See also PC201

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: **PC200**

DATE VERIFIED: **October 31, 2012**

QUALITY ASSURANCE TECHNICIAN: **Leah Hardenbergh**

Leah Hardenbergh

LOCATION: WILLIAMSBURG, VIRGINIA

Stormwater Division

MEMORANDUM

DATE: March 13, 2010

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

FROM: Jo Anna Ripley, Stormwater

PO: 270712

RE: Files Approved for Scanning

General File ID or BMP ID: PC200

PIN: 3822400005

Subdivision, Tract, Business or Owner Name (if known): New Town

Property Description: Blocks 6 & 7 Parcel A

Site Address: 4935 Courthouse Street

(For internal use only) **Box** 3 **Drawer:** 2

Agreements: (in file as of scan date) **Y** **Book or Doc#:** 040028871 **Page:**

000012573 333

Comments

Inspection Maintenance Agreement includes parcel 3822400005 4935 Courthouse Street and 3822400002 5100 Center Street aka Blocks 6 & 7 Parcel B New Town. The Street address listed on the Inspection Maintenance Agreement is wrong.

COPY

COUNTY OF JAMES CITY, VIRGINIA

DECLARATION OF COVENANTS

INSPECTION/MAINTENANCE OF DRAINAGE SYSTEM

THIS DECLARATION, made this 26th day of October, 20 04, between New Town Associates, LLC, and all successors in interest, ("COVENANTOR(S),") owner(s) of the following property:

Street Address: 5216 Monticello Avenue

Legal Description: Parcel "A" and Parcel "B" of Block 6 and Block 7 New Town

Project Name: New Town Section 4 Blocks 6 and 7 and New Town - Movie Theatre

Document No. _____, Deed Book _____, Page No. 333;

Instrument No. 000012573, and the County of James City, Virginia ("COUNTY.")

WITNESSETH:

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, 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.

Recorded on 12/2/2004.

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.

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) have executed this DECLARATION OF COVENANTS as of the date first above written.

COVENANTOR(S)

New Town Associates, LLC
BY: _____

Print Name/Title John P. McCann, Executive Director

ATTEST:

_____

Says this is an original signature.

CO' _____

Print Name/Title _____

ATTEST:

_____

COMMONWEALTH OF VIRGINIA

CITY/COUNTY OF WILLIAMSBURG

I hereby certify that on this 26th day of OCTOBER, 2004, before the subscribed, a Notary Public of the State of Virginia, and for the City/County of WILLIAMSBURG, aforesaid personally appeared JOHN P. McCANN, EXECUTIVE DIRECTOR and did acknowledge the aforegoing instrument to be their Act.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal this 26th day of OCTOBER, 2004.

Teresa Cusfman Knighten
Notary Public

My Commission expires: 8/31/08

Approved as to form:

Asst. County Attorney

This Declaration of Covenants prepared by:

TERRESA KNIGHTEN
(Print Name)

ADMINISTRATIVE ASSISTANT
(Title)

4801 COURTHOUSE ST, STE 329
(Address)

WILLIAMSBURG, VA 23188
(City) (State) (Zip)

(757) 565-6200
(Phone Number)

drainage1.pre

Revised 06/04

James City County, Virginia
Environmental Division

Stormwater Management/BMP Record Drawing and Construction Certification Review
Tracking Form

County Plan No.: New Town Sec 2+4 Block 6+7
Project Name: SP-19-05 ; SP-102-04
Stormwater Management Facility: PC 200 Double 8x6 Filtrera 7-1-A & 7-1-B
BMP Phase #: ☐ I ☐ II ☒ III

- ☒ Information Package Received. Date/By: AES MAR 24 '06
- ☐ Administrative Check.
  - ☒ Record Drawing Date/By: AES MAR 24 '06 Instrument #
  - ☒ Construction Certification Date/By: AES 3/24/06 0400288 21 +
  - ☒ RD/CC Standard Forms (Required for all BMPs after Feb 1st 2001 Only)
  - ☒ Insp/Maint Agreement #/Date: BLANKET NEW TOWN 30000/4769, 7/26/00
  - ☒ BMP Maintenance Plan Location: IN PLAN, MFGRS LIT, VSMH
  - ☐ Other: Sheet 10
- ☒ Standard E&SC Note on Approved Plan Requiring RD/CC or County comment in plan review file.
  ☒ Yes ☐ No Location: Note 20 Sheet 9
- ☒ Assign **County BMP ID Code #**: Code: PC 200
- ☒ Preliminary Input/Log into Division's "As-Built Tracking Log"
- ☒ Add Location to GIS Database Map. Obtain site information (GPIN, Owner, Site Area, Address, etc.)
- ☒ Preliminary Log into Access BMP Database (BMP ID #, Plan No., GPIN, Project Name, etc.)
- ☒ Active Project File Review (correspondence, H&H, etc.).
- ☒ Initial As-Built File setup (Label, copy hydraulics, BMP plan and detail information, etc.).
- ☐ NA Inspector Check of RD/CC (forward to inspector using transmittal for cursory review).
- ☒ Pre-Inspection Drawing Review - Approved Plan (Quick look prior to Field Inspection).
- ☒ Final Inspection (FI) Performed Date: 1/17/08 JLB
- ☒ Record Drawing (RD) Review (***) Date: 5/2/06
- ☒ Construction Certification (CC) Review Date: 5/2/06
- ☒ Actions:
  - ☒ No comments.
  - ☐ Comments. Letter Forwarded. Date:
    - ☐ Record Drawing (RD)
    - ☐ Construction Certification (CC)
    - ☐ Construction-Related (CR)
    - ☐ Site Issues (SI)
    - ☐ Other :
- ☐ Second Submission:
- ☐ Reinspection (if necessary):
- ☒ Acceptable for stormwater managment facility purposes (RD/CC/CR/Other). Proceed with bond release.
- ☒ Complete "Surety Request Form".
- ☒ Check/Clean active file of any remaining material and finish "As-Built" file.
- ☒ Add to County BMP Inventory/Inspection schedule (Phase I, II or III).
- ☒ Copy Final Inspection Report into County BMP Inspection Program file.
- ☒ Obtain Digital Photographs of BMP and log into computer.
- ☐ N/A Request mylar/reproducible from As-Built plan preparer.
- ☒ Complete "As-built Tracking Log"
- ☒ Last check of BMP Access Database.
- ☐ Add to JCC Hydrology & Hydraulic database (optional).
- ☐ Add to PRIDE BMP ratings database.

Final Sign-Off

Plan Reviewer: Jason Beck Date: 1/23/08

*** See separate checklist, if needed.

1/23/08

James City County, Virginia
Environmental Division

Stormwater Management / BMP Facilities
Record Drawing and Construction Certification Forms

(Note: In accordance with the requirements of the Chesapeake Bay Preservation Ordinance, Chapter 23, Section 23-10(4), BMP's shall be designed and constructed in accordance with the manual entitled James City County Guidelines for Design and Construction of Stormwater Management BMP's. Erosion and sediment control policy and approved 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 involving the construction of an impounding structure or dam embankment, certification is required by a Professional Engineer who has inspected the structure during its construction. Currently there are over 20 water quality type BMP's accepted by the County.)

Section 1 – Site Information:

Project Name: New Town
Structure/BMP Name: Filterra #7-1-A
Project Location: New Town Block 6 & 7
BMP Location: New Town Block 6 & 7 (See Attached Sketch)
County Plan No.: SP - 019 - 05

Project Type:
- ☐ Residential
- ☐ Commercial
- ☐ Institutional
- ☐ Public
- ☒ Other Mixed Use
- ☐ Business
- ☐ Office
- ☐ Industrial
- ☐ Roadway

Tax Map/Parcel No.: (38-2) 24-0-0005
BMP ID Code (if known): PC200
Zoning District: MU
Land Use:
Site Area (sf or acres): 3.1 Ac.

Brief Description of Stormwater Management/BMP Facility: #7-1-A is a Filterra (Manufactured Tree Box Filter)

Nearest Visible Landmark to SWM/BMP Facility: New Town Movie Theater

Nearest Vertical Ground Control (if known):
☐ JCC Geodetic Ground Control ☐ USGS ☐ Temporary ☐ Arbitrary ☐ Other
Station Number or Name: _____
Datum or Reference Elevation: _____
Control Description: _____
Control Location from Subject Facility: _____

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: October 2004
Facility Monitored by County Representative during Construction: ☐ Yes ☐ No ☒ Unknown
Name of Site Work Contractor Who Constructed Facility: Branscome, Inc.
Name of Professional Firm Who Routinely Monitored Construction: AES Consulting Engineers
Date of Completion for SWM/BMP Facility: November 2005
Date of Record Drawing/Construction Certification Submittal: 2/24/06

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

Section 3 – Owner / Designer / Contractor Information:

Owner/Developer: *(Note: Site Owner or Applicant responsible for development of the project.)*

Name: New Town Associates, L.L.C.
Mailing Address: 4801 Courthouse St., Suite 329

Business Phone: (757) 565-6200 Fax:(757) 565-6291
Contact Person: John McCann Title:

Design Professional: *(Note: Professional Engineer or Certified Land Surveyor responsible for the design and preparation of plans and specifications for the Stormwater Management / BMP facility.)*

Firm Name: AES Consulting Engineers
Mailing Address: 5248 Olde Towne Rd., Suite 1

Business Phone: (757) 253-0040
Fax: (757) 220-8994
Responsible Plan Preparer: Robert Cosby III, P.E.
Title: Project Manager
Plan Name: New Town - Block 6 & 7
Firm's Project No. 6632-E-21-1
Plan Date: 04/13/05
Sheet No.'s Applicable to SWM/BMP Facility: 5 / 10 / ____ / ____ / ____

BMP Contractor: *(Note: Site Work Contractor directly responsible for construction of the Stormwater Management / BMP facility.)*

Name: Branscome, Inc.
Mailing Address:

Business Phone:
Fax:
Contact Person: Danny Johnson
Site Foreman/Supervisor: Dwight Dunn
Specialty Subcontractors & Purpose (for BMP Construction Only):

Section 4 – Professional Certifications:

Certifying Professionals: *(Note: A Registered Professional Engineer of Certified Land Surveyor is responsible for preparation of a Record Drawing, sometimes referred to as an As-Built plan, for the drainage system for the project including any Stormwater Management/BMP Facilities. A Registered Professional Engineer is responsible for the inspection, monitoring and certification of Stormwater Management / BMP facilities during its construction.)*

Record Drawing and Construction Certifications for Stormwater Management / BMP Facilities

Record Drawing Certification

Firm Name: _____
Mailing Address: _____

_____
Business Phone: _____
Fax: _____

Name: _____
Title: _____

Signature: _____
Date: _____

I hereby certify to the best of my knowledge and belief that this record drawing represents the actual condition of the Stormwater Management / BMP facility. The facility appears to conform with the provisions of the approved design plan, specifications and stormwater management plan, except as specifically noted.

_____ (Seal)

Virginia Registered Professional Engineer
Or Certified Land Surveyor

Construction Certification

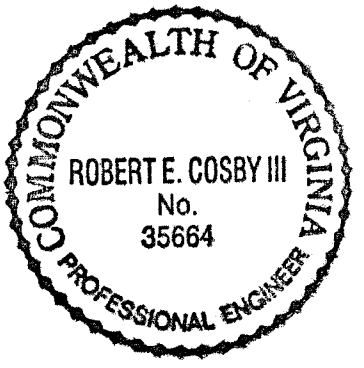
Firm Name: AES Consulting Engineers
Mailing Address: 5248 Olde Towne Rd., Suite 1

_____
Business Phone: (757) 253-0040
Fax: (757) 220-8994

Name: Robert Cosby III, P.E.
Title: Project Manager

Signature: _____
Date: 3/14/05

I hereby certify to the best of my knowledge and belief that this Stormwater Management / BMP facility was monitored and constructed in accordance with the provisions of the approved design plan, specifications and stormwater management plan, except as specifically noted.



_____ (Seal)

Virginia Registered
Professional Engineer

James City County, Virginia
Environmental Division

Stormwater Management / BMP Facilities
Record Drawing and Construction Certification

Standard Forms & Instructions

PC200
7-1-A

Issue Date
February 1, 2001

7-3-B
8'x 6' FILTERRA
RIM=102.80
(SEE DETAIL
SHEET 10)

7-3-A
8'x 6' FILTERRA
RIM=102.80
(SEE DETAIL
SHEET 10)

6" HDPE
PIPE

7-1-B
8'x 6' FILTERRA
RIM=102.80
(SEE DETAIL
SHEET 10)

7-1-A
8'x 6' FILTERRA
RIM=102.80
(SEE DETAIL
SHEET 10)

96 LF
24" RCP
@ 1.3%

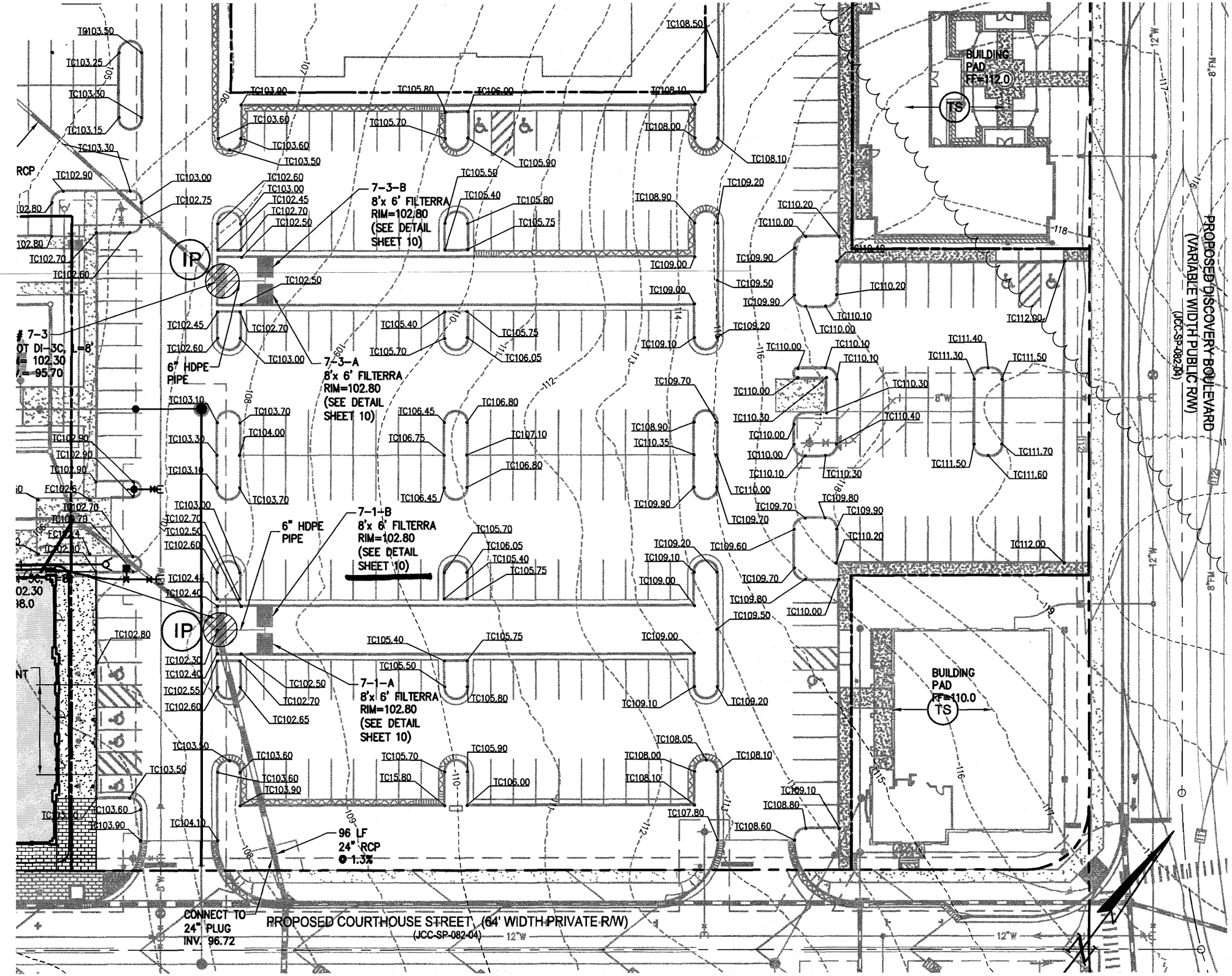
CONNECT TO
24" PLUG
INV. 96.72

BUILDING
PAD
FF=112.0

BUILDING
PAD
FF=110.0

PROPOSED DISCOVERY BOULEVARD
(VARIABLE WIDTH PUBLIC R/W)
(JCC-SP-082-04)

PROPOSED COURTHOUSE STREET (64' WIDTH PRIVATE R/W)
(JCC-SP-082-04)


7-3-B
8'x 6' FILTERRA
RIM=102.80
(SEE DETAIL
SHEET 10)
7-3-A
8'x 6' FILTERRA
RIM=102.80
(SEE DETAIL
SHEET 10)
6" HDPE
PIPE
7-1-B
8'x 6' FILTERRA
RIM=102.80
(SEE DETAIL
SHEET 10)
7-1-A
8'x 6' FILTERRA
RIM=102.80
(SEE DETAIL
SHEET 10)
6" HDPE
PIPE
96 LF
24" RCP
@ 1.3%
CONNECT TO
24" PLUG
INV. 96.72
BUILDING
PAD
FF=112.0
BUILDING
PAD
FF=110.0
TS
IP
PROPOSED DISCOVERY BOULEVARD
(VARIABLE WIDTH PUBLIC R/W)
(JCC-SP-082-04)
PROPOSED COURTHOUSE STREET (64' WIDTH PRIVATE R/W)
(JCC-SP-082-04)

SP-102-04
AMEND SP-45

CTION 7

SECTION 3

PC 201
TWO FILTERRA
7-3-A UNITS
7-3-B

SECTION 4

VILLAGE
GREEN

DISCOVERY BOULEVARD

PHASE III ROADW
(JCC-SP-082-0

PHASE III ROADWAY
(JCC-SP-082-04)

BLOCK 8

PHASE 1B

THEATER

PC 200
TWO FILTERRA
7-1-A UNITS
7-1-B

PEC
SQUA

PHASE 1A

NEW TOWN AVENUE

CENTER STREET

COURTHOUSE STREET

PARCEL E
(MIXED USE)

PARCEL D
(MIXED USE)

PARCEL C
(CORNER
POCKET)

URE
#54

BLOCK 5
PARCEL A

PARCEL F
(OFFICE
BUILDING)

SECTION 2

MAIN STREET

PARCEL E
(OFFICE
BUILDING)

BMP#53
JCC BMP I.D. CODE
PC 173

PARCEL B
(SUNTRUST)

BLOCK 2
PARCEL A

PARCEL D
(1st AVANTAGE
FED. CREDIT UNION)

PARCEL B
(W.E. WOOD)

MONTICELLO AVENUE EXTENDED

A.V.I.

NEW TOWN UNITED
METHODIST CHURCH

00_NEW_TOWN_SEC_2THRU4_BLOCK6AND7 - 013

NOTE:
THE EXISTING BMP FACILITY
FACILITY WHICH PROVIDES 2
DETENTION FOR THE WATER
THE OWNER OF THIS FACILI
ASSOCIATES, LLC.

FUTURE DEVELOPMENT

LIMITS OF WETLANDS

FUTURE DEVELOPMENT

DISCOVERY BOULEVARD (VARIABLE WIDTH R/W)

NEW TOWN AVENUE (64' R/W)

COURTHOUSE STREET (64' R/W)

CENTER STREET (64' R/W)

COURTHOUSE STREET (64' R/W)

FUTURE

FUTURE

SS#2-32
SS#2-30
SS#2-31
SS#2-29
SS#2-28
SS#2-27
SS#2-26
SS#2-25
SS#2-16
SS#2-15A
SS#2-15B
SS#2-14A
SS#2-14B
SS#2-13B
SS#2-12
SS#2-11
SS#2-10B
SS#2-10A
SS#2-10
SS#2-9
SS#2-9A
SS#2-8A
SS#2-8
SS#2-7
SS#6-8

PC 201
7-3-B
7-3-A
PC 200
2.09!
7-1-B
7-1-A

0.09 AC.
0.03 AC.
0.09 AC.
0.07 AC.
0.15 AC.
0.17 AC.
0.12 AC.
0.32 AC.
0.16 AC.
0.21 AC.
0.46 AC.
0.23 AC.
1.23 AC.
0.30 AC.
0.12 AC.
0.17 AC.
0.16 AC.
0.88 AC.
0.59 AC.
0.19 AC.
0.20 AC.
0.10 AC.
0.22 AC.
1.49 AC.
0.15 AC.
0.07 AC.
0.36 AC.
0.17 AC.
0.12 AC.
0.16 AC.
0.24 AC.
0.15 AC.
0.05 AC.
0.15 AC.
0.12 AC.
0.09 AC.
0.84 AC.
0.21 AC.
2.30 AC.
0.17 AC.
0.21 AC.
0.13 AC.
0.22 AC.
0.36 AC.
0.18 AC.
0.18 AC.
0.41 AC.
0.11 AC.
0.20 AC.
0.54 AC.
0.19 AC.
0.26 AC.
0.18 AC.
0.18 AC.
0.29 AC.
0.27 AC.
0.34 AC.
0.84 AC.
0.18 AC.
0.18 AC.
6.69 AC.
0.48 AC.
0.19 AC.
0.14 AC.

RANCES FOR
CC-SP-082-04)
FOR THIS PROJECT.

PROPOSED NEW TOWN AVENUE (64' WIDTH PUBLIC R/W)
(JCC-SP-082-04)

3A
90
50
TO
LRCP
50)

TC103.90
TC104.30
TC107.80
TC108.60
TC108.8
TC103.35
TC103.45
TC103.80
TC103.50
TC103.25
TC103.30
TC103.15
TC103.30
TC102.90
TC103.00
TC102.75
TC102.80
TC102.80
TC102.70
TC102.60
TC102.50
TC102.70
TC102.45
TC102.60
TC103.00
TC102.60
TC103.00
TC102.45
TC102.70
TC102.50
TC103.60
TC103.60
TC103.50
TC105.80
TC106.00
TC108.10
TC103.90
TC105.70
TC108.00
TC105.90
TC105.50
TC105.40
TC105.80
TC105.75
TC108.50
TC108.90
TC109.20
TC109.90
TC109.00
TC109.50
TC109.00
TC109.20
TC109.10
TC106.05
TC103.10
TC103.70
TC104.00
TC103.30
TC103.10
TC103.70
TC106.45
TC106.80
TC106.75
TC107.10
TC106.80
TC106.45
TC108.80
TC110.35
TC109.70
TC110.00
TC110.30
TC109.90
TC109.70
TC105.70
TC106.05
TC105.40
TC105.75
TC109.20
TC109.60
TC109.10
TC109.00
TC109.80
TC109.50
TC105.40
TC105.75
TC109.00
TC105.50
TC105.80
TC109.10
TC109.20
TC102.50
TC102.70
TC102.65
TC103.50
TC103.60
TC105.70
TC105.90
TC108.05
TC108.00
TC108.10

TS

IP

R

210 LF
15" HDPE/RCP
@ 2.0%

2-8'x 6'
FILTERRA
RIM=102.80
(SEE DETAIL
SHEET 10)

2-8'x 6'
FILTERRA
RIM=102.80
(SEE DETAIL
SHEET 10)

SS# 7-3
VDOT DI-3C, L=8'
RIM= 102.30
INV.= 95.70

SS# 7-1
VDOT DI-3C, L=8'
RIM= 102.30
INV.= 98.0

6" HDPE
PIPE

6" HDPE
PIPE

8"W

13+00
12+00
11+00

FC102.50
FC102.6
FC102.4
FC102.70

B FLUSH
I PAVEMENT

BE MUTCD R1-1(30"x30")
HEIGHT

ARE AUTHORIZED TO
STING JCSA WATER LINES

NOTE:
ALL JCSA URBAN EASEMENTS FOR BLOCK 6 & 7 ARE SHOWN ON THIS SHEET. EASEMENTS SHOWN ARE FROM THE FOLLOWING SITE PLANS:
JCC-SP-082-04 - PHASE IV ROADS
JCC-SP-102-04 - BLOCK 6 & 7
JCC-SP-127-04 - RETAIL PHASE I

FUTURE BLOCK 10

RANT
-SP-082-04)

EX. VARIABLE WIDTH
JCSA URBAN EASEMENT
(JCC-SP-082-04)

35'
URB
(JCC

8"W

HT DISTANCE
)'+ TO INTERSECTION

SIGHT DISTANCE
250'+

PROPOSED NEW TOWN AVENUE

(JCC-SP-082-04)

12"W

8" SAN

SIGHT DISTANCE
250'+

SIGHT
150'+

TILITY
T

24" WIDE
WHITE STOP BAR

MUTCD R1-1
"STOP SIGN"

24"
WHIT

EX. 5' UTILITY
EASEMENT

FIRE HYDRANT
(SEE JCC-SP-082-04)

EX. 20'x7'
JCSA URBAN
EASEMENT
(JCC-SP-082-04)

5'R

117'

10'

5'R

8"W

STA 13+30 "6-A"
REMOVE EX. BLOW-OFF
CONNECT TO EX. 8" WATER

80.5'

HANDICAP SIGN

7' FC TO SIGN
(TYP.)

30'

13 SPACES @ 9' EA. = 117'

A. = 90'

13+00

10'

30'

A. = 90'

CG-6 CURB
& GUTTER

6-A" 16' LEFT

5'R

10'

9 SPACES @ 9' EA. = 81'

10'

9 SPACES @ 9' EA PLUS 1
VAN ACCESS AISLE = 90'

10'

ASSY.

5'R (TYP.)

5'R

CG-6R CURB
& GUTTER (TYP.)

5'R

9'
(TYP.)

5'R

CG-2 CURB
(TYP.)

17.6'

5'R

2' CURB CUT (TYP.)
(SEE DETAIL SHEET 10)

5'R

5'R

10'

9 SPACES @ 9' EA. = 81'

10'

10 SPACES @ 9' EA. = 90'

10'

5'R
(TYP.)

8'x6' FILTERRA

20'

CONC. DUMPSTER PAD
(SEE DETAIL SHEET 10)

URBAN

12+00

10'

9 SPACES @ 9' EA. = 81'

10'

10 SPACES @ 9' EA. = 90'

10'

2'R
(TYP.)

24'

"6-A"

5'R

5'R

5'R

8" PVC WATERLINE

10'

9 SPACES @ 9' EA. = 81'

10'

10 SPACES @ 9' EA. = 90'

10'

5'R

5'R

5'R

30'

5'R
(TYP.)

V.B.

IDTH JCSA
EMENT

CG-2

9 SPACES @ 9' EA. = 81'

10 SPACES @ 9' EA. = 90'

6" DI
WATERLINE

24'

7'

3.5'R

5'R(TYP.)

5'R

5'R

5'R

3.5'R

11+00

24'
(TYP.)

5'R
(TYP.)

18'

7'

8"W

10'

9 SPACES @ 9' EA. = 81'

10'

10 SPACES @ 9' EA. = 90'

10'

5'R

8 SPACES AND 2
VAN ACCESS AISLES
@ 9' EA. = 90'

9'
(TYP.)

18'
(TYP.)

8'x6' FILTERRA

20'

CG-6 CURB
& GUTTER (TYP.)

30'

10'

9 SPACES @ 9' EA. = 81'

10'

10 SPACES @ 9' EA. = 90'

10'

30'

18'

5'R

5'R

5'R

11 SPACES
9' EA. =

CONC.
WHEEL STOP

CG-6R CURB

PC200_NEW TOWN_SEC_2THRU4_BLOCK6AND7 - 016

URB AND
RUCTED
E OF
S PROVIDED
" IS

D-CUTTRU.dwg

PLAIN AREA
TAL LBS.
ER ACRE
00 LBS.
75 LBS.
50 LBS.
ULLED)
ULLED)

LBS.
LBS.
LBS.

LBS.
LBS.
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-PS

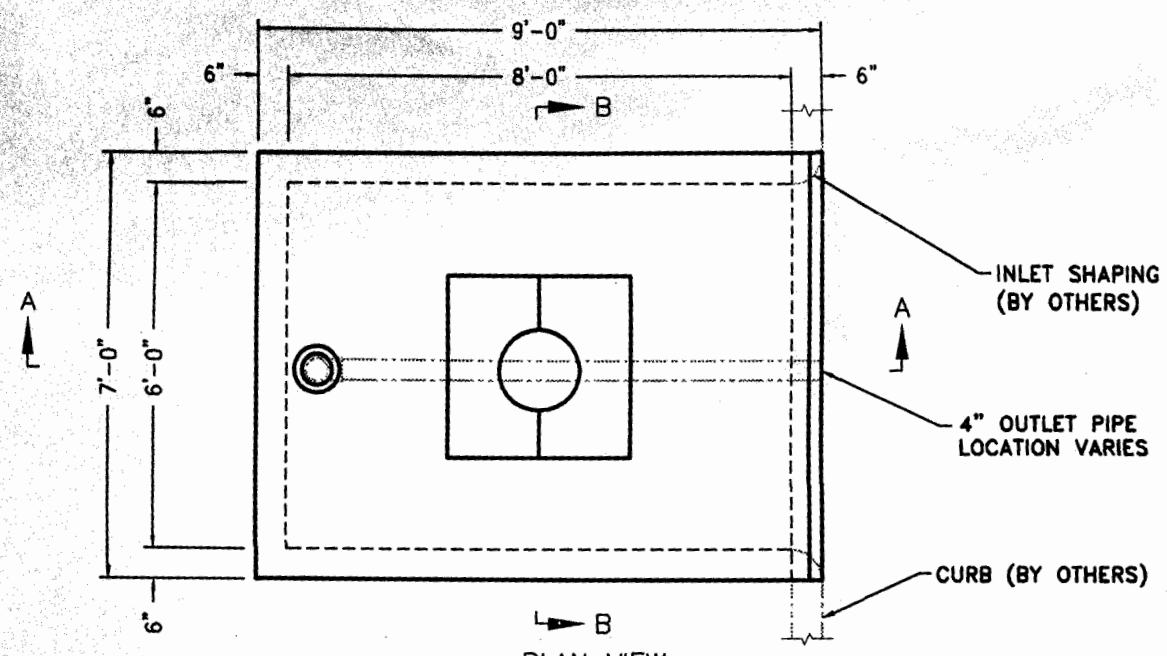
NOTE:

1.) FILTERRA INLETS SHALL BE PROTECTED UNTIL SITE IS STABILIZED. ONCE SITE IS STABILIZED FILTER MEDIA AND PLANTS SHALL BE INSTALLED.

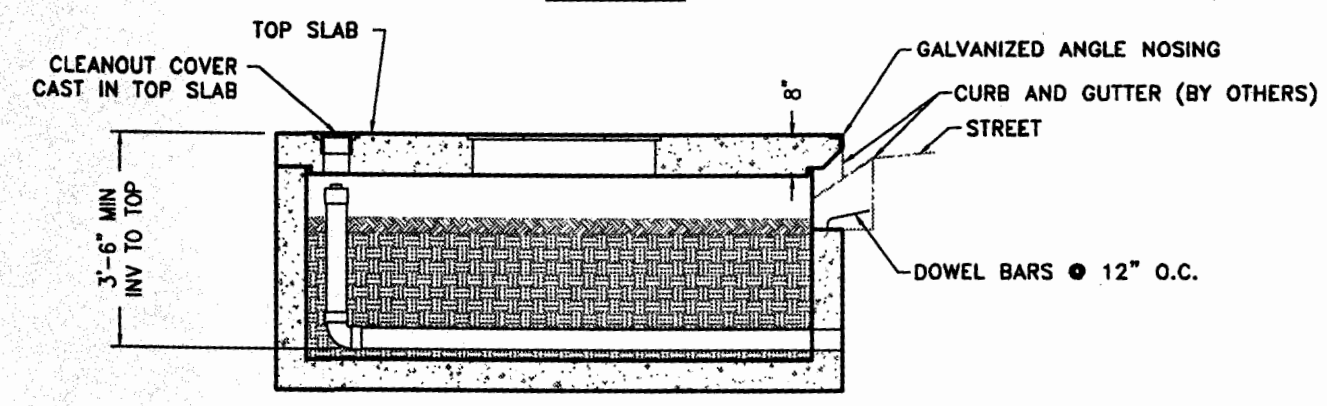
2.) RECORD DRAWING (AS-BUILTS) AND CONSTRUCTION CERTIFICATION OF BMP (FILTERRA INLETS) SHALL BE COMPLETED BY CONTRACTOR IN ACCORDANCE WITH JAMES CITY COUNTY GUIDELINES.

3.) FILTERRA INLETS SHALL BE MAINTAINED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATION AND MINIMUM STANDARD AND SPECIFICATION 3.11C OF THE VIRGINIA STORM WATER MANAGEMENT HANDBOOK.

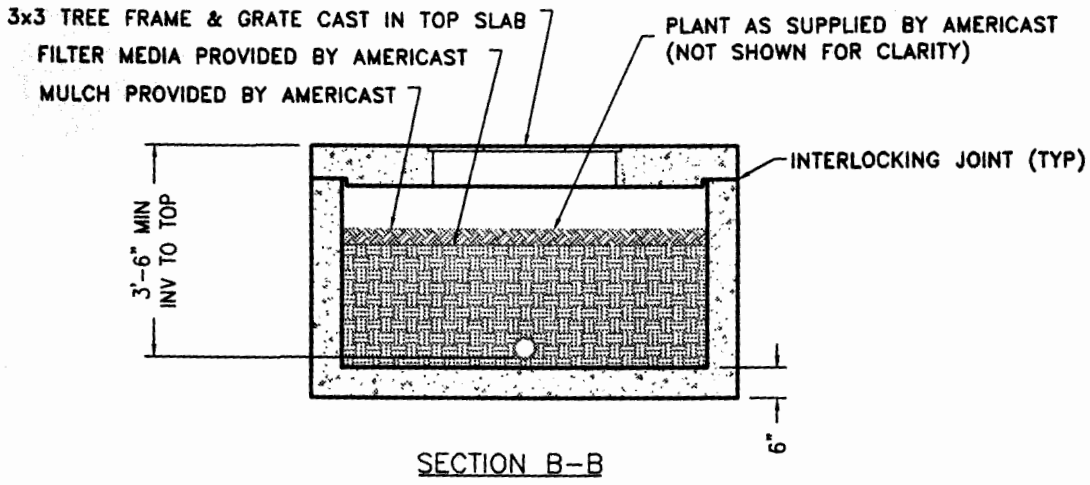
*NOTE: FILTERRA INLETS SHALL BE BLOCKED OFF UNTIL PAVEMENT IS INSTALLED UPSTREAM



PLAN VIEW



SECTION A-A



SECTION B-B

N.T.S.

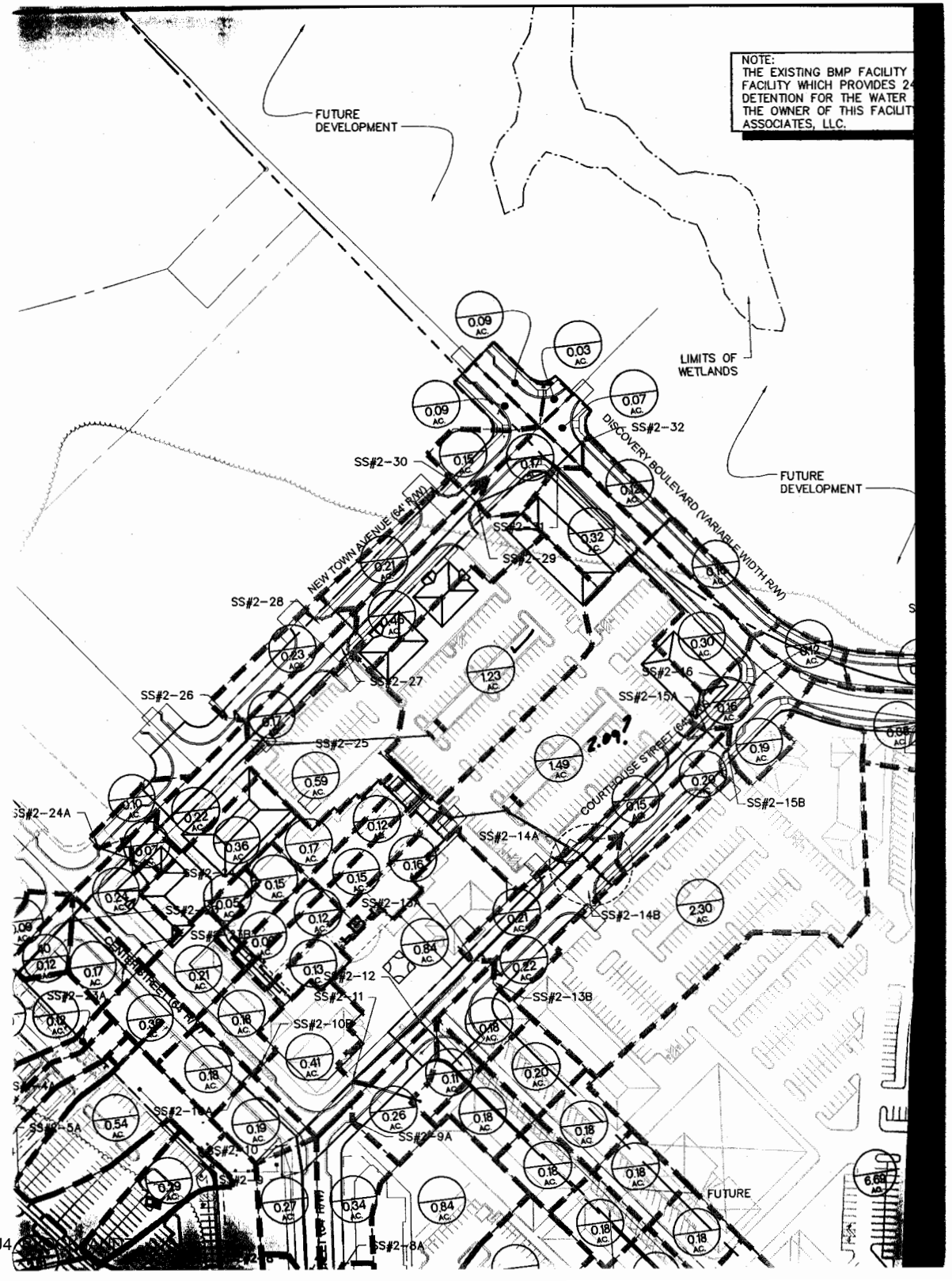
AMERICAST.

DATE: 06-27-03	DWG: FT6X8-1

PRECAST 6'-0 x 8'-0
FILTERRA™ INL

PC200_NEW_TOWN_SEC_2THRU4_BLOCK6A-SD7.dgn

COMPACT



PC200_NEW_TOWN_SEC_2THRU4

6 & 7

NOTE:
1) A WAIVER TO SEC. 24-527(A), SETBACK REQUIREMENTS FROM A PLANNED OR EXISTING PUBLIC ROAD RIGHT OF WAY, WAS GRANTED BY THE JAMES CITY COUNTY PLANNING COMMISSION ON APRIL 5, 2004 PROVIDED PROPOSALS ARE IN ACCORDANCE WITH THE NEW TOWN DESIGN GUIDELINES.

2) A WAIVER TO SEC. 24-55, LOCATION OF OFF-SITE PARKING AND MINIMUM OFF STREET PARKING REQUIREMENTS WAS GRANTED BY THE JAMES CITY COUNTY PLANNING COMMISSION ON MARCH 1, 2004 PROVIDED PROPOSALS ARE IN ACCORDANCE WITH THE "NEW TOWN TOWN CENTER PARKING OVERVIEW" LETTER JANUARY 2004.

APR 2005
RECEIVED
PLANNING DEPARTMENT

SP-019-

COUNTY OF JAMES
FINAL SITE PLA

APPROVALS
Fire Dept. GT/td
Health Dept.
VDOT BW/td 3/
Planning
Environ PEC/td 4
SCSA SG/td 4/
County Eng. WB/td 3/
REA
Other SW/td 4/

GENERAL NOTES

1. THE SITE IS CURRENTLY ZONED MIXED USE WITH PROFFERS. FOR PROFFERS REFERENCE JCC CASE NO. Z-03-01 AND MP-02-97 APPROVED BY THE BOARD OF SUPERVISORS ON DECEMBER 11, 2001.
2. ALL UTILITIES SHALL BE PLACED UNDERGROUND.
3. CONTACT MISS UTILITY (1-800-552-7001) FOR EXISTING UTILITY LOCATIONS PRIOR TO COMMENCING THE WORK.
4. EXISTING UTILITY LOCATIONS INDICATED ARE APPROXIMATE. FIELD VERIFY PRIOR TO COMMENCING THE WORK.
5. A LAND DISTURBING PERMIT AND SILTATION AGREEMENT, WITH SURETY ARE REQUIRED FOR THIS PROJECT.
6. PARKING SPACES SHALL BE DELINEATED BY PAVEMENT STRIPING. HANDICAP PARKING SPACES SHALL BE DESIGNATED BY ABOVE GROUND SIGNS PER USBC REQUIREMENTS.
7. VERIFY ALL DIMENSIONS AND NOTIFY JAMES CITY SERVICE AUTHORITY PRIOR TO ANY EXCAVATION OR DEMOLITION WITHIN UTILITY CORRIDORS.
8. ANY EXISTING UNUSED WELLS SHALL BE ABANDONED IN ACCORDANCE WITH STATE PRIVATE WELL REGULATIONS AND JAMES CITY COUNTY CODE.
9. CONTRACTOR SHALL BE RESPONSIBLE FOR THE COORDINATION OF CONSTRUCTION EFFORTS WITH VIRGINIA NATURAL GAS, DOMINION VIRGINIA POWER, VERIZON TELEPHONE, APPROPRIATE TELEVISION CABLE COMPANY, AND OTHERS THAT MAY BE REQUIRED.
10. CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS FOR THE WORK INDICATED.
11. ALL NEW SIGNS SHALL BE IN ACCORDANCE WITH ARTICLE II, DIVISION 3 OF THE JAMES CITY COUNTY ZONING ORDINANCE.
12. CONTOUR INTERVAL IS 1 FOOT.
13. EVERYTHING BEYOND THE RIGHT-OF--WAY LINE WILL BE CONSIDERED PRIVATE AND NOT MAINTAINED BY VDOT.
14. THIS PROPERTY LIES IN ZONE X (AREAS DETERMINED TO BE OUTSIDE THE 500 YEAR FLOOD PLAIN) PER F.I.R.M. # 510201 0035 B DATED 2/6/91.
15. ALL COMPONENTS OF THE WATER DISTRIBUTION AND SANITARY SEWER SYSTEM SHALL BE INSTALLED AND TESTED IN ACCORDANCE WITH THE LATEST EDITION OF THE AUTHORITY STANDARDS AND SPECIFICATIONS FOR WATER DISTRIBUTION AND SANITARY SEWER SYSTEMS, THE HRPDC REGIONAL STANDARDS, AND THE COMMONWEALTH OF VIRGINIA WATERWORKS AND SEWERAGE REGULATIONS. THE CONTRACTOR SHALL USE ONLY NEW MATERIALS, PARTS AND PRODUCTS ON ALL PROJECTS. ALL MATERIALS SHALL BE STORED SO AS TO ASSURE THE PRESERVATION OF THEIR QUALITY AND FITNESS FOR THE WORK. A COPY OF THE JCSA STANDARDS AND REGIONAL STANDARDS MUST BE KEPT ON-SITE BY THE CONTRACTOR DURING THE FULL TIME OF INSTALLING, TESTING, AND CONVEYING THE FACILITIES TO JCSA.
16. STORM STRUCTURES, SEWER AND BEDDING SHALL CONFORM TO THE VDOT ROAD AND BRIDGE STANDARDS AND VDOT SPECIFICATIONS. ALL PIPE BEDDING SHALL BE IN ACCORDANCE WITH PB-1 AND MANUFACTURER SPECS. AND GUIDELINES, AND MANHOLES DEEPER THAN 4 FEET SHALL HAVE STEPS (ST-1). ALL REINFORCED CONCRETE PIPE (RCP) SHALL BE CLASS III UNLESS OTHERWISE NOTED. STORM SEWER OUTSIDE OF VDOT R.O.W. CAN BE HIGH DENSITY POLYETHYLENE (HDPE).
17. OWNER/DEVELOPER: NEW TOWN ASSOCIATES, L.L.C.
    4801 COURTHOUSE STREET, SUITE 329
    WILLIAMSBURG, VA 23188
    CONTACT: MR. JOHN MCCANN
    PHONE NO.: (757) 565-6200
18. SITE ADDRESS: 5206 MONTICELLO AVE.
19. TAX PARCEL ID NO.: 3840100050
20. LEGAL DESCRIPTION: A PORTION OF 300.714 AC. BELONGING TO C.C. CASEY LTD. CO.
21. PROPERTY REF.: INSTRUMENT # 000012573, P.B.77, PG.94-96
22. THE PROFESSIONAL WHOSE SEAL IS AFFIXED HEREON SHALL ACT AS THE "RESPONSIBLE LAND DISTURBER" FOR PURPOSES OF PLAN APPROVAL ONLY. PRIOR TO ISSUANCE OF THE LAND DISTURBING PERMIT, THE OWNER OR DEVELOPER SHALL PROVIDE THE NAME OF A "RESPONSIBLE LAND DISTURBER" WHO SHALL ASSUME RESPONSIBILITY AS THE "RESPONSIBLE LAND DISTURBER" FOR THE CONSTRUCTION PHASE OF THE PROJECT. THE OWNER OR DEVELOPER SHALL PROVIDE WRITTEN NOTIFICATION SHOULD THE "RESPONSIBLE LAND DISTURBER" CHANGE DURING CONSTRUCTION.
23. THIS PROJECT IS LOCATED IN JAMES CITY COUNTY SUB WATERSHED 208 (LOWER CHISEL RUN) AND CATCHMENT 208-103-1 OF THE POWHATAN CREEK WATERSHED.
24. ALL WORK SHALL BE IN COMPLIANCE WITH NEW TOWN'S GENERAL VPDES PERMIT (PERMIT VAR 102294). THIS SHALL CONSIST OF, BUT NOT BE LIMITED TO, DAILY LOGS OF EARTHWORK, RECORDATION OF STORM EVENTS, AND LOGS OF MAINTENANCE OF EROSION AND SEDIMENT CONTROL MEASURES.

AMENDMENT #1 TO APPROVED SITE PLAN JCC-SP-102-04

CHANGES TO SITE PLAN DATED APRIL 13, 2005

BLOCK 6 & 7 LAND USE SUMMARY

BLOCK 6 & 7	S.F.	AC.	% SITE
IMPERVIOUS AREA	112,187	2.57	36.5
OPEN SPACE	194,656	4.47	63.5
TOTAL BLOCK 6 & 7 SITE AREA	306,843	7.04	
TOTAL BLOCK 6 & 7 DISTURBED AREA	306,843	7.04	100%

BLOCK 6 & 7 PARKING CALCULATIONS

TYPE:	PROVIDED	REQUIRED
REGULAR	268 *	–
HANDICAP	8	7
TOTAL PARKING SPACES	276	–

* ALL SPACES ARE FOR FUTURE DEVELOPMENT.
(ON-STREET PARKING IS NOT INCLUDED IN THIS NUMBER. SEE ROAD PLANS SP-50-02.)

No.	DATE	REVISION / COMMENT / NOTE	BY
3	4/13/05	REVISED PER COUNTY COMMENTS	REC
2	3/1/05	REVISED PER NEW TOWN	REC
1	9/9/04	REVISIONS PER JCC COMMENTS & BID SET	REC

COMMONWEALTH OF VIRGINIA
ROBERT E. COSBY III
No. 35664
4/13/05
ENGINEER
PROFESSIONAL

5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax (757) 220-8994

& 7

VIRGINIA

CONSULTING ENGINEERS
WILLIAMSBURG • RICHMOND

DRAINAGE CALCULATIONS

FOR

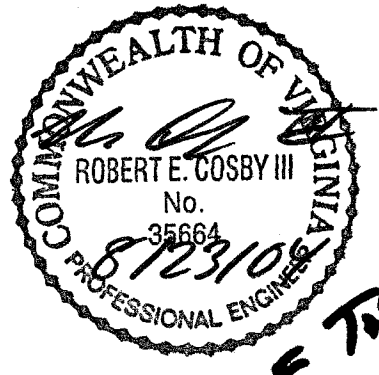
NEW TOWN
BLOCK 6&7 (JCC-SP-102-04)
MOVIE THEATER (JCC-SP-103-04)

SITE:

James City County

SUBMITTED TO:

Environmental Division
James City County



MOVIE THEATRE
SP-103-04

Prepared By:

AES Consulting Engineers
5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188

August 23, 2004

AES Project No. 6632-E-21-1 & 6632-E-21-2

6632E20-1-drncalcs.doc

CONSULTING ENGINEERS

TABLE OF CONTENTS

CONSULTING ENGINEERS

I INTRODUCTION

These projects known as Block 6 & 7 and the Movie Theater are separate site plans, but the drainage and erosion and sediment control is the same. The erosion sediment control from Phase IIII Roadway (JCC-SP-082-04) shall be utilized for the continuation of this project. Block 6&7 project consists of the construction of the 255 space parking lot and associated infrastructure. The Movie Theater project consists of the Theater building, and associated sidewalks to connect the building to the parking lot in addition to the roof drainage system, which connects to the parking lot drainage system and Phase III Roadway drainage system. All drainage associated with this project is directed into the drainage system installed as part of Phase I Roadways, and planned as part of Phase III roadways This is then directed into BMP#53 (also known as the Courthouse BMP). The existing BMP facility is an extended dry detention facility. This BMP is sized to accommodate 109.5 acres of drainage, which included these project areas. During construction diversion dikes will be utilized to collect runoff from the disturbed area into the sediment basin.

II EXISTING SITE CONDITIONS

The majority of this site is an open fallow farmland. The site will be initially rough graded as part of the Phase III Roadway Project. Stormwater is currently conveyed via sheet flow to natural channels downstream.

III PROPOSED STORMDRAIN SYSTEM

This project will be collected by a single storm drainage system which is designed to collect the runoff from the roadway and commercial blocks upon the completion of all construction. The drainage system is draining to an existing best management practice (BMP) facility. This facility was designed and approved as part of the James City County Courthouse Site Plan. One of the sediment basins proposed as part of the Phase III Roadway Plans(JCC-SP-082-04) shall be utilized for these projects. The sediment basins are designed for the roadways and the commercial blocks using the ultimate drainage areas for sizing the basins. The sediment basin that serves this project area has been revised accordingly to fit the final layout of the theater and provide the 67 CY/acre required in the "wet" and "dry" volumes.

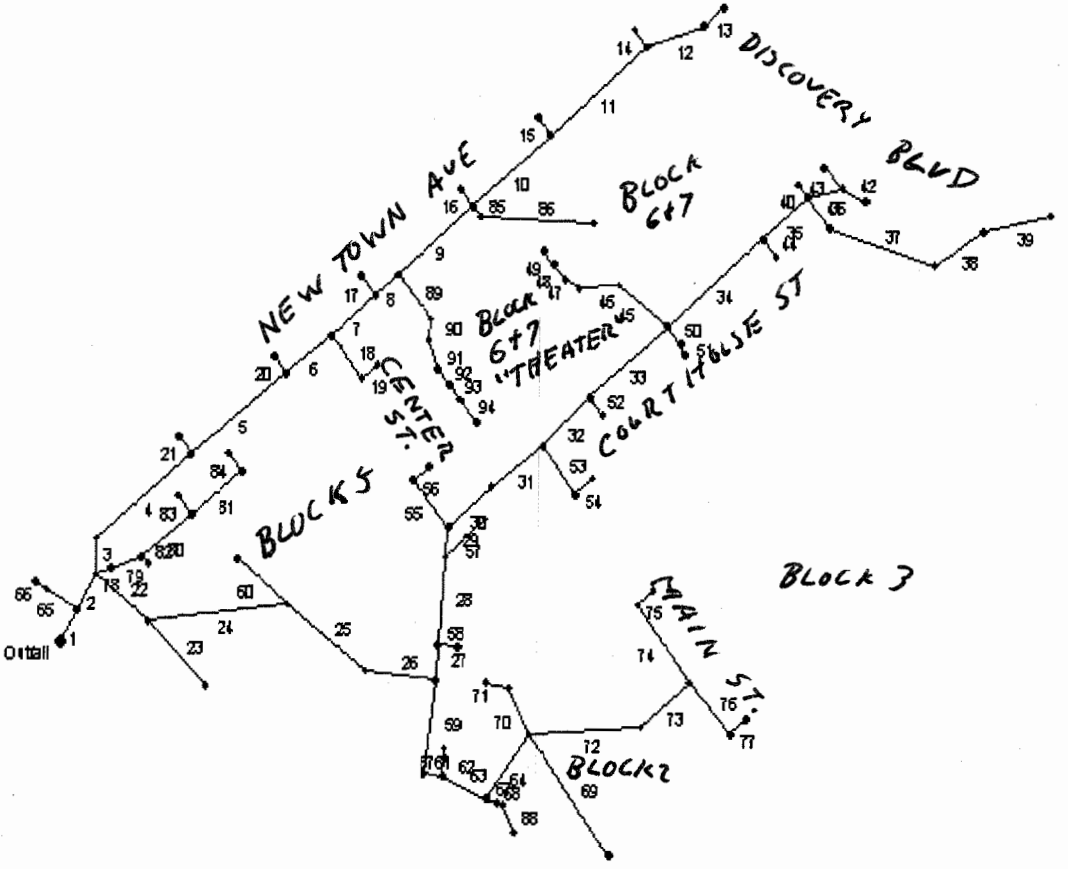
AES
CONSULTING ENGINEERS

APPENDIX A

STORM SEWER SYSTEM

CONSULTING ENGINEERS

Hydraflow Plan View



Project file: 6632E19-sys2(REV-1).stm	No. Lines: 94	08-23-2004

Hydraflow Storm Sewers 2003

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr line No.	Line length (ft)	Defl angle (deg)	Junc type	Known Q (cfs)	Drng area (ac)	Runoff coeff (C)	Inlet time (min)	Invert El Dn (ft)	Line slope (%)	Invert El Up (ft)	Line size (in)	Line type	N value (n)	J-loss coeff (K)	Inlet/ Rim El (ft)	
1	End	61.0	-60.0	MH	0.00	0.00	0.00	0.0	65.00	6.23	68.80	60	Cir	0.013	1.00	77.00	#2-1A TO #2-1
2	1	68.0	0.0	MH	0.00	0.00	0.00	0.0	68.80	4.71	72.00	60	Cir	0.013	1.00	81.50	#2-2 TO #2-1A
3	2	59.0	-30.0	MH	0.00	0.27	0.80	5.0	72.00	7.46	76.40	36	Cir	0.013	0.75	83.80	#2-20 TO #2-2
4	3	220.0	51.0	MH	0.00	0.50	0.65	5.0	76.40	2.73	82.40	30	Cir	0.013	1.00	89.89	#2-21 TO #2-20
5	4	219.0	2.0	MH	0.00	0.12	0.65	5.0	82.40	2.15	87.10	30	Cir	0.013	1.00	96.70	#2-22 TO #2-21
6	5	105.0	1.0	MH	0.00	0.00	0.00	0.0	87.10	1.05	88.20	30	Cir	0.013	1.00	98.76	#2-23 TO #2-22
7	6	105.0	-3.0	MH	0.00	0.07	0.65	5.0	88.20	1.05	89.30	30	Cir	0.013	0.15	99.65	#2-24 TO #2-23
8	7	56.0	0.0	MH	0.00	0.22	0.70	5.0	89.30	0.34	89.49	30	Cir	0.013	1.00	99.92	#2-25 TO #2-24
9	8	178.0	0.0	MH	0.00	0.17	0.70	5.0	89.49	1.00	91.27	24	Cir	0.013	1.00	101.41	#2-26 TO #2-25
10	9	185.0	0.0	MH	0.00	0.46	0.80	5.0	91.27	3.17	97.14	15	Cir	0.013	1.00	104.52	#2-27 TO #2-26
11	10	230.0	0.0	MH	0.00	0.17	0.80	5.0	97.14	1.73	101.13	15	Cir	0.013	1.00	108.51	#2-29 TO #2-27
12	11	112.0	21.0	MH	0.00	0.32	0.70	5.0	101.13	2.18	103.57	15	Cir	0.013	1.00	111.04	#2-31 TO #2-29
13	12	47.0	-22.0	MH	0.00	0.12	0.80	5.0	103.57	1.00	104.04	15	Cir	0.013	0.45	111.04	#2-32 TO #2-31
14	11	38.0	-90.0	MH	0.00	0.15	0.80	5.0	101.13	1.00	101.51	15	Cir	0.013	1.00	108.51	#2-30 TO #2-29
15	10	38.0	-90.0	MH	0.00	0.21	0.75	5.0	97.14	1.00	97.52	15	Cir	0.013	1.00	104.52	#2-28 TO #2-27
16	9	38.0	-90.0	MH	0.00	0.23	0.80	5.0	91.27	8.26	94.41	15	Cir	0.013	1.00	101.41	#2-25A TO #2-25
17	7	43.0	-90.0	MH	0.00	0.10	0.80	5.0	92.10	1.05	92.55	12	Cir	0.013	1.00	99.50	#2-24A TO #2-24
18	6	90.0	87.0	MH	0.00	0.53	0.65	5.0	89.10	1.33	90.30	15	Cir	0.013	1.00	97.75	#2-23A TO #2-23
19	18	36.0	-88.0	MH	0.00	0.45	0.75	5.0	90.30	1.11	90.70	12	Cir	0.013	1.00	97.75	#2-23B TO #2-23A
20	5	36.0	-90.0	MH	0.00	0.09	0.70	5.0	89.20	1.11	89.60	12	Cir	0.013	1.00	96.70	#2-22A TO #2-22
21	4	36.0	-88.0	MH	0.00	0.47	0.65	5.0	82.40	1.11	82.80	12	Cir	0.013	1.00	89.89	#2-21A TO #2-21

Project File: 6632E19-sys2(REV-1).stm

Number of lines: 94

Date: 08-23-2004

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr line No.	Line length (ft)	Defl angle (deg)	Junc type	Known Q (cfs)	Drng area (ac)	Runoff coeff (C)	Inlet time (min)	Invert El Dn (ft)	Line slope (%)	Invert El Up (ft)	Line size (in)	Line type	N value (n)	J-loss coeff (K)	Inlet/ Rim El (ft)	
22	2	123.0	99.0	MH	0.00	2.51	0.85	5.0	72.00	1.63	74.00	54	Cir	0.013	0.75	82.00	#2-3 TO #2-2
23	22	150.0	6.0	MH	0.00	0.59	0.84	5.0	74.00	2.00	77.00	15	Cir	0.013	1.00	85.80	#2-4 TO #2-3
24	22	258.0	-45.0	MH	0.00	0.29	0.84	5.0	74.00	1.36	77.50	54	Cir	0.013	1.00	91.00	#2-5 TO #2-3
25	24	183.0	43.0	MH	0.00	0.14	0.84	5.0	77.50	0.98	79.30	54	Cir	0.013	0.45	94.30	#2-6 TO #2-5
26	25	131.0	-30.0	MH	0.00	0.00	0.00	0.0	79.30	0.99	80.60	54	Cir	0.013	1.00	95.04	#2-7 TO #2-6
27	26	59.0	-93.0	MH	0.00	0.27	0.65	5.0	86.00	1.02	86.60	30	Cir	0.013	1.00	96.37	#2-8 TO #2-7
28	27	145.0	1.0	MH	0.00	0.00	0.00	0.0	86.60	1.03	88.10	30	Cir	0.013	0.75	98.54	#2-9 TO #2-8
29	28	48.0	0.0	MH	0.00	0.00	0.00	0.0	88.10	1.04	88.60	30	Cir	0.013	0.75	98.55	#2-10 TO #2-9
30	29	104.0	45.0	MH	0.00	0.84	0.70	5.0	88.60	0.96	89.60	30	Cir	0.013	0.15	99.68	#2-11 TO #2-10
31	30	116.0	5.0	MH	0.00	0.00	0.00	0.0	89.60	1.72	91.59	30	Cir	0.013	0.45	100.49	#2-12 TO #2-11
32	31	118.0	-8.0	MH	0.00	0.21	0.80	5.0	91.59	1.53	93.39	30	Cir	0.013	0.45	102.02	#2-13A TO #2-12
33	32	185.0	4.0	MH	0.00	0.15	0.70	5.0	93.39	1.57	96.30	30	Cir	0.013	1.00	104.93	#2-14A TO #2-13A
34	33	230.0	0.0	MH	0.00	0.16	0.70	5.0	96.30	2.17	101.29	18	Cir	0.013	1.00	108.67	#2-15A TO #2-14A
35	34	108.0	0.0	MH	0.00	0.00	0.00	0.0	101.29	1.27	102.66	18	Cir	0.013	1.00	110.46	#2-16 TO #2-15A
36	35	66.0	90.0	MH	0.00	0.25	0.70	5.0	102.66	1.00	103.32	18	Cir	0.013	0.45	110.75	#2-17 TO #2-16
37	36	202.0	-33.0	MH	0.00	0.28	0.70	5.0	103.32	1.00	105.34	15	Cir	0.013	0.75	112.49	#2-17A TO #2-17
38	37	107.0	-50.0	MH	0.00	0.18	0.70	5.0	105.34	1.00	106.41	15	Cir	0.013	0.45	113.45	#2-17B TO #2-17A
39	38	127.0	20.0	MH	0.00	0.38	0.70	5.0	106.41	7.06	115.38	15	Cir	0.013	1.00	118.00	#2-17C TO #2-17B
40	35	27.0	-90.0	MH	0.00	0.30	0.70	5.0	102.66	7.93	104.80	15	Cir	0.013	1.00	111.80	#2-16A TO #2-16
41	35	66.0	26.0	MH	0.00	0.12	0.80	5.0	102.66	1.27	103.50	15	Cir	0.013	0.75	110.79	#2-16B TO #2-16A
42	41	48.0	41.0	MH	0.00	0.24	0.80	5.0	103.50	2.00	104.46	15	Cir	0.013	1.00	110.97	#2-16C TO #2-16B

Project File: 6632E19-sys2(REV-1).stm | Number of lines: 94 | Date: 08-23-2004

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr line No.	Line length (ft)	Defl angle (deg)	Junc type	Known Q (cfs)	Drng area (ac)	Runoff coeff (C)	Inlet time (min)	Invert El Dn (ft)	Line slope (%)	Invert El Up (ft)	Line size (in)	Line type	N value (n)	J-loss coeff (K)	Inlet/ Rim El (ft)	
43	41	48.0	-122.0	MH	0.00	0.16	0.80	5.0	103.50	2.00	104.46	15	Cir	0.013	1.00	110.98	#2-16D TO #2-16B
44	34	38.0	90.0	MH	0.00	0.21	0.70	5.0	101.29	1.00	101.67	15	Cir	0.013	1.00	108.67	#2-15B TO #2-15A
45	33	113.0	-104.0	MH	0.00	1.49	0.85	10.0	96.50	1.33	98.00	24	Cir	0.013	0.75	102.30	#7-1 TO #2-14A
46	45	74.0	-40.0	MH	0.00	0.16	0.90	5.0	98.00	2.30	99.70	15	Cir	0.013	0.45	102.70	#7-4 TO #7-1
47	46	29.0	33.0	MH	0.00	0.15	0.90	5.0	99.70	1.03	100.00	12	Cir	0.013	0.45	102.75	#7-5 TO #7-4
48	47	32.0	20.0	MH	0.00	0.12	0.90	5.0	100.00	0.94	100.30	12	Cir	0.013	0.15	102.75	#7-6 TO #7-5
49	48	28.0	0.0	MH	0.00	0.17	0.90	5.0	100.30	1.07	100.60	12	Cir	0.013	1.00	102.75	#7-7 TO #7-6
50	33	38.0	90.0	MH	0.00	0.25	0.75	5.0	96.30	4.29	97.93	24	Cir	0.013	0.45	104.93	#2-14B TO #2-14A
51	50	20.0	14.0	MH	0.00	2.30	0.84	5.0	97.93	1.00	98.13	24	Cir	0.013	1.00	106.00	BL 3 TO #2-14B
52	32	38.0	94.0	MH	0.00	0.18	0.70	5.0	93.39	4.29	95.02	15	Cir	0.013	1.00	102.02	#2-13B TO #2-13A
53	31	100.0	88.0	MH	0.00	0.29	0.70	5.0	92.84	1.00	93.84	15	Cir	0.013	1.00	100.44	MAIN ST. TO #2-12
54	53	41.0	-92.0	MH	0.00	0.38	0.65	5.0	93.84	1.00	94.25	12	Cir	0.013	1.00	100.44	FUTURE
55	29	101.0	-45.0	MH	0.00	0.37	0.65	5.0	89.60	0.99	90.60	15	Cir	0.013	1.00	97.75	#2-10A TO #2-10
56	55	36.0	92.0	MH	0.00	0.59	0.75	5.0	90.60	1.11	91.00	12	Cir	0.013	1.00	97.75	#2-10B TO #2-10A
57	28	96.0	45.0	MH	0.00	0.26	0.65	5.0	91.70	1.04	92.70	15	Cir	0.013	1.00	99.68	#2-9A TO #2-9
58	27	36.0	93.0	MH	0.00	0.34	0.70	5.0	89.00	1.11	89.40	12	Cir	0.013	1.00	96.37	#2-8A TO #2-8
59	26	155.0	91.0	MH	0.00	0.35	0.65	5.0	80.60	0.97	82.10	54	Cir	0.013	1.00	92.73	#2-7A TO #2-7
60	24	120.0	-135.0	MH	0.00	0.54	0.85	5.0	83.00	1.67	85.00	15	Cir	0.013	1.00	90.40	#2-5A TO #2-5
61	59	36.0	-90.0	MH	0.00	0.00	0.00	0.0	82.10	1.11	82.50	48	Cir	0.013	1.00	92.45	#2-7B TO #2-7A
62	61	29.0	-90.0	MH	0.00	0.00	0.00	0.0	85.00	4.48	86.30	12	Cir	0.013	0.45	93.10	#2-7BB TO #2-7B
63	61	88.0	16.5	MH	0.00	0.00	0.00	0.0	82.50	1.40	83.73	48	Cir	0.013	1.00	92.80	#6-1 TO #2-7B

Project File: 6632E19-sys2(REV-1).stm

Number of lines: 94

Date: 08-23-2004

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr line No.	Line length (ft)	Defl angle (deg)	Junc type	Known Q (cfs)	Drng area (ac)	Runoff coeff (C)	Inlet time (min)	Invert El Dn (ft)	Line slope (%)	Invert El Up (ft)	Line size (in)	Line type	N value (n)	J-loss coeff (K)	Inlet/ Rim El (ft)	
64	63	132.0	-76.9	MH	0.00	0.78	0.84	5.0	83.73	2.37	86.86	42	Cir	0.013	1.00	95.50	#6-2 TO #6-1
65	1	67.0	-90.0	MH	0.00	0.13	0.80	5.0	68.80	10.00	75.50	15	Cir	0.013	0.15	82.76	#2-1B TO #2-1A
66	65	24.0	0.0	MH	0.00	0.53	0.80	5.0	75.50	1.25	75.80	12	Cir	0.013	1.00	82.76	#2-1C TO #2-1B
67	63	23.0	-5.0	MH	0.00	0.21	0.90	5.0	83.73	5.52	85.00	15	Cir	0.013	0.15	93.20	#6-1B TO #6-2
68	67	11.0	0.0	MH	0.00	0.66	0.84	5.0	85.00	5.91	85.65	15	Cir	0.013	0.75	93.00	#6-1A TO #6-1B
69	64	249.0	106.0	MH	0.00	1.68	0.84	5.0	86.86	2.00	91.84	18	Cir	0.013	1.00	95.50	#6-6 TO #6-2
70	64	86.0	-65.0	MH	0.00	0.48	0.84	5.0	86.86	1.50	88.15	15	Cir	0.013	0.75	95.50	#6-8 TO #6-2
71	70	43.0	-50.0	MH	0.00	0.84	0.75	5.0	88.15	1.51	88.80	15	Cir	0.013	1.00	95.00	#6-9 TO #6-8
72	64	205.0	49.3	MH	0.00	0.00	0.00	0.0	86.86	2.11	91.18	36	Cir	0.013	0.75	100.50	#6-3 TO #6-2
73	72	116.0	-36.1	MH	0.00	6.69	0.84	5.0	91.18	2.00	93.50	36	Cir	0.013	1.00	99.50	#6-4 TO #6-3
74	73	161.0	-88.2	MH	0.00	0.55	0.65	5.0	93.50	1.06	95.20	15	Cir	0.013	1.00	100.59	FUTURE
75	74	38.0	88.2	MH	0.00	0.54	0.80	5.0	95.20	1.05	95.60	12	Cir	0.013	1.00	100.59	FUTURE
76	73	115.0	87.5	MH	0.00	2.77	0.65	5.0	93.50	1.04	94.70	24	Cir	0.013	1.00	100.59	FUTURE
77	76	38.0	-87.5	MH	0.00	0.56	0.75	5.0	94.70	1.05	95.10	15	Cir	0.013	1.00	100.59	FUTURE
78	2	29.0	41.6	MH	0.00	0.27	0.85	5.0	72.00	22.07	78.40	15	Cir	0.011	0.15	81.90	#1-1 TO #2-2
79	78	59.0	-0.3	MH	0.00	0.07	0.85	5.0	78.40	2.03	79.60	15	Cir	0.011	0.85	84.60	#1-2 TO #1-1
80	79	113.0	-18.6	MH	0.00	0.16	0.85	5.0	79.60	3.16	83.17	12	Cir	0.011	1.00	87.67	#1-3 TO #1-2
81	80	116.0	-0.3	MH	0.00	0.12	0.85	8.0	83.17	3.26	86.95	12	Cir	0.011	1.00	91.45	#1-4 TO #1-3
82	79	16.0	59.9	MH	0.00	0.29	0.85	10.0	79.60	1.94	79.91	12	Cir	0.011	1.00	84.64	#1-2A TO 1-2
83	80	40.0	-90.0	MH	0.00	0.05	0.85	5.0	83.17	5.83	85.50	12	Cir	0.011	1.00	87.50	#1-3A TO 1-3
84	81	40.0	-90.0	MH	0.00	0.11	0.85	5.0	86.95	6.38	89.50	12	Cir	0.011	1.00	91.50	#1-4A TO #1-4

Project File: 6632E19-sys2(REV-1).stm | Number of lines: 94 | *Date:* 08-23-2004

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr line No.	Line length (ft)	Defl angle (deg)	Junc type	Known Q (cfs)	Drng area (ac)	Runoff coeff (C)	Inlet time (min)	Invert El Dn (ft)	Line slope (%)	Invert El Up (ft)	Line size (in)	Line type	N value (n)	J-loss coeff (K)	Inlet/ Rim El (ft)	
85	9	23.0	88.0	MH	0.00	0.59	0.75	5.0	91.27	1.00	91.50	15	Cir	0.013	0.75	101.00	#7-2 TO #2-25
86	85	210.0	-46.0	MH	0.00	1.23	0.85	10.0	91.50	2.00	95.70	15	Cir	0.013	1.00	102.70	#7-3 TO #7-2
87	62	18.0	-15.0	MH	0.00	0.36	0.75	5.0	86.30	6.67	87.50	12	Cir	0.013	1.00	93.50	#2-7BBB TO #2-7BB
88	68	50.0	45.0	MH	0.00	0.38	0.75	5.0	85.65	7.70	89.50	15	Cir	0.013	1.00	93.50	#6-1A TO #6-1
89	8	95.0	90.0	MH	0.00	0.36	0.90	5.0	95.35	2.00	97.25	15	Cir	0.013	0.75	100.00	#7-8 TO #2-25
90	89	36.0	45.0	MH	0.00	0.05	0.90	5.0	97.25	2.08	98.00	12	Cir	0.013	0.45	102.50	#7-9 TO #7-8
91	90	50.0	-26.0	MH	0.00	0.15	0.90	5.0	98.00	2.00	99.00	12	Cir	0.013	0.45	102.50	#7-10 TO #7-9
92	91	32.0	-19.0	MH	0.00	0.09	0.90	5.0	99.00	1.87	99.60	12	Cir	0.013	0.15	102.50	#7-11 TO #7-10
93	92	32.0	0.0	MH	0.00	0.12	0.90	5.0	99.60	1.87	100.20	12	Cir	0.013	0.15	102.50	#7-12 TO #7-11
94	93	50.0	0.0	MH	0.00	0.13	0.90	5.0	100.20	1.20	100.80	12	Cir	0.013	1.00	102.50	#7-13 TO #7-12

Project File: 6632E19-sys2(REV-1).stm | Number of lines: 94 | Date: 08-23-2004

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	61.0	0.00	40.82	0.00	0.00	32.07	0.0	14.2	5.3	168.8	650.1	8.60	60	6.23	68.80	65.00	79.16	78.90	77.00	82.76	#2-1A TO #2-1
2	1	68.0	0.00	40.16	0.00	0.00	31.54	0.0	14.0	5.3	166.8	565.0	8.50	60	4.71	72.00	68.80	80.59	80.31	81.50	77.00	#2-2 TO #2-1A
3	2	59.0	0.27	7.37	0.80	0.22	5.65	5.0	13.6	5.3	30.19	182.1	4.27	36	7.46	76.40	72.00	81.83	81.71	83.80	81.50	#2-20 TO #2-2
4	3	220.0	0.50	7.10	0.65	0.33	5.44	5.0	13.0	5.4	29.60	67.73	6.89	30	2.73	82.40	76.40	85.73	82.04	89.89	83.80	#2-21 TO #2-20
5	4	219.0	0.12	6.13	0.65	0.08	4.81	5.0	12.3	5.6	26.73	60.08	6.42	30	2.15	87.10	82.40	90.17	85.73	96.70	89.89	#2-22 TO #2-21
6	5	105.0	0.00	5.92	0.00	0.00	4.66	0.0	11.9	5.6	26.21	41.98	5.41	30	1.05	88.20	87.10	90.59	90.17	98.76	96.70	#2-23 TO #2-22
7	6	105.0	0.07	4.94	0.65	0.05	3.98	5.0	11.5	5.7	22.65	41.98	5.78	30	1.05	89.30	88.20	92.01	90.59	99.65	98.76	#2-24 TO #2-23
8	7	56.0	0.22	4.77	0.70	0.15	3.86	5.0	11.3	5.7	22.09	23.89	4.50	30	0.34	89.49	89.30	92.17	92.01	99.92	99.65	#2-25 TO #2-24
9	8	178.0	0.17	3.65	0.70	0.12	2.89	5.0	10.7	5.8	16.86	22.62	5.37	24	1.00	91.27	89.49	93.47	92.48	101.41	99.92	#2-26 TO #2-25
10	9	185.0	0.46	1.43	0.80	0.37	1.10	5.0	8.6	6.2	6.88	11.50	5.93	15	3.17	97.14	91.27	99.25	93.92	104.52	101.41	#2-27 TO #2-26
11	10	230.0	0.17	0.76	0.80	0.14	0.58	5.0	7.4	6.5	3.75	8.51	3.87	15	1.73	101.13	97.14	102.41	99.25	108.51	104.52	#2-29 TO #2-27
12	11	112.0	0.32	0.44	0.70	0.22	0.32	5.0	6.4	6.8	2.16	9.53	2.78	15	2.18	103.57	101.13	104.45	102.41	111.04	108.51	#2-31 TO #2-29
13	12	47.0	0.12	0.12	0.80	0.10	0.10	5.0	5.0	7.1	0.68	6.46	1.34	15	1.00	104.04	103.57	104.45	104.45	111.04	111.04	#2-32 TO #2-31
14	11	38.0	0.15	0.15	0.80	0.12	0.12	5.0	5.0	7.1	0.86	6.46	0.80	15	1.00	101.51	101.13	102.41	102.41	108.51	108.51	#2-30 TO #2-29
15	10	38.0	0.21	0.21	0.75	0.16	0.16	5.0	5.0	7.1	1.12	6.46	0.91	15	1.00	97.52	97.14	99.26	99.25	104.52	104.52	#2-28 TO #2-27
16	9	38.0	0.23	0.23	0.80	0.18	0.18	5.0	5.0	7.1	1.31	18.56	2.14	15	8.26	94.41	91.27	95.06	93.92	101.41	101.41	#2-25A TO #2-25
17	7	43.0	0.10	0.10	0.80	0.08	0.08	5.0	5.0	7.1	0.57	3.64	2.63	12	1.05	92.55	92.10	92.99	92.42	99.50	99.65	#2-24A TO #2-24
18	6	90.0	0.53	0.98	0.65	0.34	0.68	5.0	5.2	7.1	4.82	7.46	4.58	15	1.33	90.30	89.10	91.85	90.59	97.75	98.76	#2-23A TO #2-23
19	18	36.0	0.45	0.45	0.75	0.34	0.34	5.0	5.0	7.1	2.40	3.75	3.06	12	1.11	90.70	90.30	92.01	91.85	97.75	97.75	#2-23B TO #2-23
20	5	36.0	0.09	0.09	0.70	0.06	0.06	5.0	5.0	7.1	0.45	3.75	0.77	12	1.11	89.60	89.20	90.17	90.17	96.70	96.70	#2-22A TO #2-22
21	4	36.0	0.47	0.47	0.65	0.31	0.31	5.0	5.0	7.1	2.18	3.75	2.77	12	1.11	82.80	82.40	85.87	85.73	89.89	89.89	#2-21A TO #2-21

Project File: 6632E19-sys2(REV-1).stm

Number of lines: 94

Run Date: 08-23-2004

NOTES: Intensity = 143.72 / (Inlet time + 19.20) ^ 0.94; Return period = 10 Yrs.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Up	Dn	Up	Dn	Up	Dn	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
22	2	123.0	2.51	31.72	0.85	2.13	24.98	5.0	13.7	5.3	133.2	250.8	8.38	54	1.63	74.00	72.00	82.27	81.71	82.00	81.50	#2-3 TO #2-2
23	22	150.0	0.59	0.59	0.84	0.50	0.50	5.0	5.0	7.1	3.53	9.13	2.88	15	2.00	77.00	74.00	83.54	83.09	85.80	82.00	#2-4 TO #2-3
24	22	258.0	0.29	28.62	0.84	0.24	22.35	5.0	13.1	5.4	121.4	229.1	7.64	54	1.36	77.50	74.00	84.07	83.09	91.00	82.00	#2-5 TO #2-3
25	24	183.0	0.14	27.79	0.84	0.12	21.65	5.0	12.6	5.5	119.2	195.0	7.50	54	0.98	79.30	77.50	85.65	84.98	94.30	91.00	#2-6 TO #2-5
26	25	131.0	0.00	27.65	0.00	0.00	21.53	0.0	12.3	5.6	119.7	195.9	7.53	54	0.99	80.60	79.30	86.53	86.05	95.04	94.30	#2-7 TO #2-6
27	26	59.0	0.27	10.80	0.65	0.18	8.28	5.0	12.2	5.6	46.17	41.36	9.67	30	1.02	86.60	86.00	91.43	88.25	96.37	95.04	#2-8 TO #2-7
28	27	145.0	0.00	10.19	0.00	0.00	7.86	0.0	11.9	5.6	44.24	41.71	9.01	30	1.03	88.10	86.60	93.11	91.43	98.54	96.37	#2-9 TO #2-8
29	28	48.0	0.00	9.93	0.00	0.00	7.69	0.0	11.8	5.6	43.42	41.86	8.85	30	1.04	88.60	88.10	94.60	94.06	98.55	98.54	#2-10 TO #2-9
30	29	104.0	0.84	8.97	0.70	0.59	7.01	5.0	11.6	5.7	39.84	40.22	8.12	30	0.96	89.60	88.60	96.50	95.51	99.68	98.55	#2-11 TO #2-10
31	30	116.0	0.00	8.13	0.00	0.00	6.42	0.0	11.3	5.7	36.80	53.72	7.50	30	1.72	91.59	89.60	97.58	96.65	100.49	99.68	#2-12 TO #2-11
32	31	118.0	0.21	7.46	0.80	0.17	5.97	5.0	11.0	5.8	34.53	50.65	7.04	30	1.53	93.39	91.59	98.81	97.98	102.02	100.49	#2-13A TO #2-12
33	32	185.0	0.15	7.07	0.70	0.11	5.68	5.0	10.5	5.9	33.31	51.44	6.79	30	1.57	96.30	93.39	100.38	99.16	104.93	102.02	#2-14A TO #2-13
34	33	230.0	0.16	2.28	0.70	0.11	1.65	5.0	9.0	6.2	10.17	15.47	5.76	18	2.17	101.29	96.30	103.38	101.10	108.67	104.93	#2-15A TO #2-14
35	34	108.0	0.00	1.91	0.00	0.00	1.39	0.0	8.6	6.2	8.68	11.83	5.01	18	1.27	102.66	101.29	104.40	103.38	110.46	108.67	#2-16 TO #2-15A
36	35	66.0	0.25	1.09	0.70	0.18	0.76	5.0	8.2	6.3	4.83	10.50	2.98	18	1.00	103.32	102.66	104.50	104.40	110.75	110.46	#2-17 TO #2-16
37	36	202.0	0.28	0.84	0.70	0.20	0.59	5.0	7.2	6.6	3.86	6.46	3.95	15	1.00	105.34	103.32	106.65	104.58	112.49	110.75	#2-17A TO #2-17
38	37	107.0	0.18	0.56	0.70	0.13	0.39	5.0	6.4	6.8	2.65	6.46	3.13	15	1.00	106.41	105.34	107.42	106.65	113.45	112.49	#2-17B TO #2-17
39	38	127.0	0.38	0.38	0.70	0.27	0.27	5.0	5.0	7.1	1.90	17.16	2.71	15	7.06	115.38	106.41	116.19	107.42	118.00	113.45	#2-17C TO #2-17
40	35	27.0	0.30	0.30	0.70	0.21	0.21	5.0	5.0	7.1	1.50	18.18	2.29	15	7.93	104.80	102.66	105.50	104.40	111.80	110.46	#2-16A TO #2-16
41	35	66.0	0.12	0.52	0.80	0.10	0.42	5.0	6.1	6.8	2.85	7.28	2.50	15	1.27	103.50	102.66	104.51	104.40	110.79	110.46	#2-16B TO #2-16
42	41	48.0	0.24	0.24	0.80	0.19	0.19	5.0	5.0	7.1	1.37	9.13	2.23	15	2.00	104.46	103.50	105.12	104.59	110.97	110.79	#2-16C TO #2-16

Project File: 6632E19-sys2(REV-1).stm

Number of lines: 94

Run Date: 08-23-2004

NOTES: Intensity = 143.72 / (Inlet time + 19.20) ^ 0.94; Return period = 10 Yrs.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
43	41	48.0	0.16	0.16	0.80	0.13	0.13	5.0	5.0	7.1	0.91	9.13	1.84	15	2.00	104.46	103.50	104.98	104.59	110.98	110.79	#2-16D TO #2-16
44	34	38.0	0.21	0.21	0.70	0.15	0.15	5.0	5.0	7.1	1.05	6.46	0.85	15	1.00	101.67	101.29	103.39	103.38	108.67	108.67	#2-15B TO #2-15
45	33	113.0	1.49	2.09	0.85	1.27	1.81	10.0	10.0	6.0	10.78	26.06	3.43	24	1.33	98.00	96.50	101.35	101.10	102.30	104.93	#7-1 TO #2-14A
46	45	74.0	0.16	0.60	0.90	0.14	0.54	5.0	5.7	6.9	3.75	9.79	3.05	15 (12" ON PLAN)	2.30	99.70	98.00	101.74	101.49	102.70	102.30	#7-4 TO #7-1
47	46	29.0	0.15	0.44	0.90	0.14	0.40	5.0	5.6	7.0	2.76	3.62	3.52	12	1.10 1.03	100.00	99.70	101.98	101.81	102.75	102.70	#7-5 TO #7-4
48	47	32.0	0.12	0.29	0.90	0.11	0.26	5.0	5.3	7.0	1.84	3.45	2.34	12	0.94	100.30	100.00	102.15	102.07	102.75	102.75	#7-6 TO #7-5
49	48	28.0	0.17	0.17	0.90	0.15	0.15	5.0	5.0	7.1	1.09	3.69	1.39	12	1.10 ~~1.07~~	100.60	100.30	102.19	102.16	102.75	102.75	#7-7 TO #7-6
50	33	38.0	0.25	2.55	0.75	0.19	2.12	5.0	5.1	7.1	15.06	46.84	4.79	24	4.29	97.93	96.30	101.27	101.10	104.93	104.93	#2-14B TO #2-14
51	50	20.0	2.30	2.30	0.84	1.93	1.93	5.0	5.0	7.1	13.77	22.62	4.38	24	1.00	98.13	97.93	101.50	101.43	106.00	104.93	BL 3 TO #2-14B
52	32	38.0	0.18	0.18	0.70	0.13	0.13	5.0	5.0	7.1	0.90	13.37	0.73	15	4.29	95.02	93.39	99.17	99.16	102.02	102.02	#2-13B TO #2-13
53	31	100.0	0.29	0.67	0.70	0.20	0.45	5.0	5.3	7.0	3.17	6.46	2.58	15	1.00	93.84	92.84	98.22	97.98	100.44	100.49	MAIN ST. TO #2-
54	53	41.0	0.38	0.38	0.65	0.25	0.25	5.0	5.0	7.1	1.76	3.56	2.24	12	1.00	94.25	93.84	98.42	98.32	100.44	100.44	FUTURE
55	29	101.0	0.37	0.96	0.65	0.24	0.68	5.0	5.1	7.1	4.84	6.43	3.94	15	0.99	90.60	89.60	96.08	95.51	97.75	98.55	#2-10A TO #2-10
56	55	36.0	0.59	0.59	0.75	0.44	0.44	5.0	5.0	7.1	3.15	3.75	4.02	12	1.11	91.00	90.60	96.60	96.32	97.75	97.75	#2-10B TO #2-10
57	28	96.0	0.26	0.26	0.65	0.17	0.17	5.0	5.0	7.1	1.20	6.59	0.98	15	1.04	92.70	91.70	94.10	94.06	99.68	98.54	#2-9A TO #2-9
58	27	36.0	0.34	0.34	0.70	0.24	0.24	5.0	5.0	7.1	1.70	3.75	2.16	12	1.11	89.40	89.00	91.51	91.43	96.37	96.37	#2-8A TO #2-8
59	26	155.0	0.35	16.85	0.65	0.23	13.26	5.0	7.0	6.6	87.54	193.5	5.50	54	0.97	82.10	80.60	87.72	87.41	92.73	95.04	#2-7A TO #2-7
60	24	120.0	0.54	0.54	0.85	0.46	0.46	5.0	5.0	7.1	3.27	8.34	3.55	15	1.67	85.00	83.00	86.16	84.98	90.40	91.00	#2-5A TO #2-5
61	59	36.0	0.00	16.50	0.00	0.00	13.03	0.0	6.9	6.6	86.33	151.4	6.87	48	1.11	82.50	82.10	88.32	88.19	92.45	92.73	#2-7B TO #2-7A
62	61	29.0	0.00	0.36	0.00	0.00	0.27	0.0	5.1	7.1	1.91	7.54	2.44	12	4.48	86.30	85.00	89.14	89.05	93.10	92.45	#2-7BB TO #2-7B
63	61	88.0	0.00	16.14	0.00	0.00	12.76	0.0	6.7	6.7	85.27	169.8	6.79	48	1.40	83.73	82.50	89.37	89.05	92.80	92.45	#6-1 TO #2-7B

Project File: 6632E19-sys2(REV-1).stm | Number of lines: 94 | Run Date: 08-23-2004

NOTES: Intensity = 143.72 / (Inlet time + 19.20) ^ 0.94; Return period = 10 Yrs.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Up	Dn	Up	Dn	Up	Dn	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
64	63	132.0	0.78	14.89	0.84	0.66	11.73	5.0	6.4	6.8	79.23	154.9	8.24	42	2.37	86.86	83.73	91.35	90.08	95.50	92.80	#6-2 TO #6-1
65	1	67.0	0.13	0.66	0.80	0.10	0.53	5.0	5.1	7.1	3.75	20.42	3.05	15	10.00	75.50	68.80	80.53	80.31	82.76	77.00	#2-1B TO #2-1A
66	65	24.0	0.53	0.53	0.80	0.42	0.42	5.0	5.0	7.1	3.02	3.98	3.85	12	1.25	75.80	75.50	80.73	80.55	82.76	82.76	#2-1C TO #2-1B
67	63	23.0	0.21	1.25	0.90	0.19	1.03	5.0	5.5	7.0	7.18	15.17	5.85	15	5.52	85.00	83.73	90.37	90.08	93.20	92.80	#6-1B TO #6-2
68	67	11.0	0.66	1.04	0.84	0.55	0.84	5.0	5.5	7.0	5.87	15.70	4.78	15	5.91	85.65	85.00	90.54	90.45	93.00	93.20	#6-1A TO #6-1B
69	64	249.0	1.68	1.68	0.84	1.41	1.41	5.0	5.0	7.1	10.06	14.85	5.69	18	2.00	91.84	86.86	93.90	91.35	95.50	95.50	#6-6 TO #6-2
70	64	86.0	0.48	1.32	0.84	0.40	1.03	5.0	5.2	7.1	7.31	7.91	5.95	15	1.50	88.15	86.86	92.45	91.35	95.50	95.50	#6-8 TO #6-2
71	70	43.0	0.84	0.84	0.75	0.63	0.63	5.0	5.0	7.1	4.49	7.94	3.66	15	1.51	88.80	88.15	93.08	92.87	95.00	95.50	#6-9 TO #6-8
72	64	205.0	0.00	11.11	0.00	0.00	8.63	0.0	6.0	6.9	59.22	96.82	8.98	36	2.11	91.18	86.86	96.11	91.35	100.50	95.50	#6-3 TO #6-2
73	72	116.0	6.69	11.11	0.84	5.62	8.63	5.0	5.8	6.9	59.74	94.32	8.45	36	2.00	93.50	91.18	97.89	96.11	99.50	100.50	#6-4 TO #6-3
74	73	161.0	0.55	1.09	0.65	0.36	0.79	5.0	5.2	7.1	5.59	6.64	4.56	15	1.06	95.20	93.50	99.10	97.89	100.59	99.50	FUTURE
75	74	38.0	0.54	0.54	0.80	0.43	0.43	5.0	5.0	7.1	3.08	3.65	3.92	12	1.05	95.60	95.20	99.70	99.42	100.59	100.59	FUTURE
76	73	115.0	2.77	3.33	0.65	1.80	2.22	5.0	5.3	7.1	15.66	23.10	4.99	24	1.04	94.70	93.50	98.44	97.89	100.59	99.50	FUTURE
77	76	38.0	0.56	0.56	0.75	0.42	0.42	5.0	5.0	7.1	2.99	6.63	2.44	15	1.05	95.10	94.70	98.91	98.83	100.59	100.59	FUTURE
78	2	29.0	0.27	1.07	0.85	0.23	0.91	5.0	10.4	5.9	5.35	35.85	4.36	15	22.07	78.40	72.00	81.85	81.71	81.90	81.50	#1-1 TO #2-2
79	78	59.0	0.07	0.80	0.85	0.06	0.68	5.0	10.1	5.9	4.04	10.88	3.29	15	2.03	79.60	78.40	82.06	81.90	84.60	81.90	#1-2 TO #1-1
80	79	113.0	0.16	0.44	0.85	0.14	0.37	5.0	9.2	6.1	2.29	7.48	3.61	12	3.16	83.17	79.60	84.24	82.20	87.67	84.60	#1-3 TO #1-2
81	80	116.0	0.12	0.23	0.85	0.10	0.20	8.0	8.0	6.4	1.25	7.60	2.50	12	3.26	86.95	83.17	87.66	84.24	91.45	87.67	#1-4 TO #1-3
82	79	16.0	0.29	0.29	0.85	0.25	0.25	10.0	10.0	6.0	1.47	5.86	1.87	12	1.94	79.91	79.60	82.22	82.20	84.64	84.60	#1-2A TO 1-2
83	80	40.0	0.05	0.05	0.85	0.04	0.04	5.0	5.0	7.1	0.30	10.16	1.28	12	5.83	85.50	83.17	85.81	84.24	87.50	87.67	#1-3A TO 1-3
84	81	40.0	0.11	0.11	0.85	0.09	0.09	5.0	5.0	7.1	0.67	10.63	1.94	12	6.38	89.50	86.95	89.98	87.66	91.50	91.45	#1-4A TO #1-4

Project File: 6632E19-sys2(REV-1).stm

Number of lines: 94

Run Date: 08-23-2004

NOTES: Intensity = 143.72 / (Inlet time + 19.20) ^ 0.94; Return period = 10 Yrs.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
85	9	23.0	0.59	1.82	0.75	0.44	1.49	5.0	10.7	5.8	8.69	6.46	7.08	15	1.00	91.50	91.27	94.34	93.92	101.00	101.41	#7-2 TO #2-25
86	85	210.0	1.23	1.23	0.85	1.05	1.05	10.0	10.0	6.0	6.24	9.13	5.38	15	2.00	95.70	91.50	97.53	94.92	102.70	101.00	#7-3 TO #7-2
87	62	18.0	0.36	0.36	0.75	0.27	0.27	5.0	5.0	7.1	1.92	9.20	2.45	12	6.67	87.50	86.30	89.23	89.18	93.50	93.10	#2-7BBB TO #2-7
88	68	50.0	0.38	0.38	0.75	0.29	0.29	5.0	5.0	7.1	2.03	17.92	1.65	15	7.70	89.50	85.65	90.85	90.80	93.50	93.00	#6-1A TO #6-1
89	8	95.0	0.36	0.90	0.90	0.32	0.81	5.0	6.6	6.7	5.43	9.13	5.53	15	2.00	97.25	95.35	98.95	96.28	100.00	99.92	#7-8 TO #2-25
90	89	36.0	0.05	0.54	0.90	0.05	0.49	5.0	6.5	6.7	3.28	5.14	4.17	12	2.08	98.00	97.25	99.26	98.95	102.50	100.00	#7-9 TO #7-8
91	90	50.0	0.15	0.49	0.90	0.14	0.44	5.0	6.2	6.8	3.00	5.04	4.33	12	2.00	99.00	98.00	100.32	99.38	102.50	102.50	#7-10 TO #7-9
92	91	32.0	0.09	0.34	0.90	0.08	0.31	5.0	6.0	6.8	2.09	4.88	2.91	12	1.87	99.60	99.00	100.40	100.32	102.50	102.50	#7-11 TO #7-10
93	92	32.0	0.12	0.25	0.90	0.11	0.23	5.0	5.8	6.9	1.56	4.88	3.01	12	1.87	100.20	99.60	101.02	100.40	102.50	102.50	#7-12 TO #7-11
94	93	50.0	0.13	0.13	0.90	0.12	0.12	5.0	5.0	7.1	0.83	3.90	2.09	12	1.20 1.90	100.80	100.20	101.35	101.02	102.50	102.50	#7-13 TO #7-12
		32																				

Project File: 6632E19-sys2(REV-1).stm

Number of lines: 94

Run Date: 08-23-2004

NOTES: Intensity = 143.72 / (Inlet time + 19.20) ^ 0.94; Return period = 10 Yrs.

APPENDIX B

DRAINAGE AREA MAP

CONSULTING ENGINEERS

NOTE:
THE EXISTING BMP FACILITY IS A DESIGN TYPE 2 FACILITY WHICH PROVIDES 24 HOUR EXTENDED DETENTION FOR THE WATER QUALITY VOLUME. THE OWNER OF THIS FACILITY IS NEW TOWN ASSOCIATES, LLC.

NOTE:
CONTRACTOR SHALL MAINTAIN A MINIMUM 2' OF COVER OVER STORM PIPES AT ALL TIMES.

FUTURE DEVELOPMENT

LIMITS OF WETLANDS

DISCOVERY BOULEVARD (VARIABLE WIDTH R/W)

NEW TOWN AVENUE (64' R/W)

COURTHOUSE STREET (64' R/W)

CENTER STREET (64' R/W)

IRONBOUND ROAD

MONTICELLO AVENUE

EX. VDOT R/W

N/F
WHS LAND HOLDINGS, LLC.
TM # (38-4)(1-3)
INSTR. #010006507

GRAPHIC SCALE
100' 0' 100' 200'
SCALE: 1" = 100'

No.	DATE	REVISION / COMMENT / NOTE	BY

COMMONWEALTH OF VIRGINIA
CHARLES B. ROBBINS
No. 039172
REGISTERED
PROFESSIONAL ENGINEER
7/6/04

5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
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CONSULTING ENGINEERS
WILLIAMSBURG • RICHMOND

OVERALL DRAINAGE PLAN
NEW TOWN
SECTION 2 AND 4
ROADWAY INFRASTRUCTURE PLANS
PHASE III
BERKELEY DISTRICT JAMES CITY COUNTY VIRGINIA

Designed	Drawn
CBR/RMK	AES
Scale	Date
1"=100'	7/6/04

Project No.
6632-E-19
Drawing No.
9

APPENDIX C

TEMPORARY SEDIMENT BASIN 2

E&S MANUAL WORKSHEETS
STORAGE ELEVATIONS CURVE "WET" & "DRY" STORAGE
STORMWATER ROUTING 2 & 25 YEAR STORM

Storm Event	Incoming Flow (cfs)	Outgoing Flow (cfs)	Water Surface Elevation
2 yr	23.1	21.0	96.1
25 yr	56.0	39.2	97.1

CONSULTING ENGINEERS

TEMPORARY SEDIMENT BASIN DESIGN DATA SHEET

(with or without an emergency spillway)

Project NEW TOWN PHASE III

Basin # SB-2 Location EAST CORNER OF NEW TOWN + CENTER (BLOCK G+7)

Total area draining to basin: 8.9 acres.

Basin Volume Design

Wet Storage:

1. Minimum required volume = 67 cu. yds. x Total Drainage Area (acres).

   67 cu. yds. x 8.9 acres = 596.3 cu. yds.

2. Available basin volume = 603.9 cu. yds. at elevation 93.0. (From storage - elevation curve)

3. Excavate 603.9 cu. yds. to obtain required volume*.

   * Elevation corresponding to required volume = invert of the dewatering orifice.

4. Available volume before cleanout required.

   33 cu. yds. x 8.9 acres = 293.7 cu. yds.

5. Elevation corresponding to cleanout level = 91.5. 328.6 CY REMAINING IN "WET" POOL ✓

   (From Storage - Elevation Curve)

6. Distance from invert of the dewatering orifice to cleanout level = 1.5 ft. ✓ (Min. = 1.0 ft.)

Dry Storage:

7. Minimum required volume = 67 cu. yds. x Total Drainage Area (acres).

   67 cu. yds. x 8.9 acres = 596.3 cu. yds.

   134 cy × 8.9 Acres = 1192.6 cy.

8. Total available basin volume at crest of riser* = 1,277.7 cu. yds. at elevation 95.5. (From Storage - Elevation Curve) ✓
673.8 cy AVAILABLE IN "DRY" POOL ✓

* Minimum = 134 cu. yds./acre of total drainage area.

9. Diameter of dewatering orifice = 3 in. * MIN SIZE ORIFICE

10. Diameter of flexible tubing = 6 in. (diameter of dewatering orifice plus 2 inches).
6" PERFORATED TUBING USED FOR STANDARD MATERIAL

Preliminary Design Elevations

11. Crest of Riser = 95.5

Top of Dam = 99.5

Design High Water = 97.1

Upstream Toe of Dam = 90.0

Basin Shape

12. Length of Flow / Effective Width $\frac{L}{We}$ = $\frac{115}{56}$ = 2.1 ✓

If > 2, baffles are not required

If < 2, baffles are required _____

Runoff

13. Q_2 = 23.1 INFLOW / 20.0 OUTFLOW cfs (From Chapter 5)

14. Q_{25} = 56.0 INFLOW / 39.2 OUTFLOW cfs (From Chapter 5)

Principal Spillway Design

15. With emergency spillway, required spillway capacity $Q_p = Q_2$ = _____ cfs. (riser and barrel)

Without emergency spillway, required spillway capacity $Q_p = Q_{25}$ = 39.2 cfs. (riser and barrel)

16. With emergency spillway:

Assumed available head (h) = NA ft. (Using Q_2)

h = Crest of Emergency Spillway Elevation - Crest of Riser Elevation

Without emergency spillway:

Assumed available head (h) = 1.6 ft. (Using Q_{25})

h = Design High Water Elevation - Crest of Riser Elevation

17. Riser diameter (D_r) = 48 in. Actual head (h) = 1.0 ft.

(From Plate 3.14-8.)

Note: Avoid orifice flow conditions.

18. Barrel length (l) = 42 ft.

Head (H) on barrel through embankment = 7.4 ft.

(From Plate 3.14-7).

19. Barrel diameter = 24 in.

(From Plate 3.14-B [concrete pipe] or Plate 3.14-A [corrugated pipe]).

20. Trash rack and anti-vortex device

Diameter = 72 inches.

Height = 21 inches.

(From Table 3.14-D).

Emergency Spillway Design NOT AVAILABLE

21. Required spillway capacity $Q_e = Q_{25} - Q_p$ = ~ cfs.

22. Bottom width (b) = — ft.; the slope of the exit channel (s) = — ft./foot; and the minimum length of the exit channel (x) = — ft.
(From Table 3.14-C).

Anti-Seep Collar Design NOT REQUIRED - BASIN FULLY EXCAVATED

23. Depth of water at principal spillway crest (Y) = — ft.

Slope of upstream face of embankment (Z) = — :1.

Slope of principal spillway barrel (S_b) = — %

Length of barrel in saturated zone (L_s) = — ft.

24. Number of collars required = — dimensions = —

(from Plate 3.14-12).

Final Design Elevations

25. Top of Dam = 99.5

Design High Water = 97.1

Emergency Spillway Crest = N/A

Principal Spillway Crest = 95.5

Dewatering Orifice Invert = 93.0

Cleanout Elevation = 91.5

Elevation of Upstream Toe of Dam or Excavated Bottom of "Wet Storage Area" (if excavation was performed) = 90.0

AES Consulting Engineers
Project #6632-E-19

New Town
Phase III
James City County

Temporary Sediment Basin Volumes **"Wet" and "Dry" Volume**

Elev.	Countour Area (in s.f.)	Storage (Between contours)	Cumulative Storage Volume
99	Area = 10898 s.f.		Cumulative Storage = 2510.5 c.y.
		Storage = 10493 c.f.= 388.6 c.y.	
98	Area = 10087 s.f.		Cumulative Storage = 2121.9 c.y.
		Storage = 9694 c.f.= 359.0 c.y.	
97	Area = 9301 s.f.		Cumulative Storage = 1762.8 c.y.
		Storage = 8921 c.f.= 330.4 c.y.	
96	Area = 8540 s.f.		Cumulative Storage = 1432.4 c.y.
		Storage = 4177 c.f.= 154.7 c.y.	
95.5	Area = 8169 s.f.		Cumulative Storage = 1277.7 c.y.
		Storage = 3993 c.f.= 147.9 c.y.	
95	Area = 7804 s.f.		Cumulative Storage = 1129.8 c.y.
		Storage = 7449 c.f.= 275.9 c.y.	
94	Area = 7093 s.f.		Cumulative Storage = 853.9 c.y.
		Storage = 6750 c.f.= 250.0 c.y.	
93	Area = 6407 s.f.		Cumulative Storage = 603.9 c.y.
		Storage = 6077 c.f.= 225.1 c.y.	
92	Area = 5747 s.f.		Cumulative Storage = 378.9 c.y.
		Storage = 2794 c.f.= 103.5 c.y.	
91.5	Area = 5429 s.f.		Cumulative Storage = 275.4 c.y.
		Storage = 2635 c.f.= 97.6 c.y.	
91	Area = 5111 s.f.		Cumulative Storage = 177.8 c.y
		Storage = 4801 c.f.= 177.8 c.y.	
90	Area = 4490 s.f.		Cumulative Storage = 0.0 c.y.
		Storage = 0 c.f.= 0.0 c.y.	

Volume Required
67 CY per acre "Wet"
67 CY per acre "Dry"
33 CY per acre "Cleanout"

Total Drainage Area = 8.9 acre

"Wet & Dry" Volume Required = 596.3 c.y.
"Cleanout" Volume Required = 293.7

"Wet" Volume Provided = 603.9 c.y. at Elevation 93

Adequate "Wet" Volume is provided in Sediment Basin

"Dry" Volume Provided = 673.8 c.y. at Elevation 95.5

Adequate "Dry" Volume is provided in Sediment Basin

"Cleanout" Volume Provided = 328.6 c.y. at Elevation 91.5

Adequate "Cleanout" Volume is provided in Sediment Basin

8/22/04

6632-E-21-1-WQV-8-20-04.xls
Sediment Basin

CONSULTING ENGINEERS
Williamsburg • Richmond

Willamsburg (757) 253-0040
Richmond (804) 330-8040

PROJECT NEW TOWN PHASE 3 ROADWAYS

PROJECT NO. 6632-19

SUBJECT TIME OF CONCENTRATION

SHEET NO. _____ OF _____

CALCULATED BY VAB DATE _____

T_c FOR SEDIMENT BASIN 2 :

SHEET FLOW

L = 200 FT

BARE SOIL
SLOPE = 2.5%

T_t = 9.8 min

SHALLOW CONCENTRATED FLOW

H = 15 FT
L = 700 FT

T_t = 5.2 min

CHANNEL FLOW

H = 1 FT
L = 200 FT

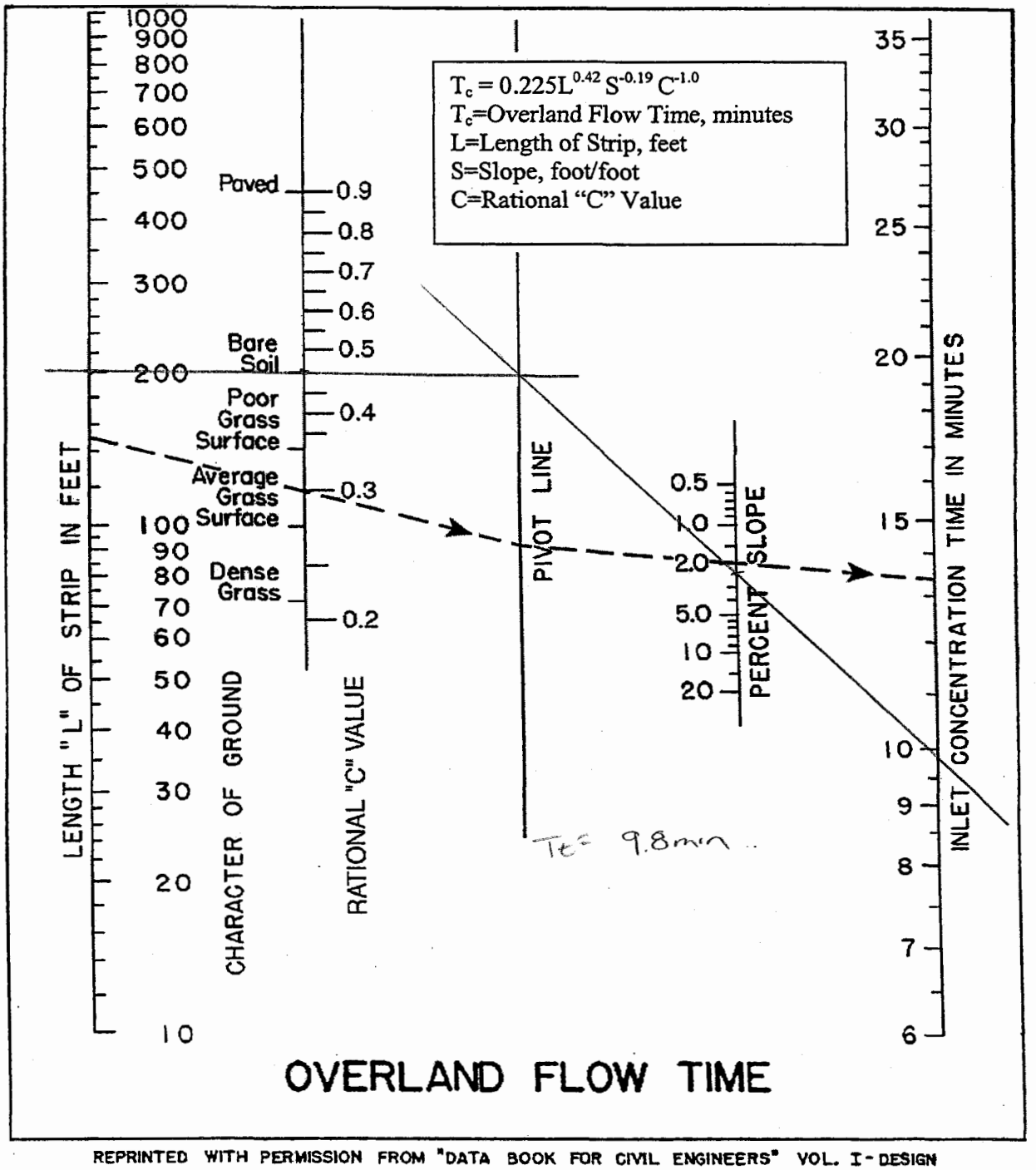
T_t = 3.5 min

$T_c = 9.8 + 5.2 + 3.5 = 18.5$ min

SEDIMENT BASIN 2

OVERLAND FLOW

Appendix 6D-1 Overland Flow Time - Seelye



REPRINTED WITH PERMISSION FROM "DATA BOOK FOR CIVIL ENGINEERS" VOL. I - DESIGN 2ND EDITION (1951) BY E. E. SEELYE

Comments:
VDOT added a 'C-VALUE' scale and a derived equation for Overland Flow Time to this nomograph. This was done without the permission of the author in the interest of providing the user with a quantitative comparison for the selection of 'CHARACTER OF GROUND' and an optional manual solution to the nomograph. The Department warrants neither the accuracy nor the validity of either enhancement and cautions the user that it be used at their own risk.

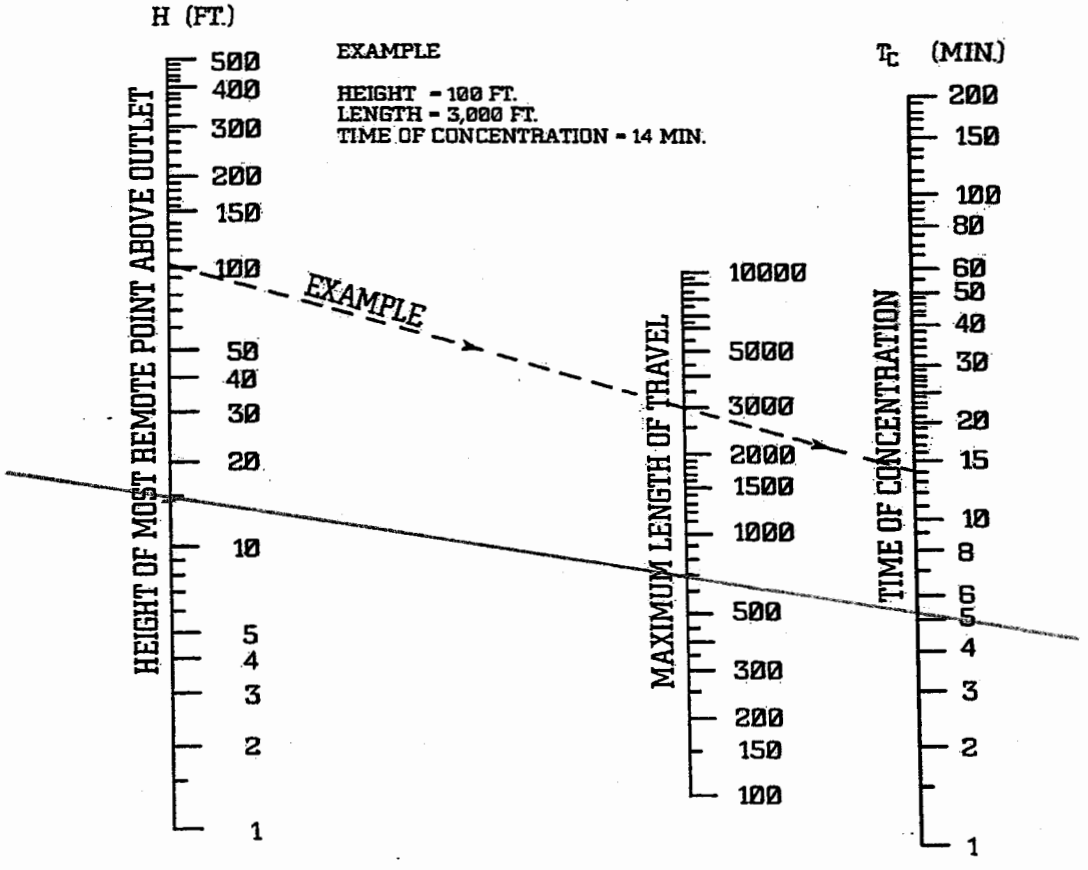
SEDIMENT BASIN 2

SHALLOW CONCENTRATED FLO

Appendix 6D-5 Time of Concentration for Small Drainage Basins - Kirpich

$T_C = 0.00948\ H^{-0.38}\ L^{1.13}$

T_C = FLOW TIME, MINUTES
H = HEIGHT, FEET
L = LENGTH, FEET



Based on study by P.Z. Kirpich,
Civil Engineering, Vol. 10 No. 6, June 1940, p. 362

Tc = 5.2 min

TIME OF CONCENTRATION OF SMALL DRAINAGE BASINS

* NOTE:
USE NOMOGRAPH FOR NATURAL BASINS WITH WELL-DEFINED CHANNELS AND FOR MOWED GRASS ROADSIDE CHANNELS.

Comments:
VDOT derived an equation from and added it to this nomograph. This was done without the author's permission in the interest of providing the user with an optional mathematical solution. The Department warrants neither the accuracy nor the validity of this equation and cautions the user that it be used at their own risk.

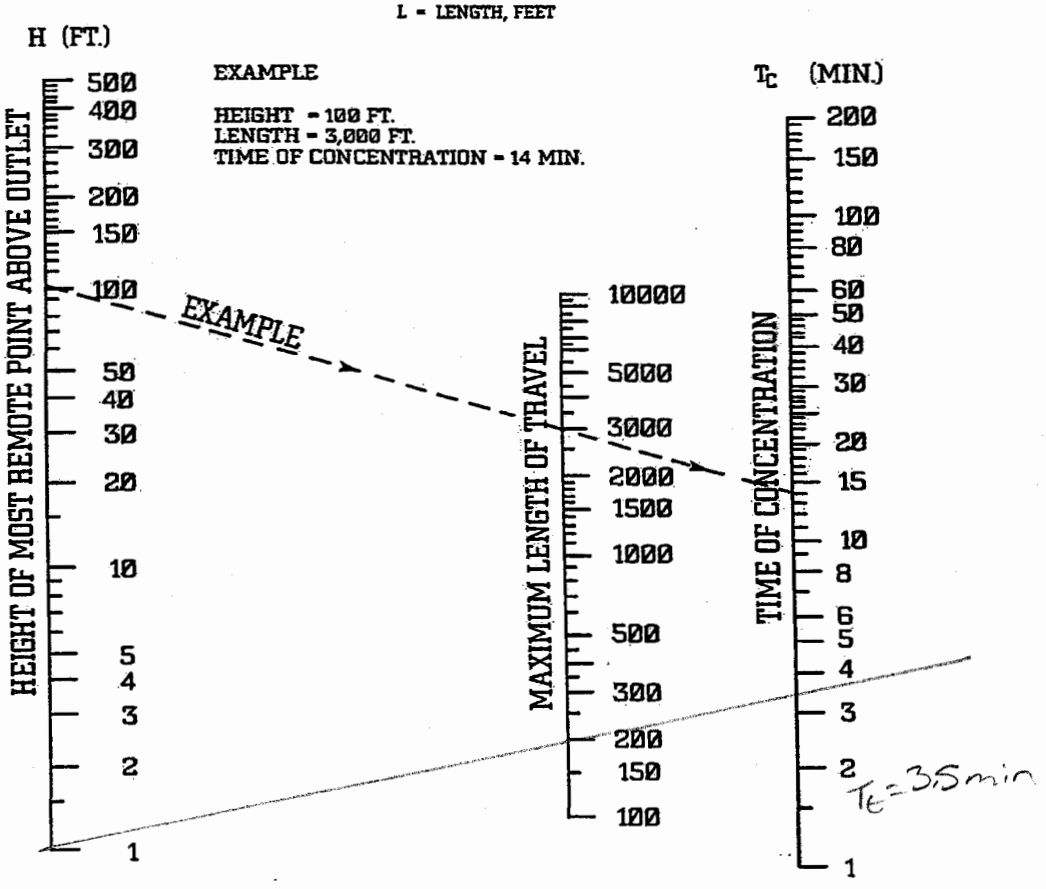
**The Kirpich Chart should only be used for channel time in Virginia.

SEDIMENT BASIN 2
CHANNEL FLOW

Appendix 6D-5 Time of Concentration for Small Drainage Basins - Kirpich

$$T_C = 0.00948\ H^{-0.38}\ L^{1.13}$$

T_C = FLOW TIME, MINUTES
H = HEIGHT, FEET
L = LENGTH, FEET



Based on study by P.Z. Kirpich.
Civil Engineering, Vol. 10 No. 6, June 1940, p. 362

TIME OF CONCENTRATION OF SMALL DRAINAGE BASINS

* NOTE:
USE NOMOGRAPH FOR NATURAL BASINS WITH WELL-DEFINED CHANNELS AND FOR MOWED GRASS ROADSIDE CHANNELS.

Comments:
VDOT derived an equation from and added it to this nomograph. This was done without the author's permission in the interest of providing the user with an optional mathematical solution. The Department warrants neither the accuracy nor the validity of this equation and cautions the user that it be used at their own risk.

**The Kirpich Chart should only be used for channel time in Virginia.

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PROJECT NEWTOWN PHASE 3 ROADWA
PROJECT NO. 6632-19
SUBJECT ORIFICE SIZING
SHEET NO. _____ OF _____
CALCULATED BY VAB DATE _____

SIZE ORIFICE TO ACHIEVE 6HR RELEASE

ORIFICE EQUATION SEDIMENT BASIN #2

$$Q = KA\sqrt{2g\Delta h}$$

K=0.8 FOR PIPE PROJECTING INTO RESERVOIR

$\Delta h = 95.5 - \underset{93.0}{\cancel{90.5}} = \underset{2.5}{\cancel{5}}$ FT.

Q = VOL/TIME

$Q = 30,196\ FT^3/21,600\ SEC$

$Q = 1.4\ cfs$

$1.4\ cfs = 0.8\ A\ \sqrt{2(32.2)(\cancel{5})2.5}$

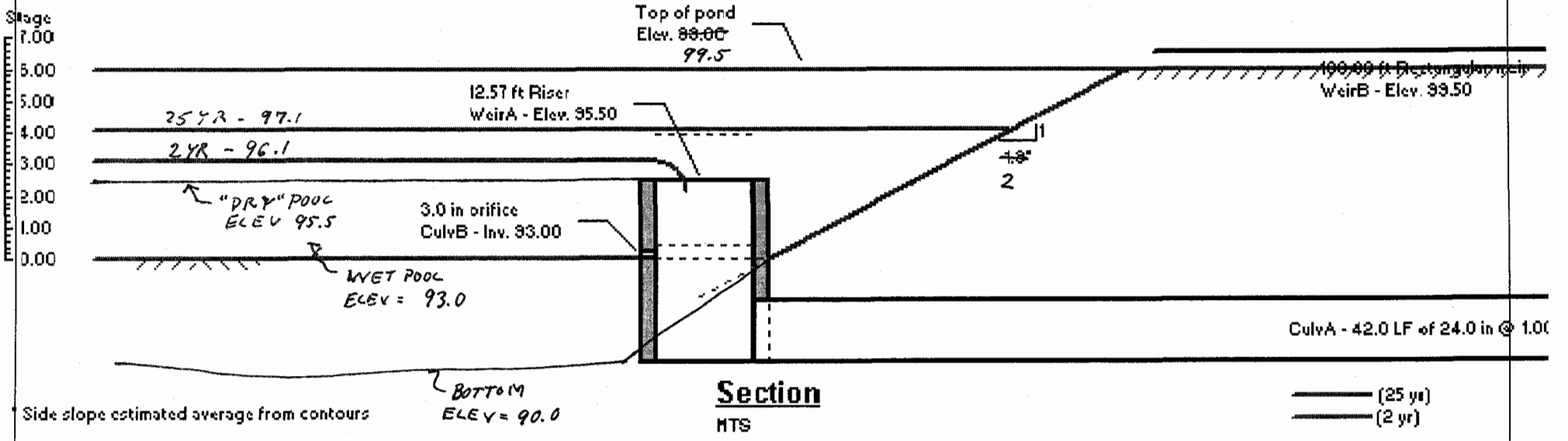
$\underset{0.14}{\cancel{0.10}} = A = \pi r^2$

$r = \underset{0.21}{\cancel{0.18}}$ FT.

MIN DIA = ~~2.16~~ 2.5"

MIN DIA TO BE USED IS 3"

Total Pod Volume SB# 2



Schematic only. Not for construction.

Pond Report

Pond No. 3 - Total Pod Volume SB# 2

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	93.00	6,407	0	0
1.00	94.00	7,093	6,750	6,750
2.00	95.00	7,804	7,449	14,199
2.50	95.50	8,169	3,993	18,192
3.00	96.00	8,540	4,177	22,369
4.00	97.00	9,301	8,921	31,290
5.00	98.00	10,087	9,694	40,984
6.00	99.00	10,898	10,493	51,476

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise (in)	= 24.00	3.00	0.00	0.00
Span (in)	= 24.00	3.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 89.72	93.00	0.00	0.00
Length (ft)	= 42.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	0.00
N-Value	= .013	.013	.013	.000
Orif. Coeff.	= 0.60	0.60	0.60	0.00
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.57	100.00	0.00	0.00
Crest El. (ft)	= 95.50	99.50	0.00	0.00
Weir Coeff.	= 3.33	3.33	0.00	0.00
Weir Type	= Riser	Rect	---	---
Multi-Stage	= Yes	No	No	No

Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	93.00	0.00	0.00	---	---	0.00	0.00	---	---	---	0.00
0.10	675	93.10	22.84	0.02	---	---	0.00	0.00	---	---	---	0.02
0.20	1,350	93.20	22.84	0.06	---	---	0.00	0.00	---	---	---	0.06
0.30	2,025	93.30	22.84	0.10	---	---	0.00	0.00	---	---	---	0.10
0.40	2,700	93.40	22.84	0.12	---	---	0.00	0.00	---	---	---	0.12
0.50	3,375	93.50	22.84	0.14	---	---	0.00	0.00	---	---	---	0.14
0.60	4,050	93.60	22.84	0.16	---	---	0.00	0.00	---	---	---	0.16
0.70	4,725	93.70	22.84	0.18	---	---	0.00	0.00	---	---	---	0.18
0.80	5,400	93.80	22.84	0.19	---	---	0.00	0.00	---	---	---	0.19
0.90	6,075	93.90	22.84	0.21	---	---	0.00	0.00	---	---	---	0.21
1.00	6,750	94.00	22.84	0.22	---	---	0.00	0.00	---	---	---	0.22
1.10	7,495	94.10	22.84	0.23	---	---	0.00	0.00	---	---	---	0.23
1.20	8,240	94.20	22.84	0.25	---	---	0.00	0.00	---	---	---	0.25
1.30	8,985	94.30	22.84	0.26	---	---	0.00	0.00	---	---	---	0.26
1.40	9,729	94.40	22.84	0.27	---	---	0.00	0.00	---	---	---	0.27
1.50	10,474	94.50	22.84	0.28	---	---	0.00	0.00	---	---	---	0.28
1.60	11,219	94.60	22.84	0.29	---	---	0.00	0.00	---	---	---	0.29
1.70	11,964	94.70	22.84	0.30	---	---	0.00	0.00	---	---	---	0.30
1.80	12,709	94.80	22.84	0.31	---	---	0.00	0.00	---	---	---	0.31
1.90	13,454	94.90	22.84	0.31	---	---	0.00	0.00	---	---	---	0.31
2.00	14,199	95.00	22.84	0.32	---	---	0.00	0.00	---	---	---	0.32
2.05	14,598	95.05	22.84	0.33	---	---	0.00	0.00	---	---	---	0.33
2.10	14,997	95.10	22.84	0.33	---	---	0.00	0.00	---	---	---	0.33
2.15	15,396	95.15	22.84	0.34	---	---	0.00	0.00	---	---	---	0.34
2.20	15,796	95.20	22.84	0.34	---	---	0.00	0.00	---	---	---	0.34
2.25	16,195	95.25	22.84	0.34	---	---	0.00	0.00	---	---	---	0.34
2.30	16,594	95.30	22.84	0.35	---	---	0.00	0.00	---	---	---	0.35
2.35	16,994	95.35	22.84	0.35	---	---	0.00	0.00	---	---	---	0.35
2.40	17,393	95.40	22.84	0.36	---	---	0.00	0.00	---	---	---	0.36
2.45	17,792	95.45	22.84	0.36	---	---	0.00	0.00	---	---	---	0.36

Continues on next page...

Total Pod Volume SB# 2

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
2.50	18,192	95.50	22.84	0.36	---	---	0.00	0.00	---	---	---	0.36
2.55	18,609	95.55	22.84	0.37	---	---	0.47	0.00	---	---	---	0.84
2.60	19,027	95.60	22.84	0.37	---	---	1.32	0.00	---	---	---	1.70
2.65	19,445	95.65	22.84	0.38	---	---	2.43	0.00	---	---	---	2.81
2.70	19,863	95.70	22.84	0.38	---	---	3.74	0.00	---	---	---	4.12
2.75	20,280	95.75	22.84	0.38	---	---	5.23	0.00	---	---	---	5.62
2.80	20,698	95.80	22.84	0.39	---	---	6.88	0.00	---	---	---	7.27
2.85	21,116	95.85	22.84	0.39	---	---	8.67	0.00	---	---	---	9.06
2.90	21,534	95.90	22.84	0.39	---	---	10.59	0.00	---	---	---	10.98
2.95	21,951	95.95	22.84	0.40	---	---	12.64	0.00	---	---	---	13.03
3.00	22,369	96.00	22.84	0.40	---	---	14.80	0.00	---	---	---	15.20
3.10	23,261	96.10	22.84	0.41	---	---	19.45	0.00	---	---	---	19.86
3.20	24,153	96.20	24.91	0.39	---	---	24.51	0.00	---	---	---	24.91
3.30	25,045	96.30	30.25	0.30	---	---	29.95	0.00	---	---	---	30.25
3.40	25,937	96.40	33.90	0.19	---	---	33.71	0.00	---	---	---	33.90
3.50	26,829	96.50	34.85	0.16	---	---	34.69	0.00	---	---	---	34.85
3.60	27,721	96.60	35.54	0.14	---	---	35.40	0.00	---	---	---	35.54
3.70	28,613	96.70	36.10	0.13	---	---	35.97	0.00	---	---	---	36.10
3.80	29,505	96.80	36.59	0.11	---	---	36.47	0.00	---	---	---	36.59
3.90	30,397	96.90	37.02	0.10	---	---	36.91	0.00	---	---	---	37.02
4.00	31,290	97.00	37.43	0.09	---	---	37.33	0.00	---	---	---	37.42
4.10	32,259	97.10	37.80	0.09	---	---	37.71	0.00	---	---	---	37.79
4.20	33,228	97.20	38.16	0.08	---	---	38.07	0.00	---	---	---	38.15
4.30	34,198	97.30	38.51	0.07	---	---	38.42	0.00	---	---	---	38.49
4.40	35,167	97.40	38.84	0.07	---	---	38.77	0.00	---	---	---	38.84
4.50	36,137	97.50	39.16	0.07	---	---	39.09	0.00	---	---	---	39.16
4.60	37,106	97.60	39.48	0.06	---	---	39.40	0.00	---	---	---	39.47
4.70	38,075	97.70	39.79	0.06	---	---	39.72	0.00	---	---	---	39.77
4.80	39,045	97.80	40.09	0.05	---	---	40.03	0.00	---	---	---	40.08
4.90	40,014	97.90	40.39	0.05	---	---	40.33	0.00	---	---	---	40.38
5.00	40,984	98.00	40.69	0.05	---	---	40.63	0.00	---	---	---	40.68
5.10	42,033	98.10	40.98	0.05	---	---	40.91	0.00	---	---	---	40.96
5.20	43,082	98.20	41.27	0.04	---	---	41.19	0.00	---	---	---	41.23
5.30	44,131	98.30	41.55	0.04	---	---	41.49	0.00	---	---	---	41.53
5.40	45,181	98.40	41.83	0.04	---	---	41.76	0.00	---	---	---	41.80
5.50	46,230	98.50	42.11	0.04	---	---	42.02	0.00	---	---	---	42.06
5.60	47,279	98.60	42.39	0.04	---	---	42.31	0.00	---	---	---	42.35
5.70	48,328	98.70	42.66	0.04	---	---	42.57	0.00	---	---	---	42.61
5.80	49,378	98.80	42.93	0.04	---	---	42.83	0.00	---	---	---	42.87
5.90	50,427	98.90	43.20	0.03	---	---	43.12	0.00	---	---	---	43.15
6.00	51,476	99.00	43.47	0.03	---	---	43.37	0.00	---	---	---	43.41

...End

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	25.28	6	726	103,312	----	------	------	Ultimate Drainage Area for SB 1
3	SCS Runoff	23.15	6	720	71,393	----	------	------	Ultimate Drainage Area for SB 2
8	Reservoir	14.83	6	744	103,265	1	95.99	71,077	Routed Thru SB 1
11	Reservoir	21.03	6	726	71,360	3	96.12	23,467	Routed Thru SB 2

Hydrograph Report

Hydraflow Hydrographs by Intelisolve | Sunday, Aug 22 2004, 3:16 PM

Hyd. No. 3

Ultimate Drainage Area for SB 2

Hydrograph type	= SCS Runoff	Peak discharge	= 23.15 cfs
Storm frequency	= 2 yrs	Time interval	= 6 min
Drainage area	= 8.90 ac	Curve number	= 89
Basin Slope	= 2.4 %	Hydraulic length	= 1100 ft
Tc method	= USER	Time of conc. (Tc)	= 18.5 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 71,393 cuft

(Printed values >= 1% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Outflow (cfs)	Time (hrs)	Outflow (cfs)	Time (hrs)	Outflow (cfs)	Time (hrs)	Outflow (cfs)
8.80	0.24	12.20	13.38	15.60	0.72	19.00	0.43
8.90	0.25	12.30	6.89	15.70	0.70	19.10	0.42
9.00	0.27	12.40	3.89	15.80	0.69	19.20	0.42
9.10	0.29	12.50	3.31	15.90	0.67	19.30	0.41
9.20	0.30	12.60	2.78	16.00	0.65	19.40	0.40
9.30	0.32	12.70	2.38	16.10	0.63	19.50	0.40
9.40	0.33	12.80	2.13	16.20	0.62	19.60	0.39
9.50	0.33	12.90	1.97	16.30	0.61	19.70	0.38
9.60	0.34	13.00	1.84	16.40	0.60	19.80	0.38
9.70	0.36	13.10	1.71	16.50	0.59	19.90	0.37
9.80	0.38	13.20	1.60	16.60	0.59	20.00	0.36
9.90	0.41	13.30	1.52	16.70	0.58	20.10	0.36
10.00	0.44	13.40	1.44	16.80	0.57	20.20	0.35
10.10	0.47	13.50	1.37	16.90	0.57	20.30	0.35
10.20	0.51	13.60	1.30	17.00	0.56	20.40	0.35
10.30	0.55	13.70	1.23	17.10	0.56	20.50	0.35
10.40	0.59	13.80	1.18	17.20	0.55	20.60	0.35
10.50	0.64	13.90	1.12	17.30	0.54	20.70	0.34
10.60	0.69	14.00	1.07	17.40	0.54	20.80	0.34
10.70	0.75	14.10	1.02	17.50	0.53	20.90	0.34
10.80	0.82	14.20	0.99	17.60	0.52	21.00	0.34
10.90	0.89	14.30	0.96	17.70	0.52	21.10	0.34
11.00	0.97	14.40	0.94	17.80	0.51	21.20	0.34
11.10	1.07	14.50	0.92	17.90	0.50	21.30	0.34
11.20	1.20	14.60	0.90	18.00	0.50	21.40	0.34
11.30	1.36	14.70	0.89	18.10	0.49	21.50	0.33
11.40	1.55	14.80	0.87	18.20	0.48	21.60	0.33
11.50	1.76	14.90	0.85	18.30	0.48	21.70	0.33
11.60	2.40	15.00	0.83	18.40	0.47	21.80	0.33
11.70	4.41	15.10	0.81	18.50	0.46	21.90	0.33
11.80	8.44	15.20	0.79	18.60	0.46	22.00	0.33
11.90	16.02	15.30	0.78	18.70	0.45	22.10	0.33
12.00	23.15 <<	15.40	0.76	18.80	0.44	22.20	0.33
12.10	21.16	15.50	0.74	18.90	0.44	22.30	0.32

Continues on next page...

Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Sunday, Aug 22 2004, 1:33 PM

Hyd. No. 11

Routed Thru SB 2

Hydrograph type	= Reservoir	Peak discharge	= 21.03 cfs
Storm frequency	= 2 yrs	Time interval	= 6 min
Inflow hyd. No.	= 3	Reservoir name	= Total Pod Volume
Max. Elevation	= 96.12 ft	Max. Storage	= 23,467 cuft

Storage Indication method used.

Outflow hydrograph volume = 71,360 cuft

(Printed values >= 1% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
11.60	2.40	93.99	22.84	0.22	-----	-----	-----	-----	-----	-----	-----	0.22
11.70	4.41	94.14	22.84	0.24	-----	-----	-----	-----	-----	-----	-----	0.24
11.80	8.44	94.44	22.84	0.27	-----	-----	-----	-----	-----	-----	-----	0.27
11.90	16.02	95.02	22.84	0.33	-----	-----	-----	-----	-----	-----	-----	0.33
12.00	23.15 <<	95.75	22.84	0.38	-----	-----	5.33	-----	-----	-----	-----	5.71
12.10	21.16	96.12 <<	23.32	0.40	-----	-----	20.62	-----	-----	-----	-----	21.03 <<
12.20	13.38	96.05	22.84	0.40	-----	-----	16.93	-----	-----	-----	-----	17.34
12.30	6.89	95.89	22.84	0.39	-----	-----	10.07	-----	-----	-----	-----	10.47
12.40	3.89	95.76	22.84	0.38	-----	-----	5.66	-----	-----	-----	-----	6.05
12.50	3.31	95.70	22.84	0.38	-----	-----	3.73	-----	-----	-----	-----	4.11
12.60	2.78	95.67	22.84	0.38	-----	-----	2.96	-----	-----	-----	-----	3.34
12.70	2.38	95.65	22.84	0.38	-----	-----	2.42	-----	-----	-----	-----	2.79
12.80	2.13	95.63	22.84	0.37	-----	-----	2.07	-----	-----	-----	-----	2.45
12.90	1.97	95.62	22.84	0.37	-----	-----	1.82	-----	-----	-----	-----	2.19
13.00	1.84	95.61	22.84	0.37	-----	-----	1.63	-----	-----	-----	-----	2.00
13.10	1.71	95.61	22.84	0.37	-----	-----	1.48	-----	-----	-----	-----	1.86
13.20	1.60	95.60	22.84	0.37	-----	-----	1.36	-----	-----	-----	-----	1.73
13.30	1.52	95.60	22.84	0.37	-----	-----	1.26	-----	-----	-----	-----	1.63
13.40	1.44	95.59	22.84	0.37	-----	-----	1.18	-----	-----	-----	-----	1.55
13.50	1.37	95.59	22.84	0.37	-----	-----	1.10	-----	-----	-----	-----	1.47
13.60	1.30	95.58	22.84	0.37	-----	-----	1.03	-----	-----	-----	-----	1.40
13.70	1.23	95.58	22.84	0.37	-----	-----	0.96	-----	-----	-----	-----	1.33
13.80	1.18	95.57	22.84	0.37	-----	-----	0.89	-----	-----	-----	-----	1.26
13.90	1.12	95.57	22.84	0.37	-----	-----	0.83	-----	-----	-----	-----	1.20
14.00	1.07	95.57	22.84	0.37	-----	-----	0.78	-----	-----	-----	-----	1.15
14.10	1.02	95.56	22.84	0.37	-----	-----	0.72	-----	-----	-----	-----	1.09
14.20	0.99	95.56	22.84	0.37	-----	-----	0.68	-----	-----	-----	-----	1.05
14.30	0.96	95.56	22.84	0.37	-----	-----	0.64	-----	-----	-----	-----	1.01
14.40	0.94	95.56	22.84	0.37	-----	-----	0.61	-----	-----	-----	-----	0.98
14.50	0.92	95.56	22.84	0.37	-----	-----	0.58	-----	-----	-----	-----	0.95
14.60	0.90	95.56	22.84	0.37	-----	-----	0.56	-----	-----	-----	-----	0.93
14.70	0.89	95.55	22.84	0.37	-----	-----	0.54	-----	-----	-----	-----	0.91
14.80	0.87	95.55	22.84	0.37	-----	-----	0.52	-----	-----	-----	-----	0.89
14.90	0.85	95.55	22.84	0.37	-----	-----	0.51	-----	-----	-----	-----	0.87
15.00	0.83	95.55	22.84	0.37	-----	-----	0.49	-----	-----	-----	-----	0.86
15.10	0.81	95.55	22.84	0.37	-----	-----	0.47	-----	-----	-----	-----	0.84
15.20	0.79	95.55	22.84	0.37	-----	-----	0.46	-----	-----	-----	-----	0.83
15.30	0.78	95.55	22.84	0.37	-----	-----	0.44	-----	-----	-----	-----	0.81

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Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	51.72	6	726	217,477	----	------	------	Ultimate Drainage Area for SB 1
3	SCS Runoff	48.97	6	720	155,183	----	------	------	Ultimate Drainage Area for SB 2
8	Reservoir	35.36	6	738	217,430	1	97.53	90,535	Routed Thru SB 1
11	Reservoir	37.61	6	726	155,149	3	97.05	31,773	Routed Thru SB 2

6632e19SedimentBasins-REV-1.gpw | Return Period: 25 Year | Sunday, Aug 22 2004, 3:16 PM

Hydrograph Report

Hydraflow Hydrographs by Intelisolve | Sunday, Aug 22 2004, 3:16 PM

Hyd. No. 3

Ultimate Drainage Area for SB 2

Hydrograph type	= SCS Runoff	Peak discharge	= 48.97 cfs
Storm frequency	= 25 yrs	Time interval	= 6 min
Drainage area	= 8.90 ac	Curve number	= 89
Basin Slope	= 2.4 %	Hydraulic length	= 1100 ft
Tc method	= USER	Time of conc. (Tc)	= 18.5 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 155,183 cuft

(Printed values >= 1% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Outflow (cfs)	Time (hrs)	Outflow (cfs)	Time (hrs)	Outflow (cfs)	Time (hrs)	Outflow (cfs)
7.50	0.50	10.90	2.38	14.30	1.88	17.70	1.00
7.60	0.51	11.00	2.57	14.40	1.84	17.80	0.99
7.70	0.53	11.10	2.79	14.50	1.80	17.90	0.97
7.80	0.54	11.20	3.07	14.60	1.77	18.00	0.96
7.90	0.56	11.30	3.45	14.70	1.73	18.10	0.95
8.00	0.57	11.40	3.88	14.80	1.69	18.20	0.94
8.10	0.59	11.50	4.34	14.90	1.66	18.30	0.92
8.20	0.61	11.60	5.81	15.00	1.62	18.40	0.91
8.30	0.64	11.70	10.41	15.10	1.59	18.50	0.90
8.40	0.68	11.80	19.26	15.20	1.55	18.60	0.88
8.50	0.72	11.90	34.98	15.30	1.51	18.70	0.87
8.60	0.76	12.00	48.97 <<	15.40	1.48	18.80	0.86
8.70	0.80	12.10	43.87	15.50	1.44	18.90	0.85
8.80	0.84	12.20	27.35	15.60	1.41	19.00	0.83
8.90	0.89	12.30	13.86	15.70	1.37	19.10	0.82
9.00	0.93	12.40	7.75	15.80	1.33	19.20	0.81
9.10	0.97	12.50	6.59	15.90	1.30	19.30	0.79
9.20	1.01	12.60	5.52	16.00	1.26	19.40	0.78
9.30	1.03	12.70	4.72	16.10	1.23	19.50	0.77
9.40	1.05	12.80	4.22	16.20	1.20	19.60	0.75
9.50	1.06	12.90	3.89	16.30	1.18	19.70	0.74
9.60	1.08	13.00	3.63	16.40	1.17	19.80	0.73
9.70	1.12	13.10	3.38	16.50	1.15	19.90	0.72
9.80	1.17	13.20	3.16	16.60	1.14	20.00	0.70
9.90	1.24	13.30	2.98	16.70	1.13	20.10	0.69
10.00	1.31	13.40	2.83	16.80	1.12	20.20	0.68
10.10	1.38	13.50	2.69	16.90	1.10	20.30	0.68
10.20	1.47	13.60	2.55	17.00	1.09	20.40	0.67
10.30	1.57	13.70	2.42	17.10	1.08	20.50	0.67
10.40	1.67	13.80	2.31	17.20	1.06	20.60	0.67
10.50	1.78	13.90	2.20	17.30	1.05	20.70	0.67
10.60	1.90	14.00	2.10	17.40	1.04	20.80	0.66
10.70	2.04	14.10	2.01	17.50	1.03	20.90	0.66
10.80	2.20	14.20	1.93	17.60	1.01	21.00	0.66

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Hydrograph Report

Hydraflow Hydrographs by Intelisolve | Sunday, Aug 22 2004, 1:33 PM

Hyd. No. 11

Routed Thru SB 2

Hydrograph type	= Reservoir	Peak discharge	= 37.61 cfs
Storm frequency	= 25 yrs	Time interval	= 6 min
Inflow hyd. No.	= 3	Reservoir name	= Total Pod Volume
Max. Elevation	= 97.05 ft	Max. Storage	= 31,773 cuft

Storage Indication method used.

Outflow hydrograph volume = 155,149 cuft

(Printed values >= 1% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
11.50	4.34	95.62	22.84	0.37	-----	-----	1.77	-----	-----	-----	-----	2.14
11.60	5.81	95.70	22.84	0.38	-----	-----	3.81	-----	-----	-----	-----	4.19
11.70	10.41	95.80	22.84	0.39	-----	-----	6.98	-----	-----	-----	-----	7.37
11.80	19.26	95.98	22.84	0.40	-----	-----	13.81	-----	-----	-----	-----	14.21
11.90	34.98	96.24	27.06	0.35	-----	-----	26.71	-----	-----	-----	-----	27.06
12.00	48.97 <<	96.66	35.90	0.13	-----	-----	35.77	-----	-----	-----	-----	35.90
12.10	43.87	97.05 <<	37.61	0.09	-----	-----	37.52	-----	-----	-----	-----	37.61 <<
12.20	27.35	96.98	37.34	0.10	-----	-----	37.24	-----	-----	-----	-----	37.34
12.30	13.86	96.38	33.33	0.21	-----	-----	33.12	-----	-----	-----	-----	33.33
12.40	7.75	95.91	22.84	0.39	-----	-----	11.05	-----	-----	-----	-----	11.45
12.50	6.59	95.81	22.84	0.39	-----	-----	7.22	-----	-----	-----	-----	7.61
12.60	5.52	95.77	22.84	0.38	-----	-----	5.92	-----	-----	-----	-----	6.30
12.70	4.72	95.74	22.84	0.38	-----	-----	4.96	-----	-----	-----	-----	5.34
12.80	4.22	95.72	22.84	0.38	-----	-----	4.28	-----	-----	-----	-----	4.66
12.90	3.89	95.70	22.84	0.38	-----	-----	3.81	-----	-----	-----	-----	4.19
13.00	3.63	95.69	22.84	0.38	-----	-----	3.49	-----	-----	-----	-----	3.87
13.10	3.38	95.68	22.84	0.38	-----	-----	3.23	-----	-----	-----	-----	3.60
13.20	3.16	95.67	22.84	0.38	-----	-----	2.98	-----	-----	-----	-----	3.36
13.30	2.98	95.66	22.84	0.38	-----	-----	2.77	-----	-----	-----	-----	3.15
13.40	2.83	95.66	22.84	0.38	-----	-----	2.60	-----	-----	-----	-----	2.98
13.50	2.69	95.65	22.84	0.38	-----	-----	2.44	-----	-----	-----	-----	2.82
13.60	2.55	95.64	22.84	0.38	-----	-----	2.31	-----	-----	-----	-----	2.69
13.70	2.42	95.64	22.84	0.37	-----	-----	2.18	-----	-----	-----	-----	2.56
13.80	2.31	95.63	22.84	0.37	-----	-----	2.06	-----	-----	-----	-----	2.43
13.90	2.20	95.63	22.84	0.37	-----	-----	1.95	-----	-----	-----	-----	2.32
14.00	2.10	95.62	22.84	0.37	-----	-----	1.84	-----	-----	-----	-----	2.21
14.10	2.01	95.62	22.84	0.37	-----	-----	1.74	-----	-----	-----	-----	2.11
14.20	1.93	95.61	22.84	0.37	-----	-----	1.65	-----	-----	-----	-----	2.02
14.30	1.88	95.61	22.84	0.37	-----	-----	1.57	-----	-----	-----	-----	1.94
14.40	1.84	95.61	22.84	0.37	-----	-----	1.52	-----	-----	-----	-----	1.89
14.50	1.80	95.61	22.84	0.37	-----	-----	1.47	-----	-----	-----	-----	1.84
14.60	1.77	95.60	22.84	0.37	-----	-----	1.43	-----	-----	-----	-----	1.80
14.70	1.73	95.60	22.84	0.37	-----	-----	1.40	-----	-----	-----	-----	1.77
14.80	1.69	95.60	22.84	0.37	-----	-----	1.36	-----	-----	-----	-----	1.73
14.90	1.66	95.60	22.84	0.37	-----	-----	1.32	-----	-----	-----	-----	1.70
15.00	1.62	95.60	22.84	0.37	-----	-----	1.29	-----	-----	-----	-----	1.67
15.10	1.59	95.60	22.84	0.37	-----	-----	1.26	-----	-----	-----	-----	1.63
15.20	1.55	95.59	22.84	0.37	-----	-----	1.23	-----	-----	-----	-----	1.60

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DRAINAGE CALCULATIONS

FOR

NEW TOWN
BLOCK 6&7 (JCC-SP-102-04)
MOVIE THEATER (JCC-SP-103-04)

SITE:

James City County

SUBMITTED TO:

Environmental Division
James City County

Block 6+7 Parking
SP-102-04

Prepared By:

AES Consulting Engineers
5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188

August 23, 2004

AES Project No. 6632-E-21-1 & 6632-E-21-2

6632E20-1-drncalcs.doc

AES CONSULTING ENGINEERS

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	61.0	0.00	40.82	0.00	0.00	32.07	0.0	14.2	5.3	168.8	650.1	8.60	60	6.23	68.80	65.00	79.16	78.90	77.00	82.76	#2-1A TO #2-1
2	1	68.0	0.00	40.16	0.00	0.00	31.54	0.0	14.0	5.3	166.8	565.0	8.50	60	4.71	72.00	68.80	80.59	80.31	81.50	77.00	#2-2 TO #2-1A
3	2	59.0	0.27	7.37	0.80	0.22	5.65	5.0	13.6	5.3	30.19	182.1	4.27	36	7.46	76.40	72.00	81.83	81.71	83.80	81.50	#2-20 TO #2-2
4	3	220.0	0.50	7.10	0.65	0.33	5.44	5.0	13.0	5.4	29.60	67.73	6.89	30	2.73	82.40	76.40	85.73	82.04	89.89	83.80	#2-21 TO #2-20
5	4	219.0	0.12	6.13	0.65	0.08	4.81	5.0	12.3	5.6	26.73	60.08	6.42	30	2.15	87.10	82.40	90.17	85.73	96.70	89.89	#2-22 TO #2-21
6	5	105.0	0.00	5.92	0.00	0.00	4.66	0.0	11.9	5.6	26.21	41.98	5.41	30	1.05	88.20	87.10	90.59	90.17	98.76	96.70	#2-23 TO #2-22
7	6	105.0	0.07	4.94	0.65	0.05	3.98	5.0	11.5	5.7	22.65	41.98	5.78	30	1.05	89.30	88.20	92.01	90.59	99.65	98.76	#2-24 TO #2-23
8	7	56.0	0.22	4.77	0.70	0.15	3.86	5.0	11.3	5.7	22.09	23.89	4.50	30	0.34	89.49	89.30	92.17	92.01	99.92	99.65	#2-25 TO #2-24
9	8	178.0	0.17	3.65	0.70	0.12	2.89	5.0	10.7	5.8	16.86	22.62	5.37	24	1.00	91.27	89.49	93.47	92.48	101.41	99.92	#2-26 TO #2-25
10	9	185.0	0.46	1.43	0.80	0.37	1.10	5.0	8.6	6.2	6.88	11.50	5.93	15	3.17	97.14	91.27	99.25	93.92	104.52	101.41	#2-27 TO #2-26
11	10	230.0	0.17	0.76	0.80	0.14	0.58	5.0	7.4	6.5	3.75	8.51	3.87	15	1.73	101.13	97.14	102.41	99.25	108.51	104.52	#2-29 TO #2-27
12	11	112.0	0.32	0.44	0.70	0.22	0.32	5.0	6.4	6.8	2.16	9.53	2.78	15	2.18	103.57	101.13	104.45	102.41	111.04	108.51	#2-31 TO #2-29
13	12	47.0	0.12	0.12	0.80	0.10	0.10	5.0	5.0	7.1	0.68	6.46	1.34	15	1.00	104.04	103.57	104.45	104.45	111.04	111.04	#2-32 TO #2-31
14	11	38.0	0.15	0.15	0.80	0.12	0.12	5.0	5.0	7.1	0.86	6.46	0.80	15	1.00	101.51	101.13	102.41	102.41	108.51	108.51	#2-30 TO #2-29
15	10	38.0	0.21	0.21	0.75	0.16	0.16	5.0	5.0	7.1	1.12	6.46	0.91	15	1.00	97.52	97.14	99.26	99.25	104.52	104.52	#2-28 TO #2-27
16	9	38.0	0.23	0.23	0.80	0.18	0.18	5.0	5.0	7.1	1.31	18.56	2.14	15	8.26	94.41	91.27	95.06	93.92	101.41	101.41	#2-25A TO #2-25
17	7	43.0	0.10	0.10	0.80	0.08	0.08	5.0	5.0	7.1	0.57	3.64	2.63	12	1.05	92.55	92.10	92.99	92.42	99.50	99.65	#2-24A TO #2-24
18	6	90.0	0.53	0.98	0.65	0.34	0.68	5.0	5.2	7.1	4.82	7.46	4.58	15	1.33	90.30	89.10	91.85	90.59	97.75	98.76	#2-23A TO #2-23
19	18	36.0	0.45	0.45	0.75	0.34	0.34	5.0	5.0	7.1	2.40	3.75	3.06	12	1.11	90.70	90.30	92.01	91.85	97.75	97.75	#2-23B TO #2-23
20	5	36.0	0.09	0.09	0.70	0.06	0.06	5.0	5.0	7.1	0.45	3.75	0.77	12	1.11	89.60	89.20	90.17	90.17	96.70	96.70	#2-22A TO #2-22
21	4	36.0	0.47	0.47	0.65	0.31	0.31	5.0	5.0	7.1	2.18	3.75	2.77	12	1.11	82.80	82.40	85.87	85.73	89.89	89.89	#2-21A TO #2-21

Project File: 6632E19-sys2(REV-1).stm

Number of lines: 94

Run Date: 08-23-2004

NOTES: Intensity = 143.72 / (Inlet time + 19.20) ^ 0.94; Return period = 10 Yrs.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
22	2	123.0	2.51	31.72	0.85	2.13	24.98	5.0	13.7	5.3	133.2	250.8	8.38	54	1.63	74.00	72.00	82.27	81.71	82.00	81.50	#2-3 TO #2-2
23	22	150.0	0.59	0.59	0.84	0.50	0.50	5.0	5.0	7.1	3.53	9.13	2.88	15	2.00	77.00	74.00	83.54	83.09	85.80	82.00	#2-4 TO #2-3
24	22	258.0	0.29	28.62	0.84	0.24	22.35	5.0	13.1	5.4	121.4	229.1	7.64	54	1.36	77.50	74.00	84.07	83.09	91.00	82.00	#2-5 TO #2-3
25	24	183.0	0.14	27.79	0.84	0.12	21.65	5.0	12.6	5.5	119.2	195.0	7.50	54	0.98	79.30	77.50	85.65	84.98	94.30	91.00	#2-6 TO #2-5
26	25	131.0	0.00	27.65	0.00	0.00	21.53	0.0	12.3	5.6	119.7	195.9	7.53	54	0.99	80.60	79.30	86.53	86.05	95.04	94.30	#2-7 TO #2-6
27	26	59.0	0.27	10.80	0.65	0.18	8.28	5.0	12.2	5.6	46.17	41.36	9.67	30	1.02	86.60	86.00	91.43	88.25	96.37	95.04	#2-8 TO #2-7
28	27	145.0	0.00	10.19	0.00	0.00	7.86	0.0	11.9	5.6	44.24	41.71	9.01	30	1.03	88.10	86.60	93.11	91.43	98.54	96.37	#2-9 TO #2-8
29	28	48.0	0.00	9.93	0.00	0.00	7.69	0.0	11.8	5.6	43.42	41.86	8.85	30	1.04	88.60	88.10	94.60	94.06	98.55	98.54	#2-10 TO #2-9
30	29	104.0	0.84	8.97	0.70	0.59	7.01	5.0	11.6	5.7	39.84	40.22	8.12	30	0.96	89.60	88.60	96.50	95.51	99.68	98.55	#2-11 TO #2-10
31	30	116.0	0.00	8.13	0.00	0.00	6.42	0.0	11.3	5.7	36.80	53.72	7.50	30	1.72	91.59	89.60	97.58	96.65	100.49	99.68	#2-12 TO #2-11
32	31	118.0	0.21	7.46	0.80	0.17	5.97	5.0	11.0	5.8	34.53	50.65	7.04	30	1.53	93.39	91.59	98.81	97.98	102.02	100.49	#2-13A TO #2-12
33	32	185.0	0.15	7.07	0.70	0.11	5.68	5.0	10.5	5.9	33.31	51.44	6.79	30	1.57	96.30	93.39	100.38	99.16	104.93	102.02	#2-14A TO #2-13
34	33	230.0	0.16	2.28	0.70	0.11	1.65	5.0	9.0	6.2	10.17	15.47	5.76	18	2.17	101.29	96.30	103.38	101.10	108.67	104.93	#2-15A TO #2-14
35	34	108.0	0.00	1.91	0.00	0.00	1.39	0.0	8.6	6.2	8.68	11.83	5.01	18	1.27	102.66	101.29	104.40	103.38	110.46	108.67	#2-16 TO #2-15A
36	35	66.0	0.25	1.09	0.70	0.18	0.76	5.0	8.2	6.3	4.83	10.50	2.98	18	1.00	103.32	102.66	104.50	104.40	110.75	110.46	#2-17 TO #2-16
37	36	202.0	0.28	0.84	0.70	0.20	0.59	5.0	7.2	6.6	3.86	6.46	3.95	15	1.00	105.34	103.32	106.65	104.58	112.49	110.75	#2-17A TO #2-17
38	37	107.0	0.18	0.56	0.70	0.13	0.39	5.0	6.4	6.8	2.65	6.46	3.13	15	1.00	106.41	105.34	107.42	106.65	113.45	112.49	#2-17B TO #2-17
39	38	127.0	0.38	0.38	0.70	0.27	0.27	5.0	5.0	7.1	1.90	17.16	2.71	15	7.06	115.38	106.41	116.19	107.42	118.00	113.45	#2-17C TO #2-17
40	35	27.0	0.30	0.30	0.70	0.21	0.21	5.0	5.0	7.1	1.50	18.18	2.29	15	7.93	104.80	102.66	105.50	104.40	111.80	110.46	#2-16A TO #2-16
41	35	66.0	0.12	0.52	0.80	0.10	0.42	5.0	6.1	6.8	2.85	7.28	2.50	15	1.27	103.50	102.66	104.51	104.40	110.79	110.46	#2-16B TO #2-16
42	41	48.0	0.24	0.24	0.80	0.19	0.19	5.0	5.0	7.1	1.37	9.13	2.23	15	2.00	104.46	103.50	105.12	104.59	110.97	110.79	#2-16C TO #2-16

Project File: 6632E19-sys2(REV-1).stm

Number of lines: 94

Run Date: 08-23-2004

NOTES: Intensity = 143.72 / (Inlet time + 19.20) ^ 0.94; Return period = 10 Yrs.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
43	41	48.0	0.16	0.16	0.80	0.13	0.13	5.0	5.0	7.1	0.91	9.13	1.84	15	2.00	104.46	103.50	104.98	104.59	110.98	110.79	#2-16D TO #2-16
44	34	38.0	0.21	0.21	0.70	0.15	0.15	5.0	5.0	7.1	1.05	6.46	0.85	15	1.00	101.67	101.29	103.39	103.38	108.67	108.67	#2-15B TO #2-15
45	33	113.0	1.49	2.09	0.85	1.27	1.81	10.0	10.0	6.0	10.78	26.06	3.43	24	1.33	98.00	96.50	101.35	101.10	102.30	104.93	#7-1 TO #2-14A
46	45	74.0	0.16	0.60	0.90	0.14	0.54	5.0	5.7	6.9	3.75	9.79	3.05	15	2.30	99.70	98.00	101.74	101.49	102.70	102.30	#7-4 TO #7-1
47	46	29.0	0.15	0.44	0.90	0.14	0.40	5.0	5.6	7.0	2.76	3.62	3.52	12	1.03	100.00	99.70	101.98	101.81	102.75	102.70	#7-5 TO #7-4
48	47	32.0	0.12	0.29	0.90	0.11	0.26	5.0	5.3	7.0	1.84	3.45	2.34	12	0.94	100.30	100.00	102.15	102.07	102.75	102.75	#7-6 TO #7-5
49	48	28.0	0.17	0.17	0.90	0.15	0.15	5.0	5.0	7.1	1.09	3.69	1.39	12	1.07	100.60	100.30	102.19	102.16	102.75	102.75	#7-7 TO #7-6
50	33	38.0	0.25	2.55	0.75	0.19	2.12	5.0	5.1	7.1	15.06	46.84	4.79	24	4.29	97.93	96.30	101.27	101.10	104.93	104.93	#2-14B TO #2-14
51	50	20.0	2.30	2.30	0.84	1.93	1.93	5.0	5.0	7.1	13.77	22.62	4.38	24	1.00	98.13	97.93	101.50	101.43	106.00	104.93	BL 3 TO #2-14B
52	32	38.0	0.18	0.18	0.70	0.13	0.13	5.0	5.0	7.1	0.90	13.37	0.73	15	4.29	95.02	93.39	99.17	99.16	102.02	102.02	#2-13B TO #2-13
53	31	100.0	0.29	0.67	0.70	0.20	0.45	5.0	5.3	7.0	3.17	6.46	2.58	15	1.00	93.84	92.84	98.22	97.98	100.44	100.49	MAIN ST. TO #2-
54	53	41.0	0.38	0.38	0.65	0.25	0.25	5.0	5.0	7.1	1.76	3.56	2.24	12	1.00	94.25	93.84	98.42	98.32	100.44	100.44	FUTURE
55	29	101.0	0.37	0.96	0.65	0.24	0.68	5.0	5.1	7.1	4.84	6.43	3.94	15	0.99	90.60	89.60	96.08	95.51	97.75	98.55	#2-10A TO #2-10
56	55	36.0	0.59	0.59	0.75	0.44	0.44	5.0	5.0	7.1	3.15	3.75	4.02	12	1.11	91.00	90.60	96.60	96.32	97.75	97.75	#2-10B TO #2-10
57	28	96.0	0.26	0.26	0.65	0.17	0.17	5.0	5.0	7.1	1.20	6.59	0.98	15	1.04	92.70	91.70	94.10	94.06	99.68	98.54	#2-9A TO #2-9
58	27	36.0	0.34	0.34	0.70	0.24	0.24	5.0	5.0	7.1	1.70	3.75	2.16	12	1.11	89.40	89.00	91.51	91.43	96.37	96.37	#2-8A TO #2-8
59	26	155.0	0.35	16.85	0.65	0.23	13.26	5.0	7.0	6.6	87.54	193.5	5.50	54	0.97	82.10	80.60	87.72	87.41	92.73	95.04	#2-7A TO #2-7
60	24	120.0	0.54	0.54	0.85	0.46	0.46	5.0	5.0	7.1	3.27	8.34	3.55	15	1.67	85.00	83.00	86.16	84.98	90.40	91.00	#2-5A TO #2-5
61	59	36.0	0.00	16.50	0.00	0.00	13.03	0.0	6.9	6.6	86.33	151.4	6.87	48	1.11	82.50	82.10	88.32	88.19	92.45	92.73	#2-7B TO #2-7A
62	61	29.0	0.00	0.36	0.00	0.00	0.27	0.0	5.1	7.1	1.91	7.54	2.44	12	4.48	86.30	85.00	89.14	89.05	93.10	92.45	#2-7BB TO #2-7B
63	61	88.0	0.00	16.14	0.00	0.00	12.76	0.0	6.7	6.7	85.27	169.8	6.79	48	1.40	83.73	82.50	89.37	89.05	92.80	92.45	#6-1 TO #2-7B

Project File: 6632E19-sys2(REV-1).stm

Number of lines: 94

Run Date: 08-23-2004

NOTES: Intensity = 143.72 / (Inlet time + 19.20) ^ 0.94; Return period = 10 Yrs.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
64	63	132.0	0.78	14.89	0.84	0.66	11.73	5.0	6.4	6.8	79.23	154.9	8.24	42	2.37	86.86	83.73	91.35	90.08	95.50	92.80	#6-2 TO #6-1
65	1	67.0	0.13	0.66	0.80	0.10	0.53	5.0	5.1	7.1	3.75	20.42	3.05	15	10.00	75.50	68.80	80.53	80.31	82.76	77.00	#2-1B TO #2-1A
66	65	24.0	0.53	0.53	0.80	0.42	0.42	5.0	5.0	7.1	3.02	3.98	3.85	12	1.25	75.80	75.50	80.73	80.55	82.76	82.76	#2-1C TO #2-1B
67	63	23.0	0.21	1.25	0.90	0.19	1.03	5.0	5.5	7.0	7.18	15.17	5.85	15	5.52	85.00	83.73	90.37	90.08	93.20	92.80	#6-1B TO #6-2
68	67	11.0	0.66	1.04	0.84	0.55	0.84	5.0	5.5	7.0	5.87	15.70	4.78	15	5.91	85.65	85.00	90.54	90.45	93.00	93.20	#6-1A TO #6-1B
69	64	249.0	1.68	1.68	0.84	1.41	1.41	5.0	5.0	7.1	10.06	14.85	5.69	18	2.00	91.84	86.86	93.90	91.35	95.50	95.50	#6-6 TO #6-2
70	64	86.0	0.48	1.32	0.84	0.40	1.03	5.0	5.2	7.1	7.31	7.91	5.95	15	1.50	88.15	86.86	92.45	91.35	95.50	95.50	#6-8 TO #6-2
71	70	43.0	0.84	0.84	0.75	0.63	0.63	5.0	5.0	7.1	4.49	7.94	3.66	15	1.51	88.80	88.15	93.08	92.87	95.00	95.50	#6-9 TO #6-8
72	64	205.0	0.00	11.11	0.00	0.00	8.63	0.0	6.0	6.9	59.22	96.82	8.98	36	2.11	91.18	86.86	96.11	91.35	100.50	95.50	#6-3 TO #6-2
73	72	116.0	6.69	11.11	0.84	5.62	8.63	5.0	5.8	6.9	59.74	94.32	8.45	36	2.00	93.50	91.18	97.89	96.11	99.50	100.50	#6-4 TO #6-3
74	73	161.0	0.55	1.09	0.65	0.36	0.79	5.0	5.2	7.1	5.59	6.64	4.56	15	1.06	95.20	93.50	99.10	97.89	100.59	99.50	FUTURE
75	74	38.0	0.54	0.54	0.80	0.43	0.43	5.0	5.0	7.1	3.08	3.65	3.92	12	1.05	95.60	95.20	99.70	99.42	100.59	100.59	FUTURE
76	73	115.0	2.77	3.33	0.65	1.80	2.22	5.0	5.3	7.1	15.66	23.10	4.99	24	1.04	94.70	93.50	98.44	97.89	100.59	99.50	FUTURE
77	76	38.0	0.56	0.56	0.75	0.42	0.42	5.0	5.0	7.1	2.99	6.63	2.44	15	1.05	95.10	94.70	98.91	98.83	100.59	100.59	FUTURE
78	2	29.0	0.27	1.07	0.85	0.23	0.91	5.0	10.4	5.9	5.35	35.85	4.36	15	22.07	78.40	72.00	81.85	81.71	81.90	81.50	#1-1 TO #2-2
79	78	59.0	0.07	0.80	0.85	0.06	0.68	5.0	10.1	5.9	4.04	10.88	3.29	15	2.03	79.60	78.40	82.06	81.90	84.60	81.90	#1-2 TO #1-1
80	79	113.0	0.16	0.44	0.85	0.14	0.37	5.0	9.2	6.1	2.29	7.48	3.61	12	3.16	83.17	79.60	84.24	82.20	87.67	84.60	#1-3 TO #1-2
81	80	116.0	0.12	0.23	0.85	0.10	0.20	8.0	8.0	6.4	1.25	7.60	2.50	12	3.26	86.95	83.17	87.66	84.24	91.45	87.67	#1-4 TO #1-3
82	79	16.0	0.29	0.29	0.85	0.25	0.25	10.0	10.0	6.0	1.47	5.86	1.87	12	1.94	79.91	79.60	82.22	82.20	84.64	84.60	#1-2A TO 1-2
83	80	40.0	0.05	0.05	0.85	0.04	0.04	5.0	5.0	7.1	0.30	10.16	1.28	12	5.83	85.50	83.17	85.81	84.24	87.50	87.67	#1-3A TO 1-3
84	81	40.0	0.11	0.11	0.85	0.09	0.09	5.0	5.0	7.1	0.67	10.63	1.94	12	6.38	89.50	86.95	89.98	87.66	91.50	91.45	#1-4A TO #1-4

Project File: 6632E19-sys2(REV-1).stm

Number of lines: 94

Run Date: 08-23-2004

NOTES: Intensity = 143.72 / (Inlet time + 19.20) ^ 0.94; Return period = 10 Yrs.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
85	9	23.0	0.59	1.82	0.75	0.44	1.49	5.0	10.7	5.8	8.69	6.46	7.08	15	1.00	91.50	91.27	94.34	93.92	101.00	101.41	#7-2 TO #2-25
86	85	210.0	1.23	1.23	0.85	1.05	1.05	10.0	10.0	6.0	6.24	9.13	5.38	15	2.00	95.70	91.50	97.53	94.92	102.70	101.00	#7-3 TO #7-2
87	62	18.0	0.36	0.36	0.75	0.27	0.27	5.0	5.0	7.1	1.92	9.20	2.45	12	6.67	87.50	86.30	89.23	89.18	93.50	93.10	#2-7BBB TO #2-7
88	68	50.0	0.38	0.38	0.75	0.29	0.29	5.0	5.0	7.1	2.03	17.92	1.65	15	7.70	89.50	85.65	90.85	90.80	93.50	93.00	#6-1A TO #6-1
89	8	95.0	0.36	0.90	0.90	0.32	0.81	5.0	6.6	6.7	5.43	9.13	5.53	15	2.00	97.25	95.35	98.95	96.28	100.00	99.92	#7-8 TO #2-25
90	89	36.0	0.05	0.54	0.90	0.05	0.49	5.0	6.5	6.7	3.28	5.14	4.17	12	2.08	98.00	97.25	99.26	98.95	102.50	100.00	#7-9 TO #7-8
91	90	50.0	0.15	0.49	0.90	0.14	0.44	5.0	6.2	6.8	3.00	5.04	4.33	12	2.00	99.00	98.00	100.32	99.38	102.50	102.50	#7-10 TO #7-9
92	91	32.0	0.09	0.34	0.90	0.08	0.31	5.0	6.0	6.8	2.09	4.88	2.91	12	1.87	99.60	99.00	100.40	100.32	102.50	102.50	#7-11 TO #7-10
93	92	32.0	0.12	0.25	0.90	0.11	0.23	5.0	5.8	6.9	1.56	4.88	3.01	12	1.87	100.20	99.60	101.02	100.40	102.50	102.50	#7-12 TO #7-11
94	93	50.0	0.13	0.13	0.90	0.12	0.12	5.0	5.0	7.1	0.83	3.90	2.09	12	1.20	100.80	100.20	101.35	101.02	102.50	102.50	#7-13 TO #7-12

Project File: 6632E19-sys2(REV-1).stm

Number of lines: 94

Run Date: 08-23-2004

NOTES: Intensity = 143.72 / (Inlet time + 19.20) ^ 0.94; Return period = 10 Yrs.

Scott Thomas

From: Bob Cosby [bcosby@aesva.com]
Sent: Friday, March 11, 2005 10:31 AM
To: Scott Thomas
Subject: RE: New Town - Block 6&7 Amendment #1

DA = 0.33ac.

✓ OK

Scott,

When computing the drainage area based on the cross slope of the parking lots the drainage area of 1/3 acre for the 8x6 box is confirmed. Area to the left is measured at 0.30 acres, area to right is 0.35 (0.02 acres high, but not substantial). (10-15% of drainage area is grass, mulched, or planted with trees and shrubs)

Please remember that the parking lot slopes along the gutter at approximately 4%, while the cross slope is only 2%. Therefore the main parking bay where the Filterra is located only contributes approximately half of the area. If measuring a rectangular section of the parking lot, yes the area is too great for this size of Filterra.

Additionally the 0.33 acres is based on Fully paved. Americast will allow slightly greater areas if some area is pervious. The inlet's capacity and pollutant removal ability is based on volume of runoff treated, and having the green areas in the parking lots do reduce that volume per acre slightly. The numbers noted above are not higher than those discussed with Americast previously for all four inlets in this parking lot based on the original design.

Bob Cosby

From: Scott Thomas [mailto:SCOTTT@james-city.va.us]
Sent: Friday, March 11, 2005 9:29 AM
To: Cosby, Robert E.
Subject: RE: New Town - Block 6&7 Amendment #1

For the storm piping, response acknowledged. I am still worried about the Filterras. Based on information I have from Filterra (ie. Quick Sizing table) for a 6 x 8 box or an 8 x 6 box the total contributing drainage area is 0.26 to 0.33 acres. For the two 8 x 6 which handle drainage from the new parking area (toward Discovery), it would appear that drainage area to either of the two boxes is well more than 0.33 acres. Based on rough scaling of the grading/drainage plan, it would appear that drainage area to each of the boxes is about double that.

Scott J. Thomas, P.E.
James City County
Environmental Division

Visit:
http://www.james-city.va.us/resources/devmgmt/div_devmgmt_environ.html
and
www.protectedwithpride.org

> -----Original Message-----
> **From:** Cosby, Robert E. [mailto:rcosby@aesva.com]
> **Sent:** Friday, March 11, 2005 8:59 AM
> **To:** Scott Thomas
> **Subject:** New Town - Block 6&7 Amendment #1
>
> Scott,
>
> As discussed Thursday March 10, the shape of the drainage area associated with the Filterra and Storm Drain inlets do change slightly; however for area of the parking lot that was added, an equal amount of building area was removed. The "C" Factor remains consistent based on the area served. The Filterras continue to have an adequate drainage area for each inlet in accordance with Americast

recommendations. The storm drainage system in the parking lots and roadways continues to function as designed.

Regarding the installation of the Filterra Inlets, the first two were installed several weeks ago. The remaining two were installed yesterday. The Contractor (Branscome) indicated they might be backfilling the inlets today, and the gutter pan is expected to be placed in front of the inlets in the near future. I am checking on the status of the Filterra Inlets planned as part of Phase 2 (Block 8), work being completed by Massie, to determine if they know when the two inlets located there are to be installed.

Thanks
Bob Cosby

Robert E. Cosby III, P.E.

Project Manager

AES Consulting Engineers

5248 Olde Towne Road, Suite 1

Williamsburg, VA 23188

(757) 253-0040

Fax: (757) 220-8994

WWW.AESVA.COM

AES CONSULTING ENGINEERS
Engineering, Surveying and Planning
5248 Olde Towne Road, Suite 1
WILLIAMSBURG, VIRGINIA 23188

(757) 253-0040
FAX (757) 220-8994

LETTER OF TRANSMITTAL

TO JCC ENVIRONMENTAL

DATE	JOB NO.
3/24/06	6632-E-21

ATTENTION SCOTT THOMAS

RE: NEW TOWN
BLOCK 6+7
BMP AS BUILT / CERTIFICATION

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1	PC200	7-1-A	FILTERRA
1		7-1-B	FILTERRA
1	PC201	7-3-A	FILTERRA
1		7-3-B	FILTERRA

RECEIVED
MAR 24
ENVIRONMENTAL DIVISION

SP-19-05
NEW TOWN SEC 2+4 BLOCK 6+7

THESE ARE TRANSMITTED as checked below:

☒ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval

☒ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution

☐ As requested ☐ Returned for corrections ☐ Return _____ corrected prints

☐ For review and comment ☐ _____

☐ FOR BIDS DUE _____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS

ATTACHED IS CERTIFICATIONS FOR THE FOUR (4) FILTERRAS INSTALLED IN BLOCK 6+7.

COPY TO _____ SIGNED: BOB COSBY

BRANSCOME INC.
Post Office Drawer 268
Williamsburg, Virginia 23187
WILLIAMSBURG (757) 220-0494
NORFOLK (757) 622-4909
FAX (757) 220-0390

October 26, 2004

James City County Environmental Division
101 Mounts Bay Road
Williamsburg, VA 23187-8784

Attn: Mr. Pat Menichino,
Senior Engineering Inspector

Re: New Town Ph. III Roads and Block 6&7
Fax: 259-4032

Dear Mr. Menichino,

Per your request we are providing information on the topsoil stockpile on the above referenced job. We will place the topsoil in the area designated on the plan sheet provided to James City County on Friday October 22, 2004. The erosion control measures shown on the drawing will be installed prior to the placement of topsoil in this area.

If you have any questions please call.

Sincerely,

Danny Johnson
Branscome, Inc.

ENVIRONMENTAL – STORMWATER
TRANSMITTAL

PROTECTING RESOURCES PRIDE IN DELICATE ENVIRONMENTS

James City County Jamestown 1607

COUNTY PLAN NO: SP-103-04 & SP-019-05

BMP ID CODE: PC200

WATERSHED: Powhatan Creek

- ☒ **ENTIRE RECORD FILE**
- ☐ **ASBUILTS**
- ☐ **CONSTRUCTION CERTIFICATION**
- ☐ **COMPUTATIONS**
- ☐ **OTHER:** _____

NAME: Jason Beck

SIGNATURE: Jason Beck

DATE: 1/23/08

RECEIVED JAN 23 2008
Stormwater Division

James City County Environmental Division
Stormwater Management / BMP Inspection Report
Infiltration Basin and Trench Facilities

County BMP ID Code (if known): PC200

Name of Facility: New Town Section 2+4 BlK7 BMP No.: 7-1-A/7-1-B Date: 1/17/08

Location: Parking lot adjacent to the theater

Name of Owner: New Town Associates, L.L.C.

Name of Inspector: Jason Beck

Type of Facility: _____

Weather Conditions: snowing Type: ☒ Final Inspection ☐ County BMP Inspection Program ☐ Owners Inspection

If an inspection item is not applicable, mark NA, otherwise mark the appropriate column.

O.K. - The item checked is in adequate condition and the maintenance program is currently satisfactory. No action required.
Routine - The item checked requires attention, but does not present an immediate threat to the function/integrity of the BMP.
Urgent - The item checked requires immediate attention to keep the BMP operational and prevent damage to the facility.

Provide an explanation and details in the comment column, if routine or urgent are marked.

Facility Item	O.K.	Routine	Urgent	Comments
Accessibility:				
Roads	✓			
Parking Areas	✓			
Gates				
Locks				
Safety Fencing				
Observation Wells/Areas:				
Trap Doors				
Manhole Covers				
Grates	✓			
Steps				
Pretreatment Devices: ☐ Inlet ☐ Sump ☐ Forebay ☐ Other				
Sediment				
Trash & Debris				
Structure				
Other				

Facility Item	O.K.	Routine	Urgent	Comments
Primary Storage/ Infiltration Area: 7-1-A / 7-1-B				
Trash & Debris	✓			
Sediment	✓			
Ponding / Drawdown	✓			
Surface Aggregates	✓			
Aesthetics	✓			
Other				
Inlet Structure # 1 (Describe Location): 7-1-A				
Condition of Structure	✓			
Erosion	✓			
Trash and Debris	✓			
Sediment	✓			
Aesthetics	✓			
Other				
Inlet Structure # 2 (Describe Location): 7-1-B				
Condition of Structure	✓			
Erosion	✓			
Trash and Debris	✓			
Sediment	✓			
Aesthetics	✓			
Other				
Inlet Structure # 3 (Describe Location):				
Condition of Structure				
Erosion				
Trash and Debris				
Sediment				
Aesthetics				
Other				
Outlets - Overflow or Bypass Control Structures (Describe Location):				
Condition of Structure	✓			
Erosion	✓			
Trash and Debris	✓			
Sediment	✓			
Other				
Nuisance Type Conditions:				

Facility Item	O.K.	Routine	Urgent	Comments
Mosquito Breeding	✓			
Animals, Rodents	✓			
Graffiti	✓			
Other				
Perimeter (Contributing Drainage Area) Conditions:				
Stabilization	✓			
Vegetation Condition	✓			
Trash and Debris	✓			
Aesthetics	✓			
Other				

Remarks:

Overall Environmental Division Internal Rating: 4

Signature: Jason Beck **Date:** 1/12/08

Title: Environmental Inspector

SWMProg\BMP\CoInspProg\SubDetInfil.wpd

WATERSHED	PC	MAINTENANCE PLAN	Yes	CTRL STRUC DESC	Conc Box
BMP ID NO	200	SITE AREA acre	7.04	CTRL STRUC SIZE inches	
PLAN NO	SP-102-03	LAND USE	Mixed Use	OTLT BARRL DESC	HDPE
TAX PARCEL		old BMP TYP		OTLT BARRL SIZE inch	6
PIN NO		JCC BMP CODE	ZI Manuf BMP systems		
CONSTRUCTION DATE	11/1/2005	POINT VALUE	na	EMERG SPILLWAY	No
PROJECT NAME	New Town Sec 2 & 4, Block 6 & 7			DESIGN HW ELEV	102.8
FACILITY LOCATION	East Parking Lot			PERM POOL ELE	na
CITY-STATE	Williamsburg, VA 23188	SVC DRAIN AREA acres	0.35	2-YR OUTFLOW cfs	0.00
CURRENT OWNER	New Town Assoc. LLC			10-YR OUTFLOW cfs	0.00
OWNER ADDRESS	4801 Courthouse Street			REC DRAWING	Yes
OWNER ADDRESS 2		SERVICE AREA DESCRI	Parking Lot (right)		
CITY-STATE-ZIP CODE	Williamsburg, VA 23188	IMPERV AREA acres	0.35	CONSTR CERTI	Yes
OWNER PHONE	757-565-6200	RECV STREAM	UT of Pow Creek		
MAINT AGREEMENT	Yes	EXT DET-WQ-CTRL	Yes	LAST INSP DATE	
EMERG ACTION PLAN	No	WTR QUAL VOL acre-ft		INTERNAL RATING	
		CHAN PROT CTRL	No	MISC/COMMENTS	
		CHAN PROT VOL acre-ft	0	Unit 7-1-A & 7-1-B,Double 8x6. Amended SP1905. LID component approved MSWMP.	
		SW/FLOOD CONTROL	No		
		GEOTECH REPORT	No		

Get Last BMP No

Return to Menu

Erosion and Sediment Control Preconstruction Meeting Checklist

Project: New Town Section 4 Blocks 6 + 7

Date: 10/8/04 Time: 9:30 AM/PM

Permitee: NewTown Associates LLC Address: 4801 Courthouse St. Suite 329

Contractor: Branscome

Phone No.: 229-2504 Fax No.: 220-0390

Address: P.O Drawer 2100 Williamsburg, VA 23187

1. Phasing of Erosion and Sediment Control Practices

   A. Narrative Plan

   B. Contractor-Developed Sequence of Construction

2. Installation Procedure for Primary Erosion and Sediment Control Practices

✓	Construction Entrance	✓	Sediment Basins
	Silt Fence		Stormwater Management/BMP Facilities
	Rock Check Dams	✓	Diversions
	Culvert & Storm Drain Inlet Protection		Soil Blankets & Mattings
	Stormwater Conveyance Channels		Mulching
	Temporary Seeding		Permanent Seeding
	Outlet Protection		Storm Drainage System
✓	Sediment Traps		Other

3. Inspection and Enforcement Procedures

   A. Permittee/Contractor Inspections:

   B. County Inspections: ✓

   C. Enforcement Actions: ✓

      1. Informal Contact: ✓

      2. Inspection Report: ✓

Revised 1/02


PC201
PC200

ENVIRONMENTAL DIVISION REVIEW COMMENTS
NEW TOWN BLOCK 6 & 7 / NEW TOWN MOVIE THEATRE
COUNTY PLAN NOS. SP - 102 – 04 / SP – 103 - 04
August 30, 2004

MDW/SJT

Note: Due to "expedited review" status, both plans as referenced above were reviewed concurrently by the Environmental Division. Comments are presented below.

NEW TOWN BLOCK 6 & 7(PARKING AREA)

1. A Land-Disturbing Permit and Siltation Agreement, with surety, are required for this project.

2. Water and sewer inspection fees, as applicable, must be paid in full prior to issuance of a Land-Disturbing Permit.

3. Record Drawing and Construction Certification. The stormwater management/BMP facilities as proposed for this project (bioretention filter boxes) will require submission, review and approval of a record drawing (as-built) and construction certification prior to release of the posted bond/surety. Provide notes on the plan accordingly to ensure this activity is adequately coordinated and performed before, during and following construction in accordance with current County guidelines.

4. VPDES. It appears land disturbance for the project may exceed one (1) acre. Therefore, it is the owner's responsibility to register for a General Virginia Pollutant Discharge Elimination System (VPDES) Permit for Discharges of Stormwater from Construction Activities, in accordance with current requirements of the Virginia Department of Environmental Quality and 9 VAC 25-180-10 et seq. Contact the Tidewater Regional Office of the DEQ at (757) 518-2000 or the Central Office at (804) 698-4000 for further information.

5. Label the Phase III roadway (County Plan SP-82-04) on Sheet 2.

6. Diversion Dike. Provide slope protection where the diversion dike enters the interior of the onsite temporary sediment basin.

7. Stormwater Management. Similar to that provided in the design report, provide a note on the cover sheet of the plans to indicate that all drainage associated with this project is directed into the drainage system associated with the Phase III roadway (County Plan No. SP-82-04) and the Phase I roadway (SP-50-02) and into BMP # 53 (County BMP ID # PC 173).

8. Manufactured BMPs. The use of four (4) bioretention tree box units are indicated on Sheet 5. Provide a specific maintenance plan for the BMP units, or at a minimum, provide a note referencing manufacturer's recommendations and Minimum Standard & Spec. 3.11 C of the VSMH for maintenance. (*Note: A maintenance plan is required for all BMPs per the Chesapeake Bay Preservation ordinance.)*

sheet 10

3. Record Drawing and Construction Certification. The stormwater management/BMP facilities as proposed for this project (bioretention filter boxes) will require submission, review and approval of a record drawing (as-built) and construction certification prior to release of the posted bond/surety. Provide notes on the plan accordingly to ensure this activity is adequately coordinated and performed before, during and following construction in accordance with current County guidelines.

A note has been added to Sheet 10.

4. VPDES. It appears land disturbance for the project may exceed one (1) acre. Therefore, it is the owner's responsibility to register for a General Virginia Pollutant Discharge Elimination System (VPDES) Permit for Discharges of Stormwater from Construction Activities, in accordance with current requirements of the Virginia Department of Environmental Quality and 9 VAC 25-180-10 et seq. Contact the Tidewater Regional Office of the DEQ at (757) 518-2000 or the Central Office at (804) 698-4000 for further information.

Permit # VAR 102294

New Town has acquired a VPDES permit for all development within the Project Area. A General Note has been added to the Cover Sheet indicating permit number.

5. Label the Phase III roadway (County Plan SP-82-04) on Sheet 2.

Phase III roads are labeled as requested.

6. Diversion Dike. Provide slope protection where the diversion dike enters the interior of the onsite temporary sediment basin.

A note has been provided from the revised Phase III Road Plans which indicates that rip rap will be provided at the end of the diversion dike into the sediment basin.

7. Stormwater Management. Similar to that provided in the design report, provide a note on the cover sheet of the plans to indicate that all drainage associated with this project is directed into the drainage system associated with the Phase III roadway (County Plan No. SP-82-04) and the Phase I roadway (SP-50-02) and into BMP # 53 (County BMP ID # PC 173).

Note has been added to the cover sheet as requested.

8. Manufactured BMPs. The use of four (4) bioretention tree box units are indicated on Sheet 5. Provide a specific maintenance plan for the BMP units, or at a minimum, provide a note referencing manufacturer's recommendations and Minimum Standard & Spec. 3.11 C of the VSMH for maintenance. (*Note: A maintenance plan is required for all BMPs per the Chesapeake Bay Preservation ordinance.)*

Note indicating maintenance of the Filterra units in accordance with Manufacturer's Recommendations and Minimum Stadards is included on Sheet 10.

VDOT

1. On both sets of plans provide a note stating, "VDOT does not assume responsibility for maintenance of the detention/retention pond or its structures, and shall be saved harmless from any damage."

Note has been added to the Cover Sheet.

Minimum Standard 3.11C
Filterra™ Bioretention Filter System
(revised 11/01/02)

Definition

The Filterra™ treatment system is a manufactured bioretention stormwater best management practice (BMP) that filters stormwater runoff from impervious surfaces (roadways, parking lots and roof tops). The Filterra™ treatment system consists of a concrete container filled with an engineered soil filter media, a mulch layer, an under-drain system and a tree, shrub or other plant selection. This filtration system can be integrated into the site design of both new development and redeveloped projects. Runoff drains directly from the impervious surface, through the filter media, and then out of the container through the under drain system to be discharged to a receiving system or infiltrated into the surrounding soil.

Purpose

Filterra™ is designed to be a water quality filter device to remove a wide range of nonpoint source pollutants from urban runoff in the same manner as bioretention practices (refer to **Minimum Standard 3.11: Bioretenion Practices**). Pollutants are efficiently removed by a complex combination of physical, chemical and biological processes within the mulch, soil particles, microorganisms, and the plant materials.

Filterra™ can serve as a water quality BMP in areas where discharge of stormwater runoff into the sub-soils is not desired (e.g., gas stations and karst soils). An under drain system is used to convey filtered runoff to an adjacent drainage system. Where soils are permeable and ground water recharge is desirable Filterra™ can be designed to infiltrate highly treated water into the subsurface. It can be used as a filter only or as a combination filter and infiltration device. Filterra™ is generally not used for attenuation of large volumes of runoff for stream channel erosion control and flood control purposes. However, some degree of volume / flow reduction can be achieved by combining this filter system with an adjacent under ground storage / detention system (gravel trench or pipes). Such a combined system may be useful for urban retrofit projects to address problems associated with combined sewer overflows or for stream protection.

Conditions where Practice Applies

Filterra™ takes up little space (surface area or depth) and can be used in any type of urban or suburban commercial, industrial or residential development. Filterra™ is a suitable device for urban retrofit due to its flexible design, sizing criteria and concrete container and easy drop in place construction, it can be installed within the green space or streetscapes of redevelopment projects. Filterra™ can be modified to fit any curb line as a drop inlet along roadways, parking lots, or pedestrian plaza areas, **See Figure 1.** An adjacent drainage conveyance system is necessary in order to connect the under-drain system, and accept large storm bypass flows.

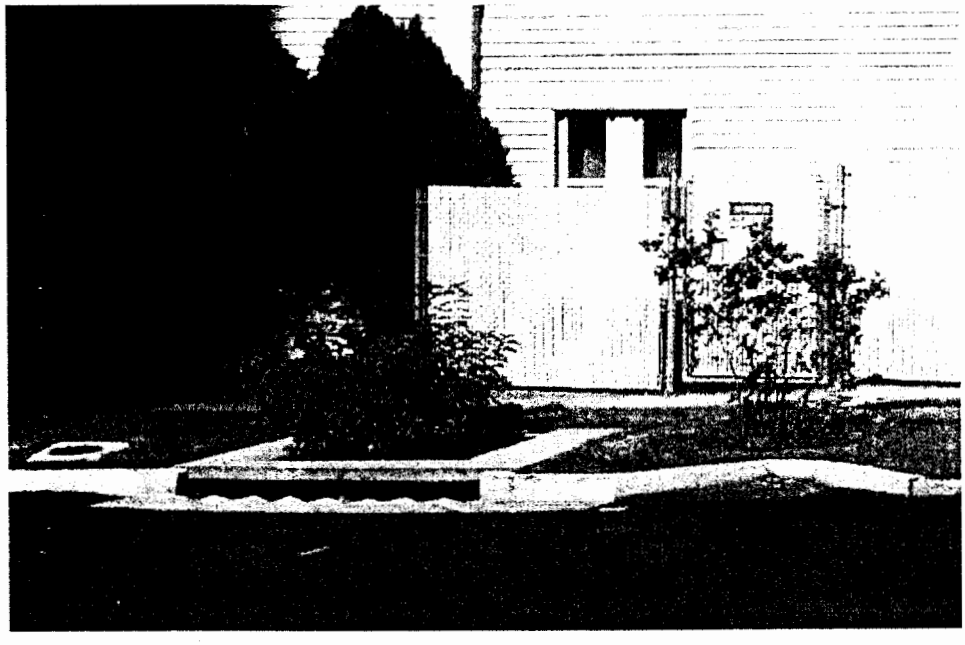


Figure 1. Filterra™ Urban Streetscape Design

It is designed to be used where runoff is likely to contain high concentrations of urban pollutants such as heavy metals, oil, and organics (such as gas stations, maintenance facilities and roadways). The system can be used alone or in combination with other BMP's. When used alone, pretreatment is not necessary as the system is designed to operate effectively without clogging from typical urban runoff concentrations of sediment and other particulate matter. The nature of the surface mulch and engineered filter media is such that particles become entrained into the mulch / filter media itself without clogging at the surface. The plant root system also keeps the soil open and free from clogging. As long as the

manufacturer's operating and maintenance procedures are followed the filter device is projected to work for 20 years or more without replacement of the filter media or plant material.

Planning Considerations

Site Conditions

The enclosed non-permeable concrete container makes Filterra™ suitable for situations where infiltration is undesirable or not possible. These situations would include: karst topography, high groundwater conditions, close proximity to buildings, steep slopes, contaminated soils, brownfields sites, highly contaminated runoff or where chemical or oil spills are likely (maintenance facilities, industrial and gas stations). For "hot spots" where chemical spills are likely, the system can be fitted with a valve to quickly close the discharge drain pipe isolating the spill in the concrete container and filter media for easy clean-up, removal and replacement.

Where Filterra™ is being used to provide a combination of filtration and infiltration into the adjacent soils, planning considerations should include unique site conditions such as soil permeability, seasonal high groundwater table, depth to bedrock, karst topography, etc. Soil permeability will determine the degree to which it can be used as an infiltration device. For further discussion on planning considerations for infiltration practices, refer to the planning considerations described in the **General Infiltration Practices, Minimum Standard3.10, and Bioretention Basin Practices, Minimum Standard 3.11.**

Developed Conditions

Filterra™ is highly adaptable and can be used for most developments. Since the filter is contained in a concrete box it can be built in and around roadways sidewalks buildings and parking lots. It can be installed on many slope conditions typical of parking lots and roadways. In highly urban areas it is possible to use it in the design of an entire streetscape converting the typical non-functional streetscape into one large vegetated filter treatment device.

Location Guidelines

Filterra™ is best incorporated into the overall site, or streetscape or parking lot landscaping plan. The individual box locations represent a combination of drainage considerations (based on final grades and water quality requirements), desired aesthetics, and minimum landscaping requirements, and must be coordinated with the design of the drainage infrastructure.

Aesthetic Considerations

Aesthetic considerations must be evaluated early in the site planning process. While topography and hydraulic considerations may dictate the general placement of each structure, overall aesthetics of the site should be integrated into the site plan and stormwater concept plan from their inception. Both the stormwater engineer and the Landscape Architect must participate during the layout of facilities and infrastructure to be placed on the site.

Sediment Control

Similar to bioretention basins and sand filters, Filterra™ if installed prior to full site stabilization and without proper inlet protection will become choked with sediment from upland construction operations, rendering it inoperable from the outset. Simply providing inlet protection or some other filtering mechanism during construction will not adequately control the sediment. One large storm may completely clog the soil media, requiring immediate maintenance.

Filterra™ should be installed AFTER the site work is complete and stabilization measures have been implemented. (External and adjacent drainage and conveyance systems are typically built along with the site utilities and other infrastructure, and later connected to the boxes when installed. If this is not possible, strict implementation of E&S protective measures must be installed and maintained in order to protect the filter media from premature clogging and failure.

Sizing Guidelines

In general, bioretention has proven successful in part because of the relatively small surface area, low construction costs and ease of maintenance. Filterra™ provides these same benefits.

The current **Minimum Standard 3.11: Bioretention Practices** establishes a target ratio of bioretention surface area to contributing impervious area of 2.5%. The manufacturer of Filterra™ in cooperation with the University of Virginia has conducted research to optimize the flow / pollutant removal characteristics of the filter media to significantly reduce this ratio. The patented filter media has both high flow rates and high pollutant removal capabilities. To establish the sizing criteria the manufacturer has examined the rainfall distribution and frequency data from the mid-Atlantic region to size the filter surface area to treat 90% of the total annual rainfall volume. Pollutant removal data was also related to the filter surface area and drainage area relationships. The optimum filter surface area to drainage area ratio is 0.33%. For example, the required minimum size filter for ¼ acre of impervious surface would be 36 square feet of filter surface area or one 6 ft. by 6 ft. filter box.

The pollutant removal rates for Filterra™ also vary as a function of the filter surface area to drainage area. At the minimum 0.33% ratio filtering 90% of the annual runoff the expected pollutant removal rates are shown below. It is not recommended that a ratio of less than 0.33% be used.

Expected Pollutant Removal (@ 0.33% filter surface area / drainage area)
Total Suspended Solids Removal = 85%
Total Phosphorous Removal = 74%
Total Nitrogen Removal = 68%
Total Metal Removal = 82%

Higher pollutant removal rates are possible by increasing the ratio of filter surface area to drainage area. See the manufactures detailed calculations for sizing and pollutant removal on their web site at: http://www.americastusa.com/filterra.html. Local jurisdictions may want to consider achieving the highest pollutant removals possible to protect water supplies (surface and ground water) or sensitive water bodies and streams. This may be achieved with Filterra™ by increasing the filter surface area to drainage area ratio.

However it is well documented that the pollutant removal efficiency of a filter device varies with the concentration of pollutants in the inflow (the higher the pollutant levels are in the inflow the higher the pollutant removal rates will be). In order to account for this variability in efficiency, the maximum allowable pollutant removal rates for Filterra™ are as follows:

Maximum Pollutant Removal Rates
Total Suspended Solids Removal = 90%
Total Phosphorous Removal = 80%
Total Nitrogen Removal = 65%
Total Metals Removal = 85%

***The above guidance on calculating pollutant removal is based on review of the manufacturer's laboratory data and the best available existing body of data on bioretention systems. However, these removal rates are subject to continuing review, and evaluation of future monitoring data. These pollutant removal rates may be modified on a periodic basis by DCR as determined by ongoing field testing and future improvements to the Filterra™ system. ***

Design Criteria

General

The design of Filterra™ shall be in accordance with manufacturers specifications. The designer is not only responsible for selecting the appropriate components for the particular design but also for ensuring long-term operation.

Soils Investigation

When infiltration into the surrounding subsoil is desired, refer to the **Planning Considerations and Design Criteria of General Infiltration Practices, MS-3.10**, and to local jurisdiction soil study requirements such as **Chapter 5, Section V. of the *Northern Virginia BMP Handbook***. A minimum of one soil boring log should be required for each structure where infiltration is considered.

Sizing Methodology

The designer must verify that Filterra™ has been sized and installed in accordance with the manufacturer's specifications. The distribution and sizing of the system of filters should be in accordance with the manufacturer's recommendations to achieve the most cost-effective treatment practicable while satisfying the performance-based or technology-based water quality criteria. Typical development / redevelopment streetscape or parking lot design will use a minimum of one 6'x6' filter box in an off-line configuration for every ¼of drainage area, or a combination of boxes so as to maintain a 0.33% ratio of filter surface area to drainage area.

When designing the system, consideration must be given for overflows during major storm events. Once the filter flow capacity is exceeded a backflow condition develops forcing runoff to by-pass the filter. Overflows should be diverted to a safe conveyance device (inlet, swale or green space).

Pretreatment

Pretreatment is generally not necessary as the filter's media, mulch and plant root system is designed to operate without clogging under normal conditions. Routine annual inspection and maintenance will ensure that the filter will operate for at least 20 years. Normal conditions mean a stabilized drainage area with typical concentrations of sediment and other urban pollutants. Follow the manufacturer's recommendations for unusual site conditions where high pollutant loads are expected. If it is installed when there is active construction within the

drainage area the opening to the filter should be blocked off. Follow the manufacturer's recommendations on protection of the filter box and media during construction activities.

Observation Well and Clean-out

Filterra™ is typically delivered to the site completely assembled or assembled by the manufacturer at the site. The system comes with an observation well installed that can also be used as a clean out to remove any blockages in the under drain piping.

Plant Materials

The plant materials used for Filterra™ should follow the manufacturer's recommendations. Generally, the manufacturer will provide and install the filter material and plants. The system can use typical readily available landscape plant materials. It is designed to use upland plants not wetland plants. Filterra™ provides a hydrologic regime where wetland plants will not survive and should not be used. The plants used for bioretention will also work for Filterra™. **See Minimum Standard 3.11a Bioretention Basin Practices.** One of the advantages of this system is that it uses commonly available nursery stock plant materials so the end user can select from a wide range of plants to also achieve aesthetic and habitat values. The types of plants used will also determine the depth and design of the concrete container. The standard 6' x 6' box is designed to accommodate a typical shrub, herbaceous material or a very small tree. If a standard street tree is used, the filter box must be larger to accommodate the larger root system, prevent wind throw and to ensure adequate filter surface area as the tree matures. A 9' x 12' box would be the minimum size needed for most street trees. In some cases the manufacturer may recommend a customized box size and configuration to accommodate special plant requirements, unique site conditions, water quality protection goals and ensure adequate performance.

It is not recommended that one filter be used to treat very large volumes of runoff from a large drainage area. Runoff should not be detained and stored in a holding tank to be metered out to the filter media over a long period of time. Exposing the soil, microbes and plants to prolonged and frequent flooding and wet conditions will significantly change the hydrologic regime reducing the effectiveness of the media to capture pollutants and the microbe's / plant's ability to cycle nutrients, break down organics and uptake heavy metals. Therefore, continuous or frequent flows (such as basement sump pump discharges, cooling water, condensate water, artesian wells, etc.) MUST BE EXCLUDED from routing through the system. If the filter media remains water logged for 3 or 4 days anaerobic conditions will develop dropping both oxygen and pH levels which may kill desirable soil microbes and the plants. Filterra™ is an upland system that must periodically dry out to maintain aerobic conditions to ensure the

productivity and vigor of the microbes and plants. The unique filtering system approach of designing for small drainage areas and distributing the filters uniformly throughout the site ensures that the filter drains properly in about one hour to maintain aerobic conditions and enable the filter to be ready to accept the next rain storm event in just a few hours. Follow the manufacturer's recommendations on sizing and distribution of the filter boxes as deviations from the manufacturer's specifications may void any manufacturer's warranty and significantly reduce the ability of the filter to perform properly.

Construction Specifications

Accepted construction standards and specifications should be followed where applicable. Specifications and the work should conform to methods and procedures applicable to the installation of a prefabricated concrete box such as an inlet or other type container structure. The construction specification of the concrete container or use of an alternative material for the container should comply with the recommendations of the manufacturer and all applicable standards by the local or state approval authority.

Sequence of Construction

Filterra™ can be constructed and installed at any convenient time during the construction of the site or after the installation of the site's infrastructure as a "drop in place" devise. However, it should not be placed in service until the contributing drainage area has been stabilized. If the device is installed during the construction of the site's infrastructure, the inlet opening must be protected from sediment. Follow the manufacturer's recommendations on sediment / erosion protection.

The specification for the construction of the system should state the following: 1) the earliest point at which the runoff can be safely directed to the device and 2) the means by which this "delay in usage" is to be accomplished. When the device is made operational will depend on a variety of unique site conditions and should be evaluated and determined on those conditions.

Excavation

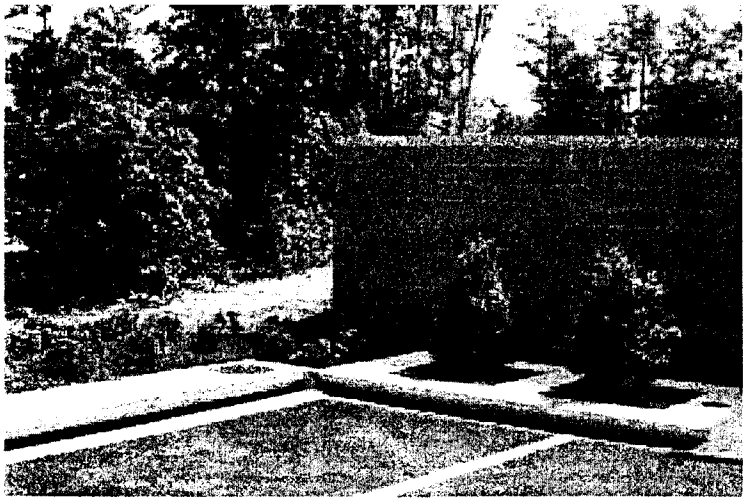
When Filterra™ is to be used in conjunction with or as an infiltration device the preparation of the infiltration trench placement and type of stone used or filter fabric should conform to the **Construction Specifications of on Infiltration Trenches: Minimum Standard 3.10B.** Placement of the filter box should be on an acceptable base (gravel, sand or compacted soil) to prevent the device from settling. The filter container should be backfilled and compacted in the same

manner as any precast concrete structure. The under drain leaving the box and connecting to the receiving conveyance system should be appropriately supported to prevent deflection during backfilling operations and sealed at the connection points to prevent leakage.

Maintenance and Inspection Guidelines

The manufacturer provides for the inspection, care and maintenance of the Filterra™ device for the first two years. After this initial two year period, the owner / operator of the system should follow all of the manufacturer's maintenance and inspection guidelines. In general, annual routine inspection and maintenance activities required are of a similar nature to any landscaped area and would include removal of trash, debris and sediment, replenishment of the mulch, and care or replacement of plants. The plant material requires no special care or attention once it has acclimated. Annual maintenance and care of the plants in a 6'x6' FT may require using one bag of mulch, a hand full of all-purpose fertilizer (optional) and 20 minutes of time. Fertilization of the plants is optional since the system receives adequate nitrogen, organics and phosphorus from the runoff. During extreme droughts the plants may need to be watered in the same manner as any other landscape material. In the event of a chemical spill all of the soil and plants should be removed and properly disposed and replaced with new uncontaminated filter media and plants.

Manufacturer Contact:
Mr. Terry Siviter
Americast Inc.
Phone: 804 798 6068 / Web site: www.americastusa.com



filterra®

A Growing Idea in Stormwater Filtration.

Filterra® Stormwater Bioretention Filtration System

Features and Benefits

Best Value. The most cost effective stormwater treatment system available with relatively low costs for materials, installation and long-term maintenance.

Regulatory Compliance. University of Virginia testing proved that Filterra® meets or exceeds federal and state regulatory requirements for pollutant removal.

Aesthetics. Landscaping enhances appearance, habitat and pollutant removal.

Maintenance Support. Unlike competitive systems, a standard maintenance agreement is included with the purchase of every unit.

Versatility. May be used for new construction or as an urban retrofit device.

- **Streetscapes**
- **Parking lots**
- **Highways**
- **Industrial settings**
- **Urban settings**
- **Roof drains**
- **Combined Sewer Overflows (CSO)**

Design Support. Americast engineers can assist your design team with all aspects of each Filterra® application, including flora selection and sizing.*

Adaptability. May be used alone or in combination with other BMPs.

Selection. Varying configurations to meet both standard and unique site conditions.*

*For more details, see the "Sizing Made Easy" sheet for your region.

A Highly Effective Stormwater Treatment System

Filterra® is well-suited for the ultra-urban environment with high removal efficiency for many toxic substances such as petroleum and heavy metals.

The Filterra® system meets or exceeds federal and state regulatory guidelines for pollutant removal efficiencies of Total Suspended Solids (TSS), Phosphorus and Nitrogen.

Expected Pollutant Removal

(Based on a 0.33% FSA/DA ratio in Mid-Atlantic region*)

Annual Volume Percent Filtered = 90%
TP Removal = 74%
TN Removal = 68%
TSS Removal = 88%
Metal Removal = 82%

Information on the pollutant removal efficiency of the filter soil/plant media is based on a two-year research study performed by the Civil Engineering Department at the University of Virginia.

Headquarters & Mid-Atlantic Region Support
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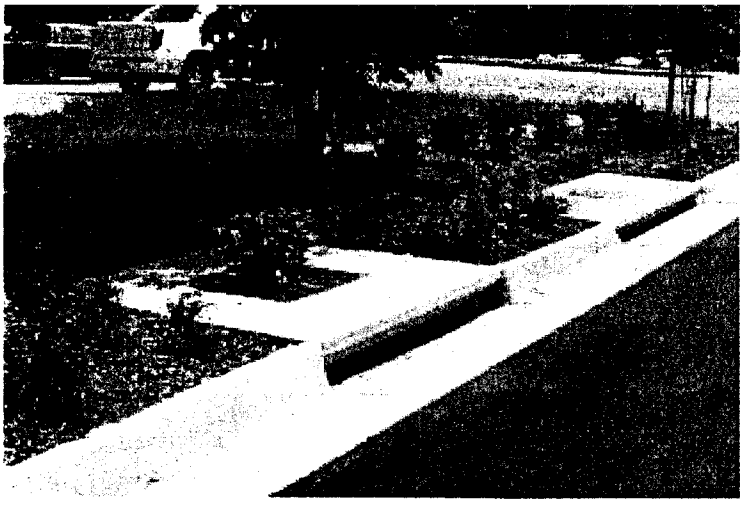
Email: design@filterra.com • Web: www.filterra.com



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A Growing Idea in Stormwater Filtration.

Filterra® Stormwater Bioretention Filtration System

Sizing Made Easy – Mid-Atlantic Region

Filterra® sizing is easy. Since the filter flow rate is known, the annual volume of runoff treated can be calculated based on the relationship of filter surface area to drainage area to rainfall intensity as shown in Figure 1 below.

The target annual volume treated for Filterra® is 90%. The filter surface area (FSA) to drainage area (DA) ratio should always be a minimum of 0.33%. For example, based on this target ratio, a 36-square-foot Filterra® (6' x 6') will treat 0.25 acre of drainage area. Other Filterra® sizes and their corresponding maximum drainage areas are listed in Table 1. Sizing of Filterra® is based on TOTAL contributing drainage areas, regardless of the percent imperviousness.

Mid-Atlantic Filterra® FSA/DA Graph

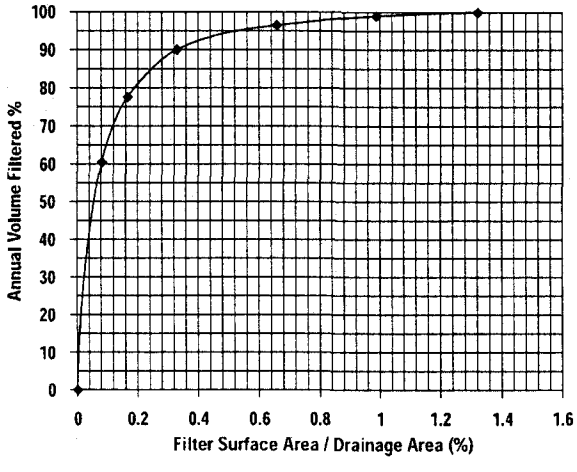

Figure 1

Design Assistance

Phone or email us at design@filterra.com to request your Filterra® DAKit (Design Assistance Kit). This includes placement "Do's and Don'ts," example scenarios, detail drawings, specifications, project information sheet, and other essential design information.

Sizing Procedure

1) Use the Filterra® DAKit (Design Assistance Kit) as a reference
2) Determine Filterra® locations (with effective bypass) in accordance with placement guidelines
3) Determine contributing drainage areas to each Filterra®
4) Choose the corresponding size Filterra® from Table 1
5) Complete the project information sheet
6) For best results, get us involved early in the design process. Send your completed project information sheet along with plans to Americast for placement and application review.

Mid-Atlantic Region Filterra® Sizes

Available Sizes	Total Contributing Drainage Area
4' x 6' or 6' x 4'	0.17 ac
4' x 8' or 8' x 4'	0.22 ac
Standard 6' x 6'	0.25 ac
6' x 8' or 8' x 6'	0.33 ac
6' x 10' or 10' x 6'	0.42 ac
6' x 12' or 12' x 6'	0.50 ac

Table 1

Headquarters & Mid-Atlantic Region Support

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Email: design@filterra.com • Web: www.filterra.com

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Filterra® Stormwater Bioretention Filtration System

Proper Placement

1) Do not place in a sump condition. Filterra® cannot be used as a standalone inlet – it will need effective bypass during higher intensity rainfall events.
2) Do not direct surface flow to Filterra® in a "head-on" configuration. The ideal way to load Filterra® to prevent system damage is a cross linear flow (left-to-right or right-to-left) in the gutter in front of Filterra®. This prevents the re-suspension and possible exit of the trapped pollutants, mulch, and engineered media from within Filterra® during the high flow bypass stage.
3) Refer to example scenarios in the Filterra® DAKit (Design Assistance Kit).
4) Send completed project information sheet along with plans to Americast for placement and application review.

Filterra® Placement Example

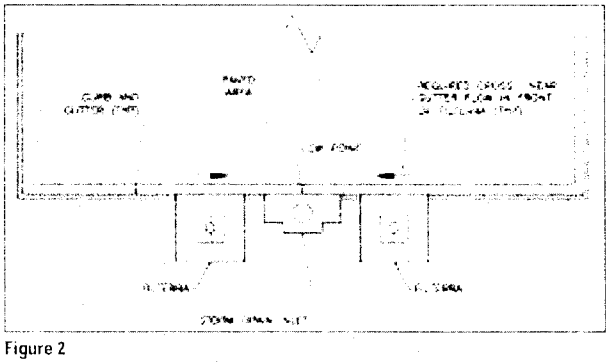

Figure 2

Placement Review

Because we want your project with Filterra® to be a great success, we *respectfully require* that each Filterra® project be reviewed by our placement/design staff. This review is mandatory, as proper placement ensures you of the most efficient and cost effective solution, as well as optimum performance and minimal maintenance.

Determining Annual Pollutant Removal

Simply multiply the percent annual volume treated by the maximum pollutant removal percentage for each pollutant from Table 2 below. Removals are based on University of Virginia (UVA) monitoring.

Filterra® Pollutant Removal Efficiency

Pollutant Removal (From UVA Testing)	
Pollutant	**Maximum %**
Total Suspended Solids	98
Total Phosphorus	82
Total Nitrogen	75
Metals as Cu	91

Table 2

Example

Annual volume treated = 90%

Maximum TSS Removal = 98% (from table above)

Annual Removal = (0.90) (0.98) = 88%

Headquarters & Mid-Atlantic Region Support

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Filterra® by Americast

An Advanced Sustainable Stormwater Treatment System

By Larry S. Coffman[1] and Terry Siviter[2]

I. Abstract

Filterra® is the latest advancement in Bioretention treatment technology for urban stormwater runoff. Americast, a Division of Valley Blox, Inc., working with the University of Virginia's Civil Engineering Department has optimized the treatment capacity of this innovative best management practice (BMP). Filterra® relies on a specially engineered high flow rate treatment system to provide exceptional pollutant removal. Monitoring data shows Filterra® can treat over 90% of the total annual volume of rainfall with maximum pollutant removal rates reaching 95% for total suspended solids, 82% total phosphorus, 76% total nitrogen and 91% heavy metals (measured as Cu).

The high pollutant removal efficiency is primarily due the multiple treatment systems inherent in its unique plant / soil / microbe treatment media. Its unique design and use of typical landscape plants also provides many added values such as low maintenance costs, enhanced aesthetics, improved habitat value, and easy / safe inspection. The "at-the-source" treatment strategy is highly adaptable for any urban setting to achieve multiple stormwater management water quality and quantity goals including combined sewer overflow control.

II. Background

Filterra® is based on Bioretention technology. Bioretention has been defined as filtering stormwater runoff through a terrestrial aerobic plant / soil / microbe complex to capture, remove, and cycle pollutants through a variety of physical, chemical, and biological processes. The multiple pollutant removal mechanisms of this technology make it the most efficient of all BMP's. The word "Bioretention" was derived from the fact that the biomass of the plant / microbe complex retains, degrades, uptakes, and cycles many of the pollutants / contaminants of concern including bacteria, nitrogen, phosphorus, heavy metals, and organics such as oil / grease and polycyclic aromatic hydrocarbons (PAH). Therefore, it is the "bio"-mass that ultimately "retains" and transforms the pollutants - hence "Bio-retention".

Treatment technologies using soils, sand, organic materials, microbes and plants have been used in both water and wastewater treatment. For example, wastewater effluent spray irrigation on fields and meadows has been successfully used for centuries throughout the world (Shuval et al.,

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[1] Mr. Coffman has over 30 years of experience in the stormwater / water resources management. He has authored numerous papers and articles on stormwater management programs and pioneered the development of bioretention or "Rain Gardens". He is the principal author of Prince George's County's, Maryland national award wining "Low Impact Development Design Manual" - an alternative technological approach to stormwater management. He is a member of American Society of Civil Engineer's Urban Water Resources Research Council and the Water Environment Research Federation Stormwater Technical Advisory Committee. Mr. Coffman is considered one of the nation's leading experts on Low Impact Development technologies for water resources / ecosystem protection.

[2] Mr. Siviter has been the Director of Business Development for Americast for over 10 years. He is responsible for the technical development, marketing, and sales of products and services for stormwater treatment / conveyance systems and industrial wastewater and water pollution control technologies.

1986). These systems have been shown to be both economically and environmentally sustainable (Feigin et al., 1991).

Bioretention was first developed by Prince George's County, Maryland's Department of Environmental Resources (PGCDER) in the early 1990's (Coffman et al. 1993). The PGCDER design manual provides basic Bioretention planning, design and maintenance guidance. The practice was originally developed to allow use of sites' landscaped and green space to filter and treat runoff. The original design was essentially an enhanced infiltration technique where the filtered water was allowed to infiltrate into the ground.

Since the introduction of Bioretention, the success of the practice has been mixed primarily due to the lack of detailed specific design and construction standards. This lack of specificity has lead to wide variations in the soil / filter mix, infiltration rates, plant materials, and sizing resulting in costly reconstruction and maintenance repairs. The advanced design of Filterra® has eliminated all of the past problems and liabilities of conventional Bioretention designs and greatly improved its performance, reliability, and ease of construction and maintenance.

III. Filterra® Physical Description

The system consists of a concrete container, a 3 inch mulch layer, 1.5 to 3.5 feet of a unique soil filter media, an observation / cleanout pipe, an under-drain system and an appropriate type of plant i.e., flowers, grasses, shrub, or tree (see Figure 1).

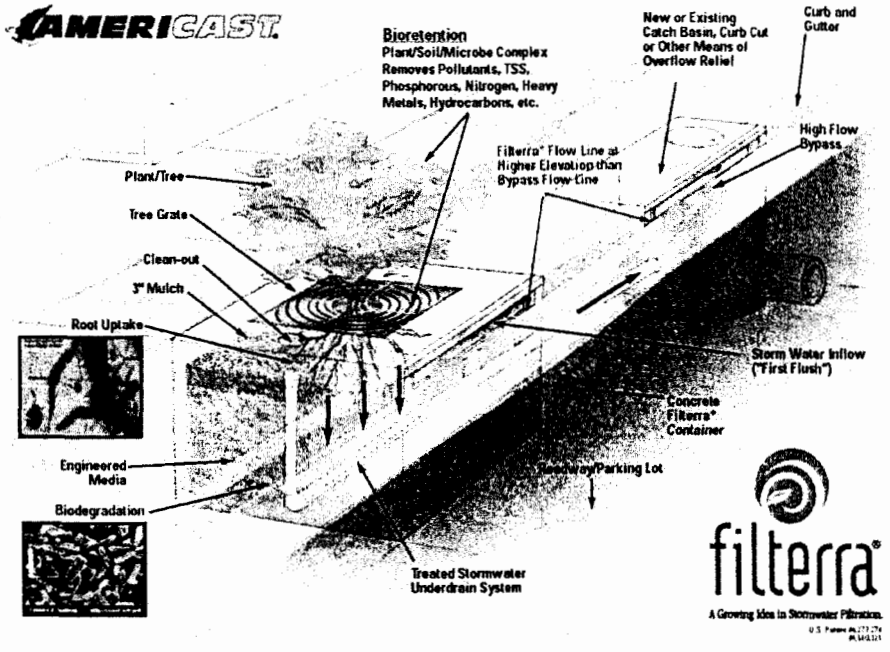


Figure 1

Stormwater runoff drains directly from impervious surfaces through an inlet structure in the concrete box and flows through the mulch, plant, and soil filter media. Treated water flows out of the system via an under-drain connected to a storm drain pipe or other appropriate outfall.

Filterra® can also be used to control runoff volumes / flows by adding storage volume beneath the filter box for either infiltration or detention control (e.g. a gravel infiltration trench area beneath the box).

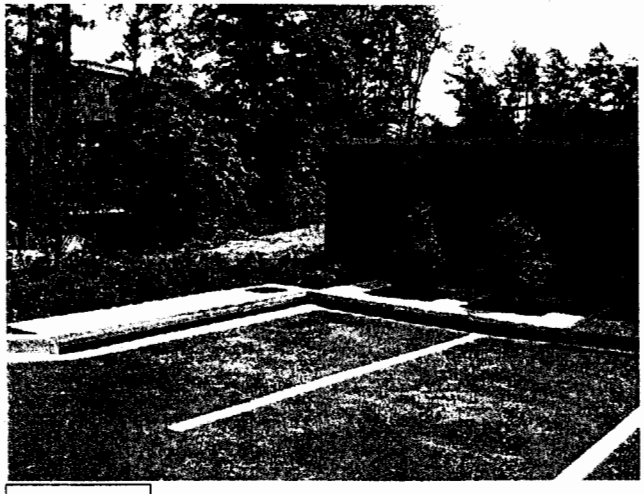


Figure 2

The concrete container and treatment media are below grade with the only features visible being the top concrete slab, tree grate, plant, and inlet opening. Filterra® looks very similar to an ordinary tree box except that it is specially designed to treat runoff (see Figure 2). This is one of the few commercially available BMP that can also help to enhance the aesthetic value of the urban setting.

IV. Pollutant Removal Processes

Pollutants are captured, cycled, and removed by a wide variety of complex physical, chemical, and biological processes as the contaminated runoff flows onto and through the mulch / soil / microbe / plant treatment system. Suspended solids are removed through sedimentation as runoff is allowed to pond above the filter media with filtration of pollutants as the runoff passes through the media. Organic compounds are removed by chemical complexing with the organic constituents of the media, microbial degradation, filtration, and sedimentation. Nitrogen is captured through physical and chemical means and removed through nitrification, denitrification, and plant uptake. Phosphorus is removed through adsorption, sedimentation, precipitation and plant uptake. Heavy metals are removed through sedimentation, organic complexing, precipitation, adsorption, and plant uptake.

The pollutant removal mechanisms operate in two distinct time scales. The first time scale occurs during the storm event when pollutants come into contact with the media and are captured instantaneously through sedimentation, filtration, adsorption, absorption, infiltration, and chemical precipitation. The second time scale is between storm events. Pollutant removal and cycling occurs in a matter of hours, days, and weeks through biological degradation, biological uptake, and volatilization. The Filterra® filter media is designed to capture pollutants during the storm event while biological processes degrade, metabolize, detoxify, and volatilize the pollutants during and between storms.

The difficulty with removing pollutants in urban runoff is that they occur in a wide array of

organic and inorganic forms and in various particle sizes from gross solids to dissolved molecules. Each of the various pollutant forms and particle sizes can require different processes and mechanisms for capture and treatment. Filterra® complex media structure provides for an array of physical, chemical, and biological treatment processes to handle a wide variety of pollutants. Each of these processes is described below.

A. Physical Processes

1. Sedimentation (Event Time Scale)

The storage area above the mulch layer is designed to allow a quiescent pooling of runoff within the filter box that encourages sedimentation. Most of the larger particles associated with gross and suspended solids are deposited on the surface and / or entrained within the 3-dimensional mulch layer. The amount of sedimentation is a function of particle density, size, and water density (Stokes Law). Heavy metals are commonly attached to these particles so the sedimentation process is effective in removing a portion of the heavy metals and other pollutants in particulate form.

2. Filtration (Event Time Scale)

The mulch and sandy organic media are designed to filter out many particulate pollutants. As runoff passes through the mulch layer and into the underlining sandy filter media, many smaller particles are captured in the media. The efficiency of the filtration process is a function of filter depth, media size, porosity, velocity, and nature of the particles. Studies at the University of Virginia helped to optimize the filter media to achieve both high flows and pollutant removal. Particles found in runoff range in size from trash and debris to less than 1 micron all of which can be captured in the media.

3. Infiltration (Event Time Scale)

When designed as an infiltration device, where soils permit, Filterra® removes pollutants from runoff by reducing the total annual runoff volume. This infiltrated runoff is further treated through additional chemical and biological processes occurring in the soils.

B. Chemical Processes

1. Adsorption (Event Time Scale)

The mulch and sandy / organic treatment media is complex and has a tremendous surface area. The process of adsorption is simply the preferential partitioning of a substance onto the surface of a solid substrate. This physical adsorption is caused mainly by electrostatic forces and is a function of surface area and the polarity of the materials. The media contains hydrophilic adsorbents such as aluminosilicates (sand) and hydrophobic adsorbents such as carbonaceous / organic matter that allow for wide range of pollutants to adhere to the surface of the media's components.

2. Absorption (Event Time Scale)

Absorption can be physical or chemical where the molecules of one substance are taken into the physical structure of another substance. For example, organic matter can act as a sponge to essentially soak up soluble molecules within its physical structure such as occurs with activated carbon.

3. Volatilization (Between Event Time Scale)

Volatile organic compounds (i.e., gasoline) found in runoff and captured in the filter media and will, over time, be volatized back into the atmosphere. Gases such as water, CO_2, and N_2, which are derived from metabolic processes, will also be volatized back into the atmosphere.

C. Biological Processes

1. Biological Adsorption and Capture (Event Time Scale)

The bacteria growing in the Filterra® media are encapsulated with a slime layer. This layer helps to protect the bacteria and provides a "sticky" surface to bind with particles containing organic matter and heavy metals. As the bacteria level increases in the filter media the greater the volume of sticky surface cell surfaces there are to capture pollutants.

2. Evapotranspiration

Plants also transpire or release gases to the atmosphere through openings in their leaf tissues. Phytoremediation technology has shown that plants can remove volatile substance from the soil and transpire them back into the atmosphere including volatile organic compounds VOC's (Zhang, et al., 2001).

3. Biological Processes (Between Event Time Scale)

There are several biological processes that are important in the removing pollutants from the runoff. These processes are quite complex and vary as a function of moisture, temperature, pH, salinity, exposure to toxins, and the presence of or absence of oxygen. Basically, these processes transform pollutants into other less harmful chemicals and compounds or incorporate the pollutants into the microbe/ plant biomass to create new cell matter. Some of these processes are listed below and briefly defined.

a. Nutrient Assimilation – Biologically available forms of nitrogen, phosphorus, and carbon are actively taken into the cells of organisms and used for metabolic processes (energy production and growth). Bacteria will use all types of carbon sources for food including (oil products) breaking them down for a variety of metabolic processes and needs. Nitrogen and phosphorus are actively taken up by organisms as nutrients that are vital for a number of cell functions, growth, and energy production. These processes remove metabolites from the media during

and between storm events.

b. Nitrification / Denitrification – Through a complex series of processes and reactions that occur with and without oxygen, bacteria transform various forms of nitrogen into cell tissue or nitrogen gas. These processes help to reduce the total nitrogen in the treated discharge.

c. Biodegradation – Organisms can break down a wide array of organic compounds into less toxic forms or completely break them down into CO_2 and water. This process is important in detoxifying or eliminating a number of toxic organic compounds of concern.

d. Bioremediation – Bacteria and plants have a wide array of mechanisms to immobilize and detoxify organic compounds and heavy metals. For example, bacteria can cause metals to precipitate out as salts, bind them in proteins in the cell and cell wall slime, and accumulate metals in nodules within the cells. Metals are captured in the bacteria and transformed in ways that are generally less toxic to them and the plants (Means et al, 1994).

e. Phytoremediation - Plants also have the ability to metabolize many pollutants such as the uptake and accumulation of metals in the cell tissue to make them less toxic (Reeves and Baker, 2000).

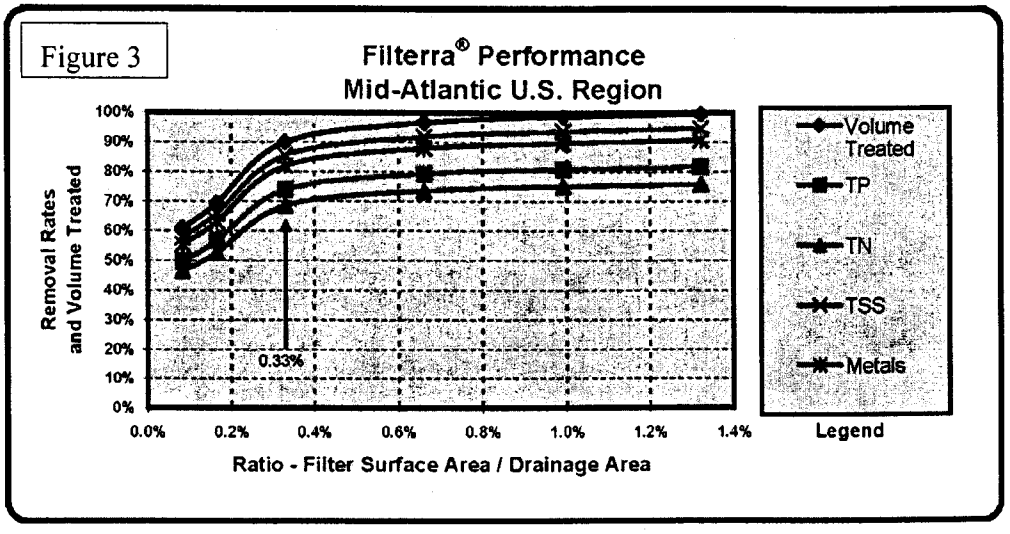
Filterra® is a living system that metabolizes volatizes, detoxifies, and cycles many pollutants in runoff. Nitrogen and phosphorus are used by the plants and bacteria to grow more cells. Organic matter is used as an energy source and metabolized into water and carbon dioxide. This means that as the biomass (plant and microbes) of the system increases in mass; so does the system's capacity to capture and process more pollutants.

Filterra® uses all of the natural process of the plant / soil complex possible to treat urban runoff. These processes can last many years as pollutants are simply recycled within the system and converted into biomass. The accumulation of debris and sediment can be removed with simple annual maintenance practices. If toxic substances should ever build to levels that may cause harm to the receiving water or wildlife, the media and plants can easily be replaced.

V. Treatment Capacity

The treatment capacity of Filterra® is dependant on the overall pollutant removal capabilities of the treatment media and the hydraulic properties of the media. Many of the pollutant removal processes were mentioned above. The hydraulic properties of importance are the flow rate through the media and the volume of runoff it can treat. Both the pollutant removal and hydraulic capacity of the system have been measured though monitoring conducted by the University of Virginia. Based on these measured values, a performance curve can be developed for various pollutants (see Figure 3). This curve shows that pollutant removal capabilities vary with the ratio of media's surface area to contributing drainage area. Increasing this ratio will

increase the pollutant removal rate up to the maximum removal capacity of the media to capture and process the pollutants.



Based on test data and rainfall distribution of the Mid-Atlantic region of the U.S., the optimum media surface to drainage area ratio is about 0.33% or 36 square feet of media / 0.25 acres of contributing drainage area. Using the 0.33% ratio, the system will treat approximately 90% of the annual volume of runoff and can achieve maximum expected pollutant removals of 95% for total suspended solids, 82% total phosphorus, 76% total nitrogen, and 91% heavy metals (measured as Cu). The 0.33% ratio will vary from region to region as rainfall intensities varies. An explanation of the hydrology and hydraulic method for sizing the system is provided below.

VI. Hydrology and Hydraulic Analytical Method

Filterra® uses a unique and sound analytical method to determine the appropriate media surface area needed to achieve the desired treatment levels. The key is to appropriately match the media's flow rate to the unique rainfall / runoff characteristics of the drainage area. This is achieved by matching the volume of runoff treated by the media to the volume of runoff generated by the drainage area based on actual rainfall intensity distributions for any given region.

For the Mid-Atlantic region, 50 years of rainfall data was analyzed from Reagan National Airport from which the probability and frequencies of all rainfall intensities (inches/hour) were determined. Knowing this and the flow characteristics of the Filterra® media (from University of Virginia testing), one can determine the annual volume of runoff that can be treated and the optimum surface area for any given drainage area. The Filterra® performance chart for the Mid-Atlantic U.S. region (see Figure 4) summarizes the rainfall intensity distributions, predicted pollutant removal rates, and volumes treated for 36 sq. ft. of media surface area with a ¼ acre drainage area. The MS Excel based performance spreadsheet will automatically calculate the filter media surface area needed to treatment goals of any given drainage area. If other pollutant removals are required or certain annual pollutant load reductions are needed, the spreadsheet can also calculate the surface area needed.

Filterra® Performance for Mid-Atlantic U.S. Region

Drainage Area (DA) =	0.25	Acres	DA =	10,890	ft²
Filterra® Length =	6.00	feet	Filter Surface Area (FSA) =	36.00	ft²
Filterra® Width =	6.00	feet			

Available Sizes	Total Contributing Drainage Area
4x6 or 6x4	0.17 ac
4x8 or 8x4	0.22 ac
Standard 6x6	0.25 ac
6x8 or 8x6	0.33 ac
6x10 or 10x6	0.42 ac
6x12 or 12x6	0.50 ac

FSA to DA Ratio =	0.331%
Flow Volume Filtered =	90.64%
TP Removal (Max 82%) =	74.33%
TN Removal (Max 76%) =	68.89%
TSS Removal (Max 95%) =	86.11%
Metal Removal (Max 91%) =	82.49%

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Site Condition = Consider total contributing DA as 100% Impervious

Filterra® Flow Volume = 0.01 x (LxW) / 4.276 x 3600 = 303.09 cu ft/hr

Volumetric Runoff Coefficient, R_v (use MDE Formula) = 0.95

Runoff Volume = P * R_v / 12 * DA = 862.125 P cu ft/hr

(a) Rainfall (in / hr)	(b) Runoff Volume (cu ft / hr)	(c) Runoff Treated (cu ft / hr)	(d) Cumulative Frequency	(e) Probability Frequency	(f) (c) x (e) (cu ft / hr)	(g) (b) x (e) (cu ft / hr)
0.020	17.24	17.24	0.4205	0.4205	7.25	7.25
0.040	34.49	34.49	0.6027	0.1822	6.28	6.28
0.060	51.73	51.73	0.7133	0.1106	5.72	5.72
0.080	68.97	68.97	0.7850	0.0717	4.95	4.95
0.100	86.21	86.21	0.8352	0.0502	4.33	4.33
0.125	107.77	107.77	0.8745	0.0393	4.24	4.24
0.150	129.32	129.32	0.9030	0.0285	3.69	3.69
0.200	172.43	172.43	0.9382	0.0352	6.07	6.07
0.250	215.53	215.53	0.9570	0.0188	4.05	4.05
0.300	258.64	258.64	0.9687	0.0117	3.03	3.03
0.350	301.74	301.74	0.9756	0.0069	2.08	2.08
0.400	344.85	303.09	0.9810	0.0054	1.64	1.86
0.450	387.96	303.09	0.9856	0.0046	1.39	1.78
0.500	431.06	303.09	0.9881	0.0025	0.76	1.08
0.550	474.17	303.09	0.9899	0.0018	0.55	0.85
0.600	517.28	303.09	0.9918	0.0019	0.58	0.98
0.650	560.38	303.09	0.9930	0.0012	0.36	0.67
0.700	603.49	303.09	0.9942	0.0012	0.36	0.72
0.750	646.59	303.09	0.9950	0.0008	0.24	0.52
0.800	689.70	303.09	0.9957	0.0007	0.21	0.48
0.900	775.91	303.09	0.9971	0.0014	0.42	1.09
1.000	862.13	303.09	0.9979	0.0008	0.24	0.69
1.500	1293.19	303.09	0.9999	0.0020	0.61	2.59
2.000	1724.25	303.09	1.0000	0.0001	0.03	0.17
			Totals	**1.0000**	**59.07**	**65.17**

Table is based on precipitation data obtained from NCDC (National Climatic Data Center).

Figure 4

Calculating the annual pollutant load removal is determined by simply multiplying the percent annual volume treated by the maximum pollutant removal percentage for each pollutant. These values can be found in the performance chart above.

Example: Annual volume treated = 90.64 %

Maximum TSS Removal = 95%

Annual TSS Removal = $\frac{(90.64\%)\ (95\%)}{100}$ = 86.11%

VII. Unique Decentralized Placement of Filterra® Systems

Another unique feature of the design, sizing, and placement of Filterra® is that it utilizes a distributed design approach fundamental to the innovative Low Impact Development technology

(LID). This design philosophy promotes at-the-source controls; off-line configuration of the units, treating relatively small drainage areas (less than ½ acre), and a more uniform distribution of controls throughout the site. This is opposed to conventional end-of pipe and in-line treatment approach used for most BMP designs. The LID approach reduces the effective hydraulic and pollutant load to each unit thereby increasing performance and reducing maintenance burdens. Controlling runoff as close to the source as possible also eliminates problems common to conventional BMP's such as concentrated high flows that cause erosion and resuspension of pollutants or expensive control structures to store, split, or divert high flows. Using small drainage areas ensures that runoff flows and velocities are always very low.

VIII. Ease of Design

Americast's recommend media surface area to drainage area ratio of 0.33% for the Mid-Atlantic region is adequate to meet current state and Federal NPDES pollutant removal requirements. For your convenience, Americast offers a variety of precast concrete Filterra® box sizes to meet most of your site design needs. As long as you follow the LID design principles by distributing the units and keeping the drainage area to each unit at or below ½ acres, all you have to do is to properly place the right size unit to match drainage area (see Figure 5).

Available Sizes	Total Contributing Drainage Area
4x6 or 6x4	0.17 ac
4x8 or 8x4	0.22 ac
Standard 6x6	0.25 ac
6x8 or 8x6	0.33 ac
6x10 or 10x6	0.42 ac
6x12 or 12x6	0.50 ac

Figure 5

IX. Off-Line / Bypass Design

Another unique design feature of Filterra® is its off-line design configuration. This design strategy improves treatment and avoids the possibility of resuspension of particulate matter. It is important that the site designer confer with Americast on the proper location of the unit to ensure that the site grading and placement are correct (see Figure 6). Example scenarios are available by contacting Americast.

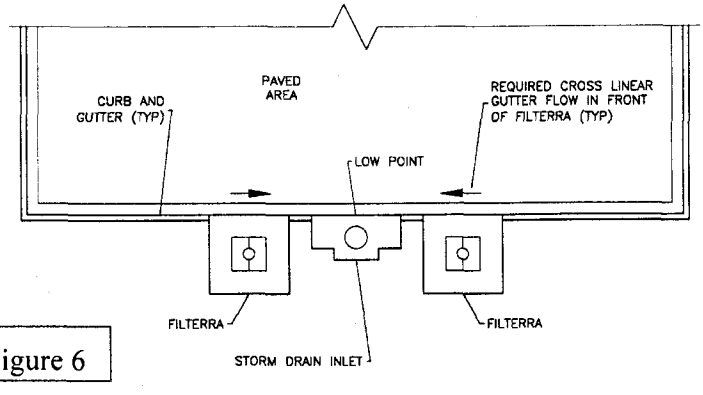

Figure 6

The site designer must also plan for the by-pass of high flows. Although the system will treat about 90% of the total rainfall events / volume, occasionally the flow capacity of the treatment media will be exceeded causing the unit to go into bypass mode. The bypass flows must be safely conveyed to a nearby inlet or other appropriate discharge point. Sump conditions must be avoided. If the unit is placed in a sump, bypass mode will result in flooding around the unit and cause resuspension of the debris collected in the unit.

X. Construction Considerations

Perhaps the most critical construction issue is proper location of the unit in relationship to the site grading. Generally, the units are placed in the curb line of parking lots and roadways. In this configuration, the site grading must direct runoff to the curb first to allow the flow to enter the unit from the curb in a cross linear manner along the face of the inlet. Filterra® looks very much like an inlet structure and often contractors will grade the site as if the unit is a standard inlet (i.e. placing it in a sump condition). The site engineer must ensure that this does not happen.

XI. Conclusions

Filterra® is one of the most advanced and adaptive BMP's on the market today. It has been carefully engineered and designed to meet all your water quality needs in the most cost effective manner possible.

XII. References

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