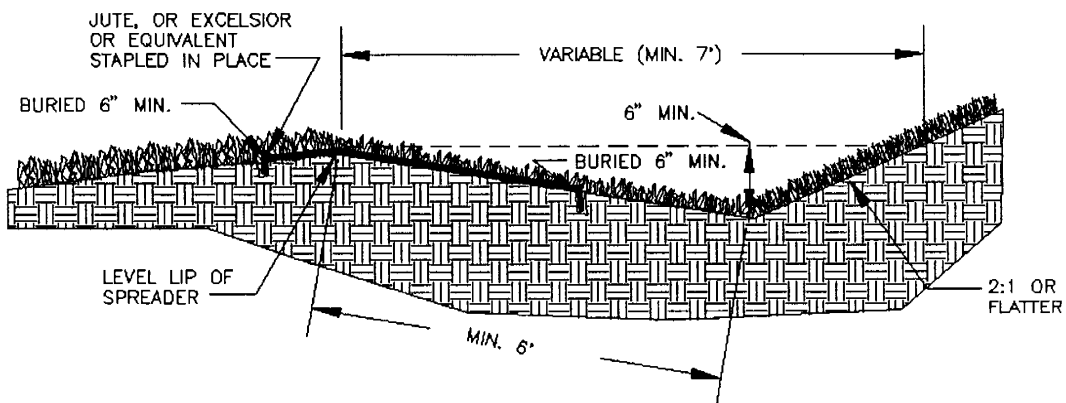
1. Level spreaders must be constructed on undisturbed soil (not fill material).
2. The entrance to the spreader must be shaped in such a manner as to insure that runoff enters directly onto the 0% channel.
3. Construct a 20-ft. transition section from the diversion channel to blend smoothly to the width and depth of the spreader.
4. The level lip shall be constructed at 0% grade to insure uniform spreading of stormwater runoff.
5. Protective covering for vegetated lip should be a minimum of 4 feet wide extending 6 inches over the lip and buried 6 inches deep in a vertical trench on the lower edge. The upper edge should butt against smoothly cut sod and be securely held in place with closely spaced heavy duty wire staples (see Plate 3.21-2).
6. Rigid level lip should be entrenched at least 2 inches below existing ground and securely anchored to prevent displacement. An apron of VDOT #1, #2 or #3 Coarse Aggregate should be placed to top of level lip and extended downslope at least 3 feet. Place filter fabric under stone and use galvanized wire mesh to hold stone securely in place (see Plate 3.21-2).
7. The released runoff must outlet onto undisturbed stabilized areas with slope not exceeding 10%. Slope must be sufficiently smooth to preserve sheet flow and prevent flow from concentrating.
8. Immediately after its construction, appropriately seed and mulch the entire disturbed area of the spreader.

Maintenance

The measure shall be inspected after every rainfall and repairs made, if required. Level spreader lip must remain at 0% slope to allow proper function of measure. The contractor should avoid the placement of any material on and prevent construction traffic across the structure. If the measure is damaged by construction traffic, it shall be repaired immediately.

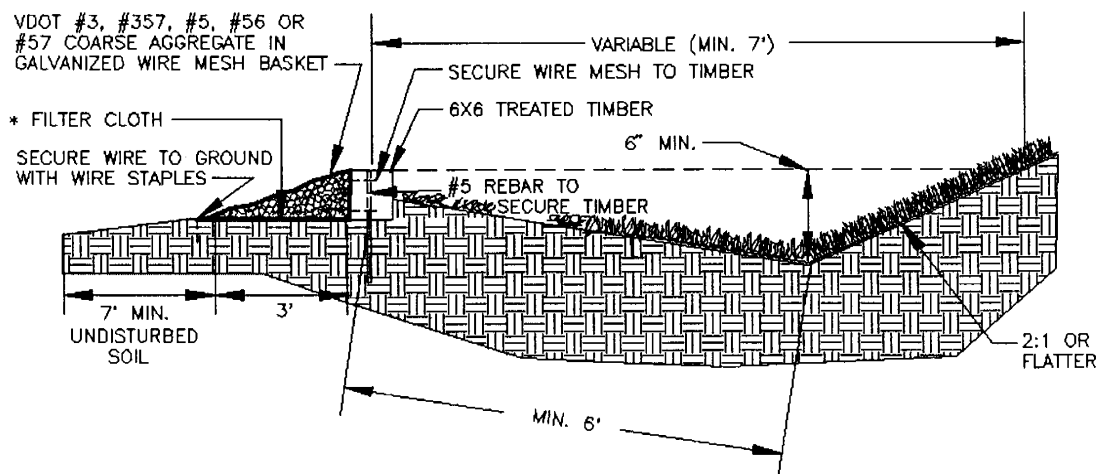
LEVEL SPREADER

CROSS SECTION



LEVEL SPREADER WITH VEGETATED LIP

CROSS SECTION



LEVEL SPREADER WITH RIGID LIP

* MIN. PHYSICAL REQUIREMENTS OF FILTER CLOTH NOTED IN STD. & SPEC. 3.19, RIPRAP

Source: Va. DSWC and N.C. Erosion and Sediment Control Planning and Design Manual

Plate 3.21-2

Appendix is taken from the Virginia Erosion and Sediment Control Handbook (1992 Edition)

APPENDIX B.6:

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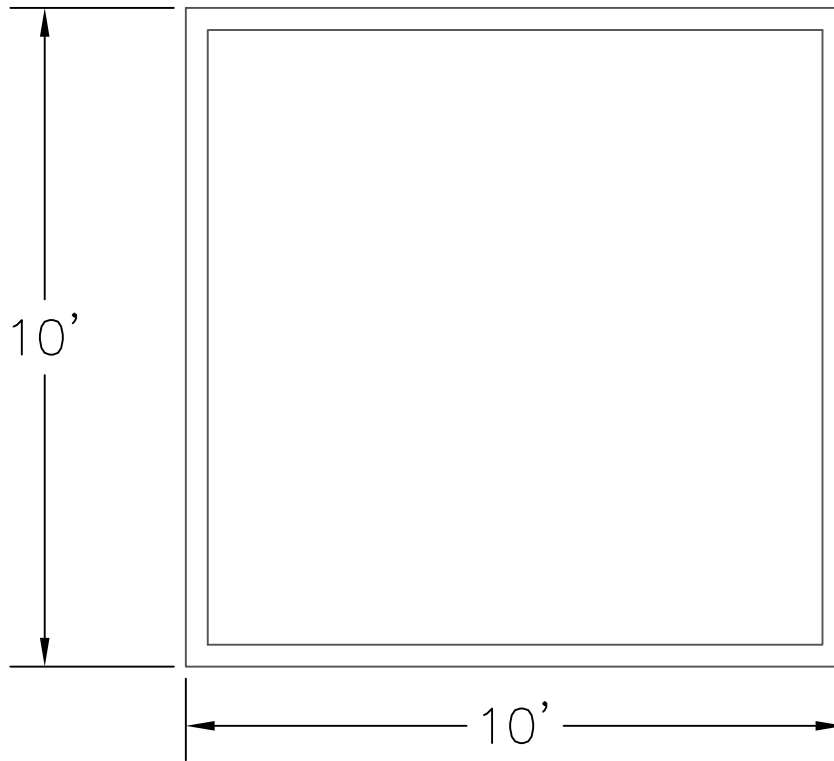
© 2012 das Manufacturing, Inc.

4" / COLORS: 286 BLUE, 349 GREEN, 116 YELLOW

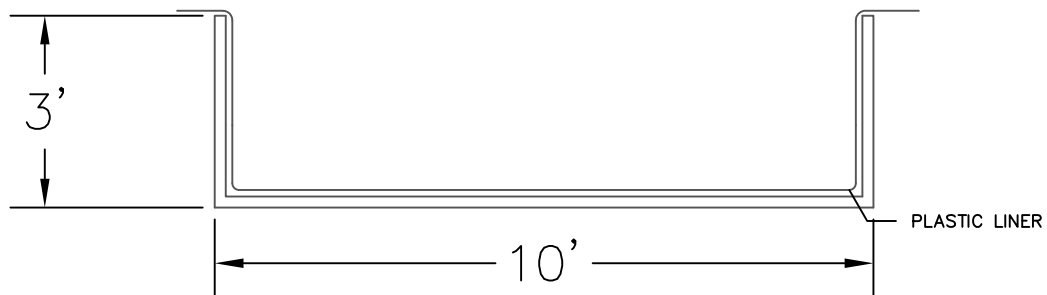


APPENDIX B.7:

PLAN



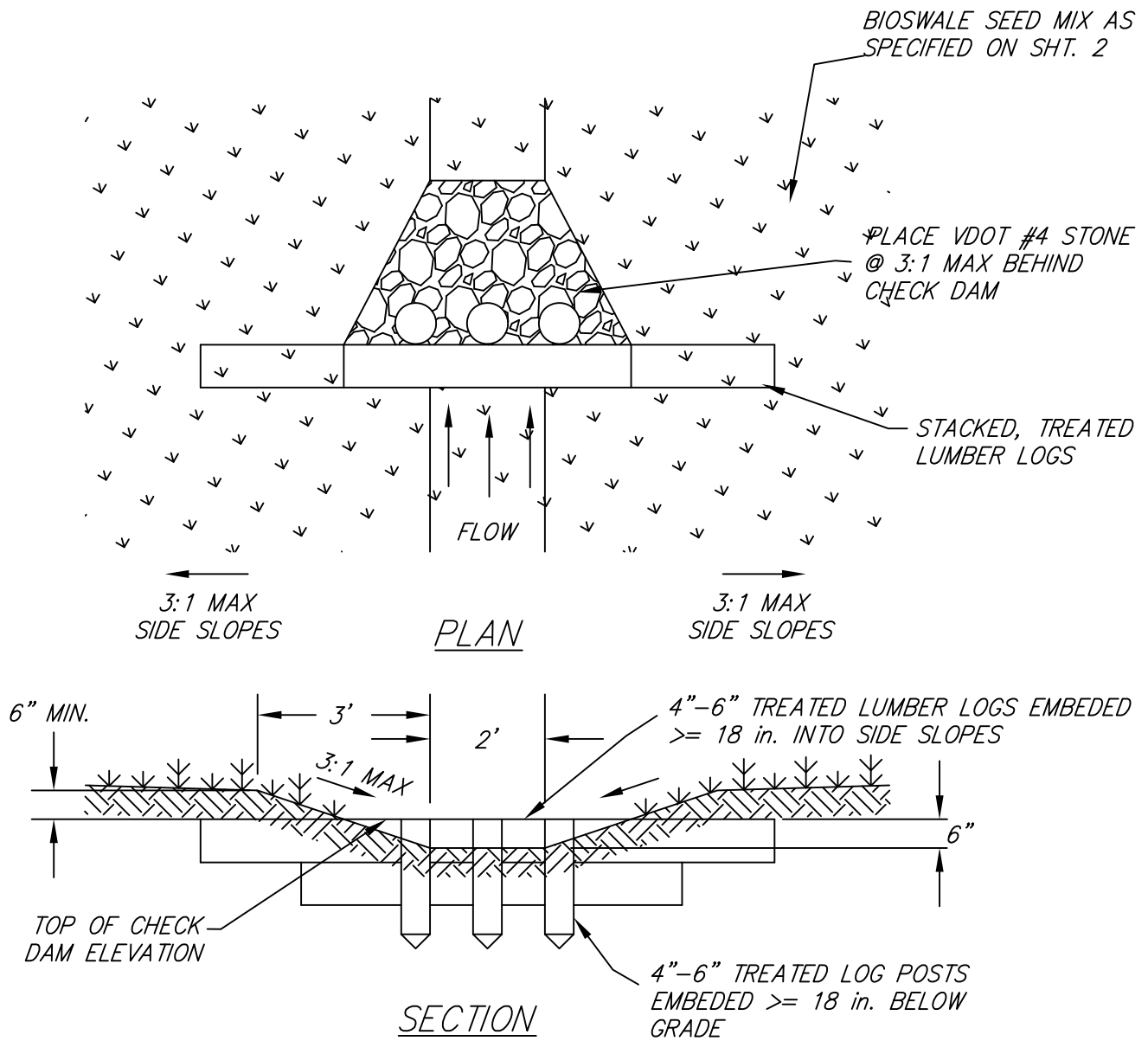
CROSS SECTION



NOT TO SCALE

<p>MASON LAND DEVELOPMENT</p> <hr/> <p>APPROVED</p>	<p>GEORGE MASON UNIVERSITY</p>	<p>DETAIL NO: LD-001</p>
<p>9-19-12</p> <hr/> <p>DATE</p>	<p>CONCRETE WASHOUT</p>	

APPENDIX B.8:



TYPICAL PERMANENT CHECK DAM

NOT TO SCALE

<p>MASON LAND DEVELOPMENT</p> <p>APPROVED</p>	<p>GEORGE MASON UNIVERSITY</p>	<p>DETAIL NO: LD-035</p>
<p>12-3-12</p> <p>DATE</p>	<p>TYPICAL PERMANENT CHECK DAM</p>	<p>Sheet No: 1 of 2</p>

SEED MIXTURE: ERNST CONSERVATION SEED MIX ERNMX-178 (OR EQUAL AS APPROVED BY GMU):

10% FOX SEDGE (*CAREX VULPIOIDEA*)
 8% VIRGINIA WILD RYE (*ELYMUS VIRGINICUS*)
 8% RIVERBANK WILD RYE (*ELYMUS RIPARIUS*)
 8% DEER TOUNG, "TIOGA" (*PANICUM CLANDESTINUM*)
 8% LITTLE BLUESTEM (*SCHIZACHRYIUM SCOPARIUM*)
 7% INDIANGRASS (*SORGHASTRUM NUTANS*)
 6% PARTRIDGE PEA (*CHAMAECRISTA FASCICULATA*)
 5% BLUE VERVAIN (*VERBENA HASTATA*)
 5% BIG BLUESTEM, "NIAGRA" (*ANDROPOGON GERARDII*)
 4% SWITCHGRASS, "SHAWNEE" (*PANICUM VIRGATUM*)
 4% SILKY DOGWOOD (*CORNUS AMOMUM*)
 2% GRASS LEAVED GOLDENROD (*EUTHAMIA GRAMINIFOLIA*)
 2% ARROW WOOD (*VIBURNUM DENTATUM*)
 2% OX EYE SUNFLOWER (*HELIOPSIS HELIANTHOIDES*)
 2% BLACK EYED SUSAN (*RUDBECKIA HIRTA*)
 2% STAGHORN SUMAC (*RHUS TYPHINA*)
 2% WILD BERGAMOT (*MONARDA FISTULOSA*)
 2% JOE PYE WEED (*EUPATORIUM FISTULOSUM*)
 2% SPOTTED JOE PYE WEED (*EUPATORIUM MACULATUM*)
 2% TALL WHITE BEARD TONGUE (*PENSTEMON DIGITALIS*)
 2% COMMON MILKWEED (*ASCLEPIAS SYRIACA*)
 2% SOFT RUSH (*JUNCUS EFFUSUS*)
 2% BONESET (*EUPATORIUM PERFOLIATUM*)
 1% BLUE FALSE INDIGO (*BAPTISIA AUSTRALIS*)
 1% COMMON SNEEZEWEED (*HELENIUM AUTUMNALE*)
 1% GIANT IRONWEED (*VERNONIA GIGANTEA*)

NOT TO SCALE

MASON LAND DEVELOPMENT <hr/> APPROVED	GEORGE MASON UNIVERSITY TYPICAL PERMANENT CHECK DAM	DETAIL NO: LD-035
<hr/> 12-3-12 DATE		Sheet No: 2 of 2

APPENDIX C:

Specifications

APPENDIX C.1: PLANTING SOILS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Preparing and reshaping subgrade into planting subsoil.
 - 2. Amending and spreading existing soils.
 - 3. Importing and spreading soils.
 - 4. Edging to landscape soil areas.
 - 5. Finish grading.
 - 6. Landscape soil reinforcing/stabilizing.
 - 7. Landscape soil erosion control.
 - 8. Inorganic mulching.

1.3 REFERENCED STANDARDS

- A. American Society for Testing and Materials:
 - 1. ASTM C136-84a - Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 2. ASTM D422-63 (1972) - Method for Particle Size Analysis of Soils
 - 3. ASTM D2607-69 - Classification of Peats, Mosses, Humus, and Related Products.
 - 4. ASTM D2974-84 - Test Method for Moisture, Ash, and Organic Matter of Peat Materials.
 - 5. ASTM D2976-71 (1981) - Test Method for pH of Peat Materials.
 - 6. ASTM D5268-92 - Standard Specification for Topsoil Used for Landscaping Purposes.
- B. United States Department of Agriculture:
 - 1. USDA Soil Particle Size & Texture Classes.
- C. Association of Official Agricultural Chemists:
 - 1. AOAC Standards.

1.4 DEFINITIONS

- A. Finish Grade: Elevation of finished surface.
- B. Planting Topsoil: Proposed upper horizon of soil in planting areas that may or may not contain a large proportion of Topsoil. If conforming, sources may include existing topsoil

un-amended or amended, imported topsoil amended or un-amended and manufactured and/or imported soil mixes amended or un-amended. Planting Topsoil shall consist of the same base material as the Planting Subsoil except with additional organic matter worked into it.

- C. Planting Subsoil: Proposed lower horizon of soil in planting areas between the Planting Topsoil and the Subgrade. If conforming, sources can include existing subsoil un-amended or amended; existing subgrade un-amended or amended, manufactured and/or imported subsoil amended.
- D. Planting Soils: Proposed Planting Soil profile made up of amended Subgrade, Planting Subsoil, Planting Topsoil and Mulch layer.
- E. Topsoil: Surface 'A' horizon from natural or cultivated surface profile (not including bogs or wetlands) containing organic matter, sand, silt, and clay particles. It shall be friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil. It shall be free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of weeds, roots, and other deleterious materials. Percentage by mass and pH shall meet ASTM D5268-92 specification (table 1).
- F. Subsoil: Lower 'B' horizon from a natural or cultivated soil profile (not including bogs or wetlands) containing less organic matter than overlying topsoil.
- G. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below sub-base, drainage fill, or topsoil materials. Subgrade resulting from
Earthworks may or may not be suitable for plant growth and shall be amended.

1.5 SYSTEM DESCRIPTION

- A. Design Requirement: Test, adapt and refine Planting Soil mix design to suit the performance requirements, locally available materials, project site conditions, mock up performance and the Mason LD's review. Mix design includes but is not limited to the proportion of components, amendment types and their application rates.
- B. Performance Requirement: Be responsible for all means, techniques and methods to achieve the soil characteristics specified.

1.6 SUBMITTALS

- A. Suppliers and Subcontractors: Submit written particulars of all proposed suppliers before ordering of materials.

- B. Supply Difficulties: Notify University immediately if any supply difficulties are encountered. No extension of time will be granted if any material or product is not available because of late ordering.
- C. Alternatives: Submit list of proposed alternative materials within 14 days of contract award. Alternatives shall not be permissible after this time.
- D. Product Data: For manufactured products submit data sheets with samples.
- E. Qualifications: Submit qualifications of proposed testing laboratory for approval before sampling.
- F. Samples for Verification: For each of the following:
 - 1. 5 lb (2.2 kg) of each type of proposed Planting Soil required, in labeled plastic bags showing sample name, location and date. Submit at least 28 days prior to ordering or processing. Submit only samples that conform as evidenced by the Soil Reports.
 - 2. 5 lb (2.2 kg) of mulch for each color and texture required, in labeled plastic bags.
 - 3. Edging materials and accessories, of manufacturer's standard size, to verify color selected.
- G. Source Quality Control - Soils Report:
 - 1. Planting Subsoil & Planting Topsoil - For each proposed type, submit Soils Report describing all components, composition, amendments, test results, analysis, trial results and interpretations and source location at least 28 days prior to ordering or processing.
- H. Field Quality Control - Soils Report:
 - 1. Amended Subgrade - For each type, submit test results at least 14 days prior to planting.
 - 2. Planting Soils - For each placed type, submit test results showing compliance of soils after the first area is planted but before soil is spread in remaining areas.
- I. Approval by Mason LD of submitted product data, samples, test reports, and certificates, shall not constitute final acceptance.

1.7 QUALITY ASSURANCE

- A. Soil-Testing Laboratory Qualifications: Laboratory shall be an approved independent laboratory, recognized by the local State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed. Provide the laboratory with representative samples and a copy of the Contract Document Planting Plans, Schedules and Specifications. Test, analyze and interpret in accordance with current AOAC standards.
- B. Soil Reports: As a minimum include the following in each Soil Report;

1. Sampling: Methods used to achieve a true representation of soil variability.
 2. Soil Analysis: Test for the specified characteristics. USDA Texture shall be tested to ASTM D 422-63 and presented in graph form. Continue to sample and retest until each proposed soil type conforms to the specified characteristics. Contractor to pay for all such testing.
 3. All topsoil shall be tested by a recognized laboratory for the following criteria:
 - a. Organic matter content shall be not less than 1.5% by weight.
 - b. pH range shall be from 6.0-7.5. If pH is less than 6.0, lime shall be added in accordance with soil test results or in accordance with the recommendations of the vegetative establishment practice being used.
 - c. Soluble salts shall not exceed 500 ppm.
 - d. If additional off-site topsoil is needed, it must meet the standards stated above.
 4. Interpretation: Report on suitability of each proposed soil type for growing plants indicated on the Plant Schedule and propose recommended quantities of amendments to be added to produce conforming soils. Substantiate with data and/or research any proposed alternatives.
 5. Liming: Where the pH of the subsoil is 6.0 or less, or the soil is composed of heavy clays, agricultural limestone shall be spread in accordance with the soil test or the vegetative establishment practice being used.
 6. Bonding: After the areas to be topsoiled have been brought to grade, and immediately prior to dumping and spreading the topsoil, the subgrade shall be loosened by discing or scarifying to a depth of at least 2 inches to ensure bonding of the topsoil and subsoil.
- C. Amendment Trial: If amendments or modifications are proposed to soils, perform trials and retest to show conformance prior to finalizing Soil Reports. Undertake trial amendments or modifications with same methods, techniques and/or equipment as proposed for execution.
1. Minimum Trial volume for each soil type – 5 cubic yards.
 2. Perform amendment trials for both soils stored offsite and on-site soils.
- D. Independent Tests: MASON reserves to right to have soil tested independently at the MASON's cost.
- E. Shop Drawings: Submit calculations, site layout drawings and anchoring details of Cellular Confinement System in accordance with Manufacturer's written recommendations specific to the project application.
- F. Field Observation: Give not less than 10 working days' notice so that field observations may be made of the following:
1. Prepared Planting Subsoil prior to spreading Planting Topsoil.
 2. Fine grading operations.

- G. Surveyor Qualifications: An independent licensed surveyor, acceptable to authorities having jurisdiction and experienced in ground surveys.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Prevent spillage when hauling on or adjacent to University's property. In the event that spillage occurs, remove all spillage and sweep, wash, or otherwise clean such streets or open areas as required by State Authorities.
- B. Take precautions to prevent a dust nuisance to adjacent public or private properties and to prevent erosion and transportation of soil to downstream or adjacent properties due to work under this Contract. At project site exit, clean dirt from tires. Do not track dirt out of construction area.
- C. Prior to delivery, propose suitable stockpile locations. Stockpile to a 6-foot high maximum and protect from traffic, wind and water erosion. Provide temporary seeding and/or erosion control measures as approved by the Mason LD. Topsoil shall be stockpiled in such a manner that natural drainage is not obstructed and no off-site sediment damage shall result. Stabilize or protect stockpiles in accordance with MS #2. Perimeter controls must be placed around the stockpile immediately; seeding of stockpiles shall be completed within 7 days of the formation of the stockpile, in accordance with Std. & Spec. 3.31, TEMPORARY SEEDING if it is to remain dormant for longer than 30 days (refer to MS #1 and MS #2).
- D. Protect inorganic mulch from contamination by foreign materials. Isolate stockpiles to prevent mixing of different aggregate grades. Prevent contamination by organic materials.
- E. Use quality control sampling and testing to ensure that delivered materials match the approved samples/mockups and the specified criteria.
- F. Before Planting Soils are redistributed from stockpiles, ensure a uniform mix of soils, free of subgrade lenses and other irregularities.

1.9 PROJECT CONDITIONS

- A. Existing Soil Tests: Soil testing (geotechnical) for design purposes has been prepared for the University. This information is not intended as a representation, or to warranty the continuity, of such conditions between soil tests. The University shall not be responsible for interpretations or conclusions drawn therefrom. The data is made available only for information and not for construction. Make any additional tests and other exploratory operations at no cost to the University.
- B. Existing Soil Volumes: The University may have existing soil that may be suitable for reuse. The University shall not be responsible for interpretations or conclusions drawn concerning the actual volume of conforming soil that may be recovered nor the volume of

actual unsuitable material remaining. Make any additional tests and other exploratory operations at no cost to the University.

1.10 SEQUENCING

- A. Coordination with Utilities: Ensure the works are staged and sequenced to:
 - 1. Minimize tracking of equipment and compaction of planting areas. Compacted soil must be reworked to comply with specifications.
 - 2. Prevent mixing, contamination or reversing soil profile from utility excavations and back filling. Repair any disturbance to the soil layers after placing to comply with the specified requirements.
- B. Slopes Steeper than 1 in 3:
 - 1. Complete all work on slopes (irrigation pipes, soil, erosion control etc.) before surrounding flatter areas are prepared for Planting Soil.

1.11 COORDINATION

- A. Coordinating stockpiles: Be responsible for any necessary temporary storage and staging of soil works including relocating stockpiles to accommodate the scheduling of other work.

PART 2 – PRODUCTS

2.1 PLANTING SOILS GENERALLY

- A. Allowed Sources:
 - 1. Reuse existing soils stockpiled on-site. Verify suitability of stockpiled soil to produce Planting Soil Profile including but not limited to amendments, raking and/or screening.
 - 2. Supplement with imported or manufactured soils from off-site sources when quantities are insufficient.
 - 3. Import soil or manufactured soil from off-site sources.
 - 4. Amend existing in-place soils to produce Planting Soils. Verify suitability of stockpiled soil to produce Planting Soil including but not limited to amendments, raking and/or screening.
- B. Disallowed Sources:
 - 1. Do not use soil from USDA Classified Prime Farmland.
- C. Blending and Batching: Ensure Planting Soil has uniform color and texture for each vegetation type and blend materials uniformly and thoroughly incorporate soil amendments to assure uniform distribution. For each soil type, use only a single supply source for the entire quantity required.
- D. All planting soils shall be free from gravel and debris.

2.2 AMENDED SUBGRADE

A. Amended Subgrade Characteristics: As applicable, amended subgrade shall conform to the following characteristics.

Property	Unit	Amended Subgrade
Physical		
Bulk density – moist	lb/ft ³ (kg/m ³)	< (1600)
Organic content - dry	%mass	1 - 2
Solid materials size	inch(mm)	< 4 (100)
Solid materials content	% Vol	< 20
Infiltration	inch/hr.	1 to 3
Chemical		
pH	CaCl ₂	5-6.5
EC	dS/m	< 2
Toxins		
Oil	No visual evidence in top 6 inches	

Property	Unit	Common to each horizon	Type 1 Planting Subsoil	Type 1 Planting Topsoil
Physical				
Texture by particle size distribution analysis	USDA		sandy loam	Loam to sandy loam
Air filled porosity	%Vol		5 - 25	10 - 25
Bulk density - dry	lb/ft ³ (kg/m ³)	NA		
Bulk density - moist	lb/ft ³ (kg/m ³)	<90 (1440)		
Organic content - dry	%mass		1 - 2	4 - 5
Solid materials size	inch(mm)	< 0.5 (13)		
Solid materials content	%Vol	< 5		
Water stable aggregation	%	>30		
Infiltration	inch/hr	1 to 3		
Temperature	°C	NA		
Chemical				
pH	CaCl ₂	5-6.5		
EC	dS/m	< 2		
Cg / Mg	ratio	3 to 6		
CEC cation exch. Capacity	meq%	5 to 20		
ESP exch. Sodium	%	< 5		
SAR	ratio	< 6		
N nitrogen as ammonium	ppm	6 to 24		
N nitrogen as nitrate	ppm	30 to 100		
P phosphorus	ppm	3 to 18		
K potassium	ppm	25 to 110		
S sulphur	ppm	< 200		
Cu copper	ppm	0.4 to 6		
Zn zinc	ppm	0.3 to 10		
Mn manganese	ppm	3 to 15		
Fe iron	ppm	3 to 20		
B boron	ppm	0.3 to 1		
Odor		no strong odor		
Toxins				
Heavy metals & toxins	ppm	< EPA & Local State acceptable levels		
Biological				
Micro organisms other than parasitic nematodes		present		
Mycorrhiza fungi		present		
Fungal diseases		absent		
Weed viable reproductive parts		absent		

Planting Soil component proportions by volume:

1. For Broadleaves
 - a. 40% Existing subsoil
 - b. 45% Imported topsoil & sand
 - c. 15% Organic amendment
2. For Conifers
 - a. 10% Existing subsoil
 - b. 65% Imported topsoil & sand
 - c. 25% Organic amendment
3. For Grass Areas
 - a. 1 inch compost missed homogenously into top 6 inches of subsoil on site.

B. Planting Soil component proportions by volume:

1. Topsoil 40%
2. Sand 10%
3. Peat 20%
4. Compost 10%

5. Wood Derivatives 20%
 6. To each cubic yard of mix add:
 - a. Amendments as required by the Soils Report.
- C. Planting Soil component proportions by volume:
1. For Planting Subsoil
 - a. 100% Imported Topsoil or Subsoil
 2. For Planting Topsoil
 - a. 90% minimum Planting Subsoil amended with,
 - b. 10% maximum composted organic matter,
 - c. Other amendments to suit species as identified in the Soils Report.

- A. Planting Soil Characteristics Placed Planting Soils shall conform to the following characteristics.

Property	Unit	Common to each horizon	Type 2 Planting Subsoil	Type 2 Planting Topsoil
Physical				
Texture by particle size USDA distribution analysis			Medium loamy sand	Coarse loamy sand
Air filled porosity	%Vol	10 - 25		
Bulk density - dry	lb/ft ³ (kg/m ³)	NA		
Bulk density - moist	lb/ft ³ (kg/m ³)	<90 (1440)		
Organic content - dry	%mass		0 - 1	4 - 5
Solid materials size	inch(mm)	< 0.5 (13)		
Solid materials content	%Vol	< 5		
Water stable aggregation	%	>30		
Infiltration	inch/hr	1 to 3		
Temperature	°C	NA		
Chemical				
pH	CaCl ₂	5-6.5		
EC	dS/m	< 2		
Cg / Mg	ratio	3 to 6		
CEC cation exch. Capacity	meq%	5 to 20		
ESP exch. Sodium	%	< 5		
SAR	ratio	< 6		
N nitrogen as ammonium	ppm	6 to 24		
N nitrogen as nitrate	ppm	30 to 100		
P phosphorus	ppm	3 to 18		
K potassium	ppm	25 to 110		
S sulphur	ppm	< 200		
Cu copper	ppm	0.4 to 6		
Zn zinc	ppm	0.3 to 10		
Mn manganese	ppm	3 to 15		
Fe iron	ppm	3 to 20		
B boron	ppm	0.3 to 1		
Odor		no strong odor		
Toxins				
Heavy metals & toxins	ppm	< EPA & Local State acceptable levels		
Biological				
Micro organisms other than parasitic nematodes		present		
Mycorrhiza fungi		present		
Fungal diseases		absent		
Weed viable reproductive parts		absent		

- B. Component proportions by volume:
- For Planting Subsoil: 100% Imported Topsoil or sand/topsoil mix.
 - For Planting Topsoil
 - 90% minimum Planting Subsoil amended with
 - 10% maximum composted organic matter,
 - Other amendments to suit species as identified in the Soils Report.

2.5 PLANTING SOILS TYPE 3 – SHRUB & GROUND COVER AREAS

- A. Planting Soil Characteristics: Placed Planting Soils shall conform to the following characteristics.

Property	Unit	Common to each horizon	Type 3 Planting Subsoil	Type 3 Planting Topsoil
Physical				
Texture by particle size USDA distribution analysis			Silt loam to fine sandy loam	Silt loam to fine sandy loam
Air filled porosity	%Vol	5 - 25		
Bulk density - dry	b/ft3 (kg/m3)	NA		
Bulk density - moist	lb/ft3 (kg/m3)	<90 (1440)		
Organic content - dry	%mass		0 - 1	10 - 15
Solid materials size	inch(mm)	< 1 (25)		
Solid materials content	%Vol	< 5		
Water stable aggregation	%	>30		
Infiltration	inch/hr	1 to 3		
Temperature	°C	NA		
Chemical				
pH	CaCl ₂	5-6.5		
EC	dS/m	< 2		
Cg / Mg	ratio	3 to 6		
CEC cation exch. Capacity	meq%	5 to 20		
ESP exch. Sodium	%	< 5		
SAR	ratio	< 6		
N nitrogen as ammonium	ppm	6 to 24		
N nitrogen as nitrate	ppm	30 to 100		
P phosphorus	ppm	3 to 18		
K potassium	ppm	25 to 110		
S sulphur	ppm	< 200		
Cu copper	ppm	0.4 to 6		
Zn zinc	ppm	0.3 to 10		
Mn manganese	ppm	3 to 15		
Fe iron	ppm	3 to 20		
B boron	ppm	0.3 to 1		
Odor		no strong odor		
Toxins				
Heavy metals & toxins	ppm	< EPA & Local State acceptable levels		
Biological				
Micro organisms other than parasitic nematodes		present		
Mycorrhiza fungi		present		
Fungal diseases		absent		
Weed viable reproductive parts		absent		

- B. Planting Soil component proportions by volume:
1. For Planting Subsoil: 100% Imported Topsoil
 2. For Planting Topsoil
 - a. 80% minimum Planting Subsoil amended with,
 - b. 20% maximum composted organic matter,
 - c. Other amendments to suit species as identified in the Soils Report.

2.6 PLANTING SOILS TYPE 4 – UNDER PAVING USE

- A Planting Soil Characteristics: Placed Planting Soils shall conform to the following characteristics.

Property	Unit	Common to each horizon	Type 4 Planting Subsoil	Type 4 Planting Topsoil
Physical				
Texture by particle size distribution analysis	USDA		Very coarse to coarse loamy sand	Gravel #2
Air filled porosity	%Vol		5 - 25	25 plus
Bulk density - dry	lb/ft ³ (kg/m ³)		<67 (1072)	
Bulk density - moist	lb/ft ³ (kg/m ³)		<90 (1440)	NA
Organic content - dry	%mass		2 - 3	
Solid materials size	inch(mm)	< 1 (25)		
Solid materials content	%Vol	< 5		
Water stable aggregation	%	>30		
Infiltration	inch/hr	2 to 3		
Temperature	°C	NA		
Chemical				
pH	CaCl ₂	5-6.5		
EC	dS/m	< 2		
Cg / Mg	ratio	3 to 6		
CEC cation exch. Capacity	meq%	5 to 20		
ESP exch. Sodium	%	< 5		
SAR	ratio	< 6		
N nitrogen as ammonium	ppm	6 to 24		
N nitrogen as nitrate	ppm	30 to 100		
P phosphorus	ppm	3 to 18		
K potassium	ppm	25 to 110		
S sulphur	ppm	< 200		
Cu copper	ppm	0.4 to 6		
Zn zinc	ppm	0.3 to 10		
Mn manganese	ppm	3 to 15		
Fe iron	ppm	3 to 20		
B boron	ppm	0.3 to 1		
Odor		no strong odor		
Toxins				
Heavy metals & toxins	ppm	< EPA & Local State acceptable levels		
Biological				
Micro organisms other than parasitic nematodes		present		
Mycorrhiza fungi		present		
Fungal diseases		absent		
Weed viable reproductive parts		absent		

- B Planting Soil component proportions by volume:
1. For Planting Subsoil
 - a. 94% Imported Sands amended with,
 - b. 6% stable peat,
 - c. Other amendments to suit species as identified in the Soils Report.
 2. For Planting Topsoil
 - a. 100% imported clean-washed neutral pH gravel #2.

2.7 PLANTING SOILS TYPE 5 – LIGHTWEIGHT

- A. Planting Soil Characteristics: Placed Planting Soils shall conform to the following characteristics.

Property	Unit	Common to each horizon	Type 5 Planting Subsoil	Type 5 Planting Topsoil
Physical				
Texture by particle size USDA distribution analysis			sand	Loamy sand
Air filled porosity	%Vol	10 - 25		
Bulk density - dry	lb/ft ³ (kg/m ³)	<67 (1072)		
Bulk density - moist	lb/ft ³ (kg/m ³)	<90 (1440)		
Organic content - dry	%mass		4 - 6	10 - 20
Solid materials size	inch(mm)	< 0.5 (13)		
Solid materials content	%Vol	< 5		
Water stable aggregation	%	>30		
Infiltration	inch/hr	2 to 3		
Temperature	°C	< 40		
Chemical				
pH	CaCl ₂	5-6.5		
EC	dS/m	< 2		
Cg / Mg	ratio	3 to 6		
CEC cation exch. Capacity	meq%	5 to 20		
ESP exch. Sodium	%	< 5		
SAR	ratio	< 6		
N nitrogen as ammonium	ppm	6 to 24		
N nitrogen as nitrate	ppm	30 to 100		
P phosphorus	ppm	3 to 18		
K potassium	ppm	25 to 110		
S sulphur	ppm	< 200		
Cu copper	ppm	0.4 to 6		
Zn zinc	ppm	0.3 to 10		
Mn manganese	ppm	3 to 15		
Fe iron	ppm	3 to 20		
B boron	ppm	0.3 to 1		
Odor		no strong odor		
Toxins				
Heavy metals & toxins	ppm	< EPA & Local State acceptable levels		
Biological				
Micro organisms other than parasitic nematodes		present		
Mycorrhiza fungi		present		
Fungal diseases		absent		
Weed viable reproductive parts		absent		

B. Planting Soil component proportions by volume

1. fine sand 40%
2. fir bark 20%
3. perlite 30%
4. peat moss 10%
5. To each cubic yard add:
 - a. Amendments as required by the Soils Report.
6. Void Filler: high-density polystyrene blocks with a minimum compressive strength of 60 pounds per square inch.
7. Maximum weight: 90 pounds per cubic foot when saturated with water.

C. Planting Topsoil mix proportions by volume:

1. Expanded clay/shale 45%

2. Gap graded sand 45%
3. Pine bark 10%
4. To each cubic yard add:
 - a. Other amendments as required by the Soils Report.
5. Void Filler: high-density polystyrene blocks with a minimum compressive strength of 60 pounds per square inch.
6. Maximum weight: 90 pounds per cubic foot when saturated with water.

2.8 INORGANIC PLANTING SOIL AMENDMENTS

- A. Amendments: Use amendments to make the soil conform to the specified requirements. Use amendment types as recommended by the Soils Report.
- B. Lime: ASTM C 602, agricultural limestone containing a minimum 85 percent calcium carbonate equivalent and as follows:
 1. Class: Class T, with a minimum 99 percent passing through No. 8 (2.36-mm) sieve and a minimum 75 percent passing through No. 60 (0.25-mm) sieve.
 2. Provide lime in form of dolomitic limestone.
- C. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through No. 6 (3.35-mm) sieve and a maximum 10 percent passing through No. 40 (0.425-mm) sieve.
- D. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- E. Aluminum Sulfate: Commercial grade, unadulterated.
- F. Perlite: Horticultural perlite, soil amendment grade. Handle to avoid breaking or crushing particles.
- G. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.
- H. Sand: Clean, washed, sharp, natural or manufactured, free of toxic materials. The saturation extract conductivity shall not exceed 3.0 millimhos/cm. The concentration of boron in the saturation extract shall not exceed 1.0 ppm. The sodium adsorption ratio (SAR) as calculated from analysis of the saturation extract shall not exceed 6.0.
 1. Percent Passing Sieve Size
 - a. 100 4.76mm (#4,4mesh)
 - b. 95 – 100 1.00mm (#18,16mesh)
 - c. 65 – 100 500 micron (#35, 32mesh)
 - d. 0 – 10 53 micron (#270,270mesh)

- I. Gravel: Clean, washed, sharp, natural or manufactured, free of toxic materials. #2 size from granite or sandstone parent material not limestone or marble.
- J. Diatomaceous Earth: Calcined, diatomaceous earth, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- K. Expanded Shale: Chemically inert, neutral pH, 1/6 inch to 1/2 inch.
- L. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.
- M. Water: Clean, fresh and free from harmful materials. If the University's potable water supply is used, meter and pay for quantity used by the Contractor.

2.9 ORGANIC SOIL AMENDMENTS

- A. Amendments: Use amendments to make the soil conform to the specified requirements. Use amendment types as recommended by the Soils Report. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch (13-mm) sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plants; and as follows:
 - 1. Organic Matter Content: 50 to 60 percent of dry weight.
 - 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; source separated or compostable mixed solid waste.
 - 3. Carbon/Nitrogen Ratio: less than 25:1.
 - 4. EPA Grade A.
- B. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.
- C. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.
 - 1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with at least 0.15 lb (2.4 kg) of ammonium nitrate or 0.25 lb of ammonium sulfate per cubic foot of loose sawdust or ground bark.
 - 2. Damp composted for at least 12 weeks prior to use.
 - 3. The saturation extract conductivity shall not exceed 3.0 millimhos/cm at 25oC.
- D. Manure: Well-rotted, unbleached, stable or cattle manure containing not more than 15 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances,

stones, sticks, soil, weed seed, and material harmful to plant growth. Age manure between one and two years before use.

1. Milorganite or other human-derived manure products not allowed.

2.10 FERTILIZER

- A. Fertilizer application shall conform to the University's current approved Nutrient Management Plan.
- B. Bone meal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 20 percent phosphoric acid.
- C. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- D. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of
fast- and slow-release nitrogen, 50 percent

2.11 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing agency to perform quality control testing.
- B. Sampling: Visually inspect soils on the surface and in core holes and take samples to reflect the maximum range of variability in each type of soil from each source.
 1. Random sampling is not permitted.
 2. Composite sampling is only permitted if soil source has undergone mixing during stockpiling.
 3. Take a large enough sample for each different test required.
- C. Test for specified characteristics of each soil type from each source.
- D. If testing agency reports that soils have not achieved specified requirements rework and retest until specified characteristics are obtained. Proceed with subsequent soil work only after test results for previously completed work comply with requirements.

2.12 LANDSCAPE SOIL REINFORCING

- A. Non-degradable Cellular Confinement System: UV stabilized black PE cells
 1. Requirement: 6 inches deep and larger than 16 inches wide with perforated walls. Provide necessary data for manufacturer to recommend appropriate anchoring materials and installation methods.
 2. Manufacturer: Subject to compliance with requirements, provide products by one of the following:

- a. Presto Geosystems: Geoweb Cellular Confinement System, www.prestogeo.com.
 - b. Nilex Geo-Cel Cellular Confinement System, www.nilex.com.
- B. Non-degradable Mat System: Black nylon three-dimensional geo-matrix of fused filaments creating an open mat.
1. Requirement: Minimum thickness of 0.75 inches. Provide necessary data for Manufacturer to recommend appropriate anchoring materials and installation methods.
 2. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
 - a. Akzo Industrial Systems -“Enkamat 7020”.
 - b. Or equivalent, as accepted by University.
- C. Non-degradable Cellular Paver Systems: UV stabilized Green recycled HDPE cellular paver blocks with minimum thickness of 1 ¼ inches.
1. Requirement: Minimum strength of 61,000 lbs per sf 27,700 kgs/0.09m². Provide necessary data for Manufacturer to recommend appropriate anchoring materials and installation methods.
 2. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
 - a. Barton Corporation -“Grassroad Pavers Plus”.
 - b. Landscape Products Company - “Grass-Cel”.
 - c. Invisible Structures Inc. – “Grass-Pave2”.
 - d. Or equivalent, as accepted by University.
- D. Non-degradable Fiber Reinforcing Systems:
1. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
 - a. Turfgrids Root Zone Mix polypropylene fibers, as manufactured by Stabilizer Inc., 2218 Magnolia Street, Phoenix, AZ 85034, (800) 336-2468.
 - b. Netlon – “Relexmesh”.
 - c. Or equivalent, as accepted by University.
- E. Non-degradable Mesh Reinforcing Systems:
1. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
 - a. Tensar – “Geogrid BX1100”.
 - b. Or equivalent, as accepted by University.

2.13 CRUSHED STONE MULCH

- A. Crushed Stone: Decomposed granite or crushed granite aggregate less than. inch free from clay lumps, organic matter, and deleterious material.
1. Color: As selected by University from Supplier’s full range (sample to be provided by Contractor).

- B. Suppliers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Texas Architectural Aggregate, Inc.
 - 2. Fister Quarries Group Inc.
 - 3. Or equivalent, as accepted by University.
- C. Use only a single supply source for the entire quantity required.
- D. Screening shall be clean, hard, durable particles of fragments of select granite. Fines shall be evenly mixed throughout the aggregate. When produced from gravel, 50 percent, by weight, of the material retained on a No.4 sieve shall have one fractured face.
- E. The portion retained on the No.4 sieve shall have a maximum percentage of wear of 50 at 500 revolutions as determined by AASHTO T96-77. The portion passing a No. 4 sieve shall have a maximum liquid limit of 25 and a maximum plasticity index of 7, as determined by AASHTO T89-81, respectively.
- F. Grading requirements:

Percentage of Weight Passing a Square Mesh Sieve
AASHTO T11-82 and T27-82

<u>Sieve Designations</u>	<u>Passing Percent</u>	<u>Sieve Designation</u>	<u>Passing Percent</u>
No. 4	95 – 100%	No. 50	25 – 35%
No. 8	75 - 90%	No. 100	20 – 25%
No. 16	55 - 65%	No. 200	10 – 15%
No. 30	40 - 50%		

- 1. Before topsoiling, establish needed erosion and sediment control practices such as diversions, grade stabilization structures, berms, dikes, level spreaders, waterways, sediment basins, etc. These practices must be maintained during topsoiling.
- 2. Grading: Previously established grades on the areas to be topsoiled shall be maintained according to the approved plan.

2.14 LANDSCAPE EDGES

- A. Steel Edging: Standard commercial-steel edging, rolled edge, fabricated in sections of standard lengths, with loops stamped from or welded to face of sections to receive stakes.
 - 1. Edging Size: 1/4 inch (6.4 mm) wide by 5 inches (125 mm) deep
 - 2. Stakes: Tapered steel, a minimum of 15 inches (380 mm) long.
 - 3. Accessories: Standard tapered ends, corners, and splicers.
 - 4. Finish: Zinc coated
 - 5. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Border Concepts, Inc.
 - b. Collier Metal Specialties, Inc.
 - c. Russell, J. D. Company (The).

- d. Ryerson Tull, Inc.
- e. Or equivalent, as accepted by University.

2.15 EROSION CONTROL FABRIC

A. Temporary Turf Reinforcement Mat (TRM)

1. North American Green DS75 or approved equivalent, FHWA Type 1.C, ultra-short term single-net erosion control blanket
 - a. Longevity: 45-days
 - b. Matrix: 100% straw fiber (0.50-lb/yd²)
 - c. Netting: top side only, lightweight photodegradable with photo-accelerators, minimum netting weight 1.50-lb/1000-ft²
 - d. Thread: degradable
2. North American Green DS150 or approved equivalent, FHWA Type 1.D, ultra-short term double-net erosion control blanket
 - a. Longevity: 2-months
 - b. Matrix: 100% straw fiber (0.50-lb/yd²)
 - c. Netting: both sides, lightweight photodegradable with photo-accelerators, minimum netting weight 1.50-lb/1000-ft².
 - d. Thread: degradable.
3. North American Green S75 or approved equivalent, FHWA Type 2.C, short-term singlenet erosion control blanket and open weave textile.
 - a. Longevity: 12-months
 - b. Matrix: 100% straw fiber (0.50-lb/yd²)
 - c. Netting: top side only, lightweight photodegradable, minimum netting weight 1.50-lb/1000-ft²
 - d. Thread: degradable
4. North American Green S150, S150BN, or approved equivalent, FHWA Type 2.D, shortterm double-net erosion control blanket.
 - a. Longevity: 12-months
 - b. Matrix: 100% straw fiber (0.50-lb/yd²)
 - c. Netting:
 1. S150: both sides, lightweight minimum netting weight 1.50-lb/1000-ft²
 2. S150BN: top – leno woven 100% biodegradable organic jute fiber, minimum netting weight 9.30-lb/1000-ft², bottom - 100% biodegradable organic jute fiber, minimum netting weight 7.70-lb/1000-ft².
 - d. Thread:
 1. S150: degradable
 2. S150BN: biodegradable
5. North American Green SC150, SC150BN, or approved equivalent, FHWA Type 3.B, extended term double-net erosion control blanket and open weave textile
 - a. Longevity: 24-months (SC150), 18-months (SC150BN)

- b. Matrix: 70% straw fiber (0.35-lb/yd²), 30% coconut fiber (0.15-lb/yd²)
 - c. Netting:
 - 1. SC150: top side heavyweight photodegradable with UV additives, 3.00-lb/1000-ft², bottom side – lightweight photodegradable, minimum netting weight 1.50-lb/1000-yd
 - 2. SC150BN: top – leno woven 100% biodegradable organic jute fiber, minimum netting weight 9.30-lb/1000-ft², bottom - 100% biodegradable organic jute fiber, minimum netting weight 7.70-lb/1000-ft².
 - d. Thread:
 - 1. S150: degradable
 - 2. S150BN: biodegradable
6. North American Green C125, C125BN, or approved equivalent, FHWA Type 4, long term double-net erosion control blanket or open weave textile
- a. Longevity: 36-months (C125), 24-months (C125BN)
 - b. Matrix: 100% coconut fiber, 0.50-lb/yd².
 - c. Netting:
 - 1. C125: both sides, heavyweight UV stabilized approximate netting weight 3.00-lb/1000-ft².
 - 2. C125BN: top – leno woven 100% biodegradable organic jute fiber, minimum netting weight 9.30-lb/1000-ft², bottom - 100% biodegradable organic jute fiber, minimum netting weight 7.70-lb/1000-ft².
 - d. Thread:
 - 1. C125: 100% black polypropylene
 - 2. C125BN: Biodegradable

B. Semi-Permanent

- 1. Biodegradable woven fabric.
 - a. Requirements:
 - b. Material: 100% spun coir or jute functional for at least 2 growing seasons.
 - c. Open area: 50% to 65% suitable for seedings after installation.
 - d. Wide width tensile (wet): 38 lbs.
 - e. Elongation at failure (wet): 47%.
 - f. Water Flow Velocity: .8 ft. /sec.
 - g. Application: specifically recommended for use as erosion control on slopes up to 1 in 2 until planting is established.
- 2. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
 - a. North American Green
 - b. Belton Industries Inc. – “Geocoir DeKoWe 400” Coir mat.
 - c. Belton Industries Inc. – “Geocoir DeKoWe 700” Coir mat.
 - d. RoLanka International Inc. – “Jute mat.”
 - e. Or equivalent, as accepted by University.

C. Permanent Turf Reinforcement Mat (TRM)

1. North American Green P300, SC250, C350, P550, or approved equivalent, FHWA Type 5.A/5.B, permanent turf reinforcement mat
 - a. Longevity: NA
 - b. Matrix:
 1. P300: 100% UV stable polypropylene fiber, 0.70-lb/yd²
 2. SC250: 70% straw fiber (0.35-lb/yd²), 30% coconut fiber (0.15-lb/yd²)
 3. C350: 100% coconut fiber, 0.50-lb/yd²
 4. P550: 100% UV stable polypropylene fiber, 0.50-lb/yd²
 - c. Netting:
 1. P300: top side – heavyweight UV stabilized, netting weight 5.00-lb/1000-ft², bottom side - heavyweight UV stabilized, netting weight 3.00-lb/1000-ft²
 2. SC250: top and bottom – heavy duty UV stabilized polypropylene netting weight 5.00-lb/1000-ft², mid – corrugated ultra-heavy duty UV stabilized polypropylene, netting weight 24-lb/1000-ft²
 3. C350: top and bottom – super heavy duty UV stabilized polypropylene netting weight 8.00-lb/1000-ft², mid – corrugated ultra-heavy duty UV stabilized polypropylene, netting weight 24-lb/1000-ft².
 4. P550: top and bottom – ultra heavy duty UV stabilized polypropylene netting weight 24-lb/1000-ft², mid – corrugated ultra-heavy duty UV stabilized polypropylene, netting weight 24-lb/1000-ft².
 - d. Thread:
 1. P300: 100% Black Polypropylene
 2. SC250, C350, P550: UV Stabilized polypropylene

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Existing conditions: Before starting work, examine related work and surfaces. Verify that Earthwork rough grading has resulted in the conforming subgrades with in specified tolerances.
- B. Weather Limitations: Proceed with soil works when existing and forecasted weather conditions permit.
- C. Moisture Content: Do not work when moisture content is so great that excessive compaction will occur, nor when it is so dry that dust will form in air or clods will not break readily. Water, if necessary, to bring soil to moisture content suitable for tilling and spreading. Do not spread if subgrade is frozen, muddy, at optimum moisture content or excessively wet.
- D. The topsoil shall be uniformly distributed to a minimum compacted depth of 2 inches on 3:1 or steeper slopes and 4 inches on flatter slopes. (See Table 3.30-A to determine volume of topsoil required for application to various depths). Any irregularities in the

surface, resulting from topsoiling or other operations, shall be corrected in order to prevent the formation of depressions or water pockets.

- E. It is necessary to compact the topsoil enough to ensure good contact with the underlying soil and to obtain a level seedbed for the establishment of high maintenance turf. However, undue compaction is to be avoided as it increases runoff velocity and volume, and deters seed germination. Special consideration should be given to the types of equipment used to place topsoil in areas to receive fine turf. Avoid unnecessary compaction by heavy machinery whenever possible. In areas which are not going to be mowed, the surface should be left rough in accordance with SURF ACE ROUGHENING (Std. & Spec. 3.29).
- F. Fine grading shall conform with approved grading plan and positively drain in all directions as indicated on the approved plan.

3.2 PREPARATION

- A. Protect utilities, structures, foundations, sidewalks, pavements, other facilities, lawns and plants from damage caused by operations or as a result of operations.
 - 1. Utilities: After locating and marking, verify the status of utilities. Protect or temporarily divert existing utilities to remain active. Rectify immediately any obstruction or damage to utilities to remain active and provide and pay for temporary utilities where repairs are carried out to the satisfaction of the utility owner.
 - 2. Property: Do not interfere with or damage property that is to remain on or adjacent to the site, including adjoining property to the site, and trees. Rectify immediately any interference or damage to such property. Protect finishes from staining.
 - 3. Trees: If the trees are damaged or placed under unnecessary and avoidable stress by the Contractor, the University Representative shall deduct damages from the Contractor's progress claim. In addition, the Contractor shall provide vegetation of like species with cumulative equivalent tree canopy coverage.
 - 4. Irrigation: Install a temporary diversion main, control cable and valves to isolate contract area and to maintain service to areas outside of the contract area.
- B. Provide temporary erosion-control and slope stability measures to prevent erosion, displacement of soils, and discharge of soil-bearing water runoff or airborne dust to adjacent properties and completed work. Provide all stabilization and control measures needed to establish plantings on planted slopes and soils.

3.3 LAYOUT

- A. Lines and Elevations: The visual appearance and acceptable tolerances of the design is critically dependent upon the layout of the works. Include all costs and provide all instruments necessary to set out the works accurately. Establish lines and elevation markers located and laid out by survey instrumentation for all finish grades. Provide additional grade stakes and string lines as required to achieve grades and to enable field

observations by the University. Reinstall markers/stakes as required throughout the works.

- B. Verify: Include all costs and provide all calculations necessary to verify the subgrade, substrate and/or structural set-down elevations from the finish elevations minus thickness of overlying finishes. If any discrepancy is found notify Mason LD before final grading.
- C. Review: Mason LD shall review the field layout and retains the right to direct adjustments to the layout within 2 days. Include costs and allow time to adjust the layout.

3.4 GRADING FIELD ADJUSTMENTS

- A. Field Direction: Mason LD may direct field adjustments to the documented grades including but not limited to,
 - 1. fine grading for ridges, swales, edges, planar slopes,
 - 2. aesthetic shaping,
 - 3. transitioning to existing elements,
 - 4. Adjustments due to the tolerance of the survey.
- B. Include costs and allow time to adjust the fine grading assuming adjustments shall be cut to fill within the project site.

3.5 AMENDING SUBGRADE

- A. Weed control: Eradicate all non-sterile weeds. Ensure weeds are actively growing prior to spraying. Protect non-target species. Do not spray in temperatures over 90 degrees F (32 degrees C), windy conditions nor if rain is forecasted within 6 hours. Wear safety protection when mixing and spraying. Erect warning signs and exclude entry by other personnel. Apply without spray drift or over spray and in strict accordance with manufacturer's directions. Allow weeds to deteriorate approximately one-week prior to any necessary re-treatment. After retreated weeds have died, slash weeds and leave as mulch to be turned into soil. Continue isolated or spot control of any further invasion or germination throughout the course of the work.
- B. Testing: Take representative tests of each homogenous area of subgrade color and texture to be planted and raise the standard of the subgrade by the use of additives and/or aeration as determined by the subsoil tests and recommended by the Soils Report.
- C. Field exploration of the site shall be made to determine if there is sufficient surface soil of good quality to justify stripping. Topsoil shall be friable and loamy (loam, sandy loam, silt loam, sandy clay loam, and clay loam). It shall be free of debris, trash, stumps, rocks, roots, and noxious weeds, and shall give evidence of being able to support healthy vegetation. It shall contain no substance that is potentially toxic to plant growth.

- D. Topsoil operations should not be performed when the soil is wet or frozen. Stripping shall be confined to the immediate construction area. A 4-to 6-inch stripping depth is common, but depth may vary depending on the particular soil. All perimeter dikes, basins, and other sediment controls shall be in place prior to stripping.
- E. Shaping & Trimming: Grade, trim and shape rough grading subgrades from prior earthworks to a depth below finished surface levels as determined by the specified thickness of overlaying materials. Ensure shaping reflects the finish elevations plus or minus the thickness tolerances of the overlaying materials.
- F. Plowing/Ripping: Rip subgrade of planting areas and to a minimum thickness of 6 inches (150 mm). Remove or breakup all materials larger than 2 inches (50 mm) in any dimension, sticks, roots, rubbish, and other extraneous matter and legally dispose of them. All gravel and stone shall be removed from the topsoil prior to vegetation placement.
- G. Deep Plowing/Subsoiling: Ensure utilities are located and moisture content is correct. Space rippers/chisels to loosen 100% of surface on slopes less than 1in3 and 50% of surface on slopes steeper than 1in3 parallel to contours.
- H. Amending: Apply amendments in proportions and amounts recommended by the Soils Report over the loosened subgrade. Mix thoroughly to a depth determined by Soils Report.
- I. Existing Trees: Hand-cultivate less than 2 inches deep within the drip line of existing trees to remain. Cultivate immediately prior to placing the overlying Planting Soil.
- J. Protection: Protect prepared area from re-compaction and crust formation until spreading Planting Topsoil. Repeat ripping for any area re-compacted or eroded. Hydro-mulch with a sterile nurse crop and/or cover with jute mat if subgrade is to be exposed for more than 10 working days.

3.6 PLACING AND SPREADING PLANTING SOILS

- A. Only commence spreading after soils have been tested and shown to conform.
- B. Use equipment and methods that spread loads without over-compacting the Planting Soil profile. Do not use vibratory equipment.
- C. Spread Planting Soils in lifts not exceeding 6 inches to the depths and tolerances shown on the drawings but not less than required to meet finish grades after settlement/consolidation.
- D. Spread Planting Soils evenly throughout areas and rototill or disk-harrow the top of each lift before placing the next lift. Blend different soil types where they adjoin.

- E. On slopes steeper than 1 in 4, place and spread Planting Soils from the bottom up and apply jute matting to promote soil stability.
- F. If Planting Topsoil includes in field amendments rototill before planting.
- G. Apply water as required to induce settlement.
- H. When adequately dry, re-grade or re-screed smooth, adding additional Planting Topsoil as required to meet finished grades and elevations.
- I. Grading between required lines and grades to be smooth, uniform and planar. Slope finish grades to drain surface water away from buildings, and other structures. Slope finish grades to drain with uniform slope between points where elevations are given or between points and existing grades.
- J. Unless otherwise noted, grade intersections of planar slopes to crisp sharp intersections at high point ridges and low point troughs and swales. Do not round off such intersections.
- K. Fine rake until the surface is smooth, friable, and of a uniform fine texture and compaction having no lumps or stones over the specified solid materials size. Screed if necessary to achieve smooth slopes and sharp intersections of planes.
- L. Protect soil from further compaction. Where areas are compacted to more than 85% Proctor, rip to depth of soil, rototill and blade smooth. Restore planting beds if eroded or otherwise disturbed after finish grading and before planting.
- M. Hydroseed with a sterile nurse crop and/or cover with erosion control mat if Planting Topsoil is to be exposed for more than 10 working days.
- N. If possible leave Planting Topsoil fallow and encourage any weeds to germinate before eradicating them.
- O. Top-up Planting Soils if settlement and/or consolidation occur outside the specified tolerances anytime during the contract maintenance period.

3.7 TOLERANCES

- A. Comply with tolerances as follows:
 - 1. Elevation: Plus 1/2 inch (15 mm) or minus 1/2 inch (15 mm).
 - 2. Thickness: Plus 2 inches (50 mm) or minus 0 inch (0 mm).
 - 3. Surface: Gap below 10-foot- (3-m-) long straightedge not to exceed 1 inch (25 mm) in any direction (excluding intersections of planes at ridge & toe lines).

4. Slope: unless otherwise noted on the drawings not less than 1% fall.
5. Settlement: less than 1/4 inch (6 mm) against adjoining pavements, structures and drainage inlets.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing agency to perform quality control testing.
- B. Sampling: Visually inspect soils on the surface and in core holes and take samples to reflect the maximum range of variability in each type of soil from each source.
 1. Composite sampling is only permitted if soil source has undergone mixing during execution.
 2. Take sample of size adequate provide soil for each test required.
- C. Test Type: For in field compliance testing the following definitions apply.
 1. Full Test – All specified characteristics.
 2. Part Test – pH and EC only.
- D. Test for specified characteristics of each soil type from each source at the following locations and frequencies:
 1. One Full Test for every soil type from each source.
 2. At least one Part Test for every 250 cubic yards (192 cubic meters), but in no case fewer than three tests.
- E. When testing agency reports that soils have not achieved specified requirements undertake a Full Test, rework and retest until specified characteristics are obtained.

3.9 PLACING LANDSCAPE SOIL REINFORCING

- A. Seek and comply with manufacturer's written installation guidelines on anchoring, pegging, stapling, joining and overlapping. Such guidelines shall be specific to the Project site and application.

3.10 PLACING EROSION CONTROL FABRIC

- A. Lay loosely on surface to ensure fabric/ground contact. Provide at least 12 inches (300mm) overlap at joints. If not detailed on drawings use dead stout stake to manufacturer's written recommendations.

3.11 PLACING INORGANIC MULCH

- A. Prior to application of mulch remove all grass, weeds, rubbish and other deleterious matter from surface. Mulch may be applied immediately after planting and irrigation piping.

- B. After blending, place on prepared Planting Subsoil, and rake smooth using a steel line rake to desired grade and cross section. Place in two equal thickness lifts to avoid segregation.
- C. Place to thickness of 4 inches (100mm). Do not place mulch against plant stems.
- D. Hand-tamp edges around benches, signposts, etc. Use a lawn roller, to obtain the final desired dense, smooth, uniform texture. Do not use wackers or vibratory rollers.
- E. Take care compacting adjacent to planting and irrigation systems.
- F. Rake and finish surface of mulch to be smooth, uniform, and solid. Dried, compacted material shall be firm all the way through with no “spongy” areas. Loose material shall not be present on the surface until after the first year of use. Tamp or roller marks shall not be present.
- G. Smooth out any significant irregularities prior to Substantial Completion. Smooth by rewetting /saturating rough areas thoroughly, and then rolling again.

3.12 INORGANIC MULCH TOLERANCES

- A. Comply with tolerances as follows:
 - 1. Elevation: 1/4 inch (6 mm).
 - 2. Thickness: Plus or minus 1/4 inch (6 mm).
 - 3. Surface: Gap below 10-foot- (3-m-) long straightedge not to exceed 1/4 inch (6 mm) in any direction.
 - 4. Slope: unless otherwise noted on the Drawings not less than 1% fall.
 - 5. Settlement: less than 1/4 inch (6 mm) against adjoining pavements, structures and drainage inlets.

3.13 EDGING INSTALLATION

- A. Steel Edging: Install steel edging where indicated according to manufacturer's written instructions. Anchor with steel stakes spaced approximately 30 inches (760 mm) apart, driven below top elevation of edging.
- B. Tolerance: Install edges to the following tolerances.
 - 1. Horizontal alignment plus or minus 1/2-inch (13-mm) over 10-foot- (3-m-) long straightedge.
 - 2. Vertical alignment plus or minus 1/2-inch (13-mm) over 10-foot- (3-m-) long straightedge.

3.14 CLEANUP AND PROTECTION

- A. Keep adjacent paving and construction clean and work area in an orderly condition.

APPENDIX C.2: TURF AND GRASSES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. George Mason University (Mason) Design Manual
- C. Virginia Erosion and Sediment Control Handbook (VESCH)

1.2 SUMMARY

A. Section Includes:

- 1. Seeding.
- 2. Hydroseeding
- 3. Sodding

1.3 DEFINITIONS

- A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- D. Mason LD: Mason Land Development
- E. Pesticide: A substance or mixture intended for preventing, destroying, repelling or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

- F. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- G. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizer to produce a soil mixture best for plant growth.
- H. Subgrade: Surface or elevation of subsoil remaining after excavation is complete or top surface of a fill or backfill before planting soil is placed.
- I. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- J. Surface Soil: Soil that is present at the top layer of the existing or pre-developed soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - A. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.
- B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
 - 1. Certification of each seed mixture for turf grass sod. Include identification of source and name and telephone number of supplier.
- C. Qualification Data: For qualified landscape installer.
- D. Product Certificates: For soil amendments and fertilizers, from manufacturer.
- E. Material Test Reports: For all existing imported or manufactured topsoils.

- F. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf during calendar year. Submit before expiration of required initial maintenance periods.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscaper Installer whose work has resulted in successful turf establishment.
 - 1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - 2. Maintenance Proximity: Not more than two hours normal travel time from Installer's place of business to Project site.
- B. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- C. Soil Analysis: Furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the soil.
 - 1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.
 - 2. The soil-testing laboratory shall oversee soil sampling, with depth, location, and number of samples to be taken per instructions from the geotechnical engineer. A minimum of three representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
 - 3. Report suitability of tested soil for turf growth.
 - a. Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. (92.9 sq. m) or volume per cu. yd. (0.76 cu. m) for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
 - b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations or corrective action.

D. Soil Preparation (VESCH)

1. Prior to soil preparation, areas to be seeded, hydroseeded, and/or sodded shall be brought to final grade in accordance with the approved plan.
2. Soil tests will be executed to determine the exact requirements for lime and fertilizer. Soil tests may be conducted by an independent laboratory or university laboratory, recognized by the State Department of Agriculture.
3. Under difficult circumstances where it is not possible to obtain a soil test, the following soil amendments shall be made:
 - a. Pulverized agricultural limestone at 90 lbs. /1000 sq. ft. (2 tons/acre).
 - b. Fertilizer at 25 lbs./1000 sq. ft. (1000 lbs./acre) of 10-10-10 in fall, or 25 lbs./1000 sq. ft. of 5-10-10 in spring.
4. Note: Equivalent nutrients may be applied with other fertilizer formulations.
 - a. These amendments shall be spread evenly over the area to be seeded, hydroseeded, and/or sodded, and incorporated (if possible) into the top 3 to 6 inches of the soil by discing, harrowing or other acceptable means.
5. Any irregularities in the soil surface resulting from top-soiling or other operations shall be filled or leveled in order to prevent the formation of depressions or water pockets.
6. Areas to be topsoiled and topsoil used shall fulfill the requirements of TOPSOILING, Std. & Spec. 3.30. No sod shall be spread on soil which has been treated with soil sterilants or any other toxic herbicides until enough time has elapsed to permit dissipation of toxic materials.

E. Preinstallation Conference: Conduct conference at Project Site <location> with Mason LD.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.
- B. Bulk Materials:
 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.

2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

1.7 PROJECT CONDITIONS

- A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion. Permanent seeding only during Spring – Fall, no seeding in winter, otherwise use sod.
 1. Spring Planting: March 1-March 14, or as approved by the Owner.
 2. Fall Planting: August 15-November 15, or as approved by the Owner.
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.8 MAINTENANCE SERVICE

- A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:
 1. Seeded Turf: 90 days from date of planting completion.
 2. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.
 3. Sodded Turf: 30 days from date of planting completion.
 4. Plugged Turf: 30 days from date of planting completion.
 5. Sprigged Turf: 30 days from date of planting completion.

PART 2 – PRODUCTS

2.1 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

- B. Seed Species: State-certified seed of grass species as follows: See Drawings.
- C. Seed Species: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than percent weed seed:
 - 1. Full Sun Mixture: Proportioned by weight as follows:
 - a. 50 percent Kentucky bluegrass.
 - b. 20 percent perennial ryegrass.
 - c. 15 percent chewings fescue.
 - d. 15 percent creeping red fescue.
 - 2. Shade Mixture: Proportioned by weight as follows:
 - a. 30 percent chewing fescue.
 - b. 15 percent creeping red fescue.
 - c. 30 percent Kentucky bluegrass.
 - d. 35 percent hard fescue.
- D. Grass Seed Mix: Proprietary seed mix as follows:
 - 1. Products: Subject to compliance with requirements and approval from Owner.

2.2 TURFGRASS SOD

- A. Turfgrass Sod: Certified, complying with “Specifications for Turfgrass Sod Materials” in TPI’s “Guideline Specifications to Turfgrass Sodding.” Furnish viable sod of uniform density, color and texture, strongly rooted, and capable of vigorous growth and development when planted. Sod used shall be state-certified. Certified turfgrass sod is grown from Certified seed, inspected and certified by the Virginia Crop Improvement Association (VCIA) or the certifying agency in other states. This ensures genetic purity, high quality, freedom from noxious weeds and excessive insect or disease problems. The sod must meet published state standards and bear an official blue “Certified Turf” label on the bill of lading.

**VIRGINIA CROP
IMPROVEMENT
ASSOCIATION**
BLACKSBURG, VIRGINIA



Certified Turf

The turf accompanying this invoice is represented by the producer to be a part of the lot that has been officially field inspected and has met the requirements for "Certified Turf" under the rules and regulations of the Virginia Crop Improvement Association.

No. 255

- B. Sod shall be machine cut at a uniform soil thickness of 3/4 inch (\pm 1/4 inch) at the time of cutting. This thickness shall exclude shoot growth and thatch.
- C. Pieces of sod shall be cut to the supplier's standard width and length, with a maximum allowable deviation in any dimension of 5%. Torn or uneven pads will not be acceptable.
- D. Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape when suspended from a firm grasp on one end of the section.
- E. Turfgrass Species: Sod of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:
 - 1. 50 percent Kentucky bluegrass.
 - 2. 30 percent chewing fescue.
 - 3. 20 percent perennial ryegrass.
 - 4. 10 percent redtop

2.3 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 - 1. Class: T, with a minimum of 99 percent passing through No.8 (2.36-mm) sieve and a minimum of 75 percent passing through No. 60 (0.25-mm) sieve.
 - 2. Class: 0, with a minimum of 95 percent passing through No.8 (2.36-mm) sieve and a minimum of 55 percent passing through No. 60 (0.25-mm) sieve.
 - 3. Provide lime in form of ground calcitic limestone.
- B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No.6 (3.35-mm) sieve and a maximum of 10 percent passing through No. 40 (0.425-mm) sieve.

- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Aluminum Sulfate: Commercial grade, unadulterated.
- E. Perlite: Horticultural perlite, soil amendment grade.
- F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 (0.30-mm) sieve.
- G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.
- H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.4 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch (12.5-mm) sieve; soluble salt content of 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - 1. Organic Matter Content: 50 to 60 percent of dry weight.
 - 2. Feedstock: Agricultural, food, or industrial residuals; bio-solids; yard trimmings; or source separated or compostable mixed solid waste.
- B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture, with a pH range of 3.4 to 4.8.
- C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent
- D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
 - 1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. (2.4 kg/cu. m) of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. (4 kg/cu. m) of loose sawdust or ground bark.

- E. Manure: Well-rotted, un leached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.5 FERTILIZERS

- A. Fertilizers to be used on site shall abide by the approved Nutrient Management Plan for the university.

2.6 PLANTING SOILS

- A. Planting Soil: ASTM D 5268 topsoil, with pH range of 5.5 to 7, a minimum of 6 percent organic material content; free of stones 1 inch (25 mm) or larger in any dimension and other extraneous materials harmful to plant growth. Mix ASTM D 5268 topsoil in accordance with the VESCH to produce planting soil.
- B. Planting Soil: Existing, native surface topsoil formed under natural conditions with the duff layer retained during excavation process and stockpiled on-site. Verify suitability of native surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 - 1. Supplement with accepted planting soil when quantities are insufficient.
 - 2. Mix existing, native surface topsoil in accordance with the VESCH to produce planting soil.
- C. Planting Soil: Existing, in-place surface soil. Verify suitability of existing surface soil to produce viable planting soil. Remove stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth. Mix surface soil in accordance with the VESCH to produce planting soil.
- D. Planting Soil: Imported topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from bogs or marshes.
 - 1. Additional Properties of Imported Topsoil or Manufactured Topsoil: Screened and free of stones 1 inch (25 mm) or larger in any dimension; free of roots, plants, sod, clods, clay lumps, pockets of coarse sand, paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials harmful to plant growth; free of obnoxious weeds and invasive plants including quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and brome grass; not infested with nematodes, grubs, other pests, pest eggs, or other undesirable organisms

and disease-causing plant pathogens; friable and with sufficient structure to give good tilth and aeration. Continuous, airfilled, pore-space content on a volume/volume basis shall be at least 15 percent when moisture is present at field capacity. Soil shall have a field capacity of at least 15 percent on a dry weight basis.

2. Mix imported topsoil or manufactured topsoil in accordance with the VESCH to produce planting soil.
- E. Lightweight On-Structure Planting Soil: Mix produced by modifying planting soil as follows:
1. Planting Soil: One part(s), except replace half of sand content with perlite.
 2. Additional Perlite: One part.
 3. Additional Sphagnum or Muck Peat: One part.
 4. Additional Lime: Ground calcitic limestone applied at the rate of 3 lb per cu. yd. (1.36 kg per cu. m).

2.7 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew-and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
- B. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8.
- C. Muck Peat Mulch: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.
- D. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 1. Organic Matter Content: 50 to 60 percent of dry weight.
 2. Feedstock: Agricultural, food, or industrial residuals; bio-solids; yard trimmings; or source separated or compostable mixed solid waste.
- E. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

- F. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.
- G. Asphalt Emulsion: ASTM D 977, Grade SS-I; nontoxic and free of plant-growth or germination inhibitors.

2.8 PESTICIDES

- A. Pesticides to be used on site shall abide by the approved Nutrient Management Plan for the university.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
 - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 - 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Owner and replace with new planting soil.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
 - 1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.

2. Protect grade stakes set by others until directed to remove them.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

- A. Limit turf subgrade preparation to areas to be planted.
- B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches (100 mm). Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 1. Apply superphosphate fertilizer directly to subgrade before loosening.
 2. Spread topsoil, apply soil amendments and fertilizer on surface as specified, and thoroughly blend planting soil.
 - a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
 - b. Mix lime with dry soil before mixing fertilizer.
 3. Spread planting soil to a depth of 8 inches (200 mm) but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - a. Spread approximately 1/2 the thickness of planting soil over loosened subgrade. Mix thoroughly into top 4 inches (100 mm) of subgrade. Spread remainder of planting soil.
 - b. Reduce elevation of planting soil to allow for soil thickness of sod.
- C. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
 1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
 2. Loosen surface soil to a depth of at least 4 inches (100 mm). Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches (100 mm) of soil. Till soil to a homogeneous mixture of fine texture.
 - a. Apply superphosphate fertilizer directly to surface soil before loosening.

3. Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, trash, and other extraneous matter.
 4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
- D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch (13 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
- E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- F. Before planting, obtain Owner's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 SEEDING

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
1. Do not use wet seed or seed that is moldy or otherwise damaged.
 2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Sow seed at a total rate per VESCH.
- C. Rake seed lightly into top 1/8 inch (3 mm) of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets and 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.
- E. Protect seeded areas with erosion-control mats where shown on Drawings; install and anchor according to manufacturer's written instructions.
- F. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate per VESCH to form a continuous blanket 1-1/2 inches (38mm) in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.
1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

2. Bond straw mulch by spraying with asphalt emulsion at a rate of 10 to 13 gal./1000 sq. ft. (38 to 49 L/92.9 sq. m). Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.
- G. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch or planting soil within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch (4.8 mm), and roll surface smooth.

3.5 HYDROSEEDING

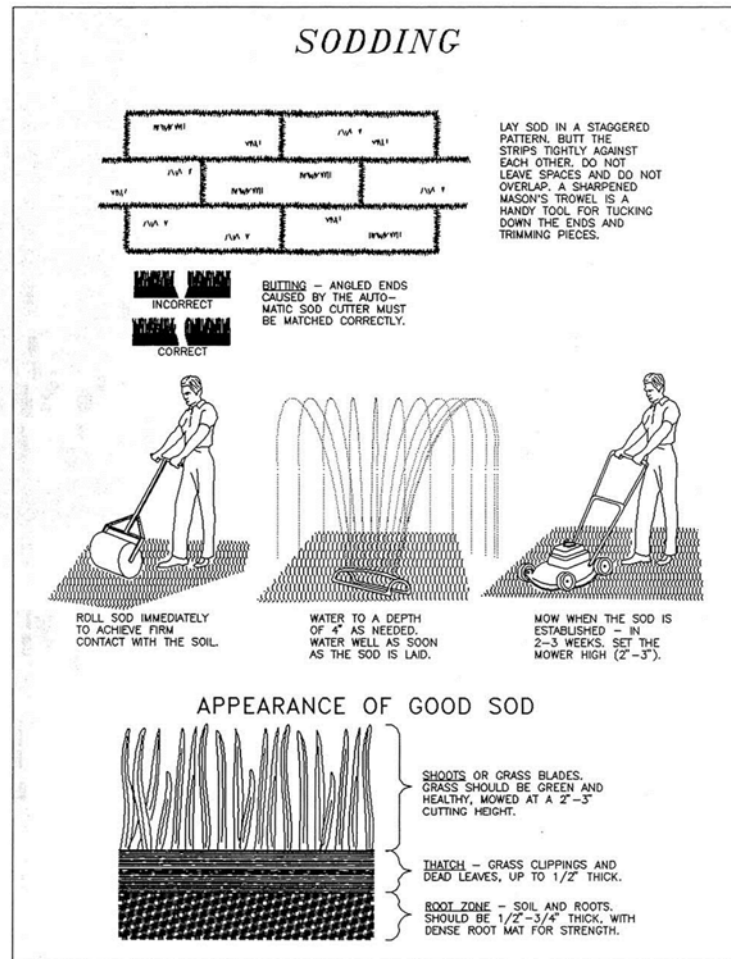
- A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseeded application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
1. Mix slurry with nonasphaltic tackifier.
 2. Apply slurry uniformly to all areas to be seeded in a one-step process.
 3. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre (15.6-kg/92.9 sq. m) dry weight, and seed component is deposited at not less than the specified seed-sowing rate.

3.6 SODDING

- A. Lay sod within 24 hours of harvesting [unless a suitable preservation method is accepted by Owner prior to delivery time]. Do not lay sod if dormant or if ground is frozen or muddy. Sod shall be harvested, delivered, and installed within a period of 36 hours.

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3.33



Source: Va. DSWC

Plate 3.33-1

- B. Install thin cut sand-based sod directly over sand filled clovers, sand filled no higher than the top of the clovers.
- C. Lay sod to form a solid mass with tightly fitted joints, moistened and rolled to create good contact for growth. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
 1. Lay sod across slopes exceeding 1:3, sod shall be laid with staggered joints and secured by stapling or other approved methods. Sod shall be installed with the length perpendicular to the slope (on the contour).

2. Anchor sod on slopes exceeding 1:6 with wood pegs [or steel staples] spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.
- D. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below sod.
- E. Sodded areas must be fertilized and kept moist during root establishment (minimum of 3 weeks).
- F. Sod should not be laid on soil surfaces that are frozen.
- G. During periods of high temperature, the soil shall be lightly irrigated immediately prior to laying the sod, to cool the soil and reduce root burning and dieback.
- H. As sodding of clearly defined areas is completed, sod shall be rolled or tamped to provide firm contact between roots and soil.
- I. After rolling, sod shall be irrigated to a depth sufficient that the underside of the sod pad and the soil 4 inches below the sod is thoroughly wet.
- J. Until such time a good root system becomes developed, in the absence of adequate rainfall, watering shall be performed as often as necessary to maintain moist soil to a depth of at least 4 inches.

The first mowing shall not be attempted until the sod is firmly rooted, usually 2-3 weeks. Not more than one third of the grass leaf shall be removed at any one cutting.

3.7 TURF MAINTENANCE

- A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
 1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
 3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

- B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches (100 mm).
1. During the 2 to 3 week establishment stage, sod shall be watered as necessary to maintain adequate moisture in the root zone and prevent dormancy of sod.
 2. No more than one third of the shoot (grass leaf) should be removed in any mowing. Grass height should be maintained between 2 and 3 inches unless otherwise specified.
 3. After the first growing season, established sod will require fertilization and may require lime. Follow soil test recommendations when possible, or apply maintenance levels as outlined in Table 3.33-B.
 4. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 5. Water turf with fine spray at a minimum rate of 1 inch (25 mm) per week unless rainfall precipitation is adequate.
 - a. Watering of turf shall be required for 1 month after installation.
- C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
1. Mow [bentgrass] to a height of 1/2 inch (13 mm) or less.
 2. Mow [bermudagrass] to a height of 1/2 to 1 inch (13 to 25 mm).
 3. Mow [carpetgrass] [centipedegrass] [perennial ryegrass] [zoysiagrass] to a height of 1 to 2 inches (25 to 50 mm).
 4. Mow [Kentucky bluegrass] [buffalograss] [annual ryegrass] [chewings red fescue] to a height of 1-1/2 to 2 inches (38 to 50 mm).
 5. Mow [bahia] [turf-type tall fescue] [St. Augustinegrass] to a height of 2 to 3 inches (50 to 75 mm).
- D. Turf Postfertilization: Apply [commercial fertilizer] [slow-release fertilizer] after initial mowing and when grass is dry.

3.8 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Owner:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding [90 percent over any 5 sq. ft. (0.46 sq. m) and bare spots not exceeding 3 by 3 inches (76 by 76 mm)].
 2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
 3. Satisfactory Plugged Turf: At end of maintenance period, the required number of plugs has been established as well-rooted, viable patches of grass, and areas between plugs are free of weeds and other undesirable vegetation.
 4. Satisfactory Sprigged Turf: At end of maintenance period, the required number of sprigs has been established as well-rooted, viable plants, and areas between sprigs are free of weeds and other undesirable vegetation.
- B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

3.9 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
- C. Remove non-degradable erosion-control measures after grass establishment period.
- D. Retain one of the following two subparagraphs to match grass installation method.
 1. Seeded areas must be protected from any traffic, other than for actual emergencies, for a period of 4 to 8 weeks, or until grass is mature enough to handle traffic.
 2. Sodded areas must be protected from any traffic, other than emergency vehicles, for a period of 3 to 4 weeks, or until root system has penetrated into subsoil.
- E. Remove nondegradable erosion-control measures after grass establishment period.
- F. Repair any damage to adjacent materials and surfaces resulting from installation of this work.

3.10 PERFORMANCE WARRANTY

- A. The turf or grasses shall be guaranteed for 1 year from the date of the Land Disturbance Permit Termination.
- B. In the event that any turf does not meet the design intention, the contractor shall replace or repair all unsatisfactory turf.
 - a. All repair work shall be guaranteed for 1 year from the date of repair acceptance.

APPENDIX C.3: PIPE SEWER TV INSPECTION

PART 1 GENERAL

1.1 SCOPE:

- A. Work consists of furnishing all materials, labor, supervision, and equipment for the television inspection of new pipe sewers.
- B. Related Work Specified Elsewhere May Include But Is Not Limited To:
 - 1. Sewer Manholes.
 - 2. Pipe Sewer

1.2 QUALITY ASSURANCE

- A. Experience:
 - 1. Television inspection work shall be performed by a Contractor who is regularly engaged in work of the character required.
- B. Equipment:
 - 1. All equipment, devices and tools required for the contract shall be owned (or leased) and operated by the TV Inspection Contractor.

1.3 SUBMITTALS

- A. Before commencing work, the Contractor shall submit to MASON LD for approval:
 - 1. Specific documentation, information, and references that the TV Inspection Contractor and the on-site supervisor for the work have had successful experience in similar work under similar conditions.
 - 2. Detailed written descriptions, including pertinent supplemental drawings, literature, tables and other material, of equipment, methods, procedures and scheduling proposed for the work.
- B. A television inspection log shall be maintained during the television inspection work. This log shall be on a printed form and shall include the following:
 - 1. Job/work assignment number;
 - 2. Date of inspection;
 - 3. Location and identification of sewer section televised;
 - 4. Size and type of pipe;
 - 5. Length of sewer section televised;
 - 6. Locations of all service connections;
 - 7. Locations of all structural problems encountered such as cracked or broken pipe; offset or open joints; protruding service connections;
 - 8. Sags (including length and estimated depth);
 - 9. Incidence of root intrusion;

10. Areas where further cleaning is required;
 11. Recommendation of lining requirement.
 12. Locations of service connections as referenced by horizontal distance from identified manhole and circumferential position with respect to pipe axes.
- C. A summary report shall be submitted to the Engineer within ten days of the conclusion of TV inspection work including copies of all television inspection logs. The report shall be neatly bound in a protective cover.
1. DVD/CDs shall be submitted to the Engineer within ten days of the conclusion of fieldwork.

PART 2 EQUIPMENT

2.1 TELEVISION INSPECTION EQUIPMENT:

- A. Television inspection equipment shall include at least the following minimum items:
1. A color, sewer television camera, specifically designed for operation through a minimum of 2,000 feet of single conductor cable in sanitary and storm sewers.
 - a. Camera outside diameter no greater than 3-inches to allow for inspection in small size pipes. Camera operating temperature range of 0 to 50 degrees C.
 - b. Capable of providing 320 lines of horizontal resolution and 350 lines of vertical resolution.
 - c. Solid-state image pickup device containing in excess of 250,000 picture elements (pixels).
 - d. 525 scanning lines, 60 fields, 30 frames, interlaces 2:1 - NTSC Color Standard, with geometrical image distortion not exceeding two percent (picture transmission systems requiring use of R.F. suppressors and subject to local transmitter interference not acceptable).
 - e. Full, true color, sharp image video bandwidths with no sacrifice or visible streaking of low frequency response; also no visible streaking of the low frequency test bars when viewing a standard EIA Test Chart.
 - f. 1.0V (140 IRE units) composite camera video signal at the monitor after transmission through 2,000 feet of single conductor cable.
 - g. Equipped with an f/1.4 wide angle lens with optical viewing angle to 70 degrees, auto iris type to control the illumination range for an acceptable picture between 10 and 100,000 Lux, with manual override remotely controlled from the viewing station.
 - h. A minimum of 1,000 linear feet of cable to transmit picture from camera to recording and viewing unit.
 2. DVDs documenting all the television inspection with a ninety (90) minutes duration maximum, with "labels" indicating project address identification, date, along with voice description of sewer inspected during video recording.
 3. An on-board television viewing monitor consisting of high quality, industrial grade color unit providing in excess of 500 lines of resolution.

- a. High-resolution "trinitron" type picture tube or approved equivalent, measuring a minimum of 12 inches diagonally.
 - b. Include voltage compensation circuits to reduce picture distortion to less than one percent under voltage conditions varying from 105V to 120V.
 - c. Housed in a steel cabinet which acts as shield to minimize effects of local magnetic fields such as transformers, coils, wraps of cable, etc. (monitors having inadequate or no protection from local magnetic fields, thereby contributing to loss of color picture purity, not acceptable).
 - d. Equipped with a speaker to allow for audio playback from the DVD recording.
4. Lighting Equipment:
 - a. The halogen lighting system or approved equivalent system shall be comprised of controlled-beam, reflector-sealed lamps with an automatic light compensator. The lighting system shall be capable of supplying variable light of high intensity.
- B. Camera Transport:
 1. Portable, manual winches or motorized mechanical equipment of indirect drive type shall be provided complete with sufficient cable or rods to permit inspection of all sewer sections specified and capable of moving camera through the sewer pipe in either direction at a uniform, slow rate.
- C. Metering Device:
 1. A remote reading, footage metering device(s) shall be provided such that camera location at ground level is visually displayed at all times on the television screen. Footage metering device shall be designed so that the distance recorder can be set at zero when camera is at entrance of pipe. Metering device shall have an accuracy of one percent \pm of actual distance between manholes. Marking of cable or similar means that require interpolation of depth of sewer, will not be permitted.
 2. A measuring target in front of the television camera shall be an exact measurement reference point, and the meter reading shall show the exact location of the reference point.
- D. Monitor Trailer:
 1. A lighted trailer or other suitable shelter, complete with table and chairs, shall be provided for observation of the television monitor and record keeping. Trailer shall be large enough to accommodate at least three people at any time for the purpose of viewing the monitor while TV inspection is in progress.
- E. Accessories:
 1. Accessory items shall include barricades, ladders, pulleys, safety equipment, etc.

PART 3 EXECUTION

3.1 TV INSPECTION:

A. General

1. The interior of new pipe sewers and the interior of existing pipe sewers and building sewers shall be visually inspected as directed by means of closed circuit television in the presence of the Engineer.
2. Inspection for all sewers shall be performed by moving the camera through the line along the axis of the pipe in either direction at a uniform slow rate by remote means, stopping at each joint or defect to allow adequate evaluation by the Engineer. For sewers 42-inches diameter and larger, camera movement shall be on a "hand held" basis.
3. The Engineer shall have access to the television monitor and all other operations at all times. The Contractor shall provide space for two MASON personnel at the same time in the trailer.
4. Picture quality and definition shall be as approved by the Engineer. If unsatisfactory, Contractor shall remove equipment, replace it with satisfactory equipment and repeat the inspection at no additional cost to MASON.
5. The Contractor shall make visual (with audio) tape recordings of each sewer inspection. Date, station (distance from manhole) and manhole identification shall be visually displayed on the videotape at all times.
6. All points of interest including all obstructions, broken pipe and other problems shall be indicated via audio during inspection.
7. Throughout the television inspection activities, MASON reserves the right to alter the speed at which the camera is moved through the sewer. Should the quality of the television picture fail to provide a clear view of the entire sewer, the Contractor shall make appropriate adjustments in his monitoring equipment or discontinue work until the Engineer agrees an acceptable picture has been obtained. Telephones or other suitable means of communication shall be set up between the two winches and the control monitor to coordinate the work.
8. Should the camera become stuck in the sewer, the Contractor will be responsible for its removal at no additional cost to MASON.

B. Safety:

1. Contractor is responsible for safety of personnel and the public during Contract period. The Contractor shall provide all devices, material and equipment necessary to assure the safety and health of personnel and the public.

PART 4 MEASURE AND PAYMENT

4.1 MEASURE

- A. Unit of measure will be the job with no direct measure taken, or per linear foot as provided in the Schedule of Prices and the Contract.

4.2 PAYMENT

- A. Payment for Pipe Sewer TV Inspection will be made at Contract price, as specified, which price and payment will include preparation of logs for all sections inspected, television equipment, and a complete DVD of each section, and all labor, materials, tools, equipment, and incidentals needed to perform television inspection as specified.

END OF SECTION