CERTIFICATE OF AUTHENTICITY

THIS IS TO CERTIFY THAT THE FOLLOWING ELECTRONIC RECORDS ARE TRUE AND ACCURATE REPRODUCTIONS OF THE ORIGINAL RECORDS OF JAMES CITY COUNTY GENERAL SERVICES DEPARTMENT- STORMWATER DIVISION; WERE SCANNED IN THE REGULAR COURSE OF BUSINESS PURSUANT TO GUIDELINES ESTABLISHED BY THE LIBRARY OF VIRGINIA AND ARCHIVES; AND HAVE BEEN VERIFIED IN THE CUSTODY OF THE INDIVIDUAL LISTED BELOW.

BMP NUMBER: **WC099**

DATE VERIFIED: **November 15, 2012**

QUALITY ASSURANCE TECHNICIAN: **Leah Hardenbergh**

Leah Hardenbergh

LOCATION: WILLIAMSBURG, VIRGINIA

Stormwater Division

MEMORANDUM

Date: April 5, 2012

To: Michael J. Gillis, Virginia Correctional Enterprises Document Management Services

From: Leah Hardenbergh

PO: 110426

Re: Files Approved for Scanning

General File ID or BMP ID: **WC099 & WC100**

PIN: **0440100016**

Owner Name (if known): **AMERICAN DYNC**

Legal Property Description:

Site Address: **Stuckeys Redevelopment**

(For internal use only):

Box # 2

Agreements (in file as of scan date): Y Book or Doc #: 090010755/080007215

Contents for Stormwater Management Facilities As-built Files

Each file is to contain:

1. As-built plan
2. Completed construction certification
3. Construction Plan
4. Design Calculations
5. Watershed Map in calc. end
6. Maintenance Agreement
7. Correspondence with owners
8. Inspection Records
9. Enforcement Actions

COPY

Return to:
JCC Attorney's Office
101-C Mount's Bay Road
Williamsburg, VA 23185
(757) 253-6612

COUNTY OF JAMES CITY, VIRGINIA

DECLARATION OF COVENANTS
INSPECTION/MAINTENANCE OF DRAINAGE SYSTEM

Please type or print legibly in black ink. Covenantor(s) should submit this form to the JCC Environmental Division, 101-E Mounts Bay Road, Williamsburg, VA 23185.

THIS DECLARATION OF COVENANTS, made this 6TH day of APRIL, 20 09, between AMERICAN DYNC HOLDINGS TOANO, LLC, and all successors in interest, ("COVENANTOR(S)"), owner(s) of the following property:

Parcel Identification Number: 0440100016
Legal Description: 6.27100 ACRES PT BIRD HILL FARM PARCEL A
Project or Subdivision Name: SITE DEVELOPMENT PLAN FORMER STUCKEY'S SITE*
Document/Instrument No. 080007215 or Deed Book _____, Page No. _____, and the County of James City, Virginia ("COUNTY.")

*9220 OLD STAGE RAOD

WITNESSETH:

I (We), the COVENANTOR(S), with full authority to execute deeds, mortgages, other covenants, and all rights, titles and interests in the property described above, do hereby covenant with the COUNTY as follows:

1. The COVENANTOR(S) shall provide maintenance for the drainage system including any runoff control facilities, conveyance systems and associated easements, hereinafter referred to as the "SYSTEM," located on and serving the above-described property to ensure that the SYSTEM is and remains in proper working condition in accordance with approved design standards, and with the law and applicable executive regulations. The SYSTEM shall not include any elements located within any Virginia Department of Transportation rights-of-way.

2. If necessary, the COVENANTOR(S) shall levy regular or special assessments against all present or subsequent owners of property served by the SYSTEM to ensure that the SYSTEM is properly maintained.

3. The COVENANTOR(S) shall provide and maintain perpetual access from public right-of-ways to the SYSTEM for the COUNTY, its agent and its contractor.

4. The COVENANTOR(S) shall grant the COUNTY, its agent and its contractor a right of entry to the SYSTEM for the purpose of inspecting, monitoring, operating, installing, constructing, reconstructing, maintaining or repairing the SYSTEM.

5. If, after reasonable notice by the COUNTY, the COVENANTOR(S) shall fail to maintain the SYSTEM in accordance with the approved design standards and with the law and applicable executive regulations, the COUNTY may perform all necessary repair or maintenance work, and the COUNTY may assess the COVENANTOR(S) and/or all property served by the SYSTEM for the cost of the work and any applicable penalties.

6. The COVENANTOR(S) shall indemnify and save the COUNTY harmless from any and all claims for damages to persons or property arising from the installation, construction, maintenance, repair, operation or use of the SYSTEM.

Instrument # 090010755
Recorded on April 16, 2009

7. The COVENANTOR(s) shall promptly notify the COUNTY when the COVENANTOR(S) legally transfers any of the COVENANTOR(S) responsibilities for the SYSTEM. The COVENANTOR(S) shall supply the COUNTY with a copy of any document of transfer, executed by both parties.

8. The covenants contained herein shall run with the land and shall bind the COVENANTOR(S) and the COVENANTOR(S)' heirs, executors, administrators, successors and assignees, and shall bind all present and subsequent owners of property served by the SYSTEM.

9. This COVENANT shall be recorded in the County Land Records.

IN WITNESS WHEREOF, the COVENANTOR(S) has executed this DECLARATION OF COVENANTS as of the date first above written.

COVENANTOR(S)
AMERICAN DYNC HOLDINGS TOANOA, LLC

Signature

DANNY PATEL, MEMBER
Print Name and Title

ACKNOWLEDGMENT

COMMONWEALTH OF VIRGINIA
~~CITY~~/COUNTY OF Prince George, to wit:

I hereby certify that on this 10th day of April, 20 09, before the subscribed, a Notary Public for the Commonwealth of Virginia, personally appeared Danny Patel and did acknowledge the foregoing instrument to be his/her Act.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal this 10th day of April, 20 09.

[SEAL]

Notary Public

Notary Registration Number: 357571
My Commission expires: 2-28-2013

Approved as to form:

Asst. ~~County~~ Attorney

This Declaration of Covenants prepared by:

Signature: Print Name and Title: JENIFER TEDDER, ADMIN. ASSIST

Address: 12224 WILFONG COURT, MIDLOTHIAN, VA 23112

Phone Number: 804-595-1762

Drainage1_pre_doc
(Revised 9-5-08)

WC099

James City County, Virginia
Stormwater Division

Stormwater Facilities - BMP and Conveyance Systems
Record Drawing and Construction Certification Forms

Note: In accordance with the requirements of the Chesapeake Bay Preservation Ordinance, Chapter 23, Section 23-10(4), BMPs shall be designed and constructed in accordance with the manual entitled* James City County Guidelines for Design and Construction of Stormwater Management BMPs. *The Subdivision Ordinance, Chapter 19-62, the Zoning Ordinance, Chapter 24-159, and approved construction plans generally require that at the completion of the project and prior to release of surety, an "as-built" plan prepared by a registered Professional Engineer or Certified Land Surveyor must be provided for the drainage system for the project including any Best Management Practice (BMP) facilities. In addition, for BMP facilities, written construction certification is required by a Professional Engineer who inspected the structure during its construction. Currently there are over 20 water quality type BMPs accepted by the County.

Section 1 - Site Information:

Project Name: FORMER STUCKEY'S SITE - 9220 OLD STAGE ROAD

Structure/BMP Name: PROP. BMP 'C'

Project Location: 9220 OLD STAGE ROAD (STONEHOUSE MAGISTERIAL DISTRICT)

BMP Location: NORTH END OF SITE - ALONG RAMP "D" OF I-64

County Plan No.: SP - 0021 - 2009

Project Type:
- ☐ Residential
- ☐ Business
- ☑ Commercial
- ☐ Office
- ☐ Institutional
- ☐ Industrial
- ☐ Public
- ☐ Roadway
- ☐ Other _____

Tax Map/Parcel No.: 04401 00016

BMP ID Code (If known): _____

Zoning District: B1 GENERAL BUSINESS

Land Use: _____

Site Area (sf or acres): 6.77 ACRES

Brief Description of Stormwater Management/BMP Facility: WET BMP LYING ON THE NORTH END OF THE SITE

Nearest Visible Landmark to SWM/BMP Facility: NEW CONVENIENCE STORE

Nearest Vertical Ground Control (if known):

☐ JCC Geodetic Ground Control ☐ USGS ☐ Temporary ☐ Arbitrary ☒ Other

Station Number or Name: ON-SITE HORIZONTAL AND VERTICAL CONTROL

Datum or Reference Elevation: NAD83 (VA SOUTH ZONE) - HORIZONTAL NGVD29 - VERTICAL

Control Description: REBARS DRIVEN FLUSH W/ JSPC CONTROL CAPS

Control Location from Subject Facility: SOUTH AND WEST OF BMP 'C'

Section 2 - Stormwater Management / BMP Facility Construction Information:

Preconstruction Meeting Held for Construction of SWM/BMP Facility: ☑ Yes ☐ No ☐ Unknown

Approx. Construction Start Date for SWM/BMP Facility: JULY 2009 +/-

Facility Monitored by County Representative during Construction: ☐ Yes ☐ No ☑ Unknown

Name of Site Work Contractor Who Constructed Facility: G.L. PRUETT, INC.

Name of Professional Firm Who Routinely Monitored Construction: _____

Date of Completion for SWM/BMP Facility: AUGUST 2009 +/-

Date of Record Drawing/Construction Certification Submittal: 4/28/09

(Note: Record Drawing and Construction Certifications are required within thirty (30) days of the completion of construction of a Stormwater Facility – BMP or Conveyance system. Record Drawings and Construction Certifications must be reviewed and approved by the James City County Stormwater Division prior to final inspection, acceptance and surety release.)

Section 3 - Owner / Designer / Contractor Information:

Owner/Developer: *(Note: Site Owner or Applicant responsible for development of the project.)*
Name: AMERICAN DYNE HOLDINGS OF TOANO, LLC
Mailing Address: 12224 WILFONG CT., MIDLOTHIAN, VA 23112
Business Phone: (804) 595-1762 Fax: (804) 595-1762
Contact Person: RICK LaMERE Title: _____

Design Professional: *(Note: Professional Engineer or Certified Land Surveyor responsible for the design and preparation of plans and specifications for the Stormwater facilities.)*
Firm Name: LANDMARK DESIGN GROUP
Mailing Address: 4029 IRONBOUND ROAD, SUITE 100, WILLIAMSBURG, VA 23188
Business Phone: (757) 253-2975 Fax: (757) 229-0049
Responsible Plan Preparer: STEPHEN A. ROMEO
Title: LAND SURVEYOR B
Plan Name: SITE DEVELOPMENT PLAN - FORMER STUCKEY'S SITE - 9220 OLD STAGE ROAD
Firm's Project No. 2004224-000.00 Plan Date: 4/28/09
Sheet No. Applicable to SWM/BMP Facility: C-4 / C-6 / D-2 / ____ / ____

Stormwater Facility Contractor: *(Note: Site Work Contractor directly responsible for construction of the Stormwater facilities.)*
Name: G.L. PRUETT, INC.
Mailing Address: 10996 RICHARDSON RD., ASHLAND, VA 23005
Business Phone: (804) 798-3584 Fax: (804) 798-3596
Contact Person: GREG JONES
Site Foreman/Supervisor: DAVID PRUETT
Specialty Subcontractors & Purpose (for BMP Construction Only): _____

Section 4 - Professional Certifications

Certifying Professionals: *A Registered Professional Engineer or Certified Land Surveyor is responsible for preparation of a Record Drawing, sometimes referred to as an As-Built plan, for the stormwater facilities for the project including all BMP and conveyance systems. A Registered Professional Engineer is responsible for the inspection, monitoring and certification of all stormwater facilities – BMP and conveyance systems during their construction.*

Record Drawing and Construction Certifications for Stormwater Facilities - BMP and Conveyance Systems

Record Drawing Certification

Firm Name: JENNING STEPHENSON, P.C.
Mailing Address: 10160 STAPLES MILL ROAD
GLEN ALLEN, VA 23060
Business Phone: (804) 545-6235
Fax: (804) 545-6259

Name: H. TROY STEPHENSON
Title: LAND SURVEYOR B
Signature: H. T. St
Date: 12/28/09

I hereby certify to the best of my knowledge and belief that this record drawing represents the actual condition of the Stormwater Facilities. The facilities appear to conform to the provisions of the approved construction plans and specifications except as specifically noted.

COMMONWEALTH OF VIRGINIA
12/28/09
H TROY STEPHENSON
NO. 1522-B
H. T. St
LAND SURVEYOR

(Seal)
Virginia Registered Professional Engineer or Certified Land Surveyor

Construction Certification

Firm Name: GET SOLUTIONS, INC.
Mailing Address: 1592 E Penniman Rd
Williamsburg, VA 23185
Business Phone: 757-564-6452
Fax: 757-564-6453

Name: CAMILLE A. KATTAN, PE
Title: PRINCIPAL ENGINEER
Signature: Camille A. Kattan
Date: 2/19/10

I hereby certify to the best of my knowledge and belief that these Stormwater Facilities were monitored and constructed in accordance with the provisions of the approved construction plans and specifications except as specifically noted.

COMMONWEALTH OF VIRGINIA
CAMILLE A. KATTAN
Lic. No. 018045
2/19/10
PROFESSIONAL ENGINEER

(Seal)
Virginia Registered Professional Engineer

STAR EXPRESS

INTERSTATE 64
RAMP "D"

PROPERTY LINE

N88°30'09"E

WC099

PIPE INVERT
(UNDER WATER)
104.8'±

WATER SURFACE
ELEVATION
108.9'
(11/19/09)

RIP-RAP
ELEV.=
111.8'

RIP-RAP
ELEV.=
112.4'

RIP-RAP
ELEV.=
106.8'

RIP-RAP

RIP-RAP
ELEV.=
111.9'

RIP-RAP
ELEV.=
110.9'

RIP-RAP
ELEV.=
106.0'

STORM
MANHOLE
TOP=114.07'
FLOOR=107.05'
(PIPES UNDER
WATER)

15" RCP

INV.=107.90'

CURB
(SHOWN FOR GRAPHIC
PURPOSES ONLY)

STORM INLET
TOP=113.20'

INV.=107.95'
15" RCP

INV.=108.25'

3.3' X 3.0'
GRATE INLET
TOP=112.80'

NAD83
(VA SOUTH ZONE)

ONE STORY
STORE
(SHOWN FOR GRAPHIC
PURPOSES ONLY)

WC100

ELEV.
114.7'

ELEV.
114.0'

EDGE OF
MULCH

INV.=110.65'

ELEV.
114.2'

INV.=
110.51'

INV.=110.57'

ELEV.
114.4'

ELEVATED
3.0' X 3.5'
GRATE INLET
TOP(E)=116.03'
TOP(W)=115.08'

INV.=
110.46'

INV.=110.64'
15" RCP

INV.=110.66'

CURB
(SHOWN FOR GRAPHIC
PURPOSES ONLY)

ELEV.
114.2'

ELEV.
114.7'

GROUND
ELEV. @
GRATE INLET
114.3'

STORM MH
TOP=116.04'

INV.=
111.54'

15" RCP

CONCRETE PUMP ISLAND
(SHOWN FOR GRAPHIC
PURPOSES ONLY)

INV.=111.74'

8" PVC

INV.=110.15'

WC101

STORM MH
TOP=116.58'
FLOOR=108.8'

INV.=113.71'

8" PVC
INV.=113.73'

TOP=116.87'
INV.=116.27'

TRENCH DRAIN

TOP=116.60'
INV.=114.58'

TOP=116.62'
INV.=116.07'

COMMONWEALTH OF VIRGINIA
12/21/09
H. TROY STEPHENSON
NO. 1522-B
LAND SURVEYOR

GRAPHIC SCALE
30 0 15 30
(IN FEET)
1 inch = 30 ft.

NOTE

THE STORM SEWER IMPROVEMENTS SHOWN HEREON ARE FROM AN ACTUAL FIELD SURVEY DONE ON DECEMBER 18, 2009.

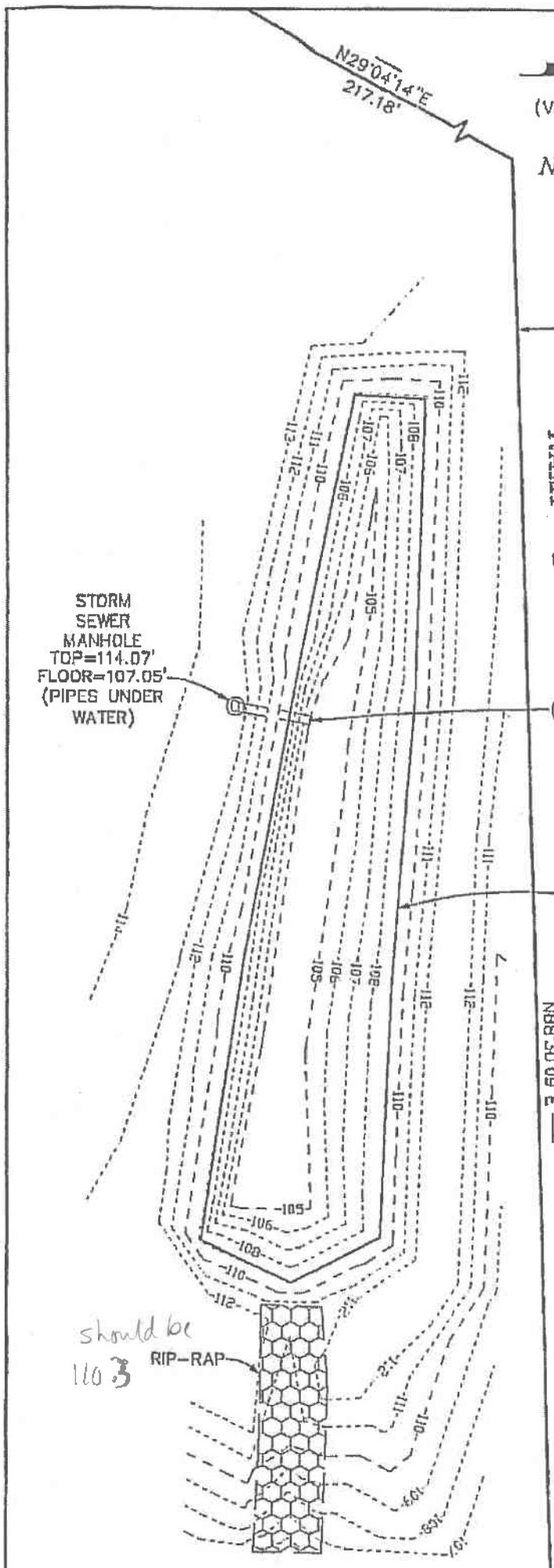
PLAT SHOWING AN AS-BUILT SURVEY OF THE STORM SEWER ON THE STUCKEY'S SITE AT 9220 OLD STAGE ROAD

STONEHOUSE DISTRICT
JAMES CITY COUNTY, VIRGINIA

JENNING STEPHENSON, P.C.
LAND SURVEYORS & PLANNERS
10160 STAPLES MILL ROAD
GLEN ALLEN, VA 23060
PHONE (804) 545-6235
FAX (804) 545-6239

DATE: DEC. 21, 2009	SCALE: 1" = 30'
	J.N.: 09-520
DRAWN BY: HTS	CHECK BY: HTS

tstephenson@jspc-va.com



PLAT SHOWING AN AS-BUILT SURVEY OF BMP C ON THE STUCKEY'S SITE AT 9220 OLD STAGE ROAD

STONEHOUSE DISTRICT
JAMES CITY COUNTY, VIRGINIA

JENNING STEPHENSON, P.C.
LAND SURVEYORS & PLANNERS
10160 STAPLES MILL ROAD
GLEN ALLEN, VA 23060
PHONE (804) 545-6235
FAX (804) 545-6239

DATE: NOV. 19, 2009	SCALE: 1" = 25'
	J.N.: 09-520
DRAWN BY: HTS	CHECK BY: HTS

WC099

INTERSTATE 64
RAMP "D"

PROPERTY LINE

N88°30'09"E

WC099

PIPE INVERT
(UNDER WATER)
104.8'±

WATER SURFACE
ELEVATION
108.9'
(11/19/09)

RIP-RAP

112.48

STORM
MANHOLE
TOP=114.07'
FLOOR=107.05'
(PIPES UNDER
WATER)

107.0

15" RCP

INV.=107.90'

108.12
107.95

CURB
(SHOWN FOR GRAPHIC
PURPOSES ONLY)

STORM INLET
TOP=113.20'

INV.=107.95'
15" RCP

108.33
INV.=108.25'

3.3' X 3.0'
GRATE INLET
TOP=112.80'

112.83

NAD83
(VA SOUTH ZONE)

ONE STORY
STORE
(SHOWN FOR GRAPHIC
PURPOSES ONLY)

WC100

ELEV.
114.7'

ELEV.
114.0'

EDGE OF
MULCH

110.75

INV.=110.65'

114.67

ELEV.
114.2'

INV.=
110.51'

INV.=110.57'

ELEV.
114.4'

110.6

ELEVATED
3.0' X 3.5'
GRATE INLET
TOP(E)=116.03'
TOP(W)=115.08'

INV.=
110.46'

15" RCP

110.58

115.17

INV.=110.64'

15" RCP

INV.=110.66'

110.8

ELEV.
114.2'

ELEV.
114.7'

GROUND
ELEV. @
GRATE INLET
114.3'

CURB
(SHOWN FOR GRAPHIC
PURPOSES ONLY)

STORM MH
TOP=116.04'

INV.=
111.54'

116.10

STONE
Diaphragm

CONCRETE PUMP ISLAND
(SHOWN FOR GRAPHIC
PURPOSES ONLY)

INV.=111.74'

111.60

8" PVC

INV.=113.71'

STORM MH
TOP=116.58'
FLOOR=108.8'

116.61
113.78

WC101

8" PVC
INV.=113.73'

TOP=116.87'
INV.=116.27'

TRENCH DRAIN

TOP=116.60'
INV.=114.58'

.50

TOP=116.62'
INV.=116.07'

110.20

15" RCP
INV.=110.15'

COMMONWEALTH OF VIRGINIA
12/18/09
H. TROY STEPHENSON
NO. 1522-B
LAND SURVEYOR

GRAPHIC SCALE
30 0 15 30
(IN FEET)
1 inch = 30 ft.

PLAT SHOWING AN AS-BUILT SURVEY OF THE STORM SEWER ON THE STUCKEY'S SITE AT 9220 OLD STAGE ROAD

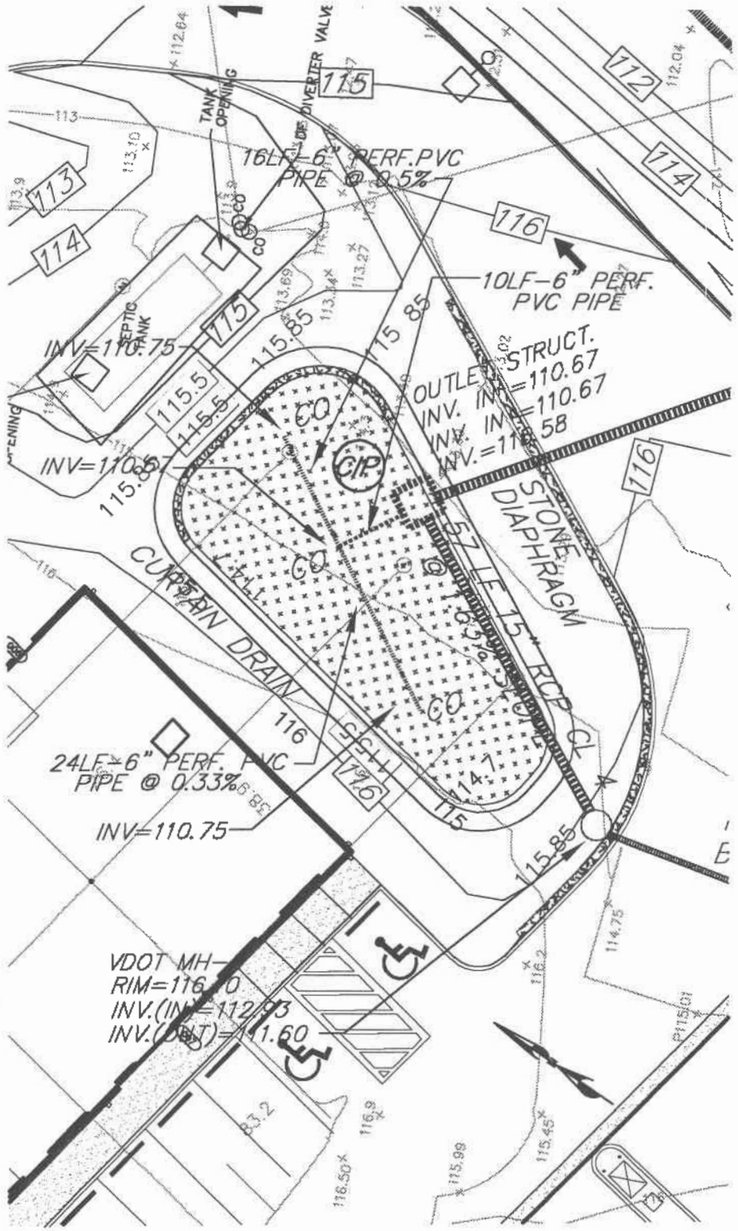
STONEHOUSE DISTRICT
JAMES CITY COUNTY, VIRGINIA

NOTE

THE STORM SEWER IMPROVEMENTS SHOWN HEREON ARE FROM AN ACTUAL FIELD SURVEY DONE ON DECEMBER 18, 2009.

JENNING STEPHENSON, P.C.
LAND SURVEYORS & PLANNERS
10160 STAPLES MILL ROAD
GLEN ALLEN, VA 23060
PHONE (804) 545-6235
FAX (804) 545-6239

DATE: DEC. 18, 2009	SCALE: 1" = 30'
	J.N.: 09-528
DRAWN BY: HTS	CHECK BY: HTS



WC100

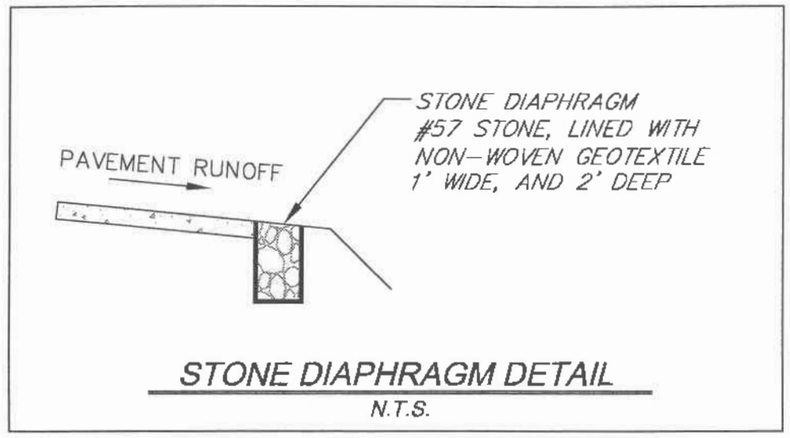
BIORETENTION BASIN PLAN

SCALE: 1"=20'

NOTES:

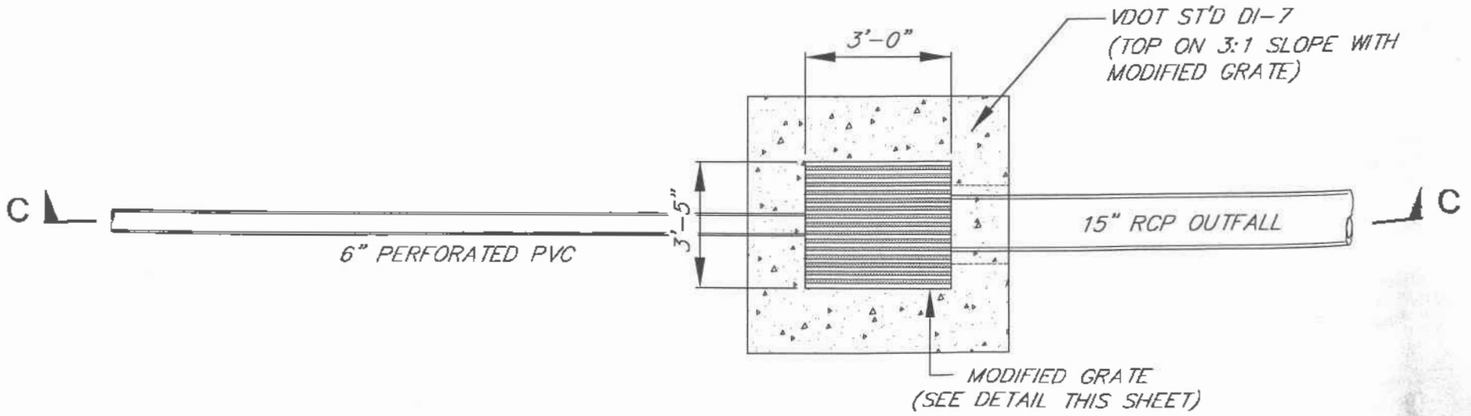
1) CONSTRUCTION AND MATERIALS SHALL BE IN ACCORDANCE WITH MIN. STD. & SPEC. 3.05 & 3.11 OF THE VSMH AND THE JAMES CITY COUNTY GUIDELINES FOR DESIGN AND CONSTRUCTION OF STORMWATER MANAGEMENT BMPS (LATEST EDITION).

2) SOIL MIXTURE SHALL BE TESTED AND CERTIFIED BY A GEOTECHNICAL ENGINEER.



STONE DIAPHRAGM DETAIL

N.T.S.



3"x3"x3/8" ANGLE FRAME

1/2"ø REBAR @ 2" O.C.

WELD TO FRAME

MAINTAINED BETWEEN TWO UTILITY LINES.

CONSTRUCTION ZONE"
POTENTIAL DRAINFIELD AREA.
CONTRACTOR TO FENCE OFF PRIOR TO CONSTRUCTION.

STAR EXPRESS (STUCKEYS REDEV)
WC099
RESERVE DRAINFIELD WC100
PER AUGUST, 1994 VDH WC101
DETERMINATION

VDOT CLASS I RIPRAP
La=26'
D50=1.1'
DEPTH=2'
W=9'
AREA=3 SY

EXISTING SEPTIC DRAINFIELDS

PARCEL "A"
TAX PARCEL 040100016
6.2715 AC.
ZONED B1
PLAT DOC.#070035345

JCC BMP C4
LIMIT OF CONSTRUCTION

OUTLET ELEVATION 110.30
5' WIDTH (SEE DETAIL)

VDOT MH-2
RIM=112.48
INV.(IN)=107.00
INV.(OUT)=105.06

HRPDC RS CURB INLET
RIM =113.20
INV. (IN)=108.12
INV. (OUT)=107.95

DO NOT DISTURB AREA EXTENDING EAST FROM EXISTING SEPTIC BOXES

HRPDC RS YARD DRAIN
TG EL =112.83
INV.=108.33

OUTLET STRUCTURE
INV. IN=110.67
INV. IN=110.67
INV.=110.58

S16°57'16"E

EXISTING DRAINAGE CHANNEL

RAMP "D"

PROP. BMP C

HA/INF-2

GRADE TO DRAIN

TC114.50
EP114.00

40 LF-15" RCP
@0.50% SLOPE

EW-1
105.00

80 LF 15" RCP
@ 1.19% SLOPE

TC113.33
EP112.83

HA/INF-3

GRADE TO DRAIN

108 LF 15" RCP CL 4
@ 0.33% SLOPE

12 LF-18" RCP CL 4
@ 0.50% SLOPE

TC115.85
EP115.85

VDOT ES-1 15"
INV.=110.20

7" THICK 12'x36' CONCRETE PA
SHALL BE PLACED ON TOP OF
10'x34' 20K GAL. COMPARTMEN
UNDERGROUND FUEL TANKS

30 LF 8" PVC SCH. 40
@ 4.25% SLOPE

TC116.82
EP116.32

TC113.70
EP113.20

TC112.81
EP112.81

JCC BMP D1*

CURTAIN DRAIN

STONE DIAPHRAGM

45 LF-15" RCP
@ 2.00% SLOPE

116.23

116.21

116.68

HA/INF-1

VDOT MH-2
RIM=116.20
INV.(IN)=112.93
INV.(OUT)=111.60

30 LF-8" PVC SCH.40
@2.4% SLOPE

TC112.92
EP112.92

TC114.12
EP113.62

TC115.24
EP114.74

116.80

JCC BMP 01*

F.F.=117.00

TC116.90
EP116.40

TC116.90
EP116.40

TC116.90
EP116.40

TC116.95
EP116.45

TC116.30
EP115.80

TC116.20
EP115.70

TC115.39
EP114.89

TC114.94
EP114.44

TC115.80
EP115.30

TC116.70
EP116.20

TC115.24
EP114.74

TC114.12
EP113.62

TC112.92
EP112.92

TC113.70
EP113.20

TC112.81
EP112.81

TC116.80

TC116.77
EP116.27

TC116.85
EP116.35

116.90

116.80

1.0%

CURTAIN DRAIN

STONE DIAPHRAGM

45 LF 15" RCP @ 2.01% SLOPE

VDOT MH-2
RIM=116.20
INV.(IN)=112.93
INV.(OUT)=111.60

116.21

116.23

TC116.10
EP116.10

116.68
HA/INF-1

30 LF 8" PVC SCH. 40 @ 4.25% SLOPE

TC116.82
EP116.32

WC101

30 LF-8" PVC SCH. 40 @2.4% SLOPE

TC11
EP11

116.85

TG EL.=116.50
INV.=114.50

ACO DRAIN
3K-900

FUEL STATION ARCHITECTURAL PLANS
SEE

116.78

116.85

FRONTAGE ROAD
(F-827)

S78°20'20"W

TC117.16
EP117.16

TC117.50
EP117.00

TC117.60
EP117.10
H.P.

117.10

TC117.44
EP116.94

TC117.31
EP116.81

TC117.58
EP117.08

GRADE TO DRAIN

LIMIT OF CONSTRUCTION

INTERSTATE 64
INTERCHANGE

N29°04'44"E

N34°38'11"W

SITE BENCH MARK
SPIKE SET IN POWER
POLE GB43 ELEV=118.66

OLD STAGE ROAD/BARHAMSVILLE ROAD
ROUTE 30
VARIABLE WIDTH R/W

VIRGINIA STATE PLANE SOUTH ZONE

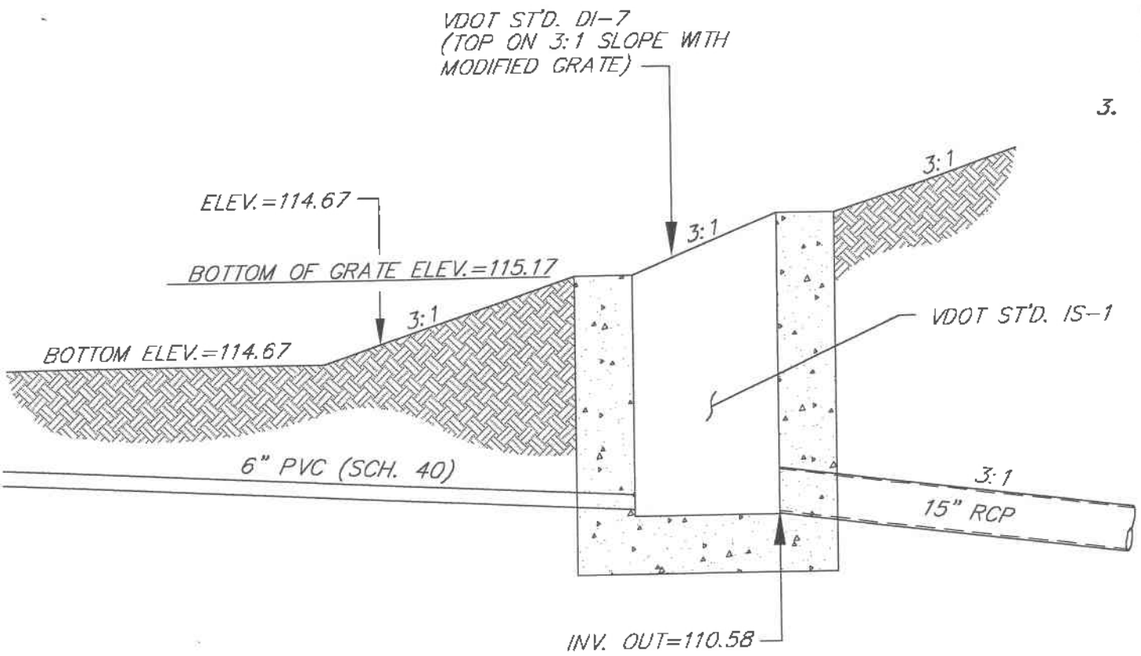
WER
=114.62

L DATA:

E	APRON LENGTH	OUTLET PIPE DIAMETER	TOP WIDTH	BOTTOM WIDTH	DEPTH OF STONE	MEDIAN STONE SIZE	STONE	SQ. YARDS
							CLASS I	

(SEE DETAIL THIS SHEET)

PLAN VIEW
N.T.S.



VALVE NOTES:

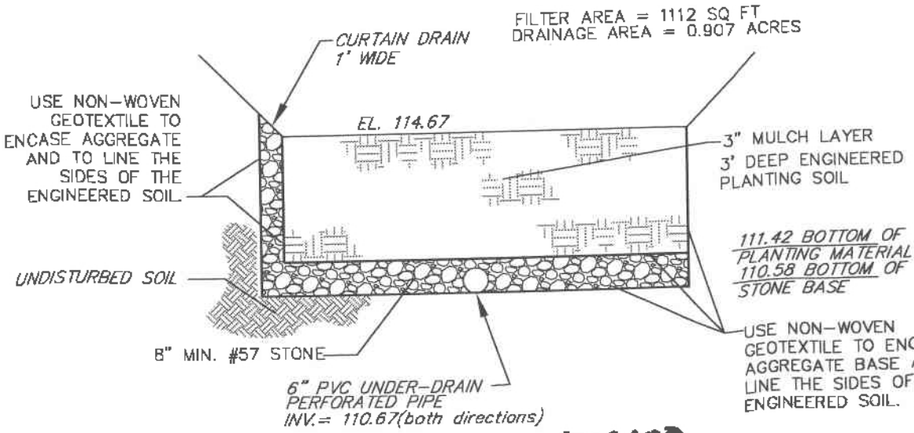
1. DEWATERING DEVICE VALVE SHALL BE NEENAH FLANGED FLAP VALVE R-5004-A2 OR APPROVED EQUAL.
2. STAINLESS STEEL CHAIN SHALL BE ATTACHED. CHAIN LENGTH WILL VARY PER LOCATION. CONTRACTOR SHALL VERIFY NEEDED LENGTH PRIOR TO ORDERING.
3. VALVE SHALL REMAIN CLOSED EXCEPT WHEN POND MUST BE PARTIALLY DRAINED FOR MAINTENANCE ACTIVITIES.

NOTE:
REINFORCING STEEL SHALL BE ASTM GRADE 60,
ASTM A-615 FOR CAST-IN-PLACE CONC. STRUCTURE.

SECTION C-C
N.T.S.

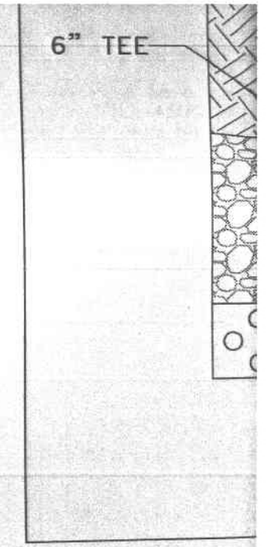
WC100

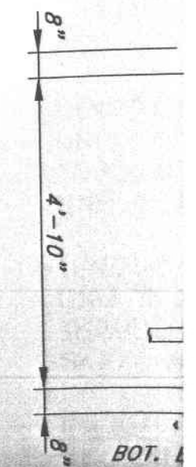
BMP-OUTLET STRUCTURE DETAIL
N.T.S.



WC100

NOTES:
THE CONTRIBUTING DRAINAGE AREA SHALL BE COMPLETELY STABILIZED PRIOR TO CONSTRUCTION OF THE BIORETENTION FACILITY.





'AST-IN-PLACE CONCRETE OR
CONCRETE
ETE
UNIT IS PRECAST

STAR EXPRESS

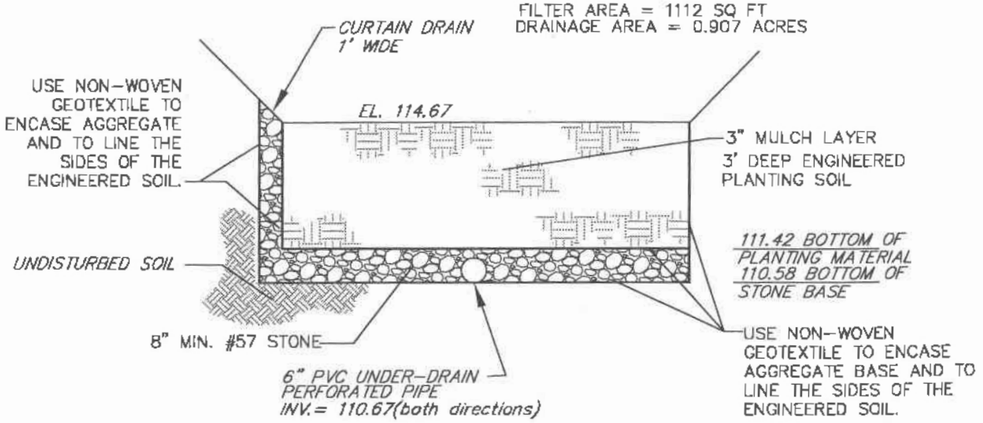
FUND MUST BE PARTIALLY DRAINED FOR MAINTENANCE ACTIVITIES.

IS-1

ILL BE ASTM GRADE 60,
-IN-PLACE CONC. STRUCTURE.

CLEAN OUT MAINTENANCE PORT FOR BIORETENTION FACILITY

N.T.S.



NOTES:
THE CONTRIBUTING DRAINAGE AREA SHALL BE COMPLETELY STABILIZED PRIOR TO CONSTRUCTION OF THE BIORETENTION FACILITY.

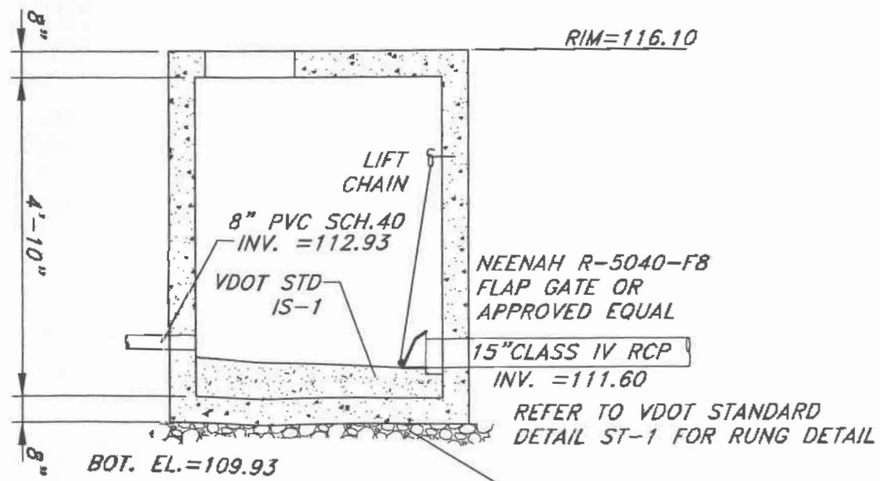
REFER TO LANDSCAPE PLANS AND DETAILS FOR TYPES AND SPACING OF PLANTS MATERIALS, AND SOIL SPECIFICATIONS.

THE PERIMETER OF THE BIORETENTION FACILITY SHALL BE STABILIZED WITH SEED AND TEMPORARY SOIL STABILIZATION MATTING. VEGETATION SHALL BE WELL ESTABLISHED PRIOR TO CONSTRUCTION OF BIORETENTION FACILITY. AREAS DAMAGED BY CONSTRUCTION EQUIPMENT SHALL BE RESEEDED.

CROSS SECTION OF PROPOSED BIORETENTION BASIN

N.T.S.

WC100



FLAP GATE SHALL REMAIN OPEN UNDER NORMAL OPERATING CONDITIONS
IN EMERGENCY ONLY:
IN THE EVENT OF MAJOR FUEL DISCHARGE, FLAP GATE SHALL BE CLOSED TEMPORARILY UNTIL OTHER MEASURES MAY BE TAKEN.

MODIFIED VDOT MH-2

N.T.S.

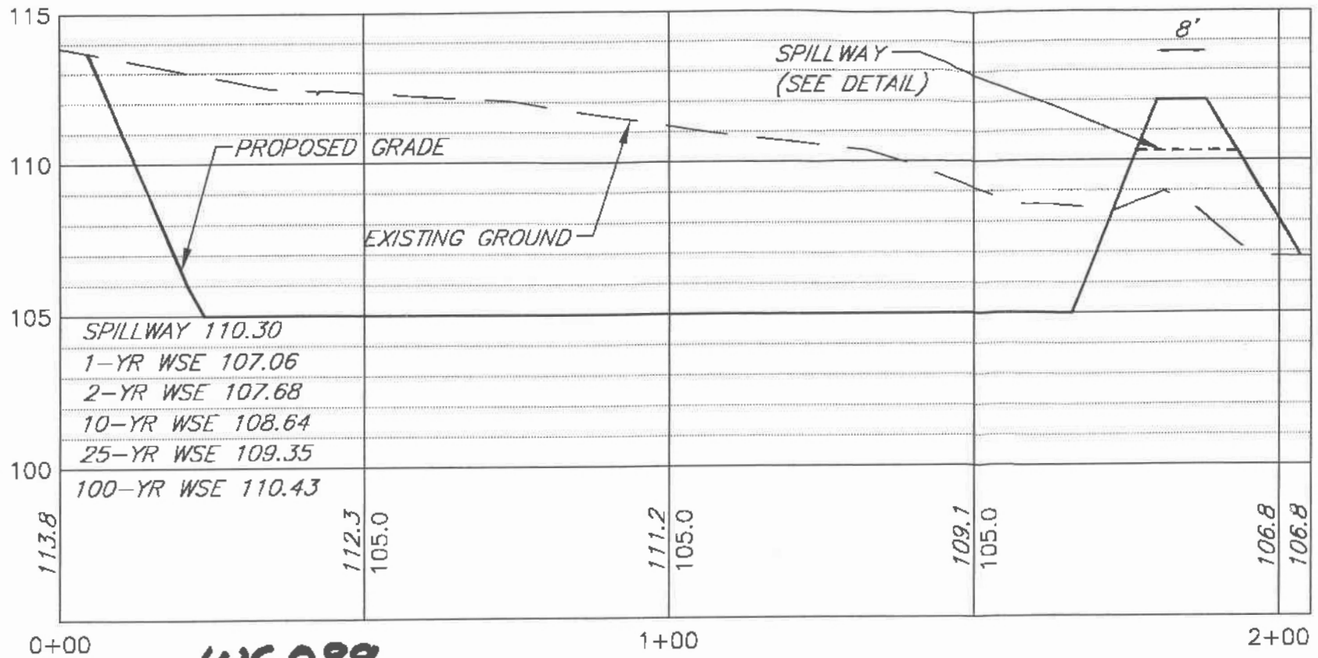
JCC-SP-0021-2009

DRAWING
Interc
Client
Pre A

BIORETENTION BASIN PLAN AND DETAILS

Designed: CBN
Checked: SAR
File Mgr./L LFV
Project Nu 2004224-C
Drawing Nu

STAR EXPRESS

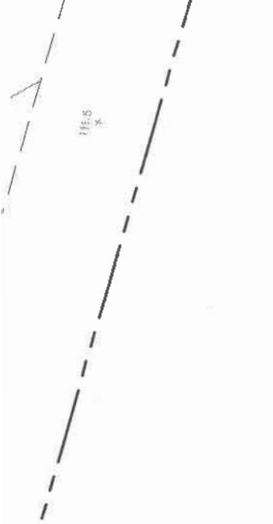


WC099

BMP C CROSS-SECTION A-A

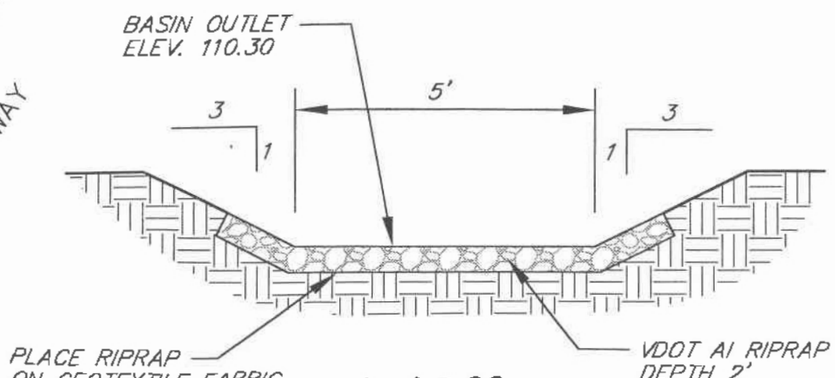
SCALE: 1"=25' (HORIZONTAL)
1"=5' (VERTICAL)

[redacted]



PARCEL "C"
TAX PARCEL 040100032
1.1677 AC.
ZONED B1
PLAT DOC#070035345

FUTURE RIGHT-OF-WAY



WC101

PROPOSED BMP A CDS TECHNOLOGIES MODEL PMIU 20-15-5 (OR APPROVED EQUAL) RIM=116.61 INV.(IN)=113.78

WC099

BASIN #C OUTLET

WC099_STUCKEYS_REDEVELOPMENT_017

COMMONWEALTH OF VIRGINIA
4-28-09
STEPHEN A. ROMEO
LIC. No. 1448-B
Stephen Romeo
LAND SURVEYOR

5544 Greenwich Road
Suite 260
Virginia Beach, VA 23462
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Fax (757) 497-7933
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4029 Ironbound Road
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Williamsburg, VA 23188
Tel. (757) 253-2975
Fax (757) 229-0049
Email: lmdg@landmarkdg.com

LANDMARK DESIGN GROUP
Engineers • Planners • Surveyors
Landscape Architects • Environmental Scientists

REVISIONS:		
	Comment	By
1	REVISED PER JCC COMMENTS	LFV

C

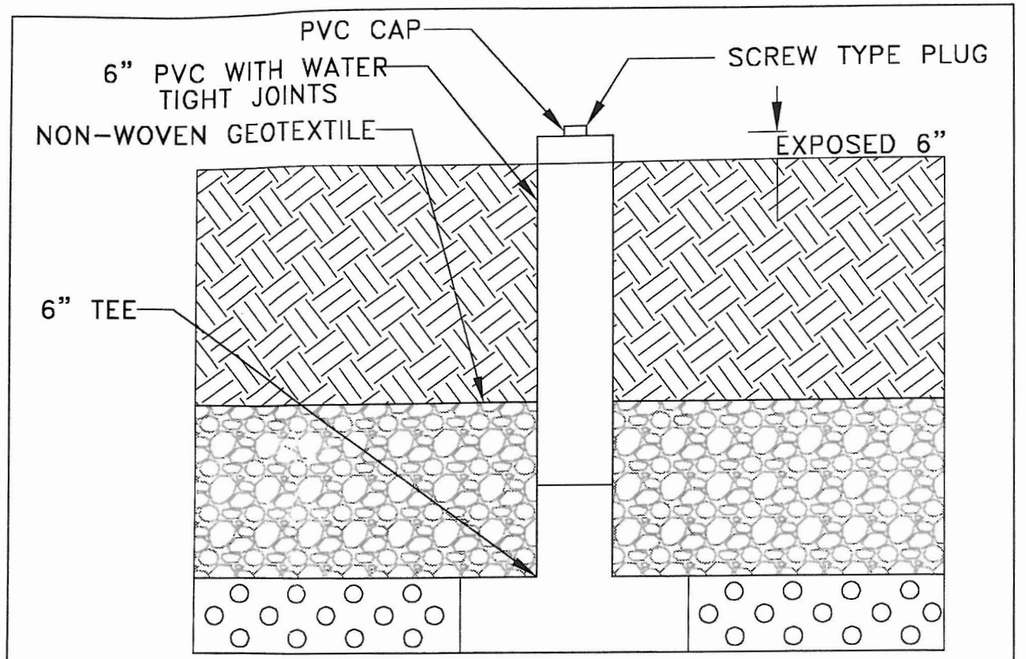
RING DEVICE VALVE SHALL BE NEENAH
FLAP VALVE R-5004-A2 OR
ED EQUAL.

SS STEEL CHAIN SHALL BE ATTACHED.
ENGTH WILL VARY PER LOCATION.
CTOR SHALL VERIFY NEEDED LENGTH
O ORDERING.

SHALL REMAIN CLOSED EXCEPT WHEN
IST BE PARTIALLY DRAINED FOR
INCE ACTIVITIES.

60,
STRUCTURE.

must be verified by a qualified pr



CLEAN OUT MAINTENANCE
PORT FOR BIORETENTION FACILITY

N.T.S.

WC100

STAR EXPRESS

WC099_STUCKEYS_REDEVELOPMENT - 018

LAND DESIGN
Engineers • Planners
Landscape Architects

REVISIONS:

No.	Date	Comment	By
1	4/27/09	REVISED PER JCC COMMENTS	LFV

DRAWING STATUS
- Interoffice Review
- Client for Review
- Pre Approval Bidding

COUNTY APPROVAL
- 1st Submittal
- 4/28/09 2nd Submittal
- 3rd Submittal
- Approved

IN PLAN AND DETAILS

LOPMENT PLAN

STUCKEY'S SITE

220 OLD STAGE ROAD

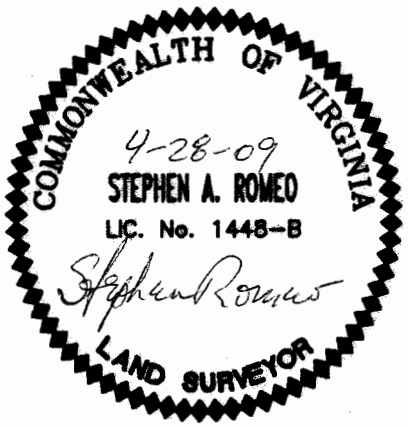
ICT JAMES CITY COUNTY, VIRGINIA

Site Plan Amendment
To Development Plan SP-25-07
For Former Stuckey's Site
James City County, VA

STAR EXPRESS

Supporting Engineering Documents

February 23rd, 2009
Revised April 27th, 2009



Job #: 2004224-000.00

LANDMARK
DESIGN GROUP

Engineers ♦ Planners ♦ Surveyors ♦ Landscape Architects ♦ Environmental Scientists
4029 Ironbound Road, Suite 100, Williamsburg, VA 23188 (757) 253-2975 FAX: (757) 229-0049
lmdg@landmarkdg.com

Site Development Plan for Former Stuckey's Site

Table of Contents

Former Stuckey's Site
James City County, VA
Narrative

1.0 Project Description

The site is previously developed, closed Stuckey's restaurant and gas station. The lot will be 6.27-acres. The project includes the removal of the existing underground fuel tanks and gas pumps, installation of new underground fuel tanks and gas pumps in a new location. Site improvements include reconfigured parking areas, entrance and loop road, minor alterations to the building, an infiltration basin and a bioretention basin.

2.0 Soil Types

According to the Soil Survey of James City County Virginia, the following soils are located within or around the project Construction Limits: 11-Craven-Uchee Complex, 19B-Kempsville-Emporia Fine Sandy Loam, 31B-Suffolk Fine Sandy Loam, & 35-Udorthents.

11 - Craven-Uchee Complex, 2% to 6% slopes
The Craven soils are moderately well drained and the Uchee soils are well drained. Typically, the surface layer or the Craven soils are dark grayish brown fine sandy loam. The subsurface layer is pale olive fine sandy loam. The subsoil is a yellowish brown clay in the upper part with yellowish brown sandy clay loam mottled with gray in the middle and lower parts. The substratum is brownish yellow fine sandy loam mottled with gray in the upper part and gray loamy fine sand with yellow mottles in the lower part. Typically, the surface layer of the Uchee soils are dark grayish brown loamy fine sand. The subsurface layer is light yellowish brown and very pale brown loamy fine sand. The subsoil is strong brown sandy clay loam in the upper part and strong brown sandy clay loam and clay mottled with gray and red in the lower part. The substratum is variegated red, brown and gray stratified sandy loam and sandy clay loam. In the Craven soils, permeability is slow; and in the Uchee soils, it is moderate in the upper part of the subsoil and moderately slow in the lower part. The shrink/swell potential for the Craven and Uchee soils are low to moderate. The erosion factor "K" is from 0.32 to 0.37 for the Craven soil and 0.20 to 0.28 for the Uchee soil. Craven soils are in hydrologic soils Group "C", Uchee soils are in hydrologic soils Group "A".

19B - Kempsville-Emporia Fine Sandy Loam, 2% to 6% slopes
Kempsville-Emporia soils are well drained. Typically, the surface layer of this soil is dark grayish brown fine sandy loam. The subsurface layer is light yellowish brown fine sandy loam. The subsoil is yellowish brown and strong brown fine sandy loam, sandy clay loam, and mottled fine sandy loam that is somewhat firm and compact over yellowish brown fine sandy clay loam. The substratum is yellowish brown fine sandy loam. The permeability of Kempsville soil is moderate. In the Emporia soil, permeability is moderate in the upper part of the subsoil and moderately slow to slow in the lower part.

The available water capacity is moderate for both soils. The subsoil of Kempsville soil has a low shrink-swell potential, and that of Emporia soil has moderate shrink-swell potential. The erosion factor K is from 0.24 to 0.32. Kempsville soils are in hydrologic soils Group "B", and Emporia soils are in hydrologic soils Group "C".

31B - Suffolk Fine Sandy Loam, 2% to 6% slopes
The Suffolk Fine Sandy Loam soil is well drained. Typically, the surface layer of this soil is very dark grayish brown fine sandy loam. The subsurface layer is yellowish brown fine sandy loam. The subsoil is strong brown fine sandy loam and sandy clay loam. The substratum is brown loamy fine sand. The permeability of this Suffolk soil is moderate and the available water capacity is high. The shrink/swell potential for the Suffolk soil is low. The erosion factor "K" is from 0.17 to 0.28. Suffolk soils are in hydrologic group "B".

For the hydrologic modeling for site improvements, as this facility was previously developed, hydrologic soil group 'C' was utilized in the determination of the runoff curve number for pervious areas. Within the confines of the bioretention facility filter material, hydrologic soil group 'A' was utilized in the determination of the runoff curve number.

3.0 Stormwater Management

This site is a redevelopment project. That there are no stated procedures for redevelopment in the *James City County Guidelines for Design and Construction of Stormwater Management BMP's* should be noted. A series of improvements will be made to the site. A fuel water separator has been incorporated into the plans. This will help protect waterways from fuel spills. The site's impervious area will be reduced. This reduction of impervious area will decrease the rate of flow for the 2 and 10-year storms and will diminish the pollutant load coming from the site. The reduction of impervious area more than meets the Chesapeake Bay requirements, using the state guidelines in the *Virginia Stormwater Management Handbook.*

To prevent channel erosion, an infiltration basin will store and infiltrate the 2-year and 10-year storms. This basin can pass the 100-year storm with 1-foot of freeboard. The SCS method was used to model the 1-year storm frequency while the rational method was used to model the higher frequency storm events.

A bioretention basin is proposed to be constructed adjacent to the existing building, inside the loop access road. This facility was sized to manage 0.902 acres which includes the fueling island canopy. The SCS method was used to model the 1-year storm frequency while the rational method was used to model the higher frequency storm events.

Attached hydrologic computation shows that proposed stomwater management facilities detain the 2-year, 10-year, 25-year and 100-year post development runoff to the pre-development rates.

Point of Investigation I – Bioretention Basin

Pre-Developed Storm	Pre-Developed (cfs)	Post-Developed Storm	Post-Developed (cfs)	Difference (cfs)
-	-	1-Year	2.19	-
2-year	4.24	2-Year	2.20	-2.04
10-year	5.50	10-Year	3.09	-2.41
25-year	6.23	25-Year	3.61	-2.62
100-year	7.28	100-Year	4.33	-2.95

Point of Investigation II – Infiltration Basin

Pre-Developed Storm	Pre-Developed (cfs)	Post-Developed Storm	Post-Developed (Infiltration) (cfs)	Post-Developed (Spillway) (cfs)	Difference (cfs)
-	-	1-Year	0.24	0.00	-
2-year	3.56	2-Year	0.30	0.00	-3.56
10-year	4.65	10-Year	0.39	0.00	-4.65
25-year	5.29	25-Year	0.45	0.00	-5.29
100-year	6.15	100-Year	0.55	0.59	-5.56

4.0 BMP Maintenance

Recommended maintenance methods / schedules are presented in the project plans for the bioretention facility, the infiltration basin and the proprietary stormwater management device.

5.0 Erosion and Sedimentation Control Measures

All vegetative and structural erosion and sediment control practices will be constructed and maintained according to minimum standards and specifications of the Virginia Erosion and Sediment Control Handbook, 1992, and in accordance with the James City County standards.

The contractor shall, as a minimum, use the following practices shown on the site plans and detailed on the erosion control detail sheet. These include:

1. Temporary Construction Entrance (3.02)
   Temporary construction entrance shall be installed where shown on the site plan.

2. Straw Bale Barrier (3.04)

A temporary sediment barrier consisting of a row of entrenched and anchored straw bales; it is used to intercept and detain small amounts of sediment from leaving the construction site and to decrease the velocity of sheet flows.

3. Silt Fence (3.05)
Silt fence with wire support shall be installed where shown on the site plan.

4. Storm Drain Inlet Protection (3.07)
Storm drain inlet protection shall be installed for all drainage inlet structures where shown on the plan.

5. Temporary Diversion Dike (3.09)
A ridge of compacted soil constructed at the top or base of a slope disturbed area which diverts off-site runoff away from unprotected slopes and to a stabilized outlet, or to divert sediment laden runoff to a sediment trap structure. Maximum effective life is 18 months.

6. Outlet Protection (3.18)
Structurally lined aprons or other acceptable energy dissipating devices placed at the outlets of pipes or paved channel sections, used to prevent scour at stormwater outlets, to protect the outlet structure, and to minimize the potential for downstream erosion by reducing the velocity and energy of concentrated stormwater flows.

7. Temporary Seeding (3.31)
All disturbed areas on-site shall be seeded with a fast-germinating, temporary vegetation immediately following grading and where exposed soil surfaces will remain dormant for longer than 30 days. Selection of the appropriate seed mixture, as recommended by the Virginia Erosion and Sediment Control Handbook, 1992, will vary depending on the construction season.

8. Permanent Seeding (3.32)
All areas disturbed by grading shall be stabilized with permanent seeding immediately following finish grading. Permanently seeded areas shall be protected during establishment with straw mulch.

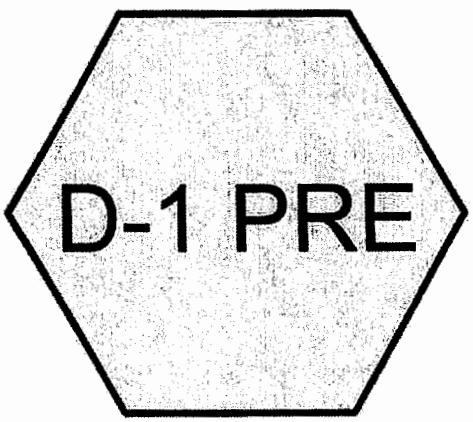
9. Tree Protection (3.38)
Tree protection fencing or other suitable devices shall be placed along the "clearing limits" to protect desirable trees from mechanical and other injury during land disturbing and construction activity.

6.0 Erosion and Sediment Control Maintenance

Maintenance of temporary erosion and sediment control devices are the responsibility of the contractor. In general, all erosion and sediment control measures shall be checked weekly and after each significant rainfall. Silt fencing and straw bales shall be inspected immediately after each rainfall and at least daily during prolonged rainfall for undermining and the need for repair. All seeded areas shall be checked to insure a good stand of grass is maintained. Seeded areas deemed as deficient shall be reseeded as necessary.

Pre-Development Drainage Calculations

Point of Investigation I



D-1 Pre Development Drainage Area

Drainage Diagram for Stuckeys Site Pre-Post
Prepared by LandMark Design Group , Printed 2/23/2009
HydroCAD® 9.00 s/n 01765 © 2009 HydroCAD Software Solutions LLC

2-year

Summary for Subcatchment D-1 PRE: D-1 Pre Development Drainage Area

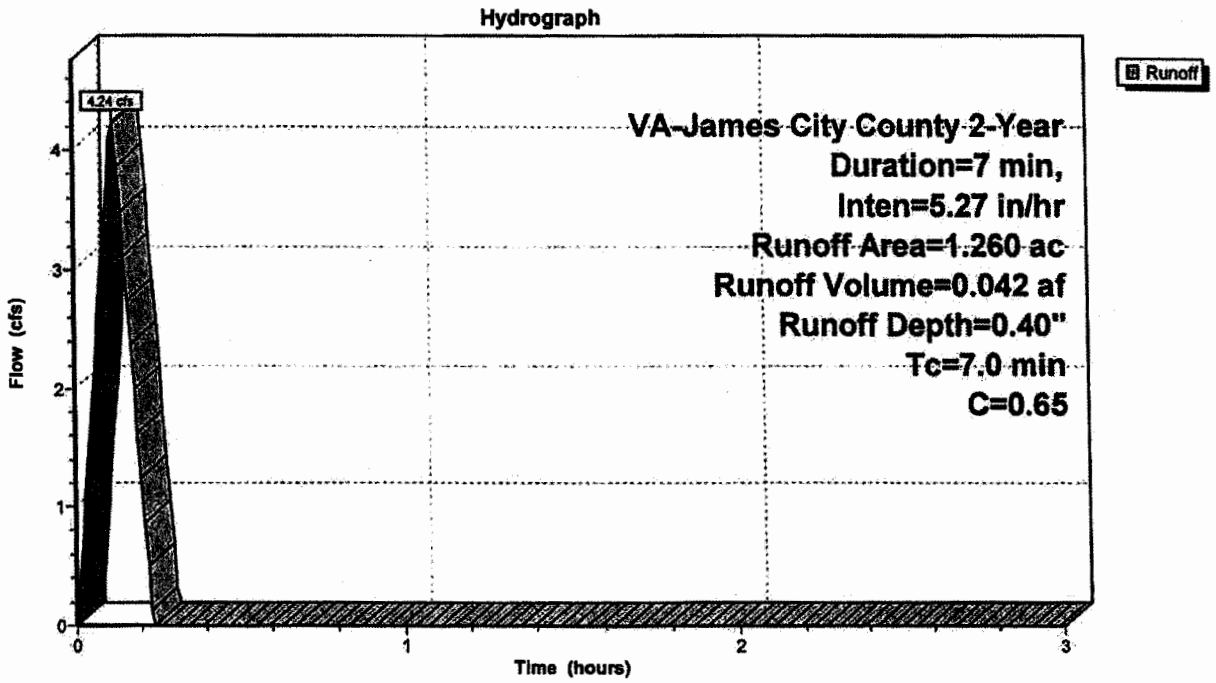
Runoff = 4.24 cfs @ 0.12 hrs, Volume= 0.042 af, Depth= 0.40"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
VA-James City County 2-Year Duration=7 min, Inten=5.27 in/hr

Area (ac)	C	Description
0.680	0.90	Roof/Concrete/Asphalt
0.580	0.35	Lawn/Grass
1.260	0.65	Weighted Average
1.260		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					Direct Entry, Tc

Subcatchment D-1 PRE: D-1 Pre Development Drainage Area



10-year

Summary for Subcatchment D-1 PRE: D-1 Pre Development Drainage Area

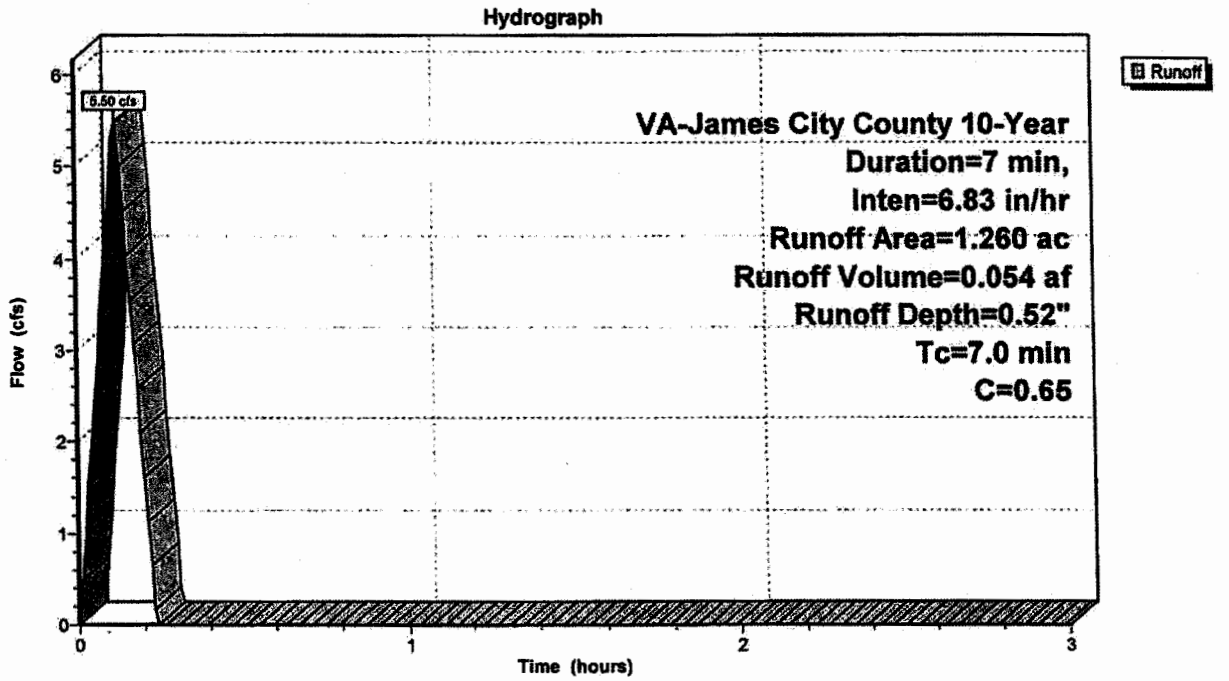
Runoff = 5.50 cfs @ 0.12 hrs, Volume= 0.054 af, Depth= 0.52"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
VA-James City County 10-Year Duration=7 min, Inten=6.83 in/hr

Area (ac)	C	Description
0.680	0.90	Roof/Concrete/Asphalt
0.580	0.35	Lawn/Grass
1.260	0.65	Weighted Average
1.260		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					Direct Entry, Tc

Subcatchment D-1 PRE: D-1 Pre Development Drainage Area



25-year

Summary for Subcatchment D-1 PRE: D-1 Pre Development Drainage Area

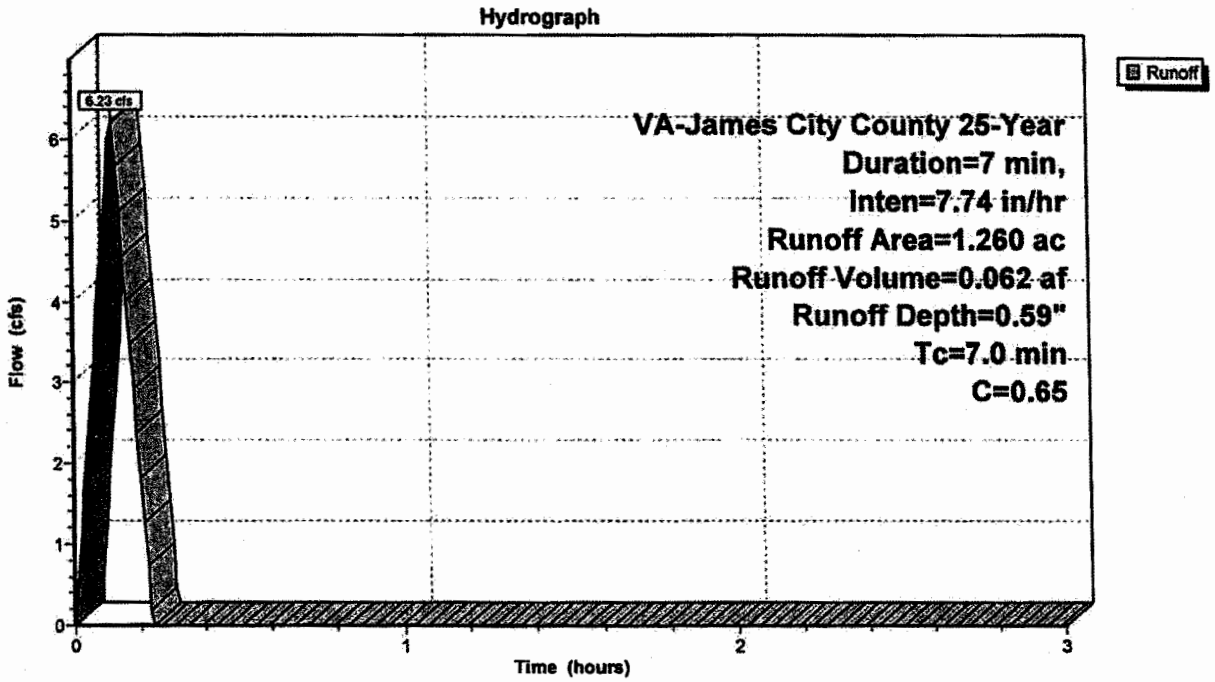
Runoff = 6.23 cfs @ 0.12 hrs, Volume= 0.062 af, Depth= 0.59"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
VA-James City County 25-Year Duration=7 min, Inten=7.74 in/hr

Area (ac)	C	Description
0.680	0.90	Roof/Concrete/Asphalt
0.580	0.35	Lawn/Grass
1.260	0.65	Weighted Average
1.260		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					Direct Entry, Tc

Subcatchment D-1 PRE: D-1 Pre Development Drainage Area



100-year

Summary for Subcatchment D-1 PRE: D-1 Pre Development Drainage Area

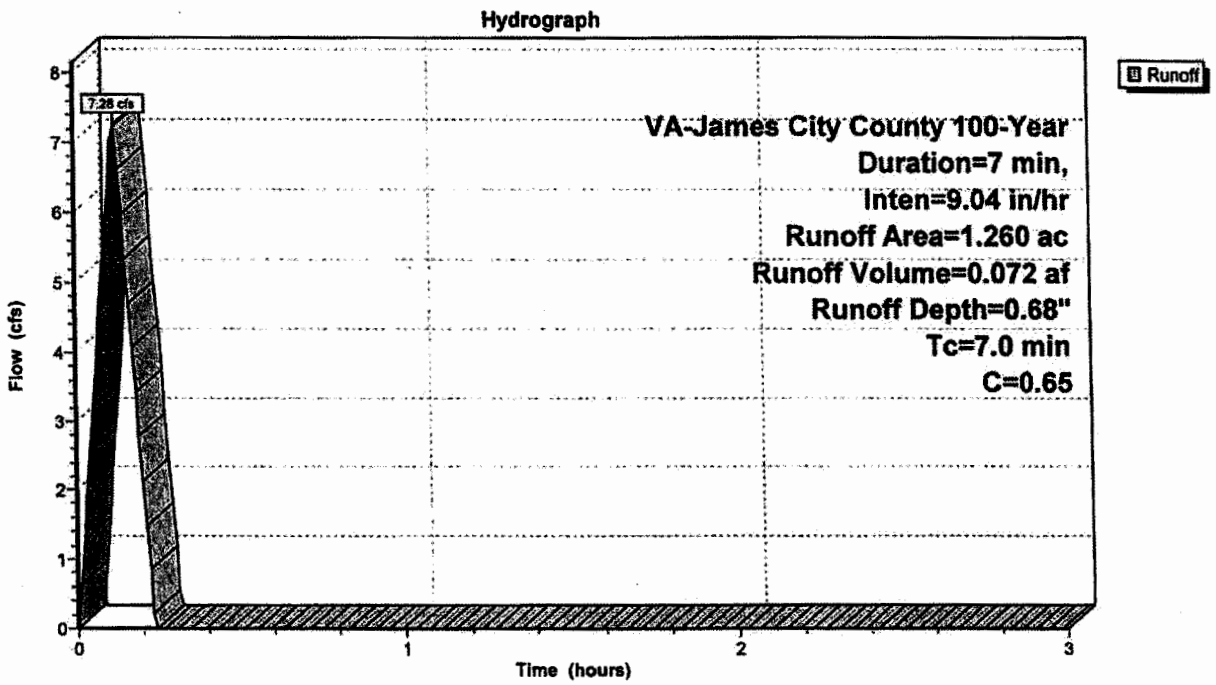
Runoff = 7.28 cfs @ 0.12 hrs, Volume= 0.072 af, Depth= 0.68"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
VA-James City County 100-Year Duration=7 min, Inten=9.04 in/hr

Area (ac)	C	Description
0.680	0.90	Roof/Concrete/Asphalt
0.580	0.35	Lawn/Grass
1.260	0.65	Weighted Average
1.260		100.00% Pervious Area

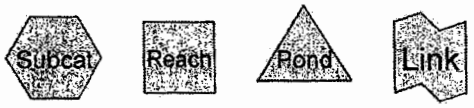
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					Direct Entry, Tc

Subcatchment D-1 PRE: D-1 Pre Development Drainage Area



Point of Investigation II

D-2 Pre Development Drainage Area



Drainage Diagram for Stuckeys Site Pre-Post
Prepared by LandMark Design Group , Printed 2/23/2009
HydroCAD® 9.00 s/n 01765 © 2009 HydroCAD Software Solutions LLC

2-year

Summary for Subcatchment D-2 PRE: D-2 Pre Development Drainage Area

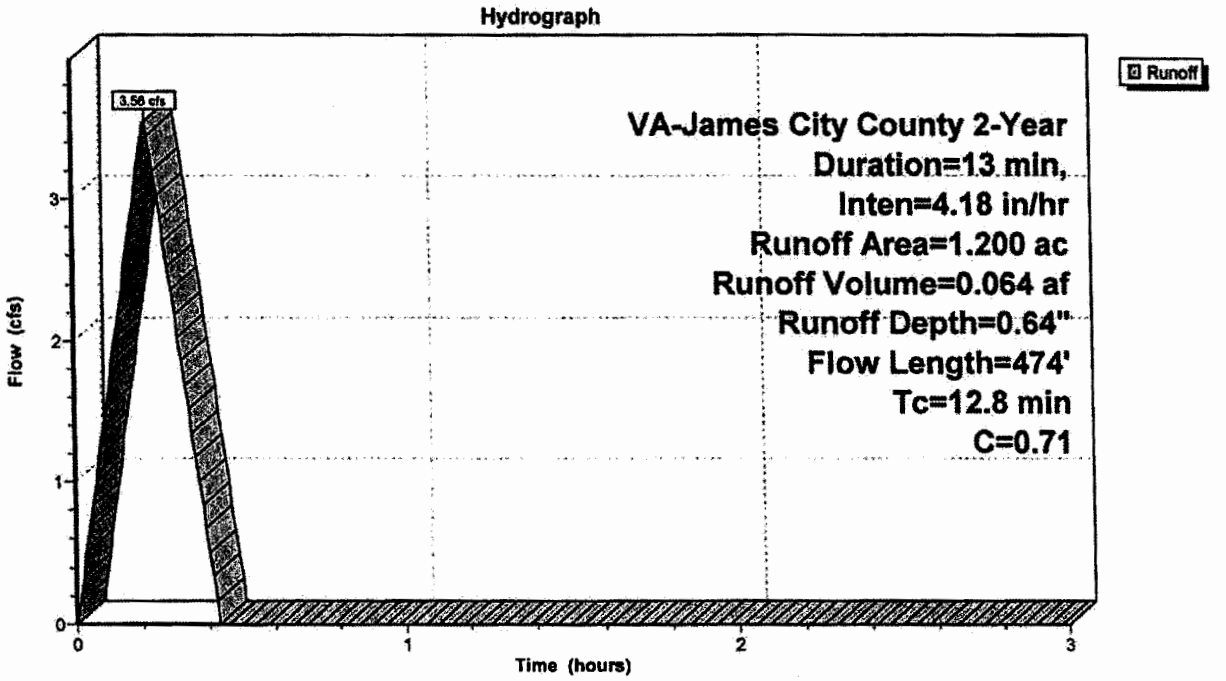
Runoff = 3.56 cfs @ 0.22 hrs, Volume= 0.064 af, Depth= 0.64"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
VA-James City County 2-Year Duration=13 min, Inten=4.18 in/hr

Area (ac)	C	Description
0.410	0.35	Grass cover
0.790	0.90	Paved parking & roofs
1.200	0.71	Weighted Average
1.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0180	0.17		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.50"
2.9	346	0.0150	1.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1	28	0.3214	9.13		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.8	474	Total			

Subcatchment D-2 PRE: D-2 Pre Development Drainage Area



10-year

Summary for Subcatchment D-2 PRE: D-2 Pre Development Drainage Area

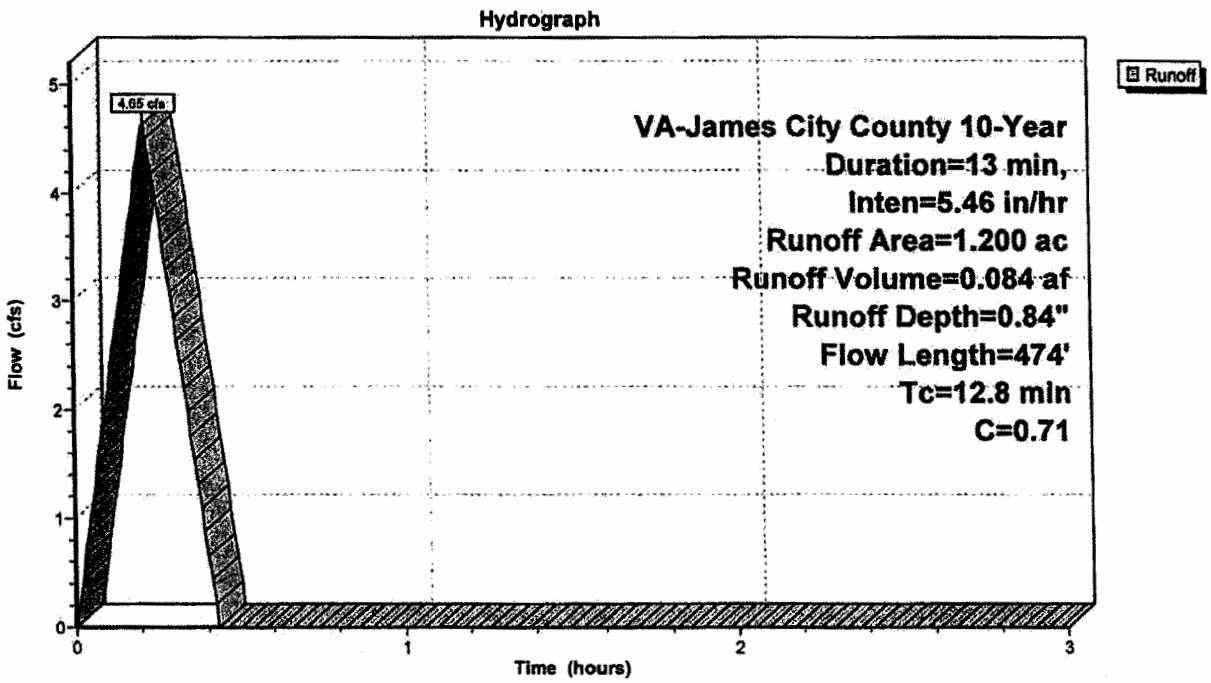
Runoff = 4.65 cfs @ 0.22 hrs, Volume= 0.084 af, Depth= 0.84"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
VA-James City County 10-Year Duration=13 min, Inten=5.46 in/hr

Area (ac)	C	Description
0.410	0.35	Grass cover
0.790	0.90	Paved parking & roofs
1.200	0.71	Weighted Average
1.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0180	0.17		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.50"
2.9	346	0.0150	1.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1	28	0.3214	9.13		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.8	474	Total			

Subcatchment D-2 PRE: D-2 Pre Development Drainage Area



25-year

Summary for Subcatchment D-2 PRE: D-2 Pre Development Drainage Area

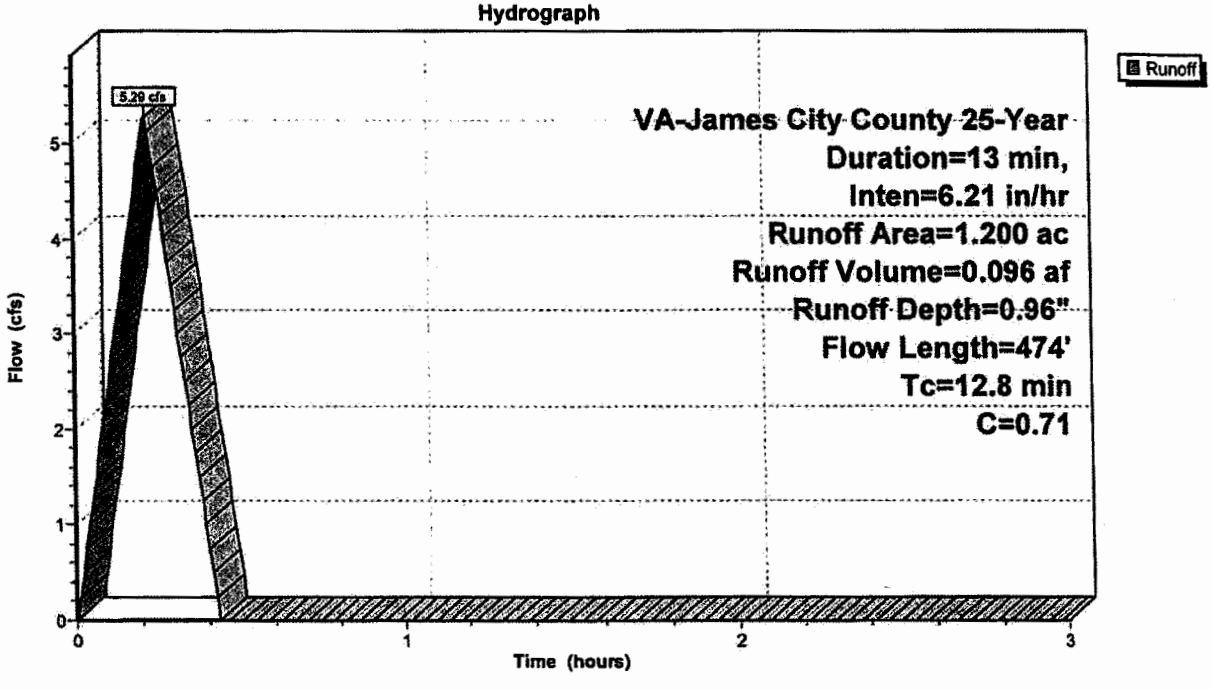
Runoff = 5.29 cfs @ 0.22 hrs, Volume= 0.096 af, Depth= 0.96"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
VA-James City County 25-Year Duration=13 min, Inten=6.21 in/hr

Area (ac)	C	Description
0.410	0.35	Grass cover
0.790	0.90	Paved parking & roofs
1.200	0.71	Weighted Average
1.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0180	0.17		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.50"
2.9	346	0.0150	1.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1	28	0.3214	9.13		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.8	474	Total			

Subcatchment D-2 PRE: D-2 Pre Development Drainage Area



100-year

Summary for Subcatchment D-2 PRE: D-2 Pre Development Drainage Area

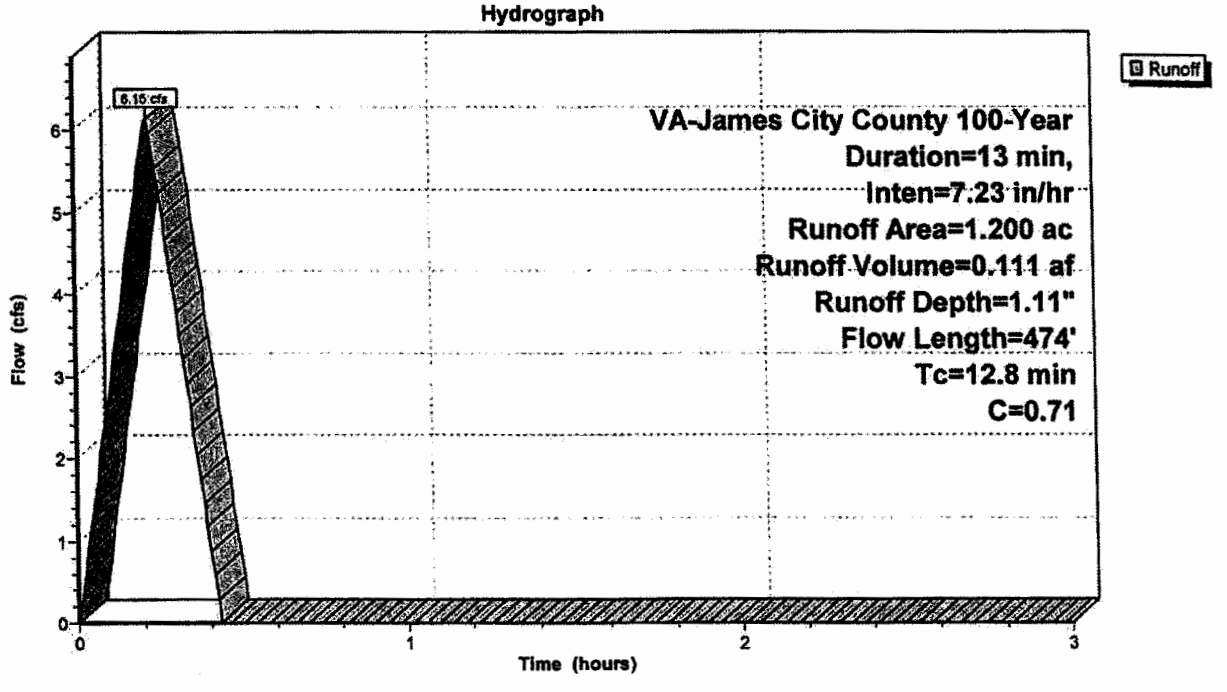
Runoff = 6.15 cfs @ 0.22 hrs, Volume= 0.111 af, Depth= 1.11"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
VA-James City County 100-Year Duration=13 min, Inten=7.23 in/hr

Area (ac)	C	Description
0.410	0.35	Grass cover
0.790	0.90	Paved parking & roofs
1.200	0.71	Weighted Average
1.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0180	0.17		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.50"
2.9	346	0.0150	1.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1	28	0.3214	9.13		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.8	474	Total			

Subcatchment D-2 PRE: D-2 Pre Development Drainage Area



Performance-Based Water Quality Calculations

Worksheet 1
Page 1 of 3

STEP 1 **Determine the applicable area (A) and the post-developed impervious cover (I_{post}).**

Applicable area (A)* = 6.27 acres

Post-development impervious cover:

structures = _____ acres

parking lot = _____ acres

roadway = _____ acres

other:

_____ = _____ acres

_____ = _____ acres

Total = 1.08 acres

I_{post} = (total post-development impervious cover ÷ A) × 100 = 17 %

* The area subject to the criteria may vary from locality to locality. Therefore, consult the locality for proper determination of this value.

STEP 2 **Determine the average land cover condition ($I_{watershed}$) or the existing impervious cover ($I_{existing}$).**

Average land cover condition ($I_{watershed}$):
If the locality has determined land cover conditions for individual watersheds within its jurisdiction, use the watershed specific value determined by the locality as $I_{watershed}$.

$I_{watershed}$ = 16 %

Otherwise, use the Chesapeake Bay default value:

$I_{watershed}$ = 16%

Worksheet 1
Page 2 of 3

Existing impervious cover ($I_{existing}$):

Determine the existing impervious cover of the development site if present.

Existing impervious cover:

structures =_____acres

parking lot =_____acres

roadway =_____acres

other:

_____=_____acres

_____=_____acres

Total = 1.37 acres

$I_{existing}$ = (total existing impervious cover ÷ A*) × 100 = 22 %

* The area should be the same as used in STEP 1.

STEP 3 Determine the appropriate development situation.

The site information determined in STEP 1 and STEP 2 provide enough information to determine the appropriate development situation under which the performance criteria will apply. Check (•) the appropriate development situation as follows:

_____ **Situation 1:** This consists of land development where the existing percent impervious cover ($I_{existing}$) is less than or equal to the average land cover condition ($I_{watershed}$) and the proposed improvements will create a total percent impervious cover (I_{post}) which is less than or equal to the average land cover condition ($I_{watershed}$).

I_{post} _____% • $I_{watershed}$ _____%

Worksheet 1
Page 3 of 3

____ **Situation 2:** This consists of land development where the existing percent impervious cover ($I_{existing}$) is less than or equal to the average land cover condition ($I_{watershed}$) and the proposed improvements will create a total percent impervious cover (I_{post}) which is greater than the average land cover condition ($I_{watershed}$).

$I_{existing}$ _____ % ≤ $I_{watershed}$ _____ %; **and**

I_{post} _____ % > $I_{watershed}$ _____ %

√ **Situation 3:** This consists of land development where the existing percent impervious cover ($I_{existing}$) is greater than the average land cover condition ($I_{watershed}$).

$I_{existing}$ 22 % > $I_{watershed}$ 16 %

____ **Situation 4:** This consists of land development where the existing percent impervious cover ($I_{existing}$) is served by an existing stormwater management BMP(s) that addresses water quality.

If the proposed development meets the criteria for development Situation 1, than the low density development is considered to be the BMP and no pollutant removal is required. The calculation procedure for Situation 1 stops here. If the proposed development meets the criteria for development Situations 2, 3, or 4, then proceed to STEP 4 on the appropriate worksheet.

Worksheet 1
Page 3 of 3

____ **Situation 2:** This consists of land development where the existing percent impervious cover ($I_{existing}$) is less than or equal to the average land cover condition ($I_{watershed}$) and the proposed improvements will create a total percent impervious cover (I_{post}) which is greater than the average land cover condition ($I_{watershed}$).

$I_{existing}$ _____ % • $I_{watershed}$ _____ %; and

I_{post} _____ % > $I_{watershed}$ _____ %

✓ **Situation 3:** This consists of land development where the existing percent impervious cover ($I_{existing}$) is greater than the average land cover condition ($I_{watershed}$).

$I_{existing}$ 22 % > $I_{watershed}$ 16 %

____ **Situation 4:** This consists of land development where the existing percent impervious cover ($I_{existing}$) is served by an existing stormwater management BMP(s) that addresses water quality.

If the proposed development meets the criteria for development Situation 1, than the low density development is considered to be the BMP and no pollutant removal is required. The calculation procedure for Situation 1 stops here. If the proposed development meets the criteria for development Situations 2, 3, or 4, then proceed to STEP 4 on the appropriate worksheet.

Worksheet 3 : Situation 3

Page 1 of 5

Summary of Situation 3 criteria: from calculation procedure **STEP 1** thru **STEP 3**, Worksheet 1:

Applicable area (A)* = 6.27 acres

I_{post} = (total post-development impervious cover ÷ A) × 100 = 17 %

$I_{watershed}$ = 16 % or $I_{watershed}$ = 16%

$I_{existing}$ = (total existing impervious cover ÷ A*) × 100 = 17 %

$I_{existing}$ 22 % > $I_{watershed}$ 16 %

STEP 4 **Determine the relative pre-development pollutant load (L_{pre}).**

1. Pre-development pollutant load based on the existing impervious cover:

$$L_{pre(existing)} = [0.05 + (0.009 \times I_{existing})] \times A \times 2.28 \quad \textbf{(Equation 5-17)}$$

where:
- $L_{pre(existing)}$ = relative pre-development total phosphorous load (pounds per year)
- $I_{existing}$ = existing site impervious cover (percent expressed in whole numbers)
- A = applicable area (acres)

$L_{pre(existing)}$ = [0.05 + (0.009 × 22)] × 6.27 × 2.28

= 3.55 pounds per year

Worksheet 3 : Situation 3
Page 2 of 5

2. Pre-development pollutant load based on the average land cover condition:

$$L_{pre(watershed)} = [0.05 + (0.009 \times I_{watershed})] \times A \times 2.28 \quad \textbf{(Equation 5-16)}$$

where: $L_{pre(watershed)}$ = relative pre-development total phosphorous load (pounds per year)
$I_{watershed}$ = average land cover condition for specific watershed or locality **or** the Chesapeake Bay default value of 16% (percent expressed in whole numbers)
A = applicable area (acres)

$L_{pre(watershed)} = [0.05 + (0.009 \times \underline{16})] \times \underline{6.27} \times 2.28$

$= \underline{2.77}$ pounds per year

STEP 5 **Determine the relative post-development pollutant load (L_{post}).**

$$L_{post} = [0.05 + (0.009 \times I_{post})] \times A \times 2.28 \quad \textbf{(Equation 5-21)}$$

where: L_{post} = relative post-development total phosphorous load (pounds per year)
I_{post} = post-development percent impervious cover (percent expressed in whole numbers)
A = applicable area (acres)

$L_{post} = [0.05 + (0.009 \times \underline{17})] \times \underline{6.27} \times 2.28$

$= \underline{2.90}$ pounds per year

STEP 6 **Determine the relative pollutant removal requirement (RR).**

$RR = L_{post} - (0.9 \times L_{pre(existing)})$

$= \underline{2.90} - (0.9 \times \underline{3.55}) = \underline{-0.295}$ pounds per year

THE SITE UNDER POST DEVELOPMENT CONDITION WILL CREATE LESS POLLUTANT LOAD THAN 90% OF THE POLLUTANT LOAD UNDER EXISTING CONDITION

or

$RR = L_{post} - L_{pre(watershed)}$

$= \underline{2.90} - \underline{2.77} = \underline{0.13}$ pounds per year

5D-14

Worksheet 3 : Situation 3
Page 3 of 5

The pollutant removal requirement (RR) for Situation 3 is the lesser of the two values calculated above:

RR = -0.295 pounds per year THE POLLUTANT LOAD FOR POST DEVELOPED CONDITION IS LESS THAN 90% OF THE POLLUTANT LOAD UNDER EXISTING CONDITION

STEP 7 **Identify best management practice (BMP) for the site.**

1. Determine the required pollutant removal efficiency for the site:

$$EFF = (RR \div L_{post}) \times 100 \qquad \textbf{(Equation 5-22)}$$

where: EFF = required pollutant removal efficiency (percent expressed in whole numbers)
RR = pollutant removal requirement (pounds per year)
L_{post} = relative post-development total phosphorous load (pounds per year)

EFF = (_____ ÷ _____) × 100

= _____ %

2. Select BMP(s) from **Table 5-15** and locate on the site:

BMP 1: BIORETENTION BASIN

BMP 2: INFILTRATION BASIN

BMP 3: _____

Worksheet 3 : Situation 3
Page 4 of 5

3. Determine the pollutant load entering the proposed BMP(s):

$L_{BMP} = [0.05 + (0.009 \times I_{BMP})] \times A \times 2.28$ **(Equation 5-23)**

where: L_{BMP} = relative post-development total phosphorous load entering proposed BMP (pounds per year)
I_{BMP} = post-development percent impervious cover of BMP drainage area (percent expressed in whole numbers)
A = drainage area of proposed BMP (acres)

$I_{BMP1} = 0.576/0.888 = 65\%$

$I_{BMP2} = 0.582/1.400 = 42\%$

$L_{BMP1} = [0.05 + (0.009 \times 65)] \times 0.888 \times 2.28$

$= 1.286$ pounds per year

$L_{BMP2} = [0.05 + (0.009 \times 42)] \times 1.400 \times 2.28$

$= 1.386$ pounds per year

$L_{BMP3} = [0.05 + (0.009 \times \_\_\_\_)] \times \_\_\_\_ \times 2.28$

$= \_\_\_\_$ pounds per year

4. Calculate the pollutant load removed by the proposed BMP(s):

$L_{removed} = Eff_{BMP} \times L_{BMP}$ **(Equation 5-24)**

where: $L_{removed}$ = Post-development pollutant load removed by proposed BMP (pounds per year)
Eff_{BMP} = pollutant removal efficiency of BMP (expressed in decimal form)
L_{BMP} = relative post-development total phosphorous load entering proposed BMP (pounds per year)

$L_{removed/BMP1} = 65\% \times 1.286 = 0.836$ pounds per year

$L_{removed/BMP2} = 65\% \times 1.386 = 0.901$ pounds per year

$L_{removed/BMP3} = \_\_\_\_ \times \_\_\_\_ = \_\_\_\_$ pounds per year

Worksheet 3 : Situation 3
Page 5 of 5

5. Calculate the total pollutant load removed by the BMP(s):

$L_{removed/total} = L_{removed/BMP1} + L_{removed/BMP2} + L_{removed/BMP3} + \ldots$ **(Equation 5-25)**

where: $L_{removed/total}$ = **total** pollutant load removed by proposed BMPs
$L_{removed/BMP1}$ = pollutant load removed by proposed BMP No. 1
$L_{removed/BMP2}$ = pollutant load removed by proposed BMP No. 2
$L_{removed/BMP3}$ = pollutant load removed by proposed BMP No. 3

$L_{removed/total}$ = 0.836 + 0.901 + _____ + ...

= 1.737 pounds per year

6. Verify compliance:

$L_{removed/total}$ • RR

1.737 > 0.295

5D-17

Post-Development Drainage Calculations

Point of Investigation I – Bioretention Basin "B"

Water Quality Calculations

LANDMARK DESIGN GROUP

Project:	Former Stuckey's Site	**Prepared by:**	**PS**
Location:	James City County, VA	**Date:**	**Apr-09**

Impervious Area =	0.576 acres	Total Area =	0.888 acres

Method A

Reqd. Surface Area		Treatment	
2.5% x Impervious Area	627.264 sf	0.5"	
5.0% x Impervious Area	1254.528 sf	1"	
		Provd. Af =	1,111.9 sf

Method B

Rv =	0.634	I =	64.9 %
WQv =	0.047 ac-ft	2043.0 cf	
df =	3.25 ft	k =	0.5 ft/day
hf =	0.25 ft	tf =	4 days
Reqd. Af =	948.5 sf	Provd. Af =	1,111.9 sf

Subject OUTFLOW STRUCTURE

Computed P.S. Checked

LANDMARK DESIGN GROUP

Project # 2004 224-00000

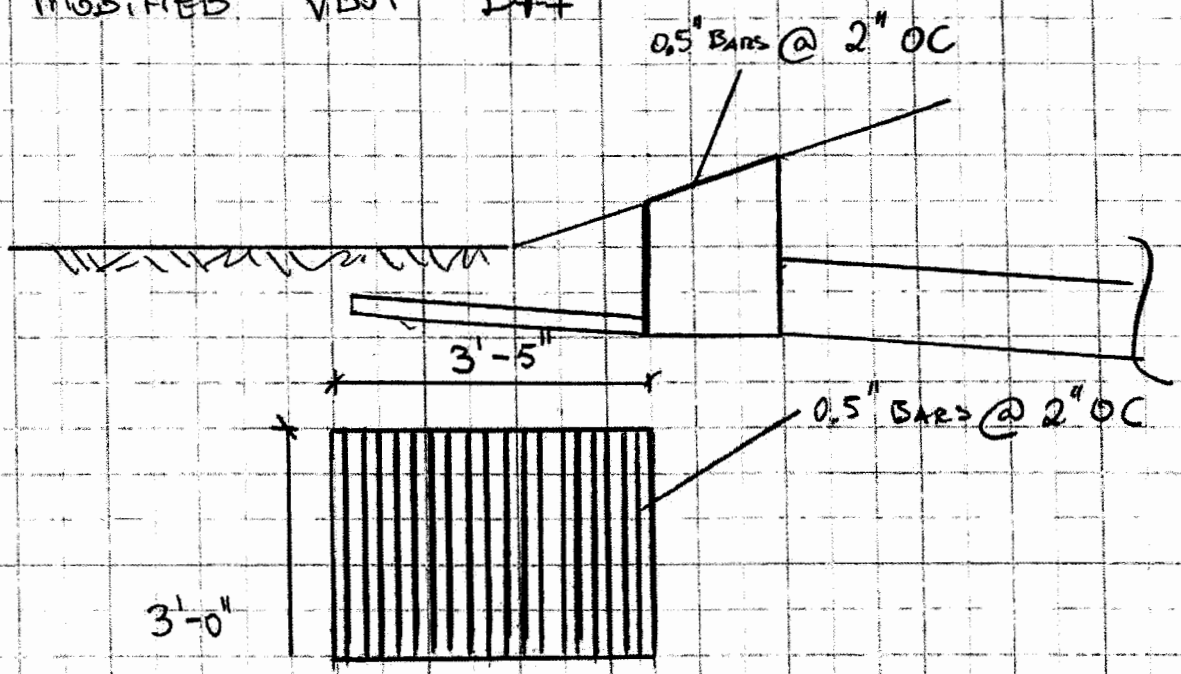
Client FORMER STUCKEY'S SITE

Date FEB 2009 Sheet #

Engineers • Planners • Surveyors • Landscape Architects • Environmental Scientists

BIORETENTION BASIN OUTFLOW STRUCTURE

MODIFIED VDOT DH-7

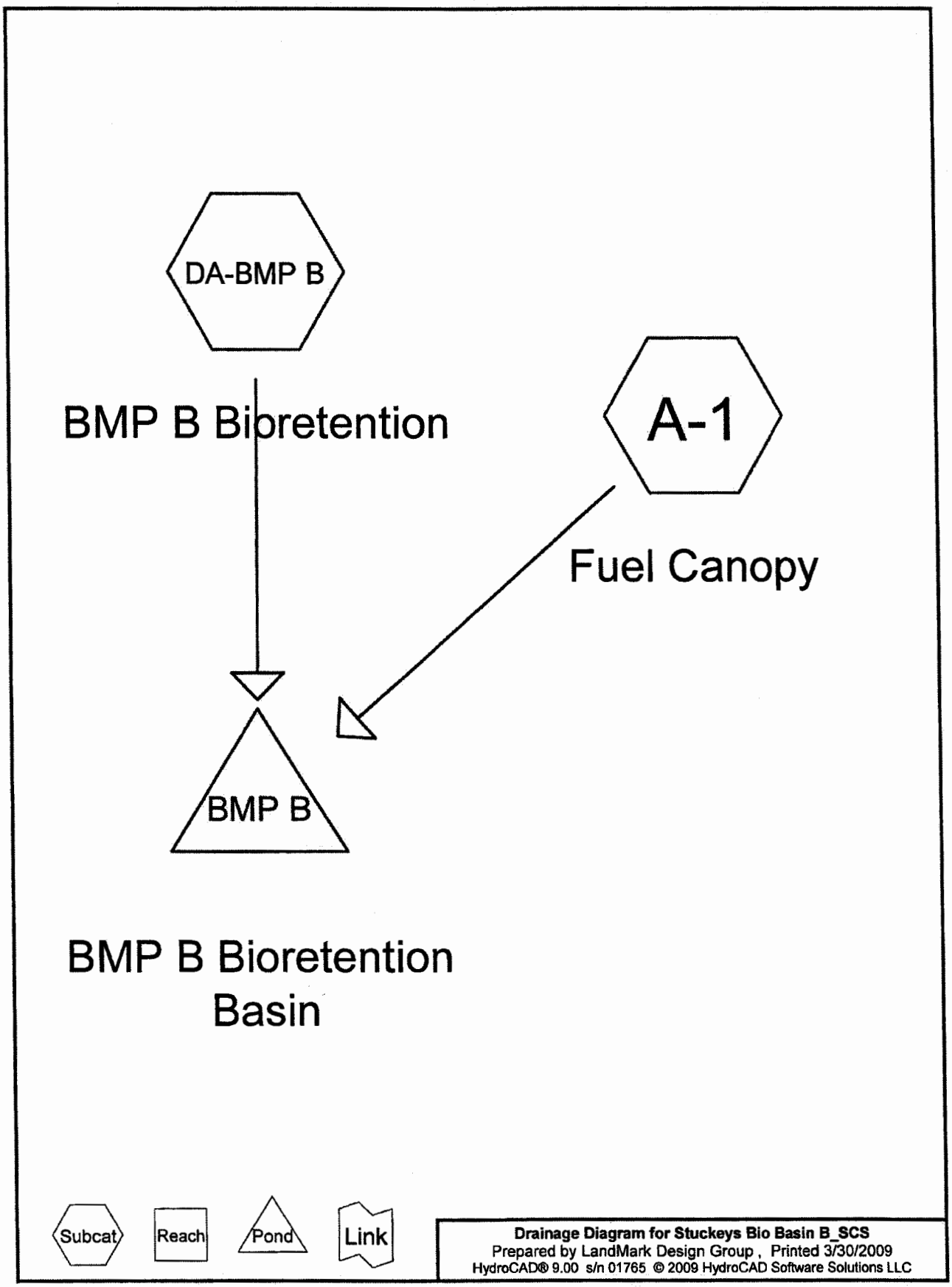


CALCULATIONS OF THE EFFECTIVE OPENNING.

HEIGHT = 3'-0" HEIGHT ON 3:1 SLOPE ≈ 0.95ft

WIDTH = 41" − 19 × 0.5" = 31.5" ≈ 2.63 ft

HydroCad Model
SCS Method


DA-BMP B
BMP B Bioretention
A-1
Fuel Canopy
BMP B
BMP B Bioretention Basin
Subcat
Reach
Pond
Link
Drainage Diagram for Stuckeys Bio Basin B_SCS
Prepared by LandMark Design Group , Printed 3/30/2009
HydroCAD® 9.00 s/n 01765 © 2009 HydroCAD Software Solutions LLC

1-year

Summary for Pond BMP B: BMP B Bioretention Basin

Inflow Area = 0.888 ac, 64.86% Impervious, Inflow Depth > 1.71" for 1-Year event
Inflow = 2.48 cfs @ 11.98 hrs, Volume= 0.127 af
Outflow = 2.19 cfs @ 12.02 hrs, Volume= 0.112 af, Atten= 12%, Lag= 2.4 min
Primary = 2.19 cfs @ 12.02 hrs, Volume= 0.112 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 115.52' @ 12.02 hrs Surf.Area= 1,820 sf Storage= 1,191 cf

Plug-Flow detention time= 79.5 min calculated for 0.112 af (88% of inflow)
Center-of-Mass det. time= 22.9 min (829.4 - 806.5)

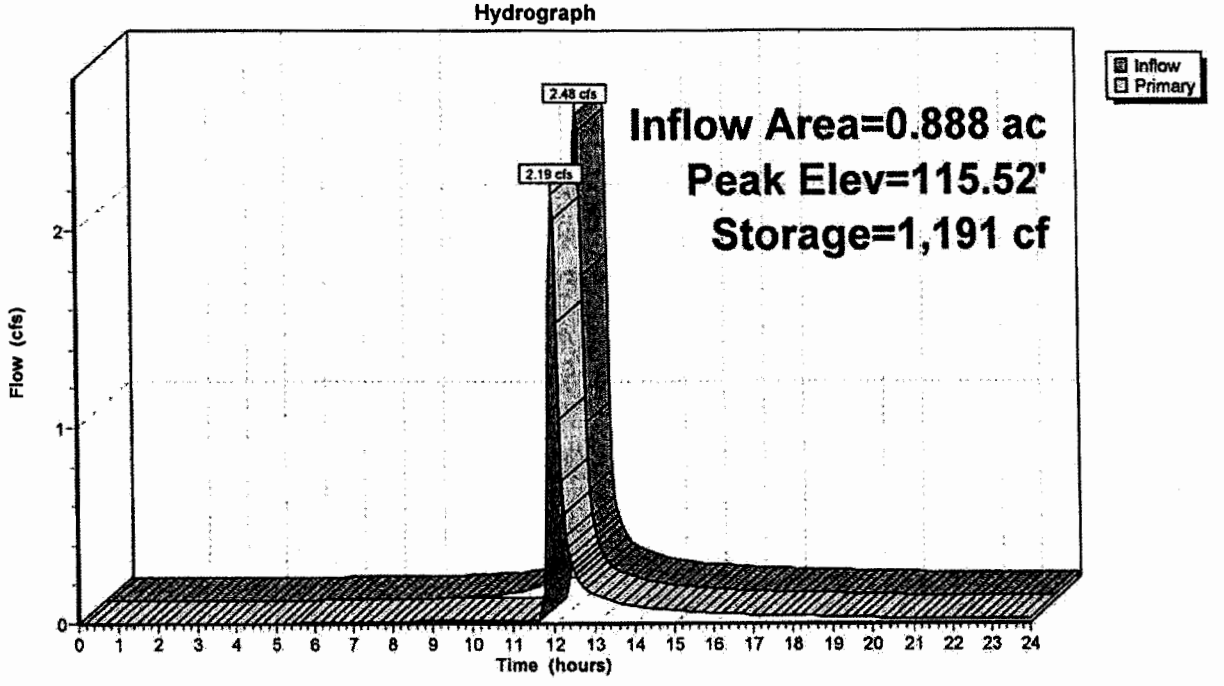
Volume	Invert	Avail.Storage	Storage Description
#1	114.67'	1,632 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
114.67	1,112	156.4	0	0	1,112
115.00	1,271	162.7	393	393	1,280
115.50	1,808	188.4	766	1,159	2,004
115.75	1,982	196.8	474	1,632	2,266

Device	Routing	Invert	Outlet Devices
#1	Primary	110.58'	**15.0" Round Culvert - 15" RCP** L= 108.0' Ke= 0.500 Outlet Invert= 110.20' S= 0.0035 '/' Cc= 0.900 n= 0.013
#2	Device 1	115.17'	**31.5" x 36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 2	115.17'	**143.0 deg x 2.6' long x 0.95' rise Sharp-Crested Vee/Trap Weir** C= 2.47
#4	Device 1	114.67'	**0.520 in/hr Exfiltration over Surface area**

Primary OutFlow Max=2.13 cfs @ 12.02 hrs HW=115.51' (Free Discharge)
└─**1=Culvert - 15" RCP** (Passes 2.13 cfs of 9.90 cfs potential flow)
  ├─**2=Orifice/Grate** (Passes 2.11 cfs of 7.35 cfs potential flow)
  │ └─**3=Sharp-Crested Vee/Trap Weir** (Weir Controls 2.11 cfs @ 1.70 fps)
  └─**4=Exfiltration** (Exfiltration Controls 0.02 cfs)

Pond BMP B: BMP B Bioretention Basin



Summary for Subcatchment A-1: Fuel Canopy

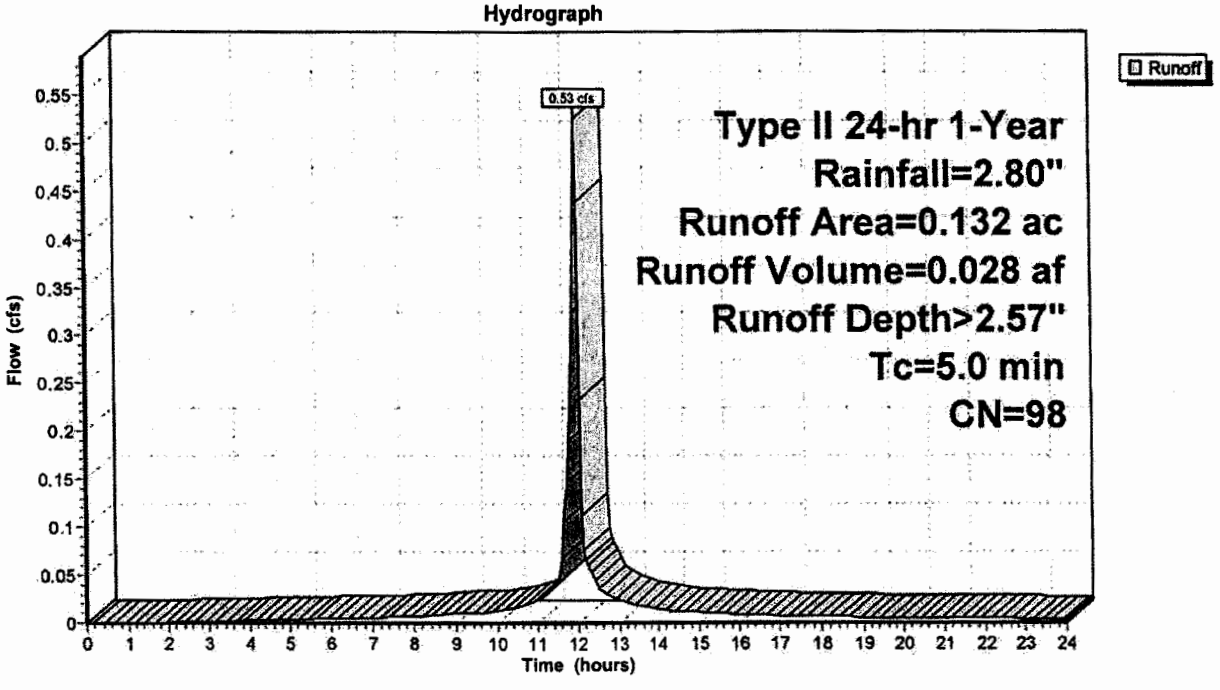
Runoff = 0.53 cfs @ 11.95 hrs, Volume= 0.028 af, Depth> 2.57"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-Year Rainfall=2.80"

Area (ac)	CN	Description
0.132	98	Paved parking & roofs
0.132		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, Tc

Subcatchment A-1: Fuel Canopy



Summary for Subcatchment DA-BMP B: BMP B Bioretention

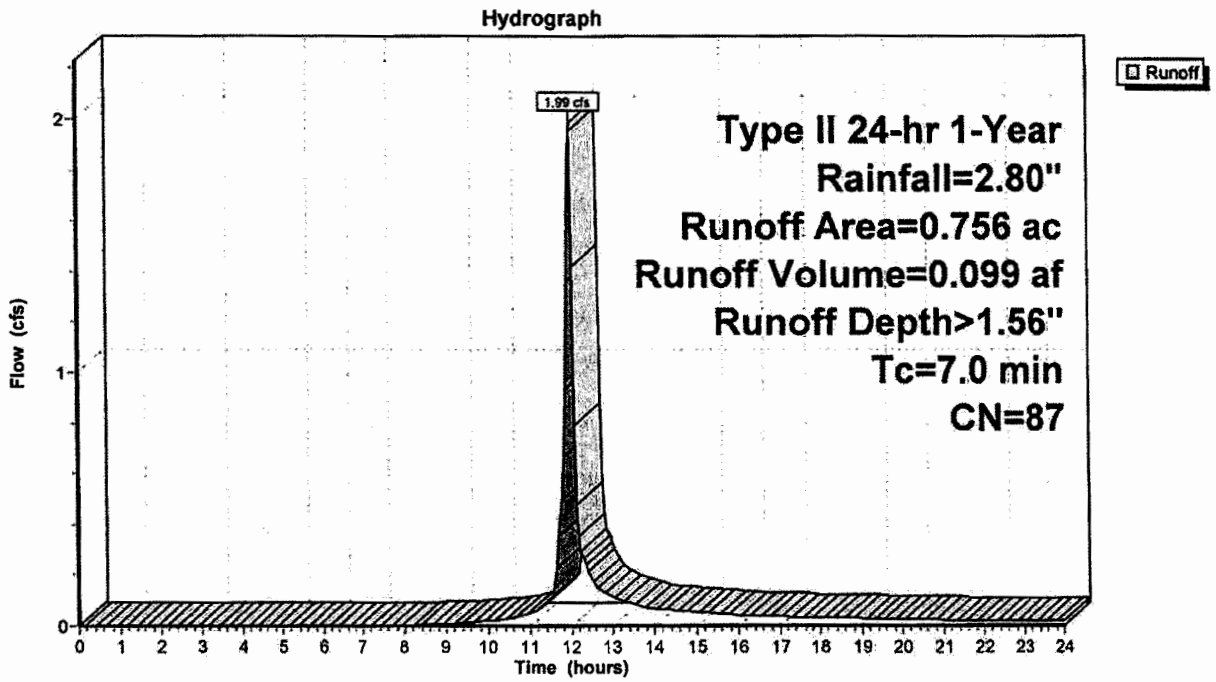
Runoff = 1.99 cfs @ 11.98 hrs, Volume= 0.099 af, Depth> 1.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-Year Rainfall=2.80"

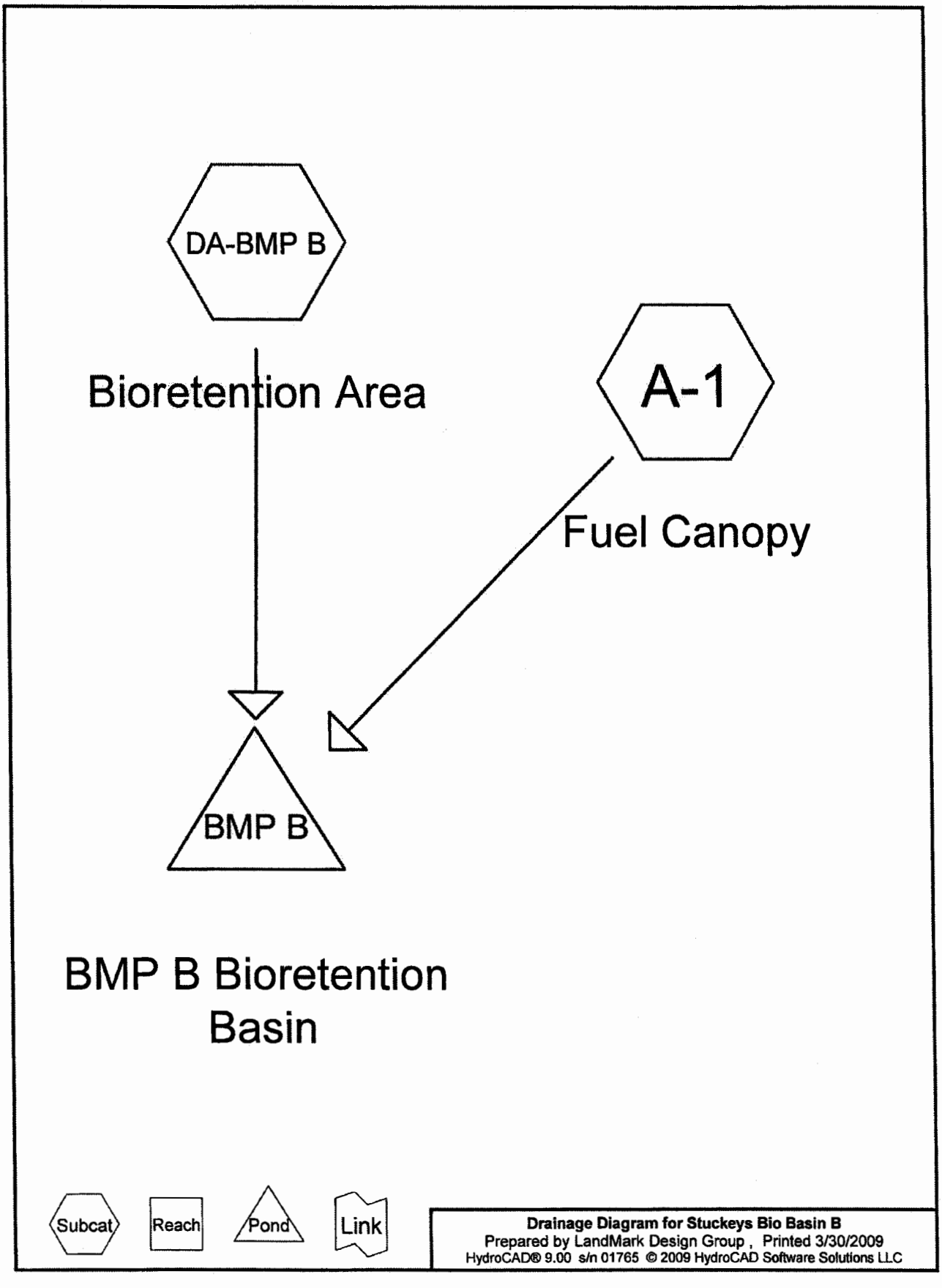
Area (ac)	CN	Description
0.444	98	Paved roads w/curbs & sewers
0.290	74	>75% Grass cover, Good, HSG C
0.022	39	>75% Grass cover, Good, HSG A
0.756	87	Weighted Average
0.312		41.27% Pervious Area
0.444		58.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					Direct Entry, Tc

Subcatchment DA-BMP B: BMP B Bioretention



Rational Method


DA-BMP B
Bioretention Area
A-1
Fuel Canopy
BMP B
BMP B Bioretention Basin
Subcat
Reach
Pond
Link
Drainage Diagram for Stuckeys Bio Basin B
Prepared by LandMark Design Group , Printed 3/30/2009
HydroCAD® 9.00 s/n 01765 © 2009 HydroCAD Software Solutions LLC

2-year

Summary for Pond BMP B: BMP B Bioretention Basin

Inflow Area = 0.888 ac, 0.00% Impervious, Inflow Depth = 0.77" for 2-Year event
Inflow = 2.47 cfs @ 0.12 hrs, Volume= 0.057 af
Outflow = 2.20 cfs @ 0.27 hrs, Volume= 0.049 af, Atten= 11%, Lag= 8.9 min
Primary = 2.20 cfs @ 0.27 hrs, Volume= 0.049 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Peak Elev= 115.52' @ 0.27 hrs Surf.Area= 1,821 sf Storage= 1,192 cf

Plug-Flow detention time= 34.4 min calculated for 0.049 af (86% of inflow)
Center-of-Mass det. time= 33.0 min (44.8 - 11.8)

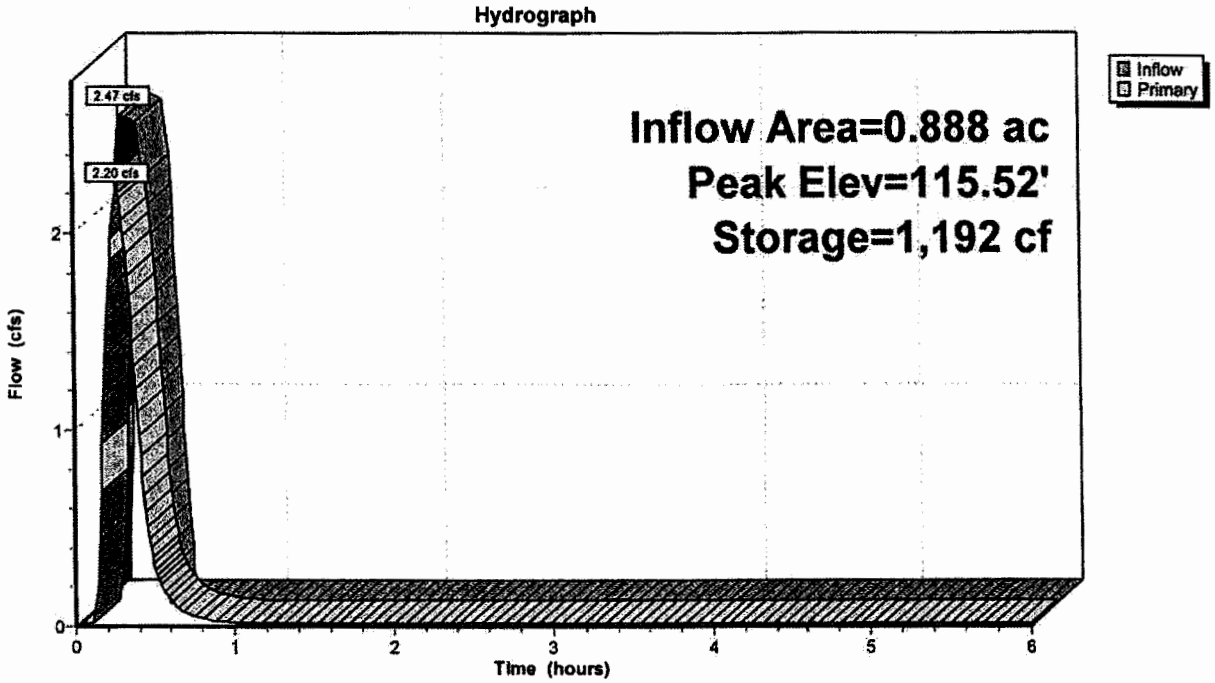
Volume	Invert	Avail.Storage	Storage Description
#1	114.67'	1,632 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
114.67	1,112	156.4	0	0	1,112
115.00	1,271	162.7	393	393	1,280
115.50	1,808	188.4	766	1,159	2,004
115.75	1,982	196.8	474	1,632	2,266

Device	Routing	Invert	Outlet Devices
#1	Primary	110.58'	**15.0" Round Culvert - 15" RCP** L= 108.0' Ke= 0.500 Outlet Invert= 110.20' S= 0.0035 '/' Cc= 0.900 n= 0.013
#2	Device 1	115.17'	**31.5" x 36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 2	115.17'	**143.0 deg x 2.6' long x 0.95' rise Sharp-Crested Vee/Trap Weir** C= 2.47
#4	Device 1	114.67'	**0.520 in/hr Exfiltration over Surface area**

Primary OutFlow Max=2.20 cfs @ 0.27 hrs HW=115.52' (Free Discharge)
- **1=Culvert - 15" RCP** (Passes 2.20 cfs of 9.91 cfs potential flow)
  - **2=Orifice/Grate** (Passes 2.18 cfs of 7.56 cfs potential flow)
    - **3=Sharp-Crested Vee/Trap Weir** (Weir Controls 2.18 cfs @ 1.72 fps)
  - **4=Exfiltration** (Exfiltration Controls 0.02 cfs)

Pond BMP B: BMP B Bioretention Basin



Summary for Subcatchment DA-BMP B: Bioretention Area

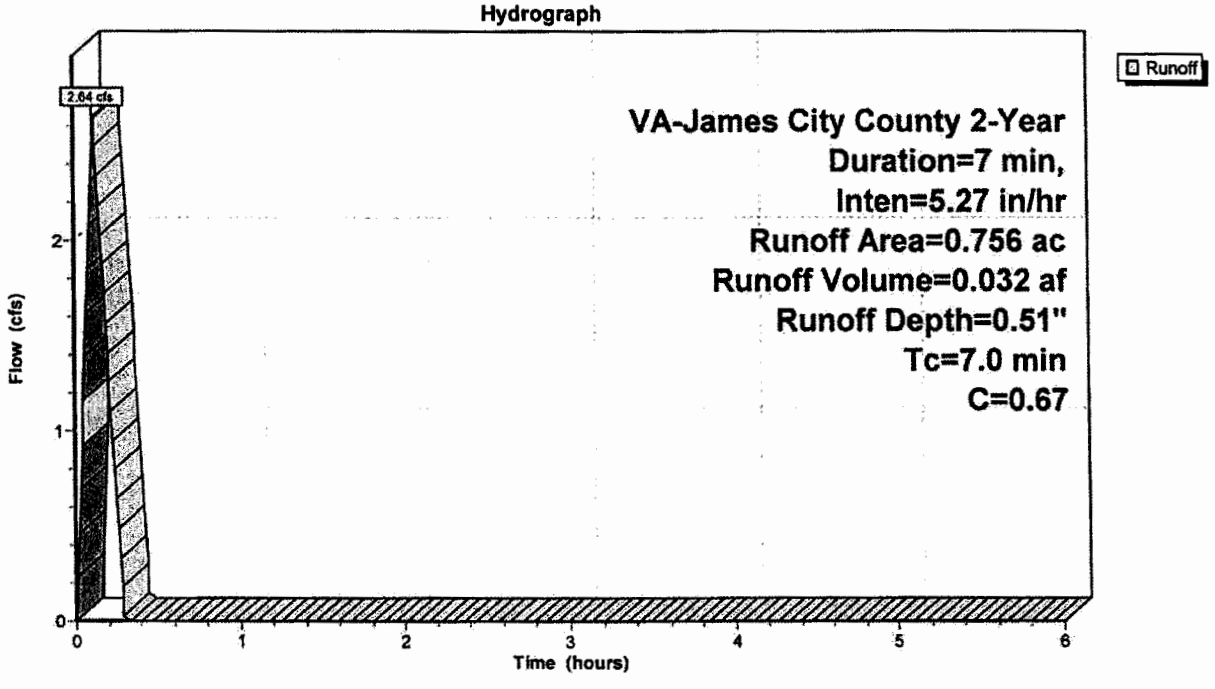
Runoff = 2.64 cfs @ 0.12 hrs, Volume= 0.032 af, Depth= 0.51"

Runoff by Rational method, Rise/Fall=1.0/1.5 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
VA-James City County 2-Year Duration=7 min, Inten=5.27 in/hr

Area (ac)	C	Description
0.444	0.90	Roof/Concrete/Asphalt
0.312	0.35	Lawn/Grass
0.756	0.67	Weighted Average
0.756		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry, Tc**

Subcatchment DA-BMP B: Bioretention Area



Summary for Subcatchment A-1: Fuel Canopy

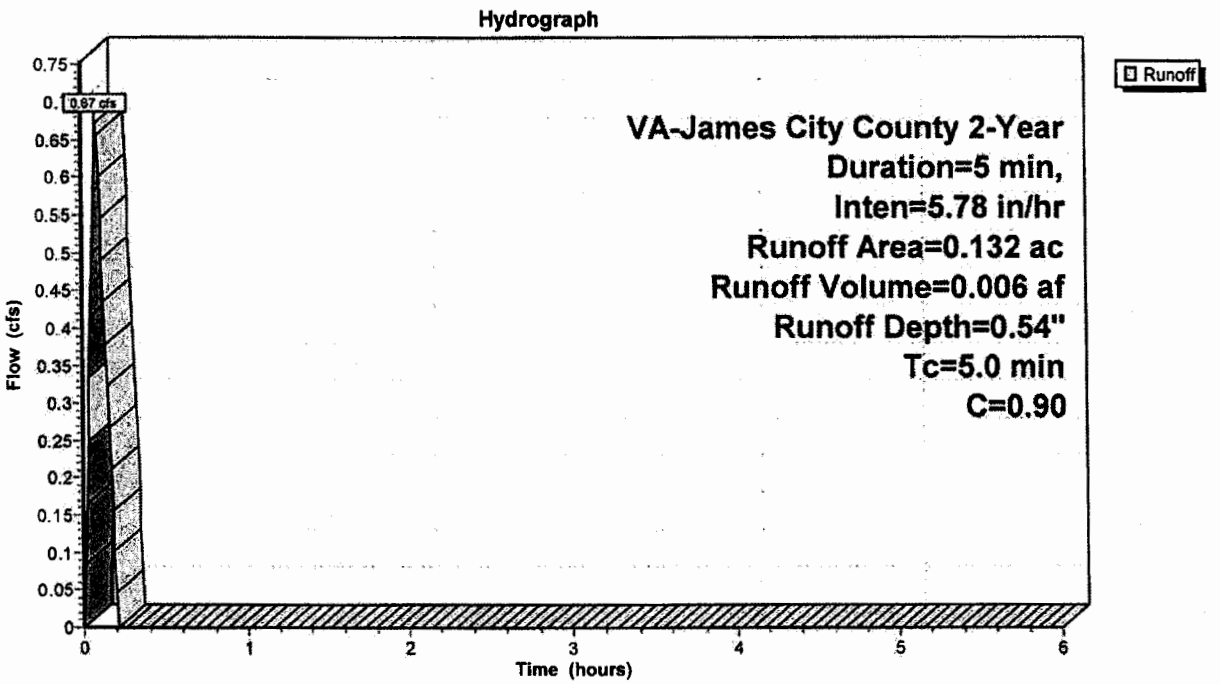
Runoff = 0.67 cfs @ 0.08 hrs, Volume= 0.006 af, Depth= 0.54"

Runoff by Rational method, Rise/Fall=1.0/1.5 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
VA-James City County 2-Year Duration=5 min, Inten=5.78 in/hr

Area (ac)	C	Description
0.132	0.90	Roof/Concrete/Asphalt
0.132		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, Tc

Subcatchment A-1: Fuel Canopy



10-year

Summary for Pond BMP B: BMP B Bioretention Basin

Inflow Area = 0.888 ac, 0.00% Impervious, Inflow Depth = 0.94" for 10-Year event
Inflow = 3.44 cfs @ 0.12 hrs, Volume= 0.070 af
Outflow = 3.09 cfs @ 0.23 hrs, Volume= 0.062 af, Atten= 10%, Lag= 6.8 min
Primary = 3.09 cfs @ 0.23 hrs, Volume= 0.062 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Peak Elev= 115.59' @ 0.23 hrs Surf.Area= 1,872 sf Storage= 1,329 cf

Plug-Flow detention time= 27.4 min calculated for 0.062 af (89% of inflow)
Center-of-Mass det. time= 26.8 min (37.6 - 10.8)

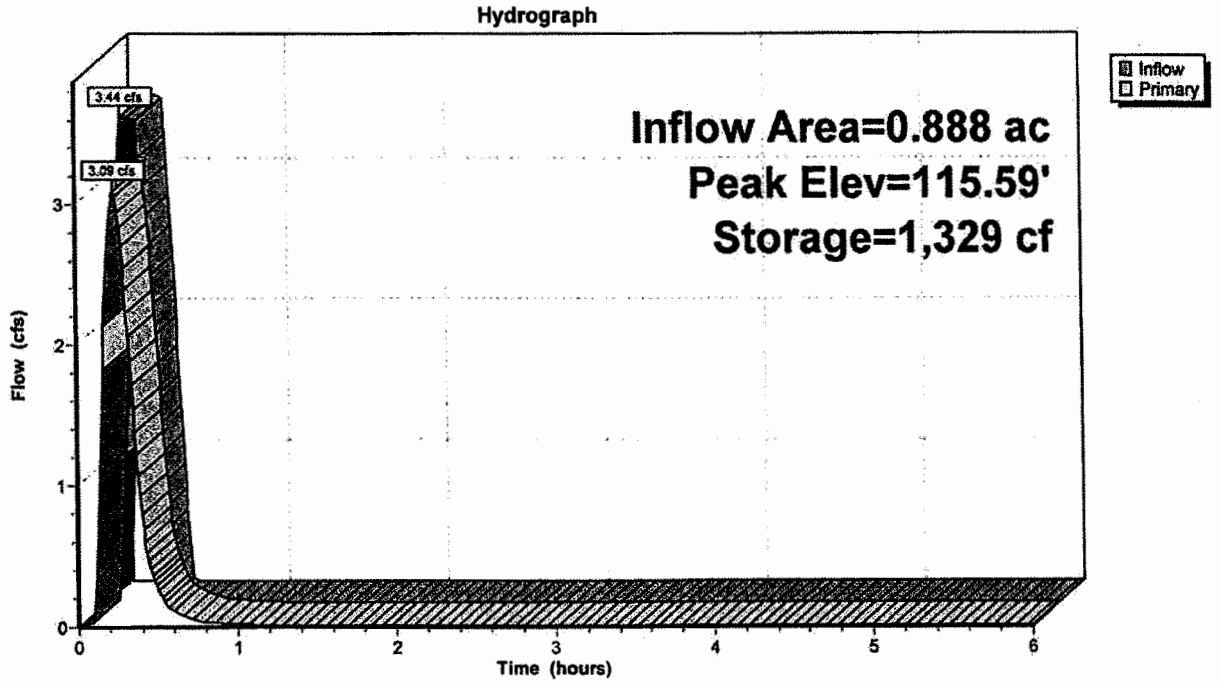
Volume	Invert	Avail.Storage	Storage Description
#1	114.67'	1,632 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
114.67	1,112	156.4	0	0	1,112
115.00	1,271	162.7	393	393	1,280
115.50	1,808	188.4	766	1,159	2,004
115.75	1,982	196.8	474	1,632	2,266

Device	Routing	Invert	Outlet Devices
#1	Primary	110.58'	**15.0" Round Culvert - 15" RCP** L= 108.0' Ke= 0.500 Outlet Invert= 110.20' S= 0.0035 '/' Cc= 0.900 n= 0.013
#2	Device 1	115.17'	**31.5" x 36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 2	115.17'	**143.0 deg x 2.6' long x 0.95' rise Sharp-Crested Vee/Trap Weir** C= 2.47
#4	Device 1	114.67'	**0.520 in/hr Exfiltration over Surface area**

Primary OutFlow Max=3.08 cfs @ 0.23 hrs HW=115.59' (Free Discharge)
- **1=Culvert - 15" RCP** (Passes 3.08 cfs of 10.00 cfs potential flow)
  - **2=Orifice/Grate** (Passes 3.06 cfs of 10.09 cfs potential flow)
    - **3=Sharp-Crested Vee/Trap Weir** (Weir Controls 3.06 cfs @ 1.88 fps)
  - **4=Exfiltration** (Exfiltration Controls 0.02 cfs)

Pond BMP B: BMP B Bioretention Basin



Summary for Subcatchment DA-BMP B: Bioretention Area

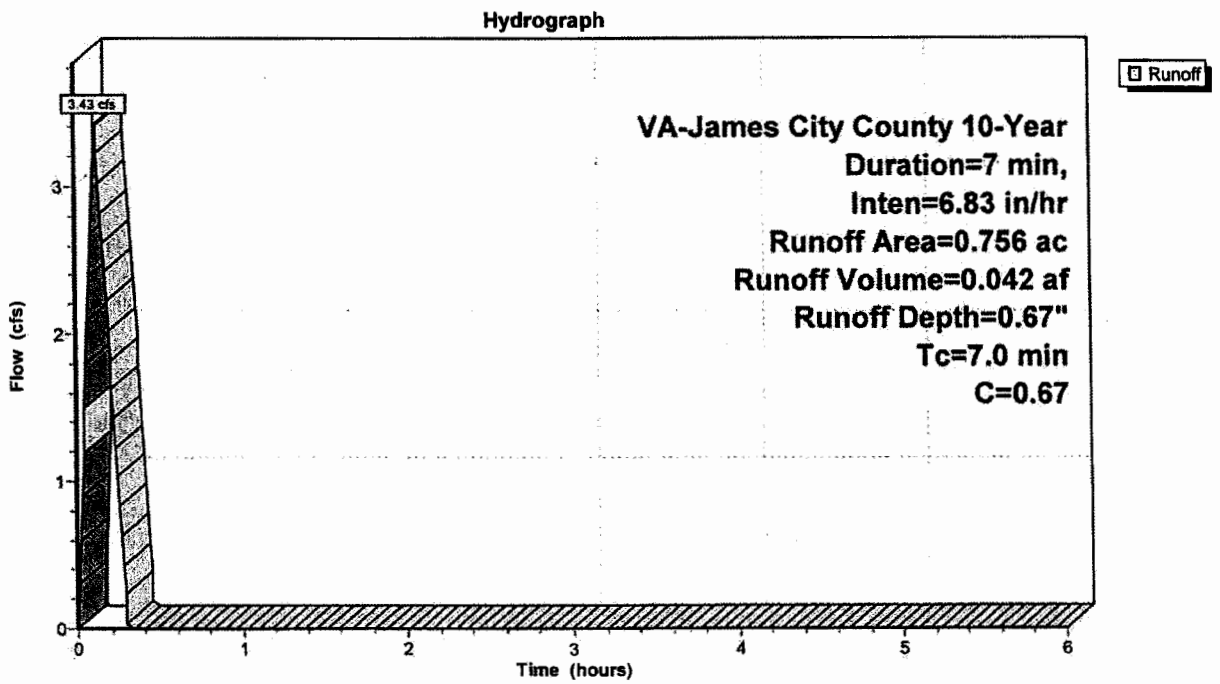
Runoff = 3.43 cfs @ 0.12 hrs, Volume= 0.042 af, Depth= 0.67"

Runoff by Rational method, Rise/Fall=1.0/1.5 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
VA-James City County 10-Year Duration=7 min, Inten=6.83 in/hr

Area (ac)	C	Description
0.444	0.90	Roof/Concrete/Asphalt
0.312	0.35	Lawn/Grass
0.756	0.67	Weighted Average
0.756		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry, Tc**

Subcatchment DA-BMP B: Bioretention Area



Summary for Subcatchment A-1: Fuel Canopy

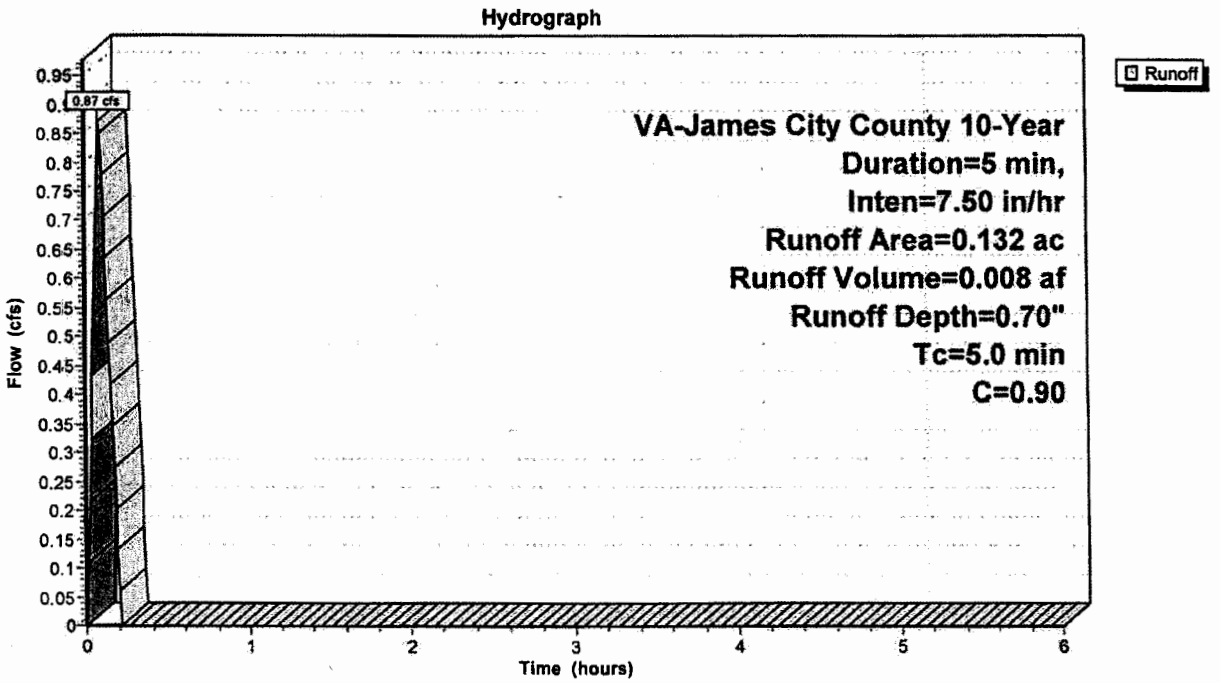
Runoff = 0.87 cfs @ 0.08 hrs, Volume= 0.008 af, Depth= 0.70"

Runoff by Rational method, Rise/Fall=1.0/1.5 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
VA-James City County 10-Year Duration=5 min, Inten=7.50 in/hr

Area (ac)	C	Description
0.132	0.90	Roof/Concrete/Asphalt
0.132		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, Tc

Subcatchment A-1: Fuel Canopy



25-year

Summary for Pond BMP B: BMP B Bioretention Basin

Inflow Area = 0.888 ac, 0.00% Impervious, Inflow Depth = 1.03" for 25-Year event
Inflow = 4.05 cfs @ 0.12 hrs, Volume= 0.076 af
Outflow = 3.61 cfs @ 0.22 hrs, Volume= 0.068 af, Atten= 11%, Lag= 5.9 min
Primary = 3.61 cfs @ 0.22 hrs, Volume= 0.068 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Peak Elev= 115.63' @ 0.22 hrs Surf.Area= 1,899 sf Storage= 1,403 cf

Plug-Flow detention time= 25.5 min calculated for 0.068 af (90% of inflow)
Center-of-Mass det. time= 24.5 min (34.8 - 10.3)

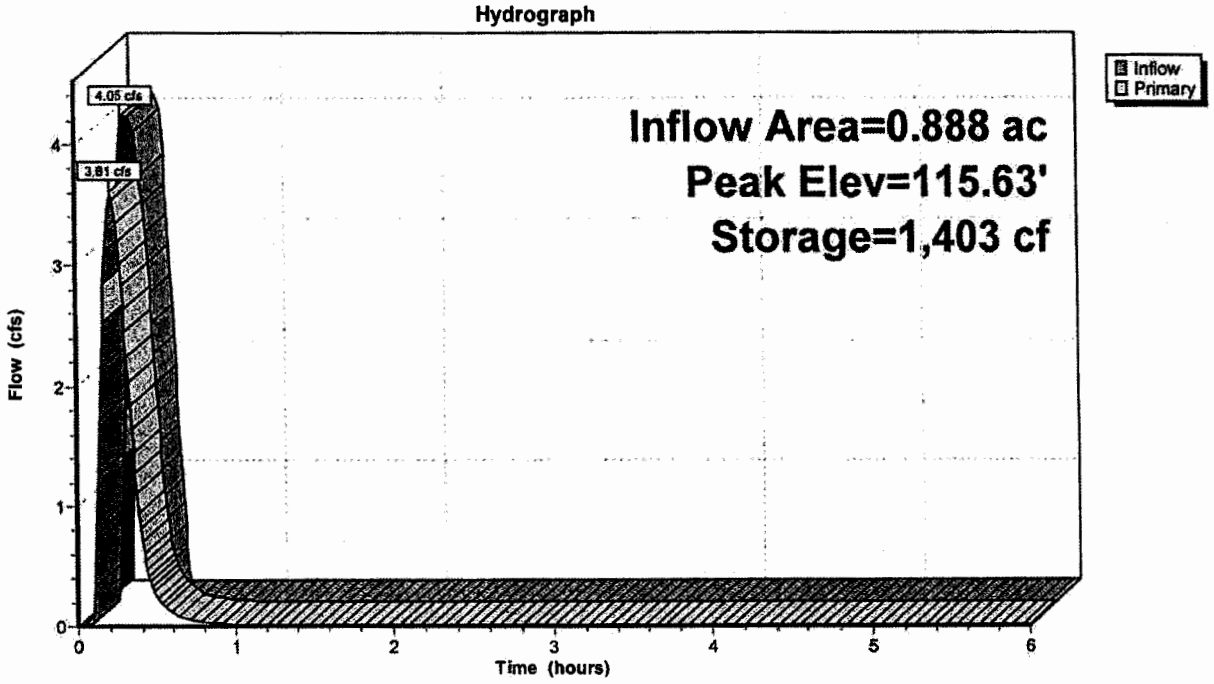
Volume	Invert	Avail.Storage	Storage Description
#1	114.67'	1,632 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
114.67	1,112	156.4	0	0	1,112
115.00	1,271	162.7	393	393	1,280
115.50	1,808	188.4	766	1,159	2,004
115.75	1,982	196.8	474	1,632	2,266

Device	Routing	Invert	Outlet Devices
#1	Primary	110.58'	**15.0" Round Culvert - 15" RCP** L= 108.0' Ke= 0.500 Outlet Invert= 110.20' S= 0.0035 '/' Cc= 0.900 n= 0.013
#2	Device 1	115.17'	**31.5" x 36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 2	115.17'	**143.0 deg x 2.6' long x 0.95' rise Sharp-Crested Vee/Trap Weir** C= 2.47
#4	Device 1	114.67'	**0.520 in/hr Exfiltration over Surface area**

Primary OutFlow Max=3.61 cfs @ 0.22 hrs HW=115.63' (Free Discharge)
↑**1=Culvert - 15" RCP** (Passes 3.61 cfs of 10.05 cfs potential flow)
↑**2=Orifice/Grate** (Passes 3.58 cfs of 11.53 cfs potential flow)
↑**3=Sharp-Crested Vee/Trap Weir** (Weir Controls 3.58 cfs @ 1.95 fps)
4=Exfiltration (Exfiltration Controls 0.02 cfs)

Pond BMP B: BMP B Bioretention Basin



Summary for Subcatchment DA-BMP B: Bioretention Area

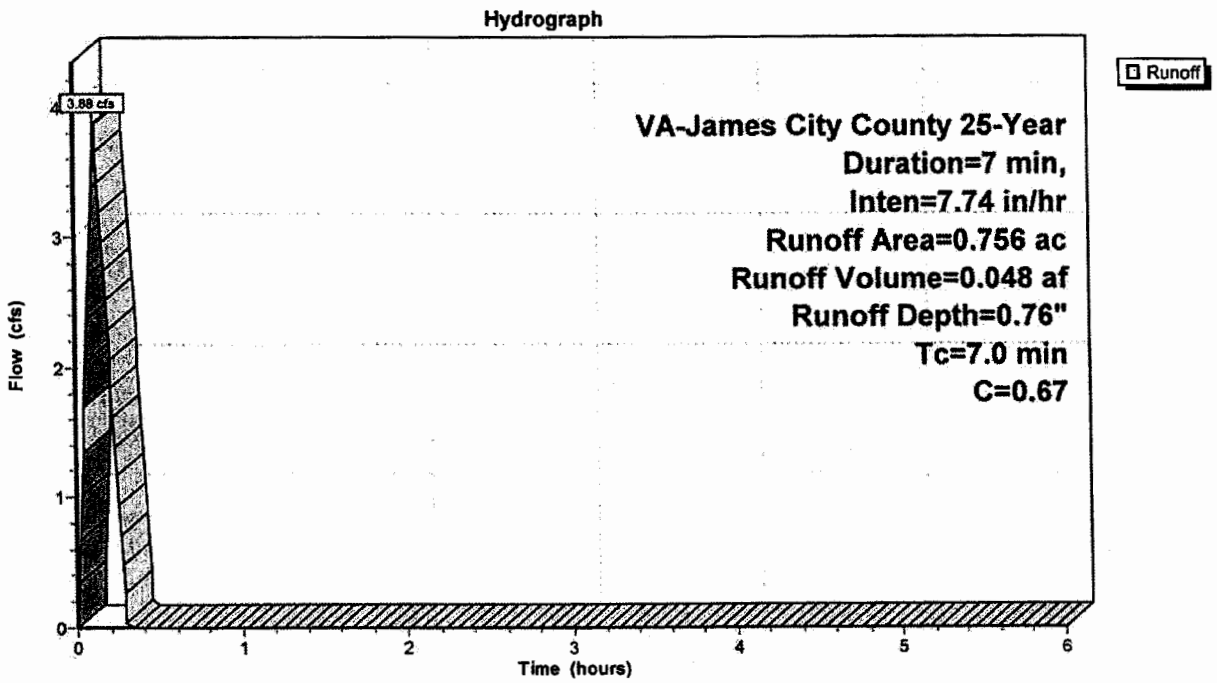
Runoff = 3.88 cfs @ 0.12 hrs, Volume= 0.048 af, Depth= 0.76"

Runoff by Rational method, Rise/Fall=1.0/1.5 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
VA-James City County 25-Year Duration=7 min, Inten=7.74 in/hr

Area (ac)	C	Description
0.444	0.90	Roof/Concrete/Asphalt
0.312	0.35	Lawn/Grass
0.756	0.67	Weighted Average
0.756		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry, Tc**

Subcatchment DA-BMP B: Bioretention Area



Summary for Subcatchment A-1: Fuel Canopy

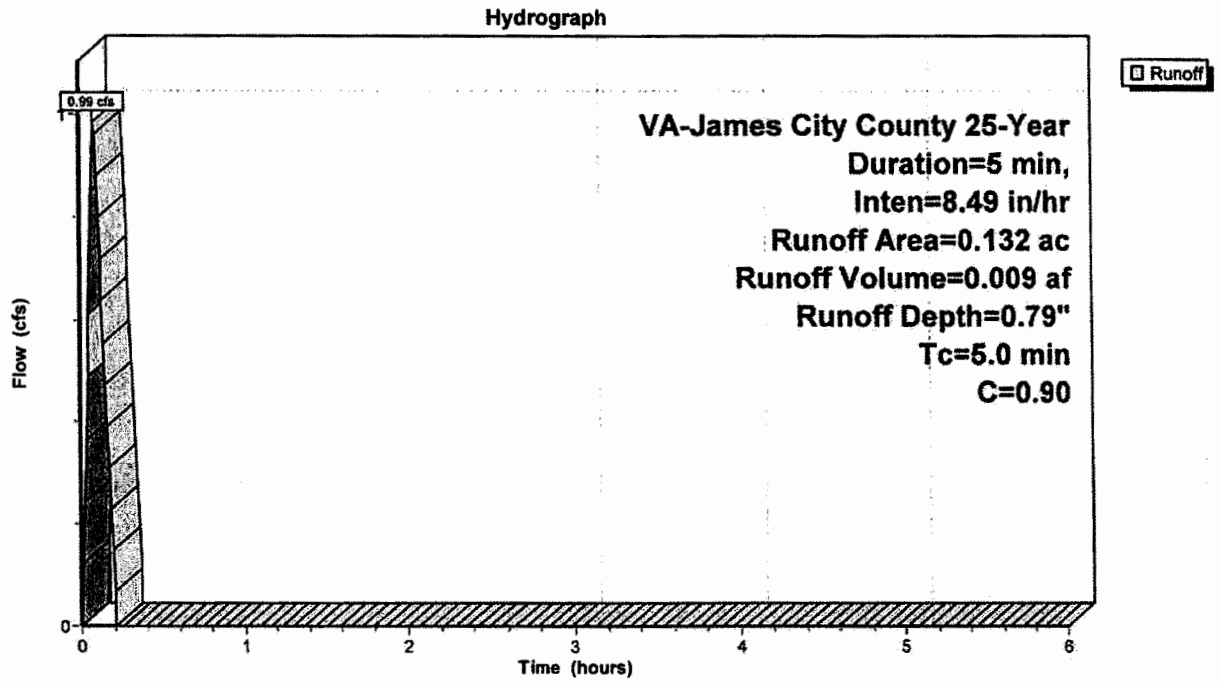
Runoff = 0.99 cfs @ 0.08 hrs, Volume= 0.009 af, Depth= 0.79"

Runoff by Rational method, Rise/Fall=1.0/1.5 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
VA-James City County 25-Year Duration=5 min, Inten=8.49 in/hr

Area (ac)	C	Description
0.132	0.90	Roof/Concrete/Asphalt
0.132		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Tc**

Subcatchment A-1: Fuel Canopy



100-year

Summary for Pond BMP B: BMP B Bioretention Basin

Inflow Area = 0.888 ac, 0.00% Impervious, Inflow Depth = 1.20" for 100-Year event
Inflow = 4.71 cfs @ 0.12 hrs, Volume= 0.088 af
Outflow = 4.33 cfs @ 0.21 hrs, Volume= 0.081 af, Atten= 8%, Lag= 5.6 min
Primary = 4.33 cfs @ 0.21 hrs, Volume= 0.081 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Peak Elev= 115.68' @ 0.21 hrs Surf.Area= 1,933 sf Storage= 1,497 cf

Plug-Flow detention time= 21.5 min calculated for 0.081 af (91% of inflow)
Center-of-Mass det. time= 21.2 min (31.6 - 10.3)

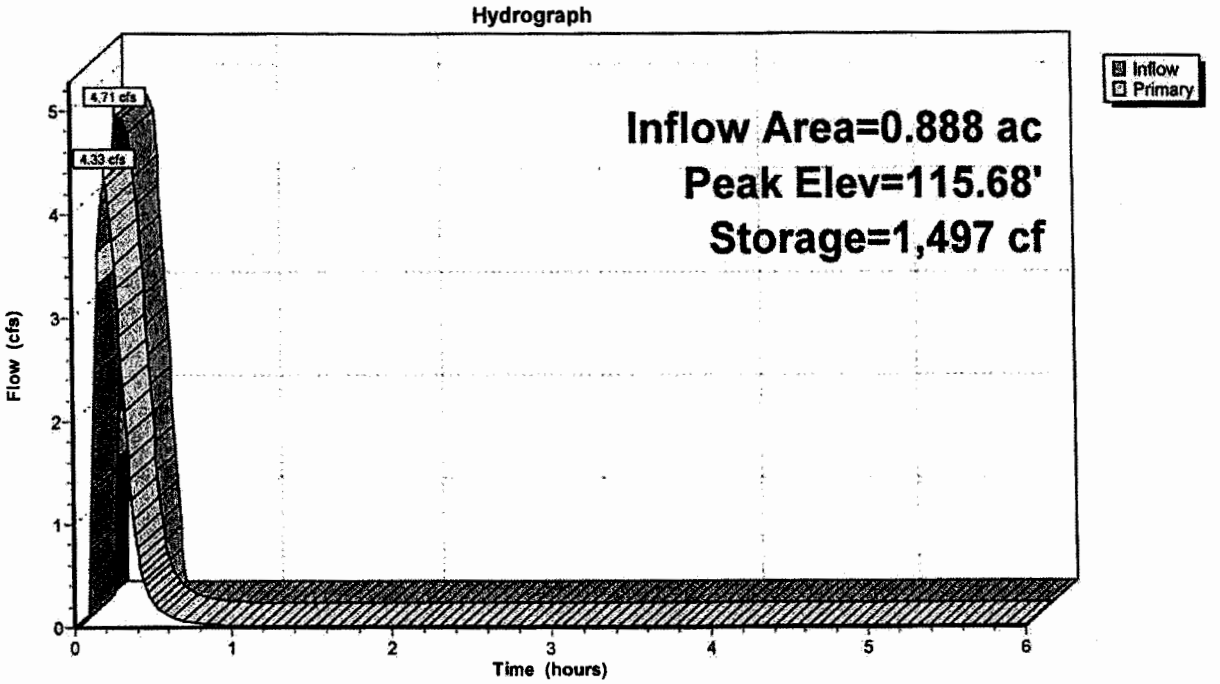
Volume	Invert	Avail.Storage	Storage Description
#1	114.67'	1,632 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
114.67	1,112	156.4	0	0	1,112
115.00	1,271	162.7	393	393	1,280
115.50	1,808	188.4	766	1,159	2,004
115.75	1,982	196.8	474	1,632	2,266

Device	Routing	Invert	Outlet Devices
#1	Primary	110.58'	**15.0" Round Culvert - 15" RCP** L= 108.0' Ke= 0.500 Outlet Invert= 110.20' S= 0.0035 '/' Cc= 0.900 n= 0.013
#2	Device 1	115.17'	**31.5" x 36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 2	115.17'	**143.0 deg x 2.6' long x 0.95' rise Sharp-Crested Vee/Trap Weir** C= 2.47
#4	Device 1	114.67'	**0.520 in/hr Exfiltration over Surface area**

Primary OutFlow Max=4.32 cfs @ 0.21 hrs HW=115.68' (Free Discharge)
- **1=Culvert - 15" RCP** (Passes 4.32 cfs of 10.10 cfs potential flow)
  - **2=Orifice/Grate** (Passes 4.29 cfs of 13.40 cfs potential flow)
    - **3=Sharp-Crested Vee/Trap Weir** (Weir Controls 4.29 cfs @ 2.04 fps)
  - **4=Exfiltration** (Exfiltration Controls 0.02 cfs)

Pond BMP B: BMP B Bioretention Basin



Summary for Subcatchment DA-BMP B: Bioretention Area

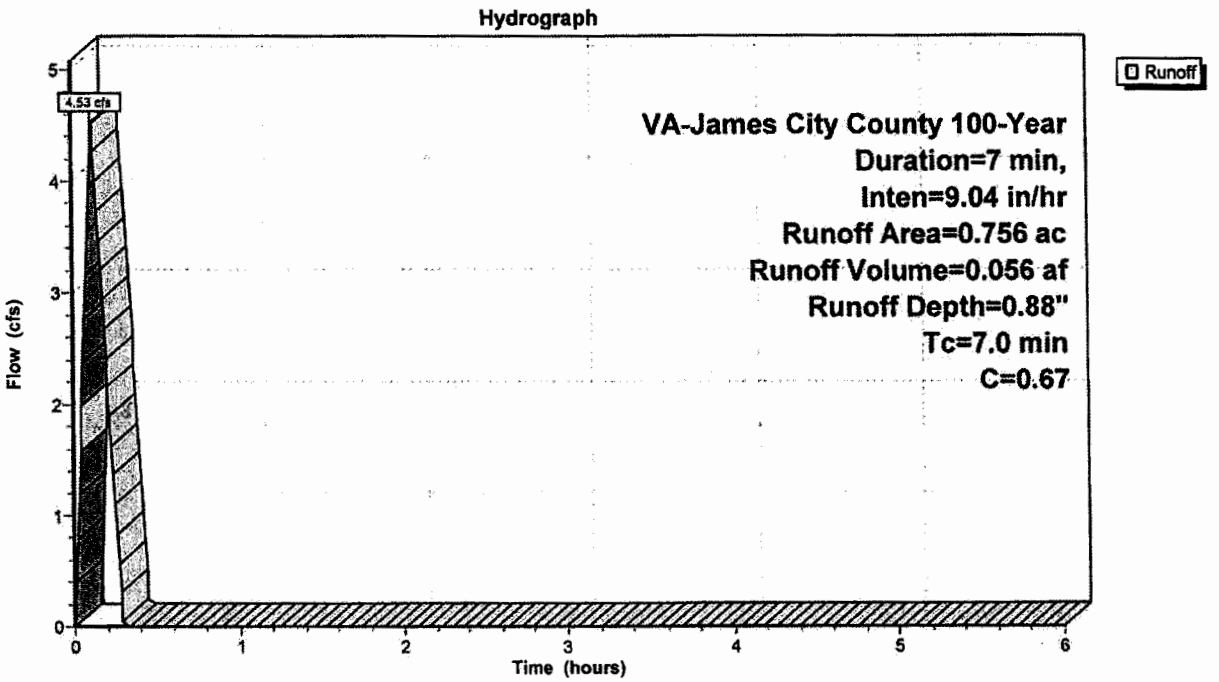
Runoff = 4.53 cfs @ 0.12 hrs, Volume= 0.056 af, Depth= 0.88"

Runoff by Rational method, Rise/Fall=1.0/1.5 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
VA-James City County 100-Year Duration=7 min, Inten=9.04 in/hr

Area (ac)	C	Description
0.444	0.90	Roof/Concrete/Asphalt
0.312	0.35	Lawn/Grass
0.756	0.67	Weighted Average
0.756		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry, Tc**

Subcatchment DA-BMP B: Bioretention Area



Summary for Subcatchment A-1: Fuel Canopy

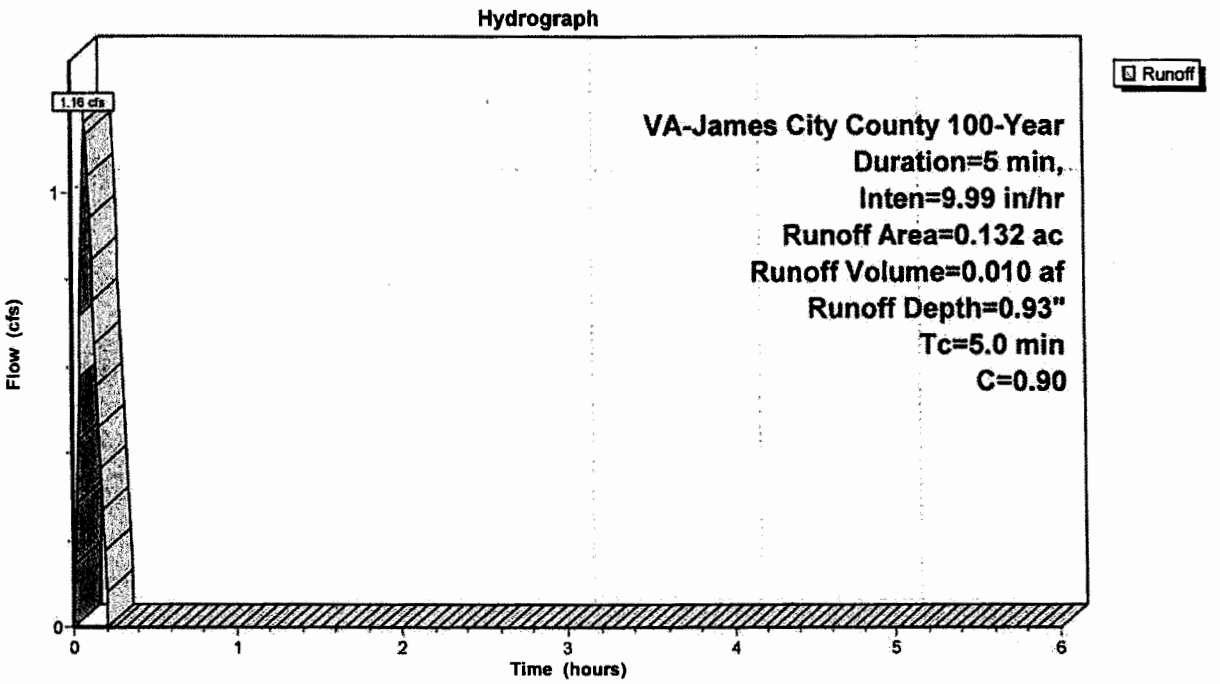
Runoff = 1.16 cfs @ 0.08 hrs, Volume= 0.010 af, Depth= 0.93"

Runoff by Rational method, Rise/Fall=1.0/1.5 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
VA-James City County 100-Year Duration=5 min, Inten=9.99 in/hr

Area (ac)	C	Description
0.132	0.90	Roof/Concrete/Asphalt
0.132		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Tc**

Subcatchment A-1: Fuel Canopy



Point of Investigation II – Infiltration Basin "C"

Water Quality Calculations

Subject WATER QUALITY CALCULATIONS
Computed P.S. Checked

LANDMARK DESIGN GROUP

Project # 2004224-000.00
Client FORMER STUCKEY'S SITE
Date APRIL 2009 Sheet #

Engineers • Planners • Surveyors • Landscape Architects • Environmental Scientists

INFILTRATION BASIN WATER QUALITY CALCULATIONS

1 inch IMP AREA = 0.582 Ac

$VOL_{WQ\ REQ} = 1\text{inch} \times \frac{1}{12}\frac{ft}{inch} \times 0.582\ Ac \times 43560\ ft^2 = 2,113\ ft^3$

$WOL_{WQ\ PROVIDED} = 13,520\ ft^3$ @ EL = 110.30 (1 year WSEL = 107.06)

THE MINIMUM SURFACE AREA OF THE FACILITY BOTTOM

$$SA_{min} = \frac{VOL_{WQ}}{f_d\ T_{max}}$$

$f_d = 0.5f$ where $f = 8.30\ inch/hr$ (REFER TO THE ATTACHED GEOTECHNICAL REPORT)

$f_d = 0.5 \times 8.30 = 4.15\ inch/hr$

$$SA_{min} = \frac{2,113\ ft^3}{4.15\frac{inch}{hrs} \cdot \frac{1\ ft}{12\ inch} \times 48\ hrs} = 127.3\ ft^2$$

SA BASED ON PROVIDED WATER QUALITY STORAGE VOLUME

$VOL_{PROVIDED} = 13,520\ ft^3$

$$SA_{PROVIDED} = \frac{13,520\ ft^3}{4.15\ inch/hrs \times \frac{1}{12}\frac{ft}{inch} \times 48 hrs} = 814\ ft^2$$

PROVIDED SURFACE AREA OF THE BOTTOM OF THE INFILTRATION BASIN

EL = 105.00	$812\ ft^2$
EL = 106.00	$1,428\ ft^2$

FOR TOTAL DRAWN DOWN CALCULATIONS SEE NEXT PAGE.

Hydrograph for Pond BMP C: BMP C Infiltration Basin

TOTAL DRAWNDOWN CALCULATIONS

STARTING EL=110.30 (WEIR ELEVATION)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
1.00	**0.00**	**13,520**	**110.30**	**0.54**	**0.54**	**0.00**
1.50	0.00	12,574	110.08	0.52	0.52	0.00
2.00	0.00	11,663	109.87	0.50	0.50	0.00
2.50	0.00	10,786	109.65	0.48	0.48	0.00
3.00	0.00	9,943	109.43	0.46	0.46	0.00
3.50	0.00	9,134	109.21	0.44	0.44	0.00
4.00	0.00	8,359	109.00	0.42	0.42	0.00
4.50	0.00	7,619	108.78	0.40	0.40	0.00
5.00	0.00	6,917	108.56	0.38	0.38	0.00
5.50	0.00	6,250	108.34	0.36	0.36	0.00
6.00	0.00	5,620	108.13	0.34	0.34	0.00
6.50	0.00	5,026	107.91	0.32	0.32	0.00
7.00	0.00	4,466	107.70	0.30	0.30	0.00
7.50	0.00	3,941	107.49	0.28	0.28	0.00
8.00	0.00	3,449	107.28	0.26	0.26	0.00
8.50	0.00	2,991	107.07	0.25	0.25	0.00
9.00	0.00	2,566	106.86	0.23	0.23	0.00
9.50	0.00	2,173	106.65	0.21	0.21	0.00
10.00	0.00	1,811	106.45	0.19	0.19	0.00
10.50	0.00	1,481	106.25	0.18	0.18	0.00
11.00	0.00	1,180	106.05	0.16	0.16	0.00
11.50	0.00	909	105.86	0.14	0.14	0.00
12.00	0.00	664	105.66	0.13	0.13	0.00
12.50	0.00	446	105.47	0.11	0.11	0.00
13.00	0.00	255	105.29	0.10	0.10	0.00
13.50	0.00	88	105.10	0.09	0.09	0.00
14.00	0.00	0	105.00	0.00	0.00	0.00
14.50	0.00	0	105.00	0.00	0.00	0.00
15.00	0.00	0	105.00	0.00	0.00	0.00
15.50	0.00	0	105.00	0.00	0.00	0.00
16.00	0.00	0	105.00	0.00	0.00	0.00
16.50	0.00	0	105.00	0.00	0.00	0.00
17.00	0.00	0	105.00	0.00	0.00	0.00
17.50	0.00	0	105.00	0.00	0.00	0.00
18.00	0.00	0	105.00	0.00	0.00	0.00
18.50	0.00	0	105.00	0.00	0.00	0.00
19.00	0.00	0	105.00	0.00	0.00	0.00
19.50	0.00	0	105.00	0.00	0.00	0.00
20.00	0.00	0	105.00	0.00	0.00	0.00

TOTAL DRAWDOWN TIME 14hrs < 48hrs ok

Stage-Area-Storage for Pond BMP C: BMP C Infiltration Basin

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
105.00	812	812	0
105.02	823	828	16
105.04	833	843	33
105.06	844	859	50
105.08	855	874	67
105.10	866	890	84
105.12	877	905	101
105.14	888	921	119
105.16	899	937	137
105.18	910	952	155
105.20	921	968	173
105.22	933	984	192
105.24	944	999	211
105.26	956	1,015	230
105.28	967	1,031	249
105.30	979	1,047	268
105.32	990	1,062	288
105.34	1,002	1,078	308
105.36	1,014	1,094	328
105.38	1,026	1,110	348
105.40	1,038	1,126	369
105.42	1,050	1,142	390
105.44	1,062	1,157	411
105.46	1,074	1,173	432
105.48	1,086	1,189	454
105.50	1,098	1,205	476
105.52	1,111	1,221	498
105.54	1,123	1,237	520
105.56	1,136	1,253	543
105.58	1,148	1,269	566
105.60	1,161	1,285	589
105.62	1,174	1,301	612
105.64	1,186	1,317	636
105.66	1,199	1,333	660
105.68	1,212	1,349	684
105.70	1,225	1,365	708
105.72	1,238	1,381	733
105.74	1,251	1,397	758
105.76	1,264	1,413	783
105.78	1,278	1,429	808
105.80	1,291	1,446	834
105.82	1,304	1,462	860
105.84	1,318	1,478	886
105.86	1,331	1,494	912
105.88	1,345	1,510	939
105.90	1,359	1,527	966
105.92	1,372	1,543	994
105.94	1,386	1,559	1,021
105.96	1,400	1,575	1,049
105.98	1,414	1,592	1,077
106.00	1,428	1,608	1,106
106.02	1,440	1,625	1,134

Stage-Area-Storage for Pond BMP C: BMP C Infiltration Basin (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
106.04	1,452	1,642	1,163
106.06	1,464	1,660	1,192
106.08	1,476	1,677	1,222
106.10	1,488	1,694	1,251
106.12	1,500	1,712	1,281
106.14	1,512	1,729	1,311
106.16	1,524	1,746	1,342
106.18	1,536	1,764	1,372
106.20	1,548	1,781	1,403
106.22	1,561	1,799	1,434
106.24	1,573	1,816	1,466
106.26	1,585	1,833	1,497
106.28	1,598	1,851	1,529
106.30	1,610	1,868	1,561
106.32	1,623	1,886	1,593
106.34	1,635	1,903	1,626
106.36	1,648	1,921	1,659
106.38	1,661	1,939	1,692
106.40	1,673	1,956	1,725
106.42	1,686	1,974	1,759
106.44	1,699	1,991	1,793
106.46	1,712	2,009	1,827
106.48	1,725	2,027	1,861
106.50	1,738	2,044	1,896
106.52	1,751	2,062	1,931
106.54	1,764	2,080	1,966
106.56	1,777	2,097	2,001
106.58	1,790	2,115	2,037
106.60	1,803	2,133	2,073
106.62	1,817	2,151	2,109
106.64	1,830	2,168	2,146
106.66	1,843	2,186	2,182
106.68	1,857	2,204	2,219
106.70	1,870	2,222	2,257
106.72	1,884	2,240	2,294
106.74	1,897	2,258	2,332
106.76	1,911	2,275	2,370
106.78	1,925	2,293	2,408
106.80	1,938	2,311	2,447
106.82	1,952	2,329	2,486
106.84	1,966	2,347	2,525
106.86	1,980	2,365	2,564
106.88	1,994	2,383	2,604
106.90	2,008	2,401	2,644
106.92	2,022	2,419	2,684
106.94	2,036	2,437	2,725
106.96	2,050	2,455	2,766
106.98	2,064	2,473	2,807
107.00	2,078	2,492	2,848
107.02	2,091	2,510	2,890
107.04	2,104	2,528	2,932
107.06	2,116	2,546	2,974

REQUIRED STORAGE VOLUME

WQV REQ = 2,113 ft³

Stage-Area-Storage for Pond BMP C: BMP C Infiltration Basin (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
107.08	2,129	2,564	3,017
107.10	2,142	2,582	3,059
107.12	2,155	2,601	3,102
107.14	2,168	2,619	3,146
107.16	2,181	2,637	3,189
107.18	2,194	2,655	3,233
107.20	2,207	2,674	3,277
107.22	2,220	2,692	3,321
107.24	2,234	2,710	3,366
107.26	2,247	2,728	3,411
107.28	2,260	2,747	3,456
107.30	2,273	2,765	3,501
107.32	2,287	2,784	3,547
107.34	2,300	2,802	3,592
107.36	2,313	2,820	3,639
107.38	2,327	2,839	3,685
107.40	2,340	2,857	3,732
107.42	2,354	2,876	3,779
107.44	2,367	2,894	3,826
107.46	2,381	2,913	3,873
107.48	2,395	2,931	3,921
107.50	2,408	2,950	3,969
107.52	2,422	2,968	4,017
107.54	2,436	2,987	4,066
107.56	2,450	3,006	4,115
107.58	2,463	3,024	4,164
107.60	2,477	3,043	4,213
107.62	2,491	3,061	4,263
107.64	2,505	3,080	4,313
107.66	2,519	3,099	4,363
107.68	2,533	3,117	4,414
107.70	2,547	3,136	4,465
107.72	2,561	3,155	4,516
107.74	2,576	3,174	4,567
107.76	2,590	3,192	4,619
107.78	2,604	3,211	4,671
107.80	2,618	3,230	4,723
107.82	2,633	3,249	4,775
107.84	2,647	3,268	4,828
107.86	2,661	3,287	4,881
107.88	2,676	3,305	4,935
107.90	2,690	3,324	4,988
107.92	2,705	3,343	5,042
107.94	2,719	3,362	5,096
107.96	2,734	3,381	5,151
107.98	2,748	3,400	5,206
108.00	2,763	3,419	5,261
108.02	2,777	3,438	5,316
108.04	2,790	3,457	5,372
108.06	2,804	3,476	5,428
108.08	2,817	3,495	5,484
108.10	2,831	3,514	5,541

Stage-Area-Storage for Pond BMP C: BMP C Infiltration Basin (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
108.12	2,845	3,533	5,597
108.14	2,858	3,552	5,654
108.16	2,872	3,571	5,712
108.18	2,886	3,591	5,769
108.20	2,900	3,610	5,827
108.22	2,913	3,629	5,885
108.24	2,927	3,648	5,944
108.26	2,941	3,667	6,002
108.28	2,955	3,687	6,061
108.30	2,969	3,706	6,120
108.32	2,983	3,725	6,180
108.34	2,997	3,744	6,240
108.36	3,011	3,764	6,300
108.38	3,025	3,783	6,360
108.40	3,040	3,802	6,421
108.42	3,054	3,822	6,482
108.44	3,068	3,841	6,543
108.46	3,082	3,860	6,605
108.48	3,096	3,880	6,666
108.50	3,111	3,899	6,728
108.52	3,125	3,919	6,791
108.54	3,139	3,938	6,853
108.56	3,154	3,957	6,916
108.58	3,168	3,977	6,980
108.60	3,183	3,996	7,043
108.62	3,197	4,016	7,107
108.64	3,212	4,036	7,171
108.66	3,226	4,055	7,235
108.68	3,241	4,075	7,300
108.70	3,256	4,094	7,365
108.72	3,270	4,114	7,430
108.74	3,285	4,133	7,496
108.76	3,300	4,153	7,562
108.78	3,314	4,173	7,628
108.80	3,329	4,192	7,694
108.82	3,344	4,212	7,761
108.84	3,359	4,232	7,828
108.86	3,374	4,252	7,895
108.88	3,389	4,271	7,963
108.90	3,404	4,291	8,031
108.92	3,419	4,311	8,099
108.94	3,434	4,331	8,168
108.96	3,449	4,351	8,236
108.98	3,464	4,370	8,306
109.00	3,479	4,390	8,375
109.02	3,493	4,408	8,445
109.04	3,507	4,426	8,515
109.06	3,522	4,443	8,585
109.08	3,536	4,461	8,656
109.10	3,550	4,479	8,726
109.12	3,564	4,497	8,798
109.14	3,579	4,515	8,869

Stage-Area-Storage for Pond BMP C: BMP C Infiltration Basin (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
109.16	3,593	4,532	8,941
109.18	3,608	4,550	9,013
109.20	3,622	4,568	9,085
109.22	3,636	4,586	9,158
109.24	3,651	4,604	9,231
109.26	3,666	4,622	9,304
109.28	3,680	4,640	9,377
109.30	3,695	4,658	9,451
109.32	3,709	4,676	9,525
109.34	3,724	4,694	9,599
109.36	3,739	4,712	9,674
109.38	3,753	4,730	9,749
109.40	3,768	4,748	9,824
109.42	3,783	4,766	9,900
109.44	3,797	4,784	9,975
109.46	3,812	4,802	10,051
109.48	3,827	4,820	10,128
109.50	3,842	4,838	10,204
109.52	3,857	4,856	10,281
109.54	3,872	4,874	10,359
109.56	3,887	4,892	10,436
109.58	3,902	4,910	10,514
109.60	3,917	4,928	10,592
109.62	3,932	4,946	10,671
109.64	3,947	4,965	10,750
109.66	3,962	4,983	10,829
109.68	3,977	5,001	10,908
109.70	3,992	5,019	10,988
109.72	4,007	5,037	11,068
109.74	4,023	5,056	11,148
109.76	4,038	5,074	11,229
109.78	4,053	5,092	11,310
109.80	4,068	5,110	11,391
109.82	4,084	5,129	11,472
109.84	4,099	5,147	11,554
109.86	4,115	5,165	11,636
109.88	4,130	5,184	11,719
109.90	4,145	5,202	11,802
109.92	4,161	5,220	11,885
109.94	4,176	5,239	11,968
109.96	4,192	5,257	12,052
109.98	4,207	5,275	12,136
110.00	4,223	5,294	12,220
110.02	4,238	5,312	12,305
110.04	4,252	5,331	12,389
110.06	4,267	5,349	12,475
110.08	4,282	5,368	12,560
110.10	4,297	5,386	12,646
110.12	4,312	5,405	12,732
110.14	4,327	5,423	12,818
110.16	4,342	5,442	12,905
110.18	4,357	5,460	12,992

Stage-Area-Storage for Pond BMP C: BMP C Infiltration Basin (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
110.20	4,371	5,479	13,079
110.22	4,386	5,497	13,167
110.24	4,401	5,516	13,255
110.26	4,417	5,534	13,343
110.28	4,432	5,553	13,432
110.30	4,447	5,572	13,520
110.32	4,462	5,590	13,609
110.34	4,477	5,609	13,699
110.36	4,492	5,628	13,788
110.38	4,507	5,646	13,878
110.40	4,523	5,665	13,969
110.42	4,538	5,684	14,059
110.44	4,553	5,702	14,150
110.46	4,568	5,721	14,241
110.48	4,584	5,740	14,333
110.50	4,599	5,758	14,425
110.52	4,614	5,777	14,517
110.54	4,630	5,796	14,609
110.56	4,645	5,815	14,702
110.58	4,661	5,834	14,795
110.60	4,676	5,852	14,889
110.62	4,692	5,871	14,982
110.64	4,707	5,890	15,076
110.66	4,723	5,909	15,171
110.68	4,738	5,928	15,265
110.70	4,754	5,947	15,360
110.72	4,769	5,966	15,455
110.74	4,785	5,985	15,551
110.76	4,801	6,003	15,647
110.78	4,817	6,022	15,743
110.80	4,832	6,041	15,839
110.82	4,848	6,060	15,936
110.84	4,864	6,079	16,033
110.86	4,880	6,098	16,131
110.88	4,895	6,117	16,228
110.90	4,911	6,136	16,327
110.92	4,927	6,155	16,425
110.94	4,943	6,174	16,524
110.96	4,959	6,194	16,623
110.98	4,975	6,213	16,722
111.00	4,991	6,232	16,822
111.02	5,006	6,249	16,922
111.04	5,021	6,265	17,022
111.06	5,037	6,282	17,122
111.08	5,052	6,299	17,223
111.10	5,067	6,316	17,325
111.12	5,083	6,333	17,426
111.14	5,098	6,350	17,528
111.16	5,113	6,367	17,630
111.18	5,129	6,384	17,732
111.20	5,144	6,401	17,835
111.22	5,159	6,418	17,938

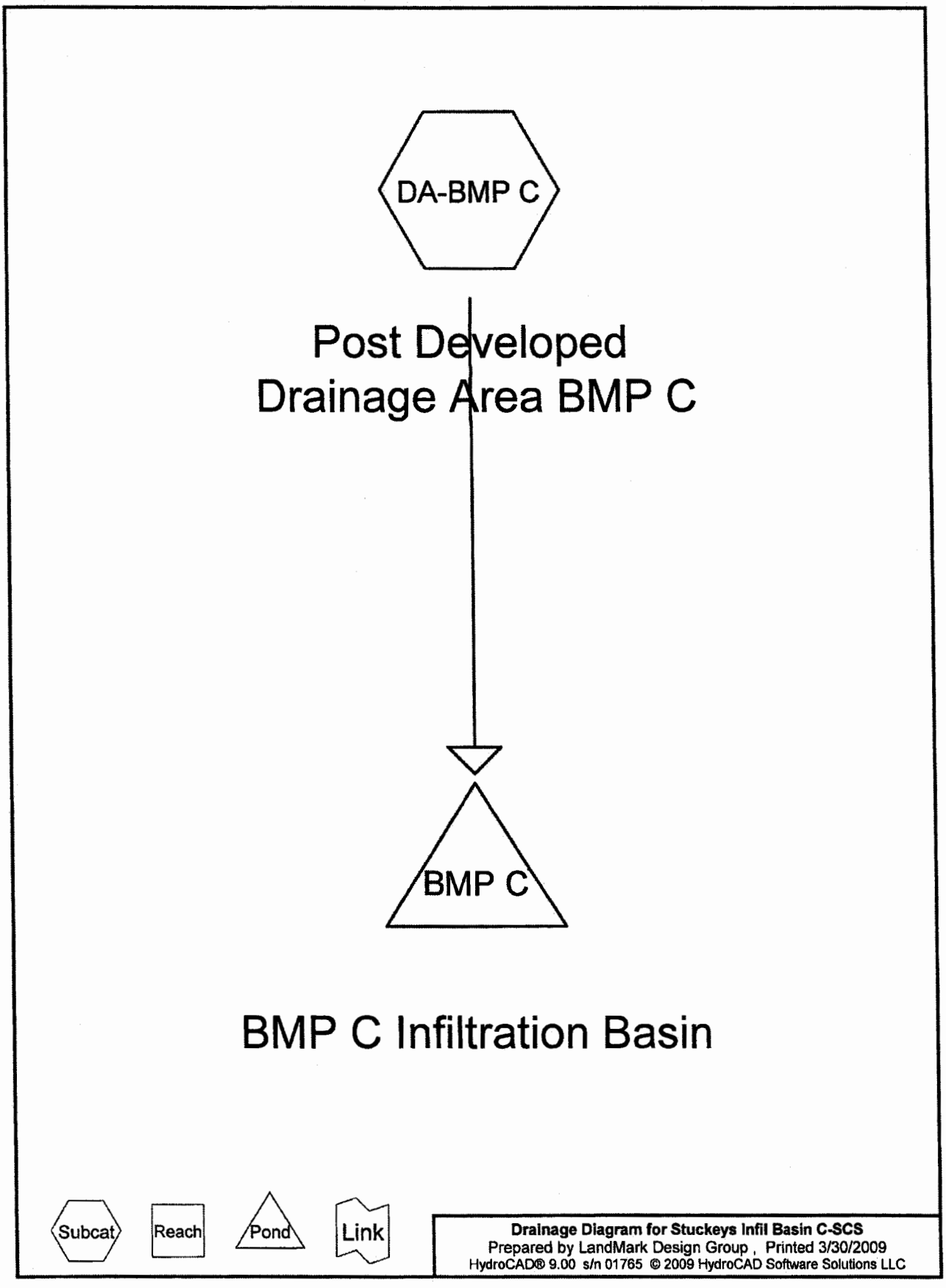
PROVIDED STORAGE VOLUME

$WQV_{PROVIDED} = 13,520\ ft^3$

Stage-Area-Storage for Pond BMP C: BMP C Infiltration Basin (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
111.24	5,175	6,435	18,041
111.26	5,190	6,452	18,145
111.28	5,206	6,469	18,249
111.30	5,221	6,486	18,353
111.32	5,237	6,503	18,458
111.34	5,252	6,520	18,563
111.36	5,268	6,537	18,668
111.38	5,284	6,554	18,774
111.40	5,299	6,571	18,879
111.42	5,315	6,588	18,986
111.44	5,331	6,605	19,092
111.46	5,346	6,622	19,199
111.48	5,362	6,639	19,306
111.50	5,378	6,656	19,413
111.52	5,394	6,674	19,521
111.54	5,409	6,691	19,629
111.56	5,425	6,708	19,737
111.58	5,441	6,725	19,846
111.60	5,457	6,742	19,955
111.62	5,473	6,759	20,064
111.64	5,489	6,776	20,174
111.66	5,505	6,794	20,284
111.68	5,521	6,811	20,394
111.70	5,537	6,828	20,505
111.72	5,553	6,845	20,616
111.74	5,569	6,863	20,727
111.76	5,585	6,880	20,838
111.78	5,601	6,897	20,950
111.80	5,617	6,914	21,062
111.82	5,633	6,932	21,175
111.84	5,649	6,949	21,288
111.86	5,665	6,966	21,401
111.88	5,681	6,983	21,514
111.90	5,698	7,001	21,628
111.92	5,714	7,018	21,742
111.94	5,730	7,035	21,857
111.96	5,746	7,053	21,971
111.98	5,763	7,070	22,086
112.00	**5,779**	**7,088**	**22,202**

HydroCad Model
SCS Method


DA-BMP C
Post Developed
Drainage Area BMP C
BMP C
BMP C Infiltration Basin
Subcat
Reach
Pond
Link
Drainage Diagram for Stuckeys Infil Basin C-SCS
Prepared by LandMark Design Group , Printed 3/30/2009
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1-year

Summary for Pond BMP C: BMP C Infiltration Basin

Inflow Area = 1.400 ac, 41.57% Impervious, Inflow Depth > 1.24" for 1-Year event
Inflow = 2.62 cfs @ 12.05 hrs, Volume= 0.145 af
Outflow = 0.24 cfs @ 12.77 hrs, Volume= 0.135 af, Atten= 91%, Lag= 43.3 min
Discarded = 0.24 cfs @ 12.77 hrs, Volume= 0.135 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 107.06' @ 12.77 hrs Surf.Area= 2,117 sf Storage= 2,978 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 116.9 min (911.9 - 795.0)

Volume	Invert	Avail.Storage	Storage Description
#1	105.00'	22,202 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

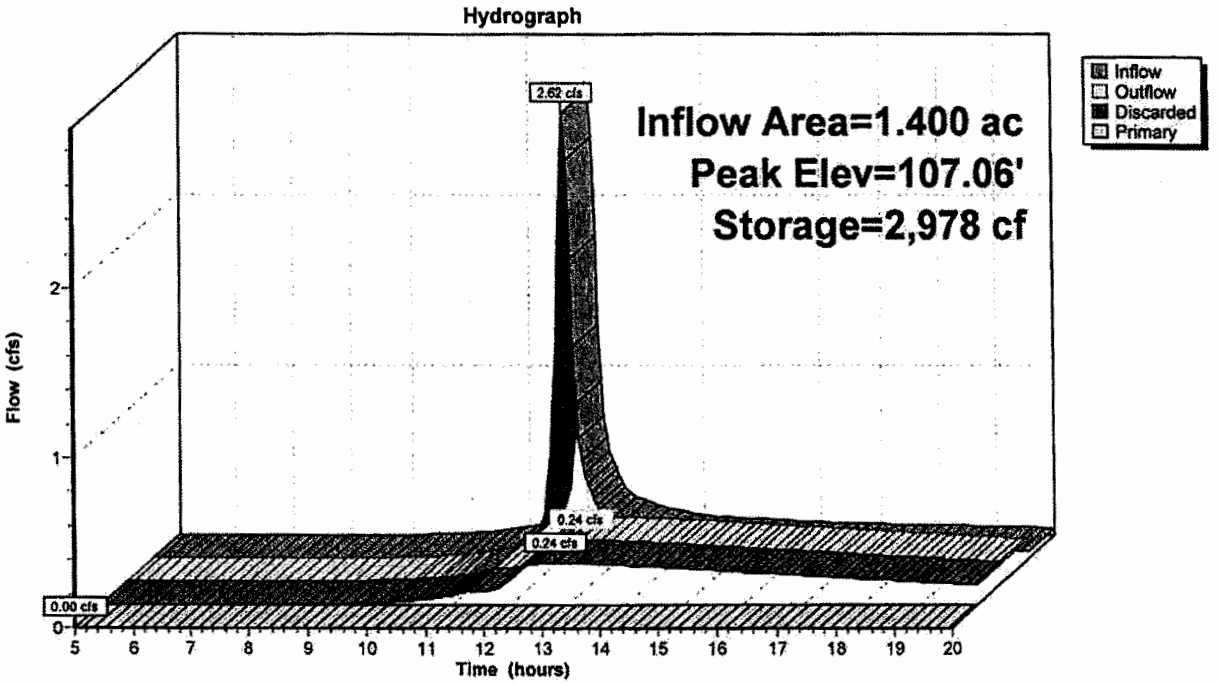
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
105.00	812	300.0	0	0	812
106.00	1,428	315.0	1,106	1,106	1,608
107.00	2,078	331.0	1,743	2,848	2,492
108.00	2,763	347.0	2,412	5,261	3,419
109.00	3,479	363.0	3,114	8,375	4,390
110.00	4,223	377.0	3,845	12,220	5,294
111.00	4,991	391.0	4,602	16,822	6,232
112.00	5,779	403.0	5,380	22,202	7,088

Device	Routing	Invert	Outlet Devices
#1	Primary	110.30'	**5.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Discarded	105.00'	**4.150 in/hr Exfiltration - Half of KSat Value 8.3 over Wetted area**

Discarded OutFlow Max=0.24 cfs @ 12.77 hrs HW=107.06' (Free Discharge)
↑—**2=Exfiltration - Half of KSat Value 8.3** (Exfiltration Controls 0.24 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=105.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond BMP C: BMP C Infiltration Basin



Summary for Subcatchment DA-BMP C: Post Developed Drainage Area BMP C

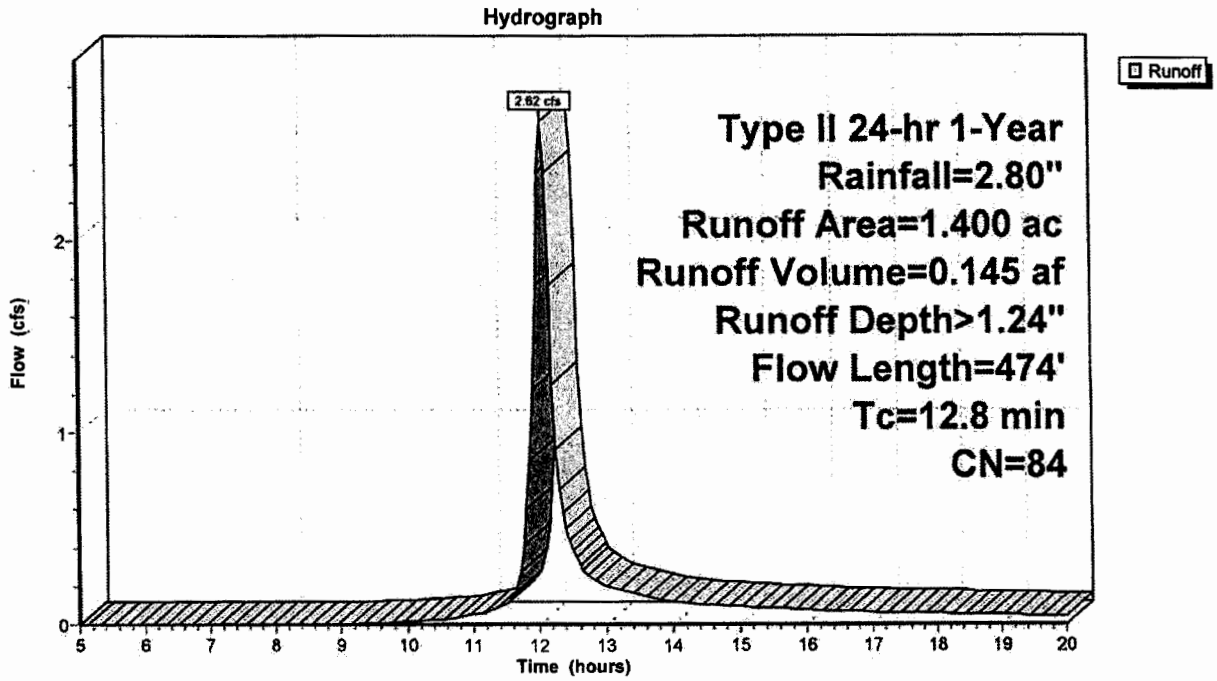
Runoff = 2.62 cfs @ 12.05 hrs, Volume= 0.145 af, Depth> 1.24"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-Year Rainfall=2.80"

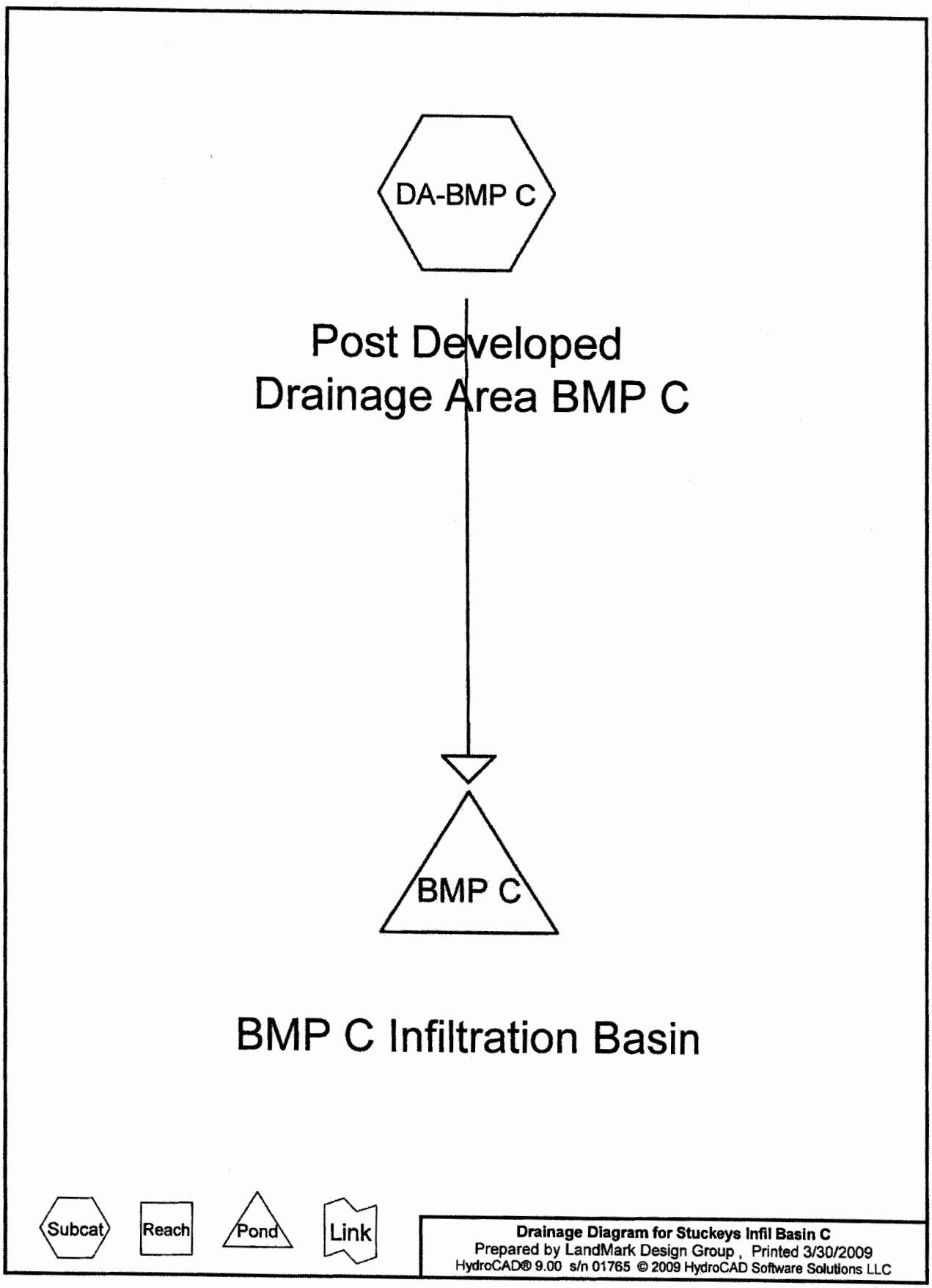
Area (ac)	CN	Description
0.818	74	>75% Grass cover, Good, HSG C
0.582	98	Paved parking & roofs
1.400	84	Weighted Average
0.818		58.43% Pervious Area
0.582		41.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0180	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.50"
2.9	346	0.0150	1.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1	28	0.3214	9.13		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.8	474	Total			

Subcatchment DA-BMP C: Post Developed Drainage Area BMP C



Rational Method


DA-BMP C
Post Developed
Drainage Area BMP C
BMP C
BMP C Infiltration Basin
Subcat
Reach
Pond
Link
Drainage Diagram for Stuckeys Infil Basin C
Prepared by LandMark Design Group , Printed 3/30/2009
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2-year

Summary for Pond BMP C: BMP C Infiltration Basin

Inflow Area = 1.400 ac, 0.00% Impervious, Inflow Depth = 1.14" for 2-Year event
Inflow = 1.00 cfs @ 0.22 hrs, Volume= 0.133 af
Outflow = 0.30 cfs @ 1.77 hrs, Volume= 0.133 af, Atten= 70%, Lag= 93.3 min
Discarded = 0.30 cfs @ 1.77 hrs, Volume= 0.133 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-12.00 hrs, dt= 0.01 hrs
Peak Elev= 107.68' @ 1.77 hrs Surf.Area= 2,534 sf Storage= 4,417 cf

Plug-Flow detention time= 167.2 min calculated for 0.133 af (100% of inflow)
Center-of-Mass det. time= 167.4 min (222.0 - 54.6)

Volume	Invert	Avail.Storage	Storage Description
#1	105.00'	22,202 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

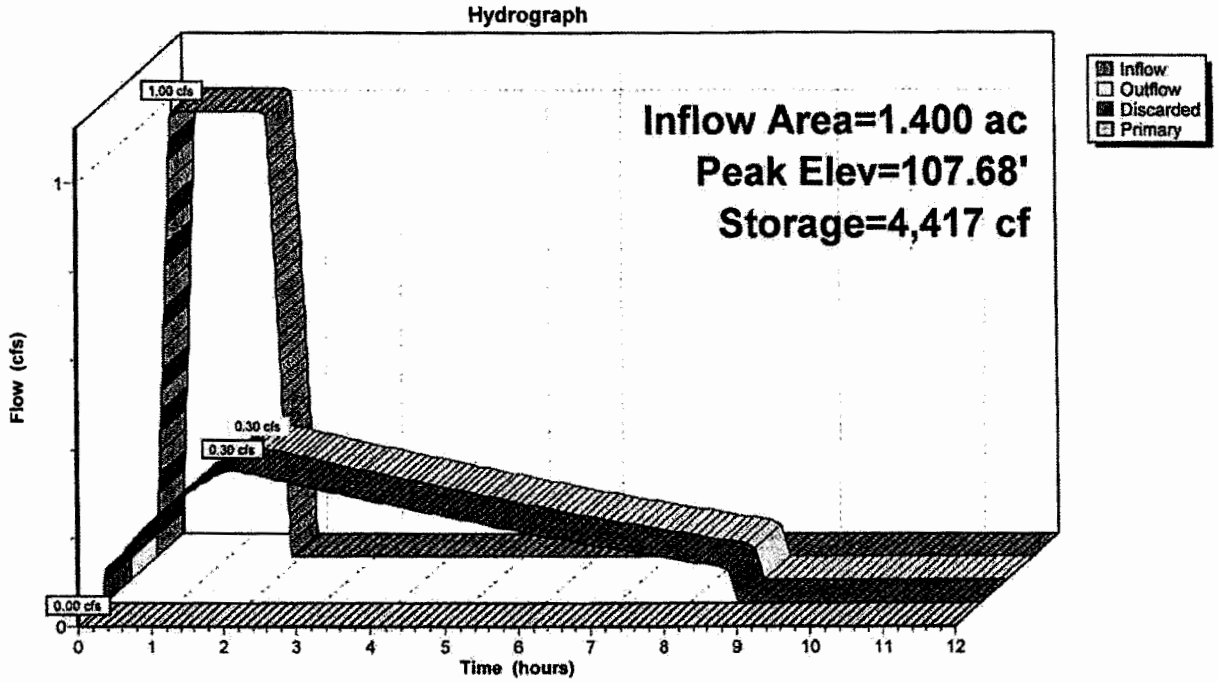
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
105.00	812	300.0	0	0	812
106.00	1,428	315.0	1,106	1,106	1,608
107.00	2,078	331.0	1,743	2,848	2,492
108.00	2,763	347.0	2,412	5,261	3,419
109.00	3,479	363.0	3,114	8,375	4,390
110.00	4,223	377.0	3,845	12,220	5,294
111.00	4,991	391.0	4,602	16,822	6,232
112.00	5,779	403.0	5,380	22,202	7,088

Device	Routing	Invert	Outlet Devices
#1	Primary	110.30'	**5.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Discarded	105.00'	**4.150 in/hr Exfiltration - Half of KSat Value 8.3 over Wetted area**

Discarded OutFlow Max=0.30 cfs @ 1.77 hrs HW=107.68' (Free Discharge)
↑**2=Exfiltration - Half of KSat Value 8.3** (Exfiltration Controls 0.30 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=105.00' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond BMP C: BMP C Infiltration Basin



Summary for Subcatchment DA-BMP C: Post Developed Drainage Area BMP C

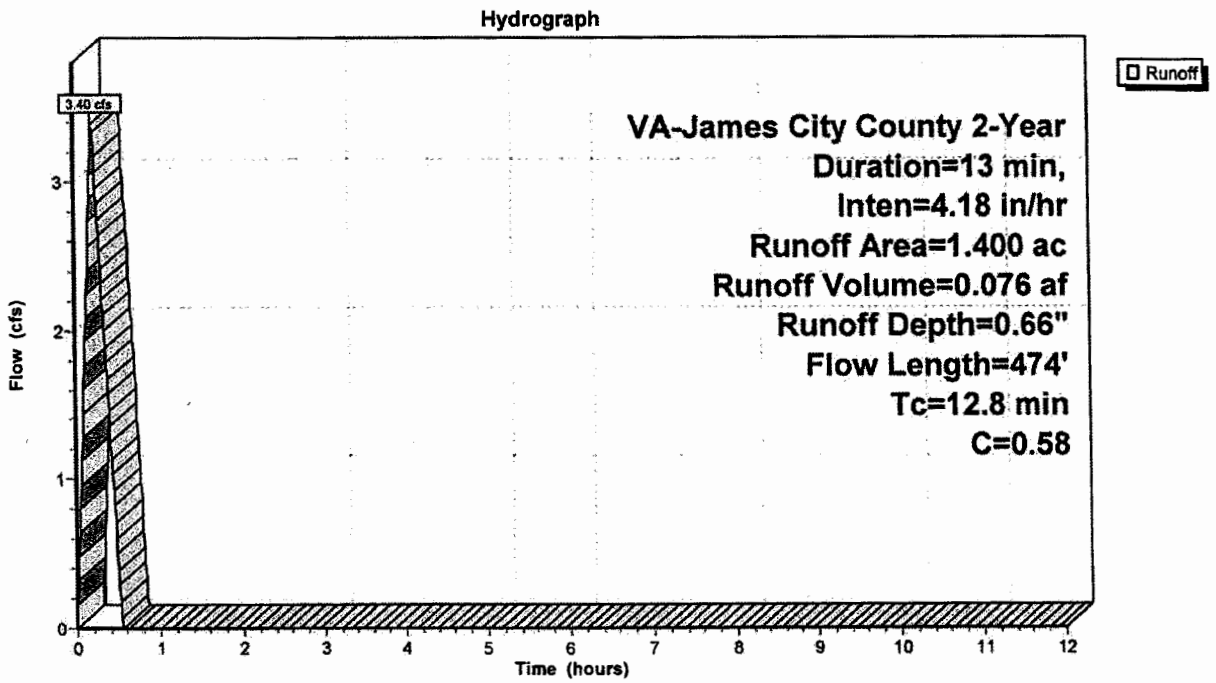
Runoff = 3.40 cfs @ 0.22 hrs, Volume= 0.076 af, Depth= 0.66"

Runoff by Rational method, Rise/Fall=1.0/1.5 xTc, Time Span= 0.00-12.00 hrs, dt= 0.01 hrs
VA-James City County 2-Year Duration=13 min, Inten=4.18 in/hr

Area (ac)	C	Description
0.818	0.35	Grass cover
0.582	0.90	Paved parking & roofs
1.400	0.58	Weighted Average
1.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0180	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.50"
2.9	346	0.0150	1.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1	28	0.3214	9.13		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.8	474	Total			

Subcatchment DA-BMP C: Post Developed Drainage Area BMP C



10-year

Summary for Pond BMP C: BMP C Infiltration Basin

Inflow Area = 1.400 ac, 0.00% Impervious, Inflow Depth = 2.02" for 10-Year event
Inflow = 0.95 cfs @ 0.22 hrs, Volume= 0.235 af
Outflow = 0.39 cfs @ 3.14 hrs, Volume= 0.234 af, Atten= 59%, Lag= 175.2 min
Discarded = 0.39 cfs @ 3.14 hrs, Volume= 0.234 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-12.00 hrs, dt= 0.01 hrs
Peak Elev= 108.64' @ 3.14 hrs Surf.Area= 3,212 sf Storage= 7,170 cf

Plug-Flow detention time= 214.7 min calculated for 0.234 af (99% of inflow)
Center-of-Mass det. time= 214.5 min (311.0 - 96.5)

Volume	Invert	Avail.Storage	Storage Description
#1	105.00'	22,202 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

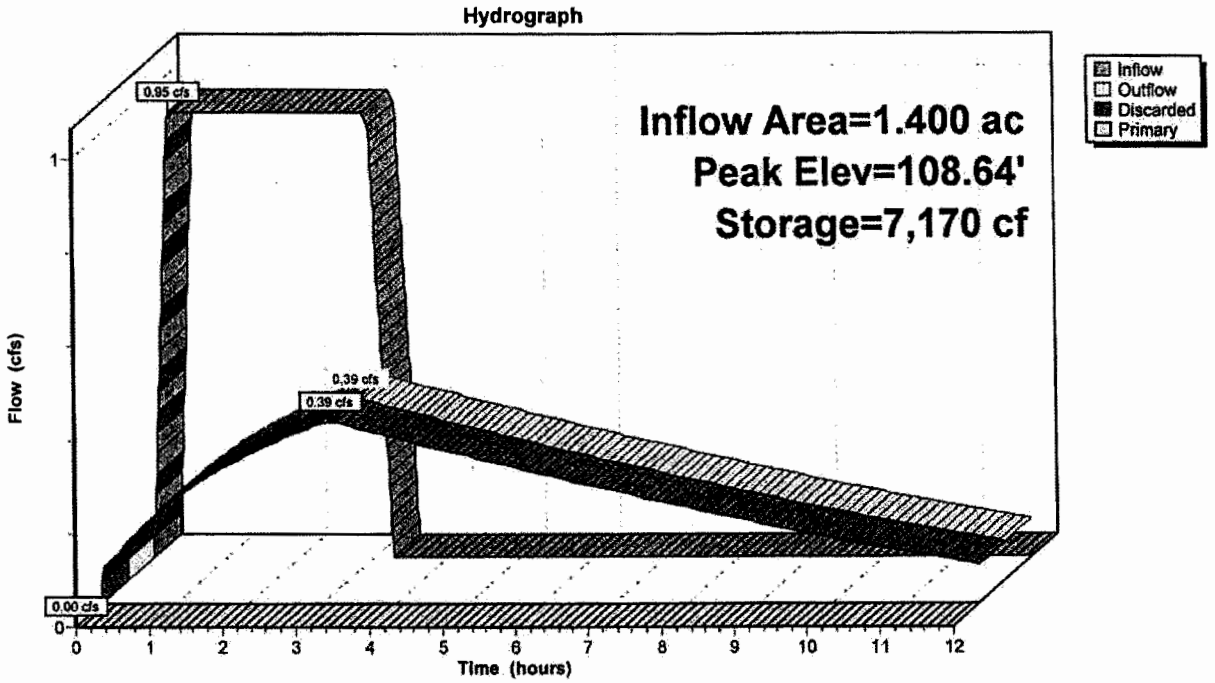
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
105.00	812	300.0	0	0	812
106.00	1,428	315.0	1,106	1,106	1,608
107.00	2,078	331.0	1,743	2,848	2,492
108.00	2,763	347.0	2,412	5,261	3,419
109.00	3,479	363.0	3,114	8,375	4,390
110.00	4,223	377.0	3,845	12,220	5,294
111.00	4,991	391.0	4,602	16,822	6,232
112.00	5,779	403.0	5,380	22,202	7,088

Device	Routing	Invert	Outlet Devices
#1	Primary	110.30'	**5.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Discarded	105.00'	**4.150 in/hr Exfiltration - Half of KSat Value 8.3 over Wetted area**

Discarded OutFlow Max=0.39 cfs @ 3.14 hrs HW=108.64' (Free Discharge)
↑**2=Exfiltration - Half of KSat Value 8.3** (Exfiltration Controls 0.39 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=105.00' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond BMP C: BMP C Infiltration Basin



Summary for Subcatchment DA-BMP C: Post Developed Drainage Area BMP C

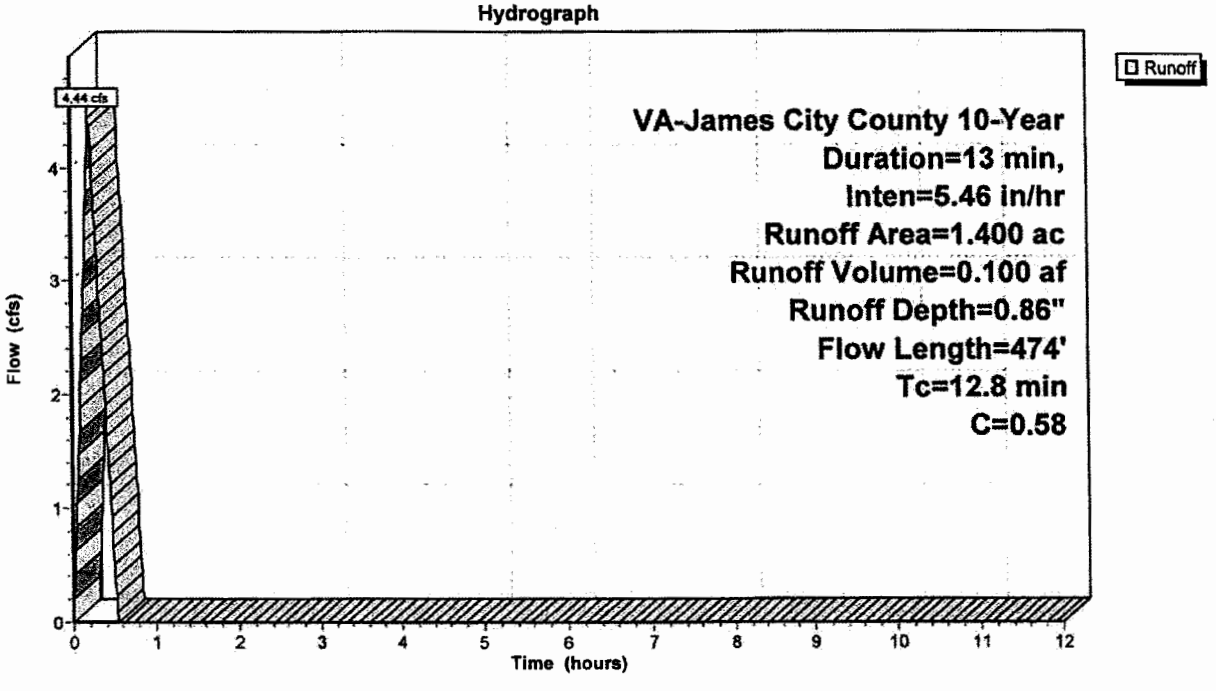
Runoff = 4.44 cfs @ 0.22 hrs, Volume= 0.100 af, Depth= 0.86"

Runoff by Rational method, Rise/Fall=1.0/1.5 xTc, Time Span= 0.00-12.00 hrs, dt= 0.01 hrs
VA-James City County 10-Year Duration=13 min, Inten=5.46 in/hr

Area (ac)	C	Description
0.818	0.35	Grass cover
0.582	0.90	Paved parking & roofs
1.400	0.58	Weighted Average
1.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0180	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.50"
2.9	346	0.0150	1.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1	28	0.3214	9.13		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.8	474	Total			

Subcatchment DA-BMP C: Post Developed Drainage Area BMP C



25-year

Summary for Pond BMP C: BMP C Infiltration Basin

Inflow Area = 1.400 ac, 0.00% Impervious, Inflow Depth = 2.89" for 25-Year event
Inflow = 0.95 cfs @ 0.22 hrs, Volume= 0.338 af
Outflow = 0.45 cfs @ 4.42 hrs, Volume= 0.307 af, Atten= 52%, Lag= 251.9 min
Discarded = 0.45 cfs @ 4.42 hrs, Volume= 0.307 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-12.00 hrs, dt= 0.01 hrs
Peak Elev= 109.35' @ 4.42 hrs Surf.Area= 3,728 sf Storage= 9,622 cf

Plug-Flow detention time= 222.2 min calculated for 0.306 af (91% of inflow)
Center-of-Mass det. time= 210.4 min (346.0 - 135.5)

Volume	Invert	Avail.Storage	Storage Description
#1	105.00'	22,202 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

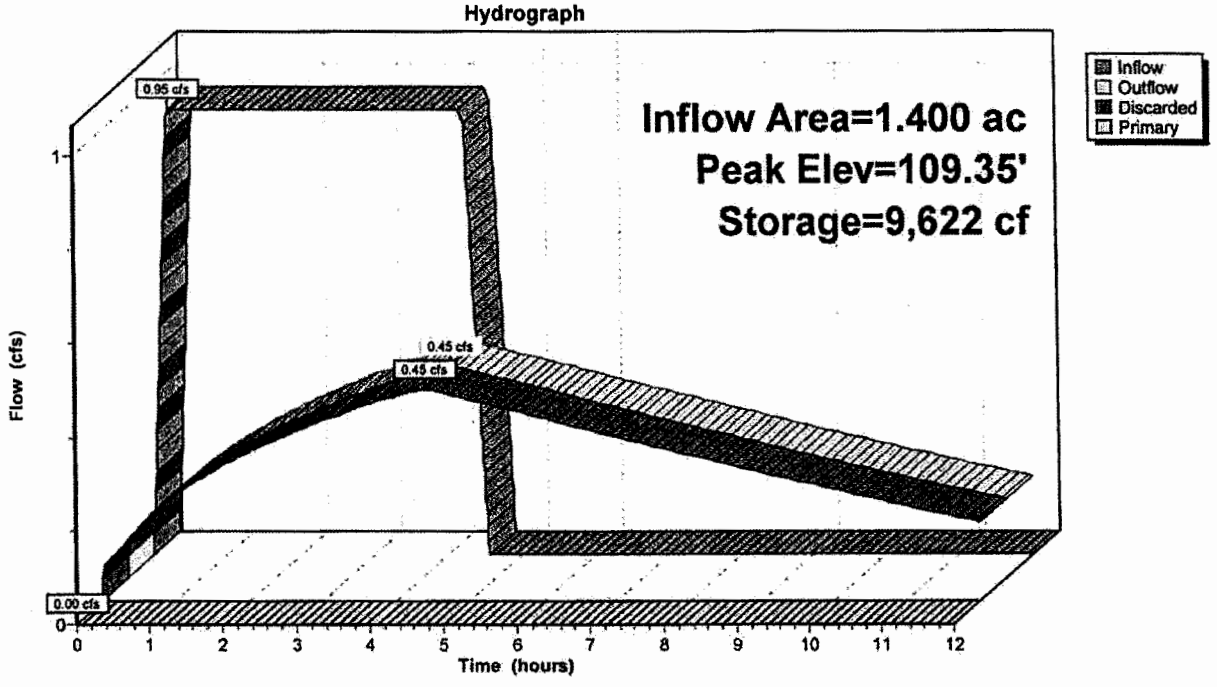
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
105.00	812	300.0	0	0	812
106.00	1,428	315.0	1,106	1,106	1,608
107.00	2,078	331.0	1,743	2,848	2,492
108.00	2,763	347.0	2,412	5,261	3,419
109.00	3,479	363.0	3,114	8,375	4,390
110.00	4,223	377.0	3,845	12,220	5,294
111.00	4,991	391.0	4,602	16,822	6,232
112.00	5,779	403.0	5,380	22,202	7,088

Device	Routing	Invert	Outlet Devices
#1	Primary	110.30'	**5.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Discarded	105.00'	**4.150 in/hr Exfiltration - Half of KSat Value 8.3 over Wetted area**

Discarded OutFlow Max=0.45 cfs @ 4.42 hrs HW=109.35' (Free Discharge)
↑—**2=Exfiltration - Half of KSat Value 8.3** (Exfiltration Controls 0.45 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=105.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond BMP C: BMP C Infiltration Basin



Summary for Subcatchment DA-BMP C: Post Developed Drainage Area BMP C

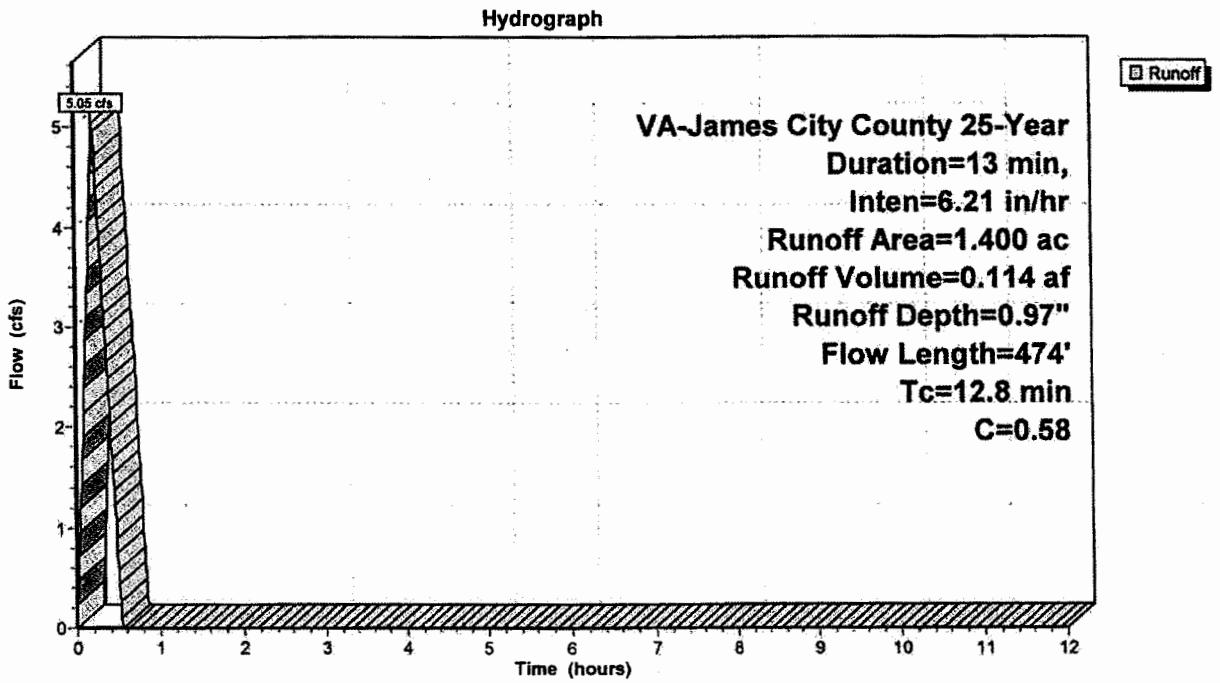
Runoff = 5.05 cfs @ 0.22 hrs, Volume= 0.114 af, Depth= 0.97"

Runoff by Rational method, Rise/Fall=1.0/1.5 xTc, Time Span= 0.00-12.00 hrs, dt= 0.01 hrs
VA-James City County 25-Year Duration=13 min, Inten=6.21 in/hr

Area (ac)	C	Description
0.818	0.35	Grass cover
0.582	0.90	Paved parking & roofs
1.400	0.58	Weighted Average
1.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0180	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.50"
2.9	346	0.0150	1.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1	28	0.3214	9.13		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.8	474	Total			

Subcatchment DA-BMP C: Post Developed Drainage Area BMP C



100-year

Summary for Pond BMP C: BMP C Infiltration Basin

Inflow Area = 1.400 ac, 0.00% Impervious, Inflow Depth = 4.38" for 100-Year event
Inflow = 1.22 cfs @ 0.22 hrs, Volume= 0.511 af
Outflow = 1.13 cfs @ 5.02 hrs, Volume= 0.422 af, Atten= 7%, Lag= 288.2 min
Discarded = 0.55 cfs @ 5.02 hrs, Volume= 0.398 af
Primary = 0.59 cfs @ 5.02 hrs, Volume= 0.024 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-12.00 hrs, dt= 0.01 hrs
Peak Elev= 110.43' @ 5.02 hrs Surf.Area= 4,546 sf Storage= 14,106 cf

Plug-Flow detention time= 229.5 min calculated for 0.422 af (83% of inflow)
Center-of-Mass det. time= 203.2 min (361.3 - 158.0)

Volume	Invert	Avail.Storage	Storage Description
#1	105.00'	22,202 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

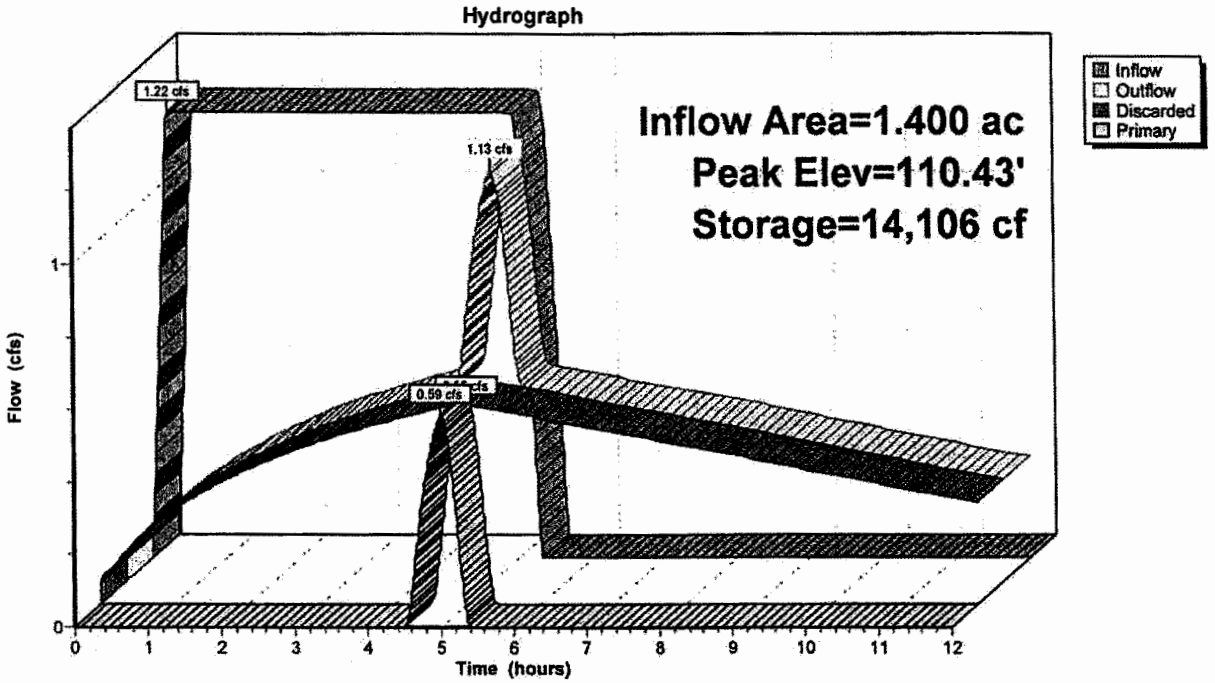
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
105.00	812	300.0	0	0	812
106.00	1,428	315.0	1,106	1,106	1,608
107.00	2,078	331.0	1,743	2,848	2,492
108.00	2,763	347.0	2,412	5,261	3,419
109.00	3,479	363.0	3,114	8,375	4,390
110.00	4,223	377.0	3,845	12,220	5,294
111.00	4,991	391.0	4,602	16,822	6,232
112.00	5,779	403.0	5,380	22,202	7,088

Device	Routing	Invert	Outlet Devices
#1	Primary	110.30'	**5.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Discarded	105.00'	**4.150 in/hr Exfiltration - Half of KSat Value 8.3 over Wetted area**

Discarded OutFlow Max=0.55 cfs @ 5.02 hrs HW=110.43' (Free Discharge)
↑—**2=Exfiltration - Half of KSat Value 8.3** (Exfiltration Controls 0.55 cfs)

Primary OutFlow Max=0.59 cfs @ 5.02 hrs HW=110.43' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.59 cfs @ 0.90 fps)

Pond BMP C: BMP C Infiltration Basin



Summary for Subcatchment DA-BMP C: Post Developed Drainage Area BMP C

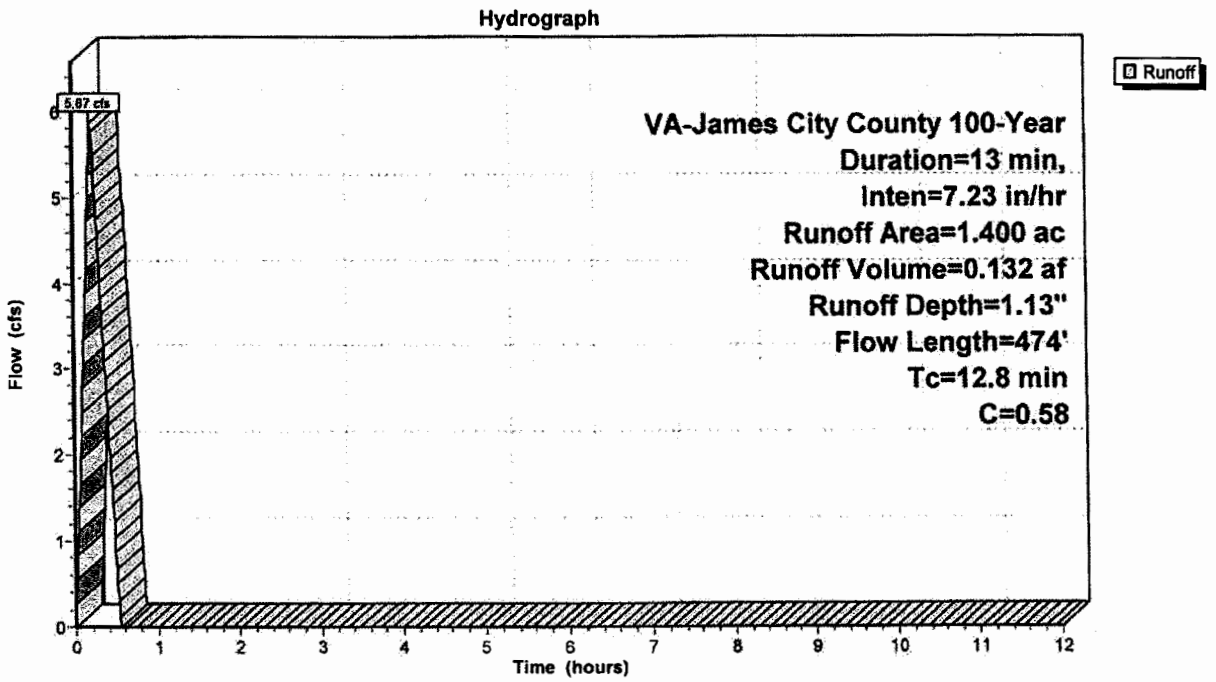
Runoff = 5.87 cfs @ 0.22 hrs, Volume= 0.132 af, Depth= 1.13"

Runoff by Rational method, Rise/Fall=1.0/1.5 xTc, Time Span= 0.00-12.00 hrs, dt= 0.01 hrs
VA-James City County 100-Year Duration=13 min, Inten=7.23 in/hr

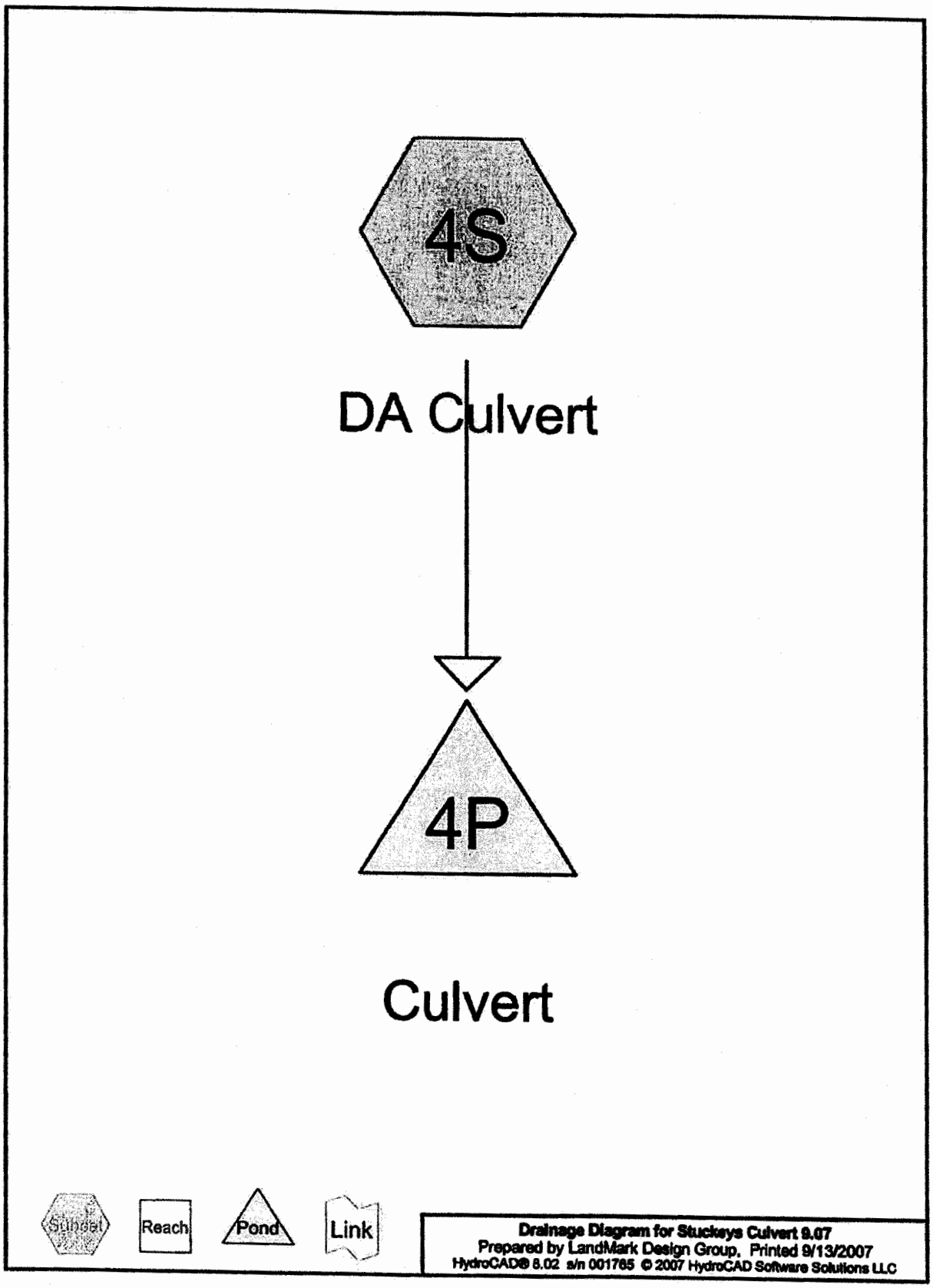
Area (ac)	C	Description
0.818	0.35	Grass cover
0.582	0.90	Paved parking & roofs
1.400	0.58	Weighted Average
1.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0180	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.50"
2.9	346	0.0150	1.97		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1	28	0.3214	9.13		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.8	474	Total			

Subcatchment DA-BMP C: Post Developed Drainage Area BMP C



Culvert Evaluation Calculations


4S
DA Culvert
4P
Culvert
Subcat
Reach
Pond
Link
Drainage Diagram for Stuckeys Culvert 9.07
Prepared by LandMark Design Group, Printed 9/13/2007
HydroCAD® 8.02 s/n 001765 © 2007 HydroCAD Software Solutions LLC

2-year

Summary for Subcatchment 4S: DA Culvert

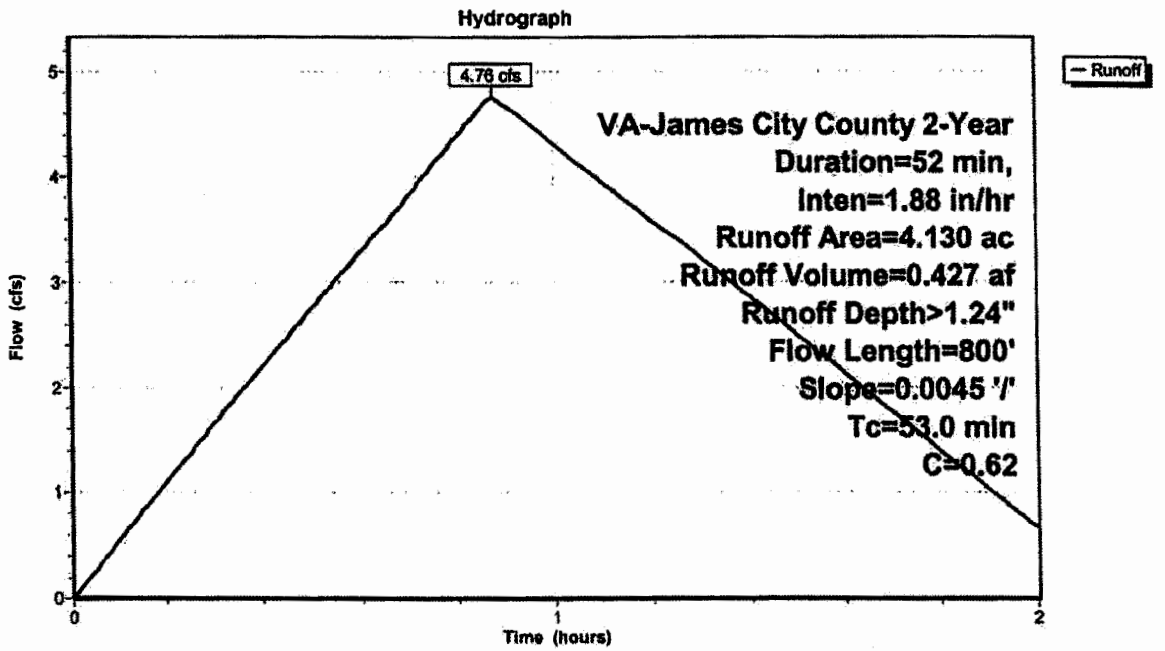
Runoff = 4.76 cfs @ 0.88 hrs, Volume= 0.427 af, Depth> 1.24"

Runoff by Rational method, Rise/Fall=1.0/1.5 xTc, Time Span= 0.00-2.00 hrs, dt= 0.01 hrs
VA-James City County 2-Year Duration=52 min, Inten=1.88 in/hr

Area (ac)	C	Description
2.020	0.90	Roof/Concrete/Asphalt
2.110	0.35	Lawn/Grass
4.130	0.62	Weighted Average
4.130		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
43.1	200	0.0045	0.08		**Sheet Flow, Sheet Flow Tc** Grass: Dense n= 0.240 P2= 3.50"
9.9	600	0.0045	1.01		**Shallow Concentrated Flow, Shallow Concentrated Tc** Grassed Waterway Kv= 15.0 fps
53.0	800	Total			

Subcatchment 4S: DA Culvert



Summary for Pond 4P: Culvert

Inflow Area = 4.130 ac, 0.00% Impervious, Inflow Depth > 1.24" for 2-Year event
Inflow = 4.76 cfs @ 0.88 hrs, Volume= 0.427 af
Outflow = 4.72 cfs @ 0.89 hrs, Volume= 0.427 af, Atten= 1%, Lag= 1.0 min
Primary = 4.72 cfs @ 0.89 hrs, Volume= 0.427 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-2.00 hrs, dt= 0.01 hrs
Peak Elev= 116.01' @ 0.89 hrs Surf.Area= 297 sf Storage= 141 cf
Flood Elev= 118.00' Surf.Area= 1,386 sf Storage= 1,665 cf

Plug-Flow detention time= 0.4 min calculated for 0.425 af (99% of inflow)
Center-of-Mass det. time= 0.3 min (60.8 - 60.4)

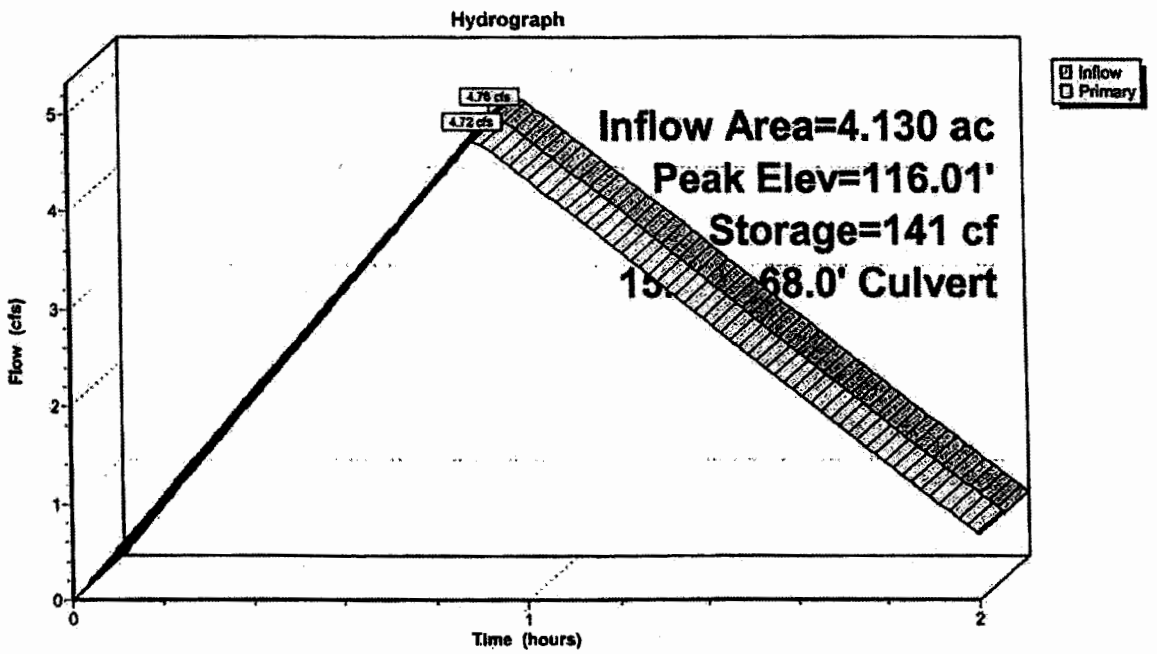
Volume	Invert	Avail.Storage	Storage Description
#1	114.72'	1,665 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
114.72	0	0.0	0	0	0
115.00	26	23.0	2	2	42
116.00	295	91.0	136	139	662
117.00	719	145.0	492	630	1,683
118.00	1,386	251.0	1,034	1,665	5,029

Device	Routing	Invert	Outlet Devices
#1	Primary	114.72'	**15.0" x 68.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 114.19' S= 0.0078 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished

Primary OutFlow Max=4.72 cfs @ 0.89 hrs HW=116.01' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 4.72 cfs @ 4.64 fps)

Pond 4P: Culvert



10-year

Summary for Subcatchment 4S: DA Culvert

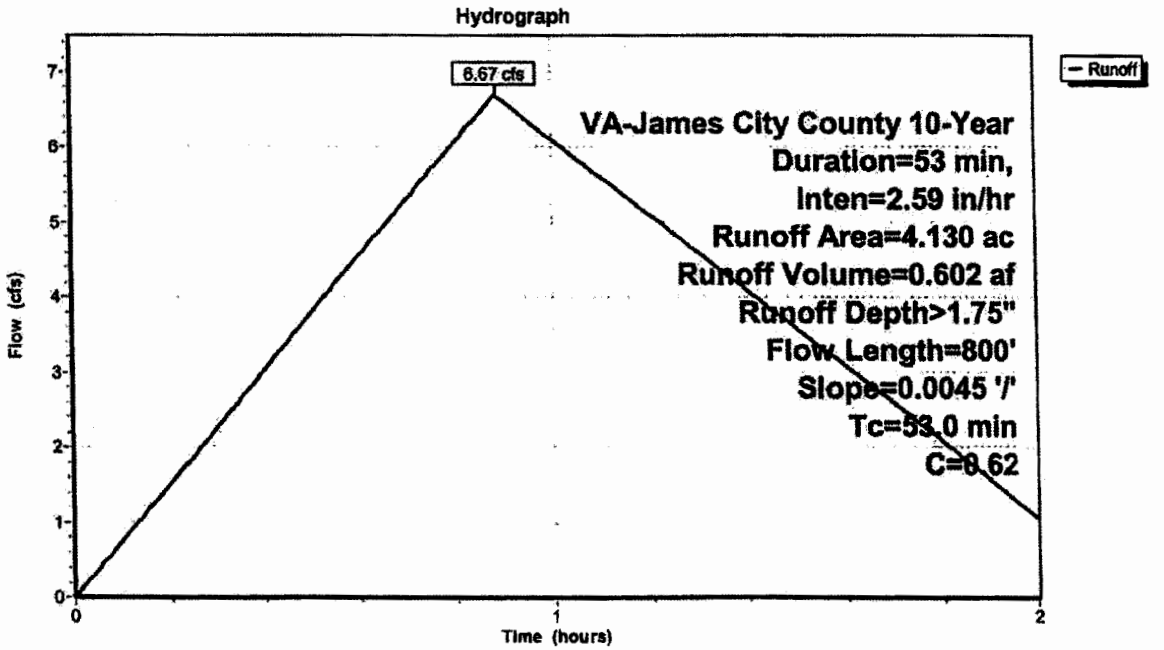
Runoff = 6.67 cfs @ 0.88 hrs, Volume= 0.602 af, Depth> 1.75"

Runoff by Rational method, Rise/Fall=1.0/1.5 xTc, Time Span= 0.00-2.00 hrs, dt= 0.01 hrs
VA-James City County 10-Year Duration=53 min, Inten=2.59 in/hr

Area (ac)	C	Description
2.020	0.90	Roof/Concrete/Asphalt
2.110	0.35	Lawn/Grass
4.130	0.62	Weighted Average
4.130		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
43.1	200	0.0045	0.08		**Sheet Flow, Sheet Flow Tc** Grass: Dense n= 0.240 P2= 3.50"
9.9	600	0.0045	1.01		**Shallow Concentrated Flow, Shallow Concentrated Tc** Grassed Waterway Kv= 15.0 fps
53.0	800	Total			

Subcatchment 4S: DA Culvert



Summary for Pond 4P: Culvert

Inflow Area = 4.130 ac, 0.00% Impervious, Inflow Depth > 1.75" for 10-Year event
Inflow = 6.67 cfs @ 0.88 hrs, Volume= 0.602 af
Outflow = 6.43 cfs @ 0.93 hrs, Volume= 0.602 af, Atten= 4%, Lag= 3.0 min
Primary = 6.43 cfs @ 0.93 hrs, Volume= 0.602 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-2.00 hrs, dt= 0.01 hrs
Peak Elev= 116.66' @ 0.93 hrs Surf.Area= 553 sf Storage= 413 cf
Flood Elev= 118.00' Surf.Area= 1,386 sf Storage= 1,665 cf

Plug-Flow detention time= 0.6 min calculated for 0.602 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (61.5 - 60.9)

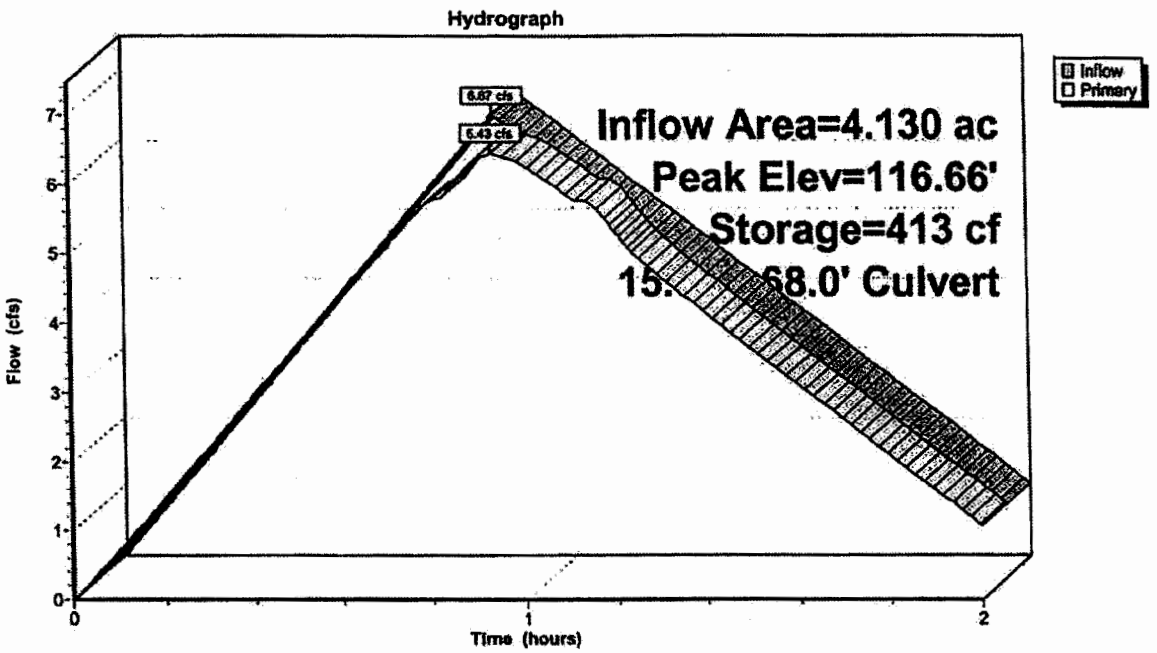
Volume	Invert	Avail.Storage	Storage Description
#1	114.72'	1,665 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
114.72	0	0.0	0	0	0
115.00	26	23.0	2	2	42
116.00	295	91.0	136	139	662
117.00	719	145.0	492	630	1,683
118.00	1,386	251.0	1,034	1,665	5,029

Device	Routing	Invert	Outlet Devices
#1	Primary	114.72'	**15.0" x 68.0' long Culvert** RCP, square edge headwall, Ke= 0.500 Outlet Invert= 114.19' S= 0.0078 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished

Primary OutFlow Max=6.43 cfs @ 0.93 hrs HW=116.66' (Free Discharge)
↳**1=Culvert** (Barrel Controls 6.43 cfs @ 5.24 fps)

Pond 4P: Culvert



Storm Sewer Calculations

LANDMARK DESIGN GROUP INC
Storm Sewer Design Computations
Stuckey's **10-Year Frequency**

DATE: April-1-2009

PROJECT NO. 2004224-000.00

55.61 =B 10.00 =D 0.74 =E 10 YR STM		AREA DRAIN. "A"	RUNOFF COEF.	CA		INLET TIME	RAIN FALL	RUNOFF "Q"		INVERT ELEVATIONS		PIPE LNGTH	SLOPE	DIA	CAPA-CITY	VEL.	FLOW TIME	REMARKS		
FROM POINT	TO POINT	ACRES	C	INCRE-MENT	ACCUM-ULATED	MIN-UTES	IN.\HR	INCRE-MENT	ACCUM-ULATED	UPPER END	LOWER END	FT.	FT./FT.	IN.	C.F.S.	F.P.S.	MIN.		RIM	MANN. N
A1*	A2	0.13	0.90	0.12	0.06	5.00	7.50	0.89	0.45	114.50	113.78	30	0.0240	8	2.21	4.97	0.10	ACO drain	116.50	0.011
A2	A3	0.00	0.00	0.00	0.06	5.10	7.50	0.00	0.45	113.78	112.93	20	0.0425	8	2.94	6.10	0.05	CDS Tech	116.61	0.011
A3	A4	0.00	0.00	0.00	0.06	5.16	7.50	0.00	0.45	111.60	110.67	45	0.0207	15	9.29	3.91	0.19	MH-2	116.10	0.013
A4	FES-A5	Outflow from Bioretention Basin C						3.09	3.54	110.58	110.22	108	0.0033	15	3.71	3.44	0.52	Outlet Stucture	116.67	0.013
B1	B2	0.13	0.49	0.07	0.07	5.00	7.50	0.49	0.49	108.33	108.12	42	0.0050	15	4.57	2.43	0.29	HRPDC RS Yard Drain	112.83	0.013
B2	B3	0.17	0.86	0.15	0.21	5.29	7.39	1.09	1.57	107.95	107.00	80	0.0119	15	7.04	4.62	0.29	HRPDC RS Curb Inlet	113.20	0.013
B-3	FES-B4	0.00	0.00	0.00	0.21	5.58	7.39	0.00	1.57	105.06	105.00	12	0.0050	18	7.42	3.33	0.06	MH-2	112.48	0.013

* The following assumption was made: 50% of the runoff from the canopy area will drain into the storm system and the rest will reach the Bioretention B

LANDMARK DESIGN GROUP INC DATE April-1-2009 PROJECT 2004224-000.00

Hydraulic Gradeline Computations

Stuckey's **10-Year Frequency**

RCP PIPE n= 0.013

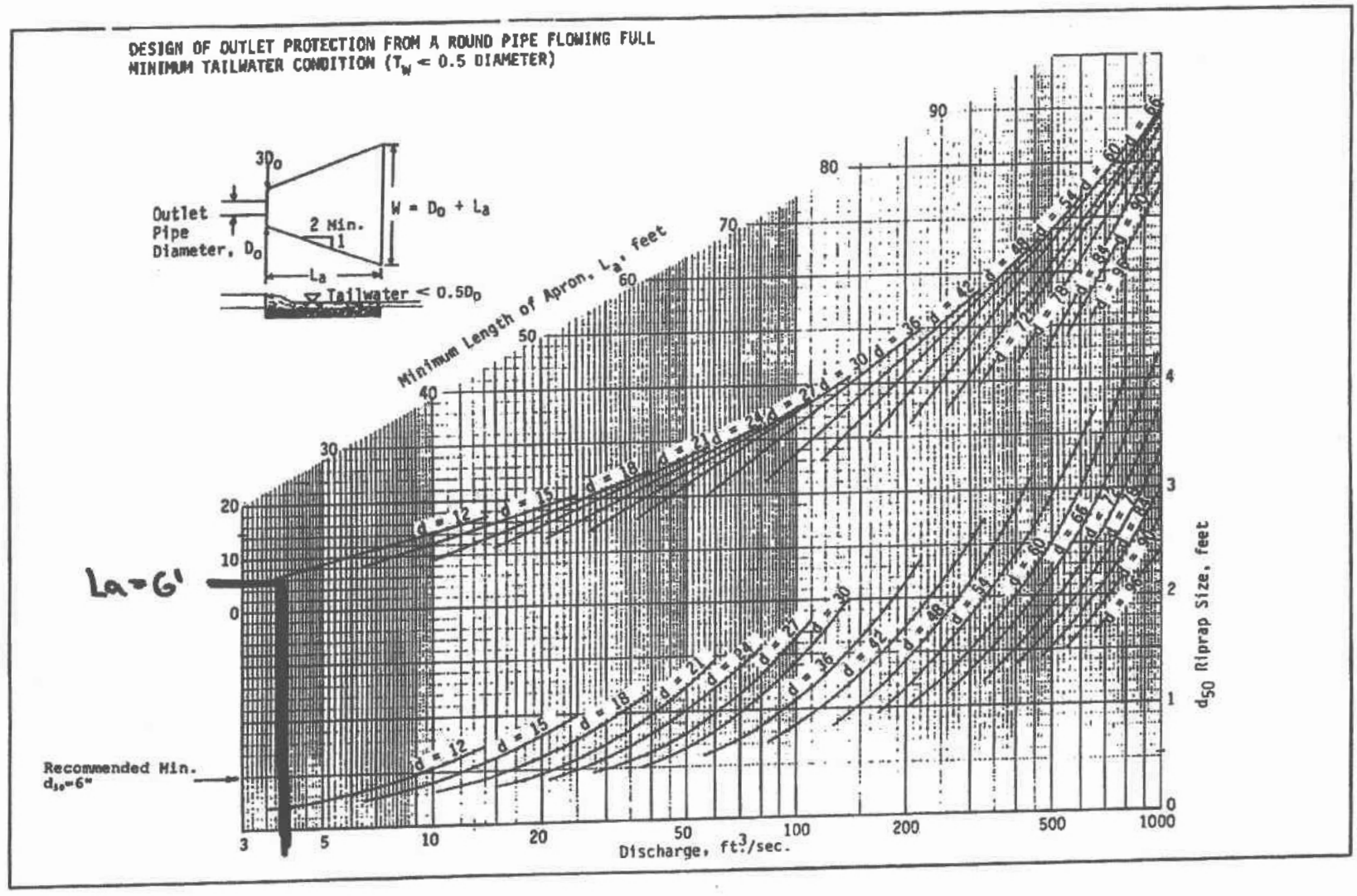
PVC PIPE n= 0.011

INLET STATION	OUTLET SURFACE ELEV	D(O)	Q(O)	L(O)	SF(O)	H(F)	JUNCTION LOSS														FINAL H	INLET SURFACE ELEV	RIM ELEV	Outlet Condition
							V(O)	H(O)	Q(I)	D(I)	V(I)	Q*V	V^2/2G	H(I)	ANGLE	E K	H(>)	H(T)	1*3 H(T)	0.5* H(T)				
A4	111.22	15	3.54	108	0.0030	0.32	2.88	0.0322	0.45	15	0.36	0	0.00	0.00	78	0.64	0.00	0.03	0.04	0.02	0.35	111.57	116.67	Free
A3	111.67	15	0.45	45	0.0000	0.00	0.36	0.0005	0.45	8	1.28	1	0.03	0.01	42	0.38	0.01	0.02	0.02	0.01	0.01	111.68	116.10	
A2	113.46	8	0.45	20	0.0010	0.02	1.28	0.0063	0.45	8	1.28	I	0.03	0.01	28	0.22	0.01	0.02	0.03	0.01	0.03	113.50	116.61	
A1	114.31	8	0.45	30	0.0010	0.03	1.28	0.0063												0.00	0.03	114.34	116.50	
B3	108.64	18	1.57	12	0.0002	0.00	3.33	0.0430	1.57	15	4.62	7	0.33	0.12	62	0.55	0.18	0.34	0.44	0.22	0.22	108.86	112.48	
B2	108.86	15	1.57	80	0.0006	0.05	4.62	0.0829	0.49	15	2.43	1	0.09	0.03	69	0.58	0.05	0.17	0.22	0.11	0.16	109.02	113.20	
B1	109.12	15	0.49	42	0.0001	0.00	0.40	0.0006										0.00	0.00	0.00	0.00	109.12	112.83	

Outlet Protection Calculations

OUTLET FES-A-5

$\begin{cases} La = 6' \\ W = 1.25' + 6' = 7.25' \end{cases}$



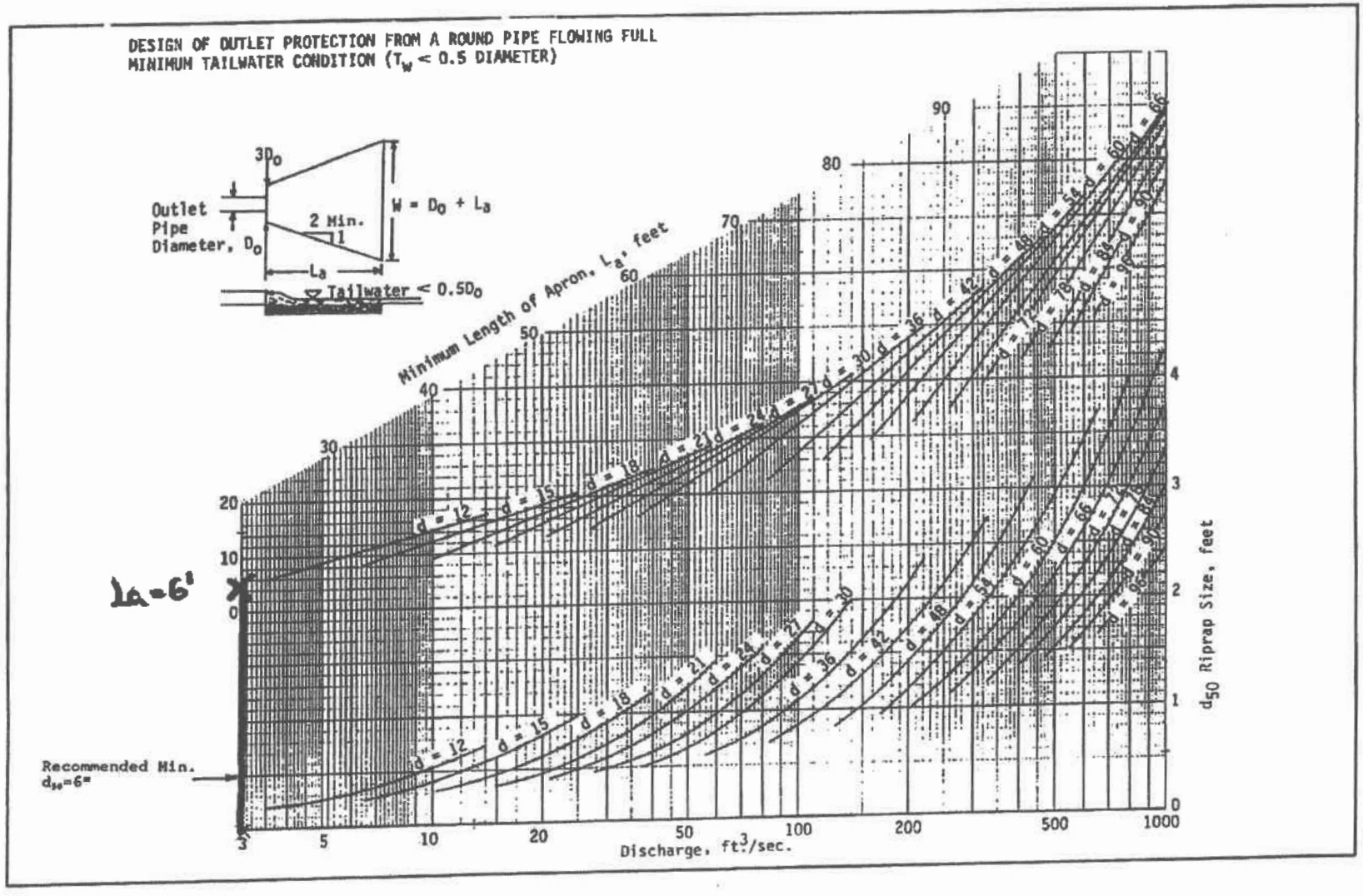
Source: USDA-SCS

Plate 3.18-3

$Q_{10} = 3.54$ cfs

OUTLET FES B-4

$\begin{cases} L_a = 6' \\ W = 1.5' + 6' = 7.5' \end{cases}$



$Q_{10} = 1.57$ cfs

Source: USDA-SCS

Plate 3.18-3

HH - 164

1992

3.18

Channel Adequacy Calculations

2-year

Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	k:\l&m\projects\2004224-000.00 stuckeys\engineering\channel.fm2
Worksheet	SECTION I - 2YR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

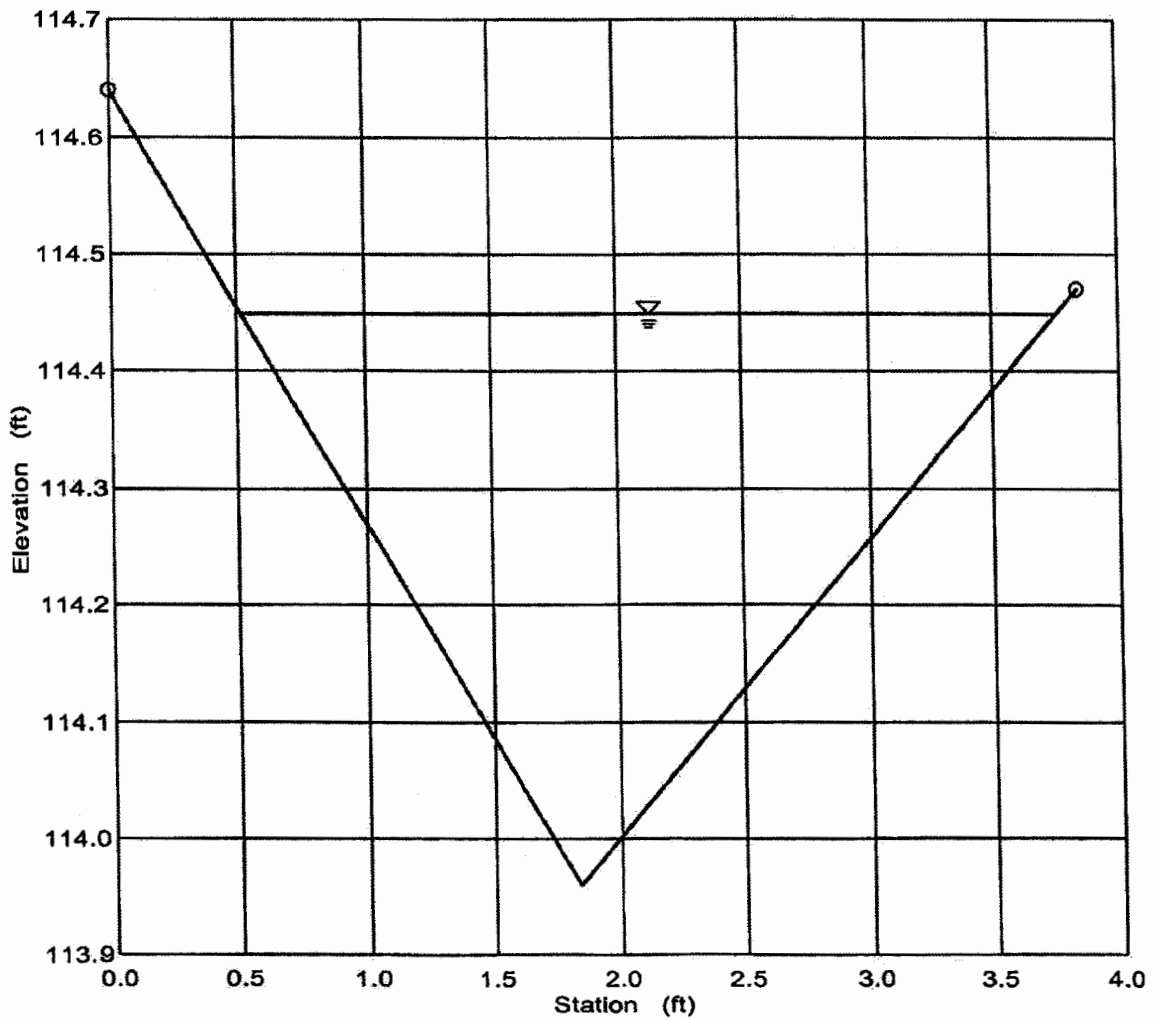
Input Data				
Channel Slope	0.018669 ft/ft			
Elevation range: 113.96 ft to 114.64 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	114.64	0.00	3.84	0.013
1.84	113.96			
3.84	114.47			
Discharge	4.72 cfs			

Results		
Wtd. Mannings Coefficient	0.013	
Water Surface Elevation	114.45	ft
Flow Area	0.80	ft²
Wetted Perimeter	3.40	ft
Top Width	3.25	ft
Height	0.49	ft
Critical Depth	114.61	ft
Critical Slope	0.003847	ft/ft
Velocity	5.93	ft/s
Velocity Head	0.55	ft
Specific Energy	115.00	ft
Froude Number	2.11	
Flow is supercritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\l&m\projects\2004224-000.00 stuckeys\engineering\channel.fm2
Worksheet	SECTION I - 2YR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.013	
Channel Slope	0.018669	ft/ft
Water Surface Elevation	114.45	ft
Discharge	4.72	cfs



Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	k:\l&m\projects\2004224-000.00 stuckeys\engineering\channel.fm2
Worksheet	SECTION II - 2YR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

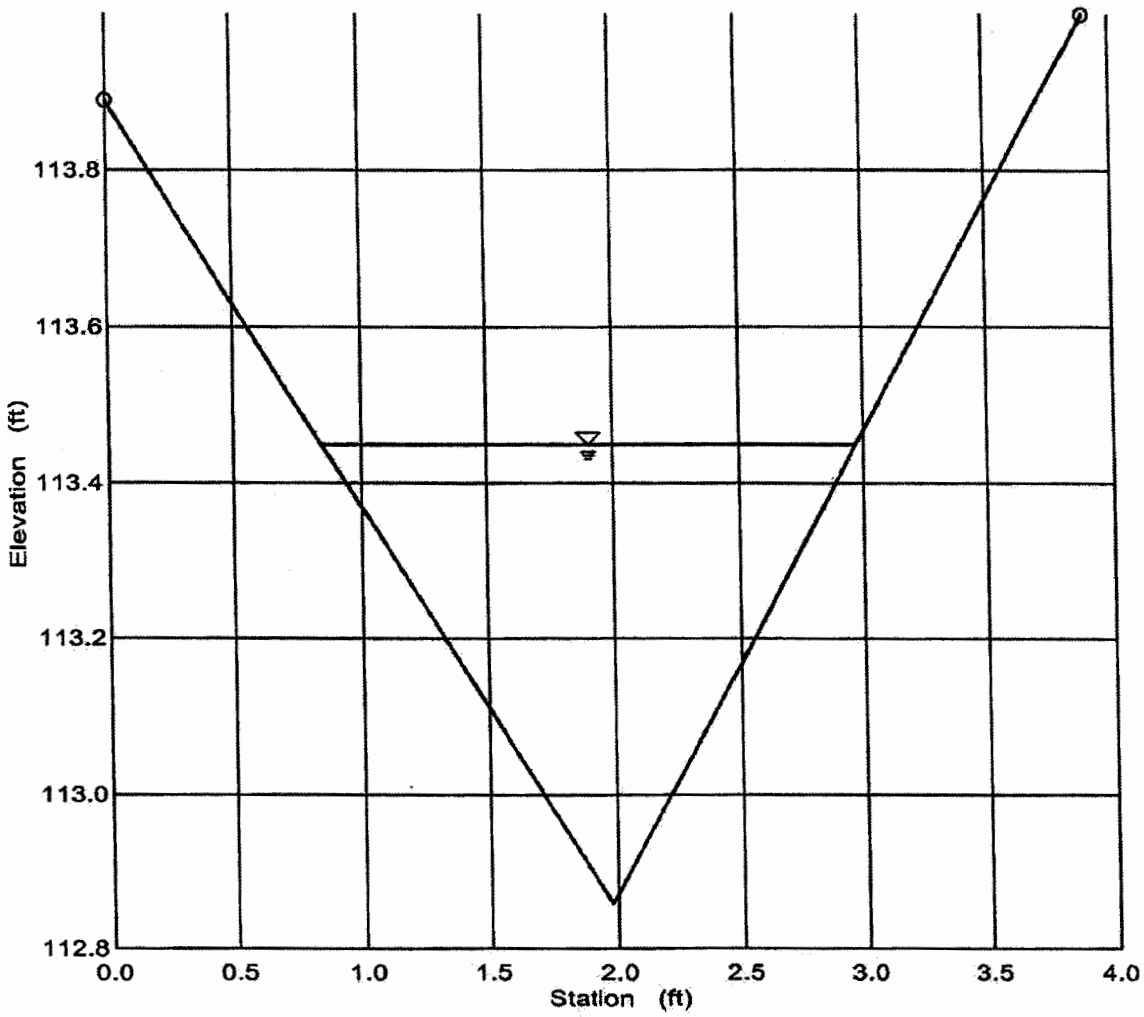
Input Data				
Channel Slope	0.026706 ft/ft			
Elevation range: 112.86 ft to 114.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	113.89	0.00	3.90	0.013
1.98	112.86			
3.90	114.00			
Discharge	4.72 cfs			

Results		
Wtd. Mannings Coefficient	0.013	
Water Surface Elevation	113.45	ft
Flow Area	0.62	ft²
Wetted Perimeter	2.43	ft
Top Width	2.12	ft
Height	0.59	ft
Critical Depth	113.70	ft
Critical Slope	0.003929	ft/ft
Velocity	7.56	ft/s
Velocity Head	0.89	ft
Specific Energy	114.34	ft
Froude Number	2.46	
Flow is supercritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\l&m\projects\2004224-000.00 stuckeys\engineering\channel.fm2
Worksheet	SECTION II - 2YR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.013	
Channel Slope	0.026706	ft/ft
Water Surface Elevation	113.45	ft
Discharge	4.72	cfs



Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	k:\l&m\projects\2004224-000.00 stuckeys\engineering\channel.fm2
Worksheet	SECTION III - 2YR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

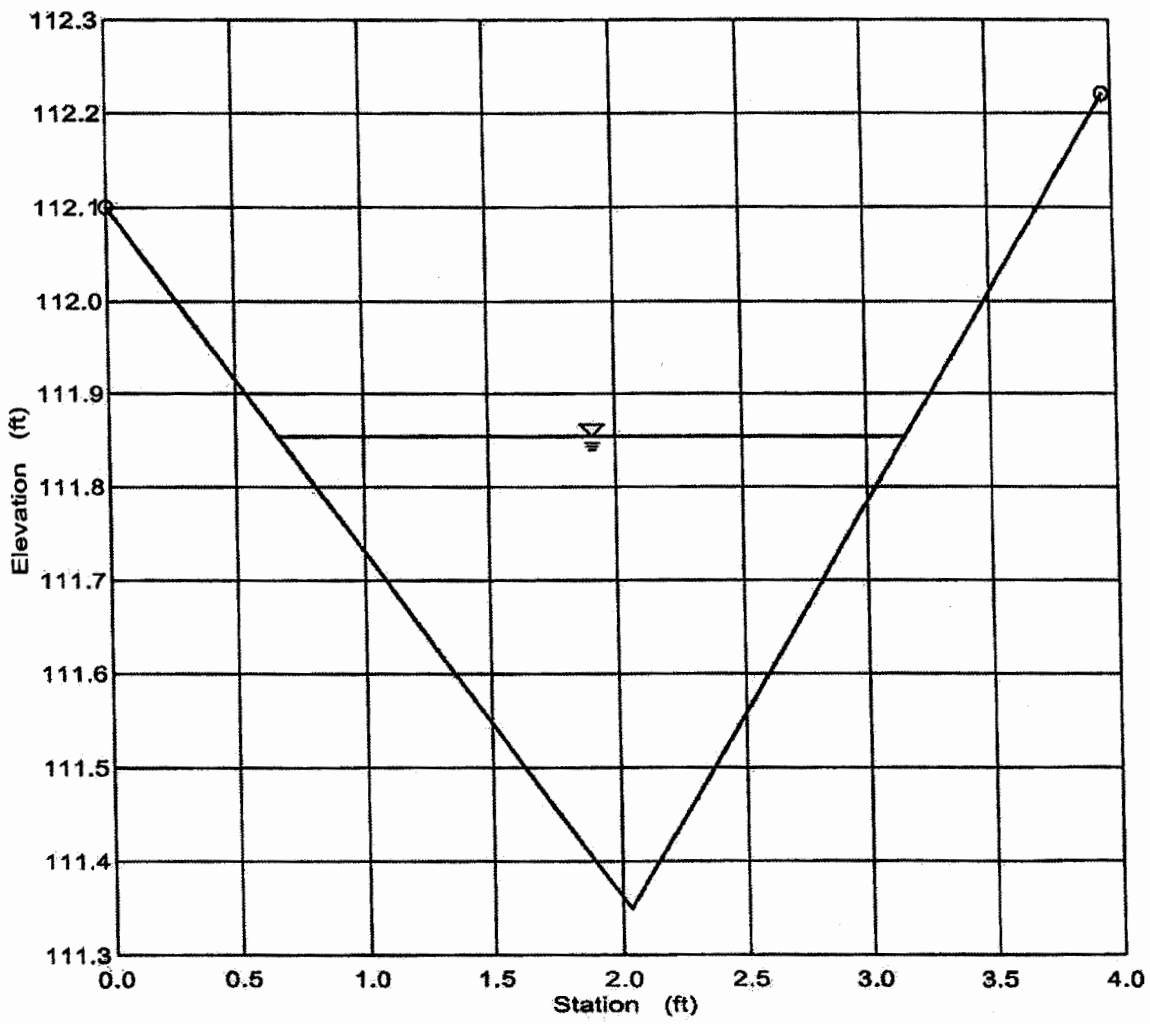
Input Data				
Channel Slope	0.030242 ft/ft			
Elevation range: 111.35 ft to 112.22 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	112.10	0.00	3.97	0.013
2.04	111.35			
3.97	112.22			
Discharge	4.72 cfs			

Results		
Wtd. Mannings Coefficient	0.013	
Water Surface Elevation	111.85	ft
Flow Area	0.63	ft²
Wetted Perimeter	2.69	ft
Top Width	2.49	ft
Height	0.50	ft
Critical Depth	112.09	ft
Critical Slope	0.003793	ft/ft
Velocity	7.53	ft/s
Velocity Head	0.88	ft
Specific Energy	112.74	ft
Froude Number	2.65	
Flow is supercritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\l&m\projects\2004224-000.00 stuckeys\engineering\channel.fm2
Worksheet	SECTION III - 2YR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.013	
Channel Slope	0.030242	ft/ft
Water Surface Elevation	111.85	ft
Discharge	4.72	cfs



10-year

Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	k:\l&m\projects\2004224-000.00 stuckeys\engineering\channel.fm2
Worksheet	SECTION I - 10YR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

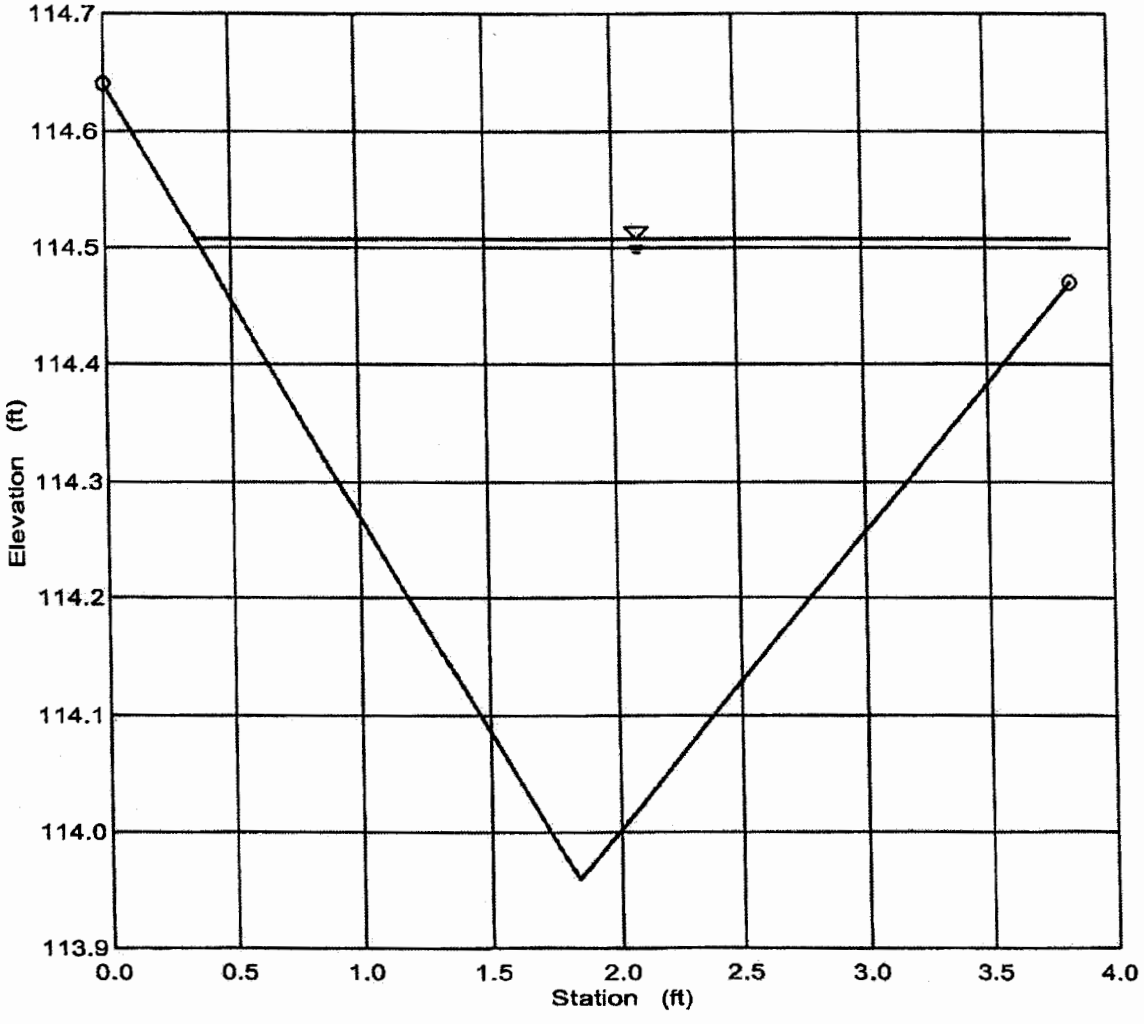
Input Data				
Channel Slope	0.018669 ft/ft			
Elevation range: 113.96 ft to 114.64 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	114.64	0.00	3.84	0.013
1.84	113.96			
3.84	114.47			
Discharge	6.43 cfs			

Results		
Wtd. Mannings Coefficient	0.013	
Water Surface Elevation	114.51	ft
Flow Area	0.99	ft²
Wetted Perimeter	3.68	ft
Top Width	3.48	ft
Height	0.55	ft
Critical Depth	114.70	ft
Critical Slope	0.003771	ft/ft
Velocity	6.50	ft/s
Velocity Head	0.66	ft
Specific Energy	115.16	ft
Froude Number	2.15	
Flow is supercritical.		
Water elevation exceeds lowest end station by 0.04 ft.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\l&m\projects\2004224-000.00 stuckeys\engineering\channel.fm2
Worksheet	SECTION I - 10YR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.013	
Channel Slope	0.018669	ft/ft
Water Surface Elevation	114.51	ft
Discharge	6.43	cfs



Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	k:\l&m\projects\2004224-000.00 stuckeys\engineering\channel.fm2
Worksheet	SECTION II - 10YR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data		
Channel Slope	0.026706	ft/ft
Elevation range: 112.86 ft to 114.00 ft.		
Discharge	6.43	cfs

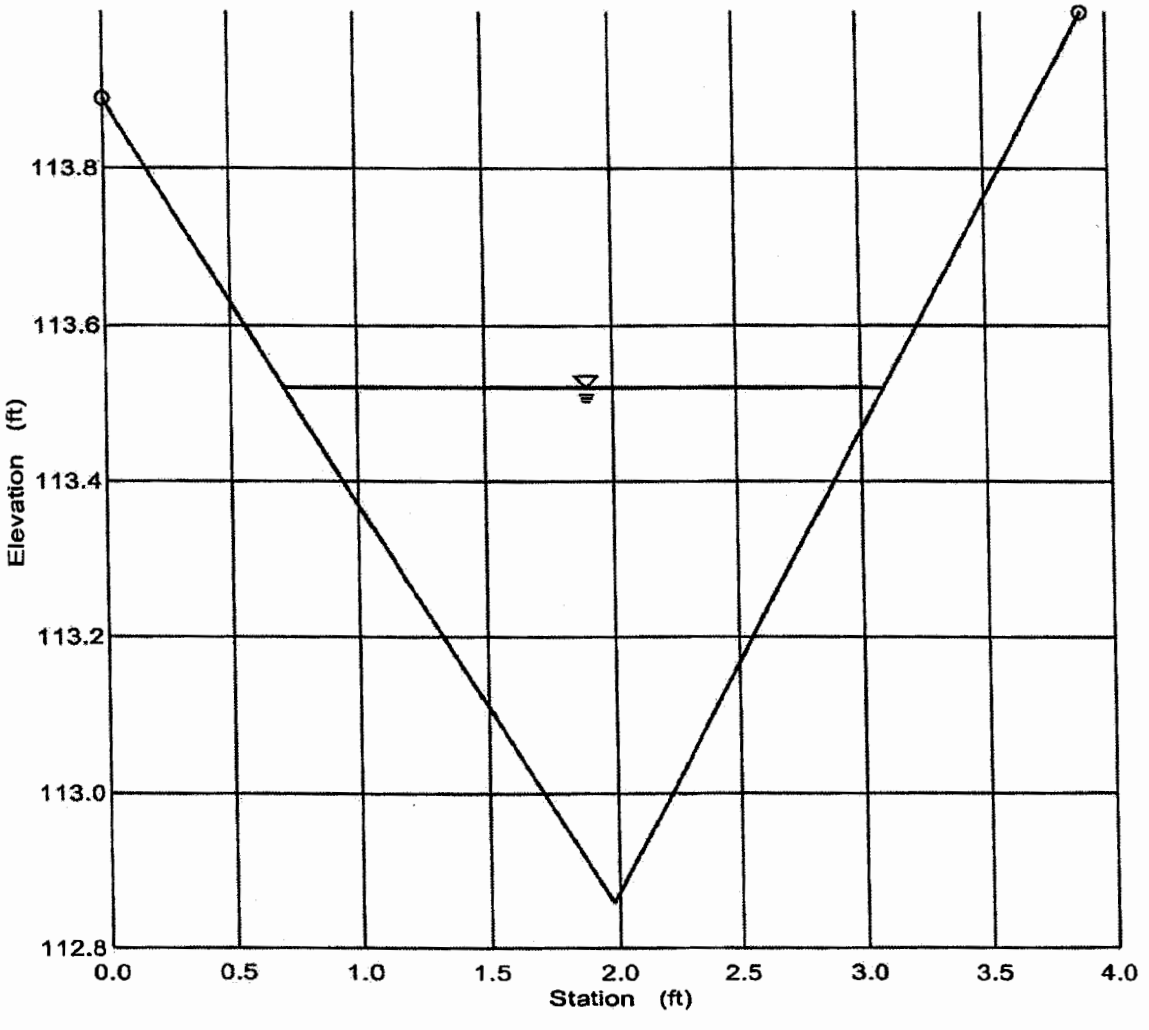
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	113.89	0.00	3.90	0.013
1.98	112.86			
3.90	114.00			

Results		
Wtd. Mannings Coefficient	0.013	
Water Surface Elevation	113.52	ft
Flow Area	0.79	ft²
Wetted Perimeter	2.73	ft
Top Width	2.38	ft
Height	0.66	ft
Critical Depth	113.81	ft
Critical Slope	0.003771	ft/ft
Velocity	8.16	ft/s
Velocity Head	1.04	ft
Specific Energy	114.56	ft
Froude Number	2.50	
Flow is supercritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\l&m\projects\2004224-000.00 stuckeys\engineering\channel.fm2
Worksheet	SECTION II - 10YR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.013	
Channel Slope	0.026706	ft/ft
Water Surface Elevation	113.52	ft
Discharge	6.43	cfs



Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	k:\l&m\projects\2004224-000.00 stuckeys\engineering\channel.frn2
Worksheet	SECTION III - 10YR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

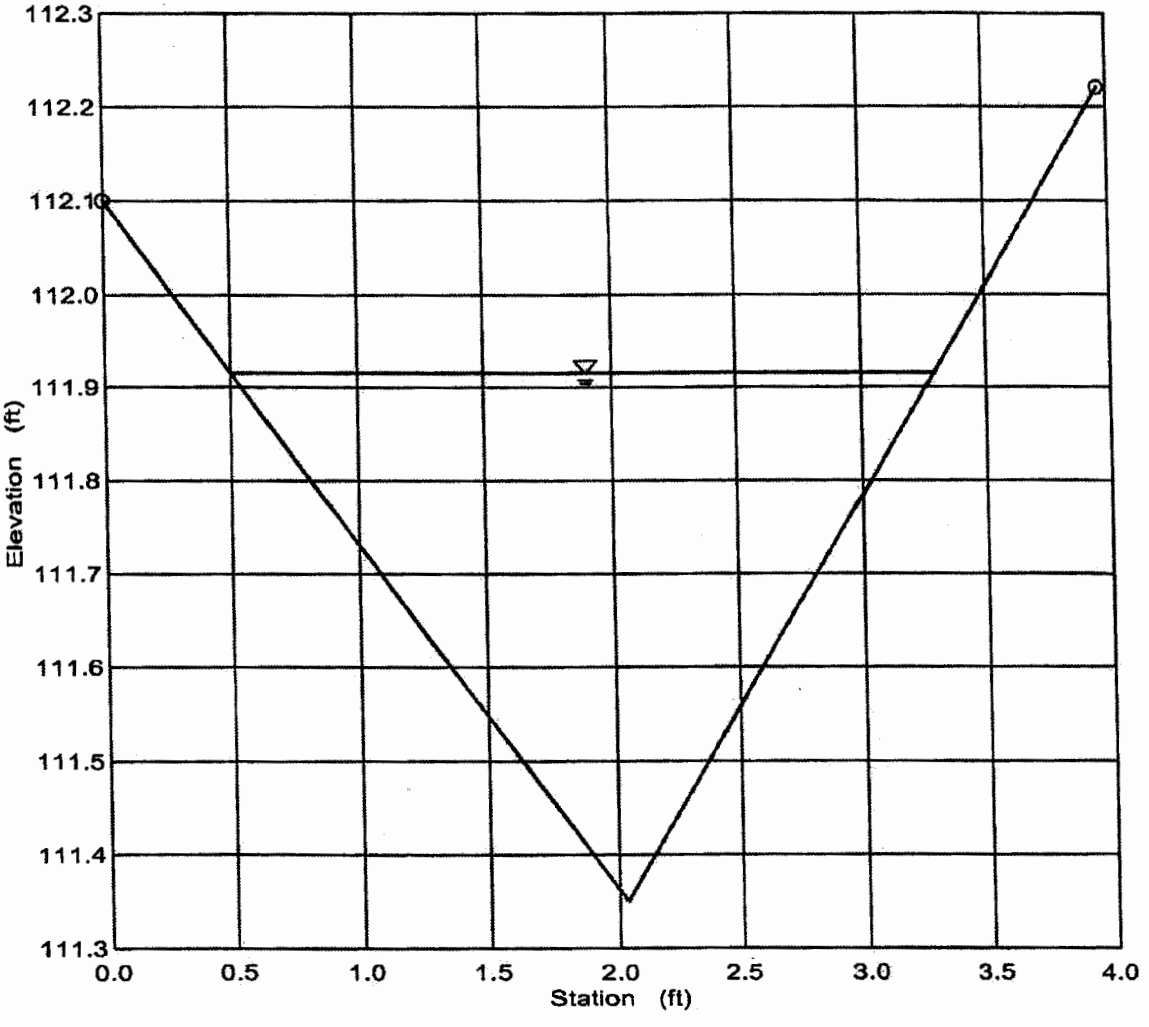
Input Data				
Channel Slope	0.030242 ft/ft			
Elevation range: 111.35 ft to 112.22 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	112.10	0.00	3.97	0.013
2.04	111.35			
3.97	112.22			
Discharge	6.43 cfs			

Results		
Wtd. Mannings Coefficient	0.013	
Water Surface Elevation	111.92	ft
Flow Area	0.79	ft²
Wetted Perimeter	3.02	ft
Top Width	2.79	ft
Height	0.57	ft
Critical Depth	112.18	ft
Critical Slope	0.003688	ft/ft
Velocity	8.14	ft/s
Velocity Head	1.03	ft
Specific Energy	112.94	ft
Froude Number	2.70	
Flow is supercritical.		

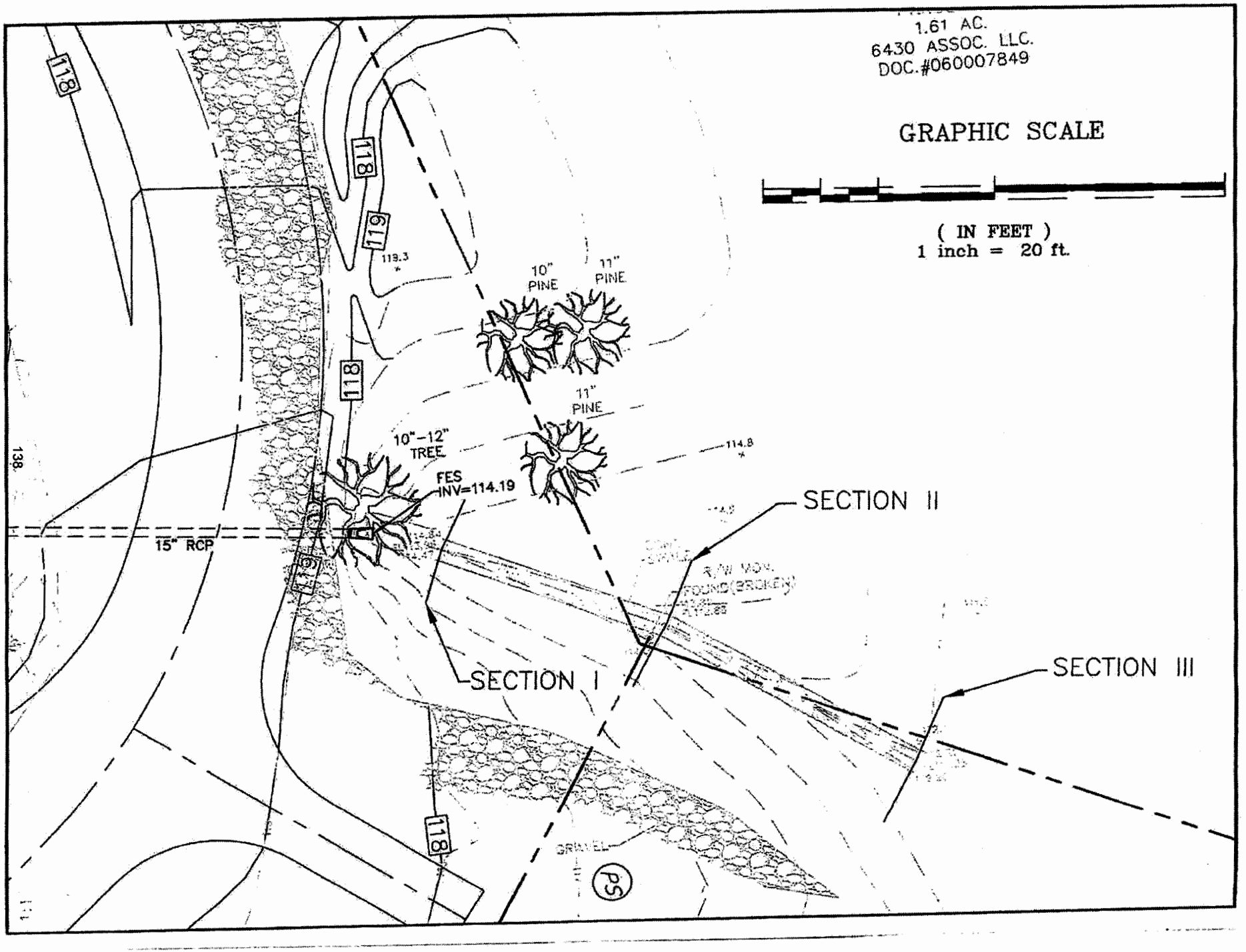
Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\l&m\projects\2004224-000.00 stuckeys\engineering\channel.fm2
Worksheet	SECTION III - 10YR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.013	
Channel Slope	0.030242	ft/ft
Water Surface Elevation	111.92	ft
Discharge	6.43	cfs



Channel Sections Map


1.61 AC.
6430 ASSOC. LLC.
DOC.#060007849
GRAPHIC SCALE
(IN FEET)
1 inch = 20 ft.
118
119
118
119.3
10" PINE
11" PINE
11" PINE
10"-12" TREE
FES INV=114.19
114.8
138
15" RCP
SECTION II
SECTION I
SECTION III
R/W MON. FOUND(BROKEN)
GRAVEL
PS
118

BMP A Specifications

STORM WATER TREATMENT UNIT

Performance & Design Specifications

The Contractor shall install a precast storm water treatment unit (SWTU) in accordance with the notes and details shown on the Drawings and in conformance with these Specifications. The precast storm water treatment units shall be a continuous deflective separator (CDS®) unit, model PMSU20_15 unit as manufactured by CDS Technologies or proven equivalent.

Acceptable SWTU unit(s) shall be non-mechanical and gravity driven, requiring no external power requirements. The SWTU unit shall be capable of capturing and permanently retaining settleable, floatable, and neutrally buoyant particles and contaminants in accordance with the sizing criteria of these specifications. The SWTU unit shall be equipped with a stainless steel expanded metal screen having a screen opening of 4700 microns (4.7 mm or 0.185 inches). The separation screen shall be self-cleaning and non-blocking for all flows diverted to it, even when flows within the storm drain pipeline exceed the SWTU unit's design treatment flow capacity. A bypass structure shall be provided to allow conveyance of design flows in excess of the SWTU treatment capacity.

Alternative SWTUs shall only be considered equivalent when all conditions of the Storm Water Treatment BMP Equivalency Approval Process portion of these specifications listed below have been satisfied and subject to the complete submittal, review and approved process.

Storm Water Treatment Unit Design

Solids Removal Performance Requirements: The SWTU shall remove oil and sediment from storm water during frequent wet weather events. The SWTU shall treat a minimum of 75 to 90 percent of the annual runoff volume and be capable of removing 80 percent of the total suspended sediment load (TSS) and greater than 90 percent of the floatable free oil. The SWTU must be capable of trapping silt and clay size particles in addition to large particles. The SWTU units shall capture 100% of the floatables and 100% of all particles equal to or greater than 4.7 millimeter (mm) for all flow conditions up to unit's design treatment flow capacity, regardless of the particle's specific gravity. The SWTU unit shall capture 100% of all neutrally buoyant material greater than 4.7 mm for all flow conditions up to its design treatment flow capacity.

There shall be no flow conditions up to the design treatment flow capacity of the SWTU unit in which a flow path through the SWTU unit can be identified that allows the passage of a 4.7-mm or larger neutrally buoyant object. The SWTU unit shall permanently retain all captured material for all flow conditions of the storm drains to include flood conditions. The SWTU unit shall not allow materials that have been captured within the unit to be flushed through or out of the unit during any flow condition to include flood and/or tidal influences.

Minimum Treatment Flow Capacity: The Model PMSU20_15 storm water treatment unit shall have a minimum treatment flow capacity of 0.7-cfs (19.8-liters/sec). This treatment capacity shall be achieved without any flow bypassing the overflow weir of the treatment unit. The hydraulic loading rate (gpm/ft^2) of the unit shall not exceed recommended loadings when calculated using the peak runoff rate of the water quality storm event.

Storm Water Treatment Unit Structure: The structure shall be designed to withstand H20 traffic and earth loadings to be experienced **during the life of the treatment unit.**

Minimum Sump Design: The Model PMSU20_15 shall be furnished with a sump that has a minimum volume of 1.1 cubic yards (0.8 cubic meters) for storage of sediment, organic solids, and other settleable trash and debris. This sump zone shall be separated from the swirl chamber by a constricting access-way for both physical and hydraulic shear separation.

The storm water filtration unit shall be furnished with a sump to store settleable materials and pollutants. The sump shall be below the invert of the separation swirl concentrating or vortexing zone or chamber. Units without sumps or units in which settleable material is deposited within the separation or vortexing chamber shall not be allowed. The unit shall have the volumetric sump capacities list above which is materially separated from the separation or vortex chamber to ensure that settled material does not reside in the treatment flow path and thus subject to re-suspension.

Oil and Grease Removal Performance: The SWTU unit is equipped with a conventional oil baffle to capture and retain oil and grease and Total Petroleum Hydrocarbons (TPH) pollutants as they are transported through the storm drain system during dry weather (gross spills) and wet weather flows. The conventional oil baffle within a unit assures satisfactory oil and grease removal from typical urban storm water runoff.

Minimum Oil Storage Capacity: The Model PMSU20_15 shall be furnished with a baffle that provides a minimum gross oil storage volume of 92 gallons (348-liters).

The SWTUs shall be equipped with a conventional oil baffle to capture and retain oil and grease and Total Petroleum Hydrocarbons (TPH) pollutants as they are transported through the storm drain system during dry weather (gross spills) and wet weather flows.

The SWTU units shall also be capable of receiving and retaining the addition of Oil Sorbents within their separation chambers. The addition of the oil sorbents can ensure the permanent removal of 80% to 90% of the free oil and grease from the storm water runoff. The addition of sorbents enables increased oil and grease capture efficiencies beyond that obtainable by conventional oil baffle systems. Sorbent material shall be added in accordance with the **"USE OF OIL SORBENTS"** specifications provided by CDS Technologies.

Manufacturers Performance Certificate

The manufacturer of the SWTU unit shall submit details and shop drawings of sufficient detail for the Engineer to confirm that no available flow paths exist that would allow the passage of an object greater than 4.7 mm and that the hydraulic loading rate at the peak runoff of the water quality storm event is with in does not exceed recommendations. Additionally, the manufacturer shall submit a "Manufacturers Performance Certificate" certifying that the SWTU unit shall achieve the specified removal efficiencies listed in these specifications. This Manufacturer's Performance Certification of removal efficiencies shall clearly and unequivocally state that the listed removal efficiency shall be achieved throughout the entire treatment flow processed by the SWTU unit with no attenuation of removal efficiency as the flow increase up to the minimum treatment flow capacity specified above.

Warranty

The manufacturer of the SWTU unit shall guarantee the filtration unit free from defects in materials and workmanship for a period one year following installation. Equipment supplied by the manufacturer shall be installed and used only in the particular application for which it was specifically designed.

Storm Water Treatment BMP Equivalency Approval Process

It is the responsibility of the Project Civil Engineer to design a post-construction treatment control BMP system that conforms to storm water treatment unit these product and performance specifications. When considering equivalencies of previously approved post-construction treatment control BMPs, the project Civil Engineer of Record shall provide a stamped BMP Treatment Report that includes that following:

Sizing Storm Water Treatment Unit for Treatment Efficiency and Conveyance

Treatment Efficiency: Submit stamped project specific SWTU sizing calculations that explicitly state that the proposed SWTU has been sized in conformance with either of the following:

1. The alternative unit's treatment hydraulic loading rate does not exceed 24-gallons/square foot of separator chamber area at the peak of the design ***Minimum Treatment Flow Capacity*** listed in the following paragraph(s). This is the (horizontal) plan area of the separator zone within the vortex separation chamber, not the total footprint area of the unit.

2. Alternative solid separators whose treatment process is primary based on particle settling in vaults or tanks shall only be considered equivalent when the unit's treatment hydraulic loading rate does not exceed 2-gallons/square foot of separator chamber footprint at the peak of the design ***Minimum Treatment Flow Capacity***

listed in the SWTU performance specifications. This is the (horizontal) internal area of the settling tank or vault, not the total footprint area of the unit.

This portion of the submittal shall also include an explicit listing of design criteria and/or methodology used to develop the minimum flow-based treatment capacities.

Hydraulic Analysis: Submit stamped project specific hydraulic calculations stamped by professional engineer registered with the state where the project is located. This Hydraulic Analysis shall provide the following.

1. The Hydraulic Gradeline (HGL) through the diversion structure and proposed storm water treatment system for the water quality storm event shall be calculated and plotted on a detail of the storm water treatment system.

   This hydraulic analysis shall explicitly show that the water quality volume or water quality runoff flow rate calculated in accordance with the best practices of hydraulic analysis performed by civil engineers.

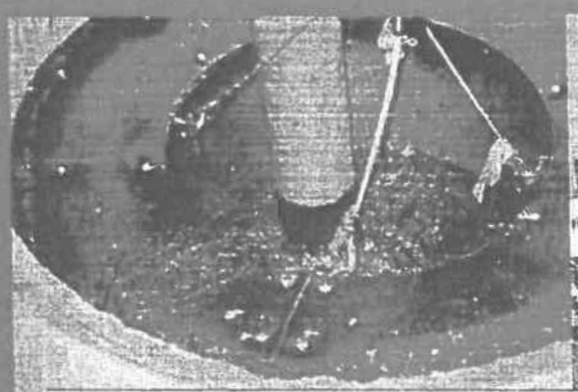
2. The HGL for the design flood event (e.g., Q_{10}, Q_{15}, Q_{25}, etc.) shall also be calculated and plotted through the Treatment Control BMP.

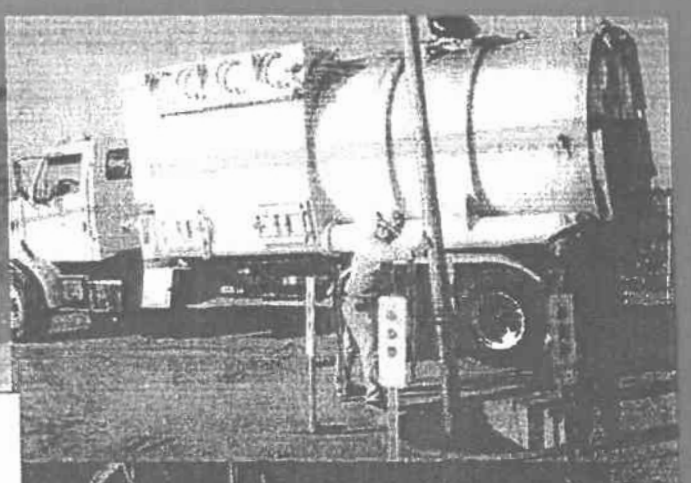
Reference:

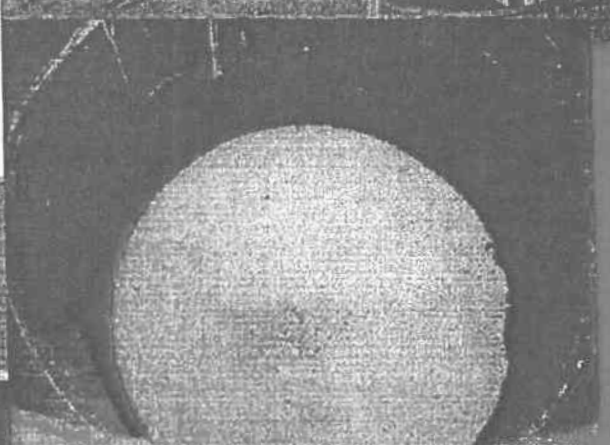
Section 5.5 BMP Design Criteria for Flow and Volume of the California Stormwater Best Management Practice Handbook New Development and Redevelopment published by California Stormwater Quality Association (CASQA) Stormwater Best Management Practice Handbook for New Development and Redevelopment.

CDS Storm Water Treatment Unit Operation & Maintenance Manual

Project Name
Project Location







CDS Technologies
16360 S. Monterey Rd., Suite 250
Morgan Hill, CA 95037
888-535-7559
408-779-6363
408-782-0721 fax

CDS

TABLE OF CONTENTS

OPERATIONS AND MAINTENANCE GUIDELINES
For the CDS Technologies Models PMSU, PSW & PSWC
CONTINUOUS DEFLECTIVE SEPARATION UNIT
Located at

INTRODUCTION

The CDS unit is an important and effective component of your storm water management program and proper operation and maintenance of the unit are essential to demonstrate your compliance with local, state and federal water pollution control requirements.

The CDS technology features a patented non-blocking, indirect screening technique developed in Australia to treat water runoff. The unit is highly effective in the capture of suspended solids, fine sands and larger particles. Because of its non-blocking screening capacity, the CDS unit is un-matched in its ability to capture and retain gross pollutants such as trash and debris. In short, CDS units capture a very wide range of organic and in-organic solids and pollutants that typically result in tons of captured solids each year such as: Total suspended solids (TSS) and other sedimentitious materials, oil and greases, trash, and other debris (including floatables, neutrally buoyant, and negatively buoyant debris). These pollutants will be captured even under very high flow rate conditions.

CDS units are equipped with conventional oil baffles to capture and retain oil and grease. Laboratory evaluations show that the CDS units are capable of capturing up to 70% of the free oil and grease from storm water. CDS units can also accommodate the addition of oil sorbents within their separation chambers. The addition of the oil sorbents can ensure the permanent removal of 80% to 90% of the free oil and grease from the storm water runoff.

OPERATIONS

The CDS unit is a non-mechanical self-operating system and will function any time there is flow in the storm drainage system. The unit will continue to effectively capture pollutants in flows up to the design capacity even during extreme rainfall events when the design capacity may be exceeded. Pollutants captured in the CDS unit's separation chamber and sump will be retained even when the units design capacity is exceeded.

CDS UNIT CLEANOUT

The frequency of cleaning the CDS unit will depend upon the generation of trash and debris and sediments in your application. Cleanout and preventive maintenance schedules will be determined based on operating experience unless precise pollutant loadings have been determined. The unit should be periodically inspected to determine the amount of accumulated pollutants and to ensure that the cleanout frequency is adequate to handle the predicted pollutant load being processed by the CDS unit. The recommended cleanout of solids within the CDS unit's sump should occur at 75% of the

sump capacity. However, the sump may be completely full with no impact to the CDS unit's performance.
Access to the CDS unit is typically achieved through two manhole access covers – one allows inspection and cleanout of the separation chamber (screen/cylinder) & sump and another allows inspection and cleanout of sediment captured and retained behind the screen. The PSW & PSWC off-line models have an additional access cover over the weir of the diversion vault. For units possessing a sizable depth below grade (depth to pipe), a single manhole access point would allow both sump cleanout and access behind the screen.

CDS Technologies Recommends The Following:

NEW INSTALLATIONS – Check the condition of the unit after every runoff event for the first 30 days. The visual inspection should ascertain that the unit is functioning properly (no blockages or obstructions to inlet and/or separation screen), measuring the amount of solid materials that have accumulated in the sump, the amount of fine sediment accumulated behind the screen, and determining the amount of floating trash and debris in the separation chamber. This can be done with a calibrated "dip stick" so that the depth of deposition can be tracked. Refer to the "Cleanout Schematic" **(Appendix B)** for allowable deposition depths and critical distances. Schedules for inspections and cleanout should be based on storm events and pollutant accumulation.

ONGOING OPERATION – During the rainfall season, the unit should be inspected at least once every 30 days. The floatables should be removed and the sump cleaned when the sump is 75-85% full. If floatables accumulate more rapidly than the settleable solids, the floatables should be removed using a vactor truck or dip net before the layer thickness exceeds one to two feet.

Cleanout of the CDS unit at the end of a rainfall season is recommended because of the nature of pollutants collected and the potential for odor generation from the decomposition of material collected and retained. This end of season cleanout will assist in preventing the discharge of pore water from the CDS® unit during summer months.

USE OF SORBENTS – It needs to be emphasized that the addition of sorbents is not a requirement for CDS units to effectively control oil and grease from storm water. The conventional oil baffle within a unit assures satisfactory oil and grease removal. However, the addition of sorbents is a unique enhancement capability special to CDS units, enabling increased oil and grease capture efficiencies beyond that obtainable by conventional oil baffle systems.

Under normal operations, CDS units will provide effluent concentrations of oil and grease that are less than 15 parts per million (ppm) for all dry weather spills where the volume is less than or equal to the spill capture volume of the CDS unit. During wet weather flows, the oil baffle system can be expected to remove between 40 and 70% of the free oil and grease from the storm water runoff.

CDS Technologies only recommends the addition of sorbents to the separation chamber if there are specific land use activities in the catchment watershed that

could produce exceptionally large concentrations of oil and grease in the runoff, concentration levels well above typical amounts. If site evaluations merit an increased control of free oil and grease then oil sorbents can be added to the CDS unit to thoroughly address these particular pollutants of concern.

Recommended Oil Sorbents

Rubberizer® Particulate 8-4 mesh or OARS™ Particulate for Filtration, HPT4100 or equal. Rubberizer® is supplied by Haz-Mat Response Technologies, Inc. 4626 Santa Fe Street, San Diego, CA 92109 (800) 542-3036. OARS™ is supplied by AbTech Industries, 4110 N. Scottsdale Road, Suite 235, Scottsdale, AZ 85251 (800) 545-8999.

The amount of sorbent to be added to the CDS separation chamber can be determined if sufficient information is known about the concentration of oil and grease in the runoff. Frequently the actual concentrations of oil and grease are too variable and the amount to be added and frequency of cleaning will be determined by periodic observation of the sorbent. As an initial application, CDS recommends that approximately 4 to 8 pounds of sorbent material be added to the separation chamber of the CDS units per acre of parking lot or road surface per year. Typically this amount of sorbent results in a ½ inch to one (1") inch depth of sorbent material on the liquid surface of the separation chamber. The oil and grease loading of the sorbent material should be observed after major storm events. Oil Sorbent material may also be furnished in pillow or boom configurations.

The sorbent material should be replaced when it is fully discolored by skimming the sorbent from the surface. The sorbent may require disposal as a special or hazardous waste, but will depend on local and state regulatory requirements.

CLEANOUT AND DISPOSAL

A vactor truck is recommended for cleanout of the CDS unit and can be easily accomplished in less than 30-40 minutes for most installations. Standard vactor operations should be employed in the cleanout of the CDS unit. Disposal of material from the CDS unit should be in accordance with the local municipality's requirements. Disposal of the decant material to a POTW is recommended. Field decanting to the storm drainage system is not recommended. Solids can be disposed of in a similar fashion as those materials collected from street sweeping operations and catch-basin cleanouts.

MAINTENANCE

The CDS unit should be pumped down at least once a year and a thorough inspection of the separation chamber (inlet/cylinder and separation screen) and oil baffle performed. The unit's internal components should not show any signs of damage or any loosening of the bolts used to fasten the various components to the manhole

structure and to each other. Ideally, the screen should be power washed for the inspection. If any of the internal components is damaged or if any fasteners appear to be damaged or missing, please contact CDS Technologies to make arrangements to have the damaged items repaired or replaced:

CDS Technologies, Inc.
16360 Monterey Road, Suite 250
Morgan Hill, CA 95037-5406

Phone, Toll Free: (888) 535-7559
Fax: (408) 782-0721

The screen assembly is fabricated from Type 316 stainless steel and fastened with Type 316 stainless steel fasteners that are easily removed and/or replaced with conventional hand tools. The damaged screen assembly should be replaced with the new screen assembly placed in the same orientation as the one that was removed.

CONFINED SPACE

The CDS unit is a confined space environment and only properly trained personnel possessing the necessary safety equipment should enter the unit to perform particular maintenance and/or inspection activities beyond normal procedure. Inspections of the internal components can, in most cases, be accomplished by observations from the ground surface.

RECORDS OF OPERATION AND MAINTENANCE

CDS Technologies recommends that the owner maintain annual records of the operation and maintenance of the CDS unit to document the effective maintenance of this important component of your storm water management program. The attached **Annual Record of Operations and Maintenance** form (see **Appendix A**) is suggested and should be retained for a minimum period of three years.

CDS TECHNOLOGIES
ANNUAL RECORD
OF
OPERATION AND MAINTENANCE

OWNER _____

ADDRESS _____

OWNER REPRESENTATIVE _____ **PHONE** _____

CDS INSTALLATION:

MODEL DESIGNATION _____ DATE _____

SITE LOCATION _____

DEPTH FROM COVER TO BOTTOM OF SUMP _____

VOLUME OF SUMP _____ CUYD VOLUME/INCH DEPTH _____ CUYD

INSPECTIONS:

DATE/INSPECTOR	SCREEN INTEGRITY	FLOATABLES DEPTH	SEDIMENT VOLUME	SORBENT DISCOLORATION

OBSERVATIONS OF FUNCTION: _____

_____

_____

_____

CLEANOUT:

DATE	VOLUME FLOATABLES	VOLUME SEDIMENTS	METHOD OF DISPOSAL OF FLOATABLES, SEDIMENTS, DECANT AND SORBENTS

OBSERVATIONS:

_____

_____

_____

_____

_____

_____

SCREEN MAINTENANCE:

DATE OF POWER WASHING, INSPECTION AND OBSERVATIONS: _____

_____

_____

CERTIFICATION: _____ **TITLE:** _____

DATE: _____

Erosion & Sediment Control Checklist

JAMES CITY COUNTY, VIRGINIA
ENVIRONMENTAL DIVISION

EROSION AND SEDIMENT CONTROL PLAN CHECKLIST

I. *GENERAL:*

Yes	No	N/A	
☑	☐	☐	*FAMILIARITY* with current versions of Chapter 8, Erosion and Sedimentation Control and Chapter 23, Chesapeake Bay Preservation ordinances of the Code of James City County, Virginia and the Virginia Erosion and Sediment Control Handbook (VESCH).
☑	☐	☐	*LAND DISTURBING PERMIT AND SILTATION AGREEMENT* with surety are required for the project.
☐	☑	☐	*VARIANCE* if necessary, requested in writing, for the plan approving authority to waive or modify any of the minimum standards and specifications of the VESCH deemed inappropriate based on site conditions specific to this review case only. Variances which are approved shall be properly documented in the plan and become part of the approved erosion and sediment control plan for the site.

II. *SITE PLAN:*

Yes	No	N/A	
☑	☐	☐	*VICINITY MAP* locating the site in relation to the surrounding area. Include any major landmarks which might assist in physically locating the site.
☑	☐	☐	*INDICATE NORTH* direction in relation to the site.
☑	☐	☐	*LIMITS OF CLEARING AND GRADING* for the site including that required for implementation of erosion and sediment controls, stockpile areas and utilities.
☑	☐	☐	*DISTURBED AREA ESTIMATES* in acres or square feet for the project.
☑	☐	☐	*EXISTING TOPOGRAPHY* or contours for the site at no more than 5 foot contour interval.
☑	☐	☐	*FINAL TOPOGRAPHY*, contours or proposed site grading in accordance with the design plan which indicates changes to existing topography and drainage patterns at no more than 2 foot contour interval (or 1 foot contours where required).
☑	☐	☐	*EXISTING AND PROPOSED SPOT ELEVATIONS* to supplement existing and proposed contours, topography or site grading information. Spot elevations may replace final contours in some instances, especially if terrain is in a low lying area or relatively flat.
☑	☐	☐	*EXISTING VEGETATION* including existing tree lines, grassed or unique vegetation areas.

Yes	No	N/A	
☑	☐	☐	*EXISTING SITE FEATURES* including roads, buildings, homes, utilities, streams, fences, structures and other important surface features of the site.
☑	☐	☐	*SOILS MAP* with soil symbols, boundaries and legend in accordance with the current Soil Survey of James City and York Counties and the City of Williamsburg, Virginia.
☑	☐	☐	*ENVIRONMENTAL INVENTORY* in accordance with Section 23-10(2) of the Chesapeake Bay Preservation Ordinance of James City County. Inventory generally includes: tidal shores and wetlands, non-tidal wetlands, resource protection area, hydric soils and slopes steeper than 25 percent. For wetlands, provide a copy of issued permits or satisfactory evidence that appropriate permits are being pursued for the entire project.
☐	☐	☑	*100-YEAR FLOODPLAIN LIMITS* or any special flood hazard areas or flood zones based on appropriate Federal Management Agency Flood Insurance Rate Maps (FIRMs) or Flood Hazard Boundary Maps (FHBMs) of James City County, Virginia.
☐	☐	☑	*DRAINAGE AREAS* for offsite and onsite areas, existing or proposed as applicable. Include drainage divides and directional labels for all subareas at points of interest and size (in acres), weighted runoff coefficient or curve number and times of concentration for each subarea.
☐	☐	☑	*CRITICAL EROSION AREAS* which require special consideration or unique erosion and sediment control measures. Refer to the VESCH, Chapter 6 for criteria.
☑	☐	☐	*DEVELOPMENT PLAN* for the site showing all improvements such as buildings, structures, parking areas, access roadways, above and below ground utilities, stormwater management and drainage facilities, trails or sidewalks, proposed vegetation and landscaping, amenities, etc.
☑	☐	☐	*LOCATION OF PRACTICES* proposed for erosion and sediment control, tree protection and temporary stormwater management due to land disturbance activities at the site. Use standard abbreviations, labels and symbols consistent for plan views based on minimum standards and specifications in Chapter 3 of the VESCH.
☐	☑	☐	*TEMPORARY STOCKPILE AREAS* or staging and equipment storage areas as required for onsite or offsite construction activities or indicate that none are anticipated for this project.
☑	☐	☐	*OFFSITE LAND DISTURBING AREAS* including borrow sites, waste areas, utility extensions, etc. and required erosion and sediment controls. If none are anticipated for the project, then indicate on the plans by general or erosion and sediment control notes.
☑	☐	☐	*DETAILS* or alternately, appropriate reference to current minimum standards and specifications of the VESCH for each measure proposed for the project. Non-modified, standard duplicated details (silt fence, diversion dikes, etc.) may be referenced to the current version of the VESCH. Specific dimensional or modified standards (basins, traps, outlet protections, check dams, etc.) require presentation on detail sheets. Schedules or tables may be used for multiple site measures such as sediment traps, basins, channels, slope drains, etc. Any modification to standard details should be clearly defined, explained and illustrated.

Yes No N/A

☑ ☐ ☐ *MAINTENANCE PLAN* or alternately, appropriate reference to current minimum standards and specifications of the VESCH, outlining the inspection frequency and maintenance requirements for all erosion and sediment control measures proposed for the project.

☐ ☑ ☐ *TRENCH DEWATERING* methods and erosion and sediment controls, if anticipated for the project.

☑ ☐ ☐ *CONSTRUCTION SEQUENCE* outlining the anticipated sequence for installation of erosion and sediment controls and site, grading and utility work to be performed for the project by the site contractor.

☐ ☑ ☐ *PHASING PLAN* if required for larger project sites that are to be developed in stages or phases.

☑ ☐ ☐ *STANDARD COUNTY NOTES* are required to be placed on the erosion and sediment control plan. Refer to the standard James City County Erosion and Sediment Control Notes, latest version.

☑ ☐ ☐ *PROFESSIONAL SEAL AND SIGNATURE* required on final and complete approved plans, drawings, technical reports and specifications.

III. *NARRATIVE:*

Yes No N/A

☑ ☐ ☐ *PROJECT DESCRIPTION* briefly describing the nature and purpose of the land disturbing activity and the acreage to be disturbed.

☑ ☐ ☐ *EXISTING SITE CONDITIONS* description of existing topography, land use, cover and drainage patterns at the site.

☐ ☑ ☐ *ADJACENT AREA* descriptions of neighboring onsite or offsite areas such as streams, lakes, property, roads, etc. and potential impacts due to concentrated flow or runoff from the land disturbing activity.

☐ ☑ ☐ *OFFSITE DISTURBED AREA* descriptions of proposed borrow sites, waste or surplus areas, utility extensions and erosion and sediment controls to be implemented.

☑ ☐ ☐ *SOILS DESCRIPTION* briefly summarizing site, disturbed area and drainage basin soils including name, unit, hydrologic soil group (HSG) classification, surface runoff potential, erodibility, permeability, depth, texture, structure, erosion hazards, shrink-swell potential, limitations for use and anticipated depths to bedrock and the seasonal water table, as applicable.

☐ ☑ ☐ *CRITICAL AREAS* on the site which many have potentially serious erosion and sediment control problems and special considerations required (ie. steep slopes, hydric soils, channels, springs, sinkholes, water supply reservoirs, groundwater recharge areas, etc.)

Yes No N/A

☑ ☐ ☐ *PROPOSED EROSION & SEDIMENT CONTROL MEASURES* inclusive to the specific erosion and sediment control plan as proposed for the land disturbing activity. Measures should be consistent with those proposed on the site drawings. Address general use, installation, limitations, sequencing and maintenance requirements for each control measure.

☑ ☐ ☐ *STABILIZATION MEASURES* required for the site, either temporary or permanent, and during and following construction including temporary and permanent seeding and mulching, paving, stone, soil stabilization blankets and matting, sodding, landscaping or special stabilization techniques to be utilized at the site.

☑ ☐ ☐ *STORMWATER MANAGEMENT CONSIDERATIONS* for the site, either of temporary or permanent nature, and strategies, sequences and measures required for control. May reference the stormwater management plan for the site, if prepared, for permanent stormwater management facilities and control of drainage once the site is stabilized.

IV. *CALCULATIONS:*

Yes No N/A

☑ ☐ ☐ *CALCULATIONS AND COMPUTATIONS* associated with hydrology, hydraulics and design of proposed temporary and permanent erosion and sediment control measures including: sediment traps and basins, diversions, stormwater conveyance channels, culverts, slope drains, outlet protections, etc. Computations are not required on the construction plan and may be attached in a supplemental erosion and sediment control plan design report, if presented in a clear and organized format.

☐ ☑ ☐ *TEMPORARY SEDIMENT BASIN DESIGN DATA SHEET* submitted for each basin along with schematic or sketch cross-section showing applicable design and construction data, storage volumes (wet-dry), dimensions and elevations. Peak design runoff to be based on the 2- or 25-year design storm event based on maximum disturbed site conditions (existing, interim or proposed conditions) in accordance with Minimum Standard 3.14 of the VESCH.

Stormwater Management Checklist

JAMES CITY COUNTY, VIRGINIA
ENVIRONMENTAL DIVISION

STORMWATER MANAGEMENT DESIGN PLAN CHECKLIST

I. *GENERAL:*

Yes	No	N/A	
☑	☐	☐	*FAMILIARITY* with current versions of the James City County Guidelines for Design and Construction of Stormwater Management BMPs manual; Chapter 8, Erosion and Sediment Control and Chapter 23, Chesapeake Bay Preservation ordinances of the Code of James City County, Virginia; the Virginia Erosion and Sediment Control Handbook (VESCH); and the Virginia Stormwater Management Handbook (VSMH).
☐	☑	☐	*WAIVER OR EXCEPTION* if necessary, requested in writing, for the plan approving authority to waive or except the requirements of Chapter 23, Chesapeake Bay Preservation ordinance in accordance with procedure established in Sections 23-14 through 23-17 of the ordinance. Applies to this review case only.
☐	☑	☐	*VARIANCE REQUEST* if necessary, requested in writing for the plan approving authority to waive or modify any of the minimum standards and specifications of the VESCH deemed inappropriate based on site conditions specific to this review case only. Variances which are approved shall be properly documented in the plan and become part of the approved erosion and sediment control plan for the site.
☑	☐	☐	*PROFESSIONAL SEAL AND SIGNATURE* required on final and complete approved stormwater management plans, drawings, technical reports and specifications.
☑	☐	☐	*WORKSHEET FOR BMP POINT SYSTEM* to ensure the stormwater management plan for the project attains at least 10 BMP points (New Development) or traditional pollutant load reduction computations per the Chesapeake Bay Local Assistance Manual (Redevelopment Only).
☐	☑	☐	*PROPOSED CONSERVATION EASEMENT AREAS* for any natural open space points claimed in the BMP worksheet.
☐	☑	☐	*INSPECTION/MAINTENANCE AGREEMENT* is required to be prepared and executed with the County for the project.
☑	☐	☐	*FEMA FIRM PANEL* reference with designated special flood hazard areas or zone designations associated with the site, as applicable.
☐	☑	☐	*DRAINAGE AREA MAP* at a maximum scale of 1"=200' scale showing drainage area boundaries for pre- and postdevelopment conditions and associated time of concentration flow paths. Labels to include drainage area size, runoff coefficient or curve number and time of concentration for each subarea shown on the map.

Yes	No	N/A	
☑	☐	☐	*SOILS MAP* with soil symbols, boundaries and legend in accordance with the current Soil Survey of James City and York Counties and the City of Williamsburg, Virginia with approximate locations of the project site, BMPs and applicable drainage basins.
☑	☐	☐	*STORMWATER MANAGEMENT NARRATIVE* in a brief and simple format which describes the project; location; site and drainage basin soil characteristics; receiving water or drainage facility; existing site and drainage basin conditions (topography, land use, cover, slopes, etc.); proposed site development; proposed stormwater management and drainage plan including County BMP type selected; summary of hydrology and hydraulics; maintenance program; and any special assumptions utilized for development of the stormwater management and drainage design plan or computations.
☐	☐	☑	*TEMPORARY STORMWATER MANAGEMENT* (if applicable) for control of stormwater runoff encountered during construction activities in addition to measures provided in the erosion and sediment control plan or stormwater management/drainage plan for the site. Adequate protection measures or sequencing provided.
☐	☐	☑	*MODIFICATION PLAN* clearly defined for temporary sediment control structures which will be converted to permanent SWM/BMP structures. Includes appropriate hydrologic and hydraulic computations, conversions, sequencing and cleanout information or details. Normally related to primary control structures associated with dry detention or wet retention ponds. Normally not permitted for Group C or D categories such as bioretention, infiltration and filtering system facilities.
☑	☐	☐	*STORMWATER MANAGEMENT and DRAINAGE DESIGN REPORT* in a bound 8-1/2 x 11 inch size format. Report shall generally include a title sheet, date, project identification, owner and preparer information, table of contents, narrative, summaries and computations as required. Computations may include: backwater, closed conduit, headwater, hydraulic, hydraulic grade line, hydrology, inlet, open channel, storm sewer, water quality, extended detention or stream channel protection and muti-stage storm routing calculations, as applicable, for the project. Computation data may include hand or computer generated computations, maps or schematics. All information should be presented in a clear, easy to follow format and should closely match construction plan information.
☑	☐	☐	*PLAN VIEW* at 1 inch = 50 ft. scale or less (1" = 40', 1" = 30', etc.)
☑	☐	☐	North arrow and plan legend.
☑	☐	☐	Property lines.
☑	☐	☐	Adjacent property information.
☑	☐	☐	Existing site features and existing impervious cover areas.
☑	☐	☐	Impervious cover tabulations.
☑	☐	☐	Existing drainage facilities (natural or manmade).
☑	☐	☐	Existing environmentally sensitive areas (RPA, wetlands, floodplain, steep slopes, critical soils, buffers, etc.).
☑	☐	☐	Existing and proposed contours (1' or 2' contour interval) and spot elevations as necessary to define high and low topography.
☐	☑	☐	Existing and proposed easement locations.

Yes	No	N/A	
☑	☐	☐	Proposed site improvements and proposed impervious cover areas.
☐	☑	☐	Proposed stormwater conveyance, drainage and management facilities with appropriate labeled construction data and information.
☑	☐	☐	Proposed landscaping and seeding plans (disturbed areas, pond interior, etc.).
☑	☐	☐	Proposed slope stabilization areas (riprap, blankets, mattings, walls, etc.).
☐	☑	☐	Delineation of permanent pools and the 1-, 2-, 10- and 100-year Design Water Surface Elevations.
☐	☑	☐	Delineation of ponding, headwater, surcharge or backwater areas which may affect adjacent existing or proposed buildings, structures or upstream adjacent properties.
☐	☑	☐	Test boring locations with reference surface elevations (if known).
☐	☑	☐	Risers, barrels, underdrains, overflows and outlet protections.
☐	☑	☐	Emergency spillway level section and outlet channel.
☐	☑	☐	Existing and proposed site utilities and protection measures.
☑	☐	☐	Erosion and sediment control measures (for site or BMP).
☐	☑	☐	Maintenance or access corridors to permanent stormwater management, BMP or drainage facilities.

II. ***STORMWATER CONVEYANCE SYSTEMS:***

Yes	No	N/A	
☑	☐	☐	*PLAN VIEWS*
☑	☐	☐	Storm drain lengths, sizes, types, classes and slopes for all segments. Label directly on plan or use structure/pipe schedule.
☑	☐	☐	Access structure (inlets, manholes, junctions, etc.) rim elevations, inverts, type and required grate or top unit and lengths labeled.
☑	☐	☐	All structure numbers labeled.
☑	☐	☐	Adequate horizontal clearance from other site utilities or structures.
☐	☐	☑	*PROFILES* generally are not required but are encouraged to expedite review. If not provided, ensure all pipe segments have adequate minimum cover, do not exceed maximum depths of cover for the type/class of pipe specified and do not conflict with other site utilities or excavation areas.
☐	☐	☐	*DETAILS*
☑	☐	☐	Typical storm drain bedding details or reference note.
☑	☐	☐	Standard details or reference note for all proposed access structure types (inlets, manholes, junctions, etc.).
☐	☐	☑	Inlet shaping detail or applicable reference note.
☐	☐	☑	Step detail or applicable reference note (if depth 4 ft. or more).
☐	☐	☑	Typical open channel details with designation, location, shape, type, bottom width, top width, lining, slope, length, side slope, and installation depth required for construction. Channel design data as necessary may also be included.
☑	☐	☐	Outlet protections at all pipe outfalls.

Yes No N/A

☐ ☐ ☐ *STORMWATER CONVEYANCE SYSTEM COMPUTATIONS*

- ☑ ☐ ☐ Storm Sewer Design computations based on 10-year design event.
- ☑ ☐ ☐ Hydraulic Grade Line computations based on 10-year design event.
- ☐ ☑ ☐ Inlet computations based on current VDOT procedure for spread, ponding depth and grate size required.
- ☐ ☑ ☐ Culvert Headwater computations. Design based on 10-year design storm event and check only for 100-year storm event.
- ☐ ☑ ☐ Open Channel computations based on 2-year design event for velocity and 10-year design event for capacity.
- ☑ ☐ ☐ Standard outlet protection or special energy dissipators.
- ☐ ☐ ☑ Pipe thickness design computations, as required, for selected pipe type (live load, minimum cover, maximum height of cover, etc.).
- ☐ ☑ ☐ Adequate channel computations for receiving channels (based on field measured channel section data).

III. ***STORMWATER MANAGEMENT / BMP FACILITIES:***

Yes No N/A

☐ ☐ ☑ *HYDROLOGY* - An SCS based methodology is required for the design of stormwater management/BMP facilities with watersheds exceeding 20 acres. Under 20 acres, other generally accepted methodologies such as the modified rational, critical storm are allowable. Refer to Chapter 5 of the VESCH or Chapter 5 of the VSMH.

- ☐ ☐ ☑ Runoff Curve Number or Coefficient determinations: predeveloped and ultimate development land use scenarios.
- ☐ ☐ ☑ Time of concentration: predeveloped and ultimate development indicating overland, shallow concentrated, and channel flow components (200 ft. maximum length for overland flow).
- ☐ ☐ ☑ Hydrograph generation (tabular or graphical): pre- and postdevelopment conditions for the 1-, 2-, 10-, and 100-year design storm events.

☐ ☐ ☑ *FACILITY CONFIGURATION and MINIMUM SEPARATIONS*

- ☐ ☐ ☐ Screening and layout consistent with Section 24-98(d) of the Chapter 24 Zoning ordinance (landscaping, screening, visibility, etc.).
- ☐ ☐ ☐ Basic considerations for safety and unauthorized entry.
- ☐ ☐ ☐ Proper length to width ratio (Typically 2H:1V).
- ☐ ☐ ☐ Facilities with deep pools (4 feet or more in depth) provided with two benches. Fifteen (15) ft. safety bench outward from normal pool at maximum 6 percent slope and aquatic bench inward from normal shoreline below normal pool. Narrower widths may be considered on a case-by-case basis.
- ☐ ☐ ☐ Pond buffer minimum 25 feet outward from maximum design WSEL. Additional setbacks may be required to permanent structures.
- ☐ ☐ ☐ No trees, shrubs or woody plants within 15 feet of embankment toe or 25 feet from principal spillway structure.

Yes No N/A

☑ ☐ ☐ Infiltration and filtering system facilities generally located at least 100 feet horizontally from any water supply well; 100 feet from any downslope building; and 25 feet from any upslope buildings, unless site specific investigation allows for reduced separation.

Yes No N/A

☐ ☐ ☑ *HYDRAULIC COMPUTATIONS*

- ☐ ☐ ☑ Elevation- or Stage- Storage curve and/or tabular data.
- ☐ ☐ ☑ Weir / Orifice Control - Extended Detention.
- ☐ ☐ ☑ Weir / Orifice Control - riser 1-year control for channel protection.
- ☐ ☐ ☑ Weir / Orifice Control - riser 2-year control for quantity (if required).
- ☐ ☐ ☑ Weir / Orifice Control - riser 10-year control for quantity (if required).
- ☐ ☐ ☑ Inlet / Outlet (barrel) control - (All Storms).
- ☐ ☐ ☑ Check for barrel control prior to riser orifice flow to prevent slug flow-water hammer conditions.
- ☐ ☐ ☑ Emergency spillway capacity and depth of flow.
- ☐ ☐ ☑ Elevation - Discharge (Outlet Rating) curve and/or table. Provide all supporting calculations and/or design assumptions.
- ☐ ☐ ☑ Adequate channel computations for receiving channel. May be waived if facility is designed based on current Stream Channel Protection criteria.

☐ ☐ ☑ *POND or RESERVOIR ROUTING*

- ☐ ☐ ☑ Storage-Indication Routing of postdeveloped inflow hydrographs for the 1-, 2-, 10-, and 100-year design storms. Preference is for structure to discharge up to the 10-year storm through the principal spillway and pass the 100-year storm with a minimum 1 foot of freeboard through a combination principal and emergency spillways. If no emergency spillway is provided, riser must be large enough to pass the design high water flow and trash without overtopping the facility, have 3 square feet or more of cross-sectional area, contain a hood type inlet and have a minimum freeboard of 2 feet. Token spillways with minimum 8 ft. width are also recommended at or above the design 100-year storm elevation.
- ☐ ☐ ☑ Downstream hydrographs at established study points, if conditions warrant (ie. facility discharge combined with uncontrolled bypass).

☐ ☐ ☑ *MISCELLANEOUS COMPUTATIONS*

- ☑ ☐ ☐ Water quality volume for permanent pool based on selected BMP treatment volume (WQv).
- ☑ ☐ ☐ Water quality volume for extended detention based on selected BMP treatment volume (WQv) with drawdown computations.
- ☐ ☑ ☐ Drawdown computations for the 1-year, 24 hour detention for stream channel protection criteria.
- ☐ ☑ ☐ Pond drain computations (within 24 hours).
- ☐ ☑ ☐ Anti-seep collar design (concrete preferred) or match material type.
- ☐ ☑ ☐ Filter diaphragm design (or alternative method of controlling seepage).

Yes No N/A

- ☐ ☐ ☑ Riser / base structure flotation analyses. FS = 1.25 minimum.
- ☐ ☐ ☑ Downstream danger reach study and/or emergency action plan (if conditions warrant).
- ☐ ☐ ☑ Upstream backwater analyses onto offsite adjacent property (if conditions warrant).
- ☐ ☐ ☑ 100 year floodplain impacts (if conditions warrant).

Yes No N/A

☑ ☐ ☐ *GEOTECHNICAL REQUIREMENTS*

- ☑ ☐ ☐ Geotechnical Report with recommendations specific to BMP facility type selected. Report prepared by a registered professional engineer. Requires submission, review and approval prior to issuance of Land Disturbance Permit.
- ☑ ☐ ☐ Initial Feasibility Testing requirements satisfied as per Appendix E of the James City County Guidelines for Design and Construction of Stormwater Management BMPs manual. (Infiltration, Bioretention and Filtering System BMP types only).
- ☑ ☐ ☐ Concept Design Testing requirements satisfied as per Appendix E of the James City County Guidelines for Design and Construction of Stormwater Management BMPs manual. (Infiltration, Bioretention and Filtering System BMP types only).
- ☑ ☐ ☐ Minimum Boring locations: borrow area, pool area, principal control structure, top of facility near one abutment and emergency spillway if provided.
- ☑ ☐ ☐ Boring logs with Unified Soil Classification (ASTM D2487), soils descriptions and depths to bedrock and the seasonal water table indicated.
- ☑ ☐ ☐ Standard County Record Drawing/Construction Certification note provided on plan. *Note: It is understood that preparation of record drawings and construction certifications as required for project facilities may not necessarily be performed by the plan preparer. These components may be performed by others.*

☐ ☐ ☑ *PRINCIPAL SPILLWAY PROFILE AND ASSOCIATED DETAILS*

☐ ☐ ☐ *EXISTING GROUND AND PROPOSED GRADE*

- ☑ ☐ ☐ Embankment or excavation side slopes labeled (3H:1V maximum).
- ☑ ☐ ☐ Minimum top width labeled (per VESCH or VSMH requirements).
- ☑ ☐ ☐ Removal of unsuitable material under proposed facility (per Geotechnical Report requirements).

Yes No N/A

☐ ☐ ☑ *CORE TRENCH*

- ☐ ☐ ☑ Material (per plan or Geotechnical Report).
- ☐ ☐ ☑ Bottom width (4' minimum or greater as dictated by Geotechnical Report recommendations).
- ☐ ☐ ☑ Side slopes (1:1 maximum steepness)
- ☐ ☐ ☑ Depth (4' minimum or greater as dictated by Geotechnical Report).

☐ ☐ ☑ *PRINCIPAL CONTROL STRUCTURE. RISER OR SIMILAR STRUCTURE (DETAILS REQUIRED FOR ALL ITEMS)*

- ☐ ☐ ☑ Durable, watertight, resistant material (concrete preferred).
- ☐ ☐ ☑ Riser diameter is at least 1.25 times larger than barrel diameter.
- ☐ ☐ ☑ All pertinent dimensions and elevations shown.
- ☐ ☐ ☑ Control orifice or weir dimensions and elevations shown.
- ☐ ☐ ☑ Trash rack - removable - for each release.
- ☐ ☐ ☑ Anti-vortex device, baffle or plate.
- ☐ ☐ ☑ Riser base structure with dimensions and embedment specifications (concrete preferred).
- ☐ ☐ ☑ Interior access (steps, ladders, etc.) for maintenance for structures over 4 feet in height. Excessively high risers may need some form of exterior access on top portion.
- ☐ ☐ ☑ Low flow orifice with trash rack device.

☑ ☐ ☐ *PRINCIPAL CONTROL STRUCTURE OUTLET BARREL*

- ☑ ☐ ☐ Material (ASTM C-361 reinforced concrete pipe) with watertight joints. Prior approval required for all other pipe material (other RCP types, CMP, CPP, PVC, etc.).
- ☑ ☐ ☐ Support and bedding requirements for barrel - concrete cradles, etc. or as recommended by the Geotechnical Report.
- ☑ ☐ ☐ Pipe inverts, length, size, class and slope shown.
- ☑ ☐ ☐ Flared end section or endwall provided on barrel outlet.

☐ ☑ ☐ *SEEPAGE CONTROL*

- ☐ ☑ ☐ Phreatic line shown (4:1 slope measured from the intersection of the embankment and the principal spillway design high water).

☐ ☑ ☐ *ANTI-SEEP COLLARS*

- ☐ ☑ ☐ Anti-seep collar, concrete preferred.
- ☐ ☑ ☐ Size - 15 percent increase in length of saturation using outside pipe diameter.
- ☐ ☑ ☐ Spacing and location on barrel (located at least 2 feet from a pipe joint).
- ☐ ☑ ☐ *FILTER DIAPHRAGMS*
- ☐ ☑ ☐ Design based on latest NRCS design methods and certified by a professional engineer.

Yes No N/A

☐ ☑ ☐ *ELEVATION AND DIMENSIONAL DESIGN DATA*

- ☐ ☑ ☐ Top of facility - construction height and settled height (10 percent settlement).
- ☐ ☑ ☐ Crest of principal control structure spillway at least one (1) foot below crest of emergency spillway, if provided.
- ☐ ☑ ☐ Minimum freeboard of one (1) foot above the 100-year design high water elevation for facilities with an emergency spillway.
- ☐ ☑ ☐ Minimum freeboard of two (2) feet above the 100-year design high water elevation for facilities without an emergency spillway or in accordance with the SCS National Engineering Handbook (prior approval required).
- ☐ ☑ ☐ Basin Sediment Clean-Out elevation (permanent mode). Typically 10 to 25 percent of water quality volume.

☐ ☐ ☑ *CROSS SECTION THROUGH FACILITY*

- ☐ ☐ ☑ Existing Ground.
- ☐ ☐ ☑ Proposed grade.
- ☐ ☐ ☑ Top of facility - constructed and settled.
- ☐ ☐ ☑ Location of emergency spillway with side slopes labeled (emergency spillway in cut).
- ☐ ☐ ☑ Bottom of core trench (4' minimum).
- ☐ ☐ ☑ Location of each soil boring.
- ☐ ☐ ☑ Barrel location.
- ☐ ☐ ☑ Existing and proposed utility location/protection.

☐ ☐ ☑ *EMERGENCY SPILLWAY PROFILE*

- ☐ ☐ ☑ Existing ground.
- ☐ ☐ ☑ Inlet, level (control) and outlet sections per SCS.
- ☐ ☐ ☑ Spillway and crest elevations.

☐ ☑ ☐ *PRETREATMENT DEVICES* of adequate depth and properly designed using required pretreatment volumes for the selected County BMP facility type. Including, but not limited to: sediment forebays, sediment basins, sumps, grass channels, gravel diaphragms, plunge pools, chamber separators, manufactured systems or other acceptable methods.

Yes	No	N/A	
☐	☐	☐	*CONSTRUCTION SPECIFICATIONS and NOTES*
☑	☐	☐	Anticipated sequence of construction for BMP (consistent with erosion and sediment control plan).
☐	☐	☑	Provisions to control base stream or storm flow conditions encountered during construction.
☑	☐	☐	Site and subgrade preparation requirements.
☐	☐	☑	Embankment, fill and backfill material soil and placement (lift) thickness requirements.
☐	☐	☑	Compaction and soil moisture content requirements.
☑	☐	☐	Geosynthetics for drainage, filtration, moisture barrier, separation, and reinforcement purposes.
☐	☐	☑	Clay or synthetic (PVC or HDPE) pond liners.
☐	☐	☑	Storm drain, underdrain and pipe conduit requirements.
☐	☐	☑	Minimum depth of pipe cover for temporary (construction) and final cover conditions.
☐	☐	☑	Permanent shutoff valve and pond drain.
☐	☐	☑	Concrete requirements for structural components.
☑	☐	☐	Riprap and slope protection.
☐	☐	☑	Access or maintenance road surface, base, subbase.
☑	☐	☐	Temporary and permanent stabilization measures.
☐	☑	☐	Temporary or permanent safety fencing.
☑	☐	☐	BMP Landscaping (deep, shallow, fringe, perimeter,etc.)
☐	☑	☐	Dust and traffic control (if warranted).
☐	☐	☑	Construction monitoring and certification by professional.
☐	☐	☐	Other: _____
☐	☐	☐	Other: _____

☐	☐	☐	*MAINTENANCE PROVISIONS*
☐	☐	☑	Entity responsible for maintenance identified..
☐	☐	☑	Maintenance Plan which outlines the long-term schedule for inspection/maintenance of the facility and forebays
☐	☐	☑	Maintenance access from public right-of-way or publicly traveled road.
☐	☐	☑	Maintenance easement provided encompassing high water pool and buffer, principal and emergency spillways, outlet structures, forebays, embankment area and possible sediment-removal stockpile areas.
☐	☐	☑	Minimum 6 foot wide public safety shelf (landing) or alternative fencing.

IV. ***OUTLET PROTECTIONS:***

Yes	No	N/A	
☑	☐	☐	Sized for maximum design release (generally 10-year storm).
☑	☐	☐	Flared end section or endwall.
☑	☐	☐	Dimensions.
☑	☐	☐	Rock or riprap size, quantity and placement thickness.
☐	☑	☐	Slope at 0 percent (Level Grade).
☑	☐	☐	Geotextiles (nonwoven).
☐	☑	☐	Special energy dissipators are required for design discharge velocities that exceed eighteen (18) feet per second; or if use of standard outlet protection would result in velocities exceeding permissible channel velocities; or if space restricts or limits their use.

V. ***ADDITIONAL COMMENTS OR INFORMATION SPECIFIC TO THE PLAN:***

Plan Preparer: PIOTR SWIETUCHOWSKI

Date: APRIL 1st, 2009

SWMProg/BMP/Checklist/ChkList

Geotechnical Report – GET Solutions

Report of Subsurface Investigation and
Geotechnical Engineering Services
Former Stuckey's Site
Barhamsville Road (State Route 30)
James City County, Virginia
G E T Project No. WM06-145G
June 22, 2006
Prepared For: LandMark Design Group

GET Solutions, Inc.

GET Solutions, Inc.

Geotechnical • Environmental • Testing

June 22, 2006

TO: **LandMark Design Group**
4029 Ironbound Road
Suite 100
Williamsburg, Virginia 23188

Attn: Mr. Steve Romeo, L.S.

RE: **Report of Subsurface Investigation and Geotechnical Engineering Services**
Former Stuckey's Site
Barhamsville Road (State Route 30)
James City County, Virginia
GET Project No: WM06-145G

Dear Mr. Romeo:

In compliance with your instructions, we have completed our Subsurface Investigation and Geotechnical Engineering Services for the referenced project. The results of this study, together with our recommendations, are presented in this report.

Often, because of design and construction details that occur on a project, questions arise concerning subsurface conditions. **G E T Solutions, Inc.** would be pleased to continue its role as Geotechnical Engineer during the final design phase and project implementation.

We trust that the information contained herein meets your immediate need, and we would ask that you call this office with any questions that you may have.

Respectfully Submitted,
G E T Solutions, Inc.

James Wheeler
Project Geologist

Glenn W. Hohmeier, P.E.
Sr. Project Engineer
VA Lic. #036735

COMMONWEALTH OF VIRGINIA
6-23-06
GLENN W. HOHMEIER
NO. 036735
PROFESSIONAL ENGINEER

Copies: (3) Client

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info@getsolutionsinc.com

TABLE OF CONTENTS

1.0 PROJECT INFORMATION

1.1 Project Description:

G E T Solutions, Inc. has completed our Geotechnical Engineering study for the Former Stuckey's Site located along Barhamsville Road (State Route 30) in James City County, Virginia. The construction at this site is planned to consist of renovating the current restaurant and gas station facilities. Also, new paved driveways and parking areas, along with other pertinent infrastructure components (utilities, BMP facilities, etc.) will also be reconstructed at this site.

If any of the noted information is incorrect or has changed, please inform **G E T Solutions, Inc.** so that we may amend the recommendations presented in this report, if appropriate.

1.2 Purpose and Scope of Services:

The purpose of this study was to obtain information on the general subsurface conditions at the proposed project site within the renovated area. The subsurface conditions encountered were then evaluated with respect to the available project characteristics. In this regard, engineering assessments for the following items were formulated:

1. General assessment of the soils revealed by the borings performed at the proposed development.

2. General location and description of potentially deleterious material encountered in the borings that may interfere with construction progress, including existing fills or surficial/subsurface organics.

3. Evaluation of the permeability of the soils within the renovated area by means of performing in-situ infiltration tests.

The scope of services did not include an environmental assessment for determining the presence or absence of wetlands or hazardous or toxic material in the soil, bedrock, surface water, groundwater or air, on or below or around this site. Prior to development of this site, an environmental assessment is advisable.

2.0 FIELD AND LABORATORY PROCEDURES

2.1 Field Exploration:

In order to explore the general subsurface soil types and to aid in developing associated design parameters, three (3) 10-foot deep hand auger borings (designated as HA-1, HA-2 and HA-3) were performed by **G E T Solutions, Inc.** within the potential BMP stormwater collection areas. In addition, three infiltration tests (designated as INF-1, INF-2 and INF-3) were performed within the hand auger borings at various depths.

The boring locations were established, located and staked in the field by a representative of **G E T Solutions, Inc.** The approximate boring locations are shown on the "Boring Location Plan" (Figure 1) attached to this report (Appendix I).

2.2 Laboratory Testing:

Representative portions of all soil samples collected at the hand auger locations were sealed in plastic bags, labeled and transferred to our laboratory for classification and analysis. The soil classification was performed by a Geotechnical Engineer in accordance with ASTM D 2488.

Three representative soil samples were selected and subjected to laboratory testing, which included natural moisture and -#200 sieve wash, in order to corroborate the visual classification. These test results are noted in Table 1 and are presented on the "Log of Boring" sheet (Appendix II), included with this report.

Table 1 – Laboratory Test Results

Boring No.	Depth (Ft)	Natural Moisture (%)	-#200 Sieve (%)	Atterberg Limits (LL/PL/PI)	Classification
HA-1/INF-1*	7.5	10.8	14.8	Non-Plastic	SM
HA-2/INF-2*	5.5	14.9	24.2	Non-Plastic	SM
HA-3/INF-3*	1.5	8.4	37.3	Non-Plastic	SM

* Sample obtained from the infiltration test depth.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Location and Description:

The project site is located along Barhamsville Road (State Route 30) in James City County, Virginia. The property is bordered to the north by an entrance ramp to Interstate 64, to the south by a vacant wooded area, to the west by Barhamsville Road, and to the east by a vacant wooded tract followed by Interstate 64. Currently, the site is a developed area consisting of a restaurant/gas station facility, paved parking lot, and associated infrastructure. Based on our visual observation, grade changes typically across the project site are less than 2-feet in vertical elevation every 100 linear feet.

3.2 Subsurface Soil Conditions:

The results of our field exploration program indicated the presence of approximately 3 inches of topsoil material at the boring locations. The topsoil thickness could vary across the site. Underlying the topsoil and extending to the boring termination depth of 10 feet below existing grades, the subsurface soils consisted of various soil types generally comprised of SAND (SM, SC) with varying amounts of Silt and Clay and Sandy CLAY (CL).

The subsurface description is of a generalized nature provided to highlight the major soil strata encountered. The records of the subsurface exploration included in Appendix II (Log of Boring sheets) and in the Generalized Soil Profile presented in Appendix III, which should be reviewed for specific information as to the individual borings. The stratifications shown on the records of the subsurface exploration represent the conditions only at the actual boring locations. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the transition may be gradual.

3.3 Groundwater Information:

The groundwater table depth was not encountered at the boring locations during our field exploration to the depth explored (10 feet below existing grades).

Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as man-made influences, such as existing swales, drainage ponds, underdrains and areas of covered soil (paved parking lots, side walks, etc.). It is estimated normal seasonal high groundwater level will fluctuate within 2 feet of the current levels. We recommend that the contractor determine the actual groundwater levels at the time of the construction to determine groundwater impact on this project.

4.0 EVALUATION AND RECOMMENDATIONS

4.1 Infiltration Testing

Three infiltration tests (INF-1, INF-2 and INF-3) were performed within the lateral limits of the potential BMP stormwater collection areas, corresponding to boring locations HA-1, HA-2 and HA-3. Specifically, infiltration test INF-1 was performed at a depth of 7 to 8 feet below existing grades within hand auger boring HA-1, INF-2 was performed at a depth of 5 to 6 feet below existing grades within hand auger boring HA-2, and infiltration test INF-3 was performed at a depth of 1 to 2 feet below existing grades within hand auger boring HA-3. The infiltration test boreholes were prepared utilizing a planer auger to remove soil clippings from its base (test levels ranged from 1 to 8 below the ground surface). Infiltration testing was then conducted within the vadose zone utilizing a Precision Permeameter and the following testing procedures.

A support stand was assembled and placed adjacent to the boreholes. This stand holds a calibrated reservoir (2000 ml) and a cable used to raise and lower the water control unit (WCU). The WCU establishes a constant water head within the boreholes during testing by use of a precision valve and float assembly. The WCU was attached to the flow reservoir with a 2-meter (6.6 foot) braided PVC hose and then lowered by cable into the boreholes to the test depth elevation. As required by the Glover solution, the WCU was suspended 6 –inches above the bottom of the boreholes. The shut-off valve was then opened allowing water to pass through the WCU to fill the boreholes to the constant water level elevation. The absorption rate slowed as the soil voids became filled and an equilibrium developed as a wetting bulb developed around the borehole. Water was continuously added until the flow rate stabilized. The reservoir was then re-filled in order to begin testing. During testing, as the water drained into the boreholes and surrounding soils, the water level within the calibrated reservoir was recorded as well as the elapsed time during each interval. The test was continued until relatively consistent flow rates were documented. During testing the quick release connections and shutoff valve were monitored to ensure that no leakage occurred. The flow rate (Q), height of the constant water level (H), and borehole diameter (D) were used to calculate K_s utilizing the Glover Solution.

Based on the field testing and corroborated with laboratory testing results (published values compared to classification results), the hydraulic conductivity of the shallow soils at the tested depths (ranging from 1 to 8 feet) as identified at the location of the infiltration tests ranged from k = 8.60 x 10^{-4} cm/sec (or 1.219 in /hour) to k = 7.00 x 10^{-3} cm/sec (or 9.916 in/hour). The following provides the infiltration test results corresponding to the specific locations and depths.

Table 2 – Infiltration Test Results

Infiltration Test	Boring Location	Depth Test Conducted (ft)	Percent Fines	Hydraulic Conductivity (cm/sec)
INF-1	HA-1	7-8	14.8	7.00×10^{-3}
INF-2	HA-2	5-6	24.2	5.85×10^{-3}
INF-3 *	HA-3	1-2	37.3	8.60×10^{-4}

* Note: Sandy soils encountered at this infiltration location were observed to be very loose. Compaction of these soils should result in lower rates.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Drainage and Groundwater Concerns:

It is expected that dewatering will be required for excavations that extend near or below the groundwater level. We recommend that the contractor determine the actual groundwater levels at the time of the construction to determine groundwater impact on this project.

It would be advantageous to construct all fills early in the construction. If this is not accomplished, disturbance of the existing site drainage could result in collection of surface water in some areas, thus rendering these areas wet and very loose. Temporary drainage ditches should be employed by the contractor to accentuate drainage during construction.

5.2 Excavations:

In Federal Register, Volume 54, No. 209 (October, 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document was issued to better insure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that all excavations, whether they be utility trenches, basement excavation or footing excavations, be constructed in accordance with the new (OSHA) guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's responsible person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

We are providing this information solely as a service to our client. **G E T Solutions, Inc.** is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

6.0 REPORT LIMITATIONS

The recommendations submitted are based on the available soil information obtained by **G E T Solutions, Inc.** and the information supplied by the LandMark Design Group, and his consultants for the proposed project. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, **G E T Solutions, Inc.** should be notified immediately to determine if changes in the foundation recommendations are required. If **G E T Solutions, Inc.** is not retained to perform these functions, **G E T Solutions, Inc.** can not be responsible for the impact of those conditions on the geotechnical recommendations for the project.

The Geotechnical Engineer warrants that the findings, recommendations, specifications or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

After the plans and specifications are more complete the Geotechnical Engineer should be provided the opportunity to review the final design plans and specifications to assure our engineering recommendations have been properly incorporated into the design documents, in order that the earthwork and foundation recommendations may be properly interpreted and implemented. At that time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of the LandMark Design Group and their consultants for the specific application to the Former Stuckey's project located along Barhamsville Road (State Route 30) in James City County, Virginia.

APPENDICES

I. BORING LOCATION PLAN

II. LOG OF BORINGS

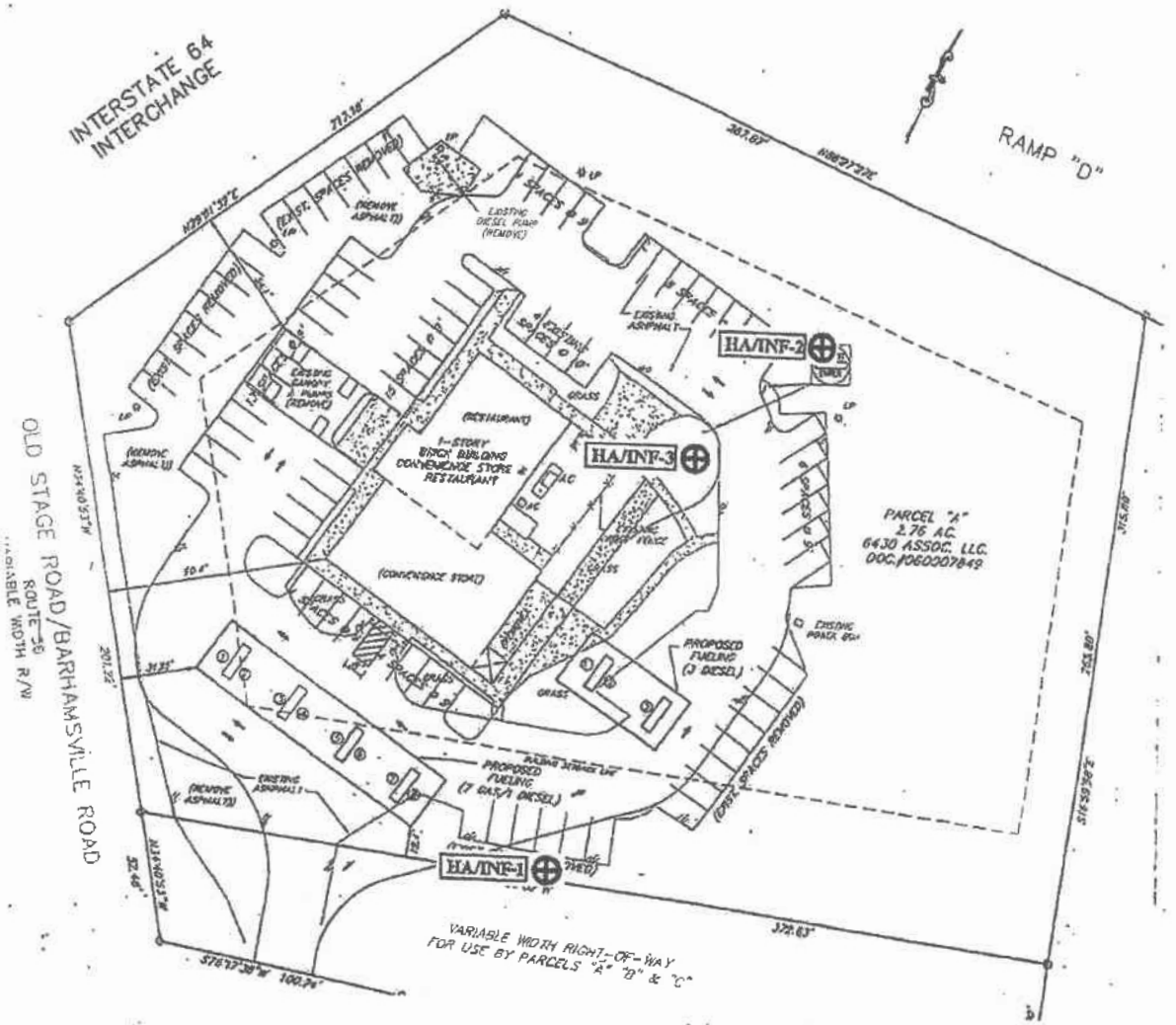
III. GENERALIZED SOIL PROFILE

IV. INFILTRATION TEST RESULTS

APPENDIX I -

BORING LOCATION PLAN

Figure 1



Locations are approximate

BORING LOCATION PLAN

PROJECT:	**Former Stuckey's James City County, Virginia**	**SCALE: NTS**
PROJECT NO:	**WM06-145G**	**DATE: 5/31/06**
CLIENT:	**LandMark Design Group**	**PLOT BY: SS**

APPENDIX II -

LOG OF BORINGS

LOG OF BORING No. HA-1

PROJECT: Former Stuckey's — PROJECT NO.: WM06-145G
CLIENT: LandMark Design Group
PROJECT LOCATION: James City County, Virginia
LOCATION: See Attached Boring Location Plan — ELEVATION:
DRILLER: GET Solutions, Inc. — LOGGED BY: S. Smith
DRILLING METHOD: Hand Auger — DATE: 5-19-2006
DEPTH TO - WATER> INITIAL: ▽ — AFTER 24 HOURS: ▽ — CAVING> ⊥

Depth (feet)	Description	Graphic	Sample No.	Blow Counts	% < #200	TEST RESULTS: Plastic Limit — Liquid Limit; Water Content - ●; Penetration - ▨ (10 20 30 40 50 60 70)
0						
	3 Inches of Topsoil (0.25)					
	Brown, moist, Sandy CLAY (CL) with trace organics (1)					
	Orangish brown, moist, Sandy CLAY (CL)					
2						
4						
6	(6)					
	Orangish brown, moist, Silty fine to medium SAND (SM)				15	●
	Trace Clay from 5 to 7 feet					
8						
10	Boring terminated at 10 ft.					
12						
14						

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

Figure PAGE 1 of 1

LOG OF BORING No. HA-2

PROJECT: Former Stuckey's — PROJECT NO.: WM06-145G
CLIENT: LandMark Design Group
PROJECT LOCATION: James City County, Virginia
LOCATION: See Attached Boring Location Plan — ELEVATION:
DRILLER: GET Solutions, Inc. — LOGGED BY: S. Smith
DRILLING METHOD: Hand Auger — DATE: 5-19-2006
DEPTH TO - WATER> INITIAL: ▼ — AFTER 24 HOURS: ▼ — CAVING> ⊥

Depth (feet)	Description	Graphic	Sample No.	Blow Counts	% < #200	TEST RESULTS: Plastic Limit ⊢ Liquid Limit; Water Content - ●; Penetration - ▨ (10 20 30 40 50 60 70)
0						
	3 Inches of Topsoil (0.25)					
	Brown, moist, Silty, fine to medium SAND (SM) (1)					
2	Brown to orangish brown, moist, Sandy CLAY (CL)					
4						
	Orangish brown, moist, Silty, fine to medium SAND (SM) (5)				24	●
6						
	Mottled orangish brown-gray, moist, Sandy CLAY (CL) (7)					
8						
10	Boring terminated at 10 ft.					
12						
14						

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

Figure PAGE 1 of 1

LOG OF BORING No. HA-3

PROJECT: Former Stuckey's — PROJECT NO.: WM06-145G
CLIENT: LandMark Design Group
PROJECT LOCATION: James City County, Virginia
LOCATION: See Attached Boring Location Plan — ELEVATION:
DRILLER: GET Solutions, Inc. — LOGGED BY: S. Smith
DRILLING METHOD: Hand Auger — DATE: 5-19-2006
DEPTH TO - WATER> INITIAL: ▼ — AFTER 24 HOURS: ▼ — CAVING> ℄

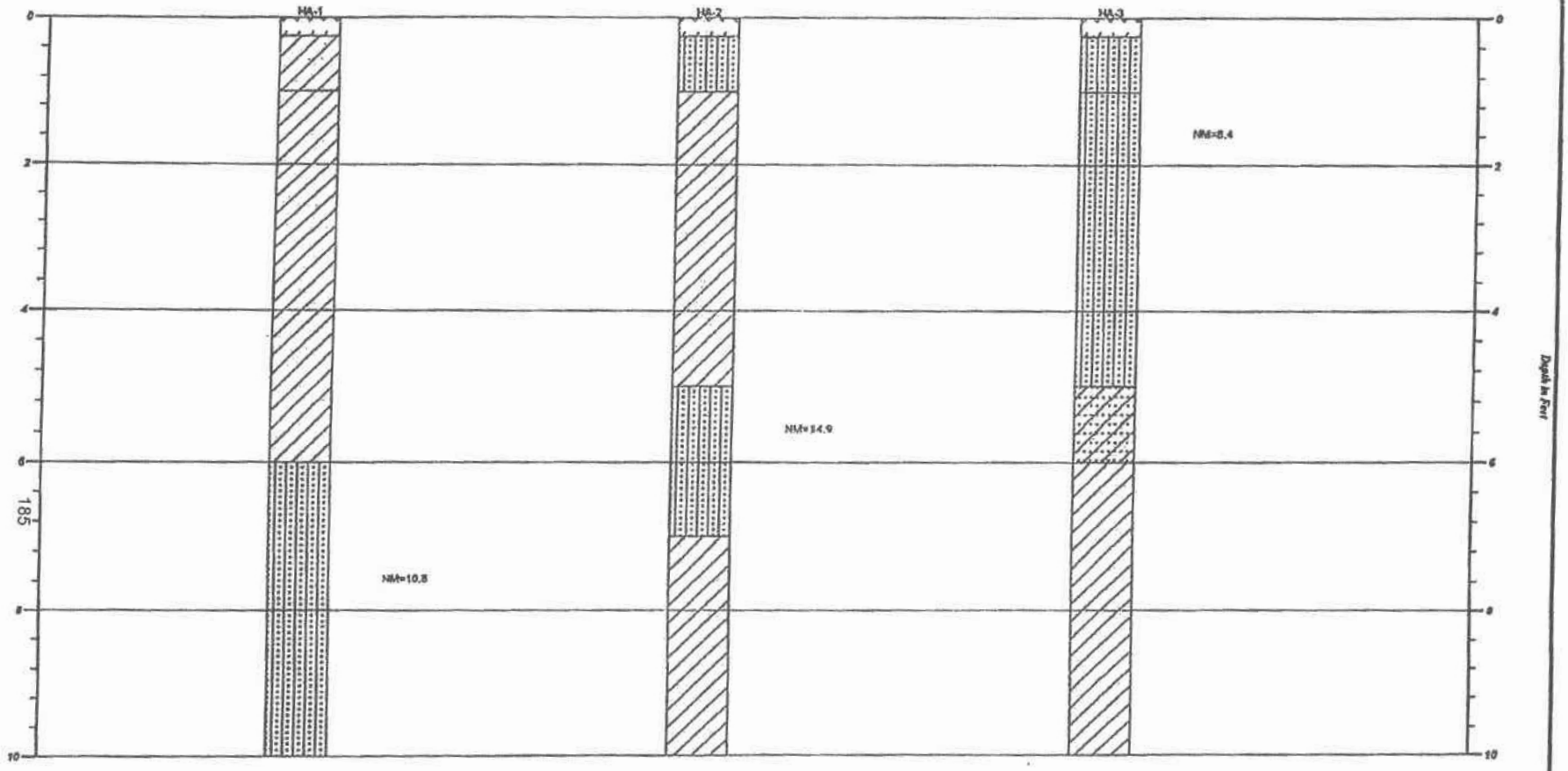
Depth (feet)	Description	Graphic	Sample No.	Blow Counts	% < #200	TEST RESULTS
0	3 Inches of Topsoil					Plastic Limit ⊢—⊣ Liquid Limit; Water Content - ●; Penetration - ▨; 10 20 30 40 50 60 70
	0.25					
	Brown, moist, Silty, fine to medium SAND (SM) with trace Clay and organcis					
	1					
	Brown, moist, Silty, fine to medium SAND (SM) with trace Clay				37	●
2						
4	4					
	Brown, moist, Silty, fine to medium SAND (SM)					
	5					
	Brown, moist, Clayey, fine to medium SAND (SC)					
6	6					
	Orangish brown, moist, Sandy CLAY (CL)					
8						
10	Boring terminated at 10 ft.					
12						
14						

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

Figure — PAGE 1 of 1

APPENDIX III -

GENERALIZED SOIL PROFILE



Strata symbols

- Topsoil
- Low plasticity clay
- Silty sand
- Clayey sand

GET Solutions, Inc.		
GENERALIZED SOIL PROFILE		
HORIZONTAL SCALE: VERTICAL SCALE: 1"=2'	DRAWN BY/APPROVED BY: SS	DATE DRAWN: 6/22/2006
Former Stuckey's James City County, Virginia		
PROJECT NO. WM06-145G		FIGURE NUMBER: 1

APPENDIX IV -

INFILTRATION TEST RESULTS

GET SOLUTIONS, INC.			SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET							Sheet No.: 1
Project Name.:	Former Stuckey's		Location.....	Toano/Barhamsville		Terminology and Solution				
Boring No.....:	INF-1		Date.....:	5/30/2006		Ksat : Saturated hydraulic conductivity				
Investigators.:	S. Smith, T. Bieckert, D. Clark		File Name.....:	WM06-145G		Q: Steady-state rate of water flow into the soil				
Boring Depth.:	96 inches		WCU Base. Ht. h:	15.0 cm		H: Constant height of water in borehole				
Boring Dia.....:	8.3 cm		WCU Susp. Ht. S:	15.2 cm		r: Radius of cylindrical borehole				
Boring Rad. (r):	4.15 cm		Const. Wtr. Ht. H:	30.2 cm		Ksat = Q[sinh-1(H/r) - (r2/H2+1).5 + r/H] / (2pH2) [Glover Solution]				

VOLUME (ml)	Volume Out (ml) [a]	TIME (hr:min:sec a/p)	Elapsed Time (hr:min:sec)	Elapsed Time (min) [b]	Flow Rate Q (ml/min) [a/b]	Ksat Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
2000		9:55:00 AM								
1900	100	9:55:04 AM	0:00:04	0.07	1500.00	0.474	7.90E-03	682.5	11.195	22.39
1800	100	9:55:08 AM	0:00:04	0.07	1500.00	0.474	7.90E-03	682.5	11.195	22.39
1700	100	9:55:12 AM	0:00:04	0.07	1500.00	0.474	7.90E-03	682.5	11.195	22.39
1600	100	9:55:16 AM	0:00:04	0.07	1500.00	0.474	7.90E-03	682.5	11.195	22.39
1500	100	9:55:21 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
1400	100	9:55:25 AM	0:00:04	0.07	1500.00	0.474	7.90E-03	682.5	11.195	22.39
1300	100	9:55:30 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
1200	100	9:55:35 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
1100	100	9:55:39 AM	0:00:04	0.07	1500.00	0.474	7.90E-03	682.5	11.195	22.39
1000	100	9:55:44 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
900	100	9:55:49 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
800	100	9:55:54 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
700	100	9:55:59 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
600	100	9:56:04 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
Natural Moisture:	Moist	Init. Satur.Time:	9:40:00 AM	ESTIMATED FIELD KSAT:		0.420	7.00E-03	604.5	9.916	19.83
Texture/Classif:	SAND (SM)	Consistency:	Loose	Depth to an Impermeable Layer:	N/A	Notes: Ksat Class = High				
Structure/Fabric:	N/A	Slope/Landsc:	slope	Depth to Bedrock.....:	N/A					

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GET SOLUTIONS, INC.		SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET		Sheet No.: 2
Project Name.:	Former Stuckey's	Location.....	Toano/Barhamsville	Terminology and Solution
Boring No.....:	INF-2	Date.....:	5/30/2006	Ksat : Saturated hydraulic conductivity
Investigators.:	S. Smith, T. Bleckert, D. Clark	File Name.....:	WM06-145G	Q: Steady-state rate of water flow into the soil
Boring Depth.:	72 inches	WCU Base. Ht. h:	15.0 cm	H: Constant height of water in borehole
Boring Dia.....:	8.3 cm	WCU Susp. Ht. S:	15.2 cm	r: Radius of cylindrical borehole
Boring Rad. (r):	4.15 cm	Const. Wtr. Ht. H:	30.2 cm	Ksat = Q[sinh-1(H/r) - (r2/H2+1).5 + r/H] / (2pH2) [Glover Solution]

VOLUME (ml)	Volume Out (ml) [a]	TIME (hr:min:sec a/p)	Elapsed Time (hr:min:sec)	Elapsed Time (min) [b]	Flow Rate Q (ml/min) [a/b]	Ksat Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
2000		9:25:00 AM								
1900	100	9:25:05 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
1800	100	9:25:10 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
1700	100	9:25:14 AM	0:00:04	0.07	1500.00	0.474	7.90E-03	682.5	11.195	22.39
1600	100	9:25:19 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
1500	100	9:25:25 AM	0:00:06	0.10	1000.00	0.316	5.27E-03	455.0	7.463	14.93
1400	100	9:25:31 AM	0:00:06	0.10	1000.00	0.316	5.27E-03	455.0	7.463	14.93
1300	100	9:25:37 AM	0:00:06	0.10	1000.00	0.316	5.27E-03	455.0	7.463	14.93
1200	100	9:25:43 AM	0:00:06	0.10	1000.00	0.316	5.27E-03	455.0	7.463	14.93
1100	100	9:25:48 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
1000	100	9:25:53 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
900	100	9:25:59 AM	0:00:06	0.10	1000.00	0.316	5.27E-03	455.0	7.463	14.93
800	100	9:26:04 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
700	100	9:26:10 AM	0:00:06	0.10	1000.00	0.316	5.27E-03	455.0	7.463	14.93
600	100	9:26:17 AM	0:00:07	0.12	857.14	0.271	4.51E-03	390.0	6.397	12.79
				ESTIMATED FIELD KSAT:		0.351	5.85E-03	505.6	8.294	16.59

Natural Moisture:	Moist	Init. Satur.Time:	9:10:00 AM	Depth to an Impermeable Layer:	N/A	Notes: Ksat Class = High
Texture/Classif:	SAND (SM)	Consistency:	Loose	Depth to Bedrock.....:	N/A	
Structure/Fabric:	N/A	Slope/Landsc:	slope			

GET SOLUTIONS, INC.		SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET		Sheet No.: 3
Project Name.:	Former Stuckey's	Location.....	Toano/Barhamsville	Terminology and Solution
Boring No.....:	INF-3	Date.....:	5/24/2006	Ksat : Saturated hydraulic conductivity
Investigators.:	D. Mitchell, T. Bleckert	File Name.....:	WM06-145G	Q: Steady-state rate of water flow into the soil
Boring Depth.:	24 inches	WCU Base. Ht. h:	15.0 cm	H: Constant height of water in borehole
Boring Dia.....:	8.3 cm	WCU Susp. Ht. S:	15.2 cm	r: Radius of cylindrical borehole
Boring Rad. (r):	4.15 cm	Const. Wtr. Ht. H:	30.2 cm	Ksat = Q[sinh-1(H/r) - (r2/H2+1).5 + r/H] / (2pH2) [Glover Solution]

VOLUME (ml)	Volume Out (ml) [a]	TIME (hr:min:sec a/p)	Elapsed Time (hr:min:sec)	Elapsed Time (min) [b]	Flow Rate Q (ml/min) [a/b]	Ksat Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
2000		3:42:00 PM								
1900	100	3:42:36 PM	0:00:36	0.60	166.67	0.053	8.78E-04	75.8	1.244	2.49
1800	100	3:43:10 PM	0:00:34	0.57	176.47	0.056	9.29E-04	80.3	1.317	2.63
1700	100	3:43:48 PM	0:00:38	0.63	157.89	0.050	8.31E-04	71.8	1.178	2.36
1600	100	3:44:24 PM	0:00:36	0.60	166.67	0.053	8.78E-04	75.8	1.244	2.49
1500	100	3:45:00 PM	0:00:36	0.60	166.67	0.053	8.78E-04	75.8	1.244	2.49
1400	100	3:45:34 PM	0:00:34	0.57	176.47	0.056	9.29E-04	80.3	1.317	2.63
1300	100	3:46:12 PM	0:00:38	0.63	157.89	0.050	8.31E-04	71.8	1.178	2.36
1200	100	3:46:51 PM	0:00:39	0.65	153.85	0.049	8.10E-04	70.0	1.148	2.30
1100	100	3:47:29 PM	0:00:38	0.63	157.89	0.050	8.31E-04	71.8	1.178	2.36
1000	100	3:48:05 PM	0:00:36	0.60	166.67	0.053	8.78E-04	75.8	1.244	2.49
900	100	3:48:43 PM	0:00:38	0.63	157.89	0.050	8.31E-04	71.8	1.178	2.36
800	100	3:49:20 PM	0:00:37	0.62	162.16	0.051	8.54E-04	73.8	1.210	2.42
700	100	3:49:57 PM	0:00:37	0.62	162.16	0.051	8.54E-04	73.8	1.210	2.42
600	100	3:50:35 PM	0:00:38	0.63	157.89	0.050	8.31E-04	71.8	1.178	2.36
				ESTIMATED FIELD KSAT:		0.052	8.60E-04	74.3	1.219	2.44

Natural Moisture:	Moist	Init. Satur.Time:	3:28:00 PM	Depth to an Impermeable Layer: N/A	Notes: Ksat Class = High
Texture/Classif:	SAND (SM)	Consistency:	Very Loose	Depth to Bedrock.....: N/A	
Structure/Fabric:	N/A	Slope/Landsc:	slope		

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Drainage Area Maps


RECEIVED
APR 2009
Planning Department

EXISTING CONDITIONS

SITE DEVELOPMENT PLAN
FORMER STUCKEYS SITE
PARCEL "A" 920 OLD STAGE ROAD
STONEHOUSE MAGISTERIAL DISTRICT JAMES CITY COUNTY, VIRGINIA

Designed:	Date:
PS	04/01/09
Checked:	Scale:
SAR	1"=40'
File Mgr./Drawn:	CADD File name:
PS	D-1 PRE
Project Number:	Dwg. File No.:
2004224-000.00	177464W
Drawing Number	D-1

DRAWING STATUS
- Interoffice Review
- Client for Review
- Pre Approval Bidding

COUNTY APPROVAL
- 1st Submittal
- 2nd Submittal
- 3rd Submittal
- Approved

REVISIONS:

No.	Date	Comment	By

LANDMARK DESIGN GROUP
Landscape Architects • Engineers • Surveyors • Environmental Scientists
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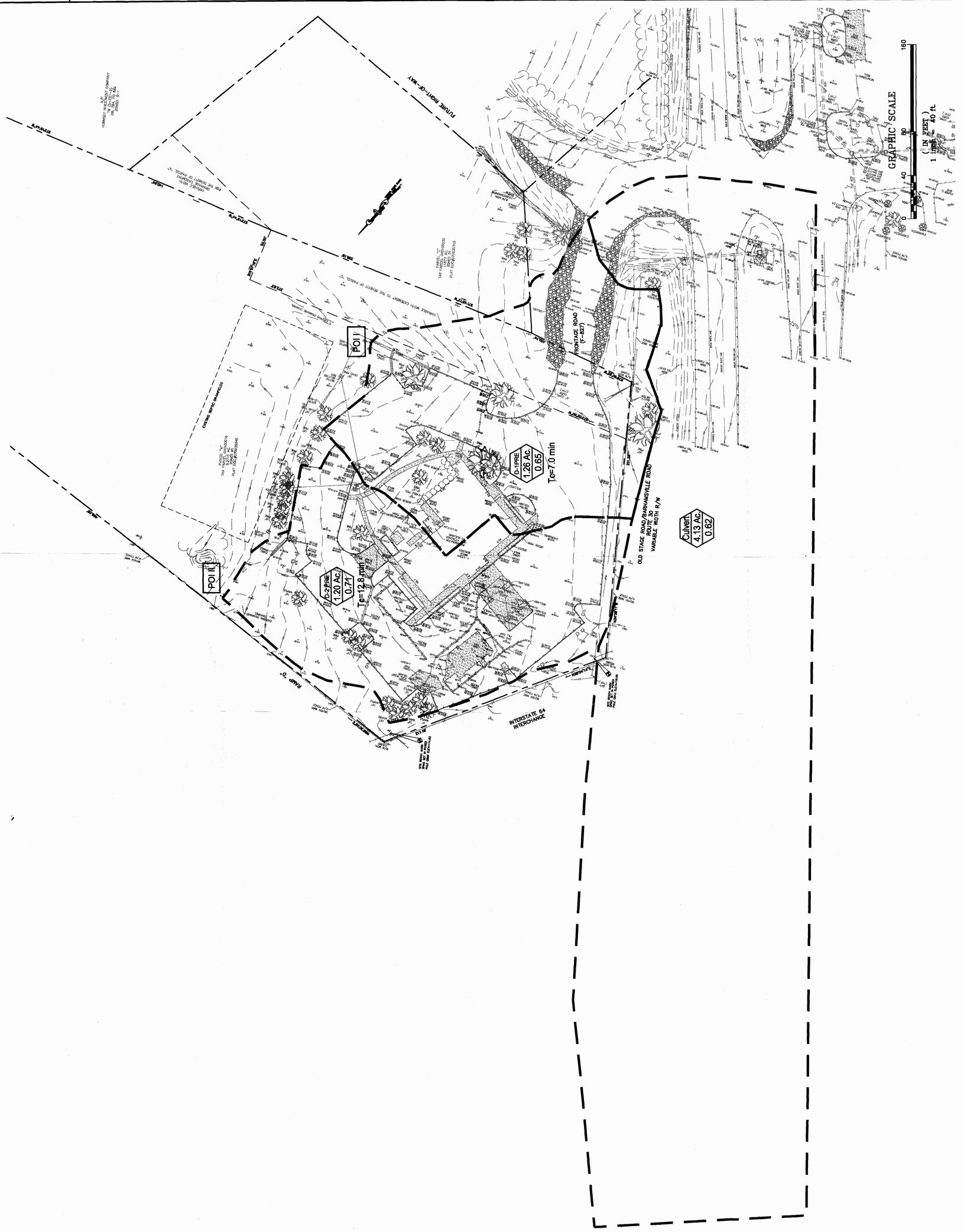
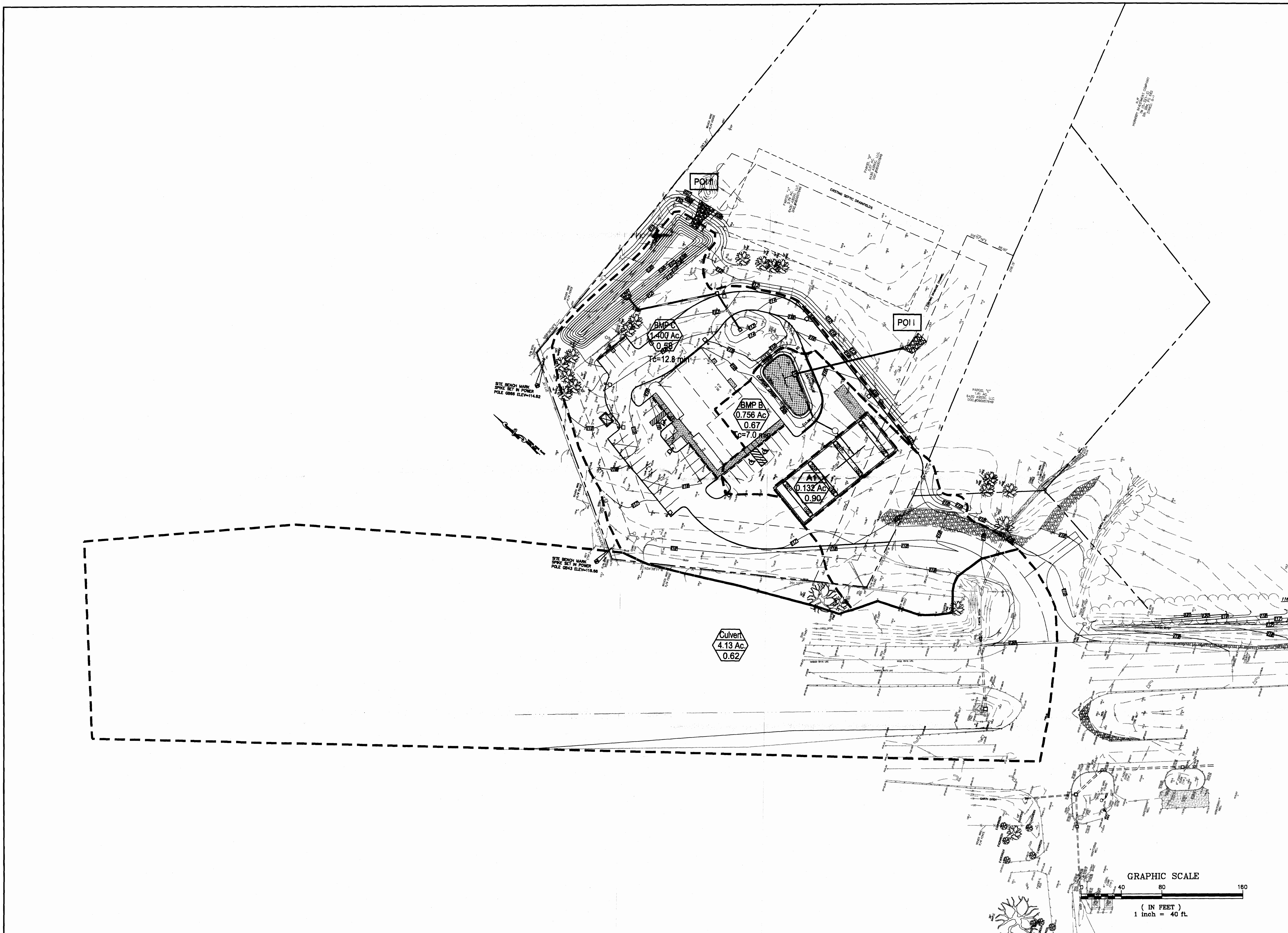
4029 Ironbound Road
Suite 100
Williamsburg, VA 23188
Tel (757) 253-2875
Fax (757) 229-0049
Email: lmdg@landmarkdg.com





REVISIONS:		
No.	Date	Comment	By

DRAWING STATUS
- Interoffice Review
- Client for Review
- Pre Approval Bidding

COUNTY APPROVAL
- 1st Submittal
- 2nd Submittal
- 3rd Submittal
- Approved

LANDMARK DESIGN GROUP
Engineers • Planners • Surveyors
Landscape Architects • Environmental Scientists

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Tel. (757) 473-2000
Fax (757) 497-7933
Email: lmdg@landmarkdg.com

4029 Ironbound Road
Suite 100
Williamsburg, VA 23188
Tel. (757) 253-2975
Fax (757) 229-0049
Email: lmdg@landmarkdg.com

POST DEVELOPED DRAINAGE AREA MAP

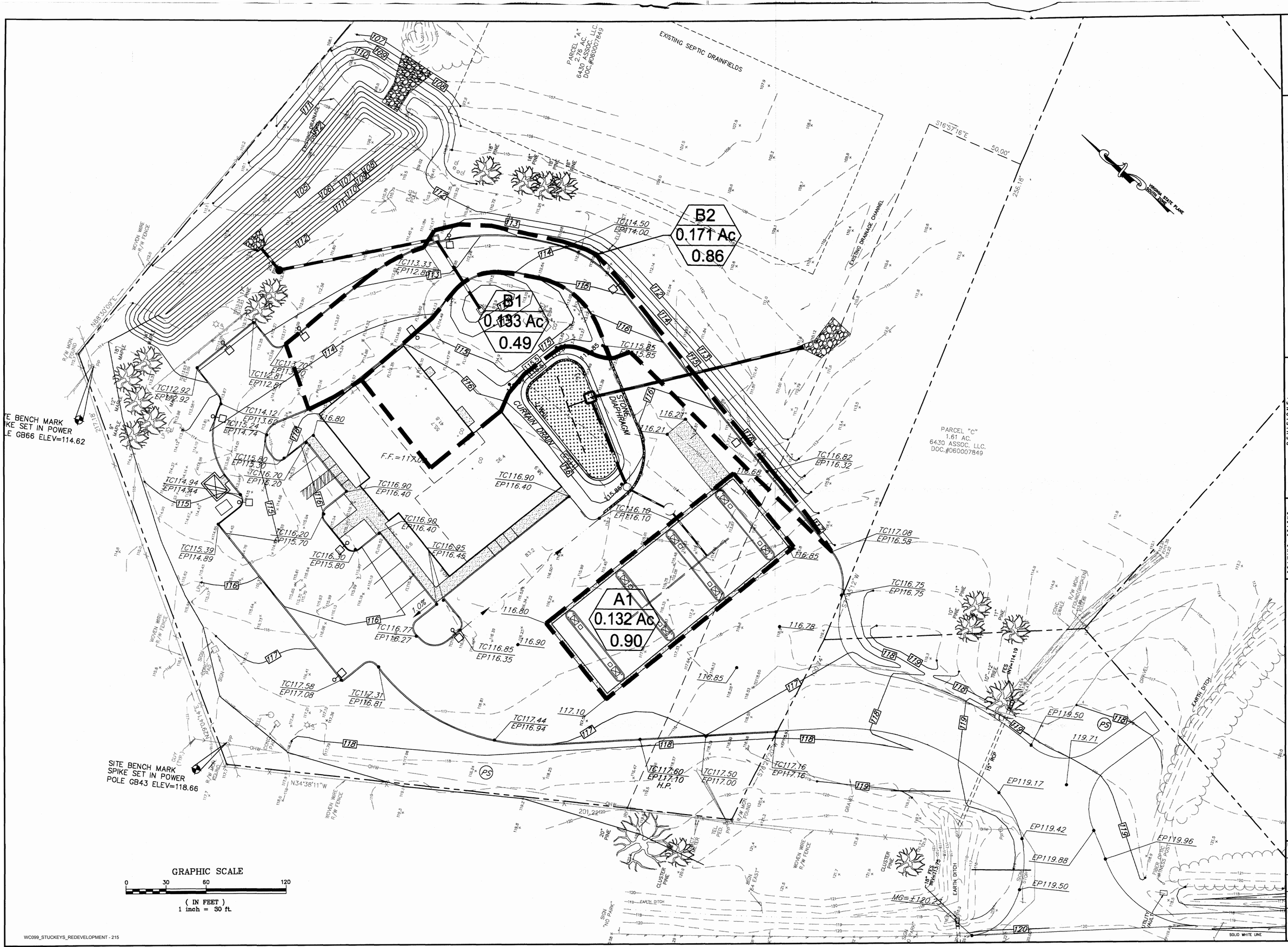
SITE DEVELOPMENT PLAN

FORMER STUCKEY'S SITE

PARCEL 9220 OLD STAGE ROAD

STONEHOUSE MAGISTERIAL DISTRICT JAMES CITY COUNTY, VIRGINIA

Designed: PS	Date: 04/01/09
Checked: SAR	Scale: 1"= 40'
File Mgr./Drawn: PS	CADD File name: D-2 Post
Project Number: 2004224-000.00	Dwg. File No.: 17237AW
Drawing Number D-2	



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Email: lmg@landmarkvdg.com

REVISIONS:			
No.	Date	Comment	By

DRAWING STATUS	COUNTY APPROVAL
Interoffice Review	1st. Submittal
Client for Review	2nd. Submittal
Pre Approval Bidding	3rd. Submittal
	Approved

DRAINAGE AREA MAP - STORM

SITE DEVELOPMENT PLAN

FORMER STUCKEY'S SITE
PARCEL 9220 OLD STAGE ROAD

STONEHOUSE MAGISTERIAL DISTRICT JAMES CITY COUNTY, VIRGINIA

Designed: PS	Date: 04/01/09
Checked: SAR	Scale: 1"= 30'
File Mgr./Drawn: PS	CADD File name: D-3 Storm
Project Number: 2004224-000.00	Dwg. File No.: 17237BW

Drawing Number
D-3

WC099_STUCKEYS_REDEVELOPMENT - 215

Report of Subsurface Investigation and
Geotechnical Engineering Services
Former Stuckey's Site
Barhamsville Road (State Route 30)
James City County, Virginia
G E T Project No. WM06-145G
June 22, 2006
Prepared For: LandMark Design Group

GET Solutions, Inc.

GET
Solutions, Inc.

Geotechnical · Environmental · Testing

June 22, 2006

TO: **LandMark Design Group**
4029 Ironbound Road
Suite 100
Williamsburg, Virginia 23188

Attn: Mr. Steve Romeo, L.S.

RE: Report of Subsurface Investigation and Geotechnical Engineering Services
Former Stuckey's Site
Barhamsville Road (State Route 30)
James City County, Virginia
GET Project No: WM06-145G

Dear Mr. Romeo:

In compliance with your instructions, we have completed our Subsurface Investigation and Geotechnical Engineering Services for the referenced project. The results of this study, together with our recommendations, are presented in this report.

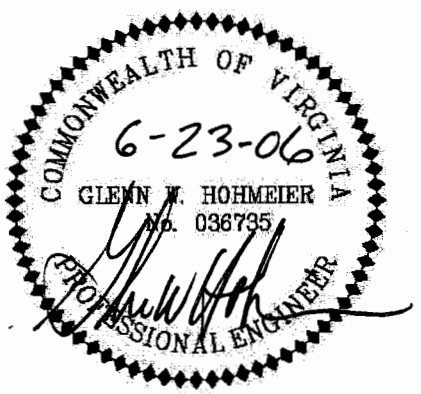
Often, because of design and construction details that occur on a project, questions arise concerning subsurface conditions. **G E T Solutions, Inc.** would be pleased to continue its role as Geotechnical Engineer during the final design phase and project implementation.

We trust that the information contained herein meets your immediate need, and we would ask that you call this office with any questions that you may have.

Respectfully Submitted,
G E T Solutions, Inc.

James Wheeler
Project Geologist

Glenn W. Hohmeier, P.E.
Sr. Project Engineer
VA Lic. #036735



Copies: (3) Client

1592 Penniman Road, Suite E • Williamsburg, VA 23185 • Phone (757) 564-6452 • Fax (757) 564-6453
info@getsolutionsinc.com

TABLE OF CONTENTS

GET Solutions, Inc.

1.0 PROJECT INFORMATION

1.1 Project Description:

G E T Solutions, Inc. has completed our Geotechnical Engineering study for the Former Stuckey's Site located along Barhamsville Road (State Route 30) in James City County, Virginia. The construction at this site is planned to consist of renovating the current restaurant and gas station facilities. Also, new paved driveways and parking areas, along with other pertinent infrastructure components (utilities, BMP facilities, etc.) will also be reconstructed at this site.

If any of the noted information is incorrect or has changed, please inform **G E T Solutions, Inc.** so that we may amend the recommendations presented in this report, if appropriate.

1.2 Purpose and Scope of Services:

The purpose of this study was to obtain information on the general subsurface conditions at the proposed project site within the renovated area. The subsurface conditions encountered were then evaluated with respect to the available project characteristics. In this regard, engineering assessments for the following items were formulated:

1. General assessment of the soils revealed by the borings performed at the proposed development.

2. General location and description of potentially deleterious material encountered in the borings that may interfere with construction progress, including existing fills or surficial/subsurface organics.

3. Evaluation of the permeability of the soils within the renovated area by means of performing in-situ infiltration tests.

The scope of services did not include an environmental assessment for determining the presence or absence of wetlands or hazardous or toxic material in the soil, bedrock, surface water, groundwater or air, on or below or around this site. Prior to development of this site, an environmental assessment is advisable.

2.0 FIELD AND LABORATORY PROCEDURES

2.1 Field Exploration:

In order to explore the general subsurface soil types and to aid in developing associated design parameters, three (3) 10-foot deep hand auger borings (designated as HA-1, HA-2 and HA-3) were performed by **G E T Solutions, Inc.** within the potential BMP stormwater collection areas. In addition, three infiltration tests (designated as INF-1, INF-2 and INF-3) were performed within the hand auger borings at various depths.

The boring locations were established, located and staked in the field by a representative of **G E T Solutions, Inc.** The approximate boring locations are shown on the "Boring Location Plan" (Figure 1) attached to this report (Appendix I).

2.2 Laboratory Testing:

Representative portions of all soil samples collected at the hand auger locations were sealed in plastic bags, labeled and transferred to our laboratory for classification and analysis. The soil classification was performed by a Geotechnical Engineer in accordance with ASTM D 2488.

Three representative soil samples were selected and subjected to laboratory testing, which included natural moisture and -#200 sieve wash, in order to corroborate the visual classification. These test results are noted in Table 1 and are presented on the "Log of Boring" sheet (Appendix II), included with this report.

Table 1 – Laboratory Test Results

Boring No.	Depth (Ft)	Natural Moisture (%)	-#200 Sieve (%)	Atterberg Limits (LL/PL/PI)	Classification
HA-1/INF-1*	7.5	10.8	14.8	Non-Plastic	SM
HA-2/INF-2*	5.5	14.9	24.2	Non-Plastic	SM
HA-3/INF-3*	1.5	8.4	37.3	Non-Plastic	SM

* Sample obtained from the infiltration test depth.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Location and Description:

The project site is located along Barhamsville Road (State Route 30) in James City County, Virginia. The property is bordered to the north by an entrance ramp to Interstate 64, to the south by a vacant wooded area, to the west by Barhamsville Road, and to the east by a vacant wooded tract followed by Interstate 64. Currently, the site is a developed area consisting of a restaurant/gas station facility, paved parking lot, and associated infrastructure. Based on our visual observation, grade changes typically across the project site are less than 2-feet in vertical elevation every 100 linear feet.

3.2 Subsurface Soil Conditions:

The results of our field exploration program indicated the presence of approximately 3 inches of topsoil material at the boring locations. The topsoil thickness could vary across the site. Underlying the topsoil and extending to the boring termination depth of 10 feet below existing grades, the subsurface soils consisted of various soil types generally comprised of SAND (SM, SC) with varying amounts of Silt and Clay and Sandy CLAY (CL).

The subsurface description is of a generalized nature provided to highlight the major soil strata encountered. The records of the subsurface exploration included in Appendix II (Log of Boring sheets) and in the Generalized Soil Profile presented in Appendix III, which should be reviewed for specific information as to the individual borings. The stratifications shown on the records of the subsurface exploration represent the conditions only at the actual boring locations. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the transition may be gradual.

3.3 Groundwater Information:

The groundwater table depth was not encountered at the boring locations during our field exploration to the depth explored (10 feet below existing grades).

Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as man-made influences, such as existing swales, drainage ponds, underdrains and areas of covered soil (paved parking lots, side walks, etc.). It is estimated normal seasonal high groundwater level will fluctuate within 2 feet of the current levels. We recommend that the contractor determine the actual groundwater levels at the time of the construction to determine groundwater impact on this project.

4.0 EVALUATION AND RECOMMENDATIONS

4.1 Infiltration Testing

Three infiltration tests (INF-1, INF-2 and INF-3) were performed within the lateral limits of the potential BMP stormwater collection areas, corresponding to boring locations HA-1, HA-2 and HA-3. Specifically, infiltration test INF-1 was performed at a depth of 7 to 8 feet below existing grades within hand auger boring HA-1, INF-2 was performed at a depth of 5 to 6 feet below existing grades within hand auger boring HA-2, and infiltration test INF-3 was performed at a depth of 1 to 2 feet below existing grades within hand auger boring HA-3. The infiltration test boreholes were prepared utilizing a planer auger to remove soil clippings from its base (test levels ranged from 1 to 8 below the ground surface). Infiltration testing was then conducted within the vadose zone utilizing a Precision Permeameter and the following testing procedures.

A support stand was assembled and placed adjacent to the boreholes. This stand holds a calibrated reservoir (2000 ml) and a cable used to raise and lower the water control unit (WCU). The WCU establishes a constant water head within the boreholes during testing by use of a precision valve and float assembly. The WCU was attached to the flow reservoir with a 2-meter (6.6 foot) braided PVC hose and then lowered by cable into the boreholes to the test depth elevation. As required by the Glover solution, the WCU was suspended 6 –inches above the bottom of the boreholes. The shut-off valve was then opened allowing water to pass through the WCU to fill the boreholes to the constant water level elevation. The absorption rate slowed as the soil voids became filled and an equilibrium developed as a wetting bulb developed around the borehole. Water was continuously added until the flow rate stabilized. The reservoir was then re-filled in order to begin testing. During testing, as the water drained into the boreholes and surrounding soils, the water level within the calibrated reservoir was recorded as well as the elapsed time during each interval. The test was continued until relatively consistent flow rates were documented. During testing the quick release connections and shutoff valve were monitored to ensure that no leakage occurred. The flow rate (Q), height of the constant water level (H), and borehole diameter (D) were used to calculate K_s utilizing the Glover Solution.

Based on the field testing and corroborated with laboratory testing results (published values compared to classification results), the hydraulic conductivity of the shallow soils at the tested depths (ranging from 1 to 8 feet) as identified at the location of the infiltration tests ranged from $k = 8.60 \times 10^{-4}$ cm/sec (or 1.219 in /hour) to $k = 7.00 \times 10^{-3}$ cm/sec (or 9.916 in/hour). The following provides the infiltration test results corresponding to the specific locations and depths.

Table 2 – Infiltration Test Results

Infiltration Test	Boring Location	Depth Test Conducted (ft)	Percent Fines	Hydraulic Conductivity (cm/sec)
INF-1	HA-1	7-8	14.8	7.00×10^{-3}
INF-2	HA-2	5-6	24.2	5.85×10^{-3}
INF-3 *	HA-3	1-2	37.3	8.60×10^{-4}

9.9 IN/HR
8.31 IN/HR
1.21 IN/HR

* Note: Sandy soils encountered at this infiltration location were observed to be very loose. Compaction of these soils should result in lower rates.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Drainage and Groundwater Concerns:

It is expected that dewatering will be required for excavations that extend near or below the groundwater level. We recommend that the contractor determine the actual groundwater levels at the time of the construction to determine groundwater impact on this project.

It would be advantageous to construct all fills early in the construction. If this is not accomplished, disturbance of the existing site drainage could result in collection of surface water in some areas, thus rendering these areas wet and very loose. Temporary drainage ditches should be employed by the contractor to accentuate drainage during construction.

5.2 Excavations:

In Federal Register, Volume 54, No. 209 (October, 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document was issued to better insure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that all excavations, whether they be utility trenches, basement excavation or footing excavations, be constructed in accordance with the new (OSHA) guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's responsible person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

We are providing this information solely as a service to our client. **G E T Solutions, Inc.** is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

6.0 REPORT LIMITATIONS

The recommendations submitted are based on the available soil information obtained by **G E T Solutions, Inc.** and the information supplied by the LandMark Design Group, and his consultants for the proposed project. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, **G E T Solutions, Inc.** should be notified immediately to determine if changes in the foundation recommendations are required. If **G E T Solutions, Inc.** is not retained to perform these functions, **G E T Solutions, Inc.** can not be responsible for the impact of those conditions on the geotechnical recommendations for the project.

The Geotechnical Engineer warrants that the findings, recommendations, specifications or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

After the plans and specifications are more complete the Geotechnical Engineer should be provided the opportunity to review the final design plans and specifications to assure our engineering recommendations have been properly incorporated into the design documents, in order that the earthwork and foundation recommendations may be properly interpreted and implemented. At that time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of the LandMark Design Group and their consultants for the specific application to the Former Stuckey's project located along Barhamsville Road (State Route 30) in James City County, Virginia.

APPENDICES

I. BORING LOCATION PLAN

II. LOG OF BORINGS

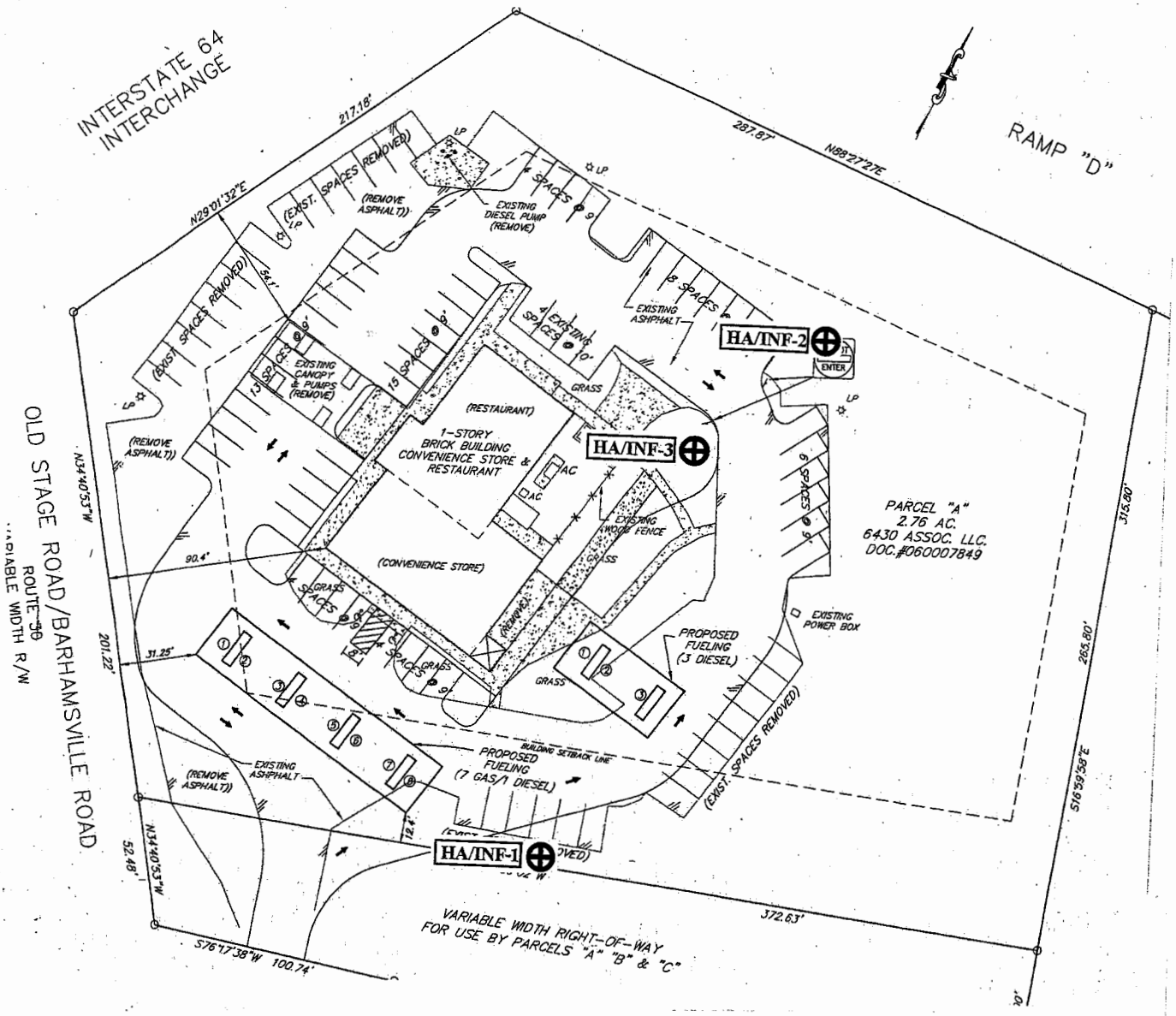
III. GENERALIZED SOIL PROFILE

IV. INFILTRATION TEST RESULTS

APPENDIX I -

BORING LOCATION PLAN

Figure 1



Locations are approximate

BORING LOCATION PLAN

PROJECT:	**Former Stuckey's James City County, Virginia**	**SCALE: NTS**
PROJECT NO:	**WM06-145G**	**DATE: 5/31/06**
CLIENT:	**LandMark Design Group**	**PLOT BY: SS**

APPENDIX II -

LOG OF BORINGS

GET Solutions, Inc.
Geotechnical · Environmental · Testing

LOG OF BORING No. HA-1

PROJECT: Former Stuckey's **PROJECT NO.:** WM06-145G
CLIENT: LandMark Design Group
PROJECT LOCATION: James City County, Virginia
LOCATION: See Attached Boring Location Plan **ELEVATION:**
DRILLER: GET Solutions, Inc. **LOGGED BY:** S. Smith
DRILLING METHOD: Hand Auger **DATE:** 5-19-2006
DEPTH TO - WATER> INITIAL: ▼ **AFTER 24 HOURS:** ▼ **CAVING>**

Depth (feet)	Description	Graphic	Sample No.	Blow Counts	% < #200
0					
	3 Inches of Topsoil (0.25)				
	Brown, moist, Sandy CLAY (CL) with trace organics (1)				
	Orangish brown, moist, Sandy CLAY (CL)				
2					
4					
6	(6)				
	Orangish brown, moist, Silty fine to medium SAND (SM)				
	Trace Clay from 5 to 7 feet				15
8					
10					
	Boring terminated at 10 ft.				
12					
14					

TEST RESULTS
Plastic Limit ⊢——⊣ Liquid Limit
Water Content - ●
Penetration - ▨
10 20 30 40 50 60 70

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

GET Solutions, Inc.
Geotechnical - Environmental - Testing

LOG OF BORING No. HA-2

PROJECT: Former Stuckey's **PROJECT NO.:** WM06-145G
CLIENT: LandMark Design Group
PROJECT LOCATION: James City County, Virginia
LOCATION: See Attached Boring Location Plan **ELEVATION:**
DRILLER: GET Solutions, Inc. **LOGGED BY:** S. Smith
DRILLING METHOD: Hand Auger **DATE:** 5-19-2006
DEPTH TO - WATER> INITIAL: ▽ **AFTER 24 HOURS:** ▽ **CAVING>** C

Depth (feet)	Description	Graphic	Sample No.	Blow Counts	% < #200
0					
	3 Inches of Topsoil				
	0.25				
	Brown, moist, Silty, fine to medium SAND (SM)				
	1				
	Brown to orangish brown, moist, Sandy CLAY (CL)				
2					
4					
	5				
	Orangish brown, moist, Silty, fine to medium SAND (SM)				24
6					
	7				
	Mottled orangish brown-gray, moist, Sandy CLAY (CL)				
8					
10					
	Boring terminated at 10 ft.				
12					
14					

TEST RESULTS
Plastic Limit ⊢——⊣ Liquid Limit
Water Content - ●
Penetration - ▨
10 20 30 40 50 60 70

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

GET Solutions, inc.

Geotechnical • Environmental • Testing

LOG OF BORING No. HA-3

PROJECT: Former Stuckey's **PROJECT NO.:** WM06-145G

CLIENT: LandMark Design Group

PROJECT LOCATION: James City County, Virginia

LOCATION: See Attached Boring Location Plan **ELEVATION:**

DRILLER: GET Solutions, Inc. **LOGGED BY:** S. Smith

DRILLING METHOD: Hand Auger **DATE:** 5-19-2006

DEPTH TO - WATER> INITIAL: ▽ **AFTER 24 HOURS:** ▽ **CAVING>** C

Depth (feet)	Description	Graphic	Sample No.	Blow Counts	% < #200
0					
	3 Inches of Topsoil				
	0.25				
	Brown, moist, Silty, fine to medium SAND (SM) with trace Clay and organcis				
	1				
	Brown, moist, Silty, fine to medium SAND (SM) with trace Clay				37
2					
4					
	4				
	Brown, moist, Silty, fine to medium SAND (SM)				
	5				
	Brown, moist, Clayey, fine to medium SAND (SC)				
6					
	6				
	Orangish brown, moist, Sandy CLAY (CL)				
8					
10					
	Boring terminated at 10 ft.				
12					
14					

TEST RESULTS

Plastic Limit ⊢——⊣ Liquid Limit

Water Content - ●

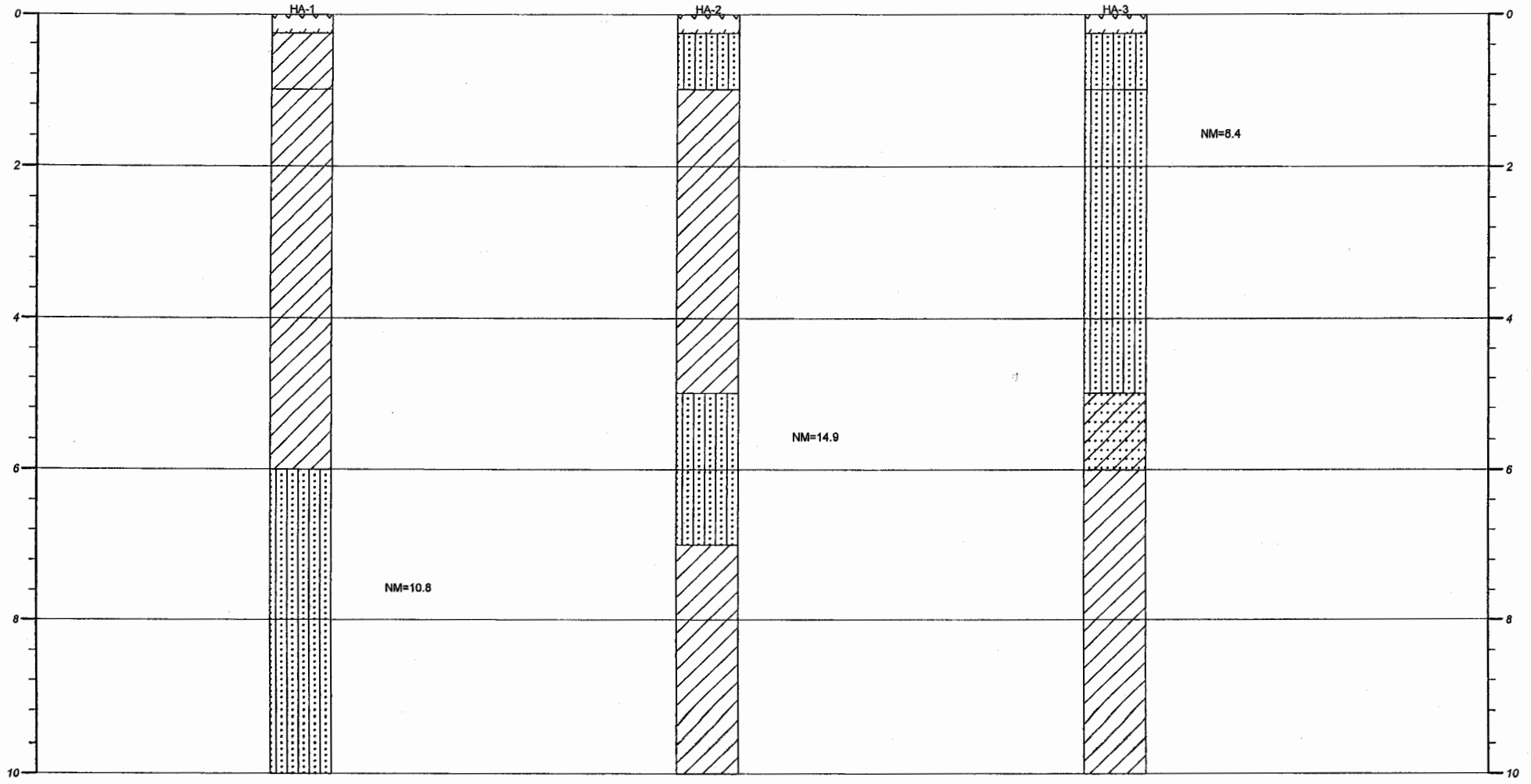
Penetration - ▨

10 20 30 40 50 60 70

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

APPENDIX III -

GENERALIZED SOIL PROFILE



Strata symbols

- Topsoil
- Low plasticity clay
- Silty sand
- Clayey sand

GET Solutions, Inc.

GENERALIZED SOIL PROFILE

HORIZONTAL SCALE:	DRAWN BY/APPROVED BY	DATE DRAWN
VERTICAL SCALE: 1"=2'	SS	6/22/2006

Former Stuckey's

James City County, Virginia

PROJECT NO. WM06-145G

FIGURE NUMBER 1

APPENDIX IV -

INFILTRATION TEST RESULTS

GET SOLUTIONS, INC.	SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET	Sheet No.: 1
Project Name.: Former Stuckey's	**Location.....** Toano/Barhamsville	**Terminology and Solution**
Boring No.....: INF-1	**Date.....:** 5/30/2006	Ksat : Saturated hydraulic conductivity
Investigators.: S. Smith, T. Bieckert, D. Clark	**File Name.....:** WM06-145G	Q: Steady-state rate of water flow into the soil
Boring Depth.: 96 inches	**WCU Base. Ht. h:** 15.0 cm	H: Constant height of water in borehole
Boring Dia.....: 8.3 cm	**WCU Susp. Ht. S:** 15.2 cm	r: Radius of cylindrical borehole
Boring Rad. (r): 4.15 cm	**Const. Wtr. Ht. H:** 30.2 cm	Ksat = Q[sinh-1(H/r) - (r2/H2+1).5 + r/H] / (2pH2) [Glover Solution]

VOLUME (ml)	Volume Out (ml) [a]	TIME (hr:min:sec a/p)	Elapsed Time (hr:min:sec)	Elapsed Time (min) [b]	Flow Rate Q (ml/min) [a/b]	Ksat Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
2000		9:55:00 AM								
1900	100	9:55:04 AM	0:00:04	0.07	1500.00	0.474	7.90E-03	682.5	11.195	22.39
1800	100	9:55:08 AM	0:00:04	0.07	1500.00	0.474	7.90E-03	682.5	11.195	22.39
1700	100	9:55:12 AM	0:00:04	0.07	1500.00	0.474	7.90E-03	682.5	11.195	22.39
1600	100	9:55:16 AM	0:00:04	0.07	1500.00	0.474	7.90E-03	682.5	11.195	22.39
1500	100	9:55:21 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
1400	100	9:55:25 AM	0:00:04	0.07	1500.00	0.474	7.90E-03	682.5	11.195	22.39
1300	100	9:55:30 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
1200	100	9:55:35 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
1100	100	9:55:39 AM	0:00:04	0.07	1500.00	0.474	7.90E-03	682.5	11.195	22.39
1000	100	9:55:44 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
900	100	9:55:49 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
800	100	9:55:54 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
700	100	9:55:59 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
600	100	9:56:04 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
Natural Moisture: Moist		**Init. Satur.Time:** 9:40:00 AM		**ESTIMATED FIELD KSAT:**		0.420	7.00E-03	604.5	9.916	19.83
Texture/Classif: SAND (SM)		**Consistency:** Loose		**Depth to an Impermeable Layer:**		N/A	**Notes:**	Ksat Class = High		
Structure/Fabric: N/A		**Slope/Landsc:** slope		**Depth to Bedrock.....:**		N/A				

ksatReport1.xls — **Precision Permeameter**[tm] — Rev. 4/5/002

GET SOLUTIONS, INC.	SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET	Sheet No.: 2
Project Name.: Former Stuckey's	**Location.....** Toano/Barhamsville	**Terminology and Solution**
Boring No.....: INF-2	**Date.....:** 5/30/2006	Ksat : Saturated hydraulic conductivity
Investigators.: S. Smith, T. Bieckert, D. Clark	**File Name.....:** WM06-145G	Q: Steady-state rate of water flow into the soil
Boring Depth.: 72 inches	**WCU Base. Ht. h:** 15.0 cm	H: Constant height of water in borehole
Boring Dia.....: 8.3 cm	**WCU Susp. Ht. S:** 15.2 cm	r: Radius of cylindrical borehole
Boring Rad. (r): 4.15 cm	**Const. Wtr. Ht. H:** 30.2 cm	Ksat = Q[sinh-1(H/r) - (r2/H2+1).5 + r/H] / (2pH2) [Glover Solution]

VOLUME (ml)	Volume Out (ml) [a]	TIME (hr:min:sec a/p)	Elapsed Time (hr:min:sec)	Elapsed Time (min) [b]	Flow Rate Q (ml/min) [a/b]	Ksat Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
2000		9:25:00 AM								
1900	100	9:25:05 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
1800	100	9:25:10 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
1700	100	9:25:14 AM	0:00:04	0.07	1500.00	0.474	7.90E-03	682.5	11.195	22.39
1600	100	9:25:19 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
1500	100	9:25:25 AM	0:00:06	0.10	1000.00	0.316	5.27E-03	455.0	7.463	14.93
1400	100	9:25:31 AM	0:00:06	0.10	1000.00	0.316	5.27E-03	455.0	7.463	14.93
1300	100	9:25:37 AM	0:00:06	0.10	1000.00	0.316	5.27E-03	455.0	7.463	14.93
1200	100	9:25:43 AM	0:00:06	0.10	1000.00	0.316	5.27E-03	455.0	7.463	14.93
1100	100	9:25:48 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
1000	100	9:25:53 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
900	100	9:25:59 AM	0:00:06	0.10	1000.00	0.316	5.27E-03	455.0	7.463	14.93
800	100	9:26:04 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
700	100	9:26:10 AM	0:00:06	0.10	1000.00	0.316	5.27E-03	455.0	7.463	14.93
600	100	9:26:17 AM	0:00:07	0.12	857.14	0.271	4.51E-03	390.0	6.397	12.79
				ESTIMATED FIELD KSAT:		0.351	5.85E-03	505.6	8.294	16.59

Natural Moisture:	Moist	**Init. Satur.Time:**	9:10:00 AM	**Depth to an Impermeable Layer:**	N/A	**Notes:** Ksat Class = High
Texture/Classif:	SAND (SM)	**Consistency:**	Loose	**Depth to Bedrock.....:**	N/A	
Structure/Fabric:	N/A	**Slope/Landsc:**	slope			

GET SOLUTIONS, INC.	SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET	Sheet No.: 3

Project Name.:	Former Stuckey's	**Location.....**	Toano/Barhamsville	**Terminology and Solution**	
Boring No.....:	INF-3	**Date.....:**	5/24/2006	Ksat :	Saturated hydraulic conductivity
Investigators.:	D. Mitchell, T. Bieckert	**File Name.....:**	WM06-145G	Q:	Steady-state rate of water flow into the soil
Boring Depth.:	24 inches	**WCU Base. Ht. h:**	15.0 **cm**	H:	Constant height of water in borehole
Boring Dia.....:	8.3 **cm**	**WCU Susp. Ht. S:**	15.2 **cm**	r:	Radius of cylindrical borehole
Boring Rad. (r):	4.15 **cm**	**Const. Wtr. Ht. H:**	30.2 **cm**	Ksat = Q[sinh-1(H/r) - (r2/H2+1).5 + r/H] / (2pH2)	[Glover Solution]

VOLUME (ml)	Volume Out (ml) [a]	TIME (hr:min:sec a/p)	Elapsed Time (hr:min:sec)	Elapsed Time (min) [b]	Flow Rate Q (ml/min) [a/b]	Ksat Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
2000		3:42:00 PM								
1900	100	3:42:36 PM	0:00:36	0.60	166.67	0.053	8.78E-04	75.8	1.244	2.49
1800	100	3:43:10 PM	0:00:34	0.57	176.47	0.056	9.29E-04	80.3	1.317	2.63
1700	100	3:43:48 PM	0:00:38	0.63	157.89	0.050	8.31E-04	71.8	1.178	2.36
1600	100	3:44:24 PM	0:00:36	0.60	166.67	0.053	8.78E-04	75.8	1.244	2.49
1500	100	3:45:00 PM	0:00:36	0.60	166.67	0.053	8.78E-04	75.8	1.244	2.49
1400	100	3:45:34 PM	0:00:34	0.57	176.47	0.056	9.29E-04	80.3	1.317	2.63
1300	100	3:46:12 PM	0:00:38	0.63	157.89	0.050	8.31E-04	71.8	1.178	2.36
1200	100	3:46:51 PM	0:00:39	0.65	153.85	0.049	8.10E-04	70.0	1.148	2.30
1100	100	3:47:29 PM	0:00:38	0.63	157.89	0.050	8.31E-04	71.8	1.178	2.36
1000	100	3:48:05 PM	0:00:36	0.60	166.67	0.053	8.78E-04	75.8	1.244	2.49
900	100	3:48:43 PM	0:00:38	0.63	157.89	0.050	8.31E-04	71.8	1.178	2.36
800	100	3:49:20 PM	0:00:37	0.62	162.16	0.051	8.54E-04	73.8	1.210	2.42
700	100	3:49:57 PM	0:00:37	0.62	162.16	0.051	8.54E-04	73.8	1.210	2.42
600	100	3:50:35 PM	0:00:38	0.63	157.89	0.050	8.31E-04	71.8	1.178	2.36
ESTIMATED FIELD KSAT:						0.052	8.60E-04	74.3	1.219	2.44

Natural Moisture:	Moist	**Init. Satur.Time:**	3:28:00 PM	**Depth to an Impermeable Layer:**	N/A	**Notes:**	Ksat Class = High
Texture/Classif:	SAND (SM)	**Consistency:**	Very Loose	**Depth to Bedrock.....:**	N/A		
Structure/Fabric:	N/A	**Slope/Landsc:**	slope				

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GET Solutions, Inc.

Geotechnical · Environmental · Testing

SUP-18-06
PRE PLAN OF DEV.
Report.

June 22, 2006

Initially ok to show concept infiltration. SAT 7-24-06 satisfies SUP comm. #5 dated 6/16/06.

TO: **LandMark Design Group**
4029 Ironbound Road
Suite 100
Williamsburg, Virginia 23188

Attn: Mr. Steve Romeo, L.S.

RE: Report of Subsurface Investigation and Geotechnical Engineering Services
Former Stuckey's Site
Barhamsville Road (State Route 30)
James City County, Virginia
GET Project No: WM06-145G

Dear Mr. Romeo:

In compliance with your instructions, we have completed our Subsurface Investigation and Geotechnical Engineering Services for the referenced project. The results of this study, together with our recommendations, are presented in this report.

Often, because of design and construction details that occur on a project, questions arise concerning subsurface conditions. **G E T Solutions, Inc.** would be pleased to continue its role as Geotechnical Engineer during the final design phase and project implementation.

We trust that the information contained herein meets your immediate need, and we would ask that you call this office with any questions that you may have.

Respectfully Submitted,
G E T Solutions, Inc.

James Wheeler
Project Geologist

Glenn W. Hohmeier, P.E.
Sr. Project Engineer
VA Lic. #036735

COMMONWEALTH OF VIRGINIA
6-23-06
GLENN W. HOHMEIER
NO. 036735
PROFESSIONAL ENGINEER

Copies: (3) Client

1592 Penniman Road, Suite E • Williamsburg, VA 23185 • Phone (757) 564-6452 • Fax (757) 564-6453
info@getsolutionsinc.com

SUP-18-06

Report of Subsurface Investigation and Geotechnical Engineering Services
Former Stuckey's Site
Barhamsville Road (State Route 30)
James City County, Virginia
G E T Project No. WM06-145G
June 22, 2006
Prepared For: LandMark Design Group

GET Solutions, Inc.

TABLE OF CONTENTS

GET Solutions, Inc.

1.0 PROJECT INFORMATION

1.1 Project Description:

G E T Solutions, Inc. has completed our Geotechnical Engineering study for the Former Stuckey's Site located along Barhamsville Road (State Route 30) in James City County, Virginia. The construction at this site is planned to consist of renovating the current restaurant and gas station facilities. Also, new paved driveways and parking areas, along with other pertinent infrastructure components (utilities, BMP facilities, etc.) will also be reconstructed at this site.

If any of the noted information is incorrect or has changed, please inform **G E T Solutions, Inc.** so that we may amend the recommendations presented in this report, if appropriate.

1.2 Purpose and Scope of Services:

The purpose of this study was to obtain information on the general subsurface conditions at the proposed project site within the renovated area. The subsurface conditions encountered were then evaluated with respect to the available project characteristics. In this regard, engineering assessments for the following items were formulated:

1. General assessment of the soils revealed by the borings performed at the proposed development.

2. General location and description of potentially deleterious material encountered in the borings that may interfere with construction progress, including existing fills or surficial/subsurface organics.

3. Evaluation of the permeability of the soils within the renovated area by means of performing in-situ infiltration tests.

The scope of services did not include an environmental assessment for determining the presence or absence of wetlands or hazardous or toxic material in the soil, bedrock, surface water, groundwater or air, on or below or around this site. Prior to development of this site, an environmental assessment is advisable.

2.0 FIELD AND LABORATORY PROCEDURES

2.1 Field Exploration:

In order to explore the general subsurface soil types and to aid in developing associated design parameters, three (3) 10-foot deep hand auger borings (designated as HA-1, HA-2 and HA-3) were performed by **G E T Solutions, Inc.** within the potential BMP stormwater collection areas. In addition, three infiltration tests (designated as INF-1, INF-2 and INF-3) were performed within the hand auger borings at various depths.

The boring locations were established, located and staked in the field by a representative of **G E T Solutions, Inc.** The approximate boring locations are shown on the "Boring Location Plan" (Figure 1) attached to this report (Appendix I).

2.2 Laboratory Testing:

Representative portions of all soil samples collected at the hand auger locations were sealed in plastic bags, labeled and transferred to our laboratory for classification and analysis. The soil classification was performed by a Geotechnical Engineer in accordance with ASTM D 2488.

Three representative soil samples were selected and subjected to laboratory testing, which included natural moisture and #200 sieve wash, in order to corroborate the visual classification. These test results are noted in Table 1 and are presented on the "Log of Boring" sheet (Appendix II), included with this report.

Table 1 – Laboratory Test Results

Boring No.	Depth (Ft)	Natural Moisture (%)	#200 Sieve (%)	Atterberg Limits (LL/PL/PI)	Classification
HA-1/INF-1*	7.5	10.8	14.8	Non-Plastic	SM
HA-2/INF-2*	5.5	14.9	24.2	Non-Plastic	SM
HA-3/INF-3*	1.5	8.4	37.3	Non-Plastic	SM

* Sample obtained from the infiltration test depth.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Location and Description:

The project site is located along Barhamsville Road (State Route 30) in James City County, Virginia. The property is bordered to the north by an entrance ramp to Interstate 64, to the south by a vacant wooded area, to the west by Barhamsville Road, and to the east by a vacant wooded tract followed by Interstate 64. Currently, the site is a developed area consisting of a restaurant/gas station facility, paved parking lot, and associated infrastructure. Based on our visual observation, grade changes typically across the project site are less than 2-feet in vertical elevation every 100 linear feet.

3.2 Subsurface Soil Conditions:

The results of our field exploration program indicated the presence of approximately 3 inches of topsoil material at the boring locations. The topsoil thickness could vary across the site. Underlying the topsoil and extending to the boring termination depth of 10 feet below existing grades, the subsurface soils consisted of various soil types generally comprised of SAND (SM, SC) with varying amounts of Silt and Clay and Sandy CLAY (CL).

The subsurface description is of a generalized nature provided to highlight the major soil strata encountered. The records of the subsurface exploration included in Appendix II (Log of Boring sheets) and in the Generalized Soil Profile presented in Appendix III, which should be reviewed for specific information as to the individual borings. The stratifications shown on the records of the subsurface exploration represent the conditions only at the actual boring locations. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the transition may be gradual.

3.3 Groundwater Information:

The groundwater table depth was not encountered at the boring locations during our field exploration to the depth explored (10 feet below existing grades).

Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as man-made influences, such as existing swales, drainage ponds, underdrains and areas of covered soil (paved parking lots, side walks, etc.). It is estimated normal seasonal high groundwater level will fluctuate within 2 feet of the current levels. We recommend that the contractor determine the actual groundwater levels at the time of the construction to determine groundwater impact on this project.

4.0 EVALUATION AND RECOMMENDATIONS

4.1 Infiltration Testing

Three infiltration tests (INF-1, INF-2 and INF-3) were performed within the lateral limits of the potential BMP stormwater collection areas, corresponding to boring locations HA-1, HA-2 and HA-3. Specifically, infiltration test INF-1 was performed at a depth of 7 to 8 feet below existing grades within hand auger boring HA-1, INF-2 was performed at a depth of 5 to 6 feet below existing grades within hand auger boring HA-2, and infiltration test INF-3 was performed at a depth of 1 to 2 feet below existing grades within hand auger boring HA-3. The infiltration test boreholes were prepared utilizing a planer auger to remove soil clippings from its base (test levels ranged from 1 to 8 below the ground surface). Infiltration testing was then conducted within the vadose zone utilizing a Precision Permeameter and the following testing procedures.

A support stand was assembled and placed adjacent to the boreholes. This stand holds a calibrated reservoir (2000 ml) and a cable used to raise and lower the water control unit (WCU). The WCU establishes a constant water head within the boreholes during testing by use of a precision valve and float assembly. The WCU was attached to the flow reservoir with a 2-meter (6.6 foot) braided PVC hose and then lowered by cable into the boreholes to the test depth elevation. As required by the Glover solution, the WCU was suspended 6 –inches above the bottom of the boreholes. The shut-off valve was then opened allowing water to pass through the WCU to fill the boreholes to the constant water level elevation. The absorption rate slowed as the soil voids became filled and an equilibrium developed as a wetting bulb developed around the borehole. Water was continuously added until the flow rate stabilized. The reservoir was then re-filled in order to begin testing. During testing, as the water drained into the boreholes and surrounding soils, the water level within the calibrated reservoir was recorded as well as the elapsed time during each interval. The test was continued until relatively consistent flow rates were documented. During testing the quick release connections and shutoff valve were monitored to ensure that no leakage occurred. The flow rate (Q), height of the constant water level (H), and borehole diameter (D) were used to calculate K_s utilizing the Glover Solution.

Based on the field testing and corroborated with laboratory testing results (published values compared to classification results), the hydraulic conductivity of the shallow soils at the tested depths (ranging from 1 to 8 feet) as identified at the location of the infiltration tests ranged from $k = 8.60 \times 10^{-4}$ cm/sec (or 1.219 in /hour) to $k = 7.00 \times 10^{-3}$ cm/sec (or 9.916 in/hour). The following provides the infiltration test results corresponding to the specific locations and depths.

Table 2 – Infiltration Test Results

Infiltration Test	Boring Location	Depth Test Conducted (ft)	Percent Fines	Hydraulic Conductivity (cm/sec)
INF-1	HA-1	7-8	14.8	7.00×10^{-3}
INF-2	HA-2	5-6	24.2	5.85×10^{-3}
INF-3 *	HA-3	1-2	37.3	8.60×10^{-4}

* Note: Sandy soils encountered at this infiltration location were observed to be very loose. Compaction of these soils should result in lower rates.

9.92 IN/HR
8.29 IN/HR
1.21 IN/HR
ALL 70.5 IN/HR

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Drainage and Groundwater Concerns:

It is expected that dewatering will be required for excavations that extend near or below the groundwater level. We recommend that the contractor determine the actual groundwater levels at the time of the construction to determine groundwater impact on this project.

It would be advantageous to construct all fills early in the construction. If this is not accomplished, disturbance of the existing site drainage could result in collection of surface water in some areas, thus rendering these areas wet and very loose. Temporary drainage ditches should be employed by the contractor to accentuate drainage during construction.

5.2 Excavations:

In Federal Register, Volume 54, No. 209 (October, 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document was issued to better insure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that all excavations, whether they be utility trenches, basement excavation or footing excavations, be constructed in accordance with the new (OSHA) guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

w/ FS 2 4.95 IN/HR
4.14
0.60

GET Solutions, Inc.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's responsible person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

We are providing this information solely as a service to our client. **G E T Solutions, Inc.** is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

6.0 REPORT LIMITATIONS

The recommendations submitted are based on the available soil information obtained by **G E T Solutions, Inc.** and the information supplied by the LandMark Design Group, and his consultants for the proposed project. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, **G E T Solutions, Inc.** should be notified immediately to determine if changes in the foundation recommendations are required. If **G E T Solutions, Inc.** is not retained to perform these functions, **G E T Solutions, Inc.** can not be responsible for the impact of those conditions on the geotechnical recommendations for the project.

The Geotechnical Engineer warrants that the findings, recommendations, specifications or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

After the plans and specifications are more complete the Geotechnical Engineer should be provided the opportunity to review the final design plans and specifications to assure our engineering recommendations have been properly incorporated into the design documents, in order that the earthwork and foundation recommendations may be properly interpreted and implemented. At that time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of the LandMark Design Group and their consultants for the specific application to the Former Stuckey's project located along Barhamsville Road (State Route 30) in James City County, Virginia.

APPENDICES

I. BORING LOCATION PLAN

II. LOG OF BORINGS

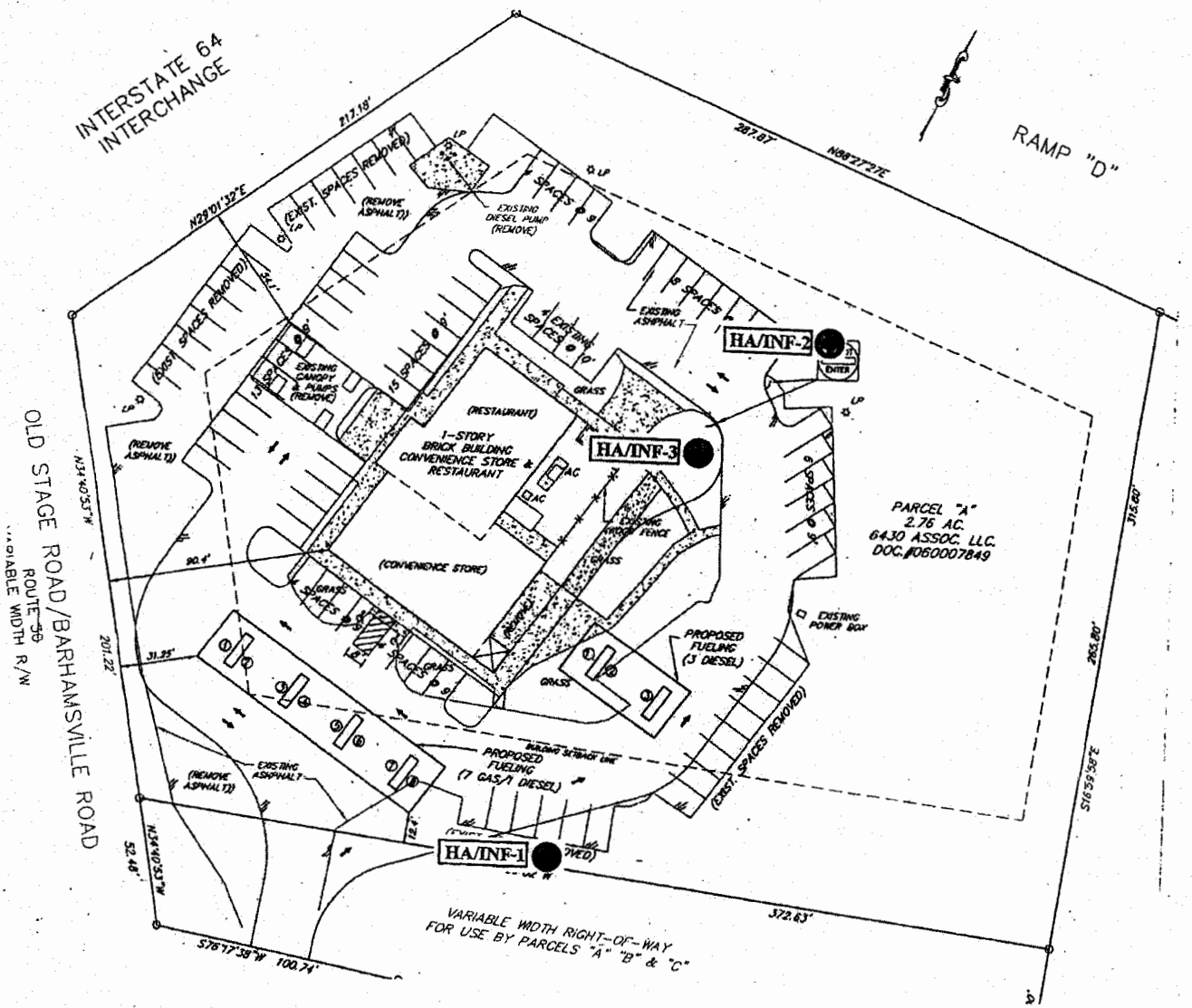
III. GENERALIZED SOIL PROFILE

IV. INFILTRATION TEST RESULTS

APPENDIX I -

BORING LOCATION PLAN

Figure 1



Locations are approximate

BORING LOCATION PLAN

PROJECT:	**Former Stuckey's** **James City County, Virginia**	**SCALE: NTS**
PROJECT NO:	**WM06-145G**	**DATE: 5/31/06**
CLIENT:	**LandMark Design Group**	**PLOT BY: SS**

APPENDIX II -

LOG OF BORINGS

GET Solutions, Inc.

Geotechnical · Environmental · Testing

LOG OF BORING No. HA-1

PROJECT: Former Stuckey's **PROJECT NO.:** WM06-145G

CLIENT: LandMark Design Group

PROJECT LOCATION: James City County, Virginia

LOCATION: See Attached Boring Location Plan **ELEVATION:**

DRILLER: GET Solutions, Inc. **LOGGED BY:** S. Smith

DRILLING METHOD: Hand Auger **DATE:** 5-19-2006

DEPTH TO - WATER> INITIAL: ▼ **AFTER 24 HOURS:** ▼ **CAVING>**

Depth (feet)	Description	Graphic	Sample No.	Blow Counts	% < #200	TEST RESULTS: Plastic Limit — Liquid Limit; Water Content - ●; Penetration - ▨ (10 20 30 40 50 60 70)
0						
	3 Inches of Topsoil					
	0.25					
	Brown, moist, Sandy CLAY (CL) with trace organics					
	1					
	Orangish brown, moist, Sandy CLAY (CL)					
2						
4						
6						
	6					
	Orangish brown, moist, Silty fine to medium SAND (SM)					
	Trace Clay from 5 to 7 feet				15	●
8						
10						
	Boring terminated at 10 ft.					
12						
14						

GET Solutions, Inc.

LOG OF BORING No. HA-2

PROJECT: Former Stuckey's **PROJECT NO.:** WM06-145G
CLIENT: LandMark Design Group
PROJECT LOCATION: James City County, Virginia
LOCATION: See Attached Boring Location Plan **ELEVATION:**
DRILLER: GET Solutions, Inc. **LOGGED BY:** S. Smith
DRILLING METHOD: Hand Auger **DATE:** 5-19-2006
DEPTH TO - WATER> INITIAL: ▼ **AFTER 24 HOURS:** ▼ **CAVING>**

Depth (feet)	Description	Graphic	Sample No.	Blow Counts	% < #200
0					
	3 Inches of Topsoil (0.25)				
	Brown, moist, Silty, fine to medium SAND (SM) (1)				
2	Brown to orangish brown, moist, Sandy CLAY (CL)				
4					
	Orangish brown, moist, Silty, fine to medium SAND (SM) (5)				24
6					
	Mottled orangish brown-gray, moist, Sandy CLAY (CL) (7)				
8					
10					
	Boring terminated at 10 ft.				
12					
14					

TEST RESULTS
Plastic Limit ⊢——⊣ Liquid Limit
Water Content - ●
Penetration - ▨
10 20 30 40 50 60 70

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

Figure

GET Solutions, Inc.

LOG OF BORING No. HA-3

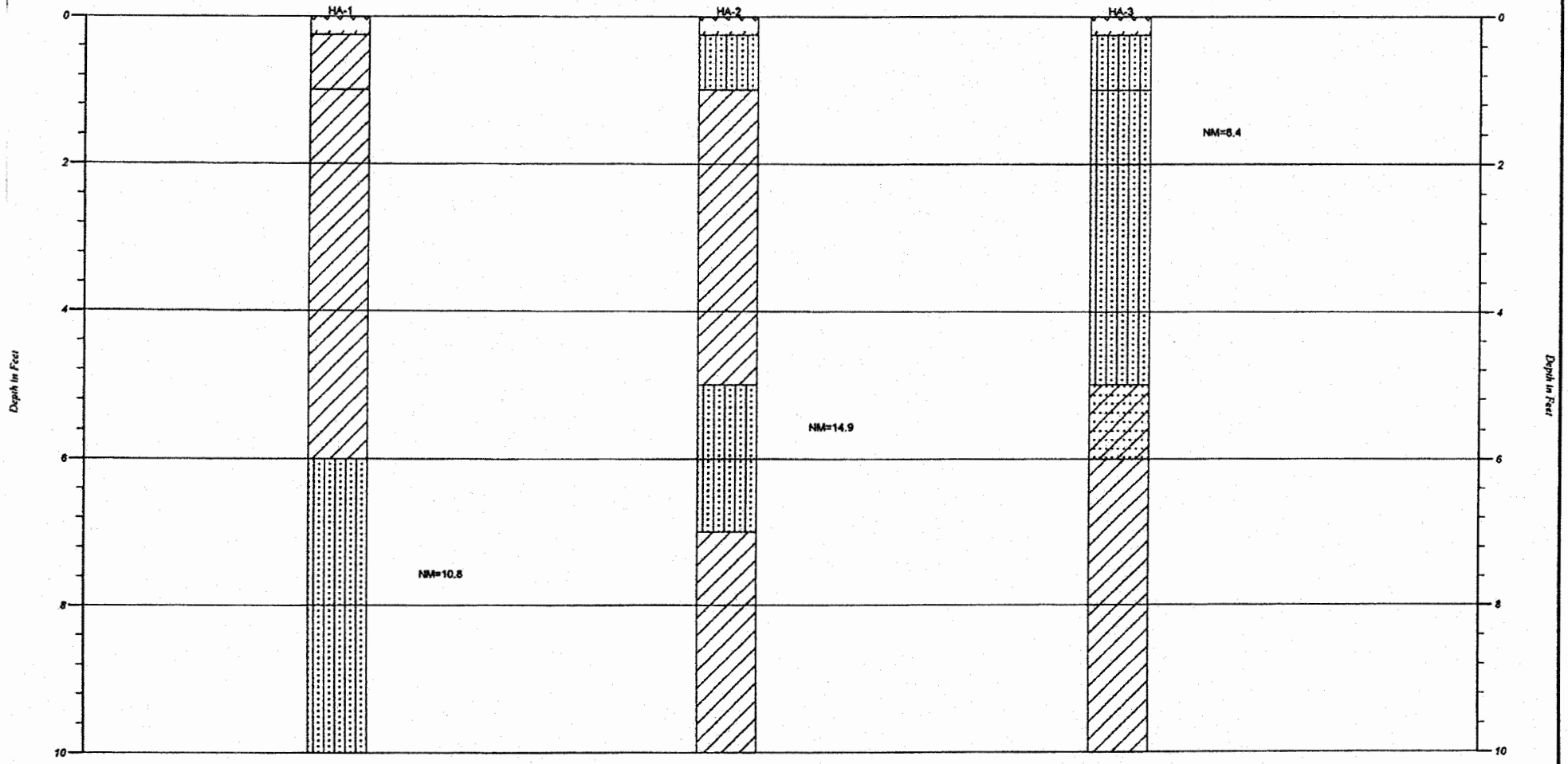
PROJECT: Former Stuckey's | PROJECT NO.: WM06-145G
CLIENT: LandMark Design Group
PROJECT LOCATION: James City County, Virginia
LOCATION: See Attached Boring Location Plan | ELEVATION:
DRILLER: GET Solutions, Inc. | LOGGED BY: S. Smith
DRILLING METHOD: Hand Auger | DATE: 5-19-2006
DEPTH TO - WATER> INITIAL: ▼ | AFTER 24 HOURS: ▼ | CAVING>

Depth (feet)	Description	Graphic	Sample No.	Blow Counts	% < #200	TEST RESULTS
0	3 Inches of Topsoil					Plastic Limit ⊢—⊣ Liquid Limit
	0.25 Brown, moist, Silty, fine to medium SAND (SM) with trace Clay and organcis					Water Content - ●
	1 Brown, moist, Silty, fine to medium SAND (SM) with trace Clay				37	Penetration - ▨
2						10 20 30 40 50 60 70
4	4 Brown, moist, Silty, fine to medium SAND (SM)					
	5 Brown, moist, Clayey, fine to medium SAND (SC)					
6	6 Orangish brown, moist, Sandy CLAY (CL)					
8						
10	Boring terminated at 10 ft.					
12						
14						

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

APPENDIX III -

GENERALIZED SOIL PROFILE



Strata symbols

- Topsoil
- Low plasticity clay
- Silty sand
- Clayey sand

GET Solutions, Inc.		
GENERALIZED SOIL PROFILE		
HORIZONTAL SCALE: VERTICAL SCALE: 1"=2'	DRAWN BY/APPROVED BY: SS	DATE DRAWN: 6/22/2006
Former Stuckey's James City County, Virginia		
PROJECT NO. WM06-145G		FIGURE NUMBER: 1

APPENDIX IV -

INFILTRATION TEST RESULTS

GET SOLUTIONS, INC.	SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET	Sheet No.: 1
Project Name.: Former Stuckey's	Location..... Toano/Barhamsville	Terminology and Solution
Boring No.....: INF-1	Date.....: 5/30/2006	Ksat : Saturated hydraulic conductivity
Investigators.: S. Smith, T. Bieckert, D. Clark	File Name.....: WM06-145G	Q: Steady-state rate of water flow into the soil
Boring Depth.: 96 inches	WCU Base. Ht. h: 15.0 cm	H: Constant height of water in borehole
Boring Dia.....: 8.3 cm	WCU Susp. Ht. S: 15.2 cm	r: Radius of cylindrical borehole
Boring Rad. (r): 4.15 cm	Const. Wtr. Ht. H: 30.2 cm	Ksat = Q[sinh-1(H/r) - (r2/H2+1).5 + r/H] / (2pH2) [Glover Solution]

VOLUME (ml)	Volume Out (ml) [a]	TIME (hr:min:sec a/p)	Elapsed Time (hr:min:sec)	Elapsed Time (min) [b]	Flow Rate Q (ml/min) [a/b]	Ksat Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
2000		9:55:00 AM								
1900	100	9:55:04 AM	0:00:04	0.07	1500.00	0.474	7.90E-03	682.5	11.195	22.39
1800	100	9:55:08 AM	0:00:04	0.07	1500.00	0.474	7.90E-03	682.5	11.195	22.39
1700	100	9:55:12 AM	0:00:04	0.07	1500.00	0.474	7.90E-03	682.5	11.195	22.39
1600	100	9:55:16 AM	0:00:04	0.07	1500.00	0.474	7.90E-03	682.5	11.195	22.39
1500	100	9:55:21 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
1400	100	9:55:25 AM	0:00:04	0.07	1500.00	0.474	7.90E-03	682.5	11.195	22.39
1300	100	9:55:30 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
1200	100	9:55:35 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
1100	100	9:55:39 AM	0:00:04	0.07	1500.00	0.474	7.90E-03	682.5	11.195	22.39
1000	100	9:55:44 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
900	100	9:55:49 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
800	100	9:55:54 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
700	100	9:55:59 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
600	100	9:56:04 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
				ESTIMATED FIELD KSAT:		0.420	7.00E-03	604.5	9.916	19.83

Natural Moisture: Moist	Init. Satur.Time: 9:40:00 AM	Depth to an Impermeable Layer: N/A	Notes: Ksat Class = High		
Texture/Classif: SAND (SM)	Consistency: Loose				
Structure/Fabric: N/A	Slope/Landsc: slope	Depth to Bedrock.....: N/A			

ksatReport1.xls — Precision Permeameter[tm] — Rev. 4/5/002

>0.5"/HR

GET SOLUTIONS, INC.	SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET	Sheet No.: 2
Project Name.: Former Stuckey's	Location..... Toano/Barhamsville	**Terminology and Solution**
Boring No.....: INF-2	Date.....: 5/30/2006	Ksat : Saturated hydraulic conductivity
Investigators.: S. Smith, T. Bieckert, D. Clark	File Name.....: WM06-145G	Q: Steady-state rate of water flow into the soil
Boring Depth.: 72 inches	WCU Base. Ht. h: 15.0 cm	H: Constant height of water in borehole
Boring Dia.....: 8.3 cm	WCU Susp. Ht. S: 15.2 cm	r: Radius of cylindrical borehole
Boring Rad. (r): 4.15 cm	Const. Wtr. Ht. H: 30.2 cm	Ksat = Q[sinh-1(H/r) - (r2/H2+1).5 + r/H] / (2pH2) [Glover Solution]

VOLUME (ml)	Volume Out (ml) [a]	TIME (hr:min:sec a/p)	Elapsed Time (hr:min:sec)	Elapsed Time (min) [b]	Flow Rate Q (ml/min) [a/b]	Ksat Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
2000		9:25:00 AM								
1900	100	9:25:05 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
1800	100	9:25:10 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
1700	100	9:25:14 AM	0:00:04	0.07	1500.00	0.474	7.90E-03	682.5	11.195	22.39
1600	100	9:25:19 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
1500	100	9:25:25 AM	0:00:06	0.10	1000.00	0.316	5.27E-03	455.0	7.463	14.93
1400	100	9:25:31 AM	0:00:06	0.10	1000.00	0.316	5.27E-03	455.0	7.463	14.93
1300	100	9:25:37 AM	0:00:06	0.10	1000.00	0.316	5.27E-03	455.0	7.463	14.93
1200	100	9:25:43 AM	0:00:06	0.10	1000.00	0.316	5.27E-03	455.0	7.463	14.93
1100	100	9:25:48 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
1000	100	9:25:53 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
900	100	9:25:59 AM	0:00:06	0.10	1000.00	0.316	5.27E-03	455.0	7.463	14.93
800	100	9:26:04 AM	0:00:05	0.08	1200.00	0.379	6.32E-03	546.0	8.956	17.91
700	100	9:26:10 AM	0:00:06	0.10	1000.00	0.316	5.27E-03	455.0	7.463	14.93
600	100	9:26:17 AM	0:00:07	0.12	857.14	0.271	4.51E-03	390.0	6.397	12.79
				ESTIMATED FIELD KSAT:		0.351	5.85E-03	505.6	8.294	16.59

Natural Moisture:	Moist	Init. Satur.Time:	9:10:00 AM	Depth to an Impermeable Layer:	N/A	Notes: Ksat Class = High
Texture/Classif:	SAND (SM)	Consistency:	Loose	Depth to Bedrock.....:	N/A	
Structure/Fabric:	N/A	Slope/Landsc:	slope			

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>0.5"/HR

GET SOLUTIONS, INC.	SATURATED HYDRAULIC CONDUCTIVITY WORKSHEET	Sheet No.: 3
Project Name.: Former Stuckey's	Location..... Toano/Barhamsville	Terminology and Solution
Boring No.....: INF-3	Date.....: 5/24/2006	Ksat : Saturated hydraulic conductivity
Investigators.: D. Mitchell, T. Bieckert	File Name.....: WM06-145G	Q: Steady-state rate of water flow into the soil
Boring Depth.: 24 inches	WCU Base. Ht. h: 15.0 cm	H: Constant height of water in borehole
Boring Dia.....: 8.3 cm	WCU Susp. Ht. S: 15.2 cm	r: Radius of cylindrical borehole
Boring Rad. (r): 4.15 cm	Const. Wtr. Ht. H: 30.2 cm	Ksat = Q[sinh-1(H/r) - (r2/H2+1).5 + r/H] / (2pH2) [Glover Solution]

VOLUME (ml)	Volume Out (ml) [a]	TIME (hr:min:sec a/p)	Elapsed Time (hr:min:sec)	Elapsed Time (min) [b]	Flow Rate Q (ml/min) [a/b]	Ksat Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
2000		3:42:00 PM								
1900	100	3:42:36 PM	0:00:36	0.60	166.67	0.053	8.78E-04	75.8	1.244	2.49
1800	100	3:43:10 PM	0:00:34	0.57	176.47	0.056	9.29E-04	80.3	1.317	2.63
1700	100	3:43:48 PM	0:00:38	0.63	157.89	0.050	8.31E-04	71.8	1.178	2.36
1600	100	3:44:24 PM	0:00:36	0.60	166.67	0.053	8.78E-04	75.8	1.244	2.49
1500	100	3:45:00 PM	0:00:36	0.60	166.67	0.053	8.78E-04	75.8	1.244	2.49
1400	100	3:45:34 PM	0:00:34	0.57	176.47	0.056	9.29E-04	80.3	1.317	2.63
1300	100	3:46:12 PM	0:00:38	0.63	157.89	0.050	8.31E-04	71.8	1.178	2.36
1200	100	3:46:51 PM	0:00:39	0.65	153.85	0.049	8.10E-04	70.0	1.148	2.30
1100	100	3:47:29 PM	0:00:38	0.63	157.89	0.050	8.31E-04	71.8	1.178	2.36
1000	100	3:48:05 PM	0:00:36	0.60	166.67	0.053	8.78E-04	75.8	1.244	2.49
900	100	3:48:43 PM	0:00:38	0.63	157.89	0.050	8.31E-04	71.8	1.178	2.36
800	100	3:49:20 PM	0:00:37	0.62	162.16	0.051	8.54E-04	73.8	1.210	2.42
700	100	3:49:57 PM	0:00:37	0.62	162.16	0.051	8.54E-04	73.8	1.210	2.42
600	100	3:50:35 PM	0:00:38	0.63	157.89	0.050	8.31E-04	71.8	1.178	2.36
Natural Moisture: Moist		Init. Satur.Time: 3:28:00 PM		ESTIMATED FIELD KSAT:		0.052	8.60E-04	74.3	1.219	2.44
Texture/Classif: SAND (SM)		Consistency: Very Loose		Depth to an Impermeable Layer: N/A		Notes: Ksat Class = High				
Structure/Fabric: N/A		Slope/Landsc: slope		Depth to Bedrock.....: N/A						

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> 0.5"/HR.

GET Solutions, Inc.
Geotechnical • Environmental • Testing

G E T Solutions, Inc.
1592-E Penniman Road
Williamsburg, Virginia 23185
Tel: (757) 564-6452
Fax:(757) 564-6453

FIELD REPORT No. 4

Project No. **WM09-150T**
Permit No.
Permit Date:

Project Name:		Day/Date:	**Thurs/2 July 09**
	Star Express	Weather/Temp:	**P. Sunny/85°**
Location:		Arrive on Site:	**0630**
	James City County, VA	Depart Site:	**1430**
Client:		Time on Site:	**8.0**
	North South Construction, Inc.	Travel Time:	**1.0**
Contractor:		Prep./Reporting Time:	**1.0**
	North South Construction, Inc.	Total Chargeable Hours:	**10**
Scope of Services:		Chargeable Expenses:	**35** Miles
	Storm Drain Installation Observations		

Deficiency Needing Correction ☐ No Deficiency Observed ■

As requested, a **G E T** representative visited the project site in order to monitor the on-going storm drain utility pipe installation. The contractor installed the required 15" RCP pipe from Structure B2 to B3 (80 linear feet of pipe) during today's operations. Refer to the attached sketch for locations. The 15" RCP pipe was installed in general accordance with the project plans with the proper rubber gaskets at the joints and #57 stone bedding. Compaction testing was performed on the utility trench backfill and has been submitted as a separate report.

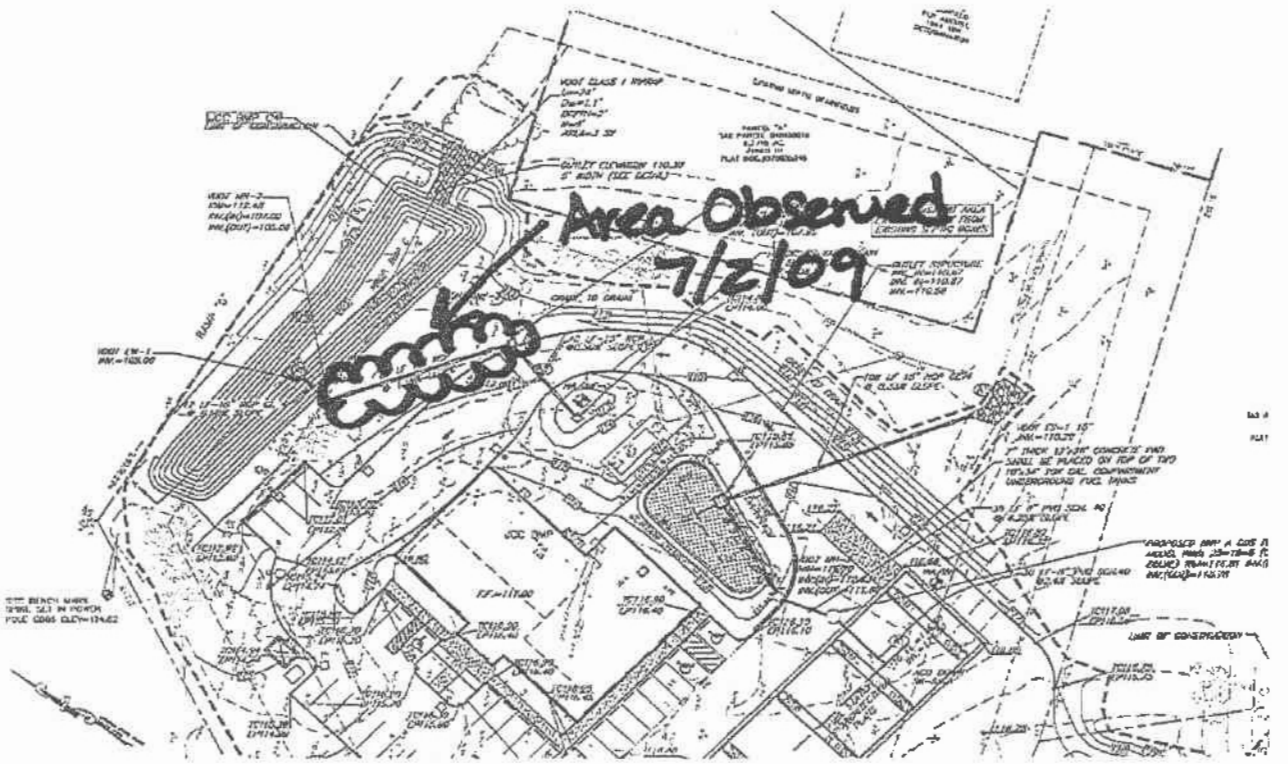
By:
A. Libby
G E T Solutions, Inc.

Distribution:
jtedder@northsouthcon.com
northsouthcon@aol.com

Reviewed by:

J. Wheeler
G E T Solutions, Inc.

Figure 1



Locations are approximate

LOCATION SKETCH

PROJECT:	Star Express James City County, VA	SCALE: NTS
PROJECT NO:	WM09-150T	DATE: 7/2/2009
CLIENT:	North South Construction, Inc.	PLOT BY: AL

GET Solutions, Inc.
Geotechnical · Environmental · Testing

G E T Solutions, Inc.
1592-E Penniman Road
Williamsburg, Virginia 23185
Tel: (757) 564-6452
Fax:(757) 564-6453

FIELD REPORT No. 3

Project No. **WM09-150T**
Permit No.
Permit Date:

Project Name:		Day/Date:	**Wed/1 July 09**
	Star Express	Weather/Temp:	**Sunny/80-90's**
Location:		Arrive on Site:	**1015**
	James City County, VA	Depart Site:	**1645**
Client:		Time on Site:	**6.5**
	North South Construction, Inc.	Travel Time:	**1.0**
Contractor:		Prep./Reporting Time:	**1.0**
	North South Construction, Inc.	Total Chargeable Hours:	**8.5**
Scope of Services:		Chargeable Expenses:	**35** Miles
	Undercut Observations		

Deficiency Needing Correction ☐ No Deficiency Observed ■

As requested, a **G E T** representative visited the project site in order to observe the undercuts within the building footprint that were recommended to be completed during our June 29, 2009, inspection. The undercuts averaged between 2 to 2.5 feet deep in order to remove the abandoned sewer pipes, concrete pipes, and bricks, with the exception of the removal of an old grease trap which extended to about 8 feet deep. The actual dimensions are provided below. Please refer to the attached sketch for the specific locations. It should be noted that the undercut dimensions provided below are different from those provided on June 29, 2009 (due to encountering the abandoned utilities and structures). The observed undercut excavations were approved for fill placement.

Undercut Dimensions:
#1) 55' x 30' x 2'
#2) 42' x 36' x 2.5'
#3) 22' x 14' x 8' (grease trap area)

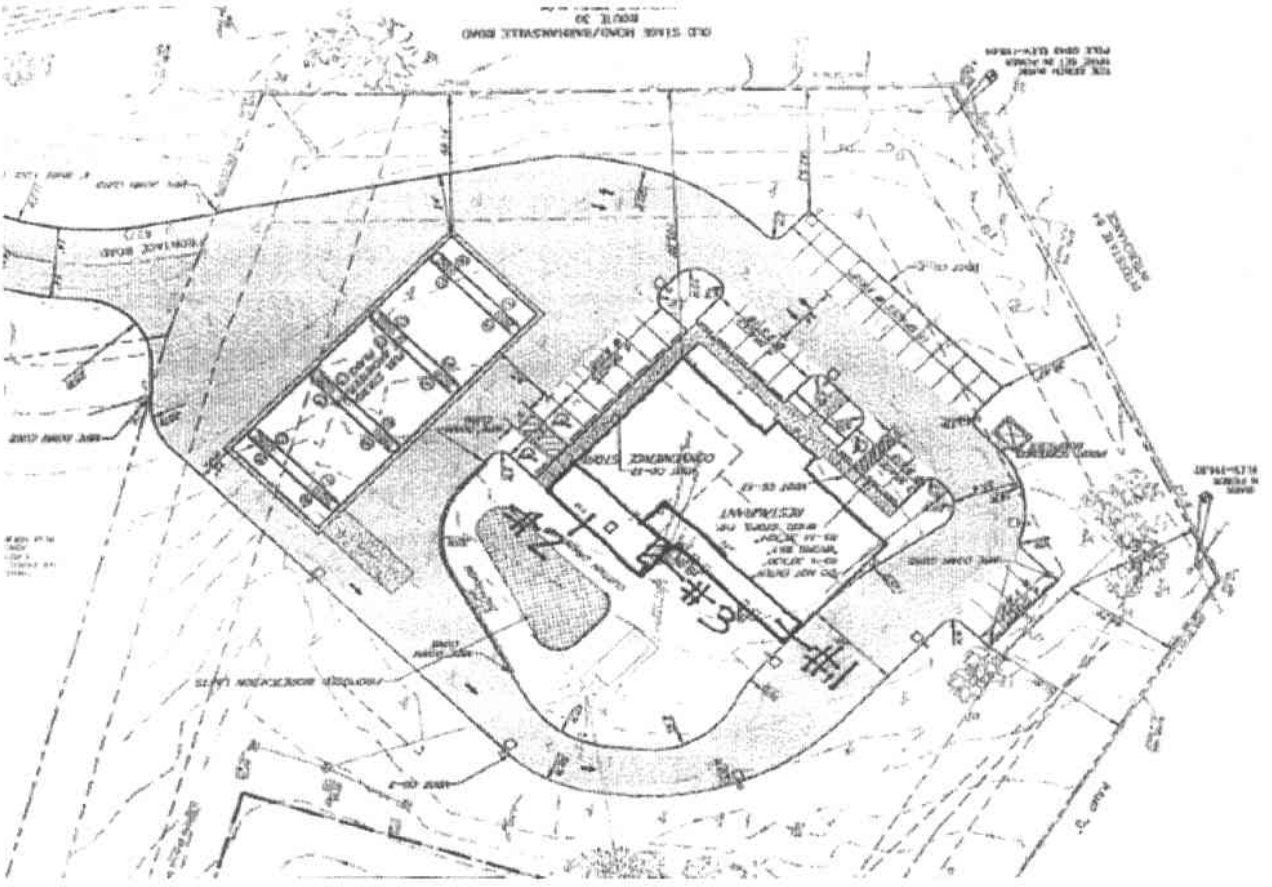
By:
R. Tweedy
G E T Solutions, Inc.

Distribution:
jtedder@northsouthcon.com
northsouthcon@aol.com

Reviewed by:

J. Wheeler
G E T Solutions, Inc.

Figure 1



Locations are approximate

LOCATION SKETCH

PROJECT:	Star Express James City County, VA	SCALE: NTS
PROJECT NO:	WM09-150T	DATE: 7/1/2009
CLIENT:	North South Construction, Inc.	PLOT BY: RT

GET Solutions, Inc.
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G E T Solutions, Inc.
1592-E Penniman Road
Williamsburg, Virginia 23185
Tel: (757) 564-6452
Fax:(757) 564-6453

FIELD REPORT No. 6

Project No. **WM09-150T**
Permit No.
Permit Date:

Project Name:	Day/Date:	**Tues/7 July 09**
Star Express	Weather/Temp:	**Cloudy/75°**
Location:	Arrive on Site:	**1000**
James City County, VA	Depart Site:	**1030**
Client:	Time on Site:	**0.5**
North South Construction, Inc.	Travel Time:	**1.0**
Contractor:	Prep./Reporting Time:	**1.0**
North South Construction, Inc.	Total Chargeable Hours:	**2.5**
Scope of Services:	Chargeable Expenses:	**35** Miles
Storm Drain Installation Observations		

Deficiency Needing Correction ☐ No Deficiency Observed ■

As requested, a G E T representative visited the project site in order to monitor the on-going storm drain utility pipe installation. The contractor installed the required 15" RCP pipe from Structure B1 to B2 (40 linear feet of pipe) during today's operations. Refer to the attached sketch for locations. The 15" RCP pipe was installed in general accordance with the project plans with the proper rubber gaskets at the joints and #57 stone bedding. Compaction testing was performed on the utility trench backfill and has been submitted as a separate report.

By:
A. Libby
G E T Solutions, Inc.

Distribution:
jtedder@northsouthcon.com
northsouthcon@aol.com

Reviewed by:

J. Wheeler
G E T Solutions, Inc.

Figure 1

Locations are approximate

LOCATION SKETCH

PROJECT:	Star Express James City County, VA	SCALE: NTS
PROJECT NO:	WM09-150T	DATE: 7/7/2009
CLIENT:	North South Construction, Inc.	PLOT BY: AL

G E T Solutions, Inc.
1592-E Penniman Road
Williamsburg, Virginia 23185
Tel: (757) 564-6452
Fax:(757) 564-6453

COMPACTION TEST REPORT (No. 7) - Sheet 1 of 2

Project:	Star Express	Date:	7/7/09
Project Location:	James City County, Virginia	Technician:	A. Libby
Client:	North South Construction, Inc.	Job Number:	WM09-150T
General Contractor:	North South Construction, Inc.	Weather:	Cloudy Temp. (°F) 70's
Grading Contractor:	G. L. Pruett	General Test Location:	Parking Lot

Test Number	Moisture (%)	Dry Density (pcf)	Wet Density (pcf)	Proctor Number	% Proctor		Pass	Fail	Test Elevation*	Test Location (Grid, Coordinates, Roadway Station, etc.)
					Spec	Actual				
1	8.9	116.6	127.0	1	95	95	X		Subgrade	See Attached Sketch
2	9.6	118.9	130.3	1	95	97	X		Subgrade	See Attached Sketch

Compaction Equipment Used:	Troxler Nuclear Density Gauge	Proctor Number:	1
Field Testing Procedure:	ASTM D698	Proctor Type:	ASTM D698
Testing Depth:	12 inches	Material Description:	Silty SAND (SM)
Test Conducted on:	Backfill over Storm Drain	Max. Dry Density (pcf):	122.2
		Optimum Moisture (%):	10.0%

Remarks:

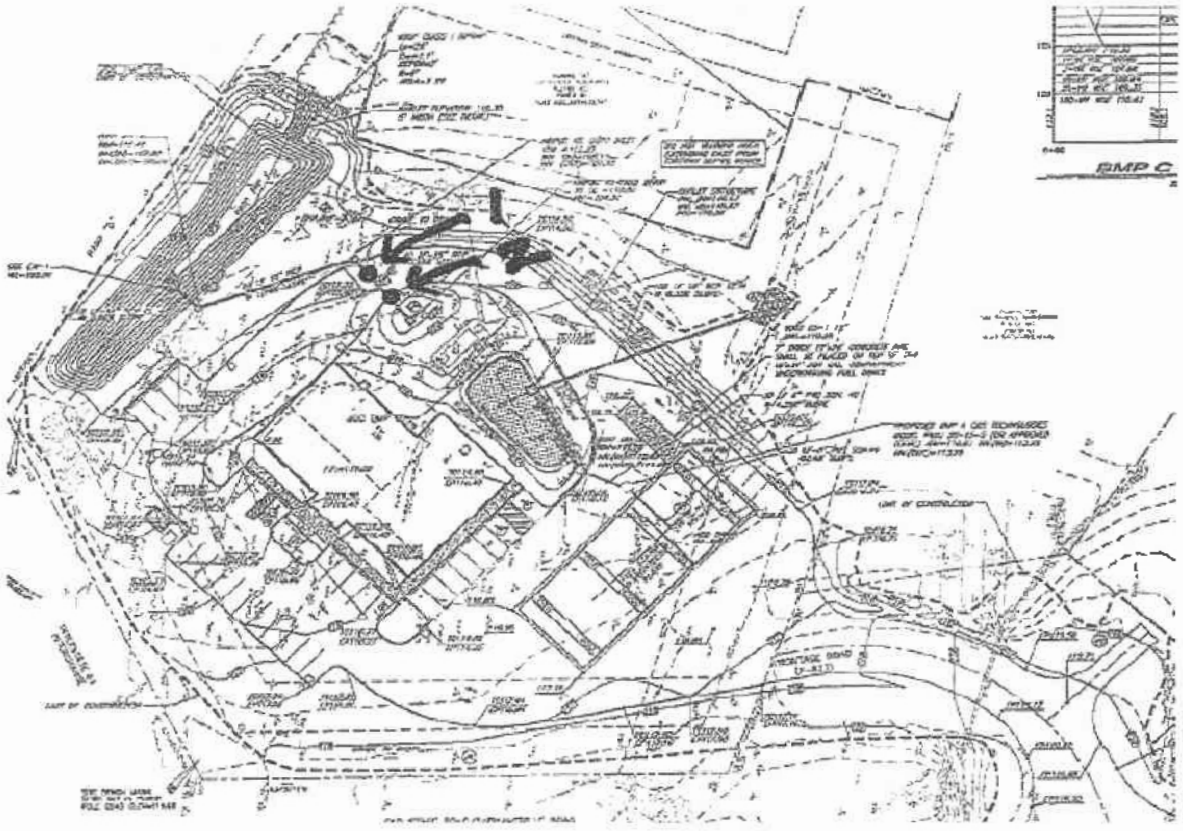
Test locations and test elevations are approximate and are established in the field by the GET Solutions, Inc. technician.

* Note: BFF = Below Finish Floor, BFG = Below Finish Grade, FG = Finished Grade, BSG = Below Subgrade

Reviewed By:

J. Wheeler
G E T Solutions, Inc.

Figure 1



Locations are approximate

LOCATION SKETCH

PROJECT:	Star Express James City County, Virginia	SCALE:	NTS
PROJECT NO:	WM09-150T	DATE:	7/7/2009
CLIENT:	North South Construction, Inc.	PLOT BY:	AL

GET Solutions, Inc.
Geotechnical • Environmental • Testing

G E T Solutions, Inc.
1592-E Penniman Road
Williamsburg, Virginia 23185
Tel: (757) 564-6452
Fax:(757) 564-6453

COMPACTION TEST REPORT (No. 6) - Sheet 1 of 2

Project:	Star Express	Date:	7/6/09
Project Location:	James City County, Virginia	Technician:	A. Libby
Client:	North South Construction, Inc.	Job Number:	WM09-150T
General Contractor:	North South Construction, Inc.	Weather:	Cloudy Temp. (°F) 70's
Grading Contractor:	G. L. Pruett	General Test Location:	Building Pad Retests and 15" RCP

Test Number	Moisture (%)	Dry Density (pcf)	Wet Density (pcf)	Proctor Number	% Proctor		Pass	Fail	Test Elevation*	Test Location (Grid, Coordinates, Roadway Station, etc.)
					Spec	Actual				
1	8.8	122.0	130.5	2	95	100	X		4" BFF	Retest of Test #1on 7/2/2009
2	8.2	123.3	131.0	2	95	101	X		4" BFF	Retest of Test #4 on 7/2/2009
3	10.2	119.1	131.2	1	95	97	X		Subgrade	See Attached Sketch
4	9.5	118.2	129.5	1	95	97	X		Subgrade	See Attached Sketch

Compaction Equipment Used:	Troxler Nuclear Density Gauge	Proctor Number:	1	2
Field Testing Procedure:	ASTM D698	Proctor Type:	ASTM D698	
Testing Depth:	12 inches	Material Description:	Silty SAND (SM)	
Test Conducted on:	Building Pad Fill/Backfill over Storm Drain	Max. Dry Density (pcf):	122.2	122.4
		Optimum Moisture (%):	10.0%	10.4%

Remarks:

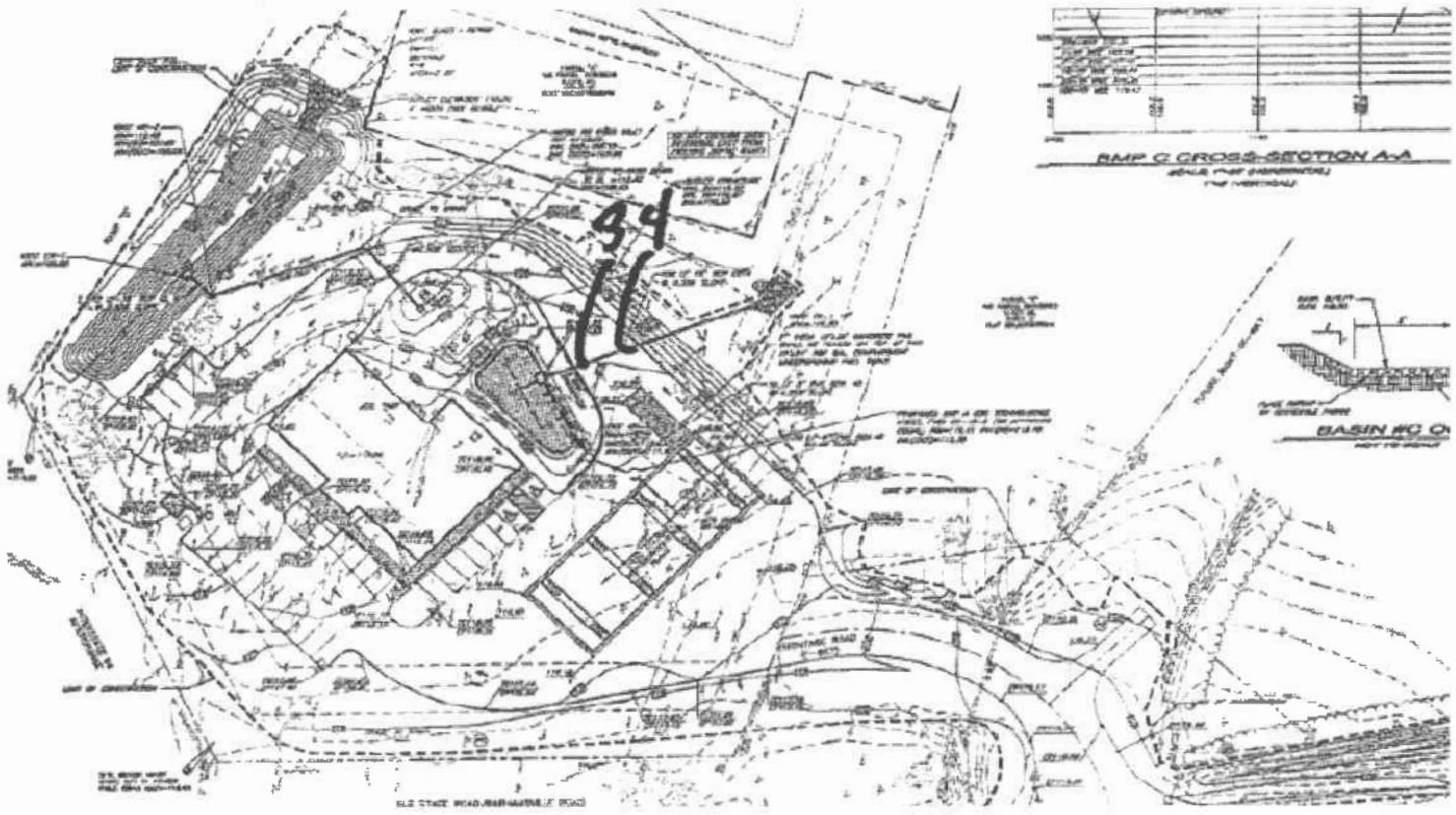
Test locations and test elevations are approximate and are established in the field by the GET Solutions, Inc. technician.

* Note: BFF = Below Finish Floor, BFG = Below Finish Grade, FG = Finished Grade, BSG = Below Subgrade

Reviewed By:

J. Wheeler
G E T Solutions, Inc.

Figure 1



Locations are approximate

LOCATION SKETCH

PROJECT:	**Star Express** **James City County, Virginia**	**SCALE:**	**NTS**
PROJECT NO:	**WM09-150T**	**DATE:**	**7/6/2009**
CLIENT:	**North South Construction, Inc.**	**PLOT BY:**	**AL**

GET Solutions, Inc.
Geotechnical • Environmental • Testing

G E T Solutions, Inc.
1592-E Penniman Road
Williamsburg, Virginia 23185
Tel: (757) 564-6452
Fax:(757) 564-6453

COMPACTION TEST REPORT (No. 8) - Sheet 1 of 1

Project:	Star Express	Date:	1/15/10
Project Location:	James City County, Virginia	Technician:	J. Wagner
Client:	North South Construction, Inc.	Job Number:	WM09-150T
General Contractor:	North South Construction, Inc.	Weather:	Cloudy Temp. (°F) 40's
Grading Contractor:	G. L. Pruett	General Test Location:	BMP "C" Embankment

Test Number	Moisture (%)	Dry Density (pcf)	Wet Density (pcf)	Proctor Number	% Proctor		Pass	Fail	Test Elevation*	Test Location (Grid, Coordinates, Roadway Station, etc.)
					Spec	Actual				
1	20.5	110.2	120.8	1	N/A	92			1' BFG	Embankment - South side of Rip Rap Spillway
2	10.9	116.4	122.3	1	N/A	97			2' BFG	Embankment - South side of Rip Rap Spillway
3	18.9	110.3	138.4	1	N/A	92			1' BFG	Embankment - North side of Rip Rap Spillway
4	10.9	114.4	120.2	1	N/A	95			2' BFG	Embankment - North side of Rip Rap Spillway

Compaction Equipment Used:	N/A	Proctor Number:	4
Field Testing Procedure:	ASTM D698	Proctor Type:	ASTM D698
Testing Depth:	12 inches	Material Description:	Clayey SAND (SC)
Test Conducted on:	Embankment Dam Fill	Max. Dry Density (pcf):	120.1
		Optimum Moisture (%):	11.8%

Remarks: No compaction requirements were indicated on the project plans.

Test locations and test elevations are approximate and are established in the field by the GET Solutions, Inc. technician.

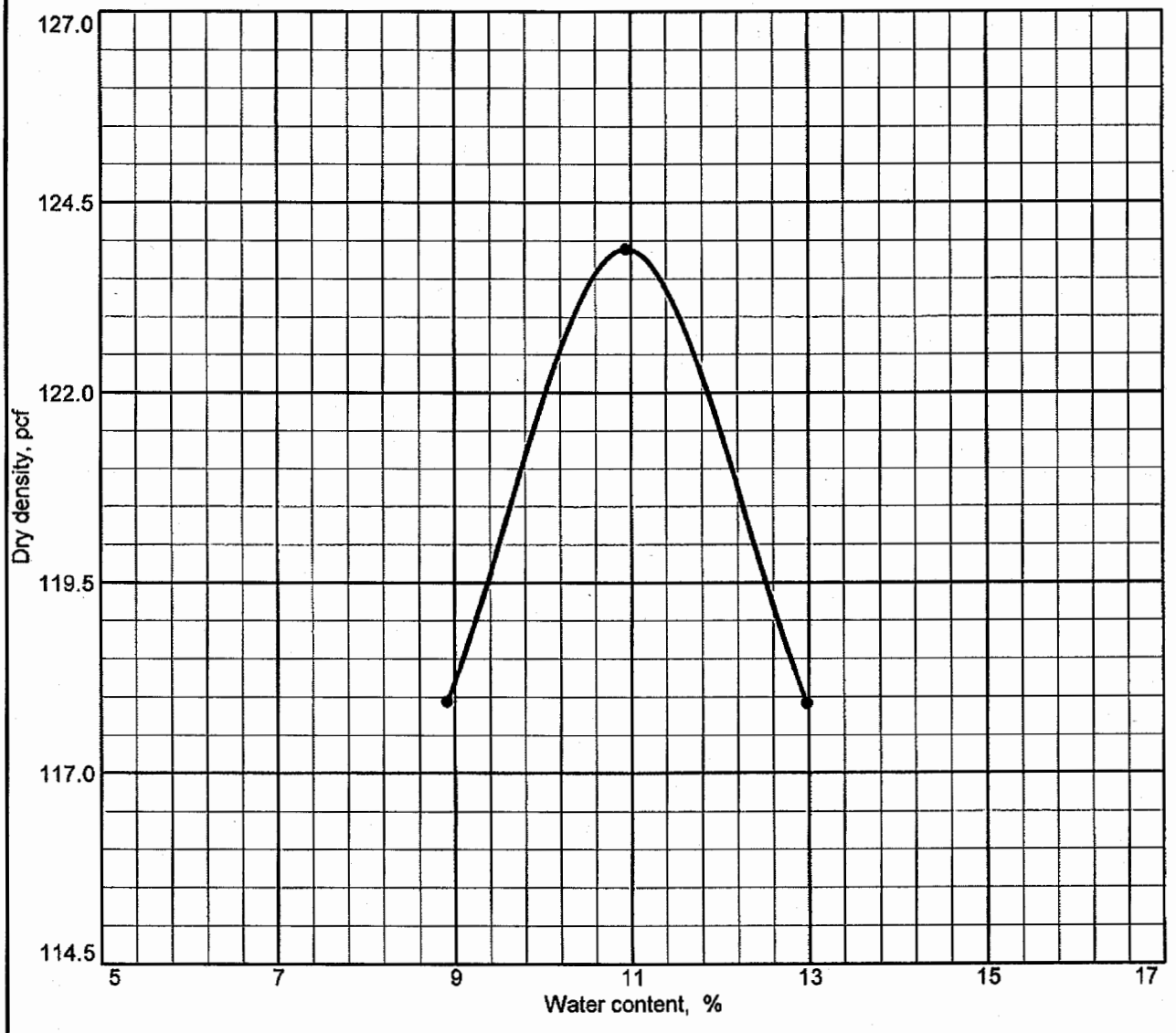
* Note: BFF = Below Finish Floor, BFG = Below Finish Grade, FG = Finished Grade, BSG = Below Subgrade

Reviewed By:

J. Wheeler
G E T Solutions, Inc.

WC099

MOISTURE DENSITY TEST REPORT (PROCTOR CURVE)



Test specification: ASTM D 698-91 Procedure A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
1-2 Ft Below G.	SC	N/A	12.0	Estimated	N/A	N/A	0.0	35.0

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 123.9 pcf Optimum moisture = 10.9 %	Orangish brown, Clayey, fine to medium SAND (SC)

Project No. WM09-150T **Client:** North South Construction, Inc.
Project: Star Express
● **Location:** On-Site Material

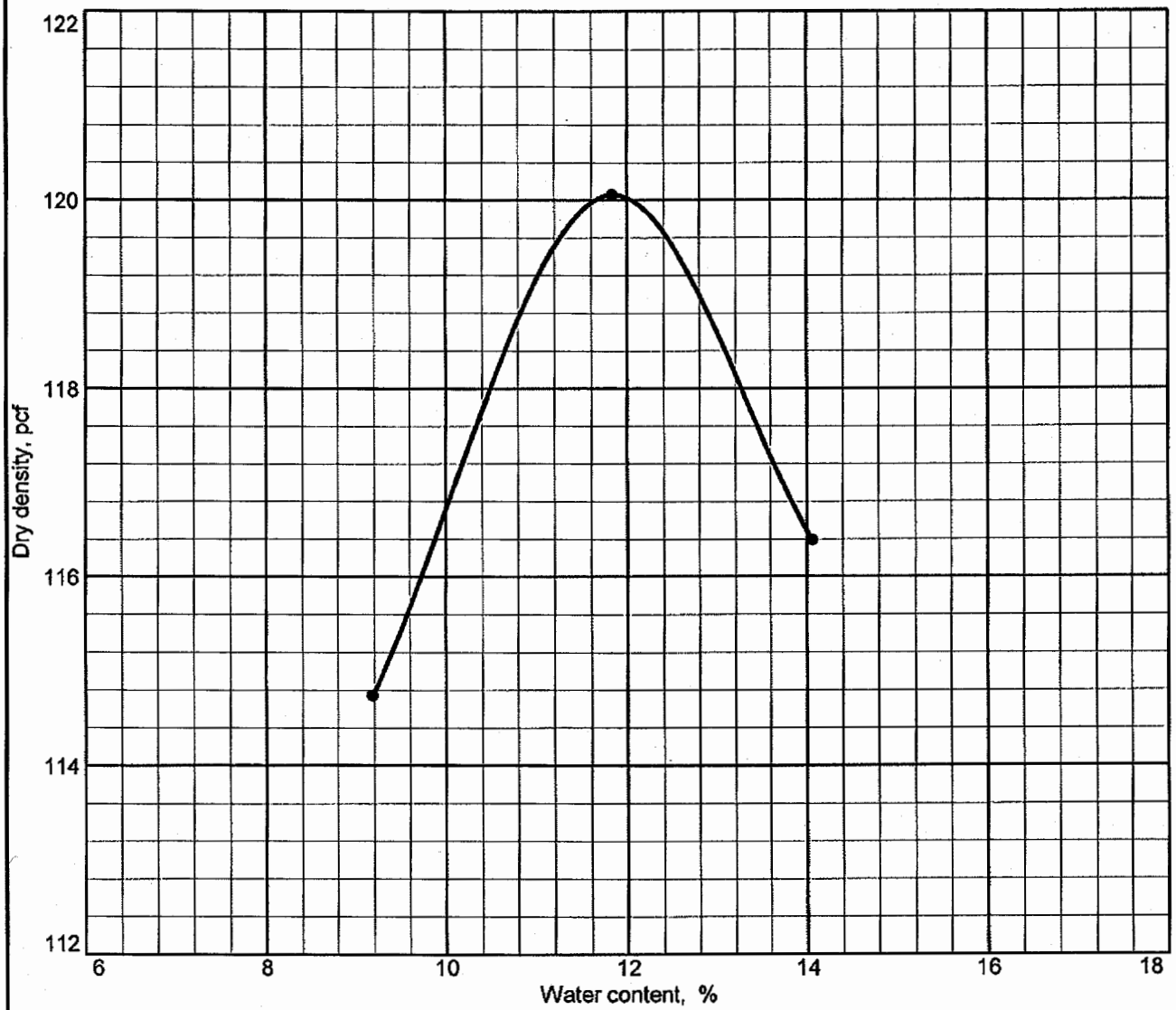
Remarks:
Proctor #5
Sample Obtained: 1/15/10
Sample Tested: 1/17/10

MOISTURE DENSITY TEST REPORT (PROCTOR CURVE)

GET SOLUTIONS, INC.

Figure 2

MOISTURE DENSITY TEST REPORT (PROCTOR CURVE)



Test specification: ASTM D 698-91 Procedure A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
1-2 Ft Below G.	SC	N/A	11.5	Estimated	N/A	N/A	0.0	32.8

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 120.1 pcf Optimum moisture = 11.8 %	Brown, Clayey, fine to medium SAND (SC)

Project No. WM09-150T **Client:** North South Construction, Inc.
Project: Star Express
• **Location:** On-Site Material

Remarks:
Proctor #4
Sample Obtained: 1/15/10
Sample Tested: 1/17/10

MOISTURE DENSITY TEST REPORT (PROCTOR CURVE)

GET SOLUTIONS, INC.

Figure 1

TRANSMITTAL

DATE: July 11, 2006

TO: Environmental

FROM: Joel Almquist, Planner

SUBJECT: **SUP-18-06. Stuckey's Redevelopment.**

ITEMS ATTACHED: Geotechnical Report

ACTION: **Please review and return comments by July 28, 2006.**

Geotechnical report as submitted by GET Solutions Inc. (WMG06-145G; June 22 2006) is acceptable to meet Initial Feasibility Testing & Concept Design testing requirements for the infiltration facility based concept stormwater management plan & speatically address comment #5 by the Environmental Division dated June 16, 2006 for SUP case # SUP-18-06. Note: Geotechnical Report submission is in advance of the plan of development application.

07-24-06

Development Management
101-A Mounts Bay Road
P.O. Box 8784
Williamsburg, VA 23187-8784
P: 757-253-6671
F: 757-253-6822
devman@james-city.va.us

jccEgov.com

Code Compliance
757-253-6620
codecomp@james-city.va.us

Environmental Division
757-253-6670
environ@james-city.va.us

Planning and Zoning
757-253-6685
planning@james-city.va.us

January 15, 2010

Mr. Wheeler,

As a follow-up to our meeting today at the Star Express Fueling Station and Convenience Store in regards to the bio-retention facility that is located adjacent to the main building, I attest that on December 11, 2009, I witnessed and approved of the installation of the bio-retention facility and it's components as follows:

6" PVC underdrain system – Installed per plan specifications

Geotextile liner located on the sides and bottom of facility and above stone filter – Installed per plan specifications

Layer of 8" #57 Stone at bottom of bio-retention facility-Installed per plan specifications

Layer of 3' deep engineered planting soil-Installed per plan specifications

3" mulch top layer-Installed per plan specifications

1' wide and 2' deep curtain drain consisting of #57 stone at edge of pavement-Installed per plan specifications

Following construction silt fence was installed around the facility to prevent sediment contamination from the surrounding areas that do not yet have vegetation established.

If you have any questions please feel free to contact me at (757) 253-6670.

Sincerely,

Earl Croft

James City County Environmental Division

Darryl Cook

From: Jay Wheeler [jwheeler@GETSOLUTIONSINC.com]
Sent: Sunday, February 21, 2010 9:01 AM
To: Darryl Cook; northsouthcon@aol.com
Cc: Michael Majdeski; Valerie Olds
Subject: RE: Star Express - Stuckey's Redevelopment
Attachments: 20100219101959282.pdf

Darryl, attached is the required certifications, one for each facility.
Please let me know if you have any questions, original signature to follow early next week. As we discussed on-site, we included a statement on the bio facility one.

Also, I will email the compaction report and proctors we obtained from the embankment near the spillway to BMP Facility "C" that was performed after our meeting. It wasn't bad, 92% compaction 1 foot down and 95% to 97% compaction below that. I think the upper foot results may have been affected by the deep frost line we had at that time.

Again, let me know if you have any questions or problems.

Thanks, Jay

James R. Wheeler
Senior Project Geologist

G E T Solutions, Inc.
1592 Penniman Road, Suite E
Williamsburg, VA 23185

Ph: (757) 564-6452
Fax:(757) 564-6453
Cell:(757) 761-6026

jwheeler@getsolutionsinc.com

-----Original Message-----
From: Darryl Cook [mailto:decook@james-city.va.us]
Sent: Wednesday, February 17, 2010 11:21 AM
To: Jay Wheeler; northsouthcon@aol.com
Subject: RE: Star Express - Stuckey's Redevelopment

Jay is right - I didn't examine the certification close enough to notice that it was for just the one BMP. The surveyor did give me the information I needed in his as-built drawings - he just needs to provide the certification at this point.

-----Original Message-----
From: Jay Wheeler [mailto:jwheeler@GETSOLUTIONSINC.com]
Sent: Wednesday, February 17, 2010 10:57 AM
To: northsouthcon@aol.com; Darryl Cook
Subject: FW: Star Express - Stuckey's Redevelopment

Rick,

ENVIRONMENTAL – STORMWATER TRANSMITTAL

PROTECTING RESOURCES PRIDE IN DELICATE ENVIRONMENTS

RECEIVED ON
MAR 05 '10
Stormwater Division

James City County
Jamestown 1607

COUNTY PLAN NO: SP-025-07

BMP ID CODE: WC099 + WC0100

WATERSHED: WARE CREEK

- ☐ **ENTIRE RECORD FILE**
- ☐ **ASBUILTS**
- ☐ **CONSTRUCTION CERTIFICATION**
- ☐ **COMPUTATIONS**
- ☑ **OTHER:** DARRYL, THIS IS MY STORMWATER FILE FOR STAR EXPRESS. THERE IS PROBABLY SOME DUPLICATE INFO WITH WHAT YOU ALREADY HAVE BUT IT ALSO INCLUDES MY STORMWATER INSPECTION FORMS.

NAME: MICHAEL MAJDESKI

SIGNATURE: Michael P. Majdeski

DATE: 3/5/2010

Darryl Cook

From: Darryl Cook
Sent: Tuesday, February 23, 2010 8:32 AM
To: 'northsouthcon@aol.com'; jwheeler@GETSOLUTIONSINC.com
Cc: Michael Majdeski; volds@getsolutionsinc.com; clowery@northsouthcon.com
Subject: RE: Star Express - Stuckey's Redevelopment

Yes – I now have everything I need. Thanks for taking care of these items everyone.

Mike – it is ok to release the surety as far as Stormwater is concerned.

From: northsouthcon@aol.com [mailto:northsouthcon@aol.com]
Sent: Monday, February 22, 2010 12:54 PM
To: jwheeler@GETSOLUTIONSINC.com; Darryl Cook
Cc: Michael Majdeski; volds@getsolutionsinc.com; clowery@northsouthcon.com
Subject: Re: Star Express - Stuckey's Redevelopment

Darryl,

Are the reports satisfactory for you to release our bond?

Mike,

You said we could reduce the bond amount for the grass areas. What will that amount be +/- $5,000.00 dollars. I need to get an addendum to the bond from our bonding company.

Thanks,

Rick LaMere

-----Original Message-----
From: Jay Wheeler <jwheeler@GETSOLUTIONSINC.com>
To: Darryl Cook <decook@james-city.va.us>; northsouthcon@aol.com
Cc: Michael Majdeski <MMajdeski@james-city.va.us>; Valerie Olds <volds@getsolutionsinc.com>
Sent: Sun, Feb 21, 2010 9:00 am
Subject: RE: Star Express - Stuckey's Redevelopment

Darryl, attached is the required certifications, one for each facility. Please let me know if you have any questions, original signature to follow early next week. As we discussed on-site, we included a statement on the bio facility one.

Also, I will email the compaction report and proctors we obtained from the embankment near the spillway to BMP Facility "C" that was performed after our meeting. It wasn't bad, 92% compaction 1 foot down and 95% to 97% compaction below that. I think the upper foot results may have been affected by the deep frost line we had at that time.

Again, let me know if you have any questions or problems.

Thanks, Jay

James R. Wheeler
Senior Project Geologist

Project Name: STUCKEY'S REDEVELOPMENT

Location: RT 60 TOANO

Project Number: SP-025-07

Date of Inspection: ON-GO. WK

Inspector(s): M MATUSKI

Date: ON-GO WK2

Time:

BMP Number: 1+2

Infiltration and Filtering Practice Construction Inspection Checklist

Development Status (Active, Inactive, Complete): ACTIVE

Stage of Construction (Pre-Construction, Installation, etc): ON-GO. WK

Key Questions		
Item	X	Comments
1. Type of facility (check all that apply)		
a. Infiltration - C1, C2, C3 or C4	X	
b. Filtration - D2, D3, D4, D5, or D6		
c. Bioretention - D1	X	BIORETENTION NEAR GAS PUMPS
d. Extended detention (storage for Cpv)		
2. Facility Location		
a. Surface	X	
b. Underground	X	
3. Filtration Media		
a. No filtration media (e.g. dry well)	X	
b. Sand		
c. Bioretention soil	X	BIORETENTION ONLY
d. Peat		
e. Other		
4. Hydraulic configuration		
a. On-line facility	X	
b. Off-line facility		
5. Type of pretreatment facility		Pretreatment must be provided
a. Sediment forebay (above ground)		
b. Sedimentation chamber		
c. Grass channel		
d. Grass filter strip		
e. Plunge pool		
f. Stone diaphragm	X	BIORETENTION ONLY
g. Other		Type:

A. Pre-Construction S = Satisfactory U = Unsatisfactory N/A = Not Applicable				
Item	S	U	N/A	Comments
1. Pre-construction meeting	✓			
a. Review of facility details, testing reqts and sequence of construction	✓			
b. Review of required inspections, geo-tech reports, checklists & certificates	✓			

B. Site Preparation

S = Satisfactory U = Unsatisfactory N/A = Not Applicable

Item	S	U	N/A	Comments
1. If infiltration practice, facility is not used for sediment control during construction	✓			INFIL TO BE EXCAVATED FURTHER FOLLOWING FINAL STABILIZATION
2. Stormwater runoff diverted around facility				
3. Tree save and non-compaction areas	✓			
4. Facility location staked out and cleared	✓			

C. Excavation/Grading

S = Satisfactory U = Unsatisfactory N/A = Not Applicable

Item	S	U	N/A	Comments
1. Excavation and grading conform to plans (25 MIN INSPECTION) 7/1/09	✓			BENCHMARK INSPECTION
a. Location, size and depth of facility are correct	✓			
2. If infiltration practice, underlying soils not compacted during excavation	✓			
3. Embankment/berm constructed according to plan	✓			
a. Suitable fill material used for construction of embankment/berm	✓			
b. Compaction completed in accordance with approved plans and specifications	✓			
c. Embankment/berm elevations, slopes and top widths are correct	✓			

D. Installation

S = Satisfactory U = Unsatisfactory N/A = Not Applicable

Item	S	U	N/A	Comments
1. If off-line facility, flow diversion structure installed according to plans			✓	
2. Pretreatment facility installed according to approved plans	✓			
3. Inlet(s) and inlet protection installed				
4. Structural components (e.g. foundation, walls) installed according to plans				
5. Underground chambers or pipes installed correctly with bedding if required	✓			BENCHMARK INSPECTION 12/11/09 per EC (BIO RETENTION ONLY)
6. Liner installed correctly, if applicable	✓			BENCHMARK INSPECTION OKAY 12/10/09
7. Filter bed composition, depth and installation conforms to approved plans and	✓			BENCHMARK INSPECTION OKAY 12/11/09
8. Riser/outlet structure installed correctly	✓			12/2/09
a. Location, dimensions and type of riser are correct	✓			
b. Riser equipped with removable trash rack or maintenance access	✓			
c. Location, dimensions and type of low flow orifice are correct	✓			
d. Low flow orifice installed correctly and adequately protected from clogging	✓			

e. If a filtration system, underdrain system installed correctly	✓			
8. Emergency overflow structure/spillway installed according to plans			✓	

E. *Vegetation*
S = Satisfactory U = Unsatisfactory N/A = Not Applicable

Item	S	U	N/A	Comments
1. Vegetation complies with approved planting plan and specifications				

F. *Final Inspection*
S = Satisfactory U = Unsatisfactory N/A = Not Applicable

Item	S	U	N/A	Comments
1. Contributing drainage area stabilized				
2. If off-line facility, flow diversion installed and operational				
3. Pretreatment facility installed and operational				
4. Inlet(s) installed and operational				
5. Configuration, size and depth of bioretention facility conforms with approved plans				
7. Vegetation established				
8. Riser/Outlet Structure installed and operational				
9. Emergency overflow structure/spillway installed and operational				
10. Maintenance access routes provided				
11. Observation Ports Installed				
12. Flow diversions removed; runoff reaches facility				

G. *Permit Approval and Documentation*
S = Satisfactory U = Unsatisfactory N/A = Not Applicable

Item	S	U	N/A	Comments
1. Construction certification submitted				
2. As-built plans submitted and approved				
3. Performance bond status				
a. Not released				
b. Partial release				
c. Full release				
4. Certificate of completion issued				

Additional Comments:
12/17/09 - (SF) INSTALLED AROUND BIO-RETENTION UNTIL PLANTING BEDS ARE COMPLETED INFILTRATION BASIN WELL STABILIZED AND FUNCTIONING PROPERLY

Actions to be Taken:	X	
1. No action necessary; continue routine inspections		
2. Correct noted deficiencies		Correct by:
a. 1st notice		
b. 2nd notice		
3. Submit modifications to project plans		Submit by:

rev 9/08

Project Name: STUCKEY'S REDEVELOPMENT
Location: RT 30 ADJACENT TO I-64
Project Number: SP-025-07
Date of Inspection: ON GOING
Inspector(s): M. MASIESKI
Date: PRE CON 06/09
Time:

Closed Storm Drain System Construction Inspection Checklist

Development Status (Active, Inactive, Complete): Active

Stage of Construction (Pre-Construction, Installation, etc): _____

Key Questions		
Item	X	Comments
1. Type of closed pipe system		
a. Round	X	
b. Elliptical		
c. Other		
2. Type of pipe material		
a. Reinforced concrete pipe (RCP)		
b. HPDE		
c. Corrugated metal		
d. Other		

A. Pre-Construction S = Satisfactory U = Unsatisfactory N/A = Not Applicable				
Item	S	U	N/A	Comments
1. Pre-construction meeting	✓			6/09 PRE CON
a. Review of plan details, and sequence of construction	✓			↓
b. Review of required inspections, geo-tech reports, checklists & certificates	✓			↓

B. Site Preparation S = Satisfactory U = Unsatisfactory N/A = Not Applicable				
Item	S	U	N/A	Comments
1. Pipe and structures delivered and inspected prior to construction	✓			6/10/09
a. Inspect for material, diameter, dimensions and condition	✓			↓

C. Excavation/Grading S = Satisfactory U = Unsatisfactory N/A = Not Applicable				
Item	S	U	N/A	Comments
1. Excavation and grading conform to plans	✓			7/1/09
a. Trench bottom shaped to permit barrel of pipe to be in direct contact with soil or bedding	✓			↓
b. Areas excavated below established grade shall be backfilled with VDOT #25 or 26 aggregate (unless water is encountered - then #57 aggregate shall be used).				

2. All earthwork shall be in conformance with VDOT Standard and Specification #303				

D. Installation

S = Satisfactory U = Unsatisfactory N/A = Not Applicable

Item	S	U	N/A	Comments
1. Bedding per VDOT 302.03(a)2(b)	✓			7/7/09 INSPECTION
a. Material shall be VDOT #25 or #26 aggregate or as specificied on the approved plans (unless water is encountered - then #57 aggregate shall be used).	✓			
b. Shall be lightly compacted and shaped so pipe is in full contact with bedding				
c. Shall be shaped to accommodate the bell when bell and spigot pipe is used				
2. Placing Pipe per VDOT 302.03(a)2c				
a. Pipe shall be placed beginning at downstream end with bell or groove ends of rigid pipe facing upstream	✓			
b. Pipe shall be inspected before backfill is placed	✓			
3. Joining Pipe per VDOT 302.03(a)2(d)				
a. Rigid pipe sections shall have ends fully entered and inner surfaces flush and even				
b. Joints shall be sealed to form a leak-resistant joint				
c. Flexible pipe sections shall be firmly joined by approved coupling bands to form a leak-resistant joint				
d. When pipes enter structure, the inside of the pipe/structure joint shall be flush and fully mortared	✓			7/12/09 INSPECTION
e. Lift holes in rigid pipe shall be plugged with a lift hole plug furnished by the manufacturer (302.03)	✓			
4. Backfill shall be compacted in horizontal layers not more that six inches in thickness, loose measurement. VDOT 303.04(g)	✓			
5. Compaction of backfill shall be in accordance with VTM-1 to the following densities:	✓			See COMPACTION REPORTS INCLD W/THIS FILE (GET IS GEOTECH) 7/7/09
a. 95% beneath pavement, walks and road shoulders	✓			
b. 90% in other unpaved areas	✓			
6. Testing and Inspection	✓			
a. Each lift shall be tested for compaction on alternating sides of the pipe at intervals not to exceed 300 feet	✓			
b. Pipe shall be inspected before any backfill is placed. (VDOT 302.03(a)2c)	✓			

E. Final Inspection S = Satisfactory U = Unsatisfactory N/A = Not Applicable				
Item	S	U	N/A	Comments
1. Pipes and structures shall be free of sediment and debris				
2. All inlet protection measures removed				
3. All joints sealed				
4. Outlet protection installed and operational				
5. Configuration and dimensions of pipe system conforms with approved plans				

G. Permit Approval and Documentation S = Satisfactory U = Unsatisfactory N/A = Not Applicable				
Item	S	U	N/A	Comments
1. Construction certification submitted and				
2. As-built plans submitted and approved				
3. Performance bond status				
a. Not released				
b. Partial release				
c. Full release				
4. Certificate of completion issued				

Additional Comments:

12/17/09 - INQUIRED BY SITE SUPT. INTENDENT THAT AS-BUILTS FOR POND + STORM SYSTEM ARE CURRENTLY BEING COMPLETED

Actions to be Taken:		X	
1. No action necessary; continue routine			
2. Correct noted deficiencies			Correct by:
a.	1st notice		
b.	2nd notice		
3. Submit modifications to project plans			Submit by:

rev 9/08

STORMWATER DIVISION

Preconstruction Meeting Checklist

Project: STUCKEY'S REDEVELOPMENT

Date: 6/19/09 **Time:** 11 ☑ AM ☐ PM

Permittee: AMERICAN DYNC HOLDINGS TOWNO **Address:** 4595 SANDESHARA ROAD PRINCE GEORGE, VA 23875

Contractor: NORTH SOUTH CONSTRUCTION

Phone No.: 804-595-1762 804-641-2974 **Fax No.:** 804-595-1766

Address: 12224 Wilfing Court; MIDLOTHIAN VA 23112

1. **Timing of Installation of Stormwater Facilities:**

   A. **Narrative Plan**

   B. **Contractor-Developed Sequence of Construction**

2. **Inspection Requirements for Stormwater Facilities:**

_____	**Wet Ponds**	_____	**Extended Dry Detention**
_____	**Wetlands**	_____	**Outlet Protection**
_____	**Infiltration**	_____	**Stormwater Conveyance Channels**
_____	**Filtering Systems**	_____	**Storm Drainage System (Pipe)**
_____	**Open Channel Systems**	_____	**Other**
_____	**Sediment Basins**		

3. **Inspection and Enforcement Procedures**

   A. **Permittee/Contractor Inspections:** _____

   B. **County Inspections:** _____

      1. **Benchmark:** _____

      2. **Routine:** _____

Rev. 09/08

JAY WHEELER - GET

Rick LaMere - 804-595-1672

North/South 804-595-1762
804-641-3897

Stormwater Division

Preconstruction Meeting Checklist

C. **Enforcement Actions:** _____

1. **Inspection Reports & Initial Contact:** _____
2. **Notice Comply:** _____
3. **Stop Work Order:** _____
4. **Legal Proceedings:** _____

4. **Limits of Clearing and Non-compaction Areas Protection Measures Inspection**

A. **Non-compaction Areas protected adequately** ☐ Yes ☐ No

B. **Color of Flagging:** _____

C. **Non-compaction Areas Protection Measures, Type:** _____

5. **Issuance of Stormwater Facility Inspection, Record Drawing and Construction Certification; Standard Forms and Instructions (as applicable to project)**

6. **Attendees – Identify contract Person for Stormwater Facilities Construction**

Signature:	Sam Mallisee	Greg Jones	James R. Wheeler
Printed Name:	Sam Mallisee	Greg Jones	James R. Wheeler
Affiliation:	GC Super	G.L. Pruett, Inc.	GET Solutions, Inc.
Address:	12226 Wilfong Ct Midlothian VA 23112	10996 Richardson Rd. Ashland, Va. 23005	1592 Penniman Rd. Suite E Williamsburg, VA 23185
Phone No.:	641-2974	804-798-3584	757-564-6452

7. **Comments:** _____

_____

County Representative: Darryl Cook **Date:** 6/19/09

Rev. 09/08

STORMWATER FACILITIES

Data Sheet and Application for Certificate to Construct

Date of Application: June 17, 2009 JCC CASE: SP-21-2009

I. GENERAL INFORMATION:

a. Project Name: Stuckey's Redevelopment (SP Amendment)
b. Project Address: 9220 Old Stage Road
c. Developer: American DYNC Holdings Torno
d. Submitted By: North South Construction
e. Contact Person: Sam Mollisee
f. Address: _____
g. Phone: _____ Fax: _____ Email: _____
h. Tax Map number(s) _____

II. STORMWATER CONVEYANCE SYSTEM

TYPE OF CONVEYANCE	LENGTH (FT)	FEE AMOUNT ($0.90/LF)
STORM DRAIN	203'	183
OPEN CHANNEL		
TOTALS		

III. BEST MANAGEMENT PRACTICE

COUNTY BMP TYPE	BMP DESCRIPTION	NUMBER of BMPs	FEE AMOUNT ($900/BMP)
C4	Infiltration	1	N/A *
D1	Bioretention	1	N/A *
	* BMPs not necessary for		
	Chesapeake Bay compliance		
TOTAL			

IV. TOTAL FEE: TABLE II: $183 + **TABLE III:** _____ = **TOTAL FEE** $183

Reviewed by: David Cook Inspection fee of: $ 183.00 Paid on: 6/19/09
Certificate issued on 6/19/09

Revised: 08/ 2008

Certificate to Construct Stormwater Facilities

AMERICAN DYNC HOLDINGS TOWNO is hereby granted a Certificate to Construct Stormwater Facilities as shown on the approved construction documents for the project. The stormwater facilities shall be installed in accordance with the Virginia Department of Transportation Standards and Specifications, the Virginia Stormwater Management Handbook, the James City County Guidelines for Design and Construction of Stormwater Management BMPs, and the approved construction documents. The James City County Stormwater Division shall inspect these facilities for conformance with these referenced documents in accordance with Sections 19-62(d) and 24-159(3) of the County Code.

LOCATION AND DESCRIPTION

Project: Stuckey's Redevelopment

County Plan Number: SP-0021-2009

Stormwater Management Facilities: Infiltration; Bioretention

Stormwater Conveyance Facilities: Storm Drain – 203 feet

Conditions: _____

Approved by: Daryl Elcock Date: June 19, 2009

Note:

- **Certificate to construct is not valid without a Land Disturbing Permit.**
- **Work cannot begin until after a Preconstruction Meeting has been held onsite with the Stormwater Division.**
- **The Certificate to Construct and the approved construction plans must be onsite at all times.**

Stormwater Facilities Inspection Fee Program Preconstruction Policy and Checklist

Purpose

In accordance with Chapters 19 and 24 of the James City County Code, inspections are required for stormwater facilities constructed for all development projects. This policy establishes the guidelines for the stormwater inspection program preconstruction meeting and contains necessary documentation of the meeting.

Guidelines

1. The meeting will be held in conjunction with the Erosion and Sediment Control preconstruction meeting conducted by the Environmental Division. It is the responsibility of the owner/developer to schedule the preconstruction meeting. If a joint meeting is not possible because of unusual extenuating circumstances, then an alternate meeting can be arranged on a case-by-case basis. However, no work on any stormwater facility (BMP or storm drain pipes) can begin until the meeting is conducted.

2. Representatives of the owner/developer, general contractor, site contractor, pipe contractor, and a geotechnical engineer responsible for certifying the facilities' construction must be in attendance at the meeting. If all these representatives are not in attendance at the meeting, the meeting will be rescheduled and a Certificate to Construct stormwater Facilities will not be issued.

3. The stormwater portion of the meeting shall be conducted by the Stormwater Division (Division) representative who will inform the attendees of the minimum requirements and procedures necessary to document and certify the construction of the stormwater facilities in accordance with the approved development plans. Checklists, documentation requirements, and inspection schedules will be presented and discussed by the Division representative.

4. The approved construction plans will be reviewed at the meeting to ensure all parties are aware of the various stormwater facilities and the construction requirements including the timing of installation associated with each facility.

5. The Division representative will inform the attendees about the enforcement procedures that will be undertaken to correct any deficiencies found during the inspection process. All observations of noncompliance with the approved plans and specifications shall be documented and communicated to the contractor. If the noncompliance is not corrected immediately, the contractor and owner will be given a Notice to Comply with and appropriate time frame for correction. If the work has not been corrected, a Stop Work Order will be issued and remain in force until the problem is corrected.

6. Certification requirements will also be discussed. At the completion of the project, all stormwater facilities will require completion of a construction certification and record drawings. In addition, any temporary sediment control measure that will be converted to a permanent BMP will be required to have an interim certification completed by the geotechnical engineer.

7. The signature of each of the meeting attendees and their contact information shall be required on the checklist at the conclusion of the meeting.

Rev. 09/08

STORMWATER DIVISION

Preconstruction Meeting

Project: Stuckey's Redevelopment Date: 6/19/09

1. Is the person who will be certifying the construction of the stormwater facilities present?

   YES ☑ NO ☐ Name: Jay Wheeler - GET

2. Is the contractor (s) who will be installing the stormwater facilities present?

   YES ☑ NO ☐ Name: Greg Jones GL Prwett Const

3. Is a representative of the owner/developer present?

   YES ☐ NO ☐ Name: _____

4. Is a representative of the general contractor present?

   YES ☑ NO ☐ Name: Sam Mollisee, North Smith

5. A copy of the approved site plan is required to be on the project site daily.

6. Are there any proposed revisions to the approved plan pending?

   YES ☐ NO ☑

7. Any proposed changes to the approved plan must be submitted to James City County for review and approval prior to implementation.

8. Are any representative present aware of any discrepancies, errors or deficiencies with the approved plan?

   YES ☐ NO ☑

9. Are all representatives aware of the inspection and documentation requirements for the project?

   YES ☐ NO ☐

County Representative: Darryl Cook

Rev. 09/08

7-18-06

SCOTT,
ON 2ND LOOK
PERM. TESTS O.K.
NEED TO REVIEW
SPECIFICS WHEN
PLAN COMES IN.
B

~~Need cont. certif~~
~~Check on Stone~~

~~Diaphragm~~ - ok

~~Y~~ 06Z

WC099 - Inf

WC100 - Bio

WC101 - Manuf

12/7/09

GREG - GL. PRUITT

O (804) 748 3897

C (804) 402 1864

BIO-RETENTION
INSPECTION
1:00PM 12/7/09

PHOTOS FROM CHICK HAVEN TO ERNIE

12/11/09 - 9:00AM Inspect. 1st complete

11:00 - 3:00 - Pipe, Storm, Fabric installed
Began Fill