Final Design Phase Stormwater Management Report Dump Road Area Groundwater Treatment Plant Martin State Airport Middle River, Maryland

Prepared for:

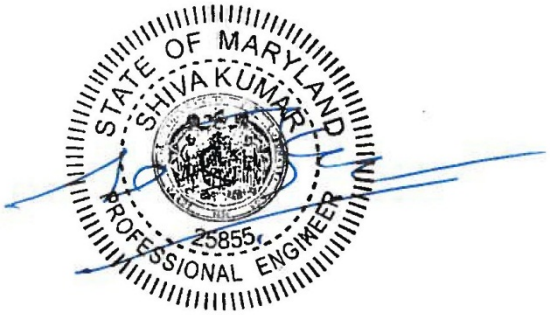
Lockheed Martin Corporation

Prepared by:

Tetra Tech

November 7, 2014

Michael Martin, P.G.
Regional Manager



Christopher Pike, P.E.
Project Manager

This page intentionally left blank.

TABLE OF CONTENTS

Section **Page**

ACRONYMS ..... **v**

1 INTRODUCTION **1-1**

1.1 BACKGROUND 1-1

1.2 SITE DESCRIPTION 1-3

1.3 METHODOLOGY AND SOFTWARE 1-3

1.4 SITE SOILS 1-6

2 EXISTING DRAINAGE ANALYSIS **2-1**

2.1 GENERAL DRAINAGE DESCRIPTION 2-1

2.2 HYDRAULIC AND HYDROLOGIC/ESD ANALYSIS 2-4

2.2.1 Drainage Area 1, Lynbrook Road 2-5

2.2.2 Drainage Area 2: Groundwater Treatment Plant and Site Amenities 2-5

2.2.3 Drain Age Area 3: Well Access Roads 2-6

3 PROPOSED DRAINAGE ANALYSIS **3-1**

3.1 GENERAL DRAINAGE DESCRIPTION 3-1

3.2 PROPOSED DEVELOPMENT AND STORMWATER MANAGEMENT 3-2

3.2.1 Drainage Area 1, Main Access Road 3-2

3.2.2 Drainage Area 2: Groundwater Treatment Plan and Site Amenities 3-3

3.2.3 Drainage Area 3: Well Access Roads 3-5

3.2.4 General Stormwater Conveyance 3-6

3.2.5 Recharge 3-6

3.3 ENVIRONMENTAL SITE DESIGN (ESD) ANALYSIS 3-6

3.4 HYDRAULIC AND HYDROLOGIC ANALYSIS 3-10

3.5 SWALE, CULVERT, AND STORM PIPE DESIGN 3-13

3.5.1 SWALE DESIGN 3-14

3.5.2 CULVERT DESIGN 3-14

3.5.3 STORM PIPE DESIGN 3-15

3.5.4 TAXIWAY TANGO (TWT) ANALYSIS 3-16

TABLE OF CONTENTS

Section **Page**

3.6 OTHER PERMITTING REQUIREMENTS 3-17

3.7 EROSION AND SEDIMENT CONTROL 3-19

4 CONCLUSION 4-1

5 REFERENCES 5-1

APPENDICES

APPENDIX A — SOIL RESOURCE REPORT

APPENDIX B — GEOTECHNICAL AND GROUNDWATER INFORMATION

APPENDIX C — PHOTOGRAPHS

APPENDIX D — STORMWATER MANAGEMENT PLANS

APPENDIX E — CONSTRUCTION DOCUMENTS - CIVIL SET

APPENDIX F — SIDE-BY-SIDE COMPARISON OF ESD GOALS/REQUIREMENTS TO SITE-SPECIFIC BMPS

APPENDIX G — PRESTO GEOPAVE LITERATURE

APPENDIX H — TR-55 ANALYSIS (HYDRAFLOW HYDROGRAPHS)

APPENDIX I — SWALE/CULVERT/STORM PIPE ANALYSIS (HYDRAFLOW STORM SEWERS AND HYDRAFLOW EXPRESS)

APPENDIX J — MDE APPROVAL OF MAA STANDARD E&S NOTES

APPENDIX K — EROSION AND SEDIMENT CONTROL SUMMARY CALCULATIONS

LIST OF FIGURES

Figure 1-1 Dump Road Area Site Location Map 1-2

Figure 1-2 Critical Areas Map 1-5

Figure 1-3 Soils Map 1-7

Figure 2-1 Middle River, Maryland (USGS Map) 2-2

Figure 3-1 Example Rainfall Targets/ Runoff Curve Number Reductions for Environmental Site Design 3-8

TABLE OF CONTENTS (continued)

LIST OF TABLES

Table 3-1 Impervious Cover in Existing and Proposed Conditions 3-1
Table 3-2 Best Management Goals and Requirements for Environmental Site Design 3-7
Table 3-3 Impervious Area Requiring Treatment (IART) for Each Sub-drainage Area 3-9
Table 3-4 Environmental Site Design Volume Requirements (Summary) 3-10
Table 3-5 Soil Conservation Service Curve Number, Type C Soil 3-12
Table 3-6 Manning's "n" Values 3-12
Table 3-7 1 and 10-Year Storm Peak Discharge Rate at Points of Investigation 3-13
Table 3-8 Taxiway Tango Swale Conveyance – 10 Years Storm at POI-TWT 3-17

This page intentionally left blank.

ACRONYMS

BMP	best management practices
BWI	Baltimore-Washington International
CAC	Critical Area Commission
cfs	cubic feet per second
CMP	corrugated metal pipe
CN	curve number
COMAR	Code of Maryland Regulations
Cp_v	channel protection volume
DA	drainage area
DDF	depth duration frequency
DRA	Dump Road Area
E&SC	erosion and sediment control
ESD	environmental site design
ESD_v	ESD runoff volume
FEMA	Federal Emergency Management Agency
FHA	Federal Highway Administration
fps	feet per second
GWTP	groundwater treatment plant
HDPE	high-density polyethylene
HDS	Hydraulic Design Series (FHA)
HSG	hydrologic soil groups
IART	impervious area requiring treatment
IDA	intensely developed area
LEED	Leadership in Energy and Environmental Design
Lockheed Martin	Lockheed Martin Corporation
LOD	limits of disturbance
MAA	Maryland Aviation Administration
MDE	Maryland Department of the Environment
MDANG	Maryland Air National Guard
MEP	maximum extent practicable
MHW	mean high water
MRC	Middle River Complex
MSA	Martin State Airport

NAVD88	North American Vertical Datum of 1988
NOAA	National Oceanic and Atmospheric Administration
NRCS	National Resource Conservation Service
P_{Ev}	target rainfall to be captured
Q_f	peak flow rate
Q_{p2}	2-year storm flow
Q_{p10}	10-year storm flow
Q_{p100}	100-year storm flow
RCN	runoff curve number
RCP	reinforced concrete pipe
Re_v	recharge volume requirements
ROP	rock outlet protection
SCS	Soil Conservation Service
SHA	State Highway Administration (Maryland)
SWM	stormwater management
T_c	time of concentration (line)
Tetra Tech	Tetra Tech, Inc.
TGOS	temporary gabion outlet structures
TSOS	temporary stone outlet structures
TWT	Taxiway Tango
USACE	United States Army Corps of Engineers
USC	unified sizing criteria
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WHM	wildlife hazard management
WQv	water quality volume

Section 1
Introduction

1.1 BACKGROUND

On behalf of Lockheed Martin Corporation (Lockheed Martin) and Maryland Aviation Administration (MAA), Tetra Tech has prepared this report for stormwater management for the proposed groundwater treatment plant (GWTP) to be constructed at the Dump Road Area (DRA) of Martin State Airport (MSA, also referred to as MTN) in Baltimore County, Maryland. Over the past twenty years, the Maryland Aviation Administration and Lockheed Martin Corporation have performed several site investigations at the Dump Road Area site (Figure 1-1), which have included monitoring well installation, soil and groundwater sampling, test pit excavations, and geophysical surveys. The results of these investigations indicate past practices have impacted soils which, in turn, have impacted groundwater beneath the site. A plan was proposed by Tetra Tech, Inc. (Tetra Tech) on behalf of Lockheed Martin Corporation to capture and treat the contaminated groundwater via a pump-and-treat groundwater treatment system before it reaches the Frog Mortar Creek.

This report discusses various stormwater management (SWM) alternatives for the proposed groundwater treatment plant site based on existing conditions, and includes a conceptual exhibit of each alternative. The groundwater treatment plant and its site amenities are still in design, and information regarding the building and the treatment system is available in further detail in *90% Groundwater Interim Response Action Basis of Design* (Tetra Tech, 2014a).

Maryland Department of the Environment's (MDE's) stormwater management review process for new development consists of three phases and submissions: 1) the concept phase (Tetra Tech, 2013a), 2) the site development phase (Tetra Tech, 2014b), and 3) the final design phase. A draft final design phase report was issued (Tetra Tech, 2014c) to address any site-development comments prior to issuing the final report. This document is the final design phase report.

Map Document: (K:\GProject\MartinStateAirport-LMC\MapDocs\MXD\Maps\Dump Road Area Location Map.mxd)
8/3/2010 -- 2:06:40 PM



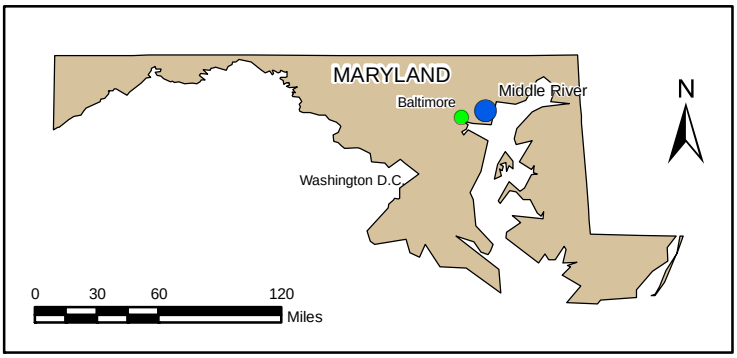


Figure 1-1

Dump Road Area Site Location Map

Lockheed Martin, Martin State Airport
Middle River, Maryland

DATE MODIFIED:	CREATED BY:
8/03/10	MP

Tetra Tech, Inc.

1.2 SITE DESCRIPTION

Martin State Airport is located at 701 Wilson Point Road in Middle River, Maryland. The airport is bounded by Frog Mortar Creek to the east and Stansbury Creek to the west.

Both creeks join the Chesapeake Bay at the southern side of the airport. The Dump Road Area is located on the southeast portion of the airport, and is bounded by Frog Mortar Creek to the east, and the airfield to the west. The Maryland Air National Guard (MDANG) is located to the north portion of the Dump Road Area.

1.3 METHODOLOGY AND SOFTWARE

Stormwater design is based on the following criteria:

1. Maryland Aviation Administration *2011 Design Standards, Volume I of III, Chapter 10* (MAA, 2011)
2. Maryland Aviation Administration *Criteria for Stormwater Management and Sediment Control Design Within the BWI Airport Zone* (MAA, 2010)
3. Maryland Department of the Environment's (MDE's) *2000 Stormwater Design Manual*, as amended through 2009 (MDE, 2000), and the Stormwater Management Act of 2007
4. *Maryland Stormwater Management Guidelines for State and Federal Projects* (MDE, 2010)
5. Chesapeake and Atlantic Coastal Bays *Critical Area 10% Rule Guidance Manual* (MDNR, 2003), as amended through 2014
6. Known on-site or nearby environmental hazards and other site constraints
7. Leadership in Energy and Environmental Design (LEED) credits requiring stormwater quality and quantity management

The Maryland Aviation Administration has strict criteria that limit stormwater management implementation methods in and around their airports, mainly due to standing water and their negative impact of attracting water fowl. Their guidance provides designations for different wildlife hazard management (WHM) zones. An approximate five-mile radius around the Baltimore-Washington International (BWI) Airport is designated as "Zone A." The same radius is assumed for Martin State Airport; therefore, this site is considered to be in wildlife hazard management "Zone A."

Maryland's stormwater design manual (MDE, 2000) provides instructions and worksheets that were used to select and size best management practices (BMPs) for stormwater management, including the implementation of environmental site design (ESD). Environmental site design has been exhausted to the maximum extent practicable (MEP) to control stormwater generated from site development, including its quality, quantity, and peak rate management.

The groundwater treatment plant will be located within an area designated as an intensely developed area (IDA) according to the critical area rule guidance (Figure 1-2). As such, development in this area is subject to more stringent stormwater management practices, which include reducing the phosphorus load to levels at least 10% below pre-development conditions. The *Critical Area 10% Rule Guidance Manual* (MDNR, 2003) provides additional instructions and worksheets that have been incorporated into the project; however, these documents are not included herein, but rather as part of a separate application to the Critical Area Commission.

Since this report is submitted under the Maryland Aviation Administration, the *Maryland Stormwater Management Guidelines for State and Federal Projects* (MDE, 2010) guidance was also reviewed. Some supplemental instructions and information are also available in that publication. The major parameters or requirements for this project do not appear to deviate from that guidance. Notable items are a focus on agency or area-wide stormwater management planning, and language allowing a request for stormwater management waiver or variance due to hardship, if needed.

Local site constraints and other design constraints will dictate the proposed stormwater management methods and features, such as poor drainage, the water table, proximity to Frog Mortar Creek, and known on-site or nearby environmental hazards.

Besides the ESD method, the stormwater design uses United States Department of Agriculture (USDA) *Urban Hydrology for Small Watersheds (TR-55)* software (USDA, 1986) to route time of concentration (T_c) lines through drainage areas, to determine various peak flows and to demonstrate conveyance to Frog Mortar Creek. The Rational Method and the Manning equation are used for swale analysis and storm pipe / culvert design.

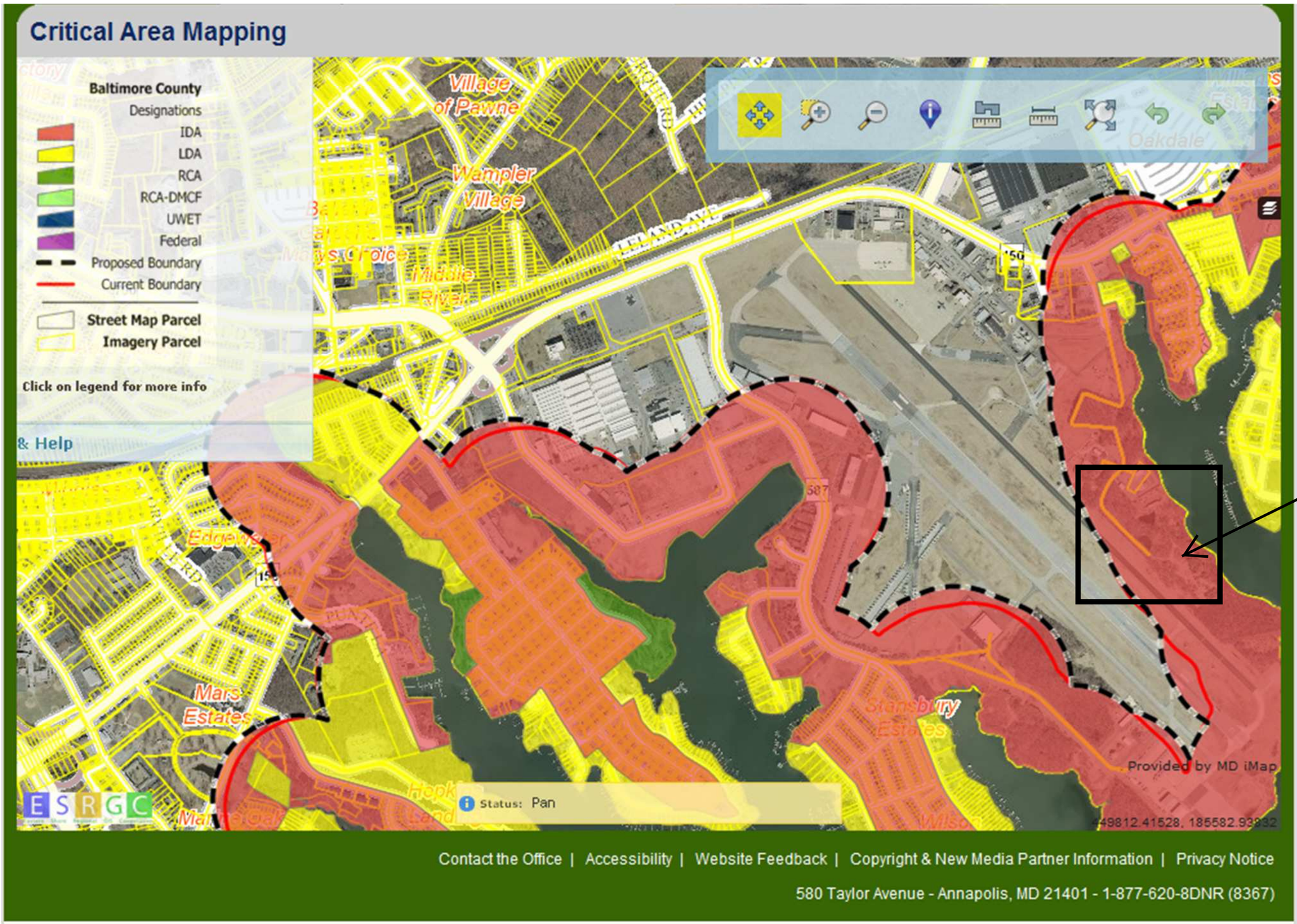


Figure 1-2: Critical Areas Map

AutoDesk's AutoCAD® Civil 3D® software– in particular its Hydraflow extensions- was also used in this evaluation. Hydraflow Hydrographs software is used for watershed analysis and detention pond design (Autodesk, 2011a), while Hydraflow Express provides flexible calculators for solving hydraulics and hydrology problems for culverts, open channels, and hydrology (Autodesk, 2011b). Hydraflow Storm Sewers Extension is used in storm pipe design and analysis (Autodesk, 2011c).

1.4 SITE SOILS

Site soil data was obtained from the United States Department of Agriculture National Resource Conservation Service (NRCS) Geospatial Data Gateway website (http://datagateway.nrcs.usda.gov/GDGHome.aspx). A custom soil resource report for the site was generated from the website, and is provided as Appendix A (USDA, 2012). The soils map is shown on Figure 1-3. Based on the United States Department of Agriculture soil survey for Baltimore County, Maryland, the entire site is on Mattapex soil (MkB - Mattapex - Urban land complex, HSG C Soil). The Mattapex series is a moderately well-drained soil that occurs on summits and side slopes. It forms in sandy marine and old alluvial soils. The depth to seasonal groundwater in soils of this type is typically greater than 72 inches.

Much of the soil in the study area has been filled over; thus, the subject area may not have the Mattapex soil characteristics described in the soils report. A geotechnical report was prepared for the site in an effort to confirm the foundation needs. Several test pits were excavated and soil borings were advanced in the area the future building and stormwater management facilities will be located. One of several site-specific stratigraphic profiles is provided in Appendix B.

The site-specific profile in Appendix B provides a more accurate snapshot of the current soil conditions in the subject area. Stratum A consists of about 10 feet of historic fill that was placed directly on Stratum B, which is comprised of about five feet of silty clay organic material (likely the Mattapex soil described in the United States Department of Agriculture soils report). Beneath Stratum B lies Stratum C, which is an approximate five-foot layer of clayey sand. The water table is about 20 feet below ground surface. Stratum A is heterogeneous mix of scattered deposits (clays, sands, debris), and is not considered suitable for infiltration (HSG D). Stratum B (the assumed Mattapex soil) is listed in the TR-55 manual as HSG C, and is considered somewhat conducive to infiltration (i.e., moderately well drained). Stratum C (clayey sand) is

Custom Soil Resource Report
Soil Map (Martin State Airport)



Figure 1-3: Soils Map

also somewhat conducive to infiltration (moderately well drained), but typically not suitable for absorption. Strata at or below the water table are not relevant to stormwater; the bottom of the stormwater management facilities are typically required to be two feet or more above the water table.

Section 2
Existing Drainage Analysis

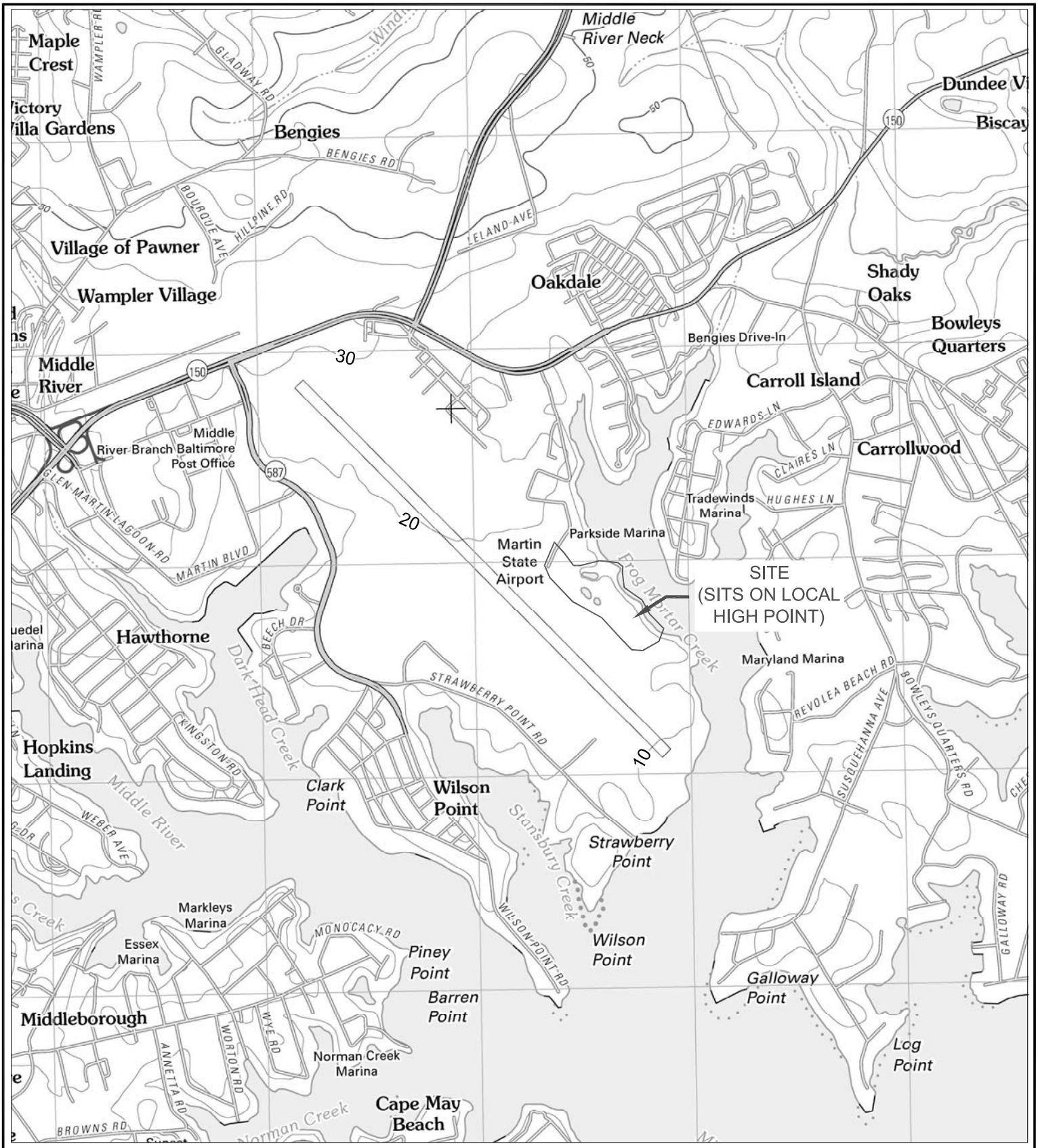
2.1 GENERAL DRAINAGE DESCRIPTION

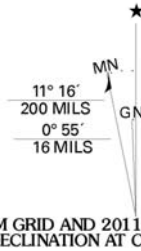
The Dump Road Area (DRA) is located in the southeastern portion of Martin State Airport (MSA), and is relatively inaccessible except through the Maryland Air National Guard (MDANG). The grade of MSA/MDANG generally runs southeast towards Frog Mortar Creek and Strawberry Point. In addition, MSA's runway has an extensive underground drainage system to keep the runway well-drained. The proposed groundwater treatment plant (GWTP) will sit on a local high point about 10 feet above its surrounding area (elevation 20). Figure 2-1 shows a portion of a United States Geological Survey (USGS) map demonstrating the general drainage pattern of the site.

The DRA is mostly covered with overgrown vegetation (grass, tall brush, understory, and canopy). Photos of existing conditions in the subject areas are in Appendix C. The *Resources Map* SWM-01 in Appendix D shows site characteristics such as wetlands, floodplain, and steep slopes, including buffer areas. The *Proposed Disturbance Map* SWM-02 in Appendix D shows the limits of disturbance (LOD) for the proposed GWTP by disturbance type (e.g., clearing vegetation or paving road).

An existing access dirt/gravel road often referred to as "Lynbrook Road, Extended" leads to several meandering dirt/gravel paths that have been used to access various site areas. These paths have been cleared for the installation and sampling of monitoring wells. The proposed GWTP development is concentrated in an area that is relatively clear (no canopy trees).

The rest of the subject area is generally between elevations 10 and 20, although there is a low point (elevation 6) along the main access road. A steep drop-off is located towards Frog Mortar Creek. Although not officially defined as the "edge of landfill", these steep slopes exhibit typical characteristics of landfill/dumping operation sites. The 100-year floodplain elevation is 8.7, which encompasses portions of the main access road and a large, flat area at the bottom of the





UTM GRID AND 2011 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET



MIDDLE RIVER, MD

2011

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

TETRA TECH
240 Continental Drive, Suite 200
Newark, Delaware 19713
302 738-7551 302 454-5988 fax

PROJECT NO.	112IC03834
DRAWN BY:	CSG
DATE:	10/02/2012
DRAWING TITLE:	USGS MAP, MIDDLE RIVER MD
DRAWING NUMBER:	FIGURE 2-1

K:\LMC – Mital\112IC03834 – 50% design phase\SWM\ Fig2-1_USGS.dwg

steep slopes near Frog Mortar Creek. The mean high water (MHW) line in this area is about elevation. 0.6, based upon the conversions of individual datum from several National Oceanic and Atmospheric Administration (NOAA) stations to North American Vertical Datum of 1988 (NAVD88). The MHW line encompasses very little of the site, and more-or-less defines the edge of Frog Mortar Creek. There is one inland location, the "munitions area ditch", that is tidal based on the MHW.

Two large existing ponds at the DRA have standing water (Ponds 1 and 2). The ponds are not engineered with discharge outlets, and have no actively flowing inlet. These ponds are not proposed as stormwater management (SWM) features for use on this project, and are considered out-of-scope regarding SWM, other than for general observation. The standing water (ponds) on-site demonstrates poor drainage for site soils. Information provided in the geotechnical report and the presence of standing water in the ponds indicates water does not infiltrate well through site soils. On-going groundwater studies in this area also discuss and confirm the low transmissivity of site soils.

Several drainage paths and pockets of wetlands exist throughout the DRA. Most notable is a flow path through a reinforced concrete pipe (RCP) culvert (two, parallel 36-inch pipes) under the access dirt/gravel road, hereafter called the "Lynbrook Road Culvert". This flow path, designated as wetlands, receives about 60 acres of offsite drainage contributed from both MDANG and portions of MSA airfield (Tetra Tech, Inc. [Tetra Tech], 2013b). The flow path continues through wetlands through another culvert (hereinafter called "the munitions area culvert") that leads to a man-made ditch (the "munitions area ditch") running through the MDANG munitions storage area, where it exits to Frog Mortar Creek.

An exterior visual inspection of the Lynbrook Road culvert documented that the culvert was in stable condition, and that its invert at the main road culvert is around elevation 1.5. Tidal waters are apparent at the downstream MDANG culvert/ditch (the approximate MHW line is elevation. 0.6, the MDANG culvert invert is 0.5).

The other flow paths and designated wetlands around the Dump Road Area are described further in the individual drainage area discussions. Note that the method used to describe tidal waters in this report is based on averaging historical data from several local NOAA tidal gauges. This is

different from the methods (biology-based) used to identify the presence of tidal wetlands. This report does not focus on whether wetlands are tidal or non-tidal.

2.2 HYDRAULIC AND HYDROLOGIC/ESD ANALYSIS

The primary goal of SWM is to maintain pre-development runoff characteristics after development has occurred. Traditional SWM design tends to use centralized structural practices to mitigate adverse water quality and/or quantity impacts through the analysis of pre- vs. post-development conditions.

The Maryland Stormwater Management Act of 2007 requires implementation of environmental site design (ESD) to the maximum extent practicable (MEP), so that natural hydrologic runoff characteristics are imitated. This ensures that structural practices are used only where absolutely necessary. The Maryland Department of the Environment (MDE) has implemented a consistent standard (Environmental Site Design Sizing Criteria) that must be applied to all sites with the goal of maintaining "natural" runoff characteristics, regardless of actual pre-development conditions.

The ESD method has preset criteria that are used as defaults for existing conditions (e.g., 'woods in good condition'), and these may not reflect actual site conditions. For instance, the scrub brush open area where the proposed GWTP is to be located could be considered in worse existing condition than "woods in good condition" (the default). In traditional SWM calculations, an engineer could take advantage of that situation, but this is not the case for ESD.

The only qualifier for less stringent criteria is if the site qualifies for is redevelopment. No sub-drainage areas within the project area are considered as redevelopment sites because they are all less than 40% impervious. Therefore, the project areas are preset in the existing conditions as "woods in good condition".

Traditional SWM analysis typically includes a "pre- vs. post-" SWM analysis. However, existing conditions (TR-55 routing) do not need to be considered since ESD is the required management method. Only a few select pre-development runoff calculations were reviewed to check for adequate conveyance in certain existing culverts or swales post-development. These are discussed later in the "Proposed Conditions" section under "Swale Design".

The site is broken into three drainage areas (DAs) that will be affected by the development, which are:

- DA-1 – Lynbrook Road
- DA-2 – the GWTP building area
- DA-3 – the well access roads

Pre-development conditions of these DAs are illustrated in SWM-03 in Appendix D.

2.2.1 Drainage Area 1, Lynbrook Road

DA-1 is about 10.8 acres and includes the main dirt/gravel access road (Lynbrook Road, Extended), the large densely vegetated central area containing the ponds (undisturbed by this project), and various small flow channels. DA-1 also receives off-site stormwater contribution from about 60 acres or MSA airfield and MDANG which is routed through the Lynbrook Road culvert. The DA-1 point of investigation (POI-1) is the munitions culvert (MDANG) which discharges to Frog Mortar Creek. Many of the smaller flow channels in DA-1 are overgrown with wetland vegetation and are poorly defined. One small (12-inch metal) culvert near the main bend of the access road (under the airfield access stub to Gate 13) is clogged and collapsed and needs to be replaced. Water accumulates at a saddle point at this main bend of the access road; this area requires local rehabilitation during construction (filling divots) and will be permanently addressed via re-grading and paving the access road. Most of DA-1 will remain untouched (particularly Ponds 1 & 2), aside from addressing stormwater management and upgrading Lynbrook Road, Extended. The proposed area of disturbance within DA-1 is substantially less than the actual drainage area.

2.2.2 Drainage Area 2: Groundwater Treatment Plant and Site Amenities

DA-2 is about 2.5 acres and is comprised of open field and brush. The access road in this area branches out into several dirt and gravel paths that have been cleared in the past for monitoring well installations and general grounds maintenance. Several dense stands of brush containing small-diameter trees are scattered throughout most of the area.

Currently, runoff from DA-2 drains toward the Taxiway Tango (POI-2) and flows into a swale that runs along the northern side of the Taxiway Tango (hereinafter referred to as the “TWT swale”) then drains to Frog Mortar Creek via a low-lying marshy wetland area. The TWT swale

also receives runoff from the airport runway and additional areas to the south of DA-2; this is discussed later in the "Proposed Conditions" section under "Taxiway Swale (TWT) Analysis".

The proposed GWTP and its site amenities (e.g., a parking area, truck maneuvering area, and SWM facilities) will be located in DA-2; stormwater discharge will be directed toward the TWT swale.

2.2.3 Drainage Area 3: Well Access Roads

DA-3 is a 6.2-acre strip area between DA-1/DA-2 and Frog Mortar Creek. It is a densely vegetated area with dirt and gravel paths, steep slopes, and a large low-lying flat area of wetlands (referred to as "Wetland 3"). Much of this area is within the Critical Area's 100-foot expanded tidal buffer. A 1,000-foot long chain link fence runs along the eastern side of existing well access paths and holds back vegetation. Overland flow from this area runs uncontrolled to the east directly to Frog Mortar Creek. Proposed development for this drainage area includes installing extractions wells and upgrading and extending access paths to create reinforced grass turf roads.

Section 3
Proposed Drainage Analysis

3.1 GENERAL DRAINAGE DESCRIPTION

Three drainage areas (DAs) will be affected by construction and development of the proposed groundwater treatment plant (GWTP), as follows:

DA-1: Lynbrook Road
DA-2: the GWTP area
DA-3: the well access roads

These three delineated DAs are illustrated in Appendix D, SWM-04 through SWM-06. These post-development drainage areas are similar to the pre-development size and shape, but with the addition of sub-areas. Offsite stormwater contribution routed through the Lynbrook Road Culvert in DA-1 is illustrated in SWM-07; and the downstream conveyance from DA-2 to the Taxiway Tango swale (TWT) is illustrated in Sheet SWM-08. Portions of the construction documents are also attached (Appendix E), demonstrating the proposed layout and grading of the site, as well as SWM details. The impervious cover changes for each drainage area are listed below in Table 3-1; DA-2 exhibits the most concentrated change.

Table 3-1
Impervious Cover in Existing and Proposed Conditions
Lockheed Martin Corporation Dump Road Area Groundwater Treatment Plant

Drainage Area	Existing Conditions			Proposed Conditions			Impervious Change	Impervious Change
	Total	Impervious		Total	Impervious			
	[Acres]	[Acres]	[%]	[Acres]	[Acres]	[%]	[Acres]	[%]
DA-1	10.8	0.47	4%	10.8	0.74	7%	+0.26	3%
DA-2	2.5	0.13	5%	2.5	0.71 *	28%	+0.58	23%
DA-3	6.2	0.12	2%	6.3	0.05 *	1%	-0.07	-1%
Total	19.5	0.73	3.7%	19.6	1.50	7.6%	+0.77	4%

* Reinforced Turf roads not counted as impervious in this table

As previously stated, Maryland Department of the Environment's (MDE's) environmental site design (ESD) method has preset (default) criteria (e.g., "woods in good condition"), so the above table is provided only to help the reader quantify the proposed changes to site conditions.

3.2 PROPOSED DEVELOPMENT AND STORMWATER MANAGEMENT

This section describes the proposed development and SWM features.

3.2.1 Drainage Area 1, Main Access Road

DA-1 remains nearly the same size (10.8 acres) post-development, but the impervious surface area increases due to the access road widening (from 8 feet to 20 feet). The proposed surface material for the road is asphalt. Unless noted, SWM will be accomplished by directing flow from the road to a 10-foot wide non-rooftop disconnect (also known as a filter strip) to a grass swale with an eight-foot wide bottom running alongside the length of the road. The two culverts (the airfield access stub culvert and the Lynbrook Road culvert) will be improved in DA-1; flow will be adequately conveyed and discharged to tidal waters.

DA-1 is broken into four sub-areas (SUB-DA 1.1, 1.2, 1.3, and 1.4) for ESD, as shown in Sheet SWM-04 in Appendix D. The combined ESD sub-areas are substantially smaller (2.6 acres) than the entire DA-1; the remaining area of DA-1 (labeled SUB-DA 1.5) was not analyzed for ESD. Wetlands will inevitably be disturbed in DA-1, but wetlands disturbance is not addressed in this report; a separate Joint Application submission is has been submitted to MDE's Wetlands and Waterways group and the Army Corps of Engineers.

SWM methods are subject to grading constraints and efforts to limit disturbance. The existing swales along the road will be re-graded. The proposed road will follow the existing grade except where there are known localized issues (such as ponding), or for improvements such as raising grade for the Lynbrook Road culvert replacement.

SUB-DA 1.1 (0.45 acres) begins at the existing Lynbrook Road/Jennie Road intersection and ends at the Lynbrook Road culvert. The swale is on the east side of the road and discharges at the outlet side of the Lynbrook Road culvert into wetlands.

SUB-DA 1.2 (0.15 acres) covers the bend of the access road, including the Lynbrook Road culvert, where the proposed grade will be raised to support the culvert replacement and address some ponding issues at the bend. The runoff from this sub-area drains from the road to non-rooftop disconnect, to a swale on the east side of the access road, which discharges at the outlet side of the Lynbrook Road culvert into wetlands.

SUB-DA 1.3 (1.53 acres) is the long stretch of Lynbrook Road that parallels the airport runway. The proposed SWM is a non-rooftop disconnect and swale. At the lower end of the swale, a small pocket of wetlands (1,250 square feet) will be disturbed but not be restored. This swale will convey flow though the improved airfield access stub culvert, which discharges into a short swale that joins the flow path running into the Lynbrook Road culvert (inlet side).

SUB-DA 1.4 (0.48 acres) is a small strip along Lynbrook Road, upstream of SUB-DA 1.3. Lynbrook Road bends and the grade steepens to tie-into the proposed GWTP building parking area in DA-2. In keeping the existing drainage pattern, DA-1.4 runoff is directed into an existing side swale that parallels the DA-1.3 swale (airfield side), and flows back into DA-1 near Gate 13. This side swale was not analyzed for conveyance because change is limited. The side swale is considered a portion of the "offsite contribution to DA-1" since it receives runoff from the airport runway.

The combined flows of all the DA-1 aforementioned sub-areas converge with the rest of the flows from undisturbed areas of DA-1 (labeled SUB-DA 1.5), as well as with the off-site runoff contribution from MSA/MDANG through the Lynbrook Road culvert. The final DA-1 point of investigation (POI) is the MDANG munitions culvert (POI-1), which can be considered "tidal waters".

3.2.2 Drainage Area 2: Groundwater Treatment Plant and Site Amenities

The majority of the clear/brush area in DA-2 will be covered by the proposed GWTP and site amenities (parking/truck maneuvering area). Sufficient space must be provided adjacent to the GWTP for access, deliveries, storage, maintenance, truck turnaround, and parking. The proposed surface material for the road is asphalt, which will result in an increase in stormwater runoff from this area that needs to be controlled. SWM will be accomplished via bioretention, with non-rooftop disconnect pretreatment where feasible.

The construction documents, particularly the stormwater utility plan set (Appendix E) illustrate SWM design for DA-2. DA-2 includes four sub-areas for ESD (SUB-DA 2.1, 2.2, 2.3 and 2.4; see Sheet SWM-05 in Appendix D). The remaining area, which does not require SWM/ESD, is labeled SUB-DA 2.5.

Each sub-area requiring ESD will have a bioretention area with a disconnect as pre-treatment. For reasons outside the scope of this report, an impermeable membrane will be installed under the bio-retention areas, limiting infiltration in these areas. Each bio-retention area will be fitted with an under-drain and an emergency outlet structure, both of which will lead to a storm pipe network with a single surface discharge outfall (POI-2). Surface water will further discharge into the TWT swale. The TWT swale discharges directly to the tidal waters of Frog Mortar Creek (see Sheet SWM-08 in Appendix D).

Runoff from SUB-DA 2.1 is mostly from the roof of the GWTP, which will be treated via bioretention and routed through the storm pipe network (see Sheet C-165 in Appendix E). About half of the rooftop runoff will be routed through a rooftop disconnect with level spreader. There is a small utility access area that will have reinforced grass turf (~200 sf).

SUB-DA 2.2 is mostly runoff from the south portion of the parking area/truck maneuvering area (asphalt). Runoff will be directed as sheet flow to a 20-foot-wide non-rooftop disconnect for pre-treatment and then to a bioretention area with underdrain, discharging to the pipe network described in SUB-DA 2.1 above (Sheet C-165 [SWM #2 Profile] in Appendix E).

SUB-DA 2.3 includes another small portion of the parking area. SUB-DA 2.3 will have a 10-foot-wide non-rooftop disconnect, a bioretention area with an underdrain which discharges to the storm pipe network described earlier.

SUB-DA 2.4 includes the northern portion of the parking area. SUB-DA 2.4 will have a bioretention area with non-rooftop disconnect that discharges into the storm pipe system as previously described.

The outflow of the storm pipe system will discharge into the TWT swale located along the northern side of the Taxiway Tango, and will further discharge into Frog Mortar Creek (tidal waters). Analysis of this storm pipe system, the outfall, and the TWT swale is discussed in Section 3.5.

3.2.3 Drainage Area 3: Well Access Roads

Development within DA-3 is wellheads (vaults) with surrounding pads, and the access roads to the wells. Well access roads will be 12-feet wide reinforced grass turf, which acts as a traversable surface as well as a stormwater management feature. The paving plan and utility plan sets of the construction documents (Appendix E) show well access road layout and well head pad locations. Sheet C-301 in Appendix E provides a detail section of reinforced turf; wellhead and pad details are forthcoming. This vegetated turf section was designed according to MDE standards and will support the light vehicle loads with occasional heavy loads from a drill rig or other maintenance vehicles. The selected product is Presto GeoPave (engineered aggregate / topsoil type). Product literature is provided as Appendix G. Note that the literature states H-15 and H-20 loads are "not recommended" on the vegetated type; this is common for reinforced turf. H-20 loads will be rare (emergency situations only), and due to ESD sizing calculations, the underlying turf base depth will be 12" thick. This is substantially thicker than what is recommended by the vendor, and this base will provide the support needed for heavy loads. In the rare case of an extreme load (fire truck), some surficial repairs may be required. Weight restriction signage will be placed at the head of the reinforced turf road.

The wellheads are in clusters where feasible to reduce site disturbance. Each wellhead pad is about 100 square feet of gravel for a total 1,670 square feet of new impervious surface spread out over more than 60,500 square feet. 10-foot wide non-rooftop disconnects are proposed on the downstream side of each wellhead pad/cluster.

DA-3 is broken into four sub areas requiring ESD (SUB-DA 3.1, 3.2, 3.3 and 3.4), as shown in Sheet SWM-06 of Appendix D. Although each area has its own set of design constraints (existing dirt paths, steep slopes, etc), all DA-3 sub-areas use the same SWM/ESD practices (reinforced turf for access roads and non-rooftop disconnects on the downstream side of the wellheads). SUB-DA 3.5 is the remaining area of DA-3; no SWM/ESD is proposed in this area.

Additional clearing and grading will be required in this area to create shoulders for turn-around and utility installation. This clearing will be avoided whenever possible to reduce disturbance.

3.2.4 General Stormwater Conveyance

Connectivity to tidal waters is a critical element; without it, costly on-site management of peak flows associated with various storm events would be required. Managing peak flows is also unfeasible because it would violate the Maryland Aviation Administration's (MAA's) standing water policy. Secondary storage ponds or underground stormwater storage chambers are not part of the design.

Conveyance from DA-1 to tidal waters is provided via MDANG munitions culvert. Conveyance from DA-2 to tidal waters is provided via the TWT swale. DA-3 has direct connectivity to Frog Mortar Creek via overland flow with little to no change in the drainage pattern.

The post-development peak flows at various points were checked for "safe and adequate" conveyance to tidal waters. The computation and methodology are discussed in Sections 3.4 and 3.5.

3.2.5 Recharge

ESD inherently addresses water quality volume (WQ_v) and recharge volume (Re_v); therefore, it is assumed that the grass filter strip(s), grass swale(s), and reinforced turf used for this project meet the water quality and recharge volume parameters. However, since an impermeable membrane is proposed under the bio-retention areas, DA-2 will likely not meet the recharge requirements.

If BMPs will not meet the recharge requirements because of site conditions, a hardship waiver will be requested due to local groundwater and soil is contamination, and MAA requirements to avoid standing water in a wildlife hazard management (WHM) zone. No groundwater recharge-specific BMPs (such as dry wells) are proposed at this time.

3.3 ENVIRONMENTAL SITE DESIGN (ESD) ANALYSIS

MDE's SWM review for new development follows a 3-step submission process: concept phase, site development phase, and final design phase.

Rationale and screening for BMP selection can be found in the previously submitted concept plan (Tetra Tech, Inc. [Tetra Tech], 2013a), and detailed stormwater ESD and BMP goals,

performance, and sizing were provided in the site development phase (Tetra Tech, Inc. [Tetra Tech], 2014b). Table 3-2 (below) lists goals or requirements that were considered:

Table 3-2
Best Management Goals and Requirements for Environmental Site Design
Lockheed Martin Corporation Dump Road Area Groundwater Treatment Plant

Acronym	Title	Notes
ESD_v	Environmental site design runoff Volume,(in cubic feet or acre-feet)	Leads the hierarchy of calculations
WQ_v	Water quality volume (in cubic feet or acre-feet)	Likely inherent if ESD_v is met, otherwise additional storage is required Refers to management of the one-inch rainfall Minimum requirements - 0.2 inches per acre
Re_v	Recharge volume (in cubic feet or acre-feet)	May be inherent if ESD_v is met, but dependent on ability to infiltrate
Cp_v	Channel protection volume (in cubic feet or acre-feet)	**Not required** if discharges directly to tidal waters. However, it is likely inherent if the ESD_v is met Refers to the 24-hour extended detention of 1-year storm.
Q_{p2} and Q_{p10}	Overbank flood protection volumes (in cubic feet or acre-feet)	Q_{p10} is required in Baltimore County unless discharge directly to tidal waters (Adequate discharge to tidal waters is shown, and "safe and non-erosive conveyance" of the 10-year storm is provided).
Q_{f100}	Extreme flood volume (cubic feet or acre-feet)	Not required if discharges directly to tidal waters. Refers to management of the peak discharge rate for the 100-year storm.

Q_{p2} – two-year storm flow
Q_{p10} – ten-year storm flow
Q_{f100} – hundred-year storm flow

MDE's ESD method is based on Technical Release 55 (TR-55), the hydrology model and method [USDA, 1986] developed by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) that generates runoff curve numbers (RCN). However, unlike traditional TR-55, under the MDE method the user is not allowed to select a pre-development curve number; rather, the user must use a set number. RCN 70 (for Hydrologic Soil Group [HSG] "C") is used for this site. According to MDE, the "…*The goal is to provide enough treatment using ESD practices to address* Cp_v *requirements by replicating the RCN for woods in good condition for the 1-year rainfall event. This eliminates the need for structural practices…*" (MDE, Stormwater Design Manual, 5.2.2 Environmental Site Design Sizing Criteria).

MDE has developed a table (Table 5.3 in MDE, 2000) which can be used to determine the target rainfall required to be captured and treated (referred to as P_E), when discussing depth. This value

is used to calculate the ESD_v (environmental site design target volume). If the target is unable to be met with ESD practices, Table 5.3 can also be used to determine a reduced RCN, which is then used to further size secondary (structural) practices. Based on the impervious surface percentage in each sub-drainage area, the target P_E is identified. An example for DA-1.1 is presented in Figure 3-1.

Figure 3-1
Example Rainfall Targets/ Runoff Curve Number Reductions for Environmental Site Design

Hydrologic Soil Group C										
%I	RCN*	P_E = 1"	1.2"	1.4"	1.6"	1.8"	2.0"	2.2"	2.4"	2.6"
0%	74									
5%	75									
10%	76									
15%	78									
20%	79	**70**								
25%	80	72	**70**	**70**						
30%	81	73	72	71						
35%	82	74	73	72	**70**					
40%	84	77	75	73	71					
45%	85	78	76	74	71					
50%	86	78	76	74	71					
55%	86	78	76	74	71	**70**				
60%	88	80	78	76	73	71				
65%	90	82	80	77	75	72				
70%	91	82	80	78	75	72				
75%	92	83	81	79	75	72				
80%	93	84	82	79	76	72				
85%	94	85	82	79	76	72				
90%	95	86	83	80	77	73	**70**			
95%	97	88	85	82	79	75	71			
100%	98	89	86	83	80	76	72	**70**		

Example: DA-1.1
(refer to App. F)

Taken from MDE, 2000 SWM Manual, (Table 5.3)

Since no portion of the site qualifies for redevelopment, all areas on this site must strive for 100% capture of post-development impervious runoff, or the design must incorporate an approved alternative measure.

Table 3-3 shows the impervious area requiring treatment (IART) in each sub-drainage area:

Table 3-3
Impervious Area Requiring Treatment (IART) for Each Sub-drainage Area
Lockheed Martin Corporation Dump Road Area Groundwater Treatment Plant

Sub-Drainage Area:	Existing Impervious Surface Applicable for Redevelopment?**	Post-Development Impervious Surface (in square feet)***	Percent Captured by ESD to MEP
1.1	No	8,054	100%
1.2	No	2,688	0%
1.3	No	15,639	100%
1.4	No	6,027	100%
2.1*	No	10,649	100%
2.2	No	6,105	100%
2.3	No	6,839	100%
2.4	No	7,306	100%
3.1*	No	600	100%
3.2*	No	410	100%
3.3*	No	5,514	100%
3.4*	No	448	100%
Total Impervious Surface:		70,279	

DA – drainage area
ESD – environmental site design
MEP – maximum extent practicable

* Reinforced turf is not counted towards impervious area in this table.

** When the total site impervious area under existing conditions exceeds the 40% threshold, redevelopment requirements will apply.

*** All Post-Development Impervious is counted as "New Development" and is routed through BMPs.

These sub-areas were developed in an effort to demonstrate flows intercepted by BMPs. The proposed BMPs are not located in areas that will receive contributions from off-site drainage, therefore, BMP sizing does not need to compensate for off-site drainage.

Appendix F provides a side-by-side comparison of ESD and unified sizing criteria (USC) requirement calculations compared to the proposed BMPs for each sub-area. Table 3-4 summarizes the ESD volume requirements and practices to be used in the main drainage areas, and indicates that the ESD goals are met for entire site.

Table 3-4
Environmental Site Design Volume Requirements (Summary)
Lockheed Martin Corporation Dump Road Area Groundwater Treatment Plant

Drainage Area	ESDv, target (in cubic feet)	ESDv, provided (in cubic feet)	BMPs
DA-1	4,248	6,124	Non-rooftop disconnect, grass swales
DA-2	5,066	8,187	Reinforced turf, non-rooftop disconnect, bioretention
DA-3	2,966	3,378	Reinforced turf and non-rooftop disconnect
Entire DA	**12,280**	**17,679**	

BMP – best management practices
DA – drainage area
ESD_v – environmental site design runoff volume

Appendix F demonstrates that the provided ESD runoff volume (ESD_v) inherently addresses the unified sizing criteria (USC) water quality volume (WQ_v) and recharge volume (Re_v) requirements. Although ESD practices are designed to satisfy channel protection volume (Cp_v) requirements, the Cp_v check is not required since conveyance and discharge to tidal waters is provided (discussed in the next sections). No secondary or structural practices are proposed at this site.

Appendix F further provides the design checks for the swales (depths and velocities) and the bioretention areas (surface and media storage volume capacity). Swale design checks required an H&H review to establish the relevant peak flows, which is discussed in the following section of this report. Appendices H and I provide the hydrographs and swale cross sections used for the design checks.

ESD planning strategies are addressed in the earlier phases of the design, and there are no updates in this phase.

3.4 HYDRAULIC AND HYDROLOGIC ANALYSIS

Post-development peak discharge rates and velocities for the 1-year and the 10-year, 24-hour design storm events (Q_a and Q_{p10}, respectively) were analyzed to demonstrate a safe and non-erosive conveyance at various discharge points (swales and culverts). Peak discharges for existing conditions at the Taxiway Tango swale are provided for comparison to the post-

development conditions. Analysis of the extreme flood volume (Q_{f100}), is not required as direct discharge to tidal waters can be proven.

The USC states TR-55 or TR-20 must be used to determine peak discharge rates; both methods require review of historical rainfall events. Depth duration frequency (DDF) data for 1-, 2-, 10-, and 100-year frequency storm events in Baltimore County were used as input into TR-55, using the 24-hour duration rainfall depths (in inches) provided in Table 2-2 of the *2000 Maryland Stormwater Design Manual* (MDE, 2000). The manual does not provide intensity duration frequency (IDF) data. The National Oceanic and Atmosphere Administration's (NOAA's) National Weather Service Hydro-meteorological Design Studies Center website (http://hdsc.nws.noaa.gov/hdsc/pfds/) provides precipitation frequency (PF) estimates based on the frequency analysis of partial duration series (PDS), and reports it in the form of both DDF and IDF tables; this data is collected and reported by various stations throughout the United States. The "Baltimore WSO City" station appears to be the closest station to the site, and the data provided for that location was used when reviewing and checking data via the rational method[1].

The standard Soil Conservation Service (SCS)/NRCS unit hydrograph (484) was used, and because of short flow distances, a one- minute time interval was used. Tables 3–5 and 3-6 provide the curve number (CN) and the Manning's "n" values (respectively) used for establishment of the Tc line in the TR-55 routing analysis. The CN is an empirical parameter used to predict direct runoff or infiltration from rainfall excess, and is based on a given site's hydrologic soil group, land use, treatment, and hydrologic condition. The Manning's "n" value is a measure of the roughness of the surface material present in open flow channels. A composite curve number for each drainage area was derived based on the percentage of each land use type in each area.

[1] There are two other nearby stations, and all three stations show a higher rainfall depth than the 2000 MDE stormwater manual. Regardless, the same data set should be used to model existing and proposed conditions.

Table 3-5
Soil Conservation Service Curve Number, Type C Soil
Lockheed Martin Corporation Dump Road Area Groundwater Treatment Plant

Land Use	Curve Number
woods, good condition	70
open space, good condition	74
dirt / gravel road	87
impervious areas (buildings and parking)	98

Table 3-6
Manning's "n" Values
Lockheed Martin Corporation Dump Road Area Groundwater Treatment Plant

Type of surface material	"n" value
smooth surfaces (concrete, asphalt)	0.011
high-density polyethylene (HDPE) pipe, smooth wall	0.012
reinforced concrete pipe (RCP)	0.013
corrugated metal pipe (CMP)	0.023
natural stream, main channel (very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush)	0.10
grass areas (non-rooftop disconnect, misc. turf areas)	0.24
grass swale channel (value required per MDE Ch. 5)	0.15
wooded areas (light underbrush)	0.40

Table 3-7 summarizes the points of investigation:

Table 3-7
1 and 10-Year Storm Peak Discharge Rate at Points of Investigation
(Post-Development Conditions)
Lockheed Martin Corporation Dump Road Area Groundwater Treatment Plant

POI	Description	Proposed Conditions				
		Acres	Composite CN	Tc [minutes]	1-yr Peak Discharge [cfs]	10-yr Peak Discharge [cfs]
POI-1.1	SUB-DA 1-1 swale discharge	0.45	84	8.2	0.67	1.89
POI-1.2	SUB-DA 1.2 swale discharge	0.17	82	2.2	0.36	1.01
POI-1.3	SUB-DA 1.3 swale discharge	1.53	80	33.2	1.07	3.48
POI-1.4	SUB-DA 1.4 swale discharge	0.44	81	15	0.59	1.82
POI-1-CVT	Lynbrook Road - Main Culvert	59.7	80	42	-	114.3
POI-1-MUN	Munitions Culvert	10.8	73	32.2	-	132.8 *
POI-2	DA-2, storm pipe outfall	2.45	81	17.5	-	8.34
POI-TWT	taxiway swale downstream section	See sub-section "Taxiway Swale (TWT) Analysis", this report.				

* Includes the flow contribution from POI-1-CVT
cfs – cubic feet per second
CN – composite curve number
DA – drainage area
MDANG – Maryland Air National Guard
N/A – not applicable
POI – point of investigation
Tc – time of concentration

Appendix H contains the hydrograph report and TR-55 analysis (Hydraflow® Hydrographs). Only the 1-year and 10-year 24-hour design storms were analyzed to demonstrate safe and non-erosive conveyance through swales, culverts, and storm pipes, including areas downstream of the development areas.

3.5 SWALE, CULVERT, AND STORM PIPE DESIGN

This site is generally undeveloped, and therefore requires new or improved stormwater conveyance infrastructure. The information gathered from the hydraulic analysis was used to design proposed swales, culverts, and storm pipes with Hydraflow® products; results are provided in Appendix I.

3.5.1 Swale Design

Grass swales are the main treatment method for DA-1. The swales parallel Lynbrook Road, providing conveyance, water quality treatment, and flow attenuation of stormwater runoff. Each swale was designed as a micro-scale practice in accordance with ESD guidelines (MDE, 2000) with channel side slope ratio of 3:1 (horizontal:vertical), and an 8-foot bottom width. The stormwater runoff from the road is delivered as sheet flow via the non-rooftop disconnect prior to entering the swale.

To check the swale flow depths and velocities, typical cross-sections of all proposed swales were analyzed using Manning's Equation in Hydraflow® Express using a roughness coefficient (Manning's n value) of 0.15 in accordance with the MDE Stormwater Management Guide.

All swales pass the design checks specified in the Maryland Stormwater Design Manual, and these checks are shown in Appendix F for each

3.5.2 Culvert Design

There are three culverts on this site that require analysis and/or design:

- the Lynbrook Road culvert replacement
- the airfield access stub culvert replacement
- the MDANG munitions culvert (analysis only)

Lynbrook Road culvert replacement: An existing drainage path flows through a dual two-by-36-inch RCP culvert under the main dirt/gravel road. This flow path receives substantial offsite drainage contribution from MSA/MDANG, and is encompassed by wetlands. Its invert at the main road culvert is around elevation 1.5. The analysis and design of this culvert was performed using the Federal Highway Administration's *"Hydraulic Design of Highway Culverts, Hydraulic Design Series 5"* (FHA HDS-5) standard using Bentley's Culvert Master software.

This culvert is slated to be replaced with a box culvert as part of the site development (Tetra Tech, 2013b). The drainage area contributing to the culvert was estimated to be 59.7 acres as shown in SWM-07. The twin 36"RCP will be replaced with a bottomless box culvert (with a 10ft x 2ft opening), and Lynbrook Road will be raised about 1.5-ft for a utility corridor. The culvert is

designed to provide "safe and non-erosive conveyance" while working within the infrastructure requirements and the site constraints. Refer to the design memo for details regarding this design.

Airfield access stub culvert replacement: A gravel road ("the airfield access stub") connects Lynbrook Road to Gate 13, and underneath this stub there is a 12" metal culvert that is intended to convey flow from SUB-DA 1.3, but it is clogged with sediment. Capacity was reviewed under the peak flow results of the 10-year, 24-hour design storm during post-development. Results indicate that a 15-inch RCP was found to be the appropriate replacement (minimum allowable pipe size is 15 inches per MD SHA, and RCP was selected due to limited pipe cover). Stormwater will be directed to the permanent gabion inflow protection area that leads to the upstream side of the Lynbrook Road culvert.

MDANG munitions culvert analysis: This existing, twin 30-inch RCP culvert is located at the MDANG munitions storage area, downstream of the Lynbrook Road Culvert, and it discharges to Frog Mortar Creek via a 350' long ditch. It is demoted on the SWM plans as POI-1. The physical conditions of the pipes and roadway appear stable. Capacity was reviewed under the peak flow results of the 10-year, 24-hour design storm during post-development, including the contribution via the Lynbrook Road culvert. The model indicates that stormwater will overtop the existing culvert during this event, however, the overtopping will be negligible (a few inches). Although not ideal, the performance of the culvert was found to be generally acceptable, and no modification to this culvert is recommended or proposed at this time.

3.5.3 Storm Pipe Design

An underground storm pipe network is required to convey stormwater through DA-2. This system was designed to adequately convey the 10-year storm event using Hydraflow® Storm Sewers (the Rational Method). The storm pipe analysis is provided in Appendix I.

Stormwater runoff from small storms will be temporarily stored and filtered through micro-bioretention facilities, then discharged via an underdrain at the bottom of each bioretention system. The surface area of each system is designed to overflow once the one-year storm capacity is reached. Each micro-bioretention area has an overflow outlet (elevated yard inlet) to allow excess runoff to enter the storm pipe system during events greater than the one-year storm. Flow that has managed to filter through the media during a large storm will combine with

overflow runoff at these juncture. Flows combine and discharge at a single location into the TWT swale.

Storm pipes are a minimum of 15-inches in diameter per Maryland SHA, and made of double-walled high-density polyethylene (HDPE) pipe (smooth interior, corrugated exterior). Minimum required cover is provided in H-20 traffic areas, and pipe depths do not exceed maximum cover. Standard MD SHA yard inlets will be used for the overflow outlet structures, and rectangular inlets were used for junction boxes. Outlet protection is provided at the outfall of the storm pipe system to reduce the velocity of the discharge.

3.5.4 Taxiway Swale (TWT) Analysis

The storm pipe system from DA-2 discharges into the taxiway (TWT) swale. The TWT swale runs along the northern side of the taxiway tango and eventually discharges to marshy wetlands, which can be considered tidal waters (Frog Mortar Creek). A downstream impact analysis was performed at the point where the drainage area becomes at least twice the size of the DA-2. The point of investigation in the taxiway swale (POI-TWT) is about 235 linear feet downstream from the DA-2 outfall (POI-2).

The drainage area contributing runoff to POI-TWT is delineated on Sheet SWM-09 in Appendix D, and the hydrograph for this point is provided in Appendix H. The drainage area is about 5 acres and includes DA-2 (about 2.5 acres), a portion of the taxiway, maintained grass areas, and brush areas. The added post-development impervious is as previously stated for DA-2. There are no proposed changes in or around the taxiway or the taxiway swale.

A cross-section of the taxiway swale was reviewed at POI-TWT. Using the results of the hydrograph, this cross-section was analyzed using Hydraflow® Express (Manning's Equation) to check that the swale is able to provide stormwater conveyance is a safe-and non-erosive manner. This information is also presented in Appendix I. Table 3-8 summarizes the flow velocity and the depth change during the 10-year storm event.

Table 3-8
Taxiway Tango Swale Conveyance – 10 Year Storm at POI-TWT
Lockheed Martin Corporation Dump Road Area Groundwater Treatment Plant

	Existing Condition Flow			Proposed Condition Flow		
Storm Event	**Peak Flow (cubic feet per second)**	**Velocity [feet per second]**	**Depth [feet]**	**Peak Flow (cubic feet per second)**	**Velocity [feet per second]**	**Depth [feet]**
10-year	9.6	0.34	0.78	13.87	0.38	0.90

Based upon this analysis, the TWT swale appears to have adequate conveyance capacity to handle the increased runoff from proposed conditions during a 10-year storm event.

According to the Federal Emergency Management Agency (FEMA) flood map, the 100-year flood plain is located at elevation 8.9 feet. At this elevation, much the TWT swale will be submerged regardless of site development; proposed development does not appear to increase the risk of damage to downstream infrastructure.

3.6 OTHER PERMITTING REQUIREMENTS

This site is subject to other permitting that impacts site design, including SWM design. The following are of greatest concern:

Critical Area Commission: The entire Dump Road Area is located within the Chesapeake Bay Critical Area (a 1,000 foot zone offsetting the mean high water line of the Chesapeake Bay). Projects within the critical area are subject to plan review and approval by the Chesapeake Bay Critical Area Commission per the Critical Area Act (Code of Maryland Regulations [COMAR] Title 8, Subtitle 18). This site is further categorized as an intensely developed area (IDA).

Once a site is identified within the 1,000 buffer, a 100-foot expanded tidal buffer must be established which includes environmentally sensitive contiguous areas such as wetlands and steep slopes. This site needs to comply with two major requirements:

1) A 10% phosphorus reduction (Section 4 of MDNR, 2003).
2) Mitigation to impacts (clearing, disturbance, etc) both within and outside the expanded tidal buffer: impacts outside the expanded tidal buffer are typically mitigated at a 1:1 ratio, and impacts inside the expanded tidal buffer are mitigated at a higher rate, up to a 3:1 ratio.

The Critical Area 10% Rule Guidance Manual (MDNR, 2003) provides instructions and worksheets for phosphorus reduction (Worksheets A & B). Worksheet A calculations were run for each sub-area to demonstrate that the requirement can be met if the ESD practices are installed. DA-1 and DA-3 and all their sub drainage areas meet the "10% rule" per the proposed BMP practices. All sub-drainage areas pass the check in Worksheet A. Routing of off-site contributions through proposed areas of BMPs is not anticipated. Therefore, Worksheet B was not used.

Due to site constraints and restrictions, mitigation for land clearing will be performed either off-site or by fee in-lieu. The worksheets and mitigation plan will be provided to the Critical Area Commission as a separate document.

Maryland Forest Conservation Act: The site is exempt from the requirements of the Maryland Forest Conservation Act (FCA), Annotated Code of Maryland, Natural Resources Article Section 5-1601, et seq., and regulations adopted thereunder, because the site is located within the Critical Area and areas under Federal Aviation Administration restrictions.

MDE Wetlands and Waterways Program: Several delineated wetlands and other waters occur within and adjacent to the DRA portion of Martin State Airport. The location and boundaries of all delineated wetlands/waters within the DRA have been approved by the United States Army Corps of Engineers (USACE) and impacts to these areas are therefore regulated by local, state, and federal laws. Wetlands and other waters within and adjacent to the DRA include a non-tidal intermittent tributary channel, non-tidal emergent/scrub-shrub wetlands, two non-tidal man-made ponds, and the tidal boundary of Frog Mortar Creek.

Development of the site has been designed to avoid and minimize impacts to all wetlands and waters to the maximum extent practicable; however, unavoidable impacts to these features will include impact to a portion of the non-tidal intermittent tributary and certain non-tidal emergent/scrub-shrub wetlands. An application for unavoidable impacts to wetland and waters will be submitted to the USACE and MDE as part of a Joint Permit Application. The nature and extent of these impacts are anticipated to meet approval criteria for the USACE and MDE under the Maryland State Programmatic General Permit - 4.

Other Site Permitting: Additional permitting documents related to site design include a National Environmental Policy Act (NEPA) review, an environmental assessment (EA), and acquisition of a groundwater appropriation permit for the groundwater extraction. The site design should not require a review by Baltimore County Conservation District. Site design will be reviewed internally by MAA's Division of Documents and Permits.

3.7 EROSION AND SEDIMENT CONTROL

Erosion and sediment control (E&SC) is designed in accordance with the *2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control* (MDE, 2011), along with the MAA's *Specifications for Performing Landscaping Activities for the Maryland Aviation Administration* (MAA, 2006). Pre- and post-bulk grading plans are provided within the construction documents (Appendix E). MDE's approval of the MAA's standard E&SC notes is provided as Appendix J.

E&SC practices at this site include silt fences, swales, diversion berms, outlet protection, a sediment trap, and other typical E&SC features (e.g., a stabilized construction entrance and a mountable berm). A clear water diversion pipe will be required during replacement of the Lynbrook Road culvert due to an active, low-flowing stream (typically 2-3 inches deep).

E&SC areas generally mimic the SWM ESD sub-areas (SUB-DA 1.1, SUB-DA 1.2, etc). Clear water diversions are provided to divert off-site water or water from for undisturbed areas within the project area from entering the disturbance areas.

Temporary swales were sized using Table C.4 of the MDE E&SC manual, and Temporary Swale #1 was engineered as a check to validate the table (See Appendix K for E&SC summary calculations). Temporary stone outlet structures (TSOS) and gabion outlet structures (TGOS) were sized per volume requirements. Earth berms were designed around these structures to ensure the volume requirement is met; berms were designed using Table C.2 of the E&SC manual.

One sediment trap is proposed, and was sized using Table G.3 of the MDE E&SC manual. Sizing is detailed in the construction documents (see Sheet C-065 in Appendix E).

Per the MDE E&S manual, if the DA contributing to the clear water diversion pipe is greater than five acres, the pipe requires engineering design based on the 2-year storm. The Lynbrook Road culvert design memo (Tetra Tech, Inc. [Tetra Tech], 2013b) provides a 2-year peak discharge rate of 52.2 cubic feet per second (cfs Headwater height will be less than twice the diameter of the pipes if twin 24-inch smooth-wall HDPE pipes are used; this is in-line with the design criteria for the related sandbags. The top of sandbags will be elevation 6, which matches the existing top of stream bank elevation (See Appendix K).

All rock outlet protection (ROP) and gabion inflow protection shown in post-bulk grading is permanent, and sizing and location is as shown on the construction documents. ROP sizing for the Lynbrook Road culvert is in the design memo; ROP design for the DA-2 outfall is provided in Appendix K (sized for minimum tailwater conditions). Roof drain outlets are six inches; each drains half the roof. This size is not available on ROP design charts; therefore, only half of the roof and leader system was modeled. A velocity of 5 feet per second was estimated for 1 cfs during the 10-year storm. Given this, ROP needs are minimal, ROP was sized using available space, and a level spreader will be used to dissipate and evenly distribute the flow to a non-rooftop disconnect.

The SWM to E&S overlays are Sheets SWM-08 and SWM-09 in Appendix D. These overlays show soil stockpiles away from the bioretention areas.

For reinforced turf to be considered pervious, the sub-base and stone base must be un-compacted (the stone may be lightly compacted). Since the use of heavy equipment in the proposed reinforced turf areas is required during construction, the existing well access paths will already be compacted; “disking” of soil (or some other form of soil aeration) will be required in these turf areas.

Temporary and permanent seeding will follow the MAA standard seeding schedule, and are detailed in the construction documents (Appendix E, Sheet C-066). Landscaping is in accordance with MAA specifications and guidance (MAA, 2006). Plans and exceptions to specifications will be coordinated with the MAA’s Division of Environmental Planning. Landscaping will be designed as low-maintenance (no irrigation), for protection or restoration of native plantings, and to prevent the attraction of birds and waterfowl. Beautification landscaping

around the building will be minimal. Landscaping within the stormwater management areas (bioretention and swales) is subject to review and approval by both MAA and MDE.

This page intentionally left blank.

Section 4

Conclusion

This stormwater management design generally meets the intent of the stormwater and erosion and sediment control regulations set forth by the Maryland Department of the Environment (MDE). The following key items summarize this report:

1. Environmental site design (ESD) was used to the maximum extent practicable (MEP), and best management procedures (BMPs) were selected and sized according to the criteria set forth in guidance documents.

2. Safe and non-erosive conveyance to tidal waters is feasible, and all proposed swales, culverts, and storm pipes will provide adequate conveyance.

3. Temporary and permanent erosion and sediment control (E&SC) features are based on standard practices, match the design intent, and can be implemented at this site.

4. All written comments from the Maryland Department of the Environment regarding the site development phase of this project have been adequately addressed (a line-by-line response is provided in this submittal package as part of the cover letter).

This page intentionally left blank.

Section 5
References

1. Autodesk, 2011a. *Hydraflow Express Extension.* Software for AutoCAD® Civil 3D®, San Rafael, California. September.

2. Autodesk, 2011b. *Hydraflow Hydrograph Extension.* Software for AutoCAD® Civil 3D®, San Rafael, California. September.

3. Autodesk, 2011c. *Hydraflow Storm Sewers Extension.* Software for AutoCAD® Civil 3D®, San Rafael, California. September.

4. Chesapeake Bay Critical Area Protection Act, 1984. (COMAR Title 8, Subtitle 18).

5. Maryland Aviation Administration (MAA), 2010. *Criteria for Stormwater Management and Sediment Control Design Within the BWI Airport Zone.*

6. Maryland Aviation Administration (MAA), 2011. *2011 Design Standards, Volume I of III, Chapter 10.* Office of Design & Construction. November.

7. Maryland Aviation Administration (MAA), July 2006 Revised. *Specifications for Performing Landscaping Activities for the Maryland Aviation Administration*

8. Maryland Department of Natural Resources (MDNR), 2003. *Critical Area 10% Rule Guidance Manual.* Prepared for: Critical Area Commission for Chesapeake and Atlantic Coastal Bays by the Center for Watershed Protection, funded by National Oceanic and Atmospheric Administration. Fall (autumn) 2003.

9. Maryland Department of the Environment (MDE), 1990. *Maryland Erosion &Sediment Control Guidelines for State and Federal Projects.* Revised January 2004

10. Maryland Department of the Environment (MDE), 2000. *2000 Stormwater Design Manual.* Prepared by: Center for Watershed Protection, Elliot City, Maryland and the Maryland Department of the Environment.as amended through 2009 (MDE, 2000), and the Stormwater Management Act of 2007

11. Maryland Department of the Environment (MDE), 2010. *Maryland Stormwater Management Guidelines for State and Federal Projects.* 15 April.

12. Maryland Department of the Environment (MDE), 2011. *2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control.* December.

13. Maryland Department of the Environment (MDE), 2012. Surface Storage Volume Tables for Bioretention and Bioswales, 8 May.

14. Maryland Stormwater Management Act, 2007. (Maryland Environment Article 4 §201.1 and §203). October.

15. National Oceanic and Atmosphere Administration (NOAA), 2013. National Weather Service Hydro-meteorological Design Studies Center website (http://hdsc.nws.noaa.gov/hdsc/pfds/)

16. Tetra Tech, Inc. (Tetra Tech), 2013a. *Conceptual Stormwater Management Report*. Prepared by Tetra Tech, Inc., Newark, Delaware for Lockheed Martin Corporation, Bethesda, Maryland. January.

17. Tetra Tech, Inc. (Tetra Tech), 2013b. *Culvert Design Memorandum*. Prepared by Tetra Tech, Inc., Newark, Delaware for Lockheed Martin Corporation, Bethesda, Maryland. December.

18. Tetra Tech, Inc. (Tetra Tech), 2014a. *90% Groundwater Interim Response Action Basis of Design Report*. Prepared by Tetra Tech, Inc., Germantown, Maryland for Lockheed Martin Corporation, Bethesda, Maryland. July.

19. Tetra Tech, Inc. (Tetra Tech), 2014b. *Site Development Stormwater Management Report*. Prepared by Tetra Tech, Inc., Newark, Delaware for Lockheed Martin Corporation, Bethesda, Maryland. April.

20. Tetra Tech, Inc. (Tetra Tech), 2014c. *Draft Final Stormwater Management Report*. Prepared by Tetra Tech, Inc., Newark, Delaware for Lockheed Martin Corporation, Bethesda, Maryland. August.

21. United States Department of Agriculture (USDA), 1986. *Urban Hydrology for Small Watersheds (TR-55.)* Natural Resources Conservation Service, Conservation Engineering Division. June.

22. United States Department of Agriculture (USDA), 2012. *Custom Soil Resource Report for Baltimore County, Maryland. MSA Soil Report.* National Resource Conservation Service (NRCS). September.

23. United States Department of Agriculture (USDA), 2013a. Geospatial Data Gateway website (http://datagateway.nrcs.usda.gov/GDGHome.aspx) National Resource Conservation Service (NRCS).

APPENDIX A – SOIL RESOURCE REPORT

United States Department of Agriculture

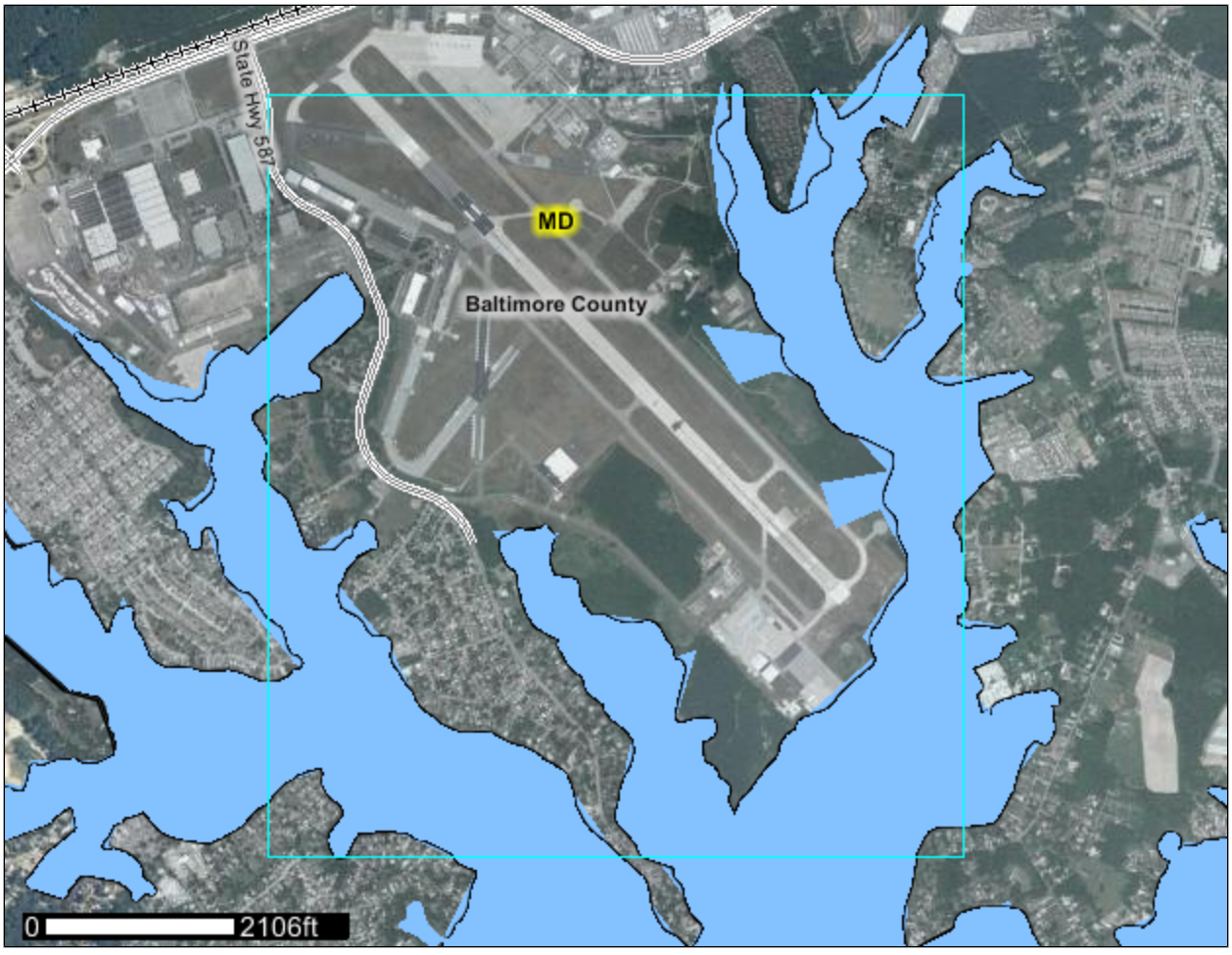
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Baltimore County, Maryland

MSA Soil Report



September 25, 2012

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means

for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Preface.....2
How Soil Surveys Are Made.....5
Soil Map.....7
Soil Map (Martin State Airport).....8
Legend.....9
Map Unit Legend (Martin State Airport).....10
Map Unit Descriptions (Martin State Airport).....10
Baltimore County, Maryland.....13
EeA—Elkton silt loam, 0 to 2 percent slopes.....13
EfA—Elkton-Urban land complex, 0 to 2 percent slopes.....14
FaA—Fallsington sandy loam, 0 to 2 percent slopes.....15
IsA—Issue silt loam, occasionally flooded.....16
IuA—Issue-Urban land complex, occasionally flooded.....17
KeA—Keyport silt loam, 0 to 2 percent slopes.....19
KeB—Keyport silt loam, 2 to 5 percent slopes.....20
KeC—Keyport silt loam, 5 to 10 percent slopes.....21
KuB—Keyport-Urban land complex, 0 to 5 percent slopes.....22
MhB—Mattapex silt loam, 2 to 5 percent slopes.....23
MkB—Mattapex-Urban land complex, 0-5 percent slopes.....24
SaA—Sassafras sandy loam, 0 to 2 percent slopes.....26
SaB—Sassafras sandy loam, 2 to 5 percent slopes.....27
SfB—Sassafras-Urban land complex, 0 to 5 percent slopes.....28
UaB—Udorthents, 0 to 8 percent slopes.....30
Ur—Urban land 0 to 8 percent slopes.....30
UuB—Urban land-Udorthents complex, 0 to 8 percent.....31
W—Water.....31
WoA—Woodstown sandy loam, 0 to 2 percent slopes.....31
WoB—Woodstown sandy loam, 2 to 5 percent slopes.....33
WuB—Woodstown-Urban land complex, 0 to 5 percent slopes.....34
References.....36

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

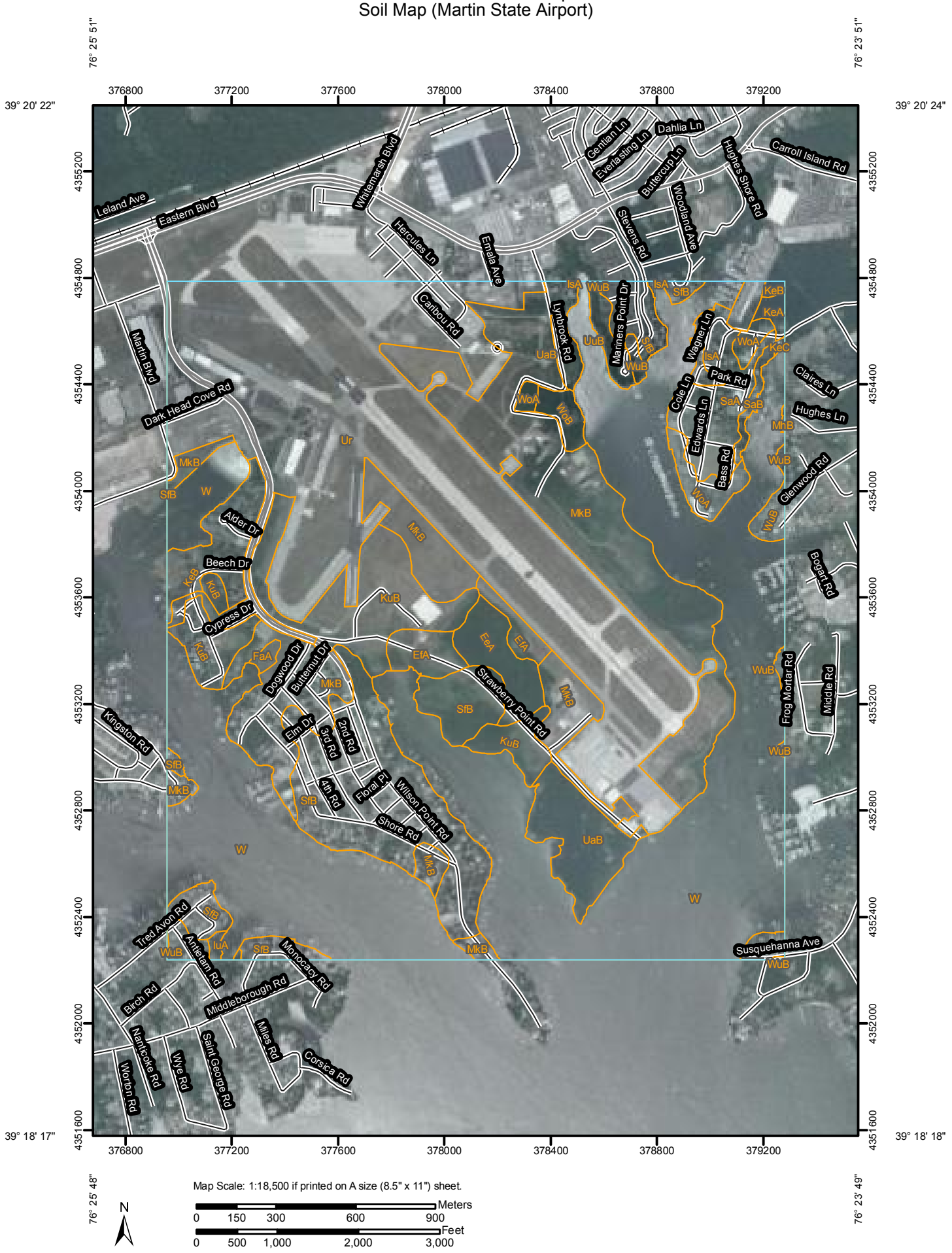
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map (Martin State Airport)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads

MAP INFORMATION

Map Scale: 1:18,500 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 18N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Baltimore County, Maryland
Survey Area Data: Version 6, Feb 17, 2010

Date(s) aerial images were photographed: 6/23/2005; 6/21/2005

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Martin State Airport)

Baltimore County, Maryland (MD005)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
EeA	Elkton silt loam, 0 to 2 percent slopes	18.3	1.3%
EfA	Elkton-Urban land complex, 0 to 2 percent slopes	16.8	1.1%
FaA	Fallsington sandy loam, 0 to 2 percent slopes	1.8	0.1%
IsA	Issue silt loam, occasionally flooded	2.8	0.2%
IuA	Issue-Urban land complex, occasionally flooded	1.2	0.1%
KeA	Keyport silt loam, 0 to 2 percent slopes	3.0	0.2%
KeB	Keyport silt loam, 2 to 5 percent slopes	24.0	1.6%
KeC	Keyport silt loam, 5 to 10 percent slopes	0.4	0.0%
KuB	Keyport-Urban land complex, 0 to 5 percent slopes	74.7	5.1%
MhB	Mattapex silt loam, 2 to 5 percent slopes	0.3	0.0%
MkB	Mattapex-Urban land complex, 0-5 percent slopes	225.5	15.4%
SaA	Sassafras sandy loam, 0 to 2 percent slopes	30.5	2.1%
SaB	Sassafras sandy loam, 2 to 5 percent slopes	3.7	0.2%
SfB	Sassafras-Urban land complex, 0 to 5 percent slopes	128.9	8.8%
UaB	Udorthents, 0 to 8 percent slopes	34.2	2.3%
Ur	Urban land 0 to 8 percent slopes	376.2	25.7%
UuB	Urban land-Udorthents complex, 0 to 8 percent	6.9	0.5%
W	Water	476.2	32.5%
WoA	Woodstown sandy loam, 0 to 2 percent slopes	15.1	1.0%
WoB	Woodstown sandy loam, 2 to 5 percent slopes	6.4	0.4%
WuB	Woodstown-Urban land complex, 0 to 5 percent slopes	17.0	1.2%
Totals for Area of Interest		**1,464.1**	**100.0%**

Map Unit Descriptions (Martin State Airport)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic

class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Baltimore County, Maryland

EeA—Elkton silt loam, 0 to 2 percent slopes

Map Unit Setting

Elevation: 10 to 210 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 57 degrees F
Frost-free period: 180 to 210 days

Map Unit Composition

Elkton and similar soils: 85 percent
Minor components: 15 percent

Description of Elkton

Setting

Landform: Fluviomarine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty eolian deposits over loamy fluviomarine deposits

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 10 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Available water capacity: High (about 9.4 inches)

Interpretive groups

Land capability (nonirrigated): 5w

Typical profile

0 to 2 inches: Silt loam
2 to 7 inches: Silt loam
7 to 38 inches: Silty clay loam
38 to 54 inches: Clay loam
54 to 72 inches: Sandy clay loam

Minor Components

Fallsington

Percent of map unit: 5 percent
Landform: Flats, depressions, swales
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

Piccowaxen

Percent of map unit: 5 percent
Landform: Terraces
Landform position (three-dimensional): Riser

Down-slope shape: Linear
Across-slope shape: Linear

Lenni, undrained
Percent of map unit: 5 percent
Landform: Depressions on broad interstream divides, fluviomarine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

EfA—Elkton-Urban land complex, 0 to 2 percent slopes

Map Unit Setting
Elevation: 10 to 210 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 57 degrees F
Frost-free period: 180 to 210 days

Map Unit Composition
Elkton and similar soils: 60 percent
Urban land: 30 percent
Minor components: 10 percent

Description of Elkton

Setting
Landform: Fluviomarine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty eolian deposits over loamy fluviomarine deposits

Properties and qualities
Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 10 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Available water capacity: High (about 9.4 inches)

Interpretive groups
Land capability (nonirrigated): 5w

Typical profile
0 to 2 inches: Silt loam
2 to 7 inches: Silt loam
7 to 38 inches: Silty clay loam
38 to 54 inches: Clay loam

54 to 72 inches: Sandy clay loam

Description of Urban Land

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 10 inches to

Interpretive groups

Land capability (nonirrigated): 8

Minor Components

Fallsington

Percent of map unit: 5 percent
Landform: Flats, depressions, swales
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

Lenni, undrained

Percent of map unit: 5 percent
Landform: Depressions on broad interstream divides, fluviomarine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

FaA—Fallsington sandy loam, 0 to 2 percent slopes

Map Unit Setting

Elevation: 0 to 1,000 feet
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 45 to 58 degrees F
Frost-free period: 120 to 220 days

Map Unit Composition

Fallsington and similar soils: 75 percent
Minor components: 25 percent

Description of Fallsington

Setting

Landform: Swales, drainageways, depressions
Down-slope shape: Linear, concave
Across-slope shape: Concave
Parent material: Loamy fluviomarine deposits

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 0 to 10 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Available water capacity: Moderate (about 7.5 inches)

Interpretive groups
Land capability (nonirrigated): 4w

Typical profile
0 to 6 inches: Sandy loam
6 to 37 inches: Sandy clay loam
37 to 41 inches: Gravelly loamy sand
41 to 58 inches: Gravelly coarse sand
58 to 72 inches: Stratified sandy loam to clay loam

Minor Components

Corsica, undrained
Percent of map unit: 10 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave

Comus
Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Footslope
Down-slope shape: Linear
Across-slope shape: Linear

Hambrook
Percent of map unit: 5 percent
Landform: Flats, fluviomarine terraces, knolls, depressions
Landform position (three-dimensional): Rise
Down-slope shape: Linear, convex, concave
Across-slope shape: Linear, convex, concave

Woodstown
Percent of map unit: 5 percent
Landform: Depressions, broad interstream divides, fluviomarine terraces, flats
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

IsA—Issue silt loam, occasionally flooded

Map Unit Setting
Elevation: 0 to 250 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 57 degrees F

Frost-free period: 180 to 210 days

Map Unit Composition
Issue and similar soils: 80 percent
Minor components: 20 percent

Description of Issue

Setting
Landform: Flood plains, drainageways
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Properties and qualities
Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 10 to 20 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water capacity: High (about 9.9 inches)

Interpretive groups
Land capability (nonirrigated): 4w

Typical profile
0 to 4 inches: Silt loam
4 to 19 inches: Loam
19 to 30 inches: Fine sandy loam
30 to 58 inches: Fine sandy loam
58 to 70 inches: Silt loam

Minor Components

Woodstown
Percent of map unit: 10 percent
Landform: Depressions, drainageways, swales

Potobac
Percent of map unit: 10 percent
Landform: Flood plains, drainageways

IuA—Issue-Urban land complex, occasionally flooded

Map Unit Setting
Elevation: 0 to 250 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 175 to 220 days

Map Unit Composition

Issue and similar soils: 60 percent
Urban land: 30 percent
Minor components: 10 percent

Description of Issue

Setting

Landform: Drainageways on flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 10 to 20 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water capacity: High (about 9.9 inches)

Interpretive groups

Land capability (nonirrigated): 4w

Typical profile

0 to 4 inches: Silt loam
4 to 19 inches: Loam
19 to 30 inches: Fine sandy loam
30 to 58 inches: Fine sandy loam
58 to 70 inches: Silt loam

Description of Urban Land

Interpretive groups

Land capability (nonirrigated): 8

Minor Components

Potobac

Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear

Fallsington

Percent of map unit: 5 percent
Landform: Swales, drainageways, depressions
Down-slope shape: Linear, concave
Across-slope shape: Concave

KeA—Keyport silt loam, 0 to 2 percent slopes

Map Unit Setting

Elevation: 0 to 210 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days

Map Unit Composition

Keyport and similar soils: 80 percent
Minor components: 20 percent

Description of Keyport

Setting

Landform: Flats, depressions, fluviomarine terraces
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Silty and clayey eolian deposits over fluviomarine sediments

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.1 inches)

Interpretive groups

Land capability (nonirrigated): 2w

Typical profile

0 to 10 inches: Silt loam
10 to 48 inches: Silty clay loam
48 to 80 inches: Stratified silt loam to sandy loam

Minor Components

Mattapex

Percent of map unit: 10 percent
Landform: Flats

Crosiadore

Percent of map unit: 5 percent
Landform: Flats, swales, depressions
Landform position (three-dimensional): Rise

Lenni

Percent of map unit: 3 percent
Landform: Flats, depressions, drainageways, swales
Landform position (three-dimensional): Dip

Elkton

Percent of map unit: 2 percent
Landform: Flats, depressions

KeB—Keyport silt loam, 2 to 5 percent slopes

Map Unit Setting

Elevation: 20 to 70 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days

Map Unit Composition

Keyport and similar soils: 80 percent
Minor components: 20 percent

Description of Keyport

Setting

Landform: Flats, depressions, fluviomarine terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty and clayey eolian deposits over fluviomarine sediments

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.1 inches)

Interpretive groups

Land capability (nonirrigated): 2e

Typical profile

0 to 10 inches: Silt loam
10 to 48 inches: Silty clay loam
48 to 80 inches: Stratified silt loam to sandy loam

Minor Components

Mattapex
Percent of map unit: 10 percent
Landform: Flats

Crosiadore
Percent of map unit: 5 percent
Landform: Flats, swales, depressions
Landform position (three-dimensional): Rise

Lenni
Percent of map unit: 3 percent
Landform: Flats, depressions, drainageways, swales
Landform position (three-dimensional): Dip

Elkton
Percent of map unit: 2 percent
Landform: Depressions, flats

KeC—Keyport silt loam, 5 to 10 percent slopes

Map Unit Setting
Elevation: 0 to 210 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days

Map Unit Composition
Keyport and similar soils: 80 percent
Minor components: 20 percent

Description of Keyport

Setting
Landform: Hillslopes, fluviomarine terraces
Down-slope shape: Concave, linear
Across-slope shape: Convex, linear
Parent material: Silty and clayey eolian deposits over fluviomarine sediments

Properties and qualities
Slope: 5 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.1 inches)

Interpretive groups

Land capability (nonirrigated): 3e

Typical profile

0 to 10 inches: Silt loam
10 to 48 inches: Silty clay loam
48 to 80 inches: Stratified silt loam to sandy loam

Minor Components

Mattapex

Percent of map unit: 10 percent
Landform: Flats

Crosiadore

Percent of map unit: 5 percent
Landform: Flats, swales, depressions
Landform position (three-dimensional): Rise

Lenni

Percent of map unit: 3 percent
Landform: Flats, depressions, drainageways, swales
Landform position (three-dimensional): Dip

Elkton

Percent of map unit: 2 percent
Landform: Flats, depressions

KuB—Keyport-Urban land complex, 0 to 5 percent slopes

Map Unit Setting

Elevation: 0 to 660 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days

Map Unit Composition

Keyport and similar soils: 65 percent
Urban land: 20 percent
Minor components: 15 percent

Description of Keyport

Setting

Landform: Flats, depressions, fluviomarine terraces
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Silty and clayey eolian deposits over fluviomarine sediments

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches

Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.1 inches)

Interpretive groups
Land capability (nonirrigated): 2w

Typical profile
0 to 10 inches: Silt loam
10 to 48 inches: Silty clay loam
48 to 80 inches: Stratified silt loam to sandy loam

Description of Urban Land

Setting
Parent material: Human transported material

Properties and qualities
Slope: 0 to 5 percent
Depth to restrictive feature: 10 inches to

Interpretive groups
Land capability (nonirrigated): 8

Minor Components

Udorthents, reclaimed gravel pits
Percent of map unit: 10 percent
Landform: Interfluves, fluviomarine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Elkton
Percent of map unit: 5 percent
Landform: Flats, depressions

MhB—Mattapex silt loam, 2 to 5 percent slopes

Map Unit Setting
Elevation: 0 to 200 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days

Map Unit Composition
Mattapex and similar soils: 80 percent

Minor components: 20 percent

Description of Mattapex

Setting

Landform: Flats, depressions, swales
Landform position (three-dimensional): Rise
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Silty eolian deposits over fluviomarine sediments

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability (nonirrigated): 2e

Typical profile

0 to 11 inches: Silt loam
11 to 15 inches: Silt loam
15 to 36 inches: Silt loam
36 to 60 inches: Fine sandy loam
60 to 80 inches: Loamy sand

Minor Components

Nassawango

Percent of map unit: 10 percent
Landform: Flats

Othello

Percent of map unit: 5 percent
Landform: Swales, drainageways, depressions, flats
Landform position (three-dimensional): Dip

Crosiadore

Percent of map unit: 5 percent
Landform: Flats, depressions, swales

MkB—Mattapex-Urban land complex, 0-5 percent slopes

Map Unit Setting

Elevation: 0 to 260 feet

Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days

Map Unit Composition
Mattapex and similar soils: 50 percent
Urban land: 40 percent
Minor components: 10 percent

Description of Mattapex

Setting
Landform: Flats, depressions, swales
Landform position (three-dimensional): Rise
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Silty eolian deposits over fluviomarine sediments

Properties and qualities
Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.3 inches)

Interpretive groups
Land capability classification (irrigated): 2e
Land capability (nonirrigated): 2e

Typical profile
0 to 11 inches: Silt loam
11 to 15 inches: Silt loam
15 to 36 inches: Silt loam
36 to 60 inches: Fine sandy loam
60 to 80 inches: Loamy sand

Description of Urban Land

Setting
Landform: Flats
Down-slope shape: Linear
Across-slope shape: Linear

Minor Components

Udorthents, loamy
Percent of map unit: 10 percent
Landform: Knolls, flats
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear

SaA—Sassafras sandy loam, 0 to 2 percent slopes

Map Unit Setting

Elevation: 40 to 330 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days

Map Unit Composition

Sassafras and similar soils: 80 percent
Minor components: 20 percent

Description of Sassafras

Setting

Landform: Fluviomarine terraces, flats
Down-slope shape: Linear
Across-slope shape: Linear

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability (nonirrigated): 1

Typical profile

0 to 9 inches: Sandy loam
9 to 15 inches: Sandy loam
15 to 30 inches: Loam
30 to 37 inches: Sandy loam
37 to 80 inches: Loamy sand

Minor Components

Downer

Percent of map unit: 5 percent
Landform: Flats

Hambrook

Percent of map unit: 5 percent
Landform: Flats, swales

Ingleside
Percent of map unit: 5 percent
Landform: Flats, swales

Woodstown
Percent of map unit: 5 percent
Landform: Depressions, swales

SaB—Sassafras sandy loam, 2 to 5 percent slopes

Map Unit Setting
Elevation: 40 to 330 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days

Map Unit Composition
Sassafras and similar soils: 80 percent
Minor components: 20 percent

Description of Sassafras

Setting
Landform: Knolls, fluviomarine terraces, interfluves
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear

Properties and qualities
Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.8 inches)

Interpretive groups
Land capability (nonirrigated): 2e

Typical profile
0 to 9 inches: Sandy loam
9 to 15 inches: Sandy loam
15 to 30 inches: Loam
30 to 37 inches: Sandy loam
37 to 80 inches: Loamy sand

Minor Components

Downer
Percent of map unit: 5 percent
Landform: Flats

Hambrook
Percent of map unit: 5 percent
Landform: Flats, swales

Ingleside
Percent of map unit: 5 percent
Landform: Flats, swales

Woodstown
Percent of map unit: 5 percent
Landform: Depressions, swales

SfB—Sassafras-Urban land complex, 0 to 5 percent slopes

Map Unit Setting
Elevation: 10 to 330 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 57 degrees F
Frost-free period: 175 to 220 days

Map Unit Composition
Sassafras and similar soils: 45 percent
Urban land: 35 percent
Minor components: 20 percent

Description of Sassafras

Setting
Landform: Knolls, fluviomarine terraces, broad interstream divides
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy fluviomarine deposits

Properties and qualities
Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability (nonirrigated): 2e

Typical profile

0 to 9 inches: Sandy loam
9 to 15 inches: Sandy loam
15 to 30 inches: Loam
30 to 37 inches: Sandy loam
37 to 80 inches: Loamy sand

Description of Urban Land

Interpretive groups

Land capability (nonirrigated): 8

Minor Components

Matapeake

Percent of map unit: 5 percent
Landform: Broad interstream divides, fluviomarine terraces, interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Hambrook

Percent of map unit: 5 percent
Landform: Broad interstream divides, fluviomarine terraces, interfluves, drainhead complexes, swales
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Phalanx

Percent of map unit: 5 percent
Landform: Divides
Down-slope shape: Linear
Across-slope shape: Linear

Woodstown

Percent of map unit: 5 percent
Landform: Broad interstream divides, swales, fluviomarine terraces, depressions, interfluves, drainhead complexes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

UaB—Udorthents, 0 to 8 percent slopes

Map Unit Setting

Elevation: 0 to 300 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 57 degrees F
Frost-free period: 190 to 210 days

Map Unit Composition

Udorthents and similar soils: 100 percent

Description of Udorthents

Setting

Parent material: Graded areas of schist and/or gneiss

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 60 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.3 inches)

Interpretive groups

Land capability (nonirrigated): 6s

Typical profile

0 to 2 inches: Sandy loam
2 to 65 inches: Sandy loam

Ur—Urban land 0 to 8 percent slopes

Map Unit Setting

Elevation: 300 to 900 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 160 to 220 days

Map Unit Composition

Urban land: 85 percent
Minor components: 15 percent

Description of Urban Land

Setting
Parent material: Human transported material

Interpretive groups
Land capability (nonirrigated): 8

Minor Components

Udorthents
Percent of map unit: 15 percent

UuB—Urban land-Udorthents complex, 0 to 8 percent

Map Unit Composition
Sand and gravel pits: 95 percent
Minor components: 5 percent

Description of Sand And Gravel Pits

Interpretive groups
Land capability (nonirrigated): 8s

Typical profile
0 to 6 inches: Very gravelly sand

Minor Components

Unnamed soils
Percent of map unit: 5 percent
Landform: Depressions

W—Water

Map Unit Composition
Water: 100 percent

WoA—Woodstown sandy loam, 0 to 2 percent slopes

Map Unit Setting
Elevation: 0 to 120 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 50 to 58 degrees F
Frost-free period: 175 to 220 days

Map Unit Composition

Woodstown and similar soils: 80 percent
Minor components: 20 percent

Description of Woodstown

Setting

Landform: Broad interstream divides, swales, fluviomarine terraces, depressions, interfluves, drainhead complexes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Loamy fluviomarine deposits

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: About 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.9 inches)

Interpretive groups

Land capability (nonirrigated): 2w

Typical profile

0 to 8 inches: Sandy loam
8 to 28 inches: Loam
28 to 42 inches: Fine sandy loam
42 to 60 inches: Sandy loam
60 to 72 inches: Loamy sand

Minor Components

Hammonton

Percent of map unit: 10 percent
Landform: Flats, depressions, drainageways
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

Fallsington

Percent of map unit: 5 percent
Landform: Swales, drainageways, depressions
Down-slope shape: Linear, concave
Across-slope shape: Concave

Hambrook

Percent of map unit: 5 percent
Landform: Flats, fluviomarine terraces, knolls, depressions
Landform position (three-dimensional): Rise
Down-slope shape: Linear, convex, concave
Across-slope shape: Linear, convex, concave

WoB—Woodstown sandy loam, 2 to 5 percent slopes

Map Unit Setting

Elevation: 10 to 120 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 57 degrees F
Frost-free period: 180 to 210 days

Map Unit Composition

Woodstown and similar soils: 75 percent
Minor components: 25 percent

Description of Woodstown

Setting

Landform: Broad interstream divides, swales, fluviomarine terraces, depressions, interfluves, drainhead complexes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Loamy fluviomarine deposits

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: About 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.9 inches)

Interpretive groups

Land capability (nonirrigated): 2w

Typical profile

0 to 8 inches: Sandy loam
8 to 28 inches: Loam
28 to 42 inches: Fine sandy loam
42 to 60 inches: Sandy loam
60 to 72 inches: Loamy sand

Minor Components

Hammonton

Percent of map unit: 10 percent
Landform: Broad interstream divides, depressions, drainhead complexes, fluviomarine terraces, interfluves, swales

Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

Hambrook
Percent of map unit: 10 percent
Landform: Broad interstream divides, interfluves
Landform position (two-dimensional): Summit

Fallsington
Percent of map unit: 5 percent
Landform: Depressions, drainageways, drainhead complexes, swales

WuB—Woodstown-Urban land complex, 0 to 5 percent slopes

Map Unit Setting
Elevation: 10 to 120 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 57 degrees F
Frost-free period: 180 to 210 days

Map Unit Composition
Woodstown and similar soils: 50 percent
Urban land: 35 percent
Minor components: 15 percent

Description of Woodstown

Setting
Landform: Broad interstream divides, swales, fluviomarine terraces, depressions, interfluves, drainhead complexes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Loamy fluviomarine deposits

Properties and qualities
Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: About 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.9 inches)

Interpretive groups
Land capability (nonirrigated): 2e

Typical profile

0 to 8 inches: Sandy loam
8 to 28 inches: Loam
28 to 42 inches: Fine sandy loam
42 to 60 inches: Sandy loam
60 to 72 inches: Loamy sand

Description of Urban Land

Interpretive groups

Land capability (nonirrigated): 8

Minor Components

Hammonton

Percent of map unit: 5 percent
Landform: Broad interstream divides, depressions, drainhead complexes, fluviomarine terraces, interfluves, swales
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

Hambrook

Percent of map unit: 5 percent
Landform: Broad interstream divides, interfluves
Landform position (two-dimensional): Summit

Fallsington

Percent of map unit: 5 percent
Landform: Depressions, drainageways, drainhead complexes, swales

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://soils.usda.gov/

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://soils.usda.gov/

Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://soils.usda.gov/

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://soils.usda.gov/

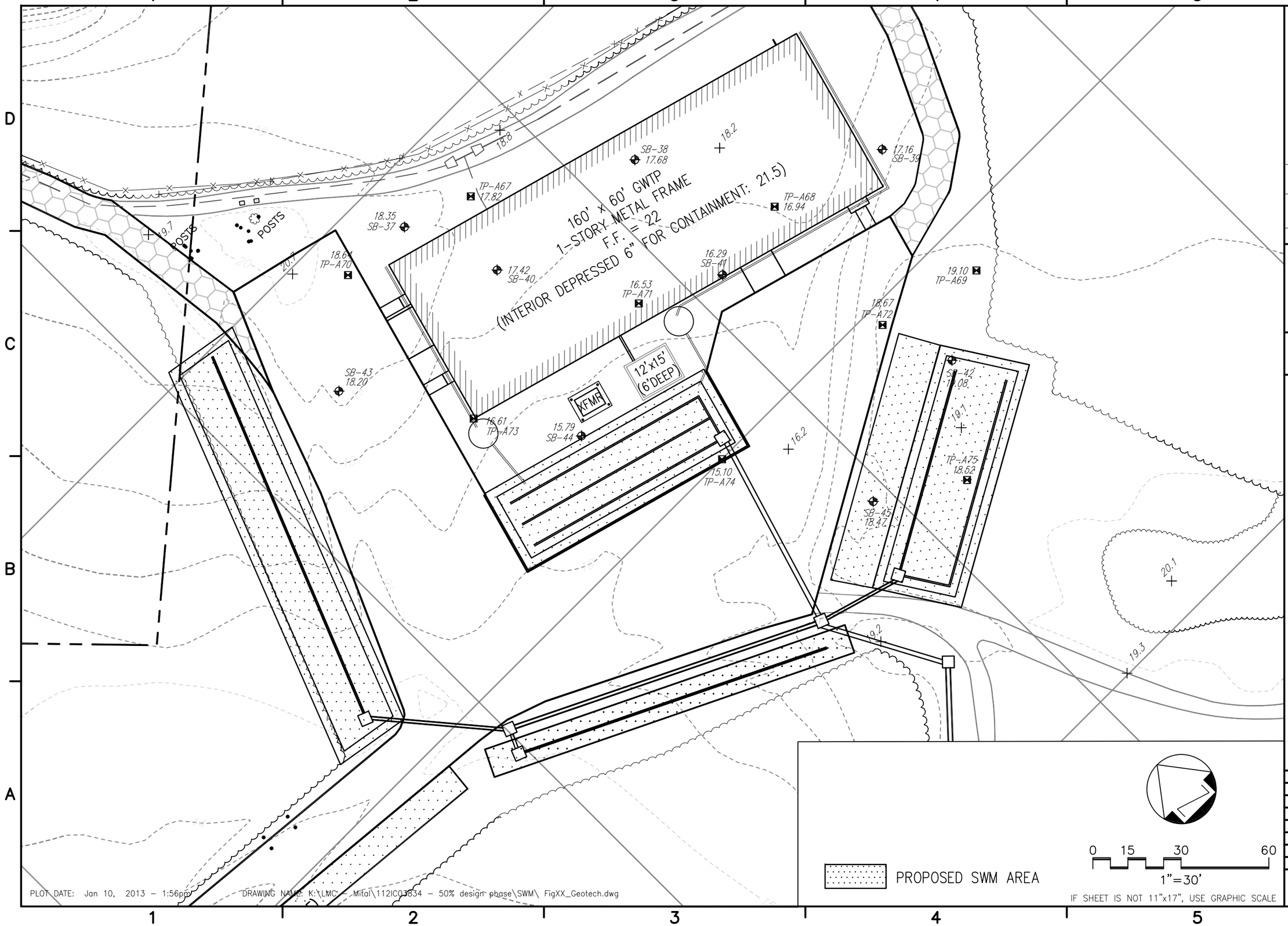
United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.glti.nrcs.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://soils.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://soils.usda.gov/

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210.

APPENDIX B – GEOTECHNICAL AND GROUNDWATER INFORMATION



NO.	DATE	BY	DESCRIPTION
5	-	-	-
4	-	-	-
3	-	-	-
2	-	-	-
1	-	-	-
0	XX/XX/XX	-	-

REVISIONS

LOCKHEED MARTIN
MARTIN STATE AIRPORT DUMP ROAD AREA
GROUNDWATER INTERIM REMEDIAL ACTION

TEST PIT/SOIL BORING LOCATIONS

APPENDIX B-1

PROJECT NO.:	112IC03834
FILE:	SEE PLOT STAMP
DESIGN BY:	XXX
DRAWN BY:	XXX
DEPT CHECK:	XXX
PROJ CHECK:	XXX
DATE:	MONTH DAY, YEAR
SCALE:	XXXXX

DWG. NO

SHEET X OF X

PLOT DATE: Jan 10, 2013 – 1:56pm DRAWING NAME: K:\LMC – Mital\112IC03834 – 50% design phase\SWM\ FigXX_Geotech.dwg

TETRA TECH
240 Continental Drive, Suite 200
Newark, Delaware 19713
302.738.7551
fax: 302.454.5988

TEST BORING LOG

Project Name: GROUNDWATER TREATMENT PLANT			Project No.: 112IC04297
Project Location: MARTIN STATE AIRPORT, MIDDLE RIVER, MD			Page 1 of 1
Test Boring No.: SB42	Dates(s) Drilled: 07/16/12	Inspector:	J. COSTELLO
Drilling Contractor: John D. Hynes & Assoc.	Drilling Method: SPT - ASTM D1586	Driller:	M. HYNES
Surface Elevation (ft): 19.1	Groundwater Depth (ft): 19.2	Total Depth (ft):	45.5

Sample No.	Sample Depth (ft) From	Sample Depth (ft) To	Strata Depth (ft) From	Strata Depth (ft) To	Recov. (in)	Strata	Description of Materials	HS (PPM)	6" Increment Blows *				N
1	0.0	2.0	0.0		24		DARK BROWN F-M SAND, LITTLE SILT, TRACE F-	10.6	5	11	12	13	**23**
							GRAVEL (FILL)						
2	2.0	4.0			24		DARK BROWN F-M SAND WITH SOME SILT, TRACE	195	7	8	12	10	**20**
							F-GRAVEL (FILL).						
3	4.0	6.0			24	**A**	DARK BROWN AND GRAY F-C SAND, INTERMITTENT	6.9	7	8	8	7	**16**
							CLAY, LITTLE F-GRAVEL (FILL).						
4	6.0	8.0			24		VERY DRY RED CLAY (PULVARIZED RED BRICK?),	31.5	7	3	4	3	**7**
							BROWN GRAVELLY CLAY, WOOD FRAG. (FILL)						
5	8.0	10.0		9.5	2		SAME	12.9	5	4	3	1	**7**
			9.5										
6	10.0	12.0			24		DARK GRAY ORGANIC SILTY CLAY.	8.8	1	2	3	1	**5**
						B							
7	12.0	14.0			24		DARK GRAY ORGANIC SILTY CLAY.	6.3	3	4	2	1	**6**
8	14.0	16.0		16.0	24		MEDIUM GRAY SILTY CLAY, POSSIBLY ORGANIC.	17.2	4	3	3	2	**6**
			16.0			**C**							
9	16.0	18.0		19.0	24		GRAY CLAYEY SILT, TRACE F-SAND.	8.1	3	3	3	3	**6**
			19.0										
10	18.0	20.0			24		YELLOWISH BROWN F-M SAND WITH A TRACE	4.7	6	4	6	5	**10**
						D	SILT.						
11	24.0	25.5			24		ORANGE BROWN TO GRAY F-M SAND WITH A	7.8	17	27	29		**56**
				27.0			LITTLE SILT.						
12	29.0	30.5	27.0		24		VARICOLORED WHITE, TAN, REDDISH BROWN, CLAYEY	8.2	7	4	5		**9**
							SILTY WITH FINE SAND INTERBEDS.						
13	34.0	35.5			24		VARICOLORED WHITE, MUAVE, TAN F-M SAND	4.4	9	27	50/1"		**>50**
							TRACE SILT.						
14	39.0	40.5			24	**E**	RED TO REDDISH BROWN F-M SAND, TRACE SILT.	4.6	8	12	17		**29**
15	44.0	45.5			18		VARICOLORED TAN, REDDISGH BROWN, WHITE	5	30	47	13		**60**
				45.5			F-M SAND, TRACE SILT.						

Notes/Comments:

Pocket Shear Vane Testing
S6: 0.15 kg/cm2
S7: 0.18 kg/cm2
S8: 0.2.0 kg/cm2
S9: 0.20 kg/cm2

Pocket Pentrometer Testing
S7: 0.5 tsf
S8: 0.5 tsf
S9: 0.5 tsf

* Number of blows of 140 lb. Hammer dropped 30 in. required to drive 2 in. split-spoon sampler in 6 in. increments.
N: Number of blows to drive spoon from 6" to 18" interval.

TETRA TECH
240 Continental Drive, Suite 200
Newark, Delaware 19713
302.738.7551
fax: 302.454.5988

TEST BORING LOG

Project Name: GROUNDWATER TREATMENT PLANT	Project No.: 112IC04297
Project Location: MARTIN STATE AIRPORT, MIDDLE RIVER, MD	Page 1 of 2

Test Boring No.: SB43	Dates(s) Drilled: 07/18/12	Inspector: J. COSTELLO
Drilling Contractor: John D. Hynes & Assoc.	Drilling Method: SPT - ASTM D1586	Driller: M. HYNES
Surface Elevation (ft): 18.2	Groundwater Depth (ft): 20.0	Total Depth (ft): 61

Sample No.	Sample Depth (ft) From	Sample Depth (ft) To	Strata Depth (ft) From	Strata Depth (ft) To	Recov. (in)	Strata	Description of Materials	HS (PPM)	6" Increment Blows *				N
1	0.0	2.0	0.0		24		VARIABLE MATRIX OF BROWN F-M SAND AND VARI-	58.3	8	7	6	10	**13**
							COLORED (RED, TAN, GRAY) SANDY CLAY (FILL).						
2	2.0	4.0			20		SAME (WITH A LITTLE F-GRAVEL) (FILL).	42.5	10	12	8	7	**20**
3	4.0	6.0			20		VARIABLE MATRIX OF VARI-COLORED (GRAY, TAN,	393	5	7	9	11	**16**
							BROWN) SAND, CLAY AND F-GRAVEL (FILL).						
4	6.0	8.0			20	**A**	SAME (FILL).	184	2	3	4	10	**7**
5	8.0	10.0			15		MOTTLED DARK BROWN, LIGHT GRAY, TAN SANDY	126	7	13	16	20	**29**
							CLAY (FILL).						
6	10.0	12.0			10		VARIABLE MATRIX OF DARK BROWN F-M SAND, RED	478	5	4	9	9	**13**
				11.8			CLAY, TRACE C-GRAVEL (FILL). GRAY CLAY IN TIP.						
7S	12.0		11.8	13.5	22	**B**	SHELBY TUBE: DARK GRAY ORGANIC SILTY CLAY.						
		14.0	13.5				(LOWER PORTION: BROWN F-M SAND, SOME SILT.						
8	14.0	16.0			20		BROWN F-M SAND WITH SOME SILTY CLAY, BLACK	95.1	5	4	3	4	**7**
							NODULES.						
9	16.0	18.0			20		BROWN F-M SAND WITH A TRACE SILT.	84.6	4	5	7	11	**12**
10	18.0	20.0			20		DARK GRAY TO BROWN F-M SAND WITH A LITTLE SILT.	51.8	10	14	16	16	**30**
11	24.0	26.0			20	**D**	LIGHT GRAY TO TAN FINE SAND.	107	3	11	15	18	**26**
12	29.0	31.0			20		REDDISH BROWN F-M SAND WITH A LITTLE SILTY CLAY	32	8	5	7	8	**12**
13	34.0	36.0			20		YELLOWISH BROWN F-M SAND, TRACE SILT.	75	8	5	7	8	**12**
14	39.0	41.0			20		YELLOWISH BROWN F-M SAND WITH A LITTLE CLAYEY	52.3	10	8	6	10	**14**
							SILT.						
15	44.0	46.0		47.0	20		SAME	35.5	10	40	30	31	**70**

Notes/Comments: Switched to mud rotary at 26 feet.

* Number of blows of 140 lb. Hammer dropped 30 in. required to drive 2 in. split-spoon sampler in 6 in. increments.
N: Number of blows to drive spoon from 6" to 18" interval.

TETRA TECH
240 Continental Drive, Suite 200
Newark, Delaware 19713
302.738.7551
fax: 302.454.5988

TEST BORING LOG

Project Name: GROUNDWATER TREATMENT PLANT	Project No.: 112IC04297
Project Locatio LMC MIDDLE RIVER COMPLEX (BLOCK I)	Page 2 of 2

Test Boring No.: SB43	Dates(s) Drilled: 07/18/12	Inspector: J. COSTELLO
Drilling Contractor: John D. Hynes & Assoc.	Drilling Method: SPT - ASTM D1586	Driller: M. HYNES
Surface Elevation (ft): 18.2	Groundwater Depth (ft): 20.0	Total Depth (ft): 61

Sample No.	Sample Depth (ft) From	Sample Depth (ft) To	Strata Depth (ft) From	Strata Depth (ft) To	Recov. (in)	Strata	Description of Materials	HS (PPM)	6" Increment Blows *				N
16	49.0	51.0	47.0		10		WHITE FINE SAND AND SILTY CLAY.	15.6	10	20	50/1"		**>50**
17	54.0	56.0			4		VARIABLE WHITE TO REDDISH BROWN FINE SAND	29.5	50/5"				**>50**
						E	WITH SOME SILTY CLAY.						
18	59.0	61.0			4		VARIABLE WHITE, RED, REDDISH BROWN, TA F-SAND	9.1	50/5"				**>50**
				61.0			WITH A LITTLE TO SOME SILTY CLAY.						

Notes/Comments:

Pocket Shear Vane Testing
n/a

Pocket Pentrometer Testing
S5: 4.0 tsf
S6: 2.5 tsf (CLAY FRACTION)

* Number of blows of 140 lb. Hammer dropped 30 in. required to drive 2 in. split-spoon sampler in 6 in. increments.
N: Number of blows to drive spoon from 6" to 18" interval.

TETRA TECH
240 Continental Drive, Suite 200
Newark, Delaware 19713
302.738.7551
fax: 302.454.5988

TEST BORING LOG

Project Name: GROUNDWATER TREATMENT PLANT	Project No.: 112IC04297
Project Location: MARTIN STATE AIRPORT, MIDDLE RIVER, MD	Page 1 of 1

Test Boring No.: SB44	Dates(s) Drilled: 07/20/12	Inspector: J. COSTELLO
Drilling Contractor: John D. Hynes & Assoc.	Drilling Method: SPT - ASTM D1586	Driller: M. HYNES
Surface Elevation (ft): 15.8	Groundwater Depth (ft): 16.0	Total Depth (ft): 46

Sample No.	Sample Depth (ft) From	Sample Depth (ft) To	Strata Depth (ft) From	Strata Depth (ft) To	Recov. (in)	Strata	Description of Materials	HS (PPM)	6" Increment Blows *				N
1	0.0	2.0			20		VARIABLE BROWN TO GRAY F-M SAND, TRACE F-	0	5	6	9	13	**15**
							GRAVEL, CLAY PLUGS (FILL).						
2	2.0	4.0			20		VARIABLE MATRIX OF RED, TAN, BROWN, DAR GRAY	0	9	9	11	11	**20**
						A	SILTY CLAY AND F-M SAND (FILL)						
3	4.0	6.0			20		VARIABLE RED, BROWN, TAN, WHITE CLAY WITH F-M	0	6	8	6	6	**14**
							SAND INTERBEDS (FILL).						
4	6.0	8.0			20		DARK BROWN SILTY CLAY AND F-SAND (FILL).	0.2	4	4	4	4	**8**
				8.0									
5S	8.0	10.0	8.0		24		SHELBY TUBE: DARK GRAY ORGANIC SILTY CLAY.						
6	10.0	12.0			20		GRAY TO BROWN F-M SAND WITH SOME SILT/CLAY.	0	3	2	3	3	**5**
						B							
7	12.0	14.0			20		DARK GRAY ORGANIC SILTY CLAY WITH SOME FINE	0.6	3	1	6	7	**7**
							SAND.						
8	14.0	16.0			20		DARK GRAY ORGANIC SILTY CLAY, TRACE FINE	0	3	3	5	5	**8**
				17.5			SAND.						
9	16.0	18.0	17.5		20		LIGHT BROWN F-M SAND, TRACE SILT.	0	10	10	9	25	**19**
10	18.0	20.0			20		YELLOWISH BROWN TO LIGHT GRAY F-M SAND WITH	0	9	10	18	25	**28**
						D	A LITTLE SILT.						
11	24.0	26.0			10		REDDISH BROWN TO GRAY F-C SAND, TRACE F-	0.2	9	30	50/1"		**>50**
				28.0			GRAVEL.						
12	29.0	31.0	28.0		20		VARIABLE WHITE TO TAN SILTY CLAY, TRACE F-	0	8	11	15	18	**26**
							SAND.						
13	34.0	36.0			20		VARIABLE RED TO REDDISH BROWN F-M SAND WITH	0.9	4	6	7	6	**13**
							A LITTLE SILTY CLAY.						
14	39.0	41.0			20	**E**	VARIABLE WHITE, RED, BROWN, TAN SILTY CLAY,	0.7	9	22	36	42	**>50**
							WITH F-SAND INTERBEDDING.						
15	44.0	46.0			6		VARIABLE WHITE, REDDISH BROWN, TAN F-SAND AND	7.3	15	50/1"			**>50**
				46.0			SILTY CLAY.						

Notes/Comments:

Pocket Shear Vane Testing
S7: 0.35 kg/cm2
S8: 0.35 kg/cm2

Pocket Pentrometer Testing
S2: 3.0 tsf
S3: 2.0 tsf
S4: 2.0 tsf
S12: 2.75 tsf
S14: 4.0 tsf (clay fraction)

* Number of blows of 140 lb. Hammer dropped 30 in. required to drive 2 in. split-spoon sampler in 6 in. increments.
N: Number of blows to drive spoon from 6" to 18" interval.

TETRA TECH
240 Continental Drive, Suite 200
Newark, Delaware 19713
302.738.7551
fax: 302.454.5988

TEST BORING LOG

Project Name: GROUNDWATER TREATMENT PLANT	Project No.: 112IC04297
Project Location: MARTIN STATE AIRPORT, MIDDLE RIVER, MD	Page 1 of 2
Test Boring No.: SB45	Dates(s) Drilled: 07/19/12 — Inspector: J. COSTELLO
Drilling Contractor: John D. Hynes & Assoc.	Drilling Method: SPT - ASTM D1586 — Driller: M. HYNES
Surface Elevation (ft): 18.5	Groundwater Depth (ft): 19 — Total Depth (ft): 61

Sample No.	Sample Depth (ft) From	Sample Depth (ft) To	Strata Depth (ft) From	Strata Depth (ft) To	Recov. (in)	Strata	Description of Materials	HS (PPM)	6" Increment Blows *				N
1	0.0	2.0	0.0		24	A	BROWN F-M SAND, A FEW CLAY INTERBEDS, TRACE	0	11	21	16	31	**37**
							F-GRAVEL.						
2	2.0	4.0			24		DARK BROWN F-M SAND WITH SOME SILTY CLAY.	9	16	18	24	30	**42**
3	4.0	6.0			24		DARK BROWN F-M SAND WITH A LITTLE SILT, TRACE	2.6	5	7	7	6	**14**
							F-GRAVEL.						
4	6.0	8.0			24		DARK BROWN F-M SAND WITH A LITTLE SILT, TRACE	9.7	7	8	7	10	**15**
							F-GRAVEL, CONTAINS CLAY INTERBEDS.						
5	8.0	10.0			24		DARK BROWN F-M SAND WITH A LITTLE SILT, TRACE	345	7	7	6	2	**13**
				10.0			F-GRAVEL, CONTAINS CLAY INTERBEDS.						
6S	10.0	12.0	10.0		24	B	SHELBY TUBE: DARK GRAY ORGANIC SILTY CLAY.						
7	12.0	14.0			20		DARK GRAY ORGANIC SILTY CLAY.	513	1	1	1	2	**2**
8S	14.0	16.0		15.0	24		(SHELBY TUBE) UPPER: DARK GRAY ORG. SILT/CLAY.						
			15.0			C	LOWER: DARK GRAY F-M SAND, SOME SILTY CLAY.						
9	16.0	18.0			20		MEDIUM TO DARK GRAY F-M SAND WITH A LITTLE	286	2	2	2	6	**4**
				17.5			SILT.						
10	18.0	20.0	17.5		20	D	GRAY AND TAN F-M SAND WITH A LITTLE SILT.	23.1	4	7	9	10	**16**
11	24.0	26.0			20		LIGHT BROWN TO TAN F-SAND WITH A LITTLE SILT.	7.9	18	19	20	31	**39**
				28.0									
12	29.0	31.0	28.0		20	E	WHITE SILTY CLAY WITH SOME FINE SAND.	10	11	16	19	21	**35**
13	34.0	36.0			20		REDDISH BROWN TO BROWN FINE SAND WITH A	3.8	14	14	24	30	**38**
							TRACE TO LITTLE SILT.						
14	39.0	41.0			4		REDDISH BROWN TO BROWN F-M SAND WITH A LITTLE	1	37	50/1"			**>50**
							SILT.						
15	44.0	46.0			6		VARIABLE WHITE, DARK RED, TAN F-M SAND WITH	0	10	16	30	35	**46**
							CLAY INTERBEDS.						

Notes/Comments:

Pocket Shear Vane Testing
S7: 0.25 kg/cm2

Pocket Pentrometer Testing
S12: 3.75 tsf

* Number of blows of 140 lb. Hammer dropped 30 in. required to drive 2 in. split-spoon sampler in 6 in. increments.
N: Number of blows to drive spoon from 6" to 18" interval.

TETRA TECH
240 Continental Drive, Suite 200
Newark, Delaware 19713
302.738.7551
fax: 302.454.5988

TEST BORING LOG

Project Name: GROUNDWATER TREATMENT PLANT			Project No.: 112IC04297
Project Locatio LMC MIDDLE RIVER COMPLEX (BLOCK I)			Page 2 of 2
Test Boring No.: SB45	Dates(s) Drilled: 07/19/12	Inspector:	J. COSTELLO
Drilling Contractor: John D. Hynes & Assoc.	Drilling Method: SPT - ASTM D1586	Driller:	M. HYNES
Surface Elevation (ft): 18.5	Groundwater Depth (ft): 19	Total Depth (ft):	61

Sample No.	Sample Depth (ft) From	Sample Depth (ft) To	Strata Depth (ft) From	Strata Depth (ft) To	Recov. (in)	Strata	Description of Materials	HS (PPM)	6" Increment Blows *				N
16	49.0	51.0			18		REDDISH BROWN, TAN TO GRAY F-M SAND WITH A	4.6	12	16	24	25	**40**
							LITTLE SILT.						
17	54.0	56.0			17	**E**	REDDISH BROWN, TAN TO GRAY F-M SAND WITH A	0.6	16	18	30	35	**48**
							LITTLE SILT.						
18	59.0	61.0			5		YELLOWISH BROWN TO TAN F-M SAND WITH A	0.1	37	50/1"			**>50**
				61.0			LITTLE SILTY CLAY.						

Notes/Comments:

* Number of blows of 140 lb. Hammer dropped 30 in. required to drive 2 in. split-spoon sampler in 6 in. increments.
N: Number of blows to drive spoon from 6" to 18" interval.

TEST PIT LOG

Tetra Tech

PROJECT NAME: MSA GW Treatment Bldg.
PROJECT NUMBER: 112IC04297
LOCATION: Middle River, MD
TEST PIT No.: A69
DATE: 6/22/2012
GEOLOGIST: E. Watt

Depth (Ft.)	Lithology Change (Depth/Ft.)	MATERIAL DESCRIPTION Soil/Waste Characteristics (lithology, density, color, etc.)	USCS	Remarks	PID/FID READING Source (ppm)	 BZ (ppm)
0 to 3'		Dry, brown fine sand, pieces of rock up to 12" wide/diameter, some silt.		Screening @ 3'	177	
3' to 10'		Dry, fine to medium sand with debris to 10' Glass, tree stumps, rock, metal debris, brick 6" thick concrete with wire mesh, 4" pipe, 50% soil / 50% debris		Screening @ 6'	273	
10' to 15'		Grey silt/clay		Screening @ 11' Screening @ 15'	161 41.5	

TEST PIT CROSS SECTION AND / OR PLAN VIEW

REMARKS: Total depth 15', no groundwater.

PHOTO LOG:

Tetra Tech

TEST PIT LOG

PROJECT NAME: MSA GW Treatment Bldg. TEST PIT No.: A72
PROJECT NUMBER: 112IC04297 DATE: 6/21/2012
LOCATION: Middle River, MD GEOLOGIST: E. Watt

Depth (Ft.)	Lithology Change (Depth/Ft.)	MATERIAL DESCRIPTION Soil/Waste Characteristics (lithology, density, color, etc.)	USCS	Remarks	PID/FID READING Source (ppm)	 BZ (ppm)
0 to 2'		Dry, brown fine sand. Root layer 0 to 0.8'				
2' to 10'		Dry, brown fine to medium sand, with some silt and rock (possible select borrow fill?) Small, hyrdaulic motor between 2' and 3', some brown fluid inside. Small valve near 5'		Screening @ 2' Screening @ 5' Screening @ 8'	21.4 0.9 0.5	
10' to 13'		Grey/black silt/clay		Screening @ 10'	0.5	
13'		Moist, light grey/light brown silt to silty sand		Screening @ 13'	0.6	

TEST PIT CROSS SECTION AND / OR PLAN VIEW

REMARKS: Total depth 13', no groundwater

PHOTO LOG:

Tetra Tech

TEST PIT LOG

PROJECT NAME: MSA GW Treatment Bldg. TEST PIT No.: A73
PROJECT NUMBER: 112IC04297 DATE: 6/20/2012
LOCATION: Middle River, MD GEOLOGIST: E. Watt

Depth (Ft.)	Lithology Change (Depth/Ft.)	MATERIAL DESCRIPTION Soil/Waste Characteristics (lithology, density, color, etc.)	USCS	Remarks	PID/FID READING Source (ppm)	 BZ (ppm)
0 to		Dry, brown fine sand. Root layer 0 to 1.5'.				
2'		Pieces of rock, concrete up to 12" wide				
2'		Dry to moderately moist grey/red silt to silty				
to		sand. Pieces of concrete up to 18" near 3'.				
6'		6" to 8" diameter logs near 5'				
6'		Grey, silt/clay		Screening @ 6'	0.1	
7'		Pieces of processed wood, slight organic odor				
8'		Yellow zinc chromate paint?, 5 gallon bucket		Screening @ 8'	1.9	
		Continue grey silt/clay; 50% soil / 50% debris		Screening @ 9.5'	0.3	
11'		Processed wood - small pieces to 2' x 4'				
14'		Continue grey silt/clay and processed wood				
		Pieces of drums; 60% soil / 40% debris				
15'		Brown/orange fine sand		Screening @ 15'	0.8	

TEST PIT CROSS SECTION AND / OR PLAN VIEW

REMARKS: Total depth 15.5', groundwater near 11', large piece of concrete (~12" thick) on west end of excavation near 9.5' to 10'

PHOTO LOG:

Tetra Tech

TEST PIT LOG

PROJECT NAME: MSA GW Treatment Bldg. TEST PIT No.: A74
PROJECT NUMBER: 112IC04297 DATE: 6/20/2012
LOCATION: Middle River, MD GEOLOGIST: E. Watt

Depth (Ft.)	Lithology Change (Depth/Ft.)	MATERIAL DESCRIPTION Soil/Waste Characteristics (lithology, density, color, etc.)	USCS	Remarks	PID/FID READING Source (ppm)	 BZ (ppm)
0 to 2.5'		Dry, brown silty to fine sand, 1/2" pieces of rock		Screening @ 2'	0.0	
2.5' to 5'		Dry, red, brown, grey mottled silt, processed wood, rock, metal, plastic 70% soil / 30% debris		Screening @ 3' Screening @ 5'	1.3 3.5	
5' to 11'		Grey/black silt/clay down to 11' Drums between 6' and 7'; 10% soil/90% debris Yellow paint near 6.5', processed wood near 9' 60% soil / 40% debris from 7' to 11'		Screening @ 6' Screening @ drums Screening @ 7' Screening @ 8' Screening @ 10.5	8.5 15.1 163 13.8 49.7	
11' to 15.5'		Light brown/light grey silt to silty sand		Screening @ 12' Screening @ 14'	3.8 3.1	

TEST PIT CROSS SECTION AND / OR PLAN VIEW

REMARKS: Total depth 15.5', groundwater starts trickling in at 7.5'. Extended test pit to the east and uncovered additional drums, concrete slabs, and green and yellow paint

PHOTO LOG:

TEST PIT LOG

Tetra Tech

PROJECT NAME: MSA GW Treatment Bldg. TEST PIT No.: A75
PROJECT NUMBER: 112IC04297 DATE: 6/22/2012
LOCATION: Middle River, MD GEOLOGIST: E. Watt

Depth (Ft.)	Lithology Change (Depth/Ft.)	MATERIAL DESCRIPTION Soil/Waste Characteristics (lithology, density, color, etc.)	USCS	Remarks	PID/FID READING Source (ppm)	 BZ (ppm)
0 to 5'		Dry, brown fine sand, pieces of rock and concrete, 6" to 8" thick, up to 2' wide		Screening @ 2'	198	
5' to 10'		Dry, black/grey fine to medium sand to 10' Metal wire, processed wood, rock, cargo netting, glass, axle, brick, head light, metal pieces. 50% soil / 50% debris		Screening @ 5' Screening @ 9'	376 384	
10' to 11'		Black/grey silt/clay		Screening @ 11'	229	

TEST PIT CROSS SECTION AND / OR PLAN VIEW

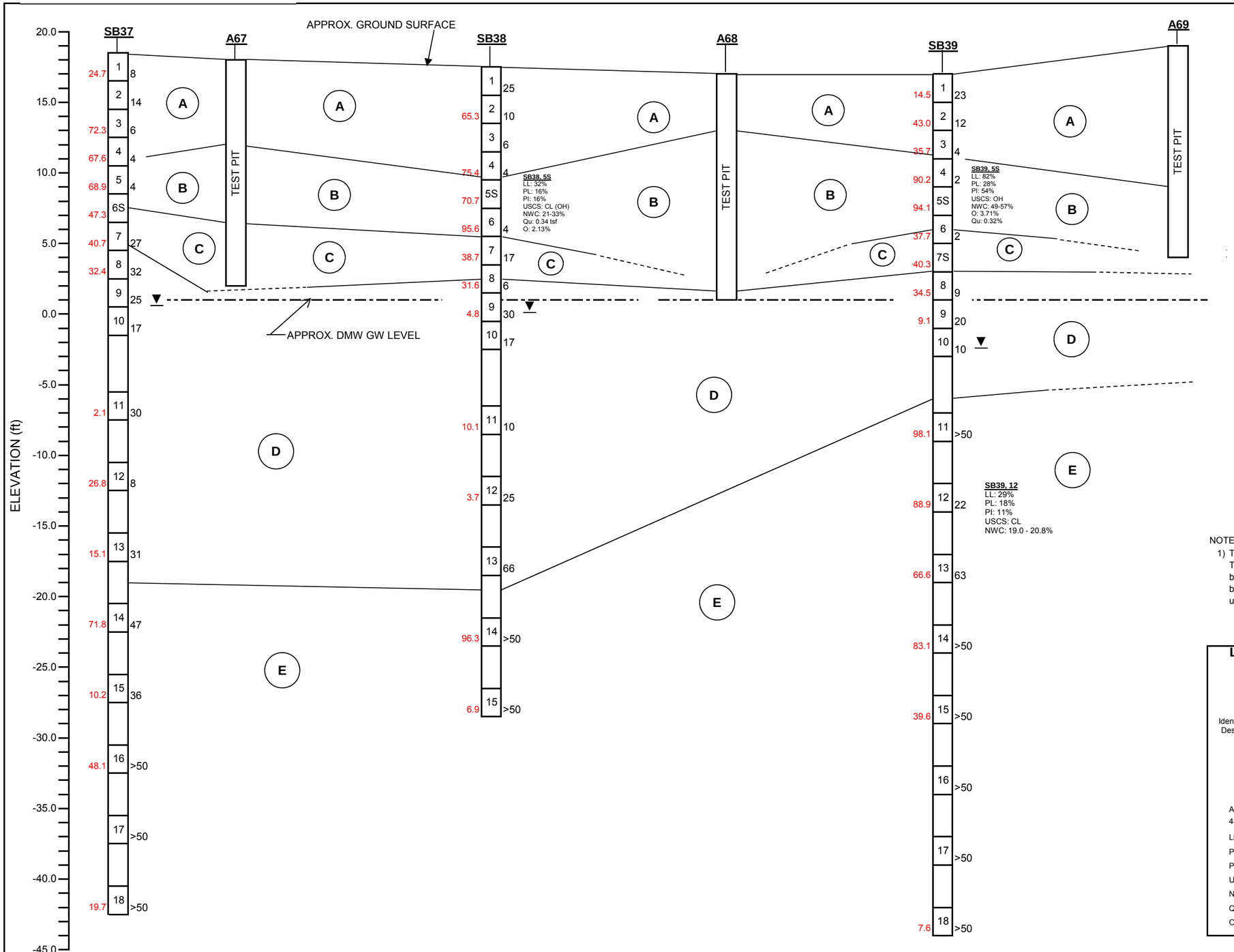
REMARKS: Total depth 11', groundwater trickling in between 10.5' and 11'. Large piece of orange/yellow soil noticed on south end of test pit; it was not excavated.

PHOTO LOG:

TETRA TECH

MARTIN STATE AIRPORT
LMC GROUNDWATER TREATMENT BUILDING
GENERALIZED STRATIGRAPHIC PROFILE (SB37, A67, SB38, A68, SB39, A69)

Appendix B-3



GENERALIZED STRATUM DESCRIPTIONS

STRATUM A: HISTORIC FILL: VARYING MATRIX OF SAND, SILT, CLAY AND GRAVEL CONTAINING AN APPRECIABLE AMOUNT OF DEBRIS AND RUBBLE (CONCRETE, TREE LIMBS AND STUMPS, LUMBER, ASH, TRACE PIGMENTS, ROCK, BRICKS, METAL AND OTHER DELETERIOUS DEBRIS.

STRATUM B: SOFT TO VERY SOFT DARK GRAY ORGNIC SILTY CLAY WITH A TRACE TO SOME FINE SAND (USCS: OH).

STRATUM C: MEDIUM DENSE GRAY TO DARK GRAY CLAYEY FINE TO MEDIUM SAND WITH VARYING AMOUNTS OF FINE TO COARSE GRAVEL (USCS: SC, VISUAL).

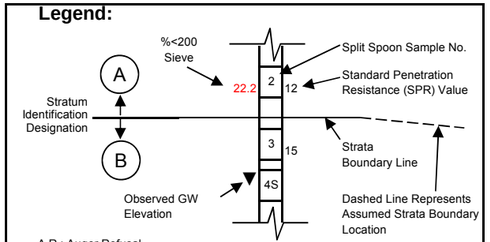
STRATUM D: MEDIUM DENSE BROWN OR GRAY FINE TO FINE TO MEDIUM SAND WITH VARYING AMOUNTS OF SILT AND CLAY (USCS: VARYING SP, SP-SM, SM, AND SC [VISUAL]).

STRATUM E: WHITE TO VARICOLORED, VERY STIFF TO HARD SILTY CLAY OF MEDIUM PLASTICITY WITH VARYING AMOUNTS OF FINE SAND (USCS: CL), TO A DENSE TO VERY DENSE FINE TO COARSE SAND WITH VARYING AMOUNTS OF SILT AND CLAY (USCS: VARYING SP-SM, SM AND SC [VISUAL]) .

NOTES:

1) The profiles shown are based on Tetra Tech's description of the samples. The test borings represent subsurface conditions encountered at each test boring location, and the profile is based on straight-line interpolation between borings. Conditions between boring locations are relatively unknown.

Legend:



A.R.: Auger Refusal
4S: S Denotes shelby tube sample
LL: Liquid Limit
PL: Plastic Limit
PI: Plasticity Index
USCS: Unified Soil Classification System
NWC: Natural Water Content
Qu: Unconfined Compressive Strength
O: Organic Content

Map Document: (K:\GProject\MartinStateAirport-LMC\MapDocs\MXD\Maps\Groundwater contours Upper Surficial aquifer Jan 2010.mxd)
11/16/2010 -- 10:47:30 AM



Appendix B-4

Groundwater Elevation Contour Map - Upper Surficial Aquifer Wells, January 2010

Legend

- Groundwater Monitoring Well
- Abandoned Well
- Groundwater Elevation Contour, Contour Interval = 1 Foot
- 1.79 Groundwater Elevation, Feet, NAVD 88
- Maryland Air National Guard Boundary
- Ponds

* Not used for contouring: well installed in clay and may represent perched groundwater.
NAVD 88 = North American Vertical Datum of 1988

Lockheed Martin Martin State Airport
Middle River, Maryland

0 50 100 200 Feet

N

DATE MODIFIED: 11/16/10

CREATED BY: MP

Tetra Tech, Inc.

APPENDIX C – PHOTOGRAPHS



Photo 1: Existing Conditions of Main Access Road
(compacted dirt w/ evidence of previous "as-needed" gravel placement)



Photo 2: Existing Conditions of Main Access Road
(compacted dirt w/ evidence of previous "as-needed" gravel placement)

Note: More stone / broken asphalt visible as the access road approaches MANG



Photo 3: Example of partially cleared areas and access paths



Photo 4: Example of partially cleared areas and access paths



Photo 5: Example of partially cleared areas and access paths



Photo 6: Example of partially cleared areas and access paths



Photo 7: Example of an existing access path to be extended for new extraction wells

APPENDIX D – STORMWATER MANAGEMENT PLANS

(Provided as large-format roll)

SWM-01	Stormwater Management Plan Resources Map
SWM-02	Stormwater Management Plan Proposed Disturbance Map
SWM-03	Stormwater Management Plan Pre-development (all DA's)
SWM-04	Stormwater Management Plan Post-development (DA-1)
SWM-05	Stormwater Management Plan Post-development (DA-2)
SWM-06	Stormwater Management Plan Post-development (DA-3)
SWM-07	Stormwater Management Plan Lynbrook Road Culvert Drainage Area
SWM-08	Stormwater Management Plan Post Development T_c Lines
SWM-08	Stormwater Management Plan Taxiway Swale Conveyance
SWM-10	Stormwater Management Plan Erosion and Sediment Control Overlay I
SWM-11	Stormwater Management Plan Erosion and Sediment Control Overlay II

(INTERPOLATED 100' BUFFER)

FROG MORTAR CREEK

PROJECT AREA

MARYLAND AIR NATIONAL GUARD

5100

5110

5130

TIDAL

NON-TIDAL

TAXIWAY TANGO

CRITICAL AREA (IDA)

SOIL MAP UNIT DESCRIPTIONS
MkB - Mattapex - Urban land complex, 0-5 percent slopes
UR - Urban land 0-8 percent slopes
WoB - Woodstown sandy loam, 2 to 5 percent slopes

LIST OF PLANS	
SHEET	DESCRIPTION
SWM 01	RESOURCES MAP
SWM 02	PROPOSED DISTURBANCE MAP
SWM 03	PRE-DEVELOPMENT MAP (ALL DA'S)
SWM 04	POST-DEVELOPMENT (DA-1)
SWM 05	POST-DEVELOPMENT (DA-2)
SWM 06	POST DEVELOPMENT (DA-3)
SWM 07	CONVEYANCE THROUGH TAXIWAY SWALE
SWM 08	EROSION AND SEDIMENT CONTROL OVERLAY I
SWM 09	EROSION AND SEDIMENT CONTROL OVERLAY II

WETLANDS

SLOPES 10% OR GREATER (DRAFT)

FOREST (UNOFFICIAL)

EDGE OF WATER

100-YR FLOODPLAIN

EXPANDED 100' TIDAL BUFFER

NON-TIDAL WETLAND BUFFER (25' OFFSET)

STEEP SLOPE BUFFER (25' OFFSET)

0 30 60 120
1"=60'

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: STORMWATER MANAGEMENT PLAN RESOURCES MAP

SCALE: AS NOTED

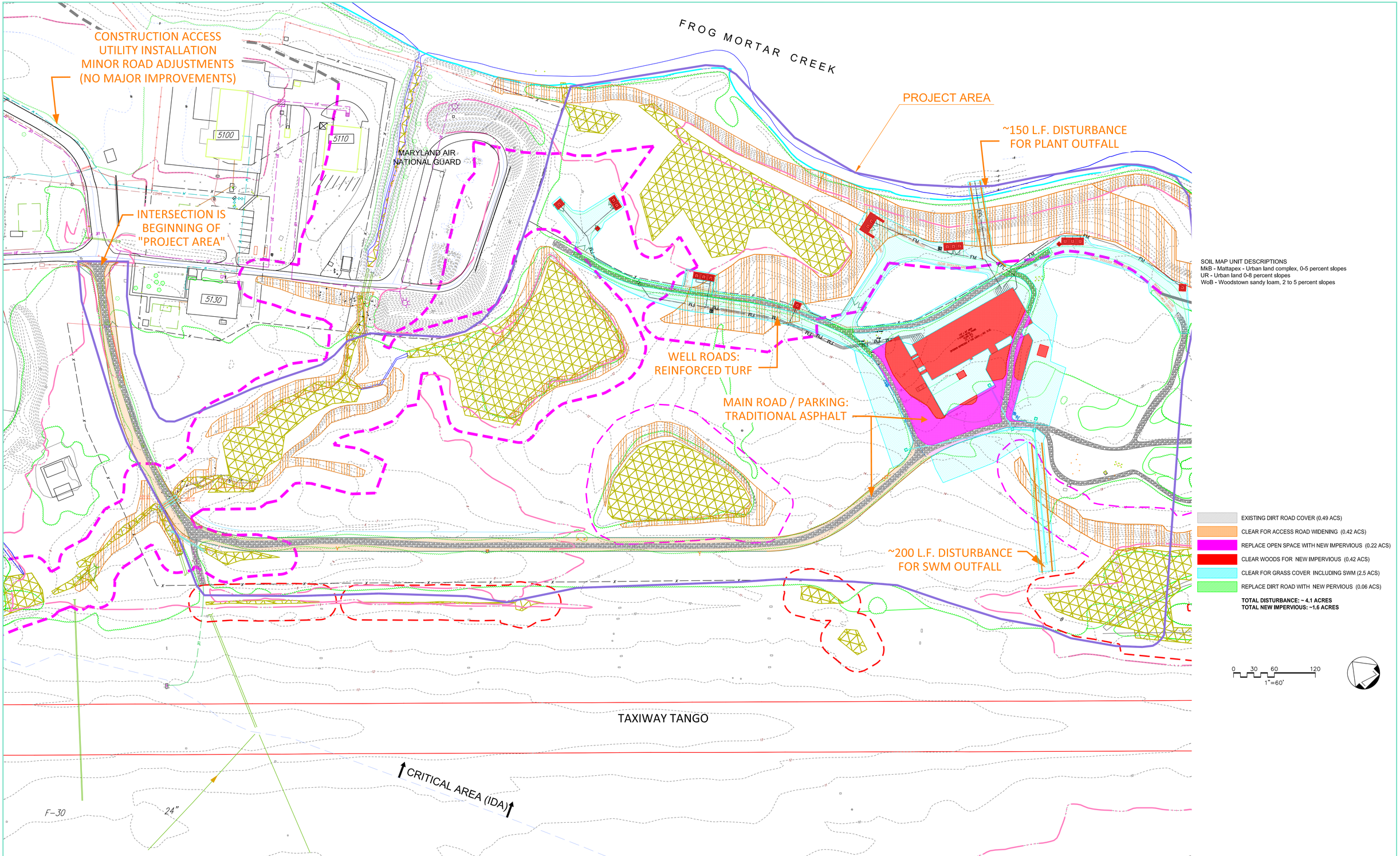
DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: SWM - 01

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\SWM\ 112C03834-SWM.dwg

PLOT DATE: Jul 10, 2013 - 10:49am



DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\SWM\ 112IC03834-SWM.dwg

PLOT DATE: Jul 03, 2013 - 11:31am

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

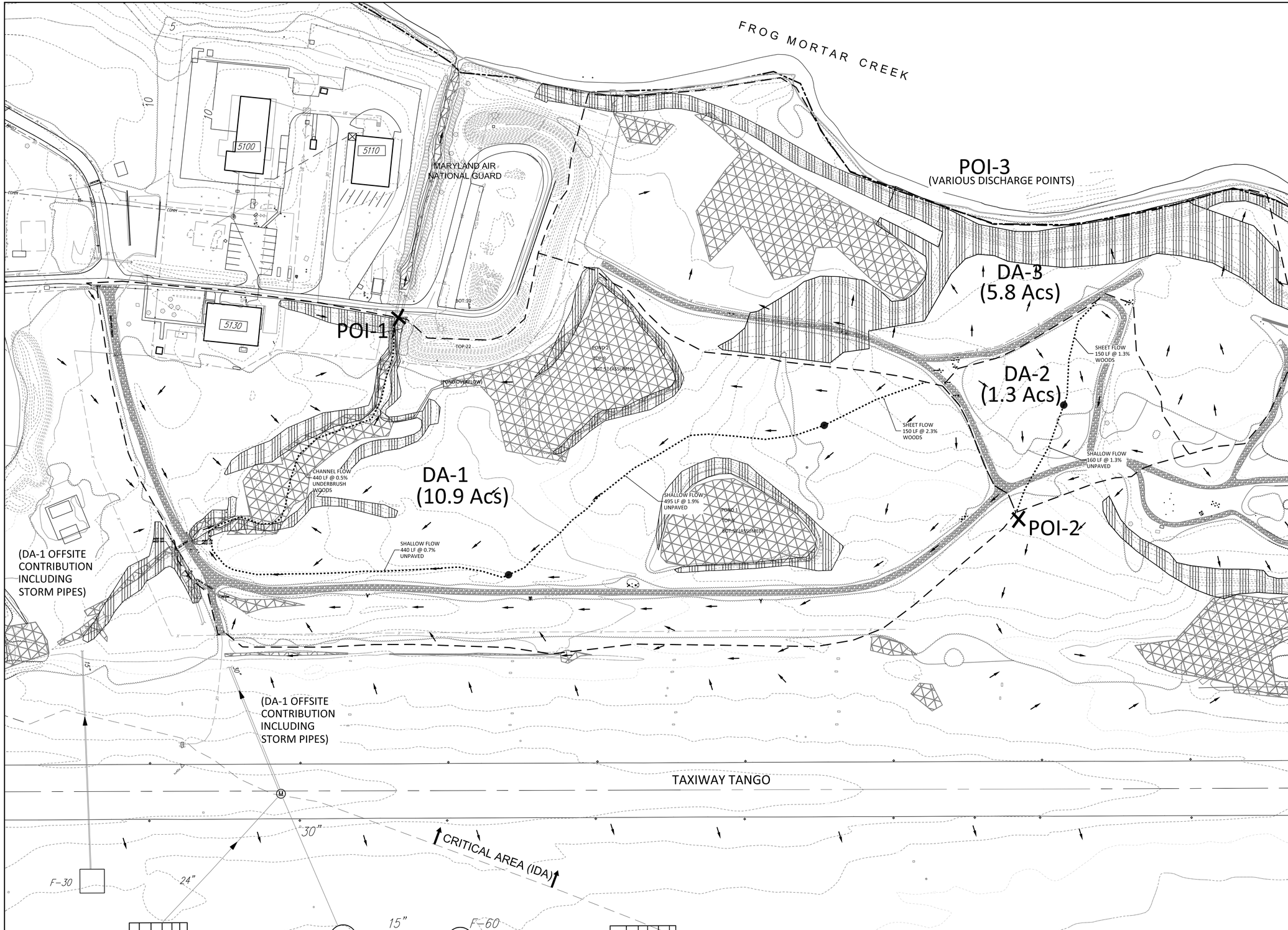
SHEET TITLE: STORMWATER MANAGEMENT PLAN PROPOSED DISTURBANCE MAP

SCALE: AS NOTED

DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: SWM - 02



NOTES:

1. THE SITE DEVELOPMENT IS LOCATED WITHIN THE INTENSELY DEVELOPED AREA (IDA) DESIGNATION OF THE CRITICAL AREA AND THE CRITICAL AREA 10% RULE APPLIES.
2. THE POINT OF INVESTIGATION (POI) FOR DRAINAGE AREA 1 (DA-1) IS THE MDANG CULVERT WHICH DISCHARGED TO FROG MORTAR CREEK, TIDAL WATERS.
3. THE RUNOFF FROM DA-2 DRAINS TO "TAXIWAY TANGO SWALE", WHICH RUNS ALONG THE NORTHERN SIDE OF THE TAXIWAY TANGO AND CONTRIBUTES TO FROG MORTAR CREEK.
4. THE RUNOFF FROM DA-3 DRAINS DIRECTLY TO FROG MORTAR CREEK AT VARIOUS POINTS.

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: STORMWATER MANAGEMENT PLAN PRE-DEVELOPMENT (ALL DA'S)

SCALE: AS NOTED

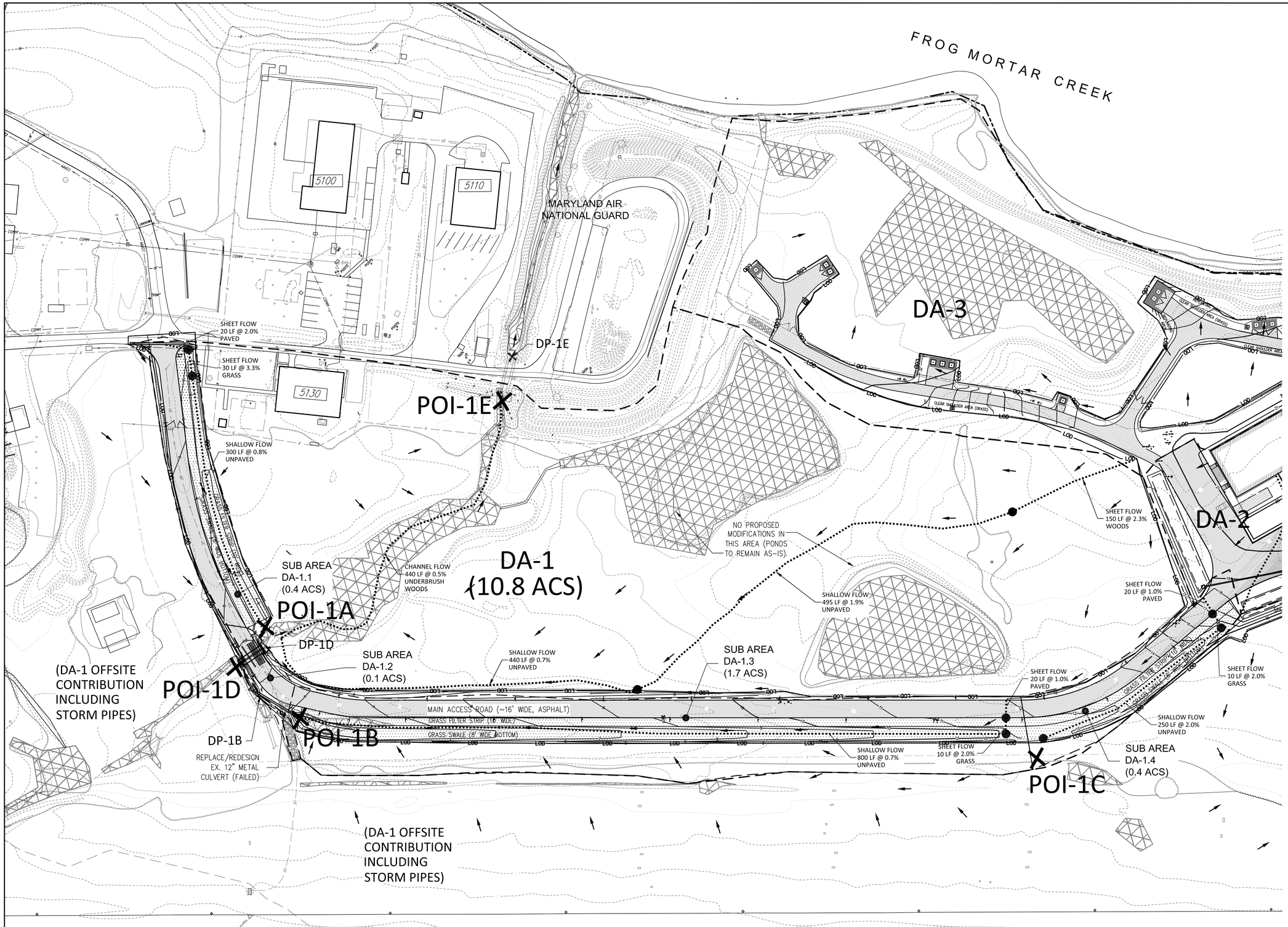
DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: SWM - 03

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\SWM\112IC03834-SWM.dwg

PLOT DATE: Jul 08, 2013 - 2:12pm



NOTES:

1. UNIFIED SIZING CRITERIA IN MARYLAND STORMWATER DESIGN MANUAL WAS FOLLOWED FOR THE STORMWATER MANAGEMENT. ENVIRONMENTAL SITE DESIGN (ESD) WAS IMPLEMENTED TO THE MAXIMUM EXTENT PRACTICABLE (MEP) FOR THE SITE DEVELOPMENT. ESD WAS USED TO ADDRESS THE WATER QUALITY (WQv) AND CHANNEL PROTECTION STORAGE (Cpv) REQUIREMENTS FOR POST-DEVELOPMENT CONDITIONS.
2. STORMWATER RUNOFF FROM THE IMPROVED ROADS ARE TYPICALLY TREATED BY MULTIPLE ESD PRACTICES; COMBINATION OF DISCONNECTION OF NON-ROOFTOP RUNOFF (FILTER STRIP) AND MICRO-SCALE PRACTICE (GRASS-SWALE). NO STRUCTURAL PRACTICES ARE PROPOSED.
3. BASED ON A TIDE STUDY OF LOCAL NOAA STATION DATUM, THE MEAN HIGH WATER (MHL) LINE IN THIS AREA IS ABOUT EL. 0.6 IN NAVD88. THIS IS MORE-OR-LESS THE EDGE OF FROG MORTAR CREEK, INCLUDING THE FIRST 300' LONG SECTION OF THE MDANG DITCH (UP TO THE FIRST CULVERT AT THE FIRING RANGE).
4. THE POINT OF INVESTIGATION (POI) FOR DRAINAGE AREA 1 (DA-1) IS THE MDANG CULVERT WHICH DISCHARGED TO FROG MORTAR CREEK, TIDAL WATERS.
5. THE EXISTING DIRT/GRAVEL ROAD (APPROXIMATELY 10' WIDE) WILL BE EXPANDED TO 20' WIDE, PAVING CURRENTLY DESIGNED AS ASPHALT.

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: STORMWATER MANAGEMENT PLAN POST-DEVELOPMENT (DA-1)

SCALE: AS NOTED

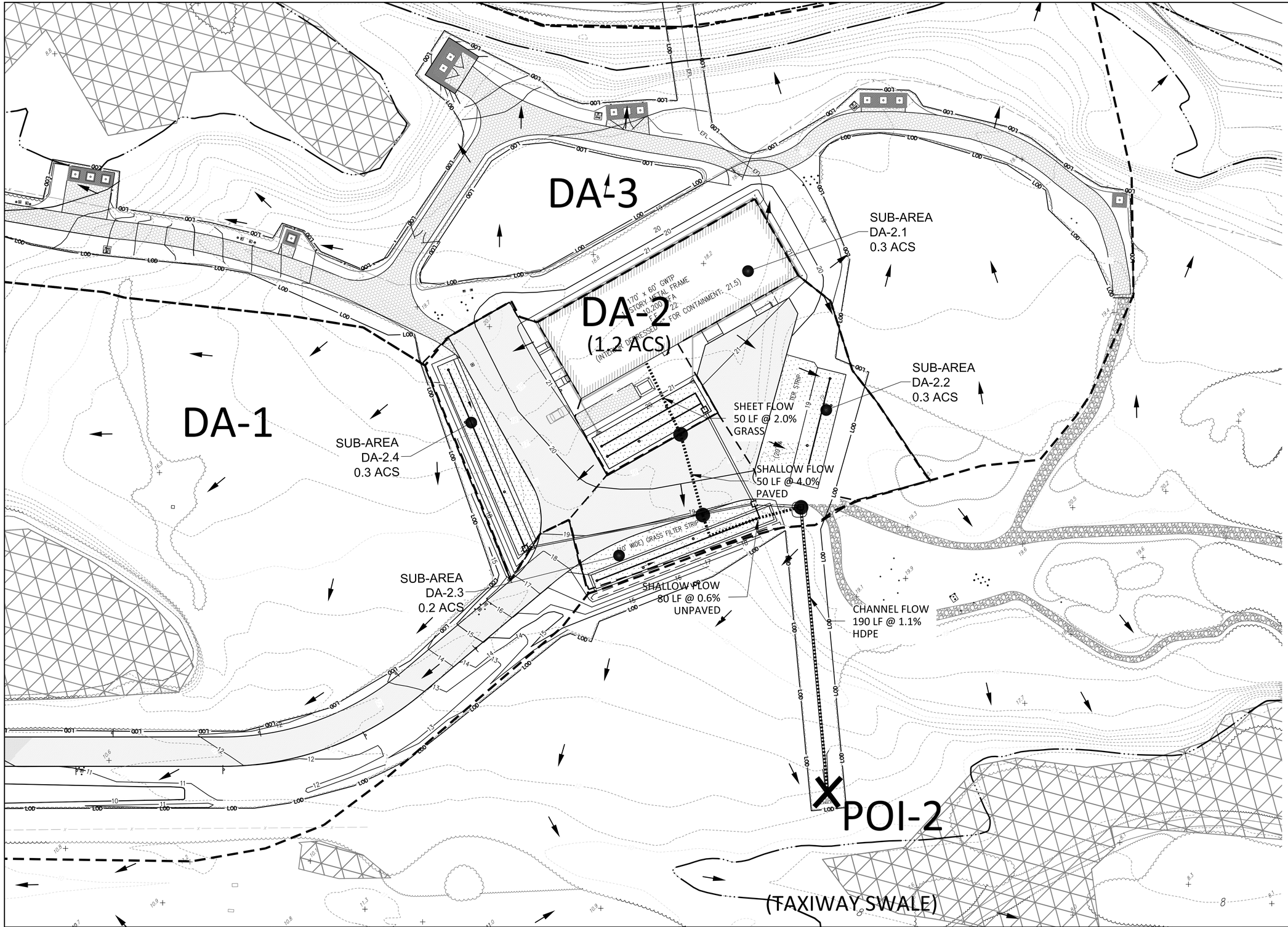
DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: SWM-04

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\SWM\ 112003834-SWM.dwg

PLOT DATE: Jul 09, 2013 - 3:28pm



NOTES:

1. UNIFIED SIZING CRITERIA IN MARYLAND STORMWATER DESIGN MANUAL WAS FOLLOWED FOR THE STORMWATER MANAGEMENT. ENVIRONMENTAL SITE DESIGN (ESD) WAS IMPLEMENTED TO THE MAXIMUM EXTENT PRACTICABLE (MEP) FOR THE SITE DEVELOPMENT. ESD WAS USED TO ADDRESS THE WATER QUALITY (WQv) AND CHANNEL PROTECTION STORAGE (Cpv) REQUIREMENTS FOR POST-DEVELOPMENT CONDITIONS.
2. STORMWATER RUNOFF FROM THE IMPROVED AREAS ARE TYPICALLY TREATED BY MULTIPLE ESD PRACTICES; COMBINATION OF REINFORCED TURF OR DISCONNECTION OF NON-ROOFTOP RUNOFF (FILTER STRIP) WITH MICRO-SCALE PRACTICE (MICRO-BIORETENTION). NO STRUCTURAL PRACTICES ARE REQUIRED.
3. THE PARKING/DRIVEWAY PAVEMENT IS CURRENTLY DESIGNED AS ASPHALT UNLESS NOTED OTHERWISE.
4. THE STORM DRAIN FROM DA-2 DISCHARGES TO "TAXIWAY TANGO SWALE", WHICH RUNS ALONG THE NORTHERN SIDE OF THE TAXIWAY TANGO AND CONTRIBUTES TO FROG MORTAR CREEK. REFER TO SWM-07 PLAN DEMONSTRATING ADEQUATE CONVEYANCE TO TIDAL WATERS.

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: STORMWATER MANAGEMENT PLAN POST-DEVELOPMENT (DA-2)

SCALE: AS NOTED

DATE: 07/03/2013

CONTRACT NO.: N/A

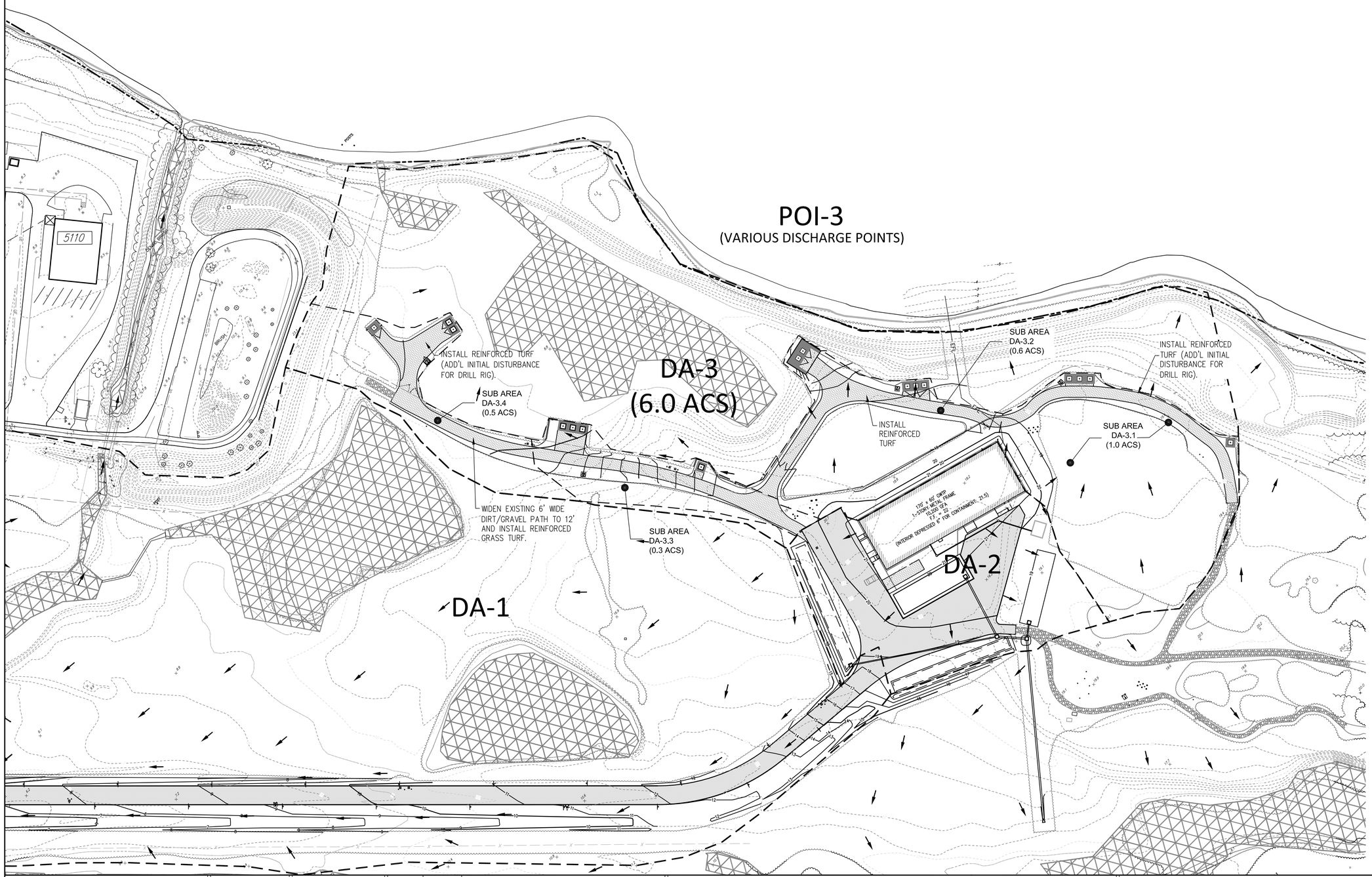
SHEET NO.: SWM-05

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30ft design Phase-2013\SWM\112103834-SWM.dwg

PLOT DATE: Jul 08, 2013 - 5:36pm

NOTES:

1. UNIFIED SIZING CRITERIA IN MARYLAND STORMWATER DESIGN MANUAL WAS FOLLOWED FOR THE STORMWATER MANAGEMENT. ENVIRONMENTAL SITE DESIGN (ESD) WAS IMPLEMENTED TO THE MAXIMUM EXTENT PRACTICABLE (MEP) FOR THE SITE DEVELOPMENT. ESD WAS USED TO ADDRESS THE WATER QUALITY (WQv) AND CHANNEL PROTECTION STORAGE (Cpv) REQUIREMENTS FOR POST-DEVELOPMENT CONDITIONS.
2. STORMWATER RUNOFF FROM THE IMPROVED OR EXTENDED WELL ACCESS ROADS ARE CONVERTED FROM EXISTING DIRT/GRAVEL PATHS AND TREATED BY ESD PRACTICES. NO STRUCTURAL PRACTICES ARE REQUIRED.
3. THE WELL ACCESS ROAD PAVEMENT IS CURRENTLY DESIGNED AS REINFORCED TURF AS A PROVISION FOR STORMWATER MANAGEMENT CONTROL.
4. BASED ON A TIDE STUDY OF LOCAL NOAA STATION DATUM, THE MEAN HIGH WATER (MHL) LINE IN THIS AREA IS ABOUT EL. 0.6 IN NAVD88. THIS IS MORE-OR-LESS THE EDGE OF FROG MORTAR CREEK.
5. DA-3 DISCHARGES DIRECTLY TO TIDAL WATERS (FROG MORTAR CREEK) AT VARIOUS POINTS.



TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: STORMWATER MANAGEMENT PLAN POST-DEVELOPMENT (DA-3)

SCALE: AS NOTED

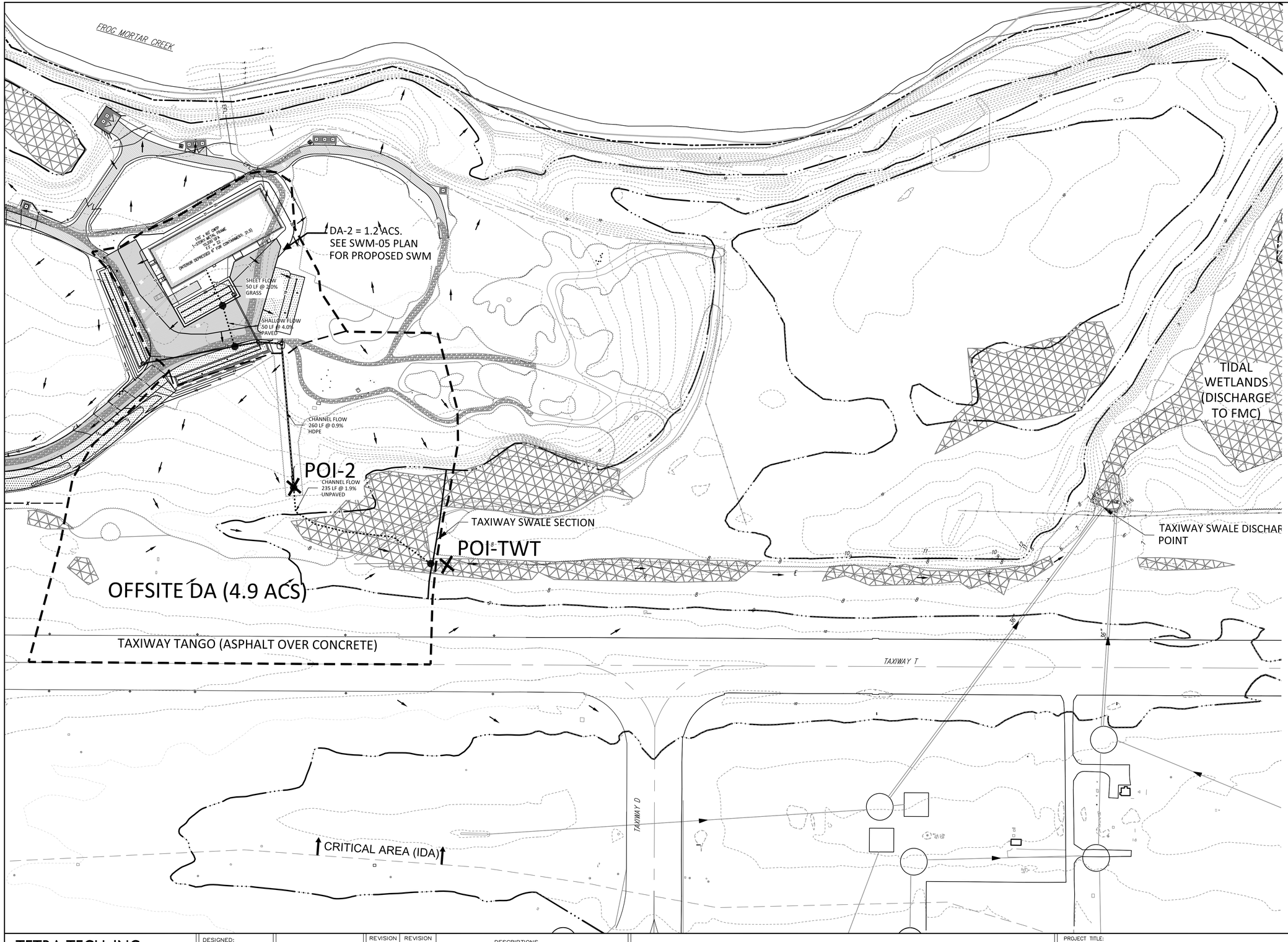
DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: SWM-06

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P25710-DRA-30% design Phase-2013\SWM\ 112103834-SWM.dwg

PLOT DATE: Jul 08, 2013 - 6:02pm



ADEQUATE CONVEYANCE TO TIDAL WATERS VS. PEAK FLOW STORAGE:

BASED ON A TIDE STUDY BASED ON LOCAL NOAA STATION DATUM, THE MEAN HIGH WATER (MHL) LINE IN THIS AREA IS ABOUT EL. 0.6 IN NAVD88. THIS IS MORE-OR-LESS THE EDGE OF FROG MORTAR CREEK.

CONVEYANCE FROM DA-2 TO FROG MORTAR CREEK IS PROVIDED VIA THE TAXIWAY SWALE. THE DOWNSTREAM IMPACT ANALYSIS WAS PERFORMED AT POI-TWT, WHERE THE TOTAL DRAINAGE AREA EXCEEDS MORE THAN TWICE OF DA-2 CONTRIBUTORY AREA.

AN ADEQUATE CONVEYANCE CANNOT BE PROVEN, THE DESIGN MAY REQUIRE PEAK FLOW CONTROL. ALTHOUGH THE STORAGE REQUIREMENTS TO CONTROL PEAK FLOW HAVE NOT BEEN CALCULATED AT THIS TIME, THIS COULD BE CONSIDERED A SUBSTANTIAL AMOUNT OF STORMWATER STORAGE.

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: STORMWATER MANAGEMENT PLAN CONVEYANCE THROUGH TAXIWAY SWALE

SCALE: AS NOTED

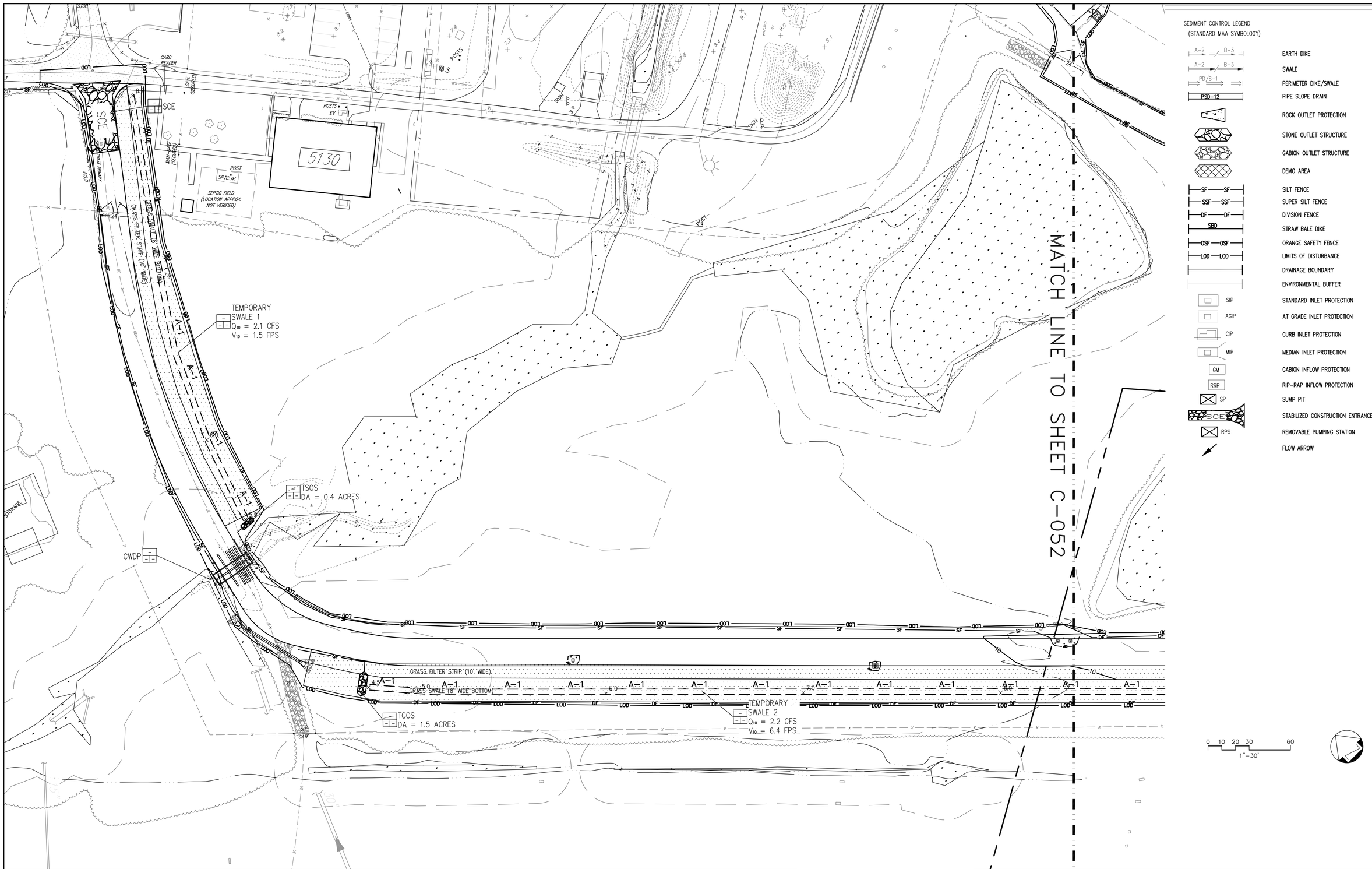
DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: SWM - 07

PLOT DATE: Jul 08, 2013 - 6:04pm

DRAWING NAME: S:\03-Projects\Commercial\LMC\10309257101-DRA-30% design Phase-2013\SWM\ 112103834-SWM.dwg



TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: STORMWATER MANAGEMENT PLAN EROSION AND SEDIMENT CONTROL OVERLAY I

SCALE: AS SHOWN

DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: SWM-8

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\SWM\112IC03834-SWM_8_9.dwg

PLOT DATE: Jul 10, 2013 - 10:44am

MATCH LINE TO SHEET C-051

EARTH DIKE 3
Q_{10} = 1.9 CFS
V_{10} = 2.9 FPS

EARTH DIKE 2
Q_{10} = 1.5 CFS
V_{10} = 1.5 FPS

TSOS
DA = 0.3 ACRES

EARTH DIKE 1
Q_{10} = 1.5 CFS
V_{10} = 2.4 FPS

ST II
DA = 0.7 ACRES

TEMPORARY
SWALE 3
Q_{10} = 2.2 CFS
V_{10} = 2.0 FPS

TSOS
DA = 0.4 ACRES

EARTH DIKE 4
Q_{10} = 2.2 CFS
V_{10} = 1.9 FPS

ROP III
CLASS I RIPRAP
La = 10 FT
W = 11.5 FT
T = 19 IN

RPS

SP

BATTERY BOARD

(20' WIDE) GRASS FILTER STRIP

GRASS SWALE (SLOPE BELOW 1%)

SEDIMENT CONTROL LEGEND
(STANDARD MAA SYMBOLOGY)

- EARTH DIKE
- SWALE
- PERIMETER DIKE/SWALE
- PSD-12 — PIPE SLOPE DRAIN
- ROCK OUTLET PROTECTION
- STONE OUTLET STRUCTURE
- GABION OUTLET STRUCTURE
- DEMO AREA
- SF — SILT FENCE
- SSF — SUPER SILT FENCE
- DF — DIVISION FENCE
- SBD — STRAW BALE DIKE
- OSF — ORANGE SAFETY FENCE
- LOD — LIMITS OF DISTURBANCE
- DRAINAGE BOUNDARY
- ENVIRONMENTAL BUFFER
- SIP — STANDARD INLET PROTECTION
- AGIP — AT GRADE INLET PROTECTION
- CIP — CURB INLET PROTECTION
- MIP — MEDIAN INLET PROTECTION
- GM — GABION INFLOW PROTECTION
- RRP — RIP-RAP INFLOW PROTECTION
- SP — SUMP PIT
- SCE — STABILIZED CONSTRUCTION ENTRANCE
- RPS — REMOVABLE PUMPING STATION
- FLOW ARROW

0 10 20 30 60
1"=30'

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE:
DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE:
STORMWATER MANAGEMENT PLAN
EROSION AND SEDIMENT CONTROL OVERLAY II

SCALE: AS SHOWN
DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: SWM-9

PLOT DATE: Jul 10, 2013 - 10:44am
DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\SWM\ 112003834-SWM_S_9.dwg

APPENDIX E – CONSTRUCTION DOCUMENTS

CIVIL SET

(Provided as large-format roll)

See sheet “C-000 - Key Sheet” for sheet list.

Other discipline sets are available upon request.

MARTIN STATE AIRPORT

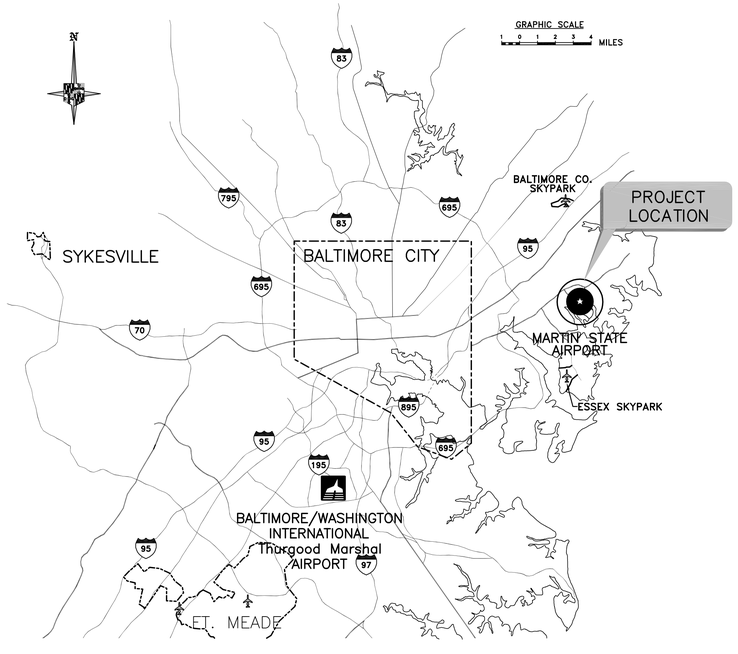
MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION
FACILITIES DEVELOPMENT AND ENGINEERING

DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SITE / CIVIL SET

AIP NO. X-XX-XXXX-XXX

CONTRACT NO. MAA-CO-XX-XXX

VICINITY MAP

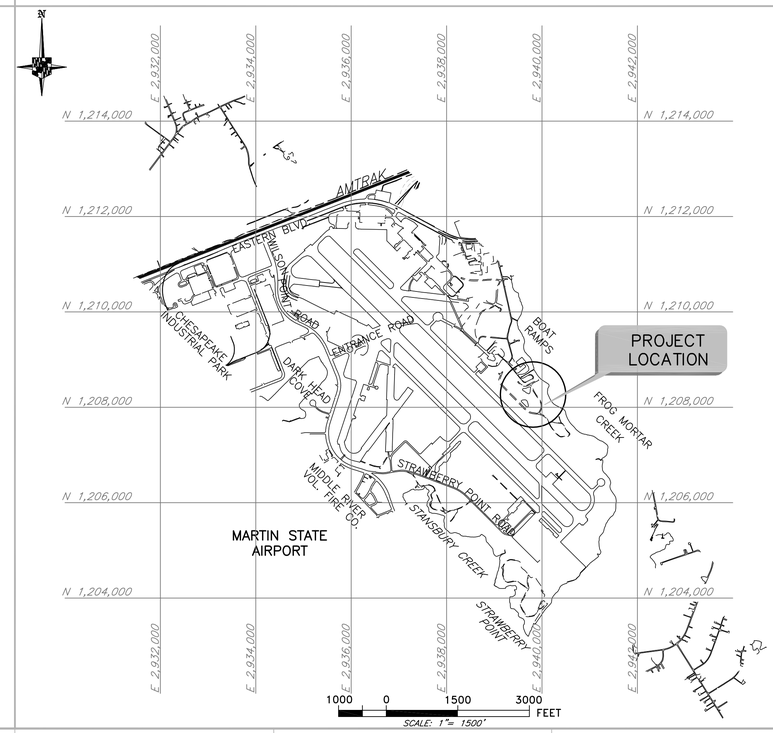


INDEX OF DRAWINGS

30% DESIGN DRAWING LIST

DRAWING NO.	DRAWING TITLE
COVER	COVER SHEET
C-000	KEY SHEET
C-00x	GENERAL CONSTRUCTION SAFETY NOTES, LEGEND SHEET
C-01x	EXISTING CONDITIONS
C-03x thru C-06x	EROSION AND SEDIMENT CONTROL NOTES, PLANS, & DETAILS
C-10x	DEMOLITION PLANS
C-11x	PAVING PLANS
C-12x	SURVEY CONTROL PLANS
C-123	LYNBROOK ROAD, EXTENDED - PROFILE
C-13x	SITE GRADING & DRAINAGE PLANS
C-14x	SITE SIGNAGE & STRIPING PLANS
C-15x	UTILITY PLANS: GENERAL
C-16x	UTILITY PLANS: STORMWATER MANAGEMENT
C-17x	CULVERT PLANS, PROFILES, AND DETAILS
C-18x	TREATMENT PLANT EFFLUENT OUTFALL PLANS, PROFILES, AND DETAILS
C-3XX	SITE DETAILS

SITE MAP



TETRA TECH
TETRA TECH
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
(302) 738-7551
(302) 454-5988

APPROVED BY DATE

SEAL

PROFESSIONAL CERTIFICATION

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NUMBER _____, EXPIRATION DATE _____.

CONSULTANT

Maryland Aviation Administration

OFFICE OF DESIGN AND CONSTRUCTION

EMERGENCY NUMBERS

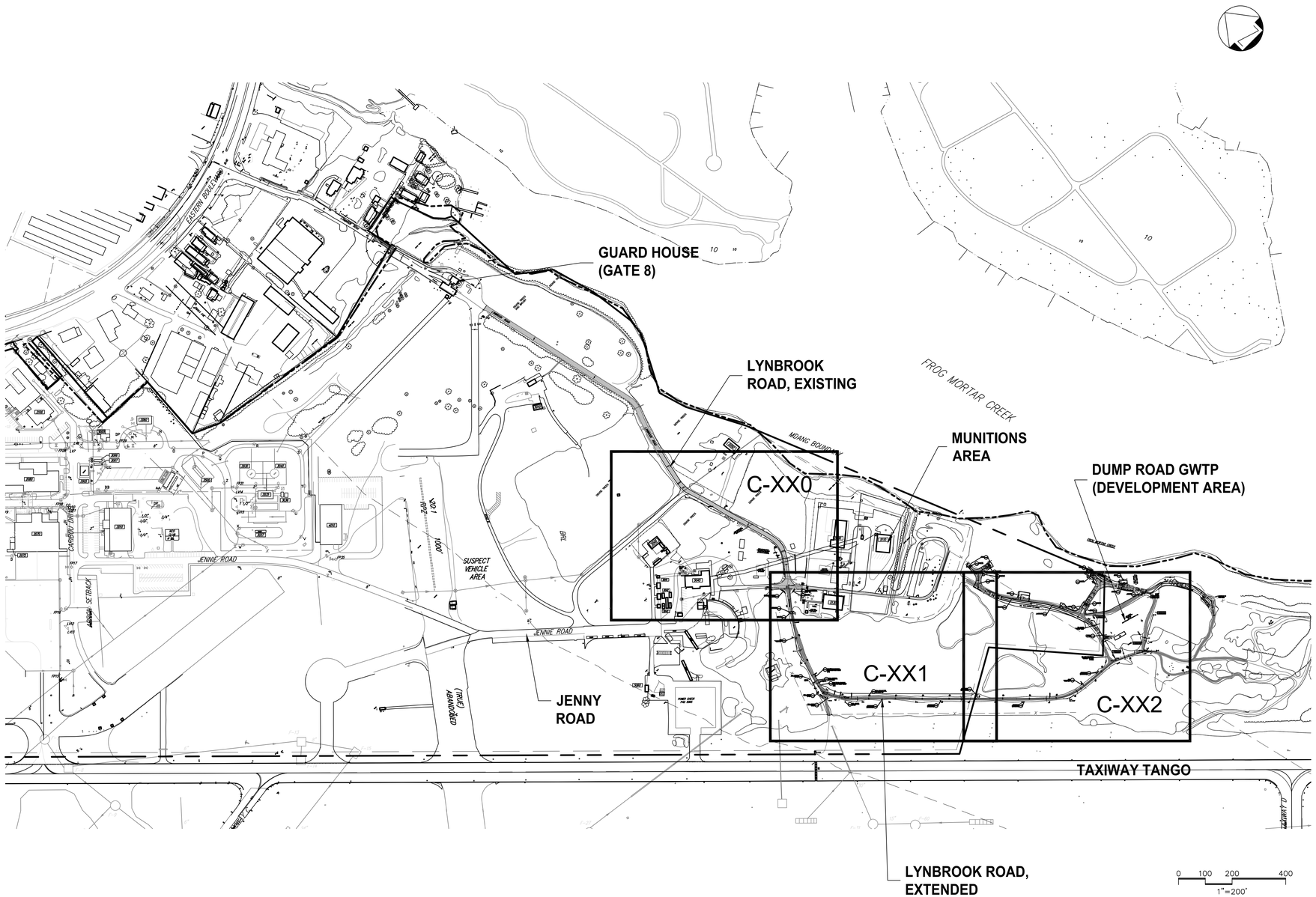
FIRE/RESCUE/MEDICAL: 911
POLICE: 911
AIRPORT OPERATIONS: (410) 682-8831
AIRPORT MAINTENANCE: (410) 682-8813
B.G.E. EMERGENCY: (410) 685-0123

SUBMITTAL

SWM / E&S SUBMISSION

07/15/2013

S:\03-Projects\Commercial\LMC\103IP257101-DRA-30% design Phase-2013\CAD drawings\112IC03834_Cover.dwg Jul 03,2013 1:46pm casey.grabowski



DUMP ROAD AREA 30% DESIGN DRAWING LIST – SITE/CIVIL

COVER – COVER SHEET

C-000 – KEY SHEET

C-001 – GENERAL CONSTRUCTION AND SAFETY NOTES I
C-002 – GENERAL CONSTRUCTION AND SAFETY NOTES II
C-003 – GENERAL LEGEND AND ABBREVIATIONS SHEET

C-010 – EXISTING CONDITIONS – I
C-011 – EXISTING CONDITIONS – II
C-012 – EXISTING CONDITIONS – III

C-031 – EROSION AND SEDIMENT CONTROL NOTES I
C-032 – EROSION AND SEDIMENT CONTROL NOTES II
C-041 – EROSION AND SEDIMENT CONTROL PRE-BULK GRADING PLAN I
C-042 – EROSION AND SEDIMENT CONTROL PRE-BULK GRADING PLAN II
C-051 – EROSION AND SEDIMENT CONTROL POST-BULK GRADING PLAN I
C-052 – EROSION AND SEDIMENT CONTROL POST-BULK GRADING PLAN II
C-061 – EROSION AND SEDIMENT CONTROL DETAILS I
C-062 – EROSION AND SEDIMENT CONTROL DETAIL II
C-063 – EROSION AND SEDIMENT CONTROL DETAIL III
C-064 – EROSION AND SEDIMENT CONTROL DETAIL IV
C-065 – EROSION AND SEDIMENT CONTROL DETAIL V
C-066 – EROSION AND SEDIMENT CONTROL VEGETATIVE SPECIFICATIONS

C-101 – DEMOLITION PLAN – I
C-102 – DEMOLITION PLAN – II

C-111 – PAVING PLAN – I
C-112 – PAVING PLAN – II

C-120 – MSA SURVEY CONTROL
C-121 – SITE LAYOUT / CONTROL PLAN – I
C-122 – SITE LAYOUT / CONTROL PLAN – II
C-123 – LYNBROOK ROAD, EXTENDED PROFILE

C-131 – SITE GRADING & DRAINAGE PLAN – I
C-132 – SITE GRADING & DRAINAGE PLAN – II

C-141 – SITE SIGNAGE & STRIPING PLAN – I
C-142 – SITE SIGNAGE & STRIPING PLAN – II

C-150 – UTILITY PLAN – I
C-151 – UTILITY PLAN – II
C-152 – UTILITY PLAN – III
C-153 – UTILITY PLAN – BUILDING TIE-INS

C-161 – STORMWATER UTILITY PLAN – I
C-162 – STORMWATER UTILITY PLAN – II
C-163 – STORM SEWER PROFILES – I
C-164 – STORM SWALE CROSS-SECTIONS – I
C-165 – MICRO-BIORETENTION CROSS-SECTIONS – I
C-166 – REINFORCED TURF – I
C-167 – STORMWATER MANAGEMENT CERTIFICATIONS AND ADD'L NOTES

C-171 – CULVERT PLAN/PROFILE (NOT IN THIS SET)
C-172 – CULVERT SITE/STRUCTURAL DETAILS (NOT IN THIS SET)

C-181 – TREATMENT PLANT EFFLUENT PLAN/PROFILE
C-182 – TREATMENT PLANT EFFLUENT DETAILS (NOT IN THIS SET)

C-301 – PAVING DETAILS
C-311 – FENCE / GATE DETAILS I
C-312 – FENCE / GATE DETAILS II
C-321 – UTILITY DETAILS, GENERAL I
C-322 – UTILITY DETAILS, GENERAL II
C-323 – UTILITY DETAILS, GENERAL III
C-331 – UTILITY DETAILS, STORMWATER I
C-332 – UTILITY DETAILS, STORMWATER II
C-341 – UTILITY DETAILS, SANITARY I
C-351 – UTILITY DETAILS, ENVIRONMENTAL I
C-352 – UTILITY DETAILS, ENVIRONMENTAL II
C-361 – SITE SIGNAGE DETAILS I
C-362 – SITE SIGNAGE DETAILS II

L-101 – LANDSCAPE PLAN I (NOT IN THIS SET)
L-102 – LANDSCAPE PLAN II (NOT IN THIS SET)
L-111 – LANDSCAPE DETAILS (NOT IN THIS SET)
L-201 – OFFSITE REFORESTATION PLAN (NOT IN THIS SET)

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE: KEY SHEET
SCALE: 1"=200'
DATE: 07/03/2013
CONTRACT NO.: N/A
SHEET NO.: C-000

DRAWING NAME: S:\03-Projects\Commercial\MC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112003834_C00X-General.dwg
PLOT DATE: Jul 10, 2013 - 11:00am

GENERAL CONSTRUCTION NOTES

1. THIS PROJECT IS FOR WORK AT MARTIN STATE AIRPORT (MTN), HEREAFTER REFERRED TO AS 'THE AIRPORT'.

2. THIS PROJECT SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE CONTRACT PLANS AND SPECIFICATIONS AND ANY RULES, REGULATIONS, STANDARDS, OR SPECIFICATIONS REFERENCED THEREIN. THE PROJECT IS SUBJECT TO INSPECTION BY REPRESENTATIVES OF THE MARYLAND AVIATION ADMINISTRATION (MAA), THE FEDERAL AVIATION ADMINISTRATION (FAA), AND OTHER GOVERNING AGENCIES.

3. PROJECT PHASING – THE PROJECT IS TO BE COMPLETED IN CLOSE CONFORMANCE WITH THE PHASING PLANS AND NOTES AS CONTAINED IN THE CONTRACT DOCUMENTS. UPON COMPLETION OF ANY STAGE OR PHASE OF WORK, THE ENGINEER WILL ARRANGE A PHYSICAL INSPECTION OF THE AREA WITH AIRPORT OPERATIONS PERSONNEL PRIOR TO THE OPENING OF ANY TAXIWAY, RUNWAY, RAMP AREA OR AIRPORT ROADWAY THAT HAS BEEN CLOSED FOR WORK OR USED FOR A CROSSING POINT OR HAUL ROUTE BY THE CONTRACTOR.

4. PROJECT COMPLETION TIMES – THE CONTRACTOR IS EXPECTED TO COMPLETE CRITICAL PORTIONS OF THE PROJECT WITHIN THE SPECIFIED TIMEFRAMES AND TO COMPLETE THE ENTIRE PROJECT ON TIME. LIQUIDATED DAMAGES, IF SPECIFIED, WILL BE ASSESSED SHOULD THE TIMEFRAME BE EXCEEDED.

5. AIRPORT OPERATIONS – THE AIRPORT WILL BE IN OPERATION DURING THE CONSTRUCTION OF THIS PROJECT. RUNWAY 15–33 WILL OPERATE AS A 3,000 FOOT RUNWAY DAWN TO DUSK DAILY. COORDINATION OF WORK WITH AIRPORT OPERATIONS IS MANDATORY TO MINIMIZE IMPACTS TO AIRPORT USERS.

6. CONTRACTOR COORDINATION – CONSTRUCTION AND MAINTENANCE OPERATIONS BY OTHERS MAY OCCUR CONCURRENTLY AND IN THE VICINITY OF CONSTRUCTION ASSOCIATED WITH THIS PROJECT. THE CONTRACTOR SHALL COORDINATE OPERATIONS AND COOPERATE WITH MAINTENANCE CREWS AND OTHER CONTRACTORS WORKING AT THE AIRPORT. CONTRACTOR COORDINATION WITH APPROPRIATE GOVERNMENT AND UTILITY AGENCIES IS ALSO REQUIRED PRIOR TO AND DURING CONSTRUCTION.

7. FACILITY CLOSURES – PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL ARRANGE TO MEET WITH AIRPORT OPERATIONS, THE FAA, AND THE ENGINEER TO EVALUATE AND ESTABLISH ANY RUNWAY AND TAXIWAY CLOSURE TIMES AND DURATIONS. TO THE EXTENT POSSIBLE, THE CONTRACTOR SHALL COORDINATE CONSTRUCTION TO COINCIDE WITH RUNWAY AND TAXIWAY CLOSURES ALREADY SCHEDULED FOR CONSTRUCTION AND MAINTENANCE OPERATIONS BY OTHERS.

8. WASTE MATERIALS (i.e. TREES, STUMPS, EXCESS SOIL, ETC.) SHALL BE DISPOSED OF OFF AIRPORT PROPERTY. TRASH (i.e. CUPS, CANS, BOTTLES, PAPER, ETC.) SHALL BE DISPOSED OF THROUGH PROPER SANITARY METHODS.

9. EXISTING AIRFIELD LIGHTING SYSTEMS – INTERRUPTION OF EXISTING AIRFIELD LIGHTING SYSTEMS NOT INCLUDED IN THIS PROJECT SHALL NOT BE PERMITTED. ALL AIRFIELD LIGHTING CIRCUITS AFFECTED BY THIS PROJECT SHALL BE TEMPORARILY MAINTAINED BY THE CONTRACTOR DURING OPERATIONAL PERIODS.

10. PORTABLE FLOODLIGHTING – THE CONTRACTOR SHALL PROVIDE PORTABLE FLOODLIGHTING AS REQUIRED FOR NIGHT CONSTRUCTION OPERATIONS. THE CONTRACTOR SHALL PROVIDE SUFFICIENT UNITS SO THAT ALL WORK AREAS ARE ILLUMINATED TO A LEVEL OF FIVE (5) HORIZONTAL FOOT CANDLES. THE LIGHTING LEVELS SHALL BE CALCULATED AND MEASURED IN ACCORDANCE WITH THE CURRENT STANDARDS OF THE ILLUMINATION ENGINEERING SOCIETY. THE CONTRACTOR SHALL COORDINATE THE USE OF FLOODLIGHTING WITH THE CONTROL TOWER TO ENSURE THAT THE LIGHTING DOES NOT COMPROMISE THE CONTROL TOWER'S VISIBILITY OR CAUSE CONFUSION TO PILOTS.

11. THE CONTRACTOR SHALL PROVIDE TIMBER AND BUCKET TYPE CONSTRUCTION BARRICADES WITH FLASHING RED LIGHTS AS SHOWN ON THE DRAWINGS TO DELINEATE THE WORK AREAS WHEN CLOSED TO AIRPORT TRAFFIC. OPEN TRENCHES, EXCAVATIONS AND STOCKPILE MATERIAL LOCATED IN THE AOA SHALL BE PROMINENTLY MARKED WITH ORANGE FLAGS AND LIGHTED BY APPROVED LIGHT UNITS DURING HOURS OF LIMITED VISIBILITY AND DARKNESS.

12. THE CONTRACTOR SHALL PROVIDE AN ADEQUATE NUMBER OF WATER TRUCKS TO CONTROL DUST IN THE PROJECT WORK AREA, STAGING/STORAGE AREAS, HAUL ROUTES AND THE WASTE SITE.

13. ALL THE PERMITS AND LICENSES REQUIRED FOR THE PROJECT WORK SHALL BE OBTAINED AT THE CONTRACTOR'S EXPENSE.

14. EXISTING TOPOGRAPHIC FIELD SURVEYS AND UTILITY SURVEYS FOR THIS PROJECT WERE PERFORMED BY TETRA TECH FROM 2012 THROUGH 2013 AT VARIOUS TIMES. THE CONTROL ON THIS PROJECT IS TIED TO THE NAD 83/91 HORIZONTAL DATUM AND NAVD 88 VERTICAL DATUM.

15. IN ACCORDANCE WITH THE SPECIFICATIONS, FEDERAL WAGE RATES SHALL BE POSTED OUTSIDE THE SITE FIELD OFFICE(S) IN A WEATHERPROOF ENCLOSURE. (FOR FEDERALLY FUNDED PROJECTS ONLY.)

GENERAL AIRFIELD SAFETY DURING CONSTRUCTION

1. THE CONTRACTOR SHALL ACQUAINT SUPERVISORS AND EMPLOYEES WITH ACTIVITY AND OPERATIONS THAT ARE INHERENT TO THE AIRPORT AND SHALL CONDUCT CONSTRUCTION ACTIVITIES TO CONFORM TO ALL ROUTINE AND EMERGENCY AIR TRAFFIC REQUIREMENTS AND GUIDELINES FOR SAFETY SPECIFIED HEREIN.

2. THE CONTRACTOR AND HIS/HER SUBCONTRACTOR(S) SHALL PROTECT WORKERS, MAA AND AIRPORT TENANT EMPLOYEES, AND THE GENERAL PUBLIC. THE CONTRACTOR SHALL ALSO ENSURE THAT PROPERTY OR EQUIPMENT, UNRELATED TO WORK, WHICH BELONGS TO MAA OR AIRPORT TENANTS IS NOT DAMAGED DURING CONSTRUCTION.

3. THE CONTRACTOR SHALL NOT ALLOW EMPLOYEES, SUBCONTRACTORS, SUPPLIERS, OR ANY OTHER UNAUTHORIZED PERSON TO ENTER OR REMAIN IN ANY AIRPORT AREA WHICH WOULD BE HAZARDOUS TO PERSONS OR TO AIRCRAFT OPERATIONS.

4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ALL NECESSARY PROTECTIVE GEAR AND EQUIPMENT REQUIRED FOR THE PROTECTION OF THE CONTRACTOR'S PERSONNEL DURING CONSTRUCTION.

5. DURING PERFORMANCE OF THIS CONTRACT, THE AIRPORT RUNWAYS, TAXIWAYS, AND AIRCRAFT PARKING APRONS SHALL REMAIN IN USE BY AIRCRAFT TO THE MAXIMUM EXTENT POSSIBLE. ALL AIRCRAFT TRAFFIC ON THESE SURFACES SHALL HAVE PRIORITY OVER CONTRACTOR'S TRAFFIC. WHILE USE OF AREAS NEAR THE CONTRACTOR'S WORK MAY BE CONTROLLED TO MINIMIZE DISTURBANCE TO THE CONTRACTOR'S OPERATION, THE OWNER RESERVES THE RIGHT TO ORDER THE CONTRACTOR, AT ANY TIME, TO VACATE ANY AREA NECESSARY TO MAINTAIN SAFE AIRCRAFT OPERATIONS.

6. ALL WORK TO BE PERFORMED WITHIN CERTAIN LIMITS OF AN ACTIVE RUNWAY, TAXIWAY, OR APRON UNDER OPERATIONAL CONDITIONS SHALL BE PERFORMED WHEN THE RUNWAY, TAXIWAY OR APRON IS NOT IN USE. SUCH WORK SHALL ONLY BE ACCOMPLISHED WITH PRIOR PERMISSION FROM THE ENGINEER. REQUESTS FOR RUNWAY CLOSURES SHALL BE MADE AT LEAST 7 DAYS IN ADVANCE. REQUESTS FOR TAXIWAY OR APRON CLOSURES SHALL BE MADE AT LEAST 96 HOURS IN ADVANCE.

7. THE CONTRACTOR SHALL INSPECT ALL CONSTRUCTION AND STORAGE AREAS AS OFTEN AS NECESSARY AND PROMPTLY TAKE ALL STEPS NECESSARY TO PREVENT OR REMEDY ANY UNSAFE OR POTENTIALLY UNSAFE CONDITIONS OR ACTIVITIES DISCOVERED.

8. THE CONTRACTOR SHALL BE AWARE OF THE FOLLOWING TYPES OF SAFETY PROBLEMS AND/OR HAZARDS:

   a. TRENCHES, HOLES, OR EXCAVATION ON OR ADJACENT TO ANY OPEN RUNWAY OR IN SAFETY AREAS.

   b. PAVEMENT DROP–OFFS OR PAVEMENT TURF–LIPS GREATER THAN 1½ INCHES WHETHER PERMANENT OR TEMPORARY.

   c. UNMARKED/UNLIGHTED HOLES OR EXCAVATION IN ANY APRON, OPEN TAXIWAY, OPEN TAXILANE, OR RELATED SAFETY AREA.

   d. MOUNDS OR PILES OF EARTH, CONSTRUCTION MATERIALS, TEMPORARY STRUCTURES, OR OTHER OBJECTS IN THE VICINITY OF ANY OPEN RUNWAY, TAXIWAY, TAXILANE, OR IN A RELATED SAFETY AREA, APPROACH, OR DEPARTURE AREA.

   e. VEHICLES OR EQUIPMENT, WHETHER OPERATING OR IDLE, ON ANY OPEN RUNWAY, TAXIWAY, TAXILANE, OR IN ANY RELATED SAFETY AREA, APPROACH, OR DEPARTURE AREA.

   f. VEHICLES, EQUIPMENT, EXCAVATION, STOCKPILES, OR OTHER MATERIALS WHICH COULD DEGRADE OR OTHERWISE INTERFERE WITH ELECTRONIC SIGNALS FROM RADIOS OR ELECTRONIC NAVIGATIONAL AIDS (NAVAIDS).

   g. UNMARKED UTILITY, NAVAID, WEATHER SERVICE, RUNWAY LIGHTING, OR OTHER POWER OR SIGNAL CABLES THAT COULD BE DAMAGED DURING CONSTRUCTION.

   h. OBJECTS, WHETHER OR NOT MARKED OR FLAGGED, OR ACTIVITIES ANYWHERE ON OR IN THE VICINITY OF THE AIRPORT WHICH COULD BE DISTRACTING, CONFUSING, OR ALARMING TO PILOTS DURING AIRCRAFT OPERATIONS.

   i. UNFLAGGED/UNLIGHTED LOW VISIBILITY ITEMS SUCH AS TALL CRANES, DRILLS, ETC. ANYWHERE IN THE VICINITY OF ACTIVE RUNWAYS OR IN ANY APPROACH OR DEPARTURE AREA. SUCH EQUIPMENT SHALL BE PARKED IN THE CONTRACTOR'S STAGING AREA AND THE BOOM(S) LOWERED TO THE GROUND WHEN NOT IN USE.

   j. MISLEADING OR MALFUNCTIONING LIGHTS OR UNLIGHTED/UNMARKED OBSTRUCTIONS IN THE APPROACH TO ANY ACTIVE RUNWAY.

   k. INADEQUATE APPROACH OR DEPARTURE SURFACES (THESE SURFACES ARE NEEDED TO ASSURE ADEQUATE LANDING OR TAKEOFF CLEARANCE OVER OBSTRUCTIONS, INCLUDING THE CONTRACTOR'S WORK AND STORAGE AREAS).

   l. MARKING AND LIGHTING OF RUNWAYS, TAXIWAYS OR TAXILANES THAT COULD BE CONFUSING OR MISLEADING TO PILOTS, INCLUDING IMPROPERLY MARKED DISPLACED OR RELOCATED THRESHOLDS.

   m. INADEQUATE OR IMPROPER METHODS OF MARKING, BARRICADING, AND LIGHTING OF TEMPORARILY CLOSED PORTIONS OF THE AIRPORT AOA.

   n. WATER, SNOW, DIRT, DEBRIS, OR OTHER TRANSIENT ACCUMULATION WHICH TEMPORARILY OBSCURES PAVEMENT MARKINGS OR PAVEMENT EDGES, OR DIMINISHES THE VISIBILITY OF RUNWAY OR TAXIWAY LIGHTING.

   o. BIRD ATTRACTANTS SUCH AS EDIBLES (FOOD SCRAPS, ETC.), MISCELLANEOUS TRASH, OR PONDED WATER. FOOD SCRAPS AND MISCELLANEOUS TRASH SHALL BE SECURED BY THE CONTRACTOR AND DISPOSED OF USING PROPER SANITARY METHODS.

   p. FOREIGN OBJECTS DEBRIS:

   i. DEBRIS, WASTE, LOOSE MATERIAL (INCLUDING DUST AND DIRT), TRASH OR OTHER MATERIALS WHETHER ON RUNWAYS, TAXIWAYS, APRONS, OR IN RELATED SAFETY AREAS IS CONSIDERED FOREIGN OBJECT DEBRIS AND PRESENTS THE POTENTIAL FOR DAMAGE TO AIRCRAFT. SUCH MATERIAL SHALL NOT BE ALLOWED ON ANY AIRCRAFT MOVEMENT AREAS (REGARDLESS OF WHETHER THE AREA IS OPEN OR CLOSED) OR ADJACENT GRASSED AREAS. ANY DEBRIS (WHETHER CAUSED BY THE CONTRACTOR OR NOT) OBSERVED TO BE WITHIN THESE AREAS SHALL BE REMOVED IMMEDIATELY AND CONTINUOUSLY BY THE CONTRACTOR.

   ii. THE CONTRACTOR SHALL BE REQUIRED TO HAVE A VACUUM SWEEPER WITH PLASTIC BRUSHES (NOT STEEL) AND OPERATOR ON SITE AND READY AT ALL TIMES DURING CONSTRUCTION ACTIVITY.

   iii. WHERE TRAVEL ON OR ACROSS RUNWAYS, RAMP AREAS, TAXIWAYS, OR AIRCRAFT APRONS IS REQUIRED, THE CONTRACTOR SHALL PROVIDE ADEQUATE PERSONNEL AND EQUIPMENT TO KEEP SUCH SURFACES CLEAR OF DEBRIS.

   iv. ALL MATERIALS THAT COULD BLOW ACROSS ANY PAVEMENTS SHALL BE SECURED BY THE CONTRACTOR AND DISPOSED OF USING PROPER SANITARY METHODS.

   q. INADEQUATE BARRICADING OR OTHER MARKING WHICH IS PLACED TO SEPARATE CONSTRUCTION OR MAINTENANCE AREAS FROM OPEN AIRCRAFT OPERATING AREAS.

   r. FAILURE TO CONTROL UNAUTHORIZED VEHICLE AND HUMAN ACCESS THROUGH ACTIVE AIRCRAFT OPERATING AREAS.

   s. FAILURE TO MAINTAIN RADIO COMMUNICATION BETWEEN CONSTRUCTION AND MAINTENANCE VEHICLES AND ATCT.

   t. CONSTRUCTION AND MAINTENANCE ACTIVITIES OR MATERIALS WHICH COULD HAMPER THE RESPONSE OF AIRCRAFT RESCUE AND FIRE FIGHTING EQUIPMENT FROM REACHING AIRCRAFT, ALL OR ANY PART OF THE RUNWAY/TAXIWAY SYSTEM, RUNWAY APPROACH AND DEPARTURE AREAS, AND AIRCRAFT PARKING LOCATIONS.

9. THE CONTRACTOR SHALL CONDUCT ACTIVITIES SO AS NOT TO VIOLATE ANY SAFETY STANDARDS CONTAINED HEREIN. THE CONTRACTOR SHALL INSPECT ALL CONSTRUCTION AND STORAGE AREAS AS OFTEN AS NECESSARY AND PROMPTLY TAKE ALL STEPS NECESSARY TO PREVENT OR REMEDY ANY UNSAFE OR POTENTIALLY UNSAFE CONDITIONS OR ACTIVITIES DISCOVERED.

10. AT LEAST 48 HOURS BEFORE ACTUAL COMMENCEMENT OF CONSTRUCTION ACTIVITY, THE CONTRACTOR SHALL NOTIFY MAA, IN WRITING, INDICATING THE PROPOSED TIME, DATE, AND AREA OF WHICH COMMENCEMENT IS TO OCCUR. UPON COMPLETION OF WORK AND RETURN OF ALL RELATED AREAS TO STANDARD CONDITIONS, THE CONTRACTOR SHALL AGAIN NOTIFY MAA, IN WRITING, AND DESCRIBE THE AREA THAT IS COMPLETE AND AVAILABLE FOR NORMAL AIRPORT OPERATIONS. MAA REQUIRES THIS INFORMATION SO THEY MAY ISSUE APPROPRIATE NOTICE TO AIRMEN (NOTAM) CONCERNING CONSTRUCTION ACTIVITY ON THE AIRFIELD.

11. MOTORIZED VEHICLES – THIS PROJECT INCLUDES WORK WITHIN THE ACTIVE AIRCRAFT OPERATIONS AREA (AOA) (i.e. THE SECURE PORTION OF THE AIRPORT). ALL PERMITTED VEHICLES SHALL DISPLAY IN FULL VIEW ABOVE THE VEHICLE A 3 FOOT BY 3 FOOT OR LARGER, ORANGE AND WHITE CHECKERBOARD, PLASTIC FLAG. EACH CHECKERBOARD COLOR SHALL BE 1 FOOT SQUARE. ANY VEHICLE OPERATING IN THE AOA DURING THE HOURS OF DARKNESS SHOULD BE EQUIPPED WITH A FLASHING AMBER (YELLOW) DOME–TYPE LIGHT, MOUNTED ON TOP OF THE VEHICLE AND OF SUCH INTENSITY TO CONFORM TO LOCAL CODES FOR MAINTENANCE AND EMERGENCY VEHICLES. DARKNESS SHALL BE DEFINED AS ONE HOUR BEFORE OFFICIAL SUNSET UNTIL ONE HOUR AFTER SUNRISE. ALL VEHICLES OPERATING WITHIN THE AIRFIELD BOUNDARY SHALL BE IDENTIFIED WITH A SIGN ON EACH SIDE OF THE VEHICLE BEARING THE CONTRACTOR'S NAME WITH A 12 INCH MINIMUM LETTER HEIGHT.

12. RADIO COMMUNICATIONS – RADIO COMMUNICATIONS ARE REQUIRED BETWEEN THE CONTRACTOR'S REPRESENTATIVE AND THE AIR TRAFFIC CONTROL TOWER (ATCT). RADIO CONTACT IS REQUIRED AT ALL TIMES WHILE THE CONTRACTOR HAS PERSONNEL AND EQUIPMENT ON THE PROJECT SITE AND WHILE THEY ARE IN AN ACTIVE AIR OPERATIONS AREA (AOA). RADIOS SHALL BE FURNISHED BY THE CONTRACTOR AND SHALL BE CAPABLE OF TRANSMITTING AND RECEIVING AT A GROUND CONTROL FREQUENCY OF 121.8 MHZ. THIS FREQUENCY IS TO BE UTILIZED WHEN CROSSING ACTIVE FACILITIES. SUFFICIENT RADIOS SHALL BE ON SITE AND OPERATING AT ALL TIMES SO THAT INSTRUCTIONS OR COMMUNICATIONS MAY BE DISPATCHED TO ALL CREWS WITHIN AN ACTIVE AOA WITHIN ONE MINUTE AFTER RECEIPT OF DIRECTION FROM THE ATCT.

13. FLAGMEN – IN ACCORDANCE WITH THE SPECIFICATIONS, THE CONTRACTOR SHALL FURNISH, AT HIS OWN EXPENSE, FLAGMEN AS NECESSARY TO CONTROL CONSTRUCTION TRAFFIC UNLESS OTHERWISE DIRECTED BY THE ENGINEER. ALL CONTRACTOR VEHICLES THAT ARE REQUIRED TO CROSS ACTIVE RUNWAYS, RUNWAY SAFETY AREAS, TAXIWAYS AND APRONS SHALL DO SO UNDER THE DIRECT CONTROL OF A COMPETENT FLAGMAN WHO IS IN DIRECT RADIO CONTACT WITH FAA ATCT GROUND CONTROL. ALL AIRCRAFT TRAFFIC ON RUNWAYS, TAXIWAYS AND APRONS SHALL HAVE PRIORITY OVER CONTRACTOR'S TRAFFIC. AT NO TIME SHALL THE CONTRACTOR'S VEHICLES OR PERSONNEL BE ALLOWED TO ENTER OR CROSS ACTIVE RUNWAYS OR CLEAR ZONES WITHOUT PROPER AUTHORIZATION OBTAINED THROUGH GROUND CONTROL.

14. OPEN FLAME, WELDING OR TORCH CUTTING OPERATIONS ARE PROHIBITED UNLESS ADEQUATE FIRE AND SAFETY PRECAUTIONS HAVE BEEN TAKEN AND THE PROCEDURE PREVIOUSLY APPROVED BY THE ENGINEER. A FIRE WATCH IS REQUIRED. OPEN FLAME OPERATIONS REQUIRE A BURNING/WELDING PERMIT OBTAINABLE AT AIRPORT OPERATIONS 410–682–8831.

SITE ACCESS, CONTRACTOR STAGING, HAUL ROUTES AND MATERIAL STORAGE

1. ACCESS TO THE SITE – THE CONTRACTOR'S ACCESS POINTS TO THE SITE SHALL BE AS SHOWN ON THE GENERAL PROJECT LAYOUT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL VEHICLES AND PERSONNEL WHO ENTER THE AIRPORT THROUGH THESE ACCESS POINTS. GATES SHALL BE SECURED WHEN NOT IN USE. THE CONTRACTOR SHALL PROVIDE AIRPORT OPERATIONS WITH A SCHEDULE OF TIMES THAT THE GATE WILL BE MANNED FOR ENTRY BY THE CONTRACTOR.

2. ALL OFF–SITE HAUL ROUTES SHALL BE SELECTED TO MINIMIZE DISTURBANCE TO THE PUBLIC. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO COORDINATE OFF–SITE HAUL ROUTES (STATE HIGHWAYS, COUNTY ROADS, OR CITY STREETS) WITH THE APPROPRIATE OWNER WHO HAS JURISDICTION OVER THE AFFECTED ROUTE. THE CONTRACTOR'S ON–AIRPORT HAUL ROUTES ARE INDICATED ON THE GENERAL PROJECT LAYOUT. THESE SHALL BE EXISTING HAUL ROADS, WHERE AVAILABLE, OR ALONG TAXIWAY/TAXILANE PAVEMENTS UNLESS OTHERWISE INDICATED IN THE CONTRACT DRAWINGS.

3. ON–SITE ROADS AND OTHER AIRFIELD PAVEMENTS USED AS HAUL ROUTES SHALL BE MAINTAINED BY THE CONTRACTOR AND SHALL BE RESTORED AT THE CONTRACTOR'S EXPENSE TO THEIR ORIGINAL CONDITION UPON COMPLETION OF BEING USED AS A HAUL ROUTE, UNLESS OTHERWISE DIRECTED BY THE CONTRACT DOCUMENTS OR BY THE ENGINEER. THE BEFORE AND AFTER CONDITION OF ALL ON–SITE HAUL ROUTES (TEMPORARY OR PERMANENT) SHALL BE JOINTLY INSPECTED AND DETERMINED BY THE CONTRACTOR AND THE ENGINEER THROUGH THE USE OF DIGITAL PHOTOGRAPHY AND/OR VIDEO. THE CONTRACTOR MAY NEED TO COORDINATE HAUL ROUTE USAGE WITH OTHER CONTRACTORS WORKING ON THE AIRPORT.

4. FENCING, DRAINAGE, GRADING AND OTHER MISCELLANEOUS CONSTRUCTION REQUIRED TO CONSTRUCT OR RESTORE TEMPORARY OR PERMANENT HAUL ROUTES OR ACCESS POINTS ON THE AIRPORT WILL BE THE CONTRACTOR'S RESPONSIBILITY AND SHALL BE APPROVED BY THE ENGINEER PRIOR TO COMMENCING THE WORK.

5. ALL ON–SITE ACCESS ROADS TO AIRPORT FACILITIES SHALL REMAIN OPEN AND MAINTAINED AT ALL TIMES.

6. CONTRACTOR'S STAGING AREA – AN AREA WILL BE MADE AVAILABLE FOR CONTRACTOR'S MOBILIZATION AND STORAGE. THE CONTRACTOR'S STAGING AREA SHALL BE FREE OF DEBRIS. IF DIRECTED BY THE ENGINEER, THE CONTRACTOR WILL BE REQUIRED TO STAKE OUT AND FLAG THE STAGING AREA LIMITS. NO STAGING WILL BE ALLOWED WITHIN RUNWAY SAFETY AREAS. UPON COMPLETION OF THE PROJECT, THE STAGING AREA SHALL BE RESTORED TO ITS ORIGINAL CONDITION AT THE CONTRACTOR'S EXPENSE.

7. ALL MATERIALS AND EQUIPMENT (INCLUDING STOCKPILED MATERIAL) WHEN NOT IN USE SHALL BE PLACED IN APPROVED AREAS WHERE THEY WILL NOT CONSTITUTE A HAZARD TO AIRCRAFT OPERATIONS AND NOT PENETRATE CLEARANCE SURFACES SHOWN ON THE GENERAL PROJECT LAYOUT.

   - THE OBSTACLE FREE ZONE (OFZ) GOVERNS EQUIPMENT CLEARANCE DURING CONSTRUCTION ADJACENT TO AN ACTIVE RUNWAY. UNDER NO CIRCUMSTANCES SHALL ANY MEN OR EQUIPMENT PENETRATE THESE SURFACES UNLESS PRIOR ARRANGEMENTS HAVE BEEN MADE WITH AIRPORT OPERATIONS.

   - THE FAR PART 77 APPROACH, PRIMARY, AND TRANSITIONAL SURFACES GOVERN STOCKPILES AND PARKED EQUIPMENT. UNDER NO CIRCUMSTANCES SHALL STOCKPILES, PARKED EQUIPMENT, OR OTHER CONSTRUCTION ITEMS PENETRATE THESE SURFACES ADJACENT TO AN ACTIVE RUNWAY.

8. EQUIPMENT SHALL BE PARKED AT THE CONTRACTOR'S STAGING AREA WHEN NOT IN USE. TALL EQUIPMENT SUCH AS CRANES SHALL BE LOWERED TO THE GROUND WHEN NOT IN USE. STOCKPILED MATERIAL SHALL BE CONSTRAINED IN A MANNER TO PREVENT MOVEMENT RESULTING FROM AIRCRAFT JET BLAST OR WIND CONDITIONS IN EXCESS OF 10 KNOTS.

9. ALL CONTRACTOR VEHICLES AND TRAFFIC (UNLESS OTHERWISE AUTHORIZED) SHALL REMAIN WITHIN THE DESIGNATED CONSTRUCTION LIMITS OR HAUL ROUTES.

SECURITY

1. THE AIRPORT WILL NOT PROVIDE AIRFIELD OPERATIONS AREA ESCORTS. THE CONTRACTOR MUST PROVIDE RADIOS TO THE CREW AND AQUAINT PERTINENT PERSONNEL WITH THE PROPER PROCEDURES IN COMMUNICATIONS WITH GROUND CONTROL.

2. THE CONTRACTOR SHALL PROVIDE THE ENGINEER WITH A CURRENT LIST OF ALL EMPLOYEES WORKING ON THE AIRPORT. THE LIST SHALL BE MAINTAINED CURRENT BY THE CONTRACTOR AND APPLIES TO BOTH THE CONTRACTOR AND SUBCONTRACTORS.

UTILITIES

1. UNDERGROUND UTILITIES – LOCATIONS OF KNOWN UNDERGROUND UTILITIES SHOWN ON THE PLANS ARE APPROXIMATE. ALL UTILITY LOCATIONS SHALL BE FIELD VERIFIED BY THE CONTRACTOR PRIOR TO COMMENCING CONSTRUCTION. THE CONTRACTOR IS REQUIRED TO COMPLETE A DIGGING AUTHORIZATION FORM, AS SUPPLIED BY THE ENGINEER, PRIOR TO INITIATION OF EXCAVATION OPERATIONS.

2. REPAIR OF UTILITIES DAMAGED DURING CONSTRUCTION MUST BE STARTED IMMEDIATELY AND CONTINUE UNTIL COMPLETED.

3. ALL SUCH REPAIRS SHALL BE IN ACCORDANCE WITH THE CONTRACT SPECIFICATIONS OR AS DIRECTED BY THE ENGINEER AND SHALL BE AT THE CONTRACTOR'S EXPENSE.

4. IF FAA CABLES ARE DAMAGED, REPAIRS SHALL BE DONE IN ACCORDANCE WITH FAA REQUIREMENTS AND IN THE PRESENCE OF AN FAA REPRESENTATIVE. THE FAA MAY ELECT TO HAVE THE REPAIR PERFORMED BY OTHERS IN WHICH CASE THE CONTRACTOR SHALL BE RESPONSIBLE FOR PAYING THE INCURRED COSTS OF REPAIRS.

5. UTILITIES NOTIFICATION – AT LEAST TWO WORKING DAYS PRIOR TO COMMENCING CONSTRUCTION OPERATIONS IN AN AREA WHICH MAY INVOLVE UNDERGROUND UTILITIES, THE CONTRACTOR SHALL NOTIFY THE ENGINEER AND THE OWNER OF EACH UNDERGROUND UTILITY AFFECTED.

6. THE FOLLOWING LIST INCLUDES POSSIBLE UTILITIES WITHIN THE CONSTRUCTION LIMITS. ADDITIONAL UTILITIES NOT LISTED BELOW MAY ALSO BE ON–SITE.

UTILITY OWNERSHIP:	
MISS UTILITY CENTER	1–800–257–7777
BGE	410–685–0123/410–234–5000/1–800–685–0123
VERIZON REPAIR BURIED CABLE	(410) 954–2222 1–800–275–2355
FAA AIRWAY FACILITIES SSC	(410) 859–7252

EMERGENCY CONTACT INFORMATION

1. EXCEPT FOR EMERGENCIES, ALL CONTACT WITH AIRPORT PERSONNEL SHALL BE MADE THROUGH THE ENGINEER. FOR EMERGENCIES INVOLVING SAFETY (INJURIES, FIRES, SECURITY BREACHES, ETC.) THE CONTRACTOR SHALL MAKE DIRECT CONTACT WITH AIRPORT OPERATIONS FOLLOWED BY NOTIFICATION TO THE ENGINEER AS SOON AS POSSIBLE.

2. THE PROJECT SUPERVISORS SHALL HAVE THE FOLLOWING TELEPHONE NUMBERS WITH THEM AT ALL TIMES:

a.	MAA FIRE MARSHAL	410–859–7815/7511
b.	MTN FIRE/POLICE EMERGENCY	911
c.	MTN OPERATIONS	410–682–8831
d.	MTN ATCT	410–682–8856
e.	MDE OIL CONTROL PROGRAM (COMPLIANCE AND REMEDIATION)	410–537–3442

3. THE CONTRACTOR SHALL PROVIDE THE PHONE NUMBERS OF THREE PERSONNEL, INCLUDING THE PROJECT SUPERINTENDENT, WHO MAY BE CONTACTED IN AN EMERGENCY. PERSONNEL SHALL BE ON CALL 24 HOURS PER DAY FOR MAINTAINING AIRPORT HAZARD LIGHTING AND BARRICADES.

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ___

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE: GENERAL CONSTRUCTION & SAFETY NOTES – I
SCALE: NTS
DATE: 07/03/2013
CONTRACT NO.: N/A
SHEET NO.: C-001

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 120303834_C00X-General.dwg
PLOT DATE: Jul 03, 2013 - 11:59am

RELATED DOCUMENTS

1. FAA ADVISORY CIRCULARS (AC's), ORDERS AND FEDERAL AVIATION REGULATIONS (FAR's) – THE FOLLOWING PUBLICATIONS CONTAIN DEFINITIONS OR DESCRIPTIONS OF CRITICAL AIRPORT OPERATING AREAS. COPIES OF THESE PUBLICATIONS ARE AVAILABLE THROUGH THE FAA AT WWW.FAA.GOV AND CAN BE REVIEWED AT THE OFFICES OF THE MAA.

   THE ITEMS OUTLINED BELOW PERTAIN TO AIRFIELD SAFETY REQUIREMENTS AND ARE REFERENCED THROUGHOUT THE CONTRACT DOCUMENTS.

   a. AC 150/5370-2, 'OPERATIONAL SAFETY ON AIRPORTS DURING CONSTRUCTION', CURRENT EDITION, SETS FORTH GUIDELINES TO ASSIST AIRPORT OPERATORS IN COMPLYING WITH FAR PART 139, "CERTIFICATION AND OPERATION: LAND AIRPORTS SERVING CERTAIN AIR CARRIERS" AND WITH THE REQUIREMENTS OF FEDERALLY FUNDED AIRPORT CONSTRUCTION PROJECTS.

   b. FAR PART 77 'OBJECTS AFFECTING NAVIGABLE AIRSPACE', CURRENT EDITION:

   i. ESTABLISHES STANDARDS FOR DETERMINING OBSTRUCTIONS TO NAVIGABLE AIRSPACE. IMAGINARY SURFACES ARE DEFINED IN THE PUBLICATION AND ARE SHOWN ON THIS SHEET.

   ii. ESTABLISHES REQUIREMENTS FOR FILING NOTICE TO THE FAA FOR CERTAIN PROPOSED CONSTRUCTION OR ALTERATION PROPOSALS. COMPLETION OF THE 'NOTICE OF PROPOSED CONSTRUCTION OR ALTERATION' FORM (FAA FORM 7460-1) IS DISCUSSED IN AC 70/7460-1 'OBSTRUCTION MARKING AND LIGHTING', CURRENT EDITION.

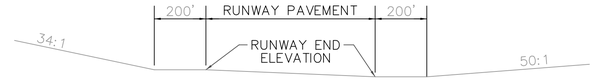
   c. AC 70/7460-2, 'PROPOSED CONSTRUCTION OF OBJECTS THAT MAY AFFECT THE NAVIGABLE AIRSPACE', CURRENT EDITION, PROVIDES INFORMATION TO PERSONS PROPOSING TO ERECT OR ALTER AN OBJECT THAT MAY AFFECT NAVIGABLE AIRSPACE. THE AC EXPLAINS THE REQUIREMENT TO NOTIFY THE FAA BEFORE CONSTRUCTION BEGINS AND THE FAA'S RESPONSIBILITY TO RESPOND TO THESE NOTICES.

   d. AC 150/5300-13, 'AIRPORT DESIGN', CURRENT EDITION, ESTABLISHES DESIGN, OPERATIONAL, AND MAINTENANCE STANDARDS FOR AIRPORTS. STANDARD TERMS USED IN THE CONTRACT PLANS AND SPECIFICATIONS ARE DEFINED BELOW.

   i. OBSTACLE FREE ZONE (OFZ) – A VOLUME OF SPACE WHICH IS FREE OF ALL FIXED OBJECTS AND CLEAR OF VEHICLES IN THE PROXIMITY OF AN AIRPLANE CONDUCTING AN APPROACH, MISSED APPROACH, LANDING, TAKEOFF, OR DEPARTURE. AN OFZ TYPICAL SECTION IS SHOWN ON GENERAL PROJECT LAYOUT.

   ii. OBJECT FREE AREA (OFA) – A TWO DIMENSIONAL GROUND AREA SURROUNDING RUNWAYS, TAXIWAYS, AND TAXILANES WHICH IS CLEAR OF OBJECTS EXCEPT FOR OBJECTS WHOSE LOCATION IS FIXED BY FUNCTION.

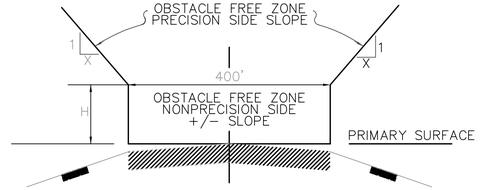
   iii. SAFETY AREA – THE SURFACE ADJACENT TO RUNWAYS, TAXIWAYS, AND TAXILANES OVER WHICH AIRCRAFT SHOULD, IN DRY WEATHER, BE ABLE TO CROSS AT NORMAL SPEEDS WITHOUT INCURRING ANY SIGNIFICANT DAMAGE. A SAFETY AREA IS GRADED, DRAINED AND COMPACTED. IT IS FREE OF ANY HOLES, TRENCHES, BUMPS OR OTHER SIGNIFICANT SURFACE VARIATIONS OR OBJECTS OTHER THAN THOSE WHICH MUST BE THERE BECAUSE OF THEIR ESSENTIAL AERONAUTICAL FUNCTION. THE SAFETY AREA REQUIRES THE CAPABILITY OF SUPPORTING MAINTENANCE VEHICLES AND AIRCRAFT RESCUE AND FIRE FIGHTING VEHICLES UNDER NORMAL (DRY) CONDITIONS.



RUNWAY END	ELEVATION	APPROACH SLOPE
15	24.5	34:1
33	10.3	50:1

TYPICAL PROFILE
F A R PART 77 IMAGINARY SURFACES

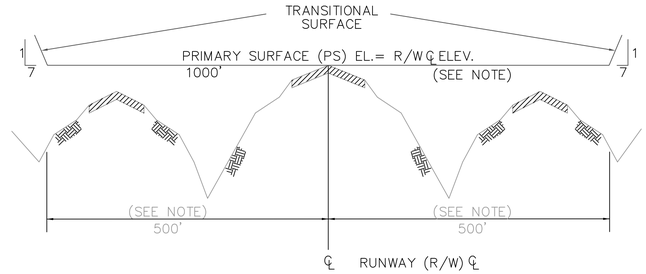
NOT TO SCALE



RUNWAY END	TYPE OF RUNWAY	SIDE SLOPE-X	H
15-33	PRECISION	6:1	41.0

TYPICAL SECTION
RUNWAY OBSTACLE FREE ZONE

NOT TO SCALE



NOTE

SEE "SAFETY REQUIREMENTS DURING CONSTRUCTION" AS CONTAINED IN THE SPECIFICATIONS, AND PLANS REGARDING RESTRICTED AREAS IN THE VICINITY OF ACTIVE RUNWAYS AND TAXIWAYS.

TYPICAL SECTION
F A R PART 77 IMAGINARY SURFACES

NOT TO SCALE

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE: GENERAL CONSTRUCTION & SAFETY NOTES - II
SCALE: NTS
DATE: 07/03/2013
CONTRACT NO.: N/A
SHEET NO.: C-002

DRAWING NAME: S:\03-Projects\Commercial\MAC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112003834_C00X-General.dwg
PLOT DATE: Jul 03, 2013 - 11:59am

CIVIL LEGEND

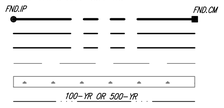
NOTE:
THIS LEGEND IS GENERAL.
SYMBOL AND LINE SIZES, COLORS, AND TYPES
MAY VARY BY PLAN.

EXISTING FEATURES

CONTROL

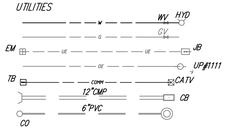
- SURVEY TRAVERSE POINT
- GPS VERT
- GPS HORIZ
- GPS VERT/HORIZ

PROPERTIES AND BUFFERS



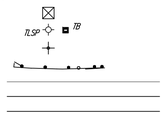
- PROPERTY LINE W/ MONUMENTS
- ADJOINING PROPERTY
- RIGHT-OF-WAY
- EASEMENT OR AGREEMENT
- WETLANDS W/ FLAG
- FLOOD PLAIN

UTILITIES



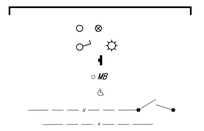
- WATER LINE W/ VALVE & HYDRANT
- GAS LINE W/ VALVE
- UNDERGROUND ELECTRIC W/ METER & JUNCTION BOX
- ABOVE-GROUND ELECTRIC W/ POLE & GUY
- COMMUNICATIONS W/ BOX
- STORM PIPE W/ CULVERT AND INLET
- SANITARY LINE W/ CLEAN-OUT & MANHOLE

TRAFFIC



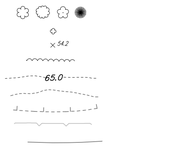
- RAILROAD SIGNAL
- TRAFFIC LIGHT SUPPORT POLE
- STREET SIGN
- GUARD RAIL
- EDGE OF GRAVEL ROAD
- EDGE OF ASPHALT
- EDGE OF CONCRETE

IMPROVEMENTS



- BUILDING - MAJOR
- POST
- LAMP POLE OR POST
- SIGNAGE (GENERAL)
- MAIL BOX
- HANDICAP STRIPING
- CHAIN LINK FENCE W/ GATE
- SPLIT RAIL FENCE

GROUND FEATURES



- TREES (GENERAL)
- BUSH
- SPOT ELEVATION
- TREELINE
- MAJOR CONTOUR (5')
- INDEX CONTOUR (1')
- DEPRESSION CONTOUR
- GROUND OBSCURED
- FIELD LINE

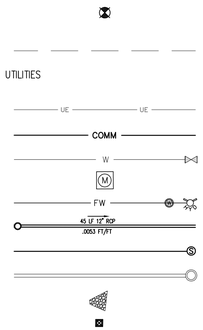
GEOTECHNICAL, ENVIRONMENTAL, AND HYRDOGEOLOGICAL



- SOIL BORING OR TEST PIT
- MONITORING WELL

PROPOSED FEATURES

PROPERTIES AND BUFFERS

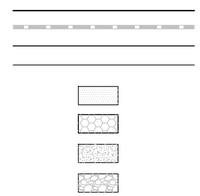


- LAYOUT CONTROL POINT
- EASEMENT

UTILITIES

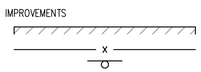
- UNDERGROUND ELECTRIC
- COMMUNICATIONS
- WATER LINE W/ VALVE
- WATER METER PIT
- FIRE LINE W/ VALVE & HYDRANT
- STORM W/ MANHOLE
- SANITARY SEWER W/ MANHOLE
- ROOF DRAIN LEADER W/ DOWNSPOUT
- RIP-RAP
- STORM INLET

TRAFFIC



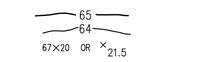
- EDGE OF PAVEMENT
- CURB
- EDGE OF WALKWAY
- STRIPING
- HEAVY PAVING AREA
- REINFORCED TURF
- CONCRETE
- GRAVEL

IMPROVEMENTS



- BUILDING OUTLINE
- CHAIN LINK FENCE
- SIGN (GENERAL)

GRADING AND GROUND FEATURES

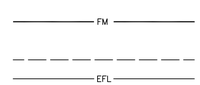


- MAJOR CONTOUR (5')
- INDEX CONTOUR (1')
- PROPOSED SPOT GRADE
  HP: HIGH POINT
  LP: LOW POINT
  BC: BOTTOM CURB
  TC: TOP CURB
- DRAINAGE SLOPES
- TREE OR BRUSH LINE

ENVIRONMENTAL AND HYRDOGEOLOGICAL

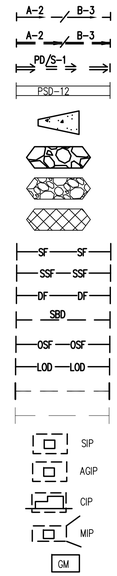


- NEW MONITORING WELL
- NEW OR MODIFIED GROUNDWATER WELL
  RW: RECOVERY WELL
  IW: INJECTION WELL
  EX: EXTRACTION WELL



- FORCE MAIN
  * AS LABELED FOR INJECTION OR RECOVERY
- WELL CONDUIT
- TREATMENT PLANT EFFLUENT

SEDIMENT CONTROL LEGEND
(STANDARD MAA SYMBOLOGY)



- EARTH DIKE
- SWALE
- PERIMETER DIKE/SWALE
- PIPE SLOPE DRAIN
- ROCK OUTLET PROTECTION
- STONE OUTLET STRUCTURE
- GABION OUTLET STRUCTURE
- DEMO AREA
- SILT FENCE
- SUPER SILT FENCE
- DIVISION FENCE
- STRAW BALE DIKE
- ORANGE SAFETY FENCE
- LIMITS OF DISTURBANCE
- DRAINAGE BOUNDARY
- ENVIRONMENTAL BUFFER
- STANDARD INLET PROTECTION
- AT GRADE INLET PROTECTION
- CURB INLET PROTECTION
- MEDIAN INLET PROTECTION
- GABION INFLOW PROTECTION
- RIP-RAP INFLOW PROTECTION
- SUMP PIT
- STABILIZED CONSTRUCTION ENTRANCE
- REMOVABLE PUMPING STATION
- FLOW ARROW

NOTES:

1. MAPPING COMPILED BY PHOTOMETRIC METHODS FROM AERIAL PHOTOGRAPHY EXPOSED 04-03-12 BY LAND AND MAPPING SERVICES.

2. THE MAP WAS EDITED PER FIELD SURVEY FROM 2011 THROUGH 2013 AT VARIOUS TIMES BY TETRA TECH.

3. REFER TO SHEET C-120, SURVEY CONTROL, FOR CONTROL POINT INFORMATION.

DATUM:

HORIZONTAL: MARYLAND STATE PLANE FEET NAD83 (2007)
VERTICAL: NAVD88 FEET

NGS CONTROL POINT: "MARTAIR AZ MK" (JV6476)

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE: GENERAL LEGENDS AND ABBREVIATIONS SHEET
SCALE: NTS
DATE: 07/03/2013

CONTRACT NO.: N/A
SHEET NO.: C-003

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P25710-DRA-30% design Phase-2013\CAD drawings\Civil\ 112003834_C00X-General.dwg
PLOT DATE: Jul 03, 2013 - 11:59am



EXISTING FEATURES

CONTROL

- SURVEY TRAVERSE POINT
- GPS VERT
- GPS HORIZ
- GPS VERT/HORIZ

PROPERTIES AND BUFFERS

- FND.IP — FND.CM — PROPERTY LINE W/ MONUMENTS
- ADJOINING PROPERTY
- RIGHT-OF-WAY
- EASEMENT OR AGREEMENT
- WETLANDS W/ FLAG
- 100-YR OR 500-YR — FLOOD PLAIN

UTILITIES

- WV HYD — WATER LINE W/ VALVE & HYDRANT
- GV — GAS LINE W/ VALVE
- EM — JB — UNDERGROUND ELECTRIC W/ METER & JUNCTI
- UP#1111 — ABOVE-GROUND ELECTRIC W/ POLE & GUY
- TB — CATV — COMMUNICATIONS W/ BOX
- 12"CMP — CB — STORM PIPE W/ CULVERT AND INLET
- 6"PVC — CO — SANITARY LINE W/ CLEAN-OUT & MANHOLE

TRAFFIC

- RAILROAD SIGNAL
- TLSP — TB — TRAFFIC LIGHT SUPPORT POLE
- STREET SIGN
- GUARD RAIL
- EDGE OF GRAVEL ROAD
- EDGE OF ASPHALT
- EDGE OF CONCRETE

IMPROVEMENTS

- BUILDING - MAJOR
- POST
- LAMP POLE OR POST
- SIGNAGE (GENERAL)
- MB — MAIL BOX
- HANDICAP STRIPING
- CHAIN LINK FENCE W/ GATE
- SPLIT RAIL FENCE

GROUND FEATURES

- TREES (GENERAL)
- BUSH
- 54.2 — SPOT ELEVATION
- TREELINE
- 65.0 — MAJOR CONTOUR (5')
- INDEX CONTOUR (1')
- DEPRESSION CONTOUR
- GROUND OBSCURED
- FIELD LINE

GEOTECHNICAL, ENVIRONMENTAL, AND HYRDOGEOLOGICAL

- BOR-x — SB — TP — SOIL BORING OR TEST PIT
- CW-x — PZ-x — MONITORING WELL

NOTES:

1. MAPPING COMPILED BY PHOTOMETRIC METHODS FROM AERIAL PHOTOGRAPHY EXPOSED 04-03-12 BY LAND AND MAPPING SERVICES.

2. THE MAP WAS EDITED PER FIELD SURVEY FROM 2011 THROUGH 2013 AT VARIOUS TIMES BY TETRA TECH.

3. REFER TO SHEET C-120, SURVEY CONTROL, FOR CONTROL POINT INFORMATION.

DATUM:

HORIZONTAL: MARYLAND STATE PLANE FEET NAD83 (2007)
VERTICAL: NAVD88 FEET

NGS CONTROL POINT: "MARTAIR AZ MK" (JV6476)

0 10 20 30 60
1"=30'

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: EXISTING CONDITION - I

SCALE: 1"=30'

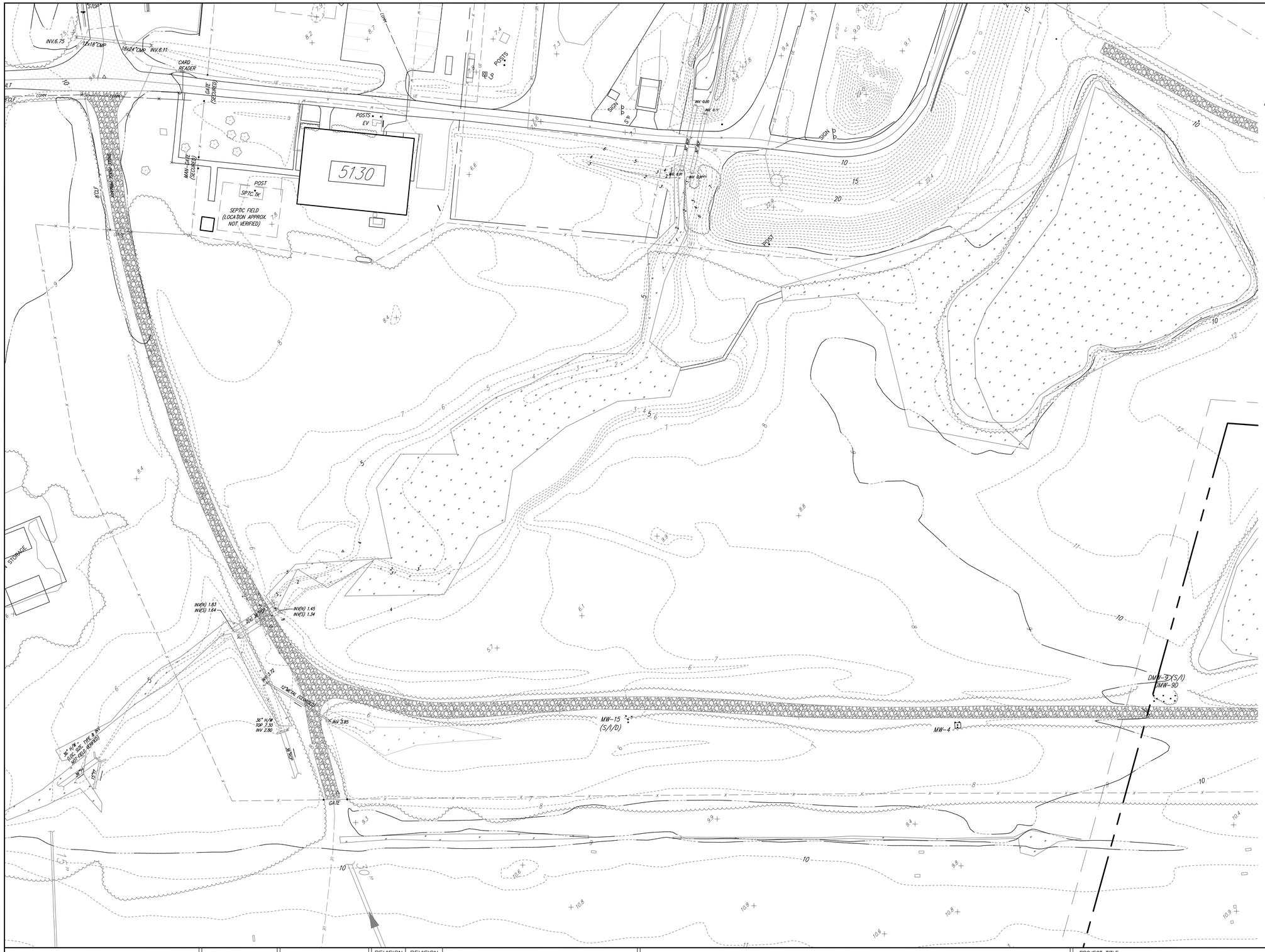
DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-010

DRAWING NAME: S:\03-Projects\Commercial\LMC\103IP257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112IC03834_C01X-ExCond.dwg

PLOT DATE: Jul 03, 2013 - 12:03pm



EXISTING FEATURES

CONTROL

- SURVEY TRAVERSE POINT
- GPS VERT
- GPS HORIZ
- GPS VERT/HORIZ

PROPERTIES AND BUFFERS

- PROPERTY LINE W/ MONUMENTS
- ADJOINING PROPERTY
- RIGHT-OF-WAY
- EASEMENT OR AGREEMENT
- WETLANDS W/ FLAG
- 100-YR OR 500-YR FLOOD PLAIN

UTILITIES

- WATER LINE W/ VALVE & HYDRANT
- GAS LINE W/ VALVE
- UNDERGROUND ELECTRIC W/ METER & JUNCTION
- ABOVE-GROUND ELECTRIC W/ POLE & GUY
- COMMUNICATIONS W/ BOX
- STORM PIPE W/ CULVERT AND INLET
- SANITARY LINE W/ CLEAN-OUT & MANHOLE

TRAFFIC

- RAILROAD SIGNAL
- TRAFFIC LIGHT SUPPORT POLE
- STREET SIGN
- GUARD RAIL
- EDGE OF GRAVEL ROAD
- EDGE OF ASPHALT
- EDGE OF CONCRETE

IMPROVEMENTS

- BUILDING - MAJOR
- POST
- LAMP POLE OR POST
- SIGNAGE (GENERAL)
- MAIL BOX
- HANDICAP STRIPING
- CHAIN LINK FENCE W/ GATE
- SPLIT RAIL FENCE

GROUND FEATURES

- TREES (GENERAL)
- BUSH
- SPOT ELEVATION
- TREELINE
- MAJOR CONTOUR (5')
- INDEX CONTOUR (1')
- DEPRESSION CONTOUR
- GROUND OBSCURED
- FIELD LINE

GEOTECHNICAL, ENVIRONMENTAL, AND HYRDOGEOLOGICAL

- SOIL BORING OR TEST PIT
- MONITORING WELL

NOTES:

1. MAPPING COMPILED BY PHOTOMETRIC METHODS FROM AERIAL PHOTOGRAPHY EXPOSED 04-03-12 BY LAND AND MAPPING SERVICES.
2. THE MAP WAS EDITED PER FIELD SURVEY FROM 2011 THROUGH 2013 AT VARIOUS TIMES BY TETRA TECH.
3. REFER TO SHEET C-120, SURVEY CONTROL, FOR CONTROL POINT INFORMATION.

DATUM:

HORIZONTAL: MARYLAND STATE PLANE FEET NAD83 (2007)
VERTICAL: NAVD88 FEET

NGS CONTROL POINT: "MARTAIR AZ MK" (JV6476)

0 10 20 30 60
1"=30'

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

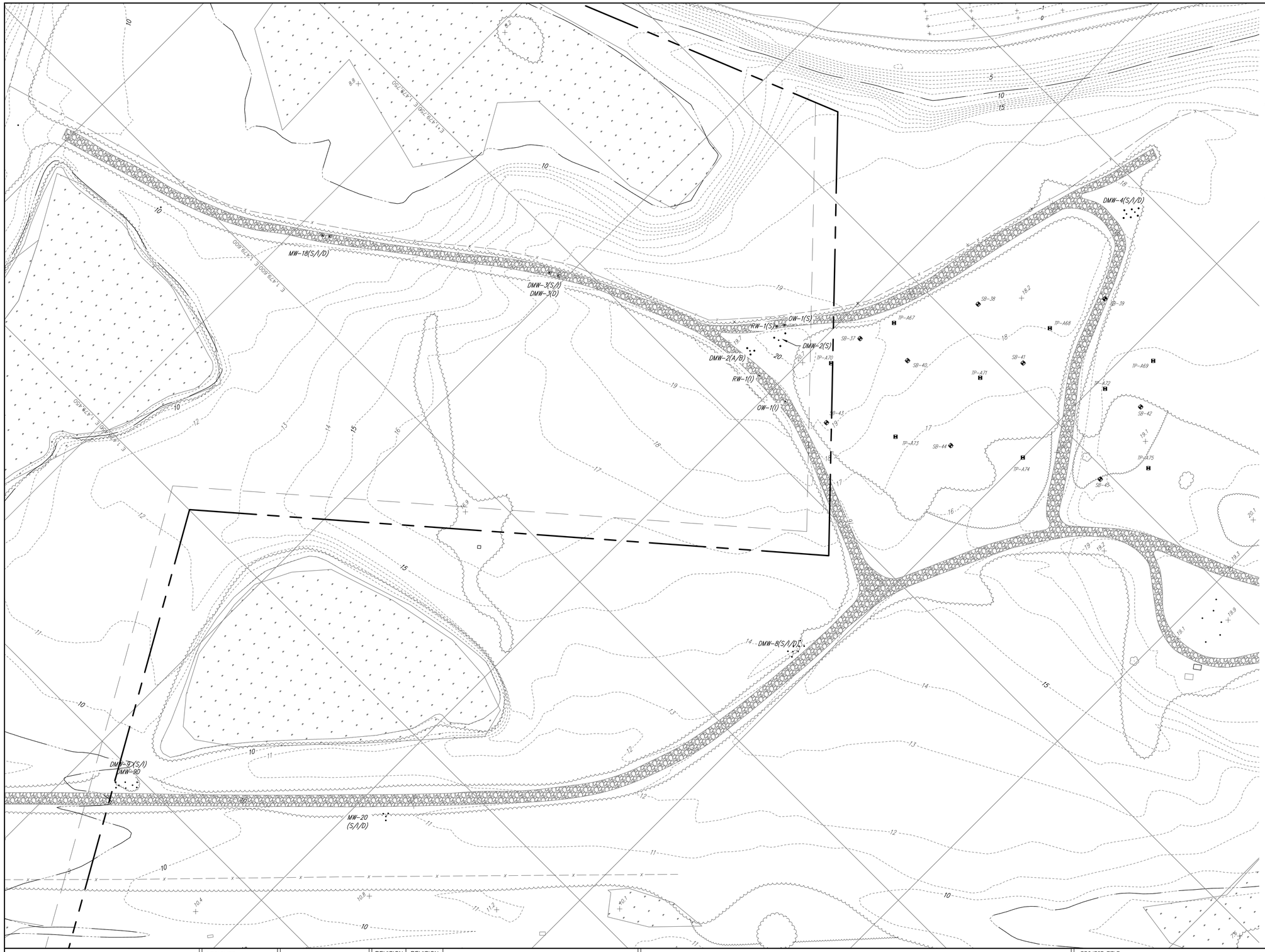
SHEET TITLE: EXISTING CONDITIONS - II

SCALE: 1"=30' DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-011

PLOT DATE: Jul 03, 2013 - 12:05pm
DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112103834_C01X-ExCond.dwg



EXISTING FEATURES

CONTROL

- SURVEY TRAVERSE POINT
- GPS VERT
- GPS HORIZ
- GPS VERT/HORIZ

PROPERTIES AND BUFFERS

- PROPERTY LINE W/ MONUMENTS (FND.IP / FND.CM)
- ADJOINING PROPERTY
- RIGHT-OF-WAY
- EASEMENT OR AGREEMENT
- WETLANDS W/ FLAG
- 100-YR OR 500-YR FLOOD PLAIN

UTILITIES

- WATER LINE W/ VALVE & HYDRANT (WV, HYD)
- GAS LINE W/ VALVE (GV)
- UNDERGROUND ELECTRIC W/ METER & JUNCTION (EM, UE, JB)
- ABOVE-GROUND ELECTRIC W/ POLE & GUY (UP#1111)
- COMMUNICATIONS W/ BOX (TB, COM, CATV)
- STORM PIPE W/ CULVERT AND INLET (12"CMP, 6"PVC, CB)
- SANITARY LINE W/ CLEAN-OUT & MANHOLE (CO)

TRAFFIC

- RAILROAD SIGNAL
- TRAFFIC LIGHT SUPPORT POLE (TLSP, TB)
- STREET SIGN
- GUARD RAIL
- EDGE OF GRAVEL ROAD
- EDGE OF ASPHALT
- EDGE OF CONCRETE

IMPROVEMENTS

- BUILDING - MAJOR
- POST
- LAMP POLE OR POST
- SIGNAGE (GENERAL)
- MAIL BOX (MB)
- HANDICAP STRIPING
- CHAIN LINK FENCE W/ GATE
- SPLIT RAIL FENCE

GROUND FEATURES

- TREES (GENERAL)
- BUSH
- SPOT ELEVATION (×54.2)
- TREELINE
- MAJOR CONTOUR (5') (65.0)
- INDEX CONTOUR (1')
- DEPRESSION CONTOUR
- GROUND OBSCURED
- FIELD LINE

GEOTECHNICAL, ENVIRONMENTAL, AND HYRDOGEOLOGICAL

- SOIL BORING OR TEST PIT (BOR-x, SB, TP)
- MONITORING WELL (CW-x, PZ-x)

NOTES:

1. MAPPING COMPILED BY PHOTOMETRIC METHODS FROM AERIAL PHOTOGRAPHY EXPOSED 04-03-12 BY LAND AND MAPPING SERVICES.

2. THE MAP WAS EDITED PER FIELD SURVEY FROM 2011 THROUGH 2013 AT VARIOUS TIMES BY TETRA TECH.

3. REFER TO SHEET C-120, SURVEY CONTROL, FOR CONTROL POINT INFORMATION.

DATUM:

HORIZONTAL: MARYLAND STATE PLANE FEET NAD83 (2007)
VERTICAL: NAVD88 FEET

NGS CONTROL POINT: "MARTAIR AZ MK" (JV6476)

0 10 20 30 60
1"=30'

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE:	DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE:	EXISTING CONDITIONS - III
SCALE:	1"=30'
DATE:	07/03/2013
CONTRACT NO.:	N/A
SHEET NO.:	C-012

PLOT DATE: Jul 03, 2013 - 12:06pm
DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112C00383A_C01X-ExCond.dwg

GENERAL NOTES

1. DESCRIPTION

THIS WORK SHALL CONSIST OF THE APPLICATION OF MEASURES THROUGH–OUT THE LIFE OF THE PROJECT TO CONTROL EROSION AND MINIMIZE THE SEDIMENTATION OF RIVERS, STREAMS AND IMPOUNDMENTS (LAKES, RESERVOIRS, BAYS, AND COASTAL WATERS). THE MEASURES SHALL INCLUDE BUT ARE NOT LIMITED TO THE USE OF BERMS, DIKES, DAMS, SEDIMENT BASINS AND/OR TRAPS, GEOTEXTILES, STONE CHECKS, SILT FENCES, SURFACE ROUGHING, MATS & NETS, AGGREGATE, MULCH, GRASSES, SLOPE DRAINS AND OTHER APPROVED METHODS. EROSION AND SEDIMENT CONTROL MEASURES AS DESCRIBED HEREIN AND APPROVED BY M.D.E. SHALL BE APPLIED TO ERODIBLE MATERIAL EXPOSED BY ANY ACTIVITY ON THIS PROJECT.

EROSION AND SEDIMENT CONTROL MEASURES SHALL BE COORDINATED WITH THE CONSTRUCTION OF THE PAVEMENT, DRAINAGE FACILITIES SUCH AS PIPES, CULVERTS, HEADWALLS, DITCH PAVING, FLUMES, ETC., WHICH SHALL BE CONSTRUCTED CONCURRENT WITH THE COMMENCEMENT OF THE GRADING OPERATION TO ASSURE ECONOMICAL, EFFECTIVE AND CONTINUOUS EROSION AND SEDIMENT CONTROL.

2. TEMPORARY CONTROLS

IN ACCORDANCE WITH THE DEPARTMENT OF THE ENVIRONMENT, TITLE 4, SUBTITLE 106, SEDIMENT CONTROL, ANNOTATED CODE OF MARYLAND REGULATIONS, AND GENERAL PROVISION 7.12 OF THE MARYLAND DEPARTMENT OF TRANSPORTATION, STATE HIGHWAY ADMINISTRATION STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MATERIALS, THE CONTRACTOR WILL PROVIDE TEMPORARY POLLUTION CONTROL MEASURES FOR THE PURPOSE OF CORRECTING CONDITIONS THAT DEVELOP DURING CONSTRUCTION NOT FORESEEN DURING THE DESIGN OF THE PROJECT AND FOR THE PURPOSE OF PROVIDING CONTINUOUS EROSION AND SEDIMENT CONTROL FOR THE DURATION OF THE PROJECT.

3. STANDARDS & SPECIFICATIONS

THIS PLAN WILL BE IN ACCORDANCE WITH THE STATE HIGHWAY ADMINISTRATION'S STANDARD SPECIFICATIONS TITLED "STANDARD SPECIFICATIONS FOR CONSTRUCTION & MATERIALS" DATED OCTOBER 1993, AND REVISIONS THEREOF, AND ADDITIONS THERETO INCLUDED IN THESE CONTRACT DOCUMENTS.

THE 2011 "MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL" (AND AMENDMENTS) WILL BE AN ACCEPTABLE REFERENCE FOR THIS PROJECT.

THIS INFORMATION MUST BE PRESENT ON THE PROJECT AT ALL TIMES.

4. DEFINITIONS

CLEARING: SHALL MEAN THE CLEARING OF TREES, BRUSH, SHRUBS, DOWN TIMBER, ROTTEN WOOD, RUBBISH, AND ANY OTHER VEGETATION (EXCEPT WHERE EXCLUDED BY THE DEFINITION FOR GRUBBING), AS WELL AS THE REMOVAL OF FENCES AND INCIDENTAL STRUCTURES.

GRUBBING: SHALL MEAN THE REMOVAL FROM THE GROUND OF STUMPS, ROOTS AND STUBS, BRUSH, FOREST LITTER, ORGANIC MATERIAL, AND DEBRIS.

DISTURBED AREA: SHALL MEAN AN AREA WHERE GRUBBING AND/OR GRADING HAS BEEN INITIATED.

STABILIZATION/STABILIZED: (CASE 1) – TO MEET THE REQUIREMENTS TO PROCEED WITH THE NEXT GRADING UNIT(S) OR OPERATION SHALL MEAN THE PLACEMENT OF SEED AND MULCH, SOD, ETC.

(CASE 2) – TO MEET THE REQUIREMENT FOR REMOVAL OF THE CONTROLS SHALL MEAN THAT THE COMPLETE GROWTH OF VEGETATION HAS OCCURRED (I.E., 3" HEIGHT OF PERMANENT GRASS OVER ALL AREAS).

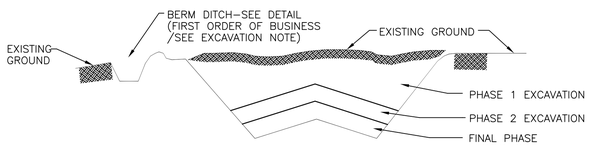
5. CLEARING AND GRUBBING

EROSION AND SEDIMENT CONTROL MEASURES WILL BE IMPLEMENTED AT THE BEGINNING OF THE GRUBBING PORTION OF THIS OPERATION. GRUBBING WILL BE RESTRICTED TO THE GRADING UNIT CURRENTLY ACTIVE.

6. EXCAVATION

IF BERM DITCHES ARE TO BE USED IN A CUT SECTION, THEY WILL BE EXCAVATED AND STABILIZED AS THE FIRST ORDER OF BUSINESS AS DIRECTED BY THE ENGINEER.

ALL CUT SLOPES SHALL BE DRESSED, PREPARED, SEEDED, AND MULCHED AS THE WORK PROGRESSES. SLOPES SHALL BE EXCAVATED AND STABILIZED IN EQUAL INCREMENTS NOT TO EXCEED 15 FEET.



CONSTRUCTION SEQUENCE:

1. EXCAVATE AND STABILIZE BERM, SIDE AND OUTLET DITCHES.
2. PERFORM PHASE 1 EXCAVATION, DRESS, SEED & MULCH SLOPES WITH PERMANENT SEED & MULCH.
3. PERFORM PHASE 2 EXCAVATION, DRESS, SEED & MULCH SLOPES WITH PERMANENT SEED & MULCH.
4. OVERSEED PHASE 1 SLOPES, IF REQUIRED.
4. PERFORM FINAL PHASE EXCAVATION, DRESS, SEED & MULCH SLOPES WITH PERMANENT SEED & MULCH. STABILIZE SURFACE DRAIN DITCHES, OVERSEED PHASE 1 & 2 SLOPES, IF REQUIRED, AS DETERMINED BY THE ENGINEER.

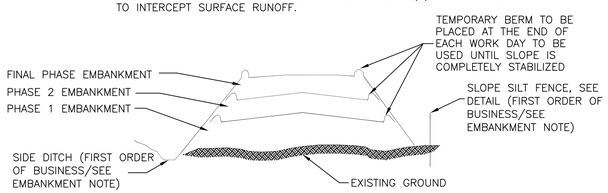
PHASING PLAN–CUT SECTION

NOTE: ONCE THE EXCAVATION WITHIN A SPECIFIC AREA HAS BEGUN, THE OPERATION SHALL BE CONTINUOUS FROM GRUBBING THROUGH THE COMPLETION OF THE GRADING AND PLACEMENT OF PERMANENT SEED AND MULCH. ANY INTERRUPTIONS IN THE OPERATION OF 14 DAYS OR MORE MUST BE APPROVED BY THE ENGINEER. ANY VIOLATION OF THIS REQUIREMENT WILL RESULT IN THE CONTRACTOR ASSUMING THE RESPONSIBILITY OF PLACING TEMPORARY STABILIZATION AT HIS OWN COST AND EXPENSE.

7. EMBANKMENT

THE FIRST ORDER OF BUSINESS WILL BE THE EXCAVATION AND STABILIZATION OF SIDE DITCHES AND PLACEMENT OF PERIMETER CONTROL (SILT FENCE, ETC.). THE EMBANKMENT WILL BE MADE IN LIFTS MEETING THE SAME HEIGHT REQUIREMENTS AS PREVIOUSLY STATED FOR CUT SECTIONS. THE SLOPES WILL BE STABILIZED IMMEDIATELY FOLLOWING THE COMPLETION OF THE INTERMEDIATE STAGE(S).

AT THE END OF EACH WORK DAY, TEMPORARY BERMS (EARTH) AND SLOPE DRAINS WILL BE CONSTRUCTED ALONG THE TOP EDGE(S) OF THE EMBANKMENT TO INTERCEPT SURFACE RUNOFF.



CONSTRUCTION SEQUENCE:

1. EXCAVATE AND STABILIZE SIDE DITCH AND/OR INSTALL PROPOSED CONTROLS AT THE TOE OF SLOPE.
2. PLACE PHASE 1 EMBANKMENT, PROVIDE TEMPORARY SEEDING OR STRAW MULCH.
3. PLACE PHASE 2 EMBANKMENT, DRESS. PROVIDE TEMPORARY SEEDING OR STRAW MULCH.
4. PLACE FINAL PHASE EMBANKMENT, DRESS. PREPARE & PLACE PERMANENT SEED & MULCH ON THE ENTIRE SLOPE.

PHASING PLAN–FILL SECTION

8. STABILIZATION / LIMITS OF DISTURBANCE

OTHER THAN LISTED BELOW, ONE UNIT EQUALING 20 ACRES (872,800 SQUARE FEET) THAT HAS BEEN CLEARED CAN BE ACTIVELY GRADED AT ONE TIME. ONCE GRADING BEGINS IN THE FIRST UNIT, A SECOND UNIT MAY BE GRUBBED, TWO UNITS (ONE GRADED AND ONE GRUBBED) WILL BE ALLOWED PER GRADING OPERATION. A GRADING OPERATION IS DEFINED AS THE CONTRACTOR'S ABILITY TO PROVIDE ADEQUATE RESOURCES TO PERFORM THE GRADING IN A TIMELY MANNER AND PROVIDE AND MAINTAIN THE PROPER EROSION AND SEDIMENT CONTROL MEASURES. THE DISTRICT ENGINEER OR HIS DESIGNATE WILL BE THE FINAL AUTHORITY IN THIS DETERMINATION. A GRADING UNIT NEED NOT BE 20 CONTINUOUS ACRES. ALL APPROPRIATE PERIMETER CONTROLS WILL BE INSTALLED PRIOR TO ANY GRUBBING OPERATION. AREAS ARE TO BE PERMANENTLY OR TEMPORARILY SEEDED AND MULCHED WHEN SITE DEVELOPMENT WORK, GRADING OR OTHER EARTH DISTURBING ACTIVITIES CEASE TO BE CONTINUOUS FOR A PERIOD TO EXCEED 7 CALENDAR DAYS. UPON COMPLETION OF THE GRADING OR CONSTRUCTION, THE AREA WILL BE PERMANENTLY STABILIZED WITHIN 3 CALENDAR DAYS. THIS PERTAINS TO OTHER PERIMETER CONTROLS, DIKES, SWALES, DITCHES, PERIMETER SLOPES, AND OTHER SLOPES GREATER THAN 3:1. SLOPES LESS THAN 3:1 NEED NOT BE TEMPORARILY STABILIZED, HOWEVER, THE PERMANENT STABILIZATION WITHIN 3 DAYS IS REQUIRED. ONCE THE EXCAVATION OR EMBANKMENT REACHES THE "BOTTOM OR SUBGRADE," (I.E., CAPPING MATERIAL OR AGGREGATE SUBGRADE IN PLACE), THOSE AREAS IN WHICH PAVING WILL BE PLACED WILL BE EXEMPT FROM THE STABILIZATION REQUIREMENTS." ROADWAYS AND HAUL ROADS ACTIVELY BEING USED FOR DAILY CONVEYANCE OF EQUIPMENT WILL ALSO BE EXEMPT FROM THE STABILIZATION REQUIREMENTS. AREAS BETWEEN "TEMPORARY BERMS" EXCEPT MEDIAN AREAS NEED NOT BE STABILIZED UPON COMPLETION OF GRADING. THE 3 / 7 DAY REQUIREMENTS IS TAKEN TO MEAN THAT THE STABILIZATION OPERATION IS COMPLETE OR NEARING COMPLETION.

WHEN BALANCING EARTHWORK (BORROW FROM A CUT USED AS FILL AT A LOCATION DISTANT FROM THE CUT), CONSIDERATION WILL BE ALLOWED FOR GREATER THAN ONE UNIT OF GRADING. IN SUCH CASES, ONE UNIT OF CUT AND ONE GRADING UNIT OF FILL WILL BE ALLOWED TO BE GRUBBED AND GRADED. GREATER THAN ONE UNIT OF GRUBBED AND GRADED AREA SHALL BE ALLOWED FOR INTERCHANGE CONSTRUCTION. WHEN WET SOIL CONDITIONS ARE ENCOUNTERED, THE CONTRACTOR WILL BE ALLOWED TO GRUB AND GRADE ANOTHER UNIT PROVIDING THE INITIAL UNIT HAS BEEN PROPERLY STABILIZED.

NO SLOPE SHALL BE LEFT DISTURBED WITHOUT BENEFIT OF SURFACE ROUGHENING FOR MORE THAN 5 DAYS.

THE MOST STRINGENT REQUIREMENTS FOR STABILIZATION UNDER EXCAVATION, EMBANKMENT OR STABILIZATION/LIMITS OF DISTURBANCE WILL BE PREFERENTIALLY ENFORCED.

9. MAINTENANCE

SEDIMENT TRAPS, SEDIMENT BASINS, DITCHES, STRAW BALES, SILT FENCES, STONE OUTLET STRUCTURES, EARTH BERMS, ETC. SHALL BE MAINTAINED DURING THE CONSTRUCTION SEASON AS WELL AS THE WINTER MONTHS AND OTHER TIMES WHEN THE PROJECT IS CLOSED DOWN. THE MAINTENANCE INTERVAL SHALL BE AS SPECIFIED IN THE DOT/SHA STANDARD SPECIFICATIONS, THE SPECIAL PROVISIONS AND PLANS OR WHEN DIRECTED BY THE ENGINEER.

TRAPS WILL BE CLEANED WHEN THEY ARE 50% FILLED. SILT FENCE STONE OUTLET STRUCTURES AND STRAW BALES SHALL HAVE SEDIMENTATION REMOVED WHEN IT REACHES 50% THE HEIGHT OF THE CONTROL DEVICE. THESE SPOILS WILL BE REMOVED TO AN APPROVED SITE.

CONTROLS WILL BE INSPECTED IMMEDIATELY FOLLOWING RAIN STORMS. THE CONTRACTOR WILL IMMEDIATELY REPAIR CONTROLS WHEN DAMAGED.

ACCESS SHALL BE MAINTAINED TO ALL SEDIMENT CONTROL REQUIRING MAINTENANCE UNTIL THOSE CONTROLS ARE NO LONGER REQUIRED.

MAINTENANCE OF THE CONTROL DEVICES IS ESSENTIAL. LACK OF COOPERATION ON THE PART OF THE CONTRACTOR WILL BE CONSIDERED AS A MAJOR VIOLATION TO THE PLAN AND GROUNDS FOR A "SHUT DOWN" OF THE PROJECT. THE CONTRACTOR SHALL PROVIDE A POINT OF CONTACT TO ADDRESS MAINTENANCE ISSUES.

10. EROSION AND SEDIMENT CONTROL EXCAVATION

THIS ITEM HAS BEEN ESTABLISHED TO INCLUDE THE EXCAVATION, BACKFILLING AND MAINTENANCE OF SEDIMENT TRAPS. IT SHALL ALSO INCLUDE THE REMOVAL OF SILT IN AND AROUND SEDIMENT BASINS, SILT FENCE, STRAW BALE DITCH CHECKS, TEMPORARY STONE OUTLET STRUCTURE, EARTH BERMS, SWALES AND DITCHES. MEASUREMENT AND PAYMENT WILL BE BASED ON THE CUBIC YARD WHICH SHALL INCLUDE ALL EQUIPMENT, TOOLS AND LABOR REQUIRED.

11. STOCKPILED MATERIAL

SALVAGED TOPSOIL WILL BE PLACED ON WELL DRAINED LAND AWAY FROM LIVE STREAMS AND IN ACCORDANCE WITH APPROVED EROSION AND SEDIMENT CONTROL MEASURES. IT SHALL BE PLACED IN PILES OF NEAT CONFORMATIONS AND SEEDED WITH TEMPORARY SEED IMMEDIATELY AFTER FINAL SHAPING OF THE PILE IN ACCORDANCE WITH SECTION 704 OF THE DOT/SHA STANDARD SPECIFICATIONS. THE CONTRACTOR WILL PROVIDE AN ADEQUATE QUANTITY OF SILT FENCE TO CONTROL THE PERIMETER OF THE STOCKPILE UNTIL SUITABLE VEGETATION IS ESTABLISHED. IF HE ELECTS, THE CONTRACTOR, WITH THE APPROVAL OF THE ENGINEER, MAY CONSTRUCT AN EARTH BERM IN LIEU OF SILT FENCE. THE COST FOR THESE CONTROLS WILL BE IN ACCORDANCE WITH THE APPROPRIATE CONTRACT ITEMS.

12. EXCAVATED MATERIAL

MATERIALS EXCAVATED FOR THE CONSTRUCTION OF SEDIMENT TRAPS WILL NOT BE STOCKPILED IN THE AREA OF THE TRAP. IT WILL EITHER BE PLACED IN AN EMBANKMENT OR WASTED AS DIRECTED BY THE ENGINEER. EXCAVATION FROM CUTS TO BE USED FOR EMBANKMENTS WILL NOT BE STOCKPILED UNLESS PERIMETER CONTROLS ARE UTILIZED. COSTS FOR THESE CONTROLS WILL BE BORNE BY THE CONTRACTOR. IF THIS MATERIAL IS STOCKPILED UNDER THE DIRECTION OF THE ENGINEER, THE ADMINISTRATION WILL ASSUME THE COSTS OF THE CONTROLS.

13. DEWATERING DISCHARGE

SEDIMENT – LADEN DEWATERING DISCHARGE MUST BE DIRECTED TO AN APPROVED SEDIMENT TRAPPING MEASURE PRIOR TO RELEASE FROM THE SITE.

14. TEMPORARY SLOPE DRAINS

ALL TEMPORARY SLOPE DRAINS WILL DISCHARGE INTO THE BACK OF SEDIMENT TRAPS, INTO SEDIMENT BASINS, OR DITCHES DISCHARGING INTO TRAPS OR BASINS.

15. GEOTEXTILE

GEOTEXTILE WILL BE USED WITH ALL RIPRAP DITCHES (BY TYPE), TEMPORARY STONE OUTLET STRUCTURES (T.S.O.S.) AND STABILIZED CONSTRUCTION ENTRANCES (S.C.E.), BOTH LIGHT AND HEAVY DUTY.

A LIGHT DUTY S.C.E. IS USED WHERE MOST TRAVEL WILL BE SINGLE AXLE VEHICLES WITH AN OCCASIONAL MULTI–AXLE TRUCK AND THE AREA HAS BEEN GRADED TO OR NEAR SUBGRADE. A HEAVY DUTY S.C.E. IS WHERE THE AREA IS ROUGH GRADED AND THE MAJORITY OF THE TRAFFIC IS MULTI–AXLED.

TO PREVENT DAMAGE TO THE GEOTEXTILE, THE MAXIMUM DROP HEIGHT FOR THE MATERIALS SHALL BE:

MATERIAL	MAXIMUM DROP HEIGHT
4" – 12" STONE FOR T.S.O.S.	3 FT.
CLASS I RIPRAP	3 FT.
CLASS II, III RIPRAP	PLACED WITHOUT FREEFALL

THE FABRIC SHALL BE INERT TO COMMONLY ENCOUNTERED CHEMICALS, HYDRO–CARBONS, MILDEW, ROT RESISTANT AND CONFORM TO THE FOLLOWING PROPERTIES:

GEOTEXTILES SHALL MEET THE CLASS SPECIFIED IN THE SPECIAL PROVISIONS, PLANS OR STANDARDS, AND SHALL BE MANUFACTURED FROM FIBERS CONSISTING OF LONG CHAIN SYNTHETIC POLYMERS, COMPOSED AS A MINIMUM OF 85 PERCENT BY WEIGHT OF POLYOLEPHINS, POLYESTERS OR POLYAMIDES. THE GEOTEXTILE SHALL RESIST DETERIORATION FROM ULTRAVIOLET EXPOSURE. GEOTEXTILES USED IN THE CONSTRUCTION OF SILT FENCE SHALL CONTAIN SUFFICIENT AMOUNTS OF ULTRAVIOLET RAY INHIBITORS AND STABILIZERS TO PROVIDE A MINIMUM OF 12 MONTHS OF EXPECTED USABLE CONSTRUCTION LIFE AT A TEMPERATURE RANGE OF 0 TO 120 DEGREES F.

ALL VALUES SPECIFIED ARE MINIMUM OR MAXIMUM ROLL VALUES.

CLASS F GEOTEXTILES (SILT FENCE) SHALL HAVE A 50 LB./IN. MINIMUM TENSILE STRENGTH AND A 20 LB./IN. MINIMUM TENSILE MODULUS WHEN TESTED IN ACCORDANCE WITH MSMT 509. THE MATERIAL SHALL ALSO HAVE A 0.3 GAL/SQ. FT./ MINUTE MINIMUM LOW RATE AND A 75 PERCENT MINIMUM FILTERING EFFICIENCY WHEN TESTED IN ACCORDANCE WITH MSMT 322.

CLASSES A THROUGH E SHALL HAVE A 0.01 CM/SECOND MINIMUM PERMEABILITY WHEN TESTED IN ACCORDANCE WITH MSMT 507, AND AN APPARENT MINIMUM ELONGATION OF 20 PERCENT WHEN TESTED IN ACCORDANCE WITH THE GRAB TENSILE STRENGTH REQUIREMENTS SPECIFIED BELOW. CLASSES A THROUGH E SHALL ALSO MEET THE FOLLOWING ADDITIONAL REQUIREMENTS:

CLASS	APPARENT OPENING SIZE MM. MAX.	GRAB TENSILE STRENGTH LB. MIN.	BURST STRENGTH PSI, MIN.
A	0.30	250	500
B	0.60	200	320
C	0.30	200	320
D	0.60	90	145
E	0.30	90	145

THE PROPERTIES SHALL BE DETERMINED IN ACCORDANCE WITH THE FOLLOWING PROCEDURES:

APPARENT OPENING SIZE: MSMT 323
GRAB TENSILE STRENGTH: ASTM D 1682, GRAB TEST 4 X 8 IN. SPECIMEN, 1 X 2 IN. CLAMPS, 12 IN. / MINUTE STRAIN RATE, BOTH PRINCIPAL DIRECTIONS OF GEOTEXTILE
BURST STRENGTH: ASTM D 3786

16. NOTE TO CONTRACTOR

THE CONTRACTOR WILL NOTE THAT NO CONSTRUCTION ACTIVITIES WILL BE UNDERTAKEN WITHIN SPECIFIED AREAS OF THE PROJECT WITHOUT PRIOR NOTIFICATION OF SUCH ACTIVITIES TO THE ENGINEER. ALL WORK IN THESE AREAS WILL BE MONITORED BY A RESPONSIBLE PARTY DESIGNATED BY THE CONTRACTOR TO ASSURE THAT REASONABLE CARE BE TAKEN WHILE WORKING THESE ENVIRONMENTALLY SENSITIVE AREAS. THESE AREAS ARE AS FOLLOWS:

WETLANDS
STEEP SLOPES

17. CONTRACTOR PAYMENT

THE CONTRACTOR WILL ONLY BE COMPENSATED FOR WORK THAT IS DONE IN ACCORDANCE WITH THE SPECIFICATION, SPECIAL PROVISIONS AND THESE PLANS. ANY CORRECTIONS BROUGHT ABOUT BY NON–COMPLIANCE OR ERRORS BY THE CONTRACTOR WILL BE MADE AT HIS EXPENSE.

MDE NO. 13-SF-0255
NOTE TO CONTRACTOR:
EROSION AND SEDIMENT CONTROL SHALL BE STRICTLY ENFORCED

FOR EROSION AND SEDIMENT CONTROL ONLY.

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ___

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE: EROSION AND SEDIMENT CONTROL NOTES I
SCALE:
DATE: 07/03/2013

CONTRACT NO.: N/A
SHEET NO.: C-031

PLOT DATE: Jul 03, 2013 - 12:18pm
DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112C03834-C03X-ES_Notes.dwg

STANDARD EROSION AND SEDIMENT CONTROL NOTES

1. THE CONTRACTOR SHALL NOTIFY THE ADMINISTRATION (WMA) AT (410) 537–3510 SEVEN (7) DAYS BEFORE COMMENCING ANY LAND DISTURBING ACTIVITY AND, UNLESS WAIVED BY THE ADMINISTRATION, SHALL BE REQUIRED TO HOLD A PRE–CONSTRUCTION MEETING BETWEEN PROJECT REPRESENTATIVES AND A REPRESENTATIVE OF WMA.

2. THE CONTRACTOR MUST NOTIFY WMA IN WRITING AND BY TELEPHONE AT THE FOLLOWING POINTS:

   A. THE REQUIRED PRE–CONSTRUCTION MEETING.

   B. FOLLOWING INSTALLATION OF SEDIMENT CONTROL MEASURES.

   C. DURING THE INSTALLATION OF SEDIMENT BASINS (TO BE CONVERTED INTO PERMANENT STORMWATER MANAGEMENT STRUCTURES) AT THE REQUIRED INSPECTION POINTS (SEE INSPECTION CHECKLIST ON PLAN). NOTIFICATION PRIOR TO COMMENCING CONSTRUCTION OF EACH STEP IS MANDATORY.

   D. PRIOR TO REMOVAL OR MODIFICATION OF ANY SEDIMENT CONTROL STRUCTURE(S).

   E. PRIOR TO REMOVAL OF ALL SEDIMENT CONTROL DEVICES.

   F. PRIOR TO FINAL ACCEPTANCE.

3. THE CONTRACTOR SHALL CONSTRUCT ALL EROSION AND SEDIMENT CONTROL MEASURES PER THE APPROVED PLAN AND CONSTRUCTION SEQUENCE AND SHALL HAVE THEM INSPECTED AND APPROVED BY THE AGENCY INSPECTOR OR WMA INSPECTOR PRIOR TO BEGINNING ANY OTHER LAND DISTURBANCES. MINOR SEDIMENT CONTROL DEVICE LOCATION ADJUSTMENTS MAY BE MADE IN THE FIELD WITH THE APPROVAL OF THE WMA INSPECTOR. THE CONTRACTOR SHALL ENSURE THAT ALL RUNOFF FROM DISTURBED AREAS IS DIRECTED TO THE SEDIMENT CONTROL DEVICES, AND SHALL NOT REMOVE ANY EROSION OR SEDIMENT CONTROL MEASURE WITHOUT PRIOR PERMISSION FROM WMA INSPECTOR AND AGENCY INSPECTOR. THE CONTRACTOR MUST OBTAIN PRIOR AGENCY AND WMA APPROVAL FOR CHANGES TO THE SEDIMENT CONTROL PLAN AND/OR SEQUENCE OF CONSTRUCTION.

4. THE CONTRACTOR SHALL PROTECT ALL POINTS OF CONSTRUCTION INGRESS AND EGRESS TO PREVENT THE DEPOSITION OF MATERIALS ONTO PUBLIC ROADS. ALL MATERIALS DEPOSITED ONTO PUBLIC ROADS SHALL BE REMOVED IMMEDIATELY.

5. THE CONTRACTOR SHALL INSPECT DAILY AND MAINTAIN CONTINUOUSLY IN AN EFFECTIVE OPERATING CONDITION ALL EROSION AND SEDIMENT CONTROL MEASURES UNTIL SUCH TIMES AS THEY ARE REMOVED WITH PRIOR PERMISSION FROM WMA INSPECTOR AND AGENCY INSPECTOR.

6. ALL SEDIMENT BASINS, TRAP EMBANKMENTS AND SLOPES, PERIMETER DIKES, SWALES, AND ALL DISTURBED SLOPES STEEPER OR EQUAL TO 3:1 SHALL BE STABILIZED WITH SOD OR SEED AND ANCHORED STRAW MULCH, OR OTHER APPROVED STABILIZATION MEASURES, AS SOON AS POSSIBLE BUT NO LATER THAN THREE (3) CALENDAR DAYS AFTER ESTABLISHMENT. ALL AREAS DISTURBED OUTSIDE OF THE PERIMETER SEDIMENT CONTROL SYSTEM MUST BE MINIMIZED. MAINTENANCE MUST BE PERFORMED AS NECESSARY TO ENSURE CONTINUED STABILIZATION.

7. THE CONTRACTOR SHALL APPLY SOD OR SEED AND ANCHORED STRAW MULCH, OR OTHER APPROVED STABILIZATION MEASURES TO ALL DISTURBED AREAS AND STOCKPILES WITHIN SEVEN (7) CALENDAR DAYS AFTER STRIPPING AND GRADING ACTIVITIES HAVE CEASED IN THE AREA. MAINTENANCE SHALL BE PERFORMED AS NECESSARY TO ENSURE CONTINUED STABILIZATION.

8. PRIOR TO REMOVAL OF SEDIMENT CONTROL MEASURES, THE CONTRACTOR SHALL STABILIZE AND HAVE ESTABLISHED PERMANENT STABILIZATION FOR ALL CONTRIBUTORY DISTURBED AREAS USING SOD OR AN APPROVED PERMANENT SEED MIXTURE WITH REQUIRED SOIL AMENDMENTS AND AN APPROVED ANCHOR MULCH. WOOD FIBER MULCH MAY ONLY BE USED IN SEEDING SEASON WHERE THE SLOPE DOES NOT EXCEED 10% AND GRADING HAS BEEN DONE TO PROMOTE SHEET FLOW DRAINAGE. AREAS BROUGHT TO FINISHED GRADE DURING THE SEEDING SEASON SHALL BE PERMANENTLY STABILIZED AS SOON AS POSSIBLE, BUT NO LATER THAN SEVEN (7) CALENDAR DAYS AFTER ESTABLISHMENT. WHEN PROPERTY IS BROUGHT TO FINISHED GRADE DURING THE MONTHS OF NOVEMBER THROUGH FEBRUARY, AND PERMANENT STABILIZATION IS FOUND TO BE IMPRACTICAL, TEMPORARY SEED AND ANCHORED STRAW MULCH SHALL BE APPLIED TO DISTURBED AREAS. THE FINAL PERMANENT STABILIZATION OF SUCH PROPERTY SHALL BE APPLIED BY MARCH 15 OR EARLIER IF GROUND AND WEATHER CONDITIONS ALLOW.

9. THE SITE'S APPROVAL LETTER, APPROVED EROSION AND SEDIMENT CONTROL PLANS, DAILY LOG BOOKS, AND TEST REPORTS SHALL BE AVAILABLE AT THE SITE FOR INSPECTION BY DULY AUTHORIZED OFFICIALS OF WMA AND AGENCY RESPONSIBLE FOR PROJECT.

10. SURFACE DRAINAGE FLOWS OVER UNSTABILIZED CUT AND FILL SLOPES SHALL BE CONTROLLED BY EITHER PREVENTING DRAINAGE FLOWS FROM TRAVERSING THE SLOPES OR BY INSTALLING PROTECTIVE DEVICES TO LOWER THE WATER DOWNSLOPE WITHOUT CAUSING EROSION. DIKES SHALL BE INSTALLED AND MAINTAINED AT THE TOP OF A CUT OR FILL SLOPE UNTIL THE SLOPE AND DRAINAGE AREA TO IT ARE FULLY STABILIZED, AT WHICH TIME THEY MUST BE REMOVED AND FINAL GRADING DONE TO PROMOTE SHEET FLOW DRAINAGE. PROTECTIVE METHODS MUST BE PROVIDED AT POINTS OF CONCENTRATED FLOW WHERE EROSION IS LIKELY TO OCCUR.

11. PERMANENT SWALES OR OTHER POINTS OF CONCENTRATED WATER FLOW SHALL BE STABILIZED WITH SOD OR SEED WITH AN APPROVED EROSION CONTROL MATTING, RIPRAP OR OTHER APPROVED STABILIZATION MEASURES.

12. TEMPORARY SEDIMENT CONTROL DEVICES MAY BE REMOVED, WITH PERMISSION OF WMA INSPECTOR AND AGENCY INSPECTORS, WITHIN THIRTY (30) CALENDAR DAYS FOLLOWING ESTABLISHMENT OF PERMANENT STABILIZATION IN ALL CONTRIBUTORY DRAINAGE AREAS. STORMWATER MANAGEMENT STRUCTURES USED TEMPORARILY FOR SEDIMENT CONTROL SHALL BE CONVERTED TO THE PERMANENT CONFIGURATION WITHIN THIS TIME PERIOD AS WELL.

13. NO PERMANENT CUT OR FILL SLOPE WITH A GRADIENT STEEPER THAN 3:1 WILL BE PERMITTED IN LAWN MAINTENANCE AREAS. A SLOPE GRADIENT OF UP TO 2:1 WILL BE PERMITTED IN NON–MAINTENANCE AREAS PROVIDED THAT THOSE AREAS ARE INDICATED ON THE EROSION AND SEDIMENT CONTROL PLAN WITH A LOW–MAINTENANCE GROUND COVER SPECIFIED FOR PERMANENT STABILIZATION. SLOPE GRADIENT STEEPER THAN 2:1 WILL NOT BE PERMITTED WITH VEGETATIVE STABILIZATION.

14. FOR FINISHED GRADING, THE CONTRACTOR SHALL PROVIDE ADEQUATE GRADIENTS TO PREVENT THE WATER FROM PONDING FOR MORE THAN TWENTY–FOUR (24) HOURS AFTER THE END OF A RAINFALL EVENT. DRAINAGE COURSES AND SWALE FLOW AREAS, MAY TAKE AS LONG AS FOURTY–EIGHT (48) HOURS AFTER THE END OF A RAINFALL EVENT TO DRAIN. AREAS DESIGNED TO HAVE STANDING WATER SHALL NOT BE REQUIRED TO MEET THIS REQUIREMENT.

15. SEDIMENT TRAPS OR BASINS ARE NOT PERMITTED WITHIN 20 FEET OF A FOUNDATION WHICH IS EXISTING OR UNDER CONSTRUCTION. NO STRUCTURE MAY BE CONSTRUCTED WITHIN 20 FEET OF AN ACTIVE SEDIMENT TRAP OR BASIN.

16. THE WMA INSPECTOR HAS THE OPTION OF REQUIRING ADDITIONAL SAFETY OR SEDIMENT CONTROL MEASURES, IF DEEMED NECESSARY.

17. ALL TRAP DEPTH DIMENSIONS ARE RELATIVE TO THE OUTLET ELEVATION. ALL TRAPS MUST HAVE A STABLE OUTFALL. ALL TRAPS AND BASINS SHALL HAVE STABLE INFLOW POINTS.

18. VEGETATIVE STABILIZATION SHALL BE PERFORMED IN ACCORDANCE WITH THE STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL. REFER TO APPROPRIATE SPECIFICATIONS FOR TEMPORARY SEEDING, PERMANENT SEEDING, MULCHING, SODDING, AND GROUND COVERS.

19. SEDIMENT SHALL BE REMOVED AND THE TRAP OR BASIN RESTORED TO ITS ORIGINAL DIMENSIONS WHEN SEDIMENT HAS ACCUMULATED TO ONE QUARTER OF THE TOTAL DEPTH OF THE TRAP OR BASIN. TOTAL DEPTH SHALL BE MEASURED FROM THE TRAP OR BASIN BOTTOM TO THE CREST OF THE OUTLET.

20. SEDIMENT REMOVED FROM TRAPS (AND BASINS) SHALL BE PLACED AND STABILIZED IN APPROVED AREAS, BUT NOT WITHIN A FLOODPLAIN, WETLAND OR TREE–SAVE AREA. WHEN PUMPING SEDIMENT LADEN WATER, THE DISCHARGE MUST BE DIRECTED TO A SEDIMENT TRAPPING DEVICE PRIOR TO RELEASE FROM THE SITE. A SUMP PIT MAY BE USED IF SEDIMENT TRAPS THEMSELVES ARE BEING PUMPED OUT.

21. ALL WATER REMOVED FROM EXCAVATED AREAS (E.G. UTILITY TRENCHES) SHALL BE PASSED THROUGH AN APPROVED DEWATERING PRATICE OR PUMPED TO A SEDIMENT TRAP OR BASIN PRIOR TO DISCHARGE FROM THE SITE (I.E. VIA FUNCTIONAL STORM DRAIN SYSTEM OR TO STABLE GROUND SURFACE).

22. SEDIMENT CONTROL FOR UTILITY CONSTRUCTION FOR AREAS OUTSIDE OF DESIGNED CONTROLS OR AS DIRECTED BY ENGINEER OR WMA INSPECTOR:

   A. CALL "MISS UTILITY" AT 1–800–257–7777 48 HOURS PRIOR TO THE START OF WORK.

   B. EXCAVATED TRENCH MATERIAL SHALL BE PLACED ON THE HIGH SIDE OF THE TRENCH.

   C. TRENCHES FOR UTILITY INSTALLATION SHALL BE BACKFILLED, COMPACTED AND STABILIZED AT THE END OF EACH WORKING DAY. NO MORE TRENCH SHALL BE OPENED THAN CAN BE COMPLETED THE SAME DAY, UNLESS;

   D. TEMPORARY SILT FENCE SHALL BE PLACED IMMEDIATELY DOWNSTREAM OF ANY DISTURBED AREA INTENDED TO REMAIN DISTURBED FOR MORE THAN ONE DAY.

23. WHERE DEEMED APPROPRIATE BY THE ENGINEER OR INSPECTOR, SEDIMENT BASINS AND TRAPS MAY NEED TO BE SURROUNDED WITH AN APPROVED SAFETY FENCE. THE FENCE MUST CONFORM TO LOCAL ORDINANCES AND REGULATIONS. THE DEVELOPER OR OWNER SHALL CHECK WITH LOCAL BUILDING OFFICIALS ON APPLICABLE SAFETY REQUIREMENTS. WHERE SAFETY FENCE IS DEEMED APPROPRIATE AND LOCAL ORDINANCES DO NOT SPECIFY FENCING SIZES AND TYPES, THE FOLLOWING SHALL BE USED AS A MINIMUM STANDARD: THE SAFETY FENCE MUST BE MADE OF WELDED WIRE AND AT LEAST 42 INCHES HIGH, HAVE POSTS SPACED NO FURTHER APART THAN 8 FEET, HAVE MESH OPENINGS NO GREATER THAN 2 INCHES IN WIDTH AND 4 INCHES IN HEIGHT WITH A MINIMUM OF 14 GAUGE WIRE. SAFETY FENCE MUST BE MAINTAINED AND IN GOOD CONDITION AT ALL TIMES.

24. OFF–SITE SPOIL OR BORROW AREAS ON STATE OF FEDERAL PROPERTY MUST HAVE PRIOR APPROVAL BY WMA AND OTHER APPLICABLE STATE, FEDERAL, AND LOCAL AGENCIES; OTHERWISE APPROVAL MUST BE GRANTED BY THE LOCAL AUTHORITIES. ALL WASTE AND BORROW AREAS OFF–SITE MUST BE PROTECTED BY SEDIMENT CONTROL MEASURES AND STABILIZED.

25. SITES WHERE INFILTRATION DEVICES ARE USED FOR THE CONTROL OF STORMWATER, EXTREME CARE MUST BE TAKEN TO PREVENT RUNOFF FROM UNSTABILIZED AREAS FROM ENTERING THE STRUCTURE DURING CONSTRUCTION. SEDIMENT CONTROL DEVICES PLACED IN INFILTRATION AREAS MUST HAVE BOTTOM ELEVATIONS AT LEAST TWO (2) FEET HIGHER THAN THE FINISH GRADE BOTTOM ELEVATION OF THE INFILTRATION PRACTICE. WHEN CONVERTING A SEDIMENT TRAP TO AN INFILTRATION DEVICE, ALL ACCUMULATED SEDIMENT MUST BE REMOVED AND DISPOSED OF PRIOR TO FINAL GRADING OF INFILTRATION DEVICE.

26. WHEN A STORM DRAIN SYSTEM OUTFALL IS DIRECTED TO A SEDIMENT TRAP OR SEDIMENT BASIN AND THE SYSTEM IS TO BE USED FOR TEMPORARILY CONVEYING SEDIMENT LADEN WATER, ALL STORM DRAIN INLETS IN NON–SUMP AREAS SHALL HAVE TEMPORARY ASPHALT BERMS CONSTRUCTED AT THE TIME OF BASE PAVING TO DIRECT GUTTER FLOW INTO THE INLETS TO AVOID SURCHARGING AND OVERFLOW OF INLETS IN SUMP AREAS.

27. SITE INFORMATION:

A.	TOTAL AREA OF FACILITY	X.X ACRES
B.	TOTAL AREA OF PROJECT SITE	19.5 ACRES*
C.	AREA DISTURBED	4.5 ACRES
D.	AREA TO BE ROOFED OR PAVED	1.4 ACRES
E.	TOTAL CUT	3,200 CUBIC YARDS**
F.	TOTAL FILL	9,500 CUBIC YARDS**
G.	OFF–SITE WASTE/BORROW AREA LOCATION	TO BE DETERMINED

* TOTAL AREA OF PROJECT SITE DOES NOT INCLUDE AREA FOR UTILITY CONNECTIONS.
**CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE TOTAL AMOUNT OF CUT AND FILL REQUIRED WHEN BIDDING AND CONSTRUCTING THE PROJECT.

DESIGN CERTIFICATION

I HEREBY CERTIFY THAT THIS PLAN HAS BEEN DESIGNED IN ACCORDANCE WITH THE 2011 MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL, THE 2000 MARYLAND STORMWATER DESIGN MANUAL, VOLUMES I & II AND THE MARYLAND DEPARTMENT OF THE ENVIRONMENT EROSION AND SEDIMENT CONTROL AND STORMWATER MANAGEMENT REGULATIONS.

Date _____ Designer's Signature _____

Md. Registration No._____ Printed Name _____
P.E., R.L.S. OR R.L.A. (Circle)

STANDARD STABILIZATION NOTE

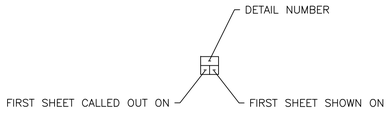
FOLLOWING INITIAL SOIL DISTURBANCE OR REDISTURBANCE, PERMANENT OR TEMPORARY STABILIZATION SHALL BE COMPLETED WITHIN THREE (3) CALENDAR DAYS AS TO THE SURFACE OF ALL PERIMETER CONTROLS, DIKES, SWALES, DITCHES, PERIMETER SLOPES, AND ALL SLOPES GREATER THAN 3 HORIZONTAL TO 1 VERTICAL (3:1); AND SEVEN (7) DAYS AS TO ALL OTHER DISTURBED OR GRADED AREAS ON THE PROJECT SITE.

OWNER'S/DEVELOPER'S CERTIFICATION

I/WE HEREBY CERTIFY THAT ALL CLEARING, GRADING, CONSTRUCTION, AND/OR DEVELOPMENT WILL BE DONE PURSUANT TO THIS PLAN AND THAT ANY RESPONSIBLE PERSONNEL INVOLVED IN THE CONSTRUCTION PROJECT WILL HAVE A CERTIFICATE OR ATTENDANCE AT A MARYLAND DEPARTMENT OF THE ENVIRONMENT APPROVED TRAINING PROGRAM FOR THE CONTROL OF EROSION AND SEDIMENT BEFORE BEGINNING THE PROJECT. I HEREBY AUTHORIZE THE RIGHT OF ENTRY FOR PERIODIC ON–SITE EVALUATION BY STATE OF MARYLAND, DEPARTMENT OF THE ENVIRONMENT, COMPLIANCE INSPECTORS.

Date _____ Owner/Developer Signature _____

Card No. _____ Printed Name and Title _____



DETAIL INDICATOR

EROSION AND SEDIMENT CONTROL SEQUENCE OF CONSTRUCTION

REFER TO THE STANDARD EROSION AND SEDIMENT CONTROL NOTES FOR THE INITIAL SEQUENCE OF OPERATION ITEMS NOT SPECIFICALLY IDENTIFIED IN THE SEQUENCE OF CONSTRUCTION BELOW, IN ADDITION TO CONSTRUCTION PHASING PLANS.

1. NOTIFY MDE WMA COMPLIANCE INSPECTOR AT (410) 537–3510 AT LEAST SEVEN (7) DAYS PRIOR TO BEGINNING EARTH DISTURBANCE TO SCHEDULE A PRE–CONSTRUCTION MEETING.
2. THE LIMITS OF DISTURBANCE MUST BE FIELD MARKED PRIOR TO CLEARING OF TREES, INSTALLATION OF SEDIMENT CONTROL MEASURES, CONSTRUCTION, OR OTHER LAND DISTURBING ACTIVITIES.
3. THE CONTRACTOR MUST OBTAIN APPROVAL FROM THE MDE INSPECTOR, CERTIFYING THAT THE LIMITS OF DISTURBANCE AND TREE PROTECTION MEASURES ARE CORRECTLY MARKED AND INSTALLED PRIOR TO COMMENCING ANY CLEARING.

CONSTRUCTION PHASE

PRE–BULK GRADING

1. WITH THE APPROVAL OF THE MDE INSPECTOR, CLEAR AND GRUB TO GRADE FOR INSTALLATION OF PERIMETER SEDIMENT CONTROL DEVICES.
2. INSTALL INITIAL SEDIMENT CONTROL DEVICES. INSTALL STABILIZED CONSTRUCTION ENTRANCE, SILT FENCE, DIVERSION FENCE, EARTH DIKE, TEMPORARY SWALE, MOUNTABLE BERM, TEMPORARY STONE OUTLET STRUCTURE, TEMPORARY GABION OUTLET STRUCTURE, AND SEDIMENT TRAP AS SHOWN IN THE PRE–DEVELOPMENT PLAN.
3. ONCE THE SEDIMENT CONTROL DEVICES ARE INSTALLED, THE CONTRACTOR MUST OBTAIN WRITTEN APPROVAL FROM THE MDE INSPECTOR BEFORE PROCEEDING WITH ANY ADDITIONAL GRADING OR CONSTRUCTION.

POST–BULK GRADING

4. CLEAR AND GRUB THE SITE INCLUDING THE PROPOSED GROUNDWATER TREATMENT PLANT BUILDING, PARKING, AND STORM SEWER SYSTEM (BIO–RETENTION BASINS AND THE OUTFALL PIPE).
5. CLEAR AND GRUB THE SITE INCLUDING THE EXTRACTION WELLS, THE ACCESS ROAD, AND THE TREATMENT DISCHARGE PIPE. BE CAREFUL NOT TO COMPACT THE SUB–BASE FOR THE GRASSY PAVER INSTALLATION.
6. REMOVE THE SOIL BENEATH THE BUILDING FOOTPRINT TO BEARING STRATA AND BACKFILLED WITH STRUCTURAL FILL. IMPACTED SOILS WILL BE SEPARATED FROM THE STOCKPILE AND HAULED OFFSITE.
7. INSTALL IMPERMEABLE VAPOR BARRIER BENEATH THE BUILDING AND EXTEND IT OUTSIDE THE FOOTPRINT FOR FUTURE CAP LINER.
8. INSTALL UTILITIES (GAS, WATER, ELECTRIC, COMMUNICATION LINE, SEPTIC TANK, STORM SEWER SYSTEM) AS SHOWN ON THE UTILITY PLAN. COORDINATE WITH MSA AND MDANG FOR TIE–IN LOCATIONS.
9. INSTALL ROCK OUTLET PROTECTION AT THE PROPOSED STORM SEWER OUTFALL AND RELOCATE THE DOWNSTREAM SILT FENCE TO UPSTREAM OF THE OUTFALL.
10. GRADE THE REMAINING SITE ACCORDING TO THE APPROVED GRADING PLAN. INSTALL BIO–RETENTION BASINS. REPLACE THE CLOGGED EXISTING 12" METAL CULVERT WITH 24" RCP UNDER LYNBROOK ROAD.
11. CONVERT TEMPORARY SWALES TO PERMANENT GRASS SWALES. INSTALL FILTER STRIP ALONG THE EDGE OF PAVEMENT.
12. INSTALL FINAL STABILIZATION OF ALL STORMWATER MANAGEMENT FACILITIES ONCE THEIR CONTRIBUTING DRAINAGE AREAS HAVE BEEN COMPLETELY STABILIZED.
13. PAVE THE WELL ACCESS ROAD (GRASSY PAVER), PARKING LOT AND MAIN ACCESS ROAD.
14. THE CONTRACTOR SHALL OBTAIN WRITTEN APPROVAL FROM MDE INSPECTOR, PRIOR TO THE REMOVAL OF ANY SEDIMENT CONTROL DEVICE.
15. STABILIZE ALL REMAINING DISTURBED AREAS. REMOVE REMAINING SEDIMENT CONTROL DEVICES UPON FINAL APPROVAL OF THE MDE INSPECTOR.

MDE NO. 13-SF-0255
NOTE TO CONTRACTOR:
EROSION AND SEDIMENT CONTROL SHALL BE STRICTLY ENFORCED
FOR EROSION AND SEDIMENT CONTROL ONLY.

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ___

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

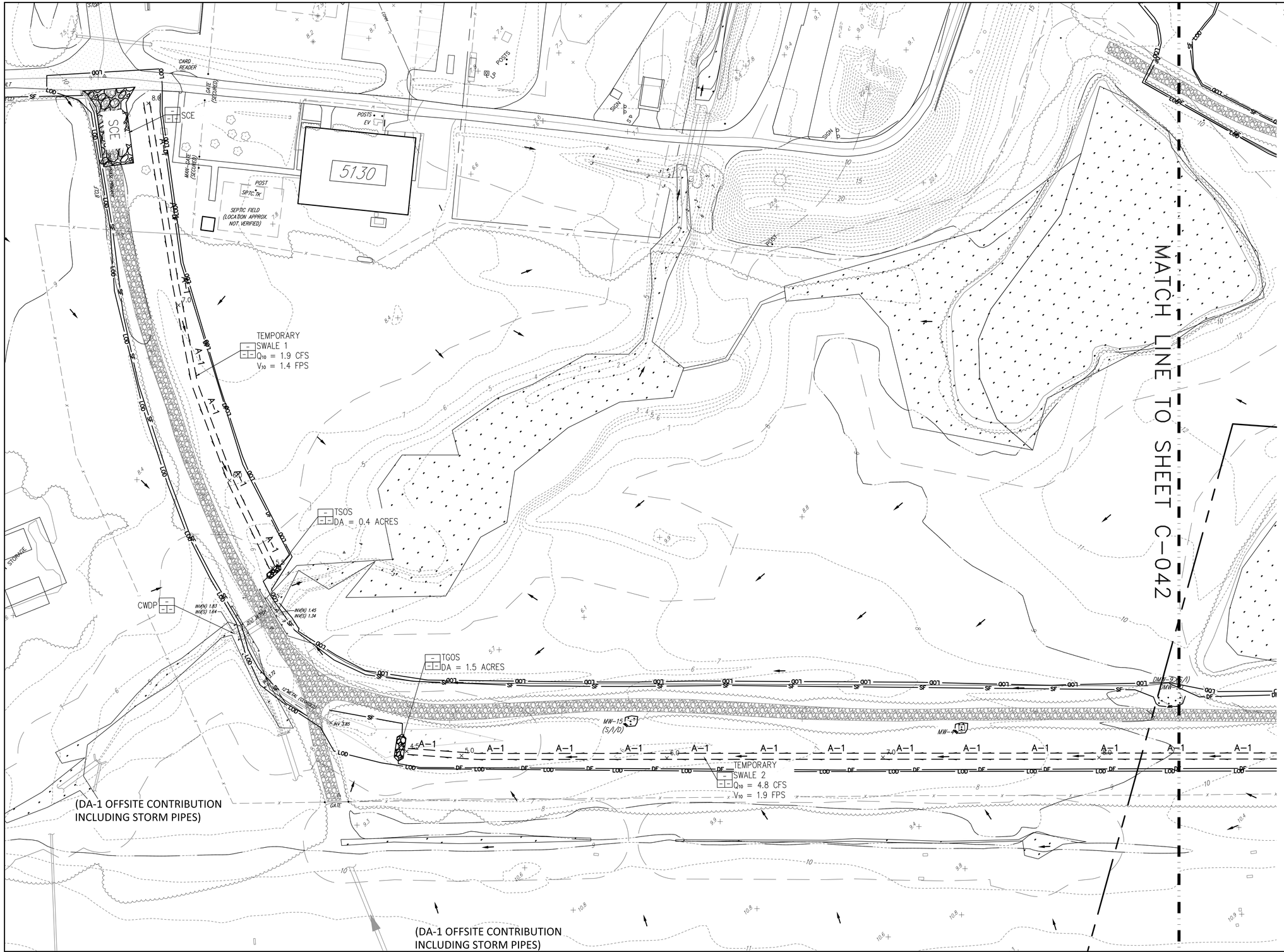
MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION
OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE: EROSION AND SEDIMENT CONTROL NOTES II
SCALE:
DATE: 07/03/2013

CONTRACT NO.: N/A
SHEET NO.: C-032

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112103834-033X-ES_Notes.dwg
PLOT DATE: Jul 03, 2013 - 12:18pm



SEDIMENT CONTROL LEGEND
(STANDARD MAA SYMBOLOGY)

- EARTH DIKE
- SWALE
- PERIMETER DIKE/SWALE
- PIPE SLOPE DRAIN
- ROCK OUTLET PROTECTION
- STONE OUTLET STRUCTURE
- GABION OUTLET STRUCTURE
- DEMO AREA
- SILT FENCE
- SUPER SILT FENCE
- DIVISION FENCE
- STRAW BALE DIKE
- ORANGE SAFETY FENCE
- LIMITS OF DISTURBANCE
- DRAINAGE BOUNDARY
- ENVIRONMENTAL BUFFER
- STANDARD INLET PROTECTION
- AT GRADE INLET PROTECTION
- CURB INLET PROTECTION
- MEDIAN INLET PROTECTION
- GABION INFLOW PROTECTION
- RIP-RAP INFLOW PROTECTION
- SUMP PIT
- STABILIZED CONSTRUCTION ENTRANCE
- REMOVABLE PUMPING STATION
- FLOW ARROW

MDE NO. 13-SF-0255
NOTE TO CONTRACTOR:
EROSION AND SEDIMENT CONTROL SHALL BE STRICTLY ENFORCED
FOR EROSION AND SEDIMENT CONTROL ONLY.

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: EROSION AND SEDIMENT CONTROL PRE-BULK GRADING PLAN

SCALE: 1"=30'

DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-041

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30ft design Phase-2013\CAD drawings\Civil\ 112D3834-C04X-ES_Pre.dwg
PLOT DATE: Jul 09, 2013 - 3:59pm

MATCH LINE TO SHEET C-041

SOIL STOCKPILE
EARTH DIKE 3
Q_{10} = 0.4 CFS
V_{10} = 1.6 FPS

MB

TSOS
DA = 0.1 ACRES

EARTH DIKE 1
Q_{10} = 0.9 CFS
V_{10} = 2.1 FPS

ST-II
DA = 1.3 ACRES

EARTH DIKE 2
Q_{10} = 0.2 CFS
V_{10} = 0.7 FPS

SOIL STOCKPILE

TEMPORARY
SWALE 3
Q10 = 1.6 CFS
V10 = 1.8 FPS

TSOS
DA = 0.4 ACRES

EARTH DIKE 4
Q_{10} = 1.6 CFS
V_{10} = 1.7 FPS

SEDIMENT CONTROL LEGEND
(STANDARD MAA SYMBOLOGY)

- EARTH DIKE
- SWALE
- PERIMETER DIKE/SWALE
- PSD-12 — PIPE SLOPE DRAIN
- ROCK OUTLET PROTECTION
- SOS — STONE OUTLET STRUCTURE
- GOS — GABION OUTLET STRUCTURE
- DEMO AREA
- SF — SILT FENCE
- SSF — SUPER SILT FENCE
- DF — DIVISION FENCE
- SBD — STRAW BALE DIKE
- OSF — ORANGE SAFETY FENCE
- LOD — LIMITS OF DISTURBANCE
- DRAINAGE BOUNDARY
- ENVIRONMENTAL BUFFER
- SIP — STANDARD INLET PROTECTION
- AGIP — AT GRADE INLET PROTECTION
- CIP — CURB INLET PROTECTION
- MIP — MEDIAN INLET PROTECTION
- GM — GABION INFLOW PROTECTION
- RRP — RIP-RAP INFLOW PROTECTION
- SP — SUMP PIT
- SCE — STABILIZED CONSTRUCTION ENTRANCE
- RPS — REMOVABLE PUMPING STATION
- FLOW ARROW

0 10 20 30 60
1"=30'

MDE NO. 13-SF-0255
NOTE TO CONTRACTOR:
EROSION AND SEDIMENT CONTROL SHALL BE STRICTLY ENFORCED
FOR EROSION AND SEDIMENT CONTROL ONLY.

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: EROSION AND SEDIMENT CONTROL PRE-BULK GRADING PLAN

SCALE: 1"=30'

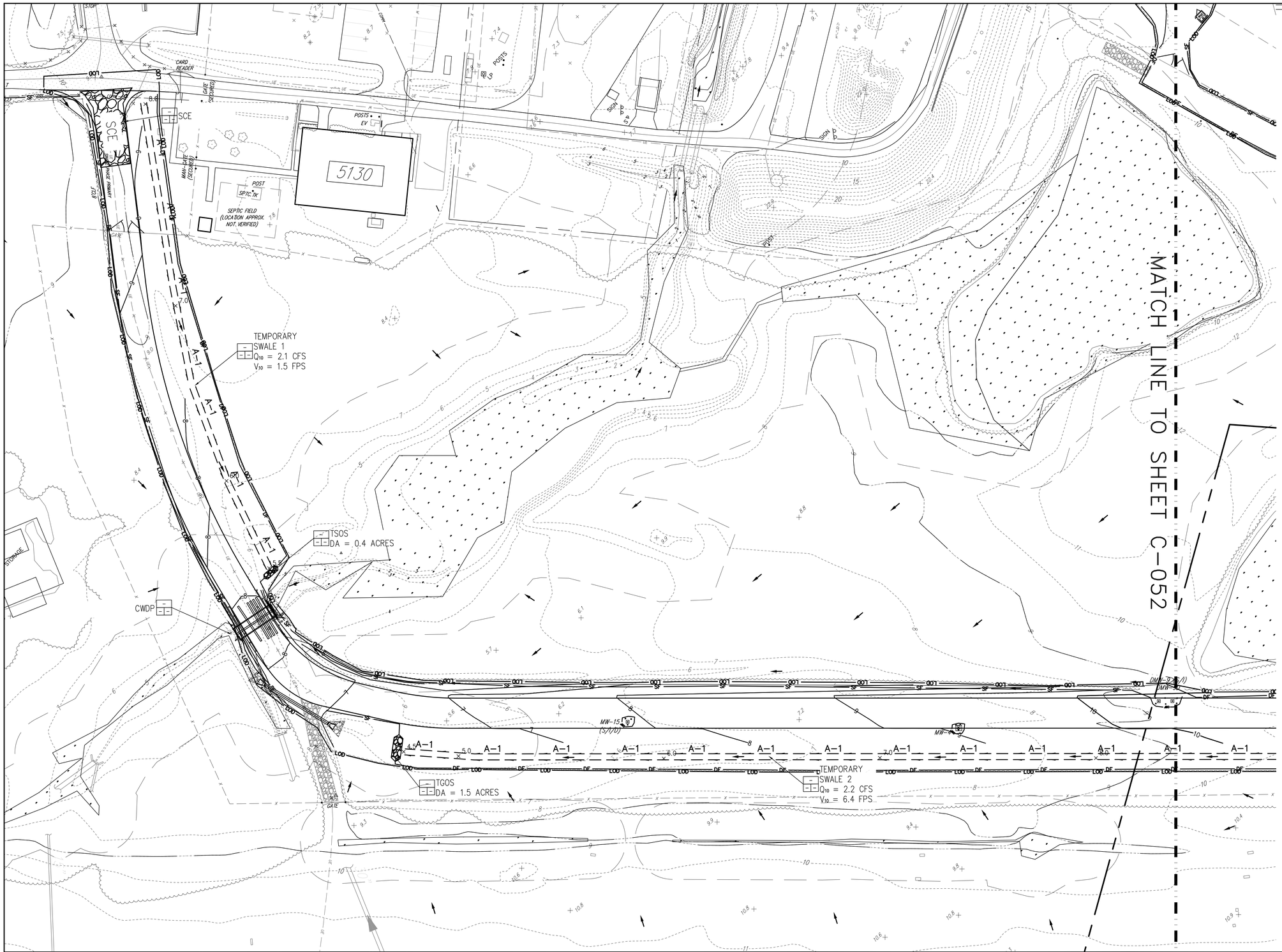
DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-042

PLOT DATE: Jul 09, 2013 - 4:00pm

DRAWING NAME: S:\03-Projects\Commercial\LMC\1039\257101-DRA-308 design Phase-2013\CAD drawings\Civil\ 1120033834-C04X-ES_Pre.dwg



SEDIMENT CONTROL LEGEND
(STANDARD MAA SYMBOLOGY)

- EARTH DIKE
- SWALE
- PERIMETER DIKE/SWALE
- PSD-12 — PIPE SLOPE DRAIN
- ROCK OUTLET PROTECTION
- STONE OUTLET STRUCTURE
- GABION OUTLET STRUCTURE
- DEMO AREA
- SF — SILT FENCE
- SSF — SUPER SILT FENCE
- DF — DIVISION FENCE
- SBD — STRAW BALE DIKE
- OSF — ORANGE SAFETY FENCE
- LOD — LIMITS OF DISTURBANCE
- DRAINAGE BOUNDARY
- ENVIRONMENTAL BUFFER
- SIP — STANDARD INLET PROTECTION
- AGIP — AT GRADE INLET PROTECTION
- CIP — CURB INLET PROTECTION
- MIP — MEDIAN INLET PROTECTION
- GM — GABION INFLOW PROTECTION
- RRP — RIP-RAP INFLOW PROTECTION
- SP — SUMP PIT
- SCE — STABILIZED CONSTRUCTION ENTRANCE
- RPS — REMOVABLE PUMPING STATION
- FLOW ARROW

MDE NO. 13-SF-0255
NOTE TO CONTRACTOR:
EROSION AND SEDIMENT CONTROL SHALL BE STRICTLY ENFORCED
FOR EROSION AND SEDIMENT CONTROL ONLY.

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	— — —

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: EROSION AND SEDIMENT CONTROL POST-BULK GRADING PLAN

SCALE: 1"=30'

DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-051

PLOT DATE: Jul 09, 2013 - 4:15pm

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-08A-305 design Phase-2013\CAD drawings\Civil\ 112\203834-C05X-ES_Post.dwg

MATCH LINE TO SHEET C-051

EARTH DIKE 3
Q_{10} = 1.9 CFS
V_{10} = 2.9 FPS

TSOS
DA = 0.3 ACRES

TEMPORARY
SWALE 3
Q_{10} = 2.2 CFS
V_{10} = 2.0 FPS

TSOS
DA = 0.4 ACRES

EARTH DIKE 4
Q_{10} = 2.2 CFS
V_{10} = 1.9 FPS

EARTH DIKE 2
Q_{10} = 1.5 CFS
V_{10} = 1.5 FPS

BAFFLE BOARD

EARTH DIKE 1
Q_{10} = 1.5 CFS
V_{10} = 2.4 FPS

ST II
DA = 0.7 ACRES

ROP III
CLASS I RIPRAP
La = 10 FT
W = 11.5 FT
T = 19 IN

RPS

SP

SEDIMENT CONTROL LEGEND
(STANDARD MAA SYMBOLOGY)

- EARTH DIKE
- SWALE
- PERIMETER DIKE/SWALE
- PSD-12 — PIPE SLOPE DRAIN
- ROCK OUTLET PROTECTION
- STONE OUTLET STRUCTURE
- GABION OUTLET STRUCTURE
- DEMO AREA
- SF — SILT FENCE
- SSF — SUPER SILT FENCE
- DF — DIVISION FENCE
- SBD — STRAW BALE DIKE
- OSF — ORANGE SAFETY FENCE
- LOD — LIMITS OF DISTURBANCE
- DRAINAGE BOUNDARY
- ENVIRONMENTAL BUFFER
- SIP — STANDARD INLET PROTECTION
- AGIP — AT GRADE INLET PROTECTION
- CIP — CURB INLET PROTECTION
- MIP — MEDIAN INLET PROTECTION
- GM — GABION INFLOW PROTECTION
- RRP — RIP-RAP INFLOW PROTECTION
- SP — SUMP PIT
- SCE — STABILIZED CONSTRUCTION ENTRANCE
- RPS — REMOVABLE PUMPING STATION
- FLOW ARROW

0 10 20 30 60
1"=30'

MDE NO. 13-SF-0255
NOTE TO CONTRACTOR:
EROSION AND SEDIMENT CONTROL SHALL BE STRICTLY ENFORCED
FOR EROSION AND SEDIMENT CONTROL ONLY.

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: EROSION AND SEDIMENT CONTROL POST-BULK GRADING PLAN

SCALE: 1"=30'

DATE: 07/03/2013

CONTRACT NO.: N/A

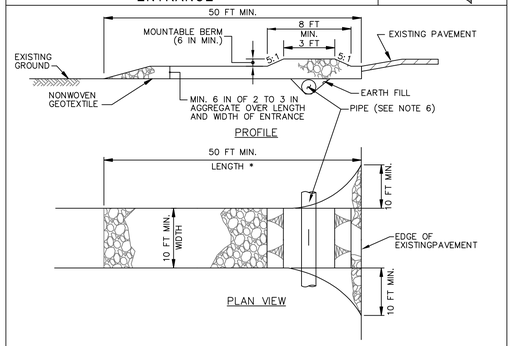
SHEET NO.: C-052

DRAWING NAME: S:\03-Projects\Commercial\MC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112IC03834-C05X-ES_Post.dwg

PLOT DATE: Jul 09, 2013 - 4:18pm

DETAIL B-1 STABILIZED CONSTRUCTION ENTRANCE

STANDARD SYMBOL: SCE



CONSTRUCTION SPECIFICATIONS

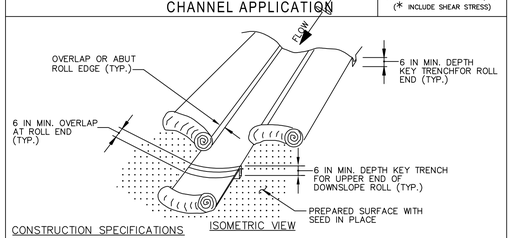
1. PLACE STABILIZED CONSTRUCTION ENTRANCE IN ACCORDANCE WITH THE APPROVED PLAN. VEHICLES MUST TRAVEL OVER THE ENTIRE LENGTH OF THE SCE. USE MINIMUM LENGTH OF 50 FEET (*30 FEET FOR SINGLE RESIDENCE LOT). USE MINIMUM WIDTH OF 10 FEET. FLARE SCE 10 FEET MINIMUM AT THE EXISTING ROAD TO PROVIDE A TURNING RADIUS.
2. PIPE ALL SURFACE WATER FLOWING TO OR DIVERTED TOWARD THE SCE UNDER THE ENTRANCE, MAINTAINING POSITIVE DRAINAGE. PROTECT PIPE INSTALLED THROUGH THE SCE WITH A MOUNTABLE BERM WITH 5:1 SLOPES AND A MINIMUM OF 12 INCHES OF STONE OVER THE PIPE. PROVIDE PIPE AS SPECIFIED ON APPROVED PLAN. WHEN THE SCE IS LOCATED AT A HIGH SPOT AND HAS NO DRAINAGE TO CONVEY, A PIPE IS NOT NECESSARY. A MOUNTABLE BERM IS REQUIRED WHEN SCE IS NOT LOCATED AT A HIGH SPOT.
3. PREPARE SUBGRADE AND PLACE NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H–1 MATERIALS.
4. PLACE CRUSHED AGGREGATE (2 TO 3 INCHES IN SIZE) OR EQUIVALENT RECYCLED CONCRETE (WITHOUT REBAR) AT LEAST 6 INCHES DEEP OVER THE LENGTH AND WIDTH OF THE SCE.
5. MAINTAIN ENTRANCE IN A CONDITION THAT MINIMIZES TRACKING OF SEDIMENT. ADD STONE OR MAKE OTHER REPAIRS AS CONDITIONS DEMAND TO MAINTAIN CLEAN SURFACE, MOUNTABLE BERM, AND SPECIFIED DIMENSIONS. IMMEDIATELY REMOVE STONE AND/OR SEDIMENT SPILLED, DROPPED, OR TRACKED ONTO ADJACENT ROADWAY BY VACUUMING, SCRAPING, AND/OR SWEEPING. WASHING ROADWAY TO REMOVE MUD TRACKED ONTO PAVEMENT IS NOT ACCEPTABLE UNLESS WASH WATER IS DIRECTED TO AN APPROVED SEDIMENT CONTROL PRACTICE.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL B-4-6-A TEMPORARY SOIL STABILIZATION MATTING CHANNEL APPLICATION

STANDARD SYMBOL: TSSMC – * lb./ft² (* INCLUDE SHEAR STRESS)



CONSTRUCTION SPECIFICATIONS

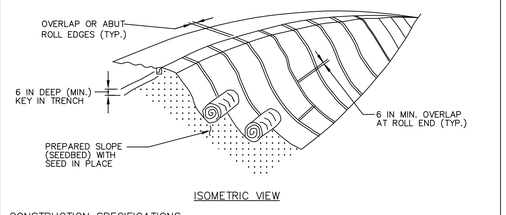
1. USE MATTING THAT HAS A DESIGN VALUE FOR SHEAR STRESS EQUAL TO OR HIGHER THAN THE SHEAR STRESS DESIGNATED ON APPROVED PLANS.
2. USE TEMPORARY SOIL STABILIZATION MATTING MADE OF DEGRADABLE (LASTS 6 MONTHS MINIMUM) NATURAL OR MAN–MADE FIBERS (MOSTLY ORGANIC). MAT MUST HAVE UNIFORM THICKNESS AND DISTRIBUTION OF FIBERS THROUGHOUT AND BE SMOLDER RESISTANT. CHEMICALS USED IN THE MAT MUST BE NON–LEACHING AND NON–TOXIC TO VEGETATION AND SEED GERMINATION AND NON–INJURIOUS TO THE SKIN. IF PRESENT, NETTING MUST BE EXTRUDED PLASTIC WITH A MAXIMUM MESH OPENING OF 2x2 INCHES AND SUFFICIENTLY BONDED OR SEWN ON 2 INCH CENTERS ALONG LONGITUDINAL AXIS OF THE MATERIAL TO PREVENT SEPARATION OF THE NET FROM THE PARENT MATERIAL.
3. SECURE MATTING USING STEEL STAPLES, WOOD STAKES, OR BIODEGRADABLE EQUIVALENT. STAPLES MUST BE "U" OR "T" SHAPED STEEL WIRE HAVING A MINIMUM GAUGE OF NO. 11 AND NO. 8 RESPECTIVELY. "U" SHAPED STAPLES MUST AVERAGE 1 TO 1½ INCHES WIDE AND BE A MINIMUM OF 6 INCHES LONG. "T" SHAPED STAPLES MUST HAVE A MINIMUM 8 INCH MAIN LEG, A MINIMUM 1 INCH SECONDARY LEG, AND A MINIMUM 4 INCH HEAD. WOOD STAKES MUST BE ROUGH–SAWN HARDWOOD, 12 TO 24 INCHES IN LENGTH, 1x3 INCH IN CROSS SECTION, AND WEDGE SHAPED AT THE BOTTOM.
4. PERFORM FINAL GRADING, TOPSOIL APPLICATION, SEEDBED PREPARATION, AND PERMANENT SEEDING IN ACCORDANCE WITH SPECIFICATIONS. PLACE MATTING WITHIN 48 HOURS OF COMPLETING SEEDING OPERATIONS UNLESS END OF WORKDAY STABILIZATION IS SPECIFIED ON THE APPROVED EROSION AND SEDIMENT CONTROL PLAN.
5. UNROLL MATTING IN DIRECTION OF WATER FLOW, CENTERING THE FIRST ROLL ON THE CHANNEL CENTERLINE. WORK FROM CENTER OF CHANNEL OUTWARD WHEN PLACING ROLLS. LAY MAT SMOOTHLY AND FIRMLY ON THE SEEDED SURFACE. AVOID STRETCHING THE MATTING.
6. KEY–IN UPSTREAM END OF EACH MAT ROLL BY DIGGING A 6 INCH (MINIMUM) TRENCH AT THE UPSTREAM END OF THE MATTING, PLACING THE ROLL END IN THE TRENCH, STAPLING THE MAT IN PLACE, REPLACING THE EXCAVATED MATERIAL, AND TAMPING TO SECURE THE MAT END.
7. OVERLAP OR ABUT THE ROLL EDGES PER MANUFACTURER RECOMMENDATIONS. OVERLAP ROLL ENDS BY 6 INCHES (MINIMUM), WITH THE UPSTREAM MAT OVERLAPPING ON TOP OF THE NEXT DOWNSTREAM MAT.
8. STAPLE/STAKE MAT IN A STAGGERED PATTERN ON 4 FOOT (MAXIMUM) CENTERS THROUGHOUT AND 2 FOOT (MAXIMUM) CENTERS ALONG SEAMS, JOINTS, AND ROLL ENDS.
9. ESTABLISH AND MAINTAIN VEGETATION SO THAT REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT ARE CONTINUOUSLY MET IN ACCORDANCE WITH SECTION B–4 VEGETATIVE STABILIZATION.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL B-4-6-B TEMPORARY SOIL STABILIZATION MATTING SLOPE APPLICATION

STANDARD SYMBOL: TSSMS – * lb./ft² (* INCLUDE SHEAR STRESS)



CONSTRUCTION SPECIFICATIONS

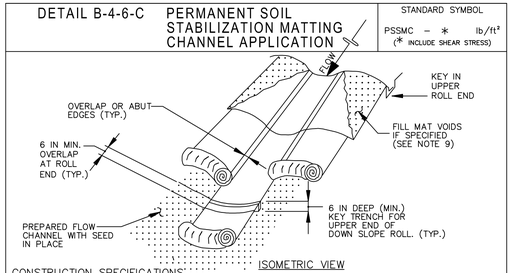
1. USE MATTING THAT HAS A DESIGN VALUE FOR SHEAR STRESS EQUAL TO OR HIGHER THAN THE SHEAR STRESS DESIGNATED ON APPROVED PLANS.
2. USE TEMPORARY SOIL STABILIZATION MATTING MADE OF DEGRADABLE (LASTS 6 MONTHS MINIMUM) NATURAL OR MAN–MADE FIBERS (MOSTLY ORGANIC). MAT MUST HAVE UNIFORM THICKNESS AND DISTRIBUTION OF FIBERS THROUGHOUT AND BE SMOLDER RESISTANT. CHEMICALS USED IN THE MAT MUST BE NON–LEACHING AND NON–TOXIC TO VEGETATION AND SEED GERMINATION AND NON–INJURIOUS TO THE SKIN. IF PRESENT, NETTING MUST BE EXTRUDED PLASTIC WITH A MAXIMUM MESH OPENING OF 2x2 INCHES AND SUFFICIENTLY BONDED OR SEWN ON 2 INCH CENTERS ALONG LONGITUDINAL AXIS OF THE MATERIAL TO PREVENT SEPARATION OF THE NET FROM THE PARENT MATERIAL.
3. SECURE MATTING USING STEEL STAPLES, WOOD STAKES, OR BIODEGRADABLE EQUIVALENT. STAPLES MUST BE "U" OR "T" SHAPED STEEL WIRE HAVING A MINIMUM GAUGE OF NO. 11 AND NO. 8 RESPECTIVELY. "U" SHAPED STAPLES MUST AVERAGE 1 TO 1½ INCHES WIDE AND BE A MINIMUM OF 6 INCHES LONG. "T" SHAPED STAPLES MUST HAVE A MINIMUM 8 INCH MAIN LEG, A MINIMUM 1 INCH SECONDARY LEG, AND A MINIMUM 4 INCH HEAD. WOOD STAKES MUST BE ROUGH–SAWN HARDWOOD, 12 TO 24 INCHES IN LENGTH, 1x3 INCH IN CROSS SECTION, AND WEDGE SHAPED AT THE BOTTOM.
4. PERFORM FINAL GRADING, TOPSOIL APPLICATION, SEEDBED PREPARATION, AND PERMANENT SEEDING IN ACCORDANCE WITH SPECIFICATIONS. PLACE MATTING WITHIN 48 HOURS OF COMPLETING SEEDING OPERATIONS UNLESS END OF WORKDAY STABILIZATION IS SPECIFIED ON THE APPROVED EROSION & SEDIMENT CONTROL PLAN.
5. UNROLL MATTING DOWNSLOPE. LAY MAT SMOOTHLY AND FIRMLY UPON THE SEEDED SURFACE. AVOID STRETCHING THE MATTING.
6. OVERLAP OR ABUT ROLL EDGES PER MANUFACTURER RECOMMENDATIONS. OVERLAP ROLL ENDS BY 6 INCHES (MINIMUM), WITH THE UPSLOPE MAT OVERLAPPING ON TOP OF THE DOWNSLOPE MAT.
7. KEY IN THE UPSLOPE END OF MAT 6 INCHES (MINIMUM) BY DIGGING A TRENCH, PLACING THE MATTING ROLL END IN THE TRENCH, STAPLING THE MAT IN PLACE, REPLACING THE EXCAVATED MATERIAL, AND TAMPING TO SECURE THE MAT END IN THE KEY.
8. STAPLE/STAKE MAT IN A STAGGERED PATTERN ON 4 FOOT (MAXIMUM) CENTERS THROUGHOUT AND 2 FOOT (MAXIMUM) CENTERS ALONG SEAMS, JOINTS, AND ROLL ENDS.
9. ESTABLISH AND MAINTAIN VEGETATION SO THAT REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT ARE CONTINUOUSLY MET IN ACCORDANCE WITH SECTION B–4 VEGETATIVE STABILIZATION.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL B-4-6-C PERMANENT SOIL STABILIZATION MATTING CHANNEL APPLICATION

STANDARD SYMBOL: PSSMC – * lb./ft² (* INCLUDE SHEAR STRESS)



CONSTRUCTION SPECIFICATIONS

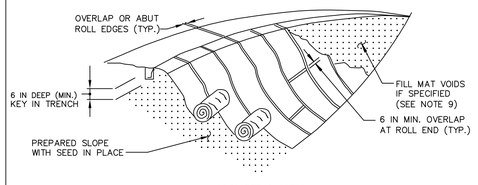
1. USE MATTING THAT HAS A DESIGN VALUE FOR SHEAR STRESS EQUAL TO OR HIGHER THAN THE SHEAR STRESS DESIGNATED ON APPROVED PLANS.
2. USE PERMANENT SOIL STABILIZATION MATTING MADE OF OPEN WEAVE SYNTHETIC, NON–DEGRADABLE FIBERS OR ELEMENTS OF UNIFORM THICKNESS AND DISTRIBUTION THROUGHOUT. CHEMICALS USED IN THE MAT MUST BE NON–LEACHING AND NON–TOXIC TO VEGETATION AND SEED GERMINATION AND NON–INJURIOUS TO THE SKIN. IF PRESENT, NETTING MUST BE EXTRUDED PLASTIC WITH A MAXIMUM MESH OPENING OF 2x2 INCHES AND SUFFICIENTLY BONDED OR SEWN ON 2 INCH CENTERS ALONG LONGITUDINAL AXIS OF THE MATERIAL TO PREVENT SEPARATION OF THE NET FROM THE PARENT MATERIAL.
3. SECURE MATTING USING STEEL STAPLES, WOOD STAKES. STAPLES MUST BE "U" OR "T" SHAPED STEEL WIRE HAVING A MINIMUM GAUGE OF NO. 11 AND NO. 8 RESPECTIVELY. "U" SHAPED STAPLES MUST AVERAGE 1 TO 1½ INCHES WIDE AND BE A MINIMUM OF 6 INCHES LONG. "T" SHAPED STAPLES MUST HAVE A MINIMUM 8 INCH MAIN LEG, A MINIMUM 1 INCH SECONDARY LEG, AND MINIMUM 4 INCH HEAD. WOOD STAKES MUST BE ROUGH–SAWN HARDWOOD, 12 TO 24 INCHES IN LENGTH, 1x3 INCH IN CROSS SECTION, AND WEDGE SHAPE AT THE BOTTOM.
4. PERFORM FINAL GRADING, TOPSOIL APPLICATION, SEEDBED PREPARATION, AND PERMANENT SEEDING IN ACCORDANCE WITH SPECIFICATIONS. PLACE MATTING WITHIN 48 HOURS OF COMPLETING SEEDING OPERATIONS, UNLESS END OF WORKDAY STABILIZATION IS SPECIFIED ON THE APPROVED EROSION AND SEDIMENT CONTROL PLAN.
5. UNROLL MATTING IN DIRECTION OF WATER FLOW, CENTERING THE FIRST ROLL ON THE CHANNEL CENTER LINE. WORK FROM CENTER OF CHANNEL OUTWARD WHEN PLACING ROLLS. LAY MATTING SMOOTHLY AND FIRMLY UPON THE SEEDED SURFACE. AVOID STRETCHING THE MATTING.
6. OVERLAP OR ABUT EDGES OF MATTING ROLLS PER MANUFACTURER RECOMMENDATIONS. OVERLAP ROLL ENDS BY 6 INCHES (MINIMUM), WITH THE UPSTREAM MAT OVERLAPPING ON TOP OF THE NEXT DOWNSTREAM MAT.
7. KEY IN THE TOP OF SLOPE END OF MAT 6 INCHES (MINIMUM) BY DIGGING A TRENCH, PLACING THE MATTING ROLL END IN THE TRENCH, STAPLING THE MAT IN PLACE, REPLACING THE EXCAVATED MATERIAL, AND TAMPING TO SECURE THE MAT END IN THE KEY.
8. STAPLE/STAKE MAT IN A STAGGERED PATTERN ON 4 FOOT (MAXIMUM) CENTERS THROUGHOUT AND 2 FOOT (MAXIMUM) CENTERS ALONG SEAMS, JOINTS, AND ROLL ENDS.
9. IF SPECIFIED BY THE DESIGNER OR MANUFACTURER AND DEPENDING ON THE TYPE OF MAT BEING INSTALLED, ONCE THE MATTING IS KEYED AND STAPLED IN PLACE, FILL THE MAT VOIDS WITH TOP SOIL OR GRANULAR MATERIAL AND LIGHTLY COMPACT OR ROLL TO MAXIMIZE SOIL/MAT CONTACT WITHOUT CRUSHING MAT.
10. ESTABLISH AND MAINTAIN VEGETATION SO THAT REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT ARE CONTINUOUSLY MET IN ACCORDANCE WITH SECTION B–4 VEGETATIVE STABILIZATION.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL B-4-6-D PERMANENT SOIL STABILIZATION MATTING SLOPE APPLICATION

STANDARD SYMBOL: PSSMS – * lb./ft² (* INCLUDE SHEAR STRESS)



CONSTRUCTION SPECIFICATIONS

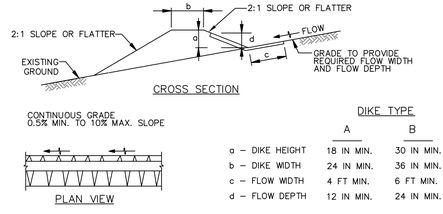
1. USE MATTING THAT HAS A DESIGN VALUE FOR SHEAR STRESS EQUAL TO OR HIGHER THAN THE SHEAR STRESS DESIGNATED ON APPROVED PLANS.
2. USE PERMANENT SOIL STABILIZATION MATTING MADE OF OPEN WEAVE SYNTHETIC, NON–DEGRADABLE FIBERS OR ELEMENTS OF UNIFORM THICKNESS AND DISTRIBUTION THROUGHOUT. CHEMICALS USED IN THE MAT MUST BE NON–LEACHING AND NON–TOXIC TO VEGETATION AND SEED GERMINATION AND NON–INJURIOUS TO THE SKIN. IF PRESENT, NETTING MUST BE EXTRUDED PLASTIC WITH A MAXIMUM MESH OPENING OF 2x2 INCHES AND SUFFICIENTLY BONDED OR SEWN ON 2 INCH CENTERS ALONG LONGITUDINAL AXIS OF THE MATERIAL TO PREVENT SEPARATION OF THE NET FROM THE PARENT MATERIAL.
3. SECURE MATTING USING STEEL STAPLES OR WOOD STAKES. STAPLES MUST BE "U" OR "T" SHAPED STEEL WIRE HAVING A MINIMUM GAUGE OF NO. 11 AND NO. 8 RESPECTIVELY. "U" SHAPED STAPLES MUST AVERAGE 1 TO 1½ INCHES WIDE AND BE A MINIMUM OF 6 INCHES LONG. "T" SHAPED STAPLES MUST HAVE A MINIMUM 8 INCH MAIN LEG, A MINIMUM 1 INCH SECONDARY LEG, AND MINIMUM 4 INCH HEAD. WOOD STAKES MUST BE ROUGH–SAWN HARDWOOD, 12 TO 24 INCHES IN LENGTH, 1x3 INCH IN CROSS SECTION, AND WEDGE SHAPE AT THE BOTTOM.
4. PERFORM FINAL GRADING, TOPSOIL APPLICATION, SEEDBED PREPARATION, AND PERMANENT SEEDING IN ACCORDANCE WITH SPECIFICATIONS. PLACE MATTING WITHIN 48 HOURS OF COMPLETING SEEDING OPERATIONS, UNLESS END OF WORKDAY STABILIZATION IS SPECIFIED ON THE APPROVED EROSION AND SEDIMENT CONTROL PLAN.
5. UNROLL MATTING DOWN SLOPE. LAY MATTING SMOOTHLY AND FIRMLY UPON THE SEEDED SURFACE. AVOID STRETCHING THE MATTING.
6. OVERLAP OR ABUT EDGES OF MATTING ROLLS PER MANUFACTURER RECOMMENDATIONS. OVERLAP ROLL ENDS BY 6 INCHES (MINIMUM), WITH THE UPSTREAM MAT OVERLAPPING ON TOP OF THE DOWNSLOPE MAT.
7. KEY IN THE TOP OF SLOPE END OF MAT 6 INCHES (MINIMUM) BY DIGGING A TRENCH, PLACING THE MATTING ROLL END IN THE TRENCH, STAPLING THE MAT IN PLACE, REPLACING THE EXCAVATED MATERIAL, AND TAMPING TO SECURE THE MAT END IN THE KEY.
8. STAPLE/STAKE MAT IN A STAGGERED PATTERN ON 4 FOOT (MAXIMUM) CENTERS THROUGHOUT AND 2 FOOT (MAXIMUM) CENTERS ALONG SEAMS, JOINTS, AND ROLL ENDS.
9. IF SPECIFIED BY THE DESIGNER OR MANUFACTURER AND DEPENDING ON THE TYPE OF MAT BEING INSTALLED, ONCE THE MATTING IS KEYED AND STAPLED IN PLACE, FILL THE MAT VOIDS WITH TOP SOIL OR GRANULAR MATERIAL AND LIGHTLY COMPACT OR ROLL TO MAXIMIZE SOIL/MAT CONTACT WITHOUT CRUSHING MAT.
10. ESTABLISH AND MAINTAIN VEGETATION SO THAT REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT ARE CONTINUOUSLY MET IN ACCORDANCE WITH SECTION B–4 VEGETATIVE STABILIZATION.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL C-1 EARTH DIKE

STANDARD SYMBOL: A–1 — PLACE DESIGNATION (e.g. A–1) ON FLOW CHANNEL SIDE OF DIKE.



DIKE TYPE	A	B
a – DIKE HEIGHT	18 IN MIN.	30 IN MIN.
b – DIKE WIDTH	24 IN MIN.	36 IN MIN.
c – FLOW WIDTH	4 FT MIN.	6 FT MIN.
d – FLOW DEPTH	12 IN MIN.	24 IN MIN.

FLOW CHANNEL STABILIZATION

A–1 SEED WITH STRAW MULCH AND TACK. (NOT ALLOWED FOR CLEAR WATER DIVERSION.)

A–2/B–2 SEED WITH SOIL STABILIZATION MATTING OR LINE WITH SOD.

A–3/B–3 4 TO 7 INCH STONE OR EQUIVALENT RECYCLED CONCRETE PRESSED INTO SOIL A MINIMUM OF 7 INCHES AND FLUSH WITH GROUND.

CONSTRUCTION SPECIFICATIONS

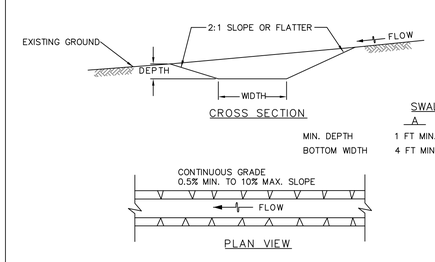
1. REMOVE AND DISPOSE OF ALL TREES, BRUSH, STUMPS, OBSTRUCTIONS, AND OTHER OBJECTIONABLE MATERIAL SO AS NOT TO INTERFERE WITH PROPER FUNCTION OF EARTHDIKE.
2. EXCAVATE OR SHAPE EARTH DIKE TO LINE, GRADE, AND CROSS SECTION AS SPECIFIED. BANK PROJECTIONS OR OTHER IRREGULARITIES ARE NOT ALLOWED.
3. COMPACT FILL.
4. CONSTRUCT FLOW CHANNEL ON AN UNINTERRUPTED, CONTINUOUS GRADE, ADJUSTING THE LOCATION DUE TO FIELD CONDITIONS AS NECESSARY TO MAINTAIN POSITIVE DRAINAGE.
5. PROVIDE OUTLET PROTECTION AS REQUIRED ON APPROVED PLAN.
6. STABILIZE EARTH DIKE WITHIN THREE DAYS OF INSTALLATION. STABILIZE FLOW CHANNEL FOR CLEAR WATER DIVERSION WITHIN 24 HOURS OF INSTALLATION.
7. MAINTAIN LINE, GRADE, AND CROSS SECTION. REMOVE ACCUMULATED SEDIMENT AND DEBRIS, AND MAINTAIN POSITIVE DRAINAGE. KEEP EARTH DIKE AND POINT OF DISCHARGE FREE OF EROSION, AND CONTINUOUSLY MEET REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT IN ACCORDANCE WITH SECTION B–4 VEGETATIVE STABILIZATION.
8. UPON REMOVAL OF EARTH DIKE, GRADE AREA FLUSH WITH EXISTING GROUND. WITHIN 24 HOURS OF REMOVAL STABILIZE DISTURBED AREA WITH TOPSOIL, SEED, AND MULCH, OR AS SPECIFIED ON APPROVED PLAN.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL C-2 TEMPORARY SWALE

STANDARD SYMBOL: A–1



SWALE TYPE	A	B
MIN. DEPTH	1 FT MIN.	1 FT MIN.
BOTTOM WIDTH	4 FT MIN.	6 FT MIN.

FLOW CHANNEL STABILIZATION

A–1 SEED WITH STRAW MULCH AND TACK. (NOT ALLOWED FOR CLEAR WATER DIVERSION.)

A–2/B–2 SEED WITH SOIL STABILIZATION MATTING OR LINE WITH SOD.

A–3/B–3 4 TO 7 INCH STONE OR EQUIVALENT RECYCLED CONCRETE PRESSED INTO SOIL A MINIMUM OF 7 INCHES AND FLUSH WITH GROUND.

CONSTRUCTION SPECIFICATIONS

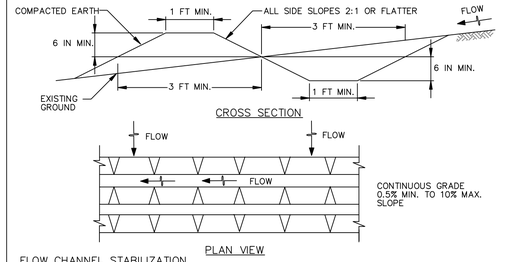
1. REMOVE AND DISPOSE OF ALL TREES, BRUSH, STUMPS, OBSTRUCTIONS, AND OTHER OBJECTIONABLE MATERIAL SO AS NOT TO INTERFERE WITH PROPER FUNCTION OF TEMPORARY SWALE.
2. EXCAVATE OR SHAPE TEMPORARY SWALE TO LINE, GRADE, AND CROSS SECTION AS SPECIFIED. BANK PROJECTIONS OR OTHER IRREGULARITIES ARE NOT ALLOWED.
3. STABILIZE TEMPORARY SWALE WITHIN THREE DAYS OF INSTALLATION. STABILIZE SWALES USED FOR CLEAR WATER DIVERSION WITHIN 24 HOURS OF INSTALLATION.
4. CONSTRUCT FLOW CHANNEL ON AN UNINTERRUPTED, CONTINUOUS GRADE, ADJUSTING THE LOCATION DUE TO FIELD CONDITIONS AS NECESSARY TO MAINTAIN POSITIVE DRAINAGE.
5. PROVIDE OUTLET PROTECTION AS REQUIRED ON APPROVED PLAN.
6. MAINTAIN LINE, GRADE, AND CROSS SECTION. REMOVE ACCUMULATED SEDIMENT AND DEBRIS, AND MAINTAIN POSITIVE DRAINAGE. KEEP TEMPORARY SWALE AND POINT OF DISCHARGE FREE OF EROSION, AND CONTINUOUSLY MEET REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT IN ACCORDANCE WITH SECTION B–4 VEGETATIVE STABILIZATION.
7. UPON REMOVAL OF TEMPORARY SWALE, GRADE AREA FLUSH WITH EXISTING GROUND. WITHIN 24 HOURS OF REMOVAL STABILIZE DISTURBED AREA WITH TOPSOIL, SEED, AND MULCH, OR AS SPECIFIED ON APPROVED PLAN.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL C-3 PERIMETER DIKE/SWALE

STANDARD SYMBOL: PDS–1 — PLACE DESIGNATION (PDS–1 OR 2) ON FLOW CHANNEL SIDE OF DIKE–SWALE.



FLOW CHANNEL STABILIZATION

PDS–1 SEED AND MULCH AND TACK (DRAINING < 1 ACRE) (NOT ALLOWED FOR CLEAR WATER DIVERSION.)

PDS–2 SEED WITH SOIL STABILIZATION MATTING OR LINE WITH SOD (DRAINING BETWEEN 1 AND 2 ACRES)

NOTE: THE MAXIMUM DRAINAGE AREA FOR THIS PRACTICE IS 2 ACRES.

CONSTRUCTION SPECIFICATIONS

1. REMOVE AND DISPOSE OF ALL TREES, BRUSH, STUMPS, OBSTRUCTIONS, AND OTHER OBJECTIONABLE MATERIAL SO AS NOT TO INTERFERE WITH PROPER FUNCTION OF DIKE/SWALE.
2. EXCAVATE OR SHAPE DIKE/SWALE TO LINE, GRADE, AND CROSS SECTION AS SPECIFIED. BANK PROJECTIONS OR OTHER IRREGULARITIES ARE NOT ALLOWED.
3. COMPACT FILL.
4. CONSTRUCT DIKE/SWALE ON AN UNINTERRUPTED, CONTINUOUS GRADE, ADJUSTING THE LOCATION DUE TO FIELD CONDITIONS AS NECESSARY TO MAINTAIN POSITIVE DRAINAGE.
5. PROVIDE OUTLET PROTECTION AS REQUIRED ON APPROVED PLAN.
6. STABILIZE DIKE/SWALE WITHIN 3 DAYS OF INSTALLATION. STABILIZE DIKE/SWALES USED FOR CLEAR WATER DIVERSION WITHIN 24 HOURS OF INSTALLATION.
7. MAINTAIN LINE, GRADE, AND CROSS SECTION. REMOVE ACCUMULATED SEDIMENT AND DEBRIS, AND MAINTAIN POSITIVE DRAINAGE. KEEP PERIMETER DIKE/SWALE AND POINT OF DISCHARGE FREE OF EROSION AND CONTINUOUSLY MEET REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT IN ACCORDANCE WITH SECTION B–4 VEGETATIVE STABILIZATION.
8. UPON REMOVAL OF DIKE/SWALE, GRADE AREA FLUSH WITH EXISTING GROUND. WITHIN 24 HOURS OF REMOVAL STABILIZE DISTURBED AREA WITH TOPSOIL, SEED, MULCH, OR AS SPECIFIED ON APPROVED PLAN.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

MDE NO. 13-SF-0255
NOTE TO CONTRACTOR: EROSION AND SEDIMENT CONTROL SHALL BE STRICTLY ENFORCED
FOR EROSION AND SEDIMENT CONTROL ONLY.

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ___

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

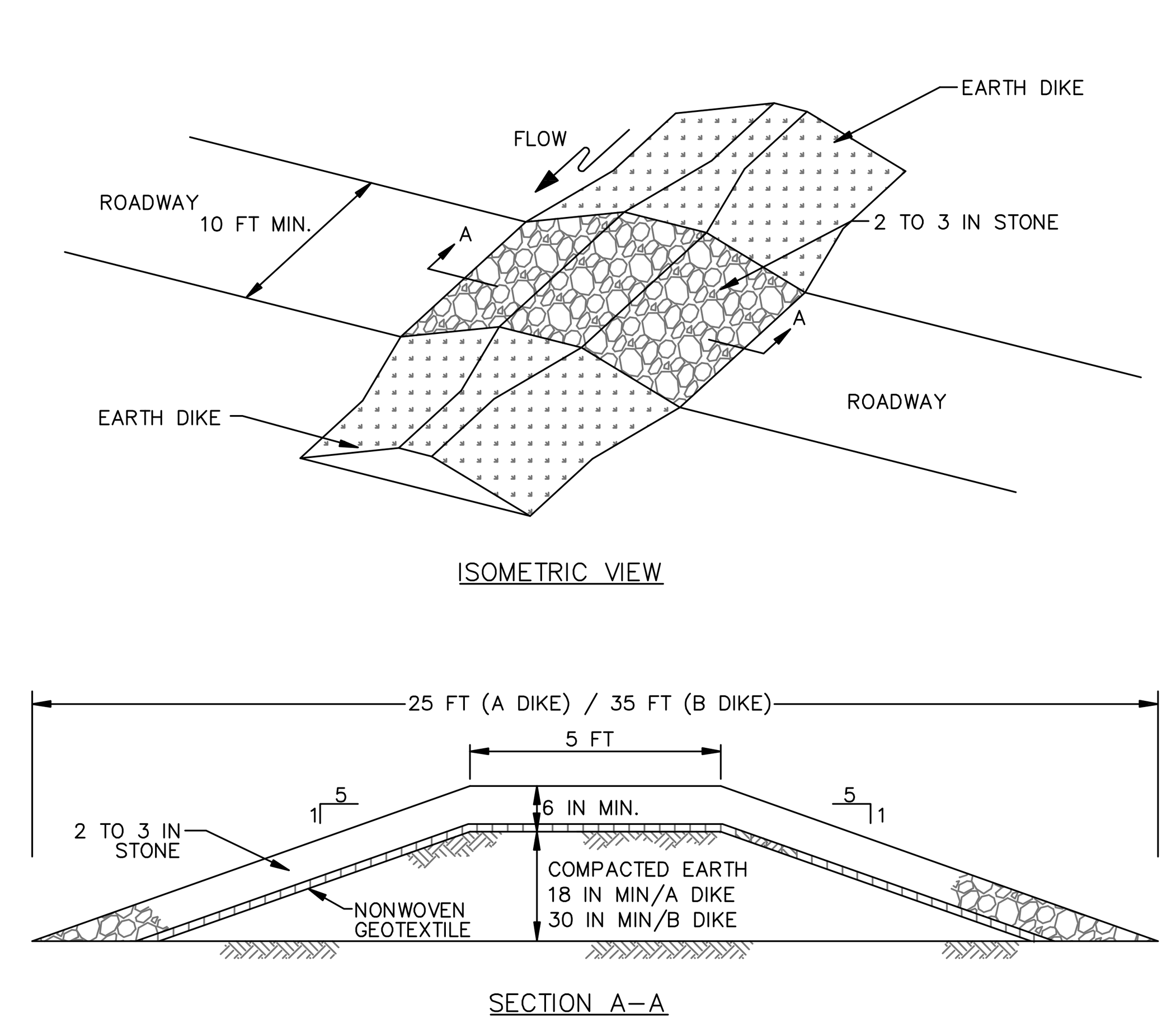
MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION
OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE: EROSION AND SEDIMENT CONTROL DETAILS I
SCALE:
DATE: 07/03/2013
CONTRACT NO.: N/A
SHEET NO.: C–061

DRAWING NAME: S:\03–Projects\Commercial\LMC\103P257101–DRA–308 design Phase–2013\CAD drawings\Civil\ 112003834–C06X–ESDetailsSpecs.dwg
PLOT DATE: Jul 03, 2013 – 12:26pm

DETAIL C-8 MOUNTABLE BERM

STANDARD SYMBOL: MB



CONSTRUCTION SPECIFICATIONS

1. USE MINIMUM WIDTH OF 10 FEET TO ALLOW FOR VEHICULAR PASSAGE.
2. PLACE NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H–1 MATERIALS, OVER THE EARTH MOUND PRIOR TO PLACING STONE.
3. PLACE 2 TO 3 INCH STONE OR EQUIVALENT RECYCLED CONCRETE AT LEAST 6 INCHES DEEP OVER THE LENGTH AND WIDTH OF THE MOUNTABLE BERM.
4. MAINTAIN LINE, GRADE, AND CROSS SECTION. ADD STONE OR MAKE OTHER REPAIRS AS CONDITIONS DEMAND TO MAINTAIN SPECIFIED DIMENSIONS. REMOVE ACCUMULATED SEDIMENT AND DEBRIS. MAINTAIN POSITIVE DRAINAGE.

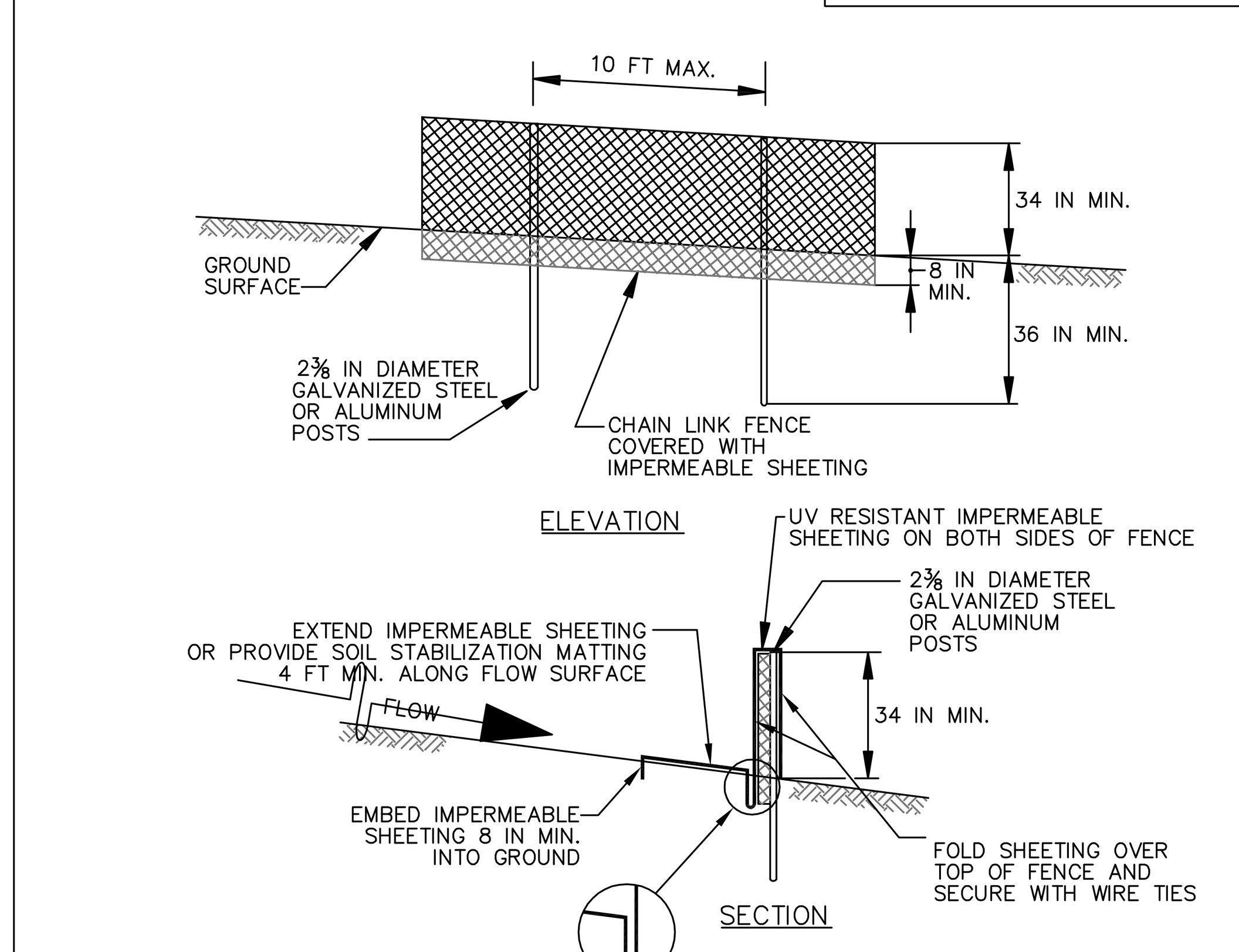
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL C-9 DIVERSION FENCE

STANDARD SYMBOL: DF

MAXIMUM DRAINAGE AREA = 2 ACRES



CONSTRUCTION SPECIFICATIONS

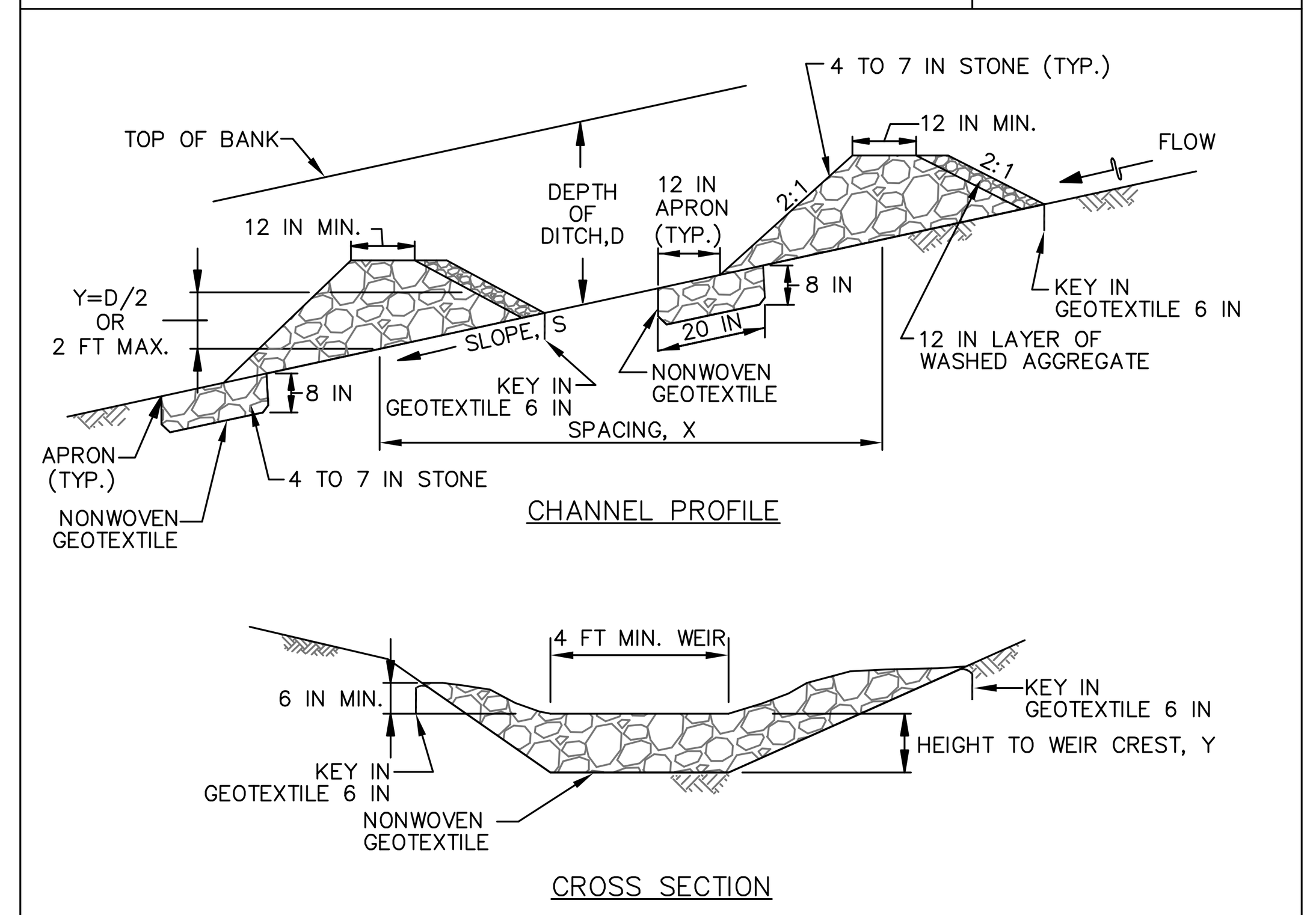
1. USE 42 INCH HIGH, 9 GAUGE OR THICKER CHAIN LINK FENCING (2⅜ INCH MAXIMUM OPENING).
2. USE 2⅜ INCH DIAMETER GALVANIZED STEEL POSTS OF 0.095 INCH WALL THICKNESS AND SIX FOOT LENGTH SPACED NO FURTHER THAN 10 FEET APART. THE POSTS DO NOT NEED TO BE SET IN CONCRETE.
3. FASTEN CHAIN LINK FENCE SECURELY TO THE FENCE POSTS WITH WIRE TIES.
4. SECURE 10 MIL OR THICKER UV RESISTANT, IMPERMEABLE SHEETING TO CHAIN LINK FENCE WITH TIES SPACED EVERY 24 INCHES AT TOP, MID SECTION, AND BELOW GROUND SURFACE.
5. EXTEND SHEETING A MINIMUM OF 4 FEET ALONG FLOW SURFACE AND EMBED END A MINIMUM OF 8 INCHES INTO GROUND. SOIL STABILIZATION MATTING MAY BE USED IN LIEU OF IMPERMEABLE SHEETING ALONG FLOW SURFACE.
6. WHEN TWO SECTIONS OF SHEETING ADJOIN EACH OTHER, OVERLAP BY 6 INCHES AND FOLD WITH SEAM FACING DOWNGRADE.
7. KEEP FLOW SURFACE ALONG DIVERSION FENCE AND POINT OF DISCHARGE FREE OF EROSION. REMOVE ACCUMULATED SEDIMENT AND DEBRIS. MAINTAIN POSITIVE DRAINAGE. REPLACE IMPERMEABLE SHEETING IF TORN. IF UNDERMINING OCCURS, REINSTALL FENCE.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL D-2 STONE CHECK DAM

STANDARD SYMBOL: CD



CONSTRUCTION SPECIFICATIONS

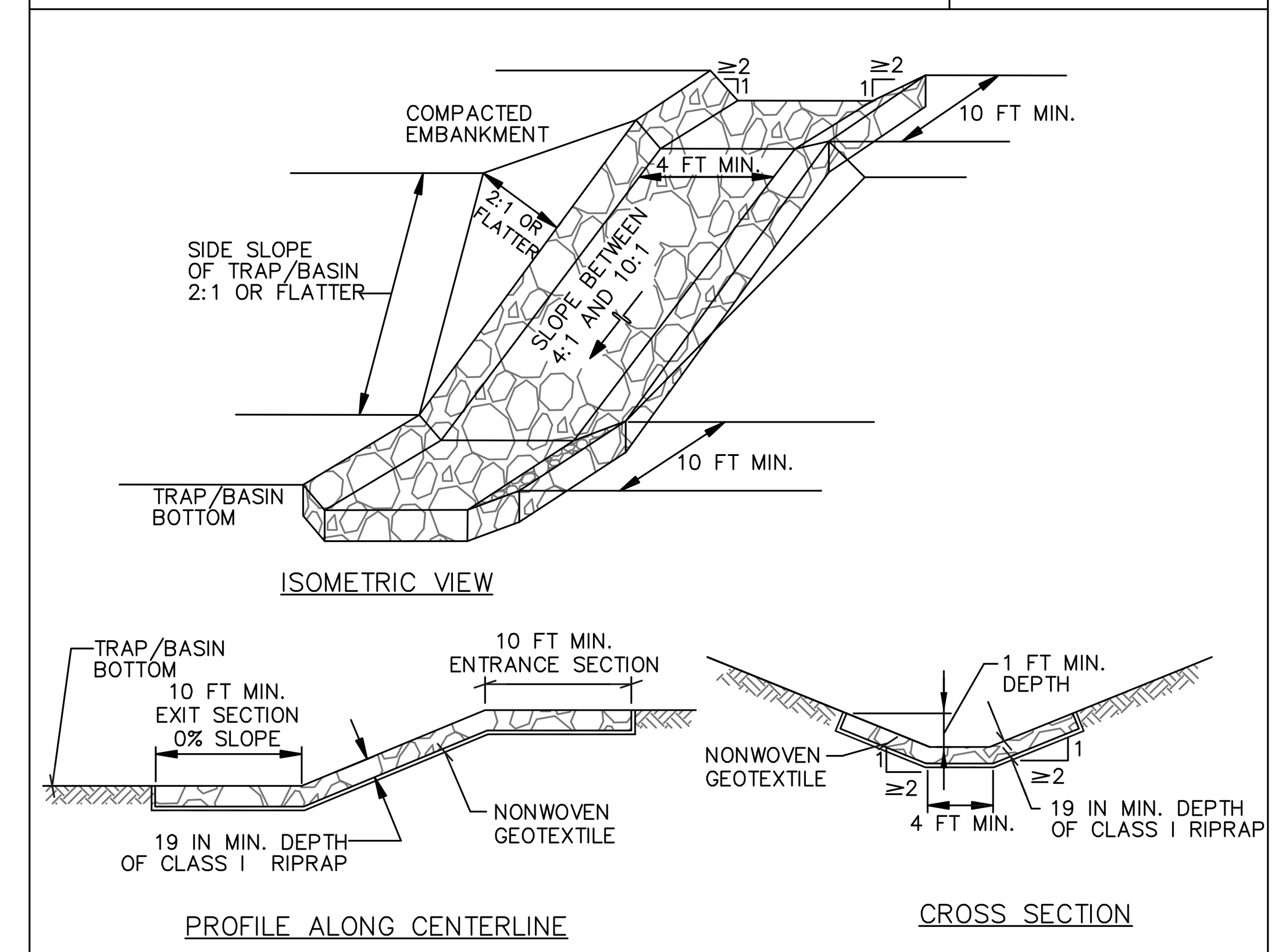
1. PREPARE SWALES IN ACCORDANCE WITH THE CONSTRUCTION SPECIFICATIONS DESCRIBED IN SECTION C–2, STANDARDS AND SPECIFICATIONS FOR TEMPORARY SWALE, OR AS SPECIFIED ON PLAN.
2. PLACE NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H–1 MATERIALS, UNDER THE BOTTOM AND SIDES OF THE DAM PRIOR TO PLACEMENT OF STONE. CONSTRUCT THE CHECK DAM WITH WASHED 4 TO 7 INCH STONE OR EQUIVALENT RECYCLED CONCRETE (WITHOUT REBAR) WITH SIDE SLOPES OF 2:1 OR FLATTER AND A MINIMUM TOP WIDTH OF 12 INCHES. PLACE THE STONE SO THAT IT COMPLETELY COVERS THE WIDTH OF THE CHANNEL AND CHANNEL BANKS. FORM THE WEIR SO THAT TOP OF THE OUTLET CREST IS APPROXIMATELY 6 INCHES LOWER THAN THE OUTER EDGES. LINE THE UPSTREAM FACE OF THE DAM WITH A 1 FOOT THICK LAYER OF WASHED AGGREGATE (¾ TO 1½ INCH).
3. SET THE HEIGHT FOR THE WEIR CREST EQUAL TO ONE–HALF THE DEPTH OF THE CHANNEL OR DITCH. TO AVOID SCOUR THE MAXIMUM HEIGHT OF THE WEIR CREST MUST NOT EXCEED 2.0 FEET.
4. REMOVE ACCUMULATED SEDIMENT WHEN IT REACHES ONE–HALF OF THE HEIGHT OF THE WEIR CREST. MAINTAIN LINE, GRADE, AND CROSS SECTION.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL D-3-1 RIPRAP INFLOW PROTECTION

STANDARD SYMBOL: RRP



CONSTRUCTION SPECIFICATIONS

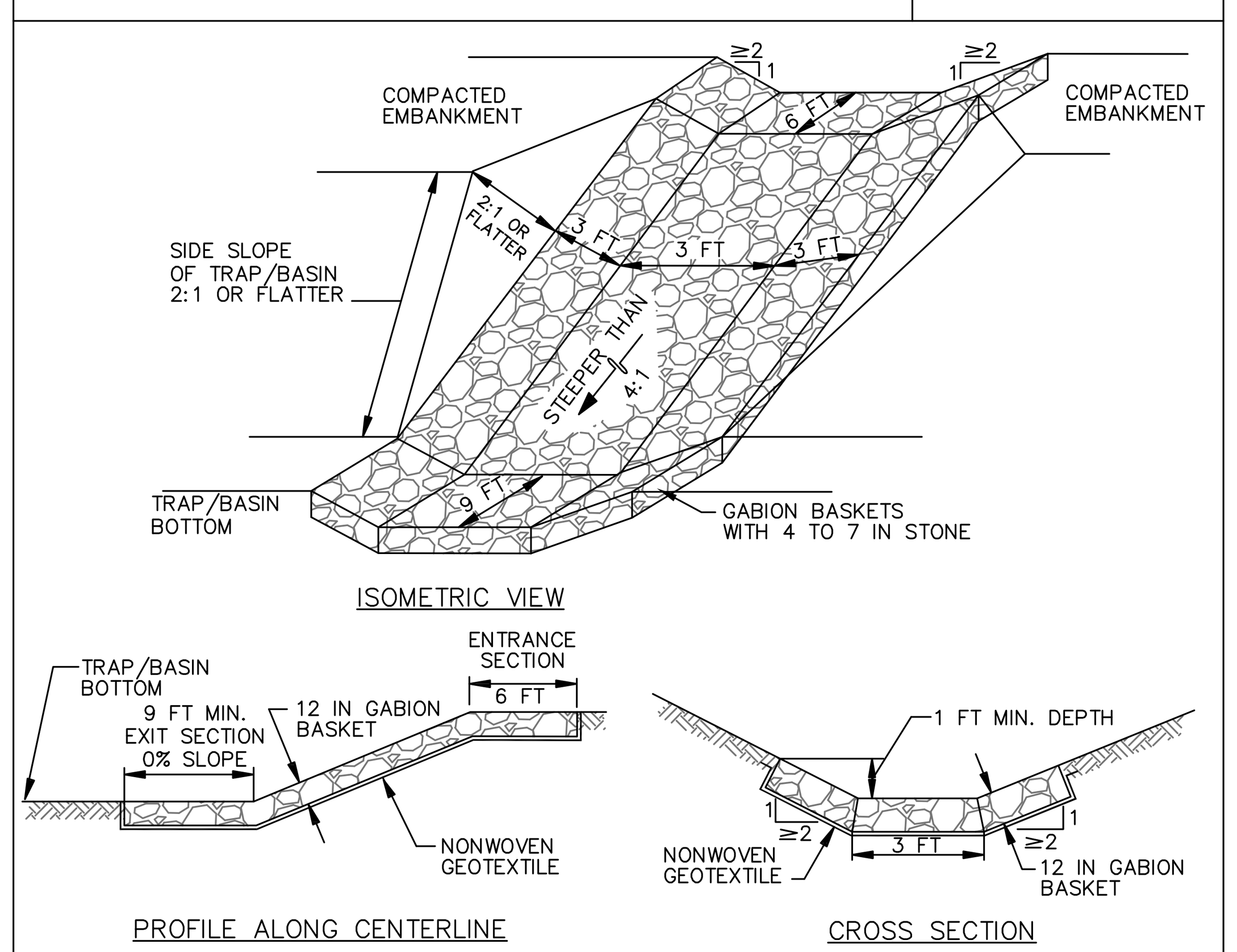
1. PROVIDE NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H–1 MATERIALS, UNDER THE BOTTOM AND ALONG SIDES OF ALL RIPRAP.
2. CONSTRUCT INFLOW CHANNEL WITH CLASS I RIPRAP OR EQUIVALENT RECYCLED CONCRETE LINING TO A MINIMUM DEPTH OF 19 INCHES (2 x D_{50}) AND A 1 FOOT DEEP FLOW CHANNEL. INFLOW RIPRAP PROTECTION CHANNEL MUST HAVE A TRAPEZOIDAL CROSS SECTION WITH 2:1 OR FLATTER SIDE SLOPES AND A 4 FOOT MINIMUM BOTTOM WIDTH.
3. INSTALL ENTRANCE AND EXIT SECTIONS AS SHOWN ON THE PROFILE.
4. BLEND RIPRAP INTO EXISTING GROUND.
5. MAINTAIN LINE, GRADE, AND CROSS SECTION. REMOVE ACCUMULATED SEDIMENT AND DEBRIS. KEEP POINTS OF INFLOW AND OUTFLOW FREE OF EROSION.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL D-3-2 GABION INFLOW PROTECTION

STANDARD SYMBOL: GP



CONSTRUCTION SPECIFICATIONS

1. PROVIDE NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H–1 MATERIALS, UNDER THE BOTTOM AND ALONG SIDES OF ALL GABION BASKETS.
2. USE BASKETS MADE OF MINIMUM 11 GAUGE WIRE.
3. CONSTRUCT GABION INFLOW PROTECTION BY ARRANGING 9 X 3 X 1 FOOT GABION BASKETS TO FORM A TRAPEZOIDAL SECTION WITH A 3 FOOT BOTTOM WIDTH, 1 FOOT MINIMUM DEPTH, 3 FOOT SIDE WALLS, AND 2:1 OR FLATTER SIDE SLOPES. FILL GABION BASKETS WITH 4 TO 7 INCH STONE OR EQUIVALENT RECYCLED CONCRETE WITHOUT REBAR OR WEIR MESH.
4. INSTALL ENTRANCE AND EXIT SECTIONS AS SHOWN ON THE PROFILE.
5. INSTALL GABIONS IN ACCORDANCE WITH MANUFACTURER RECOMMENDATIONS.
6. BLEND GABIONS INTO EXISTING GROUND.
7. MAINTAIN LINE, GRADE, AND CROSS SECTION. REMOVE ACCUMULATED SEDIMENT AND DEBRIS. KEEP POINTS OF INFLOW AND OUTFLOW FREE OF EROSION

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

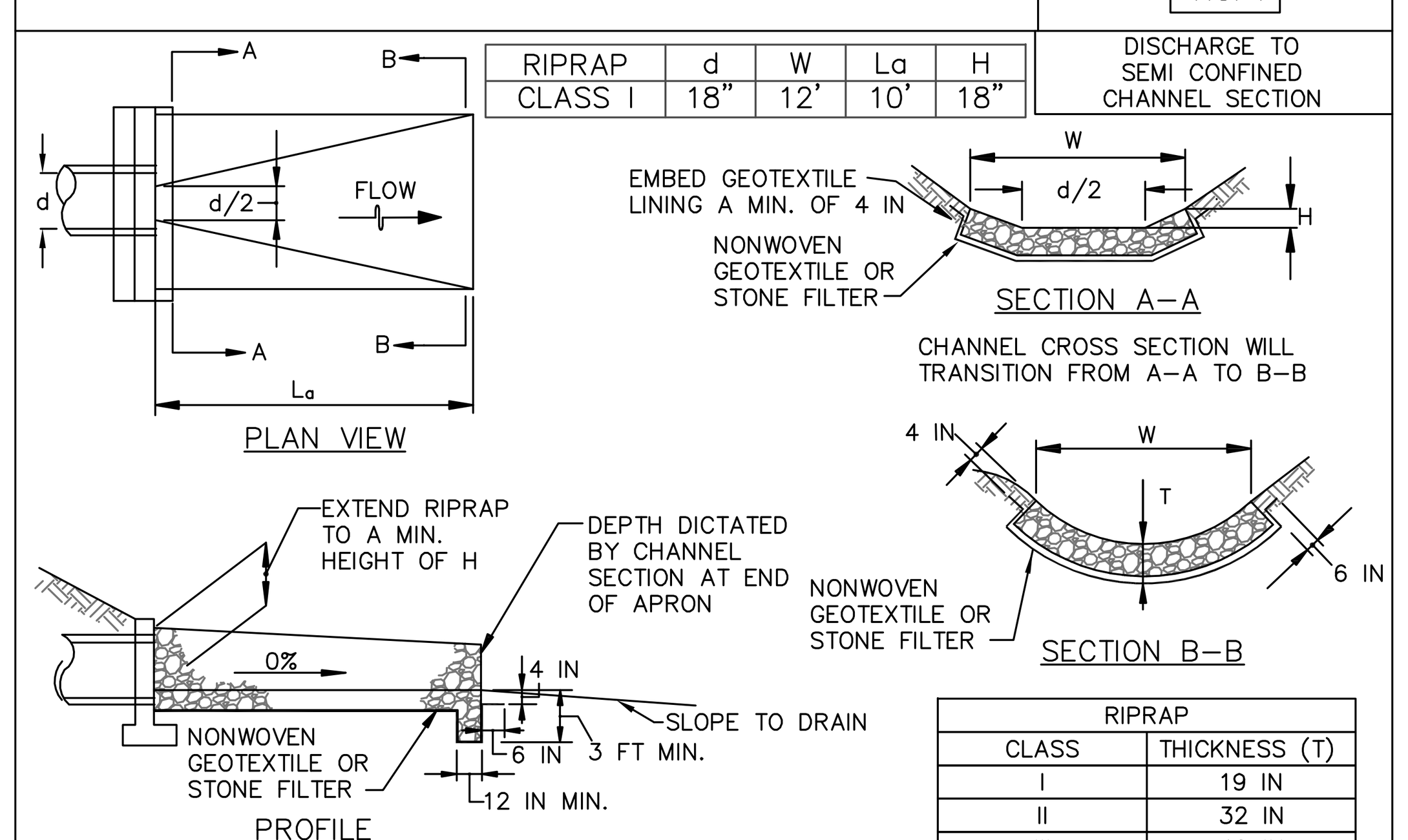
U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL D-4-1-A ROCK OUTLET PROTECTION I

STANDARD SYMBOL: ROP1

DISCHARGE TO SEMI CONFINED CHANNEL SECTION

RIPRAP	d	W	La	H
CLASS I	18"	12'	10'	18"



RIPRAP	
CLASS	THICKNESS (T)
I	19 IN
II	32 IN
III	46 IN

CONSTRUCTION SPECIFICATIONS

1. RIPRAP AND STONE MUST CONFORM TO THE SPECIFIED CLASS.
2. USE NONWOVEN GEOTEXTILE AS SPECIFIED IN SECTION H–1 MATERIALS, AND PROTECT FROM PUNCTURING, CUTTING, OR TEARING. REPAIR ANY DAMAGE OTHER THAN AN OCCASIONAL SMALL HOLE BY PLACING ANOTHER PIECE OF GEOTEXTILE OVER THE DAMAGED PART OR BY COMPLETELY REPLACING THE GEOTEXTILE. PROVIDE A MINIMUM OF ONE FOOT OVERLAP FOR ALL REPAIRS AND FOR JOINING TWO PIECES OF GEOTEXTILE TOGETHER.
3. PREPARE THE SUBGRADE FOR GEOTEXTILE OR STONE FILTER (⅜ TO 1½ INCH STONE FOR 6 INCH MINIMUM DEPTH) AND RIPRAP TO THE REQUIRED LINES AND GRADES. COMPACT ANY FILL REQUIRED IN THE SUBGRADE TO A DENSITY OF APPROXIMATELY THAT OF THE SURROUNDING UNDISTURBED MATERIAL.
4. EXTEND GEOTEXTILE AT LEAST 6 INCHES BEYOND EDGES OF RIPRAP AND EMBED AT LEAST 4 INCHES AT SIDES OF THE RIPRAP.
5. CONSTRUCT RIPRAP OUTLET TO FULL COURSE THICKNESS IN ONE OPERATION AND IN SUCH A MANNER AS TO AVOID DISPLACEMENT OF UNDERLYING MATERIALS. PLACE STONE FOR RIPRAP OUTLET IN A MANNER THAT WILL ENSURE THAT IT IS REASONABLY HOMOGENOUS WITH THE SMALLER STONES AND SPALLS FILLING THE VOIDS BETWEEN THE LARGER STONES. PLACE RIPRAP IN A MANNER TO PREVENT DAMAGE TO THE STONE FILTER BLANKET OR GEOTEXTILE. HAND PLACE TO THE EXTENT NECESSARY.
6. WHERE NO ENDWALL IS USED, CONSTRUCT THE UPSTREAM END OF THE APRON SO THAT THE WIDTH IS TWO TIMES THE DIAMETER OF THE OUTLET PIPE, AND EXTEND THE STONE UNDER THE OUTLET BY A MINIMUM OF 18 INCHES.
7. CONSTRUCT APRON WITH 0% SLOPE ALONG ITS LENGTH AND WITHOUT OBSTRUCTIONS. PLACE STONE SO THAT IT BLENDS IN WITH EXISTING GROUND.
8. MAINTAIN LINE, GRADE, AND CROSS SECTION. KEEP OUTLET FREE OF EROSION. REMOVE ACCUMULATED SEDIMENT AND DEBRIS. AFTER HIGH FLOWS INSPECT FOR SCOUR AND DISLODGED RIPRAP. MAKE NECESSARY REPAIRS IMMEDIATELY.

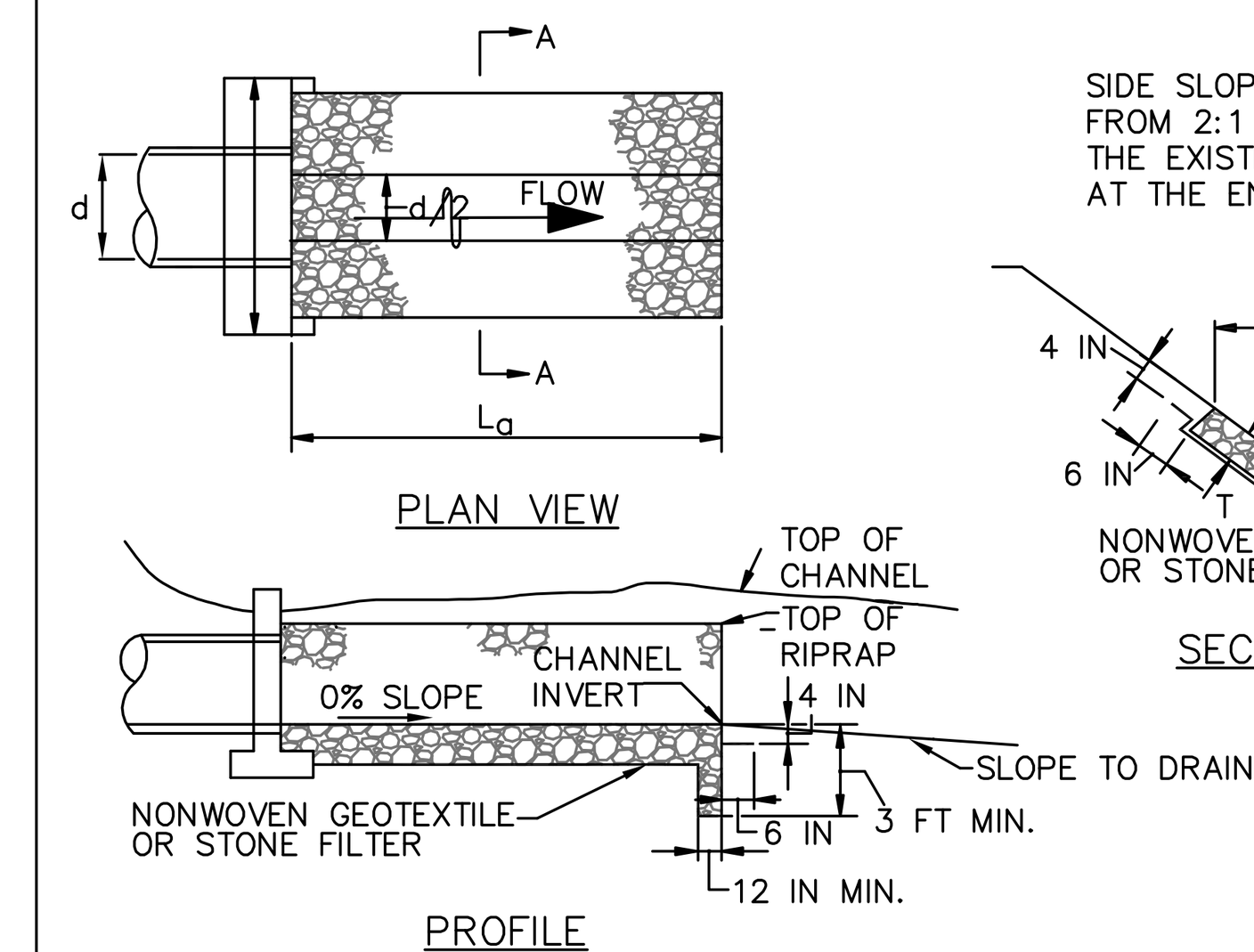
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL D-4-1-B ROCK OUTLET PROTECTION II

STANDARD SYMBOL: ROPII

DISCHARGE TO CONFINED CHANNEL SECTION



RIPRAP	
CLASS	THICKNESS (T)
I	19 IN
II	32 IN
III	46 IN

CONSTRUCTION SPECIFICATIONS

1. RIPRAP AND STONE MUST CONFORM TO THE SPECIFIED CLASS.
2. USE NONWOVEN GEOTEXTILE AS SPECIFIED IN SECTION H–1 MATERIALS, AND PROTECT FROM PUNCTURING, CUTTING, OR TEARING. REPAIR ANY DAMAGE OTHER THAN AN OCCASIONAL SMALL HOLE BY PLACING ANOTHER PIECE OF GEOTEXTILE OVER THE DAMAGED PART OR BY COMPLETELY REPLACING THE GEOTEXTILE. PROVIDE A MINIMUM OF ONE FOOT OVERLAP FOR ALL REPAIRS AND FOR JOINING TWO PIECES OF GEOTEXTILE TOGETHER.
3. PREPARE THE SUBGRADE FOR GEOTEXTILE OR STONE FILTER (⅜ TO 1½ INCH STONE FOR 6 INCH MINIMUM DEPTH) AND RIPRAP TO THE REQUIRED LINES AND GRADES. COMPACT ANY FILL REQUIRED IN THE SUBGRADE TO A DENSITY OF APPROXIMATELY THAT OF THE SURROUNDING UNDISTURBED MATERIAL.
4. EXTEND GEOTEXTILE AT LEAST 6 INCHES BEYOND EDGES OF RIPRAP AND EMBED AT LEAST 4 INCHES AT SIDES OF RIPRAP.
5. CONSTRUCT RIPRAP OUTLET TO FULL COURSE THICKNESS IN ONE OPERATION AND IN SUCH A MANNER AS TO AVOID DISPLACEMENT OF UNDERLYING MATERIALS. PLACE STONE FOR RIPRAP OUTLET IN A MANNER THAT WILL ENSURE THAT IT IS REASONABLY HOMOGENOUS WITH THE SMALLER STONES AND SPALLS FILLING THE VOIDS BETWEEN THE LARGER STONES. PLACE RIPRAP IN A MANNER TO PREVENT DAMAGE TO THE STONE FILTER BLANKET OR GEOTEXTILE. HAND PLACE TO THE EXTENT NECESSARY.
6. WHERE NO ENDWALL IS USED, CONSTRUCT THE UPSTREAM END OF THE APRON SO THAT THE WIDTH IS TWO TIMES THE DIAMETER OF THE OUTLET PIPE, AND EXTEND THE STONE UNDER THE OUTLET BY A MINIMUM OF 18 INCHES.
7. CONSTRUCT APRON WITH 0% SLOPE ALONG ITS LENGTH AND WITHOUT OBSTRUCTIONS. PLACE STONE SO THAT IT BLENDS IN WITH EXISTING GROUND.
8. MAINTAIN LINE, GRADE, AND CROSS SECTION. KEEP OUTLET FREE OF EROSION. REMOVE ACCUMULATED SEDIMENT AND DEBRIS. AFTER HIGH FLOWS INSPECT FOR SCOUR AND DISLODGED RIPRAP. MAKE NECESSARY REPAIRS IMMEDIATELY.

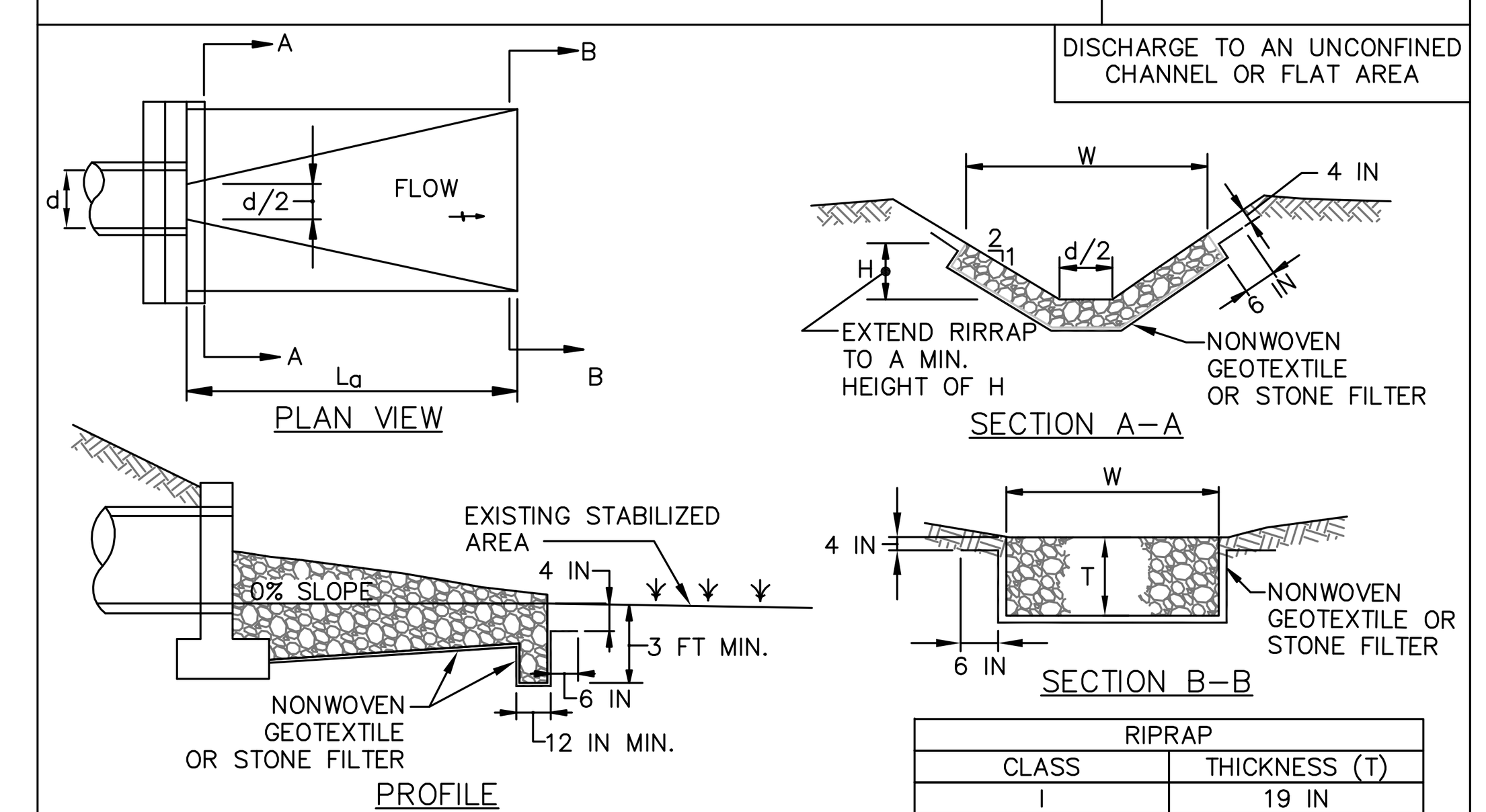
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL D-4-1-C ROCK OUTLET PROTECTION III

STANDARD SYMBOL: ROPIII

DISCHARGE TO AN UNCONFINED CHANNEL OR FLAT AREA



RIPRAP	
CLASS	THICKNESS (T)
I	19 IN
II	32 IN
III	46 IN

CONSTRUCTION SPECIFICATIONS

1. RIPRAP AND STONE MUST CONFORM TO THE SPECIFIED CLASS.
2. USE NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H–1 MATERIALS, AND PROTECT FROM PUNCTURING, CUTTING, OR TEARING. REPAIR ANY DAMAGE OTHER THAN AN OCCASIONAL SMALL HOLE BY PLACING ANOTHER PIECE OF GEOTEXTILE OVER THE DAMAGED PART OR BY COMPLETELY REPLACING THE GEOTEXTILE. PROVIDE A MINIMUM OF ONE FOOT OVERLAP FOR ALL REPAIRS AND FOR JOINING TWO PIECES OF GEOTEXTILE TOGETHER.
3. PREPARE THE SUBGRADE FOR GEOTEXTILE OR STONE FILTER (⅜ TO 1½ INCH MINIMUM STONE FOR 6 INCH MINIMUM DEPTH) AND RIPRAP TO THE REQUIRED LINES AND GRADES. COMPACT ANY FILL REQUIRED IN THE SUBGRADE TO A DENSITY OF APPROXIMATELY THAT OF THE SURROUNDING UNDISTURBED MATERIAL.
4. EXTEND GEOTEXTILE AT LEAST 6 INCHES BEYOND EDGES OF RIPRAP AND EMBED AT LEAST 4 INCHES AT SIDES OF RIPRAP.
5. CONSTRUCT RIPRAP OUTLET TO FULL COURSE THICKNESS IN ONE OPERATION AND IN SUCH A MANNER AS TO AVOID DISPLACEMENT OF UNDERLYING MATERIALS. PLACE STONE FOR RIPRAP OUTLET IN A MANNER THAT WILL ENSURE THAT IT IS REASONABLY HOMOGENOUS WITH THE SMALLER STONES AND SPALLS FILLING THE VOIDS BETWEEN THE LARGER STONES. PLACE RIPRAP IN A MANNER TO PREVENT DAMAGE TO THE FILTER BLANKET OR GEOTEXTILE. HAND PLACE TO THE EXTENT NECESSARY.
6. WHERE NO ENDWALL IS USED, CONSTRUCT THE UPSTREAM END OF THE APRON SO THAT THE WIDTH IS TWO TIMES THE DIAMETER OF THE OUTLET PIPE, AND EXTEND THE STONE UNDER THE OUTLET BY A MINIMUM OF 18 INCHES.
7. CONSTRUCT APRON WITH 0% SLOPE ALONG ITS LENGTH AND WITHOUT OBSTRUCTIONS. PLACE STONE SO THAT IT BLENDS IN WITH EXISTING GROUND.
8. MAINTAIN LINE, GRADE, AND CROSS SECTION. KEEP OUTLET FREE OF EROSION. REMOVE ACCUMULATED SEDIMENT AND DEBRIS. AFTER HIGH FLOWS INSPECT FOR SCOUR AND RIPRAP DISLODGED RIPRAP. MAKE NECESSARY REPAIRS IMMEDIATELY.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

MDE NO. 13-SF-0255
NOTE TO CONTRACTOR: EROSION AND SEDIMENT CONTROL SHALL BE STRICTLY ENFORCED

FOR EROSION AND SEDIMENT CONTROL ONLY.

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ———

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

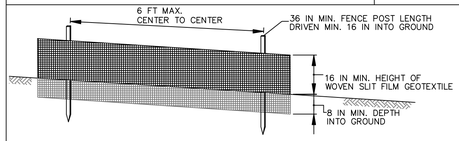
MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION
OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE: EROSION AND SEDIMENT CONTROL DETAILS II
SCALE:
DATE: 07/03/2013
CONTRACT NO.: N/A
SHEET NO.: C-062

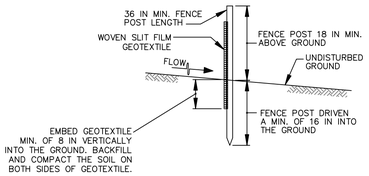
DRAWING NAME: S:\03-Projects\Commercial\LMC\103IP257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112IC03834-C06X-ESDetailsSpecs.dwg
PLOT DATE: Jul 03, 2013 – 12:26pm

DETAIL E-1 SILT FENCE

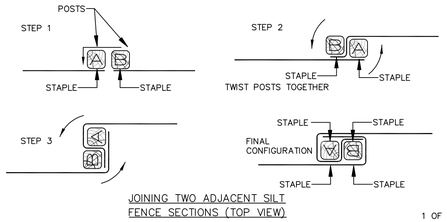
STANDARD SYMBOL: SF



ELEVATION



CROSS SECTION



JOINING TWO ADJACENT SILT FENCE SECTIONS (TOP VIEW)

1 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL E-1 SILT FENCE

STANDARD SYMBOL: SF

CONSTRUCTION SPECIFICATIONS

1. USE WOOD POSTS 1⅜ X 1⅜ ± 1/8 INCH (MINIMUM) SQUARE CUT OF SOUND QUALITY HARDWOOD. AS AN ALTERNATIVE TO WOODEN POST USE STANDARD "T" OR "U" SECTION STEEL POSTS WEIGHING NOT LESS THAN 1 POUND PER LINEAR FOOT.
2. USE 36 INCH MINIMUM POSTS DRIVEN 16 INCH MINIMUM INTO GROUND NO MORE THAN 6 FEET APART.
3. USE WOVEN SLIT FILM GEOTEXTILE AS SPECIFIED IN SECTION H-1 MATERIALS AND FASTEN GEOTEXTILE SECURELY TO UPSLOPE SIDE OF FENCE POSTS WITH WIRE TIES OR STAPLES AT TOP AND MID-SECTION.
4. PROVIDE MANUFACTURER CERTIFICATION TO THE AUTHORIZED REPRESENTATIVE OF THE INSPECTION/ENFORCEMENT AUTHORITY SHOWING THAT THE GEOTEXTILE USED MEETS THE REQUIREMENTS IN SECTION H-1 MATERIALS.
5. EMBED GEOTEXTILE A MINIMUM OF 8 INCHES VERTICALLY INTO THE GROUND. BACKFILL AND COMPACT THE SOIL ON BOTH SIDES OF FABRIC.
6. WHERE TWO SECTIONS OF GEOTEXTILE ADJOIN: OVERLAP, TWIST, AND STAPLE TO POST IN ACCORDANCE WITH THIS DETAIL.
7. EXTEND BOTH ENDS OF THE SILT FENCE A MINIMUM OF FIVE HORIZONTAL FEET UPSLOPE AT 45 DEGREES TO THE MAIN FENCE ALIGNMENT TO PREVENT RUNOFF FROM GOING AROUND THE ENDS OF THE SILT FENCE.
8. REMOVE ACCUMULATED SEDIMENT AND DEBRIS WHEN BULGES DEVELOP IN SILT FENCE OR WHEN SEDIMENT REACHES 25% OF FENCE HEIGHT. REPLACE GEOTEXTILE IF TORN. IF UNDERMINING OCCURS, REINSTALL FENCE.

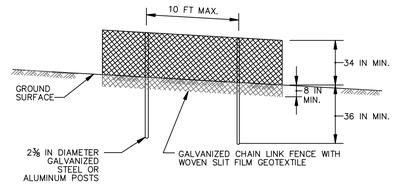
2 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

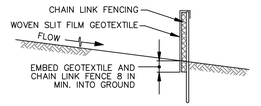
U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL E-3 SUPER SILT FENCE

STANDARD SYMBOL: SSF



ELEVATION



CROSS SECTION

CONSTRUCTION SPECIFICATIONS

1. INSTALL 2⅜ INCH DIAMETER GALVANIZED STEEL POSTS OF 0.095 INCH WALL THICKNESS AND SIX FOOT LENGTH SPACED NO FURTHER THAN 10 FEET APART. DRIVE THE POSTS A MINIMUM OF 36 INCHES INTO THE GROUND.
2. FASTEN 9 GAUGE OR HEAVIER GALVANIZED CHAIN LINK FENCE (2⅜ INCH MAXIMUM OPENING) 42 INCHES IN HEIGHT SECURELY TO THE FENCE POSTS WITH WIRE TIES OR HOG RINGS.
3. FASTEN WOVEN SLIT FILM GEOTEXTILE AS SPECIFIED IN SECTION H-1 MATERIALS, SECURELY TO THE UPSLOPE SIDE OF CHAIN LINK FENCE WITH TIES SPACED EVERY 24 INCHES AT THE TOP AND MID SECTION. EMBED GEOTEXTILE AND CHAIN LINK FENCE A MINIMUM OF 8 INCHES INTO THE GROUND.
4. WHERE ENDS OF THE GEOTEXTILE COME TOGETHER, THE ENDS SHALL BE OVERLAPPED BY 6 INCHES, FOLDED, AND STAPLED TO PREVENT SEDIMENT BY PASS.
5. EXTEND BOTH ENDS OF THE SUPER SILT FENCE A MINIMUM OF FIVE HORIZONTAL FEET UPSLOPE AT 45 DEGREES TO THE MAIN FENCE ALIGNMENT TO PREVENT RUNOFF FROM GOING AROUND THE ENDS OF THE SUPER SILT FENCE.
6. PROVIDE MANUFACTURER CERTIFICATION TO THE INSPECTION/ENFORCEMENT AUTHORITY SHOWING THAT GEOTEXTILE USED MEETS THE REQUIREMENTS IN SECTION H-1 MATERIALS.
7. REMOVE ACCUMULATED SEDIMENT AND DEBRIS WHEN BULGES DEVELOP IN FENCE OR WHEN SEDIMENT REACHES 25% OF FENCE HEIGHT. REPLACE GEOTEXTILE IF TORN. IF UNDERMINING OCCURS, REINSTALL CHAIN LINK FENCING AND GEOTEXTILE.

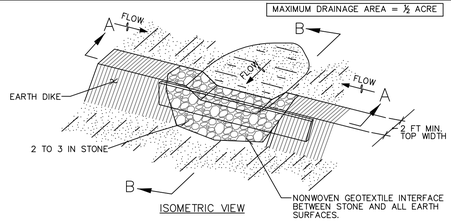
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

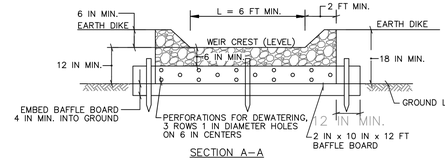
DETAIL E-7 TEMPORARY STONE OUTLET STRUCTURE

STANDARD SYMBOL: TSOS

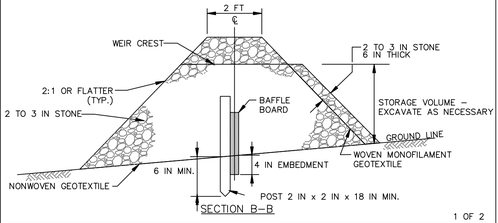
MAXIMUM DRAINAGE AREA = ½ ACRE



ISOMETRIC VIEW



SECTION A-A



SECTION B-B

1 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL E-7 TEMPORARY STONE OUTLET STRUCTURE

STANDARD SYMBOL: TSOS

CONSTRUCTION SPECIFICATIONS

1. PROVIDE STORAGE VOLUME AS SPECIFIED ON APPROVED PLANS.
2. USE NONWOVEN GEOTEXTILE ON INTERFACE BETWEEN GROUND AND STONE.
3. PERFORATE BAFFLE BOARD WITH 3 ROWS OF 1 INCH DIAMETER HOLES 6 INCHES ON CENTER, EMBED A MINIMUM OF 4 INCHES INTO GROUND, AND EXTEND BAFFEL BOARD MINIMUM OF 12 INCHES INTO EARTH DIKE.
4. USE CLEAN 2 TO 3 INCH STONE OR EQUIVALENT RECYCLED CONCRETE. PLACE WOVEN MONOFILAMENT GEOTEXTILE ON UPSTREAM FACE AND COVER WITH A MINIMUM OF 6 INCHES OF ADDITIONAL STONE.
5. USE NONWOVEN AND WOVEN MONOFILAMENT GEOTEXTILES AS SPECIFIED IN SECTION H-1 MATERIALS.
6. SET WEIR CREST OF STONE 6 INCHES LOWER THAN THE TOP OF EARTH DIKE. USE MINIMUM LENGTH OF 6 FEET FOR WEIR CREST.
7. REMOVE SEDIMENT WHEN IT HAS ACCUMULATED TO WITHIN 6 INCHES OF WEIR CREST. REPLACE GEOTEXTILE AND STONE FACING WHEN STRUCTURE CEASES TO DRAIN. MAINTAIN LINE, GRADE, AND CROSS SECTION.
8. UPON REMOVAL OF STONE OUTLET STRUCTURE, GRADE AREA FLUSH WITH EXISTING GROUND. WITHIN 24 HOURS STABILIZE DISTURBED AREA WITH TOPSOIL, SEED, AND MULCH, OR AS SPECIFIED ON APPROVED PLAN.

2 OF 2

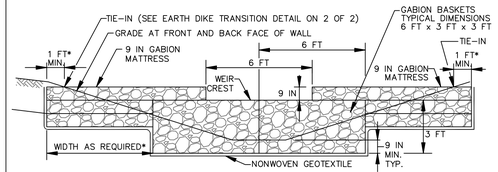
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL E-8 TEMPORARY GABION OUTLET STRUCTURE

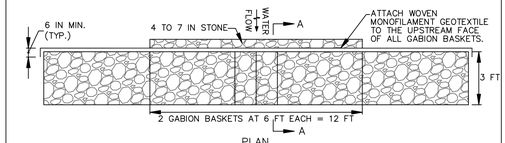
STANDARD SYMBOL: TGOS

MAXIMUM DRAINAGE AREA = 1½ ACRE

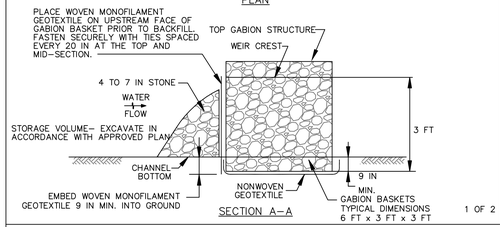


*ONE BASKET OR MULTIPLE MATTRESSES NEED TO EXTEND FROM THE GABION/EARTH INTERSECTION (TIE IN) TO A MINIMUM 1 FOOT BEYOND THE TIE IN.

ELEVATION



PLAN



SECTION A–A

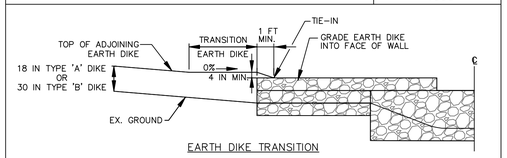
1 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL E-8 TEMPORARY GABION OUTLET STRUCTURE

STANDARD SYMBOL: TGOS



EARTH DIKE TRANSITION

NOTES:

1. PROVIDE TRANSITION LENGTH AND HEIGHT AS SPECIFIED ON PLAN. HEIGHT OF TRANSITION EARTH DIKE MUST EXCEED 4 INCH MINIMUM FREEBOARD ABOVE TOP OF GABION AND EXTEND AT THIS ELEVATION UNTIL IT INTERCEPTS THE TOP OF ADJOINING EARTH DIKE.
2. PROVIDE POSITIVE DRAINAGE ALONG EARTH DIKE TO GABION OUTLET STRUCTURE.
3. COMPACT FILL.
4. SHAPE EARTH DIKE TO LINE, GRADE, AND CROSS SECTION AS SPECIFIED ON PLAN. BANK PROJECTIONS OR IRREGULARITIES ARE NOT ALLOWED.

CONSTRUCTION SPECIFICATIONS

1. PROVIDE STORAGE VOLUME AS SPECIFIED ON APPROVED PLANS.
2. USE BASKETS MADE OF 11 GAUGE WIRE OR HEAVIER.
3. USE NONWOVEN AND WOVEN MONOFILAMENT GEOTEXTILES AS SPECIFIED IN SECTION H-1 MATERIALS.
4. INSTALL GABIONS IN ACCORDANCE WITH MANUFACTURER RECOMMENDATIONS.
5. EMBED THE GABION OUTLET STRUCTURE INTO THE SOIL A MINIMUM OF 9 INCHES. PROVIDE NONWOVEN GEOTEXTILE UNDER ALL GABIONS.
6. FILL GABION BASKETS WITH CLEAN 4 TO 7 INCH STONE OR EQUIVALENT RECYCLED CONCRETE WITHOUT REBAR OR WIRE MESH.
7. MAKE THE WEIR CREST OF THE GABION OUTLET STRUCTURE 9 INCHES LOWER THAN THE TOP OF THE ADJACENT GABIONS.
8. PROVIDE A MINIMUM WEIR CREST OF 6 FEET.
9. ATTACH WOVEN MONOFILAMENT GEOTEXTILE TO THE UPSTREAM FACE OF GABION BASKETS AND COVER WITH 4 TO 7 INCH STONE.
10. REMOVE SEDIMENT WHEN IT HAS ACCUMULATED TO WITHIN 12 INCHES OF THE WEIR CREST. REPLACE GEOTEXTILE AND STONE FACING WHEN STRUCTURE CEASES TO FUNCTION. MAINTAIN LINE, GRADE, AND CROSS SECTION.
11. UPON REMOVAL OF GABION OUTLET STRUCTURE, GRADE AREA FLUSH WITH EXISTING GROUND. WITHIN 24 HOURS STABILIZE DISTURBED AREA WITH TOPSOIL, SEED, AND MULCH, OR AS SPECIFIED ON APPROVED PLAN.

2 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

MDE NO. 13-SF-0255
NOTE TO CONTRACTOR:
EROSION AND SEDIMENT CONTROL SHALL BE STRICTLY ENFORCED
FOR EROSION AND SEDIMENT CONTROL ONLY.

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

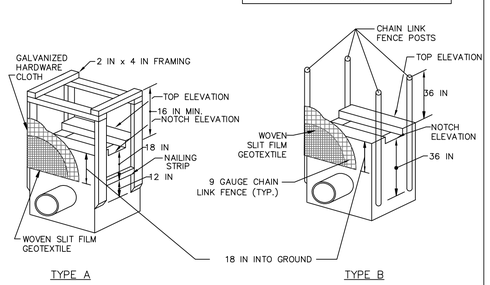
OFFICE OF DESIGN AND CONSTRUCTION

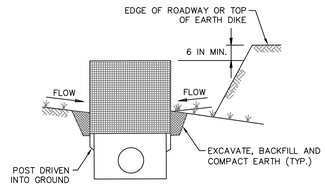
PROJECT TITLE:	DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE:	EROSION AND SEDIMENT CONTROL DETAILS III
SCALE:	
DATE:	07/03/2013
CONTRACT NO.:	N/A
SHEET NO.:	C-063

PLOT DATE: Jul 03, 2013 - 12:27pm
DRAWING NAME: S:\03-Projects\Commercial\UMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112C003834-C06X-ESDetailsSpecs.dwg

DETAIL E-9-1 STANDARD INLET PROTECTION

STANDARD SYMBOL: SIP





SECTION FOR TYPE A AND B

1 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL E-9-1 STANDARD INLET PROTECTION

STANDARD SYMBOL: SIP

CONSTRUCTION SPECIFICATIONS

1. USE WOVEN SLIT FILM GEOTEXTILE AS SPECIFIED IN SECTION H-1 MATERIALS.
2. EXCAVATE COMPLETELY AROUND THE INLET TO A DEPTH OF 18 INCHES BELOW THE NOTCH ELEVATION.
3. FOR TYPE A, USE NOMINAL 2 INCH X 4 INCH CONSTRUCTION GRADE LUMBER POSTS, DRIVEN 1 FOOT INTO THE GROUND AT EACH CORNER OF THE INLET. PLACE NAIL STRIPS BETWEEN THE POSTS ON THE ENDS OF THE INLET. ASSEMBLE THE TOP PORTION OF THE 2X4 FRAME AS SHOWN. STRETCH ½ INCH GALVANIZED HARDWARE CLOTH TIGHTLY AROUND THE FRAME AND FASTEN SECURELY. FASTEN GEOTEXTILE SECURELY TO THE HARDWARE CLOTH WITH TIES SPACED EVERY 24 INCHES AT THE TOP AND MID SECTION. EMBED GEOTEXTILE AND HARDWARE CLOTH A MINIMUM OF 18 INCHES BELOW THE WEIR CREST. THE ENDS OF THE GEOTEXTILE MUST MEET AT A POST, BE OVERLAPPED AND FOLDED, THEN FASTENED TO THE POST.

   FOR TYPE B, USE 2⅜ INCH DIAMETER GALVANIZED STEEL POSTS OF 0.095 INCH WALL THICKNESS AND 6 FOOT LENGTH, DRIVEN A MINIMUM OF 36 INCHES BELOW THE WEIR CREST AT EACH CORNER OF THE STRUCTURE. FASTEN 9 GAUGE OR HEAVIER CHAIN LINK FENCE, 42 INCHES IN HEIGHT, SECURELY TO THE FENCE POSTS WITH WIRE TIES. FASTEN GEOTEXTILE SECURELY TO THE CHAIN LINK FENCE WITH TIES SPACED EVERY 24 INCHES AT THE TOP AND MID SECTION. EMBED GEOTEXTILE AND CHAIN LINK FENCE A MINIMUM OF 18 INCHES BELOW THE WEIR CREST.
4. BACKFILL AROUND THE INLET IN LOOSE 4 INCH LIFTS AND COMPACT UNTIL SOIL IS LEVEL WITH THE NOTCH ELEVATION ON THE ENDS AND TOP ELEVATION ON THE SIDES.
5. STORM DRAIN INLET PROTECTION REQUIRES FREQUENT MAINTENANCE. REMOVE ACCUMULATED SEDIMENT AFTER EACH RAIN EVENT TO MAINTAIN FUNCTION AND AVOID PREMATURE CLOGGING. IF INLET PROTECTION DOES NOT COMPLETELY DRAIN WITHIN 24 HOURS AFTER A STORM EVENT, IT IS CLOGGED. WHEN THIS OCCURS, REMOVE ACCUMULATED SEDIMENT AND CLEAN, OR REPLACE GEOTEXTILE AND STONE.

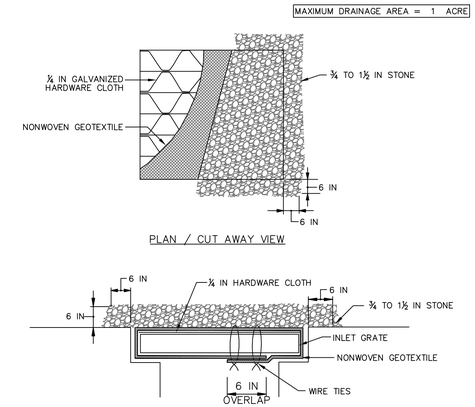
2 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL E-9-2 AT-GRADE INLET PROTECTION

STANDARD SYMBOL: AGIP



CONSTRUCTION SPECIFICATIONS

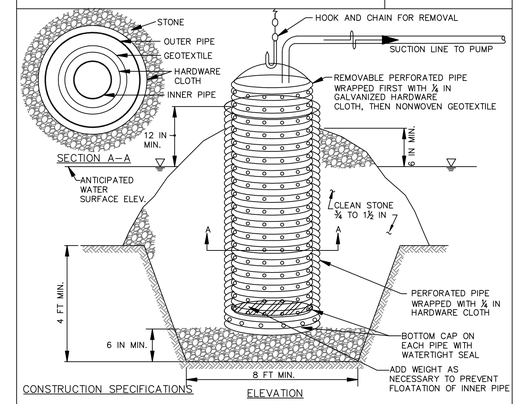
1. USE NONWOVEN GEOTEXTILE AS SPECIFIED IN SECTION H-1 MATERIALS.
2. LIFT GRATE AND WRAP WITH NONWOVEN GEOTEXTILE TO COMPLETELY COVER ALL OPENINGS. SECURE WITH WIRE TIES AND SET GRATE BACK IN PLACE.
3. PLACE CLEAN ¾ TO 1½ INCH STONE OR EQUIVALENT RECYCLED CONCRETE 6 INCHES THICK ON THE GRATE.
4. STORM DRAIN INLET PROTECTION REQUIRES FREQUENT MAINTENANCE. REMOVE ACCUMULATED SEDIMENT AFTER EACH RAIN EVENT TO MAINTAIN FUNCTION AND AVOID PREMATURE CLOGGING. IF INLET PROTECTION DOES NOT COMPLETELY DRAIN WITHIN 24 HOURS AFTER A STORM EVENT, IT IS CLOGGED. WHEN THIS OCCURS, REMOVE ACCUMULATED SEDIMENT AND CLEAN, OR REPLACE GEOTEXTILE AND STONE.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL F-1 REMOVABLE PUMPING STATION

STANDARD SYMBOL: ☒RPS



CONSTRUCTION SPECIFICATIONS

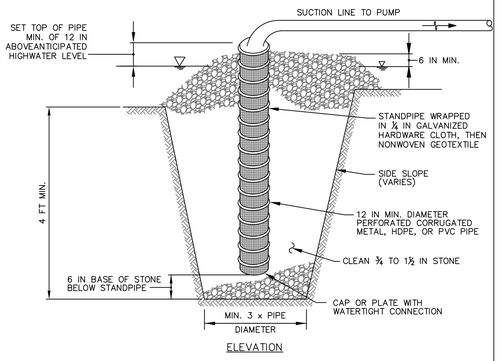
1. USE CORRUGATED METAL OR PLASTIC PIPE WITH 1 INCH DIAMETER PERFORATIONS 6 INCHES ON CENTER.
2. USE A MINIMUM 12 INCH DIAMETER INNER PIPE WITH AN OUTER PIPE A MINIMUM 6 INCHES LARGER IN DIAMETER. BOTTOM OF EACH PIPE MUST BE CAPPED WITH WATERTIGHT SEAL.
3. WRAP EACH PIPE WITH ¼ INCH GALVANIZED HARDWARE CLOTH. ON INNER PIPE WRAP NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H-1 MATERIALS, OVER THE HARDWARE CLOTH.
4. EXCAVATE 8 FEET X 8 FEET X 4 FEET DEEP PIT FOR PIPE PLACEMENT. PLACE CLEAN ¾ TO 1½ INCH STONE OR EQUIVALENT RECYCLED CONCRETE, 6 INCHES IN DEPTH PRIOR TO PIPE PLACEMENT.
5. SET TOP OF INNER AND OUTER PIPES MINIMUM 12 INCHES ABOVE ANTICIPATED WATER SURFACE ELEVATION (OR RISER CREST ELEVATION WHEN DEWATERING A BASIN).
6. BACKFILL PIT AROUND THE OUTER PIPE WITH ¾ TO 1½ INCH CLEAN STONE OR EQUIVALENT RECYCLED CONCRETE AND EXTEND STONE A MINIMUM OF 6 INCHES ABOVE ANTICIPATED WATER SURFACE ELEVATION.
7. DISCHARGE TO A STABLE AREA AT A NONEROSIVE RATE.
8. A REMOVABLE PUMPING STATION REQUIRES FREQUENT MAINTENANCE. IF SYSTEM CLOGS, PULL OUT INNER PIPE AND REPLACE GEOTEXTILE. KEEP POINT OF DISCHARGE FREE OF EROSION.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL F-2 SUMP PIT

STANDARD SYMBOL: ☒SP



CONSTRUCTION SPECIFICATIONS

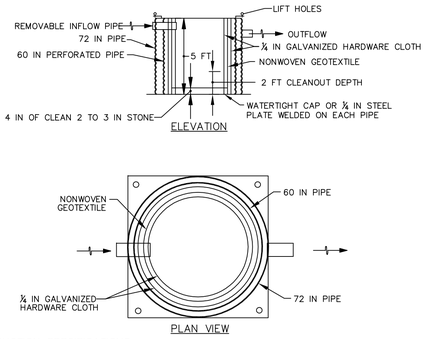
1. USE 12 INCH OR LARGER DIAMETER CORRUGATED METAL, HDPE, OR PVC PIPE WITH 1 INCH DIAMETER PERFORATIONS, 6 INCHES ON CENTER. BOTTOM OF PIPE MUST BE CAPPED WITH WATERTIGHT SEAL.
2. WRAP PIPE WITH ¼ INCH GALVANIZED HARDWARE CLOTH AND WRAP NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H-1 MATERIALS, OVER THE HARDWARE CLOTH.
3. EXCAVATE PIT TO THREE TIMES THE PIPE DIAMETER AND FOUR FEET IN DEPTH. PLACE ¾ TO 1½ INCH STONE OR EQUIVALENT RECYCLED CONCRETE, 6 INCHES IN DEPTH PRIOR TO PIPE PLACEMENT.
4. SET TOP OF PIPE MINIMUM 12 INCHES ABOVE ANTICIPATED WATER SURFACE ELEVATION.
5. BACKFILL PIT AROUND THE PIPE WITH ¾ TO 1½ INCH CLEAN STONE OR EQUIVALENT RECYCLED CONCRETE AND EXTEND STONE A MINIMUM OF 6 INCHES ABOVE ANTICIPATED WATER SURFACE ELEVATION.
6. DISCHARGE TO A STABLE AREA AT A NONEROSIVE RATE.
7. A SUMP PIT REQUIRES FREQUENT MAINTENANCE. IF SYSTEM CLOGS, REMOVE PERFORATED PIPE AND REPLACE GEOTEXTILE AND STONE. KEEP POINT OF DISCHARGE FREE OF EROSION.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL F-3 PORTABLE SEDIMENT TANK

STANDARD SYMBOL: ☒PST



CONSTRUCTION SPECIFICATIONS

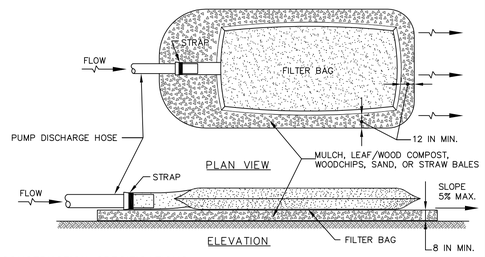
1. PROVIDE 1 CUBIC FOOT OF STORAGE FOR EACH GALLON PER MINUTE OF PUMP CAPACITY. REQUIRED STORAGE VOLUME MAY BE ATTAINED BY PLACEMENT OF TANKS IN PARALLEL WITH INFLOW EVENLY DISTRIBUTED AMONG TANKS. OVERTOPPING OF TANKS IS NOT PERMITTED.
2. USE 60 INCH CORRUGATED METAL OR PLASTIC PIPE WITH 1 INCH DIAMETER PERFORATIONS, 6 INCHES ON CENTER FOR THE INNER PIPE. LINE PIPE WITH NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H-1 MATERIALS, SANDWICHED BETWEEN, AND ATTACHED TO, ¼ INCH HARDWARE CLOTH.
3. OVERLAP GEOTEXTILE 8 INCHES MINIMUM AT VERTICAL SEAM AND AT THE BOTTOM PLATE.
4. ANCHOR GEOTEXTILE AT BOTTOM OF TANK WITH 4 INCHES OF 2 TO 3 INCH CLEAN STONE OR EQUIVALENT RECYCLED CONCRETE.
5. USE 72 INCH CORRUGATED METAL OR PLASTIC OUTER PIPE WITH PERMANENT OUTFLOW PIPE WITH INVERT LOWER THAN INFLOW PIPE
6. INFLOW PIPE MUST DISCHARGE INTO INNER PIPE AND BE REMOVABLE.
7. PLACE TANK ON LEVEL SURFACE AND DISCHARGE TO A STABLE AREA AT A NONEROSIVE RATE.
8. A PORTABLE SEDIMENT TANK REQUIRES FREQUENT MAINTENANCE. REMOVE ACCUMULATED SEDIMENT FROM INNER PIPE WHEN IT REACHES TWO FEET IN DEPTH. IF SYSTEM CLOGS, PULL OUT INNER PIPE, REMOVE ACCUMULATED SEDIMENT, AND REPLACE GEOTEXTILE. KEEP POINT OF DISCHARGE FREE OF EROSION.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL F-4 FILTER BAG

STANDARD SYMBOL: ☒FB



CONSTRUCTION SPECIFICATIONS

1. TIGHTLY SEAL SLEEVE AROUND THE PUMP DISCHARGE HOSE WITH A STRAP OR SIMILAR DEVICE.
2. PLACE FILTER BAG ON SUITABLE BASE (E.G., MULCH, LEAF/WOOD COMPOST, WOODCHIPS, SAND, OR STRAW BALES) LOCATED ON A LEVEL OR 5% MAXIMUM SLOPING SURFACE. DISCHARGE TO A STABILIZED AREA. EXTEND BASE A MINIMUM OF 12 INCHES FROM EDGES OF BAG.
3. CONTROL PUMPING RATE TO PREVENT EXCESSIVE PRESSURE WITHIN THE FILTER BAG IN ACCORDANCE WITH THE MANUFACTURER RECOMMENDATIONS. AS THE BAG FILLS WITH SEDIMENT, REDUCE PUMPING RATE.
4. REMOVE AND PROPERLY DISPOSE OF FILTER BAG UPON COMPLETION OF PUMPING OPERATIONS OR AFTER BAG HAS REACHED CAPACITY, WHICHEVER OCCURS FIRST. SPREAD THE DEWATERED SEDIMENT FROM THE BAG IN AN APPROVED UPLAND AREA AND STABILIZE WITH SEED AND MULCH BY THE END OF THE WORK DAY. RESTORE THE SURFACE AREA BENEATH THE BAG TO ORIGINAL CONDITION UPON REMOVAL OF THE DEVICE.
5. USE NONWOVEN GEOTEXTILE WITH DOUBLE STITCHED SEAMS USING HIGH STRENGTH THREAD. SIZE SLEEVE TO ACCOMMODATE A MAXIMUM 4 INCH DIAMETER PUMP DISCHARGE HOSE. THE BAG MUST BE MANUFACTURED FROM A NONWOVEN GEOTEXTILE THAT MEETS OR EXCEEDS MINIMUM AVERAGE ROLL VALUES (MARV) FOR THE FOLLOWING:

GRAB TENSILE	250 LB	ASTM D-4632
PUNCTURE	150 LB	ASTM D-4833
FLOW RATE	70 GAL/MIN/FT²	ASTM D-4491
PERMITTIVITY (SEC^{-1})	1.2 SEC^{-1}	ASTM D-4491
UV RESISTANCE	70% STRENGTH @ 500 HOURS	ASTM D-4355
APPARENT OPENING SIZE (AOS)	0.15-0.18 MM	ASTM D-4751
SEAM STRENGTH	90%	ASTM D-4632

6. REPLACE FILTER BAG IF BAG CLOGS OR HAS RIPS, TEARS, OR PUNCTURES. DURING OPERATION KEEP CONNECTION BETWEEN PUMP HOSE AND FILTER BAG WATER TIGHT. REPLACE BEDDING IF IT BECOMES DISPLACED.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

MDE NO. 13-SF-0255
NOTE TO CONTRACTOR:
EROSION AND SEDIMENT CONTROL SHALL BE STRICTLY ENFORCED
FOR EROSION AND SEDIMENT CONTROL ONLY.

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE: EROSION AND SEDIMENT CONTROL DETAILS IV
SCALE:
DATE: 07/03/2013

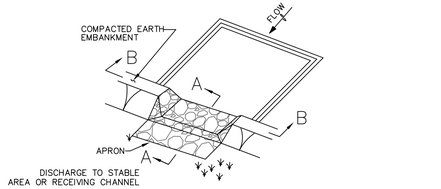
CONTRACT NO.: N/A
SHEET NO.: C-064

PLOT DATE: Jul 03, 2013 - 12:27pm
DRAWING NAME: S:\03-Projects\Commercial\UMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112C03834-C08X-ESDetailsSpecs.dwg

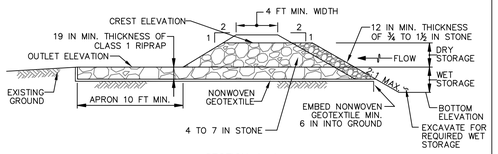
DETAIL G-1-2 STONE/RIPRAP OUTLET SEDIMENT TRAP ST-II

STANDARD SYMBOL: ST-II

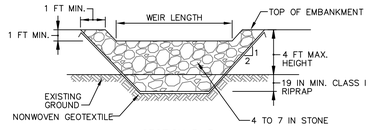
MAXIMUM DRAINAGE AREA = 10 ACRES



ISOMETRIC VIEW



SECTION A–A



SECTION B–B

1 OF 3

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL G-1-2 STONE/RIPRAP OUTLET SEDIMENT TRAP ST-II

STANDARD SYMBOL: ST-II

CONSTRUCTION SPECIFICATIONS

1. CONSTRUCT TRAP IN SUCH A MANNER THAT EROSION AND WATER POLLUTION ARE AVOIDED.
2. CLEAR, GRUB, AND STRIP ANY VEGETATION AND ROOT MAT FROM THE AREA UNDER THE EMBANKMENT AND TRAP BOTTOM.
3. USE FILL MATERIAL FREE OF ROOTS, WOODY VEGETATION, OVERSIZED STONES, ROCKS, ORGANIC MATERIAL, OR OTHER OBJECTIONABLE MATERIAL FOR THE EMBANKMENT.
4. CONSTRUCT TOP OF EMBANKMENT 1 FOOT MINIMUM ABOVE WEIR CREST. COMPACT THE EMBANKMENT BY TRAVERSING WITH EQUIPMENT WHILE IT IS BEING CONSTRUCTED.
5. MAKE ALL CUT AND FILL SLOPES 2:1 OR FLATTER.
6. PLACE NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H–1 MATERIALS, OVER THE BOTTOM AND SIDES OF OUTLET AND APRON PRIOR TO PLACEMENT OF RIPRAP. OVERLAP SECTIONS OF GEOTEXTILE AT LEAST 1 FOOT WITH THE SECTION NEARER TO THE TRAP PLACED ON TOP. EMBED GEOTEXTILE AT LEAST 6 INCHES INTO EXISTING GROUND AT ENTRANCE OF OUTLET CHANNEL.
7. USE CLEAN 4 TO 7 INCH RIPRAP TO CONSTRUCT THE WEIR. USE CLASS I RIPRAP FOR THE APRON. USE OF RECYCLED CONCRETE EQUIVALENT IS ACCEPTABLE.
8. PLACE 1 FOOT OF CLEAN ¾ TO 1½ INCH STONE OR EQUIVALENT RECYCLED CONCRETE ON THE UPSTREAM FACE OF THE WEIR.
9. CONSTRUCT AND MAINTAIN THE OUTLET ACCORDING TO APPROVED PLAN, AND IN SUCH A MANNER THAT EROSION AT OR BELOW THE OUTLET DOES NOT OCCUR.
10. STABILIZE THE EMBANKMENT AND INTERIOR SLOPES WITH SEED AND MULCH. STABILIZE POINTS OF CONCENTRATED INFLOW AS SHOWN ON APPROVED PLAN.
11. REMOVE SEDIMENT AND RESTORE TRAP TO ORIGINAL DIMENSIONS WHEN SEDIMENT HAS ACCUMULATED TO CLEANOUT ELEVATION (50% OF WET STORAGE DEPTH). DEPOSIT REMOVED SEDIMENT IN AN APPROVED AREA AND IN SUCH A MANNER THAT IT WILL NOT ERODE. KEEP POINTS OF INFLOW AND OUTFLOW AS WELL AS INTERIOR OF THE TRAP FREE FROM EROSION, AND REMOVE ACCUMULATED DEBRIS. MAINTAIN EMBANKMENTS TO CONTINUOUSLY MEET REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT IN ACCORDANCE WITH SECTION B–4 VEGETATIVE STABILIZATION. REMOVE ANY TREES, BRUSH, OR OTHER WOODY VEGETATION GROWING ON EMBANKMENT OR NEAR PRINCIPAL SPILLWAY. MAINTAIN LINE, GRADE, AND CROSS SECTION.
12. WHEN DEWATERING TRAP, PASS REMOVED WATER THROUGH AN APPROVED SEDIMENT CONTROL PRACTICE.
13. UPON REMOVAL, GRADE AND STABILIZE THE AREA OCCUPIED BY TRAP.

2 OF 3

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL G-1-2 STONE/RIPRAP OUTLET SEDIMENT TRAP ST-II

STANDARD SYMBOL: ST-II

STONE/RIPRAP OUTLET SEDIMENT TRAP ST–II, TRAP NO. _____		
DRAINAGE AREA – INITIAL	1.3	ACRES
DRAINAGE AREA – INTERIM	1.0	ACRES
DRAINAGE AREA – FINAL	0.7	ACRES
TOTAL STORAGE REQUIRED	4,680	CF
TOTAL STORAGE PROVIDED	5,960	CF
WET STORAGE REQUIRED	2,340	CF
WET STORAGE PROVIDED	3,560	CF
DRY STORAGE REQUIRED	2,340	CF
DRY STORAGE PROVIDED	2,400	CF
EXISTING GROUND ELEVATION AT OUTLET (WET STORAGE ELEVATION)	14.5	FT
TRAP BOTTOM ELEVATION	12.5	FT
TRAP BOTTOM DIMENSIONS	70 x 20	FT x FT
WEIR LENGTH	8	FT
WEIR CREST (DRY STORAGE) ELEVATION	15.5	FT
CLEANOUT ELEVATION	13.5	FT
TOP OF EMBANKMENT ELEVATION	16.5	FT
SIDE SLOPE	2:1	H:V RATIO
EMBANKMENT TOP WIDTH	4	FT
OUTLET PROTECTION – LENGTH	10	FT
OUTLET PROTECTION – DEPTH	19	IN

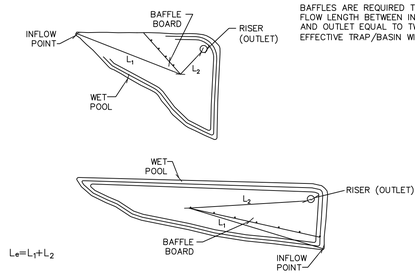
3 OF 3

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

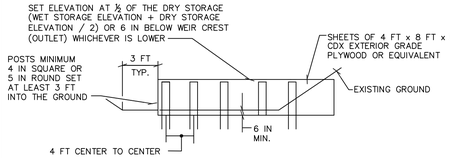
DETAIL G-2-4 BAFFLE BOARDS

STANDARD SYMBOL: BB



BAFFLES ARE REQUIRED TO PROVIDE A FLOW LENGTH BETWEEN INFLOW POINT AND OUTLET EQUAL TO TWICE THE EFFECTIVE TRAP/BASIN WIDTH.

PLAN VIEWS



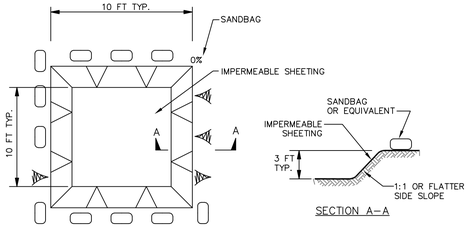
BAFFLE DETAIL

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL H-6 ONSITE CONCRETE WASHOUT STRUCTURE

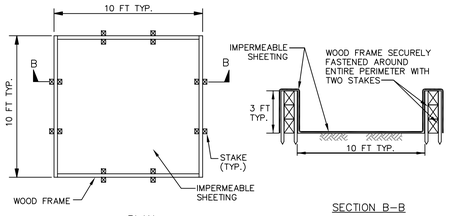
STANDARD SYMBOL: CWS



PLAN

SECTION A–A

EXCAVATED WASHOUT STRUCTURE



PLAN

SECTION B–B

WASHOUT STRUCTURE WITH WOOD PLANKS

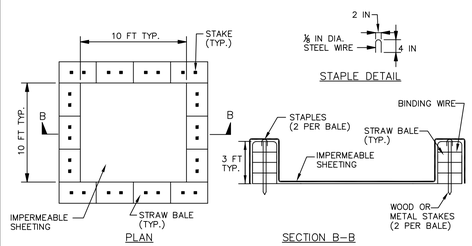
1 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL H-6 ONSITE CONCRETE WASHOUT STRUCTURE

STANDARD SYMBOL: CWS



PLAN

SECTION B–B

NOTE: CAN BE TWO STACKED BALES OR PARTIALLY EXCAVATED TO REACH 3 FT DEPTH

WASHOUT STRUCTURE WITH STRAW BALES

CONSTRUCTION SPECIFICATIONS

1. LOCATE WASHOUT STRUCTURE A MINIMUM OF 50 FEET AWAY FROM OPEN CHANNELS, STORM DRAIN INLETS, SENSITIVE AREAS, WETLANDS, BUFFERS AND WATER COURSES AND AWAY FROM CONSTRUCTION TRAFFIC.
2. SIZE WASHOUT STRUCTURE FOR VOLUME NECESSARY TO CONTAIN WASH WATER AND SOLIDS AND MAINTAIN AT LEAST 4 INCHES OF FREEBOARD. TYPICAL DIMENSIONS ARE 10 FEET X 10 FEET X 3 FEET DEEP.
3. PREPARE SOIL BASE FREE OF ROCKS OR OTHER DEBRIS THAT MAY CAUSE TEARS OR HOLES IN THE LINER. FOR LINER, USE 10 MIL OR THICKER UV RESISTANT, IMPERMEABLE SHEETING, FREE OF HOLES AND TEARS OR OTHER DEFECTS THAT COMPROMISE IMPERMEABILITY OF THE MATERIAL.
4. PROVIDE A SIGN FOR THE WASHOUT IN CLOSE PROXIMITY TO THE FACILITY.
5. KEEP CONCRETE WASHOUT STRUCTURE WATER TIGHT. REPLACE IMPERMEABLE LINER IF DAMAGED (E.G., RIPPED OR PUNCTURED). EMPTY OR REPLACE WASHOUT STRUCTURE THAT IS 75 PERCENT FULL, AND DISPOSE OF ACCUMULATED MATERIAL PROPERLY. DO NOT REUSE PLASTIC LINER. WET–VACUUM STORED LIQUIDS THAT HAVE NOT EVAPORATED AND DISPOSE OF IN AN APPROVED MANNER. PRIOR TO FORECASTED RAINSTORMS, REMOVE LIQUIDS OR COVER STRUCTURE TO PREVENT OVERFLOWS. REMOVE HARDENED SOLIDS, WHOLE OR BROKEN UP, FOR DISPOSAL OR RECYCLING. MAINTAIN RUNOFF DIVERSION AROUND EXCAVATED WASHOUT STRUCTURE UNTIL STRUCTURE IS REMOVED.

2 OF 2

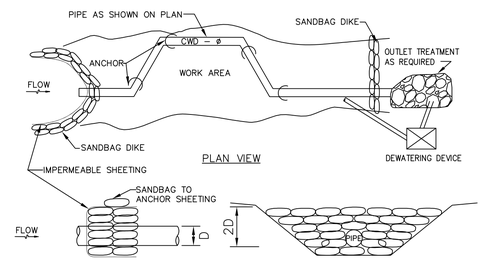
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL C-6 CLEAR WATER DIVERSION PIPE

STANDARD SYMBOL: CWD – 12

DESIGNATION CWD–12 REFERS TO 12 INCH CLEAR WATER DIVERSION.



PLAN VIEW

PROFILE OF SANDBAGS

SECTION THROUGH SANDBAGS

CONSTRUCTION SPECIFICATIONS

1. FLEXIBLE PIPE IS PREFERRED. HOWEVER, CORRUGATED METAL PIPE OR EQUIVALENT PVC PIPE CAN BE USED. MAKE ALL JOINTS WATERTIGHT.
2. FOR SANDBAGS USE MATERIALS THAT ARE RESISTANT TO ULTRA–VOLENT RADIATION, TEARING, AND PUNCTURE AND WOVEN TIGHTLY ENOUGH TO PREVENT LEAKAGE OF FILL MATERIAL.
3. USE 10 MIL OR THICKER, UV RESISTANT, IMPERMEABLE SHEETING OR OTHER APPROVED MATERIAL THAT IS IMPERMEABLE AND RESISTANT TO PUNTURING AND TEARING.
4. PLACE IMPERMEABLE SHEETING SUCH THAT UPGRADE PORTION OVERLAPS DOWNGRADE PORTION BY A MINIMUM OF 18 INCHES.
5. SET HEIGHT OF SANDBAG DIKE AT TWICE THE PIPE DIAMETER. MAINTAIN HEIGHT ALONG LENGTH OF SANDBAG DIKE. PLACE DOUBLE ROW OF SANDBAGS.
6. AT A MINIMUM, SECURELY ANCHOR DIVERSION PIPE AT EACH DOWNGRADE JOINT.
7. SET OUTLET END OF DIVERSION PIPE LOWER THAN INLET END.
8. PROVIDE OUTLET PROTECTION AS REQUIRED ON APPROVED PLAN.
9. DEWATER WORK AREA USING AN APPROVED EROSION AND SEDIMENT CONTROL PRACTICE AS SPECIFIED ON APPROVED PLAN.
10. KEEP POINT OF DISCHARGE FREE OF EROSION. MAINTAIN WATER TIGHT CONNECTIONS AND POSITIVE DRAINAGE. REPLACE SANDBAGS AND IMPERMEABLE SHEETING IF TORN.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

MDE NO. 13-SF-0255
NOTE TO CONTRACTOR:
EROSION AND SEDIMENT CONTROL SHALL BE STRICTLY ENFORCED
FOR EROSION AND SEDIMENT CONTROL ONLY.

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE: EROSION AND SEDIMENT CONTROL DETAILS V
SCALE:
DATE: 07/03/2013
CONTRACT NO.: N/A
SHEET NO.: C-065

PLOT DATE: Jul 03, 2013 - 12:28pm
DRAWING NAME: S:\03-Projects\Commercial\UMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112C03834-C06X-ESDetailsSpecs.dwg

ITEM 903 SEEDING

DESCRIPTION

903–1.1 GENERAL. This item provides specifications for seeding of areas as designated on plans or as directed by the MAA Engineer. The species, mixtures, and methods of application provided in this item have been designed to reduce the attractiveness of airport grounds to wildlife. Only MAA–approved species, mixtures, and rates of application provided in this item may be used to establish vegetation. All activities associated with seeding including soil preparation, seed application, fertilization, and maintenance shall also conform to these approved standards.

MATERIALS

903–2.1 SEED. All seed shall comply with the Maryland Seed Law (Agricultural Article of the Annotated Code of Maryland). Only MAA–approved species, mixtures, and rates of application provided in this item may be used to establish vegetation. Seed will be sampled and tested by an inspector from the Turf and Seed Section, Maryland Department of Agriculture (MDA), Annapolis, Maryland. All lawn and turf seed and mixtures shall be free from the following state–listed restricted noxious weeds:

corn cockle (Agrostemma githago),
bentgrass (Agrostis spp.),[1]
redtop (Agrostis gigantea),[1]
wild onion (Allium canadense),
wild garlic (Allium vineale),
bindweed (Calstegia spp.),
dodder (Cuscuta spp.),
Bermuda grass (Cynodon dactylon),
orchardgrass (Dactylis glomerata),
tall fescue (Festuca arundinacea),[1]
meadow fescue (Festuca pratensis),[1]
velvetgrass (Holcus lanatus),
annual bluegrass (Poa annua),
rough bluegrass (Poa trivialis),[1]
timothy (Phleum pratense), and
Johnson grass (Sorgum halepense).

[1] THESE SPECIES MAY BE INCLUDED AS A LABELED COMPONENT OF A MIXTURE WHEN EACH IS PRESENT IN EXCESS OF FIVE PERCENT OF THE MIXTURE BY WEIGHT.

Restricted noxious–weed seed may not exceed 0.5 percent by weight of any seed mixture. In addition, all seeds sold in Maryland shall be free from the following listed prohibited noxious weeds: balloonvine (Cardiospermum halicacabum), quackgrass (Elytrigia repens), sicklepod (Senna obtusifolia), sorghum (Sorghum spp.), Canada thistle (Cirsium arvense), plumeless thistle (Carduus spp.–includes musk thistle and curled thistle), and serrated tussock (Nassella trichotoma).

903–2.1.1 APPROVED SPECIES. The following table contains species that are approved by MAA for use in seed mixtures. Purity requirements and germination requirements are also provided.

APPROVED PLANT SPECIES
MAA SEED MIXTURES

	PURITY[a] NOT LESS THAN %	MINIMUM % GERMINATION	PURE LIVE SEED FACTOR
CERTIFIED TURF–TYPE TALL FESCUE (Festuca arundinacea)	98	90	1.13
CERTIFIED KENTUCKY BLUE GRASS (Poa pratensis)	90	80	1.39
FOWL BLUEGRASS (Poa Palustris)	90	80	1.39
HARD FESCUE (Festuca longifolia)	98	90	1.13
CHEWING RED FESCUE (Festuca rubra commutata)	98	90	1.13
ANNUAL RYEGRASS (Lolium multiflorum)	95	85	1.24
PERENNIAL RYEGRASS (Lolium perenne)	90	80	1.37
CREEPING BENTGRASS (Agrostis Stolonifera)	90	80	1.39
SWITCHGRASS (Pancium Virgatum)	90	80	1.39
LITTLE BLUESTEM (Andropogon scoparius)	62	94	1.71

a THE PERCENTAGE WEIGHT OF PURE SEED PRESENT SHALL BE FREE OF ANY AGRICULTURE SEEDS, INERT MATTER, AND OTHER SEEDS DSTINGUISHABLE BY THEIR PERCENTAGE.
b THE PERCENTAGE OF GERMINATION SHALL BE ACTUAL SPROUTS AND SHALL NOT INCLUDE HARD SEEDS UNLESS SOECIFICALLY PERMITTED BY THE MAA ENGINEER.

903–2.1.2 PURITY. All seed shall be free of all state–designated noxious weeds listed in Paragraph 2.1.1 and conform to MAA specifications. To ensure compliance, MAA requires sampling and testing of seed by the Turf and Seed Section, Maryland Department of Agriculture (MDA). The Contractor shall furnish the MAA Engineer with duplicate signed copies of a statement by the Turf and Seed Section certifying that each lot of seed has been laboratory tested within six months of date of delivery. This statement shall include the following information:

name and address of laboratory,
date of test,
lot number,
the results of tests as to name, percentages of purity and of germination,
percentage of weed content for the seed furnished,
and, in the case of a mixture, the proportions of each kind of seed.

Seed shall be furnished in standard containers with the seed name, lot number, net weight, percentages of purity, germination rate and hard seed, and percentage of maximum weed seed content clearly marked. All seed containers shall be tagged with a MDA supervised mix program seed tag.

903–2.1.3 MIXTURES AND APPLICATION RATES. Only seed mixtures and application rates described in this item may be used unless otherwise approved by the MAA Engineer. Seed mixtures shall meet criteria detailed in Paragraph 903–2.1.2. Seed mixtures have been formulated to minimize the attractiveness of areas to wildlife of common landscape scenarios. The appropriate seed mixture for application will be designated based on environmental conditions and may vary from site to site. All planting rates listed are in pounds of Pure Live Seed (PLS) per acre.

Seed mixtures, application scenarios, and rates for permanent cool–season grasses are as follows:

a. Seed Mixture No. 1 – relatively flat areas (grade less than 4:1) subject to normal conditions and regular mowing (Application rate = 234 lbs PLS/acre);
b. Seed Mixture No. 2 – sloped areas (grade greater than 4:1) not subject to regular mowing (Application rate = 115 lbs PLS/acre); and
c. Seed Mixture No. 3 – wetlands and their associated buffer zones (Application rate = 131 lbs PLS/acre).

Seed Mixture No. 1: Relatively flat areas regularly mowed and exposed to normal conditions (Application rate = 234 lbs PLS/acre)

Seed		Rate of Application (lbs of PLS/acre)
85%	Certified Turf–Type Tall Fescue	192
10%	Certified Kentucky Bluegrass	28
5%	Perennial Ryegrass	14
Supplemental Seed		
Annual Ryegrass		25

Seed Mixture No. 2: Sloped areas not subject to regular mowing (Application rate = 115 lbs PLS/acre)

Seed		Rate of Application (lbs of PLS/acre)
75%	Hard Fescue	85
20%	Chewings Fescue	23
5%	Kentucky Bluegrass	7
Supplemental Seed		
Redtop		3

Seed Mixture No. 3: Wetland areas and their associated buffer zones (Application rate = 131 lbs PLS/acre)

Seed		Rate of Application (lbs of PLS/acre)
60%	Creeping Bentgrass	83
30%	Fowl Bluegrass	34
10%	Switchgrass	14
Supplemental Seed		
Redtop		3

903–2.1.4 SEEDING SEASONS. Application of seed and seed mixtures shall occur within a specified seeding season unless otherwise approved by the MAA Engineer. No seed or seed mixtures are to be applied on frozen ground or when the temperature is at or below 35 degrees Farenheit (7.2 degrees Centigrade). Under these conditions, a layer of mulch should be applied in accordance with Item 905, Mulching, to stabilize the site, and permanent seeding should occur in the subsequent seeding season. Seed application may occur during the seeding season dates listed below. Seeding performed after October 20 should be a temporary cover of annual ryegrass and followed by overseeding of the appropriate seed mixture during the spring seeding season.

SEEDING SEASONS

PERMANENT COOL–SEASON GRASSES	MARCH 1 TO APRIL 20 AND AUGUST 1 TO OCTOBER 20, INLCUSIVE.
TEMPORARY COVER OF ANNUAL RYE/REDTOP	MARCH 1 TO APRIL 30 AND AUGUST 1 TO NOVEMBER 30, INCLUSIVE.
TEMPORARY COVER OF WARM–SEASON GRASSES (LITTLE BLUESTEM ONLY)	MAY 1 TO JULY 31, INCLUSIVE. RATE OF APPLICATION SHOULD BE 13.6 LBS. PLS PER ACRE.

Seeding seasons are based on typical years and can be subject to variation, which may be modified by the MAA Engineer based on seasonal trends.

If the time required to complete any of the operations necessary under this item, within the specified planting season or any authorized extensions thereof, extends beyond the Contract period, then such time will be charged against the Contract time, and liquidated damages will be enforced with respect to this portion of work.

903–2.2 LIME. Lime shall consist of ground limestone and contain at least 85 percent total carbonates. Lime shall be ground to a fineness so that at least 90 percent will pass through a No. 20 mesh sieve and 50 percent will pass through a No. 100 mesh sieve. Dolomitic lime or a high magnesium lime shall contain at least 10 percent magnesium oxide. Lime shall be applied by approved methods detailed in Section 903–3.3 of this item. The rate of application will be based on results of soil tests.

903–2.3 FERTILIZER. Fertilizer shall be standard commercial fertilizer (supplied separately or in mixtures) and meet the requirements of applicable state and federal laws (O–F–241) as well as standards of the Association of Official Agricultural Chemists. Nitrogen–Phosphorus–Potassium (N–P–K) concentrations shall be determined from analysis of soil samples. Methods of fertilizer application shall conform to standards described in Section 903–3.3 of this item. Fertilizer shall be furnished in standard containers that are clearly labeled with name, weight, and guaranteed analysis of the contents (percentage of total nitrogen, available phosphoric acid, and water–soluble potash). Mixed fertilizers shall not contain any hydrated lime or cyanamide compounds. Fertilizers failing to meet the specified analysis may be approved by the MAA Engineer, providing sufficient materials are applied to conform with the specified nutrients per unit of measure without additional cost to MAA.

The fertilizers may be supplied in the following forms:

a. A dry, free–flowing fertilizer suitable for application by a common fertilizer spreader;

b. A finely ground fertilizer soluble in water, suitable for application by power sprayers; or

c. A granular or pellet form suitable for application by blower equipment.

The rate of application will be based on results of soil tests performed by the University of Maryland Soil Testing Laboratory. By law, persons applying fertilizer to State–owned land shall follow the recommendations of the University of Maryland as set forth in the "Plant Nutrient Recommendations Based on Soil Tests for Turf Maintenance" and the "Plant Nutrient Recommendations Based on Soil Tests for Sod Production" (see Appendix B). Application of the fertilizer shall be in a manner that is consistent with the recommendations of the University of Maryland Cooperative Extension.

CONSTRUCTION METHODS AND EQUIPMENT

903–3.1 GENERAL. This section provides approved methods for the application of and includes standards for seedbed preparation, methods of application, and equipment to be used during the process. Lime and fertilizer shall be applied to seeded areas before the seed is spread. The mixture of seed will be determined for sites based on environmental conditions as described in Paragraph 903–2.1.3.

903–3.2 ADVANCE PREPARATION. Areas designated for seeding shall be properly prepared in advance of seed application. The area shall be tilled and graded prior to application of lime and fertilizer, and the surface area shall be cleared of any stones larger than 1 inch in diameter, sticks, stumps, and other debris that might interfere with sowing of seed, growth of grasses, or subsequent maintenance of grass–covered areas. Damage caused by erosion or other forces that occur after the completion of grading shall be repaired prior to the application of fertilizer and lime. The Contractor will repair such damage, which may include filling gullies, smoothing irregularities, and repairing other incidental damage before beginning the application of fertilizer and ground limestone.

If an area to be seeded is sparsely sodded, weedy, barren and unworked, or packed and hard, all grass and weeds shall first be cut or otherwise satisfactorily disposed of, and the soil then scarified or otherwise loosened to a depth not less than 5 inches (125 mm). Clods shall be broken and the top 3 inches (75 mm) of soil shall be worked into a satisfactory condition by discing or by use of cultipackers, rollers, drags, harrows, or other appropriate means.

An area to be seeded shall be considered a satisfactory seedbed (without requiring additional treatment) if it has recently been thoroughly loosened and worked to a depth of not less than 5 inches; the top 3 inches of soil is loose, friable, and is reasonably free from large clods, rocks, large roots, or other undesirable matter; appropriate amounts of fertilizer and lime have been added; and, if it has been shaped to the required grade immediately prior to seeding. For slope areas steeper than 3:1 (three horizontal to one vertical), the subsoil shall be loose to a depth of 1 inch.

After completion of tilling and grading, lime and fertilizer shall be applied within 48 hours according to the specified rate (Paragraphs 903–2.2 and 2.3) and methods (Paragraphs 903–3.3.1 and 903–3.3.2) approved by MAA. The seeding mixture shall be applied within 48 hours after application of lime and fertilizer. To firm the seeded areas, cultipacking shall occur immediately after seeding.

903–3.3 METHODS OF APPLICATION. Lime, fertilizer, and seed mixes shall be applied by either the dry or wet application methods that have been approved by MAA and are detailed below.

903–3.3.1 DRY APPLICATION METHOD

a. Liming. If soil test results indicate that lime is needed, the following procedures will be used: following advance preparation of the seedbed, lime shall be applied prior to the application of any fertilizer or seed and only on seedbeds that have been prepared as described in paragraph 903–3.2. The lime shall be uniformly spread and worked into the top 2 inches of soil, after which the seedbed shall be properly graded again.

b. Fertilizing. Following advance preparations (and liming if necessary), fertilizer shall be spread uniformly at the specified rate to provide no less than the minimum quantity stated in Paragraph 903–2.3.

c. Seeding. Seed mixtures shall be sown immediately after fertilization of the seedbed. The fertilizer and seed shall be lightly raked to a depth of 1 inch for newly graded and disturbed areas.

d. Rolling. After the seed has been properly covered, the seedbed shall be immediately compacted using a cultipacker or an approved lawnroller.

903–3.3.2 WET APPLICATION METHOD/HYDROSEEDING

A. GENERAL. THE CONTRACTOR MAY ELECT TO APPLY SEED AND FERTILIZER AS PER PARAGRAPHS C AND D OF THIS SECTION IN THE FORM OF AN AQUEOUS MIXTURE BY SPRAYING OVER THE PREVIOUSLY PREPARED SEEDBED USING METHODS AND EQUIPMENT APPROVED BY MAA. THE RATES OF APPLICATION SHALL BE AS SPECIFIED IN PARAGRAPHS 903–2.1 THROUGH 903–2.3.

B. SPRAYING EQUIPMENT. THE SPRAYING EQUIPMENT SHALL HAVE A CONTAINER OR WATER TANK EQUIPPED WITH A LIQUID LEVEL GAUGE CAPABLE OF READING INCREMENTS OF 50 GALLONS OR LESS OVER THE ENTIRE RANGE OF THE TANK CAPACITY. THE LIQUID LEVEL GAUGE SHALL BE MOUNTED SO AS TO BE VISIBLE TO THE NOZZLE OPERATOR AT ALL TIMES. THE CONTAINER OR TANK SHALL ALSO BE EQUIPPED WITH A MECHANICAL POWER–DRIVEN AGITATOR CAPABLE OF KEEPING ALL THE SOLIDS IN THE MIXTURE IN COMPLETE SUSPENSION AT ALL TIMES UNTIL USED.

THE SPRAYING EQUIPMENT SHALL ALSO INCLUDE A PRESSURE PUMP CAPABLE OF DELIVERING 100 GALLONS PER MINUTE AT A PRESSURE OF 100 POUNDS PER SQUARE INCH. THE PRESSURE PUMP ASSEMBLAGE SHALL BE CONFIGURED TO ALLOW THE MIXTURE TO FLOW THROUGH THE TANK WHEN NOT BEING SPRAYED FROM THE NOZZLE. ALL PUMP PASSAGES AND PIPELINES SHALL BE CAPABLE OF PROVIDING CLEARANCE FOR 5/8–INCH SOLIDS. THE POWER UNIT FOR THE PUMP AND AGITATOR SHALL HAVE CONTROLS MOUNTED SO AS TO BE ACCESSIBLE TO THE NOZZLE OPERATOR. A PRESSURE GAUGE SHALL BE CONNECTED TO AND MOUNTED IMMEDIATELY BEHIND THE NOZZLE.

THE NOZZLE PIPE SHALL BE MOUNTED ON AN ELEVATED SUPPORTING STAND IN SUCH A MANNER THAT IT CAN BE ROTATED THROUGH 360 DEGREES HORIZONTALLY AND INCLINED VERTICALLY FROM AT LEAST 20 DEGREES BELOW TO AT LEAST 60 DEGREES ABOVE THE HORIZONTAL. THERE SHALL BE A QUICK–ACTING, THREE–WAY CONTROL VALVE CONNECTING THE RECIRCULATING LINE TO THE NOZZLE PIPE AND MOUNTED SO THAT THE NOZZLE OPERATOR CAN CONTROL AND REGULATE THE AMOUNT OF FLOW OF MIXTURE TO BE SUPPLIED SO THAT MIXTURES MAY BE PROPERLY SPRAYED OVER A DISTANCE VARYING FROM 20 FEET TO 100 FEET. ONE SHALL BE A CLOSE–RANGE RIBBON NOZZLE, ONE A MEDIUM–RANGE RIBBON NOZZLE, AND ONE A LONG–RANGE JET NOZZLE. FOR EASE OF REMOVAL AND CLEANING, ALL NOZZLES SHALL BE CONNECTED TO THE NOZZLE PIPE BY MEANS OF QUICK–RELEASE COUPLINGS. IN ORDER TO REACH AREAS INACCESSIBLE TO THE REGULAR EQUIPMENT, AN EXTENSION HOSE AT LEAST 50 FEET IN LENGTH SHALL BE PROVIDED TO WHICH THE NOZZLES MAY BE CONNECTED.

C. MIXTURES. LIME SHALL BE APPLIED SEPARATELY IN THE QUANTITY SPECIFIED, PRIOR TO THE FERTILIZING AND SEEDING OPERATIONS. LIME SHOULD BE ADDED TO AND MIXED WITH WATER AT A CONCENTRATION NOT TO EXCEED 220 POUNDS OF LIME FOR EVERY 100 GALLONS OF WATER. AFTER LIME HAS BEEN APPLIED, THE TANK SHOULD BE EMPTIED AND RINSED WITH FRESH WATER. SEED AND FERTILIZER SHALL BE MIXED TOGETHER IN THE RELATIVE PROPORTIONS SPECIFIED, BUT THE RESULTING CONCENTRATION SHOULD NOT EXCEED 220 POUNDS OF MIXTURE PER 100 GALLONS OF WATER AND SHOULD BE APPLIED WITHIN 30 MINUTES TO PREVENT FERTILIZER BURN OF THE SEEDS.

ALL WATER USED SHALL BE OBTAINED FROM FRESH WATER SOURCES AND SHALL BE FREE FROM INJURIOUS CHEMICALS AND OTHER TOXIC SUBSTANCES HARMFUL TO PLANT LIFE. BRACKISH WATER SHALL NOT BE USED AT ANY TIME. THE CONTRACTOR SHALL IDENTIFY ALL SOURCES OF WATER TO THE MAA ENGINEER AT LEAST TWO WEEKS PRIOR TO USE. THE ENGINEER MAY TAKE SAMPLES OF THE WATER AT THE SOURCE OR FROM THE TANK AT ANY TIME AND HAVE A LABORATORY TEST THE SAMPLES FOR CHEMICAL AND SALINE CONTENT. THE CONTRACTOR SHALL NOT USE ANY WATER FROM ANY SOURCE THAT IS DISAPPROVED BY THE ENGINEER FOLLOWING SUCH TESTS.

ALL MIXTURES SHALL BE CONSTANTLY AGITATED FROM THE TIME THEY ARE MIXED UNTIL THEY ARE FINALLY APPLIED TO THE SEEDBED. ALL SUCH MIXTURES SHALL BE USED WITHIN 30 MINUTES FROM THE TIME THEY WERE MIXED OR THEY SHALL BE WASTED AND DISPOSED OF AT A LOCATION ACCEPTABLE TO THE ENGINEER.

D. SPRAYING. LIME SHALL BE SPRAYED UPON PREVIOUSLY PREPARED SEEDBEDS ON WHICH THE LIME, IF REQUIRED, SHALL HAVE BEEN WORKED IN ALREADY. THE MIXTURES SHALL BE APPLIED USING A HIGH–PRESSURE SPRAY WHICH SHALL ALWAYS BE DIRECTED UPWARD INTO THE AIR SO THAT THE MIXTURES WILL FALL TO THE GROUND IN A UNIFORM SPRAY. NOZZLES OR SPRAYS SHALL NEVER BE DIRECTED TOWARD THE GROUND IN SUCH A MANNER THAT MIGHT PRODUCE EROSION OR RUNOFF. PARTICULAR CARE SHALL BE EXERCISED TO ENSURE THAT THE APPLICATION IS MADE UNIFORMLY, AT THE PRESCRIBED RATE, AND TO GUARD AGAINST MISSES AND OVERLAPPED AREAS. PREDETERMINED QUANTITIES OF THE MIXTURE SHALL BE USED IN ACCORDANCE WITH SPECIFICATIONS TO COVER SPECIFIED SECTIONS OF KNOWN AREAS. TO CHECKS THE RATE AND UNIFORMITY OF APPLICATION, THE APPLICATOR WILL OBSERVE THE DEGREE OF WETTING OF THE GROUND OR DISTRIBUTE TEST SHEETS OF PAPER OR PANS OVER THE AREA AT INTERVALS AND OBSERVE THE QUANTITY OF MATERIAL DEPOSITED THEREON.

ON SURFACES THAT ARE TO BE MULCHED AS INDICATED BY THE PLANS OR DESIGNATED BY THE MAA ENGINEER, SEED AND FERTILIZER APPLIED BY THE SPRAY METHOD NEED NOT BE RAKED INTO THE SOIL OR ROLLED. HOWEVER, ON SURFACES ON WHICH MULCH IS NOT TO BE USED, THE RAKING AND ROLLING OPERATIONS WILL BE REQUIRED AFTER THE SOIL HAS DRIED.

903–3.4 MAINTENANCE OF SEEDED AREAS. THE CONTRACTOR SHALL PROTECT SEEDED AREAS AGAINST TRAFFIC OR OTHER USE BY WARNING SIGNS OR BARRICADES, AS APPROVED BY THE ENGINEER. SURFACES GULLIED OR OTHERWISE DAMAGED FOLLOWING SEEDING SHALL BE REPAIRED BY REGRADING AND RESEEDING AS DIRECTED. THE CONTRACTOR SHALL MOW, WATER AS DIRECTED, AND OTHERWISE MAINTAIN SEEDED AREAS IN A SATISFACTORY CONDITION UNTIL FINAL INSPECTION AND ACCEPTANCE OF THE WORK.

WHEN EITHER THE DRY OR WET APPLICATION METHOD OUTLINED ABOVE IS USED FOR WORK PERFORMED OUT OF SEASON, THE CONTRACTOR WILL BE REQUIRED TO ESTABLISH A GOOD STAND OF GRASS OF UNIFORM COLOR AND DENSITY TO THE SATISFACTION OF THE ENGINEER. IF AT THE TIME WHEN THE CONTRACT HAS BEEN OTHERWISE COMPLETED IT IS NOT POSSIBLE TO MAKE AN ADEQUATE DETERMINATION OF THE COLOR, DENSITY, AND UNIFORMITY OF SUCH STAND OF GRASS, PAYMENT FOR THE UNACCEPTED PORTIONS OF THE AREAS SEEDED OUT OF SEASON WILL BE WITHHELD UNTIL SUCH TIME AS THESE REQUIREMENTS HAVE BEEN MET.

MDE NO. 13–SF–0255
NOTE TO CONTRACTOR:
EROSION AND SEDIMENT CONTROL SHALL BE STRICTLY ENFORCED
FOR EROSION AND SEDIMENT CONTROL ONLY.

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ___

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION
OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE: EROSION AND SEDIMENT CONTROL VEGETATIVE STABILIZATION SPECIFICATIONS
SCALE:
DATE: 07/03/2013
CONTRACT NO.: N/A
SHEET NO.: C–066

PLOT DATE: Jul 03, 2013 - 12:28pm
DRAWING NAME: S:\03-Projects\Commercial\UMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112IC03834-COBX-ESDetailsSpecs.dwg

RE-ALIGN FENCE (SEE SITE PLANS)

REMOVE GATE/FENCE (SEE SITE PLAN FOR REPLACEMENT)

CLEAR AND GRUB EX. WOODED AREAS.

2x 36" RCP CULVERT TO BE REMOVED (SEE SITE PLANS)

LIMIT OF DEMO TO EXISTING ACCESS ROADS/PATHS

12" CMP CULVERT TO BE REMOVED/IMPROVED (SEE SITE PLANS)

EX. 8' WIDE GRAVEL/DIRT ACCESS ROAD TO BE REMOVED, REPLACEMENT SURFACE VARIES, SEE SITE PLANS

BOLLARDS AND WELLHEADS TO BE REMOVED AS PART OF ROAD CONSTRUCTION (CONVERTED TO FLUSHMOUNT)

CLEAR & GRUB EX. WOODED AREAS (TYP.)

EXISTING FEATURES

CONTROL
- SURVEY TRAVERSE POINT
- GPS VERT
- GPS HORIZ
- GPS VERT/HORIZ

PROPERTIES AND BUFFERS
- PROPERTY LINE W/ MONUMENTS (FND.IP – FND.CM)
- ADJOINING PROPERTY
- RIGHT-OF-WAY
- EASEMENT OR AGREEMENT
- WETLANDS W/ FLAG
- FLOOD PLAIN (100-YR OR 500-YR)

UTILITIES
- WATER LINE W/ VALVE & HYDRANT (WV, HYD, GV)
- GAS LINE W/ VALVE
- UNDERGROUND ELECTRIC W/ METER & JUNCTION BOX (EM, JB)
- ABOVE-GROUND ELECTRIC W/ POLE & GUY (UP#1111)
- COMMUNICATIONS W/ BOX (TB, CATV)
- STORM PIPE W/ CULVERT AND INLET (12"CMP, CB)
- SANITARY LINE W/ CLEAN-OUT & MANHOLE (6"PVC, CO)

TRAFFIC
- RAILROAD SIGNAL
- TRAFFIC LIGHT SUPPORT POLE (TLSP, TB)
- STREET SIGN
- GUARD RAIL
- EDGE OF GRAVEL ROAD
- EDGE OF ASPHALT
- EDGE OF CONCRETE

IMPROVEMENTS
- BUILDING – MAJOR
- POST
- LAMP POLE OR POST
- SIGNAGE (GENERAL)
- MAIL BOX (MB)
- HANDICAP STRIPING
- CHAIN LINK FENCE W/ GATE
- SPLIT RAIL FENCE

GROUND FEATURES
- TREES (GENERAL)
- BUSH
- SPOT ELEVATION (54.2)
- TREELINE
- MAJOR CONTOUR (5') (65.0)
- INDEX CONTOUR (1')
- DEPRESSION CONTOUR
- GROUND OBSCURED
- FIELD LINE

0 10 20 30 60
1"=30'

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	DRAWN:	CHECKED:	APPROVED:
YL	YL	CSG	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: DEMOLITION PLAN – I

SCALE: 1"=30' | DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-101

PLOT DATE: Jul 03, 2013 - 12:47pm

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112003834-C10X_Demo.dwg

DIFFUSERS
(SEE PLANT EFFLUENT / OUTFALL PLANS)

REMOVE GATE/FENCE
(SEE SITE PLANS FOR REPLACEMENT)

EX. 8' WIDE GRAVEL/DIRT ACCESS ROAD TO BE REMOVED, REPLACEMENT SURFACE VARIES, SEE SITE PLANS

LIMIT OF DEMO TO EXISTING ACCESS ROADS/PATHS

CLEAR AND GRUB EX. WOODED AREAS. (TYP.)

REMOVE GATE/FENCE
(SEE SITE PLANS FOR REPLACEMENT)

CLEAR AND GRUB EX. WOODED AREAS. (TYP.)

LIMIT OF DEMO TO EXISTING ACCESS ROADS/PATHS

DEMO BRUSH AND SCATTERED TREES WITHIN LOD (TYP).

LIMIT OF DEMO TO EXISTING ACCESS ROADS

BOLLARDS AND WELLHEADS TO BE REMOVED AS PART OF ROAD CONSTRUCTION (CONVERTED TO FLUSHMOUNT)

0 10 20 30 60
1"=30'

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE:
DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE:
DEMOLITION PLAN – II

SCALE: 1"=30'

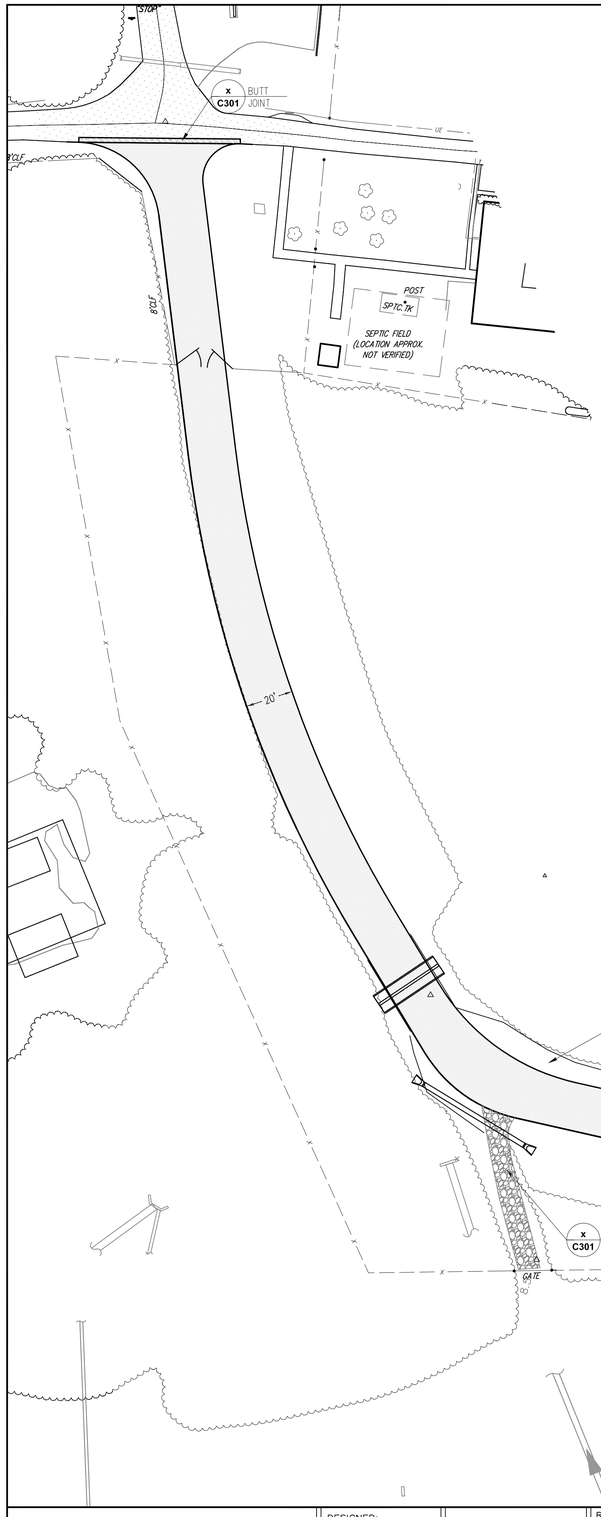
DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-102

PLOT DATE: Jul 03, 2013 - 12:50pm

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112X03834-C10X_Demo.dwg



PROPOSED FEATURES

TRAFFIC
- EDGE OF PAVEMENT
- CURB
- EDGE OF WALKWAY
- STRIPING

- HEAVY PAVING AREA
- REINFORCED TURF
- CONCRETE
- GRAVEL

IMPROVEMENTS
- BUILDING OUTLINE
- CHAIN LINK FENCE
- SIGN (GENERAL)

EXISTING FEATURES

CONTROL
- SURVEY TRAVERSE POINT
- GPS VERT
- GPS HORIZ
- GPS VERT/HORIZ

PROPERTIES AND BUFFERS
- PROPERTY LINE W/ MONUMENTS
- ADJOINING PROPERTY
- RIGHT-OF-WAY
- EASEMENT OR AGREEMENT
- WETLANDS W/ FLAG
- FLOOD PLAIN

UTILITIES
- WATER LINE W/ VALVE & HYDRANT
- GAS LINE W/ VALVE
- UNDERGROUND ELECTRIC W/ METER & JUNCTI
- ABOVE-GROUND ELECTRIC W/ POLE & GUY
- COMMUNICATIONS W/ BOX
- STORM PIPE W/ CULVERT AND INLET
- SANITARY LINE W/ CLEAN-OUT & MANHOLE

TRAFFIC
- RAILROAD SIGNAL
- TRAFFIC LIGHT SUPPORT POLE
- STREET SIGN
- GUARD RAIL
- EDGE OF GRAVEL ROAD
- EDGE OF ASPHALT
- EDGE OF CONCRETE

IMPROVEMENTS
- BUILDING - MAJOR
- POST
- LAMP POLE OR POST
- SIGNAGE (GENERAL)
- MAIL BOX
- HANDICAP STRIPING
- CHAIN LINK FENCE W/ GATE
- SPLIT RAIL FENCE

GROUND FEATURES
- TREES (GENERAL)
- BUSH
- SPOT ELEVATION
- TREELINE
- MAJOR CONTOUR (5')

0 10 20 30 60
1"=30'

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE:
DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE:
PAVING PLAN - I

SCALE: 1"=30'

DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-111

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112103834-C11X_Pave.dwg

PLOT DATE: Jul 03, 2013 - 1:11pm

3' WIDE GABION WALL 1/C301

REPLANTING AREA

CLEAR SHOULDER AREA (GRASS)

REPLANTING AREA (LEAVE 3' SWATH @ EFFLUENT LINE)

1/C301 REINFORCED TURF (9" SUBBASE)

CLEAR SHOULDER AREA (GRASS)

MATCH EXISTING CLEAR SHOULDER AREA (GRASS)

22'

46'

12'

CLEAR SHOULDER AREA (GRASS)

REINFORCED TURF (9" SUBBASE)

REINFORCED TURF (6" SUBBASE)

1/C301 REINFORCED TURF (6" SUBBASE)

170' x 60' GWTP
1-STORY METAL FRAME
10,200 GFA
F.F. = 22'
(INTERIOR DEPRESSED 6" FOR CONTAINMENT: 21.5)

PCC WALK x/C301

HC ACCESSIBLE RAMP & LANDING x/C301

1/C301 3' TAPER

1/C301 3' TAPER

REINFORCED TURF (FULL SECTION) 1/C301

6" PCC CURB (MODIFIED) x/C301

x/C301 ASPHALT STUB TIE INTO EX. GRAVEL

x/C301 REPLACE DISTURBED ACCESS PATH W/ CRUSHED STONE

0 10 20 30 60
1"=30'

PROPOSED FEATURES

TRAFFIC
- EDGE OF PAVEMENT
- CURB
- EDGE OF WALKWAY
- STRIPING

- HEAVY PAVING AREA
- REINFORCED TURF
- CONCRETE
- GRAVEL

IMPROVEMENTS
- BUILDING OUTLINE
- CHAIN LINK FENCE
- SIGN (GENERAL)

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE:
DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE:
PAVING PLAN – II

SCALE: 1"=30'

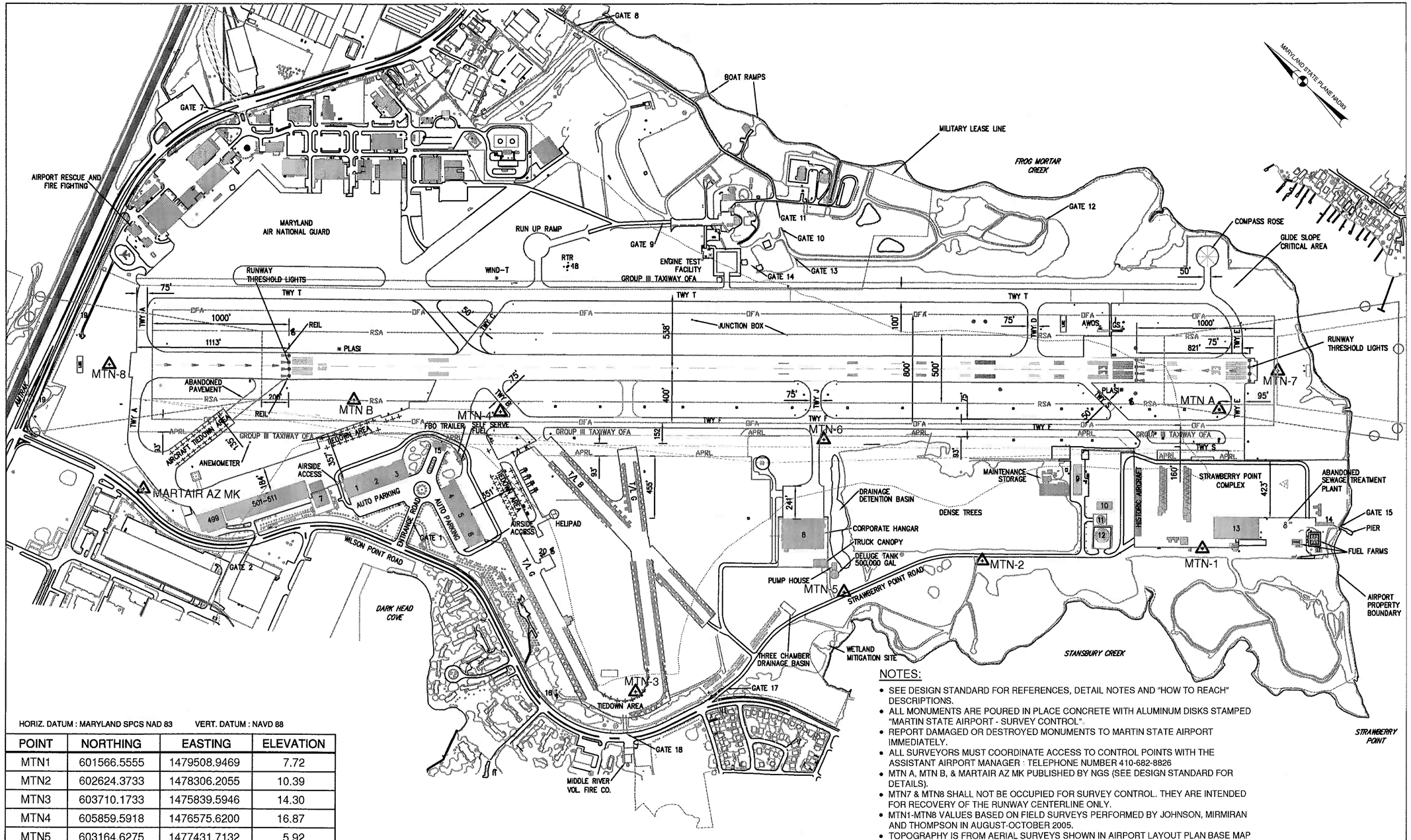
DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-112

PLOT DATE: Jul 03, 2013 - 1:11pm

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112003834-C1X_Pave.dwg



HORIZ. DATUM : MARYLAND SPCS NAD 83 VERT. DATUM : NAVD 88

POINT	NORTHING	EASTING	ELEVATION
MTN1	601566.5555	1479508.9469	7.72
MTN2	602624.3733	1478306.2055	10.39
MTN3	603710.1733	1475839.5946	14.30
MTN4	605859.5918	1476575.6200	16.87
MTN5	603164.6275	1477431.7132	5.92
MTN6	604064.3021	1478107.5955	12.90

UNITS : U.S. SURVEY FEET

NOTES:

- SEE DESIGN STANDARD FOR REFERENCES, DETAIL NOTES AND "HOW TO REACH" DESCRIPTIONS.
- ALL MONUMENTS ARE POURED IN PLACE CONCRETE WITH ALUMINUM DISKS STAMPED "MARTIN STATE AIRPORT - SURVEY CONTROL".
- REPORT DAMAGED OR DESTROYED MONUMENTS TO MARTIN STATE AIRPORT IMMEDIATELY.
- ALL SURVEYORS MUST COORDINATE ACCESS TO CONTROL POINTS WITH THE ASSISTANT AIRPORT MANAGER : TELEPHONE NUMBER 410-682-8826
- MTN A, MTN B, & MARTAIR AZ MK PUBLISHED BY NGS (SEE DESIGN STANDARD FOR DETAILS).
- MTN7 & MTN8 SHALL NOT BE OCCUPIED FOR SURVEY CONTROL. THEY ARE INTENDED FOR RECOVERY OF THE RUNWAY CENTERLINE ONLY.
- MTN1-MTN8 VALUES BASED ON FIELD SURVEYS PERFORMED BY JOHNSON, MIRMIRAN AND THOMPSON IN AUGUST-OCTOBER 2005.
- TOPOGRAPHY IS FROM AERIAL SURVEYS SHOWN IN AIRPORT LAYOUT PLAN BASE MAP DRAWING.

NOTE: NEED TO ADD THE REST OF THE CONTROL POINTS HELD BY TETRA TECH SURVEY, SPECIFICALLY: MARTAIR AZ, MTN7, AND MTN8.

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

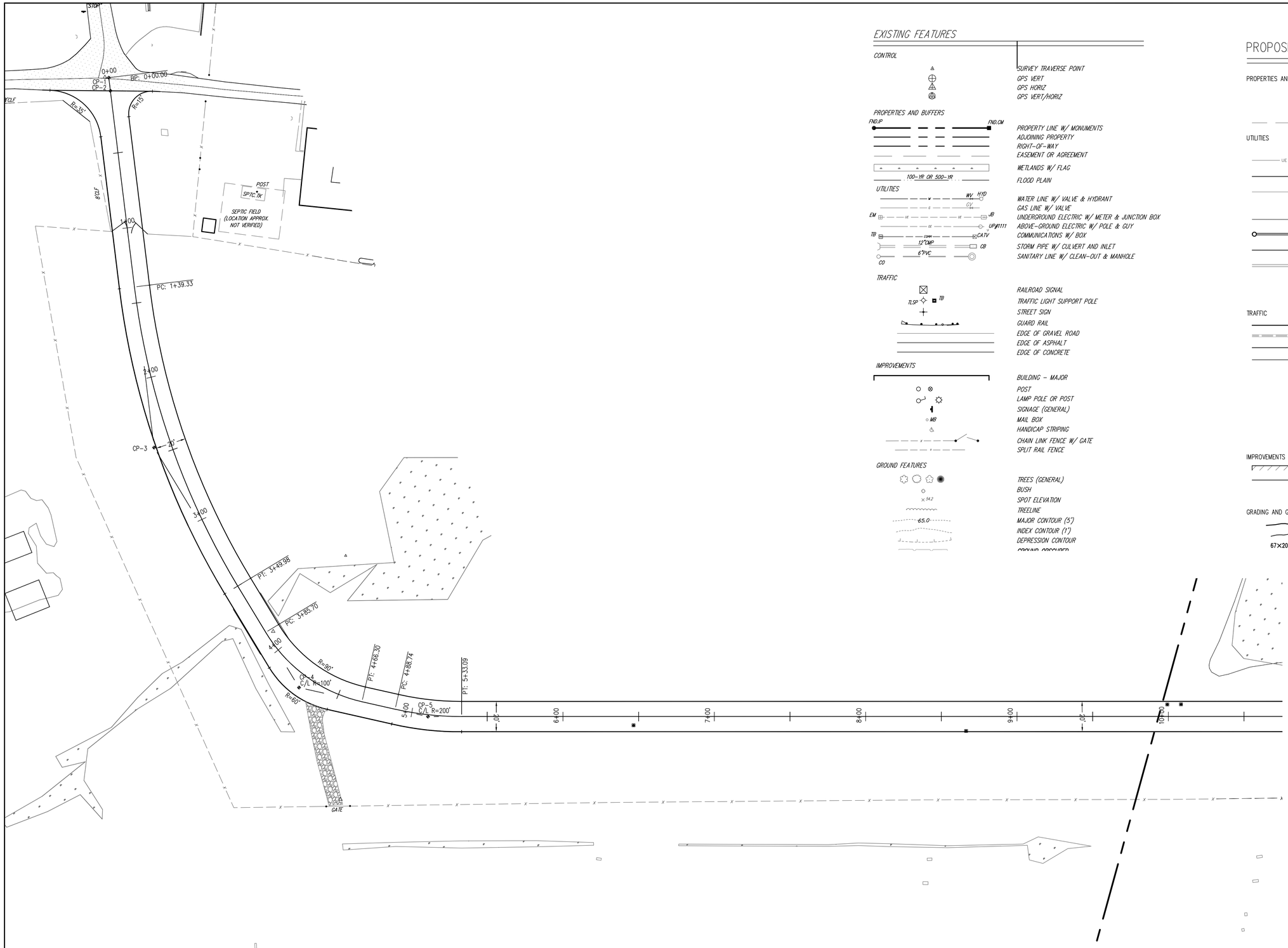
MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE: SURVEY CONTROL
SCALE: NOT TO SCALE
DATE: 07/03/2013

CONTRACT NO.: N/A
SHEET NO.: C-120

PLOT DATE: Jul 03, 2013 - 1:13pm
DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-305 design Phase-2013\CAD drawings\Civil\ 112C0383A-C12X_Site.dwg



EXISTING FEATURES

CONTROL

- SURVEY TRAVERSE POINT
- GPS VERT
- GPS HORIZ
- GPS VERT/HORIZ

PROPERTIES AND BUFFERS

- FND.IP — FND.CM — PROPERTY LINE W/ MONUMENTS
- ADJOINING PROPERTY
- RIGHT-OF-WAY
- EASEMENT OR AGREEMENT
- WETLANDS W/ FLAG
- 100-YR OR 500-YR — FLOOD PLAIN

UTILITIES

- WV HYD — WATER LINE W/ VALVE & HYDRANT
- GV — GAS LINE W/ VALVE
- EM — UE — UE — JB — UNDERGROUND ELECTRIC W/ METER & JUNCTION BOX
- UP#1111 — ABOVE-GROUND ELECTRIC W/ POLE & GUY
- TB — CATV — COMMUNICATIONS W/ BOX
- 12"CMP — CB — STORM PIPE W/ CULVERT AND INLET
- 6"PVC — CO — SANITARY LINE W/ CLEAN-OUT & MANHOLE

TRAFFIC

- RAILROAD SIGNAL
- TLSP — TB — TRAFFIC LIGHT SUPPORT POLE
- STREET SIGN
- GUARD RAIL
- EDGE OF GRAVEL ROAD
- EDGE OF ASPHALT
- EDGE OF CONCRETE

IMPROVEMENTS

- BUILDING - MAJOR
- POST
- LAMP POLE OR POST
- SIGNAGE (GENERAL)
- MB — MAIL BOX
- HANDICAP STRIPING
- CHAIN LINK FENCE W/ GATE
- SPLIT RAIL FENCE

GROUND FEATURES

- TREES (GENERAL)
- BUSH
- 54.2 — SPOT ELEVATION
- TREELINE
- 65.0 — MAJOR CONTOUR (5')
- INDEX CONTOUR (1')
- DEPRESSION CONTOUR
- GROUND OBSCURED

PROPOSED FEATURES

PROPERTIES AND BUFFERS

- LAYOUT CONTROL POINT
- EASEMENT

UTILITIES

- UE — UE — UNDERGROUND ELECTRIC
- COMM — COMMUNICATIONS
- W — WATER LINE W/ VALVE
- M — WATER METER PIT
- FW — FIRE LINE W/ VALVE & HYDRANT
- 45 LF 12" RCP .0053 FT/FT — STORM W/ MANHOLE
- SANITARY SEWER W/ MANHOLE
- ROOF DRAIN LEADER W/ DOWNSPOUT
- RIP-RAP
- STORM INLET

TRAFFIC

- EDGE OF PAVEMENT
- CURB
- EDGE OF WALKWAY
- STRIPING
- HEAVY PAVING AREA
- REINFORCED TURF
- CONCRETE
- GRAVEL

IMPROVEMENTS

- BUILDING OUTLINE
- X — CHAIN LINK FENCE
- SIGN (GENERAL)

GRADING AND GROUND FEATURES

- 65 — MAJOR CONTOUR (5')
- 64 — INDEX CONTOUR (1')
- 67×20 OR ×21.5 — PROPOSED SPOT GRADE

LAYOUT CONTROL CHART:

CP-ID	NORTHING	EASTING
CP-1		
CP-2		
CP-3		
CP-4		
CP-5		
CP-6		
CP-7		
...		

0 10 20 30 60
1"=30'

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: SITE LAYOUT / CONTROL PLAN - I

SCALE: 1"=30'

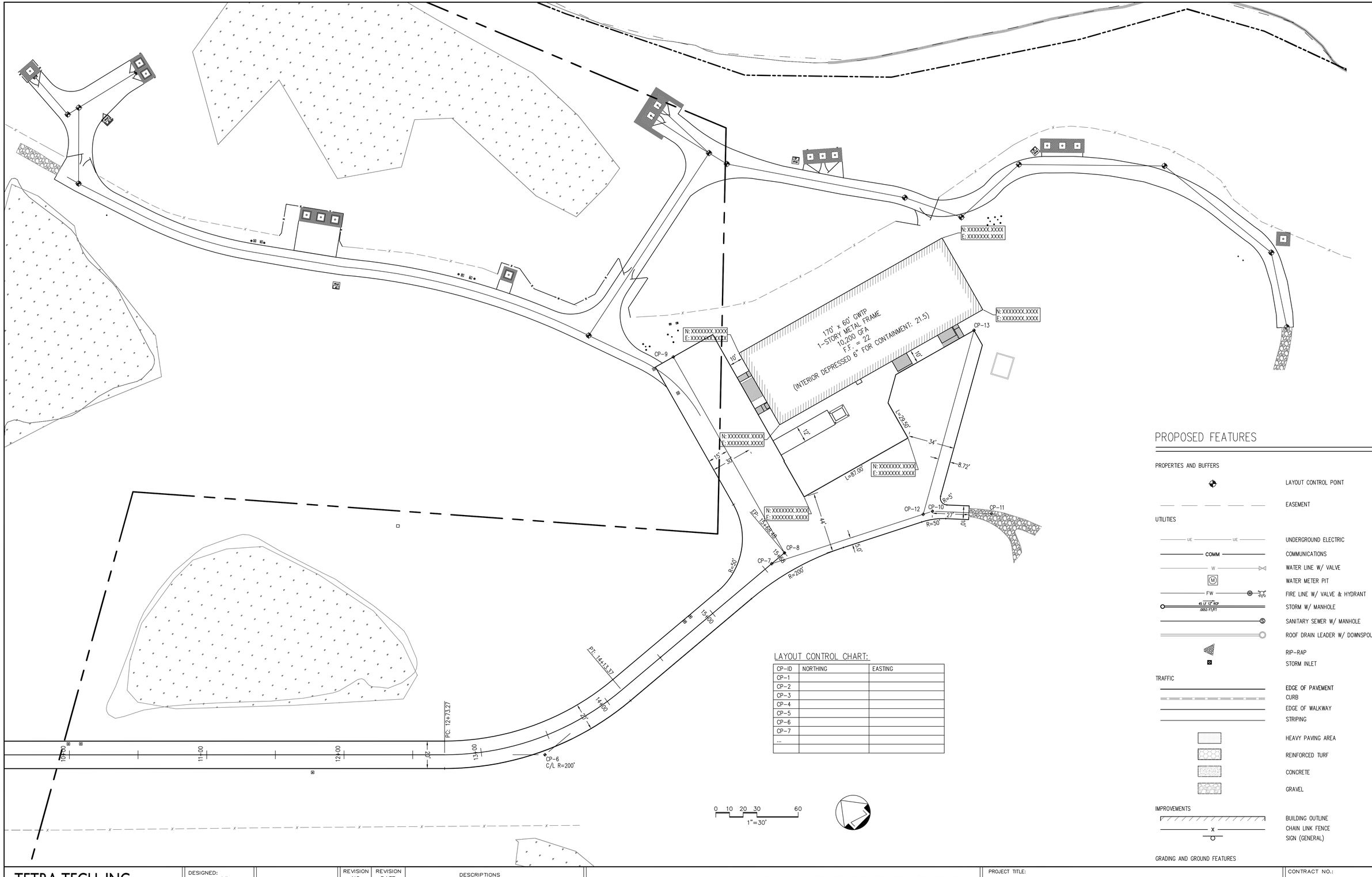
DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-121

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\112C03834-C12X_Site.dwg

PLOT DATE: Jul 03, 2013 - 1:15pm



LAYOUT CONTROL CHART:

CP-ID	NORTHING	EASTING
CP-1		
CP-2		
CP-3		
CP-4		
CP-5		
CP-6		
CP-7		
...		

PROPOSED FEATURES

PROPERTIES AND BUFFERS
- LAYOUT CONTROL POINT
- EASEMENT

UTILITIES
- UNDERGROUND ELECTRIC
- COMMUNICATIONS
- WATER LINE W/ VALVE
- WATER METER PIT
- FIRE LINE W/ VALVE & HYDRANT
- STORM W/ MANHOLE
- SANITARY SEWER W/ MANHOLE
- ROOF DRAIN LEADER W/ DOWNSPOUT
- RIP-RAP
- STORM INLET

TRAFFIC
- EDGE OF PAVEMENT
- CURB
- EDGE OF WALKWAY
- STRIPING

- HEAVY PAVING AREA
- REINFORCED TURF
- CONCRETE
- GRAVEL

IMPROVEMENTS
- BUILDING OUTLINE
- CHAIN LINK FENCE
- SIGN (GENERAL)

GRADING AND GROUND FEATURES

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: SITE LAYOUT / CONTROL PLAN - II

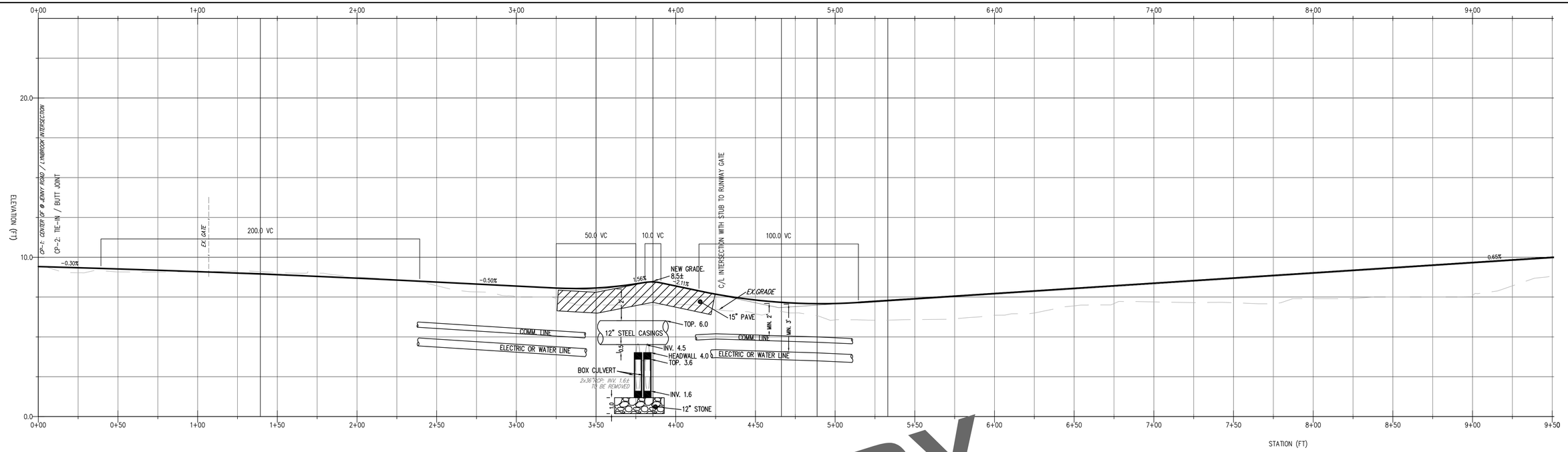
SCALE: 1"=30' | DATE: 07/03/2013

CONTRACT NO.: N/A

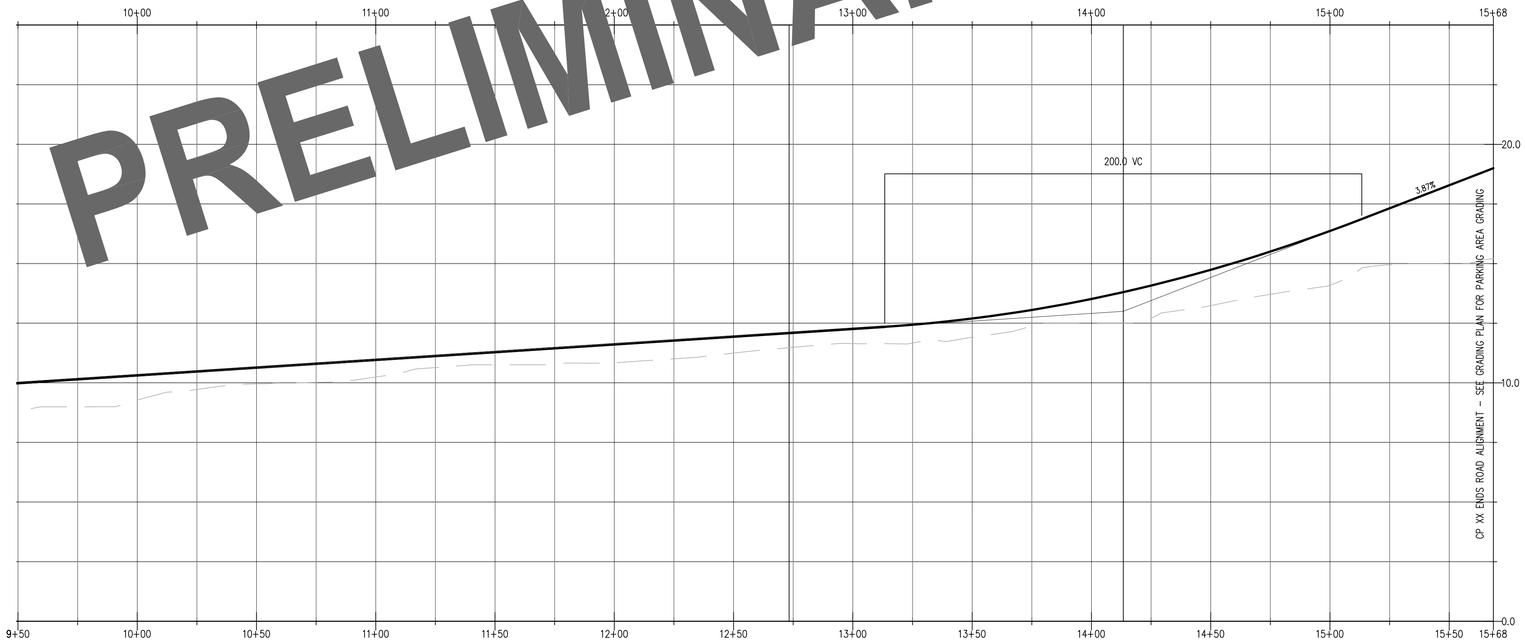
SHEET NO.: C-122

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112DD3834-C12X_Site.dwg

PLOT DATE: Jul 03, 2013 - 1:16pm



PV – CENTERLINE
Access Road
H: 1"=30'
V: 1"=3'



PRELIMINARY

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	___

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

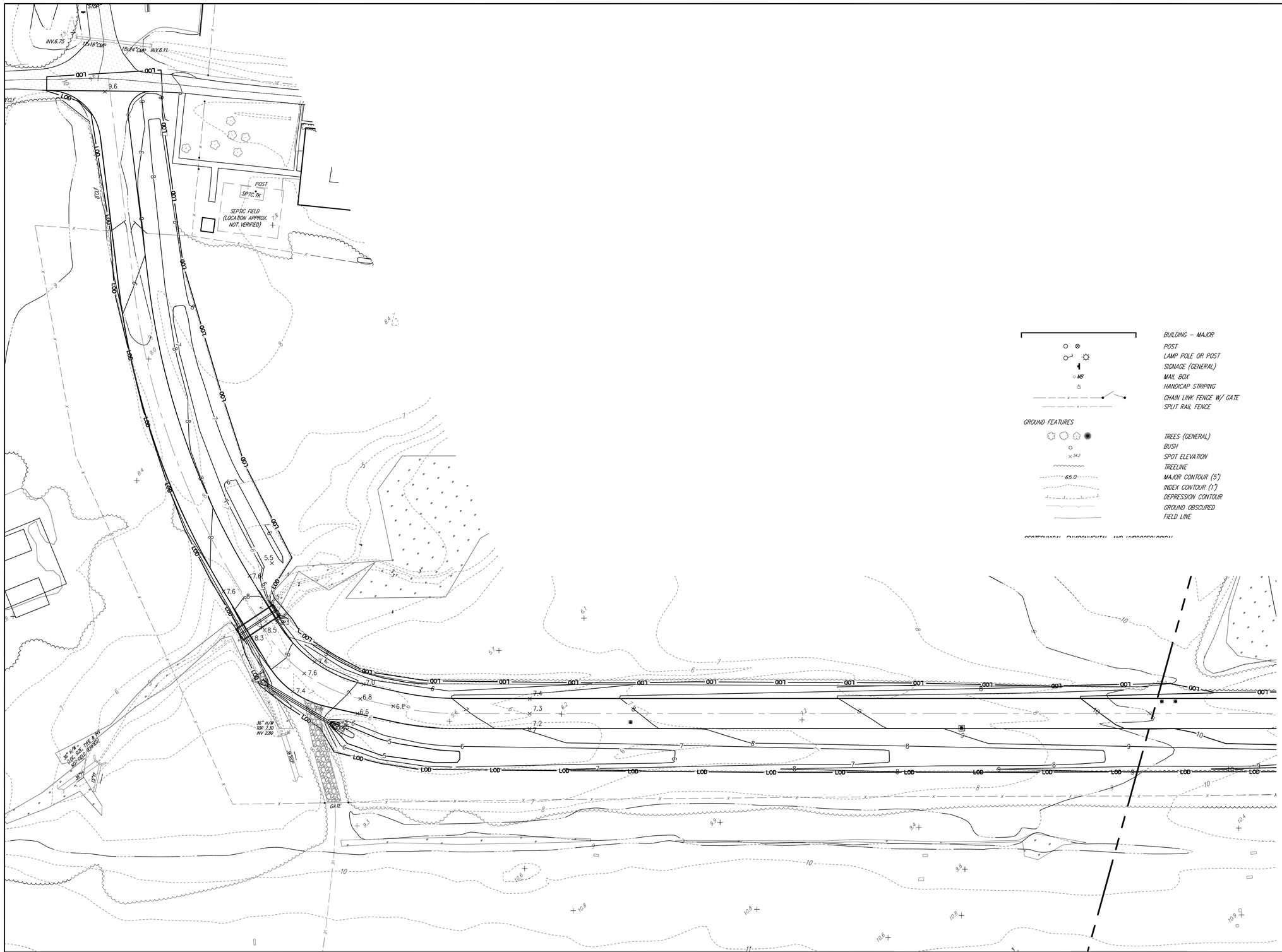
MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE:	DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE:	LYNBROOK ROAD, EXTENDED PROFILE
SCALE:	1"=30'
DATE:	07/03/2013
CONTRACT NO.:	N/A
SHEET NO.:	C-123

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112IC03834-C12X_Site.dwg
PLOT DATE: Jul 03, 2013 - 1:17pm



BUILDING – MAJOR
POST
LAMP POLE OR POST
SIGNAGE (GENERAL)
MAIL BOX
HANDICAP STRIPING
CHAIN LINK FENCE W/ GATE
SPLIT RAIL FENCE

GROUND FEATURES

TREES (GENERAL)
BUSH
SPOT ELEVATION
TREELINE
MAJOR CONTOUR (5')
INDEX CONTOUR (1')
DEPRESSION CONTOUR
GROUND OBSCURED
FIELD LINE

GRADING AND GROUND FEATURES

65
64
67×20 OR × 21.5

0.48% –3:1

MAJOR CONTOUR (5')
INDEX CONTOUR (1')
PROPOSED SPOT GRADE
HP: HIGH POINT
LP: LOW POINT
BC: BOTTOM CURB
TC: TOP CURB
DRAINAGE SLOPES
TREE OR BRUSH LINE

0 10 20 30 60
1"=30'

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

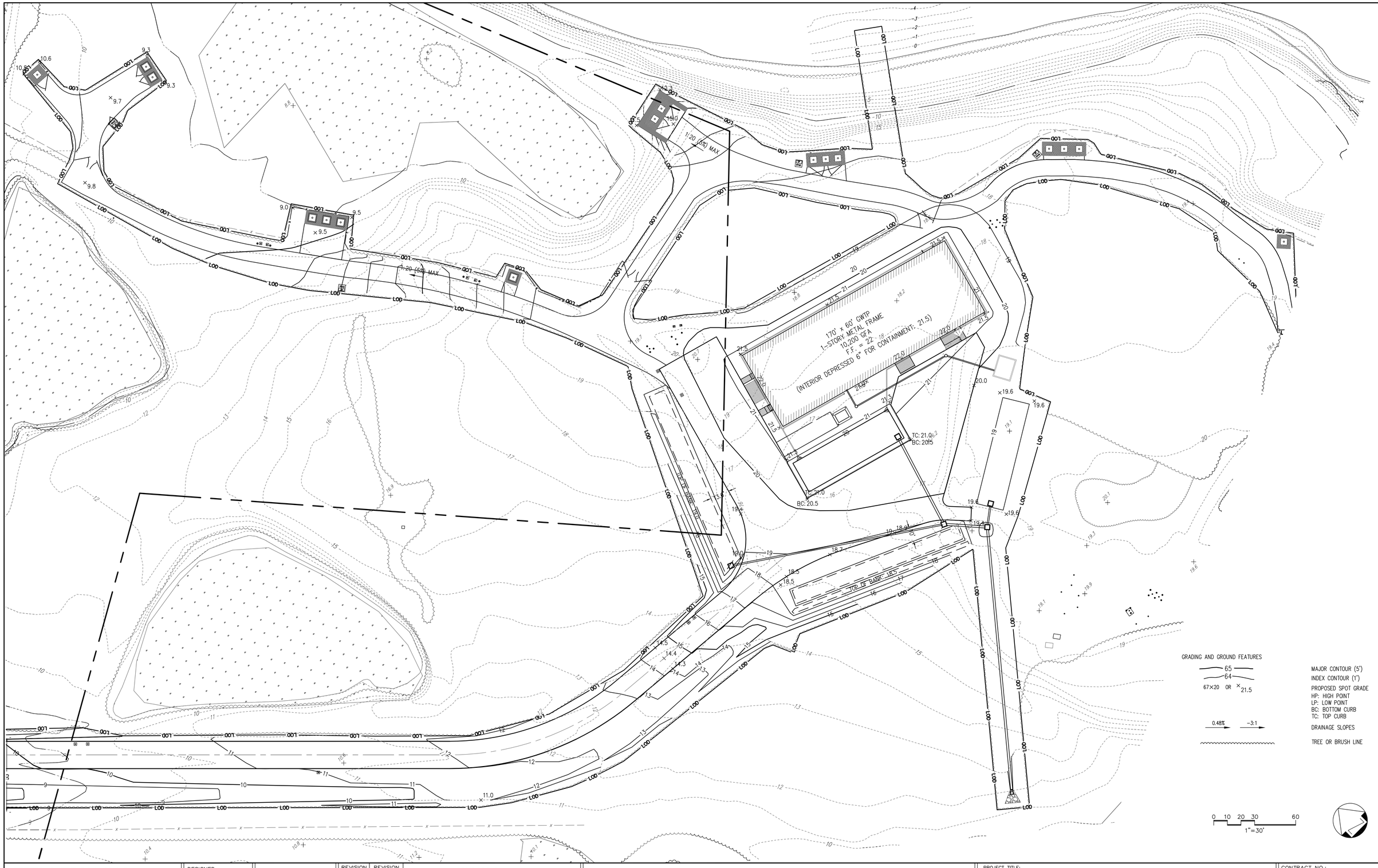
PROJECT TITLE:
DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE:
SITE GRADING & DRAINAGE PLAN – I

SCALE: 1"=30'
DATE: 07/03/2013

CONTRACT NO.: N/A
SHEET NO.: C-131

PLOT DATE: Jul 03, 2013 - 1:25pm
DRAWING NAME: S:\03-Projects\Commercial\LMC\103P25710--DRA-30% design Phase-2013\CAD drawings\Civil\ 112003834-C13X_Grad.dwg



TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE:
DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

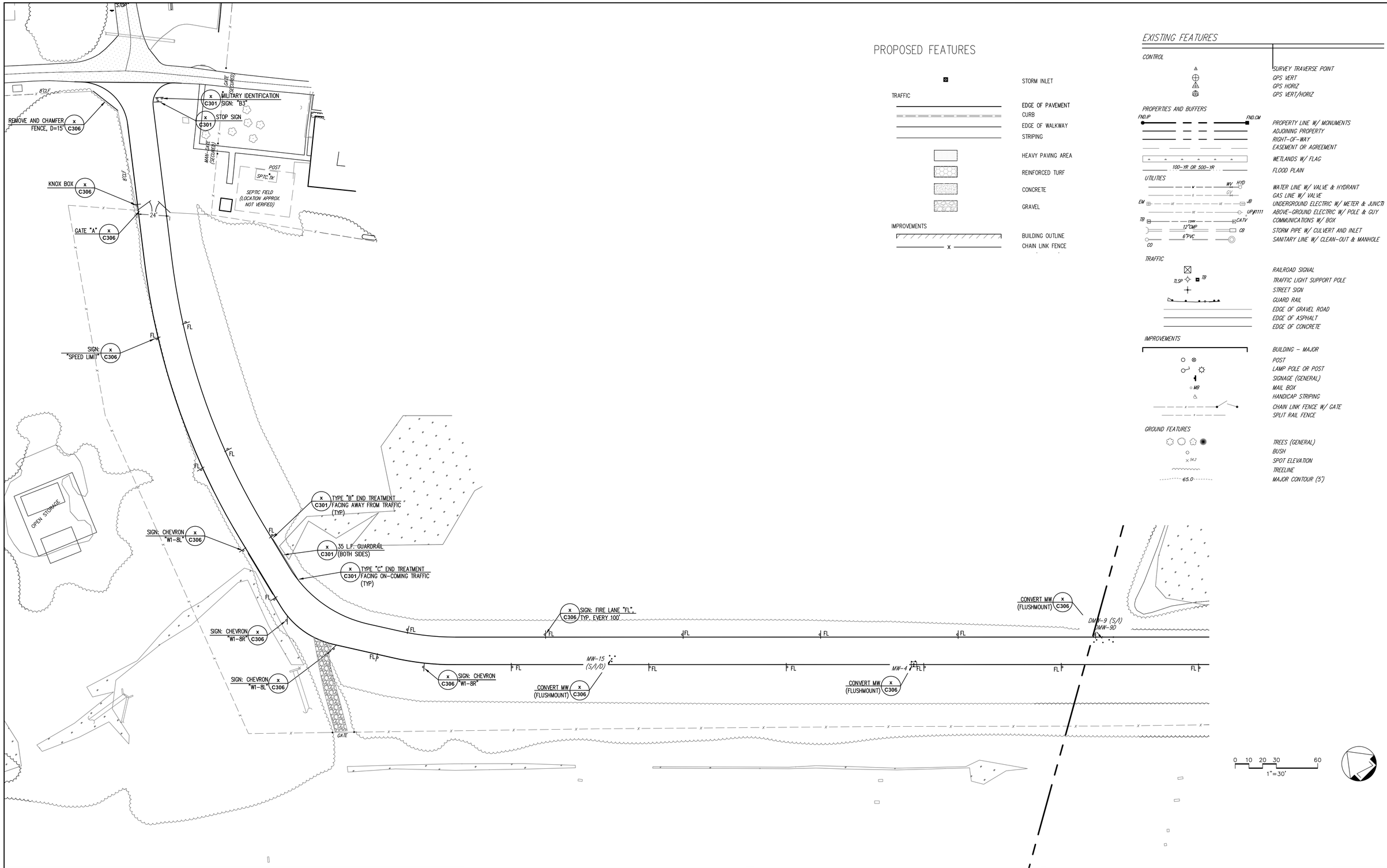
SHEET TITLE:
SITE GRADING & DRAINAGE PLAN - II

SCALE: 1"=30'
DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-132

DRAWING NAME: S:\03-Projects\Commercial\LMC\103925710\-DRA-30% design Phase-2013\CAD drawings\Civil\112003834-C13X_Grad.dwg
PLOT DATE: Jul 03, 2013 - 1:26pm



PROPOSED FEATURES

- STORM INLET

TRAFFIC

- EDGE OF PAVEMENT
- CURB
- EDGE OF WALKWAY
- STRIPING
- HEAVY PAVING AREA
- REINFORCED TURF
- CONCRETE
- GRAVEL

IMPROVEMENTS

- BUILDING OUTLINE
- CHAIN LINK FENCE

EXISTING FEATURES

CONTROL

- SURVEY TRAVERSE POINT
- GPS VERT
- GPS HORIZ
- GPS VERT/HORIZ

PROPERTIES AND BUFFERS

- PROPERTY LINE W/ MONUMENTS (FND.IP / FND.CM)
- ADJOINING PROPERTY
- RIGHT-OF-WAY
- EASEMENT OR AGREEMENT
- WETLANDS W/ FLAG
- 100-YR OR 500-YR FLOOD PLAIN

UTILITIES

- WATER LINE W/ VALVE & HYDRANT (WV, HYD)
- GAS LINE W/ VALVE (GV)
- UNDERGROUND ELECTRIC W/ METER & JUNCTI (EM, UE, MB)
- ABOVE-GROUND ELECTRIC W/ POLE & GUY (UP#1111)
- COMMUNICATIONS W/ BOX (TB, COMM, CATV)
- STORM PIPE W/ CULVERT AND INLET (12"CMP, CB)
- SANITARY LINE W/ CLEAN-OUT & MANHOLE (6"PVC, CO)

TRAFFIC

- RAILROAD SIGNAL
- TRAFFIC LIGHT SUPPORT POLE (TLSP, TB)
- STREET SIGN
- GUARD RAIL
- EDGE OF GRAVEL ROAD
- EDGE OF ASPHALT
- EDGE OF CONCRETE

IMPROVEMENTS

- BUILDING - MAJOR
- POST
- LAMP POLE OR POST
- SIGNAGE (GENERAL)
- MAIL BOX (MB)
- HANDICAP STRIPING
- CHAIN LINK FENCE W/ GATE
- SPLIT RAIL FENCE

GROUND FEATURES

- TREES (GENERAL)
- BUSH
- SPOT ELEVATION (54.2)
- TREELINE
- MAJOR CONTOUR (5') (65.0)

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: SITE SIGNAGE & STRIPING PLAN - I

SCALE: 1"=30' DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-141

PLOT DATE: Jul 03, 2013 - 1:27pm

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112C03834-C14X_Sign.dwg

FENCE C306
GATE "C" C306
GATE "D" C306
GATE "D.1" C306
GATE "B" C306
FENCE C306
GATE "F" C306
FENCE C306
GATE "G" C306
GATE "H" C306
DMW-4(S/I/D)
ADJUST PAD TO AVOID FENCE
FENCE C306
MW-18(S/I/D)
2x BOLLARDS C306
DMW-3(S/I)
DMW-3(D)
FENCE C306
GATE "E" C306
FENCE C306
OW-1(S)
RW-1(S)
DMW-2(S)
2x BOLLARDS C306
DMW-2(A/B)
RW-1(I)
TYP. PARKING STRIPING "WHITE"
OW-1(I)
HANDICAP PARKING C306
170' x 60' GWTP
1-STORY METAL FRAME
10,200 GFA
F.F. = 22
(INTERIOR DEPRESSED 6" FOR CONTAINMENT: 21.5)
DMW-5 (S/I/D)
TYP. FIRE LANE STRIPING "YELLOW", 6" OFF EDGE OF PAVE
CONVERT MW (FLUSHMOUNT) C306
DMW-8(S/I/D)
SIGN: "SPEED LIMIT" C306
CONVERT MW (FLUSHMOUNT) C306
DMW-9 (S/I) DMW-9D
MW-20 (S/I/D)
CONVERT MW (FLUSHMOUNT) C306
FL

0 10 20 30 60
1"=30'

PROPOSED FEATURES

- STORM INLET
- TRAFFIC
- EDGE OF PAVEMENT
- CURB
- EDGE OF WALKWAY
- STRIPING
- HEAVY PAVING AREA
- REINFORCED TURF
- CONCRETE
- GRAVEL
- IMPROVEMENTS
- BUILDING OUTLINE
- CHAIN LINK FENCE

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: SITE SIGNAGE & STRIPING PLAN - II

SCALE: 1"=30'

DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-142

PLOT DATE: Jul 03, 2013 - 1:28pm

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112C03834-C14X_Sign.dwg

PROPOSED FEATURES

PROPERTIES AND BUFFERS
- LAYOUT CONTROL POINT
- EASEMENT

UTILITIES
- UNDERGROUND ELECTRIC
- COMMUNICATIONS
- WATER LINE W/ VALVE
- WATER METER PIT
- FIRE LINE W/ VALVE & HYDRANT
- STORM W/ MANHOLE
- SANITARY SEWER W/ MANHOLE
- ROOF DRAIN LEADER W/ DOWNSPOUT
- RIP-RAP
- STORM INLET

TRAFFIC
- EDGE OF PAVEMENT
- CURB
- EDGE OF WALKWAY
- STRIPING

- HEAVY PAVING AREA
- REINFORCED TURF
- CONCRETE
- GRAVEL

IMPROVEMENTS
- BUILDING OUTLINE
- CHAIN LINK FENCE
- SIGN (GENERAL)

GRADING AND GROUND FEATURES
- MAJOR CONTOUR (5')

0 10 20 30 60
1"=30'

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: UTILITY PLAN – I

SCALE: 1"=30'

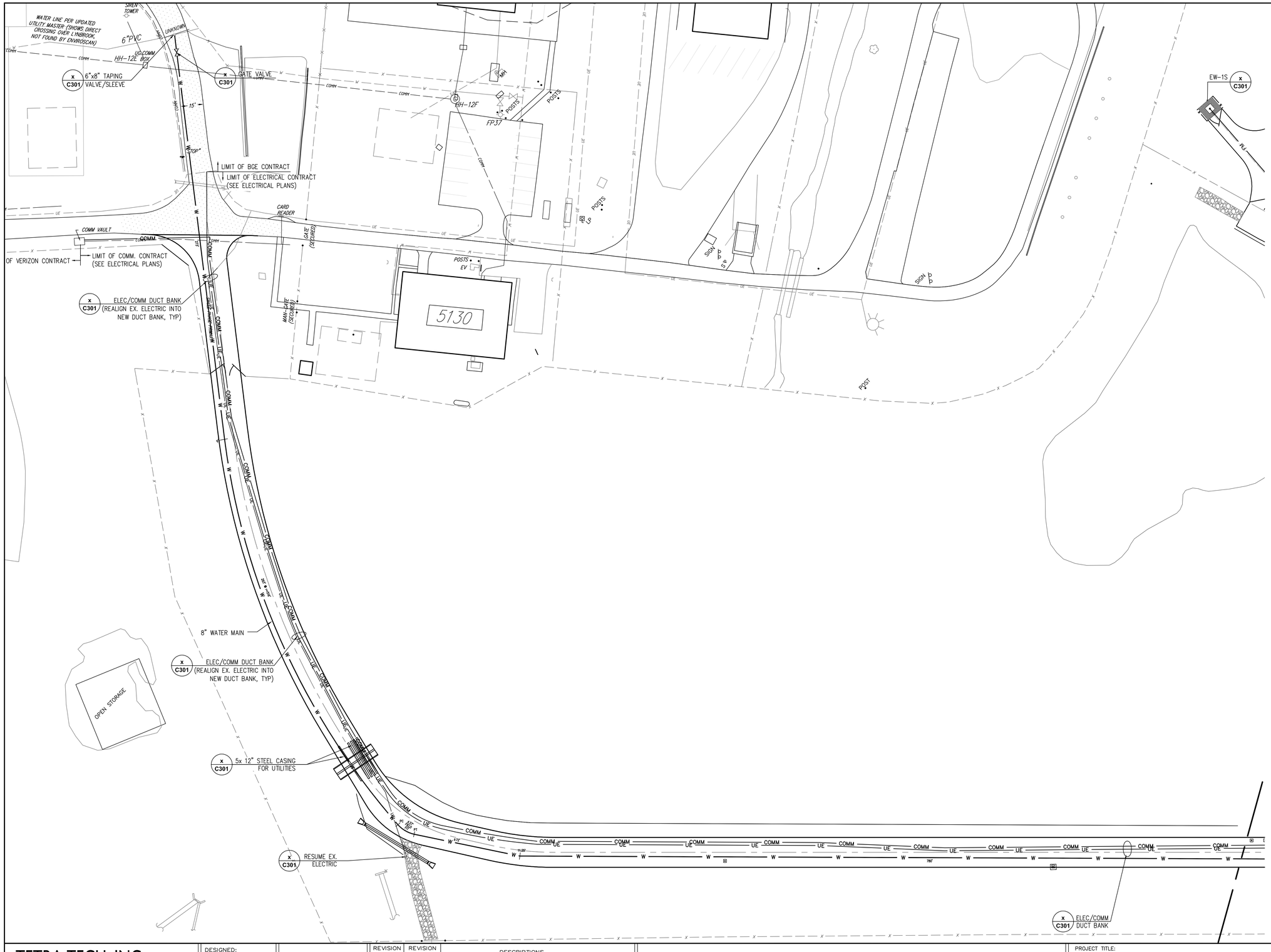
DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-150

PLOT DATE: Jul 03, 2013 - 1:31pm

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-308 design Phase-2013\CAD drawings\Civil\ 112C03834-C15X_LHI.dwg



TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

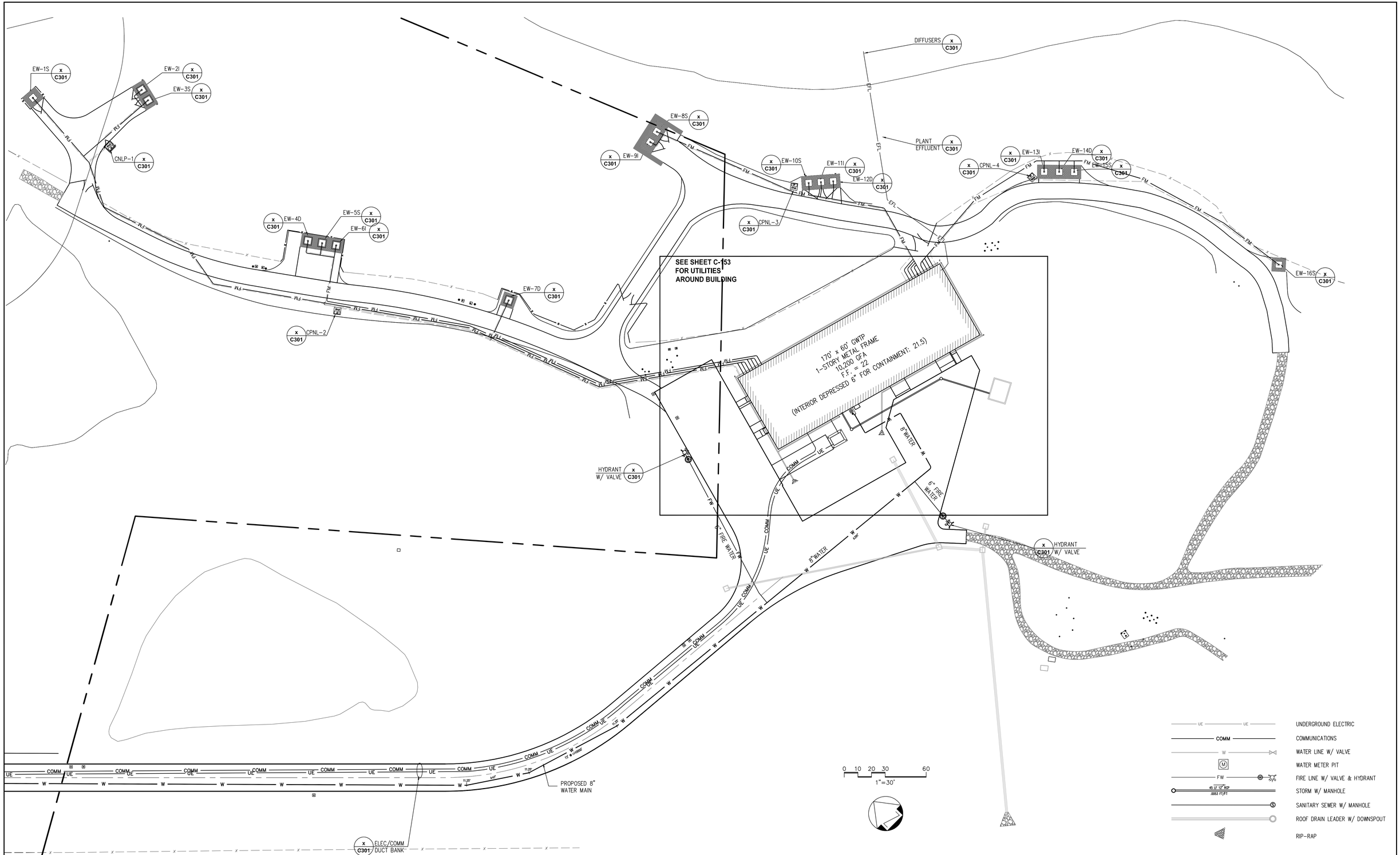
SHEET TITLE: UTILITY PLAN – II

SCALE: 1"=30' DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-151

PLOT DATE: Jul 03, 2013 - 1:31pm
DRAWING NAME: S:\03-Projects\Commercial\LMC\1030257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112003834-C15X_Util.dwg



TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: UTILITY PLAN - III

SCALE: 1"=30'

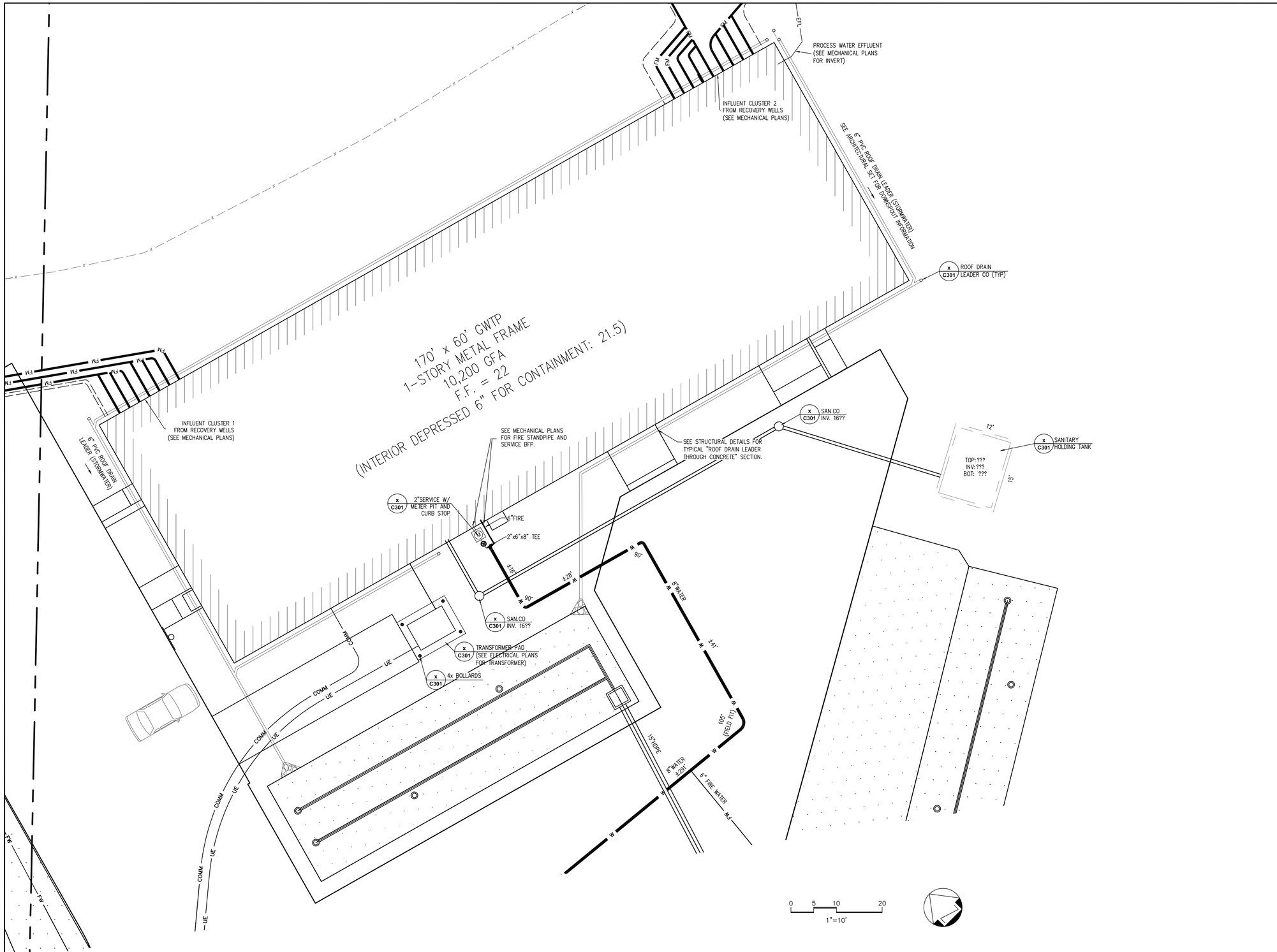
DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-152

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112C03834-C15X_Util.dwg

PLOT DATE: Jul 03, 2013 - 1:31pm



PROPOSED FEATURES

PROPERTIES AND BUFFERS

- LAYOUT CONTROL POINT
- EASEMENT

UTILITIES

- UNDERGROUND ELECTRIC
- COMMUNICATIONS
- WATER LINE W/ VALVE
- WATER METER PIT
- FIRE LINE W/ VALVE & HYDRANT
- STORM W/ MANHOLE
- SANITARY SEWER W/ MANHOLE
- ROOF DRAIN LEADER W/ DOWNSPOUT
- RIP-RAP
- STORM INLET

TRAFFIC

- EDGE OF PAVEMENT
- CURB
- EDGE OF WALKWAY
- STRIPING
- HEAVY PAVING AREA
- REINFORCED TURF
- CONCRETE
- GRAVEL

IMPROVEMENTS

- BUILDING OUTLINE
- CHAIN LINK FENCE
- SIGN (GENERAL)

GRADING AND GROUND FEATURES

- 65 — MAJOR CONTOUR (5')
- 64 — INDEX CONTOUR (1')
- 67×20 OR ×21.5 — PROPOSED SPOT GRADE HP: HIGH POINT LP: LOW POINT

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: UTILITY PLAN - BUILDING TIE-INS

SCALE: 1"=10'

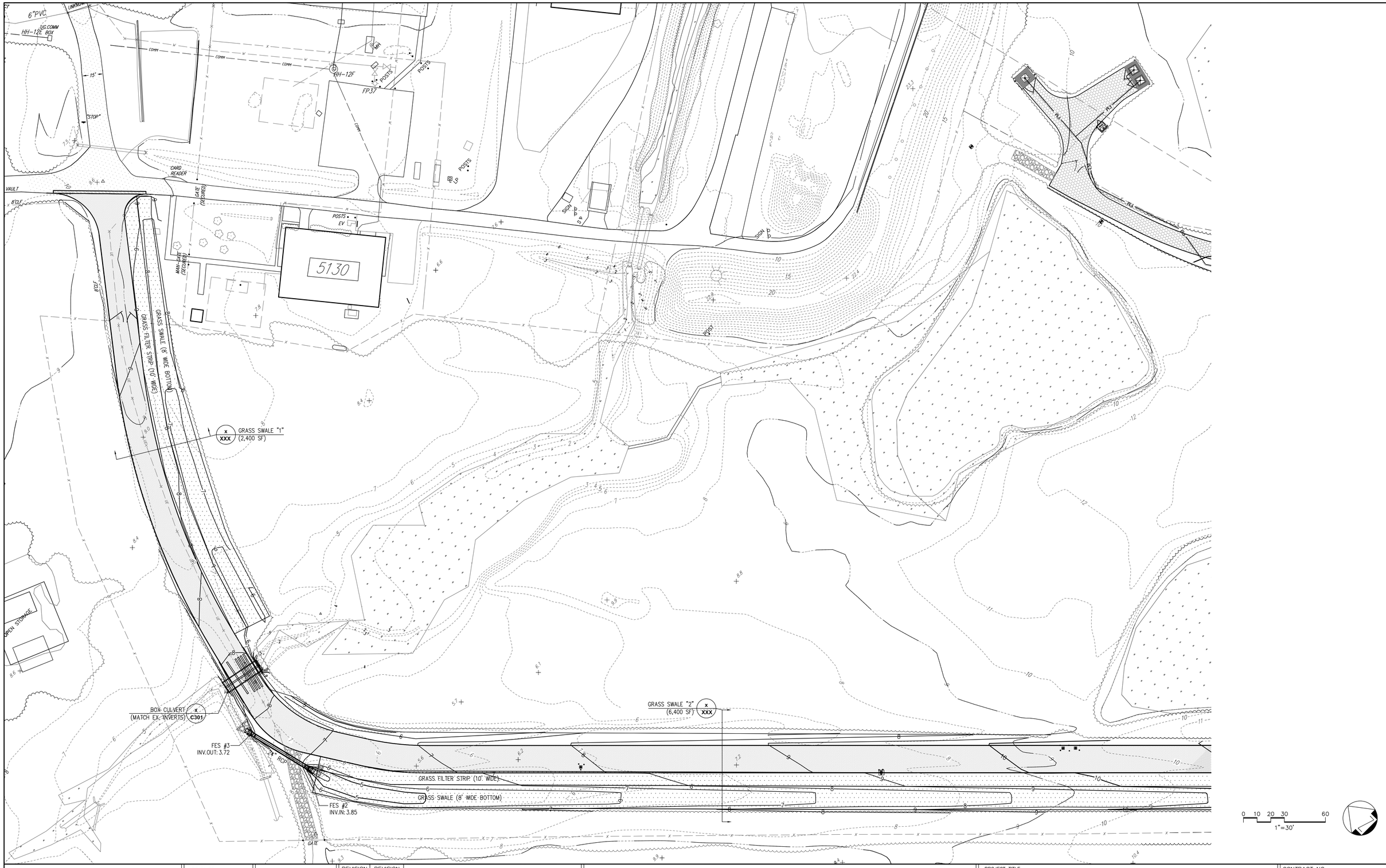
DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-153

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\112IC03834-C15X_Util.dwg

PLOT DATE: Jul 03, 2013 - 1:32pm



TETRA TECH, INC. 240 CONTINENTAL DR., SUITE 200 NEWARK, DELAWARE 19711 PH: (302) 738-7551 FAX: (302) 454-5988	DESIGNED: YL DRAWN: YL CHECKED: CSG APPROVED: ___	SWM / E&S SUBMISSION -DRAFT-	REVISION NO. / REVISION DATE / DESCRIPTIONS	MARTIN STATE AIRPORT MARYLAND DEPARTMENT OF TRANSPORTATION MARYLAND AVIATION ADMINISTRATION OFFICE OF DESIGN AND CONSTRUCTION	PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT SHEET TITLE: STORMWATER UTILITY PLAN – I SCALE: 1"=30' DATE: 07/03/2013	CONTRACT NO.: N/A SHEET NO.: C-161

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30ft design Phase-2013\CAD drawings\Civil\ 112D03834-C16X_SWM.dwg
PLOT DATE: Jul 03, 2013 - 1:33pm

REINFORCED TURF
6" SUBBASE
(9,387 SF)

x
XXX

REINFORCED TURF
9" SUBBASE
(9,431 SF)

170' x 60' CWTP
1-STORY METAL FRAME
10,200 GFA
F.F. = 22'
(INTERIOR DEPRESSED 6" FOR CONTAINMENT: 21.5)

STRM.CO
TOP: 19.3

OBSERVATION WELL

SWM "4"
W/ UNDERDRAIN (1,680 SF)
BANK: 19.0
TOP: 18.3
B/OUT: 14.7

OBSERVATION WELL

STRM.CO (2x)
TOP: 21.0

SWM "1"
W/ UNDERDRAIN
(1,920 SF)
BANK: 21.0
TOP: 20.0
B/OUT: 16.4

OVERFLOW
SD #5
TOP: 18.6
INV: 14.7

15"HDPE

(10' WIDE) GRASS FILTER STRIP

STRM.CO

OBSERVATION WELLS

SWM "3"
W/ UNDERDRAIN
(1,300 SF)
BANK: 18.5
TOP: 17.5
OUTLET: 13.9

GRASS FILTER STRIP (10' WIDE)

GRASS SWALE (8' WIDE BOTTOM)

GRASS SWALE "3"
(2,000 SF)

OVERFLOW
SD #4
TOP: 20.4
INV: 16.4

STRM.CO

OBSERVATION WELLS

GRASS FILTER STRIP
(20' WIDE)

SWM "2"
W/ UNDERDRAIN (1,600 SF)
BANK: 19.6
TOP: 19.0
OUTLET: 15.4

OVERFLOW
SD #2
TOP: 19.3
INV: 15.4

15"HDPE

SWM JBOX
SD #1
TOP: 18.5
INV.IN: 15.0(SD2)
INV.IN: 13.60(SD3)
INV.OUT: 13.5

OVERFLOW
SD #3
TOP: 18.0
INV.IN: 14.2(SD4)
INV.IN: 14.0(SD5)
INV.OUT: 13.9

18" HDPE

FLARED END
INV. 11.5

0 10 20 30 60
1"=30'

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-308 design Phase-2013\CAD drawings\Civil\ 112003834-C16X_SWM.dwg

PLOT DATE: Jul 03, 2013 - 1:34pm

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE:
DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

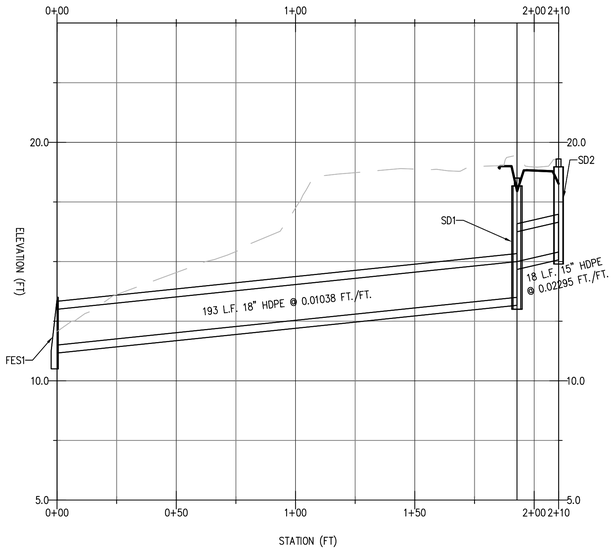
SHEET TITLE:
STORMWATER UTILITY PLAN - II

SCALE: 1"=30'

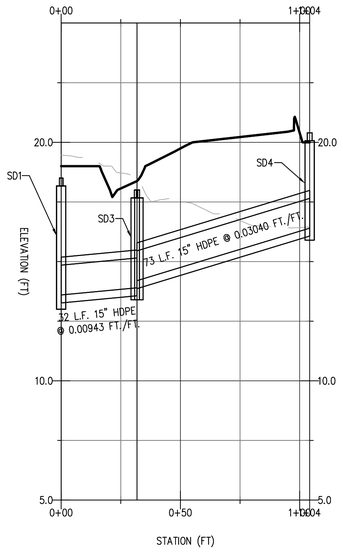
DATE: 07/03/2013

CONTRACT NO.: N/A

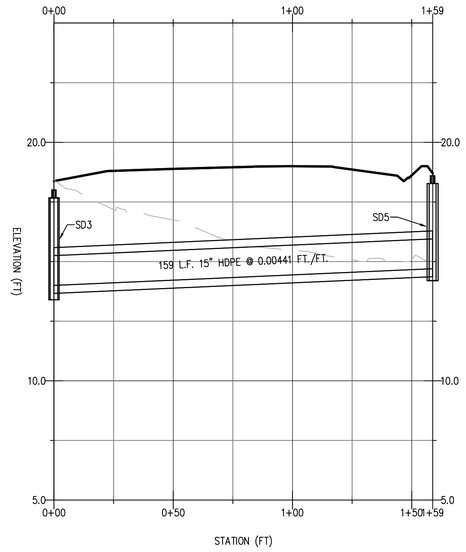
SHEET NO.: C-162



PV – FES TO SD2
STORM #1
H: 1"=30'
V: 1"=3'



PV – SD1 TO SD4
STORM #2
H: 1"=30'
V: 1"=3'



PV – SD3 TO SD5
STORM #3
H: 1"=30'
V: 1"=3'

STORM DRAIN STRUCTURE TABLE				
STRUCTURE NO.	STRUCTURE DETAILS	COORDINATES	RIM ELEV.	SUMP ELEV.
SD1	SD1 to SD2 INV IN = 15.00 SD3 to SD1 INV IN = 13.60 FES1 to SD1 INV OUT = 13.50	NORTHING: 604411.5957 EASTING: 1479871.4071	18.50	13.50
SD2	SD1 to SD2 INV OUT = 15.40	NORTHING: 604422.0317 EASTING: 1479885.3684	19.30	15.40
SD3	SD4 to SD3 INV IN = 14.20 SD5 to SD3 INV IN = 14.00 SD3 to SD1 INV OUT = 13.90	NORTHING: 604435.5578 EASTING: 1479850.4950	18.00	13.90
SD4	SD4 to SD3 INV OUT = 16.40	NORTHING: 604504.6649 EASTING: 1479871.9858	20.40	16.40
SD5	SD5 to SD3 INV OUT = 14.70	NORTHING: 604524.2970 EASTING: 1479718.8911	18.60	14.70
FES1	FLARED END SECTION OUTFALL	NORTHING: 604263.2498 EASTING: 1479748.3099	N/A	11.50
FES2	FLARED END SECTION OUTLET	NORTHING: 605198.4000 EASTING: 1478875.0400	N/A	3.72
FES3	FLARED END SECTION INLET	NORTHING: 605150.9600 EASTING: 1478886.5800	N/A	3.85

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ___

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

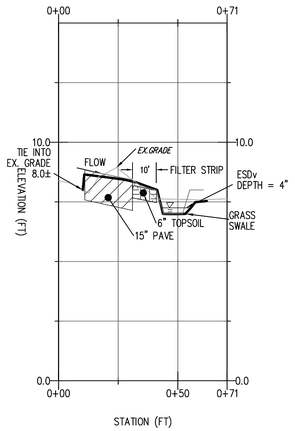
SHEET TITLE: STORM DRAIN PROFILE
STORMWATER UTILITY PLAN – III

SCALE: AS NOTED
DATE: 07/03/2013

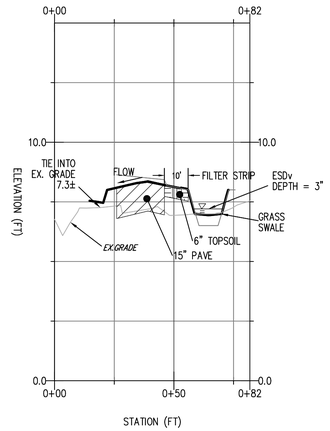
CONTRACT NO.: N/A

SHEET NO.: C-163

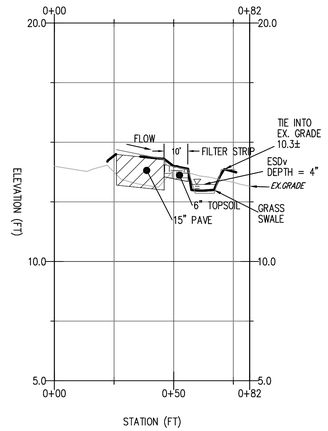
DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30ft design Phase-2013\CAD drawings\Civil\ 112103834-C16X_SWM.dwg
PLOT DATE: Jul 03, 2013 - 1:34pm



ESD 1
SWALE #1
H: 1"=30'
V: 1"=3'



ESD 2
SWALE #2
H: 1"=30'
V: 1"=3'



ESD 3
SWALE #3
H: 1"=30'
V: 1"=3'

MDE NO:

AS-BUILT DATA FOR ESD 1 DISCONNECTION OF NON-ROOFTOP RUNOFF AND GRASS SWALE (SWALE #1) *TO BE COMPLETED BY THE CERTIFYING ENGINEER		
SITE DEVELOPMENT	**DESIGN**	***AS-BUILT**
DISCONNECTION OF NON-ROOFTOP RUNOFF	GRASS FILTER STRIP	
AREA (LENGTH x WIDTH)	3,000 SF (300'x10')	
SLOPE	2%	
GRASS SWALE		
AREA (LENGTH x WIDTH)	2,400 SF (300'x8')	
CHANNEL SLOPE	0.8%	
SIDE SLOPE RATIO(S)	3H:1V	
DISCHARGE ELEVATION	5.5	
10-YEAR FLOW VELOCITY	0.49 FPS	
10-YEAR FREEBOARD	6 INCH	

DATE AS-BUILT ACCEPTED BY MDE: _____

MDE NO:

AS-BUILT DATA FOR ESD 2 DISCONNECTION OF NON-ROOFTOP RUNOFF AND GRASS SWALE (SWALE #2) *TO BE COMPLETED BY THE CERTIFYING ENGINEER		
SITE DEVELOPMENT	**DESIGN**	***AS-BUILT**
DISCONNECTION OF NON-ROOFTOP RUNOFF	GRASS FILTER STRIP	
AREA (LENGTH x WIDTH)	8,000 SF (800'x10')	
SLOPE	2%	
GRASS SWALE		
AREA (LENGTH x WIDTH)	6,400 SF (800'x8')	
CHANNEL SLOPE	0.7%	
SIDE SLOPE RATIO(S)	3H:1V	
DISCHARGE ELEVATION	4.50	
10-YEAR FLOW VELOCITY	0.66 FPS	
10-YEAR FREEBOARD	6 INCH	

DATE AS-BUILT ACCEPTED BY MDE: _____

MDE NO:

AS-BUILT DATA FOR ESD 3 DISCONNECTION OF NON-ROOFTOP RUNOFF AND GRASS SWALE (SWALE #3) *TO BE COMPLETED BY THE CERTIFYING ENGINEER		
SITE DEVELOPMENT	**DESIGN**	***AS-BUILT**
DISCONNECTION OF NON-ROOFTOP RUNOFF	GRASS FILTER STRIP	
AREA (LENGTH x WIDTH)	2,500 SF (250'x10')	
SLOPE	2%	
GRASS SWALE		
AREA (LENGTH x WIDTH)	2,000 SF (250'x8')	
CHANNEL SLOPE	1.0%	
SIDE SLOPE RATIO(S)	3H:1V	
DISCHARGE ELEVATION	11.00	
10-YEAR FLOW VELOCITY	0.53 FPS	
10-YEAR FREEBOARD	6 INCH	

DATE AS-BUILT ACCEPTED BY MDE: _____

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

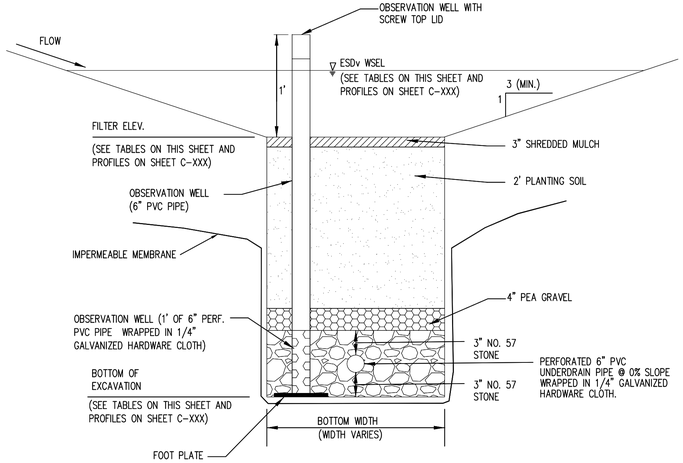
SHEET TITLE: GRASS SWALE SECTION
STORMWATER UTILITY PLAN - IV

SCALE: AS NOTED
DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-164

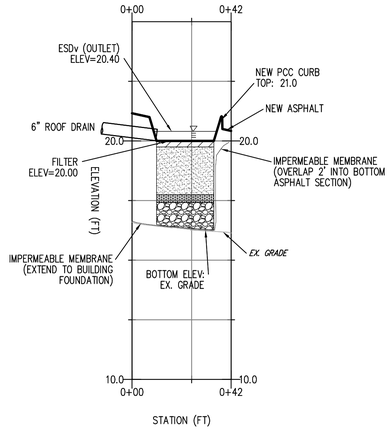
DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30ft design Phase-2013\CAD drawings\Civil\ 112103834-C16X_SWM.dwg
PLOT DATE: Jul 03, 2013 - 1:35pm



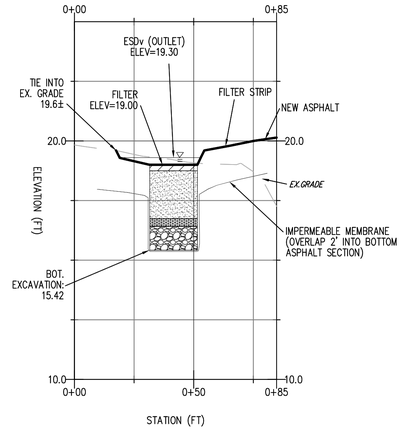
X
CXXX

TYPICAL BIORETENTION SECTION

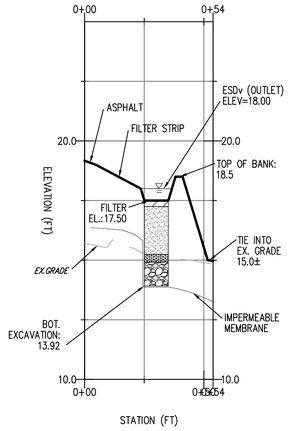
PER LENGTH AND WIDTH SHOWN ON PLAN



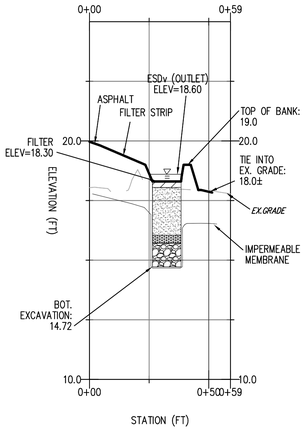
ESD 4
SWM #1
H: 1"=30'
V: 1"=3'



ESD 5
SWM #2
H: 1"=30'
V: 1"=3'



ESD 6
SWM #3
H: 1"=30'
V: 1"=3'



ESD 7
SWM #4
H: 1"=30'
V: 1"=3'

MDE NO:

AS-BUILT DATA FOR ESD 4
REINFORCED TURF AND MICRO-BIORETENTION (SWM #1)
***TO BE COMPLETED BY THE CERTIFYING ENGINEER**

SITE DEVELOPMENT	DESIGN	*AS-BUILT
ALTERNATIVE SURFACE	REINFORCED TURF	
SIZE	544 SF	
SUBBASE	9"	
ESDv WSEL (OUTLET ELEV.)	20.40	
FILTER BED AREA (LENGTH x WIDTH)	1,920 SF (80'x24')	
FILTER BED SURFACE ELEVATION	20.00	
SHREDDED MULCH THICKNESS	3 INCH	
PLANTING SOIL DEPTH	2 FT	
PEA GRAVEL THICKNESS	4 INCH	
FILTER UNDERDRAIN PIPE	PERF. PVC	
SIZE	6" DIA.	
ELEVATION	16.67	
CLEANOUT	6" PVC	
OBSERVATION WELL	6" PVC	
LENGTH OF PERFORATED PIPE	1'	
OVERFLOW OUTLET STRUCTURE	SD #4	
SIZE – CREST	4'X4'	
SUMP ELEVATION	16.40	
UNDERDRAIN INVERT	16.67	
STONE DEPTH	1 FT	
TOP ELEVATION	17.42	
BOTTOM ELEVATION	16.42	

DATE AS-BUILT ACCEPTED BY MDE: _____

MDE NO:

AS-BUILT DATA FOR ESD 5
DISCONNECTION OF NON-ROOFTOP RUNOFF AND MICRO-BIORETENTION (SWM #2)
***TO BE COMPLETED BY THE CERTIFYING ENGINEER**

SITE DEVELOPMENT	DESIGN	*AS-BUILT
NONSTRUCTURAL PRACTICE	GRASS FILTER STRIP	
DISCONNECTION LENGTH	20 FT WIDE	
ESDv WSEL (OUTLET ELEV.)	19.30	
FILTER BED AREA (LENGTH x WIDTH)	1,600 SF (80'X20')	
FILTER BED SURFACE ELEVATION	19.0	
SHREDDED MULCH THICKNESS	3 INCH	
PLANTING SOIL DEPTH	2 FT	
PEA GRAVEL THICKNESS	4 INCH	
FILTER UNDERDRAIN PIPE	PERF. PVC	
SIZE	6" DIA.	
ELEVATION	15.67	
CLEANOUT	6" PVC	
OBSERVATION WELL	6" PVC	
LENGTH OF PERFORATED PIPE	1'	
OVERFLOW OUTLET STRUCTURE	SD #2	
SIZE – CREST	4'X4'	
SUMP ELEVATION	15.40	
UNDERDRAIN INVERT	15.67	
STONE DEPTH	1 FT	
TOP ELEVATION	16.42	
BOTTOM ELEVATION	15.42	

DATE AS-BUILT ACCEPTED BY MDE: _____

MDE NO:

AS-BUILT DATA FOR ESD 6
DISCONNECTION OF NON-ROOFTOP RUNOFF AND MICRO-BIORETENTION (SWM #3)
***TO BE COMPLETED BY THE CERTIFYING ENGINEER**

SITE DEVELOPMENT	DESIGN	*AS-BUILT
NONSTRUCTURAL PRACTICE	GRASS FILTER STRIP	
DISCONNECTION LENGTH	10 FT WIDE	
ESDv WSEL (OUTLET ELEV.)	18.00	
FILTER BED AREA (LENGTH x WIDTH)	1,300 SF (130'X10')	
FILTER BED SURFACE ELEVATION	17.50	
SHREDDED MULCH THICKNESS	3 INCH	
PLANTING SOIL DEPTH	2 FT	
PEA GRAVEL THICKNESS	4 INCH	
FILTER UNDERDRAIN PIPE	PERF. PVC	
SIZE	6" DIA.	
ELEVATION	14.17	
CLEANOUT	6" PVC	
OBSERVATION WELL	6" PVC	
LENGTH OF PERFORATED PIPE	1'	
OVERFLOW OUTLET STRUCTURE	SD #3	
SIZE – CREST	4'X4'	
SUMP ELEVATION	13.90	
UNDERDRAIN INVERT	14.17	
STONE DEPTH	2'	
TOP ELEVATION	14.92	
BOTTOM ELEVATION	13.92	

DATE AS-BUILT ACCEPTED BY MDE: _____

MDE NO:

AS-BUILT DATA FOR ESD 7
MICRO-BIORETENTION (SWM #4)
***TO BE COMPLETED BY THE CERTIFYING ENGINEER**

SITE DEVELOPMENT	DESIGN	*AS-BUILT
ESDv WSEL (OUTLET ELEV.)	18.60	
FILTER BED AREA (LENGTH x WIDTH)	1,680 SF (140'x12')	
FILTER BED SURFACE ELEVATION	18.30	
SHREDDED MULCH THICKNESS	3 INCH	
PLANTING SOIL DEPTH	2 FT	
PEA GRAVEL THICKNESS	4 INCH	
FILTER UNDERDRAIN PIPE		
SIZE	6" PERF. PVC	
ELEVATION	14.97	
CLEANOUT	6" PVC	
OBSERVATION WELL	6" PVC	
LENGTH OF PERFORATED PIPE	1'	
OVERFLOW OUTLET STRUCTURE	SD #5	
SIZE – CREST	4'X4'	
SUMP ELEVATION	14.70	
UNDERDRAIN INVERT	14.97	
STONE DEPTH	1 FT	
TOP ELEVATION	15.72	
BOTTOM ELEVATION	14.72	

DATE AS-BUILT ACCEPTED BY MDE: _____

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: MICRO-BIORETENTION SECTION STORMWATER UTILITY PLAN – V

SCALE: AS NOTED

DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-165

PLOT DATE: Jul 03, 2013 - 1:35pm

DRAWING NAME: S:\03-Projects\Commercial\LMC\103925701-DRA-308 design Phase-2013\CAD drawings\Civil\ 112003834-C16X_SWM.dwg

MDE NO:

AS-BUILT DATA FOR ESD 8 REINFORCED TURF *TO BE COMPLETED BY THE CERTIFYING ENGINEER		
SITE DEVELOPMENT	**DESIGN**	***AS-BUILT**
ALTERNATIVE SURFACE	WELL ACCESS ROAD	
AREA	EW-13 TO EX-16	
SUBBASE	3,917 SF	
SIZE	9"	
AREA	EW-8 TO EX-12	
SIZE	5,514 SF	
SUBBASE	9"	
AREA	EW-4 TO EX-7	
SIZE	4,939 SF	
SUBBASE	6"	
AREA	EW-1 TO EX-3	
SIZE	4,448 SF	
SUBBASE	6"	

DATE AS-BUILT ACCEPTED BY MDE: _____

NOTES:
1. REINFORCED TURF AREAS ARE CONSIDERED AS PERMEABLE SURFACES, WHICH HAVE A LOWER LOAD LOAD BEARING CAPACITY THAN CONVENTIONAL PAVEMENTS. HEAVY VEHICLES SHALL BE LIMITED ON THESE AREAS TO AVOID COMPACTING THE SUB SOILS.
2. A BASE LAYER OF CLEAN, OPEN GRADED STONE OR SAND WITH A POROCITY (N) OF 30% (1.5" TO 2" STONE IS PREFERRED) SHALL BE USED BELOW THE TURF SURFACE. THE THICKNESS OF SUBBASE THICKNESS VARIES FROM 6" TO 9" THICK DEPENDING ON THE EXTRACTION WELL (EW) AREAS.
3. HEAVY EQUIPMENT MAY BE NECESSARY TO INSTALL THE EXTRACTION WELLS. DO NOT INSTALL THE REINFORCED TURF UNTIL EXTRACTION WELLS ARE IN PLACE. THE COMPACTED SOIL SHALL BE AERATED PRIOR TO THE INSTALLATION OF REINFORCED TURF.

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: REINFORCED TURF
STORMWATER UTILITY PLAN - VI

SCALE: AS NOTED
DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-166

PLOT DATE: Jul 03, 2013 - 1:36pm
DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30ft design Phase-2013\CAD drawings\Civil\ 112103834-C16X_SWM.dwg

OWNER'S/DEVELOPER'S CERTIFICATION

I/WE HEREBY CERTIFY THAT ALL CLEARING, GRADING, CONSTRUCTION, AND/OR DEVELOPMENT WILL BE DONE PURSUANT TO THIS PLAN AND THAT ANY RESPONSIBLE PERSONNEL INVOLVED IN THE CONSTRUCTION PROJECT WILL HAVE A CERTIFICATE OR ATTENDANCE AT A MARYLAND DEPARTMENT OF THE ENVIRONMENT APPROVED TRAINING PROGRAM FOR THE CONTROL OF EROSION AND SEDIMENT BEFORE BEGINNING THE PROJECT. I/WE HEREBY AUTHORIZE THE RIGHT OF ENTRY FOR PERIODIC ON-SITE EVALUATION BY APPROPRIATE INSPECTION AND ENFORCEMENT AUTHORITY OR THE STATE OF MARYLAND, DEPARTMENT OF THE ENVIRONMENT.

Date _____ Owner/Developer Signature _____

Card No. _____ Printed Name and Title _____

DESIGN CERTIFICATION

I HEREBY CERTIFY THAT THIS PLAN HAS BEEN DESIGNED IN ACCORDANCE WITH THE MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL, THE 2000 MARYLAND STORMWATER DESIGN MANUAL, VOLUMES I & II INCLUDING SUPPLEMENTS, THE ENVIRONMENT ARTICLE SECTIONS 4-101 THROUGH 116 AND SECTIONS 4-201 AND 215, AND THE CODE OF MARYLAND REGULATIONS (COMAR) 26.17.01 AND COMAR 26.17.02 FOR EROSION AND SEDIMENT CONTROL AND STORMWATER MANAGEMENT, RESPECTFULLY.

Date _____ Designer's Signature _____

Md. Registration No. _____ Printed Name _____
P.E., R.L.S. OR R.L.A. (Circle)

STORMWATER MANAGEMENT "AS-BUILT" CERTIFICATION

I HEREBY CERTIFY THAT THE STORMWATER MANAGEMENT FACILITITES (BOTH BMPS AND ESD PRACTICES) SHOWN ON THE PLANS HAVE BEEN CONSTRUCTED IN ACCORDANCE WITH THE PLANS APPROVED BY THE MARYLAND DEPARTMENT OF THE ENVIRONMENT, EXCEPT AS NOTED IN RED ON THE "AS-BUILT" DRAWINGS. FURTHERMORE, THE RED-NOTED EXCEPTIONS DO NOT ADVERSELY AFFECT THE INTENDED PERFORMANCE OF THE FACILITIES.

NAME (PRINTED) _____ SIGNATURE _____

MARYLAND REGISTRATION NUMBER (PE or LS) _____ DATE _____

MDE. No. _____

FACILITIES BEING CERTIFIED:

ESD 1 (DISCONNECTION OF NON-ROOF TOP RUNOFF AND GRASS SWALE) _____

ESD 2 (DISCONNECTION OF NON-ROOF TOP RUNOFF AND GRASS SWALE) _____

ESD 3 (DISCONNECTION OF NON-ROOF TOP RUNOFF AND GRASS SWALE) _____

ESD 4 (REINFORCED TURF AND MICRO-BIORETENTION) _____

ESD 5 (DISCONNECTION OF NON-ROOF TOP RUNOFF AND MICRO-BIORETENTION) _____

ESD 6 (DISCONNECTION OF NON-ROOF TOP RUNOFF AND MICRO-BIORETENTION) _____

ESD 7 (MICRO-BIORETENTION) _____

ESD 8 (REINFORCED TURF) _____

"CERTIFY" means to state or declare a professional opinion based on sufficient and appropriate onsite inspections and material tests conducted during construction.

TABLE B.4.1 SWM MATERIAL SPECIFICATIONS

MATERIAL	SPECIFICATION	SIZE	NOTES
PLANTINGS	SEE SHEET L-101	N/A	PLANTINGS ARE SITE-SPECIFIC
PLANTING SOIL [2' TO 4' DEEP]	LOAMY SAND (60 – 65%) & COMPOST (35 – 40%) OR SANDY LOAM (30%), COARSE SAND (30%), COMPOST (40%)	N/A	USDA SOIL TYPES LOAMY SAND OR SANDY LOAM; CLAY CONTENT < 5%
ORGANIC CONTENT	MIN. 10% BY DRY WEIGHT	N/A	
MULCH	SHREDDED HARDWOOD		AGED 6 MONTHS, MINIMUM; NO PINE OR WOOD CHIPS
PEA GRAVEL DIAPHRAGM	PEA GRAVEL: ASTM-D-448	NO.8 OR NO.9 (1/8" TO 3/8")	
CURTAIN DRAIN	ORNAMENTAL STONE: WASHED GOBBLES	STONE: 2" TO 5"	
GEOTEXTILE		N/A	PE TYPE 1 NONWOVEN
GRAVEL (UNDERDRAINS AND INFILTRATION BERMS)	AASHTO M-43	NO.57 OR NO.6 AGGREGATE (3/8" TO 3/4")	
UNDERDRAIN PIPING	F-758, TYPE PS 28 OR AASHTO M-278	4" TO 6" RIGID SCHEDULE 40 PVC OR SDR 35	SLOTTED OR PERFORATED PIPE; 3/8" PERF. @ 6" ON CENTER, 4 HOLES PER ROW; MINIMUM OF 3" GRAVEL OVER PIPES; NOT NECESSARY UNDERNEATH PIPES. PERFORATED PIPE SHALL BE WRAPPED WITH 1/4-INCH GALVANIZED HARDWARE CLOTH.
POURED IN PLACE CONCRETE (IF REQUIRED)	MSHA MIX NO.3 F'c= 3500 PSI @ 28 DAYS, NORMAL WEIGHT, AIR-ENTRAINED; REINFORCING TO MEET ASTM-615-60	N/A	ON-SITE TESTING OF POURED-IN-PLACE CONCRETE REQUIRED; 28 DAY STRENGTH AND SLUMP TEST; ALL CONCRETE DESIGN (CAST-IN-PLACE OR PRE-CAST) NOT USING PREVIOUSLY APPROVED STATE OR LOCAL STANDARDS REQUIRES DESIGN DRAWINGS SEALED AND APPROVED BY A PROFESSIONAL STRUCTURAL ENGINEER LICENSED IN THE STATE OF MARYLAND -DESIGN TO INCLUDE MEETING ACI CODE 350.R/89; VERTICAL LOADING [H-10 OR H-20]; ALLOWABLE HORIZONTAL LOADING (BASED ON SOIL PRESSURES); AND ANALYSIS OF POTENTIAL CRACKING
SAND	AASHTO M-6 OR ASTM C-33	0.02" – 0.04"	SAND SUBSTITUTIONS SUCH AS DIABASE AND GRAYSTONE (AASHTO) #10 ARE NOT ACCEPTABLE. NO CALCIUM CARBONATED OR DOLOMITIC SAND SUBSTITUTIONS ARE ACCEPTABLE. NO "ROCK DUST" CAN BE USED FOR SAND.

STORMWATER MAINTENANCE SCHEDULE
ENVIRONMENTAL SENSITIVE DESIGN

PRACTICE	FREQUENCY OF INSPECTION	PREVENTIVE MAINTENANCE	MAINTENANCE REQUIREMENTS
MICRO-BIORETENTION	SEASONALLY (AND AFTER A MAJOR STORM)	IF SPECIFIC PLANTS ARE NOT SURVIVING, REPLACE WITH MORE APPROPRIATE SPECIES.	IRRIGATE DURING PROLONGED DRY PERIODS. REMOVE ANY DEAD OR DYING VEGETATION AND REVEGETATE. PRUNE VEGETATION OCCASIONALLY. REMOVE ACCUMULATED SEDMENT FROM SURFACE OF FILTER BED WHEN ACCUMULATION EXCEEDS ON INCH. IF WATER PONDS FOR MORE THAN 48 HOURS, REMOVE AND REPLACE THE TOP FEW INCHES OF FILTER MEDIA. REPLACE MULCH ANNUALLY WHERE PRACTICE TREATS AREAS WITH HIGH CONCENTRATIONS OF HEAVY METALS. OTHERWISE, REPLACE TOP 2-3 INCHES AS NECESSARY.
SWALES	BIANNUALLY		MOW GRASS SWALES AT LEAST TWICE A YEAR. IRRIGATE DURING PROLONGED DRY PERIODS. REMOVE SEDIMENT, DEBRIS, AND TRASH. RE-SEED SPARSELY VEGETATED AREAS TO MAINTAIN DENSE COVERAGE. REPAIR EROSION ON BOTTOM, SIDE SLOPES, AND INLETS. STABILIZE. IF WATER PONDS FOR MORE THAN 48 HOURS, TILL BOTTOM SOIL AND REVEGETATE. ASSESS PERFORMANCE OF FACILITY AND MAINTAIN THE FOLLOWING AS NECESSARY: SLOPE INTEGRITY, VEGETATIVE HEALTH, SOIL STABILITY, COMPACTION, EROSION, PONDING, AND SEDIMENTATION.
REINFORCED TURF	SEASONALLY (AND AFTER A MAJOR STORM)	PREVENT TRUCKS AND OTHER HEAVY VEHICLES FROM DRIVING ON TURF.	MOW REGULARLY AND REMOVE CLIPPINGS FROM APPLICATION AREA. CLEAN ASSOCIATED DRAINAGE PIPES, INLETS, STONE EDGE DRAINS AND OTHER STRUCTURES DRAINING TO/FROM PRACTICE.

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: DETAILS
STORMWATER MANAGEMENT PLAN – VII

SCALE: AS NOTED
DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-167

DRAWING NAME: S:\03-Projects\Commercial\LMC\1039257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 1129030834-016X_SWM.dwg
PLOT DATE: Jul 03, 2013 - 1:36pm

CULVERT PROFILE / SECTION PLAN / PROFILE FORTHCOMING

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: CULVERT PLAN / PROFILE

SCALE: 1"=30'

DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-171

PLOT DATE: Jul 03, 2013 - 1:36pm
DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112103834-C16X_SWM.dwg

CULVERT

SITE/STRUCTURAL DETAILS

FORTHCOMING

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ___

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

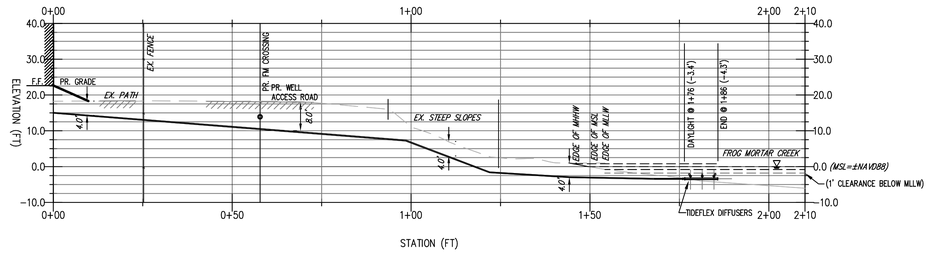
MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

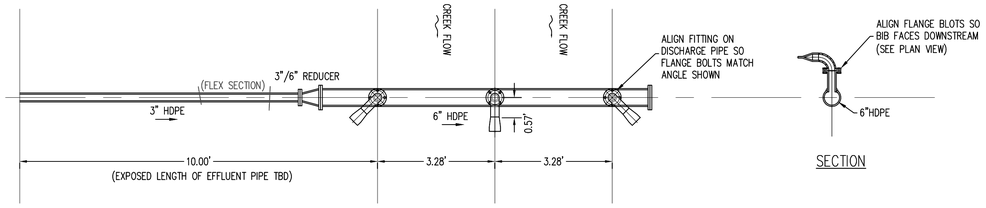
PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE: CULVERT DETAILS
SCALE: 1"=30'
DATE: 07/03/2013

CONTRACT NO.: N/A
SHEET NO.: C-172

PLOT DATE: Jul 03, 2013 - 1:37pm
DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112103834-C16X_SWM.dwg

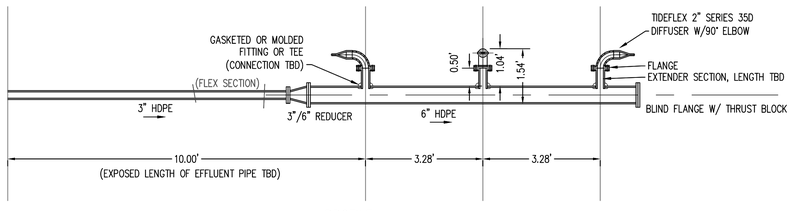


Diffuser
Diffuser
H: 1"=30'
V: 1"=30'

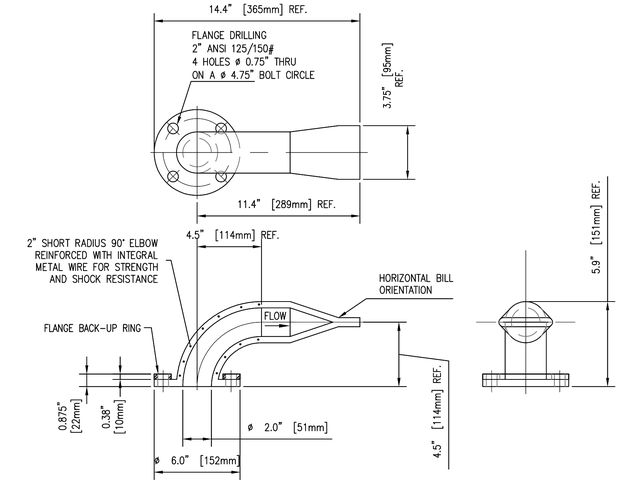


PLAN

SECTION



PROFILE



DIFFUSER PROFILE

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30X design Phase-2013\CAD drawings\Civil\ 112X03834-C16X_SWM.dwg
PLOT DATE: Jul 03, 2013 - 1:37pm

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: OUTFALL DRAIN PROFILE AND UTILITY PLAN

SCALE: AS NOTED

DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-181

OUTFALL SITE/STRUCTURAL DETAILS FORTHCOMING

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: OUTFALL DETAILS

SCALE: 1"=30'

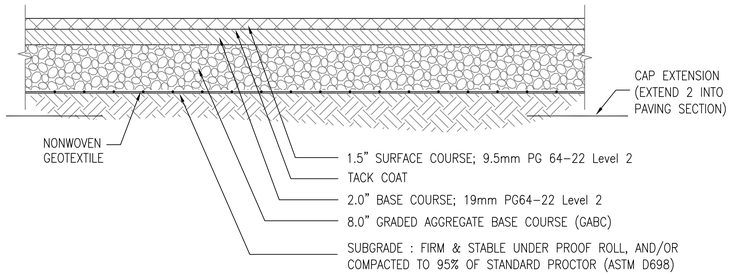
DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-182

PLOT DATE: Jul 03, 2013 - 1:38pm

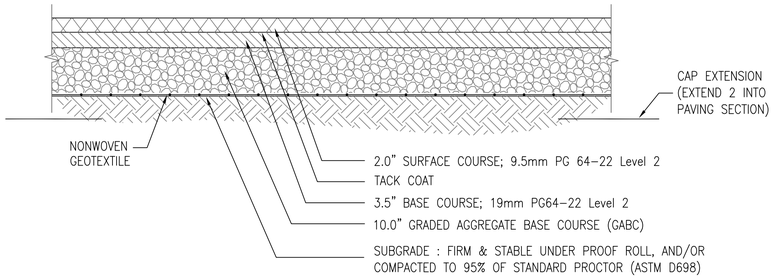
DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112103834-C16X_SWM.dwg



1 / C301 LIGHT HOT MIX ASPHALT (HMA) SECTION (CARS ONLY)

THICKNESS IS BASED UPON A FLEXIBLE PAVEMENT DESIGN DATED JUNE 6, 2013.

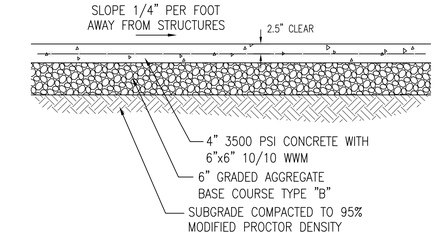
MATERIALS AND CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE MARYLAND STATE HIGHWAY ADMINISTRATION, STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION MANUAL, LATEST EDITION.



1 / C301 HEAVY HOT MIX ASPHALT (HMA) SECTION (TRUCK TRAFFIC AREA)

THICKNESS IS BASED UPON A FLEXIBLE PAVEMENT DESIGN DATED JUNE 6, 2013.

MATERIALS AND CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE MARYLAND STATE HIGHWAY ADMINISTRATION, STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION MANUAL, LATEST EDITION.

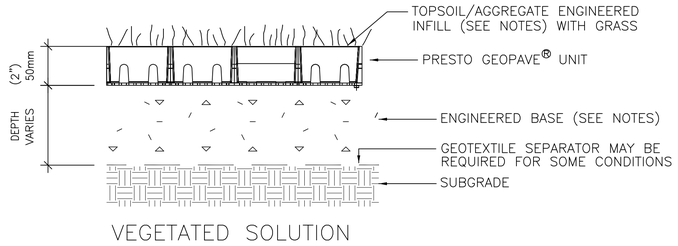


NOTES:

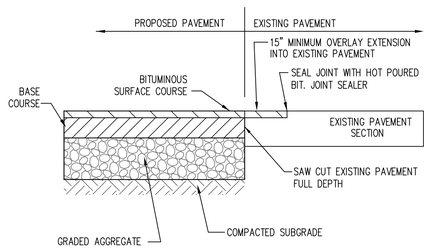
1. 3/4" PREMOLDED EXPANSION JOINT MATERIAL TO BE PLACED WHERE WALKS ABUT CURBS, STEPS, BUILDINGS, OTHER WALKS, ASPHALT, ETC. AND AT A MAXIMUM OF 20' INTERVALS ALONG THE WALK.
2. SCORING SHALL BE PROVIDED AT 4' ON CENTER.
3. ALL TOOL RADIUS TO HAVE A RADIUS OF 1/4".

3 / C301 SECTION: CONCRETE WALK / LANDING

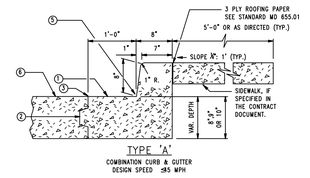
* THIS DETAIL IS BEING PROVIDED AS REFERENCE ONLY AS SIDEWALKS OR LANDINGS ARE NOT CALLED OUT ON PLANS. THIS DETAIL MAY ALSO BE USED FOR LIGHT EXTERIOR MECHANICAL EQUIPMENT (SUCH AS A/C COOLING UNITS) MAX WEIGHT 250 LBS±.



VEGETATED SOLUTION



BUTT JOINT



TYPE 'A'
COMBINATION CURB & GUTTER
DESIGN SPEED ≤35 MPH

BASE MATERIAL:
IF NECESSARY FOR LOADING REQUIREMENTS, THE RECOMMENDED BASE SHALL BE AGGREGATE OR AN ENGINEERED AGGREGATE/TOPSOIL MIXTURE, AND SHOULD BE CONSISTENT WITH THE CHOSEN INFILL TYPE.

A MINIMUM OF 50 MM (2 IN) OF BASE MATERIAL IS GENERALLY RECOMMENDED FOR DRAINAGE, EVEN IF NOT REQUIRED BY DESIGN FOR LOAD SUPPORT. ADDITIONAL BASE DEPTH MAY BE ADDED IF REQUIRED OVER A LOW-PERMEABLE BASE OR TO FUNCTION AS A STORM WATER DETENTION/RETENTION LAYER.

RECOMMENDED AGGREGATE INFILL:
THE AGGREGATE INFILL SHALL BE A WELL-GRADED 10 MM TO 13 MM (0.375 TO 0.5 IN) CRUSHED ANGULAR STONE WTIH A FINE CONTENT LESS THAN 5%.

RECOMMENDED ENGINEERED BASE FOR VEGETATED SOLUTIONS:
SUPPORT SOIL SHALL CONSIST OF A HOMOGENOUS MIXTURE CONSISTING OF 1) A CLEAR-STONE/CRUSHED ROCK HAVING AN AASHTO #5 OR SIMILAR DESIGNATION BLENDED WITH 2) PULVERIZED TOPSOIL AND 3) A VOID COMPONENT GENERALLY CONTAINING AIR AND/OR WATER. THIS HOMOGENOUS MIXTURE WILL PROMOTE VEGETATIVE GROWTH AND PROVIDE REQUIRED STRUCTURAL SUPPORT. THE AGGREGATE PORTION SHALL HAVE A PARTICLE RANGE FROM 10 MM TO 25 MM (0.375 TO 1.0 IN) WITH A D_{50} OF 13 MM (0.5 IN). THE PERCENTAGE VOID-SPACE OF THE AGGREGATE PORTION WHEN COMPACTED SHALL BE AT LEAST 30%. THE PULVERIZED TOPSOIL SHALL EQUAL 25% OF THE TOTAL VOLUME AND BE ADDED AND BLENDED TO PRODUCE A HOMOGENOUS MIXTURE PRIOR TO PLACEMENT. ONCE PLACED, THE MIXTURE SHALL BE COMPACTED TO 95% STANDARD PROCTOR DENSITY.

RECOMMENDED ENGINEERED INFILL FOR VEGETATED SOLUTIONS:
SAME AS ENGINEERED BASE BUT WITH A PARTICLE RANGE FROM 10 MM TO 13 MM (0.375 TO 0.5 IN)

4 / C301 REINFORCED TURF SECTION

SOURCE: PRESTO GEOSYSTEMS® GEOPAVE®
DRAWING# GEOPAVE-A1.dwg

6 / C301 JOINT BETWEEN BITUMINOUS PAVING AND REINFORCE TURF????

① SLOPE GUTTER PAN ½" PER FOOT TOWARD FLOW LINE ON ALL ROADWAYS INCLUDING SUPERELEVATED SECTIONS, EXCEPT INTERCHANGE RAMPS.
② PROVIDE KEY AND LONGITUDINAL TIE BAR AS REQUIRED; SEE NOTE A
③ ROADWAY PAVEMENT CONSTRUCTION JOINT
④ LONGITUDINAL TIE DEVICE "J" BAR MODIFIED
⑤ FLOW LINE
⑥ ROADWAY PAVEMENT SLOPE

WORKING DETAIL
NOT FOR REVIEW

NOTES

A. RIGID PAVEMENT ROADWAY ADJACENT TO COMBINATION CURB AND GUTTER AND CLOSED SECTION ROADWAY USING RIGID PAVEMENT WITH COMBINATION CURB AND GUTTER SHALL BE KEYED AND TIED AT THE ROADWAY PAVEMENT CONSTRUCTION JOINT. REFER TO STANDARD MD 572.61 FOR METHOD OF KEYWAY AND LONGITUDINAL TIE DEVICES. SPACING OF THE TIE BARS SHALL BE IN ACCORDANCE WITH THE SPECIFICATIONS. RIGID PAVEMENT AND CURB SHALL BE CONSTRUCTED AS INDICATED. TIE DEVICES AND KEYS ARE NOT REQUIRED WHEN USING FLEXIBLE PAVEMENT FOR ROADWAY.

B. MAXIMUM JOINT SPACING FOR CONCRETE CURB AND COMBINATION CURB & GUTTER IS 10'. SEE SPECIFICATION FOR LOCATIONS AND DESCRIPTION OF TREATMENT FOR THE TYPES OF JOINTS USED.

C. TYPE A OR B COMBINATION CURB AND GUTTER SHALL BE USED FOR ALL APPLICABLE NEW CONSTRUCTION AND IN THOSE AREAS WHERE THE COMBINATION CURB AND GUTTER IS TO BE REPLACED IN KIND.

D. TYPE A OR B CURB SHALL BE USED FOR THE REPLACEMENT OF LIKE KIND OF CURB ONLY. NOT TO BE USED FOR NEW CONSTRUCTION EXCEPT WHERE INDICATED ON APPROPRIATE INLET STANDARDS.

X / C301 TYPE 'A' CURB

SOURCE: MD STATE HIGHWAY ADMINISTRATION
BOOK OF STANDARDS
MD 620.02

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

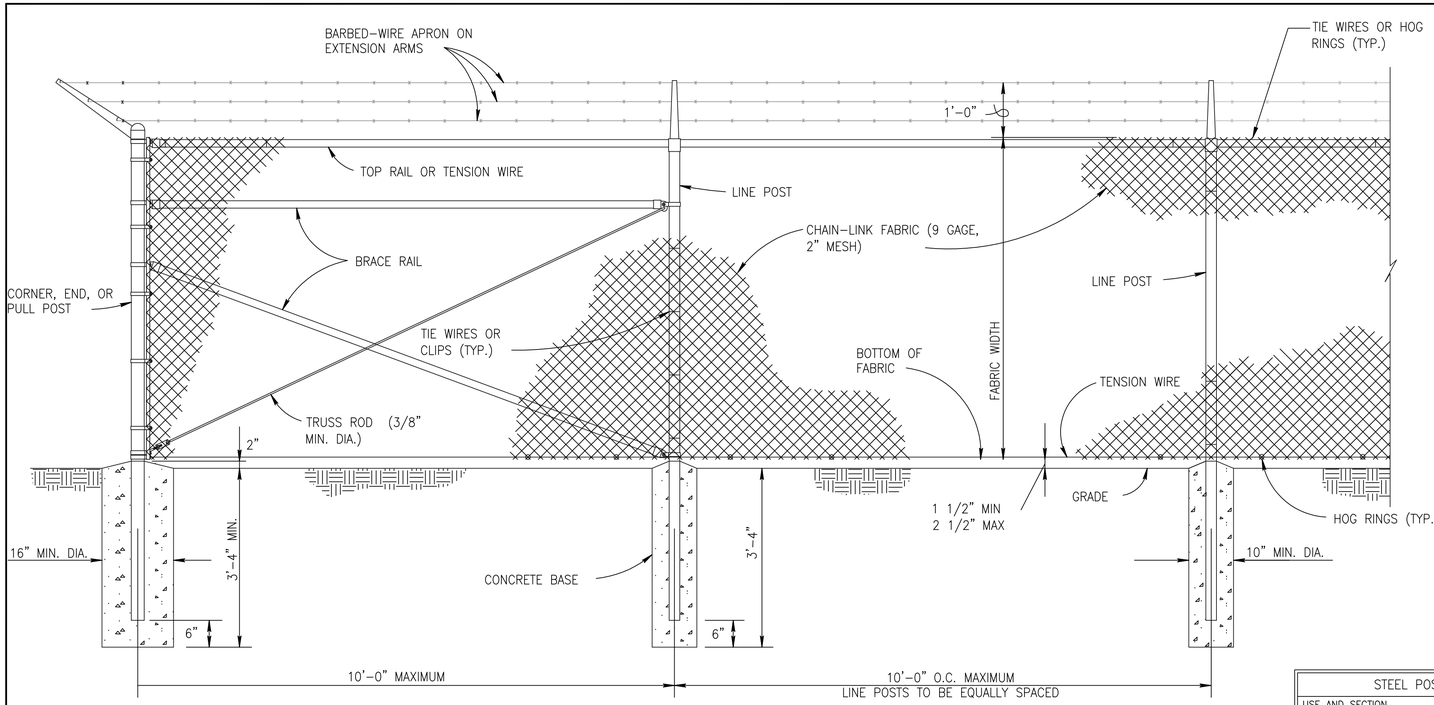
MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE: PAVING DETAILS
SCALE: N.T.S.
DATE: 07/03/2013
CONTRACT NO.: N/A
SHEET NO.: C-301

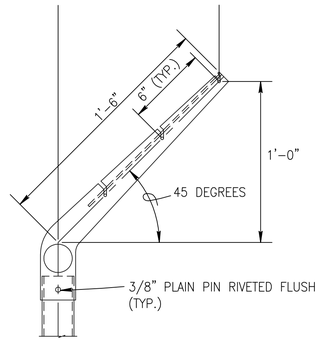
DRAWING NAME: S:\03-Projects\Commercial\LMC\103P25701-09A-30% design Phase-2013\CAD drawings\Civil\ 112003834-C30X_DT.dwg
PLOT DATE: Jul 03, 2013 - 1:40pm



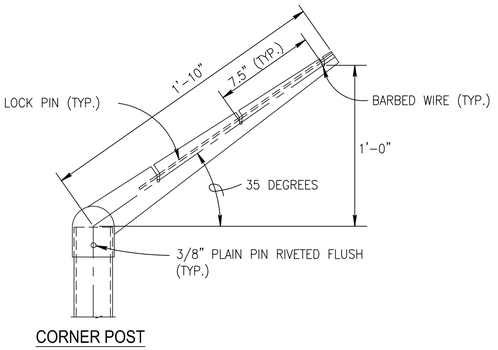
1 / C302 CHAIN-LINK SECURITY FENCE DETAIL (FE-6)

NO SCALE

STEEL POST SCHEDULE	
USE AND SECTION	MINIMUM OUTSIDE DIMENSIONS (NOMINAL)
CORNER, END, & PULL POSTS: TUBULAR – ROUND	2.875" O.D.
LINE POSTS: TUBULAR – ROUND	2.375" O.D.
TOP & BRACE RAILS: TUBULAR – ROUND	1.66" O.D.
GATE POST (4' LEAF): TUBULAR – ROUND	2.875" OD
GATE POST (6' OR 8' LEAF): TUBULAR – ROUND	4.0" OD



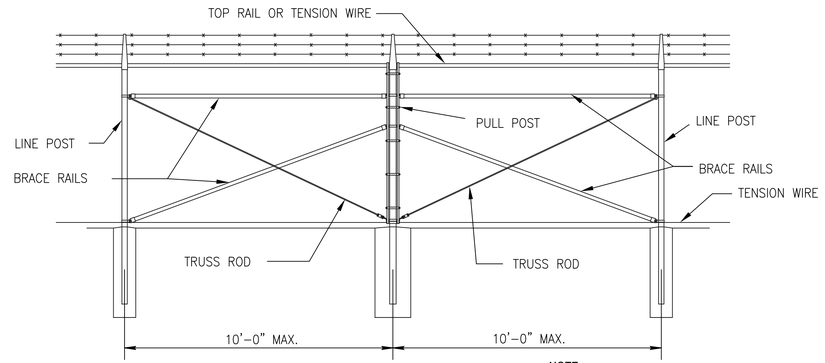
LINE POST



CORNER POST

EXTENSION ARM DETAILS

NO SCALE

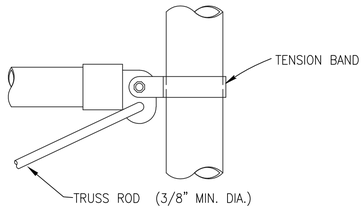


BRACE PANEL DETAIL

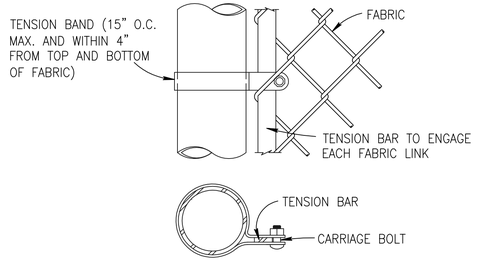
NO SCALE

NOTE:

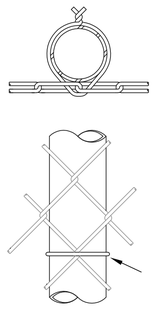
PROVIDE BRACE PANEL WHENEVER STRAIGHT RUNS EXCEED 500 FEET.



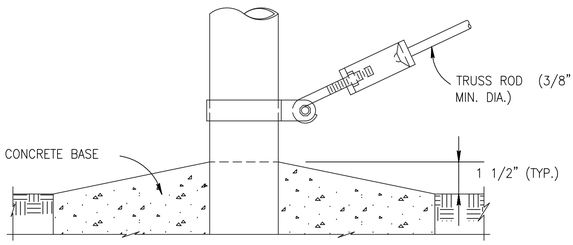
BRACE RAIL CLAMP DETAILS



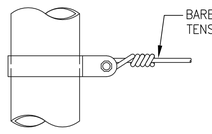
END OR GATE POST DETAIL



LINE POST ATTACHMENT



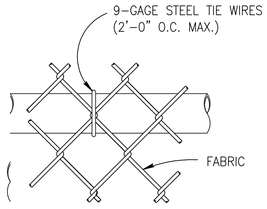
TRUSS ROD AND BAND



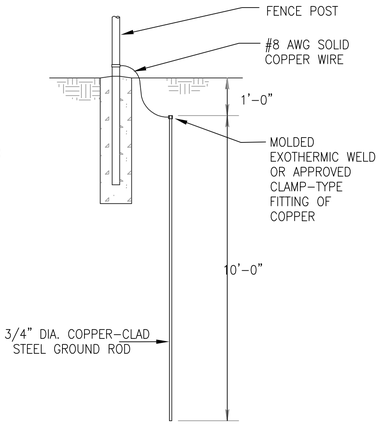
TENSION BAND DETAIL

FASTENING DETAILS

NO SCALE



TOP OR BRACE RAIL ATTACHMENT



GROUNDING DETAIL

NO SCALE

NOTES:

1. FENCE IS NON-SENSORED.
2. DETAILS SHOWN ARE TO CLARIFY REQUIREMENTS AND ARE NOT INTENDED TO LIMIT OTHER TYPES OF FENCE SECTIONS AND METHODS OF INSTALLATION THAT COMPLY WITH THE SPECIFICATIONS
3. SWING GATES SHALL BE CONSTRUCTED WITH DROP RODS, PADLOCKS, LATCH ASSEMBLY AND GATE KEEPERS EXCEPT AS NOTED.
4. ALL GATE FRAMES SHALL BE A MINIMUM 1.90" NOMINAL (ROUND). GATE FRAMES SHALL BE OF WELDED CONSTRUCTION OR SHALL BE ASSEMBLED WITH HEAVY FITTINGS.AT CONTRACTORS OPTION A WELDED HORIZONTAL BRACE MAY BE USED IN LIEU OD TRUSS RODS TO BRACE ALL WELDED GATE FRAMES.THE CONTRACTOR SHALL BE RESPPONSIBLE FOR THE PROPER RIDID CONSTRUCTION OF ALL GATES SUPPLIED.
5. WIRE TIES, RAILS, POSTS, AND BRACES SHALL BE CONSTRUCTED ON THE SECURE SIDE OF THE FENCE ALIGNMENT. CHAIN-LINK FABRIC SHALL BE PLACED ON THE SIDE OPPOSITE THE SECURE AREA.
6. PAINT AND VINYL COATING (FOR FENCE/GATE ON BOTH INTERIOR AND EXTERIOR) COLOR SHALL MATCH EXISTING: "DARK GREEN".

FENCE LEGEND:

ALL FENCE IS TYPE FE6 – CHAIN-LINK FENCE W/BARBED-WIRE ON SINGLE OUTRIGGER

TR – FENCE WITH TOP RAIL AND TENSION WIRE AT BOTTOM – TYPICAL SECTION
TBR – FENCE WITH TOP AND BOTTOM RAILS – USE ON CORNER SECTIONS AND GATE END SECTIONS
TWB – TENSION WIRE TOP AND BOTTOM – NOT USED ON THIS PROJECT
TWBR – FENCE WITH TOP TENSION WIRE AND BOTTOM RAIL – NOT USED ON THIS PROJECT

FINAL NUMBER IS FABRIC WIDTH IN INCHES.

DESIGNATORS:
ALL FENCE IS: FE6-TR-72
CORNER SECTIONS AND GATE END SECTIONS USE "TBR".

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ---

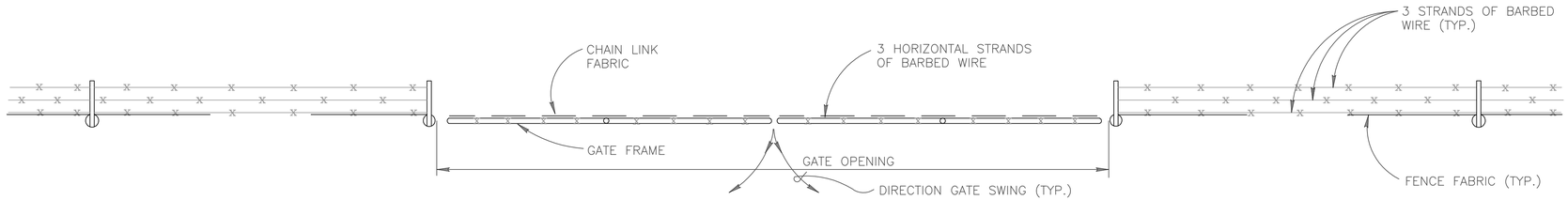
SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION
MARTIN STATE AIRPORT
OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE: FENCE DETAILS I
SCALE: N.T.S.
DATE: 07/03/2013
CONTRACT NO.: N/A
SHEET NO.: C-311

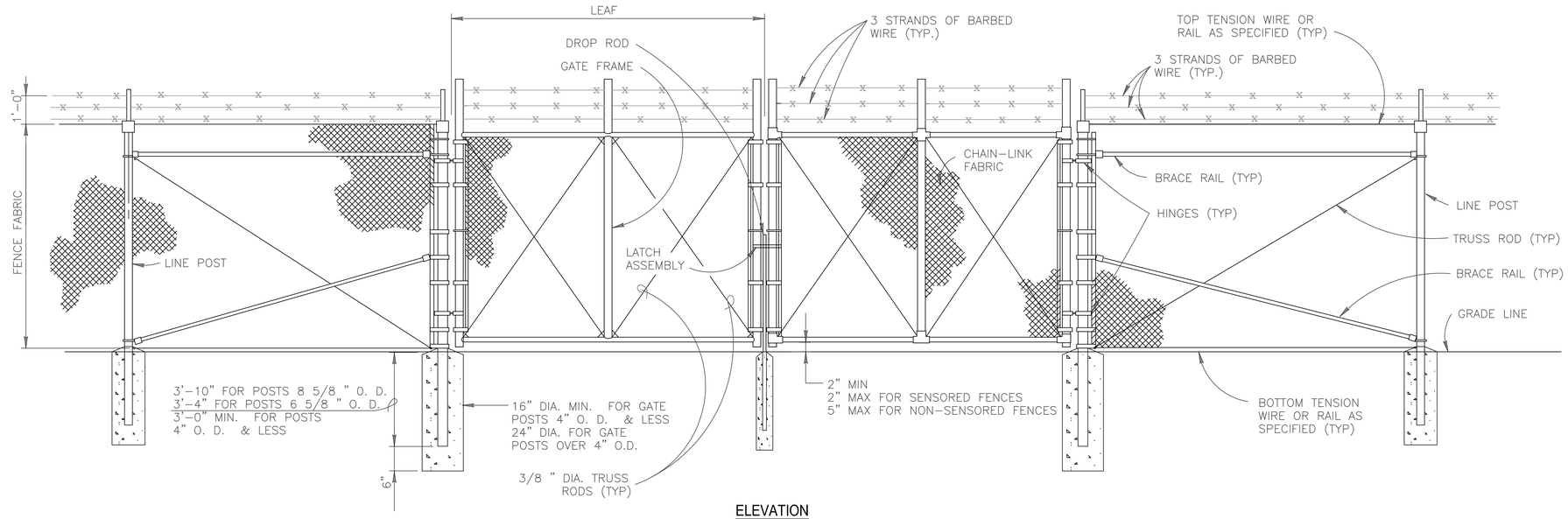
DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112003834-C30X_01.dwg
PLOT DATE: Jul 03, 2013 - 1:40pm



PLAN

SWING GATE SCHEDULE			
LOCATION	ACCESS TYPE	# LEAVES	LEAF SIZE (W)
GATE A	VEHICLE	DOUBLE	12'
GATE B	VEHICLE	DOUBLE	12'
GATE C	VEHICLE	SINGLE	12'
GATE D	VEHICLE	DOUBLE	8'
GATE D.1	PEDESTRIAN	SINGLE	4'
GATE E	VEHICLE	DOUBLE	12'
GATE F	VEHICLE	DOUBLE	10'
GATE G	VEHICLE	DOUBLE	12'
GATE H	VEHICLE	DOUBLE	18'

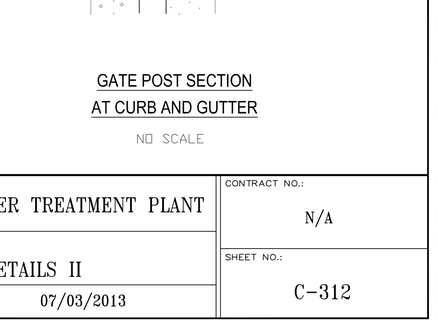
SEE FENCE DETAIL SHEET FOR POST SCHEDULE.



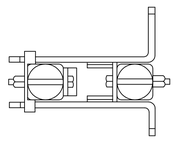
ELEVATION

DOUBLE SWING GATE (TYPE FE-6 FENCE)

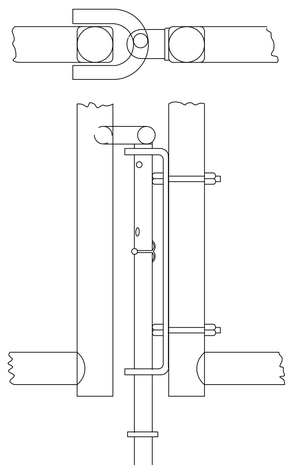
NO SCALE



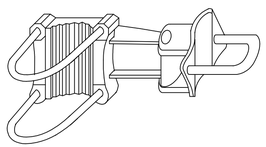
PLAN



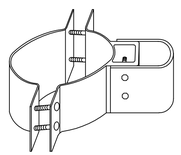
LATCH ASSEMBLY



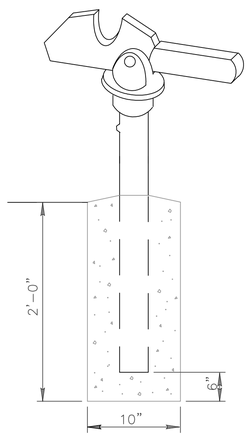
DROP ROD ASSEMBLY



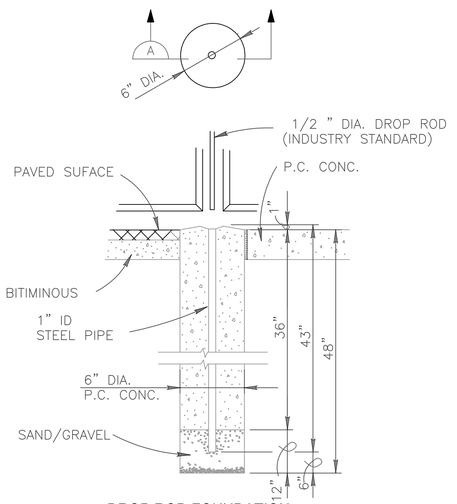
OFFSET HINGE



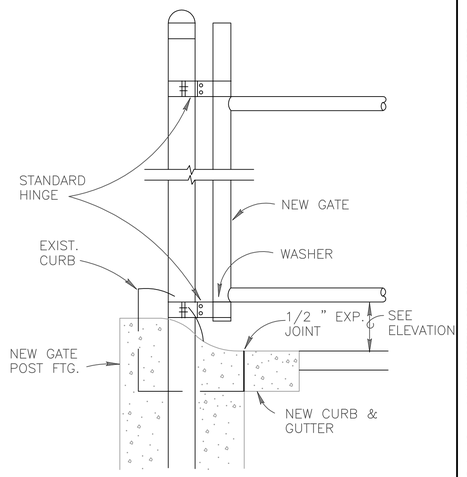
STANDARD HINGE



GATE KEEPER
(TO HOLD GATE OPEN)



DROP ROD FOUNDATION



GATE POST SECTION
AT CURB AND GUTTER

NO SCALE

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	DRAWN:	CHECKED:	APPROVED:
YL	YL	CSG	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: FENCE / GATE DETAILS II

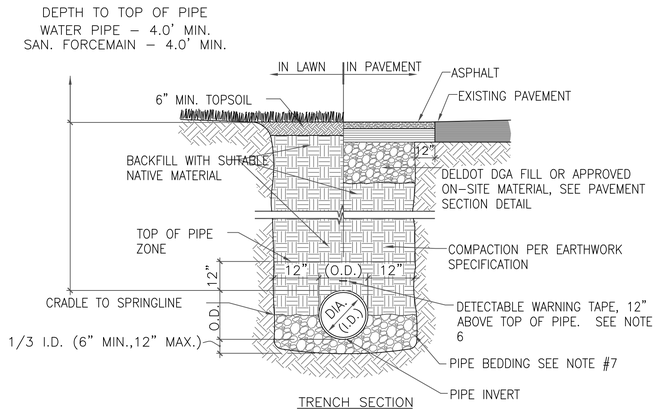
SCALE: N.T.S.

DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-312

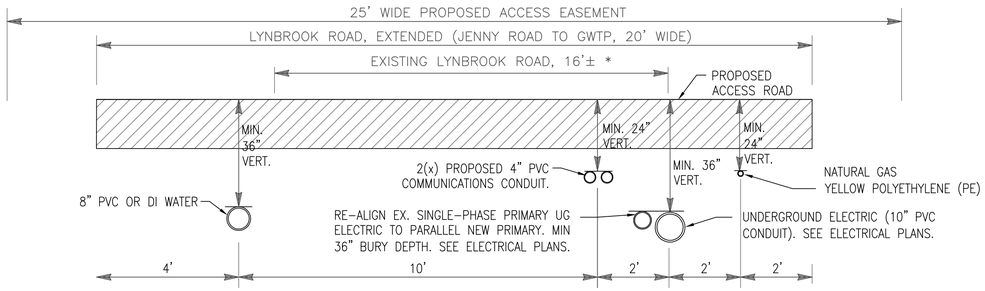
DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112C03834-C30V_DT.dwg
PLOT DATE: Jul 03, 2013 - 1:40pm



NOTES:

1. PIPE INSTALLATION SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
2. TRENCHING OPERATIONS SHALL INCLUDE SHORING AND DEWATERING.
3. TRENCH DETAILS ARE ONLY SHOWN FOR PURPOSES OF MATERIAL PLACEMENT. THICKNESSES INDICATED ARE MINIMUMS. WHERE EXISTING CONDITIONS EXCEED THOSE SHOWN, MATCH EXISTING.
4. MOVABLE PROTECTIVE TRENCH SHIELDS SHALL BE USED IN UNSHEETED TRENCH AREAS AS REQUIRED BY OSHA REGULATIONS.
5. MINIMUM BURY DEPTHS SHOWN IN THE TRENCH CORRIDOR DETAIL APPLY UNLESS OTHERWISE INDICATED.
6. PROVIDE DETECTABLE WARNING TAPE AS SPECIFIED.
7. PIPE BEDDING SHALL BE:
   WATER SERVICE, FORCEMAIN, GAS, ELECTRICAL AND COMM: SAND IN PIPE CRADLE. USE MATERIAL EXCAVATED FROM TRENCH WITH 6" AND LARGER STONE REMOVED IN REMAINING PIPE ZONE.
   FIRE WATER: AASHTO #57 STONE BEDDING

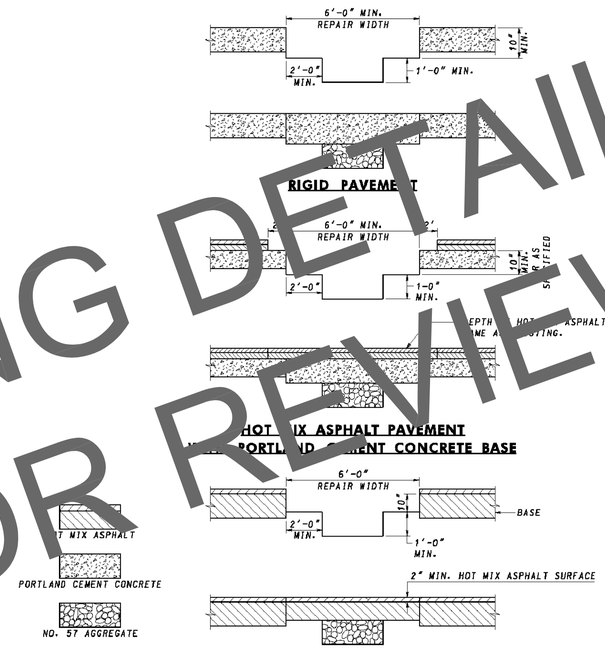
X / C304 PIPE TRENCH



* EXISTING LYNBROOK ROAD IS NOT PROPOSED TO BE WIDENED OR IMPROVED FROM EASTERN BOULEVARD TO JENNY ROAD INTERSECTION.

INSTALL DETECTABLE WARNING TAPE 12" BELOW GROUND SURFACE FOR EACH UTILITY IN THE CORRIDOR.

6 / C304 TYPICAL UTILITY TRENCH CORRIDOR
LYNBROOK ROAD

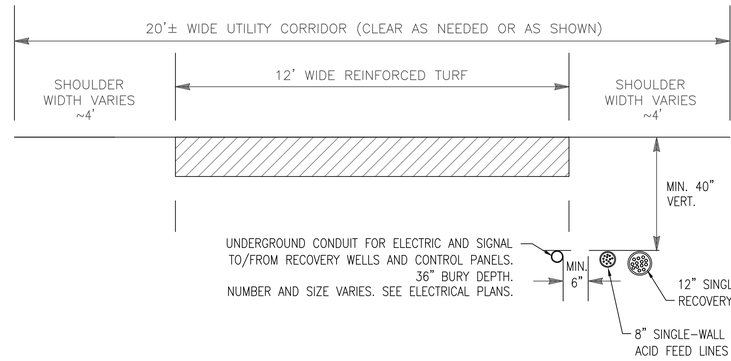


FLEXIBLE PAVEMENT

NOTES

1. THIS STANDARD IS TO BE USED IN ACCORDANCE WITH SECTIONS 505 AND 522. THE ROADWAY SHALL BE PATCHED WITH THE SAME TYPE MATERIAL REMOVED UNLESS NOTED IN THE SPECIFICATIONS. PORTLAND CEMENT CONCRETE PAVEMENT REPAIR SHALL BE IN ACCORDANCE WITH STANDARDS 577.02, 577.03, 577.04, 577.05, 577.06, OR 577.10.
2. THE TOP 1 FT. OF THE TRENCH SHALL BE FILLED WITH NO. 57 AGGREGATE. TRENCH TO BE EXTENDED TO DITCH LINE.
3. WHEREVER A TRENCH CROSSES A CONCRETE ROADWAY THAT HAS JOINT INSTALLATIONS THE ENTIRE SLAB BETWEEN THE EDGE OF THE TRENCH AND NEAREST JOINT SHALL BE REMOVED IF THE DISTANCE IS LESS THAN 6 FT.
4. CLEAN AND WET EDGES OF CUT AND SUBBASE BEFORE PLACING CONCRETE.
5. ALL WORK SUCH AS TRENCH BACKFILL, CURING OF CONCRETE, MATERIALS USED, ETC. SHALL BE IN ACCORDANCE WITH SECTIONS 201, 505 AND 522 OF THE SPECIFICATIONS OR AS SPECIFIED IN THE PERMIT.
6. ALL COSTS FOR SAWCUTS, TRENCH EXCAVATION, BACKFILL, HOT MIX ASHALT, CONCRETE, NO. 57 AGGREGATE, MATERIALS, TOOLS, LABOR AND INCIDENTALS SHALL BE INCLUDED IN THE PRICE OF THE UTILITY ITEMS.
7. RIGID PAVEMENT REPAIRS AS SHOWN SHALL BE MADE USING CONCRETE MIX NO. 9 (NINE) MEETING THE REQUIREMENTS OF SECTION 902 OF THE SPECIFICATIONS UNLESS OTHERWISE SPECIFIED IN THE SPECIAL PROVISIONS, ON THE PLANS OR AS DIRECTED BY THE ENGINEER.

X / C301 REPARING PAVEMENT OPENINGS FOR UTILITY TRENCHES



THIS SECTION IS TYPICAL AND MAY NOT REFLECT FIELD CONDITIONS. LOCATION AND NUMBER OF CONDUIT WILL VARY BASED ON DISTANCE FROM WELLHEADS, CONTROL PANELS, OR GWTP BUILDING; SEE SITE PLAN FOR CONTROL THESE LOCATIONS.

INSTALL DETECTABLE WARNING TAPE 12" BELOW GROUND SURFACE FOR EACH UTILITY IN THE CORRIDOR.

6 / C304 TYPICAL UTILITY TRENCH CORRIDOR
WELL ACCESS ROADS

WORKING DETAILS
NOT FOR REVIEW

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ---

SWM / E&S SUBMISSION -DRAFT-

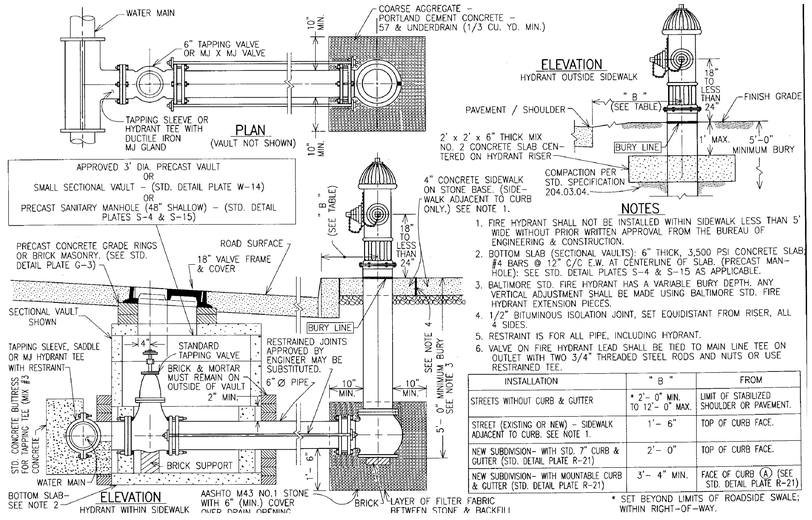
REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION
OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE: UTILITY DETAILS – GENERAL I
SCALE: N.T.S.
DATE: 07/03/2013
CONTRACT NO.: N/A
SHEET NO.: C-321

DRAWING NAME: S:\03-Projects\Commercial\LMC\10339257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112003834-C30X_DT.dwg
PLOT DATE: Jul 03, 2013 - 1:41pm



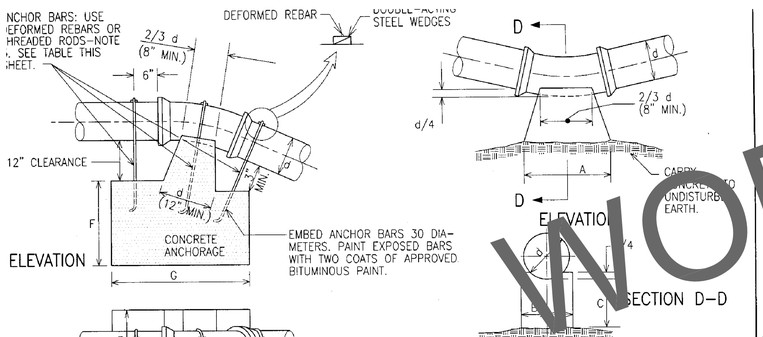
NOTES

1. FIRE HYDRANT SHALL NOT BE INSTALLED WITHIN SIDEWALK LESS THAN 5' WIDE WITHOUT PRIOR WRITTEN APPROVAL FROM THE BUREAU OF ENGINEERING & CONSTRUCTION.
2. BOTTOM SLAB (SECTIONAL VAULTS): 6" THICK, 3,500 PSI CONCRETE SLAB #4 BARS @ 12" C/C E.W. AT CENTERLINE OF SLAB. (PRECAST MANHOLE): SEE STD. DETAIL PLATES S-4 & S-15 AS APPLICABLE.
3. BALTIMORE STD. FIRE HYDRANT HAS A VARIABLE BURY DEPTH. ANY VERTICAL ADJUSTMENT SHALL BE MADE USING BALTIMORE STD. FIRE HYDRANT EXTENSION PIECES.
4. 1/2" BITUMINOUS ISOLATION JOINT, SET EQUIDISTANT FROM RISER, ALL 4 SIDES.
5. RESTRAINT IS FOR ALL PIPE, INCLUDING HYDRANT.
6. VALVE ON FIRE HYDRANT LEAD SHALL BE TIED TO MAIN LINE TEE ON OUTLET WITH TWO 3/4" THREADED STEEL RODS AND NUTS OR USE RESTRAINED TEE.

INSTALLATION	" B "	FROM
STREETS WITHOUT CURB & GUTTER	* 2'– 0" MIN. TO 12'– 0" MAX.	LIMIT OF STABILIZED SHOULDER OR PAVEMENT.
STREET (EXISTING OR NEW) – SIDEWALK ADJACENT TO CURB. SEE NOTE 1.	1'– 6"	TOP OF CURB FACE.
NEW SUBDIVISION– WITH STD. 7" CURB & GUTTER (STD. DETAIL PLATE R-21)	2'– 0"	TOP OF CURB FACE.
NEW SUBDIVISION– WITH MOUNTABLE CURB & GUTTER (STD. DETAIL PLATE R-21)	3'– 4" MIN.	FACE OF CURB (A) (SEE STD. DETAIL PLATE R-21)

* SET BEYOND LIMITS OF ROADSIDE SWALE; WITHIN RIGHT-OF-WAY.

3 / C304 TYPICAL FIRE HYDRANT SETTING N.T.S.



ANCHORAGE FOR VERTICAL BENDS

NOTES :

1. ALL CONCRETE TO BE MIX #1.
2. BUTTRESS DIMENSIONS SHOWN ARE MINIMUM. DIMENSIONS ARE BASED UPON 3,000 P.S.F. SOIL BEARING PRESSURE, 150 P.S.I. STATIC WATER PRESSURE AND DUCTILE IRON PIPE SIZES. SPECIAL BUTTRESS DESIGN IS REQUIRED WHERE PRESSURE EXCEEDS 150 P.S.I. OR WHERE SOIL BEARING PRESSURE IS LESS THAN 3,000 P.S.F.
3A. USE DEFORMED REBAR OR THREADED ROD AS SHOWN FOR ANCHORING DIP. SEE STD. DETAIL PLATE W-1 FOR THREADED RODS. DEFORMED REBARS: TACK WELD STEEL WEDGES TOGETHER & TACK WELD REBAR TO TOP STEEL WEDGE AFTER PLACEMENT.
3B. FOR ANCHORING HDPE PIPE, USE 3" WIDE HEAVY GAUGE 18-8 TYPE 304 S.S. STRAPS & THREADED STEEL RODS & NUTS.
4. ALTERNATE DESIGNS WILL BE CONSIDERED SUBJECT TO APPROVAL BY BUREAU OF ENGINEERING & CONSTRUCTION.

PIPE SIZE	ANCHOR BARS * 1/64 BEND	1/32 BEND	1/16 BEND	1/8 BEND
6"		3–#6	3–#6	3–#6
8"		3–#6	3–#6	3–#6
10"		3–#6	3–#6	3–#6
12"		3–#6	3–#6	3–#6
16"	3–#6	3–#6	3–#6	3–#6
20"	3–#6	3–#6	3–#6	4–#6
24"	3–#6	3–#6	3–#6	5–#6
30"	3–#6	3–#6	5–#6	5–#7
36"	3–#6	4–#6	5–#7	6–#7

* REBAR # AS INDICATED OR EQUAL DIAM. THREADED ROD

BUTTRESSES FOR VERTICAL BENDS

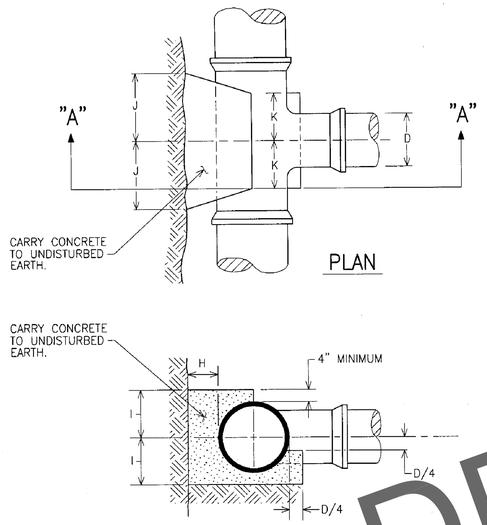
BUTTRESSES FOR VERTICAL BENDS

		PIPE SIZE 6"	8"	10"	12"	16"	20"	24"	30"	36"
1/64 BEND	A						1'–4"	1'–8"	2'–0"	2'–6"
	B						10"	1'–0"	1'–3"	1'–6"
	C						10"	1'–0"	1'–1"	1'–2"
1/32 BEND	A	8"	8"	10"	1'–0"	1'–4"	1'–8"	2'–0"	2'–6"	3'–0"
	B	7"	8"	9"	10"	1'–0"	1'–2"	1'–4"	1'–7"	1'–11"
	C	7"	7"	8"	8"	9"	10"	1'–0"	1'–1"	1'–2"
1/16 BEND	A	9"	1'–0"	1'–6"	1'–9"	2'–3"	3'–0"	3'–8"	4'–4"	5'–6"
	B	7"	8"	8"	10"	1'–1"	1'–3"	1'–5"	1'–10"	2'–1"
	C	7"	7"	8"	8"	9"	1'–0"	1'–2"	1'–4"	1'–9"
1/8 BEND	A	1'–3"	1'–8"	2'–3"	2'–10"	3'–6"	4'–4"	5'–6"	6'–8"	8'–1"
	B	7"	9"	10"	1'–0"	1'–4"	1'–8"	1'–10"	2'–4"	2'–9"
	C	7"	8"	10"	1'–1"	1'–4"	1'–8"	2'–1"	2'–6"	3'–1"

ANCHORAGES FOR VERTICAL BENDS

		PIPE SIZE 6"	8"	10"	12"	16"	20"	24"	30"	36"
1/64 BEND	E					2'–0"	2'–3"	2'–8"	3'–6"	4'–0"
	F					2'–11"	3'–7"	4'–4"	4'–6"	5'–0"
	G					4'–0"	4'–6"	4'–6"	5'–0"	5'–7"
1/32 BEND	E	1'–6"	1'–8"	2'–0"	3'–0"	3'–6"	4'–0"	4'–3"	4'–6"	5'–0"
	F	2'–0"	2'–7"	2'–11"	2'–8"	3'–5"	3'–8"	4'–4"	5'–5"	6'–3"
	G	2'–6"	3'–0"	3'–4"	3'–5"	4'–0"	5'–0"	5'–9"	6'–6"	7'–4"
1/16 BEND	E	2'–0"	3'–4"	3'–8"	4'–0"	4'–6"	4'–10"	5'–4"	6'–0"	6'–10"
	F	2'–7"	2'–7"	2'–9"	3'–3"	3'–10"	4'–0"	4'–7"	5'–8"	6'–5"
	G	2'–10"	3'–0"	3'–10"	4'–2"	5'–6"	7'–6"	8'–6"	9'–4"	10'–4"
1/8 BEND	E	2'–6"	3'–4"	4'–0"	4'–6"	5'–4"	6'–0"	6'–6"	7'–6"	8'–6"
	F	3'–4"	3'–5"	3'–8"	4'–4"	5'–0"	5'–7"	6'–2"	7'–1"	8'–3"
	G	3'–4"	4'–2"	4'–10"	5'–2"	6'–6"	8'–0"	9'–6"	11'–0"	12'–0"

1 / C304 BUTTRESSES AND ANCHORAGES FOR HORIZONTAL BENDS N.T.S.



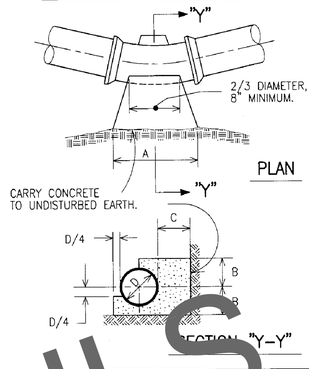
BUTTRESS FOR TEES SIZE OF BRANCH									
D	6"	8"	10"	12"	16"	20"	24"	30"	36"
H	8"	9"	10"	1'–0"	1'–2"	1'–4"	1'–8"	2'–6"	4'–6"
I	9"	11"	1'–2"	1'–4"	1'–9"	2'–2"	2'–7"	3'–3"	3'–11"
J	8"	11"	1'–3"	1'–4"	1'–9"	2'–2"	2'–7"	3'–2"	3'–9"
K	6"	8"	8"	8"	10"	1'–2"	1'–4"	1'–5"	1'–10"

2 / C304 BUTTRESS FOR TEES N.T.S.

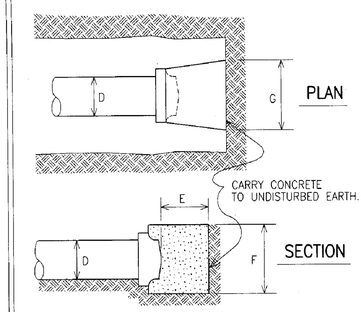
NOTES

1. ALL CONCRETE TO BE MIX #1, f'c=2,500 p.s.i.
2. BUTTRESS DIMENSIONS SHOWN ARE MINIMUM. DIMENSIONS ARE BASED UPON SOIL BEARING PRESSURE OF 3,000 p.s.f., STATIC WATER PRESSURE OF 150 p.s.i. AND DUCTILE IRON PIPE SIZES. WHERE PRESSURE EXCEEDS 150 p.s.i. OR WHERE SOIL BEARING PRESSURE IS LESS THAN 3,000 p.s.f. SPECIAL BUTTRESS DESIGN IS REQUIRED.

BUTTRESS FOR HORIZONTAL BENDS



BUTTRESS FOR CAPS



NOTES :

1. ALL CONCRETE TO BE MIX #1.
2. BUTTRESS DIMENSIONS SHOWN ARE MINIMUM. DIMENSIONS ARE BASED UPON SOIL BEARING PRESSURE OF 3,000 p.s.f., STATIC WATER PRESSURE OF 150 p.s.i. AND DUCTILE IRON PIPE SIZES. WHERE PRESSURE EXCEEDS 150 p.s.i. OR WHERE SOIL BEARING PRESSURE IS LESS THAN 3,000 p.s.f. SPECIAL BUTTRESS DESIGN IS REQUIRED, OR ALTERNATIVE RESTRAINT METHODS SHALL BE USED.

BUTTRESS FOR HORIZONTAL BENDS

	D	6"	8"	10"	12"	16"	20"	24"	30"	36"
1/64 BEND	A						1'–8"	2'–0"	2'–6"	3'–0"
	B						10"	1'–0"	1'–3"	1'–6"
	C						10"	1'–0"	1'–1"	1'–2"
1/32 BEND	A	8"	8"	10"	1'–0"	1'–4"	1'–8"	2'–0"	2'–6"	3'–0"
	B	7"	8"	9"	10"	1'–0"	1'–2"	1'–4"	1'–7"	1'–11"
	C	7"	7"	8"	8"	9"	10"	1'–0"	1'–1"	1'–2"
1/16 BEND	A	9"	1'–0"	1'–6"	1'–9"	2'–3"	3'–0"	3'–8"	4'–4"	5'–6"
	B	7"	8"	9"	10"	1'–1"	1'–3"	1'–5"	1'–10"	2'–1"
	C	8"	9"	10"	11"	1'–2"	1'–4"	1'–6"	1'–9"	2'–0"
1/8 BEND	A	1'–3"	1'–8"	2'–3"	2'–10"	3'–6"	4'–4"	5'–6"	6'–11"	8'–1"
	B	7"	9"	10"	1'–0"	1'–4"	1'–8"	1'–10"	2'–3"	2'–9"
	C	8"	9"	10"	1'–1"	1'–4"	1'–8"	2'–1"	2'–8"	3'–1"
1/4 BEND	A	2'–4"	2'–10"	3'–2"	3'–8"	5'–4"	SPECIAL DESIGN			
	B	7"	10"	1'–1"	1'–4"	1'–7"				
	C	1'–5"	1'–7"	1'–8"	1'–9"	2'–3"				

BUTTRESS FOR CAPS

D	6"	8"	10"	12"	16"	20"	24"	30"	36"
E	6"	8"	8"	10"	1'–1"	1'–4"	1'–8"	2'–4"	2'–11"
F	1'–3"	1'–8"	2'–0"	2'–4"	3'–0"	3'–10"	4'–6"	5'–1"	6'–0"
G	1'–6"	2'–0"	2'–6"	3'–0"	4'–0"	4'–10"	5'–10"	7'–11"	9'–8"

1 / C304 BUTTRESSES FOR CAPS AND HORIZONTAL BENDS N.T.S.

SOURCES: BALTIMORE COUNTY
DEPARTMENT OF PUBLIC WORKS (BCPW)

WORKING DETAILS NOT FOR REVIEW

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ---

SWM / E&S SUBMISSION -DRAFT-

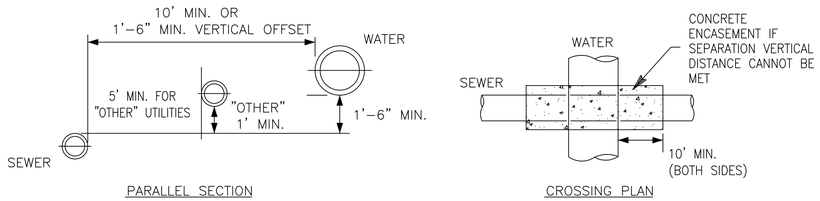
REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION
OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE: UTILITY DETAILS – GENERAL II
SCALE: N.T.S.
DATE: 07/03/2013
CONTRACT NO.: N/A
SHEET NO.: C-322

DRAWING NAME: S:\03-Projects\Commercial\LMC\1030925710\1-DRA-30ft design Phase-2013\CAD drawings\Civil\ 1120030834-C30X_DT.dwg
PLOT DATE: Jul 10, 2013 - 8:56am



PARALLEL SECTION

CROSSING PLAN

- IF STATED SEPARATION DISTANCES CANNOT BE MET, SEWER SHALL BE ENCASED IN CONCRETE WHENEVER IT FALLS WITHIN 10' OF WATER AND DOES NOT MEET THE VERTICAL SEPARATION REQUIREMENT.
- CROSSINGS SHALL BE CONSIDERED AT MIDPOINT OF FULL PIPE LENGTHS

WATER & SEWER PARALLEL OR CROSSING INSTALLATION REQUIREMENTS

2 / C304

NOTE: NO WATER/SEWER CROSSING IS PROPOSED ON THE SITE PLANS FOR THIS PROJECT.

FORTHCOMING

WATER UTILITY CROSSING (USE BALTI CTY DETAIL)

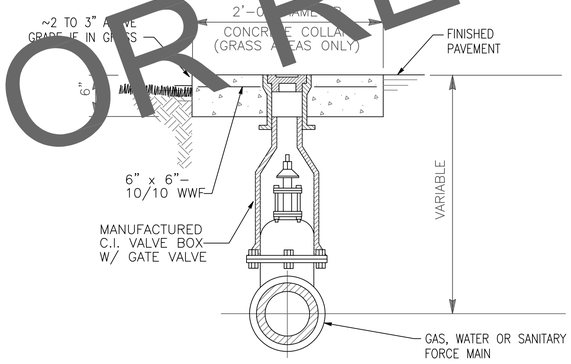
4 / C306

FORTHCOMING

OTHER? (VALVE PITS, METER PITS, ETC) (USE BALTI CTY DETAIL)

7 / C304

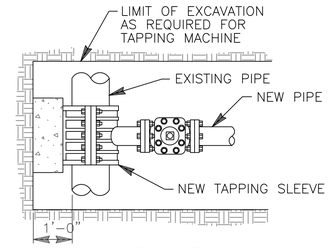
WORKING DETAILS
NOT FOR REVIEW



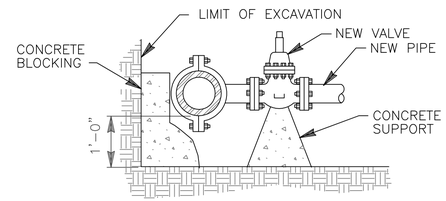
NOTE: WORD "WATER", "GAS", OR "SAN" CAST INTO CENTER OF CAST IRON CAP OR CONCRETE LID.

TYPICAL VALVE BOX DETAILS

4 / C304



PLAN VIEW



SECTIONAL VIEW

TAPPING SLEEVE AND VALVE INSTALLATION DETAIL

(FOR SANITARY FORCE MAIN CONNECTION, SEE SHEET C-203)
N.T.S.

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: UTILITY DETAILS - GENERAL III

SCALE: N.T.S.

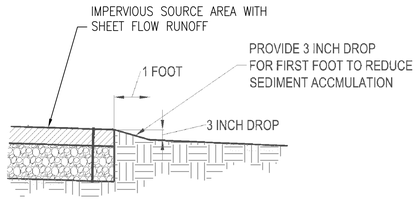
DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-323

PLOT DATE: Jul 03, 2013 - 1:42pm

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112C03834-C30X_DT.dwg

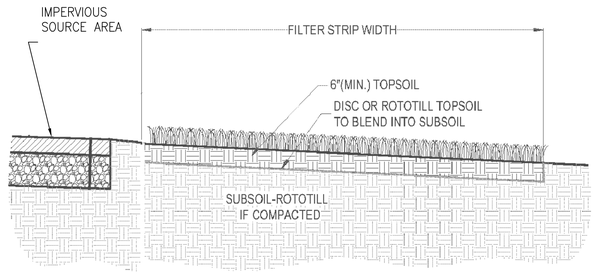


1 C305 LEVEL SPREADER (NON-TRENCH)

USE THIS DROP TO EVEN OUT FLOWS WHEREVER FILTER STRIPS / INFILTRATION TRENCHES ARE SHOWN.

THE NEED FOR A TRENCHED SPREADER IS NOT ANTICIPATED DUE TO OVERALL FLATNESS OF SITE.

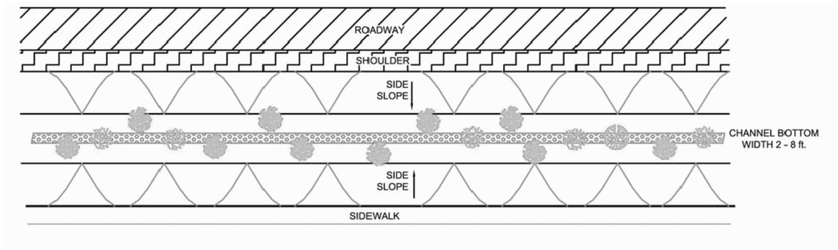
SOURCE: GREEN TECHNOLOGY – THE DELAWARE URBAN RUNOFF MANAGEMENT APPROACH



2 C305 FILTER STRIP

PER LENGTH AND WIDTH SHOWN ON PLAN

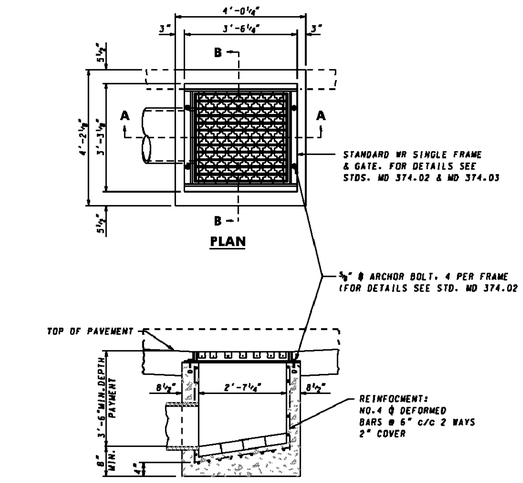
SOURCE: GREEN TECHNOLOGY – THE DELAWARE URBAN RUNOFF MANAGEMENT APPROACH

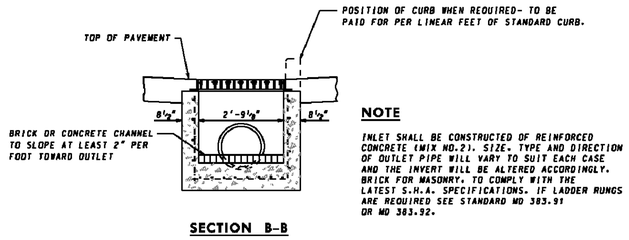


3 C305 GRASS CHANNEL

PER LENGTH AND WIDTH SHOWN ON PLAN

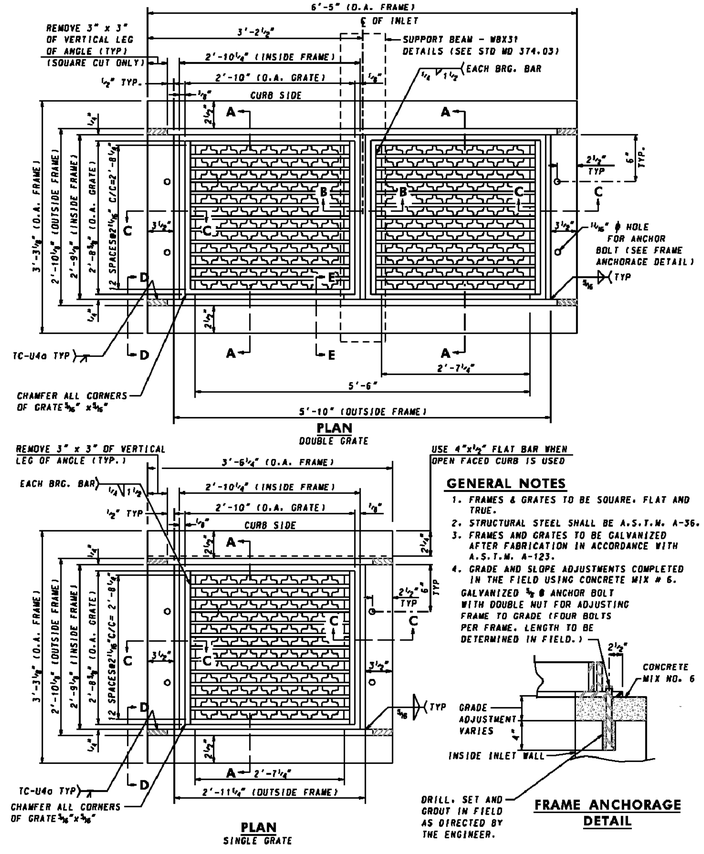
SOURCE: MARYLAND STORMWATER DESIGN MANUAL

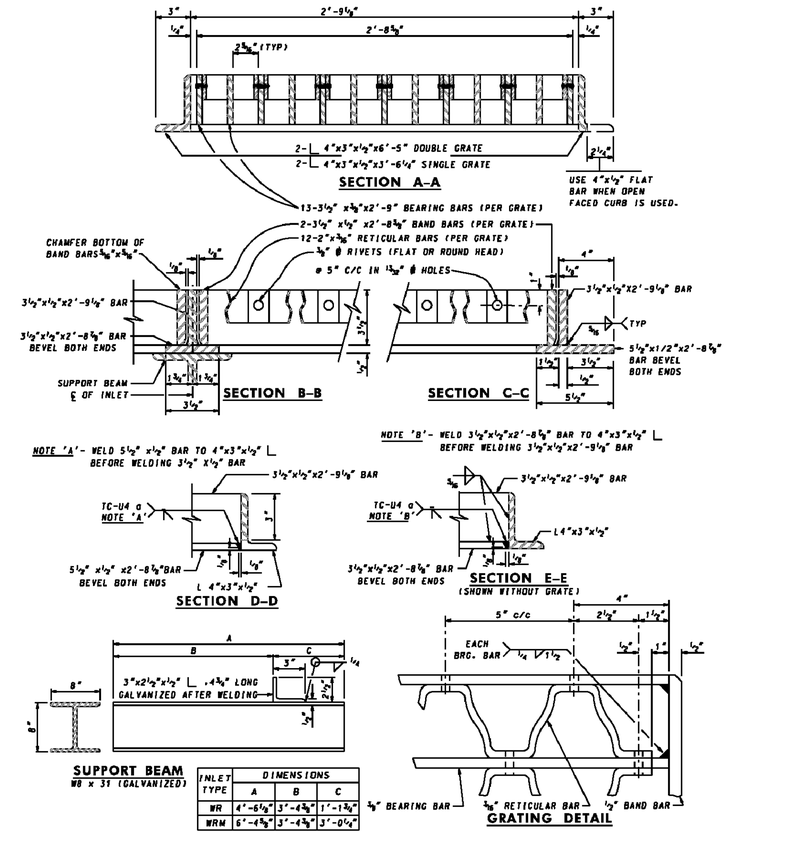




1 C306 JUNCTION BOX

MD SHA STANDARD #374.06





INLET TYPE	DIMENSIONS A	B	C
WR	4'-6⅛"	3'-4⅜"	1'-1⅜"
WRM	6'-4⅜"	3'-4⅜"	3'-0¼"

X C306 STANDARD WR & WRM INLET FRAME AND COVER

MD SHA STANDARD #374.02 & 374.03

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

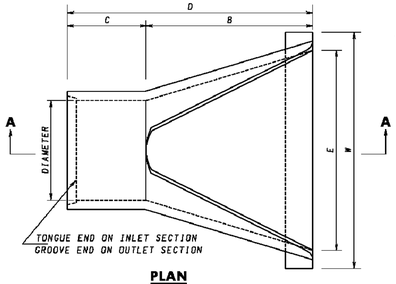
PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE: UTILITY DETAILS - STORMWATER I
SCALE: N.T.S.
DATE: 07/03/2013

CONTRACT NO.: N/A
SHEET NO.: C-331

PLOT DATE: Jul 10, 2013 - 9:46am
DRAWING NAME: S:\03-Projects\Commercial\LMC\1120257101-DRA-308 design Phase-2013\CAD drawings\Civil\ 1120203834-C30X_DT.dwg

FORTHCOMING BASED ON CHOSEN VENDOR. THIS WILL BE MAX 2 OR 3 STACKED ~3'x6'x3' UNITS.

7 / C301 GABION WALL

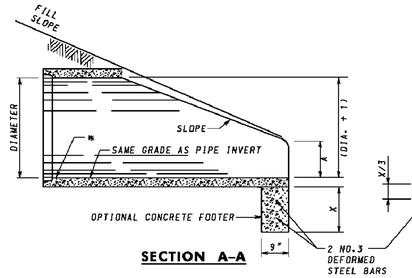


PLAN

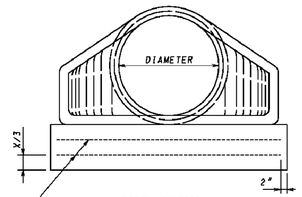
NOTES

1. CONTRACTOR HAS OPTION OF FURNISHING END SECTIONS CONFORMING TO DETAILS ON THIS SHEET OR END SECTIONS CONFORMING TO DETAILS ON STANDARD NO. MD 368.01.
2. END SECTIONS MUST BE REINFORCED TO CONFORM TO ASTM - CLASS IV REINFORCED CONCRETE PIPE.
3. CONCRETE FOOTER SHALL BE USED WHEN SPECIFIED ON THE PLANS. COST OF CONCRETE FOOTER TO BE INCLUDED IN PRICE OF END SECTION. CONCRETE TO BE MIX. NO.2 REINFORCEMENT TO BE NO.3 BARS.

* INVERT ELEVATION TO BE AT THE PIPE END OF THE STANDARD END SECTION. ELEVATION TO BE NOTED ON THE CONSTRUCTION PLANS.



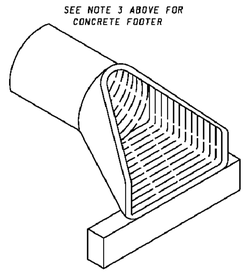
SECTION A-A



END VIEW

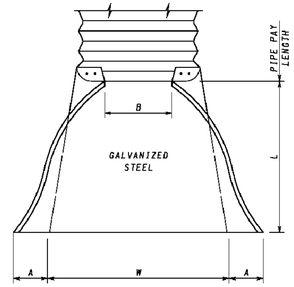
QUANTITIES FOR ESTIMATING PURPOSES ONLY

DIMENSIONS									QUANTITIES	
CONCRETE END SECTION							CONCRETE FOOTER			
DIA.	SLOPE	A	B	C	D	E	W	X	CONC. C.Y.	STEEL LBS.
12"	3:1	4"	2'-0"	4'-0⅞"	6'-0⅞"	2'-0"	3'-0"	12"	0.08	2.01
15"	3:1	6"	2'-3"	3'-10"	6'-1"	2'-6"	3'-6"	12"	0.10	2.38
18"	3:1	8"	2'-3"	3'-10"	6'-1"	3'-0"	4'-0"	12"	0.11	2.76
21"	3:1	9"	3'-0"	3'-1½"	6'-1⅛"	3'-6"	4'-6"	12"	0.13	3.13
24"	3:1	9½"	3'-7½"	2'-6"	6'-1⅛"	4'-0"	5'-0"	15"	0.17	3.51
27"	3:1	10½"	4'-1½"	2'-0"	6'-1⅛"	4'-6"	5'-6"	15"	0.19	3.89
30"	3:1	1'-0"	4'-6"	1'-7¾"	6'-1¾"	5'-0"	6'-0"	15"	0.21	4.26
33"	3:1	1'-2"	4'-7"	2'-2"	6'-9"	5'-6"	6'-6"	15"	0.23	4.64
36"	3:1	1'-3"	5'-3"	2'-10¾"	8'-1¾"	6'-0"	7'-3"	15"	0.25	5.20



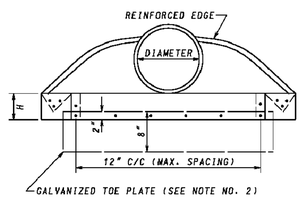
ISOMETRIC VIEW

X / CXXX DETAIL: FLARED END SECTION ROUND CONCRETE PIPE
NOT TO SCALE
MD SHA STANDARD #368.02

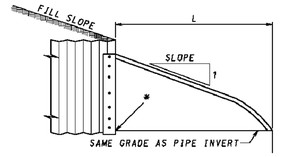


PLAN

DIMENSIONS								
PIPE DIA.	GA.	A 1"±	B MAX.	H 1"±	L 1½"±	W 2"±	APPROX. SLOPE	UNIT
12"	16	6"	6"	6"	21"	24"	2½	1 PC.
15"	16	7"	8"	6"	26"	30"	2½	1 PC.
18"	16	8"	10"	6"	31"	36"	2½	1 PC.
21"	16	9"	12"	6"	36"	42"	2½	1 PC.
24"	16	10"	13"	6"	41"	48"	2½	1 PC.
30"	14	12"	16"	8"	51"	60"	2½	1 PC.
36"	14	14"	19"	9"	60"	72"	2½	2 PC.



END VIEW



SIDE VIEW

* INVERT ELEVATION TO BE AT THE PIPE END OF THE STANDARD END SECTION. ELEVATIONS TO BE NOTED ON THE CONSTRUCTION PLANS.

NOTES

1. METAL END SECTIONS SHALL BE GAGE 16 FOR PIPES RANGING FROM 15" THRU 24", AND GAGE 14 FOR PIPES RANGING FROM 30" THRU 36" . MULTIPLE PANEL UNITS TO HAVE LAP SEAMS WHICH ARE TO BE TIGHTLY JOINED BY ⅜" DIAMETER GALVANIZED RIVETS OR BOLTS.
2. TOE PLATES SHALL BE USED WHEN SPECIFIED ON THE PLANS. THICKNESS OF END PLATE TO BE SAME AS END SECTION. COST OF TOE PLATE TO BE INCIDENTAL TO THE BID PRICE PER EACH OF METAL END SECTION.

X / CXXX DETAIL: FLARED END SECTION ROUND METAL PIPE
NOT TO SCALE
MD SHA STANDARD #370.01

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ___

SWM / E&S SUBMISSION -DRAFT-

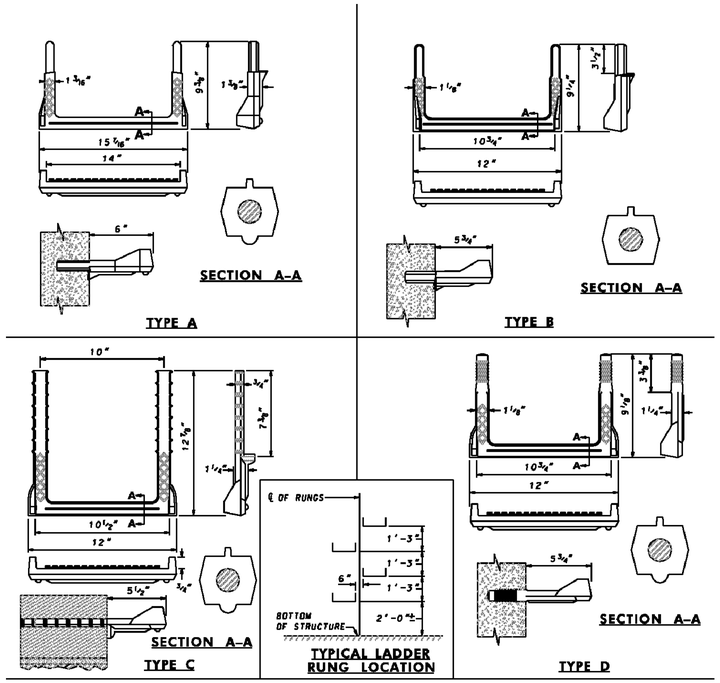
REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION
OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE: UTILITY DETAILS - STORMWATER II
SCALE: N.T.S.
DATE: 07/03/2013
CONTRACT NO.: N/A
SHEET NO.: C-332

PLOT DATE: Jul 10, 2013 - 9:13am
DRAWING NAME: S:\03-Projects\Commercial\MMC\103P25701-DRA-30% design Phase-2013\CAD drawings\Civil\ 112003834-C30X_DT.dwg

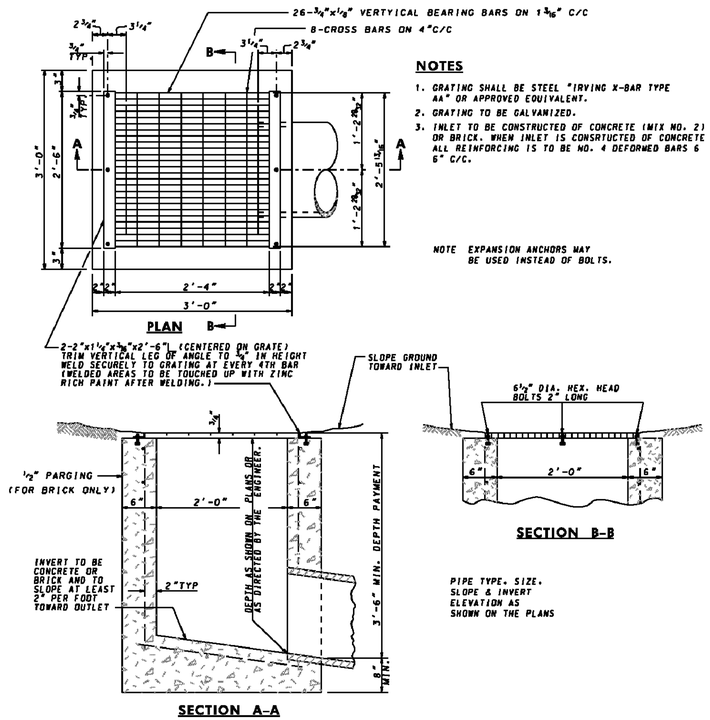


NOTES

1. TYPES A & B ARE TO BE DRIVEN INTO RECEPTACLES THAT ARE CAST INTO THE WALL.
2. TYPE C IS FOR BRICK AND BLOCK INSTALLATIONS.
3. TYPE D IS PRESS FITTED INTO PREFORMED CONCRETE HOLES.
4. LADDER RUNGS ARE TO BE USED IN INLETS, MANHOLES, AND JUNCTION BOXES OVER THREE FEET IN DEPTH OR AS DIRECTED BY THE ENGINEER, USED EITHER WITH BRICK OR CONCRETE CONSTRUCTION. (WHERE BRICK CONSTRUCTION IS EMPLOYED, THE MORTER JOINTS SHALL BE ADJUSTED TO ACCOMMODATE LADDER RUNGS.)
5. COPOLYMER POLYPROPYLENE ENCAPSULATED ½ IN. DIA. STEEL REINFORCEMENT BAR. STEEL SHALL CONFORM TO ASTM 615 GRADE 60. COPOLYMER POLYPROPYLENE SHALL BE CERTIFIED BY THE MANUFACTURER TO CONFORM TO ASTM D 4101 AND HAVE A MINIMUM EXPOSED SECTION THICKNESS OF ⅛ IN.
6. SECTION A-A SHOWS ½" DIA. STEEL REINFORCEMENT BAR.
7. INSTALLATION SHALL CONFORM TO MANUFACTURER'S RECOMMENDATIONS.

X / CXXX — DETAIL: **LADDER STEPS** (NOT TO SCALE)

MD SHA STANDARD #383.92



NOTES

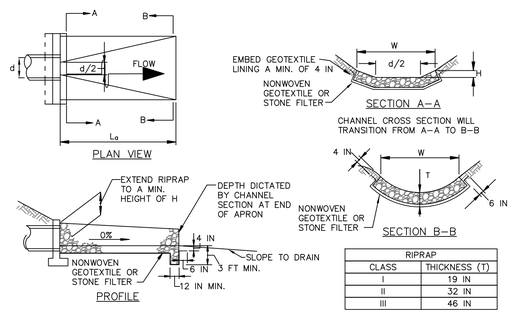
1. GRATING SHALL BE STEEL "IRVING X-BAR TYPE AA" OR APPROVED EQUIVALENT.
2. GRATING TO BE GALVANIZED.
3. INLET TO BE CONSTRUCTED OF CONCRETE (MIX NO. 2) OR BRICK. WHEN INLET IS CONSRTUCTED OF CONCRETE ALL REINFORCING IS TO BE NO. 4 DEFORMED BARS 6 6" C/C.

NOTE EXPANSION ANCHORS MAY BE USED INSTEAD OF BOLTS.

PIPE TYPE, SIZE, SLOPE & INVERT ELEVATION AS SHOWN ON THE PLANS

2 / C306 — BIO-RETENTION OUTLET STRUCTURE

MD SHA STANDARD #381.01



RIPRAP	
CLASS	THICKNESS (T)
I	19 IN
II	32 IN
III	46 IN

6 / C306 — OUTFALL RIPRAP PROTECTION

PER LENGTH AND WIDTH SHOWN ON PLAN

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ___

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION
OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE: UTILITY DETAILS - STORMWATER III
SCALE: N.T.S.
DATE: 07/03/2013

CONTRACT NO.: N/A
SHEET NO.: C-333

DRAWING NAME: S:\03-Projects\Commercial\LMC\10310257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 11210033834-C30X_DT.dwg
PLOT DATE: Jul 10, 2013 - 9:49am

FORTHCOMING

1 C305 SANITARY HOLDING TANK

PER LENGTH AND WIDTH SHOWN ON PLAN

1 C305 SANITARY CLEANOUT (SAN.CO)

XXX

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: UTILTY DETAILS - SANITARY

SCALE: N.T.S.

DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-341

PLOT DATE: Jul 03, 2013 - 1:43pm

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-308 design Phase-2013\CAD drawings\Civil\ 112103834-C30X_DT.dwg

CONVERTING STICK-UP TO FLUSH-MOUNT
(ACCESS ROAD):
MW-15S/I/D
MW-4
DMW-9S/I
DMW-9D
MW-20S/I/D
DMW-8S/I/D

FLUSH-MOUNT ADJUSTING ELEVATIONS
(PARKING AREA):
RW-1I
OW-1I

MAY ALSO NEED TO ADJUST THE 3 OR 4
WELL CLUSTERS AROUND THE BUILDING.

1 C305 EX. STICK-UP TO FLUSH MOUNT
XXX

FORTHCOMING

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: UITLITY DETAILS - ENVIRONMENTAL I

SCALE: N.T.S.
DATE: 07/03/2013

CONTRACT NO.: N/A

SHEET NO.: C-351

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\112C03834-C30X_DT.dwg
PLOT DATE: Jul 03, 2013 - 1:44pm

FORTHCOMING

EXTRACTION WELL – SHALLOW

PER LENGTH AND WIDTH SHOWN ON PLAN

EXTRACTION WELL – INTERMEDIATE

PER LENGTH AND WIDTH SHOWN ON PLAN

EXTRACTION WELL – DEEP

PER LENGTH AND WIDTH SHOWN ON PLAN

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED: YL
DRAWN: YL
CHECKED: CSG
APPROVED: ___

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION

OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT

SHEET TITLE: UITLITY DETAILS – ENVIRONMENTAL II

SCALE: N.T.S.

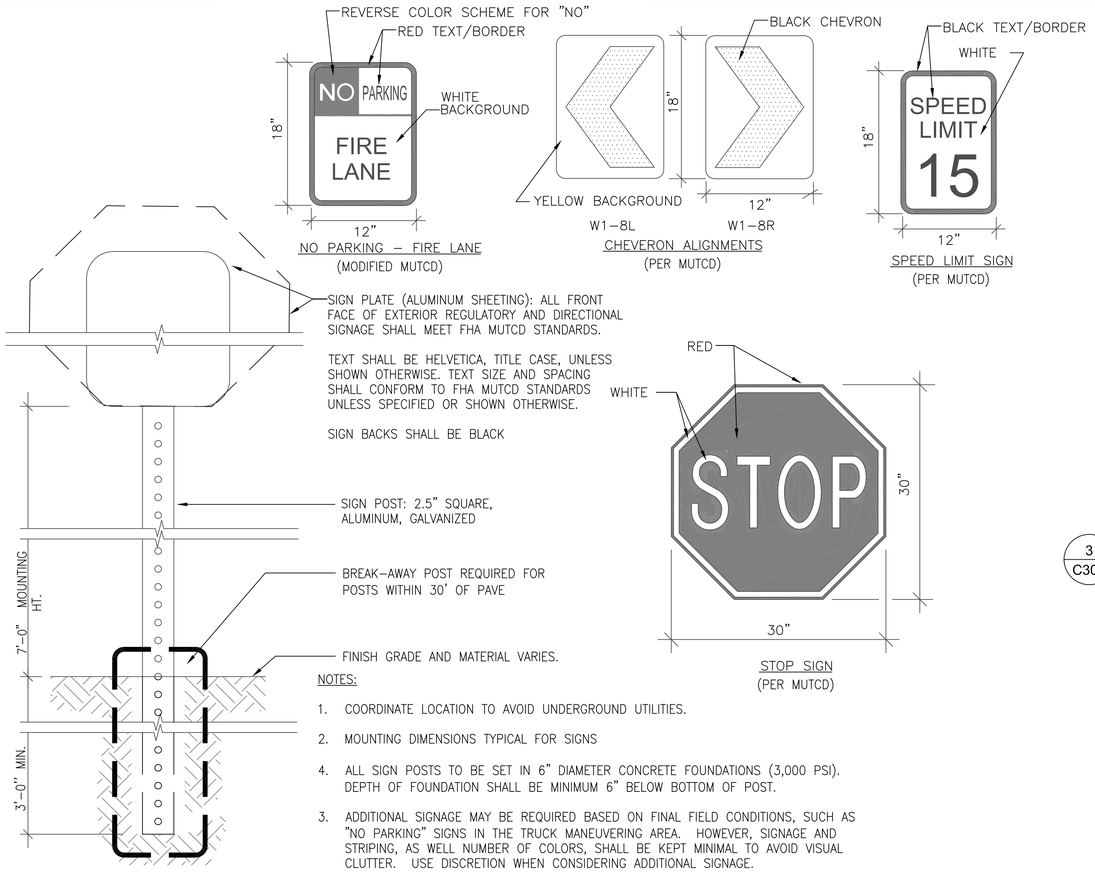
DATE: 07/03/2013

CONTRACT NO.: N/A

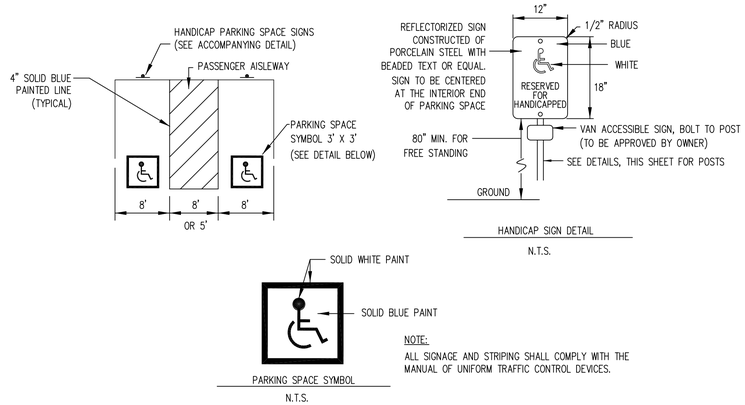
SHEET NO.: C-352

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-308 design Phase-2013\CAD drawings\Civil\ 112103834-C30X_DT.dwg

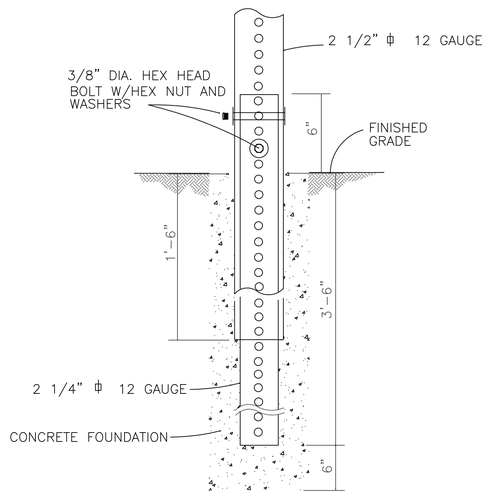
PLOT DATE: Jul 03, 2013 - 1:45pm



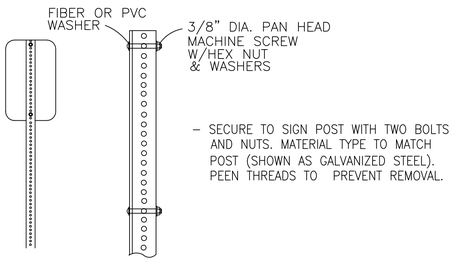
1 C306 REGULATORY AND DIRECTIONAL SIGNAGE



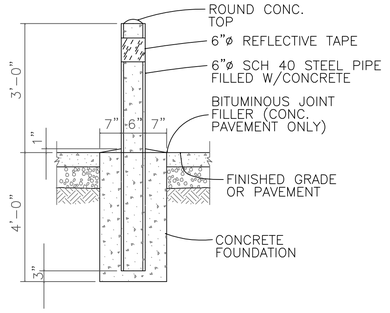
2 C306 HANDICAPPED PARKING SIGNAGE AND STRIPING



3 C306 BREAK-AWAY SIGN POST DETAIL



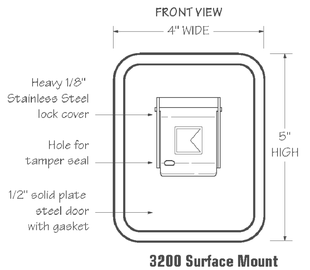
4 C306 SIGN PANEL ATTACHMENT



NOTES:
STEEL PIPE SHALL BE GALVANIZED & HAVE A MINIMUM WALL THICKNESS OF 0.28 INCHES (SCH 40).

COLOR: ALL BOLLARDS TO BE PAINTED "SAFETY YELLOW".

7 306 BOLLARD DETAIL (EXTERIOR)



8 C306 KNOX BOX – 3200 SERIES

SPECIFICATIONS:
- MODEL #3207 (LIFT-OFF DOOR, SURFACE MOUNT)
- COLOR: DARK BRONZE
- NO ALARM TAMPER SWITCHES OR OTHER SIGNAL LINES
- INSTALLATION INSTRUCTIONS: WELD THE REAR OF THE BOX TO A 1/4" STEEL PLATE (ABOUT 10" WIDE X 10" VERTICAL). WELD THE STEEL PLATE TO THE SOUTH POST/RAIL AT THE NORTH GATE (SEE SITE PLAN). ADDITIONAL PLATES AND WELDS MAY BE REQUIRED TO WORK AROUND THE FENCE MESH AND ACHIEVE A SECURE CONNECTION. THE KNOX BOX SHALL SIT LEVEL, APPROXIMATELY 5' OFF THE GROUND. GRIND SHARP EDGES/CORNERS OF STEEL PLATE(S) AS NEEDED TO AVOID FUTURE INJURY. ENSURE INSTALLATION DOES NOT INTERFERE WITH GATE OPERATION.

REFER TO MANUFACTURER RECOMMENDATIONS FOR FURTHER MOUNTING OPTIONS OR INSTRUCTIONS.

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	YL
DRAWN:	YL
CHECKED:	CSG
APPROVED:	---

SWM / E&S SUBMISSION -DRAFT-

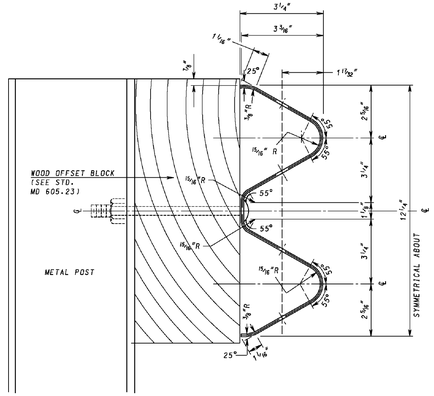
REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION
OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE: SITE SIGNAGE DETAILS I
SCALE: N.T.S.
DATE: 07/03/2013
CONTRACT NO.: N/A
SHEET NO.: C-361

PLOT DATE: Jul 03, 2013 - 1:45pm
DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112003834-C3DX_DT.dwg



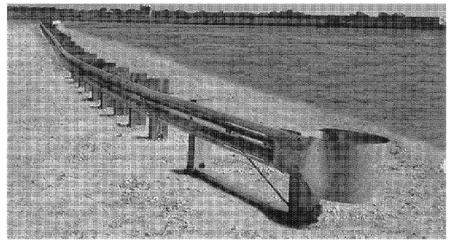
W BEAM DETAIL
(MATERIAL: 12 GA. STEEL)

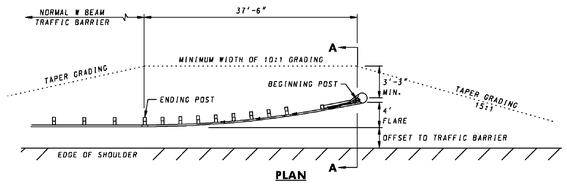
NOTES

1. RAIL ELEMENTS ARE FURNISHED SHOP CURVED. CONCAVE OR CONVEX TO RADII BETWEEN 20 FT. & 150 FT.
2. BARRIER SECTIONS SHALL BE 12'-6" OR 25'-0" LENGTHS.
3. FOR COMPOSITE OFFSET BLOCKS SEE NOTE 5 ON MD 605.21

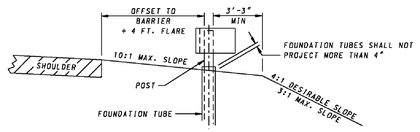
X CXXX — W BEAM – SINGLE FACE

MD SHA PANEL 605.22
REFER TO ADDITIONAL 605 PLATES FOR STANDARD POST PLACEMENT DISTANCES, SPLICES, ETC.





PLAN



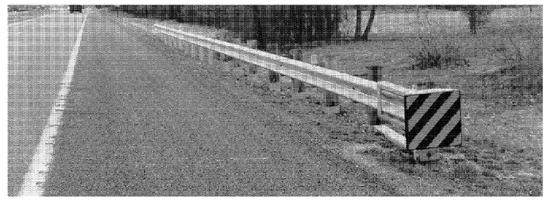
SECTION A–A

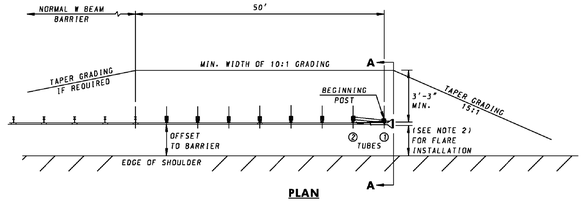
NOTES APPLICABLE TO ALL TYPE B TERMINALS

1. 6:1 MAX GRADING IS ALLOWABLE WHEN THE BARRIER IS LOCATED 12 FT. OR MORE FROM THE OUTSIDE EDGE OF SHOULDER.
2. END TREATMENT DELINEATION SHALL BE PLACED IN ACCORDANCE WITH STD. MD 605.02-01
3. 4' FLARE REQUIRED
4. TYPE B TERMINAL SHALL ONLY BE USED WHEN THE GRADING AS SHOWN AND THE REQUIRED LENGTH OF NEED IS PROVIDED.

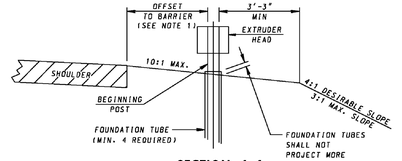
X CXXX — TYPE "B" GUARD RAIL

MD SHA PANEL 605.02





PLAN



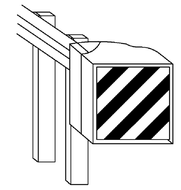
SECTION A–A

NOTES APPLICABLE TO ALL TYPE C TERMINALS

1. 6:1 MAX GRADING IS ALLOWABLE WHEN THE BARRIER IS LOCATED 12 FT. OR MORE FROM THE OUTSIDE EDGE OF SHOULDER.
2. WHEN THE TRAFFIC BARRIER POST IS PLACED LESS THAN 4' FROM THE EDGE OF SHOULDER/PAVEMENT THE END TREATMENT SHALL BE FLARED AT A RATE OF 50:1
3. GRADING SHALL BE AS SHOWN ABOVE.
4. SYSTEM MUST BE INSTALLED AT 30 INCHES.
5. END TREATMENT DELINEATION SHALL BE PLACED IN ACCORDANCE WITH STD. MD 605.02-01.

X CXXX — TYPE "C" GUARD RAIL

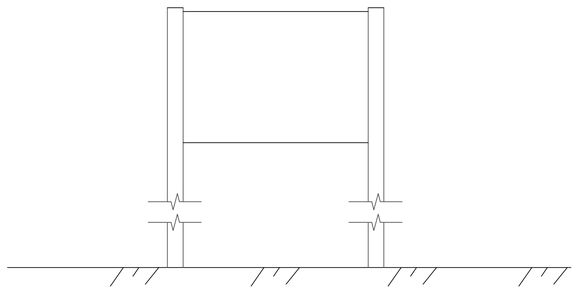
MD SHA PANELS 605.03, 605.02-01



RIGHT SIDE OF ROADWAY

NOTES

1. TYPE IX OR XI REFLECTIVE SHEETING, 4" STRIPES, BLACK ON FLUORESCENT YELLOW, RUNNING DOWN TOWARDS ROAD AT 45 DEGREE ANGLE.
2. WHEN PLACING SHEETING ON BARE METAL, METAL SHOULD BE CLEANED AS PER MANUFACTURER'S RECOMMENDATIONS PRIOR TO APPLICATION OF SHEETING.
3. SHEETING SHOULD EXTEND TO TOP AND BOTTOM AND FULL WIDTH OF TERMINAL. SIZE MAY BE ADJUSTED AS NECESSARY TO FIT DIFFERENT MANUFACTURER'S TERMINALS.
4. REFER TO APPROPRIATE 600 SERIES STANDARD FOR DETAILS ASSOCIATED WITH SPECIFIC TRAFFIC BARRIER END TREATMENTS.
5. DELINEATION WILL BE INCIDENTAL TO THE APPROPRIATE TRAFFIC BARRIER END TREATMENT.



9 C306 — MILITARY IDENTIFICATION SIGN – TYPE B3

"MILITARY IDENTIFICATION SIGN TYPE B3", IN ACCORDANCE WITH UFC 3-120-01, CONSISTS OF TWO 8' POSTS (6' ABOVE GRADE, 2' BELOW) AND A 30" X 42" SIGN PANEL FRAME.

CONFIRM ORDER DETAILS AND LETTERING/LOGO/COLOR INFORMATION WITH CONTRACTING OFFICER UPON PLACEMENT OF ORDER.

SUGGESTED VENDOR:
PIONEER SUPPLY (800-545-2233)
1710 N. FRANKLIN ST
PITTSBURG, PA 15233

TETRA TECH, INC.
240 CONTINENTAL DR., SUITE 200
NEWARK, DELAWARE 19711
PH: (302) 738-7551 FAX: (302) 454-5988

DESIGNED:	DRAWN:	CHECKED:	APPROVED:
YL	YL	CSG	---

SWM / E&S SUBMISSION -DRAFT-

REVISION NO.	REVISION DATE	DESCRIPTIONS

MARTIN STATE AIRPORT

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND AVIATION ADMINISTRATION
OFFICE OF DESIGN AND CONSTRUCTION

PROJECT TITLE: DUMP ROAD AREA GROUNDWATER TREATMENT PLANT
SHEET TITLE: SITE SIGNAGE DETAILS II
SCALE: N.T.S.
DATE: 07/03/2013
CONTRACT NO.: N/A
SHEET NO.: C-362

DRAWING NAME: S:\03-Projects\Commercial\LMC\103P257101-DRA-30% design Phase-2013\CAD drawings\Civil\ 112003834-C30X_DT.dwg
PLOT DATE: Jul 03, 2013 - 1:45pm

APPENDIX F –

SIDE-BY-SIDE COMPARISON OF ESD GOALS/REQUIREMENTS TO SITE-SPECIFIC BMPS

Appendix F: Side-by-Side Comparison of ESD Goals/Requirements to Site-Specific BMPs

Environmental Site Design (ESD) Goals and Unified Sizing Crieria (USC) Requirements

Environmental Site Design

Goal:

$$ESD_v = \frac{(P_E)(R_v)(A)}{12}$$

ESD_v = Runoff volume, in CF or Acre-ft

P_E = Rainfall Target, Inches (Table 5.3)

RCN_{goal} = 70 (for HSG "C")

R_v = Volumetric Runoff Coefficient, Dimensionless

R_v = 0.05+0.009(I)

I = % impervious cover

A = Drainage Area, SF or Acres

Unified Sizing Criteria

Water Quality Volume Requirement:

$$WQ_v = \frac{(1.0)(R_v)(A)}{12}$$ Min. Requirement= 0.2 [in/Ac]

Recharge Volume Requirement (Waiver Request):

$$Re_v = \frac{(S)(R_v)(A)}{12}$$, S=0.13 for "C" HSG

S = soil specific recharge factor

Channel Protection Storage Volume (analysis applicability TBD):

$Cp_v = Q_i \times A$

$$Q_1 = \frac{(P-0.2S)^2}{(P+0.8S)}$$ (Equation 2.3, TR-55, USDA NRCS 1986)

P= 1-year 24-hour design storm

S= (1000/RCN)-10 (Equation 2-4, TR-55)

10 and 100-yr Peak Rate Control (Not Applicable):

Use TR-55 or TR-20 if applicable.

Environmental Site Design (ESD) Treatment Methods and Calculations

"Bio-Area" Sizing Methods:

Bio-swales or Micro-Bioretention Practices:

$$P_E = 15" \; X \; \frac{(A_f)}{DA}$$ (Equation 5.2)

A_f = Surface area of practice bottom

(Note: Final sizing per void ratio / surface storage)

Rain Garden or Grass Swales:

$$P_E = 10" \; X \; \frac{(A_f)}{DA}$$ (Equation 5.3)

A_f = Surface area of practice bottom

Reinforced Turf Sizing:

Environmental Site Design (ESD) Process & Computations, July 2010, MDE

Table 1: ESD Values for Permeable Pavements

Hydrologic Soil Group "C"

Subbase	RCN_1	ESD_v/ft^2	Equiv. P_E (in.)
6"	93	0.043	0.5
9"	77	0.134	1.7
12"	70	0.160	2

[1] Effective RCN from Table 5.5, p. 5.48

The ESD_v/ft^2 assumes a volumetric runoff coefficeit (R_v) of 0.95 for the reinforced turf area only.

$$P_E = \frac{12 \times ESD_v}{R_v \times A}$$ where R_v is for the entire subarea

A-3. Reinforced Turf:

"When designed according to the guidance provided below, reinforced turf areas are considered as permeable surfaces. Post development RCN's for reinforced turf applications should reflect the surfacing material used (e.g., "open space in good condition" for grass)."

DA-1

SUB-DA 1.1, post					RCN:
Total Area =	19,597	[sf]	0.45	[ac]	84
Impervious Area =	8,054	[sf]	0.18	[ac]	98
Pervious Area =	11,543	[sf]	0.26	[ac]	74
I =	41%				
ESD / USC Targets:					
P_E=	1.8	[in]	(Table 5.3, Soil Type C)		
R_v=	0.42				Check
ESD_v=	0.03	[ac-ft]	1234	[ft^3]	WQv USC:
WQ_v=	0.02	[ac-ft]	686	[ft^3]	327
Re_v=	0.00	[ac-ft]	89	[ft^3]	

SUB-DA 1.1 (ESD 1)			
N-2. Disconnection of Non-Rooftop Runoff (10' for 20' imp. contrib. length)			
P_E Provided =	0.4	[in]	(Table 5.7, 0.5:1 imp.)
ESD_v Provided =	383	[ft^3]	See CAC Worksheet
M-8. Grass Swale: **8' x 330'**			
A_f=	2,640	[ft^2]	
DA =	19,597	[ft^2]	
Af/DA=	13%	>2%	
ESDv Provided =	880	[ft^3]	4" design depth
Swale Design Check Summary:			
Velocity < 1 during ESD_v?	0.3	[fps]	**OK**
Depth < 4" during ESD_v?	2.9	[in]	**OK**
Velocity < 2.5 during 10-yr?	0.5	[fps]	**OK**
Freeboard > 6" during 10-yr?	6.8	[in]	**OK**
Summary:			
Total P_E Provided=	1.84	[per CAC]	**OK**
Total ESD_v Provided=	1,263	[ft^3]	**OK**

SUB-DA 1.2, post					RCN:
Total Area =	7,506	[sf]	0.17	[ac]	83
Impervious Area =	2,688	[sf]	0.06	[ac]	98
Pervious Area =	4,818	[sf]	0.11	[ac]	74
I=	36%				
ESD / USC Targets:					
P_E=	1.8	[in]	(Table 5.3, Soil Type C)		
R_v=	0.37				Check
ESD_v=	0.01	[ac-ft]	419	[ft^3]	WQv USC:
WQ_v=	0.01	[ac-ft]	233	[ft^3]	125
Re_v=	0.00	[ac-ft]	30	[ft^3]	

SUB-DA 1.2 (ESD 2)			
N-2. Disconnection of Non-Rooftop Runoff (16' for 20' imp. contrib. length)			
P_E Provided =	0.8	[in]	(Table 5.7, 0.8:1 imp.)
ESD_v Provided =	255	[ft^3]	See CAC Worksheet
M-8. Grass Swale: **8' x 85'**			
A_f=	680	[ft^2]	
DA =	7,506	[ft^2]	
Af/DA=	9%	>2%	
ESDv Provided =	227	[ft^3]	4" design depth
Swale Design Check Summary:			
Velocity < 1 during ESD_v?	0.4	[fps]	**OK**
Depth < 4" during ESD_v?	1.3	[in]	**OK**
Velocity < 2.5 during 10-yr?	0.6	[fps]	**OK**
Freeboard > 6" during 10-yr?	9.6	[in]	**OK**
Summary:			
Total P_E Provided=	2.1	[per CAC]	**OK**
Total ESD_v Provided=	482	[ft^3]	**OK**

SUB-DA 1.3, post =					RCN:
Total Area =	66,853	[sf]	1.53	[ac]	80
Impervious Area =	15,639	[sf]	0.36	[ac]	98
Pervious Area =	51,214	[sf]	1.18	[ac]	74
I=	23%				
ESD / USC Targets:					
P_E=	1.2	[in]	(Table 5.3, Soil Type C)		
R_v=	0.26				Check
ESD_v=	0.04	[ac-ft]	1742	[ft^3]	WQv USC:
WQ_v=	0.03	[ac-ft]	1451	[ft^3]	1114
Re_v=	0.00	[ac-ft]	189	[ft^3]	

SUB-DA 1.3 (ESD 3)			
N-2. Disconnection of Non-Rooftop Runoff (10' for 20' imp. contrib. length)			
P_E Provided =	0.4	[in]	(Table 5.7, 0.5:1 imp.)
ESD_v Provided =	1114	[ft^3]	See CAC Worksheet
M-8. Grass Swale:	**8' x 800'**		
A_f=	6,400	[ft^2]	
DA =	66,853	[ft^2]	
Af/DA=	10%	>2%	
ESDv Provided =	2,133	[ft^3]	4" design depth
Swale Design Check Summary:			
Velocity < 1 during ESD_v?	0.4	[fps]	OK
Depth < 4" during ESD_v?	3.8	[in]	OK
Velocity < 2.5 during 10-yr?	0.4	[fps]	OK
Freeboard > 6" during 10-yr?	8.4	[in]	OK
Summary:			
Total P_E Provided=	2.2	[per CAC]	OK
Total ESD_v Provided=	3,247	[ft^3]	OK

SUB-DA 1.4 Area, post =					RCN:
Total Area =	19,357	[sf]	0.44	[ac]	81
Impervious Area =	6,027	[sf]	0.14	[ac]	98
Pervious Area =	13,330	[sf]	0.31	[ac]	74
I=	31%				
ESD / USC Targets:					
P_E=	1.6	[in]	(Table 5.3, Soil Type C)		
R_v=	0.33				Check
ESD_v=	0.02	[ac-ft]	852	[ft^3]	WQv USC:
WQ_v=	0.01	[ac-ft]	533	[ft^3]	323
Re_v=	0.00	[ac-ft]	69	[ft^3]	

SUB-DA 1.4 (ESD 4)			
N-2. Disconnection of Non-Rooftop Runoff (10' for 20' imp. contrib. length)			
P_E Provided =	0.4	[in]	(Table 5.7, 0.5:1 imp.)
ESD_v Provided =	322	[ft^3]	See CAC Worksheet
M-8. Grass Swale:	**8' x 300'**		
A_f=	2,400	[ft^2]	
DA =	19,357	[ft^2]	
Af/DA=	12%	>2%	
ESDv Provided =	800	[ft3]	4" design depth
Swale Design Check Summary:			
Velocity < 1 during ESD_v?	0.3	[fps]	OK
Depth < 4" during ESD_v?	2.5	[in]	OK
Velocity < 2.5 during 10-yr?	0.3	[fps]	OK
Freeboard > 6" during 10-yr?	7.1	[in]	OK
Summary:			
Total P_E Provided=	2.1	[per CAC]	OK
Total ESD_v Provided=	1,122	[ft^3]	OK

DA-1 Total Sub-Areas requiring ESD	**2.60**	**[ac]**	
DA-1 Total ESD_v Required =	**4,248**	**[ft^3]**	
DA-1 Total ESD_v Provided=	**6114**	**[ft^3]**	OK

DA-2

SUB-DA 2.1, post =					RCN:
Total Area =	15,324	[sf]	0.35	[ac]	91
Impervious Area (A_I) =	10,649	[sf]	0.24	[ac]	98
Reinforced Turf Area =	544	[sf]	0.01	[ac]	74
Other Pervious Area =	4,131	[sf]	0.09	[ac]	74
%I=	73%	<- incl. reinforced turf area			
ESD / USC Targets:					
P_E=	2.0	[in]	(Table 5.3, Soil Type C)		
R_v=	0.71				Check:
ESD_v=	0.04	[ac-ft]	1807	[ft^3]	WQv USC:
WQ_v=	0.02	[ac-ft]	903	[ft^3]	255
Re_v=	0.00	[ac-ft]	117	[ft^3]	

SUB-DA 2.1 (ESD 5)			
A-3. Reinforced Turf			
ESD_v/ft^2=	0.134		(Table 1, 9" base)
A_f=	544	[ft^2]	
ESD_v Provided =	73	[ft^3]	
N-1. Disconnection of Rooftop Runoff (for half roof, 10' w/ level spreader)			
P_E Provided =	0.0	[in]	CAC Worksheet Error?
ESD_v Provided =	-	[ft^3]	CAC Worksheet Error?
M-6. Micro-Bioretention w/ Underdrain		**21'W x 94'L**	
Facility Area (A_f)=	1974	[ft^2]	
DA =	15324	[ft^2]	
Af/DA=	13%	>2%	
Surface Storage Check:			
A_f/A_I =	19%		
%I =	73%		
Storage Depth =	0.4	ft	
Surface Storage for ESD_v =	789.6	[ft^3]	
% Req'd per MDE Tables	43%		(for PE= 2-2.6)
% Storage Provided	44%		**OK**
Total Storage Check:			
Storage for ESD_v	2,369	[ft^3]	CAC Sheet, ~2.0' depth
Summary:			
Total P_E Provided=	2.7	[per CAC]	**OK**
Total ESD_v Provided=	2,442	[ft^3]	**OK**

SUB-DA 2.2, post =					RCN:
Total Area =	15,905	[sf]	0.37	[ac]	83
Impervious Area (A_I) =	6,105	[sf]	0.14	[ac]	98
Pervious Area =	9,800	[sf]	0.22	[ac]	74
%I=	38%				
ESD / USC Targets:					
P_E=	1.8	[in]	(Table 5.3, Soil Type C)		
R_v=	0.40				Check:
ESD_v=	0.02	[ac-ft]	943	[ft^3]	WQv USC:
WQ_v=	0.01	[ac-ft]	524	[ft^3]	265
Re_v=	0.00	[ac-ft]	68	[ft^3]	

SUB-DA 2.2 (ESD 6)			
N-2. Disconnection of Non-Rooftop Runoff (20' w/ 65' avg. contrib. length)			
P_E Provided =	0.2	[in]	(Table 5.7, 0.3:1 imp.)
ESD_v Provided =	145	[ft^3]	See CAC Worksheet
M-6. Micro-Bioretention w/ Underdrain		**20'W x 80'L**	
Facility Area (A_f)=	1600	[ft^2]	
DA =	15905	[ft^2]	
Af/DA=	10%	>2%	
Surface Storage Check:			
A_f/A_I =	26%		
%I =	38%		
Storage Depth =	0.3	ft	
Surface Storage =	480	[ft^3]	
% Req'd per MDE Tables	30%		(for PE= 1.6)
% Storage Provided	51%		**OK**
Total Storage Check:			
Storage for ESD_v	1,760	[ft^3]	CAC Sheet, ~2.0' depth
Summary:			
Total P_E Provided=	3.6	[per CAC]	**OK**
Total ESD_v Provided=	1,905	[ft^3]	**OK**

SUB-DA 2.3, post =					RCN:
Total Area =	10,694	[sf]	0.25	[ac]	89
Impervious Area (A_I) =	6,839	[sf]	0.16	[ac]	98
Pervious Area =	3,855	[sf]	0.09	[ac]	74
%I=	64%				
ESD / USC Targets:					
P_E=	2.0	[in]	(Table 5.3, Soil Type C)		
R_v=	0.63				Check:
ESD_v=	0.03	[ac-ft]	1115	[ft^3]	WQv USC:
WQ_v=	0.01	[ac-ft]	557	[ft^3]	178
Re_v=	0.00	[ac-ft]	72	[ft^3]	

SUB-DA 2.3 (ESD 7)			
N-2. Disconnection of Non-Rooftop Runoff (10' w/ 40' avg. contrib. length)			
P_E Provided =	0.2	[in]	(Table 5.7, 0.2:1 imp.)
ESD_v Provided =	146	[ft^3]	See CAC Worksheet
M-6. Micro-Bioretention w/ Underdrain		**10' x 130'**	
Facility Area (A_f)=	1300	[ft^2]	
DA =	10694	[ft^2]	
Af/DA=	12%	>2%	
Surface Storage Check:			
A_f/A_i =	19%		
%I =	64%		
Storage Depth =	0.5	ft	
Surface Storage =	650	[ft^3]	
Req'd per MDE Tables	42%		(for PE= 2-2.6)
% Storage Provided	58%		**OK**
Total Storage Check:			
Storage for ESD_v	1,690	[ft^3]	CAC Sheet, ~2.0' depth
Summary:			
Total P_E Provided=	3.3	[per CAC]	**OK**
Total ESD_v Provided=	1,836	[ft^3]	**OK**

SUB-DA 2.4 Area, post =					RCN:
Total Area =	12,577	[sf]	0.29	[ac]	88
Impervious Area (A_I) =	7,306	[sf]	0.17	[ac]	98
Pervious Area =	5,271	[sf]	0.12	[ac]	74
%I=	58%				
ESD / USC Targets:					
P_E=	2.0	[in]	(Table 5.3, Soil Type C)		
R_v=	0.57				Check:
ESD_v=	0.03	[ac-ft]	1201	[ft^3]	WQv USC:
WQ_v=	0.01	[ac-ft]	600	[ft^3]	210
Re_v=	0.00	[ac-ft]	78	[ft^3]	

SUB-DA 2.4 (ESD 8)			
N-2. Disconnection of Non-Rooftop Runoff (10' w/ 40' avg. contrib. length)			
P_E Provided =	0.2	[in]	(Table 5.7, 0.2:1 imp.)
ESD_v Provided =	156	[ft^3]	See CAC Worksheet
M-8. Micro Bio-Retention w/ Underdrain		**12' x 140'**	
Facility Area (A_f)=	1680	[ft^2]	
DA =	12577	[ft^2]	
Af/DA=	13%	>2%	
P_E= (Prelim Size Only)	2.0	[in]	
ESD_v= (Prelim Size Only)	1,203	[ft^3]	
Surface Storage Check:			
A_f/A_i =	23%		
%I =	58%		
Storage Depth =	0.3	ft	
Surface Storage =	504	[ft^3]	
Req'd per MDE Tables	41%	required	(for PE= 2-2.6)
% Storage Provided	42%	provided	**OK**
Media Storage Check:			
Storage for ESD_v	1,848	[ft^3]	CAC Sheet, ~2' depth
Summary:			
Total P_E Provided=	3.3	[per CAC]	**OK**
Total ESD_v Provided=	2,004	[ft^3]	**OK**

DA-2 Total ESD_v Required =	**5,066**	**[ft^3]**	**DA-2 Total ESD_v Provided=**	**8,187**	**[ft^3]**	**OK**

DA-3

SUB-DA 3.1 Area, post =					RCN:
Total Area =	21,611	[sf]	0.50	[ac]	75
Impervious Area =	600	[sf]	0.01	[ac]	98
Reinforced Turf Area =	4,448	[sf]	0.10	[ac]	74
Pervious Area =	16,563	[sf]	0.38	[ac]	74
%I=	23%	<- incl. reinforced turf area			
ESD / USC Targets:					
P_E=	1.2	[in]	(Table 5.3, Soil Type C)		
R_v=	0.26				
ESD_v=	0.01	[ac-ft]	562	[ft³]	WQv USC:
WQ_v=	0.01	[ac-ft]	469	[ft³]	360
Re_v=	0.00	[ac-ft]	61	[ft³]	

SUB-DA 3.1 (ESD 9.1)				
A-3. Reinforced Turf				
ESD_v/ft^2=	0.134		(Table 1, 9" base)	
A_f=	4,448	[ft²]		
ESD_v=	596	[ft³]		
N-2. Disconnection of Non-Rooftop Runoff (10' w/ 10' avg. contrib. length)				
P_E Provided =	1.0	[in]	(Table 5.7, 1:1 imp.)	
ESD_v Provided =	107	[ft³]	Per CAC Worksheet	
Summary:				
Total P_E Provided=	1.5	[per CAC]		OK
Total ESD_v Provided=	703	[ft³]		OK

SUB-DA 3.2, post =					RCN:
Total Area =	16,551	[sf]	0.38	[ac]	75
Impervious Area =	410	[sf]	0.01	[ac]	98
Reinforced Turf Area =	4,939	[sf]	0.11	[ac]	74
Pervious Area =	11,202	[sf]	0.26	[ac]	74
%I=	32%	<- incl. reinforced turf area			
ESD / USC Targets:					
P_E=	1.6	[in]	(Table 5.3, Soil Type C)		
R_v=	0.34				
ESD_v=	0.02	[ac-ft]	752	[ft³]	WQv USC:
WQ_v=	0.01	[ac-ft]	470	[ft³]	276
Re_v=	0.00	[ac-ft]	61	[ft³]	

SUB-DA 3.2 (ESD 9.2)				
A-3. Reinforced Turf				
ESD_v/ft^2=	0.160		(Table 1, 12" base)	
A_f=	4,939	[ft²]		
ESD_v Provided =	790	[ft³]		
N-2. Disconnection of Non-Rooftop Runoff (10' w/ 10' avg. contrib. length)				
P_E Provided =	1.0	[in]	(Table 5.7, 1:1 imp.)	
ESD_v Provided =	55	[ft³]	Per CAC Worksheet	
Summary:				
Total P_E Provided=	1.8	[per CAC]		OK
Total ESD_v Provided=	845	[ft³]		OK

SUB-DA 3.3, post =					RCN:
Total Area =	27,218	[sf]	0.62	[ac]	76
Impervious Area =	2,454	[sf]	0.06	[ac]	98
Reinforced Turf Area =	5,514	[sf]	0.13	[ac]	74
Pervious Area =	19,250	[sf]	0.44	[ac]	74
%I=	29%	<- incl. reinforced turf area			
ESD / USC Targets:					
P_E=	1.6	[in]	(Table 5.3, Soil Type C)		
R_v=	0.31				
ESD_v=	0.03	[ac-ft]	1138	[ft³]	WQv USC:
WQ_v=	0.02	[ac-ft]	711	[ft³]	454
Re_v=	0.00	[ac-ft]	92	[ft³]	

SUB-DA 3.3 (ESD 9.3)				
A-3. Reinforced Turf				
ESD_v/ft^2=	0.160		(Table 1, 12" base)	
A_f=	5,514	[ft²]		
ESD_v Provided =	882	[ft³]		
N-2. Disconnection of Non-Rooftop Runoff (10' w/ 10' avg. contrib. length)				
P_E Provided =	1.0	[in]	(Table 5.7, 1:1 imp.)	
ESD_v Provided =	327	[ft³]	Per CAC Worksheet	
Summary:				
Total P_E Provided=	1.7	[per CAC]		OK
Total ESD_v Provided=	1,209.24	[ft³]		OK

SUB-DA 3.4, post =					RCN:		**SUB-DA 3.4 (ESD 9.4)**		
Total Area =	44,855	[sf]	1.03	[ac]	74		**A-3. Reinforced Turf**		
Impervious Area =	448	[sf]	0.01	[ac]	98		ESD_v/ft^2=	0.134	(Table 1, 9" base)
Reinforced Turf Area =	3,917	[sf]	0.09	[ac]	74		A_f=	3,917 [ft^2]	
Pervious Area =	40,490	[sf]	0.93	[ac]	74		ESD_v Provided =	525 [ft^3]	
%I=	10%	<- incl. reinforced turf area					**N-2. Disconnection of Non-Rooftop Runoff (10' w/ 10' avg. contrib. length)**		
ESD / USC Targets:							P_E Provided =	1.0 [in]	(Table 5.7, 1:1 imp.)
P_E=	1.0	[in]	(Table 5.3, Soil Type C)				ESD_v Provided =	96 [ft^3]	Per CAC Worksheet
R_v=	0.14				Check:		**Summary:**		
ESD_v=	0.01	[ac-ft]	514	[ft^3]	WQv USC:		Total P_E Provided=	1.2 [per CAC]	OK
WQ_v=	0.01	[ac-ft]	514	[ft^3]	748		Total ESD_v Provided=	621 [ft^3]	OK
Re_v=	0.00	[ac-ft]	67	[ft^3]					
DA-3 Total ESD_v Required =			**2,966**	**[ft^3]**			**DA-3 Total ESD_v Provided =**	**3,378 [ft^3]**	
Total ESD_v Required =			**12,280**				**Total ESD_v Provided =**	**17,679**	

Abbreviations

A	Drainage Area, square feet or acres
I	% Impervious, sqaure feet or acres
P_E	Rainfall Target, inches
R_v	Volumetric Runoff Coefficient, dimensionless
ESD_v	ESD Runoff Volume, cubic feet or acre-feet
WQ_v	Water Quality Volume, cubic feet or acre-feet
Re_v	Recharge Volume, cubic feet or acre-feet
Cp_v	Channel Protection Volume, cubic feet or acre-feet
Q_{p2} and Q_{p10}	Overbank Flood Protection Volumes, cubic feet or acre-feet
Q_f	Extreme Flood Volume, cubic feet or acre-feet

DA - drainage area
cf - cubic feet
sf - sqaure feet
ac-ft - acres-feet
ft^3 - cubic feet
ft^2 - square feet
in - inch(es)

HSG - Hydrologic Soil Group
RCN - runof curve number

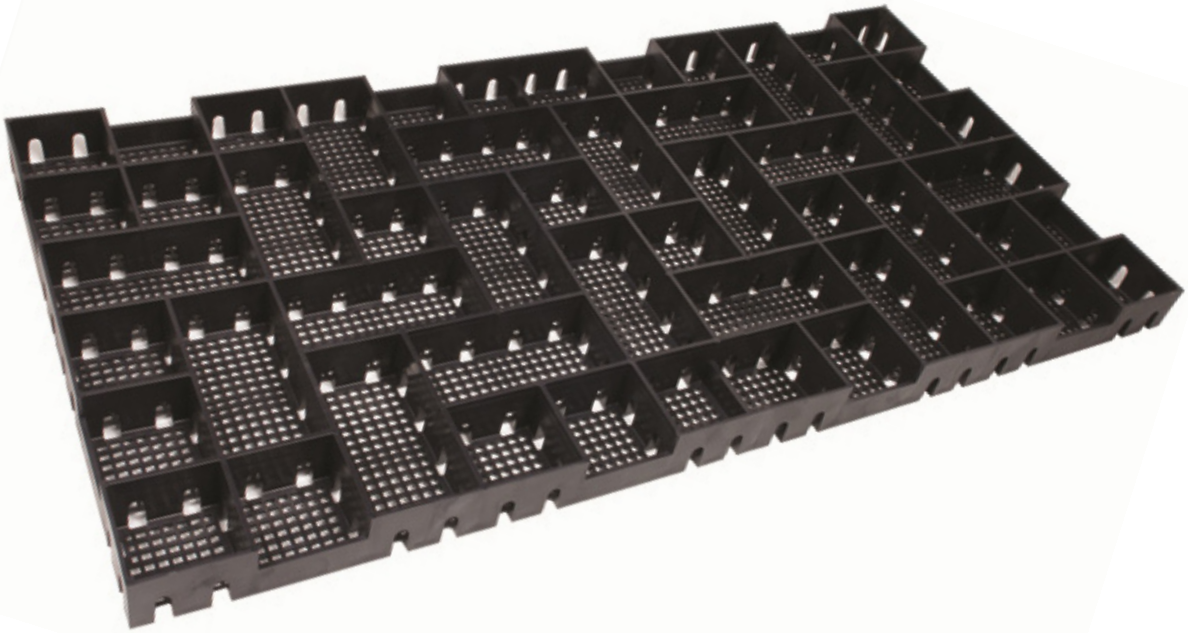
APPENDIX G — PRESTO GEOPAVE LITERATURE

PRESTO GEOSYSTEMS

GEOPAVE®

POROUS PAVEMENT SYSTEM

DESIGN & CONSTRUCTION OVERVIEW









PRESTO GEOSYSTEMS
670 N PERKINS STREET, APPLETON, WISCONSIN, USA 54914
Ph: 920-738-1328 or 800-548-3424 ■ Fax: 920-738-1222
e-mail: INFO@PRESTOGEO.COM WWW.PRESTOGEO.COM/

GP-001 – 28 SEPT 2012

Table of Contents

The GeoPave® Porous Pavement System Components 1
Figure 1 The GeoPave Porous Pavement System 1
Function of the GeoPave System Components 1
Function of the GeoPave Unit 1
Function of the Base Material 1
Function of the Optional Geosynthetic Layer 1
Function of the Optional Sub-drain Component 1
GeoPave Material Properties & Unit Dimensions 1
Table 1 GeoPave Unit Material Properties & Unit Dimensions 2
Figure 2 Full Size GeoPave Unit 2
Figure 3 The GeoPave Cell Configuration 2
Design Guideline 3
Table 2 Base Recommendations for the GeoPave Porous Pavement System 3
Infill Materials 4
Aggregate Infill 4
Aggregate/Topsoil Engineered Infill 4
Base Materials 4
Aggregate Base 4
Aggregate/Topsoil Engineered Base 4
Key Porous Pavement System Characteristics 5
Elements Important to Structural Integrity 5
Figure 4 GeoPave System Material Specification and Layout 6
Figure 5 GeoPave System Usage Guideline 7
Installing the GeoPave System 8
Subgrade Preparation 8
Optional Geosynthetic Separation Layer 8
Optional Sub-Drainage Component 8
Base Preparation 8
GeoPave Unit Installation 8
Orientation & Laying Pattern of Units 8
Figure 6 Laying Patterns 8
Positioning of Units 9
Figure 7 Joining GeoPave Units 9
Figure 8 The U-Clip Connection Device 9

Optional Anchoring of Units 9
Figure 9 Optional Stake Anchoring 9
Infilling the GeoPave Unit 10
Seed or Sod for Vegetated Systems 10
Delineation for Vegetated Systems 10
Maintenance 10
Estimating Time and Cost of Installation 11
Typical Crew Size and Responsibilities 11
Equipment Needed and Purpose 11
Typical Construction Sequences and Times 11
Table 3 Approximate Quantities of Infill Material Required for GeoPave Unit 11
General Notes 11
Total Time and Materials Required 12
Total Cost of Time and Materials 12
Limited Warranty 13
Disclaimer 13

The GeoPave® Porous Pavement System Components

The GeoPave Porous Pavement System with aggregate or an aggregate/topsoil engineered infill provides a permeable, stabilized surface for vehicular and pedestrian load support.

The complete system has three major components:

(1) the GeoPave unit

(2) the porous aggregate or aggregate/topsoil engineered base, *if required*

(3) the porous aggregate or an aggregate/topsoil engineered infill.

Other components may include a geosynthetic separation / reinforcement layer between the subgrade and base materials and sub-drain components.

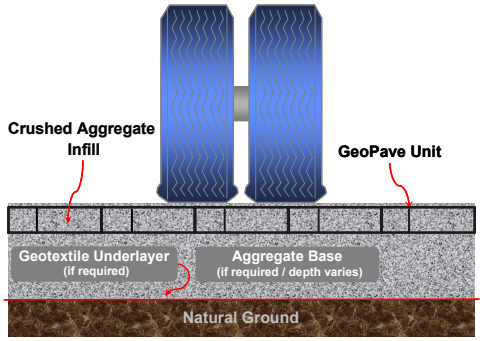


Figure 1 The GeoPave Porous Pavement System

Function of the GeoPave System Components

Function of the GeoPave Unit

The function of the GeoPave unit is to 1) create a structural framework to stabilize open-graded aggregate or an aggregate/topsoil engineered infill and to 2) increase bearing strength for vehicular or pedestrian traffic loading requirements using porous aggregate or other structural infills.

Function of the Base Material

For a given applied load over an existing subbase soil, both the base material, *if required,* and the GeoPave unit with crushed aggregate or a structural infill provide support. The depth of the base material should be determined using both loading requirements and subbase strength (Reference Table 1).

Function of the Optional Geosynthetic Layer

Under some conditions, a geosynthetic layer may be a required component between the in-situ soil and the required base layer in the porous pavement system. Generally, the geosynthetic component will serve one or more of the following functions and be one or more of the following materials:

- Tensile Reinforcement Geosynthetics:.... Woven geotextiles, Geogrids
- Separation Geosynthetics: ..... Non-woven geotextiles, Woven geotextiles
- Drainage / Separation Geosynthetics:..... Non-woven geotextiles, Geonet / geotextile separation / drainage materials

Function of the Optional Sub-drain Component

If the porous pavement system is built over non-porous soils and an excavation is required such that water could be trapped, sub drainage becomes a required component of the system. Sub-drainage will remove harmful water accumulation that will cause degradation of the in-situ soils resulting in loss of support capacity. See **Optional Sub-Drainage Component** under **Installing the GeoPave System** for additional details.

GeoPave Material Properties & Unit Dimensions

GeoPave units shall be made from materials with physical and chemical characteristics described in Table 1. The manufactured GeoPave unit shall have a minimum deflection without breakage of 1.0 in (25 mm) when units are supported at 40 in (0.50 m) centers at 70°F (21°C). The color shall be uniform throughout all units in any given pallet.

GeoPave units shall have physical dimensions as specified in Table 1 and shown in Figure 2. GeoPave units shall contain a herringbone-type cell pattern consisting of small and large cells with a mesh bottom and vented side-walls. The monolithic mesh bottom is comprised of a series of square 0.25 in by 0.25 in (6.35 mm by 6.35 mm) openings. The small cells contain 1.0 in (25 mm) high and 0.50 in (12 mm) wide vented cell-wall openings, either 4 or 6 per cell for infill lock-up and lateral drainage between cells. The large cells contain vented cell-wall openings, 12 per cell.

The GeoPave units shall be connected with U-CLIPS side-to-side and end-to end where the short cell side-walls of adjacent units align. The connection points vary depending on chosen laying pattern (See Figure 8 Laying Patterns). End-to-end or side-to-side warping of the GeoPave unit shall not create a greater opening between adjacent outside walls than 0.25 in (6 mm). The finished GeoPave pavement is a uniformly connected, laterally integrated porous pavement system.

COPYRIGHT 2012 PRESTO PRODUCTS CO.

Table 1 GeoPave Unit Material Properties & Unit Dimensions

Item	Specifications & Details
Material	Up to 97% Recycled Polyethylene*
Color	Ranges from dark shades of gray to black
Chemical Resistance	Superior
Carbon Black for Ultraviolet Light Stabilization	1.5% - 2.0%
Empty Unit Minimum Crush Strength @ 70°F (21°C)	175 psi (1,202 kPa)
Aggregate or Aggregate/Topsoil Filled Unit Minimum Crush Strength @ 70°F (21°C)	1000 psi (6,869 kPa)
Nominal Dimensions (width x length)	20 in x 40 in (0.50 m x 1.00 m)
Nominal Unit Depth	2 in (50 mm)
Nominal Coverage Area	5.38 ft² (0.50 m²)
Cells per Unit	50
Cell Size (small cell)	3.25 in x 3.25 in (83 mm x 83 mm)
Cell Size (large cell)	3.25 in x 6.5 in (83 mm x 165 mm)
Top Open Area per unit	90.5%
Bottom Open Area per unit	32.6%
Bottom Mesh Openings	0.25 in x 0.25 in (6.35 mm x 6.35 mm)
Nominal Weight per Unit	8.0 lb (3.6 kg)
Runoff Coefficient @ 63.5 mm/hr (2.5 in) Rainfall	(0 - 0.15)
Units per Pallet	46

Strength Characteristics of the GeoPave Unit	
***Empty Unit* Wall Compressive Strength** (simulated tire area loaded) Test Procedure - Full single unit loaded to failure via 9 inch flat plate	175 psi (1,202 kPa)
***Aggregate or Aggregate/Topsoil Filled Unit* Wall Compressive Strength** (simulated tire area loaded) Test Procedure - Full single unit loaded to failure via 9 inch flat plate	1000 psi (6,869 kPa)

Avoid specifications that state material compressive strength only. Material compressive strength, with applied factors-of-safety, must be sufficient to resist compressive and lateral load application. Beyond that, ultra-high material compressive strengths add little to any porous pavement system.

* The percentage of recycled content may vary depending on availability of recycled materials.

NOTE: Dimensions and weight are subject to manufacturing tolerances (± 5%) and are influenced by recycled component characteristics.

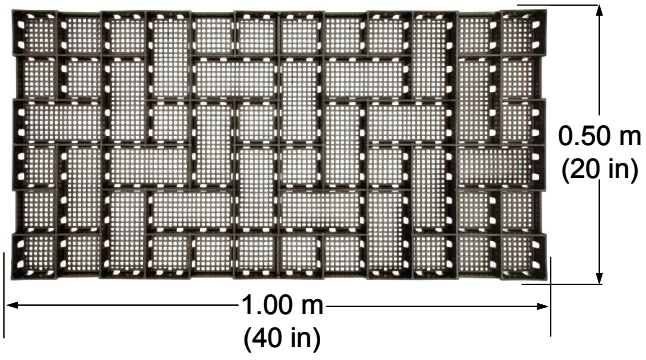


Figure 2 Full Size GeoPave Unit



Figure 3 The GeoPave Cell Configuration

COPYRIGHT 2012 PRESTO PRODUCTS CO.

Design Guideline

Table 2 Base Recommendations for the GeoPave Porous Pavement System

Load Description	Depth of Base		Depth of Base	
	Aggregate		Engineered Aggregate / Topsoil[2]	
	CBR[1] 2 – 4	*CBR[1] >4*	*CBR[1] 2 – 4*	*CBR[1] >4*
Heavy Fire Truck Access & H-20 Loading Typical 110 psi (758 kPa) maximum tire pressure. Single axle loadings of 32 kip (145 kN), tandem axle loadings of 48 kip (220 kN). Gross vehicle loads of 80,000 lb (36.3 tonne).	6 in (150 mm)	6 in (150 mm)	Not Recommended	Not Recommended
Light Fire Truck Access & H-15 Loading Typical 85 psi (586 kPa) maximum tire pressure. Single axle loadings of 24 kip (110 kN). Gross vehicle loads of 60,000 lb (27.2 tonne).	6 in (150 mm)	4 in (100 mm)	Not Recommended	Not Recommended
Utility & Delivery Truck Access & H-10 Loading Typical 60 psi (414 kPa) maximum tire pressure. Single axle loadings of 16 kip (75 kN). Gross vehicle loads of 40,000 lb (18.1 tonne).	4 in (100 mm)	2 in (50 mm)	4 in (100 mm)	2 in (50 mm)
Cars & Pick-up Truck Access. Typical 45 psi (310 kPa) maximum tire pressure. Single axle loadings of 4 kip (18 kN). Gross vehicle loads of 8,000 lb (3.6 tonne).	2 in (50 mm)	None[3]	2 in (50 mm)	None[3]
Trail Use Loading for pedestrian, wheelchair, equestrian, bicycle, motorcycle and ATV traffic.	None[3]	None[3]	None[3]	None[3]

[1] CBR is the abbreviation for California Bearing Ratio. Methods for determining CBR vary from more sophisticated laboratory methods to simple field identification methods that use hand manipulation of the soil. Presto does not recommend one method over the other, however, the user must have a high degree of confidence in the results produced by the chosen method. If other-than-CBR soil strength values exist, use available correlation charts to relate the value to CBR.

[2] With the aggregate/topsoil mix and a vegetative surface, infrequent/occasional passes are recommended. Infrequent/occasional passes are defined as the number of passes over any period of time that causes no lasting damage to the vegetation. This number will be a function of vegetation type and age, climatic conditions, and maintenance practices. This number is not a function of the GeoPave material.

[3] A minimum of 2 in (50 mm) of aggregate base should be placed below the GeoPave units as a drainage layer and an infiltration storage area. Greater depth may be required depending upon design rainfall needs and subbase permeability.

Copyright 2012– Presto Products Co.

Infill Materials

The recommended infill shall be an aggregate or an aggregate/topsoil engineered infill for aggregate and vegetated pavements respectively. When specifying infill type, consideration should be given to appropriateness of infill for loading requirements, traffic frequency, and subgrade strength.

Aggregate Infill

The aggregate infill shall be a well-graded 0.375 in to 0.5 in (10 mm to 13 mm) crushed angular stone with a fine content less than 5%.

Aggregate/Topsoil Engineered Infill

The aggregate/topsoil engineered infill shall consist of a homogenous mixture consisting of 1) a clear-stone/crushed rock having an AASHTO #5 or similar designation blended with 2) pulverized topsoil and 3) a void component generally containing air and/or water. This homogenous mixture will promote vegetative growth and provide required structural support. The aggregate portion shall have a particle range from 0.375 in to 0.5 in (10 mm to 13 mm). The percentage void-space of the aggregate portion shall be at least 30%. The pulverized topsoil shall equal 25% of the total volume and be added and blended to produce a homogenous mixture prior to placement.

Choice of vegetation shall be determined based upon local climate and proposed use.

Base Materials

If necessary for loading requirements, the recommended base shall be aggregate or an engineered aggregate/topsoil mixture, and should be consistent with the chosen infill type.

Porous Base for Storage

A minimum of 2 in (50 mm) of base material is generally recommended for drainage even if not required by design for load support. Additional base depth may be added if required over a low-permeable base or to function as a storm water detention/retention layer.

Under some conditions, a geotextile separation layer may be required between the natural ground and the base material. See **Optional Geosynthetic Separation Layer**, **Optional Sub-Drainage Component,** and **Base Preparation** for information relative to installation. Care shall be exercised in choosing this layer to assure that it does not impede permeability.

Aggregate Base

When the specified infill is aggregate, the aggregate base shall be a poorly-graded crushed aggregate with a fine content less then 5%. The aggregate shall be compacted to 95% Standard Proctor Density. After compaction, the surface shall be uniform with no protrusions from larger aggregate particles.

Base Particle Size Passing Sieve Analysis

Sieve Size	% Particles Passing Opening
½ in	95-100%
3/8 in	15-20%
#4	0-5%

Aggregate/Topsoil Engineered Base

When the specified infill is an aggregate/topsoil engineered mix for vegetated surfaces, the base material shall be an aggregate/topsoil engineered mixture. A free-draining aggregate base is not recommended for porous pavements intended to be vegetated. The aggregate/topsoil engineered base ensures proper moisture retention and the nutrient component required to maintain healthy vegetation.

The aggregate/topsoil engineered base shall consist of a homogenous mixture consisting of 1) a clear-stone/crushed rock having an AASHTO #5 or similar designation blended with 2) pulverized topsoil and 3) a void component generally containing air and/or water. This homogenous mixture will promote vegetative growth and provide required structural support. The aggregate portion shall have a particle range from 0.375 in to 1.0 in (10 mm to 25 mm) with a D_{50} of 0.5 in (13 mm). The percentage void-space of the aggregate portion when compacted shall be at least 30%. The pulverized topsoil shall equal 25% of the total volume and be added and blended to produce a homogenous mixture prior to placement. The mixture shall be compacted to 95% Standard Proctor Density.

COPYRIGHT 2012 PRESTO PRODUCTS CO.

Key Porous Pavement System Characteristics

Elements Important to Structural Integrity

The GeoPave unit (or any other similar material) must have five primary characteristics to adequately support loads, eliminate expansion-related failures, and to enable fast and efficient construction. Those characteristics are:

(1) suitable wall strength
(2) sufficient unit stiffness
(3) a supporting base, if required
(4) a large overall area and
(5) a monolithic mesh bottom

1) **Suitable Wall Strength:** The wall strength must support wheel loading from the heaviest anticipated vehicles that will travel over the porous pavement system. Vehicular loading will create direct wall compression from tires and equipment outriggers as well as lateral forces from vehicle breaking and acceleration. The wall should resist vertical and lateral deformations when loaded. **Caution** should be exercised when using systems with thin walls.

2) **Sufficient Unit Stiffness:** The unit stiffness must allow deflections without unit breakage or separation when subbase soils yield under loading. When the unit is too flexible, the base soils support the complete load. When the unit is too rigid, it could break under normal loading in low temperature conditions. **Caution** should be exercised when using systems that are either too flexible or too rigid.

3) **Supporting Base *if required:*** The unit support base must have a large enough area-of-contact with the base soil so high wheel loads at the top of the unit are reduced sufficiently when transferred to the base soil. This will provide a system with a greater range of stability. **Caution** should be exercised when using systems that have little contact area between the porous pavement unit and the base soil.

4) **Large Overall Area:** A large overall area, in conjunction with the other characteristics, ensures maximum load dissipation. If unit separation should occur and any given unit functions independently, larger unit areas will lower the pressure on base and subgrade soils. **Caution** should be exercised when using systems that have smaller contact areas.

5) Monolithic Mesh Bottom: The unit should contain a monolithic mesh bottom for encapsulating the aggregate infill and preventing material loss from the bottom of the units when exposed to repeated loading and freeze-thaw cycles. **Caution** should be exercised when using systems without monolithic mesh bottoms.

COPYRIGHT 2012– PRESTO PRODUCTS CO.

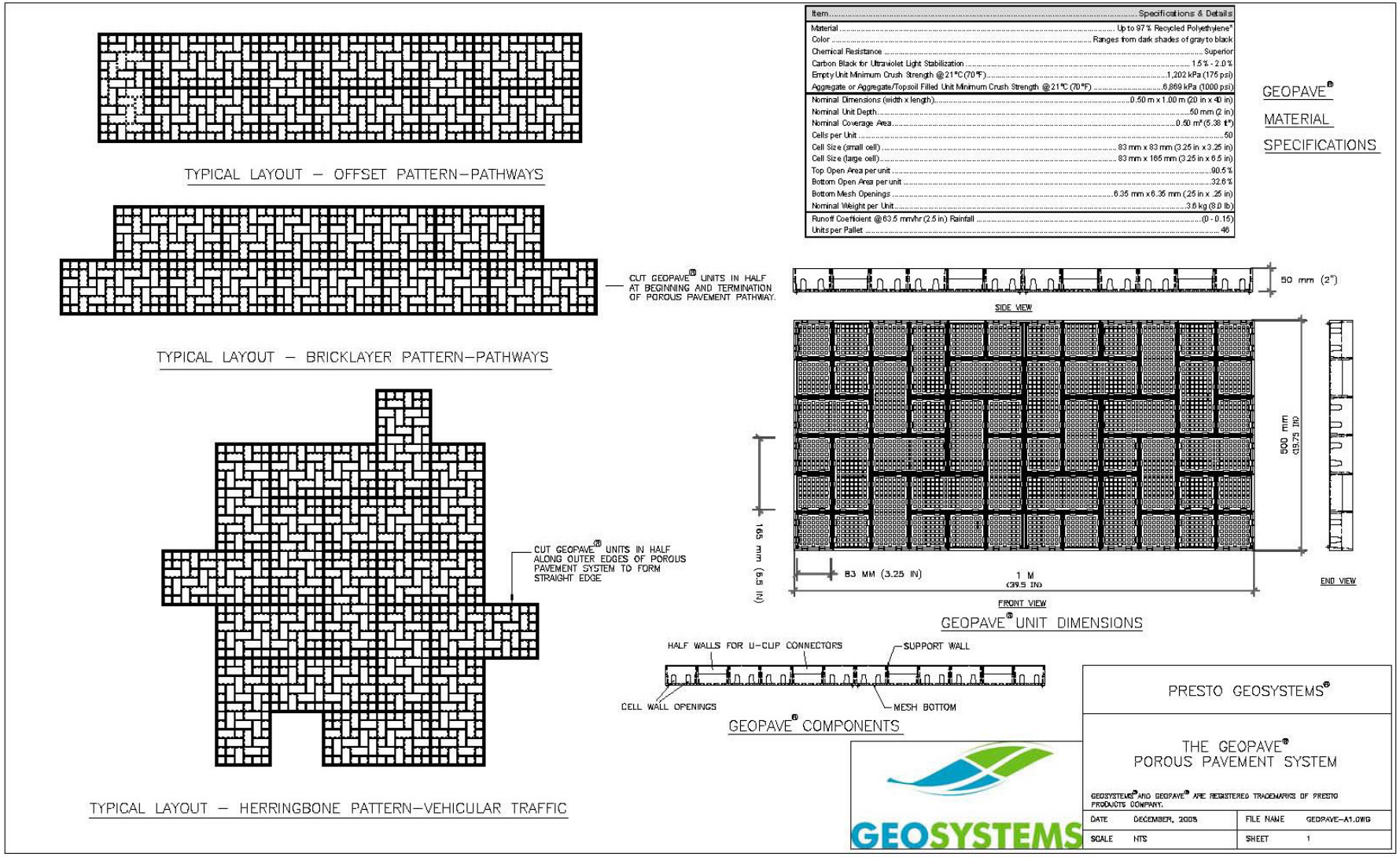


Figure 4 GeoPave System Material Specification and Layout

COPYRIGHT 2012 – PRESTO PRODUCTS CO.

Load Description	Depth of Base AGGREGATE CBR[1] 2 – 4	Depth of Base AGGREGATE CBR[1] >4	Depth of Base ENGINEERED AGGREGATE/TOPSOIL[2] CBR[1] 2 – 4	Depth of Base ENGINEERED AGGREGATE/TOPSOIL[2] CBR[1] >4
Heavy Fire Truck Access & H-20 loading. Typical 758 kPa (110 psi) maximum tire pressure. Single axle loadings of 145 kN (32 kip), tandem axle loadings of 220 kN (48 kip). Gross vehicle loads of 36.3 tonne (80,000 lb).	150 mm (6 in)	150 mm (6 in)	Not Recommended	Not Recommended
Light Fire Truck Access & H-15 loading. Typical 586 kPa (85 psi) maximum tire pressure. Single axle loadings of 110 kN (24 kip). Gross vehicle loads of 27.2 tonne (60,000 lb).	150 mm (6 in)	100 mm (4 in)	Not Recommended	Not Recommended
Utility & Delivery Truck Access & H-10 loading. Typical 414 kPa (60 psi) maximum tire pressure. Single axle loadings of 75 kN (16 kip). Gross vehicle loads of 18.1 tonne (40,000 lb).	100 mm (4 in)	50 mm (2 in)	100 mm (4 in)	50 mm (2 in)
Cars & Pick-up Truck Access. Typical 310 kPa (45 psi) maximum tire pressure. Single axle loadings of 18 kN (4 kip). Gross vehicle loads of 3.6 tonne (8,000 lb).	50 mm (2 in)	None*	50 mm (2 in)	None*
Trail Use. Loading for pedestrian, wheelchair, equestrian, bicycle, motorcycle and ATV traffic.	None*	None*	None*	None*

A minimum of 50 mm (2 in) of aggregate base should be placed below the GeoPave units as a drainage layer and an infiltration storage area. Greater depth may be required depending upon design rainfall needs and subbase permeability.

[1] CBR is the abbreviation for California Bearing Ratio. Methods for determining CBR vary from more sophisticated laboratory methods to simple field identification methods that use hand manipulation of the soil. Presto does not recommend one method over the other, however, the user must have a high degree of confidence in the results produced by the chosen method. If other-than-CBR soil strength values exist, use available correlation charts to relate the value to CBR.

[2] With the aggregate/topsoil mix and a vegetative surface, infrequent/occasional passes are recommended. Infrequent/occasional passes are defined as the number of passes over any period of time that causes no lasting damage to the vegetation. This number will be a function of vegetation type and age, climatic conditions, and maintenance practices. This number is not a function of the GeoPave material.

BASE MATERIAL:
IF NECESSARY FOR LOADING REQUIREMENTS, THE RECOMMENDED BASE SHALL BE AGGREGATE OR AN ENGINEERED AGGREGATE/TOPSOIL MIXTURE, AND SHOULD BE CONSISTENT WITH THE CHOSEN INFILL TYPE.

A MINIMUM OF 50 MM (2 IN) OF BASE MATERIAL IS GENERALLY RECOMMENDED FOR DRAINAGE, EVEN IF NOT REQUIRED BY DESIGN FOR LOAD SUPPORT. ADDITIONAL BASE DEPTH MAY BE ADDED IF REQUIRED OVER A LOW-PERMEABLE BASE OR TO FUNCTION AS A STORM WATER DETENTION/RETENTION LAYER.

RECOMMENDED AGGREGATE INFILL:
THE AGGREGATE INFILL SHALL BE A WELL-GRADED 10 MM TO 13 MM (0.375 TO 0.5 IN) CRUSHED ANGULAR STONE WITH A FINE CONTENT LESS THAN 5%.

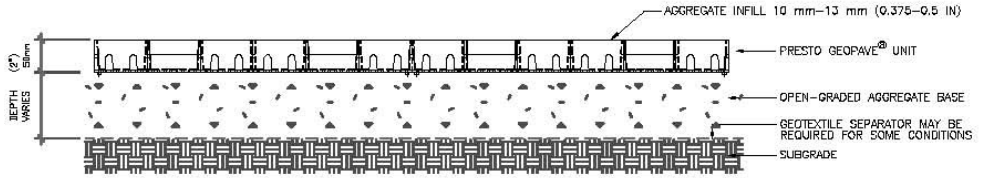
RECOMMENDED ENGINEERED BASE FOR VEGETATED SOLUTIONS:
SUPPORT SOIL SHALL CONSIST OF A HOMOGENOUS MIXTURE CONSISTING OF 1) A CLEAR-STONE/CRUSHED ROCK HAVING AN AASHTO #5 OR SIMILAR DESIGNATION BLENDED WITH 2) PULVERIZED TOPSOIL AND 3) A VOID COMPONENT GENERALLY CONTAINING AIR AND/OR WATER. THIS HOMOGENOUS MIXTURE WILL PROMOTE VEGETATIVE GROWTH AND PROVIDE REQUIRED STRUCTURAL SUPPORT. THE AGGREGATE PORTION SHALL HAVE A PARTICLE RANGE FROM 10 MM TO 25 MM (0.375 TO 1.0 IN) WITH A D_{50} OF 13 MM (0.5 IN). THE PERCENTAGE VOID-SPACE OF THE AGGREGATE PORTION WHEN COMPACTED SHALL BE AT LEAST 30%. THE PULVERIZED TOPSOIL SHALL EQUAL 25% OF THE TOTAL VOLUME AND BE ADDED AND BLENDED TO PRODUCE A HOMOGENOUS MIXTURE PRIOR TO PLACEMENT. ONCE PLACED, THE MIXTURE SHALL BE COMPACTED TO 95% STANDARD PROCTOR DENSITY.

RECOMMENDED INFILL FOR VEGETATED SOLUTIONS:
SAME AS ENGINEERED BASE BUT WITH A PARTICLE RANGE FROM 10 MM TO 13 MM (0.375 TO 0.5 IN)

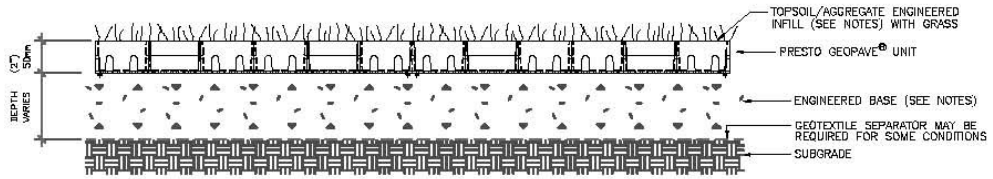
GEOPAVE® SYSTEM USAGE GUIDELINES

Item	Specifications & Details
Material	Up to 97% Recycled Polyethylene*
Color	Ranges from dark shades of gray to black
Chemical Resistance	Superior
Carbon Black for Ultraviolet Light Stabilization	1.5% - 2.0%
Empty Unit Minimum Crush Strength @ 21°C (70°F)	1,202 kPa (175 psi)
Aggregate or Aggregate/Topsoil Filled Unit Minimum Crush Strength @ 21°C (70°F)	6,869 kPa (1000 psi)
Nominal Dimensions (width x length)	0.50 m x 1.00 m (20 in x 40 in)
Nominal Unit Depth	50 mm (2 in)
Nominal Coverage Area	0.50 m² (5.38 ft²)
Cells per Unit	50
Cell Size (small cell)	83 mm x 83 mm (3.25 in x 3.25 in)
Cell Size (large cell)	83 mm x 165 mm (3.25 in x 6.5 in)
Top Open Area per unit	90.5%
Bottom Open Area per unit	32.6%
Bottom Mesh Openings	6.35 mm x 6.35 mm (.25 in x .25 in)
Nominal Weight per Unit	3.6 kg (8.0 lb)
Runoff Coefficient @ 63.5 mm/hr (2.5 in) Rainfall	(0 - 0.15)
Units per Pallet	46

GEOPAVE® MATERIAL SPECIFICATIONS



AGGREGATE SOLUTION



VEGETATED SOLUTION

GEOSYSTEMS

PRESTO GEOSYSTEMS®

THE GEOPAVE® POROUS PAVEMENT SYSTEM

GEOSYSTEMS® AND GEOPAVE® ARE REGISTERED TRADEMARKS OF PRESTO PRODUCTS COMPANY.

DATE	DECEMBER, 2005	FILE NAME	GEOPAVE-01.DWG
SCALE	NTS	SHEET	2

Figure 5 GeoPave System Usage Guideline

COPYRIGHT 2012 - PRESTO PRODUCTS COMPANY

Installing the GeoPave System

Subgrade Preparation

Excavate the area, allowing for the GeoPave unit thickness and the base material depth (where the base material is required). When working with in-situ soils that have poor permeability, provide adequate drainage from the excavated area if the area has the potential to collect water. The in-situ soil should be relatively dry and free from any standing water. Finish-grade the surface of the in-situ soil specifically when the GeoPave unit is to be installed without additional base material. Level and clear the area of large objects such as rocks, pieces of wood, etc. to enable the GeoPave units to connect properly and remain stationary after installation.

Subbase or base, when required, shall be compacted and fine graded as appropriate. Caution should be exercised to assure that porous subbases not be over compacted such that porosity is hindered.

Optional Geosynthetic Separation Layer

If required and/or specified by the project engineer, the geosynthetic layer shall be rolled out over the prepared subgrade along the alignment of the reinforced surface. The geosynthetic shall be pulled taut to ensure that there are no folds. Geosynthetic layer overlaps, if required, shall be according to plans and manufacturer's recommendations.

Optional Sub-Drainage Component

If required and/or specified by the project engineer, install the specified sub-drain and outlet according to construction drawings. Ensure that a proper slope is maintained throughout the drainage system and that the outlet is free from any obstructions preventing free drainage.

Base Preparation

If required, the specified base material is spread over the prepared base, compacted to 95% Standard Proctor Density and fine graded as appropriate. Caution should be exercised to assure that porous subbases not be over compacted such that porosity is hindered. Refer to **Table 2 Base Recommendations for the GeoPave Porous Pavement System** for base depth recommendations.

GeoPave Unit Installation

Orientation & Laying Pattern of Units

Place the GeoPave units with the mesh bottom to the ground.

When the application is a narrow pedestrian access lane, stagger the units to produce the bricklayer or the offset pattern.

When the application is a large area, stagger the units to produce the herringbone pattern. This pattern reduces straight seams to one and a half block lengths and allows for better disguise of the unit seams.

The staggered pattern is developed by using half GeoPave units made by field cutting a full unit and placing the units as illustrated. Cut the units with a hand or power saw to custom fit both contours and/or around obstructions. These final seam patterns assure maximum load transfer and support and improved aesthetics.

Other laying patterns are generally not recommended.

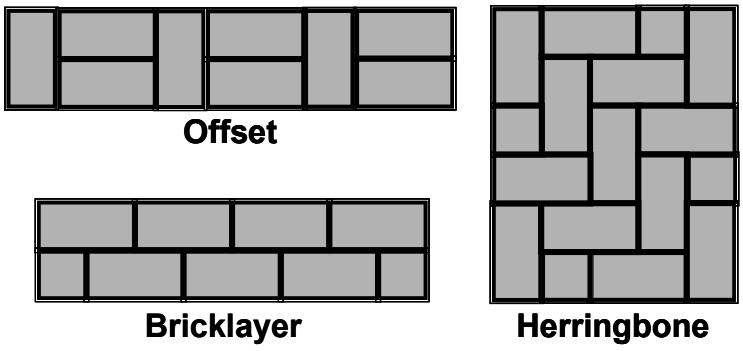


Figure 6 Laying Patterns

COPYRIGHT 2012– PRESTO PRODUCTS CO.

Positioning of Units

If required, ensure that all adjacent hard-surfaced paving work is completed before installing the GeoPave porous pavement system.

Place the first row of GeoPave units against a stationary edge when available. Units should be placed such that corners and seams do not protrude above the desired surface elevation. Abut adjoining units to form the desired laying pattern.

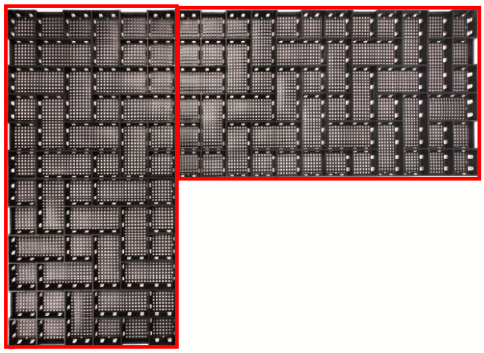


Figure 7 Joining GeoPave Units

Secure adjoining GeoPave units together using the U-CLIP connection device. U-CLIPS shall be set in place by hammer in the half-wall locations. There are four locations on each long side and two locations on each short side. They shall be driven completely so that adjacent sections have horizontally level profiles. Caution should be exercised to assure that no material is trapped between adjacent sections prior to the placement of U-CLIPS.

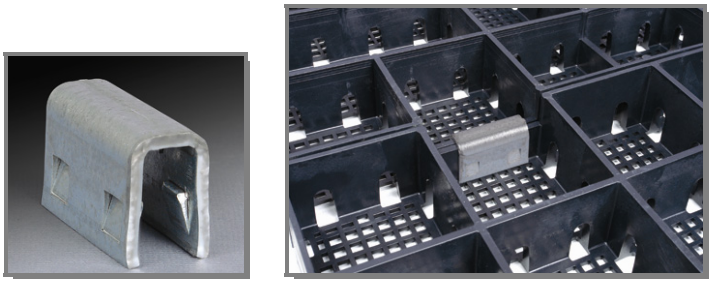


Figure 8 The U-Clip Connection Device

Optional Anchoring of Units

The GeoPave units can be fixed in-place with 0.5 in (13 mm) #4 rebar to prevent movement of the units. Anchoring may be necessary if the GeoPave units are placed on a slope (5-10%).

The anchors can be driven through the cell-wall vent holes either in the middle of the GeoPave units or along the perimeter as required.

Anchoring of units in-place should occur after installation of all the units within the defined area.

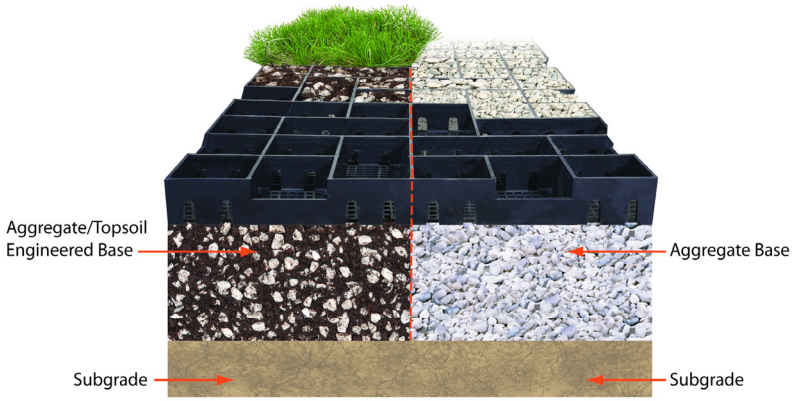


Figure 9 Optional Stake Anchoring

COPYRIGHT 2012 – PRESTO PRODUCTS CO.

Infilling the GeoPave Unit

Infill the GeoPave units with the specified material for the intended application. Infilling should take place immediately after the units are installed to minimize movement of the units.

Infill shall be placed with each successive pile of aggregate or aggregate/topsoil mixture to be placed at the edge of previously filled GeoPave units and spread with a skidsteer, small tractor or small loader. Spread the infill material uniformly over the units. Hand ranking will be performed to assure that the final aggregate fill is just over the elevation of the top walls.

For aggregate surfaces, approximately 0.5 in (13 mm) overfill should be maintained over the top of the GeoPave cell walls. Follow procedures for applying seed or sod. No specific compaction will be required, but traffic will allow for the slight settlement of the infill material under ordinary use.

Upward buckling of the GeoPave area is generally not an issue if the units have been installed using the recommended laying patterns and infilled appropriately.

Seed or Sod for Vegetated Systems

Once the aggregate/topsoil engineered mixture is evenly spread in the GeoPave units, either grass seed or sod may be applied. If using sod, the GeoPave units should be underfilled by 1.0 inch (25 mm) to allow room to seat or press the sod within the GeoPave units.

Follow good seeding, fertilizing, and water procedures for turf establishing based on regional practices.

Delineation for Vegetated Systems

With vegetated systems, once healthy turf has been established, the GeoPave structure will have minimal visibility when good turf maintenance practices are followed. Delineation may be desirable to create visibility for access lanes. Delineation methods include in-ground curbing, above-ground curbing, shrubbery or vegetation, perimeter lighting or delineation markers

Maintenance

Aggregate Surface Wear Course

When the pavement surface is aggregate, the surface should be inspected from time to time to identify signs of slight cell infill loss. If cell infill loss occurs, additional infill material should be added.

Vegetated Surface

When the pavement surface is vegetation, lawn care should follow normal watering, fertilizing and mowing procedures. Vegetated surfaces are intended for infrequent or occasional traffic with a maximum H-10 loading. The pavement should be monitored to ensure traffic frequency and loading does not exceed the pavement design.

Snow Removal

If required, snow removal should be done using one of the following basic procedures:

- Keep a metal edged plow blade a minimum of 1.0 in (25 mm) above the surface during plowing operations, or
- Use a plow blade with a flexible rubber edge, or
- Use a plow blade with skids on the lower outside corners so that the plow blade does not come in direct contact with the porous pavement system.

When deeper ground freeze occurs, the system functions as a typical hard pavement surface. If a sharp metal plow-blade comes in direct contact with the surface during plowing, any portion of the GeoPave system that protrudes above the normal surface level could be damaged or removed by the blade.

COPYRIGHT 2012– PRESTO PRODUCTS CO.

Estimating Time and Cost of Installation

Typical Crew Size and Responsibilities

2 Crew to set the GeoPave units in place.

2 Crew to spread and level the specified infill.

1 Equipment operator for the front-end loader.

NOTE: Adding or subtracting one or two people to the crew may result in a cost-effective productivity increase depending on local work efficiencies.

Equipment Needed and Purpose

- Saws, U-clips (may be purchased from Presto's distributors/representatives) and anchors (if required) – all or some of these are used for cutting and securing the GeoPave units as required per the plans or as needed during construction.
- A small tractor/backhoe or loader for infilling of the GeoPave units.
- Rakes and shovels for final leveling of the infill material.

Typical Construction Sequences and Times

Productivity is a variable and the ranges below are typical. Select an installation rate through personal experience or after discussion of project details with Presto or one of its qualified distributors.

1.	Place the GeoPave units on the prepared base and install connecting U-clips.	60-75 units/man-hr
2.	Fill the in-place GeoPave units using the small loader or backhoe to evenly distribute the specified infill.	100 - 120 units/man-hr
3.	Level the infill using rakes and shovels. If aggregate, overfill the top of the cell walls 0.5 in (13 mm). If aggregate/topsoil mixture, rake flush with the top of the cell walls.	75 - 100 units/man-hr

NOTE: The above three sequences can be in progress at the same time if workspace is adequate.

Table 3 Approximate Quantities of Infill Material Required for GeoPave Unit

Depth of unit	Volume of Aggregate Required per unit	Volume of Aggregate Required per 1000 ft² (100 m²)
2 in (50 mm)	0.0293 yd³ (0.0224 m³)	5.447 yd³ (4.48 m³)

General Notes

1. The tractor/backhoe loader must be sized so it can distribute the fill material per time/productivity requirements.
2. Experience shows that the above installation rates would be considered typical rates of installation.
3. As is with all construction operations, placement of material stockpiles, crew productivity, jobsite conditions, special installation requirements such as cutting and custom fitting of the GeoPave units, etc. significantly affect overall productivity, therefore actual results may be different than the estimates above.

COPYRIGHT 2012 – PRESTO PRODUCTS CO.

Total Time and Materials Required

Area of installation = length x width of site

(_____) ft (m) long x (_____) ft (m) wide = (_____)ft² (m²) Area

GeoPave units required = ft² (m²) (Area ÷ 5.38 ft² (0.50 m²)/unit
[the GeoPave unit is 20 in x 40 in (0.50 m x 1.00 m) nominal]

(_____) ft² (m²) Area ÷ 5.38 ft² (0.50 m²)/unit = (_____) units

Man-hr required for installation of GeoPave units = GeoPave units ÷ 75 units/man-hr

(_____) units ÷ 75 units/man-hr = (_____) man-hr

Infill material quantities = GeoPave units x yd³ (m³)/unit (see Table 3)

(_____) units x (_____) yd³ (m³)/unit = (_____) yd³ (m³)

Man-hr required for placing infill = GeoPave units ÷ 120 units/man-hr

(_____) units ÷ 120 units/man-hr = (_____) man-hr

Man-hr required for leveling of infill = GeoPave units ÷ 100 units/man-hr

(_____) units ÷ 100 units/man-hr = (_____) man-hr

Man-hr required for placing base material = GeoPave units ÷ 100 units/man-hr

(_____) units ÷ 100 units/man-hr = (_____) man-hr

Total Cost of Time and Materials

GeoPave unit cost	$_____/unit	x	_____units	=	$ _____
Cost of Infill	$_____/yd³ (m³)	x	_____yd³ (m³)	=	$ _____
Cost of Labor	$_____/man-hr	x	_____man-hr	=	$ _____
Cost of Equip. Operator	$_____/man-hr	x	_____man-hr	=	$ _____
Cost of Front-end Loader	$_____/hr	x	_____hr	=	$ _____

APPROXIMATE TOTAL COST $ _____

COPYRIGHT 2012– PRESTO PRODUCTS CO.

Limited Warranty

Presto Geosystems warrants each GeoPave unit which it ships to be free from defects in materials and workmanship at the time of manufacture. Presto's exclusive liability under this warranty or otherwise will be to furnish without charge to Presto's customer at the original f.o.b. point a replacement for any unit which proves to be defective under normal use and service during the **10-year period** which begins on the date of shipment by Presto. Presto reserves the right to inspect any allegedly defective unit in order to verify the defect and ascertain its cause.

This warranty does not cover defects attributable to causes or occurrences beyond Presto's control and unrelated to the manufacturing process, including, but not limited to, abuse, misuse, mishandling, neglect, improper storage, improper installation or improper application. Presto makes no other warranties, express or implied, written or oral, including, but not limited to, any warranties or merchantability or fitness for any particular purpose, in connection with the GeoPave™ system. In no event shall Presto be liable for any special, indirect, incidental or consequential damages for the breach of any express or implied warranty or for any other reason, including negligence, in connection with the GeoPave system. Contact Presto Products Company, Ph: 800-548-3424; 920-738-1328 or Email: info@prestogeo.com.

Disclaimer

This document has been prepared for the benefit of customers interested in the GeoPave Porous Pavement System. It was reviewed carefully prior to publication. Presto assumes no liability and makes no guarantee or warranty as to its accuracy or completeness. Final determination of the suitability of any information or material for the use contemplated, or for its manner of use, is the sole responsibility of the user.

Project specifications take precedence over all manufacturers' recommendations.

Geosystems® and GeoPave® are registered trademarks of Presto Products Company. The GeoPave system is patent pending.

COPYRIGHT 2012 – PRESTO PRODUCTS CO.

APPENDIX H – TR-55 ANALYSIS

(HYDRAFLOW HYDROGRAPHS)

Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	51.6066	12.5000	0.8820	--------
2	39792.2695	54.5997	2.1989	--------
3	0.0000	0.0000	0.0000	--------
5	62.7644	12.5000	0.8265	--------
10	62.8554	12.1000	0.7945	--------
25	58.5133	11.1000	0.7423	--------
50	54.0916	10.2000	0.6990	--------
100	50.0174	9.3000	0.6584	--------

File name: NOAA_BALTIMORE_WSO.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	4.13	3.31	2.77	2.39	2.11	1.89	1.71	1.57	1.45	1.35	1.26	1.18
2	4.97	4.16	3.53	3.03	2.63	2.30	2.03	1.80	1.61	1.44	1.30	1.18
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	5.89	4.79	4.06	3.53	3.14	2.83	2.58	2.38	2.20	2.06	1.93	1.82
10	6.59	5.37	4.57	3.99	3.56	3.22	2.95	2.72	2.53	2.36	2.22	2.10
25	7.44	6.09	5.20	4.56	4.08	3.71	3.41	3.16	2.94	2.76	2.61	2.47
50	8.07	6.62	5.67	5.00	4.49	4.09	3.77	3.50	3.28	3.08	2.92	2.77
100	8.68	7.12	6.12	5.41	4.88	4.46	4.12	3.84	3.60	3.40	3.23	3.07

Tc = time in minutes. Values may exceed 60.

Precip. file name: K:\LMC - Mital\112IC02948-08 Block G Swale Design\Data\Hydraflow\MDSWMBaltimore.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.60	3.20	0.00	0.00	5.10	0.00	0.00	7.10
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Watershed Model Schematic

1



Sub-Drainage Area 1.1
Post-Development
1-year and 10-year (for swale design checks)

TR55 Tc Worksheet

Hyd. No. 1

DA-1.1 Post-Dev

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.240		0.011		
Flow length (ft)	= 20.0		30.0		0.0		
Two-year 24-hr precip. (in)	= 3.20		3.20		0.00		
Land slope (%)	= 1.00		3.30		0.00		
Travel Time (min)	**= 0.44**	**+**	**4.46**	**+**	**0.00**	**=**	**4.90**
Shallow Concentrated Flow							
Flow length (ft)	= 300.00		0.00		0.00		
Watercourse slope (%)	= 0.90		0.00		0.00		
Surface description	= Unpaved		Unpaved		Unpaved		
Average velocity (ft/s)	=1.53		0.00		0.00		
Travel Time (min)	**= 3.27**	**+**	**0.00**	**+**	**0.00**	**=**	**3.27**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.000		0.000		0.000		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 8.20 min

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)							Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	0.674	-------	-------	-------	1.889	-------	-------	-------	DA-1.1 Post-Dev

Hydrograph Report

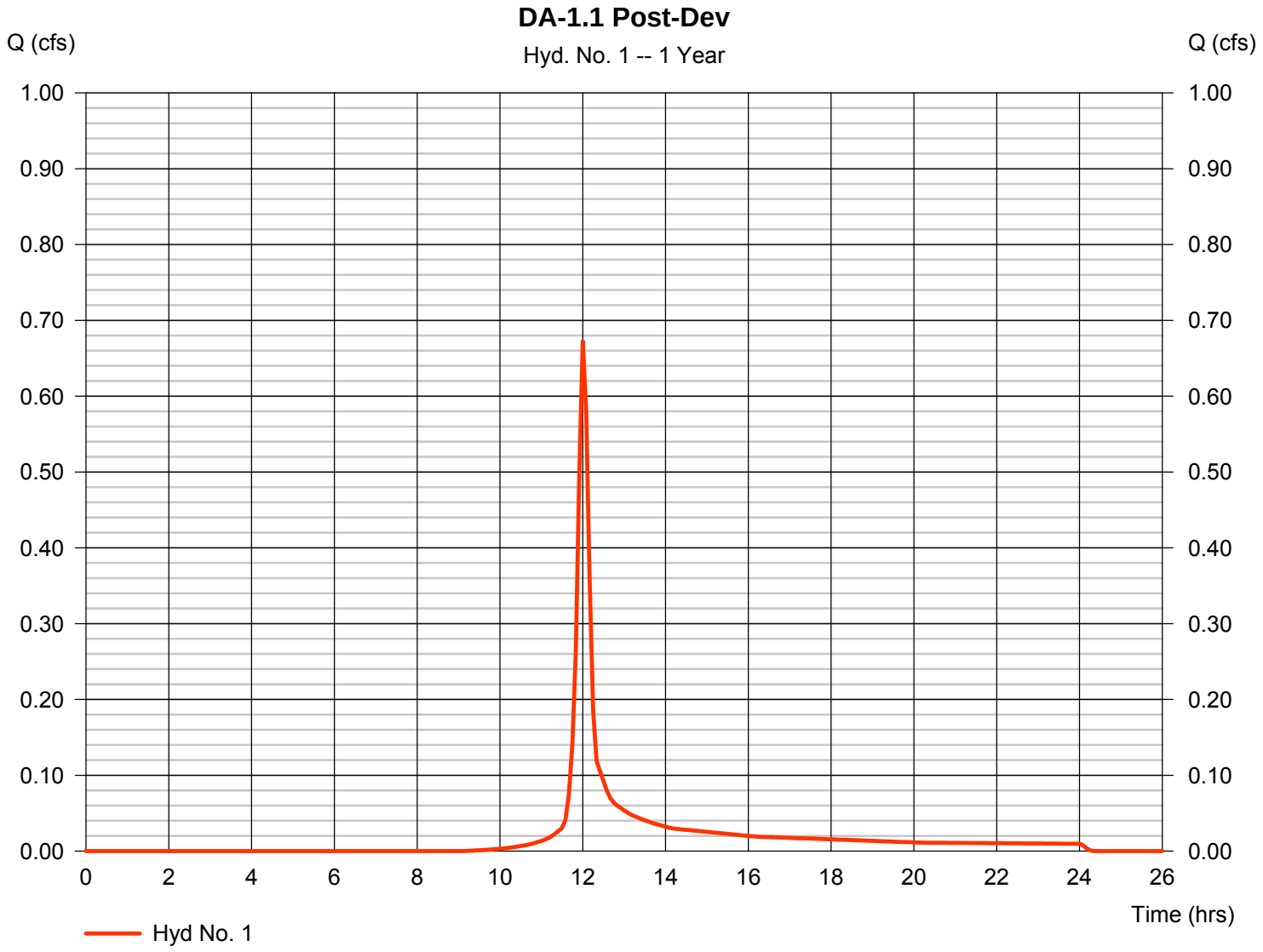
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Tuesday, Jun 17, 2014

Hyd. No. 1

DA-1.1 Post-Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 0.674 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.00 hrs
Time interval	= 5 min	Hyd. volume	= 1,829 cuft
Drainage area	= 0.450 ac	Curve number	= 84*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.20 min
Total precip.	= 2.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.160 x 98) + (0.110 x 74) + (0.150 x 70)] / 0.450



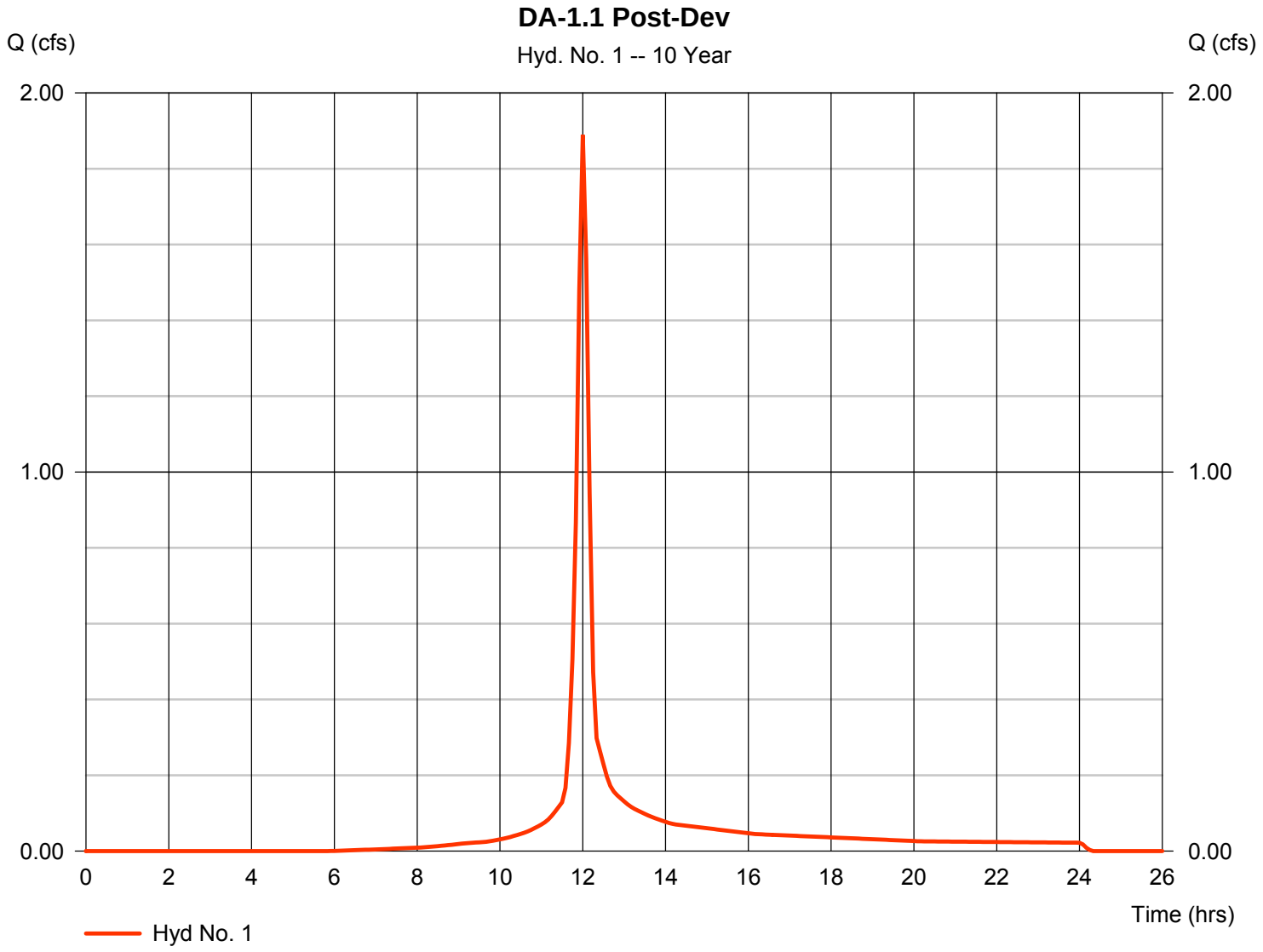
Hydrograph Report

Hyd. No. 1

DA-1.1 Post-Dev

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.889 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.00 hrs
Time interval	=	5 min	Hyd. volume	=	5,149 cuft
Drainage area	=	0.450 ac	Curve number	=	84*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	5.10 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.160 x 98) + (0.110 x 74) + (0.150 x 70)] / 0.450



Watershed Model Schematic



Sub-Drainage Area 1.2
Post-Development
1-year and 10-year (for swale design checks)

TR55 Tc Worksheet

Hyd. No. 1

DA-1.2 Post-Dev

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.240		0.011		
Flow length (ft)	= 17.0		14.0		0.0		
Two-year 24-hr precip. (in)	= 3.20		3.20		0.00		
Land slope (%)	= 1.20		10.70		0.00		
Travel Time (min)	**= 0.36**	**+**	**1.51**	**+**	**0.00**	**=**	**1.87**
Shallow Concentrated Flow							
Flow length (ft)	= 60.00		0.00		0.00		
Watercourse slope (%)	= 3.80		0.00		0.00		
Surface description	= Unpaved		Unpaved		Unpaved		
Average velocity (ft/s)	=3.15		0.00		0.00		
Travel Time (min)	**= 0.32**	**+**	**0.00**	**+**	**0.00**	**=**	**0.32**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 2.20 min

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)							Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	0.356	-------	-------	-------	1.011	-------	-------	-------	DA-1.2 Post-Dev

Hydrograph Report

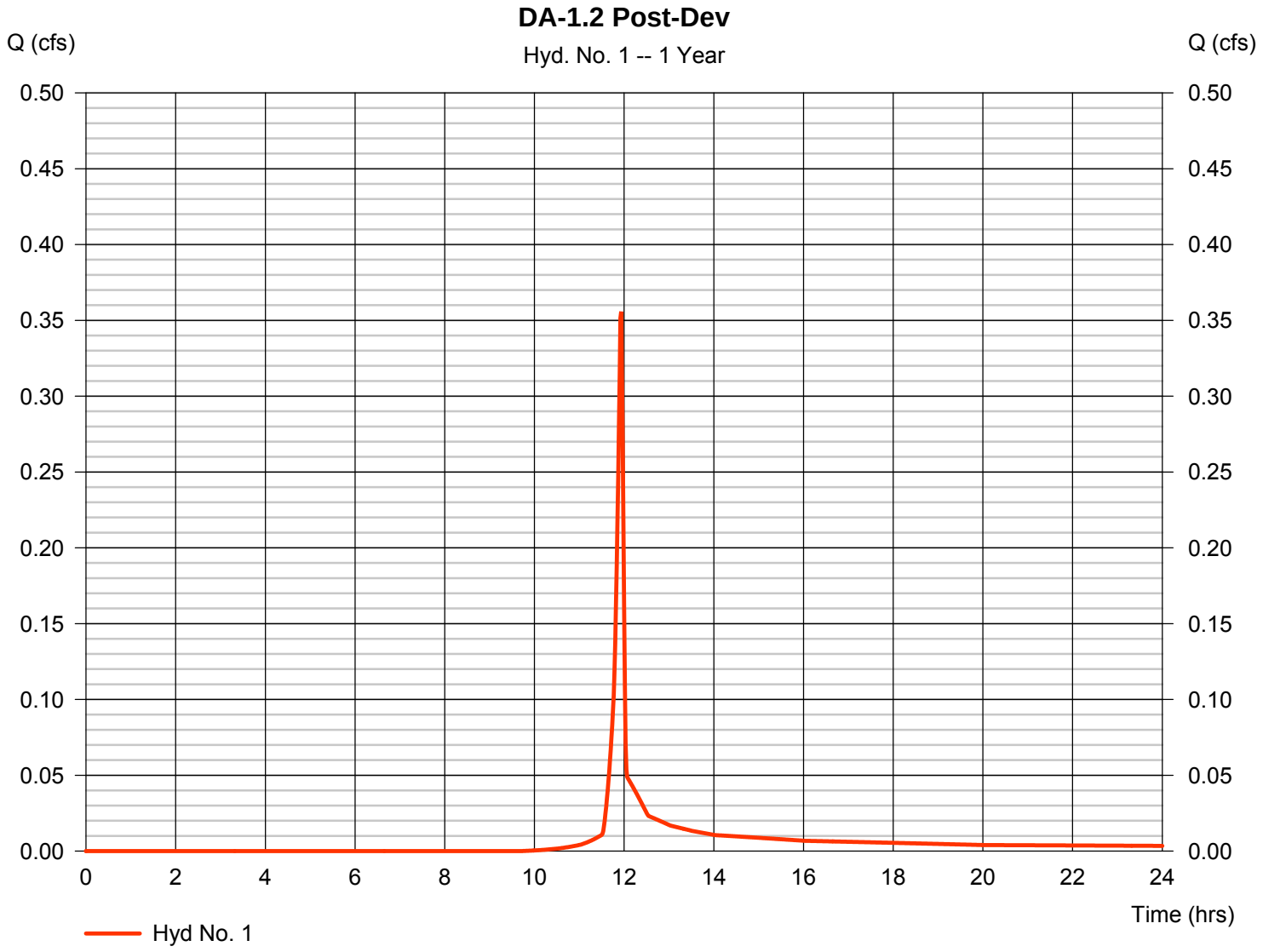
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Wednesday, Jun 18, 2014

Hyd. No. 1

DA-1.2 Post-Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 0.356 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.93 hrs
Time interval	= 1 min	Hyd. volume	= 620 cuft
Drainage area	= 0.170 ac	Curve number	= 82*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 2.20 min
Total precip.	= 2.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.160 x 98) + (0.110 x 74) + (0.150 x 70)] / 0.170



Hydrograph Report

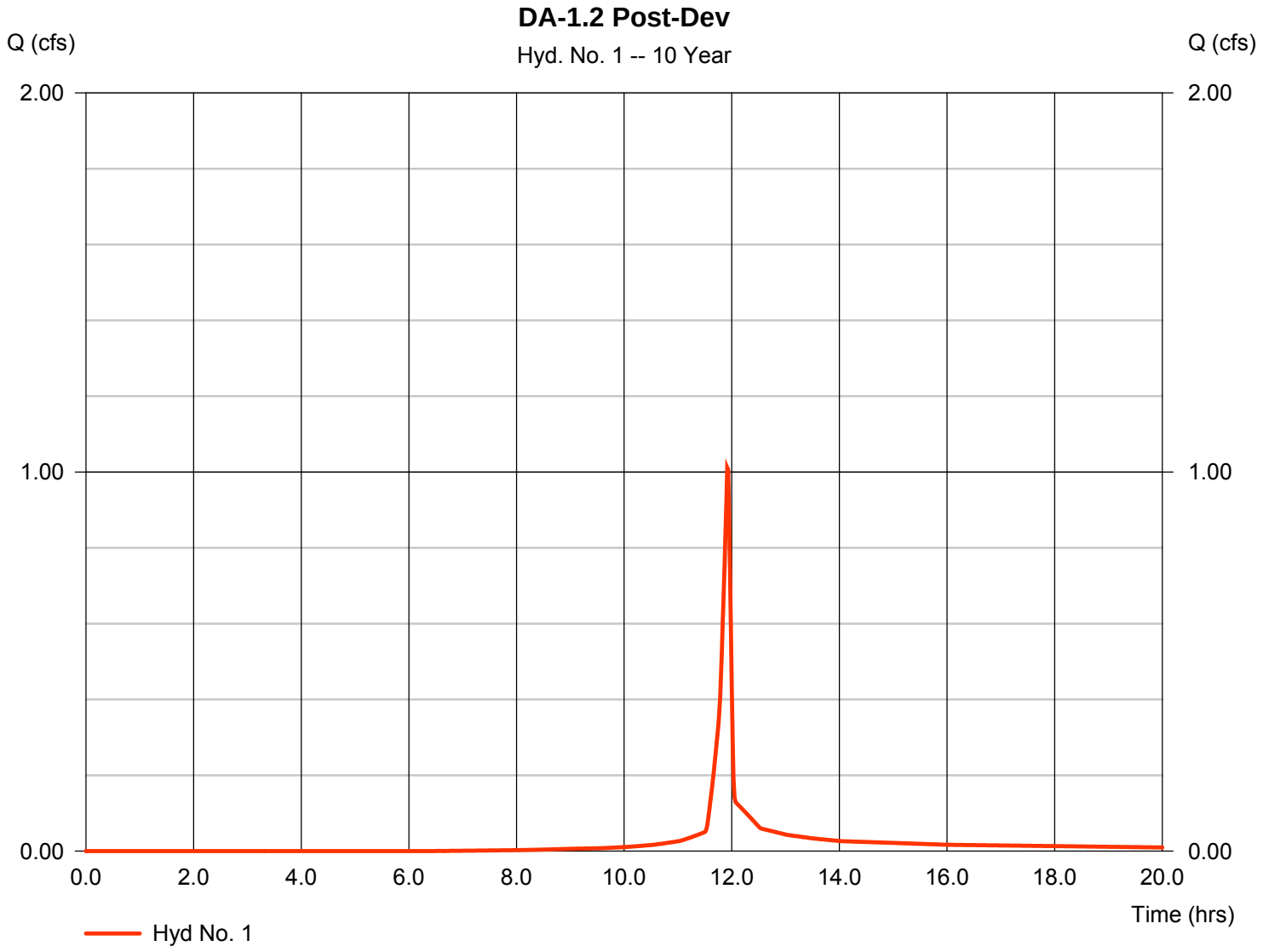
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Wednesday, Jun 18, 2014

Hyd. No. 1

DA-1.2 Post-Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 1.011 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.92 hrs
Time interval	= 1 min	Hyd. volume	= 1,833 cuft
Drainage area	= 0.170 ac	Curve number	= 82*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 2.20 min
Total precip.	= 5.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.160 x 98) + (0.110 x 74) + (0.150 x 70)] / 0.170



Watershed Model Schematic

1



Sub-Drainage Area 1.3
Post-Development
1-year and 10-year (for swale design checks)

TR55 Tc Worksheet

Hyd. No. 1

DA-1.3, Post-Dev

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.240		0.011		
Flow length (ft)	= 20.0		20.0		0.0		
Two-year 24-hr precip. (in)	= 3.20		3.20		0.00		
Land slope (%)	= 1.50		5.00		0.00		
Travel Time (min)	**= 0.38**	**+**	**2.73**	**+**	**0.00**	**=**	**3.10**
Shallow Concentrated Flow							
Flow length (ft)	= 300.00		0.00		0.00		
Watercourse slope (%)	= 0.80		0.00		0.00		
Surface description	= Unpaved		Unpaved		Unpaved		
Average velocity (ft/s)	=1.44		0.00		0.00		
Travel Time (min)	**= 3.46**	**+**	**0.00**	**+**	**0.00**	**=**	**3.46**
Channel Flow							
X sectional flow area (sqft)	= 4.75		0.00		0.00		
Wetted perimeter (ft)	= 11.16		0.00		0.00		
Channel slope (%)	= 0.80		0.00		0.00		
Manning's n-value	= 0.240		0.015		0.015		
Velocity (ft/s)	=0.31						
			0.00				
					0.00		
Flow length (ft)	({0})500.0		0.0		0.0		
Travel Time (min)	**= 26.60**	**+**	**0.00**	**+**	**0.00**	**=**	**26.60**

Total Travel Time, Tc ..... 33.20 min

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)							Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	1.074	-------	-------	-------	3.479	-------	-------	-------	DA-1.3, Post-Dev

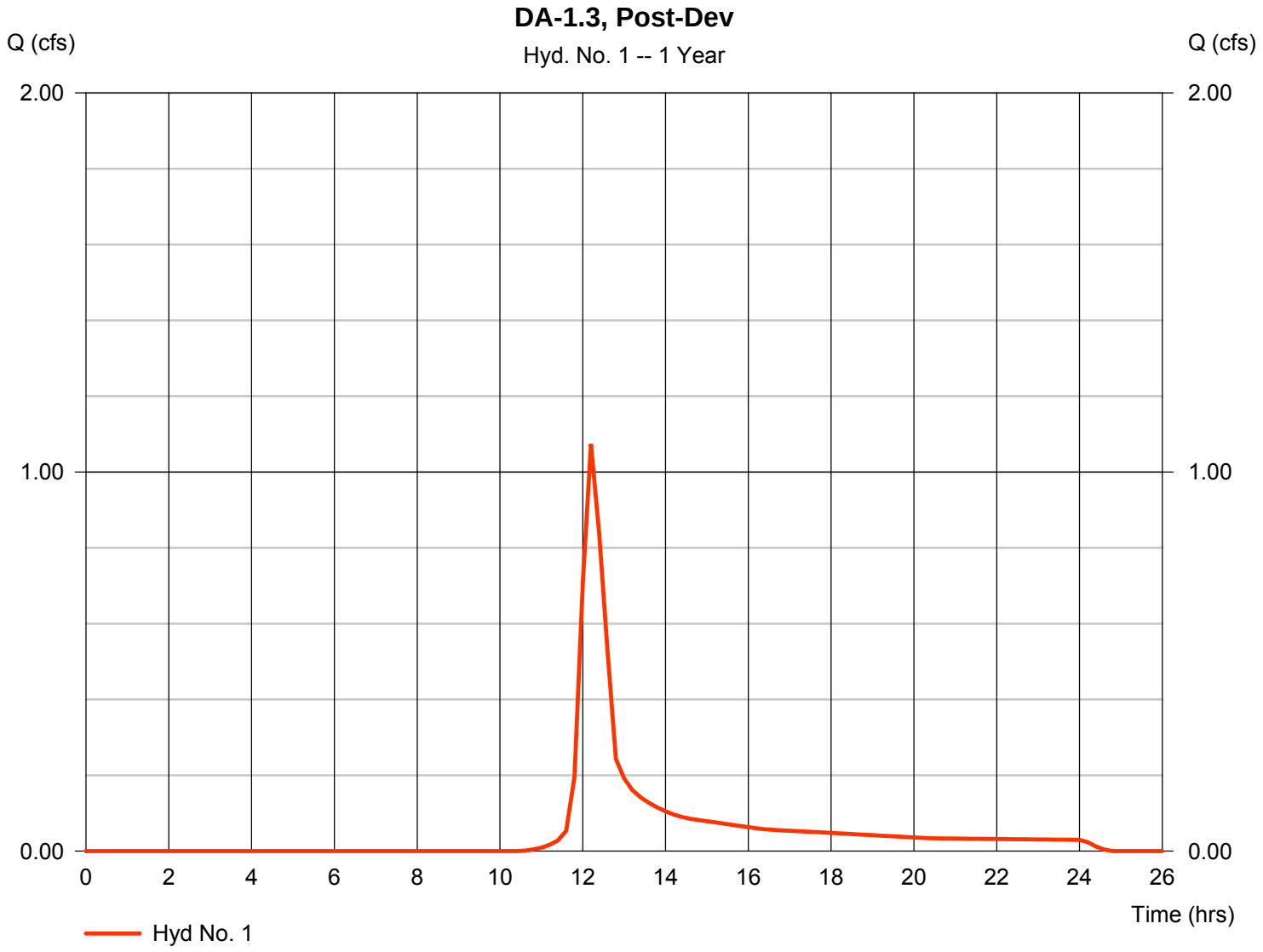
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Thursday, Jun 19, 2014

Hyd. No. 1

DA-1.3, Post-Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 1.074 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.20 hrs
Time interval	= 12 min	Hyd. volume	= 4,992 cuft
Drainage area	= 1.530 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 33.20 min
Total precip.	= 2.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



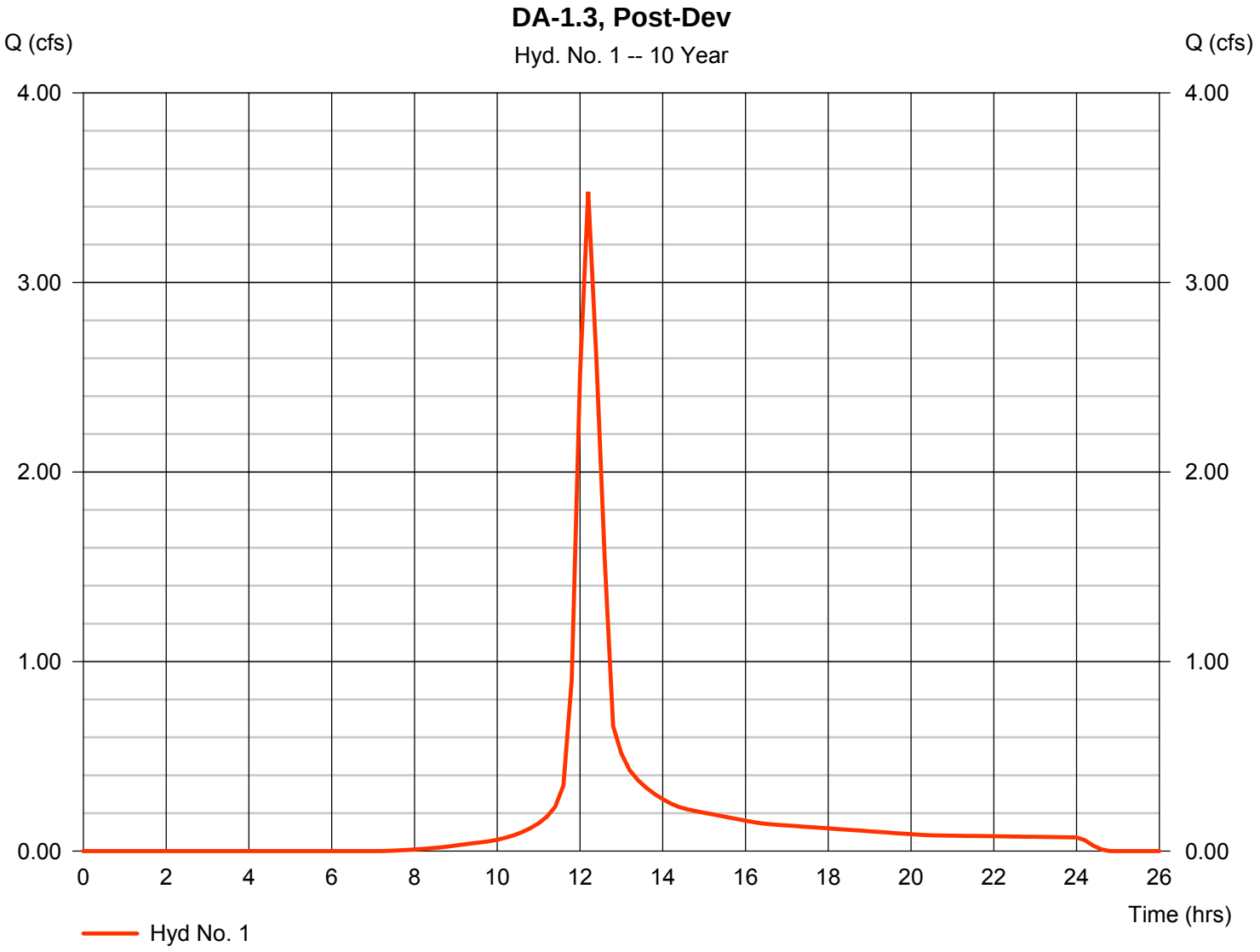
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Thursday, Jun 19, 2014

Hyd. No. 1

DA-1.3, Post-Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 3.479 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.20 hrs
Time interval	= 12 min	Hyd. volume	= 15,518 cuft
Drainage area	= 1.530 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 33.20 min
Total precip.	= 5.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Watershed Model Schematic



Sub-Drainage Area 1.4
Post-Development
1-year and 10-year (for swale design checks)

TR55 Tc Worksheet

Hyd. No. 1

DA-1.4, Proposed

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.240		0.011		
Flow length (ft)	= 36.0		40.0		0.0		
Two-year 24-hr precip. (in)	= 3.20		3.20		0.00		
Land slope (%)	= 3.90		5.00		0.00		
Travel Time (min)	**= 0.41**	**+**	**4.75**	**+**	**0.00**	**=**	**5.16**
Shallow Concentrated Flow							
Flow length (ft)	= 55.00		0.00		0.00		
Watercourse slope (%)	= 2.70		0.00		0.00		
Surface description	= Unpaved		Unpaved		Unpaved		
Average velocity (ft/s)	=2.65		0.00		0.00		
Travel Time (min)	**= 0.35**	**+**	**0.00**	**+**	**0.00**	**=**	**0.35**
Channel Flow							
X sectional flow area (sqft)	= 4.75		0.00		0.00		
Wetted perimeter (ft)	= 11.16		0.00		0.00		
Channel slope (%)	= 1.00		0.00		0.00		
Manning's n-value	= 0.240		0.015		0.015		
Velocity (ft/s)	=0.35						
			0.00				
					0.00		
Flow length (ft)	({0})200.0		0.0		0.0		
Travel Time (min)	**= 9.52**	**+**	**0.00**	**+**	**0.00**	**=**	**9.52**

Total Travel Time, Tc ..... 15.00 min

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)							Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	0.593	-------	-------	-------	1.818	-------	-------	-------	DA-1.4, Proposed

Hydrograph Report

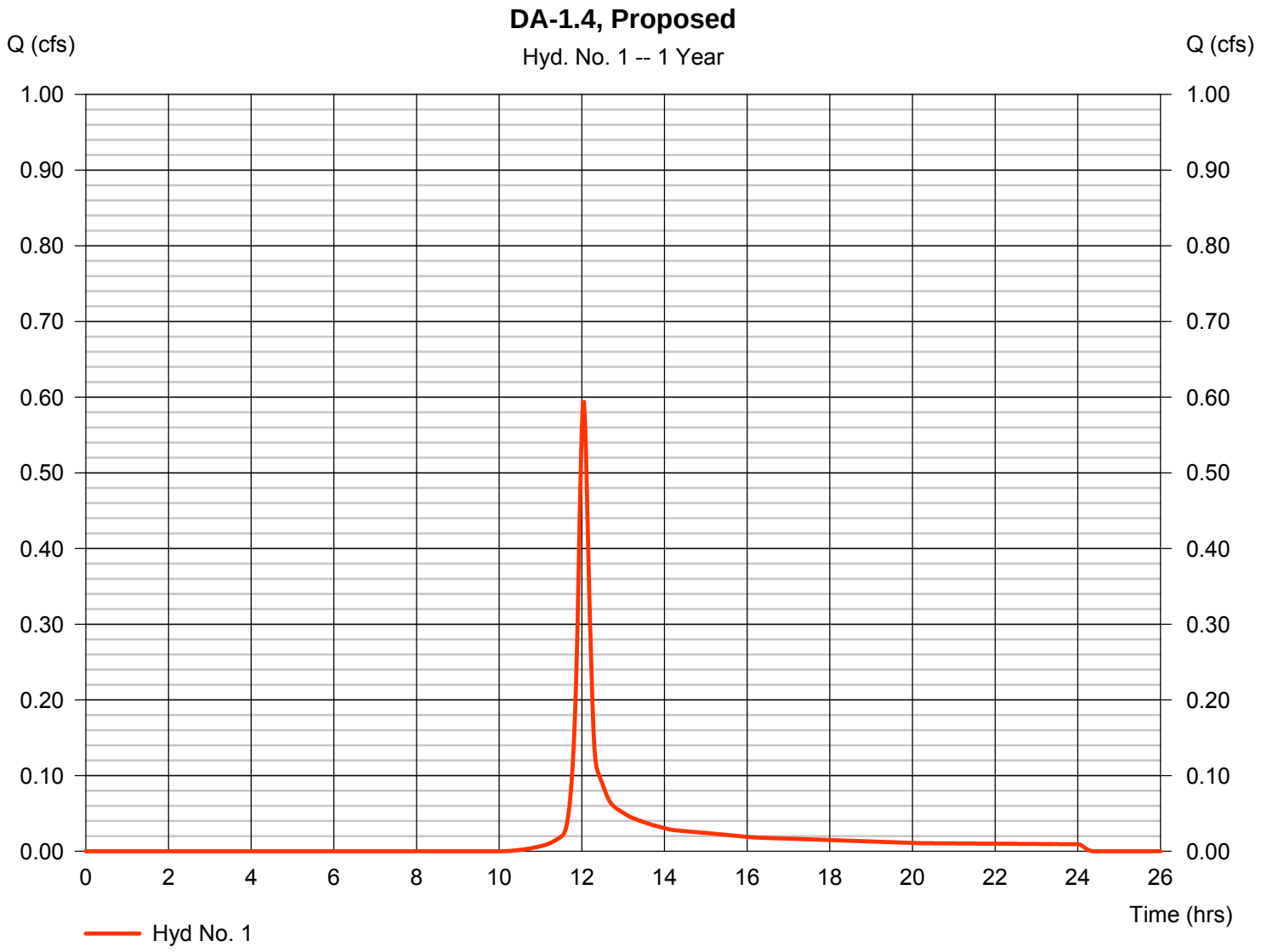
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Thursday, Jun 19, 2014

Hyd. No. 1

DA-1.4, Proposed

Hydrograph type	= SCS Runoff	Peak discharge	= 0.593 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.05 hrs
Time interval	= 1 min	Hyd. volume	= 1,620 cuft
Drainage area	= 0.440 ac	Curve number	= 81*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 15.00 min
Total precip.	= 2.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.140 x 98) + (0.090 x 74) + (0.170 x 70)] / 0.440



Hydrograph Report

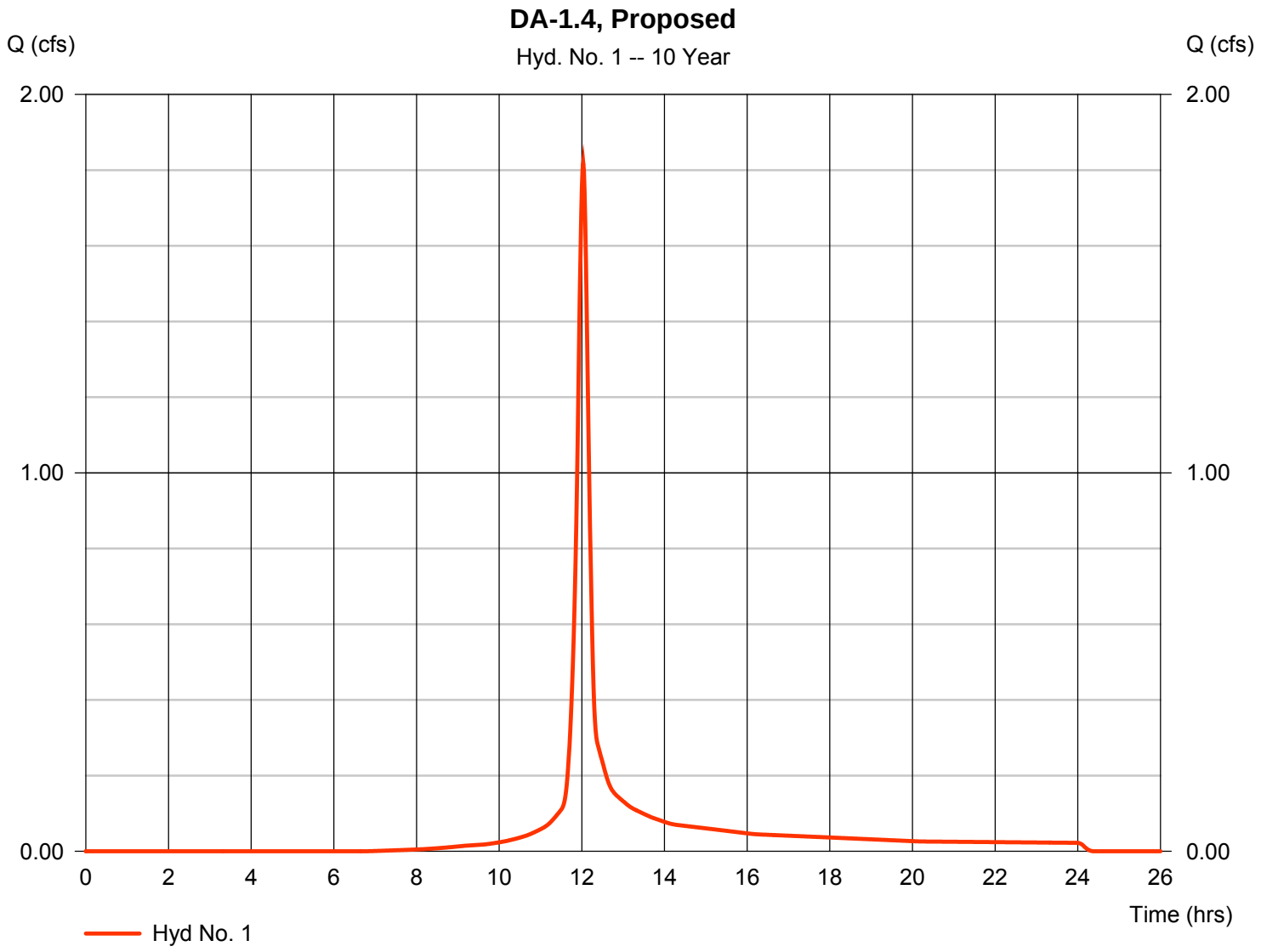
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Thursday, Jun 19, 2014

Hyd. No. 1

DA-1.4, Proposed

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.818 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.03 hrs
Time interval	=	1 min	Hyd. volume	=	4,910 cuft
Drainage area	=	0.440 ac	Curve number	=	81*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	15.00 min
Total precip.	=	5.10 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.140 x 98) + (0.090 x 74) + (0.170 x 70)] / 0.440



Watershed Model Schematic

Lynbrook Road Culvert
Pre/Post-Development (no major changes in drainage)
10-year only



TR55 Tc Worksheet

Hyd. No. 1

DA to Main Culvert,Existing

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.20		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 18.83**	**+**	**0.00**	**+**	**0.00**	**=**	**18.83**
Shallow Concentrated Flow							
Flow length (ft)	= 1040.00		0.00		0.00		
Watercourse slope (%)	= 0.30		0.00		0.00		
Surface description	= Unpaved		Unpaved		Unpaved		
Average velocity (ft/s)	=0.88		0.00		0.00		
Travel Time (min)	**= 19.61**	**+**	**0.00**	**+**	**0.00**	**=**	**19.61**
Channel Flow							
X sectional flow area (sqft)	= 7.07		37.50		0.00		
Wetted perimeter (ft)	= 9.43		25.00		0.00		
Channel slope (%)	= 0.30		1.90		0.00		
Manning's n-value	= 0.013		0.100		0.015		
Velocity (ft/s)	=5.18						
			2.69				
					0.00		
Flow length (ft)	({0})870.0		125.0		0.0		
Travel Time (min)	**= 2.80**	**+**	**0.77**	**+**	**0.00**	**=**	**3.57**

Total Travel Time, Tc ..... 42.00 min

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)							Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	34.56	52.22	-------	-------	114.27	-------	-------	183.50	DA to Main Culvert,Existing

Hydrograph Report

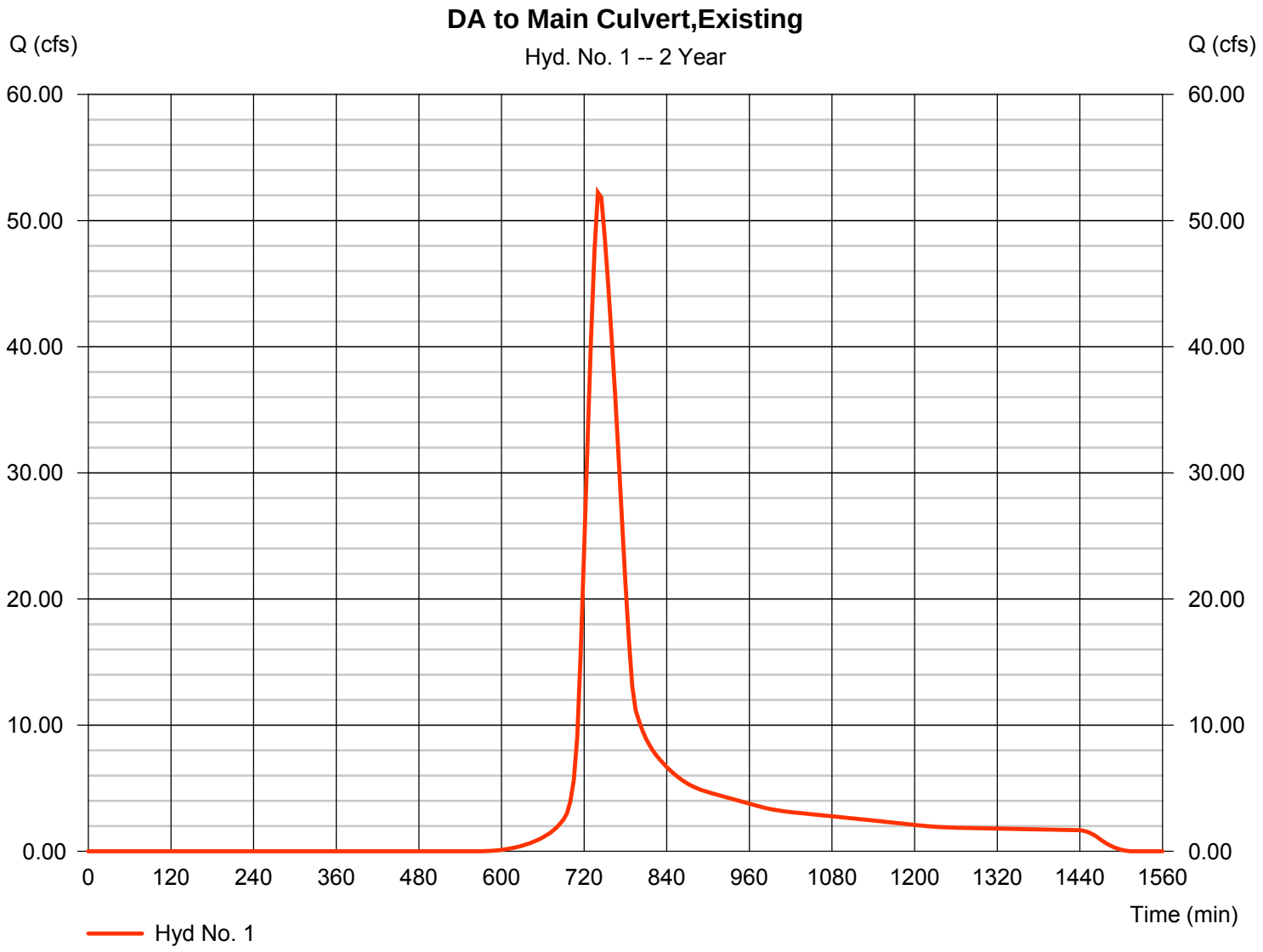
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Wednesday, Oct 2, 2013

Hyd. No. 1

DA to Main Culvert,Existing

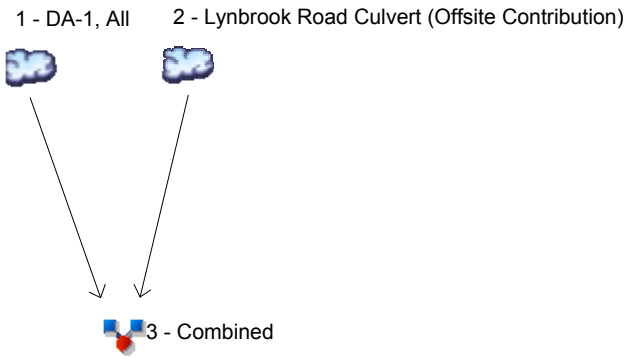
Hydrograph type	= SCS Runoff	Peak discharge	= 52.22 cfs
Storm frequency	= 2 yrs	Time to peak	= 740 min
Time interval	= 5 min	Hyd. volume	= 303,912 cuft
Drainage area	= 59.720 ac	Curve number	= 80*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 42.00 min
Total precip.	= 3.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(14.710 x 98) + (3.990 x 70) + (41.020 x 74)] / 59.720



Watershed Model Schematic

Munitions Area Culvert
Post-Development
10-year only



TR55 Tc Worksheet

Hyd. No. 1

DA-1, All

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.20		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 21.47**	**+**	**0.00**	**+**	**0.00**	**=**	**21.47**
Shallow Concentrated Flow							
Flow length (ft)	= 790.00		0.00		0.00		
Watercourse slope (%)	= 1.50		0.00		0.00		
Surface description	= Unpaved		Unpaved		Unpaved		
Average velocity (ft/s)	=1.98		0.00		0.00		
Travel Time (min)	**= 6.66**	**+**	**0.00**	**+**	**0.00**	**=**	**6.66**
Channel Flow							
X sectional flow area (sqft)	= 190.00		37.00		0.00		
Wetted perimeter (ft)	= 136.00		45.00		0.00		
Channel slope (%)	= 0.60		0.80		0.00		
Manning's n-value	= 0.100		0.100		0.015		
Velocity (ft/s)	=1.44		1.17		0.00		
Flow length (ft)	({0})200.0		125.0		0.0		
Travel Time (min)	**= 2.31**	**+**	**1.78**	**+**	**0.00**	**=**	**4.09**

Total Travel Time, Tc ..... 32.20 min

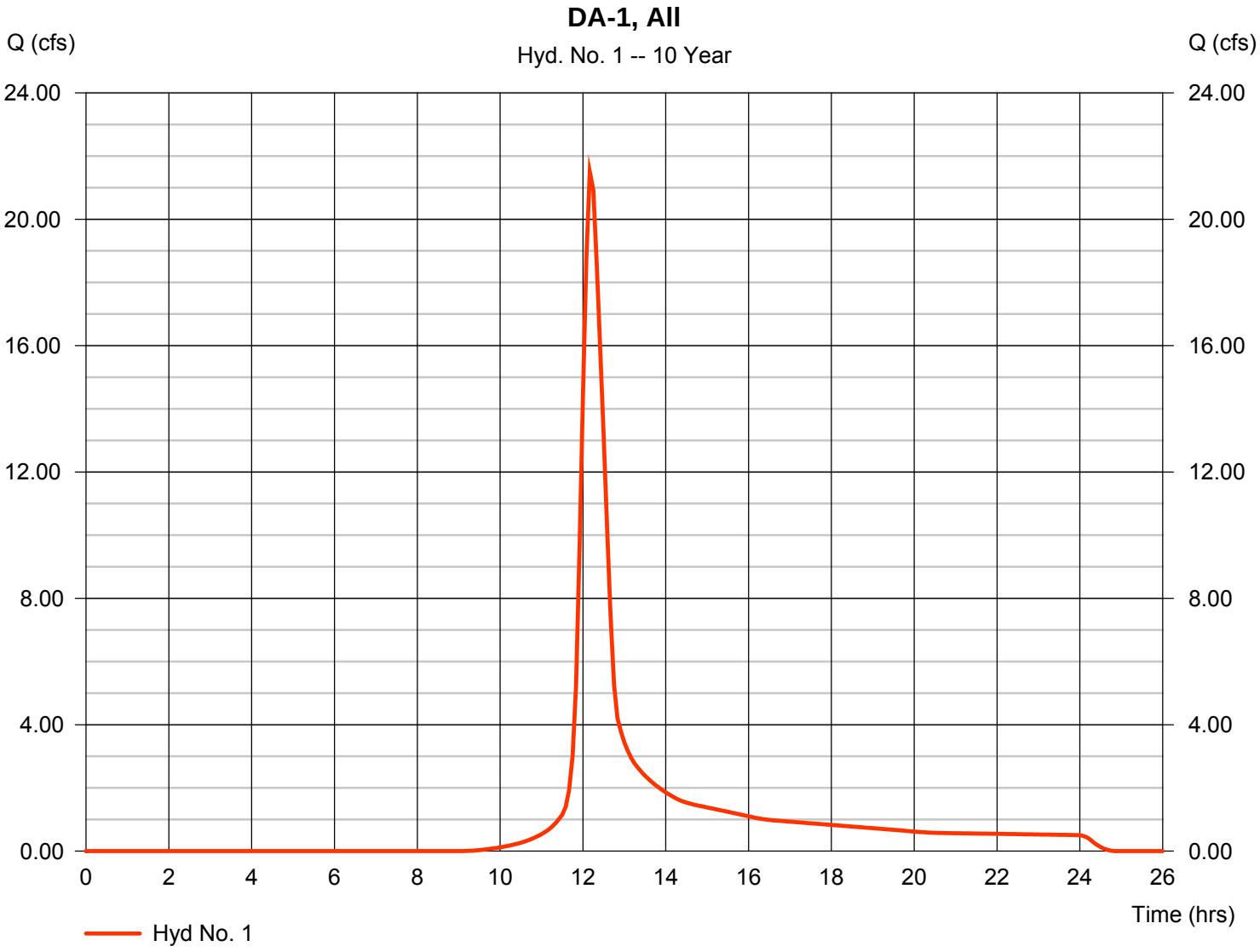
Hydrograph Report

Hyd. No. 1

DA-1, All

Hydrograph type	=	SCS Runoff	Peak discharge	=	21.50 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.17 hrs
Time interval	=	5 min	Hyd. volume	=	95,377 cuft
Drainage area	=	10.800 ac	Curve number	=	73*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	32.20 min
Total precip.	=	5.10 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(8.140 x 70) + (0.750 x 98) + (1.910 x 74)] / 10.800

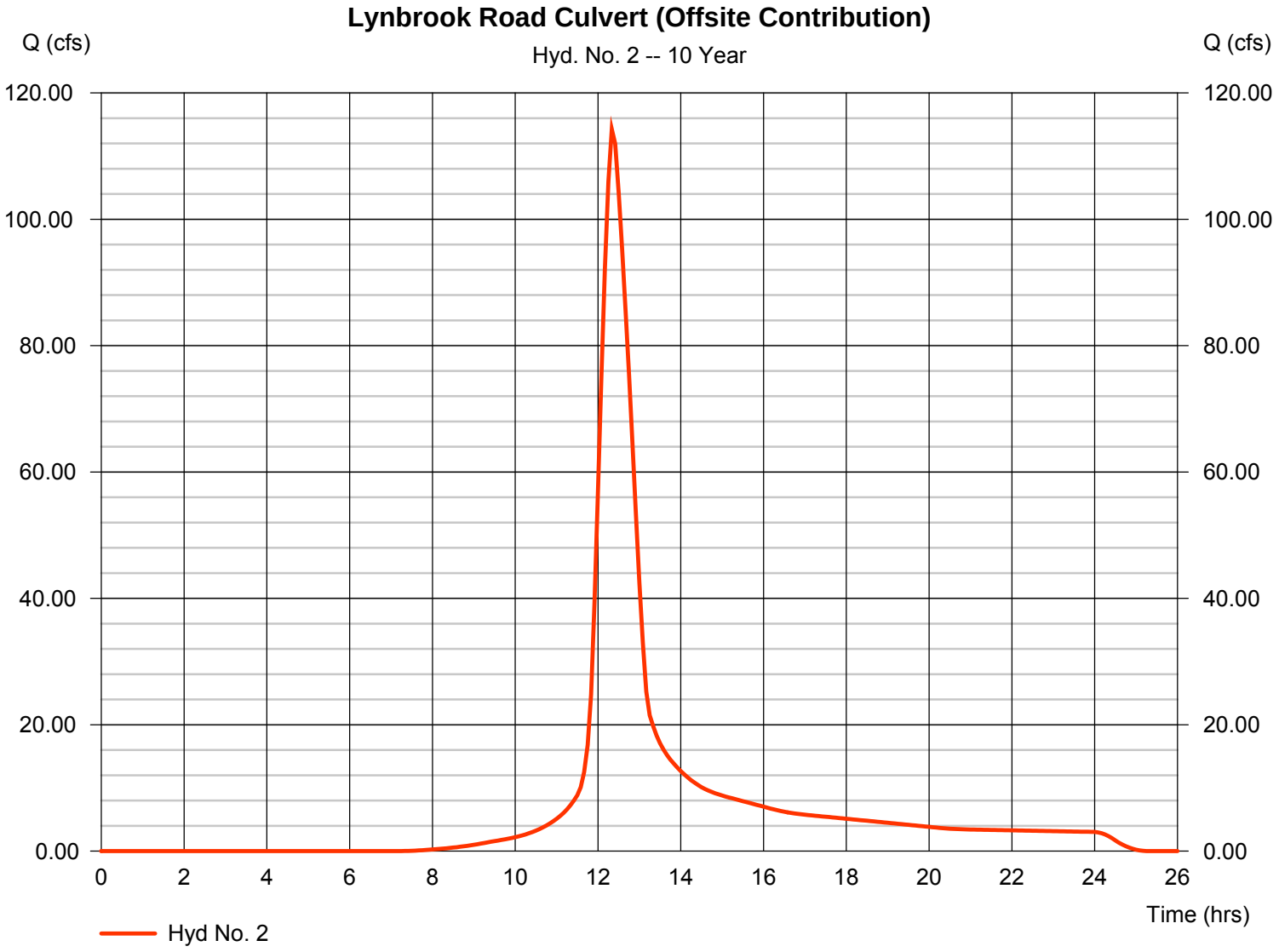


Hydrograph Report

Hyd. No. 2

Lynbrook Road Culvert (Offsite Contribution)

Hydrograph type	= SCS Runoff	Peak discharge	= 114.24 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.33 hrs
Time interval	= 5 min	Hyd. volume	= 645,859 cuft
Drainage area	= 59.700 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 42.00 min
Total precip.	= 5.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



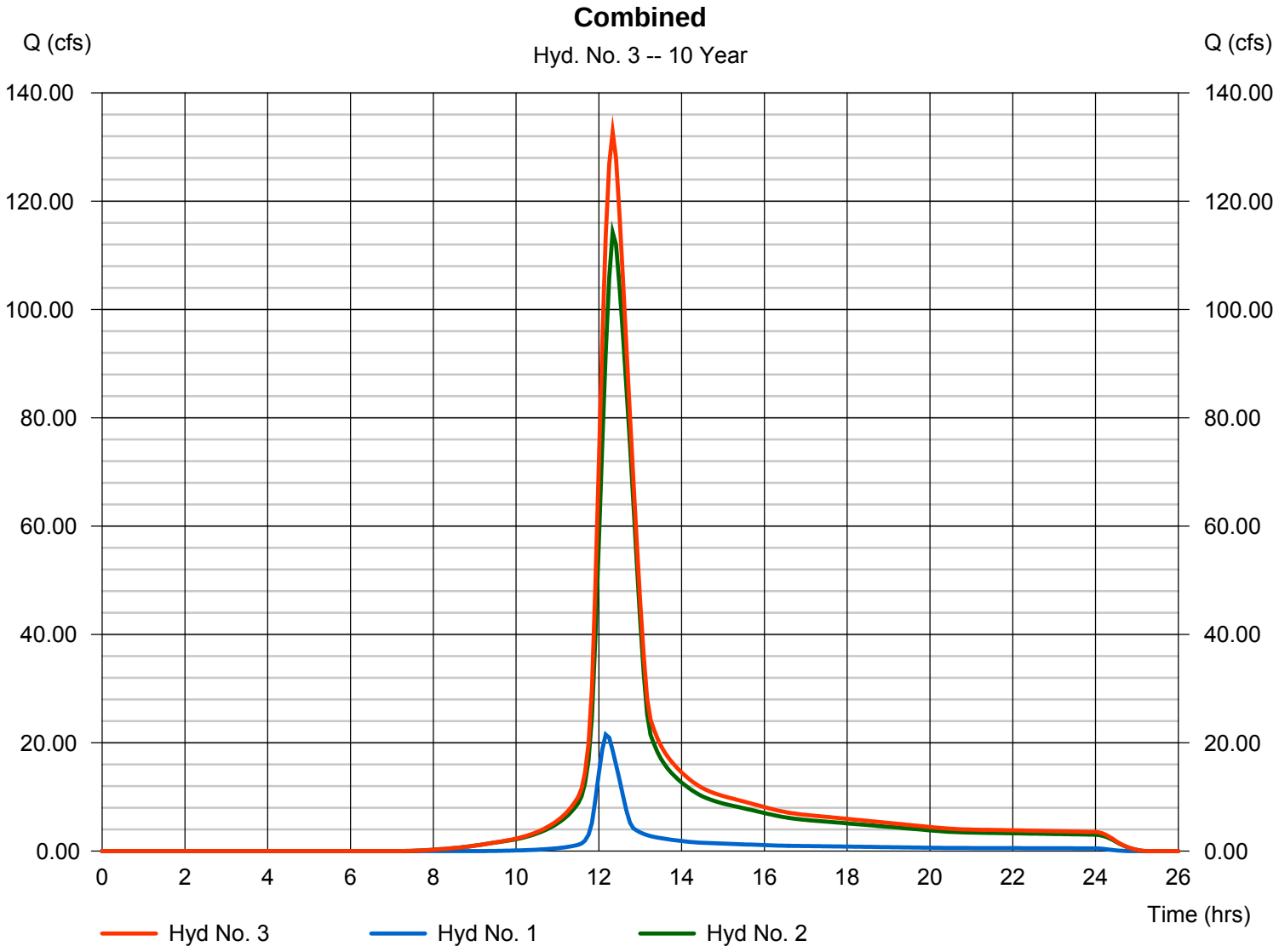
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Tuesday, Jul 8, 2014

Hyd. No. 3

Combined

Hydrograph type	= Combine	Peak discharge	= 132.80 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.33 hrs
Time interval	= 5 min	Hyd. volume	= 741,236 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 70.500 ac



Watershed Model Schematic

1 - half roof runoff



Sub-Drainage Area 2.1
Post-Development
10-year only (for outfall protection sizing on roof drains)

TR55 Tc Worksheet

Hyd. No. 1

half roof runoff

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 40.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 0.00		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		0.00		0.00		
Watercourse slope (%)	= 0.00		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	=0.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow							
X sectional flow area (sqft)	= 0.20		0.00		0.00		
Wetted perimeter (ft)	= 1.57		0.00		0.00		
Channel slope (%)	= 0.50		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=1.74						
			0.00				
					0.00		
Flow length (ft)	({0})250.0		0.0		0.0		
Travel Time (min)	**= 2.39**	**+**	**0.00**	**+**	**0.00**	**=**	**2.39**

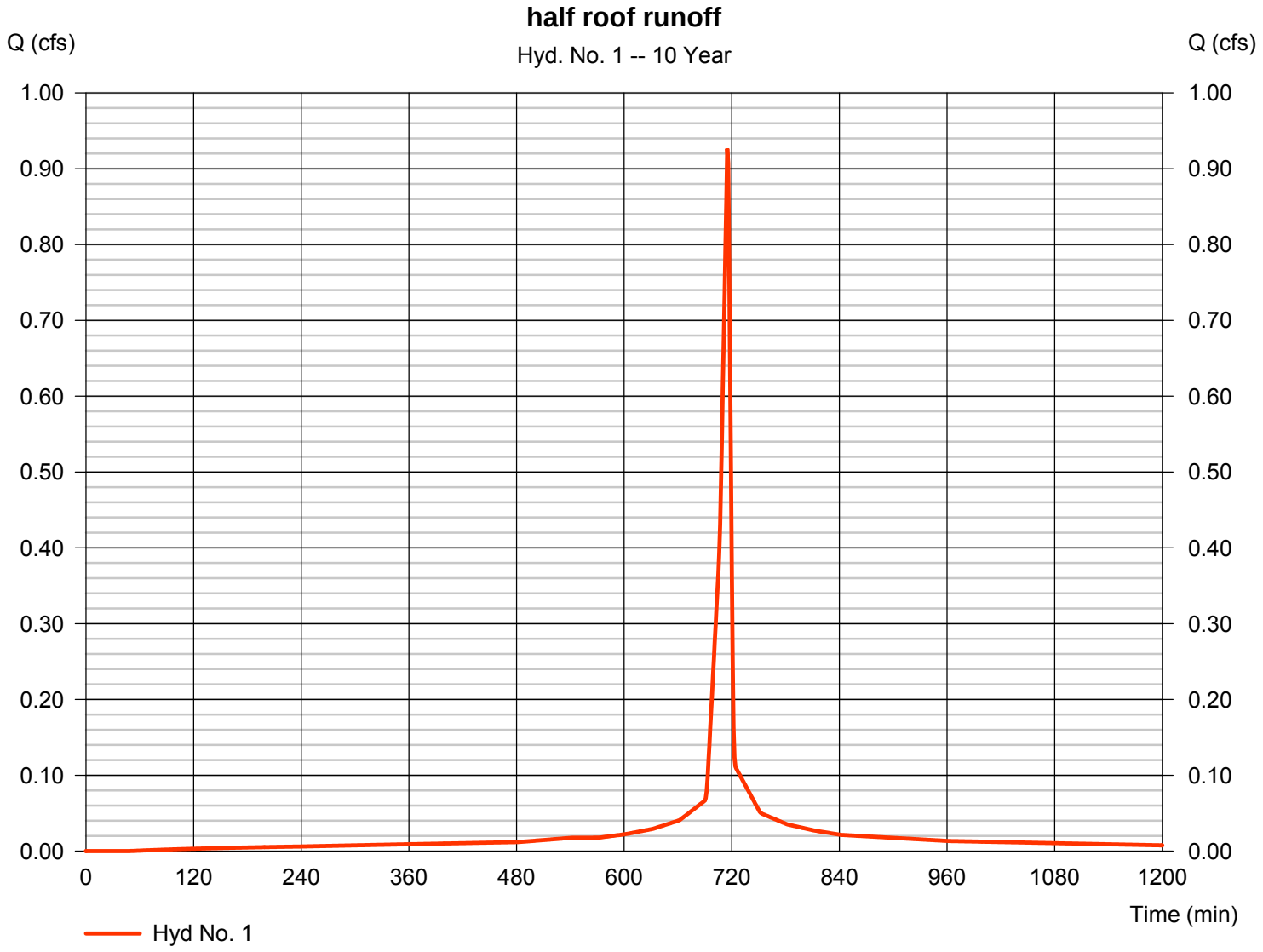
Total Travel Time, Tc ..... 2.40 min

Hydrograph Report

Hyd. No. 1

half roof runoff

Hydrograph type	= SCS Runoff	Peak discharge	= 0.927 cfs
Storm frequency	= 10 yrs	Time to peak	= 715 min
Time interval	= 1 min	Hyd. volume	= 1,986 cuft
Drainage area	= 0.120 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 2.40 min
Total precip.	= 5.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Watershed Model Schematic

1 - POI-2, Existing DA-1All



Drainage Area 2
Pre-Development
10-year only

TR55 Tc Worksheet

Hyd. No. 1

POI-2, Existing DA-1All

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.20		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 18.83**	**+**	**0.00**	**+**	**0.00**	**=**	**18.83**
Shallow Concentrated Flow							
Flow length (ft)	= 370.00		0.00		0.00		
Watercourse slope (%)	= 1.90		0.00		0.00		
Surface description	= Unpaved		Unpaved		Unpaved		
Average velocity (ft/s)	=2.22		0.00		0.00		
Travel Time (min)	**= 2.77**	**+**	**0.00**	**+**	**0.00**	**=**	**2.77**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.400		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 21.60 min

Hydrograph Report

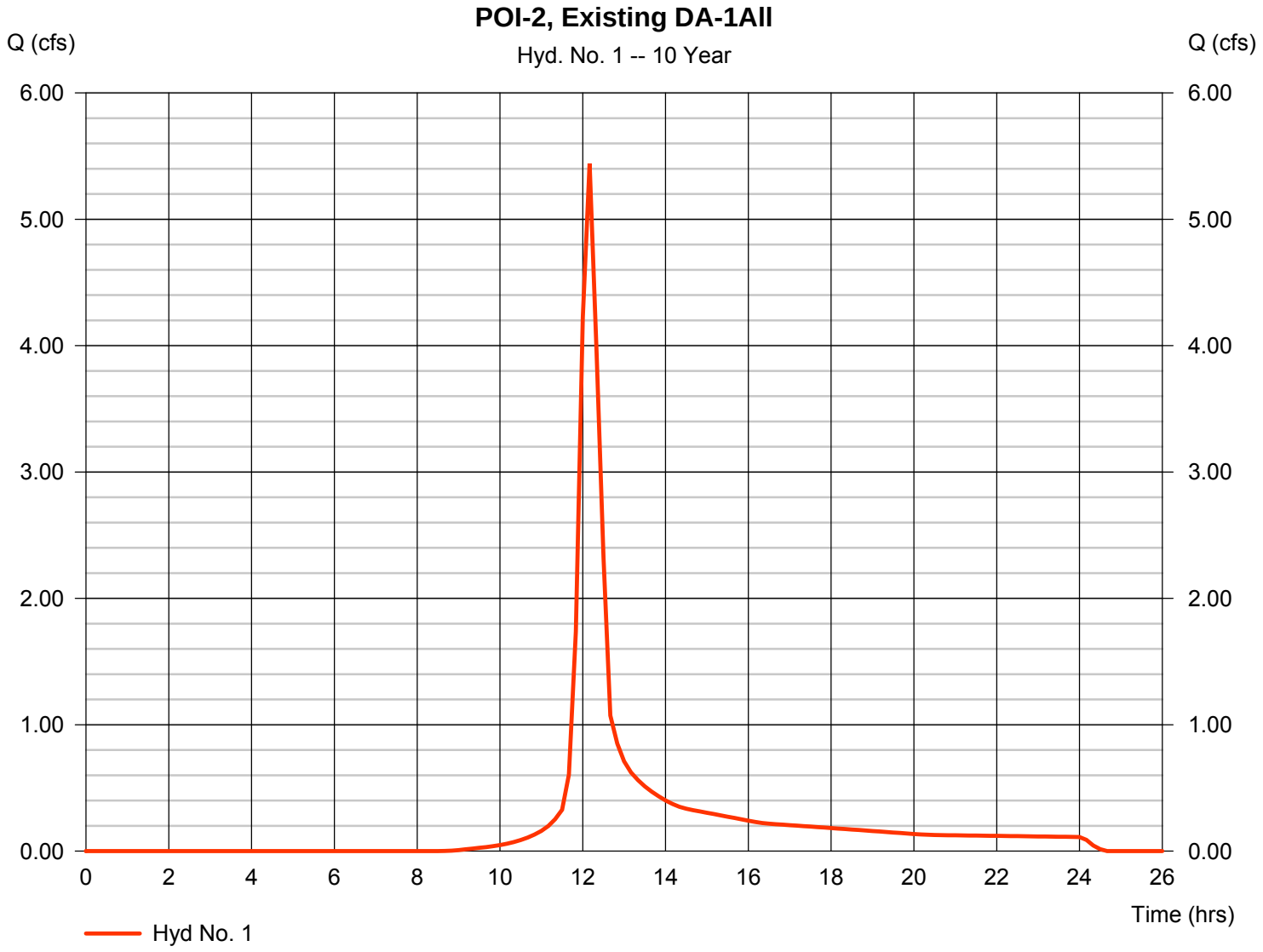
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Friday, Jul 11, 2014

Hyd. No. 1

POI-2, Existing DA-1All

Hydrograph type	= SCS Runoff	Peak discharge	= 5.441 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.17 hrs
Time interval	= 10 min	Hyd. volume	= 21,874 cuft
Drainage area	= 2.540 ac	Curve number	= 75*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 21.60 min
Total precip.	= 5.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.110 x 87) + (2.430 x 74)] / 2.540



Watershed Model Schematic

1 - POI-2, Proposed DA-2All



Drainage Area 2
Post-Development
10-year only

TR55 Tc Worksheet

Hyd. No. 1

POI-2, Proposed DA-2All

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.240		0.011		
Flow length (ft)	= 50.0		50.0		0.0		
Two-year 24-hr precip. (in)	= 3.20		3.20		0.00		
Land slope (%)	= 1.00		0.50		0.00		
Travel Time (min)	**= 0.92**	**+**	**14.27**	**+**	**0.00**	**=**	**15.19**
Shallow Concentrated Flow							
Flow length (ft)	= 78.00		0.00		0.00		
Watercourse slope (%)	= 0.50		0.00		0.00		
Surface description	= Unpaved		Unpaved		Unpaved		
Average velocity (ft/s)	=1.14		0.00		0.00		
Travel Time (min)	**= 1.14**	**+**	**0.00**	**+**	**0.00**	**=**	**1.14**
Channel Flow							
X sectional flow area (sqft)	= 0.92		1.32		0.00		
Wetted perimeter (ft)	= 2.48		2.98		0.00		
Channel slope (%)	= 0.50		1.00		0.00		
Manning's n-value	= 0.012		0.012		0.015		
Velocity (ft/s)	=4.51						
			7.21				
					0.00		
Flow length (ft)	({0})190.0		196.0		0.0		
Travel Time (min)	**= 0.70**	**+**	**0.45**	**+**	**0.00**	**=**	**1.15**

Total Travel Time, Tc ..... 17.50 min

Hydrograph Report

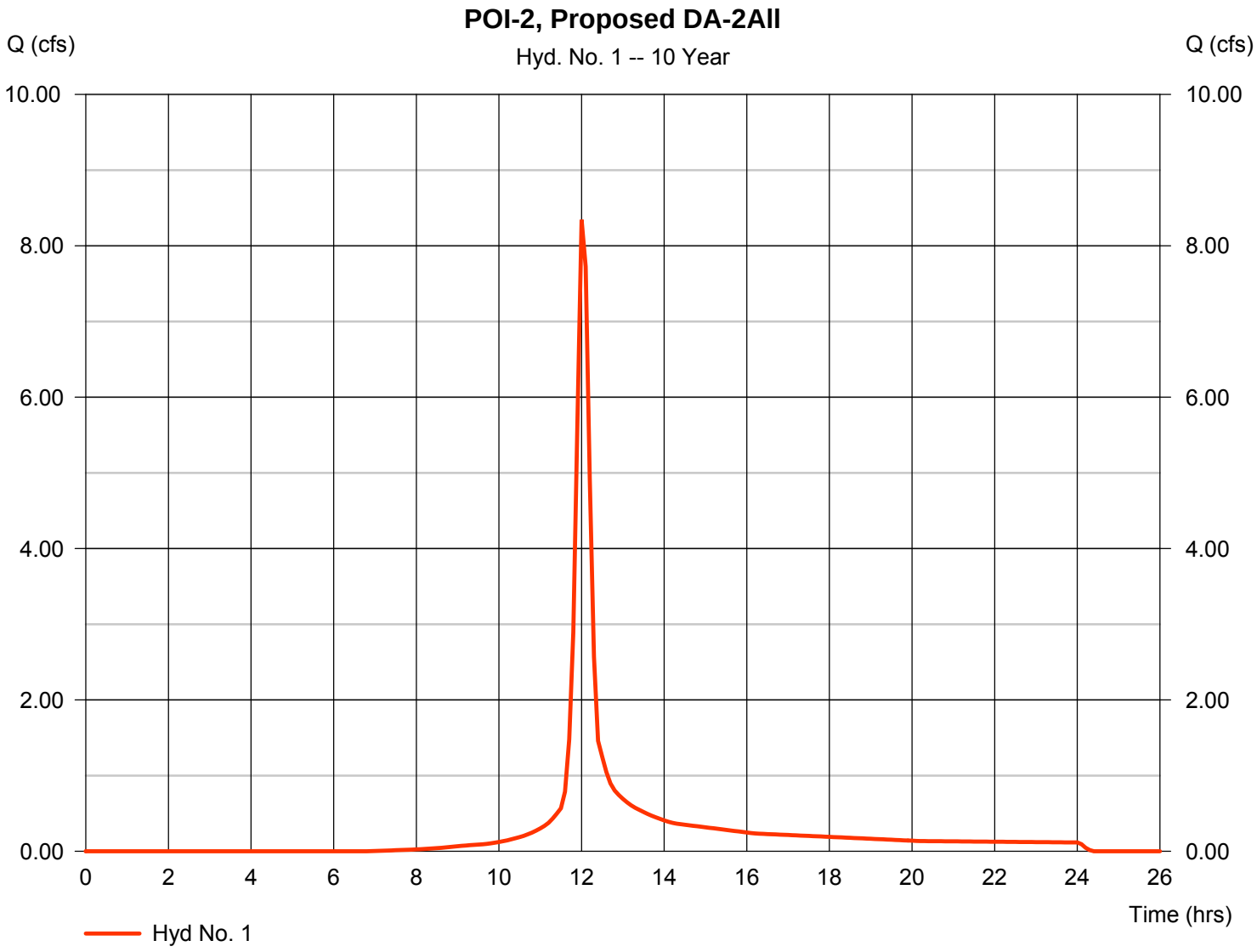
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Friday, Jul 11, 2014

Hyd. No. 1

POI-2, Proposed DA-2All

Hydrograph type	= SCS Runoff	Peak discharge	= 8.344 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.00 hrs
Time interval	= 6 min	Hyd. volume	= 25,629 cuft
Drainage area	= 2.450 ac	Curve number	= 81*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.50 min
Total precip.	= 5.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.700 x 98) + (1.750 x 74)] / 2.450



Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

1 - POI-TWT, Ex



Taxiway Swale
Drainage Area
Pre-Development
10-year only

TR55 Tc Worksheet

Hyd. No. 1

POI-TWT, Ex

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.20		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 18.83**	**+**	**0.00**	**+**	**0.00**	**=**	**18.83**
Shallow Concentrated Flow							
Flow length (ft)	= 370.00		0.00		0.00		
Watercourse slope (%)	= 1.90		0.00		0.00		
Surface description	= Unpaved		Unpaved		Unpaved		
Average velocity (ft/s)	=2.22		0.00		0.00		
Travel Time (min)	**= 2.77**	**+**	**0.00**	**+**	**0.00**	**=**	**2.77**
Channel Flow							
X sectional flow area (sqft)	= 39.00		0.00		0.00		
Wetted perimeter (ft)	= 79.70		0.00		0.00		
Channel slope (%)	= 0.80		0.00		0.00		
Manning's n-value	= 0.150		0.015		0.015		
Velocity (ft/s)	=0.55						
			0.00				
					0.00		
Flow length (ft)	({0})375.0		0.0		0.0		
Travel Time (min)	**= 11.36**	**+**	**0.00**	**+**	**0.00**	**=**	**11.36**

Total Travel Time, Tc ..... 33.00 min

Hydrograph Report

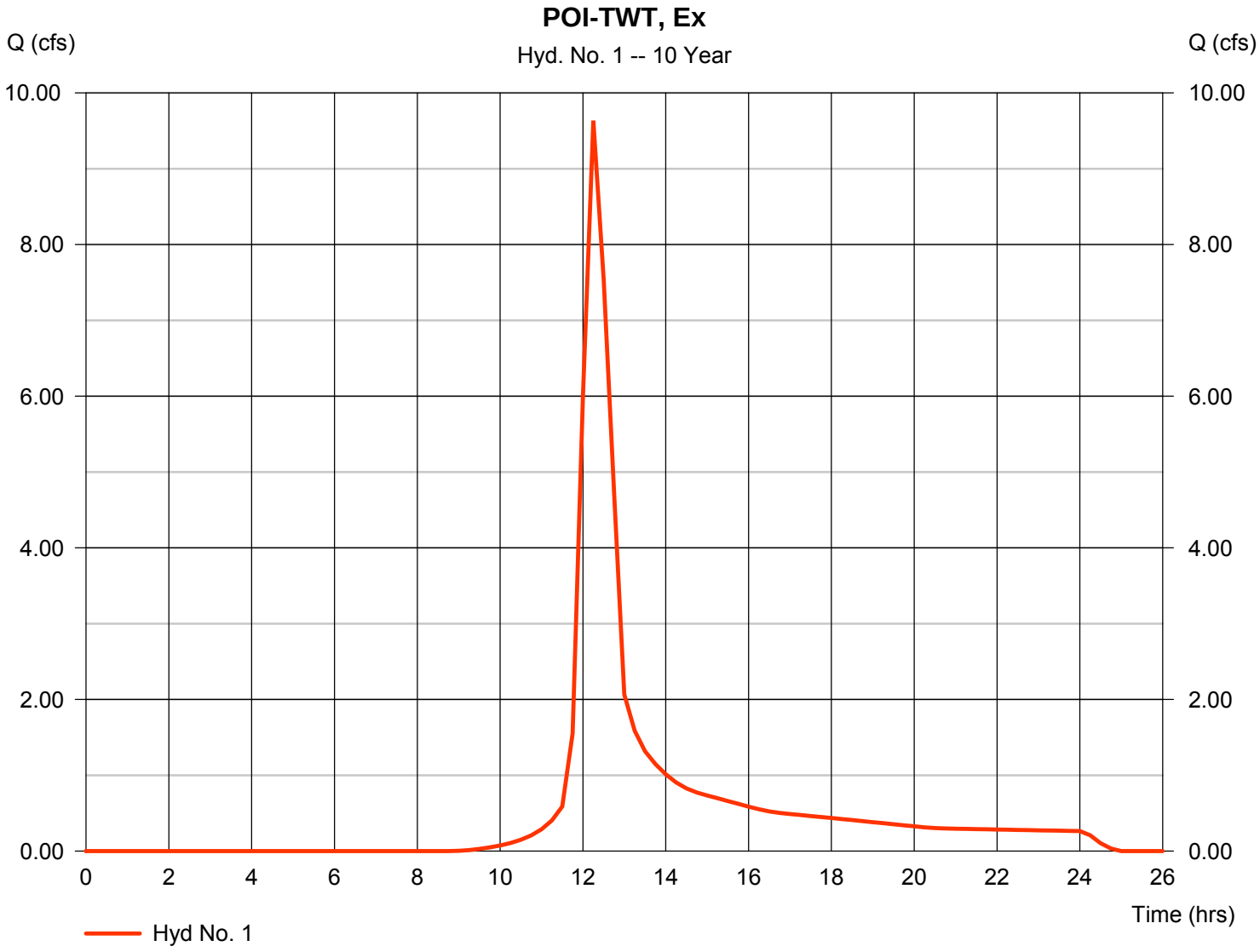
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Tuesday, Jul 15, 2014

Hyd. No. 1

POI-TWT, Ex

Hydrograph type	= SCS Runoff	Peak discharge	= 9.634 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.25 hrs
Time interval	= 15 min	Hyd. volume	= 50,491 cuft
Drainage area	= 6.070 ac	Curve number	= 74*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 33.00 min
Total precip.	= 5.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.460 x 98) + (0.190 x 87) + (5.110 x 74)] / 6.070



Watershed Model Schematic



Taxiway Swale
Drainage Area
Post-Development
10-year only

TR55 Tc Worksheet

Hyd. No. 1

POI-TWT, Pr

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.240		0.011		
Flow length (ft)	= 50.0		50.0		0.0		
Two-year 24-hr precip. (in)	= 3.20		3.20		0.00		
Land slope (%)	= 1.00		0.50		0.00		
Travel Time (min)	**= 0.92**	**+**	**14.27**	**+**	**0.00**	**=**	**15.19**
Shallow Concentrated Flow							
Flow length (ft)	= 78.00		0.00		0.00		
Watercourse slope (%)	= 0.50		0.00		0.00		
Surface description	= Unpaved		Unpaved		Unpaved		
Average velocity (ft/s)	=1.14		0.00		0.00		
Travel Time (min)	**= 1.14**	**+**	**0.00**	**+**	**0.00**	**=**	**1.14**
Channel Flow							
X sectional flow area (sqft)	= 0.92		1.32		39.00		
Wetted perimeter (ft)	= 2.48		2.98		79.70		
Channel slope (%)	= 0.50		1.00		1.90		
Manning's n-value	= 0.012		0.012		0.150		
Velocity (ft/s)	=4.51						
			7.21				
					0.85		
Flow length (ft)	({0})190.0		196.0		235.0		
Travel Time (min)	**= 0.70**	**+**	**0.45**	**+**	**4.62**	**=**	**5.77**

Total Travel Time, Tc ..... 22.10 min

Hydrograph Report

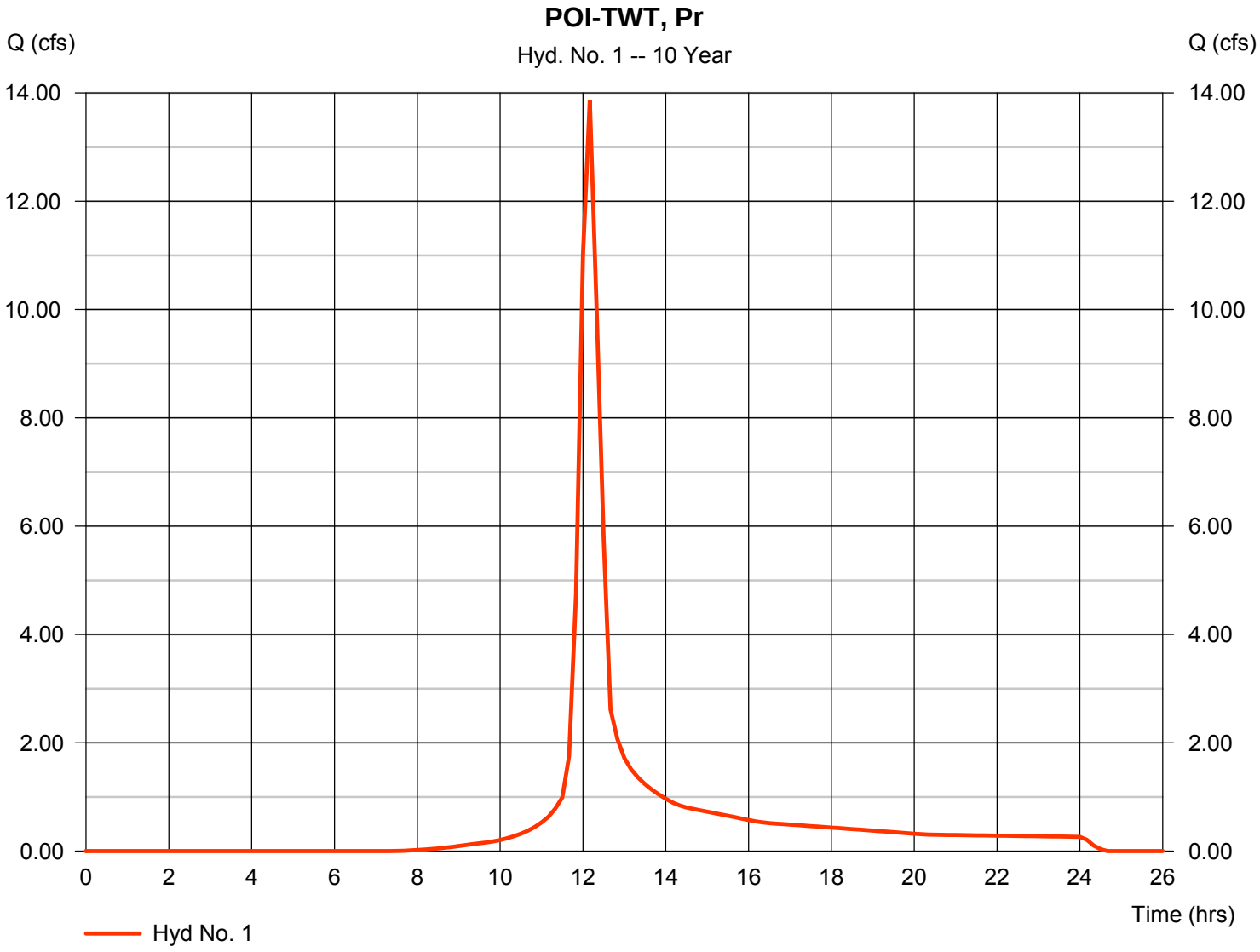
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Tuesday, Jul 15, 2014

Hyd. No. 1

POI-TWT, Pr

Hydrograph type	= SCS Runoff	Peak discharge	= 13.87 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.17 hrs
Time interval	= 10 min	Hyd. volume	= 55,626 cuft
Drainage area	= 5.660 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 22.10 min
Total precip.	= 5.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.700 x 98) + (1.750 x 74) + (0.460 x 98) + (2.750 x 74)] / 5.660



APPENDIX I – SWALE/ CULVERT/ STORM PIPE ANALYSIS (HYDRAFLOW STORM SEWERS AND HYDRAFLOW EXPRESS)

Swale Design

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. Tuesday, Jun 17 2014

DA 1.1 Grass Swale - ESD / 1 yr , Post-Dev

Trapezoidal

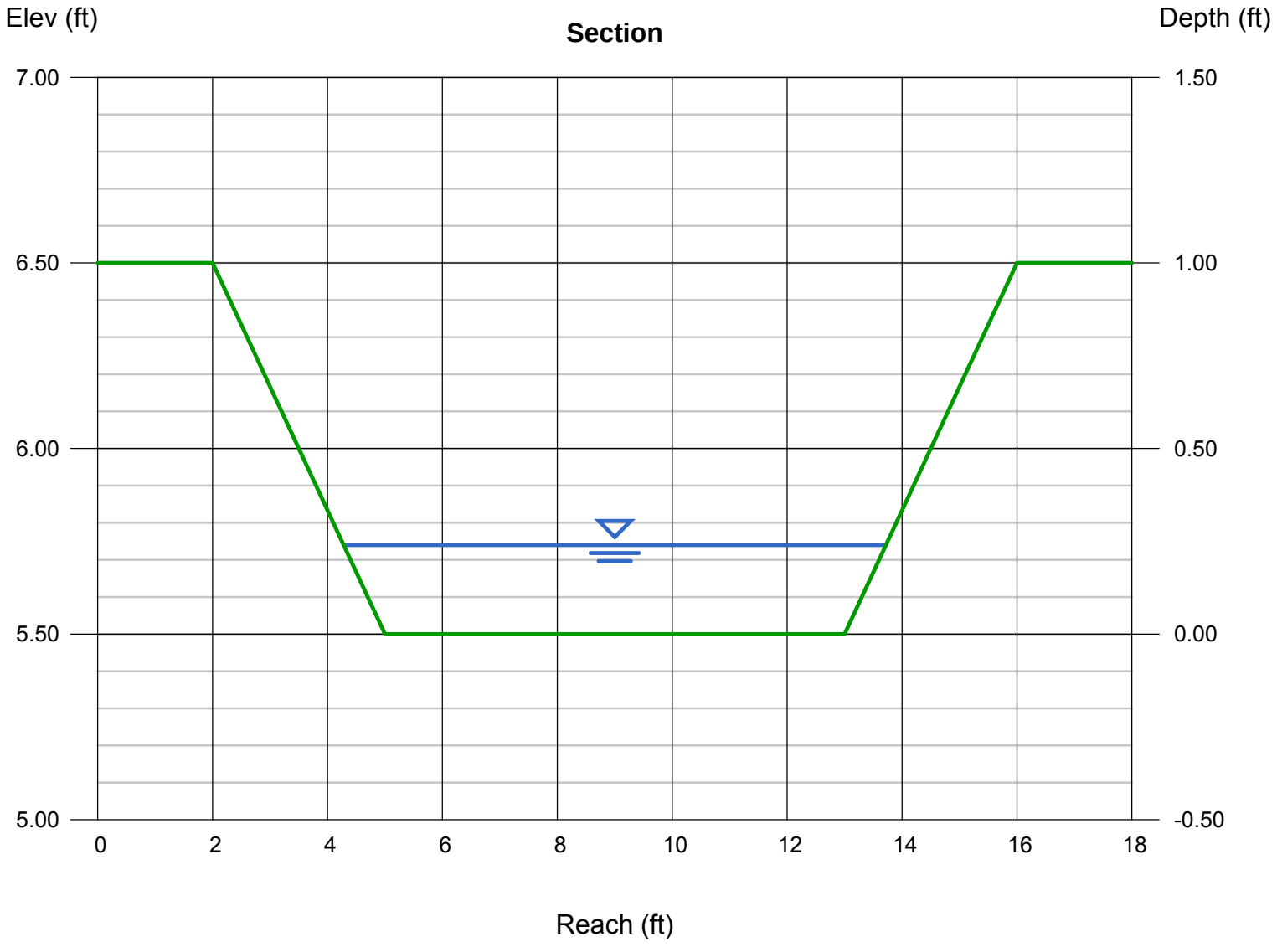
Bottom Width (ft)	= 8.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 5.50
Slope (%)	= 0.90
N-Value	= 0.150

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.67

Highlighted

Depth (ft)	= 0.24
Q (cfs)	= 0.670
Area (sqft)	= 2.09
Velocity (ft/s)	= 0.32
Wetted Perim (ft)	= 9.52
Crit Depth, Yc (ft)	= 0.06
Top Width (ft)	= 9.44
EGL (ft)	= 0.24



Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. Tuesday, Jun 17 2014

DA 1.1 Grass Swale - Q10, Post-Dev

Trapezoidal

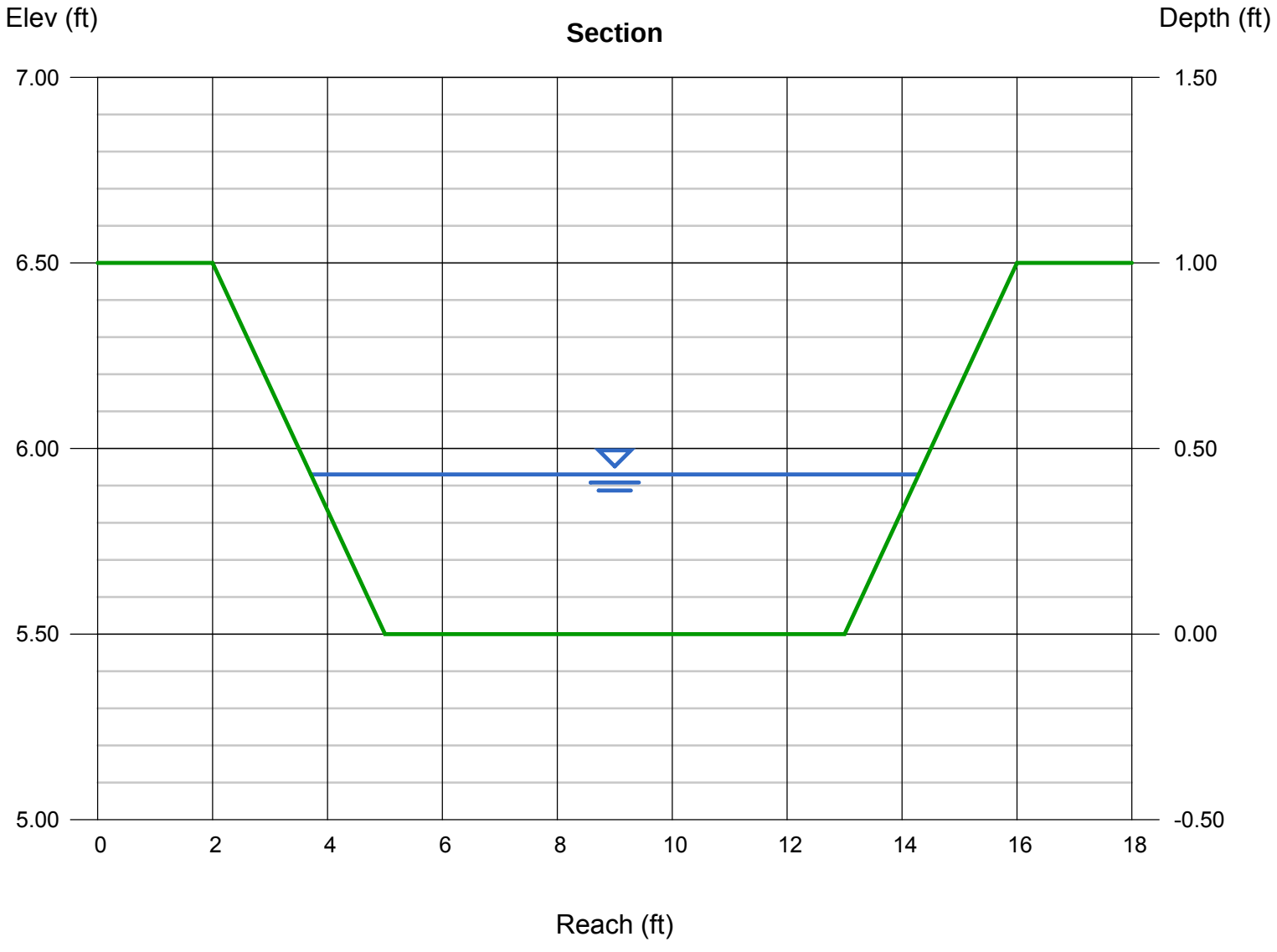
Bottom Width (ft)	= 8.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 5.50
Slope (%)	= 0.90
N-Value	= 0.150

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.89

Highlighted

Depth (ft)	= 0.43
Q (cfs)	= 1.890
Area (sqft)	= 3.99
Velocity (ft/s)	= 0.47
Wetted Perim (ft)	= 10.72
Crit Depth, Yc (ft)	= 0.12
Top Width (ft)	= 10.58
EGL (ft)	= 0.43



Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. Monday, Aug 18 2014

DA 1.2 Grass Swale - ESD / 1 yr , Post-Dev

Trapezoidal

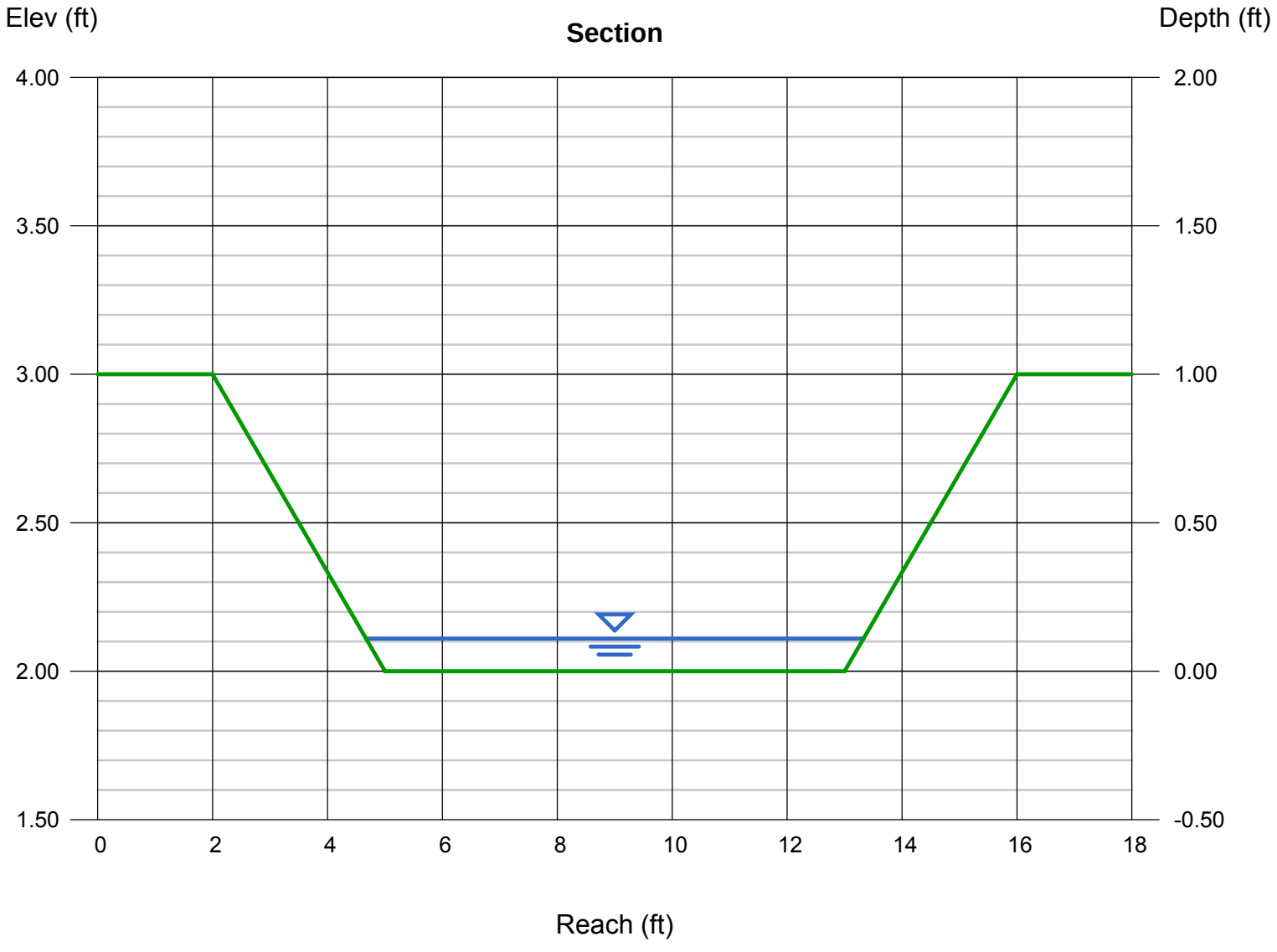
Bottom Width (ft)	= 8.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 2.00
Slope (%)	= 3.80
N-Value	= 0.150

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.36

Highlighted

Depth (ft)	= 0.11
Q (cfs)	= 0.360
Area (sqft)	= 0.92
Velocity (ft/s)	= 0.39
Wetted Perim (ft)	= 8.70
Crit Depth, Yc (ft)	= 0.04
Top Width (ft)	= 8.66
EGL (ft)	= 0.11



Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. Monday, Aug 18 2014

DA 1.2 Grass Swale - 10 yr , Post-Dev

Trapezoidal

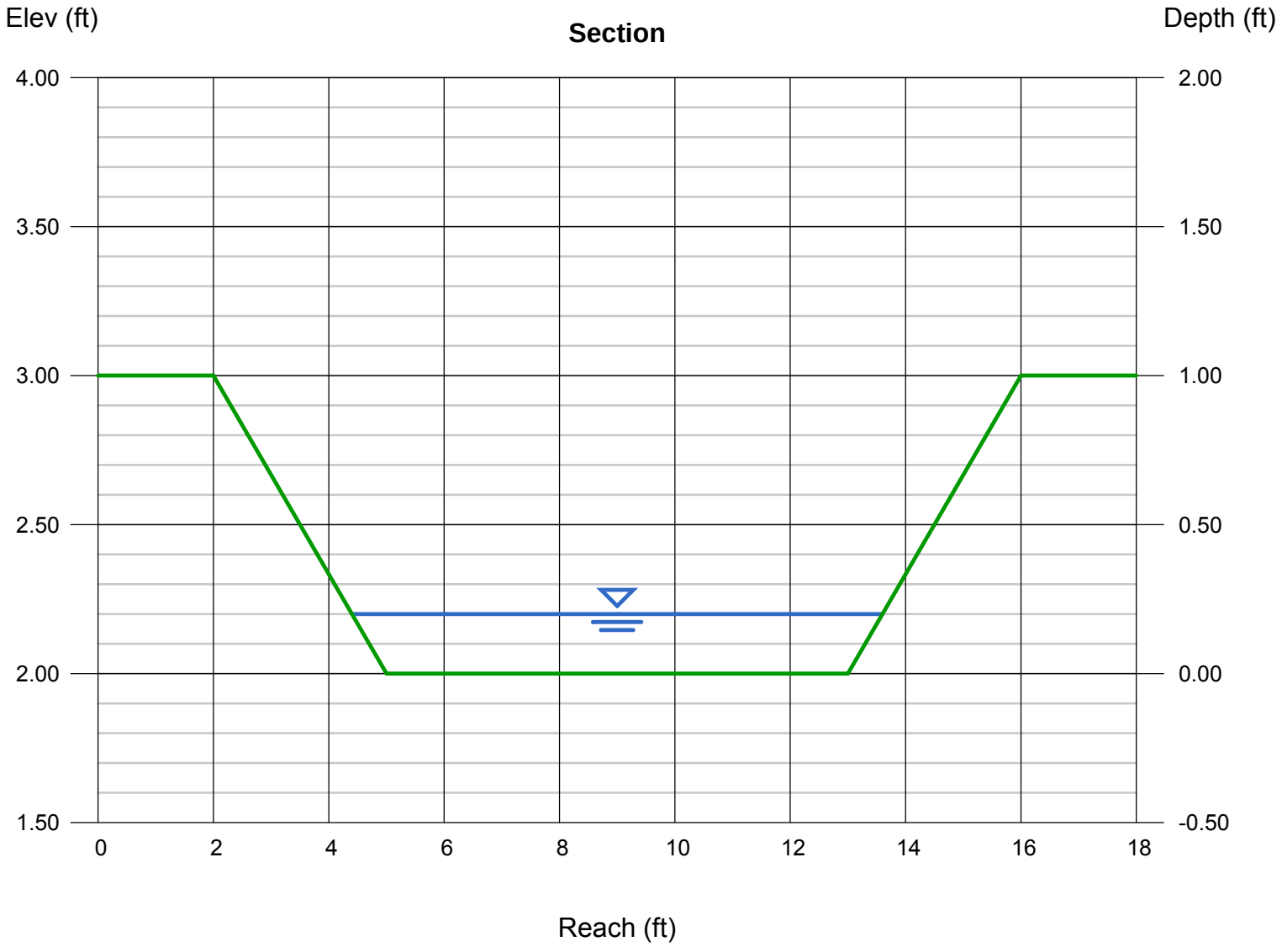
Bottom Width (ft)	= 8.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 2.00
Slope (%)	= 3.80
N-Value	= 0.150

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.01

Highlighted

Depth (ft)	= 0.20
Q (cfs)	= 1.010
Area (sqft)	= 1.72
Velocity (ft/s)	= 0.59
Wetted Perim (ft)	= 9.26
Crit Depth, Yc (ft)	= 0.08
Top Width (ft)	= 9.20
EGL (ft)	= 0.21



Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. Wednesday, Jun 18 2014

DA 1.3 Grass Swale - ESD / 1 yr, Post-Dev

Trapezoidal

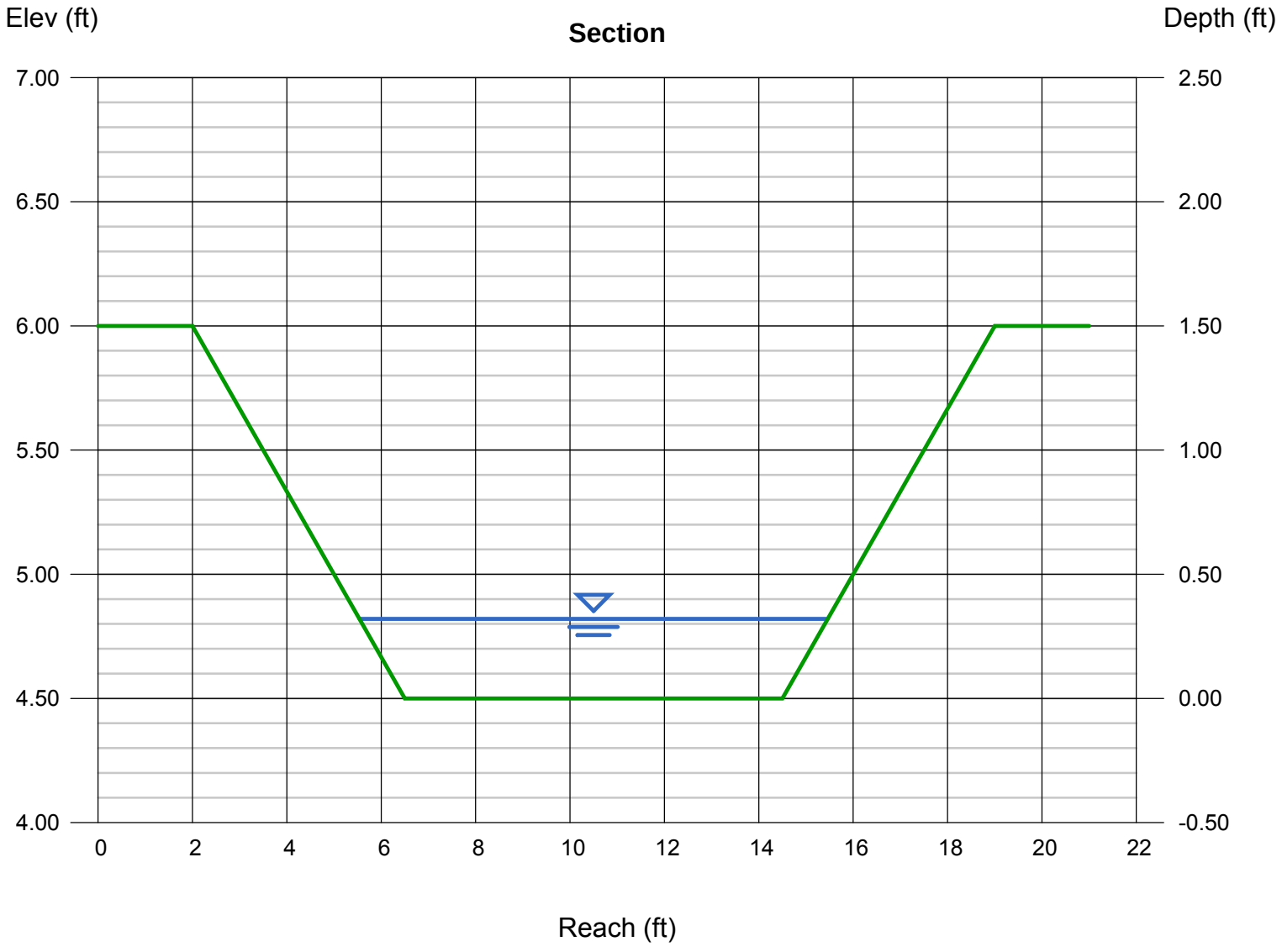
Bottom Width (ft)	= 8.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 4.50
Slope (%)	= 0.80
N-Value	= 0.150

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.07

Highlighted

Depth (ft)	= 0.32
Q (cfs)	= 1.070
Area (sqft)	= 2.87
Velocity (ft/s)	= 0.37
Wetted Perim (ft)	= 10.02
Crit Depth, Yc (ft)	= 0.09
Top Width (ft)	= 9.92
EGL (ft)	= 0.32



Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. Wednesday, Jun 18 2014

DA 1.3 Grass Swale - 10 yr, Post-Dev

Trapezoidal

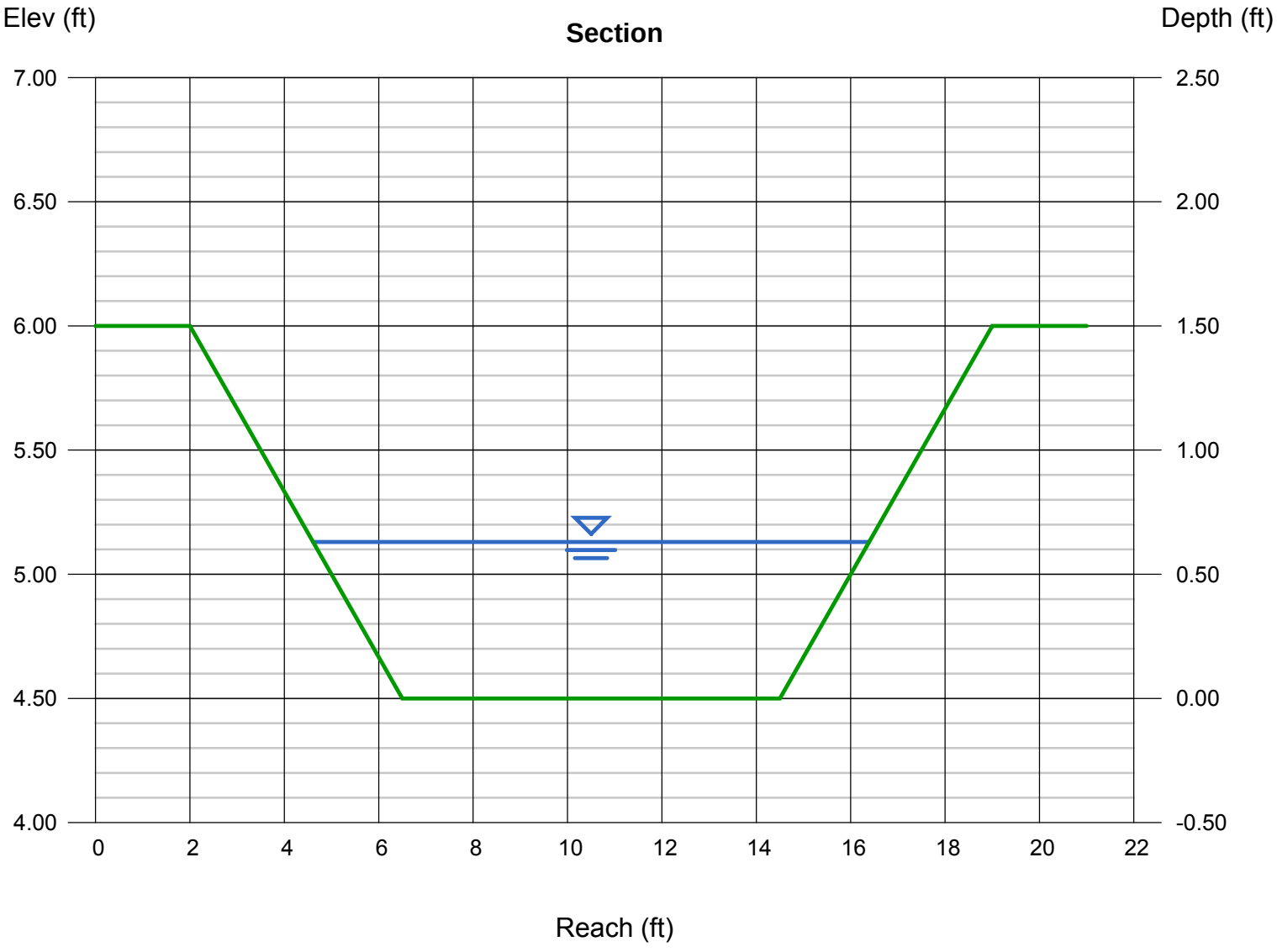
Bottom Width (ft)	= 8.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 4.50
Slope (%)	= 0.80
N-Value	= 0.150

Calculations

Compute by:	Known Q
Known Q (cfs)	= 3.48

Highlighted

Depth (ft)	= 0.63
Q (cfs)	= 3.480
Area (sqft)	= 6.23
Velocity (ft/s)	= 0.56
Wetted Perim (ft)	= 11.98
Crit Depth, Yc (ft)	= 0.18
Top Width (ft)	= 11.78
EGL (ft)	= 0.63



Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. Thursday, Jun 19 2014

DA 1.4 Grass Swale - 1 yr storm, Proposed Condition

Trapezoidal

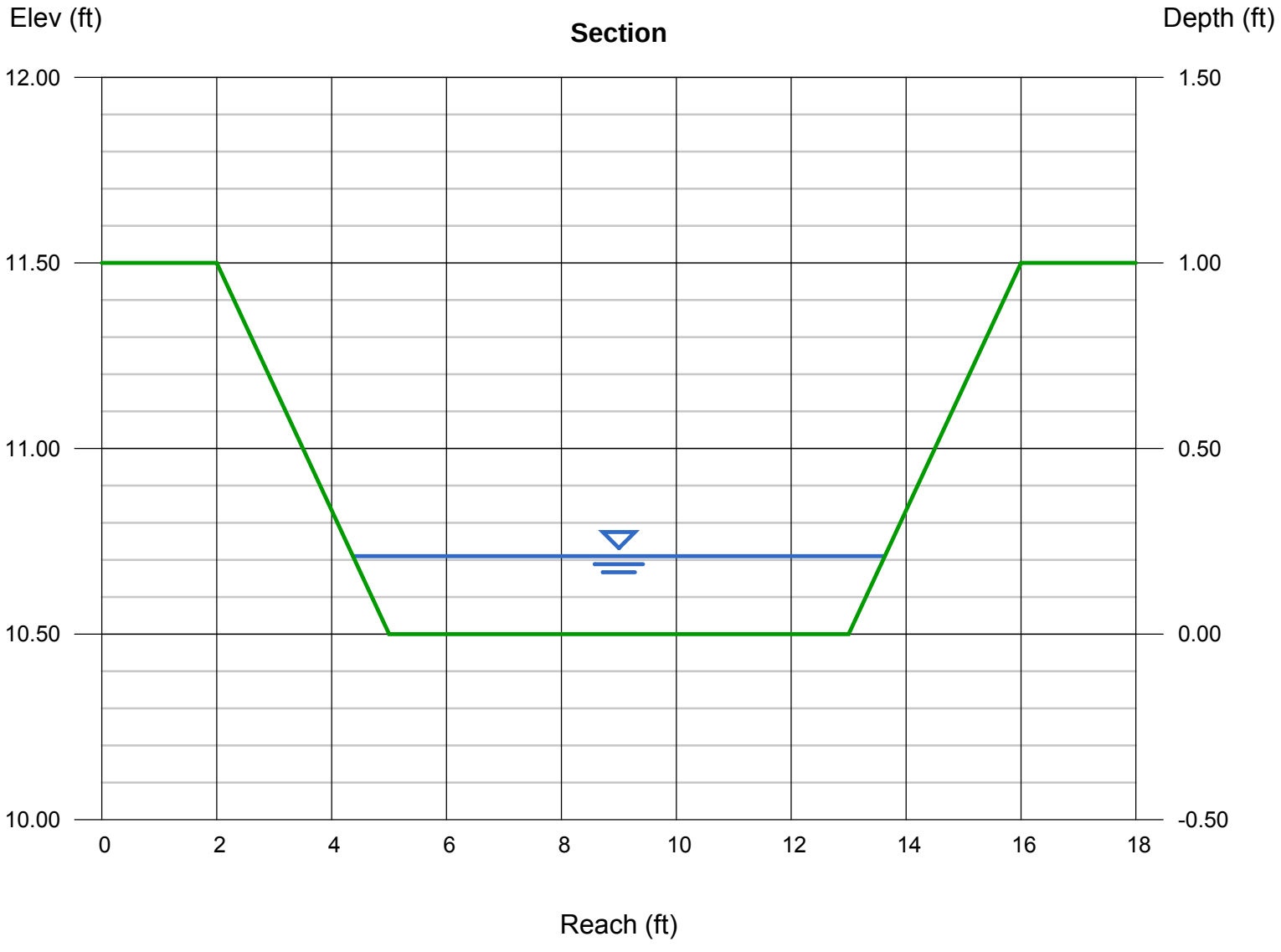
Bottom Width (ft)	= 8.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 10.50
Slope (%)	= 1.00
N-Value	= 0.150

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.59

Highlighted

Depth (ft)	= 0.21
Q (cfs)	= 0.590
Area (sqft)	= 1.81
Velocity (ft/s)	= 0.33
Wetted Perim (ft)	= 9.33
Crit Depth, Yc (ft)	= 0.06
Top Width (ft)	= 9.26
EGL (ft)	= 0.21



Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. Thursday, Jun 19 2014

DA 1.4 Grass Swale - 10 yr storm, Proposed Condition

Trapezoidal

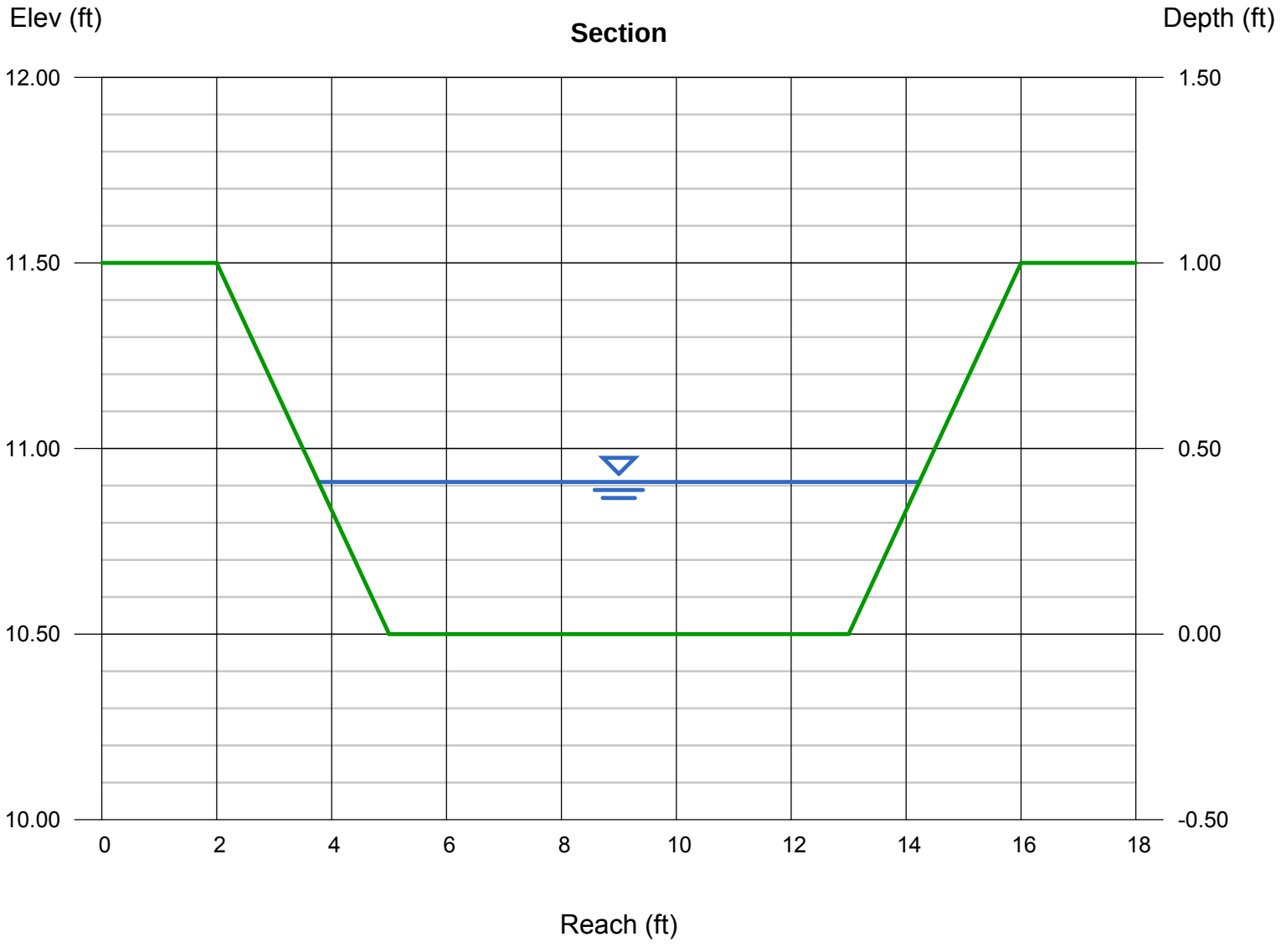
Bottom Width (ft)	= 8.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 10.50
Slope (%)	= 1.00
N-Value	= 0.150

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.82

Highlighted

Depth (ft)	= 0.41
Q (cfs)	= 1.820
Area (sqft)	= 3.78
Velocity (ft/s)	= 0.48
Wetted Perim (ft)	= 10.59
Crit Depth, Yc (ft)	= 0.12
Top Width (ft)	= 10.46
EGL (ft)	= 0.41



Culverts

Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. Tuesday, Jul 8 2014

Airfield Access Stub - 15in RCP Culvert Replacement - 10-yr, post-development

Invert Elev Dn (ft)	= 3.72
Pipe Length (ft)	= 49.00
Slope (%)	= 0.27
Invert Elev Up (ft)	= 3.85
Rise (in)	= 15.0
Shape	= Cir
Span (in)	= 15.0
No. Barrels	= 1
n-Value	= 0.013
Inlet Edge	= 0
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.5

Embankment

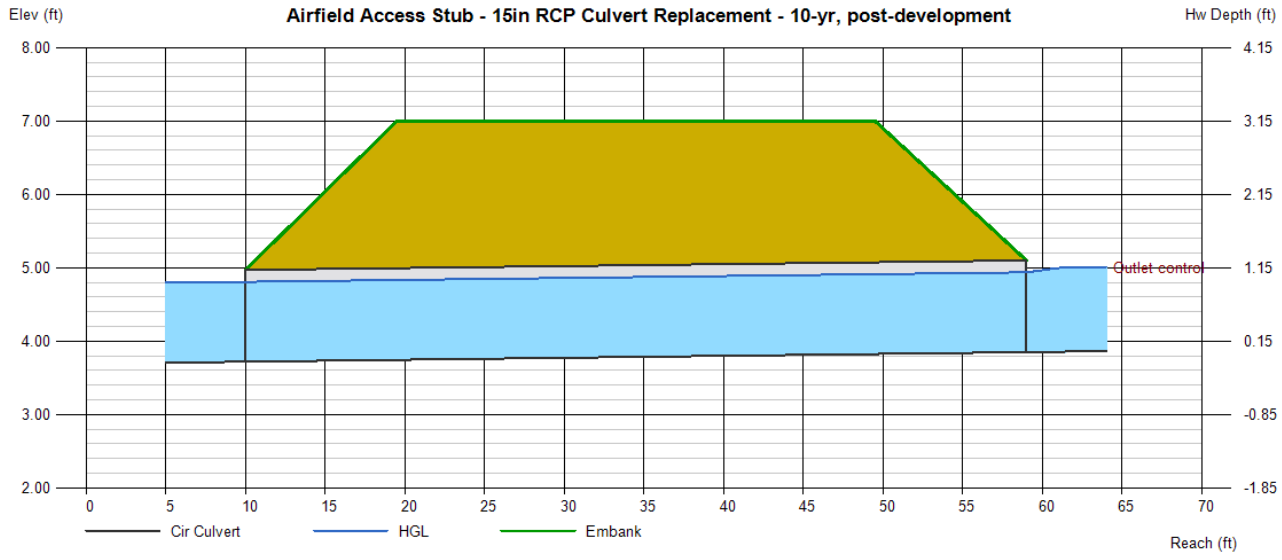
Top Elevation (ft)	= 7.00
Top Width (ft)	= 30.00
Crest Width (ft)	= 50.00

Calculations

Qmin (cfs)	= 3.48
Qmax (cfs)	= 3.48
Tailwater Elev (ft)	= Normal

Highlighted

Qtotal (cfs)	= 3.48
Qpipe (cfs)	= 3.48
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 3.07
Veloc Up (ft/s)	= 3.07
HGL Dn (ft)	= 4.81
HGL Up (ft)	= 4.94
Hw Elev (ft)	= 5.01
Hw/D (ft)	= 0.93
Flow Regime	= Outlet Control



Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. Tuesday, Jul 8 2014

MDANG Munitions Culvert - Post Development - 10 year storm

Invert Elev Dn (ft)	= 0.16
Pipe Length (ft)	= 43.00
Slope (%)	= 1.74
Invert Elev Up (ft)	= 0.91
Rise (in)	= 30.0
Shape	= Cir
Span (in)	= 30.0
No. Barrels	= 2
n-Value	= 0.012
Inlet Edge	= 0
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.5

Embankment

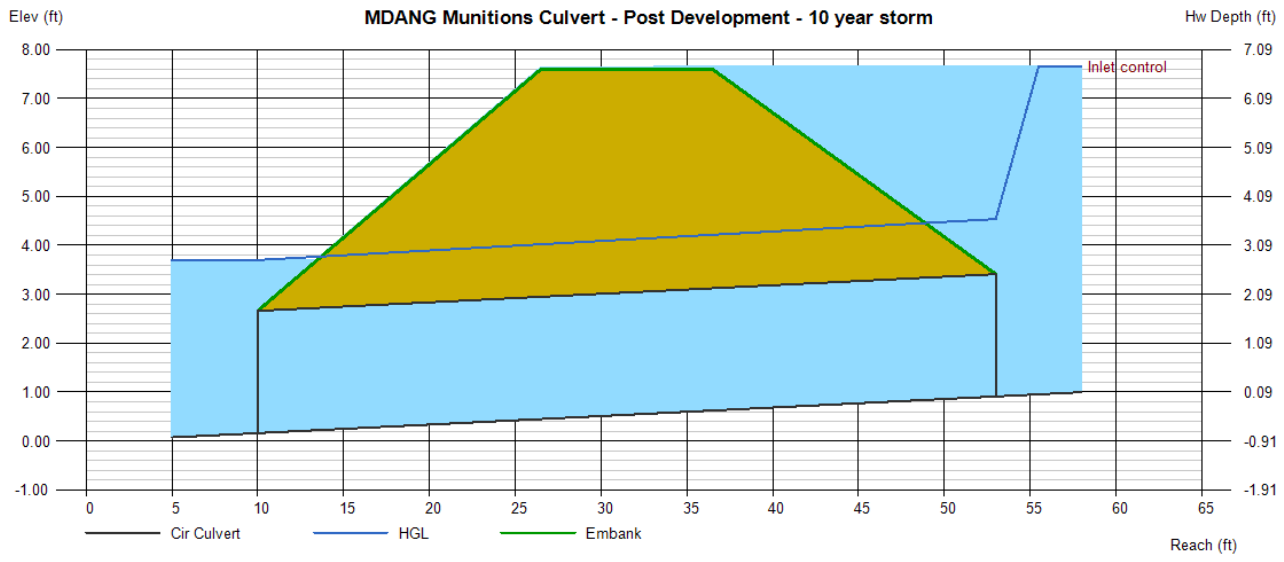
Top Elevation (ft)	= 7.60
Top Width (ft)	= 10.00
Crest Width (ft)	= 150.00

Calculations

Qmin (cfs)	= 132.80
Qmax (cfs)	= 132.80
Tailwater Elev (ft)	= 3.7

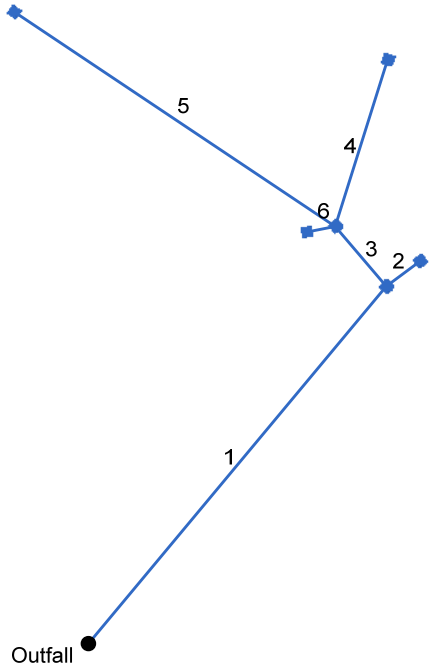
Highlighted

Qtotal (cfs)	= 132.80
Qpipe (cfs)	= 123.85
Qovertop (cfs)	= 8.95
Veloc Dn (ft/s)	= 12.62
Veloc Up (ft/s)	= 12.61
HGL Dn (ft)	= 3.70
HGL Up (ft)	= 4.54
Hw Elev (ft)	= 7.66
Hw/D (ft)	= 2.70
Flow Regime	= Inlet Control



Storm Pipes

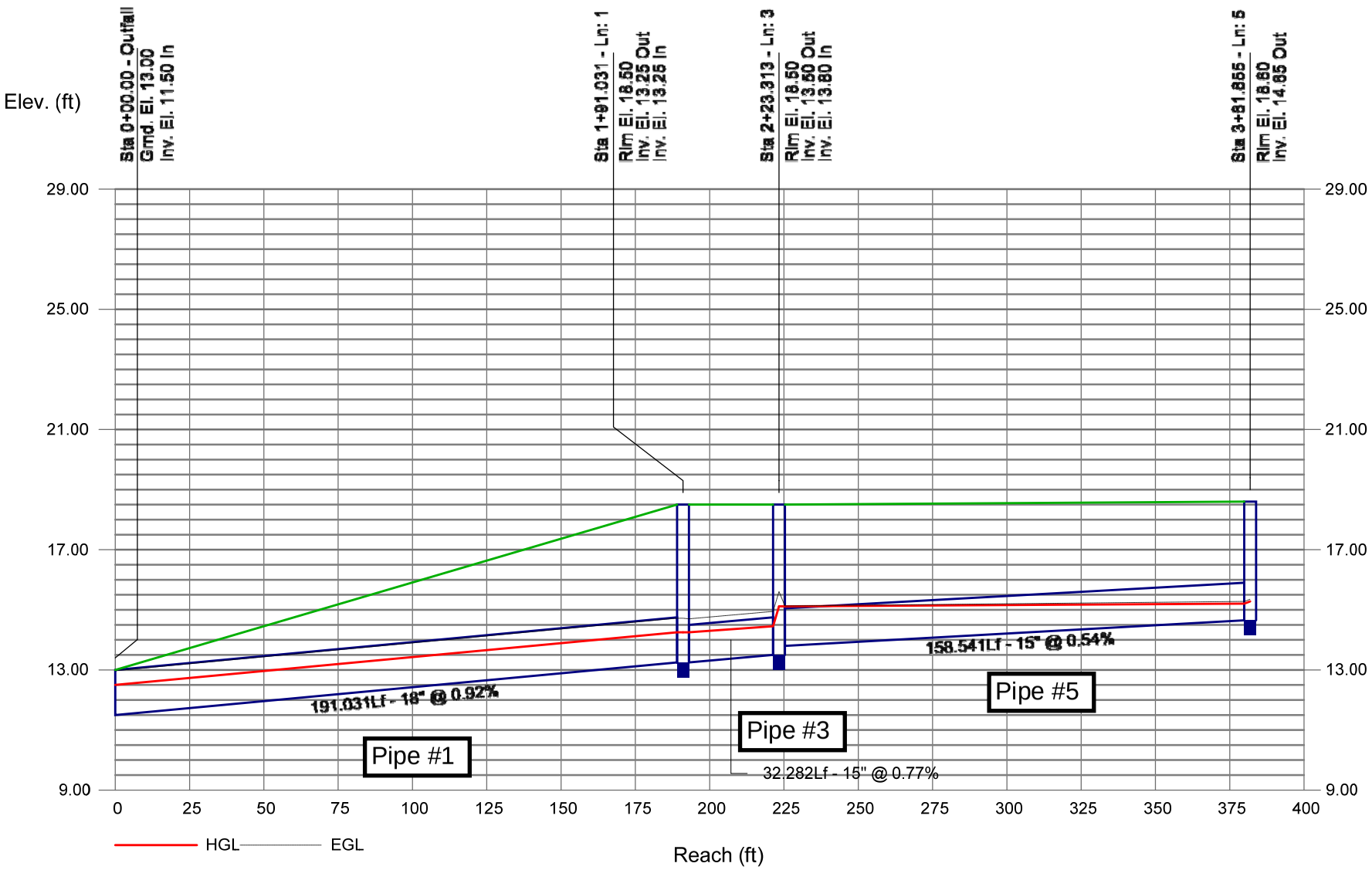
DRA



Project File: DRA.stm	Number of lines: 6	Date: 7/14/2014

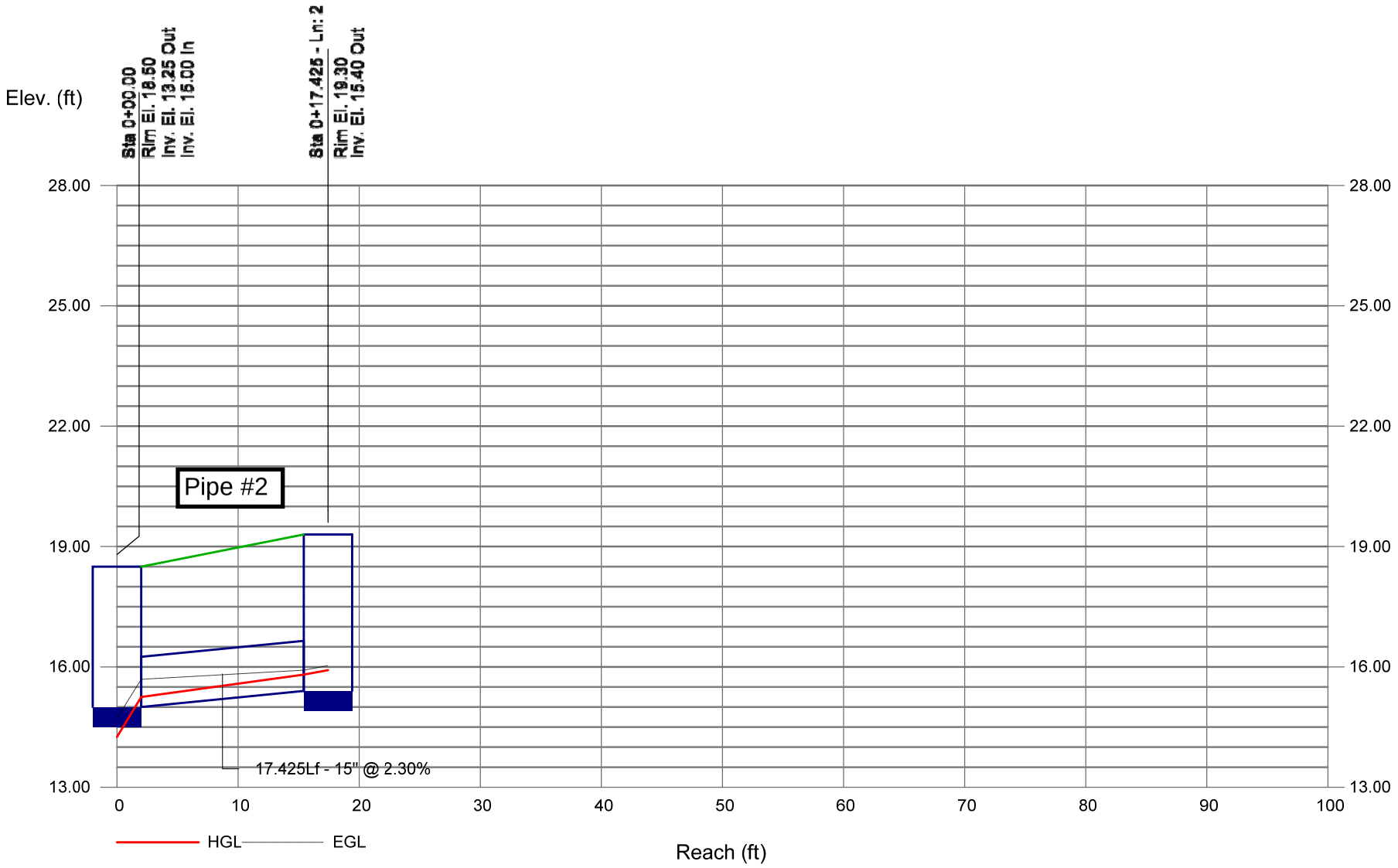
Storm Sewer Profile

Proj. file: DRA.stm



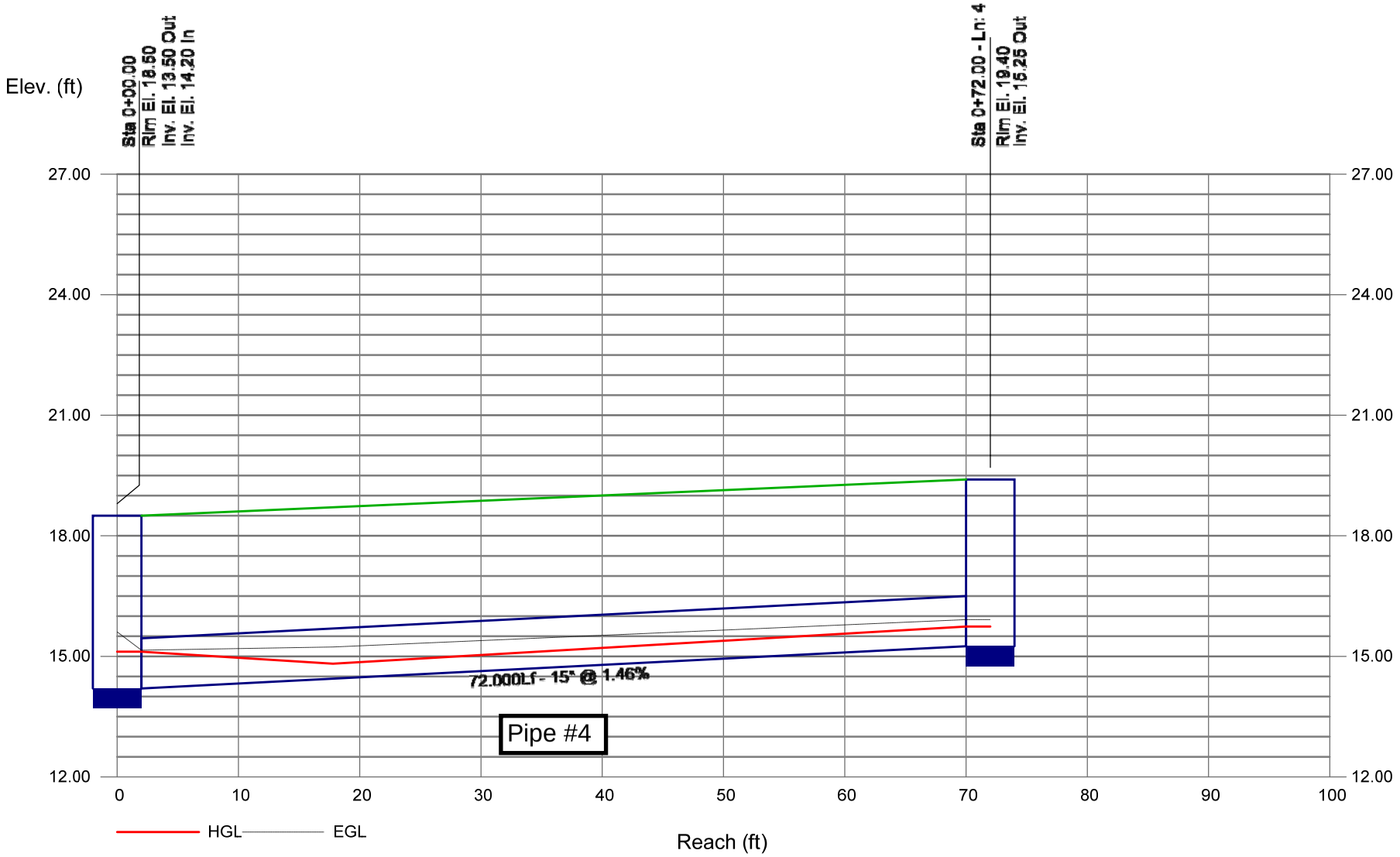
Storm Sewer Profile

Proj. file: DRA.stm



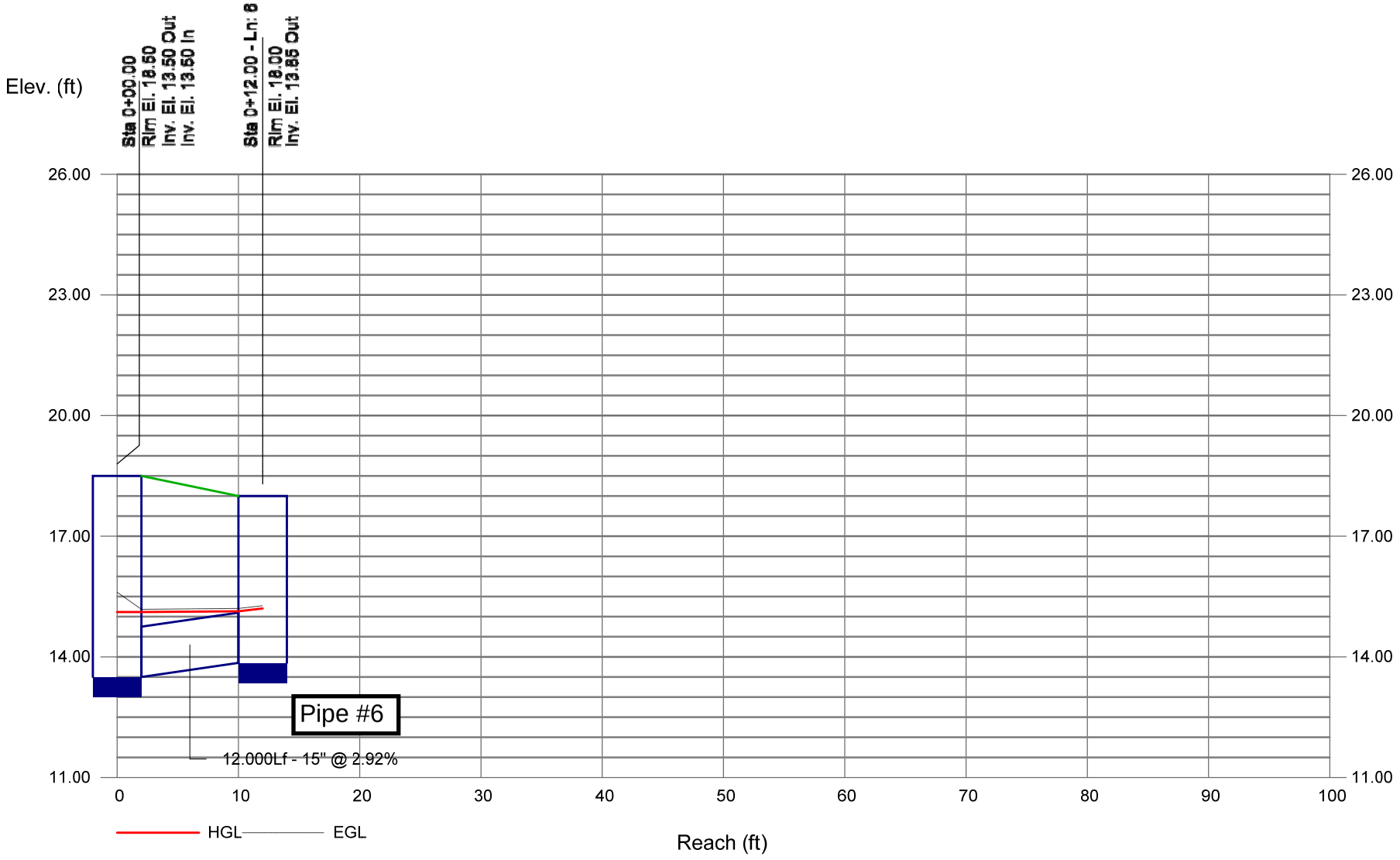
Storm Sewer Profile

Proj. file: DRA.stm



Storm Sewer Profile

Proj. file: DRA.stm



Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	191.031	-50.310	DrGrt	0.00	0.15	0.50	5.0	11.50	0.92	13.25	18	Cir	0.012	1.48	18.50	P-1, Outfall to SD
2	1	17.425	13.769	DrGrt	0.00	0.33	0.43	5.0	15.00	2.30	15.40	15	Cir	0.012	1.00	19.30	P-2, SD2 to SD1
3	1	32.282	-79.979	DrGrt	0.00	0.22	0.65	5.0	13.25	0.77	13.50	15	Cir	0.012	1.34	18.50	P-3, SD3 to SD1
4	3	72.000	57.645	DrGrt	0.00	0.33	0.69	5.0	14.20	1.46	15.25	15	Cir	0.012	1.00	19.40	P-4 - SD4 to SD3
5	3	158.541	-15.834	DrGrt	0.00	0.28	0.62	5.0	13.80	0.54	14.65	15	Cir	0.012	1.00	18.60	P-5, SD5 to SD3
6	3	12.000	-60.796	DrGrt	0.00	0.70	0.61	7.0	13.50	2.92	13.85	15	Cir	0.013	1.00	18.00	P6, SD6 TO SD3

DRA | Number of lines: 6 | Date: 7/14/2014

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	SD1	DropGrate	18.50	Rect	4.00	4.00	18	Cir	13.25	15 15	Cir Cir	15.00 13.25
2	SD2	DropGrate	19.30	Rect	4.00	4.00	15	Cir	15.40			
3	SD3	DropGrate	18.50	Rect	4.00	4.00	15	Cir	13.50	15 15 15	Cir Cir Cir	14.20 13.80 13.50
4	SD4	DropGrate	19.40	Rect	4.00	4.00	15	Cir	15.25			
5	SD5	DropGrate	18.60	Rect	4.00	4.00	15	Cir	14.65			
6	SD-6	DropGrate	18.00	Rect	4.00	4.00	15	Cir	13.85			

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
1	18	6.90	11.50	12.50	1.00	1.26	5.50	0.47	12.97	0.594	191.031	13.25	14.25	1.00**	1.26	5.50	0.47	14.72	0.594	0.594	n/a	1.48	0.70
2	15	0.93	15.00	15.25	0.25*	0.18	5.32	0.44	15.69	2.288	17.425	15.40	15.81	0.41	0.35	2.69	0.11	15.92	0.339	1.314	0.229	1.00	0.11
3	15	5.66	13.25	14.25	1.00	1.05	5.37	0.45	14.70	0.683	32.282	13.50	14.46	0.96**	1.01	5.63	0.49	14.95	0.756	0.719	0.232	1.34	0.66
4	15	1.50	14.20	15.12	0.92	0.96	1.56	0.04	15.15	0.059	72.000	15.25	15.74 j	0.49**	0.45	3.36	0.18	15.92	0.436	0.247	n/a	1.00	0.18
5	15	1.14	13.80	15.12	1.25	1.23	0.93	0.01	15.13	0.027	158.541	14.65	15.21	0.56	0.53	2.17	0.07	15.28	0.161	0.094	0.148	1.00	0.07
6	15	2.58	13.50	15.12	1.25	1.23	2.10	0.07	15.18	0.159	12.000	13.85	15.13	1.25	1.23	2.10	0.07	15.20	0.159	0.159	0.019	1.00	0.07

DRA | Number of lines: 6 | Run Date: 7/14/2014

Notes: * Normal depth assumed.; ** Critical depth.; j-Line contains hyd. jump. ; c = cir e = ellip b = box

Taxiway Swale Analysis

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. Tuesday, Jul 15 2014

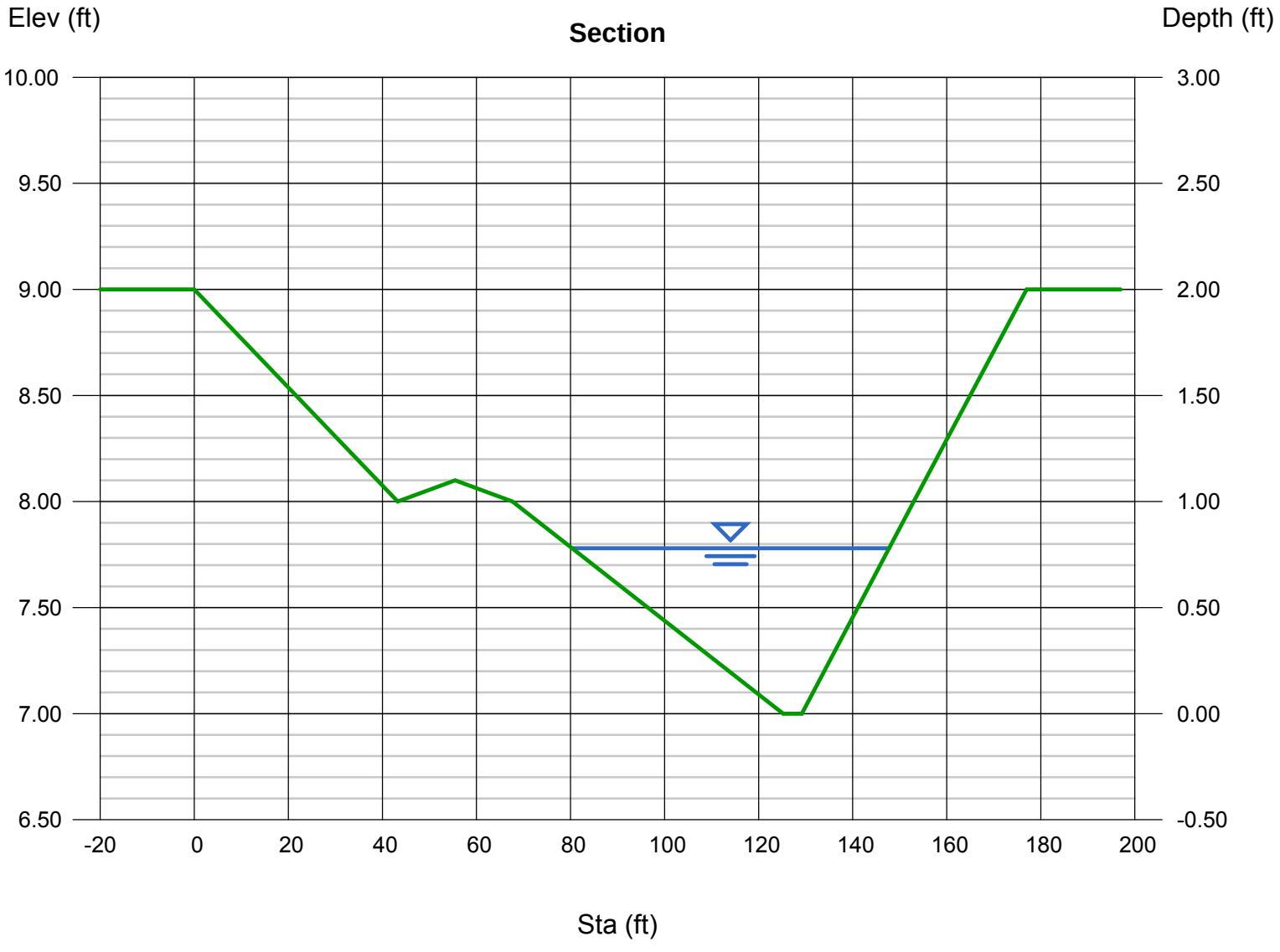
TWT Channel - 10 yr storm, Existing Condition

User-defined	
Invert Elev (ft)	= 7.00
Slope (%)	= 0.40
N-Value	= 0.150

Calculations	
Compute by:	Known Q
Known Q (cfs)	= 9.60

Highlighted	
Depth (ft)	= 0.78
Q (cfs)	= 9.600
Area (sqft)	= 27.84
Velocity (ft/s)	= 0.34
Wetted Perim (ft)	= 67.46
Crit Depth, Yc (ft)	= 0.28
Top Width (ft)	= 67.44
EGL (ft)	= 0.78

(Sta, El, n)-(Sta, El, n)... (-20.00, 9.00, 0.150)-(43.25, 8.00, 0.150)-(55.45, 8.10, 0.150)-(67.66, 8.00, 0.150)-(125.22, 7.00, 0.150)-(129.18, 7.00, 0.150)-(153.00, 8.00, 0.150)-(177.00, 9.00, 0.150)



Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. Monday, Aug 18 2014

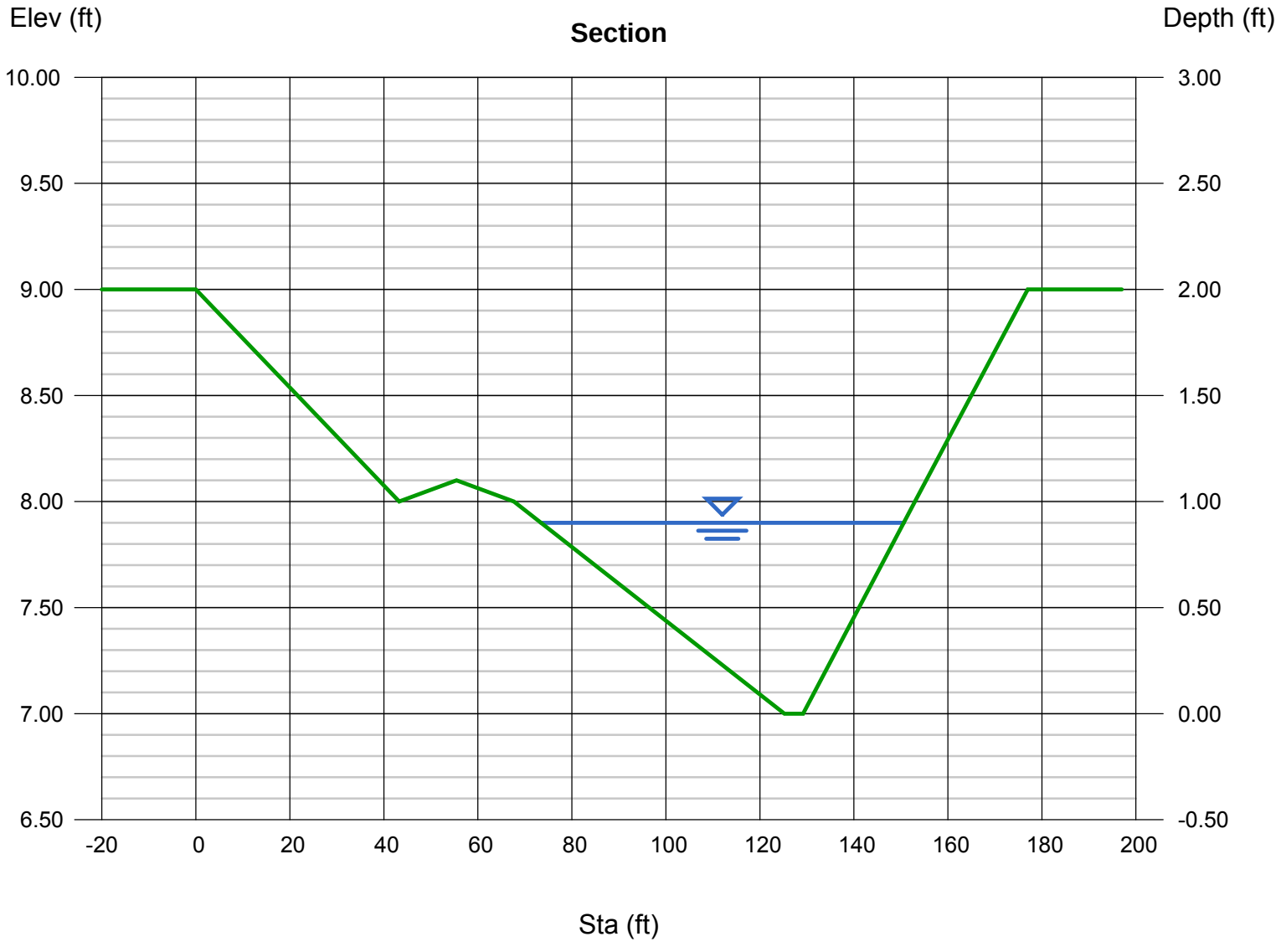
TWT Channel - 10 yr storm, Post-Development Condition

User-defined	
Invert Elev (ft)	= 7.00
Slope (%)	= 0.40
N-Value	= 0.150

Calculations	
Compute by:	Known Q
Known Q (cfs)	= 13.87

Highlighted	
Depth (ft)	= 0.90
Q (cfs)	= 13.87
Area (sqft)	= 36.52
Velocity (ft/s)	= 0.38
Wetted Perim (ft)	= 77.23
Crit Depth, Yc (ft)	= 0.33
Top Width (ft)	= 77.20
EGL (ft)	= 0.90

(Sta, El, n)-(Sta, El, n)... (0.00, 9.00)-(43.25, 8.00, 0.150)-155.45, 8.10, 0.150)-(67.66, 8.00, 0.150)-(125.22, 7.00, 0.150)-(129.18, 7.00, 0.150)-(153.00, 8.00, 0.150)
-(177.00, 9.00, 0.150)



APPENDIX J — MDE APPROVAL OF MAA STANDARD E&S NOTES

MDE
MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard • Baltimore MD 21230
410-537-3000 • 1-800-633-6101

Martin O'Malley, Governor
Anthony G. Brown, Lieutenant Governor

Robert M. Summers, Ph.D., Secretary

March 1, 2013

Mr. John Hurt
BWI Thurgood Marshall Airport
Maryland Aviation Administration
991 Corporate Boulevard
P.O. Box 8766
Baltimore, MD 21240

Dear Mr. Hurt:

The Water Management Administration has reviewed BWI Airport's proposed variations to the Vegetative Stabilization Notes and Standard Erosion and Sediment Control Notes contained within the 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control and the Maryland Erosion and Sediment Control Guidelines for State and Federal Projects respectively. As a result of this review process, the following standard erosion and sediment control notes have been determined acceptable:

- General Notes (16 notes)
- Standard Erosion and Sediment Control Notes (27 notes)
- Vegetative Stabilization Notes (3 sheets including MAA Standard Specification 903, 904, 905, and modified MDE Erosion and Sediment Control Specifications B-4-2, B-4-4, and B-4-5)

These notes may be used on MAA projects as an acceptable substitute for the standard notes found in the 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control and the Maryland Erosion and Sediment Control Guidelines for State and Federal Projects.

Please do not hesitate to contact either James Tracy or myself at 410-537-3563 or amalcolm@mde.state.md.us with any questions or comments.

Sincerely,

Amanda P. Malcolm, P.E.
Regulatory and Compliance Engineer Senior
Sediment and Stormwater Plan Review Division
Water Management Administration

apm
attachments

APPENDIX K –

EROSION AND SEDIMENT CONTROLSUMMARY CALCULATIONS

Appendix K: Erosion and Sediment Control - Summary Calculations

SUB-DA 1.1

Temporary Swale #1 (Type A-1)			
DA =	0.45	[ac]	
CN	91	(Fallow, Type C Soil)	
n	0.025		
Length:	300	[ft]	
Slope:	0.8	%	
Swale Bottom Width	4	[ft]	
Depth:	1	[ft]	Top Width=
Side Slope:	2:1	H:V	8.00
T_c	1.90	[min]	
Q_2=	1.9	[cfs]	
V_2=	1.4	[fps]	OK
Temporary Stone Outlet Structure #1			
DA (<0.5) =	0.45	[ac]	OK
Vol Req. (1,800/ac)	810	[cf]	
Avg. End Area Check:			
Top Weir	7	[ft]	
Inv. 1	5.5	[ft]	
Inv. 2	7	[ft]	
X-Section 1	9	[sf] (Temp Swale)	
X-Section 2	-		
Swale Storage Length	188		
Vol Provided:	843.8		OK
Note: Temporary Earth Dikes Required			

SUB-DA 1.2

Temporary Swale #2 (Type A-1)			
Not Engineered, used Table C.4			
Temporary Stone Outlet Structure #2			
DA (<0.5) =	0.25	[ac]	OK
Slope:	2.0	%	
Vol Req. (1,800/ac)	450	[cf]	
Avg. End Area Check:			
Swale Bottom Width	4	[ft]	
Depth:	2	[ft]	Top Width=
Side Slope:	2:1	H:V	12.00
Top Weir	4	[ft]	
Inv. 1	2	[ft]	
Inv. 2	4	[ft]	
X-Section 1	16	[sf] (Temp Swale)	
X-Section 2	-		
Swale Storage Length	100		
Vol Provided:	800.0		OK
Note: Temporary Earth Dikes Required			
Clean Water Diversion Pipe:			
Refer to attachment for culvert design			
Temporary Swale #2-OFF (Type B-3)			
Not Engineered, used Table C.5			

SUB-DA 1.3

Temporary Swale #3-B (Type A-1) Not Engineered, used Table C.4				
Temporary Gabion Outlet Structure #1				
DA (<1.5) =	0.97	[ac]		OK
Slope:	0.8	%		
Vol Req. (1,800/ac)	1,746	[cf]		
Avg. End Area Check:				
Swale Bottom Width	4.0	[ft]		
Depth:	2	[ft]	Top Width=	
Side Slope:	2:1	H:V	12.00	
Top Weir	6	[ft]		
Inv. 1	4	[ft]		
Inv. 2	6	[ft]		
X-Section 1	16	[sf]	(Temp Swale)	
X-Section 2	-			
Swale Storage Length	250			
Vol Provided:	2,000.0			OK
Note: Temporary Earth Dikes Required				

Temporary Swale #3-A (Type A-1) Not Engineered, used Table C.4				
Temporary Gabion Outlet Structure #2				
DA (<1.5) =	0.46	[ac]		OK
Slope:	0.8	%		
Vol Req. (1,800/ac)	828	[cf]		
Avg. End Area Check:				
Swale Bottom Width	4.0	[ft]		
Depth:	2	[ft]	Top Width=	
Side Slope:	2:1	H:V	12.00	
Top Weir	9.5	[ft]		
Inv. 1	7.5	[ft]		
Inv. 2	9.5	[ft]		
X-Section 1	16	[sf]	(Temp Swale)	
X-Section 2	-			
Swale Storage Length	250			
Vol Provided:	2,000.0			OK
Note: Temporary Earth Dikes Required				

Airfield Access Road Stub Culvert Replacement

Temporary Stone Outlet Structure #3				
DA (<0.5) =	0.05	[ac]		OK
Slope:	0.3	%		
Vol Req. (1,800/ac)	90	[cf]		
Avg. End Area Check:				
Swale Bottom Width	4.0	[ft]		
Depth:	2	[ft]	Top Width=	
Side Slope:	2:1	H:V		12.00
Top Weir	6	[ft]		
Inv. 1	4	[ft]		
Inv. 2	6	[ft]		
X-Section 1	16	[sf]	(Temp Swale)	
X-Section 2	-			
Swale Storage Length	100			
Vol Provided:	800.0			OK

SUB-DA 1.4

Temporary Swale #4 (Type A-1)				
Not Engineered, used Table C.4				
Temporary Stone Outlet Structure #4				
DA (<0.5) =	0.44	[ac]		OK
Slope:	1.5	%		
Vol Req. (1,800/ac)	800	[cf]		
Avg. End Area Check:				
Swale Bottom Width	4.0	[ft]		
Depth:	2	[ft]	Top Width=	
Side Slope:	2:1	H:V		12.00
Top Weir	12.5	[ft]		
Inv. 1	10.5	[ft]		
Inv. 2	12.5	[ft]		
X-Section 1	16	[sf]	(Temp Swale)	
X-Section 2	-			
Swale Storage Length	133			
Vol Provided:	1,066.7			OK
Note: Temporary Earth Dikes Required				

SUB-DA 2.1/2.2/2.3

Temporary Swale #5 (Type A-1)				
Not Engineered, used Table C.4				
Temporary Riprap Inflow Protection				
DA (<0.5) =	0.32	[ac]		OK
Slope:	2.5	%		
Vol Req. (1,800/ac)	576	[cf]		
Avg. End Area Check:				
Swale Bottom Width	4.0	[ft]		
Depth:	2	[ft]	Top Width=	
Side Slope:	2:1	H:V	12.00	
Top Weir	19.5	[ft]		
Inv. 1	17.5	[ft]		
Inv. 2	19.5	[ft]		
X-Section 1	16	[sf]	(Temp Swale)	
X-Section 2	-			
Swale Storage Length	80			
Vol Provided:	640.0			OK
Note: Temporary Earth Dikes Required				

Stone Riprap Outlet Sediment Trap (ST-II) #1				
DA (<10) =	1.20	[ac]		OK
Table G.3 (1.5 acs)	*Req'd.*		*Provided*	
Total Vol	5400	[cf]	**7797**	OK
Wet Vol	2700	[cf]	**4481**	OK
Dry Vol	2700	[cf]	**3316**	OK
Bot Length	57	[ft]	98	OK
Bot Width	28.5	[ft]	29	OK
Wet Depth	N/A	[ft]	1.5	
Crest Depth	1	[ft]	1.0	OK
Slope (x:1)	2	[ft]	2	OK
Bot Area	N/A	[sq. ft]	2793	
Wet Area	N/A	[sq. ft]	3182	
Crest Area	N/A	[sq. ft]	3451	
Wier Length (4xDA)	6	[ft]	6	OK
Cleanout Depth	N/A	[ft]	**0.5**	
Cleanout Area	N/A	[ft]	2921	
Cleanout Vol	1781	[cf]	**1428**	OK

SUB-DA 2.4

Temporary Swale #6 (Type A-1)			
Not Engineered, used Table C.4			
Temporary Stone Outlet Structure #5			
DA (<0.5) =	0.28	[ac]	OK
Slope:	2.5	%	
Vol Req. (1,800/ac)	504	[cf]	
Avg. End Area Check:			
Swale Bottom Width	4.0	[ft]	
Depth:	2	[ft]	Top Width=
Side Slope:	2:1	H:V	12.00
Top Weir	16.5	[ft]	
Inv. 1	14.5	[ft]	
Inv. 2	16.5	[ft]	
X-Section 1	16	[sf]	(Temp Swale)
X-Section 2	-		
Swale Storage Length	85		
Vol Provided:	680.0		OK
Note: Temporary Earth Dikes Required			