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- STORMW ATER DIVISION; WERE SCANNED IN THE REGULAR COURSE OF BUSINESS PURSUANT TO GUIDELINES ESTABLISHED BY THE LIBRARY OF VIRGINIA AND ARCHIVES; AND HA VE BEEN VERIFIED IN THE CUSTODY OF THE INDIVIDUAL LISTED BELOW.

BMPNUMBER: **YC024**

DATE VERIFIED: **June 23, 2016**

QUALITY ASSURANCE TECHNICIAN: **Charles E. Lovett II**

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: YC024

PIN: 2430100036

Subdivision, Tract, Business or Owner Name (if known): Smith Memorial Baptist Church

Property Description: Church site

Site Address: 6515 Richmond Road

(For internal use only) **Box** 23 **Drawer:** 9

Agreements: (in file as of scan date) **Y** **Book or Doc#:** 000015286 **Page:**

147 683

234 122

Comments

COPY

DECLARATION OF COVENANTS

INSPECTION/MAINTENANCE OF DRAINAGE SYSTEM

THIS DECLARATION, made this 25 day of July, ~~19~~ 2000, between Smith Memorial Baptist Church, and all successors in interest, hereinafter referred to as the "COVENANTOR(S)," owner(s) of the following property: 6515 Richmond Road, Deed Book 147, Page No. 683 or Instrument No. _____, and James City County, Virginia, hereinafter referred to as the "COUNTY."

234 , 122

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.

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.

Instrument # 000015286
Recorded 8/14/00

YC024_SMITH_MEMORIAL_BAPTIST_CHURCH - 003

IN WITNESS WHEREOF, the COVENANTOR(S) have executed this DECLARATION OF COVENANTS as of this 25 day of July, ~~19~~ 2000

COVENANTOR(S)

Stan Gardner

Print Name/Title Stan Gardner - Trustee

ATTEST:

_____

COVENANTOR(S)

_____

Print Name/Title _____

ATTEST:

_____

COMMONWEALTH OF VIRGINIA
CITY/COUNTY OF James City

I hereby certify that on this 25th day of July, ~~19~~ 2000, before the subscribed, a Notary Public of the State of Virginia, and for the City/County of James City, aforesaid personally appeared Stan Gardner and did acknowledge the aforegoing instrument to be their Act.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal this 25th day of July, ~~19~~ 2000.

Patricia H. Padrick
Notary Public

My Commission expires: June 30, 2002.

Approved as to form:

Lin P. Rogers
Deputy County Attorney

This Declaration of Covenants prepared by:

F. N. Neal Jr
(Print Name)

ELDER
(Title)

102 Regency Court
(Address)

Waldy, VA 23185
(City) (State) (Zip)

drainage.pre
Revised 2/97

YC024_SMITH_MEMORIAL_BAPTIST_CHURCH - 004

James City County, Virginia
Environmental Division

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

County Plan No.: SP-118-99 (AMENDED SP-112-01)
Project Name: SMITH MEMORIAL BAPTIST CHURCH (FAMILY LIFE CENTER)
Stormwater Management Facility: MANUFACTURED BMP (UNDERGROUND INFILTRATOR SYSTEMS)
Phase: ☐ I ☒ II ☒ III

☒ Information Received. Date: 7/2/02
☒ Administrative Check.
- ☒ Record Drawing Date: 9/17/02 VHB
- ☒ Construction Certification Date: 7/2/02 ECS
- ☒ RD/CC Standard Forms (Required after Feb 1st 2001Only)
- ☒ Insp/Maint Agreement Info: Yes Ilm # 000015286 (8/14/00)
- ☒ BMP Maintenance Plan Location: Yes, Sheet C-7
- ☐ Other:

☒ Standard E&SC Note on Approved Plan Requiring RD/CC or County comment in plan review file.
☐ Yes ☐ No Location: Note #20 Sheet C-7
☒ Assign County BMP ID Code Code: YC 024
☒ Log into Division's "As-Built" Tracking Log
☒ Add Location to GIS Database Map. Obtain GIS site information (GPIN, Owner, Site Area, Address, etc.)
☒ Preliminary Log into BMP Database (BMP ID #, Site Plan #, GPIN, Project Name)
☒ Active Project File Review (correspondence, H&H, etc.).
☒ Initial As-Built File setup (label, copy hydraulics, BMP information, etc.).
☒ Inspector Check of RD/CC. 10-2-02 - OK.
☒ Pre-Inspection Drawing Review - Approved Plan (Quick look prior to field inspection).
☒ Final Inspection (FI) Performed Date: 10/04/02
☒ Record Drawing (RD) Review Date: 10/03/02
☒ Construction Certification (CC) Review Date: 10/03/02
☐ Actions:
- ☐ No comments.
- ☒ Comments. Letter Forwarded. Date: 10/4/02
  - ☒ Record Drawing (RD)
  - ☐ Construction Certification (CC)
  - ☒ Construction-Related (CR)
  - ☐ Site Issues (SI)
  - ☐ Other :

☐ Second Submission: RD 10-10-02 OK
☐ Third Submission:
☑ Acceptable for stormwater managment facility purposes (RD/CC/CR/Other). Proceed with bond release.
☑ Notify Darryl/Joan/Pat of acceptability using email (preferred), form or verbal. Surety Release
☑ 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.
☑ Digital Photographs obtained.
☐ Add to JCC Hydrology & Hydraulic database (optional).

BMP Certification Information Acceptable

Plan Reviewer: [signature] Date: 10-14-02

24 301 000 36
6515 Richmond Road
Smith Mem Bapt Church
P.O. Box 9 Lightfoot VA 23090
3.67AC B1

FINAL CERT. DOCUMENTS

SEP 2002 RECEIVED ENVIRONMENTAL DIVISION

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: SMITH MEMORIAL BAPTIST CHURCH FAMILY LIFE CENTER
Structure/BMP Name: BMP INFILTRATION SYSTEM
Project Location: 6515 RICHMOND ROAD
BMP Location: UNDER NEW EASTERN PARKING LOT
County Plan No.: SP - 118 - 99 (AMEND SP-112-01)

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

Tax Map/Parcel No.: (24-3) (1-36)
BMP ID Code (if known): YC-024
Zoning District:: B1 GENERAL BUSINESS
Land Use: HOUSE OF WORSHIP
Site Area (sf or acres): 3.64 AC

Brief Description of Stormwater Management/BMP Facility: INFILTRATION SYSTEM
H-20 HI-CAPACITY INFILTRATOR CHAMBER SYSTEM
(UNDERGROUND P.E. MANUFALTURED BMP UNITS)

Nearest Visible Landmark to SWM/BMP Facility: FAMILY LIFE CENTER

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: APRIL 23, 2002
Facility Monitored by County Representative during Construction: ☒ Yes ☐ No ☐ Unknown
Name of Site Work Contractor Who Constructed Facility: MASSIE
Name of Professional Firm Who Routinely Monitored Construction: VHB. INC.
Date of Completion for SWM/BMP Facility: APRIL 29, 2002 TO BE PAVED OVER IN 9/2002
Date of Record Drawing/Construction Certification Submittal: JUNE 13, 2002

(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: SMITH MEMORIAL BAPTIST CHURCH
Mailing Address: 6515 RICHMOND ROAD
WILLIAMSBURG Va. 23188
Business Phone: 565-0476 Fax:
Contact Person: RON WADE Title: PASTOR

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: LAND MARK DESIGN GROUP
Mailing Address: 4029 IRONBOUND ROAD SUITE 100
WILLIAMSBURG VA. 23188
Business Phone: 253-2975
Fax: 229-0049
Responsible Plan Preparer: RICHARD S. PHILLIPS
Title: PROFESSIONAL ENGINEER
Plan Name: SMITH MEMORIAL BAPTIST CHURCH FAMILY LIFE CENTER
Firm's Project No. 1990072-000.01
Plan Date: 8/11/2000
Sheet No.'s Applicable to SWM/BMP Facility: C-3 / C-4 / C-5 / C-7 /

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

Name: Jack L Massie CONTRACTOR
Mailing Address: 3900 COKES LANE
WILLIAMSBURG, VA. 23183
Business Phone: 566-8613
Fax: 757-566-8566
Contact Person: STEVE MASSIE
Site Foreman/Supervisor: NATHAN POLLARD
Specialty Subcontractors & Purpose (for BMP Construction Only):

SEP 2002
RECEIVED
ENVIRONMENTAL DIVISION

Section 4 - Professional Certifications:

Certifying Professionals: *(Note: A Registered Professional Engineer or Certified Land Surveyor is responsible for preparation of a Record Drawing, sometimes referred to as an As-Built plan, for the 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: VHB, Inc.
Mailing Address: 477 McLaws Circle
Williamsburg, Va 23185
Business Phone: 220-0500
Fax: 220-8544

Name: FRANK G. MUNDY, II
Title: SURVEY MANAGER

Signature: Frank G Mundy II
Date: 6/10/02

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.

COMMONWEALTH OF VIRGINIA
FRANK G. MUNDY, II
No. 002382
6-10-02
LAND SURVEYOR

_____ (Seal)

Virginia Registered Professional Engineer or Certified Land Surveyor

Construction 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 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.

SEP 2002
RECEIVED
ENVIRONMENTAL DIVISION

SEE ECS CERT. 6/28/02

_____ (Seal)

Virginia Registered Professional Engineer

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.)

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Structure/BMP Name: BMP INFILTRATION SYSTEM
Project Location: 6515 RICHMOND ROAD
BMP Location: UNDER NEW EASTERN PARKING LOT
County Plan No.: SP - 118 - 99

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

Tax Map/Parcel No.: (24-3) (1-36)
BMP ID Code (if known): YC-024
Zoning District: B1 GENERAL BUSINESS
Land Use: HOUSE OF WORSHIP
Site Area (sf or acres): 3.64 AC

Brief Description of Stormwater Management/BMP Facility: INFILTRATION SYSTEM

Nearest Visible Landmark to SWM/BMP Facility: FAMILY LIFE CENTER

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: _____

YC024_SMITH_MEMORIAL_BAPTIST_CHURCH - 009

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: APRIL 23, 2002
Facility Monitored by County Representative during Construction: ☒ Yes ☐ No ☐ Unknown
Name of Site Work Contractor Who Constructed Facility: MASSIE
Name of Professional Firm Who Routinely Monitored Construction: VHB, INC.
Date of Completion for SWM/BMP Facility: APRIL 29, 2002 TO BE PAVED OVER IN 9/2002
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Contact Person: RON WADE Title: PASTOR

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Business Phone: 253-2975
Fax: 229-0049
Responsible Plan Preparer: RICHARD S. PHILLIPS
Title: PROFESSIONAL ENGINEER
Plan Name: SMITH MEMORIAL BAPTIST CHURCH FAMILY LIFE CENTER
Firm's Project No. 1990072-000.01
Plan Date: 8/11/2000
Sheet No.'s Applicable to SWM/BMP Facility: C-3 / C-4 / C-5 / C-7 / ____

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

Name: Jack L Massie CONTRACTOR
Mailing Address: 3900 COKES LANE
WILLIAMSBURG, VA. 23188
Business Phone: 566-8643
Fax: 757-566-8566
Contact Person: STEVE MASSIE
Site Foreman/Supervisor: NATHAN POLLARD
Specialty Subcontractors & Purpose (for BMP Construction Only):

YC024_SMITH_MEMORIAL_BAPTIST_CHURCH - 010

Section 4 - Professional Certifications:

Certifying Professionals: *(Note: A Registered Professional Engineer or Certified Land Surveyor is responsible for preparation of a Record Drawing, sometimes referred to as an As-Built plan, for the 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.)*

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Williamsburg, Va 23185
Business Phone: 220-0500
Fax: 220-8544

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: ECS, Ltd.
Mailing Address: 108 Ingram Rd.
Unit 1
Business Phone: 229-6677
Fax: 229-9278

Name: Michael J. Galli, P.E.
Title: Branch Manager

Signature: Michael J. Galli
Date: 6/28/02

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.

* Infiltration System

COMMONWEALTH OF VIRGINIA
MICHAEL J. GALLI
No. 030684
PROFESSIONAL ENGINEER

Michael J. Galli (Seal)

Virginia Registered Professional Engineer

YC024_SMITH_MEMORIAL_BAPTIST_CHURCH - 011

JUN. 28. 2002 1:38AM NO. 0590 P. 4

Record Drawing/Construction Certification Submittal for a BMP Facility

Date: 10/02/02

Inspector:
- [x] Pat Menichino
- [ ] Gerry Lewis
- [ ] Beth Davis
- [ ] Mike Woolson
- [ ] Joe Buchite
- [ ] Other: Jim Rudnicky

Project: Smith Memorial Baptist Church
BMP Facility: MANUFACTURED BMP (STORM CHAMBERS)
Plan No. SP-118-99
BMP ID Code: YC 024

I have received a transmittal for a [x] Record Drawing and [x] Construction Certification for the above referenced facility on Sept 17 2002. Prior to full engineering review of these items and a field inspection, I am first forwarding the items to you to cursory review in case any major field changes were performed that I should be aware of and/or to ensure the record drawing accurately portrays what you saw in the field. Please review the drawing and return to me promptly so I can proceed with the review for certification purposes.

During my review, I will look at issues related to the BMP and its primary inflow and outflow conveyance systems, and will make comment in the following areas: Record Drawing (RD), Construction Certification (CC) and Construction-Related (CR) punch list items. If you have any other related non-BMP site issues such as erosion, stabilization, removal of erosion & sediment controls, etc. that are not related to the BMP, I can easily add these items to any comment letter that I may forward to the Owner/Engineer. Let me know if any outstanding site issues remain.

If I don't hear from you I will ask you if any other outstanding issues remain before I forward any letters to the Owner/Engineer.

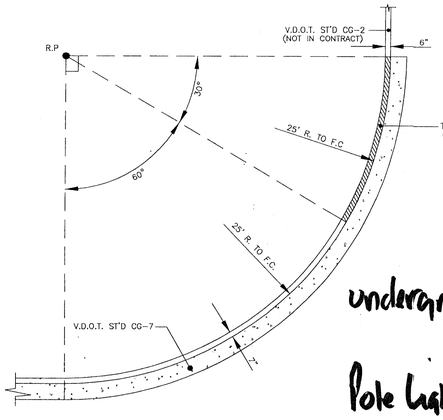
Scott

SWMProg\BMP\ConInsp\Insp.trans

I did not approve any changes to the plan or at the site. Jim

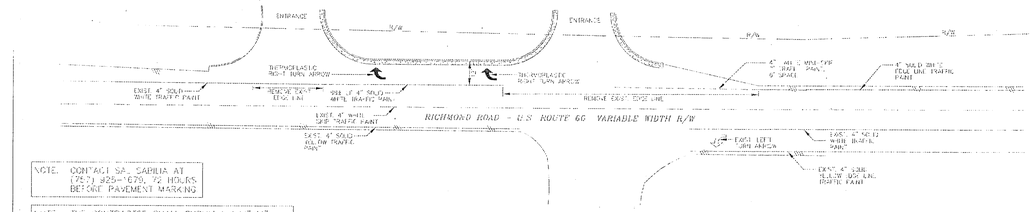
HIS LAND SURVEYING, INC.
15500 RIVER BEND TRAIL
LANEXA, VIRGINIA 23089
(804)966-7017

TOPOGRAPHIC AND BOUNDARY INFORMATION TAKEN FROM FIELD SURVEY ENTITLED "SMITH MEMORIAL BAPTIST CHURCH", (703LRP.DXF) DATED 2/10/99, BY HIS LAND SURVEYING. LANDMARK DESIGN GROUP, INC. IS NOT RESPONSIBLE FOR INACCURACIES IN SAID TOPOGRAPHIC AND BOUNDARY INFORMATION OR DESIGN CHANGES RESULTING THEREFROM.



CG-2 TO CG-7 TRANSITION DETAIL

NOT TO SCALE

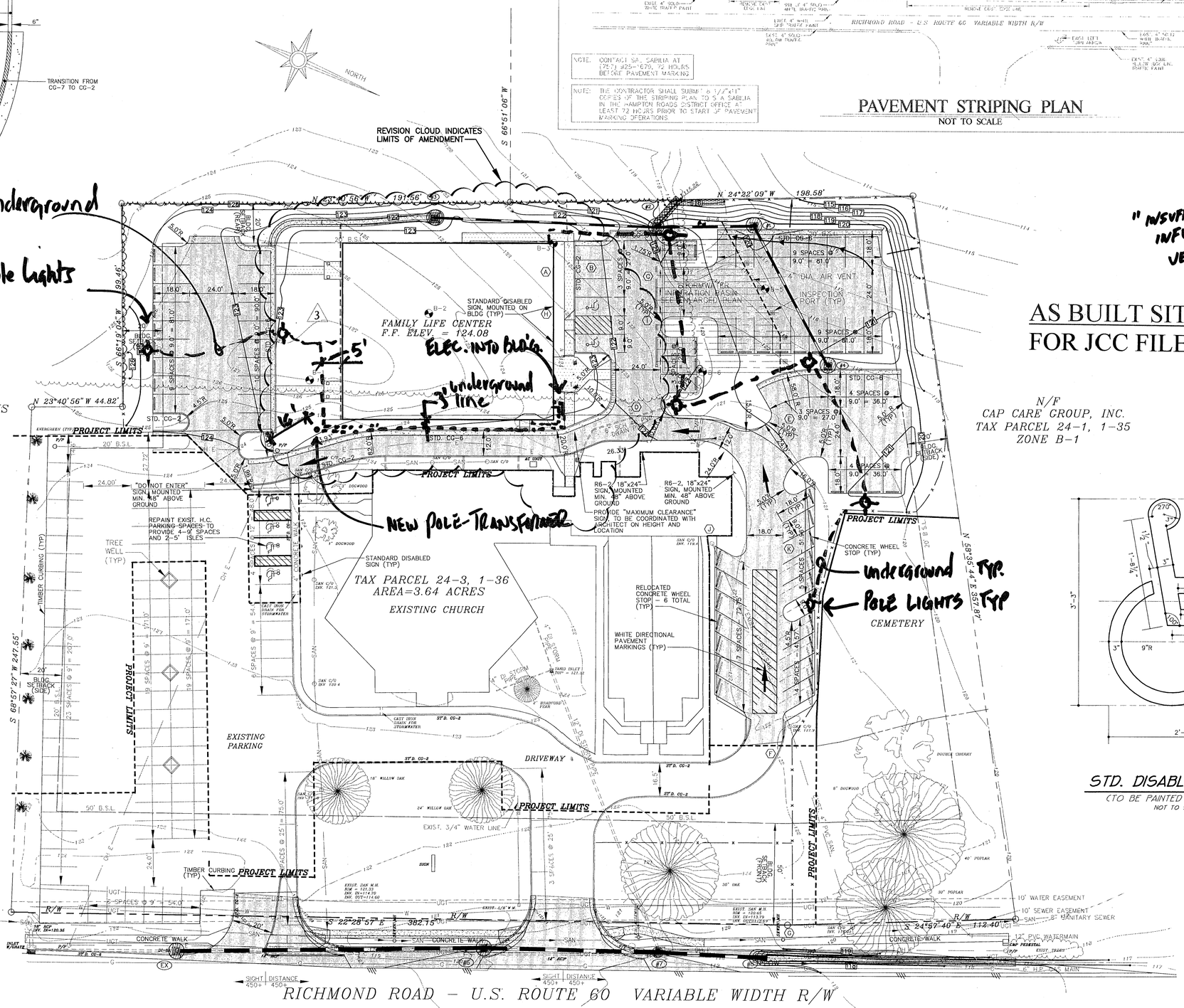


NOTE: CONTACT SP. SABLIA AT (757) 925-1679, 72 HOURS BEFORE PAVEMENT MARKING

NOTE: THE CONTRACTOR SHALL SUBMIT 8 1/2"x11" COPIES OF THE STRIPING PLAN TO S.A. SABLIA IN THE HAMPTON ROADS DISTRICT OFFICE AT LEAST 72 HOURS PRIOR TO START OF PAVEMENT MARKING OPERATIONS.

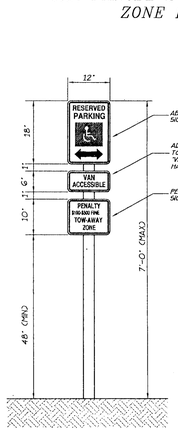
PAVEMENT STRIPING PLAN

NOT TO SCALE



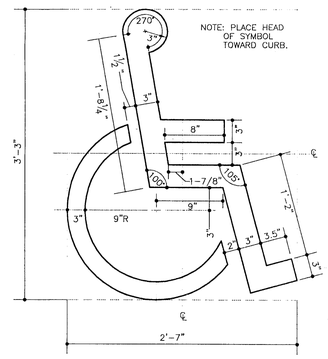
"INSUFFICIENT INFO- CONTRACTORS VERSION"

AS BUILT SITE PLAN
FOR JCC FILE 9~12~02



STD. DISABLED SIGN

NOT TO SCALE



STD. DISABLED SYMBOL

(TO BE PAINTED ON PAVEMENT)

NOT TO SCALE

NOTE:

1. THIS PLAN DOES NOT GUARANTEE THE EXISTENCE/NONEXISTENCE OF ANY UTILITIES ABOVE AND/OR BELOW GROUND. CONTRACTOR SHALL VERIFY THE HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UTILITIES PRIOR TO ORDERING OF MATERIALS AND INSTALLATION. THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR ANY UTILITIES DAMAGED DURING CONSTRUCTION AND SHALL REPAIR ANY UTILITIES DAMAGED BY CONSTRUCTION ACTIVITIES AT THEIR OWN EXPENSE.
2. ALL DISABLED PARKING SIGNS SHALL INCLUDE THE FOLLOWING LANGUAGE: "PENALTY, $100-$500 FINE, TOW AWAY ZONE" SUCH LANGUAGE MAY BE PLACED ON A SEPARATE SIGN AND ATTACHED BELOW ABOVE GRADE SIGNS PROVIDING THAT THE BOTTOM EDGE OF THE ATTACHED SIGN IS NO LOWER THAN FOUR (4) FEET ABOVE THE PARKING SURFACE.
3. SIGNS MAY BE MOUNTED ON BUILDING, AS APPROVED BY OWNER.

GEOMETRIC PLAN

SCALE: 1" = 25'

GRAPHIC SCALE IN FEET

1" = 25'

COMMONWEALTH OF VIRGINIA
10-26-01
STEPHEN A. ROMEO
No. 1448-B
LAND SURVEYOR

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

5244 Shenandoah Road
Suite 2B
Virginia Beach, VA 23462
Tel. (757) 473-2000
Fax. (757) 473-2001
Email: info@landmarkdg.com

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

No.	Date	REVISIONS: Comment	By
1	4/7/00	REVISED PER COUNTY COMMENTS	SAG
2	8/11/00	REVISED PER COUNTY COMMENTS	SAG
3	10/24/01	MARKED TO REFLECT CHANGES IN BLDG DIMENSIONS, ETC.	MEI
4			
5			
6			
7			
8			

DRAWING STATUS
DATE ___ Interdiff Review
DATE ___ Client for Review
DATE ___ Pre Approval Bidding
DATE ___ NOTE

COUNTY APPROVAL
DATE ___ 1st Submittal
DATE ___ 2nd Submittal
DATE ___ 3rd Submittal
DATE ___ Approved

GEOMETRIC PLAN

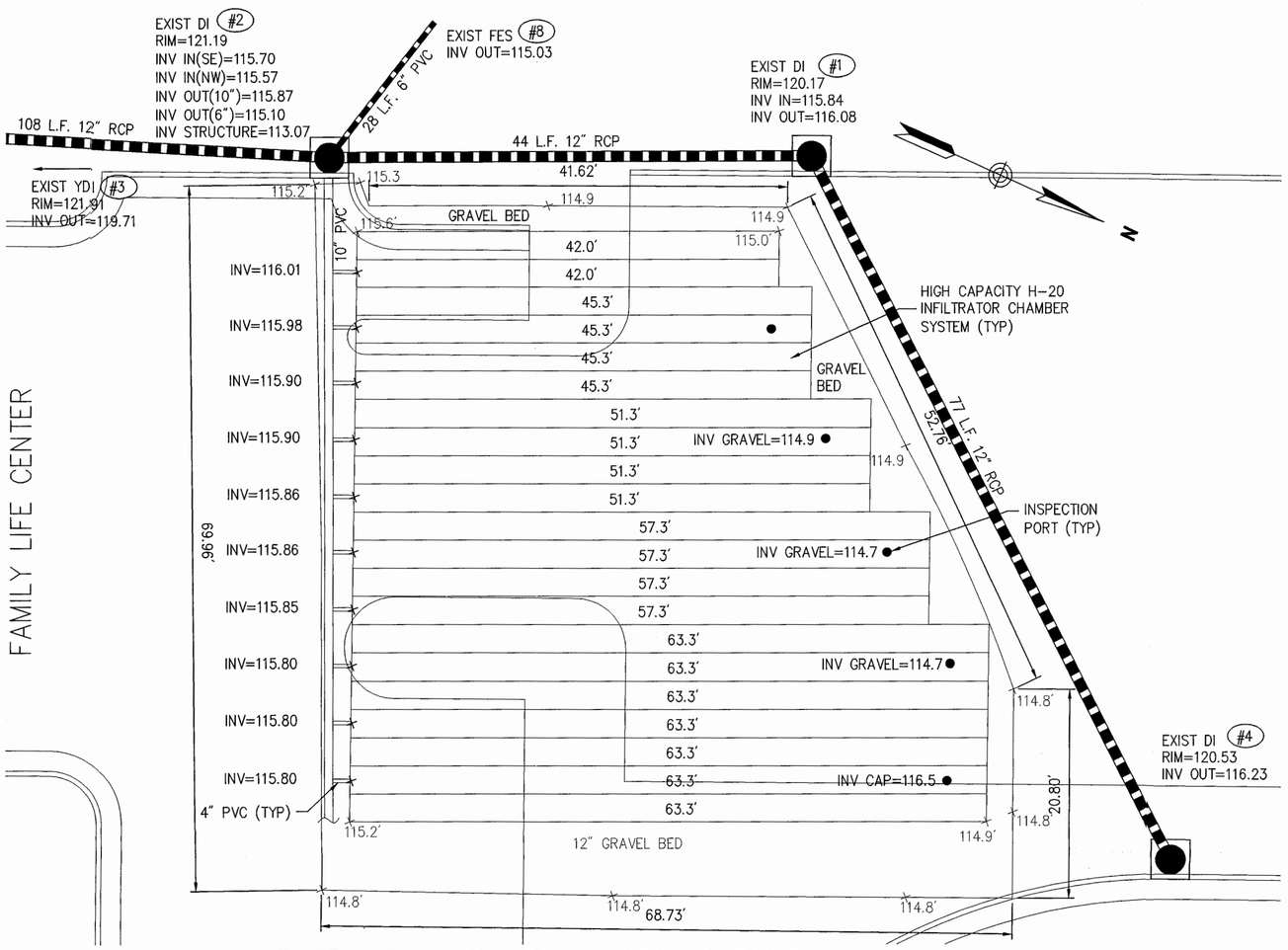
SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER
635 RICHMOND ROAD

POWHATAN DISTRICT JAMES CITY COUNTY VIRGINIA

Designed: W.F.B./S.A.G.	Date: 10/13/99
Checked: R.S.P.	Scale: 1"=25'
Drawn: S.A.G.	CADD File name: SHEET4.DWG
Project Number: 1990072.000.01	Dwg. File No.: 12735W
Drawing Number	C-4

4 OF 8

YC024_SMITH_MEMORIAL_BAPTIST_CHURCH - 013



INFILTRATION BASIN PLAN VIEW AS-BUILT

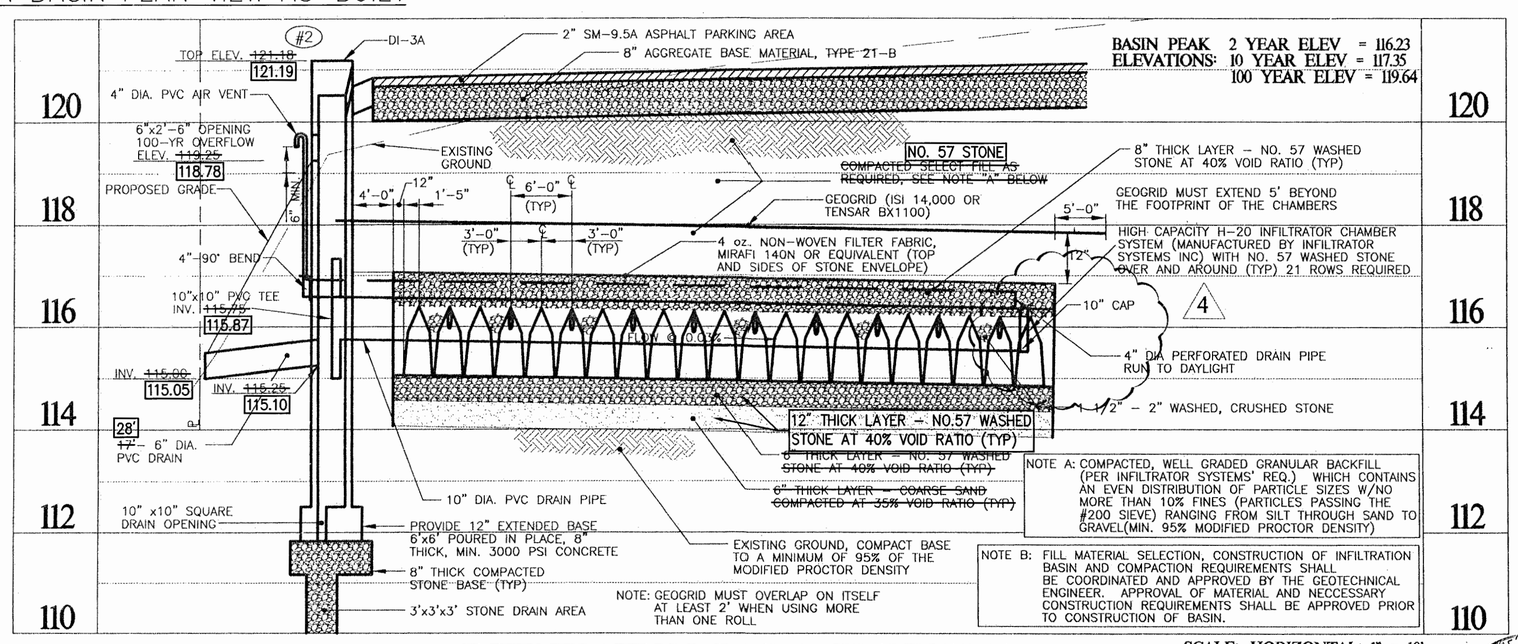
10 0 10 20
2 0 2 4
SCALE IN FEET

NOTES:

1. CONSTRUCTION INSPECTION BY ENGINEERING SERVICES, LTD.

2. PARKING IS SHOWN FOR FUTURE CONSTRUCTION ONLY.

3. INFILTRATION BASIN SECTION D-D AND INFILTRATION MAINTENANCE SCHEDULE ARE FROM THE SITE PLANS OF "SMITH MEMORIAL BAPTIST CHURCH, FAMILY LIFE CENTER" BY LANDMARK DESIGN GROUP, DATED OCTOBER 13, 1999 LATEST REVISION AUGUST 11, 2000. DATA WITHIN ILLUSTRATES AS-BUILT INFORMATION. MATERIAL AS-BUILT DATA AS SHOWN IN SECTION D-D FROM INFORMATION SUPPLIED BY JACK L. MASSIE CONTRACTOR.



INFILTRATION BASIN SECTION D-D

FROM PROJECT SITE PLAN SHEET C-7 BY LANDMARK DESIGN GROUP

SCALE: HORIZONTAL: 1" = 10'
VERTICAL: 1" = 2'

UNDERGROUND INFILTRATION BASIN INSPECTION/MAINTENANCE SCHEDULE

SMITH MEMORIAL BAPTIST CHURCH SHALL SET UP A MAINTENANCE COMMITTEE TO PERIODICALLY INSPECT THE UNDERGROUND INFILTRATION BASIN AND STORM SEWER SYSTEMS THAT DISCHARGE INTO THE BASIN.

THE COMMITTEE SHALL INSPECT THE DROP INLETS, PIPING AND UNDERGROUND INFILTRATION SYSTEM TO INSURE PROPER WORKING ORDER AND FREE OF SILT AND DEBRIS. THIS INSPECTION MUST TAKE PLACE AFTER EACH LARGE STORM EVENT TO PREVENT SILTATION AND DEBRIS FROM ENTERING THE INFILTATION BASIN. THE PAVED DITCH SHALL BE SWEPT CLEAN AND ALL SILTATION/DEBRIS SHALL BE PROPERLY DISPOSED OF ON-SITE. THIS SILTATION/DEBRIS SHALL NOT BE ALLOWED TO REENTER ANY PORTION OF THE DRAINAGE SYSTEM.

THE SUMPS WITHIN EACH DROP INLET MUST BE PUMPED OUT AND VACUUMED TO REMOVE ANY SILT AND DEBRIS. THIS SILT AND DEBRIS SHALL ALSO BE PROPERLY DISPOSED OF ON-SITE. THIS SILTATION/DEBRIS SHALL NOT BE ALLOWED TO REENTER ANY PORTION OF THE DRAINAGE SYSTEM.

THIS INSPECTION AND CLEANING PROCESS MUST BE PROVIDED ON A ROUTINE BASIS AND MAY BE PREFORMED BY EITHER THE CHURCH COMMITTEE OR A COMMERCIAL CLEANING GROUP.

THE SMBC COMMITTEE SHALL REFER TO INFILTRATOR SYSTEMS INC. FOR SPECIFIC LONG-TERM INSPECTION AND MAINTENANCE REQUIREMENTS. PLEASE CONTACT:
INFILTRATOR SYSTEMS INC.
6 BUSINESS PARK ROAD
P.O. BOX 768
OLD SAYBROOK, CT 06475
1-800-221-4436
www.infiltratorsystems.com

VHB
Vanasse Hangen Brustlin, Inc.
Transportation
Land Development
Environmental Services
477 McLaws Circle, Suite 1
Williamsburg, Virginia 23185-6316
757 220 0500 • FAX 757 220 8544

No.	Revision	Date	Appvd.
1	Per County Comments	10/8/02	

Designed by | Drawn by RWP | Checked by TJH
CAD checked by TJH | Approved by TJH
Scale 1"=10' H, 1"=2' V | Date 6/10/02
Project Title

Infiltration Basin As-Built

Williamsburg, Virginia

Issued for

Smith Memorial Baptist Church
Family Life Center
SWM Record Drawing

Drawing Title

County Plan # SP-118-99
BMP ID Code: YC 024

APPROVED
James City County
Environmental Division
By:
Date: 10-7-02

COMMONWEALTH OF VIRGINIA
FRANK G. MUNDY II
No. 002382
10/8/02
LAND SURVEYOR

Drawing Number
B-1

Sheet 1 of 1

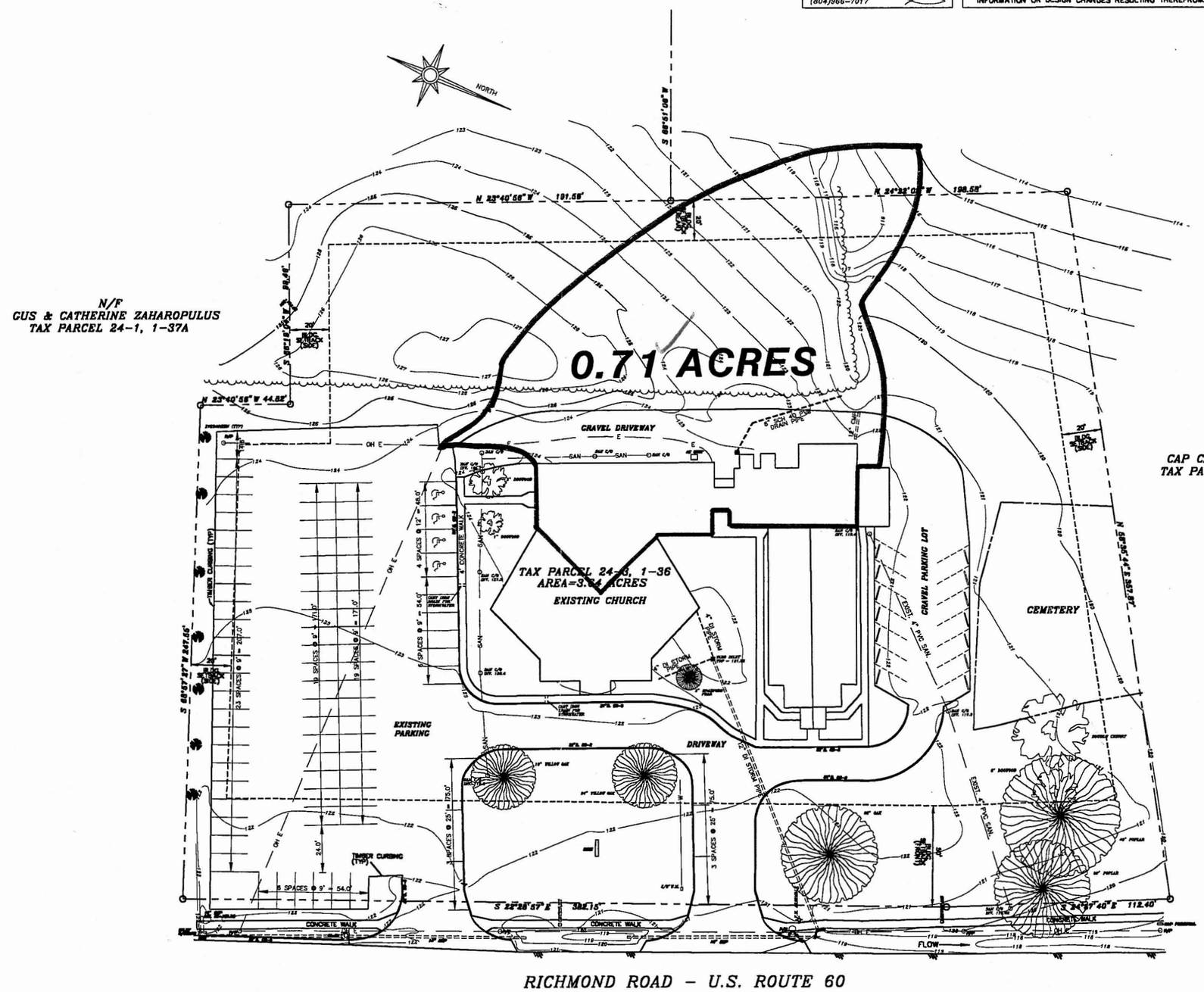
Project Number
31249.00

31249map.dwg

OCT 2002
RECEIVED
ENVIRONMENTAL DIVISION

HIS LAND SURVEYING, INC.
15500 RIVER BEND TRAIL
LANEXA, VIRGINIA 23089
(804)966-7017

TOPOGRAPHIC AND BOUNDARY INFORMATION TAKEN FROM FIELD SURVEY ENTITLED "SMITH MEMORIAL BAPTIST CHURCH", (703LRP.DXF) DATED 2/10/99, BY HIS LAND SURVEYING. LANGLEY AND McDONALD, INC. IS NOT RESPONSIBLE FOR INACCURACIES IN SAID TOPOGRAPHIC AND BOUNDARY INFORMATION OR DESIGN CHANGES RESULTING THEREFROM.



PRE-DEVELOPMENT DRAINAGE AREA

1" = 57.14'

0 25 50 75 100
GRAPHIC SCALE IN FEET
1" = 25'

Langley and McDonald, Inc.
Engineers · Surveyors · Planners
Landscape Architects · Environmental Consultants
WILLIAMSBURG
5344 Greenwich Road – Suite 200
Virginia Beach, VA 23462
Tel. (757) 473-2000
Fax (757) 497-7933
Email: langleyandmcdonald.com
4025 Nimbus Rd., Suite 100
Virginia Beach, VA 23455
Tel. (757) 363-3275
Fax (757) 226-0049
Email: langleyandmcdonald.com

REVISIONS:
No. | Date | Comment | By

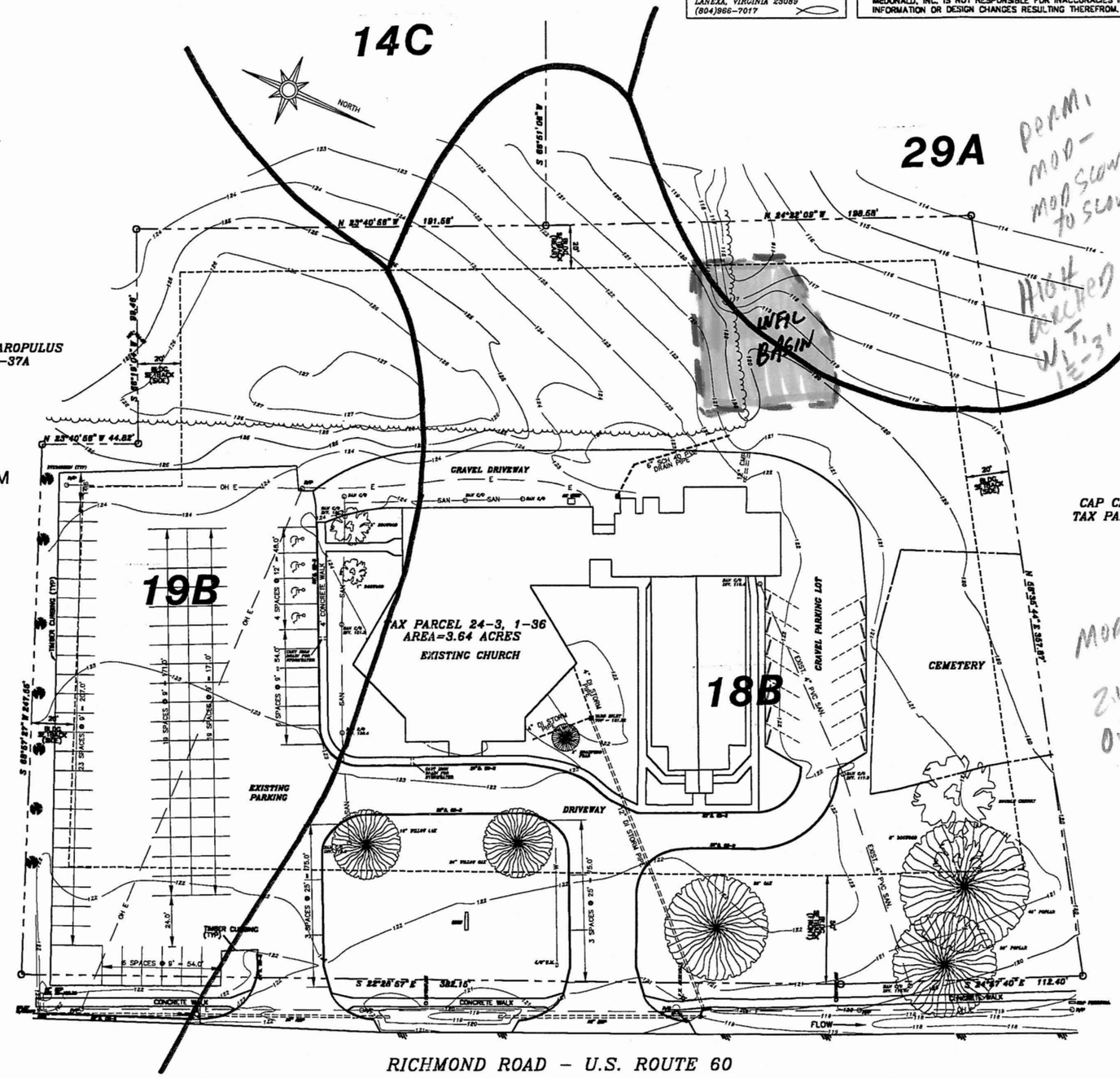
DRAWING STATUS
Issued for Review
Issued for Review
Pre Permit Meeting
NPC
COUNTY APPROVAL
Plan Review 1st Submittal
Plan Review 2nd Submittal
Final Approval

SMITH MEMORIAL BAPTIST CHURCH
CENTER
EXISTING SITE CONDITIONS

Designed: | Date: 9/7/99
Checked: | Scale: 1"=25'
Drawn: | CADD File name: SHEET2.DWG
Project Number: 1990072-000.01 | Dwg. File No.: XXXXX-X
Drawing Number C-2
2 OF 10

HIS LAND SURVEYING, INC.
15590 RIVER BEND TRAIL
LANEXA, VIRGINIA 23089
(804)966-7017

TOPOGRAPHIC AND BOUNDARY INFORMATION TAKEN FROM FIELD SURVEY ENTITLED "SMITH MEMORIAL BAPTIST CHURCH", (703LRP.DXF) DATED 2/10/99, BY HIS LAND SURVEYING. LANGLEY AND McDONALD, INC. IS NOT RESPONSIBLE FOR INACCURACIES IN SAID TOPOGRAPHIC AND BOUNDARY INFORMATION OR DESIGN CHANGES RESULTING THEREFROM.



LEGEND:

14C EMPORIA FINE SANDY LOAM

18B KEMPSVILLE FINE SANDY LOAM

19B KEMPSVILLE-EMPORIA FINE SANDY LOAM

29A FINE SANDY LOAM

NOTE:
THIS SOIL MAP BASED ON A COMPILATION OF INFORMATION OF THE SOIL CONSERVATION SERVICE SOIL SURVEY OF JAMES CITY AND YORK COUNTIES AND THE CITY OF WILLIAMSBURG VIRGINIA

SOILS MAP

0 25 50 75 100
GRAPHIC SCALE IN FEET
1" = 25'

Langley and McDonald, Inc.
Engineers · Surveyors · Planners
Landscape Architects · Environmental Consultants
WILLIAMSBURG VIRGINIA BEACH
5544 Greenwich Road - Suite 200, Virginia Beach, VA 23462
Tel. (757) 473-2000 Fax (757) 497-7833
4029 Ironbound Rd., Suite 100, Williamsburg, VA 23188
Tel. (757) 565-2175 Fax (757) 229-0049
Email: lm@langleymcdonald.com

REVISIONS: No. | Date | Comment | By

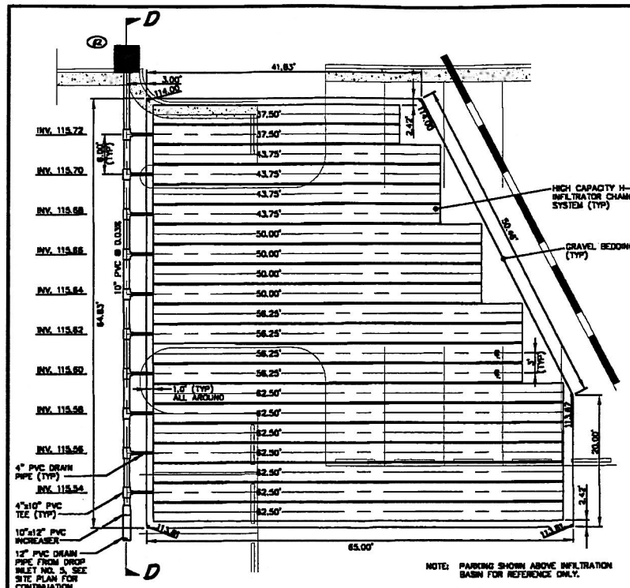
DRAWING STATUS: Preliminary Review | Final for Review | Final for Bidding | Issued for Construction
COUNTY APPROVAL: Initial | Initial | Final | Final

EXISTING SITE CONDITIONS
SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER
JAMES CITY COUNTY VIRGINIA

Designed:	Date: 9/7/99
Checked:	Scale: 1"=25'
Drawn:	CADD File name: SHEET2.DWG
Project Number: 1990072-000.01	Dwg. File No.: XXXXX-X
Drawing Number 2 OF 10	C-2

HIS LAND SURVEYING, INC.
15500 RIVER BEND TRAIL
LANEXA, VIRGINIA 23089
(804)966-7017

TOPOGRAPHIC AND BOUNDARY INFORMATION TAKEN FROM FIELD SURVEY ENTITLED "SMITH MEMORIAL BAPTIST CHURCH", (703LRP.DXF) DATED 2/10/99, BY HIS LAND SURVEYING. LANGLEY AND McDONALD, INC. IS NOT RESPONSIBLE FOR INACCURACIES IN SAID TOPOGRAPHIC AND BOUNDARY INFORMATION OR DESIGN CHANGES RESULTING THEREFROM.



INFILTRATION BASIN PLAN

SCALE: 1" = 10'

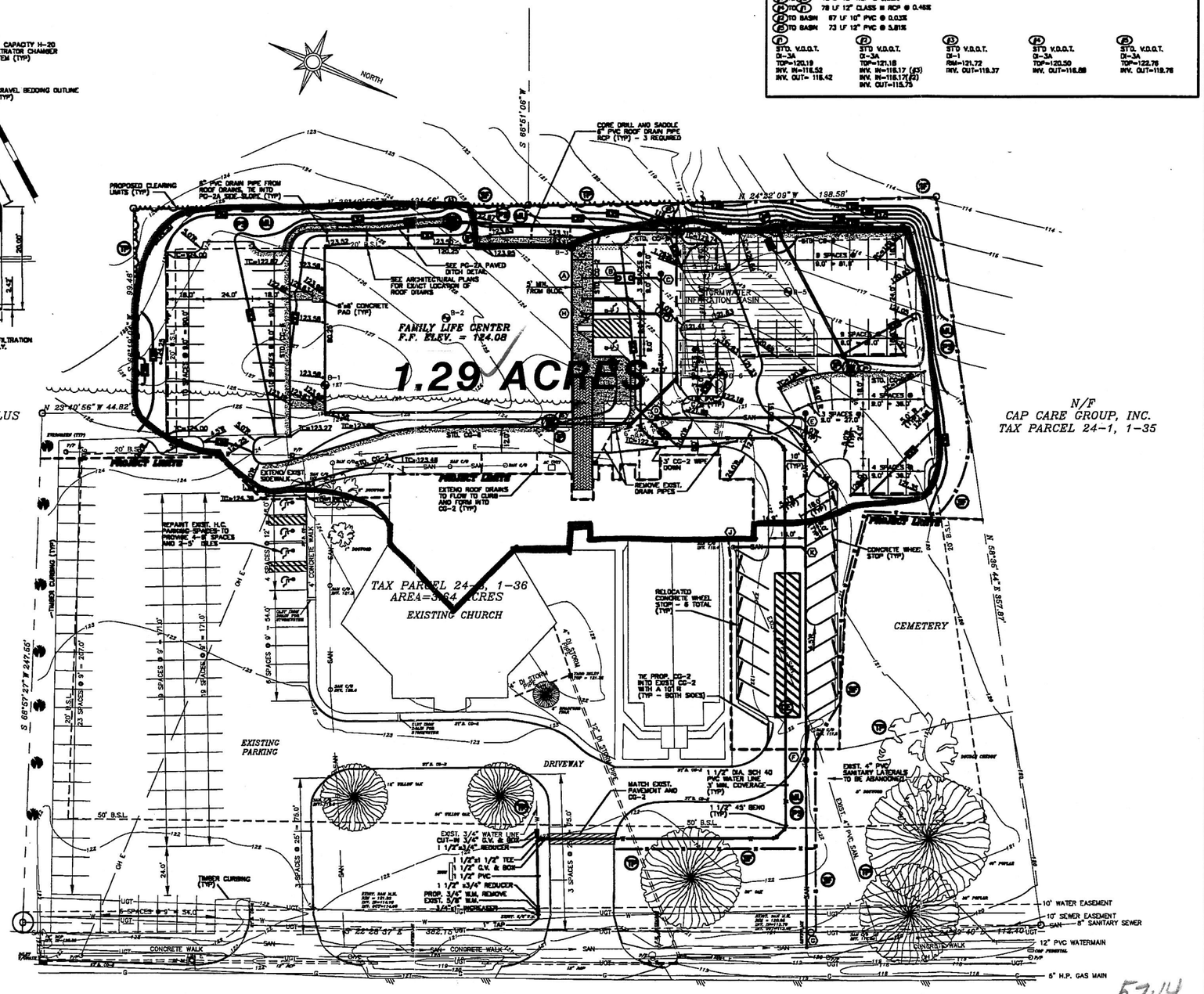
N/F
GUS & CATHERINE ZAHAROPULUS
TAX PARCEL 24-1, 1-37A

N/F
CAP CARE GROUP, INC.
TAX PARCEL 24-1, 1-35

STORM DATA

(A) TO (B)	108 LF 12" RCP @ 2.96%
(B) TO (C)	48 LF 15" RCP @ 0.52%
(C) TO (D)	78 LF 12" CLASS III RCP @ 0.46%
(D) TO BASIN	67 LF 10" PVC @ 0.03%
(E) TO BASIN	73 LF 12" PVC @ 3.81%

(A)	(B)	(C)	(D)	(E)
STD. V.D.O.T. DI-3A	STD. V.D.O.T. DI-3A	STD. V.D.O.T. DI-3A	STD. V.D.O.T. DI-1	STD. V.D.O.T. DI-3A
TOP=120.19	TOP=121.18	TOP=122.78	RIM=121.72	TOP=120.50
INV. IN=116.52	INV. IN=118.17 (E3)	INV. IN=118.17 (E2)	INV. OUT=119.37	INV. OUT=116.88
INV. OUT= 116.42	INV. IN=118.17 (E2)	INV. OUT=115.75		
	INV. OUT=115.75			



SANITARY SEWER DATA

(A)	LIMITS OF SITE PLAN SANITARY SEWER (5' FROM BLDG.), INV. = 120.35
(A) TO (B)	16 LF 2" SDR 23.5 PVC @ 2.08%
(B)	750 GAL CAPACITY GREASE TRAP OR APPROVED EQUAL, INV. IN = 120.02, INV. OUT = 119.86
(B) TO (C)	13 LF 6" SDR 23.5 PVC @ 1.62%
(C)	SANITARY CLEANOUT, INV. = 119.65
(C) TO (D)	68 LF 6" SDR 23.5 PVC @ 1.00%
(D)	SANITARY CLEANOUT, INV. = 118.97
(D) TO (E)	70 LF 6" SDR 23.5 PVC @ 1.00%
(E)	SANITARY CLEANOUT, INV. = 118.27
(E) TO (F)	189 LF 6" SDR 23.5 PVC @ 1.00%
(F)	SANITARY CLEANOUT, INV. = 116.58
(F) TO (G)	90 LF 6" SDR 23.5 PVC @ 1.00%
(G)	TIE INTO EXISTING MANHOLE, INV. IN = 115.68, CORE AND BOOT EXIST. SANITARY MANHOLE. PROVIDE INSIDE DROP CONNECTION
(H)	LIMITS OF SITE PLAN SANITARY SEWER (5' FROM BLDG.), INV. = 120.25
(H) TO (I)	38 LF 4" SDR 23.5 PVC @ 2.08%
(I)	6"x4" SDR 23.5 PVC WYE, INV. = 119.46
(J)	EXIST. SANITARY CLEANOUT, INV. = 118.4
(J) TO (K)	35 LF 4" SDR 23.5 PVC @ 5.11%
(K)	6"x4" SDR 23.5 PVC WYE, INV. = 117.61

NOTES:

1. UNLESS OTHERWISE NOTED, ALL DRAINAGE EASEMENTS DESIGNATED ON THIS PLAN SHALL REMAIN PRIVATE.
2. ALL UTILITIES SHALL BE PLACED UNDERGROUND.
3. EXTERIOR SIGNS WITHIN THE DISTRICT SHALL COMPLY WITH THE REGULATIONS FOR EXTERIOR SIGNS IN ARTICLE II DIVISION 3 OF THE JAMES CITY COUNTY ZONING ORDINANCE.
4. VDOT DOES NOT ASSUME RESPONSIBILITY FOR MAINTENANCE OF THE PROPOSED INFILTRATION BASIN AND OUTLET STRUCTURE.
5. THIS PLAN DOES NOT GUARANTEE THE EXISTENCE/NONEXISTENCE OF ANY UTILITES ABOVE AND/OR BELOW GROUND. CONTRACTOR SHALL VERIFY THE HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UTILITIES PRIOR TO ORDERING OF MATERIALS AND INSTALLATION. THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR ANY UTILITIES DAMAGED DURING CONSTRUCTION AND SHALL REPAIR ANY UTILITIES DAMAGED BY CONSTRUCTION ACTIVITIES AT THEIR OWN EXPENSE.
6. GEOTECHNICAL SOIL BORINGS SHOWN ARE APPROXIMATE LOCATIONS ONLY.
7. ALL UNUSED WELLS MUST BE ABANDONED ACCORDING TO STATE PRIVATE WELL REGULATIONS.
8. APPROVAL TO BEGIN CONSTRUCTION OF THE STORMWATER MANAGEMENT/BMP INFILTRATION BASIN MUST BE OBTAINED BY THE OFFICE OF CODE COMPLIANCE OF JAMES CITY COUNTY.

RICHMOND ROAD - U.S. ROUTE 60

POST-DEVELOPMENT DRAINAGE AREA

57.14

COMMONWEALTH OF VIRGINIA
ROBERT S. PHILIPS
No. 023531
PROFESSIONAL ENGINEER

Langley and McDonald, Inc.
Engineers · Surveyors · Planners
Landscape Architects · Environmental Consultants
WILLIAMSBURG VIRGINIA BEACH
5544 Greenwich Road - Suite 200
Virginia Beach, VA 23462
Tel. (757) 497-7933
Fax (757) 497-7935
Email: lm@langleymcd.com
4029 Ironbound Rd., Suite 100
Williamsburg, VA 23188
Tel. (757) 220-0449
Fax (757) 220-9415
Email: lm@langleymcd.com

REVISIONS:

No.	Date	By	Comment

DRAWING STATUS
DATE ___ Scoping Review
DATE ___ Check for Review
DATE ___ Pre-approval Meeting
DATE ___ WPC
DATE ___ WPO

COUNTY APPROVAL
DATE ___ 1st Submittal
DATE ___ 2nd Submittal
DATE ___ 3rd Submittal
DATE ___ Approved

SITE PLAN
SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER
@ RICHMOND ROAD
JAMES CITY COUNTY, VIRGINIA
JOB NUMBER 1990072

Designed: W.F.B./S.A.G.	Date: 10/13/99
Checked: R.S.P.	Scale: 1"=25'
Drawn: S.A.G.	CADD File name: SHEET3.DWG
Project Number: 1990072-000.01	Dwg. File No.: 10,862W
Drawing Number	C-3

3 OF 11

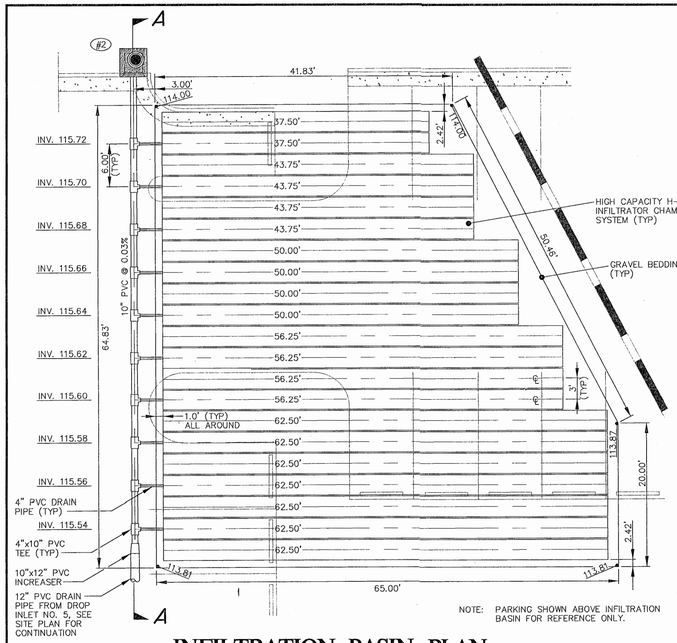
HIS LAND SURVEYING, INC.
15500 RIVER BEND TRAIL
LANEXA, VIRGINIA 23089
(804)966-7017

TOPOGRAPHIC AND BOUNDARY INFORMATION TAKEN FROM FIELD SURVEY ENTITLED "SMITH MEMORIAL BAPTIST CHURCH", (703LRP.DXF) DATED 2/10/99, BY HIS LAND SURVEYING. LANGLEY AND McDONALD, INC. IS NOT RESPONSIBLE FOR INACCURACIES IN SAID TOPOGRAPHIC AND BOUNDARY INFORMATION OR DESIGN CHANGES RESULTING THEREFROM.

STORM DATA

#3 TO #2	108 LF 12" RCP @ 2.96%
#1 TO #2	48 LF 15" RCP @ 0.52%
#4 TO #1	78 LF 12" CLASS III RCP @ 0.46%
#2 TO BASIN	67 LF 10" PVC @ 0.03%
#5 TO BASIN	73 LF 12" PVC @ 5.81%

#1	#2	#3	#4	#5
ST'D. V.D.O.T. DI-3A TOP=120.19 INV. IN=116.52 INV. OUT= 116.42	ST'D V.D.O.T. DI-3A TOP=121.18 INV. IN=116.17 (#3) INV. IN=116.17(#2) INV. OUT=115.75	ST'D V.D.O.T. DI-1 RIM=121.72 INV. OUT=119.37	ST'D V.D.O.T. DI-3A TOP=120.50 INV. OUT=116.88	ST'D V.D.O.T. DI-3A TOP=122.76 INV. OUT=119.76

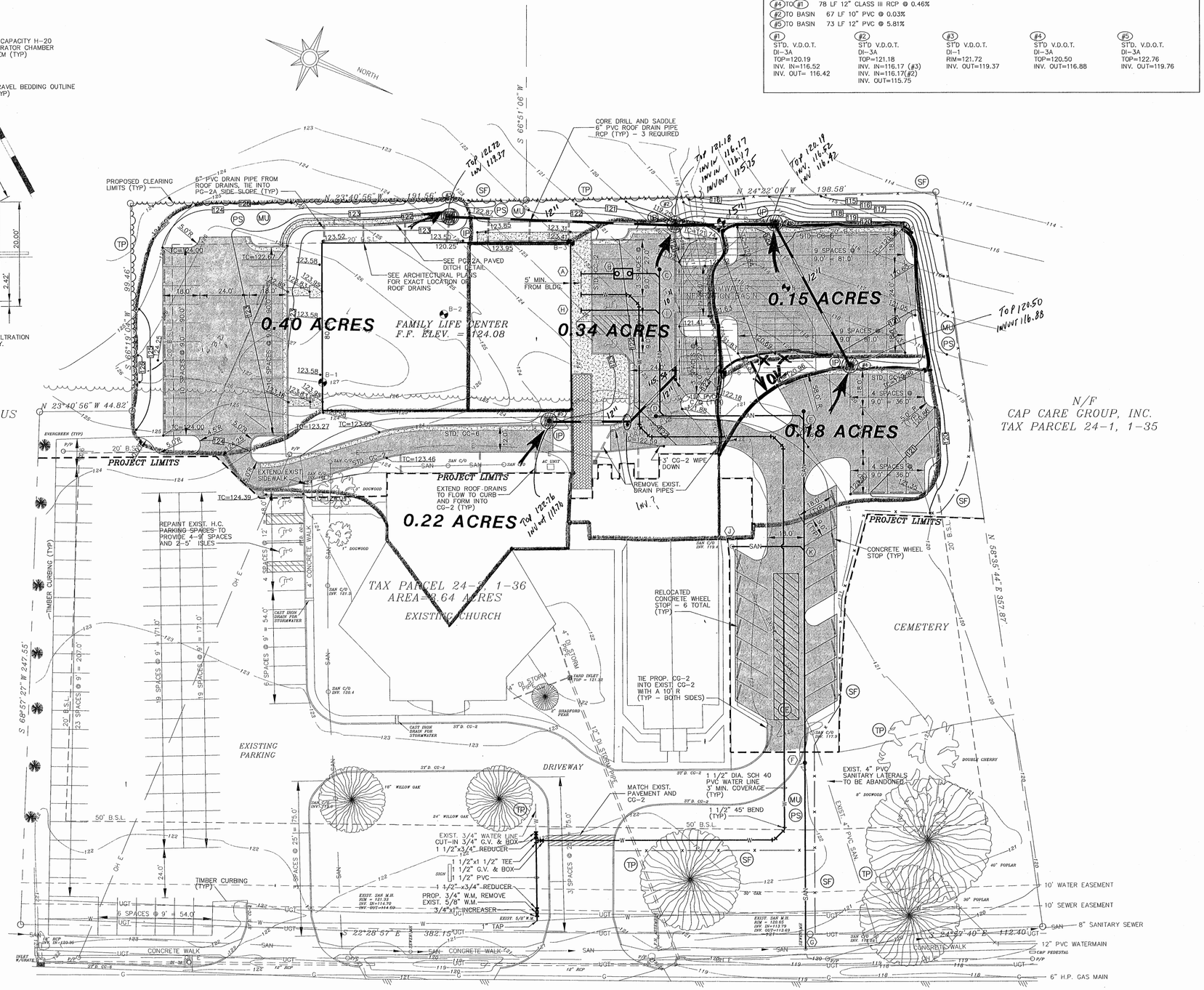


NOTE: PARKING SHOWN ABOVE INFILTRATION BASIN FOR REFERENCE ONLY.

INFILTRATION BASIN PLAN

SCALE: 1" = 10'

N/F
GUS & CATHERINE ZAHAROPULUS
TAX PARCEL 24-1, 1-37A



N/F
CAP CARE GROUP, INC.
TAX PARCEL 24-1, 1-35

SITE PLAN

SCALE: 1" = 25'

0 25 50 75 100
GRAPHIC SCALE IN FEET
1" = 25'

NOTES:

1. UNLESS OTHERWISE NOTED, ALL DRAINAGE EASEMENTS DESIGNATED ON THIS PLAN SHALL REMAIN PRIVATE.
2. ALL UTILITIES SHALL BE PLACED UNDERGROUND.
3. EXTERIOR SIGNS WITHIN THE DISTRICT SHALL COMPLY WITH THE REGULATIONS FOR EXTERIOR SIGNS IN ARTICLE II DIVISION 3 OF THE JAMES CITY COUNTY ZONING ORDINANCE.
4. VDOT DOES NOT ASSUME RESPONSIBILITY FOR MAINTENANCE OF THE PROPOSED INFILTRATION BASIN AND OUTLET STRUCTURE.
5. THIS PLAN DOES NOT GUARANTEE THE EXISTENCE/NONEXISTENCE OF ANY UTILITES ABOVE AND/OR BELOW GROUND. CONTRACTOR SHALL VERIFY THE HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UTILITIES PRIOR TO ORDERING OF MATERIALS AND INSTALLATION. THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR ANY UTILITIES DAMAGED DURING CONSTRUCTION AND SHALL REPAIR ANY UTILITIES DAMAGED BY CONSTRUCTION ACTIVITIES AT THEIR OWN EXPENSE.
6. GEOTECHNICAL SOIL BORINGS SHOWN ARE APPROXIMATE LOCATIONS ONLY.
7. ALL UNUSED WELLS MUST BE ABANDONED ACCORDING TO STATE PRIVATE WELL REGULATIONS. ? Are there exist. wells?
8. APPROVAL TO BEGIN CONSTRUCTION OF THE STORMWATER MANAGEMENT/BMP INFILTRATION BASIN MUST BE OBTAINED BY THE OFFICE OF CODE COMPLIANCE OF JAMES CITY COUNTY.

COMMONWEALTH OF VIRGINIA
RICHARD S. PHILLIPS
No. 23353
PROFESSIONAL ENGINEER

Langley and McDonald, Inc.
Engineers · Surveyors · Planners
Landscape Architects · Environmental Consultants
WILLIAMSBURG VIRGINIA BEACH
5544 Greenwich Road - Suite 200
Virginia Beach, VA. 23464
Tel. (757) 497-2033
Fax. (757) 497-2034
Email: info@langleyweb.com
4029 Ironbound RD. Suite 100
Williamsburg, VA. 23188
Tel. (757) 220-0979
Fax. (757) 220-0978
Email: info@langleyweb.com

REVISIONS:

No.	Date	Comment	By

DRAWING STATUS
DATE — Interoffice Review
DATE — Client for Review
DATE — Pre Approval Bidding
DATE — NOTE

COUNTY APPROVAL
DATE — 1st Submittal
DATE — 2nd Submittal
DATE — 3rd Submittal
DATE — Approved

DRAINAGE AREA MAP
SMITH MEMORIAL BAPTIST CHURCH FAMILY LIFE CENTER

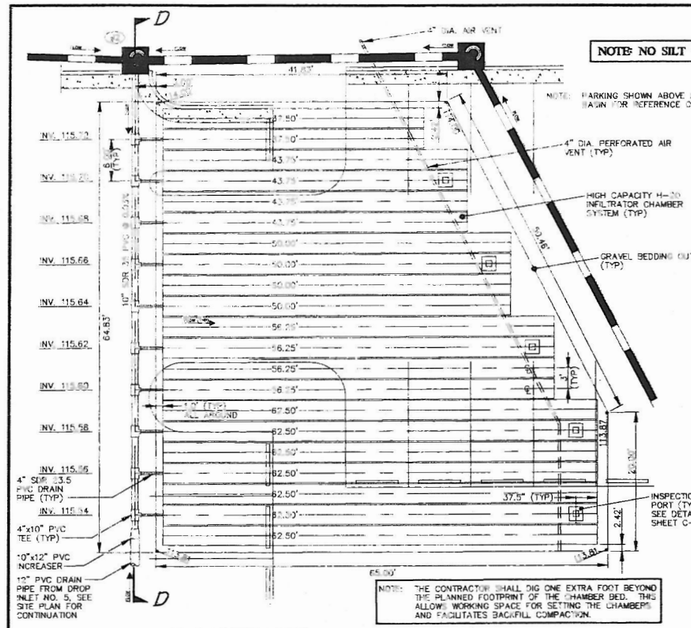
6315 RICHMOND ROAD
POWHATAN DISTRICT JAMES CITY COUNTY VIRGINIA

Designed: W.F.B./S.A.G.	Date: 10/13/99
Checked: R.S.P.	Scale: 1"=25'
Drawn: S.A.G.	CADD File name: SHEET3.DWG
Project Number: 19900072-000.01	Dwg. File No.: 10,862AW
Drawing Number	C-3A

1 OF 1

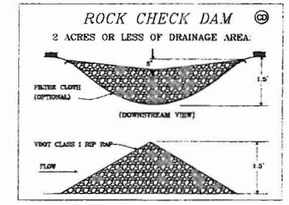
HIS LAND SURVEYING, INC.
15500 RIVER BEND TRAIL
LANEXA, VIRGINIA 23089
(804)966-7017

TOPOGRAPHIC AND BOUNDARY INFORMATION TAKEN FROM FIELD SURVEY ENTITLED "SMITH MEMORIAL BAPTIST CHURCH" (TOSLRP.DWG) DATED 2/10/99, BY HIS LAND SURVEYING. LANDMARK DESIGN GROUP, INC. IS NOT RESPONSIBLE FOR INACCURACIES IN SAID TOPOGRAPHIC AND BOUNDARY INFORMATION OR DESIGN CHANGES RESULTING THEREFROM.



INFILTRATION BASIN PLAN

SCALE: 1" = 10'



STORM DATA

(A1) TO (A2)	108 LF 12" CLASS III RCP @ 2.96%
(A2) TO (A3)	48 LF 12" CLASS III RCP @ 0.53%
(A4) TO (A1)	96 LF 12" CLASS III RCP @ 0.46%
(A2) TO BA1N	67 LF 10" SDR 35 PVC @ 0.03%
(B) TO BA1N	73 LF 12" SDR 35 PVC @ 0.84%
(E) TO OUTFALL	17 LF 6" SDR 23.5 PVC @ 1.47%
VDOT RIGHT-OF-WAY	
(EX) TO (#6)	147 LF 14"x23" ELLIPTICAL RCP @ 1.13%
(#6) TO (#7)	89 LF 14"x23" ELLIPTICAL RCP @ 1.17%
(#7) TO (#8)	54 LF 14"x23" ELLIPTICAL RCP @ 0.48%

(#1) STD. V.D.O.T. DI-3A TOP=123.19 INV. N=116.52 INV. OUT= 116.42 BOTTOM=115.40

(#2) STD. V.D.O.T. DI-3A TOP=122.18 INV. N=116.17 (48") INV. N=116.17 (8") INV. OUT=115.75 (10") INV. OUT=115.75 (6") BOTTOM=112.50

(#3) STD. V.D.O.T. DI-1 RIM=121.72 INV. OUT=119.37 BOTTOM=118.30

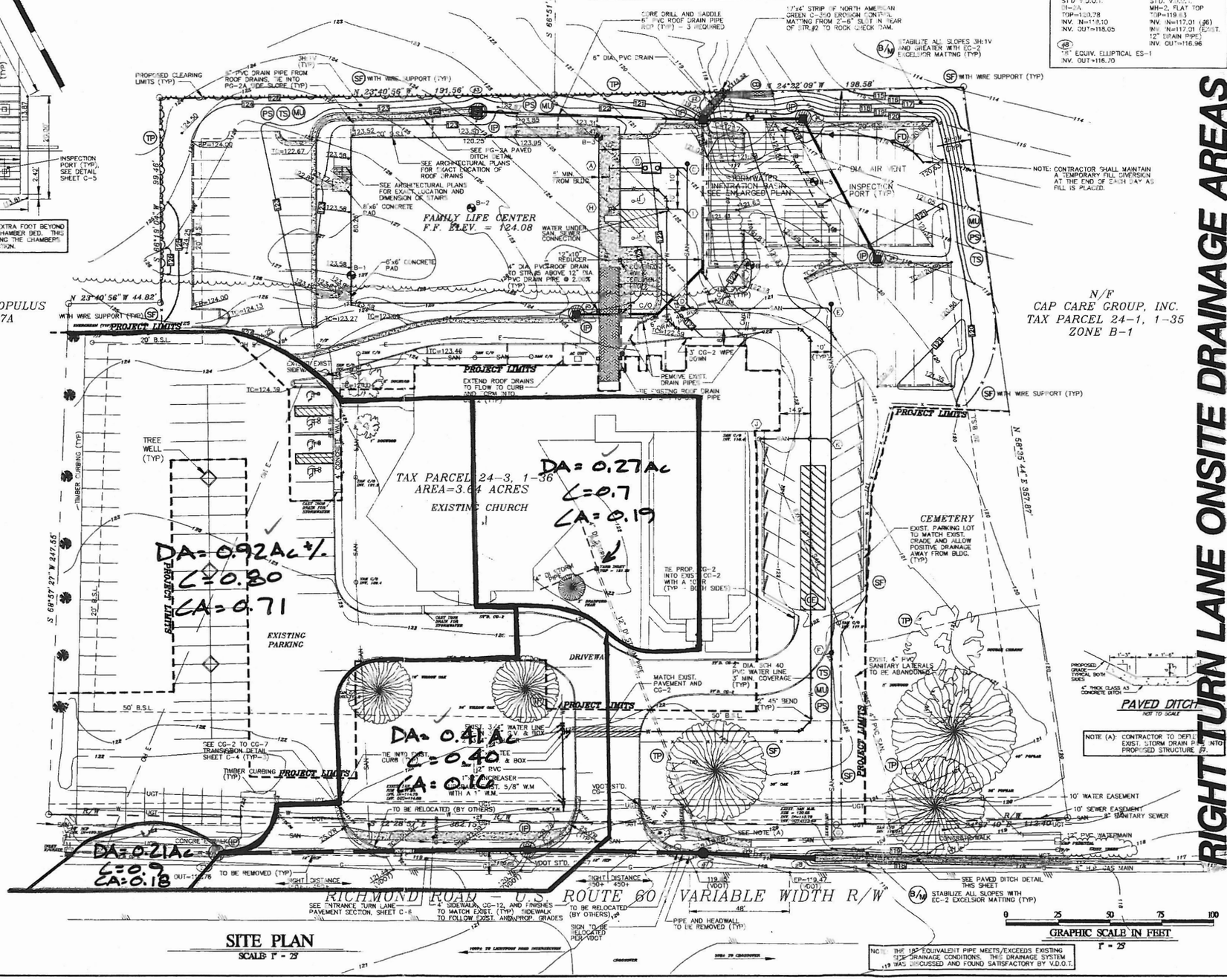
(#4) STD. V.D.O.T. DI-3A TOP=120.50 INV. OUT=116.88 BOTTOM=115.80

(#5) STD. V.D.O.T. DI-3A TOP=122.76 INV. N=119.17 (14") INV. OUT=117.59 BOTTOM=116.50

(#6) STD. V.D.O.T. DI-3A TOP=123.78 INV. N=118.10 INV. OUT=118.05

(#7) STD. V.D.O.T. MH-2, FLAT TOP TOP=119.63 INV. N=117.01 (36") INV. N=117.01 (EXIST. 12" DRAIN PIPE) INV. OUT=116.96

(#8) 78" EQUIV. ELLIPTICAL ES-1 INV. OUT=116.70



NOTE: THE 18" EQUIVALENT PIPE MEETS/EXCEEDS EXISTING SITE DRAINAGE CONDITIONS. THIS DRAINAGE SYSTEM WAS DISCUSSED AND FOUND SATISFACTORY BY V.D.O.T.

SITE PLAN

SCALE: 1" = 25'

SANITARY SEWER DATA

(A)	LIMITS OF SITE PLAN SANITARY SEWER (5' FROM BLDG.), INV. = 119.34
(A) TO (B)	16 LF 4" SDR 23.5 PVC @ 2.08%
(E)	750 GAL CAPACITY GREASE TRAP OR APPROVED EQUAL, INV. IN = 119.01, INV. OUT = 118.84
(B) TO (C)	13 LF 6" SDR 23.5 PVC @ 1.62%
(C)	SANITARY CLEANOUT, INV. = 118.63
(C) TO (D)	98 LF 6" SDR 23.5 PVC @ 1.00%
(D)	SANITARY CLEANOUT, INV. = 117.95
(D) TO (E)	70 LF 6" SDR 23.5 PVC @ 1.00%
(E)	SANITARY CLEANOUT, INV. = 117.25
(E) TO (F)	167 LF 6" SDR 23.5 PVC @ 1.00%
(F)	SANITARY CLEANOUT, INV. = 115.58
(F) TO (G)	90 LF 6" SDR 23.5 PVC @ 1.00%
(G)	TIE INTO EXISTING MANHOLE, INV. IN = 114.69, CORE DRILL AND BOOT EXIST. SANITARY MANHOLE, PROVIDE INSIDE DROP CONNECTION
(H)	LIMITS OF SITE PLAN SANITARY SEWER (5' FROM BLDG.), INV. = 119.25
(H) TO (I)	35 LF 4" SDR 23.5 PVC @ 2.16%
(I)	6"x4" SDR 23.5 PVC WYE, INV. = 118.43
(J)	EXIST. SANITARY CLEANOUT, INV. = 119.4
(J) TO (K)	35 LF 4" SDR 23.5 PVC @ 7.97%
(K)	6"x4" SDR 23.5 PVC WYE, INV. = 116.61

NOTES:

1. UNLESS OTHERWISE NOTED, ALL DRAINAGE EASEMENTS DESIGNATED ON THIS PLAN SHALL REMAIN PRIVATE.
2. ALL UTILITIES SHALL BE PLACED UNDERGROUND, IN ACCORDANCE WITH SECTION 24-200 OF THE JAMES CITY COUNTY ZONING ORDINANCE.
3. EXTERIOR SIGNS WITHIN THE DISTRICT SHALL COMPLY WITH THE REGULATIONS FOR EXTERIOR SIGNS IN ARTICLE II DIVISION 3 OF THE JAMES CITY COUNTY ZONING ORDINANCE.
4. VDOT DOES NOT ASSUME RESPONSIBILITY FOR MAINTENANCE OF THE PROPOSED INFILTRATION BASIN AND OUTLET STRUCTURE.
5. THIS PLAN DOES NOT GUARANTEE THE EXISTENCE/NONEXISTENCE OF ANY UTILITES ABOVE AND/OR BELOW GROUND. CONTRACTOR SHALL VERIFY THE HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UTILITIES PRIOR TO ORDERING OF MATERIALS AND INSTALLATION. THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR ANY UTILITIES DAMAGED DURING CONSTRUCTION AND SHALL REPAIR ANY UTILITIES DAMAGED BY CONSTRUCTION ACTIVITIES AT THEIR OWN EXPENSE.
6. GEOTECHNICAL SOIL BORINGS SHOWN ARE APPROXIMATE LOCATIONS ONLY.
7. ALL UNUSED WELLS MUST BE ABANDONED ACCORDING TO STATE PRIVATE WELL REGULATIONS.
8. APPROVAL TO BEGIN CONSTRUCTION OF THE STORMWATER MANAGEMENT/BMP INFILTRATION BASIN MUST BE OBTAINED BY THE JAMES CITY COUNTY ENVIRONMENTAL DIVISION.
9. SPOT ELEVATIONS DESIGNATED AS XX.XX (VDOT) REPRESENT ELEVATION AFTER A 1.5" PAVEMENT OVERLAYMENT SCHEDULED IN 2000.

COMMONWEALTH OF VIRGINIA
RICHARD S. PHILLIPS
No. 022531
PROFESSIONAL ENGINEER

4310 Varsity Drive
Suite 100
Williamsburg, VA 23188
Tel: (757) 220 2949
Fax: (757) 220 2943
Email: lmdg@landmarkdesigngroup.com

3544 Greenwich Road
Suite 200
Virginia Beach, VA 23452
Tel: (757) 497 7053
Fax: (757) 497 7055
Email: lmdg@landmarkdesigngroup.com

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

No.	Date	Comment	By
1	4/7/00	REVISED_PER_COUNTY_COMMENTS	SAG
2	5/31/00	REVISED_PER_COUNTY_COMMENTS	SAG
3	6/11/00	REVISED_PER_VDOT_COMMENTS	SAG

REVISIONS

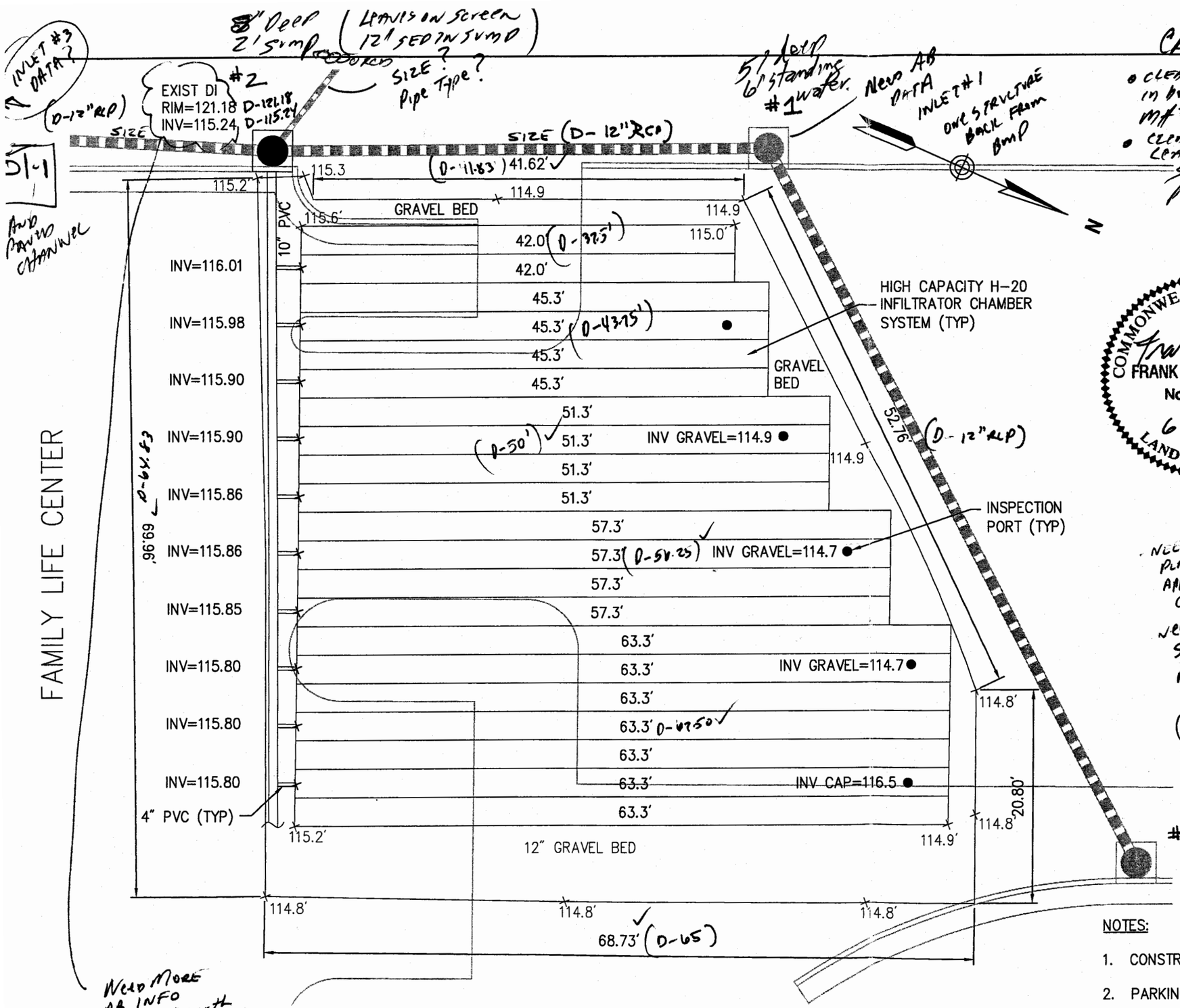
DRAWING STATUS: Preliminary Review DATE; Clients for Review DATE; Pre Approval Bidding DATE; NOTE DATE; Final Submittal DATE; 3-5 Submittal DATE; Approved DATE

COUNTY APPROVAL DATE

SITE PLAN
SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER
6513 RICHMOND ROAD
POWHATAN DISTRICT JAMES CITY COUNTY VIRGINIA

Designed: W.F.B./S.A.G.	Date: 10/13/99
Checked: R.S.P.	Scale: NTS
Drawn: S.A.G.	CADD File name: SHEET3.DWG
Project Number: 19900072-000.01	Dwg. File No. 10,862W
Drawing Number	C-3

3 OF 11



INLET #3 DATA?

8" Deep 2' sump (Leaves on screen 12" SED IN SUMP)

SIZE? Pipe Type?

(D-12"RCP)

5' deep 6" standing water.

New AB DATA

INLET #1 ONE STRUCTURE BACK FROM BMP

CR

- CLEAN SED 1' deep in bottom sump @ MH #2 (Invert Strut)
- CLEAN TRASH LEAVES FROM TOP SCREEN TO 18" PIPE INTO BMP.

D|-1

AND PAVED CHANNEL

NEED MAINT PLAN from APPVD plan sheet C-7

NEED INFIL BASIN SEC D-D ANNOTATED W/ CONST INFO (Sheet of A.P.)

CHANGES MADE TO COVER OVER CHAMBER AND BEDDING LAYERS

MEASURED 5' deep 8" standing water Same gravel

NEED MORE AB INFO
INV. 12" North
INV 12" South
INV. SUMP (BOTTOM)
INV 10" TO INFIL SYSTEM
INV 6" OUTLET PIPE
(INLET WAS SUPPOSED FOR TO BE SUMPED OUTLET EMBANKMENT)

SJT REVIEW SEP

NOTES:

1. CONSTRUCTION INSPECTION BY ENGINEERING SERVICES, LTD.
2. PARKING IS SHOWN FOR FUTURE CONSTRUCTION ONLY.

10 0 10 20
SCALE IN FEET

COMMONWEALTH OF VIRGINIA
FRANK G. MUNDY, II
No. 002382
6-10-02
LAND SURVEYOR

VHB

Vanasse Hangen Brustlin, Inc.
Transportation
Land Development
Environmental Services
477 McLaws Circle, Suite One
Williamsburg, Virginia 23185-6316
(757)220-0500 FAX (757)220-8544

No.	Revision	Date	Approved

Designed by	Drawn by RWP	Checked by TJH
CAD checked by TJH	Approved by TJH	
Scale 1"=10'	Date 06/10/02	

Project Title

SEP 2002 RECEIVED ENVIRONMENTAL DIVISION

Infiltration Basin

Williamsburg, Virginia

Issued for

Smith Memorial Baptist Curch
Family Life Center
SWM Record Drawing

SP-118-99; YC 024

Drawing Title

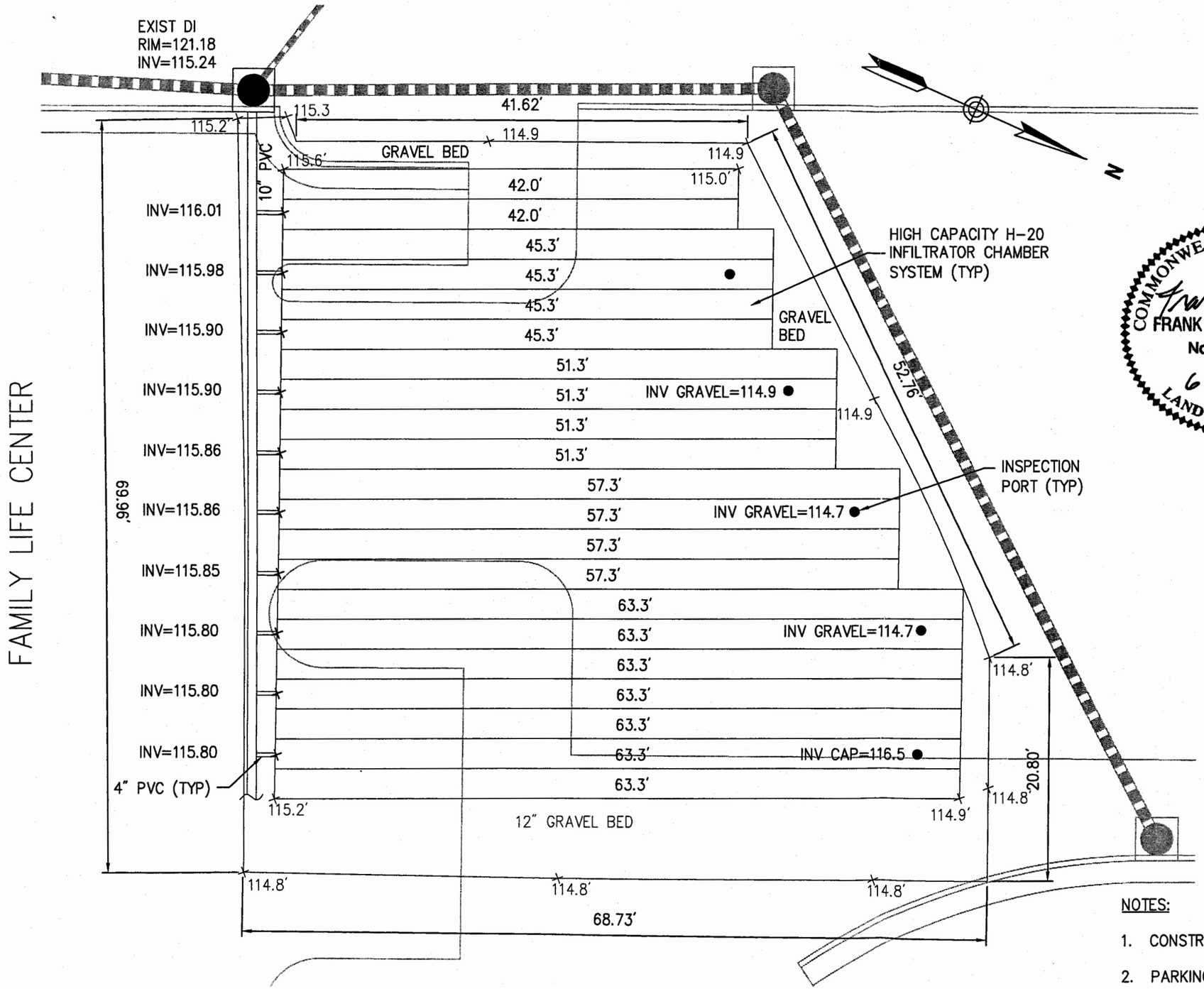
Drawing Number

B-1

Sheet 1 of 01

VHBCad File Name 31249MAP.dwg

Project Number 31249



INFILTRATION BASIN

COMMONWEALTH OF VIRGINIA
FRANK G. MUNDY, II
No. 002382
6-10-02
LAND SURVEYOR

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SCALE IN FEET

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Scale 1"=10'	Date 06/10/02	

Project Title

SEP 2002
RECEIVED
ENVIRONMENTAL DIVISION

Infiltration Basin

Williamsburg, Virginia

Issued for

Smith Memorial Baptist Curch
Family Life Center
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Drawing Title

Drawing Number

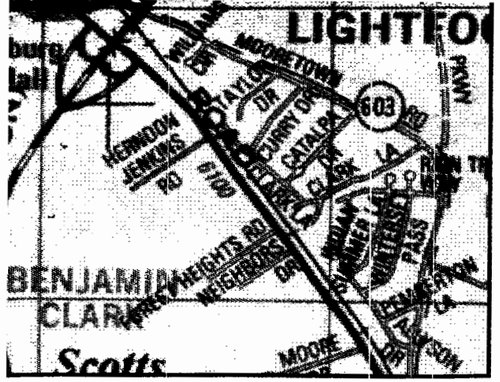
B-1

Sheet 1 of 01

VHBCad File Name
31249MAP.dwg

Project Number
31249

SP-118-99, YC024
SUT REVIEW SET



PERMITTED USE NO. 20201150

MAP

003'

ER 3, 2000 AS JCC CASE SP-118-99. THIS
EFLECTS CHANGES MADE NECESSARY BY A
FIC CHANGES INCLUDE: 1) REDUCTION OF
ELOCATION OF ROOF DRAINS. 3) REDUCTION
REMOVAL OF BRICK CONNECTING WALK. 5)
E DRAINAGE STRUCTURE. 7) REVISION OF
IGNS AND STOP BARS AT ENTRANCES.

SITE COVERAGE BY BUILDINGS:	15,777 SQ. FT. (EXISTING)
PROJECT AREA:	53,578.8 SQ. FT. (1.23 AC.)
TOTAL SITE IMPERVIOUS AREA, (PERCENT):	94,090 SQ. FT. (59.4 PERCENT OF SITE)
TOTAL SITE PERVIOUS AREA, (PERCENT):	64,468 SQ. FT. (40.6 PERCENT OF SITE)
AREA DISTURBED:	1.30 ± AC.
F.E.M.A. PANEL NUMBER	510201 0020 B
F.E.M.A. F.I.R.M. ZONE	ZONE X
BUILDING DATA:	
TOTAL FLOOR AREA OF CHURCH:	8,944 SQ. FT.
PROPOSED HEIGHT OF CHURCH:	30 FT.
PROPOSED FLOORS IN CHURCH:	ONE FLOOR
PROPOSED CHURCH BUILDING TYPE:	TYPE 2C, USE GROUP A4
PARKING REQUIREMENTS:	
USE CATEGORY:	CATEGORY C
PARKING REQUIRED:	78 SPACES
PARKING PROPOSED:	58 SPACES
HANDICAPPED SPACES REQUIRED:	6 H.C. SPACES (1 VAN ACCESSIBLE)
HANDICAPPED SPACES EXISTING:	4 H.C. SPACES
HANDICAPPED SPACES PROPOSED:	2 H.C. SPACES (2 VAN ACCESSIBLE)
TOTAL EXISTING SITE PARKING:	98 SPACES (80 PAVED, 14 GRAVEL, 4 H.C.)
TOTAL PROPOSED SITE PARKING:	158 SPACES (98 EXISTING, 58 PROPOSED, 2 H.C.)
B-1 DISTRICT BULK REGULATIONS:	
MINIMUM FRONT SETBACK:	50 FT
MINIMUM SIDE YARD:	20 FT, 10 FT FOR ACCESSORY STRUCTURES
MINIMUM REAR YARD:	20 FT, 10 FT FOR ACCESSORY STRUCTURES
MAXIMUM BUILDING HEIGHT:	60 FT, INCLUDING SPIRE
OWNER:	SMITH MEMORIAL BAPTIST CHURCH CONTACT PERSON: NORMAN NEAL, JR. (757) 667-5238 DR. RON WADE, PASTOR 6515 RICHMOND ROAD WILLIAMSBURG, VA 23188 (757) 565-0476

COMMONWEALTH OF VIRGINIA
12/4/01
STEPHEN A. ROMEO
No. 1448 B
LAND SURVEYOR

LARK
ROUP
• Surveyors
onmental Consultants
5544 Greenwich Road – Suite 200
Virginia Beach, VA 23464
Tel. (757) 473-2000
Fax (757) 497-7933
Email: info@langleyeng.com

SP-118-99 (AMEND SP-112-01)

REVISED 12/04/01 PER JAMES CITY COUNTY AND VDOT COMMENTS

Project Number:	Dwg. File No.:
1990072-000.08	12,738W

Drawing ~~Number~~ C-1

(C) TO (D)	68 LF 6" SDR 23.5 PVC @ 1.00%
(D)	SANITARY CLEANOUT, INV. = 117.95
(D) TO (E)	70 LF 6" SDR 23.5 PVC @ 1.00%
(E)	SANITARY CLEANOUT, INV. = 117.25
(E) TO (F)	167 LF 6" SDR 23.5 PVC @ 1.00%
(F)	SANITARY CLEANOUT, INV. = 115.58
(F) TO (G)	90 LF 6" SDR 23.5 PVC @ 1.00%
(G)	TIE INTO EXISTING MANHOLE, INV. IN = 114.69, CORE AND BOOT EXIST. SANITARY MANHOLE, PROVIDE INSIDE DROP CONNECTION
(H)	LIMITS OF SITE PLAN SANITARY SEWER (5' FROM BLDG.), INV. = 119.25
(H) TO (I)	38 LF 4" SDR 23.5 PVC @ 2.16%
(I)	6"x4" SDR 23.5 PVC WYE, INV. = 118.43
(J)	EXIST. SANITARY CLEANOUT, INV. = 119.4
(J) TO (K)	35 LF 4" SDR 23.5 PVC @ 7.97%
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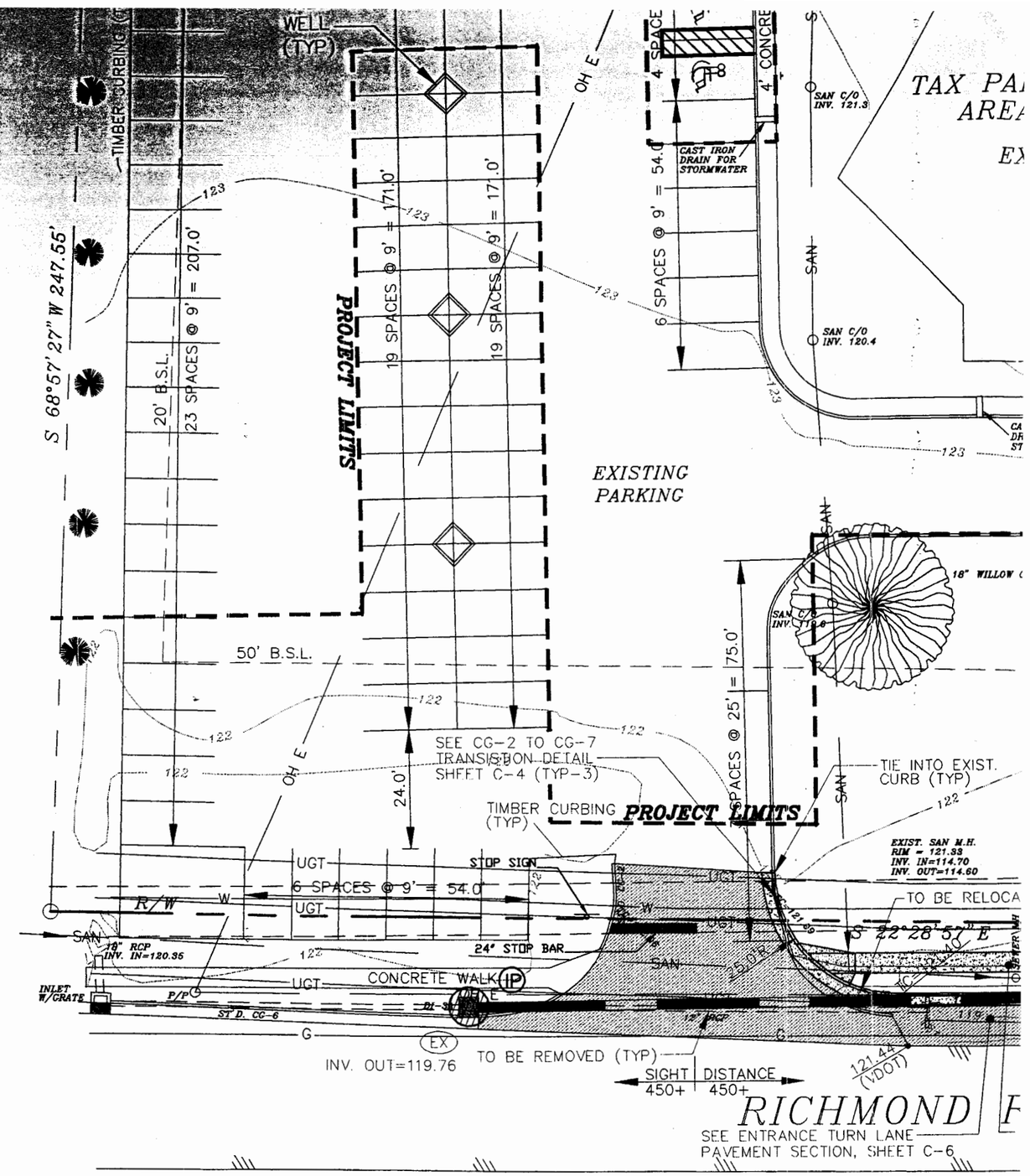


SITE PLAN

SCALE: 1" = 25'

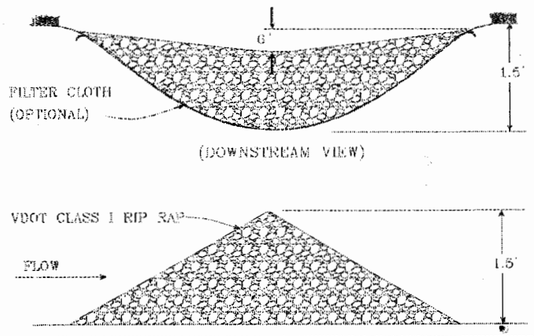
HIS LAND SURVEYING, INC.
15500 RIVER BEND TRAIL
LANEXA, VIRGINIA 23089
(804)966-7017

TOPOGRAPHIC AND BOUNDARY INFORMATION TAKEN FROM FIELD SURVEY ENTITLED "SMITH MEMORIAL BAPTIST CHURCH", (703LRP.DXF) DATED 2/10/99, BY HIS LAND SURVEYING. LANDMARK DESIGN GROUP, INC. IS NOT RESPONSIBLE FOR INACCURACIES IN SAID TOPOGRAPHIC AND BOUNDARY INFORMATION OR DESIGN CHANGES RESULTING THEREFROM.

COMMONWEALTH OF VIRGINIA
12/4/01
STEPHEN A. ROMEO
No. 1448-B
LAND SURVEYOR

ROCK CHECK DAM (CD)

2 ACRES OR LESS OF DRAINAGE AREA:



STORM DATA

(#5) TO (#2) 108 LF 12" CLASS III RCP @ 2.96%
(#1) TO (#2) 48 LF 12" CLASS III RCP @ 0.52%
(#4) TO (#1) 78 LF 12" CLASS III RCP @ 0.46%
(#2) TO BASIN 67 LF 10" SDR 35 PVC @ 0.03%
(#2) TO OUTFALL 17 LF 6" SDR 23.5 PVC @ 1.47%
VDOT RIGHT-OF-WAY
(EX) TO (#6) 147 LF 14"x23" ELLIPTICAL RCP @ 1.13%
(#6) TO (#7) 89 LF 14"x23" ELLIPTICAL RCP @ 1.17%
(#7) TO (#8) 54 LF 14"x23" ELLIPTICAL RCP @ 0.46%

(#1)
ST'D. V.D.O.T.
DI-3A
TOP=120.19
INV. IN=116.52
INV. OUT= 116.42
BOTTOM=115.40

(#2)
ST'D V.D.O.T.
DI-3B, L=4'
TOP=121.18
INV. IN=116.17 (#3)
INV. IN=116.17(#1)
INV. OUT=115.75 (10")
INV. OUT=115.25 (6")
BOTTOM=112.50

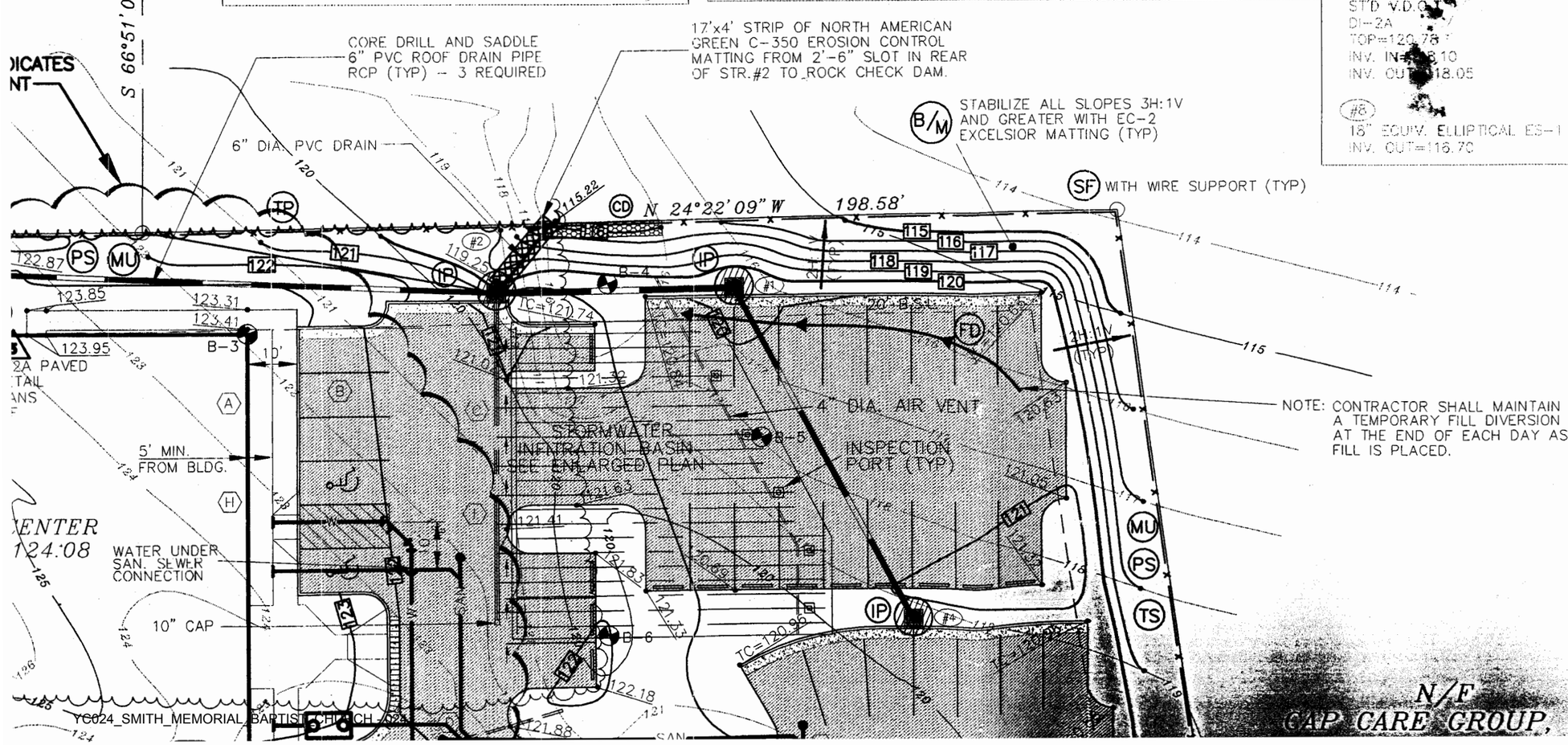
(#3)
ST'D V.D.O.T.
DI-1
RIM=121.72
INV. OUT=119.37
BOTTOM=118.30

(#4)
ST'D V.D.O.T.
DI-3A
TOP=120.50
INV. OUT=116.68
BOTTOM=115.80

(#6)
ST'D V.D.O.T.
DI-2A
TOP=120.78
INV. IN=118.10
INV. OUT=118.05

(#7)
ST'D. V.D.O.T.
MH-2, FLAT TOP
TOP=119.63
INV. IN=117.01 (#6)
INV. IN=117.01 (EXIST. 12" DRAIN PIPE)
INV. OUT=116.96

(#8)
15" EQUIV. ELLIPTICAL ES-1
INV. OUT=116.70



4029 Ironbound Road
Suite 100
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Tel. (757) 253-2975
Fax (757) 229-0049
Email: lmdg@landmarkdgwb.com

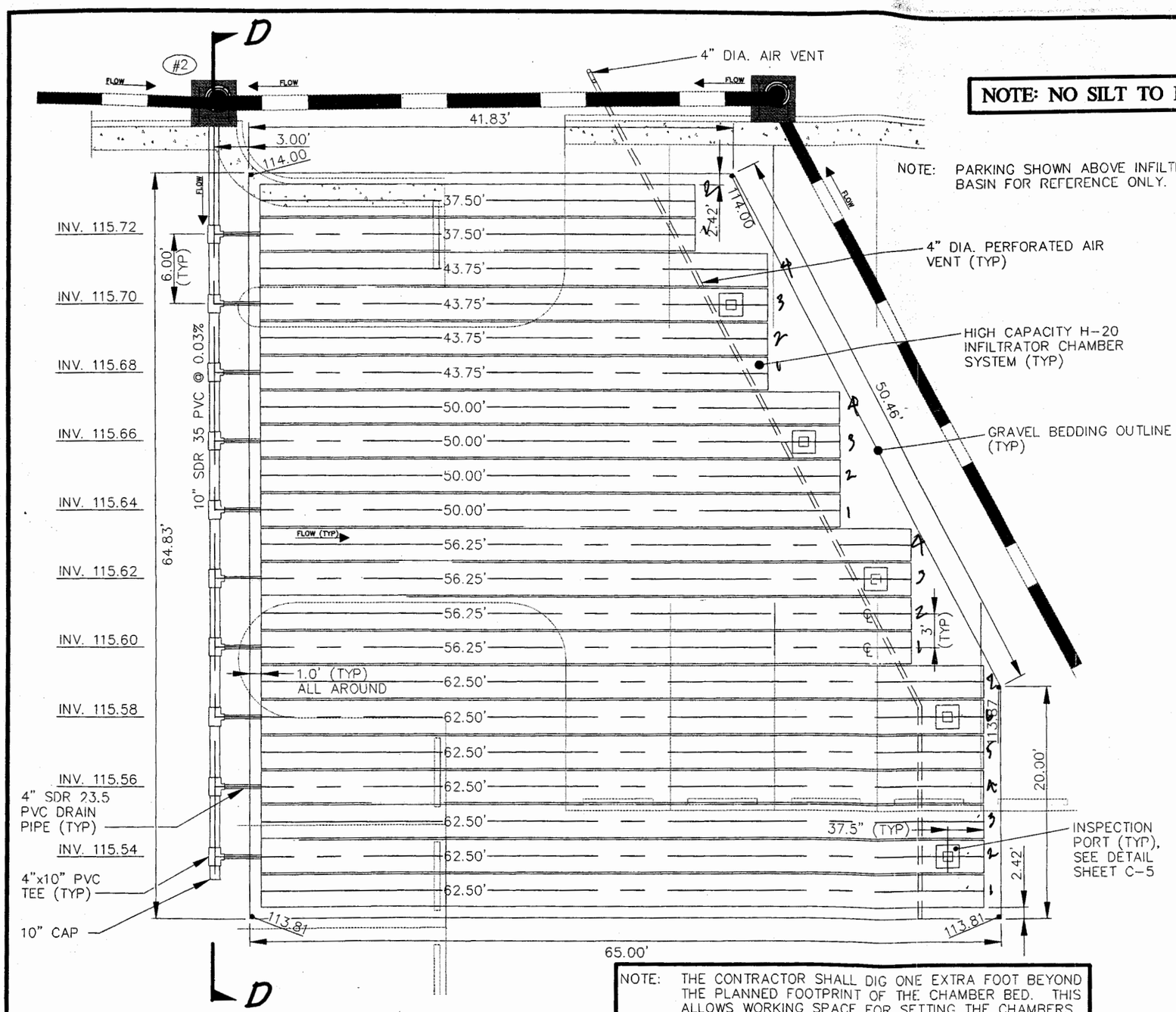
5544 Greenwich Road
Suite 200
Virginia Beach, VA 23462
Tel. (757) 473-2000
Fax (757) 497-7933
Email: lmdg@landmarkdg.com

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

	By
	SAG
	SAG
	SAG
	MEI
	TRC

NOTE: NO SILT TO ENTER INFILTRATION BASIN

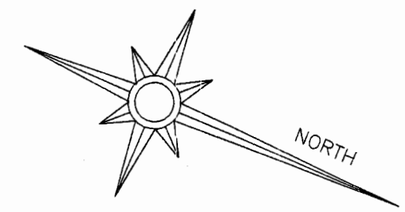
NOTE: PARKING SHOWN ABOVE INFILTRATION BASIN FOR REFERENCE ONLY.

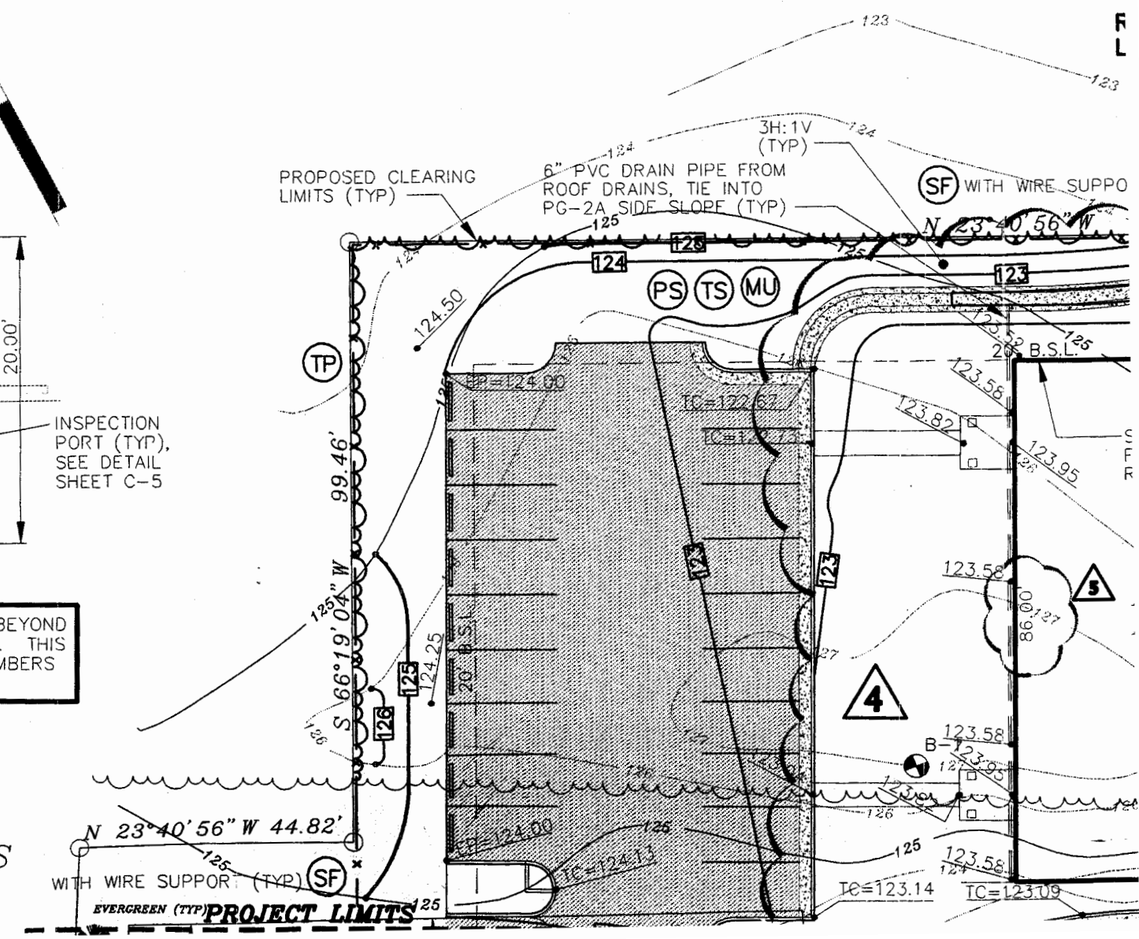


NOTE: THE CONTRACTOR SHALL DIG ONE EXTRA FOOT BEYOND THE PLANNED FOOTPRINT OF THE CHAMBER BED. THIS ALLOWS WORKING SPACE FOR SETTING THE CHAMBERS AND FACILITATES BACKFILL COMPACTION.

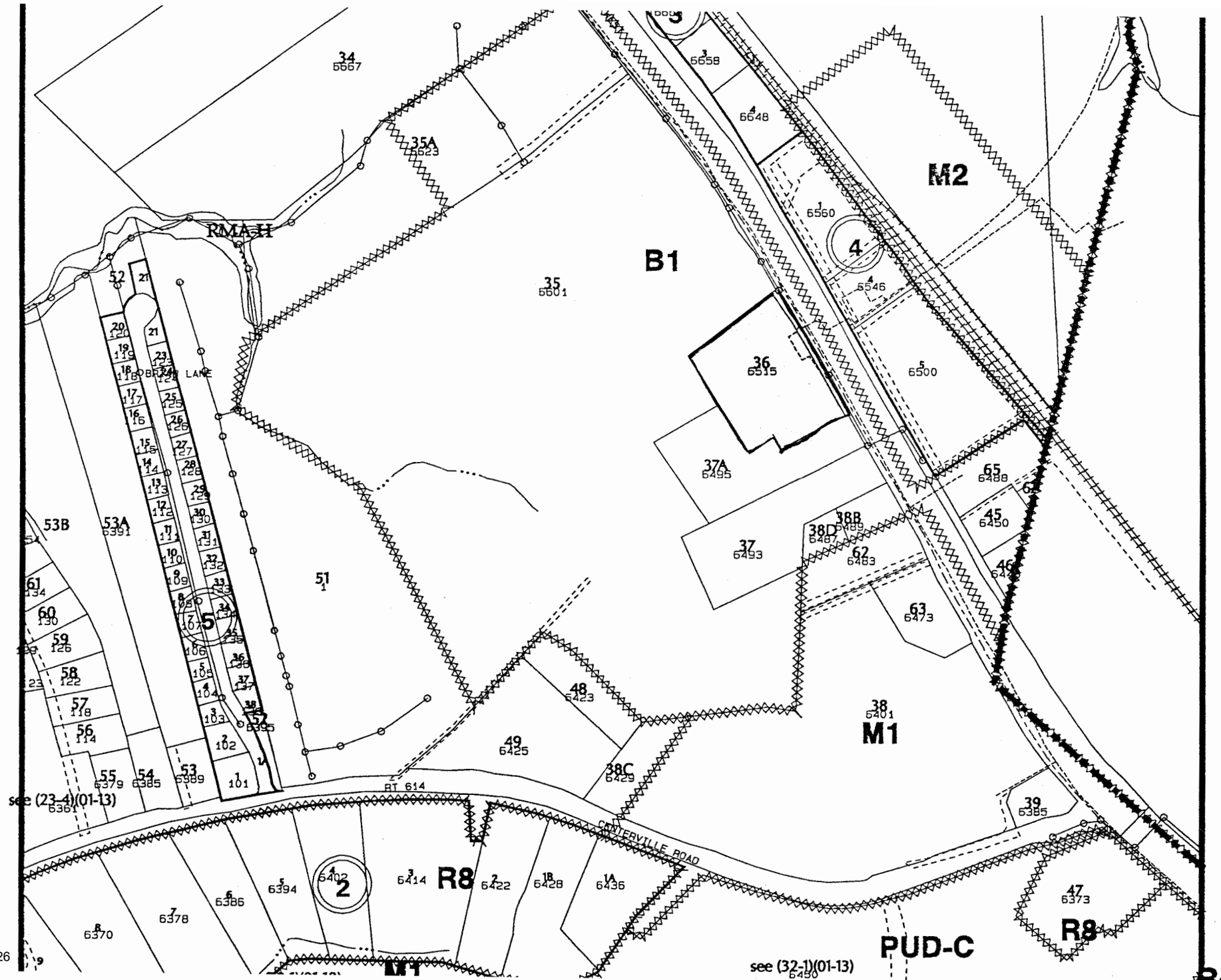
INFILTRATION BASIN PLAN

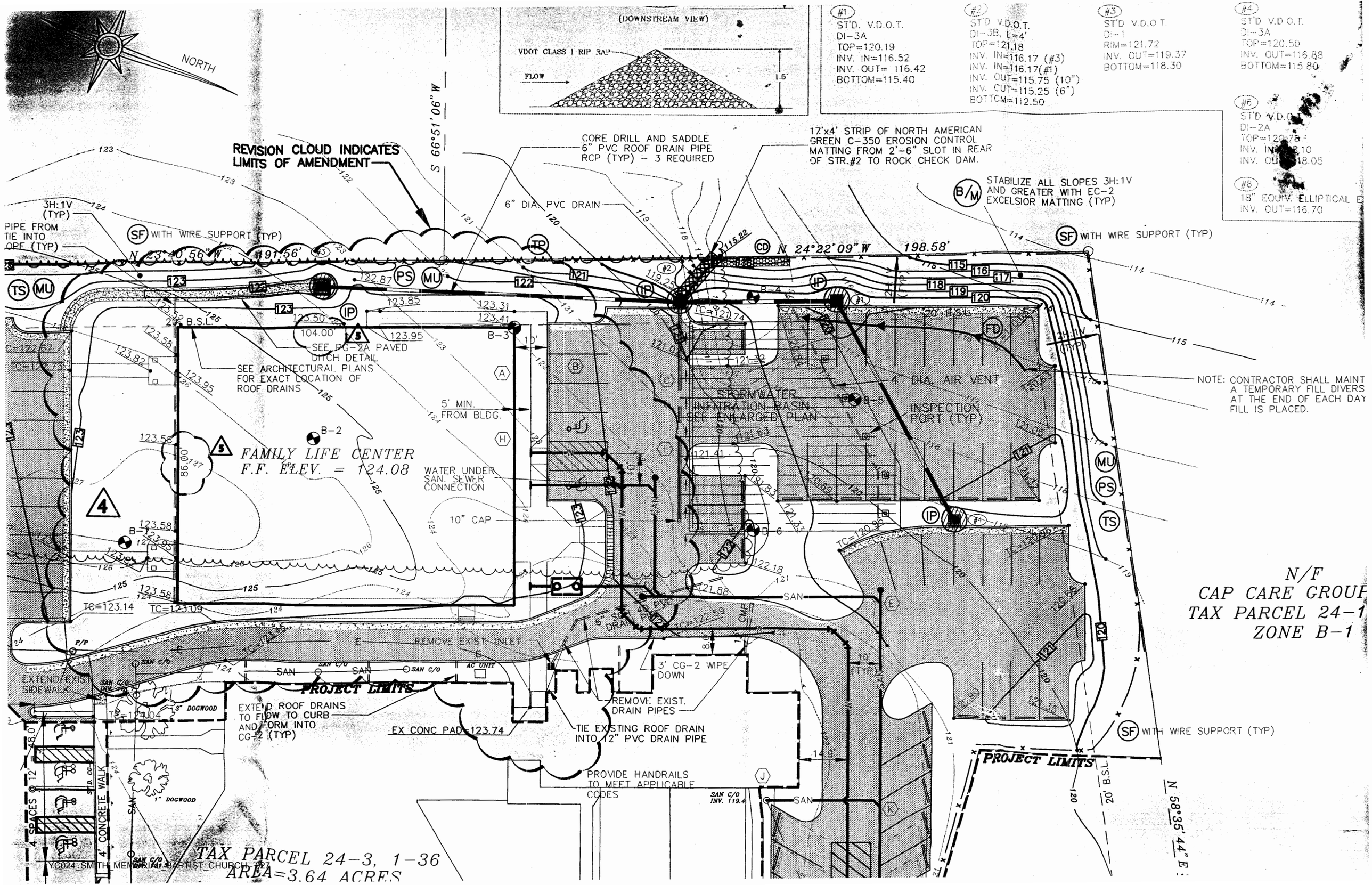
SCALE: 1" = 10'



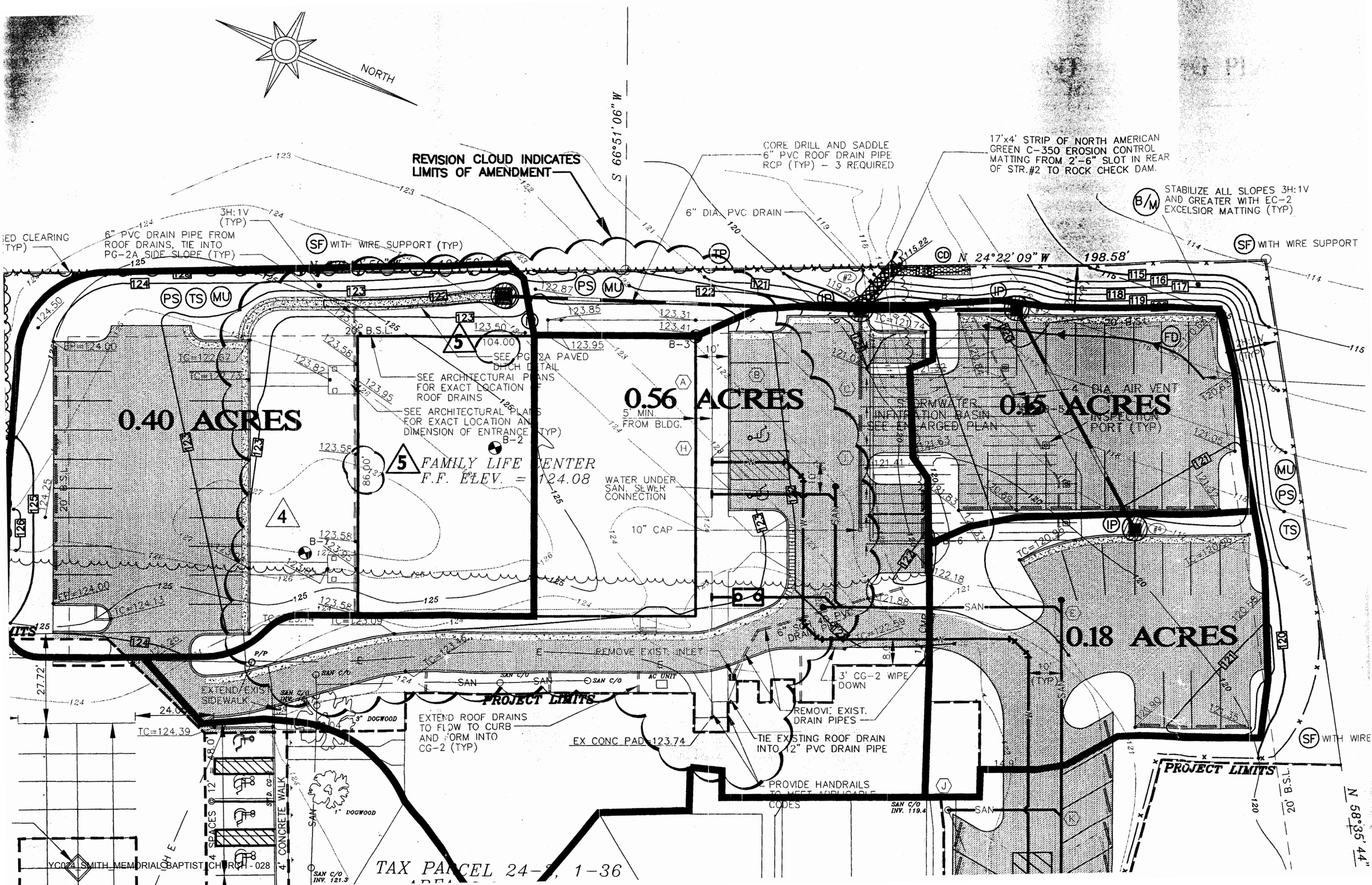


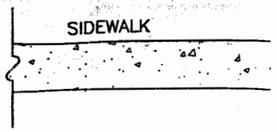
N/F
GUS & CATHERINE ZAHAROPULUS
TAX PARCEL 24-1, 1-37A
ZONE B-1


B1
M2
M1
R8
PUD-C
RMA-H
see (23-4)(01-13)
see (32-1)(01-13)
RT 614
CANTERVILLE ROAD
LANE



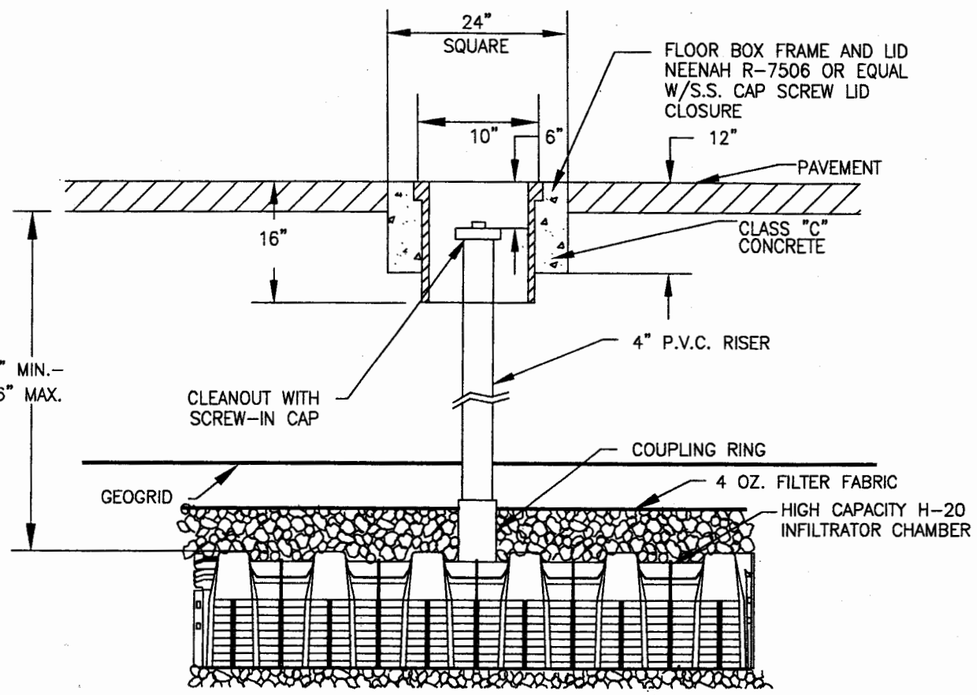
YC024_SMITH_MEMORIAL_BAPTIST_CHURCH_027


NORTH
REVISION CLOUD INDICATES LIMITS OF AMENDMENT
S 66°51'06" W
CORE DRILL AND SADDLE 6" PVC ROOF DRAIN PIPE RCP (TYP) – 3 REQUIRED
17'x4' STRIP OF NORTH AMERICAN GREEN C-350 EROSION CONTROL MATTING FROM 2'-6" SLOT IN REAR OF STR.#2 TO ROCK CHECK DAM.
STABILIZE ALL SLOPES 3H:1V AND GREATER WITH EC-2 EXCELSIOR MATTING (TYP)
6" DIA. PVC DRAIN
3H:1V (TYP)
6" PVC DRAIN PIPE FROM ROOF DRAINS, TIE INTO PG-2A SIDE SLOPE (TYP)
SF WITH WIRE SUPPORT (TYP)
N 24°22'09" W 198.58'
0.40 ACRES
0.56 ACRES
0.15 ACRES
0.18 ACRES
SEE ARCHITECTURAL PLANS FOR EXACT LOCATION OF ROOF DRAINS
SEE ARCHITECTURAL PLANS FOR EXACT LOCATION AND DIMENSION OF ENTRANCE (TYP)
SEE PG-2A PAVED DITCH DETAIL
5' MIN. FROM BLDG.
FAMILY LIFE CENTER
F.F. ELEV. = 124.08
WATER UNDER SAN. SEWER CONNECTION
10" CAP
STORMWATER INFILTRATION BASIN SEE ENLARGED PLAN
4" DIA. AIR VENT INSPECTION PORT (TYP)
REMOVE EXIST. INLET
3' CG-2 WIPE DOWN
REMOVE EXIST. DRAIN PIPES
TIE EXISTING ROOF DRAIN INTO 12" PVC DRAIN PIPE
EXTEND ROOF DRAINS TO FLOW TO CURB AND FORM INTO CG-2 (TYP)
EX CONC PAD=123.74
PROVIDE HANDRAILS TO MEET APPLICABLE CODES
EXTEND/EXIST. SIDEWALK
PROJECT LIMITS
4 SPACES @ 12'
4' CONCRETE WALK
TAX PARCEL 24-2, 1-36
N 58°35'44"
YC024_SMITH_MEMORIAL_BAPTIST_CHURCH - 028



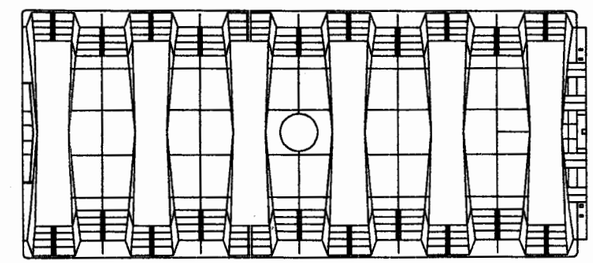
ISOLATIC

NO



INSPECTION PORT DETAIL

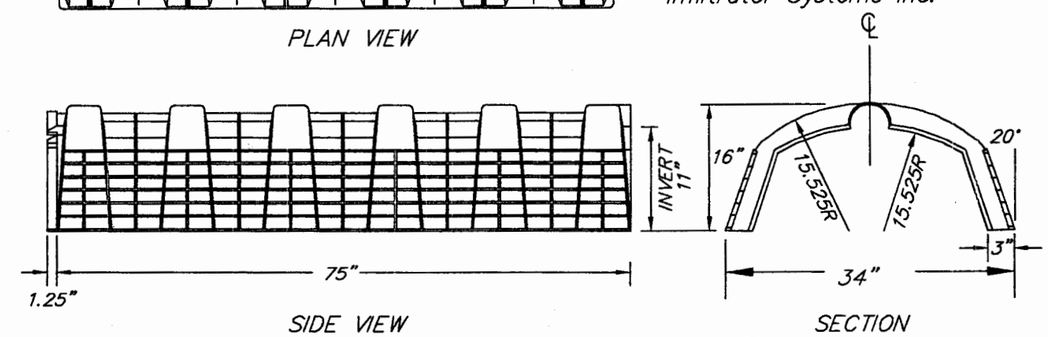
NOT TO SCALE



PLAN VIEW

NOMINAL CHAMBER SPECIFICATIONS	
SIZE (W x L x H)	34" x 75" x 16"
STORAGE	122 gal/16.3 c.f.
WEIGHT	38 lb

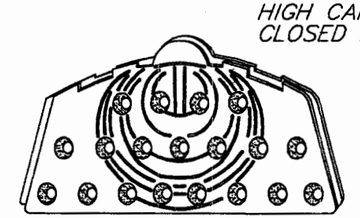
NOTE: Contractor shall install infiltrator chambe system as approved by Infiltrator Systems Inc. per all current installation requirements, materi specifications, and construction methods by Infiltrator Systems Inc.



HIGH CAPACITY INFILTRATOR® CHAMBER

NOT TO SCALE

HIGH CAPACITY INFILTRATOR CHAMBER
CLOSED END PLATE



NOTE: Holes may be cut in the end plate to accept pipes up to 12" in diameter.

INFILTRATOR® END PLATE

NOT TO SCALE

ACCELERATED EROSION IS [illegible] ATTENTION SHALL BE PAID
PERCENT.

MEASURES SUCH AS SILT FENCE ARE NOT TO BE REMOVED UNTIL ALL DISTURBED AREAS ARE SHALL BE SPREAD, SEEDED AND MULCHED. AFTER THE PROJECT AND STABILIZATION IS SEDIMENT CONTROL MEASURES SHALL BE REMOVED WITHIN 30 DAYS.

TRAP OR SEDIMENT BASIN SHALL BE REMOVED UNTIL A) AT LEAST 75 PERCENT OF THE LOTS WITHIN THE THE TRAP OR BASIN HAVE BEEN SOLD TO A THIRD PARTY (UNRELATED TO THE DEVELOPER) FOR THE OF HOMES AND/OR B) 60 PERCENT OF THE SINGLE FAMILY LOTS WITHIN THE DRAINAGE AREA TO THE TRAP OR HAVE BEEN COMPLETED AND THE SOIL STABILIZED. A BULK SALE OF THE LOTS TO ANOTHER BUILDER DOES NOT SATISFY PROVISION. SEDIMENT TRAPS AND SEDIMENT BASINS SHALL NOT BE REMOVED WITHOUT THE EXPRESS AUTHORIZATION OF JAMES CITY COUNTY ENVIRONMENTAL DIVISION.

20. RECORD DRAWINGS (AS-BUILTS) AND CONSTRUCTION CERTIFICATIONS ARE BOTH REQUIRED FOR NEWLY CONSTRUCTED OR MODIFIED STORMWATER MANAGEMENT/BMP FACILITIES. CERTIFICATION ACTIVITIES SHALL BE ADEQUATELY COORDINATED AND PERFORMED BEFORE, DURING AND FOLLOWING CONSTRUCTION IN ACCORDANCE WITH THE CURRENT VERSION OF THE JAMES CITY COUNTY ENVIRONMENTAL DIVISION, STORMWATER MANAGEMENT/BMP FACILITIES, RECORD DRAWINGS AND CONSTRUCTION CERTIFICATION, STANDARD FORMS & INSTRUCTIONS.

21. DESIGN AND CONSTRUCTION OF PRIVATE-TYPE SITE DRAINAGE SYSTEMS OUTSIDE VDOT RIGHTS-OF-WAY SHALL BE PERFORMED IN ACCORDANCE WITH THE CURRENT VERSION OF THE JAMES CITY COUNTY ENVIRONMENTAL DIVISION, STORMWATER DRAINAGE CONVEYANCE SYSTEMS (NON-BMP RELATED), GENERAL DESIGN AND CONSTRUCTION GUIDELINES.

9. THE CONTRACTOR SHALL CONSTRUCT THE TURN LANE AND ENTRANCE UPGRADES UNDER CLOSE COORDINATION WITH VDOT AND OVERLAYMENT PAVING OF ROUTE 60. THE TURN LANE AND ENTRANCE UPGRADES SHALL COMPLY WITH ALL VDOT STANDARDS AND SPECIFICATIONS. THE DRAINAGE SYSTEM SHALL BE CONSTRUCTED FROM UPSTREAM TO DOWNSTREAM, ALLOWING POSITIVE DRAINAGE AT ALL TIMES. EXISTING DRAINAGE PIPING AND DITCHES SHALL REMAIN IN PLACE UNTIL THAT PORTION OF THE NEW DRAINAGE SYSTEM IS FUNCTIONAL.

10. COMPLETE CONSTRUCTION OF UTILITIES AND SITE GRADING. TIE PROPOSED WATER SYSTEM INTO EXISTING SYSTEM AT PROPOSED TEE. PROVIDE NEW WATER METER. CORE DRILL AND "KOR-N-SEAL" BOOT PROPOSED SANITARY LATERAL INTO EXISTING MANHOLE. ABANDON EXISTING SANITARY LATERALS AS SPECIFIED ON SITE PLAN.

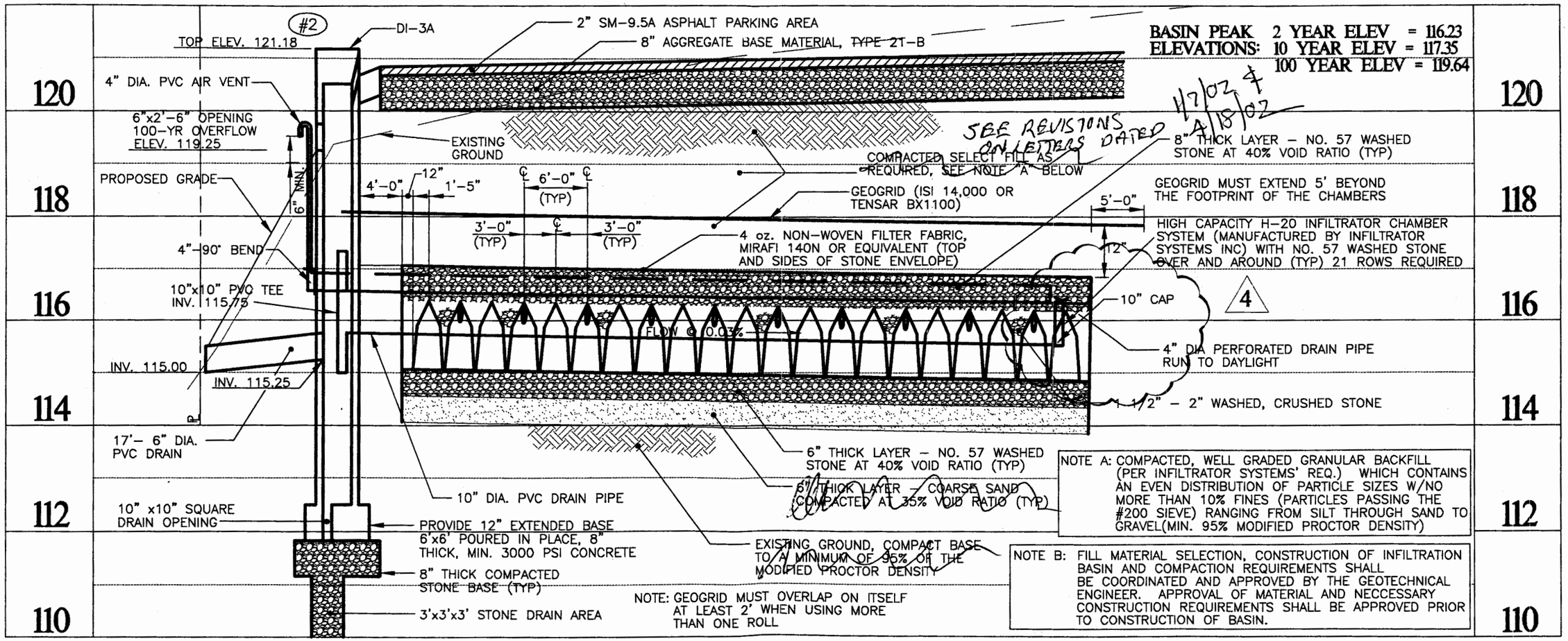
11. PAVE ALL PROPOSED AREAS PER THE APPLICABLE PAVEMENT SECTION. THE ENTRANCE UPGRADES AND TURN LANE SUBBASE SHALL BE PAVED JUST PRIOR TO OVERLAYMENT OF ROUTE 60. FINAL SURFACING OF THE ENTRANCE UPGRADES AND TURN LANE SHALL BE COORDINATED AND SCHEDULE IN CONJUCTION WITH ROUTE 60 OVERLAYMENT.

12. PERMANENT SEED AND MULCH ALL DISTURBED AREAS ONCE FINAL GRADE HAS BEEN ESTABLISHED PER THE V.E.S.C.H. COASTAL PLAIN REGION. PROVIDE EC-2 MATTING AS DESIGNATED ON THE PLANS.

13. CLEAN AND REMOVE TEMPORARY SEDIMENTS AS AREAS ARE STABILIZED. PROVIDE INLET PROTECTION UNTIL ALL DISTURBED AREAS ARE STABILIZED.

14. THE INFILTRATION BASIN SHALL BE PROLONGED FOR SERVICE UNTIL FINAL GRADING HAS BEEN REACHED FOR ALL AREAS, STABILIZATION HAS BEEN OBTAINED, AND AREAS ARE CLEANED.

15. AFTER AN ACCEPTABLE AND STABLE GROUND COVER HAS BEEN ESTABLISHED, REMOVE SILT FENCE AND OTHER TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES.



SEE REVISIONS ON LETTERS DATED 1/7/02 & 4/18/02

INFILTRATION BASIN SECTION D-D

SCALE: HORIZONTAL: 1" = 10'
VERTICAL: 1" = 2'

SMITH
TO PEF
SEWER

THE CC
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12"
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HALL EXCERCISE EXTRA
) THE INFILTRATION BASIN AND
TAKE WHATEVER MEASURES
)N BASIN AREA. SUCH MEASURES
PORARY DIVERSIONS, ADDITIONAL
STABILIZATION SUCH AS
PROGRESSES IN ADDITION TO THE
: MANUFACTURED BMP
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CONSTRUCT THE INFILTRATION
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TORM DRAIN FLOW TO THE ROCK
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CE UPGRADES UNDER CLOSE
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POSITIVE DRAINAGE AT ALL TIMES.
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ROPOSED WATER SYSTEM INTO
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N EXISTING SANITARY LATERALS

ON. THE ENTRANCE UPGRADES
ENT OF ROUTE 60. FINAL
OORDINATED AND SCHEDULE IN

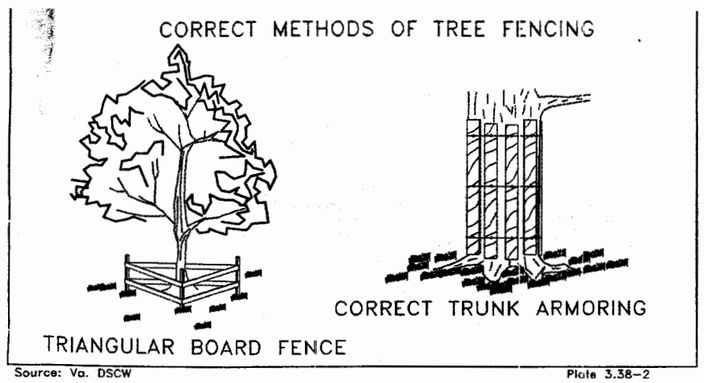
GRADE HAS BEEN ESTABLISHED
S DESIGNATED ON THE PLANS.

LIZED. PROVIDE INLET

. FINAL GRADING HAS BEEN
EAS ARE CLEANED.

STABLISHED, REMOVE SILT
URES.

ELEV = 116.23 R ELEV = 117.35 AR ELEV = 119.64	120
57 WASHED TIO (TYP)	
BEYOND IAMBERS	118
TRATOR CHAMBER Y INFILTRATOR 7 WASHED STONE 21 ROWS REQUIRED	116
PIPE	
STONE	114
ULAR BACKFILL) WHICH CONTAINS CLE SIZES W/NO ES PASSING THE THROUGH SAND TO	112



Source: Va. DSCW Plate 3.38-2

UNDERGROUND INFILTRATION BASIN INSPECTION/MAINTENANCE SCHEDULE

SMITH MEMORIAL BAPTIST CHURCH SHALL SET UP A MAINTENANCE COMMITTEE TO PERIODICALLY INSPECT THE UNDERGROUND INFILTRATION BASIN AND STORM SEWER SYSTEMS THAT DISCHARGE INTO THE BASIN.

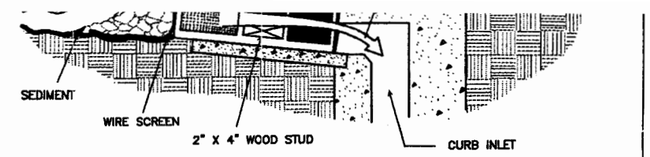
THE COMMITTEE SHALL INSPECT THE DROP INLETS, PIPING AND UNDERGROUND INFILTRATION SYSTEM TO INSURE PROPER WORKING ORDER AND FREE OF SILT AND DEBRIS. THIS INSPECTION MUST TAKE PLACE AFTER EACH LARGE STORM EVENT TO PREVENT SILTATION AND DEBRIS FROM ENTERING THE INFILTATION BASIN. THE PAVED DITCH SHALL BE SWEPT CLEAN AND ALL SILTATION/DEBRIS SHALL BE PROPERLY DISPOSED OF ON-SITE. THIS SILTATION/DEBRIS SHALL NOT BE ALLOWED TO REENTER ANY PORTION OF THE DRAINAGE SYSTEM.

THE SUMPS WITHIN EACH DROP INLET MUST BE PUMPED OUT AND VACUUMED TO REMOVE ANY SILT AND DEBRIS. THIS SILT AND DEBRIS SHALL ALSO BE PROPERLY DISPOSED OF ON-SITE. THIS SILTATION/DEBRIS SHALL NOT BE ALLOWED TO REENTER ANY PORTION OF THE DRAINAGE SYSTEM.

THIS INSPECTION AND CLEANING PROCESS MUST BE PROVIDED ON A ROUTINE BASIS AND MAY BE PREFORMED BY EITHER THE CHURCH COMMITTEE OR A COMMERCIAL CLEANING GROUP.

THE SMBC COMMITTEE SHALL REFER TO INFILTRATOR SYSTEMS INC. FOR SPECIFIC LONG-TERM INSPECTION AND MAINTENANCE REQUIREMENTS. PLEASE CONTACT:
INFILTRATOR SYSTEMS INC.
6 BUSINESS PARK ROAD
P.O. BOX 768
OLD SAYBROOK, CT 06475
1-800-221-4436
www.infiltratorsystems.com

12" PVC DRAIN PIPE FROM
DI-#5 @ 5.81%



SPECIAL APPLICATION

THIS METHOD OF INLET PROTECTION IS APPLICABLE AT CURB INLETS WHERE AN OVERFLOW CAPABILITY IS NECESSARY TO PREVENT EXCESSIVE PONDING IN FRONT OF THE STRUCTURE.

- GRAVEL SHALL BE VDOT #3, #357 OR #5 COARSE AGGREGATE

PLATE 3.07-8

TEMPORARY FILL DIVERSION (FD)

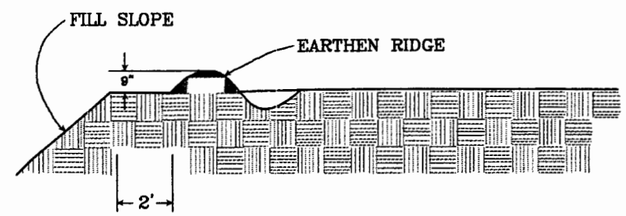
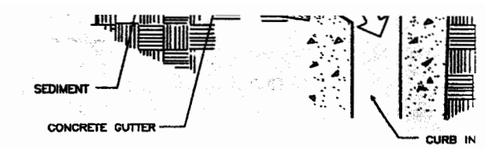


PLATE 3.10-1



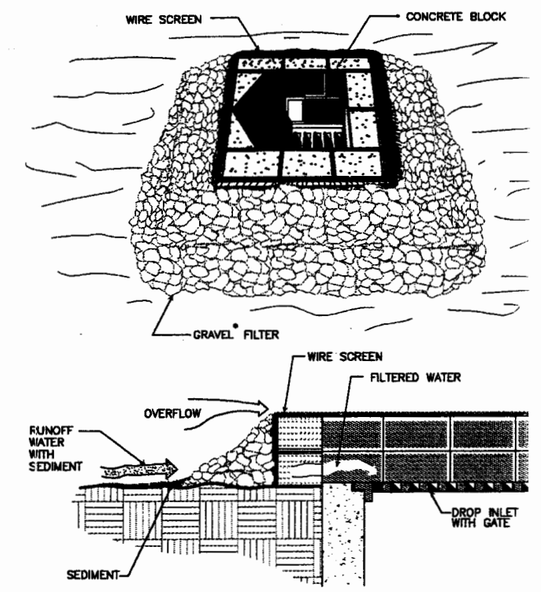
SPECIFIC APPLICATION

THIS METHOD OF INLET PROTECTION IS APPLICABLE AT CURB INLETS WHERE PONDING IN FRONT OF THE STRUCTURE IS NOT LIKELY TO C INCONVENIENCE OR DAMAGE TO ADJUST STRUCTURES AND UNPROTEC AREAS.

- GRAVEL SHALL BE VDOT #3, #357 OR 5 COARSE AGGREGATE.

SOURCE: VA. DSWC

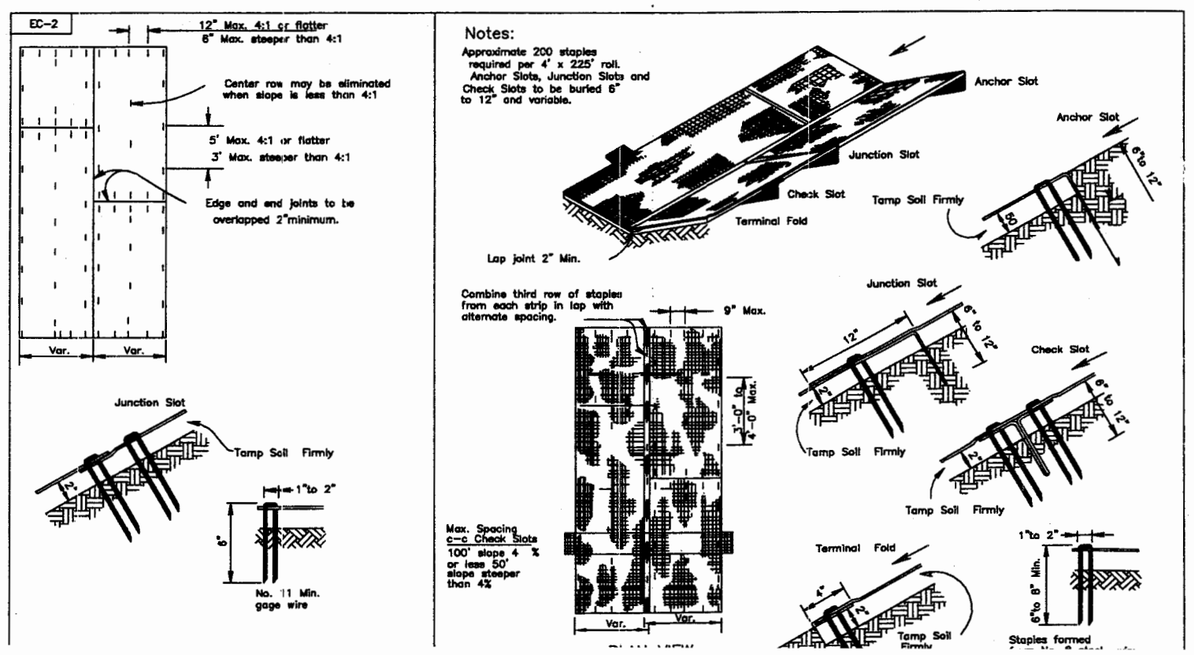
BLOCK AND GRAVEL DROP INL SEDIMENT FILTER

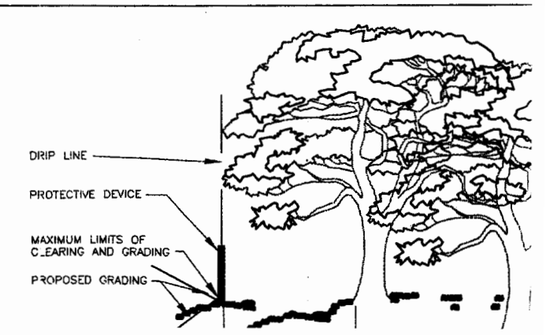


SPECIFIC APPLICATION

THIS METHOD OF INLET PROTECTION IS APPLICABLE WHERE HEAVY FLOWS ARE EXPECTED AND WHERE AN OVERFLOW CAPACITY IS NECESSARY TO PREVENT EXCESSIVE PONDING AROUND THE STRUCTURE.

- GRAVEL SHALL BE VDOT #3, #357 OR #5 COARSE AGGREGA



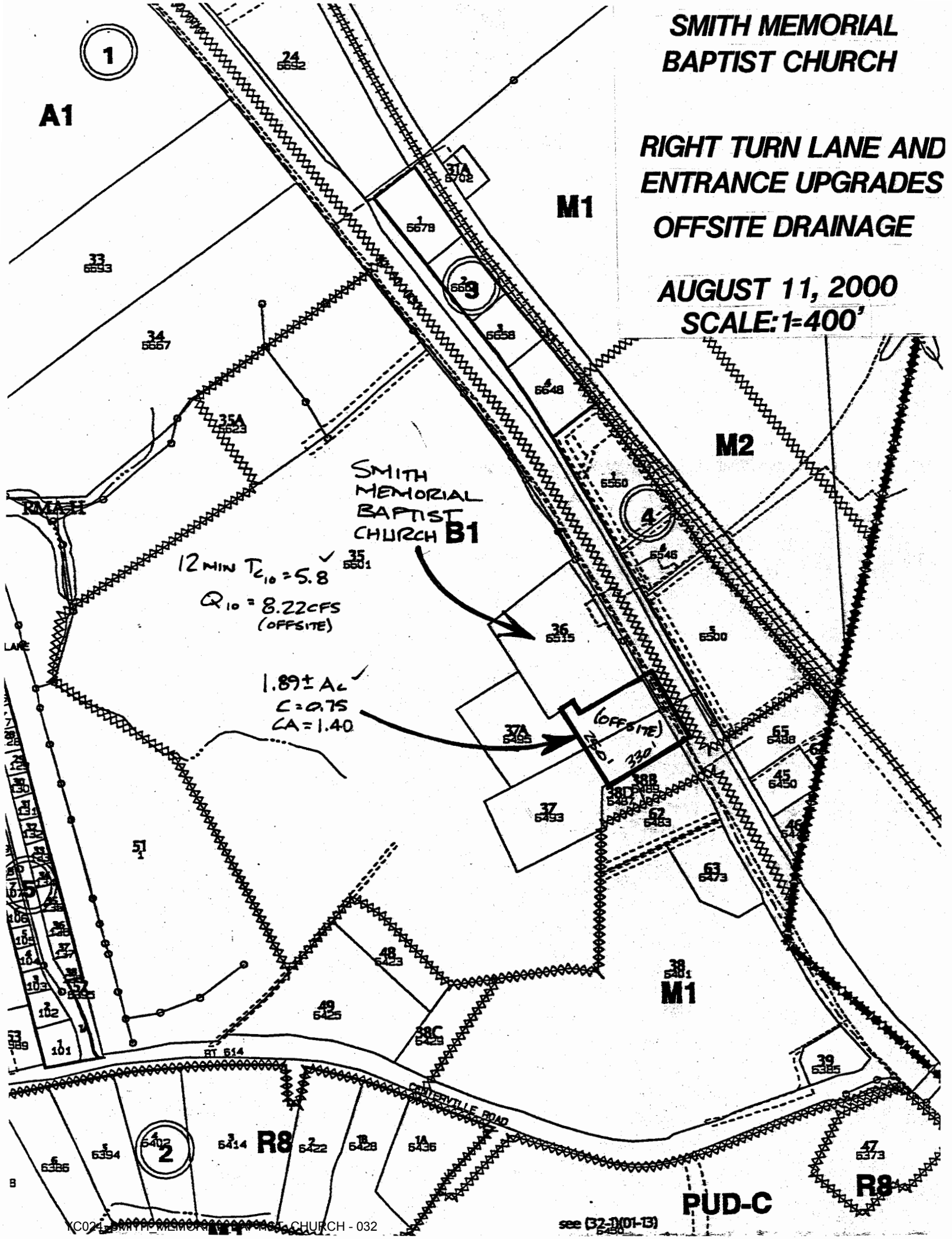


SMITH MEMORIAL BAPTIST CHURCH

RIGHT TURN LANE AND ENTRANCE UPGRADES

OFFSITE DRAINAGE

AUGUST 11, 2000
SCALE: 1=400'



SP.118.99

SUPPLEMENTAL CALCULATIONS

FOR

SMITH MEMORIAL BAPTIST CHURCH

FAMILY LIFE CENTER

AUGUST 11, 2000

Right Turn Lane Addition Summary

These Supplemental Calculations are to incorporate the right turn lane addition along Richmond Road, Route 60, per Virginia Department of Transportation requirements. In meetings with Mr. Quinton Elliott and Mr. John Mazur this design incorporating an 18-inch equivalent elliptical pipe. This pipe was found to be satisfactory due to ground cover constraints at the site. No additional drainage areas will be added to this design. A portion of the existing ditch will be filled and replaced with reinforced concrete pipe. Additional drainage structures will added to collect the water presently draining into the ditch to be removed. The existing 18-inch culvert at the west of the site is the controlling factor for all onsite and offsite stormwater.

This system will ultimately be owned and maintained by the Virginia Department of Transportation.

NEW

PREVIOUS LD & FSP Approval!
This is new area to
amend plan SP-118-99.

Subject FAMILY LIFE CENTER RT TURN LANE ADDITION
Computed WFB Checked

LANDMARK DESIGN GROUP

Project # 1990072-000.03
Client SMBC
Date 8/11/00 Sheet # 1

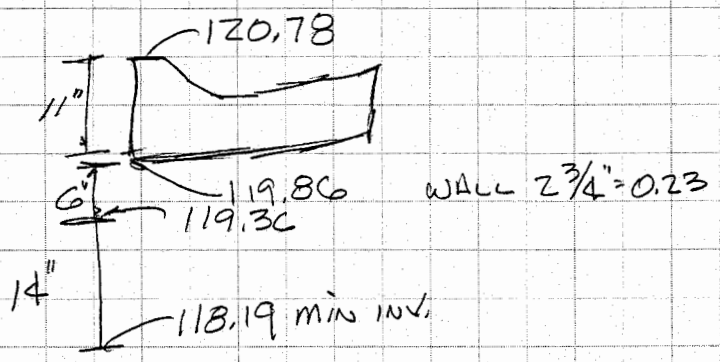
Engineers • Planners • Surveyors • Landscape Architects • Environmental Consultants

STRUCTURE #3 EXISTING Rim = 122.34
IN = 119.76 31" DEEP

PIPE IN = 12" EXISTING
PIPE OUT = 14" X 23" PROPOSED

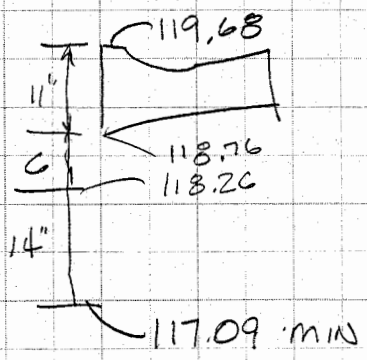
PIPE = 147'-14" X 23" ELLIPTICAL PIPE @ 1.129%

STRUCTURE #4 PROPOSED Rim = 120.78
INV = 118.10 IN.
INV = 118.05 OUT.



PIPE = 89'-14" X 23" ELLIPTICAL PIPE @ 1.17%

STRUCTURE #5 PROPOSED M.H.



Rim = 119.63

M.H. Depth = 2.62'

INV IN = 117.01
INV OUT = 116.96

STORM - SEWER DESIGN COMPUTATIONS

L & D 229

ROUTE 60 PROJ. SMITH MEMORIAL BAPTIST CHURCH FAMILY LIFE CENTER

COUNTY JAMES CITY COUNTY DISTRICT POWHATAN

DESCRIPTION Richmond Road Improvements

SHEET ____ OF ____

FROM POINT	TO POINT	AREA DRAIN. "A" ACRES	RUN-OFF COEF. C	CA INCRE-MENT	CA ACCUM-ULATED	INLET TIME MIN-UTES	RAIN FALL IN./HR.	RUNOFF Q C.F.S.	INVERT ELEVATIONS UPPER END	INVERT ELEVATIONS LOWER END	LENGTH FT.	SLOPE FT./FT.	DIA. IN.	CAPA-CITY C.F.S.	VEL. F.P.S.	FLOW TIME SEC.	REMARKS
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
EXIST. 18" RCP	EXIST. INLET W/GRATE	1.87	0.75	—	1.40	15	5.2	7.28	120.35	120.24	10'	0.011	18"	11.02	6.23		HW/D=1.28
EXIST. INLET W/GRATE	EX	0.95	0.75	0.71	2.11	15	5.2	10.97	120.24	119.76	72'	0.0067	12"	2.92	3.71		
EX	6	0.21	0.85	0.18	2.29	15	5.2	11.91	119.76	118.10	147'	0.01129	14"x23"	11.16	7.20		
6	7	0.41	0.40	0.16	2.45	15	5.2	12.74	118.05	117.01	89'	0.0117	14"x23"	11.36	6.43		
7	8	—	—	0.19	2.64	16	5.0	13.20	116.96	116.70	54'-1"	0.0048	14"x23"	7.28	4.12		
														CAP?	✓		

WOULD NEED VDOT Review + Approval. No further comment.

YC024_SMITH_MEMORIAL_BAPTIST_CHURCH - 036

PROJECT 0
HEC12 Version: V2.91 Run Date: 08-22-2000

==========

INLET NUMBER 6 LENGTH 2.5 STATION Richmond Road

DRAINAGE AREA = 0.410 ACRES C VALUE = .400 CA = 0.164
SUM CA= 0.164 INT= 4.00 CFS= 0.656 CO= 0.000 GUTTER FLOW= 0.656

GUTTER SLOPE = 0.0086 FT/FT PAVEMENT CROSS SLOPE = 0.0208 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
3.99	2.0	0.50	0.0833	4.0	0.95	3.5	0.146	0.159

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 4.5 EFFICIENCY= 0.77
CFS INTERCEPTED= 0.50 CFS CARRYOVER= 0.15

Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	Circular Channel - EXIST 18" RC
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data		
Mannings Coefficient	0.013	
Slope	0.013600	ft/ft
Diameter	18	in

Results		
Depth	1.50	ft ✓
Discharge	12.25	cfs
Flow Area	1.8	ft²
Wetted Perimeter	4.71	ft
Top Width	0.00	ft
Critical Depth	1.32	ft
Percent Full	100.0	%
Critical Slope	0.012195	ft/ft
Velocity	6.93	ft/s ✓
Velocity Head	0.75	ft
Specific Energy	2.25	ft
Froude Number	0.00	
Maximum Dischar	13.18	cfs
Discharge Full	12.25	cfs
Slope Full	0.013600	ft/ft
Flow Type	N/A	

Smith Memorial Baptist Church
Worksheet for Circular Channel

Project Description	
Worksheet	Circular Channel - EX to 6
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data		
Mannings Coefficient	0.013	
Slope	0.011290	ft/ft
Diameter	18	in

Results		
Depth	1.50	ft
Discharge	11.16	cfs
Flow Area	1.8	ft²
Wetted Perimeter	4.71	ft
Top Width	0.00	ft
Critical Depth	1.28	ft
Percent Full	100.0	%
Critical Slope	0.010598	ft/ft
Velocity	6.32	ft/s ✓
Velocity Head	0.62	ft
Specific Energy	2.12	ft
Froude Number	0.00	
Maximum Dischar	12.01	cfs
Discharge Full	11.16	cfs
Slope Full	0.011290	ft/ft
Flow Type	N/A	

Notes: 147' 14" x 23" ELLIPTICAL RCP PIPE @ 1.129% SLOPE

Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	Circular Channel 6 to 7
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data		
Mannings Coefficient	0.013	
Slope	0.011700	ft/ft
Diameter	18	in

Results		
Depth	1.50	ft
Discharge	11.36	cfs
Flow Area	1.8	ft²
Wetted Perimeter	4.71	ft
Top Width	0.00	ft
Critical Depth	1.29	ft
Percent Full	100.0	%
Critical Slope	0.010871	ft/ft
Velocity	6.43	ft/s
Velocity Head	0.64	ft
Specific Energy	2.14	ft
Froude Number	0.00	
Maximum Dischar	12.22	cfs
Discharge Full	11.36	cfs
Slope Full	0.011700	ft/ft
Flow Type	N/A	

Notes: 89' - 14" x 23" ELLIPTICAL RCP PIPE @ 1.17% SLOPE

Smith Memoral Baptist Church
Worksheet for Circular Channel

Project Description	
Worksheet	Circular Channel 7 to 8
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data		
Mannings Coefficient	0.013	
Slope	0.004800	ft/ft
Diameter	18	in

Results		
Depth	1.50	ft
Discharge	7.28	cfs
Flow Area	1.8	ft²
Wetted Perimeter	4.71	ft
Top Width	0.00	ft
Critical Depth	1.04	ft
Percent Full	100.0	%
Critical Slope	0.006936	ft/ft
Velocity	4.12	ft/s ✓
Velocity Head	0.26	ft
Specific Energy	1.76	ft
Froude Number	0.00	
Maximum Dischar	7.83	cfs
Discharge Full	7.28	cfs
Slope Full	0.004800	ft/ft
Flow Type	N/A	

Notes: 54' - 1" 14" X 23" ELLIPTICAL RCP PIPE @ 0.48% SLOPE

Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Trapezoidal Channel - 1
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.015	
Slope	0.003200	ft/ft
Left Side Slope	1.00	H : V
Right Side Slope	1.00	H : V
Bottom Width	1.50	ft
Discharge	13.20	cfs

Results		
Depth	1.17	ft
Flow Area	3.1	ft²
Wetted Perimete	4.82	ft
Top Width	3.85	ft
Critical Depth	1.05	ft
Critical Slope	0.004826	ft/ft
Velocity	4.21	ft/s
Velocity Head	0.28	ft
Specific Energy	1.45	ft
Froude Number	0.82	
Flow Type	Subcritical	

SUPPLEMENTAL CALCULATIONS

FOR

SMITH MEMORIAL BAPTIST CHURCH

FAMILY LIFE CENTER

April 7, 2000

Supplement to Report
dated October 13 1999

LANDMARK
DESIGN GROUP

Subject SMBC FAMILY LIFE CENTER
Computed WFB Checked

LANDMARK DESIGN GROUP

Project # 1990072-000.01
Client SMBC
Date 4/7/00 Sheet # 1

Engineers • Planners • Surveyors • Landscape Architects • Environmental Consultants

INFILTRATION BASIN DRAWDOWN TIME

AVERAGE PERCOLATION RATE OF 1.0 IN/HR

DRAWDOWN = 0.085519 CF/SEC

(3694.59 S.F. BOTTOM AREA × 0.00002315 FT/SEC = 0.0855 CF/SEC)

THE 6" DIAMETER PVC OUTFALL WILL DRAW THE INFILTRATION SYSTEM DOWN TO ELEV. 115.75

VOLUME OF INFILTRATION BASIN:

646.55 CF IN SAND ✓
738.92 CF IN STONE ✓
1619.80 CF IN INFILTRATORS
452.77 CF IN STONE

75" @ 21 ROWS
1112.5 LF.
178 chambers
16.3 cf/chamber

$\frac{1619}{16.3}$ = 99.37 chambers × 75"/12 = 621 ft.

3458.04 CF TO ELEV. 115.75 > 2,047.32 CF REQUIRED

WQ_V = 1"/IMP. AC.
60% imperv
0.9047 IMP AC. OF 1.43 AC. SITE AREA

$\frac{.9047}{3.64}$ = 0.2485 25% TOTAL SITE.

DRAWDOWN FROM 115.75

3458 CF / 0.085519 CF/SEC

= 40,435.93 SEC

sec × MIN/60 sec = 673.9 MIN × HR/60 MIN = 11.23 HR.

40,435.93 SEC = 673.93 MIN = 11.23 HRS

DRAWDOWN FROM EL. 115.75 = 11.23 HRS < 48 hrs. OK.

STORM SEWER DESIGN COMPUTATIONS

L & D 229

ROUTE 60 PROJ. SMITH MEMORIAL BAPTIST CHURCH FAMILY LIFE CENTER
COUNTY JAMES CITY COUNTY DISTRICT POWHATAN
DESCRIPTION n = 0.013
SHEET 1 OF 1

FROM POINT	TO POINT	AREA DRAIN. "A" ACRES	RUN-OFF COEF. C	CA INCREMENT	CA ACCUMULATED	INLET TIME MINUTES	RAIN FALL IN./HR.	RUNOFF Q C.F.S.	INVERT ELEVATIONS UPPER END	INVERT ELEVATIONS LOWER END	LENGTH FT.	SLOPE FT./FT.	DIA. IN.	CAPACITY C.F.S.	VEL. F.P.S.	FLOW TIME SEC.	REMARKS
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
3	2	0.40	0.85	–	0.34	10	6.0	2.04	119.37	116.17	108'	0.0296	12"	6.13	7.02		
4	1	0.18	0.85	–	0.15	10	6.0	0.90	116.88	116.52	78'	0.0046	12"	2.42	2.85	27.4	
1	2	0.15	0.90	0.14	0.29	10	6.0	1.74	116.42	116.17	48'	0.0052	12"	3.19	4.15	11.5	
5	BASIN	0.22	0.85	–	0.19	10	6.0	1.14	117.59	115.52	73'	0.0284	12"	6.00	5.88		
2	BASIN	0.34	0.90	0.31	0.60	11	5.9	3.54									

OK ✓

REVISED: APRIL 7, 2000

OUTFALL DITCH TO STR #3
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\haestad\fmw\smbchurc.fm2
Worksheet	FROM CURB CUT TO STR # 3
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013 ✓	
Channel Slope	0.005000	ft/ft
Left Side Slope	2.000000	H : V
Right Side Slope	2.000000	H : V
Bottom Width	2.00	ft
Discharge	2.04	cfs

Results		
Depth	0.27	ft ✓
Flow Area	0.70	ft²
Wetted Perimeter	3.23	ft
Top Width	3.10	ft
Critical Depth	0.29	ft
Critical Slope	0.004220	ft/ft
Velocity	2.92	ft/s ✓
Velocity Head	0.13	ft
Specific Energy	0.41	ft
Froude Number	1.08	
Flow is supercritical.		

< 6" OK

FROM #3 TO #2 (REVISED)
Worksheet for Circular Channel

Project Description	
Project File	c:\d-drive\haestad\fmw\smbcsewe.fm2
Worksheet	FROM #3 TO #2
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.029600	ft/ft
Diameter	12.00	in
Discharge	2.04	cfs

Results		
Depth	0.40	ft
Flow Area	0.29	ft²
Wetted Perimeter	1.36	ft
Top Width	0.98	ft
Critical Depth	0.61	ft
Percent Full	39.73	
Critical Slope	0.006916	ft/ft
Velocity	7.02	ft/s
Velocity Head	0.77	ft
Specific Energy	1.16	ft
Froude Number	2.27	
Maximum Discharge	6.59	cfs
Full Flow Capacity	6.13	cfs
Full Flow Slope	0.003279	ft/ft
Flow is supercritical.		

Notes:

108' - 12" PIPE @ 2.96%

FROM #1 TO #2 (REVISED 12/2/99)
Worksheet for Circular Channel

Project Description	
Project File	c:\d-drive\haestad\fmw\smbc.fm2
Worksheet	From #1 to #2
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.005200	ft/ft
Diameter	12.00	in
Discharge	1.74	cfs

Results		
Depth	0.60	ft
Flow Area	0.50	ft²
Wetted Perimeter	1.78	ft
Top Width	0.98	ft
Critical Depth	0.56	ft
Percent Full	60.32	
Critical Slope	0.006518	ft/ft
Velocity	3.51	ft/s
Velocity Head	0.19	ft
Specific Energy	0.80	ft
Froude Number	0.87	
Maximum Discharge	2.76	cfs
Full Flow Capacity	2.57	cfs
Full Flow Slope	0.002385	ft/ft
Flow is subcritical.		

Notes:

48 lf - 12" RCP @ 0.52%

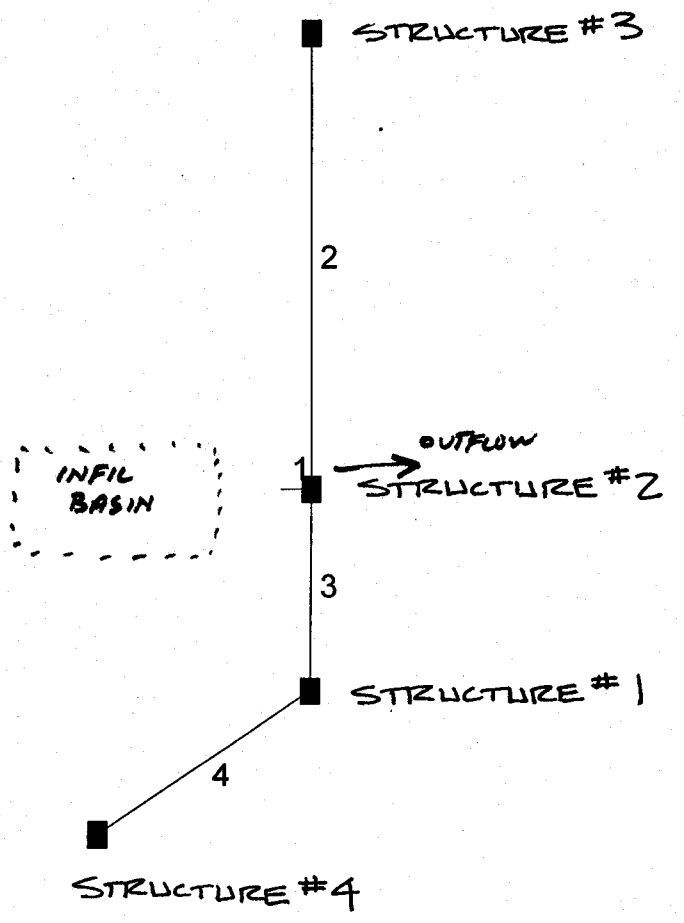
STRUCTURE #5 TO BASIN (REVISED)
Worksheet for Circular Channel

Project Description	
Project File	c:\d-drive\haestad\fmw\smbcsewe.fm2
Worksheet	STRUCTURE #5 TO BASIN
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.028400	ft/ft
Diameter	12.00	in
Discharge	1.14	cfs

Results		
Depth	0.30	ft
Flow Area	0.19	ft²
Wetted Perimeter	1.15	ft
Top Width	0.91	ft
Critical Depth	0.45	ft
Percent Full	29.53	
Critical Slope	0.005914	ft/ft
Velocity	5.88	ft/s
Velocity Head	0.54	ft
Specific Energy	0.83	ft
Froude Number	2.25	
Maximum Discharge	6.46	cfs
Full Flow Capacity	6.00	cfs
Full Flow Slope	0.001024	ft/ft
Flow is supercritical.		

Hydraflow Plan View



Project file: smbapch.stm	IDF file: Norfork.IDF	No. Lines: 4	12-09-1999

Hydraflow 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	10.0	0.0	Curb	0.00	0.34	0.90	10.0	115.74	0.10	115.75	10	Cir	0.013	1.50	121.18	1
2	1	108.0	-90.0	Curb	0.00	0.40	0.85	5.0	116.17	2.96	119.37	12	Cir	0.013	1.00	121.72	2
3	1	48.0	90.0	Curb	0.00	0.18	0.85	5.0	116.17	0.52	116.42	12	Cir	0.013	1.25	120.19	3
4	3	78.0	64.0	Curb	0.00	0.18	0.85	5.0	116.52	0.46	116.88	12	Cir	0.013	1.00	120.50	4

Project File: smbapch.stm	I-D-F File: Norfork.IDF	Total number of lines: 4	Date: 12-09-1999

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	1	5.64	10 c	10.0	115.74	115.75	0.100	116.78*	117.45*	2.50	End
2	2	2.36	12 c	108.0	116.17	119.37	2.963	119.94	120.36	0.14	1
3	3	2.10	12 c	48.0	116.17	116.42	0.521	119.94*	120.11*	0.14	1
4	4	1.06	12 c	78.0	116.52	116.88	0.462	120.25*	120.32*	0.03	3

Project File: smbapch.stm | I-D-F File: Norfork.IDF | Total No. Lines: 4 | Run Date: 12-09-1999

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

Hydraflow Inlet Report

Line No	Line ID	A (ac)	Inlet time (min)	I (in/hr)	C	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet Ht (in)	Curb Inlet L (ft)	Grate Inlet area (sqft)	Grate Inlet L (ft)	Grate Inlet W (ft)	Gutter So (ft/ft)	Gutter W (ft)	Gutter Sw (ft/ft)	Gutter Sx (ft/ft)	Flow depth (ft)	Flow spread (ft)	Byp line No
1	1	0.34	10.0	5.93	0.90	1.81	0.00	1.81	0.00	Curb	5.0	2.50	0.00	0.00	0.00	Sag	2.00	0.083	0.020	0.31	9.37	Offsite
2	2	0.40	5.0	6.96	0.85	2.36	0.00	2.36	0.00	Curb	5.0	2.50	0.00	0.00	0.00	Sag	2.00	0.083	0.020	0.39	13.04	1
3	3	0.18	5.0	6.96	0.85	1.06	0.00	1.06	0.00	Curb	5.0	2.50	0.00	0.00	0.00	Sag	2.00	0.083	0.020	0.32	9.85	1
4	4	0.18	5.0	6.96	0.85	1.06	0.00	1.06	0.00	Curb	5.0	2.50	0.00	0.00	0.00	Sag	2.00	0.083	0.020	0.32	9.85	3

Project File: smbapch.stm | I-D-F File: Norfork.IDF | Total number of lines: 4 | Run Date: 12-09-1999

NOTES: Inlet N-Values = 0.013 ; Design depth for grate(s) = 0.3 (ft); Intensity = 201.00 / (Inlet time + 23.90) ^ 1.00; Return period = 10 Yrs. ; * Indicates Known Q added

Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	10	5.64	115.74	116.78	0.83	0.55	10.35	1.67	118.45	6.647	10.0	115.75 ✓	117.45 ✓	0.83	0.55	10.35	1.67	119.11	6.644	6.645	0.665	1.50	2.50
2	12	2.36	116.17	119.94	1.00	0.79	3.01	0.14	120.08	0.441	108	119.37	120.36	0.99	0.78	3.01	0.14	120.50	0.409	0.425	0.459	1.00	0.14
3	12	2.10	116.17	119.94	1.00	0.79	2.67	0.11	120.05	0.347	48.0	116.42	120.11	1.00	0.79	2.67	0.11	120.22	0.347	0.347	0.166	1.25	0.14
4	12	1.06	116.52	120.25	1.00	0.79	1.36	0.03	120.28	0.089	78.0	116.88	120.32	1.00	0.79	1.35	0.03	120.35	0.089	0.089	0.070	1.00	0.03

Project File: smbapch.stm	I-D-F File: Norfork.IDF	Total number of lines: 4	Run Date: 12-09-1999

NOTES: Initial tailwater elevation = 116.78 (ft) , * Normal depth assumed., ** Critical depth assumed.

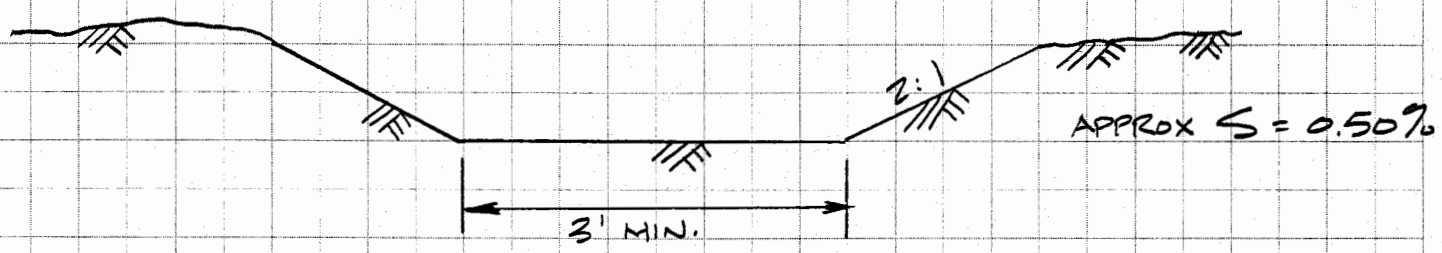
Subject SMBC FAMILY LIFE CENTER
Computed _____ Checked _____

LANDMARK DESIGN GROUP

Project # 1990072-000.01
Client SMBC
Date 4/7/00 Sheet # 1

Engineers • Planners • Surveyors • Landscape Architects • Environmental Consultants

EXISTING OUTFALL CHANNEL



2 YEAR	10 YEAR	100 YEAR
$Q_2 = 0.88$ CFS	$Q_{10} = 1.42$ CFS	$Q_{100} = 3.89$ CFS
$d_2 = 0.24$ FT	$d_{10} = 0.32$ FT	$d_{100} = 0.56$ FT
$V_2 = 1.05$ FT/S	$V_{10} = 1.23$ FT/S	$V_{100} = 1.68$ FT/S

Existing Outfall Channel 2 year storm
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Trapezoidal Channel - 1
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.005000	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	3.00	ft
Discharge	0.88	cfs

Results		
Depth	0.24	ft
Flow Area	0.8	ft²
Wetted Perimete	4.08	ft
Top Width	3.97	ft
Critical Depth	0.13	ft
Critical Slope	0.036623	ft/ft
Velocity	1.05	ft/s
Velocity Head	0.02	ft
Specific Energy	0.26	ft
Froude Number	0.40	
Flow Type	Subcritical	

Existing Outfall Channel 10 year storm
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Trapezoidal Channel - 1
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.005000	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	3.00	ft
Discharge	1.42	cfs

Results		
Depth	0.32	ft
Flow Area	1.2	ft²
Wetted Perimete	4.42	ft
Top Width	4.27	ft
Critical Depth	0.18	ft
Critical Slope	0.033548	ft/ft
Velocity	1.23	ft/s
Velocity Head	0.02	ft
Specific Energy	0.34	ft
Froude Number	0.42	
Flow Type	Subcritical	

Existing Outfall Channel 100 year storm
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Trapezoidal Channel - 1
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.005000	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	3.00	ft
Discharge	3.89	cfs ✓

Results		
Depth	0.56	ft ✓
Flow Area	2.3	ft²
Wetted Perimete	5.51	ft
Top Width	5.24	ft
Critical Depth	0.34	ft
Critical Slope	0.028296	ft/ft
Velocity	1.68	ft/s ✓
Velocity Head	0.04	ft
Specific Energy	0.60	ft
Froude Number	0.45	
Flow Type	Subcritical	

6" PVC SANITARY SEWER
Worksheet for Circular Channel

Project Description	
Project File	c:\d-drive\haestad\fmw\smbcsewe.fm2
Worksheet	6" PVC SANITARY SEWER
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.010000	ft/ft
Diameter	6.00	in
Discharge	100.4	gpm

Results		
Depth	0.22	ft
Flow Area	0.08	ft^2
Wetted Perimeter	0.72	ft
Top Width	0.50	ft
Critical Depth	0.24	ft
Percent Full	43.90	
Critical Slope	0.007584	ft/ft
Velocity	2.70	ft/s
Velocity Head	0.11	ft
Specific Energy	0.33	ft
Froude Number	1.16	
Maximum Discharge	0.60	cfs
Full Flow Capacity	0.56	cfs
Full Flow Slope	0.001589	ft/ft
Flow is supercritical.		

Notes:

AVERAGE DESIGN FLOW = 25.1 GPM

USE PEAK FACTOR OF 4 FOR A LATERAL PER SECTION 21.04.02 OF THE VIRGINIA DEPARATMENT OF HEALTH SEWERAGE REGULATIONS.

25.1 GPMx(4) = 100.4 GPM (MINIMUM PEAK DESIGN FLOW)

SP-118-99
YC 024

DRAINAGE, STORMWATER MANAGEMENT

AND

EROSION CONTROL CALCULATIONS

FOR

SMITH MEMORIAL BAPTIST CHURCH

FAMILY LIFE CENTER

OCTOBER 13, 1999

Langley and McDonald, P.C.

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Surveyors
Planners
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DRAINAGE, STORMWATER MANAGEMENT

AND

EROSION CONTROL CALCULATIONS

FOR

SMITH MEMORIAL BAPTIST CHURCH

FAMILY LIFE CENTER

COMMONWEALTH OF VIRGINIA
RICHARD S. PHILLIPS
No. 023631
PROFESSIONAL ENGINEER

10/13/99

OCTOBER 13, 1999

STORM SEWER DESIGN COMPUTATIONS

L & D 229

ROUTE 60 PROJ. FAMILY LIFE CENTER
COUNTY JAMES CITY COUNTY DISTRICT POWHATAN
DESCRIPTION n = 0.013

SHEET 1 OF 1

FROM POINT	TO POINT	AREA DRAIN. "A" ACRES	RUN-OFF COEF. C	CA INCRE-MENT	CA ACCUM-ULATED	INLET TIME MIN-UTES	RAIN FALL IN./HR.	RUNOFF Q C.F.S.	INVERT ELEVATIONS UPPER END	INVERT ELEVATIONS LOWER END	LENGTH FT.	SLOPE FT./FT.	DIA. IN.	CAPA-CITY C.F.S.	VEL. F.P.S.	FLOW TIME SEC.	REMARKS
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
3	2	0.40	0.85	–	0.34	10	6.0	2.04	119.37	116.17	108'	0.0296	12"	6.13	7.02		
4	1	0.18	0.85	–	0.15	10	6.0	0.90	116.88	116.52	78'	0.0046	12"	2.42	2.85	27.4	
1	2	0.15	0.90	0.14	0.29	10	6.0	1.74	116.42	116.17	48'	0.0052	12"	3.19	4.15	11.5	
5	BASIN	0.22	0.85	–	0.19	10	6.0	1.14	119.76	115.52	75'	0.0581	12"	8.59	7.59		
2	BASIN	0.34	0.90	0.31	0.60	11	5.9	3.54									

BASED ON 0.8% NOT 0.52%

ALL SEEM TOO LARGE
5 MIN T_c more reasonable.

T_c = 3.2 MIN. (5 MIN.)

FROM #3 TO #2
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\smbchurc.fm2
Worksheet	From #3 to #2
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.017200	ft/ft
Diameter	12.00	in
Discharge	2.04	cfs

2.96%

Does not match plan S= 2.96%

Results		
Depth	0.46	ft
Flow Area	0.35	ft²
Wetted Perimeter	1.50	ft
Top Width	1.00	ft
Critical Depth	0.61	ft
Percent Full	46.22	
Critical Slope	0.006916	ft/ft
Velocity	5.75	ft/s
Velocity Head	0.51	ft
Specific Energy	0.98	ft
Froude Number	1.70	
Maximum Discharge	5.03	cfs
Full Flow Capacity	4.67	cfs
Full Flow Slope	0.003279	ft/ft
Flow is supercritical.		

>.02 FPS

6.13 CFS

Notes:

108' - 12" pipe @ 1.72 % slope

2.96%

FROM #4 TO #1
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\smbchurc.fm2
Worksheet	From #4 to #1
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.004600	ft/ft
Diameter	12.00	in
Discharge	0.90	cfs

Results		
Depth	0.42	ft
Flow Area	0.32	ft²
Wetted Perimeter	1.42	ft
Top Width	0.99	ft
Critical Depth	0.40	ft
Percent Full	42.27	
Critical Slope	0.005746	ft/ft
Velocity	2.85	ft/s
Velocity Head	0.13	ft
Specific Energy	0.55	ft
Froude Number	0.89	
Maximum Discharge	2.60	cfs
Full Flow Capacity	2.42	cfs
Full Flow Slope	0.000638	ft/ft
Flow is subcritical.		

Notes:

78' - 12" PIPE @ 0.46%

FROM #1 TO #2
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\smbchurc.fm2
Worksheet	From #1 to #2
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

0.0052 ½

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.008000	ft/ft
Diameter	12.00	in
Discharge	1.74	cfs

Results			
Depth	0.53	ft	
Flow Area	0.42	ft²	
Wetted Perimeter	1.62	ft	
Top Width	1.00	ft	
Critical Depth	0.56	ft	
Percent Full	52.70		
Critical Slope	0.006518	ft/ft	
Velocity	4.15	ft/s	4.15
Velocity Head	0.27	ft	
Specific Energy	0.79	ft	
Froude Number	1.13		
Maximum Discharge	3.43	cfs	
Full Flow Capacity	3.19	cfs	3.10
Full Flow Slope	0.002385	ft/ft	
Flow is supercritical.			

Notes:

48 -12" pipe @0.80% slope

FROM #5 TO BASIN
Worksheet for Circular Channel

Project Description	
Project File	c:\d-drive\haestad\fmw\smbc.fm2
Worksheet	FROM #5 TO BASIN
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.058100	ft/ft
Diameter	12.00	in
Discharge	1.14	cfs

Results			
Depth	0.25	ft	
Flow Area	0.15	ft²	
Wetted Perimeter	1.04	ft	
Top Width	0.86	ft	
Critical Depth	0.45	ft	
Percent Full	24.61		
Critical Slope	0.005914	ft/ft	
Velocity	7.59	ft/s	7.59 ok
Velocity Head	0.90	ft	
Specific Energy	1.14	ft	
Froude Number	3.21		
Maximum Discharge	9.24	cfs	
Full Flow Capacity	8.59	cfs	8.59 ok
Full Flow Slope	0.001024	ft/ft	
Flow is supercritical.			

Notes:

73' - 12" PVC PIPE @ 5.81% SLOPE

SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER
STORMWATER MANAGEMENT/BMP INFILTRATION BASIN

FROM THE GEOTECHNICAL ENGINEERING STUDY PREPARED BY ATLANTIC GEOTECHNICAL SERVICES, INC. DATED AUGUST 5, 1999 THE RECOMMENDED AVERAGE PERCOLATION RATE OF 1.0 INCH PER HOUR SHOULD BE USED FOR THE INFILTRATION SYSTEM DESIGN.

1.0 INCH PER HOUR	=	0.08333 FT/HR
(1.0 INCH PER HOUR) / 60	=	0.001389 FT/MIN
(0.001389 FT/MIN) / 60	=	0.00002315 FT/SEC

BOTTOM OF STORAGE BASIN HAS 3,694.59 SQ FT

(3,694.59 SQ FT) x 0.00002315 FT/SEC = 0.085519 CU FT/SEC

OK CHECKED COMP

Rough
65 x 17.5 = 1137.5 SF
= 2100
500
3737 SF
≈ 3694 SF

BMP INFILTRATION BASIN STORAGE BREAKDOWN

6 INCHES COURSE SAND (35% VOIDS)	=	646.55 CF
6 INCHES NO. 57 STONE (40% VOIDS)	=	738.92 CF
STORAGE IN INFILTRATORS ~~Total Length Total Wt/LF~~	=	2,892.50 CF
16 INCHES NO. 57 STONE (40% VOIDS) AROUND INFILTRATORS 3,701.02 CF - 2892.50 CF	=	808.52 CF
8 INCHES NO. 57 STONE (40% VOIDS)	=	990.15 CF
TOTAL STORAGE PROVIDED	**=**	**6,076.64 CF**

SEE NEXT PAGE

YC024_SMITH_MEMORIAL_BAPTIST_CHURCH - 067

SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER
STORMWATER MANAGEMENT/BMP INFILTRATION BASIN

NO. 1,	L = 37.5'	NO. 12,	L = 56.25'
NO. 2,	L = 37.5'	NO. 13,	L = 56.25'
NO. 3,	L = 43.75'	NO. 14,	L = 56.25'
NO. 4,	L = 43.75'	NO. 15,	L = 62.50'
NO. 5,	L = 43.75'	NO. 16,	L = 62.50'
NO. 6,	L = 43.75'	NO. 17,	L = 62.50'
NO. 7,	L = 50.00'	NO. 18,	L = 62.50'
NO. 8,	L = 50.00'	NO. 19,	L = 62.50'
NO. 9,	L = 50.00'	NO. 20,	L = 62.50'
NO. 10,	L = 50.00'	NO. 21,	L = 62.50'
NO. 11,	L = 56.25'	**TOTAL LENGTH**	**= 1,112.5'**

BASIS??

VOLUME PER LF OF INFILTRATOR = 2.60 CF PER LF

STORAGE = (TOTAL LENGTH) X (VOLUME PER LF)

TOTAL STORAGE IN INFILTRATORS = 2, 892.50 CF

SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER
STORMWATER MANAGEMENT/BMP INFILTRATION BASIN

WATERSHED AREAS

PRE-DEVELOPED AREA	=	0.71 ACRES
POST-DEVELOPED AREA	=	1.29 ACRES

RUNOFF COEFFICIENT

PRE-DEVELOPED COEFFICIENT	=	0.40
POST-DEVELOPED COEFFICIENT (WEIGHTED)	=	0.80

TIME OF CONCENTRATION

PRE-DEVELOPED T_C	=	15 MINUTES
POST-DEVELOPED T_C	=	12 MINUTES (FROM DRAINAGE CALCULATIONS)

RAINFALL INTENSITIES

PRE-DEVELOPED (15 MINUTES)

2 YEAR STORM	=	4.0 INTENSITY
10 YEAR STORM	=	5.2 INTENSITY
25 YEAR STORM	=	6.0 INTENSITY
100 YEAR STORM	=	7.1 INTENSITY

YC024_SMITH_MEMORIAL_BAPTIST_CHURCH - 069

SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER
STORMWATER MANAGEMENT/BMP INFILTRATION BASIN

POST-DEVELOPED (12 MINUTES)

2 YEAR STORM	=	4.3 INTENSITY
10 YEAR STORM	=	5.8 INTENSITY
25 YEAR STORM	=	6.5 INTENSITY
100 YEAR STORM	=	7.8 INTENSITY

FLOWS

PRE-DEVELOPED Q

AREA X COEFFICIENT				=		CA
0.71 X 0.40				=		0.28
2 YEAR STORM	0.28	X	4.0	=	Q_2	1.12
10 YEAR STORM	0.28	X	5.2	=	Q_{10}	1.46
25 YEAR STORM	0.28	X	6.0	=	Q_{25}	1.68
100 YEAR STORM	0.28	X	7.1	=	Q_{100}	1.98

POST-DEVELOPED Q

AREA X COEFFICIENT				=		CA
1.29 X 0.80				=		1.03
2 YEAR STORM	1.03	X	4.3	=	Q_2	4.43
10 YEAR STORM	1.03	X	5.8	=	Q_{10}	5.97
25 YEAR STORM	1.03	X	6.5	=	Q_{25}	6.70 + 1.1%
100 YEAR STORM	1.03	X	7.8	=	Q_{100}	8.03 + 1.25%

YC024_SMITH_MEMORIAL_BAPTIST_CHURCH - 070

Langley and McDonald
A PROFESSIONAL CORPORATION
ENGINEERS • PLANNERS • SURVEYORS
VIRGINIA BEACH – WILLIAMSBURG, VIRGINIA

Subject _____

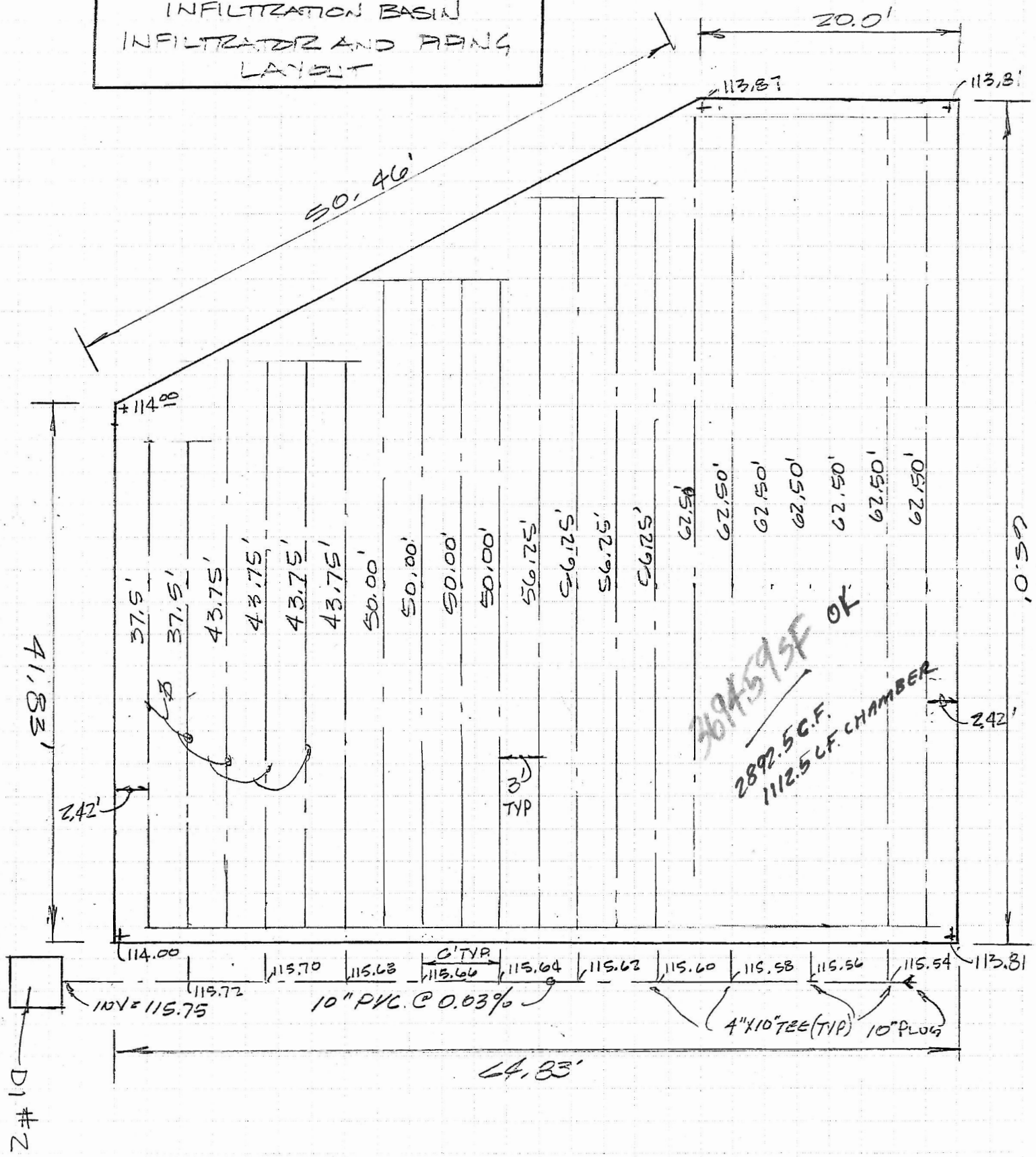
Computed By _____ Checked By _____

Project No. _____

Client _____

Date _____ Sheet No. _____

INFILTRATION BASIN
INFILTRATOR AND PIPING
LAYOUT



SMITH MEMORIAL BAPTIST CHURCH

FAMILY LIFE CENTER

DRAINAGE, STORMWATER MANAGEMENT, AND BMP DESIGN

The Drainage, Stormwater Management, and Chesapeake Bay B.M.P. Control Facilities for this project have developed in basic conformance with the "Overall Drainage and Stormwater Management Plan." We have designed the infiltration basin as a 10 point B.M.P. The design volume required is as follows:

Required Volume of BMP

$$V_r = \frac{(R_M)(R_v)}{12} \times Ac.$$

60.07% ACTUAL

$R_v = (0.05 + 0.009I)$ = [0.05 + 0.009(63)] = 0.62
(Where I = 63% Impervious Area
(0.9047 Ac) / Project Limits (1.43 Ac.)

R_m = 1.0" INFIL TRENCH 62 1.0"/IMP. ACRE

Impervious Ac. = 0.905 Acres

$$V_r = \frac{(1.0)(0.62)}{12} \times 0.905 = 0.047 \text{ ac.-ft.} = 2{,}047.32 \text{ cu. ft.}$$

The BMP pond was designed using the Modified Rational Method and run on Haestad Methods Inc.'s Quick TR-55 and Pond-2 software. Intensity, Duration, and Frequency Curve data used was taken from the VDOT Drainage Manual for Norfolk (Rev. 6/92).

Quick TR-55 Ver.5.46 S/N:
Executed: 13:22:37 09-17-1999

```
*************************************************************************
*************************************************************************
*                                                                       *
*                                                                       *
*                        MODIFIED RATIONAL METHOD                       *
*           ---- Grand Summary For All Storm Frequencies ----           *
*                                                                       *
*                                                                       *
*************************************************************************
*************************************************************************
```

First peak outflow point assumed to occur at inflow recession leg.

SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER

13 min.

Area = 1.29 acres Tc = 13.00 minutes

Frequency (years)	Adjusted 'C'	Duration minutes	Intens. in/hr	Qpeak cfs	Allowable cfs	VOLUMES Inflow (cu.ft.)	VOLUMES Storage (cu.ft.)
2	0.700	84	1.540	1.39	1.12	7,009	3,750
10	0.700	88	2.053	1.85	1.46	9,790	5,366
100	0.875	96	2.710	3.06	1.98	17,619	11,145

PREDEV

Quick TR-55 Ver.5.46 S/N:
Executed: 13:22:37 09-17-1999

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at inflow recession leg.

SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER

4.43 cfs?

```
*****************************************************************
*  RETURN FREQUENCY:   2 yr      |  Allowable Outflow:     1.12 cfs   *
*  'C' Adjustment: 1.000         |  Required Storage:    3,750 cu.ft. *
*---------------------------------------------------------------*
*  Peak Inflow:    1.39 cfs      |  Inflow .HYD stored: 2IN1    .HYD   *
*****************************************************************
```

```
|                Td =  84 minutes                  |  Return Freq:     2 yr
/------- Approx. Duration for Max. Storage ------/  C adj.factor: 1.00
|                                                  |
|                Tc=   13.00  minutes              |
|                I =   4.240  in/hr                |  Area (ac):      1.29
|              . Q =    3.83  cfs                  |  Weighted C:     0.70
|             .|.                                  |  Adjusted C:     0.70
F            .   .
L           .  |  .            Required Storage    |
O          .       .       .--     3,750 cu.ft.   |  Td=       84 minutes
W         .   |   .          |                    |  I =    1.540 in/hr
         .    x x x x x x x x|x x x x x x x x x x x  Q =     1.39 cfs
c       .                    |
f      .    x                                      x
s     .                                              o   Q=    1.12 cfs
     .   x                                o          |x  (Allow.Outflow)
    .  x                   .     o
   .  x                o    .       NOT TO SCALE      |   x
  . x       o                .      ============      |
 o                           .                        |       x
\-------------------------------------------------------|------------
                                                     86.53 minutes
```

Quick TR-55 Ver.5.46 S/N:
Executed: 13:22:37 09-17-1999

SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER

**** Modified Rational Hydrograph *****

Weighted C = 0.700 Area= 1.290 acres Tc = 13.00 minutes

Adjusted C = 0.700 Td= 84.00 min. I= 1.54 in/hr Qp= 1.39 cfs

RETURN FREQUENCY: 2 year storm Adj.factor = 1.00
Output file: 2IN1 .HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 2 Year Storm

Time Hours	Time increment = 0.017 Hours Time on left represents time for first Q in each row.						
0.000	0.00	0.11	0.21	0.32	0.43	0.53	0.64
0.117	0.75	0.86	0.96	1.07	1.18	1.28	1.39
0.233	1.39	1.39	1.39	1.39	1.39	1.39	1.39
0.350	1.39	1.39	1.39	1.39	1.39	1.39	1.39
0.467	1.39	1.39	1.39	1.39	1.39	1.39	1.39
0.583	1.39	1.39	1.39	1.39	1.39	1.39	1.39
0.700	1.39	1.39	1.39	1.39	1.39	1.39	1.39
0.817	1.39	1.39	1.39	1.39	1.39	1.39	1.39
0.933	1.39	1.39	1.39	1.39	1.39	1.39	1.39
1.050	1.39	1.39	1.39	1.39	1.39	1.39	1.39
1.167	1.39	1.39	1.39	1.39	1.39	1.39	1.39
1.283	1.39	1.39	1.39	1.39	1.39	1.39	1.39
1.400	1.39	1.28	1.18	1.07	0.96	0.86	0.75
1.517	0.64	0.53	0.43	0.32	0.21	0.11	0.00

Quick TR-55 Ver.5.46 S/N:
Executed: 13:22:37 09-17-1999

SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER

* * * * * * SUMMARY OF RATIONAL METHOD PEAK DISCHARGES * * * * * *

Q = adj * C * I * A
Where: Q=cfs, C=Weighted Runoff Coefficient, I=in/hour, A=acres
adj = 'C' adjustment factor for each return frequency

RETURN FREQUENCY = 2 years
'C' adjustment, k = 1
Adj. 'C' = Wtd.'C' x 1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
POST DEV DA								
	0.700	1.29						
			13.00	0.700	0.700	4.240	1.29	3.83

Quick TR-55 Ver.5.46 S/N:
Executed: 13:22:37 09-17-1999

MODIFIED RATIONAL METHOD
---- Summary for Single Storm Frequency ----

First peak outflow point assumed to occur at inflow recession leg.

SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER

RETURN FREQUENCY: 2 yr 'C' Adjustment = 1.000 Allowable Q = 1.12 cfs

Hydrograph file duration= 84.00 minutes
Hydrograph file: 2IN1 .HYD Tc = 13.00 minutes

Weighted 'C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (cu.ft.)	Storage (cu.ft.)
0.700	0.700	13	4.240	1.29	3.83	2,986	2,113
0.700	0.700	15	4.000	1.29	3.61	3,251	2,310
0.700	0.700	20	3.500	1.29	3.16	3,793	2,684
0.700	0.700	30	2.750	1.29	2.48	4,470	3,025
0.700	0.700	40	2.250	1.29	2.03	4,876	3,095
0.700	0.700	50	2.000	1.29	1.81	5,418	3,301
0.700	0.700	60	1.800	1.29	1.63	5,851	3,399
Storage Maximum							
0.700	0.700	84	1.540	1.29	1.39	7,009	3,750
0.700	0.700	120	1.150	1.29	1.04	Qpeak < Qallow	

Quick TR-55 Ver.5.46 S/N:
Executed: 13:22:37 09-17-1999

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at inflow recession leg.

SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER

```
*****************************************************************
*  RETURN FREQUENCY:  10 yr      |  Allowable Outflow:     1.46 cfs    *
*  'C' Adjustment: 1.000         |  Required Storage:    5,366 cu.ft. *
*---------------------------------------------------------------*
*  Peak Inflow:    1.85 cfs      |  Inflow .HYD stored: 10IN1   .HYD   *
*****************************************************************
```

```
|                Td =  88 minutes                  |  Return Freq:    10 yr
/------- Approx. Duration for Max. Storage ------/  C adj.factor: 1.00
|                                                  |
|                Tc=   13.00  minutes              |
|                I =   5.450  in/hr                |  Area (ac):      1.29
|              . Q =    4.92  cfs                  |  Weighted C:     0.70
|            .|.                                   |  Adjusted C:     0.70
F          .   .                                   |
L         .  |  .            Required Storage      |
O        .      .        .--     5,366 cu.ft.     |  Td=       88 minutes
W       .   |   .        |                         |  I =    2.053 in/hr
       .    x x x x x x x|x x x x x x x x x x x x  Q =     1.85 cfs
c     .                   |
f    .   x                                         x
s   .                                                o   Q=    1.46 cfs
   .  x                              o              |x  (Allow.Outflow)
  .  x                .     o                       |
 .  x            o    .       NOT TO SCALE          |   x
. x      o             .      ============          |
o                       .                           |      x
`---------------------------------------------------|------------
                                                   90.76 minutes
```

Quick TR-55 Ver.5.46 S/N:
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SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER

**** Modified Rational Hydrograph *****

Weighted C = 0.700 Area= 1.290 acres Tc = 13.00 minutes

Adjusted C = 0.700 Td= 88.00 min. I= 2.05 in/hr Qp= 1.85 cfs

RETURN FREQUENCY: 10 year storm Adj.factor = 1.00
Output file: 10IN1 .HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 10 Year Storm

Time Hours	Time increment = 0.017 Hours Time on left represents time for first Q in each row.						
0.000	0.00	0.14	0.29	0.43	0.57	0.71	0.86
0.117	1.00	1.14	1.28	1.43	1.57	1.71	1.85
0.233	1.85	1.85	1.85	1.85	1.85	1.85	1.85
0.350	1.85	1.85	1.85	1.85	1.85	1.85	1.85
0.467	1.85	1.85	1.85	1.85	1.85	1.85	1.85
0.583	1.85	1.85	1.85	1.85	1.85	1.85	1.85
0.700	1.85	1.85	1.85	1.85	1.85	1.85	1.85
0.817	1.85	1.85	1.85	1.85	1.85	1.85	1.85
0.933	1.85	1.85	1.85	1.85	1.85	1.85	1.85
1.050	1.85	1.85	1.85	1.85	1.85	1.85	1.85
1.167	1.85	1.85	1.85	1.85	1.85	1.85	1.85
1.283	1.85	1.85	1.85	1.85	1.85	1.85	1.85
1.400	1.85	1.85	1.85	1.85	1.85	1.71	1.57
1.517	1.43	1.28	1.14	1.00	0.86	0.71	0.57
1.633	0.43	0.29	0.14	0.00			

Quick TR-55 Ver.5.46 S/N:
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SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER

* * * * * * SUMMARY OF RATIONAL METHOD PEAK DISCHARGES * * * * * *

Q = adj * C * I * A
Where: Q=cfs, C=Weighted Runoff Coefficient, I=in/hour, A=acres
adj = 'C' adjustment factor for each return frequency

RETURN FREQUENCY = 10 years
'C' adjustment, k = 1
Adj. 'C' = Wtd.'C' x 1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
POST DEV DA								
	0.700	1.29						
			13.00	0.700	0.700	5.450	1.29	4.92

Quick TR-55 Ver.5.46 S/N:
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MODIFIED RATIONAL METHOD
---- Summary for Single Storm Frequency ----

First peak outflow point assumed to occur at inflow recession leg.

SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER

RETURN FREQUENCY: 10 yr 'C' Adjustment = 1.000 Allowable Q = 1.46 cfs

Hydrograph file duration= 88.00 minutes
Hydrograph file: 10IN1 .HYD Tc = 13.00 minutes

Weighted 'C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (cu.ft.)	Storage (cu.ft.)
0.700	0.700	13	5.450	1.29	4.92	3,839	2,700
0.700	0.700	15	5.250	1.29	4.74	4,267	3,040
0.700	0.700	20	4.700	1.29	4.24	5,093	3,648
0.700	0.700	30	3.750	1.29	3.39	6,095	4,212
0.700	0.700	40	3.150	1.29	2.84	6,827	4,505
0.700	0.700	50	2.750	1.29	2.48	7,450	4,690
0.700	0.700	60	2.450	1.29	2.21	7,964	4,767
Storage Maximum							
0.700	0.700	88	2.053	1.29	1.85	9,790	5,366
0.700	0.700	120	1.600	1.29	1.44	Qpeak < Qallow	

Quick TR-55 Ver.5.46 S/N:
Executed: 13:22:37 09-17-1999

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at inflow recession leg.

SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER

```
*****************************************************************
*  RETURN FREQUENCY: 100 yr     |  Allowable Outflow:     1.98 cfs    *
*  'C' Adjustment: 1.250        |  Required Storage:    11,145 cu.ft. *
*---------------------------------------------------------------*
*  Peak Inflow:    3.06 cfs     |  Inflow .HYD stored: 100IN1  .HYD   *
*****************************************************************
```

```
|                Td =  96 minutes                  |  Return Freq:   100 yr
/------- Approx. Duration for Max. Storage ------/  C adj.factor: 1.25
|                                                  |
|                                                  |
|                Tc=   13.00  minutes              |
|                I =   7.520  in/hr                |  Area (ac):      1.29
|              . Q =    8.49  cfs                  |  Weighted C:     0.70
|            .|.                                   |  Adjusted C:     0.88
F           .   .                                  |
L         .  |  .            Required Storage      |
O       .       .        .--    11,145 cu.ft.     |  Td=       96 minutes
W      .    |    .       |                        |  I =    2.710 in/hr
      .     x x x x x x x|x x x x x x x x x x x   |  Q =     3.06 cfs
c    .                   |                         |
f   .    x                                         |  x
s  .                                                |    o   Q=    1.98 cfs
  .   x                                o           |   |x  (Allow.Outflow)
 .  x                 .     o                      |
 . x              o    .       NOT TO SCALE        |   x
. x      o              .      ============        |
o                        .                         |      x
\-------------------------------------------------|------------
                                                  100.59 minutes
```

Quick TR-55 Ver.5.46 S/N:
Executed: 13:22:37 09-17-1999

SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER

**** Modified Rational Hydrograph *****

Weighted C = 0.700 Area= 1.290 acres Tc = 13.00 minutes

Adjusted C = 0.875 Td= 96.00 min. I= 2.71 in/hr Qp= 3.06 cfs

RETURN FREQUENCY: 100 year storm Adj.factor = 1.25
Output file: 100IN1 .HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 100 Year Storm

Time increment = 0.017 Hours
Time on left represents time for first Q in each row.

Time Hours							
0.000	0.00	0.24	0.47	0.71	0.94	1.18	1.41
0.117	1.65	1.88	2.12	2.35	2.59	2.82	3.06
0.233	3.06	3.06	3.06	3.06	3.06	3.06	3.06
0.350	3.06	3.06	3.06	3.06	3.06	3.06	3.06
0.467	3.06	3.06	3.06	3.06	3.06	3.06	3.06
0.583	3.06	3.06	3.06	3.06	3.06	3.06	3.06
0.700	3.06	3.06	3.06	3.06	3.06	3.06	3.06
0.817	3.06	3.06	3.06	3.06	3.06	3.06	3.06
0.933	3.06	3.06	3.06	3.06	3.06	3.06	3.06
1.050	3.06	3.06	3.06	3.06	3.06	3.06	3.06
1.167	3.06	3.06	3.06	3.06	3.06	3.06	3.06
1.283	3.06	3.06	3.06	3.06	3.06	3.06	3.06
1.400	3.06	3.06	3.06	3.06	3.06	3.06	3.06
1.517	3.06	3.06	3.06	3.06	3.06	3.06	2.82
1.633	2.59	2.35	2.12	1.88	1.65	1.41	1.18
1.750	0.94	0.71	0.47	0.24	0.00		

Quick TR-55 Ver.5.46 S/N:
Executed: 13:22:37 09-17-1999

SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER

* * * * * * SUMMARY OF RATIONAL METHOD PEAK DISCHARGES * * * * * *

Q = adj * C * I * A
Where: Q=cfs, C=Weighted Runoff Coefficient, I=in/hour, A=acres
adj = 'C' adjustment factor for each return frequency

RETURN FREQUENCY = 100 years
'C' adjustment, k = 1.25
Adj. 'C' = Wtd.'C' x 1.25

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
POST DEV DA								
	0.700	1.29						
			13.00	0.700	0.875	7.520	1.29	8.49

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Executed: 13:22:37 09-17-1999

MODIFIED RATIONAL METHOD
---- Summary for Single Storm Frequency ----

First peak outflow point assumed to occur at inflow recession leg.

SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER

RETURN FREQUENCY: 100 yr 'C' Adjustment = 1.250 Allowable Q = 1.98 cfs

Hydrograph file duration= 96.00 minutes
Hydrograph file: 100IN1 .HYD Tc = 13.00 minutes

Weighted 'C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (cu.ft.)	Storage (cu.ft.)
0.700	0.875	13	7.520	1.29	8.49	6,621	5,076
0.700	0.875	15	7.200	1.29	8.13	7,314	5,651
0.700	0.875	20	6.500	1.29	7.34	8,804	6,844
0.700	0.875	30	5.250	1.29	5.93	10,667	8,112
0.700	0.875	40	4.500	1.29	5.08	12,190	9,042
0.700	0.875	50	3.800	1.29	4.29	12,868	9,126
0.700	0.875	60	3.400	1.29	3.84	13,816	9,480
********** Storage Maximum							
0.700	0.875	96	2.710	1.29	3.06	17,619	11,145
0.700	0.875	120	2.250	1.29	2.54	18,286	10,386
0.700	0.875	180	1.700	1.29	1.92	Qpeak < Qallow	

POND-2 Version: 5.20
S/N:

SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER

CALCULATED 09-20-1999 12:35:22
DISK FILE: a:SMBAPCH1.VOL

Planimeter scale: 1 inch = 25 ft.

Elevation (ft)	Planimeter (sq.in.)	Area (sq.ft)	A1+A2+sqr(A1*A2) (sq.ft)	* Volume (cubic-ft)	Volume Sum (cubic-ft)
114.00	2.07	1,293	0	0	0
114.15	2.07	1,293	3,878	194	194
114.49	2.07	1,293	3,878	439	633
114.50	2.36	1,473	4,145	14	647
114.99	2.36	1,473	4,419	722	1,369
115.00	4.44	2,775	6,270	21	1,390
116.33	4.44	2,775	8,325	3,691	5,081
116.34	2.36	1,475	6,273	21	5,102
116.83	2.36	1,475	4,425	723	5,824
117.00	2.37	1,481	4,434	251	6,076
117.13	0.00	2	1,536	67	6,142
117.43	0.00	2	6	1	6,143
117.73	0.00	2	6	1	6,143
118.03	0.00	2	6	1	6,144
118.33	0.00	2	6	1	6,144
118.63	0.00	2	6	1	6,145
118.93	0.00	2	6	1	6,145
119.23	0.00	2	6	1	6,146
119.53	0.00	2	6	1	6,147
119.83	0.00	2	6	1	6,147
120.13	0.00	2	6	1	6,148
120.43	0.00	2	6	1	6,148
120.73	0.00	2	6	1	6,149
121.03	0.00	2	6	1	6,149

Elevations With Areas Interpolated From
The Closest Two Planimeter Readings

115.24	-----	2,775	8,325	666	2,056

$$IA = (sq.rt(Area1) + ((Ei-E1)/(E2-E1))*(sq.rt(Area2)-sq.rt(Area1)))^2$$

where: E1, E2 = Closest two elevations with planimeter data
Ei = Elevation at which to interpolate area
Area1,Area2 = Areas computed for E1, E2, respectively
IA = Interpolated area for Ei

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

Outlet Structure File: SMBAPCH1.STR

POND-2 Version: 5.20 S/N:
Date Executed: Time Executed:

****
SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER

****

***** COMPOSITE OUTFLOW SUMMARY ****

Elevation (ft)	Q (cfs)	Contributing Structures
114.00	0.0	1
114.30	0.1	1
114.60	0.1	1
114.90	0.1	1
115.20	0.1	1
115.50	0.1	1
115.75	0.6	3 +1
115.80	0.6	3 +1
116.10	0.8	3 +1
116.40	1.0	3 +1
116.70	1.1	3 +1
117.00	1.2	3 +1
117.30	1.4	3 +1
117.60	1.5	3 +1
117.90	1.6	3 +1
118.20	1.6	3 +1
118.50	1.7	3 +1
118.80	1.8	3 +1
119.10	1.9	3 +1
119.40	2.4	3 +2 +1
119.70	4.3	3 +2 +1
120.00	6.8	3 +2 +1
120.30	9.8	3 +2 +1
120.60	13.1	3 +2 +1
120.75	0.0	

Outlet Structure File: SMBAPCH1.STR

POND-2 Version: 5.20 S/N:
Date Executed: Time Executed:

****
SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER

****

Outlet Structure File: a:SMBAPCH1.STR
Planimeter Input File: a:SMBAPCH1.VOL
Rating Table Output File: a:SMBAPCH1.PND

Min. Elev.(ft) = 114 Max. Elev.(ft) = 120.75 Incr.(ft) = .3

Additional elevations (ft) to be included in table:
* *
115.75

****
SYSTEM CONNECTIVITY
****

Structure	No.	Q Table		Q Table
ORIFICE-VC	3		->	3
WEIR-VR	2		->	2
TABLE	1		->	1

Outflow rating table summary was stored in file:
a:SMBAPCH1.PND

Outlet Structure File: SMBAPCH1.STR

POND-2 Version: 5.20 S/N:
Date Executed: Time Executed:

****
SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER

****

>>>>>> Structure No. 3 <<<<<<
(Input Data)

ORIFICE-VC
Orifice - Vertical Circular

E1 elev.(ft)?	115.75
E2 elev.(ft)?	120.75
Orifice coeff.?	0.6
Invert elev.(ft)?	115.25
Datum elev.(ft)?	115.50
Diameter (ft)?	0.50

Outlet Structure File: SMBAPCH1.STR

POND-2 Version: 5.20 S/N:
Date Executed: Time Executed:

****
SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER

****

>>>>>> Structure No. 2 <<<<<<
(Input Data)

WEIR-VR
Weir - Vertical Rectangular

E1 elev.(ft)?	119.25
E2 elev.(ft)?	120.75
Weir coefficient?	3.1
Weir elev.(ft)?	119.25
Length (ft)?	2.5
Contracted/Suppressed (C/S)?	C

Outlet Structure File: SMBAPCH1.STR

POND-2 Version: 5.20 S/N:
Date Executed: Time Executed:

****
SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER

****

>>>>>> Structure No. 1 <<<<<<
(Input Data)

TABLE
Input your own rating table.
E1 (ft) =114.00 E2 (ft) =120.75

Constant (ft) added to each elevation was:

Elev. (ft)	Q (cfs)
114	0
114.33	.085519
114.83	.085519
115.33	.085519
115.83	.085519
116.33	.085519
116.83	.085519
117.33	.085579
117.83	.085591
118.33	.085591
118.83	.085591
119.33	.085591
119.83	.085591
120.33	.085591
120.83	.085591

THIS IS INFILTRATION RATE FOR STRUCTURE
$Q_{INFIL} = 0.0855 CFS$

HOW WAS THIS DERIVED BASED ON 1" / HR PERC RATE

CHECK COMP:

$\frac{IN}{HR} \times \frac{1 HR}{60 MIN} \times \frac{1 MIN}{60 S} = \frac{CF}{S}$

1.0 INCH PER HOUR =

$0.0003 \frac{IN}{S} \times \frac{1 FT}{12 IN} = 0.000031 \frac{FT}{S} \times 3694.59 SF$

$= 0.0855 \frac{CF}{S}$

0.0855 cfs OK

Outlet Structure File: SMBAPCH1.STR

POND-2 Version: 5.20 S/N:
Date Executed: Time Executed:

****
SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER

****

Outflow Rating Table for Structure #3
ORIFICE-VC Orifice - Vertical Circular

Elevation (ft)	Q (cfs)	Computation Messages
114.00	0.0	E < E1=115.75
114.30	0.0	E < E1=115.75
114.60	0.0	E < E1=115.75
114.90	0.0	E < E1=115.75
115.20	0.0	E < E1=115.75
115.50	0.0	E < E1=115.75
115.75	0.5	H =.25
115.80	0.5	H =.3
116.10	0.7	H =.6
116.40	0.9	H =.9
116.70	1.0	H =1.2
117.00	1.2	H =1.5
117.30	1.3	H =1.8
117.60	1.4	H =2.1
117.90	1.5	H =2.4
118.20	1.6	H =2.7
118.50	1.6	H =3.0
118.80	1.7	H =3.3
119.10	1.8	H =3.6
119.40	1.9	H =3.9
119.70	1.9	H =4.2
120.00	2.0	H =4.5
120.30	2.1	H =4.8
120.60	2.1	H =5.1
120.75	0.0	E = or > E2=120.75

C = .6 A = .1963496 sq.ft.
H (ft) = Table elev. - Datum elev. (115.5 ft)
Q (cfs) = C * A * sqr(2g * H)

Outlet Structure File: SMBAPCH1.STR

POND-2 Version: 5.20 S/N:
Date Executed: Time Executed:

****
SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER

****

Outflow Rating Table for Structure #2
WEIR-VR Weir - Vertical Rectangular

***** INLET CONTROL ASSUMED *****

Elevation (ft)	Q (cfs)	Computation Messages
114.00	0.0	E < Inv.El.= 119.25
114.30	0.0	E < Inv.El.= 119.25
114.60	0.0	E < Inv.El.= 119.25
114.90	0.0	E < Inv.El.= 119.25
115.20	0.0	E < Inv.El.= 119.25
115.50	0.0	E < Inv.El.= 119.25
115.75	0.0	E < Inv.El.= 119.25
115.80	0.0	E < Inv.El.= 119.25
116.10	0.0	E < Inv.El.= 119.25
116.40	0.0	E < Inv.El.= 119.25
116.70	0.0	E < Inv.El.= 119.25
117.00	0.0	E < Inv.El.= 119.25
117.30	0.0	E < Inv.El.= 119.25
117.60	0.0	E < Inv.El.= 119.25
117.90	0.0	E < Inv.El.= 119.25
118.20	0.0	E < Inv.El.= 119.25
118.50	0.0	E < Inv.El.= 119.25
118.80	0.0	E < Inv.El.= 119.25
119.10	0.0	E < Inv.El.= 119.25
119.40	0.4	H =.15
119.70	2.3	H =.45
120.00	4.7	H =.750
120.30	7.6	H =1.05
120.60	10.8	H =1.35
120.75	0.0	E = or > E2=120.75

C = 3.1 L (ft) = 2.5
H (ft) = Table elev. - Invert elev. (119.25 ft)
Q (cfs) = C * (L-.2H) * (H**1.5) -- Contracted Weir

Outlet Structure File: SMBAPCH1.STR

POND-2 Version: 5.20 S/N:
Date Executed: Time Executed:

****
SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER

****

Outflow Rating Table for Structure #1
TABLE Input your own rating table.

Elevation (ft)	Q (cfs)	Computation Messages
114.00	0.0	
114.30	0.1	Interpolated from input table
114.60	0.1	Interpolated from input table
114.90	0.1	Interpolated from input table
115.20	0.1	Interpolated from input table
115.50	0.1	Interpolated from input table
115.75	0.1	Interpolated from input table
115.80	0.1	Interpolated from input table
116.10	0.1	Interpolated from input table
116.40	0.1	Interpolated from input table
116.70	0.1	Interpolated from input table
117.00	0.1	Interpolated from input table
117.30	0.1	Interpolated from input table
117.60	0.1	Interpolated from input table
117.90	0.1	Interpolated from input table
118.20	0.1	Interpolated from input table
118.50	0.1	Interpolated from input table
118.80	0.1	Interpolated from input table
119.10	0.1	Interpolated from input table
119.40	0.1	Interpolated from input table
119.70	0.1	Interpolated from input table
120.00	0.1	Interpolated from input table
120.30	0.1	Interpolated from input table
120.60	0.1	Interpolated from input table
120.75	0.0	E = or > E2=120.75

```
**********************************
*                                *
*   SMITH MEMORIAL BAPTIST CHURCH *
*        FAMILY LIFE CENTER      *
*                                *
*                                *
*                                *
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Inflow Hydrograph: a:2IN1 .HYD
Rating Table file: a:SMBAPCH1.PND

----INITIAL CONDITIONS----
Elevation = 114.00 ft
Outflow = 0.00 cfs
Storage = 0 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + O (cfs)
114.00	0.0	0	0.0	0.0
114.30	0.1	388	12.9	13.0
114.60	0.1	795	26.5	26.6
114.90	0.1	1,236	41.2	41.3
115.20	0.1	1,945	64.8	64.9
115.50	0.1	2,777	92.6	92.7
115.75	0.6	3,471	115.7	116.3
115.80	0.6	3,610	120.3	120.9
116.10	0.8	4,442	148.0	148.8
116.40	1.0	5,190	173.0	174.0
116.70	1.1	5,633	187.7	188.8
117.00	1.2	6,076	202.5	203.7
117.30	1.4	6,142	204.7	206.1
117.60	1.5	6,143	204.7	206.2
117.90	1.6	6,144	204.7	206.3
118.20	1.6	6,144	204.8	206.4
118.50	1.7	6,145	204.8	206.5
118.80	1.8	6,145	204.8	206.6
119.10	1.9	6,146	204.8	206.7
119.40	2.4	6,146	204.8	207.2
119.70	4.3	6,147	204.9	209.2
120.00	6.8	6,148	204.9	211.7
120.30	9.8	6,148	204.9	214.7
120.60	13.1	6,148	204.9	218.0

Time increment (t) = 0.017 hrs.

Pond File: a:SMBAPCH1.PND
Inflow Hydrograph: a:2IN1 .HYD
Outflow Hydrograph: a:2OUT1 .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.000	0.00	-----	0.0	0.0	0.00	114.00
0.017	0.11	0.1	0.1	0.1	0.00	114.00
0.033	0.21	0.3	0.4	0.4	0.00	114.01
0.050	0.32	0.5	0.9	1.0	0.01	114.02
0.067	0.43	0.8	1.7	1.7	0.01	114.04
0.083	0.53	1.0	2.6	2.6	0.02	114.06
0.100	0.64	1.2	3.7	3.8	0.03	114.09
0.117	0.75	1.4	5.0	5.1	0.04	114.12
0.133	0.86	1.6	6.5	6.6	0.05	114.15
0.150	0.96	1.8	8.2	8.3	0.06	114.19
0.167	1.07	2.0	10.1	10.2	0.08	114.24
0.183	1.18	2.3	12.1	12.3	0.09	114.28
0.200	1.28	2.5	14.4	14.6	0.10	114.33
0.217	1.39	2.7	16.9	17.1	0.10	114.39
0.233	1.39	2.8	19.4	19.6	0.10	114.45
0.250	1.39	2.8	22.0	22.2	0.10	114.50
0.267	1.39	2.8	24.6	24.8	0.10	114.56
0.283	1.39	2.8	27.2	27.4	0.10	114.62
0.300	1.39	2.8	29.8	30.0	0.10	114.67
0.317	1.39	2.8	32.3	32.5	0.10	114.72
0.333	1.39	2.8	34.9	35.1	0.10	114.77
0.350	1.39	2.8	37.5	37.7	0.10	114.83
0.367	1.39	2.8	40.1	40.3	0.10	114.88
0.383	1.39	2.8	42.7	42.9	0.10	114.92
0.400	1.39	2.8	45.2	45.4	0.10	114.95
0.417	1.39	2.8	47.8	48.0	0.10	114.99
0.433	1.39	2.8	50.4	50.6	0.10	115.02
0.450	1.39	2.8	53.0	53.2	0.10	115.05
0.467	1.39	2.8	55.6	55.8	0.10	115.08
0.483	1.39	2.8	58.1	58.3	0.10	115.12
0.500	1.39	2.8	60.7	60.9	0.10	115.15
0.517	1.39	2.8	63.3	63.5	0.10	115.18
0.533	1.39	2.8	65.9	66.1	0.10	115.21
0.550	1.39	2.8	68.5	68.7	0.10	115.24
0.567	1.39	2.8	71.0	71.2	0.10	115.27
0.583	1.39	2.8	73.6	73.8	0.10	115.30
0.600	1.39	2.8	76.2	76.4	0.10	115.32
0.617	1.39	2.8	78.8	79.0	0.10	115.35
0.633	1.39	2.8	81.4	81.6	0.10	115.38
0.650	1.39	2.8	83.9	84.1	0.10	115.41
0.667	1.39	2.8	86.5	86.7	0.10	115.44
0.683	1.39	2.8	89.1	89.3	0.10	115.46
0.700	1.39	2.8	91.7	91.9	0.10	115.49
0.717	1.39	2.8	94.2	94.5	0.14	115.52
0.733	1.39	2.8	96.6	97.0	0.19	115.55

Return Freq: 2 years

Pond File: a:SMBAPCH1.PND
Inflow Hydrograph: a:2IN1 .HYD
Outflow Hydrograph: a:2OUT1 .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.750	1.39	2.8	98.9	99.4	0.24	115.57
0.767	1.39	2.8	101.1	101.7	0.29	115.60
0.783	1.39	2.8	103.2	103.9	0.34	115.62
0.800	1.39	2.8	105.2	106.0	0.38	115.64
0.817	1.39	2.8	107.1	108.0	0.42	115.66
0.833	1.39	2.8	109.0	109.9	0.47	115.68
0.850	1.39	2.8	110.8	111.8	0.50	115.70
0.867	1.39	2.8	112.5	113.5	0.54	115.72
0.884	1.39	2.8	114.1	115.2	0.58	115.74
0.900	1.39	2.8	115.7	116.9	0.60	115.76
0.917	1.39	2.8	117.2	118.4	0.60	115.77
0.934	1.39	2.8	118.8	120.0	0.60	115.79
0.950	1.39	2.8	120.4	121.6	0.60	115.81
0.967	1.39	2.8	121.9	123.2	0.62	115.82
0.984	1.39	2.8	123.5	124.7	0.63	115.84
1.000	1.39	2.8	125.0	126.2	0.64	115.86
1.017	1.39	2.8	126.4	127.7	0.65	115.87
1.034	1.39	2.8	127.9	129.2	0.66	115.89
1.050	1.39	2.8	129.3	130.7	0.67	115.91
1.067	1.39	2.8	130.8	132.1	0.68	115.92
1.084	1.39	2.8	132.2	133.5	0.69	115.94
1.100	1.39	2.8	133.5	134.9	0.70	115.95
1.117	1.39	2.8	134.9	136.3	0.71	115.97
1.134	1.39	2.8	136.2	137.7	0.72	115.98
1.150	1.39	2.8	137.6	139.0	0.73	115.99
1.167	1.39	2.8	138.9	140.3	0.74	116.01
1.184	1.39	2.8	140.2	141.6	0.75	116.02
1.200	1.39	2.8	141.4	142.9	0.76	116.04
1.217	1.39	2.8	142.7	144.2	0.77	116.05
1.234	1.39	2.8	143.9	145.4	0.78	116.06
1.250	1.39	2.8	145.1	146.7	0.78	116.08
1.267	1.39	2.8	146.3	147.9	0.79	116.09
1.284	1.39	2.8	147.5	149.1	0.80	116.10
1.300	1.39	2.8	148.6	150.3	0.81	116.12
1.317	1.39	2.8	149.8	151.4	0.82	116.13
1.334	1.39	2.8	150.9	152.5	0.83	116.14
1.350	1.39	2.8	152.0	153.7	0.84	116.16
1.367	1.39	2.8	153.1	154.8	0.85	116.17
1.384	1.39	2.8	154.1	155.9	0.86	116.18
1.400	1.39	2.8	155.2	156.9	0.86	116.20
1.417	1.28	2.7	156.1	157.9	0.87	116.21
1.434	1.18	2.5	156.8	158.6	0.88	116.22
1.450	1.07	2.3	157.3	159.1	0.88	116.22
1.467	0.96	2.0	157.6	159.3	0.88	116.23
1.484	0.86	1.8	157.6	159.4	0.88	116.23
1.500	0.75	1.6	157.5	159.2	0.88	116.22

2 YEAR

Pond File: a:SMBAPCH1.PND
Inflow Hydrograph: a:2IN1 .HYD
Outflow Hydrograph: a:2OUT1 .HYD

INFLOW HYDROGRAPH

TIME (hrs)	INFLOW (cfs)
1.517	0.64
1.534	0.53
1.550	0.43
1.567	0.32
1.584	0.21
1.600	0.11
1.617	0.00

ROUTING COMPUTATIONS

I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
1.4	157.1	158.9	0.88	116.22
1.2	156.5	158.3	0.88	116.21
1.0	155.7	157.5	0.87	116.20
0.8	154.8	156.5	0.86	116.19
0.5	153.6	155.3	0.85	116.18
0.3	152.2	153.9	0.84	116.16
0.1	150.7	152.4	0.83	116.14

********** SUMMARY OF ROUTING COMPUTATIONS **********

Pond File: a:SMBAPCH1.PND
Inflow Hydrograph: a:2IN1 .HYD
Outflow Hydrograph: a:2OUT1 .HYD

Starting Pond W.S. Elevation = 114.00 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow = 1.39 cfs
Peak Outflow = 0.88 cfs
Peak Elevation = 116.23 ft

2YEAR

***** Summary of Approximate Peak Storage *****

Initial Storage	=	0 cu-ft
Peak Storage From Storm	=	4,756 cu-ft
Total Storage in Pond	=	4,756 cu-ft

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*                               *
*   SMITH MEMORIAL BAPTIST CHURCH *
*        FAMILY LIFE CENTER     *
*                               *
*                               *
*                               *
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Inflow Hydrograph: a:10IN1 .HYD
Rating Table file: a:SMBAPCH1.PND

----INITIAL CONDITIONS----
Elevation = 114.00 ft
Outflow = 0.00 cfs
Storage = 0 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + O (cfs)
114.00	0.0	0	0.0	0.0
114.30	0.1	388	12.9	13.0
114.60	0.1	795	26.5	26.6
114.90	0.1	1,236	41.2	41.3
115.20	0.1	1,945	64.8	64.9
115.50	0.1	2,777	92.6	92.7
115.75	0.6	3,471	115.7	116.3
115.80	0.6	3,610	120.3	120.9
116.10	0.8	4,442	148.0	148.8
116.40	1.0	5,190	173.0	174.0
116.70	1.1	5,633	187.7	188.8
117.00	1.2	6,076	202.5	203.7
117.30	1.4	6,142	204.7	206.1
117.60	1.5	6,143	204.7	206.2
117.90	1.6	6,144	204.7	206.3
118.20	1.6	6,144	204.8	206.4
118.50	1.7	6,145	204.8	206.5
118.80	1.8	6,145	204.8	206.6
119.10	1.9	6,146	204.8	206.7
119.40	2.4	6,146	204.8	207.2
119.70	4.3	6,147	204.9	209.2
120.00	6.8	6,148	204.9	211.7
120.30	9.8	6,148	204.9	214.7
120.60	13.1	6,148	204.9	218.0

Time increment (t) = 0.017 hrs.

Pond File: a:SMBAPCH1.PND
Inflow Hydrograph: a:10IN1 .HYD
Outflow Hydrograph: a:10OUT1 .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.000	0.00	-----	0.0	0.0	0.00	114.00
0.017	0.14	0.1	0.1	0.1	0.00	114.00
0.033	0.29	0.4	0.6	0.6	0.00	114.01
0.050	0.43	0.7	1.3	1.3	0.01	114.03
0.067	0.57	1.0	2.2	2.3	0.02	114.05
0.083	0.71	1.3	3.5	3.5	0.03	114.08
0.100	0.86	1.6	4.9	5.0	0.04	114.12
0.117	1.00	1.9	6.7	6.8	0.05	114.16
0.133	1.14	2.1	8.7	8.8	0.07	114.20
0.150	1.28	2.4	11.0	11.1	0.09	114.26
0.167	1.43	2.7	13.5	13.7	0.10	114.31
0.183	1.57	3.0	16.3	16.5	0.10	114.38
0.200	1.71	3.3	19.3	19.5	0.10	114.44
0.217	1.85	3.6	22.7	22.9	0.10	114.52
0.233	1.85	3.7	26.2	26.4	0.10	114.60
0.250	1.85	3.7	29.7	29.9	0.10	114.67
0.267	1.85	3.7	33.2	33.4	0.10	114.74
0.283	1.85	3.7	36.7	36.9	0.10	114.81
0.300	1.85	3.7	40.2	40.4	0.10	114.88
0.317	1.85	3.7	43.7	43.9	0.10	114.93
0.333	1.85	3.7	47.2	47.4	0.10	114.98
0.350	1.85	3.7	50.7	50.9	0.10	115.02
0.367	1.85	3.7	54.2	54.4	0.10	115.07
0.383	1.85	3.7	57.7	57.9	0.10	115.11
0.400	1.85	3.7	61.2	61.4	0.10	115.16
0.417	1.85	3.7	64.7	64.9	0.10	115.20
0.433	1.85	3.7	68.2	68.4	0.10	115.24
0.450	1.85	3.7	71.7	71.9	0.10	115.28
0.467	1.85	3.7	75.2	75.4	0.10	115.31
0.483	1.85	3.7	78.7	78.9	0.10	115.35
0.500	1.85	3.7	82.2	82.4	0.10	115.39
0.517	1.85	3.7	85.7	85.9	0.10	115.43
0.533	1.85	3.7	89.2	89.4	0.10	115.46
0.550	1.85	3.7	92.7	92.9	0.11	115.50
0.567	1.85	3.7	96.0	96.4	0.18	115.54
0.583	1.85	3.7	99.2	99.7	0.25	115.57
0.600	1.85	3.7	102.3	102.9	0.32	115.61
0.617	1.85	3.7	105.2	106.0	0.38	115.64
0.633	1.85	3.7	108.0	108.9	0.44	115.67
0.650	1.85	3.7	110.7	111.7	0.50	115.70
0.667	1.85	3.7	113.3	114.4	0.56	115.73
0.683	1.85	3.7	115.8	117.0	0.60	115.76
0.700	1.85	3.7	118.3	119.5	0.60	115.78
0.717	1.85	3.7	120.8	122.0	0.61	115.81
0.733	1.85	3.7	123.2	124.5	0.63	115.84

Pond File: a:SMBAPCH1.PND
Inflow Hydrograph: a:10IN1 .HYD
Outflow Hydrograph: a:10OUT1 .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.750	1.85	3.7	125.7	126.9	0.64	115.86
0.767	1.85	3.7	128.0	129.4	0.66	115.89
0.783	1.85	3.7	130.4	131.7	0.68	115.92
0.800	1.85	3.7	132.7	134.1	0.69	115.94
0.817	1.85	3.7	135.0	136.4	0.71	115.97
0.833	1.85	3.7	137.2	138.7	0.73	115.99
0.850	1.85	3.7	139.4	140.9	0.74	116.01
0.867	1.85	3.7	141.6	143.1	0.76	116.04
0.884	1.85	3.7	143.8	145.3	0.77	116.06
0.900	1.85	3.7	145.9	147.5	0.79	116.09
0.917	1.85	3.7	148.0	149.6	0.81	116.11
0.934	1.85	3.7	150.0	151.7	0.82	116.13
0.950	1.85	3.7	152.1	153.7	0.84	116.16
0.967	1.85	3.7	154.0	155.8	0.85	116.18
0.984	1.85	3.7	156.0	157.7	0.87	116.21
1.000	1.85	3.7	157.9	159.7	0.89	116.23
1.017	1.85	3.7	159.8	161.6	0.90	116.25
1.034	1.85	3.7	161.7	163.5	0.92	116.28
1.050	1.85	3.7	163.5	165.4	0.93	116.30
1.067	1.85	3.7	165.3	167.2	0.95	116.32
1.084	1.85	3.7	167.1	169.0	0.96	116.34
1.100	1.85	3.7	168.9	170.8	0.97	116.36
1.117	1.85	3.7	170.6	172.6	0.99	116.38
1.134	1.85	3.7	172.3	174.3	1.00	116.41
1.150	1.85	3.7	174.0	176.0	1.01	116.44
1.167	1.85	3.7	175.6	177.7	1.02	116.47
1.184	1.85	3.7	177.2	179.3	1.04	116.51
1.200	1.85	3.7	178.8	180.9	1.05	116.54
1.217	1.85	3.7	180.4	182.5	1.06	116.57
1.234	1.85	3.7	182.0	184.1	1.07	116.61
1.250	1.85	3.7	183.5	185.7	1.08	116.64
1.267	1.85	3.7	185.1	187.2	1.09	116.67
1.284	1.85	3.7	186.6	188.8	1.10	116.70
1.300	1.85	3.7	188.0	190.3	1.11	116.73
1.317	1.85	3.7	189.5	191.7	1.12	116.76
1.334	1.85	3.7	190.9	193.2	1.13	116.79
1.350	1.85	3.7	192.4	194.6	1.14	116.82
1.367	1.85	3.7	193.8	196.1	1.15	116.85
1.384	1.85	3.7	195.1	197.5	1.16	116.87
1.400	1.85	3.7	196.5	198.8	1.17	116.90
1.417	1.85	3.7	197.9	200.2	1.18	116.93
1.434	1.85	3.7	199.2	201.6	1.19	116.96
1.450	1.85	3.7	200.5	202.9	1.19	116.98
1.467	1.85	3.7	201.7	204.2	1.24	117.06
1.484	1.71	3.6	202.6	205.3	1.33	117.20
1.500	1.57	3.3	203.1	205.9	1.38	117.27

Pond File: a:SMBAPCH1.PND
Inflow Hydrograph: a:10IN1 .HYD
Outflow Hydrograph: a:10OUT1 .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
1.517	1.43	3.0	203.3	206.1	1.42	117.35
1.534	1.28	2.7	203.2	206.0	1.39	117.29
1.550	1.14	2.4	202.9	205.6	1.36	117.24
1.567	1.00	2.1	202.4	205.1	1.31	117.17
1.584	0.86	1.9	201.8	204.3	1.25	117.07
1.600	0.71	1.6	201.0	203.4	1.20	116.99
1.617	0.57	1.3	199.9	202.2	1.19	116.97
1.634	0.43	1.0	198.5	200.9	1.18	116.94
1.650	0.29	0.7	196.9	199.2	1.17	116.91
1.667	0.14	0.4	195.0	197.3	1.16	116.87
1.684	0.00	0.1	192.9	195.1	1.14	116.83

********** SUMMARY OF ROUTING COMPUTATIONS **********

Pond File: a:SMBAPCH1.PND
Inflow Hydrograph: a:10IN1 .HYD
Outflow Hydrograph: a:10OUT1 .HYD

Starting Pond W.S. Elevation = 114.00 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow = 1.85 cfs
Peak Outflow = 1.42 cfs
Peak Elevation = 117.35 ft

***** Summary of Approximate Peak Storage *****

Initial Storage	=	0 cu-ft
Peak Storage From Storm	=	6,142 cu-ft
Total Storage in Pond	=	6,142 cu-ft

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*                                 *
*   SMITH MEMORIAL BAPTIST CHURCH *
*        FAMILY LIFE CENTER       *
*                                 *
*                                 *
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Inflow Hydrograph: a:100IN .HYD
Rating Table file: a:SMBAPCH1.PND

----INITIAL CONDITIONS----
Elevation = 114.00 ft
Outflow = 0.00 cfs
Storage = 0 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + O (cfs)
114.00	0.0	0	0.0	0.0
114.30	0.1	388	12.9	13.0
114.60	0.1	795	26.5	26.6
114.90	0.1	1,236	41.2	41.3
115.20	0.1	1,945	64.8	64.9
115.50	0.1	2,777	92.6	92.7
115.75	0.6	3,471	115.7	116.3
115.80	0.6	3,610	120.3	120.9
116.10	0.8	4,442	148.0	148.8
116.40	1.0	5,190	173.0	174.0
116.70	1.1	5,633	187.7	188.8
117.00	1.2	6,076	202.5	203.7
117.30	1.4	6,142	204.7	206.1
117.60	1.5	6,143	204.7	206.2
117.90	1.6	6,144	204.7	206.3
118.20	1.6	6,144	204.8	206.4
118.50	1.7	6,145	204.8	206.5
118.80	1.8	6,145	204.8	206.6
119.10	1.9	6,146	204.8	206.7
119.40	2.4	6,146	204.8	207.2
119.70	4.3	6,147	204.9	209.2
120.00	6.8	6,148	204.9	211.7
120.30	9.8	6,148	204.9	214.7
120.60	13.1	6,148	204.9	218.0

Time increment (t) = 0.017 hrs.

POND-2 Version: 5.20 S/N:
EXECUTED: 09-20-1999 12:30:24

Return Freq: 100 years

Pond File: a:SMBAPCH1.PND
Inflow Hydrograph: a:100IN .HYD
Outflow Hydrograph: a:100OUT1 .HYD

INFLOW HYDROGRAPH / ROUTING COMPUTATIONS

TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.000	0.00	-----	0.0	0.0	0.00	114.00
0.017	0.31	0.3	0.3	0.3	0.00	114.01
0.033	0.62	0.9	1.2	1.2	0.01	114.03
0.050	0.94	1.6	2.7	2.8	0.02	114.06
0.067	1.25	2.2	4.8	4.9	0.04	114.11
0.083	1.56	2.8	7.5	7.7	0.06	114.18
0.100	1.87	3.4	10.8	11.0	0.08	114.25
0.117	2.19	4.1	14.7	14.9	0.10	114.34
0.133	2.50	4.7	19.2	19.4	0.10	114.44
0.150	2.81	5.3	24.3	24.5	0.10	114.55
0.167	3.12	5.9	30.0	30.2	0.10	114.67
0.183	3.12	6.2	36.0	36.2	0.10	114.80
0.200	3.12	6.2	42.1	42.3	0.10	114.91
0.217	3.12	6.2	48.1	48.3	0.10	114.99
0.233	3.12	6.2	54.2	54.4	0.10	115.07
0.250	3.12	6.2	60.2	60.4	0.10	115.14
0.267	3.12	6.2	66.2	66.4	0.10	115.22
0.283	3.12	6.2	72.3	72.5	0.10	115.28
0.300	3.12	6.2	78.3	78.5	0.10	115.35
0.317	3.12	6.2	84.4	84.6	0.10	115.41
0.333	3.12	6.2	90.4	90.6	0.10	115.48
0.350	3.12	6.2	96.3	96.6	0.18	115.54
0.367	3.12	6.2	101.9	102.5	0.31	115.60
0.383	3.12	6.2	107.3	108.1	0.43	115.66
0.400	3.12	6.2	112.4	113.5	0.54	115.72
0.417	3.12	6.2	117.5	118.7	0.60	115.78
0.433	3.12	6.2	122.5	123.7	0.62	115.83
0.450	3.12	6.2	127.4	128.7	0.66	115.88
0.467	3.12	6.2	132.3	133.6	0.69	115.94
0.483	3.12	6.2	137.0	138.5	0.73	115.99
0.500	3.12	6.2	141.8	143.3	0.76	116.04
0.517	3.12	6.2	146.4	148.0	0.79	116.09
0.533	3.12	6.2	151.0	152.7	0.83	116.15
0.550	3.12	6.2	155.5	157.2	0.87	116.20
0.567	3.12	6.2	159.9	161.7	0.90	116.25
0.583	3.12	6.2	164.3	166.2	0.94	116.31
0.600	3.12	6.2	168.6	170.5	0.97	116.36
0.617	3.12	6.2	172.8	174.8	1.01	116.42
0.633	3.12	6.2	177.0	179.1	1.03	116.50
0.650	3.12	6.2	181.1	183.2	1.06	116.59
0.667	3.12	6.2	185.2	187.3	1.09	116.67
0.683	3.12	6.2	189.2	191.4	1.12	116.75
0.700	3.12	6.2	193.1	195.4	1.14	116.83
0.717	3.12	6.2	197.0	199.4	1.17	116.91
0.733	3.12	6.2	200.9	203.3	1.20	116.99

Pond File: a:SMBAPCH1.PND
Inflow Hydrograph: a:100IN .HYD
Outflow Hydrograph: a:100OUT1 .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.750	3.12	6.2	202.6	207.1	2.28	119.33
0.767	3.12	6.2	200.9	208.8	3.95	119.64
0.783	3.12	6.2	202.5	207.1	2.31	119.34
0.800	3.12	6.2	200.9	208.8	3.92	119.64
0.817	3.12	6.2	202.5	207.2	2.33	119.36
0.833	3.12	6.2	201.0	208.7	3.89	119.64
0.850	3.12	6.2	202.5	207.2	2.36	119.38
0.867	3.12	6.2	201.0	208.7	3.87	119.63
0.884	3.12	6.2	202.5	207.2	2.38	119.39
0.900	3.12	6.2	201.0	208.7	3.84	119.63
0.917	3.12	6.2	202.4	207.2	2.41	119.40
0.934	3.12	6.2	201.0	208.7	3.82	119.62
0.950	3.12	6.2	202.4	207.3	2.43	119.40
0.967	3.12	6.2	201.0	208.6	3.80	119.62
0.984	3.12	6.2	202.4	207.3	2.45	119.41
1.000	3.12	6.2	201.1	208.6	3.78	119.62
1.017	3.12	6.2	202.4	207.3	2.47	119.41
1.034	3.12	6.2	201.1	208.6	3.76	119.61
1.050	3.12	6.2	202.3	207.3	2.49	119.41
1.067	3.12	6.2	201.1	208.6	3.74	119.61
1.084	3.12	6.2	202.3	207.3	2.51	119.42
1.100	3.12	6.2	201.1	208.6	3.72	119.61
1.117	3.12	6.2	202.3	207.4	2.53	119.42
1.134	3.12	6.2	201.1	208.6	3.70	119.61
1.150	3.12	6.2	202.3	207.4	2.54	119.42
1.167	3.12	6.2	201.2	208.5	3.69	119.60
1.184	3.12	6.2	202.3	207.4	2.56	119.43
1.200	3.12	6.2	201.2	208.5	3.67	119.60
1.217	3.12	6.2	202.3	207.4	2.58	119.43
1.234	3.12	6.2	201.2	208.5	3.65	119.60
1.250	3.12	6.2	202.2	207.4	2.59	119.43
1.267	3.12	6.2	201.2	208.5	3.64	119.60
1.284	3.12	6.2	202.2	207.4	2.61	119.43
1.300	3.12	6.2	201.2	208.5	3.62	119.59
1.317	3.12	6.2	202.2	207.5	2.63	119.44
1.334	3.12	6.2	201.2	208.5	3.61	119.59
1.350	3.12	6.2	202.2	207.5	2.64	119.44
1.367	3.12	6.2	201.3	208.4	3.59	119.59
1.384	3.12	6.2	202.2	207.5	2.66	119.44
1.400	3.12	6.2	201.3	208.4	3.58	119.59
1.417	3.12	6.2	202.2	207.5	2.67	119.44
1.434	3.12	6.2	201.3	208.4	3.56	119.58
1.450	3.12	6.2	202.2	207.5	2.68	119.44
1.467	3.12	6.2	201.3	208.4	3.55	119.58
1.484	3.12	6.2	202.1	207.5	2.70	119.45
1.500	3.12	6.2	201.3	208.4	3.54	119.58

Pond File: a:SMBAPCH1.PND
Inflow Hydrograph: a:100IN .HYD
Outflow Hydrograph: a:100OUT1 .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
1.517	3.12	6.2	202.1	207.5	2.71	119.45
1.534	3.12	6.2	201.3	208.4	3.53	119.58
1.550	3.12	6.2	202.1	207.6	2.72	119.45
1.567	3.12	6.2	201.3	208.4	3.51	119.58
1.584	3.12	6.2	202.1	207.6	2.73	119.45
1.600	2.81	5.9	201.6	208.0	3.19	119.53
1.617	2.50	5.3	202.7	207.0	2.13	119.24
1.634	2.19	4.7	202.3	207.4	2.55	119.42
1.650	1.87	4.1	203.2	206.3	1.60	117.89
1.667	1.56	3.4	203.0	206.6	1.78	118.74
1.684	1.25	2.8	203.1	205.8	1.38	117.27
1.700	0.94	2.2	202.6	205.3	1.33	117.20
1.717	0.62	1.6	201.7	204.2	1.24	117.06
1.734	0.31	0.9	200.2	202.6	1.19	116.98
1.750	0.00	0.3	198.2	200.5	1.18	116.94

********** SUMMARY OF ROUTING COMPUTATIONS **********

Pond File: a:SMBAPCH1.PND
Inflow Hydrograph: a:100IN .HYD
Outflow Hydrograph: a:100OUT1 .HYD

Starting Pond W.S. Elevation = 114.00 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow	=	3.12 cfs
Peak Outflow	=	3.95 cfs
Peak Elevation	=	119.64 ft

***** Summary of Approximate Peak Storage *****

Initial Storage	=	0 cu-ft
Peak Storage From Storm	=	6,147 cu-ft

Total Storage in Pond	=	6,147 cu-ft

File:	1990072-000.01 DEWATER 10 Yr.	LANGLEY and McDONALD, P.C.
Project:	**Smith Memorial Baptist Church**	4029 Ironbound Rd, Suite 100
Location:	Str #2	Williamsburg, Virginia 23188
Design:	Bill Brown	
Date:	10/12/99	
Rev.:		

ORFICE SIZE	=	4	in.
STAGE INCREMENT	=	0.07	ft.
INVERT ELEV.	=	115.97	
UPPER RANGE	=	117.35	
COEFFICIENT	=	0.6	
CONSTANT	=	0.04375	
TOTAL VOLUME	=	26	cf

ELEV.	HEAD	FLOW
115.97	0.00	0.00
116.04	0.07	0.11
116.11	0.14	0.16
116.18	0.21	0.19
116.25	0.28	0.22
116.32	0.35	0.25
116.38	0.41	0.27
116.45	0.48	0.29
116.52	0.55	0.31
116.59	0.62	0.33
116.66	0.69	0.35
116.73	0.76	0.37
116.80	0.83	0.38
116.87	0.90	0.40
116.94	0.97	0.41
117.01	1.04	0.43
117.07	1.10	0.44
117.14	1.17	0.45
117.21	1.24	0.47
117.28	1.31	0.48
117.35	1.38	0.49

		6.31 cfs

AVG. FLOW RATE = 0.32 cfs

DETENTION TIME = 0.02 hrs.

File:	1990072-000.01 DEW	TER FULL		LANGLEY and McDONALD, P.C.
Project:	**Smith Memorial Baptist Church**			4029 Ironbound Rd, Suite 100
Location:	Str #2			Williamsburg, Virginia 23188
Design:	Bill Brown			
Date:	10/12/99			
Rev.:				

ORFICE SIZE	=	4	in.
STAGE INCREMENT	=	0.16	ft.
INVERT ELEV.	=	115.97	
UPPER RANGE	=	119.25	
COEFFICIENT	=	0.6	
CONSTANT	=	0.04375	
TOTAL VOLUME	=	56	cf

ELEV.	HEAD	FLOW
115.97	0.00	0.00
116.13	0.16	0.17
116.30	0.33	0.24
116.46	0.49	0.29
116.63	0.66	0.34
116.79	0.82	0.38
116.95	0.98	0.42
117.12	1.15	0.45
117.28	1.31	0.48
117.45	1.48	0.51
117.61	1.64	0.54
117.77	1.80	0.56
117.94	1.97	0.59
118.10	2.13	0.61
118.27	2.30	0.64
118.43	2.46	0.66
118.59	2.62	0.68
118.76	2.79	0.70
118.92	2.95	0.72
119.09	3.12	0.74
119.25	3.28	0.76

		9.73 cfs

AVG. FLOW RATE	=	0.49	cfs
DETENTION TIME	=	0.03	hrs.

TABLE 3

WORKSHEET FOR BMP POINT SYSTEM

A. STRUCTURAL BMP POINT ALLOCATION

BMP	BMP Points		Fraction of Site Served by BMP		Weighted BMP Points
DESIGN 9	10	x	91%	=	9.1
EXIST. BLDG INTO BMP	10	x	13%	=	1.3
		x		=	
		x		=	

TOTAL WEIGHTED STRUCTURAL BMP POINTS: 10.4

B. NATURAL OPEN SPACE CREDIT

Fraction of Site		Natural Open Space Credit (0.1 per 1%)		Points for Natural Open Space
	x		=	

C. TOTAL WEIGHTED POINTS

10.4	+	0	=	10.4
Structural BMP Points		Natural Open Space Points		TOTAL

TOTAL SITE 3.64 ACRES
THIS PHASE 1.23 ACRES

James City County, Virginia
Environmental Division
Stormwater Management Program

Stormwater Management Design Plan
Staff "Quick" Review

Plan No. SP - 118 - 99 Date/Time: 5/02/00 2:30 PM
Project Name: SMITH MEMORIAL BAPTIST CHURCH - FAMILY LIFE CENTER
Rough Location: US 60 WEST SIDE, 2000' NORTH INTX US 60 + CENTERVILLE RD SR 614.
ADC Map: Sheet 2 Grid: C - 11 ☒ First Review NOV 18 99
Flood Map / Zone: 510201- 00 20 Zone: X ☒ 2nd Review
Description: Outside 100-YEAR FLOODPLAIN.

Drainage Area: ☒ Onsite Only ☐ Offsite Only ☐ Combination of Both

Submitted:

Y	N		
☒	☐	Demolition Plan (If Applicable)	Sheets: C-3 (MINOR)
☒	☐	Site Plan	Sheets: C-3, C-4
☒	☐	Grading Plan	Sheets: C-4
☒	☐	Drainage Plan	Sheets: C-3, C-4
☒	☐	E&SC Plan	Sheets: C-3
☐	☒	Environmental Inventory	Sheets: C
☐	☐	Notes & Details	Sheets: C-5, C-6, C-7
☒	☐	Drainage Map(s)	C-3A Report
☒	☒	Soils Map	
☐	☐	Standard E&SC and SWM Checklist.	
☐	☒	E&SC Design Report (Attachment).	
☒	☐	Stormwater Management / Drainage Narrative.	Report dated Oct 13 + supplement April 7th
☒	☐	Stormwater Management Design Report (Attachment).	
☐	☐	Waivers, Variances, Exceptions included (Attached in Writing).	
		☐ VESCH ☐ CBPO ☐ Other,	
☐	☐	Other (List):	

JCC GIS Database: Zoning: B - 1 Tax Parcel ID: Gen. Business District (24-3)(01-0-0036)
Receiving Water: YARMOUTH CREEK Site Acreage: 3.674 acres / s.f.

Site Plan Information: Owner: SMITH MEMORIAL BAPTIST Church c/o Norman Neal 667-5238
REDEVELOPMENT PROJ. AREA = 1.23 AC.
Zoning: B - 1 Description: GEN BUSINESS DISTRICT
Site Area: 3.64 acres / s.f
Disturbed Area: 1.30 AC. acres / s.f. (35.7 %)
☐ Disturbance > 5 acres, NPDES Notice of Intent required.

TOTAL SITE = 95,119 SF IMP. IMPERV

Impervious: 2.1836 acres / s.f. (60.0 %)
☐ Less than or equal to 60 percent. Meets CBP Ordinance requirements.
☐ More than 60 percent. Does Not Meet CBP Ordinance requirements.

~~BMP BASED ON 60% IMP. 95119 SF = 2.1836 AC.~~

Open / Green Space: 1.4564 acres / s.f. (40.0 %)

PROJECT AREA 0.905 AC IMP. SITE = 1.43 63%

Site Development Plan:

☐ Residential, Lots, etc.	☐ Commercial (B / O / R)	☐ Industrial	☐ Governmental
☒ Roadways or Entrances	☒ Parking or Loading	☒ Water	☒ Sewer
☒ Landscaping	☒ SWM/BMP control	☒ Manmade Drainage	☐ Parks, Amenities
☐ Pump/Lift Station	☐ Dams	☐ Other, FAMILY LIFE CENTER (church) 9600 SF.	

0.905 AC IMP × 3630 CF/AC (1" WQV) = 3285 CF VOL. REQ'D

Soils Information: Site: 18B, 19B, 29A Hydric: ❒ Yes ☒ No B/C
Soil Survey Sheet DA: SAME HSG: 18B(B) / 19B(B/C) / 29A(C)
BMP: 18B, 29A Hydric: ❒ Yes ☒ No EH SLIGHT
Description of Soils at Site / DA / BMP: 18B Kempsville Fine Sandy Loam, mod. perm 2-6 in/hr upper, 0.6-2"/hr lower / 29A Fine Sandy Loam, perm. mod to mod slow to slow, 2-6"/hr. upper, 0.6-2 mid, 0.06-0.6 lower, High W.T. (slagle), EH slight

BMP Control: ❒ None ☒ Onsite ❒ Offsite ❒ Previous Approved
BMP Types: 1- Name: MANUFACT. BMP (JCC BMP Type _____ - _____), Points _____
2- Name: _____ (JCC BMP Type _____ - _____), Points _____

OnSite Drainage Type: ☒ Reinforced Concrete Pipe CL 3 ❒ Corrugated Metal Pipe ❒ Aluminum Type Pipe
❒ Corrugated Polyethylene Pipe ☒ PVC Type Pipe ❒ Open Channel Type
❒ Culverts Type: _____
❒ Other (Specify): INFILTRATOR UNIT BMP

1. VDOT Standards & Specifications Referenced for work within R/W: ☒ Yes ❒ No
2. VDOT Standards & Specifications Referenced for work outside R/W: ☒ Yes ❒ No

Site Limitations: ❒ RPA ❒ RMA ❒ Steep Slopes ❒ Delineated Wetlands
❒ Hydric Soils ❒ Critical Soils ❒ Vegetated ❒ Buffers
☒ Defined Natural Drainage Features onsite ❒ Downstream Storm/Culv.
❒ Evidence of Downstream Channel Erosion (by Field Observation) _____
❒ Floodplain or Problem Drainage Area ❒ Stormwater Hotspot
☒ Other (Specify): BACK EXIST PARCEL, DENSE WOODED

Site Stormwater Management / BMP Control (Add sheets if necessary for multiple facilities): 0.905 AC. IMP.

☒ Yes ❒ No (#1 / #2)	#1	#2
Predev (Present) DA = 0.71 / ac. C/CN = 0.40 /	Tc = 15 / min / hrs.	
2-year	1.12 cfs	cfs
10-year	1.46 cfs	cfs
100-year	1.98 cfs	cfs
PostDev w/o Detention DA = 1.29 / ac. C/CN = 0.80 /	Tc = 12 / min / hrs.	
2-year 3.83	4.43 cfs	cfs
10-year 4.92	5.97 cfs	cfs
100-year 8.49	10.03 cfs	cfs
PostDev w/ Detention DA = 1.29 / ac. C/CN = 0.80 /	Tc = 12 / min / hrs.	
2-year	0.88 cfs at El. 116.23	cfs at El.
10-year	1.42 cfs at El. 117.35	cfs at El.
100-year	3.89 cfs at El. 119.64	cfs at El.

Downstream Tailwater Assumption for Pond Routing: _____
Routed Peak Discharges (Outflows) from BMP - 1 meets Predevelopment Allowables: ❒ Yes ❒ No
Routed Peak Discharges (Outflows) from BMP - 2 meets Predevelopment Allowables: ❒ Yes ❒ No
Appears to Meet VESCH / E&SC Ordinance / CBP Ordinance Requirements: ❒ Yes ❒ No

Pond / BMP Design Data (Add Sheet If Necessary for Multiple Facilities): UNDERGROUND MFGR BMP INFILTRATOR SYSTEMS, INC.

☐ Check if None ☒ Provided: BMP # _____ Type: _____

Y	N				
☒	☐	Top of Facility	El.	121 ±	TOP OF PAVEMENT 121.18 TOP INLET
☒	☐	Design High Water	El.	119.64	
☒	☐	Emergency Spillway (E.S.) Crest	El.	119.25	BW: 2.5' ± 6" SS: RECT SLOT
☒	☐	FreeBoard		1.54'	1 ft. or > with E.S.
		☒ Acceptable ☐ Not Acceptable.			2 ft. or > w/o E.S.
☒	☐	Principal Spillway (Riser) Crest	El.	INFIL	Size/Type: 1" PER HOLE
☐	☐	Principal Spillway Crest 1 ft. below crest of emergency spillway.			☐ Yes ☐ No ☒ N/A
☒	☐	Stage-Storage Curve or Data			
☒	☐	Outlet Rating Curve or Table (Discharge Structure Rating)			0.085519 CFS CONSTANT DRAW DOWN
☐	☒	1-year design storm	El.	_____	or Volume _____
☐	☒	1-year, 24 hour detention criteria for stream channel protection.			☐ Yes ☐ No ☒ N/A
☐	☒	Extended Detention Provided (Min. 24 hours)			☐ Yes ☐ No ☐ N/A
☐	☒	Normal/Permanent Pool	El.	N/A	
☒	☐	Orifice/Weir #1 (highest El.)	El.	119.25	Type: _____
☐	☒	Orifice/Weir #2	El.	_____	Type: _____
☐	☐	Orifice/Weir #3	El.	_____	Type: _____
☐	☐	Orifice/Weir #4	El.	_____	Type: _____
☒	☐	Orifice/Weir #5 (lowest El.)	El.	115.25	Type: 6" DRAIN.
☐	☒	Low Flow Orifice (ExDet, CPv)	El.	_____	Type: _____
☐	☒	Pond Drain w/ Valve	El.	_____	Type: _____
☒	☐	Pond Bottom	El.	114 ±	Riser Height: N/A
☐	☒	Steps or Access Provided (for over 4 ft. depth)			
☐	☒	Riser Base	Bottom El.	_____	Type: _____
☐	☒	Core Trench			
☐	☒	Anti-Seep Collars or other acceptable Seepage Control Method.			
☐	☐	Principal Spillway Anti-Vortex Device and Trash Rack.			Type: _____
☐	☐	Low Flow Orifice Cage-Type Trash Rack.			Type: _____
☐	☐	Outlet Barrel:	Type/Class: _____		Size: _____
			Inv. U/S: _____		Inv D/S: _____
			Slope: _____		Length: _____ (ft.)
☐	☐	Flared End Section. Matches Outlet Barrel material type.			
☐	☐	Outlet Protection.			
		☐ Standard riprap outlet protection (OP)			Type: _____
		☐ Special Dissipator Structure (SDS)			Type: _____
☐	☐	Sediment / Cleanout Elevation		El. _____	or Depth _____
☐	☐	Adequate Channel Downstream of BMP using MS #19 or 1-year, 24-hour detention criteria.			

Sketch and Notes, If Needed: INFILTRATOR CHAMBER H-20 UNIT. PE CHAMBER SYSTEM, 1112.5 L.F. (21 ROWS) BASED ON 1" WQV. 3458 CF 2047 CF RQD BASED ON 0.9047 AC. IMPERV AREA IN 1.43 AC SITE. REDEV OF 3.64 AC. SITE.

Sediment Trap & Basins

N/A
☐ Temporary Sediment Trap # 1 _____ DA = _____ < 3 acres
☐ Temporary Sediment Trap # 2 _____ DA = _____ < 3 acres
☐ Temporary Sediment Trap # 3 _____ DA = _____ < 3 acres

N/A
☐ Temporary Sediment Basin # 1 _____ DA = _____ ☐ BMP # ____ convert.
☐ Temporary Sediment Basin # 2 _____ DA = _____ ☐ BMP # ____ convert.

Plan Review Steps & Components:

Y	N	
☒	☐	First "Look-Thru". Quick look through plan for familiarity.
☒	☐	Worksheet for BMP Point System. Check for 10 BMP points. N/A DO NOT ASSIGN VALUES FOR MANUF. SYSTEM
☒	☐	FEMA Special Flood Hazard Area check against property, site and development.
☒	☐	Check Tax Parcel Maps for RPA/RMA and parcel location.
☐	☒	Stormwater hotspot, general screening, layout or separation distances (if any) are satisfied. 40'<100'
☒	☐	Environmental Inventory components based on Chesapeake Bay Ordinance requirements.
☒	☐	Highlight environmental sensitive areas (wetlands, RPA, steep slope,etc.).
☒	☐	Demolition plan (if any) and identification of offsite LD, borrow, waste areas and E&SC.
☒	☐	Review existing topography to determine adequacy of E&SC plan (Phase I).
☒	☐	Review grading plan to check for conflicts (offsite grading, cut-fills, slopes,) & Phase II E&SC.
☒	☐	Review layout plan to check for conflicts (buildings, parking, buffers, etc.).
☒	☐	Highlight storm drain system. Check for major utility conflicts and cover situations.
☒	☐	Review storm drain system specifications, notes, and details.
☒	☐	Review sequence of construction (for E&SC and SWM/BMP plan purposes).
☒	☒	Review plan based on Chapter 19 Subdivision ordinance as it relates to SWM. N/A
☒	☐	Review plan based on Chapter 24 Zoning as it relates to SWM.
☒	☐	Review plan based on Chapter 23 Chesapeake Bay ordinance requirements.
☒	☐	Review plan based on General Knowledge and Experience for Design/Construction.
☒	☐	Review plan based on JCC BMP manual for the BMP type selected for project. N/A MFG. BMP
☐	☒	Review plan based on JCC Stormwater Conveyance System D/C Guidelines (Future).
☒	☐	Review plan based on Virginia Erosion and Sediment Control Handbook (VESCH).
☒	☐	Review plan based on Virginia Stormwater Management Handbook (VSMH). (3.10E)
☒	☐	Review plan based on Hampton Roads BMP Design Guidance manual (Optional). UNDERGROUND DET.
☒	☐	Review plan based on MWCOG, Controlling Urban Runoff BMP manual (Optional). INFILT. BASIN
☒	☐	Review plan based on standard JCC E&SC and SWM Design Plan Checklists.
☐	☒	Review plan based on JCC BMP Construction Specifications (Future).
☒	☐	Review Maintenance Plan for SWM / BMP facility.
☒	☐	Review E&SC Plan Design Report and computations (Attachment).
☒	☐	Review SWM Design Report and computations (Attachment). Hydrology & Hydraulics.
☒	☐	Adequate Channel downstream of both uncontrolled or BMP areas.
☒	☐	Adequate function of BMPs used as Temp. Sed. Basins (storage volume, discharge, WSEL).
☒	☐	Geotechnical. Information per App. E JCC BMP manual or to substantiate use of other BMPs.
☒	☐	Provisions on plan requiring proper As-Built and Certification of facility during construction.
☒	☐	Inclusion of SWM/BMP data into any Departmental databases.
☒	☐	~~Reserved.~~ Complete Review of INFILTRATOR SYSTEM, Inc. H20 INFILTRATOR CHAMBER PERVULT LIT. SUBMITTED APRIL 14TH 2000.

Prepared Environmental Division comments for the following categories based on above review areas:

☐	☐	***General Comments:***	☐ ☐	***Erosion & Sediment Control Plan:***
☐	☐	***Floodplain:***	☐ ☐	***Chesapeake Bay Preservation:***
☐	☐	***Stormwater Management / Drainage:***		

Additional Notes & Comments: Appears OK To meet WQ compliance (1" per imp. ac.) Temp. Control of runoff to BMP cell. East uncontrolled parking area. INFILT. SEPARATION, GEOTECH @ B-6, MINOR BMP DETAIL ISSUES. & MAINT. PLAN

(Note: THIS FORM FOR COUNTY USE ONLY.)

☐ 1st Rev ☒ 2nd Rev ☐ 3rd Rev

Signature 05-04-00
Date

GEOTECHNICAL ENGINEERING STUDY

Family Life Center
Smith Memorial Baptist Church
Williamsburg, Virginia
(SP-118-99)

GEOTECH REPORT
INFIL. FACILITY NOTES

- NO LAB TESTING PERFORMED ON BASIN SAMPLES.
- NO INFILT. /PERC RATE TESTS ~~ESTIMATE~~ FOR BASIN SAMPLES. BY CLASSIFICATION AVG. 1" PER HOUR IF DEPTH 6.5-7.0' CAN USE 2.0"/HR.
- WET SOIL CONDITIONS ENCOUNTERED IN B-6 (BASIN) ABOUT 4' BELOW EXIST GROUND. SUGGESTS GW SEEPAGE IN VICINITY OF BORING ON TRANSIENT BASIS.

REPORT

PROJECT

Geotechnical Engineering Study
Family Life Center
Smith Memorial Baptist Church
Williamsburg, Virginia

CLIENT

Smith Memorial Baptist Church
6515 Richmond Road
Williamsburg, Virginia 23188-7204

SUBMITTED BY

Atlantic Geotechnical Services, Inc.
10971 Richardson Road
Ashland, Virginia 23005

DATE

August 5, 1999

GEOTECHNICAL ENGINEERING STUDY

Family Life Center
Smith Memorial Baptist Church
Williamsburg, Virginia

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APPENDIX

Figure 1:	Plan of Borings
Figures 2 - 4:	Logs of Building Borings
Table 1:	Logs of Basin Borings

ATLANTIC GEOTECHNICAL SERVICES, INC.
Geotechnical + Materials Testing + Environmental

August 5, 1999
AGS Report No. RG99-550

Mr. F. Norman Neal, Jr.
Smith Memorial Baptist Church
6515 Richmond Road
Williamsburg, Virginia 23188-7204

Reference: Geotechnical Engineering Study
Family Life Center
Smith Memorial Baptist Church
Williamsburg, Virginia

Dear Mr. Neal:

Presented here is our geotechnical engineering report for the above referenced building addition to Smith Memorial Baptist Church, located at 6515 Richmond Road in Williamsburg, Virginia. Written authorization for this study was received on July 22, 1999.

Purposes and Scope of Work

The purposes of this study are to provide information suitable for James City County to issue the necessary building permit and to provide you with foundation design and construction information. This investigation consisted of several phases of work. These include:

- Field Exploration Programs
- Laboratory Testing Program
- Engineering Analysis

The results of all these phases are included in this geotechnical report. Investigation of man-made features (i.e., excavations, mines, shafts, etc.) was not included within the scope of this study.

10971 Richardson Road, Ashland, Virginia 23005 • 804-550-2203 • FAX 804-550-2204

Principal Findings and Conclusions

Presented below are the principal findings and conclusions for foundation design obtained from our geotechnical investigation at this site:

1) Soils encountered within the vertical reaches of the test borings consist predominantly of low plasticity (low shrink-swell potential), silty sands and clayey sands.

2) Footings should be founded at a minimum depth of 18 inches below perimeter finished and extended through all soft soils and/or topsoil.

3) Footing width should be at least 12 inches for slab turndown footings and 30 inches for widened column pads; minimum reinforced footing thickness of 12 inches.

4) Natural soils can provide a 2000 psf bearing capacity.

Field Exploration Program

Building Borings. Subsurface conditions within the building footprint were explored by drilling three sample borings at the approximate locations shown on the Plan of Boring (Figure 1) in the Appendix of this report. The building borings were drilled to a depth of 10 feet below existing grade. The building boring locations were staked in the field by the AGS Geotechnical Engineer using tape and right angle measurements from property pins and existing building corners. Drilling and sampling activities were performed by Ayers & Ayers, Inc. of Powhatan, Virginia under the coordination of AGS personnel.

The building borings were advanced using a four-wheel drive, truck-mounted drill rig and hollow-stem auger drilling techniques. A small dozer was used to provide drill rig access to the building boring locations. Soil samples were obtained in the building borings using Standard Penetration Test (SPT) procedures (ASTM D 1587) at approximate 2-ft intervals. All building soil samples obtained were sealed in protective containers and returned to our laboratory for further classification and

testing. Logs of stratigraphic conditions encountered in the building borings are presented on Figures 2 through 4 in the Appendix.

Water levels were recorded within the hollow stem augers upon completion of drilling as well as within the open boreholes immediately following removal of the augers from the ground. For safety purposes, the boreholes were backfilled with the soil auger cuttings prior to departure from the site. Water levels recorded in the augers and open boreholes are presented on the boring logs.

Basin Borings. Prior to completion of our study, the Civil Engineers (Langley and McDonald, Inc.) requested additional information concerning soil conditions and associated percolation rates for infiltration structure considerations in the stormwater management basin proposed northwest of the building footprint. Subsurface conditions in the stormwater management basin area were explored by drilling three hand-auger borings at locations selected by the Civil Engineers (see Figure 1 in the Appendix). The basin borings were located in the field by an AGS field engineering technician using tape and right angle measurements from existing building corners and property pins.

The basin borings were extended to a depth of about 8 feet below existing grades using hand auger techniques in general accordance with ASTM D 1452. In this procedure, the auger borings were made by rotating and advancing the auger bucket to the desired depths while periodically removing the bucket from the hole to remove, observe, and save auger cuttings.

Auger samples collected from the basin borings were visually classified by an AGS Geotechnical Engineer. Detailed descriptions of soil conditions found in the basin borings are presented on Table 1 in the Appendix to this report. As agreed, no laboratory testing was conducted on the basin boring samples.

Laboratory Soil Tests

Soil samples recovered from the field exploration program for the building were tested to classify the soils. Natural moisture content and percent fines (minus No. 200 sieve) tests were performed in our laboratory. Results of the laboratory tests are presented graphically on the individual boring logs provided in the Appendix to this report.

Subsurface Conditions

Stratigraphy. Soils penetrated within the vertical reaches of the test borings consist predominantly of multi-hued (brown, red, yellow and gray), fine-graded, silty sands and clayey sands. Exceptions include low to moderately plastic, very sandy clays encountered within the near-surface soil profile in two of the basin borings. A fines content (defined as silt and clay particles) of 33 percent was measured for one specimen of the silty/clayey sands. Natural soil moisture contents measured in the silty/clayey sands varied between 4 and 17 percent at the time of our field exploration, with soil moisture contents generally increasing with depth. Standard penetration resistance values recorded in the silty/clayey sands vary between 5 and 17 blows per foot of sampler penetration, indicating loose to medium dense relative densities.

Ground Water. Ground water was not encountered within the building borings either during or immediately upon completion of drilling. The building boreholes remained "dry" upon removal of the augers from the ground, although sidewall caving occurred in all building boreholes at depths varying from 4 to 4.5 feet below existing grades.

With respect to the basin borings, ground water was not encountered in the open boreholes during or immediately upon completion of hand augering. However, wet soil conditions were encountered in Boring B-6 at an approximate depth of 4 feet below

existing grade, suggesting possible groundwater seepage in the vicinity of this boring location on a transient basis.

Foundation Design and Construction

Construction. The Family Life Center is expected to consist of a 120-ft by 80-ft, single-story (24-ft eave height), pre-engineered metal building with a monolithic, turndown ground floor slab. Light structural loads are anticipated for the church building addition. Based on the existing topography and proposed finished floor elevation of 124 feet, both cut and fill grading (plus or minus 2 to 3 feet in depth) is anticipated to achieve finished grade in the building footprint.

With respect to stormwater management, consideration is being given to substituting a below-ground infiltration system for the stormwater attenuation basin shown on the plans furnished. We understand the infiltration system will likely be 6 to 7 feet in depth.

Foundation Depth Criteria. Soils are checked to see that the footings will extend to a sufficient depth: (a) to develop adequate bearing capacity, (b) to resist soil and associated foundation movement due to frost penetration and heave, (c) to reduce foundation movement due to shrinkage and/or swelling of the soil beneath the footing with changing moisture contents, and (d) to extend below any deleterious soil, fill or topsoil.

Foundation Design Recommendations. With the light loading anticipated, the Family Life Center may be supported on the turndown slab proposed. The slab turndown footings and widened pads for column support should bear in the native, undisturbed silty/clayey sands and/or compacted structural fill materials comprised of

the native silty/clayey sands at a minimum depth of 18 inches **below perimeter finished grade**.

Turndown footings and widened column pads founded at the minimum specified depth may be designed using a soil bearing capacity of 2,000 psf. This allowable bearing capacity is expected to provide a factor of safety in excess of 2 with respect to the design soil shear strength, provided all structural fill materials are selected and placed in accordance with the recommendations presented in the **Earthwork Considerations** section of this report. To reduce the chances of localized shear bearing failure, the slab turndown footings should have a minimum width of 12 inches and widened column pads should have a least plan dimension of 30 inches. We recommend the footing concrete be a minimum 12-inches thick and sufficiently reinforced to prevent local shear failure.

Estimated settlements (1-inch total and 1/2-inch differential) are expected to be within acceptable limits provided the design and construction recommendations presented within this report are followed.

Foundation Construction. Foundations should be excavated immediately before concrete is due to be placed. Excavation depth should be in accordance with the recommendations provided above. If fill, topsoil, or a soft soil is found at the planned footing depth during excavation, it is recommended the Geotechnical Engineer be consulted to help ascertain what corrective action should be taken. Backhoes used to excavate foundations should preferably use a smooth (i.e., no teeth) bucket. Any loose or soft materials left in the bottom of the excavation should be removed. Concrete should not be placed on frozen soils. For excavations, OSHA guidelines should be followed relative to excavation stability and safety. Good construction practices (including following all local code requirements) should be followed throughout all footing, subgrade and other soil-related work.

Surface and Groundwater Control. The foundation excavation should be maintained in a dry condition until ready for placement of concrete. The outside ground surface should be sloped and/or the excavation protected to prevent surface water from running into the open excavation. If water does get into the excavation, it should be removed rapidly and any loose, wet or softened material left in the excavation bottom should be removed down to strong, natural soils. If soft, wet soil is present in the bottom of the footing excavation when the concrete is placed, then added settlement will occur during and after construction and the bearing capacity will be reduced.

Based on the soil borings, groundwater seepage is not expected to occur in the foundation excavation. Any groundwater seepage encountered in the footing excavations at the time of construction is expected to be minor in quantity and controllable using conventional sump and pump dewatering methods. After all footings have been installed, the footings should be protected from ponded water in or around footings.

Foundation Testing and Inspection. It is essential the foundation subgrade be tested and inspected prior to placement of concrete. The footing excavations should be examined by the Geotechnical Engineer or a County Inspector who is qualified in determining the in-place bearing capacity and settlement potential of soils at the proposed foundation depths to verify the footings are founded on the strong, natural soils found in this study (i.e., extending through all fills, topsoil, and any upper, weaker soils) or in compacted, select structural fill materials. The County Inspector or other representative (if used) should also verify the soil observed in the bottom of the footing excavation does not contain deleterious materials.

Drainage

Care should be taken to prevent substantial moisture change in the foundation soils during and after building construction. To help accomplish this, roof and surface runoff water should be directed away from the building. The exterior grade within 5 feet of the building should have a minimum ten percent slope (away from the structure) to prevent ponding close to the building. If water is allowed too near the footings, it can seep down and wet the soils beneath the footings which can result in footing movement and subsequent cracking. The above recommended features should not only be established, they must be maintained for the life of the structure.

Stormwater Management

Field testing associated with determining percolation rates for soils penetrated in borings drilled in the stormwater attenuation basin area was not included within the scope of work for this study. Instead, it was agreed percolation rates would be determined for soils penetrated in the basin borings by comparison of soil classifications on the boring logs with soil series classifications presented in the Soil Survey for James City County prepared by the Soil Conservation Service (SCS) of the United States Department of Agriculture.

A review of the SCS Soil Survey for James City County reveals the soils underlying the church site consist predominantly of fine sandy loams of the Kempsville Series. The SCS reports the soil profile in the Kempsville series to consist of a surficial 20-inch thick layer of fine sandy loams overlying sandy clay loams and fine sandy loams extending to a depth of 58 inches below ground, which in turn are underlain by stratified loamy sands to sandy clay loams extending to at least a depth of 68 inches below ground. This stratigraphy compares favorably with conditions encountered in both the building and basin borings.

The SCS Soil Survey reports the Kempsville series soils to possess moderate limitations to septic tank absorption fields due to slow percolation. Percolation rates presented for the Kempsville series soils in the SCS Soil Survey vary from 2.0 to 6.0 inches per hour for the fine sandy loams located within 20 inches of the ground surface, to 0.6 to 2.0 inches per hour for the underlying sandy clay loams and fine sandy loams.

Based on our past experience with similar soils, we anticipate percolation rates for the clayey sands and clayey, silty sands (SC and SM-SC soil classifications on the boring logs) will lie closer to the lower limits of the 0.6 to 2.0 inches per hour rates tabulated in SCS Soil Survey, while the silty to slightly silty sands (SM soil classifications on the boring logs) will exhibit percolation rates closer to the upper limits of the 0.6 to 2.0 inches per hour rates reported by the SCS. For this project, without the benefit of field percolation testing, we recommend an average percolation rate of 1.0 inch per hour be used for infiltration system design to account for the stratified nature of the silty sands and clayey sands. Should the systems extend greater than 6.5 to 7 feet below existing grade, that portion of the infiltration system extending below a depth of 6.5 to 7 feet may be designed using a percolation rate of 2.0 inches per hour to take advantage of the slightly silty sands encountered in the lower reaches of all basin borings.

Earthwork Considerations

Site Preparation. All vegetation, forest litter and topsoil should be stripped from proposed building and pavement areas. Upon completion of site stripping activities, the subgrade soils exposed in structural fill areas should be proofrolled with a loaded, tandem-axle dump truck or equally heavy, pneumatic-tired equipment in the presence of the Geotechnical Engineer to help identify near-surface soft areas. Weak, soft areas identified during subgrade proofrolling should be undercut to firm soils at the discretion of the Geotechnical Engineer and the resulting excavations backfilled using

structural fill materials selected and placed as described in a subsequent section of this report. In proposed cut areas, the proofrolling activities should be performed following completion of cut grading activities.

Select Structural Fill. Soils classified as GW, GP, GM, GC, SW, SP, SM and SC under the Unified Soil Classification System (USCS) are considered suitable for use as structural fill materials on this project. Imported materials proposed for use as structural fill materials on this project should be submitted to AGS for visual assessment and final approval.

With the exception of the topsoil layer, the soils underlying this site are considered suitable for reuse as structural fill materials in required fill areas. Some soil processing (i.e., spreading and discing) may be required between excavation and placement/compaction to adjust soil moisture contents to near-optimum conditions, particularly if earthwork activities for this project commence during wet seasons of the year.

It should be noted that some difficulty may be experienced in achieving specified compaction in structural fill materials containing little or no binder (fine soil particles) due to the moisture-sensitive nature of these soils. Furthermore, chances of soil caving increase in foundation and utility excavations completed in compacted granular soils (sands or gravels) containing little or no fines, particularly in open excavations completed prior to rainstorm events.

All structural fill materials should be placed in maximum 8-inch loose lifts and compacted to a minimum of 95 percent of the maximum dry density as determined by ASTM D 698 (standard Proctor compaction) procedures. The moisture content of the structural fill materials should be maintained within plus or minus 2 percent of optimum moisture content until permanently covered. AGS representatives should be present at

the site during structural fill placement activities to ensure that the structural fill materials satisfy the selection criteria presented in this report.

* * *

We hope this provides you with the information needed. Please call if you have any questions!

Sincerely,

ATLANTIC GEOTECHNICAL
SERVICES, INC.

A. Scot Harrell, P.E.
Manager, Geotechnical Engineering

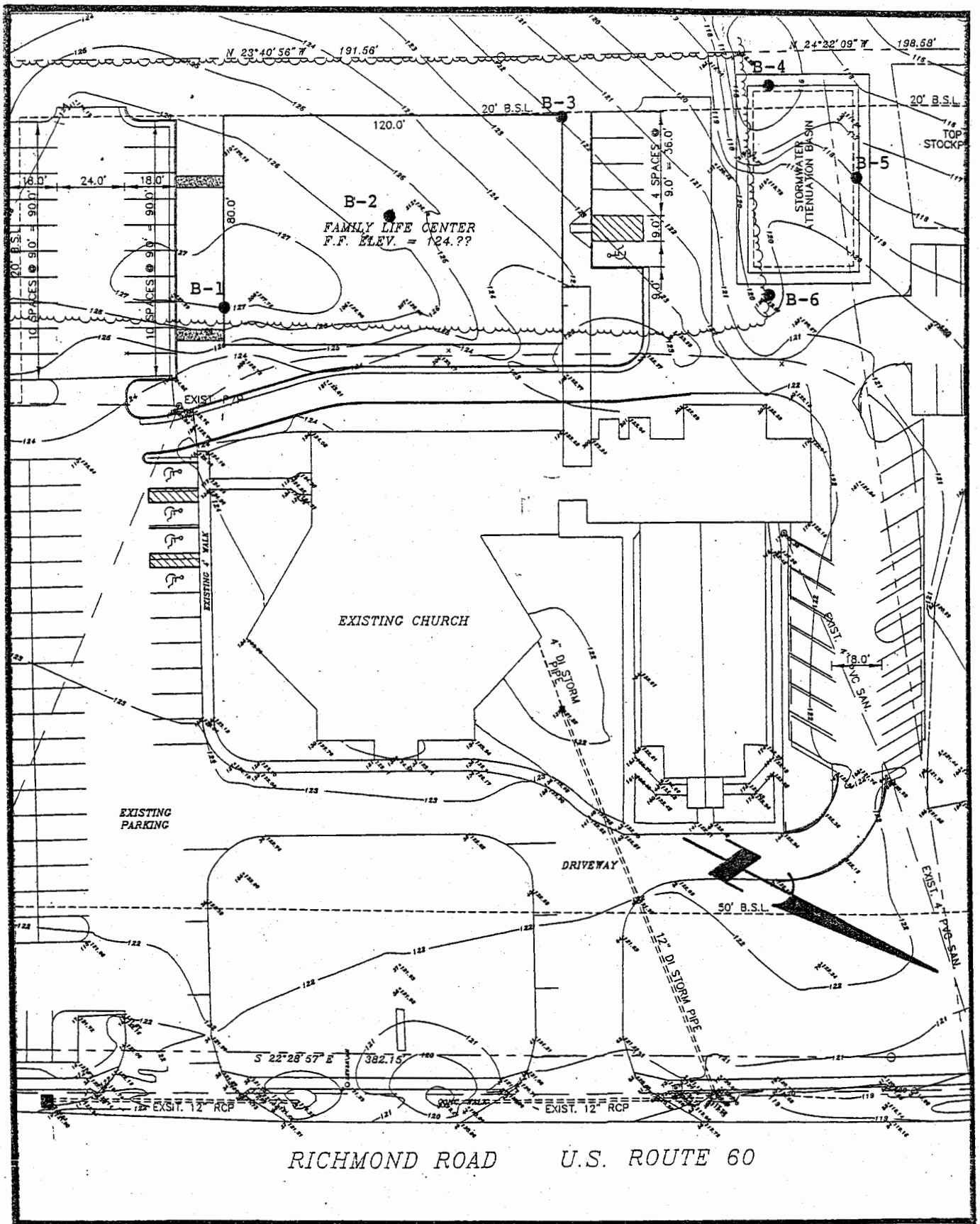
COMMONWEALTH OF VIRGINIA
A. SCOT HARRELL
NO. 026169
PROFESSIONAL ENGINEER

ASH/eab
Enclosures

Copies Submitted: Above (1)
Construction Management Group (2)
Langley and McDonald (2)

APPENDIX

Figure 1:	Plan of Borings
Figures 2 - 4:	Logs of Building Borings
Table 1:	Logs of Basin Borings



PLAN OF BORINGS

Family Life Center
Smith Memorial Baptist Church
Williamsburg, Virginia

RG99-550

Figure 1

OWNER	JOB #	BORING #	SHEET
SMITH MEMORIAL BAPTIST CHURCH	RG99-550	B-1	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
FAMILY LIFE CENTER	CONSTRUCTION MANAGEMENT GROUP

SITE LOCATION
6515 RICHMOND ROAD, WILLIAMSBURG, VIRGINIA

CALIBRATED PENETROMETER ○ TONS/FT^2 (1, 2, 3, 4, 5)
WATER CONTENT ● (%)
PLASTIC LIMIT +----------+ LIQUID LIMIT
STANDARD PENETRATION ⊗ (BLOWS/FT.) (10, 20, 30, 40, 50)

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 127.0 ft	FINES (%)	ELEVATION (FEET)
0	1	SS	18	Loose Dry Tan Fine Silty SAND (SM)		
				Medium Moist Dense Yellowish-Brown Slightly Clayey Silty SAND (SM)		
	2	SS	18	- loose below 2 feet		124
4	3	SS	18			
						120
8	4	SS	18	Loose Moist Yellowish-Tan Fine Clayey SAND (SC)		
	5	SS	18			
						116
12						
						112
16						
						108
20						
						104
24						
						100
28						

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES: IN-SITU THE TRANSITION MAY BE GRADUAL

WATER DEPTH IN BOREHOLE	BORING STARTED July 6, 1999	CAVE-IN DEPTH AT 4.0 ft
AFTER DRILLING Dry FT.	BORING COMPLETED July 6, 1999	DRILLING METHOD Hollow Stem Auger
AFTER 0.1 HRS: Dry FT.	DRILLER Ayers & Ayers, Inc.	

Figure 2

OWNER	JOB #	BORING #	SHEET
SMITH MEMORIAL BAPTIST CHURCH	RG99-550	B-2	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
FAMILY LIFE CENTER	CONSTRUCTION MANAGEMENT GROUP

SITE LOCATION
6515 RICHMOND ROAD, WILLIAMSBURG, VIRGINIA

CALIBRATED PENETROMETER ○ TONS/FT^2 (1, 2, 3, 4, 5)
WATER CONTENT ● (%)
PLASTIC LIMIT +----------+ LIQUID LIMIT
STANDARD PENETRATION ⊗ (BLOWS/FT.) (10, 20, 30, 40, 50)

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 125.5 ft	FINES (%)	ELEVATION (FEET)
0	1	SS	18	Loose Dry Light Grayish-Tan Fine Silty Silty SAND (SM)		
				Medium Dense Yellowish-Brown Fine Clayey SAND (SC)		124
	2	SS	18	Loose Dry Yellowish-Tan Fine Slightly Silty SAND (SM)		
4	3	SS	18	- medium dense below 4 feet		120
8	4	SS	18	Medium Dense Moist Light Brown/Gray/ Light Red Fine Clayey SAND (SC)		
	5	SS	18	- light gray and light brown below 8.5 feet		116
12						112
16						108
20						104
24						100
28						

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES: IN-SITU THE TRANSITION MAY BE GRADUAL

WATER DEPTH IN BOREHOLE	BORING STARTED July 6, 1999	CAVE-IN DEPTH AT 4.5 ft
AFTER DRILLING Dry FT.	BORING COMPLETED July 6, 1999	DRILLING METHOD Hollow Stem Auger
AFTER 0.1 HRS: Dry FT.	DRILLER Ayers & Ayers, Inc.	

Figure 3

OWNER	JOB #	BORING #	SHEET
SMITH MEMORIAL BAPTIST CHURCH	RG99-550	B-3	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
FAMILY LIFE CENTER	CONSTRUCTION MANAGEMENT GROUP

SITE LOCATION
6515 RICHMOND ROAD, WILLIAMSBURG, VIRGINIA

CALIBRATED PENETROMETER ○ TONS/FT² (1, 2, 3, 4, 5)
WATER CONTENT ● (%)
PLASTIC LIMIT +----------+ LIQUID LIMIT
STANDARD PENETRATION ⊗ (BLOWS/FT.) (10, 20, 30, 40, 50)

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 122.0 ft	FINES (%)	ELEVATION (FEET)
0	1	SS	18	Loose Dry Grayish-Tan to Tan Fine Slightly Silty SAND (SM)		
	2	SS	18	Loose Moist Yellowish-Brown Fine Clayey SAND (SC)	33	120
4	3	SS	18	Loose Moist Yellowish-Tan Fine Slightly Clayey Silty SAND (SM)		116
8	4	SS	18	Loose Moist Yellowish-Tan Fine Clayey SAND (SC)		
	5	SS	18	- medium dense, light brown/gray/ light red below 8.5 feet		112
12						108
16						104
20						100
24						96
28						

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES: IN-SITU THE TRANSITION MAY BE GRADUAL

WATER DEPTH IN BOREHOLE	BORING STARTED July 6, 1999	CAVE-IN DEPTH AT 4.0 ft
AFTER DRILLING Dry FT.	BORING COMPLETED July 6, 1999	DRILLING METHOD Hollow Stem Auger
AFTER 0.1 HRS: Dry FT.	DRILLER Ayers & Ayers, Inc.	

Figure 4

TABLE 1 - LOGS OF BASIN BORINGS

Family Life Center
Smith Memorial Baptist Church
Williamsburg, Virginia

Depth, ft	Soil Description	
Boring B-4		
0.0 - 1.5	Orangish-Brown Moist Very Sandy CLAY (CL)	
1.5 - 3.5	Orangish-Tan Moist Fine Clayey Silty SAND (SM-SC)	
	- slightly clayey below 2.5 feet	
3.5 - 5.5	Orangish-Tan Moist Fine Slightly Silty SAND (SM)	
5.5 - 6.5	Orangish-Tan and Light Gray Moist Fine Clayey SAND (SC)	
6.5 - 8.0	Orangish-Tan and Beige Moist Fine Slightly Silty SAND (SM)	
	Boring Terminated at 8 feet	
Boring B-5		
0.0 - 1.5	Light Brown Moist Very Sandy CLAY (CL)	SM, SC, SM
1.5 - 3.5	Orangish-Tan Moist Fine Clayey Silty SAND (SM-SC)	SM-SC, SM-SC
3.5 - 5.5	Orangish-Tan Moist Fine Silty SAND (SM)	SM
	- slightly silty, yellowish-tan below 4 feet	
5.5 - 6.5	Yellowish-Tan Moist Fine Clayey Silty SAND (SM-SC)	
6.5 - 8.0	Yellowish-Tan Moist Fine Slightly Silty SAND (SM)	
	Boring Terminated at 8 feet	
Boring B-6		
0.0 - 2.5	Grayish-Brown Moist Fine Slightly Silty SAND (SM) with roots (Topsoils)	
2.5 - 3.0	Orangish-Brown Moist Fine Clayey Silty SAND (SM-SC)	
3.0 - 4.0	Tan Very Moist Fine Slightly Silty SAND (SM)	
4.0 - 6.5	Orangish-Tan Wet Fine Clayey Silty SAND (SM-SC)	
	- very moist, orangish-brown and beige below 5 feet	
	- slightly clayey, very moist, orangish-tan below 6 feet	
6.5 - 8.0	Orangish-Tan Moist Fine Silty SAND (SM)	
	- slightly silty, yellowish-tan below 7.5 feet	
	Boring Terminated at 8 feet	

BASIN BOTTOM

WET SOIL CONDITIONS ENCOUNTERED AT BASIN BORING B-6 @ 4' BELOW EXIST GRADE (APPROX. EL. 116). GEOTECH REPORT SUGGESTS POSSIBLE GW SEEPAGE IN THE VICINITY OF THIS BORING ON A TRANSIENT BASIS

(P.5)

GEOTECHNICAL ENGINEERING STUDY

Family Life Center
Smith Memorial Baptist Church
Williamsburg, Virginia

▷ NO LABORATORY Testing was conducted on BASIN Boring Samples (B-4, B-5, B-6). Perc. Rate based on boring log + soil survey soil classification. (FIELD Testing to determine Percolation Rates)

18B Kempsville B
SOILS

▷ Design f_c = 1.0"/HOUR consistent w/ sandy loam, HSG B 1.02"/HOUR.

▷ Bottom 6'± (EL. 114.0)

▷ SCS 18B, 0.6-2"/HOUR

▷ wet soils found @ basin boring B-6 @ 4' Depth (EL. 116± OR 2' ABOVE BASIN FLOOR)

▷ CLASSIFICATION @ BOTTOM OF BASIN

SM silty SAND, SAND-SILT MIXTURE
SC clayey sand, sand-clay MIXTURE
SM-SC

REPORT

PROJECT

Geotechnical Engineering Study
Family Life Center
Smith Memorial Baptist Church
Williamsburg, Virginia

CLIENT

Smith Memorial Baptist Church
6515 Richmond Road
Williamsburg, Virginia 23188-7204

SUBMITTED BY

Atlantic Geotechnical Services, Inc.
10971 Richardson Road
Ashland, Virginia 23005

DATE

August 5, 1999

GEOTECHNICAL ENGINEERING STUDY

Family Life Center
Smith Memorial Baptist Church
Williamsburg, Virginia

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APPENDIX

Figure 1:	Plan of Borings
Figures 2 - 4:	Logs of Building Borings
Table 1:	Logs of Basin Borings

ATLANTIC GEOTECHNICAL SERVICES, INC.
Geotechnical + Materials Testing + Environmental

August 5, 1999
AGS Report No. RG99-550

Mr. F. Norman Neal, Jr.
Smith Memorial Baptist Church
6515 Richmond Road
Williamsburg, Virginia 23188-7204

Reference: Geotechnical Engineering Study
Family Life Center
Smith Memorial Baptist Church
Williamsburg, Virginia

Dear Mr. Neal:

Presented here is our geotechnical engineering report for the above referenced building addition to Smith Memorial Baptist Church, located at 6515 Richmond Road in Williamsburg, Virginia. Written authorization for this study was received on July 22, 1999.

Purposes and Scope of Work

The purposes of this study are to provide information suitable for James City County to issue the necessary building permit and to provide you with foundation design and construction information. This investigation consisted of several phases of work. These include:

- Field Exploration Programs
- Laboratory Testing Program
- Engineering Analysis

The results of all these phases are included in this geotechnical report. Investigation of man-made features (i.e., excavations, mines, shafts, etc.) was not included within the scope of this study.

10971 Richardson Road, Ashland, Virginia 23005 • 804-550-2203 • FAX 804-550-2204

Principal Findings and Conclusions

Presented below are the principal findings and conclusions for foundation design obtained from our geotechnical investigation at this site:

1) Soils encountered within the vertical reaches of the test borings consist predominantly of low plasticity (low shrink-swell potential), silty sands and clayey sands.

2) Footings should be founded at a minimum depth of 18 inches below perimeter finished and extended through all soft soils and/or topsoil.

3) Footing width should be at least 12 inches for slab turndown footings and 30 inches for widened column pads; minimum reinforced footing thickness of 12 inches.

4) Natural soils can provide a 2000 psf bearing capacity.

Field Exploration Program

Building Borings. Subsurface conditions within the building footprint were explored by drilling three sample borings at the approximate locations shown on the Plan of Boring (Figure 1) in the Appendix of this report. The building borings were drilled to a depth of 10 feet below existing grade. The building boring locations were staked in the field by the AGS Geotechnical Engineer using tape and right angle measurements from property pins and existing building corners. Drilling and sampling activities were performed by Ayers & Ayers, Inc. of Powhatan, Virginia under the coordination of AGS personnel.

The building borings were advanced using a four-wheel drive, truck-mounted drill rig and hollow-stem auger drilling techniques. A small dozer was used to provide drill rig access to the building boring locations. Soil samples were obtained in the building borings using Standard Penetration Test (SPT) procedures (ASTM D 1587) at approximate 2-ft intervals. All building soil samples obtained were sealed in protective containers and returned to our laboratory for further classification and

testing. Logs of stratigraphic conditions encountered in the building borings are presented on Figures 2 through 4 in the Appendix.

Water levels were recorded within the hollow stem augers upon completion of drilling as well as within the open boreholes immediately following removal of the augers from the ground. For safety purposes, the boreholes were backfilled with the soil auger cuttings prior to departure from the site. Water levels recorded in the augers and open boreholes are presented on the boring logs.

Basin Borings. Prior to completion of our study, the Civil Engineers (Langley and McDonald, Inc.) requested additional information concerning soil conditions and associated percolation rates for infiltration structure considerations in the stormwater management basin proposed northwest of the building footprint. Subsurface conditions in the stormwater management basin area were explored by drilling three hand-auger borings at locations selected by the Civil Engineers (see Figure 1 in the Appendix). The basin borings were located in the field by an AGS field engineering technician using tape and right angle measurements from existing building corners and property pins.

EL. 114 BOTTOM BASIN

The basin borings were extended to a depth of about 8 feet below existing grades using hand auger techniques in general accordance with ASTM D 1452. In this procedure, the auger borings were made by rotating and advancing the auger bucket to the desired depths while periodically removing the bucket from the hole to remove, observe, and save auger cuttings.

Auger samples collected from the basin borings were visually classified by an AGS Geotechnical Engineer. Detailed descriptions of soil conditions found in the basin borings are presented on Table 1 in the Appendix to this report. As agreed, no laboratory testing was conducted on the basin boring samples.

Laboratory Soil Tests

Soil samples recovered from the field exploration program for the building were tested to classify the soils. Natural moisture content and percent fines (minus No. 200 sieve) tests were performed in our laboratory. Results of the laboratory tests are presented graphically on the individual boring logs provided in the Appendix to this report.

Subsurface Conditions

Stratigraphy. Soils penetrated within the vertical reaches of the test borings consist predominantly of multi-hued (brown, red, yellow and gray), fine-graded, silty sands and clayey sands. Exceptions include low to moderately plastic, very sandy clays encountered within the near-surface soil profile in two of the basin borings. A fines content (defined as silt and clay particles) of 33 percent was measured for one specimen of the silty/clayey sands. Natural soil moisture contents measured in the silty/clayey sands varied between 4 and 17 percent at the time of our field exploration, with soil moisture contents generally increasing with depth. Standard penetration resistance values recorded in the silty/clayey sands vary between 5 and 17 blows per foot of sampler penetration, indicating loose to medium dense relative densities.

Ground Water. Ground water was not encountered within the building borings either during or immediately upon completion of drilling. The building boreholes remained "dry" upon removal of the augers from the ground, although sidewall caving occurred in all building boreholes at depths varying from 4 to 4.5 feet below existing grades.

With respect to the basin borings, ground water was not encountered in the open boreholes during or immediately upon completion of hand augering. However, wet soil conditions were encountered in Boring B-6 at an approximate depth of 4 feet below

(El. 116±)
(2' ABVE BASIN BOTTOM)

existing grade, suggesting possible groundwater seepage in the vicinity of this boring location on a transient basis.

Foundation Design and Construction

Construction. The Family Life Center is expected to consist of a 120-ft by 80-ft, single-story (24-ft eave height), pre-engineered metal building with a monolithic, turndown ground floor slab. Light structural loads are anticipated for the church building addition. Based on the existing topography and proposed finished floor elevation of 124 feet, both cut and fill grading (plus or minus 2 to 3 feet in depth) is anticipated to achieve finished grade in the building footprint.

With respect to stormwater management, consideration is being given to substituting a below-ground infiltration system for the stormwater attenuation basin shown on the plans furnished. We understand the infiltration system will likely be 6 to 7 feet in depth.

Foundation Depth Criteria. Soils are checked to see that the footings will extend to a sufficient depth: (a) to develop adequate bearing capacity, (b) to resist soil and associated foundation movement due to frost penetration and heave, (c) to reduce foundation movement due to shrinkage and/or swelling of the soil beneath the footing with changing moisture contents, and (d) to extend below any deleterious soil, fill or topsoil.

Foundation Design Recommendations. With the light loading anticipated, the Family Life Center may be supported on the turndown slab proposed. The slab turndown footings and widened pads for column support should bear in the native, undisturbed silty/clayey sands and/or compacted structural fill materials comprised of

the native silty/clayey sands at a minimum depth of 18 inches **below perimeter finished grade**.

Turndown footings and widened column pads founded at the minimum specified depth may be designed using a soil bearing capacity of 2,000 psf. This allowable bearing capacity is expected to provide a factor of safety in excess of 2 with respect to the design soil shear strength, provided all structural fill materials are selected and placed in accordance with the recommendations presented in the **Earthwork Considerations** section of this report. To reduce the chances of localized shear bearing failure, the slab turndown footings should have a minimum width of 12 inches and widened column pads should have a least plan dimension of 30 inches. We recommend the footing concrete be a minimum 12-inches thick and sufficiently reinforced to prevent local shear failure.

Estimated settlements (1-inch total and 1/2-inch differential) are expected to be within acceptable limits provided the design and construction recommendations presented within this report are followed.

Foundation Construction. Foundations should be excavated immediately before concrete is due to be placed. Excavation depth should be in accordance with the recommendations provided above. If fill, topsoil, or a soft soil is found at the planned footing depth during excavation, it is recommended the Geotechnical Engineer be consulted to help ascertain what corrective action should be taken. Backhoes used to excavate foundations should preferably use a smooth (i.e., no teeth) bucket. Any loose or soft materials left in the bottom of the excavation should be removed. Concrete should not be placed on frozen soils. For excavations, OSHA guidelines should be followed relative to excavation stability and safety. Good construction practices (including following all local code requirements) should be followed throughout all footing, subgrade and other soil-related work.

Surface and Groundwater Control. The foundation excavation should be maintained in a dry condition until ready for placement of concrete. The outside ground surface should be sloped and/or the excavation protected to prevent surface water from running into the open excavation. If water does get into the excavation, it should be removed rapidly and any loose, wet or softened material left in the excavation bottom should be removed down to strong, natural soils. If soft, wet soil is present in the bottom of the footing excavation when the concrete is placed, then added settlement will occur during and after construction and the bearing capacity will be reduced.

Based on the soil borings, groundwater seepage is not expected to occur in the foundation excavation. Any groundwater seepage encountered in the footing excavations at the time of construction is expected to be minor in quantity and controllable using conventional sump and pump dewatering methods. After all footings have been installed, the footings should be protected from ponded water in or around footings.

Foundation Testing and Inspection. It is essential the foundation subgrade be tested and inspected prior to placement of concrete. The footing excavations should be examined by the Geotechnical Engineer or a County Inspector who is qualified in determining the in-place bearing capacity and settlement potential of soils at the proposed foundation depths to verify the footings are founded on the strong, natural soils found in this study (i.e., extending through all fills, topsoil, and any upper, weaker soils) or in compacted, select structural fill materials. The County Inspector or other representative (if used) should also verify the soil observed in the bottom of the footing excavation does not contain deleterious materials.

Drainage

Care should be taken to prevent substantial moisture change in the foundation soils during and after building construction. To help accomplish this, roof and surface runoff water should be directed away from the building. The exterior grade within 5 feet of the building should have a minimum ten percent slope (away from the structure) to prevent ponding close to the building. If water is allowed too near the footings, it can seep down and wet the soils beneath the footings which can result in footing movement and subsequent cracking. The above recommended features should not only be established, they must be maintained for the life of the structure.

Stormwater Management

Field testing associated with determining percolation rates for soils penetrated in borings drilled in the stormwater attenuation basin area was not included within the scope of work for this study. Instead, it was agreed percolation rates would be determined for soils penetrated in the basin borings by comparison of soil classifications on the boring logs with soil series classifications presented in the Soil Survey for James City County prepared by the Soil Conservation Service (SCS) of the United States Department of Agriculture.

A review of the SCS Soil Survey for James City County reveals the soils underlying the church site consist predominantly of fine sandy loams of the Kempsville Series. The SCS reports the soil profile in the Kempsville series to consist of a surficial 20-inch thick layer of fine sandy loams overlying sandy clay loams and fine sandy loams extending to a depth of 58 inches below ground, which in turn are underlain by stratified loamy sands to sandy clay loams extending to at least a depth of 68 inches below ground. This stratigraphy compares favorably with conditions encountered in both the building and basin borings.

The SCS Soil Survey reports the Kempsville series soils to possess moderate limitations to septic tank absorption fields due to slow percolation. **Percolation rates presented for the Kempsville series soils in the SCS Soil Survey vary from 2.0 to 6.0 inches per hour for the fine sandy loams located within 20 inches of the ground surface, to 0.6 to 2.0 inches per hour for the underlying sandy clay loams and fine sandy loams.**

Based on our past experience with similar soils, we anticipate percolation rates for the clayey sands and clayey, silty sands (SC and SM-SC soil classifications on the boring logs) will lie closer to the lower limits of the 0.6 to 2.0 inches per hour rates tabulated in SCS Soil Survey, while the silty to slightly silty sands (SM soil classifications on the boring logs) will exhibit percolation rates closer to the upper limits of the 0.6 to 2.0 inches per hour rates reported by the SCS. **For this project, without the benefit of field percolation testing, we recommend an average percolation rate of 1.0 inch per hour be used for infiltration system design to account for the stratified nature of the silty sands and clayey sands.** Should the systems extend greater than 6.5 to 7 feet below existing grade, that portion of the infiltration system extending below a depth of 6.5 to 7 feet may be designed using a percolation rate of 2.0 inches per hour to take advantage of the slightly silty sands encountered in the lower reaches of all basin borings.

EL. 114 ± BELOW E.G.

Earthwork Considerations

Site Preparation. All vegetation, forest litter and topsoil should be stripped from proposed building and pavement areas. Upon completion of site stripping activities, the subgrade soils exposed in structural fill areas should be proofrolled with a loaded, tandem-axle dump truck or equally heavy, pneumatic-tired equipment in the presence of the Geotechnical Engineer to help identify near-surface soft areas. Weak, soft areas identified during subgrade proofrolling should be undercut to firm soils at the discretion of the Geotechnical Engineer and the resulting excavations backfilled using

structural fill materials selected and placed as described in a subsequent section of this report. In proposed cut areas, the proofrolling activities should be performed following completion of cut grading activities.

Select Structural Fill. Soils classified as GW, GP, GM, GC, SW, SP, SM and SC under the Unified Soil Classification System (USCS) are considered suitable for use as structural fill materials on this project. Imported materials proposed for use as structural fill materials on this project should be submitted to AGS for visual assessment and final approval.

With the exception of the topsoil layer, the soils underlying this site are considered suitable for reuse as structural fill materials in required fill areas. Some soil processing (i.e., spreading and discing) may be required between excavation and placement/compaction to adjust soil moisture contents to near-optimum conditions, particularly if earthwork activities for this project commence during wet seasons of the year.

It should be noted that some difficulty may be experienced in achieving specified compaction in structural fill materials containing little or no binder (fine soil particles) due to the moisture-sensitive nature of these soils. Furthermore, chances of soil caving increase in foundation and utility excavations completed in compacted granular soils (sands or gravels) containing little or no fines, particularly in open excavations completed prior to rainstorm events.

All structural fill materials should be placed in maximum 8-inch loose lifts and compacted to a minimum of 95 percent of the maximum dry density as determined by ASTM D 698 (standard Proctor compaction) procedures. The moisture content of the structural fill materials should be maintained within plus or minus 2 percent of optimum moisture content until permanently covered. AGS representatives should be present at

the site during structural fill placement activities to ensure that the structural fill materials satisfy the selection criteria presented in this report.

* * *

We hope this provides you with the information needed. Please call if you have any questions!

Sincerely,

ATLANTIC GEOTECHNICAL
SERVICES, INC.

A. Scot Harrell, P.E.
Manager, Geotechnical Engineering

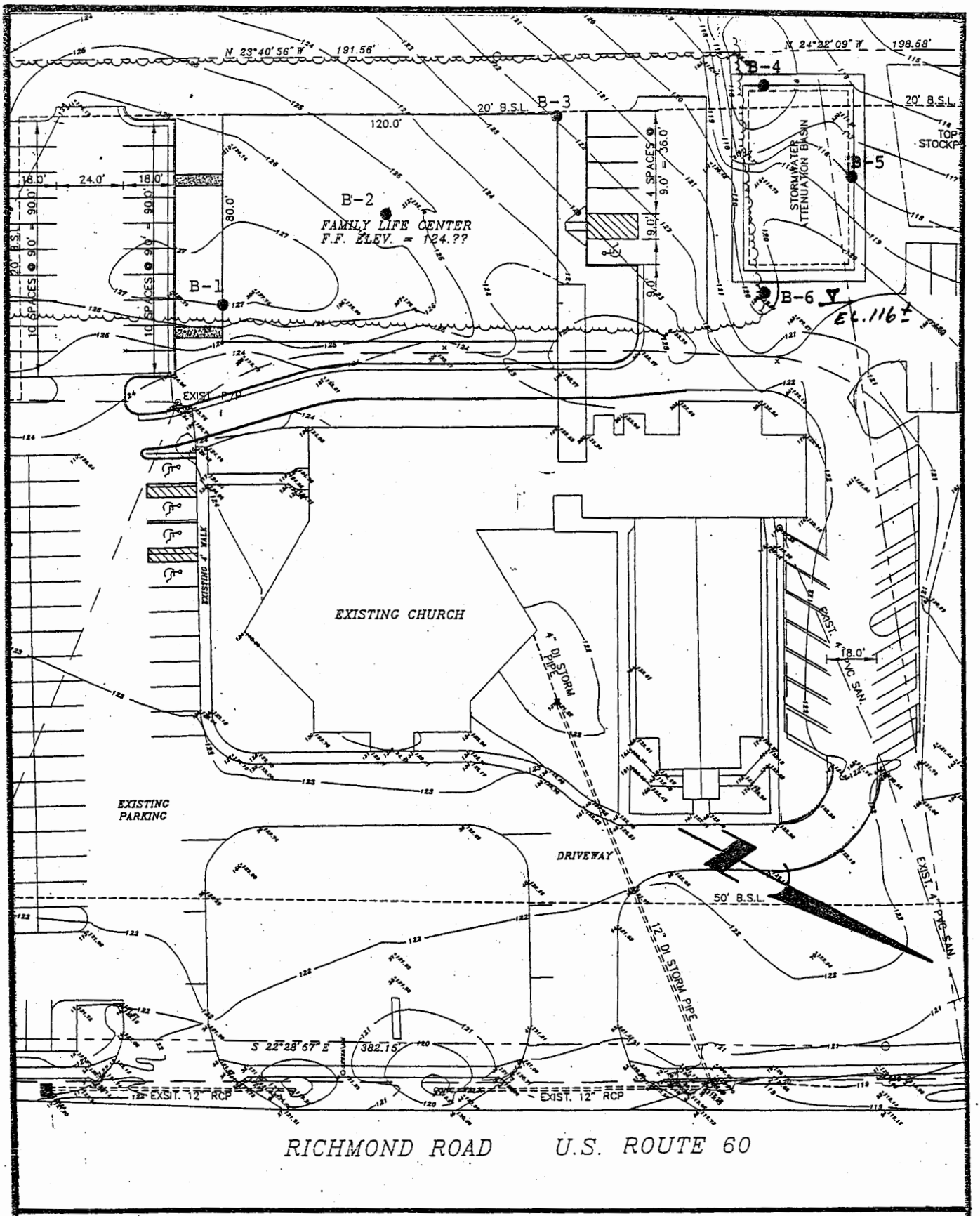
COMMONWEALTH OF VIRGINIA
A. SCOT HARRELL
NO. 026169
PROFESSIONAL ENGINEER

ASH/eab
Enclosures

Copies Submitted: Above (1)
Construction Management Group (2)
Langley and McDonald (2)

APPENDIX

Figure 1:	Plan of Borings
Figures 2 - 4:	Logs of Building Borings
Table 1:	Logs of Basin Borings



PLAN OF BORINGS

Family Life Center
Smith Memorial Baptist Church
Williamsburg, Virginia

RG99-550

Figure 1

OWNER	JOB #	BORING #	SHEET
SMITH MEMORIAL BAPTIST CHURCH	RG99-550	B-1	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
FAMILY LIFE CENTER	CONSTRUCTION MANAGEMENT GROUP

SITE LOCATION
6515 RICHMOND ROAD, WILLIAMSBURG, VIRGINIA

CALIBRATED PENETROMETER ○ TONS/FT² (1, 2, 3, 4, 5)
WATER CONTENT ● (%)
PLASTIC LIMIT +----------+ LIQUID LIMIT
STANDARD PENETRATION ⊗ (BLOWS/FT.) (10, 20, 30, 40, 50)

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 127.0 ft	FINES (%)	ELEVATION (FEET)
0	1	SS	18	Loose Dry Tan Fine Silty SAND (SM)		
				Medium Moist Dense Yellowish-Brown Slightly Clayey Silty SAND (SM)		
	2	SS	18	- loose below 2 feet		124
4	3	SS	18			
						120
8	4	SS	18	Loose Moist Yellowish-Tan Fine Clayey SAND (SC)		
	5	SS	18			
						116
12						
						112
16						
						108
20						
						104
24						
						100
28						

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES: IN-SITU THE TRANSITION MAY BE GRADUAL

WATER DEPTH IN BOREHOLE	BORING STARTED July 6, 1999	CAVE-IN DEPTH AT 4.0 ft
AFTER DRILLING Dry FT.	BORING COMPLETED July 6, 1999	DRILLING METHOD Hollow Stem Auger
AFTER 0.1 HRS: Dry FT.	DRILLER Ayers & Ayers, Inc.	

Figure 2

OWNER	JOB #	BORING #	SHEET
SMITH MEMORIAL BAPTIST CHURCH	RGS9-550	B-2	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
FAMILY LIFE CENTER	CONSTRUCTION MANAGEMENT GROUP

SITE LOCATION
6515 RICHMOND ROAD, WILLIAMSBURG, VIRGINIA

CALIBRATED PENETROMETER ○ TONS/FT^2 (1, 2, 3, 4, 5)
WATER CONTENT ● (%)
PLASTIC LIMIT +----------+ LIQUID LIMIT
STANDARD PENETRATION ⊗ (BLOWS/FT.) (10, 20, 30, 40, 50)

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 125.5 ft	FINES (%)	ELEVATION (FEET)
0	1	SS	18	Loose Dry Light Grayish-Tan Fine Silty Silty SAND (SM)		
				Medium Dense Yellowish-Brown Fine Clayey SAND (SC)		124
	2	SS	18	Loose Dry Yellowish-Tan Fine Slightly Silty SAND (SM)		
4	3	SS	18	- medium dense below 4 feet		120
8	4	SS	18	Medium Dense Moist Light Brown/Gray/ Light Red Fine Clayey SAND (SC)		
	5	SS	18	- light gray and light brown below 8.5 feet		116
12						112
16						108
20						104
24						100
28						

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES: IN-SITU THE TRANSITION MAY BE GRADUAL

WATER DEPTH IN BOREHOLE	BORING STARTED **July 6, 1999**	CAVE-IN DEPTH AT **4.5 ft**
AFTER DRILLING **Dry** FT.	BORING COMPLETED **July 6, 1999**	DRILLING METHOD **Hollow Stem Auger**
AFTER **0.1** HRS: **Dry** FT.	DRILLER **Ayers & Ayers, Inc.**	

Figure 3

OWNER	JOB #	BORING #	SHEET
SMITH MEMORIAL BAPTIST CHURCH	RG99-550	B-3	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
FAMILY LIFE CENTER	CONSTRUCTION MANAGEMENT GROUP

SITE LOCATION
6515 RICHMOND ROAD, WILLIAMSBURG, VIRGINIA

CALIBRATED PENETROMETER ○ TONS/FT^2 (1, 2, 3, 4, 5)
WATER CONTENT ● (%)
PLASTIC LIMIT +----------+ LIQUID LIMIT
STANDARD PENETRATION ⊗ (BLOWS/FT.) (10, 20, 30, 40, 50)

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 122.0 ft	FINES (%)	ELEVATION (FEET)
0	1	SS	18	Loose Dry Grayish-Tan to Tan Fine Slightly Silty SAND (SM)		
	2	SS	18	Loose Moist Yellowish-Brown Fine Clayey SAND (SC)	33	120
4	3	SS	18	Loose Moist Yellowish-Tan Fine Slightly Clayey Silty SAND (SM)		116
8	4	SS	18	Loose Moist Yellowish-Tan Fine Clayey SAND (SC)		
	5	SS	18	- medium dense, light brown/gray/ light red below 8.5 feet		112
12						108
16						104
20						100
24						96
28						

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES: IN-SITU THE TRANSITION MAY BE GRADUAL

WATER DEPTH IN BOREHOLE	BORING STARTED July 6, 1999	CAVE-IN DEPTH AT 4.0 ft
AFTER DRILLING Dry FT.	BORING COMPLETED July 6, 1999	DRILLING METHOD Hollow Stem Auger
AFTER 0.1 HRS: Dry FT.	DRILLER Ayers & Ayers, Inc.	

Figure 4

Transportation
Land Development
Environmental
Services

VHB

imagination | innovation | energy Creating results for our clients and benefits for our communities

OCT 2002
RECEIVED
ENVIRONMENTAL DIVISION

Vanasse Hangen Brustlin, Inc.

October 10, 2002

Ref: 31249.00

REVISED RD INFORMATION. ADDRESSES ENV DIV COMMENTS 10/04/02. SAT 10-14-02

Scott J. Thomas
Civil Engineer
James City County Environmental Division
101 Mounts Bay Road
P.O. Box 8784
Williamsburg, Va. 23187-8784

Re: Family Life Center
Smith Memorial Baptist Church
County Plan No. SP-118-99; Amended Plan No. SP-112-01
Underground Manufactured BMP System
County BMP ID Code: YC 024

Dear Mr. Thomas:

VHB is in receipt of your comment letter dated October 4, 2002 on the above-mentioned project. The As-Built Drawing has been revised accordingly. Please find attached three (3) copies for your final review and approval. VHB offers the following responses to your comments in the order in which we received them.

Record Drawing:

2. Additional information has been included for inlets labeled #2, #1 and #4 as shown on the drawing. Pipe sizes and material types have also been shown. Additionally, the size, material and invert out elevation of the PVC pipe which outlets from DI#2 has been shown.
3. Additional information has been added for inlet #2. This data includes information for the two inflow storm drains, the outlet to the 10" pipe which leads to the underground chambers, the overflow pipe, and the structural invert of the inlet.
4. Infiltration Section D-D from Sheet C-7 of the project site plans has been added to the As-Built Drawing. This detail has been revised to include as-built information as required. Field modifications including material substitutions and cover depth

477 McLaws Circle, Suite 1
Williamsburg, Virginia 23185
757.220.0500 ▪ FAX 757.220.8544
email: info@vhb.com
www.vhb.com

\\\31249\docs\letters\Response Letter to Scott Thomas -021010.doc

variances from plan have been included and are based solely on data supplied by Jack L. Massie Contractor.

5. The approved maintenance plan from Sheet C-7 of the project site plans has been added.
6. The County Plan and BMP identifiers have been added to the plan.

If you require any additional information or have any further comments or questions please feel free to contact me directly at 220-0500.

Very truly yours,

VANASSE HANGEN BRUSTLIN, INC.

Frank G. Mundy, II, L.S.
Survey Manager

Cc: Ron Wade (Smith Memorial Baptist Church)
Michael Galli (ECS, Ltd.)
Steve Massie (Jack L. Massie Contractor)

VHB

SJT File.

DEVELOPMENT MANAGEMENT

101-E MOUNTS BAY ROAD, P.O. BOX 8784, WILLIAMSBURG, VIRGINIA 23187-8784
(757) 253-6671 Fax: (757) 253-6850 E-MAIL: devtman@james-city.va.us

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codecomp@james-city.va.us

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environ@james-city.va.us

PLANNING
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planning@james-city.va.us

COUNTY ENGINEER
(757) 253-6678

INTEGRATED PEST MANAGEMENT
(757) 253-2620

October 4, 2002

Reinspect 10-15-01 SJT

Mr. Ron Wade
Smith Memorial Baptist Church
6515 Richmond Road
Williamsburg, Va. 23188

Re: Family Life Center
County Plan No. SP-118-99; Amended Plan No. SP-112-01
Underground Manufactured BMP System
County BMP ID Code: YC 024

Dear Wade:

The Environmental Division has reviewed a record drawing and construction certification as submitted to our office for the above referenced project. The record drawing provides as-built information for a underground polyethylene pipe chamber (manufactured BMP) system situated below the paved parking area in the northwest corner of the site.

Based on our review of the project and a concurrent field inspection as performed on October 4th 2002, the following items must be addressed prior to release of the developer's surety instrument for the stormwater management/BMP facility at the site:

Construction Certification:

PREV OK

1. The construction certification dated June 28th 2002 is **satisfactory**.

Record Drawing:

Rev RD RECEIVED 10-24-02

2. Show the following additional information on the record drawing: label inlets # 2, # 1 and # 4 as shown on the drawing; label all pipe sizes and material types for the primary storm drain system shown on the drawing; show the size, material and invert out elevation for the PVC pipe which outlets from DI # 2.

3. Additional information is needed for DI # 2. This is the parking lot inlet which throttles flow from the onsite drainage system into the 10" PVC pipe which leads to the underground chambers and which serves as the diversion/bypass overflow structure. This inlet has two inflow storm drains, an outlet to the 10" PVC pipe which leads to the underground chambers, and overflow outlet pipe and, per the approved design, has a sump below all pipe inverts for pretreatment purposes.

4. Add Infiltration Basin Section D-D from Sheet C-7 of the approved plan, annotated as necessary with construction information, to the record drawing set. It is our understanding that field modifications were made during construction of the BMP to backfill (cover) and bedding layers associated with the underground polyethylene chamber units. The as-built needs to reflect final construction configuration in accordance with modifications that were made.

5. Add the approved maintenance plan from Sheet C-7 of the approved plan to the record drawing.

6. If possible add the following County identifiers to the lower right hand corner of the record drawing: County Plan Number SP-118-99 and BMP ID Code: YC 024.

Construction - Related Items:

7. Clean and remove all sediment in the bottom (sump) of DI # 2. This is the parking lot inlet which throttles flow from the onsite drainage system into the 10" PVC pipe which leads to the underground chambers and which serves as the diversion/bypass overflow structure. A sump approximately 2 feet deep is present at structure of which approximately one-half (12 inches) was filled with sediment.

Massie 10-15-02

8. At the same DI # 2, clean and remove all trash, leaves and debris from the wire-mesh screen which surrounds the tee elbow for 10-inch PVC pipe which leads to the underground BMP. The primary inflow into the BMP shall not be obstructed with debris and vegetation.

10-15-02

9. Clean and remove all trash and debris present from within the stilling basin at the outfall end of the 6-inch PVC pipe which outlets from DI # 2 to the downstream natural channel. *(Note: The rock check dam which was installed at this location for primary site erosion and sediment control can be left in place as a permanent water quality device.)*

10-15-02

Also, as a note, during our field inspection, grass mowing operations were just performed at the site. It was observed that grass clipping were present at and near to the onsite parking lot inlets, specifically MH # 1 and MH # 4. Efforts should be made by the owner, landscaper or any individual who cuts grass at the site to not allow grass clippings to migrate from grass mowing areas onto the parking lot or associated site curb and gutter. Grass clippings which could find their way into site yard and curb inlets could be very detrimental to the function of an underground storm chamber (manufactured BMP) unit. We also stress owner maintenance of the facility in strict conformance with manufacturer's recommendations and the maintenance plan on Sheet C-7 of the approved plan.

Once this work is satisfactorily completed, contact our office appropriately. We can then proceed with final release of the surety on the project. One reproducible and one blue/black line set of the record drawings will be required once the above record drawing items are adequately addressed.

Please contact me at 757-253-6639 or the assigned Environmental Division inspector, Mr. Jim Rudnicky, at 757-259-4026 if you have any further comments or questions.

Sincerely,

Scott J. Thomas

Scott J. Thomas, P.E.
Civil Engineer
Environmental Division

cc: Frank G. Mundy (VHB) - via fax
Michael Galli (ECS, Ltd.) - via fax
Steve Massie (Jack L. Massie Contractor)- via fax
Jim Rudnicky - JCC Environmental Division Inspector

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AB File

DEVELOPMENT MANAGEMENT

101-E MOUNTS BAY ROAD, P.O. BOX 8784, WILLIAMSBURG, VIRGINIA 23187-8784
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planning@james-city.va.us

COUNTY ENGINEER
(757) 253-6678

INTEGRATED PEST MANAGEMENT
(757) 253-2620

October 4, 2002

Mr. Ron Wade
Smith Memorial Baptist Church
6515 Richmond Road
Williamsburg, Va. 23188

Re: Family Life Center
County Plan No. SP-118-99; Amended Plan No. SP-112-01
Underground Manufactured BMP System
County BMP ID Code: YC 024

Dear Wade:

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1. The construction certification dated June 28th 2002 is **satisfactory**.

Record Drawing:

2. Show the following additional information on the record drawing: label inlets # 2, # 1 and # 4 as shown on the drawing; label all pipe sizes and material types for the primary storm drain system shown on the drawing; show the size, material and invert out elevation for the PVC pipe which outlets from DI # 2.

3. Additional information is needed for DI # 2. This is the parking lot inlet which throttles flow from the onsite drainage system into the 10" PVC pipe which leads to the underground chambers and which serves as the diversion/bypass overflow structure. This inlet has two inflow storm drains, an outlet to the 10" PVC pipe which leads to the underground chambers, and overflow outlet pipe and, per the approved design, has a sump below all pipe inverts for pretreatment purposes.

4. Add Infiltration Basin Section D-D from Sheet C-7 of the approved plan, annotated as necessary with construction information, to the record drawing set. It is our understanding that field modifications were made during construction of the BMP to backfill (cover) and bedding layers associated with the underground polyethylene chamber units. The as-built needs to reflect final construction configuration in accordance with modifications that were made.

5. Add the approved maintenance plan from Sheet C-7 of the approved plan to the record drawing.

6. If possible add the following County identifiers to the lower right hand corner of the record drawing: County Plan Number SP-118-99 and BMP ID Code: YC 024.

Construction - Related Items:

7. Clean and remove all sediment in the bottom (sump) of DI # 2. This is the parking lot inlet which throttles flow from the onsite drainage system into the 10" PVC pipe which leads to the underground chambers and which serves as the diversion/bypass overflow structure. A sump approximately 2 feet deep is present at structure of which approximately one-half (12 inches) was filled with sediment.

8. At the same DI # 2, clean and remove all trash, leaves and debris from the wire-mesh screen which surrounds the tee elbow for 10-inch PVC pipe which leads to the underground BMP. The primary inflow into the BMP shall not be obstructed with debris and vegetation.

9. Clean and remove all trash and debris present from within the stilling basin at the outfall end of the 6-inch PVC pipe which outlets from DI # 2 to the downstream natural channel. *(Note: The rock check dam which was installed at this location for primary site erosion and sediment control can be left in place as a permanent water quality device.)*

Also, as a note, during our field inspection, grass mowing operations were just performed at the site. It was observed that grass clipping were present at and near to the onsite parking lot inlets, specifically MH # 1 and MH # 4. Efforts should be made by the owner, landscaper or any individual who cuts grass at the site to not allow grass clippings to migrate from grass mowing areas onto the parking lot or associated site curb and gutter. Grass clippings which could find their way into site yard and curb inlets could be very detrimental to the function of an underground storm chamber (manufactured BMP) unit. We also stress owner maintenance of the facility in strict conformance with manufacturer's recommendations and the maintenance plan on Sheet C-7 of the approved plan.

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Please contact me at 757-253-6639 or the assigned Environmental Division inspector, Mr. Jim Rudnicky, at 757-259-4026 if you have any further comments or questions.

Sincerely,

Scott J. Thomas, P.E.
Civil Engineer
Environmental Division

cc: Frank G. Mundy (VHB) - via fax
Michael Galli (ECS, Ltd.) - via fax
Steve Massie (Jack L. Massie Contractor)- via fax
Jim Rudnicky - JCC Environmental Division Inspector

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INFILTRATOR® SYSTEMS INC

Environmental Onsite Wastewater Solutions

April 18, 2002

Chris Jones
Hughes Supply
7830 George Washington Highway
Yorktown, VA 23692

RE: Smith Memorial Baptist Church, Williamsburg, VA

Chris,

Per our conversion April 18, 2002 I have addressed the following topics.

The plans dated 10/13/99, indicate that the sub-base material is to be compacted to a minimum 95% modified proctor density. Infiltrator System's minimum requirements for the sub-base have been changed to a 95% standard proctor density compaction or having a geotechnical engineer ascertain the sub-base is suitable.

The system is currently designed to be inletted with a manifold. In the past the chamber beds have been inletted in the stone above the chambers. Typically, the solid pipe enters the bed and is coupled to a perforated pipe. This pipe is extended out over the chambers to allow the stormwater to drain into the surrounding stone and then down to the chambers. Please note, when this is done the perforated pipe cannot be in contact with the chambers.

The system was currently designed with 8 inches of stone above the chambers. Infiltrator System's minimum specifications are for 6 inches of stone above the chambers. Additional stone above this 6 inch minimum is acceptable.

Infiltrator System Inc. does not approve plans, sizing, or system designs. The designing engineer is responsible for all design decisions. The designing engineer must be contacted for any design changes.

After reviewing this letter please call me with any questions or concerns at 800-221-4436.

Very truly yours,

Ken Sanok
Technical Consultant

cc: Rob Chapman, Infiltrator Systems Inc.

Corporate Office
6 Business Park Road • P.O. Box 768 • Old Saybrook, CT 06475 • (800) 221-4436 • Fax (860) 388-6810

Vanasse Hangen Brustlin, Inc. TRANSMITTAL

Transportation
Land Development
Environmental Services

477 McLaws Circle, Suite 1
Williamsburg, VA 23185-6316
757 220 0500
FAX 757 220 8544

Date: Sept. 16, 2002	**VHB Project No.:** 31249.00

Re: Smith Memorial Baptist Church
Stormwater As-Built Survey

YC 024; SP-118-99

SEP 2002 RECEIVED ENVIRONMENTAL DIVISION

To: Scott J. Thomas, PE
c/o James CIty County
101 Mounts Bay Road, P.O. Box 8784
Williamsburg, Va. 23187-8784

We are sending you: ☒ Attached ☐ Under Separate cover via Regular Mail the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Diskettes ☐ Specifications ☐ Copy of Letter ☐ Change Order
☐ Other

Copies	Date	No.	Description
1	6/10/02		Completed As-built Forms
5	6/10/01		SWM Record Drawing

These are transmitted as checked below:

☒ For approval
☐ For your use
☐ As requested
☒ For review and comment
☐ Returned prints on loan to VHB

☐ Approved as submitted
☐ Approved as noted
☐ Return for corrections
☐ For bids due

☐ Resubmit ____ Copies for approval
☐ Submit ____ Copies for distribution
☐ Return ____ Corrected prints

REMARKS: Please call should you have any questions.

Copy to: Joseph Bacha, BETCO Construction
Bob Bean, Jack Massie Contractor

By: Frank G. Mundy, II, L.S.
Survey Manager

Scott Thomas

From: Scott Thomas
Sent: Friday, September 20, 2002 5:02 PM
To: Jim Rudnicky
Cc: Pat Menichino; Darryl Cook
Subject: Smith Memorial & Colonial Golf Course Projects

Jim

I will respond to you on both these projects, the easy one first.

Smith Memorial (SP-118-99; County BMP ID Code: YC 024)
I previously received a construction certification received for the project, which is ok. I just got the as-builts in a week after your email. I will need to review the asbuilts and perform a final inspection, probably next week as I need to get out and do several others. Depending on the results of review of the asbuilts and the field inspection, I may or may not need to issue a letter to the Owner. If both are ok, then we can release/reduce bond. As this is an underground manufactured BMP (stormchambers), obviously the field inspection mainly focus on the inflows and outflows to the chambers and stabilization of the drainage area. I will rely heavily upon the asbuilts and certification information. This was strongly stressed during the precon and construction stages to both the owner and Massie and his certifying engineers, VHB and ECS.

Colonial Golf Course (SP-112-92; County BMP ID Codes: DC 005, Large Lake 2 and DC 006 Smaller Lake)
This thing had quite a history to it but I think I got it sorted out by reviewing the files and talking to Gerry. The original plan SP-112-92 called for 3 ponds on the site. The central bigger lake was actually two interconnected ponds (Lake 1 and Lake 2) and the third was a smaller lake in the southwest corner (Holes 3 & 5).

The original plans and Environmental (Code Compliance) comments required asbuilts only for the onsite ponds. Note # 21 on Sheet 10 states the following: "Asbuilt drawings shall be provided for all detention basins upon completion." Plan review comment # 2 for the project also says the same thing. Therefore, asbuilts are required for the project but not construction certification.

However, as I interpret it, Lake 1/2 did not get constructed per the approved plan. Darryl issued a letter in March 1994 stating that asbuilts were required due to visual inspections which showed the lakes were not constructed per the approved plan. He also relayed 7 comments about the revised design and construction of the dam which seriously concerned him. Computations were forwarded back and forth until finally a letter dated April 15th 1994 by PE Randall Strawbridge was forwarded to our office. To me it does not look like this package was an asbuilt but served as a formal "design" revision to the dam. This is supported by language in that package that states that "the dam was not quite completed when we inspected it on 4/19/94; there was additional work required for the dam to conform to the revised plans."

I can find anything that resembles asbuilts in the files after that April 1994 date. **Therefore, asbuilts are required but none were ever received or reviewed by this office. We would need asbuilts for Lake 2 and Lake 3.**

DC 005 Lake 2 Large Pond between Holes 13/18
DC 006 Lake 3 Smaller Pond SW Corner of the site, Holes 3/5

Hopefully this answers your questions for both projects.

Scott

-----Original Message-----
From: Jim Rudnicky
Sent: Tuesday, September 10, 2002 7:42 AM
To: Scott Thomas
Cc: Pat Menichino
Subject: Projects Requesting Close Outs

Hi Scott,

Because you have been so busy lately, I thought I would put into writing recent requests I received from groups that want to close out their projects.

Scott Thomas

To: Jim Rudnicky
Subject: RE: Projects Requesting Close Outs

-----Original Message-----
From: Jim Rudnicky
Sent: Tuesday, September 10, 2002 7:42 AM
To: Scott Thomas
Cc: Pat Menichino
Subject: Projects Requesting Close Outs

Hi Scott,

Because you have been so busy lately, I thought I would put into writing recent requests I received from groups that want to close out their projects.

Colonial golf course wants to close out that project. I was originally contacted by Francis Fenderson, but now a Ms. Trudy Sears from the golf course has been in contact with me. She wants me to give her updates and let her know what they need to do to finalize the project and release their money which is held in a CD.

Smith Memorial Baptist church wants to close out their parking lot expansion/new building project. If you have not received their as-builts yet, they will be sending them to you soon.

****
Jim Rudnicky
Environmental Inspector
James City County
757-259-4026 (Office)
757-259-4032 (Fax)
jrudnicky@james-city.va.us
****

<< File: Jim Rudnicky.vcf >>

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****

Jim Rudnicky
Environmental Inspector
James City County
757-259-4026 (Office)
757-259-4032 (Fax)
jrudnicky@james-city.va.us
****

<< File: Jim Rudnicky.vcf >>

RECORD OF PHONE CONVERSATION

Call To: Rick Cook – 810-5524 Date: 4/4/02

Call By: Bob Lane

Re: Smith Memorial Baptist Church Family Life Center

Rick (J Massie), had requested permission to begin construction of the infiltration structure. I called him and told him he would need to provide temporary plugs at the inlets to the infiltration piping until all drainage was stabilized, as it was particularly important that no silt get into the chambers. He was agreeable.

I suggested he request a pre construction meeting and contact the Infiltrator manufacturer as required by the approved plans.

PRECON HELD FOR START OF INFILTRATOR SYSTEM CONSTRUCTION 4/9/02 @ 10:00 AM SJ THOMAS + Bob LANE (JCC), VHB, ECS, JACK MASSIE personnel present. Discussed BMP Installation; temporary stormwater + E+SC; bottom compaction; cover stone; geogrid and certification process.

Scott Thomas
04-09-02

Cc Pat M
Scott T
File – Smith Baptist Church

LANDMARK DESIGN GROUP

FACSIMILE

TO: Bob Bean
FACSIMILE NUMBER: 566-8566
COMPANY: Jack L Massie Contractor
TELEPHONE NUMBER: 566-8643
FROM: Steve Powers
NUMBER OF PAGES: 1 (including cover)
DATE: 1-7-02
SUBJECT: Smith Memorial Baptist Church
JOB NO.: 1990072
ORIGINAL: ☐ WILL ☑ WILL NOT BE MAILED.

MESSAGE:

Per our telephone conversation this morning regarding the Infiltration Basin at the referenced Project, this is to confirm that you are not required to strictly adhere to the requirements specified on Sheet C-7 Infiltration Basin Section D-D:

A) "Existing Ground, Compact Base to a Minimum of 95% of the Modified Proctor Density" – You indicate that this would necessitate undercutting existing material and replacing with select fill – I replied that the objective is to provide a good, firm, permeable base – You responded that you could accomplish that with insitu material.

B) "Compacted Select Fill as Required, See Note "A" Below" – You asked if 21-A or #57 Stone would be adequate – I replied that #57 Stone would be preferable.

Please let me know if you are not in agreement with this recap.

Thanks,

Steve Powers

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

LANDMARK DESIGN GROUP
FACSIMILE

TO: Bob Bean
COMPANY: Jack Massie Contr.
FROM: Steve Romero
DATE: 4-19-02
SUBJECT: Smith Memorial
JOB NO.: 1990072
ORIGINAL: ☐ WILL ☑ WILL NOT BE MAILED.

FACSIMILE NUMBER:
TELEPHONE NUMBER:
NUMBER OF PAGES: 1 (including cover)

MESSAGE:

PER OUR TELEPHONE CONVERSATION TODAY, THIS IS TO CONFIRM THAT #57 WASHED STONE IS AN ACCEPTABLE SUBSTITUTE FOR THE COARSE SAND LAYER SHOWN ON THE INFILTRATION BASIN DETAIL (SECTION D-D), SHEET C-7, OF THE APPROVED SITE PLAN.

Stephen Romero
Va LS # 1448B
4-19-02

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

LANDMARK DESIGN GROUP
TRANSMITTAL

To: Scott Thomas

Company: JCC Environmental Division

From: Shawn Gordon

Date: April 27, 2000

Subject: Smith Memorial Baptist Church Family Life Center

LMDG Job No.: 1990072-000.01

Attached please find:
- ☒ Prints
- ☐ Plans
- ☐ Specifications
- ☐ Drawings
- ☐ Report
- ☐ Letter
- ☐

Transmitted as checked below:
- ☒ For your use
- ☐ As requested
- ☐ For review and comment
- ☐ For approval
- ☐ Approved
- ☐

Copies	Date	Drawing No.	Description
1	4/27/00	–	Letter from Infiltrator Systems Inc.

Notes:
Scott,
Please find attached the review letter for the infiltration basin design.

Should you have any questions or require additional information please call.

Copies	Enclosures
1. File: 1990072-000.01	☒
2.	☐
3.	☐
4.	☐
5.	☐

LandMark Design Group, Inc.

By: Shawn A. Gordon

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

JACK L. MASSIE CONTRACTOR, INC.

3900 Cokes Lane
Williamsburg, Va. 23188-7010

Road and Site Construction since 1947
Stone and Topsoil Sales

FACSIMILE TRANSMITTAL COVER SHEET

DATE: 4/18/02

TO: JCSA.

ATTN: Bob Lane

FROM: Bob Bean

PHONE:

PHONE: (757) 566-8643

FAX: 1-757-259-4032

FAX: (757) 566-8566

COMMENTS: Smith Memorial Baptist Church

Number of pages including transmittal cover sheet 2

If there are any problems receiving this transmission, please telephone Jack L. Massie Contractor, Inc. at (757) 566-8643.

INFILTRATOR® SYSTEMS INC

Environmental Onsite Wastewater Solutions℠

April 18, 2002

Chris Jones
Hughes Supply
7830 George Washington Highway
Yorktown, VA 23692

RE: Smith Memorial Baptist Church, Williamsburg, VA

Chris,

Per our conversion April 18, 2002 I have addressed the following topics.

The plans dated 10/13/99, indicate that the sub-base material is to be compacted to a minimum 95% modified proctor density. Infiltrator System's minimum requirements for the sub-base have been changed to a 95% standard proctor density compaction or having a geotechnical engineer ascertain the sub-base is suitable.

The system is currently designed to be inletted with a manifold. In the past the chamber beds have been inletted in the stone above the chambers. Typically, the solid pipe enters the bed and is coupled to a perforated pipe. This pipe is extended out over the chambers to allow the stormwater to drain into the surrounding stone and then down to the chambers. Please note, when this is done the perforated pipe cannot be in contact with the chambers.

The system was currently designed with 8 inches of stone above the chambers. Infiltrator System's minimum specifications are for 6 inches of stone above the chambers. Additional stone above this 6 inch minimum is acceptable.

Infiltrator System Inc. does not approve plans, sizing, or system designs. The designing engineer is responsible for all design decisions. The designing engineer must be contacted for any design changes.

After reviewing this letter please call me with any questions or concerns at **800-221-4436**.

Very truly yours,

Ken Sanok
Technical Consultant

cc: Rob Chapman, Infiltrator Systems Inc.

Corporate Office
6 Business Park Road • P.O. Box 768 • Old Saybrook, CT 06475 • (800) 221-4436• Fax (860) 388-6810

JAMES CITY COUNTY - ENVIRONMENTAL DIVISION

Office Phone: 757-253-6670 Fax Number: 757-259-4032

DATE SENT: 05/25/00

Name: SHAWN GORDON
Firm or Company: LANDMARK
Facsimile Number: 229-0049
Number of pages including this transmittal: 7
From: SCOTT J. THOMAS

James City County
P O Box 8784
Williamsburg VA 23187-8784

Comments:
SEE "*" ON PAGES 19, 20 & 22 (INSTALLATION & INSPECT/MAINT.)
1991 INFILTRATOR SYSTEMS DESIGN MANUAL

If you do not receive all pages, call 757-253-6670 as soon as possible

SCOTT J. THOMAS, P.E.
CIVIL ENGINEER

ENVIRONMENTAL DIVISION

101 MOUNTS BAY ROAD, P.O. BOX 8784 (757) 253-6639
WILLIAMSBURG, VIRGINIA 23187-8784 FAX: (757) 259-4032
E-MAIL: scottt@james-city.va.us

JAMES CITY COUNTY - ENVIRONMENTAL DIVISION

Office Phone: 757-253-6670 Fax Number: 757-259-4032

DATE SENT: 05/03/00

Name: Shawn Gordon
Firm or Company: LANDMARK
Facsimile Number: 229-0049
Number of pages including this transmittal: 12
From: Scott J. Thomas

James City County
P O Box 8784
Williamsburg VA 23187-8784

Comments:
Tech Bulletin #3, Virginia DCR
VSMH, 1999 edition supplement
Min. STANDARD 3.10E (Polyethylene
Chamber Systems)

If you do not receive all pages, call 757-253-6670 as soon as possible

DCR VSMH STANDARDS

SCOTT J. THOMAS, P.E.
CIVIL ENGINEER

ENVIRONMENTAL DIVISION

101 MOUNTS BAY ROAD, P.O. BOX 8784 (757) 253-6639
WILLIAMSBURG, VIRGINIA 23187-8784 FAX: (757) 259-4032
E-MAIL: scottt@james-city.va.us

LANDMARK DESIGN GROUP
TRANSMITTAL

APR 2000 RECEIVED ENVIRONMENTAL DIVISION

To: Scott Thomas

Company: James City County Environmental Division

From: Shawn Gordon

Date: April 14, 2000

Subject: **Smith Memorial Baptist Church** Family Life Center

LMDG Job No.: 1990072-000.01

SP-118-99

Attached please find:
- ☐ Prints
- ☐ Plans
- ☐ Specifications
- ☐ Drawings
- ☒ Report
- ☐ Letter
- ☒ Manual

Transmitted as checked below:
- ☒ For your use
- ☒ As requested
- ☐ For review and comment
- ☐ For approval
- ☐ Approved
- ☐

Copies	Date	Drawing No.	Description
1			The High Capacity H-20 Infiltrator Chamber System for Stormwater Management Design Manual
1	8/5/99		Geotechnical Engineering Study

Notes:
Please call should you have any questions or require additional information.

Copies	Enclosures
1. File: 1990072-000.01	☐
2.	☐
3.	☐
4.	☐
5.	☐

LandMark Design Group, Inc.

By: Shawn A. Gordon

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

SAL

Atlantic Geotechnical Services, Inc.
10971 Richardson Road, Ashland, VA 23005
PH: 804-550-2203 FX: 804-550-2204

FAX TRANSMISSION

DATE: MAY 24, 2000

TO: LANDMARK DESIGN GROUP

ATTENTION: SHAWN GORDON

FAX NO.: 757-229-0049

FROM: SCOT HARRELL

REFERENCE: SMITH MEMORIAL BAPTIST FAMILY LIFE CENTER

NO. OF PAGES TRANSMITTED (including this page): 3

COMMENTS: AS REQUESTED

CSH

Copies: _____ FAX #: _____

_____ FAX #: _____

_____ FAX #: _____

_____ FAX #: _____

ATLANTIC GEOTECHNICAL SERVICES, INC.
Geotechnical + Materials Testing + Environmental

VIA FACSIMILE (757-229-0049)

PROJECT MEMORANDUM

TO: Shawn Gordon
Landmark Design Group

FROM: Scot Harrell
Atlantic Geotechnical Services

DATE: May 24, 2000

RE: Smith Memorial Baptist Church
Family Life Center
James City County, Virginia

As requested, I have reviewed Comment #5 of the James City County Review regarding Stormwater Management/Drainage Plans for the above captioned site in light of our geotechnical report. Comment #5 addresses wet soil conditions encountered in one of the shallow, hand auger test borings drilled in the vicinity of the infiltration basin and the possible impact of shallow groundwater seepage on the future performance of the infiltration basin.

The scope of work formulated for our geotechnical study of this site did not include the installation and long-term monitoring of piezometers to evaluate groundwater conditions beneath this site. However, based on the limited information gathered from our field studies, the wet soil conditions noted at a depth of 4 feet in Boring B-6 are believed to be attributable to periodic discharge following rainfall events from the two drainage pipes (6-inch diameter PVC pipe and 12-inch diameter CMP) outfalling in the vicinity of Boring B-6. This conclusion is based on the observation that similar wet soil conditions or groundwater seepage were not found in the other two hand auger borings drilling in the vicinity of the infiltration basin (Borings B-4 and B-5), nor in the deeper drill rig borings completed within the building footprint. Natural moisture contents measured in soil specimens collected from the building borings provide further evidence that static groundwater conditions lie below a depth of 10 feet at this site.

10971 Richardson Road, Ashland, Virginia 23005 • 804-550-2203 • FAX 804-550-2204

James City County Environmental Division
Stormwater Management / BMP Inspection Report
Subsurface - Detention and Infiltration Facilities

SP-118-99

County BMP ID Code (if known): YC024

Name of Facility: Smith Memorial Baptist Church BMP No.: 1 of 1 Date: 10/4/02

Location: Family Life Center Expansion

Name of Owner: Smith Memorial Baptist Church

Name of Inspector: SJ Thomas

Type of Facility: Underground DE Chamber Units

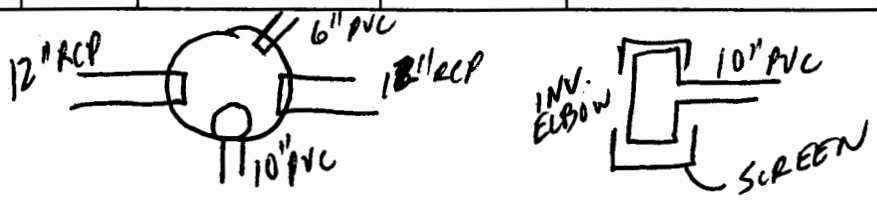
Weather Conditions: Sunny, Warm 70's Type: ☒ Final Inspection ☐ County BMP Inspection Program ☐ Owners Inspection

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: NW Corner Site; North New Building; NW old BLDG.				
Roads	✓			Two Roads to BMP.
Parking Areas	✓			Clean, newly paved
Gates	NA			
Locks	NA			
Safety Fencing	NA			
Access Points: 5 observ wells on top pavement later, cont. anchors				
Trap Doors	✓			All 5 OB tops opened
Manhole Covers	NA			OK.
Grates	NA			
Steps				
Pretreatment Devices: ☒ Inlet ☒ Sump ☐ Forebay ☐ Other				Inlet #2 (see sketch) 8' deep
Sediment		✓	✓	Sump 2'+ deep; 12" sed.
Trash & Debris		✓		Clean trash from screen.
Structure	✓			
Other				



Facility Item	O.K.	Routine	Urgent	Comments
Primary Storage/ Infiltration Area Structure (Pipe, Stone, etc): FI NOT SEEN; OBSERVED DURING CONST				
Trash & Debris	✓			
Sediment	✓			
Ponding / Drawdown	✓			
Cracks	✓			
Joints	✓			
Seams	✓			
Coating	✓			PE storm chambers
Aesthetics				
Other				
Inlet Structure # 1 (Describe Location): INLET #2				
Condition of Structure	✓			
Erosion	✓			
Trash and Debris		✓	✓	Screen has leaves
Sediment		✓	✓	12" deep sump
Aesthetics	✓			
Other				Note: Grass cutting operations
Inlet Structure # 2 (Describe Location): NA				
Condition of Structure				Beware not to allow
Erosion				grass clippings in
Trash and Debris				yard & parking lot
Sediment				inlets, Could clog BMP
Aesthetics				devel.
Other				
Inlet Structure # 3 (Describe Location): NA				
Condition of Structure				Recent grass cut &
Erosion				leave blowing while
Trash and Debris				onsite.
Sediment				Site Stabilization OK.
Aesthetics				
Other				
Outlet - Principal Overflow or Bypass Structure (Describe Location): INLET #2 to 6" PVC				
Condition of Structure	✓			
Erosion	✓			
Trash and Debris		✓	✓	See Above
Sediment		✓	✓	See Above.
Other		✓		RCP at outlet. Leave in place. Clean trash + debris

Rating 4 ↓? Rest of sheet?

Facility Item	O.K.	Routine	Urgent	Comments
Nuisance Type Conditions:				
Mosquito Breeding	✓			
Animals, Rodents	✓			
Graffiti	✓			
Other	✓			
Perimeter (Contributing Drainage Area) Conditions:				Churches Buildings(2); Parking Area
Stabilization	✓			GOOD SITE STABILIZATION
Vegetation Condition	✓			
Trash and Debris	✓			
Aesthetics				
Other				

Remarks:

Inlet #2 (Divert Structure)

- Needs cleaned of sediment, 1' deep.
- Trash screen needs cleaned.
- clean trash & debris from stilling basin @ outfall of 6" PVC

* Owner needs to be aware to not allow cut grass clippings into parking lot DI's.

Overall Environmental Division Internal Rating: 4

Signature: [signature], P.E. **Date:** 10/4/02

Title: Civil Engineer ENV DIV.

SWMProg\BMP\CoInspProg\SubDetInfil.wpd

Date Record Created:

Created By:

WS_BMPNO: YC024

Print Form

PRINTED ON:
Saturday, March 13, 2010
2:47:10 PM

WATERSHED	YC
BMP ID NO	024
PLAN NO	SP-118-99
TAX PARCEL	(24-3)(1-36)
PIN NO	2430100036
CONSTRUCTION DATE	4/29/2002
PROJECT NAME	Smith Memorial Baptist Church
FACILITY LOCATION	6515 Richmond Road
CITY-STATE	Williamsburg, Va. 23188
CURRENT OWNER	Smith Memorial Baptist Church
OWNER ADDRESS	6515 Richmond Road
OWNER ADDRESS 2	
CITY-STATE-ZIP CODE	Williamsburg, Va. 23188
OWNER PHONE	
MAINT AGREEMENT	Yes
EMERG ACTION PLAN	No

Get Last BMP No

Return to Menu

MAINTENANCE PLAN	Yes
SITE AREA acre	3.64
LAND USE	B1 Church
old BMP TYP	Infiltration
JCC BMP CODE	ZI Manuf BMP systems
POINT VALUE	10
SVC DRAIN AREA acres	1.29
SERVICE AREA DESCRI	New Building & Parking Areas
IMPERV AREA acres	0.90
RECV STREAM	UT of Ware Creek
EXT DET-WQ-CTRL	Yes
WTR QUAL VOL acre-ft	0.047
CHAN PROT CTRL	No
CHAN PROT VOL acre-ft	0
SW/FLOOD CONTROL	Yes
GEOTECH REPORT	Yes

CTRL STRUC DESC	H20 Infil Cha
CTRL STRUC SIZE inches	16
OTLT BARRL DESC	PVC Drain
OTLT BARRL SIZE inch	6
EMERG SPILLWAY	No
DESIGN HW ELEV	119.6
PERM POOL ELEV	na
2-YR OUTFLOW cfs	0.88
10-YR OUTFLOW cfs	1.42
REC DRAWING	Yes
CONSTR CERTIF	Yes

LAST INSP DATE 10/4/2002 Inspected by:

INTERNAL RATING 4

MISC/COMMENTS

Family Life Center. Hi-Cap Infiltrator Chamber System.

Additional Comments:

IMPORTANT MESSAGE

FOR Scott

DATE 6/28/02 TIME _____ A.M. P.M.

WHILE YOU WERE OUT

M _____

OF Rick Cook

PHONE NO. 810-5524

Returned call 7-2-02 no need to see before painting start 7-2-02

TELEPHONED		PLEASE CALL	
CALLED TO SEE YOU		WILL CALL AGAIN	
WANTS TO SEE YOU		RUSH	

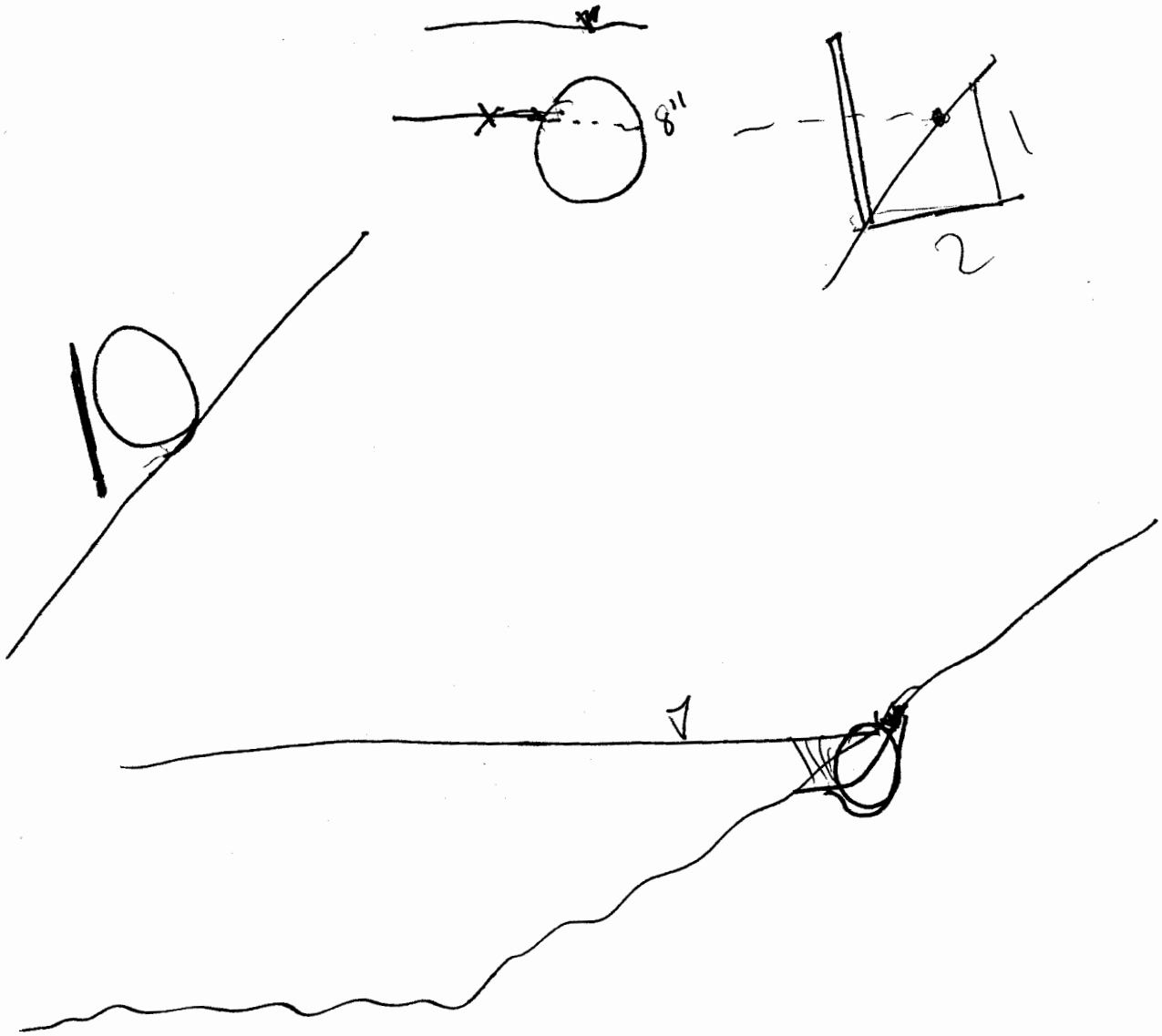
RETURNED YOUR CALL

MESSAGE

Paving Smith Memorial Monday. Infiltration system will be on line after that. Do you want to inspect today prior to paving?

SIGNED

HighMark P3-A2334 PRINTED IN U.S.A.


8"
1
2
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7

INFILTRATOR SYSTEMS INC

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REGULATOR'S FORUM
INSTALLER'S FORUM
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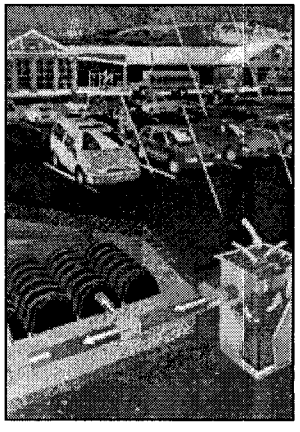
The High Capacity Infiltrator® Chamber System for Shallow Stormwater Systems.

High Capacity Infiltrator chambers are the ideal solution for stormwater systems and special management applications.



High Capacity Infiltrator chambers from Infiltrator Systems Inc. are a practical and effective choice for stormwater management when you're faced with restrictive site conditions.

The High Capacity Infiltrator chamber is ideal for:

- **Shallow site conditions due to high water tables, stone ledge, or hardpan.**
- **Small stormwater disposal systems.**
- **Residential and commercial downspout drainage.**

Each High Capacity Infiltrator chamber provides 16.3 cubic feet (122 gallons) of stormwater storage exclusive of stone backfill and is equally effective for retention and detention applications. The runoff may recharge into the ground, or meter out to an outfall, depending on the particular design goals and site conditions.

High Capacity Infiltrator chambers are also ideal for small stormwater disposal needs such as downspout drainage on residential sites. The system is easily installed and durable enough to be situated under a driveway or parking lot.

High Capacity Infiltrator chamber benefits:

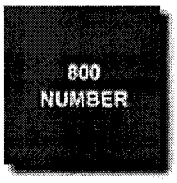
- Maximum storage at a volume of 16.3ft³ or 122 gallons of water per chamber exclusive of stone backfill.
- Typical cross section with stone provides 24ft³ (179 gallons) at a 35% stone void ratio.
- The open chamber bottom and louvered sidewall provide enormous infiltrative surface area.
- Structurally sound system constructed of Poly-Tuff™, a proprietary blend of polyolefin plastic, makes the chambers inert to chemicals typically found in stormwater runoff.
- The strong and durable units have passed an H-20 loading of 32,000 pounds per axle, with a minimum of 18 inches compacted cover exclusive of finished grade or pavement.
- The lightweight chambers can be hand carried and easily positioned in beds or trenches.
- Patented-chamber interlocks allow for the simple connection of units to form desired configurations.

Retrieved by S. Thomas via Internet. NOT SUBMITTED BY ENGINEER

For a free High Capacity Infiltrator Chamber Stormwater Design or Installation Manual, call 1-888-860-1391.

Click here to sign the Infiltrator guest register and receive additional technical, product, and company material.

Click here to reference product, company, and technical support documentation. These files may be downloaded for your viewing convenience.



Click here to access Infiltrator Systems' contact information page. Call **1-888-860-1391** to speak directly with a customer representative for information specific to your area.

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Installer's Forum | Employment | Industry News | Tradeshows/Conferences | Library
Guest Register | Contact Info

INFILTRATOR SYSTEMS INC

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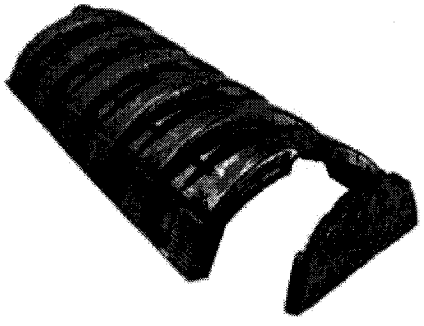
INSTALLER'S FORUM

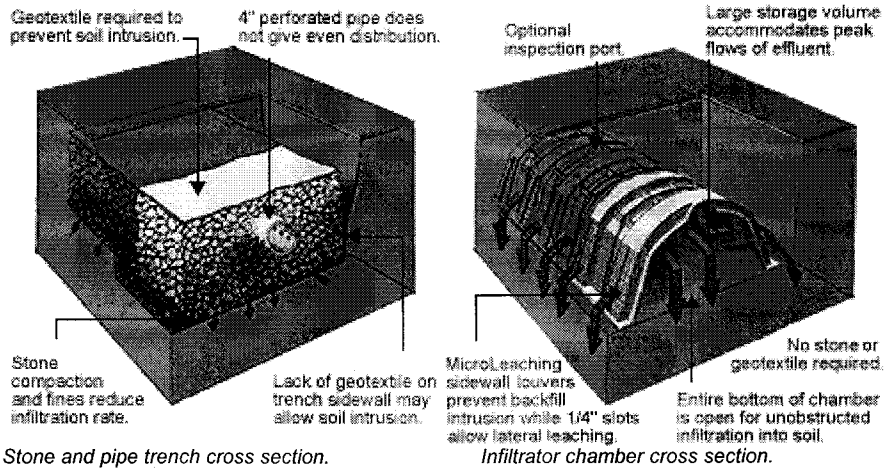
The Standard Infiltrator® chamber is the original product designed by Infiltrator Systems Inc. for septic leachfield applications. This unit is 34" wide, 75" long, and 12" tall. It's designed to fit into a three-foot wide trench as a direct replacement for stone and pipe and doesn't require any stone whatsoever. That means no stone for you to haul, no stone to shovel or level, and no stone mess to clean up. So, there's no yard damage or compaction on the site from heavy trucks.



Standard Infiltrator chamber.

With the Standard Infiltrator Chamber System, the whole leachfield system can be delivered in one pickup truck load. It can be installed by just two people, one on a backhoe and the other installing the plastic units. The chambers easily interlock end-to-end and can be assembled into trenches or beds. They're suitable for a variety of applications, including mound, serial-distributed, and pressure-dosed systems.

Each chamber has an open bottom and louvered sidewall. These features provide more than twice the infiltrative capacity of a conventional stone and pipe system. And, because they're constructed of PolyTuff(TM) plastic, a proprietary blend of polyolefin, the chambers are strong and are impervious to wastewater constituents. The Standard Infiltrator model has an AASHTO H-10 load rating and can withstand 16,000 lb/axle, with the proper compacted cover. It's hollow interior allows each chamber to store up to 77 gallons of household effluent.



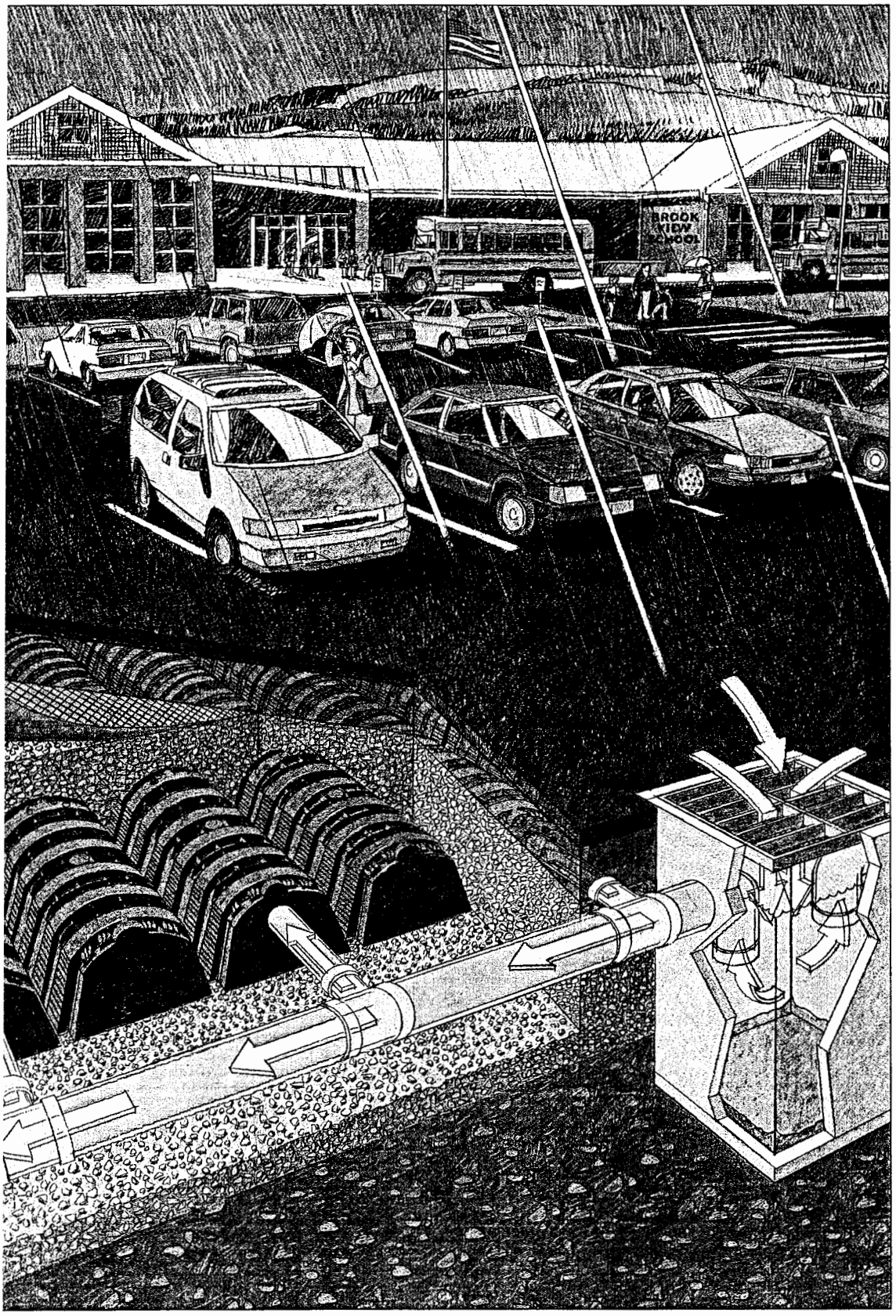
Stone and pipe trench cross section. *Infiltrator chamber cross section.*

Infiltrator Systems Inc., headquartered in Old Saybrook, Connecticut, is the world leader in chamber technology. Today there are more than 13 million Infiltrator chambers in operation in 50 states, Canada, and throughout the world, forming more than 240 million square feet of chamber systems. In addition to the Standard Infiltrator model, there are several other septic units manufactured by Infiltrator Systems Inc. Each is just as easy to install and handle as the Standard unit.

Visit the Industry News section and learn about the latest advances in

The High Capacity H-20 Infiltrator® Chamber System for Stormwater Management.

INFILTRATOR® SYSTEMS INC



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Design Manual

INFILTRATOR® SYSTEMS INC

This manual is intended to help the design professional plan a subsurface stormwater system using High Capacity Infiltrator chambers that meets all of Infiltrator Systems' standards and specifications. When more stringent requirements are imposed on the design process by local regulations, they must be followed and are the responsibility of the design professional.

For design and technical assistance, call Infiltrator Systems' engineering department at 1-800-221-4436. All systems must be approved in writing by this department prior to installation.

PRODUCT APPLICATIONS

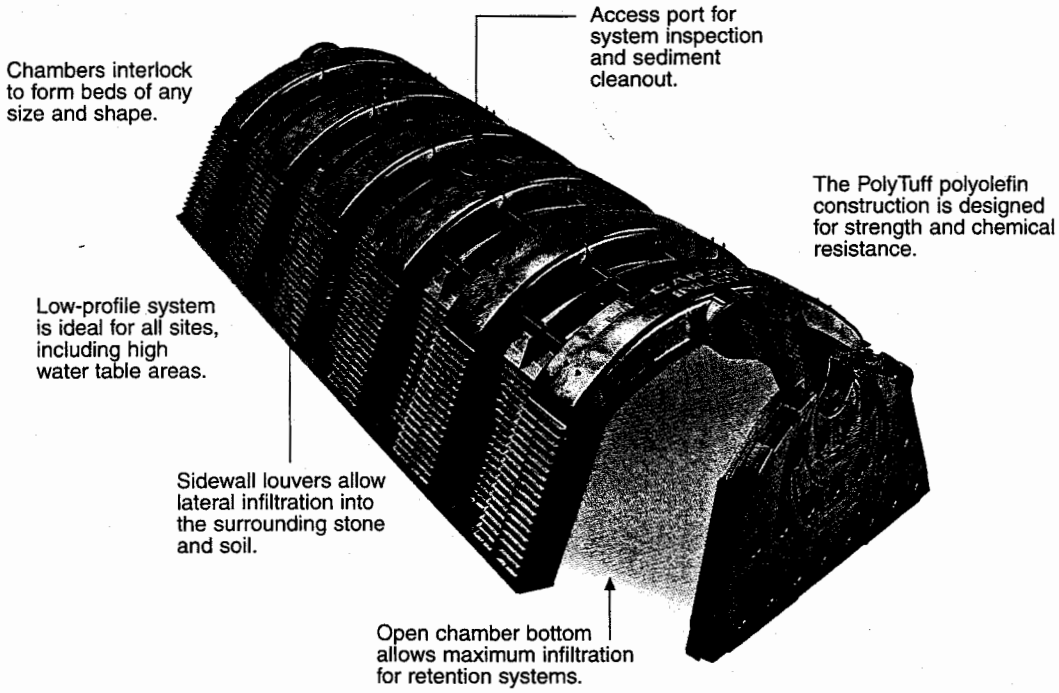
The High Capacity Infiltrator Chamber System is ideal for subsurface stormwater storage in detention facilities and for exfiltration in retention systems. It's an excellent alternative to all other methods of stormwater attenuation including surface ponds. The High Capacity Infiltrator Chamber System can be used under pavement or vegetated surfaces, for commercial, industrial, recreational, and residential developments.

STORAGE AND STRENGTH CAPABILITY

High Capacity Infiltrator chambers are open-bottomed structures with louvered sidewalls that provide maximum infiltration into the surrounding stone and soil. Each chamber stores up to 122 gallons (16.3 cubic feet) of runoff. The chambers are molded from PolyTuff™ plastic, a proprietary blend of polyolefin, for maximum strength and resistance to chemicals typically found in stormwater runoff. The High Capacity Chamber System provides the needed storage and the greatest possible infiltrative interface of any stormwater system. Its low profile also makes it ideal for use in high water table areas.

DESIGN CAPABILITY

One of the greatest advantages of the High Capacity Infiltrator Chamber System is its design flexibility. The chambers may be configured into beds or trenches of various sizes and fit on nearly all sites.



The engineer must first determine the purpose of the system when designing a High Capacity Chamber System. This may be stormwater detention, retention, first flush storage, or some combination of these.

It is important to consider the natural characteristics of the site and adjacent sites when determining the size and configuration of each chamber bed. Soils, topography, water table elevation, restrictive layers (i.e. ledge, hardpan), and surface drainage patterns are some of the factors that must be assessed in the preliminary stages of design work.

All pertinent regulatory concerns must also be addressed throughout the entire design process and are the responsibility of the design engineer.

For technical support, contact Infiltrator Systems Inc. at 1-800-221-4436.

REGULATORY REQUIREMENTS.

Regulations often dictate the type of system to be used in a particular application.

Detention - The purpose of a detention system is to store a calculated volume of stormwater in the chamber bed before releasing it to an outflow structure. Outflow is allowed at a predetermined rate based on regulatory mandates and the calculated peak runoff for both pre-development and post-development conditions. Detention systems use controlled-flow outlets, usually in the form of multi-stage orifices or weirs, sized to allow specific flows at various vertical stages within the storage system. They are designed to drain completely within a specified period, usually less than 48 hours.

Retention - In a retention system, a calculated volume of stormwater is stored in the chamber bed. The primary drainage mechanism is infiltration into the soil and typically no principal outlet is used. This drainage method makes the soil's permeability and the depth to the water table especially important. It is also important to intercept sediment and organic materials suspended within the stormwater before they reach the chamber bed in this type of system. Depth to bedrock or other restrictive layers must be in accordance with local requirements.

First Flush Attenuation - A first flush attenuation system provides storage for the first 0.5 to 1.0 inches of rainfall over the contributing watershed. The first flush of stormwater runoff from paved areas and other impervious surfaces carries a large percentage of pollutants. It's better to store this runoff and subject it to the soil's filtration and renovation capabilities when the protection of groundwater is a primary concern.

Flow exceeding the first flush must be directed towards a storage system such as the High Capacity Infiltrator Chamber System, stream, storm sewer, or other outlet where it can be disposed of according to proper engineering practice. The first flush design is similar to that of a retention facility but is usually of a much lower volume. Interception of solids through the use of water quality inlets is very important to the longevity of this type of system.

INFILTRATOR® SYSTEMS INC

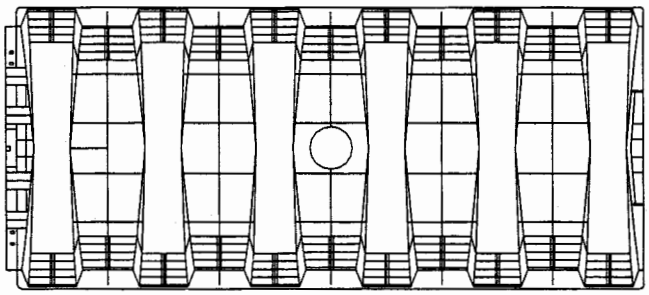
SYSTEM COMPONENTS

The High Capacity Infiltrator Chamber System is manufactured by Infiltrator Systems Inc., headquartered in Old Saybrook, Connecticut. The system is comprised of High Capacity Infiltrator chambers and closed end plates that seal the ends of each chamber row. These components are illustrated in Figures 1 and 2. The endplates are blow molded from high-density polyethylene and the chambers are injection molded from PolyTuff polyolefin with a minimum density of 0.90 grams per cubic centimeter (ASTM D1248, D1505). The following chart shows the nominal specifications of each chamber:

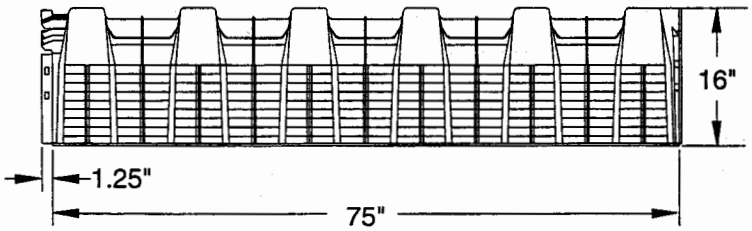
NOMINAL CHAMBER SPECIFICATIONS	
Size (W x L x H)	34" x 75" x 16"
Storage	122 gal/16.3 ft^3
Weight	38 lb

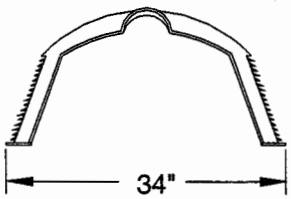
FIGURE 1: HIGH CAPACITY INFILTRATOR CHAMBER

Plan View



Side View

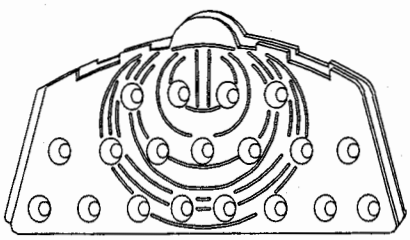




The top of the chamber is arched and the bottom is completely open. Both the top and sidewalls are corrugated for structural support. The sidewalls are louvered, allowing for infiltration into the surrounding stone and soil. Each unit has a nominal wall thickness of at least 1/8 inch and a bearing footprint of 2.05 square feet. The minimum sidewall opening area is 0.42 square feet per linear foot, or 2.60 square feet per unit. The sidewall openings measure 0.20 inches high and have ribs above and below them. They overlap 1 1/4 inches at the joints with interlocking latches which allow the chamber rows to extend indefinitely for the best system design. Each chamber has a knockout port in the center of its top, capable of receiving a 4 inch diameter pipe through which the system can be inspected.

High Capacity Infiltrator chambers used in stormwater management applications have an American Association of State Highway and Transportation Officials (AASHTO) H-20 load rating. The chambers can support 32,000 pounds per axle with 18 to 96 inches of cover (excluding the pavement), properly compacted as specified in the Infiltrator installation requirements.

FIGURE 2: HIGH CAPACITY INFILTRATOR CHAMBER CLOSED END PLATE



NOTE: Holes may be cut in the end plate to accept pipes up to 12" in diameter.

INFILTRATOR® SYSTEMS INC

The following items must be included in each design to meet Infiltrator Systems' standards and specifications, to ensure proper installation, and to satisfy the product warranty conditions.

1 **To confirm that the installation will be in accordance with Infiltrator Systems' current standards and specifications, a note indicating that the contractor must contact Infiltrator Systems Inc. prior to installation must be placed in a prominent place on the plans.** Notes and drawings are available from Infiltrator Systems Inc. Construction must comply with Infiltrator Systems' current installation requirements. This applies to material specifications as well as construction methods. **The contractor must contact Infiltrator Systems Inc. to ensure that he/she has the latest requirements before the installation begins and to schedule a pre-construction meeting. Allow 5 business days advance notice for this meeting.**

2 It is the design engineer's responsibility to ensure that the base of the system is suitable for the desired application.

3 The chamber bed's base must be properly compacted to a minimum of 95% of the modified Proctor density (AASHTO T180) using hydraulic (flooding) and/or mechanical means.

4 A minimum 3 inch layer of 1½ - 2 inch washed, crushed stone must be specified on the bottom of the chamber bed. The stone layer must be leveled and compacted with a vibratory roller to provide a flat, smooth surface for placement of the High Capacity Infiltrator chambers. In retention systems, the crushed stone must be washed to prevent fines from clogging the soil surface. Crushed stone must also be placed around the perimeter of the chamber bed for additional infiltrative surface and proper structural support. This stone must be compacted with at least two passes of a vibratory plate compactor in maximum one foot lifts.

5 Soil backfill must be compacted to a minimum of 95% of the modified Proctor density or according to local code, whichever is more restrictive. Refer to local codes for compaction requirements. Backfill must be placed and compacted in lifts of 12" or less.

6 **A note must be placed on the plan alerting the contractor to dig one extra foot beyond the planned footprint of the chamber bed. This allows working space for setting the chambers and facilitates backfill compaction.**

7 The water collection and inlet system must be designed to intercept as much sediment and organic debris as possible. Catch basin sumps, downward facing 90° elbows on catch basin pipe outlets, settling tanks, sand filters, and other measures can be considered for this purpose. These can also be used in combination for the best results. The most common and easiest method is to use 90° elbows in conjunction with adequate catch basin sumps. All water quality inlets should be inspected on a regular basis and maintained as necessary. **It is recommended that a maintenance and inspection schedule for the stormwater management system be included as part of the design. Call Infiltrator Systems' stormwater department at 1-800-221-4436 for assistance in developing this schedule.**

8 **Erosion and sediment control measures must be integrated in the plan and must be designed to protect the site both during and after construction.** These practices may have a direct impact on the water quality of the site. Erosion and sedimentation can be controlled by vegetation, temporary sediment barriers (silt fences, hay bales, fabric-wrapped catch basin grates), and strategic stormwater runoff management.

9 There must be an adequate pavement design in traffic bearing applications that complies with or exceeds local codes and regulations. Pavement thickness is not included in the required cover.

10 **All plans must be submitted and reviewed by Infiltrator Systems Inc. prior to shipment of the chambers.** Forward the plans to: *Stormwater Department, Infiltrator Systems Inc., 4 Business Park Road, P.O. Box 768, Old Saybrook, CT 06475.* A prompt response will follow.

 3694 SF PROVIDED

INFILTRATOR® SYSTEMS INC

The following steps provide the calculations needed to size a system once its type (i.e. detention, retention, or first flush) is determined. The worksheet on page 7 itemizes these calculations and costs.

0.905 AC × 3630 CF/AC (1") = 3285 CF.

1 Determine the amount of storage volume (V_s) needed. The amount of storage needed for the anticipated flow must be determined based on local code requirements. It is commonly found using TR-55 or the rational method. 1.29 AC × 1" IMP. AC. 4682 CF.

2 Determine the number of chambers (C) needed. To find the number of chambers needed for adequate storage, divide the storage volume (V_s) by 24 cubic feet per chamber.

NOTE: The void volume of the stone (35%) plus the chamber volume (16.3 cubic feet) is approximately 24 cubic feet. CHAMBERS (21 ROWS) 1112.5 LF / 75/12 = 178 PROV. OK.

$$(C) = \frac{(V_s)}{24\ ft^3}$$

$$\frac{3285}{24} = 136.87 \text{ RND}$$

3 Determine the required bed size (S). To find the size of the bed, multiply the number of chambers needed (C) by 17.7 square feet. 136.87 × 17.7 = 2422 SF ✗ 3694 PROVIDED

NOTE: It is necessary to add one foot around the perimeter of the bed, for working space.

If you need assistance determining the number of chambers per row or customizing the bed configuration to fit a specific site, call Infiltrator Systems' stormwater department at 1-800-221-4436.

$$(S) = (C) \times 17.7\ ft^2$$

4 Determine the quantity of stone (V_{st}) needed. Each chamber, in accordance with Infiltrator Systems' requirements, requires 0.85 cubic yards of 1½ to 2 inch washed, crushed stone.

NOTE: Extra stone is needed around the perimeter of the system, between the chambers and the trench walls. This number will vary depending on the site. The following calculation includes a 10% overage of stone.

$$(V_{st}) = (C) \times 0.85\ yd^3$$

136.87 × 0.85 = 116.33 c.y.

5 Determine the volume of excavation (E_x) needed. Based on a minimum of 18 inches of cover, each chamber requires a minimum of 2.0 cubic yards of excavation.

*NOTE: The volume of excavation will vary depending on the depth of the cover. This factor does **not** include the required extra foot of excavation around the perimeter of the bed.*

$$(E_x) = (C) \times 2.0\ yd^3$$

6 Determine the area of filter fabric (F) needed. The sides of the bed and top of the stone must be covered with a 4 ounce/square yard, non-woven filter fabric (Mirafi 140N or equivalent). The area of the sidewalls must be calculated and a 2-foot overlap must be included where two pieces of filter fabric are placed side by side or end to end. NOT BOTTOM

NOTE: In areas where there are wide fluctuations in the water table, the bottom of the trench (at the soil/stone interface) should be lined as well.

7 Determine the amount of geogrid (G) needed. All beds must have geogrid (ISI 14,000 or Tensar BX 1100) placed over the system, 12" above the top of the chambers. The geogrid must extend 5 feet past the perimeter of the chamber footprint in all directions. If two pieces of geogrid are placed side by side or end to end, they must overlap a minimum of 2 feet. ✓

NOTE: Refer to manufacturer's installation instructions for specific information.

8 Determine the number of end plates (E_p) needed. Each row of chambers requires two end plates.

$$(E_p) = 2 \times (\#\ of\ rows)$$

CONTACT INFILTRATOR SYSTEMS INC. FOR FINAL DESIGN REVIEW AND APPROVAL.
All designs must be reviewed and approved by Infiltrator Systems Inc. to ensure that compliance with current Infiltrator standards and specifications have been met. Failure to forward plans to Infiltrator Systems Inc. will void the product warranty. Forward all plans to: Stormwater Department, Infiltrator Systems Inc., 4 Business Park Road, P.O. Box 768, Old Saybrook, CT 06475. A prompt response will follow.

MATERIALS WORKSHEET

High Capacity Infiltrator H-20 Chamber System

INFILTRATOR® SYSTEMS INC

Project _____

By _____ Date _____

Location _____

Checked by _____ Date _____

SYSTEM REQUIREMENTS

1. Required storage volume **(V_s)** = ... [ ] ft³ **(V_s)**
2. Number of chambers **(C)** needed: $\frac{(V_s)}{(24\ ft^3)}$ = ... [ ] chambers **(C)**
3. Required bed size **(S)**: **(C)** x 17.7 ft² = ... [ ] ft² **(S)**
4. Quantity of stone **(V_{st})** needed: **(C)** x 0.85 yd³ = ... [ ] yd³ **(V_{st})**

   Quantity of stone in tons: **(V_{st})** x 1.4 = ... [ ] tons of stone **(T_{st})**
5. Volume of excavation **(E_x)**: **(C)** x 2.0 yd³ = ... [ ] yd³ **(E_x)**
6. Area of filter fabric **(F)** required = ... [ ] yd² **(F)**
7. Required geogrid (ISI 14,000 or Tensar BX1100) **(G)** = ... [ ] yd² **(G)**
8. Quantity of end plates needed **(E_p)**: 2 x (# of rows) = ... [ ] end plates **(E_p)**

NOTE: Round up to the nearest whole number.

SYSTEM COST

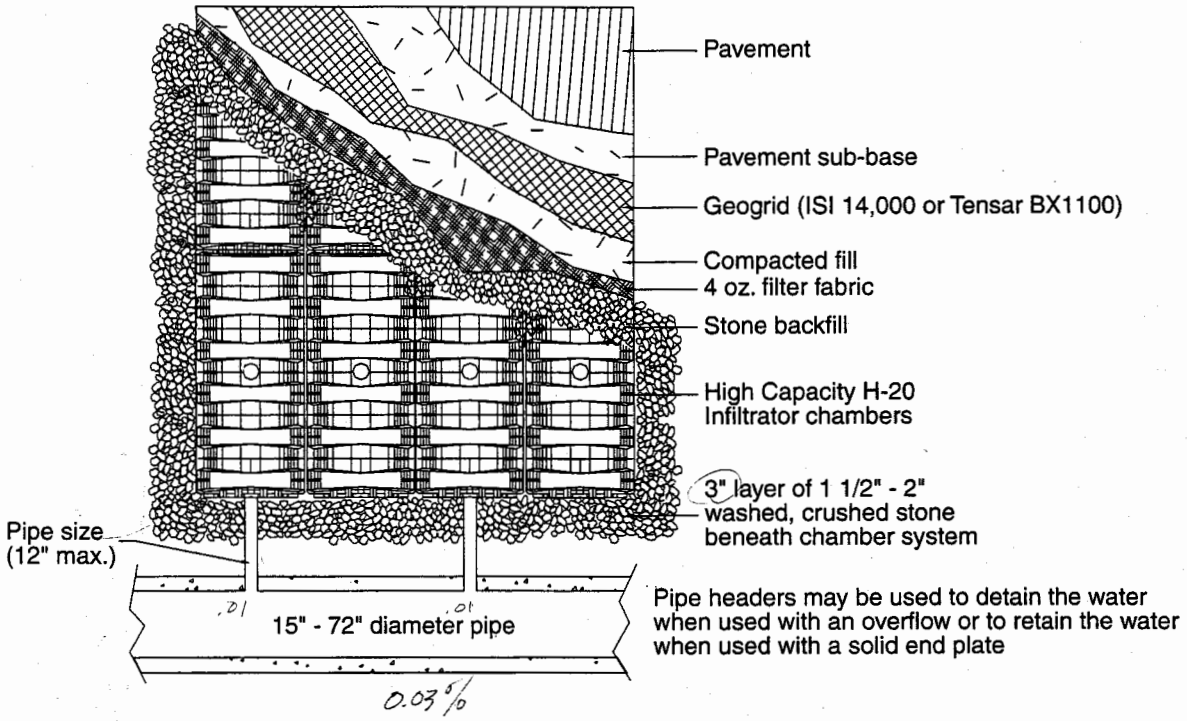
	Quantity			Cost			Total
Chambers **(C)**	_____		x	$ _____	/ chamber	=	$ _____
Stone **(T_{st})**	_____	tons	x	$ _____	/ ton	=	$ _____
Excavation* **(E_x)**	_____	yd³	x	$ _____	/ yd³	=	$ _____
Filter fabric **(F)**	_____	yd²	x	$ _____	/ yd²	=	$ _____
Geogrid **(G)**	_____	yd²	x	$ _____	/ yd²	=	$ _____
End plates **(E_p)**	_____		x	$ _____	/ end plate	=	$ _____

SUBTOTAL (does not include cost for installation): **$** _____

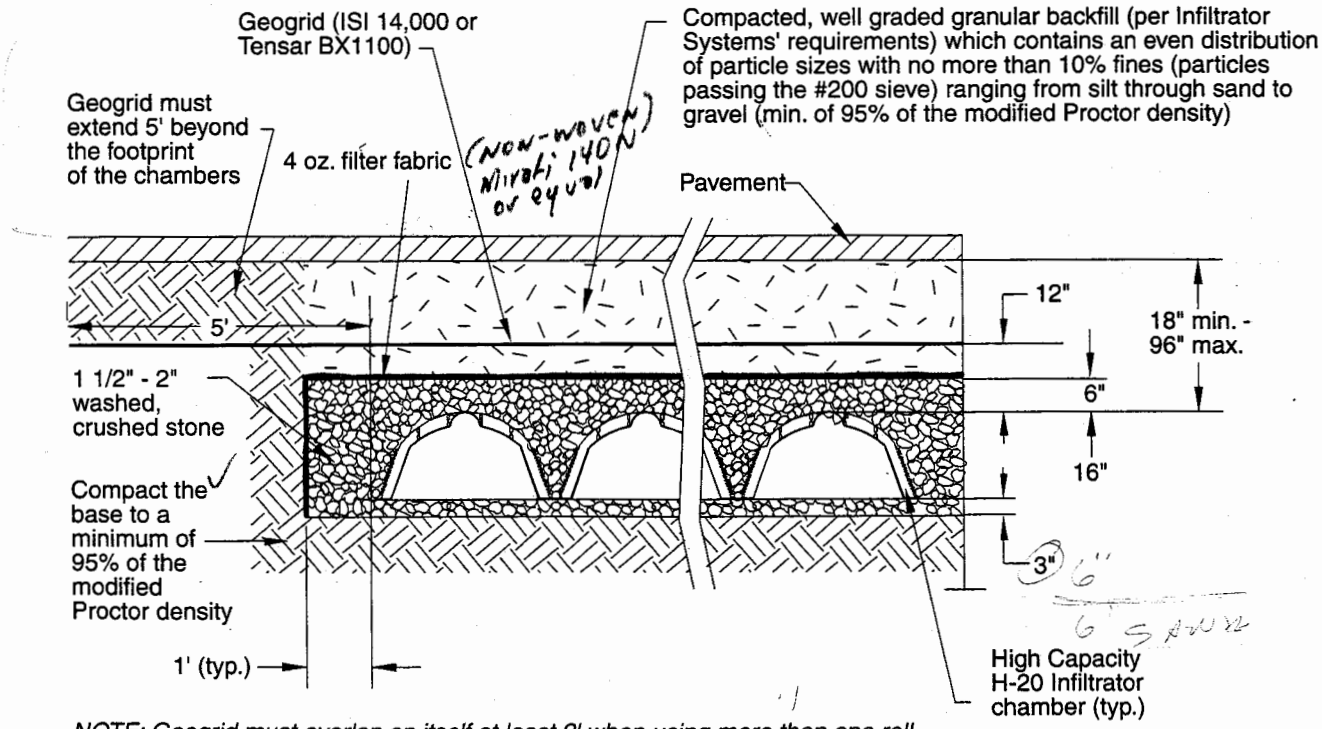
** Excavation includes backfill and compaction.*

INFILTRATOR® SYSTEMS INC

PLAN VIEW OF HIGH CAPACITY H-20 INFILTRATOR CHAMBER SYSTEM



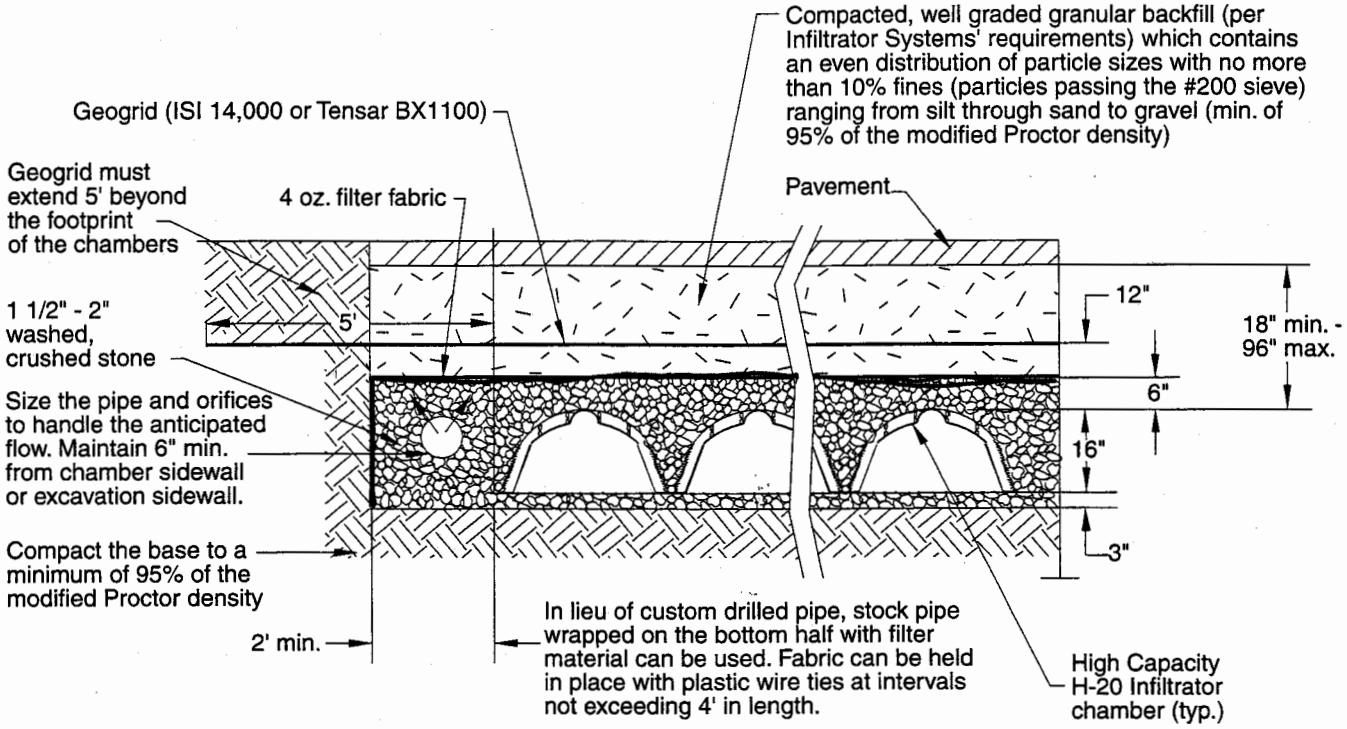
TYPICAL CROSS SECTION HIGH CAPACITY H-20 INFILTRATOR CHAMBER SYSTEM



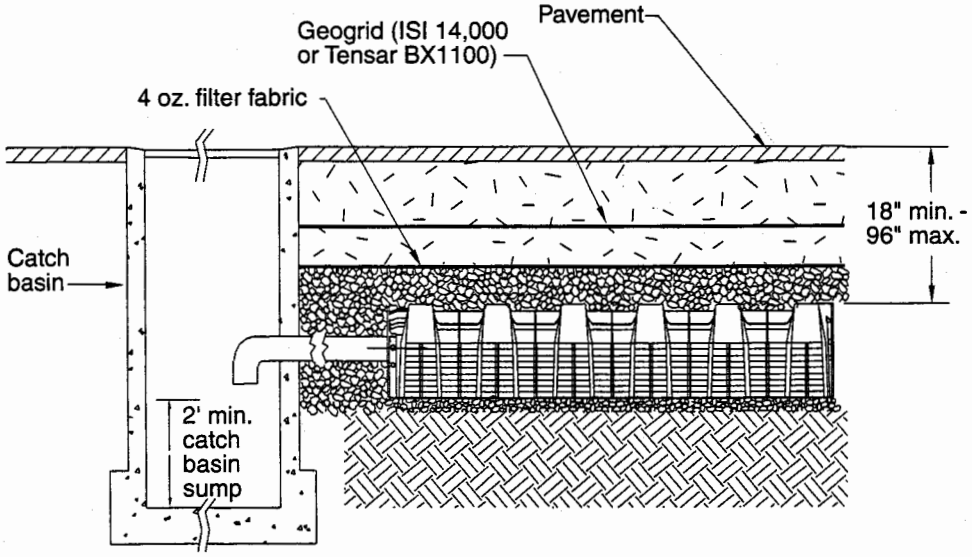
NOTE: Geogrid must overlap on itself at least 2' when using more than one roll.

INFILTRATOR® SYSTEMS INC

TYPICAL CROSS SECTION OF THE PERFORATED PIPE DISTRIBUTION METHOD



TYPICAL CROSS SECTION OF A CATCH BASIN SUMP TO A RETENTION SYSTEM



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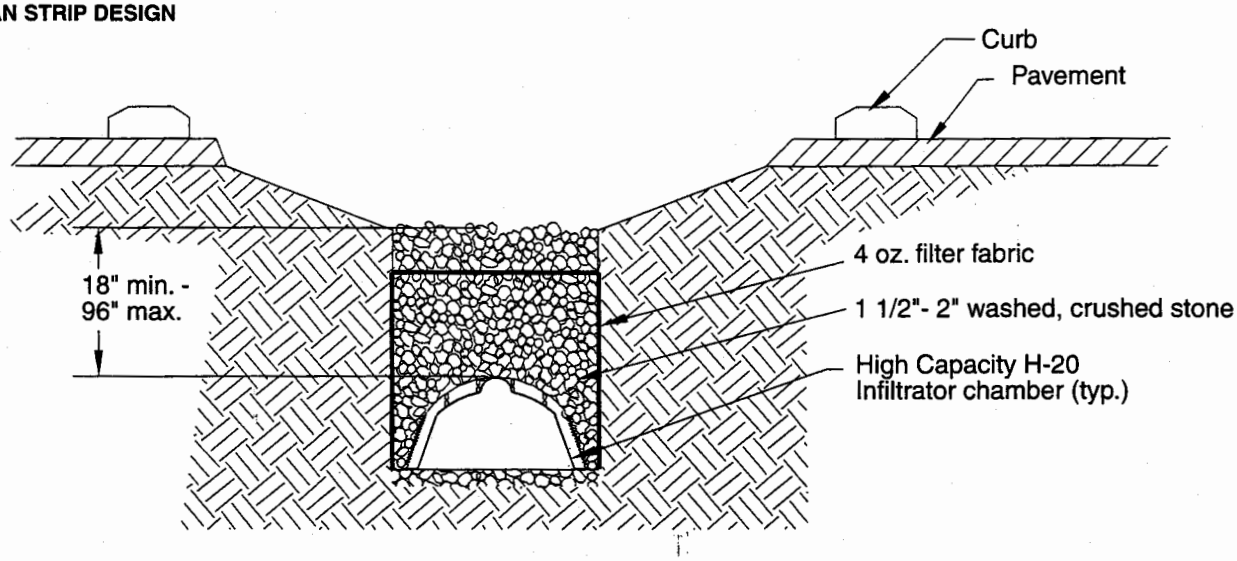
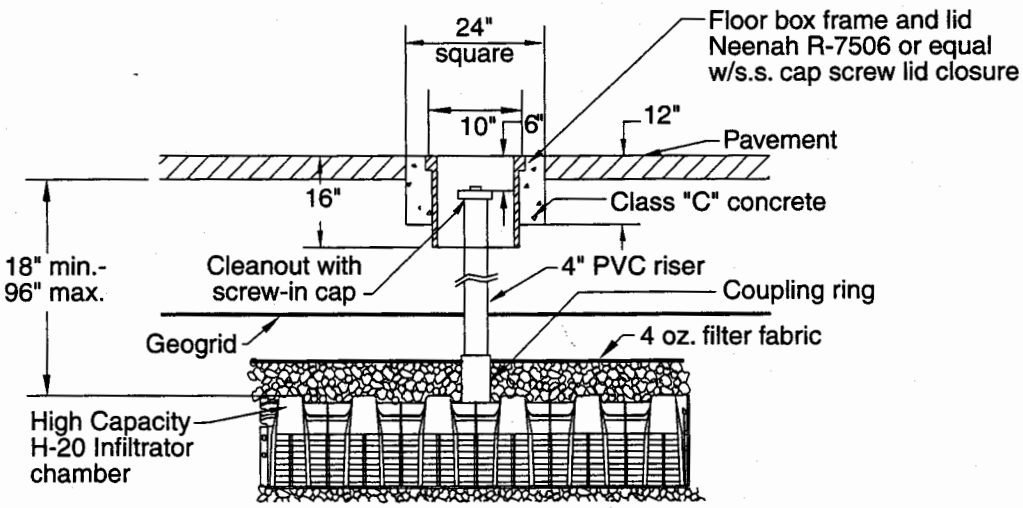
MEDIAN STRIP DESIGN



INSPECTION PORT DETAIL



a. The structural integrity of the High Capacity H-20 System (as defined below), when installed in accordance with Infiltrator's written specifications at the time of installation, is warranted to the original purchasing contractor or subcontractor (the "Purchaser") against defective materials and workmanship for one (1) year from the date of purchase. Should a defect appear in the warranty period, the Purchaser must inform Infiltrator Systems Inc. ("Infiltrator") of the defect in writing within ten (10) days of the discovery of the defect. Infiltrator agrees to supply replacement components for those parts of the System found by Infiltrator to be defective. The supply of replacement components is the sole remedy of the Purchaser for breaches of this warranty. **THIS WARRANTY IS EXCLUSIVE. THERE ARE NO OTHER WARRANTIES WITH RESPECT TO THE SYSTEM, INCLUDING NO WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.**

b. This Limited Warranty applies solely to the System, which is defined as the H-20 units and endplates manufactured by Infiltrator and sold to the Purchaser. This Limited Warranty only applies to such units and endplates when installed in a single layer. **UNDER NO CIRCUMSTANCES, SHALL THE UNITS AND ENDPLATES BE INSTALLED IN A MULTI-LAYER CONFIGURATION.**

c. If the System is not installed in strict accordance with a design approved by Infiltrator, including any modifications required by Infiltrator, Infiltrator shall have no liability or responsibility to the Purchaser, including no liability or responsibility under this Limited Warranty.

d. Prior to installation of the System, Purchaser shall require the installing contractor to attend a conference with Infiltrator to discuss installation requirements. If the installing contractor fails to attend this conference, Infiltrator shall have no liability or responsibility to the Purchaser, including no liability or responsibility under this Limited Warranty.

e. Infiltrator may elect to have a representative onsite during all or part of the installation of the System. The Purchaser agrees to permit the Infiltrator representative to be onsite for the installation and to cooperate with the Infiltrator representative in all reasonable respects. If the Purchaser breaches this subsection (e), then this Limited Warranty shall be void.

   If the representative is onsite, the representative shall be there solely for purposes designated by Infiltrator. **THE REPRESENTATIVE SHALL NOT ASSUME ANY OBLIGATIONS OF ANY CONTRACTOR OR SUBCONTRACTOR. SPECIFICALLY, AND WITHOUT LIMITATION, ALL SUPERVISORY DUTIES ARE THE SOLE RESPONSIBILITY OF THE PURCHASER; AND THE PURCHASER SHALL BE SOLELY RESPONSIBLE FOR INSTALLATION OF THE SYSTEM IN ACCORDANCE WITH THE APPROVED DESIGN AND INFILTRATOR'S WRITTEN SPECIFICATIONS AT THE TIME OF INSTALLATION AND IN ACCORDANCE WITH ALL APPLICABLE LAWS, CODES, RULES, AND REGULATIONS.**

   The providing of a representative onsite shall have no effect on the terms and conditions of this Limited Warranty or on the relative rights and responsibilities of Infiltrator and Purchaser under this Limited Warranty, nor shall the presence of the representative at the site increase Infiltrator's liability under this Limited Warranty.

f. Under no circumstances shall Infiltrator be liable to the Purchaser or to any third party for claims arising from the design of the System, shipment of the components of the System, or installation of the System.

g. **THE WARRANTY DOES NOT EXTEND TO INCIDENTAL, CONSEQUENTIAL, SPECIAL, OR INDIRECT DAMAGES; PENALTIES OR LIQUIDATED DAMAGES, INCLUDING LOSS OF PRODUCTION AND PROFITS; LABOR AND MATERIALS; OVERHEAD COSTS; OR OTHER LOSS OR EXPENSE INCURRED BY THE PURCHASER IN REMOVAL OR INSTALLATION OF THE SYSTEM. SPECIFICALLY EXCLUDED FROM WARRANTY COVERAGE ARE DAMAGE ARISING FROM ORDINARY WEAR AND TEAR; ALTERATION, ACCIDENT, MISUSE, ABUSE, OR NEGLECT; THE SYSTEM BEING SUBJECTED TO STRESSES GREATER THAN THOSE PRESCRIBED IN INFILTRATOR'S WRITTEN SPECIFICATIONS; THE PLACEMENT OF IMPROPER MATERIALS INTO THE SYSTEM; OR ANY OTHER EVENT NOT CAUSED BY INFILTRATOR.**

h. This warranty may not be amended except by a written instrument signed by an officer of Infiltrator at its corporate headquarters in Old Saybrook, Connecticut. This Limited Warranty does not apply to any party other than to the Purchaser.

Distributed By:

INFILTRATOR® SYSTEMS INC

The world leader in chamber technology℠

4 Business Park Road, P.O. Box 768 Old Saybrook, CT 06475
800-221-4436 860-388-6639 FAX 860-388-6810
www.infiltratorsystems.com

800-221-4436

U.S. Patents: 4,759,661; 5,017,041; 5,156,488; 5,336,017; 5,401,116; 5,401,459; 5,511,903; 5,588,778; 5,716,163; 1,815,925; 1,974,938; 1,729,383; 448,338
Canadian Patents: 1,329,959; 2,004,564 Other U.S., Canadian, and foreign patents pending.

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GROUP 34 - STORM WATER
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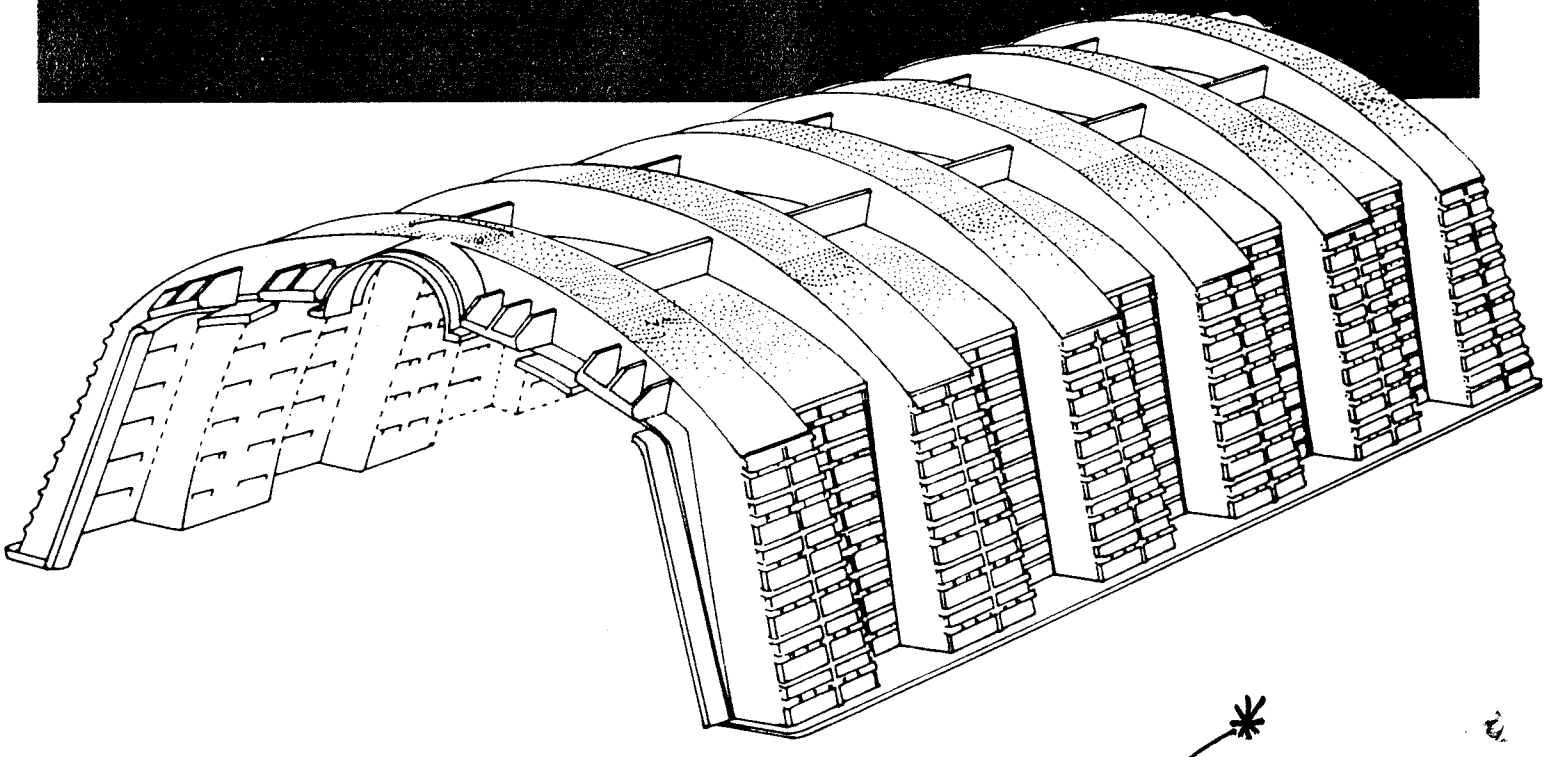
THE INFILTRATOR™

CHAMBER SYSTEMS

Stormwater Design Manual



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Because of this fact, many regulatory communities have allowed for total system volume reduction to account for this increased exfiltration. However, in many cases this total volume reduction may not actually be a reduction in soil interface area, so the effectiveness of the system is maintained.

6. Design Flexibility

INFILTRATOR™ chambers combine the wisdom of chamber technology with the modern material technology of polyethylene. This simplistic design allows for tremendous design flexibility to the engineering and regulatory communities. INFILTRATOR™ chambers may be easily interlocked to form trenches, or laid side-by-side to form large beds. In areas where land area is restricted, multiple INFILTRATOR™ chambers may be used. The tiers must be laid perpendicular to each other. In all cases, INFILTRATOR™ chambers can provide a technically sound cost effective alternative to conventional stormwater management systems.

7. Material

INFILTRATOR™ chambers are molded from a high density polyethylene polymer which enables the product to be incredibly strong while still being relatively lightweight. This combination allows INFILTRATOR™ chambers to be installed at a significant cost savings over other more bulky and costly materials. Polyethylene is also a very chemically resistant material and is completely inert to most of the chemicals found in stormwater runoff.

VI. INSTALLATION

1. General

A subsurface stormwater facility which utilizes INFILTRATOR™ chambers will provide time, labor, and ultimately money savings over other conventional systems. Each durable, lightweight unit is easily handled by one man for a quick and easy installation. There is no need for any additional heavy equipment to lay the units. INFILTRATOR™ units snap together with interlocking joints to form trenches. Trench runs may be laid side by side to form beds. In most all stormwater applications, the use of stone for stabilization, and geo-textile fabric to prevent fines intrusion, is required and detailed in the following sections.

2. Stone or Gravel Specification

The benefits of an aggregate material in an INFILTRATOR™ chamber system is four fold: it stabilizes the base material, provides energy dissipation to stop erosion, provides free flow between the chambers, and provides additional void storage volume. However, also critical to the use of aggregate is that it must not adversely effect the structural integrity of the chambers. As stone is placed in the system, it inherently has the ability to move before it settles. Infiltrator Systems Inc. recommends that each lift of stone be compacted with a light vibratory plate or roller (see VI 5). This will reduce the ability of the stone to move during construction and provide increased structural stability.

Through extensive testing and increased field experience, Infiltrator Systems Inc. requires the following stone specifications:

1. crushed stone - 1.5 inch to 2.5 inch

2. rounded gravel - 2 inch to 2.5 inch

or:

American Society for Testing and Materials
ASTM D - 448, size number #2

3. Geo-textile or Filter Fabric

The use of geo-textiles as a filtering medium has revolutionized the stormwater industry over the last decade. Infiltrator Systems Inc. recommends a minimum weight of 4 oz. filter fabric be used to wrap the sides and top of the stone surrounding the chambers to prevent fines intrusion and maintain void area between the stones. The following chart is a partial list of acceptable geo-textiles that may be used in an INFILTRATOR™ chamber system.

ACCEPTABLE GEO-TEXTILES FOR USE WITH INFILTRATOR™ CHAMBERS

AMOCO	45/45 , 45/47	
MARAFI	140-N , 180N	NOTE: This is a partial list only and should not be limited to, or endorse any products.
POLYFELT	TS500 , TS700	
SPARTAN TECH.	ST-45 , ST-80	
SUPAC	4.5NP , 8NP	
TERRATEX	SD, NO-8	

4. Cover Material and Backfill

The backfill material for H-20 applications should be a well-graded sandy material ranging from silt to gravel. A well-graded soil contains an even distribution of grain sizes, ranging from silt through sand to gravel. A maximum of 10% should pass the no. 200 sieve and 90% should pass the 3" sieve. The material should at minimum meet the applicable state's Department of Transportation specifications for sub-grade material.

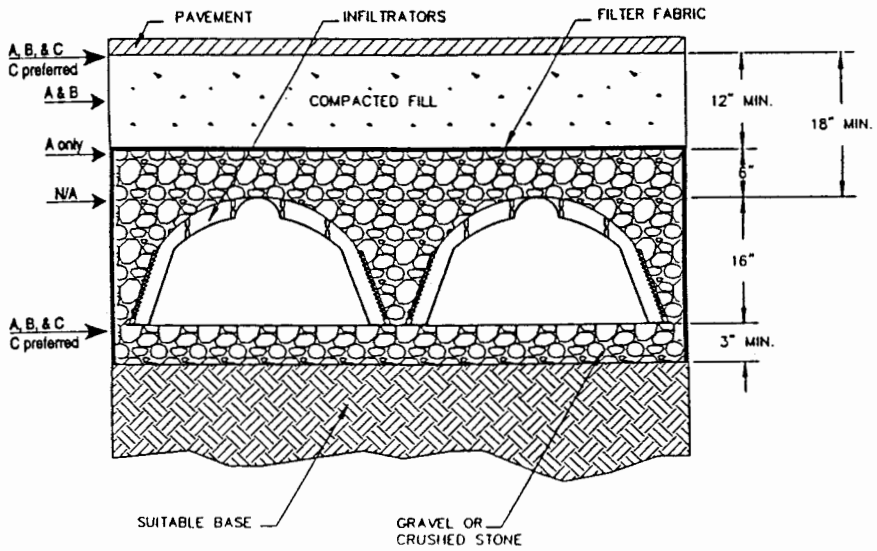
5. Vibratory Roller Specification

TYPE:

A.	Maximum gross vehicle weight of 8,000 lbs.	Maximum dynamic force of 10,000 lbs.
B.	Maximum gross vehicle weight of 12,000 lbs.	Maximum dynamic force of 20,000 lbs.
C.	Maximum gross vehicle weight of 20,000 lbs.	Maximum dynamic force of 40,000 lbs.

Use:

A, B or C (preferrably C)	on 6" base layer of stone
A ONLY	on 6" of stone over INFILTRATOR™ units
A or B	on 6" of stone plus 6" of compacted soil cover over INFILTRATOR™
A, B, or C (preferrably C)	on 6" of stone plus 12" of compacted soil cover over INFILTRATOR™



6. Installation Instructions

An installation instruction brochure is available upon request and outlines general guidelines which should be followed when installing an INFILTRATOR™ chamber system. It should be noted however that most jobs are site specific and may require additional guidelines. Detailed installation instructions are listed below and should be used as a minimum standard when installing an INFILTRATOR™ chamber bed.

1. Before the site is disturbed by excavation, the area planned for the INFILTRATOR™ bed should be roped off to prevent heavy equipment from compacting the underlying soils.

2. Silt fence should be placed around the perimeter of the bed before construction begins to keep sediment out of system area. Actual construction of the bed should not begin until the site is completely stabilized.

3. Excavate bed area using either a bulldozer, front-end loader, or an excavator. (Note. A shallow INFILTRATOR™ system may be excavated using a dozer or loader for a significant cost savings.) The bed bottom should be leveled to the specified depth.

   a. Labor and construction costs can be reduced on larger systems by using "Dig and Lay Process" approach, rather than by doing the entire system in individual steps.

4. Analyze basal material for soil type and texture; if the soil is a loose, well- sorted sand, then the base may be lightly compacted with a vibratory plate or roller. However, if the soil is a firm to dense, well-graded material, then careful consideration should be taken to not further compact and reduce the soil's permeability.

5. Line perimeter of excavation (sidewall) with specified geo-textile. Infiltrator Systems Inc. does not recommend geotextile beneath the bed.

6. Place specified stone in bed and level to form 3" to 6" base layer. The base layer of stone should be compacted to a minimum level of 95% using a vibratory roller (see VI, 5 c.)

7. Place first INFILTRATOR™ units in the inlet end of excavation with interlocks facing downstream.

8. Slip INFILTRATOR™ units together, fully engaging interlocks to form desired bed length. Place rows of chambers side by side to achieve desired bed width.

   a. To keep joints from coming apart during construction, joints may be screwed together.

   b. Bed laterals may be kept from shifting by tying bottom flanges of INFILTRATOR™ units together using plastic wire ties through molded holes at random locations along rows.

   c. System grade can be checked with a level or surveying equipment.

9. Construct inlet structure as specified in appropriate design requirements. Run distribution pipe to rows of INFILTRATOR™ chambers as per design. NOTE: There is no need to inlet every row of chambers - several inlet points per bed is sufficient.

10. Cut appropriate size hole in closed end plate for distribution pipe. Screw end plate into both inlet and outlet ends of each row.

    a. End plates are stepped to fit either end of chambers. Upper step fits into inlet end and lower step in downstream end (with interlocks).

    b. A cordless drill and self drilling screws work well for all connections.

11. Run distribution pipe through inlet opening in end plate. NOTE: Pipe does not run the length of the system. The water will enter at inlet and rise level throughout the stone and chamber bed.

12. Fill stone in between and 6" (when specified) over of the INFILTRATOR™ chambers. In long, narrow trenches and beds the stone may be ladled on to the bed, flush with top of units, from an excavator, avoiding vehicular traffic on the chambers. For larger rectangular beds, where this is not possible, the stone should be spread carefully to a minimum depth of 6" with a track mounted machine with a gross vehicle weight no greater than 16,000 lbs. An equivalent low ground pressure machine with greater gross weight may be used. When spreading the stone, a 6" minimum layer of stone MUST be kept beneath the tracks of the vehicle at all times. In addition, the tracks must be kept perpendicular to the chamber rows at all times with a minimal amount of abrupt track turning. A vibratory roller meeting specification 5.a., shall be used to compact the first 6" lift.

13. The backfill material should be laid in 6" to 12" lifts to the required H-20 AASHTO rating of 32,000 lbs/axle with 18" of backfill cover. A minimum of 6" lifts may be used when backfilling with a machine less than or equal to 16,000 lbs gross weight. When using a machine greater than 16,000 lbs then the backfill material should be spread with a minimum of 12" of soil always beneath the tracks of the machine. The gross vehicle weight of the track mounted machine should not exceed 30,000 lbs. and should always operate perpendicular to the chamber rows. Once the backfill material has been properly placed in the lifts, then the soil should be compacted. The compaction may be performed with a vibratory plate or roller. The compaction levels and sub-base preparation should at a minimum, meet the applicable State's Department of Transportation specification for asphalt or pavement sub-base.

NOTE: DO NOT USE WHEELED VEHICLES ON THE BED DURING CONSTRUCTION. Infiltrator Systems Inc. recommends using a well-graded soil for backfill to maximize load carrying capability.

14. Rope off immediate bed area when construction is completed to avoid any unnecessary wheeled vehicle traffic. After proper depth of cover is compacted and settled, INFILTRATOR™ chambers will support H-10 and H-20 loads as marked, and final surface grade may be constructed. NOTE: A full paving truck will in most situations be the greatest loads that the system will encounter, so careful consideration should be taken during this construction phase to avoid any increased dynamic loading through abrupt movement.

15. Engineering designs may require a multi-layer system. Follow previous instructions, adding additional tiers of INFILTRATOR™ units, separated by a 6" minimum stone layer. In a multi-layer system, it is particularly critical to compact the intermediate layer of stone with a light vibratory plate or roller (spec. 5.a.) to ensure proper settle ment for structural support. Tiers MUST be perpendicular to each other and must be constructed using H-20 units.

    a. Run distribution to the top tier only, with gravity distribution to the lower tiers.

    b. Distribution need only be run to rows indicated by engineering design, and not to every row.

NOTE: Single-layer systems maximize exfiltration area and minimize construction costs.

VII. INSPECTION AND MAINTENANCE

1. General

It is essential to any subsurface stormwater system to detail and perform a proper inspection and maintenance program because poor maintenance can soon render a system useless. Many communities set forth a legally binding maintenane agreement which is outlined in the property deeds. This agreement should detail maintenance tasks and schedules, and grant access for regular inspections to enable the town to perform the maintenance and sen the bill to the owner if the system has been neglected.

2. Operation

Each INFILTRATOR™ chamber is provided with a "knock out" in the center of the unit. This may be used to provide an inspection port at grade level. A 2" - 6" pvc or cast iron pipe can be placed through the access port as a riser to grade. This riser can be capped with various cast iron covers in paved areas as needed. Inspection should be conducted following major storm events so that potential sediment levels and draw down times can be determined. This routine inspection will allow for a maintenance schedule to be determined prior to system malfunction.

3. Maintenance

The following maintenance schedule is to be used as a minimum requirement for systems utilizing INFILTRATOR™ chambers. Site specific designs may deviate from these general requirements.

	STRUCTURE	TYPE OF REMOVAL	MINIMUM SCHEDULE
PRIMARY	catch basin sump	heavy solids, debris, sediment	quarterly or when routine inspection shows need
SECONDARY	oil & grit seperation tank, oversized manifold or header pipe	hydrocarbons, fine sediment	bi-annually or when routine inspection shows need
PRIMARY/ SECONDARY	parking lot perimeter filter strip	heavy solid fine sediment hydrocarbons	quarterly or when routine inspection shows need

Sediment removal should take place prior to entering any subsurface infiltration system - chambers included. However, because of their large open areas, chambers are less susceptible to silt clogging than pipe and stone designs.

If the pretreatment structures are not completely effective in silt removal and it enters the chamber system, then INFILTRATOR™ chambers may be maintained through the access port. Water may be injected into the system which should put the fine sediments back into suspention where it can be pumped out and removed.

Various types of equipment are available commercially for the clean out of systems. The most commonly used equipment and techniques used for cleaning subsurface systems are vacuum pump and water jet spray. Both systems are generally mounted on a self-contained vehicle and can effectively remove stones, leaves, litter and sediment deposits from sumps and chambers.

Virginia Department of Conservation and Recreation

Stormwater and Erosion & Sediment Control Programs

TECHNICAL BULLETINS

TECHNICAL BULLETIN No. 1: *Stream Channel Erosion Control Policy Guidance*

Technical Bulletin No. 1 provides formal guidance on the implementation of the Stream Channel Erosion Component of the Stormwater and Erosion and Sediment Control (MS-19) programs.

TECHNICAL BULLETIN No. 2: *Hydrologic Modeling and Design in Karst*

Technical Bulletin No. 2 serves as in insert into Chapter 4 of Volume II of the Virginia Stormwater Management Handbook. Section 4-6 was adapted from the New Jersey Soil Erosion and Sediment Control Design Manual Published by the New Jersey Department of Agriculture. Special thanks goes to Mr. John Showler and Mr. Samuel R. Race of the New Jersey Department of Agriculture, as well as Ms. Terri Brown of the Virginia Natural Heritage Program, for their assistance in the development of this section.

TECHNICAL BULLETIN No. 3: *Minimum Standard 3.10E - Polyethylene Chamber Systems*

Technical Bulletin No. 3 serves as an insert into Minimum Standard 3.10: General Infiltration Practices of Volume I of the Virginia Stormwater Management Handbook, 1999.

TECHNICAL BULLETIN No. 4: *Performance- and Technology-Based Water Quality Criterion*

Technical Bulletin No. 4 provides a design based example for compliance with both the Performance-based and Technology-based water quality criterion. The goal is to illustrate that both methodologies require the same level of water quality treatment for most development sites. Special thanks to Douglas Beisch, Environmental Engineer, of the Chesapeake Bay Local Assistance Department for developing this Technical Bulletin.

Special Thanks to Wendy Mears, of the Albemarle, Chowan & Coastal Watersheds Office, for her dedicated support in producing the Virginia Stormwater Management Handbook.

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The views expressed herein are those of the authors and do not necessarily reflect the views of NOAA or any of its subagencies.

MINIMUM STANDARD 3.10E

POLYETHYLENE CHAMBER SYSTEMS

Definition

Polyethylene chambers are arch-shaped, open bottom, high-density polyethylene structures of various sizes and related storage capacities.

Purpose

Polyethylene chambers are typically used as a component to a water quality BMP for providing increased subsurface storage volume for stormwater runoff. Infiltration trenches rely on the void ratio of the stone reservoir to hold the runoff while it slowly infiltrates into the subsoil. These chambers provide a large void capacity and can be used to increase the storage volume in order to store and therefore infiltrate a greater volume of runoff, or they can be used to decrease the required trench size and stone necessary to provide the equivalent required volume. The large open-bottom chamber design is also intended to provide increased water quality enhancement due to the relatively large area of bio-mat formation under the chambers, similar to the chambers' function when used for septic drain fields.

Polyethylene chamber systems can also be used to provide detention storage for purposes of stream channel erosion control, i.e. detention of runoff from the 1-year, 2-year, or even 10-year frequency storm.

It should be noted that these chambers can be used in a linear configuration, in place of conveyance pipe, from inlet structures to stormwater BMPs. Some of the larger chambers currently manufactured are capable of conveyance comparable to a 48 inch diameter pipe. An advantage of this alternative conveyance approach is to encourage infiltration in areas where it otherwise would not be provided.

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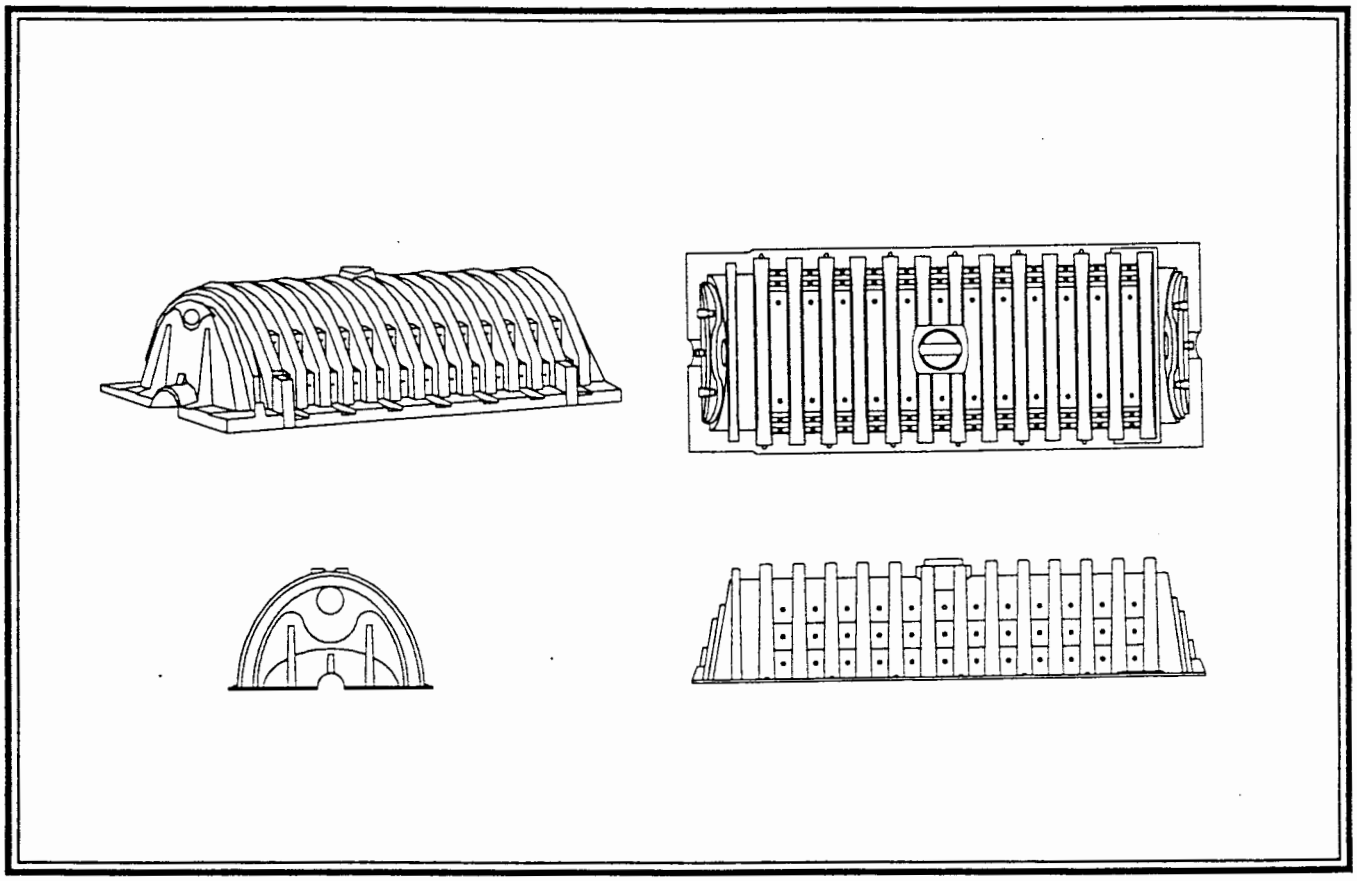
FIGURE 3.10E - 1
Polyethylene Chamber Systems



Note: Refer to manufacturer specifications for dimensions. Several sizes and shapes are available.

Conditions Where Practice Applies

Polyethylene chamber systems are presented here as a component of infiltration practices. *Drainage Area* and *Development Condition* considerations and limitations associated with Infiltration Practices and Bioretention Basins will apply here, with the exception of allowing increased drainage area size as a function of the increased storage volume provided by utilizing the chambers. These chamber systems can be placed in the subsurface storage area of infiltration trenches, roof down spout systems, porous pavement, and bioretention basins and filters. Some models are available in both H10 and H20 wheel load rated versions for application in trenches under porous pavement.

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reasonable infiltration rate and where the water table is low enough to prevent pollution of groundwater. However, where the subsoil is not sufficiently permeable to provide a reasonable infiltration rate, polyethylene chamber systems can be used as subsurface detention facilities for purposes of stream channel erosion or flood control. When these systems are used for detention purposes, the economics of placing detention underground, and therefore freeing up property which would otherwise be dedicated to a detention facility, must be weighed against the initial cost of the chamber system and the long term maintenance costs of the system. In general, a pretreatment design which prevents trash, debris, or excessive sediment from entering the chambers and potentially clogging the outlet device must be provided. Underground detention of stormwater raises concerns regarding maintenance. The structure will remain full of water for extended periods if debris clogs the outlet pipe. In some cases this may result in increased opportunities for infiltration. However, if the soils are not permeable, the structure will remain full and possibly cause the next storm to bypass or backup the system.

Polyethylene chambers are well suited for retrofit of existing stormwater systems to provide a water quality BMP and/or runoff quantity control benefits. This is particularly applicable in highly developed areas with storm sewer systems with little or no integrated water quality BMPs or water quantity controls. Relatively small polyethylene chamber systems can be "tucked" into available areas, can be used to replace existing stormwater conveyance pipe, or used in place of conveyance pipe for new construction.

Polyethylene chambers can also be used as an integral component of other infiltration facilities. When used in place of perforated pipe in an infiltration trench, the functional life of the infiltration trench can be extended due to the open bottom area of the chambers. When used within the base area of a bioretention facility, they increase the amount of water which can be filtered through the engineered soil media during storms which produce runoff in excess of the infiltration capacity of the underlying soils.

Infiltration facilities are not recommended for areas where Karst topography is present due to the possibility of causing subsurface collapse and solution channel formation.

Drainage Area

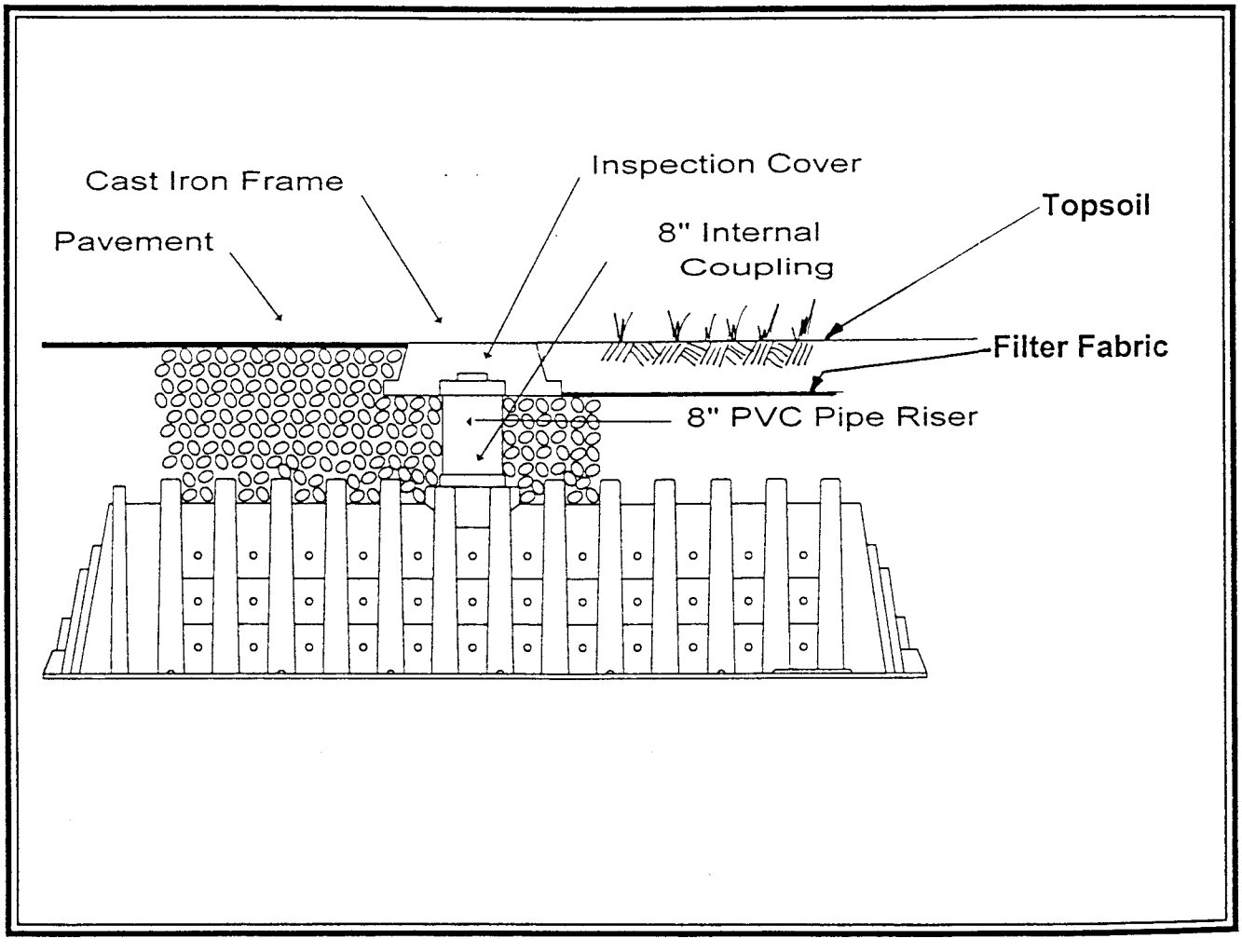
Polyethylene chamber systems are practical for small to medium sized drainage areas. Generally, polyethylene chamber systems can be used for drainage areas of up to 10 acres. For infiltration facilities which rely on the bottom surface area for infiltrating into the subsoil, the designer must check to verify that the facility will drain within the required time period. When the chambers are used under a Bioretention Filter (with an under drain system), the surface or planting area of the facility will determine the allowable drainage area.

Development Conditions

Because polyethylene chamber systems can be installed under trafficked or non-trafficked, open space or paved areas, they are equally well suited for low- to high- density residential, commercial, and industrial developments. They can be installed under roadways or within the roadway shoulder, or under parking lots, landscaped areas, tennis and basketball courts, play areas, or athletic fields. Smaller, multiple systems can be scattered throughout a site, under various types of land uses, each separate from the others with its own inlet structures. Due to their great flexibility in configuration and installation, polyethylene chamber systems can be configured in a single long line or in a rectangular or square "block" of numerous parallel rows of chambers. Other configurations are also possible by altering the number of chambers in different rows.

FIGURE 3.10E - 2

Application of Polyethylene Chamber System Under Porous Pavement and Open Space



Planning Considerations

Planning considerations include site conditions: soil permeability, depth to seasonal high groundwater table and bedrock, topographic conditions; sediment (and debris) control: construction runoff and urban runoff; and maintenance. Site conditions must be reviewed to verify that the site does not overlay Karst topography. Soil permeability will determine whether the polyethylene chambers can be utilized as a water quality BMP to promote infiltration, or simply for temporary detention of stormwater. For further discussion, refer to the **Planning Considerations** previously discussed in **General Infiltration Practices, Minimum Standard 3.10**, and **Bioretention Basin Practices, Minimum Standard 3.10**.

Design Criteria

The purpose of this section is to provide recommendations and minimum criteria for the design of polyethylene chamber systems. The designer must verify that the use of the selected product is in accordance with the manufacturers specifications.

General

Polyethylene chamber systems can be designed in many configurations to meet the specific limitations of the site and the main purpose for which they are being used, e.g. temporary storage of runoff as either detention or retention, for a water quality BMP, or for stormwater conveyance. This section shall focus on the use of polyethylene chamber systems for temporary storage of runoff and for a water quality BMP.

The reader should refer to **Minimum Standard 3.10B: Infiltration Trench** for soils investigation requirements, topographic conditions and limitations, design infiltration rate, and maximum storage time and trench depth. (Refer to manufacturers specifications for maximum depth and loading capacities of specific product models.)

The storage volume of a polyethylene chamber system is calculated by summing the void space provided by the chambers and that of the surrounding stone.

Runoff Pretreatment

Preventative maintenance of subsurface storage systems, i.e. catch basins with sumps, silt diversion structures, siltation basins, etc. is in accordance with sound BMP practices. Additional chambers may be added to the system to compensate for potential loss of storage capacity. This has been

achieved with some installations by replacing the inflow and/or outflow manifold pipes with chambers, and/or by using polyethylene chambers in place of conveyance pipe. Another approach includes segregating the first two or three chambers of each row from the rest of the polyethylene chamber system with high density polyethylene pipe connecting the upper holes in the end walls of the chambers. The first set of polyethylene chambers functions as a sediment trap. In this type of configuration, eight inch PVC risers can be placed on the first, and/or second chambers of the first two "up-flow" polyethylene chamber rows for observation and clean-out.

Backfill Material

Backfill material for polyethylene chamber systems should be clean 1½ to 2 inch hard granite-type stone aggregate up to at least the top of the chambers. Limestone aggregate should not be used in order to avoid the "pasting" of limestone fines that can deter infiltration. Additional aggregate of the same specifications can be added for the remaining fill to also function as the base for porous pavement (refer to **Minimum Standard 3.10D: Porous Pavement**), or to a height suitable for the addition of sufficient soil for grass and/or shrub placement.

A minimum of 6 inches of clean 1½ to 2 inch hard granite-type stone aggregate should also be placed as a base, underlying the polyethylene chamber system. A geotechnical investigation should be undertaken to determine if stabilization of the system base is needed.

Filter Fabric

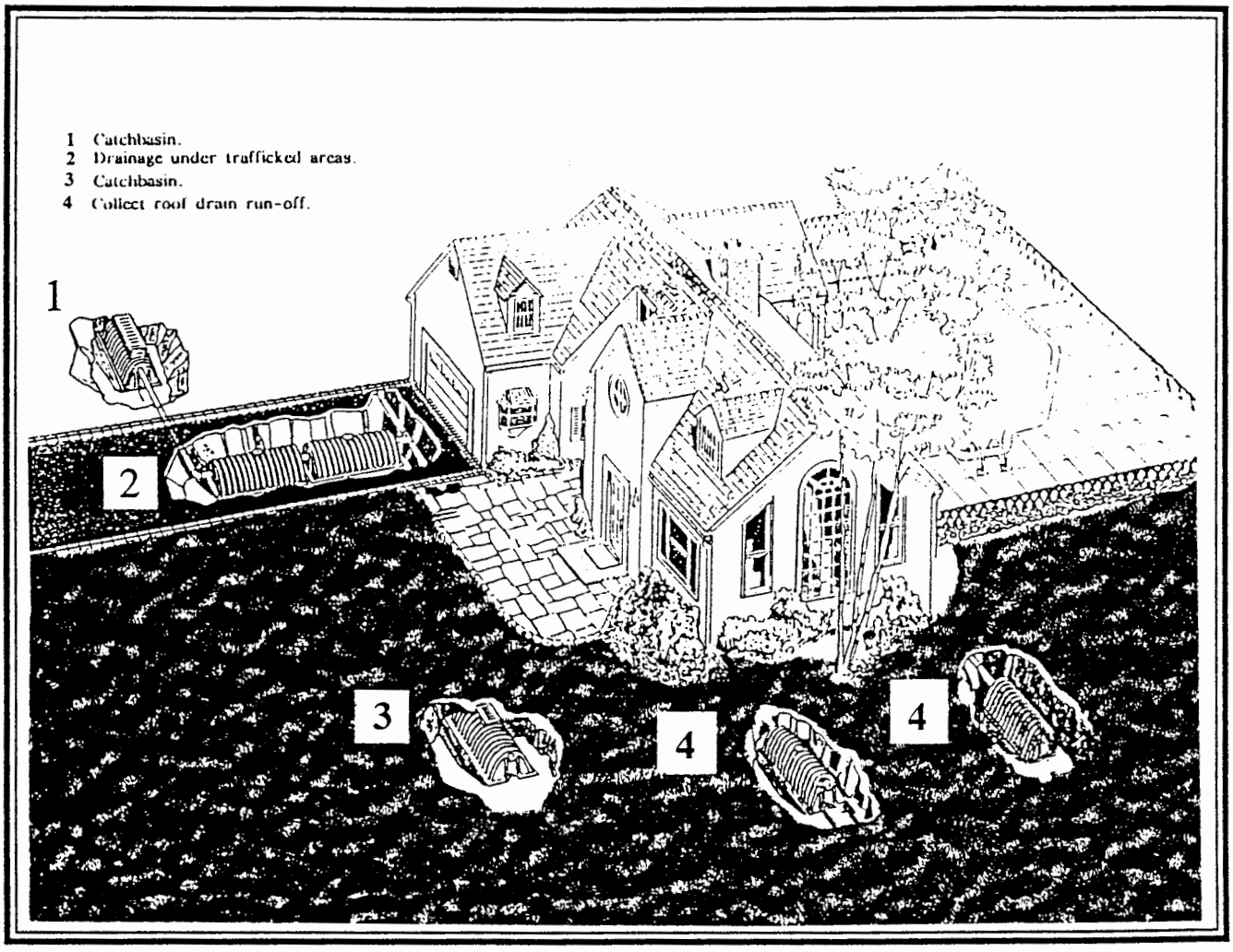
The top of the aggregate fill material should be covered with an engineering filter fabric. It is also recommended that an engineering filter fabric should be placed along the sides of the trench. Note, however, that filter fabric should **not** be placed on the trench bottom.

Overflow Channel

Because of the small drainage areas controlled by a polyethylene chamber system, an emergency spillway is not necessary. Due to their relatively higher void capacity, polyethylene chamber systems can hold relatively higher storage volumes. Polyethylene chamber systems, particularly with the larger chambers, are capable of retaining significant storm events without an overflow facility in many cases.

However, the overland flow path to be taken by the surface runoff, when the capacity of the polyethylene chamber system is exceeded, should always be evaluated. A nonerosive overflow channel leading to a stabilized watercourse should be provided, as necessary, to insure that uncontrolled, erosive, concentrated flow does not develop.

FIGURE 3.10E - 3
Example Site Design Using Polyethylene Chamber Systems



Observation Well

An observation well should be installed through the top of the first chambers of the first two rows receiving the runoff flow. The observation well will show how quickly the polyethylene chamber system drains following a storm, as well as providing a means of determining when maintenance is needed.

The observation wells should consist of perforated PVC pipe, 8 inches in diameter. They should be installed flush with the ground elevation of the polyethylene chamber system. The top of the well should be capped to discourage vandalism and tampering.

Construction Specifications

Accepted construction standards and specifications should be followed where applicable. Specifications for the work should conform to the methods and procedures indicated for installing earthwork, concrete, reinforcing steel, pipe, water gates, metal work, woodwork and masonry, as they apply to the site and the purpose of the structure. The specification should also satisfy any requirements of the local government.

The use and installation of polyethylene chamber systems must be in conformance with all manufacturers specifications. Construction of a polyethylene chamber system should also be in conformance with the following:

Sequence of Construction

A polyethylene chamber system should not be constructed or placed into service until all of the contributing drainage area has been stabilized. Runoff from untreated, recently constructed areas within the drainage area may load the newly formed polyethylene chamber system and/or pretreatment facility with a large volume of fine sediment. Other devises, such as temporary inlet structure silt sacks can be used until site stabilization is achieved.

The specifications for the construction of a polyethylene chamber system should state the following: 1) *the earliest point at which storm drainage may be directed to the polyethylene chamber system, and 2) the means by which this delay in use is to be accomplished.* Due to the wide variety of conditions encountered among development projects, each project should be evaluated separately to postpone the polyethylene chamber system use for as long as possible.

Trench Preparation

Trench excavation and preparation, stone placement, and filter fabric placement should conform to the Construction Specifications of **Infiltration Trenches: Minimum Standard 3.10B**.

The trench should be excavated with a backhoe or similar device that allows the equipment to stand away from the trench bottom. This bottom surface should be scarified with the excavator bucket teeth on the final pass to eliminate any smearing or shearing of the soil surface. Similarly, the stone aggregate base should be placed on the trench bottom so that it does not compact or smear the soil surface. Clean, washed, broken hard granite-type stone, 1½ to 2 inches, should be used instead of limestone. Limestone and its associated fines, with prolonged exposure to water, tends to leave a pasty residue which retards infiltration.

Large tree roots must be trimmed flush with the trench sides to prevent the fabric from puncturing or tearing during subsequent installation procedures. No void between the filter fabric and the excavation walls should be present. If boulders or similar obstacles are removed from the excavated walls, natural soils should be placed in these voids before the filter fabric in installed. The sidewalls of the trench should be roughened where sheared and sealed by heavy equipment.

Polyethylene Chamber System Placement

The first chamber of each row of the polyethylene chamber system is placed upon the stone aggregate base and the inlet manifold system installed. Sufficient additional stone aggregate is placed around the chambers and the inlet manifold system to hold the chambers in place so that the next chamber in each row can be installed. Additional stone aggregate is then placed on these chambers to hold them in place. The process progresses until all chambers are in place and the outlet manifold, if utilized, is installed. Extra care should be taken when placing stone at the end walls at the end of each chamber row. Place stone along the centerline of the top of the end chambers to spill over the ends. Placing a large amount of stone directly against the end walls could cause them to deform.

Inlet Manifold Installation

An inlet manifold is used to disperse the runoff into the rows of the polyethylene chamber system. Under normal conditions, laterals are used off of the header pipe into every other row. Where large flash flows are anticipated, laterals should be placed into every row of the polyethylene chamber system. A minimum diameter for the laterals is 4 inches; 12 inch laterals are recommended for sites where typical flow conditions are anticipated. Some of the larger polyethylene chambers can accommodate up to 24 inch laterals.

Outlet Manifold Installation

An outlet manifold can be used at the down-flow end of a polyethylene chamber system. Construction specifications are the same as for the inlet manifold. Alternatives to an outlet manifold include placing the polyethylene chamber system off-line or directing chamber flow from the inlet structure at a lower elevation than the excess flow.

Stone Aggregate Fill Placement

At a minimum, place enough additional fill of the 1½ to 2 inch washed stone aggregate to just cover the chambers. The top of this fill should be level.

Backfill

Polyethylene chamber systems are typically backfilled with soil. Additional 1½ to 2 inch washed stone aggregate can also be used up to the minimum depth needed for soil to support a vegetative cover or for placement of the base for porous pavement.

Surface Cover Placement

For areas proposed for open space, grass, ground cover or shrubs can be used. The use of trees is not recommended to avoid possible problems with roots extending into the chambers.

For areas proposed for porous pavement, sufficient depth should be left for placement of the pavement base and the overlying pavement.

Observation Well

Observation wells should be provided as specified in the design criteria. The depth of the well at the time of installation should be clearly marked on the well cap.

Maintenance / Inspection Guidelines

The following maintenance and inspection guidelines are not intended to be all-inclusive. Specific facilities may require other measures not discussed here.

Inspection Schedule

Same as for **Infiltration Trench, Minimum Standard 3.10B.**

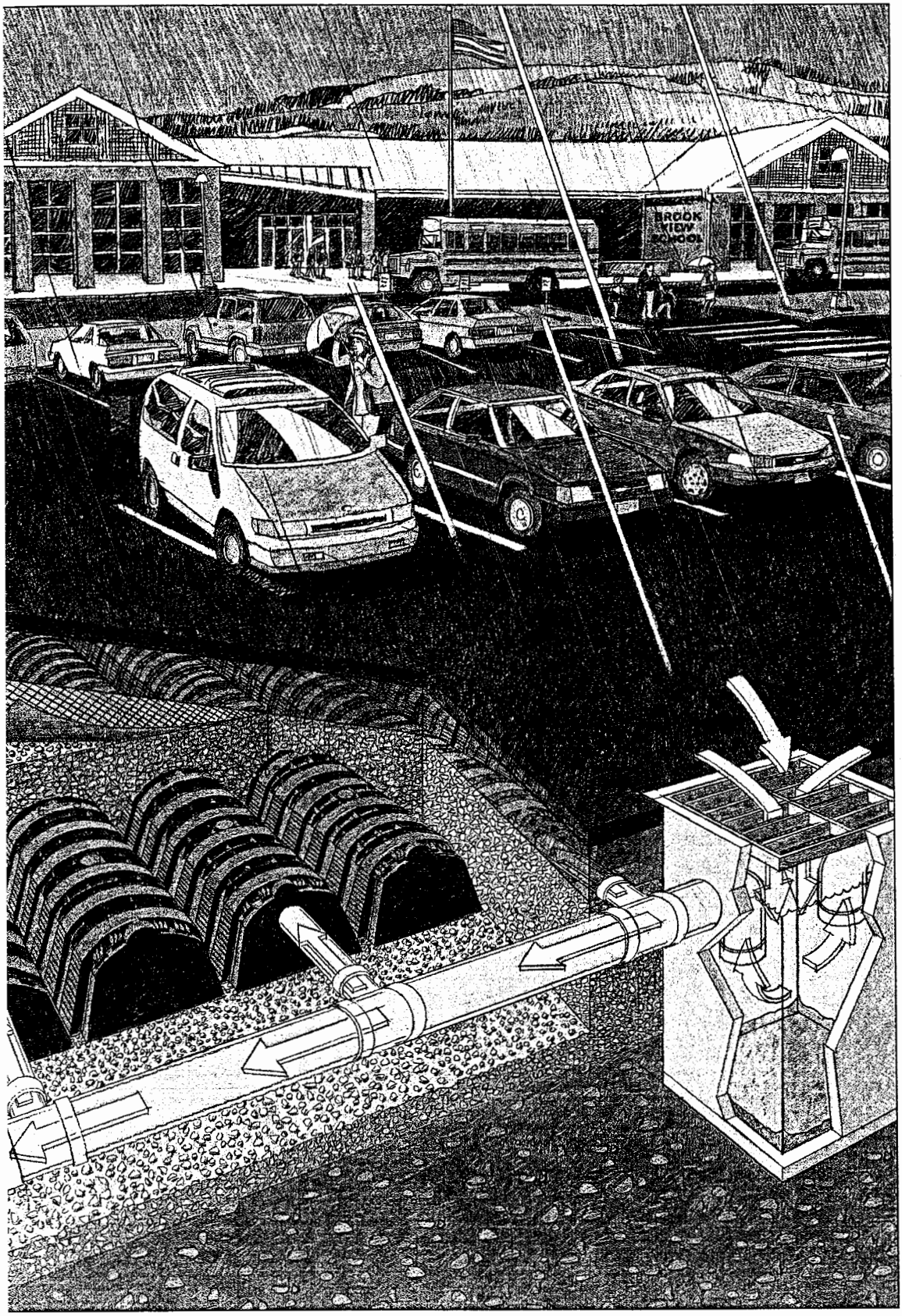
Sediment Control

Sediment buildup within the pretreatment structure should be monitored on the same schedule as the observation well within the trench and chamber system.

Manufacturer Contact:
Mr. Bob Maestro
Practical Environmental Technologies
P.O. Box 672
Occoquan, VA 22125
E-mail: cultec.envirotec@erols.com ph: (703) 492-0686

The High Capacity H-20 Infiltrator® Chamber System for Stormwater Management.

INFILTRATOR® SYSTEMS INC



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Design Manual

INFILTRATOR® SYSTEMS INC

This manual is intended to help the design professional plan a subsurface stormwater system using High Capacity Infiltrator chambers that meets all of Infiltrator Systems' standards and specifications. When more stringent requirements are imposed on the design process by local regulations, they must be followed and are the responsibility of the design professional.

For design and technical assistance, call Infiltrator Systems' engineering department at 1-800-221-4436. All systems must be approved in writing by this department prior to installation.

PRODUCT APPLICATIONS

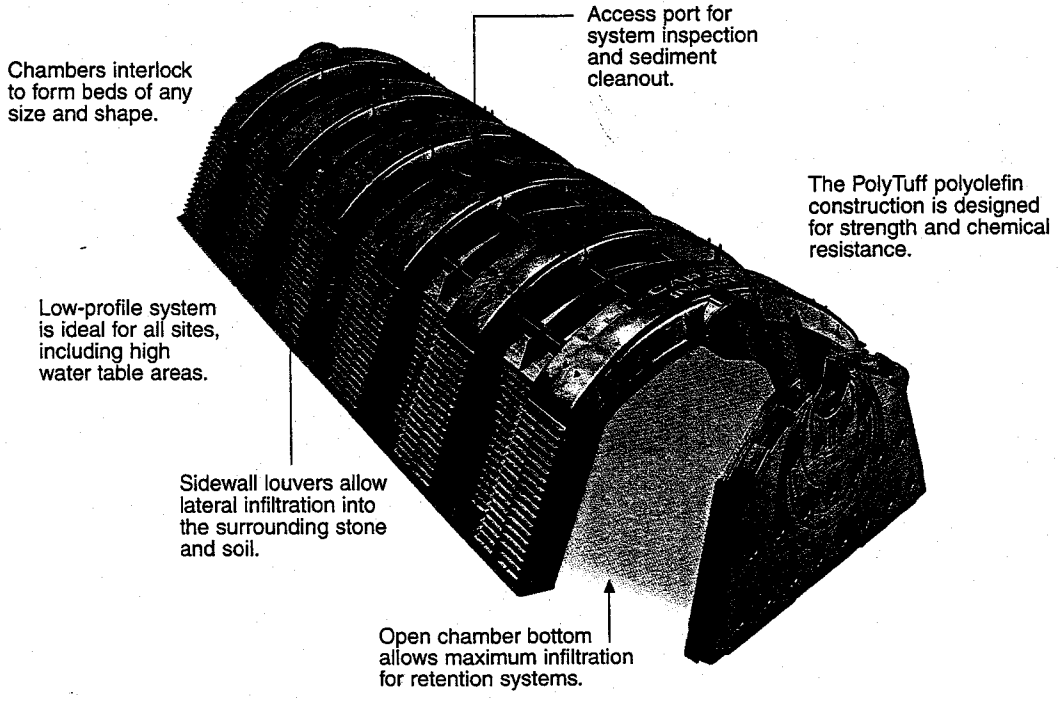
The High Capacity Infiltrator Chamber System is ideal for subsurface stormwater storage in detention facilities and for exfiltration in retention systems. It's an excellent alternative to all other methods of stormwater attenuation including surface ponds. The High Capacity Infiltrator Chamber System can be used under pavement or vegetated surfaces, for commercial, industrial, recreational, and residential developments.

STORAGE AND STRENGTH CAPABILITY

High Capacity Infiltrator chambers are open-bottomed structures with louvered sidewalls that provide maximum infiltration into the surrounding stone and soil. Each chamber stores up to 122 gallons (16.3 cubic feet) of runoff. The chambers are molded from PolyTuff™ plastic, a proprietary blend of polyolefin, for maximum strength and resistance to chemicals typically found in stormwater runoff. The High Capacity Chamber System provides the needed storage and the greatest possible infiltrative interface of any stormwater system. Its low profile also makes it ideal for use in high water table areas.

DESIGN CAPABILITY

One of the greatest advantages of the High Capacity Infiltrator Chamber System is its design flexibility. The chambers may be configured into beds or trenches of various sizes and fit on nearly all sites.



The engineer must first determine the purpose of the system when designing a High Capacity Chamber System. This may be stormwater detention, retention, first flush storage, or some combination of these.

It is important to consider the natural characteristics of the site and adjacent sites when determining the size and configuration of each chamber bed. Soils, topography, water table elevation, restrictive layers (i.e. ledge, hardpan), and surface drainage patterns are some of the factors that must be assessed in the preliminary stages of design work.

All pertinent regulatory concerns must also be addressed throughout the entire design process and are the responsibility of the design engineer.

For technical support, contact Infiltrator Systems Inc. at 1-800-221-4436.

REGULATORY REQUIREMENTS.

Regulations often dictate the type of system to be used in a particular application.

Detention - The purpose of a detention system is to store a calculated volume of stormwater in the chamber bed before releasing it to an outflow structure. Outflow is allowed at a predetermined rate based on regulatory mandates and the calculated peak runoff for both pre-development and post-development conditions. Detention systems use controlled-flow outlets, usually in the form of multi-stage orifices or weirs, sized to allow specific flows at various vertical stages within the storage system. They are designed to drain completely within a specified period, usually less than 48 hours.

Retention - In a retention system, a calculated volume of stormwater is stored in the chamber bed. The primary drainage mechanism is infiltration into the soil and typically no principal outlet is used. This drainage method makes the soil's permeability and the depth to the water table especially important. It is also important to intercept sediment and organic materials suspended within the stormwater before they reach the chamber bed in this type of system. Depth to bedrock or other restrictive layers must be in accordance with local requirements.

First Flush Attenuation - A first flush attenuation system provides storage for the first 0.5 to 1.0 inches of rainfall over the contributing watershed. The first flush of stormwater runoff from paved areas and other impervious surfaces carries a large percentage of pollutants. It's better to store this runoff and subject it to the soil's filtration and renovation capabilities when the protection of groundwater is a primary concern.

Flow exceeding the first flush must be directed towards a storage system such as the High Capacity Infiltrator Chamber System, stream, storm sewer, or other outlet where it can be disposed of according to proper engineering practice. The first flush design is similar to that of a retention facility but is usually of a much lower volume. Interception of solids through the use of water quality inlets is very important to the longevity of this type of system.

INFILTRATOR® SYSTEMS INC

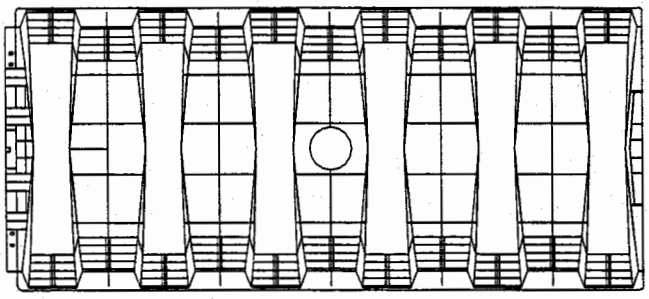
SYSTEM COMPONENTS

The High Capacity Infiltrator Chamber System is manufactured by Infiltrator Systems Inc., headquartered in Old Saybrook, Connecticut. The system is comprised of High Capacity Infiltrator chambers and closed end plates that seal the ends of each chamber row. These components are illustrated in Figures 1 and 2. The endplates are blow molded from high-density polyethylene and the chambers are injection molded from PolyTuff polyolefin with a minimum density of 0.90 grams per cubic centimeter (ASTM D1248, D1505). The following chart shows the nominal specifications of each chamber:

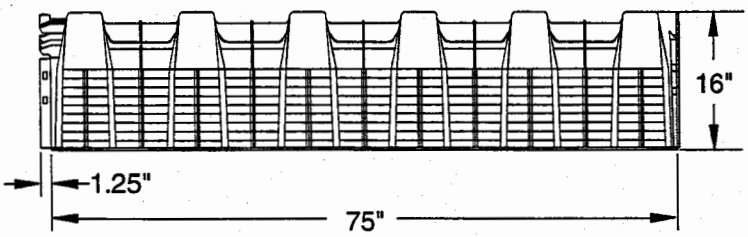
NOMINAL CHAMBER SPECIFICATIONS	
Size (W x L x H)	34" x 75" x 16"
Storage	122 gal/16.3 ft³
Weight	38 lb

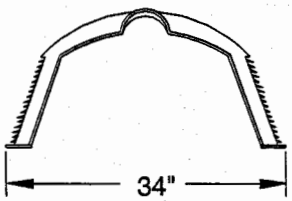
FIGURE 1: HIGH CAPACITY INFILTRATOR CHAMBER

Plan View



Side View

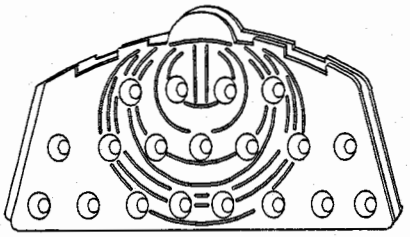




The top of the chamber is arched and the bottom is completely open. Both the top and sidewalls are corrugated for structural support. The sidewalls are louvered, allowing for infiltration into the surrounding stone and soil. Each unit has a nominal wall thickness of at least 1/8 inch and a bearing footprint of 2.05 square feet. The minimum sidewall opening area is 0.42 square feet per linear foot, or 2.60 square feet per unit. The sidewall openings measure 0.20 inches high and have ribs above and below them. They overlap 1 1/4 inches at the joints with interlocking latches which allow the chamber rows to extend indefinitely for the best system design. Each chamber has a knockout port in the center of its top, capable of receiving a 4 inch diameter pipe through which the system can be inspected.

High Capacity Infiltrator chambers used in stormwater management applications have an American Association of State Highway and Transportation Officials (AASHTO) H-20 load rating. The chambers can support 32,000 pounds per axle with 18 to 96 inches of cover (excluding the pavement), properly compacted as specified in the Infiltrator installation requirements.

FIGURE 2: HIGH CAPACITY INFILTRATOR CHAMBER CLOSED END PLATE



NOTE: Holes may be cut in the end plate to accept pipes up to 12" in diameter.

The following items must be included in each design to meet Infiltrator Systems' standards and specifications, to ensure proper installation, and to satisfy the product warranty conditions.

1 To confirm that the installation will be in accordance with Infiltrator Systems' current standards and specifications, a **note indicating that the contractor must contact Infiltrator Systems Inc. prior to installation must be placed in a prominent place on the plans.** Notes and drawings are available from Infiltrator Systems Inc. Construction must comply with Infiltrator Systems' current installation requirements. This applies to material specifications as well as construction methods. **The contractor must contact Infiltrator Systems Inc. to ensure that he/she has the latest requirements before the installation begins and to schedule a pre-construction meeting. Allow 5 business days advance notice for this meeting.**

2 It is the design engineer's responsibility to ensure that the base of the system is suitable for the desired application.

3 The chamber bed's base must be properly compacted to a minimum of 95% of the modified Proctor density (AASHTO T180) using hydraulic (flooding) and/or mechanical means.

4 A minimum 3 inch layer of 1½ - 2 inch washed, crushed stone must be specified on the bottom of the chamber bed. The stone layer must be leveled and compacted with a vibratory roller to provide a flat, smooth surface for placement of the High Capacity Infiltrator chambers. In retention systems, the crushed stone must be washed to prevent fines from clogging the soil surface. Crushed stone must also be placed around the perimeter of the chamber bed for additional infiltrative surface and proper structural support. This stone must be compacted with at least two passes of a vibratory plate compactor in maximum one foot lifts.

5 Soil backfill must be compacted to a minimum of 95% of the modified Proctor density or according to local code, whichever is more restrictive. Refer to local codes for compaction requirements. Backfill must be placed and compacted in lifts of 12" or less.

6 A note must be placed on the plan alerting the contractor to dig one extra foot beyond the planned footprint of the chamber bed. This allows working space for setting the chambers and facilitates backfill compaction.

7 The water collection and inlet system must be designed to intercept as much sediment and organic debris as possible. Catch basin sumps, downward facing 90° elbows on catch basin pipe outlets, settling tanks, sand filters, and other measures can be considered for this purpose. These can also be used in combination for the best results. The most common and easiest method is to use 90° elbows in conjunction with adequate catch basin sumps. All water quality inlets should be inspected on a regular basis and maintained as necessary. **It is recommended that a maintenance and inspection schedule for the stormwater management system be included as part of the design. Call Infiltrator Systems' stormwater department at 1-800-221-4436 for assistance in developing this schedule.**

8 **Erosion and sediment control measures must be integrated in the plan and must be designed to protect the site both during and after construction.** These practices may have a direct impact on the water quality of the site. Erosion and sedimentation can be controlled by vegetation, temporary sediment barriers (silt fences, hay bales, fabric-wrapped catch basin grates), and strategic stormwater runoff management.

9 There must be an adequate pavement design in traffic bearing applications that complies with or exceeds local codes and regulations. Pavement thickness is not included in the required cover.

10 **All plans must be submitted and reviewed by Infiltrator Systems Inc. prior to shipment of the chambers.** Forward the plans to: *Stormwater Department, Infiltrator Systems Inc., 4 Business Park Road, P.O. Box 768, Old Saybrook, CT 06475.* A prompt response will follow.

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The following steps provide the calculations needed to size a system once its type (i.e. detention, retention, or first flush) is determined. The worksheet on page 7 itemizes these calculations and costs.

1 Determine the amount of storage volume (V_s) needed. The amount of storage needed for the anticipated flow must be determined based on local code requirements. It is commonly found using TR-55 or the rational method.

2 Determine the number of chambers (C) needed. To find the number of chambers needed for adequate storage, divide the storage volume (V_s) by 24 cubic feet per chamber.

NOTE: The void volume of the stone (35%) plus the chamber volume (16.3 cubic feet) is approximately 24 cubic feet.

$$(C) = \frac{(V_s)}{24\ ft^3}$$

3 Determine the required bed size (S). To find the size of the bed, multiply the number of chambers needed (C) by 17.7 square feet.

NOTE: It is necessary to add one foot around the perimeter of the bed, for working space.

If you need assistance determining the number of chambers per row or customizing the bed configuration to fit a specific site, call Infiltrator Systems' stormwater department at 1-800-221-4436.

$$(S) = (C) \times 17.7\ ft^2$$

4 Determine the quantity of stone (V_{st}) needed. Each chamber, in accordance with Infiltrator Systems' requirements, requires 0.85 cubic yards of 1½ to 2 inch washed, crushed stone.

NOTE: Extra stone is needed around the perimeter of the system, between the chambers and the trench walls. This number will vary depending on the site. The following calculation includes a 10% overage of stone.

$$(V_{st}) = (C) \times 0.85\ yd^3$$

5 Determine the volume of excavation (E_x) needed. Based on a minimum of 18 inches of cover, each chamber requires a minimum of 2.0 cubic yards of excavation.

*NOTE: The volume of excavation will vary depending on the depth of the cover. This factor does **not** include the required extra foot of excavation around the perimeter of the bed.*

$$(E_x) = (C) \times 2.0\ yd^3$$

6 Determine the area of filter fabric (F) needed. The sides of the bed and top of the stone must be covered with a 4 ounce/square yard, non-woven filter fabric (Mirafi 140N or equivalent). The area of the sidewalls must be calculated and a 2-foot overlap must be included where two pieces of filter fabric are placed side by side or end to end.

NOTE: In areas where there are wide fluctuations in the water table, the bottom of the trench (at the soil/stone interface) should be lined as well.

7 Determine the amount of geogrid (G) needed. All beds must have geogrid (ISI 14,000 or Tensar BX 1100) placed over the system, 12" above the top of the chambers. The geogrid must extend 5 feet past the perimeter of the chamber footprint in all directions. If two pieces of geogrid are placed side by side or end to end, they must overlap a minimum of 2 feet.

NOTE: Refer to manufacturer's installation instructions for specific information.

8 Determine the number of end plates (E_p) needed. Each row of chambers requires two end plates.

$$(E_p) = 2 \times (\#\ of\ rows)$$

CONTACT INFILTRATOR SYSTEMS INC. FOR FINAL DESIGN REVIEW AND APPROVAL.
All designs must be reviewed and approved by Infiltrator Systems Inc. to ensure that compliance with current Infiltrator standards and specifications have been met. Failure to forward plans to Infiltrator Systems Inc. will void the product warranty. Forward all plans to: Stormwater Department, Infiltrator Systems Inc., 4 Business Park Road, P.O. Box 768, Old Saybrook, CT 06475. A prompt response will follow.

MATERIALS WORKSHEET

High Capacity Infiltrator H-20 Chamber System

INFILTRATOR® SYSTEMS INC

Project _____

By _____ Date _____

Location _____

Checked by _____ Date _____

SYSTEM REQUIREMENTS

1. Required storage volume **(V_s)** = ... [ ] ft³ **(V_s)**
2. Number of chambers **(C)** needed: $\frac{(V_s)}{(24\ ft^3)}$ = ... [ ] chambers **(C)**
3. Required bed size **(S)**: **(C)** x 17.7 ft² = ... [ ] ft² **(S)**
4. Quantity of stone **(V_{st})** needed: **(C)** x 0.85 yd³ = ... [ ] yd³ **(V_{st})**

   Quantity of stone in tons: **(V_{st})** x 1.4 = ... [ ] tons of stone **(T_{st})**
5. Volume of excavation **(E_x)**: **(C)** x 2.0 yd³ = ... [ ] yd³ **(E_x)**
6. Area of filter fabric **(F)** required = ... [ ] yd² **(F)**
7. Required geogrid (ISI 14,000 or Tensar BX1100) **(G)** = ... [ ] yd² **(G)**
8. Quantity of end plates needed **(E_p)**: 2 x (# of rows) = ... [ ] end plates **(E_p)**

NOTE: Round up to the nearest whole number.

SYSTEM COST

	Quantity			Cost			Total
Chambers **(C)**	_____		x	$ _____	/ chamber	=	$ _____
Stone **(T_{st})**	_____	tons	x	$ _____	/ ton	=	$ _____
Excavation* **(E_x)**	_____	yd³	x	$ _____	/ yd³	=	$ _____
Filter fabric **(F)**	_____	yd²	x	$ _____	/ yd²	=	$ _____
Geogrid **(G)**	_____	yd²	x	$ _____	/ yd²	=	$ _____
End plates **(E_p)**	_____		x	$ _____	/ end plate	=	$ _____

SUBTOTAL (does not include cost for installation): **$** _____

** Excavation includes backfill and compaction.*

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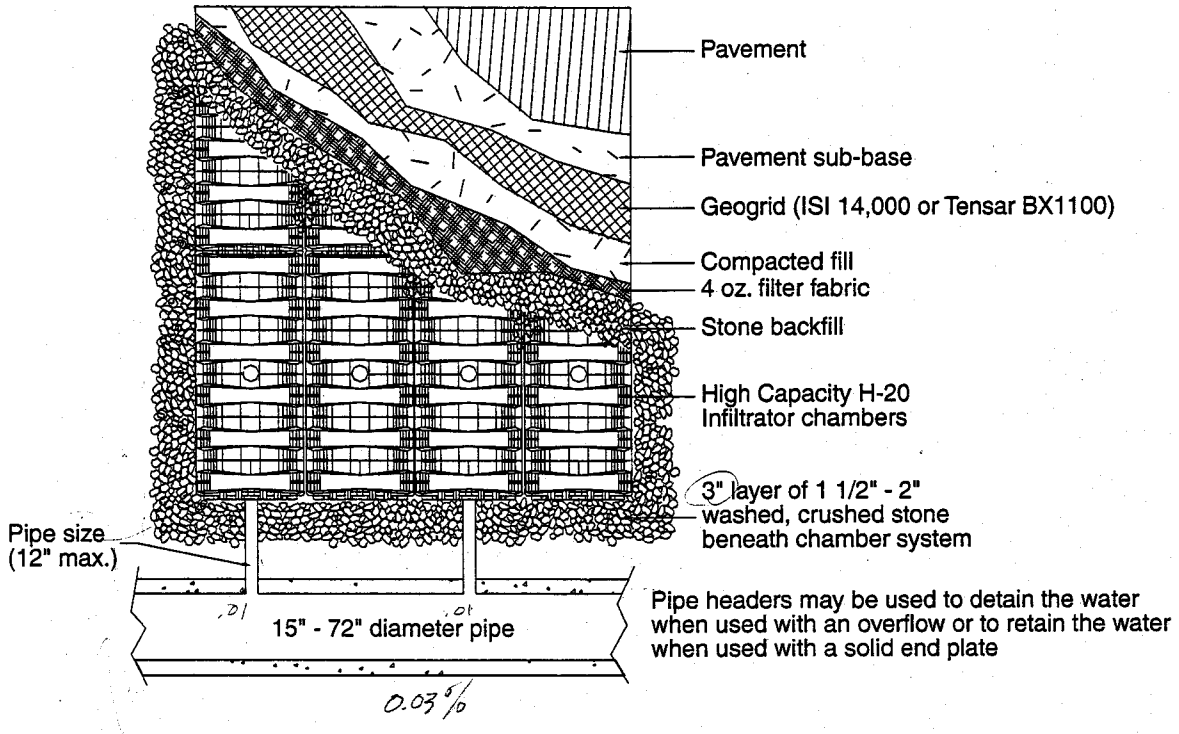
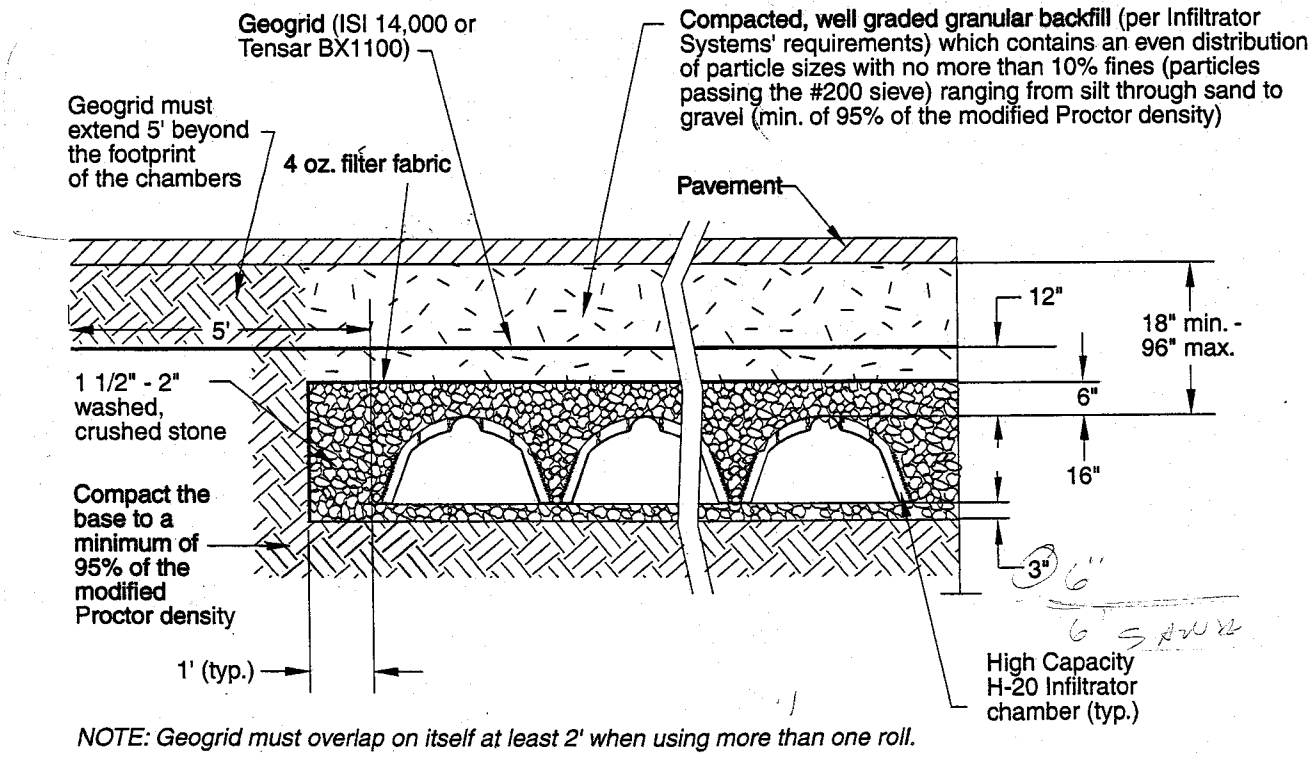
PLAN VIEW OF HIGH CAPACITY H-20 INFILTRATOR CHAMBER SYSTEM



TYPICAL CROSS SECTION HIGH CAPACITY H-20 INFILTRATOR CHAMBER SYSTEM



NOTE: Geogrid must overlap on itself at least 2' when using more than one roll.

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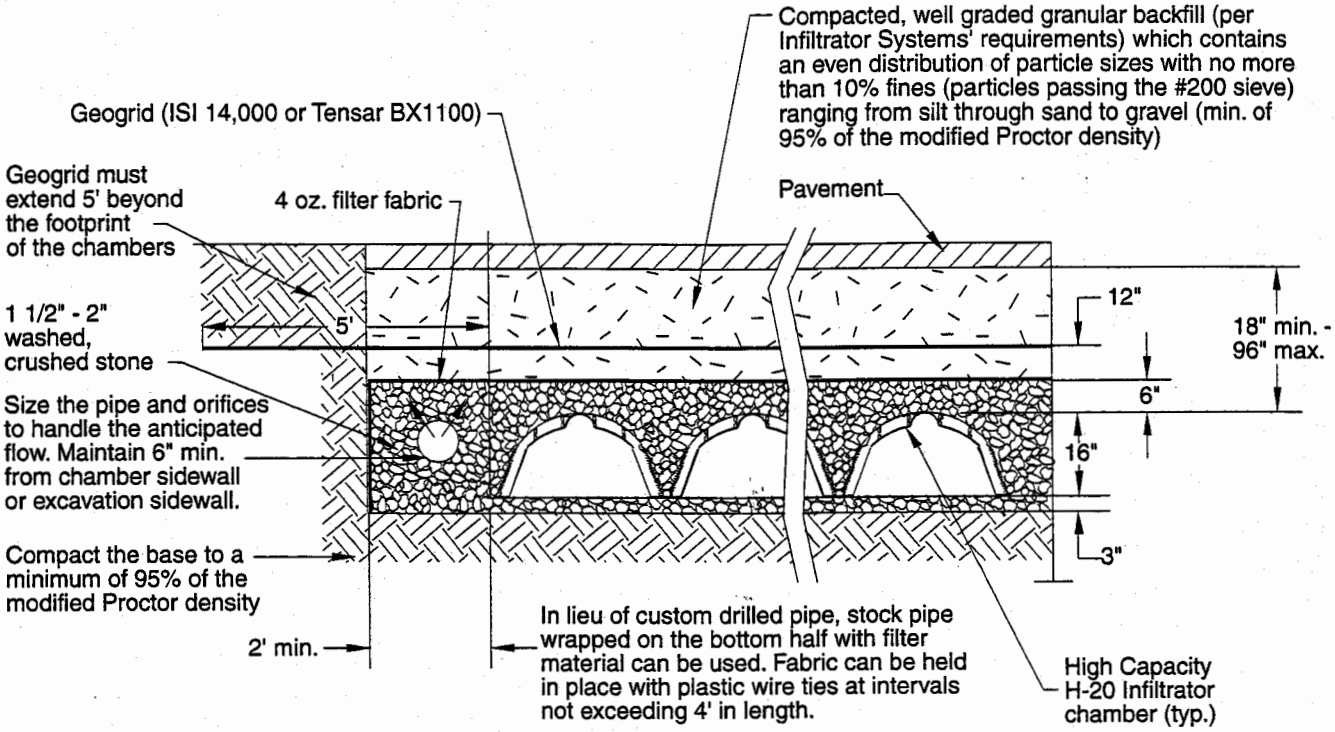
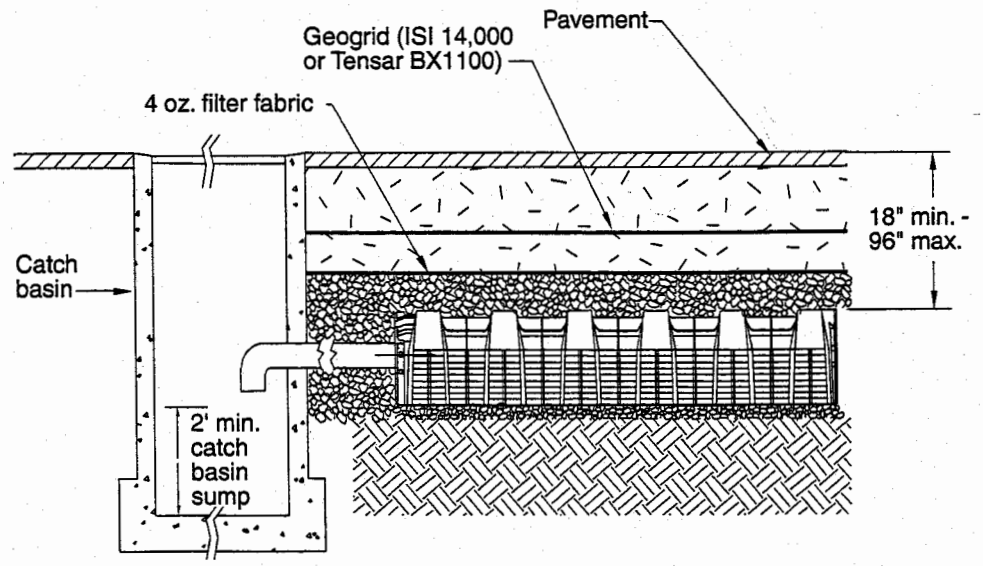
TYPICAL CROSS SECTION OF THE PERFORATED PIPE DISTRIBUTION METHOD



TYPICAL CROSS SECTION OF A CATCH BASIN SUMP TO A RETENTION SYSTEM



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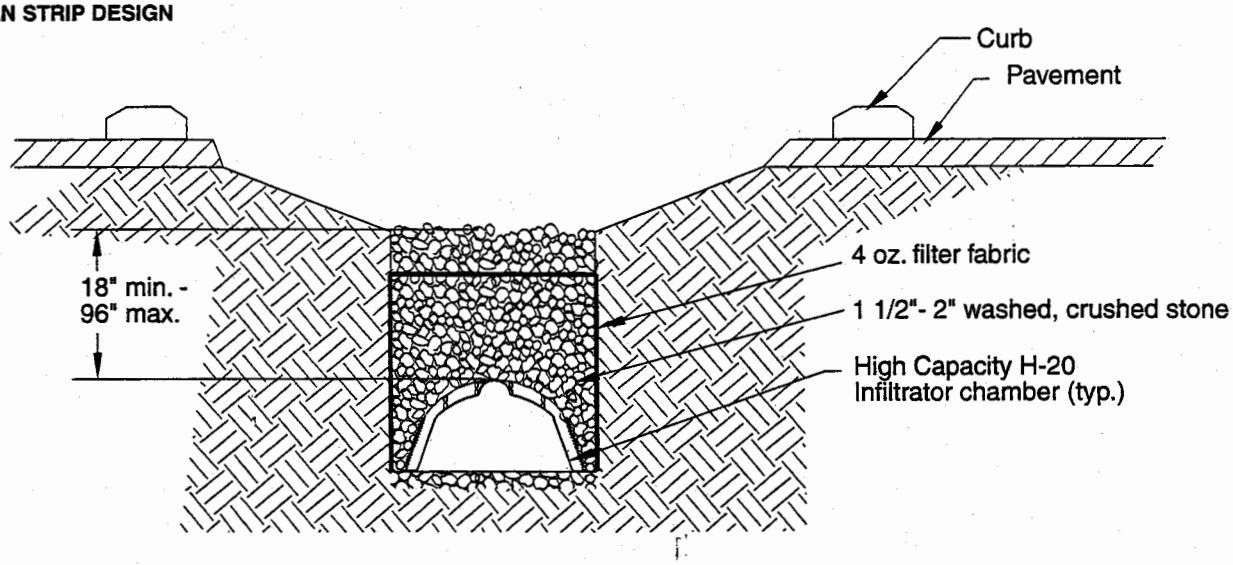
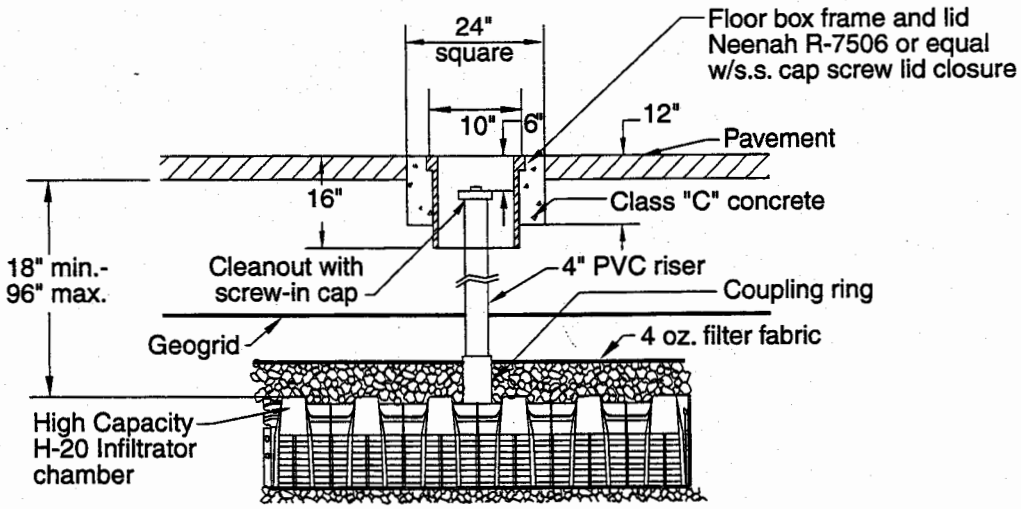
MEDIAN STRIP DESIGN



INSPECTION PORT DETAIL



a. The structural integrity of the High Capacity H-20 System (as defined below), when installed in accordance with Infiltrator's written specifications at the time of installation, is warranted to the original purchasing contractor or subcontractor (the "Purchaser") against defective materials and workmanship for one (1) year from the date of purchase. Should a defect appear in the warranty period, the Purchaser must inform Infiltrator Systems Inc. ("Infiltrator") of the defect in writing within ten (10) days of the discovery of the defect. Infiltrator agrees to supply replacement components for those parts of the System found by Infiltrator to be defective. The supply of replacement components is the sole remedy of the Purchaser for breaches of this warranty. **THIS WARRANTY IS EXCLUSIVE. THERE ARE NO OTHER WARRANTIES WITH RESPECT TO THE SYSTEM, INCLUDING NO WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.**

b. This Limited Warranty applies solely to the System, which is defined as the H-20 units and endplates manufactured by Infiltrator and sold to the Purchaser. This Limited Warranty only applies to such units and endplates when installed in a single layer. **UNDER NO CIRCUMSTANCES, SHALL THE UNITS AND ENDPLATES BE INSTALLED IN A MULTI-LAYER CONFIGURATION.**

c. If the System is not installed in strict accordance with a design approved by Infiltrator, including any modifications required by Infiltrator, Infiltrator shall have no liability or responsibility to the Purchaser, including no liability or responsibility under this Limited Warranty.

d. Prior to installation of the System, Purchaser shall require the installing contractor to attend a conference with Infiltrator to discuss installation requirements. If the installing contractor fails to attend this conference, Infiltrator shall have no liability or responsibility to the Purchaser, including no liability or responsibility under this Limited Warranty.

e. Infiltrator may elect to have a representative onsite during all or part of the installation of the System. The Purchaser agrees to permit the Infiltrator representative to be onsite for the installation and to cooperate with the Infiltrator representative in all reasonable respects. If the Purchaser breaches this subsection (e), then this Limited Warranty shall be void.

If the representative is onsite, the representative shall be there solely for purposes designated by Infiltrator. **THE REPRESENTATIVE SHALL NOT ASSUME ANY OBLIGATIONS OF ANY CONTRACTOR OR SUBCONTRACTOR. SPECIFICALLY, AND WITHOUT LIMITATION, ALL SUPERVISORY DUTIES ARE THE SOLE RESPONSIBILITY OF THE PURCHASER; AND THE PURCHASER SHALL BE SOLELY RESPONSIBLE FOR INSTALLATION OF THE SYSTEM IN ACCORDANCE WITH THE APPROVED DESIGN AND INFILTRATOR'S WRITTEN SPECIFICATIONS AT THE TIME OF INSTALLATION AND IN ACCORDANCE WITH ALL APPLICABLE LAWS, CODES, RULES, AND REGULATIONS.**

The providing of a representative onsite shall have no effect on the terms and conditions of this Limited Warranty or on the relative rights and responsibilities of Infiltrator and Purchaser under this Limited Warranty, nor shall the presence of the representative at the site increase Infiltrator's liability under this Limited Warranty.

f. Under no circumstances shall Infiltrator be liable to the Purchaser or to any third party for claims arising from the design of the System, shipment of the components of the System, or installation of the System.

g. **THE WARRANTY DOES NOT EXTEND TO INCIDENTAL, CONSEQUENTIAL, SPECIAL, OR INDIRECT DAMAGES; PENALTIES OR LIQUIDATED DAMAGES, INCLUDING LOSS OF PRODUCTION AND PROFITS; LABOR AND MATERIALS; OVERHEAD COSTS; OR OTHER LOSS OR EXPENSE INCURRED BY THE PURCHASER IN REMOVAL OR INSTALLATION OF THE SYSTEM. SPECIFICALLY EXCLUDED FROM WARRANTY COVERAGE ARE DAMAGE ARISING FROM ORDINARY WEAR AND TEAR; ALTERATION, ACCIDENT, MISUSE, ABUSE, OR NEGLECT; THE SYSTEM BEING SUBJECTED TO STRESSES GREATER THAN THOSE PRESCRIBED IN INFILTRATOR'S WRITTEN SPECIFICATIONS; THE PLACEMENT OF IMPROPER MATERIALS INTO THE SYSTEM; OR ANY OTHER EVENT NOT CAUSED BY INFILTRATOR.**

h. This warranty may not be amended except by a written instrument signed by an officer of Infiltrator at its corporate headquarters in Old Saybrook, Connecticut. This Limited Warranty does not apply to any party other than to the Purchaser.

Distributed By:

INFILTRATOR® SYSTEMS INC

The world leader in chamber technology℠

4 Business Park Road, P.O. Box 768 Old Saybrook, CT 06475
800-221-4436 860-388-6639 FAX 860-388-6810
www.infiltratorsystems.com

800-221-4436

U.S. Patents: 4,759,661; 5,017,041; 5,156,488; 5,336,017; 5,401,116; 5,401,459; 5,511,903; 5,588,778; 5,716,163; 1,815,925; 1,974:938; 1,729,383; 448,338
Canadian Patents: 1,329,959; 2,004,564 Other U.S., Canadian, and foreign patents pending.

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PRECON FOR INFILTRATION BASIN

JCC Environmental Division Preconstruction Meeting

Project SMITH MEMORIAL BAPTIST CHURCH FAMILY LIFE CENTER **Date** 4/9/02 10:00 AM

1. Is the person who will be designated as the *Responsible Land Disturber* for implementation of the approved Erosion Control Plan present?

   YES ___ NO X Name ~~[illegible]~~

2. Does the person who has been identified above possess a certificate of competence issued by the Department of Conservation and Recreation in Erosion and Sediment Control or are they a licensed Professional Engineer, Land Surveyor, Landscape Architect, or Architect?

   YES ___ NO___ Certificate or License No.___

3. The person designated above, is required by the Virginia Erosion and Sediment Control Regulations to insure the installation and daily maintenance of the erosion and sediment control measures.

4. A copy of the Virginia Erosion and Sediment Control Handbook (VESCH) is required to be on the project site daily. ✓

5. A copy of the approved site plan is required to be on the project site daily. ✓

6. Are there any proposed revisions to the approved plan pending?

   YES X NO___ J. CHRISTOPHER JONES, HUGHES SUPPLY, TO COORDINATE CHANGES WITH MANUFACTURER AND SUBMIT FOR APPROVAL. 757 877-8033

7. Any proposed changes to the approved plan must be submitted to James City County for review and approval prior to implementation. ✓ J. CHRISTOPHER JONES ADVISED

8. Is the person designated above aware of any discrepancies, errors or deficiencies with the approved plan?

   YES ___ NO X

9. James City County is authorized under the Virginia Erosion and Sediment Control Law to require project monitoring and inspection reports to insure compliance with the approved plan. If James City County determines that inspection reports are required, they shall be submitted to the Environmental Division for review at intervals determined by the Division.

County Agent P. MENICHINO

Responsible Land Disturber BILL MANNING

Rev. 1/02

PRECON FOR -

Erosion and Sediment Control Preconstruction Meeting Checklist

Project: SMITH MEMORIAL BAPTIST CHURCH FAMILY LIFE CENTER

Date: 4/9/02 Time: 10:00 AM (AM)/PM

Permitee: SMITH MEMORIAL BAPTIST CHURCH Address: 6575 RICHMOND ROAD WILLIAMSBURG, VA 23188

Contractor: J L MASSIE RICK COOK

Phone No.: 810-5524 Fax No.: 566-8566

Address:

1. Phasing of Erosion and Sediment Control Practices

   A. Narrative Plan – REVIEWED

   B. Contractor-Developed Sequence of Construction – REVIEWED/DISCUSSED

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	X	Storm Drainage System
____	Sediment Traps	X	Other INFILTRATION BASIN

3. Inspection and Enforcement Procedures

   A. Permittee/Contractor Inspections: DISCUSSED WITH RICK COOK

   B. County Inspections: "

   C. Enforcement Actions: "

      1. Informal Contact: ✓

      2. Inspection Report: ✓

Revised 1/02

Erosion and Sediment Control
Preconstruction Meeting Checklist

3. Notice to Comply: DISCUSSED WITH RICK COOK

4. Legal Proceedings: "

4. Limits of Clearing, Tree and Other Critical Areas Protection Measures Inspection

A. Clearing limits properly flagged? ☒ Yes ☐ No

B. Color of Flagging: ORANGE

C. Tree Presservations/Critical Areas protected adequately? ☒ Yes ☐ No

D. Color of Flagging: ORANGE

E. Tree Preservation/Critical Areas Protection Measures, Type: SILT FENCE WITH WIRE

5. Issuance of Stormwater Management/BMP, Record Drawing and Construction Certification, Standard Forms and Instructions (If Applicable to Project)

6. Attendees - Identify Contract Person for Erosion Control

Signature: [signature]

Printed Name: RICK COOK

Affiliation: J L MASSIE

Address:

Phone No. 766-8643 OFFICE
810-5524 CELL

7. Comments: PRECON MEETING FOR INSTALLATION OF INFILTRATION.
J. MASSIE
CONTRACTOR, MANUFACTURER, SOILS CONSULTANT - ECS, ENGINEER
VHB INC.
FOR CERTIFICATION, JCC PRESENT - WORK TO BE SCHEDULED DURING NEXT PERIOD OF NO RAIN (4-5 DAYS)

County Agent: BOB LANE / SCOTT THOMAS Date: 4/9/02

Title: INSPECTOR

espolicy.frm

Revised 1/02

Hughes SUPPLY, INC.

J. CHRISTOPHER JONES
Branch Manager

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Yorktown, VA 23692

Tel 757.877.8033
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jonathan.jones@hughessupply.com
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Frank G. Mundy, II, L.S.
Land Surveyor

VHB *Vanasse Hangen Brustlin, Inc.*
477 McLaws Circle
Suite 1
Williamsburg
Virginia 23185-6316
757.220.0500 ▪ FAX 757.220.8544
email: fmundy@vhb.com
www.vhb.com

Timothy J. Hogan, P.E.
Project Manager

VHB *Vanasse Hangen Brustlin, Inc.*
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Virginia 23185-6316
757.220.0500 ▪ FAX 757.220.8544
email: thogan@vhb.com
www.vhb.com

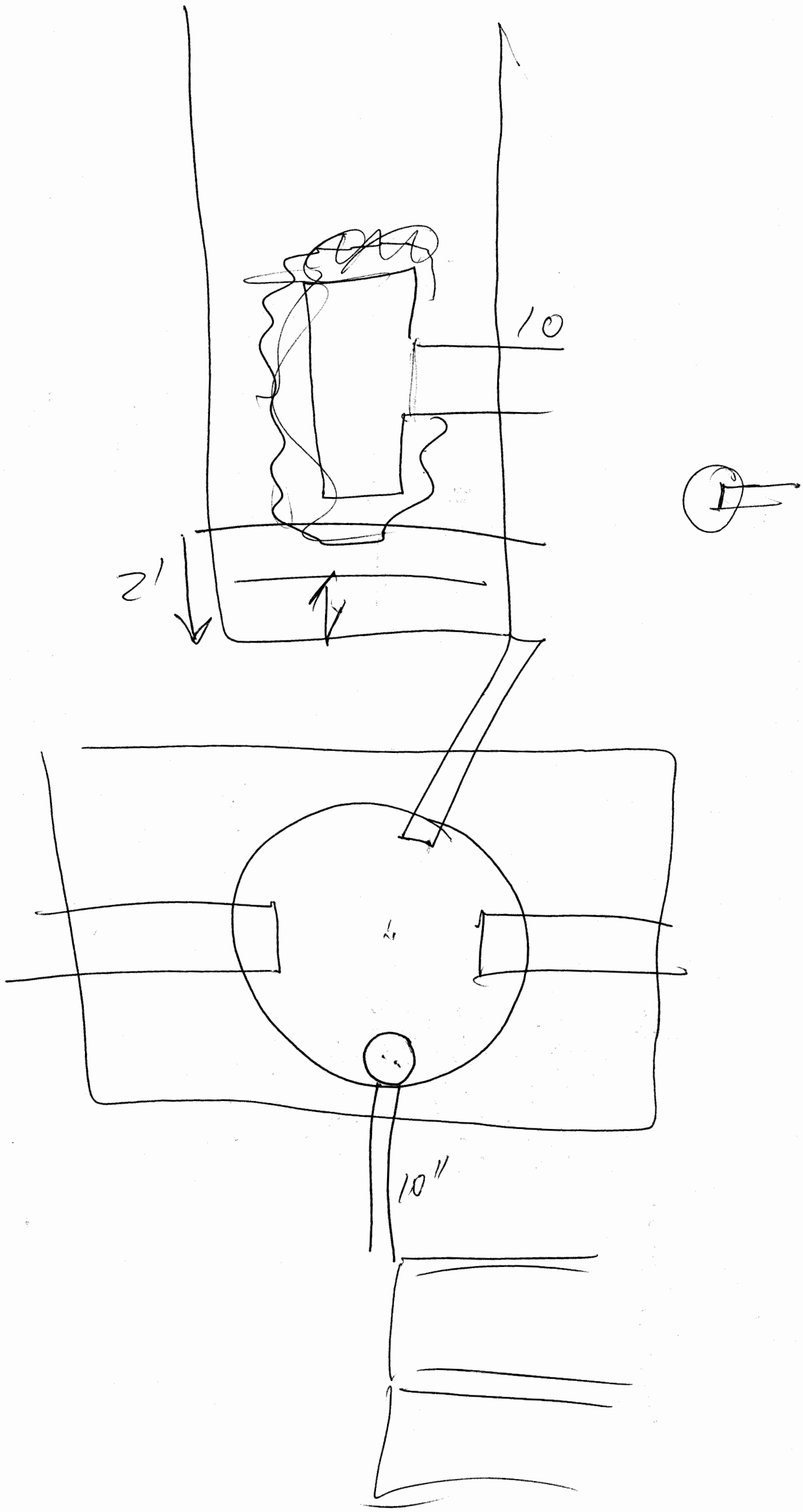
** TOTAL PAGE.02 **

	NAME	COMPANY	PHONE	FAX
	Beth Cook	Jack Massie	566-8643	566-8566
	MARK SCHWINDT	ECS	229-6677	229-9978
	Nathan Pollard	Jack Massie		
	BOB LANE	JCC ENVIR	CELL 592-6021 253-6672	259-4032
	FRANK MUNDY	VHB	220-0500	220-8544
	TIM HOGAN	"	"	"
	MIC HOPKINS	"	"	"
MANUF REP	CHRIS JONES	HUGHES SUPPLY	870-0837	877-8038
	Scott J. Thomas	JCC ENV. DIV	253-6639	259-4032
	STEVE MASSIE		810 6244	
NOT AT MTG	BOB BEAN		566 8643	

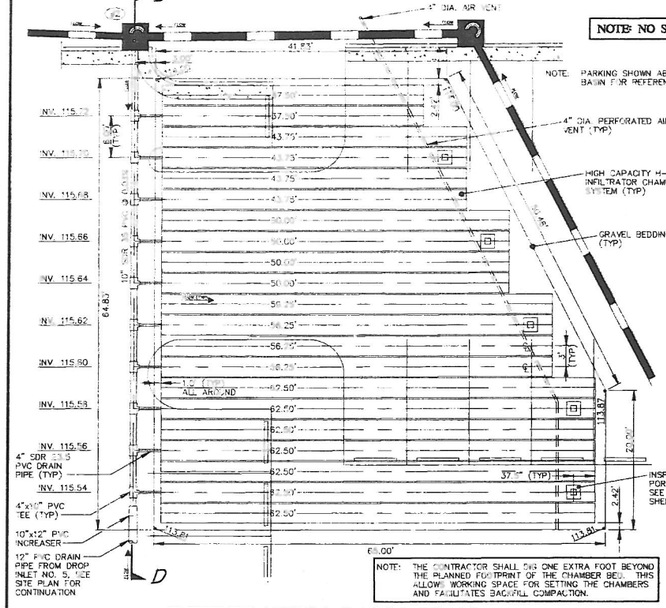
YC024_SMITH_MEMORIAL_BAPTIST_CHURCH_1232

In our opinion, removal of the two drainage pipes currently discharging in the vicinity of the infiltration basin will likely result in "drying" of the wet soil conditions encountered at shallow depth in Boring B-6. However, as stated in our geotechnical report, groundwater seepage may exist at shallow depths beneath this site on a transient basis due to the sandy nature of a majority of the soils penetrated in the test borings. Such seepage is expected to be minor in quantity and should not adversely impact the performance of the infiltration basin, provided a small factor of safety has been applied to basin capacity during design of the stormwater managment basin to account for such seepage conditions.

We hope this information addresses the concerns of James City County review personnel. Call me if you have questions or require further review.

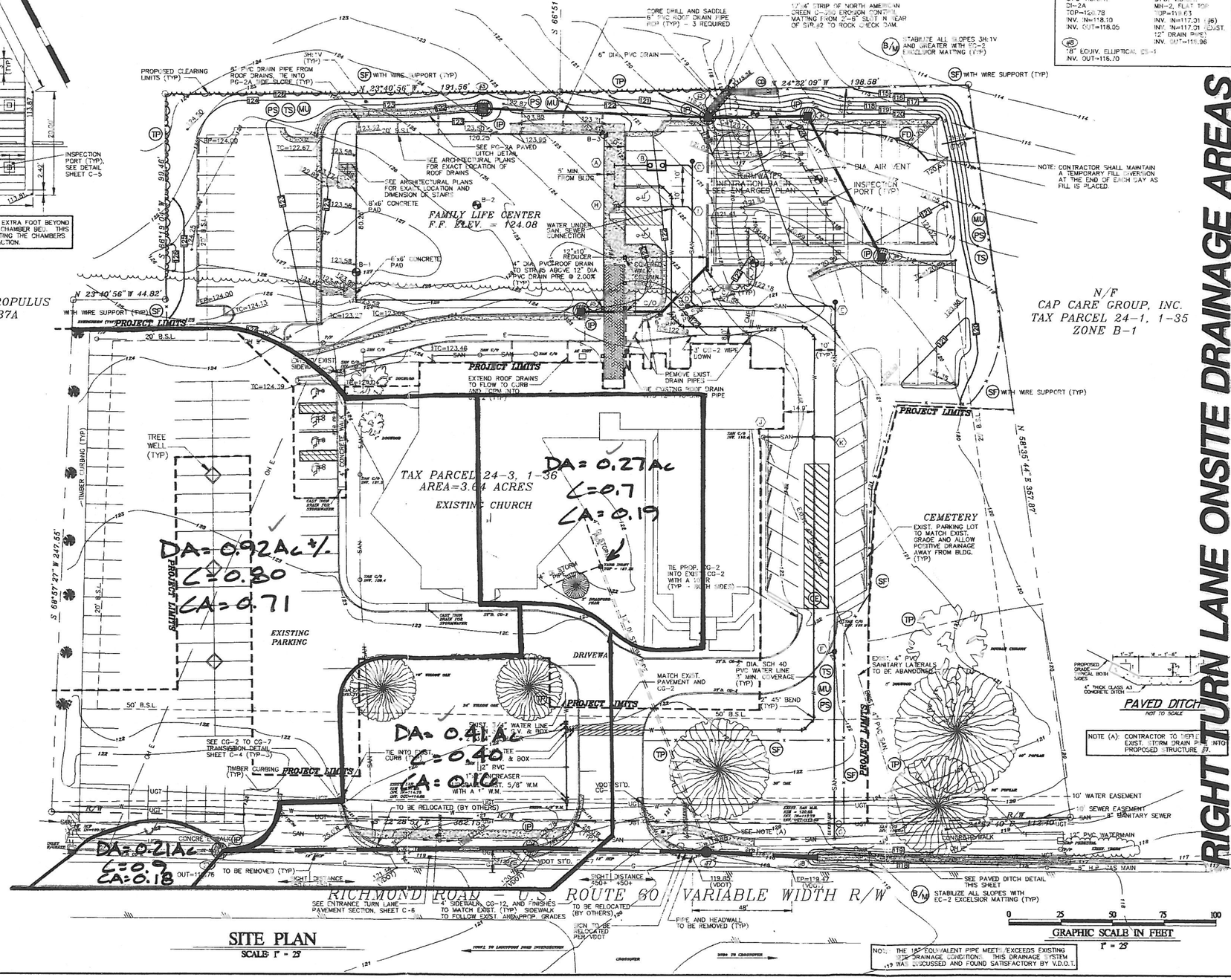

10
2'
10"

NOTE: NO SILT TO ENTER INFILTRATION BASIN



INFILTRATION BASIN PLAN

SCALE: 1" = 10'



SITE PLAN

SCALE: 1" = 25'

SANITARY SEWER DATA

- (A) LIMITS OF SITE PLAN SANITARY SEWER (5' FROM BLDG.), INV. = 119.34
- (A) TO (B) 16 LF 4" SDR 23.5 PVC @ 2.08%
- (B) 750 GAL CAPACITY GREASE TRAP OR APPROVED EQUAL, INV. IN = 119.05, INV. OUT = 118.84
- (B) TO (C) 13 LF 6" SDR 23.5 PVC @ 1.62%
- (C) SANITARY CLEANOUT, INV. = 118.63
- (C) TO (D) 84 LF 6" SDR 23.5 PVC @ 1.00%
- (D) SANITARY CLEANOUT, INV. = 117.95
- (D) TO (E) 70 LF 6" SDR 23.5 PVC @ 1.00%
- (E) SANITARY CLEANOUT, INV. = 117.25
- (E) TO (F) 167 LF 6" SDR 23.5 PVC @ 1.00%
- (F) SANITARY CLEANOUT, INV. = 115.58
- (F) TO (I) 90 LF 6" SDR 23.5 PVC @ 1.00%
- (I) TIE INTO EXISTING MANHOLE, INV. IN = 114.08, CORE AND REMOVE EXIST. SANITARY MANHOLE, PROVIDE INSIDE DROP CONNECTION
- (H) LIMITS OF SITE PLAN SANITARY SEWER (5' FROM BLDG.), INV. = 119.25
- (H) TO (I) 38 LF 4" SDR 23.5 PVC @ 2.18%
- (I) 6"x4" SDR 23.5 PVC WYE, INV. = 118.43
- (J) EXIST. SANITARY CLEANOUT, INV. = 119.4
- (J) TO (K) 35 LF 4" SDR 23.5 PVC @ 7.97%
- (K) 6"x4" SDR 23.5 PVC WYE, INV. = 116.61

NOTES:

1. UNLESS OTHERWISE NOTED, ALL DRAINAGE EASEMENTS DESIGNATED ON THIS PLAN SHALL REMAIN PRIVATE.
2. ALL UTILITIES SHALL BE PLACED UNDERGROUND IN ACCORDANCE WITH SECTION 24-200 OF THE JAMES CITY COUNTY ZONING ORDINANCE.
3. EXTERIOR SIGNS WITHIN THE DISTRICT SHALL COMPLY WITH THE REGULATIONS FOR EXTERIOR SIGNS IN ARTICLE II DIVISION 3 OF THE JAMES CITY COUNTY ZONING ORDINANCE.
4. VDOT DOES NOT ASSUME RESPONSIBILITY FOR MAINTENANCE OF THE PROPOSED INFILTRATION BASIN AND OUTLET STRUCTURE.
5. THIS PLAN DOES NOT GUARANTEE THE EXISTENCE/NONEXISTENCE OF ANY UTILITES ABOVE AND/OR BELOW GROUND. CONTRACTOR SHALL VERIFY THE HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UTILITIES PRIOR TO ORDERING OF MATERIALS AND INSTALLATION. THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR ANY UTILITIES DAMAGED DURING CONSTRUCTION AND SHALL REPAIR ANY UTILITIES DAMAGED BY CONSTRUCTION ACTIVITIES AT THEIR OWN EXPENSE.
6. GEOTECHNICAL SOIL BORINGS SHOWN ARE APPROXIMATE LOCATIONS ONLY.
7. ALL UNUSED WELLS MUST BE ABANDONED ACCORDING TO STATE PRIVATE WELL REGULATIONS.
8. APPROVAL TO BEGIN CONSTRUCTION OF THE STORMWATER MANAGEMENT/BMP INFILTRATION BASIN MUST BE OBTAINED BY THE JAMES CITY COUNTY ENVIRONMENTAL DIVISION.
9. SPOT ELEVATIONS DESIGNATED AS 123.45X (VERIFY) REPRESENT ELEVATION AFTER A 1.5" PAVEMENT OVERLAYMENT SCHEDULED IN 2000.

HIS LAND SURVEYING, INC.
15500 RIVER BEND TRAIL
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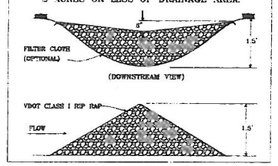
(804)966-7017

TOPOGRAPHIC AND BOUNDARY INFORMATION TAKEN FROM FIELD SURVEY ENTITLED "SMITH MEMORIAL BAPTIST CHURCH" COMPLETED DATED 2/10/99, BY HIS LAND SURVEYING. LANDMARK DESIGN GROUP, INC. IS NOT RESPONSIBLE FOR INACCURACIES IN LAND TOPOGRAPHIC AND BOUNDARY INFORMATION OR DESIGN CHANGES RESULTING THEREFROM.

ROCK CHECK DAM (CD)

2 ACRES OR LESS OF DRAINAGE AREA:



STORM DATA

(#1) TO (#2)	108 LF 12" CLASS III RCP @ 2.96%
(#1) TO (#4)	48 LF 12" CLASS III RCP @ 0.52%
(#4) TO (#3)	78 LF 12" CLASS III RCP @ 0.46%
(#2) TO BASIN	67 LF 10" SDR 35 PVC @ 0.03%
(#3) TO BASIN	70 LF 12" SDR 35 PVC @ 0.84%
(#2) TO OUTFALL	12 LF 8" SDR 23.5 PVC @ 1.47%
VDOT RIGHT-OF-WAY	
(EX) TO (#5)	147 LF 14"x23" ELLIPTICAL RCP @ 1.12%
(#5) TO (#7)	99 LF 14"x23" ELLIPTICAL RCP @ 1.17%
(#7) TO (#8)	54 LF 14"x23" ELLIPTICAL RCP @ 0.48%

(#1) STD. V.D.O.T. DI-3A TOP=120.19 INV. IN=115.50 INV. OUT= 116.40 BOTTOM=115.40

(#2) STD. V.D.O.T. DI-2A TOP=120.18 INV. IN=116.77 (#3) INV. IN=116.77 (#1) INV. OUT=115.75 (10") INV. OUT=115.25 (8") BOTTOM=112.50

(#3) STD. V.D.O.T. DI-1 RIM=121.72 INV. OUT=119.37 BOTTOM=118.30

(#4) STD. V.D.O.T. DI-3A TOP=120.50 INV. OUT=116.88 BOTTOM=115.80

(#5) STD. V.D.O.T. DI-2A TOP=122.76 INV. IN=119.67 (#4) INV. OUT=117.59 BOTTOM=116.00

(#6) STD. V.D.O.T. DI-2A TOP=120.78 INV. IN=118.10 INV. OUT=118.05

(#7) STD. V.D.O.T. MH-2, FLAT TOP TOP=119.63 INV. IN=117.01 (#6) INV. IN=117.01 (EXIST. 12" DRAIN PIPE) INV. OUT=116.96

(#8) 18" EQUIV. ELLIPTICAL CS-1 INV. OUT=116.70

COMMONWEALTH OF VIRGINIA
RICHARD S. PHILIPS
No. 021631
PROFESSIONAL ENGINEER

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Email: landmarkvb@aol.com

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

DRAWING STATUS	REVISIONS		
DATE ___ Initial Review	No.	Date	Comment	By
DATE ___ Client for Review	1	4/7/00	REVISED PER COUNTY COMMENTS	SAG
DATE ___ Pre Approval Drawing	2	5/31/00	REVISED PER COUNTY COMMENTS	SAG
DATE ___ NOTE	3	8/11/00	REVISED PER VDOT COMMENTS	SAG
COUNTY APPROVAL	4			
DATE ___ 1st Submittal	5			
DATE ___ 2nd Submittal	6			
DATE ___ 3rd Submittal	7			
DATE ___ Approved	8			

SITE PLAN

SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER
635 RICHMOND ROAD

POWHATAN DISTRICT JAMES CITY COUNTY VIRGINIA

Designed: W.F.B./S.A.G.	Date: 10/13/99
Checked: R.S.P.	Scale: NTS
Drawn: S.A.G.	CADD File name: SHEET3.DWG
Project Number: 1990072-000.01	Dwg. File No. 10,862W
Drawing Number	C-3

3 OF 11

12. IF DISTURBED AREA STABILIZATION IS TO BE ACCOMPLISHED DURING THE MONTHS OF DECEMBER, JANUARY OR FE
STABILIZATION SHALL CONSIST OF MULCHING (STD. & SPEC. 3.35). SEEDING WILL THEN TAKE PLACE AS SOON AS TH

STABILIZATION ON THIS PLAN SHALL MEAN THE SUCCESSFUL GER
FROM A PROPERLY PREPARED SEEDBED CONTAINING THE SPECIFIED AMOUNTS
FERTILIZER (STD. & SPEC. 3.32). IRRIGATION SHALL BE REQUIRED AS NECESSARY TO ENSURE

3H:1V SHALL REQUIRE THE USE OF EROSION CONTROL BLANKETS AND MATTINGS TO AID IN THE
INSTALLATION SHALL BE IN ACCORDANCE WITH STD. & SPEC. 3.35, MULCHING, STD. &
STABILIZATION BLANKETS AND MATTING AND MANUFACTURERS INSTRUCTIONS. NO SLOPES SHALL BE CREATED

15. INLET PROTECTION (STD. & SPEC., 3.07 AND 3.08) SHALL BE PROVIDED FOR ALL STORM DRAIN AND CULVERT INLETS FOLLOWING CONSTRUCTION OF THE SAME.

16. TEMPORARY LINERS, SUCH AS POLYETHYLENE SHEETS, SHALL BE PROVIDED FOR ALL PAVED DITCHES UNTIL THE PERMANENT CONCRETE LINER IS INSTALLED.

17. PAVED DITCHES

INFILTRATOR® SYSTEMS INC

Environmental Onsite Wastewater Solutions™

April 18, 2002

Chris Jones
Hughes Supply
7830 George Washington Highway
Yorktown, VA 23692

RE: Smith Memorial Baptist Church, Williamsburg, VA

Chris,

Per our conversion April 18, 2002 I have addressed the following topics.

The plans dated 10/13/99, indicate that the sub-base material is to be compacted to a minimum 95% modified proctor density. Infiltrator System's minimum requirements for the sub-base have been changed to a 95% standard proctor density compaction or having a geotechnical engineer ascertain the sub-base is suitable.

The system is currently designed to be inletted with a manifold. In the past the chamber beds have been inletted in the stone above the chambers. Typically, the solid pipe enters the bed and is coupled to a perforated pipe. This pipe is extended out over the chambers to allow the stormwater to drain into the surrounding stone and then down to the chambers. Please note, when this is done the perforated pipe cannot be in contact with the chambers.

The system was currently designed with 8 inches of stone above the chambers. Infiltrator System's minimum specifications are for 6 inches of stone above the chambers. Additional stone above this 6 inch minimum is acceptable.

Infiltrator System Inc. does not approve plans, sizing, or system designs. The designing engineer is responsible for all design decisions. The designing engineer must be contacted for any design changes.

After reviewing this letter please call me with any questions or concerns at 800-221-4436.

Very truly yours,

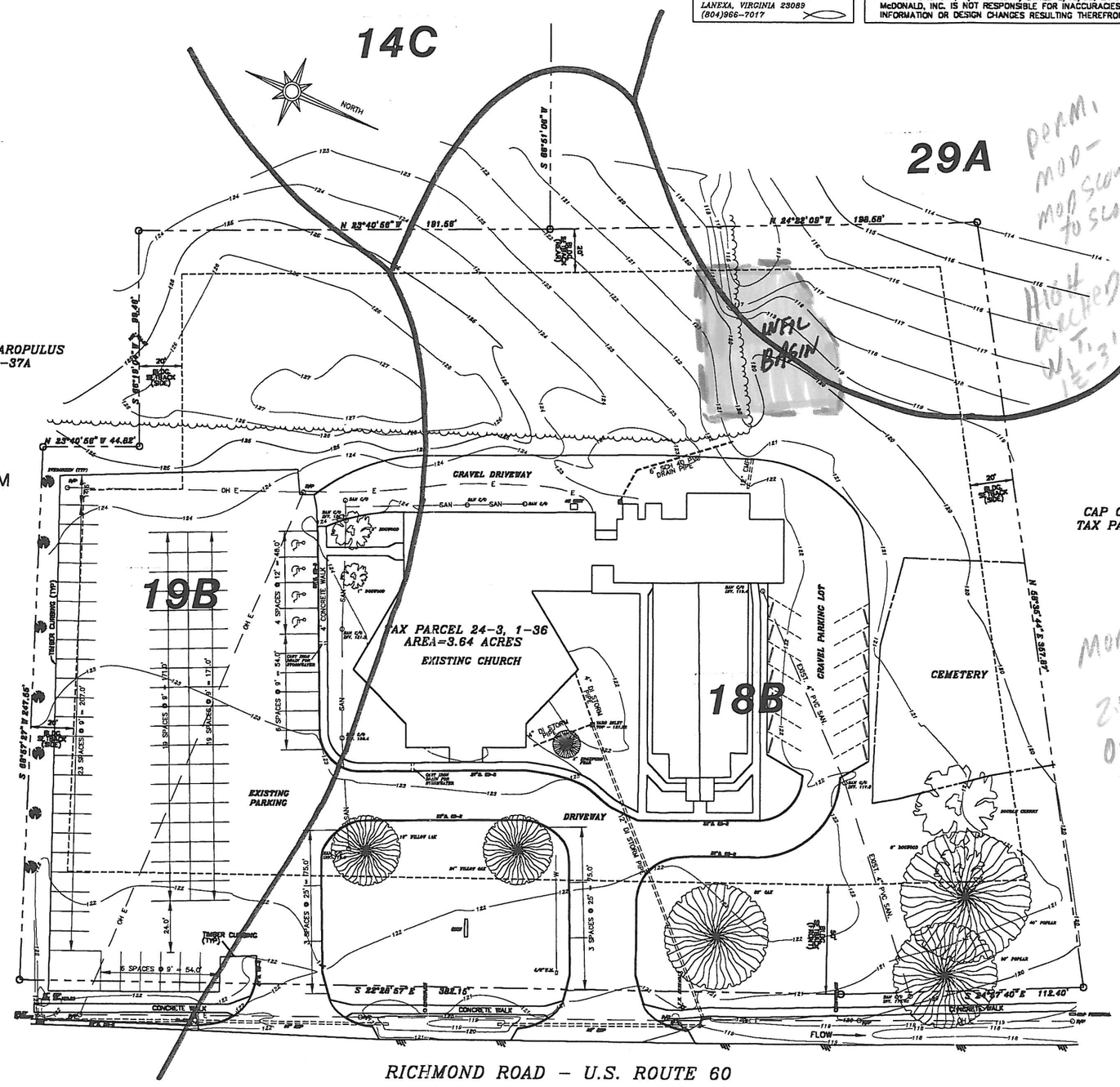
Ken Sanok
Technical Consultant

cc: Rob Chapman, Infiltrator Systems Inc.

Corporate Office
6 Business Park Road • P.O. Box 768 • Old Saybrook, CT 06475 • (800) 221-4436 • Fax (860) 388-6810

HIS LAND SURVEYING, INC.
15500 RIVER BEND TRAIL
LANEXA, VIRGINIA 23089
(804)966-7017

TOPOGRAPHIC AND BOUNDARY INFORMATION TAKEN FROM FIELD SURVEY ENTITLED "SMITH MEMORIAL BAPTIST CHURCH", (703LRP.DXF) DATED 2/10/99, BY HIS LAND SURVEYING. LANGLEY AND McDONALD, INC. IS NOT RESPONSIBLE FOR INACCURACIES IN SAID TOPOGRAPHIC AND BOUNDARY INFORMATION OR DESIGN CHANGES RESULTING THEREFROM.



LEGEND:

14C EMPORIA FINE SANDY LOAM

18B KEMPSVILLE FINE SANDY LOAM

19B KEMPSVILLE-EMPORIA FINE SANDY LOAM

29A FINE SANDY LOAM

NOTE:
THIS SOIL MAP BASED ON A COMPILATION OF INFORMATION OF THE SOIL CONSERVATION SERVICE SOIL SURVEY OF JAMES CITY AND YORK COUNTIES AND THE CITY OF WILLIAMSBURG VIRGINIA

RICHMOND ROAD – U.S. ROUTE 60

SOILS MAP

0 25 50 75 100
GRAPHIC SCALE IN FEET
1" = 25'

Langley and McDonald, Inc.
Engineers · Surveyors · Planners
Landscape Architects · Environmental Consultants
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VIRGINIA BEACH
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Fax (757) 565-3703
5544 Greenwich Road – Suite 200
Virginia Beach, Va. 23462
Tel. (757) 473-2004
Fax (757) 497-7933
Email: lldo@langleyandmcdonald.com

REVISIONS: No. | Date | Comment | By

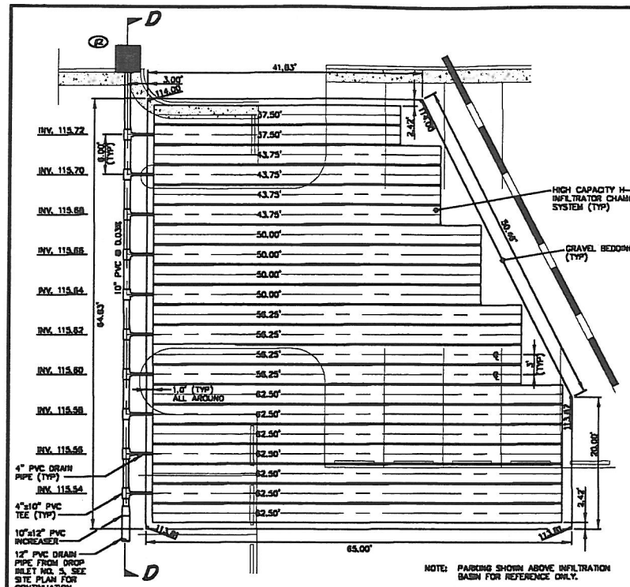
DRAWING STATUS: Preliminary Review; Client for Review; Pre Approval Mtng; NOPC

COUNTY APPROVAL: Not Submitted; Submitted; Not Submitted; Approved

EXISTING SITE CONDITIONS
SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER
OF WILLIAMSBURG
RICHMOND ROAD JAMES CITY COUNTY VIRGINIA

Designed:	Date: 9/7/99
Checked:	Scale: 1"=25'
Drawn:	CADD File name: SHEET2.DWG
Project Number: 1990072-000.01	Dwg. File No.: XXXXXX
Drawing Number	C-2

2 of 10



INFILTRATION BASIN PLAN

SCALE 1" = 10'

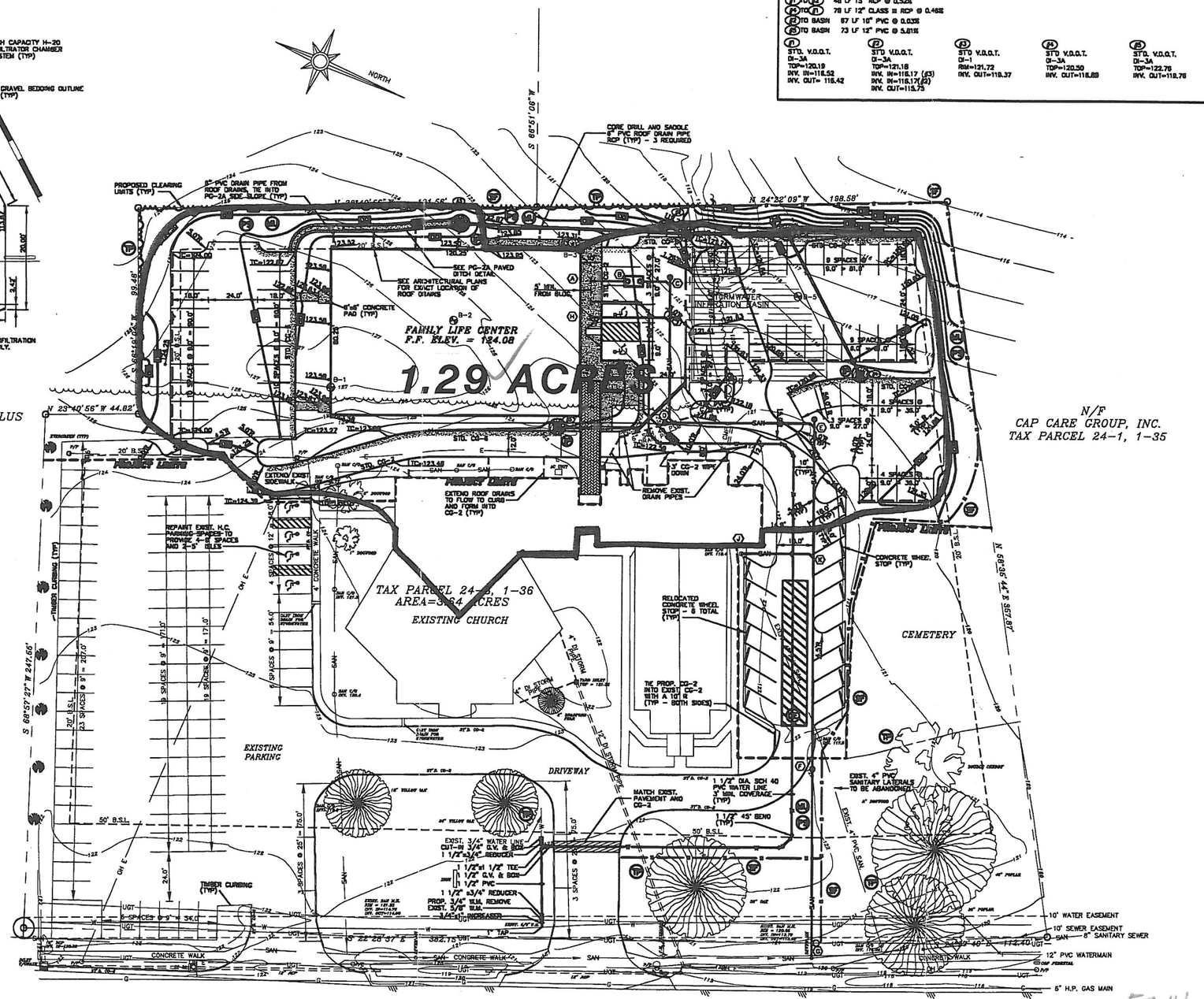
HIS LAND SURVEYING, INC.
15500 RIVER BEND TRAIL
LANEXA, VIRGINIA 23089
(804)966-7017

TOPOGRAPHIC AND BOUNDARY INFORMATION TAKEN FROM FIELD SURVEY ENTITLED "SMITH MEMORIAL BAPTIST CHURCH", (703LRP.DXF) DATED 2/10/99, BY HIS LAND SURVEYING. LANGLEY AND McDONALD, INC. IS NOT RESPONSIBLE FOR INACCURACIES IN SAID TOPOGRAPHIC AND BOUNDARY INFORMATION OR DESIGN CHANGES RESULTING THEREFROM.

STORM DATA

(A) TO (B)	108 LF 12" RCP @ 2.96%
(B) TO (C)	48 LF 12" RCP @ 0.52%
(D) TO (C)	78 LF 12" CLASS III RCP @ 0.46%
(E) TO BASIN	87 LF 10" PVC @ 0.03%
(F) TO BASIN	73 LF 12" PVC @ 5.81%

(1)	(2)	(3)	(4)	(5)
STD. V.D.O.T. DI-3A	STD. V.D.O.T. DI-3A	STD. V.D.O.T. DI-1	STD. V.D.O.T. DI-3A	STD. V.D.O.T. DI-3A
TOP=120.19	TOP=121.18	RIM=121.72	TOP=120.50	TOP=122.76
INV. IN=116.52	INV. IN=116.17 (E3)	INV. OUT=118.37	INV. OUT=116.89	INV. OUT=118.76
INV. OUT= 116.42	INV. IN=116.17 (E2) INV. OUT=115.73			



SANITARY SEWER DATA

(A)	LIMITS OF SITE PLAN SANITARY SEWER (5' FROM BLDG.), INV. = 120.35
(A) TO (B)	16 LF 2" SDR 23.5 PVC @ 2.00%
(B)	750 GAL CAPACITY GREASE TRAP OR APPROVED EQUAL, INV. IN = 120.02, INV. OUT = 119.85
(B) TO (C)	13 LF 6" SDR 23.5 PVC @ 1.62%
(C)	SANITARY CLEANOUT, INV. = 119.65
(C) TO (D)	68 LF 6" SDR 23.5 PVC @ 1.00%
(D)	SANITARY CLEANOUT, INV. = 118.97
(D) TO (E)	70 LF 6" SDR 23.5 PVC @ 1.00%
(E)	SANITARY CLEANOUT, INV. = 118.27
(E) TO (F)	169 LF 6" SDR 23.5 PVC @ 1.00%
(F)	SANITARY CLEANOUT, INV. = 116.58
(F) TO (G)	80 LF 6" SDR 23.5 PVC @ 1.00%
(G)	TIE INTO EXISTING MANHOLE, INV. IN = 115.68, CORE AND BOOT EXIST. SANITARY MANHOLE. PROVIDE INSIDE DROP CONNECTION
(H)	LIMITS OF SITE PLAN SANITARY SEWER (5' FROM BLDG.), INV. = 120.25
(H) TO (I)	30 LF 4" SDR 23.5 PVC @ 2.00%
(I)	6"x4" SDR 23.5 PVC WYE, INV. = 119.46
(J)	EXIST. SANITARY CLEANOUT, INV. = 119.4
(J) TO (K)	35 LF 4" SDR 23.5 PVC @ 5.11%
(K)	6"x4" SDR 23.5 PVC WYE, INV. = 117.61

NOTES:

1. UNLESS OTHERWISE NOTED, ALL DRAINAGE EASEMENTS DESIGNATED ON THIS PLAN SHALL REMAIN PRIVATE.
2. ALL UTILITIES SHALL BE PLACED UNDERGROUND.
3. EXTERIOR SIGNS WITHIN THE DISTRICT SHALL COMPLY WITH THE REGULATIONS FOR EXTERIOR SIGNS IN ARTICLE II DIVISION 3 OF THE JAMES CITY COUNTY ZONING ORDINANCE.
4. VDOT DOES NOT ASSUME RESPONSIBILITY FOR MAINTENANCE OF THE PROPOSED INFILTRATION BASIN AND OUTLET STRUCTURE.
5. THIS PLAN DOES NOT GUARANTEE THE EXISTENCE/NONEXISTENCE OF ANY UTILITES ABOVE AND/OR BELOW GROUND. CONTRACTOR SHALL VERIFY THE HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UTILITIES PRIOR TO ORDERING OF MATERIALS AND INSTALLATION. THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR ANY UTILITIES DAMAGED DURING CONSTRUCTION AND SHALL REPAIR ANY UTILITIES DAMAGED BY CONSTRUCTION ACTIVITIES AT THEIR OWN EXPENSE.
6. GEOTECHNICAL SOIL BORINGS SHOWN ARE APPROXIMATE LOCATIONS ONLY.
7. ALL UNUSED WELLS MUST BE ABANDONED ACCORDING TO STATE PRIVATE WELL REGULATIONS.
8. APPROVAL TO BEGIN CONSTRUCTION OF THE STORMWATER MANAGEMENT/BMP INFILTRATION BASIN MUST BE OBTAINED BY THE OFFICE OF CODE COMPLIANCE OF JAMES CITY COUNTY.

RICHMOND ROAD – U.S. ROUTE 60

POST-DEVELOPMENT DRAINAGE AREA

0 25 50 75 100
GRAPHIC SCALE IN FEET
1" = 25'

COMMONWEALTH OF VIRGINIA
EDWIN S. PHILIPS
No. 023631
PROFESSIONAL ENGINEER

Langley and McDonald, Inc.
Engineers · Surveyors · Planners
Landscape Architects · Environmental Consultants
WILLIAMSBURG VIRGINIA BEACH
5544 Greenwich Road – Suite 200, Virginia Beach, VA 23462
Tel. (757) 473-2000 Fax. (757) 473-2010
Email: info@langleymcd.com
4029 Ironbound Rd. Suite 100, Williamsburg, VA 23188
Tel. (757) 220-9160 Fax. (757) 220-9175
Email: info@langleymcd.com

REVISIONS: No.	Date	Comment	By

DRAWING STATUS: DATE ___ Preliminary Review; DATE ___ Client for Review; DATE ___ Pre Approval Meeting; DATE ___ DATE

COUNTY APPROVAL: DATE ___ 1st Submittal; DATE ___ 2nd Submittal; DATE ___ 3rd Submittal; DATE ___ Approval

SITE PLAN
SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER

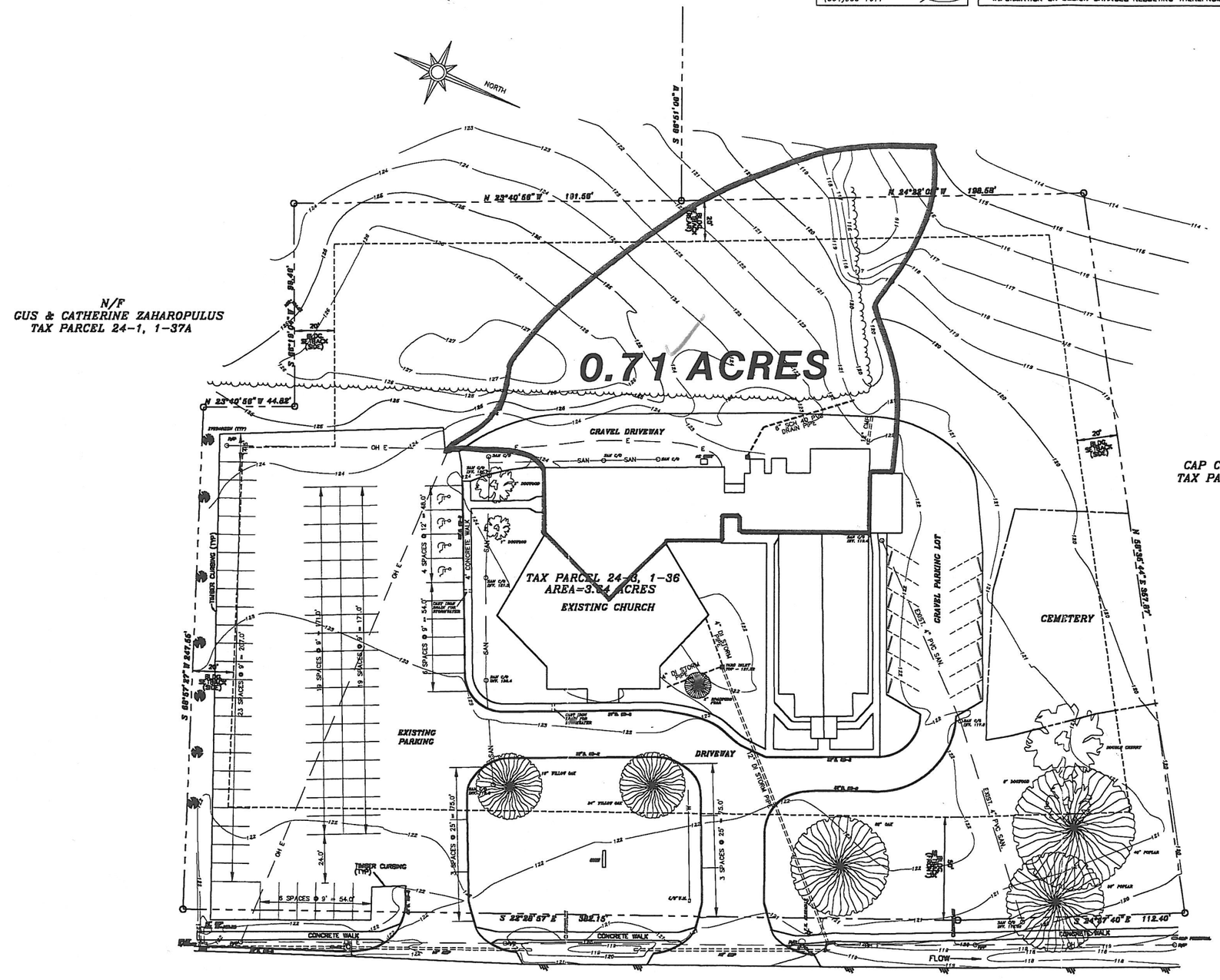
@ RICHMOND ROAD

JAMES CITY COUNTY, VIRGINIA

Designed: W.F.B./S.A.G.	Date: 10/13/99
Checked: R.S.P.	Scale: 1"=25'
Drawn: S.A.G.	CADD file name: SHEET3.DWG
Project Number: 1990072-000.01	Dwg. File No.: 10,862W
Drawing Number: 3 OF 11	C-3

HIS LAND SURVEYING, INC.
15500 RIVER BEND TRAIL
LANEXA, VIRGINIA 23089
(804)966-7017

TOPOGRAPHIC AND BOUNDARY INFORMATION TAKEN FROM FIELD SURVEY ENTITLED "SMITH MEMORIAL BAPTIST CHURCH", (703LRP.DXF) DATED 2/10/99, BY HIS LAND SURVEYING. LANGLEY AND McDONALD, INC. IS NOT RESPONSIBLE FOR INACCURACIES IN SAID TOPOGRAPHIC AND BOUNDARY INFORMATION OR DESIGN CHANGES RESULTING THEREFROM.



PRE-DEVELOPMENT DRAINAGE AREA

1"=57.14'

0 25 50 75 100
GRAPHIC SCALE IN FEET
1" = 25'

Langley and McDonald, Inc.
Engineers · Surveyors · Planners
Landscape Architects · Environmental Consultants
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5344 Greenwich Road – Suite 200
Virginia Beach, VA 23462
Tel. (757) 473-2000
Fax. (757) 497-7833
Email: langleymcdonald.com

REVISIONS: No. | Date | Comment | By

DRAWING STATUS: Preliminary Review; Client for Review; Pre Approval Meeting; NOTE; COUNTY APPROVAL: 1st Submittal; 2nd Submittal; 3rd Submittal; Approved

EXISTING SITE CONDITIONS
SMITH MEMORIAL BAPTIST CHURCH
FAMILY LIFE CENTER
CHESAPEAKE, VIRGINIA
JAMES CITY COUNTY

Designed:	Date: 9/7/99
Checked:	Scale: 1"=25'
Drawn:	CADD File name: SHEET2.DWG
Project Number: 1990072-000.01	Dwg. File No.: XXXXX-X
Drawing Number	C-2

2 OF 10

TABLE 1 - LOGS OF BASIN BORINGS

Family Life Center
Smith Memorial Baptist Church
Williamsburg, Virginia

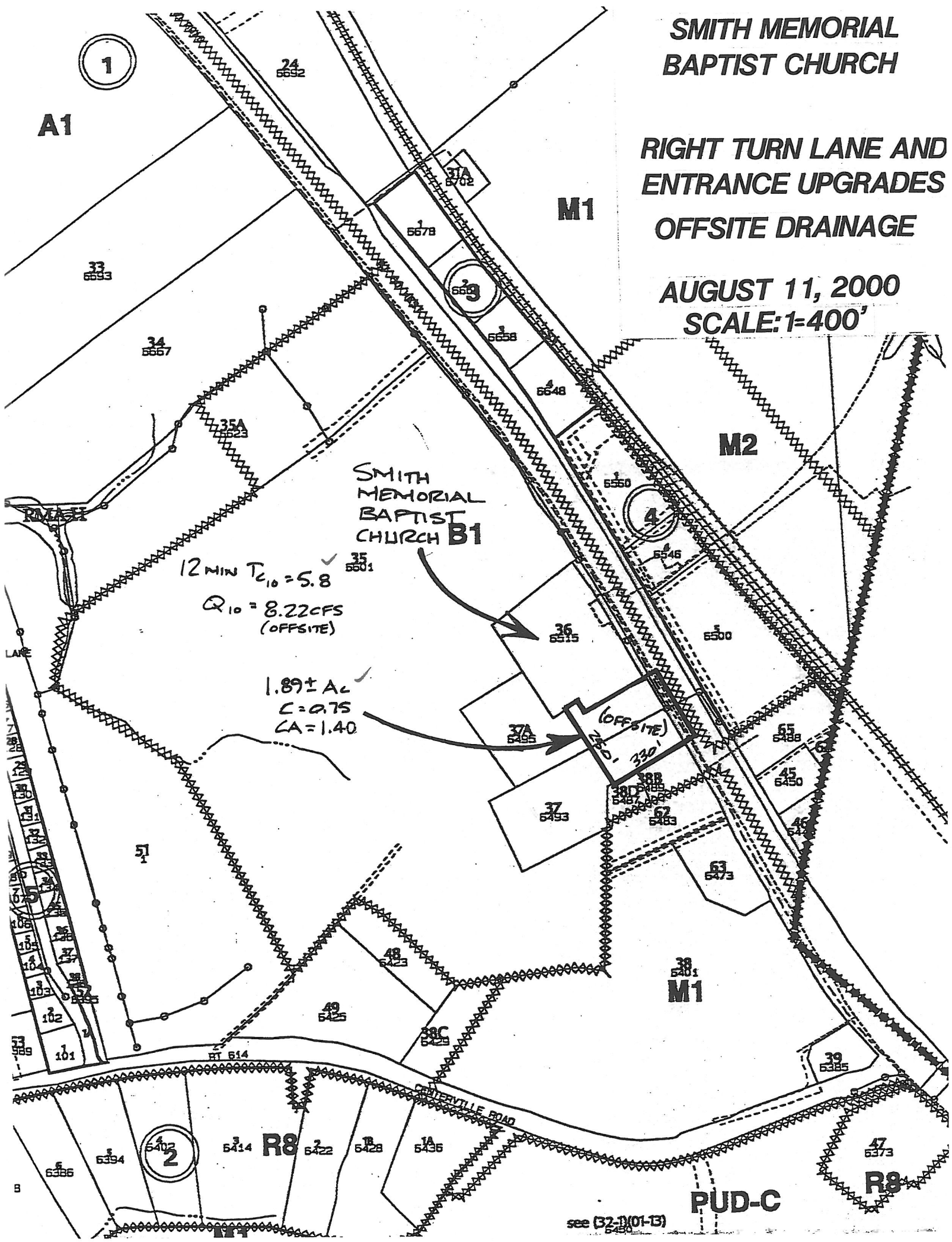
Depth, ft	Soil Description
Boring B-4	
0.0 - 1.5	Orangish-Brown Moist Very Sandy CLAY (CL)
1.5 - 3.5	Orangish-Tan Moist Fine Clayey Silty SAND (SM-SC)
	- slightly clayey below 2.5 feet
3.5 - 5.5	Orangish-Tan Moist Fine Slightly Silty SAND (SM)
5.5 - 6.5	Orangish-Tan and Light Gray Moist Fine Clayey SAND (SC)
6.5 - 8.0	Orangish-Tan and Beige Moist Fine Slightly Silty SAND (SM)
	Boring Terminated at 8 feet
Boring B-5	
0.0 - 1.5	Light Brown Moist Very Sandy CLAY (CL)
1.5 - 3.5	Orangish-Tan Moist Fine Clayey Silty SAND (SM-SC)
3.5 - 5.5	Orangish-Tan Moist Fine Silty SAND (SM)
	- slightly silty, yellowish-tan below 4 feet
5.5 - 6.5	Yellowish-Tan Moist Fine Clayey Silty SAND (SM-SC)
6.5 - 8.0	Yellowish-Tan Moist Fine Slightly Silty SAND (SM)
	Boring Terminated at 8 feet
Boring B-6	
0.0 - 2.5	Grayish-Brown Moist Fine Slightly Silty SAND (SM) with roots (Topsoils)
2.5 - 3.0	Orangish-Brown Moist Fine Clayey Silty SAND (SM-SC)
3.0 - 4.0	Tan Very Moist Fine Slightly Silty SAND (SM)
4.0 - 6.5	Orangish-Tan Wet Fine Clayey Silty SAND (SM-SC)
	- very moist, orangish-brown and beige below 5 feet
	- slightly clayey, very moist, orangish-tan below 6 feet
6.5 - 8.0	Orangish-Tan Moist Fine Silty SAND (SM)
	- slightly silty, yellowish-tan below 7.5 feet
	Boring Terminated at 8 feet

SM, SC, SM
SM-SC, SM-SC
SM

BASIN BOTTOM

WET SOIL CONDITIONS ENCOUNTERED AT BASIN BORING B-6 @ 4' BELOW EXIST GRADE (APPROX. EL. 116). GEOTECH REPORT SUGGESTS POSSIBLE GW SEEPAGE IN THE VICINITY OF THIS BORING ON A TRANSIENT BASIS.

(P.5)


SMITH MEMORIAL BAPTIST CHURCH
RIGHT TURN LANE AND ENTRANCE UPGRADES
OFFSITE DRAINAGE
AUGUST 11, 2000
SCALE: 1=400'
A1
M1
M2
R8
PUD-C
SMITH MEMORIAL BAPTIST CHURCH B1
12 MIN $T_{c_{10}}$ = 5.8
Q_{10} = 8.22 CFS (OFFSITE)
1.89± Ac
C = 0.75
CA = 1.40
(OFFSITE)
250
330
CENTERVILLE ROAD
see (32-1)(01-13)