Stormwater Division

MEMORANDUM

DATE: March 5, 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: PC170

PIN: 322100001A

Subdivision, Tract, Business or Owner Name (if known): Villages at Westminster (The)

Property Description: Common Area

Site Address:

(For internal use only) **Box** 6 **Drawer:** 3

Agreements: (in file as of scan date) **Y** **Book or Doc#:** 970015901 **Page:** 809 636

Comments

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: **PC170**

DATE VERIFIED: **December 18, 2015**

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

LOCATION: WILLIAMSBURG, VIRGINIA

Date Record Created:

Created By:

WS_BMPNO: PC170

Print Record

PRINTED ON
Friday, March 05, 2010
8:42:56 AM

WATERSHED	PC
BMP ID NO	170
PLAN NO	SP-100-97
TAX PARCEL	(32-2)(1-1A)
PIN NO	3221000001A
CONSTRUCTION DATE	1/1/1998
PROJECT NAME	Villages at Westminster Pond I
FACILITY LOCATION	Behind (west) of 6201 Weathersfield Way
CITY-STATE	Williamsburg, Va. 23188
CURRENT OWNER	Villages of Westminster Homeowners Assoc.
OWNER ADDRESS	2 Eaton Street
OWNER ADDRESS 2	Suite 1101
CITY-STATE-ZIP CODE	Hampton, VA 23669
OWNER PHONE	
MAINT AGREEMENT	Yes
EMERG ACTION PLAN	No

Get Last BMP No | Return to Menu

MAINTENANCE PLAN	No
SITE AREA acre	63.6
LAND USE	Gen Residential
old BMP TYP	Wet Pond
JCC BMP CODE	A2 Wet Pond
POINT VALUE	9
SVC DRAIN AREA acres	63.6
SERVICE AREA DESCRI	SF Lots & Roads I, II, III, IV
IMPERV AREA acres	14.70
RECV STREAM	UT of Powhatan Creek
EXT DET-WQ-CTRL	Yes
WTR QUAL VOL acre-ft	2.48
CHAN PROT CTRL	No
CHAN PROT VOL acre-ft	0
SW/FLOOD CONTROL	Yes
GEOTECH REPORT	Yes

CTRL STRUC DESC	RCP Riser
CTRL STRUC SIZE inches	66
OTLT BARRL DESC	RCP Barrel
OTLT BARRL SIZE inch	48
EMERG SPILLWAY	No
DESIGN HW ELEV	66.49
PERM POOL ELEV	62
2-YR OUTFLOW cfs	26.36
10-YR OUTFLOW cfs	0.00
REC DRAWING	Yes
CONSTR CERTIF	No

LAST INSP DATE 10/11/2007 Inspected by:

INTERNAL RATING 3

MISC/COMMENTS

Wellesley Rd. Design 7. Road is embankment. Also see PC 171.

Additional Comments:

COPY

DECLARATION OF COVENANTS

INSPECTION/MAINTENANCE OF DRAINAGE SYSTEM

THIS DECLARATION, made this 26th day of September, 1997, between Atlantic Homes Development, and all successors in interest, hereinafter referred to as the "COVENANTOR(S)," owner(s) of the following property: The Villages of Westminster: SP-100-97 (North and South Ponds), Deed Book 809, Page No. 636 or Instrument No. _____, and James City County, Virginia, hereinafter referred to as the "COUNTY."

WITNESSETH:

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

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

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

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

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

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

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 # 970015901
Recorded 10-1-97

IN WITNESS WHEREOF, the COVENANTOR(S) have executed this DECLARATION OF COVENANTS as of this 26th day of September, 1997.

COVENANTOR(S)

Willard W. Morris
President

ATTEST:

COVENANTOR(S)

ATTEST:

COMMONWEALTH OF VIRGINIA
~~CITY~~/COUNTY OF James City

I hereby certify that on this 26 day of September, 1997, before the subscribed, a Notary Public of the State of Virginia, and for the County of James City, aforesaid personally appeared WILLARD W. MORRIS and did acknowledge the aforegoing instrument to be their Act.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal this 26 day of September, 1997.

Carole C. Galiano
Notary Public

My Commission expires: May 31, 1998

Approved as to form:

This Declaration of Covenants prepared by:

Willard W. Morris
(Print Name)

President, Atlantic Homes Development
(Title)

2 Eaton St #1101
(Address)

Hampton VA 23669
(City) (State) (Zip)

drainage.pre
Revised 2/97

ENVIRONMENTAL – STORMWATER
TRANSMITTAL

PROTECTING RESOURCES
PRIDE
IN DELICATE ENVIRONMENTS

James City County
Jamestown 1607

COUNTY PLAN NO: SP-100-97

BMP ID CODE: PC170 & PC171

WATERSHED: Powhatan

- [x] **ENTIRE RECORD FILE**
- [x] **ASBUILTS**
- [x] **CONSTRUCTION CERTIFICATION**
- [x] **COMPUTATIONS**
- [ ] **OTHER:** Inspection documents, numerous letters concerning BMP repairs and ECS certification & pictures (final)

NAME: Tina Cooke

SIGNATURE: Tina Cooke

DATE: 6/12/08

serves PH 2,3 + 4

James City County, Virginia
Environmental Division

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

County Plan No.: SP-100-97
Project Name: VILLAGES AT WESTMINSTER (COTSWALD) South of Glencoe Way
Stormwater Management Facility: POND 2 – WET POND (~~North of Wellesley Blvd.~~)
Phase: ☐ I ☒ II ☐ III

- ☐ Information Received. Date: 03-01-02
- ☐ Administrative Check.
  - ☐ Record Drawing Date: 03-06-02 Richmond
  - ☐ Construction Certification Date:
  - ☐ RD/CC Standard Forms (Required after Feb 1st 2001Only)
  - ☐ Insp/Maint Agreement Info: INST# 970015901 10-1-97
  - ☐ BMP Maintenance Plan Location: None
  - ☐ Other:
- ☐ Standard E&SC Note on Approved Plan Requiring RD/CC or County comment in plan review file.
  ☐ Yes ☐ No Location: Note 18 Sheet C5; Note #7 S2+S3
- ☐ Assign County BMP ID Code Code: PC171
- ☐ 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.
- ☐ Pre-Inspection Drawing Review - Approved Plan (Quick look prior to field inspection).
- ☐ Final Inspection (FI) Performed Date: May 14 '02; Reinspect 10-9-02; Reinspect 12-6-02.
- ☐ Record Drawing (RD) Review Date: May 13 '02; ~~[illegible]~~ 6/20/02
- ☐ Construction Certification (CC) Review Date:
- ☐ Actions:
  - ☐ No comments.
  - ☐ Comments. Letter Forwarded. Date: May 15 '02
    - ☐ Record Drawing (RD) Resub 6/20/02 OK
    - ☐ Construction Certification (CC) OK 6-25-03
    - ☐ Construction-Related (CR) OK 10-9-02 + 12-6-02
    - ☐ Site Issues (SI)
    - ☐ Other :
- ☐ Second Submission: RD Resub 6/20/02;
- ☐ 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 FORM
- ☒ Check/Clean active file of any remaining material and finish "As-Built" file.
- ☒ Add to County BMP Inventory/Inspection schedule (Phase I, II or III).
- ☒ Copy Final Inspection Report into County BMP Inspection Program file.
- ☒ Digital Photographs obtained.
- ☐ No Add to JCC Hydrology & Hydraulic database (optional). Released 6/5/08

BMP Certification Information Acceptable

Plan Reviewer: [signature] P.E. Date: 7/10/03

1/1/98 constructed
Design Type 7 9pt.

James City County, Virginia
Environmental Division

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

County Plan No.: SP-100-97
Project Name: VILLAGES AT WESTMINSTER (Wellesley)
Stormwater Management Facility: POND 1 - WET POND (West of South MAYFAIR Circle)
Phase: ☐ I ☒ II ☐ III

- ☑ Information Received. Date: 03-01-02
- ☐ Administrative Check.
  - ☑ Record Drawing Date: 03-06-01 RICHMOND
  - ☐ Construction Certification Date: ~~Comp Port Screen Report 12/97~~ subsurf report not const'cert
  - ☐ RD/CC Standard Forms (Required after Feb 1st 2001Only)
  - ☑ Insp/Maint Agreement Info: INST# 9700015901 11-1-97
  - ☐ BMP Maintenance Plan Location: NONE
  - ☐ Other:
- ☑ Standard E&SC Note on Approved Plan Requiring RD/CC or County comment in plan review file.
  ☑ Yes ☐ No Location: NOTE #18 Sheet 55; Comm #3 Sept 8 97; NOTE 7 S2+S3
- ☑ Assign County BMP ID Code Code: PC 170
- ☑ 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.
- ☑ Pre-Inspection Drawing Review - Approved Plan (Quick look prior to field inspection).
- ☑ Final Inspection (FI) Performed Date: 5/14/02
- ☑ Record Drawing (RD) Review Date: 5/13/02; 6/20/02
- ☑ Construction Certification (CC) Review Date:
- ☐ Actions:
  - ☐ No comments.
  - ☑ Comments. Letter Forwarded. Date: MAY 15 '02
    - ☑ Record Drawing (RD) Comments ADDRESSED 6-20-02. ??
    - ☑ Construction Certification (CC) ADDRESSED 2/11/03
    - ☑ Construction-Related (CR)
    - ☐ Site Issues (SI)
    - ☐ Other : Only for POND 4
- ☑ Second Submission: RD MAY 20 '02 OK; CC 2/11/03 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.
- ☑ 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).

Released 4/5/08

BMP Certification Information Acceptable

Plan Reviewer: _____ Date: _____

COPY

DECLARATION OF COVENANTS

INSPECTION/MAINTENANCE OF DRAINAGE SYSTEM

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

Instrument # 970015-901
Recorded 10-1-97

IN WITNESS WHEREOF, the COVENANTOR(S) have executed this DECLARATION OF COVENANTS as of this 26th day of September, 1997.

COVENANTOR(S)

Willard W. Morris
President

ATTEST:

COVENANTOR(S)

ATTEST:

COMMONWEALTH OF VIRGINIA
~~CITY~~/COUNTY OF James City

I hereby certify that on this 26 day of September, 1997, before the subscribed, a Notary Public of the State of Virginia, and for the County of James City, aforesaid personally appeared WILLARD W. MORRIS and did acknowledge the aforegoing instrument to be their Act.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal this 26 day of September, 1997.

Carole C. Galiano
Notary Public

My Commission expires: May 31, 1998

Approved as to form:

This Declaration of Covenants prepared by:

Willard W. Morris
(Print Name)

President, Atlantic Homes Development
(Title)

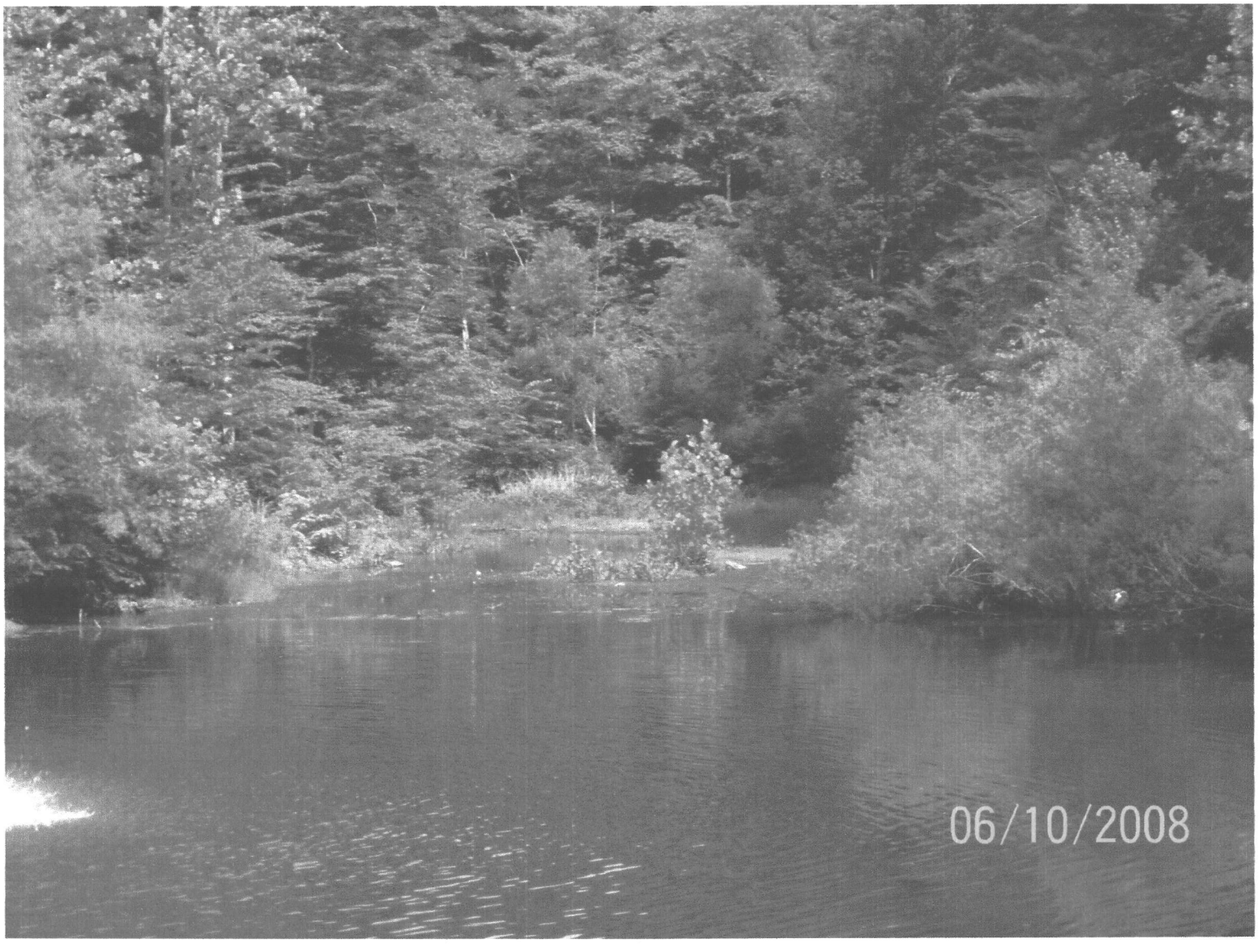
2 Eaton St #1101
(Address)

Hampton VA 23669
(City) (State) (Zip)

drainage.pre
Revised 2/97

06/10/2008

06/10/2008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06/10/2008

ECS MID-ATLANTIC, LLC
Geotechnical • Construction Materials • Environmental • Facilities

April 29, 2008

Mr. Pete Fallon 596-8800 - office
Atlantic Homes 449-8775 - cell
109 Nat Turner Boulevard
Newport News, VA 23606

Reference: Site Visit
PC171 (Pond 2)
The Villages of Westminster Subdivision
Williamsburg, Virginia

ECS Project No. 07:9474

Dear Mr. Fallon:

An engineering representative of ECS Mid-Atlantic, LLC visited the site to observe the pipe joint that was exposed based on our previous site meeting with the County. As a result of the previous meeting, it was agreed that one of the pipe joints in question would be exposed because of previous observations by the county and their concerns about the integrity of the joint.

When we arrived on-site, a test pit had been excavated down to the top of the pipe and we observed the visible portion of the pipe joint in question. The joint did not have any signs of damage or distress. Please see the attached pictures of the joint.

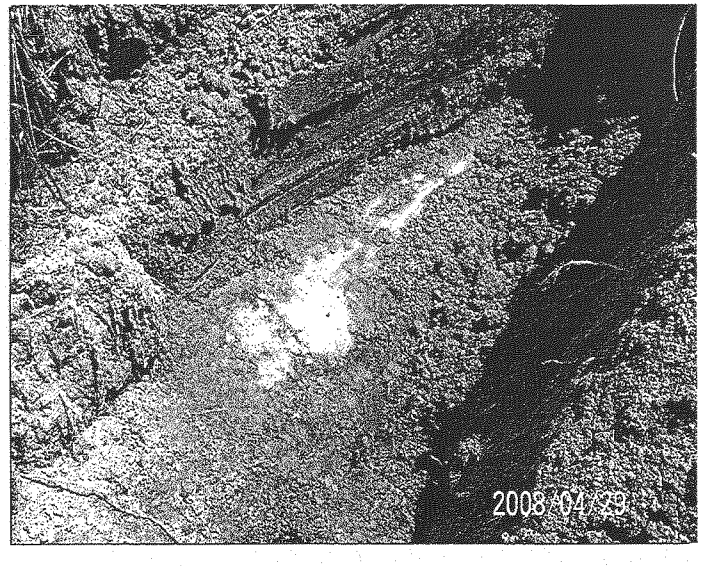
We have enjoyed being of service to Atlantic Homes during this project. If you should have any questions regarding this letter, please do not hesitate to contact us.

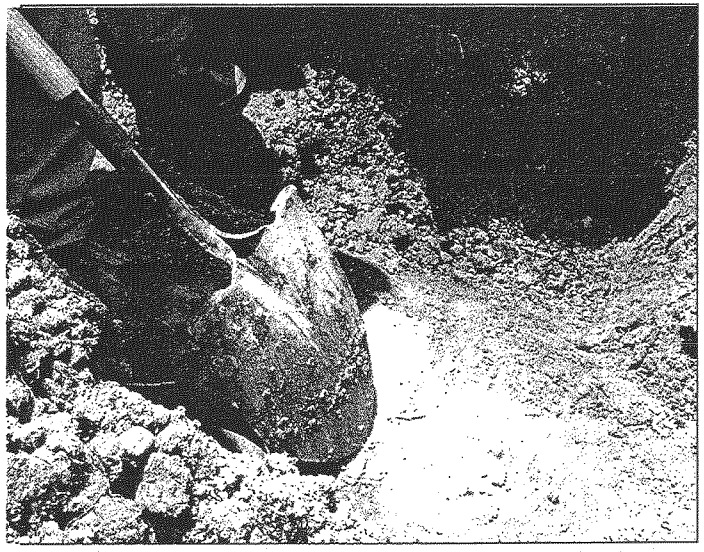
Respectfully,
ECS Mid-Atlantic, LLC.

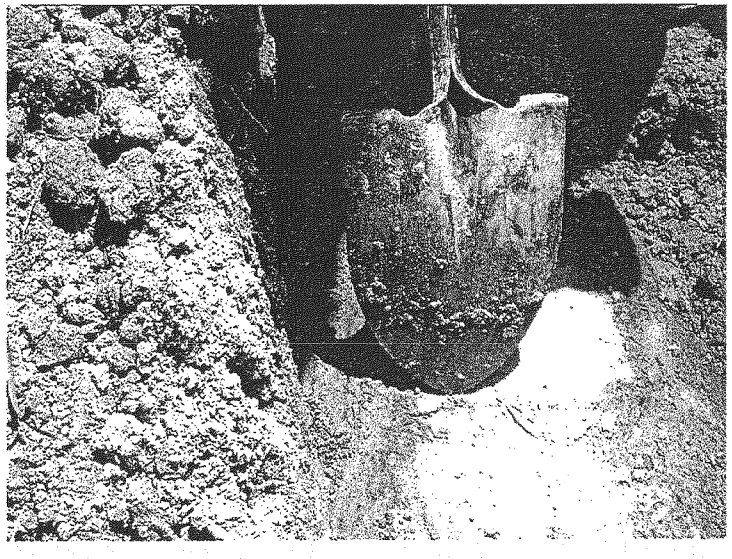
W. Lloyd Ward, P.E.
VP/Branch Manager

Lloyd Ward
312-8439
mobile #

108 Ingram Road, Unit 1 • Williamsburg, Virginia 23188 • (757) 229-6677 • Fax (757) 229-9978 • www.ecslimited.com
Aberdeen, MD • Baltimore, MD • Chantilly, VA • Charlottesville, VA* • Frederick, MD • Fredericksburg, VA • Manassas, VA
Ocean City, MD* • Richmond, VA • Roanoke, VA • Virginia Beach, VA • Waldorf, VA • Williamsburg, VA • Winchester, VA • York, PA
*testing services only







Villages of Westminster Dams
James City County, Virginia

Project No. 07:9474

Atlantic Homes, LLC

109 Nat Turner Boulevard • Newport News, Virginia 23606 • Telephone: (757) 596-8800 • Fax (757) 596-8516

November 7, 2006

RECEIVED
NOV 8 2006
ENVIRONMENTAL DIVISION

Mr.Scott Thomas
Civil Engineer
Environmental Division
James City County
101 Mounts Bay Road, Bldg E
Williamsburg, Virginia 23185

RE: Villages of Westminster

Dear Mr. Thomas:

Enclosed is the letter from Bury + Partners for the Certification of the Pond on Wellesley Boulevard In Villages of Westminster.

Also enclosed is my correspondence with Joan concerning the field issue for that pond.

If you have any questions please call me.

Yours truly,

Fran Barber

Fran Barber
Development Coordinator

Bury+Partners
ENGINEERING SOLUTIONS

October 26, 2006

Ms. Fran Barber
Atlantic Homes
109 Nat Turner Boulevard
Newport News, Virginia 23606

RE: Villages of Westminster Construction Certification

Dear Ms. Barber:

I would first like to apologize for the delay in writing this letter to revise my letter from September of last year. On September 23, 2005 we performed a site inspection of the subdivision and the wet pond (BMP PC170) at the referenced project site. Based on this inspection it appears that the pond was constructed in conformance with the approved plans. Final mature vegetation has been established and there did not appear to be any outstanding storm water or erosion control items.

We truly appreciate the opportunity to work with you on this issue. Again, please accept my apology for the delay in writing this letter. Please feel free to call me at 757-229-1776 if you have any questions or concerns.

Sincerely,

BURY+PARTNERS-VIRGINIA, INC.

M. Sean Fisher

M. Sean Fisher, P.E.
Civil Department Manager

I:\04318 - Orchard Hill\letter,Barber,msf,10,26,06.doc

BURY+PARTNERS-VIRGINIA, INC.
4095 Ironbound Road, Suite 200
Williamsburg, Virginia 23188

TEL (757) 229-1776
FAX (757) 229-4683

www.burypartners.com

FAXED Joan

nancy

From: "Joe Buchite" <JBUCHITE@james-city.va.us>
To: <atlantichomes@widomaker.com>
Sent: Wednesday, January 11, 2006 10:29 AM
Subject: Villages of Westminster phase 4

Mrs. Thomas,
I am writing you today in response to your request to review the subdivision bond for the Villages of Westminster phase 4. After a field inspection the bond will have to remain at it's current status due to a field issue involving subsidence around a storm drop inlet (storm sewer # 5 on the approved plan). If you have any questions feel free to contact me at (757) 253 -6643.

Thank you,
Joe Buchite

1/16/06 Joan said repair had been made + supposed to be reinspected today. Joan will call tomorrow & let me know if everything OK

Call Joan
2/2/06

Scott Thomas

From: Scott Thomas
Sent: Thursday, May 16, 2002 10:26 AM
To: Renee Dallman
Subject: RE: BMPs

Yes that would be ok. Just let me know when. As it turns out, I was just working on that project. On Tues May 14th I met on site with one of the HOA reps who is on the BMP committee, Mr. Peter Van Dyke. I was performing final inspections for the two BMPs and he wanted to accompany me. Usually I don't know who is involved with the HOA at this point in the project, but in this case they have been very proactive.

Currently we still hold bond for the two BMPs and I am about to issue letters to the developer with a punch list of items relative to certification documents required and a punch list of construction related items that are necessary to be addressed. We will not release any bond being held until the items are completed to our satisfaction and we perform a reinspection.

I already discussed with Mr. Van Dyke that after the closeout, I would certainly be willing to coordinate and meet with the HOA representatives who are on the BMP team to help them in any way possible such as developing maintenance plans for the BMPs, etc.

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

-----Original Message-----
From: Renee Dallman
Sent: Thursday, May 16, 2002 9:19 AM
To: Scott Thomas
Subject: BMPs

Scott,
Good morning! I am the facilitator for Villages of Westminster and they are gearing up to transition from developer control to homeowners control. They have several (at least 2) large BMPs and they are interested in learning more about what they are and what they need to do to keep them up as well as learning what the County's requirements are. Would you be available/interested in coming out and talking with them?
Thanks!
Renee

Renee Dallman
Communications and Neighborhoods Specialist
James City County Communications and Neighborhood Connections
5248 Olde Towne Road, Suite 11
Williamsburg, VA 23188

Phone (757)229-7630
Fax (757)229-4688
www.jccEgov.com

James City County Environmental Division
Stormwater Management / BMP Inspection Report
Detention and Retention Pond Facilities

County BMP ID Code (if known): PC170

Name of Facility: Villages @ Westminster Pond I (wellesley) BMP No.: 1 of 2 Date: 5/14/02

Location: EAST OF REC CENTER; West of 6201 Weathersfield WAY

Name of Owner: Villages of Westminster HOA

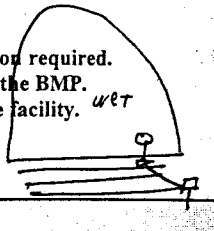
Name of Inspector: SJ Thomas

Type of Facility: Wet Pond

Weather Conditions: Sunny, 70's Type: ☒ Final Inspection ☐ County BMP Inspection Program ☐ Owner 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 to 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
Embankments and Side Slopes:	Earthen Dam (Road is Embankment) 3H:1V U/S 60' TW 2 LANES 3H:1V D/S			
Grass Height	✓			U/S cut; DS 2-4' high GRASS
Vegetation Condition	✓			OK U/S + D/S
Tree Growth	✓			None on U/S or D/S.
Erosion	•	✓		U/S embank @ barrel thru dam.
Trash & Debris	✓			
Seepage	✓			None observed
Fencing or Benches				NA
Interior Landscaping/Planted Areas:	☒ None ☐ Constructed Wetland/Shallow Marsh ☐ Naturally Established Vegetation			
Vegetated Conditions	✓			10' deep per design wet pond
Trash & Debris		✓		dead log clogging orifice.
Floating Material	✓			
Erosion	✓			
Sediment	✓			
Dead Plant	✓			
Aesthetics	✓			
Other				
Notes: Serves SF Lots + Roads				

Facility Item	O.K.	Routine	Urgent	Comments
Water Pools: ☒ Permanent Pool (Retention Basin) ☐ Shallow Marsh (Detention Basin) ☐ None, Dry (Detention Basin)				
Shoreline Erosion	✓			Some but OK
Algae	✓			None, Fountain aerator
Trash & Debris	✓	✓		Dead wood, back north side.
Sediment	✓			2-3' @ riser
Aesthetics	✓			
Other				
Inflows (Describe Types/Locations): ① 24" RCP (north) backend; ② 18" PVC south emb/road.				
Condition of Structure	✓			① OK ② OK
Erosion	✓			① OK ② OK
Trash and Debris	✓			① OK ② OK
Sediment	✓	✓		① OK ② SED 1-3' deep obstructed
Outlet Protection				
Other				
Principal Flow Control Structure - Riser, Intake, etc. (Describe Type): 66" RISER RCP w/ 10' CAP; 4-6' HIGH				
Condition of Structure	✓			
Corrosion	✓			
Trash and Debris		✓	✓	8" ϕ x 30' long dead wood log + trash + debris on 10" LF RIP
Sediment	✓	✓		2-3' @ Riser
Vegetation	✓	✓		clear veg 10' from riser
Other				
Principal Outlet Structure - Barrel, Conduit, etc.: 48" RCP with ES-1 (END); Thru 2 01's 15' deep.				
Condition of Structure	✓			
Settlement	✓			
Trash & Debris		✓		Debris @ outfall; stone @ ES-1 end
Erosion/Sediment	✓			
Outlet Protection	✓			CLASS I OP 20x10'
Other				
Emergency Spillway (Overflow): None Road is overflow. Low Point clear				
Vegetation	✓			None.
Lining	✓			
Erosion	✓			
Trash & Debris	✓			
Other	✓			
Notes: Signs of beaver activity, back side of pond (old.)				

Facility Item	O.K.	Routine	Urgent	Comments
Nuisance Type Conditions:				
Mosquito Breeding	✓			None Observed.
Animal Burrows	✓			East side shore. Watch.
Graffiti	✓			
Other				
Surrounding Perimeter Conditions:	North Woods, East + West Lots, South Public Road.			
Land Uses	✓			SF.
Vegetation	✓			Could be better pond buffer
Trash & Debris	✓			(25') East + West shores.
Aesthetics	✓			
Access /Maintenance Roads or Paths				Wellesley Blvd. Easy access.
Other				

Remarks:
- Clean veg, trash + debris 10' from barrel out.
- Restablish riprap at ES-1 outlet.
- subsidence @ barrel 10' from riser 3-4' deep. Repair.
- clean sed 2-3' @ riser, clear LF orifice of accumulated trash, debris and 8" x 30' long dead wood (ag which has floated and jammed into the riser (obstructed)
- INFLOW Pipe 1 (48") Remove SF @ END, RESTORE OP
- clear + remove some of the large floatable dead wood pieces from back of pond which can work there way to riser.
- clear cattail veg 10' from riser.
- clean outfall at Pipe 2 (18" RC) along embankment, sed obstructing Flow 2-3' deep.

(Note: Barrel subsidence does not appear to be piping. Just subsidence.)

Overall Environmental Division Internal Rating: 3 (CLOGGED ORIF)

Signature: Scott J Thorne P.E. **Date:** 5/14/02 1:55 pm

Title: Civil Engineer Env Div

SWMProg\BMP\CoInspProg\DetRet.wpd

WATERSHED	PC	MAINTENANCE PLAN	No	CTRL STRUC DESC	RCP Riser
BMP ID NO	170	SITE AREA acre	63.6	CTRL STRUC SIZE inches	66
PLAN NO	SP-100-97	LAND USE	Gen Residential	OTLT BARRL DESC	RCP Barrel
TAX PARCEL	(32-2)(01-1A)	old BMP TYP	Wet Pond	OTLT BARRL SIZE inch	48
PIN NO	3221000001A	JCC BMP CODE			
CONSTRUCTION DATE	1/1/1998	POINT VALUE	9	EMERG SPILLWAY	No
PROJECT NAME	Villages at Westminster Pond I			DESIGN HW ELEV	66.49
FACILITY LOCATION	Behind (west) of 6201 Weathersfield Way			PERM POOL ELE	62
CITY-STATE	Williamsburg, Va. 23188	SVC DRAIN AREA acres	63.6	2-YR OUTFLOW cfs	26.36
CURRENT OWNER	Villages of Westminster Homeowners Assoc.			10-YR OUTFLOW cfs	0.00
OWNER ADDRESS	2 Eaton Street			REC DRAWING	Yes
OWNER ADDRESS 2	Suite 1101	SERVICE AREA DESCRI	SF Lots & Roads I, II, III, IV		
CITY-STATE-ZIP CODE	Hampton, VA 23669	IMPERV AREA acres	14.70	CONSTR CERTI	No
OWNER PHONE		RECV STREAM	UT of Powhatan Creek		
MAINT AGREEMENT	Yes	EXT DET-WQ-CTRL	Yes	LAST INSP DATE	5/14/2002
EMERG ACTION PLAN	No	WTR QUAL VOL acre-ft	2.48	INTERNAL RATING	3
		CHAN PROT CTRL	No	MISC/COMMENTS	
		CHAN PROT VOL acre-ft	0	Wellesley Rd. Design 7. Road is embankment.	
		SW/FLOOD CONTROL	Yes		
		GEOTECH REPORT	Yes		

Get Last BMP No

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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: The Villages at Westminster
Structure/BMP Name: Pond I
Project Location: Intersection Wellesley Blvd & Route 60
BMP Location: Intersection Wellesley Blvd & Weathersfield Way
County Plan No.: SP - 100 - 97

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

Tax Map/Parcel No.: 3221000001A
BMP ID Code (if known): PC 170
Zoning District:: RZ
Land Use: Residential Open Space
Site Area (sf or acres): 31.32 acres

Brief Description of Stormwater Management/BMP Facility: Wet Pond

Nearest Visible Landmark to SWM/BMP Facility: Villages at Westminster Clubhouse

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: Fall, 1997
Facility Monitored by County Representative during Construction: ☐ Yes ☐ No ☒ Unknown
Name of Site Work Contractor Who Constructed Facility: H.B. Hankins, Inc.
Name of Professional Firm Who Routinely Monitored Construction: _____
Date of Completion for SWM/BMP Facility: Fall 1997
Date of Record Drawing/Construction Certification Submittal: 3/6/01

(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: Westminster Village, L.L.C.
Mailing Address: 10 San Jose Dr, Suite 4C
Newport News, Va. 23606
Business Phone: 596-8800 Fax: 596-8516
Contact Person: Steve Deal Title: _____

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

Firm Name: Rickmond Engineering, Inc.
Mailing Address: 1643 Merrimac Trail
Williamsburg, Va. 23185
Business Phone: 229-1776
Fax: 229-4683
Responsible Plan Preparer: Kenneth Jenkins, PE.
Title: Project Engineer
Plan Name: The Villages at Westminster Retention Ponds
Firm's Project No. 96106
Plan Date: 8/6/97
Sheet No.'s Applicable to SWM/BMP Facility: C1 / S2 / S3 / S4 / S5

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

Name: H.B. Hankins, Inc.
Mailing Address: 739 Thimble Shoals Blvd
Newport News, Va. 23606
Business Phone: 873-2196
Fax: _____
Contact Person: Howard Hankins
Site Foreman/Supervisor: Hank Mullins
Specialty Subcontractors & Purpose (for BMP Construction Only): _____

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: RICKHOND ENGINEERING INC.
Mailing Address: 1643 MERRIMAC TRAIL
WILLIAMSBURG VA 23185
Business Phone: 1.757.229.1776
Fax: 1.757.229.4683

Name: CRAIG DAVENPORT
Title: SURVEY DEPT. HEAD

Signature:
Date: 3.6.01

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
CRAIG B. DAVENPORT
No. 002055
3.6.01
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.

_____ (Seal)

Virginia Registered Professional Engineer

Section 5 - Record Drawing and Construction Certification Requirements and Instructions:

☐ PreConstruction Meeting - Provides an opportunity to review SWM / BMP facility construction, maintenance and operation plans and address any questions regarding construction and/or monitoring of the structure. The design engineer, certifying professionals (if different), Owner/Applicant, Contractor and County representative(s) are encouraged to attend the preconstruction meeting. Advanced notice to the Environmental Division is requested. Usually, this requirement can be met simultaneously with Erosion and Sediment Control preconstruction meetings held for the project.

☒ A fully completed ***STORMWATER MANAGEMENT / BMP FACILITIES, RECORD DRAWING and CONSTRUCTION CERTIFICATION FORM*** and ***RECORD DRAWING CHECKLIST***. All applicable sections shall be completed in their entirety and certification statements signed and sealed by the registered professional responsible for individual record drawing and/or construction certification.

☒ The Record Drawing shall be prepared by a Registered Professional Engineer or Certified Land Surveyor for the drainage system of the project including any Best Management Practices.

☐ Construction Certification. Construction of Stormwater Management / BMP facilities which contain impoundments, embankments and related engineered appurtenances including subgrade preparation, compacted soils, structural fills, liners, geosynthetics, filters, seepage controls, cutoffs, toe drains, hydraulic flow control structures, etc. shall be visually observed and monitored by a Registered Professional Engineer or his/her authorized representative. The Engineer must certify that the structure, embankment and associated appurtenances were built in accordance with the approved design plan, specifications and stormwater management plan and standard accepted construction practice and shall submit a written certification and/or drawings to the Environmental Division as required. Soil and compaction test reports, concrete test reports, inspection reports, logs and other required construction material or installation documentation may be required by the Environmental Division to substantiate the certification, if specifically requested. The Engineer shall have the authority and responsibility to make minor changes to the approved plan, in coordination with the assigned County inspector, in order to compensate for unsafe or unusual conditions encountered during construction such as those related to bedrock, soils, groundwater, topography, etc. as long as changes do not adversely affect the integrity of the structure(s). Major changes to the approved design plan or structure must be reviewed and approved by the original design professional and the James City County Environmental Division.

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

Dual Purpose Facilities - Completion of construction also includes an interim stage for Stormwater Management / BMP facilities which serve dual purpose as temporary sediment basins during construction and as permanent stormwater management / BMP facilities following construction, once development and stabilization are substantially complete. For these dual purpose facilities, construction certification is required once the temporary sediment basin phase of construction is complete. Final record drawing and construction certification of additional permanent components is required once permanent facility construction is complete.

Interim Construction Certification is required for those dual purpose embankment-type facilities that are generally ten (10) feet or greater in dam height (*) and may not be converted, modified or begin function as a permanent SWM / BMP structure for a period generally ranging from six (6) to eighteen (18) months or more from issuance of a Land Disturbance permit for construction.

Interim or final record drawing and construction certifications are not required for temporary sediment basins which are designed and constructed in accordance with current minimum standards and specifications for temporary sediment basins per the Virginia Erosion and Sediment Control Handbook (VESCH); have a temporary service life of less than eighteen (18) months; and will be removed completely once associated disturbed areas are stabilized, unless a distinct hazard to the public's health, safety and welfare is determined by the Environmental Division due to the size or presence of the structure or due to evidence of improper construction.

(*Note: Dam Height as referenced above is generally defined as the vertical distance from the natural bed of the stream or waterway at the downstream toe of the embankment to the top of the embankment structure in accordance with 4VAC50-20-30, Virginia Impoundment Structure Regulations and the Virginia Dam Safety Program.)

☒ Record Drawings shall provide, at a minimum, all information as shown within these requirements and the attached **RECORD DRAWING CHECKLIST** specific to the type of SWM/BMP facility being constructed. Other additional record data may be formally requested by the James City County Environmental Division. *(Note: Refer to the current edition of the James City County Guidelines for Design and Construction of Stormwater Management BMP's manual for a complete list of acceptable BMP's. Currently there are over 20 acceptable water quality type BMP's accepted by the County.)*

☒ Record Drawings shall consist of blue/black line prints and a reproducible (mylar, sepia, diazo, etc.) set of the approved stormwater management plan including applicable plan views, profiles, sections, details, maintenance plans, etc. as related to the subject SWM / BMP facility. The set shall indicate **"RECORD DRAWING "** in large text in the lower right hand corner of each sheet with record elevations, dimensions and data drawn in a clearly annotated format and/or boxed beside design values. Approved design plan values, dimensions and data shall not be removed or erased. Drawing sheet revision blocks shall be modified as required to indicate record drawing status. Elevations to the nearest 0.1' are sufficiently accurate except where higher accuracy is needed to show positive drainage. Certification statements as shown in Section 4 of the Record Drawing and Construction Certification Form, ***or similar forms thereof***, and professional signatures and seals, with dates matching that of the record drawing status in the revision or title block, are also required on all associated record drawing plans, prints or reproducibles.

☒ Submission Requirements. Initial and subsequent submissions for review shall consist of a minimum of one (1) blue/black line set for record drawings and one copy of the construction certification documents with appropriate transmittal. Under certain circumstances, it is understood that the record drawing and construction certification submissions may be performed by different professional firms. Therefore, record drawing submission may be in advance of construction certification or vice versa. Upon approval and prior to release of bond/surety, final submission shall include one (1) reproducible set of the record drawings, one (1) blue/black line set of the record drawings and one (1) copy of the construction certification. Also for current and/or future incorporation into the County BMP database and GIS system, it is requested that the record drawings also be submitted to the Environmental Division on a diskette or CD-ROM in an acceptable electronic file format such as *.dxf, *.dwg, etc. or in a standard scanned and readable format. The electronic file requirement can be discussed and coordinated with Environmental Division staff at the time of final submission.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

I. Methods and Presentation: *(Required for all Stormwater Management / BMP facilities.)*

XX 1. All constructed facilities meet approved design plans, unless otherwise shown. Record information or deviations from approved design plan shown in clearly annotated format and/or boxed beside design values.

XX 2. Elevations to the nearest 0.1' unless higher accuracy is needed to show positive drainage.

XX 3. All plan sheets labeled with "RECORD DRAWING" in large text in lower right hand corner (Approved County Plan Number and BMP ID Code can be included if known).

XX 4. All plan sheet revision blocks modified to indicate date and record drawing status.

XX 5. All plan sheets have certification statements and certifying professional's signature and seal.

II. Minimum Standards: *(Required for all Stormwater Management / BMP facilities, as applicable.)*

XX 1. All requirements of Section I (Methods and Presentation) apply to this section.

XX 2. Plan Views: Show general location, arrangement and dimensions. Location and alignment shall generally match approved design plans.

XX 3. Profile or elevations along top or berm of the facility. At a minimum, elevations are required at each end, at intervals not to exceed 50 feet and where low spots may be present. Top of embankment or berm elevations must be no less than design elevation plus any settlement allowances.

XX 4. Top widths, berm widths and embankment side slopes.

XX 5. Show length, width and depth of facility or grading, contours or spot elevations as required to verify permanent pool and design storage volumes were met or were reasonably close to the approved design. Evaluation of as-built grading, contours, spot elevations, or cross-sections, may be necessary by the professional to ensure approved design configurations, depths and volumes were closely maintained. If grading or elevations are significantly different from the approved plan, the Environmental Division shall be contacted immediately to determine whether the variation is acceptable or whether further evidence will be required. Facilities which do not closely resemble approved plan grades, elevations or configurations may require regrading by the Contractor; check volumetric computations; and/or a check hydraulic routing to ensure approved design water surface elevations, discharges or freeboard were closely maintained.

XX 6. Cross-section of the embankment through the principal spillway or outlet barrel. Must extend at least 100 ft. downstream of the pipe outlet or to recorded site property line, whichever is closer. Proper correlation is required between principal spillway (control structure) crest, emergency spillway crest, orifice and weirs and the top of the dam or facility. All elevations and dimensions must reasonably match the design plan or be sequentially relative to each other and the facility must reflect the required design storage volume(s) and/or design depth.

NA 7. Profile or elevations along the entire centerline of the emergency spillway. Emergency spillway may be steeper, but no flatter or narrower than design.

XX 8. Elevation of the principal spillway crest or outlet crest of the structure.

XX 9. Primary control structure (riser) diameter or dimensions, height, type of material and base size. Indicate provisions for access that are present such as steps, ladders, etc.

XX 10. Dimensions, locations and elevations of outlet orifices, weirs, slots and drains.

XX 11. Type and size of anti-vortex and trash rack device. Height, diameter, dimensions, bar spacings (if applicable) and elevations relative to the principal spillway crest. Indicate if lockable hatch is present or not.

____ 12. Type, location, size and number of anti-seep collars or documentation of other methods utilized for seepage control. **May need to obtain this information during construction.**

____ 13. Top of impervious core embankment, core trench limits and elevation of cut-off trench bottom. **May need to obtain this information during construction.**

XX 14. Elevation of the principal spillway barrel (outlet pipe) inlet and outlet invert.

XX 15. Outlet barrel diameter, length, slope, type and thickness class of material and type of flared end sections, headwall or endwall.

XX 16. Outfall protection dimension, type and depth of rock and if underlain filter fabric is present.

XX 17. BMP interior and periphery landscaping zones conform with arrangements and requirements of the approved design plan.

NA 18. Maintenance plan taken from approved design plan transposed onto record drawing set.

XX 19. Fencing location and type, if applicable to facility.

____ 20. BMP vicinity properly cleaned of stockpiles and construction debris.

____ 21. No visual signs of erosion or channel degradation immediately downstream of facility.

XX 22. Any other information formally requested by the Environmental Division specific to the constructed SWM/BMP facility.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

III. Group A - Wet Ponds *(Includes A-1 Small Wet Ponds; A-2 Wet Ponds; A-3 Wet Ext Det Ponds.)*

XX A1. All requirements of Section II, Minimum Standards, apply to Group A facilities.

XX A2. Principal spillway consists of reinforced concrete pipe with O-Ring gaskets for watertight joint construction.

NA A3. Sediment forebays or pretreatment devices provided at inlets to pond. Generally 4 to 6 ft. deep.

NA A4. Access for maintenance and equipment is provided to the forebay(s). Access corridors are at least 12 ft. wide, have a maximum slope of 15 percent and are adequately stabilized to withstand heavy equipment or vehicle use.

NA A5. Adequate fixed vertical sediment depth markers installed in the forebay(s) for future sediment monitoring purposes.

NA A6. Pond liner (if required) provided. Either clay liners, polyliners, bentonite liners or use of chemical soil additives based on requirements of the approved plan.

XX A7. Minimum 6 percent slope safety bench extending a minimum of 15 feet outward from normal pool edge and/or an aquatic bench extending a minimum of 10 feet inward from the normal shoreline with a maximum depth of 12 inches below the normal pool elevation, if applicable, per the approved design plans. (Note: Safety benches may be waived if pond side slopes are no steeper than 4H:1V).

XX A8. No trees are present within a zone 15 feet around the embankment toe and 25 feet from the principal spillway structure.

XX A9. Wet permanent pool, typically 3 to 6 feet deep, is provided and maintains level within facility.

XX A10. Low flow orifice has a non-clogging mechanism.

NA A11. A pond drain pipe with valve was provided.

XX A12. Pond side slopes are not steeper than 3H:1V, unless approved plan allowed for steeper slope.

NA A13. End walls above barrels (outlet pipe) greater than 48 inch in diameter are fenced to prevent a fall hazard.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

X. Storm Drainage Systems (Associated with BMP's Only)

(Includes all incidental stormwater drainage conveyance systems associated with SWM/BMP facilities such as onsite or offsite storm drains, open channels, inlets, manholes, junctions, outlet protections, deflectors, etc. These facilities are external to the treatment function of, but are directly associated with drainage to and/or from a constructed SWM/BMP facility. The intent of this portion of the certification is to accurately identify the type and quantity of inflow or outflow points associated with the facility for future reference. The Professional may use his/her own discretion to determine inclusive facilities to meet the intent of this section. As a general rule, storm drainage systems would include incidental facilities to the nearest access structure upslope or downslope from the normal physical limits of the facility or 800 feet of storm drainage conveyance system length, whichever is less.)

XX SD1. All requirements of Section II, Minimum Standards, apply to Storm Drainage Systems.

XX SD2. Horizontal location of all pipe and structures relative to the SWM/BMP facility.

XX SD3. Type, top elevation and invert elevation of all access type structures (inlets, manholes, etc.).

XX SD4. Material type, size or diameter, class, invert elevations, lengths and slopes for all pipe segments.

XX SD5. Class, length, width and depth of riprap and outlet protections or dimensions of special energy dissipation structures.

XII. Other Systems

(Includes any non-typical, specialty, manufactured or innovative stormwater management/BMP practices or systems generally accepted for use as or in conjunction with other acceptable stormwater management / BMP practices. Requires evidence of prior satisfactory industry use and prior Environmental Division approval, waiver or exception .)

XX O1. All requirements of Section II, Minimum Standards, apply to this section.

NA O2. Certification criteria to be determined on a case-by-case basis by the Environmental Division specific to the proposed SWM/BMP facility.

OVERALL BMP MAP
VILLAGES AT WESTMINSTER

THE VILLAGES AT WESTMINSTER
RETENTION PONDS

BMP AND DRAINAGE CALCULATIONS

Rickmond

PC 170 POND I
PC 171 POND II
SP-100-97

RICKMOND ENGINEERING, INC.
1643 Merrimac Trail
Williamsburg, VA 23185
(757) 229-1776

COMMONWEALTH OF VIRGINIA
K.M. JENKINS II
No.022872
9/12/97
PROFESSIONAL ENGINEER

Project No. 96106

August 6, 1997

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PREFACE

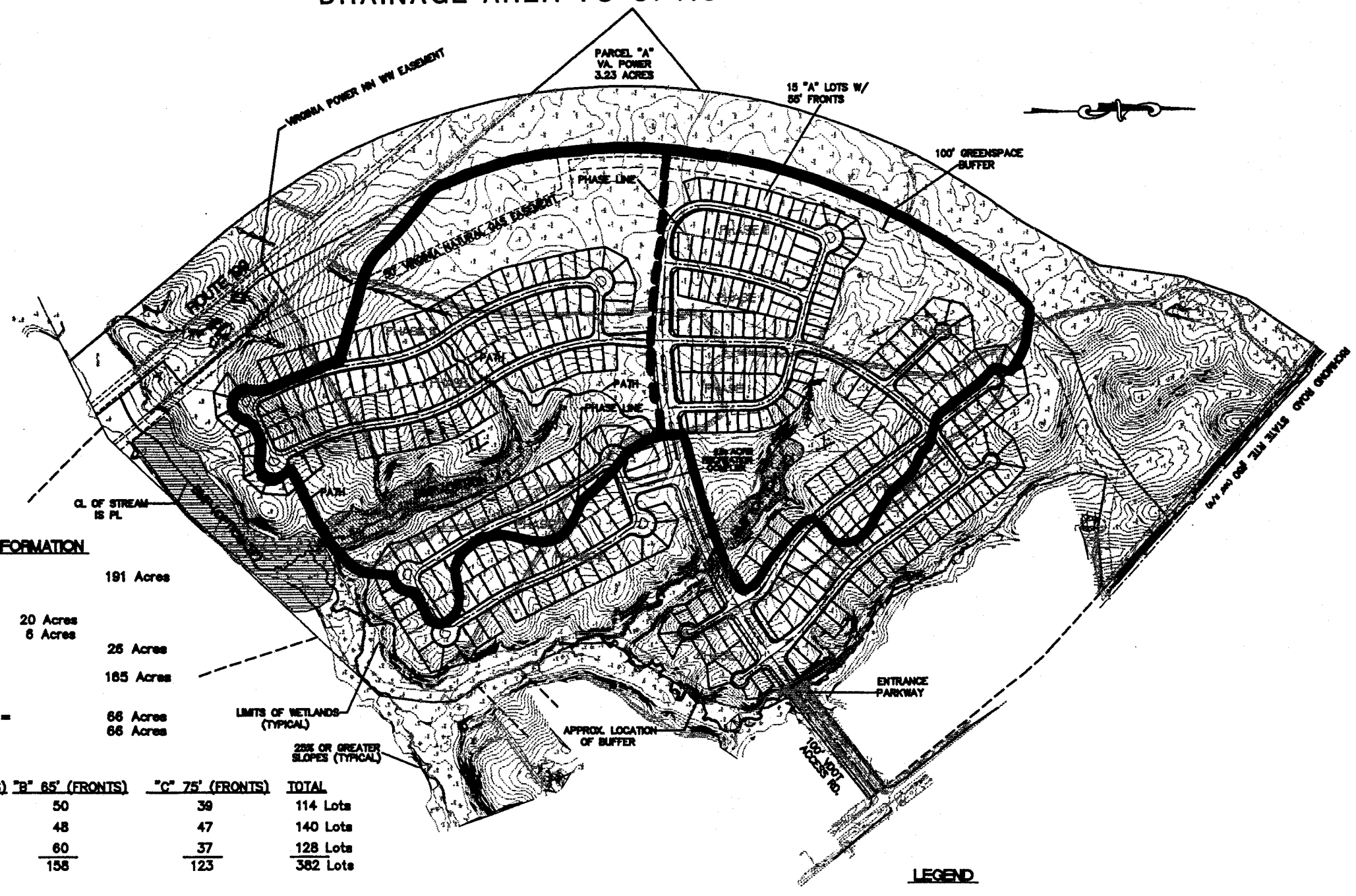
The following BMP and drainage calculations pertain to the Villages at Westminster located in James City County, Virginia.

To meet James City County's 10 point BMP requirements two Design 7 ponds are used to achieve 5.65 points and the remaining 4.35 points are obtained by dedicating 83 acres as natural open space. The ponds also release the 2 year storm at below the pre-development rate and pass the 100 year storm without overtapping the dam.

WARHILL SECONDARY
MASTER PLAN AND PHASING PLAN

JAMES CITY COUNTY, VIRGINIA

DRAINAGE AREA TO OPTION "A" BMP'S



STATISTICAL INFORMATION

GROSS ACREAGE:		191 Acres
UNDEVELOPABLE AREA:		
WETLANDS	20 Acres	
25% OR GREATER SLOPES	6 Acres	
TOTAL UNDEVELOPABLE AREA		26 Acres
NET DEVELOPABLE AREA		165 Acres
OPEN SPACE		
REQUIRED: 40% x 165 Acres =		66 Acres
PROVIDED:		66 Acres

TOTAL NUMBER OF LOTS:

	"A" 50' (FRONTS)	"B" 65' (FRONTS)	"C" 75' (FRONTS)	TOTAL
PHASE I	25	50	39	114 Lots
PHASE II	45	48	47	140 Lots
PHASE III	31	60	37	128 Lots
TOTAL	101	158	123	382 Lots

LEGEND

- BMP
- LIMITS OF WETLANDS
- PHASE LINE
- 25% OR GREATER SLOPE
- PROPERTY LINE
- EASEMENT LINE

SCALE: 1"=600'

CURRENT OWNER:
TMB SERVICE CORPORATION
P.O. BOX 130
MISSION KANSAS 66201

FUTURE OWNER/DEVELOPER:
ATLANTIC HOMES DEVELOPMENT CORP.
2 EATON STREET
SUITE 101
HAMPTON, VIRGINIA 23669

Rickmond Engineering, Inc.
1643-C Merrimac Trail
Williamsburg, VA 23185
(804)229-1776 or 876-1785
Civil Engineering
Environmental Engineering
Land Surveying

Date 9/27/96 Project No. 96026 File No. 96026C1 Sheet No. MP1

WORKSHEET FOR BMP POINT SYSTEM

A. STRUCTURAL BMP POINT ALLOCATION

	BMP	BMP POINTS		Fraction of Site Served by BMP		Weighted BMP Points
POND I	Design 7	9	X	(63.6 ac) .333	=	2.99
POND II	Design 7	9	X	(56.4ac) .295	=	2.66
			X		=	
			X		=	

TOTAL WEIGHTED STRUCTURAL BMP POINTS: 5.65

B. NATURAL OPEN SPACE CREDIT

Fraction of Site (83.0ac)		Natural Open Space Credit		Points for Natural Open Space
.435	X	10	=	4.35

C. TOTAL WEIGHTED POINTS

5.65	+	4.35	=	10.0
Structural BMP Points		Natural Open Space Points		TOTAL

POND I

RICKMOND ENGINEERING, INC.
1643 C Merrimac Trail
Williamsburg, Virginia 23185-5624
(804) 229-1776 or (804) 898-4149
Fax Number (804) 220-9370

JOB 96106
SHEET NO. 3 OF
CALCULATED BY KMJ DATE 4/28/97
CHECKED BY DATE
SCALE

DESIGN POND I FOR
JCC BMP DESIGN 7

DESIGN 7 POND [4 times the volume of runoff generated from the mean storm over the watershed area]

Impervious Area = 14.70ac Area = 63.6ac

$$I = \frac{14.70}{63.60} = 23\%$$

$$Rv = 0.05 + 0.009(23) = .26$$

$$\text{Volume Required} = \frac{.45\,in}{} \Big| 4 \Big| 63.6\,ac \Big| \frac{43560\,sf}{1\,ac} \Big| .26 \Big| \frac{1\,ft}{12\,in} = 108{,}050\,cf$$

RICKMOND ENGINEERING, INC.
1643 C Merrimac Trail
Williamsburg, Virginia 23185-5624
(804) 229-1776 or (804) 898-4149
Fax Number (804) 220-9370

JOB 96106
SHEET NO. 4 OF
CALCULATED BY KMJ DATE 4/25/97
CHECKED BY DATE
SCALE

DESIGN WET POND I

ELEV (ft)	S.A. (ft²)	Δ ELEV (ft)	Storage (cf)	Accum Storage (cf)
50	5,460			0
		2	12,220	
52	6,760			12,220
		2	14,990	
54	8,230			27,210
		2	18,080	
56	9,850			45,290
		2	21,440	
58	11,590			66,730
		2	28,050	
60	16,460			94,780
		1	17,260	
61	18,065			112,040

2 YEAR HYDROGRAPH

```
1*******************************     SCSHYDRO
*******************************
 *******************************   Version 3.21
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
*******************

 PROJECT: VILLAGES AT WESTMINSTER
    User: Rickmond Engineering
    Date: 09/11/1997  Thursday
    Time: 10:52:30
   Input: VWI2.IN
  Output: VWI2.OUT


 ============================   PROGRAM EXECUTION
============================


                         NUMBER OF STORMS TO BE MODELED    :     1
                         NUMBER OF CHANNELS                :     0
                         NUMBER OF SUBAREAS                :     1
                         UPSTREAM HYDROGRAPHS ENTER AT     :     0
LOCATIONS
                         NUMBER OF TIME STEPS              :   300
                         COMPUTATIONAL TIME INCREMENT      :  .100 Hours

 NOTE:   The DURATION of the final computed hydrograph(s) for this
watershed
         system will be 30.000 hours.


 ========================   UNIT HYDROGRAPH METHODOLOGY
========================


 The SCS DIMENSIONLESS UNIT HYDROGRAPH is used in all runoff
computations.
 The peak rate factor (PRF) for all unit hydrographs is 484 (U.S.
Customary
 units) or 2.08356 (Metric units).
1*******************************     SCSHYDRO
*******************************
 *******************************   Version 3.21
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
*******************

 PROJECT: VILLAGES AT WESTMINSTER
```

User: Rickmond Engineering
Date: 09/11/1997 Thursday
Time: 10:52:30
Input: VWI2.IN
Output: VWI2.OUT

========== SUBAREA DATA
==========

SUBAREA ID NO	AREA (mi2)	TIME OF CONCENTRATION (hrs)	CURVE NUMBER	BASEFLOW (cfs)	DOWNSTREAM CHANNELS
1	.0994	.770	66.00	.0	

Composite Watershed Curve Number = 66.00 - my Mon 64
Minimum Subarea Time of Concentration = .770 hours.

1********** SCSHYDRO
****
********** Version 3.21
****
********** COMPUTER-AIDED HYDROLOGY & HYDRAULICS
****

PROJECT: VILLAGES AT WESTMINSTER
User: Rickmond Engineering
Date: 09/11/1997 Thursday
Time: 10:52:30
Input: VWI2.IN
Output: VWI2.OUT

RETURN PERIOD (yrs): 2

========== RAINFALL HYETOGRAPH INFORMATION
==========

RAINFALL HYETOGRAPH: SCS TYPE II
RAINFALL DURATION: 24.00 Hours
RAINFALL DEPTH: 3.50 Inches

RAINFALL HYETOGRAPH,
SCS TYPE II
Time (Hours), Total Depth (Inches):

.000,	.00	2.000,	.08	4.000,	.17	6.000,	.28
7.000,	.34	8.000,	.42	8.500,	.47	9.000,	.51
9.500,	.57	9.750,	.60	10.000,	.63	10.500,	.71
11.000,	.82	11.500,	.99	11.750,	1.25	12.000,	2.32

```
     12.500,  2.57     13.000,  2.70     13.500,  2.80     14.000,  2.87
     16.000,  3.08     20.000,  3.33     24.000,  3.50
1*******************************     SCSHYDRO
*******************************
 *******************************   Version 3.21
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
*******************

 PROJECT: VILLAGES AT WESTMINSTER
   Input: VWI2.IN
  Output: VWI2.OUT
                                                        RETURN PERIOD
(yrs):      2

    SUBAREA     1       SUBAREA     1       SUBAREA     1       SUBAREA
1


     AREA (square miles)          :        .0994
     TIME OF CONCENTRATION (hrs):          .77
     RUNOFF CURVE NUMBER          :        86.00
     BASEFLOW (cfs)               :        .00
     DOWNSTREAM CHANNELS          :

                                   SUBAREA RUNOFF (cfs)
```

TIME: (hrs)	+.00 hrs	+.10 hrs	+.20 hrs	+.30 hrs	+.40 hrs	+.50 hrs	+.60 hrs	+.70 hrs	+.80 hrs	+.90 hrs
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
6.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
7.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
8.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
9.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
10.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
11.00	.00	.00	.00	.00	.00	.00	.01	.06	.43	1.96

```
 12.00 |    5.92  12.24  19.49  24.54  26.36  25.74  23.45  20.31  17.46
15.15
 13.00 |   13.24  11.62  10.28   9.19   8.29   7.57   6.98   6.48   6.05
5.68
 14.00 |    5.36   5.09   4.85   4.68   4.56   4.46   4.37   4.25   4.13
3.99
 15.00 |    3.86   3.72   3.58   3.45   3.32   3.20   3.09   2.98   2.88
2.79
 16.00 |    2.71   2.64   2.58   2.53   2.49   2.45   2.42   2.39   2.37
2.35
 17.00 |    2.33   2.31   2.29   2.27   2.25   2.24   2.22   2.20   2.19
2.17
 18.00 |    2.15   2.14   2.12   2.10   2.09   2.07   2.05   2.03   2.02
2.00
 19.00 |    1.98   1.96   1.95   1.93   1.91   1.89   1.87   1.86   1.84
1.82
 20.00 |    1.80   1.78   1.76   1.74   1.73   1.71   1.69   1.67   1.65
1.64
 21.00 |    1.62   1.60   1.59   1.57   1.55   1.54   1.52   1.51   1.50
1.48
 22.00 |    1.47   1.46   1.45   1.44   1.43   1.42   1.41   1.40   1.39
1.38
 23.00 |    1.37   1.37   1.36   1.35   1.35   1.34   1.34   1.33   1.33
1.33
 24.00 |    1.32   1.30   1.24   1.12    .95    .75    .57    .42    .30
.22
 25.00 |     .16    .11    .08    .06    .04    .03    .02    .02    .01
.01
 26.00 |     .01    .00    .00    .00    .00    .00    .00    .00    .00
.00
 27.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 28.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 29.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00

                    PEAK RUNOFF (cfs):      26.36
                   TIME TO PEAK (hrs):      12.40
1*******************************     SCSHYDRO
*******************************
 *******************************   Version 3.21
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************

 PROJECT: VILLAGES AT WESTMINSTER
    User: Rickmond Engineering
    Date: 09/11/1997  Thursday
    Time: 10:52:30
   Input: VWI2.IN
  Output: VWI2.OUT
                                                        RETURN PERIOD
(yrs):      2

 ==========================   DOWNSTREAM HYDROGRAPH
==========================
```

DISCHARGE (cfs)

TIME: (hrs)	+.00 hrs	+.10 hrs	+.20 hrs	+.30 hrs	+.40 hrs	+.50 hrs	+.60 hrs	+.70 hrs	+.80 hrs	+.90 hrs
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
6.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
7.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
8.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
9.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
10.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
11.00	.00	.00	.00	.00	.00	.00	.01	.06	.43	1.96
12.00	5.92	12.24	19.49	24.54	26.36	25.74	23.45	20.31	17.46	15.15
13.00	13.24	11.62	10.28	9.19	8.29	7.57	6.98	6.48	6.05	5.68
14.00	5.36	5.09	4.85	4.68	4.56	4.46	4.37	4.25	4.13	3.99
15.00	3.86	3.72	3.58	3.45	3.32	3.20	3.09	2.98	2.88	2.79
16.00	2.71	2.64	2.58	2.53	2.49	2.45	2.42	2.39	2.37	2.35
17.00	2.33	2.31	2.29	2.27	2.25	2.24	2.22	2.20	2.19	2.17
18.00	2.15	2.14	2.12	2.10	2.09	2.07	2.05	2.03	2.02	2.00
19.00	1.98	1.96	1.95	1.93	1.91	1.89	1.87	1.86	1.84	1.82
20.00	1.80	1.78	1.76	1.74	1.73	1.71	1.69	1.67	1.65	1.64
21.00	1.62	1.60	1.59	1.57	1.55	1.54	1.52	1.51	1.50	1.48
22.00	1.47	1.46	1.45	1.44	1.43	1.42	1.41	1.40	1.39	1.38
23.00	1.37	1.37	1.36	1.35	1.35	1.34	1.34	1.33	1.33	1.33
24.00	1.32	1.30	1.24	1.12	.95	.75	.57	.42	.30	

```
.22
 25.00 |     .16    .11    .08    .06    .04    .03    .02    .02    .01
.01
 26.00 |     .01    .00    .00    .00    .00    .00    .00    .00    .00
.00
 27.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 28.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 29.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00

                    PEAK DISCHARGE (cfs):      26.36
                      TIME TO PEAK (hrs):      12.40
 Hydrograph Saved In: VWI2.DAT

1*******************************     SCSHYDRO
*******************************
 *******************************   Version 3.21
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************

 PROJECT: VILLAGES AT WESTMINSTER
    User: Rickmond Engineering
    Date: 09/11/1997  Thursday
    Time: 10:52:30
   Input: VWI2.IN
  Output: VWI2.OUT
                                                        RETURN PERIOD
(yrs):      2

 ============================   HYDROLOGIC SUMMARY
============================
 =====================   Volumes, Losses, and Discharges
=====================


 SCS TYPE II  Hyetograph.
 SCS DIMENSIONLESS UNIT HYDROGRAPH was used.
 APPLIED RAINFALL DEPTH (inches):  3.50


                VOLUME OF                                |
                 RAINFALL     VOLUME OF    RAINFALL      |     PEAK
PEAK
                 APPLIED       RUNOFF       LOSSES       |   DISCHARGE
DISCHARGE
                 (ac-ft)       (ac-ft)     (percent)     |     (cfs)
(cfs/ac)
                ___________   ___________  __________    |  ___________
___________
                                                        |
                                                        |
 SUBAREA    1   18.555        4.2429        77.13       |      26.362
.414
                                                        |
                                                        |
                                                        |
```

TOTAL WATERSHED	18.555	4.2429	77.13		26.362 .414

TOTAL WATERSHED AREA (square miles): .0994
TOTAL VOLUME OF DISCHARGE LEAVING WATERSHED (ac-ft): 4.2429
COMPOSITE WATERSHED CURVE NUMBER: 66.00
MINIMUM SUBAREA TIME OF CONCENTRATION: .770 hours.

NOTE: "VOLUME OF RUNOFF" includes surface runoff only; baseflows are not included in this summation. The "TOTAL VOLUME OF DISCHARGE LEAVING WATERSHED" includes all baseflows.

1

100 YEAR HYDROGRAPH

```
1*******************************     SCSHYDRO
*******************************
 *******************************   Version 3.21
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************

 PROJECT: VILLAGES AT WESTMINSTER
    User: Rickmond Engineering
    Date: 09/11/1997  Thursday
    Time: 10:53:47
   Input: VWI100.IN
  Output: VWI100.OUT



 ============================   PROGRAM EXECUTION
============================


                         NUMBER OF STORMS TO BE MODELED    :     1
                         NUMBER OF CHANNELS                :     0
                         NUMBER OF SUBAREAS                :     1
                         UPSTREAM HYDROGRAPHS ENTER AT     :     0
LOCATIONS
                         NUMBER OF TIME STEPS              :   300
                         COMPUTATIONAL TIME INCREMENT      :  .100 Hours


 NOTE:   The DURATION of the final computed hydrograph(s) for this
watershed
         system will be 30.000 hours.



 ========================   UNIT HYDROGRAPH METHODOLOGY
========================


 The SCS DIMENSIONLESS UNIT HYDROGRAPH is used in all runoff
computations.
 The peak rate factor (PRF) for all unit hydrographs is 484 (U.S.
Customary
 units) or 2.08356 (Metric units).
1*******************************     SCSHYDRO
*******************************
 *******************************   Version 3.21
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************

 PROJECT: VILLAGES AT WESTMINSTER
```

User: Rickmond Engineering
Date: 09/11/1997 Thursday
Time: 10:53:47
Input: VWI100.IN
Output: VWI100.OUT

========== SUBAREA DATA
==========

SUBAREA ID NO	AREA (mi2)	TIME OF CONCENTRATION (hrs)	CURVE NUMBER	BASEFLOW (cfs)	DOWNSTREAM CHANNELS
1	.0994	.770	66.00	.0	

Composite Watershed Curve Number = 66.00
Minimum Subarea Time of Concentration = .770 hours.

1********** SCSHYDRO
****
********** Version 3.21
****
********** COMPUTER-AIDED HYDROLOGY & HYDRAULICS
****

PROJECT: VILLAGES AT WESTMINSTER
User: Rickmond Engineering
Date: 09/11/1997 Thursday
Time: 10:53:47
Input: VWI100.IN
Output: VWI100.OUT

RETURN PERIOD (yrs): 100

========== RAINFALL HYETOGRAPH INFORMATION
==========

RAINFALL HYETOGRAPH: SCS TYPE II
RAINFALL DURATION: 24.00 Hours
RAINFALL DEPTH: 8.00 Inches

RAINFALL HYETOGRAPH,
SCS TYPE II
Time (Hours), Total Depth (Inches):

.000,	.00	2.000,	.18	4.000,	.38	6.000,	.64
7.000,	.78	8.000,	.96	8.500,	1.06	9.000,	1.18
9.500,	1.30	9.750,	1.38	10.000,	1.45	10.500,	1.63
11.000,	1.88	11.500,	2.26	11.750,	2.86	12.000,	5.30

```
     12.500,  5.88     13.000,  6.18     13.500,  6.39     14.000,  6.56
     16.000,  7.04     20.000,  7.62     24.000,  8.00
1*******************************     SCSHYDRO
*******************************
 *******************************   Version 3.21
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
*******************

 PROJECT: VILLAGES AT WESTMINSTER
   Input: VWI100.IN
  Output: VWI100.OUT
                                                        RETURN PERIOD
(yrs):    100


    SUBAREA     1       SUBAREA     1       SUBAREA     1       SUBAREA
1


     AREA (square miles)          :        .0994
     TIME OF CONCENTRATION (hrs):        .77
     RUNOFF CURVE NUMBER          :      66.00
     BASEFLOW (cfs)               :        .00
     DOWNSTREAM CHANNELS          :
```

SUBAREA RUNOFF (cfs)

TIME: (hrs)	+.00 hrs	+.10 hrs	+.20 hrs	+.30 hrs	+.40 hrs	+.50 hrs	+.60 hrs	+.70 hrs	+.80 hrs	+.90 hrs
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
6.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
7.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
8.00	.00	.00	.00	.00	.00	.00	.01	.03	.07	.12
9.00	.19	.27	.37	.48	.61	.74	.88	1.04	1.20	1.38
10.00	1.56	1.76	1.98	2.24	2.53	2.85	3.19	3.58	4.05	4.59
11.00	5.16	5.80	6.58	7.58	8.78	10.08	11.95	15.00	21.80	36.51

```
 12.00 |   63.92 100.91 137.28 157.72 159.35 147.84 128.65 107.18  89.07
74.93
 13.00 |   63.63  54.33  46.88  40.95  36.19  32.42  29.38  26.89  24.79
23.03
 14.00 |   21.54  20.21  19.07  18.26  17.70  17.24  16.80  16.31  15.78
15.22
 15.00 |   14.66  14.10  13.55  13.02  12.51  12.03  11.58  11.16  10.77
10.42
 16.00 |   10.10   9.83   9.58   9.37   9.20   9.04   8.92   8.80   8.70
8.61
 17.00 |    8.53   8.45   8.37   8.30   8.22   8.15   8.08   8.01   7.94
7.87
 18.00 |    7.80   7.73   7.66   7.59   7.52   7.45   7.38   7.31   7.24
7.17
 19.00 |    7.10   7.03   6.96   6.89   6.82   6.75   6.68   6.61   6.53
6.46
 20.00 |    6.39   6.32   6.25   6.18   6.11   6.04   5.97   5.90   5.83
5.77
 21.00 |    5.70   5.64   5.58   5.52   5.46   5.41   5.35   5.30   5.25
5.20
 22.00 |    5.15   5.10   5.06   5.02   4.98   4.94   4.90   4.87   4.84
4.80
 23.00 |    4.78   4.75   4.72   4.70   4.68   4.66   4.64   4.62   4.61
4.59
 24.00 |    4.58   4.51   4.30   3.87   3.27   2.60   1.97   1.44   1.04
.75
 25.00 |     .55    .40    .29    .21    .15    .11    .08    .05    .04
.03
 26.00 |     .02    .01    .01    .00    .00    .00    .00    .00    .00
.00
 27.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 28.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 29.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00

                    PEAK RUNOFF (cfs):     159.35
                   TIME TO PEAK (hrs):      12.40
1*******************************     SCSHYDRO
*******************************
 *******************************   Version 3.21
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************

 PROJECT: VILLAGES AT WESTMINSTER
    User: Rickmond Engineering
    Date: 09/11/1997  Thursday
    Time: 10:53:47
   Input: VWI100.IN
  Output: VWI100.OUT
                                                        RETURN PERIOD
(yrs):    100


 ==========================   DOWNSTREAM HYDROGRAPH
==========================
```

DISCHARGE (cfs)

TIME: (hrs)	+.00 hrs	+.10 hrs	+.20 hrs	+.30 hrs	+.40 hrs	+.50 hrs	+.60 hrs	+.70 hrs	+.80 hrs	+.90 hrs
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
6.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
7.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
8.00	.00	.00	.00	.00	.00	.00	.01	.03	.07	.12
9.00	.19	.27	.37	.48	.61	.74	.88	1.04	1.20	1.38
10.00	1.56	1.76	1.98	2.24	2.53	2.85	3.19	3.58	4.05	4.59
11.00	5.16	5.80	6.58	7.58	8.78	10.08	11.95	15.00	21.80	36.51
12.00	63.92	100.91	137.28	157.72	159.35	147.84	128.65	107.18	89.07	74.93
13.00	63.63	54.33	46.88	40.95	36.19	32.42	29.38	26.89	24.79	23.03
14.00	21.54	20.21	19.07	18.26	17.70	17.24	16.80	16.31	15.78	15.22
15.00	14.66	14.10	13.55	13.02	12.51	12.03	11.58	11.16	10.77	10.42
16.00	10.10	9.83	9.58	9.37	9.20	9.04	8.92	8.80	8.70	8.61
17.00	8.53	8.45	8.37	8.30	8.22	8.15	8.08	8.01	7.94	7.87
18.00	7.80	7.73	7.66	7.59	7.52	7.45	7.38	7.31	7.24	7.17
19.00	7.10	7.03	6.96	6.89	6.82	6.75	6.68	6.61	6.53	6.46
20.00	6.39	6.32	6.25	6.18	6.11	6.04	5.97	5.90	5.83	5.77
21.00	5.70	5.64	5.58	5.52	5.46	5.41	5.35	5.30	5.25	5.20
22.00	5.15	5.10	5.06	5.02	4.98	4.94	4.90	4.87	4.84	4.80
23.00	4.78	4.75	4.72	4.70	4.68	4.66	4.64	4.62	4.61	4.59
24.00	4.58	4.51	4.30	3.87	3.27	2.60	1.97	1.44	1.04	

```
.75
 25.00 |     .55    .40    .29    .21    .15    .11    .08    .05    .04
.03
 26.00 |     .02    .01    .01    .00    .00    .00    .00    .00    .00
.00
 27.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 28.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 29.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00

                    PEAK DISCHARGE (cfs):      159.35   vs 149.6
                      TIME TO PEAK (hrs):       12.40
 Hydrograph Saved In: VWI100.DAT

1*******************************     SCSHYDRO
*******************************
 *******************************   Version 3.21
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************

 PROJECT: VILLAGES AT WESTMINSTER
    User: Rickmond Engineering
    Date: 09/11/1997  Thursday
    Time: 10:53:47
   Input: VWI100.IN
  Output: VWI100.OUT
                                                          RETURN PERIOD
(yrs):    100


 ============================   HYDROLOGIC SUMMARY
============================
 =====================   Volumes, Losses, and Discharges
=====================


 SCS TYPE II  Hyetograph.
 SCS DIMENSIONLESS UNIT HYDROGRAPH was used.
 APPLIED RAINFALL DEPTH (inches):  8.00


                VOLUME OF                                |
                 RAINFALL      VOLUME OF     RAINFALL    |     PEAK
PEAK
                 APPLIED        RUNOFF        LOSSES     |   DISCHARGE
DISCHARGE
                 (ac-ft)        (ac-ft)      (percent)   |     (cfs)
(cfs/ac)
                ___________    ___________   __________  |  ___________
___________
                                                         |
                                                         |
 SUBAREA    1   42.411         21.246         49.90      |     159.354
2.505
                                                         |
                                                         |
                                                         |
```

TOTAL WATERSHED	42.411	21.246	49.90	159.354	2.505

TOTAL WATERSHED AREA (square miles): .0994
TOTAL VOLUME OF DISCHARGE LEAVING WATERSHED (ac-ft): 21.2460
COMPOSITE WATERSHED CURVE NUMBER: 66.00
MINIMUM SUBAREA TIME OF CONCENTRATION: .770 hours.

NOTE: "VOLUME OF RUNOFF" includes surface runoff only; baseflows are not included in this summation. The "TOTAL VOLUME OF DISCHARGE LEAVING WATERSHED" includes all baseflows.

1

Worksheet 2: Runoff curve number and runoff

Project Villages @ Westminster By KMJ Date 4/24/97

Location James City County, Va Checked ____ Date ____

Circle one: (Present) Developed Pond I

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☒ acres ☐ mi² ☐ %	Product of CN x area
EMPORIA KENASVILLE UCEE (B)	Woods (Good Cover)	55			63.6	
				Totals =	63.6	

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 55

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr	2		
Rainfall, P (24-hour)	in	3.5		
Runoff, Q ..... (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in	0.3		

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Villages @ Westminster By KMJ Date 4/24/97

Location James City County, Va Checked ____ Date ____

Circle one: (Present) Developed Pond I

Circle one: (T_c) T_t through subarea

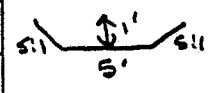
NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID	AB	
1. Surface description (table 3-1)			woods Light	
2. Manning's roughness coeff., n (table 3-1) ..			0.40	
3. Flow length, L (total L ≤ 300 ft)	ft		300	
4. Two-yr 24-hr rainfall, P_2	in		3.5	
5. Land slope, s	ft/ft		.0133	
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr		.97	+ ____ = ____

Shallow concentrated flow		Segment ID	BC	
7. Surface description (paved or unpaved)			UNPAVED	
8. Flow length, L	ft		850	
9. Watercourse slope, s	ft/ft		.0247	
10. Average velocity, V (figure 3-1)	ft/s		2.5	
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		.09	+ ____ = ____

Channel flow		Segment ID	CD	
12. Cross sectional flow area, a	ft^2		10	
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft		0.66	
15. Channel slope, s	ft/ft		.024	
16. Manning's roughness coeff., n			.035	
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s		4.99	
18. Flow length, L	ft		1000	
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		.06	+ ____ = ____



20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr 1.12

Worksheet 5a: Basic watershed data

Project Villages @ Westminster Location James City County, Va. By KMJ Date 4/24/97

Circle one: (Present) Developed Pond I Frequency (yr) _____ Checked _____ Date _____

	Subarea name	Drainage area A_m (mi^2)	Time of concentration T_c (hr)	Travel time through subarea T_t (hr)	Downstream subarea names	Travel time summation to outlet ΣT_t (hr)	24-hr Rainfall P (in)	Runoff curve number CN	Runoff Q (in)	$A_m Q$ (mi^2-in)	Initial abstraction I_a (in)	I_a/P
2		.0994	1.12				3.5	55	0.3	.0298	1.636	.47
		↑ ↑ ↑ ↑ ↑	↑ ↑ ↑ ↑ ↑				↑ ↑ ↑ ↑ ↑	↑ ↑ ↑ ↑	↑ ↑ ↑ ↑			
			From worksheet 3					From worksheet 2			From table 5-1	

12

Worksheet 5b: Tabular hydrograph discharge summary

Project Villages @ Westminster Location James City County, Va By KMJ Date 4/24/97

Circle one: (Present) Developed Pond I Frequency (yr) ____ Checked ____ Date ____

Subarea name	Basic watershed data used 1/				Select and enter hydrograph times in hours from exhibit 5-II 2/											
	Sub-area T_c (hr)	ΣT_t to outlet (hr)	I_a/P	A_mQ (mi^2-in)					13.0							
					Discharges at selected hydrograph times 3/ -(cfs)-											
2	1.12		.47	.0298					4.77							
Composite hydrograph at outlet																

1/ Worksheet 5a. Rounded as needed for use with exhibit 5.
2/ Enter rainfall distribution type used.
3/ Hydrograph discharge for selected times is A_mQ multiplied by tabular discharge from appropriate exhibit 5.

Worksheet 2: Runoff curve number and runoff

Project Villages @ Westminster By KMJ Date 4/24/97

Location James City County, Va Checked ____ Date ____

Circle one: Present (Developed) Pond I

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☒ acres ☐ mi² ☐ %	Product of CN x area
EMPORIA KENANSVILLE UCEE (B)	Woods (Good Cover)	55			34.85	1916.75
" (B)	Grass (Good Cover)	61			14.05	857.05
" (B)	Roof / Driveway	98			8.60	842.80
" (B)	Road	98			6.10	597.80
				Totals =	63.6	4214.40

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{4214.4}{63.6} = 66.2$; Use CN = 66

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr	2	100	
Rainfall, P (24-hour) ..... in	3.5	8.0	
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	0.8	4.0	

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Villages @ Westminster By KWJ Date 4/23/97

Location James City County, Va Checked ____ Date ____

Circle one: Present (Developed) POND

Circle one: (T_c) T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID	EF	
1. Surface description (table 3-1)			Woods Light	
2. Manning's roughness coeff., n (table 3-1) ..			0.4	
3. Flow length, L (total L ≤ 300 ft)	ft		300	
4. Two-yr 24-hr rainfall, P_2	in		3.5	
5. Land slope, s	ft/ft		.0367	
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t	hr		.65	+ ____ = ____

Shallow concentrated flow		Segment ID	FC	
7. Surface description (paved or unpaved)			UNPAVED	
8. Flow length, L	ft		500	
9. Watercourse slope, s	ft/ft		.0240	
10. Average velocity, V (figure 3-1)	ft/s		2.5	
11. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		.06	+ ____ = ____

Channel flow		Segment ID	CD	
12. Cross sectional flow area, a	ft^2		10	
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft		0.66	
15. Channel slope, s	ft/ft		.024	
16. Manning's roughness coeff., n			.035	
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		4.99	
18. Flow length, L	ft		1000	
19. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		.06	+ ____ = ____

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr .77

Worksheet 5a: Basic watershed data

Project Villages @ Westminster Location James City County, Va By KWJ Date 4/23/97

Circle one: Present (Developed) Pond I Frequency (yr) _____ Checked _____ Date _____

	Subarea name	Drainage area A_m (mi^2)	Time of concentration T_c (hr)	Travel time through subarea T_t (hr)	Downstream subarea names	Travel time summation to outlet ΣT_t (hr)	24-hr Rainfall P (in)	Runoff curve number CN	Runoff Q (in)	$A_m Q$ (mi^2-in)	Initial abstraction I_a (in)	I_a/P
2		.0994	.77				3.5	66	0.8	.0795	1.030	.29
100		.0994	.77				8.0	66	4.0	.3976	1.030	.13

From worksheet 3 From worksheet 2 From table 5-1

25

Worksheet 5b: Tabular hydrograph discharge summary

Project Villages @ Westminster Location James City County, Va. By KMJ Date 4/23/97

Circle one: Present (Developed) Pond I Frequency (yr) _____ Checked _____ Date _____

	Subarea name	Basic watershed data used 1/				Select and enter hydrograph times in hours from exhibit 5-II 2/											
		Sub-area T_c (hr)	ΣT_t to outlet (hr)	I_a/P	A_mQ (mi^2-in)			12.6	12.7								
						Discharges at selected hydrograph times 3/ -(cfs)-											
2		.77		.29	.0795				27.67								
100		.77		.12	.3976				168.58								
Composite hydrograph at outlet																	

1/ Worksheet 5a. Rounded as needed for use with exhibit 5.
2/ Enter rainfall distribution type used.
3/ Hydrograph discharge for selected times is A_mQ multiplied by tabular discharge from appropriate exhibit 5.

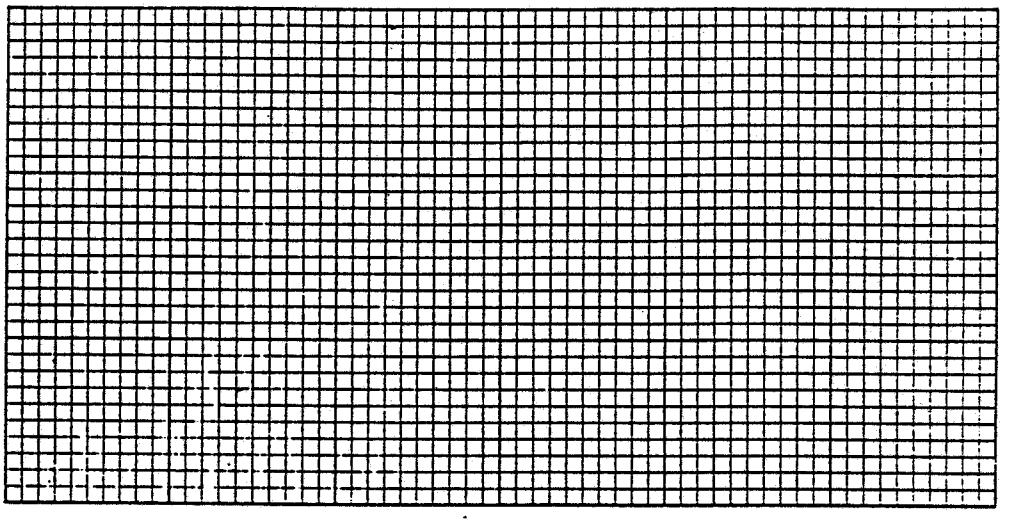
Worksheet 6a: Detention basin storage, peak outflow discharge (q_o) known

Project Villages @ Westminster By RMJ Date 4/23/97

Location James City County, Va. Checked ____ Date ____

Circle one: Present (Developed) Pond I

Elevation or stage



Detention basin storage

1. Data:
   Drainage area ..... A_m = .0994 mi^2
   Rainfall distribution type (I, IA, II, III) = II

	1st stage	2nd stage
2. Frequency ..... yr	2	
3. Peak inflow discharge, q_i .... cfs (From worksheet 4 or 5b)	27.67	
4. Peak outflow discharge, q_o .... cfs 1/	4.77	
5. Compute $\frac{q_o}{q_i}$	.17	
6. $\frac{V_s}{V_r}$ ..... (Use $\frac{q_o}{q_i}$ with figure 6-1)	.48	
7. Runoff, Q ..... in (From worksheet 2)	0.8	
8. Runoff volume, V_r ..... ac-ft ($V_r = QA_m 53.33$)	4.24	
9. Storage volume, V_s ..... ac-ft ($V_s = V_r(\frac{V_s}{V_r})$)	2.04	
10. Maximum stage, E_{max} (From plot)		

88,865 cF

1/ 2nd stage q_o includes 1st stage q_o.

RICKMOND ENGINEERING, INC.
1643 C Merrimac Trail
Williamsburg, Virginia 23185-5624
(804) 229-1776 or (804) 898-4149
Fax Number (804) 220-9370

JOB 96106
SHEET NO. 28 OF
CALCULATED BY KMJ DATE 4/23/97
CHECKED BY DATE
SCALE

DESIGN DRY POND I

ELEV (ft)	S.A. (ft)	Δ ELEV (ft)	Δ Storage (cf)	Accum Storage (cf)
61	18,065			0
		1	20,097	
62	22,128			20,097
		2	54,408	
64	32,280			74,505
		2	77,766	
66	45,486			152,271
		2	106,428	
68	60,942			258,699
		2	143,360	
70	82,418			402,059

RICKMOND ENGINEERING, INC.
1643 A Merrimac Trail
Williamsburg, Virginia 23185-5624
(757) 229-1776 or (757) 898-4149
Fax Number (757) 229-4683

JOB 96106
SHEET NO. 29 OF
CALCULATED BY KMS DATE 8/6/97
CHECKED BY DATE
SCALE

DESIGN OUTLET ORIFICE

$Q = 4.77$ cfs Pre-Development 2 year

2 yr storm Volume of 75,000 cf rises to Elev 64.00 now 82,805 ft³

$Q = CA\sqrt{2gh}$ $h = 64.00 - 61.00 = 3.00$

$4.77 = .6A\sqrt{2(32.2)(3.0)}$

$A = \pi r^2 = .57$ ft²

$r = .43' = 5.1''$ use 10" diameter orifice

ELEV	h	Q
61.00	0	0
62.00	1	2.74
63.00	2	3.88
64.00	3	4.75
65.00	4	5.49
66.00	5	6.14
67.00	6	6.72
68.00	7	7.26
69.00	8	7.76
70.00	9	8.23

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Williamsburg, Virginia 23185-5624
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Fax Number (757) 229-4683

JOB 96106
SHEET NO. 30 OF
CALCULATED BY KWJ DATE 8/6/97
CHECKED BY DATE
SCALE

DESIGN OUTLET BARREL

190' of 48" RCP @ 0.92% n=.013

Q	d_n	d_c	y_n	R	H	h_o	LS_o	HW	HW_{ELEV}
0	—	—	—	—	—	—	—	—	58.00
25	1.15	1.48	8.33	.66	3.36	2.74	1.75	4.35	62.35
50	1.67	2.12	10.09	.89	4.09	3.06	1.75	5.40	63.40
75	2.10	2.62	11.20	1.04	4.64	3.31	1.75	6.20	64.20
100	2.53	3.03	11.95	1.14	5.06	3.52	1.75	6.83	64.83
125	2.99	3.36	12.42	1.21	5.32	3.68	1.75	7.25	65.25
150	4.00	4.00	11.93	1.00	5.37	4.00	1.75	7.62	65.62
175	4.00	4.00	13.92	1.00	7.32	4.00	1.75	9.57	67.57
200	4.00	4.00	15.91	1.00	9.56	4.00	1.75	11.81	69.81

RICKMOND ENGINEERING, INC.
1643 A Merrimac Trail
Williamsburg, Virginia 23185-5624
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Fax Number (757) 229-4683

JOB 96106
SHEET NO. 31 OF
CALCULATED BY KMJ DATE 8/6/97
CHECKED BY DATE
SCALE

DESIGN RISER OUTLET

66" ø Riser

$Q = 9.739\ D_r\ H^{3/2}$

ELEV	H	Q
64.50	0	0
66.00	1.5	98.40
68.00	3.5	350.74
70.00	5.5	690.91

RICKMOND ENGINEERING, INC.
1643 A Merrimac Trail
Williamsburg, Virginia 23185-5624
(757) 229-1776 or (757) 898-4149
Fax Number (757) 229-4683

JOB 96186
SHEET NO. 32 OF
CALCULATED BY KMJ DATE 8/6/97
CHECKED BY DATE
SCALE

STAGE - STORAGE - DISCHARGE

STAGE (ft)	STORAGE (ac-ft)	DISCHARGE (cfs)
61	.415	0
62	.508	2.74
63	.623	3.88
64	.741	4.75
65	.893	19.26
66	1.044	104.54
67	1.222	167.69
68	1.399	187.06
69	1.646	198.72

?

2-YR STORM ROUTING

```
1*******************************     PONDOPT
*******************************
 *******************************   Version 1.83
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************
```

PROJECT: VILLAGES AT WESTMINSTER
User: Rickmond Engineering
Date: 09/11/1997 Thursday
Time: 10:55:31
Output: VWIP2.OUT

SOLUTION FOR 1 STORMS.

TIME INCREMENT: .100 Hours

STORM NUMBER	HYDROGRAPH IN FILE:
1	VWI2.DAT

TAILWATER STAGE (ft)	STORM NUMBER	PEAK INFLOW (cfs)	ALLOWABLE PEAK DISCHARGE (cfs)	DURATION (min)	RUNOFF VOLUME (ft3)
60.000	1	26.362	N/A	1794.00	.1848E+06

```
1*******************************     PONDOPT
*******************************
 *******************************   Version 1.83
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************
```

PROJECT: VILLAGES AT WESTMINSTER
User: Rickmond Engineering
Date: 09/11/1997 Thursday
Time: 10:55:31
Output: VWIP2.OUT

Stage-Area-Discharge
Filename: VWIP.DAT

```
          TAILWATER STAGE:    60.000 feet.
            INITIAL STAGE:    61.000 feet.

 ===================   STAGE-STORAGE-DISCHARGE RELATIONSHIP
===================

 <<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<   STORM  1
>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
```

STAGE (ft)	STORAGE VOLUME (ac-ft)	DISCHARGE (cfs)
61.000	.0000	.0000
62.000	.4607	2.740
63.000	1.026	3.880
64.000	1.708	4.750
65.000	2.524	19.26
66.000	3.492	104.5
67.000	4.624	167.7
68.000	5.933	187.1
69.000	7.454	198.7

```
1*******************************     PONDOPT
*******************************
 *******************************   Version 1.83
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************

 PROJECT: VILLAGES AT WESTMINSTER
    User: Rickmond Engineering
    Date: 09/11/1997  Thursday
    Time: 10:55:31
  Output: VWIP2.OUT
```

was 61.0

```
          TAILWATER STAGE:    60.000 feet.
            INITIAL STAGE:    61.000 feet.

 <<<<<<<<<<<<<<<<<<<<<<<   ROUTING RESULTS FOR STORM  1
>>>>>>>>>>>>>>>>>>>>>>>

     MAXIMUM ELEVATION:    63.99     feet.
        MAXIMUM INFLOW:    26.36     cfs.
       MAXIMUM OUTFLOW:    4.745     cfs.
       MAXIMUM STORAGE:    1.704     acre-feet.

      CONTINUITY ERROR:    -.808E-05 percent.
```

POND

SURFACE ELEVATION (ft)	TIME (min)	INFLOW RATE (cfs)	OUTFLOW RATE (cfs)

0	.000	.000	61.000
6	.000	.000	61.000
12	.000	.000	61.000
18	.000	.000	61.000
24	.000	.000	61.000
30	.000	.000	61.000
36	.000	.000	61.000
42	.000	.000	61.000
48	.000	.000	61.000
54	.000	.000	61.000
60	.000	.000	61.000
66	.000	.000	61.000
72	.000	.000	61.000
78	.000	.000	61.000
84	.000	.000	61.000
90	.000	.000	61.000
96	.000	.000	61.000
102	.000	.000	61.000
108	.000	.000	61.000
114	.000	.000	61.000
120	.000	.000	61.000
126	.000	.000	61.000
132	.000	.000	61.000
138	.000	.000	61.000
144	.000	.000	61.000
150	.000	.000	61.000
156	.000	.000	61.000
162	.000	.000	61.000
168	.000	.000	61.000
174	.000	.000	

61.000				
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1*******************************     PONDOPT
*******************************
 *******************************   Version 1.83
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
```

****

PROJECT: VILLAGES AT WESTMINSTER
User: Rickmond Engineering
Date: 09/11/1997 Thursday
Time: 10:55:31
Output: VWIP2.OUT

ROUTING SUMMARY ----------
SIMULATION MODE ----------
FOR THE ABOVE CASE ----------

STORM NUMBER	PEAK STAGE (ft)	PEAK STORAGE (ac-ft)	PEAK INFLOW (cfs)	PEAK OUTFLOW (cfs)
1	63.994	1.70	26.362	4.745
			vs 21.9	4.4

100-YR STORM ROUTING

```
1*******************************     PONDOPT
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 *******************************   Version 1.83
*******************************
 *******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
*******************

 PROJECT: VILLAGES AT WESTMINSTER
    User: Rickmond Engineering
    Date: 09/11/1997  Thursday
    Time: 10:58:49
  Output: VWIP100.OUT


 SOLUTION FOR  1  STORMS.


 TIME INCREMENT:   .100  Hours


 STORM
 NUMBER   HYDROGRAPH IN FILE:
 ------   ----------------------------------------------------------

   1      VWI100.DAT
```

TAILWATER STAGE (ft)	STORM NUMBER	PEAK INFLOW (cfs)	ALLOWABLE PEAK DISCHARGE (cfs)	DURATION (min)	RUNOFF VOLUME (ft3)
60.000	1	159.354	N/A	1794.00	.9255E+06

```
1*******************************     PONDOPT
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 *******************************   Version 1.83
*******************************
 *******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
*******************

 PROJECT: VILLAGES AT WESTMINSTER
    User: Rickmond Engineering
    Date: 09/11/1997  Thursday
    Time: 10:58:49
  Output: VWIP100.OUT


 Stage-Area-Discharge
 Filename: VWIP.DAT
```

```
          TAILWATER STAGE:   60.000 feet.
            INITIAL STAGE:   61.000 feet.

 ==================   STAGE-STORAGE-DISCHARGE RELATIONSHIP
===================

 <<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<   STORM  1
>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
```

STAGE (ft)	STORAGE VOLUME (ac-ft)	DISCHARGE (cfs)
61.000	.0000	.0000
62.000	.4607	2.740
63.000	1.026	3.880
64.000	1.708	4.750
65.000	2.524	19.26
66.000	3.492	104.5
67.000	4.624	167.7
68.000	5.933	187.1
69.000	7.454	198.7

```
1*******************************     PONDOPT
*******************************
 *******************************   Version 1.83
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************

 PROJECT: VILLAGES AT WESTMINSTER
    User: Rickmond Engineering
    Date: 09/11/1997  Thursday
    Time: 10:58:49
  Output: VWIP100.OUT


          TAILWATER STAGE:   60.000 feet.
            INITIAL STAGE:   61.000 feet.

 <<<<<<<<<<<<<<<<<<<<<   ROUTING RESULTS FOR STORM  1
>>>>>>>>>>>>>>>>>>>>>

     MAXIMUM ELEVATION:    66.49     feet.
        MAXIMUM INFLOW:    159.4     cfs.
       MAXIMUM OUTFLOW:    135.6     cfs.
       MAXIMUM STORAGE:    4.048     acre-feet.

      CONTINUITY ERROR:    -.276E-05 percent.
```

POND

TIME (min)	INFLOW RATE (cfs)	OUTFLOW RATE (cfs)	SURFACE ELEVATION (ft)

61.000	0	.000	.000
61.000	6	.000	.000
61.000	12	.000	.000
61.000	18	.000	.000
61.000	24	.000	.000
61.000	30	.000	.000
61.000	36	.000	.000
61.000	42	.000	.000
61.000	48	.000	.000
61.000	54	.000	.000
61.000	60	.000	.000
61.000	66	.000	.000
61.000	72	.000	.000
61.000	78	.000	.000
61.000	84	.000	.000
61.000	90	.000	.000
61.000	96	.000	.000
61.000	102	.000	.000
61.000	108	.000	.000
61.000	114	.000	.000
61.000	120	.000	.000
61.000	126	.000	.000
61.000	132	.000	.000
61.000	138	.000	.000
61.000	144	.000	.000
61.000	150	.000	.000
61.000	156	.000	.000
61.000	162	.000	.000
61.000	168	.000	.000
61.000	174	.000	.000

61.000				
	180	.000	.000	I
61.000				
	186	.000	.000	I
61.000				
	192	.000	.000	I
61.000				
	198	.000	.000	I
61.000				
	204	.000	.000	I
61.000				
	210	.000	.000	I
61.000				
	216	.000	.000	I
61.000				
	222	.000	.000	I
61.000				
	228	.000	.000	I
61.000				
	234	.000	.000	I
61.000				
	240	.000	.000	I
61.000				
	246	.000	.000	I
61.000				
	252	.000	.000	I
61.000				
	258	.000	.000	I
61.000				
	264	.000	.000	I
61.000				
	270	.000	.000	I
61.000				
	276	.000	.000	I
61.000				
	282	.000	.000	I
61.000				
	288	.000	.000	I
61.000				
	294	.000	.000	I
61.000				
	300	.000	.000	I
61.000				
	306	.000	.000	I
61.000				
	312	.000	.000	I
61.000				
	318	.000	.000	I
61.000				
	324	.000	.000	I
61.000				
	330	.000	.000	I
61.000				
	336	.000	.000	I
61.000				
	342	.000	.000	I
61.000				
	348	.000	.000	I
61.000				
	354	.000	.000	I

61.000				
	360	.000	.000	|
61.000				
	366	.000	.000	|
61.000				
	372	.000	.000	|
61.000				
	378	.000	.000	|
61.000				
	384	.000	.000	|
61.000				
	390	.000	.000	|
61.000				
	396	.000	.000	|
61.000				
	402	.000	.000	|
61.000				
	408	.000	.000	|
61.000				
	414	.000	.000	|
61.000				
	420	.000	.000	|
61.000				
	426	.000	.000	|
61.000				
	432	.000	.000	|
61.000				
	438	.000	.000	|
61.000				
	444	.000	.000	|
61.000				
	450	.000	.000	|
61.000				
	456	.000	.000	|
61.000				
	462	.000	.000	|
61.000				
	468	.000	.000	|
61.000				
	474	.000	.000	|
61.000				
	480	.000	.000	|
61.000				
	486	.000	.000	|
61.000				
	492	.000	.000	|
61.000				
	498	.000	.000	|
61.000				
	504	.000	.000	|
61.000				
	510	.003	.000	|
61.000				
	516	.011	.000	|
61.000				
	522	.030	.001	|
61.000				
	528	.065	.004	|
61.001				
	534	.117	.008	|

61.003				
	540	.186	.015	|
61.005				
	546	.270	.025	|
61.009				
	552	.368	.039	|
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	558	.481	.058	|
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	564	.607	.081	|
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	570	.741	.109	|
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	576	.884	.143	|
61.052				
	582	1.037	.182	|
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	588	1.202	.227	|
61.083				
	594	1.379	.278	|
61.102				
	600	1.562	.335	|
61.122				
	606	1.758	.399	|
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	612	1.978	.469	|
61.171				
	618	2.237	.548	|
61.200				
	624	2.532	.636	|
61.232				
	630	2.846	.735	|
61.268				
	636	3.190	.844	|
61.308				
	642	3.581	.966	|
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	648	4.049	1.103	|
61.402				
	654	4.587	1.257	|
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	660	5.159	1.430	|
61.522				
	666	5.804	1.625	|
61.593				
	672	6.582	1.844	|
61.673				
	678	7.582	2.095	|
61.765				
	684	8.781	2.387	|
61.871				
	690	10.080	2.725	|
61.995				
	696	11.946	2.872	|
62.116				
	702	14.998	3.047	|
62.269				
	708	21.800	3.301	|
62.492				
	714	36.506	3.728	|

62.866				
	720	63.922	4.271	
63.449				
	726	100.906	9.191	
64.306				
	732	137.280	38.680	
65.228				
	738	157.722	96.787	
65.909				
	744	159.354	122.239	
66.280				
	750	147.836	133.988	
66.466				
	756	128.649	135.583	
66.492				
	762	107.184	128.963	
66.387				
	768	89.068	117.408	
66.204				
	774	74.926	103.968	
65.993				
	780	63.635	85.446	
65.776				
	786	54.327	71.314	
65.610				
	792	46.881	60.256	
65.481				
	798	40.950	51.531	
65.378				
	804	36.195	44.612	
65.297				
	810	32.424	39.111	
65.233				
	816	29.381	34.728	
65.181				
	822	26.886	31.207	
65.140				
	828	24.791	28.340	
65.106				
	834	23.027	25.974	
65.079				
	840	21.538	24.003	
65.056				
	846	20.211	22.332	
65.036				
	852	19.073	20.896	
65.019				
	858	18.260	19.705	
65.005				
	864	17.697	19.138	
64.992				
	870	17.239	18.909	
64.976				
	876	16.798	18.650	
64.958				
	882	16.310	18.363	
64.938				
	888	15.779	18.046	
64.916				
	894	15.224	17.697	

64.892				
	900	14.661	17.320	
64.866				
	906	14.101	16.918	
64.839				
	912	13.550	16.494	
64.809				
	918	13.018	16.055	
64.779				
	924	12.510	15.604	
64.748				
	930	12.030	15.148	
64.717				
	936	11.578	14.690	
64.685				
	942	11.157	14.235	
64.654				
	948	10.771	13.787	
64.623				
	954	10.420	13.350	
64.593				
	960	10.104	12.927	
64.564				
	966	9.825	12.521	
64.536				
	972	9.582	12.136	
64.509				
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64.484				
	984	9.196	11.431	
64.460				
	990	9.045	11.115	
64.439				
	996	8.916	10.822	
64.419				
	1002	8.804	10.554	
64.400				
	1008	8.703	10.307	
64.383				
	1014	8.612	10.081	
64.367				
	1020	8.527	9.874	
64.353				
	1026	8.447	9.684	
64.340				
	1032	8.370	9.510	
64.328				
	1038	8.295	9.348	
64.317				
	1044	8.222	9.199	
64.307				
	1050	8.150	9.060	
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	1056	8.079	8.931	
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	1062	8.009	8.809	
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	1068	7.938	8.695	
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	1080	7.799	8.484	
64.257				
	1086	7.729	8.385	
64.251				
	1092	7.659	8.290	
64.244				
	1098	7.590	8.199	
64.238				
	1104	7.520	8.111	
64.232				
	1110	7.450	8.025	
64.226				
	1116	7.380	7.942	
64.220				
	1122	7.310	7.860	
64.214				
	1128	7.240	7.780	
64.209				
	1134	7.169	7.701	
64.203				
	1140	7.099	7.623	
64.198				
	1146	7.029	7.547	
64.193				
	1152	6.958	7.471	
64.188				
	1158	6.888	7.396	
64.182				
	1164	6.817	7.322	
64.177				
	1170	6.747	7.248	
64.172				
	1176	6.676	7.174	
64.167				
	1182	6.605	7.101	
64.162				
	1188	6.535	7.028	
64.157				
	1194	6.464	6.956	
64.152				
	1200	6.393	6.884	
64.147				
	1206	6.322	6.812	
64.142				
	1212	6.251	6.740	
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64.132				
	1224	6.109	6.596	
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64.122				
	1236	5.970	6.454	
64.117				
	1242	5.902	6.383	
64.113				
	1248	5.834	6.312	
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64.103				
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64.093				
	1272	5.580	6.037	
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	1278	5.520	5.970	
64.084				
	1284	5.462	5.904	
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	1290	5.405	5.840	
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	1296	5.351	5.777	
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	1308	5.247	5.654	
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64.058				
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64.050				
	1332	5.061	5.427	
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	1338	5.019	5.374	
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	1362	4.869	5.178	
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	1368	4.836	5.134	
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	1392	4.722	4.972	
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	1398	4.698	4.936	
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	1464	3.266	4.724	|
63.970				
	1470	2.602	4.705	|
63.949				
	1476	1.974	4.680	|
63.919				
	1482	1.437	4.649	|
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63.842				
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63.798				
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63.750				
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63.651				
	1518	.207	4.403	|
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	1524	.149	4.358	|
63.550				
	1530	.108	4.314	|
63.499				
	1536	.077	4.270	|
63.448				
	1542	.055	4.226	|
63.397				
	1548	.039	4.182	|
63.347				
	1554	.027	4.138	|
63.297				
	1560	.018	4.095	|
63.247				
	1566	.011	4.052	|
63.198				
	1572	.006	4.010	|
63.150				
	1578	.002	3.968	|
63.101				
	1584	.001	3.926	|
63.053				
	1590	.000	3.885	|
63.006				
	1596	.000	3.824	|
62.951				
	1602	.000	3.761	|
62.896				
	1608	.000	3.699	|
62.841				
	1614	.000	3.638	|

62.787				
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	1626	.000	3.519	|
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	1632	.000	3.460	|
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	1638	.000	3.403	|
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	1644	.000	3.347	|
62.532				
	1650	.000	3.292	|
62.484				
	1656	.000	3.237	|
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	1662	.000	3.184	|
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	1668	.000	3.131	|
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	1674	.000	3.079	|
62.298				
	1680	.000	3.029	|
62.253				
	1686	.000	2.979	|
62.209				
	1692	.000	2.929	|
62.166				
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62.124				
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	1710	.000	2.787	|
62.041				
	1716	.000	2.740	|
62.000				
	1722	.000	2.610	|
61.953				
	1728	.000	2.485	|
61.907				
	1734	.000	2.365	|
61.863				
	1740	.000	2.252	|
61.822				
	1746	.000	2.144	|
61.782				
	1752	.000	2.041	|
61.745				
	1758	.000	1.943	|
61.709				
	1764	.000	1.850	|
61.675				
	1770	.000	1.761	|
61.643				
	1776	.000	1.677	|
61.612				
	1782	.000	1.596	|
61.583				
	1788	.000	1.520	|
61.555				
	1794	.000	1.447	|

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	1800	.000	1.377	|
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	1806	.000	1.311	|
61.479				
	1812	.000	1.248	|
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	1818	.000	1.189	|
61.434				
	1824	.000	1.132	|
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	1872	.000	.764	|
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	1878	.000	.727	|
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	1884	.000	.692	|
61.253				
	1890	.000	.659	|
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	1896	.000	.627	|
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	1902	.000	.597	|
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	1908	.000	.569	|
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	1914	.000	.541	|
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61.188				
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	1938	.000	.445	|
61.162				
	1944	.000	.423	|
61.154				
	1950	.000	.403	|
61.147				
	1956	.000	.384	|
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	1962	.000	.365	|
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	1968	.000	.348	|
61.127				
	1974	.000	.331	|

61.121				
	1980	.000	.315	|
61.115				
	1986	.000	.300	|
61.110				
	1992	.000	.286	|
61.104				
	1998	.000	.272	|
61.099				
	2004	.000	.259	|
61.094				
	2010	.000	.246	|
61.090				
	2016	.000	.235	|
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	2022	.000	.223	|
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	2028	.000	.213	|
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	2034	.000	.202	|
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	2040	.000	.193	|
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	2064	.000	.158	|
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	2070	.000	.151	|
61.055				
	2076	.000	.144	|
61.052				
	2082	.000	.137	|
61.050				
	2088	.000	.130	|
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	2094	.000	.124	|
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	2100	.000	.118	|
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	2106	.000	.112	|
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	2112	.000	.107	|
61.039				
	2118	.000	.102	|
61.037				
	2124	.000	.097	|
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	2130	.000	.092	|
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	2142	.000	.084	|
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	2154	.000	.076	|

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	2172	.000	.065	|
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	2178	.000	.062	|
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	2184	.000	.059	|
61.022				
	2190	.000	.056	|
61.021				
	2196	.000	.054	|
61.020				
	2202	.000	.051	|
61.019				
	2208	.000	.049	|
61.018				
	2214	.000	.046	|
61.017				
	2220	.000	.044	|
61.016				
	2226	.000	.042	|
61.015				
	2232	.000	.040	|
61.015				
	2238	.000	.038	|
61.014				
	2244	.000	.036	|
61.013				
	2250	.000	.034	|
61.013				
	2256	.000	.033	|
61.012				
	2262	.000	.031	|
61.011				
	2268	.000	.030	|
61.011				
	2274	.000	.028	|
61.010				
	2280	.000	.027	|
61.010				
	2286	.000	.026	|
61.009				
	2292	.000	.024	|
61.009				
	2298	.000	.023	|
61.008				
	2304	.000	.022	|
61.008				
	2310	.000	.021	|
61.008				
	2316	.000	.020	|
61.007				
	2322	.000	.019	|
61.007				
	2328	.000	.018	|
61.007				
	2334	.000	.017	|

61.006				
	2340	.000	.017	|
61.006				
	2346	.000	.016	|
61.006				
	2352	.000	.015	|
61.005				
	2358	.000	.014	|
61.005				
	2364	.000	.014	|
61.005				
	2370	.000	.013	|
61.005				
	2376	.000	.012	|
61.004				
	2382	.000	.012	|
61.004				
	2388	.000	.011	|
61.004				
	2394	.000	.011	|
61.004				
	2400	.000	.010	|
61.004				
	2406	.000	.010	|
61.004				
	2412	.000	.009	|
61.003				
	2418	.000	.009	|
61.003				
	2424	.000	.008	|
61.003				
	2430	.000	.008	|
61.003				
	2436	.000	.008	|
61.003				
	2442	.000	.007	|
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 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
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 PROJECT: VILLAGES AT WESTMINSTER
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    Date: 09/11/1997  Thursday
    Time: 10:58:49
  Output: VWIP100.OUT
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ROUTING SUMMARY ----------
SIMULATION MODE ----------
FOR THE ABOVE CASE ----------

Pond I

STORM NUMBER	PEAK STAGE (ft)	PEAK STORAGE (ac-ft)	PEAK INFLOW (cfs)	PEAK OUTFLOW (cfs)
1	66.492	4.05	159.354	135.583

D.H.W

Villages @ Westminster BMPs

JAMES CITY COUNTY
STORMWATER DETENTION BASIN DESIGN CHECKLIST

I. STORMWATER MANAGEMENT COMPUTATIONS

A. HYDROLOGY - An SCS-based methodology is required for stormwater detention structures with watersheds exceeding 20 acres. Under 20 acres, other generally accepted methodologies such as the modified rational, critical storm are allowable. See Chapter 5, VESCH for more information.

- __–__ RCN determinations: predeveloped and ultimate development land use scenarios. needs to be revised – results in 75 RCN when should be 85
- __✓__ Time of concentration: predeveloped and ultimate development indicating overland, shallow concentrated, and channel flow components.
- __–__ Hydrograph generation: predevelopment and ultimate development peak flows for 2-, 10-, and 100-year design storms.
  10-year storm?

B. RESERVOIR ROUTING

- __–__ 10 year storm? Storage indication routing of ultimate development hydrographs for 2-, 10-, and 100-year design storms. Structure must discharge up to 10-year storm through principal spillway and pass the 100-year storm with 1 foot of freeboard through a combination of the principal and emergency spillways.
- __NA__ Downstream hydrographs at established study points (if required).

C. HYDRAULIC COMPUTATIONS

- __✓__ Elevation-Storage (curve)
- __✓__ Weir/Orifice control - extended detention control.
- __NA__ Weir/Orifice control - riser 2 year control.
- __–__ Weir/Orifice control - riser 10 year control. —
- __–__ Inlet/Outlet (barrel) control - (all storms). riser/barrel same Ø -
- __–__ Check for barrel control prior to riser orifice flow to prevent slug flow-water hammer conditions.
- __NA__ Emergency spillway capacity.
- __✓__ Elevation-Discharge (provide supporting calculations and/or design assumptions).

D. MISCELLANEOUS COMPUTATIONS

- __✓__ Water quality volume for permanent pool.
- __NA__ Water quality volume for extended detention with drawdown computations.

✓ Anti-seep collar design.
NA Filter diaphragm design (or alternative method of controlling seepage).
___ Riser structure flotation analysis (factor of safety = 1.2 min.).
___ Danger reach study (if required).
___ 100 year floodplain impacts (if required).

II. SOILS INVESTIGATION

___ Geotechnical report.
___ Minimum boring locations: borrow area; pool area; principal spillway; top of dam near one abutment or emergency spillway if provided.
___ Boring logs with Unified Soil Classification, and soil description, with depth to bedrock, seasonal water table.

III. STORMWATER MANAGEMENT PLAN

A. PLAN VIEW 1"=50' or less (40', 30', etc.)

1. GENERAL TERMS

✓ North arrow.
✓ Sealed by P.E.
✓ Existing and proposed contours (1' or 2' interval).
✓ Existing and proposed improvements.
✓ Delineation of permanent/extended detention, 2, 10, and 100-year pools.
___ Locations of test borings.
✓ Outflow pipe, outlet protection (detail required), and outfall channel.
___ Emergency spillway level section and outlet channel.
___ Existing and proposed utility location/protection.

B. MAINTENANCE ITEMS

✓ Person or organization responsible for maintenance.
___ Inspection and maintenance agreement.
___ Maintenance access from public right-of-way or publicly traveled road.
___ Maintenance easement, minimum 15 feet around 100-year pool elevation.
NA Forebay (if proposed).
✓ Temporary erosion and sediment control measures for pond construction.
___ Fence, or minimum 6' wide safety shelf for public safety.
___ Provisions for use as a temporary sediment basin with cleanout schedule and instructions for conversion to permanent facility.

C. PRINCIPAL SPILLWAY PROFILE AND ASSOCIATED DETAILS

1. EXISTING GROUND AND PROPOSED GRADE

✓ Dam side slopes labeled.
✓ Top width labeled (per VESCH).
— Removal of unsuitable material under proposed dam (per geotechnical report).

2. CORE TRENCH

✓ Materials (per construction specifications)
✓ Bottom width (4' minimum or greater as dictated by geotechnical report)
✓ Side slopes (1:1 maximum steepness)
— Depth (4' minimum or greater as dictated by the geotechnical report)

3. RISER OR SIMILAR STRUCTURE (DETAIL REQUIRED)

✓ Materials (as required)
✓ All structure dimensions
NA Control orifice dimensions
✓ Trash rack - removable - for each release (detail as required for construction)
✓ Anti-vortex device (detail as required for construction)
✓ Proper structure footing
✓ Maintenance access

4. BARREL

✓ Materials (ASTM C-361 or as required)
✓ Support for concrete barrels-concrete cradles, etc. (detail required)
NA Gauge and corrugation size for metal barrels

5. SEEPAGE CONTROL

— Phreatic line (4:1 slope measured from the intersection of the dam and the principal spillway design high water.

a. ANTI-SEEP COLLAR

Pond I
— Anti-seep collar (detail required)
— Size - 15% increase in length of saturation using outside pipe diameter

_____ Spacing and location on barrel (located at least 2' from a pipe joint)

b. FILTER DIAPHRAGM

NA Design based on latest SCS methods and certified by a professional geotechnical engineer

6. OUTFALL PROTECTION

✓ Size for maximum barrel release (but not greater than 10 year storm)
NA Cross-section at end of barrel in accordance with receiving channel section
NA Endsection with footer
✓ Outfall dimensions
✓ Slope - 0%
✓ Rip-rap size, VDOT Classification
✓ Thickness (1.5 Times Maximum Stone Diameter)
✓ Approved filter fabric (nonwoven)

7. ELEVATIONS

✓ Top of dam - construction height and settled height (10% settlement)
— Crest of emergency spillway
✓ Crest of riser structure
✓ Inverts of control release orifice/weirs
✓ Pools: permanent; extended detention; 2-year; 10-year; 100-year; and appropriate safety storms
✓ Appropriate freeboard per SCS National Engineering Handbook, provide minimum one foot of free board above the 100-year design highwater.
✓ Inlet and outlet inverts of pipes (with slopes in %)

D. CROSS SECTION THROUGH DAM ALONG CENTERLINE

— Existing ground
— Proposed grade
✓ Top of dam - constructed and settled
— Location of emergency spillway with side slopes labeled (emergency spillway in cut)
✓ Bottom of core trench (4' minimum)
— Location of each soil boring
✓ Barrel location
_____ Existing and proposed utility location/protection

E. EMERGENCY SPILLWAY PROFILE

_____ Existing ground
_____ Inlet, level (control), and outlet sections per SCS
_____ Spillway and crest elevations

F. CONSTRUCTION SPECIFICATIONS

_____ Sequence of construction (generally by contractor)
_____ Care of base flow during construction (if necessary)
_____ Site preparation
_____ Earthfill: _____ Material, _____ Placement,
_____ Compaction, _____ Core trench
_____ Structural backfill
_____ Pipe conduits
_____ Concrete
_____ Rip-Rap and slope protection
_____ Fencing
_____ Stabilization
_____ Inspection and Certification by Engineer

COMMENTS:

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BY: _____

DATE: _____

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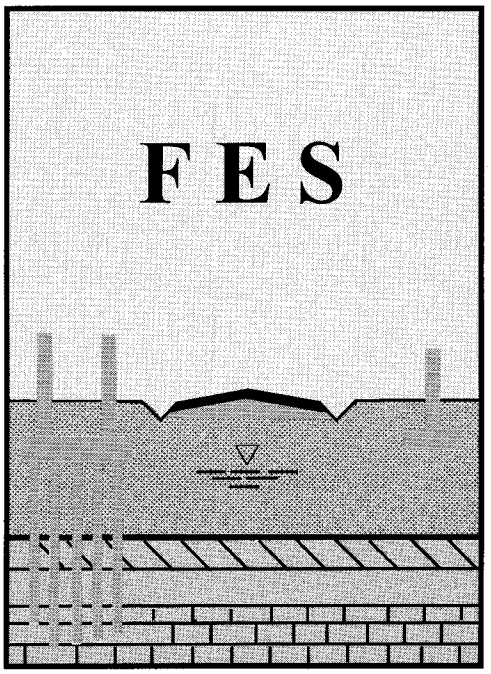
FES

NOT CC. 12/11/97

SUBSURFACE EXPLORATION STUDY REPORT
STORM WATER MANAGEMENT DETENTION BASIN
THE VILLAGES AT WESTMINSTER
JAMES CITY COUNTY, VIRGINIA
FES PROJECT NO: 1-701218.002

CLIENT: ATLANTIC HOMES DEVELOPMENT CORP.

PC170

FOUNDATION ENGINEERING SCIENCE, INC.
• Geotechnical Engineering
• Environmental Management
• Construction Materials Testing

11843-B Canon Boulevard, Suite 6
Newport News, Virginia 23606
Phone: (757) 873-4113
Fax: (757) 873-4114
Email: Elawar@aol.com

December 11, 1997

Atlantic Homes Development Corporation
2 Eaton Street, Suite 1101
Hampton, Virginia 23669

Attn: Mr. Willard W. Morris
President

Re: Subsurface Exploration Study Report
Storm Water Management Detention Basin (Pond I)
The Villages At Westminster
James City County, Virginia
FES Project No. 1-701218.002

Dear Mr. Morris:

Pursuant to your request and verbal authorization, Foundation Engineering Science, Inc. (FES) has completed a subsurface exploration study for the storm water management detention basin (Pond I) at the Villages of Westminster in James City County, Virginia. The subsurface exploration study consisted of performing standard penetration test (SPT) borings for the existing roadway embankment (acting as a storm water management detention basin at Station Number 15+00 along Wellesley Boulevard). The subsurface exploration study included a review of the project plans as prepared by Rickmond Engineering dated August 6, 1997 and revised September 8, 1997, information obtained from Mr. Hank Mullins with H. B. Hankins, Inc. and the geotechnical engineering service, report [FES Project No. 1-701218.001, dated October 6, 1997].

Briefly, the results of the subsurface exploration study indicated that the earthfill material located within the embankment in the **upper fifteen (15) feet consisted of silty sand** (SM), **clayey sand (SC)** and **sandy clay** (CL). The standard penetration resistance N-values within the borings performed in the upper fifteen (15) feet of the embankment ranged from three (3) to thirty-three (33) blows per foot (bpf). The soil properties of the earthfill material located within the upper fifteen (15) feet of the existing embankment of the storm water management detention basin (Pond I) is shown in detail within this report.

FES appreciates the opportunity to be of service to Atlantic Homes Development Corporation on this important project and look forward to its successful completion. Should you have any questions regarding this report, please do not hesitate to contact the undersigned.

Respectfully submitted,

FOUNDATION ENGINEERING SCIENCE, INC.

Jeffrey C. Norman
Project Geologist

Raja S. Elawar, P.E. 12/12/97
Vice President
VA Reg. No. 23683

Copies: (2) Client
(1) Rickmond Engineering, Inc. (Mr. Kenneth M. Jenkins, P.E.)

Appendix:
- Figure 1 - Boring Location Sketch
- Boring Profile Sheets

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COMMONWEALTH OF VIRGINIA
RAJA S. ELAWAR
No. 023683
PROFESSIONAL ENGINEER

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- FIGURE
- BORINGS PROFILE SHEETS

INTRODUCTION

Project Characteristics

The project site is located along Richmond Road (State Route 60) in James City County, Virginia. The proposed Villages At Westminster development is planned to consist of constructing paved roadways, two (2) storm water management detention basins (Ponds I and II), approximately 380 residential lots within four (4) Villages. The Villages are named Gableton, Glenwilton, Roane Ridge and Chaseoaks. The storm water detention basins are expected to be twenty-two (22) to fourteen (14) feet in height for Pond I and II, respectively. The normal pool design depth is expected to be six (6) feet for Pond I and II, respectively. Based on review of the design plans as prepared by Rickmond Engineering, Inc., the embankment side slopes are three (3) horizontal to one (1) vertical (3H:1V).

Site Description

During the time of our site visits on September 15, 1997 and December 10, 1997, the initial detention basin, Pond I was located along Wellesley Boulevard (approximate Station Number 15+00) and was accessible to a truck mounted drill rig. Based on our review of the plans prepared by Rickmond Engineering, Inc. the detention basin, Pond I will retain approximately six (6) feet of water and have a final top of berm elevation of 74 feet National Geodetic Vertical Datum (NGVD) of 1929 and a base elevation of 50 feet NGVD.

A review of the United States Geological Survey (USGS) Quadrangle maps titled "Norge and Williamsburg, Virginia" published 1983 revealed the approximate development elevations to range from sixty (60) to one hundred and ten (110) feet National Geodetic Vertical Datum (NGVD) of 1929.

PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to obtain information on the general subsurface soil and ground water conditions at the existing storm water management detention basin (Pond I). The subsurface materials encountered were then evaluated with respect to the available project characteristics. In this regard, the following items were formulated:

1. Development of subsurface soil and ground water conditions within the existing embankment of the storm water management detention basin (Pond I) recently filled area.

2. General location and description of potentially deleterious materials encountered in the borings performed which may which may detrimental to the design life of the existing embankment.

3. Determination of the design soil properties within the upper fifteen (15) feet of the recently placed earthfill material and the relative density.

The following services were provided in order to achieve the preceding objectives:

1. FES executed a program of subsurface exploration consisting of subsurface sampling and field testing. FES performed five (5) Standard Penetration Test (SPT) borings within the general embankment area at the detention basin located along Wellesly Boulevard (approximate Station No. 15+00). The SPT borings were drilled at random locations within the earthen dam (existing) to approximate depths ranging from fifteen (15) to thirty-five (35) feet below the existing grades. The SPT borings were performed with the use of a power ATV mounted drill rig [B-1 and B-2] and a 4X4 truck mounted drill rig [B-5, B-6 and B-7] in general accordance with ASTM-1586 test method. In the SPT borings, soil samples were collected and Standard Penetration Test resistance N-values will be measured virtually continuously for the top ten (10) feet and on intervals of five (5) feet thereafter.

2. Visually classified and stratify representative soil samples in the laboratory using the Unified Soil Classification System (USCS) in general accordance with ASTM D-2487. Conducted a limited laboratory testing program [visual classification]. Identified soil conditions at the boring locations and form an opinion of the site soil stratigraphy.

3. Collected ground water level measurements in the borings performed.

4. The results of the field exploration and laboratory testing program were utilized in performing soil properties evaluations. The results of the field exploration and soil properties evaluations, laboratory testing program [visual classification] are presented in a comprehensive subsurface exploration study report prepared by a Professional "Geotechnical" Engineer.

Report Format

This report begins with a discussion of the field and laboratory programs followed by a description of the general subsurface conditions, soil design properties and general conditions. The boring location sketch [Figure 1] and the boring profiles are presented in the appendix of this report.

FIELD EXPLORATION

In order to explore the general foundation soil types and to aid in developing associated design parameters, a total of five (5) Standard Penetration Test (SPT) soil borings were drilled at locations which were within the existing embankment earthfill of the storm water management detention basin [Pond I]. These boring locations were located in the field based on existing topographic features and stakes performed by Rickmond Engineering, Inc. The approximate location of the borings are illustrated on Figure 1, which has been included in the appendix of this report. The SPT borings were drilled to approximate depths ranging from fifteen (15) to thirty-five (35) feet.

SPT Borings

The SPT borings were performed with the use of an ATV and 4X4 truck mounted drill rigs utilizing hollow stem auger (HSA) procedures. The soil sampling was performed in general accordance with the American Society of Testing and Materials (ASTM) Test Designation D-1586. These samples were taken continuously from the ground surface to an approximate depth of ten (10) feet and on five (5) foot intervals thereafter. Representative portions of these soil samples were collected, labeled and transported to our office for classification, laboratory testing and analysis. SPT borings B-1 and B-2 were performed for an earlier study at this project site and SPT borings B-5, B-6 and B-7 were completed for this subsurface exploration study. SPT borings B-3 and B-4 were performed for the storm water management detention basin (Pond II).

LABORATORY TESTING

The soil samples were transported to our laboratory and were classified by the Geotechnical Engineer using the Unified Soil Classification System (USCS) in general accordance with ASTM test designations D-2487. Due to the project characteristics and our experience with similar subsurface conditions, refined laboratory testing was not deemed necessary.

GENERALIZED SUBSURFACE CONDITIONS

Subsurface Soil Conditions

Soil stratification was based on visual examination of the recovered soil samples, laboratory testing and interpretation of the field boring logs by an experienced geotechnical engineer. The boring stratification lines represent the approximate boundaries between soil types of significantly different engineering properties; however, the actual transition may be gradual. In some cases, small variations in properties not considered pertinent to our engineering evaluation may have been abbreviated or omitted for clarity. The boring profiles present the conditions at the particular boring location and variations do occur among the borings and between soil samples. On this basis, the subsurface soils encountered generally consisted of approximately two (2) to three (3) inches of dark brown silty fine sand (SM) with roots "Topsoil" underlain by a two (2) layer soil configuration.

B-1 and B-2

The initial soil layer was encountered from below the "Topsoil" to approximate depths ranging from eighteen (18) to twenty-three (23) feet below the existing ground surface. This soil layer consisted of "Earth Fill" with interbedded layers ranging from silty sand (SM) to sandy clay (CL). The Standard Penetration resistance N-values recorded within this soil layer ranged from 4 to 16 blows per foot (bpf), indicating these soils to be of soft to stiff consistency for the sandy clay (CL) and loose to medium dense relative density for the silty sand (SM).

The second soil layer was encountered from approximate depths ranging from eighteen (18) to twenty-three (23) feet to boring termination depths [approximate depths ranging from twenty-five (25) thirty-five (35) feet below the existing ground surface]. This soil layer consisted of brown to gray, wet silty to clayey sand (SM-SC) with shell fragments "Yorktown Formation". The Standard Penetration Test N-values recorded within this soil layer ranged from 2 to 16 bpf, indicating this soil layer to be of a very loose to medium dense relative density.

B-5, B-6 and B-7

The initial soil layer was encountered from below the "Topsoil" to an approximate depth of two (2) feet below the existing ground surface. This soil layer consisted of sandy clay (CL). The Standard Penetration Test N-values recorded within this soil layer were on the order of 4 bpf, indicating this soil layer to be of a soft consistency.

The second soil layer was encountered from an approximate depth of two (2) feet to boring termination depth [an approximate depth of fifteen (15) feet below the ground surface]. This soil layer consisted of "Earth Fill" with interbedded layers ranging from silty sand (SM) to clayey sand (SC). The Standard Penetration Test N-values recorded within this soil layer ranged from 9 to 22 bpf, indicating this soil layer to be of a loose to medium dense relative density.

The soils encountered typically have low to moderate potential for shrink/swell behavior to moisture variations. Specific details concerning the subsurface materials and conditions encountered at each test location during the subsurface exploration program may be obtained from the soil boring profiles located in the appendix of this report.

Ground Water Conditions

The existing ground water was recorded immediately after drilling during the time of our subsurface exploration on September 24, 1997, and corroborated through a visual examination of the obtained soil samples. The ground water level was encountered at an approximate depth of eighteen (18) to twenty (20) feet below the existing ground surface. The ground water table was not encountered during our drilling services performed on December 10, 1997.

If the ground water level is critical to design or construction, ground water observation wells should be installed on-site to monitor ground water fluctuations over a period of time and permit more accurate determinations of wet season and dry season levels.

Design Soil Parameters

The subsurface exploration program performed at the subject site, indicated the presence of approximately four (4) distinct types of soil conditions within the upper fifteen (15) feet of the existing earthfill embankment located at the storm water management detention basin (Pond I). Based on our extensive experience with similar soil conditions and the results of the Standard Penetration Test (SPT) N-values encountered in the boring, the following design soil parameters were developed.

Summary of Soil Parameters Storm Water Management Detention Basin (Pond I) York County, Virginia							
Depth (feet)	USCS	Typical SPT N-value	Approx. Relative Density (%)	Estimated Soil Unit Weight (pcf)		Estimated Angle of Internal Friction (degrees)	Estimated Cohesion (psf)
				Total	Submerged		
0 - 2	CL	3 - 8	> 85	125	63	0	800
2 - 4	SC	9 - 11	> 90	130	68	30	0
4 - 13	SM	22 - 33	95 - 100	130	68	34	0
13 - 15	SC	6 - 14	> 90	130	68	30	0

Based on the results of the SPT borings performed, Standard Penetration resistance N-values and literature correlations for similar soil types, the existing embankment soils within the upper fifteen (15) feet appeared to have been compacted to approximate relative densities varying from in excess of eighty-five (85) percent to one hundred (100) percent. The upper two (2) feet of the existing embankment earthfill appeared to require additional grading and compaction. In this regard, we recommend that the upper two (2) feet of the existing embankment and the limited sloughed areas [discussed in FES Project No. 1-701218.001, dated October 6, 1997] within Pond I be re-worked by compaction equipment and heavily re-sodded to prevent future sloughing problems.

review in field - anti-seep, rework of surface soils

GENERAL CONDITIONS

These design soil parameters were developed from the information obtained in the test borings which depict subsurface conditions only at these specific locations and at the particular time designated on the boring profiles. Soil conditions at other locations may differ from conditions occurring at these boring locations. In addition, the passage of time may result in a change to the soil conditions at these boring locations. The nature and extent of variations between the borings may not become evident until the course of construction. If variations then appear evident, it will be necessary for a re-evaluation of the recommendations presented in this report.

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted Geotechnical Engineering Principles and Practices. Foundation Engineering Science, Inc. is not responsible for the conclusions, opinions or recommendations made by others based on this geotechnical engineering services report.

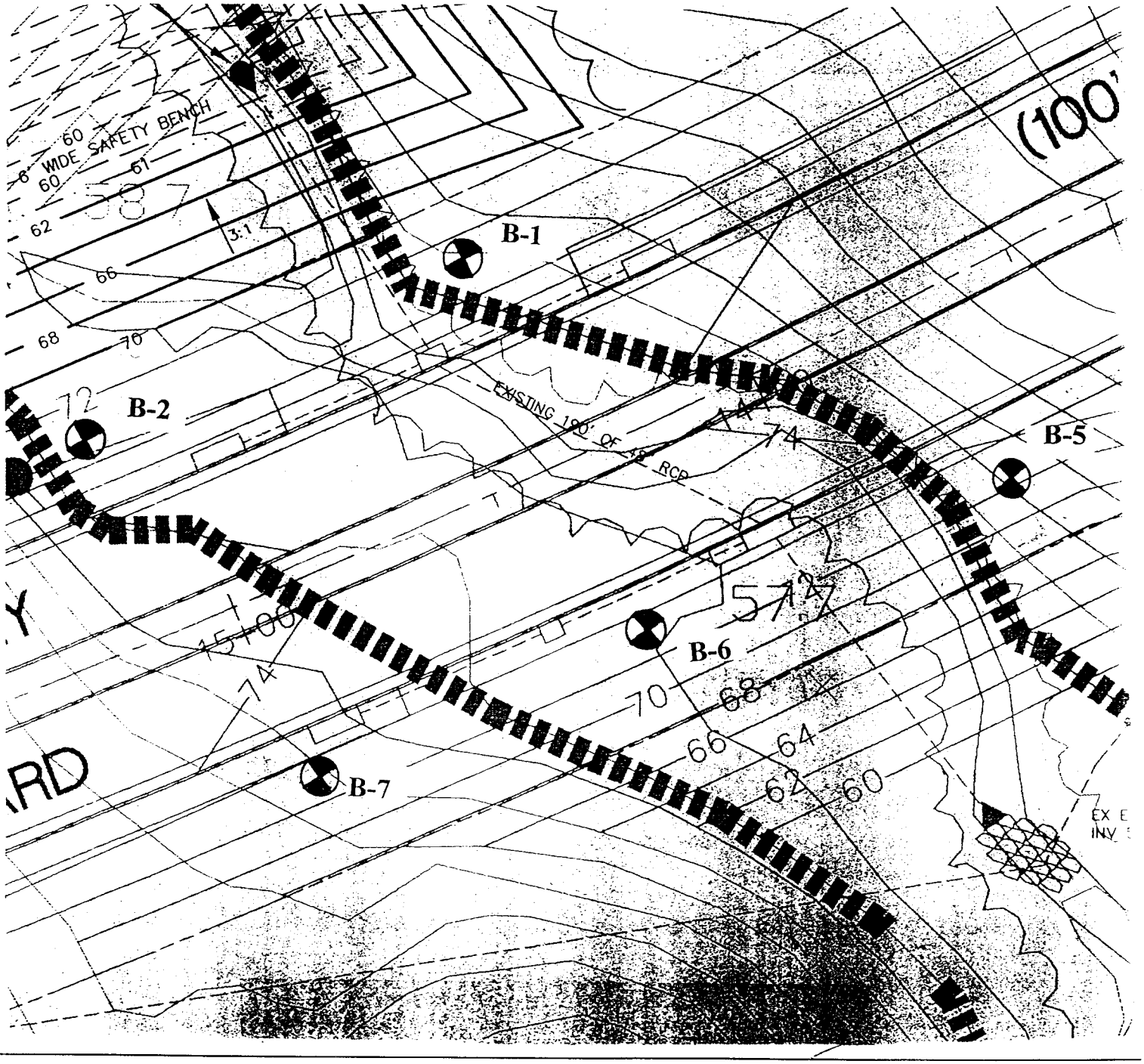
APPENDIX

- FIGURE
- BORINGS PROFILE SHEETS

FIGURE

Figure 1 - Boring Location Sketch

FIGURE 1



BORING LOCATION SKETCH

PROJECT NAME:	Storm Water Management Detention Basins The Villages at Westminster		
LOCATION:	James City County, Virginia	SCALE:	N/A
FES PROJECT NUMBER:	1-701218.002	DATE:	Dec., 1997
CLIENT:	Atlantic Homes Development Corporation		

FOUNDATION ENGINEERING SCIENCE, INC.

BORING PROFILE SHEETS

FOUNDATION ENGINEERING SCIENCE, INC.

PROJECT NAME: Storm Water Management Detention Basins The Villages at Westminister	**PROJECT NO.:** 1-701218.001	**BORING NO.:** B-1
CLIENT: Atlantic Homes Development Corp.	**BORING LOCATION:** See Figure 3	**DATE:** September 24, 1997
PROJECT LOCATION: James City County, Virginia	**DRILLING METHOD:** Hollow Stem Auger	**BORING DEPTH:** 25 Feet
FES REPRESENTATIVE: J. Norman	**OBSERVED G.W.T.:** 18 Feet	**STATION NO.:** N/A

DEPTH (FEET)	LEGEND	SOIL SYMBOL	SOIL DESCRIPTION	SPT N-VALUE	REMARKS
0.00		SM-SC	Brown, moist silty to clayey SAND with trace of organic, "Earthfill"	4-4-4-4	2" Topsoil
				6-6-5-7	
5.00				4-4-6-8	
		CL	Brown, moist sandy CLAY with trace organic, "Earthfill"	5-6-7-8	
		SC	Brown to gray, moist clayey SAND with trace organic, "Earthfill"		
10.00				5-6-8-10	
		SM	Brown, moist silty SAND, "Possible Earthfill"	6-6-8-9	
15.00					
		SM-SC	Gray, saturated silty to clayey SAND with shell fragments ["Yorktown Formation"], Loose	3-3-4-5	
20.00					
				4-4-3-5	
25.00			Boring terminated @ 25 feet		
30.00					
35.00					

FOUNDATION ENGINEERING SCIENCE, INC.

PROJECT NAME: Storm Water Management Detention Basins The Villages at Westminister	**PROJECT NO.:** 1-701218.001	**BORING NO.:** B-2
CLIENT: Atlantic Homes Development Corp.	**BORING LOCATION:** See Figure 3	**DATE:** September 24, 1997
PROJECT LOCATION: James City County, Virginia	**DRILLING METHOD:** Hollow Stem Auger	**BORING DEPTH:** 35 Feet
FES REPRESENTATIVE: J. Norman	**OBSERVED G.W.T.:** 20 Feet	**STATION NO.:** N/A

DEPTH (FEET)	LEGEND	SOIL SYMBOL	SOIL DESCRIPTION	SPT N-VALUE	REMARKS
0.00		SM-SC	Brown, moist silty to clayey SAND with trace organic and fine gravel, "Earthfill"	4-4-6-6	2" Topsoil
				4-5-6-5	
5.00				3-3-4-5	
				9-8-8-8	
10.00				4-8-8-10	
		CL	Brown to gray, moist to saturated sandy CLAY, "Possible Earthfill"	3-3-4-5	
15.00					
				1-2-2-2	
20.00					
		SM-SC	Brown to gray, saturated silty to clayey SAND with shell fragments, ["Yorktown Formation"]	1-1-1-2	
25.00			Very loose to medium dense		
				5-6-6-7	
30.00					
				5-8-8-12	
35.00			Boring terminated @ 35 feet		

FOUNDATION ENGINEERING SCIENCE, INC.

PROJECT NAME: Storm Water Management Detention Basins The Villages at Westminister	**PROJECT NO.:** 1-701218.002	**BORING NO.:** B-5
CLIENT: Atlantic Homes Development Corp.	**BORING LOCATION:** See Figure 1	**DATE:** December 10, 1997
PROJECT LOCATION: James City County, Virginia	**DRILLING METHOD:** Mud Drilling	**BORING DEPTH:** 15 Feet
FES REPRESENTATIVE: J. Norman	**OBSERVED G.W.T.:** > 15 Feet	**STATION NO.:** 13+75

DEPTH (FEET)	LEGEND	SOIL SYMBOL	SOIL DESCRIPTION	SPT N-VALUE	REMARKS
0.00		CL	Reddish brown, moist sandy CLAY with fine gravel, "Earthfill", soft	2-2-2-4	
		SC	Reddish brown, moist clayey SAND with trace organic and fine gravel, "Earthfill", Loose	3-4-5-5	
		SM	Reddish brown to tan, moist silty SAND, trace roots, "Earthfill", medium dense		
5.00				8-9-12-16	
				8-10-12-14	
10.00				8-10-12-10	
		SC	Reddish brown, moist clayey SAND, "Earthfill", medium dense	7-7-7-8	
15.00			Boring terminated @ 15 feet		
20.00					
25.00					
30.00					
35.00					

FOUNDATION ENGINEERING SCIENCE, INC.

PROJECT NAME: Storm Water Management Detention Basins The Villages at Westminister	**PROJECT NO.:** 1-701218.002	**BORING NO.:** B-6
CLIENT: Atlantic Homes Development Corp.	**BORING LOCATION:** See Figure 1	**DATE:** December 10, 1997
PROJECT LOCATION: James City County, Virginia	**DRILLING METHOD:** Mud Drilling	**BORING DEPTH:** 15 Feet
FES REPRESENTATIVE: J. Norman	**OBSERVED G.W.T.:** > 15 Feet	**STATION NO.:** 14+50

DEPTH (FEET)	LEGEND	SOIL SYMBOL	SOIL DESCRIPTION	SPT N-VALUE	REMARKS
0.00		CL	Reddish brown, moist sandy CLAY with fine gravel, "Earthfill", medium stiff	3-3-5-8	
		SM	Brown to reddish brown, moist silty SAND with trace organic, "Earthfill", medium dense	8-7-6-10	
5.00				9-7-10-10	
				8-7-6-7	
		SC	Reddish brown, moist clayey SAND with trace organic, "Earthfill", loose to medium dense		
10.00				5-5-5-5	
				5-3-5-4	
15.00			Boring terminated @ 15 feet		
20.00					
25.00					
30.00					
35.00					

FOUNDATION ENGINEERING SCIENCE, INC.

PROJECT NAME: Storm Water Management Detention Basins The Villages at Westminister	**PROJECT NO.:** 1-701218.002	**BORING NO.:** B-7
CLIENT: Atlantic Homes Development Corp.	**BORING LOCATION:** See Figure 1	**DATE:** December 10, 1997
PROJECT LOCATION: James City County, Virginia	**DRILLING METHOD:** Mud Drilling	**BORING DEPTH:** 15 Feet
FES REPRESENTATIVE: J. Norman	**OBSERVED G.W.T.:** > 15 Feet	**STATION NO.:** 15+00

DEPTH (FEET)	LEGEND	SOIL SYMBOL	SOIL DESCRIPTION	SPT N-VALUE	REMARKS
0.00		CL	Reddish brown, moist sandy CLAY with fine gravel, "Earthfill", soft	1-1-2-3	
		SM	Reddish brown, moist silty SAND with trace organic, "Earthfill", medium dense	7-8-8-10	
5.00		SC	Reddish brown, moist clayey SAND with trace organic, "Earthfill", medium dense	11-8-12-13	
		SM	Reddish brown, moist silty SAND, "Earthfill", dense	15-15-18-15	
10.00				12-16-17-19	
		SC	Reddish brown, moist clayey SAND, "Earthfill", loose	5-3-3-3	
15.00			Boring terminated @ 15 feet		
20.00					
25.00					
30.00					
35.00					

FOUNDATION ENGINEERING SCIENCE, INC.
• Geotechnical Engineering
• Environmental Management
• Construction Materials Testing

11843-B Canon Boulevard, Suite 6
Newport News, Virginia 23606
Phone: (757) 873-4113
Fax: (757) 873-4114
Email: Elawar@aol.com

November 8, 1997

RECEIVED
NOV 1997
ENVIRONMENTAL DIVISION

PC170

Atlantic Homes Development Corp.
2 Eaton Street, Suite 1101
Hampton, Virginia 23669

Attn: Mr. Willard Morris, President

Re: Storm Water Drainage Pipe Evaluation
The Villages at Westminster, Phase I
James City County, Virginia
FES Project No. 1-703101.007

Dear Mr. Morris:

Pursuant to your request, a Professional "Geotechnical" Engineer visited the project site on November 5, 1997. The specific purpose of this visit was to observe the general condition of the storm water drainage pipe installed for the storm water management detention basin located along Wellesley Boulevard within the Villages at Westminster, Phase I in James City County, Virginia. subbase. In addition, a review of the project plans as prepared by Rickmond Engineering, Inc. dated June 18, 1996 and revised November 14, 1996 and a transmittal letter submitted to our office by H. B. Hankins, Inc. Referencing the installation procedure were performed. the

SITE OBSERVATIONS

Our site visit was performed on November 5, 1997 and consisted of observing the existing embankment slopes within the down and up stream of the storm water drainage detention basin and the forty-eight (48) inch diameter reinforced concrete pipe (RCP). Our site visit consisted of carefully traversing the site and entering into the RCP located below the embankment.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our review of the plans, H. B. Hankins, Inc. transmittal letter and our site visit, the following conclusions and recommendations are presented.

1. The embankment immediately adjacent to the entrance and egress of the storm water drainage pipe appeared to have a sloughing failure.

FES

2. **The grout at the RCP joints appeared to have cracked and separated from the joints.**

3. **Soil and water infiltration was not observed at the interior joints located within the RCP although all of the grout at the RCP joints have cracked.** Recommend regrouting? No

4. We recommend that the sloughed soils along the lower portion of the embankment adjacent to the entrance and egress of the RCP be regraded, compacted and re-sodded to prevent future sloughing.

5. Compaction density test results for the embankment have not yet been submitted to our office for review. Upon receiving the compaction density test results for the embankment soils placed above the RCP for this crossing, we will evaluate them and submit a supplemental written report. Based on the height [approximately seventeen (17) feet] of the embankment at this crossing [exiting grade of 56.5 feet NGVD (within the creek) to final grade of 73.7 feet, NGVD], we anticipate a minimum of sixteen (16) tests based on twelve (12) inches of compacted soils per lift.

FES appreciates the opportunity to be of service to Atlantic Homes Development Corporation on this important project and look forward to its successful completion. Should you have any questions regarding this report, please do not hesitate to contact the undersigned.

Respectfully submitted,

FOUNDATION ENGINEERING SCIENCE, INC.

11/9/97

Raja S. Elawar, P.E.
Principal
VA Reg. No. 26383

COMMONWEALTH OF VIRGINIA
RAJA S. ELAWAR
No. 026383
PROFESSIONAL ENGINEER

Copies: (1) Client
(1) Rickmond Engineering, Inc. (Mr. Kenny Jenkins, P.E.)
(1) James City County

Attachment: H. B. Hankins, Inc. Transmittal

Do recommend that anti-seep collars be installed prior to riser being installed.

wpdocs\cmt\1-703101.007

Materials,
Compaction,
Grades,
Pipes
Cutoff Trenches
Wrap w/Filter Fabric - pipe joints

FES

H. B. HANKINS, INC.

739 Thimble Shoals Blvd., Ste 704
Newport News, Virginia 23606

(757) 873-2196 Office
(757) 873-0943 Fax

November 6, 1997

Ref. The Villages at Westminister
Fill and 48" RCP installed on Wellesley Blvd.

Dear Sir:
In reference to the 48" RCP we installed on Wellesley Blvd., it was put on 6" to 24"of #57 stone base. All of the fill for that crossing was onsite material installed in 8" lifts compacted to 95% density and tested by E. C. S. Ltd.

If I can be of any further assistance, please feel free to contact me.

Sincerely,

Hank Mullins
Vice President

atlantic homes development corporation

Willard W. Morris
President

Office: (757) 727-7772
Fax: (757) 722-3881

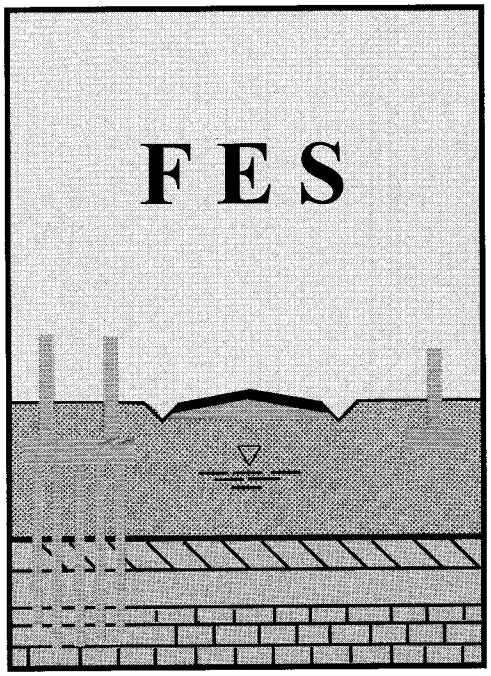
e-mail: atlhome@atlantichomes.com
www: http://www.atlantichomes.com

Harbour Centre
2 Eaton Street
Suite 1101, Hampton, VA 23669

To: Darryl Cook

Need to put in anti-seep collar
Testing of
Reworking of Face -

[redacted]



10/6/97

FINAL REPORT
GEOTECHNICAL ENGINEERING SERVICES
STORM WATER MANAGEMENT DETENTION BASINS
THE VILLAGES AT WESTMINSTER
JAMES CITY COUNTY, VIRGINIA
FES PROJECT NO: 1-701218.001

CLIENT: ATLANTIC HOMES DEVELOPMENT CORP.

FOUNDATION ENGINEERING SCIENCE, INC.

- Geotechnical Engineering
- Environmental Management
- Construction Materials Testing

11843-B Canon Boulevard, Suite 6
Newport News, Virginia 23606
Phone: (757) 873-4113
Fax: (757) 873-4114
Email: Elawar@aol.com

October 6, 1997

Atlantic Homes Development Corporation
2 Eaton Street, Suite 1101
Hampton, Virginia 23669

Attn: Mr. Willard W. Morris
President

Re: Geotechnical Engineering Services
Storm Water Management Detention Basins
The Villages At Westminster
James City County, Virginia
FES Project No. 1-701218.001

Dear Mr. Morris:

Pursuant to your request and verbal authorization, Foundation Engineering Science, Inc. (FES) has completed a geotechnical engineering study for the development of The Villages at Westminster in James City County, Virginia. The geotechnical engineering study consisted of performing foundation design recommendations for the existing roadway embankment (acting as a storm water management detention basin at Station Number 15+00 along Wellesley Boulevard, Pond I) and the proposed future storm water management detention basin (Pond II). The geotechnical engineering study consisted of performing soil test borings, a field permeability test and laboratory testing. The information obtained and the available project characteristics were then evaluated in regards to the existing and proposed storm water management detention basins (Pond I and II). Our design recommendations were based on a review of the project plans as prepared by Rickmond Engineering dated August 6, 1997 and revised September 8, 1997, information obtained from Mr. Hank Mullins with H. B. Hankins, Inc. and the subsurface conditions obtained on site during our geotechnical engineering study.

Briefly, based on the results of our geotechnical engineering study, **the existing embankment located along Wellesley Boulevard will be capable of embounding the design normal pool and acting as a dam for the upstream flow.** Embankment slope stability analysis indicate the embankment slopes of three (3) horizontal to one (1) vertical (3H:1V) are stable with a factor of safety in excess of 1.3. A draw down analysis of this retention basin indicated a factor of safety in excess of one (1). A field permeability test performed at approximate elevation of 56 to 58 feet National Geodetic Vertical Datum (NGVD) of 1929, indicated the soils at that location to have an infiltration rate of 1.3xE-01 feet per day (4.6xE-03 meter per second). The soils located in the auger boring (AB-1) performed for the field permeability test are shown in the appendix of this report. We recommend utilizing a factor of safety equal to two (2), in this regard, the design infiltration rate of 6.5xE-02 feet per day (2.3xE-03 meter per second) should be utilized in the design.

The storm water management detention basin (Pond II) should be constructed in general accordance with the State and Local applicable codes and have maximum side slopes of 3H:1V. A key should be utilized and be approximately three (3) feet deep for the entire length of the dam and to full height. The core of the dam should be constructed of impermeable material, such as silty sand (SM) with a PI value not less than six (6), clayey sand (SC) or sandy clay (CL). In addition, quality control and quality assurance should be performed during the construction of the storm water detention basin to insure proper construction methods, the State and Local codes are implemented.

FES appreciates the opportunity to be of service to Atlantic Homes Development Corporation on this important project and look forward to its successful completion. Should you have any questions regarding this report, please do not hesitate to contact the undersigned.

Respectfully submitted,

FOUNDATION ENGINEERING SCIENCE, INC.

10/6/97

Raja S. Elawar, P.E.
Principal
VA Reg. No. 23683

COMMONWEALTH OF VIRGINIA
RAJA S. ELAWAR
No. 026383
PROFESSIONAL ENGINEER

Copies: (2) Client
(1) Rickmond Engineering, Inc. (Mr. Kenneth M. Jenkins, P.E.)

Appendix:
- Figure 1 - USDA Soil Conservation Survey Map
- Figure 2 - USGS Quadrangle Map
- Figure 3 - Boring Location Sketch
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INTRODUCTION

Project Characteristics

The project site is located along Richmond Road (State Route 60) in James City County, Virginia. The proposed Villages At Westminster development is planned to consist of constructing paved roadways, two (2) storm water management detention basins (Ponds I and II), approximately 380 residential lots within four (4) Villages. The Villages are named Gableton, Glenwilton, Roane Ridge and Chaseoaks. The storm water detention basins are expected to be twenty-two (22) to fourteen (14) feet in height for Pond I and II, respectively. The **normal pool design depth is expected to be six (6) feet** for Pond I and II, respectively. Based on review of the design plans as prepared by Rickmond Engineering, Inc., the embankment side slopes are three (3) horizontal to one (1) vertical (3H:1V).

Site Description

During the time of our site visit on September 15, 1997, the initial detention basin, Pond I was located along Wellesley Boulevard (approximate Station Number 15+00) and was accessible to a truck mounted drill rig, however, the second detention basin, Pond II required an all terrain vehicle (ATV) mounted drill rig and was located in a heavily wooded section of the development along an existing stream. Based on our review of the plans prepared by Rickmond Engineering, Inc. the detention basin, Pond I will retain approximately six (6) feet of water and have a final top of berm elevation of 74 feet National Geodetic Vertical Datum (NGVD) of 1929 and a base elevation of 50 feet NGVD. The detention basin, Pond II will retain approximately six (6) feet of water and have a final top of berm elevation of 58 feet NGVD and a base elevation of 44 feet NGVD.

A review of the United States Geological Survey (USGS) Quadrangle maps titled "Norge and Williamsburg, Virginia" published 1983 revealed the approximate development elevations to range from sixty (60) to one hundred and ten (110) feet National Geodetic Vertical Datum (NGVD) of 1929.

PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to obtain information on the general subsurface soil and ground water conditions at the existing and proposed project sites. The subsurface materials encountered were then evaluated with respect to the available project characteristics. In this regard, engineering assessments for the following items were formulated:

1. Development of subsurface soil and ground-water condition within the storm water management detention basin areas.

2. Performed slope stability analysis for the normal pool design and during flooded conditions. In addition performed, embankment settlement and bearing capacity analysis.

3. Suitability and availability of in-situ materials that may be moved during site grading for use as pavement subgrade fill soils and as general backfill (if required).

4. General location and description of potentially deleterious materials encountered in the boring performed which may which may interfere with construction progress or equipment performance, including existing fills or surficial organic (if encountered).

5. Identified critical embankment/dam design, construction details, including normal ground water level and ground water seasonal fluctuations.

6. Measured the hydraulic conductivity of the shallow subsurface soils within the existing and proposed storm water management detention basin area (Pond I). The hydraulic conductivity for the proposed storm water management detention basin area (Pond II) will be performed following completion of the embankment/dam.

The following services were provided in order to achieve the preceding objectives:

1. Reviewed readily available published geologic and topographic information. This published information will be obtained from quadrangle maps published by the United States Geologic Survey (USGS) and "Soil Survey of James City and York Counties and the City of Williamsburg, Virginia" developed by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS).

2. FES executed a program of subsurface exploration consisting of subsurface sampling and field testing. FES performed two (2) Standard Penetration Test (SPT) borings at each detention basin within the area planned for construction (the detention basin at Pond I has been completed). The SPT borings were drilled the location of the earthen dams (existing and proposed) to approximate depths ranging from twenty-five (25) to thirty-five (35) feet below the existing grades. The SPT borings were performed with the use of a power ATV mounted drill rig, in general accordance with ASTM-1586 test method. In the SPT borings, soil samples were collected and Standard Penetration Test resistance N-values will be measured virtually continuously for the top ten (10) feet and on intervals of five (5) feet thereafter.

3. FES performed one (1) field permeability test within the storm water management detention basin area (Pond I) at an approximate depth range of four (4) to six (6) feet below the existing ground surface elevation [an approximate elevation of 62 feet NGVD].

4. Visually classified and stratify representative soil samples in the laboratory using the Unified Soil Classification System (USCS) in general accordance with ASTM D-2487 and D-2488. Conducted a limited laboratory testing program. Identified soil conditions at the boring locations and form an opinion of the site soil stratigraphy.

5. Collected ground-water level measurements in the borings performed.

6. The results of the field exploration and laboratory testing program were utilized in performing engineering evaluation, analysis and in the formulation of foundation system and pavement structural section design recommendations. The results of the field exploration, laboratory testing program, design and construction recommendations are presented in a comprehensive geotechnical engineering report prepared by a professional Geotechnical Engineer.

Report Format

This report begins with a discussion of the field and laboratory programs followed by a description of the general subsurface conditions and earthwork recommendations. Evaluations, design and construction recommendations are presented for the existing Pond I and proposed Pond II. The USDA Soil Conservation Survey, USGS Quadrangle Map and soil boring location sketches are presented on Figures 1, 2 and 3 respectively in the appendix of this report. The boring profiles, laboratory test results and design analysis are presented in the appendix of this report.

FIELD EXPLORATION

In order to explore the general foundation soil types and to aid in developing associated design parameters, a total of four (4) Standard Penetration Test (SPT) soil borings were drilled at locations which were within the existing Pond I and proposed Pond II. In addition, we performed one (1) auger boring within the existing Pond I. These boring locations were located in the field based on existing topographic features and stakes performed by Rickmond Engineering, Inc. The approximate location of the borings are illustrated on Figure 3, which has been included in the appendix of this report. The SPT borings were drilled to approximate depths ranging from twenty-five (25) to thirty-five (35) feet, while the auger boring was drilled to an approximate depth of six (6) feet below the existing ground surface [an approximate ground surface elevation of 62 feet NGVD] .

SPT Borings

The SPT borings were performed with the use of an ATV mounted drill rig utilizing hollow stem auger (HSA) procedures. The soil sampling was performed in general accordance with the American Society of Testing and Materials (ASTM) Test Designation D-1586. These samples were taken continuously from the ground surface to an approximate depth of ten (10) feet and on five (5) foot intervals thereafter. Representative portions of these soil samples were collected, labeled and transported to our office for classification, laboratory testing and analysis.

Auger Borings

The auger boring was performed with the use of a three (3) inch bucket auger. The soil sampling was performed in general accordance with the American Society of Testing and Materials (ASTM) Test Designation D-1452. These samples were taken continuously from the ground surface to boring termination depth. Representative portions of these soil samples were collected, labeled and transported to our office for classification, laboratory testing and analysis.

Field Permeability

One (1) field permeability test (open-hole, constant head method) was performed by initially installing a two (2) inch inside diameter PVC pipe (ground-water observation well) with flush joints to an approximate depth of six (6) feet below the existing grade. The permeability test consisted of a PVC pipe with a close-ended section and a twenty-four (24) inch screen (using a 0.01-inch slot size opening) from forty-eight (48) to sixty-four (64) inches below the existing grade. Coarse sand (#2) was backfilled to six (6) inches above the screened annual space of the well, followed by a one (1) foot bentonite seal placed over the sand. The purpose of this construction method was to restrict upward (test) water flow between well hole and outside wall of the augered hole. The bentonite seal and the neat cement-bentonite mix were allowed to cure for a minimum period of one (1) hour prior to beginning the permeability test.

LABORATORY TESTING

The soil samples were transported to our laboratory and were classified by the Geotechnical Engineer using the Unified Soil Classification System (USCS) in general accordance with ASTM test designations D-2487 and D-2488. Representative soil samples were selected and subjected to grain-size determination (- #200 Sieve) and moisture content determination tests. The laboratory test results are presented in a tabular format below.

LOCATION	APPROX SAMPLE DEPTH (feet)	NATURAL MOISTURE CONTENT (%)	-#200 SIEVE (%)	USCS
Pond I (AB-1)	4 - 6	28.8	86.2	Brown, moist sandy CLAY (CL)

GENERALIZED SUBSURFACE CONDITIONS

USDA Soil Survey

The "Soil Survey of York and James City Counties and the City of Williamsburg, Virginia", published in 1985 by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS), was reviewed for general near-surface soil information within the general project vicinity. This information indicated that there are eight (8) primary mapping units (map numbers 10B, 11C, 15D, 15E, 20B, 29A, 29B and 34B) within the proposed project area. The USDA Soil Conservation Service (SCS) Survey map for the project vicinity is presented on Figure 1 in the appendix of this report. The map soil units encountered are as follows:

SOIL SERIES	SOIL TYPE & DEPTH (INCHES)	USCS[1]	USDA SEASONAL HIGH GROUNDWATER TABLE		K[2] (IN/HR)	SHRINK/SWELL POTENTIAL
			DEPTH (FEET)	MONTHS		
Craven Fine Sandy Loam (10B&C)	0-9 Fine sandy loam 9-30 Clay, silty clay, silty clay loam 30-72 Sandy clay loam, sandy loam, loamy sand	ML, CL-ML, SM, SM-SC CH SM, SM-SC, SC	2 - 3	Dec-Apr	0.6 - 2.0 0.06 - 0.2 0.2 - 6.0	Low Moderate Low
Craven-Uchee Complex (11C)	0-24 Loamy fine sand 24-36 Sandy loam, sandy clay loam 36-56 Sandy clay loam, sandy clay, clay 56-65 Sandy loam, sandy clay loam, Sandy clay	SM SC, SM-SC MH, CH, CL, SC MH, CH, CL, SC	2.0 - 3.0	Dec-Apr	6 - 20 0.6 - 2.0 0.2 - 0.6 0.2 - 2.0	Low Low Moderate Moderate
Emporia Complex (15D)	0-11 Fine sandy loam 11-37 Sandy clay loam, sandy loam,clay loam 37-54 Sandy clay loam, clay loam, sandy clay 54-75 Stratified sandy loam to clay loam	CL, SC, SM, ML SC, CL SC, CL SM, SC, ML, CL	3 - 4.5 Perched	Nov-Apr	2 - 6 0.2 - 2 0.06 - 0.6 0.06 - 2	Low Low Moderate Moderate
Emporia Complex (15E)	0-9 Fine sandy loam 9-37 Sandy clay loam, sandy loam,clay loam 37-50 Sandy clay loam, clay loam, sandy clay 50-75 Stratified sandy loam to clay loam	CL, SC, SM, ML SC, CL SC, CL SM, SC, ML, CL	3 - 4.5 Perched	Nov-Apr	2 - 6 0.2 - 2 0.06 - 0.6 0.06 - 2	Low Low Moderate Moderate
Kenansville loamy fine sand (20B)	0-25 Loamy fine sand 25-43 Sandy loam, fine sandy loam, sandy clay loam 43-78 Sand, loamy sand	SM SM, SC, SM-SC SP-SM, SM, SP	4 - 6	Dec-Apr	6 - 20 2 - 6 6 - 20	Low Low Low
Slagle fine sandy loam (29A&B)	0-9 Fine sandy loam 9-25 Fine sandy loam, sandy clay loam, loam 25-60 Sandy clay loam, loam, clay loam	SM, SC, ML, CL SC, SM-SC, CL, CL-ML SC, CL	1.5 - 3.0 Perched	Nov-Apr	2 - 6 0.6 - 2 0.06 - 0.6	Low Low Moderate
Uchee loamy fine sand (34B&C)	0-24 Loamy fine sand 24-36 Sandy loam, sandy clay loam 36-56 Sandy clay loam, sandy clay, clay 56-65 Sandy loam, sandy clay loam, sandy clay	SM SC, SM-SC MH, CH, CL, SC MH, CH, CL, SC	3.5 - 5.0 Perched	Jan-Apr	6 - 20 0.6 - 2 0.2 - 0.6 0.2 - 2	Low Low Moderate Moderate

[1] USCS = Unified Soil Classification System
[2] K = Permeability

USGS Topographic Survey

The topographic survey map published by the United States Geological Survey titled "Williamsburg and Norge, Virginia" dated 1983 was reviewed for ground surface features at the proposed project location. Based on this review, the natural ground surface elevation ranges from approximately sixty (60) to one hundred ten (110) feet National Geodetic Vertical Datum of 1929 (NGVD). The USGS topographic map for the project vicinity is presented on Figure 2 in the appendix of this report.

Subsurface Soil Conditions

Soil stratification was based on visual examination of the recovered soil samples, laboratory testing and interpretation of the field boring logs by an experienced geotechnical engineer. The boring stratification lines represent the approximate boundaries between soil types of significantly different engineering properties; however, the actual transition may be gradual. In some cases, small variations in properties not considered pertinent to our engineering evaluation may have been abbreviated or omitted for clarity. The boring profiles present the conditions at the particular boring location and variations do occur among the borings and between soil samples. On this basis, the subsurface soils encountered generally consisted of approximately two (2) to three (3) inches of dark brown silty fine sand (SM) with roots "Topsoil" underlain by two (2) to three (3) layer soil configurations.

Pond I

The initial soil layer was encountered from below the "Topsoil" to approximate depths ranging from eighteen (18) to twenty-three (23) feet below the existing ground surface. This soil layer consisted of "Earth Fill" with interbedded layers ranging from silty sand (SM) to sandy clay (CL). The Standard Penetration Test N-values recorded within this soil layer ranged from 4 to 16 blows per foot (bpf), indicating these soils of soft to stiff consistency for the clay and loose to medium dense relative density for the sand.

The second soil layer was encountered from approximate depths ranging from eighteen (18) to twenty-three (23) feet to boring termination depths [approximate depths ranging from twenty-five (25) thirty-five (35) feet below the ground surface]. This soil layer consisted of brown to gray, saturated silty to clayey sand (SM-SC) with shell fragments "Yorktown Formation". The Standard Penetration Test N-values recorded within this soil layer ranged from 2 to 16 bpf, indicating this soil layer to be of a very loose to medium dense relative density.

Pond II

The initial soil layer was encountered from below the "Topsoil" to an approximate depth of eight (8) feet below the existing ground surface. This soil layer consisted of silty to clayey sand (SM-SC). The Standard Penetration Test N-values recorded within this soil layer ranged from 8 to 19 blows per foot (bpf), indicating this soil layer to be of loose to medium dense relative density for the sand.

The second soil layer was encountered from an approximate depth of eight (8) feet to an approximate depth of thirteen (13) feet below the existing ground surface. This soil

layer consisted of a gray, saturated clayey silt (ML). The Standard Penetration Test N-value recorded within this soil layer was on the order of 14 bpf, indicating this soil layer to be of a stiff consistency.

The final soil layer was encountered from an approximate depth of thirteen (13) to boring termination depth [an approximate depth of twenty-five (25) feet below the ground surface]. This soil layer consisted of a gray, saturated silty sand (SM) with shell fragments "Yorktown Formation". The Standard Penetration Test N-values recorded within this soil layer ranged from 10 to 20 bpf, indicating this soil layer to be of a loose to medium dense relative density.

The soils encountered typically have low to moderate potential for shrink/swell behavior to moisture variations. Specific details concerning the subsurface materials and conditions encountered at each test location during the subsurface exploration program may be obtained from the soil boring profiles located in the appendix of this report.

Ground Water Conditions

The existing ground water was recorded immediately after drilling during the time of our subsurface exploration on September 24, 1997, and corroborated through a visual examination of the obtained soil samples. The ground water level was encountered at an approximate depth of eighteen (18) to twenty (20) feet below the existing ground surface at Pond I and six (6) feet below the existing ground surface at Pond II at the tested locations. It should be noted, that ground water levels tend to fluctuate during periods of prolonged drought and extended rainfall and may be effected by man-made influences. In addition, a seasonal effect may also occur in which higher ground water levels are normally recorded in rainy seasons. In this regard, it is estimated that the seasonal normal high ground water levels will be encountered at approximate depths of ten (10) feet below the existing grades at Pond I and one (1) foot at Pond II.

If the ground water level is critical to design or construction, ground-water observation wells should be installed on-site to monitor ground water fluctuations over a period of time and permit more accurate determinations of wet season and dry season levels.

EARTHWORK RECOMMENDATIONS

General

The soil borings performed indicated approximately two (2) to three (3) inches of "Topsoil" overlie the Pond site areas was observed. In general, the subsurface soils encountered in the borings performed consisted of earth fill at Pond I (sandy clay and clayey sand) and silty to clayey sand at Pond II.

Clearing

Prior to construction, the location of any existing underground utility lines within the construction area should be established. Provisions should then be made to relocate any interfering utility lines within the construction area to appropriate locations. In this regard, it should be noted that if

underground pipes are not properly removed or plugged, they may serve as conduits for subsurface erosion which subsequently may result in excessive settlements.

The site (Pond II) should be cleared; this primarily includes removing the "Topsoil" surficial layer, ground brushes, trees and any soft soils located within the existing stream. We recommend that this unsuitable material be removed to the satisfaction of a Professional "Geotechnical" Engineer, prior to beginning construction at this site. Based on the near-surface soils encountered, it is expected that a minimum of three (3) inches of "Topsoil" will be required to be removed from the embankment/dam area. We recommend that the clearing operations extend a minimum of five (5) feet beyond the embankment foot print area. The unsuitable "Topsoil" removed from the embankment area should be stockpiled in designated locations and used in areas to be grassed.

Grading

The excavated/cleared exposed subgrade should be evaluated by a Professional "Geotechnical" Engineer to confirm that all unsuitable surficial materials have been removed. Following the approval of the Professional "Geotechnical" Engineer, it is recommended that within the embankment and key area, the exposed subgrade be compacted to a dry density of at least 95.0 percent of the Standard Proctor maximum dry density in general accordance with ASTM test designation D-698 to a minimum depth of twelve (12) inches.

Prior to beginning compaction, soil moisture contents may need to be controlled in order to facilitate proper compaction. If less moisture is necessary to achieve compaction objectives, then the soil should be properly aerated; if additional moisture is necessary to achieve compaction objectives, then water should be applied in such a way that it will not cause erosion or removal of the subgrade soils. A moisture content within three (3) percentage points of the optimum indicated by the Standard Proctor test (ASTM D-698) is recommended.

The exposed compacted subgrade should be proof rolled with a fully-loaded tandem wheeled dump truck [approximate minimum loaded weight of twenty (20) tons] to check for soft pockets materials hidden beneath a thin crust of better soil. Depending on the conditions of these exposed soils, some undercutting or stabilization may be necessary. Any soft, yielding areas should be removed and replaced with a well-compacted material under the guidance of professional Geotechnical Engineer or his representative.

Following the compaction operation and after achieving passing densities and a stable subgrade, begin backfilling with suitable [impervious material within the core] fill in general accordance with the project plans and specifications.

Structural Fill

All materials to be used for backfill or compacted fill construction should be evaluated and tested by a consulting firm that specializes in construction materials testing prior to placement to determine if they are suitable for the intended use. Suitable fill materials should consist of sand with more than thirty-five percent (35%) passing the No. 200 sieve, having a liquid limit more than thirty (30) percent and plasticity index more than six (6). This material may be classified as SM, SM-SC, SC, CL or ML and should be free of rubble, organic, debris and other deleterious material. Additionally, all excavated

in-situ soils which do not contain debris, organic matter and classified as "Topsoil" may be utilized upon classification and approval by a Professional "Geotechnical" Engineer.

All structural fill should be compacted to a dry density of at least 95.0 percent of the Standard Proctor maximum dry density (ASTM D-698). In general, the compaction should be accomplished by placing the fill in maximum eight (8) inches loose lifts and mechanically compacting each lift to at least the specified minimum dry density.

Backfill in utility trenches and beneath structure areas should be compacted in four (4) to six (6) inch lifts to the above specified densities using hand compaction equipment. In addition, in order to facilitate construction, the soils utilized to backfill utility trenches should consist of clean sand with less than twenty percent (20%) passing the No. 200 Sieve (SP, SP-SM and SM). A qualified, experienced, and certified Engineering Technician under the direct supervision of a professional Geotechnical Engineer should perform field density tests on each lift as necessary to assure that adequate compaction is achieved.

Foundation Excavations

All foundation excavations should be observed by a Professional "Geotechnical" Engineer or his representative to explore the extent of any fill and excessively loose, soft, or otherwise undesirable materials. If soft pockets are encountered in the foundation excavations, the unsuitable materials should be removed. The proposed foundation base elevation may be re-established by backfilling after the undesirable material has been removed. This backfilling may be done with on site excavated material [free of rubble, organic, debris and other deleterious material], that consist of sand with more than thirty-five percent (35%) passing the No. 200 sieve, having a liquid limit more than thirty (30) percent and plasticity index more than six (6). This material may be classified as SM, SM-SC, SC, CL or ML.

Temporary Side Slopes

Side slopes for temporary excavations may stand near one (1) horizontal to one (1) vertical (1H:1V) for short dry periods of time and a maximum excavation depth of four (4) feet. Where restrictions do not permit slopes to be constructed as recommended above, the excavation should be shored in accordance with current OSHA requirements. Furthermore, open-cut excavations up to a maximum depth of ten (10) feet (for periods longer than 24 hours) should be properly de-watered and sloped on 1½H:1V or flatter slopes or be braced using an approved bracing plan. In addition, any open-cut excavations adjacent to existing structures should be evaluated by a geotechnical engineer on a case-by-case basis. During foundation construction, excavated materials should not be stockpiled at the top of the slope within a horizontal distance equal to the excavation depth.

Ground-Water Control

Depending upon ground-water levels at the time of construction, some form of dewatering may be required to achieve the required compaction. Ground-water can normally be controlled in shallow excavations with a sump pump. During subgrade soil preparation any plastic soils below design grade could become disturbed by construction activities. If this becomes the case, the contractor may be directed by the owners representative to remove the disturbed or pumping soils to a depth of 12 to

18 inches below design grade and backfill the area with structural fill. Depending on the seasonal conditions, some seepage from water bearing pervious seams located at shallow depths may occur. It is anticipated that such seams could be handled by simple de-watering methods such as by pumping from sumps. The ground-water table is expected to interfere with construction activities (Pond II) as it was encountered in the borings at an approximate depth of six (6) feet below the existing grades and within the existing Stream.

On-Site Soil Suitability

All materials to be used for backfill or compacted fill construction should be evaluated and, if necessary, tested by a consulting firm that specializes in construction materials testing, prior to placement to determine if they are suitable for the intended use. In general, based on the boring results, the majority of the on-site sandy soils (SM-SC and SC) are expected to be acceptable for use as structural fill in the embankment and core areas and as general subgrade fill and backfill in other areas, provided the fill material is free of rubble, rock [greater than four (4) inches], roots and organic. Borrow materials used as fill should be approved by a Professional "Geotechnical" Engineer prior to their acquisition.

These recommendations are considered minimum for the site-soil and embankment/dam construction. However, the final dam design should be performed by the project Civil Engineer using information obtained during the geotechnical engineering study and the design drainage for each Pond at the project site.

EMBANKMENT/DAM DESIGN RECOMMENDATIONS

The following design recommendations have been developed on the basis of the previously described project characteristics and subsurface conditions encountered. If there is any change in these project criteria, including project location on the site, a review must be made by FES to determine if any modifications in the recommendations will be required. The findings of such a review should be presented in a supplemental report.

Once final design plans and specifications are available, a general review by FES is strongly recommended as means to check that the evaluations made in preparation of this report are correct and that earthwork and design recommendations are properly interpreted and implemented.

Embankment/Dam

The embankment/dam should be constructed by utilizing a key and a core. The key should be designed by the Civil Engineer but in no case should be less than three (3) feet deep and six (6) feet wide at the base with side slopes no less than one and one half (1.5) horizontal to one (1) vertical (1.5H:1V). The key and core of the dam [located within slopes steeper than 1.5H:1V] should be constructed of impermeable material as discussed in the earthwork recommendation section of this report. The remaining embankment material should consist of sandy soils or on site excavated material free of organic, rubbles or material greater than four (4) inches in size.

The side slopes of the final embankment/dam should be no steeper than 3H:1V and protected in the upstream by erosion control measures to the normal pool design elevation [such as heavy sodding or rip rap]. The steepest slopes recommended by the United States Department of the Interior, Bureau of Reclamation, for small, homogeneous dams on stable foundation is 2.5H:1V.

We recommend that all existing soft soils, organic soils within five (5) feet of the embankment/dam foot print be removed and replaced with compacted structural fill (impermeable). In addition, we recommend that the embankment/dam be constructed with a blanket drain on the down stream slope. Dewatering during construction may be needed to build the key and primary spillway. The blanket drain should extend along the down stream side of the embankment/dam and a geotextile engineered fabric [such as Mirafi 140N or approved equivalent] should be utilized to separate the well graded gravel filter soils/rock from the compacted fill and subgrade soils.

Primary And Emergency Spillway

The primary spillway should consist of minimum of 30-inch pipe with a minimum of 48-inch riser designed by the project Civil Engineer. The primary spillway should be constructed with seepage collars. The inclusion of seepage collars around the primary spillway increases the length of the seepage path which will reduce the potential for piping. However, the seepage collars are very difficult to compact around and these loose zones of soil could cause piping instead of preventing it. If seepage collars are included in the design, the lower portions of the collars should be backfilled with lean concrete or flowable fill.

The primary spillway pipe should be placed on a concrete cradle. The cradle should be poured on the foundation soils and the sides of the cradle should be formed with a slope to facilitate compaction around the cradle. If primary spillways are constructed in a trench, the sides of the trenches should be sloped no steeper than 1.5H:1V and sufficient clearance on either side of the pipe should be provided to allow space for the construction of the concrete cradle and hand operated mechanical compaction
equipment.

If an emergency spillway is constructed, the spillway should be a minimum of ten (10) feet wide, heavily sodded to protect against erosion.

Embankment Settlement

The existing embankment/dam (Pond I) located along Wellesley Boulevard was constructed approximately over one (1) year before performing the geotechnical engineering study. In addition, the soils encountered consisted of granular/cohesionless material, in this regard, we do not anticipate that would pose major limitations to the existing embankment. We estimated that the majority of the soil settlements have been completed and the remaining settlements are expected to be negligible for this crossing (Pond I).

The foundation soils located within the influence of the maximum stress from the base of the shallow foundations consisted of loose to medium dense sand, in this regard the majority of settlements should occur during the embankment/dam construction phase as dead loads are imposed. The total settlements for the proposed embankment/dam is not expected to exceed approximately one (1) inch

with differential settlements on the order of fifty percent (50%) of the total settlements, with the subgrade preparation recommended herein. Differential settlements of these magnitudes are usually considered tolerable for the anticipated embankment/dam construction.

Slope Stability

We performed slope stability analysis for the existing and proposed embankments/dams by a two-dimensional limit equilibrium method using the computer program "PCSTABL6". This program was developed at Purdue University under sponsorship of the Federal Highway Administration (FHWA). The program uses the method of slices to determine the safety factor against deep seated circular failure.

Using the three (3) horizontal to one (1) vertical (3H:1V) slope, we evaluated the stability against slope failure at the highest embankment [22 feet at Pond I and 14 feet at Pond II]. The soil parameters were developed from the SPT borings performed at each pond. Input data for the subsurface soils obtained using general correlations from laboratory test data and Standard Penetrations Test N-values. The safety factor for the highest embankment/dam at Pond I and Pond II were computed to exceed 1.3. The results of the slope stability analysis are included in the appendix of this report.

Storm Water Management Detention Basin Seepage

One (1) hand auger boring was performed within the storm water management detention basin (Pond I). The purpose of the hand auger boring was to determine the soil conditions and the ground-water level. The results of the hand auger boring are presented on the attached Boring Profile Sheets (AB-1). The purpose of the field permeability test was to determine the hydraulic conductivity of the subsurface soils within the recently constructed embankment/dam (Pond I). A field permeability was not performed at Pond II. Following completion of the embankment/dam at Pond II, a field permeability will be performed and submitted in a separate report.

Water was pumped into the well [for a minimum time period of one (1) hour] in order to create a ground-water "mounding" effect surrounding the screened section. Once ground-water mounding was achieved, water was added to the well to insure a constant head. This process was repeated several time until we achieved a constant rate of flow over a three (3) consecutive readings at which time the test was terminated.

The collected field data was reduced using a computer model representing the U.S. Department of the Navy, Naval Facilities Engineering Command equation for determining the coefficient of permeability of the subject soil stratum. The infiltration rate was calculated to be 1.3xE-01 feet per day (4.6xE-03 meter per second). In sizing the storm water management area, the infiltration rate presented in this report should be used conservatively with proper application of a safety factor [minimum of two (2)]. In this regard, it is recommended that the design infiltration rate of 6.5xE-02 feet per day (2.3xE-3 meter per second) be utilized.

The height of the ground-water mound and the rate of recovery of the storm water management area depends upon several factors, including:

- The thickness, porosity and hydraulic conductivity of the receiving surficial aquifer (ground-water table).

- Ambient ground-water level in the surficial aquifer.
- The leakage coefficient of the semi-confining unit (if any), inter-aquifer head difference and transmissibility of these aquifers.
- The geometry of the hydraulically loaded area.
- The influence of nearby surface and subsurface drainage features such as canals, creeks and wetlands.

Embankment/Dam Fill Preparation

The performance and life of the embankments/dams is greatly dependent on the quality control during construction, as soil variations may occur along the construction site. As such, the following field control procedures are strongly recommended to insure proper construction and stability of the embankments/dams are achieved.

1. The development area plus a margin of five (5) feet should be stripped and cleared of surface vegetation, organic or root laden topsoil, roots and stumps (if encountered). Any "Topsoil" removed from the construction areas should be stockpiled in designated locations and used in areas to be grassed. Any undercut soils removed from the construction areas should be evaluated by a an experienced "Geotechnical" Engineer to determine their suitability as general embankment/dam fill material.

2. Compact the cleared, undercut and stripped subgrade areas to a minimum of 95.0 percent of the maximum Standard Proctor dry density in general accordance with ASTM D-698 for a minimum depth of twelve (12) inches.

3. Compaction should be accomplished with a large sheepsfoot roller or equivalent compacting equipment. A minimum of eight (8) overlapping passes should be made at the bottom of the excavation in a cris-cross pattern by the compacting equipment. The compacting equipment should have a minimum static drum weight on the order of six (6) to eight (8) tons. Care should be exercised when operating the compactor adjacent to existing structure. We recommend performing static compaction within fifty (50) feet of existing structures (if any).

4. Prior to beginning compaction, soil moisture contents may need to be controlled in order to facilitate proper compaction. If additional moisture is necessary to achieve compaction objectives of improved fill, then water should be applied in such a way that it will not cause erosion or removal of the subgrade soils. A moisture content within three (3) percentage points of the optimum indicated by the Standard Proctor test in general accordance with ASTM D-698 is recommended prior to compaction.

5. Proof-roll the excavated/compacted subgrade area. Proof-rolling should be accomplished with a fully-loaded, tandem-wheeled dump truck not weighing less than twenty (20) tons to check for pockets of soft materials hidden beneath a thick crust of better soil. Depending on the conditions of these exposed soils, some undercutting and/or Geogrid (TENSAR BX-1100 or approved equivalent) soil stabilization may become necessary. Any soft, yielding areas should be removed and replaced with a well-compacted material under the guidance of a Professional "Geotechnical" Engineer.

6. Following satisfactory completion of the initial compaction/proof-rolling at the excavated area, the proposed embankment/dam areas may be brought up to finished final elevations. Approved sand fill should be placed in loose lifts not exceeding twelve (12) inches in thickness and should be compacted to a minimum of 95.0 percent of the maximum Standard Proctor dry density in general accordance with ASTM D-698. Density tests to confirm compaction should be performed at intervals not exceeding fifty (50) feet on-center and on each fill lift before the next lift is placed.

7. The top six (6) inches of the final design subgrade elevation (if utilized for future traffic) should be compacted to a dry density of at least 100.0 percent of the Standard Proctor maximum dry density (ASTM D-698).

GENERAL CONDITIONS

The design recommendations have been developed on the basis of the previously described project characteristics and subsurface conditions. If there is any change in these project criteria, including project location on the site, a review must be made by FES to determine if any modifications in the recommendations will be required. The findings of such a review should be presented in a supplemental report.

These recommendations were developed from the information obtained in the test borings which depict subsurface conditions only at these specific locations and at the particular time designated on the boring profiles. Soil conditions at other locations may differ from conditions occurring at these boring locations. In addition, the passage of time may result in a change to the soil conditions at these boring locations. The nature and extent of variations between the borings may not become evident until the course of construction. If variations then appear evident, it will be necessary for a re-evaluation of the recommendations presented in this report. A complete re-evaluation of the previous recommendations will be performed after completing on-site observations during the construction period and noting the characteristics of any variation. We recommended that Foundation Engineering Science, Inc. be retained during the construction phase of this project as the Geotechnical Engineer of Records.

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted Geotechnical Engineering Principles and Practices. Foundation Engineering Science, Inc. is not responsible for the conclusions, opinions or recommendations made by others based on this geotechnical engineering services report.

APPENDIX

- Figures
- Boring Profile Sheets
- Design Analysis

FIGURES

Figure 1 - USDA Soil Conservation Survey

Figure 2 - USGS Quadrangle Map

Figure 3 - Boring Location Sketch

FIGURE 1

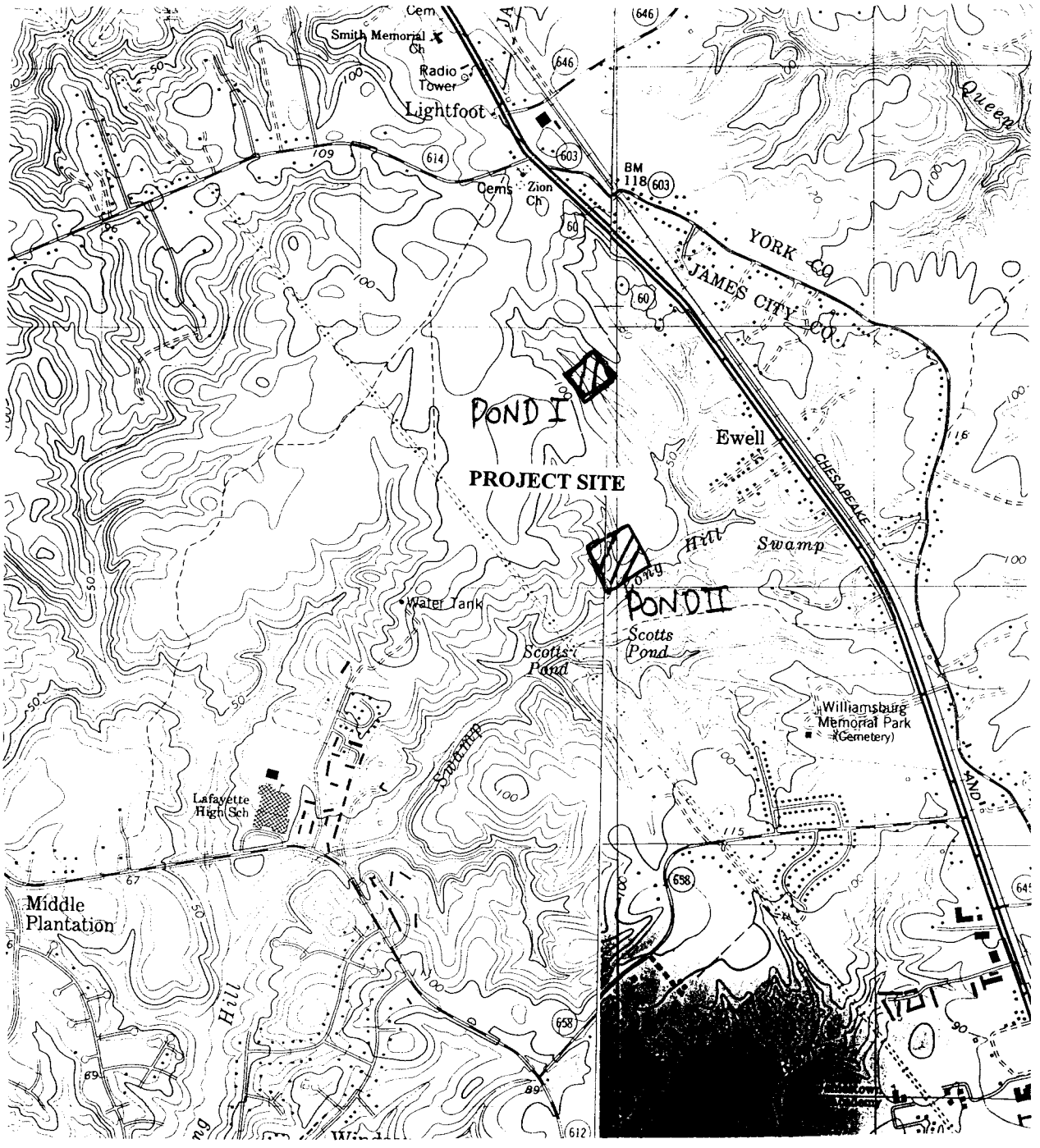
USDA SOIL CONSERVATION SURVEY MAP

"The Soil Survey of James City and York Counties and the City of Williamsburg, Virginia"

PROJECT NAME:	Storm Water Management Detention Basins The Villages at Westminster		
LOCATION:	James City County, Virginia	SCALE:	1":20001
FES PROJECT NUMBER:	1-701218.001	DATE:	October, 1997
CLIENT:	Atlantic Homes Development Corporation		

FOUNDATION ENGINEERING SCIENCE, INC.

FIGURE 2

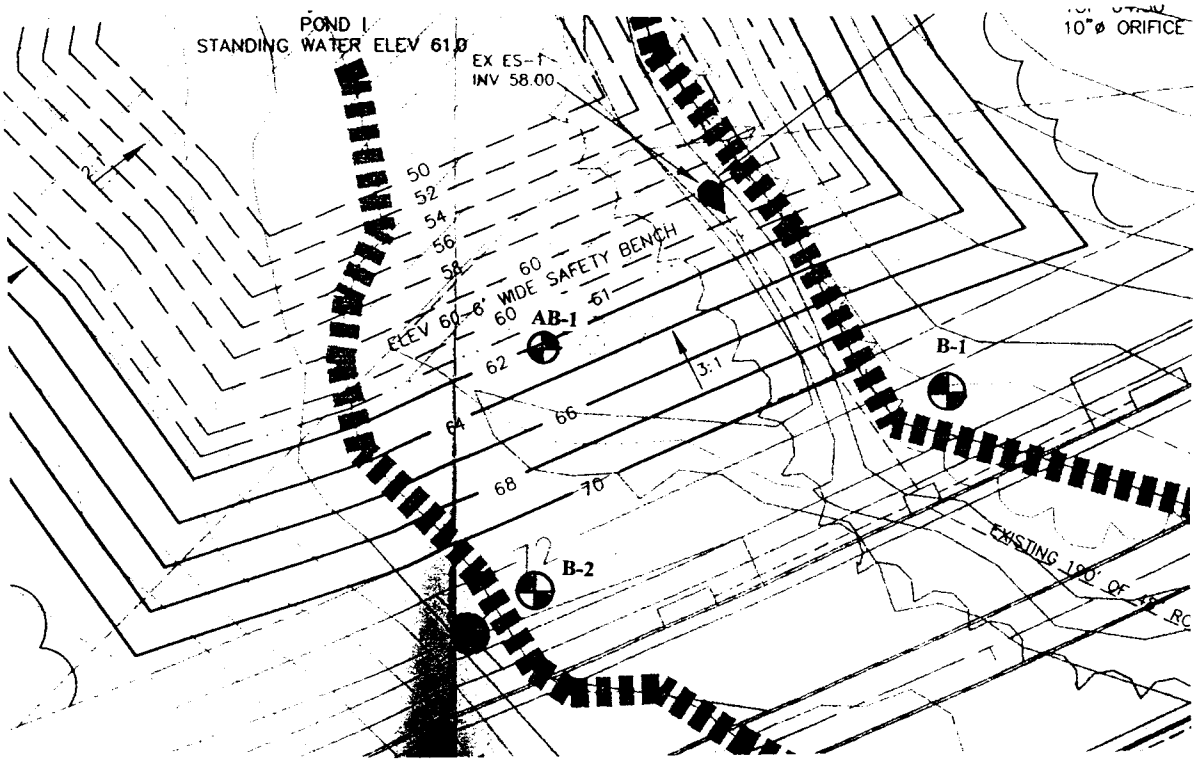


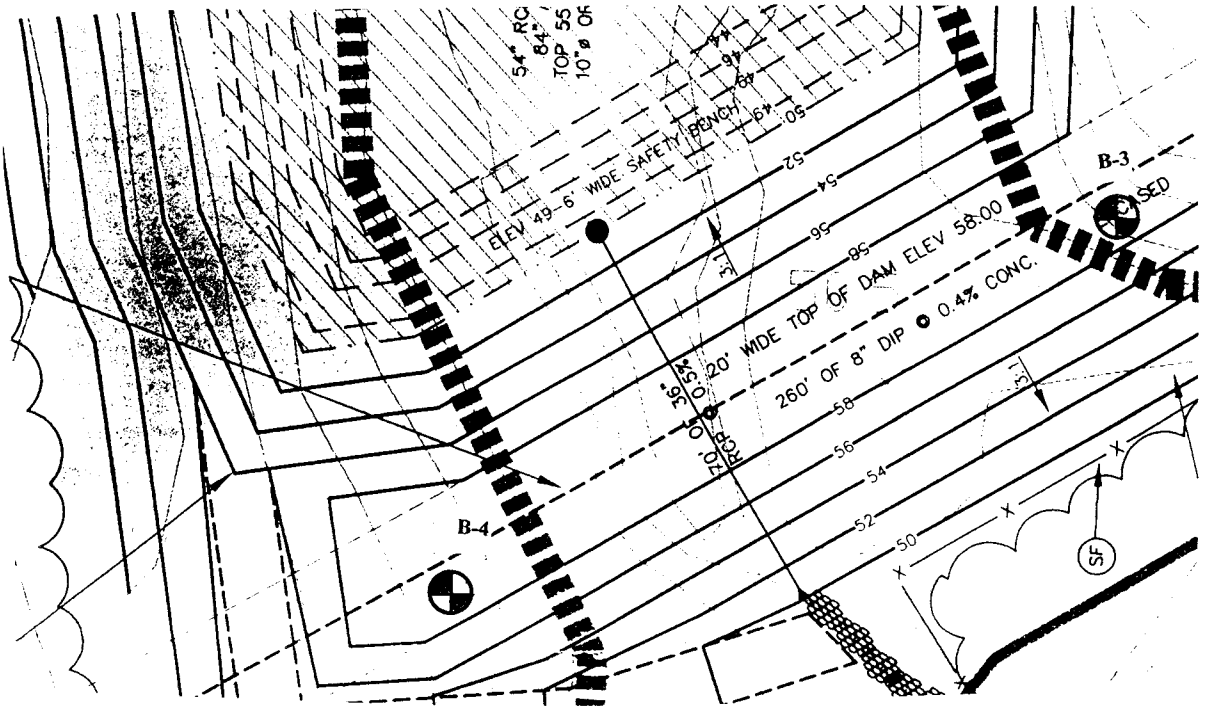
USGS QUADRANGLE MAP
"Norge and Williamsburg, Virginia"

PROJECT NAME:	Storm Water Management Detention Basins The Villages at Westminster		
LOCATION:	James City County, Virginia	SCALE:	1:24000
FES PROJECT NUMBER:	1-701218.001	DATE:	October, 1997
CLIENT:	Atlantic Homes Development Corporation		

FOUNDATION ENGINEERING SCIENCE, INC.

FIGURE 3





BORING LOCATION SKETCH

PROJECT NAME:	Storm Water Management Detention Basins The Villages at Westminster		
LOCATION:	James City County, Virginia	SCALE:	N/A
FES PROJECT NUMBER:	1-701218.001	DATE:	October, 1997
CLIENT:	Atlantic Homes Development Corporation		

FOUNDATION ENGINEERING SCIENCE, INC.

BORING PROFILE SHEETS

FOUNDATION ENGINEERING SCIENCE, INC.

PROJECT NAME: Storm Water Management Detention Basins, The Villages at Westminister	**PROJECT NO.:** 1-701218.001	**BORING NO.:** AB-1
CLIENT: Atlantic Homes Development Corp.	**BORING LOCATION:** See Figure 3	**DATE:** September 23, 1997
PROJECT LOCATION: James City County, Virginia	**DRILLING METHOD:** Hand Auger	**BORING DEPTH:** 6 Feet
FES REPRESENTATIVE: J. Norman	**OBSERVED G.W.T.:** > 6 Feet	**STATION NO.:** N/A

DEPTH (FEET)	LEGEND	SOIL SYMBOL	SOIL DESCRIPTION	REMARKS
0.00		SM	Dark brown, moist silty fine SAND with roots "TOPSOIL"	
		SM-SC	Brown, moist, interbedded, silty to clayey SAND and sandy CLAY with trace organic, "Earthfill"	
		CL		
5.00				
			Boring terminated @ 6 feet	
10.00				

FOUNDATION ENGINEERING SCIENCE, INC.

PROJECT NAME: Storm Water Management Detention Basins The Villages at Westminister	**PROJECT NO.:** 1-701218.001	**BORING NO.:** B-1
CLIENT: Atlantic Homes Development Corp.	**BORING LOCATION:** See Figure 3	**DATE:** September 24, 1997
PROJECT LOCATION: James City County, Virginia	**DRILLING METHOD:** Hollow Stem Auger	**BORING DEPTH:** 25 Feet
FES REPRESENTATIVE: J. Norman	**OBSERVED G.W.T.:** 18 Feet	**STATION NO.:** N/A

DEPTH (FEET)	LEGEND	SOIL SYMBOL	SOIL DESCRIPTION	SPT N-VALUE	REMARKS
0.00		SM-SC	Brown, moist silty to clayey SAND with trace of organic, "Earthfill"	4-4-4-4	2" Topsoil
				6-6-5-7	
5.00				4-4-6-8	
		CL	Brown, moist sandy CLAY with trace organic, "Earthfill"	5-6-7-8	
		SC	Brown to gray, moist clayey SAND with trace organic, "Earthfill"		
10.00				5-6-8-10	
		SM	Brown, moist silty SAND, "Possible Earthfill"	6-6-8-9	
15.00					
		SM-SC	Gray, saturated silty to clayey SAND with shell fragments ["Yorktown Formation"], Loose	3-3-4-5	
20.00					
				4-4-3-5	
25.00			Boring terminated @ 25 feet		
30.00					
35.00					

FOUNDATION ENGINEERING SCIENCE, INC.

PROJECT NAME: Storm Water Management Detention Basins The Villages at Westminister	**PROJECT NO.:** 1-701218.001	**BORING NO.:** B-2
CLIENT: Atlantic Homes Development Corp.	**BORING LOCATION:** See Figure 3	**DATE:** September 24, 1997
PROJECT LOCATION: James City County, Virginia	**DRILLING METHOD:** Hollow Stem Auger	**BORING DEPTH:** 35 Feet
FES REPRESENTATIVE: J. Norman	**OBSERVED G.W.T.:** 20 Feet	**STATION NO.:** N/A

DEPTH (FEET)	LEGEND	SOIL SYMBOL	SOIL DESCRIPTION	SPT N-VALUE	REMARKS
0.00		SM-SC	Brown, moist silty to clayey SAND with trace organic and fine gravel, "Earthfill"	4-4-6-6	2" Topsoil
				4-5-6-5	
5.00				3-3-4-5	
				9-8-8-8	
10.00				4-8-8-10	
		CL	Brown to gray, moist to saturated sandy CLAY, "Possible Earthfill"	3-3-4-5	
15.00					
				1-2-2-2	
20.00					
		SM-SC	Brown to gray, saturated silty to clayey SAND with shell fragments, ["Yorktown Formation"]	1-1-1-2	
25.00			Very loose to medium dense		
				5-6-6-7	
30.00					
				5-8-8-12	
35.00			Boring terminated @ 35 feet		

FOUNDATION ENGINEERING SCIENCE, INC.

PROJECT NAME: Storm Water Management Detention Basins The Villages at Westminister	**PROJECT NO.:** 1-701218.001	**BORING NO.:** B-3
CLIENT: Atlantic Homes Development Corp.	**BORING LOCATION:** See Figure 3	**DATE:** September 24, 1997
PROJECT LOCATION: James City County, Virginia	**DRILLING METHOD:** Hollow Stem Auger	**BORING DEPTH:** 25 Feet
FES REPRESENTATIVE: J. Norman	**OBSERVED G.W.T.:** 6 Feet	**STATION NO.:** N/A

DEPTH (FEET)	LEGEND	SOIL SYMBOL	SOIL DESCRIPTION	SPT N-VALUE	REMARKS
0.00		SM-SC	Brown, moist to saturated silty to clayey SAND, Loose to medium dense	3-6-7-8	3" Topsoil
				4-6-6-8	
				3-4-4-6	
5.00				9-5-8-9	
		ML	Gray, saturated clayey SILT, Stiff	3-6-8-18	
10.00					
		SM	Gray, saturated silty SAND and shell fragments "Yorktown Formation", meduim dense	3-4-6-7	
15.00					
				6-8-8-12	
20.00					
				9-10-10-11	
25.00			Boring terminated @ 25 feet		
30.00					
35.00					

FOUNDATION ENGINEERING SCIENCE, INC.

PROJECT NAME: Storm Water Management Detention Basins The Villages at Westminister	**PROJECT NO.:** 1-701218.001	**BORING NO.:** B-4
CLIENT: Atlantic Homes Development Corp.	**BORING LOCATION:** See Figure 3	**DATE:** September 24, 1997
PROJECT LOCATION: James City County, Virginia	**DRILLING METHOD:** Hollow Stem Auger	**BORING DEPTH:** 25 Feet
FES REPRESENTATIVE: J. Norman	**OBSERVED G.W.T.:** 6 Feet	**STATION NO.:** N/A

DEPTH (FEET)	LEGEND	SOIL SYMBOL	SOIL DESCRIPTION	SPT N-VALUE	REMARKS
0.00		SM	Brown, moist silty SAND, Medium dense	2-4-6-10	3" Topsoil
		CL	Brown, moist sandy CLAY, Very stiff	10-10-9-8	
		SC	Brown to gray, moist to saturated clayey SAND, Very stiff	4-8-10-10	
5.00				7-5-5-6	
		SM	Brown to gray, saturated silty SAND and shell fragments "Yorktown Formation"	1-1-2-6	
10.00			, Very loose to medium dense		
				6-6-6-6	
15.00					
				7-6-5-6	
20.00					
				8-9-7-9	
25.00			Boring terminated @ 25 feetf		
30.00					
35.00					

DESIGN ANALYSIS

FOUNDATION ENGINEERING SCIENCE, INC.

Date 10/5/97

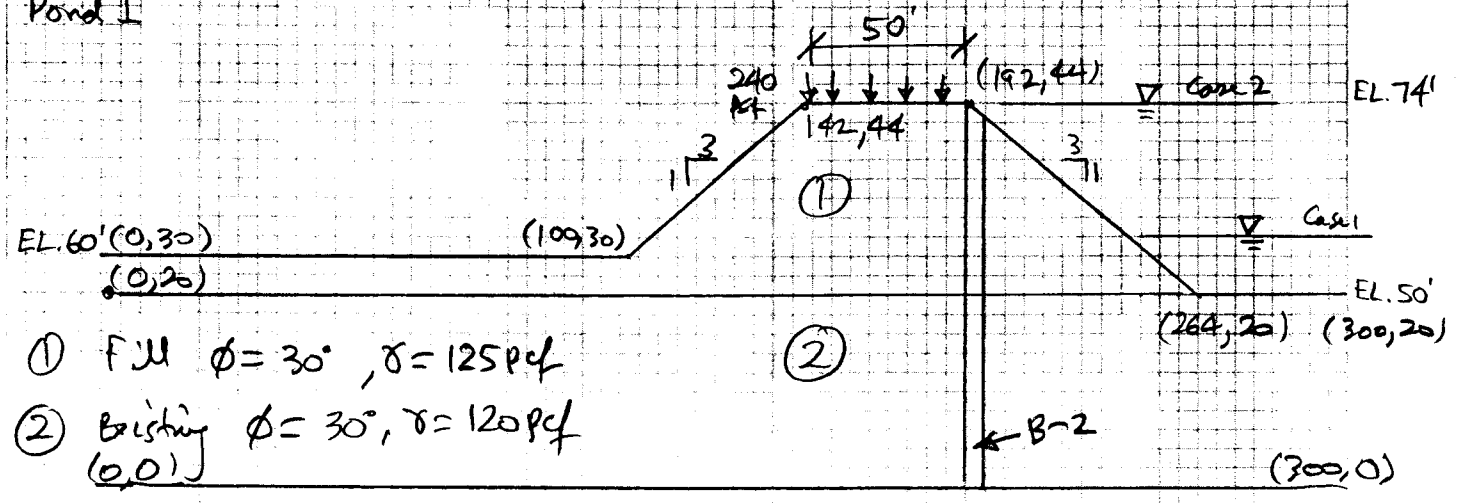
Project No. 1-701218

Subject Stormwater Management Detention Basins By R.S. Elawar

Page 1 of

Embankment Slope Stability

Pond I



① Fill $\phi = 30°$, $\gamma = 125$ pcf

② Existing $\phi = 30°$, $\gamma = 120$ pcf
(0,0)

Case 1 – Normal Pool

Case 2 – Drawdown

Case 3 – Upstream Failure (Reverse analysis of Case 1).

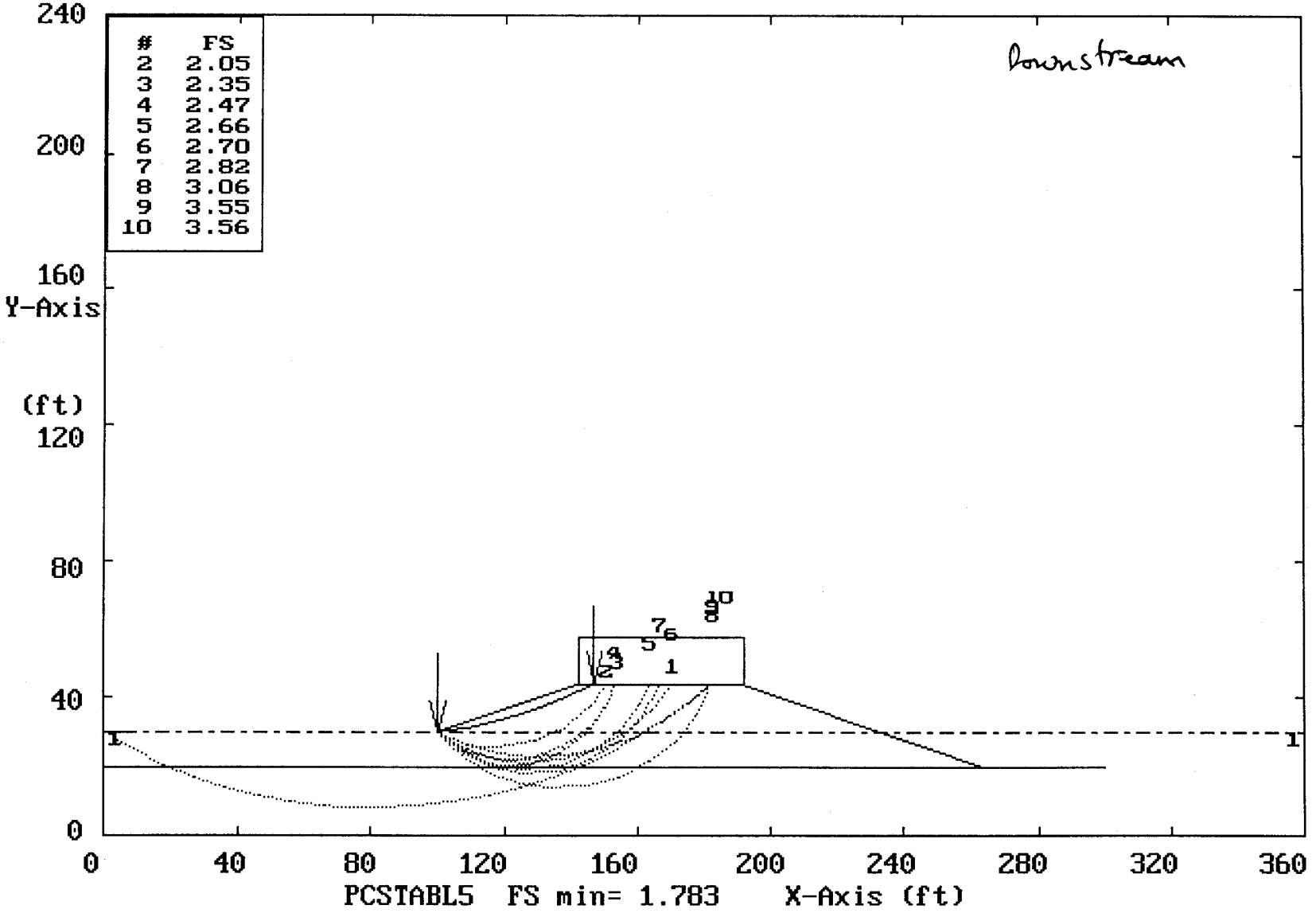
Soil conditions @ Pond II are better than at Pond I and embankment height at Pond II is less than at Pond I. Therefore, if the criteria are satisfied at Pond I, the analysis will not be performed for Pond II.

The factors of safety for downstream, upstream and drawdown conditions are 2.0, 1.7, and 1.1, respectively. Therefore, the embankment/Dam is stable against slope failure.

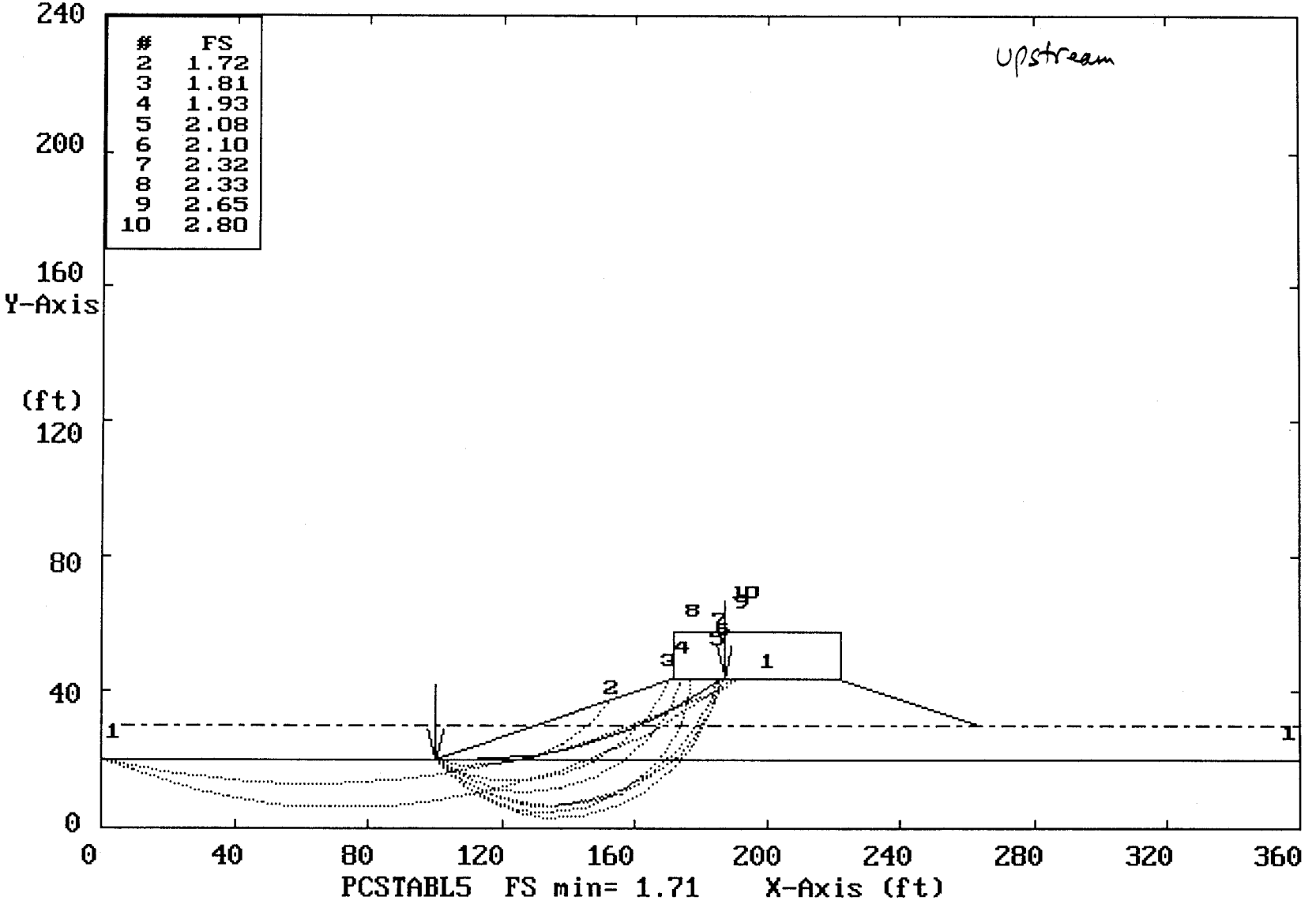
Embankment Settlement

The embankment @ Pond I was completed over one (1) year ago, the subsurface soil conditions are cohesionless, in this regard all embankment settlements have been completed and the remaining settlements (if any) are expected to be negligible.

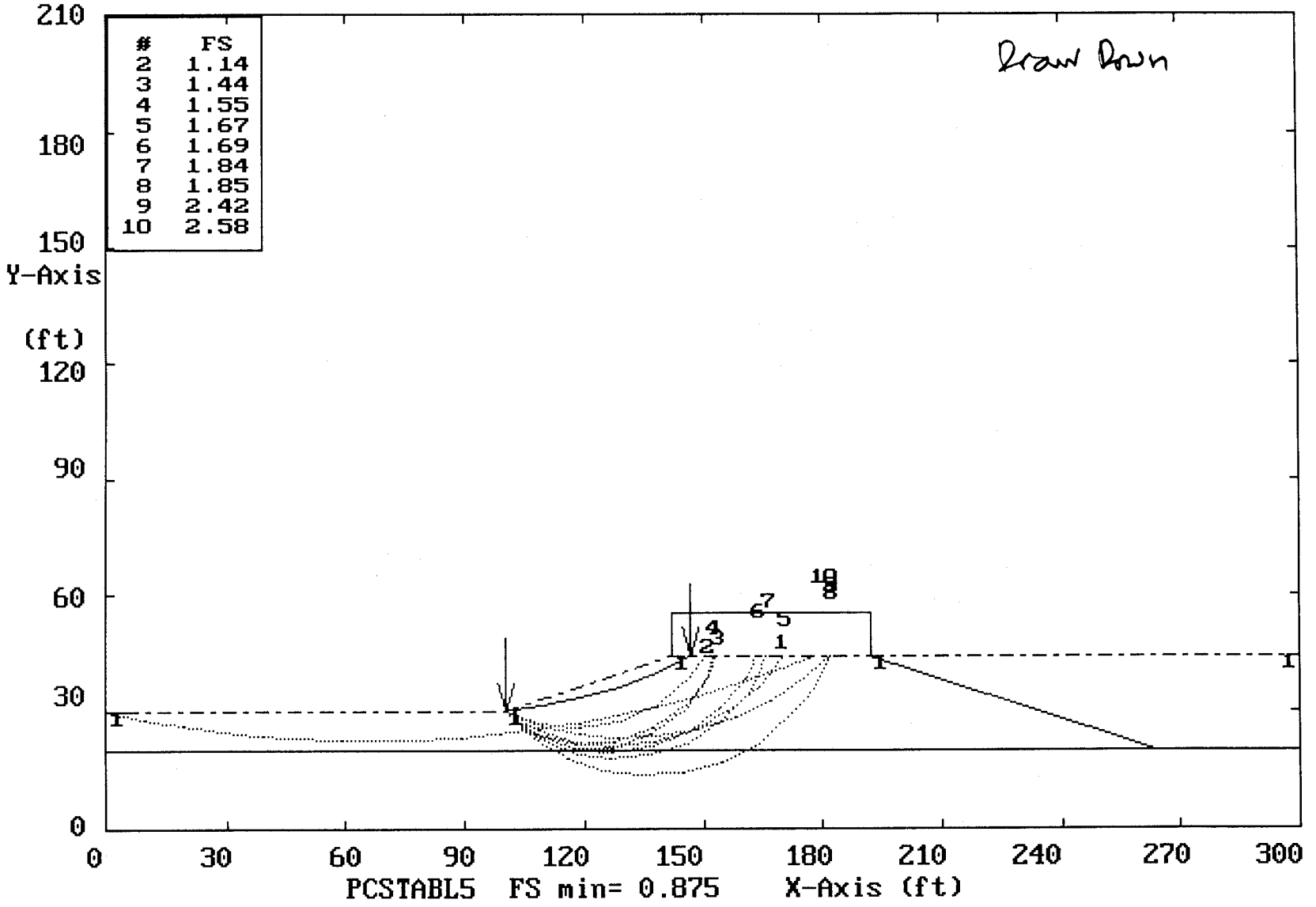
Pond I, Slope Stability Analysis The Villages at Wesminster, JCC
Ten Most Critical. C:SLOPE.PLT By: Raja S. Elawar, P.E. 10-05-97 3:36pm



Pond I, Slope Stability Analysis The Villages at Wesminster, JCC
Ten Most Critical. C:SLOPE.PLT By: Raja S. Elawar, P.E. 10-05-97 3:34pm



Pond I, Slope Stability Analysis The Villages at Wesminster, JCC
Ten Most Critical. C:SLOPE.PLT By: Raja S. Elawar, P.E. 10-05-97 3:37pm



James City County Environmental Division
Stormwater Management / BMP Inspection Report
Detention and Retention Pond Facilities

County BMP ID Code (if known): PC170

Name of Facility: Villages of Westminster BMP No.: Wellesley 1 of Date: 10/9/07

Location: Wellesley

Name of Owner: Atlantic Homes

Name of Inspector: Tina Cooke

Type of Facility: Wet pond

Weather Conditions: Sunny Type: ☑ Final Inspection ☐ County BMP Inspection Program ☐ Owner 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 to 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
Embankments and Side Slopes:				
Grass Height	✓			
Vegetation Condition		✓		May want to remove saplings from embankment.
Tree Growth		✓		
Erosion		✓		minor scours
Trash & Debris	✓			
Seepage	✓			
Fencing or Benches	N/A			
Interior Landscaping/Planted Areas: ☐ None ☐ Constructed Wetland/Shallow Marsh ☐ Naturally Established Vegetation				
Vegetated Conditions	✓			
Trash & Debris	✓			
Floating Material	✓			
Erosion	✓			
Sediment	✓			
Dead Plant	✓			
Aesthetics	✓			
Other				
Notes:				

Facility Item	O.K.	Routine	Urgent	Comments
Water Pools: ❒ Permanent Pool (Retention Basin) ❒ Shallow Marsh (Detention Basin) ❒ None, Dry (Detention Basin)				
Shoreline Erosion		✓		minor scours at shoreline
Algae	✓			
Trash & Debris	✓			
Sediment	✓			
Aesthetics	✓			
Other				
Inflows (Describe Types/Locations):				
Condition of Structure	✓			
Erosion	✓			
Trash and Debris	✓			
Sediment		✓		Sediment at end of Inflow pipes (2)
Outlet Protection	✓			
Other				
Principal Flow Control Structure - Riser, Intake, etc. (Describe Type): unable to inspect (concrete lid)				
Condition of Structure	?			
Corrosion	N/A			
Trash and Debris	✓			none outside riser
Sediment	✓			
Vegetation	✓			
Other				
Principal Outlet Structure - Barrel, Conduit, etc. :				
Condition of Structure	✓			
Settlement	✓			
Trash & Debris		✓		Rip Rap displaced into barrel.
Erosion/Sediment			✓	depressed area above/around
Outlet Protection	✓			pipe (approx. 10' from riser on
Other				embankment)
Emergency Spillway (Overflow):				
Vegetation		✓		1" to 2" saplings around flared end
Lining	✓			
Erosion			✓ *	Gully erosion at toe of slope
Trash & Debris	✓			depositing sediment to outlet
Other				protection - needs compacted
Notes:				material, stabilized, & checks installed. Also minor erosion around flared end (rip rap area) OP

Facility Item	O.K.	Routine	Urgent	Comments
Nuisance Type Conditions:				
Mosquito Breeding	✓			
Animal Burrows	✓			
Graffiti	✓			
Other				
Surrounding Perimeter Conditions:				
Land Uses	✓			
Vegetation	✓			
Trash & Debris	✓			
Aesthetics	✓			
Access /Maintenance Roads or Paths	N/A			
Other				

Remarks:

Overall Environmental Division Internal Rating: 3/4

Signature: Dia Orth **Date:** 10/9/07

Title: Environmental Inspector II

SWMProg\BMP\CoInspProg\InspForms\DetRet.wpd

Bury+Partners
ENGINEERING SOLUTIONS

October 26, 2006

Ms. Fran Barber
Atlantic Homes
109 Nat Turner Boulevard
Newport News, Virginia 23606

RE: Villages of Westminster Construction Certification

Dear Ms. Barber:

I would first like to apologize for the delay in writing this letter to revise my letter from September of last year. On September 23, 2005 we performed a site inspection of the subdivision and the wet pond (BMP PC170) at the referenced project site. Based on this inspection it appears that the pond was constructed in conformance with the approved plans. Final mature vegetation has been established and there did not appear to be any outstanding storm water or erosion control items.

We truly appreciate the opportunity to work with you on this issue. Again, please accept my apology for the delay in writing this letter. Please feel free to call me at 757-229-1776 if you have any questions or concerns.

Sincerely,

BURY+PARTNERS-VIRGINIA, INC.

M. Sean Fisher

M. Sean Fisher, P.E.
Civil Department Manager

I:\04318 - Orchard Hill\letter,Barber,msf,10,26,06.doc

BURY+PARTNERS-VIRGINIA, INC.
4095 Ironbound Road, Suite 200
Williamsburg, Virginia 23188

TEL (757) 229-1776
FAX (757) 229-4683

www.burypartners.com

Atlantic Homes, LLC
109 Nat Turner Boulevard • Newport News, Virginia 23606 • Telephone: (757) 596-8800 • Fax (757) 596-8516

Overnighted
11/7/06

November 7, 2006

Mr.Scott Thomas
Civil Engineer
Environmental Division
James City County
101 Mounts Bay Road, Bldg E
Williamsburg, Virginia 23185

RE: Villages of Westminster

Dear Mr. Thomas:

Enclosed is the letter from Bury + Partners for the Certification of the Pond on Wellesley Boulevard In Villages of Westminster.

Also enclosed is my correspondence with Joan concerning the field issue for that pond.

If you have any questions please call me.

Yours truly,

Fran Barber

Fran Barber
Development Coordinator

Nancy Thomas

From: Scott Thomas [SCOTTT@james-city.va.us]
Sent: Tuesday, February 06, 2007 4:01 PM
To: Nancy Thomas
Cc: Jason Beck; William A. Cain
Subject: RE: westminster

VaW.map.jpg (313 KB)

As discussed, the siltation bond being held for the Villages at Westminster-BMP Facilities (North) project, County Plan No. SP-100-97, Land-Disturbing Permit No. 98-33, Surety No. SPM08121419 cannot be released due to observed piping problems associated with both BMPs for the project. These were previous issues that were not addressed in a satisfactory manner.

(Note: Piping is an engineering term associated with dam construction where there is erosion or subsidence along the bedding or backfill associated with a pipe through a dam. It is a serious situation which threatens the structural integrity of the dam structure and the stormwater function of the facility.)

The BMPs include the front wet pond along Wellesley County BMP ID Code PC 170 and the back BMP near Cotswald Court County BMP ID Code PC 171.
See Attached Map.

To address these issues there are two options:

1. Provide a geotechnical engineering report stating that there are no piping issues associated with the basins;

2. Repair piping problems associated with the basins and provide a geotechnical engineer's certification of repairs performed to address the piping problems.

If you have any questions, call me at 757-253-6639.

Scott J. Thomas, P.E.
Chief Engineer - Stormwater
James City County
Environmental Division

Visit:
http://www.james-city.va.us/resources/devmgmt/div_devmgmt_environ.html
and
www.protectedwithpride.org
-----Original Message-----
From: Nancy Thomas [mailto:nthomas@atlahomes.com]
Sent: Friday, February 02, 2007 5:00 PM
To: Scott Thomas
Subject: westminster

Scott,

Please send info on problem with piping, so I can try and get this resolved.

Thanks.

Nancy Thomas

Atlantic Homes, LLC

109 Nat Turner Blvd. • Newport News, VA 23606

NORFOLK VA 233
HAMPTON ROADS
17 SEP 2007 PM 1 T

USA First-Class

MR. SCOTT THOMAS
CIVIL ENGINEER
ENV. DIVISION, JAMES CITY CO,
101 MOUNTS BAY RD. BLDG E
WILLIAMSBURG, VIRGINIA 23185

2318536569

Tina - Atlantic has been bugging the
heck out of me since receipt of this.
The const cert was the issue
remaining for the front pond (PC170).
It look in order to serve as
const cert for the pond. The file
is in Joe's office under "V"
Check it out & lets proceed if ok.

Antt
10-4-07

Atlantic Homes, LLC

109 Nat Turner Boulevard • Newport News, Virginia 23606 • Telephone: (757) 596-8800 • Fax (757) 596-8516

SP-100-97
PC 170

September 17, 2007

RECEIVED
SEP 19 2007
ENVIRONMENTAL DIVISION

Mr. Scott Thomas
Civil Engineer
Environmental Division
James City County
101 Mounts Bay Road, Bldg. E
Williamsburg, Virginia 23185

RE: Villages of Westminster
Pond BMP, North Pond

Dear Mr. Thomas:

In November of 2006 we overnighted you the attached Certification from Bury & Partners that was done per your instructions to Nancy Thomas of our office. I assume that this certification includes any work that was done on the piping that we needed on this pond, since the Certification states that everything is done and vegetation has been established.

We are still awaiting the release of our bond ($10,500) for this pond.

If there is further information needed to get this bond released please call me at 596-8900

We are most anxious to get this resolved and have the bond released by the County.

Thanks

Yours truly,

Fran Barber

Fran Barber
Atlantic Homes

596-8800

7006 0810 0001 0466 3868

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Restricted Delivery Fee (Endorsement Required)	
Total Postage & Fees	$

Postmark Here

Sent To Steve Deal Westminste Village LLC
Street, Apt. No.; or PO Box No. 40 Atlantic Homes LLC
City, State, ZIP+4 10 San Jose Dr Suite 4C
Newport News VA

PS Form 3800, June 2002 See Reverse for Instructions

Mr. Steve Deal
Westminster Village LLC
c/o Atlantic Homes LLC
10 San Jose Drive, Suite 4C
Newport News, Va. 23606

October 17, 2007

Certified mail #7006-0810-0001-0466-3868

Re:
Villages at Westminster
County Plan SP 100-97
Stormwater management Facility – Pond 1 (Wellesley)
County BMP Code: PC 170

Dear Mr. Deal:

The Environmental Divisions received a record drawing on March 4th 2002 for the above referenced project. The information related to this submittal was reviewed and a concurrent field inspection was performed on May 14, 2002, the findings of which were provided to you in our May 15, 2002 letter. Since that time, the Environmental Division has performed several inspections on this basin with findings being provided after each, with each being consistent with the discrepancies as stated in the original May 15th letter. Due to recent inquiries regarding the release of bond associated with this phase of the Westminster development, we have again inspected the referenced facility and have again found discrepancies consistent with the original letter. Based on our review of the project and a concurrent field inspection as performed on October 11, 2007, the following items remain for address prior to release of the developer's surety instrument for the stormwater management/BMP facility at the site and to proceed with closing out the project:

Construction Certification:

1. The letter from Bury + Partners – Virginia dated October 26, 2006 indicates that the pond was constructed in conformance with approved plans. They also indicated that final stabilization has been established with no outstanding stormwater or erosion control items. However, during the field inspection, many of the items that were initially documented during the May 14th, 2002 inspection have not been addressed. Please see the notes below that document the current conditions. Darryl Rickman with Bury + Partners - Virginia was contacted on October 17, 2007 to request the field notes, geotech information, etc. that was utilized to make this determination.

Construction - Related Items:

2. Remove the rip rap from the flared end section of the outlet. It should be placed at the end rather than obstructing the barrel flow.

3. Remove the 1" – 2" saplings from the dam located on both sides of the outfall barrel.

4. Minor erosion located on the pond embankment and around the flared end section of the outfall barrel should be repaired with compacted topsoil, seed, and matting to insure proper stabilization.

5. The sink hole that was filled located along the dam outlet barrel, approximately 10' south (roadside) of the riser pipe, has eroded again. This is an indication that piping problems still exist and need immediate attention.

6. The inlet pipes to the pond have several feet of sediment accumulation that should be removed to insure positive flow into the pond.

Once all of the associated work as listed above is satisfactorily completed, contact our office appropriately for reinspection. We can then proceed with final release of the surety and/or closing out the project. One reproducible and one blue/black line set of the record drawings will be required once the above items are adequately addressed.

Please contact me at 757-253-6743 if you have any further comments or questions.

Sincerely,

Tina Cooke
Inspector
Environmental Division

cc: Craig Davenport, Richmond Engineering Inc. (via fax)
William Cain – JCC Chief Environmental Engineer (via email)
Scott Thomas – JCC Environmental Director (via email)

G:\AsBuilts\admin\final\SP9502.wc070

ECS MID-ATLANTIC, LLC
Geotechnical • Construction Materials • Environmental • Facilities

March 5, 2008

Mr. Pete Fallon
Atlantic Homes
109 Nat Turner Boulevard
Newport News, VA 23606

Reference: Dam Observation and Engineering Evaluation
Dam ID PC170 (Pond 1) and PC171 (Pond 2)
The Villages of Westminster Subdivision
Williamsburg, Virginia

ECS Project No. 07:9474

Dear Mr. Fallon:

ECS Mid-Atlantic, LLC has completed our observation and engineering evaluation for the above referenced project. It was our understanding that the Environmental Division of Development Management previously visited the site and initially provided a letter concerning specific comments regarding the dams during their site visit. These comments involved possible piping issues associated with the basins of both dams. Based on this correspondence, we were asked to evaluate the conditions of both dams, specific to the potential piping issues.

Both ponds were visited by a representative of ECS on November 9, 2007. Our report dated November 26, 2007 identified our findings and our recommendations for work to be accomplished prior to our final observation and engineering evaluation. Our original observations were as follows:

1) The dam at Pond 1, which is traversed by Wellesley Boulevard, had grassy slopes on both the upstream and downstream sides of the dam. We observed an area of subsidence approximately five feet in diameter to a depth of approximately six inches located approximately ten feet south (roadside) of the riser pipe. The depression was probed using a GeoStick and was softer than the surrounding embankment. This "sink hole" was noted in the original letter from the Environmental Division of Development Management dated May 15, 2002 (item # 9) within which a repair of the problem was requested. Subsequent to the email from the Environmental Division of Development Management dated November 28, 2005 (item # 2) the area had been backfilled but had returned (however was smaller), potentially indicative of a piping issue. In addition, during our site visit, we also observed a sinkhole approximately six inches in diameter and probed to a depth of approximately four feet in the grass island immediately adjacent to a storm drain on the pond side of Wellesley Boulevard. Site plans indicate the storm drain is located immediately above the RCP barrel through the dam further suggesting a possibly unresolved piping problem.

2) The dam at Pond 2 was heavily vegetated on both the upstream and downstream slopes. The pond outlet structure and outlet pipe appeared to be working properly. Correspondence from the Environmental Division of Development Management dated November 28, 2005 (item # 3) indicated a possibility of piping. Although we walked the slopes as well as possible under current conditions and did not observe evidence of a piping issue, the heavily vegetated slopes did not allow us to make a full assessment and to draw conclusions concerning possible piping problems. Additional work was recommended.

With concern to Pond 1 and pursuant to our recommendations, the pipe outlet structure through the dam was video inspected. Review of the video inspection showed no gaps in the drain pipe structure and neither signs of external seepage or internal leakage. With regards to both shallow surficial depressions located on the upstream side of the dam and associated with the RCP barrel, the depressions were filled to grade, compacted, and over seeded approximately six weeks ago. The site was again visited by our representative on February 26, 2008 to observe any further settling. No additional settling or any evidence of piping was observed within the dam structure.

With concern to Pond 2, representatives of ECS visited the site to observe conditions after the woody vegetation on both slopes of the dam were removed. Both upstream and downstream slopes of the dam were surficially graded and reseeded. As noted in our first report and again observed after the vegetation was removed, we did not identify any evidence of piping within the dam structure.

We, therefore, do not consider piping issues to be present at either dam at this time. We have enjoyed being of service to Atlantic Homes during this project. If you should have any questions regarding the information and recommendations contained in the accompanying report or if we can be of further assistance, please do not hesitate to contact us.

Respectfully,
ECS Mid-Atlantic, LLC.

Daniel E. De Avies
Project Geologist

W. Lloyd Ward, P.E.
Vice President, Branch Manager

COMMONWEALTH OF VIRGINIA
W. LLOYD WARD
Lic. No. 034612
3/5/08
PROFESSIONAL ENGINEER

4/10/08

Pond 1 - depressed area is not veg & "soft"

Pond 2 - rod sank 1½' without pressure? - outfall side of dam...

I THINK THEY FILLED IN THE HOLES AND DIDN'T FIX THE PROBLEM. ~~WHAT DO YOU THINK~~ LET ME KNOW HOW YOU WANT ME TO PROCEED.

Bre

*LET ME KNOW IF OR WHERE YOUR ORIGINAL LETTER IS (IF SENT OUT) AND I WILL TAKE IT FROM HERE.

Atlantic Homes, LLC

109 Nat Turner Boulevard • Newport News, Virginia 23606 • Telephone: (757) 596-8800 • Fax (757) 596-8516

March 20, 2008

RECEIVED
MAR 21 2008
ENVIRONMENTAL DIVISION

Mr. Scott Thomas
Environmental Division
James City County
101 Mounts Bay Road, Bldg E
Williamsburg, VA 23185

Re: Villages of Westminster, bond release

Dear Mr. Thomas,

Enclosed is a copy of a report prepared by ECS Mid-Atlantic, LLC addressing your concerns with ponds I & II at the Villages of Westminster. The report states that there are no piping issues present at either pond. We respectfully request the release of the bond LPM08121419 currently being held per your e-mail dated 2/6/07.

Sincerely,

Peter Fallon

Peter Fallon
Atlantic Homes

Cc: Darryl Cook
Director Environmental Division, JCC

Bill, Review + let me know what you think. Scott

Nancy Thomas

From: Scott Thomas [SCOTTT@james-city.va.us]
Sent: Tuesday, February 06, 2007 4:01 PM
To: Nancy Thomas
Cc: Jason Beck; William A. Cain
Subject: RE: westminster

VaW.map.jpg (313 KB)

As discussed, the siltation bond being held for the Villages at Westminster-BMP Facilities (North) project, County Plan No. SP-100-97, Land-Disturbing Permit No. 98-33, Surety No. SPM08121419 cannot be released due to observed piping problems associated with both BMPs for the project. These were previous issues that were not addressed in a satisfactory manner.

(Note: Piping is an engineering term associated with dam construction where there is erosion or subsidence along the bedding or backfill associated with a pipe through a dam. It is a serious situation which threatens the structural integrity of the dam structure and the stormwater function of the facility.)

The BMPs include the front wet pond along Wellesley County BMP ID Code PC 170 and the back BMP near Cotswald Court County BMP ID Code PC 171.
See Attached Map.

To address these issues there are two options:

1. Provide a geotechnical engineering report stating that there are no piping issues associated with the basins;

2. Repair piping problems associated with the basins and provide a geotechnical engineer's certification of repairs performed to address the piping problems.

If you have any questions, call me at 757-253-6639.

Scott J. Thomas, P.E.
Chief Engineer - Stormwater
James City County
Environmental Division

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

-----Original Message-----
From: Nancy Thomas [mailto:nthomas@atlahomes.com]
Sent: Friday, February 02, 2007 5:00 PM
To: Scott Thomas
Subject: westminster

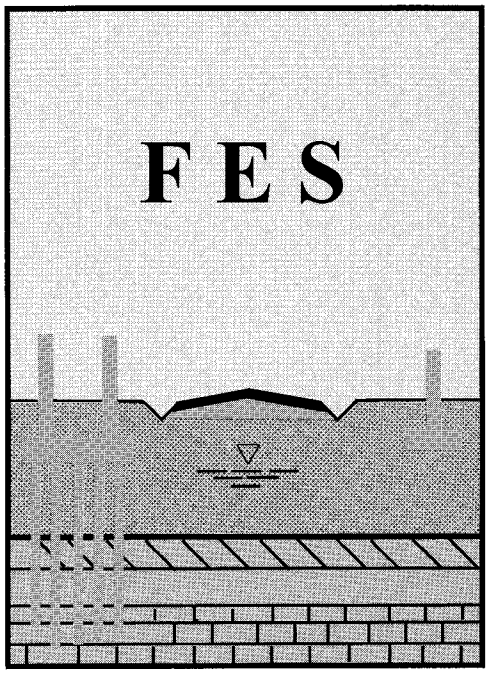
Scott,

Please send info on problem with piping, so I can try and get this resolved.

Thanks.

Nancy Thomas

[redacted]



GEOTECHNICAL ENGINEERING STUDY REPORT
THE VILLAGES AT WESTMINSTER –
EARTHEN DAM CERTIFICATION
JAMES CITY COUNTY, VIRGINIA
FES REPORT NO. 1-81295.115

NEED CC FOR POND I

PC 170
SP-100-97

CLIENT: MR. KEN DODD
ATLANTIC HOMES, LLC

This is report for Pond II Cotswold

FEB 2003
RECEIVED
ENVIRONMENTAL DIVISION

APPROVED
James City County
Environmental Division
By: [signature]
Date: 2-11-03

Post-Construction Geotech Report

Geotechnical Engineering Study Report
The Villages at Westminster
Earthen Dam Certification
James City County, Virginia

Prepared for

Atlantic Homes, LLC

Prepared by

Foundation Engineering Science, Inc.

January 16, 2003

FOUNDATION ENGINEERING SCIENCE, INC.

- Drilling Services [Geotechnical & Environmental]
- Geotechnical Engineering [Shallow & Deep Foundations, Retaining Walls & Pavement Design]
- Environmental Management [Phase I & II]
- Construction Inspection Services [Quality Control & Quality Assurance]
- Foundation/Structure & Pavement Distress Evaluations
- Value Engineering During Design & Construction
- Design & Build Segmental Reinforced Retaining Walls [SRRW]

Mr. Ken Dodd
Atlantic Homes, LLC
10 San Jose Drive
Newport News, Virginia 23606

January 16, 2003

Re: Geotechnical Engineering Study Report
The Villages at Westminster – Earthen Dam Certification
James City County, Virginia
FES Report No. 1-81295.115

Dear Mr. Dodd:

Foundation Engineering Science, Inc. (FES) has completed a geotechnical engineering study at the existing project site. This geotechnical engineering study was performed in general accordance with FES Proposal No. NP668.001, dated June 10, 2002, following your written authorization on July 23, 2002. Pursuant to your request, FES delayed the field testing due to limited access to the site until August 6, 2002. The geotechnical engineering study consisted of performing four (4) Standard Penetration Test (SPT) borings to approximate depths ranging from fifteen (15) to twenty (20) feet below the existing grades, obtained two (2) bulk soil samples for laboratory testing, performed two (2) hand auger borings to six (6) feet in depth, performed two (2) field permeability tests and performed compaction density tests on the final grade for the existing Earthen Dam.

Briefly, the results of our analyses indicated that there were silty sand (SM), clayey sand (SC), sandy clay to sandy silt (CL-ML) and sandy clay (CL) within the borings performed. The clayey sand (SC), sandy clay (CL) and sandy clay to sandy silt (CL-ML) soils are acceptable for use as fill material for the core of the earthen dam. Additionally, all the soils are acceptable as fill material for the earthen dam embankment [outer shell].

Based on the as built plans prepared by Rickmond Engineering, Inc. and dated January 13, 2003, The side slopes of the earthen dam appear to be three (3) horizontal to one (1) vertical [3H:1V] and as shown in the plans. The global stability indicated that the down stream slopes will be stable during a flooded condition, with a factor of safety greater than one (1) as required for a draw down analysis.

FES did not inspect the earthen dam during construction. Additionally, the existing subgrade in the earthen dam area and the key trench were not evaluated prior to placement of the fill materials. The concrete cradle was not inspected.

11843-B CANON BOULEVARD ➢ NEWPORT NEWS, VIRGINIA 23606 ➢ PHONE: 757-873-4113 FAX: 757-873-4114

FES appreciates the opportunity to be of service to the **Atlantic Homes, LLC** on this important project and looks forward to its approval. If we can be of any further assistance or you have any questions regarding this report, please do not hesitate to contact the undersigned.

Respectfully submitted,

FOUNDATION ENGINEERING SCIENCE, INC.

Idres Hawarry / lp

Idres Hawarry
Project Engineer

1/17/03

Raja S. El-Awar, P.E.
Principal Engineer
VA Reg. No. 26383

RAJA S. ELAWAR
No. 026383
PROFESSIONAL ENGINEER

Attachments: *Appendix*

Figure- 1 USDA Soil Survey Map
Figure- 2 USGS Quadrangle Map
Figure- 3 Permeability and Borings Location Sketch
Figure- 4 Compaction Density Test Locations
Borings Profile Sheets
Laboratory Testing Program Results

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1.0 INTRODUCTION

1.1 Site Characteristics and Project Information

The project site is located in James City County, Virginia. Specifically, the project site is located within the Villages at Westminster off Route 60 just immediately south of Route 199. The site currently contains existing Earthen Dam and identified in the project plans as POND II.

Our review of the project plans and specifications prepared by Rickmond Engineering, Inc. and dated March 6, 2001 and revised dated January 13, 2003 indicated that the dimension for the earthen dam are approximately 145 feet in length and ranges approximately from 65 to 100 feet in plan width [toe to toe]. The as built plans indicated side slopes that are three (3) horizontal to one (1) vertical [3H:1V] and the design high water elevation in the pond is 56.99 feet National Geodetic Vertical Datum (NGVD) of 1929. The plans did not show any details for the core of the earthen dam.

2.0 PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to obtain information on the soils located within the Earthen Dam and degree of compaction of the soils placed for the existing Earthen Dam. The existing materials encountered were then evaluated with respect to the available project information and site characteristics. In this regard, for the following items were formulated:

1. Development of shallow and deep subsurface soil and ground water conditions at the existing Earthen Dam area.

2. Performed compaction density testing on the final grade and approximately one (1) to two (2) feet below the final grade to develop correlation between the Standard Penetration Test (SPT) boring N-values and relative compaction.

3. General location and description of potentially deleterious materials encountered in the borings performed, including existing fills or surficial organic.

4. Certify the existing Earthen Dam in general accordance with the plans and specifications. If the existing Earthen Dam does not meet the approved project plans and specifications and James City County requirements, FES will provide parameters required for improving and/or replacing the existing Earthen Dam.

The following services were provided in order to achieve the preceding objectives:

1. Reviewed readily available published geologic and topographic information. This published information was obtained from quadrangle maps published by the United States Geologic Survey (USGS) and Soil Survey published by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS), if available.

2. FES executed a program of subsurface exploration that consisted of subsurface sampling, filed and laboratory testing.

3. Performed two (2) hand auger borings to six (6) feet in depth and obtained two (2) bulk soil samples for laboratory testing and analyses. The bulk samples were collected from the existing materials placed for the existing Dam areas. FES performed two (2) field permeability tests within the existing Earthen Dam fill materials.

4. Visually classify and stratify representative soil samples in the laboratory using the Unified Soil Classification System (USCS)), in general accordance with ASTM D-2487 and D-2488. Conducted a laboratory program, that consisted of performing natural moisture content [ASTM D-2216], Atterberg Limits [ASTM D-4318], grain size determination [(-#200) ASTM D-1140] and Standard Proctor [ASTM D-698 tests.

5. Collected ground water level measurements in the borings performed.

6. The results of the field exploration and laboratory testing program were utilized in performing engineering evaluation, analysis and in the formulation of suitability and stability of the existing Earthen Dam. The results of the field exploration, laboratory testing program, conclusions and recommendations are presented in a comprehensive geotechnical engineering study report prepared by an FES experienced Professional Engineer registered in the Commonwealth of Virginia.

2.1 Report Format

This report begins with a discussion of the field and laboratory programs followed by a description of the general subsurface conditions, field permeability testing, compaction density testing suitability of the existing materials within the existing Earthen Dam and report limitations. The USDA soil survey, USGS quadrangle map, the borings and sample locations sketches are presented in Figures 1, 2 and 3, respectively in the Appendix of this report. Additionally, the boring profile sheets and laboratory test figures are also presented in the Appendix of this report.

3.0 FIELD EXPLORATION

3.1 General

A total of four (4) Standard Penetration Test (SPT) borings were drilled within the existing Earthen Dam area to explore the general soil types. The SPT borings were drilled to approximate depths ranging from fifteen (15) to twenty (20) feet below the existing top of the Earthen Dam grades. The approximate location of the borings is illustrated in Figure 3. Performed two (2) hand auger borings, two (2) field permeability test and obtained two (2) bulk soil samples for the laboratory testing program.

3.2 SPT Borings

The SPT borings were performed with the use of an All Terrain Vehicle (ATV) mounted drill rig by utilizing hollow steam auger (HSA) procedures. The soil sampling was performed in general accordance with the American Society of Testing and Materials (ASTM) Test Designation D-1586. These samples were taken continuously from the final grade to approximate depths ranging from fifteen (15) to twenty (20) feet below the final/existing grade elevations. Representative portions of these soil samples were collected, labeled and transported to our office for laboratory testing, analysis and classification.

3.3 Bulk Soil Sampling

Two (2) bulk soil samples were obtained in the field from the existing materials placed for the Earthen Dam at approximate depths ranging from one (1) to two (2) feet below the existing subgrade elevations. The locations of the bulk soil samples are shown in Figure 3 in the appendix of this report.

3.4 Auger Borings

The auger borings were performed with the use of a three (3) inch bucket auger, the soil sampling was performed in general accordance with American Society for Testing and Materials (ASTM) test designation D-1452, titled "Soil Investigation and Sampling by Auger Borings". The soil samples were obtained virtually continuously from the ground surface to boring termination an approximate depth of six (6) feet below the final grades. Representative portions of these soil samples were collected, labeled and transported to our office for laboratory testing, analysis and classification.

3.5 Field Permeability

Two (2) field permeability tests [open-hole, falling head method] were performed by installing a two (2) inch inside diameter PVC pipe (ground water observation well) with flush joints to an approximate depth of six (6) feet below the existing grades. The permeability testing equipment consisted of a PVC pipe with a close-ended section and a twenty-four (24) inch screen (using a 0.01-inch slot size opening) from four (4) to six (8) feet below the existing grades. Coarse sand (#2) was backfilled to six (6) inches above the screened annual space of the well, followed by a six (6) inch bentonite seal placed over the sand. The purpose of this construction method was to restrict upward (test) water flow between the well hole and the outside wall of the augered hole.

The wells were developed by pumping water into them and allowing them to soak for a period of one (1) hour. Following a soaking period of one (1) hour, water was added until it reached the top of the well casing and allowed to fall a known distance over a measured time. This procedure was repeated a minimum of three (3) times or until time deviation between the tests was less than ten (10) percent.

The collected field data was utilized in the equation found in the "Stormwater Retention Pond Infiltration Analyses in Unconfined Aquifers" for determining the coefficient of permeability of the subject soil stratum. The infiltration rates calculated are presented in tabular format below:

TEST LOCATION	PB-1	PB-2
PERMEABILITY (In/hr)	3.8	2.55

4.0 LABORATORY TESTING

4.1 General

The soil samples were transported to our laboratory and were classified by an experienced Geologist and Geotechnical Engineer using the Unified Soil Classification System (USCS) in general accordance with ASTM test designations D-2487 and D-2488.

4.2 Tests Performed

Representative soil samples were subjected to a laboratory program. The laboratory program consisted of performing natural moisture content [ASTM D-2216], Atterberg Limits [ASTM D-4318], grain size determination [(-#200) ASTM D-1140] and moisture-density relation ship [Standard Proctor ASTM D-698] tests. The laboratory test results are presented in tabular formats below and in the appendix of this report.

LABORATORY TEST	ASTM PROCEDURE	NO. OF TESTS
Moisture Content Determination	ASTM D-2216	16
Grain-Size Determination (-#200 Sieve)	ASTM D-1140	16
Atterberg Limits (Liquid and Plastic)	ASTM D-4318	4
Moisture-Density Relationship (Std. Proctor)	ASTM D-698	3

4.3 Test Results

LOCATION	APPROX. SAMPLE DEPTH (Feet)	NATURAL MOIST. CONTENT (%)	#200 SIEVE (%)	ATTERBERG LIMITS		USCS	OPT. MOIST. CONTENT (%)	MAX. DRY DENSITY (pcf)	CBR VALUE (%)
				LL (%)	PI (%)				
Proctor-1	1.5	7.1	32.5	---	NP	SM	10.5	122.5	---
Proctor-2	1.5	8.2	22.5	---	NP	SM	11.5	119.5	---
Proctor- 3	1.5	17.0	84.9	24	9	CL	13.5	116.5	---
FES-1	3	8.9	35.2	---	---	SM	---	---	---
FES-1	5	27.0	78.5	---	---	CL	---	---	---
FES-1	7	25.3	62.4	---	---	CL-ML	---	---	---
FES-2	4	16.9	50.4	42	21	CL	---	---	---
FES-2	7	12.6	42.6	---	---	SC	---	---	---
FES-2	14	20.6	68.5	---	---	CL-ML	---	---	---
FES-3	3	15.3	65.1	---	NP	CL-ML	---	---	---
FES-3	5	9.8	27.0	---	NP	SM	---	---	---
FES-3	7	11.8	32.0	---	---	SM	---	---	---
FES-3	15	21.9	74.5	38	42	CL	---	---	---
FES-4	5	13.6	25.8	---	---	SM	---	---	---
FES-4	8	18.8	57.2	38	14	CL	---	---	---
FES-4	14	22.1	50.1	---	---	CL	---	---	---

5.0 GENERALIZED SUBSURFACE CONDITIONS

5.1 USGS Topographic Survey

The topographic survey map published by the United States Geological Survey titled "Williamsburg, Virginia" dated 1984, was reviewed for ground surface features at the proposed project location. Based on this review, the natural ground surface elevation approximately fifty (50) to sixty (60) feet National Geodetic Vertical Datum (NGVD) of 1929. The USGS topographic map for the project vicinity is presented in Figure 1 in the appendix of this report.

5.2 USDA Soil Survey

The "James City County, Virginia" Soil Survey, developed by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS), was reviewed for general near-surface soil information within the general site vicinity. This information indicated that there are three (3) primary mapping units (11C and 15E) within the proposed site area. The USDA Soil Conservation Service (SCS) Survey map for the project vicinity is presented in Figure 1 in the appendix of this report. The map soil units encountered are as follows:

SOIL SERIES	DEPTH (IN.)	SOIL DESCRIPTION	USCS	USDA SEASONAL HIGH GROUNDWATER TABLE (%)		K [2] (IN/HR)	SHRINK/ SWELL POTENTIAL
				DEPTH (FEET)	MON.		
Craven (11C)	0 – 9	Fine sandy loam	ML, CL-ML,	2.0 – 3.0	Dec –Apr	0.6 – 2.0	Low
	9 – 30	Clay, silty clay, silty clay, loam	SM, SM-SC CH			0.06 – 0.2	Moderate
	30 – 72	Sandy clay loam, sandy loam, fine, sandy loam	SM, SM-SC, SC			0.2 – 6.0	Low
Emporia (15E)	0 – 9	Fine sandy loam	CL, SC, SM, ML	3.0 – 4.5	Nov – Apr	2.0 – 6.0	Low
	9 – 37	Sandy clay loam, Sandy loam, Clay loam	SC, CL			0.2 – 2	Low
	37 – 50	Sandy clay loam, Clay loam, Clay loam	SC, CL			0.06 – 0.6	Moderate
	50 – 75	Stratified sandy loam to clay loam	SM, SC, ML, CL			0.06 – 2.0	Moderate

(1) USCS = Unified Soil Classification System
(2) K = Permeability

5.3 General

Soil stratification was based on visual examination of the recovered soil samples, laboratory testing and interpretation of the field boring log by an experienced Geologist and Geotechnical Engineer. The boring stratification lines represent the approximate boundaries between soil types of significantly different engineering properties; however, the actual transition may be gradual. In some cases, small variations in properties not considered pertinent to our engineering evaluation may have been abbreviated or omitted for clarity. The boring profiles present the conditions at the particular boring location and variations do occur among the borings and between soil samples.

5.4 Subsurface Soil Conditions

The subsurface soils encountered at each structure location have been summarized and are presented in tabular format below:

BORING LOCATION	SOIL LAYER	SOIL DESCRIPTION	DEPTH RANGE (FEET)	AVARAGE SPT "N" VALUES (BPF)	AASHTO SYMBOL
FES-1	1	Light brown, dry to moist, silty SAND with roots "Topsoil"	0 – 0.5	---	SM
	2	Light brown to brown, moist, silty SAND	0.5 – 4	10	SM
	3	Light brown, moist, sandy CLAY to sandy SILT with lenses of clayey sand (SC) from 5 to 6 and organic matter from 13 to 15 feet	4 – 15	6	CL-ML
FES-2	1	Light brown, dry to moist, silty SAND with roots "Topsoil"	0 – 0.5	---	SM
	2	Brown, moist, sandy CLAY	0.5 – 6	10	CL
	3	Brown, moist, clayey SAND	6 – 10	5	SC
	4	Light brown, moist, sandy CLAY to sandy SILT	10 – 20	7	CL-ML
FES-3	1	Light brown, dry to moist, silty SAND with roots "Topsoil"	0 – 0.5	---	SM
	2	Light brown, moist, sandy CLAY to sandy SILT	0.5 – 4	8	CL-ML
	3	Light brown, moist, silty SAND	4 –12	7	SM
	4	Light brown, moist, sandy CLAY	12 – 20	7	CL
FES-4	1	Light brown, dry to moist, silty SAND with roots "Topsoil"	0 – 0.5	---	SM
	2	Light brown, moist, silty SAND	0.5 – 6	9	SM
	3	Light brown, moist, sandy CLAY	6 – 15	7	CL
AB-1	1	Light brown, dry to moist, silty SAND with roots "Topsoil"	0 – 0.5	---	SM
	2	Light brown, moist, silty SAND with trace clay	0.5 – 4	---	SM
	3	Light brown, moist, clayey SAND	4 – 6	---	SC
AB-2	1	Light brown, dry to moist, silty SAND with roots "Topsoil"	0 – 0.5	---	CL-Ml
	2	Brown, moist, silty SAND	0.5 – 3	---	SM
	3	Brown to light brown, moist, sandy CLAY to sandy SILT	3 – 6	---	SC
Ground Water Conditions: The ground water table was not encountered in the borings performed on August 15, 2002.					

Based on our extensive experience with similar soil types, it is expected that the majority of the subsurface soils encountered within the borings performed, will consist of a cohesive and cohesion less soils. Please refer to the soil boring profiles located in the appendix of this report for specific information at each boring location.

5.5 Ground Water Conditions

The ground water table was not encountered in the SPT borings performed during the field exploration program on August 15, 2002. Ground water levels tend to fluctuate in response to variations in seasonal rainfall, infiltration, site topography and drainage. Based on the soil conditions encountered and the USGS Topographic Map, FES estimates the seasonal normal high ground water level to be encountered at an approximate depth of three (3) feet below the existing grades. However, a "perched" ground water condition, which dissipates with time may be encountered within the top three (3) feet following periods of significant rainfall during and immediately following the wet season.

6.0 EARTEN DAM SOIL SUITABILITY AND STABILITY

6.1 Soil Suitability

The clayey sand (SC), sandy clay (CL) and sandy clay to sandy silt (CL-ML) soils are acceptable material for the core of the Earthen Dam. Additionally, all the soils are suitable as fill material for the Earthen Dam embankment [outer shell].

6.2 Stability

FES representative performed slope stability analyses by a two-dimensional limit equilibrium method using the computer program PCSTABL6. This program was developed at Purdue University under sponsorship of the Federal Highway Administration (FHWA). The program uses the method of slices to determine the safety factor against deep seated circular failure.

Using a 3.0:1V side slopes, we evaluated the stability against slope failure at the highest embankment of eight (8) feet. The soil parameters were developed from the SPT borings performed for the existing Earthen Dam. Input data for the subsurface soils were obtained using general correlations from laboratory test data and Standard Penetration Test N-values.

The global stability safety factors for the assumed embankment elevation of eight (8) feet and the draw down analysis were computed to be 1.8 and 1.1, respectively [the required design factors of safety for the assumed design embankment and draw down should be 1.25 and 1.0, respectively]. The computed factors of safety for the assumed highest embankment and the draw down analysis met the minimum required factors of safety.

7.0 COMPACTION DENSITY TESTING

Foundation Engineering Science, Inc. (FES) performed compaction density testing on the final subgrade material for the existing Earthen Dam. These tests were performed in general accordance with the American Society for Testing and Materials (ASTM) Test Designation D-2922, titled "Compaction Density Testing with Portable Nuclear Gauge". The results of the compaction density tests are tabulated below:

FIELD COMPACTION DENSITY REPORT[1]

Gauge #	26814	Model #	3430	Density Std. Ct.	2516	Moisture Std. Ct.	633	FES REP.:	CD

Proctor	Dry Density[2] (pcf)	Opt. Moist. (%)	Passing #200[3] (%)	Material Description & Classification[4]	Source	Compaction Requirement
2	119.5	10.6	41.2	Brown clayey SAND (SC)	On-site	Moderate effort
3	116.5	17.0	84.9	Brown to gray sandy CLAY (CL)	On-site	Extensive effort

TEST NO.	DEPTH (inches)	ELEVATION (feet)	PROC. NO.	D.D. (PCF)	MOIST (%)	W.D. (PCF)	% COMP	PASS	FAIL	
1	12	Final Subgrade	2	117.8	6.0	124.8	98.5	X		
2	12	Final Subgrade	3	117.3	5.1	123.3	100.7	X		
3	12	Final Subgrade	3	120.4	6.4	128.1	103.3	X		
4	12	Final Subgrade	2	124.2	6.4	132.1	103.9	X		
5	12	Final Subgrade	2	115.6	8.4	125.4	96.7	X		

TEST NO.	TEST LOCATION
1	Site No. 1, See Attached Figure 4
2	Site No. 2, See Attached Figure 4
3	Site No. 3, See Attached Figure 4
4	Site No. 1, See Attached Figure 4
5	Site No. 1, See Attached Figure 4

SPEC. REQUIREMENTS	Utility Trench	Sidewalk	Structure	Roadway/Parking	Earthen Dam
COMPACTION (%)					95.0
MOISTURE (%)					O.M. ± 20

Comments

Compaction density testing was performed in general accordance with [1]ASTM D2922, [2]ASTM D698, [3]ASTM D1140, [4]ASTM D2488

A correlation between the SPT N-values and the relative density was developed based on the laboratory test data shown above. The relative density of the subsurface soils within the upper eight (8) feet of the Earthen Dam indicates that the compaction is approximately

CORRELATION BETWEEN SPT N-VALUES & RELATIVE DENSITY				
TEST LOCATION	N-VALUE (BPF)	WET DENSITY (PCF)	RELATIVE COMPACTION (%)	REMARKS
1	10	124.8	98.5	Pass
2	10	123.3	100.7	Pass
3	10	128.1	103.3	Pass
4	8	132.1	103.9	Pass
5	10	125.4	96.7	Pass

8.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the subsurface exploration and laboratory testing programs, our site observations, engineering judgment, review of the plans and specifications, the following conclusions and recommendations are presented.

1. Compaction density testing was performed on the final/existing grade elevations. The subgrade soils were compacted to 95.0 percent of the laboratory maximum dry density in general accordance with ASTM D-698 [Standard Proctor] and to an approximate depth of twelve (12) inches. Based on the limited tests performed, the fill material within the final grade of the earthen dam placed appears to meet the intent of the project plans and specifications. Additionally, the fill material placed within the earthen dam embankment appears to have been compacted to a minimum relative density on the order of 90.0 percent of the laboratory maximum dry density. A minimum relative compaction of 90.0 percent is sufficient for similar projects.

2. The existing soils encountered within the earthen dam are sandy clay (CL), sandy clay to sandy silt (CL-ML), clayey sand (SC) and silty sand (SM) soils. The clayey sand (SC), sandy clay (CL) and sandy clay to sandy silt (CL-ML) soils are acceptable as core and embankment fill materials. The silty sand (SM) soils are acceptable as fill materials for the outer shells of the earthen dam (embankment).

3. The side slopes of the earthen dam were measured to be three (3) horizontal to one (1) vertical [3H:1V] and as shown in the plans prepared by Rickmond Engineering, Inc., dated January 13, 2003.

4. The global stability indicated that the down stream slopes will be stable during the service life of the structure including flooded conditions for draw down periods.

5. Inspection was not performed during construction of the earthen dam. Additionally, a core was not shown for the earthen dam in the project plans.

6. Considering that a core was not constructed and the material encountered within the Earthen Dam, water within the storm water management area dam may not be impounded due to the presence of silty sand (SM) within the embankment and core.

7. During extended and heavy rain fall events, the water within the Earthen Dam will rise but may not rise enough to seep through the over flow structure, thus seeping through the embankment of the Earthen Dam. However, above design storm events may occur thus overflowing above the embankment of the Earthen Dam.

9.0 REPORT LIMITATIONS

The engineering evaluation and analysis have been developed on the basis of the previously described project characteristics and subsurface conditions. These engineering evaluation and analysis were developed from the information obtained in the test borings, which depict subsurface conditions only at these specific locations and at the particular time designated on the boring profiles. Soil conditions at other locations may differ from conditions occurring at these boring locations. In addition, the passage of time may result in a change to the soil conditions at these boring locations.

Our professional services have been performed, our findings obtained, and our engineering evaluation and analysis prepared in accordance with generally accepted Geotechnical Engineering Principles and Practices. Foundation Engineering Science, Inc. is not responsible for the conclusions, opinions or recommendations made by others based on this geotechnical engineering study report.

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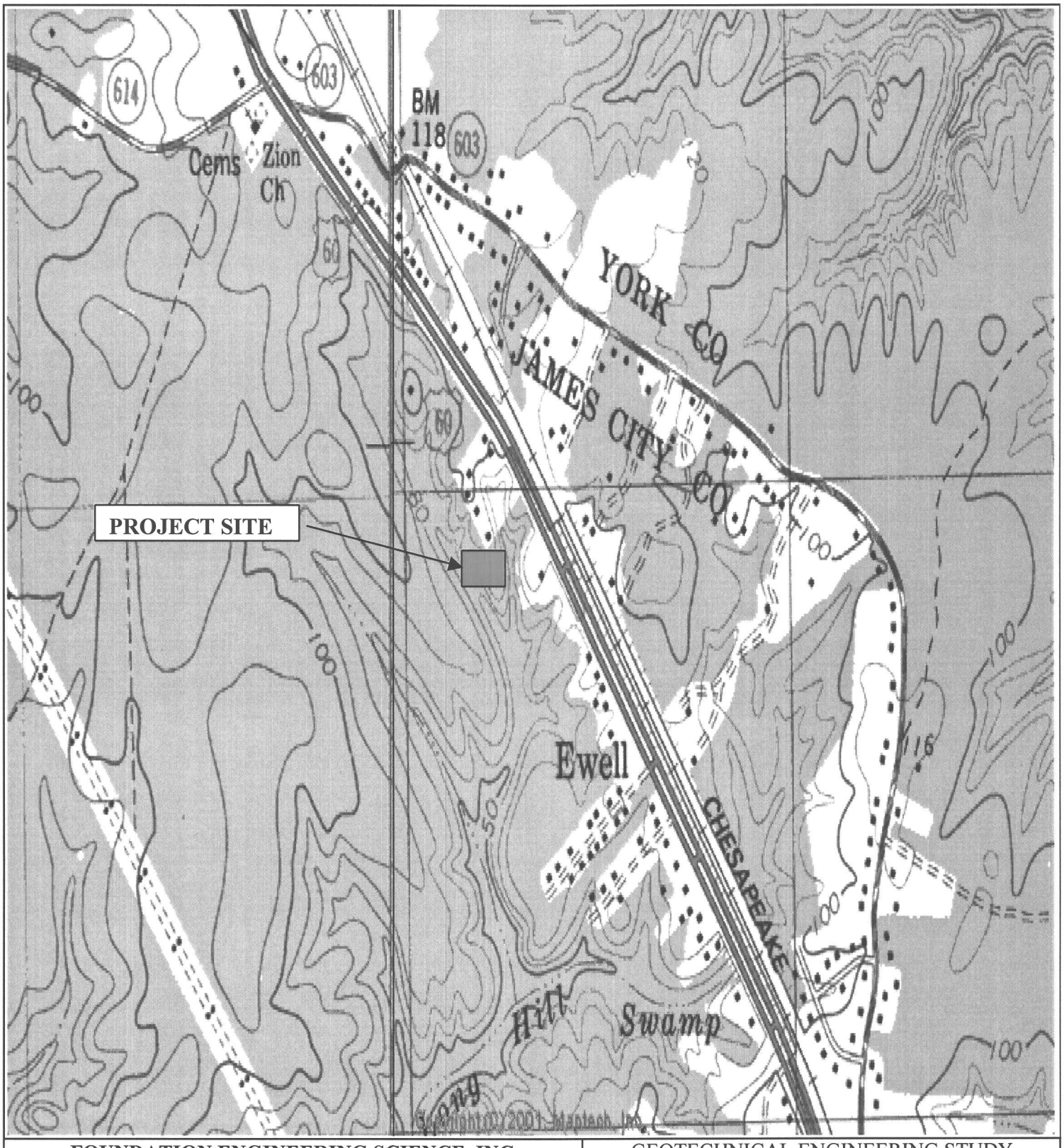
APPENDIX

FIGURES

FOUNDATION ENGINEERING SCIENCE, INC. GEOTECHNICAL, ENVIRONMENTAL & CONSTRUCTION INSPECTION 11843-B CANON BOULEVARD NEWPORT NEWS, VIRGINIA 23606 PHONE: 757-873-4113 FAX: 757-873-4114 EMAIL: RELAWAR@FESVA.COM			GEOTECHNICAL ENGINEERING STUDY **THE VILLAGES AT WESTMINSTER EARTHEN DAM CERTIFICATON** JAMES CITY COUNTY, VIRGINIA
DATE: **AUGUST 8, 2002**	SCALE: **N/A**	FES REPORT NO. **1-81295.115**	**FIGURE – 1** **USDA SOIL SURVEY MAP**



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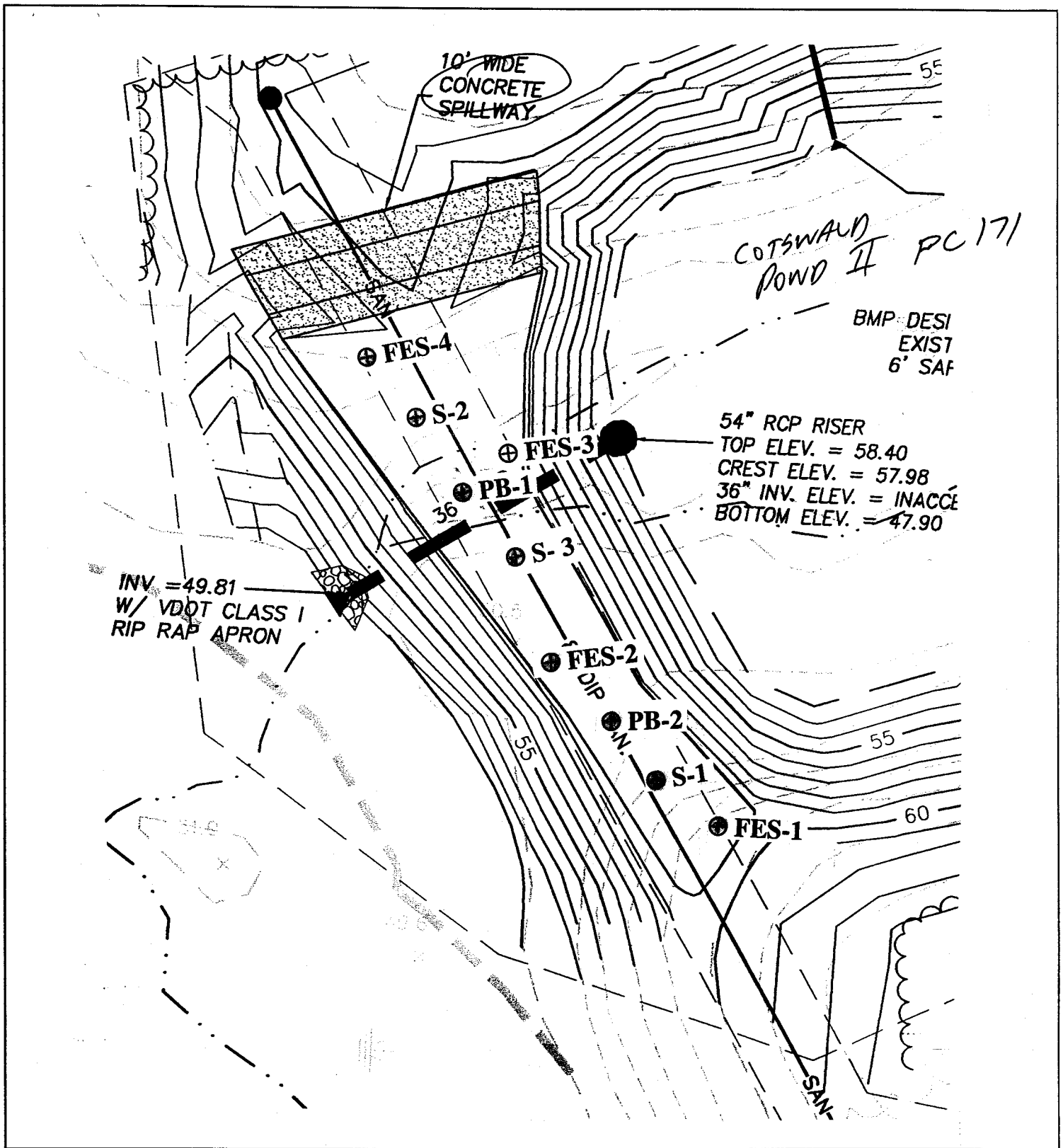
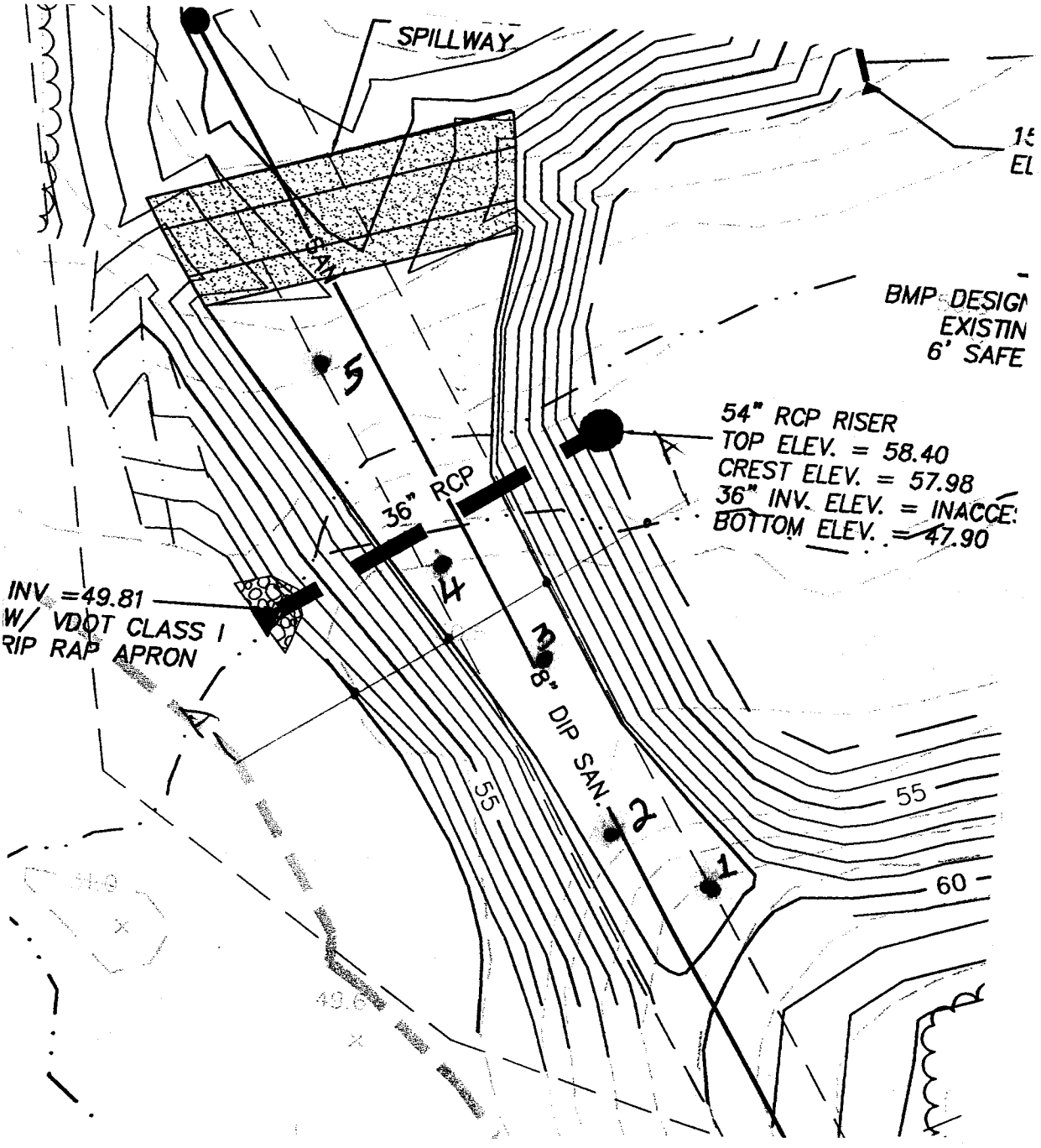
DATE: **AUGUST 8, 2002**	SCALE: **N/A**	FES REPORT NO. **1-81295.115**	**FIGURE – 2** **USGS QUADRANGLE MAP**



FOUNDATION ENGINEERING SCIENCE, INC. GEOTECHNICAL, ENVIRONMENTAL & CONSTRUCTION INSPECTION 11843-B CANON BOULEVARD NEWPORT NEWS, VIRGINIA 23606 PHONE: 757-873-4113 FAX: 757-873-4114 EMAIL: RELAWAR@FESVA.COM			GEOTECHNICAL ENGINEERING STUDY **THE VILLAGES AT WESTMINSTER** **EARTHEN DAM CERTIFICATON** JAMES CITY COUNTY, VIRGINIA
DATE: **AUGUST 8, 2002**	SCALE: **N/A**	FES REPORT NO. **1-81295.115**	**FIGURE – 3** **SAMPLE, PERMEABILITY AND BORINGS LOCATIONS SKETCH**



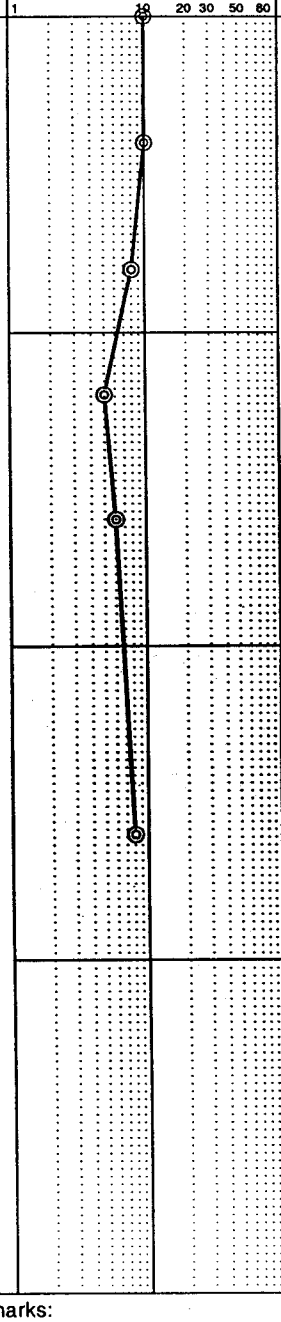
FOUNDATION ENGINEERING SCIENCE, INC. GEOTECHNICAL, ENVIRONMENTAL & CONSTRUCTION INSPECTION 11843-B CANON BOULEVARD NEWPORT NEWS, VIRGINIA 23606 PHONE: 757-873-4113 FAX: 757-873-4114 EMAIL: RELAWAR@FESVA.COM			GEOTECHNICAL ENGINEERING STUDY **THE VILLAGES AT WESTMINSTER** **EARTHEN DAM CERTIFICATON** JAMES CITY COUNTY, VIRGINIA
DATE: **AUGUST 8, 2002**	SCALE: **N/A**	FES REPORT NO. **1-81295.115**	**FIGURE – 4** **FIELD COMPCTION DENSITY LOCATIONS SKETCH**

BORING PROFILE SHEETS

FOUNDATION ENGINEERING SCIENCE, INC.
· Geotechnical Engineering
· Environmental Management
· Construction Materials Testing
11843-B Canon Boulevard
Newport News, Virginia 23606
Phone: 757-873-4113 Fax: 757-873-4114
Email: relawar@fesva.com

PROJECT NAME:	The Villages at Westminster - Earthern Dam Certification	PROJECT NO.:	1-81295.115
CLIENT:	Atlantic Homes, LLC	DRILLING METHOD:	HSA
PROJECT LOCATION:	James City County, Virginia	OBSERVED G.W.T.:	Not Encountered
BORING LOCATION:	See Figure 3	STATION NO.:	

ELEVATION (Feet)	DEPTH (Feet)	SOIL LEGEND & SAMPLE TYPES	SAMPLE NO.	SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT, N VALUE OR RQD %	STANDARD PENETRATION TEST N-VALUE ◎ (Blows/Ft)	HOLE COMPLETION & REMARKS
	0		1	SM	Light brown, dry to moist, silty SAND with roots "Topsoil"	10		
				SM	Light brown to brown, moist, silty SAND			
			2			10		
			3	CL	Light brown, moist, sandy CLAY with lenses of clayey sand (SC) from 4 to 6 feet and organic matter from 13 to 15 feet	8		
	5		4			5		
			5			6		
	10							
			6			8		
	15							



COMPLETION DEPTH:	15.0 feet
DATE BORING STARTED:	8/15/02
DATE BORING COMPLETED:	8/15/02
ENGINEER/GEOLOGIST:	IH
DRILLING CONTRACTOR:	SDS

Sample Types:
- Auger Cutting
- Vane Shear
- SPT
- UD
- Penetrometer
- Rock Core

Remarks:

Unless otherwise noted, water encountered but not

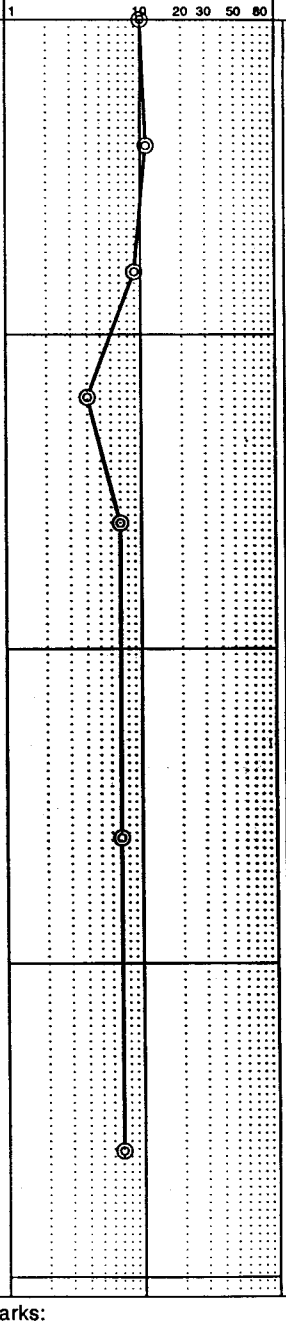
The stratification lines represent approximate boundaries.

FOUNDATION ENGINEERING SCIENCE, INC.
· Geotechnical Engineering
· Environmental Management
· Construction Materials Testing
11843-B Canon Boulevard
Newport News, Virginia 23606
Phone: 757-873-4113 Fax: 757-873-4114
Email: relawar@fesva.com

PROJECT NAME:	The Villages at Westminster - Earthern Dam Certification	PROJECT NO.:	1-81295.115
CLIENT:	Atlantic Homes, LLC	DRILLING METHOD:	HSA
PROJECT LOCATION:	James City County, Virginia	OBSERVED G.W.T.:	Not Encountered
BORING LOCATION:	See Figure 3	STATION NO.:	

ELEVATION (Feet)	DEPTH (Feet)	SAMPLE NO.	SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT, N VALUE OR RQD %
	0	1	SM	Light brown, dry to moist, silty SAND with roots	10
			CL	"Topsoil" Brown , moist, sandy CLAY	
		2			11
		3			9
	5				
		4	SC	Brown, moist, clayey SAND	4
		5			7
	10		CL-ML	Light brown, moist, sandy CLAY to sandy SILT	
		6			7
	15				
		7			7
	20				

STANDARD PENETRATION TEST N-VALUE (Blows/Ft)



HOLE COMPLETION & REMARKS

COMPLETION DEPTH:	20.0 feet
DATE BORING STARTED:	8/15/02
DATE BORING COMPLETED:	8/15/02
ENGINEER/GEOLOGIST:	IH
DRILLING CONTRACTOR:	SDS

Sample Types:
- Auger Cutting
- Vane Shear
- SPT
- UD
- Penetrometer
- Rock Core

Remarks:

Unless otherwise noted, water encountered but not

The stratification lines represent approximate boundaries.

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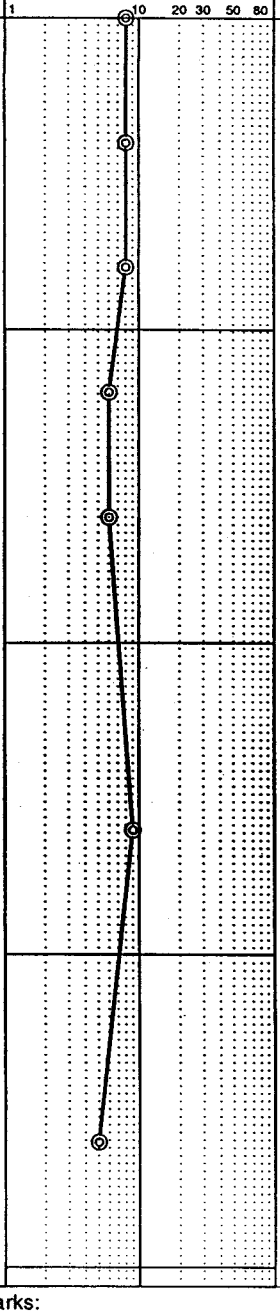
PROJECT NAME:	The Villages at Westminster - Earthern Dam Certification	PROJECT NO.:	1-81295.115
CLIENT:	Atlantic Homes, LLC	DRILLING METHOD:	HSA
PROJECT LOCATION:	James City County, Virginia	OBSERVED G.W.T.:	Not Encountered
BORING LOCATION:	See Figure 3	STATION NO.:	

ELEVATION (Feet)	DEPTH (Feet)	SAMPLE NO.	SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT, N VALUE OR RQD %
	0	1	SM	Light brown, dry to moist, silty SAND with roots	8
			CL-ML	"Topsoil" Light brown, moist, sandy CLAY to sandy SILT	
		2			8
		3	SM	Light brown to brown, moist, silty SAND	8
	5	4			6
		5			6
	10				
			CL	Light brown, moist, sandy CLAY	
		6			9
	15				
		7			5
	20				

STANDARD PENETRATION TEST N-VALUE (Blows/Ft)



HOLE COMPLETION & REMARKS

COMPLETION DEPTH:	20.0 feet
DATE BORING STARTED:	8/15/02
DATE BORING COMPLETED:	8/15/02
ENGINEER/GEOLOGIST:	IH
DRILLING CONTRACTOR:	SDS

Sample Types:
Auger Cutting
Vane Shear
SPT
UD
Penetrometer
Rock Core

Remarks:

Unless otherwise noted, water encountered but not recorded.

The stratification lines represent approximate boundaries. The transition may be gradual.

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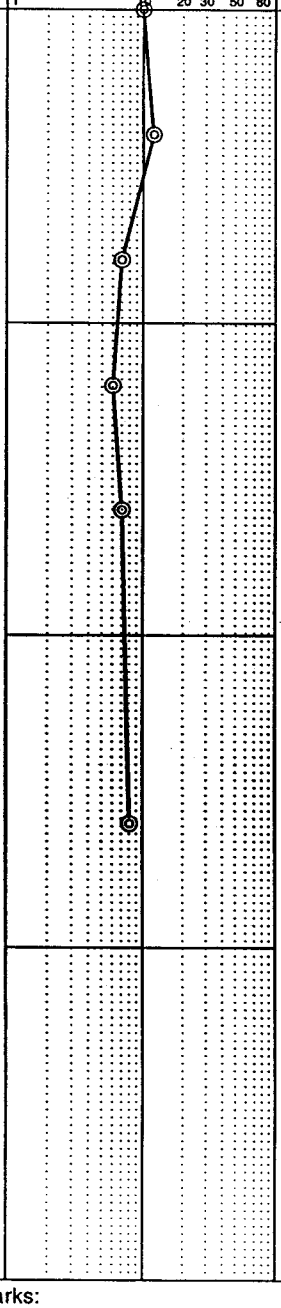
· Geotechnical Engineering
· Environmental Management
· Construction Materials Testing
11843-B Canon Boulevard
Newport News, Virginia 23606
Phone: 757-873-4113 Fax: 757-873-4114
Email: relawar@fesva.com

PROJECT NAME:	The Villages at Westminster - Earthern Dam Certification	PROJECT NO.:	1-81295.115
CLIENT:	Atlantic Homes, LLC	DRILLING METHOD:	HSA
PROJECT LOCATION:	James City County, Virginia	OBSERVED G.W.T.:	Not Encountered
BORING LOCATION:	See Figure 3	STATION NO.:	

ELEVATION (Feet)	DEPTH (Feet)	SOIL LEGEND & SAMPLE TYPES	SAMPLE NO.	SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT, N VALUE OR RQD %	STANDARD PENETRATION TEST N-VALUE ◎ (Blows/Ft)	HOLE COMPLETION & REMARKS
	0		1	SM	Light brown, dry to moist, silty SAND with roots "Topsoil"	10		
				SM	Brown, moist, silty SAND			
			2			12		
			3			7		
	5							
			4	CL	Light brown, moist, sandy CLAY	6		
			5			7		
	10							
			6			8		
	15							



COMPLETION DEPTH:	15.0 feet
DATE BORING STARTED:	8/15/02
DATE BORING COMPLETED:	8/15/02
ENGINEER/GEOLOGIST:	IH
DRILLING CONTRACTOR:	SDS

Sample Types:
- Auger Cutting
- Vane Shear
- SPT
- UD
- Penetrometer
- Rock Core

Remarks:

Unless otherwise noted, water encountered but not recorded.

The stratification lines represent approximate boundaries. The transition may be gradual.

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· Geotechnical Engineering
· Environmental Management
· Construction Materials Testing
11843-B Canon Boulevard
Newport News, Virginia 23606
Phone: 757-873-4113 Fax: 757-873-4114
Email: relawar@fesva.com

AB-1

PROJECT NAME:	The Villages at Westminster - Earthern Dam Certification	PROJECT NO.:	1-81295.115
CLIENT:	Atlantic Homes, LLC	DRILLING METHOD:	Hand Auger
PROJECT LOCATION:	James City County, Virginia	OBSERVED G.W.T.:	Not Encountered
BORING LOCATION:	See Figure 3	STATION NO.:	

ELEVATION (Feet)	DEPTH (Feet)	SOIL LEGEND & SAMPLE TYPES	SAMPLE NO.	SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT, N VALUE OR RQD %	STANDARD PENETRATION TEST N-VALUE ◎ (Blows/Ft) 1 10 20 30 50 80	HOLE COMPLETION & REMARKS
	0			SM	Light brown, dry to moist, silty fine SAND with roots "Topsoil"			
				SM	Light brown, moist, silty SAND with trace clay			
				SC	Light brown, moist, clayey SAND			
	5							

COMPLETION DEPTH:	6.0 feet
DATE BORING STARTED:	8/8/02
DATE BORING COMPLETED:	8/8/02
ENGINEER/GEOLOGIST:	IH
DRILLING CONTRACTOR:	FES

Sample Types:
- Auger Cutting
- Vane Shear
- SPT
- UD
- Penetrometer
- Rock Core

Remarks:

Unless otherwise noted, water encountered but not recorded

The stratification lines represent approximate boundaries. The transition may be gradual.

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· Geotechnical Engineering
· Environmental Management
· Construction Materials Testing
11843-B Canon Boulevard
Newport News, Virginia 23606
Phone: 757-873-4113 Fax: 757-873-4114
Email: relawar@fesva.com

AB-2

PROJECT NAME:	The Villages at Westminster - Earthern Dam Certification	PROJECT NO.:	1-81295.115
CLIENT:	Atlantic Homes, LLC	DRILLING METHOD:	Hand auger
PROJECT LOCATION:	James City County, Virginia	OBSERVED G.W.T.:	Not Encountered
BORING LOCATION:	See Figure 3	STATION NO.:	

ELEVATION (Feet)	DEPTH (Feet)	SOIL LEGEND & SAMPLE TYPES	SAMPLE NO.	SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT, N VALUE OR RQD %	STANDARD PENETRATION TEST N-VALUE ◎ (Blows/Ft) 1 10 20 30 50 80	HOLE COMPLETION & REMARKS
	0			SM	Light brown, dry to moist, silty SAND with roots "Topsoil"			
				SM	Brown, moist, silty SAND			
				SC	Brown to light brown, moist, clayey SAND with pockets of sandy CLAY			
	5							

COMPLETION DEPTH:	6.0 feet
DATE BORING STARTED:	8/8/02
DATE BORING COMPLETED:	8/8/02
ENGINEER/GEOLOGIST:	IH
DRILLING CONTRACTOR:	FES

Sample Types:
- Auger Cutting
- Vane Shear
- SPT
- UD
- Penetrometer
- Rock Core

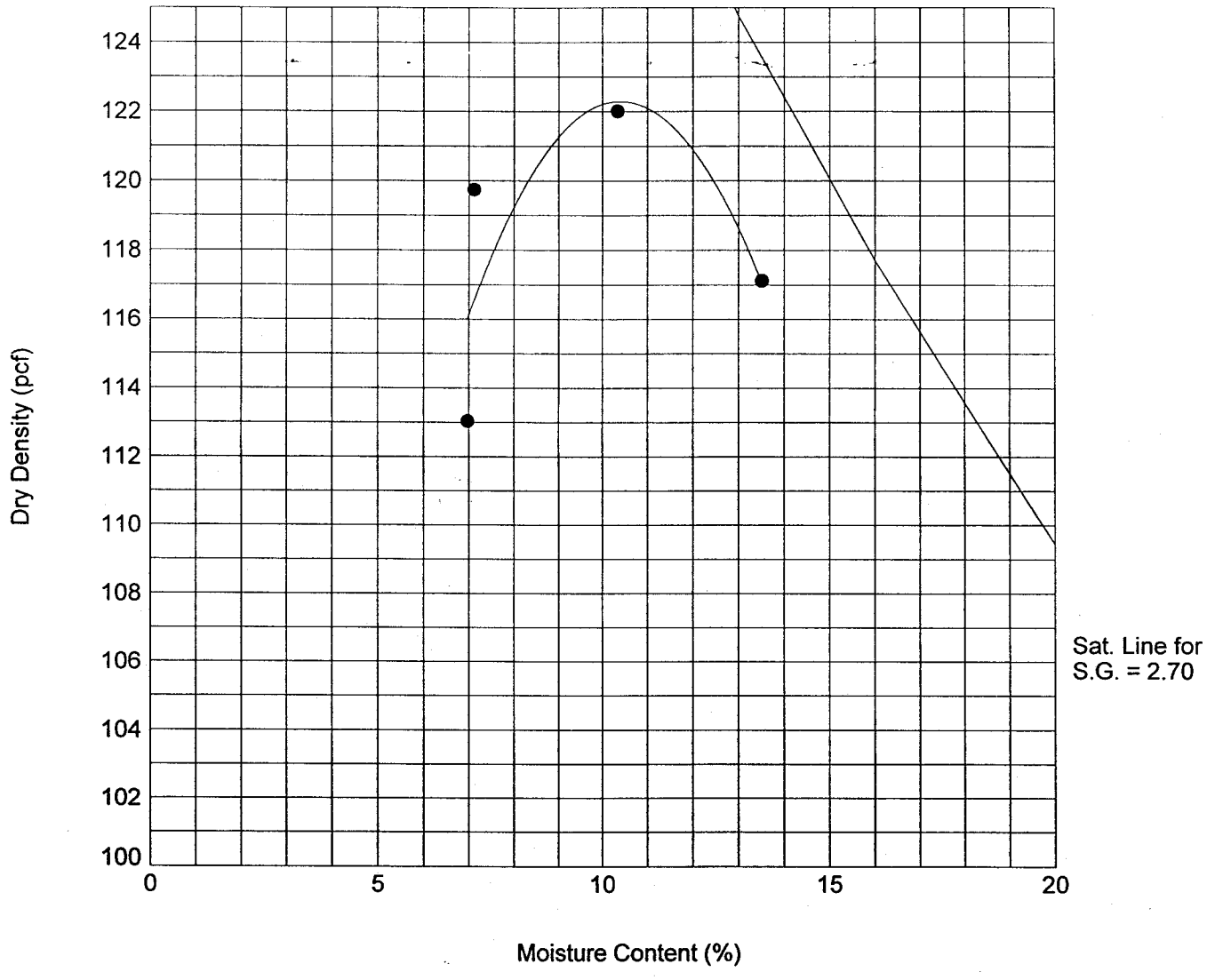
Remarks:

Unless otherwise noted, water encountered but not recorded

The stratification lines represent approximate boundaries. The transition may be gradual.

LABORATORY TEST RESULTS

MOISTURE-DENSITY RELATIONSHIP REPORT



Sample Depth	Classification		Nat'l Moist.	S.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
1 0.0	SM	A-2-6	10.8	2.70		NP	0	41.1

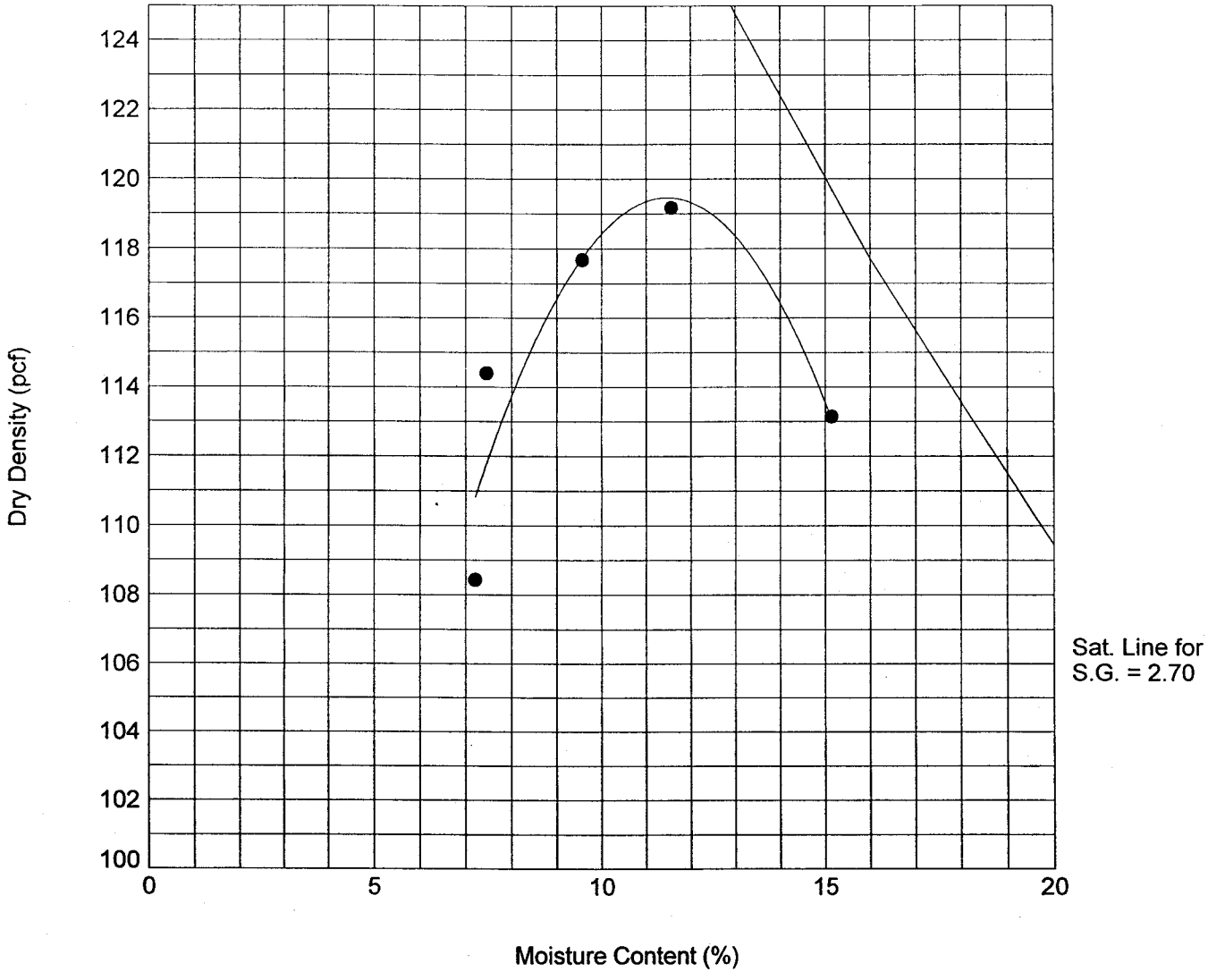
Test Results	Material Description
Optimum Moisture Content = 10.5 Maximum Dry Density = 122.5	Brown silty SAND
Project No.: 1-81295 Project Name: Villages at Westminster Development Location: Williamsburg, Virginia Date: 08/01/2002	Remarks: On July 30, 2002 a FES representative obtained a bulk soil sample of the on-site material. Procedure: ASTM D698, Method A Rammer: Manual Preparation: Dry

FOUNDATION ENGINEERING SCIENCE, INC.

Figure 1

PROCTOR 1-81295.GPJ FES.GDT 8/28/02

MOISTURE-DENSITY RELATIONSHIP REPORT



Sample Depth	Classification		Nat'l Moist.	S.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
2 0.0	SM	A-2-6	10.6	2.70		NP	0	41.2

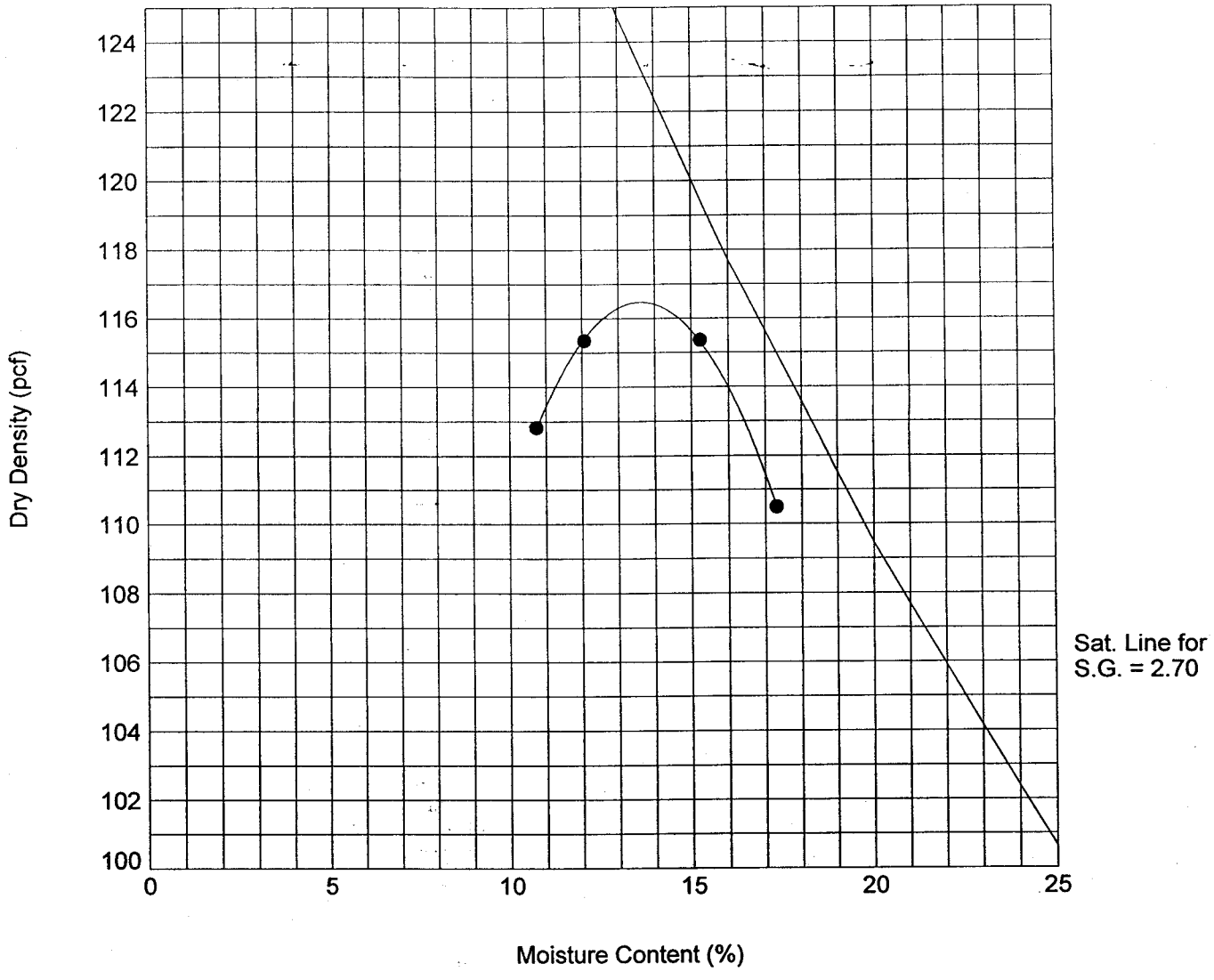
Test Results	Material Description
Optimum Moisture Content = 11.5 Maximum Dry Density = 119.5	Brown silty SAND
Project No.: 1-81295 Project Name: Villages at Westminster Development Location: Williamsburg, Virginia Date: 07/31/2002	Remarks: On July 30, 2002 a FES representative obtained a bulk soil sample of the on-site material. Procedure: ASTM D698, Method A Rammer: Manual Preparation: Dry

FOUNDATION ENGINEERING SCIENCE, INC.

Figure 2

PROCTOR 1-81295.GPJ FES.GDT 8/28/02

MOISTURE-DENSITY RELATIONSHIP REPORT



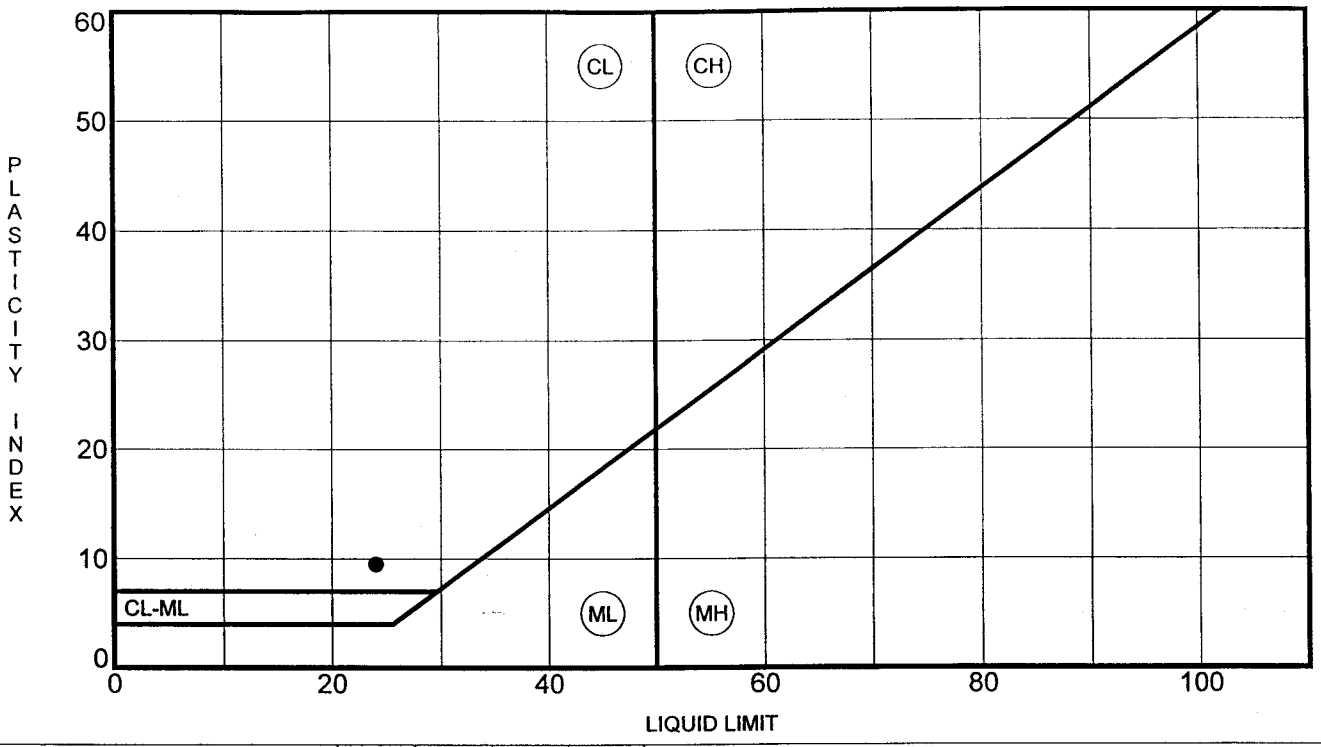
Sample Depth	Classification		Nat'l Moist.	S.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
3 0.0	CL	A-6	17.0	2.70	24	9	0	84.9

Test Results	Material Description
Optimum Moisture Content = 13.5 Maximum Dry Density =116.5	Brown to gray sandy CLAY
Project No.: 1-81295 Project Name: Villages at Westminster Development Location: Williamsburg, Virginia Date: 09/19/2002	Remarks: On September 18, 2002 a FES representative obtained one bulk soil sample from the existing earthen dam. Procedure: ASTM D698, Method A Rammer: Manual Preparation: Dry

FOUNDATION ENGINEERING SCIENCE, INC.

Figure 1

PROCTOR 1-81295.GPJ FES.GDT 9/24/02



	Specimen Identification		LL	PL	PI	Fines	Classification
●	3	0.0	24	15	9	85	(CL)

FES

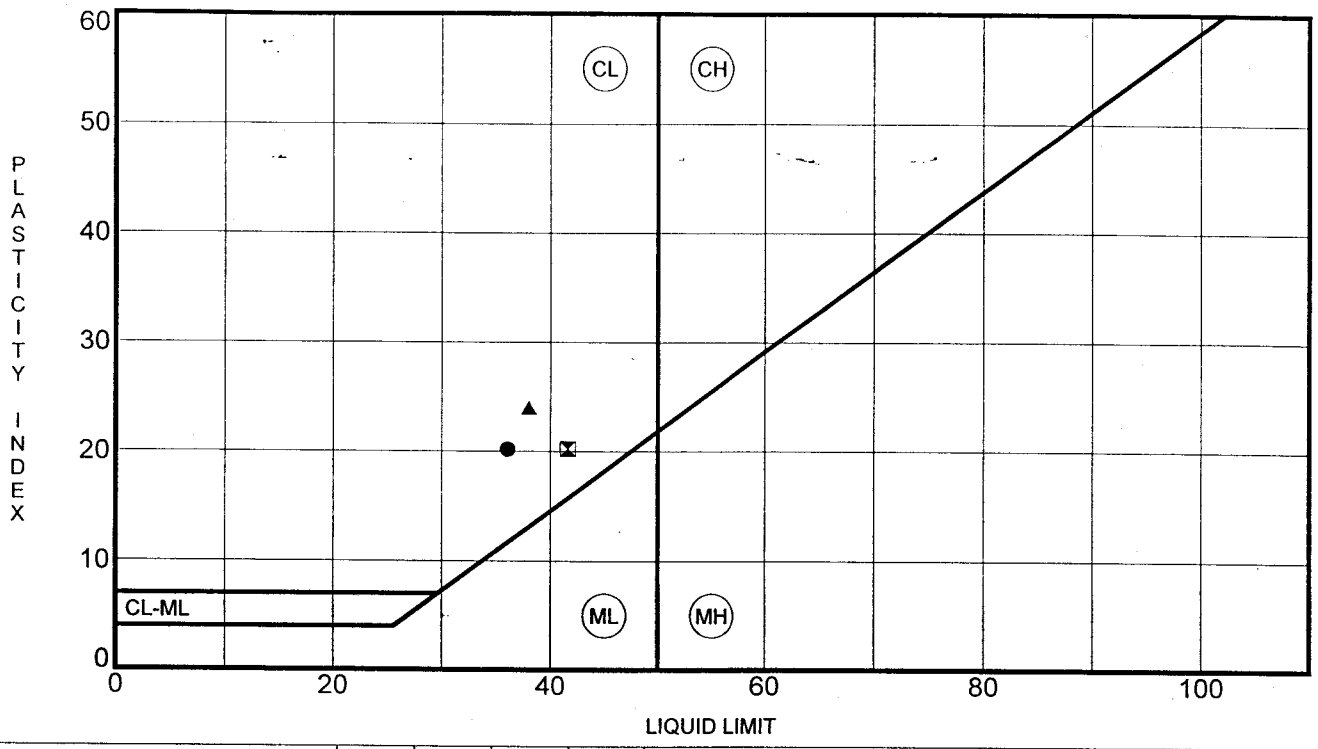
Foundation Engineering Science, Inc.
11843-B Canon Boulevard
Newport News, Virginia 23606
Telephone: 757-873-4113
Fax: 757-873-4114

ATTERBERG LIMITS RESULTS

Project: Villages at Westminster Development

Location: Williamsburg, Virginia

Number: 1-81295



	Specimen Identification		LL	PL	PI	Fines	Classification
●	FES-2	4.0	36	16	20		Reddish brown sandy CLAY (CL)
⊠	FES-3	15.0	42	21	21		Reddish brown sandy CLAY (CL)
▲	FES-4	8.0	38	14	24		Reddish brown sandy CLAY (CL)

US_ATTERBERG_LIMITS 1-81295.GPJ US_LAB.GDT 8/28/02

FES

Foundation Engineering Science, Inc.
11843-B Canon Boulevard
Newport News, Virginia 23606
Telephone: 757-873-4113
Fax: 757-873-4114

ATTERBERG LIMITS RESULTS

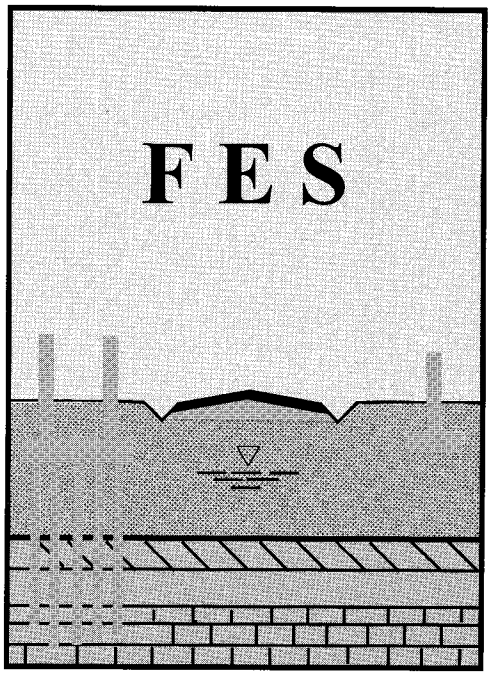
Project: Villages at Westminster Development

Location: Williamsburg, Virginia

Number: 1-81295

Check
the Back
Pond

[redacted]



GEOTECHNICAL ENGINEERING STUDY REPORT
THE VILLAGES AT WESTMINSTER –
EARTHEN DAM CERTIFICATION
JAMES CITY COUNTY, VIRGINIA
FES REPORT NO. 1-81295.115

CLIENT: MR. KEN DODD
ATLANTIC HOMES, LLC

JUN 2003
RECEIVED
ENVIRONMENTAL DIVISION

SP-100-97
PC 171
POND II

APPROVED
James City County
Environmental Division
By: _____
Date: 6-25-03

Geotechnical Engineering Study Report
The Villages at Westminster
Earthen Dam Certification
James City County, Virginia

Prepared for

Atlantic Homes, LLC

Prepared by

Foundation Engineering Science, Inc.

January 16, 2003

FOUNDATION ENGINEERING SCIENCE, INC.

- Drilling Services [Geotechnical & Environmental]
- Geotechnical Engineering [Shallow & Deep Foundations, Retaining Walls & Pavement Design]
- Environmental Management [Phase I & II]
- Construction Inspection Services [Quality Control & Quality Assurance]
- Foundation/Structure & Pavement Distress Evaluations
- Value Engineering During Design & Construction
- Design & Build Segmental Reinforced Retaining Walls [SRRW]

Mr. Ken Dodd
Atlantic Homes, LLC
10 San Jose Drive
Newport News, Virginia 23606

January 16, 2003

Re: Geotechnical Engineering Study Report
The Villages at Westminster – Earthen Dam Certification
James City County, Virginia
FES Report No. 1-81295.115

Dear Mr. Dodd:

Foundation Engineering Science, Inc. (FES) has completed a geotechnical engineering study at the existing project site. This geotechnical engineering study was performed in general accordance with FES Proposal No. NP668.001, dated June 10, 2002, following your written authorization on July 23, 2002. Pursuant to your request, FES delayed the field testing due to limited access to the site until August 6, 2002. The geotechnical engineering study consisted of performing four (4) Standard Penetration Test (SPT) borings to approximate depths ranging from fifteen (15) to twenty (20) feet below the existing grades, obtained two (2) bulk soil samples for laboratory testing, performed two (2) hand auger borings to six (6) feet in depth, performed two (2) field permeability tests and performed compaction density tests on the final grade for the existing Earthen Dam.

Briefly, the results of our analyses indicated that there were silty sand (SM), clayey sand (SC), sandy clay to sandy silt (CL-ML) and sandy clay (CL) within the borings performed. The clayey sand (SC), sandy clay (CL) and sandy clay to sandy silt (CL-ML) soils are acceptable for use as fill material for the core of the earthen dam. Additionally, all the soils are acceptable as fill material for the earthen dam embankment [outer shell].

Based on the as built plans prepared by Rickmond Engineering, Inc. and dated January 13, 2003, The side slopes of the earthen dam appear to be three (3) horizontal to one (1) vertical [3H:1V] and as shown in the plans. The global stability indicated that the down stream slopes will be stable during a flooded condition, with a factor of safety greater than one (1) as required for a draw down analysis.

FES did not inspect the earthen dam during construction. Additionally, the existing subgrade in the earthen dam area and the key trench were not evaluated prior to placement of the fill materials. The concrete cradle was not inspected.

11843-B CANON BOULEVARD ➢ NEWPORT NEWS, VIRGINIA 23606 ➢ PHONE: 757-873-4113 FAX: 757-873-4114

FES appreciates the opportunity to be of service to the **Atlantic Homes, LLC** on this important project and looks forward to its approval. If we can be of any further assistance or you have any questions regarding this report, please do not hesitate to contact the undersigned.

Respectfully submitted,

FOUNDATION ENGINEERING SCIENCE, INC.

Idres Hawarry / lp

Idres Hawarry
Project Engineer

1/17/03

Raja S. El-Awar, P.E.
Principal Engineer
VA Reg. No. 26383

COMMONWEALTH OF VIRGINIA
RAJA S. ELAWAR
No. 026383
PROFESSIONAL ENGINEER

Attachments: *Appendix*

Figure- 1 USDA Soil Survey Map
Figure- 2 USGS Quadrangle Map
Figure- 3 Permeability and Borings Location Sketch
Figure- 4 Compaction Density Test Locations
Borings Profile Sheets
Laboratory Testing Program Results

X Copies: *(2) Client*

C:\company\Old File\1998\geotech\1-81295.115

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Boring Profile Sheets
Laboratory Testing Program Results

1.0 INTRODUCTION

1.1 Site Characteristics and Project Information

The project site is located in James City County, Virginia. Specifically, the project site is located within the Villages at Westminster off Route 60 just immediately south of Route 199. The site currently contains existing Earthen Dam and identified in the project plans as POND II.

Our review of the project plans and specifications prepared by Rickmond Engineering, Inc. and dated March 6, 2001 and revised dated January 13, 2003 indicated that the dimension for the earthen dam are approximately 145 feet in length and ranges approximately from 65 to 100 feet in plan width [toe to toe]. The as built plans indicated side slopes that are three (3) horizontal to one (1) vertical [3H:1V] and the design high water elevation in the pond is 56.99 feet National Geodetic Vertical Datum (NGVD) of 1929. The plans did not show any details for the core of the earthen dam.

2.0 PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to obtain information on the soils located within the Earthen Dam and degree of compaction of the soils placed for the existing Earthen Dam. The existing materials encountered were then evaluated with respect to the available project information and site characteristics. In this regard, for the following items were formulated:

1. Development of shallow and deep subsurface soil and ground water conditions at the existing Earthen Dam area.

2. Performed compaction density testing on the final grade and approximately one (1) to two (2) feet below the final grade to develop correlation between the Standard Penetration Test (SPT) boring N-values and relative compaction.

3. General location and description of potentially deleterious materials encountered in the borings performed, including existing fills or surficial organic.

4. Certify the existing Earthen Dam in general accordance with the plans and specifications. If the existing Earthen Dam does not meet the approved project plans and specifications and James City County requirements, FES will provide parameters required for improving and/or replacing the existing Earthen Dam.

The following services were provided in order to achieve the preceding objectives:

1. Reviewed readily available published geologic and topographic information. This published information was obtained from quadrangle maps published by the United States Geologic Survey (USGS) and Soil Survey published by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS), if available.

2. FES executed a program of subsurface exploration that consisted of subsurface sampling, filed and laboratory testing.

3. Performed two (2) hand auger borings to six (6) feet in depth and obtained two (2) bulk soil samples for laboratory testing and analyses. The bulk samples were collected from the existing materials placed for the existing Dam areas. FES performed two (2) field permeability tests within the existing Earthen Dam fill materials.

4. Visually classify and stratify representative soil samples in the laboratory using the Unified Soil Classification System (USCS)), in general accordance with ASTM D-2487 and D-2488. Conducted a laboratory program, that consisted of performing natural moisture content [ASTM D-2216], Atterberg Limits [ASTM D-4318], grain size determination [(-#200) ASTM D-1140] and Standard Proctor [ASTM D-698 tests.

5. Collected ground water level measurements in the borings performed.

6. The results of the field exploration and laboratory testing program were utilized in performing engineering evaluation, analysis and in the formulation of suitability and stability of the existing Earthen Dam. The results of the field exploration, laboratory testing program, conclusions and recommendations are presented in a comprehensive geotechnical engineering study report prepared by an FES experienced Professional Engineer registered in the Commonwealth of Virginia.

2.1 Report Format

This report begins with a discussion of the field and laboratory programs followed by a description of the general subsurface conditions, field permeability testing, compaction density testing suitability of the existing materials within the existing Earthen Dam and report limitations. The USDA soil survey, USGS quadrangle map, the borings and sample locations sketches are presented in Figures 1, 2 and 3, respectively in the Appendix of this report. Additionally, the boring profile sheets and laboratory test figures are also presented in the Appendix of this report.

3.0 FIELD EXPLORATION

3.1 General

A total of four (4) Standard Penetration Test (SPT) borings were drilled within the existing Earthen Dam area to explore the general soil types. The SPT borings were drilled to approximate depths ranging from fifteen (15) to twenty (20) feet below the existing top of the Earthen Dam grades. The approximate location of the borings is illustrated in Figure 3. Performed two (2) hand auger borings, two (2) field permeability test and obtained two (2) bulk soil samples for the laboratory testing program.

3.2 SPT Borings

The SPT borings were performed with the use of an All Terrain Vehicle (ATV) mounted drill rig by utilizing hollow steam auger (HSA) procedures. The soil sampling was performed in general accordance with the American Society of Testing and Materials (ASTM) Test Designation D-1586. These samples were taken continuously from the final grade to approximate depths ranging from fifteen (15) to twenty (20) feet below the final/existing grade elevations. Representative portions of these soil samples were collected, labeled and transported to our office for laboratory testing, analysis and classification.

3.3 Bulk Soil Sampling

Two (2) bulk soil samples were obtained in the field from the existing materials placed for the Earthen Dam at approximate depths ranging from one (1) to two (2) feet below the existing subgrade elevations. The locations of the bulk soil samples are shown in Figure 3 in the appendix of this report.

3.4 Auger Borings

The auger borings were performed with the use of a three (3) inch bucket auger, the soil sampling was performed in general accordance with American Society for Testing and Materials (ASTM) test designation D-1452, titled "Soil Investigation and Sampling by Auger Borings". The soil samples were obtained virtually continuously from the ground surface to boring termination an approximate depth of six (6) feet below the final grades. Representative portions of these soil samples were collected, labeled and transported to our office for laboratory testing, analysis and classification.

3.5 Field Permeability

Two (2) field permeability tests [open-hole, falling head method] were performed by installing a two (2) inch inside diameter PVC pipe (ground water observation well) with flush joints to an approximate depth of six (6) feet below the existing grades. The permeability testing equipment consisted of a PVC pipe with a close-ended section and a twenty-four (24) inch screen (using a 0.01-inch slot size opening) from four (4) to six (8) feet below the existing grades. Coarse sand (#2) was backfilled to six (6) inches above the screened annual space of the well, followed by a six (6) inch bentonite seal placed over the sand. The purpose of this construction method was to restrict upward (test) water flow between the well hole and the outside wall of the augered hole.

The wells were developed by pumping water into them and allowing them to soak for a period of one (1) hour. Following a soaking period of one (1) hour, water was added until it reached the top of the well casing and allowed to fall a known distance over a measured time. This procedure was repeated a minimum of three (3) times or until time deviation between the tests was less than ten (10) percent.

The collected field data was utilized in the equation found in the "Stormwater Retention Pond Infiltration Analyses in Unconfined Aquifers" for determining the coefficient of permeability of the subject soil stratum. The infiltration rates calculated are presented in tabular format below:

TEST LOCATION	PB-1	PB-2
PERMEABILITY (In/hr)	3.8	2.55

4.0 LABORATORY TESTING

4.1 General

The soil samples were transported to our laboratory and were classified by an experienced Geologist and Geotechnical Engineer using the Unified Soil Classification System (USCS) in general accordance with ASTM test designations D-2487 and D-2488.

4.2 Tests Performed

Representative soil samples were subjected to a laboratory program. The laboratory program consisted of performing natural moisture content [ASTM D-2216], Atterberg Limits [ASTM D-4318], grain size determination [(-#200) ASTM D-1140] and moisture-density relation ship [Standard Proctor ASTM D-698] tests. The laboratory test results are presented in tabular formats below and in the appendix of this report.

LABORATORY TEST	ASTM PROCEDURE	NO. OF TESTS
Moisture Content Determination	ASTM D-2216	16
Grain-Size Determination (-#200 Sieve)	ASTM D-1140	16
Atterberg Limits (Liquid and Plastic)	ASTM D-4318	4
Moisture-Density Relationship (Std. Proctor)	ASTM D-698	3

4.3 Test Results

LOCATION	APPROX. SAMPLE DEPTH (Feet)	NATURAL MOIST. CONTENT (%)	#200 SIEVE (%)	ATTERBERG LIMITS		USCS	OPT. MOIST. CONTENT (%)	MAX. DRY DENSITY (pcf)	CBR VALUE (%)
				LL (%)	PI (%)				
Proctor-1	1.5	7.1	32.5	---	NP	SM	10.5	122.5	---
Proctor-2	1.5	8.2	22.5	---	NP	SM	11.5	119.5	---
Proctor- 3	1.5	17.0	84.9	24	9	CL	13.5	116.5	---
FES-1	3	8.9	35.2	---	---	SM	---	---	---
FES-1	5	27.0	78.5	---	---	CL	---	---	---
FES-1	7	25.3	62.4	---	---	CL-ML	---	---	---
FES-2	4	16.9	50.4	42	21	CL	---	---	---
FES-2	7	12.6	42.6	---	---	SC	---	---	---
FES-2	14	20.6	68.5	---	---	CL-ML	---	---	---
FES-3	3	15.3	65.1	---	NP	CL-ML	---	---	---
FES-3	5	9.8	27.0	---	NP	SM	---	---	---
FES-3	7	11.8	32.0	---	---	SM	---	---	---
FES-3	15	21.9	74.5	38	42	CL	---	---	---
FES-4	5	13.6	25.8	---	---	SM	---	---	---
FES-4	8	18.8	57.2	38	14	CL	---	---	---
FES-4	14	22.1	50.1	---	---	CL	---	---	---

5.0 GENERALIZED SUBSURFACE CONDITIONS

5.1 USGS Topographic Survey

The topographic survey map published by the United States Geological Survey titled "Williamsburg, Virginia" dated 1984, was reviewed for ground surface features at the proposed project location. Based on this review, the natural ground surface elevation approximately fifty (50) to sixty (60) feet National Geodetic Vertical Datum (NGVD) of 1929. The USGS topographic map for the project vicinity is presented in Figure 1 in the appendix of this report.

5.2 USDA Soil Survey

The "James City County, Virginia" Soil Survey, developed by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS), was reviewed for general near-surface soil information within the general site vicinity. This information indicated that there are three (3) primary mapping units (11C and 15E) within the proposed site area. The USDA Soil Conservation Service (SCS) Survey map for the project vicinity is presented in Figure 1 in the appendix of this report. The map soil units encountered are as follows:

SOIL SERIES	DEPTH (IN.)	SOIL DESCRIPTION	USCS	USDA SEASONAL HIGH GROUNDWATER TABLE (%)		K [2] (IN/HR)	SHRINK/ SWELL POTENTIAL
				DEPTH (FEET)	MON.		
Craven (11C)	0 – 9	Fine sandy loam	ML, CL-ML,			0.6 – 2.0	Low
	9 – 30	Clay, silty clay, silty clay, loam	SM, SM-SC CH	2.0 – 3.0	Dec –Apr	0.06 – 0.2	Moderate
	30 – 72	Sandy clay loam, sandy loam, fine, sandy loam	SM, SM-SC, SC			0.2 – 6.0	Low
Emporia (15E)	0 – 9	Fine sandy loam	CL, SC, SM, ML	3.0 – 4.5	Nov – Apr	2.0 – 6.0	Low
	9 – 37	Sandy clay loam, Sandy loam, Clay loam	SC, CL			0.2 – 2	Low
	37 – 50	Sandy clay loam, Clay loam, Clay loam	SC, CL			0.06 – 0.6	Moderate
	50 – 75	Stratified sandy loam to clay loam	SM, SC, ML, CL			0.06 – 2.0	Moderate

[1] USCS = Unified Soil Classification System
[2] K = Permeability

5.3 General

Soil stratification was based on visual examination of the recovered soil samples, laboratory testing and interpretation of the field boring log by an experienced Geologist and Geotechnical Engineer. The boring stratification lines represent the approximate boundaries between soil types of significantly different engineering properties; however, the actual transition may be gradual. In some cases, small variations in properties not considered pertinent to our engineering evaluation may have been abbreviated or omitted for clarity. The boring profiles present the conditions at the particular boring location and variations do occur among the borings and between soil samples.

5.4 Subsurface Soil Conditions

The subsurface soils encountered at each structure location have been summarized and are presented in tabular format below:

BORING LOCATION	SOIL LAYER	SOIL DESCRIPTION	DEPTH RANGE (FEET)	AVARAGE SPT "N" VALUES (BPF)	AASHTO SYMBOL
FES-1	1	Light brown, dry to moist, silty SAND with roots "Topsoil"	0 – 0.5	---	SM
	2	Light brown to brown, moist, silty SAND	0.5 – 4	10	SM
	3	Light brown, moist, sandy CLAY to sandy SILT with lenses of clayey sand (SC) from 5 to 6 and organic matter from 13 to 15 feet	4 – 15	6	CL-ML
FES-2	1	Light brown, dry to moist, silty SAND with roots "Topsoil"	0 – 0.5	---	SM
	2	Brown, moist, sandy CLAY	0.5 – 6	10	CL
	3	Brown, moist, clayey SAND	6 – 10	5	SC
	4	Light brown, moist, sandy CLAY to sandy SILT	10 – 20	7	CL-ML
FES-3	1	Light brown, dry to moist, silty SAND with roots "Topsoil"	0 – 0.5	---	SM
	2	Light brown, moist, sandy CLAY to sandy SILT	0.5 – 4	8	CL-ML
	3	Light brown, moist, silty SAND	4 –12	7	SM
	4	Light brown, moist, sandy CLAY	12 – 20	7	CL
FES-4	1	Light brown, dry to moist, silty SAND with roots "Topsoil"	0 – 0.5	---	SM
	2	Light brown, moist, silty SAND	0.5 – 6	9	SM
	3	Light brown, moist, sandy CLAY	6 – 15	7	CL
AB-1	1	Light brown, dry to moist, silty SAND with roots "Topsoil"	0 – 0.5	---	SM
	2	Light brown, moist, silty SAND with trace clay	0.5 – 4	---	SM
	3	Light brown, moist, clayey SAND	4 – 6	---	SC
AB-2	1	Light brown, dry to moist, silty SAND with roots "Topsoil"	0 – 0.5	---	CL-Ml
	2	Brown, moist, silty SAND	0.5 – 3	---	SM
	3	Brown to light brown, moist, sandy CLAY to sandy SILT	3 – 6	---	SC
Ground Water Conditions: The ground water table was not encountered in the borings performed on August 15, 2002.					

Based on our extensive experience with similar soil types, it is expected that the majority of the subsurface soils encountered within the borings performed, will consist of a cohesive and cohesion less soils. Please refer to the soil boring profiles located in the appendix of this report for specific information at each boring location.

5.5 Ground Water Conditions

The ground water table was not encountered in the SPT borings performed during the field exploration program on August 15, 2002. Ground water levels tend to fluctuate in response to variations in seasonal rainfall, infiltration, site topography and drainage. Based on the soil conditions encountered and the USGS Topographic Map, FES estimates the seasonal normal high ground water level to be encountered at an approximate depth of three (3) feet below the existing grades. However, a "perched" ground water condition, which dissipates with time may be encountered within the top three (3) feet following periods of significant rainfall during and immediately following the wet season.

6.0 EARTEN DAM SOIL SUITABILITY AND STABILITY

6.1 Soil Suitability

The clayey sand (SC), sandy clay (CL) and sandy clay to sandy silt (CL-ML) soils are acceptable material for the core of the Earthen Dam. Additionally, all the soils are suitable as fill material for the Earthen Dam embankment [outer shell].

6.2 Stability

FES representative performed slope stability analyses by a two-dimensional limit equilibrium method using the computer program PCSTABL6. This program was developed at Purdue University under sponsorship of the Federal Highway Administration (FHWA). The program uses the method of slices to determine the safety factor against deep seated circular failure.

Using a 3.0:1V side slopes, we evaluated the stability against slope failure at the highest embankment of eight (8) feet. The soil parameters were developed from the SPT borings performed for the existing Earthen Dam. Input data for the subsurface soils were obtained using general correlations from laboratory test data and Standard Penetration Test N-values.

The global stability safety factors for the assumed embankment elevation of eight (8) feet and the draw down analysis were computed to be 1.8 and 1.1, respectively [the required design factors of safety for the assumed design embankment and draw down should be 1.25 and 1.0, respectively]. The computed factors of safety for the assumed highest embankment and the draw down analysis met the minimum required factors of safety.

7.0 COMPACTION DENSITY TESTING

Foundation Engineering Science, Inc. (FES) performed compaction density testing on the final subgrade material for the existing Earthen Dam. These tests were performed in general accordance with the American Society for Testing and Materials (ASTM) Test Designation D-2922, titled "Compaction Density Testing with Portable Nuclear Gauge". The results of the compaction density tests are tabulated below:

FIELD COMPACTION DENSITY REPORT[1]

Gauge #	26814	Model #	3430	Density Std. Ct.	2516	Moisture Std. Ct.	633	FES REP.:	CD

Proctor	Dry Density[2] (pcf)	Opt. Moist. (%)	Passing #200[3] (%)	Material Description & Classification[4]	Source	Compaction Requirement
2	119.5	10.6	41.2	Brown clayey SAND (SC)	On-site	Moderate effort
3	116.5	17.0	84.9	Brown to gray sandy CLAY (CL)	On-site	Extensive effort

TEST NO.	DEPTH (inches)	ELEVATION (feet)	PROC. NO.	D.D. (PCF)	MOIST (%)	W.D. (PCF)	% COMP	PASS	FAIL	
1	12	Final Subgrade	2	117.8	6.0	124.8	98.5	X		
2	12	Final Subgrade	3	117.3	5.1	123.3	100.7	X		
3	12	Final Subgrade	3	120.4	6.4	128.1	103.3	X		
4	12	Final Subgrade	2	124.2	6.4	132.1	103.9	X		
5	12	Final Subgrade	2	115.6	8.4	125.4	96.7	X		

TEST NO.	TEST LOCATION
1	Site No. 1, See Attached Figure 4
2	Site No. 2, See Attached Figure 4
3	Site No. 3, See Attached Figure 4
4	Site No. 1, See Attached Figure 4
5	Site No. 1, See Attached Figure 4

SPEC. REQUIREMENTS	Utility Trench	Sidewalk	Structure	Roadway/Parking	Earthen Dam
COMPACTION (%)					95.0
MOISTURE (%)					O.M. ± 20
Comments					

Compaction density testing was performed in general accordance with [1]ASTM D2922, [2]ASTM D698, [3]ASTM D1140, [4]ASTM D2488

A correlation between the SPT N-values and the relative density was developed based on the laboratory test data shown above. The relative density of the subsurface soils within the upper eight (8) feet of the Earthen Dam indicates that the compaction is approximately

CORRELATION BETWEEN SPT N-VALUES & RELATIVE DENSITY				
TEST LOCATION	N-VALUE (BPF)	WET DENSITY (PCF)	RELATIVE COMPACTION (%)	REMARKS
1	10	124.8	98.5	Pass
2	10	123.3	100.7	Pass
3	10	128.1	103.3	Pass
4	8	132.1	103.9	Pass
5	10	125.4	96.7	Pass

8.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the subsurface exploration and laboratory testing programs, our site observations, engineering judgment, review of the plans and specifications, the following conclusions and recommendations are presented.

1. Compaction density testing was performed on the final/existing grade elevations. The subgrade soils were compacted to 95.0 percent of the laboratory maximum dry density in general accordance with ASTM D-698 [Standard Proctor] and to an approximate depth of twelve (12) inches. Based on the limited tests performed, the fill material within the final grade of the earthen dam placed appears to meet the intent of the project plans and specifications. Additionally, the fill material placed within the earthen dam embankment appears to have been compacted to a minimum relative density on the order of 90.0 percent of the laboratory maximum dry density. A minimum relative compaction of 90.0 percent is sufficient for similar projects.

2. The existing soils encountered within the earthen dam are sandy clay (CL), sandy clay to sandy silt (CL-ML), clayey sand (SC) and silty sand (SM) soils. The clayey sand (SC), sandy clay (CL) and sandy clay to sandy silt (CL-ML) soils are acceptable as core and embankment fill materials. The silty sand (SM) soils are acceptable as fill materials for the outer shells of the earthen dam (embankment).

3. The side slopes of the earthen dam were measured to be three (3) horizontal to one (1) vertical [3H:1V] and as shown in the plans prepared by Rickmond Engineering, Inc., dated January 13, 2003.

4. The global stability indicated that the down stream slopes will be stable during the service life of the structure including flooded conditions for draw down periods.

5. Inspection was not performed during construction of the earthen dam. Additionally, a core was not shown for the earthen dam in the project plans.

6. Considering that a core was not constructed and the material encountered within the Earthen Dam, water within the storm water management area dam may not be impounded due to the presence of silty sand (SM) within the embankment and core.

7. During extended and heavy rain fall events, the water within the Earthen Dam will rise but may not rise enough to seep through the over flow structure, thus seeping through the embankment of the Earthen Dam. However, above design storm events may occur thus overflowing above the embankment of the Earthen Dam.

9.0 REPORT LIMITATIONS

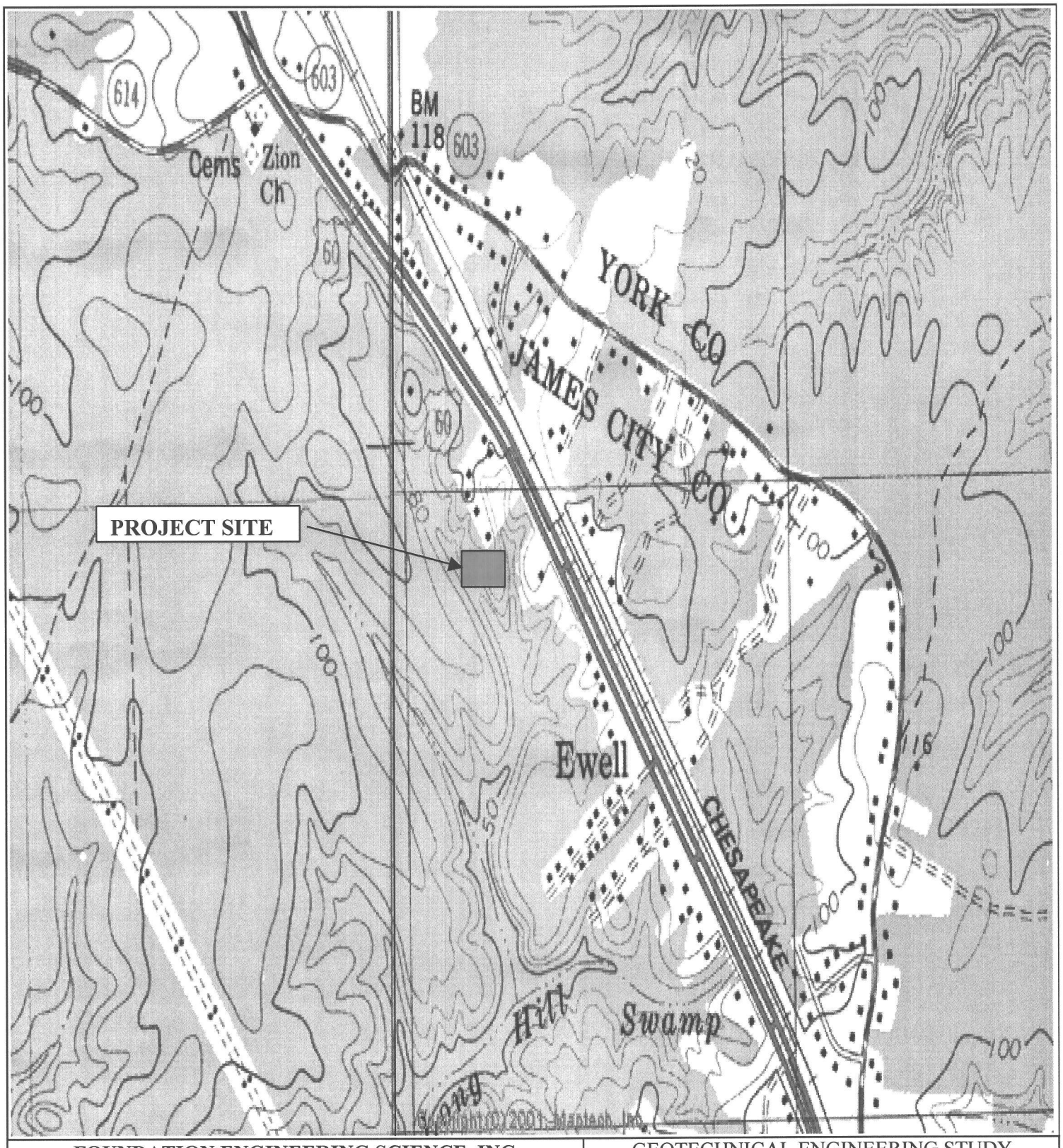
The engineering evaluation and analysis have been developed on the basis of the previously described project characteristics and subsurface conditions. These engineering evaluation and analysis were developed from the information obtained in the test borings, which depict subsurface conditions only at these specific locations and at the particular time designated on the boring profiles. Soil conditions at other locations may differ from conditions occurring at these boring locations. In addition, the passage of time may result in a change to the soil conditions at these boring locations.

Our professional services have been performed, our findings obtained, and our engineering evaluation and analysis prepared in accordance with generally accepted Geotechnical Engineering Principles and Practices. Foundation Engineering Science, Inc. is not responsible for the conclusions, opinions or recommendations made by others based on this geotechnical engineering study report.

APPENDIX

FIGURES

FOUNDATION ENGINEERING SCIENCE, INC. GEOTECHNICAL, ENVIRONMENTAL & CONSTRUCTION INSPECTION 11843-B CANON BOULEVARD NEWPORT NEWS, VIRGINIA 23606 PHONE: 757-873-4113 FAX: 757-873-4114 EMAIL: RELAWAR@FESVA.COM			GEOTECHNICAL ENGINEERING STUDY **THE VILLAGES AT WESTMINSTER** **EARTHEN DAM CERTIFICATON** JAMES CITY COUNTY, VIRGINIA
DATE: **AUGUST 8, 2002**	SCALE: **N/A**	FES REPORT NO. **1-81295.115**	**FIGURE – 1** **USDA SOIL SURVEY MAP**



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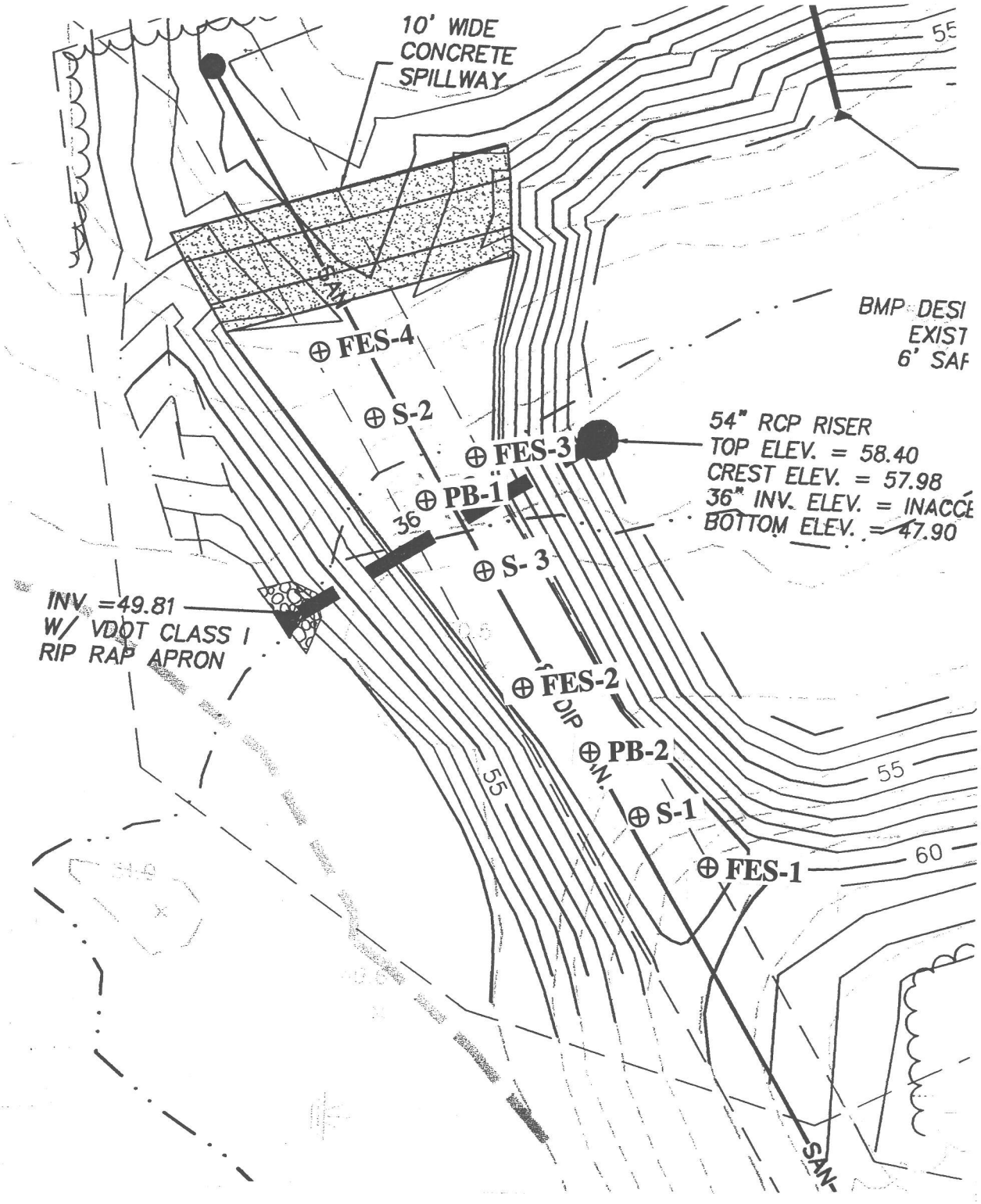
DATE: **AUGUST 8, 2002**	SCALE: **N/A**	FES REPORT NO. **1-81295.115**	**FIGURE – 2** **USGS QUADRANGLE MAP**



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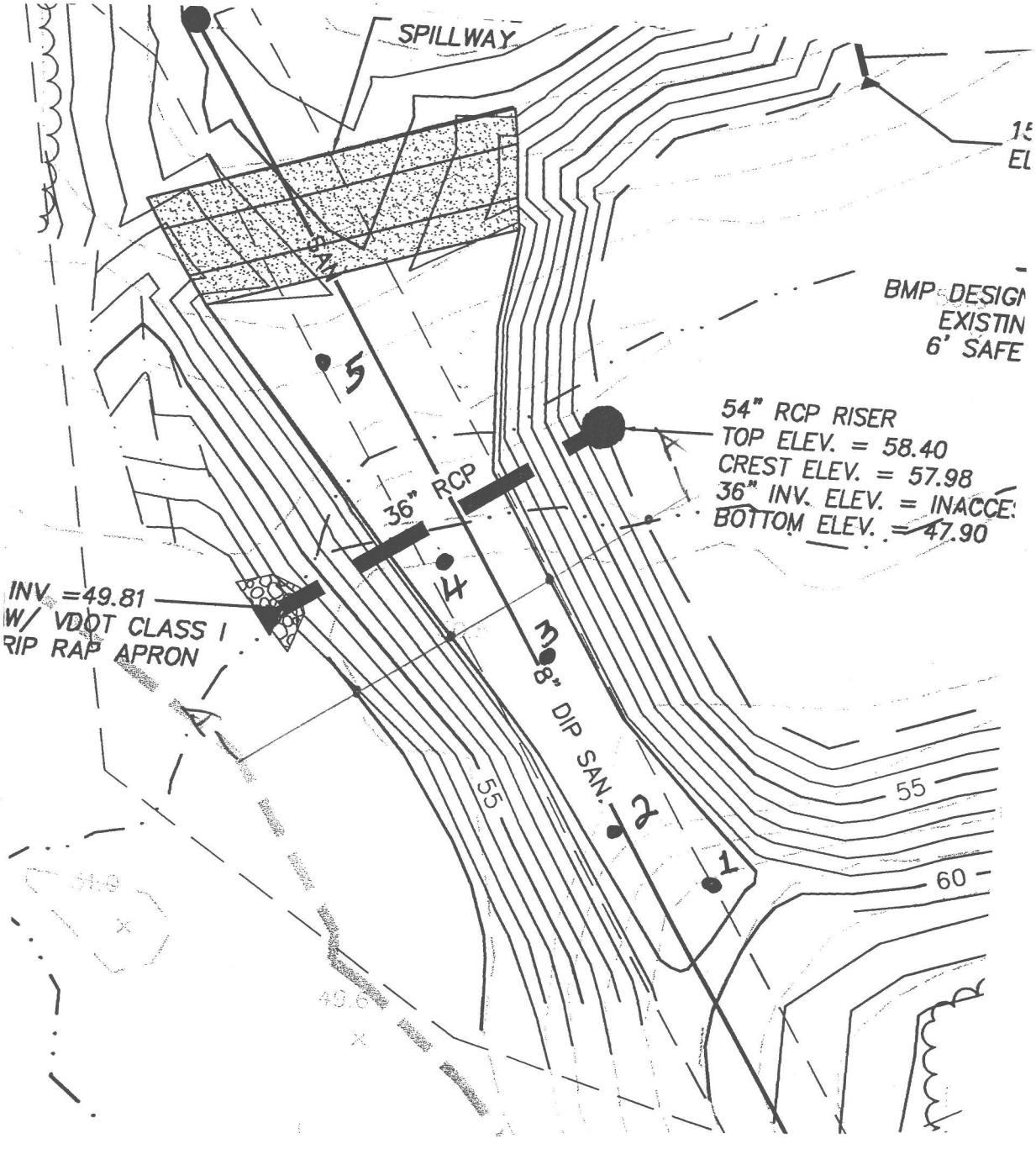
DATE: **AUGUST 8, 2002**	SCALE: **N/A**	FES REPORT NO. **1-81295.115**	**FIGURE – 3** **SAMPLE, PERMEABILITY AND BORINGS LOCATIONS SKETCH**



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DATE: **AUGUST 8, 2002**	SCALE: **N/A**	FES REPORT NO. **1-81295.115**	**FIGURE – 4** **FIELD COMPCTION DENSITY LOCATIONS SKETCH**

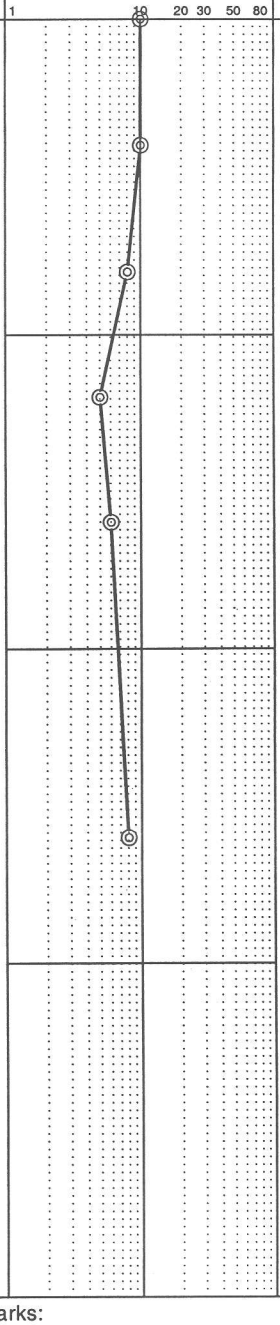
BORING PROFILE SHEETS

FOUNDATION ENGINEERING SCIENCE, INC.
· Geotechnical Engineering
· Environmental Management
· Construction Materials Testing
11843-B Canon Boulevard
Newport News, Virginia 23606
Phone: 757-873-4113 Fax: 757-873-4114
Email: relawar@fesva.com

PROJECT NAME:	The Villages at Westminster - Earthern Dam Certification	PROJECT NO.:	1-81295.115
CLIENT:	Atlantic Homes, LLC	DRILLING METHOD:	HSA
PROJECT LOCATION:	James City County, Virginia	OBSERVED G.W.T.:	Not Encountered
BORING LOCATION:	See Figure 3	STATION NO.:	

ELEVATION (Feet)	DEPTH (Feet)	SOIL LEGEND & SAMPLE TYPES	SAMPLE NO.	SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT, N VALUE OR RQD %
	0		1	SM	Light brown, dry to moist, silty SAND with roots "Topsoil"	10
				SM	Light brown to brown, moist, silty SAND	
			2			10
			3	CL	Light brown, moist, sandy CLAY with lenses of clayey sand (SC) from 4 to 6 feet and organic matter from 13 to 15 feet	8
	5		4			5
			5			6
	10		6			8
	15					

STANDARD PENETRATION TEST N-VALUE (Blows/Ft)



HOLE COMPLETION & REMARKS

COMPLETION DEPTH:	15.0 feet
DATE BORING STARTED:	8/15/02
DATE BORING COMPLETED:	8/15/02
ENGINEER/GEOLOGIST:	IH
DRILLING CONTRACTOR:	SDS

Sample Types:
- Auger Cutting
- Vane Shear
- SPT
- UD
- Penetrometer
- Rock Core

Remarks:

Unless otherwise noted, water encountered but not recorded.

The stratification lines represent approximate boundaries. The transition may be gradual.

FOUNDATION ENGINEERING SCIENCE, INC.
· Geotechnical Engineering
· Environmental Management
· Construction Materials Testing
11843-B Canon Boulevard
Newport News, Virginia 23606
Phone: 757-873-4113 Fax: 757-873-4114
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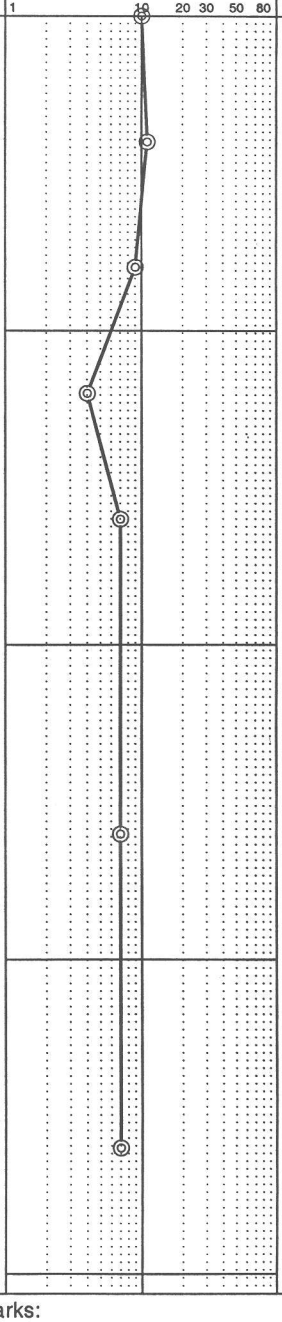
CLIENT:	Atlantic Homes, LLC	DRILLING METHOD:	HSA
PROJECT LOCATION:	James City County, Virginia	OBSERVED G.W.T.:	Not Encountered
BORING LOCATION:	See Figure 3	STATION NO.:	

ELEVATION (Feet)	DEPTH (Feet)	SOIL LEGEND & SAMPLE TYPES	SAMPLE NO.	SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT, N VALUE OR RQD %	STANDARD PENETRATION TEST N-VALUE ◎ (Blows/Ft)	HOLE COMPLETION & REMARKS
	0		1	SM	Light brown, dry to moist, silty SAND with roots "Topsoil"	10		
				CL	Brown , moist, sandy CLAY			
			2			11		
			3			9		
	5							
			4	SC	Brown, moist, clayey SAND	4		
			5			7		
	10			CL-ML	Light brown, moist, sandy CLAY to sandy SILT			
			6			7		
	15							
			7			7		
	20							



COMPLETION DEPTH:	20.0 feet
DATE BORING STARTED:	8/15/02
DATE BORING COMPLETED:	8/15/02
ENGINEER/GEOLOGIST:	IH
DRILLING CONTRACTOR:	SDS

Sample Types:
- Auger Cutting
- Vane Shear
- SPT
- UD
- Penetrometer
- Rock Core

Remarks:

Unless otherwise noted, water encountered but not recorded.

The stratification lines represent approximate boundaries. The transition may be gradual.

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11843-B Canon Boulevard
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Phone: 757-873-4113 Fax: 757-873-4114
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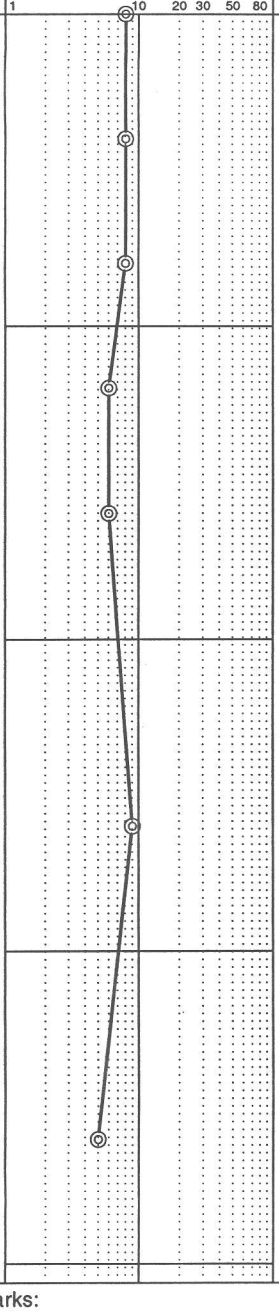
PROJECT NAME:	The Villages at Westminster - Earthern Dam Certification	PROJECT NO.:	1-81295.115
CLIENT:	Atlantic Homes, LLC	DRILLING METHOD:	HSA
PROJECT LOCATION:	James City County, Virginia	OBSERVED G.W.T.:	Not Encountered
BORING LOCATION:	See Figure 3	STATION NO.:	

ELEVATION (Feet)	DEPTH (Feet)	SAMPLE NO.	SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT, N VALUE OR RQD %
	0	1	SM	Light brown, dry to moist, silty SAND with roots	8
			CL-ML	"Topsoil" Light brown, moist, sandy CLAY to sandy SILT	
		2			8
		3	SM	Light brown to brown, moist, silty SAND	8
	5	4			6
		5			6
	10				
			CL	Light brown, moist, sandy CLAY	
		6			9
	15				
		7			5
	20				

STANDARD PENETRATION TEST N-VALUE (Blows/Ft)



HOLE COMPLETION & REMARKS

COMPLETION DEPTH:	20.0 feet
DATE BORING STARTED:	8/15/02
DATE BORING COMPLETED:	8/15/02
ENGINEER/GEOLOGIST:	IH
DRILLING CONTRACTOR:	SDS

Sample Types:
- Auger Cutting
- Vane Shear
- SPT
- UD
- Penetrometer
- Rock Core

Remarks:

Unless otherwise noted, water encountered but not recorded.

The stratification lines represent approximate boundaries. The transition may be gradual.

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11843-B Canon Boulevard
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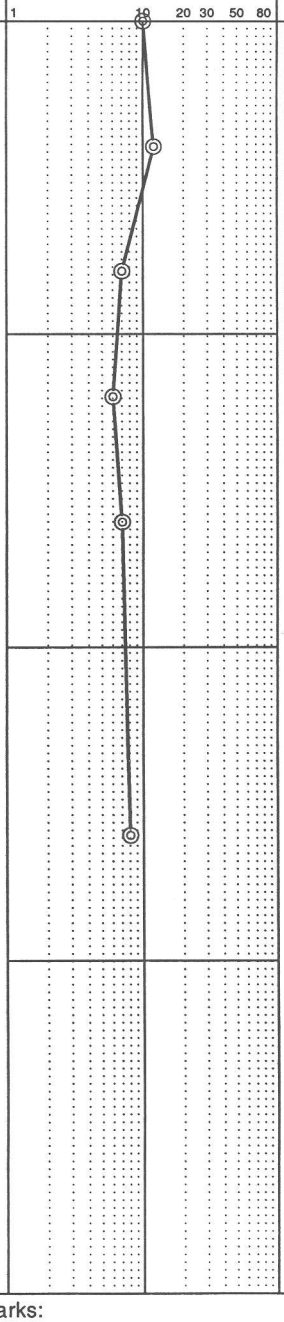
Email: relawar@fesva.com

PROJECT NAME:	The Villages at Westminster - Earthern Dam Certification	PROJECT NO.:	1-81295.115
CLIENT:	Atlantic Homes, LLC	DRILLING METHOD:	HSA
PROJECT LOCATION:	James City County, Virginia	OBSERVED G.W.T.:	Not Encountered
BORING LOCATION:	See Figure 3	STATION NO.:	

ELEVATION (Feet)	DEPTH (Feet)	SOIL LEGEND & SAMPLE TYPES	SAMPLE NO.	SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT, N VALUE OR RQD %	STANDARD PENETRATION TEST N-VALUE ◎ (Blows/Ft)	HOLE COMPLETION & REMARKS
	0		1	SM	Light brown, dry to moist, silty SAND with roots	10		
				SM	"Topsoil" Brown, moist, silty SAND			
			2			12		
			3			7		
	5							
			4	CL	Light brown, moist, sandy CLAY	6		
			5			7		
	10							
			6			8		
	15							



COMPLETION DEPTH:	15.0 feet
DATE BORING STARTED:	8/15/02
DATE BORING COMPLETED:	8/15/02
ENGINEER/GEOLOGIST:	IH
DRILLING CONTRACTOR:	SDS

Sample Types:
- Auger Cutting
- Vane Shear
- SPT
- UD
- Penetrometer
- Rock Core

Remarks:

Unless otherwise noted, water encountered but not recorded.

The stratification lines represent approximate boundaries. The transition may be gradual.

FOUNDATION ENGINEERING SCIENCE, INC.
· Geotechnical Engineering
· Environmental Management
· Construction Materials Testing
11843-B Canon Boulevard
Newport News, Virginia 23606
Phone: 757-873-4113 Fax: 757-873-4114
Email: relawar@fesva.com

AB-1

PROJECT NAME:	The Villages at Westminster - Earthern Dam Certification	PROJECT NO.:	1-81295.115
CLIENT:	Atlantic Homes, LLC	DRILLING METHOD:	Hand Auger
PROJECT LOCATION:	James City County, Virginia	OBSERVED G.W.T.:	Not Encountered
BORING LOCATION:	See Figure 3	STATION NO.:	

ELEVATION (Feet)	DEPTH (Feet)	SOIL LEGEND & SAMPLE TYPES	SAMPLE NO.	SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT, N VALUE OR RQD %	STANDARD PENETRATION TEST N-VALUE ◎ (Blows/Ft) 1 10 20 30 50 80	HOLE COMPLETION & REMARKS
	0			SM	Light brown, dry to moist, silty fine SAND with roots "Topsoil"			
				SM	Light brown, moist, silty SAND with trace clay			
				SC	Light brown, moist, clayey SAND			
	5							

COMPLETION DEPTH:	6.0 feet
DATE BORING STARTED:	8/8/02
DATE BORING COMPLETED:	8/8/02
ENGINEER/GEOLOGIST:	IH
DRILLING CONTRACTOR:	FES

Sample Types:
Auger Cutting
Vane Shear
SPT
UD
Penetrometer
Rock Core

Remarks:

Unless otherwise noted, water encountered but not recorded.

The stratification lines represent approximate boundaries. The transition may be gradual.

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· Geotechnical Engineering
· Environmental Management
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11843-B Canon Boulevard
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Email: relawar@fesva.com

AB-2

PROJECT NAME:	The Villages at Westminster - Earthern Dam Certification	PROJECT NO.:	1-81295.115
CLIENT:	Atlantic Homes, LLC	DRILLING METHOD:	Hand auger
PROJECT LOCATION:	James City County, Virginia	OBSERVED G.W.T.:	Not Encountered
BORING LOCATION:	See Figure 3	STATION NO.:	

ELEVATION (Feet)	DEPTH (Feet)	SOIL LEGEND & SAMPLE TYPES	SAMPLE NO.	SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT, N VALUE OR RQD %	STANDARD PENETRATION TEST N-VALUE ◎ (Blows/Ft) 1 10 20 30 50 80	HOLE COMPLETION & REMARKS
	0			SM	Light brown, dry to moist, silty SAND with roots "Topsoil"			
				SM	Brown, moist, silty SAND			
				SC	Brown to light brown, moist, clayey SAND with pockets of sandy CLAY			
	5							

COMPLETION DEPTH:	6.0 feet
DATE BORING STARTED:	8/8/02
DATE BORING COMPLETED:	8/8/02
ENGINEER/GEOLOGIST:	IH
DRILLING CONTRACTOR:	FES

Sample Types:
- Auger Cutting
- Vane Shear
- SPT
- UD
- Penetrometer
- Rock Core

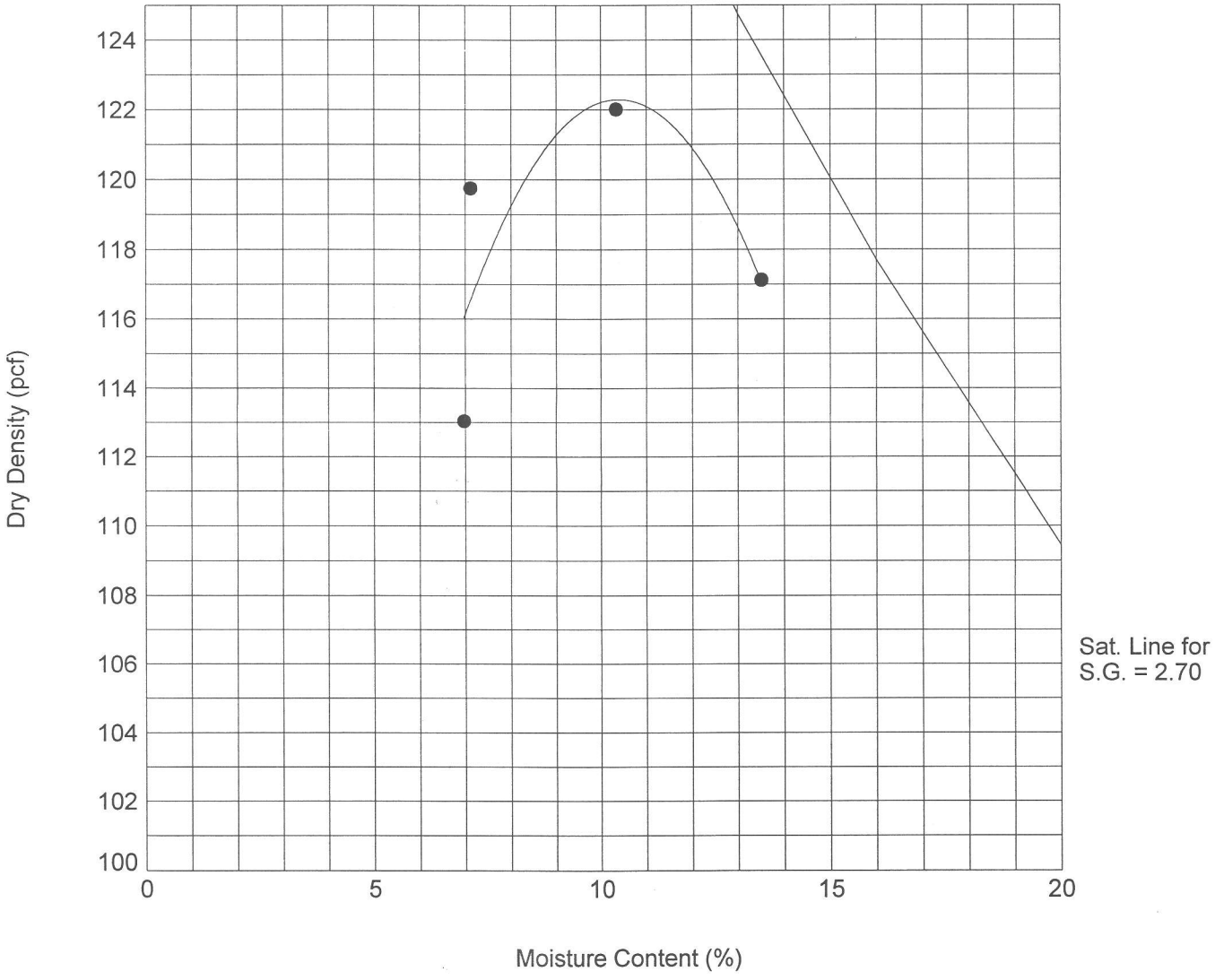
Remarks:

Unless otherwise noted, water encountered but not recorded.

The stratification lines represent approximate boundaries. The transition may be gradual.

LABORATORY TEST RESULTS

MOISTURE-DENSITY RELATIONSHIP REPORT



Sample Depth	Classification		Nat'l Moist.	S.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
1 0.0	SM	A-2-6	10.8	2.70		NP	0	41.1

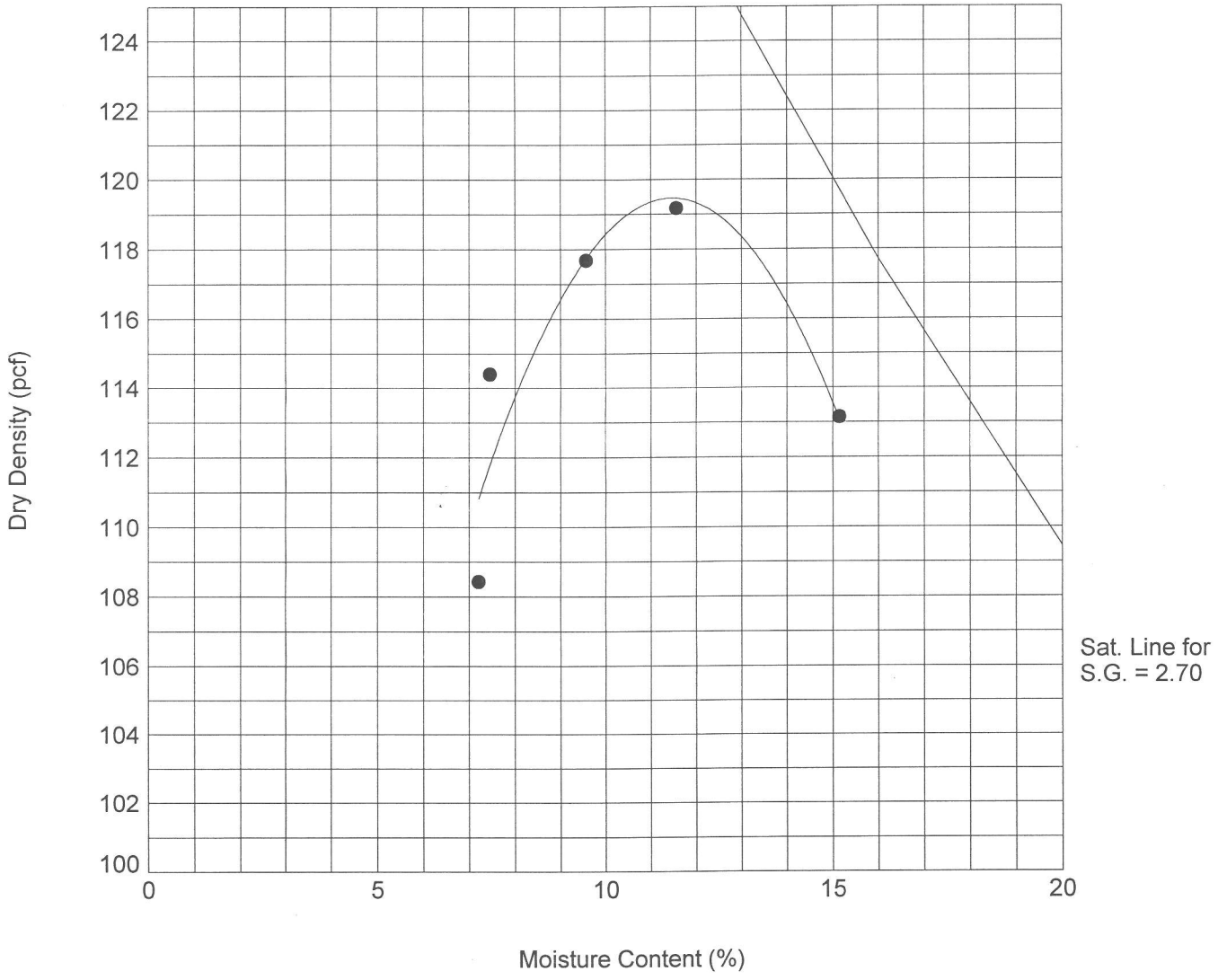
Test Results	Material Description
Optimum Moisture Content = 10.5 Maximum Dry Density = 122.5	Brown silty SAND
Project No.: 1-81295 Project Name: Villages at Westminster Development Location: Williamsburg, Virginia Date: 08/01/2002	Remarks: On July 30, 2002 a FES representative obtained a bulk soil sample of the on-site material. Procedure: ASTM D698, Method A Rammer: Manual Preparation: Dry

FOUNDATION ENGINEERING SCIENCE, INC.

Figure 1

PROCTOR 1-81295.GPJ FES.GDT 8/28/02

MOISTURE-DENSITY RELATIONSHIP REPORT



Sample Depth	Classification		Nat'l Moist.	S.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
2 0.0	SM	A-2-6	10.6	2.70		NP	0	41.2

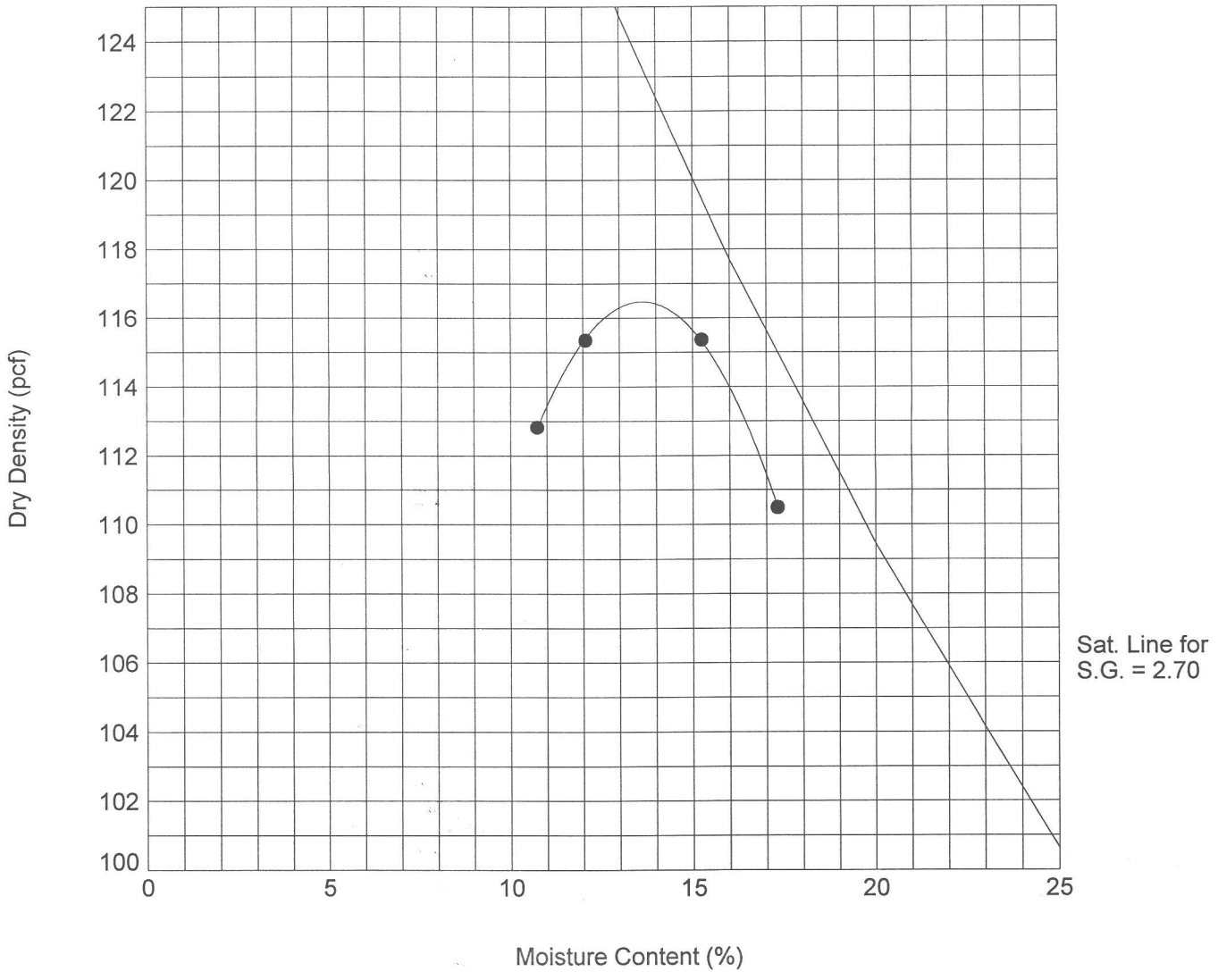
Test Results	Material Description
Optimum Moisture Content = 11.5 Maximum Dry Density = 119.5	Brown silty SAND
Project No.: 1-81295 Project Name: Villages at Westminster Development Location: Williamsburg, Virginia Date: 07/31/2002	Remarks: On July 30, 2002 a FES representative obtained a bulk soil sample of the on-site material. Procedure: ASTM D698, Method A Rammer: Manual Preparation: Dry

FOUNDATION ENGINEERING SCIENCE, INC.

Figure 2

PROCTOR 1-81295.GPJ FES.GDT 8/28/02

MOISTURE-DENSITY RELATIONSHIP REPORT



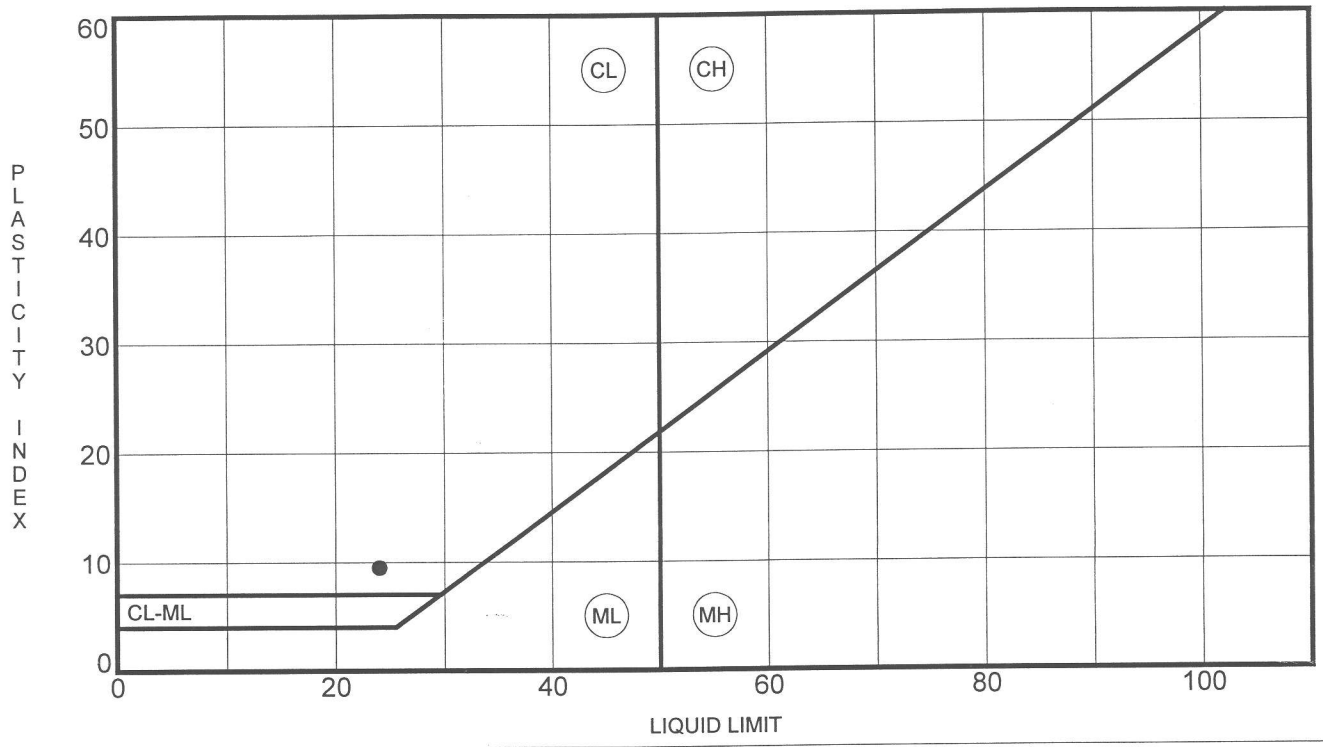
Sample Depth	Classification		Nat'l Moist.	S.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
3 0.0	CL	A-6	17.0	2.70	24	9	0	84.9

Test Results	Material Description
Optimum Moisture Content = 13.5 Maximum Dry Density =116.5	Brown to gray sandy CLAY
Project No.: 1-81295 Project Name: Villages at Westminster Development Location: Williamsburg, Virginia Date: 09/19/2002	Remarks: On September 18, 2002 a FES representative obtained one bulk soil sample from the existing earthen dam. Procedure: ASTM D698, Method A Rammer: Manual Preparation: Dry

FOUNDATION ENGINEERING SCIENCE, INC.

Figure 1

PROCTOR 1-81295.GPJ FES.GDT 9/24/02



	Specimen Identification		LL	PL	PI	Fines	Classification
●	3	0.0	24	15	9	85	(CL)

US_ATTERBERG_LIMITS 1-81295.GPJ US_LAB.GDT 9/24/02

FES

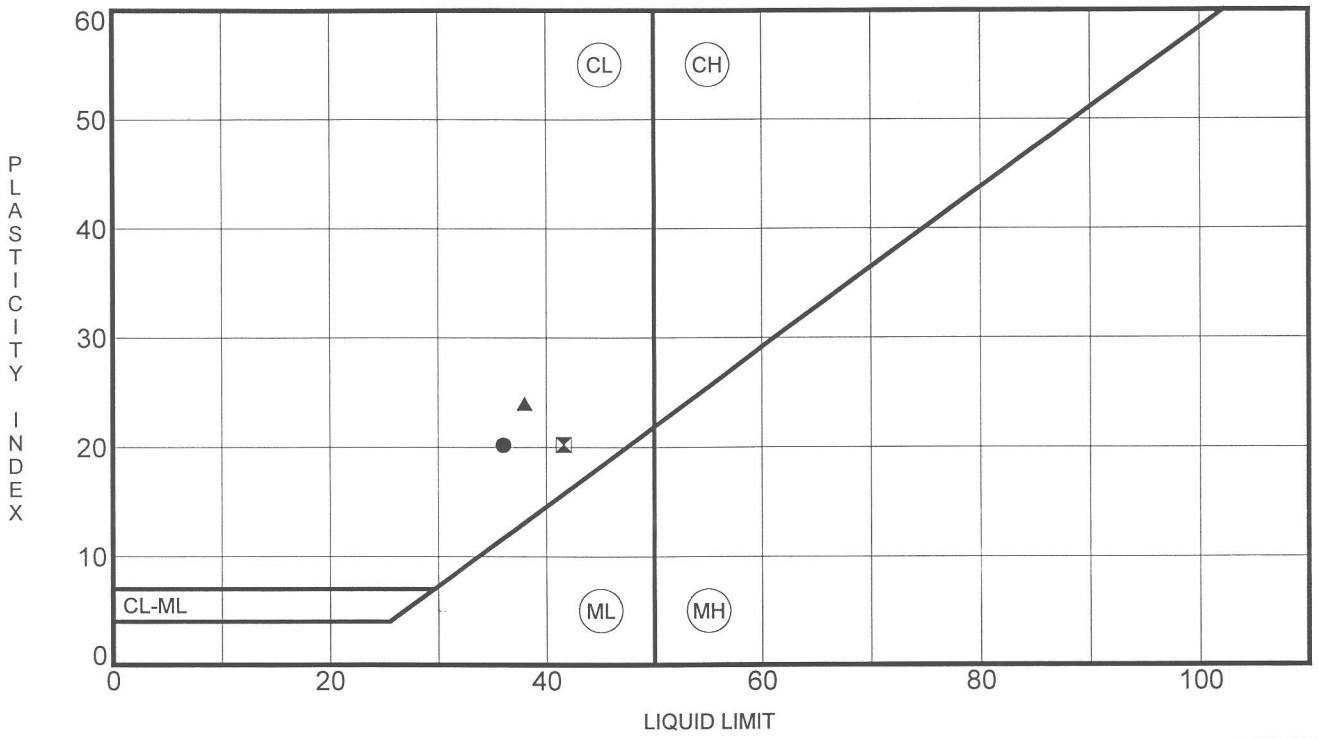
Foundation Engineering Science, Inc.
11843-B Canon Boulevard
Newport News, Virginia 23606
Telephone: 757-873-4113
Fax: 757-873-4114

ATTERBERG LIMITS RESULTS

Project: Villages at Westminster Development

Location: Williamsburg, Virginia

Number: 1-81295



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**FES-2**	**4.0**	**36**	**16**	**20**		Reddish brown sandy CLAY (CL)
⊠	**FES-3**	**15.0**	**42**	**21**	**21**		Reddish brown sandy CLAY (CL)
▲	**FES-4**	**8.0**	**38**	**14**	**24**		Reddish brown sandy CLAY (CL)

US_ATTERBERG_LIMITS 1-81295.GPJ US_LAB.GDT 8/28/02

FES

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11843-B Canon Boulevard
Newport News, Virginia 23606
Telephone: 757-873-4113
Fax: 757-873-4114

ATTERBERG LIMITS RESULTS

Project: Villages at Westminster Development

Location: Williamsburg, Virginia

Number: 1-81295

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: The Villages at Westminster
Structure/BMP Name: Pond II
Project Location: Intersection of Wellesley Blvd and Rt. 60
BMP Location: Behind Cotswold Court
County Plan No.: SP - 100 - 97

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

Tax Map/Parcel No.: 3220100057
BMP ID Code (if known): PC 171
Zoning District:: R2
Land Use: Residential Open Space
Site Area (sf or acres): 46.79 acres

Brief Description of Stormwater Management/BMP Facility: Wet Pond

Nearest Visible Landmark to SWM/BMP Facility: Cotswold Court

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: Spring 1998
Facility Monitored by County Representative during Construction: ☐ Yes ☐ No ☒ Unknown
Name of Site Work Contractor Who Constructed Facility: H.B. Hankins, Inc.
Name of Professional Firm Who Routinely Monitored Construction: _____
Date of Completion for SWM/BMP Facility: Summer 1998
Date of Record Drawing/Construction Certification Submittal: 3/6/01

(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: Westminster Village, L.L.C.
Mailing Address: 10 San Jose Dr., Suite 4C
Newport News, Va. 23606
Business Phone: 596-8800 Fax: 596-8516
Contact Person: Steve Deal Title: _____

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

Firm Name: Rickmond Engineering, Inc.
Mailing Address: 1643 Merrimac Trail
Williamsburg, Va. 23185
Business Phone: 229-1776
Fax: 229-4683
Responsible Plan Preparer: Kenneth Jenkins, P.E.
Title: Project Engineer
Plan Name: The Villages at Westminster Retention Ponds
Firm's Project No. 96106
Plan Date: 8/6/97
Sheet No.'s Applicable to SWM/BMP Facility: C5 / S2 / S3 / S4 / S5

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

Name: H.B. Hankins, Inc.
Mailing Address: 739 Thimble Shoals Blvd.
Newport News, Va. 23606
Business Phone: 873-2196
Fax: _____
Contact Person: Howard Hankins
Site Foreman/Supervisor: Hank Mullins
Specialty Subcontractors & Purpose (for BMP Construction Only): _____

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: RICHMOND ENGINEERING INC.
Mailing Address: 1643 MERRIMAC TRAIL
WILLIAMSBURG VA 23185
Business Phone: 1.757.229.1776
Fax: 1.757.229.4683

Name: CRAIG DAVENPORT
Title: ~~SENE~~ SURVEY DEPT. HEAD

Signature:
Date: 3.06.01

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
CRAIG B. DAVENPORT
No. 002055
3.6.01
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.

_____ (Seal)

Virginia Registered Professional Engineer

Section 5 - Record Drawing and Construction Certification Requirements and Instructions:

☐ PreConstruction Meeting - Provides an opportunity to review SWM / BMP facility construction, maintenance and operation plans and address any questions regarding construction and/or monitoring of the structure. The design engineer, certifying professionals (if different), Owner/Applicant, Contractor and County representative(s) are encouraged to attend the preconstruction meeting. Advanced notice to the Environmental Division is requested. Usually, this requirement can be met simultaneously with Erosion and Sediment Control preconstruction meetings held for the project.

☒ A fully completed ***STORMWATER MANAGEMENT / BMP FACILITIES, RECORD DRAWING and CONSTRUCTION CERTIFICATION FORM*** and ***RECORD DRAWING CHECKLIST***. All applicable sections shall be completed in their entirety and certification statements signed and sealed by the registered professional responsible for individual record drawing and/or construction certification.

☒ The Record Drawing shall be prepared by a Registered Professional Engineer or Certified Land Surveyor for the drainage system of the project including any Best Management Practices.

☐ Construction Certification. Construction of Stormwater Management / BMP facilities which contain impoundments, embankments and related engineered appurtenances including subgrade preparation, compacted soils, structural fills, liners, geosynthetics, filters, seepage controls, cutoffs, toe drains, hydraulic flow control structures, etc. shall be visually observed and monitored by a Registered Professional Engineer or his/her authorized representative. The Engineer must certify that the structure, embankment and associated appurtenances were built in accordance with the approved design plan, specifications and stormwater management plan and standard accepted construction practice and shall submit a written certification and/or drawings to the Environmental Division as required. Soil and compaction test reports, concrete test reports, inspection reports, logs and other required construction material or installation documentation may be required by the Environmental Division to substantiate the certification, if specifically requested. The Engineer shall have the authority and responsibility to make minor changes to the approved plan, in coordination with the assigned County inspector, in order to compensate for unsafe or unusual conditions encountered during construction such as those related to bedrock, soils, groundwater, topography, etc. as long as changes do not adversely affect the integrity of the structure(s). Major changes to the approved design plan or structure must be reviewed and approved by the original design professional and the James City County Environmental Division.

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

Dual Purpose Facilities - Completion of construction also includes an interim stage for Stormwater Management / BMP facilities which serve dual purpose as temporary sediment basins during construction and as permanent stormwater management / BMP facilities following construction, once development and stabilization are substantially complete. For these dual purpose facilities, construction certification is required once the temporary sediment basin phase of construction is complete. Final record drawing and construction certification of additional permanent components is required once permanent facility construction is complete.

Interim Construction Certification is required for those dual purpose embankment-type facilities that are generally ten (10) feet or greater in dam height (*) and may not be converted, modified or begin function as a permanent SWM / BMP structure for a period generally ranging from six (6) to eighteen (18) months or more from issuance of a Land Disturbance permit for construction.

Interim or final record drawing and construction certifications are not required for temporary sediment basins which are designed and constructed in accordance with current minimum standards and specifications for temporary sediment basins per the Virginia Erosion and Sediment Control Handbook (VESCH); have a temporary service life of less than eighteen (18) months; and will be removed completely once associated disturbed areas are stabilized, unless a distinct hazard to the public's health, safety and welfare is determined by the Environmental Division due to the size or presence of the structure or due to evidence of improper construction.

(*Note: Dam Height as referenced above is generally defined as the vertical distance from the natural bed of the stream or waterway at the downstream toe of the embankment to the top of the embankment structure in accordance with 4VAC50-20-30, Virginia Impoundment Structure Regulations and the Virginia Dam Safety Program.)

☒ Record Drawings shall provide, at a minimum, all information as shown within these requirements and the attached **RECORD DRAWING CHECKLIST** specific to the type of SWM/BMP facility being constructed. Other additional record data may be formally requested by the James City County Environmental Division. *(Note: Refer to the current edition of the James City County Guidelines for Design and Construction of Stormwater Management BMP's manual for a complete list of acceptable BMP's. Currently there are over 20 acceptable water quality type BMP's accepted by the County.)*

☒ Record Drawings shall consist of blue/black line prints and a reproducible (mylar, sepia, diazo, etc.) set of the approved stormwater management plan including applicable plan views, profiles, sections, details, maintenance plans, etc. as related to the subject SWM / BMP facility. The set shall indicate **"RECORD DRAWING "** in large text in the lower right hand corner of each sheet with record elevations, dimensions and data drawn in a clearly annotated format and/or boxed beside design values. Approved design plan values, dimensions and data shall not be removed or erased. Drawing sheet revision blocks shall be modified as required to indicate record drawing status. Elevations to the nearest 0.1' are sufficiently accurate except where higher accuracy is needed to show positive drainage. Certification statements as shown in Section 4 of the Record Drawing and Construction Certification Form, ***or similar forms thereof***, and professional signatures and seals, with dates matching that of the record drawing status in the revision or title block, are also required on all associated record drawing plans, prints or reproducibles.

☒ Submission Requirements. Initial and subsequent submissions for review shall consist of a minimum of one (1) blue/black line set for record drawings and one copy of the construction certification documents with appropriate transmittal. Under certain circumstances, it is understood that the record drawing and construction certification submissions may be performed by different professional firms. Therefore, record drawing submission may be in advance of construction certification or vice versa. Upon approval and prior to release of bond/surety, final submission shall include one (1) reproducible set of the record drawings, one (1) blue/black line set of the record drawings and one (1) copy of the construction certification. Also for current and/or future incorporation into the County BMP database and GIS system, it is requested that the record drawings also be submitted to the Environmental Division on a diskette or CD-ROM in an acceptable electronic file format such as *.dxf, *.dwg, etc. or in a standard scanned and readable format. The electronic file requirement can be discussed and coordinated with Environmental Division staff at the time of final submission.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

I. Methods and Presentation: *(Required for all Stormwater Management / BMP facilities.)*

XX 1. All constructed facilities meet approved design plans, unless otherwise shown. Record information or deviations from approved design plan shown in clearly annotated format and/or boxed beside design values.

XX 2. Elevations to the nearest 0.1' unless higher accuracy is needed to show positive drainage.

XX 3. All plan sheets labeled with "RECORD DRAWING" in large text in lower right hand corner (Approved County Plan Number and BMP ID Code can be included if known).

XX 4. All plan sheet revision blocks modified to indicate date and record drawing status.

XX 5. All plan sheets have certification statements and certifying professional's signature and seal.

II. Minimum Standards: *(Required for all Stormwater Management / BMP facilities, as applicable.)*

XX 1. All requirements of Section I (Methods and Presentation) apply to this section.

XX 2. Plan Views: Show general location, arrangement and dimensions. Location and alignment shall generally match approved design plans.

XX 3. Profile or elevations along top or berm of the facility. At a minimum, elevations are required at each end, at intervals not to exceed 50 feet and where low spots may be present. Top of embankment or berm elevations must be no less than design elevation plus any settlement allowances.

XX 4. Top widths, berm widths and embankment side slopes.

XX 5. Show length, width and depth of facility or grading, contours or spot elevations as required to verify permanent pool and design storage volumes were met or were reasonably close to the approved design. Evaluation of as-built grading, contours, spot elevations, or cross-sections, may be necessary by the professional to ensure approved design configurations, depths and volumes were closely maintained. If grading or elevations are significantly different from the approved plan, the Environmental Division shall be contacted immediately to determine whether the variation is acceptable or whether further evidence will be required. Facilities which do not closely resemble approved plan grades, elevations or configurations may require regrading by the Contractor; check volumetric computations; and/or a check hydraulic routing to ensure approved design water surface elevations, discharges or freeboard were closely maintained.

XX 6. Cross-section of the embankment through the principal spillway or outlet barrel. Must extend at least 100 ft. downstream of the pipe outlet or to recorded site property line, whichever is closer. Proper correlation is required between principal spillway (control structure) crest, emergency spillway crest, orifice and weirs and the top of the dam or facility. All elevations and dimensions must reasonably match the design plan or be sequentially relative to each other and the facility must reflect the required design storage volume(s) and/or design depth.

XX 7. Profile or elevations along the entire centerline of the emergency spillway. Emergency spillway may be steeper, but no flatter or narrower than design.

XX 8. Elevation of the principal spillway crest or outlet crest of the structure.

XX 9. Primary control structure (riser) diameter or dimensions, height, type of material and base size. Indicate provisions for access that are present such as steps, ladders, etc.

XX 10. Dimensions, locations and elevations of outlet orifices, weirs, slots and drains.

XX 11. Type and size of anti-vortex and trash rack device. Height, diameter, dimensions, bar spacings (if applicable) and elevations relative to the principal spillway crest. Indicate if lockable hatch is present or not.

____ 12. Type, location, size and number of anti-seep collars or documentation of other methods utilized for seepage control. **May need to obtain this information during construction.**

____ 13. Top of impervious core embankment, core trench limits and elevation of cut-off trench bottom. **May need to obtain this information during construction.**

XX 14. Elevation of the principal spillway barrel (outlet pipe) inlet and outlet invert.

XX 15. Outlet barrel diameter, length, slope, type and thickness class of material and type of flared end sections, headwall or endwall.

XX 16. Outfall protection dimension, type and depth of rock and if underlain filter fabric is present.

XX 17. BMP interior and periphery landscaping zones conform with arrangements and requirements of the approved design plan.

NA 18. Maintenance plan taken from approved design plan transposed onto record drawing set.

NA 19. Fencing location and type, if applicable to facility.

____ 20. BMP vicinity properly cleaned of stockpiles and construction debris.

____ 21. No visual signs of erosion or channel degradation immediately downstream of facility.

XX 22. Any other information formally requested by the Environmental Division specific to the constructed SWM/BMP facility.

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

III. Group A - Wet Ponds *(Includes A-1 Small Wet Ponds; A-2 Wet Ponds; A-3 Wet Ext Det Ponds.)*

XX A1. All requirements of Section II, Minimum Standards, apply to Group A facilities.

XX A2. Principal spillway consists of reinforced concrete pipe with O-Ring gaskets for watertight joint construction.

NA A3. Sediment forebays or pretreatment devices provided at inlets to pond. Generally 4 to 6 ft. deep.

NA A4. Access for maintenance and equipment is provided to the forebay(s). Access corridors are at least 12 ft. wide, have a maximum slope of 15 percent and are adequately stabilized to withstand heavy equipment or vehicle use.

NA A5. Adequate fixed vertical sediment depth markers installed in the forebay(s) for future sediment monitoring purposes.

NA A6. Pond liner (if required) provided. Either clay liners, polyliners, bentonite liners or use of chemical soil additives based on requirements of the approved plan.

XX A7. Minimum 6 percent slope safety bench extending a minimum of 15 feet outward from normal pool edge and/or an aquatic bench extending a minimum of 10 feet inward from the normal shoreline with a maximum depth of 12 inches below the normal pool elevation, if applicable, per the approved design plans. (Note: Safety benches may be waived if pond side slopes are no steeper than 4H:1V).

____ A8. No trees are present within a zone 15 feet around the embankment toe and 25 feet from the principal spillway structure.

XX A9. Wet permanent pool, typically 3 to 6 feet deep, is provided and maintains level within facility.

XX A10. Low flow orifice has a non-clogging mechanism.

NA A11. A pond drain pipe with valve was provided.

XX A12. Pond side slopes are not steeper than 3H:1V, unless approved plan allowed for steeper slope.

NA A13. End walls above barrels (outlet pipe) greater than 48 inch in diameter are fenced to prevent a fall hazard.

STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

X. Storm Drainage Systems (Associated with BMP's Only)

(Includes all incidental stormwater drainage conveyance systems associated with SWM/BMP facilities such as onsite or offsite storm drains, open channels, inlets, manholes, junctions, outlet protections, deflectors, etc. These facilities are external to the treatment function of, but are directly associated with drainage to and/or from a constructed SWM/BMP facility. The intent of this portion of the certification is to accurately identify the type and quantity of inflow or outflow points associated with the facility for future reference. The Professional may use his/her own discretion to determine inclusive facilities to meet the intent of this section. As a general rule, storm drainage systems would include incidental facilities to the nearest access structure upslope or downslope from the normal physical limits of the facility or 800 feet of storm drainage conveyance system length, whichever is less.)

XX SD1. All requirements of Section II, Minimum Standards, apply to Storm Drainage Systems.

XX SD2. Horizontal location of all pipe and structures relative to the SWM/BMP facility.

XX SD3. Type, top elevation and invert elevation of all access type structures (inlets, manholes, etc.).

XX SD4. Material type, size or diameter, class, invert elevations, lengths and slopes for all pipe segments.

XX SD5. Class, length, width and depth of riprap and outlet protections or dimensions of special energy dissipation structures.

XII. Other Systems

(Includes any non-typical, specialty, manufactured or innovative stormwater management/BMP practices or systems generally accepted for use as or in conjunction with other acceptable stormwater management / BMP practices. Requires evidence of prior satisfactory industry use and prior Environmental Division approval, waiver or exception .)

XX O1. All requirements of Section II, Minimum Standards, apply to this section.

NA O2. Certification criteria to be determined on a case-by-case basis by the Environmental Division specific to the proposed SWM/BMP facility.

James City County Environmental Division
Stormwater Management / BMP Inspection Report
Detention and Retention Pond Facilities

County BMP ID Code (if known): PC171

Name of Facility: Villages @ Westminster Pond II ~~Glencoe~~ (COTSWALD) BMP No.: 2 of 2 Date: 5/14/02

Location: South of Cotswald Court

Name of Owner: WARHILL ASSOCIATES LLC

Name of Inspector: SJ Thomas

Type of Facility: Wet Pond

Weather Conditions: Sunny, High 70's Type: ☒ Final Inspection ☐ County BMP Inspection Program ☐ Owner 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 to prevent damage to the facility.

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

N

Facility Item	O.K.	Routine	Urgent	Comments
Embankments and Side Slopes: Earth Embank; Tw=40'; D/S 2H:1V; D/S SLOPE 3H:1V				
Grass Height	✓			OK WEEDS + GRASS 2-4'
Vegetation Condition	✓			STABLE
Tree Growth		✓	✓	Trees, WILLOWS 4-6' Feet, shrubs
Erosion	✓	✓	✓	Some surface @ MIDDLE. TOP DAM SOUTH
Trash & Debris	✓			Some South END
Seepage	✓			None, but heavy cover. Conspicuous
Fencing or Benches				
Interior Landscaping/Planted Areas: ☒ None ☐ Constructed Wetland/Shallow Marsh ☐ Naturally Established Vegetation				
Vegetated Conditions	✓			Wet pond pool.
Trash & Debris	✓			
Floating Material	✓			
Erosion				
Sediment				
Dead Plant				
Aesthetics				
Other				
Notes:				

Facility Item	O.K.	Routine	Urgent	Comments
Water Pools: ☒ Permanent Pool (Retention Basin) ☐ Shallow Marsh (Detention Basin) ☐ None, Dry (Detention Basin)				
Shoreline Erosion	✓			Beginning signs but ok.
Algae	✓			None
Trash & Debris	✓	✓		Some dead cattails along u/s emb.
Sediment	✓			1' deep or so at riser.
Aesthetics	✓			
Other				
Inflows (Describe Types/Locations): Pipe 1 (15") North side; Pipe 2 (24" RCP) south side. (SE)				
Condition of Structure	✓			① OK ② OK
Erosion	✓	✓		① OK ② ~~OK~~ SURF EROSION OVER PIPE
Trash and Debris	✓			① OK ② OK
Sediment	✓	✓		① SED 1-3' DEEP + VEG ② 4" DEEP IN ES-1
Outlet Protection	✓	✓		① ESTABLISH OP
Other				
Principal Flow Control Structure - Riser, Intake, etc. (Describe Type): 54" RCP RISER; 9' CONC. CAP, 4" ACCESS HOLE				
Condition of Structure	✓			
Corrosion	✓			
Trash and Debris		✓		10" LF ORIF PARTIALLY CLOGGED
Sediment	✓			WITH SED & DEBRIS. SEE NOTE.
Vegetation		✓		CLEAR 10' from riser.
Other				
Principal Outlet Structure - Barrel, Conduit, etc. : 36" RCP w/ ES-1 w/ OP				
Condition of Structure	✓			
Settlement	✓			
Trash & Debris	✓			
Erosion/Sediment	✓			None
Outlet Protection				OP Riprap. No tres. water.
Other				Stilling basin 1-3' deep. water
Emergency Spillway (Overflow): Conc. Lined. 8' BW; 2' deep, 3H:1V SS; North END				
Vegetation	✓			
Lining	✓	✓		Some discolor, cracks, ok.
Erosion	✓			SEAL
Trash & Debris	✓			
Other	✓			
Notes:				

Facility Item	O.K.	Routine	Urgent	Comments
Nuisance Type Conditions:				
Mosquito Breeding	✓			
Animal Burrows	✓			
Graffiti	✓			
Other				
Surrounding Perimeter Conditions: North + South Lots; West Woods + wetland				
Land Uses	✓			
Vegetation	✓			
Trash & Debris	✓			
Aesthetics	✓			
Access /Maintenance Roads or Paths	✓			Best access is off Oswald.
Other				Buffer North + South Shores is OK.

Remarks:
- Remove trees + woody SHRUBS veg d/s embank (entire 4-6' high)
- REFILL + Seed eroded areas on top of d/s embank (middle + south)
- Stabilize bare soil (sands) 100x50 area south end top of dam.
- clean LF ORIF PARTIALLY BLOCKED TRASH + debris. CLEAR SED IN FRONT OF LF Ont. 1-2' deep.
- Clear veg 10-15' from nspr.
- * SEAL longitudinal crack in bottom of ES.
- Pipe 1 (NORTH 15" CPP) SED PLUME 2-3' @ outfall clean SED, VEG. WITHIN 10-15' OF PIPE OUTFALL. ESTABLISH RIPRAP OP.
- CLEAN SED 4-6" DEEP IN END SEC PIPE 2. (SE)
- CLEAN + REMOVE TRASH + Debris (brick) EAST END OF POND NEAR PIPE 2.
- FILL + SEED SLOPE EROSION OVER PIPE 2 ON SLOPE. RUNOFF FROM LOTS DOWN SLOPE.

Overall Environmental Division Internal Rating: 3

Signature: [signature] P.E. **Date:** 5/14/02 3:00pm

Title: Civil Engineer CWMN

SWMProg\BMP\CoInspProg\DetRet.wpd

OVERALL BMP MAP
VILLAGES AT WESTMINSTER

THE VILLAGES AT WESTMINSTER
RETENTION PONDS

BMP AND DRAINAGE CALCULATIONS

Rickmond

PC 170 POND I
PC 171 POND II
SP-100-97

RICKMOND ENGINEERING, INC.
1643 Merrimac Trail
Williamsburg, VA 23185
(757) 229-1776

COMMONWEALTH OF VIRGINIA
K.M. Jenkins II
K.M. JENKINS II
No.022872
9/12/97
PROFESSIONAL ENGINEER

Project No. 96106

August 6, 1997

POND II

RICKMOND ENGINEERING, INC.
1643 C Merrimac Trail
Williamsburg, Virginia 23185-5624
(804) 229-1776 or (804) 898-4149
Fax Number (804) 220-9370

JOB 96106
SHEET NO. 68 OF
CALCULATED BY KMJ DATE 4/25/97
CHECKED BY DATE
SCALE

DESIGN POND II FOR
JCC BMP DESIGN 7

DESIGN 7 POND [4 times the volume of runoff generated from the mean storm over the watershed area]

Impervious Area = 10.35ac Area = 56.4ac

$$I = \frac{10.35ac}{56.4ac} = 18$$

$$R_v = 0.05 + 0.009(18) = .21$$

$$\text{Volume Required} = \frac{.45in}{} \cdot \frac{4}{} \cdot \frac{56.4ac}{} \cdot \frac{43560sf}{1ac} \cdot .21 \cdot \frac{1ft}{12in} = 77{,}400cf$$

RICKMOND ENGINEERING, INC.
1643 C Merrimac Trail
Williamsburg, Virginia 23185-5624
(804) 229-1776 or (804) 898-4149
Fax Number (804) 220-9370

JOB 96106
SHEET NO. 69 OF
CALCULATED BY KMJ DATE 4/25/97
CHECKED BY DATE
SCALE

DESIGN WET POND II

ELEV (ft)	S.A. (ft²)	ΔELEV (ft)	Storage (cf)	Accum Storage (cf)
44	14,315			0
		2	30,815	
46	16,500			30,815
		2	36,675	
48	20,175			67,490
		2	43,965	
50	23,790			111,455
		2		

2 YEAR HYDROGRAPH

```
1*******************************     SCSHYDRO
*******************************
 *******************************   Version 3.21
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************

 PROJECT: VILLAGES @ WESTMINSTER
    User: Rickmond Engineering
    Date: 08/07/1997  Thursday
    Time: 11:59:45
   Input: VWII2.IN
  Output: VWII2.OUT


 ============================   PROGRAM EXECUTION
============================


                         NUMBER OF STORMS TO BE MODELED    :     1
                         NUMBER OF CHANNELS                :     0
                         NUMBER OF SUBAREAS                :     1
                         UPSTREAM HYDROGRAPHS ENTER AT     :     0
LOCATIONS
                         NUMBER OF TIME STEPS              :   300
                         COMPUTATIONAL TIME INCREMENT      :  .100 Hours

 NOTE:   The DURATION of the final computed hydrograph(s) for this
watershed
         system will be 30.000 hours.


 ========================   UNIT HYDROGRAPH METHODOLOGY
========================


 The SCS DIMENSIONLESS UNIT HYDROGRAPH is used in all runoff
computations.
 The peak rate factor (PRF) for all unit hydrographs is 484 (U.S.
Customary
 units) or 2.08356 (Metric units).
1*******************************     SCSHYDRO
*******************************
 *******************************   Version 3.21
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************

 PROJECT: VILLAGES @ WESTMINSTER
```

User: Rickmond Engineering
Date: 08/07/1997 Thursday
Time: 11:59:45
Input: VWII2.IN
Output: VWII2.OUT

========== SUBAREA DATA
==========

SUBAREA ID NO	AREA (mi2)	TIME OF CONCENTRATION (hrs)	CURVE NUMBER	BASEFLOW (cfs)	DOWNSTREAM CHANNELS
1	.0881	1.010	65.00	.0	

Composite Watershed Curve Number = 65.00
Minimum Subarea Time of Concentration = 1.010 hours.

1********** SCSHYDRO
****
********** Version 3.21
****
********** COMPUTER-AIDED HYDROLOGY & HYDRAULICS
****

PROJECT: VILLAGES @ WESTMINSTER
User: Rickmond Engineering
Date: 08/07/1997 Thursday
Time: 11:59:45
Input: VWII2.IN
Output: VWII2.OUT

RETURN PERIOD (yrs): 2

========== RAINFALL HYETOGRAPH INFORMATION
==========

RAINFALL HYETOGRAPH: SCS TYPE II
RAINFALL DURATION: 24.00 Hours
RAINFALL DEPTH: 3.50 Inches

RAINFALL HYETOGRAPH,
SCS TYPE II
Time (Hours), Total Depth (Inches):

.000,	.00	2.000,	.08	4.000,	.17	6.000,	.28
7.000,	.34	8.000,	.42	8.500,	.47	9.000,	.51
9.500,	.57	9.750,	.60	10.000,	.63	10.500,	.71
11.000,	.82	11.500,	.99	11.750,	1.25	12.000,	2.32

```
     12.500,  2.57     13.000,  2.70     13.500,  2.80     14.000,  2.87
     16.000,  3.08     20.000,  3.33     24.000,  3.50
1*******************************     SCSHYDRO
*******************************
 *******************************   Version 3.21
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************

 PROJECT: VILLAGES @ WESTMINSTER
   Input: VWII2.IN
  Output: VWII2.OUT
                                                        RETURN PERIOD
(yrs):      2


    SUBAREA     1       SUBAREA     1       SUBAREA     1       SUBAREA
1


     AREA (square miles)          :        .0881
     TIME OF CONCENTRATION (hrs):        1.01
     RUNOFF CURVE NUMBER          :      65.00
     BASEFLOW (cfs)               :        .00
     DOWNSTREAM CHANNELS          :
```

SUBAREA RUNOFF (cfs)

TIME: (hrs)	+.00 hrs	+.10 hrs	+.20 hrs	+.30 hrs	+.40 hrs	+.50 hrs	+.60 hrs	+.70 hrs	+.80 hrs	+.90 hrs
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
6.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
7.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
8.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
9.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
10.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
11.00	.00	.00	.00	.00	.00	.00	.00	.01	.15	.79

```
 12.00 |    2.47   5.15   8.74  12.60  15.55  17.25  17.90  17.60  16.49
14.83
 13.00 |   13.17  11.72  10.55   9.54   8.60   7.80   7.14   6.58   6.09
5.65
 14.00 |    5.28   4.96   4.70   4.47   4.29   4.15   4.03   3.91   3.78
3.65
 15.00 |    3.52   3.39   3.26   3.15   3.03   2.92   2.82   2.72   2.63
2.54
 16.00 |    2.46   2.39   2.32   2.27   2.22   2.17   2.14   2.10   2.07
2.05
 17.00 |    2.03   2.01   1.99   1.97   1.95   1.94   1.92   1.91   1.89
1.88
 18.00 |    1.86   1.85   1.83   1.82   1.81   1.79   1.78   1.76   1.75
1.73
 19.00 |    1.72   1.70   1.69   1.67   1.66   1.64   1.63   1.61   1.60
1.58
 20.00 |    1.57   1.55   1.53   1.52   1.50   1.49   1.47   1.46   1.44
1.43
 21.00 |    1.41   1.40   1.38   1.37   1.35   1.34   1.33   1.32   1.30
1.29
 22.00 |    1.28   1.27   1.26   1.25   1.24   1.23   1.22   1.21   1.20
1.20
 23.00 |    1.19   1.18   1.17   1.17   1.16   1.16   1.15   1.15   1.15
1.14
 24.00 |    1.14   1.13   1.10   1.04    .96    .84    .72    .59    .47
.37
 25.00 |     .28    .22    .17    .13    .10    .08    .06    .05    .04
.03
 26.00 |     .02    .02    .01    .01    .01    .01    .00    .00    .00
.00
 27.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 28.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 29.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00

                    PEAK RUNOFF (cfs):      17.90
                   TIME TO PEAK (hrs):      12.60
1*******************************     SCSHYDRO
*******************************
 *******************************   Version 3.21
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************

 PROJECT: VILLAGES @ WESTMINSTER
    User: Rickmond Engineering
    Date: 08/07/1997  Thursday
    Time: 11:59:45
   Input: VWII2.IN
  Output: VWII2.OUT
                                                        RETURN PERIOD
(yrs):      2

 ==========================   DOWNSTREAM HYDROGRAPH
==========================
```

DISCHARGE (cfs)

TIME: (hrs)	+.00 hrs	+.10 hrs	+.20 hrs	+.30 hrs	+.40 hrs	+.50 hrs	+.60 hrs	+.70 hrs	+.80 hrs	+.90 hrs
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
6.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
7.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
8.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
9.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
10.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
11.00	.00	.00	.00	.00	.00	.00	.00	.01	.15	.79
12.00	2.47	5.15	8.74	12.60	15.55	17.25	17.90	17.60	16.49	14.83
13.00	13.17	11.72	10.55	9.54	8.60	7.80	7.14	6.58	6.09	5.65
14.00	5.28	4.96	4.70	4.47	4.29	4.15	4.03	3.91	3.78	3.65
15.00	3.52	3.39	3.26	3.15	3.03	2.92	2.82	2.72	2.63	2.54
16.00	2.46	2.39	2.32	2.27	2.22	2.17	2.14	2.10	2.07	2.05
17.00	2.03	2.01	1.99	1.97	1.95	1.94	1.92	1.91	1.89	1.88
18.00	1.86	1.85	1.83	1.82	1.81	1.79	1.78	1.76	1.75	1.73
19.00	1.72	1.70	1.69	1.67	1.66	1.64	1.63	1.61	1.60	1.58
20.00	1.57	1.55	1.53	1.52	1.50	1.49	1.47	1.46	1.44	1.43
21.00	1.41	1.40	1.38	1.37	1.35	1.34	1.33	1.32	1.30	1.29
22.00	1.28	1.27	1.26	1.25	1.24	1.23	1.22	1.21	1.20	1.20
23.00	1.19	1.18	1.17	1.17	1.16	1.16	1.15	1.15	1.15	1.14
24.00	1.14	1.13	1.10	1.04	.96	.84	.72	.59	.47	

```
.37
 25.00 |     .28    .22    .17    .13    .10    .08    .06    .05    .04
.03
 26.00 |     .02    .02    .01    .01    .01    .01    .00    .00    .00
.00
 27.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 28.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 29.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00

                    PEAK DISCHARGE (cfs):      17.90
                      TIME TO PEAK (hrs):      12.60
 Hydrograph Saved In: VWII2.DAT

1*******************************     SCSHYDRO
*******************************
 *******************************   Version 3.21
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************

 PROJECT: VILLAGES @ WESTMINSTER
    User: Rickmond Engineering
    Date: 08/07/1997  Thursday
    Time: 11:59:45
   Input: VWII2.IN
  Output: VWII2.OUT
                                                        RETURN PERIOD
(yrs):      2

 ============================   HYDROLOGIC SUMMARY
============================
 =====================   Volumes, Losses, and Discharges
=====================


 SCS TYPE II  Hyetograph.
 SCS DIMENSIONLESS UNIT HYDROGRAPH was used.
 APPLIED RAINFALL DEPTH (inches):  3.50


                VOLUME OF                                |
                 RAINFALL     VOLUME OF    RAINFALL      |     PEAK
PEAK
                 APPLIED       RUNOFF       LOSSES       |   DISCHARGE
DISCHARGE
                 (ac-ft)       (ac-ft)     (percent)     |     (cfs)
(cfs/ac)
               ___________   ___________   __________    |  ___________
___________
                                                        |
                                                        |
 SUBAREA    1  16.445        3.5352         78.50       |       17.901
.317
                                                        |
                                                        |
                                                        |
```

TOTAL WATERSHED	16.445	3.5352	78.50	|	17.901
.317					

TOTAL WATERSHED AREA (square miles): .0881
TOTAL VOLUME OF DISCHARGE LEAVING WATERSHED (ac-ft): 3.5352
COMPOSITE WATERSHED CURVE NUMBER: 65.00
MINIMUM SUBAREA TIME OF CONCENTRATION: 1.010
hours.

NOTE: "VOLUME OF RUNOFF" includes surface runoff only; baseflows are not
included in this summation. The "TOTAL VOLUME OF DISCHARGE LEAVING
WATERSHED" includes all baseflows.
1

100 YEAR HYDROGRAPH

```
1*******************************     SCSHYDRO
*******************************
 *******************************   Version 3.21
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************

 PROJECT: VILLAGES @ WESTMINSTER
    User: Rickmond Engineering
    Date: 08/07/1997  Thursday
    Time: 12:00:52
   Input: VWII100.IN
  Output: VWII100.OUT



 ============================   PROGRAM EXECUTION
============================


                        NUMBER OF STORMS TO BE MODELED    :     1
                        NUMBER OF CHANNELS                :     0
                        NUMBER OF SUBAREAS                :     1
                        UPSTREAM HYDROGRAPHS ENTER AT     :     0
LOCATIONS
                        NUMBER OF TIME STEPS              :   300
                        COMPUTATIONAL TIME INCREMENT      :  .100 Hours


 NOTE:   The DURATION of the final computed hydrograph(s) for this
watershed
         system will be 30.000 hours.



 ========================   UNIT HYDROGRAPH METHODOLOGY
========================


 The SCS DIMENSIONLESS UNIT HYDROGRAPH is used in all runoff
computations.
 The peak rate factor (PRF) for all unit hydrographs is 484 (U.S.
Customary
 units) or 2.08356 (Metric units).
1*******************************     SCSHYDRO
*******************************
 *******************************   Version 3.21
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************

 PROJECT: VILLAGES @ WESTMINSTER
```

User: Rickmond Engineering
Date: 08/07/1997 Thursday
Time: 12:00:52
Input: VWII100.IN
Output: VWII100.OUT

========== SUBAREA DATA
==========

SUBAREA ID NO	AREA (mi2)	TIME OF CONCENTRATION (hrs)	CURVE NUMBER	BASEFLOW (cfs)	DOWNSTREAM CHANNELS
1	.0881	1.010	65.00	.0	

Composite Watershed Curve Number = 65.00
Minimum Subarea Time of Concentration = 1.010 hours.

1********** SCSHYDRO
****
********** Version 3.21
****
********** COMPUTER-AIDED HYDROLOGY & HYDRAULICS
****

PROJECT: VILLAGES @ WESTMINSTER
User: Rickmond Engineering
Date: 08/07/1997 Thursday
Time: 12:00:52
Input: VWII100.IN
Output: VWII100.OUT

RETURN PERIOD (yrs): 100

========== RAINFALL HYETOGRAPH INFORMATION
==========

RAINFALL HYETOGRAPH: SCS TYPE II
RAINFALL DURATION: 24.00 Hours
RAINFALL DEPTH: 8.00 Inches

RAINFALL HYETOGRAPH,
SCS TYPE II
Time (Hours), Total Depth (Inches):

.000,	.00	2.000,	.18	4.000,	.38	6.000,	.64
7.000,	.78	8.000,	.96	8.500,	1.06	9.000,	1.18
9.500,	1.30	9.750,	1.38	10.000,	1.45	10.500,	1.63
11.000,	1.88	11.500,	2.26	11.750,	2.86	12.000,	5.30

```
     12.500,  5.88     13.000,  6.18     13.500,  6.39     14.000,  6.56
     16.000,  7.04     20.000,  7.62     24.000,  8.00
1*******************************     SCSHYDRO
*******************************
 *******************************   Version 3.21
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************

 PROJECT: VILLAGES @ WESTMINSTER
   Input: VWII100.IN
  Output: VWII100.OUT
                                                        RETURN PERIOD
(yrs):    100


    SUBAREA     1       SUBAREA     1       SUBAREA     1       SUBAREA
1


     AREA (square miles)          :        .0881
     TIME OF CONCENTRATION (hrs):        1.01
     RUNOFF CURVE NUMBER          :      65.00
     BASEFLOW (cfs)               :        .00
     DOWNSTREAM CHANNELS          :
```

SUBAREA RUNOFF (cfs)

TIME: (hrs)	+.00 hrs	+.10 hrs	+.20 hrs	+.30 hrs	+.40 hrs	+.50 hrs	+.60 hrs	+.70 hrs	+.80 hrs	+.90 hrs
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
6.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
7.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
8.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01
9.00	.03	.06	.09	.15	.22	.30	.39	.49	.61	.73
10.00	.87	1.01	1.17	1.35	1.56	1.78	2.03	2.31	2.62	2.99
11.00	3.39	3.86	4.40	5.04	5.82	6.70	7.94	9.76	13.33	20.92

```
 12.00 |   34.56  53.26  75.30  95.97 109.41 114.57 113.11 106.25  95.48
82.91
 13.00 |   71.32  61.72  54.10  47.66  41.96  37.18  33.31  30.09  27.33
24.95
 14.00 |   22.95  21.28  19.89  18.73  17.80  17.06  16.44  15.80  15.13
14.47
 15.00 |   13.87  13.30  12.76  12.27  11.79  11.34  10.91  10.50  10.12
9.76
 16.00 |    9.44   9.15   8.88   8.64   8.44   8.26   8.10   7.97   7.85
7.74
 17.00 |    7.64   7.56   7.47   7.40   7.32   7.25   7.19   7.12   7.06
6.99
 18.00 |    6.93   6.87   6.81   6.74   6.68   6.62   6.56   6.50   6.44
6.38
 19.00 |    6.32   6.26   6.19   6.13   6.07   6.01   5.95   5.89   5.83
5.76
 20.00 |    5.70   5.64   5.58   5.52   5.46   5.39   5.33   5.27   5.21
5.15
 21.00 |    5.10   5.04   4.98   4.93   4.88   4.82   4.77   4.73   4.68
4.63
 22.00 |    4.59   4.55   4.50   4.46   4.43   4.39   4.36   4.32   4.29
4.26
 23.00 |    4.23   4.20   4.18   4.16   4.13   4.11   4.09   4.08   4.06
4.05
 24.00 |    4.03   3.99   3.88   3.69   3.38   2.97   2.53   2.08   1.66
1.30
 25.00 |    1.00    .78    .61    .47    .37    .29    .22    .17    .13
.10
 26.00 |     .08    .06    .05    .04    .03    .02    .01    .01    .01
.00
 27.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 28.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 29.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00

                     PEAK RUNOFF (cfs):     114.57
                    TIME TO PEAK (hrs):      12.50
1*******************************     SCSHYDRO
******************************
 ******************************   Version 3.21
******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************

 PROJECT: VILLAGES @ WESTMINSTER
    User: Rickmond Engineering
    Date: 08/07/1997  Thursday
    Time: 12:00:52
   Input: VWII100.IN
  Output: VWII100.OUT
                                                        RETURN PERIOD
(yrs):    100


 ==========================   DOWNSTREAM HYDROGRAPH
==========================
```

DISCHARGE (cfs)

TIME: (hrs)	+.00 hrs	+.10 hrs	+.20 hrs	+.30 hrs	+.40 hrs	+.50 hrs	+.60 hrs	+.70 hrs	+.80 hrs	+.90 hrs
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
6.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
7.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
8.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01
9.00	.03	.06	.09	.15	.22	.30	.39	.49	.61	.73
10.00	.87	1.01	1.17	1.35	1.56	1.78	2.03	2.31	2.62	2.99
11.00	3.39	3.86	4.40	5.04	5.82	6.70	7.94	9.76	13.33	20.92
12.00	34.56	53.26	75.30	95.97	109.41	114.57	113.11	106.25	95.48	82.91
13.00	71.32	61.72	54.10	47.66	41.96	37.18	33.31	30.09	27.33	24.95
14.00	22.95	21.28	19.89	18.73	17.80	17.06	16.44	15.80	15.13	14.47
15.00	13.87	13.30	12.76	12.27	11.79	11.34	10.91	10.50	10.12	9.76
16.00	9.44	9.15	8.88	8.64	8.44	8.26	8.10	7.97	7.85	7.74
17.00	7.64	7.56	7.47	7.40	7.32	7.25	7.19	7.12	7.06	6.99
18.00	6.93	6.87	6.81	6.74	6.68	6.62	6.56	6.50	6.44	6.38
19.00	6.32	6.26	6.19	6.13	6.07	6.01	5.95	5.89	5.83	5.76
20.00	5.70	5.64	5.58	5.52	5.46	5.39	5.33	5.27	5.21	5.15
21.00	5.10	5.04	4.98	4.93	4.88	4.82	4.77	4.73	4.68	4.63
22.00	4.59	4.55	4.50	4.46	4.43	4.39	4.36	4.32	4.29	4.26
23.00	4.23	4.20	4.18	4.16	4.13	4.11	4.09	4.08	4.06	4.05
24.00	4.03	3.99	3.88	3.69	3.38	2.97	2.53	2.08	1.66	

```
1.30
 25.00 |    1.00    .78    .61    .47    .37    .29    .22    .17    .13
.10
 26.00 |     .08    .06    .05    .04    .03    .02    .01    .01    .01
.00
 27.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 28.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00
 29.00 |     .00    .00    .00    .00    .00    .00    .00    .00    .00
.00

                    PEAK DISCHARGE (cfs):     114.57
                      TIME TO PEAK (hrs):      12.50
 Hydrograph Saved In: VWII100.DAT

1*******************************     SCSHYDRO
*******************************
 *******************************   Version 3.21
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************

 PROJECT: VILLAGES @ WESTMINSTER
    User: Rickmond Engineering
    Date: 08/07/1997  Thursday
    Time: 12:00:52
   Input: VWII100.IN
  Output: VWII100.OUT
                                                          RETURN PERIOD
(yrs):    100


 ============================   HYDROLOGIC SUMMARY
============================
 =====================   Volumes, Losses, and Discharges
======================


 SCS TYPE II  Hyetograph.
 SCS DIMENSIONLESS UNIT HYDROGRAPH was used.
 APPLIED RAINFALL DEPTH (inches):  8.00


                VOLUME OF                                |
                 RAINFALL     VOLUME OF    RAINFALL      |     PEAK
PEAK
                 APPLIED       RUNOFF       LOSSES       |   DISCHARGE
DISCHARGE
                 (ac-ft)       (ac-ft)     (percent)     |     (cfs)
(cfs/ac)
               ___________   ___________   __________    |  ___________
___________
                                                        |
                                                        |
 SUBAREA    1  37.589        18.307         51.30       |      114.568
2.032
                                                        |
                                                        |
                                                        |
```

TOTAL WATERSHED	37.589	18.307	51.30	114.568	2.032

TOTAL WATERSHED AREA (square miles):	.0881
TOTAL VOLUME OF DISCHARGE LEAVING WATERSHED (ac-ft):	18.3073
COMPOSITE WATERSHED CURVE NUMBER:	65.00
MINIMUM SUBAREA TIME OF CONCENTRATION:	1.010 hours.

NOTE: "VOLUME OF RUNOFF" includes surface runoff only; baseflows are not included in this summation. The "TOTAL VOLUME OF DISCHARGE LEAVING WATERSHED" includes all baseflows.

1

Worksheet 2: Runoff curve number and runoff

Project Villages @ Westminster By KMJ Date 4/23/97

Location James City County, Va Checked ____ Date ____

Circle one: (Present) Developed Pond II

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☒ acres ☐ mi² ☐ %	Product of CN x area
EMPORIA JOHNSTON CRAVEN (B)	WOODS (Good Cover)	55			56.4	
				Totals =	56.4	

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 55

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr	2		
Rainfall, P (24-hour)	in	3.5		
Runoff, Q ..... (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in	0.3		

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Villages @ Westminster By RWJ Date 4/23/97

Location James City County, Va Checked ____ Date ____

Circle one: (Present) Developed POND II

Circle one: (T_c) T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID	AB	
1. Surface description (table 3-1)			LIGHT WOODS	
2. Manning's roughness coeff., n (table 3-1) ..			0.40	
3. Flow length, L (total L ≤ 300 ft)	ft		300	
4. Two-yr 24-hr rainfall, P_2	in		3.5	
5. Land slope, s	ft/ft		.02	
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t	hr		.82	+ ____ = ____

Shallow concentrated flow		Segment ID	BC	
7. Surface description (paved or unpaved)			UNPAVED	
8. Flow length, L	ft		850	
9. Watercourse slope, s	ft/ft		.0318	
10. Average velocity, V (figure 3-1)	ft/s		3.9	
11. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		.06	+ ____ = ____

Channel flow		Segment ID	CD	
12. Cross sectional flow area, a	ft^2		10	
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft		0.66	
15. Channel slope, s	ft/ft		.0193	
16. Manning's roughness coeff., n			.035	
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		4.48	
18. Flow length, L	ft		1400	
19. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		.09	+ ____ = ____
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr			.97

Worksheet 5a: Basic watershed data

Project Villages @ Westminster Location James City County, Va. By HMT Date 4/23/97

Circle one: (Present) Developed POND II Frequency (yr) _____ Checked _____ Date _____

	Subarea name	Drainage area A_m (mi^2)	Time of concentration T_c (hr)	Travel time through subarea T_t (hr)	Downstream subarea names	Travel time summation to outlet ΣT_t (hr)	24-hr Rainfall P (in)	Runoff curve number CN	Runoff Q (in)	$A_m Q$ (mi^2-in)	Initial abstraction I_a (in)	I_a/P
2		.0881	.97				3.5	55	0.3	.0264	1.636	.47

From worksheet 3 From worksheet 2 From table 5-1

8
6

Worksheet 5b: Tabular hydrograph discharge summary

Project Villages @ Westminster Location James City County, Va By KMJ Date 4/23/97

Circle one: (Present) Developed POND II Frequency (yr) ____ Checked ____ Date ____

Subarea name	Basic watershed data used 1/				Select and enter hydrograph times in hours from exhibit 5- 2 2/											
	Sub-area T_c (hr)	ΣT_t to outlet (hr)	I_a/P	A_mQ (mi^2-in)				13.0								
					Discharges at selected hydrograph times 3/ -(cfs)-											
2	.97		.47	.0264				4.22								
Composite hydrograph at outlet																

1/ Worksheet 5a. Rounded as needed for use with exhibit 5.
2/ Enter rainfall distribution type used.
3/ Hydrograph discharge for selected times is A_mQ multiplied by tabular discharge from appropriate exhibit 5.

Worksheet 2: Runoff curve number and runoff

Project Villages @ Westminster By KWJ Date 4/23/97

Location James City County Checked ____ Date ____

Circle one: Present (Developed) POND II

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☒ acres ☐ mi² ☐ %	Product of CN x area
EMPORIA JOHNSTON CRAVEN (B)	Woods (Good Cover)	55			27.95	1537.25
" (B)	Grass (Good Cover)	61			18.10	1104.10
" (B)	Roof / Driveway	98			5.65	553.70
" (B)	Roads	98			4.70	460.60
				Totals =	56.4	3655.65

OK

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{3655.65}{56.4} = 64.8$; Use CN = 65

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr	2	100	
Rainfall, P (24-hour) ..... in	3.5	8.0	
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	0.7	3.9	

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Villages @ Westminster By KWJ Date 4/23/97

Location James City County, Va Checked ____ Date ____

Circle one: Present Developed POND II

Circle one: T_c T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID	AB		
1. Surface description (table 3-1)			Woods Light		
2. Manning's roughness coeff., n (table 3-1) ..			0.4		
3. Flow length, L (total L ≤ 300 ft)	ft		300		
4. Two-yr 24-hr rainfall, P_2	in		3.5		
5. Land slope, s	ft/ft		.02		
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t	hr		.82	+	=

Shallow concentrated flow		Segment ID	BE	EF	
7. Surface description (paved or unpaved)			UNPAVED	PAVED	
8. Flow length, L	ft		400	650	
9. Watercourse slope, s	ft/ft		.0225	.0185	
10. Average velocity, V (figure 3-1)	ft/s		2.4	2.8	
11. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		.05	+ .06	= .11

Channel flow		Segment ID	FD		
12. Cross sectional flow area, a	ft^2		10		
13. Wetted perimeter, p_w	ft				
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft		0.66		
15. Channel slope, s	ft/ft		.0237		
16. Manning's roughness coeff., n			.035		
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		4.96		
18. Flow length, L	ft		1350		
19. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		.08	+	=

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr 1.01

Worksheet 5a: Basic watershed data

Project Villages @ Westminster Location James City County, Va. By KMT Date 4/23/97

Circle one: Present (Developed) POND II Frequency (yr) _____ Checked _____ Date _____

	Subarea name	Drainage area A_m (mi^2)	Time of concentration T_c (hr)	Travel time through subarea T_t (hr)	Downstream subarea names	Travel time summation to outlet ΣT_t (hr)	24-hr Rainfall P (in)	Runoff curve number CN	Runoff Q (in)	$A_m Q$ (mi^2-in)	Initial abstraction I_a (in)	I_a/P
2		.0881	1.01				3.5	65	0.7	.0617	1.077	.31
100		.0881	1.01				8.0	65	3.9	.3436	1.077	.13

From worksheet 3 From worksheet 2 From table 5-1

90

Worksheet 5b: Tabular hydrograph discharge summary

Project Villages @ Westminster Location James City County, Va. By KMJ Date 4/23/97

Circle one: Present (Developed) POND II Frequency (yr) _____ Checked _____ Date _____

	Subarea name	Basic watershed data used 1/				Select and enter hydrograph times in hours from exhibit 5- 2/											
		Sub-area T_c (hr)	ΣT_t to outlet (hr)	I_a/P	A_mQ (mi^2-in)				12.8	13.0							
						Discharges at selected hydrograph times 3/ -(cfs)-											
2		1.01		.31	.0617					18.02							
100		1.01		.13	.3436				122.67								
	Composite hydrograph at outlet																

1/ Worksheet 5a. Rounded as needed for use with exhibit 5.
2/ Enter rainfall distribution type used.
3/ Hydrograph discharge for selected times is A_mQ multiplied by tabular discharge from appropriate exhibit 5.

Worksheet 6a: Detention basin storage, peak outflow discharge (q_o) known

Project Villages @ Westminster By KWJ Date 4/23/97

Location James City County, Va. Checked _____ Date _____

Circle one: Present (Developed) POND II

Elevation or stage

Detention basin storage

1. Data:
   Drainage area ..... A_m = .0881 mi^2
   Rainfall distribution type (I, IA, II, III) = II

	1st stage	2nd stage
2. Frequency ..... yr	2	
3. Peak inflow discharge, q_i .... cfs (From worksheet 4 or 5b)	18.02	
4. Peak outflow discharge, q_o .... cfs 1/	4.22	
5. Compute $\frac{q_o}{q_i}$	.23	
6. $\frac{V_s}{V_r}$ ..... (Use $\frac{q_o}{q_i}$ with figure 6-1)	.43	
7. Runoff, Q ..... in (From worksheet 2)	0.7	
8. Runoff volume, V_r ..... ac-ft ($V_r = QA_m 53.33$)	3.29	
9. Storage volume, V_s ..... ac-ft ($V_s = V_r(\frac{V_s}{V_r})$) 61,500 cf	1.41	
10. Maximum stage, E_{max} (From plot)		

1/ 2nd stage q_o includes 1st stage q_o.

RICKMOND ENGINEERING, INC.
1643 C Merrimac Trail
Williamsburg, Virginia 23185-5624
(804) 229-1776 or (804) 898-4149
Fax Number (804) 220-9370

JOB 96106
SHEET NO. 93 OF
CALCULATED BY KMJ DATE 4/23/97
CHECKED BY DATE
SCALE

DESIGN DRY POND II

ELEV (ft)	S.A. (ft²)	Δ Elev (ft)	Δ Storage (cf)	Accum Storage (cf)
50	23,790			0
		2	52,231	
52	28,441			52,231
		2	61,127	
54	32,686			113,358
		2	70,012	
56	37,326			183,370
		2	79,583	
58	42,257			262,953

RICKMOND ENGINEERING, INC.
1643 A Merrimac Trail
Williamsburg, Virginia 23185-5624
(757) 229-1776 or (757) 898-4149
Fax Number (757) 229-4683

JOB 96106
SHEET NO. 94 OF
CALCULATED BY KMJ DATE 8/7/97
CHECKED BY DATE
SCALE

DESIGN OUTLET ORIFICE

$Q = 4.22$ cfs Pre-Development 2 year

2yr Storm Volume of 61,500 cf rises to Elev 52.30

$Q = CA\sqrt{2gh}$ $h = 52.30 - 50.00 = 2.30$

$4.22 = .6A\sqrt{2(32.2)(2.30)}$

$A = \pi r^2 = .57 ft^2$

$r = .43' = 5.1''$ use 10" diameter orifice

ELEV	h	Q
50	0	0
51	1	2.74
52	2	3.88
53	3	4.75
54	4	5.49
55	5	6.14
56	6	6.72
57	7	7.26
58	8	7.76

RICKMOND ENGINEERING, INC.
1643 A Merrimac Trail
Williamsburg, Virginia 23185-5624
(757) 229-1776 or (757) 898-4149
Fax Number (757) 229-4683

JOB 96106
SHEET NO. 95 OF
CALCULATED BY KMJ DATE 8/7/97
CHECKED BY DATE
SCALE

DESIGN OUTLET BARREL

70' of 36" RCP @ 0.5% n = .013

Q	d_n	d_c	v_n	R	H	h_o	LS_o	HW	HW ELEV
0	—	—	—	—	—	—	—	—	50.00
25	1.55	1.61	6.77	.77	1.41	2.30	.35	3.36	53.36
50	2.67	2.30	7.53	.90	1.67	2.65	.35	3.97	53.97
75	3.00	3.00	10.61	.75	3.50	3.00	.35	6.15	56.15
100	3.00	3.00	14.14	.75	6.22	3.00	.35	8.87	58.87

RICKMOND ENGINEERING, INC.
1643 A Merrimac Trail
Williamsburg, Virginia 23185-5624
(757) 229-1776 or (757) 898-4149
Fax Number (757) 229-4683

JOB 96106
SHEET NO. 96 OF
CALCULATED BY KMJ DATE 8/7/97
CHECKED BY DATE
SCALE

DESIGN RISER OUTLET

54"Ø Riser

$Q = 9.739 D_r H^{3/2}$

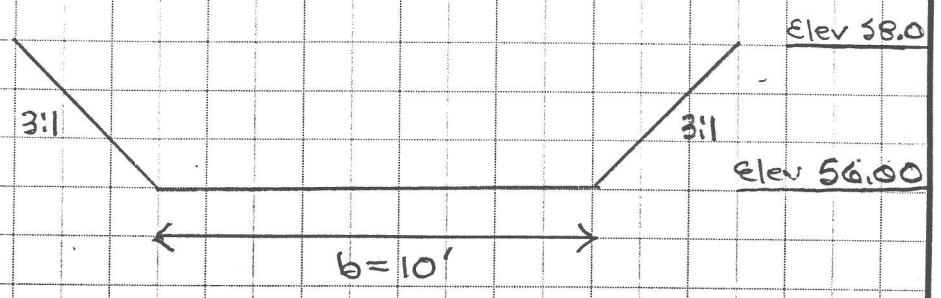
ELEV	H	Q
55.00	0	0
56.00	1	43.83
57.00	2	123.96
58.00	3	227.72

RICKMOND ENGINEERING, INC.
1643 A Merrimac Trail
Williamsburg, Virginia 23185-5624
(757) 229-1776 or (757) 898-4149
Fax Number (757) 229-4683

JOB 96106
SHEET NO. 96A OF
CALCULATED BY KMJ DATE 9/11/97
CHECKED BY DATE
SCALE

DESIGN EMERGENCY SPILLWAY

Cross Section:



n=.035

$$Q = \frac{1.49}{n} R^{2/3} S^{1/2} A$$

Elev	Q
56.00	0
57.00	15.00
58.00	54.10

RICKMOND ENGINEERING, INC.
1643 A Merrimac Trail
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Fax Number (757) 229-4683

JOB 96106
SHEET NO. 97 OF
CALCULATED BY KMJ DATE 8/7/97
CHECKED BY DATE
SCALE

STAGE - STORAGE - DISCHARGE

STAGE (ft)	STORAGE (ac-ft)	DISCHARGE (cfs)
50	.546	0
51	.600	2.74
52	.653	3.88
53	.702	4.75
54	.750	5.49
55	.804	6.14
56	.857	43.83
57	.914	97.81
58	.970	146.10

100 year flood tailwater elev 52.00

2-YR STORM ROUTING

```
1*******************************      PONDOPT
*******************************
 *******************************   Version 1.83
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************
```

PROJECT: VILLAGES AT WESTMINSTER
User: Rickmond Engineering
Date: 09/12/1997 Friday
Time: 09:46:58
Output: VWIIP2.OUT

SOLUTION FOR 1 STORMS.

TIME INCREMENT: .100 Hours

STORM NUMBER	HYDROGRAPH IN FILE:
1	VWII2.DAT

TAILWATER STAGE (ft)	STORM NUMBER	PEAK INFLOW (cfs)	ALLOWABLE PEAK DISCHARGE (cfs)	DURATION (min)	RUNOFF VOLUME (ft3)
52.000	1	17.902	N/A	1794.00	.1540E+06

```
1*******************************      PONDOPT
*******************************
 *******************************   Version 1.83
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************
```

PROJECT: VILLAGES AT WESTMINSTER
User: Rickmond Engineering
Date: 09/12/1997 Friday
Time: 09:46:58
Output: VWIIP2.OUT

Stage-Area-Discharge
Filename: VWIIP.DAT

```
          TAILWATER STAGE:   52.000 feet.
            INITIAL STAGE:   52.000 feet.

 ==================   STAGE-STORAGE-DISCHARGE RELATIONSHIP
===================

 <<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<   STORM  1
>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
```

STAGE (ft)	STORAGE VOLUME (ac-ft)	DISCHARGE (cfs)
50.000	.0000	.0000
51.000	.5728	.0000
52.000	1.199	.0000
53.000	1.876	4.750
54.000	2.602	5.490
55.000	3.379	6.140
56.000	4.210	43.83
57.000	5.095	97.81
58.000	6.037	146.1

```
1*******************************     PONDOPT
*******************************
 *******************************   Version 1.83
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************

 PROJECT: VILLAGES AT WESTMINSTER
    User: Rickmond Engineering
    Date: 09/12/1997    Friday
    Time: 09:46:58
  Output: VWIIP2.OUT


          TAILWATER STAGE:   52.000 feet.
            INITIAL STAGE:   52.000 feet.

 <<<<<<<<<<<<<<<<<<<<<   ROUTING RESULTS FOR STORM  1
>>>>>>>>>>>>>>>>>>>>>

     MAXIMUM ELEVATION:    53.66     feet.
        MAXIMUM INFLOW:    17.90     cfs.
       MAXIMUM OUTFLOW:    5.238     cfs.
       MAXIMUM STORAGE:    2.355     acre-feet.

      CONTINUITY ERROR:     .459E-03 percent.
```

POND

TIME (min)	INFLOW RATE (cfs)	OUTFLOW RATE (cfs)	SURFACE ELEVATION (ft)

0	.000	.000	52.000
6	.000	.000	52.000
12	.000	.000	52.000
18	.000	.000	52.000
24	.000	.000	52.000
30	.000	.000	52.000
36	.000	.000	52.000
42	.000	.000	52.000
48	.000	.000	52.000
54	.000	.000	52.000
60	.000	.000	52.000
66	.000	.000	52.000
72	.000	.000	52.000
78	.000	.000	52.000
84	.000	.000	52.000
90	.000	.000	52.000
96	.000	.000	52.000
102	.000	.000	52.000
108	.000	.000	52.000
114	.000	.000	52.000
120	.000	.000	52.000
126	.000	.000	52.000
132	.000	.000	52.000
138	.000	.000	52.000
144	.000	.000	52.000
150	.000	.000	52.000
156	.000	.000	52.000
162	.000	.000	52.000
168	.000	.000	52.000
174	.000	.000	

52.000				
	180	.000	.000	|
52.000				
	186	.000	.000	|
52.000				
	192	.000	.000	|
52.000				
	198	.000	.000	|
52.000				
	204	.000	.000	|
52.000				
	210	.000	.000	|
52.000				
	216	.000	.000	|
52.000				
	222	.000	.000	|
52.000				
	228	.000	.000	|
52.000				
	234	.000	.000	|
52.000				
	240	.000	.000	|
52.000				
	246	.000	.000	|
52.000				
	252	.000	.000	|
52.000				
	258	.000	.000	|
52.000				
	264	.000	.000	|
52.000				
	270	.000	.000	|
52.000				
	276	.000	.000	|
52.000				
	282	.000	.000	|
52.000				
	288	.000	.000	|
52.000				
	294	.000	.000	|
52.000				
	300	.000	.000	|
52.000				
	306	.000	.000	|
52.000				
	312	.000	.000	|
52.000				
	318	.000	.000	|
52.000				
	324	.000	.000	|
52.000				
	330	.000	.000	|
52.000				
	336	.000	.000	|
52.000				
	342	.000	.000	|
52.000				
	348	.000	.000	|
52.000				
	354	.000	.000	|

52.000				
	360	.000	.000	|
52.000				
	366	.000	.000	|
52.000				
	372	.000	.000	|
52.000				
	378	.000	.000	|
52.000				
	384	.000	.000	|
52.000				
	390	.000	.000	|
52.000				
	396	.000	.000	|
52.000				
	402	.000	.000	|
52.000				
	408	.000	.000	|
52.000				
	414	.000	.000	|
52.000				
	420	.000	.000	|
52.000				
	426	.000	.000	|
52.000				
	432	.000	.000	|
52.000				
	438	.000	.000	|
52.000				
	444	.000	.000	|
52.000				
	450	.000	.000	|
52.000				
	456	.000	.000	|
52.000				
	462	.000	.000	|
52.000				
	468	.000	.000	|
52.000				
	474	.000	.000	|
52.000				
	480	.000	.000	|
52.000				
	486	.000	.000	|
52.000				
	492	.000	.000	|
52.000				
	498	.000	.000	|
52.000				
	504	.000	.000	|
52.000				
	510	.000	.000	|
52.000				
	516	.000	.000	|
52.000				
	522	.000	.000	|
52.000				
	528	.000	.000	|
52.000				
	534	.000	.000	|

52.000				
	540	.000	.000	|
52.000				
	546	.000	.000	|
52.000				
	552	.000	.000	|
52.000				
	558	.000	.000	|
52.000				
	564	.000	.000	|
52.000				
	570	.000	.000	|
52.000				
	576	.000	.000	|
52.000				
	582	.000	.000	|
52.000				
	588	.000	.000	|
52.000				
	594	.000	.000	|
52.000				
	600	.000	.000	|
52.000				
	606	.000	.000	|
52.000				
	612	.000	.000	|
52.000				
	618	.000	.000	|
52.000				
	624	.000	.000	|
52.000				
	630	.000	.000	|
52.000				
	636	.000	.000	|
52.000				
	642	.000	.000	|
52.000				
	648	.000	.000	|
52.000				
	654	.000	.000	|
52.000				
	660	.000	.000	|
52.000				
	666	.000	.000	|
52.000				
	672	.000	.000	|
52.000				
	678	.000	.000	|
52.000				
	684	.000	.000	|
52.000				
	690	.000	.000	|
52.000				
	696	.000	.000	|
52.000				
	702	.014	.000	|
52.000				
	708	.152	.005	|
52.001				
	714	.792	.031	|

52.007				
	720	2.472	.122	|
52.026				
	726	5.146	.329	|
52.069				
	732	8.743	.702	|
52.148				
	738	12.597	1.263	|
52.266				
	744	15.547	1.985	|
52.418				
	750	17.253	2.797	|
52.589				
	756	17.902	3.629	|
52.764				
	762	17.602	4.425	|
52.931				
	768	16.486	4.807	|
53.078				
	774	14.835	4.898	|
53.201				
	780	13.167	4.975	|
53.304				
	786	11.721	5.037	|
53.389				
	792	10.550	5.089	|
53.458				
	798	9.538	5.130	|
53.514				
	804	8.604	5.163	|
53.559				
	810	7.798	5.189	|
53.593				
	816	7.137	5.208	|
53.619				
	822	6.579	5.222	|
53.637				
	828	6.088	5.231	|
53.650				
	834	5.651	5.236	|
53.657				
	840	5.276	5.238	|
53.660				
	846	4.962	5.237	|
53.659				
	852	4.696	5.234	|
53.654				
	858	4.474	5.228	|
53.647				
	864	4.293	5.221	|
53.637				
	870	4.152	5.213	|
53.626				
	876	4.035	5.204	|
53.613				
	882	3.914	5.193	|
53.599				
	888	3.782	5.182	|
53.584				
	894	3.646	5.170	|

53.567				
	900	3.516	5.156	|
53.549				
	906	3.388	5.142	|
53.530				
	912	3.263	5.127	|
53.509				
	918	3.146	5.111	|
53.487				
	924	3.032	5.094	|
53.464				
	930	2.922	5.076	|
53.440				
	936	2.818	5.057	|
53.415				
	942	2.719	5.038	|
53.390				
	948	2.626	5.018	|
53.363				
	954	2.540	4.998	|
53.335				
	960	2.461	4.977	|
53.307				
	966	2.389	4.956	|
53.278				
	972	2.324	4.934	|
53.248				
	978	2.266	4.912	|
53.218				
	984	2.216	4.889	|
53.188				
	990	2.173	4.867	|
53.158				
	996	2.135	4.844	|
53.127				
	1002	2.103	4.821	|
53.096				
	1008	2.075	4.798	|
53.065				
	1014	2.050	4.775	|
53.034				
	1020	2.027	4.752	|
53.003				
	1026	2.007	4.611	|
52.971				
	1032	1.988	4.463	|
52.940				
	1038	1.971	4.324	|
52.910				
	1044	1.954	4.191	|
52.882				
	1050	1.938	4.064	|
52.856				
	1056	1.922	3.944	|
52.830				
	1062	1.907	3.830	|
52.806				
	1068	1.892	3.721	|
52.783				
	1074	1.878	3.617	|

52.762				
	1080	1.863	3.519	|
52.741				
	1086	1.848	3.425	|
52.721				
	1092	1.834	3.336	|
52.702				
	1098	1.820	3.251	|
52.684				
	1104	1.805	3.170	|
52.667				
	1110	1.791	3.093	|
52.651				
	1116	1.776	3.019	|
52.636				
	1122	1.762	2.949	|
52.621				
	1128	1.747	2.881	|
52.607				
	1134	1.732	2.817	|
52.593				
	1140	1.717	2.756	|
52.580				
	1146	1.703	2.697	|
52.568				
	1152	1.688	2.640	|
52.556				
	1158	1.673	2.586	|
52.544				
	1164	1.658	2.534	|
52.534				
	1170	1.643	2.485	|
52.523				
	1176	1.627	2.437	|
52.513				
	1182	1.612	2.391	|
52.503				
	1188	1.597	2.346	|
52.494				
	1194	1.581	2.304	|
52.485				
	1200	1.566	2.263	|
52.476				
	1206	1.550	2.223	|
52.468				
	1212	1.535	2.185	|
52.460				
	1218	1.519	2.148	|
52.452				
	1224	1.503	2.112	|
52.445				
	1230	1.488	2.077	|
52.437				
	1236	1.472	2.043	|
52.430				
	1242	1.457	2.011	|
52.423				
	1248	1.441	1.979	|
52.417				
	1254	1.426	1.948	|

52.410				
	1260	1.411	1.919	
52.404				
	1266	1.396	1.890	
52.398				
	1272	1.382	1.861	
52.392				
	1278	1.368	1.834	
52.386				
	1284	1.354	1.807	
52.380				
	1290	1.341	1.781	
52.375				
	1296	1.328	1.756	
52.370				
	1302	1.315	1.732	
52.365				
	1308	1.303	1.708	
52.360				
	1314	1.291	1.685	
52.355				
	1320	1.280	1.662	
52.350				
	1326	1.269	1.641	
52.345				
	1332	1.258	1.619	
52.341				
	1338	1.248	1.599	
52.337				
	1344	1.238	1.579	
52.332				
	1350	1.229	1.559	
52.328				
	1356	1.220	1.540	
52.324				
	1362	1.211	1.522	
52.320				
	1368	1.203	1.504	
52.317				
	1374	1.196	1.487	
52.313				
	1380	1.188	1.471	
52.310				
	1386	1.181	1.454	
52.306				
	1392	1.175	1.439	
52.303				
	1398	1.169	1.424	
52.300				
	1404	1.163	1.409	
52.297				
	1410	1.158	1.395	
52.294				
	1416	1.154	1.382	
52.291				
	1422	1.150	1.369	
52.288				
	1428	1.146	1.356	
52.286				
	1434	1.143	1.344	

52.283				
	1440	1.140	1.333	|
52.281				
	1446	1.127	1.322	|
52.278				
	1452	1.098	1.310	|
52.276				
	1458	1.044	1.297	|
52.273				
	1464	.956	1.280	|
52.269				
	1470	.841	1.258	|
52.265				
	1476	.716	1.231	|
52.259				
	1482	.589	1.199	|
52.252				
	1488	.471	1.161	|
52.244				
	1494	.367	1.119	|
52.236				
	1500	.284	1.075	|
52.226				
	1506	.220	1.028	|
52.216				
	1512	.172	.981	|
52.207				
	1518	.134	.935	|
52.197				
	1524	.104	.889	|
52.187				
	1530	.081	.844	|
52.178				
	1536	.063	.800	|
52.169				
	1542	.049	.758	|
52.160				
	1548	.038	.718	|
52.151				
	1554	.029	.680	|
52.143				
	1560	.023	.643	|
52.135				
	1566	.017	.608	|
52.128				
	1572	.013	.574	|
52.121				
	1578	.010	.543	|
52.114				
	1584	.008	.513	|
52.108				
	1590	.006	.484	|
52.102				
	1596	.004	.457	|
52.096				
	1602	.003	.432	|
52.091				
	1608	.002	.407	|
52.086				
	1614	.001	.385	|

52.081				
	1620	.000	.363	|
52.076				
	1626	.000	.342	|
52.072				
	1632	.000	.323	|
52.068				
	1638	.000	.305	|
52.064				
	1644	.000	.288	|
52.061				
	1650	.000	.272	|
52.057				
	1656	.000	.256	|
52.054				
	1662	.000	.242	|
52.051				
	1668	.000	.228	|
52.048				
	1674	.000	.215	|
52.045				
	1680	.000	.203	|
52.043				
	1686	.000	.192	|
52.040				
	1692	.000	.181	|
52.038				
	1698	.000	.171	|
52.036				
	1704	.000	.161	|
52.034				
	1710	.000	.152	|
52.032				
	1716	.000	.144	|
52.030				
	1722	.000	.135	|
52.029				
	1728	.000	.128	|
52.027				
	1734	.000	.121	|
52.025				
	1740	.000	.114	|
52.024				
	1746	.000	.107	|
52.023				
	1752	.000	.101	|
52.021				
	1758	.000	.096	|
52.020				
	1764	.000	.090	|
52.019				
	1770	.000	.085	|
52.018				
	1776	.000	.080	|
52.017				
	1782	.000	.076	|
52.016				
	1788	.000	.072	|
52.015				
	1794	.000	.068	|

52.014				
	1800	.000	.064	|
52.013				
	1806	.000	.060	|
52.013				
	1812	.000	.057	|
52.012				
	1818	.000	.054	|
52.011				
	1824	.000	.051	|
52.011				
	1830	.000	.048	|
52.010				
	1836	.000	.045	|
52.009				
	1842	.000	.042	|
52.009				
	1848	.000	.040	|
52.008				
	1854	.000	.038	|
52.008				
	1860	.000	.036	|
52.008				
	1866	.000	.034	|
52.007				
	1872	.000	.032	|
52.007				
	1878	.000	.030	|
52.006				
	1884	.000	.028	|
52.006				
	1890	.000	.027	|
52.006				
	1896	.000	.025	|
52.005				
	1902	.000	.024	|
52.005				
	1908	.000	.022	|
52.005				
	1914	.000	.021	|
52.004				
	1920	.000	.020	|
52.004				
	1926	.000	.019	|
52.004				
	1932	.000	.018	|
52.004				
	1938	.000	.017	|
52.004				
	1944	.000	.016	|
52.003				
	1950	.000	.015	|
52.003				
	1956	.000	.014	|
52.003				
	1962	.000	.013	|
52.003				
	1968	.000	.013	|
52.003				
	1974	.000	.012	|

52.002				
	1980	.000	.011	|
52.002				
	1986	.000	.011	|
52.002				
	1992	.000	.010	|
52.002				
	1998	.000	.009	|
52.002				
	2004	.000	.009	|
52.002				
	2010	.000	.008	|
52.002				
	2016	.000	.008	|
52.002				
	2022	.000	.007	|
52.002				
	2028	.000	.007	|
52.001				
	2034	.000	.007	|
52.001				
	2040	.000	.006	|
52.001				
	2046	.000	.006	|
52.001				
	2052	.000	.006	|
52.001				
	2058	.000	.005	|
52.001				
	2064	.000	.005	|
52.001				
	2070	.000	.005	|
52.001				
	2076	.000	.004	|
52.001				
	2082	.000	.004	|
52.001				
	2088	.000	.004	|
52.001				
	2094	.000	.004	|
52.001				
	2100	.000	.004	|
52.001				
	2106	.000	.003	|
52.001				
	2112	.000	.003	|
52.001				
	2118	.000	.003	|
52.001				
	2124	.000	.003	|
52.001				
	2130	.000	.003	|
52.001				
	2136	.000	.002	|
52.001				
	2142	.000	.002	|
52.000				
	2148	.000	.002	|
52.000				
	2154	.000	.002	|

```
52.000
        2160                .000                .002                |
52.000
        2166                .000                .002                |
52.000
        2172                .000                .002                |
52.000
        2178                .000                .002                |
52.000
        2184                .000                .002                |
52.000
        2190                .000                .001                |
52.000
        2196                .000                .001                |
52.000
        2202                .000                .001                |
52.000
        2208                .000                .001                |
52.000
        2214                .000                .001                |
52.000
        2220                .000                .001                |
52.000
        2226                .000                .001                |
52.000
        2232                .000                .001                |
52.000
        2238                .000                .001                |
52.000
        2244                .000                .001                |
52.000
        2250                .000                .001                |
52.000
        2256                .000                .001                |
52.000
        2262                .000                .001                |
52.000
        2268                .000                .001                |
52.000
        2274                .000                .001                |
52.000
        2280                .000                .001                |
52.000
        2286                .000                .001                |
52.000
        2292                .000                .001                |
52.000
        2298                .000                .001                |
52.000
        2304                .000                .000                |
52.000
1*******************************     PONDOPT
*******************************
 *******************************   Version 1.83
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
*******************

 PROJECT: VILLAGES AT WESTMINSTER
    User: Rickmond Engineering
```

Date: 09/12/1997 Friday
Time: 09:46:58
Output: VWIIP2.OUT

ROUTING SUMMARY ----------
SIMULATION MODE ----------
FOR THE ABOVE CASE ----------

STORM NUMBER	PEAK STAGE (ft)	PEAK STORAGE (ac-ft)	PEAK INFLOW (cfs)	PEAK OUTFLOW (cfs)
1	53.660	2.36	17.902	5.238

100-YR STORM ROUTING

```
1*******************************     PONDOPT
*******************************
 *******************************   Version 1.83
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************
```

PROJECT: VILLAGES AT WESTMINSTER
User: Rickmond Engineering
Date: 09/12/1997 Friday
Time: 09:50:03
Output: VWIIP100.OUT

SOLUTION FOR 1 STORMS.

TIME INCREMENT: .100 Hours

STORM NUMBER	HYDROGRAPH IN FILE:
1	VWII100.DAT

TAILWATER STAGE (ft)	STORM NUMBER	PEAK INFLOW (cfs)	ALLOWABLE PEAK DISCHARGE (cfs)	DURATION (min)	RUNOFF VOLUME (ft3)
52.000	1	114.568	N/A	1794.00	.7975E+06

```
1*******************************     PONDOPT
*******************************
 *******************************   Version 1.83
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************
```

PROJECT: VILLAGES AT WESTMINSTER
User: Rickmond Engineering
Date: 09/12/1997 Friday
Time: 09:50:03
Output: VWIIP100.OUT

Stage-Area-Discharge
Filename: VWIIP.DAT

```
          TAILWATER STAGE:   52.000 feet.
            INITIAL STAGE:   52.000 feet.

 ==================   STAGE-STORAGE-DISCHARGE RELATIONSHIP
===================

 <<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<   STORM  1
>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
```

STAGE (ft)	STORAGE VOLUME (ac-ft)	DISCHARGE (cfs)
50.000	.0000	.0000
51.000	.5728	.0000
52.000	1.199	.0000
53.000	1.876	4.750
54.000	2.602	5.490
55.000	3.379	6.140
56.000	4.210	43.83
57.000	5.095	97.81
58.000	6.037	146.1

```
1*******************************     PONDOPT
*******************************
 *******************************   Version 1.83
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
******************

 PROJECT: VILLAGES AT WESTMINSTER
    User: Rickmond Engineering
    Date: 09/12/1997    Friday
    Time: 09:50:03
  Output: VWIIP100.OUT


          TAILWATER STAGE:   52.000 feet.
            INITIAL STAGE:   52.000 feet.

 <<<<<<<<<<<<<<<<<<<<<<<   ROUTING RESULTS FOR STORM  1
>>>>>>>>>>>>>>>>>>>>>>>

     MAXIMUM ELEVATION:    56.99     feet.
        MAXIMUM INFLOW:    114.6     cfs.
       MAXIMUM OUTFLOW:    97.40     cfs.
       MAXIMUM STORAGE:    5.088     acre-feet.

      CONTINUITY ERROR:     .112E-03 percent.
```

POND

TIME (min)	INFLOW RATE (cfs)	OUTFLOW RATE (cfs)	SURFACE ELEVATION (ft)

0	.000	.000	52.000
6	.000	.000	52.000
12	.000	.000	52.000
18	.000	.000	52.000
24	.000	.000	52.000
30	.000	.000	52.000
36	.000	.000	52.000
42	.000	.000	52.000
48	.000	.000	52.000
54	.000	.000	52.000
60	.000	.000	52.000
66	.000	.000	52.000
72	.000	.000	52.000
78	.000	.000	52.000
84	.000	.000	52.000
90	.000	.000	52.000
96	.000	.000	52.000
102	.000	.000	52.000
108	.000	.000	52.000
114	.000	.000	52.000
120	.000	.000	52.000
126	.000	.000	52.000
132	.000	.000	52.000
138	.000	.000	52.000
144	.000	.000	52.000
150	.000	.000	52.000
156	.000	.000	52.000
162	.000	.000	52.000
168	.000	.000	52.000
174	.000	.000	

52.000				
	180	.000	.000	I
52.000				
	186	.000	.000	I
52.000				
	192	.000	.000	I
52.000				
	198	.000	.000	I
52.000				
	204	.000	.000	I
52.000				
	210	.000	.000	I
52.000				
	216	.000	.000	I
52.000				
	222	.000	.000	I
52.000				
	228	.000	.000	I
52.000				
	234	.000	.000	I
52.000				
	240	.000	.000	I
52.000				
	246	.000	.000	I
52.000				
	252	.000	.000	I
52.000				
	258	.000	.000	I
52.000				
	264	.000	.000	I
52.000				
	270	.000	.000	I
52.000				
	276	.000	.000	I
52.000				
	282	.000	.000	I
52.000				
	288	.000	.000	I
52.000				
	294	.000	.000	I
52.000				
	300	.000	.000	I
52.000				
	306	.000	.000	I
52.000				
	312	.000	.000	I
52.000				
	318	.000	.000	I
52.000				
	324	.000	.000	I
52.000				
	330	.000	.000	I
52.000				
	336	.000	.000	I
52.000				
	342	.000	.000	I
52.000				
	348	.000	.000	I
52.000				
	354	.000	.000	I

52.000				
	360	.000	.000	|
52.000				
	366	.000	.000	|
52.000				
	372	.000	.000	|
52.000				
	378	.000	.000	|
52.000				
	384	.000	.000	|
52.000				
	390	.000	.000	|
52.000				
	396	.000	.000	|
52.000				
	402	.000	.000	|
52.000				
	408	.000	.000	|
52.000				
	414	.000	.000	|
52.000				
	420	.000	.000	|
52.000				
	426	.000	.000	|
52.000				
	432	.000	.000	|
52.000				
	438	.000	.000	|
52.000				
	444	.000	.000	|
52.000				
	450	.000	.000	|
52.000				
	456	.000	.000	|
52.000				
	462	.000	.000	|
52.000				
	468	.000	.000	|
52.000				
	474	.000	.000	|
52.000				
	480	.000	.000	|
52.000				
	486	.000	.000	|
52.000				
	492	.000	.000	|
52.000				
	498	.000	.000	|
52.000				
	504	.000	.000	|
52.000				
	510	.000	.000	|
52.000				
	516	.000	.000	|
52.000				
	522	.001	.000	|
52.000				
	528	.004	.000	|
52.000				
	534	.013	.001	|

52.000				
	540	.029	.002	|
52.000				
	546	.055	.004	|
52.001				
	552	.095	.008	|
52.002				
	558	.148	.014	|
52.003				
	564	.215	.024	|
52.005				
	570	.296	.037	|
52.008				
	576	.389	.054	|
52.011				
	582	.493	.076	|
52.016				
	588	.607	.103	|
52.022				
	594	.733	.135	|
52.028				
	600	.867	.172	|
52.036				
	606	1.013	.215	|
52.045				
	612	1.174	.265	|
52.056				
	618	1.353	.321	|
52.068				
	624	1.556	.385	|
52.081				
	630	1.778	.457	|
52.096				
	636	2.027	.538	|
52.113				
	642	2.306	.630	|
52.133				
	648	2.624	.734	|
52.154				
	654	2.990	.850	|
52.179				
	660	3.395	.982	|
52.207				
	666	3.858	1.131	|
52.238				
	672	4.397	1.300	|
52.274				
	678	5.041	1.492	|
52.314				
	684	5.818	1.714	|
52.361				
	690	6.705	1.970	|
52.415				
	696	7.942	2.272	|
52.478				
	702	9.757	2.642	|
52.556				
	708	13.325	3.144	|
52.662				
	714	20.916	3.931	|

52.828				
	720	34.560	4.828	|
53.105				
	726	53.257	5.156	|
53.548				
	732	75.304	5.623	|
54.204				
	738	95.971	7.707	|
55.042				
	744	109.412	37.710	|
55.838				
	750	114.568	65.929	|
56.409				
	756	113.114	85.213	|
56.767				
	762	106.255	95.062	|
56.949				
	768	95.478	97.398	|
56.992				
	774	82.914	94.097	|
56.931				
	780	71.316	87.262	|
56.805				
	786	61.721	78.913	|
56.650				
	792	54.097	70.459	|
56.493				
	798	47.663	62.579	|
56.347				
	804	41.963	55.429	|
56.215				
	810	37.182	49.047	|
56.097				
	816	33.313	43.565	|
55.993				
	822	30.091	39.818	|
55.894				
	828	27.330	36.309	|
55.800				
	834	24.951	33.097	|
55.715				
	840	22.945	30.207	|
55.639				
	846	21.281	27.650	|
55.571				
	852	19.887	25.418	|
55.511				
	858	18.730	23.488	|
55.460				
	864	17.797	21.838	|
55.417				
	870	17.064	20.446	|
55.380				
	876	16.440	19.279	|
55.349				
	882	15.802	18.281	|
55.322				
	888	15.127	17.392	|
55.299				
	894	14.471	16.573	|

55.277				
	900	13.874	15.815	|
55.257				
	906	13.302	15.111	|
55.238				
	912	12.764	14.455	|
55.221				
	918	12.269	13.843	|
55.204				
	924	11.791	13.270	|
55.189				
	930	11.337	12.731	|
55.175				
	936	10.906	12.223	|
55.161				
	942	10.498	11.742	|
55.149				
	948	10.118	11.289	|
55.137				
	954	9.764	10.863	|
55.125				
	960	9.440	10.465	|
55.115				
	966	9.145	10.095	|
55.105				
	972	8.880	9.753	|
55.096				
	978	8.644	9.440	|
55.088				
	984	8.437	9.156	|
55.080				
	990	8.258	8.901	|
55.073				
	996	8.101	8.673	|
55.067				
	1002	7.966	8.471	|
55.062				
	1008	7.847	8.293	|
55.057				
	1014	7.741	8.135	|
55.053				
	1020	7.645	7.995	|
55.049				
	1026	7.557	7.871	|
55.046				
	1032	7.475	7.759	|
55.043				
	1038	7.398	7.657	|
55.040				
	1044	7.325	7.563	|
55.038				
	1050	7.255	7.477	|
55.035				
	1056	7.187	7.396	|
55.033				
	1062	7.121	7.320	|
55.031				
	1068	7.056	7.247	|
55.029				
	1074	6.993	7.177	|

55.028				
	1080	6.930	7.109	|
55.026				
	1086	6.868	7.042	|
55.024				
	1092	6.806	6.977	|
55.022				
	1098	6.744	6.914	|
55.021				
	1104	6.683	6.850	|
55.019				
	1110	6.622	6.788	|
55.017				
	1116	6.561	6.726	|
55.016				
	1122	6.500	6.664	|
55.014				
	1128	6.439	6.603	|
55.012				
	1134	6.378	6.541	|
55.011				
	1140	6.317	6.480	|
55.009				
	1146	6.256	6.419	|
55.007				
	1152	6.194	6.358	|
55.006				
	1158	6.133	6.296	|
55.004				
	1164	6.072	6.235	|
55.003				
	1170	6.010	6.174	|
55.001				
	1176	5.949	6.139	|
54.999				
	1182	5.887	6.138	|
54.997				
	1188	5.826	6.136	|
54.994				
	1194	5.764	6.134	|
54.990				
	1200	5.702	6.131	|
54.986				
	1206	5.641	6.128	|
54.981				
	1212	5.579	6.124	|
54.976				
	1218	5.517	6.120	|
54.969				
	1224	5.455	6.116	|
54.963				
	1230	5.394	6.111	|
54.955				
	1236	5.333	6.106	|
54.947				
	1242	5.272	6.100	|
54.939				
	1248	5.212	6.094	|
54.930				
	1254	5.153	6.088	|

54.920				
	1260	5.095	6.081	|
54.910				
	1266	5.038	6.074	|
54.899				
	1272	4.983	6.067	|
54.888				
	1278	4.929	6.059	|
54.876				
	1284	4.876	6.052	|
54.864				
	1290	4.824	6.043	|
54.851				
	1296	4.774	6.035	|
54.838				
	1302	4.725	6.026	|
54.824				
	1308	4.678	6.017	|
54.810				
	1314	4.632	6.007	|
54.796				
	1320	4.588	5.998	|
54.781				
	1326	4.545	5.988	|
54.766				
	1332	4.504	5.978	|
54.750				
	1338	4.465	5.967	|
54.735				
	1344	4.427	5.957	|
54.718				
	1350	4.390	5.946	|
54.702				
	1356	4.356	5.935	|
54.685				
	1362	4.322	5.924	|
54.668				
	1368	4.291	5.913	|
54.651				
	1374	4.260	5.902	|
54.634				
	1380	4.232	5.891	|
54.616				
	1386	4.205	5.879	|
54.599				
	1392	4.180	5.867	|
54.581				
	1398	4.156	5.856	|
54.563				
	1404	4.134	5.844	|
54.545				
	1410	4.113	5.832	|
54.526				
	1416	4.094	5.820	|
54.508				
	1422	4.077	5.808	|
54.490				
	1428	4.061	5.796	|
54.471				
	1434	4.047	5.784	|

54.453				
	1440	4.035	5.772	|
54.434				
	1446	3.989	5.760	|
54.416				
	1452	3.884	5.748	|
54.396				
	1458	3.690	5.734	|
54.375				
	1464	3.378	5.719	|
54.352				
	1470	2.973	5.701	|
54.325				
	1476	2.528	5.681	|
54.294				
	1482	2.081	5.658	|
54.258				
	1488	1.663	5.632	|
54.218				
	1494	1.297	5.603	|
54.174				
	1500	1.003	5.572	|
54.127				
	1506	.777	5.540	|
54.077				
	1512	.606	5.507	|
54.026				
	1518	.474	5.469	|
53.971				
	1524	.368	5.426	|
53.914				
	1530	.285	5.383	|
53.856				
	1536	.222	5.340	|
53.798				
	1542	.172	5.297	|
53.740				
	1548	.133	5.254	|
53.681				
	1554	.103	5.211	|
53.623				
	1560	.079	5.168	|
53.565				
	1566	.061	5.125	|
53.507				
	1572	.047	5.083	|
53.450				
	1578	.036	5.040	|
53.392				
	1584	.027	4.998	|
53.336				
	1590	.020	4.957	|
53.279				
	1596	.015	4.915	|
53.223				
	1602	.010	4.874	|
53.168				
	1608	.006	4.833	|
53.113				
	1614	.003	4.793	|

53.058				
	1620	.001	4.753	|
53.003				
	1626	.000	4.500	|
52.947				
	1632	.000	4.246	|
52.894				
	1638	.000	4.007	|
52.844				
	1644	.000	3.781	|
52.796				
	1650	.000	3.568	|
52.751				
	1656	.000	3.367	|
52.709				
	1662	.000	3.178	|
52.669				
	1668	.000	2.999	|
52.631				
	1674	.000	2.830	|
52.596				
	1680	.000	2.670	|
52.562				
	1686	.000	2.520	|
52.531				
	1692	.000	2.378	|
52.501				
	1698	.000	2.244	|
52.472				
	1704	.000	2.118	|
52.446				
	1710	.000	1.998	|
52.421				
	1716	.000	1.886	|
52.397				
	1722	.000	1.780	|
52.375				
	1728	.000	1.679	|
52.354				
	1734	.000	1.585	|
52.334				
	1740	.000	1.496	|
52.315				
	1746	.000	1.411	|
52.297				
	1752	.000	1.332	|
52.280				
	1758	.000	1.257	|
52.265				
	1764	.000	1.186	|
52.250				
	1770	.000	1.119	|
52.236				
	1776	.000	1.056	|
52.222				
	1782	.000	.997	|
52.210				
	1788	.000	.941	|
52.198				
	1794	.000	.888	|

52.187			
	1800	.000	.838
52.176			
	1806	.000	.790
52.166			
	1812	.000	.746
52.157			
	1818	.000	.704
52.148			
	1824	.000	.664
52.140			
	1830	.000	.627
52.132			
	1836	.000	.592
52.125			
	1842	.000	.558
52.118			
	1848	.000	.527
52.111			
	1854	.000	.497
52.105			
	1860	.000	.469
52.099			
	1866	.000	.443
52.093			
	1872	.000	.418
52.088			
	1878	.000	.394
52.083			
	1884	.000	.372
52.078			
	1890	.000	.351
52.074			
	1896	.000	.331
52.070			
	1902	.000	.313
52.066			
	1908	.000	.295
52.062			
	1914	.000	.278
52.059			
	1920	.000	.263
52.055			
	1926	.000	.248
52.052			
	1932	.000	.234
52.049			
	1938	.000	.221
52.046			
	1944	.000	.208
52.044			
	1950	.000	.197
52.041			
	1956	.000	.186
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	1962	.000	.175
52.037			
	1968	.000	.165
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	1974	.000	.156

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	1986	.000	.139	|
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	1992	.000	.131	|
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	1998	.000	.124	|
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	2004	.000	.117	|
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	2010	.000	.110	|
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	2016	.000	.104	|
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	2022	.000	.098	|
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	2028	.000	.093	|
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	2034	.000	.087	|
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	2046	.000	.078	|
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	2052	.000	.073	|
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	2064	.000	.065	|
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	2070	.000	.062	|
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	2076	.000	.058	|
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	2082	.000	.055	|
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	2100	.000	.046	|
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	2508	.000	.001	|
52.000				
	2514	.000	.001	|

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         2568                .000                .001                |
52.000
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52.000
1*******************************     PONDOPT
*******************************
 *******************************   Version 1.83
*******************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS
*******************

 PROJECT: VILLAGES AT WESTMINSTER
    User: Rickmond Engineering
    Date: 09/12/1997    Friday
    Time: 09:50:03
  Output: VWIIP100.OUT


    ROUTING SUMMARY    ----------------------------------------
    SIMULATION MODE    ----------------------------------------
    FOR THE ABOVE CASE ----------------------------------------
```

STORM NUMBER	PEAK STAGE (ft)	PEAK STORAGE (ac-ft)	PEAK INFLOW (cfs)	PEAK OUTFLOW (cfs)
1	56.992	5.09	114.568	97.398

DHW

VS 87.6

RICKMOND ENGINEERING, INC.
1643 A Merrimac Trail
Williamsburg, Virginia 23185-5624
(757) 229-1776 or (757) 898-4149
Fax Number (757) 229-4683

JOB 96106
SHEET NO. 137 OF
CALCULATED BY KMJ DATE 8/7/97
CHECKED BY DATE
SCALE

DESIGN ANTI-SEEP COLLARS

DEPTH OF WATER AT PRINCIPAL SPILLWAY CREST = 8'

SLOPE OF UPSTREAM FACE OF EMBANKMENT = 3:1

SLOPE OF PRINCIPAL SPILLWAY BARREL = 0.5%

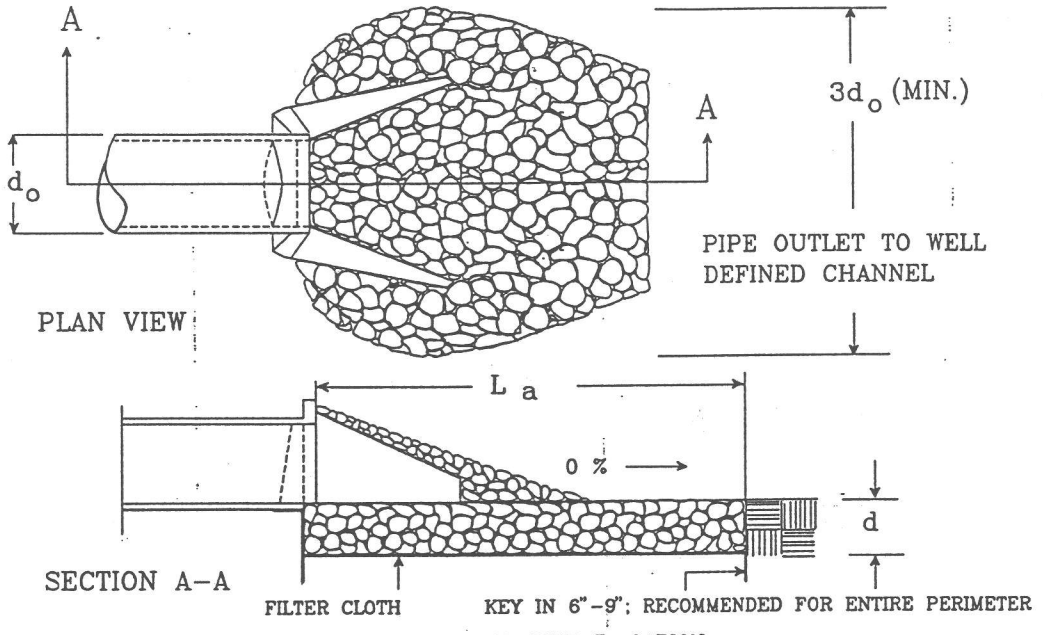
LENGTH OF BARREL IN SATURATED ZONE = 55'

USE 2 6'x6' ANTI-SEEP COLLARS

RICKMOND ENGINEERING, INC.
1643 A Merrimac Trail
Williamsburg, Virginia 23185-5624
(757) 229-1776 or (757) 898-4149
Fax Number (757) 229-4683

JOB 96106
SHEET NO. 138 OF
CALCULATED BY KMJ DATE 8/7/97
CHECKED BY DATE
SCALE

DESIGN OUTLET PROTECTION

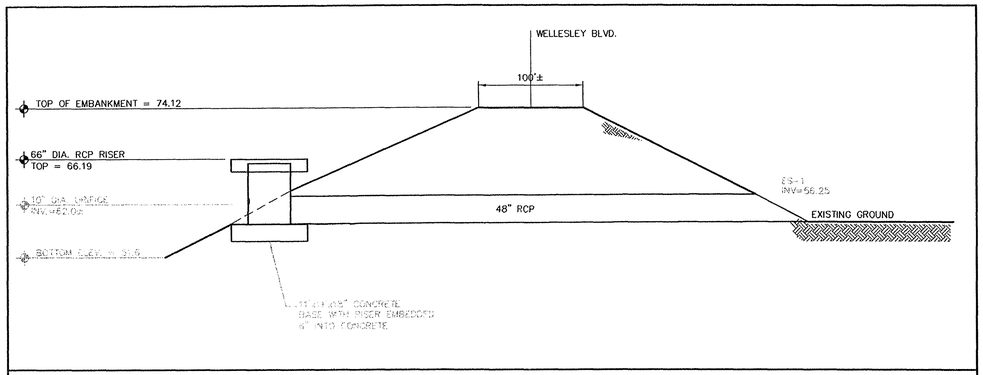


NOTES: 1. APRON LINING MAY BE RIPRAP, GROUTED RIPRAP, GABION BASKET, OR CONCRETE.
2. La IS THE LENGTH OF THE RIPRAP APRON AS CALCULATED USING PLATES 3.18–3 AND 3.18–4.
3. d = 1.5 TIMES THE MAXIMUM STONE DIAMETER, BUT NOT LESS THAN 6 INCHES.

$Q = 87.65$ cfs
$D = 3'$
$3D = 9'$
$La = 30'$
$W = D_o + .4La = 15'$
$D_{50} = 1'$

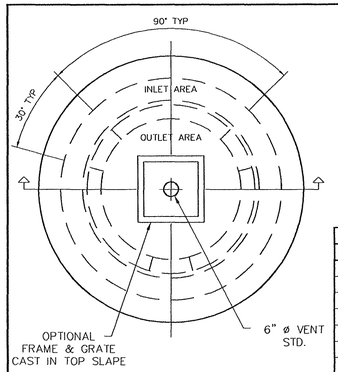
USE 30'x15'x26"
VDOT CLASS I
RIP RAP APRON

Joan -
I'll call Steve
Kelley to let him
know about permit.
Darryl

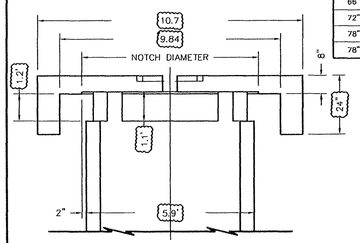


POND OUTLET STRUCTURE

NOT TO SCALE



PLAN



SECTION

NOTE:

1. ANTI-VORTEX DEVICE (CAP AND RISER) MANUFACTURED IN ACCORDANCE WITH ASTM C478.
2. DIMENSIONS SUBJECT TO PERMISSIBLE VARIATIONS OF ASTM C478.
3. INLET AREA (AREA BETWEEN DEVICE I.D. AND RISER O.D.) IS GREATER THAN OUTLET AREA (AREA OF RISER I.D.)
4. SLAB REINFORCEMENT TO BE ASTM A615 #4 BARS @ 8" E.W. CIRCUMFERENTIAL REINFORCEMENT TO BE Acs = 1 @ 0.150 2x6 W2.5 x w2.5 WWF MINIMUM. MATERIAL PROPERTIES : fy = 60 ksi, fc = ksi. CONCRETE COVER OVER REINFORCEMENT (CCOR) = 1", UNLESS NOTED.
5. DI-1 FRAME & GATE IS AVAILABLE FOR 48" I.D. RISER AND LARGER.

RISER		ANTI-VORTEX CAP		NOTCH DIA.	APPROX. CAP WEIGHT
I.D.	O.D.	I.D.	O.D.		
24"	30"	48"	58"	34"	1.49 T
27"	30-1/2"	60"	70" or 72"	37-1/2"	2.28 T
30"	37"	60"	70" or 72"	41"	2.26 T
36"	44"	60"	70" or 72"	48"	2.22 T
42"	51"	72"	86"	55"	3.16 T
48"	58"	84"	100"	62"	4.27 T
54"	66-1/2"	84"	100"	70-1/2"	4.20 T
60"	72"	96"	114"	76"	5.48 T
66"	80-1/2"	96"	114"	84-1/4"	5.39 T
72"	86"	108"	128"	90"	6.83 T
78"	94-1/4"	126"	147"	98-1/8"	8.97 T
78"	100"	126"	147"	104"	8.90 T

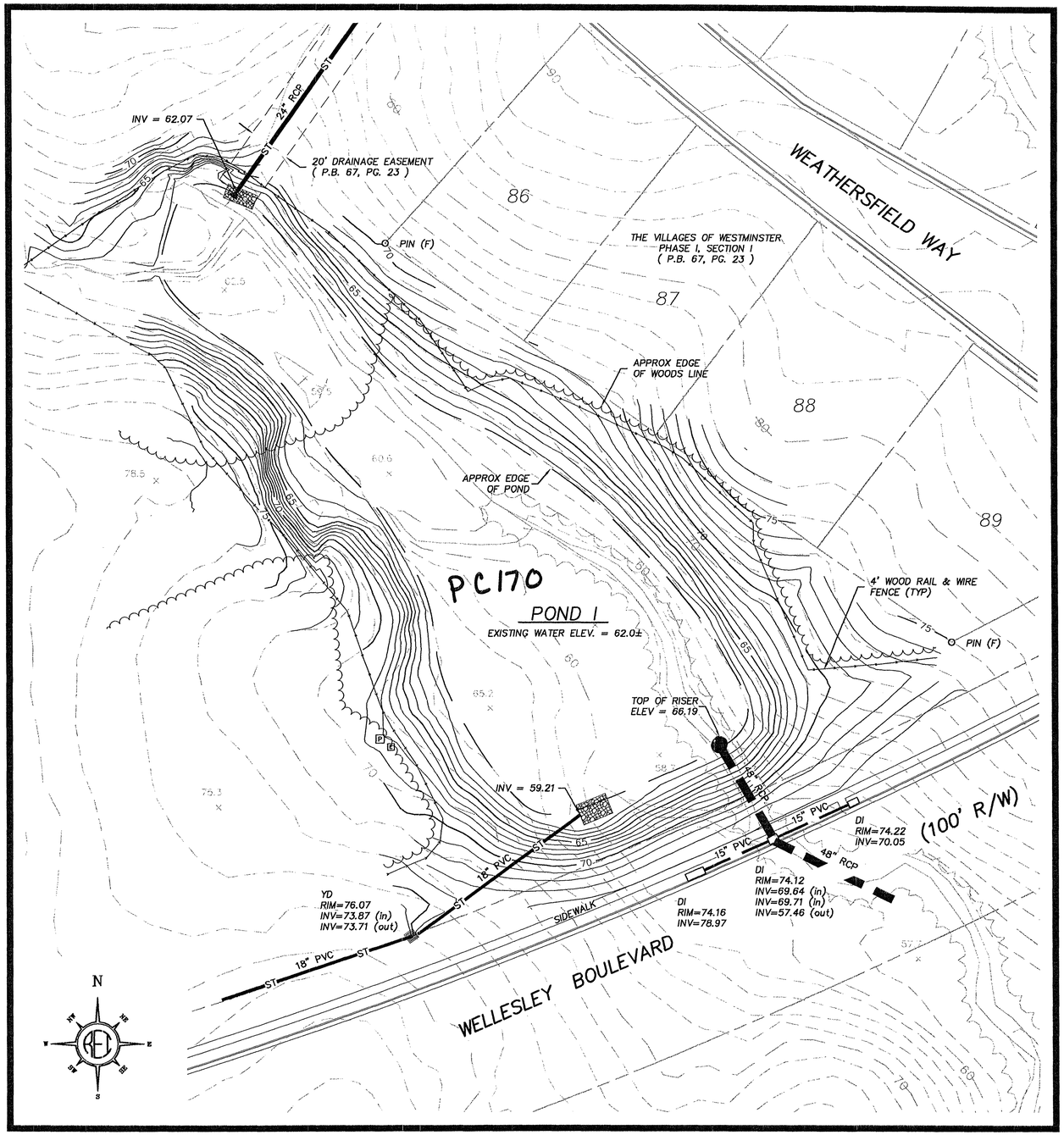
DENOTE FIELD DIMENSIONS

TECHNICAL MANUAL
PAGE 14.1

PRECAST ANTI-VORTEX DEVICE
(CAP AND RISER)

GIFFORD-HILL CONCRETE PRODUCTS
2900 Terminal Ave. • Richmond, Virginia 23234 • 804-233-5471

ORIGINAL DATE	02-01-95	RCH
LAST REVISION		
SCALE	N.T.S.	
TOPIC - PROJECT # - DRAWING #		
ST-0847-63		



GRAPHIC SCALE

30 0 15 30 60 120

(IN FEET)
1 inch = 30 ft.

BEFORE DIGGING CALL "MISS UTILITY"
OF VIRGINIA AT 1-800-552-7001

Rickmond Engineering, Inc.
Engineering Surveying Land Planning
7643 Merrimac Trail Vint Hill • P.O. Box 861647
Williamsburg, VA 23185 Warrenton, VA 20187
Voice: (757)229-1776 Voice: (540)349-7730
Fax: (757)229-4683 Fax: (540)349-7731
www.rickmond.com

Checked By: CBD | Drawn By: RJH | Scale: 1"=30' | Date: 03.06.01

COMMONWEALTH OF VIRGINIA
CRAIG B. DAVENPORT
No. 002055
3.06.01
LAND SURVEYOR

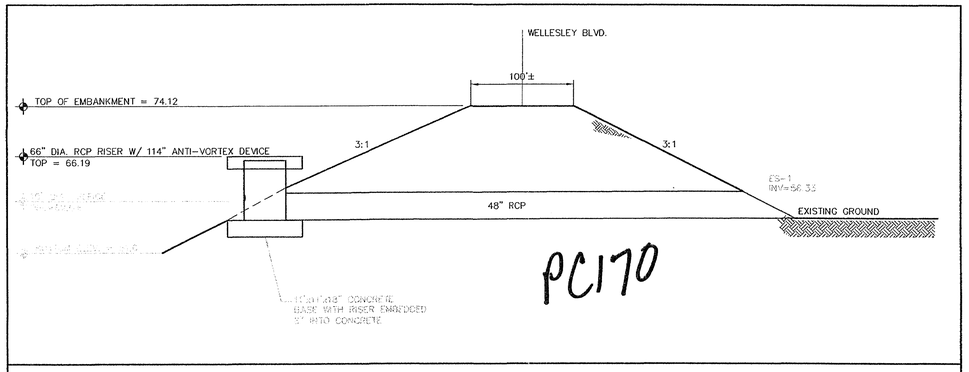
No.	By	Revision	App.	Date

THE VILLAGES AT WESTMINSTER

RECORD DRAWING OF POND I

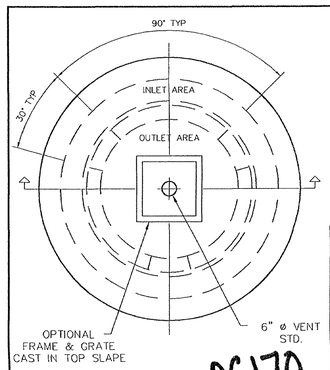
JAMES CITY COUNTY VIRGINIA

Job Number	Sheet No.
01110	1 of 1

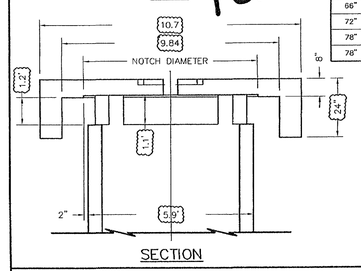


POND OUTLET STRUCTURE

NOT TO SCALE



PLAN



SECTION

NOTE:

1. ANTI-VORTEX DEVICE (CAP AND RISER) MANUFACTURED IN ACCORDANCE WITH ASTM C478.
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5. DI-1 FRAME & GATE IS AVAILABLE FOR 48" I.D. RISER AND LARGER.

RISER		ANTI-VORTEX CAP		NOTCH DIA.	APPROX. CAP WEIGHT
I.D.	O.D.	I.D.	O.D.		
24"	30"	46"	58"	34"	1.49 T
27"	30-1/2"	60"	70" or 72"	37-1/2"	2.28 T
30"	37"	60"	70" or 72"	41"	2.26 T
36"	44"	60"	70" or 72"	48"	2.22 T
42"	51"	72"	86"	55"	3.16 T
48"	58"	84"	100"	62"	4.27 T
54"	66-1/2"	84"	100"	70-1/2"	4.20 T
60"	72"	96"	114"	76"	5.48 T
66"	80-1/2"	96"	114"	84-1/4"	5.39 T
72"	86"	108"	126"	90"	6.83 T
78"	94-1/4"	126"	147"	98-1/8"	8.97 T
78"	100"	126"	147"	104"	8.90 T

DENOTE FIELD DIMENSIONS

TECHNICAL MANUAL
PAGE 14.1

PRECAST ANTI-VORTEX DEVICE
(CAP AND RISER)

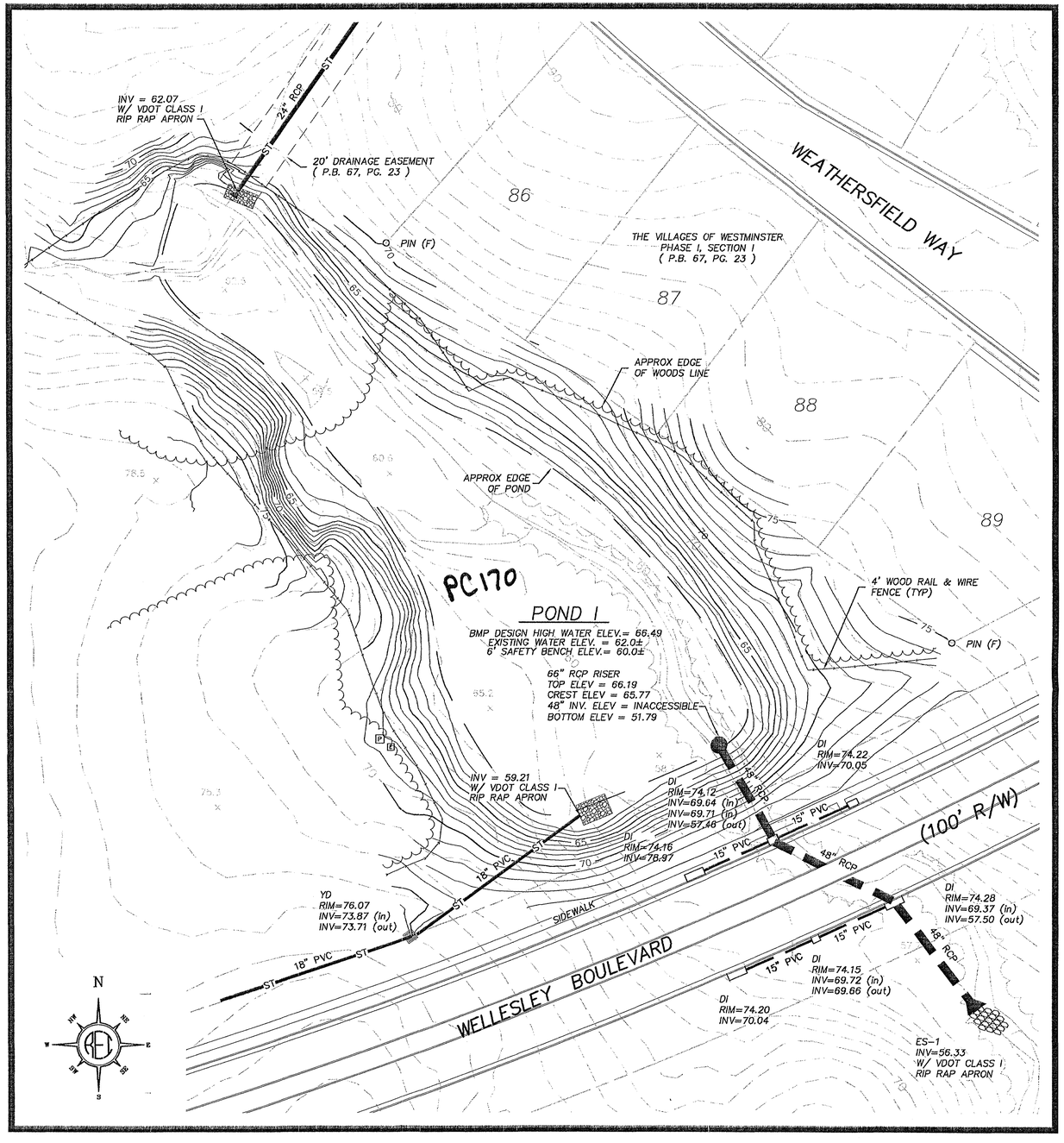
GIFFORD-HILL CONCRETE PRODUCTS
2900 Terminal Ave. • Richmond, Virginia 23234 • 804-233-5471

ORIGINAL DATE	02-01-95	RCH
LAST REVISION		
SCALE	N.T.S.	
TOPIC - PROJECT # - DRAWING #		
ST-0847-63		

RECORD DRAWING CERTIFICATION
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.

CONSTRUCTION CERTIFICATION
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.

COMMONWEALTH OF VIRGINIA
CRAIG B. DAVENPORT
No. 002055
3/6/01
LAND SURVEYOR



GRAPHIC SCALE

30 0 15 30 60 120

(IN FEET)
1 inch = 30 ft.

APPROVED JUN 20 2002

COUNTY PLAN NO. SP-100-97
BMP ID CODE NO. PC 170

BEFORE DIGGING CALL "MISS UTILITY" OF VIRGINIA AT 1-800-552-7001

Rickmond Engineering, Inc.
Engineering Surveying Land Planning
1643 Merrimac Trail
Williamsburg, VA 23185
Voice: (757)221-1776
Fax: (757)229-4683
Vint Hill • P.O. Box 861647
Warrenton, VA 20187
Voice: (540)347-7730
Fax: (540)349-7731
www.rickmond.com

Date: 03.06.01
Scale: 1"=30'
Drawn By: RJH
Checked By: CBD

No.	By	Revision	App.	Date
1	KMJ	REV PER COUNTY COMMENTS LTR DTD 5/15/02	CBD	5.20.02

THE VILLAGES AT WESTMINSTER
RECORD DRAWING OF POND I
JAMES CITY COUNTY VIRGINIA

Job Number	Sheet No.
01110	1 of 1

MATCH LINE SHEET 2

MATCH LINE SHEET 3

PHASE 1
SECTION 1

WEATHERSFIELD WAY (44' R/W)

TEWKESBURY WAY (44' R/W)

BARRINGTON LANE

WELLESLEY BOULEVARD (100' R/W)

SHREWSBURY SQUARE (40' R/W)

BARKELEY LANE (50' R/W)

RICHMOND ROAD

ROUTE 60 (160' R/W)

SOUTHBOUND

DI 11A
RIM 88.07
INV 83.97
INV 83.97

DI 10
RIM 87.90
INV 83.03
INV 78.98

DI 20
RIM 80.07
FILLED TO
FLOW LINE
WITH SILT

DI 19
RIM 81.16
INV 77.86

DI 5A
RIM 79.97
INV 75.89

DI 19A
RIM 80.64

DI 18
RIM 76.48
INV 74.55
INV 74.60
INV 74.30

DI 4
RIM 75.44
INV 67.68
INV 67.52

DI 1B
RIM 68.09
INV 63.94

DI 1
RIM 68.03
INV 63.41
INV 63.35
INV 63.33

DI 1A
RIM 68.58
INV 64.70

DI 2A
RIM 68.61
INV 64.51

DI 2B
RIM 68.27
INV 62.49
INV 61.55

DI 2
RIM 67.99
INV 63.48
INV 63.38
INV 63.30

DI 12
RIM 75.99
INV 71.17

DI 3
RIM 75.71
INV 71.31

ES-2
15" PVC RSP
INV 60.01

ES-1
INV 59.32

15" RCP
INV 93.23

15" RCP
INV 92.57

15" RCP
INV 91.28

15" RCP
INV 90.31

ES-1
15" RCP
INV 88.72

15" RCP
INV 90.15

15" RCP
INV 87.48

ES-1
15" RCP
INV 87.32

50 0 50 100 150

Scale: 1" = 50'

BEFORE DIGGING CALL "MISS UTILITY" OF VIRGINIA AT 1-800-552-7001

Rickmond Engineering, Inc.
Engineering
Surveying
Land Planning
1643 Merrimac Trail
Williamsburg, VA 23185
Voice: (757)229-1776
Fax: (757)229-4683
www.rickmond.com

Designed By:	Drawn By: CBK	Scale: 1"=50'	Date: 11/30/99

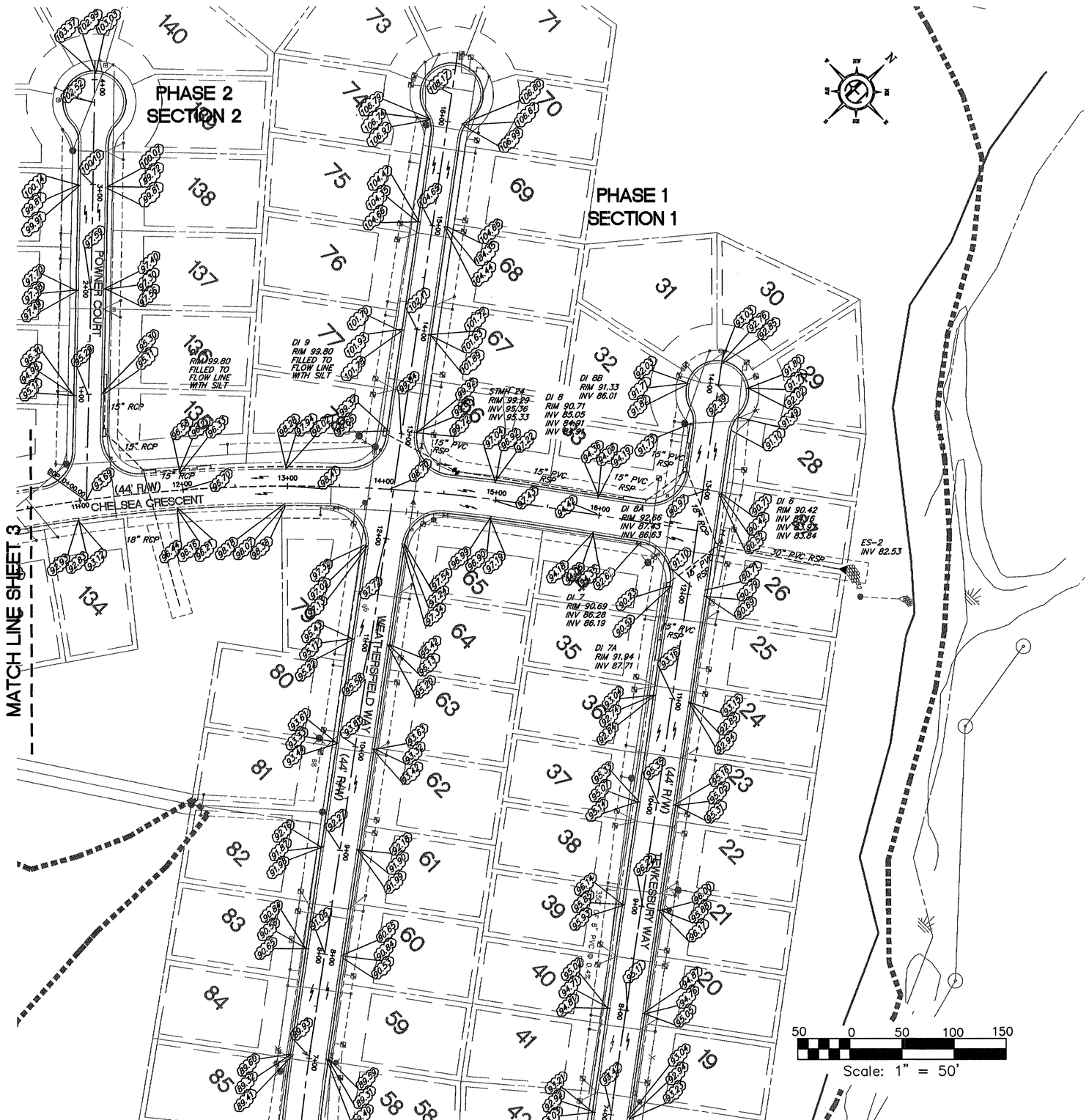
No.	By	Revision	App.	Date

VILLAGES OF WESTMINSTER PHASES I AND II

STORM SEWER AND ROAD
AS-BUILT SURVEY

JAMES CITY COUNTY VIRGINIA

Job Number	Sheet No.
99235	1



BEFORE DIGGING CALL "MISS UTILITY" OF VIRGINIA AT 1-800-552-7001

Rickmond Engineering, Inc.
Engineering
Surveying
Land Planning
1643 Merrimac Trail
Williamsburg, VA 23185
Voice: (757)229-1776
Fax: (757)229-4683
www.rickmond.com

Designed By:	Drawn By: CBK	Scale: 1"=50'	Date: 11/30/99

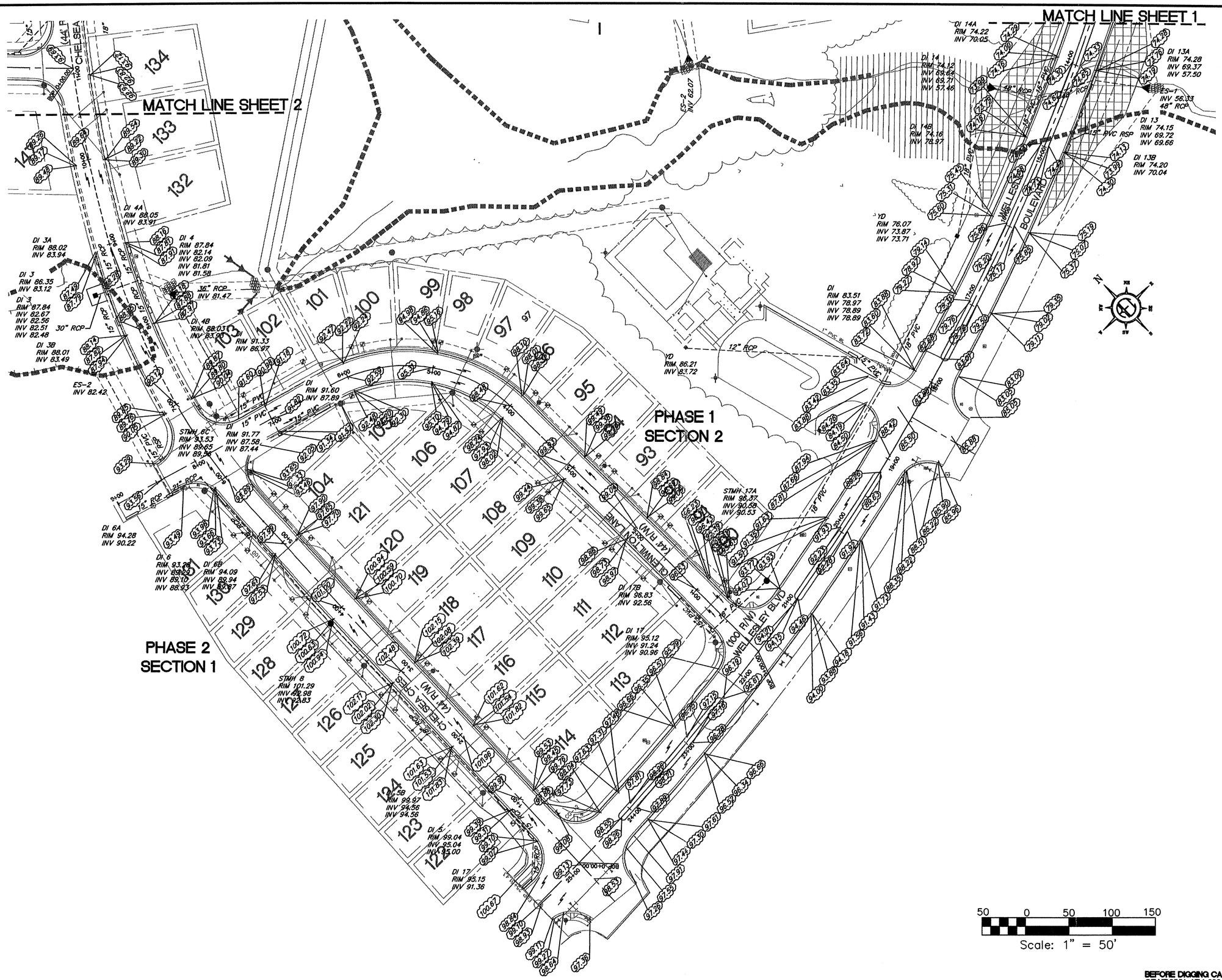
No.	By	Revision	App.	Date

VILLAGES OF WESTMINISTER PHASES I AND II

STORM SEWER AND ROAD
AS-BUILT SURVEY

JAMES CITY COUNTY VIRGINIA

Job Number	Sheet No.
99235	2



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Designed By:	Drawn By: CBK	Scale: 1"=50'	Date: 11/30/99

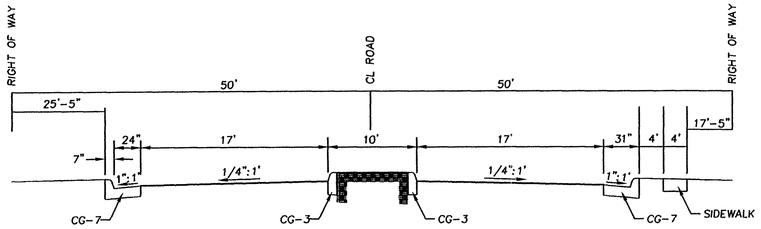
No.	By	Revision	App.	Date

VILLAGES OF WESTMINISTER PHASES I AND II

STORM SEWER AND ROAD AS-BUILT SURVEY

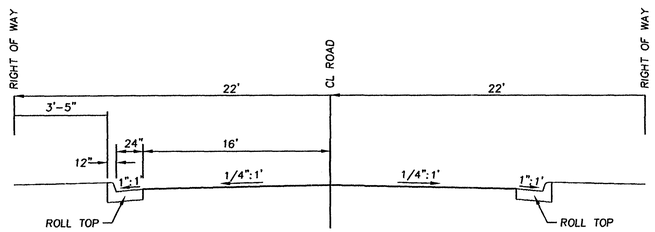
JAMES CITY COUNTY VIRGINIA

Job Number	Sheet No.
99235	3



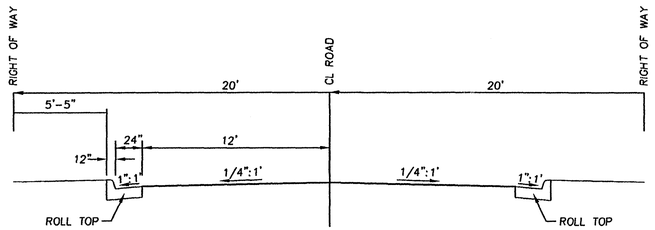
WELLESLEY BOULEVARD (100' R/W) DESIGN SPEED 30 MPH

SURFACE: 220# PSY ASPHALT CONCRETE, TYPE SM-2A
BASE: 3" ASPHALT CONCRETE, TYPE BM-2
SUBBASE: 7" AGGREGATE BASE MATERIAL, TYPE I, SIZE #21-B



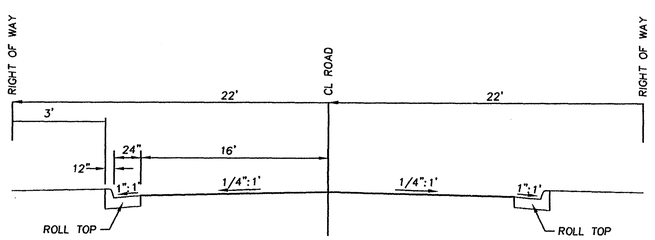
TEWKESBURY WAY (44' R/W) DESIGN SPEED 25 MPH
WEATHERSFIELD WAY STA 0+00-12+85 (44'R/W) DESIGN SPEED 25 MPH
GLENWILTON LANE (44' R/W) DESIGN SPEED 25 MPH
CHELSEA CRESCENT (44' R/W) DESIGN SPEED 25 MPH

SURFACE: 275# PSY ASPHALT CONCRETE, TYPE SM-2A
BASE: 6" UNTREATED AGGREGATE, TYPE I, SIZE #21-B



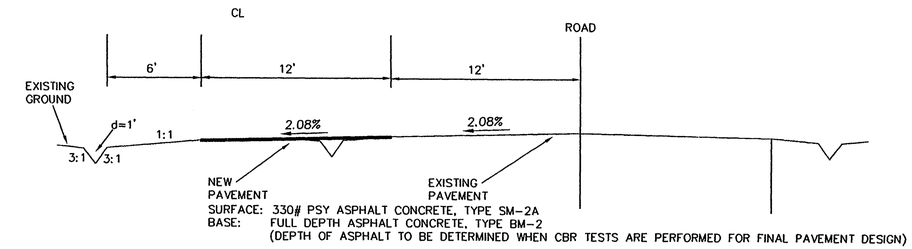
SHREWSBURY SQUARE (40' R/W) DESIGN SPEED 20 MPH
BARFLEUR PLACE (40' R/W) DESIGN SPEED 20 MPH
FOLKSTONE LANE STA 12+85-16+55 (40' R/W) DESIGN SPEED 20 MPH

SURFACE: 220# PSY ASPHALT CONCRETE, TYPE SM-2A
BASE: 8" UNTREATED AGGREGATE, TYPE I, SIZE #21-B



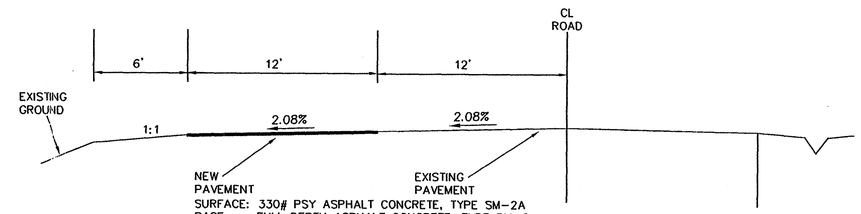
CHELSEA CRESCENT (44' R/W) DESIGN SPEED 25 MPH

SURFACE: 275# PSY ASPHALT CONCRETE, TYPE SM-2A (CHELSEA CRESCENT)
SURFACE: 220# PSY ASPHALT CONCRETE, TYPE SM-2A (MAYFAIR CIRCLE)
BASE: 6" UNTREATED AGGREGATE, TYPE I, SIZE #21-B



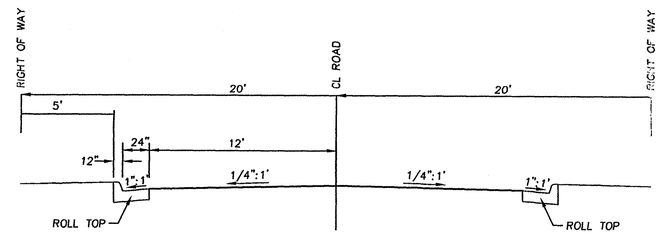
SURFACE: 330# PSY ASPHALT CONCRETE, TYPE SM-2A
BASE: FULL DEPTH ASPHALT CONCRETE, TYPE BM-2
(DEPTH OF ASPHALT TO BE DETERMINED WHEN CBR TESTS ARE PERFORMED FOR FINAL PAVEMENT DESIGN)

ROUTE 60 SOUTHBOUND RIGHT TURN LANE ADDITION

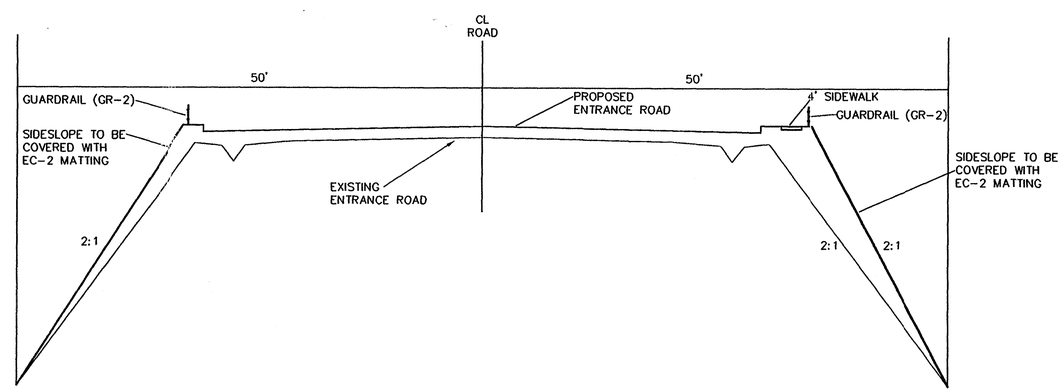


SURFACE: 330# PSY ASPHALT CONCRETE, TYPE SM-2A
BASE: FULL DEPTH ASPHALT CONCRETE, TYPE BM-2
(DEPTH OF ASPHALT TO BE DETERMINED WHEN CBR TESTS ARE PERFORMED FOR FINAL PAVEMENT DESIGN)

ROUTE 60 NORTHBOUND LEFT TURN LANE ADDITION



POWNER COURT (40' R/W) DESIGN SPEED 20 MPH



WELLESLEY BLVD. CROSS SECTION STA 3+00 – 7+00

BEFORE DIGGING CALL "MISS UTILITY" OF VIRGINIA AT 1-800-552-7001

Rickmond Engineering, Inc.
Engineering
Surveying
Land Planning
1643 Merrimac Trail
Williamsburg, VA 23185
Voice: (757)229-7776
Fax: (757)229-4683
www.rickmond.com

Designed By:
Drawn By: CBK
Scale: 1"=50'
Date: 11/30/99

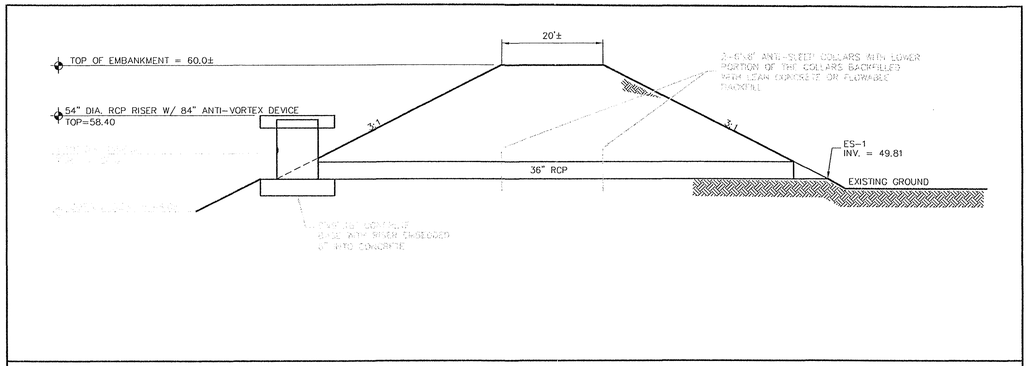
No.	By	Revision	App.	Date

VILLAGES OF WESTMINSTER PHASES I AND II

PAVEMENT SECTIONS

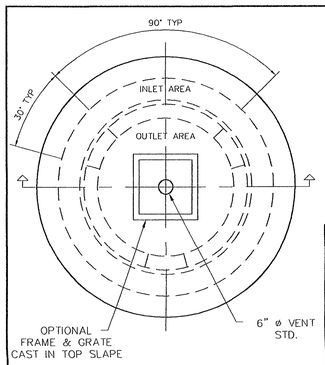
JAMES CITY COUNTY VIRGINIA

Job Number	Sheet No.
99235	4

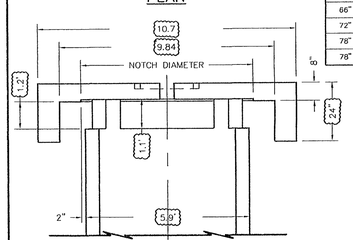


POND OUTLET STRUCTURE

NOT TO SCALE



PLAN



SECTION

NOTE:
1. ANTI-VORTEX DEVICE (CAP AND RISER) MANUFACTURED IN ACCORDANCE WITH ASTM C478
2. DIMENSIONS SUBJECT TO PERMISSIBLE VARIATIONS OF ASTM C478.
3. INLET AREA (AREA BETWEEN DEVICE I.D. AND RISER O.D.) IS GREATER THAN OUTLET AREA (AREA OF RISER I.D.)
4. SLAB REINFORCEMENT TO BE ASTM A615 #4 BARS @ 8" E.W. CIRCUMFERENTIAL REINFORCEMENT TO BE Acs = 1 @ 0.150 2x6 W2.5 x w2.5 WWF MINIMUM. MATERIAL PROPERTIES : fy = 60 ksi, fc = ksi. CONCRETE COVER OVER REINFORCEMENT (CCOR) = 1", UNLESS NOTED.
5. DI-1 FRAME & GATE IS AVAILABLE FOR 48" I.D. RISER AND LARGER.

RISER		ANTI-VORTEX CAP		NOTCH DIA.	APPROX. CAP WEIGHT
I.D.	O.D.	I.D.	O.D.		
24"	30"	48"	58"	34"	1.49 T
27"	30-1/2"	60"	70" or 72"	37-1/2"	2.28 T
30"	37"	60"	70" or 72"	41"	2.26 T
36"	44"	60"	70" or 72"	48"	2.22 T
42"	51"	72"	86"	55"	3.16 T
48"	58"	84"	100"	62"	4.27 T
54"	66-1/2"	84"	100"	70-1/2"	4.20 T
60"	72"	96"	114"	76"	5.48 T
66"	80-1/2"	96"	114"	84-1/4"	5.39 T
72"	86"	108"	128"	90"	6.83 T
78"	94-1/4"	126"	147"	98-1/8"	8.97 T
78"	100"	126"	147"	104"	8.90 T

TECHNICAL MANUAL PAGE 14.1

PRECAST ANTI-VORTEX DEVICE (CAP AND RISER)

GIFFORD-HILL CONCRETE PRODUCTS

2900 Terminal Ave. • Richmond, Virginia 23234 • 804-233-5471

ORIGINAL DATE	02-01-95	RCH
LAST REVISION		
SCALE	N.T.S.	
TOPIC - PROJECT # - DRAWING #		
ST-0847-63		

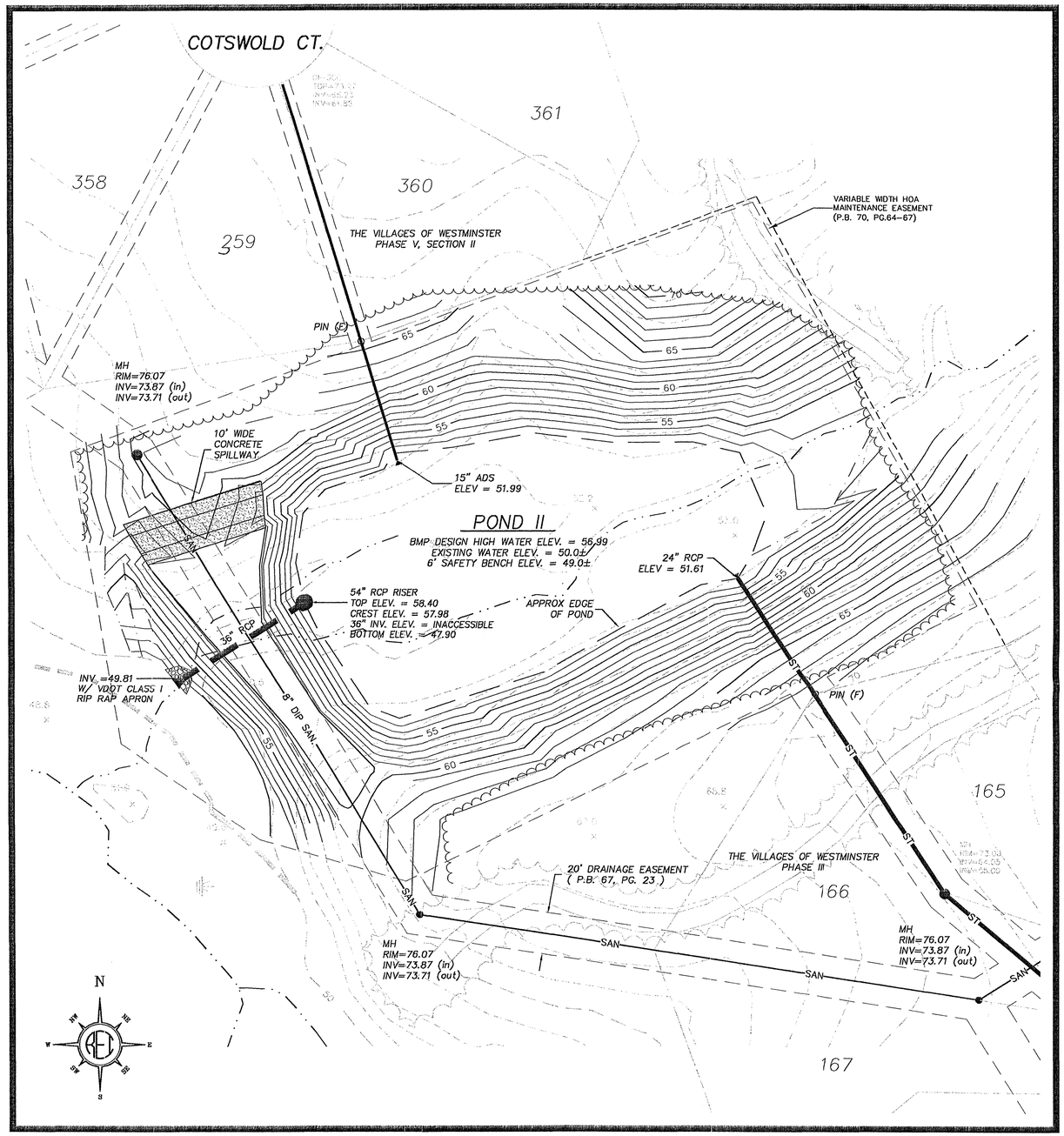
RECORD DRAWING CERTIFICATION

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
CRAIG B. DAVENPORT
No. 002055
3-06-01
LAND SURVEYOR

CONSTRUCTION CERTIFICATION

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.



GRAPHIC SCALE

30 0 15 30 60 120

(IN FEET)
1 inch = 30 ft.

APPROVED JUN 2 0 2002

COUNTY PLAN NO. SP-100-97
BMP ID CODE NO. PC 171

BEFORE DIGGING CALL "MISS UTILITY" OF VIRGINIA AT 1-800-552-7001

Rickmond Engineering, Inc.
Engineering Surveying Land Planning
16643 Merrimac Trail
Williamsburg, VA 23185
Voice: (757)229-1776
Fax: (757)229-4683
Vint Hill • P.O. Box 861647
Warrenton, VA 20187
Voice: (540)349-7730
Fax: (540)349-7731
www.rickmond.com

Date: 03.06.01
Scale: 1"=30'
Drawn By: RJH
Designed By: CBD

No.	By	Revision	Date
1	KMJ	REV PER COUNTY COMMENTS LTR DTD 5/15/02	5.20.02
	CBD		App.

THE VILLAGES AT WESTMINSTER
RECORD DRAWING OF POND II
JAMES CITY COUNTY VIRGINIA

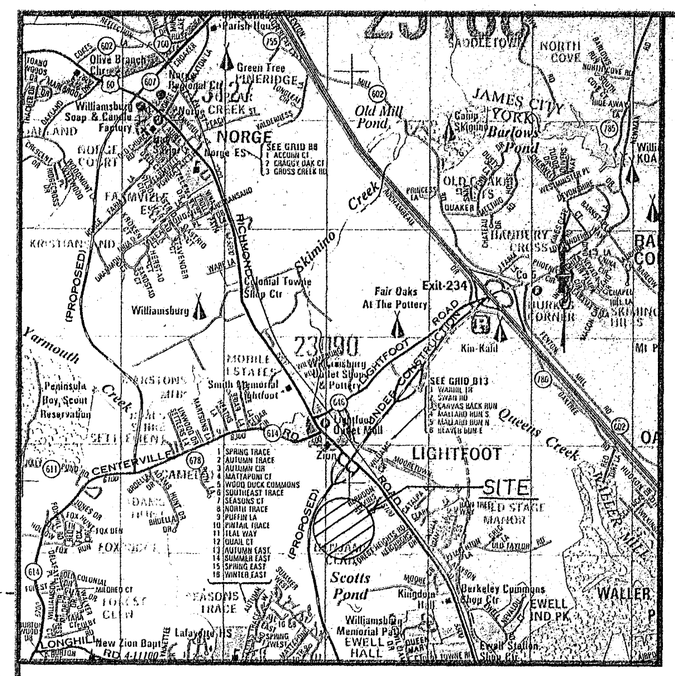
Job Number	Sheet No.
01111	1 of 1

THE VILLAGES AT WESTMINSTER
PHASE I, SECTION I

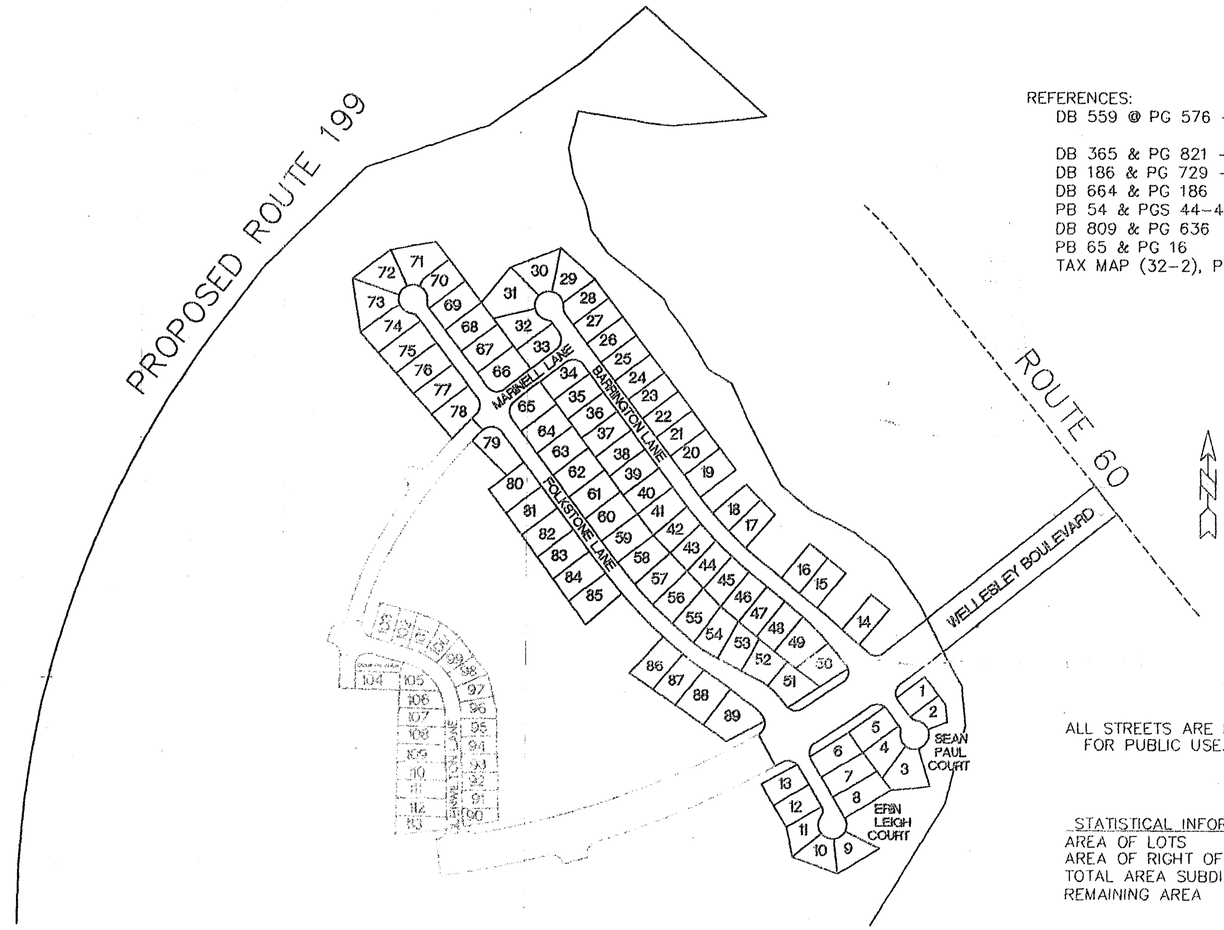
BERKELEY DISTRICT
JAMES CITY COUNTY, VIRGINIA
DATE: DECEMBER 12, 1996 SCALE: 1"=300'

MAY 1997
RECEIVED
PLANNING DEPARTMENT

S-59-96



VICINITY MAP
SCALE: 1"=2000'



REFERENCES:
- DB 559 @ PG 576 – 50' PERMANENT VIRGINIA NATURAL GAS EASEMENT
- DB 365 & PG 821 – ROUTE #60 LIMITED ACCESS
- DB 186 & PG 729 – 20' SANITARY SEWER EASEMENT
- DB 664 & PG 186
- PB 54 & PGS 44–46
- DB 809 & PG 636
- PB 65 & PG 16
- TAX MAP (32–2), PARCEL (1–57) – IN PART

ALL STREETS ARE HERBY DEDICATED FOR PUBLIC USE.

STATISTICAL INFORMATION

AREA OF LOTS	18.37 ACRES
AREA OF RIGHT OF WAY	5.46 ACRES
TOTAL AREA SUBDIVIDED	23.83 ACRES
REMAINING AREA	167.4± ACRES

SUBDIVISION CERTIFICATE

THIS SUBDIVISION OF PROPERTY AS SHOWN HEREON IS WITH THE FREE CONSENT AND IN ACCORDANCE WITH THE DESIRES OF THE UNDERSIGNED OWNER.

WARHILL ASSOCIATES, L.L.C.

BY : _____
KENNETH L. ALLEN

STATE OF VIRGINIA,
COUNTY OF JAMES CITY, TO WIT :

I, _____ A NOTARY PUBLIC IN AND FOR THE COUNTY AND STATE AFORESAID DO HEREBY CERTIFY THAT THE PERSON WHOSE NAME IS SIGNED TO THE FOREGOING WRITING HAS ACKNOWLEDGED THE SAME BEFORE ME.

GIVEN UNDER MY HAND AND SEAL THIS _____ DAY OF _____ 1995.

NOTARY PUBLIC : _____

MY COMMISSION EXPIRES : _____

STATE OF VIRGINIA,
COUNTY OF JAMES CITY

IN THE CLERK'S OFFICE OF THE CIRCUIT COURT FOR THE COUNTY OF JAMES CITY, THE MAP SHOWN HEREON WAS PRESENTED AND ADMITTED TO RECORD AS THE LAW DIRECTS.

TESTE _____ DATE _____

PLAT BOOK ____ , PAGE _____ .

NOTES:
1) THIS PROPERTY IS LOCATED IN FLOOD ZONE "A" & "AE" AS SHOWN ON FLOOD INSURANCE RATE MAP COMMUNITY–PANEL NUMBERS 510201 0020B & 510201 0035B, EFFECTIVE DATE 2–6–91.
2) PROPERTY CORNERS TO BE SET BY EDLOE MORECOCK III, CLS OF RICKMOND ENGINEERING, INC.

WATER
EACH LOT WITHIN THIS SUBDIVISION IS TO BE SERVED BY PUBLIC WATER SUPPLIED BY JAMES CITY SERVICE AUTHORITY.

SEWER
EACH LOT WITHIN THIS SUBDIVISION IS TO BE SERVED BY PUBLIC SEWER SUPPLIED BY JAMES CITY SERVICE AUTHORITY.

SURVEYOR'S CERTIFICATE

I CERTIFY THAT THIS PLAT OF SUBDIVISION WAS MADE BY ME AT THE DIRECTION OF THE OWNER, AND THAT THE SUBDIVISION IS ENTIRELY WITHIN THE BOUNDARIES OF LAND COVERED BY DEED DULY OF RECORD IN CLERK'S OFFICE OF CIRCUIT COURT OF THE COUNTY OF JAMES CITY, VIRGINIA IN DB 809, PG 636.

_____
EDLOE MORECOCK, III, CLS

I HEREBY CERTIFY THAT TO THE BEST MY OF KNOWLEDGE AND BELIEF, ALL OF THE REQUIREMENTS OF THE BOARD OF SUPERVISORS AND ORDINANCES OF THE COUNTY OF JAMES CITY , VIRGINIA, REGARDING THE PLATTING OF SUBDIVISIONS WITHIN THE COUNTY HAVE BEEN COMPLIED WITH.

_____
EDLOE MORECOCK, III, CLS

CERTIFICATE OF APPROVAL

THIS SUBDIVISION AS SHOWN HEREON IS APPROVED BY THE UNDERSIGNED IN ACCORDANCE WITH EXISTING SUBDIVISION REGULATIONS AND MAY BE ADMITTED TO RECORD.

_____ _____
AGENT OF GOVERNING BODY DATE

_____ _____
VIRGINIA DEPARTMENT OF TRANSPORTATION DATE

_____ _____
HEALTH OFFICER DATE
(THIS PROPERTY IS SERVED BY PUBLIC WATER AND PUBLIC SEWER.)

OWNER/DEVELOPER
WARHILL ASSOCIATES, L.L.C.
2 EATON ST., SUITE 1101
HAMPTON, VA. 23669

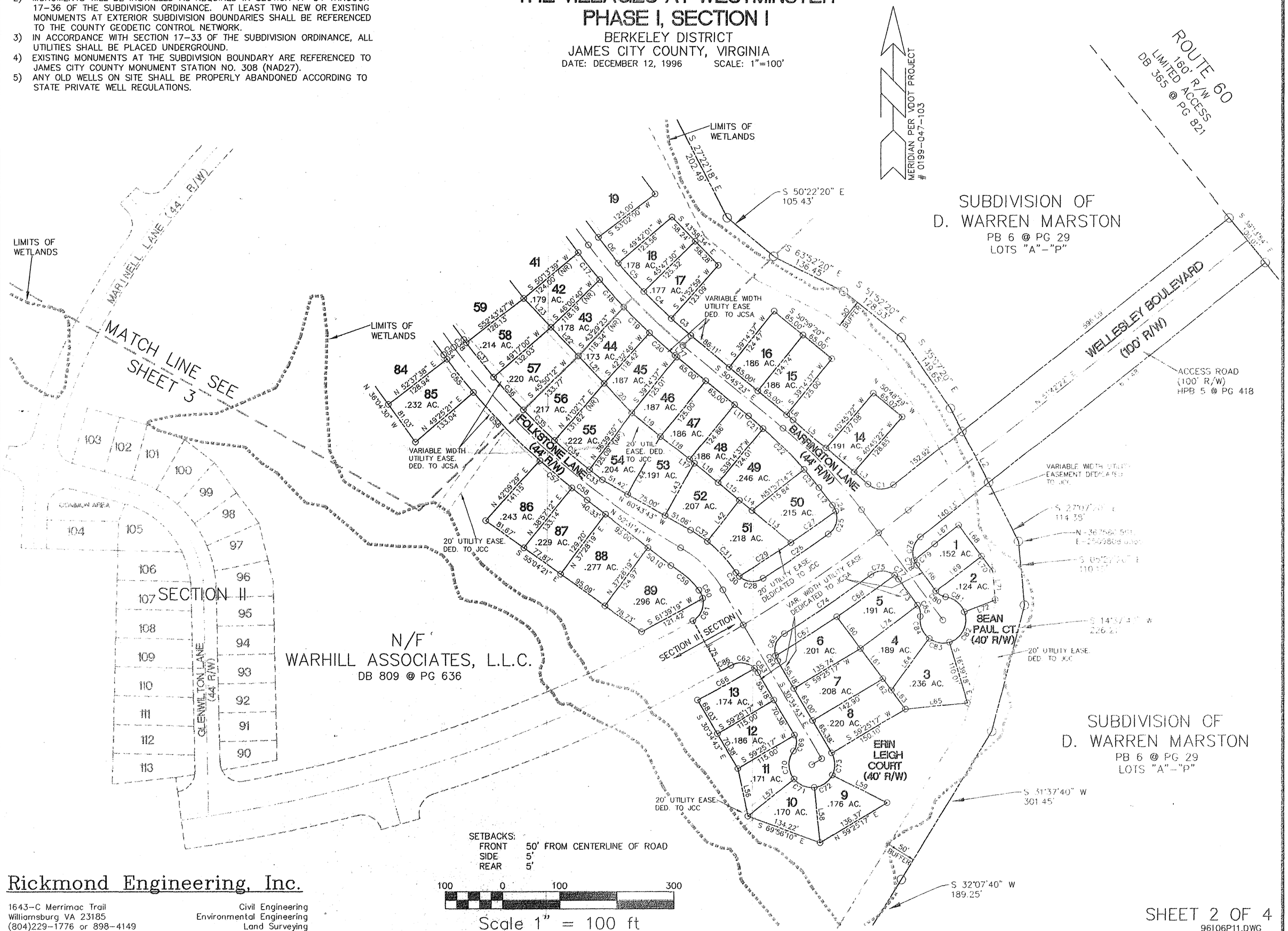
Rickmond Engineering, Inc.
1643-C Merrimac Trail
Williamsburg VA 23185
(804)229-1776 or 898-4149
Civil Engineering
Environmental Engineering
Land Surveying

96106P11.DWG

NOTES:
1) WETLANDS DELINEATED BY DOMINION ENVIRONMENTAL CONSULTANTS, INC. AND FIELD LOCATED BY RICKMOND ENGINEERING, INC.
2) MONUMENTS WILL BE INSTALLED AS REQUIRED IN SECTION 17-34 THROUGH 17-36 OF THE SUBDIVISION ORDINANCE. AT LEAST TWO NEW OR EXISTING MONUMENTS AT EXTERIOR SUBDIVISION BOUNDARIES SHALL BE REFERENCED TO THE COUNTY GEODETIC CONTROL NETWORK.
3) IN ACCORDANCE WITH SECTION 17-33 OF THE SUBDIVISION ORDINANCE, ALL UTILITIES SHALL BE PLACED UNDERGROUND.
4) EXISTING MONUMENTS AT THE SUBDIVISION BOUNDARY ARE REFERENCED TO JAMES CITY COUNTY MONUMENT STATION NO. 308 (NAD27).
5) ANY OLD WELLS ON SITE SHALL BE PROPERLY ABANDONED ACCORDING TO STATE PRIVATE WELL REGULATIONS.

THE VILLAGES AT WESTMINSTER
PHASE I, SECTION I

BERKELEY DISTRICT
JAMES CITY COUNTY, VIRGINIA
DATE: DECEMBER 12, 1996 SCALE: 1"=100'

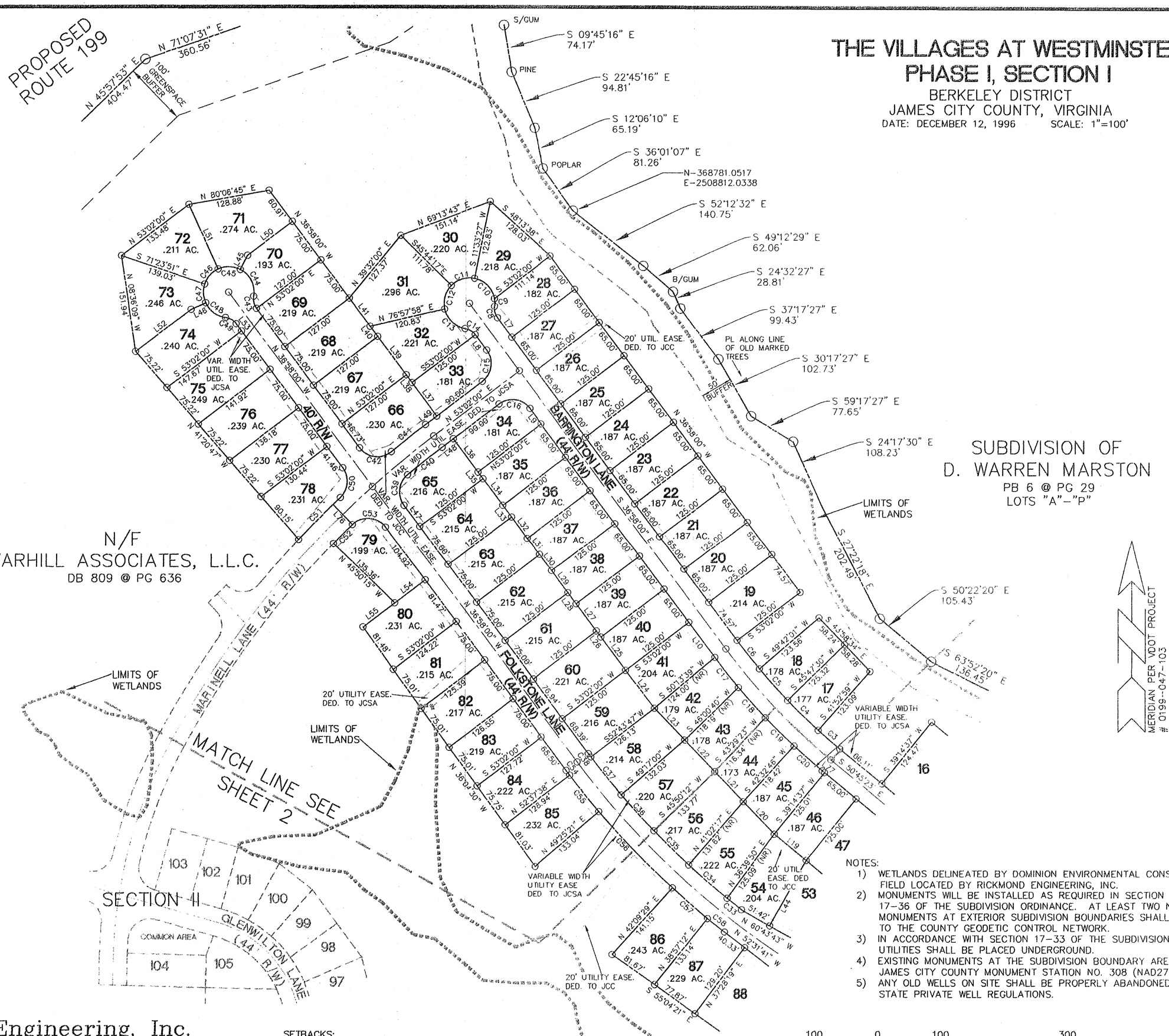


Rickmond Engineering, Inc.
1643-C Merrimac Trail
Williamsburg VA 23185
(804)229-1776 or 898-4149
Civil Engineering
Environmental Engineering
Land Surveying

SHEET 2 OF 4
96106P11.DWG

THE VILLAGES AT WESTMINSTER
PHASE I, SECTION I

BERKELEY DISTRICT
JAMES CITY COUNTY, VIRGINIA
DATE: DECEMBER 12, 1996 SCALE: 1"=100'



NOTES:

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2) MONUMENTS WILL BE INSTALLED AS REQUIRED IN SECTION 17-34 THROUGH 17-36 OF THE SUBDIVISION ORDINANCE. AT LEAST TWO NEW OR EXISTING MONUMENTS AT EXTERIOR SUBDIVISION BOUNDARIES SHALL BE REFERENCED TO THE COUNTY GEODETIC CONTROL NETWORK.
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5) ANY OLD WELLS ON SITE SHALL BE PROPERLY ABANDONED ACCORDING TO STATE PRIVATE WELL REGULATIONS.

SETBACKS:
FRONT 50' FROM CENTERLINE OF ROAD
SIDE 5'
REAR 5'

100 0 100 300
Scale 1" = 100 ft

Rickmond Engineering, Inc.
1643-C Merrimac Trail
Williamsburg VA 23185
(804)229-1776 or 898-4149
Civil Engineering
Environmental Engineering
Land Surveying

THE VILLAGES AT WESTMINSTER
PHASE I, SECTION I

BERKELEY DISTRICT
JAMES CITY COUNTY, VIRGINIA
DATE: DECEMBER 12, 1996 SCALE: 1"=100'

LINE TABLE

NUMBER	DIRECTION	DISTANCE
L1	N 27°07'20" W	44.88'
L2	S 27°07'20" E	101.93'
L3	S 49°14'38" E	32.53'
L4	S 49°14'38" E	65.00'
L5	S 49°14'38" E	76.25'
L6	S 50°45'23" E	14.35'
L7	S 36°58'00" E	37.82'
L8	S 36°58'00" E	30.00'
L9	S 36°58'00" E	30.00'
L10	N 36°58'00" W	68.39'
L11	S 50°45'23" E	31.09'
L12	N 38°02'46" W	38.44'
L13	S 50°52'34" E	87.92'
L14	S 50°52'34" E	28.21'
L15	S 50°52'34" E	47.81'
L16	S 50°52'34" E	53.88'
L17	S 50°52'34" E	11.12'
L18	S 50°52'34" E	65.00'
L19	S 50°45'23" E	65.00'
L20	S 43°53'32" E	70.87'
L21	S 43°53'32" E	65.46'
L22	S 43°53'32" E	68.53'
L23	S 43°53'32" E	68.99'
L24	N 37°51'04" W	74.47'
L25	N 36°58'00" W	65.00'
L26	N 36°58'00" W	11.94'
L27	N 36°58'00" W	53.06'
L28	N 36°58'00" W	21.94'
L29	N 36°58'00" W	43.06'
L30	N 36°58'00" W	31.94'
L31	N 36°58'00" W	33.06'
L32	N 36°58'00" W	41.94'
L33	N 36°58'00" W	23.06'
L34	N 36°58'00" W	51.94'
L35	N 36°58'00" W	13.06'
L36	N 36°58'00" W	65.00'
L37	S 36°58'00" E	65.00'
L38	S 36°58'00" E	15.17'
L39	S 36°58'00" E	75.00'
L40	S 36°58'00" E	19.98'
L41	S 36°58'00" E	55.02'
L42	S 38°04'45" W	90.67'
L43	S 29°16'17" W	104.23'
L44	S 29°16'17" W	117.26'
L45	S 27°25'24" W	25.00'
L46	N 65°26'29" E	25.00'
L47	N 36°58'00" W	41.46'
L48	N 53°02'00" E	22.14'
L49	N 53°02'00" E	22.14'
L50	N 53°02'00" E	88.39'
L51	S 24°38'50" E	111.15'
L52	N 53°02'00" E	109.93'
L53	S 36°58'00" E	14.13'
L54	N 53°02'00" E	60.18'
L55	N 53°02'00" E	62.77'
L56	N 12°03'54" W	84.60'
L57	N 51°18'31" E	103.30'
L58	N 05°59'14" W	96.37'
L59	N 63°16'58" W	107.36'
L60	N 36°51'41" W	69.14'
L61	N 36°51'41" W	65.39'
L62	N 36°51'41" W	24.53'
L63	N 36°51'41" W	41.24'
L64	N 36°36'48" E	111.25'
L65	N 84°22'25" E	108.98'
L66	N 36°51'41" W	55.77'
L67	N 51°42'22" E	53.14'
L68	N 36°51'41" W	67.38'
L69	S 53°08'19" W	100.00'
L70	N 36°51'41" W	31.82'
L71	S 05°22'20" E	49.67'
L72	S 69°18'12" W	57.93'
L73	N 36°51'41" W	55.77'
L74	S 53°08'19" W	125.00'
L75	N 28°57'35" W	100.00'
L76	S 44°12'25" E	44.00'
L77	S 50°45'23" E	4.66'

CURVE TABLE

NUMBER	DELTA ANGLE	CHORD DIRECTION	TANGENT	RADIUS	ARC LENGTH	CHORD LENGTH
C1	79°03'00"	S 88°46'08" E	28.88	35.00	48.29	44.55
C3	02°38'22"	S 49°26'12" E	22.53	978.00	45.05	45.05
C4	03°54'31"	S 46°09'46" E	33.37	978.00	66.72	66.71
C5	03°54'31"	S 42°15'14" E	33.37	978.00	66.72	66.71
C6	03°19'59"	S 38°38'00" E	28.45	978.00	56.89	56.88
C8	43°41'27"	S 15°07'17" E	10.02	25.00	19.06	18.61
C9	17°23'42"	N 01°58'24" W	6.12	40.00	12.14	12.10
C10	67°46'17"	N 44°33'24" W	26.86	40.00	47.31	44.60
C11	57°17'45"	S 72°54'35" W	21.85	40.00	40.00	38.35
C12	57°17'45"	S 15°36'50" W	21.85	40.00	40.00	38.35
C13	67°37'25"	S 46°50'45" E	26.79	40.00	47.21	44.52
C14	43°41'27"	N 58°48'44" W	10.02	25.00	19.06	18.61
C15	90°00'00"	N 08°02'00" E	35.00	35.00	54.98	49.50
C16	90°00'00"	N 81°58'00" W	35.00	35.00	54.98	49.50
C17	03°22'19"	S 38°39'10" E	30.08	1022.00	60.14	60.14
C18	03°33'27"	S 42°07'03" E	31.74	1022.00	63.46	63.45
C19	03°33'27"	S 45°40'30" E	31.74	1022.00	63.46	63.45
C20	03°18'09"	S 49°06'18" E	29.46	1022.00	58.91	58.90
C21	02°26'00"	N 49°32'23" W	16.96	798.65	33.92	33.92
C22	07°19'44"	N 44°39'31" W	51.15	798.65	102.16	102.09
C23	02°56'53"	N 39°31'12" W	20.55	798.65	41.09	41.09
C24	19°01'10"	N 28°32'11" W	5.86	35.00	11.62	11.57
C25	73°46'48"	N 17°51'48" E	26.27	35.00	45.07	42.02
C26	03°05'04"	N 56°17'44" E	68.65	2550.00	137.27	137.25
C27	02°10'11"	N 55°04'33" E	47.81	2525.00	95.61	95.61
C28	73°46'48"	S 85°16'19" E	26.27	35.00	45.07	42.02
C29	02°26'24"	N 57°22'50" E	53.77	2525.00	107.53	107.52
C30	14°18'12"	S 41°13'49" E	4.39	35.00	8.74	8.71
C31	17°50'32"	N 42°59'59" W	36.89	235.00	73.18	72.88
C32	08°37'40"	N 56°14'05" W	17.73	235.00	35.39	35.35
C33	01°18'29"	S 51°52'26" E	14.52	1272.00	29.04	29.04
C34	03°36'36"	S 49°24'53" E	40.09	1272.00	80.15	80.13
C35	03°26'48"	S 45°53'12" E	38.27	1272.00	76.52	76.50
C36	03°26'48"	S 42°26'24" E	38.27	1272.00	76.52	76.50
C37	03°26'48"	S 38°59'37" E	38.27	1272.00	76.52	76.50
C38	00°18'13"	S 37°07'06" E	3.37	1272.00	6.74	6.74
C39	87°18'17"	S 06°41'08" W	33.39	35.00	53.33	48.32
C40	02°41'43"	S 51°41'08" W	34.77	1478.00	69.53	69.52
C41	02°34'18"	S 51°44'51" W	34.16	1522.00	68.31	68.30
C42	92°34'18"	S 83°15'09" E	36.61	35.00	56.55	50.60
C43	46°11'13"	S 13°52'24" E	10.66	25.00	20.15	19.61
C44	71°47'49"	N 26°40'42" W	28.95	40.00	50.12	46.91
C45	52°04'13"	N 88°36'43" W	19.54	40.00	36.35	35.11
C46	46°45'02"	S 41°58'39" W	17.29	40.00	32.64	31.74
C47	43°09'40"	S 02°58'41" E	15.82	40.00	30.13	29.42
C48	58°35'42"	S 53°51'22" E	22.44	40.00	40.91	39.15
C49	46°11'13"	S 60°03'37" E	10.66	25.00	20.15	19.61
C50	83°22'00"	N 04°43'00" E	31.17	35.00	50.93	46.55
C51	03°31'27"	S 44°38'16" W	46.82	1522.00	93.61	93.60
C52	01°37'50"	S 44°58'40" W	21.03	1478.00	42.06	42.06
C53	97°14'24"	N 85°35'12" W	39.73	35.00	59.40	52.52
C54	00°24'22"	S 37°10'11" E	4.66	1316.00	9.33	9.33
C55	03°12'18"	S 38°58'31" E	36.82	1316.00	73.61	73.60
C56	07°15'51"	S 44°12'35" E	83.54	1316.00	166.85	166.74
C57	03°12'18"	S 49°26'40" E	36.82	1316.00	73.61	73.60
C58	01°28'53"	S 51°47'15" E	17.01	1316.00	34.02	34.02
C59	22°39'59"	N 49°12'55" W	33.07	165.00	65.27	64.85
C60	25°08'32"	N 25°18'39" W	7.80	35.00	15.36	15.24
C61	73°46'48"	N 24°09'01" E	26.27	35.00	45.07	42.02
C62	73°02'25"	N 82°53'05" W	25.92	35.00	44.62	41.66
C63	15°47'10"	N 38°28'18" W	4.85	35.00	9.64	9.61
C64	15°47'10"	S 22°41'08" E	4.85	35.00	9.64	9.61
C65	73°02'25"	S 21°43'39" W	25.92	35.00	44.62	41.66
C66	02°26'10"	N 61°05'46" E	56.88	2675.00	113.74	113.73
C67	02°43'08"	N 57°36'19" E	63.48	2675.00	126.93	126.92
C68	02°39'02"	N 54°55'14" E	61.89	2675.00	123.75	123.74
C69	67°22'48"	N 03°06'41" E	16.67	25.00	29.40	27.74
C70	75°29'34"	S 00°56'42" E	30.97	40.00	52.70	48.97
C71	57°17'45"	S 67°20'21" E	21.85	40.00	40.00	38.35
C72	57°17'45"	N 55°21'54" E	21.85	40.00	40.00	38.35
C73	57°17'45"	N 01°55'51" W	21.85	40.00	40.00	38.35
C74	03°56'07"	N 56°16'48" E	91.04	2650.00	182.01	181.97
C75	73°02'25"	N 89°10'03" W	25.92	35.00	44.62	41.66
C76	73°02'25"	S 15°26'41" W	25.92	35.00	44.62	41.66
C77	15°47'10"	N 44°45'16" W	4.85	35.00	9.64	9.61
C78	15°47'10"	S 28°58'06" E	4.85	35.00	9.64	9.61
C79	00°58'33"	N 52°11'39" E	22.78	2675.00	45.56	45.56
C80	46°11'12"	S 59°57'18" E	10.66	25.00	20.15	19.61
C81	62°21'06"	N 51°52'21" W	24.20	40.00	43.53	41.41
C82	94°02'30"	N 26°19'27" E	42.93	40.00	65.65	58.53
C83	53°16'06"	S 80°01'15" E	20.06	40.00	37.19	35.86
C84	62°42'44"	S 22°01'50" E	24.37	40.00	43.78	41.63
C85	46°11'13"	N 13°46'04" W	10.66	25.00	20.15	19.61
C86	00°26'43"	N 60°49'04" E	10.30	2650.00	20.59	20.59

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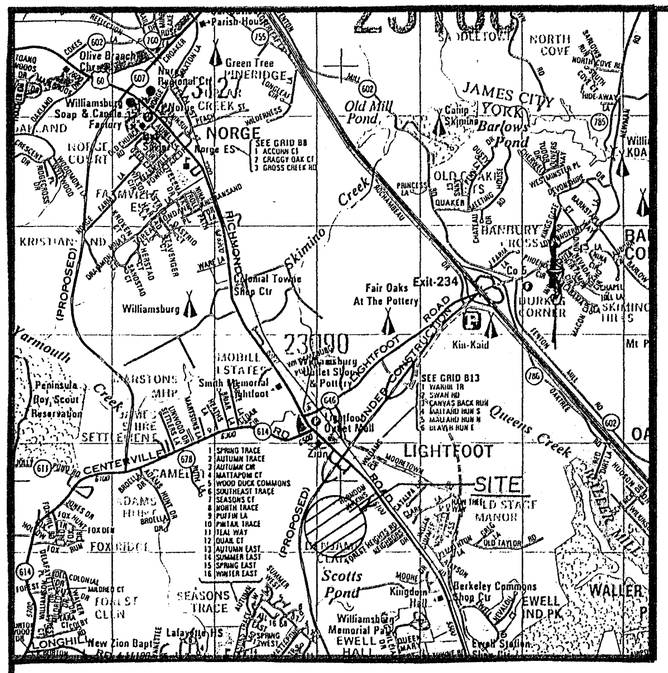
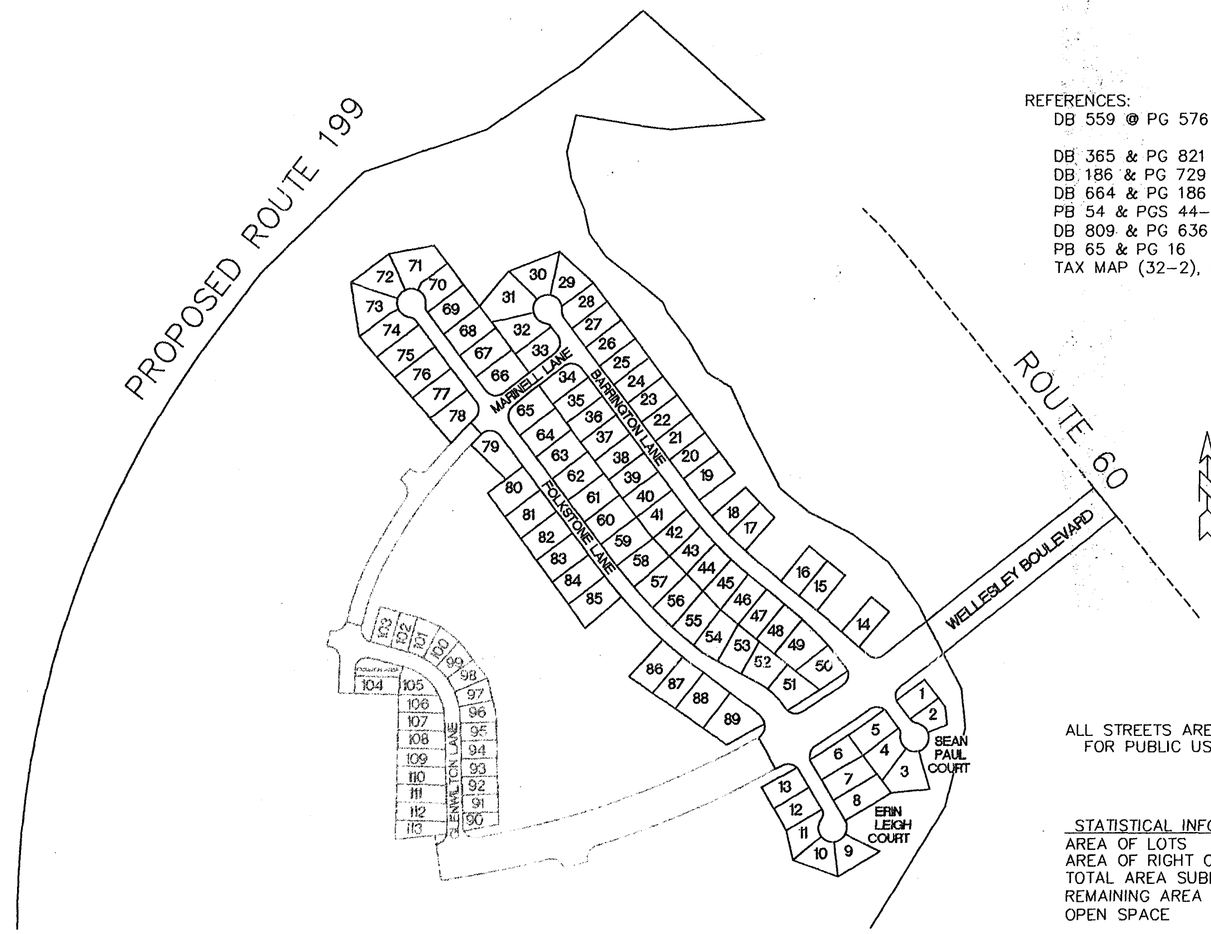
THE VILLAGES AT WESTMINSTER
PHASE I, SECTION I

BERKELEY DISTRICT
JAMES CITY COUNTY, VIRGINIA
DATE: DECEMBER 12, 1996 SCALE: 1"=300'



VICINITY MAP
SCALE: 1"=2000'



REFERENCES:
- DB 559 @ PG 576 – 50' PERMANENT VIRGINIA NATURAL GAS EASEMENT
- DB 365 & PG 821 – ROUTE #60 LIMITED ACCESS
- DB 186 & PG 729 – 20' SANITARY SEWER EASEMENT
- DB 664 & PG 186
- PB 54 & PGS 44–46
- DB 809 & PG 636
- PB 65 & PG 16
- TAX MAP (32–2), PARCEL (1–57) – IN PART

ALL STREETS ARE HERBY DEDICATED FOR PUBLIC USE.

STATISTICAL INFORMATION

AREA OF LOTS	18.37 ACRES
AREA OF RIGHT OF WAY	5.46 ACRES
TOTAL AREA SUBDIVIDED	23.83 ACRES
REMAINING AREA	167.4± ACRES
OPEN SPACE	13.99 ACRES

OWNER'S CERTIFICATE

THIS SUBDIVISION OF LAND SHOWN ON THIS PLAT AND KNOWN AS THE VILLAGES AT WESTMINSTER, PHASE I, SECTION I IS WITH THE FREE CONSENT AND IN ACCORDANCE WITH THE DESIRES OF THE UNDERSIGNED OWNERS, PROPRIETORS, AND TRUSTEES

WARHILL ASSOCIATES, L.L.C.

BY : _____
KENNETH L. ALLEN

STATE OF VIRGINIA,
COUNTY OF JAMES CITY, TO WIT :

I, Denise L H Sweeney A NOTARY PUBLIC IN AND FOR THE COUNTY AND STATE AFORESAID DO HEREBY CERTIFY THAT THE PERSON WHOSE NAME IS SIGNED TO THE FOREGOING WRITING HAS ACKNOWLEDGED THE SAME BEFORE ME.

GIVEN UNDER MY HAND AND SEAL THIS 17th DAY OF July 1997.

NOTARY PUBLIC : Denise L H Sweeney

MY COMMISSION EXPIRES : 11-30-2000

STATE OF VIRGINIA,
COUNTY OF JAMES CITY

IN THE CLERK'S OFFICE OF THE CIRCUIT COURT FOR THE COUNTY OF JAMES CITY, THE MAP SHOWN HEREON WAS PRESENTED AND ADMITTED TO RECORD AS THE LAW DIRECTS.

TESTE DATE

PLAT BOOK ____ , PAGE _____ .

NOTES:
1) THIS PROPERTY IS LOCATED IN FLOOD ZONE "A" & "AE" AS SHOWN ON FLOOD INSURANCE RATE MAP COMMUNITY–PANEL NUMBERS 510201 0020B & 510201 0035B, EFFECTIVE DATE 2–6–91.
2) PROPERTY CORNERS TO BE SET BY EDLOE MORECOCK III, CLS OF RICKMOND ENGINEERING, INC.

WATER
EACH LOT WITHIN THIS SUBDIVISION IS TO BE SERVED BY PUBLIC WATER SUPPLIED BY JAMES CITY SERVICE AUTHORITY.

SEWER
EACH LOT WITHIN THIS SUBDIVISION IS TO BE SERVED BY PUBLIC SEWER SUPPLIED BY JAMES CITY SERVICE AUTHORITY.

CERTIFICATION OF SOURCE OF TITLE

I CERTIFY THAT THIS PLAT OF SUBDIVISION WAS MADE BY ME AT THE DIRECTION OF THE OWNER, AND THAT THE SUBDIVISION IS ENTIRELY WITHIN THE BOUNDARIES OF LAND COVERED BY DEED DULY OF RECORD IN CLERK'S OFFICE OF CIRCUIT COURT OF THE COUNTY OF JAMES CITY, VIRGINIA IN DB 809, PG 636.

Kenneth M. Jenkins II
KENNETH M. JENKINS, II, PE

ENGINEER'S CERTIFICATE

I HEREBY CERTIFY THAT TO THE BEST MY OF KNOWLEDGE AND BELIEF, ALL OF THE REQUIREMENTS OF THE BOARD OF SUPERVISORS AND ORDINANCES OF THE COUNTY OF JAMES CITY , VIRGINIA, REGARDING THE PLATTING OF SUBDIVISIONS WITHIN THE COUNTY HAVE BEEN COMPLIED WITH.

Kenneth M. Jenkins II
KENNETH M. JENKINS, II, PE

COMMONWEALTH OF VIRGINIA
K.M. JENKINS II
No.022872
7/18/97
PROFESSIONAL ENGINEER

OWNER/DEVELOPER

WARHILL ASSOCIATES, L.L.C.
2 EATON ST., SUITE 1101
HAMPTON, VA. 23669

CERTIFICATE OF APPROVAL

THIS SUBDIVISION AS SHOWN HEREON IS APPROVED BY THE UNDERSIGNED IN ACCORDANCE WITH EXISTING SUBDIVISION REGULATIONS AND MAY BE ADMITTED TO RECORD.

AGENT OF GOVERNING BODY — DATE

B M Jordan — 7-21-97
VIRGINIA DEPARTMENT OF TRANSPORTATION — DATE

David S. Allen — 7-21-97
HEALTH OFFICER — DATE
(THIS PROPERTY IS SERVED BY PUBLIC WATER AND PUBLIC SEWER.)

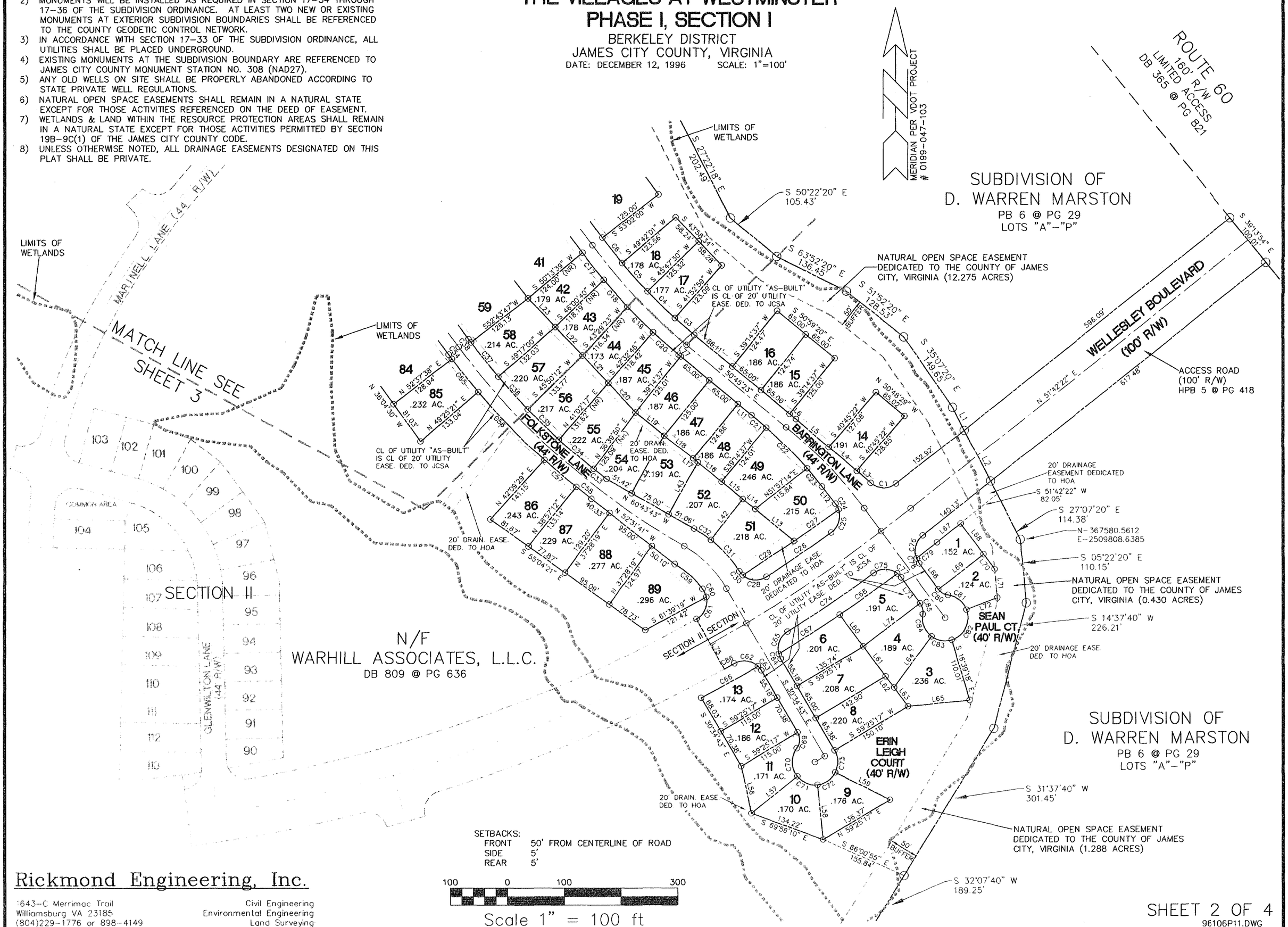
Rickmond Engineering, Inc.
1643–C Merrimac Trail
Williamsburg VA 23185
(804)229–1776 or 898–4149
Civil Engineering
Environmental Engineering
Land Surveying

NOTES:

1) WETLANDS DELINEATED BY DOMINION ENVIRONMENTAL CONSULTANTS, INC. AND FIELD LOCATED BY RICKMOND ENGINEERING, INC.
2) MONUMENTS WILL BE INSTALLED AS REQUIRED IN SECTION 17-34 THROUGH 17-36 OF THE SUBDIVISION ORDINANCE. AT LEAST TWO NEW OR EXISTING MONUMENTS AT EXTERIOR SUBDIVISION BOUNDARIES SHALL BE REFERENCED TO THE COUNTY GEODETIC CONTROL NETWORK.
3) IN ACCORDANCE WITH SECTION 17-33 OF THE SUBDIVISION ORDINANCE, ALL UTILITIES SHALL BE PLACED UNDERGROUND.
4) EXISTING MONUMENTS AT THE SUBDIVISION BOUNDARY ARE REFERENCED TO JAMES CITY COUNTY MONUMENT STATION NO. 308 (NAD27).
5) ANY OLD WELLS ON SITE SHALL BE PROPERLY ABANDONED ACCORDING TO STATE PRIVATE WELL REGULATIONS.
6) NATURAL OPEN SPACE EASEMENTS SHALL REMAIN IN A NATURAL STATE EXCEPT FOR THOSE ACTIVITIES REFERENCED ON THE DEED OF EASEMENT.
7) WETLANDS & LAND WITHIN THE RESOURCE PROTECTION AREAS SHALL REMAIN IN A NATURAL STATE EXCEPT FOR THOSE ACTIVITIES PERMITTED BY SECTION 19B-9C(1) OF THE JAMES CITY COUNTY CODE.
8) UNLESS OTHERWISE NOTED, ALL DRAINAGE EASEMENTS DESIGNATED ON THIS PLAT SHALL BE PRIVATE.

THE VILLAGES AT WESTMINSTER
PHASE I, SECTION I

BERKELEY DISTRICT
JAMES CITY COUNTY, VIRGINIA
DATE: DECEMBER 12, 1996 SCALE: 1"=100'



SETBACKS:
FRONT 50' FROM CENTERLINE OF ROAD
SIDE 5'
REAR 5'

Rickmond Engineering, Inc.
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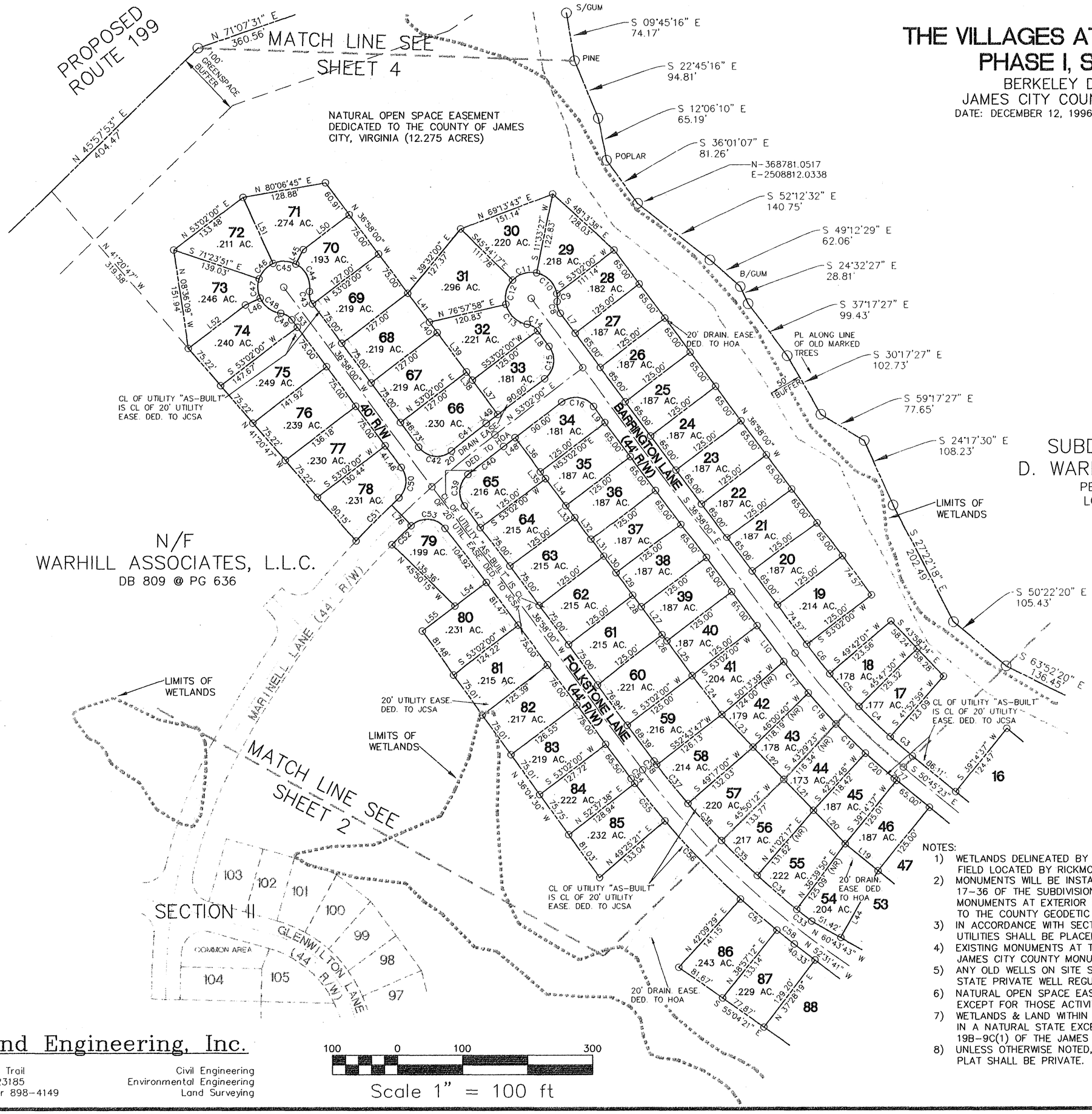
Land Surveying

SHEET 2 OF 4
96106P11.DWG

THE VILLAGES AT WESTMINSTER
PHASE I, SECTION I

BERKELEY DISTRICT
JAMES CITY COUNTY, VIRGINIA
DATE: DECEMBER 12, 1996 SCALE: 1"=100'



SETBACKS:

FRONT	50' FROM CENTERLINE OF ROAD
SIDE	5'
REAR	5'

NOTES:

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THE VILLAGES AT WESTMINSTER
PHASE I, SECTION I

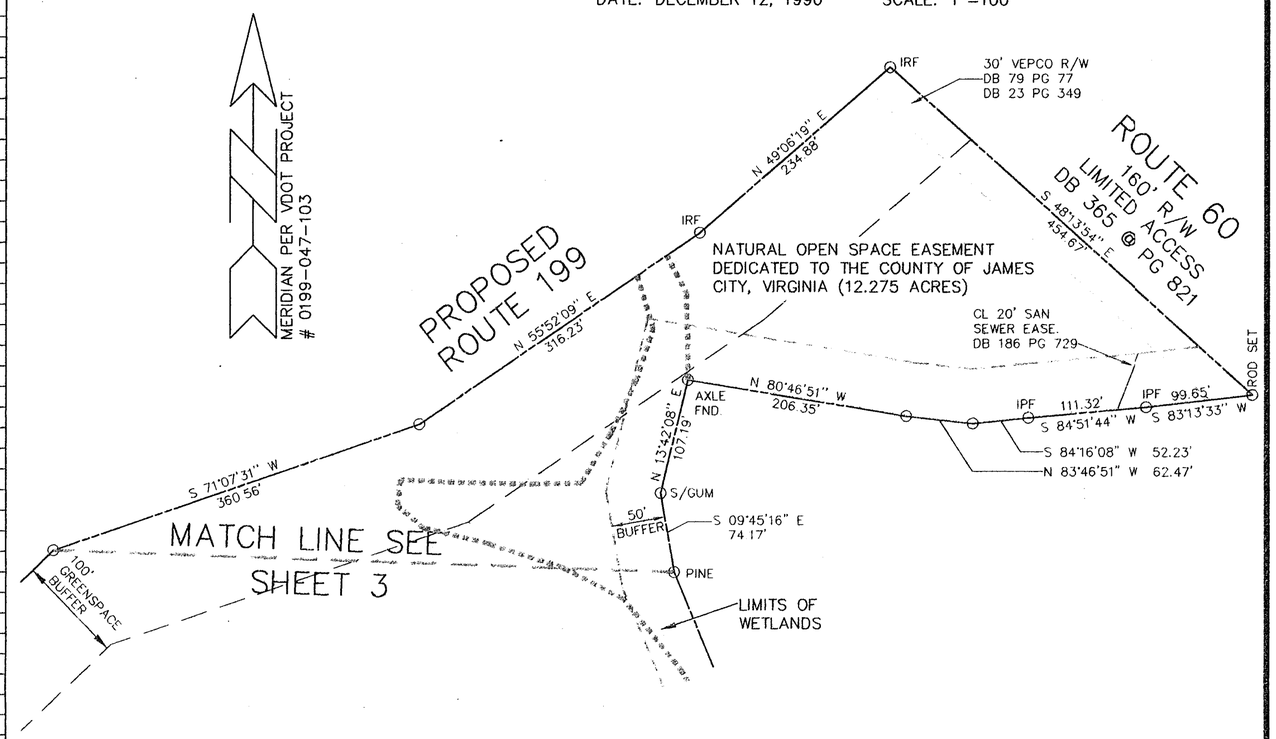
BERKELEY DISTRICT
JAMES CITY COUNTY, VIRGINIA
DATE: DECEMBER 12, 1996 SCALE: 1"=100'

LINE TABLE

NUMBER	DIRECTION	DISTANCE
L1	N 27°07'20" W	44.88'
L2	S 27°07'20" E	101.93'
L3	S 49°14'38" E	32.53'
L4	S 49°14'38" E	65.00'
L5	S 49°14'38" E	76.25'
L6	S 50°45'23" E	14.35'
L7	S 36°58'00" E	37.82'
L8	S 36°58'00" E	30.00'
L9	S 36°58'00" E	30.00'
L10	N 36°58'00" W	68.39'
L11	S 50°45'23" E	31.09'
L12	N 38°02'46" W	38.44'
L13	S 50°52'34" E	87.92'
L14	S 50°52'34" E	28.21'
L15	S 50°52'34" E	47.81'
L16	S 50°52'34" E	53.88'
L17	S 50°52'34" E	11.12'
L18	S 50°52'34" E	65.00'
L19	S 50°45'23" E	65.00'
L20	S 43°53'32" E	70.87'
L21	S 43°53'32" E	65.46'
L22	S 43°53'32" E	68.53'
L23	S 43°53'32" E	68.99'
L24	N 37°51'04" W	74.47'
L25	N 36°58'00" W	65.00'
L26	N 36°58'00" W	11.94'
L27	N 36°58'00" W	53.06'
L28	N 36°58'00" W	21.94'
L29	N 36°58'00" W	43.06'
L30	N 36°58'00" W	31.94'
L31	N 36°58'00" W	33.06'
L32	N 36°58'00" W	41.94'
L33	N 36°58'00" W	23.06'
L34	N 36°58'00" W	51.94'
L35	N 36°58'00" W	13.06'
L36	N 36°58'00" W	65.00'
L37	S 36°58'00" E	65.00'
L38	S 36°58'00" E	15.17'
L39	S 36°58'00" E	75.00'
L40	S 36°58'00" E	19.98'
L41	S 36°58'00" E	55.02'
L42	S 38°04'45" W	90.67'
L43	S 29°16'17" W	104.23'
L44	S 29°16'17" W	117.26'
L45	S 27°25'24" W	25.00'
L46	N 65°26'29" E	25.00'
L47	N 36°58'00" W	41.46'
L48	N 53°02'00" E	22.14'
L49	N 53°02'00" E	22.14'
L50	N 53°02'00" E	88.39'
L51	S 24°38'50" E	111.15'
L52	N 53°02'00" E	109.93'
L53	S 36°58'00" E	14.13'
L54	N 53°02'00" E	60.18'
L55	N 53°02'00" E	62.77'
L56	N 12°03'54" W	84.60'
L57	N 51°18'31" E	103.30'
L58	N 05°59'14" W	96.37'
L59	N 63°16'58" W	107.36'
L60	N 36°51'41" W	69.14'
L61	N 36°51'41" W	65.39'
L62	N 36°51'41" W	24.53'
L63	N 36°51'41" W	41.24'
L64	N 36°36'48" E	111.25'
L65	N 84°22'25" E	108.98'
L66	N 36°51'41" W	55.77'
L67	N 51°42'22" E	53.14'
L68	N 36°51'41" W	67.38'
L69	S 53°08'19" W	100.00'
L70	N 36°51'41" W	31.82'
L71	S 05°22'20" E	49.67'
L72	S 69°18'12" W	57.93'
L73	N 36°51'41" W	55.77'
L74	S 53°08'19" W	125.00'
L75	N 28°57'35" W	100.00'
L76	S 44°12'25" E	44.00'
L77	S 50°45'23" E	4.66'

CURVE TABLE

NUMBER	DELTA ANGLE	CHORD DIRECTION	TANGENT	RADIUS	ARC LENGTH	CHORD LENGTH
C1	79°03'00"	S 88°46'08" E	28.88	35.00	48.29	44.55
C3	02°38'22"	S 49°26'12" E	22.53	978.00	45.05	45.05
C4	03°54'31"	S 46°09'46" E	33.37	978.00	66.72	66.71
C5	03°54'31"	S 42°15'14" E	33.37	978.00	66.72	66.71
C6	03°19'59"	S 38°38'00" E	28.45	978.00	56.89	56.88
C8	43°41'27"	S 15°07'17" E	10.02	25.00	19.06	18.61
C9	17°23'42"	N 01°58'24" W	6.12	40.00	12.14	12.10
C10	67°46'17"	N 44°33'24" W	26.86	40.00	47.31	44.60
C11	57°17'45"	S 72°54'35" W	21.85	40.00	40.00	38.35
C12	57°17'45"	S 15°36'50" W	21.85	40.00	40.00	38.35
C13	67°37'25"	S 46°50'45" E	26.79	40.00	47.21	44.52
C14	43°41'27"	N 58°48'44" W	10.02	25.00	19.06	18.61
C15	90°00'00"	N 08°02'00" E	35.00	35.00	54.98	49.50
C16	90°00'00"	N 81°58'00" W	35.00	35.00	54.98	49.50
C17	03°22'19"	S 38°39'10" E	30.08	1022.00	60.14	60.14
C18	03°33'27"	S 42°07'03" E	31.74	1022.00	63.46	63.45
C19	03°33'27"	S 45°40'30" E	31.74	1022.00	63.46	63.45
C20	03°18'09"	S 49°06'18" E	29.46	1022.00	58.91	58.90
C21	02°26'00"	N 49°32'23" W	16.96	798.65	33.92	33.92
C22	07°19'44"	N 44°39'31" W	51.15	798.65	102.16	102.09
C23	02°56'53"	N 39°31'12" W	20.55	798.65	41.09	41.09
C24	19°01'10"	N 28°32'11" W	5.86	35.00	11.62	11.57
C25	73°46'48"	N 17°51'48" E	26.27	35.00	45.07	42.02
C26	03°05'04"	N 56°17'44" E	68.65	2550.00	137.27	137.25
C27	02°10'11"	N 55°04'33" E	47.81	2525.00	95.61	95.61
C28	73°46'48"	S 85°16'19" E	26.27	35.00	45.07	42.02
C29	02°26'24"	N 57°22'50" E	53.77	2525.00	107.53	107.52
C30	14°18'12"	S 41°13'49" E	4.39	35.00	8.74	8.71
C31	17°50'32"	N 42°59'59" W	36.89	235.00	73.18	72.88
C32	08°37'40"	N 56°14'05" W	17.73	235.00	35.39	35.35
C33	01°18'29"	S 51°52'26" E	14.52	1272.00	29.04	29.04
C34	03°36'36"	S 49°24'53" E	40.09	1272.00	80.15	80.13
C35	03°26'48"	S 45°53'12" E	38.27	1272.00	76.52	76.50
C36	03°26'48"	S 42°26'24" E	38.27	1272.00	76.52	76.50
C37	03°26'48"	S 38°59'37" E	38.27	1272.00	76.52	76.50
C38	00°18'13"	S 37°07'06" E	3.37	1272.00	6.74	6.74
C39	87°18'17"	S 06°41'08" W	33.39	35.00	53.33	48.32
C40	02°41'43"	S 51°41'08" W	34.77	1478.00	69.53	69.52
C41	02°34'18"	S 51°44'51" W	34.16	1522.00	68.31	68.30
C42	92°34'18"	S 83°15'09" E	36.61	35.00	56.55	50.60
C43	46°11'13"	S 13°52'24" E	10.66	25.00	20.15	19.61
C44	71°47'49"	N 26°40'42" W	28.95	40.00	50.12	46.91
C45	52°04'13"	N 88°36'43" W	19.54	40.00	36.35	35.11
C46	46°45'02"	S 41°58'39" W	17.29	40.00	32.64	31.74
C47	43°09'40"	S 02°58'41" E	15.82	40.00	30.13	29.42
C48	58°35'42"	S 53°51'22" E	22.44	40.00	40.91	39.15
C49	46°11'13"	S 60°03'37" E	10.66	25.00	20.15	19.61
C50	83°22'00"	N 04°43'00" E	31.17	35.00	50.93	46.55
C51	03°31'27"	S 44°38'16" W	46.82	1522.00	93.61	93.60
C52	01°37'50"	S 44°58'40" W	21.03	1478.00	42.06	42.06
C53	97°14'24"	N 85°35'12" W	39.73	35.00	59.40	52.52
C54	00°24'22"	S 37°10'11" E	4.66	1316.00	9.33	9.33
C55	03°12'18"	S 38°58'31" E	36.82	1316.00	73.61	73.60
C56	07°15'51"	S 44°12'35" E	83.54	1316.00	166.85	166.74
C57	03°12'18"	S 49°26'40" E	36.82	1316.00	73.61	73.60
C58	01°28'53"	S 51°47'15" E	17.01	1316.00	34.02	34.02
C59	22°39'59"	N 49°12'55" W	33.07	165.00	65.27	64.85
C60	25°08'32"	N 25°18'39" W	7.80	35.00	15.36	15.24
C61	73°46'48"	N 24°09'01" E	26.27	35.00	45.07	42.02
C62	73°02'25"	N 82°53'05" W	25.92	35.00	44.62	41.66
C63	15°47'10"	N 38°28'18" W	4.85	35.00	9.64	9.61
C64	15°47'10"	S 22°41'08" E	4.85	35.00	9.64	9.61
C65	73°02'25"	S 21°43'39" W	25.92	35.00	44.62	41.66
C66	02°26'10"	N 61°05'46" E	56.88	2675.00	113.74	113.73
C67	02°43'08"	N 57°36'19" E	63.48	2675.00	126.93	126.92
C68	02°39'02"	N 54°55'14" E	61.89	2675.00	123.75	123.74
C69	67°22'48"	N 03°06'41" E	16.67	25.00	29.40	27.74
C70	75°29'34"	S 00°56'42" E	30.97	40.00	52.70	48.97
C71	57°17'45"	S 67°20'21" E	21.85	40.00	40.00	38.35
C72	57°17'45"	N 55°21'54" E	21.85	40.00	40.00	38.35
C73	57°17'45"	N 01°55'51" W	21.85	40.00	40.00	38.35
C74	03°56'07"	N 56°16'48" E	91.04	2650.00	182.01	181.97
C75	73°02'25"	N 89°10'03" W	25.92	35.00	44.62	41.66
C76	73°02'25"	S 15°26'41" W	25.92	35.00	44.62	41.66
C77	15°47'10"	N 44°45'16" W	4.85	35.00	9.64	9.61
C78	15°47'10"	S 28°58'06" E	4.85	35.00	9.64	9.61
C79	00°58'33"	N 52°11'39" E	22.78	2675.00	45.56	45.56
C80	46°11'12"	S 59°57'18" E	10.66	25.00	20.15	19.61
C81	62°21'06"	N 51°52'21" W	24.20	40.00	43.53	41.41
C82	94°02'30"	N 26°19'27" E	42.93	40.00	65.65	58.53
C83	53°16'06"	S 80°01'15" E	20.06	40.00	37.19	35.86
C84	62°42'44"	S 22°01'50" E	24.37	40.00	43.78	41.63
C85	46°11'13"	N 13°46'04" W	10.66	25.00	20.15	19.61
C86	00°26'43"	N 60°49'04" E	10.30	2650.00	20.59	20.59



NOTES:

1) WETLANDS DELINEATED BY DOMINION ENVIRONMENTAL CONSULTANTS, INC. AND FIELD LOCATED BY RICKMOND ENGINEERING, INC.
2) MONUMENTS WILL BE INSTALLED AS REQUIRED IN SECTION 17-34 THROUGH 17-36 OF THE SUBDIVISION ORDINANCE. AT LEAST TWO NEW OR EXISTING MONUMENTS AT EXTERIOR SUBDIVISION BOUNDARIES SHALL BE REFERENCED TO THE COUNTY GEODETIC CONTROL NETWORK.
3) IN ACCORDANCE WITH SECTION 17-33 OF THE SUBDIVISION ORDINANCE, ALL UTILITIES SHALL BE PLACED UNDERGROUND.
4) EXISTING MONUMENTS AT THE SUBDIVISION BOUNDARY ARE REFERENCED TO JAMES CITY COUNTY MONUMENT STATION NO. 308 (NAD27).
5) ANY OLD WELLS ON SITE SHALL BE PROPERLY ABANDONED ACCORDING TO STATE PRIVATE WELL REGULATIONS.
6) NATURAL OPEN SPACE EASEMENTS SHALL REMAIN IN A NATURAL STATE EXCEPT FOR THOSE ACTIVITIES REFERENCED ON THE DEED OF EASEMENT.
7) WETLANDS & LAND WITHIN THE RESOURCE PROTECTION AREAS SHALL REMAIN IN A NATURAL STATE EXCEPT FOR THOSE ACTIVITIES PERMITTED BY SECTION 19B-9C(1) OF THE JAMES CITY COUNTY CODE.
8) UNLESS OTHERWISE NOTED, ALL DRAINAGE EASEMENTS DESIGNATED ON THIS PLAT SHALL BE PRIVATE.

100 0 100 300

Scale 1" = 100 ft

Rickmond Engineering, Inc.

1643-C Merrimac Trail
Williamsburg VA 23185
(804)229-1776 or 898-4149

Civil Engineering
Environmental Engineering
Land Surveying

SHEET 4 OF 4

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