CERTIFICATE OF AUTHENTICITY

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

BMP NUMBER: **YC021**

DATE VERIFIED: **January 16, 2013**

QUALITY ASSURANCE TECHNICIAN: **Leah Hardenbergh**

Leah Hardenbergh

LOCATION: WILLIAMSBURG, VIRGINIA

Stormwater Division

MEMORANDUM

DATE: March 13, 2010

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

FROM: Jo Anna Ripley, Stormwater

PO: 270712

RE: Files Approved for Scanning

General File ID or BMP ID: YC021

PIN: 2410100008

Subdivision, Tract, Business or Owner Name (if known): Dodson, John E

Property Description: Automobile Dealership

Site Address: 7101 Richmond Road

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

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

Comments

James City County, Virginia
Environmental Division

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

County Plan No.: SP-124-99
Project Name: WILLIAMSBURG DODGE
Stormwater Management Facility: LINED WET POND
Phase: ☐ I ☐ II ☑ III

☐ Information Received. Date:
☐ Administrative Check.
- ☐ Record Drawing Date:
- ☐ Construction Certification Date:
- ☐ RD/CC Standard Forms (Required after Feb 1st 2001Only)
- ☑ Insp/Maint Agreement Info: I/m # 000004677, 3/8/00 NOW SHARED WITH NORGE NEIGHBORHOOD
- ☑ BMP Maintenance Plan Location: Sheet 5
- ☐ Other: SUP-21-97

☑ Standard E&SC Note on Approved Plan Requiring RD/CC or County comment in plan review file.
☑ Yes ☐ No Location: Note #19 Sheet 2; Note #7 Sheet 5 *
☑ Assign County BMP ID Code Code: YC 021
☑ 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.).
☐ NO Inspector Check of RD/CC.
☑ Pre-Inspection Drawing Review - Approved Plan (Quick look prior to field inspection).
☐ Final Inspection (FI) Performed Date:
☑ Record Drawing (RD) Review Date: 12/28/04
☐ Construction Certification (CC) Review Date: 12/28/04
☐ Actions:
- ☐ No comments.
- ☑ Comments. Letter Forwarded. Date: 12/28/04
  - ☐ Record Drawing (RD)
  - ☐ Construction Certification (CC)
  - ☑ Construction-Related (CR)
  - ☐ Site Issues (SI)
  - ☐ Other :

FUTURE UPGRADE Norge Neighborhood

☐ Second Submission:
☐ 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).

BMP Certification Information Acceptable

Plan Reviewer: [signature] Date: 3/18/05

* JCC ENV DIV Comm #3, 12-17-99 (SP-124-99)

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: Williamsburg Dodge
Structure/BMP Name: Williamsburg Dodge BMP
Project Location: 7101 Richmond Road
BMP Location: along rear property line of Williamsburg Dodge
County Plan No.: SP - 124 - 99

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

Tax Map/Parcel No.: (24-1)(1-8)
BMP ID Code (if known): YC021
Zoning District: Powhatan
Land Use: Automobile Dealership
Site Area (sf or acres): 278,784 s.f. (6.4 ac.)

Brief Description of Stormwater Management/BMP Facility: Wet Pond BMP with riser & outfall pipe to existing unnamed stream.

Nearest Visible Landmark to SWM/BMP Facility: Williamsburg Dodge Car Dealership

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: 6/2000
Facility Monitored by County Representative during Construction: ☐ Yes ☐ No ☑ Unknown
Name of Site Work Contractor Who Constructed Facility: J.H. Martin, Inc.
Name of Professional Firm Who Routinely Monitored Construction: ECS
Date of Completion for SWM/BMP Facility: 8/2000
Date of Record Drawing/Construction Certification Submittal:

(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: John E. Dodson
Mailing Address: 7277 Richmond Road
Williamsburg, VA 23188
Business Phone: 1-800-296-9700 Fax: 757-564-1141
Contact Person: John E. Dodson Title: Owner

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: Potts, Minter & Associates, PC
Mailing Address: 3520 Courthouse Road
Richmond, VA 23236
Business Phone: (804) 745-2876
Fax: (804) 745-9571
Responsible Plan Preparer: Thomas J. Cook, PE
Title: Project Manager
Plan Name: Williamsburg Dodge
Firm's Project No. 9902-27
Plan Date: Nov. 10, 1999
Sheet No.'s Applicable to SWM/BMP Facility: 3 / 4 / 5 / / /

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

Name: J.H. Martin, Inc
Mailing Address: 6550 Ironbridge Road
Richmond, VA 23237
Business Phone: 804-275-1670
Fax: 804-275-0331
Contact Person: Andy Martin
Site Foreman/Supervisor: Andy Martin
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: Potts, Hunter and Associates, PC
Mailing Address: 3520 Courthouse Rd.
Richmond, VA 23235
Business Phone: (804) 745-2876
Fax: (804) 745-9571

Name: Thomas J. Cook, PE
Title: Sr. Project Manager
Signature: Thomas J. Cook
Date: Dec. 27, 2004

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.

Note: Certification of the BMP is based on elevations and contours depicted on a plan by AES Consulting Engineers titled Norge Neighborhood, dated 4/28/04. The AES plan proposes modifications to the Williamsburg Dodge BMP to accomodate runoff from the Norge Neighborhood project. These modifications radically change the size / shape of the design/as-built Williamsburg Dodge BMP

(Seal)
Virginia Registered Professional Engineer or Certified Land Surveyor
THOMAS J. COOK
No. 17518
COMMONWEALTH OF VIRGINIA
PROFESSIONAL ENGINEER

Construction Certification

Firm Name: ENGINEERING CONSULTING SERVICES, LTD.
Mailing Address: 108 INGRAM RD. UNIT I
WILLIAMSBURG, VA 23188
Business Phone: 757-229-6677
Fax: 757-229-9978

Name: KHOI T. NGUYEN, P.E.
Title: SR. PROJECT ENGINEER
Signature: [signature]
Date: DEC. 23, 2004

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.

Note: ECS, Ltd. oversaw the BMP dam compaction effort. Their field report indicates the dam was compacted per the project specifications (see attached).
Note: please see attached letter dated December 23, 2004.

(Seal)
Virginia Registered Professional Engineer
KHOI T. NGUYEN
No. 025706
12/23/04
COMMONWEALTH OF VIRGINIA
PROFESSIONAL ENGINEER

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: Potts, Minter and Associates, PC
Mailing Address: 3520 Courthouse Rd
Richmond, VA 23235
Business Phone: (804) 745-2876
Fax: (804) 745-9571

Name: Thomas J. Cook, PE
Title: Sr. Project Manager

Signature: ?
Date:

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(Seal)

Virginia Registered Professional Engineer or Certified Land Surveyor

COMMONWEALTH OF VIRGINIA
THOMAS J. COOK
No. 17618
PROFESSIONAL ENGINEER

Construction Certification

Firm Name:
Mailing Address:

Business Phone:
Fax:

Name:
Title:

Signature:
Date:

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?

(Seal)

Virginia Registered Professional Engineer

ENGINEERING CONSULTING SERVICES, LTD.
Geotechnical • Construction Materials • Environmental

December 23, 2004

Mr. Thomas J. Cook, P.E.
Potts, Minter and Associates, P.C.
3520 S. Courthouse Road, Suite B
Richmond, VA 23236

Project No. 07:7340

Reference: Construction Certification
Williamsburg Dodge BMP Facility
Williamsburg, Virginia

Dear Mr. Cook:

Engineering Consulting Services, Ltd. (ECS, Ltd.) is pleased to provide you with the results of our assessment regarding construction certification for the earth dam at the referenced property. Based on results of the compaction density tests conducted by ECS, Ltd. in July 2000, our review of a site drawing received from Potts, Minter and Associates, P.C. showing the original cross section design of the structure, and our site inspection on December 23, 2004, the dam appears to have been constructed in accordance with the original project specifications. The site inspection indicated that the current slopes dam, intake structure, abutment contacts, and outlet structure of the dam appeared to be structurally stable with no signs of erosion, corrosion, crack, settlements or bulges. A signed Construction Certification Form is enclosed.

Further, based on our discussion, review of a modification drawing prepared by AES, and the above site inspection, please note the following regarding additional current conditions of dam:

1. The elevation of the top of the dam has been reduced by approximately two feet. The entire surface of the upstream slope and vegetative cover of part of the surface of the downstream slope has been scarified with heavy equipment. The thickness of the scarified layer on the upstream slope is not known. We recommend that the slopes be compacted and tested as appropriate.

Norge Neighborhood

108 Ingram Road, Unit 1 • Williamsburg, Virginia 23188 • (757) 229-6677 • Fax (757) 229-9978
Offices: Richmond, VA • Chesapeake, VA • Washington, D.C. • Williamsburg, VA • Roanoke, VA • Fredericksburg, VA • Danville, VA • Winchester, VA
Aberdeen, MD • Baltimore, MD • Frederick, MD • Research Triangle Park, NC • Wilmington, NC • Charlotte, NC • Greensboro, NC • Greenville, SC • Atlanta, GA

Dodge Responsibility, unless future improvements will impact the Norge Neigh.

2. Numerous trees with trunks up to 1 inch with potentially deep roots were found throughout the downstream slope of the dam and adjacent area. All of these trees should be removed from the embankment and adjacent areas extending to at least 25 feet beyond the embankment toe and abutment contacts. The root systems should be extracted and the excavated volume should be replaced and compacted with material similar to the surrounding area. In addition, all seedlings, vine cover, and brush should be removed at the first opportunity to allow for future inspection and maintenance.

3. At least two 1-foot diameter burrows were found on the downstream slope. Burrowing animals, if found on the slope, should be removed from the area, and all burrows on the slope should be backfilled and compacted.

Interior to be regraded, NN responsible. Shared

4. Grass is currently not found on the slopes of the dam and other areas of the BMP facility. Grass should be established and maintained at least 6 inches in height at all times on slopes of the dam.

5. The BMP facility should be inspected at least once every year and maintenance procedure should be performed accordingly.

We appreciate the opportunity to provide you these services. If there are questions regarding this report, or a need for further information, please contact us at 757-229-6677.

Respectfully submitted,

ENGINEERING CONSULTING SERVICES, LTD.

Khoi T. Nguyen, P.E.
Sr. Project Engineer

Michael J. Galli, P.E.
Principal

Enclosures: Construction Certification Form

COMMONWEALTH OF VIRGINIA
KHOI T. NGUYEN
No. 025706
12/23/04
PROFESSIONAL ENGINEER

ENGINEERING CONSULTING SERVICES, LTD.
Geotechnical • Construction Materials • Environmental

December 23, 2004

Mr. Thomas J. Cook, P.E.
Potts, Minter and Associates, P.C.
3520 S. Courthouse Road, Suite B
Richmond, VA 23236

Project No. 07:7340

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Offices: Richmond, VA • Chesapeake, VA • Washington, D.C. • Williamsburg, VA • Roanoke, VA • Fredericksburg, VA • Danville, VA • Winchester, VA
Aberdeen, MD • Baltimore, MD • Frederick, MD • Research Triangle Park, NC • Wilmington, NC • Charlotte, NC • Greensboro, NC • Greenville, SC • Atlanta, GA

Construction Certification
Williamsburg Dodge BMP Facility
Project No. 07:7340

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Respectfully submitted,

ENGINEERING CONSULTING SERVICES, LTD.

Khoi T. Nguyen, P.E.
Sr. Project Engineer

Michael J. Galli, P.E.
Principal

Enclosures: Construction Certification Form

COMMONWEALTH OF VIRGINIA
KHOI T. NGUYEN
No. 025706
12/23/04
PROFESSIONAL ENGINEER

FAX COVER SHEET

Potts,Minter and Associates, P.C.
3520 Courthouse Road
Richmond, Virginia 23236
Phone #: 804-745-2876
Fax #: 804-745-9571

SEND TO James City County-Environmental Div.	*From* Tom Cook
Attention Scott Thomas	*Date* December 10, 2004
Fax number 757-259-4032	

Re: Williamsburg Dodge -BMP Certification

Total pages, including cover : 7

COMMENTS

Scott,

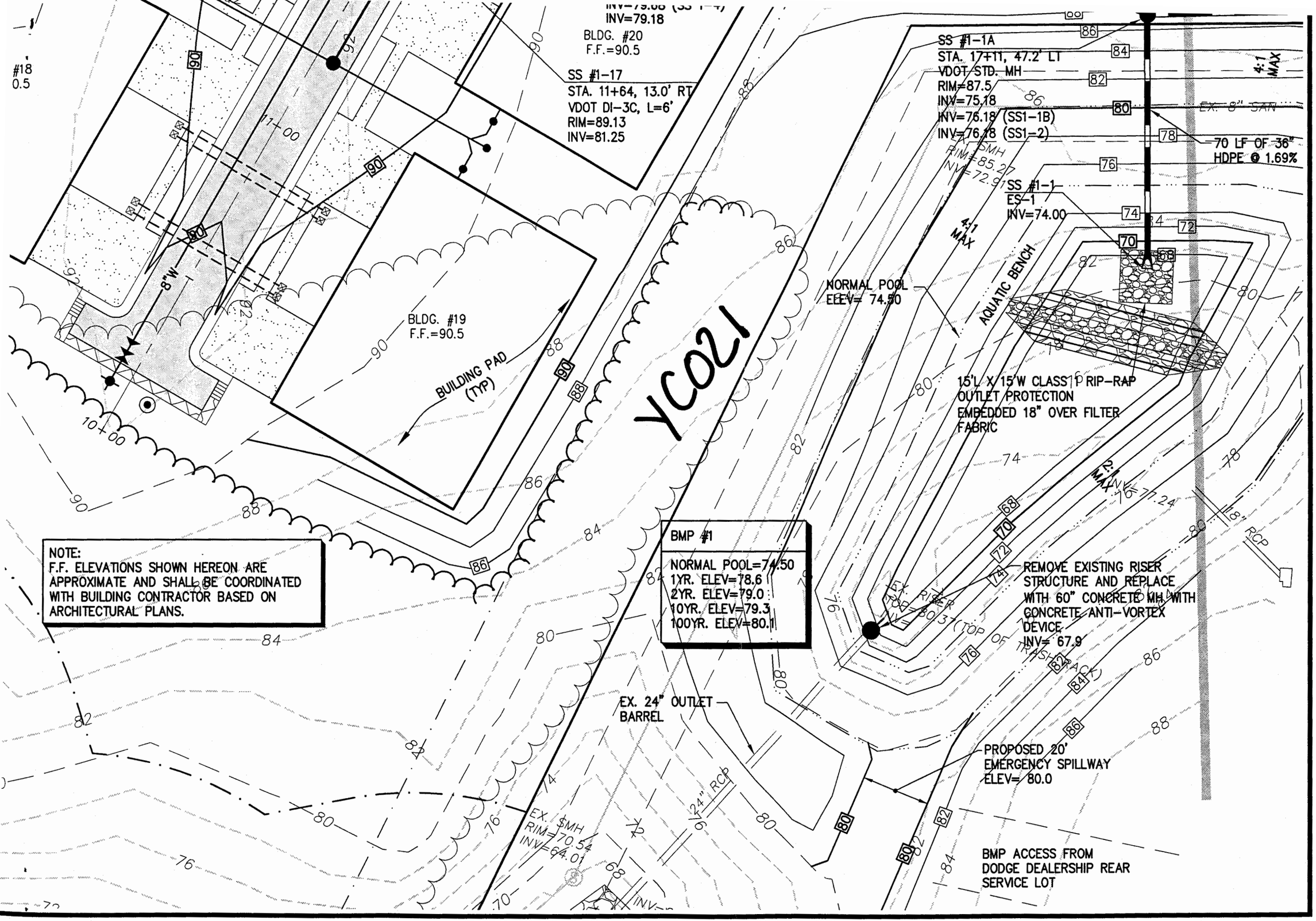
Attached is the Record Drawing/Construction Certification form for Williamsburg Dodge on Richmond Road. Also, attached is a field report by ECS,Ltd certifying the BMP dam compaction.

Please review this information and let me know if it is sufficiant to release the owner's bond County is holding on the BMP. Considering the BMP is under modification to accommodate runoff from an adjacent development and the dam was compacted to per the design specification, the release of the owner's surety bond should not present any liability for the County.

If you have any questions about the attached information please don't hesitate to call. Thanks.

Tom Cook

Cc: John Dodson, Owner



NOTE:
F.F. ELEVATIONS SHOWN HEREON ARE APPROXIMATE AND SHALL BE COORDINATED WITH BUILDING CONTRACTOR BASED ON ARCHITECTURAL PLANS.

CONSULTING ENGINEER
WILLIAMSBURG • RICHMOND

GRADING AND DRAINAGE PLAN

NORGE NEIGHBORHOOD

VIRGINIA CITY/COUNTY

Designed	Drawn
JAG	SRL
Scale	Date
1"=25'	4/28/0

Project No.
9286-01

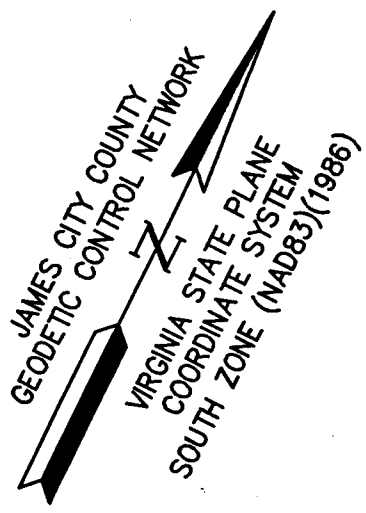
Drawing No.
11

CERTIFICATION OF SOURCE OF TITLE

THE PROPERTY SHOWN ON THIS PLAT STANDING IN THE NAME OF JOHN E. DODSON, BEING ALL OF TAX PARCEL (24-1)(1-8), WAS CONVEYED TO JOHN E. DODSON FROM OLDE GREENWICH COPORATION, A VIRGINIA CORPORATION, BY DEED DATED OCTOBER 4, 1997, RECORDED AS INSTRUMENT #970016719, AND FROM EVELYN H. ANDERSON, EXECUTOR UNDER THE WILL OF FREDERICK A. HOAR, BY DEED DATED NOVEMBER 17, 1997, RECORDED AS INSTRUMENT #970018637, BOTH DEEDS BEING OF RECORD IN THE CLERK'S OFFICE OF THE CIRCUIT COURT OF THE COUNTY OF JAMES CITY.

GENERAL NOTES:

1. THE PROPERTY SHOWN HEREON IS TAX PAR
2. ALL CENTERLINES OF JCSA EASEMENTS ARE. UTILITY CORRESPONDING TO THE CONSTRUCT
3. UTILITY EASEMENTS DENOTED AS "JCSA UTI HEREBY DEDICATED FOR THE EXCLUSIVE US SERVICE AUTHORITY AND THE PROPERTY OV SERVICE PROVIDERS DESIRING TO USE THES THE EXCEPTION OF PERPENDICULAR UTILITY OBTAIN AUTHORIZATION FOR ACCESS AND U THE PROPERTY OWNER. ADDITIONALLY, JCSA RESPONSIBLE FOR ANY DAMAGE TO IMPROV EASEMENT, FROM ANY CAUSE.



NORGE NEIGHBORHOOD, LLC
LOT 1
BOUNDARY LINE ADJUSTMENT
BETWEEN THE PROPERTIES OF
NORGE NEIGHBORHOOD, LLC AND
GEORGE C. FORD, JR. & SHARYN L. FORD
INSTR. #040017945
INSTR. #040009555
PARCEL ID #(23-2)(1-50)
ZONED: MU WITH PROFFERS

EXISTING 30' JCSA UTIL
D.B.187, PG.758, D.B. 2

20' JCSA UTILITY EASEMENT

CENTERLINE OF 20' UTILITY EASEMENT HEREBY CONVEYED TO JCSA
7,220 S.F.±
0.166 AC.±

N70°03'10"E 138.01'

48.48' (TIE)

S69°46'2

N43°34'51"E 54.03'(TIE)

S20°13'33"E 9.92'

S20°13'33"E 13.93'(TIE)

N70°03'10"E 19.63'(TIE)

S06°22'18"W 323.63'

N06°08'56"E 213.13'

EXIS
UTIL
D.B.
D.B.

PORTION OF EXISTING 25' JCSA SEWER EASEMENT HEREBY EXTINGUISHED
D.B. 214, PG. 266
7,660 S.F.±
0.176 AC.±

N06°08'56"E 30.31'(TIE)

S28°11'58"W 54.04'(TIE)

N06°22'18"E 13.80'(TIE)

IPF

IPF

S77°16'57"W 261.61'

COLONIAL HERITAGE, L.L.C.
PHASE 1, SECTION 2
COMMON OPEN SPACE #2
INSTR. # 03000331,
LP #030000329,
LP #030023467
PARCEL ID #2320900001C
ZONED: MU (WITH PROFFERS)

S75°26'30"W 6

GRAPHIC SCALE

60' 0' 60' 120'

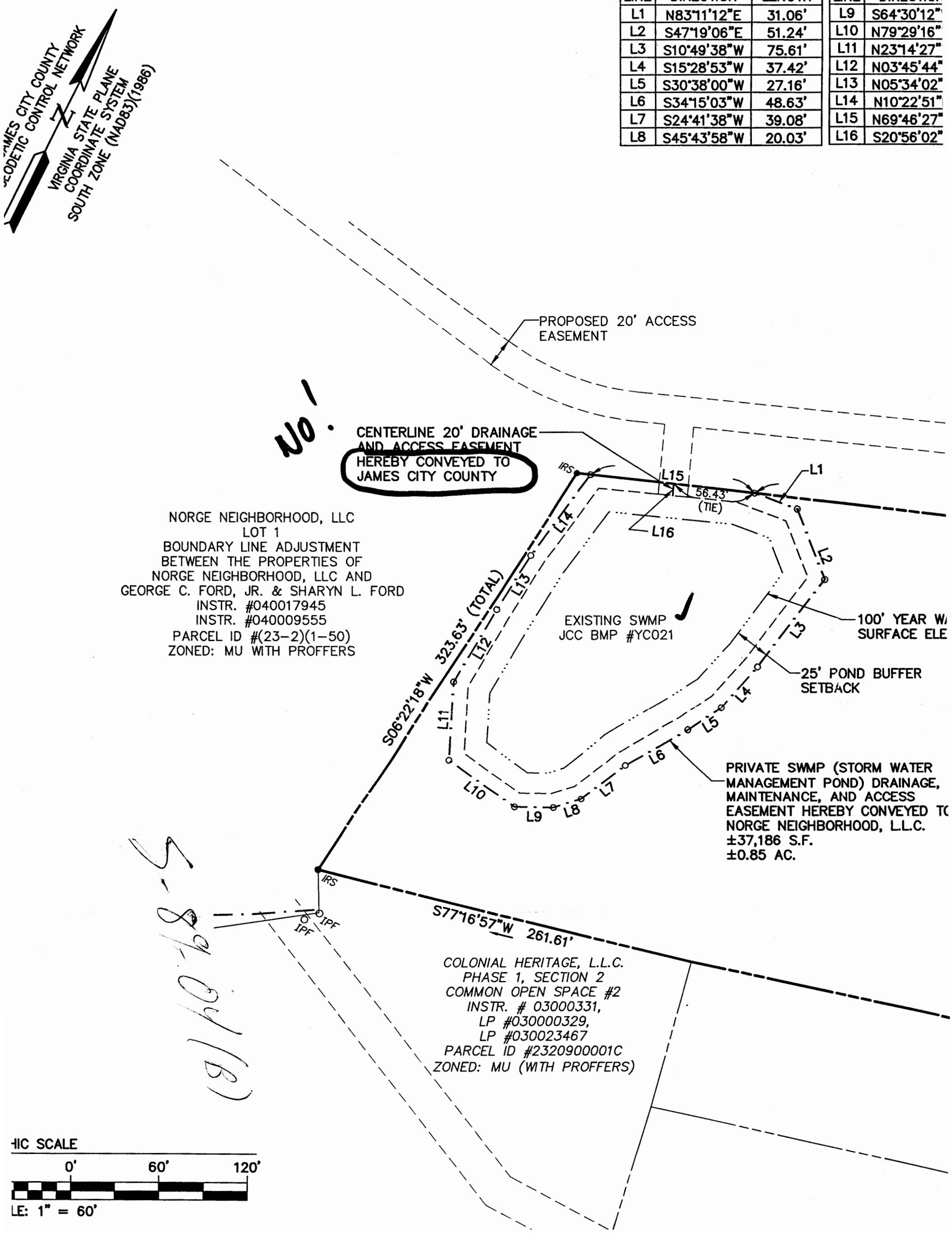
SCALE: 1" = 60'

N/F
C & J, LLC
INSTR. #970007014
PARCEL ID #(24-1)(1-10)
ZONED: B1

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

PLAT SHOWING
EASEMENTS TO BE CONV
JOHN E. DODSC
TO
JAMES CITY COUN

LINE TABLE				
LINE	DIRECTION	LENGTH	LINE	DIRECTION
L1	N83°11'12"E	31.06'	L9	S64°30'12"
L2	S47°19'06"E	51.24'	L10	N79°29'16"
L3	S10°49'38"W	75.61'	L11	N23°14'27"
L4	S15°28'53"W	37.42'	L12	N03°45'44"
L5	S30°38'00"W	27.16'	L13	N05°34'02"
L6	S34°15'03"W	48.63'	L14	N10°22'51"
L7	S24°41'38"W	39.08'	L15	N69°46'27"
L8	S45°43'58"W	20.03'	L16	S20°56'02"



No. 8 of 8 (8)

ES
LTING ENGINEERS
SBURG RICHMOND
5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax (757) 220-8994

PLAT SHOWING
EASEMENTS TO BE CONVEYED FROM
JOHN E. DODSON
TO
JAMES CITY COUNTY,
JAMES CITY SERVICE AUTHORITY, AND
NORGE NEIGHBORHOOD, L.L.C.

STONEHOUSE DISTRICT JAMES CITY COUNTY VIRGIN

Williamsburg Dodge Site
SP-124-99

Stormwater Management Plan

Hydrology & Hydraulics
Pond Liner Manufacturers Data
Geotechnical Report

JUN 2000
RECEIVED
ENVIRONMENTAL DIVISION

BENGTSON, DEBELL & ELKIN, LTD.
808 Moorefield Park Drive, Suite 220
RICHMOND, VIRGINIA 23236
(804) 320-2667

JOB Williamsburg Dodge
SHEET NO. 2 OF
CALCULATED BY TJC DATE
CHECKED BY DATE Revised 7-18-2000 Revised 9-1-00
SCALE

FINAL REVISED COMPS.

Post Developed Condition

- Project Area = 6.4 ac.

  - impervious area = 150,625 s.f. = 3.46 ac.
  - pervious area = 2.94 ac.

  INC. IMP AREA ~~0.52 AC (179,000)~~

- Wt. $C = \frac{(3.46 \times .9) + (2.94 \times .3)}{6.4 \text{ ac.}} = \frac{3.996}{6.4} = \underline{0.62}$

- Off site area = 16.1 − 6.4 = 9.7 ac, C = 0.40
  (1.1 ac from Route 60, 8.6 off site)

- Develop $C = \frac{(.4 \times 9.7) + (6.4 \times 0.62) + (.8 \times .7)}{\cancel{16.1}\ 16.8 \text{ ac}} = \cancel{0.49}\ (.50)$

post tc calc. = pre tc calc. because off-site surface characteristics are unchanged & BMP area on-site left in natural state.

Q_2 =	(.50)(.49)(3.2 in/hr)[16.8]	=	25.2 cfs	(26.9)
Q_{10} =	(.49)(4.5 in/hr.)(16.1)	=	35.5 cfs	(37.8)
Q_{50} =	(1.1)(.49)(5.7 in./hr.)(")	=	49.5 cfs	(52.7)
Q_{100} =	(1.25)(.49)(6.2)(")	=	61.1 cfs	(65.1)
Q_{25} =	(.49)(5.1)(")	=	40.2 cfs	(42.8)

Denotes revisions

Quick TR-55 Ver.5.46 S/N:
Executed: 09:03:11 09-05-2000

Williamsburg Dodge

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

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

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

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
route 60	0.800	1.80						
offsite	0.350	8.60						
onsite	0.620	6.40						
		16.8 Ac.	21.00	0.501	0.501	3.200	16.80	26.94

Quick TR-55 Ver.5.46 S/N:
Executed: 09:03:11 09-05-2000

Williamsburg Dodge

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

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

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

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
route 60	0.800	1.80						
offsite	0.350	8.60						
onsite	0.620	6.40						
		16.8	21.00	0.501	0.501	4.400	16.80	37.04

Quick TR-55 Ver.5.46 S/N:
Executed: 09:03:11 09-05-2000

Williamsburg Dodge

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

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

RETURN FREQUENCY = 25 years
'C' adjustment, k = 1
Adj. 'C' = Wtd.'C' x 1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
route 60	0.800	1.80						
offsite	0.350	8.60						
onsite	0.620	6.40						
			21.00	0.501	0.501	5.100	16.80	42.93

Quick TR-55 Ver.5.46 S/N:
Executed: 09:03:11 09-05-2000

Williamsburg Dodge

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

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

RETURN FREQUENCY = 50 years
'C' adjustment, k = 1.1
Adj. 'C' = Wtd.'C' x 1.1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
route 60	0.800	1.80						
offsite	0.350	8.60						
onsite	0.620	6.40						
			21.00	0.501	0.551	5.700	16.80	52.78

Quick TR-55 Ver.5.46 S/N:
Executed: 09:03:11 09-05-2000

Williamsburg Dodge

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

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

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

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
route 60	0.800	1.80						
offsite	0.350	8.60						
onsite	0.620	6.40						
			21.00	0.501	0.626	6.300	16.80	66.29

Quick TR-55 Ver.5.46 S/N:
Executed: 09:03:11 09-05-2000

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

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

Williamsburg Dodge

Area = 16.80 acres Tc = 21.00 minutes

Frequency (years)	Adjusted 'C'	Duration minutes	Intens. in/hr	Qpeak cfs	Allowable cfs	VOLUMES Inflow (cu.ft.)	VOLUMES Storage (cu.ft.)
2	0.501	24	3.000	25.25	21.50	36,366	7,341
10	0.501	24	4.100	34.51	30.20	49,700	8,930
50	0.551	34	4.420	40.93	38.50	83,494	19,969
100	0.626	24	5.900	62.08	52.10	89,399	19,064
25	0.501	26	4.600	38.72	34.30	60,408	12,045

EXECUTED: 09-05-2000 14:23:26 Post Dev Return Freq: 2 years

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*  Williamsburg Dodge   *
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Inflow Hydrograph: car\CAR2DEV .HYD
Rating Table file: car\OUTFLOX2.PND

----INITIAL CONDITIONS----
Elevation = 76.40 ft
Outflow = 0.08 cfs
Storage = 12,698 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + O (cfs)
70.00	0.0	0	0.0	0.0
70.50	0.0	13	0.4	0.4
71.00	0.0	105	3.5	3.5
71.50	0.0	304	10.1	10.1
72.00	0.0	593	19.8	19.8
72.50	0.0	1,017	33.9	33.9
73.00	0.0	1,628	54.3	54.3
73.50	0.0	2,451	81.7	81.7
74.00	0.0	3,502	116.7	116.7
74.50	0.0	4,818	160.6	160.6
75.00	0.0	6,434	214.4	214.4
75.50	0.0	8,364	278.8	278.8
76.00	0.0	10,617	353.8	353.8
76.50	0.1	13,218	440.5	440.6
77.00	0.2	16,194	539.7	539.9
77.50	0.2	19,701	656.6	656.8
78.00	0.3	23,924	797.3	797.6
78.50	11.4	28,958	965.1	976.5
79.00	37.8	34,908	1163.4	1201.2
79.50	73.0	41,633	1387.5	1460.5
80.00	92.3	48,958	1631.6	1723.9
80.50	94.6	56,974	1898.7	1993.3
81.00	96.8	65,783	2192.3	2289.1

Time increment (t) = 1.0 min.

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

Pond File: car\OUTFLOX2.PND
Inflow Hydrograph: car\CAR2DEV .HYD
Outflow Hydrograph: car\OUT2X .HYD

Starting Pond W.S. Elevation = 76.40 ft

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

Peak Inflow = 25.25 cfs
Peak Outflow = 20.21 cfs
Peak Elevation = 78.67 ft

2-YEAR

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

Initial Storage	=	12,698 cu-ft
Peak Storage From Storm	=	18,246 cu-ft
Total Storage in Pond	=	30,944 cu-ft

>>>>> Warning, initial pond outflow > 1st inflow ordinate. <<<<<

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*  Williamsburg Dodge  *
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Inflow Hydrograph: car\CAR10DEV.HYD
Rating Table file: car\OUTFLOX2.PND

----INITIAL CONDITIONS----
Elevation = 76.40 ft
Outflow = 0.08 cfs
Storage = 12,698 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + O (cfs)
70.00	0.0	0	0.0	0.0
70.50	0.0	13	0.4	0.4
71.00	0.0	105	3.5	3.5
71.50	0.0	304	10.1	10.1
72.00	0.0	593	19.8	19.8
72.50	0.0	1,017	33.9	33.9
73.00	0.0	1,628	54.3	54.3
73.50	0.0	2,451	81.7	81.7
74.00	0.0	3,502	116.7	116.7
74.50	0.0	4,818	160.6	160.6
75.00	0.0	6,434	214.4	214.4
75.50	0.0	8,364	278.8	278.8
76.00	0.0	10,617	353.8	353.8
76.50	0.1	13,218	440.5	440.6
77.00	0.2	16,194	539.7	539.9
77.50	0.2	19,701	656.6	656.8
78.00	0.3	23,924	797.3	797.6
78.50	11.4	28,958	965.1	976.5
79.00	37.8	34,908	1163.4	1201.2
79.50	73.0	41,633	1387.5	1460.5
80.00	92.3	48,958	1631.6	1723.9
80.50	94.6	56,974	1898.7	1993.3
81.00	96.8	65,783	2192.3	2289.1

Time increment (t) = 1.0 min.

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

Pond File: car\OUTFLOX2.PND
Inflow Hydrograph: car\CAR10DEV.HYD
Outflow Hydrograph: car\OUT10X .HYD

Starting Pond W.S. Elevation = 76.40 ft

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

10-YEAR

Peak Inflow	=	34.51 cfs
Peak Outflow	=	30.15 cfs
Peak Elevation	=	78.86 ft

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

Initial Storage	=	12,698 cu-ft
Peak Storage From Storm	=	20,486 cu-ft
Total Storage in Pond	=	33,184 cu-ft

>>>>> Warning, initial pond outflow > 1st inflow ordinate. <<<<<

EXECUTED: 09-05-2000 14:23:27 Return Freq: 25 years

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*  Williamsburg Dodge  *
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Inflow Hydrograph: car\CAR25DEV.HYD
Rating Table file: car\OUTFLOX2.PND

----INITIAL CONDITIONS----
Elevation = 76.40 ft
Outflow = 0.08 cfs
Storage = 12,698 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + O (cfs)
70.00	0.0	0	0.0	0.0
70.50	0.0	13	0.4	0.4
71.00	0.0	105	3.5	3.5
71.50	0.0	304	10.1	10.1
72.00	0.0	593	19.8	19.8
72.50	0.0	1,017	33.9	33.9
73.00	0.0	1,628	54.3	54.3
73.50	0.0	2,451	81.7	81.7
74.00	0.0	3,502	116.7	116.7
74.50	0.0	4,818	160.6	160.6
75.00	0.0	6,434	214.4	214.4
75.50	0.0	8,364	278.8	278.8
76.00	0.0	10,617	353.8	353.8
76.50	0.1	13,218	440.5	440.6
77.00	0.2	16,194	539.7	539.9
77.50	0.2	19,701	656.6	656.8
78.00	0.3	23,924	797.3	797.6
78.50	11.4	28,958	965.1	976.5
79.00	37.8	34,908	1163.4	1201.2
79.50	73.0	41,633	1387.5	1460.5
80.00	92.3	48,958	1631.6	1723.9
80.50	94.6	56,974	1898.7	1993.3
81.00	96.8	65,783	2192.3	2289.1

Time increment (t) = 1.0 min.

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*                      *
*  Williamsburg Dodge  *
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Inflow Hydrograph: car\CAR50DEV.HYD
Rating Table file: car\OUTFLOX2.PND

----INITIAL CONDITIONS----
Elevation = 76.40 ft
Outflow = 0.08 cfs
Storage = 12,698 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + O (cfs)
70.00	0.0	0	0.0	0.0
70.50	0.0	13	0.4	0.4
71.00	0.0	105	3.5	3.5
71.50	0.0	304	10.1	10.1
72.00	0.0	593	19.8	19.8
72.50	0.0	1,017	33.9	33.9
73.00	0.0	1,628	54.3	54.3
73.50	0.0	2,451	81.7	81.7
74.00	0.0	3,502	116.7	116.7
74.50	0.0	4,818	160.6	160.6
75.00	0.0	6,434	214.4	214.4
75.50	0.0	8,364	278.8	278.8
76.00	0.0	10,617	353.8	353.8
76.50	0.1	13,218	440.5	440.6
77.00	0.2	16,194	539.7	539.9
77.50	0.2	19,701	656.6	656.8
78.00	0.3	23,924	797.3	797.6
78.50	11.4	28,958	965.1	976.5
79.00	37.8	34,908	1163.4	1201.2
79.50	73.0	41,633	1387.5	1460.5
80.00	92.3	48,958	1631.6	1723.9
80.50	94.6	56,974	1898.7	1993.3
81.00	96.8	65,783	2192.3	2289.1

Time increment (t) = 1.0 min.

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

Pond File: car\OUTFLOX2.PND
Inflow Hydrograph: car\CAR50DEV.HYD
Outflow Hydrograph: car\OUT50X .HYD

Starting Pond W.S. Elevation = 76.40 ft

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

Peak Inflow = 40.93 cfs
Peak Outflow = 40.65 cfs
Peak Elevation = 79.04 ft

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

Initial Storage = 12,698 cu-ft
Peak Storage From Storm = 22,756 cu-ft

Total Storage in Pond = 35,453 cu-ft

>>>>> Warning, initial pond outflow > 1st inflow ordinate. <<<<<

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*  Williamsburg Dodge  *
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Inflow Hydrograph: car\C100D .HYD
Rating Table file: car\OUTFLOX2.PND

----INITIAL CONDITIONS----
Elevation = 76.40 ft
Outflow = 0.08 cfs
Storage = 12,698 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + 0 (cfs)
70.00	0.0	0	0.0	0.0
70.50	0.0	13	0.4	0.4
71.00	0.0	105	3.5	3.5
71.50	0.0	304	10.1	10.1
72.00	0.0	593	19.8	19.8
72.50	0.0	1,017	33.9	33.9
73.00	0.0	1,628	54.3	54.3
73.50	0.0	2,451	81.7	81.7
74.00	0.0	3,502	116.7	116.7
74.50	0.0	4,818	160.6	160.6
75.00	0.0	6,434	214.4	214.4
75.50	0.0	8,364	278.8	278.8
76.00	0.0	10,617	353.8	353.8
76.50	0.1	13,218	440.5	440.6
77.00	0.2	16,194	539.7	539.9
77.50	0.2	19,701	656.6	656.8
78.00	0.3	23,924	797.3	797.6
78.50	11.4	28,958	965.1	976.5
79.00	37.8	34,908	1163.4	1201.2
79.50	73.0	41,633	1387.5	1460.5
80.00	92.3	48,958	1631.6	1723.9
80.50	94.6	56,974	1898.7	1993.3
81.00	96.8	65,783	2192.3	2289.1

Time increment (t) = 1.0 min.

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

Pond File: car\OUTFLOX2.PND
Inflow Hydrograph: car\C100D .HYD
Outflow Hydrograph: car\OUT100X .HYD

Starting Pond W.S. Elevation = 76.40 ft

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

100-YEAR

Peak Inflow = 62.08 cfs
Peak Outflow = 58.10 cfs
Peak Elevation = 79.29 ft

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

Initial Storage	=	12,698 cu-ft
Peak Storage From Storm	=	26,088 cu-ft
Total Storage in Pond	=	38,785 cu-ft

>>>>> Warning, initial pond outflow > 1st inflow ordinate. <<<<<

PROJECT: Williamsburg Dodge
SECTION: DATE: 9-1-00
DESIGNER: TJC

POTTS, MINTER AND ASSOCIATES P.C.
Engineers, Land Surveyors, Land Planners
3520 S. Courthouse Road Suite B Richmond, Va. 23236
Phone: (804) 745-2876 Fax: 745-9571

STORM SEWER DESIGN COMPUTATIONS

STR. NO. FROM	Pipe #	STR. NO. TO	CULV. TYPE	AREA DES.	A ACRES	C	CA INCREMENT	CA ACCUMULATED	TIME OF CONCENTRATION TO PIPE (MIN)	TIME OF CONCENTRATION IN PIPE	TIME OF CONCENTRATION TOTAL TC	I_{10}	RUNOFF Q_{10} (CFS)	DESIGN DIA. IN.	DESIGN LENGTH (FT.)	DESIGN N	DESIGN SLOPE (%)	DESIGN CAPACITY C.F.S.	DESIGN VELOCITY (FT/SEC)	DESIGN FLOW TIME (MIN)	DESIGN INVERT IN	DESIGN INVERT OUT	TOP ELEV.	REMARKS
17	18	16	RCP	11	.7	.8	.56	.56	6	.15	6.15	7.0	3.92	15	68	.013	1.51	8.0	7	10	88.23	87.20	91.10	
16	15	14	RCP	2	.5	.6	.30	.86	6.15	.85	7	6.7	5.76	15	176	.013	.40	4.2	3.35	53	87.10	86.39	92.00	
14	13	12	"	3	.62	.65	.40	1.26	7	-1	8	6.6	8.32	15	184	"	.60	5.0	4	46	86.29	85.15	91.10	
12	11	10	"	5	.17	.9	.15	1.41	8.0	.5	8.5	6.5	9.16	15	254	"	1.53	8.1	6.4	40	85.05	81.16	85.35	
10	9	8	"	7	.42	.9	.39	1.80	8.5	—	8.5	6.5	11.70	18	127	"	.80	9.6	5.2	24	81.06	80.04	85.35	
8	7	BMP	"	6	.62	.9	.56	2.36	8.5	.5	9.0	6.3	14.87	24	36	"	.50	16.0	5.0	7.2	77.10	77.0		BMP Arm. WSL = 76.40

SHEET ___ OF ___
J.N. ___

PROJECT: Williamsburg Dodge
SECTION: _____ DATE: Sept. 1, 2000
DESIGNER: TJC

POTTS, MINTER AND ASSOCIATES P.C.
Engineers, Land Surveyors, Land Planners
3520 S. Courthouse Road Suite B Richmond, Va. 23236
Phone: (804) 745-2876 Fax: 745-9571

HYDRAULIC GRADE LINE COMPUTATIONS

STRUCT. NO.	OUTLET WATER SURFACE ELEV.	Do	Qo	Lo	Sfo %	Hf	JUNCTION LOSS Vo	Ho	Qi	Vi	QiVi	$\frac{Vi^2}{2g}$	Hi	Angle	H_Δ	Ht	1.3 Ht	0.5 Ht	FINAL H	INLET WATER SURFACE ELEV.	RIM ELEV.	
8	78.60	24	14.9	36	.41	.15	5.0	.10	11.70	5.2	60.84	.42	.15	70	.26	.54	.70	.35	.50	79.10	85.35	
10	79.10	18	11.70	127	1.2	1.52	5.2	.11	9.16	6.4	58.62	.64	.22	90	.45	.78	1.01	.51	2.03	81.13	85.35	
12	81.13	15	9.16	254	1.95	4.95	6.4	.16	8.32	4	33.28	.25	.09	15	.03	.28	.36	.18	5.13	86.26	91.10	
14	86.26	15	8.32	189	1.60	3.02	4	.06	5.76	3.35	19.30	.17	.06	40	.06	.18	.23	.12	3.14	89.40	92.0	
16	89.40	15	5.76	176	.78	1.37	3.35	.04	3.92	7	27.44	.76	.27	40	.29	.60	.78	.39	1.76	91.16	91.10	
17	91.16	15	3.35	68	.26	.18	7	.19	3.92	—	—	—	—	—	—	.19	.25	.12	.30	91.46	92.15	ok
5	79.9	21	11.83	30	.54	.16	4.5	.08	9.87	8	79	.99	.35	15	.10	.53	.69	.34	.50	80.40	87.0	
3	80.40	15	9.87	130	2.3	2.99	8	.25	9.22	7.5	69.15	.87	.31	25	.19	.75	.98	.49	3.48	83.96	88.5	
1	83.96	15	9.22	208	2	4.16	7.5	.22	—	—	—	—	—	—	—	.22	.29	—	4.45	88.41	90.0	ok
	← assumed full pipe flow @ Ex. MH																					
19	89.75	15	4.1	44	1.71	.57	5.7	.13	4.1	—	—	—	—	—	—	.13	.17	.08	.65	90.40	90.00	ok

* contained in ditch. E/P Rate 60 = 92.+ feet.

$Hi = 0.35 \frac{Vi^2}{2g}$ $Ho = 0.25 \frac{Vo^2}{2g}$ $H_\Delta = K \frac{Vi^2}{2g}$

FINAL $H = Hf + Ht$
$Ht = Ho + Hi + H_\Delta$

90° K=0.70	40° K=0.38
80° K=0.66	30° K=0.28
70° K=0.61	25° K=0.22
60° K=0.55	20° K=0.16
50° K=0.47	15° K=0.10

SHEET ___ OF ___
J.N. _____

POTTS, MINTER AND ASSOCIATES, P.C.
ENGINEERS, LAND SURVEYORS
LAND PLANNERS

RICHARD T. MINTER, L.S.
WAYNE K. TOY, L.S.
WILLIAM L. JETER, SR.

TO:

757-259-4032
Facsimile Phone Number

Scott Thomas, PE

FROM: Potts, Minter & Associates, P.C.
3520 S. Courthouse Road, Suite B
Richmond, Virginia 23236

Office Phone Number: (804) 745-2876
Facsimile Number: (804) 745-9571

Tom Cook
Name

James City County - Environmental Div.
Company

3-3-00
Date

Re: Williamsburg Dodge:

Total number of pages 20 (including cover sheet)
Please call if you do not receive all transmitted pages.

Comments

Contents, 1) County comments noted with responses (2 sheets)
2) Steep slope exception letter (1)
3) Outfall channel X-section detail (1)
4) 1 hr - 24 hr. comps. (15 sheets)

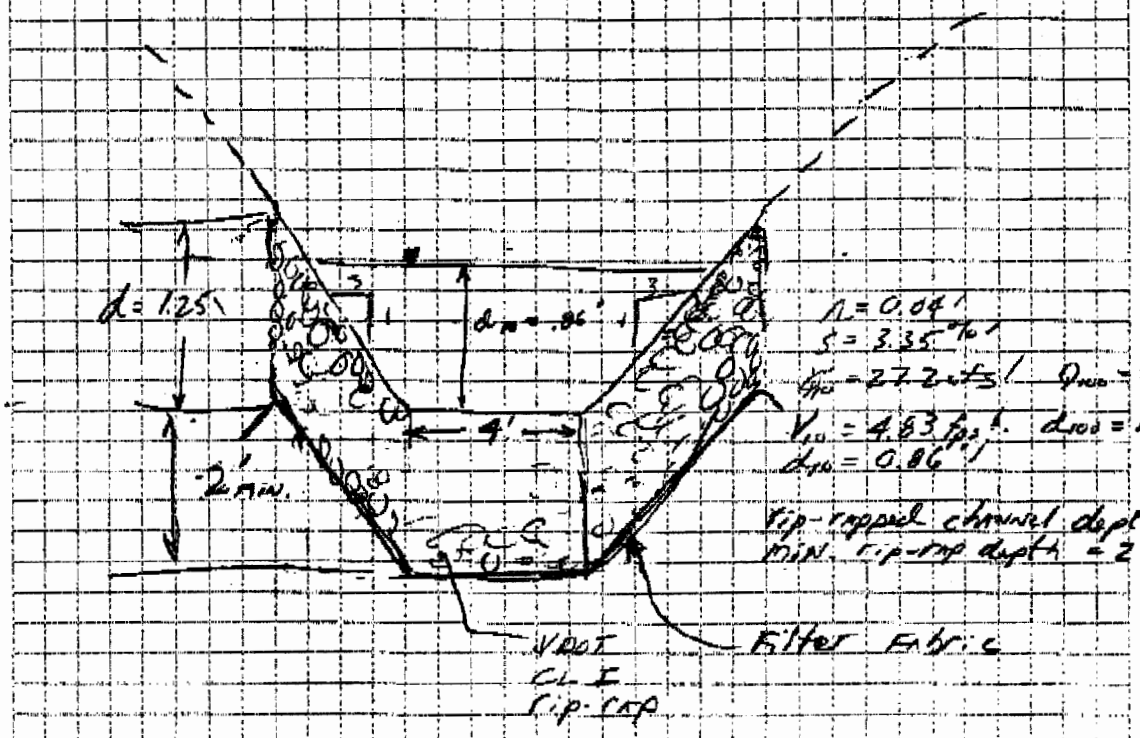
Call if you have any questions after looking this information over. Thanks.

Thanks, Have A Wonderful Day!!!!!

3520 Courthouse Road • Richmond, Virginia 23236 • Phone (804) 745-2876 • FAX (804) 745-9571

Revised Pond H&H

OUTFALL CHANNEL DESIGN



Outfall channel improvement section (on sheet 3 of revised plan)

Natural Channel

Uniform Flow:	Normal	Critical		
Slope (ft/ft):	0.0335	0.0293	Flow (cfs):	27.20 ← Q10
Velocity (ft/sec):	4.3280	4.1201	Length (ft):	40.00
Depth (ft):	1.0308	1.0565	Travel time (sec):	9.24
Depth (in):	12.3695	12.6780	(min):	0.15

Manning's n:	0.0400 NATURAL NOT RIPRAP.
Hydraulic Radius:	0.5084
Wetted Area (sq ft):	6.2846
Wetted Perimeter (ft):	12.3622
Top Width (ft):	12.1879

Hit any key to change parameter.
Return goes to menu:

Williamsburg Dodge

Quick TR-55 Version: 5.46 S/N:

Return Frequency: 1 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 03-03-2000 08:39:06
Watershed file: --> CAR\CAR .MOP
Hydrograph file: --> CAR\CAR1.HYD

21 MIN. 0 MIN.

>>>> Input Parameters Used to Compute Hydrograph <<<<

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used	
	16.10	69.0	0.30	0.30	2.80	0.57	I.32	.32

* Travel time from subarea outfall to composite watershed outfall point.
I -- Subarea where user specified interpolation between Ia/p tables.

Total area = 16.10 acres or 0.02516 sq.mi
Peak discharge = 6 cfs

>>>> Computer Modifications of Input Parameters <<<<<

Subarea Description	Input Values Tc (hr)	* Tt (hr)	Rounded Values Tc (hr)	* Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p Messages
	0.35	0.29	0.30	0.30	Yes	--

* Travel time from subarea outfall to composite watershed outfall point.

DA = 16.10 AC
CN = 69
Tc = 21 MIN

RUNOFF 0.57"
Q_{PEAK} = 7 cfs

VOLUME = 0.759 AC-FT = 33,062.04 CF

PRE 2 = 21.4 CFS
POST 2 = 25.15 CFS
ROUTED 2 = 17.34 CFS

Quick TR-55 Version: 5.46 S/N:

Return Frequency: 1 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 03-03-2000 08:39:06
Watershed file: --> CAR\CAR .MOP
Hydrograph file: --> CAR\CAR1.HYD

>>>> Summary of Subarea Times to Peak <<<<

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (hrs)
	6	12.6
Composite Watershed	6	12.6

Quick TR-55 Version: 5.46 S/N:

Return Frequency: 1 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 03-03-2000 08:39:06
Watershed file: --> CAR\CAR .MOP
Hydrograph file: --> CAR\CAR1.HYD

Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 hr
	0	0	0	0	0	0	0	1	3
Total (cfs)	0	0	0	0	0	0	0	1	3

Subarea Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 hr
	5	6	6	5	3	2	2	1	1
Total (cfs)	5	6	6	5	3	2	2	1	1

Subarea Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 hr
	1	1	1	1	1	1	1	0	0
Total (cfs)	1	1	1	1	1	1	1	0	0

Subarea Description	18.0 hr	19.0 hr	20.0 hr	22.0 hr	26.0 hr
	0	0	0	0	0
Total (cfs)	0	0	0	0	0

Quick TR-55 Version: 5.46 S/N:

Return Frequency: 1 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 03-03-2000 08:39:06
Watershed file: --> CAR\CAR .MOP
Hydrograph file: --> CAR\CAR1.HYD

Time (hrs)	Flow (cfs)	Time (hrs)	Flow (cfs)
11.0	0	14.8	1
11.1	0	14.9	1
11.2	0	15.0	1
11.3	0	15.1	1
11.4	0	15.2	1
11.5	0	15.3	1
11.6	0	15.4	1
11.7	0	15.5	1
11.8	0	15.6	1
11.9	0	15.7	1
12.0	0	15.8	1
12.1	0	15.9	1
12.2	0	16.0	1
12.3	1	16.1	1
12.4	3	16.2	1
12.5	5	16.3	1
12.6	6	16.4	1
12.7	6	16.5	1
12.8	5	16.6	1
12.9	4	16.7	1
13.0	3	16.8	0
13.1	2	16.9	0
13.2	2	17.0	0
13.3	2	17.1	0
13.4	2	17.2	0
13.5	2	17.3	0
13.6	1	17.4	0
13.7	1	17.5	0
13.8	1	17.6	0
13.9	1	17.7	0
14.0	1	17.8	0
14.1	1	17.9	0
14.2	1	18.0	0
14.3	1	18.1	0
14.4	1	18.2	0
14.5	1	18.3	0

14.6	1	18.4	0
14.7	1	18.5	0

Quick TR-55 Version: 5.46 S/N:

Return Frequency: 1 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 03-03-2000 08:39:06
Watershed file: --> CAR\CAR .MOP
Hydrograph file: --> CAR\CAR1.HYD

Time (hrs)	Flow (cfs)	Time (hrs)	Flow (cfs)
18.6	0	22.4	0
18.7	0	22.5	0
18.8	0	22.6	0
18.9	0	22.7	0
19.0	0	22.8	0
19.1	0	22.9	0
19.2	0	23.0	0
19.3	0	23.1	0
19.4	0	23.2	0
19.5	0	23.3	0
19.6	0	23.4	0
19.7	0	23.5	0
19.8	0	23.6	0
19.9	0	23.7	0
20.0	0	23.8	0
20.1	0	23.9	0
20.2	0	24.0	0
20.3	0	24.1	0
20.4	0	24.2	0
20.5	0	24.3	0
20.6	0	24.4	0
20.7	0	24.5	0
20.8	0	24.6	0
20.9	0	24.7	0
21.0	0	24.8	0
21.1	0	24.9	0
21.2	0	25.0	0
21.3	0	25.1	0
21.4	0	25.2	0
21.5	0	25.3	0
21.6	0	25.4	0
21.7	0	25.5	0
21.8	0	25.6	0
21.9	0	25.7	0
22.0	0	25.8	0
22.1	0	25.9	0
22.2	0		
22.3	0		

POND-2 Version: 5.21 S/N:
EXECUTED: 03-03-2000 08:41:25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*************************************************
*                                               *
*                                               *
*  Williamsburg Dodge:1yr-24 hr.storm routing   *
*                                               *
*                                               *
*                                               *
*************************************************
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Inflow Hydrograph: car\CAR1 .HYD
Rating Table file: car\OUTFLOX1.PND ~ ?

----INITIAL CONDITIONS----
Elevation = 76.40 ft
Outflow = 0.08 cfs
Storage = 12,698 cu-ft

GIVEN POND DATA

ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)
70.00	0.0	0
70.50	0.0	13
71.00	0.0	105
71.50	0.0	304
72.00	0.0	593
72.50	0.0	1,017
73.00	0.0	1,628
73.50	0.0	2,451
74.00	0.0	3,502
74.50	0.0	4,818
75.00	0.0	6,434
75.50	0.0	8,364
76.00	0.0	10,617
76.50	0.1	13,218
77.00	0.2	16,194
77.50	0.2	19,701
78.00	0.3	23,924
78.50	11.4	28,958
79.00	37.8	34,908
79.50	73.0	41,633
80.00	92.3	48,958
80.50	94.6	56,974
81.00	96.8	65,783

INTERMEDIATE ROUTING COMPUTATIONS

2S/t (cfs)	2S/t + O (cfs)
0.0	0.0
0.1	0.1
0.6	0.6
1.7	1.7
3.3	3.3
5.7	5.7
9.0	9.0
13.6	13.6
19.5	19.5
26.8	26.8
35.7	35.7
46.5	46.5
59.0	59.0
73.4	73.5
90.0	90.2
109.4	109.6
132.9	133.2
160.9	172.3
193.9	231.7
231.3	304.3
272.0	364.3
316.5	411.1
365.5	462.3

Time increment (t) = 6.0 min.

POND-2 Version: 5.21 S/N:
EXECUTED: 03-03-2000 08:41:25

Pond File: car\OUTFLOX1.PND
Inflow Hydrograph: car\CAR1 .HYD
Outflow Hydrograph: car\OUT .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
660.0	0.00	-----	70.5	70.6	0.08	76.40
666.0	0.00	0.0	70.3	70.5	0.08	76.39
672.0	0.00	0.0	70.1	70.3	0.08	76.39
678.0	0.00	0.0	70.0	70.1	0.08	76.38
684.0	0.00	0.0	69.8	70.0	0.08	76.38
690.0	0.00	0.0	69.7	69.8	0.07	76.37
696.0	0.00	0.0	69.5	69.7	0.07	76.37
702.0	0.00	0.0	69.4	69.5	0.07	76.36
708.0	0.00	0.0	69.3	69.4	0.07	76.36
714.0	0.00	0.0	69.1	69.3	0.07	76.35
720.0	0.00	0.0	69.0	69.1	0.07	76.35
726.0	0.00	0.0	68.8	69.0	0.07	76.34
732.0	0.00	0.0	68.7	68.8	0.07	76.34
738.0	1.00	1.0	69.6	69.7	0.07	76.37
744.0	3.00	4.0	73.4	73.6	0.10	76.50
750.0	5.00	8.0	81.1	81.4	0.15	76.74
756.0	6.00	11.0	91.7	92.1	0.20	77.05
762.0	6.00	12.0	103.3	103.7	0.20	77.35
768.0	5.00	11.0	113.8	114.3	0.22	77.60
774.0	4.00	9.0	122.3	122.8	0.26	77.78
780.0	3.00	7.0	128.7	129.3	0.28	77.92
786.0	2.00	5.0	132.8	133.7	0.45	78.01
792.0	2.00	4.0	134.2	136.8	1.33	78.05
798.0	2.00	4.0	134.8	138.2	1.71	78.06
804.0	2.00	4.0	135.0	138.8	1.88	78.07
810.0	2.00	4.0	135.1	139.0	1.95	78.07
816.0	1.00	3.0	134.7	138.1	1.69	78.06
822.0	1.00	2.0	134.1	136.7	1.30	78.05
828.0	1.00	2.0	133.9	136.1	1.13	78.04
834.0	1.00	2.0	133.8	135.9	1.06	78.03
840.0	1.00	2.0	133.7	135.8	1.02	78.03
846.0	1.00	2.0	133.7	135.7	1.01	78.03
852.0	1.00	2.0	133.7	135.7	1.00	78.03
858.0	1.00	2.0	133.7	135.7	1.00	78.03
864.0	1.00	2.0	133.7	135.7	1.00	78.03
870.0	1.00	2.0	133.7	135.7	1.00	78.03
876.0	1.00	2.0	133.7	135.7	1.00	78.03
882.0	1.00	2.0	133.7	135.7	1.00	78.03
888.0	1.00	2.0	133.7	135.7	1.00	78.03
894.0	1.00	2.0	133.7	135.7	1.00	78.03
900.0	1.00	2.0	133.7	135.7	1.00	78.03
906.0	1.00	2.0	133.7	135.7	1.00	78.03
912.0	1.00	2.0	133.7	135.7	1.00	78.03
918.0	1.00	2.0	133.7	135.7	1.00	78.03
924.0	1.00	2.0	133.7	135.7	1.00	78.03

POND-2 Version: 5.21 S/N:
EXECUTED: 03-03-2000 08:41:25

Pond File: car\OUTFLOX1.PND
Inflow Hydrograph: car\CAR1 .HYD
Outflow Hydrograph: car\OUT .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
930.0	1.00	2.0	133.7	135.7	1.00	78.03
936.0	1.00	2.0	133.7	135.7	1.00	78.03
942.0	1.00	2.0	133.7	135.7	1.00	78.03
948.0	1.00	2.0	133.7	135.7	1.00	78.03
954.0	1.00	2.0	133.7	135.7	1.00	78.03
960.0	1.00	2.0	133.7	135.7	1.00	78.03
966.0	1.00	2.0	133.7	135.7	1.00	78.03
972.0	1.00	2.0	133.7	135.7	1.00	78.03
978.0	1.00	2.0	133.7	135.7	1.00	78.03
984.0	1.00	2.0	133.7	135.7	1.00	78.03
990.0	1.00	2.0	133.7	135.7	1.00	78.03
996.0	1.00	2.0	133.7	135.7	1.00	78.03
1002.0	1.00	2.0	133.7	135.7	1.00	78.03
1008.0	0.00	1.0	133.2	134.7	0.72	78.02
1014.0	0.00	0.0	132.6	133.2	0.31	78.00
1020.0	0.00	0.0	132.0	132.6	0.30	77.99
1026.0	0.00	0.0	131.4	132.0	0.29	77.97
1032.0	0.00	0.0	130.9	131.4	0.29	77.96
1038.0	0.00	0.0	130.3	130.9	0.29	77.95
1044.0	0.00	0.0	129.7	130.3	0.29	77.94
1050.0	0.00	0.0	129.1	129.7	0.29	77.93
1056.0	0.00	0.0	128.6	129.1	0.28	77.91
1062.0	0.00	0.0	128.0	128.6	0.28	77.90
1068.0	0.00	0.0	127.4	128.0	0.28	77.89
1074.0	0.00	0.0	126.9	127.4	0.28	77.88
1080.0	0.00	0.0	126.4	126.9	0.27	77.87
1086.0	0.00	0.0	125.8	126.4	0.27	77.85
1092.0	0.00	0.0	125.3	125.8	0.27	77.84
1098.0	0.00	0.0	124.7	125.3	0.27	77.83
1104.0	0.00	0.0	124.2	124.7	0.26	77.82
1110.0	0.00	0.0	123.7	124.2	0.26	77.81
1116.0	0.00	0.0	123.2	123.7	0.26	77.80
1122.0	0.00	0.0	122.7	123.2	0.26	77.79
1128.0	0.00	0.0	122.1	122.7	0.26	77.78
1134.0	0.00	0.0	121.6	122.1	0.25	77.77
1140.0	0.00	0.0	121.1	121.6	0.25	77.75
1146.0	0.00	0.0	120.6	121.1	0.25	77.74
1152.0	0.00	0.0	120.1	120.6	0.25	77.73
1158.0	0.00	0.0	119.7	120.1	0.24	77.72
1164.0	0.00	0.0	119.2	119.7	0.24	77.71
1170.0	0.00	0.0	118.7	119.2	0.24	77.70
1176.0	0.00	0.0	118.2	118.7	0.24	77.69
1182.0	0.00	0.0	117.7	118.2	0.24	77.68
1188.0	0.00	0.0	117.3	117.7	0.23	77.67
1194.0	0.00	0.0	116.8	117.3	0.23	77.66
1200.0	0.00	0.0	116.3	116.8	0.23	77.65

POND-2 Version: 5.21 S/N:
EXECUTED: 03-03-2000 08:41:25

Pond File: car\OUTFLOX1.PND
Inflow Hydrograph: car\CAR1 .HYD
Outflow Hydrograph: car\OUT .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
1206.0	0.00	0.0	115.9	116.3	0.23	77.64
1212.0	0.00	0.0	115.4	115.9	0.23	77.63
1218.0	0.00	0.0	115.0	115.4	0.22	77.62
1224.0	0.00	0.0	114.5	115.0	0.22	77.61
1230.0	0.00	0.0	114.1	114.5	0.22	77.60
1236.0	0.00	0.0	113.7	114.1	0.22	77.59
1242.0	0.00	0.0	113.2	113.7	0.22	77.59
1248.0	0.00	0.0	112.8	113.2	0.22	77.58
1254.0	0.00	0.0	112.4	112.8	0.21	77.57
1260.0	0.00	0.0	111.9	112.4	0.21	77.56
1266.0	0.00	0.0	111.5	111.9	0.21	77.55
1272.0	0.00	0.0	111.1	111.5	0.21	77.54
1278.0	0.00	0.0	110.7	111.1	0.21	77.53
1284.0	0.00	0.0	110.3	110.7	0.20	77.52
1290.0	0.00	0.0	109.9	110.3	0.20	77.51
1296.0	0.00	0.0	109.5	109.9	0.20	77.51
1302.0	0.00	0.0	109.1	109.5	0.20	77.50
1308.0	0.00	0.0	108.7	109.1	0.20	77.49
1314.0	0.00	0.0	108.3	108.7	0.20	77.48
1320.0	0.00	0.0	107.9	108.3	0.20	77.46
1326.0	0.00	0.0	107.5	107.9	0.20	77.45
1332.0	0.00	0.0	107.1	107.5	0.20	77.44
1338.0	0.00	0.0	106.7	107.1	0.20	77.43
1344.0	0.00	0.0	106.3	106.7	0.20	77.42
1350.0	0.00	0.0	105.9	106.3	0.20	77.41
1356.0	0.00	0.0	105.5	105.9	0.20	77.40
1362.0	0.00	0.0	105.1	105.5	0.20	77.39
1368.0	0.00	0.0	104.7	105.1	0.20	77.38
1374.0	0.00	0.0	104.3	104.7	0.20	77.37
1380.0	0.00	0.0	103.9	104.3	0.20	77.36
1386.0	0.00	0.0	103.5	103.9	0.20	77.35
1392.0	0.00	0.0	103.1	103.5	0.20	77.34
1398.0	0.00	0.0	102.7	103.1	0.20	77.33
1404.0	0.00	0.0	102.3	102.7	0.20	77.32
1410.0	0.00	0.0	101.9	102.3	0.20	77.31
1416.0	0.00	0.0	101.5	101.9	0.20	77.30
1422.0	0.00	0.0	101.1	101.5	0.20	77.29
1428.0	0.00	0.0	100.7	101.1	0.20	77.28
1434.0	0.00	0.0	100.3	100.7	0.20	77.27
1440.0	0.00	0.0	99.9	100.3	0.20	77.26
1446.0	0.00	0.0	99.5	99.9	0.20	77.25
1452.0	0.00	0.0	99.1	99.5	0.20	77.24
1458.0	0.00	0.0	98.7	99.1	0.20	77.23
1464.0	0.00	0.0	98.3	98.7	0.20	77.22
1470.0	0.00	0.0	97.9	98.3	0.20	77.21
1476.0	0.00	0.0	97.5	97.9	0.20	77.20

POND-2 Version: 5.21 S/N:
EXECUTED: 03-03-2000 08:41:25

Pond File: car\OUTFLOX1.PND
Inflow Hydrograph: car\CAR1 .HYD
Outflow Hydrograph: car\OUT .HYD

INFLOW HYDROGRAPH — ROUTING COMPUTATIONS

TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
1482.0	0.00	0.0	97.1	97.5	0.20	77.19
1488.0	0.00	0.0	96.7	97.1	0.20	77.18
1494.0	0.00	0.0	96.3	96.7	0.20	77.17
1500.0	0.00	0.0	95.9	96.3	0.20	77.16
1506.0	0.00	0.0	95.5	95.9	0.20	77.15
1512.0	0.00	0.0	95.1	95.5	0.20	77.14
1518.0	0.00	0.0	94.7	95.1	0.20	77.13
1524.0	0.00	0.0	94.3	94.7	0.20	77.12
1530.0	0.00	0.0	93.9	94.3	0.20	77.11
1536.0	0.00	0.0	93.5	93.9	0.20	77.10
1542.0	0.00	0.0	93.1	93.5	0.20	77.09
1548.0	0.00	0.0	92.7	93.1	0.20	77.07
1554.0	0.00	0.0	92.3	92.7	0.20	77.06

TIME 1554 − 660 = 894 MIN.
$894 \text{ MIN} \times \frac{1 \text{ HR}}{60 \text{ MIN}} = 14.90 \text{ HR.}$

1-YEAR VOL = 33,062.04
1-YEAR POOL = 78.03
INV. = 76.40

DA = 16.10 AC
CN = 69
T_c = 21 MIN.
RUNOFF 0.57"
Q_{PEAK} = 7 CFS
0.759 AC-FT.

INV. 3" 76.40

$1.63'/2 = 0.815$ FT. HEAD AVERAGE

NO DRAWDOWN COMPS SHOWN CHECK...

$$\frac{33{,}062.04}{24 \times 60 \times 60} = 0.3827 \text{ CFS}$$

$$\frac{0.3827 \text{ CFS}}{0.6\sqrt{64.4 * 0.815}} = 0.0880 \text{ SF}$$

$$A = \frac{\pi d^2}{4}$$

$$0.0880 = \frac{\pi (d^2)}{4}$$

$$d = 0.3348'$$
$$= 4.0177''$$

CHECK USING FULL DEPTH

$$\frac{0.3827}{0.6\sqrt{64.4 \times 1.63}} = 0.0623$$

$$A = \frac{\pi d^2}{4}$$

$0.0623 =$

$d = 0.2815'$

$d = 3.37''$

OK.

4" WILL ACHIEVE A MIN. 24-HR DRAWDOWN OF THE 1-YEAR RUNOFF VOLUME; 3" PROVIDED

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

Pond File: car\OUTFLOX1.PND
Inflow Hydrograph: car\CAR1 .HYD
Outflow Hydrograph: car\OUT .HYD

Starting Pond W.S. Elevation = 76.40 ft

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

Peak Inflow = 6.00 cfs
Peak Outflow = 1.95 cfs
Peak Elevation = 78.07 ft

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

Initial Storage = 12,698 cu-ft
Peak Storage From Storm = 11,973 cu-ft

Total Storage in Pond = 24,671 cu-ft

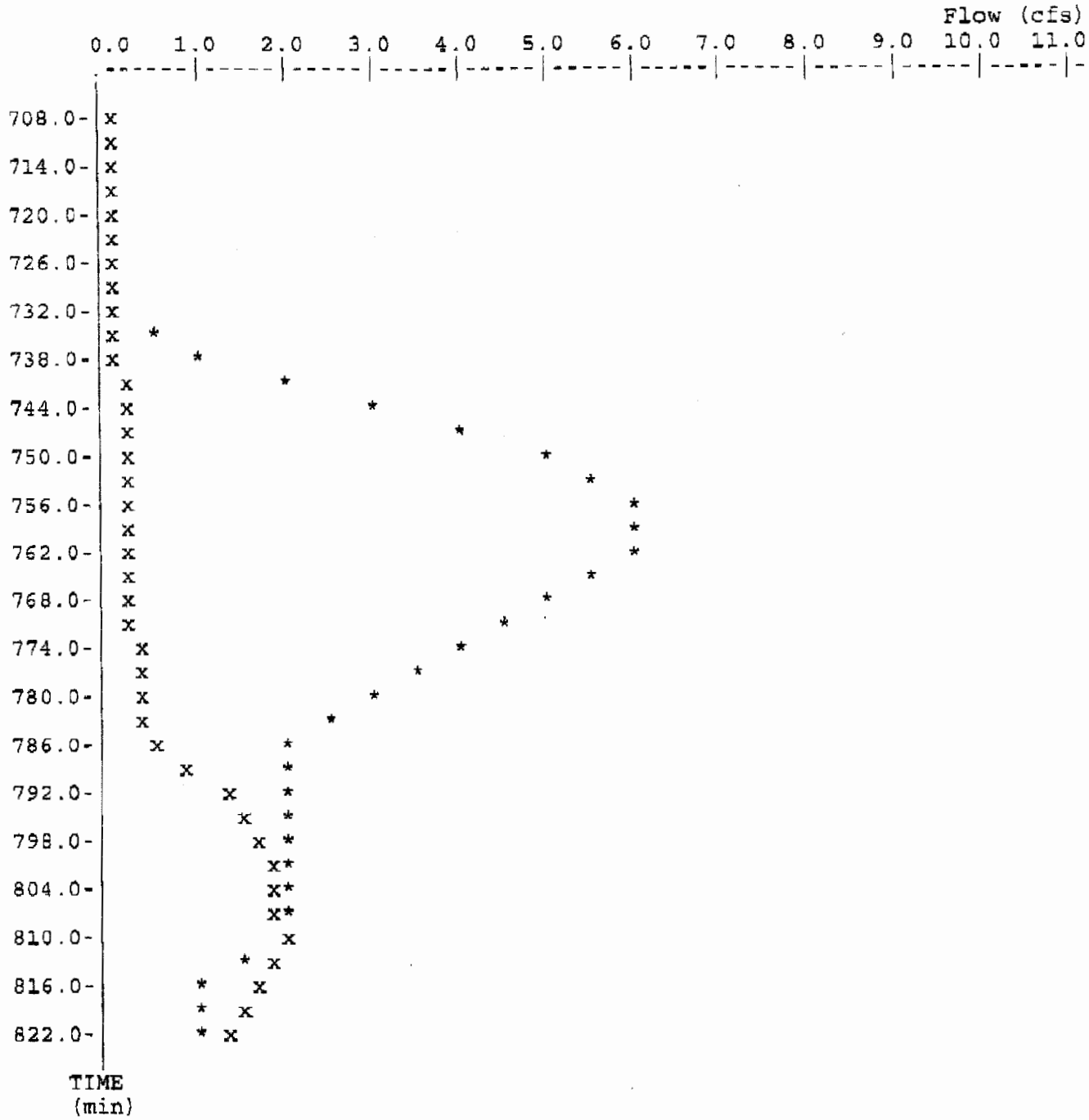
>>>>> Warning, initial pond outflow > 1st inflow ordinate. <<<<<

POND-2 Version: 5.21 S/N:

Pond File: car\OUTFLOX1.PND
Inflow Hydrograph: car\CAR1 .HYD
Outflow Hydrograph: car\OUT .HYD

EXECUTED: 03-03-2000
08:41:25

Peak Inflow = 6.00 cfs
Peak Outflow = 1.95 cfs
Peak Elevation = 78.07 ft



* File: car\CAR1 .HYD Qmax = 6.0 cfs
x File: car\OUT .HYD Qmax = 2.0 cfs

Williamsburg Dodge

Quick TR-55 Version: 5.46 S/N:

Return Frequency: 1 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 03-03-2000 08:39:06
Watershed file: --> CAR\CAR .MOP
Hydrograph file: --> CAR\CAR1.HYD

>>>> Input Parameters Used to Compute Hydrograph <<<<

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used	
	16.10	69.0	0.30	0.30	2.80	0.57	I.32	.32

* Travel time from subarea outfall to composite watershed outfall point.
I -- Subarea where user specified interpolation between Ia/p tables.

Total area = 16.10 acres or 0.02516 sq.mi
Peak discharge = 6 cfs

>>>> Computer Modifications of Input Parameters <<<<<

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p Messages
	0.35	0.29	0.30	0.30	Yes	--

* Travel time from subarea outfall to composite watershed outfall point.

Return Frequency: 1 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 03-03-2000 08:39:06
Watershed file: --> CAR\CAR .MOP
Hydrograph file: --> CAR\CAR1.HYD

>>>> Summary of Subarea Times to Peak <<<<

Subarea	Peak Discharge at Composite Outfall (cfs)	Time to Peak at Composite Outfall (hrs)
	6	12.6
Composite Watershed	6	12.6

Return Frequency: 1 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 03-03-2000 08:39:06
Watershed file: --> CAR\CAR .MOP
Hydrograph file: --> CAR\CAR1.HYD

Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 hr
	0	0	0	0	0	0	0	1	3
Total (cfs)	0	0	0	0	0	0	0	1	3

Subarea Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 hr
	5	6	6	5	3	2	2	1	1
Total (cfs)	5	6	6	5	3	2	2	1	1

Subarea Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 hr
	1	1	1	1	1	1	1	0	0
Total (cfs)	1	1	1	1	1	1	1	0	0

Subarea Description	18.0 hr	19.0 hr	20.0 hr	22.0 hr	26.0 hr
	0	0	0	0	0
Total (cfs)	0	0	0	0	0

Return Frequency: 1 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 03-03-2000 08:39:06
Watershed file: --> CAR\CAR .MOP
Hydrograph file: --> CAR\CAR1.HYD

Time (hrs)	Flow (cfs)	Time (hrs)	Flow (cfs)
11.0	0	14.8	1
11.1	0	14.9	1
11.2	0	15.0	1
11.3	0	15.1	1
11.4	0	15.2	1
11.5	0	15.3	1
11.6	0	15.4	1
11.7	0	15.5	1
11.8	0	15.6	1
11.9	0	15.7	1
12.0	0	15.8	1
12.1	0	15.9	1
12.2	0	16.0	1
12.3	1	16.1	1
12.4	3	16.2	1
12.5	5	16.3	1
12.6	6	16.4	1
12.7	6	16.5	1
12.8	5	16.6	1
12.9	4	16.7	1
13.0	3	16.8	0
13.1	2	16.9	0
13.2	2	17.0	0
13.3	2	17.1	0
13.4	2	17.2	0
13.5	2	17.3	0
13.6	1	17.4	0
13.7	1	17.5	0
13.8	1	17.6	0
13.9	1	17.7	0
14.0	1	17.8	0
14.1	1	17.9	0
14.2	1	18.0	0
14.3	1	18.1	0
14.4	1	18.2	0
14.5	1	18.3	0

14.6	1	18.4	0
14.7	1	18.5	0

Return Frequency: 1 years

TR-55 TABULAR HYDROGRAPH METHOD
Type II. Distribution
(24 hr. Duration Storm)

Executed: 03-03-2000 08:39:06
Watershed file: --> CAR\CAR .MOP
Hydrograph file: --> CAR\CAR1.HYD

Time (hrs)	Flow (cfs)	Time (hrs)	Flow (cfs)
18.6	0	22.4	0
18.7	0	22.5	0
18.8	0	22.6	0
18.9	0	22.7	0
19.0	0	22.8	0
19.1	0	22.9	0
19.2	0	23.0	0
19.3	0	23.1	0
19.4	0	23.2	0
19.5	0	23.3	0
19.6	0	23.4	0
19.7	0	23.5	0
19.8	0	23.6	0
19.9	0	23.7	0
20.0	0	23.8	0
20.1	0	23.9	0
20.2	0	24.0	0
20.3	0	24.1	0
20.4	0	24.2	0
20.5	0	24.3	0
20.6	0	24.4	0
20.7	0	24.5	0
20.8	0	24.6	0
20.9	0	24.7	0
21.0	0	24.8	0
21.1	0	24.9	0
21.2	0	25.0	0
21.3	0	25.1	0
21.4	0	25.2	0
21.5	0	25.3	0
21.6	0	25.4	0
21.7	0	25.5	0
21.8	0	25.6	0
21.9	0	25.7	0
22.0	0	25.8	0
22.1	0	25.9	0
22.2	0		
22.3	0		

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*************************************************
*                                               *
*                                               *
*  Williamsburg Dodge:1yr-24 hr.storm routing   *
*                                               *
*                                               *
*                                               *
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Inflow Hydrograph: car\CAR1 .HYD
Rating Table file: car\OUTFLOX1.PND

----INITIAL CONDITIONS----
Elevation = 76.40 ft
Outflow = 0.08 cfs
Storage = 12,698 cu-ft

GIVEN POND DATA

ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)
70.00	0.0	0
70.50	0.0	13
71.00	0.0	105
71.50	0.0	304
72.00	0.0	593
72.50	0.0	1,017
73.00	0.0	1,628
73.50	0.0	2,451
74.00	0.0	3,502
74.50	0.0	4,818
75.00	0.0	6,434
75.50	0.0	8,364
76.00	0.0	10,617
76.50	0.1	13,218
77.00	0.2	16,194
77.50	0.2	19,701
78.00	0.3	23,924
78.50	11.4	28,958
79.00	37.8	34,908
79.50	73.0	41,633
80.00	92.3	48,958
80.50	94.6	56,974
81.00	96.8	65,783

INTERMEDIATE ROUTING COMPUTATIONS

2S/t (cfs)	2S/t + 0 (cfs)
0.0	0.0
0.1	0.1
0.6	0.6
1.7	1.7
3.3	3.3
5.7	5.7
9.0	9.0
13.6	13.6
19.5	19.5
26.8	26.8
35.7	35.7
46.5	46.5
59.0	59.0
73.4	73.5
90.0	90.2
109.4	109.6
132.9	133.2
160.9	172.3
193.9	231.7
231.3	304.3
272.0	364.3
316.5	411.1
365.5	462.3

Time increment (t) = 6.0 min.

Pond File: car\OUTFLOX1.PND
Inflow Hydrograph: car\CAR1 .HYD
Outflow Hydrograph: car\OUT .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
660.0	0.00	-----	70.5	70.6	0.08	76.40
666.0	0.00	0.0	70.3	70.5	0.08	76.39
672.0	0.00	0.0	70.1	70.3	0.08	76.39
678.0	0.00	0.0	70.0	70.1	0.08	76.38
684.0	0.00	0.0	69.8	70.0	0.08	76.38
690.0	0.00	0.0	69.7	69.8	0.07	76.37
696.0	0.00	0.0	69.5	69.7	0.07	76.37
702.0	0.00	0.0	69.4	69.5	0.07	76.36
708.0	0.00	0.0	69.3	69.4	0.07	76.36
714.0	0.00	0.0	69.1	69.3	0.07	76.35
720.0	0.00	0.0	69.0	69.1	0.07	76.35
726.0	0.00	0.0	68.8	69.0	0.07	76.34
732.0	0.00	0.0	68.7	68.8	0.07	76.34
738.0	1.00	1.0	69.6	69.7	0.07	76.37
744.0	3.00	4.0	73.4	73.6	0.10	76.50
750.0	5.00	8.0	81.1	81.4	0.15	76.74
756.0	6.00	11.0	91.7	92.1	0.20	77.05
762.0	6.00	12.0	103.3	103.7	0.20	77.35
768.0	5.00	11.0	113.8	114.3	0.22	77.60
774.0	4.00	9.0	122.3	122.8	0.26	77.78
780.0	3.00	7.0	128.7	129.3	0.28	77.92
786.0	2.00	5.0	132.8	133.7	0.45	78.01
792.0	2.00	4.0	134.2	136.8	1.33	78.05
798.0	2.00	4.0	134.8	138.2	1.71	78.06
804.0	2.00	4.0	135.0	138.8	1.88	78.07
810.0	2.00	4.0	135.1	139.0	1.95	78.07
816.0	1.00	3.0	134.7	138.1	1.69	78.06
822.0	1.00	2.0	134.1	136.7	1.30	78.05
828.0	1.00	2.0	133.9	136.1	1.13	78.04
834.0	1.00	2.0	133.8	135.9	1.06	78.03
840.0	1.00	2.0	133.7	135.8	1.02	78.03
846.0	1.00	2.0	133.7	135.7	1.01	78.03
852.0	1.00	2.0	133.7	135.7	1.00	78.03
858.0	1.00	2.0	133.7	135.7	1.00	78.03
864.0	1.00	2.0	133.7	135.7	1.00	78.03
870.0	1.00	2.0	133.7	135.7	1.00	78.03
876.0	1.00	2.0	133.7	135.7	1.00	78.03
882.0	1.00	2.0	133.7	135.7	1.00	78.03
888.0	1.00	2.0	133.7	135.7	1.00	78.03
894.0	1.00	2.0	133.7	135.7	1.00	78.03
900.0	1.00	2.0	133.7	135.7	1.00	78.03
906.0	1.00	2.0	133.7	135.7	1.00	78.03
912.0	1.00	2.0	133.7	135.7	1.00	78.03
918.0	1.00	2.0	133.7	135.7	1.00	78.03
924.0	1.00	2.0	133.7	135.7	1.00	78.03

Pond File: car\OUTFLOX1.PND
Inflow Hydrograph: car\CAR1 .HYD
Outflow Hydrograph: car\OUT .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
930.0	1.00	2.0	133.7	135.7	1.00	78.03
936.0	1.00	2.0	133.7	135.7	1.00	78.03
942.0	1.00	2.0	133.7	135.7	1.00	78.03
948.0	1.00	2.0	133.7	135.7	1.00	78.03
954.0	1.00	2.0	133.7	135.7	1.00	78.03
960.0	1.00	2.0	133.7	135.7	1.00	78.03
966.0	1.00	2.0	133.7	135.7	1.00	78.03
972.0	1.00	2.0	133.7	135.7	1.00	78.03
978.0	1.00	2.0	133.7	135.7	1.00	78.03
984.0	1.00	2.0	133.7	135.7	1.00	78.03
990.0	1.00	2.0	133.7	135.7	1.00	78.03
996.0	1.00	2.0	133.7	135.7	1.00	78.03
1002.0	1.00	2.0	133.7	135.7	1.00	78.03
1008.0	0.00	1.0	133.2	134.7	0.72	78.02
1014.0	0.00	0.0	132.6	133.2	0.31	78.00
1020.0	0.00	0.0	132.0	132.6	0.30	77.99
1026.0	0.00	0.0	131.4	132.0	0.29	77.97
1032.0	0.00	0.0	130.9	131.4	0.29	77.96
1038.0	0.00	0.0	130.3	130.9	0.29	77.95
1044.0	0.00	0.0	129.7	130.3	0.29	77.94
1050.0	0.00	0.0	129.1	129.7	0.29	77.93
1056.0	0.00	0.0	128.6	129.1	0.28	77.91
1062.0	0.00	0.0	128.0	128.6	0.28	77.90
1068.0	0.00	0.0	127.4	128.0	0.28	77.89
1074.0	0.00	0.0	126.9	127.4	0.28	77.88
1080.0	0.00	0.0	126.4	126.9	0.27	77.87
1086.0	0.00	0.0	125.8	126.4	0.27	77.85
1092.0	0.00	0.0	125.3	125.8	0.27	77.84
1098.0	0.00	0.0	124.7	125.3	0.27	77.83
1104.0	0.00	0.0	124.2	124.7	0.26	77.82
1110.0	0.00	0.0	123.7	124.2	0.26	77.81
1116.0	0.00	0.0	123.2	123.7	0.26	77.80
1122.0	0.00	0.0	122.7	123.2	0.26	77.79
1128.0	0.00	0.0	122.1	122.7	0.26	77.78
1134.0	0.00	0.0	121.6	122.1	0.25	77.77
1140.0	0.00	0.0	121.1	121.6	0.25	77.75
1146.0	0.00	0.0	120.6	121.1	0.25	77.74
1152.0	0.00	0.0	120.1	120.6	0.25	77.73
1158.0	0.00	0.0	119.7	120.1	0.24	77.72
1164.0	0.00	0.0	119.2	119.7	0.24	77.71
1170.0	0.00	0.0	118.7	119.2	0.24	77.70
1176.0	0.00	0.0	118.2	118.7	0.24	77.69
1182.0	0.00	0.0	117.7	118.2	0.24	77.68
1188.0	0.00	0.0	117.3	117.7	0.23	77.67
1194.0	0.00	0.0	116.8	117.3	0.23	77.66
1200.0	0.00	0.0	116.3	116.8	0.23	77.65

Pond File: car\OUTFLOX1.PND
Inflow Hydrograph: car\CAR1 .HYD
Outflow Hydrograph: car\OUT .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
1206.0	0.00	0.0	115.9	116.3	0.23	77.64
1212.0	0.00	0.0	115.4	115.9	0.23	77.63
1218.0	0.00	0.0	115.0	115.4	0.22	77.62
1224.0	0.00	0.0	114.5	115.0	0.22	77.61
1230.0	0.00	0.0	114.1	114.5	0.22	77.60
1236.0	0.00	0.0	113.7	114.1	0.22	77.59
1242.0	0.00	0.0	113.2	113.7	0.22	77.59
1248.0	0.00	0.0	112.8	113.2	0.22	77.58
1254.0	0.00	0.0	112.4	112.8	0.21	77.57
1260.0	0.00	0.0	111.9	112.4	0.21	77.56
1266.0	0.00	0.0	111.5	111.9	0.21	77.55
1272.0	0.00	0.0	111.1	111.5	0.21	77.54
1278.0	0.00	0.0	110.7	111.1	0.21	77.53
1284.0	0.00	0.0	110.3	110.7	0.20	77.52
1290.0	0.00	0.0	109.9	110.3	0.20	77.51
1296.0	0.00	0.0	109.5	109.9	0.20	77.51
1302.0	0.00	0.0	109.1	109.5	0.20	77.50
1308.0	0.00	0.0	108.7	109.1	0.20	77.49
1314.0	0.00	0.0	108.3	108.7	0.20	77.48
1320.0	0.00	0.0	107.9	108.3	0.20	77.46
1326.0	0.00	0.0	107.5	107.9	0.20	77.45
1332.0	0.00	0.0	107.1	107.5	0.20	77.44
1338.0	0.00	0.0	106.7	107.1	0.20	77.43
1344.0	0.00	0.0	106.3	106.7	0.20	77.42
1350.0	0.00	0.0	105.9	106.3	0.20	77.41
1356.0	0.00	0.0	105.5	105.9	0.20	77.40
1362.0	0.00	0.0	105.1	105.5	0.20	77.39
1368.0	0.00	0.0	104.7	105.1	0.20	77.38
1374.0	0.00	0.0	104.3	104.7	0.20	77.37
1380.0	0.00	0.0	103.9	104.3	0.20	77.36
1386.0	0.00	0.0	103.5	103.9	0.20	77.35
1392.0	0.00	0.0	103.1	103.5	0.20	77.34
1398.0	0.00	0.0	102.7	103.1	0.20	77.33
1404.0	0.00	0.0	102.3	102.7	0.20	77.32
1410.0	0.00	0.0	101.9	102.3	0.20	77.31
1416.0	0.00	0.0	101.5	101.9	0.20	77.30
1422.0	0.00	0.0	101.1	101.5	0.20	77.29
1428.0	0.00	0.0	100.7	101.1	0.20	77.28
1434.0	0.00	0.0	100.3	100.7	0.20	77.27
1440.0	0.00	0.0	99.9	100.3	0.20	77.26
1446.0	0.00	0.0	99.5	99.9	0.20	77.25
1452.0	0.00	0.0	99.1	99.5	0.20	77.24
1458.0	0.00	0.0	98.7	99.1	0.20	77.23
1464.0	0.00	0.0	98.3	98.7	0.20	77.22
1470.0	0.00	0.0	97.9	98.3	0.20	77.21
1476.0	0.00	0.0	97.5	97.9	0.20	77.20

Pond File: car\OUTFLOX1.PND
Inflow Hydrograph: car\CAR1 .HYD
Outflow Hydrograph: car\OUT .HYD

INFLOW HYDROGRAPH

TIME (min)	INFLOW (cfs)
1482.0	0.00
1488.0	0.00
1494.0	0.00
1500.0	0.00
1506.0	0.00
1512.0	0.00
1518.0	0.00
1524.0	0.00
1530.0	0.00
1536.0	0.00
1542.0	0.00
1548.0	0.00
1554.0	0.00

ROUTING COMPUTATIONS

I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.0	97.1	97.5	0.20	77.19
0.0	96.7	97.1	0.20	77.18
0.0	96.3	96.7	0.20	77.17
0.0	95.9	96.3	0.20	77.16
0.0	95.5	95.9	0.20	77.15
0.0	95.1	95.5	0.20	77.14
0.0	94.7	95.1	0.20	77.13
0.0	94.3	94.7	0.20	77.12
0.0	93.9	94.3	0.20	77.11
0.0	93.5	93.9	0.20	77.10
0.0	93.1	93.5	0.20	77.09
0.0	92.7	93.1	0.20	77.07
0.0	92.3	92.7	0.20	77.06

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

Pond File:            car\OUTFLOX1.PND
Inflow Hydrograph:    car\CAR1     .HYD
Outflow Hydrograph:   car\OUT      .HYD


Starting Pond W.S. Elevation =    76.40 ft


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

                    Peak Inflow    =     6.00 cfs
                    Peak Outflow   =     1.95 cfs
                    Peak Elevation =    78.07 ft


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

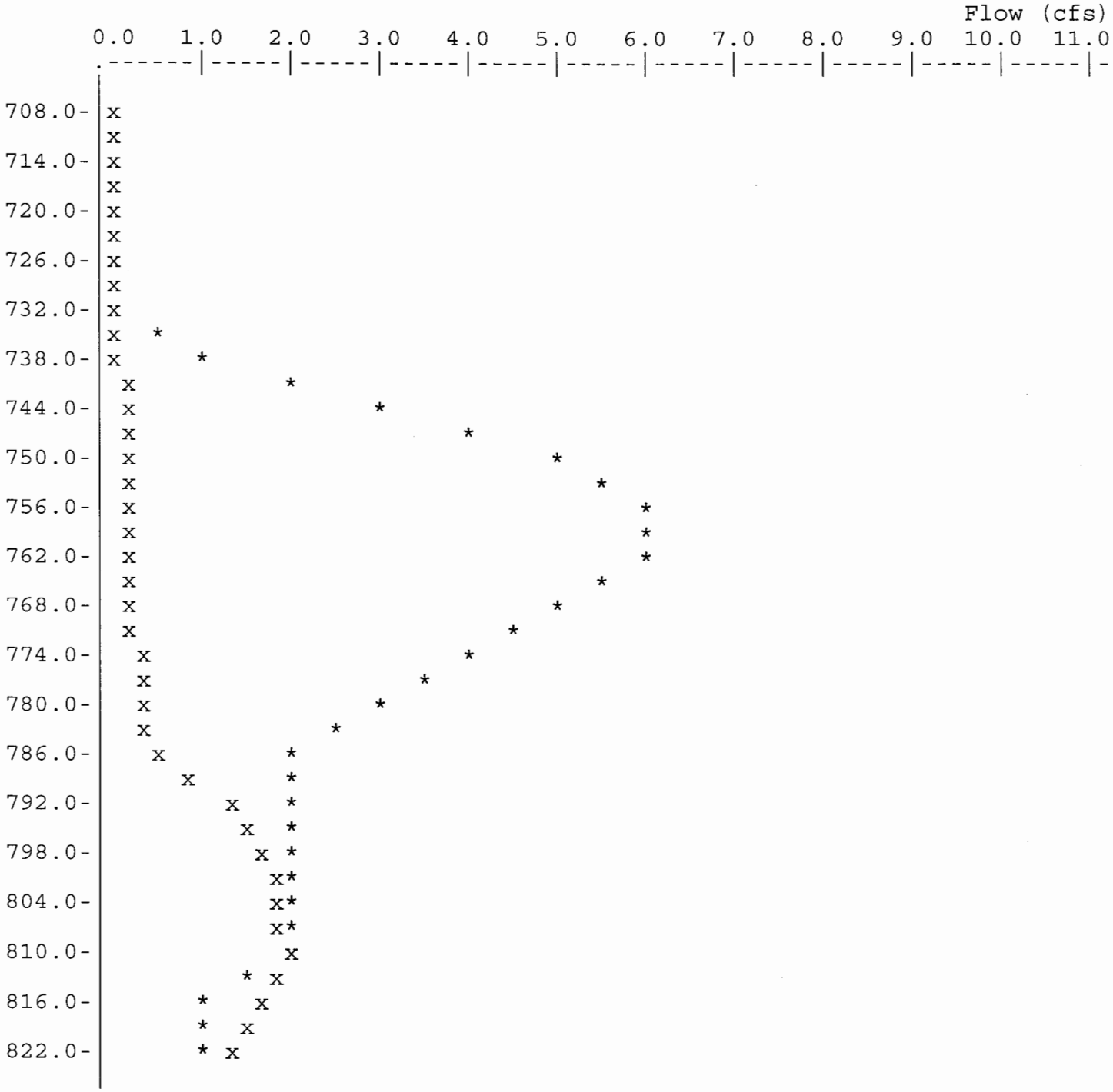
               Initial Storage          =    12,698 cu-ft
               Peak Storage From Storm  =    11,973 cu-ft
                                          ---------------
               Total Storage in Pond    =    24,671 cu-ft


  >>>>> Warning, initial pond outflow > 1st inflow ordinate. <<<<<
```

Pond File: car\OUTFLOX1.PND
Inflow Hydrograph: car\CAR1 .HYD
Outflow Hydrograph: car\OUT .HYD

EXECUTED: 03-03-2000
08:41:25

Peak Inflow = 6.00 cfs
Peak Outflow = 1.95 cfs
Peak Elevation = 78.07 ft



* File: car\CAR1 .HYD Qmax = 6.0 cfs
x File: car\OUT .HYD Qmax = 2.0 cfs

Natural Channel

Uniform Flow:	Normal	Critical
Slope (ft/ft):	0.0335	0.0293
Velocity (ft/sec):	4.3280	4.1201
Depth (ft):	1.0308	1.0565
Depth (in):	12.3695	12.6780

Flow (cfs):	27.20 ← Q_{10}
Length (ft):	40.00
Travel time (sec):	9.24
(min):	0.15

Manning's n:	0.0400
Hydraulic Radius:	0.5084
Wetted Area (sq ft):	6.2846
Wetted Perimeter (ft):	12.3622
Top Width (ft):	12.1879

Hit any key to change parameter.
Return goes to menu:

Williamsburg Dodge

BMP and Drainage Computations

Prepared by: Potts, Minter, and Associates
November 10, 1999

Revised February 21, 2000

Williamsburg Dodge

♦Hydrology Computations

BENGTSON, DEBELL & ELKIN, LTD.
808 Moorefield Park Drive, Suite 220
RICHMOND, VIRGINIA 23236
(804) 320-2667

JOB Williamsburg Dodge
SHEET NO. 1 OF
CALCULATED BY TJC DATE
CHECKED BY DATE Revised 2-18-200
SCALE

- DA to property line at discharge point below proposed BMP

- Existing runoff areas

- Area A; Large parcels, open agricultural field (offsite) and timbered wooded areas & fields (onsite)

DA = 15 ac
C = 0.35
CA = 5.25

16.8 AC TOTAL PREDEV

- Area B; Runoff from Route 60 Right-of-way

DA = 1.8 ac US ROUTE 60
C = .8
CA = 1.44

$$\text{Wt'd } C = \frac{5.25 + 1.44}{16.8} = 0.40 \qquad CA_{wt} = .4 \times 16.8 = 6.72$$

---

tc calculation, pre developed

200' OLF @ 1% over grass = 15 min.
Conc. Flow, 1000 LF
, Elev. Diff = 92-58'
ΔH = 34'
, flow time (Kirpich Chart) = 6 min

Total tc = 21 min

Pre-developed Runoff Rates

i_2 = 3.2 in/hr	Q_2 = (6.72) 3.2 = 21.50 cfs (ALLOWABLE)
i_{10} = 4.5 in/hr.	Q_{10} = " 4.5 = 30.20 cfs. (ALLOWABLE)
i_{50} = 5.2 in/hr	Q_{50} = (1.1) " (5.7) = 42.20 cfs.
i_{100} = 6.2 in/hr.	Q_{100} = (1.25) " (6.2) = 52.10 cfs.
	Q_{25} = (6.72)(5.1) = 34.30 cfs

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JOB Williamsburg Dodge
SHEET NO. 2 OF
CALCULATED BY DATE
CHECKED BY DATE Revised 7-18-2000
SCALE

Post Developed Condition

16.1 AC. TOTAL POST DEV

- Project Area = 6.4 ac.

  - impervious area = 150,625 s.f. = 3.46 ac. ✓ ONSITE
  - pervious area = 2.94 ac. ✓

- Wt. $C = \frac{(3.46 \times .9) + (2.94 \times .3)}{6.4 \text{ ac.}} = \frac{3.996}{6.4} = \underline{0.62}$

- Off site area = 16.1 (TOTAL) − 6.4 = 9.7 ac, C = 0.40
  (1.1 ac from Route 60, 8.6 offsite)

- Develop $C = \frac{(.4 \times 9.7) + (6.4 \times 0.62)}{16.1} = 0.49$

post tc calc. = pre tc calc. because off-site surface characteristics are unchanged & BMP area on-site left in natural state.

$Q_2 = (.49)(3.2 \text{ in./hr.})(16.1) = 25.2$ cfs
$Q_{10} = (.49)(4.5 \text{ in./hr.})(16.1) = 35.5$ cfs
$Q_{50} = (1.1)(.49)(5.7 \text{ in./hr.})(\text{"}) = 49.5$ cfs
$Q_{100} = (1.25)(.49)(6.2)(\text{"}) = 61.1$ cfs
$Q_{25} = (.49)(5.1)(\text{"}) = 40.2$ cfs

DISTURBED COND.

$\frac{6.3 \times 0.6}{6.4} = 0.59$

Quick TR-55 Ver.5.46 S/N:
Executed: 15:59:25 02-21-2000

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

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

Williamsburg Dodge, Pre-developed runoff calculations

Area = 16.80 acres Tc = 21.00 minutes

Frequency (years)	Adjusted 'C'	Duration minutes	Intens. in/hr	Qpeak cfs	Allowable cfs	VOLUMES Inflow (cu.ft.)	VOLUMES Storage (cu.ft.)
2	0.398	21	3.200	21.41✓	21.50	0	0
10	0.398	21	4.400	29.44✓	30.20	0	0
50	0.438	21	5.700	41.95	42.50	0	0
100	0.498	21	6.300	52.68	53.10	0	0
25	0.398	21	5.100	34.12	34.30	0	0

ALLOWABLES

SUMMARY PREDE ✓

Quick TR-55 Ver.5.46 S/N:
Executed: 15:59:25 02-21-2000

Williamsburg Dodge, Pre-developed runoff calculations

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

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

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

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
a	0.350	15.00						
b	0.800	1.80						
		16.8	21.00	0.398	0.398	3.200	16.80	21.41

Z-PRE

Quick TR-55 Ver.5.46 S/N:
Executed: 15:59:25 02-21-2000

Williamsburg Dodge, Pre-developed runoff calculations

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

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

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

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
a	0.350	15.00						
b	0.800	1.80						
			21.00	0.398	0.398	4.400	16.80	29.44

10-PRE

Quick TR-55 Ver.5.46 S/N:
Executed: 15:59:25 02-21-2000

Williamsburg Dodge, Pre-developed runoff calculations

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

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

RETURN FREQUENCY = 50 years
'C' adjustment, k = 1.1
Adj. 'C' = Wtd.'C' x 1.1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
a	0.350	15.00						
b	0.800	1.80						
			21.00	0.398	0.438	5.700	16.80	41.95

Quick TR-55 Ver.5.46 S/N:
Executed: 15:59:25 02-21-2000

Williamsburg Dodge, Pre-developed runoff calculations

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

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

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

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
a	0.350	15.00						
b	0.800	1.80						
			21.00	0.398	0.498	6.300	16.80	52.68

100-PRE

Quick TR-55 Ver.5.46 S/N:
Executed: 15:59:25 02-21-2000

Williamsburg Dodge, Pre-developed runoff calculations

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

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

RETURN FREQUENCY = 25 years
'C' adjustment, k = 1
Adj. 'C' = Wtd.'C' x 1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
a	0.350	15.00						
b	0.800	1.80						
		16.80	21.00	0.398	0.398	5.100	16.80	34.12

Quick TR-55 Ver.5.46 S/N:
Executed: 16:09:26 02-21-2000

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

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

Williamsburg Dodge, Developed Condition

Area = 16.10 acres Tc = 21.00 minutes

Frequency (years)	Adjusted 'C'	Duration minutes	Intens. in/hr	Qpeak cfs	Allowable cfs	VOLUMES Inflow (cu.ft.)	VOLUMES Storage (cu.ft.)
2	0.488	21	3.200	25.15	21.50	31,683	4,593
10	0.488	21	4.400	34.58	30.20	43,565	5,513
50	0.537	27	5.000	43.22	38.50	70,015	14,575
100	0.610	21	6.300	61.88	52.10	77,971	12,325
25	0.488	21	5.100	40.08	34.30	50,496	7,278

SUMMARY
POST W/O DET

Quick TR-55 Ver.5.46 S/N:
Executed: 16:09:26 02-21-2000

Williamsburg Dodge, Developed Condition

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

Weighted C = 0.488 Area= 16.100 acres Tc = 21.00 minutes

Adjusted C = 0.488 Td= 21.00 min. I= 3.20 in/hr Qp= 25.15 cfs

RETURN FREQUENCY: 2 year storm Adj.factor = 1.00
Output file: CAR2DEV .HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 2 Year Storm

Time increment = 1.00 Minutes
Time on left represents time for first Q in each row.

Time Minutes							
0.00	0.00	1.20	2.39	3.59	4.79	5.99	7.18
7.00	8.38	9.58	10.78	11.97	13.17	14.37	15.57
14.00	16.76	17.96	19.16	20.36	21.55	22.75	23.95
21.00	25.15	23.95	22.75	21.55	20.36	19.16	17.96
28.00	16.76	15.57	14.37	13.17	11.97	10.78	9.58
35.00	8.38	7.18	5.99	4.79	3.59	2.39	1.20
42.00	0.00						

Quick TR-55 Ver.5.46 S/N:
Executed: 16:09:26 02-21-2000

Williamsburg Dodge, Developed Condition

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

Weighted C = 0.488 Area= 16.100 acres Tc = 21.00 minutes

Adjusted C = 0.488 Td= 21.00 min. I= 4.40 in/hr Qp= 34.58 cfs

RETURN FREQUENCY: 10 year storm Adj.factor = 1.00
Output file: CAR10DEV.HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 10 Year Storm

Time increment = 1.00 Minutes
Time on left represents time for first Q in each row.

Time Minutes							
0.00	0.00	1.65	3.29	4.94	6.59	8.23	9.88
7.00	11.53	13.17	14.82	16.46	18.11	19.76	21.40
14.00	23.05	24.70	26.34	27.99	29.64	31.28	32.93
21.00	34.58	32.93	31.28	29.64	27.99	26.34	24.70
28.00	23.05	21.40	19.76	18.11	16.46	14.82	13.17
35.00	11.53	9.88	8.23	6.59	4.94	3.29	1.65
42.00	0.00						

Quick TR-55 Ver.5.46 S/N:
Executed: 16:09:26 02-21-2000

Williamsburg Dodge, Developed Condition

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

Weighted C = 0.488 Area= 16.100 acres Tc = 21.00 minutes

Adjusted C = 0.488 Td= 21.00 min. I= 5.10 in/hr Qp= 40.08 cfs

RETURN FREQUENCY: 25 year storm Adj.factor = 1.00
Output file: CAR25DEV.HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 25 Year Storm

Time Minutes	Time increment = 1.00 Minutes Time on left represents time for first Q in each row.						
0.00	0.00	1.91	3.82	5.73	7.63	9.54	11.45
7.00	13.36	15.27	17.18	19.08	20.99	22.90	24.81
14.00	26.72	28.63	30.53	32.44	34.35	36.26	38.17
21.00	40.08	38.17	36.26	34.35	32.44	30.53	28.63
28.00	26.72	24.81	22.90	20.99	19.08	17.18	15.27
35.00	13.36	11.45	9.54	7.63	5.73	3.82	1.91
42.00	0.00						

Quick TR-55 Ver.5.46 S/N:
Executed: 16:09:26 02-21-2000

Williamsburg Dodge, Developed Condition

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

Weighted C = 0.488 Area= 16.100 acres Tc = 21.00 minutes

Adjusted C = 0.537 Td= 27.00 min. I= 5.00 in/hr Qp= 43.22 cfs

RETURN FREQUENCY: 50 year storm Adj.factor = 1.10
Output file: CAR50DEV.HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 50 Year Storm

Time increment = 1.00 Minutes
Time on left represents time for first Q in each row.

Time Minutes							
0.00	0.00	2.06	4.12	6.17	8.23	10.29	12.35
7.00	14.41	16.46	18.52	20.58	22.64	24.70	26.75
14.00	28.81	30.87	32.93	34.99	37.04	39.10	41.16
21.00	43.22	43.22	43.22	43.22	43.22	43.22	43.22
28.00	41.16	39.10	37.04	34.99	32.93	30.87	28.81
35.00	26.75	24.70	22.64	20.58	18.52	16.46	14.41
42.00	12.35	10.29	8.23	6.17	4.12	2.06	0.00

Quick TR-55 Ver.5.46 S/N:
Executed: 16:09:26 02-21-2000

Williamsburg Dodge, Developed Condition

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

Weighted C = 0.488 Area= 16.100 acres Tc = 21.00 minutes

Adjusted C = 0.610 Td= 21.00 min. I= 6.30 in/hr Qp= 61.88 cfs

RETURN FREQUENCY: 100 year storm Adj.factor = 1.25
Output file: C100D .HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 100 Year Storm

Time increment = 1.00 Minutes
Time on left represents time for first Q in each row.

Time Minutes							
0.00	0.00	2.95	5.89	8.84	11.79	14.73	17.68
7.00	20.63	23.57	26.52	29.47	32.41	35.36	38.31
14.00	41.25	44.20	47.15	50.09	53.04	55.99	58.94
21.00	61.88	58.94	55.99	53.04	50.09	47.15	44.20
28.00	41.25	38.31	35.36	32.41	29.47	26.52	23.57
35.00	20.63	17.68	14.73	11.79	8.84	5.89	2.95
42.00	0.00						

Quick TR-55 Ver.5.46 S/N:
Executed: 16:09:26 02-21-2000

Williamsburg Dodge, Developed Condition

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

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

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

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
route 60	0.800	1.10						
offsite	0.350	8.60						
onsite	0.620	6.40						
			21.00	0.488	0.488	3.200	16.10	25.15

Quick TR-55 Ver.5.46 S/N:
Executed: 16:09:26 02-21-2000

Williamsburg Dodge, Developed Condition

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

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

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

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
route 60	0.800	1.10						
offsite	0.350	8.60						
onsite	0.620	6.40						
			21.00	0.488	0.488	4.400	16.10	34.58

Quick TR-55 Ver.5.46 S/N:
Executed: 16:09:26 02-21-2000

Williamsburg Dodge, Developed Condition

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

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

RETURN FREQUENCY = 25 years
'C' adjustment, k = 1
Adj. 'C' = Wtd.'C' x 1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
route 60	0.800	1.10						
offsite	0.350	8.60						
onsite	0.620	6.40						
			21.00	0.488	0.488	5.100	16.10	40.08

Quick TR-55 Ver.5.46 S/N:
Executed: 16:09:26 02-21-2000

Williamsburg Dodge, Developed Condition

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

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

RETURN FREQUENCY = 50 years
'C' adjustment, k = 1.1
Adj. 'C' = Wtd.'C' x 1.1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
route 60	0.800	1.10						
offsite	0.350	8.60						
onsite	0.620	6.40						
			21.00	0.488	0.537	5.700	16.10	49.27

Quick TR-55 Ver.5.46 S/N:
Executed: 16:09:26 02-21-2000

Williamsburg Dodge, Developed Condition

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

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

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

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
route 60	0.800	1.10						
offsite	0.350	8.60						
onsite	0.620	6.40						
		16.10	21.00	0.488	0.610	6.300	16.10	61.88

Williamsburg Dodge

♦Routing Calculations

POND-2 Version: 5.21
S/N:

Williamsburg Dodge
BMP Basin

CALCULATED 02-22-2000 11:35:54
DISK FILE: car\CARREV .VOL

Planimeter scale: 1 inch = 30 ft.

Elevation (ft)	Planimeter (sq.in.)	Area (sq.ft)	A1+A2+sqr(A1*A2) (sq.ft)	* Volume (cubic-ft)	Volume Sum (cubic-ft)
70.00	0.00	0	0	0	0
71.00	0.35	317	317	106	106
72.00	0.76	681	1,463	488	593
73.00	1.60	1,435	3,106	1,035	1,628
74.00	2.61	2,350	5,622	1,874	3,502
75.00	3.95	3,555	8,795	2,932	6,434
76.00	5.38	4,844	12,548	4,183	10,617
76.40	*I*	5,420	15,387	2,052	12,669
77.00	7.05	6,344	16,731	5,577	16,194
78.00	10.23	9,203	23,189	7,730	23,924
79.00	14.30	12,867	32,953	10,984	34,908
80.00	16.96	15,266	42,148	14,049	48,957
81.00	20.48	18,434	50,475	16,825	65,782
82.00	24.42	21,975	60,536	20,179	85,961
82.25	25.21	22,689	66,994	5,583	91,544

I ---> Interpolated area from closest two planimeter readings.

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

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

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

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

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

Outlet Structure File: CAR10REV.STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

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Williamsburg Dodge BMP/SWM Outlet Structure

****

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

Elevation (ft)	Q (cfs)	Contributing Structures
70.00	0.0	
70.50	0.0	
71.00	0.0	
71.50	0.0	
72.00	0.0	
72.50	0.0	
73.00	0.0	
73.50	0.0	
74.00	0.0	
74.50	0.0	
75.00	0.0	
75.50	0.0	
3"ϕ - 76.00	0.0	
76.50	0.1	1
77.00	0.2	1
77.50	0.2	1
78.00	0.3	1
78.50	11.4	2 +1
79.00	37.8	2 +1
79.50	73.0	2 +1
80.00	92.3	3 +1
80.50	94.6	3 +1
81.00	96.8	3 +1 (BARREL CONTROLS)
81.50	0.0	

Outlet Structure File: CAR10REV.STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

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Williamsburg Dodge BMP/SWM Outlet Structure

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Outlet Structure File: car\CAR10REV.STR
Planimeter Input File: car\CARREV .VOL
Rating Table Output File: car\OUTFLOX2.PND

Min. Elev.(ft) = 70 Max. Elev.(ft) = 81.5 Incr.(ft) = .5

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

****
SYSTEM CONNECTIVITY
****

Structure	No.	Q Table		Q Table
CULVERT-CR	3		->	3
STAND PIPE	2	? 3	->	A
ORIFICE	1		->	1

Outflow rating table summary was stored in file:
car\OUTFLOX2.PND

Outlet Structure File: CAR10REV.STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

****

Williamsburg Dodge BMP/SWM Outlet Structure

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

ORIFICE
Orifice - Based on Area and Datum Elevation

E1 elev.(ft)?	76.4
E2 elev.(ft)?	81.5
Orifice coeff.?	.6
Invert elev.(ft)?	76.4
Datum elev.(ft) ?	76.4
Orifice area (sq ft)?	.049

Outlet Structure File: CAR10REV.STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

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Williamsburg Dodge BMP/SWM Outlet Structure

****

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

STAND PIPE
Stand Pipe with weir or orifice flow

E1 elev.(ft)?	78.1
E2 elev.(ft)?	81.5
Crest elev.(ft)?	78.1
Diameter (ft)?	4.5
Weir coefficient?	3.1
Orifice coefficient?	.67
Start transition elev.(ft) @ ?	
Transition height (ft)?	

Outlet Structure File: CAR10REV.STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

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Williamsburg Dodge BMP/SWM Outlet Structure

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

CULVERT-CR
Circular Culvert (With Inlet Control)

E1 elev.(ft)?	78.10
E2 elev.(ft)?	81.5
Diam. (ft)?	2.50 (30")
Inv. el.(ft)?	67.86
Slope (ft/ft)?	.033 4.40% ON PLANS
T1 ratio?	
T2 ratio?	
K Coeff.?	.078
M Coeff.?	2
c Coeff.?	.0292
Y Coeff.?	.74
Form 1 or 2?	1
Slope factor?	.7

DOES NOT MATTER, INLET CONTROL ASSUMED.

Outlet Structure File: CAR10REV.STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

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Williamsburg Dodge BMP/SWM Outlet Structure

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Outflow Rating Table for Structure #1
ORIFICE Orifice - Based on Area and Datum Elevation

Elevation (ft)	Q (cfs)	Computation Messages
70.00	0.0	E < E1=76.4
70.50	0.0	E < E1=76.4
71.00	0.0	E < E1=76.4
71.50	0.0	E < E1=76.4
72.00	0.0	E < E1=76.4
72.50	0.0	E < E1=76.4
73.00	0.0	E < E1=76.4
73.50	0.0	E < E1=76.4
74.00	0.0	E < E1=76.4
74.50	0.0	E < E1=76.4
75.00	0.0	E < E1=76.4
75.50	0.0	E < E1=76.4
76.00	0.0	E < E1=76.4
76.50	0.1	H =.1
77.00	0.2	H =.6
77.50	0.2	H =1.1
78.00	0.3	H =1.6
78.50	0.3	H =2.1
79.00	0.4	H =2.6
79.50	0.4	H =3.1
80.00	0.4	H =3.6
80.50	0.5	H =4.1
81.00	0.5	H =4.6
81.50	0.0	E = or > E2=81.5

C = .6 A = .049 sq.ft.
H (ft) = Table elev. - Datum elev. (76.4 ft)
Q (cfs) = C * A * sqr(2g * H)

Outlet Structure File: CAR10REV.STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

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Williamsburg Dodge BMP/SWM Outlet Structure

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Outflow Rating Table for Structure #2
STAND PIPE Stand Pipe with weir or orifice flow

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

Elevation (ft)	Q (cfs)	Computation Messages
70.00	0.0	E < Inv.El.= 78.1
70.50	0.0	E < E1=78.1
71.00	0.0	E < E1=78.1
71.50	0.0	E < E1=78.1
72.00	0.0	E < E1=78.1
72.50	0.0	E < E1=78.1
73.00	0.0	E < E1=78.1
73.50	0.0	E < E1=78.1
74.00	0.0	E < E1=78.1
74.50	0.0	E < E1=78.1
75.00	0.0	E < E1=78.1
75.50	0.0	E < E1=78.1
76.00	0.0	E < E1=78.1
76.50	0.0	E < E1=78.1
77.00	0.0	E < E1=78.1
77.50	0.0	E < E1=78.1
78.00	0.0	E < E1=78.1
78.50	11.1	Weir: H =.4
79.00	37.4	Weir: H =.9
79.50	72.6	Weir: H =1.4
80.00	114.8	Weir: H =1.9
80.50	132.5	Orifice: H =2.4
81.00	145.6	Orifice: H =2.9
81.50	0.0	E = or > E2=81.5

Weir Cw = 3.1 Weir length = 14.13717 ft
Orifice Co = .67 Orifice area = 15.90431 sq.ft.
Q (cfs) = (Cw * L * H**1.5) or (Co * A * sqr(2*g*H))
No transition used, transition height = 0.0
Weir equation = Orifice equation @ elev.= 80.05123 ft

Outlet Structure File: CAR10REV.STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

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Williamsburg Dodge BMP/SWM Outlet Structure

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Outflow Rating Table for Structure #3
CULVERT-CR Circular Culvert (With Inlet Control)

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

Elevation (ft)	Q (cfs)	Computation Messages
70.00	0.0	E < E1=78.10
70.50	0.0	E < E1=78.10
71.00	0.0	E < E1=78.10
71.50	0.0	E < E1=78.10
72.00	0.0	E < E1=78.10
72.50	0.0	E < E1=78.10
73.00	0.0	E < E1=78.10
73.50	0.0	E < E1=78.10
74.00	0.0	E < E1=78.10
74.50	0.0	E < E1=78.10
75.00	0.0	E < E1=78.10
75.50	0.0	E < E1=78.10
76.00	0.0	E < E1=78.10
76.50	0.0	E < E1=78.10
77.00	0.0	E < E1=78.10
77.50	0.0	E < E1=78.10
78.00	0.0	E < E1=78.10
78.50	84.9	Submerged: HW =10.64
79.00	87.3	Submerged: HW =11.14
79.50	89.6	Submerged: HW =11.64
80.00	91.9	Submerged: HW =12.14
80.50	94.1	Submerged: HW =12.64
81.00	96.3	Submerged: HW =13.14
81.50	0.0	E = or > E2=81.5

Used Unsubmerged Equ. Form (1) for elev. less than 72.91 ft
Used Submerged Equation for elevations greater than 70.939 ft
HW=Headwater (ft) dc=Critical depth (ft) Ac=Area (sq.ft) at dc

Transition flows interpolated from the following values:
E1=72.91 ft; Q1=27.16 cfs; Dc=1.78 ft; E2=70.939 ft; Q2=31.05 cfs

Outlet Structure File: CAR10REV.STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

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Williamsburg Dodge BMP/SWM Outlet Structure

****

Outflow Rating Table A
Table A = 3 ? 2

Elevation (ft)	Q (cfs)	Contributing Structures
70.00	0.0	-
70.50	0.0	-
71.00	0.0	-
71.50	0.0	-
72.00	0.0	-
72.50	0.0	-
73.00	0.0	-
73.50	0.0	-
74.00	0.0	-
74.50	0.0	-
75.00	0.0	-
75.50	0.0	-
76.00	0.0	-
76.50	0.0	-
77.00	0.0	-
77.50	0.0	-
78.00	0.0	-
78.50	11.1	2
79.00	37.4	2
79.50	72.6	2
80.00	91.9	3
80.50	94.1	3
81.00	96.3	3
81.50	0.0	-

EXECUTED: 02-22-2000 11:25:50 Post Dev Return Freq: 2 years

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*  Williamsburg Dodge   *
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Inflow Hydrograph: car\CAR2DEV .HYD
Rating Table file: car\OUTFLOX2.PND

----INITIAL CONDITIONS----
Elevation = 76.40 ft
Outflow = 0.08 cfs
Storage = 12,698 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + O (cfs)
70.00	0.0	0	0.0	0.0
70.50	0.0	13	0.4	0.4
71.00	0.0	105	3.5	3.5
71.50	0.0	304	10.1	10.1
72.00	0.0	593	19.8	19.8
72.50	0.0	1,017	33.9	33.9
73.00	0.0	1,628	54.3	54.3
73.50	0.0	2,451	81.7	81.7
74.00	0.0	3,502	116.7	116.7
74.50	0.0	4,818	160.6	160.6
75.00	0.0	6,434	214.4	214.4
75.50	0.0	8,364	278.8	278.8
76.00	0.0	10,617	353.8	353.8
76.50	0.1	13,218	440.5	440.6
77.00	0.2	16,194	539.7	539.9
77.50	0.2	19,701	656.6	656.8
78.00	0.3	23,924	797.3	797.6
78.50	11.4	28,958	965.1	976.5
79.00	37.8	34,908	1163.4	1201.2
79.50	73.0	41,633	1387.5	1460.5
80.00	92.3	48,958	1631.6	1723.9
80.50	94.6	56,974	1898.7	1993.3
81.00	96.8	65,783	2192.3	2289.1

Time increment (t) = 1.0 min.

EXECUTED: 02-22-2000 11:25:50 Post Dev Return Freq: 2 years

Pond File: car\OUTFLOX2.PND
Inflow Hydrograph: car\CAR2DEV .HYD
Outflow Hydrograph: car\OUT2X .HYD

INFLOW HYDROGRAPH

TIME (min)	INFLOW (cfs)
0.0	0.00
1.0	1.20
2.0	2.39
3.0	3.59
4.0	4.79
5.0	5.99
6.0	7.18
7.0	8.38
8.0	9.58
9.0	10.78
10.0	11.97
11.0	13.17
12.0	14.37
13.0	15.57
14.0	16.76
15.0	17.96
16.0	19.16
17.0	20.36
18.0	21.55
19.0	22.75
20.0	23.95
21.0	25.15
22.0	23.95
23.0	22.75
24.0	21.55
25.0	20.36
26.0	19.16
27.0	17.96
28.0	16.76
29.0	15.57
30.0	14.37
31.0	13.17
32.0	11.97
33.0	10.78
34.0	9.58
35.0	8.38
36.0	7.18
37.0	5.99
38.0	4.79
39.0	3.59
40.0	2.39
41.0	1.20
42.0	0.00

ROUTING COMPUTATIONS

I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
-----	423.1	423.3	0.08	76.40
1.2	424.1	424.3	0.08	76.41
3.6	427.5	427.7	0.09	76.43
6.0	433.3	433.5	0.09	76.46
8.4	441.5	441.7	0.10	76.51
10.8	452.1	452.3	0.11	76.56
13.2	465.0	465.2	0.12	76.62
15.6	480.3	480.6	0.14	76.70
18.0	497.9	498.2	0.16	76.79
20.4	517.9	518.3	0.18	76.89
22.8	540.3	540.7	0.20	77.00
25.1	565.0	565.4	0.20	77.11
27.5	592.2	592.6	0.20	77.23
29.9	621.7	622.1	0.20	77.35
32.3	653.6	654.0	0.20	77.49
34.7	687.9	688.3	0.22	77.61
37.1	724.5	725.0	0.25	77.74
39.5	763.5	764.0	0.28	77.88
41.9	803.8	805.4	0.78	78.02
44.3	841.3	848.1	3.44	78.14
46.7	876.1	888.0	5.91	78.25
49.1	908.8	925.2	8.22	78.36
49.1	937.4	957.9	10.25	78.45
46.7	959.5	984.1	12.30	78.52
44.3	974.6	1003.8	14.61	78.56
41.9	984.3	1016.5	16.10	78.59
39.5	989.9	1023.8	16.96	78.61
37.1	992.3	1027.0	17.34	78.61
34.7	992.4	1027.1	17.34	78.61
32.3	990.6	1024.7	17.07	78.61
29.9	987.4	1020.5	16.57	78.60
27.5	983.1	1014.9	15.91	78.59
25.1	977.9	1008.2	15.13	78.57
22.8	972.2	1000.7	14.25	78.55
20.4	966.0	992.6	13.29	78.54
18.0	959.4	983.9	12.28	78.52
15.6	952.3	974.9	11.31	78.50
13.2	944.1	965.5	10.72	78.47
10.8	934.7	954.8	10.06	78.44
8.4	924.4	943.1	9.33	78.41
6.0	913.3	930.4	8.54	78.37
3.6	901.5	916.9	7.71	78.33
1.2	889.1	902.7	6.82	78.29

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

Pond File: car\OUTFLOX2.PND
Inflow Hydrograph: car\CAR2DEV .HYD
Outflow Hydrograph: car\OUT2X .HYD

Starting Pond W.S. Elevation = 76.40 ft

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

Peak Inflow = 25.15 cfs
Peak Outflow = 17.34 cfs
Peak Elevation = 78.61 ft

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

Initial Storage = 12,698 cu-ft
Peak Storage From Storm = 17,600 cu-ft

Total Storage in Pond = 30,297 cu-ft

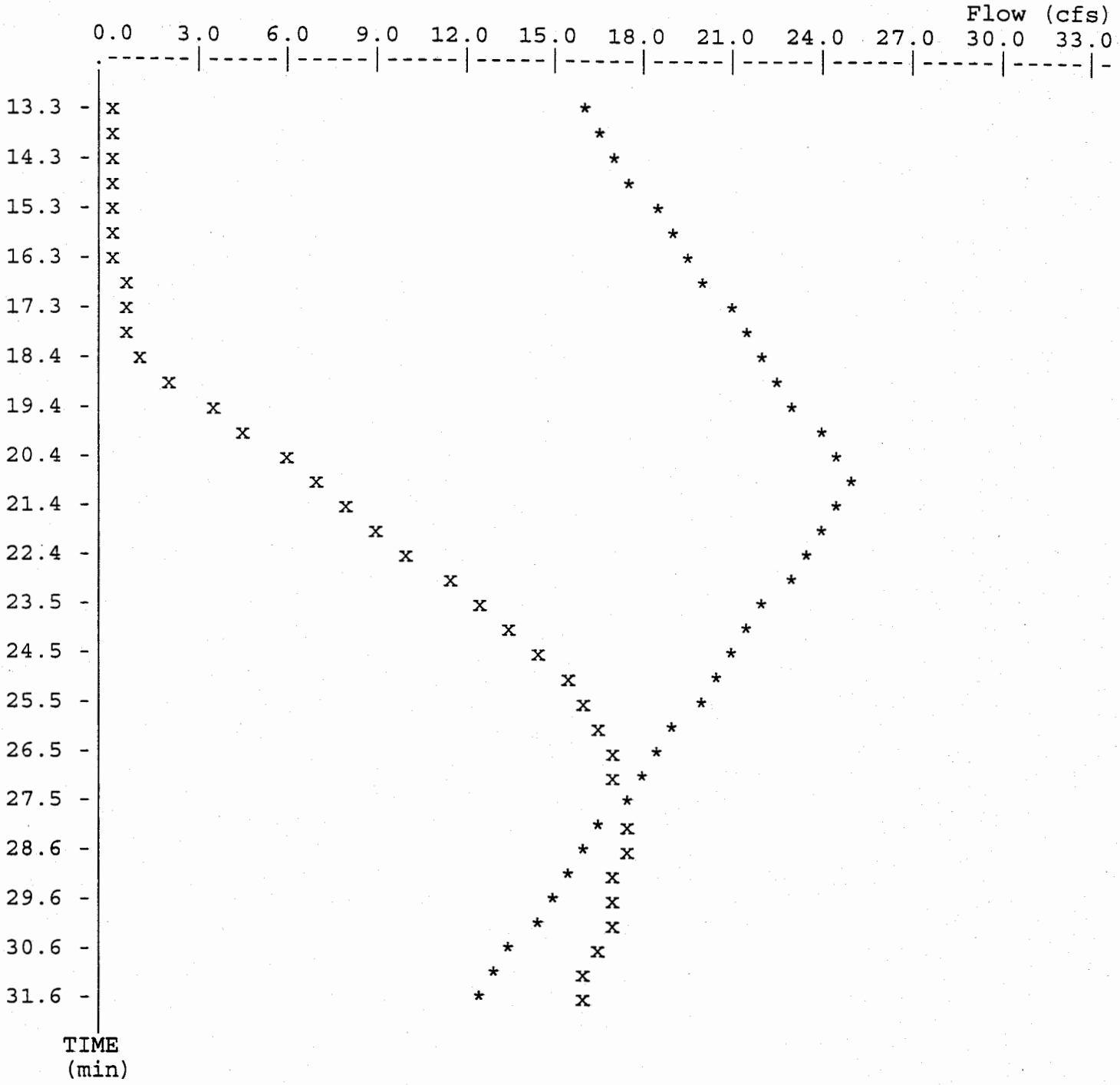
>>>>> Warning, initial pond outflow > 1st inflow ordinate. <<<<<

Post Dev Return Freq: 2 years

Pond File: car\OUTFLOX2.PND
Inflow Hydrograph: car\CAR2DEV .HYD
Outflow Hydrograph: car\OUT2X .HYD

EXECUTED: 02-22-2000
11:25:50

Peak Inflow = 25.15 cfs
Peak Outflow = 17.34 cfs
Peak Elevation = 78.61 ft



x File: car\OUT2X .HYD Qmax = 17.3 cfs
* File: car\CAR2DEV .HYD Qmax = 25.1 cfs

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*  Williamsburg Dodge  *
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Inflow Hydrograph: car\CAR10DEV.HYD
Rating Table file: car\OUTFLOX2.PND

----INITIAL CONDITIONS----
Elevation = 76.40 ft
Outflow = 0.08 cfs
Storage = 12,698 cu-ft

GIVEN POND DATA

ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)
70.00	0.0	0
70.50	0.0	13
71.00	0.0	105
71.50	0.0	304
72.00	0.0	593
72.50	0.0	1,017
73.00	0.0	1,628
73.50	0.0	2,451
74.00	0.0	3,502
74.50	0.0	4,818
75.00	0.0	6,434
75.50	0.0	8,364
76.00	0.0	10,617
76.50	0.1	13,218
77.00	0.2	16,194
77.50	0.2	19,701
78.00	0.3	23,924
78.50	11.4	28,958
79.00	37.8	34,908
79.50	73.0	41,633
80.00	92.3	48,958
80.50	94.6	56,974
81.00	96.8	65,783

INTERMEDIATE ROUTING COMPUTATIONS

2S/t (cfs)	2S/t + O (cfs)
0.0	0.0
0.4	0.4
3.5	3.5
10.1	10.1
19.8	19.8
33.9	33.9
54.3	54.3
81.7	81.7
116.7	116.7
160.6	160.6
214.4	214.4
278.8	278.8
353.8	353.8
440.5	440.6
539.7	539.9
656.6	656.8
797.3	797.6
965.1	976.5
1163.4	1201.2
1387.5	1460.5
1631.6	1723.9
1898.7	1993.3
2192.3	2289.1

Time increment (t) = 1.0 min.

Pond File: car\OUTFLOX2.PND
Inflow Hydrograph: car\CAR10DEV.HYD
Outflow Hydrograph: car\OUT10X .HYD

INFLOW HYDROGRAPH

TIME (min)	INFLOW (cfs)
0.0	0.00
1.0	1.65
2.0	3.29
3.0	4.94
4.0	6.59
5.0	8.23
6.0	9.88
7.0	11.53
8.0	13.17
9.0	14.82
10.0	16.46
11.0	18.11
12.0	19.76
13.0	21.40
14.0	23.05
15.0	24.70
16.0	26.34
17.0	27.99
18.0	29.64
19.0	31.28
20.0	32.93
21.0	34.58
22.0	32.93
23.0	31.28
24.0	29.64
25.0	27.99
26.0	26.34
27.0	24.70
28.0	23.05
29.0	21.40
30.0	19.76
31.0	18.11
32.0	16.46
33.0	14.82
34.0	13.17
35.0	11.53
36.0	9.88
37.0	8.23
38.0	6.59
39.0	4.94
40.0	3.29
41.0	1.65
42.0	0.00

ROUTING COMPUTATIONS

I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
-----	423.1	423.3	0.08	76.40
1.7	424.6	424.7	0.08	76.41
4.9	429.3	429.5	0.09	76.44
8.2	437.4	437.6	0.10	76.48
11.5	448.7	448.9	0.11	76.54
14.8	463.3	463.5	0.12	76.62
18.1	481.1	481.4	0.14	76.71
21.4	502.2	502.5	0.16	76.81
24.7	526.5	526.9	0.19	76.93
28.0	554.1	554.5	0.20	77.06
31.3	585.0	585.4	0.20	77.19
34.6	619.1	619.5	0.20	77.34
37.9	656.6	657.0	0.20	77.50
41.2	697.3	697.8	0.23	77.65
44.5	741.2	741.8	0.26	77.80
47.8	788.4	789.0	0.29	77.97
51.0	833.7	839.4	2.90	78.12
54.3	876.2	888.0	5.91	78.25
57.6	916.3	933.8	8.75	78.38
60.9	954.2	977.2	11.49	78.50
64.2	985.8	1018.4	16.33	78.59
67.5	1012.4	1053.3	20.43	78.67
67.5	1032.8	1080.0	23.56	78.73
64.2	1045.9	1097.0	25.57	78.77
60.9	1053.4	1106.8	26.72	78.79
57.6	1056.6	1111.0	27.21	78.80
54.3	1056.5	1110.9	27.20	78.80
51.0	1054.0	1107.6	26.80	78.79
47.8	1049.5	1101.7	26.12	78.78
44.5	1043.5	1093.9	25.20	78.76
41.2	1036.5	1084.7	24.12	78.74
37.9	1028.5	1074.3	22.90	78.72
34.6	1020.0	1063.1	21.58	78.69
31.3	1010.9	1051.2	20.18	78.67
28.0	1001.4	1038.9	18.73	78.64
24.7	991.6	1026.1	17.23	78.61
21.4	981.6	1013.0	15.70	78.58
18.1	971.5	999.8	14.14	78.55
14.8	961.2	986.3	12.56	78.52
11.5	950.4	972.7	11.17	78.49
8.2	938.0	958.6	10.29	78.45
4.9	924.3	943.0	9.32	78.41
1.7	909.4	926.0	8.27	78.36

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

Pond File: car\OUTFLOX2.PND
Inflow Hydrograph: car\CAR10DEV.HYD
Outflow Hydrograph: car\OUT10X .HYD

Starting Pond W.S. Elevation = 76.40 ft

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

Peak Inflow	=	34.58 cfs
Peak Outflow	=	27.21 cfs
Peak Elevation	=	78.80 ft

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

Initial Storage	=	12,698 cu-ft
Peak Storage From Storm	=	19,823 cu-ft

Total Storage in Pond	=	32,521 cu-ft

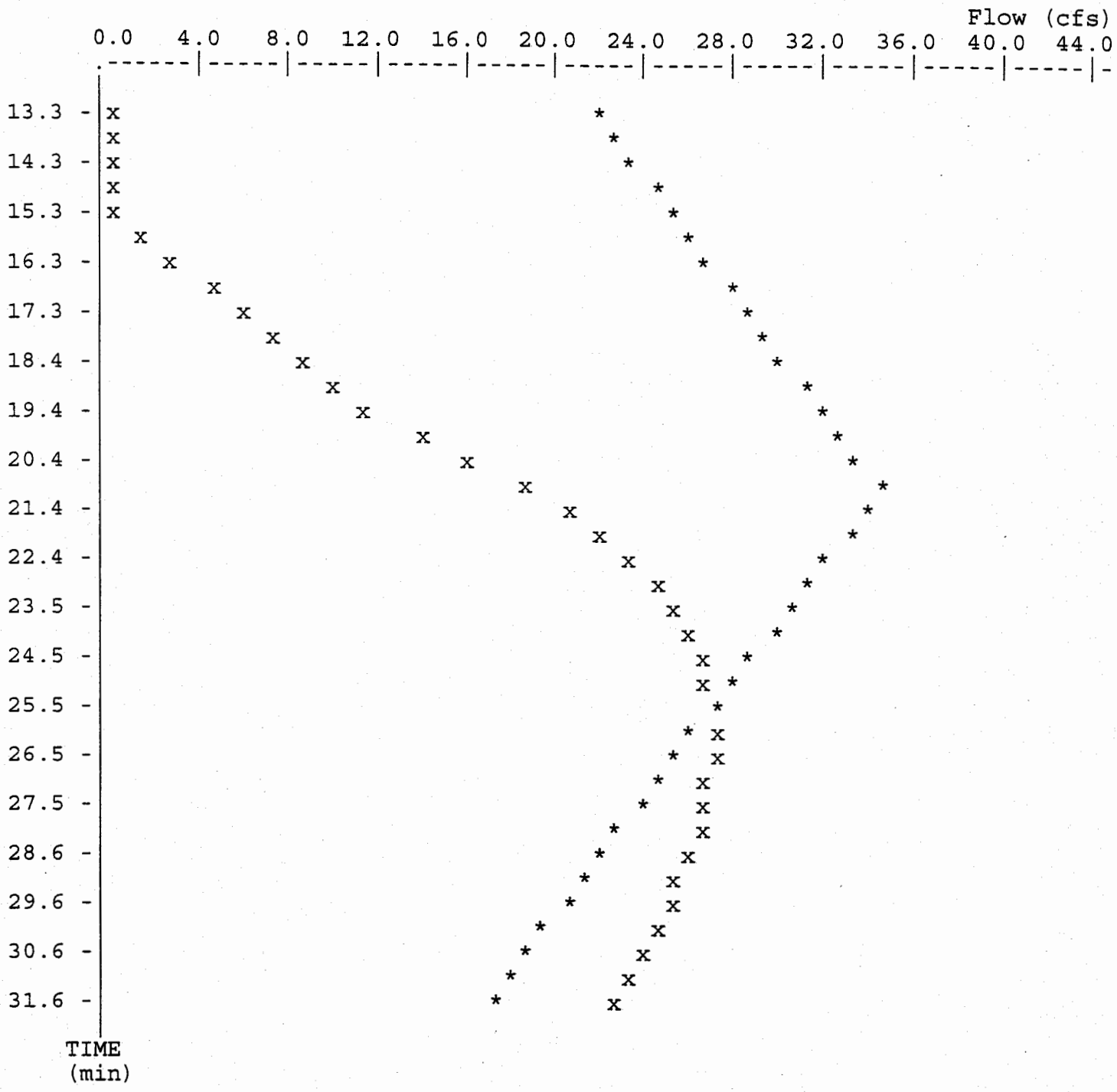
>>>>> Warning, initial pond outflow > 1st inflow ordinate. <<<<<

Return Freq: 10 years

Pond File: car\OUTFLOX2.PND
Inflow Hydrograph: car\CAR10DEV.HYD
Outflow Hydrograph: car\OUT10X .HYD

EXECUTED: 02-22-2000
11:25:50

Peak Inflow = 34.58 cfs
Peak Outflow = 27.21 cfs
Peak Elevation = 78.80 ft



x File: car\OUT10X .HYD Qmax = 27.2 cfs
* File: car\CAR10DEV.HYD Qmax = 34.6 cfs

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*  Williamsburg Dodge  *
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Inflow Hydrograph: car\CAR25DEV.HYD
Rating Table file: car\OUTFLOX2.PND

----INITIAL CONDITIONS----
Elevation = 76.40 ft
Outflow = 0.08 cfs
Storage = 12,698 cu-ft

GIVEN POND DATA

ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)
70.00	0.0	0
70.50	0.0	13
71.00	0.0	105
71.50	0.0	304
72.00	0.0	593
72.50	0.0	1,017
73.00	0.0	1,628
73.50	0.0	2,451
74.00	0.0	3,502
74.50	0.0	4,818
75.00	0.0	6,434
75.50	0.0	8,364
76.00	0.0	10,617
76.50	0.1	13,218
77.00	0.2	16,194
77.50	0.2	19,701
78.00	0.3	23,924
78.50	11.4	28,958
79.00	37.8	34,908
79.50	73.0	41,633
80.00	92.3	48,958
80.50	94.6	56,974
81.00	96.8	65,783

INTERMEDIATE ROUTING COMPUTATIONS

2S/t (cfs)	2S/t + 0 (cfs)
0.0	0.0
0.4	0.4
3.5	3.5
10.1	10.1
19.8	19.8
33.9	33.9
54.3	54.3
81.7	81.7
116.7	116.7
160.6	160.6
214.4	214.4
278.8	278.8
353.8	353.8
440.5	440.6
539.7	539.9
656.6	656.8
797.3	797.6
965.1	976.5
1163.4	1201.2
1387.5	1460.5
1631.6	1723.9
1898.7	1993.3
2192.3	2289.1

Time increment (t) = 1.0 min.

EXECUTED: 02-22-2000 11:25:50 Return Freq: 25 years

Pond File: car\OUTFLOX2.PND
Inflow Hydrograph: car\CAR25DEV.HYD
Outflow Hydrograph: car\OUT25X .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.0	0.00	-----	423.1	423.3	0.08	76.40
1.0	1.91	1.9	424.8	425.0	0.08	76.41
2.0	3.82	5.7	430.4	430.6	0.09	76.44
3.0	5.73	9.6	439.7	439.9	0.10	76.50
4.0	7.63	13.4	452.9	453.1	0.11	76.56
5.0	9.54	17.2	469.8	470.0	0.13	76.65
6.0	11.45	21.0	490.5	490.8	0.15	76.75
7.0	13.36	24.8	514.9	515.3	0.18	76.88
8.0	15.27	28.6	543.2	543.6	0.20	77.02
9.0	17.18	32.5	575.2	575.6	0.20	77.15
10.0	19.08	36.3	611.1	611.5	0.20	77.31
11.0	20.99	40.1	650.7	651.1	0.20	77.48
12.0	22.90	43.9	694.2	694.6	0.23	77.63
13.0	24.81	47.7	741.4	741.9	0.26	77.80
14.0	26.72	51.5	792.3	792.9	0.30	77.98
15.0	28.63	55.3	840.8	847.7	3.41	78.14
16.0	30.53	59.2	886.7	900.0	6.66	78.29
17.0	32.44	63.0	930.2	949.7	9.74	78.43
18.0	34.35	66.8	969.4	997.0	13.81	78.55
19.0	36.26	70.6	1002.2	1040.0	18.86	78.64
20.0	38.17	74.4	1030.3	1076.7	23.17	78.72
21.0	40.08	78.3	1054.7	1108.6	26.92	78.79
22.0	38.17	78.3	1073.4	1133.0	29.79	78.85
23.0	36.26	74.4	1084.8	1147.8	31.53	78.88
24.0	34.35	70.6	1090.5	1155.4	32.42	78.90
25.0	32.44	66.8	1092.0	1157.3	32.65	78.90
26.0	30.53	63.0	1090.3	1155.0	32.38	78.90
27.0	28.63	59.2	1086.0	1149.4	31.72	78.88
28.0	26.72	55.3	1079.8	1141.3	30.77	78.87
29.0	24.81	51.5	1072.1	1131.3	29.59	78.84
30.0	22.90	47.7	1063.4	1119.8	28.24	78.82
31.0	20.99	43.9	1053.7	1107.2	26.76	78.79
32.0	19.08	40.1	1043.4	1093.8	25.18	78.76
33.0	17.18	36.3	1032.6	1079.7	23.53	78.73
34.0	15.27	32.5	1021.5	1065.1	21.81	78.70
35.0	13.36	28.6	1010.0	1050.1	20.05	78.66
36.0	11.45	24.8	998.3	1034.8	18.25	78.63
37.0	9.54	21.0	986.4	1019.3	16.43	78.60
38.0	7.63	17.2	974.4	1003.6	14.59	78.56
39.0	5.73	13.4	962.3	987.8	12.73	78.53
40.0	3.82	9.6	949.6	971.9	11.11	78.49
41.0	1.91	5.7	935.2	955.4	10.09	78.44
42.0	0.00	1.9	919.2	937.1	8.96	78.39

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

Pond File: car\OUTFLOX2.PND
Inflow Hydrograph: car\CAR25DEV.HYD
Outflow Hydrograph: car\OUT25X .HYD

Starting Pond W.S. Elevation = 76.40 ft

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

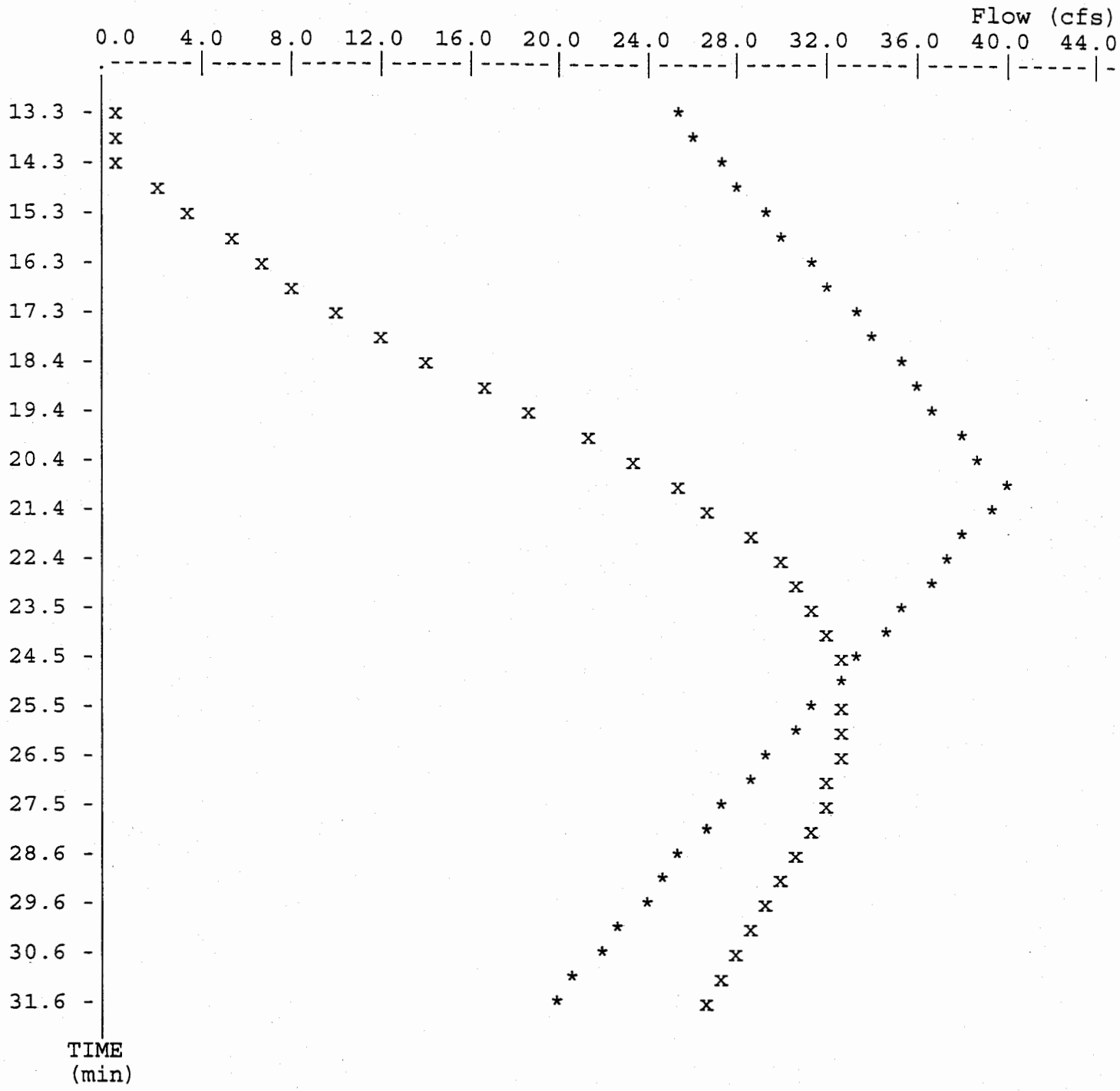
Peak Inflow = 40.08 cfs
Peak Outflow = 32.65 cfs
Peak Elevation = 78.90 ft

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

Initial Storage = 12,698 cu-ft
Peak Storage From Storm = 21,050 cu-ft

Total Storage in Pond = 33,747 cu-ft

>>>>> Warning, initial pond outflow > 1st inflow ordinate. <<<<<



x File: car\OUT25X .HYD Qmax = 32.7 cfs
* File: car\CAR25DEV.HYD Qmax = 40.1 cfs

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*  Williamsburg Dodge  *
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Inflow Hydrograph: car\CAR50DEV.HYD
Rating Table file: car\OUTFLOX2.PND

----INITIAL CONDITIONS----
Elevation = 76.40 ft
Outflow = 0.08 cfs
Storage = 12,698 cu-ft

GIVEN POND DATA

ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)
70.00	0.0	0
70.50	0.0	13
71.00	0.0	105
71.50	0.0	304
72.00	0.0	593
72.50	0.0	1,017
73.00	0.0	1,628
73.50	0.0	2,451
74.00	0.0	3,502
74.50	0.0	4,818
75.00	0.0	6,434
75.50	0.0	8,364
76.00	0.0	10,617
76.50	0.1	13,218
77.00	0.2	16,194
77.50	0.2	19,701
78.00	0.3	23,924
78.50	11.4	28,958
79.00	37.8	34,908
79.50	73.0	41,633
80.00	92.3	48,958
80.50	94.6	56,974
81.00	96.8	65,783

INTERMEDIATE ROUTING COMPUTATIONS

2S/t (cfs)	2S/t + O (cfs)
0.0	0.0
0.4	0.4
3.5	3.5
10.1	10.1
19.8	19.8
33.9	33.9
54.3	54.3
81.7	81.7
116.7	116.7
160.6	160.6
214.4	214.4
278.8	278.8
353.8	353.8
440.5	440.6
539.7	539.9
656.6	656.8
797.3	797.6
965.1	976.5
1163.4	1201.2
1387.5	1460.5
1631.6	1723.9
1898.7	1993.3
2192.3	2289.1

Time increment (t) = 1.0 min.

Pond File: car\OUTFLOX2.PND
Inflow Hydrograph: car\CAR50DEV.HYD
Outflow Hydrograph: car\OUT50X .HYD

INFLOW HYDROGRAPH

TIME (min)	INFLOW (cfs)
0.0	0.00
1.0	2.06
2.0	4.12
3.0	6.17
4.0	8.23
5.0	10.29
6.0	12.35
7.0	14.41
8.0	16.46
9.0	18.52
10.0	20.58
11.0	22.64
12.0	24.70
13.0	26.75
14.0	28.81
15.0	30.87
16.0	32.93
17.0	34.99
18.0	37.04
19.0	39.10
20.0	41.16
21.0	43.22
22.0	43.22
23.0	43.22
24.0	43.22
25.0	43.22
26.0	43.22
27.0	43.22
28.0	41.16
29.0	39.10
30.0	37.04
31.0	34.99
32.0	32.93
33.0	30.87
34.0	28.81
35.0	26.75
36.0	24.70
37.0	22.64
38.0	20.58
39.0	18.52
40.0	16.46
41.0	14.41
42.0	12.35
43.0	10.29
44.0	8.23

ROUTING COMPUTATIONS

I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
-----	423.1	423.3	0.08	76.40
2.1	425.0	425.2	0.08	76.41
6.2	431.0	431.2	0.09	76.45
10.3	441.1	441.3	0.10	76.50
14.4	455.2	455.5	0.11	76.57
18.5	473.5	473.8	0.13	76.67
22.6	495.8	496.1	0.16	76.78
26.8	522.2	522.6	0.18	76.91
30.9	552.7	553.1	0.20	77.06
35.0	587.3	587.7	0.20	77.20
39.1	626.0	626.4	0.20	77.37
43.2	668.8	669.2	0.21	77.54
47.3	715.6	716.1	0.24	77.71
51.5	766.5	767.1	0.28	77.89
55.6	818.4	822.1	1.82	78.07
59.7	867.5	878.1	5.30	78.23
63.8	914.1	931.3	8.60	78.37
67.9	957.9	982.1	12.06	78.51
72.0	994.6	1030.0	17.69	78.62
76.1	1025.8	1070.7	22.48	78.71
80.3	1052.8	1106.0	26.62	78.79
84.4	1076.6	1137.2	30.28	78.86
86.4	1096.4	1163.1	33.32	78.92
86.4	1111.6	1182.9	35.65	78.96
86.4	1123.1	1198.0	37.43	78.99
86.4	1131.7	1209.6	38.94	79.02
86.4	1137.9	1218.1	40.10	79.03
86.4	1142.5	1224.4	40.95	79.04
84.4	1144.3	1226.9	41.29	79.05
80.3	1142.6	1224.5	40.97	79.05
76.1	1138.4	1218.7	40.18	79.03
72.0	1132.3	1210.4	39.05	79.02
67.9	1124.8	1200.2	37.69	79.00
63.8	1116.0	1188.6	36.33	78.97
59.7	1106.1	1175.7	34.80	78.94
55.6	1095.3	1161.6	33.15	78.91
51.5	1083.9	1146.8	31.41	78.88
47.3	1072.1	1131.3	29.59	78.84
43.2	1059.9	1115.3	27.71	78.81
39.1	1047.4	1099.0	25.80	78.77
35.0	1034.7	1082.4	23.84	78.74
30.9	1021.8	1065.6	21.87	78.70
26.8	1008.8	1048.6	19.87	78.66
22.6	995.8	1031.5	17.86	78.62
18.5	982.6	1014.3	15.84	78.58

Pond File: car\OUTFLOX2.PND
Inflow Hydrograph: car\CAR50DEV.HYD
Outflow Hydrograph: car\OUT50X .HYD

INFLOW HYDROGRAPH

TIME (min)	INFLOW (cfs)
45.0	6.17
46.0	4.12
47.0	2.06
48.0	0.00

ROUTING COMPUTATIONS

I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
14.4	969.4	997.0	13.81	78.55
10.3	956.1	979.7	11.78	78.51
6.2	941.2	962.3	10.52	78.46
2.1	924.6	943.3	9.34	78.41

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

Pond File: car\OUTFLOX2.PND
Inflow Hydrograph: car\CAR50DEV.HYD
Outflow Hydrograph: car\OUT50X .HYD

Starting Pond W.S. Elevation = 76.40 ft

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

Peak Inflow = 43.22 cfs
Peak Outflow = 41.29 cfs
Peak Elevation = 79.05 ft

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

Initial Storage = 12,698 cu-ft
Peak Storage From Storm = 22,877 cu-ft

Total Storage in Pond = 35,574 cu-ft

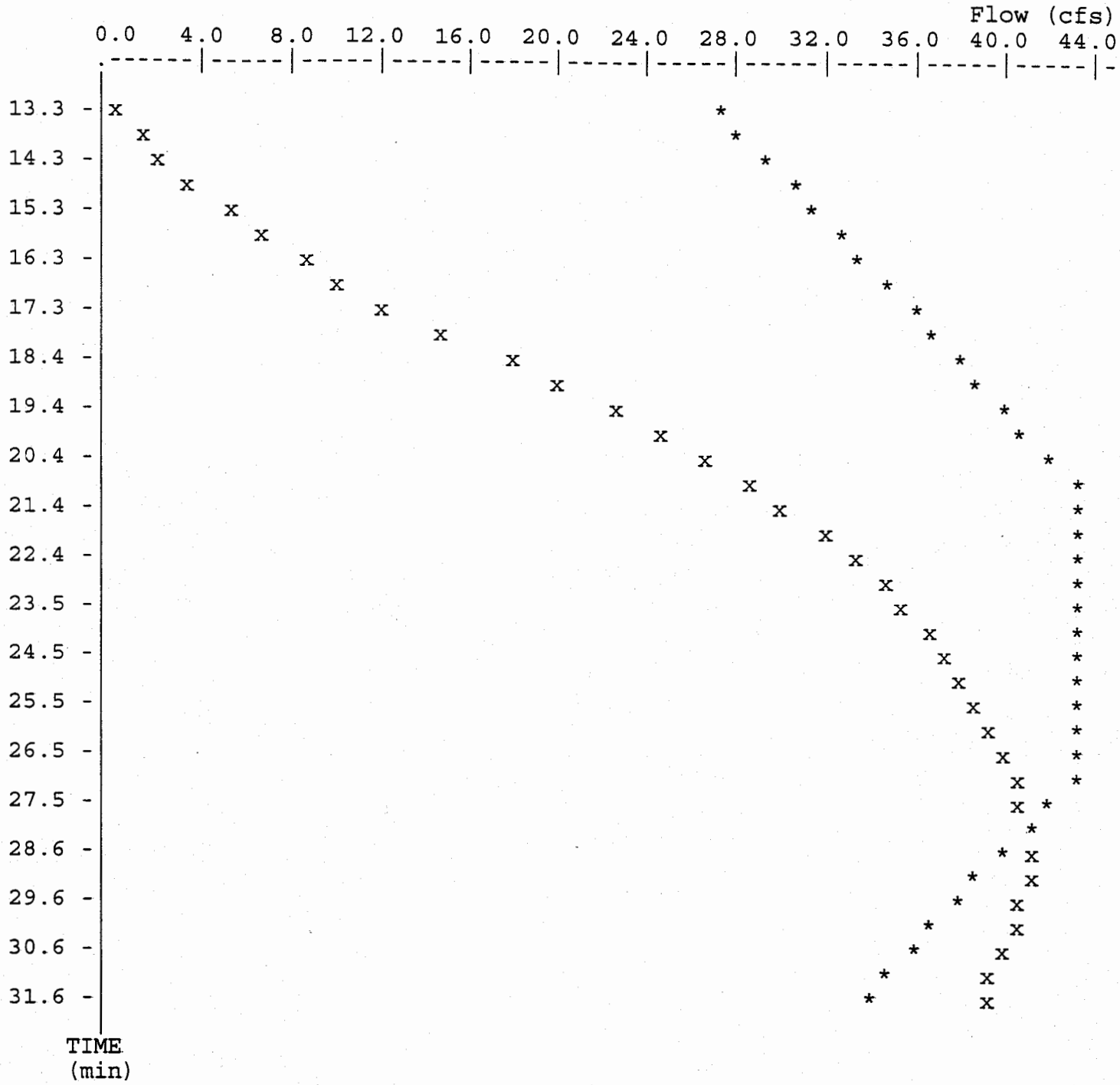
>>>>> Warning, initial pond outflow > 1st inflow ordinate. <<<<<

Return Freq: 50 years

Pond File: car\OUTFLOX2.PND
Inflow Hydrograph: car\CAR50DEV.HYD
Outflow Hydrograph: car\OUT50X .HYD

EXECUTED: 02-22-2000
11:25:50

Peak Inflow = 43.22 cfs
Peak Outflow = 41.29 cfs
Peak Elevation = 79.05 ft



x File: car\OUT50X .HYD Qmax = 41.3 cfs
* File: car\CAR50DEV.HYD Qmax = 43.2 cfs

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*  Williamsburg Dodge  *
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Inflow Hydrograph: car\C100D .HYD
Rating Table file: car\OUTFLOX2.PND

----INITIAL CONDITIONS----
Elevation = 76.40 ft
Outflow = 0.08 cfs
Storage = 12,698 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + O (cfs)
70.00	0.0	0	0.0	0.0
70.50	0.0	13	0.4	0.4
71.00	0.0	105	3.5	3.5
71.50	0.0	304	10.1	10.1
72.00	0.0	593	19.8	19.8
72.50	0.0	1,017	33.9	33.9
73.00	0.0	1,628	54.3	54.3
73.50	0.0	2,451	81.7	81.7
74.00	0.0	3,502	116.7	116.7
74.50	0.0	4,818	160.6	160.6
75.00	0.0	6,434	214.4	214.4
75.50	0.0	8,364	278.8	278.8
76.00	0.0	10,617	353.8	353.8
76.50	0.1	13,218	440.5	440.6
77.00	0.2	16,194	539.7	539.9
77.50	0.2	19,701	656.6	656.8
78.00	0.3	23,924	797.3	797.6
78.50	11.4	28,958	965.1	976.5
79.00	37.8	34,908	1163.4	1201.2
79.50	73.0	41,633	1387.5	1460.5
80.00	92.3	48,958	1631.6	1723.9
80.50	94.6	56,974	1898.7	1993.3
81.00	96.8	65,783	2192.3	2289.1

Time increment (t) = 1.0 min.

Pond File: car\OUTFLOX2.PND
Inflow Hydrograph: car\C100D .HYD
Outflow Hydrograph: car\OUT100X .HYD

INFLOW HYDROGRAPH

TIME (min)	INFLOW (cfs)
0.0	0.00
1.0	2.95
2.0	5.89
3.0	8.84
4.0	11.79
5.0	14.73
6.0	17.68
7.0	20.63
8.0	23.57
9.0	26.52
10.0	29.47
11.0	32.41
12.0	35.36
13.0	38.31
14.0	41.25
15.0	44.20
16.0	47.15
17.0	50.09
18.0	53.04
19.0	55.99
20.0	58.94
21.0	61.88
22.0	58.94
23.0	55.99
24.0	53.04
25.0	50.09
26.0	47.15
27.0	44.20
28.0	41.25
29.0	38.31
30.0	35.36
31.0	32.41
32.0	29.47
33.0	26.52
34.0	23.57
35.0	20.63
36.0	17.68
37.0	14.73
38.0	11.79
39.0	8.84
40.0	5.89
41.0	2.95
42.0	0.00

ROUTING COMPUTATIONS

I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
-----	423.1	423.3	0.08	76.40
3.0	425.9	426.0	0.08	76.42
8.8	434.5	434.7	0.09	76.47
14.7	449.0	449.3	0.11	76.54
20.6	469.4	469.7	0.13	76.65
26.5	495.6	495.9	0.16	76.78
32.4	527.7	528.0	0.19	76.94
38.3	565.6	566.0	0.20	77.11
44.2	609.4	609.8	0.20	77.30
50.1	659.1	659.5	0.20	77.51
56.0	714.6	715.0	0.24	77.71
61.9	775.9	776.4	0.28	77.92
67.8	837.3	843.6	3.16	78.13
73.7	896.3	911.0	7.34	78.32
79.6	953.2	975.9	11.36	78.50
85.5	1001.2	1038.6	18.70	78.64
91.3	1042.5	1092.6	25.04	78.76
97.2	1078.6	1139.7	30.58	78.86
103.1	1110.7	1181.7	35.51	78.96
109.0	1139.1	1219.7	40.31	79.04
114.9	1164.1	1254.0	44.97	79.10
120.8	1186.6	1284.9	49.16	79.16
120.8	1202.9	1307.4	52.22	79.20
114.9	1210.6	1317.9	53.64	79.23
109.0	1211.9	1319.6	53.88	79.23
103.1	1208.5	1315.0	53.25	79.22
97.2	1201.7	1305.7	51.99	79.20
91.3	1192.5	1293.1	50.28	79.18
85.5	1181.5	1278.0	48.23	79.15
79.6	1169.2	1261.1	45.93	79.12
73.7	1156.0	1242.9	43.46	79.08
67.8	1142.0	1223.7	40.86	79.04
61.9	1127.6	1203.9	38.17	79.01
56.0	1112.1	1183.5	35.73	78.96
50.1	1095.7	1162.2	33.22	78.91
44.2	1078.7	1139.9	30.61	78.86
38.3	1061.2	1117.0	27.92	78.81
32.4	1043.3	1093.6	25.16	78.76
26.5	1025.1	1069.8	22.37	78.71
20.6	1006.6	1045.7	19.53	78.65
14.7	988.0	1021.4	16.68	78.60
8.8	969.3	996.9	13.80	78.55
3.0	949.9	972.2	11.14	78.49

Williamsburg Dodge

BMP and Drainage Computations

Prepared by: Potts, Minter, and Associates
November 10, 1999

Reviewed SA
12-16-99

Williamsburg Dodge

♦Hydrology Computations

BENGTSON, DEBELL & ELKIN, LTD.
808 Moorefield Park Drive, Suite 220
RICHMOND, VIRGINIA 23236
(804) 320-2667

JOB Williamsburg Lodge
SHEET NO. 1 OF
CALCULATED BY TJC DATE
CHECKED BY DATE
SCALE

- DA to property line at discharge point below proposed BMP

Existing runoff areas

- Area A; Large parcels, open agricultural field (offsite) and timbered wooded areas & fields (onsite)

DA = 17 ac
C = 0.4 Need calc. / OK if used in POSTDEV.
CA = 6.8

- Area B; Runoff from Route 60 Right-of-way

DA = 1.1 ac 1.8? (1.8 based on drainage map) 18.1 ac. Total
C = .8 ✓
CA = .88

$(w = \frac{0.4(17) + 0.8(1.1)}{18.1} = 0.42$

Wt'd $C = \frac{6.8 + .88}{18.1 ac} = 0.42$ ✓ $CA_{wt} = .42 \times 18.1 = 7.60$ ✓

$\frac{6.8 + 1.44}{18.8} = 0.438$

t_c calculation, pre developed: 200' OLF @ 1% over grass = 15 min. ✓
Conc. Flow, 1000 LF
, Elev. Diff = 92-58'
ΔH = 34'
, flow time (Kirpich Chart) = 6 min ✓

Total t_c = 21 min ✓

Pre-developed Runoff Rates

- i_2 = 3.2 in/hr ✓, Q_2 = (7.60) 3.2 = 24.32 cfs. ✓
i_{10} = 4.5 in./hr. ✓ Q_{10} = " 4.5 = 34.20 cfs.
i_{50} = 5.2 in./hr ✓ Q_{50} = (1.1) " (5.2) = 43.50 cfs.
i_{100} = 6.2 in./hr. ✓ Q_{100} = (1.25) " (6.2) = 58.90 cfs.

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JOB Williamsburg Dodge
SHEET NO. 2 OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE

Post Developed Condition

- Project Area = 6.4 ac.

  - impervious area = 150,625 s.f. = 3.46 ac. (54.06%) < 60 OK.
  - pervious area = 2.94 ac. (45.94%)

- Wt. $C = \frac{(3.46 \times .9) + (2.94 \times .3)}{6.4 \text{ ac.}} = \frac{3.996}{6.4} = 0.62$ ✓

  C = 0.4 previously

- Off site area = 18.1 − 6.4 = 11.7 ac, C = 0.42 OK. FOR BASIN

  THIS WAS WEIGHTED BASED ON 17 AC. @ 0.4 OF WHICH 3.46 AC IS NOW C = 0.90

- Develop $C = \frac{(.42 \times 11.7) + (6.4 \times 0.62)}{18.1} = 0.49$

post t_c calc. = pre t_c calc. because off-site surface characteristics are unchanged & BMP area on-site left in natural state. ✓

$Q_2 = (.49)(3.2 \text{ in./hr.})(18.1) = 28.4$ cfs
$Q_{10} = (.49)(4.5 \text{ in./hr.})(18.1) = 39.9$ cfs
$Q_{50} = (1.1)(.49)(5.2 \text{ in./hr.})(\text{"}) = 50.7$ cfs
$Q_{100} = (1.25)(.49)(6.2)(\text{"}) = 68.7$ cfs

POND-2 Version: 5.21 S/N:

Return Freq: 25 years

Pond File: car\OUTFLOX2.PND
Inflow Hydrograph: car\CAR25DEV.HYD
Outflow Hydrograph: car\OUT25X .HYD

EXECUTED: 02-22-2000
11:25:50

Peak Inflow = 40.08 cfs
Peak Outflow = 32.65 cfs
Peak Elevation = 78.90 ft

Quick TR-55 Ver.5.46 S/N:
Executed: 11:24:14 11-10-1999

Williamsburg Dodge, Pre-developed inflow hydrographs

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

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

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

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
area A	0.400	17.00						
area B	0.800	1.10						
			21.00	0.424	0.424	3.200	18.10	24.58

18.1
or
18.5

1.1 ≈ 1.8

Quick TR-55 Ver.5.46 S/N:
Executed: 11:24:14 11-10-1999

Williamsburg Dodge, Pre-developed inflow hydrographs

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

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

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

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
area A	0.400	17.00						
area B	0.800	1.10						
			21.00	0.424	0.424	4.400	18.10	33.79

15.1
or
18.8

or
1.8

Quick TR-55 Ver.5.46 S/N:
Executed: 11:24:14 11-10-1999

Williamsburg Dodge, Pre-developed inflow hydrographs

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

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

RETURN FREQUENCY = 50 years
'C' adjustment, k = 1.1
Adj. 'C' = Wtd.'C' x 1.1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
area A	0.400	17.00						
area B	0.800	1.10						
			21.00	0.424	0.467	5.700	18.10	48.15

Quick TR-55 Ver.5.46 S/N:
Executed: 11:24:14 11-10-1999

Williamsburg Dodge, Pre-developed inflow hydrographs

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

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

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

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
area A	0.400	17.00						
area B	0.800	1.10						
			21.00	0.424	0.530	6.300	18.10	60.48

18.1 or 18.8

1.1 or 1.8

Quick TR-55 Ver.5.46 S/N:
Executed: 11:24:14 11-10-1999

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*                                                                       *
*                        MODIFIED RATIONAL METHOD                       *
*          ---- Grand Summary For All Storm Frequencies ----            *
*                                                                       *
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First peak outflow point assumed to occur at Tc hydrograph recession leg.

Williamsburg Dodge, Pre-developed inflow hydrographs

Area = 18.10 acres Tc = 21.00 minutes

Frequency (years)	Adjusted 'C'	Duration minutes	Intens. in/hr	Qpeak cfs	Allowable cfs	VOLUMES Inflow (cu.ft.)	VOLUMES Storage (cu.ft.)
2	0.424	21	3.200	24.58	25.00 24.5	0	0
10	0.424	21	4.400	33.79	35.00 33.8	0	0
50	0.467	21	5.700	48.15	50.00	0	0
100	0.530	21	6.300	60.48	65.00 60.5	0	0

MUST MATCH

Quick TR-55 Ver.5.46 S/N:
Executed: 11:24:14 11-10-1999

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

First peak outflow point assumed to occur at Tc hydrograph recession leg.

Williamsburg Dodge, Pre-developed inflow hydrographs

RETURN FREQUENCY: 2 yr 'C' Adjustment = 1.000 Allowable Q = 25.00 cfs

Hydrograph file duration= 0.00 minutes
Hydrograph file: 2YR .HYD Tc = 21.00 minutes

Weighted 'C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (cu.ft.)	Storage (cu.ft.)
0.424	0.424	21	3.200	18.10	24.58	Qallow = or > Qtc	

OK

18.5

Quick TR-55 Ver.5.46 S/N:
Executed: 11:24:14 11-10-1999

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

First peak outflow point assumed to occur at Tc hydrograph recession leg.

Williamsburg Dodge, Pre-developed inflow hydrographs

RETURN FREQUENCY: 10 yr 'C' Adjustment = 1.000 Allowable Q = 35.00 cfs

Hydrograph file duration= 0.00 minutes
Hydrograph file: 10YR .HYD Tc = 21.00 minutes

Weighted 'C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (cu.ft.)	Storage (cu.ft.)
0.424	0.424	21	4.400	18.10	33.79	Qallow = or > Qtc	

Quick TR-55 Ver.5.46 S/N:
Executed: 11:24:14 11-10-1999

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

First peak outflow point assumed to occur at Tc hydrograph recession leg.

Williamsburg Dodge, Pre-developed inflow hydrographs

RETURN FREQUENCY: 50 yr 'C' Adjustment = 1.100 Allowable Q = 50.00 cfs

Hydrograph file duration= 0.00 minutes
Hydrograph file: 50YR .HYD Tc = 21.00 minutes

Weighted 'C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (cu.ft.)	Storage (cu.ft.)
0.424	0.467	21	5.700	18.10	48.15	Qallow = or > Qtc	

Quick TR-55 Ver.5.46 S/N:
Executed: 11:24:14 11-10-1999

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

First peak outflow point assumed to occur at Tc hydrograph recession leg.

Williamsburg Dodge, Pre-developed inflow hydrographs

RETURN FREQUENCY: 100 yr 'C' Adjustment = 1.250 Allowable Q = 65.00 cfs

Hydrograph file duration= 0.00 minutes
Hydrograph file: 100YR .HYD Tc = 21.00 minutes

Weighted 'C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (cu.ft.)	Storage (cu.ft.)
0.424	0.530	21	6.300	18.10	60.48	Qallow = or > Qtc	

Quick TR-55 Ver.5.46 S/N:
Executed: 12:01:59 11-10-1999

Williamsburg Dodge, Postdeveloped inflow hydrographs

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

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

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

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
area A	0.400	10.60						
area B	0.620	6.40						
area C	0.800	1.10						
			21.00	0.502	0.502	3.200	18.10	29.08

18.1 or 18.8

1.1 or 1.8

Quick TR-55 Ver.5.46 S/N:
Executed: 13:23:06 11-15-1999

Williamsburg Dodge

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

Weighted C = 0.502 Area= 18.100 acres Tc = 21.00 minutes

Adjusted C = 0.502 Td= 21.00 min. I= 3.20 in/hr Qp= 29.08 cfs

RETURN FREQUENCY: 2 year storm Adj.factor = 1.00
Output file: CAR2DEV .HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 2 Year Storm

Time increment = 1.00 Minutes
Time on left represents time for first Q in each row.

Time Minutes							
0.00	0.00	1.38	2.77	4.15	5.54	6.92	8.31
7.00	9.69	11.08	12.46	13.85	15.23	16.61	18.00
14.00	19.38	20.77	22.15	23.54	24.92	26.31	27.69
21.00	29.08	27.69	26.31	24.92	23.54	22.15	20.77
28.00	19.38	18.00	16.61	15.23	13.85	12.46	11.08
35.00	9.69	8.31	6.92	5.54	4.15	2.77	1.38
42.00	0.00						

Quick TR-55 Ver.5.46 S/N:
Executed: 12:01:59 11-10-1999

Williamsburg Dodge, Postdeveloped inflow hydrographs

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

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

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

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
area A	0.400	10.60						
area B	0.620	6.40						
area C	0.800	1.10						
			21.00	0.502	0.502	4.400	18.10	39.99

02 1.8

18.1 oc
18.8

Quick TR-55 Ver.5.46 S/N:
Executed: 13:23:06 11-15-1999

Williamsburg Dodge

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

Weighted C = 0.502 Area= 18.100 acres Tc = 21.00 minutes

Adjusted C = 0.502 Td= 21.00 min. I= 4.40 in/hr Qp= 39.98 cfs

RETURN FREQUENCY: 10 year storm Adj.factor = 1.00
Output file: CAR10DEV.HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 10 Year Storm

Time increment = 1.00 Minutes
Time on left represents time for first Q in each row.

Time Minutes							
0.00	0.00	1.90	3.81	5.71	7.62	9.52	11.42
7.00	13.33	15.23	17.13	19.04	20.94	22.85	24.75
14.00	26.65	28.56	30.46	32.36	34.27	36.17	38.08
21.00	39.98	38.08	36.17	34.27	32.36	30.46	28.56
28.00	26.65	24.75	22.85	20.94	19.04	17.13	15.23
35.00	13.33	11.42	9.52	7.62	5.71	3.81	1.90
42.00	0.00						

Quick TR-55 Ver.5.46 S/N:
Executed: 12:01:59 11-10-1999

Williamsburg Dodge, Postdeveloped inflow hydrographs

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

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

RETURN FREQUENCY = 50 years
'C' adjustment, k = 1.1
Adj. 'C' = Wtd.'C' x 1.1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
area A	0.400	10.60						
area B	0.620	6.40						
area C	0.800	1.10						
			21.00	0.502	0.552	5.700	18.10	56.98

Quick TR-55 Ver.5.46 S/N:
Executed: 13:23:06 11-15-1999

Williamsburg Dodge

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

Weighted C = 0.502 Area= 18.100 acres Tc = 21.00 minutes

Adjusted C = 0.552 Td= 27.00 min. I= 5.00 in/hr Qp= 49.97 cfs

RETURN FREQUENCY: 50 year storm Adj.factor = 1.10
Output file: CAR50DEV.HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 50 Year Storm

Time increment = 1.00 Minutes
Time on left represents time for first Q in each row.

Time Minutes							
0.00	0.00	2.38	4.76	7.14	9.52	11.90	14.28
7.00	16.66	19.04	21.42	23.80	26.18	28.56	30.94
14.00	33.32	35.70	38.08	40.46	42.83	45.21	47.59
21.00	49.97	49.97	49.97	49.97	49.97	49.97	49.97
28.00	47.59	45.21	42.83	40.46	38.08	35.70	33.32
35.00	30.94	28.56	26.18	23.80	21.42	19.04	16.66
42.00	14.28	11.90	9.52	7.14	4.76	2.38	0.00

Quick TR-55 Ver.5.46 S/N:
Executed: 12:01:59 11-10-1999

Williamsburg Dodge, Postdeveloped inflow hydrographs

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

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

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

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
area A	0.400	10.60						
area B	0.620	6.40						
area C	0.800	1.10						
			21.00	0.502	0.628	6.300	18.10	71.57

or 1.8

18.1 or 18.8

Quick TR-55 Ver.5.46 S/N:
Executed: 13:23:06 11-15-1999

Williamsburg Dodge

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

Weighted C = 0.502 Area= 18.100 acres Tc = 21.00 minutes

Adjusted C = 0.627 Td= 21.00 min. I= 6.30 in/hr Qp= 71.55 cfs

RETURN FREQUENCY: 100 year storm Adj.factor = 1.25
Output file: C100D .HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 100 Year Storm

Time increment = 1.00 Minutes
Time on left represents time for first Q in each row.

Time Minutes							
0.00	0.00	3.41	6.81	10.22	13.63	17.04	20.44
7.00	23.85	27.26	30.67	34.07	37.48	40.89	44.30
14.00	47.70	51.11	54.52	57.92	61.33	64.74	68.15
21.00	71.55	68.15	64.74	61.33	57.92	54.52	51.11
28.00	47.70	44.30	40.89	37.48	34.07	30.67	27.26
35.00	23.85	20.44	17.04	13.63	10.22	6.81	3.41
42.00	0.00						

Quick TR-55 Ver.5.46 S/N:
Executed: 13:23:06 11-15-1999

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*                        MODIFIED RATIONAL METHOD                       *
*          ---- Grand Summary For All Storm Frequencies ----            *
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First peak outflow point assumed to occur at inflow recession leg.

Williamsburg Dodge

Area = 18.10 acres Tc = 21.00 minutes

Frequency (years)	Adjusted 'C'	Duration minutes	Intens. in/hr	Qpeak cfs	Allowable cfs	VOLUMES Inflow (cu.ft.)	Storage (cu.ft.)
2	0.502	21	3.200	29.08	26.00	36,636	3,876
10	0.502	21	4.400	39.98	36.70	50,374	4,132
50	0.552	27	5.000	49.97	46.60	80,958	13,854
100	0.627	21	6.300	71.55	63.20	90,158	10,526

Quick TR-55 Ver.5.46 S/N:
Executed: 12:01:59 11-10-1999

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

First peak outflow point assumed to occur at Tc hydrograph recession leg.

Williamsburg Dodge, Postdeveloped inflow hydrographs

RETURN FREQUENCY: 2 yr 'C' Adjustment = 1.000 Allowable Q = 24.32 cfs

Hydrograph file duration= 21.00 minutes
Hydrograph file: 2YR POST.HYD Tc = 21.00 minutes

Weighted 'C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (cu.ft.)	Storage (cu.ft.)
0.502	0.502	21	3.200	18.10	29.08	36,643	Storage Maximum 6,000
0.502	0.502	30	2.600	18.10	23.63	Qpeak < Qallow	

Quick TR-55 Ver.5.46 S/N:
Executed: 12:01:59 11-10-1999

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

First peak outflow point assumed to occur at Tc hydrograph recession leg.

Williamsburg Dodge, Postdeveloped inflow hydrographs

RETURN FREQUENCY: 10 yr 'C' Adjustment = 1.000 Allowable Q = 34.20 cfs

Hydrograph file duration= 21.00 minutes
Hydrograph file: 10YRPOST.HYD Tc = 21.00 minutes

Weighted 'C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (cu.ft.)	Storage (cu.ft.)
**********						Storage	Maximum
0.502	0.502	21	4.400	18.10	39.99	50,384	7,292
**********							
0.502	0.502	30	3.600	18.10	32.72	Qpeak < Qallow	

Quick TR-55 Ver.5.46 S/N:
Executed: 12:01:59 11-10-1999

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

First peak outflow point assumed to occur at Tc hydrograph recession leg.

Williamsburg Dodge, Postdeveloped inflow hydrographs

RETURN FREQUENCY: 50 yr 'C' Adjustment = 1.100 Allowable Q = 43.50 cfs

Hydrograph file duration= 21.00 minutes
Hydrograph file: 50YRPOST.HYD Tc = 21.00 minutes

Weighted 'C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (cu.ft.)	Storage (cu.ft.)
**********						Storage	Maximum
0.502	0.552	21	5.700	18.10	56.98	71,797	16,987
**********							
0.502	0.552	30	4.700	18.10	46.98	84,573	10,724
0.502	0.552	40	4.000	18.10	39.99	Qpeak < Qallow	

Quick TR-55 Ver.5.46 S/N:
Executed: 12:01:59 11-10-1999

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

First peak outflow point assumed to occur at Tc hydrograph recession leg.

Williamsburg Dodge, Postdeveloped inflow hydrographs

RETURN FREQUENCY: 100 yr 'C' Adjustment = 1.250 Allowable Q = 58.90 cfs

Hydrograph file duration= 21.00 minutes
Hydrograph file: 100 POST.HYD Tc = 21.00 minutes

Weighted 'C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (cu.ft.)	Storage (cu.ft.)
0.502	0.628	21	6.300	18.10	71.57	90,176	15,962
0.502	0.628	30	5.200	18.10	59.07	106,330	6,770
0.502	0.628	40	4.400	18.10	49.98	Qpeak < Qallow	

Hydrograph file: car\2YRPOST .HYD

HYDROGRAPH ORDINATES (cfs)
Time increment = 1.00 Minutes
Time on left represents time for first Q in each row.

Time Minutes							
0.00	0.00	1.38	2.77	4.15	5.54	6.92	8.31
7.00	9.69	11.08	12.46	13.85	15.23	16.62	18.00
14.00	19.39	20.77	22.16	23.54	24.93	26.31	27.70
21.00	29.08	27.70	26.31	24.93	23.54	22.16	20.77
28.01	19.39	18.00	16.62	15.23	13.85	12.46	11.08
35.01	9.69	8.31	6.92	5.54	4.15	2.77	1.38
42.01	0.00						

Hydrograph file: car\10YRPOST.HYD

HYDROGRAPH ORDINATES (cfs)
Time increment = 1.00 Minutes
Time on left represents time for first Q in each row.

Time Minutes							
0.00	0.00	1.90	3.81	5.71	7.62	9.52	11.42
7.00	13.33	15.23	17.14	19.04	20.95	22.85	24.75
14.00	26.66	28.56	30.47	32.37	34.27	36.18	38.08
21.00	39.99	38.08	36.18	34.27	32.37	30.47	28.56
28.01	26.66	24.75	22.85	20.95	19.04	17.14	15.23
35.01	13.33	11.42	9.52	7.62	5.71	3.81	1.90
42.01	0.00						

Hydrograph file: car\50YRPOST.HYD

HYDROGRAPH ORDINATES (cfs)
Time increment = 1.00 Minutes
Time on left represents time for first Q in each row.

Time Minutes							
0.00	0.00	2.71	5.43	8.14	10.85	13.57	16.28
7.00	18.99	21.71	24.42	27.13	29.85	32.56	35.27
14.00	37.99	40.70	43.41	46.13	48.84	51.55	54.27
21.00	56.98	54.27	51.55	48.84	46.13	43.41	40.70
28.01	37.99	35.27	32.56	29.85	27.13	24.42	21.71
35.01	18.99	16.28	13.57	10.85	8.14	5.43	2.71
42.01	0.00						

Hydrograph file: car\100POST .HYD

HYDROGRAPH ORDINATES (cfs)
Time increment = 1.00 Minutes
Time on left represents time for first Q in each row.

Time Minutes							
0.00	0.00	3.41	6.82	10.22	13.63	17.04	20.45
7.00	23.86	27.26	30.67	34.08	37.49	40.90	44.30
14.00	47.71	51.12	54.53	57.94	61.34	64.75	68.16
21.00	71.57	68.16	64.75	61.34	57.94	54.53	51.12
28.01	47.71	44.30	40.90	37.49	34.08	30.67	27.26
35.01	23.86	20.45	17.04	13.63	10.22	6.82	3.41
42.01	0.00						

Williamsburg Dodge

- Water Quality Calculations

WQV Calcs

POND-2 Version: 5.21
S/N:

Williamsburg Dodge
BMP Basin

CALCULATED 11-10-1999 16:58:35
DISK FILE: car\CAR .VOL

Planimeter scale: 1 inch = 30 ft.

Elevation (ft)	Planimeter (sq.in.)	Area (sq.ft)	A1+A2+sqr(A1*A2) (sq.ft)	* Volume (cubic-ft)	Volume Sum (cubic-ft)
•69.00	0.00	0	0	0	0
69.50	0.03	23	23	4	4
•70.00	0.05	45	99	17	20
•71.00	0.35	317	481	160	181
•72.00	0.76	681	1,463	488	668
73.00	1.60	1,435	3,106	1,035	1,704
•74.00	2.61	2,350	5,622	1,874	3,578
75.00	3.95	3,555	8,795	2,932	6,509
•76.00	5.38	4,844	12,548	4,183	10,692
76.40	*I*	5,420	15,387	2,052	12,744*
·77.00	7.05	6,344	16,731	5,577	16,269
•78.00	10.23	9,203	23,189	7,730	23,999
79.00	14.30	12,867	32,953	10,984	34,983
•80.00	16.96	15,266	42,148	14,049	49,033
81.00	20.48	18,434	50,475	16,825	65,857
•82.00 Top Dim	24.42	21,975	60,536	20,179	86,036
83.00	28.97	26,073	71,985	23,995	110,031

I ---> Interpolated area from closest two planimeter readings.

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

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

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

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

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

BENGTSON, DEBELL & ELKIN, LTD.
808 Moorefield Park Drive, Suite 220
RICHMOND, VIRGINIA 23236
(804) 320-2667

JOB Williamsburg Dodge
SHEET NO. _____ OF _____
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____
SCALE _____

WQV Detention Time Calculation

PLAN = SHOW 3"

WQV control is a 2½" diameter opening in riser

- Area Orifice $= A_o = \frac{\pi \cdot \left(\frac{d}{12}\right)^2}{4} = \frac{\pi \cdot \left(\frac{2.5}{12}\right)^2}{4} = 0.0341\ ft^2$

- Avg. head on orifice = (riser opening elev − orifice inv. elev − orifice diameter (ft.)/12) / 2

$h_{avg.} = (78' - 76.4 - 0.1)/2$

$h_{avg} = 0.8'$

- $Q_{out}(Avg) = C \cdot A \cdot \sqrt{2 g h_{avg}}$

- $Q_{out(avg)} = (.6)(.0341)\sqrt{2 \cdot 32.2 \cdot .8}$

$= 0.147$ cfs

- WQV drawdown time = WQV / $Q_{out(avg)}$

$= 12{,}744\ ft^3 / .147\ cfs / 3{,}600\ sec/hr.$

$= 24.08$ hrs

24 hours OK

PRODUCT 204-1 (Single Sheets) 205-1 (Padded)

Williamsburg Dodge

♦ Basin and Outlet Structure Calculations

Outlet Structure File: CAR10 .STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

****

Williamsburg Dodge BMP/SWM Outlet Structure

****

Outlet Structure File: car\CAR10 .STR
Planimeter Input File: car\CAR .VOL
Rating Table Output File: car\OUTFLO10.PND

Min. Elev.(ft) = 69 Max. Elev.(ft) = 81.5 Incr.(ft) = .5

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

****
SYSTEM CONNECTIVITY
****

Structure	No.	Q Table		Q Table
CULVERT-CR	3		->	3
STAND PIPE	2	? 3	->	A
ORIFICE	1		->	1

Outflow rating table summary was stored in file:
car\OUTFLO10.PND

Outlet Structure File: CAR10 .STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

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Williamsburg Dodge BMP/SWM Outlet Structure

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

ORIFICE
Orifice - Based on Area and Datum Elevation

E1 elev.(ft)?	76.4 ? Perm Pool
E2 elev.(ft)?	81.5
Orifice coeff.?	.6 ✓
Invert elev.(ft)?	76.4 ✓
Datum elev.(ft) ?	76.4 ✓
Orifice area (sq ft)?	.049 (3")

2½" - 3"

Outlet Structure File: CAR10 .STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

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Williamsburg Dodge BMP/SWM Outlet Structure

****

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

STAND PIPE
Stand Pipe with weir or orifice flow

E1 elev.(ft)?	76.4 Perm Pool
E2 elev.(ft)?	81.5
Crest elev.(ft)?	78.1
Diameter (ft)?	4.5
Weir coefficient?	3.1
Orifice coefficient?	.67
Start transition elev.(ft) @ ?	
Transition height (ft)?	

Outlet Structure File: CAR10 .STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

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Williamsburg Dodge BMP/SWM Outlet Structure

****

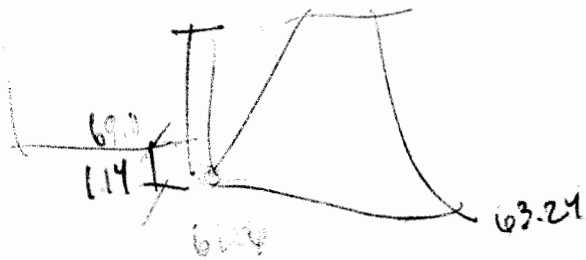
>>>>>> Structure No. 3 <<<<<<
(Input Data)

CULVERT-CR
Circular Culvert (With Inlet Control)

E1 elev.(ft)?	76.40 ✓ Perm Pool
E2 elev.(ft)?	81.5 ✓
Diam. (ft)?	2.5 ✓ (30")
Inv. el.(ft)?	69.0 — 67.86 PLAN
Slope (ft/ft)?	.044 ✓ OK
T1 ratio?	
T2 ratio?	
K Coeff.?	.078
M Coeff.?	2
c Coeff.?	.0292
Y Coeff.?	.74
Form 1 or 2?	1
Slope factor?	.7

$\frac{67.86 - 63.24}{105} = 0.044\%$ OK

SLOPE IS OK



Outlet Structure File: CAR10 .STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

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Williamsburg Dodge BMP/SWM Outlet Structure

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Outflow Rating Table for Structure #1 (3" ORIFICE)
ORIFICE Orifice - Based on Area and Datum Elevation

Elevation (ft)	Q (cfs)	Computation Messages
69.00	0.0	E < E1=76.4
69.50	0.0	E < E1=76.4
70.00	0.0	E < E1=76.4
70.50	0.0	E < E1=76.4
71.00	0.0	E < E1=76.4
71.50	0.0	E < E1=76.4
72.00	0.0	E < E1=76.4
72.50	0.0	E < E1=76.4
73.00	0.0	E < E1=76.4
73.50	0.0	E < E1=76.4
74.00	0.0	E < E1=76.4
74.50	0.0	E < E1=76.4
75.00	0.0	E < E1=76.4
75.50	0.0	E < E1=76.4
76.00	0.0	E < E1=76.4
76.50	0.1	H =.1
77.00	0.2	H =.6
77.50	0.2	H =1.1
78.00	0.3	H =1.6
78.50	0.3	H =2.1
79.00	0.4	H =2.6
79.50	0.4	H =3.1
80.00	0.4	H =3.6
80.50	0.5	H =4.1
81.00	0.5	H =4.6
81.50	0.0	E = or > E2=81.5

C = .6 A = .049 sq.ft. (3")
H (ft) = Table elev. - Datum elev. (76.4 ft)
Q (cfs) = C * A * sqr(2g * H)

Outlet Structure File: CAR10 .STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

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Williamsburg Dodge BMP/SWM Outlet Structure

****

Outflow Rating Table for Structure #2
STAND PIPE Stand Pipe with weir or orifice flow (54" ϕ RISER)

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

Elevation (ft)	Q (cfs)	Computation Messages
69.00	0.0	E < Inv.El.= 78.1
69.50	0.0	E < El=76.4
70.00	0.0	E < El=76.4
70.50	0.0	E < El=76.4
71.00	0.0	E < El=76.4
71.50	0.0	E < El=76.4
72.00	0.0	E < El=76.4
72.50	0.0	E < El=76.4
73.00	0.0	E < El=76.4
73.50	0.0	E < El=76.4
74.00	0.0	E < El=76.4
74.50	0.0	E < El=76.4
75.00	0.0	E < El=76.4
75.50	0.0	E < El=76.4
76.00	0.0	E < El=76.4
76.50	0.0	E < Inv.El.= 78.1
77.00	0.0	E < Inv.El.= 78.1
77.50	0.0	E < Inv.El.= 78.1
78.00	0.0	E < Inv.El.= 78.1
78.50	11.1	Weir: H =.4
79.00	37.4	Weir: H =.9
79.50	72.6	Weir: H =1.4
80.00	114.8	Weir: H =1.9
80.50	132.5	Orifice: H =2.4
81.00	145.6	Orifice: H =2.9
81.50	0.0	E = or > E2=81.5

Weir Cw = 3.1 Weir length = 14.13717 ft
Orifice Co = .67 Orifice area = 15.90431 sq.ft.
Q (cfs) = (Cw * L * H**1.5) or (Co * A * sqr(2*g*H))
No transition used, transition height = 0.0
Weir equation = Orifice equation @ elev.= 80.05123 ft

ORIFICE FLOW STARTS
80.05
76.40
3.65 ABOVE RISER

Outlet Structure File: CAR10 .STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

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Williamsburg Dodge BMP/SWM Outlet Structure

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30" RCP CULVERT.

Outflow Rating Table for Structure #3
CULVERT-CR Circular Culvert (With Inlet Control)

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

Elevation (ft)	Q (cfs)	Computation Messages
69.00	0.0	E < E1=76.40
69.50	0.0	E < E1=76.40
70.00	0.0	E < E1=76.40
70.50	0.0	E < E1=76.40
71.00	0.0	E < E1=76.40
71.50	0.0	E < E1=76.40
72.00	0.0	E < E1=76.40
72.50	0.0	E < E1=76.40
73.00	0.0	E < E1=76.40
73.50	0.0	E < E1=76.40
74.00	0.0	E < E1=76.40
74.50	0.0	E < E1=76.40
75.00	0.0	E < E1=76.40
75.50	0.0	E < E1=76.40
76.00	0.0	E < E1=76.40
76.50	67.8	Submerged: HW =7.5
77.00	70.8	Submerged: HW =8.0
77.50	73.6	Submerged: HW =8.5
78.00	76.4	Submerged: HW =9.0
78.50	79.1	Submerged: HW =9.5
79.00	81.6	Submerged: HW =10.0
79.50	84.1	Submerged: HW =10.5
80.00	86.5	Submerged: HW =11.0
80.50	88.9	Submerged: HW =11.5
81.00	91.2	Submerged: HW =12.0
81.50	0.0	E = or > E2=81.5

Used Unsubmerged Equ. Form (1) for elev. less than 74.07 ft
Used Submerged Equation for elevations greater than 72.1 ft
HW=Headwater (ft) dc=Critical depth (ft) Ac=Area (sq.ft) at dc

Transition flows interpolated from the following values:
E1=74.07 ft; Q1=27.16 cfs; Dc=1.78 ft; E2=72.1 ft; Q2=31.05 cfs

Outlet Structure File: CAR10 .STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

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Williamsburg Dodge BMP/SWM Outlet Structure

****

Outflow Rating Table A
Table A = 3 ? 2

Elevation (ft)	Q (cfs)	Contributing Structures
69.00	0.0	-
69.50	0.0	-
70.00	0.0	-
70.50	0.0	-
71.00	0.0	-
71.50	0.0	-
72.00	0.0	-
72.50	0.0	-
73.00	0.0	-
73.50	0.0	-
74.00	0.0	-
74.50	0.0	-
75.00	0.0	-
75.50	0.0	-
76.00	0.0	-
76.50	~~67.8~~	3
77.00	~~70.8~~	3
77.50	~~73.6~~	3
78.00	~~76.4~~	3
78.50	11.1	2
79.00	37.4	2
79.50	72.6	2
80.00	86.5	3
80.50	88.9	3
81.00	91.2	3
81.50	0.0	-

How

Riser crest @ 78.10

Outlet Structure File: CAR10 .STR

POND-2 Version: 5.21 S/N:
Date Executed: Time Executed:

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Williamsburg Dodge BMP/SWM Outlet Structure

****

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

Elevation (ft)		Q (cfs)	Contributing Structures
69.00		0.0	
69.50		0.0	
70.00		0.0	
70.50		0.0	
71.00		0.0	
71.50		0.0	
72.00		0.0	
72.50		0.0	
73.00		0.0	
73.50		0.0	
74.00		0.0	
74.50		0.0	
75.00		0.0	
75.50		0.0	
76.00		0.0	
76.50	0.1	~~67.~~9	3 +1
77.00	0.2	~~70.~~9	3 +1
77.50	0.2	~~73.~~9	3 +1
78.00	0.3	~~76.~~7	3 +1
78.50	11.1	11.4	2 +1
79.00	37.4	37.8	2 +1
79.50	72.6	73.0	2 +1
80.00	86.5	86.9	3 +1
80.50	88.9	89.4	3 +1
81.00	91.2	91.7	3 +1
81.50		0.0	

[redacted]

3 = 30" CULVERT
2 = 54" STANDPIPE
1 = 3" ORIFICE

RISE OVERST @ 78.10!!
HOW

PROBLEM!
OUTLET RATING CURVE
Q(cfs) outflow would be with increase progressively with increase in elev. (stage)
(stage discharge)

CFS

MY CALC PUNCH RONSILLY

76.4	0
76.5	0.02
77.0	0.16
77.5	0.23
78.0	0.29
78.5	11.42
79.0	37.79
80.0	75.36
80.5	77.34
81.0	79.27
81.5	81.16

OVERST 78.10

SOMETHING APPEARS WRONG WITH THE COMPOSITE OUTFLOW RATING CURVE.

Williamsburg Dodge

♦Routing Calculations

EXECUTED: 11-15-1999 11:08:32 Post Dev Return Freq: 2 years

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*************************
*                       *
*  Williamsburg Dodge   *
*                       *
*                       *
*                       *
*                       *
*************************
```

Inflow Hydrograph: car\2YRPOST .HYD
Rating Table file: car\OUTFLO11.PND

----INITIAL CONDITIONS----
Elevation = 76.40 ft
Outflow = 0.00 cfs
Storage = 13,261 cu-ft

GIVEN POND DATA

ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)
76.40	0.0	13,261
76.90	0.2	16,160
77.40	0.3	19,538
77.90	0.4	23,611
78.40	7.6	28,473
78.90	31.8	34,234
79.40	65.5	40,834
79.90	86.6	48,036
80.40	89.0	55,901
80.90	91.3	64,548
81.40	93.5	74,023

CROSS 78.10

INTERMEDIATE ROUTING COMPUTATIONS

2S/t (cfs)	2S/t + O (cfs)
442.0	442.0
538.6	538.8
651.1	651.4
786.9	787.3
948.9	956.5
1140.9	1172.7
1360.8	1426.3
1600.9	1687.5
1863.0	1952.0
2151.2	2242.5
2466.9	2560.4

Time increment (t) = 1.0 min.

THIS WAS INPUT FROM OUTLET STRUCTURE FILE. SEEMS OK HERE.

EXECUTED: 11-15-1999 11:08:32 Post Dev Return Freq: 2 years

Pond File: car\OUTFLO11.PND
Inflow Hydrograph: car\2YRPOST .HYD
Outflow Hydrograph: car\OUT2 .HYD

INFLOW HYDROGRAPH / ROUTING COMPUTATIONS

TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.0	0.00	-----	442.0	442.0	0.00	76.40
1.0	1.38	1.4	443.3	443.3	0.00	76.41
2.0	2.77	4.2	447.5	447.5	0.01	76.43
3.0	4.15	6.9	454.3	454.4	0.03	76.46
4.0	5.54	9.7	463.9	464.0	0.05	76.51
5.0	6.92	12.5	476.2	476.4	0.07	76.58
6.0	8.31	15.2	491.3	491.5	0.10	76.66
7.0	9.69	18.0	509.0	509.3	0.14	76.75
8.0	11.08	20.8	529.4	529.8	0.18	76.85
9.0	12.46	23.5	552.5	552.9	0.21	76.96
10.0	13.85	26.3	578.4	578.8	0.24	77.08
11.0	15.23	29.1	606.9	607.4	0.26	77.20
12.0	16.62	31.9	638.2	638.8	0.29	77.34
13.0	18.00	34.6	672.2	672.8	0.32	77.48
14.0	19.39	37.4	708.9	709.6	0.34	77.61
15.0	20.77	40.2	748.3	749.0	0.37	77.76
16.0	22.16	42.9	790.1	791.2	0.57	77.91
17.0	23.54	45.7	830.9	835.8	2.46	78.04
18.0	24.93	48.5	870.7	879.3	4.32	78.17
19.0	26.31	51.2	909.7	921.9	6.13	78.30
20.0	27.70	54.0	946.9	963.7	8.41	78.42
21.0	29.08	56.8	977.9	1003.7	12.88	78.51
22.0	27.70	56.8	1002.0	1034.7	16.35	78.58
23.0	26.31	54.0	1018.5	1056.0	18.74	78.63
24.0	24.93	51.2	1029.2	1069.8	20.28	78.66
25.0	23.54	48.5	1035.3	1077.7	21.16	78.68
26.0	22.16	45.7	1038.0	1081.0	21.54	78.69
27.0	20.77	42.9	1037.8	1080.9	21.52	78.69
28.0	19.39	40.2	1035.6	1078.0	21.20	78.68
29.0	18.00	37.4	1031.7	1073.0	20.64	78.67
30.0	16.62	34.6	1026.5	1066.3	19.89	78.65
31.0	15.23	31.9	1020.4	1058.4	19.01	78.64
32.0	13.85	29.1	1013.5	1049.5	18.01	78.62
33.0	12.46	26.3	1005.9	1039.8	16.92	78.59
34.0	11.08	23.5	997.9	1029.5	15.77	78.57
35.0	9.69	20.8	989.6	1018.7	14.56	78.54
36.0	8.31	18.0	980.9	1007.6	13.32	78.52
37.0	6.92	15.2	972.1	996.2	12.04	78.49
38.0	5.54	12.5	963.1	984.5	10.74	78.46
39.0	4.15	9.7	953.9	972.8	9.42	78.44
40.0	2.77	6.9	944.7	960.8	8.09	78.41
41.0	1.38	4.2	934.3	948.8	7.27	78.38
42.0	0.00	1.4	922.2	935.6	6.71	78.34

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

Pond File: car\OUTFLO11.PND
Inflow Hydrograph: car\2YRPOST .HYD
Outflow Hydrograph: car\OUT2 .HYD

Starting Pond W.S. Elevation = 76.40 ft

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

Peak Inflow = 29.08 cfs
Peak Outflow = 21.54 cfs
Peak Elevation = 78.69 ft

2 YR.

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

Initial Storage = 13,261 cu-ft
Peak Storage From Storm = 18,530 cu-ft

Total Storage in Pond = 31,791 cu-ft

Post Dev Return Freq: 2 years

Pond File: car\OUTFLO11.PND
Inflow Hydrograph: car\2YRPOST .HYD
Outflow Hydrograph: car\OUT2 .HYD

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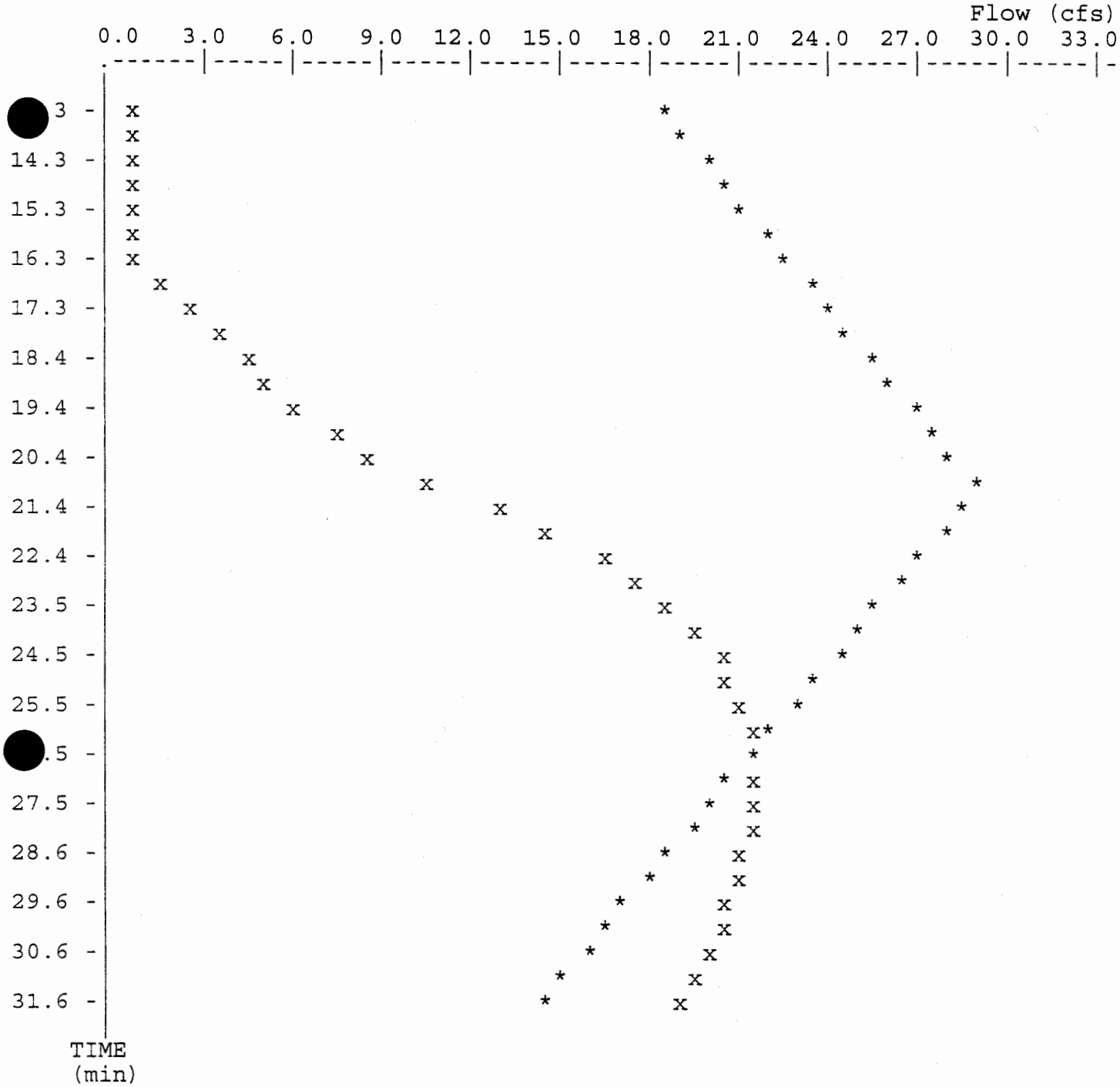
Peak Inflow = 29.08 cfs
Peak Outflow = 21.54 cfs
Peak Elevation = 78.69 ft



x File: car\OUT2 .HYD Qmax = 21.5 cfs
* File: car\2YRPOST .HYD Qmax = 29.1 cfs

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*                      *
*  Williamsburg Dodge  *
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Inflow Hydrograph: car\10YRPOST.HYD
Rating Table file: car\OUTFLO11.PND

----INITIAL CONDITIONS----
Elevation = 76.40 ft
Outflow = 0.00 cfs
Storage = 13,261 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + 0 (cfs)
76.40	0.0	13,261	442.0	442.0
76.90	0.2	16,160	538.6	538.8
77.40	0.3	19,538	651.1	651.4
77.90	0.4	23,611	786.9	787.3
78.40	7.6	28,473	948.9	956.5
78.90	31.8	34,234	1140.9	1172.7
79.40	65.5	40,834	1360.8	1426.3
79.90	86.6	48,036	1600.9	1687.5
80.40	89.0	55,901	1863.0	1952.0
80.90	91.3	64,548	2151.2	2242.5
81.40	93.5	74,023	2466.9	2560.4

Time increment (t) = 1.0 min.

Pond File: car\OUTFLO11.PND
Inflow Hydrograph: car\10YRPOST.HYD
Outflow Hydrograph: car\OUT10 .HYD

INFLOW HYDROGRAPH

TIME (min)	INFLOW (cfs)
0.0	0.00
1.0	1.90
2.0	3.81
3.0	5.71
4.0	7.62
5.0	9.52
6.0	11.42
7.0	13.33
8.0	15.23
9.0	17.14
10.0	19.04
11.0	20.95
12.0	22.85
13.0	24.75
14.0	26.66
15.0	28.56
16.0	30.47
17.0	32.37
18.0	34.27
19.0	36.18
20.0	38.08
21.0	39.99
22.0	38.08
23.0	36.18
24.0	34.27
25.0	32.37
26.0	30.47
27.0	28.56
28.0	26.66
29.0	24.75
30.0	22.85
31.0	20.95
32.0	19.04
33.0	17.14
34.0	15.23
35.0	13.33
36.0	11.42
37.0	9.52
38.0	7.62
39.0	5.71
40.0	3.81
41.0	1.90
42.0	0.00

ROUTING COMPUTATIONS

I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
-----	442.0	442.0	0.00	76.40
1.9	443.9	443.9	0.00	76.41
5.7	449.5	449.6	0.02	76.44
9.5	459.0	459.0	0.04	76.49
13.3	472.2	472.3	0.06	76.56
17.1	489.1	489.3	0.10	76.64
20.9	509.8	510.1	0.14	76.75
24.8	534.2	534.5	0.19	76.88
28.6	562.3	562.7	0.22	77.01
32.4	594.1	594.6	0.25	77.15
36.2	629.8	630.3	0.28	77.31
40.0	669.1	669.7	0.31	77.47
43.8	712.2	712.9	0.35	77.63
47.6	759.1	759.8	0.38	77.80
51.4	807.7	810.5	1.39	77.97
55.2	855.7	862.9	3.62	78.12
59.0	903.1	914.7	5.82	78.28
62.8	948.6	965.9	8.65	78.42
66.6	986.9	1015.2	14.18	78.54
70.5	1019.6	1057.3	18.89	78.63
74.3	1047.9	1093.8	22.97	78.72
78.1	1072.8	1126.0	26.57	78.79
78.1	1092.2	1150.9	29.36	78.85
74.3	1104.2	1166.4	31.10	78.89
70.5	1110.6	1174.7	32.06	78.90
66.6	1112.4	1177.2	32.40	78.91
62.8	1111.0	1175.2	32.14	78.91
59.0	1107.0	1170.0	31.50	78.89
55.2	1101.0	1162.2	30.63	78.88
51.4	1093.3	1152.4	29.53	78.85
47.6	1084.4	1140.9	28.24	78.83
43.8	1074.6	1128.2	26.82	78.80
40.0	1064.0	1114.6	25.29	78.77
36.2	1052.8	1100.2	23.68	78.73
32.4	1041.2	1085.2	22.00	78.70
28.6	1029.2	1069.7	20.27	78.66
24.8	1016.9	1053.9	18.51	78.63
20.9	1004.4	1037.9	16.71	78.59
17.1	991.8	1021.6	14.89	78.55
13.3	979.1	1005.1	13.05	78.51
9.5	966.2	988.6	11.19	78.47
5.7	953.3	971.9	9.32	78.44
1.9	940.1	955.2	7.54	78.40

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

Pond File: car\OUTFLO11.PND
Inflow Hydrograph: car\10YRPOST.HYD
Outflow Hydrograph: car\OUT10 .HYD

Starting Pond W.S. Elevation = 76.40 ft

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

Peak Inflow = 39.99 cfs
Peak Outflow = 32.40 cfs
Peak Elevation = 78.91 ft

10 YEAR

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

Initial Storage = 13,261 cu-ft
Peak Storage From Storm = 21,089 cu-ft

Total Storage in Pond = 34,351 cu-ft

Return Freq: 10 years

Pond File: car\OUTFLO11.PND
Inflow Hydrograph: car\10YRPOST.HYD
Outflow Hydrograph: car\OUT10 .HYD

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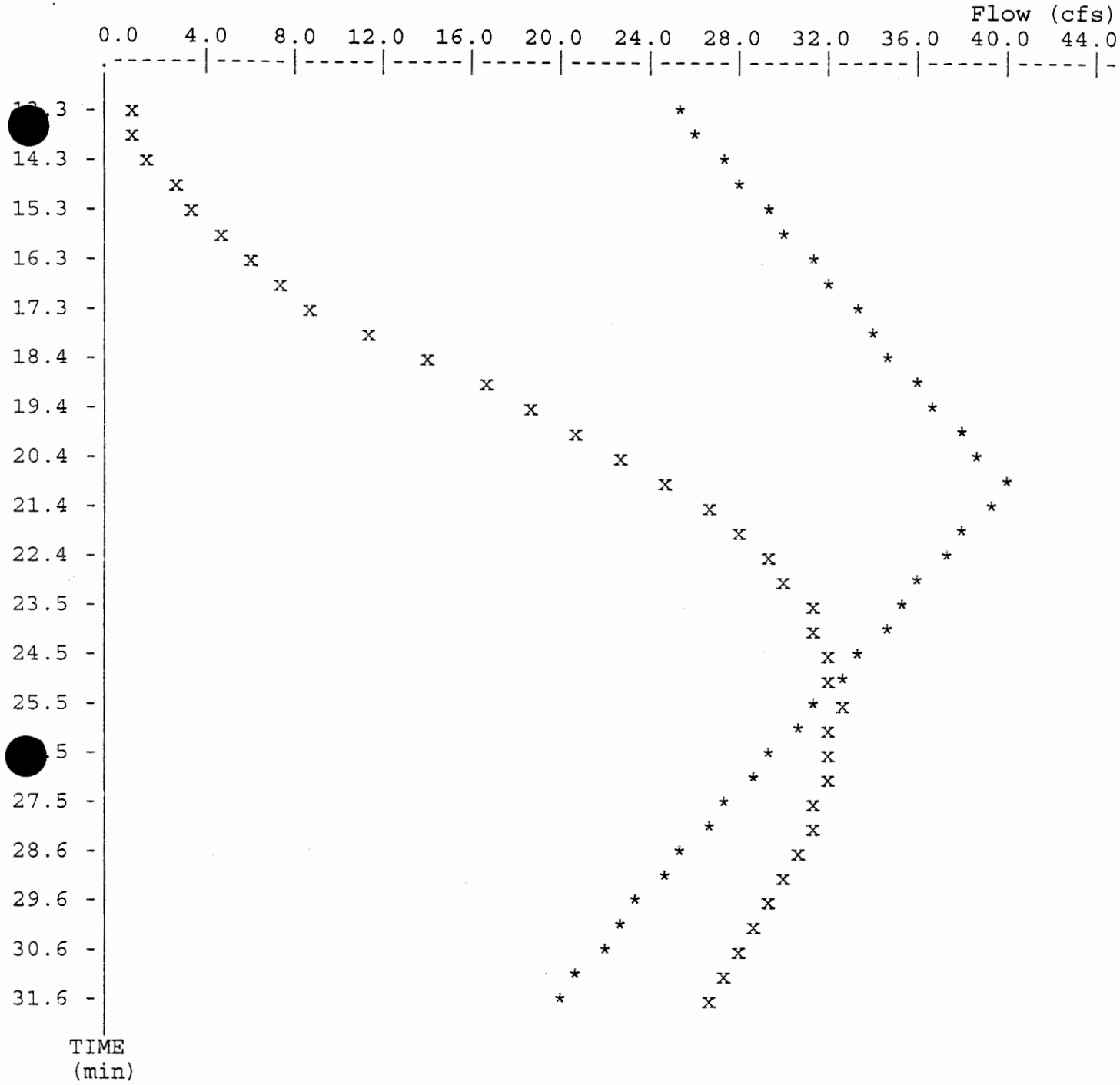
Peak Inflow = 39.99 cfs
Peak Outflow = 32.40 cfs
Peak Elevation = 78.91 ft



x File: car\OUT10 .HYD Qmax = 32.4 cfs
* File: car\10YRPOST.HYD Qmax = 40.0 cfs

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*  Williamsburg Dodge  *
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Inflow Hydrograph: car\50YRPOST.HYD
Rating Table file: car\OUTFLO11.PND

----INITIAL CONDITIONS----
Elevation = 76.40 ft
Outflow = 0.00 cfs
Storage = 13,261 cu-ft

GIVEN POND DATA

ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)
76.40	0.0	13,261
76.90	0.2	16,160
77.40	0.3	19,538
77.90	0.4	23,611
78.40	7.6	28,473
78.90	31.8	34,234
79.40	65.5	40,834
79.90	86.6	48,036
80.40	89.0	55,901
80.90	91.3	64,548
81.40	93.5	74,023

INTERMEDIATE ROUTING COMPUTATIONS

2S/t (cfs)	2S/t + O (cfs)
442.0	442.0
538.6	538.8
651.1	651.4
786.9	787.3
948.9	956.5
1140.9	1172.7
1360.8	1426.3
1600.9	1687.5
1863.0	1952.0
2151.2	2242.5
2466.9	2560.4

Time increment (t) = 1.0 min.

Pond File: car\OUTFLO11.PND
Inflow Hydrograph: car\50YRPOST.HYD
Outflow Hydrograph: car\OUT50 .HYD

INFLOW HYDROGRAPH

TIME (min)	INFLOW (cfs)
0.0	0.00
1.0	2.71
2.0	5.43
3.0	8.14
4.0	10.85
5.0	13.57
6.0	16.28
7.0	18.99
8.0	21.71
9.0	24.42
10.0	27.13
11.0	29.85
12.0	32.56
13.0	35.27
14.0	37.99
15.0	40.70
16.0	43.41
17.0	46.13
18.0	48.84
19.0	51.55
20.0	54.27
21.0	56.98
22.0	54.27
23.0	51.55
24.0	48.84
25.0	46.13
26.0	43.41
27.0	40.70
28.0	37.99
29.0	35.27
30.0	32.56
31.0	29.85
32.0	27.13
33.0	24.42
34.0	21.71
35.0	18.99
36.0	16.28
37.0	13.57
38.0	10.85
39.0	8.14
40.0	5.43
41.0	2.71
42.0	0.00

ROUTING COMPUTATIONS

I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
-----	442.0	442.0	0.00	76.40
2.7	444.7	444.7	0.01	76.41
8.1	452.8	452.8	0.02	76.46
13.6	466.2	466.3	0.05	76.53
19.0	485.0	485.2	0.09	76.62
24.4	509.2	509.5	0.14	76.75
29.9	538.6	539.0	0.20	76.90
35.3	573.4	573.9	0.23	77.06
40.7	613.6	614.1	0.27	77.23
46.1	659.1	659.7	0.31	77.43
51.6	710.0	710.7	0.34	77.62
57.0	766.2	767.0	0.39	77.83
62.4	824.3	828.6	2.16	78.02
67.8	882.4	892.1	4.86	78.21
73.3	940.5	955.7	7.56	78.40
78.7	990.0	1019.2	14.62	78.55
84.1	1032.6	1074.1	20.76	78.67
89.5	1069.8	1122.1	26.14	78.78
95.0	1103.0	1164.8	30.92	78.88
100.4	1131.6	1203.4	35.87	78.96
105.8	1156.6	1237.4	40.40	79.03
111.3	1179.0	1267.9	44.45	79.09
111.3	1195.4	1290.2	47.42	79.13
105.8	1203.5	1301.2	48.88	79.15
100.4	1205.4	1303.9	49.23	79.16
95.0	1202.9	1300.4	48.76	79.15
89.5	1197.0	1292.4	47.70	79.14
84.1	1188.7	1281.1	46.20	79.11
78.7	1178.6	1267.4	44.38	79.09
73.3	1167.2	1251.9	42.32	79.06
67.8	1154.9	1235.1	40.09	79.02
62.4	1141.9	1217.3	37.73	78.99
57.0	1128.3	1198.8	35.27	78.95
51.6	1114.3	1179.8	32.75	78.91
46.1	1099.6	1160.5	30.43	78.87
40.7	1084.0	1140.3	28.17	78.83
35.3	1067.6	1119.2	25.82	78.78
29.9	1050.7	1097.4	23.38	78.73
24.4	1033.4	1075.1	20.88	78.67
19.0	1015.7	1052.4	18.33	78.62
13.6	997.8	1029.3	15.74	78.57
8.1	979.6	1005.9	13.13	78.51
2.7	961.4	982.4	10.50	78.46

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

Pond File: car\OUTFLO11.PND
Inflow Hydrograph: car\50YRPOST.HYD
Outflow Hydrograph: car\OUT50 .HYD

Starting Pond W.S. Elevation = 76.40 ft

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

Peak Inflow = 56.98 cfs
Peak Outflow = 49.23 cfs
Peak Elevation = 79.16 ft

50 year

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

Initial Storage	=	13,261 cu-ft
Peak Storage From Storm	=	24,385 cu-ft
Total Storage in Pond	=	37,647 cu-ft

Return Freq: 50 years

Pond File: car\OUTFLO11.PND
Inflow Hydrograph: car\50YRPOST.HYD
Outflow Hydrograph: car\OUT50 .HYD

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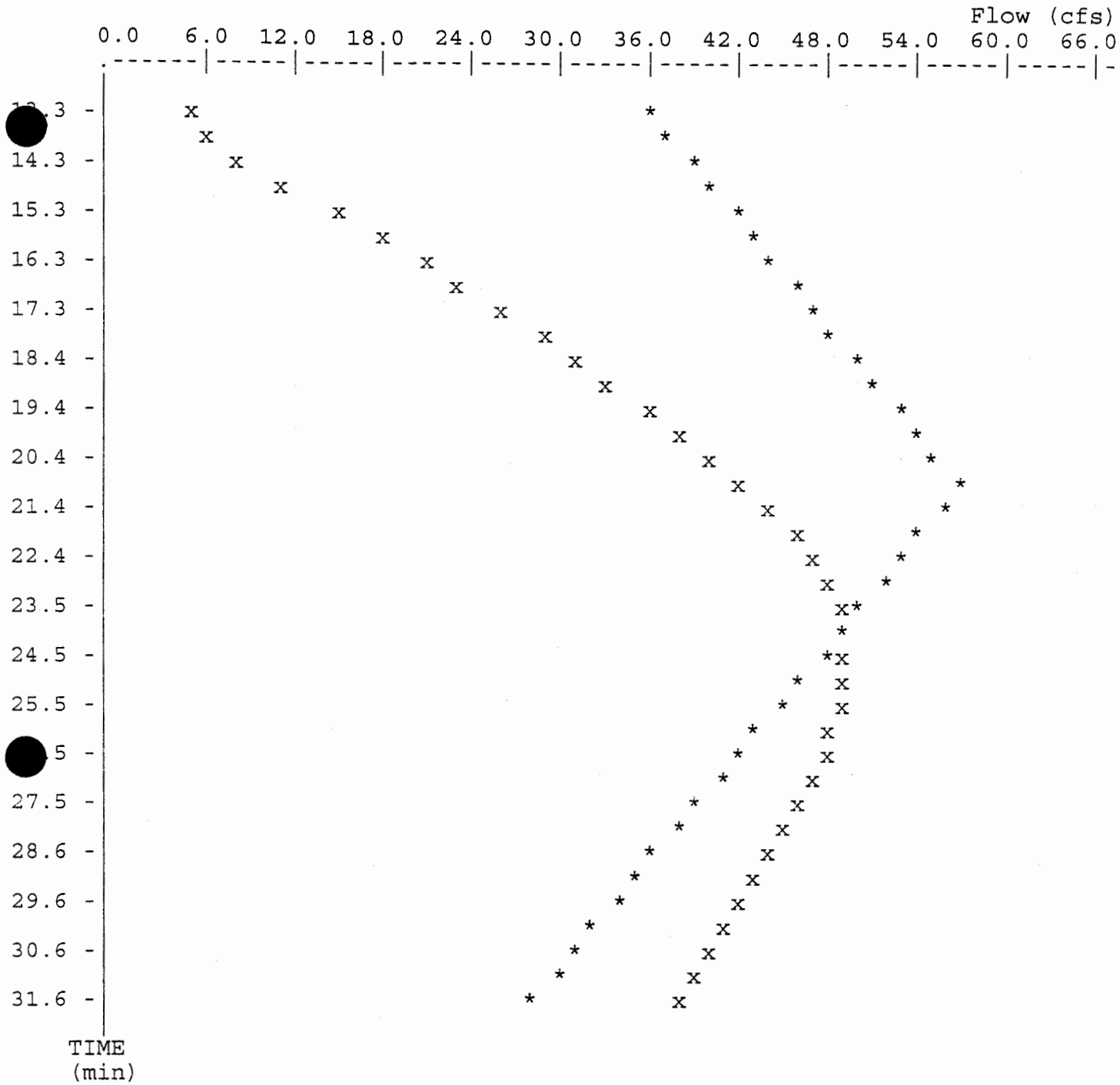
Peak Inflow = 56.98 cfs
Peak Outflow = 49.23 cfs
Peak Elevation = 79.16 ft



x File: car\OUT50 .HYD Qmax = 49.2 cfs
* File: car\50YRPOST.HYD Qmax = 57.0 cfs

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*  Williamsburg Dodge  *
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Inflow Hydrograph: car\100POST .HYD
Rating Table file: car\OUTFLO11.PND

----INITIAL CONDITIONS----
Elevation = 76.40 ft
Outflow = 0.00 cfs
Storage = 13,261 cu-ft

GIVEN POND DATA

ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)
76.40	0.0	13,261
76.90	0.2	16,160
77.40	0.3	19,538
77.90	0.4	23,611
78.40	7.6	28,473
78.90	31.8	34,234
79.40	65.5	40,834
79.90	86.6	48,036
80.40	89.0	55,901
80.90	91.3	64,548
81.40	93.5	74,023

INTERMEDIATE ROUTING COMPUTATIONS

2S/t (cfs)	2S/t + O (cfs)
442.0	442.0
538.6	538.8
651.1	651.4
786.9	787.3
948.9	956.5
1140.9	1172.7
1360.8	1426.3
1600.9	1687.5
1863.0	1952.0
2151.2	2242.5
2466.9	2560.4

Time increment (t) = 1.0 min.

Pond File: car\OUTFLO11.PND
Inflow Hydrograph: car\100POST .HYD
Outflow Hydrograph: car\OUT100 .HYD

INFLOW HYDROGRAPH

TIME (min)	INFLOW (cfs)
0.0	0.00
1.0	3.41
2.0	6.82
3.0	10.22
4.0	13.63
5.0	17.04
6.0	20.45
7.0	23.86
8.0	27.26
9.0	30.67
10.0	34.08
11.0	37.49
12.0	40.90
13.0	44.30
14.0	47.71
15.0	51.12
16.0	54.53
17.0	57.94
18.0	61.34
19.0	64.75
20.0	68.16
21.0	71.57
22.0	68.16
23.0	64.75
24.0	61.34
25.0	57.94
26.0	54.53
27.0	51.12
28.0	47.71
29.0	44.30
30.0	40.90
31.0	37.49
32.0	34.08
33.0	30.67
34.0	27.26
35.0	23.86
36.0	20.45
37.0	17.04
38.0	13.63
39.0	10.22
40.0	6.82
41.0	3.41
42.0	0.00

ROUTING COMPUTATIONS

I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
-----	442.0	442.0	0.00	76.40
3.4	445.4	445.4	0.01	76.42
10.2	455.5	455.6	0.03	76.47
17.0	472.4	472.6	0.06	76.56
23.9	496.1	496.3	0.11	76.68
30.7	526.4	526.7	0.18	76.84
37.5	563.4	563.9	0.22	77.01
44.3	607.2	607.7	0.26	77.21
51.1	657.7	658.3	0.31	77.43
57.9	715.0	715.7	0.35	77.64
64.8	778.9	779.7	0.39	77.87
71.6	844.3	850.5	3.09	78.09
78.4	910.4	922.7	6.16	78.30
85.2	971.6	995.6	11.98	78.49
92.0	1024.5	1063.6	19.59	78.65
98.8	1070.7	1123.3	26.27	78.79
105.7	1111.8	1176.4	32.29	78.91
112.5	1147.0	1224.3	38.65	79.00
119.3	1177.8	1266.3	44.23	79.08
126.1	1205.4	1303.9	49.23	79.16
132.9	1230.7	1338.3	53.81	79.23
139.7	1254.3	1370.5	58.07	79.29
139.7	1271.6	1394.0	61.21	79.34
132.9	1279.3	1404.5	62.60	79.36
126.1	1280.0	1405.4	62.72	79.36
119.3	1275.5	1399.3	61.90	79.35
112.5	1267.1	1387.9	60.40	79.32
105.7	1256.0	1372.8	58.38	79.29
98.8	1242.8	1354.8	56.00	79.26
92.0	1228.2	1334.9	53.34	79.22
85.2	1212.4	1313.4	50.49	79.18
78.4	1195.8	1290.8	47.49	79.13
71.6	1178.6	1267.4	44.38	79.09
64.8	1161.0	1243.4	41.19	79.04
57.9	1143.0	1218.9	37.94	78.99
51.1	1124.9	1194.2	34.65	78.94
44.3	1106.4	1169.2	31.40	78.89
37.5	1086.7	1143.8	28.57	78.83
30.7	1066.2	1117.4	25.61	78.77
23.9	1044.9	1090.0	22.54	78.71
17.0	1023.2	1062.0	19.40	78.64
10.2	1001.0	1033.4	16.21	78.58
3.4	978.5	1004.4	12.96	78.51

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

Pond File: car\OUTFLO11.PND
Inflow Hydrograph: car\100POST .HYD
Outflow Hydrograph: car\OUT100 .HYD

Starting Pond W.S. Elevation = 76.40 ft

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

Peak Inflow = 71.57 cfs
Peak Outflow = 62.72 cfs
Peak Elevation = 79.36 ft

100-year

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

Initial Storage	=	13,261 cu-ft
Peak Storage From Storm	=	27,028 cu-ft
Total Storage in Pond	=	40,289 cu-ft

Return Freq: 100 years

Pond File: car\OUTFLO11.PND
Inflow Hydrograph: car\100POST .HYD
Outflow Hydrograph: car\OUT100 .HYD

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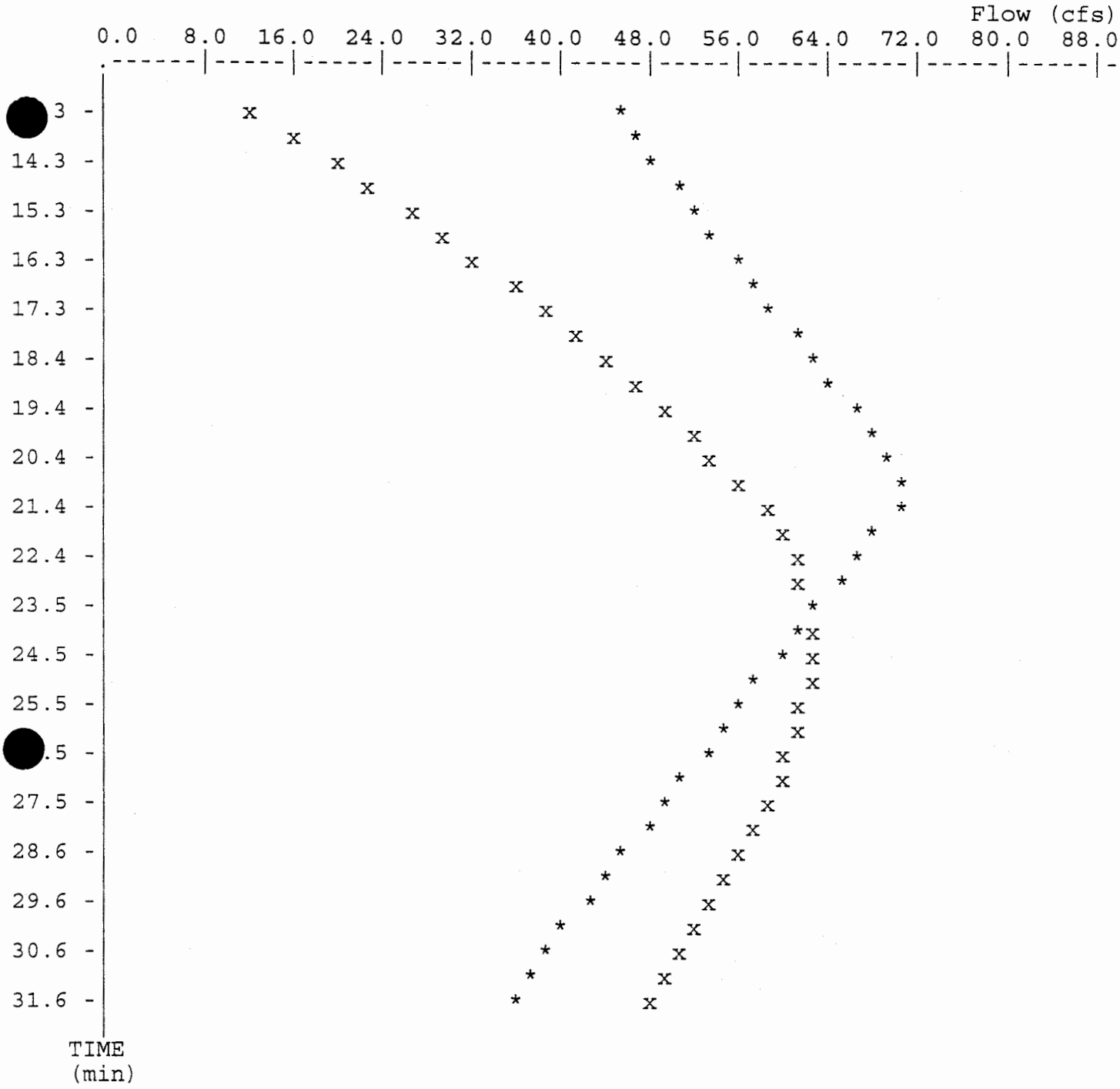
Peak Inflow = 71.57 cfs
Peak Outflow = 62.72 cfs
Peak Elevation = 79.36 ft



x File: car\OUT100 .HYD Qmax = 62.7 cfs
* File: car\100POST .HYD Qmax = 71.6 cfs

Williamsburg Dodge

♦Storm Sewer Calculations

PROJECT: Williamsburg Dodge
SECTION: _____ DATE: 9-30-99
DESIGNER: TJC

POTTS, MINTER AND ASSOCIATES P.C.
Engineers, Land Surveyors, Land Planners
3520 S. Courthouse Road Suite B Richmond, Va. 23236
Phone: (804) 745-2876 Fax: 745-9571

STORM SEWER DESIGN COMPUTATIONS

STR. NO. FROM	STR. NO. TO	CULV. TYPE	AREA DES.	A ACRES	C	CA INCREMENT	CA ACCUMULATED	TIME OF CONCENTRATION (min) TO PIPE	IN PIPE	TOTAL TC	I_{10} in/hr	RUNOFF Q_{10} (CFS)	DESIGN DIA. IN.	LENGTH (FT.)	N	SLOPE (%)	CAPACITY C.F.S.	VELOCITY (FT/SEC)	FLOW TIME	INVERT IN	INVERT OUT	TOP ELEV.	REMARKS
1	3	RCP	1	1.28	.9	1.28	1.28	5	—	5	7.2	9.22	15	208	.013	2	9.4	7.5	28	87.25	83.09	90.00	
3	5	"	8	.22	.9	0.20	1.41	5.5		5.5	7.0	9.87	15	129.5		2.31	10	8.0	16	82.99	80.00	87.00	
5	BMP	"	7	0.42	.9	.28	1.69	5.75		5.75	7.0	11.83	21	30		.55	12	4.6	6.5	78.67	78.5	—	Provide EC @ outlet
16	14	"	2	.58	.6	.30	.30	5		5	7.2	2.16	15	176		.4	4.2	3.6	49	87.10	86.39	92	
14	12	"	3	.62	.65	.40	.70	6		6	7.0	4.9	15	189		.6	5.1	4.0	47	86.29	85.15	91.1	
12	10	"	5	.17	.9	.15	.85	6.5		6.5	6.9	5.87	15	254		1.53	8.1	7.2	35	85.05	81.16	85.35	
10	8	"	9	0.42	.9	.56	1.41	7.0		7.0	6.7	9.45	18	127		.80	9.6	6.0	21	81.06	80.04	85.35	
8	BMP	"	6	0.82	.9	.38	1.79	7.2		7.2	6.7	12.00	24	36		.5	16.0	5.5	5	77.18	77.0		BMP Pern. WSL = 76.4
17	19	RCP	12	.70	.8	.56	.56	7.2		5	7.2	4.03	15	84	.013	.4	4.1	3.3	25	89.04	88.71	92.39	
19	21	"	—			—		—						92					27	88.61	88.29	92.5	
21	Ex. MH	"	11	.17	.8	.14	.70	7.1			7.1	4.97	15	87		.4	4.1	3.5	25	88.19	87.85	90.5	
																		OK					

SHEET ____ OF ____
J.N. _____

PROJECT: Williamsburg Dodge
SECTION: _____ DATE: 9-30-99
DESIGNER: TJC

POTTS, MINTER AND ASSOCIATES P.C.
Engineers, Land Surveyors, Land Planners
3520 S. Courthouse Road Suite B Richmond, Va. 23236
Phone: (804) 745-2876 Fax: 745-9571

HYDRAULIC GRADE LINE COMPUTATIONS

STRUCT. NO.	OUTLET WATER SURFACE ELEV.	Do (IN)	Qo cfs	Lo	Sfo ft/ft	Hf	JUNCTION LOSS Vo	Ho	Qi	Vi	QiVi	$\frac{Vi^2}{2g}$	Hi	Angle	Ha	Ht	1.3 Ht	0.5 Ht	FINAL H	INLET WATER SURFACE ELEV.	RIM ELEV.
8	78.60	24	12	36	.0027	.10	5.5	.12	9.45	6	56.7	.56	.20	70	.34	.66	.86	.43	.53	79.13	85.35
10	79.13	18	9.45	127	.0077	.98	6.0	.14	5.87	7.2	42.3	.80	.28	90	.56	.98	1.27	.64	1.62	80.75	85.35 Verify Rim
12	82.56	15	5.87	254	.008	2.03	7.2	.20	4.90	4	19.6	.25	.09	15	.03	.29	.38	.19	2.22	84.78	91.1
14	86.18	15	4.90	189	.0055	1.04	5.1	.10	2.16	3.6	7.8	.20	.07	40	.08	.25	.33	.16	1.20	87.38	92
16	87.38	15	2.16	176	.00105	.18	3.4	.04	—	—	—	—	—	15	—	.04	.05	—	.23	87.61	91.1
5	79.9	21	11.83	30	.0054	.16	4.5	.08	9.87	8	79	.99	.35	15	.10	.53	.69	.34	.50	80.40	87.0
3	80.40	15	9.87	130	.023	2.99	8	.25	9.22	7.5	69.15	.87	.31	25	.19	.75	.98	.49	3.48	83.96	88.5
1	83.96	15	9.22	208	.02	4.16	7.5	.22	—	—	—	—	—	—	—	.22	.29	—	4.45	88.41	90.0 ok
	← Assumed full pipe flow																				
21	89.75	15	4.97	87	.0057	.50	3.5	.05	4.1	3.3	13.53	44.65	.06	30	.05	.17	.22	.11	.61	90.36	90.5
19	90.36	15	4.1	92	.004	.37	3.3	.04	4.1	3.3	13.53	"	.06	50	.08	.18	.23	.12	.49	90.85	92.0
17	90.85	15	4.1	84	.004	.34	3.3	.04	—	—	—	—	—	—	—	.04	.05	.03	.37	91.22	91.89

$Hi = 0.35 \frac{Vi^2}{2g}$ $Ho = 0.25 \frac{Vo^2}{2g}$ $Ha = K \frac{Vi^2}{2g}$

FINAL H=Hf+Ht
Ht=Ho+Hi+Ha

90° K=0.70	40° K=0.38
80° K=0.66	30° K=0.28
70° K=0.61	25° K=0.22
60° K=0.55	20° K=0.16
50° K=0.47	15° K=0.10

SHEET ____ OF ____
J.N. _____

STORM WATER INLET COMPUTATIONS

Form LD 204
Rev 6-85

RTE Route 60 PROJ Wms'burg Dodge DATE 11-1-99

INLET NUMBER	INLET TYPE	INLET LENGTH (FT)	STATION	DRAINAGE AREA (AC)	C	CA	Σ CA	I IN/HR	Q INCH (CFS)	Q CARRY-OVER (CFS)	Q GUTTER FLOW	S GUTTER SLOPE (FT/FT)	SX CROSS SLOPE (FT/FT)	T(SPREAD)	W(FT)	W/T	Sw(FT/FT)	Sw/Sx	Eo(#10)	a (IN)	Sw-a/(12W)	Se(FT/FT)=Sx + SwEo	T(FT)=15 & EXCEED INCHES	T/L	d(FT)	E(#16)	h(FT)	S INTERC-EPTED CFS	P/H	Qb CARRY-OVER CFS	T SPREAD IN SAG @	REMARK
17	2C	12	—	0.7	.8	.56	—	3.5	2	—	—	.0025	.02		2	.222	.0833	4.165	—	6.5					.16						6.1'	

SHEET ___ OF ___

Williamsburg Dodge

TABLE 3

WORKSHEET FOR BMP POINT SYSTEM

A. STRUCTURAL BMP POINT ALLOCATION

BMP	BMP Points		Fraction of Site Served by BMP		Weighted BMP Points
Wet ED Pond	10	x	100%	=	10
		x		=	
		x		=	
		x		=	

TOTAL WEIGHTED STRUCTURAL BMP POINTS: 10

B. NATURAL OPEN SPACE CREDIT

Fraction of Site		Natural Open Space Credit		Points for Natural Open Space
8%	x	.1 (0.1 per 1%)	=	.8

THIS O.S. CREDIT CANNOT BE USED. ∴ TTL = 10 pts.

C. TOTAL WEIGHTED POINTS

10	+	.8	=	10.8
Structural BMP Points		Natural Open Space Points		TOTAL

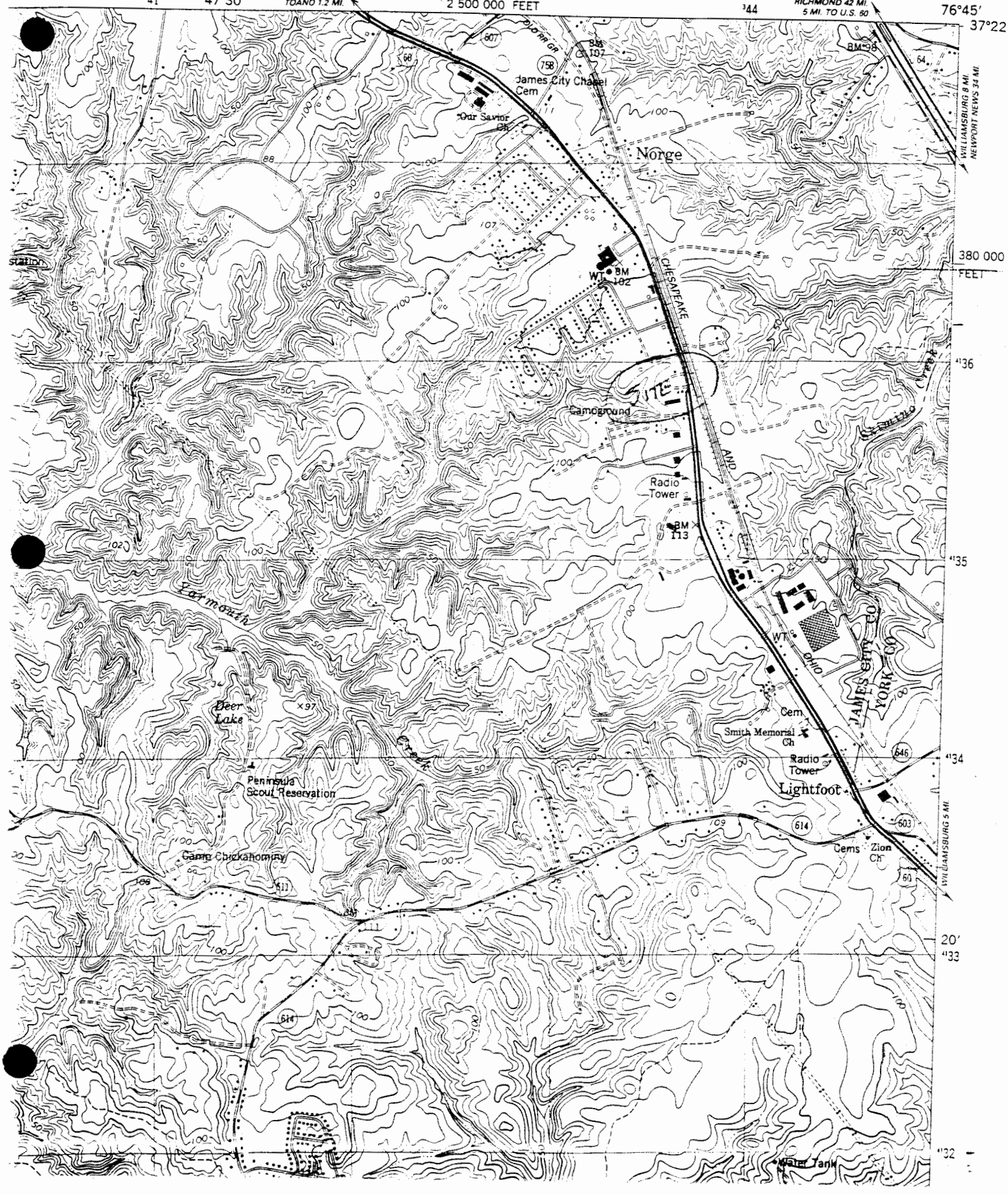
- $WQV_{req'd} = \frac{2 \text{ in imp. ac.}}{12} \times 3.458 \text{ ac} \times 43{,}560 \text{ ft}^3/\text{ac} = 25{,}105 \text{ ft}^3$ ✓ OK
- Permanent Pool Vol. $= \frac{1}{2} WQV = 12{,}553 \text{ ft}^3$ ✓ ← Permanent Pool Provided
- ED Vol (24 hr. drawdown) $= 12{,}553 \text{ ft}^3$ ✓
  30?

Williamsburg Dodge

◆Soils Data

1:2500,000 FEET
Our Saviour Parish House
Our Saviour Church
Norge
Site
JAMES
Creek

NORGE QUADRANGLE
VIRGINIA
7.5 MINUTE SERIES (TOPOGRAPHIC)



YC021_WILLIAMSBURG_DODGE_7101 - 190

The Caroline soils in this survey area are taxadjuncts to the Caroline series because they have a thinner clayey solum and less mottling in the subsoil than is defined in the range for the series. These differences, however, do not affect the use and management of the soils.

Chickahominy Series

Soils of the Chickahominy series are deep and poorly drained. They formed in clayey fluvial sediments. Chickahominy soils are on low-lying flats and depressions along major rivers on the Coastal Plain. Slopes range from 0 to 2 percent.

Chickahominy soils commonly are near Altavista, Augusta, Dogue, Newflat, Peawick, and Tetotum soils. Chickahominy soils are more poorly drained than all of those soils and have more clay in the subsoil than Altavista, Augusta, or Tetotum soils.

Typical pedon of Chickahominy silt loam, approximately 300 feet west of intersection of VA-5 and VA-613, 100 feet south of VA-5, James City County:

A1—0 to 2 inches; dark grayish brown (2.5Y 4/2) silt loam; moderate medium and fine granular structure; friable, sticky, plastic; many fine medium and coarse roots; few very fine tubular pores; extremely acid; abrupt smooth boundary.

A2—2 to 7 inches; grayish brown (2.5Y 5/2) silt loam; common fine faint light olive brown (2.5Y 5/4) mottles and common fine distinct very dark grayish brown (10YR 3/2) mottles; moderate medium granular and weak fine subangular blocky structure; friable, sticky, plastic; many fine medium and coarse roots; common very fine tubular pores; few fine flakes of mica; extremely acid; clear smooth boundary.

B21tg—7 to 13 inches; gray (N 6/0) silty clay loam; common medium prominent yellowish brown (10YR 5/8) mottles; strong medium and fine subangular blocky structure; very firm, sticky, plastic; common fine medium and coarse roots; few very fine tubular pores; few thin continuous clay films on faces of peds; few fine flakes of mica; extremely acid; gradual smooth boundary.

B22tg—13 to 33 inches; gray (N 6/0) silty clay; common fine and medium prominent yellowish brown (10YR 5/8) mottles; weak medium prismatic structure parting to strong fine and medium angular blocky; very firm, sticky, plastic; common fine and medium roots along primary structural faces; few very fine tubular pores; common thick continuous clay films on faces of peds; few fine flakes of mica; very strongly acid; gradual smooth boundary.

B23tg—33 to 47 inches; gray (5Y 6/1) silty clay; common medium prominent yellowish brown (10YR 5/8) mottles; moderate coarse prismatic structure parting to strong medium and fine angular blocky; very firm, sticky, plastic; common fine and few medium roots along primary structural faces; common thick continuous clay films on faces of peds; few fine flakes of mica; extremely acid; gradual smooth boundary.

B24tg—47 to 61 inches; gray (5Y 5/1) silty clay; common medium prominent yellowish brown (10YR 5/8) mottles; strong medium and fine subangular and angular blocky structure; firm, sticky, plastic; few fine and medium roots; few thick continuous clay films on faces of peds; few fine flakes of mica; very strongly acid; gradual smooth boundary.

B25tg—61 to 85 inches; gray (5Y 6/1) clay loam; common medium prominent yellowish brown (10YR 5/8) mottles; strong medium and fine subangular and angular blocky structure; firm, sticky, plastic; few fine roots; few very fine tubular pores; few thick continuous clay films on faces of peds; few fine flakes of mica; very strongly acid.

The solum thickness is more than 60 inches. The soil is extremely acid or very strongly acid unless limed. Quartz pebbles make up 0 to 2 percent of the solum.

The A horizon has hue of 10YR or 2.5Y, value of 3 through 5, and chroma of 1 or 2. It is loam or silt loam.

Some pedons have a B1 horizon that has no hue or hue of 10YR through 5Y, value of 4 through 6, and chroma of 0 through 2. Mottles with high chroma are in some pedons. Texture is loam, silt loam, clay loam, or silty clay loam.

The B2t horizon has no hue or hue of 10YR through 5Y, value of 4 through 7, and chroma of 0 through 2. Texture is clay loam, silty clay loam, silty clay, or clay.

Craven Series 113

Soils of the Craven series are deep and moderately well drained. They formed in clayey fluvial and marine sediments. Craven soils are on upland ridges and side slopes on the Coastal Plain. Slopes range from 2 to 10 percent.

Craven soils commonly are near Caroline, Emporia, Slagle, and Uchee soils. Craven soils are not as well drained as Caroline, Emporia, and Uchee soils. They have more clay in the subsoil than Emporia, Slagle, and Uchee soils and do not have the thick sandy surface layer characteristic of Uchee soils.

Typical pedon of Craven fine sandy loam in an area of Craven-Uchee complex, 6 to 10 percent slopes, approximately 2,700 feet east of Skimino Creek bridge on VA-602, 750 feet east of pond on Skimino Girl Scout Camp, York County:

A1—0 to 4 inches; dark grayish brown (10YR 4/2) fine

Y02WILLIAMSBURG_DODGE_7-01-19

Slagle Series 29A

Soils of the Slagle series are deep and moderately well drained. They formed in stratified loamy and clayey fluvial and marine sediments. Slagle soils are on upland flats, in slight depressions, and on side slopes of small drainageways on the Coastal Plain. Slopes range from 0 to 6 percent.

Slagle soils commonly are near Bethera, Caroline, Craven, Emporia, Izagora, Kempsville, and Uchee soils. Slagle soils have less clay in the upper part of the subsoil than Bethera, Caroline, or Craven soils. They are not as well drained as Emporia, Kempsville, or Uchee soils. They do not have as thick a subsoil as Izagora soils. They do not have a thick sandy surface layer characteristic of Uchee soils.

Typical pedon of Slagle fine sandy loam, 2 to 6 percent slopes, approximately 1.2 miles north of the Virginia Division of Highways office at Croaker, James City County:

A1—0 to 4 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak fine granular structure; friable, slightly sticky, nonplastic; many fine medium and coarse roots; common very fine and fine tubular pores; very strongly acid; abrupt wavy boundary.

A2—4 to 9 inches; light yellowish brown (10YR 6/4) fine sandy loam; weak fine granular structure; friable, slightly sticky, nonplastic; common fine and medium roots; many fine and common medium tubular pores; very strongly acid; clear smooth boundary.

B21t—9 to 25 inches; yellowish brown (10YR 5/8) clay loam; common medium faint light yellowish brown (10YR 6/4) mottles and common fine distinct strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; friable, sticky, plastic; common fine roots; common fine tubular pores; thin discontinuous clay films on faces of peds; very strongly acid; clear smooth boundary.

B22t—25 to 31 inches; mottled yellowish brown (10YR 5/8), light gray (5Y 7/1), and strong brown (7.5YR 5/8) clay loam; weak medium subangular blocky structure; friable, sticky, plastic; few fine roots; common fine and medium pores; thin discontinuous clay films on faces of peds; very strongly acid; clear smooth boundary.

B23tg—31 to 45 inches; light gray (5Y 7/1) sandy clay loam; common medium prominent yellowish brown (10YR 5/8) and strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; firm, sticky, plastic; few fine roots; common fine and medium tubular pores; thick discontinuous clay films on faces of peds; few fine flakes of mica; very strongly acid; gradual smooth boundary.

B3t—45 to 50 inches; mottled yellowish brown (10YR 5/8), light gray (5Y 7/1), and strong brown (7.5YR 5/8) clay loam; weak coarse subangular blocky structure; firm, sticky, plastic; few fine roots; common fine and medium tubular pores; thick patchy clay films on faces of peds; few fine flakes of mica; very strongly acid; clear smooth boundary.

C—50 to 60 inches; mottled yellowish brown (10YR 5/8), light gray (5Y 7/1), and strong brown (7.5YR 5/8) sandy clay loam; massive; firm, sticky, plastic; few fine roots; few fine tubular pores; few thin vertical clay flows; few fine flakes of mica; very strongly acid.

The solum thickness ranges from 40 to 60 inches or more. The soil is extremely acid through strongly acid unless limed. Coarse fragments make up 0 to 5 percent of the soil.

The Ap or A1 horizon has hue of 10YR or 2.5Y, value of 4 through 6, and chroma of 2 through 4. The A2 horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 or 4. The A horizon is sandy loam, fine sandy loam, or loam.

Some pedons have a B1 horizon that has hue of 7.5YR through 2.5Y, value of 5 or 6, and chroma of 3 through 6. It is sandy loam, fine sandy loam, or loam.

The upper part of the B2t horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 through 8. The lower part of the B2t and the B3 horizons have hue of 7.5YR through 5Y, value of 4 through 7, and chroma of 1 through 8; or they are mottled or variegated with high and low chroma colors. The B2t horizon is sandy clay loam, loam, or clay loam. The lower part of the B2t horizon and the B3 horizon are sandy clay or clay in some pedons.

The C horizon is variable in color. It is gray and has high chroma mottles, or it is mottled or variegated in shades of red, yellow, brown, olive, and gray. Texture is variable and ranges from loamy sand to clay. In some pedons it is stratified.

State Series

Soils of the State series are deep and well drained. They formed in loamy fluvial sediments. State soils are on low-lying stream terraces on the Coastal Plain. Slopes range from 0 to 3 percent.

State soils commonly are near Altavista, Augusta, Dogue, Dragston, Pamunkey, and Tetotum soils. State soils are better drained than Altavista, Augusta, Dogue, Dragston, or Tetotum soils. Also, they have less clay in the subsoil than Dogue soils and more clay than Dragston soils. They have a higher seasonal water table than Pamunkey soils.

Typical pedon of State fine sandy loam, approximately 1.8 miles east of Jamestown Island parking lot on Loop Road and 500 feet north of Loop Road, James City County:

Craven 11B

nonsticky, nonplastic; many fine and medium roots; very strongly acid; clear smooth boundary.

A2—4 to 9 inches; pale olive (5Y 6/3) fine sandy loam; weak medium granular structure; friable, slightly sticky, nonplastic; many fine and medium roots; very strongly acid; abrupt smooth boundary.

B21t—9 to 22 inches; yellowish brown (10YR 5/6) clay; strong fine subangular blocky structure; firm, sticky, plastic; common fine roots; thin continuous clay films on faces of peds; extremely acid; clear smooth boundary.

B22t—22 to 30 inches; yellowish brown (10YR 5/8) sandy clay loam; common medium prominent light gray (2.5Y 7/2) mottles; moderate medium subangular blocky structure; firm, sticky, plastic; few fine roots; thick discontinuous clay films on faces of peds; extremely acid; clear smooth boundary.

B3t—30 to 42 inches; yellowish brown (10YR 5/8) sandy clay loam; many fine prominent light gray (2.5Y 7/2) mottles; weak medium subangular blocky structure; friable, sticky, plastic; few fine roots; thin patchy clay films on faces of peds; extremely acid; clear smooth boundary.

C1—42 to 60 inches; brownish yellow (10YR 6/6) fine sandy loam; common medium prominent light gray (10YR 7/2) mottles; massive; very friable, nonsticky, nonplastic; extremely acid; clear smooth boundary.

C2g—60 to 72 inches; light gray (2.5Y 7/2) loamy fine sand; few fine prominent brownish yellow (10YR 6/6) mottles; massive; very friable, nonsticky, nonplastic; extremely acid.

The solum thickness ranges from 40 to 60 inches. The soil ranges from extremely acid through strongly acid unless limed. Coarse fragments make up 0 to 2 percent of the soil.

The A1 or Ap horizon has hue of 10YR or 2.5Y, value of 4 through 6, and chroma of 1 through 3. The A2 horizon has hue of 10YR through 5Y, value of 5 through 7, and chroma of 2 through 4. The A horizon is fine sandy loam, loam, or silt loam.

Some pedons have a B1t horizon that has hue of 10 YR or 2.5Y, value of 5 or 6, and chroma of 4 through 8. This horizon is loam, clay loam, or silty clay loam.

The B21t horizon has hue of 7.5YR through 2.5Y, value of 5 or 6, and chroma of 4 through 8. It is clay loam, silty clay loam, silty clay, or clay. The B22t horizon has hue of 7.5YR through 2.5Y, value of 5 through 7, and chroma of 4 through 8. Mottles are in shades of red, brown, yellow, or gray. Texture is sandy clay loam, clay loam, silty clay loam, silty clay, clay, or sandy clay.

The B3 horizon is mottled and has hue of 10YR or 2.5Y, value of 5 through 7, and chroma of 1 through 8. It is sandy clay loam, sandy clay, or silty clay loam.

The C horizon has hue of 10YR or 2.5Y, value of 5 through 7, and chroma of 1 through 6. Mottles are in shades of red, brown, yellow, or gray. Texture ranges from loamy fine sand to sandy clay loam.

The Craven soils in this survey area are taxadjuncts to the Craven series because they have a thinner clayey Bt horizon and more sand in the lower part of the B2t horizon than is defined in the range for the series. These differences, however, do not affect the use and management of the soils.

Dogue Series

Soils of the Dogue series are deep and moderately well drained. They formed in clayey fluvial sediments. Dogue soils are on stream terraces along major streams and rivers on the Coastal Plain. Slopes range from 0 to 3 percent.

Dogue soils commonly are near Altavista, Chickahominy, Newflat, Pamunkey, and Peawick soils. Dogue soils have more clay in the subsoil than Pamunkey and Altavista soils and are not as poorly drained as Chickahominy or Newflat soils. Dogue soils are not as well drained as Pamunkey soils and have a thinner subsoil and lower shrink-swell potential than Peawick soils.

Typical pedon of Dogue loam, approximately 2,800 feet southeast of the mouth of Taskinas Creek and 500 feet south of the York River in York River State Park, James City County:

Ap1—0 to 3 inches; dark grayish brown (10YR 4/2) loam; weak fine granular structure; friable, slightly sticky, slightly plastic; many fine, common medium, and few coarse roots; common fine pores; neutral; clear smooth boundary.

Ap2—3 to 11 inches; dark grayish brown (10YR 4/2) loam; moderate fine granular and weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; common fine and medium and few coarse roots; many fine pores; slightly acid; clear smooth boundary.

B1t—11 to 14 inches; yellowish brown (10YR 5/4) loam; moderate medium subangular blocky structure; friable, sticky, plastic; few fine and common roots; many fine pores; medium acid; abrupt smooth boundary.

B21t—14 to 26 inches; yellowish brown (10YR 5/6) clay; few fine faint pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; firm, sticky, plastic; common fine medium and coarse roots; common fine pores; common thin continuous clay films on faces of peds; strongly acid; gradual smooth boundary.

B22t—26 to 36 inches; yellowish brown (10YR 5/6) clay; many fine faint yellowish brown (10YR 5/8) mottles and common prominent gray (10YR 6/1) mottles; moderate fine and medium subangular blocky

brown (10YR 5/6) mottles; massive; friable, nonsticky, nonplastic; few fine roots; few fine and medium pores; few pebbles up to 3/4 inch in diameter; few fine flakes of mica; slightly acid; gradual wavy boundary.

C2—47 to 54 inches; yellowish brown (10YR 5/6) fine sandy loam; common medium prominent olive gray (5Y 5/2) mottles; massive; friable, slightly sticky, slightly plastic; few fine roots; common fine and medium pores; few pebbles up to 3/4 inch in diameter; iron stains on 15 percent of sand grains; few fine flakes of mica; very strongly acid; gradual wavy boundary.

IIC3g—54 to 72 inches; gray (5Y 6/1) loamy fine sand; common medium prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8) mottles; massive; very friable, nonsticky, nonplastic; few fine flakes of mica; very strongly acid.

The solum thickness ranges from 25 to 50 inches. The soil is very strongly acid or strongly acid in the A horizon and upper part of the B horizon unless limed. It ranges from very strongly acid through slightly acid in the lower part of the B horizon and in the C horizon. Quartz pebbles make up 0 to 2 percent of the solum and 0 to 10 percent of the C horizon.

The A1 or Ap horizon has hue of 10YR through 5Y, value of 3 through 5, and chroma of 2 through 4. The A2 horizon has hue of 10YR through 5Y, value of 4 through 7, and chroma of 2 through 4. The A horizon is loamy fine sand or fine sandy loam.

The B1 horizon has hue of 10YR through 5Y, value of [illegible] through 6, and chroma of 3 through 8. It has few or common mottles. The B2t horizon has no hue or hue of 10YR through 5Y, value of 4 through 6, and chroma of 0 through 8. The B2t horizon has high or low chroma mottles. The B1 and B2t horizons are sandy loam or fine sandy loam.

Some pedons have a B3 horizon that has colors and mottles similar to those of the B2t horizon. This horizon is loamy fine sand, sandy loam, or fine sandy loam.

The C horizon has no hue or has hue of 10YR through 5Y. It has value of 4 through 7 and chroma of 0 through 8. This horizon has high or low chroma mottles. It is sand, fine sand, loamy sand, loamy fine sand, fine sandy loam, or sandy loam.

Emporia Series 15F

Soils of the Emporia series are deep and well drained. They formed in stratified loamy and clayey fluvial and marine sediments. Emporia soils are on uplands on the Coastal Plain. Slopes range from 2 to 50 percent.

Emporia soils commonly are near Caroline, Izagora, Kempsville, Kenansville, Slagle, Suffolk, and Uchee soils. Emporia soils have less clay in the subsoil than Caroline soils and are better drained than Izagora or Slagle soils. They have a perched water table, unlike Kempsville or Suffolk soils, and do not have the thick sandy surface layer characteristic of Kenansville or Uchee soils.

Typical pedon of Emporia fine sandy loam, 2 to 6 percent slopes, approximately 5,500 feet southwest of mouth of Carters Creek at the York River, 1,300 feet south of Carters Creek on Camp Peary, York County:

A1—0 to 4 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak fine granular structure; friable, slightly sticky, nonplastic; many fine medium and coarse roots; common fine and medium tubular pores; very strongly acid; clear smooth boundary.

A2—4 to 13 inches; pale brown (10YR 6/3) loam; weak fine and medium granular structure; friable, slightly sticky, nonplastic; common fine medium and coarse roots; many fine and medium tubular pores; very strongly acid; gradual smooth boundary.

B1t—13 to 19 inches; yellowish brown (10YR 5/6) loam; common medium faint light yellowish brown (10YR 6/4) mottles; weak medium subangular blocky structure; friable, sticky, plastic; common medium and fine roots; many fine and medium tubular pores; few thin patchy clay films on faces of peds; very strongly acid; clear smooth boundary.

B21t—19 to 30 inches; yellowish brown (10YR 5/6) loam; common medium distinct strong brown (7.5YR 5/6) mottles and few medium faint pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable, sticky, plastic; few fine roots; common fine and medium tubular pores; common thin continuous clay films on faces of peds; very strongly acid; clear smooth boundary.

B22t—30 to 37 inches; yellowish brown (10YR 5/8) loam; common medium distinct strong brown (7.5YR 5/8) and pale brown (10YR 6/3) mottles; weak medium subangular blocky structure; friable, sticky, plastic; few fine roots; common fine and medium tubular pores; common thin discontinuous clay films on faces of peds; very strongly acid; clear smooth boundary.

B23t—37 to 51 inches; yellowish brown (10YR 5/8) sandy clay loam; common medium distinct strong brown (7.5YR 5/8) and light brownish gray (10YR 6/2) mottles; weak medium and coarse subangular blocky structure; firm, sticky, plastic; few fine roots; common fine and medium tubular pores; few thin discontinuous clay films on faces of peds; strongly acid; clear smooth boundary.

B3t—51 to 58 inches; mottled light brownish gray (10YR 6/2), yellowish brown (10YR 5/8), and strong brown (7.5YR 5/8) sandy clay loam; weak coarse subangular blocky structure; firm, sticky, plastic; common fine tubular pores; few thin patchy clay

films on faces of peds; very strongly acid; gradual smooth boundary.

C—58 to 75 inches; variegated gray (5Y 6/1), strong brown (7.5YR 5/8), yellowish brown (10YR 5/6), and yellowish red (5YR 5/6) sandy clay loam; massive; firm, sticky, plastic; very strongly acid.

The solum thickness ranges from 40 to 75 inches. The soil is very strongly acid or strongly acid unless limed. Coarse fragments make up 0 to 5 percent of the soil.

The Ap or A1 horizon has hue of 10YR or 2.5Y, value of 4 through 6, and chroma of 2 through 4. The A2 horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 or 4. The A horizon is sandy loam, fine sandy loam, or loam.

The B1 horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 through 6. It is sandy loam, fine sandy loam, or loam.

The B21t and B22t horizons have hue of 5YR through 10YR, value of 4 through 6, and chroma of 3 through 8. Texture is sandy loam, loam, sandy clay loam, or clay loam. The B23t and B3 horizons have no hue or hue of 5YR through 2.5Y, and they have value of 4 through 6 and chroma of 0 through 8. These horizons have low chroma mottles or are mottled without dominant matrix color. Texture is sandy loam, loam, sandy clay loam, clay loam, sandy clay, or clay.

The C horizon has no hue or hue of 5YR through 5Y, value of 3 through 8, and chroma of 0 through 8. This horizon is mottled or variegated. Texture ranges from sandy loam to clay.

Izagora Series

Soils of the Izagora series are deep and moderately well drained. They formed in loamy and clayey fluvial and marine sediments. Izagora soils are on uplands on the Coastal Plain. Slopes range from 0 to 3 percent.

Izagora soils commonly are near Bethera, Emporia, Slagle, and Yemassee soils. Izagora soils are better drained and have less clay in the subsoil than Bethera soils. They are not as well drained as Emporia soils, have a thicker subsoil than Slagle and Yemassee soils, and are better drained than Yemassee soils.

Typical pedon of Izagora loam, approximately 3,250 feet west southwest of the junction of US-17 and the Chesapeake and Ohio Railroad, 200 feet north of railroad, York County:

Ap—0 to 4 inches; very dark gray (10YR 3/1) loam; weak fine granular structure; friable, slightly sticky, nonplastic; many fine medium and coarse roots; common fine and medium tubular pores; extremely acid; clear wavy boundary.

A1—4 to 13 inches; light yellowish brown (2.5Y 6/4) loam; weak fine granular structure; friable, slightly sticky, nonplastic; few fine coarse and common medium roots; common fine and medium tubular pores; krotovina up to 1/2 inch in diameter filled with A1 material; strongly acid; clear smooth boundary.

B1t—13 to 17 inches; light olive brown (2.5Y 5/4) loam; weak fine subangular blocky and moderate medium granular structure; friable, sticky, plastic; few fine and medium roots; common fine and medium tubular pores; few thin patchy clay films on faces of peds; very strongly acid; clear smooth boundary.

B21t—17 to 27 inches; light olive brown (2.5Y 5/6) loam; weak medium subangular blocky structure; friable, sticky, plastic; few fine and medium roots; few fine tubular pores; thin discontinuous clay films on faces of peds; very strongly acid; gradual wavy boundary.

B22t—27 to 36 inches; mottled yellowish brown (10YR 5/8), light olive brown (2.5Y 5/4), gray (5Y 6/1), and strong brown (7.5YR 5/6) clay loam; moderate fine subangular blocky structure; friable, sticky, plastic; few fine roots; few fine vesicular pores; thin discontinuous clay films on faces of peds; vertical streaks 1/4 to 1/2 inch wide of gray (5Y 6/1) sandy clay loam; very strongly acid; gradual smooth boundary.

B23tg—36 to 44 inches; gray (5Y 6/1) clay loam; many coarse prominent yellowish brown (10YR 5/8) mottles and common fine prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm, sticky, plastic; few fine roots; few fine vesicular pores; thick continuous clay films on faces of peds; vertical streaks of gray (5Y 6/1) loam; very strongly acid; gradual smooth boundary.

B24tg—44 to 68 inches; gray (N 6/0) clay loam; common medium prominent yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure; firm, sticky, plastic; few fine roots; few fine vesicular pores; thick continuous clay films on faces of peds; vertical streaks of gray (N 6/0) loam; very strongly acid; gradual smooth boundary.

B3tg—68 to 78 inches; gray (N 6/0) clay; common medium prominent yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm, sticky, plastic; few thin patchy clay films on faces of peds; very strongly acid.

The solum is more than 60 inches thick. The A horizon ranges from extremely acid through strongly acid unless limed. The B horizon is very strongly acid or strongly acid.

The Ap or A1 horizon has hue of 10YR or 2.5Y, value of 3 through 5, and chroma of 1 through 4. The A2 horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 through 4. The A horizon is fine sandy loam or loam.

The B1 horizon and the upper part of the B2t horizon have hue of 10YR

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TABLE 15.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth*	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
1---------- Altavista	C	None---------	---	---	1.5-2.5	Apparent	Dec-Mar	>60	---	Moderate	Moderate.
2---------- Augusta	C	None---------	---	---	1.0-2.0	Apparent	Jan-May	>60	---	High------	Moderate.
3---------- Axis	D	Frequent----	Very brief	Jan-Dec	+1-1.0	Apparent	Jan-Dec	>60	---	High------	High.
4**. Beaches											
5---------- Bethera	D	None---------	---	---	+1-1.5	Apparent	Dec-Apr	>60	---	High------	High.
6---------- Bohicket	D	Frequent----	Very brief	Jan-Dec	+2-0	Apparent	Jan-Dec	>60	---	High------	High.
7---------- Bojac	B	None---------	---	---	>4.0	Apparent	Nov-Apr	>60	---	Low-------	High.
8B---------- Caroline	C	None---------	---	---	>6.0	---	---	>60	---	High------	High.
9---------- Chickahominy	D	None---------	---	---	0-0.5	Apparent	Nov-Apr	>60	---	High------	High.
10B, 10C---------- Craven	C	None---------	---	---	2.0-3.0	Apparent	Dec-Apr	>60	---	High------	High.
11B**, 11C**:											
Craven----------	C	None---------	---	---	2.0-3.0	Apparent	Dec-Apr	>60	---	High------	High.
Uchee----------	A	None---------	---	---	3.5-5.0	Perched	Jan-Apr	>60	---	Low-------	High.
12---------- Dogue	C	None---------	---	---	1.5-3.0	Apparent	Jan-Mar	>60	---	High------	High.
13---------- Dragston	C	None---------	---	---	1.0-2.5	Apparent	Nov-Apr	>60	---	Low-------	High.
14B, 14C, 15D**, 15E**, 15F**----- Emporia	C	None---------	---	---	3.0-4.5	Perched	Nov-Apr	>60	---	Moderate	High.
16---------- Izagora	C	None---------	---	---	2.0-3.0	Apparent	Dec-Mar	>60	---	Moderate	High.
17**---------- Johnston	D	Frequent----	Brief to long.	Nov-Jul	+1-1.5	Apparent	Nov-Jun	>60	---	High------	High.
18B---------- Kempsville	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	Moderate.
19B**:											
Kempsville--------	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	Moderate.
Emporia----------	C	None---------	---	---	3.0-4.5	Perched	Nov-Apr	>60	---	Moderate	High.
20B---------- Kenansville	A	None---------	---	---	4.0-6.0	Apparent	Dec-Apr	>60	---	Low-------	High.
21---------- Levy	D	Frequent----	Very long	Jan-Dec	+2-+1	Apparent	Jan-Dec	>60	---	High------	High.

See footnotes at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth*	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
Munden	B	None	---	---	1.5-2.5	Apparent	Dec-Apr	>60	---	Low	High.
23 Newflat	D	None	---	---	0.5-1.5	Apparent	Nov-Apr	>60	---	High	High.
24 Nimmo	D	None	---	---	0-0.5	Apparent	Dec-Apr	>60	---	Low	High.
25B Norfolk	B	None	---	---	4.0-6.0	Perched	Jan-Mar	>60	---	Moderate	High.
26B** Pamunkey	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
27 Peawick	D	None	---	---	1.5-3.0	Perched	Nov-Mar	>60	---	High	High.
28 Seabrook	C	None	---	---	2.0-4.0	Apparent	Dec-Mar	>60	---	Low	Moderate.
29A, 29B Slagle	C	None	---	---	1.5-3.0	Perched	Nov-Apr	>60	---	Moderate	High.
30 State	B	None	---	---	4.0-6.0	Apparent	Dec-Jun	>60	---	Moderate	High.
31B Suffolk	B	None	---	---	>6.0	---	---	>60	---	Moderate	High.
32 Tetotum	C	None	---	---	1.5-2.5	Apparent	Dec-Apr	>60	---	High	High.
33 Tomotley	B/D	None	---	---	0-1.0	Apparent	Dec-Mar	>60	---	High	High.
34B, 34C Uchee	A	None	---	---	3.5-5.0	Perched	Jan-Apr	>60	---	Low	High.
35**. Udorthents											
36**: Udorthents.											
Dumps.											
37**. Urban land											
38 Yemassee	C	None	---	---	1.0-1.5	Apparent	Dec-Mar	>60	---	High	High.

* A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the de below the surface.

** See description of the map unit for composition and behavior characteristics of the map unit.

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
11B*, 11C*:											
Craven	0-9	Fine sandy loam	ML, CL-ML, SM, SM-SC	A-4	0	100	100	75-100	45-90	<35	NP-7
	9-30	Clay, silty clay, silty clay loam.	CH	A-7	0	100	100	90-100	65-98	51-70	24-43
	30-72	Sandy clay loam, sandy loam, loamy sand.	SM, SM-SC, SC	A-2, A-4, A-6	0	100	95-100	50-100	15-49	<35	NP-15
Uchee	0-24	Loamy fine sand	SM	A-2, A-1-B	0	90-100	80-100	40-70	15-30	---	NP
	24-36	Sandy loam, sandy clay loam.	SC, SM-SC	A-2, A-4, A-6	0	90-100	80-100	50-80	25-50	20-40	6-20
	36-56	Sandy clay loam, sandy clay, clay.	MH, CH, CL, SC	A-7	0	90-100	80-100	65-90	40-70	41-70	18-38
	56-65	Sandy loam, sandy clay loam, sandy clay.	MH, CH, CL, SC	A-6, A-7, A-2-6, A-2-7	0	85-100	80-100	50-80	30-65	35-65	15-35
12 Dogue	0-11	Loam	ML, CL, SM, SC	A-4	0	95-100	75-100	60-100	40-85	<30	NP-10
	11-43	Clay loam, clay, sandy clay loam.	CL, CH, SC	A-6, A-7	0	95-100	75-100	65-100	40-90	35-60	16-40
	43-60	Stratified sand to sandy clay loam.	SM, SC, SP-SM, SM-SC	A-2, A-4, A-1	0	80-100	60-100	35-100	10-40	<30	NP-10
13 Dragston	0-17	Fine sandy loam	SM, SC, SM-SC	A-2, A-4	0	100	95-100	60-85	30-60	<20	NP-8
	17-54	Fine sandy loam, sandy loam, loam.	SM, SC, SM-SC	A-2, A-4	0	100	95-100	60-85	30-60	<25	NP-10
	54-72	Sand, loamy fine sand, fine sandy loam.	SM, SP-SM, SM-SC	A-1, A-2, A-3	0	95-100	85-100	35-70	5-30	<18	NP-7
14B, 14C Emporia	0-13	Fine sandy loam	CL, SC, SM, ML	A-2, A-4, A-6	0-3	90-100	80-100	50-95	25-65	<25	NP-15
	13-37	Sandy clay loam, sandy loam, clay loam.	SC, CL	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	25-70	20-50	8-30
	37-58	Sandy clay loam, clay loam, sandy clay.	SC, CL	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	30-80	25-50	8-30
	58-75	Stratified sandy loam to clay loam.	SM, SC, ML, CL	A-1, A-2, A-4, A-6	0-5	70-100	55-100	30-90	20-60	<40	NP-25
15D* Emporia	0-11	Fine sandy loam	CL, SC, SM, ML	A-2, A-4, A-6	0-3	90-100	80-100	50-95	25-65	<25	NP-15
	11-37	Sandy clay loam, sandy loam, clay loam.	SC, CL	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	25-70	20-50	8-30
	37-54	Sandy clay loam, clay loam, sandy clay.	SC, CL	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	30-80	25-50	8-30
	54-75	Stratified sandy loam to clay loam.	SM, SC, ML, CL	A-1, A-2, A-4, A-6	0-5	70-100	55-100	30-90	20-60	<40	NP-25
15E* Emporia	0-9	Fine sandy loam	CL, SC, SM, ML	A-2, A-4, A-6	0-3	90-100	80-100	50-95	25-65	<25	NP-15
	9-37	Sandy clay loam, sandy loam, clay loam.	SC, CL	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	25-70	20-50	8-30
	37-50	Sandy clay loam, clay loam, sandy clay.	SC, CL	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	30-80	25-50	8-30
	50-75	Stratified sandy loam to clay loam.	SM, SC, ML, CL	A-1, A-2, A-4, A-6	0-5	70-100	55-100	30-90	20-60	<40	NP-25

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
15F*---------- Emporia	0-6	Fine sandy loam	CL, SC, SM, ML	A-2, A-4, A-6	0-3	90-100	80-100	50-95	25-65	<25	NP-15
	6-37	Sandy clay loam, sandy loam, clay loam.	SC, CL	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	25-70	20-50	8-30
	37-45	Sandy clay loam, clay loam, sandy clay.	SC, CL	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	30-80	25-50	8-30
	45-75	Stratified sandy loam to clay loam.	SM, SC, ML, CL	A-1, A-2, A-4, A-6	0-5	70-100	55-100	30-90	20-60	<40	NP-25
16---------- Izagora	0-13	Loam----------	CL, CL-ML, ML	A-4	0	95-100	95-100	85-100	60-90	<30	NP-10
	13-36	Loam, clay loam, silty clay loam.	CL	A-4, A-6, A-7	0	95-100	95-100	85-100	60-95	25-45	8-25
	36-78	Clay loam, clay	CL, CH	A-6, A-7	0	95-100	95-100	90-100	70-95	35-60	20-40
17*---------- Johnston	0-8	Silt loam--------	ML, SM	A-2, A-4	0	100	100	60-100	18-65	<35	NP-10
	8-49	Stratified fine sandy loam to silty clay loam.	SM, ML	A-2, A-3	0	100	100	60-100	18-65	<35	NP-10
	49-60	Stratified sand to sandy clay loam.	SM, ML	A-2, A-4	0	100	100	50-100	25-49	<35	NP-10
18B---------- Kempsville	0-14	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-2, A-4	0-2	90-100	75-100	45-85	25-65	<18	NP-7
	14-20	Sandy loam, fine sandy loam, loam.	SM, SC, ML, CL	A-2, A-4	0-2	90-100	80-100	50-90	30-70	<22	NP-10
	20-55	Sandy clay loam, loam, fine sandy loam.	SC, CL	A-2, A-6	0-2	90-100	80-100	55-95	30-75	25-40	10-20
	55-68	Stratified loamy sand to sandy clay loam.	SC, SM, SM-SC	A-1, A-2, A-4, A-6	0-5	85-100	75-100	35-85	15-50	<30	NP-15
19B*: Kempsville------	0-14	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-2, A-4	0-2	90-100	75-100	45-85	25-65	<18	NP-7
	14-20	Sandy loam, fine sandy loam, loam.	SM, SC, ML, CL	A-2, A-4	0-2	90-100	80-100	50-90	30-70	<22	NP-10
	20-55	Sandy clay loam, loam, fine sandy loam.	SC, CL	A-2, A-6	0-2	90-100	80-100	55-95	30-75	25-40	10-20
	55-68	Stratified loamy sand to sandy clay loam.	SC, SM, SM-SC	A-1, A-2, A-4, A-6	0-5	85-100	75-100	35-85	15-50	<30	NP-15
Emporia---------	0-13	Fine sandy loam	CL, SC, SM, ML	A-2, A-4, A-6	0-3	90-100	80-100	50-95	25-65	<25	NP-15
	13-37	Sandy clay loam, sandy loam, clay loam.	SC, CL	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	25-70	20-50	8-30
	37-58	Sandy clay loam, clay loam, sandy clay.	SC, CL	A-2, A-4, A-6, A-7	0-2	90-100	80-100	45-95	30-80	25-50	8-30
	58-75	Stratified sandy loam to clay loam.	SM, SC, ML, CL	A-1, A-2, A-4, A-6	0-5	70-100	55-100	30-90	20-60	<40	NP-25
20B---------- Kenansville	0-25	Loamy fine sand	SM	A-1, A-2	0	100	95-100	45-60	10-25	<25	NP-3
	25-43	Sandy loam, fine sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2, A-4	0	100	95-100	50-75	20-40	<30	NP-10
	43-78	Sand, loamy sand	SP-SM, SM, SP	A-1, A-2, A-3	0	100	95-100	40-60	5-30	---	NP

See footnote at end of table.

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
21---------- Levy	0-18	Silty clay-------	CL, CH, ML, MH	A-6, A-7	0	100	100	98-100	85-100	30-65	12-35
	18-80	Silty clay, clay, silty clay loam.	CL, CH, ML, MH	A-6, A-7	0	100	100	98-100	85-100	35-65	15-35
22---------- Munden	0-11	Loamy fine sand	SM, SM-SC	A-2, A-4	0	100	98-100	55-85	15-45	<18	NP-7
	11-48	Sandy loam, loam, sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	100	98-100	60-95	30-75	<30	NP-15
	48-80	Loamy sand, fine sand, sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	98-100	50-90	5-35	<18	NP-7
23---------- Newflat	0-8	Silt loam--------	SM, SC, CL-ML	A-4	0	95-100	90-100	75-95	45-90	<25	NP-8
	8-11	Loam, clay loam, silty clay loam.	CL, CH	A-6, A-7	0	95-100	90-100	85-100	55-90	30-55	12-30
	11-80	Clay loam, silty clay, clay.	CL, CH	A-7	0	95-100	90-100	85-100	70-90	40-75	15-45
24---------- Nimmo	0-11	Fine sandy loam	SM, SC, SM-SC, ML	A-4	0	100	95-100	50-85	35-60	<22	NP-10
	11-36	Loam, fine sandy loam, sandy loam.	SM, SC, ML, CL	A-2, A-4, A-6	0	100	95-100	60-95	30-75	<30	NP-15
	36-60	Loamy sand, fine sand, sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	95-100	50-80	5-35	<18	NP-7
25B---------- Norfolk	0-17	Fine sandy loam	SM, SM-SC, SC	A-2	0	95-100	95-100	50-91	15-33	<25	NP-14
	17-39	Sandy loam, sandy clay loam, clay loam.	SC, SM-SC, CL, CL-ML	A-2, A-4, A-6	0	95-100	91-100	70-96	30-55	20-38	4-15
	39-72	Sandy clay loam, clay loam, sandy clay.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-7-6	0	100	98-100	65-98	36-72	20-45	4-22
26B*---------- Pamunkey	0-14	Sandy loam-------	SM, ML, SP-SM, SM-SC	A-2, A-4	0	80-100	75-100	50-85	12-55	<20	NP-7
	14-43	Sandy clay loam, clay loam, loam.	CL, SC	A-2, A-6	0-2	80-100	75-100	70-95	30-75	30-40	10-20
	43-75	Stratified sandy loam to sand.	SW, SM, SW-SM, SM-SC	A-1, A-2, A-3	0-5	60-100	50-95	25-70	2-35	<20	NP-6
27---------- Peawick	0-7	Silt loam--------	SM, SC, CL-ML	A-4	0	90-100	75-100	50-100	40-90	15-30	NP-8
	7-99	Clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	90-100	75-100	70-100	70-95	35-80	12-50
28---------- Seabrook	0-9	Loamy fine sand	SM, SP-SM	A-2, A-3	0	95-100	90-100	85-99	5-25	---	NP
	9-72	Loamy fine sand, fine sand, sand.	SM, SP-SM	A-2, A-3	0	95-100	90-100	85-100	5-25	---	NP
29A, 29B--------- Slagle	0-9	Fine sandy loam	SM, SC, ML, CL	A-2, A-4, A-6	0-3	95-100	90-100	55-95	30-75	<35	NP-15
	9-25	Fine sandy loam, sandy clay loam, loam.	SC, SM-SC, CL, CL-ML	A-2, A-4, A-6	0-2	95-100	90-100	65-85	35-60	20-40	5-20
	25-60	Sandy clay loam, loam, clay loam.	SC, CL	A-4, A-6, A-7	0-2	95-100	90-100	75-95	40-75	25-50	8-30
30---------- State	0-11	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4	0	95-100	95-100	65-100	40-85	<28	NP-7
	11-52	Loam, clay loam, sandy clay loam.	CL, SC	A-4, A-6	0	95-100	95-100	75-100	35-80	24-40	8-22
	52-97	Stratified sand to fine sandy loam.	SM, SM-SC, SP-SM	A-1, A-2, A-3, A-4	0	85-100	75-100	40-90	5-50	<25	NP-7

See footnote at end of table.

POND-2 Version: 5.21
S/N:

Williamsburg Dodge
BMP Basin

CALCULATED 11-13-1999 14:05:32
DISK FILE: car\CAR .VOL

Planimeter scale: 1 inch = 30 ft.

Elevation (ft)	Planimeter (sq.in.)	Area (sq.ft)	A1+A2+sqr(A1*A2) (sq.ft)	* Volume (cubic-ft)	Volume Sum (cubic-ft)
69.00	0.00	0	0	0	0
69.50	0.03	23	23	4	4
70.00	0.05	45	99	17	20
71.00	0.35	317	481	160	181
72.00	0.76	681	1,463	488	668
73.00	1.60	1,435	3,106	1,035	1,704
74.00	2.61	2,350	5,622	1,874	3,578
75.00	3.95	3,555	8,795	2,932	6,509
76.00	5.38	4,844	12,548	4,183	10,692
76.40	*I*	5,420	15,387	2,052	12,744
77.00	7.05	6,344	16,731	5,577	16,269
78.00	10.23	9,203	23,189	7,730	23,999
79.00	14.30	12,867	32,953	10,984	34,983
80.00	16.96	15,266	42,148	14,049	49,033
81.00	20.48	18,434	50,475	16,825	65,857
82.00	24.42	21,975	60,536	20,179	86,036
83.00	28.97	26,073	71,985	23,995	110,031

I ---> Interpolated area from closest two planimeter readings.

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

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

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

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

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

James City County, Virginia
Environmental Division
Stormwater Management Program

Stormwater Management Design Plan
Staff "Quick" Review

3rd rev. 6/05/00 - 3
4th 9/29/00 - 4

2nd REVIEW

Plan No. SP - 124 - 99 Date/Time: 02/28/00 10:15 AM
Project Name: WILLIAMSBURG DODGE
Rough Location: US Route 60 NEAR NINA LANE (NORDE)
ADC Map: Sheet 2 Grid: B - 10
Flood Map / Zone: 510201- 00 20B Zone: X
Description: Zone X Outside 500-YEAR
Drainage Area: ☐ Onsite Only ☐ Offsite Only ☒ Combination of Both
Submitted:

Y	N		
☐	☒	Demolition Plan (If Applicable)	Sheets:
☒	☐	Site Plan	Sheets: 3
☒	☐	Grading Plan	Sheets: 3
☒	☐	Drainage Plan	Sheets: 4
☒	☐	E&SC Plan	Sheets: 4
☐	☒	Environmental Inventory	Sheets:
☒	☐	Notes & Details	Sheets: cover, 2, & 5
☒	☐	Drainage Map	SHEET 4 & REPORT
☒	☐	Soils Map	4
☒	☐	Standard E&SC and SWM Checklist.	
☒	☐	E&SC Design Report (Attachment).	
☒	☐	Stormwater Management / Drainage Narrative.	
☒	☐	Stormwater Management Design Report (Attachment).	
☐	☒	Waivers, Variances, Exceptions included (Attached in Writing).	
		☐ VESCH ☐ CBPO ☐ Other,	
☒	☐	Other (List): PROFFER; SUP - 21 - 97	

JCC GIS Database: Zoning: B - 1 Tax Parcel ID: (24-1) 1-8
Receiving Water: Yarmouth Creek Site Acreage: 6.4 (acres) / s.f.

Site Plan Information: Owner: John R. Dodson
Zoning: B - 1 Description: GEN BUSINESS w/ Proffers
Site Area: 6.40 AC. (acres) / s.f
Disturbed Area: 6.0 + MOST OF SITE acres / s.f. (~~54.03~~ %)
☒ Disturbance > 5 acres, NPDES Notice of Intent required.
Impervious: 3.4579 acres / s.f. (54.03 %)
☒ Less than or equal to 60 percent. Meets CBP Ordinance requirements.
☐ More than 60 percent. Does Not Meet CBP Ordinance requirements.
Open / Green Space: 2.9421 acres / s.f. (45.97 %)

Site Development Plan:

☐ Residential, Lots, etc.	☒ Commercial (B / O / R)	☐ Industrial	☐ Governmental
☒ Roadways or Entrances	☒ Parking or Loading	☒ Water	☒ Sewer
☒ Landscaping	☒ SWM/BMP control	☒ Manmade Drainage	☐ Parks, Amenities
☐ Pump/Lift Station	☐ Dams	☐ Other, BMP is quasi-regional facility.	

YC021_WILLIAMSBURG_DODGE_7101 - 202

Soils Information: Site: 14B, 11B, 15F Hydric: ❒ Yes ❒ No
Soil Survey Sheet DA: HSG:
9 BMP: 15F Hydric: ❒ Yes ❒ No
Description of Soils at Site / DA / BMP:
15F EMPORIA, 25-50%; MOD. PERMEABILITY IN UPPER PARTS; PERCHED HW TABLE; SPRINGS OR SEEPS.

BMP Control: ❒ None ☒ Onsite ❒ Offsite ❒ Previous Approved
BMP Types: 1- Name: BMP POND (JCC BMP Type A - 3), Points 10
2- Name: (JCC BMP Type ____ - ____), Points

OnSite Drainage Type: ☒ Reinforced Concrete Pipe ❒ Corrugated Metal Pipe ❒ Aluminum Type Pipe
❒ Corrugated Polyethylene Pipe ❒ PVC Type Pipe ❒ Open Channel Type
❒ Culverts Type:
❒ Other (Specify):

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

Site Limitations: ❒ RPA ❒ RMA ☒ Steep Slopes ☒ Delineated Wetlands
❒ Hydric Soils ❒ Critical Soils ☒ Vegetated ❒ Buffers
☒ Defined Natural Drainage Features onsite ❒ Downstream Storm Sewer/Culv.
☒ Evidence of Downstream Channel Erosion (by Field Observation) SJT, MCE, WB
❒ Floodplain or Problem Drainage Area YARMOUTH CREEK WS
❒ Other (Specify):

-4

Site Stormwater Management / BMP Control: WET EXT DET. A-3 * w/ 30mil PVC LINER

☒ Yes ❒ No (#1 / #2)	#1 BMP POND	
Predev (Present) DA = 16.8 ac. C/CN = 0.398		Tc = 21.0 (min) / hrs.
2-year	21.41 cfs	cfs
10-year	29.44 cfs	cfs
100-year	52.68 cfs	cfs
** **PostDev w/o Detention** DA = ~~16.10~~ 16.8 ac. C/CN = ~~0.488~~ 0.50 Tc = 21.9		min / hrs.
2-year	~~25.15~~ 26.94 cfs	cfs
10-year	~~34.58~~ 37.04 cfs	cfs
100-year	~~61.88~~ 66.29 cfs	cfs
PostDev w/ Detention DA = ~~16.10~~ 16.8 ac. C/CN = ~~0.488~~ 0.50 Tc = 21.0		min / hrs.
2-year 20.21cfs	~~17.37~~ cfs at El. ~~78.67~~	78.67 cfs at El.
10-year 30.15cfs	~~27.27~~ cfs at El. ~~78.80~~	78.86 cfs at El.
100-year 58.10cfs	~~53.88~~ cfs at El. ~~79.25~~	79.29 cfs at El.

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

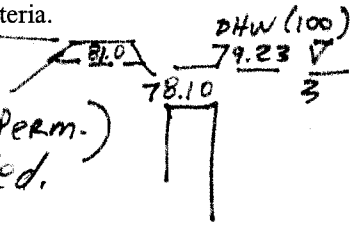
** PLAN AMENDMENT SEPT 7 2000. POND RELOCATE ROAD FRONT DRAINAGE 0.7 AC ±. STILL OK. MINOR WSEL + OUTFLOW DIFFERENCES.

Pond / BMP Design Data (Add Sheet If Necessary for Multiple Facilities):

☐ Check if None ☒ Provided: BMP # 1 Type: A-3 WET E.D. *

Y	N				
☒	☐	Top of Facility	El.	82.25	* WITH 30 MIL PVC LINER to EL 78.25
☒	☐	Design High Water	El.	~~79.23~~ (79.29)	
☒	☐	Emergency Spillway (E.S.)			
		Crest El. 81.0	Width: 8'+	SS: 2H:1V	
☒	☐	FreeBoard	3.02'	1 ft. or > with E.S.	
		☒ Acceptable ☐ Not Acceptable.		2 ft. or > w/o E.S.	
☒	☐	Principal Spillway (Riser) Crest	El. 78.10 (54")		
☒	☐	Principal Spillway Crest 1 ft. below crest of emergency spillway. (2.9') ☒ Yes ☐ No ☐ N/A			
☒	☐	Stage-Storage Curve or Data			
☒	☐	Outlet Rating Curve or Table (Discharge Structure Rating)			
☐	☐	1-year design storm	El. _____ or Volume _____		
☐	☐	1-year, 24 hour detention criteria for stream channel protection.		☐ Yes ☐ No ☐ N/A	
☒	☐	Extended Detention Provided (Min. 24 hours) EL 78.10		☒ Yes ☐ No ☐ N/A	
☒	☐	Normal/Permanent Pool	El. 76.40		
☒	☐	Orifice/Weir #1 (highest El.)	El. 78.10 PSC.	Type: PRIMC. SPILL CREST 54"ϕ	
☐	☒	Orifice/Weir #2	El. [redacted]	Type: [redacted]	
☐	☒	Orifice/Weir #3	El.	Type:	
☐	☒	Orifice/Weir #4	El.	Type:	
☐	☒	Orifice/Weir #5 (lowest El.)	El.	Type:	
☒	☐	Low Flow Orifice (ExDet, CPv)	El. 76.40	Type: 3" CIRC.	
☒	☐	Pond Drain w/ Valve	El.	Type: 6" CL 53 DIP W/VALVE	
☒	☐	Pond Bottom	El. 70	Riser Height: 8.1'	
☒	☐	Steps or Access Provided (for over 4 ft. depth)			
☒	☐	Riser Base	Bottom El. _____	Type: 9'x9'x18"	
☒	☐	Core Trench			
☒	☐	Anti-Seep Collars or other acceptable Seepage Control Method. 2 - 7x7 CONC.			
☒	☐	Principal Spillway Anti-Vortex Device and Trash Rack.		Type: CMP 84" VESCH TYPE	
☒	☐	Low Flow Orifice Cage-Type Trash Rack.		Type: REBAR	
☒	☐	Outlet Barrel:	Type/Class: III RCP	Size: 30"	
			Inv. U/S: 67.86	Inv D/S: 63.24	
			Slope: [redacted] 4.40%	Length: 105 (ft.)	
☒	☐	Flared End Section. Matches Outlet Barrel material type. ES-1 CONCRETE.			
☒	☐	Outlet Protection.			
		☒ Standard riprap outlet protection (OP)		Type: EC-1 Type A : RIPRAP CHANNEL TO R.	
		☐ Special Dissipator Structure (SDS)		Type:	
☒	☐	Sediment / Cleanout Elevation	El. 76.5 ±		
☒	☐	Adequate Channel Downstream of BMP or Meets 1-year, 24-hour detention criteria. NO PROVISIONS			

Sketch and Notes, If Needed: 54" RISER



DHW during Construct (25-YEAR) 82.0 (2.77' > DHW Perm.)
ED + Perm Pool Provided. No CPv Provided.

Sediment Trap & Basins

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

☒ Temporary Sediment Basin # 1 BMP DA = 16.10 ☒ BMP # 1 convert.
☐ Temporary Sediment Basin # 2 _____ DA = _____ ☐ BMP # ____ convert.

GEOTECH Report by ECS submitted on April 5TH 2000
(Dated March 9th 2000.)

NOTE: THIS IS 2ND REVIEW | THIS IS 3RD REV.

Plan Review Steps & Components:

Y	N	
☒	☐	First "Look-Thru". Quick look through plan for familiarity.
☒	☐	Worksheet for BMP Point System. Check for 10 BMP points.
☒	☐	FEMA Special Flood Hazard Area check against property, site and development.
☐	☒	Environmental Inventory components based on Chesapeake Bay Ordinance requirements.
☒	☐	Highlight environmental sensitive areas (wetlands, RPA, steep slope,etc.).
☐	☒	Demolition Plan (if any). Identification of offsite LD, borrow or waste areas and E&SC.
☒	☐	Review existing topography to determine adequacy of E&SC plan (Phase I).
☒	☐	Review Grading Plan to check for conflicts (offsite grading, cut-fills, slopes,) & Phase II E&SC.
☒	☐	Review Development Plan to check for conflicts (drainage, buffers, etc.).
☒	☐	Highlight storm drain system. Check for major utility conflicts and cover situations.
☒	☐	Review Storm Drain component specifications, notes, and details.
☒	☐	Review Sequence of Construction (E&SC and SWM plan purposes).
☐	☒	Review plan based on Chapter 19 Subdivision ordinance as it relates to SWM.
☒	☐	Review plan based on Chapter 24 Zoning as it relates to SWM.
☒	☐	Review plan based on Chapter 23 Chesapeake Bay ordinance requirements.
☒	☐	Review plan based on General Knowledge and Experience for Design/Construction.
☒	☐	Review plan based on Virginia Erosion and Sediment Control Handbook (VESCH).
☒	☐	Review plan based on JCC BMP manual for the BMP type(s) selected for project.
☐	☒	Review plan based on Hampton Roads BMP Design Guidance manual (Optional).
☒	☐	Review plan based on JCC E&SC and SWM Design Plan Checklist. (Pre-final).
☒	☐	Review plan based on Virginia Stormwater Management Handbook (VSMH).
☐	☒	Review plan based on JCC Stormwater Conveyance System D/C Guidelines (Pre-final).
☐	☒	Review plan based on JCC BMP Construction Specifications (Future).
☒	☐	Review Maintenance Plan for SWM / BMP facility and SOC as it relates to SWM plan.
☒	☐	Review E&SC Plan Design Report or computations (Attachment). Sediment Filter Devices.
☒	☐	Review SWM Design Report or computations (Attachment). Pond Hydraulics/Conveyances
☐	☒	Adequate Channel Information downstream of both uncontrolled or BMP areas.
☒	☐	Provisions on plan requiring proper As-Built and Certification of facility during construction.
☒	☐	Inclusion of Design Plan into any Departmental SWM/BMP databases.
☐	☐	Reserved.
☐	☐	Reserved.

* Note: PVC LINER INCORPORATED IN BMP A-3 Design. to EL. 78.25

Prepared Environmental Division comments for the following based on above components:

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

Additional Notes & Comments: No Provisions for 1-yr, 24 hour EXT. DET. IN BMP AS PREVIOUSLY requested in comments dated Dec 17 1999. Several other comments were responded with "forthcoming" and were not addressed.

-3 Minor LANDSCAPING BMP AND LINER Protection during bsd. removal.

(Note: THIS FORM FOR COUNTY USE ONLY.)

Signature: [signature] Date: 02-29-00 (LEAP/MAR)

-4 Minor DA Rev. to Pond ADD 0.7 AC.

[signature] 06-05-00

[signature] 09-29-00

REPORT OF

SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING ANALYSIS

WILLIAMSBURG DODGE BMP FACILITY
NORGE, JAMES CITY COUNTY, VIRGINIA

ECS PROJECT NO. 5856

For

Mr. John E. Dodson
Williamsburg Dodge
7277 Richmond Road
Williamsburg, Virginia 23188

March 9, 2000

ENGINEERING CONSULTING SERVICES, LTD.
Geotechnical • Construction Materials • Environmental

March 16, 2000

Mr. John E. Dodson
Williamsburg Dodge
7277 Richmond Road
Williamsburg, Virginia 23188

ECS Project No. 5856

Reference: Report of Subsurface Exploration and Geotechnical Engineering Analysis
Williamsburg Dodge BMP Facility
Norge, James City County, Virginia

Dear Mr. Dodson:

Engineering Consulting Services, Ltd. is pleased to provide you with this report of subsurface exploration and geotechnical engineering analysis for the above referenced project. This study was performed in general accordance with our proposal 5268-P dated February 28, 2000, and accepted by you.

This report contains our recommendations regarding geotechnical related design and construction issues for the proposed BMP dam. These findings are expected to aid in the design and construction of the earthen embankment and storm water management impoundment.

We have appreciated the opportunity to be of service to you in the design phases of this project and trust you will call on us if we can be of further assistance.

Very Truly Yours,

ENGINEERING CONSULTING SERVICES, LTD.

Robert C. Moss, III, P.E.
Vice President
Richmond Branch Manager

COMMONWEALTH OF VIRGINIA
ROBERT C. MOSS, III
No. 019982
PROFESSIONAL ENGINEER

copies: (1) Client
(2) Potts, Minter and Associates, P.C.

E:/Geotech/Report/5856

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Offices: Richmond, VA • Washington, DC • Norfolk, VA • Williamsburg, VA • Roanoke, VA • Fredericksburg, VA • Danville, VA
Frederick, MD • Raleigh, Triangle Park, NC • Wilmington, NC • Charlotte, NC • Greensboro, NC • Greenville, SC • Atlanta, GA

1.0 PROJECT OVERVIEW

1.1 Executive Summary

Engineering Consulting Services, Ltd. has compiled a Geotechnical study for the proposed BMP facility at the Williamsburg Dodge site in Norge, Virginia. The purpose of this study was to evaluate subsurface conditions in the vicinity of the proposed wet pond and dam and provide geotechnical recommendations to guide its design and construction. This investigation was accomplished by performing a total of two borings to ascertain subsurface conditions in the vicinity of the proposed dam and pond.

In summary, we recommend that the designer consider lining the pond to avoid excessive seepage loss, as recharge of this pond will be through an intermittent creek which is normally dry during the drier months of the year.

1.2 Scope of Work

The conclusions and recommendations in this report are based upon a total of two borings drilled to depths of 25 feet below the existing grades at the dam site, a site reconnaissance performed by the Geotechnical Engineer, laboratory test results of borings samples, and site plans indicating impoundment boundaries and general facility positioning. The proposed field sampling locations were selected by ECS.

The recommendations contained herein were developed from the data obtained in the soil test borings which indicate subsurface conditions at these specific locations at the time of the exploration. If, during the course of construction, variations appear evident, the Geotechnical Engineer should be informed so that the conditions may be addressed.

1.3 Purposes of Exploration

The purposes of this exploration were to explore the soil and groundwater conditions at the site of the proposed dam and wet pond and to develop engineering recommendations to guide design and construction procedures. We accomplished these purposes by drilling borings to explore the subsurface soil and groundwater conditions, performing a field reconnaissance, performing laboratory tests on selected representative soil samples from the borings to evaluate pertinent engineering properties, and analyzing the field and laboratory test results to develop appropriate engineering recommendations.

2.2 Laboratory Testing Program

In the ECS testing program, representative soil samples were selected and tested in our laboratory to check the field classification and to determine pertinent engineering properties. The laboratory testing program included visual classifications, natural moisture content tests, and 200 wash sieve analyses. The purpose of the sieve testing was to help estimate permeability characteristics of the in-situ foundation soils. All data obtained from the laboratory tests are included in Appendix IV of this report.

For each boring, an experienced Geotechnical Engineer classified each soil sample on the basis of texture and plasticity in accordance with the Unified Soil Classification System (ASTM D-2488 Description and Identification of Soils/Visual-Manual Procedures). The group symbols for each soil type are indicated in parentheses following the soil descriptions on the boring logs. A brief explanation of the Unified System is included in Appendix III of this report.

The Geotechnical Engineer grouped the various soil types into the major zones noted on the boring logs. The stratification lines indicating the interfaces between strata on the boring logs and profiles are approximate; in situ, the transitions may be gradual. Soil Boring logs are included in Appendix II of this report.

The soil samples will be retained in our laboratory for a period of 60 days, after which they will be discarded unless other instructions are received as to their disposition.

3.0 EXPLORATION RESULTS

3.1 Site Conditions

The site of the proposed embankment and pond consisted of a narrow ravine about 15 feet deep at the dam location. The ravine was short, extending upstream only about 500 feet from the dam towards Route 60 to the east. The ravine was vegetated with brush and scattered hardwoods at the time of our study.

Visual observations of the ravine in the vicinity of the pond and dam indicate it's bottom is usually dry. It appears that runoff channeled through the ravine has eroded the bottom, but there were no indications of permanent or even sustained seasonal water flows in the bottom of the ravine above the dam. A spring was observed about 50 feet downstream of the dam.

The site once contained a farm operation and relatively deep topsoil (cultivation zone) was observed across the site. Fill consisting of organic laden soils and debris was also observed along the shoulders of the ravine and around the farmhouse site.

3.2 Geology

The project site is located in the Toano 7.5 minute quadrangle and within the Coastal Plain Physiographic Provice midway between the Fall line and the Atlantic Ocean. The Coastal Plain is characterized by bands of alluvial and marine sediments generally paralleling the coast which were deposited by advancing and retreating ocean shorelines through the Mesozoic and Cenozoic Eras. During Pliocene times, (late Cenozoic Era - 24 million years ago), when beaches and bays transgressed through the Middle Peninsula, the characteristically granular soils (Sands) were deposited over the Yorktown and Bacons Castle Formations of earlier Pliocene Times. This created the relatively flat terrace, known as the Norge Uplands, which locally extends along the Rout 60 corridor from Toano to Williamsburg. The terrace was deeply eroded with the formation of Illionian and Wisconsinan stage glaciers as sea level fell some 330 feet below present levels. Erosion features extended outward from the ancestral York and James Rivers towards the high, flat Norge Uplands, causing the development of sharp relief, characterized by deep ravines and valleys in which the tributaries of these rivers were formed and which now touch the edge of the Norge Uplands. Melting of the Wisconsinan glaciers (10,000 years ago) resulted in the flooding of the Chesapeake Bay and its tributaries, and with this inundation the James, York, and Chickahominy rivers changed from a fluvial to an esturine, tidal mode. The lower reaches of the erosion features were filled with sediments resulting in the existing tidal marshes and mud flats.

The soil borings performed on this site passed through the sandy Windsor formation of the Norge Uplands. Marine sediment of the Bacons Castle Formation were contacted below a depth of about 12 feet. These are identified on the boring logs as Sands containing marine shell fragments. The Yorktown Formation underlies the site beyond boring termination depth (25 feet).

Additional details concerning the materials encountered can be obtained from the test boring logs and laboratory data summary included in the Appendix of this report.

3.3 Soil Conditions

The soil borings were performed at estimated surface elevations of 74 and 76 feet for borings B-1 and B-2, respectively. The bottom of the ravine at this location is at about elevation 70 feet.

The soil borings encountered about 12 inches of topsoil. Extending to a depth of about 12 feet, the soils encountered consisted of Sandy CLAY (CL) and Clayey SAND (SC) of loose consistency and in a moist condition. Below a depth of about 12 feet, Silty, fine to medium SAND (SM) containing marine shell fragments was encountered. These soils were of loose consistency and wet to saturated.

A review of the Soil Survey for James City County by the Soil Conservation Service indicates surficial soils are of the Emporia and Craven soil series. These soils are moderately well drained and of low to moderate shrink swell potential.

Additional details concerning the subsurface soils and conditions encountered can be obtained from the test boring logs and laboratory test data sheets included in Appendices II and IV of this report.

3.4 Groundwater Observations

A static groundwater table was encountered by the soil borings at a depth of about 11 or 12 feet. This corresponds to elevations ranging from 62 to 68 feet, or about 5 to 8 feet below the bottom of the ravine. Groundwater levels rise into the shoulders of the ravine. Groundwater surfaces in a spring about 50 feet downstream of the center of the dam, in the vicinity of the embankment's downstream toe.

It is noted that borings were performed during a typically wet seasonal period (March 2000) and that groundwater conditions may vary during the year.

4.0 DAM RECOMMENDATIONS

4.1 Discussion

Based on the soil test borings, it appears that there is not sufficient groundwater or surface water flow at shallow depth through the ravine to reliably create a permanent wet pond using standard dam construction procedures. A dam using a Clay core and deep (10 or more feet) Clay key could potentially impede groundwater sufficiently to create wet conditions in the impoundment during the winter months. However, it is doubtful that sufficient groundwater flow blockage could be established to maintain wet conditions into the summer months. This is because the groundwater table is located as much as 8 or 10 feet below the bottom of the ravine and the soils below the ravine bottom consist of permeable Sands.

Furthermore, as minimal regrading will occur in the impoundment area and the site grading elsewhere is balanced, it does not appear that sufficient quantities of Clay soil are available from on site cuts to construct the a Clay embankment. Therefore, importation of Clay soils would be necessary.

We have discussed options with the project Civil Engineer and it appears that the most efficient means for creating the wet pond would be to install a liner to retain surface water. The costs of this liner would be off set by elimination of Clay importation and the difficult construction operations associated with installing a deep key trench.

Therefore, this report does not discuss further the design considerations of a key and core dam, but provides design and construction recommendations for a BMP facility with a conventional embankment and lined impoundment.

4.2 Dam Embankment

The proposed dam can be constructed as homogeneous earthen embankment. Side slopes of 1 vertical to 3 horizontal can be employed with adequate protection against slope failure or excessive erosion. As much of the soils utilized in the embankment will be granular and therefore subject to erosion on exposed slopes, the slopes should be properly re-vegetated and maintained. The slopes discussed herein are considered stable for earthen dams on a stable foundation based on the U.S. Bureau of Reclamation criteria provided in Design of Small Dams. We recommend a minimum crest width of 15 feet.

In a homogeneous earthen dam, embankment fill should be a soil classified as Silty SAND (SM), Clayey SAND (SC), CLAY (CL or CH), or SILT (ML) with a minimum 30% finer than the No. 200 Sieve. These soils should be free of organics and debris. Based on our review of the Soil Survey (no borings were performed outside the dam area), we anticipate that most inorganic on site cut soils will be suitable for this use.

4.3 Geomembrane Liner

In order to create wet storage, we recommend that a geomembrane liner be used to line the bottom and sides of the pond. For this application, a liner with a 30 mil thickness should be adequate. Specific installation methods and specifications are left to the supplier, who will provide the appropriate warranty and performance criteria. However, we do recommend that the liner have welded seams and that its edges be turned down and buried at least 2 feet on the side edges and 5 feet on the up and downstream edges. The liner should be installed as per the manufacturer's specifications, and a warranty should be carried by the owner.

4.4 Groundwater and Seepage Control

We anticipate that spring flows may surface within the ravine bottom below the proposed embankment. Furthermore, steps should be taken to avoid the accumulation of water below the liner. In order to control seepage below the dam, it is recommended that a french drain be employed at ravine subgrade elevations; that is, an elevation consistent with the ground surface elevation down the ravine bottom. As the new principal spillway will generally extend down the center of the ravine, we recommend the french drain be constructed along its alignment. In this manner, it can serve as the pipe's bedding. The drain should extend from below the spillway riser to a daylight point at the downstream end of the spillway pipe. The drain should consist of a 12 inch thick by 24 inch wide layer of coarse graded aggregate such as VDOT size No.57 stone wrapped in a medium duty, non-woven Geotextile filter fabric overlapped 24 inches on an edge.

The drain should contain a pipe consisting of a 6 inch slotted polyethylene tubing which satisfies the requirements of ASTM F-405. Both up and downstream ends of the drain should be exposed at the surface ("daylighted") and the fabric lined discharge points covered in light rip rap.

For this type of embankment construction, it is not necessary to provide anti seep collars on the horizontal spillway pipe.

4.5 Principal Spillway Pipe and Headwall Foundations

It is anticipated that foundations for the dam structures will bear directly in the compacted fill of the embankment. In this regard, a bearing capacity for these structures' foundations of 1500 psf should be suitable. The presence of water in these soils during construction, however, could result in their disturbance and deterioration. We would recommend therefore that the foundations be provided with at least a 12 inch layer of No 57 Stone placed to establish a working base. In order to minimize instability of foundation structures under wet, possibly hydrostatic conditions, foundations should be provided with a minimum width of 3 feet.

Settlements of structures bearing within the embankment fills will vary. We would estimate that total long term settlements within the center of the embankments will be on the order of 1 inch. Settlements would diminish up and downstream and toward the shoulders of the dam. The design of rigid structures within the embankment fills should consider this potential settlement.

4.6 Dam Earthwork Recommendations

The bottom of the ravine contains soft organic sediments and loose alluvium that should be removed from below the embankment fills. Furthermore, the shoulders of the ravine contain deep topsoil and may contain organic and debris laden fill. These materials should also be removed prior to fill placement.

The bases of all excavations should be inspected by the Geotechnical Engineer prior to placement of fill or concrete. Where unstable material or conditions are encountered, they should be treated at his direction. We would recommend that a representative of the Geotechnical Engineer be on site full time during the earthwork phases such that the necessary tests and inspections can be performed in an expeditious manner.

All fill should be placed and compacted to a dry density of at least 95% of that soil's Standard Proctor maximum dry density (ASTM D698). The compaction should be accomplished by placing the fill in 6 to 10 inch loose lifts and mechanically compacting each lift to the required density prior to placement of subsequent lifts. A sheepsfoot roller should be employed to attain compaction of the cohesive soils used in embankment construction. A smooth drum roller should be available to assist in compactive efforts of more granular soils. Hand operated equipment should be employed around and immediately above pipes and foundations. Dam embankment soils should be compacted at moisture contents within 3% above and 1% below

optimum moisture content for the material used. We recommend field density tests be performed at a rate of at least one test per 2500 square feet per lift during construction.

Embankment fill should be placed in horizontal lifts on slopes no steeper than 1 vertical to 4 horizontal. Where greater slopes exist, they should be benched to receive fill. Bench heights should be limited to 4 feet with a minimum 5 foot horizontal bench. The natural shoulders of the ravines should be cleared of all vegetation, root matter, or other organic, unstable material prior to fill placement. Backfill along the principal spillway conduit should be placed equally on both sides of the pipe during filling.

4.7 Erosion Control and Maintenance

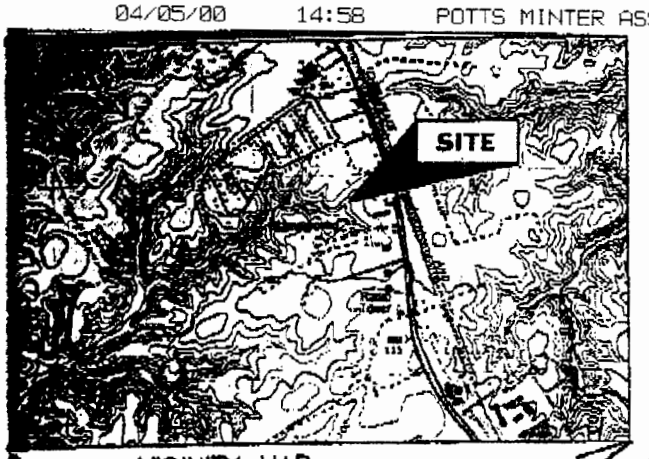
Dam embankments should be protected from erosion due to wave action and surface runoff. On the dam and pond side slopes, slope protection could probably best be attained by seeding with heavy grass. Trees should not be planted on dam embankments.

Routine maintenance should be provided for the dams. This should include annual inspections for removal of bushes and trees, filling of animal burrows, inspection for surface erosion or vertical cracks in the embankment, etc. The toe drain and stilling basin should be inspected for erosion and loss of rip rap, seepage beyond the toe drain, or increased flow or movement of fines through the drains.

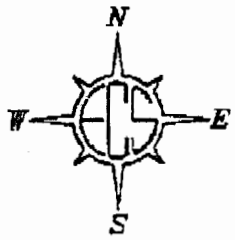
4.8 Conclusion

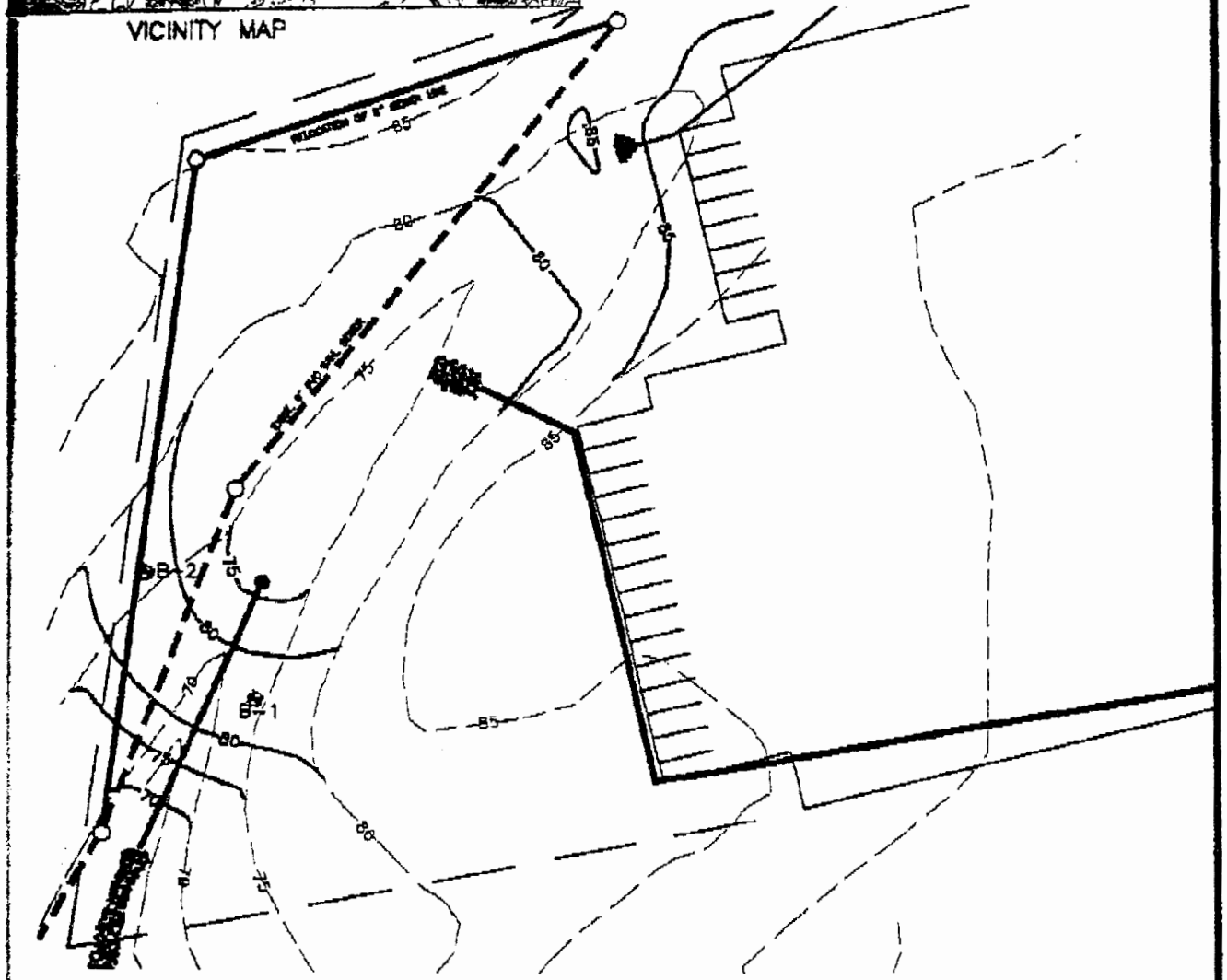
Quality assurance during dam construction is considered essential and is best accomplished with full time inspection. We would recommend that an experienced Geotechnical Engineering firm be contracted by the owner to provide these services during the critical earthwork phases.

Engineering Consulting Services, Ltd. would be pleased to provide our review of geotechnical design criteria, provide construction phase testing and inspections, and assist in the review of contractor construction submittals upon request.



VICINITY MAP





– Approximate Boring Location

Scale: 1"=50'

PREPARED FOR:		BORING LOCATION DIAGRAM
WILLIAMSBURG DODGE	ECS LTD ENGINEERING CONSULTING SERVICES, LTD	WILLIAMSBURG DODGE BMP FACILITY NORGE, VIRGINIA
		ECS, LTD. PROJECT NO. 5856

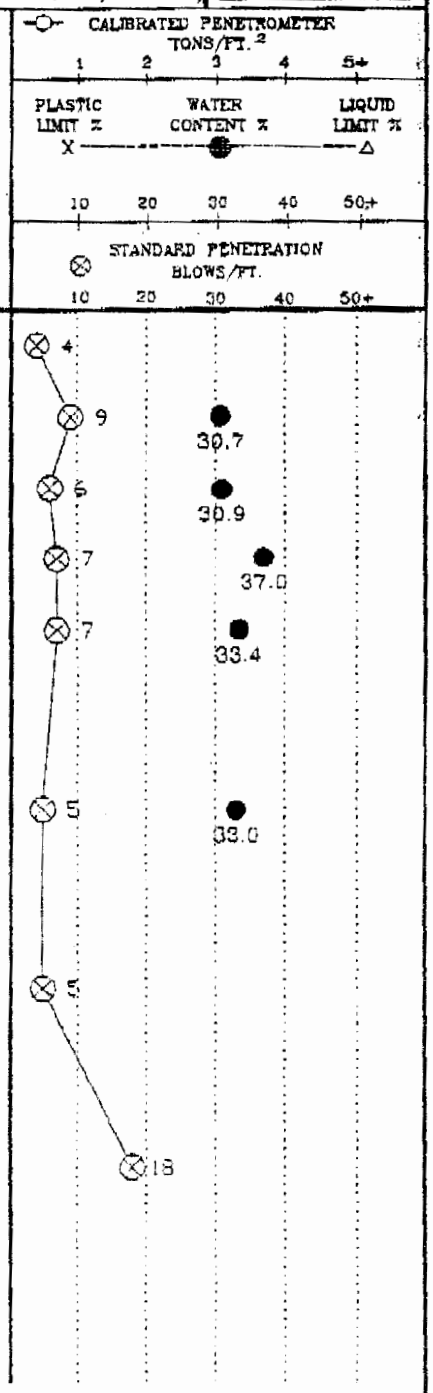
PROJECT NAME	JOB #	BORING #	SHEET
WILLIAMSBURG DODGE	5856	B-1	1 OF 1

ARCHITECT–ENGINEER: POTTS, MINTER & ASSOC., P.C.

SITE LOCATION: NORGE, VIRGINIA

SURFACE ELEVATION: 74.00±

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)
0	1	SS	24	24	Topsoil	
	2	SS	24	24	Clayey Fine SAND, Orangish Brown, Moist, Very Loose, (SC)	
5	3	SS	24	24	Fine Sandy CLAY, Reddish Brown, Moist, Medium Stiff, (CL–SC)	70
	4	SS	24	24	Silty Fine SAND, Dark Brown, Moist, Loose, (SM)	
	5	SS	24	24	Clayey Fine SAND, Grayish Brown, Moist, Loose, (SC)	65
10					Fine Sandy CLAY, Trace Organics, Dark Brown With Black, Moist, Medium Stiff, (CL)	
15	6	SS	24	24	Silty Fine to Medium SAND With Marine Shell Fragments, Grayish Tan, Saturated, Loose, (SM)	60
20	7	SS	24	24		55
25	8	SS	24	24		50
					END OF BORING @ 25.0'	45
30						



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

WL 12.0' WS OR ⊗D	BORING STARTED 3-7-00	TOPSOIL DEPTH: 12"
WL BCR ACR	BORING COMPLETED 3-7-00	CAVE IN DEPTH @ 19.0'
WL	RIG FISHBURNE FOREMAN MIKE	DRILLING METHOD HOLLOW STEM AUGER

OWNER	JOB #	BORING #	SHEET
WILLIAMSBURG DODGE	5856	B-2	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
WILLIAMSBURG DODGE BMP FACILITY	POTTS, MINTER & ASSOC., P.C.

EGS LTD

SITE LOCATION: NORGE, VIRGINIA

SURFACE ELEVATION 76.00±

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
0	1	SS	24	24	Topsoil	75	4
	2	SS	24	24	Fine Sandy CLAY, Gray and Tan, Moist, Medium Stiff, (CL)		5
5	3	SS	24	24	Silty Fine SAND, Trace Clay, Brown and Gray, Moist, Loose, (SM)		4
	4	SS	24	24	Silty Fine SAND, Trace Fine Gravel, Dark Brown, Moist, Loose, (SM)	70	9
	5	SS	24	24	Silty Fine to Medium SAND With Concretions, Trace Clay, Dark Brown, Moist, Loose, (SM)		9
10					Silty Fine to Medium SAND With Marine Shell Fragments, Brown, Moist, Loose, (SM)	65	
	6	SS	24	24	Silty Fine to Medium SAND With Marine Shell Fragments, Trace Clay, Grayish Tan, Saturated, Very Loose, (SM)		4
15						60	
	7	SS	24	24			6
20						55	
	8	SS	24	24			10
25					END OF BORING @ 25.0'	50	
30							

CALIBRATED PENETROMETER TONS/FT.^{2} (1, 2, 3, 4, 5+)

PLASTIC LIMIT % X — WATER CONTENT % ● — LIQUID LIMIT % Δ (10, 20, 30, 40, 50+)

29.5

20.8

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

WL 11.0' WS OR WD	BORING STARTED 3-7-00	TOPSOIL DEPTH: 12"
WL BCR ACR	BORING COMPLETED 3-7-00	CAVE IN DEPTH @ 9.5'
WL	RIG FISHBURNE FOREMAN MIKE	DRILLING METHOD HOLLOW STEM AUGER

S, Ltd.
Engineering Consulting Services, Ltd.
2119-D North Hamilton Street
Richmond, VA 23230
Phone: (804)353-6333
Fax #: (804)353-9478

MATERIALS ENGINEERING DIVISION
FIELD REPORT

Project No. R5856A

Project Williamsburg Dodge BMP Facility Day/Date Tuesday 07/11/20

Location Williamsburg Weather/Temp Fair /85 °

Contractor J.H. Martin & Sons Client Williamsburg Dodge

Equipment $ 0.00 Arrive Job 10:30 Depart Job 1:15

Tolls $ 0.00 Total Hours on Job 2.25

Travel Chg$ 0.00 Laboratory Time 0.50

Mileage 20 Travel Time 0.50

TOTAL CHARGEABLE HOURS 3.25

Permit No. _____

Deficiency Noted (D) _ Nuclear gauge (N) _

Summary of Services Performed. Field Test Data, Locations, Elevations & Depths are Estimated.

The undersigned arrived on site, as requested, to observe the placement and compaction of engineered fill for the Dam and the fill section opposite structure #5.

Utilizing the Nuclear Method (ASTM D-2922) to check the compaction of soils, test results indicated that compacted material, at areas and elevations tested, met or exceeded the project requirements of 95% of the maximum dry density, as obtained in our laboratory by using the Standard Proctor Method (ASTM D-698). The curved area at the Dam required recompaction after initial testing to achieve the required compaction.

By Richard Tracy

REPORT # 1

FIELD DENSITY TEST - NUCLEAR METHOD
ASTM D - 2922

PROJECT: Williamsburg Dodge JOB NO.: R5856A

SUBJECT: NUCLEAR FIELD DENSITY TESTS DATE: 7/11/00

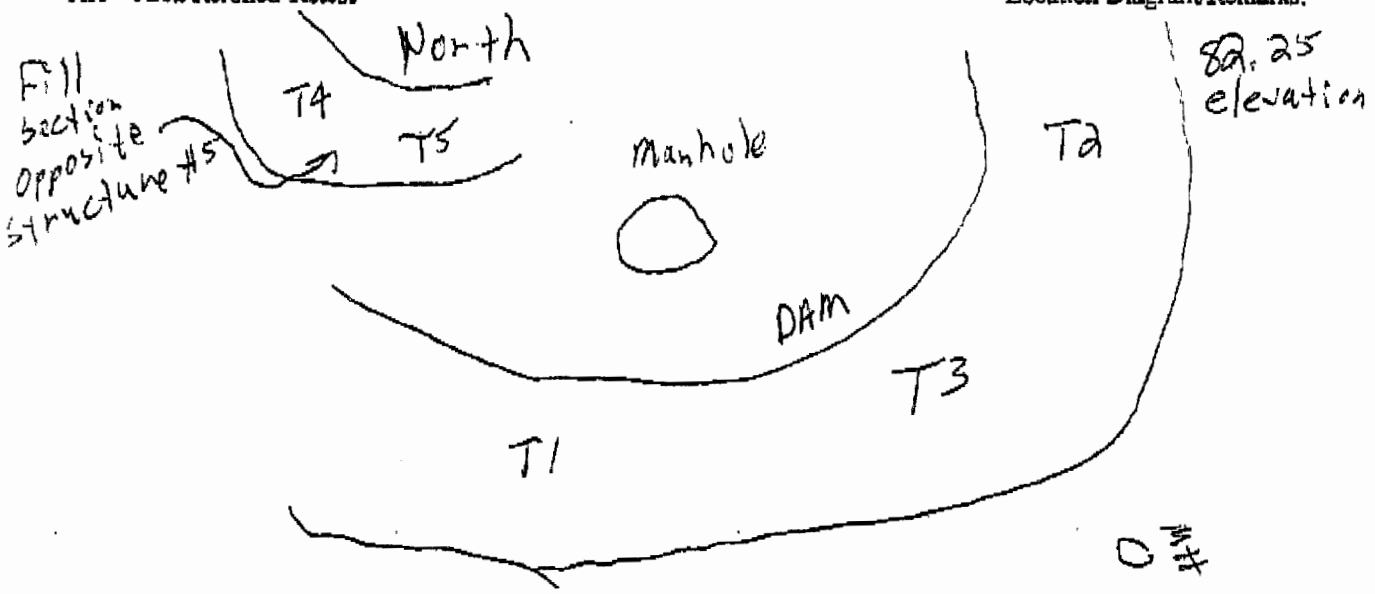
STANDARD COUNTY DENSITY _____ STANDARD COUNT MOISTURE _____

CONTRACTOR: JH Martin & Sons CLIENT: _____ TECH: Rich

TEST NO.	1	2	3	4	5		
MOISTURE CONTENT (PCF)	11.4	8.5	13.9	9.7	8.6		
WET DENSITY (PCF)	126.5	121.7	129.1	129.2	128.0		
DRY DENSITY (PCF)	115.1	113.2	115.2	119.5	119.4		
MOISTURE CONTENT (%)	9.93	7.50	12.08	8.10	7.2		
STANDARD PROCTOR MODIFIED PROCTOR	119.0						
OPT. WATER CONTENT	12.9						
LIFT, ELEVATION OR SOIL MARK	FG	FG	FG	SG-1'	SG-2'		
PROBE DEPTH (INCH)	8"						
PERCENT COMPACTION	96.7	95.1	96.8	100.4	100.3		
REQUIRED COMPACTION	95%						
* AR (TEST NO.)	PAM	PAM	PAM	Structure #5			

* AR = Area Rerolled-Retest

Location Diagram/Remarks:



POTTS, MINTER AND ASSOCIATES, P.C.
ENGINEERS, LAND SURVEYORS
LAND PLANNERS

RICHARD T. MINTER, L.S.
WAYNE K. TOY, L.S.
WILLIAM L. JETER, SR.

September 5, 2000

Mr. Scott Thomas, P.E.,
Director, Environmental Division
James City County
P.O. Box 8734
Williamsburg, Virginia 23187-8784

FINAL
H+H
REV PLAN

Re: Williamsburg Dodge, SP-124-99

Dear Scott:

Due to an alignment conflict between the proposed storm sewer improvements and the existing 16-inch public water line along Route 60, VDOT and the JCSA recommended routing the storm water runoff from Route 60 to the on site storm sewer system.

This storm sewer change will convey additional runoff to the BMP basin. The additional runoff from Route 60 will create a surcharge of the upper most drop inlet (structure 16) on the site. The parking lot grade should limit the 3-4 inches of temporary ponding to to about three spaces. The developer, Mr. Dodson, has been made aware of this situation.

The change in the BMP water surface elevations for the 2,10,50and 100 year storms from the increased drainage area is negligible(les than 1 inch). Outflows from the BMP for the 2 and 10year storms were held below the pre-developed runoff rates. Attached are the storm sewer and BMP routing computations for your review and approval.

OK
SAT

If you have any questions about the plan revisions or computations please don't hesitate to contact me.

Sincerely,

Tom Cook

Thomas J. Cook, P.E.

Cc: John Dodson

3520 Courthouse Road • Richmond, Virginia 23236 • Phone (804) 745-2876 • FAX (804) 745-9571

Scott Thomas

From: Scott Thomas
Sent: Monday, April 10, 2000 2:21 PM
To: Pat Menichino
Subject: Williamsburg Dodge

Just thought I'd let you know the following. It concerns the BMP at the site, which was designed and is to be constructed as wet extended detention pond, but because of the soils beneath the facility, some consideration was necessary due to possible infiltration properties of the normal pool. The site soils were questionable to design the BMP primarily as for infiltration.

I reviewed the geotech report by ECS dated March 9th 2000 for the project. It appears that in addition to proposing a liner to maintain a wet pool in the pond, one of the primary reasons is because of a general lack of clay material on the site to properly construct a core trench and embankment. The liner is proposed to minimize seepage through the embankment, because onsite soils are anticipate to be permeable sands. They say the cost of the liner will negate the cost of having to haul in clay material to properly construct the embankment (compaction, seepage, etc.). In addition to the 30 mil liner, they also recommend a subsurface drain at the ravine subgrade elevation to intercept the groundwater table, which was determined to be present at the site. No anti-seep collars would be required.

I have no reason to disagree with any of the findings in the geotech report and from what I saw onsite and based on my soils review, agree with their field observations. In addition, I spoke with both Wayland and Darryl about the geotech report and a Stormwater Hotspot potential for this BMP. Appendix F of our manual lists the following as hotspots:

vehicle fueling stations
vehicle service and maintenance areas
vehicle equipment and cleaning facilities
fleet storage areas

Although the Dodge site does not technically fall under any one of these categories, I feel that it could have general characteristics of any or all of the classifications. Infiltration basins are not allowed in hotspot classified areas. Also the inflow drainage area is 16 acres, which exceeds 10 acres recommended for infilt. basins. But perhaps my biggest reason to allow the liner is that the BMP location is more or less a regional-type facility. It will control drainage from the Dodge site and offsite areas tributary from along US 60. US 60 is a main highway with large ADT (avg daily traffic). I feel the facility location is at high risk for spills, pollution and groundwater contamination. I feel minimizing the potential risk for groundwater pollution outweighs the benefits against allowing a non-lined pond, to allow infiltration.

I spoke with Tom Cook (Potts Minter Assoc.) about this whole dilema. Of course, they will need to revise the plans accordingly and we are awaiting a new submission. No word on whether land disturbance activities would resume, owner is working on contract with contractor.

Scott

Powo Geotech Report

Scott Thomas

From: Scott Thomas
Sent: Friday, April 07, 2000 2:11 PM
To: Wayland Bass
Cc: Mark Eversole
Subject: Norge Outfall/Williamsburg Dodge

Wayland

I spoke with Darryl. We are ok with Wed afternoon to go out to look at the Norge Outfall site. I am sure Mark will be ok with it cause his schedule is usually lighter than ours. Wednesday is better cause I want to go through the Prelimin. Engineering Report prior to our field view. Tentatively set the date for Wed 4/12 and if Mark can't make it I will let you know.

Incidently, I spoke with Blair at Mitchell-Wilson concerning the Raintree project. We discussed several issues (ie. drainage area, depth of cover over the HDPE pipe, pipe structural design, and the adequacy of the existing railroad arch pipe. I also discussed with him the potential for water to still pond at the new 24 inch pipe inlet structure, whether it be a culvert inlet or yard inlet. Even though the 24 inch line was designed to pass the 10-year event either by gravity or pressure flow, the system may still have a backwater effect at the entrance. For final design I think I would want to see the design storm WSEL at the inlet along with a check 100-year event so the property owner would be fully aware of the limits of ponding that may occur. Of course, it would not be nearly as bad as what occurred during Floyd. I told him that I was still looking at the comps because there was some question raised about the 24 inch size.

He told me that he was going to be working on this project and another one for you (Woodlands?) this weekend so if I had any other further concerns about Raintree I should call him ASAP. I am trying to finish looking through the Raintree PER today.

Williamsburg Dodge:

I had mentioned to you about the liner scenario at the Williamsburg Dodge site. After going through the geotech report, it appears that they are also recommending a liner because of a lack of clay material onsite to construct a typical dam embankment and core trench. They are saying that the cost construct a "sandy" material embankment with available onsite soils and a pond liner to maintain a pool and prevent embankment seepage would be offset by not needing to import clay material to the site. Cut soils from the main site area are anticipated to be permeable type sands. In addition, a static groundwater table was encountered 2 to 8 feet below the bottom of pond elevation. They recommend a 30 mil pond liner and to control seepage below the dam due to the springs/groundwater, a french drain is proposed at ravine subgrade elevation along the alignment of the principal spillway outfall structure. By use of the drain, no anti-seep collars would be required. Due to the findings, they strongly recommend a geotech onsite for all critical earthwork phases.

Wayland, I have no reason to disagree with the findings of the geotechnical report and from what I saw onsite and based on my review of the site soils, agree with their field observations. In addition, I spoke with Darryl about Stormwater Hotspot considerations. Appendix F of the manual individually lists vehicle fueling stations, vehicle service and maintenance facilities, vehicle equipment cleaning facilities and fleet storage areas as hotspot areas. Although the car dealership would not technically be considered as a use under any one of the categories, I feel that it could have characteristics of all the categories combined. Infiltration basin are not allowed in hotspot areas and the pond inflow drainage area of 16 acres exceeds that recommended by the JCC BMP manual for an infiltration basin (10 acres). In addition, if you also consider that the BMP is more or less a regional type collection-treatment facility and US Route 60 is a main highway with a large ADT value which, I feel, is puts the facility location at a high risk for spills, pollution and groundwater contamination. I feel minimizing the potential risk for groundwater pollution would outweigh the benefits from allowing a non-liner, infiltration alternative.

Let me know what you think and if you want to review the report. I would like to call the design engineer and relay that we would tend to agree with the findings and recommendation of the geotech report and to proceed with the design plan modifications.

Scott

Pat Menichino

From: Scott Thomas
Sent: Tuesday, June 27, 2000 1:52 PM
To: Pat Menichino
Subject: Williamsburg Dodge

I was made aware that the sewer relocation is now done for the Williamsburg Dodge site and the contractor will now be wanting to start the BMP (temporary sediment basin) work. So I guess sometime they will want to schedule the Precon to get their land disturbance permit. I guess its not needed for sewer line work, huh?

Anyways expect them to call you. I also spoke with Michael Bowen of Williamsburg Dodge (cell 870-5035)who called me on Tuesday. I told him that they would need to schedule the precon with you and you would not be back into the office till Wednesday. Two things to remember for this site:

1. Contractor needs to coordinate activities which may affect the operation of Scavengers Paradise. The owner called me some time ago with concerns about sitework affecting access to their business. This will be a concern when utility connections are made along US 60.

2. This BMP is getting a liner due to wet pond-infiltration soil conditions. I believe It is to be installed at first construction, unless the contractor changes the sequence of construction. Although the final site plan is not approved yet, there will be provisions on the final plan to protect the liner when sediment is cleaned out at the end of construction. Stress --- Protection of the Liner During Construction.

If any questions let me know. I would like to accompany you if the schedule allows.

Scott

DEVELOPMENT MANAGEMENT

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

CODE COMPLIANCE (757) 253-6671 codecomp@james-city.va.us
ENVIRONMENTAL DIVISION (757) 253-6670 environ@james-city.va.us
PLANNING (757) 253-6685 planning@james-city.va.us
COUNTY ENGINEER (757) 253-6678
INTEGRATED PEST MANAGEMENT (757) 253-6630

Williamsburg Dodge
May 10th 2000

Reviewed the May 5th submittal by Tom Cook, Potts Minter & Associates, PC pertaining to information on the proposed PVC liner which is to be installed at the temporary sediment basin/BMP. Use of the liner arose from our outstanding comments from the Feb 28th Env. Div. comments which needed to still be addressed for final site plan approval. A geotech report by ECS dated March 9th and faxed to our office on April 5th 2000, recommended the liner to be installed.

Based on the May 5th advance submittal forwarded to the Env. Div, installation of the PVC liner is recommended as an initial step in construction. Revised plans to address outstanding Planning issues are anticipated to be submitted sometime during the week of May 15.

Due to previous LD permit issuance prior to this "liner" issue, I reviewed the May 5th submittal in advance of formal submission of revised plans back to Planning. This was to ensure any comments I had pertaining to the liner got incorporated on the revised set.

I discussed the following PVC liner issues with Tom Cook in the hope that they get incorporated on the revised plan set and will not affect LD operations, especially pertaining to placement of the liner in the sediment basin/BMP. Tom will incorporate these changes on the revised site plans and try to simultaneously coordinate submission of plans with the Pre-Construction meeting with the Owner/Contractor. Tentatively it appears a good date for the **Precon would be May 17th or May 18th.**

PVC Geomembrane (Liner) Comments by SJT

1. Define area required for PVC pond liner on plan or dam profile or by quantity or elevation, so it is clear to what limit the liner needs installed by field personnel.

2. Provide a typical detail or modify the anchor trench detail for the plan set. Clearly show vegetation requirements over the cover layer, cover depth and type over the liner, specification for liner (manufacturer and mil) and subgrade spec on the detail which matches Sec 5.2.1 and 5.2.2. of the manufacturers literature. Modification of the standard anchor trench detail as shown in the literature is best suited to serve this purpose. Putting this detail on the plan set will help if any maintenance of the liner is needed in the future.

3. Revise the sequence of construction (sheet 4) and dam construction notes (sheet 5) to clarify when the liner gets installed relative to temporary sediment basin or BMP construction.

I also discussed this with the Planner, Paul Holt.

Williamsburg Dodge

PAT,
For your info. Date is not set yet.

Pat Menichino

From: Scott Thomas
Sent: Monday, April 10, 2000 2:21 PM
To: Pat Menichino
Subject: Williamsburg Dodge

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vehicle equipment and cleaning facilities
fleet storage areas

Although the Dodge site does not technically fall under any one of these categories, I feel that it could have general characteristics of any or all of the classifications. Infiltration basins are not allowed in hotspot classified areas. Also the inflow drainage area is 16 acres, which exceeds 10 acres recommended for infilt. basins. But perhaps my biggest reason to allow the liner is that the BMP location is more or less a regional-type facility. It will control drainage from the Dodge site and offsite areas tributary from along US 60. US 60 is a main highway with large ADT (avg daily traffic). I feel the facility location is at high risk for spills, pollution and groundwater contamination. I feel minimizing the potential risk for groundwater pollution outweighs the benefits against allowing a non-lined pond, to allow infiltration.

I spoke with Tom Cook (Potts Minter Assoc.) about this whole dilema. Of course, they will need to revise the plans accordingly and we are awaiting a new submission. No word on whether land disturbance activities would resume, owner is working on contract with contractor.

Scott

Scott Thomas

From: Scott Thomas
Sent: Monday, April 10, 2000 2:21 PM
To: Pat Menichino
Subject: Williamsburg Dodge

Just thought I'd let you know the following. It concerns the BMP at the site, which was designed and is to be constructed as wet extended detention pond, but because of the soils beneath the facility, some consideration was necessary due to possible infiltration properties of the normal pool. The site soils were questionable to design the BMP primarily as for infiltration.

I reviewed the geotech report by ECS dated March 9th 2000 for the project. It appears that in addition to proposing a liner to maintain a wet pool in the pond, one of the primary reasons is because of a general lack of clay material on the site to properly construct a core trench and embankment. The liner is proposed to minimize seepage through the embankment, because onsite soils are anticipate to be permeable sands. They say the cost of the liner will negate the cost of having to haul in clay material to properly construct the embankment (compaction, seepage, etc.). In addition to the 30 mil liner, they also recommend a subsurface drain at the ravine subgrade elevation to intercept the groundwater table, which was determined to be present at the site. No anti-seep collars would be required.

I have no reason to disagree with any of the findings in the geotech report and from what I saw onsite and based on my soils review, agree with their field observations. In addition, I spoke with both Wayland and Darryl about the geotech report and a Stormwater Hotspot potential for this BMP. Appendix F of our manual lists the following as hotspots:

vehicle fueling stations
vehicle service and maintenance areas
vehicle equipment and cleaning facilities
fleet storage areas

Although the Dodge site does not technically fall under any one of these categories, I feel that it could have general characteristics of any or all of the classifications. Infiltration basins are not allowed in hotspot classified areas. Also the inflow drainage area is 16 acres, which exceeds 10 acres recommended for infilt. basins. But perhaps my biggest reason to allow the liner is that the BMP location is more or less a regional-type facility. It will control drainage from the Dodge site and offsite areas tributary from along US 60. US 60 is a main highway with large ADT (avg daily traffic). I feel the facility location is at high risk for spills, pollution and groundwater contamination. I feel minimizing the potential risk for groundwater pollution outweighs the benefits against allowing a non-lined pond, to allow infiltration.

I spoke with Tom Cook (Potts Minter Assoc.) about this whole dilema. Of course, they will need to revise the plans accordingly and we are awaiting a new submission. No word on whether land disturbance activities would resume, owner is working on contract with contractor.

Scott

Scott Thomas

From: Scott Thomas
Sent: Friday, April 07, 2000 2:11 PM
To: Wayland Bass
Cc: Mark Eversole
Subject: Norge Outfall/Williamsburg Dodge

Wayland

I spoke with Darryl. We are ok with Wed afternoon to go out to look at the Norge Outfall site. I am sure Mark will be ok with it cause his schedule is usually lighter than ours. Wednesday is better cause I want to go through the Prelimin. Engineering Report prior to our field view. Tentatively set the date for Wed 4/12 and if Mark can't make it I will let you know.

Incidently, I spoke with Blair at Mitchell-Wilson concerning the Raintree project. We discussed several issues (ie. drainage area, depth of cover over the HDPE pipe, pipe structural design, and the adequacy of the existing railroad arch pipe. I also discussed with him the potential for water to still pond at the new 24 inch pipe inlet structure, whether it be a culvert inlet or yard inlet. Even though the 24 inch line was designed to pass the 10-year event either by gravity or pressure flow, the system may still have a backwater effect at the entrance. For final design I think I would want to see the design storm WSEL at the inlet along with a check 100-year event so the property owner would be fully aware of the limits of ponding that may occur. Of course, it would not be nearly as bad as what occurred during Floyd. I told him that I was still looking at the comps because there was some question raised about the 24 inch size.

He told me that he was going to be working on this project and another one for you (Woodlands?) this weekend so if I had any other further concerns about Raintree I should call him ASAP. I am trying to finish looking through the Raintree PER today.

Williamsburg Dodge:

I had mentioned to you about the liner scenario at the Williamsburg Dodge site. After going through the geotech report, it appears that they are also recommending a liner because of a lack of clay material onsite to construct a typical dam embankment and core trench. They are saying that the cost construct a "sandy" material embankment with available onsite soils and a pond liner to maintain a pool and prevent embankment seepage would be offset by not needing to import clay material to the site. Cut soils from the main site area are anticipated to be permeable type sands. In addition, a static groundwater table was encountered 2 to 8 feet below the bottom of pond elevation. They recommend a 30 mil pond liner and to control seepage below the dam due to the springs/groundwater, a french drain is proposed at ravine subgrade elevation along the alignment of the principal spillway outfall structure. By use of the drain, no anti-seep collars would be required. Due to the findings, they strongly recommend a geotech onsite for all critical earthwork phases.

Wayland, I have no reason to disagree with the findings of the geotechnical report and from what I saw onsite and based on my review of the site soils, agree with their field observations. In addition, I spoke with Darryl about Stormwater Hotspot considerations. Appendix F of the manual individually lists vehicle fueling stations, vehicle service and maintenance facilities, vehicle equipment cleaning facilities and fleet storage areas as hotspot areas. Although the car dealership would not technically be considered as a use under any one of the categories, I feel that it could have characteristics of all the categories combined. Infiltration basin are not allowed in hotspot areas and the pond inflow drainage area of 16 acres exceeds that recommended by the JCC BMP manual for an infiltration basin (10 acres). In addition, if you also consider that the BMP is more or less a regional type collection-treatment facility and US Route 60 is a main highway with a large ADT value which, I feel, is puts the facility location at a high risk for spills, pollution and groundwater contamination. I feel minimizing the potential risk for groundwater pollution would outweigh the benefits from allowing a non-liner, infiltration alternative.

Let me know what you think and if you want to review the report. I would like to call the design engineer and relay that we would tend to agree with the findings and recommendation of the geotech report and to proceed with the design plan modifications.

Scott

Pat Menichino

From: Scott Thomas
Sent: Thursday, March 16, 2000 2:48 PM
To: Pat Menichino
Cc: Paul Holt; Darryl Cook
Subject: PreCon Williamsburg Dodge

When you have the PreCon for the Williamsburg Dodge project, please add this to the hit list for sequence of construction. The contractor needs to be made aware of the following as a result of a call to Paul Holt and myself on March 16th.

The adjacent property owner of Scavengers Paradise expressed extreme concern relative to site improvements (inlets, storm sewer, roadway, etc.) along US Route 60 and how it would impact her place of business. She is concerned that the road improvements would block her entrance for an extended period and affect access to the place of business.

It should be noted as part of the preconstruction meeting that the contractor is required to coordinate and discuss the schedule and sequence for this portion of work with the adjacent business owner to minimize impacts to the greatest extent possible and keep her informed of when and how work will be performed. The contact is Mrs. Kaufmann (Oreen?) at Scavenger Paradise at phone number 565-4125.

I also relayed this information to the design engineer Tom Cook (Potts, Minter & Associates) so he could dually coordinate this request with the Owner. I will contact Mrs. Kaufmann and relay this approach.

Scott

FAX COVER SHEET

Potts,Minter and Associates, P.C.
3520 Courthouse Road
Richmond, Virginia 23236
Phone #: 804-745-2876
Fax #: 804-745-9571

SEND TO	
James City County-Environmental Div.	From Tom Cook
Attention Scott Thomas	Date December 15, 2004
Fax number 757-259-4032	

Re: Williamsburg Dodge -BMP Certification

Total pages, including cover : 2

COMMENTS

Scott,

Attached is a copy of the portion of the AES plan sheet we reviewed to certify that the Williamsburg Dodge BMP was built in accordance with our design plan.

I'll be contacting ESC,Ltd to see what will be necesssary for them to certify the BMP dam construction. I'll let you know what I find out from them.

Tom Cook

Cc: John Dodson, Owner

ASBUILT

POTTS, MINTER AND ASSOCIATES, P.C.
ENGINEERS, LAND SURVEYORS
LAND PLANNERS

3520 Courthouse Road • Richmond, Virginia 23236

Phone (804) 745-2876 Fax (804) 745-9571

LETTER OF TRANSMITTAL

DATE May 5, 2000 JOB NO. 9902-29

ATTENTION Scott Thomas, PE

RE Williamsburg Dodge

TO James City County Development Management; Environmental Div.
101-E Mounts Bay Road
Williamsburg, VA 23187

GENTLEMEN:

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

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
3		Sets	Revised Site Plan
1		20	PVC Liner installation guidelines
			PVC Liner Information (Advance)

THESE ARE TRANSMITTED as checked below:

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

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

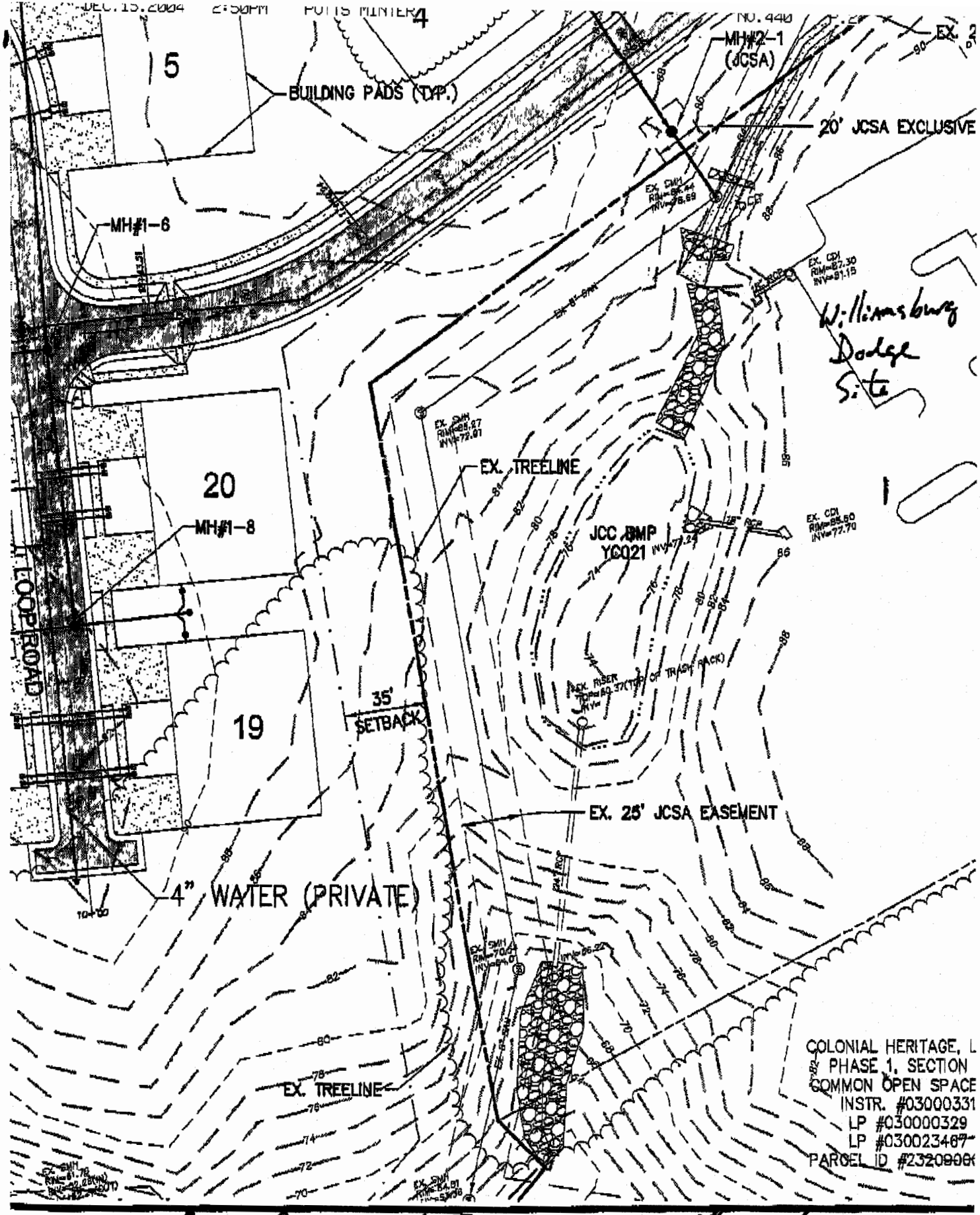
☐ As requested ☐ Returned for corrections ☐ Return _____ corrected prints

☐ For review and comment ☑ For Issuance of Land Disturbance Permit

REMARKS Scott,
The attached plans are being submitted for release of the sediment basin/BMP for construction. The contractor, J.H. Martin Inc., intends to install the PVC ~~with~~ as an ~~initial~~ initial ~~at~~ step in the construction. We'll be submitting revised site plans to the Planning Dept. next week after we address a ~~few~~ few planning issues that don't affect the BMP construction. Call if you have any questions.

COPY TO John Dodson

SIGNED: Tom Cook



BES Drawing #5
Name Neighborhood

1" = 50'

SJT File

DEVELOPMENT MANAGEMENT

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

CODE COMPLIANCE
(757) 253-6626
codecomp@james-city.va.us

ENVIRONMENTAL DIVISION
(757) 253-6670
environ@james-city.va.us

PLANNING
(757) 253-6685
planning@james-city.va.us

COUNTY ENGINEER
(757) 253-6678

INTEGRATED PEST MANAGEMENT
(757) 253-2620

December 28, 2004

Mr. John E. Dodson
7277 Richmond Road
Williamsburg, Va. 23188

Reinspect 3-18-05

Re: Williamsburg Dodge
County Plan No. SP-124-99
County BMP ID Code: YC 021

Dear Mr. Dodson:

The Environmental Divisions has received a record drawing (asbuilt) and construction certification for the stormwater management facility for the above referenced project. The stormwater management facility for the Dodge site was a wet extended detention pond situated in the west portion of the site.

It is acknowledged that this BMP is intended to be expanded, improved and upgraded (by appropriate agreements) as part of the adjacent Norge Neighborhood development project (County Plan No. SP-59-04) so that the BMP functions as a quasi-regional basin. However, this arrangement poses some unusual circumstances as it pertains to bond release. Our Division worked closely with your project (certification) representatives to ensure that certification materials required and field items that may be necessary only pertain to items which will remain unchanged or pertain exclusively to the Dodge site. Norge Neighborhood will only need to provide record drawings (asbuilts) and construction certification for only those items that are considered as modifications to the BMP.

Based on our review of the project and a concurrent field visit as performed on December 28th 2004, the following items must be addressed 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 Dodge site project:

Record Drawing:

1. The record drawing as certified to on December 27, 2004 is **satisfactory**. Additional record drawings may be required, by others, due to BMP modifications as proposed under the plan of development for Norge Neighborhood.

Construction Certification:

2. The construction certification dated December 23, 2004 is **satisfactory**. Additional construction certifications may be required, by others, due to BMP modifications as proposed under the plan of development for Norge Neighborhood.

Construction - Related Items:

3. Remove trees and woody vegetation from the entire downslope embankment. Trees, shrubs and woody vegetation are not permitted to grow on any part of pond embankments constructed using engineered (compacted) fills. This will not be required for any areas associated with the BMP that are proposed to be re-graded as proposed under the Norge Neighborhood plan. For example, the top of dam will not need to be cleared of trees as the proposed modification plan will lower the top of dam elevation.

4. Any animal burrows present on the downstream face of dam should be backfilled with compacted material and attempts made to remove the burrowing animal from the area.

It will be your responsibility to ensure that long-term maintenance is performed on this BMP in accordance with any shared maintenance agreements and maintenance plans as worked out with representatives of the Norge Neighborhood project.

Once this work is satisfactorily completed, contact our office appropriately for a re-inspection. We can then proceed with final release of the surety and/or closing out the project. Please contact me at 757-253-6639 if you have any further comments or questions.

Sincerely,

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

cc: Tom Cook, Potts-Minter - via fax
Mike Galli, ECS - via fax

G:\AsBuilts\admin\final\SP12499.yc021

FAX COVER SHEET

Potts, Minter and Associates, P.C.
3520 Courthouse Road
Richmond, Virginia 23236
Phone #: 804-745-2876
Fax #: 804-745-9571

To: Tom Cook
From: Scott Thomas
Date: 12/28/04

SEND TO James City County-Environmental Div.	From Tom Cook
Attention Scott Thomas	Date December 27, 2004
Fax number 757-259-4032	

Re: Williamsburg Dodge -BMP Certification

Total pages, including cover : 4

COMMENTS

Scott,

After making a field inspection (see letter), ECS,Ltd was able to sign the construction certification statement for the Williamsburg Dodge BMP. They make note of some items on the present condition of the BMP that AES can make sure is addressed prior to certifying the BMP modifications that are currently underway as part of the Norge Neighborhood construction.

Based on our previous conversations, with the signing of the construction certification statement James City County should be able to release the owner's bond on the BMP. Please let me know if the bond will be released with the receipt of this information.

If you have any questions about the attached please don't hesitate to call. Thanks.

Tom, Once I got the asbuilt exhibit and construction certification for the Dodge portion, I would perform my final (field) inspection of the BMP. Based on what I saw of the BMP a few weeks ago, I would agree with ECS's assessment. Contrary to above, the Dodge owner would be responsible for field-related BMP items that will not be impacted due to expansion/improvements for the Norge Neighborhood project. Dodge owner will be required to address ECS comments #2 & #3 for bond release. (I will issue a letter.)

Scott
12-28-04

Cc: John Dodson, Owner

RECEIVED
DEC 27 2004
ENVIRONMENTAL DIVISION

FAX COVER SHEET

Potts,Minter and Associates, P.C.
3520 Courthouse Road
Richmond, Virginia 23236
Phone #: 804-745-2876
Fax #: 804-745-9571

YC021
SP-124-99

SEND TO James City County-Environmental Div.	From Tom Cook
Attention Scott Thomas	Date December 27, 2004
Fax number 757-259-4032	

Re: Williamsburg Dodge -BMP Certification

Total pages, including cover : 4

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Based on our previous conversations, with the signing of the construction certification statement James City County should be able to release the owner's bond on the BMP. Please let me know if the bond will be released with the receipt of this information.

If you have any questions about the attached please don't hesitate to call. Thanks.

Const CERT

Cc: John Dodson, Owner

YC021 WMBG DODGE

MAIL

RD - Forms CERT
CL - NO

RECEIVED
DEC 27 2004
ENVIRONMENTAL DIVISION

ECS, Ltd.
Engineering Consulting Services, Ltd.
2119-D North Hamilton Street
Richmond, VA 23230
Phone: (804)353-6333
Fax #: (804)353-9478

LETTER OF TRANSMITTAL

TO: Williamsburg Dodge
7277 Richmond Road
Williamsburg, VA 23188

Date: 07/19/2000

RE: Williamsburg Dodge BMP Facility

ATTN: MR. John E. Dodson

Permit #:
Location:
Williamsburg

ECS Job No.: R5856A

We are enclosing:

_X_ Attached

___ Under separate cover, via _____, the following item:

___ Prints ___ Boring Logs ___ Specifications ___ Samples

_X_ Materials Engineering Division Reports
Field Reports 1-4

___For approval

_X_For your use

_X_As requested

___For review and comment

CC: Client
J.H. Martin & Sons (Mr. Andy Martin)
Potts Minter & Associates, P.C. (Mr. Tom Cook)

By: _____

Mark L. Jenkins, P.E.
Project Engineer

-881-202-8397

POTTS, MINTER AND ASSOCIATES, P.C.
ENGINEERS, LAND SURVEYORS
LAND PLANNERS

RICHARD T. MINTER, L.S.
WAYNE K. TOY, L.S.
WILLIAM L. JETER, SR.

SP-124-99
WILLIAMSBURG DODGE BMP

TO:

FROM: Potts, Minter & Associates, P.C.
3520 S. Courthouse Road, Suite B
Richmond, Virginia 23236

1-757-259-4032
Facsimile Phone Number

Office Phone Number: (804) 745-2876
Facsimile Number: (804) 745-9571

Scott Thomas

Tom Cook
Name

James City County Env. Division
Company

4-5-00
Date

Re: Williamsburg Dodge

Total number of pages 13 (including cover sheet)
Please call if you do not receive all transmitted pages.

Comments

Scott,
Attached is the geotechnical report for the BMP. Please review & call me to discuss BMP construction options. Thanks!
Tom Cook

Thanks, Have A Wonderful Day!!!!!

3520 Courthouse Road • Richmond, Virginia 23236 • Phone (804) 745-2876 • FAX (804) 745-9571

WATERSHED	YC
BMP ID NO	021
PLAN NO	SP-124-99
TAX PARCEL	(24-01)(01-08)
PIN NO	2410100008
CONSTRUCTION DATE	6/1/2002
PROJECT NAME	Williamsburg Dodge
FACILITY LOCATION	7101 Richmond Road
CITY-STATE	Williamburg, Va. 23188
CURRENT OWNER	John E. Dodson
OWNER ADDRESS	P.O. Box 130
OWNER ADDRESS 2	
CITY-STATE-ZIP CODE	Chesterfield, Va. 23832
OWNER PHONE	800-296-9700
MAINT AGREEMENT	Yes
EMERG ACTION PLAN	No

Get Last BMP No

Return to Menu

MAINTENANCE PLAN	Yes
SITE AREA acre	6.4
LAND USE	Car Dealership
old BMP TYP	
JCC BMP CODE	A3 Wet ED Pond
POINT VALUE	10
SVC DRAIN AREA acres	16.8
SERVICE AREA DESCRI	Site plus 9.7 ac. Offsite Richmond Rd.
IMPERV AREA acres	3.46
RECV STREAM	UT of Yarmouth Creek
EXT DET-WQ-CTRL	Yes
WTR QUAL VOL acre-ft	0.57
CHAN PROT CTRL	Yes
CHAN PROT VOL acre-ft	0.759
SW/FLOOD CONTROL	Yes
GEOTECH REPORT	Yes

CTRL STRUC DESC	RCP Riser
CTRL STRUC SIZE inches	54
OTLT BARRL DESC	RCP Barrel
OTLT BARRL SIZE inch	30
EMERG SPILLWAY	No
DESIGN HW ELEV	79.29
PERM POOL ELE	76.40
2-YR OUTFLOW cfs	20.21
10-YR OUTFLOW cfs	30.15
REC DRAWING	No
CONSTR CERTI	No
LAST INSP DATE	
INTERNAL RATING	

MISC/COMMENTS

Quasi-reg facility. Near Nina Lane. 30 mil PVC liner.

Williamsburg Dodge

JAMES CITY COUNTY ENVIRONMENTAL DIVISION CHECKLIST

I. EROSION AND SEDIMENT CONTROL PLAN

A. Site Plan

✓ Vicinity Map - A small map locating the site in relation to the surrounding area. Include any landmarks which might assist in locating the site.

✓ Indicate North - The direction of north in relation to the site.

✓ Limits of Clearing and Grading - Areas which are to be cleared and graded.

✓ Limits of Cut and Fill Slopes

✓ Areas and Amount of Disturbance (in acres or square feet).

✓ Existing Contours - The existing contours of the site at no more than five-foot intervals.

✓ Final Contours - Changes to the existing contours, including final drainage patterns at no more than two-foot intervals.

✓ Existing and Proposed Spot Elevations - To supplement existing contour information. Proposed spot elevations may replace final contours in some instances.

✓ Existing Vegetation - The existing tree lines, grassed areas, or unique vegetation.

✓ Soils - The boundaries of different soil types.

✓ Environmental Inventory - In accordance with Chesapeake Bay Ordinance, Sect. 19B-10B. For wetlands, include documentation from approving agency.

✓ Existing and Proposed Drainage Patterns - The dividing lines and the direction of flow for the different drainage areas. Include the size (acreage) of each drainage area.

N/A 100 Year Floodplain Limits.

✓ Professional Seal - Signed upon approval of plan.

N/A Critical Erosion Areas - Areas with potentially serious erosion problems. (See VESCH, Chapter 6 for criteria.)

YC021_WILLIAMSBURG_DODGE_7101 - 240

✓ Site Development - Show all improvements such as buildings, parking lots, access roads, utility construction, etc.

✓ Location of Practices - The locations of erosion and sediment controls, tree protection, and stormwater management practices used on the site. Use the standard symbols and abbreviations in Chapter 3 of the 1992 edition of the Virginia Erosion and Sediment Control Handbook.

✓ Temporary Stockpile Areas - Staging and equipment storage areas.

N/A Off-site Areas - Identify any off-site land-disturbing activities (e.g., borrow sites, waste areas, etc.). Show location of erosion controls. (Is there sufficient information to assure adequate protection and stabilization?)

✓ Sediment Basin Design Data Sheet - Submitted along with cross-section through embankment for all basins. See BMP Details. BMP to be utilized as a temporary sediment basin.

✓ Detail Drawings - Any structural practices used that are not referenced to the E&S handbook or local handbooks should be explained and illustrated with detailed drawings. Also include standard detail along with site specific details required to construct measures such as sediment traps, outlet protection, etc.

✓ Maintenance - A schedule of regular inspections and repair of erosion and sediment control structures should be set forth. Indicated IN E.C. notes

____ Trench Dewatering - Details and specifications (per VESCH). Add.

✓ Standard County Erosion and Sediment Control Notes

N/A Phasing Plan - (if required)

____ Construction Sequence - (if required) Generally supplied by contractor prior to preconstruction conference.

B. Narrative Plan (if required)

N/A Project Description - Briefly describes the nature and purpose of the land-disturbing activity, and the areas (acres) to be disturbed.

N/A Existing Site Conditions - A description of the existing topography, vegetation, and drainage.

✓ Calculations - Detailed calculations for design of temporary sediment basins and traps permanent diversion, channels, outfall protection, etc. Include calculations for pre- and post-development runoff.

YC021_WILLIAMSBURG_DODGE_7101 - 241

N/A Adjacent Areas - A description of neighboring areas such as streams, lakes, residential areas, roads, etc., which might be affected by the land disturbance.

N/A Off-site Areas - Describe any off-site land-disturbing activities that will occur (including borrow sites, waste or surplus areas, etc.). Will any other areas be disturbed?

✓ Soils - A brief description of the soils on the site giving such information as soil name, mapping unit, erodibility, permeability, depth, texture, and soil structure. In Report

N/A Critical Areas - A description of areas on the site which have potentially serious erosion problems (e.g., steep slopes, channels, wet weather/underground springs, etc.).

✓ Erosion and Sediment Control Measures - A description of the methods which will be used to control erosion and sedimentation on the site. (Controls should meet the specifications in Chapter 3 of the VESCH.)

✓ Permanent Stabilization - A brief description, including specifications, of how the site will be stabilized after construction is completed. In E.C. narrative.

✓ Stormwater Runoff Considerations - Describe the strategy to control stormwater runoff. with BMP / Stormwater management basin.

II. STORMWATER MANAGEMENT

A. STORMWATER TREATMENT SYSTEM

✓ Drainage Area Map at a maximum scale of 1"=200' showing drainage area boundaries for pre- and post-development conditions and pre- and post-development time of concentration flow paths. For multiphased projects, the map must include all future phases for the project.

✓ Soil Map with site and drainage area outlined.

✓ Receiving Channel and Pipe System Adequacy Determinations. All stormwater must be discharged to an adequate, well-defined receiving system.

✓ Worksheet for BMP Point System to determine need for and type of structural BMPs required as well as Natural Open Space BMP points.

✓ Stormwater Detention Basin Design Checklist completed for each structure.

YC021_WILLIAMSBURG_DODGE_7101 - 242

N/A Conservation Easements required for all Natural Open Space Points claimed in BMP Worksheet.

N/A Infiltration Device Design, Detail and Specification. Must include results of a soil test to verify, a minimum infiltration rate of 0.27 inches per hour at the trench location to a depth of five feet below the bottom of the trench.

✓ Stormwater Management Facility Easements including a 20-foot wide access easement and a 15-foot wide maintenance easement from the 100-year storm elevation and include the dam and outlet structure.

B. STORMWATER CONVEYANCE SYSTEMS

✓ Drainage Area Map to support the design of all conveyance systems; culverts, roadside ditches, storm drain systems, etc.

N/A Culvert Calculations, inlet and outlet control, existing and proposed based on 10-year storm.

✓ Storm Sewer Calculations to include hydraulic grade line, inlet, and spread calculations for 10-year storm.

N/A Open Ditch Calculations, lining determined based on two-year peak velocity and capacity based on 10-year peak discharge, existing, and proposed.

✓ Slope Requirements, minimum longitundinal street slope requirement is 0.75 percent for grass-lined ditch, 0.5 percent for paved ditch, and 0.3 percent for closed (curb and gutter) section.

✓ Outlet Protection required for all outfalls in accordance with Chapter 3, VESCH.

escpsts.txt

YC021_WILLIAMSBURG_DODGE_7101 - 243

Williamsburg Dodge

1/18

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.

✓ 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.

B. RESERVOIR ROUTING

✓ 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.

/ Downstream hydrographs at established study points (if required).

C. HYDRAULIC COMPUTATIONS

✓ Elevation-Storage (curve)

✓ Weir/Orifice control - extended detention control.

✓ Weir/Orifice control - riser 2 year control.

✓ Weir/Orifice control - riser 10 year control.

/ Inlet/Outlet (barrel) control - (all storms).

/ Check for barrel control prior to riser orifice flow to prevent slug flow-water hammer conditions.

Emergency spillway capacity. (Principal spillway (riser) handles 100 yr. storm.

✓ Elevation-Discharge (provide supporting calculations and/or design assumptions).

D. MISCELLANEOUS COMPUTATIONS

✓ Water quality volume for permanent pool.

✓ Water quality volume for extended detention with drawdown computations.

746-1818

2/18

___ Anti-seep collar design. SEEPAGE CONTROL
___ Filter diaphragm design (or alternative method of controlling seepage).
___ Riser structure flotation analysis (factor of safety = 1.2 min.).
N/A Danger reach study (if required).
N/A 100 year floodplain impacts (if required). ZONE X

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 (REQUIRED AS PER CHES. BAY PRESERV. ORDINANCE 23-10(4)(b), LONG TERM SCHEDULE FOR INSPECTION & MAINTENANCE)

✓ Person or organization responsible for maintenance. OWNER
___ 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.
N/A 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.

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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
✓ 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 NA

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

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

b. FILTER DIAPHRAGM

___ 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)
✓ Cross-section at end of barrel in accordance with receiving channel section
N/A 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 * (Riser will pass 100 yr. storm. Spillway will pass water only if riser is clogged)
✓ 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

5/18

E. EMERGENCY SPILLWAY PROFILE

N/A Existing ground
____ Inlet, level (control), and outlet sections per SCS
____ Spillway and crest elevations

F. CONSTRUCTION SPECIFICATIONS

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

COMMENTS:

BY: Thomas J. Cook, P.E.

DATE: 11-17-99

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Sequence. TYP INSTALL DETAIL.

VEG. COVER

PVC LINER

PREPARED SUBGRADE

Liner Comments:

1. Define area req'd for PVC membrane liner on the plan or profile (sheet 5) by elevation. Detail/on PLAN

2. TYP. the set using the anchor trench detail included in mfgr's lit. Show veg. reqmts over cover layer.

A. cover depth

B. cover over liner type

C. subgrade spec. in accord w/ 5.2.2 of mfgr's lit.

3. sequence of const. for liner installation incorp. into dam const. notes (SHT 5) AND SOC (sheet 4)

VEG. COVER

PVC LINER

SOPL

SUBGRADE

SOPL

* specific PVC CLPAR Geomembrane spec on DWG. Type of PVC Geomembrane ADD PVC Geomembrane spec guide spec and LIT

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1 GENERAL INFORMATION

1.1 PURPOSE

The purpose of this manual is to provide details of Manufacturing Quality Control (MQC), Manufacturing Quality Assurance (MQA), Construction Quality Control (CQC), and Construction Quality Assurance (CQA) for the manufacture, fabrication, and installation of PVC geomembrane products supplied by Watersaver Company, Inc.

1.2 REFERENCES

All methods and procedures referenced in this document are as prescribed by the American Society for Testing and Materials, the National Sanitation Foundation (NSF) Joint Committee on Flexible Membrane Liners - Standard 54-1991, and the Environmental Protection Agency.

1.3 CONFORMANCE WITH PROJECT SPECIFICATIONS

It is the intent of Watersaver Company Inc. to comply with the MQC, MQA, CQC and CQA requirements set forth by individual project specifications. If required, modification to this manual can be made via addendum in order to fully comply with job specific requirements.

2 GEOMEMBRANE MANUFACTURING

2.1 RAW MATERIALS

Watersaver Company Inc. requires each PVC manufacturer to certify that PVC sheeting be formulated and manufactured from 100% virgin polyvinyl chloride resin that is specifically compounded for use in hydraulic structures. Only first quality phthalate and/or phosphate plasticizers shall be used. The use of water soluble ingredients is prohibited. The compound must contain a biocide at a viable formulation level.

The manufacturer is required to submit written certification that the material meets or exceeds Watersaver Company's specifications as well as those published by NSF Standard 54-1991.

If requested by the engineer or owner, Watersaver Company Inc. can submit these test results for review and approval.

An example of Watersaver Company Inc.'s Engineering Specification Guide can be found in Appendix I.

An example of typical certified test results can be found in Appendix II.

2.2 ROLL GOODS

All roll goods received from the PVC manufacturer are visually inspected for contaminants, gas checks, windows, undispersed raw materials, surface divots, pinholes, and blisters. The material must have good surface quality and shall not exhibit cold flow.

All impurities or defects will be removed or repaired prior to being fabricated into panels. If any defect cannot be properly repaired, the affected roll goods will be rejected.

Physical property testing shall be conducted by Watersaver Company Inc. on each lot of PVC roll goods. Materials tested must meet or exceed the values specified by NSF Standard 54-1991. The following properties shall be evaluated:

PROPERTY	TEST METHOD
Thickness (inches, nominal)	ASTM D1593
Breaking Factor (lbs/in)	ASTM D882
Elongation at Break (percent)	ASTM D882

3 GEOMEMBRANE FABRICATION

3.1 FACTORY FABRICATION

Individual calendered widths of PVC shall be factory fabricated into large panels so as to minimize seaming during installation. Factory fabricated seams shall have a minimum one-half inch (1/2") width and shall extend to the edge of the sheet.

Factory seams shall be produced using either a chemical fusion agent, or by dielectric welding.

Each fabricated panel shall be logged by panel number, size, date of fabrication, material lot number and fabricator seam identification.

Each panel shall be prominently marked with the panel number and panel size.

3.2 IN-FACTORY SEAM TESTING

Visual and non-destructive inspection shall be performed on 100% of factory fabricated seams.

In addition, Watersaver Company Inc. shall perform destructive testing on factory fabricated seams in order to verify compliance with the values stated in section 3.3 of this document.

Samples of factory seams will be taken at the beginning and at the end of each production shift. All seams shall be tested for compliance.

If requested by the engineer or owner, Watersaver Company Inc. will submit a copy of these test results for review and approval. The original test results shall be archived at Watersaver Company's facility.

An example of typical test results can be found in Appendix III.

3.3 FACTORY SEAM REQUIREMENTS

All factory seams shall meet the following requirements set forth by the National Sanitation Foundation Joint Committee on Flexible Membrane Liners - Standard 54-1991:

A) PROPERTY: Bonded Seam Strength
UNITS: pounds per inch width
TEST METHOD: ASTM D882
NSF REQUIRED VALUE: 80% of specified sheet strength

B) PROPERTY: Peel Adhesion
UNITS: pounds per inch width
TEST METHOD: ASTM D413
NSF REQUIRED VALUE: 10

4 PACKAGING, HANDLING, AND TRANSPORTATION

4.1 PACKAGING AND HANDLING

After factory fabrication, the geomembrane panels shall be double accordion folded and packaged so as to minimize handling at the jobsite. Shipping cartons shall be water resistant, strong enough to prevent damage to the contents, and shall be banded to heavy duty wood pallets. Geomembrane panels which have been delivered to the jobsite shall be unloaded and stored in their original, unopened containers in a secure, dry area, and protected from direct exposure to the sun. Whenever possible, a 6-inch minimum air space between the pallets shall be maintained, especially when the geomembrane panels are to be stored over an extended period of time. Pallets shall not be stacked.

4.2 TRANSPORTATION

Transportation of the geomembrane will be arranged by Watersaver Company Inc. through an independent trucking firm, and will be shipped in either a closed trailer or on a flat bed trailer. Adequate tarps are recommended during transport.

Watersaver Company Inc. will be responsible for repairing or replacing any material damaged during shipment at no cost to the owner.

5 INSTALLATION

5.1 ANCHORAGE SYSTEM

Unless otherwise specified, the anchor trench shall be excavated by the Earthwork Contractor to the lines and grades shown on the design drawings. Excavated material shall be stored away from the area to be lined.

Trenching shall be completed prior to geomembrane placement unless anchor trench is excavated into a clay liner. In this case no more than the amount of trench required for the daily placement of geomembrane shall be excavated.

Slightly rounded corners shall be provided along the trench edge directly in contact with the geomembrane.

5.2 SUBGRADE

5.2.1 Preparation

Surfaces to be lined will be free of all rocks, roots, vegetation, sharp objects, or debris of any kind. The surface shall provide a firm, unyielding foundation for the geomembrane with no sudden, sharp, or abrupt changes in grade.

If an herbicide is required, it must be compatible with the geomembrane and shall be applied at least 48 hours prior to geomembrane installation. Compatibility with the geomembrane shall be confirmed by the herbicide manufacturer.

5.2.2 Repair and Maintenance

Prior to geomembrane installation, the surfaces to be lined shall be inspected for acceptability. Any necessary repairs will be made by the owner or earthwork contractor. It is the responsibility of the owner or earthwork contractor to maintain the integrity of the subgrade prior to, and during the geomembrane installation. This includes the control of ground water in the area to be lined.

5.3 GEOMEMBRANE PANEL PLACEMENT

5.3.1 Panel Location

PVC geomembrane panels shall be installed at the location indicated in the approved layout drawing. The installer may modify the proposed layout so as to best meet the intent of the project specification and/or to accommodate existing site conditions.

5.3.2 Weather Conditions

The PVC geomembrane panel shall remain in its original packaging and in dry condition until ready for use. The geomembrane panel shall not be positioned when material temperatures are below 32°F. Panel deployment in temperatures below 32°F is acceptable if the panel is stored in an area where the ambient temperature is at least 50°F. The panel must be placed immediately after removal from storage. Care must be taken to avoid "cold shock" of the PVC geomembrane.

5.3.3 Geomembrane Panel Deployment

The number of panels to be deployed in any day shall be limited to the number of panels which can be seamed that day. The geomembrane shall be placed over the prepared surface so as to minimize handling.

The geomembrane shall be installed in a relaxed manner and shall be free of tension and stress. In areas where grade transitions occur, "bridging" or "trampolining" of the geomembrane shall not be allowed. Adequate slack shall be allowed so as to accommodate grade transition and any expansion or contraction of the geomembrane. Wrinkling and folding of the geomembrane is acceptable and is an indicator of proper slack consideration.

Geomembrane panels shall be deployed to meet a minimum panel overlap of 6 inches.

When possible, the seam overlap should be in the predominant wind direction so as to reduce the chance of wind uplift.

5.3.4 Preparation for Seaming

Watersaver's approved installer shall verify the following:

- All personnel walking on the geomembrane liner shall have smooth soled shoes. Personnel working on the geomembrane shall not smoke and shall not engage in activities that could damage the geomembrane.
- Tools used in the installation process shall be properly stored and carried. Knives and other sharp objects shall be carried in protective sheaths.
- The method used to unfold panels will not cause damage to the geomembrane or underlying geotextiles.
- Any geosynthetic elements directly underlying the geomembrane shall be clean and free of debris.

- Adequate temporary anchoring shall be placed so as to prevent wind uplift of the geomembrane panels. Acceptable items are sand bags, ballast tubes, or any readily available item that will not cause damage to the geomembrane panel. In cases of high wind, continuous loading may be required along the edges of the geomembrane panel.

- Direct contact with the geomembrane shall be minimized. Geotextile, additional geomembrane, or any suitable material may be used as a trafficking surface where required.

- Vehicles shall not be allowed on the geomembrane unless approved by the installer. In general, only small, rubber-tired equipment with a ground pressure not exceeding 5 PSI will be allowed.

- Chemical fusion seaming agents, hydrocarbons and chemical cleaning agents shall be stored separately, away from PVC panels. Spill resistant containers shall be used while working within the field of the geomembrane and shall be stored upon a sacrificial material such as scrap geomembrane or heavy cardboard.

5.4 FIELD SEAMING

5.4.1 Seam Preparation

The overlapped geomembrane panels must be clean at the surfaces to be joined. Any foreign material (e.g. dirt, moisture) must be removed with clean, dry rags before seaming commences.

If seaming must be conducted over wet substrate, seaming boards shall be used to separate the surfaces to be seamed from the underlying moisture. A one foot by six foot pine shelf board will work well as a seaming platform.

5.4.2 Chemical Fusion Field Seaming

Chemical fusion agent shall be applied between the two surfaces to be joined. These surfaces shall be mated together, and pressure applied to the upper surface by means of a roller (high durometer rubber, nylon, or steel).

A sufficient amount of chemical fusion agent shall be applied between the two geomembrane surfaces to be joined such that when rolled, a thin excess of chemical fusion agent will be forced out of the seam. Any excess chemical fusion agent shall be wiped from the geomembrane. The lower of the two surfaces to be joined shall be completely wetted by the chemical fusion agent. Field seams shall be a minimum of 1 inch in width.

Fish mouths or unbonded seam overlaps shall be cut back and overlapped, then patched with a round or oval patch of the same geomembrane material. The patch shall extend a minimum of 8 inches beyond the repair area in all directions, and shall be seamed a minimum of 1 inch.

5.4.3 Cold Weather Chemical Fusion Field Seaming

For cold weather seaming (below 32°F), the surfaces of the geomembrane that are to be joined must be preheated. This may be accomplished by means of a radiant heater (e.g. quartz heater), hot air blower, and/or use of a confining structure such as a tent placed over the work area.

If the soil beneath the geomembrane is frozen, the application of heat to the area to be seamed may result in condensation of moisture between the surfaces to be joined. This possibility may be eliminated by placing a seaming board, or slip sheet made from the same geomembrane material, between the wet surface and the geomembrane to be seamed.

Care must be taken to remove any excess chemical fusion agent from the mated geomembrane surfaces.

5.4.4 Pipe Penetrations

Pipe penetrations shall be sealed by installing factory fabricated pipe seals. Pipe seals shall be constructed of the same material and thickness as the specified geomembrane, and shall be bonded to the geomembrane by chemical fusion agent. The method of bonding shall be as outlined in section 5.4.2.

5.5 BACKFILLING ANCHOR TRENCH

The anchor trench shall be backfilled and compacted by the Earthwork Contractor.

Care must be taken when backfilling trenches so as to prevent damage to the geomembrane. If damage occurs, the geomembrane installer shall make repairs before backfilling continues. The Earthwork Contractor shall bear the expense of such repairs.

5.6 LINING SYSTEM ACCEPTANCE

Watersaver's authorized installer shall retain responsibility for the geomembrane installation until acceptance by the Engineer and/or Owner.

The geomembrane liner installation will be accepted by the Owner when the following conditions have been met:

1. Installation of the geomembrane is complete.
2. Verification of the integrity of all seams and repairs, as required by the specifications, is complete.
3. All documentation pertaining to the geomembrane installation is completed and submitted to the Owner/Engineer.

6 FIELD QUALITY ASSURANCE

6.1 OVERVIEW

Field seam quality shall be demonstrated by non-destructive (NDT) and destructive (DT) test methods.

The primary purpose of the NDT method is to demonstrate continuity along the entire length of a given field seam. The object is to validate 100% of the field seam. NDT methodology is described in section 6.3 below.

The purpose of the DT method is to determine the quality of a given seam by removing a representative seam sample, and testing the given sample for compliance with predetermined physical property values. Testing may be conducted either at the job site, or at a remote testing laboratory. DT methodology is discussed in section 6.4 below.

6.2 TEST STRIPS/TRIAL SEAMS

In some cases, the CQA/CQC requirements of a specific project may call for construction and evaluation of test strips and/or trial seams. The purpose of these items is to prequalify a particular person or technique for producing field seams on identical geomembrane material under the same conditions as would be experienced at the jobsite.

When using chemical fusion seaming processes, it must be recognized that adequate cure time must be allowed in order for the test strip/trial seam to achieve its potential strength. Therefore, it is recommended that all testing of this type follow the guidelines set forth in section 6.4 of this document.

If field seam production is in progress before the results of trial testing are available, seam production shall be tracked and documented for future reference.

If test strip/trial seam evaluation is required, samples shall be constructed at the beginning of each installation shift.

6.3 NON-DESTRUCTIVE SEAM TESTING

6.3.1 Air Lance Method

All field seams shall be non-destructively tested over their full length. An air lance apparatus shall be used for this testing as described in Appendix IV of this document. The air lance shall be capable of supplying 30 psi through a 3/16 inch diameter nozzle. The air stream shall be directed at the edge of the seam no more than two inches from the seam edge. Testing of the field fabricated seams shall be performed at the end of each work day. Enough time shall be allowed for the seams to develop adequate strength before commencement of testing. Any defects found during testing shall be marked, repaired, and retested with the air lance. All repairs shall be performed as described in section 6.3.2 (Remedial Action).

6.3.2 Remedial Action

If unbonded areas are located, they can often be repaired by inserting additional chemical fusion agent into the seam opening, and then rolling. If this does not produce a satisfactory repair, then a patch consisting of the same geomembrane material must be installed over the repair area. The patch must extend a minimum of 6 inches beyond the area to be repaired.

6.4 DESTRUCTIVE SEAM TESTING

6.4.1 Sampling Frequency

Destructive seam testing can be conducted along completed field seams at intervals of 1000 feet (or at intervals indicated in the project specification, and as addressed by addendum to this document).

6.4.2 Sampling Procedure

Samples shall be removed from the completed geomembrane seam by the installer. The sample shall be labeled in a clear and logical manner. Immediately upon removal, the sample location shall be recorded on an as-built drawing.

Any holes in the geomembrane resulting from destructive seam sampling shall be immediately repaired by patching the sampled area with identical geomembrane material. The patch must extend a minimum of six inches beyond the repair area in all directions. The continuity of repaired sampling locations shall be confirmed via NDT methods described above.

6.4.3 Sample Geometry

The *minimum* sample geometry shall be as follows:

Sample width shall be determined as the width of the field seam plus six inches on both sides of the seam.

Sample length shall be thirty six inches.

See Appendix V for a diagram of the required sample.

6.4.4 Disposition of Samples

The sample described above shall be cut into two equal segments. One half of the sample shall be submitted for laboratory (or field) testing. The other half shall be submitted to the owner for archive storage.

6.4.5 Sample Preparation for Testing

6.4.5.1 Conditioning

Conditioning of the samples prior to testing is imperative. Field seams produced using chemical fusion agent must be allowed to cure until the required strength values can be achieved. Accelerated curing can be accomplished by conditioning the samples in a convection oven[1] at 158°F for sixteen hours. After conditioning, the samples can be removed from the oven and allowed to equilibrate at room temperature for four hours.

If accelerated curing is not an option, the samples must be allowed to cure at room temperature, which may take several days.

The samples shall be considered ready for testing when the chemical fusion agent odor is no longer detectable.

6.4.5.2 Cutting of Test Specimens

Specimen dimensions shall be one inch in width and shall extend a distance of four inches on both sides of field seam. Samples must be cut in a manner which eliminates nicks or tears in the specimen which could cause premature failure (refer to ASTM D882 for further information). Specimens *must* be cut so that the long dimension of the specimen is perpendicular to the length of the seamed sample.

A total of ten specimens shall be cut from the sample. Five specimens will be used to perform bonded seam strength testing with the remaining five specimens to be used for peel adhesion testing. Details of the test procedures are outlined below.

6.4.6 Testing Procedures

Specimens shall be tested in order to determine bonded seam strength and peel adhesion. The testing shall proceed as described by ASTM D882 and ASTM D413 as modified by the National Sanitation Foundation Standard Number 54-1991.

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[1] An oven designed specifically for this purpose is strongly recommended

6.4.7 Remedial Action - Destructive Test Failure

One of the following procedures shall apply whenever a sample fails a destructive test:

1. The field seam shall be reconstructed between two test locations shown to have acceptable results, one located on either side of the failed sample.

2. The seam shall be traced outward to intermediate points (a maximum of 10 feet from the failed sample in each direction) and sampled for additional testing. If the samples are found to provide acceptable test results, the seam is reconstructed between these two sample locations. If an intermediate sample fails, the process is repeated to establish the zone in which the seam is to be reconstructed. All reconstructed seams shall be bounded by two locations from which samples passing other destructive tests have been taken.

Reconstruction of field seams shall be accomplished by either removing the suspect seam, repositioning panels and re-seaming, or by installing a cap strip to cover the seam under reconstruction. Cap stripping shall extend a minimum of six inches beyond the reconstructed seam in all directions.

6.4.8 Verification of Repairs

Any Repair requiring a patch or cap strip shall be identified on the as-built drawing. Each repair shall undergo non-destructive testing as described in section 6.3 above. Repairs which pass the NDT shall be taken as an indication of proper repair. Failed NDT's will result in reconstruction and re-testing of the repair area until a passing result is obtained.

SPECIFIC PVC FLEXIBLE MEMBRANE LINER INFORMATION

PVC membrane liners are the most widely used of all polymeric membranes for waste impoundments. They show good chemical resistance to many inorganic chemicals; however, the inclusion of certain organic chemicals may limit their applicability (consult Watersaver Company, Inc. for specific applications). Special "Oil Resistant" (PVC-OR) grades of PVC are also available that possess a high resistance to oil and/or organic chemicals and hydrocarbon attack.

PVC liner materials are produced in roll form in various widths and thicknesses. Most liners are used as unsupported sheeting, but fabric reinforcement can be incorporated. PVC compounds contain 25% to 35% of one or more plasticizers to make the sheeting flexible and rubberlike. They also contain 1% to 5% of a chemical stabilizer and various amount of other additives. The PVC compound should not contain any water soluble ingredients. There is a wide choice of plasticizers that can be used in PVC sheeting, depending upon the application and service conditions under which the PVC compound will be used. Plasticizer selection is an extremely important aspect of a PVC liner material, since the loss of plasticizer will result in a change in physical properties. There are three basic mechanisms for plasticizer loss: volatilization, extraction and microbiologic attack. The use of the proper plasticizers and an effective biocide can virtually eliminate microbiological attack and minimize volatility and extraction. The PVC polymer, per se, is not affected by these factors.

The principal reason for loss of plasticizer is by volatilization due to the heat of the sun rather than solubility in the waste fluid. Carbon black prevents ultraviolet attack, but does cause the absorption of solar energy, raising the temperature to a level that could increase the volatilization of the plasticizer. A soil or other suitable cover material must be used to protect the PVC from heat, ultraviolet and weathering. Covering a liner also results in increased protection from unusual weather conditions, mechanical damage and vandalism.

Plasticized PVC sheeting has excellent Tensile, Elongation Puncture and Abrasion Resistance properties. It is readily seamed by chemical welding, hot wedge and dielectric welding methods.

Watersaver Company supplies PVC, which utilizes only first quality resin, primary plasticizers, stabilizers, biocides and other additives. Watersaver Company offers a wide variety of custom fabricated PVC panels.

USES OF PVC LINERS

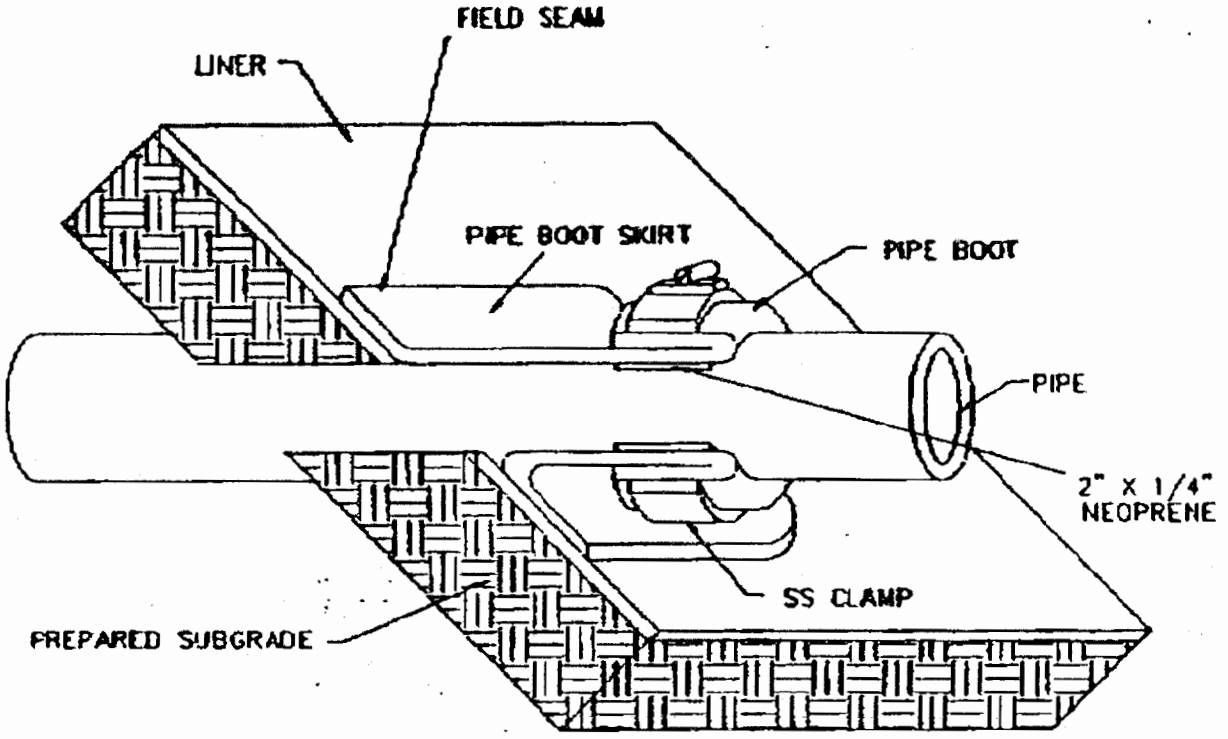
PVC liners can be used in many different applications, including:

- solid waste landfills
- landfill caps
- water treatment ponds
- sewage lagoons
- sand filter beds
- evapotranspiration fields
- golf course ponds
- decorative lakes
- fish hatcheries
- mining heap leach pads
- tailings impoundments
- irrigation reservoirs
- reserve pit liners
- fly ash disposal cells
- irrigation canals
- moisture barriers
- leachate collection ponds
- fire water ponds
- stormwater detention ponds
- solar evaporation ponds
- industrial waste ponds & impoundments

The above information is furnished to aid the Design Engineer in selecting PVC for use as a geomembrane. Watersaver Company, Inc., as a material supplier, does not assume responsibility for errors in selection, design, engineering, quantities, dimensions or installation.

For additional information, contact Watersaver Company, Inc.

WATERSAVER CO, INC. • Plant/General Office • 5870 E. 56th Avenue • Commerce City, CO 80022
P.O. Box 16465 • Denver, CO 80216 • (303) 289-1818 • Fax (303) 287-3136

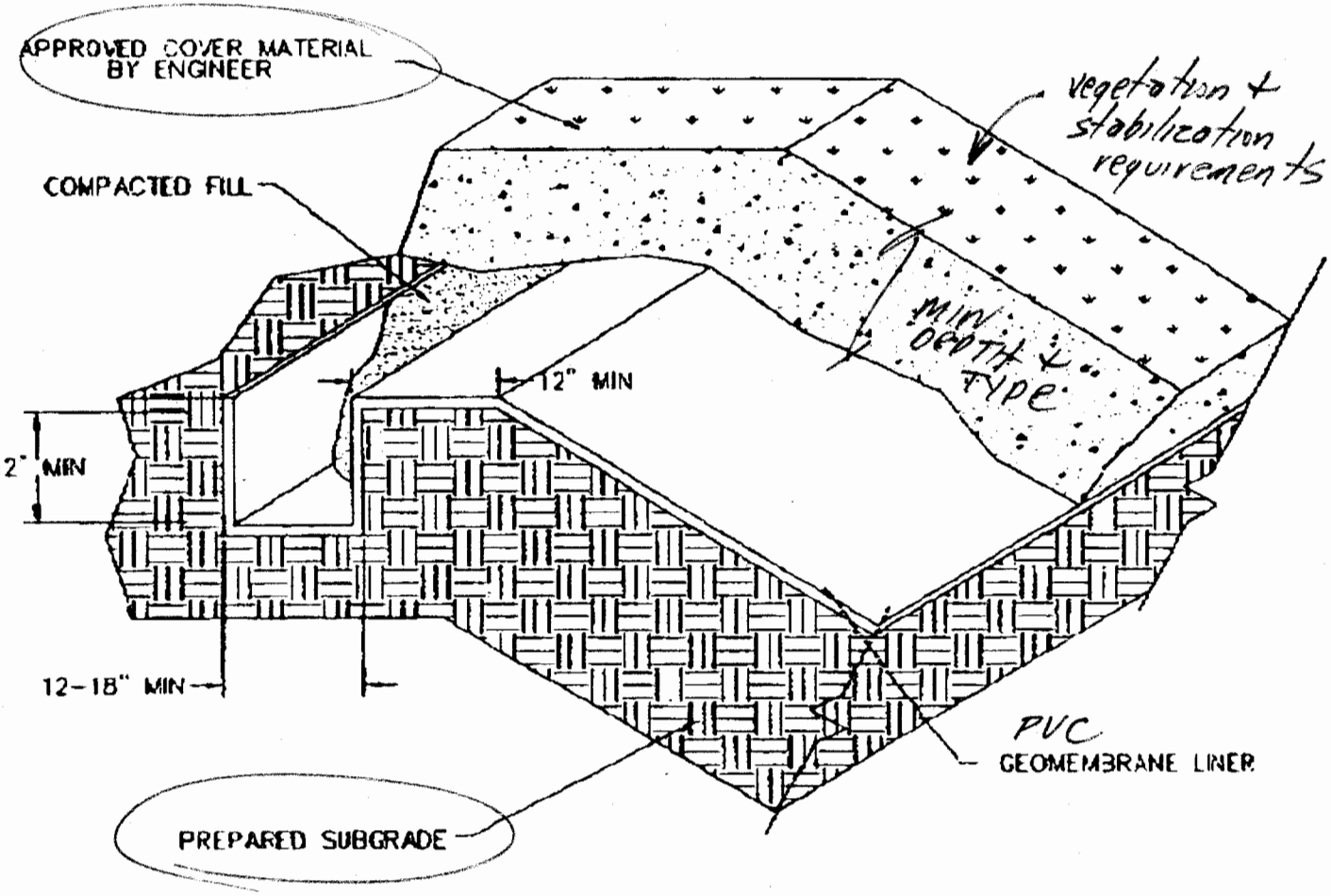


45 DEGREE PIPE BOOT

N.T.S.

WATERSAVER COMPANY INC.
P.O. BOX 16468 DENVER, CO 80216-0468
VOICE: (303)289-1618 FAX: (303)289-3138

DETAIL NUMBER: 45 DEGREE PIPE BOOT
DATE: 07/28/95
DRAWN BY: KFW

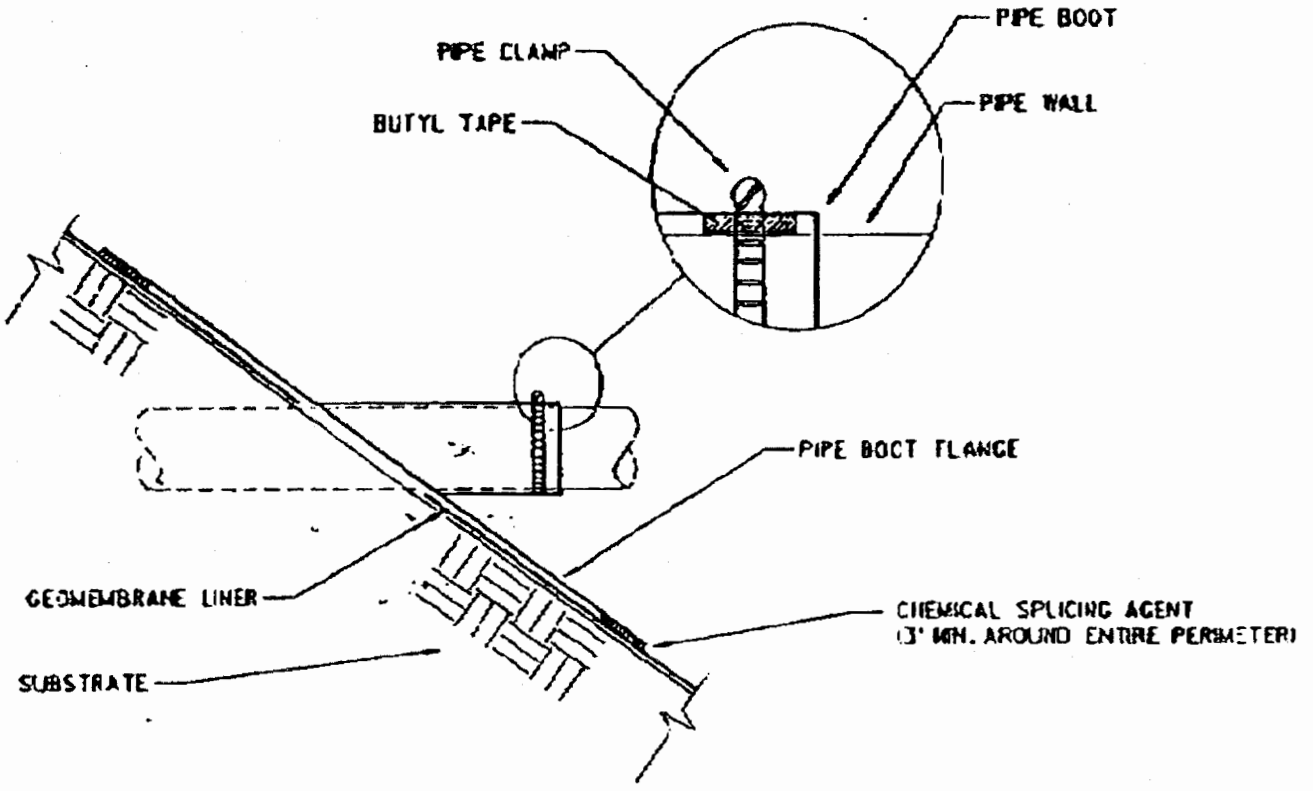


ANCHOR TRENCH DETAIL – COVERED

NOTE: ANCHOR TRENCH DIMENSIONS SHOWN ABOVE ARE FOR GENERAL INFORMATION ONLY. TRENCH AND ENBEDMANT DIMENSIONS SHOULD BE DETERMINED BY SITE SPECIFIC DESIGN.

WATERSAVER COMPANY INC.
P.O. BOX 18468 DENVER, CO 80216-0468
VOICE: (303)289-1818 FAX: (303)287-3138

DETAIL NUMBER: ANCHOR TRENCH
DATE: 07/27/95
DRAWN BY: WSW



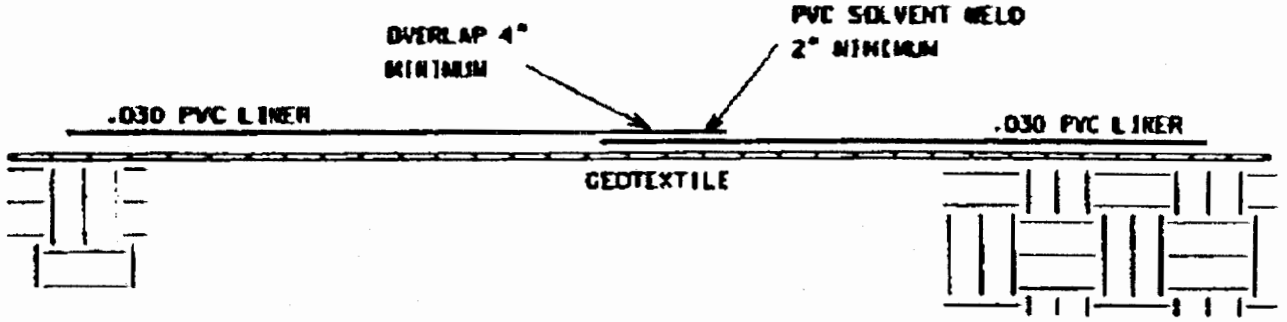
PIPE BOOT DETAIL

N.T.S.

WATERSAVER COMPANY, INC.
P.O. BOX 16465 DENVER, CO. 80216-0465 (303) 289-1818 FAX (303) 287-3136

DETAIL NUMBER: LNR2 | DRAWN BY: | DATE: 12-10-91

Same For Hypalon



FIELD SEAM DETAIL (TYP)

N.T.S.

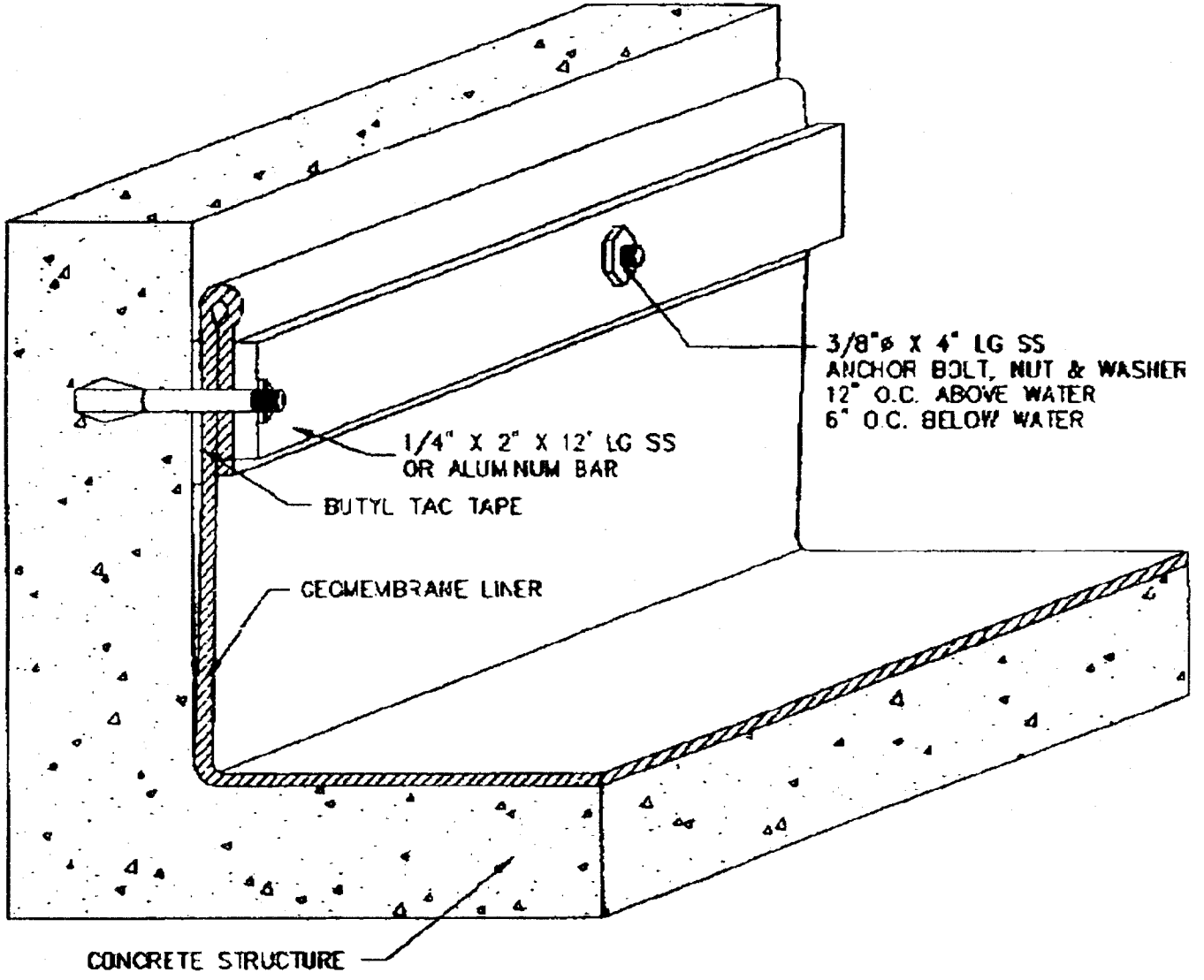
WATERSAVER COMPANY, INC.
P.O. BOX 16465 DENVER, CO. 80216-0465 (303) 289-1000 FAX (303) 287-3136

DETAIL NUMBER: LM21

DRAWN BY: RMP

DATE: 12-4-93

c:\details\lm21.dgn Mar. 3 1994 07:41:05



VERTICAL CONCRETE ANCHOR DETAIL

WATERSAVER COMPANY INC.
P.O. BOX 18488 DENVER, CO 80218-0488
VOICE: (303)289-1818 FAX: (303)297-3130

DETAIL NUMBER: V-CONANCH
DATE: 08/01/95
DRAWN BY: WSW

Landsaver Environmental †
Geosynthetic Installation Professionals

PVC GEOMEMBRANE SPECIFICATION GUIDE
ENGINEERING SPECIFICATION

Property	Test Method	Specified Values					
Thickness mils (Nominal ±5%)	ASTM D-1593	10	20	30	40	50	60
Specific Gravity (minimum)	ASTM D-792	1.20	1.20	1.20	1.20	1.20	1.20
Minimum Tensile Prop. (each direction)	ASTM D-882						
1. Breaking Factor (lbs/in width) (PSI)	Method A or B (1 inch wide)	23 (2300)	46 (2300)	69 (2300)	92 (2300)	115 (2300)	138 (2300)
2. Elongation at Break[1] (%)	Method A or B	325	325	325	350	400	450
3. Modulus (force) at 100% Elongation (lb/in width) (PSI)	Method A or B	10 (1000)	20 (1000)	30 (1000)	36 (900)	45 (900)	54 (900)
Tear Resistance (lbs, minimum)	ASTM D-1004 Die C	3	6	8	10	12	14
Low Temperature, °C (°F)	ASTM D-1790	-23 (-10)	-26 (-15)	-29 (-20)	-29 (-20)	-29 (-20)	-29 (20)
Dimensional Stability (each direction, % change maximum)	ASTM D-1204 100°C (212°F), 15 min.	5	5	5	5	5	5
Water Extraction (% loss maximum)	ASTM D-3083 (as modified in Annex A)	-0.25	-0.25	-0.25	-0.35	-0.35	-0.35
Volatile Loss (% loss maximum)	ASTM D-1203 Method A	1.5	0.9	0.7	0.5	0.5	0.5
Resistance to Soil Burial (% change maximum in original value)	ASTM D-3083 (as modified in Annex A)						
1. Breaking Factor		5	5	5	5	5	5
2. Elongation at Break		20	20	20	20	20	20
3. Modulus at 100% Elongation		20	20	20	20	20	20
Hydrostatic Resistance (lbs/sq in. minimum)	ASTM D-751 Method A	37	60	82	82	110	150

Williamsburg Dodge BMP/SWM Facility Maintenance Plan

Inspection and maintenance of the facility will consist of the following measures:

1. The inspection for sediment buildup will be performed by visual inspection and a physical determination of sediment depth within the forebay area, If the depth of the sediment reaches the depth of 1.5 feet above the bottom of the forebay (Elev. 80.5), removal is required using a rubber wheeled backhoe. At the same time or at least once a year, clean the main detention basin bottom, riser and outlet pipe of accumulated sediments. Dispose of sediment removed from the BMP facility at an acceptable disposal site.

2. Perform maintenance mowing of dam and basin slopes at least twice a year. Trees and shrubs should not be permitted to grow on any part of the graded dam embankment.

3. Perform soil sampling on stabilized pond soil areas at least every 4 years. Soil sampling and testing should be performed by a qualified independent soil testing laboratory, such as Virginia Tech. Apply fertilizer in accordance with test recommendations.

4. In stabilized pond areas, if vegetation covers less than 40% of soil surfaces, lime fertilize and seed in accordance with recommendations for new seedlings. If vegetation covers more than 40% but less than 70% of soil surfaces, lime, fertilize and over seed in accordance with current seeding recommendations.

5. Perform quarterly inspections of the forebay, riser section and emergency spillway for the observance of collected debris. Immediately remove any debris to prevent the obstruction of water, the movement of trash and litter downstream, and to maintain the integrity of the structure and provide an attractive appearance.

6. Perform yearly structural inspections of the facility for damage. Structural inspection shall be performed on the concrete riser, anti-vortex device, trash rack, orifice, outlet barrel and pond embankment. If damage is evident, further investigation by a professional engineer may be required to assess the integrity of the structure.

7. Perform quarterly inspections of the graded side slopes of the detention facility for signs of animal/rodent borrows or slope erosion. Immediately perform necessary repairs, refilling or reseeding.

8. Perform yearly observations of perimeter offsite areas that surround the detention facility to ensure changes in adjacent land use, topography or access do not affect maintenance, access or safety features provided for the facility.

9. Record Keeping. The landowner or designated representative shall keep reasonable, accurate written records of inspections performed on the facility. Records shall document routine maintenance and/or repairs performed. Copies shall be provided to the County upon request.

10. The facility shall not be modified in any way without prior approval by the County.

See
SP 59-04
Norge Neighborhood
Rezoning this BMP.

PLAT SHOWING A PROPOSED SWM/BMP EASEMENT ACROSS THE PROPERTY OF JOHN E. DODSON, IN THE POWHATAN DISTRICT, JAMES CITY COUNTY, VIRGINIA

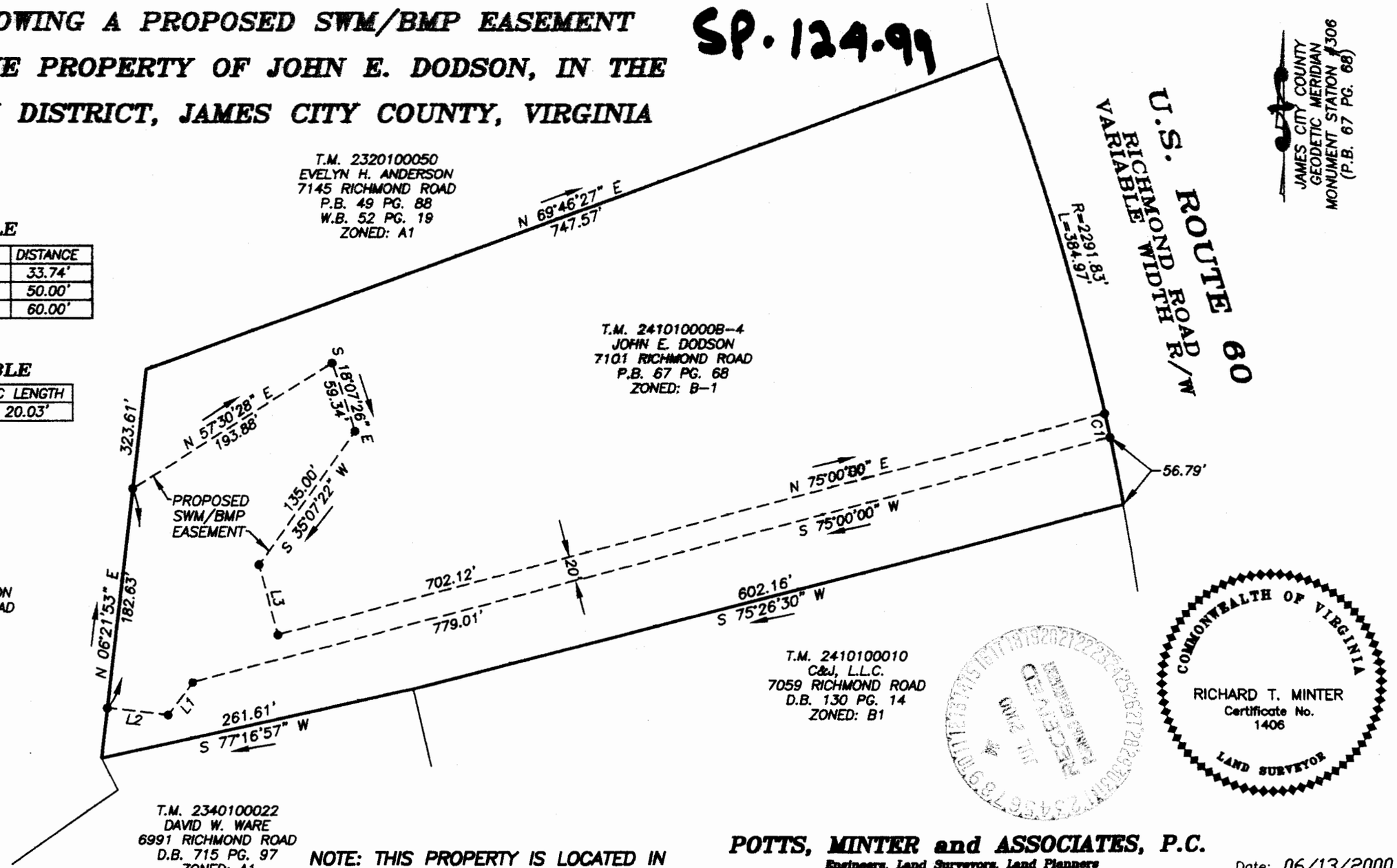
SP-124-99

LINE TABLE

NUMBER	DIRECTION	DISTANCE
L1	S 37°00'16" W	33.74'
L2	N 83°38'07" W	50.00'
L3	S 15°00'00" E	60.00'

CURVE TABLE

NUMBER	RADIUS	ARC LENGTH
C1	2291.83'	20.03'



COMMONWEALTH OF VIRGINIA
RICHARD T. MINTER
Certificate No.
1406
LAND SURVEYOR

NOTE: THIS PROPERTY IS LOCATED IN ZONE X AS SHOWN ON FEMA COMMUNITY PANEL NO. 510201 0020 B

POTTS, MINTER and ASSOCIATES, P.C.
Engineers, Land Surveyors, Land Planners
3580 Courthouse Road Suite B
Richmond, Virginia 23236
(804) 745-2876

Date: 06/13/2000
Scale: 1"=100'
J.N. 9902-29

CHECKED: RTM