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: **99147**

DATE VERIFIED: **November 5, 2012**

QUALITY ASSURANCE TECHNICIAN: **Leah Hardenbergh**

Leah Hardenbergh

LOCATION: WILLIAMSBURG, VIRGINIA

Stormwater Division

MEMORANDUM

Date: March 28, 2012

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

From: Leah Hardenbergh

PO: 110426

Re: Files Approved for Scanning

General File ID or BMP ID:	**99147**
PIN:	**4630100015**
Owner Name (if known):	**COMMONWEALTH OF VIRGINIA**
Legal Property Description:	**JAMESTOWN FESTIVAL PARK**
Site Address:	**1348 COLONIAL PARKWAY**

(For internal use only):

Box # 2

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

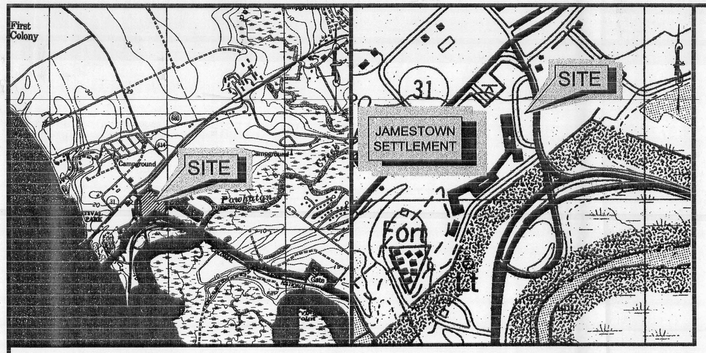
8-SO

JAMESTOWN SETTLEMENT ENTRANCE PLAZA PARKING LOT

RECEIVED 2003

JAMESTOWN ENTRANCE PLAZA AND PARKING LOT IMPROVEMENTS

PROJECT CODE NUMBER: 425–16133
JAMES CITY COUNTY, VIRGINIA



VICINITY MAP
SCALE: 1" = 2000'

LOCATION MAP
SCALE: 1" = 500'

STATISTICAL INFORMATION

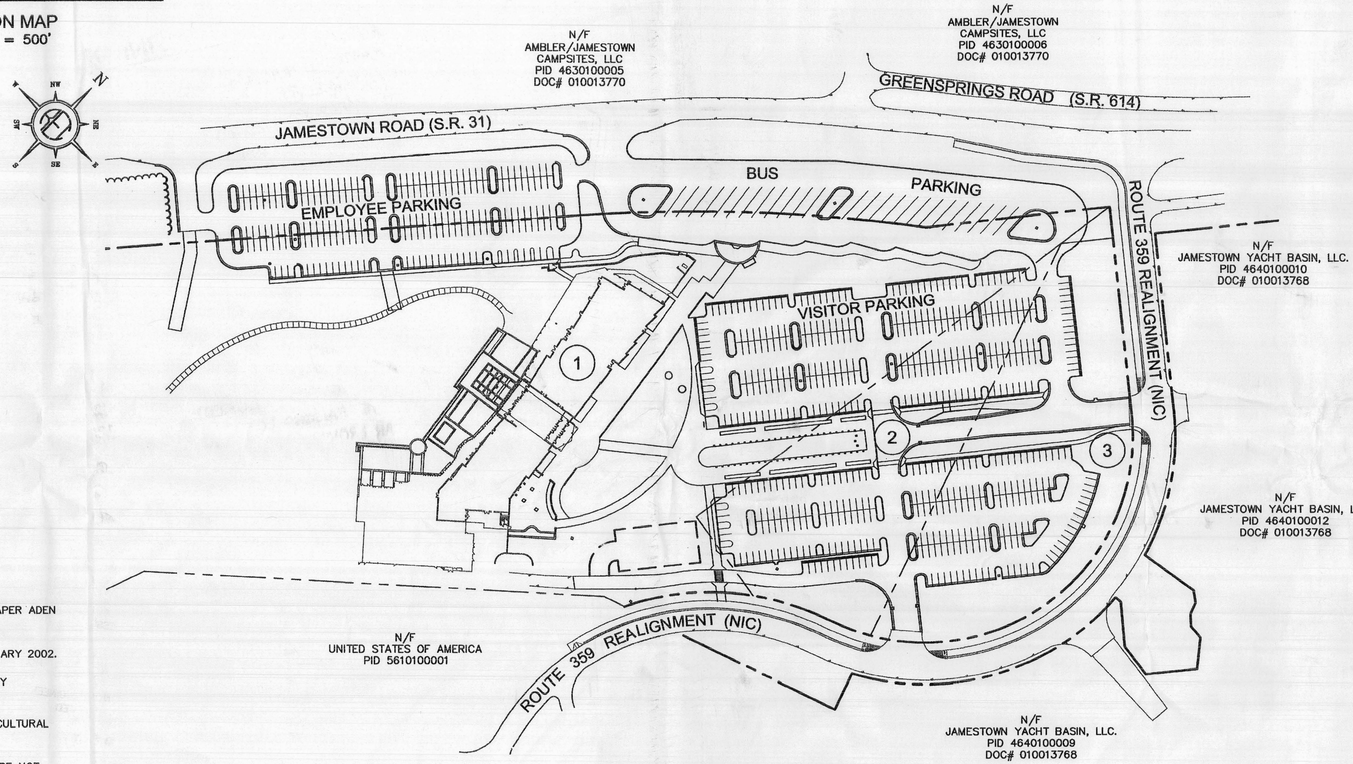
SITE AREA	29± ACRES
PARCEL ID NUMBERS:	
PARCEL ① – ZONED R8	4630100015
PARCEL ② – ZONED R8	4630100016
PARCEL ③ – ZONED B1R8	4640100009
WATER	PUBLIC WATER
SEWER	PUBLIC SEWER
DISTURBED AREA	15.09 ACRES
IMPERVIOUS AREA	7.28 ACRES
GREEN AREA	4.17 ACRES
PARKING SPACES	
VISITOR PARKING LOT:	532 TOTAL
CAR PROVIDED:	496
CAR OVERFLOW PROVIDED:	24
H/C PROVIDED (REQUIRED):	12(10)
EMPLOYEE PARKING LOT	208 TOTAL
CAR PROVIDED:	200
H/C PROVIDED(REQUIRED):	8(7)
BUS PROVIDED:	27

NOTES:

1. ENVIRONMENTAL IMPACT REVIEW ENVIRONMENTAL SITE ASSESSMENT PROVIDED BY DRAPER ADEN ASSOCIATES DATED FEBRUARY 26, 2001.
2. TOPOGRAPHIC INFORMATION PROVIDED BY RICKMOND ENGINEERING, INC. DATED FEBRUARY 2002.
3. REPORT OF SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING PROVIDED BY GEOTECHNICAL ENVIRONMENTAL TESTING SOLUTIONS, INC. DATED MARCH 22, 2002.
4. PHASE I CULTURAL RESOURCES INVESTIGATION PROVIDED BY ARCHAEOLOGICAL AND CULTURAL SOLUTIONS, INC. DATED JANUARY 2002.
5. THE EXISTENCE AND LOCATION (HORIZONTAL AND VERTICAL) OF EXISTING UTILITIES ARE NOT GUARANTEED AND SHALL BE FIELD VERIFIED BY THE CONTRACTOR.
6. THE SITE APPEARS TO BE LOCATED IN FLOOD ZONE "X" PER FEMA COMMUNITY–PANEL NUMBERS 510201 0040B AND 510201 0045B, DATED FEBRUARY 6, 1991.
7. THE RESPONSIBLE LAND DISTURBER, (RLD), FOR THIS PROJECT IS DONALD N. JENNINGS, P.E. OF RICKMOND ENGINEERING INC. UNTIL THE CONTRACT FOR LAND CLEARING IS AWARDED. AT THAT TIME, THE SITE CONTRACTOR SHALL BECOME THE RLD AND THE CONTRACTOR'S CERTIFICATION SHALL BE DELIVERED TO THE E&S CONTROL ADMINISTRATOR.
8. VDOT DOES NOT ASSUME RESPONSIBILITY FOR MAINTENANCE OF THE RETENTION POND OR ITS STRUCTURES, AND SHALL BE SAVED HARMLESS FROM ANY DAMAGE CAUSED BY FAILURE OF THE SAME.
9. VENDING STRUCTURE USE GROUP CLASSIFICATION B, VENDING STRUCTURE CONSTRUCTION TYPE 5B.

OWNER/DEVELOPER

JAMESTOWN–YORKTOWN FOUNDATION
P.O. BOX 1607
WILLIAMSBURG, VIRGINIA 23187



THE FOLLOWING CODES AND REGULATIONS APPLY TO STATE PROJECTS:

VIRGINIA UNIFORM STATEWIDE BUILDING CODE, 1996 EDITION WITH 2000 AMENDMENTS, VOLUME I (EXCEPT STANDARDS FOR THE DISABLED) INCLUDING THE REFERENCED MODEL CODES AND STANDARDS ADOPTED. SEE VUSBC SECTION 101.0 REFERENCE STANDARDS AND AMENDMENTS.

UNIFORM FEDERAL ACCESSIBILITY STANDARDS (UFAS) AND OTHER STANDARDS PROMULGATED BY THE U.S. DEPT. OF JUSTICE UNDER ADA–90

VIRGINIA UNIFORM STATEWIDE BUILDING CODE, 1996 EDITION WITH 2000 AMENDMENTS, VOLUME II INCLUDING THE REFERENCED MODEL CODES AND STANDARDS ADOPTED

CERTIFICATION OF TRADESMEN STANDARDS

APPLICABLE VIRGINIA DEPARTMENT OF TRANSPORTATION REGULATIONS

DEPT. OF CONSERVATION AND RECREATION – EROSION AND SEDIMENT CONTROL REGULATIONS (VR 625–02–00)

DEPT. OF CONSERVATION AND RECREATION – STORM WATER MANAGEMENT REGULATIONS (VR 215–02–00)

APPLICABLE DEPARTMENT OF HEALTH REGULATIONS

APPLICABLE DEPARTMENT OF ENVIRONMENTAL QUALITY, WATER DIVISION, REGULATIONS

JAMESTOWN SETTLEMENT

SITE PLAN

GRAPHIC SCALE

100 0 50 100 200 400
(IN FEET)
1 inch = 100 ft.

BEFORE DIGGING CALL "MISS UTILITY" OF VIRGINIA AT 1 - 800 - 552 - 7001

EROSION CONTROL APPROVAL NOTES

1. The DSWC must be notified one week prior to the pre-construction conference and one week prior to the commencement of land disturbing activity.
2. The approving state agency is responsible to ensure the implementation of the approved erosion and sediment control plans and compliance with the Virginia Erosion and Sediment Control Regulations.
3. Any significant alterations, modifications or deletions to the approved plan must be approved by the DSWC prior to implementation (unless emergency situation exists)

APPROVED
Erosion and Sediment Control Plan
DATE: 1/20/04 DSWC PROJECT # X05-JYF-02
REVIEWED: David L. Beale
APPROVED: David L. Beale
Virginia Division of Soil and Water Conservation

SCHEDULE OF DRAWINGS

SHEET NO.	TITLE
CIVIL	
T1	TITLE SHEET
C1	OVERALL PLAN
C1A	PHASING PLAN
C2	PHASE I E & S CONTROL PLAN
C3	PHASE I E & S CONTROL PLAN
C4	PHASE I E & S CONTROL PLAN
C5	PHASE I E & S CONTROL PLAN
D1	DEMOLITION PLAN
D2	DEMOLITION PLAN
D3	DEMOLITION PLAN
D4	DEMOLITION PLAN
C6	PHASE II E & S CONTROL PLAN
C7	PHASE II E & S CONTROL PLAN
C8	PHASE II E & S CONTROL PLAN
C9	PHASE II E & S CONTROL PLAN
C10	LAYOUT PLAN
C11	LAYOUT PLAN
C12	LAYOUT PLAN
C13	LAYOUT PLAN
C14	GRADING PLAN
C15	GRADING PLAN
C16	GRADING PLAN
C17	GRADING PLAN
C18	UTILITY PLAN
C19	UTILITY PLAN
C20	UTILITY PLAN
C21	UTILITY PLAN
C22	E & S CONTROL DETAILS
C23	E & S CONTROL DETAILS
C24	STORM WATER DETAILS
C25	STORM WATER MANAGEMENT
C26	PAVEMENT DETAILS
C27	PAVEMENT STRIPING PLAN
C28	SOILS MAP
C29	STORMCHAMBER DETAILS
LANDSCAPING	
L1	OVERALL LANDSCAPE PLAN
L2	LAYOUT PLAN
L3	LAYOUT PLAN
L4	GRADING PLAN
L5	GRADING PLAN
L–D1	DETAILS– CAFE ELEVATIONS
L–D2	DETAILS– GATES
L–D3	DETAILS– CAFE FENCE/ WALL
L–D3.A	DETAILS– SCREEN WALL ELEVATION
L–D4	DETAILS– WALLS/ COLUMNS
L–D5	DETAILS– GENERAL
L–D5.A	DETAILS– GENERAL
L–D6	DETAILS– VENDING STRUCTURE
L–D7	DETAILS– VENDING STRUCTURE
S–1	STRUCTURAL– VENDING STRUCTURE
L–P1	OVERALL PLANTING PLAN
L–P2	PLANTING PLAN
L–P3	PLANTING PLAN
L–P4	PLANTING PLAN
L–P5	PLANTING PLAN
L–P6	PLANTING DETAILS/ LEGEND
L–IR	IRRIGATION PLAN
ELECTRICAL	
E1	SITE LIGHTING PLAN
E2	SITE LIGHTING PLAN
E3	SITE LIGHTING PLAN
E4	SITE LIGHTING PLAN
E5	SITE LIGHTING PLAN
E6	DETAILS & SCHEDULES

COMMONWEALTH OF VIRGINIA
DONALD N. JENNINGS
No. 033030
10-27-03
PROFESSIONAL ENGINEER

"A Quality Control/Quality Assurance check has been made on this project's documents and corrections have been made. The undersigend states that these plans and specifications submitted for review are complete and ready for bidding."

Signed:
Martin C. Fisher, P.E.

LPDA
LAND PLANNING AND DESIGN ASSOCIATES
310 EAST MAIN STREET, SUITE 200
CHARLOTTESVILLE, VIRGINIA 22902
(804) 296-2108
www.lpda.net

J. Mosby West, P.E.
Engineer
P.O. Box 131, Irvington, Virginia 22480
Ph: (804) 438-6167 FAX: (804) 438-5275

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Vint Hill • P.O. Box 861647
Warrenton, VA 20187
Voice: (540)349-7730
Fax: (540)349-7731
www.rickmond.com

No.	By	Revision	App.	Date
		slip sheeted C2, C4, C9, C16, C20		1/20/04

JAMESTOWN ENTRANCE PLAZA AND PARKING LOT IMPROVEMENTS

Date: 10/27/03 Project No. 01198 Sheet No. T1

99147_JAMESTOWN_SETTLEMENT - 323

SHEET C2, C6, C10, C14, C18, D1

SHEET C3, C7, C11, C15, C19, D2

SHEET C5, C9, C13, C17, C21, D4

SHEET C4, C8, C12, C16, C20, D3

N/F
JAMESTOWN BEACH
CAMP SITES

GREENSPRINGS ROAD STATE ROUTE 614

JAMESTOWN ROAD STATE ROUTE 31
(VARIABLE WIDTH R/W)

JAMESTOWN ROAD STATE ROUTE 31
(VARIABLE WIDTH R/W)

DRY SWALE NO.1

EMPLOYEE
PARKING

JAMESTOWN ROAD R/W

BUS PARKING

BUS PARKING

ROUTE 359 REALIGNMENT (NIC)
(VARIABLE WIDTH R/W)

DRY SWALE NO.2

APPROXIMATE LOCATION OF
ARCHAEOLOGICAL SITE
44JC1084

VISITOR PARKING

VISITOR
PARKING

OVER FLOW
PARKING

DRY SWALE NO.3-A

DRY SWALE NO.3-B

ROUTE 359 REALIGNMENT (NIC) (VARIABLE WIDTH R/W)

ROUTE 359 REALIGNMENT (NIC) (VARIABLE WIDTH R/W)

ROUTE 359 R/W

N/F
UNITED STATES
OF AMERICA

N/F
JAMESTOWN
YACHT BASIN

50 0 50 100 150
Scale 1" = 50'

LEGEND

EXISTING	DESCRIPTION	NEW
	PROPERTY LINE	
o	IRON PIN OR ROD	
	EDGE OF PAVEMENT	
	SIDEWALK	
X X X	FENCE	X X X
o	TRAFFIC/STREET SIGN	o
20	INDEX CONTOURS	20
19	INTERMEDIATE CONTOURS	19
19.6	SPOT ELEVATIONS	TC 17.24
	DITCH	
	TOP OF BANK	
	BOTTOM OF BANK	
	UTILITY POLE	
UGE	UNDERGROUND ELECTRIC	
GAS	UNDERGROUND GAS	
SAN	SANITARY SEWER	
FM	SEWER FORCE MAIN	
T	TELEPHONE LINE	
	STORM SEWER	
	MANHOLE	
	DROP INLET	
W	WATERLINE	W
	FIRE HYDRANT	
	GATE VALVE	
ARV	AIR RELEASE VALVE	
	EVERGREEN TREE	
	DECIDUOUS TREE	
	TREELINE	
	NOT IN CONTRACT	NIC

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Fax: (757)229-4683 Fax: (540)349-7731
www.rickmond.com

Designed By: MJB
Drawn By: DAS
Scale: 1"=50'
Date: 10/27/03

COMMONWEALTH OF VIRGINIA
DONALD A. STRONG
No. 033030
10-27-03
REGISTERED PROFESSIONAL ENGINEER

No.	By	Revision	App.	Date

JAMESTOWN ENTRANCE PLAZA
AND PARKING LOT IMPROVEMENTS
STATE PN: 425-16133
OVERALL PLAN
JAMES CITY COUNTY VIRGINIA

Job Number	Sheet No.
01198	C1

99147_JAMESTOWN_SETTLEMENT - 324

MATCH LINE SEE SHEET C14

DEPRESSED ISLAND (SEE SHEET C24)

DEPRESSED ISLAND (SEE SHEET C24)

ROUTE 359 REALIGNMENT (NIC)
(VARIABLE WIDTH R/W)

MATCH LINE SEE SHEET C16

SEE LANDSCAPE PLANS FOR GRADING IN THIS AREA

Scale 1" = 30'

BEFORE DIGGING CALL "MISS UTILITY" OF VIRGINIA AT 1-800-552-7001

Job Number 01198

Sheet No. C15

JAMESTOWN ENTRANCE PLAZA AND PARKING LOT IMPROVEMENTS

STATE PN: 425-16133

GRADING PLAN

JAMES CITY COUNTY VIRGINIA

No.	By	Revision	App.	Date

COMMONWEALTH OF VIRGINIA
DONALD N. JENNINGS
No. 033030
10-27-03
PROFESSIONAL ENGINEER

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Voice: (540)349-7730
Fax: (540)349-7731
www.rickmond.com

Designed By:	Drawn By:	Scale:	Date:
MJB	DAS	1"=30'	10/27/03

MATCH LINE SEE SHEET C15

MATCH LINE SEE SHEET C17

DEPRESSED ISLAND (SEE SHEET C24)

DEPRESSED ISLAND (SEE SHEET C24)

DEPRESSED ISLAND (SEE SHEET C24)

DEPRESSED ISLAND (SEE SHEET C24)

Dry Swale #2 See Sht C25

Dry Swale 3A See Sht C25

Dry Swale 3B See Sheet C25 for details

MATCH GRADE AT ENTRANCE

ROUTE 359 REALIGNMENT (NIC) (VARIABLE WIDTH R/W)

35" TREE

12" POP

16" POP

10" TREE

DRAINAGE EASEMENT

APPROXIMATE LIMITS OF WETLANDS PER VDOT PROJ. 0359-047-101, PE-101, RW-201, C-501, DATED 8/24/02.

SEE LANDSCAPE PLANS FOR GRADING IN THIS AREA

30 0 30 60 90

Scale 1" = 30'

BEFORE DIGGING CALL "MISS UTILITY" OF VIRGINIA AT 1-800-552-7001

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www.rickmond.com

Designed By: MJB | Drawn By: DAS | Scale: 1"=30' | Date: 10/27/03

COMMONWEALTH OF VIRGINIA DONALD W. JENNINGS No. 033030 10-27-03 REGISTERED PROFESSIONAL ENGINEER

No.	By	Revision	App.	Date

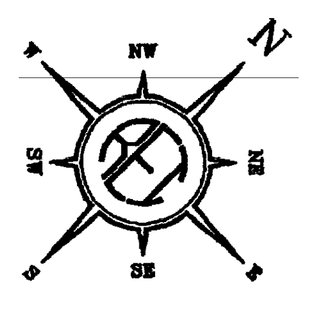
JAMESTOWN ENTRANCE PLAZA AND PARKING LOT IMPROVEMENTS

STATE PN: 425-16133

GRADING PLAN

JAMES CITY COUNTY VIRGINIA

Job Number	Sheet No.
01198	C16



STORM SEWER STRUCTURE TABLE

1-1	SEE DETAIL SHEET C25
1-1A	VDOT ES-1 INV=15.94
1-2	VDOT ES-1 INV=16.5
1-3	VDOT DI-1 RIM=19.23 INV=16.79
4-2	VDOT DI-1 RIM=14.42 INV(IN)=11.59 IN(OUT)=11.49
4-2A	VDOT MH-1 RIM=14.65 INV(OUT 10")=8.5 INV(IN SE)=11.43 INV(IN N)=11.80 INV(OUT NW)=11.43
4-2B	VDOT MH-1 RIM=15.80 INV(IN)=11.15 INV(OUT)=11.05
4-2C	VDOT MH-1 RIM=14.0 INV(IN)=10.81 INV(OUT)=9.79
4-3	VDOT DI-1 RIM=14.17 INV=11.60
4-4	VDOT DI-1 RIM=15.12 INV(IN)=12.23 INV(OUT)=12.13
4-4A	VDOT MH-1 RIM=16.80 INV(IN)=12.71 INV(OUT)=12.61
4-5	VDOT DI-1 RIM=15.57 INV=12.88
5-1	VDOT ES-1 INV=12.00
5-2	VDOT ES-1 INV=11.00
3-16	VDOT MH-1 RIM=17.63 INV=12.49

***NOTE:**

LAYOUT SHOWN IS BASED ON HYDROLOGIC SOLUTIONS' "STORMCHAMBER" PRODUCT. THE FOLLOWING MANUFACTURER'S PRODUCE AN EQUIVALENT PRODUCT THAT MAY BE USED AS A SUBSTITUTE: 1) CULTEC, INC. AND 2) STORM TECH, LLC.. IF EITHER OF THE ALTERNATE PRODUCTS ARE USED, THE CONTRACTOR SHALL ENSURE THAT A STORAGE VOLUME OF 13,504 CUBIC FEET IS PROVIDED IN THE MAIN STORAGE BAY (THIS IS A TOTAL VOLUME BASED ON STORAGE WITHIN THE CHAMBERS <u>AND</u> STORAGE IN THE VOIDS OF THE AGGREGATE USED). THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AN ALTERNATE LAYOUT IF THE CULTEC, INC. OR STORM TECH, LLC. PRODUCTS ARE SELECTED. CONTACT INFORMATION FOR EACH OF THE THREE APPROVED MANUFACTURERS IS PROVIDED IN SPECIFICATION SECTION 02630-1 "STORMCHAMBER SPECIFICATIONS."

BEFORE DIGGING CALL "MISS UTILITY"
OF VIRGINIA AT 1-800-552-7001

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Warrenton, VA 20187
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Fax: (540)349-7731
www.rickmond.com

Designed By:	Drawn By:	Scale:	Date:
MJB	DAS	1"=30'	10/27/03

DONALD K. JENNINGS
No. 033030
10-27-03

No.	By	Revision	App.	Date

JAMESTOWN ENTRANCE PLAZA AND PARKING LOT IMPROVEMENTS

STATE PN: 425-16133
UTILITY PLAN

JAMES CITY COUNTY VIRGINIA

Job Number	Sheet No.
01198	C18

MATCH LINE SEE SHEET C19

MATCH LINE SEE SHEET C21

185' OF 15" RCP @ 0.3%

128' OF 18" RCP @ 3%

175' OF 15" RCP @ 0.3%

EX. 10' JCSA WATER LINE EASEMENT

EXISTING 10' JCSA WATER LINE EASEMENT

25' OF 15" RCP @ 0.3%

SEE SHEET C25

87' OF 15" RCP @ 3%

222' OF 18" RCP @ 3%

201' OF 15" RCP @ 3%

140' OF 12" RCP @ 35%

176' OF 15" RCP @ 0.3%

87' OF 15" RCP @ 3%

8'X6'X26" VDOT CLASS I RIP RAP APRON

4'X6'X26" VDOT CLASS I RIP RAP APRON

4'X6'X26" VDOT CLASS I RIP RAP APRON

20' OF 18" RCP @ 0.3%

20' OF 18" RCP @ 0.0%

33' OF 18" RCP @ 0.0%

16' OF 18" RCP @ 0.0%

53' OF 15" RCP @ 3%

ROUTE 359 REALIGNMENT I(NIC) (VARIABLE WIDTH R/W)

DRAINAGE EASEMENT

APPROXIMATE LIMITS OF WETLANDS PER VDOT PROJ. 0359-047-101, PE-101, RW-201, C-501, DATED 8/24/02.

ELEC BOX

ELEC BOX

35" TREE

12" POP

16" POP

14" POP

10" TREE

8" POP

12" POP

16" POP

30 0 30 60 90

Scale 1" = 30'

STORM SEWER STRUCTURE TABLE

2-1 SEE DETAIL SHEET C25

2-1A VDOT MH-1
RIM=16.75
INV(IN)=7.72
INV(OUT)=7.62

2-1B VDOT MH-1
RIM=11.30
INV(IN)=7.02
INV(OUT)=6.92

2-1C VDOT MH-1
RIM=11.00
INV(IN)=6.66
INV(OUT)=6.19

2-3 VDOT DI-1
RIM=18.75
INV(IN)=14.28
INV(OUT)=14.18

2-4 VDOT DI-1
RIM=17.61
INV=14.67

3-1 SEE DETAIL SHEET C25

3-2 VDOT ES-1
INV=7.00

3-3 VDOT ES-1
INV=7.00

3-5 VDOT DI-1
RIM=13.64
INV(IN)=7.00
INV(OUT)=7.00

3-6 VDOT DI-1
RIM=11.64
INV(IN)=7.00
INV(OUT)=7.00

3-7 VDOT ES-1
INV=7.00

3-8 VDOT DI-1
RIM=14.50
INV(IN)=11.00
INV(OUT)=9.4

3-11 VDOT ES-1
INV=7.00

3-12 VDOT DI-1
RIM=12.66
INV(IN N)=10.31
INV(IN W)=10.31
INV(OUT)=7.06

3-13 VDOT DI-1
RIM=17.18
INV(IN)=11.18
INV(OUT)=10.98

3-14 VDOT DI-1
RIM=17.18
INV(IN)=11.35
INV(OUT)=11.25

3-15 VDOT DI-1
RIM=15.59
INV(IN)=11.98
INV(OUT)=11.88

3-17 VDOT DI-1
RIM=14.95
INV=10.80

BEFORE DIGGING CALL "MISS UTILITY" OF VIRGINIA AT 1-800-552-7001

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www.rickmond.com

Designed By: MJB
Drawn By: DAS
Scale: 1"=30'
Date: 10/27/03

COMMONWEALTH OF VIRGINIA DONALD V. RICKMOND No. 020809 PROFESSIONAL ENGINEER 10-27-03

No.	By	Revision	App.	Date

JAMESTOWN ENTRANCE PLAZA AND PARKING LOT IMPROVEMENTS

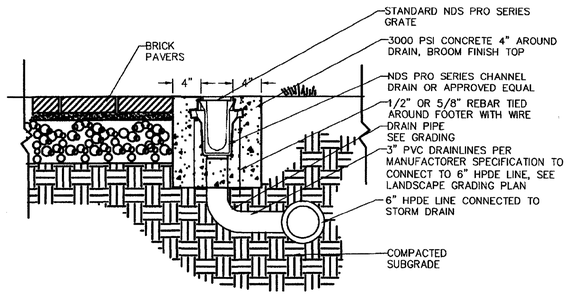
STATE PN: 425-16133
UTILITY PLAN

VIRGINIA
JAMES CITY COUNTY

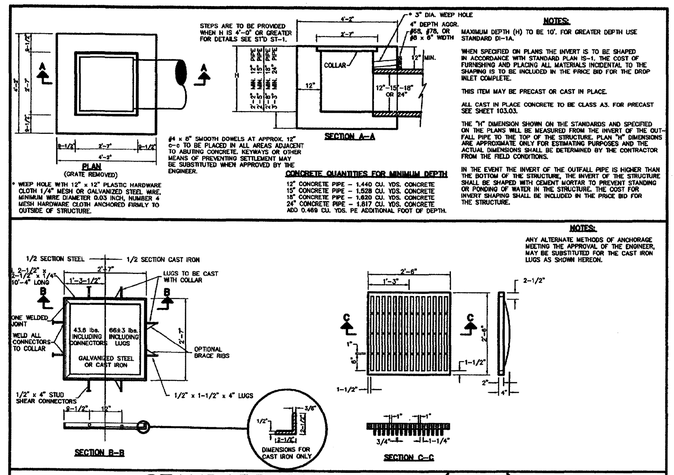
Job Number 01198

Sheet No. C20

99147_JAMESTOWN_SETTLEMENT - 328



TRENCH DRAIN



STANDARD DROP INLET (DI-1)
12" – 24" PIPE MAXIMUM DEPTH (H) = 10'

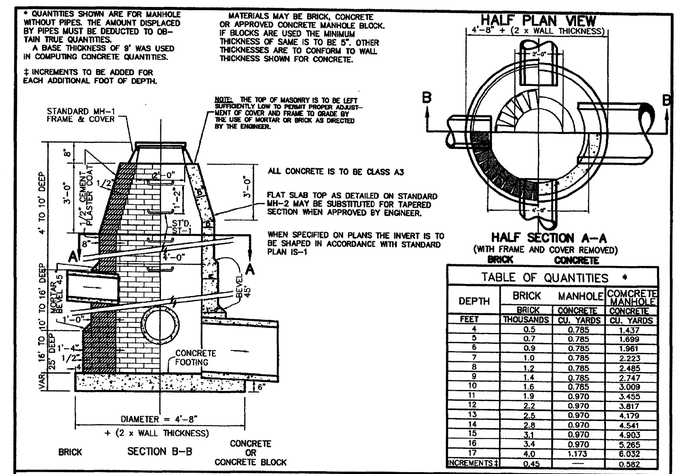
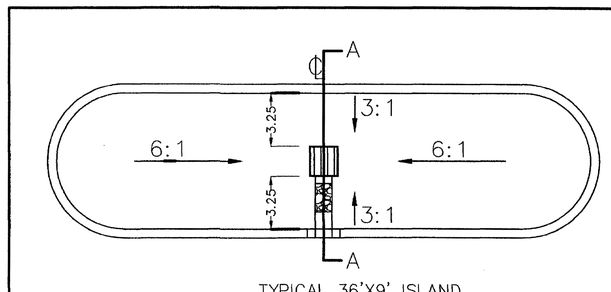


TABLE OF QUANTITIES *

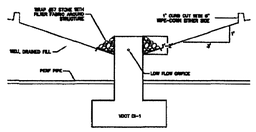
DEPTH	BRICK MANHOLE		CONCRETE MANHOLE	
	BRICK	CONCRETE	CONCRETE	
FEET	THOUSANDS	CU. YARDS	CU. YARDS	
4	0.5	0.785	1.437	
5	0.7	0.785	1.699	
6	0.9	0.785	1.961	
7	1.0	0.785	2.223	
8	1.2	0.785	2.485	
9	1.4	0.785	2.747	
10	1.6	0.785	3.009	
11	1.9	0.970	3.455	
12	2.2	0.970	3.817	
13	2.5	0.970	4.179	
14	2.8	0.970	4.541	
15	3.1	0.970	4.903	
16	3.4	0.970	5.265	
17	4.0	1.173	6.032	
INCREMENTS ‡	0.45	—	0.582	

MANHOLE FOR 12"–48" PIPE CULVERTS (MH-1)

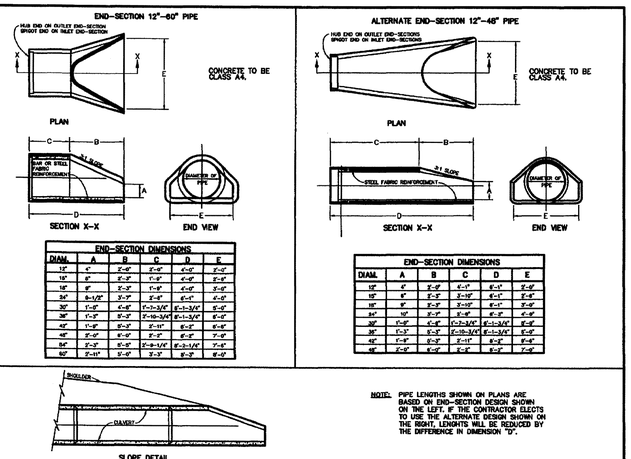


TYPICAL 36'X9' ISLAND

TYPICAL DEPRESSED ISLAND DETAIL
NTS



SECTION A–A
NTS



END-SECTION DIMENSIONS

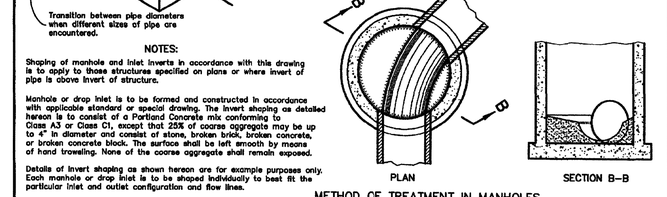
DIAM.	A	B	C	D	E
12"	4"	2'-6"	2'-0"	4'-0"	2'-6"
15"	6"	2'-7"	1'-9"	4'-0"	2'-6"
18"	8"	2'-7"	1'-9"	4'-0"	2'-6"
24"	8-1/2"	3'-7"	2'-6"	4'-0"	4'-0"
30"	1'-0"	4'-8"	1'-1-3/4"	5'-1-3/4"	5'-0"
36"	1'-0"	5'-8"	1'-10-3/4"	6'-1-3/4"	5'-0"
42"	1'-0"	6'-8"	2'-11"	6'-2"	7'-0"
48"	1'-0"	7'-8"	3'-1"	6'-2"	7'-0"
54"	1'-0"	8'-8"	3'-4-1/2"	6'-3-1/2"	7'-0"
60"	1'-0"	9'-8"	3'-7"	6'-3"	7'-0"

END-SECTION DIMENSIONS

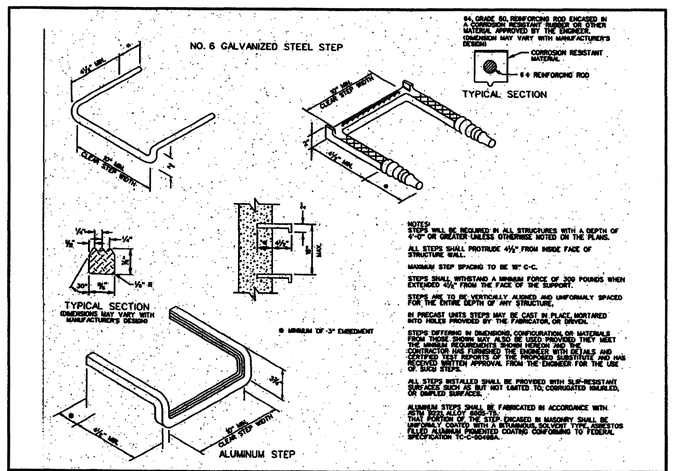
DIAM.	A	B	C	D	E
12"	4"	2'-6"	2'-0"	4'-0"	2'-6"
15"	6"	2'-7"	1'-9"	4'-0"	2'-6"
18"	8"	2'-7"	1'-9"	4'-0"	2'-6"
24"	8-1/2"	3'-7"	2'-6"	4'-0"	4'-0"
30"	1'-0"	4'-8"	1'-1-3/4"	5'-1-3/4"	5'-0"
36"	1'-0"	5'-8"	1'-10-3/4"	6'-1-3/4"	5'-0"
42"	1'-0"	6'-8"	2'-11"	6'-2"	7'-0"
48"	1'-0"	7'-8"	3'-1"	6'-2"	7'-0"

NOTE: PIPE LENGTHS SHOWN ON PLANS ARE BASED ON END-SECTION DESIGN SHOWN ON THE LEFT. IF THE CONTRACTOR ELECTS TO USE THE ALTERNATE DESIGN SHOWN ON THE RIGHT, LENGTHS WILL BE REDUCED BY THE DIFFERENCE IN DIMENSION "D".

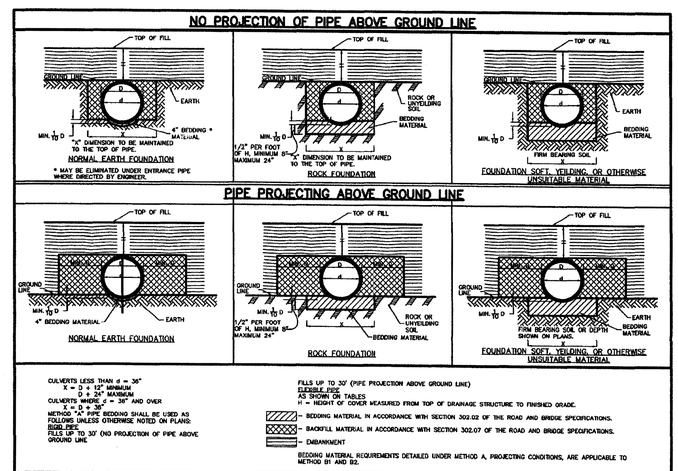
FLARED END–SECTIONS FOR CONCRETE PIPE CULVERTS (ES-1)



STANDARD METHOD OF SHAPING MANHOLE & INLET INVERTS IS-1



STANDARD STEP



INSTALLATION OF PIPE CULVERTS AND STORM SEWERS
PIPE BEDDING – METHOD "A" (FILLS UP TO 30')

Rickmond Engineering, Inc.
Engineering Surveying Land Planning
1643 Merrimac Trail Williamsburg, VA 23185
Voice: (757)229-4676 Fax: (757)229-4685
Vint Hill • P.O. Box 861647 Warrenton, VA 20187
Voice: (540)349-7730 Fax: (540)349-7731
www.rickmond.com

Designed By: KMJ | Drawn By: RJH | Scale: AS NOTED | Date: 10/27/03

COMMONWEALTH OF VIRGINIA — DONALD KEITH MARTIN — No. 022030 — PROFESSIONAL ENGINEER — No. 27-03

No.	By	Revision	Date	App.

JAMESTOWN:
ENTRANCE PLAZA/PARKING LOT IMPROVEMENTS
STATE PN: 425-16133
STORMWATER DETAILS
JAMES CITY COUNTY VIRGINIA

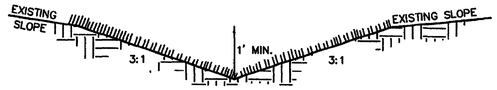
Job Number	Sheet No.
01198	C24

GENERAL NOTES

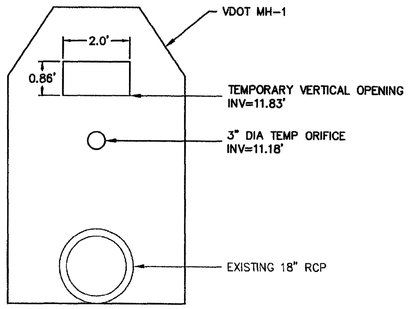
1. ALL CONSTRUCTION SHALL CONFORM TO CURRENT COUNTY AND/OR VDOT STANDARDS AND SPECIFICATIONS UNLESS OTHERWISE SPECIFIED.
2. CONTRACTOR SHALL SECURE THE LATEST EDITION OF THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK AND COMPLY WITH ALL COUNTY REQUIREMENTS FOR EROSION AND SEDIMENT CONTROL.
3. ALL CUTS, VEGETATION AND DELETERIOUS MATERIAL ENCOUNTERED SHALL BE REMOVED AND DISPOSED OF OFF SITE.
4. SELECT MATERIAL IS REQUIRED FOR FILL AND BACKFILL UNDER PARKING LOT, FOOTINGS, AND STRUCTURES. IT SHALL BE PLACED IN LAYERS NOT TO EXCEED EIGHT INCHES (8") IN THICKNESS AND COMPACTED TO 95% OF MAXIMUM DENSITY AS DETERMINED BY ASTM D-698.
5. ALL GREEN AREA, WITHIN LIMITS OF CONSTRUCTION, TO BE TOPSOILED, FERTILIZED, SEEDED, AND MULCHED.
6. CONTRACTOR SHALL OBTAIN AT HIS OWN EXPENSE, ANY PERMIT OR BOND IF REQUIRED BY ANY GOVERNMENT AGENCY PRIOR TO CONSTRUCTION.
7. CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING, PROTECTING, AND RESOLVING ANY CONFLICTS WITH EXISTING UTILITIES AND SHALL REPAIR, AT HIS OWN EXPENSE, ALL UTILITIES TO BE RELOCATED OR DAMAGED BY CONSTRUCTION.
8. ANY ERRORS OR DISCREPANCIES SHALL BE REPORTED TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.
9. DEWATERING OR EXCAVATION, IF NEEDED, IS PART OF THIS CONTRACT.
10. BEFORE DIGGING CALL "MISS UTILITY" OF VIRGINIA 1-800-552-7001.
11. CONTRACTOR SHALL OBTAIN PERMITS FROM THE STATE HIGHWAY DEPARTMENT PRIOR TO ANY WORK IN THE STATE'S RIGHT-OF-WAY. THE CONTRACTOR SHALL RESTORE AND CLEAN UP THE SITE TO THE SATISFACTION OF THE HIGHWAY DEPARTMENT.

CONSTRUCTION SEQUENCE FOR CONVERTING SEDIMENT TRAP/BASIN TO DRY SWALE

1. SEDIMENT TRAP/BASIN SHALL REMAIN IN OPERATION UNTIL ALL MAJOR LAND DISTURBING ACTIVITIES HAVE BEEN COMPLETED AND THE SITE HAS BEEN STABILIZED.
2. CONTRACTOR SHALL EXCAVATE ANY ACCUMULATED SEDIMENT AND DISPOSE OF IN A LAWFUL MANNER.
3. ADDITIONAL EXCAVATION BELOW THE SEDIMENT TRAP BOTTOM WILL BE REQUIRED TO INSTALL THE UNDERDRAIN PIPING AND WELL DRAINED FILL PER THE DETAIL ON SHEET C25 (MATERIAL DESCRIPTION IS ALSO PROVIDED ON THIS SHEET).
4. THE POND BOTTOM AND ANY OTHER DENUDED AREAS IN THE DRY SWALES SHALL BE SEEDED IMMEDIATELY.



GRASS DITCH-JAMESTOWN RD BETWEEN STRUCTURES 1-1A AND 5-2

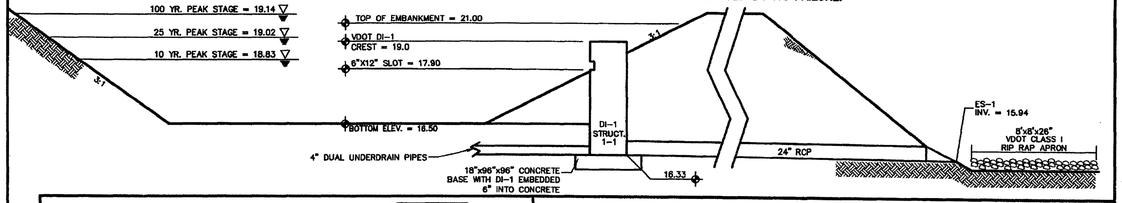


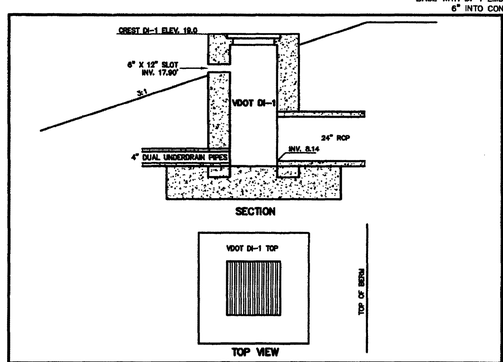
STRUCTURE 4-2C - TEMPORARY FLOW CONTROLS

NOT TO SCALE

INTERIOR SIDE SLOPES TO BE LINED WITH SOIL STABILIZATION MATTING TREATMENT - 1 AT THE TIME OF CONSTRUCTION AS A SEDIMENT TRAP.

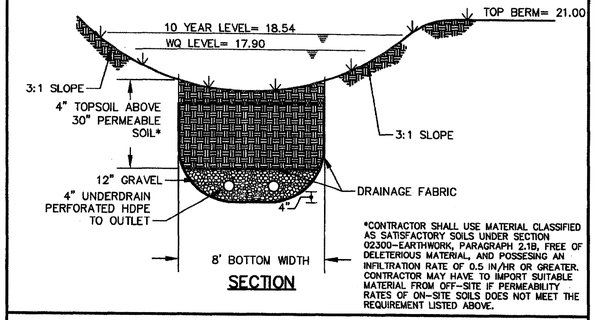
VDOT DOES NOT ASSUME RESPONSIBILITY FOR MAINTENANCE OF THE DRY SWALE OR ITS STRUCTURES, AND SHALL BE SAVED HARMLESS FOR ANY DAMAGES CAUSED BY ITS FAILURE.





DRY SWALE NO. 1 OUTLET STRUCTURE

NOT TO SCALE



*CONTRACTOR SHALL USE MATERIAL CLASSIFIED AS SATISFACTORY SOILS UNDER SECTION 02300-EARTHWORK, PARAGRAPH 2.1B, FREE OF DELETERIOUS MATERIAL, AND POSSESING AN INFILTRATION RATE OF 0.5 IN/HR OR GREATER. CONTRACTOR MAY HAVE TO IMPORT SUITABLE MATERIAL FROM OFF-SITE IF PERMEABILITY RATES OF ON-SITE SOILS DOES NOT MEET THE REQUIREMENT LISTED ABOVE.

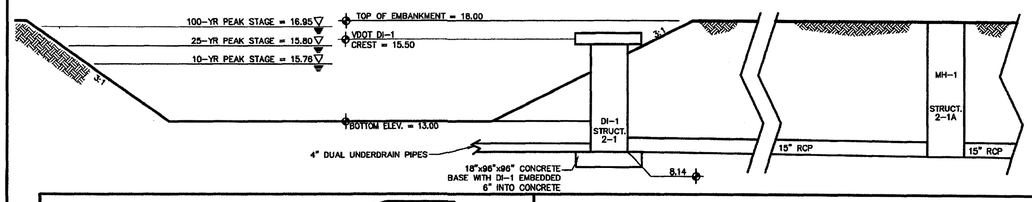
DRY SWALE CROSS SECTION

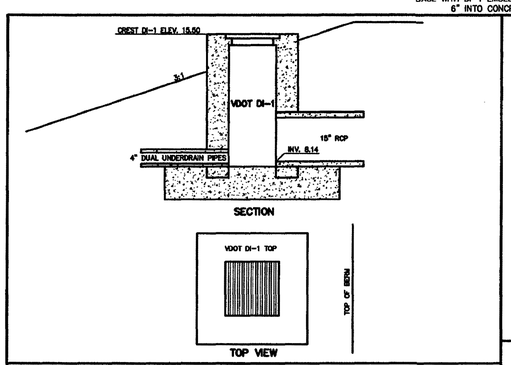
NOT TO SCALE

DRY SWALE NO. 1

INTERIOR SIDE SLOPES TO BE LINED WITH SOIL STABILIZATION MATTING TREATMENT - 1 AT THE TIME OF CONSTRUCTION AS A SEDIMENT TRAP.

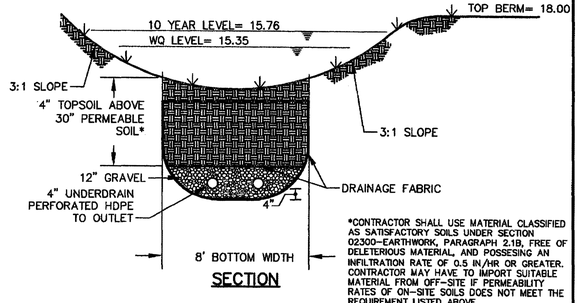
VDOT DOES NOT ASSUME RESPONSIBILITY FOR MAINTENANCE OF THE DRY SWALE OR ITS STRUCTURES, AND SHALL BE SAVED HARMLESS FOR ANY DAMAGES CAUSED BY ITS FAILURE.





DRY SWALE NO. 2 OUTLET STRUCTURE

NOT TO SCALE



*CONTRACTOR SHALL USE MATERIAL CLASSIFIED AS SATISFACTORY SOILS UNDER SECTION 02300-EARTHWORK, PARAGRAPH 2.1B, FREE OF DELETERIOUS MATERIAL, AND POSSESING AN INFILTRATION RATE OF 0.5 IN/HR OR GREATER. CONTRACTOR MAY HAVE TO IMPORT SUITABLE MATERIAL FROM OFF-SITE IF PERMEABILITY RATES OF ON-SITE SOILS DOES NOT MEET THE REQUIREMENT LISTED ABOVE.

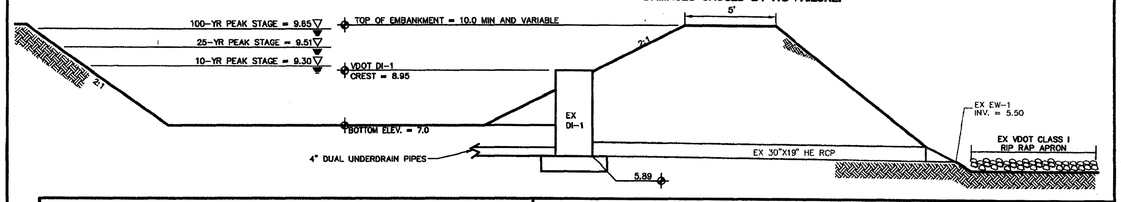
DRY SWALE CROSS SECTION

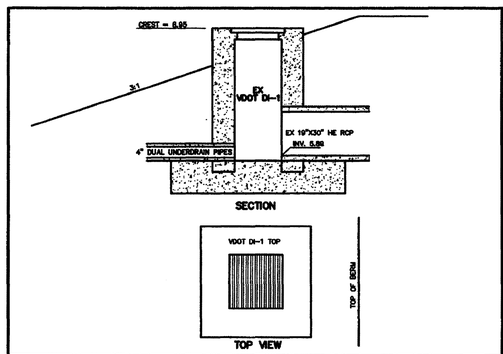
NOT TO SCALE

DRY SWALE NO. 2

INTERIOR SIDE SLOPES TO BE LINED WITH SOIL STABILIZATION MATTING TREATMENT - 1 AT THE TIME OF CONSTRUCTION AS A SEDIMENT BASIN.

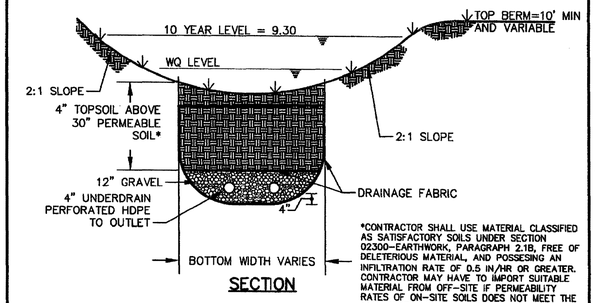
VDOT DOES NOT ASSUME RESPONSIBILITY FOR MAINTENANCE OF THE DRY SWALE OR ITS STRUCTURES, AND SHALL BE SAVED HARMLESS FOR ANY DAMAGES CAUSED BY ITS FAILURE.





DRY SWALE NO. 3 OUTLET STRUCTURE

NOT TO SCALE



*CONTRACTOR SHALL USE MATERIAL CLASSIFIED AS SATISFACTORY SOILS UNDER SECTION 02300-EARTHWORK, PARAGRAPH 2.1B, FREE OF DELETERIOUS MATERIAL, AND POSSESING AN INFILTRATION RATE OF 0.5 IN/HR OR GREATER. CONTRACTOR MAY HAVE TO IMPORT SUITABLE MATERIAL FROM OFF-SITE IF PERMEABILITY RATES OF ON-SITE SOILS DOES NOT MEET THE REQUIREMENT LISTED ABOVE.

DRY SWALE CROSS SECTION

NOT TO SCALE

DRY SWALE NO. 3

Rickmond Engineering, Inc.
Engineering Surveying Land Planning
1643 Merrimac Trail Vint Hill • P.O. Box 861647
Williamsburg, VA 23185 Warrenton, VA 20187
Voice: (757)229-4676 Voice: (540)349-7730
Fax: (757)229-4683 Fax: (540)349-7731
www.rickmond.com

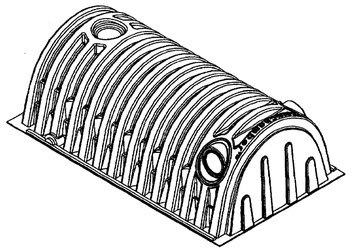
Designed By: KMJ | Drawn By: RJH | Scale: AS NOTED | Date: 10/27/03

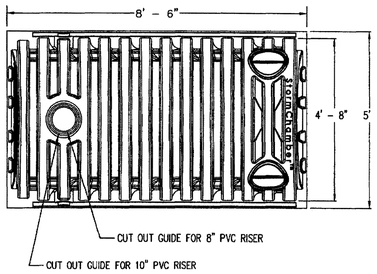
COMMONWEALTH OF VIRGINIA CHARLES K. JENNINGS No. 033090 PROFESSIONAL ENGINEER 10-27-03

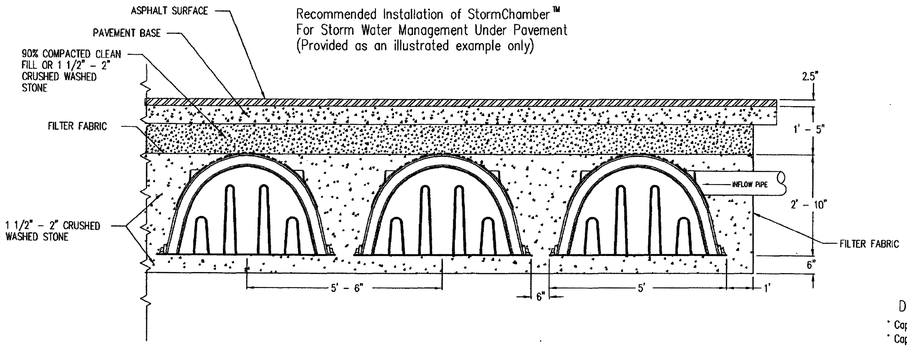
No.	By	Revision	Date	App.

JAMESTOWN:
ENTRANCE PLAZA/PARKING LOT IMPROVEMENTS
STATE PN: 425-16133
STORMWATER MANAGEMENT DETAILS
JAMES CITY COUNTY VIRGINIA

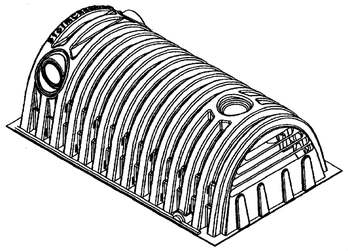
Job Number	Sheet No.
01198	C25

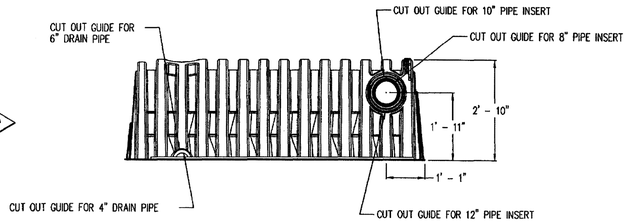


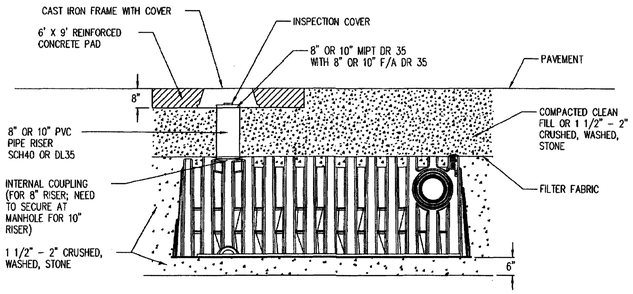




Recommended Installation of StormChamber™
For Storm Water Management Under Pavement
(Provided as an illustrated example only)

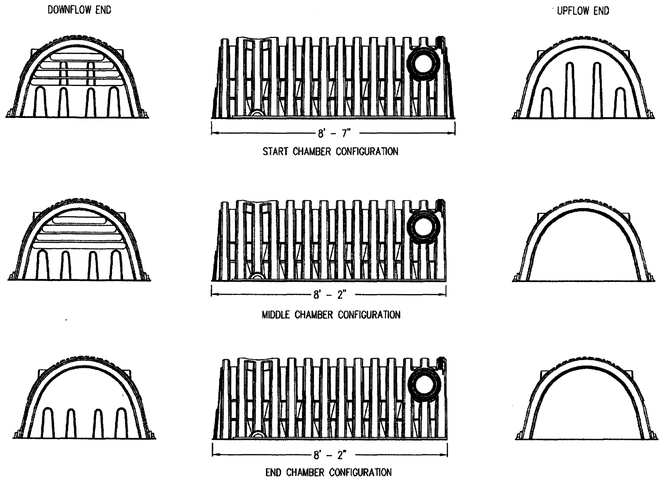






CLEAN OUT AND/OR INSPECTION WELL

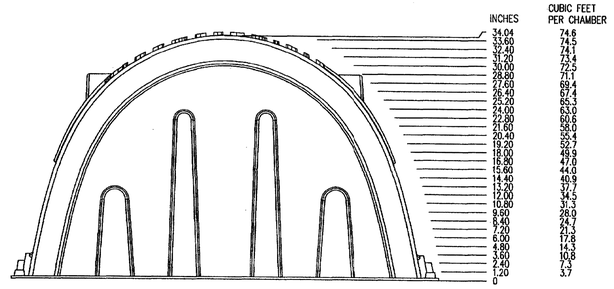
LAY-UP LENGTHS



INFILTRATION VERSUS OTHER STORMWATER BMPs
(AS MEAN PERCENT REMOVAL)

POLLUTANT PARAMETER	INFILTRATION	WETLAND	WATER QUALITY POND	FILTERING SYSTEM	WATER QUALITY SWALE
Total Phosphorus	65	51	45.5	45	14.5
Total Nitrogen	82.5	20.9	30	32	10.5
Lead	98	63	66.5	71	50
Zinc	99	53.5	50.5	69	49
Total Suspended Solids	88.5	78	70	81	66
Organic Carbon	82	28	35	57	23

Source: Brown, Whitney, Schueler, Thomas, 1997. National Pollutant Removal Performance Database for Stormwater BMPs.
Prepared for the Chesapeake Research Coonsortium. Center for Watershed Protection. Ellicott City, Maryland.



CHAMBER VOLUME MEASURED IN CUBIC FEET

For nearest distributor contact:

HydroLogic SOLUTIONS*

P.O.Box 672 Occoquan, Virginia 22125
TOLL FREE: 1-877-426-9128 FAX: (703) 491-9656
e-mail: hydrologic.solutions@erols.com

*NOTE:

DETAILS SHOWN ON THIS SHEET ARE FOR HYDROLOGIC SOLUTIONS "STORMCHAMBER" PRODUCT ONLY. SEE SHEET C18 FOR ALTERNATE MANUFACTURERS.

Design Notes:

- Capacity of void provided by stone is calculated at 40%
- Capacity of StormChamber™ is 10 cu. ft. per linear foot
- Design unit capacity is 13.33 cu. ft. per linear foot
- Total stone required per linear foot is 8.33 cu. ft.
- Total design storage capacity per chamber at lay up length is 100.5 cu.ft.

BURIAL REQUIREMENTS

A. 1 1/2" - 2" Crushed, Washed Stone Base, Minimum.	6"
B. 1 1/2" - 2" Crushed Washed Stone to Top of Chambers and Cover with Filter Fabric.	34"
C. 90% Compacted Clean Fill Cover or 1 1/2"-2" Crushed Washed Stone Top of Chamber to Grade for Non-Trafficked, H-10 Installations, Minimum.	12"
D. 90% Compacted Clean Fill Cover or 1 1/2"-2" Crushed Washed Stone Top of Chamber to Grade Under 2 1/2" of Pavement for H-20 Trafficked Installations, Minimum.	17"
E. 90% Compacted Clean Fill Cover or 1 1/2" - 2" Crushed Washed Stone Top of Chamber to Grade for Unpaved H-20 Trafficked installations, Minimum.	18"

Engineering Specifications for StormChamber™

Each unit will be 34.04" high, 60" wide and 102.5" long.

Lay-up length is 97.1" (start and end unit) and 91.1" (middle unit).

Each chamber will be formed from high molecular weight/high density polyethylene.

Use of filter fabric between the soil and stone backfill layer and lining the side walls of the excavated area is required to prevent intrusion of soil or silt into the chambers and surrounding stone.

Each chamber has 14 ribs of approximately 3.6" in height, 3.8" wide at the top and tapering to 4.4" at the bottom. Spacing of the ribs at the bottom of the chamber is approximately 4.9" and approximately 3.2" at the top. One smaller rib sized dimensionally to effectively nest under and interlock to connect units is 2.9" high, 3.3" wide at the top of rib, and 4.1" wide at the base.

Overall height to the inside rib is 30.44".
Overall height to the outside rib is 34.04".

Invert height for 12" pipe is 16.49".
Invert height for 10" pipe is 17.49".
Invert height for 8" pipe is 18.49".

Each unit has the ability to accept up to a 12" feed pipe in the unit's side portal.

Each unit is designed to handle 10 cubic feet of storage per lineal foot, for a total of 85.42 cubic feet.

Stone diameter will be 1.5"- 2".

Rickmond Engineering, Inc.
Engineering Surveying Land Planning
1643 Merrimac Trail Vint Hill • P.O. Box 861647
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Voice: (757)229-1776 Voice: (540)349-7330
Fax: (757)229-4683 Fax: (540)349-7731
www.rickmond.com

Designed By: KMJ | Drawn By: RJH | Scale: AS NOTED | Date: 10/27/03

COMMONWEALTH OF VIRGINIA — DONALD R. RICKMOND — No. 035030 — PROFESSIONAL ENGINEER — 10-27-03

No.	By	Revision	App.	Date

JAMESTOWN:
ENTRANCE PLAZA/PARKING LOT IMPROVEMENTS
STATE PN: 425-16133
STORMCHAMBER DETAILS
JAMES CITY COUNTY VIRGINIA

Job Number 01198 | Sheet No. C29

JAMESTOWN ENTRANCE PLAZA AND PARKING LOT IMPROVEMENTS

PROJECT CODE NUMBER: 425–16133
JAMES CITY COUNTY, VIRGINIA

VICINITY MAP
SCALE: 1" = 2000'

LOCATION MAP
SCALE: 1" = 500'

STATISTICAL INFORMATION

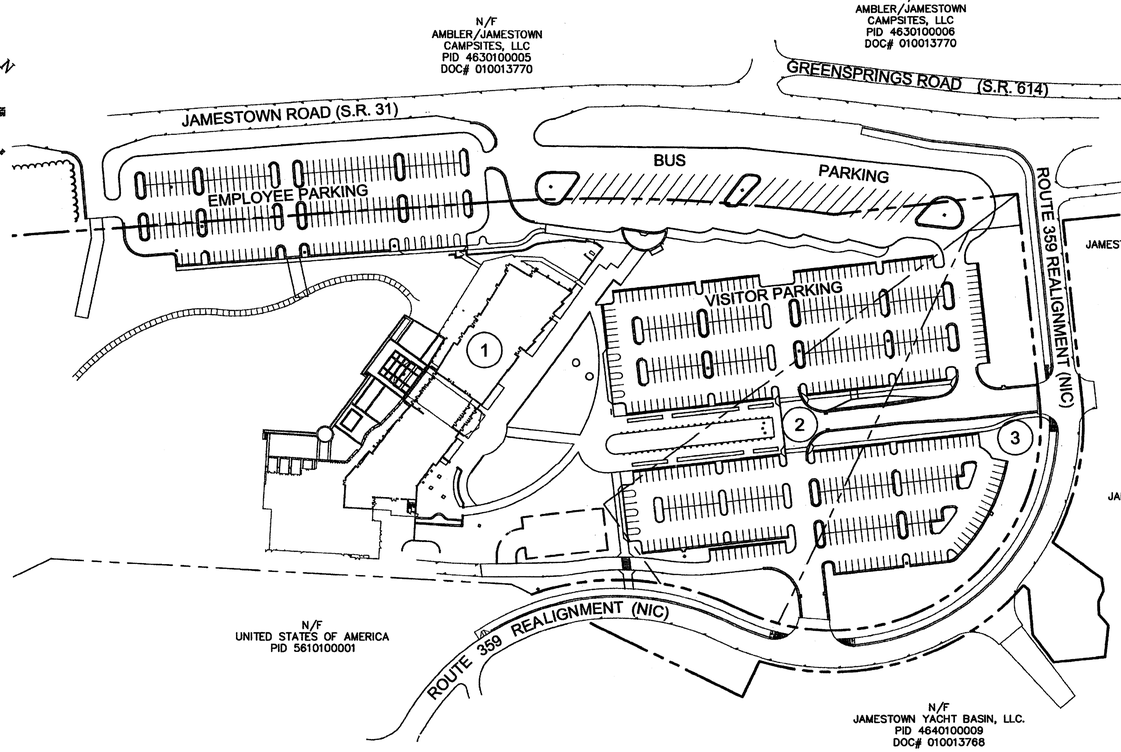
SITE AREA	29± ACRES
PARCEL ID NUMBERS:	
PARCEL ① – ZONED R8	4630100015
PARCEL ② – ZONED R8	4630100016
PARCEL ③ – ZONED B1R8	4640100009
WATER	PUBLIC WATER
SEWER	PUBLIC SEWER
DISTURBED AREA	15.09 ACRES
IMPERVIOUS AREA	7.28 ACRES
GREEN AREA	4.17 ACRES
PARKING SPACES	
VISITOR PARKING LOT:	532 TOTAL
CAR PROVIDED:	496
CAR OVERFLOW PROVIDED:	24
H/C PROVIDED (REQUIRED):	12(10)
EMPLOYEE PARKING LOT	208 TOTAL
CAR PROVIDED:	200
H/C PROVIDED(REQUIRED):	8(7)
BUS PROVIDED:	27

NOTES:

1. ENVIRONMENTAL IMPACT REVIEW ENVIRONMENTAL SITE ASSESSMENT PROVIDED BY DRAPER ADEN ASSOCIATES DATED FEBRUARY 26, 2001.
2. TOPOGRAPHIC INFORMATION PROVIDED BY RICKMOND ENGINEERING, INC. DATED FEBRUARY 2002.
3. REPORT OF SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING PROVIDED BY GEOTECHNICAL ENVIRONMENTAL TESTING SOLUTIONS, INC. DATED MARCH 22, 2002.
4. PHASE I CULTURAL RESOURCES INVESTIGATION PROVIDED BY ARCHAEOLOGICAL AND CULTURAL SOLUTIONS, INC. DATED JANUARY 2002.
5. THE EXISTENCE AND LOCATION (HORIZONTAL AND VERTICAL) OF EXISTING UTILITIES ARE NOT GUARANTEED AND SHALL BE FIELD VERIFIED BY THE CONTRACTOR.
6. THE SITE APPEARS TO BE LOCATED IN FLOOD ZONE "X" PER FEMA COMMUNITY–PANEL NUMBERS 510201 0040B AND 510201 0045B, DATED FEBRUARY 6, 1991.
7. THE RESPONSIBLE LAND DISTURBER, (RLD), FOR THIS PROJECT IS DONALD N. JENNINGS, P.E. OF RICKMOND ENGINEERING INC. UNTIL THE CONTRACT FOR LAND CLEARING IS AWARDED. AT THAT TIME, THE SITE CONTRACTOR SHALL BECOME THE RLD AND THE CONTRACTOR'S CERTIFICATION SHALL BE DELIVERED TO THE E&S CONTROL ADMINISTRATOR.
8. VDOT DOES NOT ASSUME RESPONSIBILITY FOR MAINTENANCE OF THE RETENTION POND OR ITS STRUCTURES, AND SHALL BE SAVED HARMLESS FROM ANY DAMAGE CAUSED BY FAILURE OF THE SAME.
9. VENDING STRUCTURE USE GROUP CLASSIFICATION B, VENDING STRUCTURE CONSTRUCTION TYPE 5B.

OWNER/DEVELOPER

JAMESTOWN–YORKTOWN FOUNDATION
P.O. BOX 1607
WILLIAMSBURG, VIRGINIA 23187



THE FOLLOWING CODES AND REGULATIONS APPLY TO STATE PROJECTS:

VIRGINIA UNIFORM STATEWIDE BUILDING CODE, 1996 EDITION WITH 2000 AMENDMENTS, VOLUME I (EXCEPT STANDARDS FOR THE DISABLED) INCLUDING THE REFERENCED MODEL CODES AND STANDARDS ADOPTED. SEE VUSBC SECTION 101.0 REFERENCE STANDARDS AND AMENDMENTS.

UNIFORM FEDERAL ACCESSIBILITY STANDARDS (UFAS) AND OTHER STANDARDS PROMULGATED BY THE U.S. DEPT. OF JUSTICE UNDER ADA–90

VIRGINIA UNIFORM STATEWIDE BUILDING CODE, 1996 EDITION WITH 2000 AMENDMENTS, VOLUME II INCLUDING THE REFERENCED MODEL CODES AND STANDARDS ADOPTED

CERTIFICATION OF TRADESMEN STANDARDS

APPLICABLE VIRGINIA DEPARTMENT OF TRANSPORTATION REGULATIONS

DEPT. OF CONSERVATION AND RECREATION – EROSION AND SEDIMENT CONTROL REGULATIONS (VR 625–02–00)

DEPT. OF CONSERVATION AND RECREATION – STORM WATER MANAGEMENT REGULATIONS (VR 215–02–00)

APPLICABLE DEPARTMENT OF HEALTH REGULATIONS

APPLICABLE DEPARTMENT OF ENVIRONMENTAL QUALITY, WATER DIVISION, REGULATIONS

JAMESTOWN SETTLEMENT

SITE PLAN

GRAPHIC SCALE

100 0 50 100 200 400
(IN FEET)
1 inch = 100 ft.

BEFORE DIGGING CALL "MISS UTILITY" OF VIRGINIA AT 1 - 800 - 552 - 7001

EROSION CONTROL APPROVAL NOTES

1. The owner and the contractor shall agree to the pre-construction conference prior to any land disturbing activities.
2. The approved erosion and sediment control plan must be available at the project site.
3. Any additional measures or modifications to the approved plan as required by the E&S plan official (inspector, engineer, consultant, county).

APPROVED
Erosion and Sediment Control Plan
1/20/04 Y-05-YC-02
REVIEWED: David L. Beale
APPROVED: David L. Beale
Virginia Department of Conservation and Recreation

SCHEDULE OF DRAWINGS

SHEET NO.	TITLE
CIVIL	
T1	TITLE SHEET
C1	OVERALL PLAN
C1A	PHASING PLAN
C2	PHASE I E & S CONTROL PLAN
C3	PHASE I E & S CONTROL PLAN
C4	PHASE I E & S CONTROL PLAN
C5	PHASE I E & S CONTROL PLAN
D1	DEMOLITION PLAN
D2	DEMOLITION PLAN
D3	DEMOLITION PLAN
D4	DEMOLITION PLAN
C6	PHASE II E & S CONTROL PLAN
C7	PHASE II E & S CONTROL PLAN
C8	PHASE II E & S CONTROL PLAN
C9	PHASE II E & S CONTROL PLAN
C10	LAYOUT PLAN
C11	LAYOUT PLAN
C12	LAYOUT PLAN
C13	LAYOUT PLAN
C14	GRADING PLAN
C15	GRADING PLAN
C16	GRADING PLAN
C17	GRADING PLAN
C18	UTILITY PLAN
C19	UTILITY PLAN
C20	UTILITY PLAN
C21	UTILITY PLAN
C22	E & S CONTROL DETAILS
C23	E & S CONTROL DETAILS
C24	STORM WATER DETAILS
C25	STORM WATER MANAGEMENT
C26	PAVEMENT DETAILS
C27	PAVEMENT STRIPING PLAN
C28	SOILS MAP
C29	STORMCHAMBER DETAILS
LANDSCAPING	
L1	OVERALL LANDSCAPE PLAN
L2	LAYOUT PLAN
L3	LAYOUT PLAN
L4	GRADING PLAN
L5	GRADING PLAN
L–D1	DETAILS– CAFE ELEVATIONS
L–D2	DETAILS– GATES
L–D3	DETAILS– CAFE FENCE/ WALL
L–D3.A	DETAILS– SCREEN WALL ELEVATION
L–D4	DETAILS– WALLS/ COLUMNS
L–D5	DETAILS– GENERAL
L–D5.A	DETAILS– GENERAL
L–D6	DETAILS– VENDING STRUCTURE
L–D7	DETAILS– VENDING STRUCTURE
S–1	STRUCTURAL– VENDING STRUCTURE
L–P1	OVERALL PLANTING PLAN
L–P2	PLANTING PLAN
L–P3	PLANTING PLAN
L–P4	PLANTING PLAN
L–P5	PLANTING PLAN
L–P6	PLANTING DETAILS/ LEGEND
L–IR	IRRIGATION PLAN
ELECTRICAL	
E1	SITE LIGHTING PLAN
E2	SITE LIGHTING PLAN
E3	SITE LIGHTING PLAN
E4	SITE LIGHTING PLAN
E5	SITE LIGHTING PLAN
E6	DETAILS & SCHEDULES

COMMONWEALTH OF VIRGINIA
DONALD N. JENNINGS
NO. 033030
10-27-03
PROFESSIONAL ENGINEER

"A Quality Control/Quality Assurance check has been made on this project's documents and corrections have been made. The undersigend states that these plans and specifications submitted for review are complete and ready for bidding."

Signed:
Martin C. Fisher, P.E.

LPDA
LAND PLANNING AND DESIGN ASSOCIATES
310 EAST MAIN STREET, SUITE 200
CHARLOTTESVILLE, VIRGINIA 22902
(804) 296-2108
www.lpda.net

J. Mosby West, P.E.
Engineer
P.O. Box 131, Irvington, Virginia 22480
Ph: (804) 438-6167 FAX: (804) 438-5275

Rickmond Engineering, Inc.
Engineering | Surveying | Land Planning
1643 Merrimac Trail, Williamsburg, VA 23185, Voice: (757)229-1776, Fax: (757)229-4683
Vint Hill • P.O. Box 861647, Warrenton, VA 20187, Voice: (540)349-7730, Fax: (540)349-7731
www.rickmond.com

No.	By	Revision	App.	Date
		slip sheeted C2, C4, C9 & C26		1/20/04

JAMESTOWN ENTRANCE PLAZA AND PARKING LOT IMPROVEMENTS

Date: 10/27/03 Project No. 01198 Sheet No. T1

JAMESTOWN SETTLEMENT ENTRANCE PLAZA & PARKING LOT

99147_JAMESTOWN_SETTLEMENT - 332

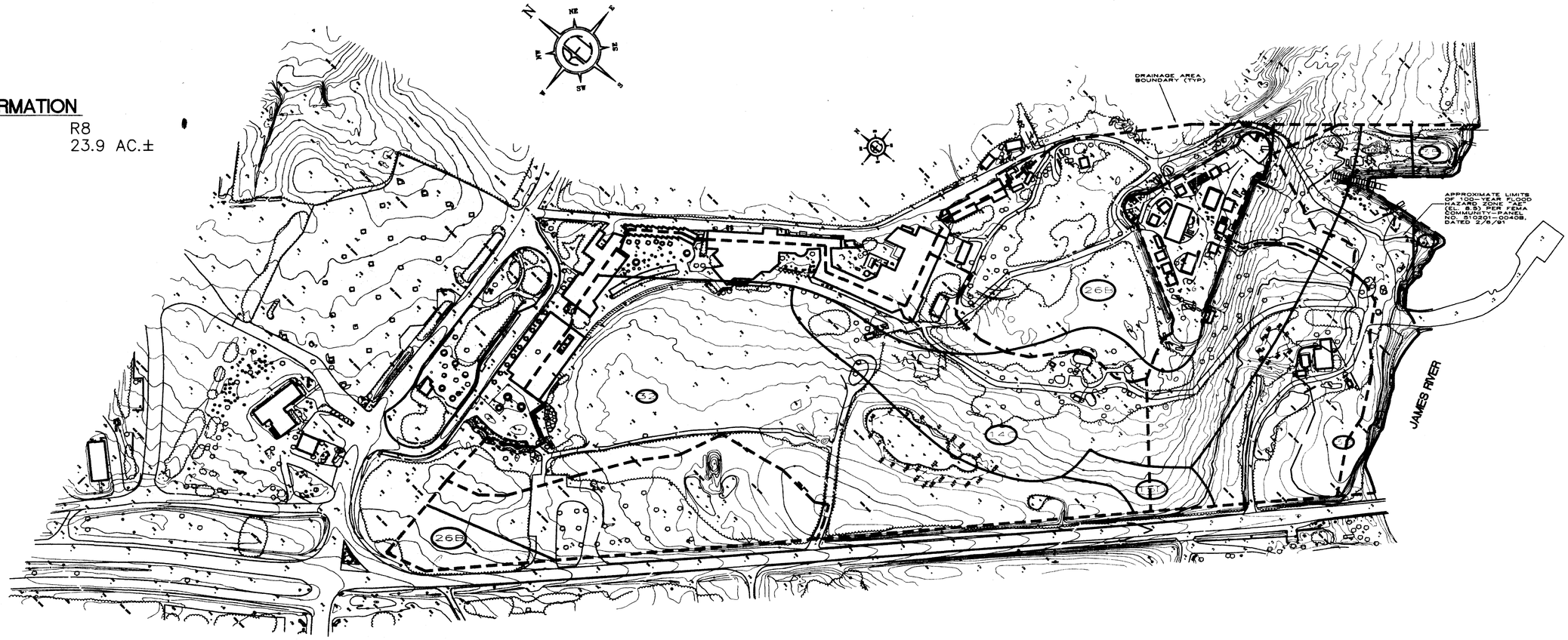
JAMESTOWN SETTLEMENT
STORMWATER MANAGEMENT MASTER PLAN

JAMES CITY COUNTY, VIRGINIA
JAMESTOWN MAGISTERIAL DISTRICT

VICINITY MAP
SCALE: 1"=2000'

STATISTICAL INFORMATION

ZONED	R8
TOTAL DRAINAGE AREA	23.9 AC.±



OWNER/DEVELOPER

JAMESTOWN–YORKTOWN FOUNDATION
P.O. BOX 1607
WILLIAMSBURG, VIRGINIA 23187
(757) 253–4838

BEFORE DIGGING CALL "MISS UTILITY" OF VIRGINIA AT 1 - 800 - 552 - 7001

SITE PLAN

100 0 100 200 300

Scale 1" = 100'

No.	By	Revision	App.	Date

Rickmond Engineering, Inc.

1643 Merrimac Trail
Williamsburg VA 23185
Voice: (757) 229-1776
Fax: (757) 229-4683

Engineering
Surveying
Land Planning
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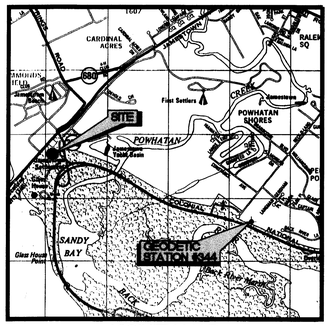
JAMESTOWN SETTLEMENT
STORMWATER MANAGEMENT MASTER PLAN

Date: 11/30/00 Project No. 00175 Appendix

JAMESTOWN SETTLEMENT
DRAINAGE IMPROVEMENTS

JAMES CITY COUNTY, VIRGINIA



VICINITY MAP
SCALE: 1"=2000'

✦ JAMES CITY COUNTY GEODETIC CONTROL STATION NUMBER 344
X=11987855.829
Y=3608279.491
ELEV=12.96

STATISTICAL INFORMATION

ZONE	R8
PROJECT AREA	2.36 ACRES
DISTURBED AREA	1.3 ACRES

NOTES

1) THIS PROPERTY APPEARS TO BE IN ZONE "AE" (ELEVATION 8.5) AS SHOWN ON THE FLOOD INSURANCE RATE MAPS FOR JAMES CITY COUNTY, COMMUNITY-PANEL NO. 510201-0040B, DATED JANUARY 6, 1991.
2) UNDERGROUND UTILITIES AS SHOWN HEREON ARE BASED ON AVAILABLE UTILITY MAPS ON FILE WITH JAMES CITY COUNTY AND PRIVATE UTILITY COMPANIES. HORIZONTAL AND VERTICAL LOCATIONS ARE APPROXIMATE AND SHALL BE FIELD VERIFIED BY CONTRACTOR.
3) AERIAL TOPOGRAPHY SHOWN ON SHEET C1 WAS PROVIDED TO RICKMOND ENGINEERING, INC. BY THE JAMESTOWN-YORKTOWN FOUNDATION.
4) THIS SURVEY DID NOT INVESTIGATE THE EXISTENCE OR NONEXISTENCE OF ANY HAZARDOUS MATERIALS OR ENVIRONMENTAL ISSUES THAT MAY AFFECT THE PROJECT.
5) RICKMOND ENGINEERING, INC. DOES NOT GUARANTEE ALL EASEMENTS AND/OR RESTRICTIONS HAVE BEEN SHOWN HEREON.
6) WETLAND DELINEATION PREFORMED BY ENVIRONMENTAL SPECIALTIES GROUP, INC. AND FIELD LOCATED BY RICKMOND ENGINEERING, INC.

LEGEND

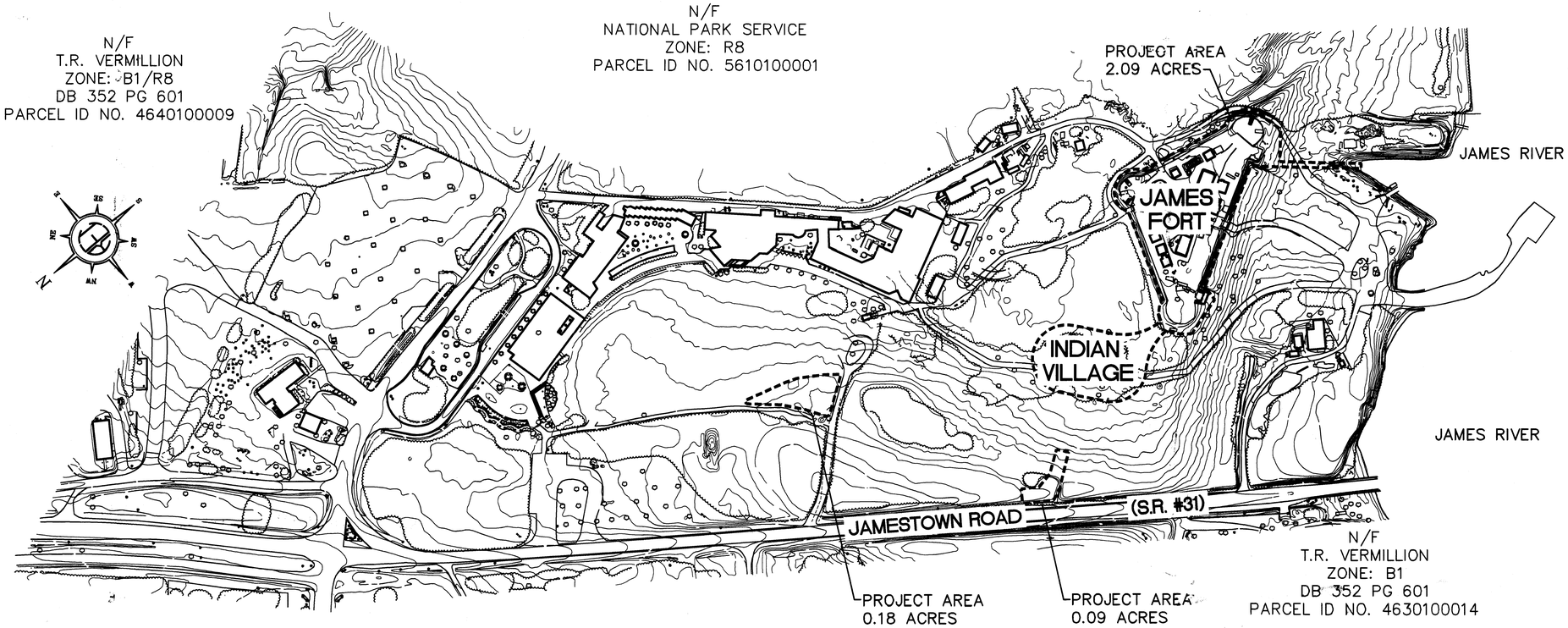
EXISTING	DESCRIPTION	NEW
	PROPERTY LINE	
+	IRON PIN OR ROD	•
	EDGE OF PAVEMENT	
	SIDEWALK	
x x x	FENCE	
	CONTOURS	
	SPOT ELEVATIONS	13x5
	DITCH	
	BUILDINGS	
	EX. WOODS	
	LIMIT OF CLEARING	
	UTILITY POLE	
S	SANITARY SEWER	
	STORM SEWER	
	MANHOLE	
	DROP INLET	■
	END SECTION	
W	WATERLINE	W
	FIRE HYDRANT	
	GATE VALVE	
	WATER METER	
	EVERGREEN TREE	
	DECIDUOUS TREE	
	APPROXIMATE SOIL BORING LOCATIONS	B-1

OWNER/DEVELOPER

JAMESTOWN-YORKTOWN FOUNDATION
P.O. BOX 1607
WILLIAMSBURG, VIRGINIA 23187
(757) 253-4838

TABLE OF CONTENTS

RECEIVED
FEB 2002
ENVIRONMENTAL DIVISION



SITE PLAN

100 0 100 200 300
Scale: 1" = 100'

CIVIL ABBREVIATIONS

APPROX	APPROXIMATE
BMP	BEST MANAGEMENT PRACTICE
CONT	CONTINUOUS
ELEV	ELEVATION
FF	FINISH FLOOR
HDPE	HIGH DENSITY POLYETHYLENE
INV	INVERT
MH	MANHOLE
MIN	MINIMUM
N/F	NOW OR FORMERLY
OC	ON CENTER
PSI	POUNDS PER SQUARE INCH
PVC	POLYVINYL CHLORIDE
SAN	SANITARY
SPEC	SPECIFICATION
STA	STATION
STD	STANDARD
SWT	SALT WATER TREATED
TYP	TYPICAL
VDOT	VIRGINIA DEPARTMENT OF TRANSPORTATION

BEFORE DIGGING CALL "MISS UTILITY" OF VIRGINIA AT 1 - 800 - 552 - 7001

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HANGSOVE, BROCKWELL & ASSOCIATE, LTD.
207 BUSINESS PARK DRIVE, SUITE 202
VIRGINIA BEACH, VIRGINIA 23462
PHONE: (757) 490-9048
FAX: (757) 490-7001

JAMESTOWN
PHASE I - DRAINAGE IMPROVEMENTS
JAMESTOWN-YORKTOWN FOUNDATION

COVER SHEET

COMMONWEALTH OF VIRGINIA
KEVIN M. BROCKWELL
LICENSED PROFESSIONAL ENGINEER
2/14/02

MARK	DATE
PRELIMINARY DESIGN SUBMITTAL	7/17/01

00044.3

C1

99147_JAMESTOWN_SETTLEMENT - 334

JAMESTOWN ROAD (S.R. 31)

VARIABLE WIDTH R/W

JAMES RIVER

N: 3,609,500

N: 3,610,000

N: 3,609,000

E: 11,981,500

E: 11,982,000

E: 11,982,500

EX INV=3.76

EX INV=3.47

APPROX. LIMITS OF EXISTING WETLANDS

APPROX. EDGE OF WATER AT TIME OF SURVEY

APPROXIMATE LIMITS OF 100' RPA BUFFER

EXIST. RIGHT-OF-WAY LINE EXTENDS TO MEAN LOW WATER OR AS FAR AS THE LAW ALLOWS

EXIST. RIGHT-OF-WAY AS ESTABLISHED BY STATE HIGHWAY PLAT BOOK 1 PAGE 241

JCSA SEWER LIFT STATION EASEMENT (DB. 152, PG 620)

1 STORY BRICK PUMP STATION BUILDING

RIP RAP JETTY

WOODEN PIER

CONCRETE

TIE NEW PATH TO EXISTING (TYP.)

8" OUTLET PIPE FROM UNDERDRAIN SYSTEM

WOOD DOCK

FINISH NEW PATH FLUSH W/ EX. DOCK

APPROX. LOCATION OF PROPOSED GRAVEL WALK

INV=3.50
6'X8'X26'
VDOT CLASS I
RIP RAP APRON

8" OUTLET PIPE FROM UNDERDRAIN SYSTEM

PROPERTY LINE EXTENDS TO MEAN LOW WATER OR AS FAR AS THE LAW ALLOWS

APPROX. LIMITS OF EXISTING WETLANDS

TWIG FENCE

BRANCH "A"
31 CHANNELS @ 3.28'=101.68'

BRANCH "A"
33 CHANNELS @ 3.28'=108.24'

BRANCH "B"
41 CHANNELS @ 3.28'=134.48'

BRANCH "C"
55 CHANNELS @ 3.28'=180.40'

WOODEN FOOT BRIDGE

GARDEN

WOODEN FORT WALL (TYP.)

THE JAMES FORT

INDIAN VILLAGE

APPROX. LIMITS OF INDIAN VILLAGE

TOP=17.00
INV=16.62

TOP=17.00
INV=16.09

TOP=16.00
INV=15.44

TOP=16.00
INV=14.89

TOP=16.80
INV=16.42

TOP=18.00
INV=16.75

TOP=18.00
INV=17.62

TOP=17.80
INV=17.42

HP 18.6

REMOVE 8" PVC

25' OF 12" RCP
INV=18.00
INVo=17.90

10' OF 15" HDPE W/ CAP

INLINE BASIN
RIM=12.00
INV=9.00

INLINE BASIN
RIM=16.50
INV=13.00

INLINE BASIN
RIM=16.00
INV=14.00

NPS MONUMENT

N/F
U.S. NATIONAL PARK SERVICE
TAX PARCEL 5610100001

7' WIDE TURF REINFORCEMENT MAT TURNED DOWN 6" AT WALL

TIMBER WALL BNP
1+16.

0+00

N 3609806.31
E 11981742.76

N 3609718.21
E 11981867.84

N 3609681.79
E 11981710.66

APPROX. LOCATION OF PROPOSED BOARDWALK

B-3

B-2

B-1

1) DRAIN BASIN
RIM=18.40
INV=14.75

2) DRAIN BASIN
RIM=19.40
INV=15.50

3) DRAIN BASIN
RIM=18.80
INV=15.00

4) DRAIN BASIN
RIM=19.80
INV=15.25

5) DRAIN BASIN
RIM=20.00
INV=15.75

6) DRAIN BASIN
RIM=20.00
INV=16.00

7) DRAIN BASIN
RIM=19.50
INV=16.25

A) DRAIN BASIN
RIM=18.20
INV=14.50

B) DRAIN BASIN
RIM=19.10
INV=14.75

C) DRAIN BASIN
RIM=18.40
INV=14.25

D) DRAIN BASIN
RIM=18.90
INV=14.50

E) DRAIN BASIN
RIM=19.20
INV=13.75

F) DRAIN BASIN
RIM=18.80
INV=14.00

G) DRAIN BASIN
RIM=18.50
INV=13.50

SAN. MH
RIM=19.80
INV= N/A

YARD DRAIN
RIM=18.07
INV=N/A

YARD DRAIN
RIM=17.56
INV=N/A

WATER FOUNTAIN

HOSE BIB

INV=11.00
6'X8'X26'
TURF REINFORCEMENT MAT W/ LEVEL SPREADER

EW-6
INV=9.98
6'X10'X26'
VDOT CLASS I
RIP RAP APRON

ADD 10' OF 15" RCP TO EX 15" RCP

EW-6
INV 10.28

APPROX. LIMITS OF EXISTING WETLANDS
2-35' OF 15" RCP @ 0.91%

WET POND
3:1 SIDESLOPES
WS ELEV=10.28
BTM ELEV=6.00

SKIMMER WEIR INLET TO WET POND

PERMANENT CHECK DAM

APPROX. LOCATION OF PROPOSED LEGACY WALK & LANDSCAPING (NIC)

BRICK CLOCK TOWER

1-STORY BRICK & BLOCK MUSEUM
F.F.=19.67

1-STORY BRICK & BLOCK PUBLIC BATHROOMS
F.F.=19.69

1-STORY BRICK & BLOCK OFFICE BLDG.
F.F.=19.69

1-STORY BRICK BUILDING

10' WOOD FENCE

LIMITS OF FIELD SURVEY

CHAIN LINK FENCE

OPENING

EG 9.2 EG 9.4 EG 9.8 EG 9.4 EG 9.2 EG 9.4 EG 9.5 EG 9.2 EG 9.4 EG 8.7 EG 9.1 EG 9.2 EG 8.2 EG 9.1 EG 9.2 EG 8.2 EG 9.0 EG 9.0 EG 8.6 EG 8.4 EG 8.2 EG 8.0 EG 8.8 EG 7.8 EG 8.4 EG 8.4 EG 8.8 EG 9.8 EG 9.6 EG 10.5 EG 12.0 EG 14.0 EG 11.2 EG 9.1 EG 9.2 EG 11.5 EG 10.9 EG 8.9 EG 8.6 EG 10.8 EG 8.5 EG 10.2 EG 10.0 EG 10.3 EG 10.0 EG 8.3 EG 9.8 EG 8.1 EG 8.0 EG 8.8

LEGEND

TITLE	SYMBOL
FLOW DIRECTION ARROW	—
TOP OF DITCH	----------
DRAIN BASIN	■
EDGE OF GRAVEL GRADE	EG 8.4

NOTES:

1) THE PERIMETER CHANNELS AROUND "THE JAMES FORT" ARE TO BE PRECAST INTERLOCKING MODULAR POLYMER CONCRETE TRENCH DRAINAGE SYSTEM MEETING THE FOLLOWING REQUIREMENTS:
   * 4" NOMINAL WIDTH AND MANUFACTURED WITH A CONTINUOUS SLOPE OF 0.6%
   * CHANNEL AND GRATING COMBINATION SHALL BE DESIGNED TO WITHSTAND IMPOSED LOADINGS UP TO 175 PSI (28,000 LBS)
   * GRATE TO BE SLOTTED GALVANIZED STEEL PAINTED WITH SELF-PRIMING HIGH SOLIDS EPOXY COLOR OF CHOICE BY THE OWNER
   * MATERIAL WATER ABSORPTION RATE SHALL NOT EXCEED 0.1% BY WEIGHT
   * MATERIAL SHALL BE DESIGNED TO WITHSTAND A COMPRESSIVE STRENGTH RANGE BETWEEN 11,000-15,000 PSI, TENSILE STRESS OF 2,800 PSI, FLEXURAL STRENGTH OF 2,900 PSI, SALT PROOF, FROST PROOF, AND RESILIENT TO DILUTE ACIDS AND ALKALIS
   * SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS AND RECOMENDATIONS
2) THE INLINE DRAIN BASINS AROUND "THE JAMES FORT" ARE TO BE 18" PVC DRAINAGE BASINS WITH SOLID (H-20 RATED) GRATES MEETING THE FOLLOWING REQUIREMENTS:
   * JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212
   * MECHANICAL PROPERTY REQUIREMENTS FOR FABRICATED FITTINGS SHALL CONFORM TO ASTM F794, F949 AND F1336
   * SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS AND RECOMENDATIONS
3) THE PERIMETER DRAIN BASINS AROUND "THE INDIAN VILLAGE" ARE TO BE 24" PVC DRAINAGE BASINS WITH (H-20 RATED) GRATES MEETING THE FOLLOWING REQUIREMENTS:
   * JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212
   * MECHANICAL PROPERTY REQUIREMENTS FOR FABRICATED FITTINGS SHALL CONFORM TO ASTM F794, F949 AND F1336
   * SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS AND RECOMENDATIONS
4) ALL STORMWATER PIPES ARE TO BE HDPE SEWER PIPE CONFORMING TO AASHTO M 294, TYPE S SPECIFICATIONS WITH SMOOTH WATERWAY FOR COUPLING JOINTS, UNLESS OTHERWISE NOTED.
5) ELEVATIONS SHOWN HEREON ARE BASED ON NGVD 1929.
6) TEMPORARY BENCH MARK FOR THIS PLAN IA A SPIKE IN A POWER POLE LOCATED ON THE EAST SIDE OF JAMESTOWN ROAD IN THE EMPLOYEES PARKING LOT ELEV.= 19.62.
7) THE NORTH MERIDIAN SHOWN IS BASED ON THE VIRGINIA STATE PLANE COORDINATE SYSTEM (SOUTH ZONE).
8) APPROXIMATE LOCATION OF LEGACY WALK AND ASSOCIATED APPURTANENCES PROVIDED BY DRAPER ADEN ASSOCIATES E-MAILED TO RICKMOND ENGINEERING, INC. ON 4/11/01.
9) THE CONTRACTOR SHALL REFER TO THE LANDSCAPE PLAN FOR TREE PROTECTION AND TREE REMOVAL DETAILS.
10) THE CONTRACTOR SHALL REFER TO SHEET S1 FOR REQUIRED BOARDWALK GRADING.
11) THE TURF REINFORCEMENT MAT SHALL MEET THE FOLLOWING REQUIREMENTS:
   * RESIST FLOW VELOCITIES OF 25 FPS AT SHEER STRESSES UP TO 10 LB/SF FOR VEGETATED CONDITIONS
   * SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS AND RECOMENDATIONS

40 0 40 80 120

Scale: 1" = 40'

99147_JAMESTOWN_SETTLEMENT - 335

HANGER/K. BROCKWELL ASSOCIATE, LTD.
207 E. CITY HALL AVE., SUITE 200
NORFOLK, VIRGINIA 23510
PHONE: (757) 490-2045
FAX: (757) 490-7881

JAMESTOWN

PHASE I - DRAINAGE IMPROVEMENTS

JAMESTOWN-YORKTOWN FOUNDATION

UTILITY PLAN

COMMONWEALTH OF VIRGINIA
K.W. BROCKWELL JR.
No. 022872
PROFESSIONAL ENGINEER
2/14/02

ISSUED FOR:	MARK:	DATE
PRELIMINARY PLAN SUBMITTAL		5/7/01
FINAL PLAN SUBMITTAL		7/27/01
ECOM WORKING DRAWING REVIEW		9/10/01
2ND ECOM WORKING DRAWING REVIEW		2/14/02

00044.3

C2

Rickmond Engineering, Inc.
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www.rickmond.com

JAMESTOWN ROAD (S.R. 31)

VARIABLE WIDTH R/W

JAMES RIVER

INDIAN VILLAGE

THE JAMES FORT

N: 3,609,500

N: 3,610,000

N: 3,609,000

E: 11,981,500

E: 11,982,000

E: 11,982,500

INV=3.76

INV=3.47

TIMBER WALL BMP

APPROX. LIMITS OF EXISTING WETLANDS

APPROX. EDGE OF WATER AT TIME OF SURVEY

APPROXIMATE LIMITS OF 100 RPA BUFFER

EXIST. RIGHT-OF-WAY AS ESTABLISHED BY STATE HIGHWAY PLAT BOOK 1 PAGE 241.

EXIST. RIGHT-OF-WAY LINE EXTENDS TO MEAN LOW WATER OR AS FAR AS THE LAW ALLOWS

JCSA SEWER LIFT STATION EASEMENT (DB. 152, PG 620)

APPROX. LOCATION OF PROPOSED BOARDWALK

APPROX. LIMITS OF EXISTING WETLANDS

APPROX. LIMITS OF EXISTING WETLANDS

APPROX. LIMITS OF INDIAN VILLAGE

APPROX. LOCATION OF PROPOSED GRAVEL WALK

APPROX. LOCATION OF PROPOSED LEGACY WALK & LANDSCAPING (NIC)

PROPERTY LINE EXTENDS TO MEAN LOW WATER OR AS FAR AS THE LAW ALLOWS

NPS MONUMENT

N/F
U.S. NATIONAL PARK SERVICE
TAX PARCEL 5610100001

10' WOOD FENCE LIMITS OF FIELD SURVEY

1-STORY BRICK & BLOCK MUSEUM F.F.=19.67

1-STORY BRICK & BLOCK PUBLIC BATHROOMS F.F.=19.69

1-STORY BRICK & BLOCK OFFICE BLDG. F.F.=19.69

1-STORY BRICK BUILDING

LEGEND

TITLE	SYMBOL	KEY	NO.
CONSTRUCTION ENTRANCE		CE	3.02
STRAW BALE BARRIER	—x—	STB	3.04
INLET PROTECTION		IP	3.07
CULVERT INLET PROTECTION		CIP	3.08
CHECK DAM		CD	3.20
LEVEL SPREADER		LS	3.21
TREE PROTECTION	----------	TP	3.38

Scale: 1" = 40'

99147_JAMESTOWN_SETTLEMENT - 336

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HARGROVE, BOCKWELL & ASSOCIATES, LTD.
207 BUSINESS PARK DRIVE, SUITE 200
VIRGINIA BEACH, VIRGINIA 23462
PHONE: (757) 490-7080
FAX: (757) 490-7081

JAMESTOWN
PHASE I - DRAINAGE IMPROVEMENTS
JAMESTOWN-YORKTOWN FOUNDATION

EROSION & SEDIMENT CONTROL PLAN

COMMONWEALTH OF VIRGINIA
KAY BOCKWELL II
No. 022020
PROFESSIONAL ENGINEER
2/4/02

MARK:	DATE
ISSUED FOR PERMIT/DESIGN SUBMITTAL	9/22/01
FOR WORKING DRAWING SUBMITTAL	11/16/01
FOR WORKING DRAWING REVIEW	1/10/02
2ND FOR WORKING DRAWING REVIEW	2/4/02

00044.3

C3

Rickmond Engineering, Inc.
Engineering Surveying Land Planning
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Williamsburg, VA 23185
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Fax: (757)229-4683
Vint Hill • P.O. Box 861647
Warrenton, VA 20187
Voice: (540)349-7730
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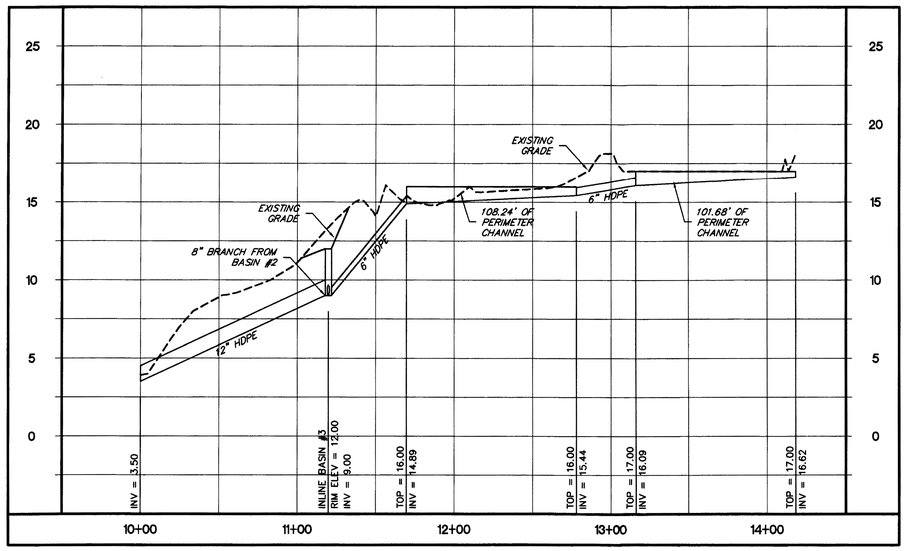
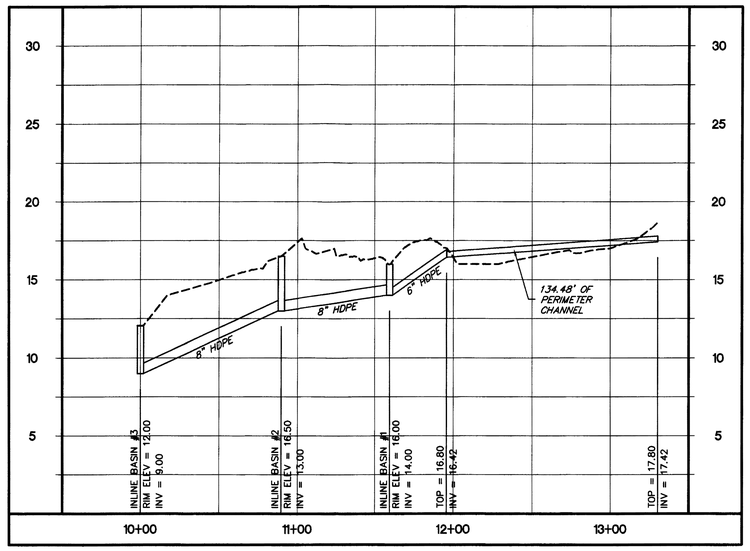


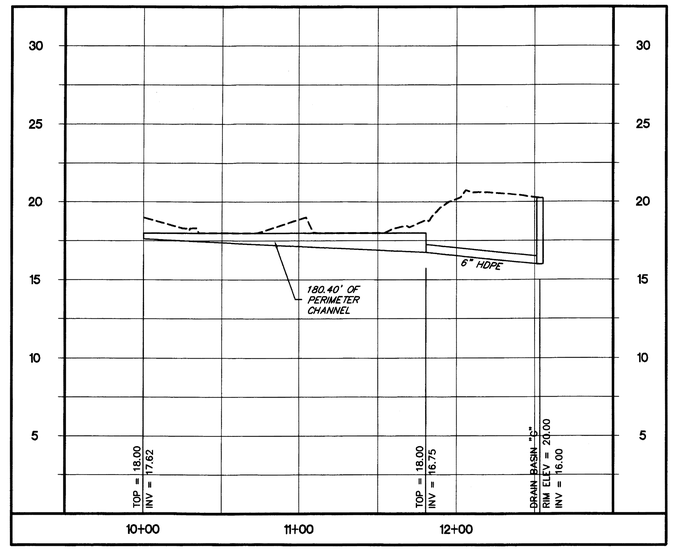
JAMES FORT BRANCH "A" STA. 10+00 - STA. 14+18.13

HORIZ. SCALE: 1" = 50', VERT. SCALE: 1" = 5'



JAMES FORT BRANCH "B" STA. 10+00 - STA. 13+30.36

HORIZ. SCALE: 1" = 50', VERT. SCALE: 1" = 5'



JAMES FORT BRANCH "C" STA. 10+00 - STA. 12+53.37

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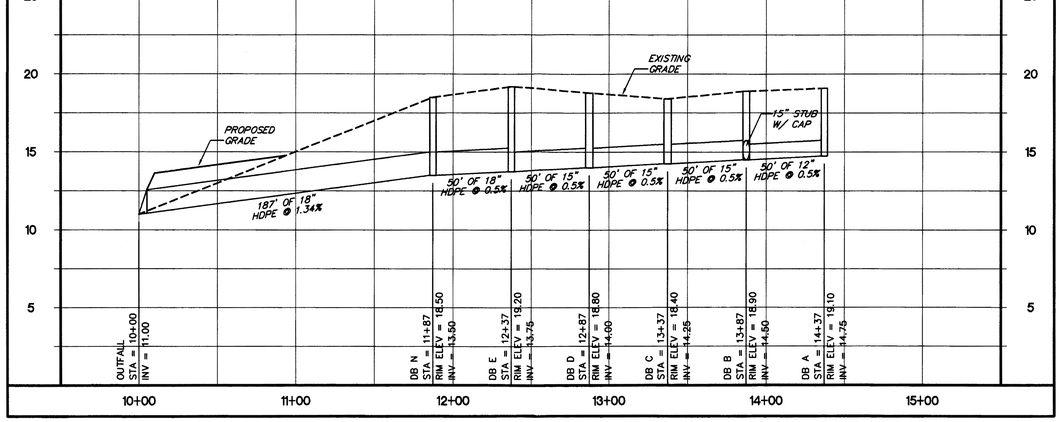
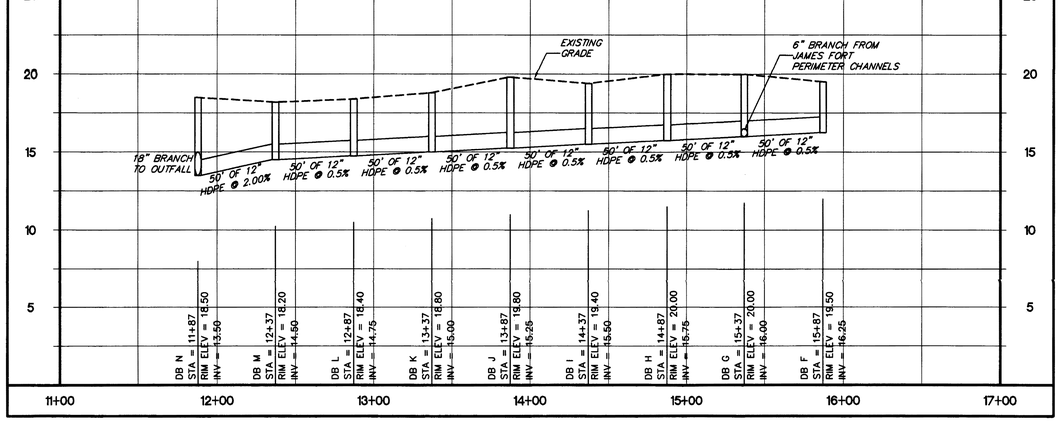


INDIAN VILLAGE-EAST STORM SEWER PROFILE - STA. 10+00 - STA. 14+37.09

HORIZ. SCALE: 1" = 50', VERT. SCALE: 1" = 5'



INDIAN VILLAGE-WEST STORM SEWER PROFILE - STA. 11+87.09 - STA. 15+87.09

HORIZ. SCALE: 1" = 50', VERT. SCALE: 1" = 5'

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JAMESTOWN
PHASE I - DRAINAGE IMPROVEMENTS
JAMESTOWN SETTLEMENT FOUNDATION

PROFILE SHEET

COMMONWEALTH OF VIRGINIA
KEVIN L. BLOCKWELL
No. 022812
PROFESSIONAL ENGINEER
2/14/02

ISSUED FOR:	DATE:
SCHEMATIC DESIGN SUBMITTAL	5/22/01
PRELIMINARY DESIGN SUBMITTAL	7/17/01
FINAL PLAN SUBMITTAL	9/10/01
NOT FOR CONSTRUCTION	
DRAWING REVIEW	2/14/02

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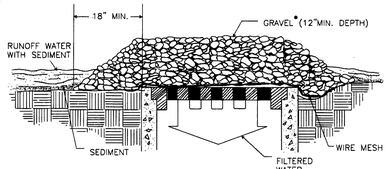
GRAVEL AND WIRE MESH DROP INLET SEDIMENT FILTER



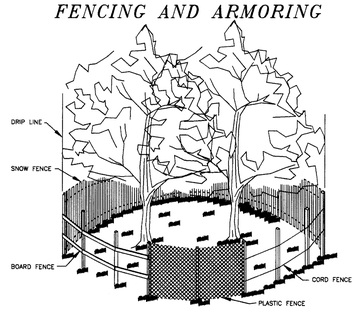
SPECIFIC APPLICATION

THIS METHOD OF INLET PROTECTION IS APPLICABLE WHERE HEAVY CONCENTRATED FLOWS ARE EXPECTED, BUT NOT WHERE PONDING AROUND THE STRUCTURE MIGHT CAUSE EXCESSIVE INCONVENIENCE OR DAMAGE TO ADJACENT STRUCTURES AND UNPROTECTED AREAS.

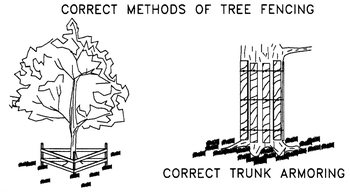
- GRAVEL SHALL BE VDOT #3, #357 OR #5 COARSE AGGREGATE.

SOURCE: VA. DSWC PLATE. 3.07-2

FENCING AND ARMORING



CORRECT METHODS OF TREE FENCING

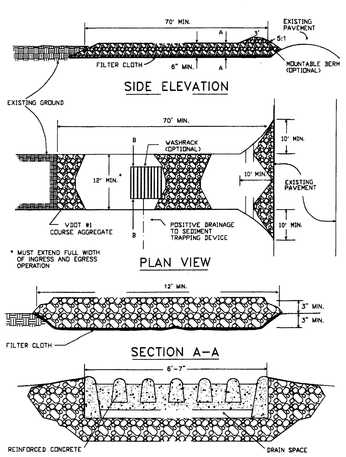


TRIANGULAR BOARD FENCE

CORRECT TRUNK ARMORING

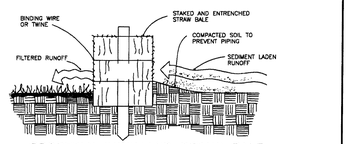
Source: Va. DSCW Plate 3.38-2

STONE CONSTRUCTION ENTRANCE



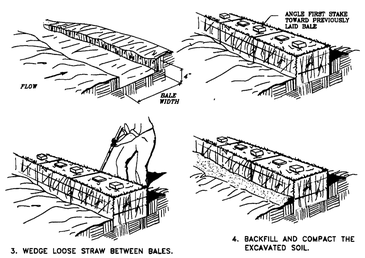
SOURCE: ADAPTED from 1983 Maryland Standards for Soil erosion and Sediment Control, and Va. DSWC Plate 3.02-1

STRAW BALE BARRIER



PROPERLY INSTALLED STRAW BALE (CROSS SECTION)

1. EXCAVATE THE TRENCH.
2. PLACE AND STAKE STRAW BALES.

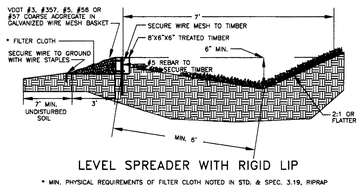


CONSTRUCTION OF STRAW BALE BARRIER

SOURCE: VA. DSWC PLATE. 3.04-1

LEVEL SPREADER

CROSS SECTION

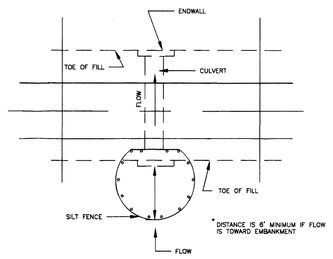


LEVEL SPREADER WITH RIGID LIP

* MIN. PHYSICAL REQUIREMENTS OF FILTER CLOTH NOTED IN STD. & SPEC. 3.19, RIPRAP

SOURCE: VA. DSWC AND N.C. Erosion and Sediment Control Planning and Design Manual PLATE: 3.21-2

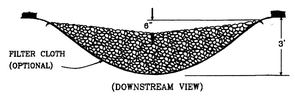
SILT FENCE CULVERT INLET PROTECTION



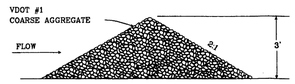
SOURCE: ADAPTED from VDOT Standard Sheets and Va. DSWC PLATE. 3.08-1

ROCK CHECK DAM

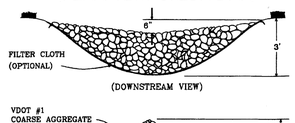
2 ACRES OR LESS OF DRAINAGE AREA:



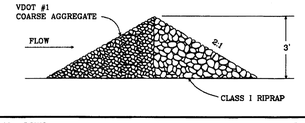
(DOWNSTREAM VIEW)



2-10 ACRES OF DRAINAGE AREA:
(PERMANENT CHECK DAM)



(DOWNSTREAM VIEW)



SOURCE: VA. DSWC PLATE. 3.20-1

JAMES CITY COUNTY EROSION AND SEDIMENT CONTROL NOTES

THE PURPOSE OF THE EROSION CONTROL MEASURES SHOWN ON THESE PLANS SHALL BE TO PRECLUDE THE TRANSPORT OF ALL WATERBORNE SEDIMENTS RESULTING FROM CONSTRUCTION ACTIVITIES FROM ENTERING ONTO ADJACENT PROPERTIES OR STATE WATERS. IF FIELD INSPECTIONS REVEALS THE INADEQUACY OF THE PLAN TO CONFINE SEDIMENT TO THE PROJECT SITE, APPROPRIATE MODIFICATIONS WILL BE MADE TO CORRECT ANY PLAN DEFICIENCE. IN ADDITION TO THESE NOTES, ALL PROVISIONS OF THE VIRGINIA EROSION AND SEDIMENT CONTROL REGULATIONS SHALL APPLY TO THIS PROJECT.

1. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH THE "VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK." THE CONTRACTOR SHALL BE THOROUGHLY FAMILIAR WITH ALL APPLICABLE MEASURES CONTAINED THEREIN WHICH MAY BE PERTINENT TO THIS PROJECT.
2. ALL POINTS OF CONSTRUCTION INGRESS AND EGRESS SHALL BR PROTECTED BY A TEMPORARY CONSTRUCTION ENTRANCE TO PREVENT TRACKING OF MUD ONTO PUBLIC RIGHT-OF-WAYS. AN ENTRANCE PERMIT FROM VDOT IS REQUIRED PRIOR TO ANY CONSTRUCTION ACTIVITIES WITHIN STATE RIGHT-OF-WAYS. WHERE SEDIMENT IS TRANSPORTED ONTO A PUBLIC ROAD SURFACE, THE ROAD SHALL BE THOROUGHLY CLEANED AT THE END OF EACH DAY.
3. A PRECONSTRUCTION MEETING SHALL BE HELD ON SITE BETWEEN THE COUNTY, THE DEVELOPER, THE PROJECT ENGINEER, AND THE CONTRACTOR PRIOR TO ISSUANCE OF THE LAND DISTURBING PERMIT. THE CONTRACTOR SHALL SUBMIT A SEQUENCE OF CONSTRUCTION TO THE COUNTY FOR APPROVAL PRIOR TO THE PRECONSTRUCTION MEETING. THE CONTRACTOR WILL SUPPLY THE ENVIRONMENTAL DIVISION WITH THE NAME OF THE INDIVIDUAL WHO WILL BE RESPONSIBLE FOR ENSURING MAINTENANCE OF INSTALLED MEASURES ON A DAILY BASIS.
4. SEDIMENT BASINS AND TRAPS, PERIMETER DIKES, SEDIMENT BARRIERS AND OTHER MEASURES INTENDED TO TRAP SEDIMENT ON-SITE MUST BE CONSTRUCTED AS A FIRST STEP IN GRADING AND BE MADE FUNCTIONAL BEFORE UPSLOPE LAND DISTURBANCE TAKES PLACE. EARTHEN STRUCTURES SUCH AS DAMS, DIKES, AND DIVERSIONS MUST BE SEEDED AND MULCHED IMMEDIATELY AFTER INSTALLATION. PERIODIC INSPECTIONS OF THE EROSION CONTROL MEASURES SHALL BE MADE TO ASSESS THEIR CONDITION. ANY NECESSARY MAINTENANCE OF THE MEASURES SHALL BE ACCOMPLISHED IMMEDIATELY UPON NOTIFICATION BY THE COUNTY AND SHALL INCLUDE THE REPAIR OF MEASURES DAMAGED BY ANY SUBCONTRACTOR INCLUDING THOSE OF THE PUBLIC UTILITY COMPANIES.
5. SURFACE FLOWS OVER CUT AND FILL SLOPES SHALL BE CONTROLLED BY EITHER REDIRECTING FLOWS FROM TRANSVERSING THE SLOPES OR BY INSTALLING MECHANICAL DEVISES TO SAFELY LOWER WATER DOWNSLOPES WITHOUT CAUSING EROSION. A TEMPORARY FILL DIVERSION (STD. & SPEC. 3.10) SHALL BE INSTALLED PRIOR TO THE END OF EACH WORKING DAY.
6. SEDIMENT CONTROL MEASURE MAY REQUIRE MINOR FIELD ADJUSTMENTS AT TIME OF CONSTRUCTION TO INSURE THEIR INTENDED PURPOSE IS ACCOMPLISHED. ENVIRONMENTAL DIVISION APPROVAL WILL BE REQUIRED FOR OTHER DEVIATIONS FROM THE APPROVED PLANS
7. THE CONTRACTOR SHALL PLACE SOIL STOCKPILES AT THE LOCATION SHOWN ON THIS PLAN OR AS DIRECTED BY THE ENGINEER. SOIL STOCKPILES SHALL BE STABILIZED OR PROTECTED WITH SEDIMENT TRAPPING MEASURES. OFF-SITE WASTE OR BORROW AREAS SHALL BE APPROVED BY THE ENVIRONMENTAL DIVISION PRIOR TO THE IMPORT OF ANY BORROW OR EXPORT OF ANY WASTE TO OR FROM THE PROJECT SITE.
8. THE CONTRACTOR SHALL COMPLETE DRAINAGE FACILITIES WITHIN 30 DAYS FOLLOWING COMPLETION OF ROUGH GRADING AT ANY POINT WITHIN THE PROJECT. THE INSTALLATION OF DRAINAGE FACILITIES SHALL TAKE PRECEDENCE OVER ALL UNDERGROUND UTILITIES. OUTFALL DITCHES FROM DRAINAGE STRUCTURES SHALL BE STABILIZED IMMEDIATELY AFTER CONSTRUCTION OF SAME. THIS INCLUDES INSTALLATION OF EROSION CONTROL STONE OR PAVED DITCHES WHERE REQUIRED. ANY DRAINAGE OUTFALLS REQUIRED FOR A STREET MUST BE COMPLETED BEFORE STREET GRADING OR UTILITY INSTALLATION BEGINS.
9. PERMANENT OR TEMPORARY SOIL STABILIZATION MUST BE APPLIED TO ALL DENUDED AREAS WITHIN 7 DAYS AFTER FINAL GRADE IS REACHED ON ANY PORTION OF THE SITE. SOIL STABILIZATION MUST ALSO BE APPLIED TO DENUDED AREAS WHICH MAY BE AT FINAL GRADE BUT WILL REMAIN DORMANT (UNDISTURBED) FOR LONGER THAN 30 DAYS. SOIL STABILIZATION MEASURES INCLUDE VEGETATIVE ESTABLISHMENT, MULCHING AND THE EARLY APPLICATION OF GRAVEL BASE MATERIAL ON AREAS TO BE PAVED.
10. NO MORE THAN 300 FEET OF SANITARY SEWER, STORM SEWER, WATERLINES, OR UNDERGROUND UTILITY LINES ARE TO BE OPEN AT ONE TIME. FOLLOWING INSTALLATION OF ANY PORTION OF THESE ITEMS, ALL DISTURBED AREAS ARE TO BE IMMEDIATELY STABILIZED (I.E., THE SAME DAY).
11. IF DISTURBED AREA STABILIZATION IS TO BE ACCOMPLISHED DURING THE MONTHS OF DECEMBER, JANUARY, OR FEBRUARY, STABILIZATION SHALL CONSIST OF MULCHING IN ACCORDANCE WITH SPECIFICATION 3.35. SEEDING WILL THEN TAKE PLACE AS SOON AS THE SEASON PERMITS.
12. THE TERM SEEDING, FINAL VEGETATIVE COVER OR STABILIZATION, ON THIS PLAN SHALL MEAN THE SUCCESSFUL GERMINATION AND ESTABLISHED OF A STABLE GRASS COVER FROM A PROPERLY PREPARED SEEDBED CONTAINING THE SPECIFIED AMOUNTS OF SEED, LIME, AND FERTILIZER IN ACCORDANCE WITH SPECIFICATION 3.32, PERMANENT SEEDING. IRRIGATION SHALL BE REQUIRED AS NECESSARY TO ENSURE ESTABLISHMENT OF GRASS COVER.
13. ALL SLOPES STEEPER THAN 3:1 SHALL REQUIRE THE USE OF EROSION CONTROL BLANKETS TO AID IN THE ESTABLISHMENT OF A VEGETATIVE COVER. INSTALLATION SHALL BE IN ACCORDANCE WITH SPECIFICATION 3.35, MULCHING AND MANUFACTURER'S INSTRUCTIONS. NO SLOPES SHALL BE CREATED STEEPER THAN 2:1.
14. INLET PROTECTION IN ACCORDANCE WITH SPECIFICATION 3.07 SHALL BE PROVIDED FOR ALL STORM DRAIN INLETS AS SOON AS PRACTICAL FOLLOWING CONSTRUCTION OF SAME.
15. TEMPORARY LINERS, SUCH AS POLYETHYLENE SHEETS, SHALL BE PROVIDED FOR ALL PAVED DITCHES UNTIL THE PERMANENT CONCRETE LINER IS INSTALLED.
16. PAVED DITCHES SHALL BE REQUIRED WHEREVER EROSION IS EVIDENT. PARTICULAR ATTENTION SHALL BE PAID TO THOSE AREAS WHERE GRADES EXCEED 3 PERCENT.
17. TEMPORARY EROSION CONTROL MEASURES SUCH AS SILT FENCE ARE NOT TO BE REMOVED UNTIL ALL DISTURBED AREAS ARE STABILIZED. AFTER STABILIZATION IS COMPLETE, MEASURES SHALL BE REMOVED WITHIN 30 DAYS. TRAPPED SEDIMENT SHALL BE SPREAD AND SEEDED.
18. ALL SEDIMENT TRAPS AND BASINS SHALL REMAIN IN PLACE UNTIL THE MAJORITY OF THE SINGLE-FAMILY HOUSE HAVE BEEN CONSTRUCTED AND SHALL NOT BE REMOVED WITHOUT AUTHORIZATION FROM THE JAMES CITY COUNTY ENVIRONMENTAL DIVISION.
19. AS-BUILT DRAWINGS MUST BE PROVIDED FOR ALL DETENTION/BMP FACILITIES. ALSO UPON COMPLETION, THE CONSTRUCTION OF ALL DETENTION/BMP FACILITIES SHALL BE CERTIFIED BY A PROFESSIONAL ENGINEER WHO INSPECTED THE STRUCTURE DURING CONSTRUCTION. THE CERTIFICATION SHALL STATE THAT THE BEST OF HIS/HER JUDGMENT, KNOWLEDGE, AND BELIEF, THE STRUCTURE WAS CONSTRUCTED IN ACCORDANCE WITH APPROVAL PLANS AND SPECIFICATIONS.

GENERAL NOTES

1. THE CONTRACTOR SHALL COMPLY WITH CURRENT COUNTY AND/OR VDOT STANDARDS AND SPECIFICATIONS UNLESS OTHERWISE SPECIFIED.
2. THE CONTRACTOR SHALL SECURE THE LATEST EDITION OF THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK AND COMPLY WITH ALL COUNTY REQUIREMENTS FOR EROSION AND SEDIMENT CONTROL.
3. THE CONTRACTOR SHALL REMOVE ALL CUTS, VEGETATION AND DELETERIOUS MATERIAL ENCOUNTERED AND DISPOSE OF OFF SITE.
4. THE CONTRACTOR SHALL OBTAIN AT HIS OWN EXPENSE, ANY PERMIT OR BOND IF REQUIRED BY ANY GOVERNMENT AGENCY.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING, PROTECTING, AND RESOLVING ANY CONFLICTS WITH EXISTING UTILITIES AND SHALL REPAIR OR RELOCATE, AT HIS OWN EXPENSE, ALL UTILITIES DAMAGED OR CONFLICTING WITH THESE IMPROVEMENTS.
6. THE CONTRACTOR SHALL REPORT ANY ERRORS OR DISCREPANCIES BEFORE PROCEEDING WITH THE WORK.
7. DEWATERING OR EXCAVATION, IF NEEDED, IS PART OF THIS CONTRACT.
8. THE CONTRACTOR SHALL CONTACT "MISS UTILITY" OF VIRGINIA 1-800-552-7001 PRIOR TO ANT LAND DISTURBING ACTIVITIES.
9. CONTRACTOR SHALL OBTAIN PERMITS FROM THE STATE HIGHWAY DEPARTMENT PRIOR TO ANY WORK IN THE STATE'S RIGHT-OF-WAY. THE CONTRACTOR SHALL RESTORE AND CLEAN UP THE SITE TO THE SATISFACTION OF THE HIGHWAY DEPARTMENT.

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JAMESTOWN
PHASE I - DRAINAGE IMPROVEMENTS
JAMESTOWN-YORKTOWN FOUNDATION

EROSION & SEDIMENT CONTROL DETAILS

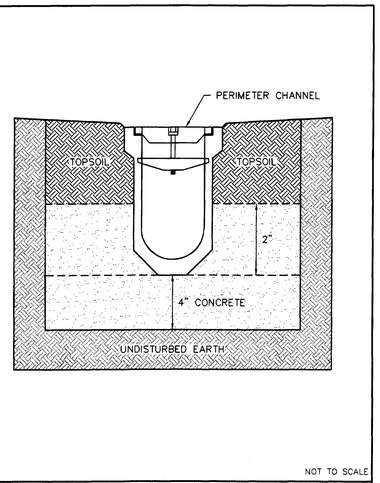
COMMONWEALTH OF VIRGINIA
KATHLEEN K. MCKNIGHT
LICENSED PROFESSIONAL ENGINEER
NO. 021401

ISSUED FOR:	DATE:
SCHEMATIC DESIGN SUBMITTAL	5/22/01
PRELIMINARY DESIGN SUBMITTAL	7/11/01
BOW WORKING DRAWING REVIEW	9/10/01
2ND BOW WORKING DRAWING REVIEW	2/4/02

00044.3

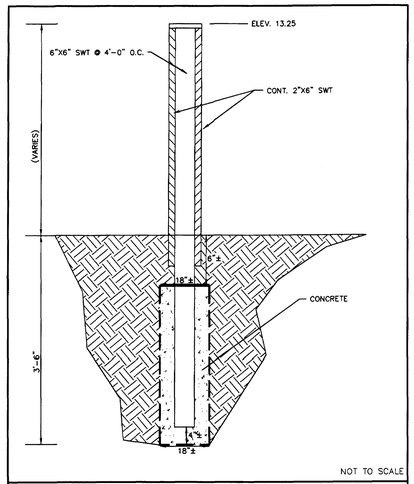
C5

99147_JAMESTOWN_SETTLEMENT - 338



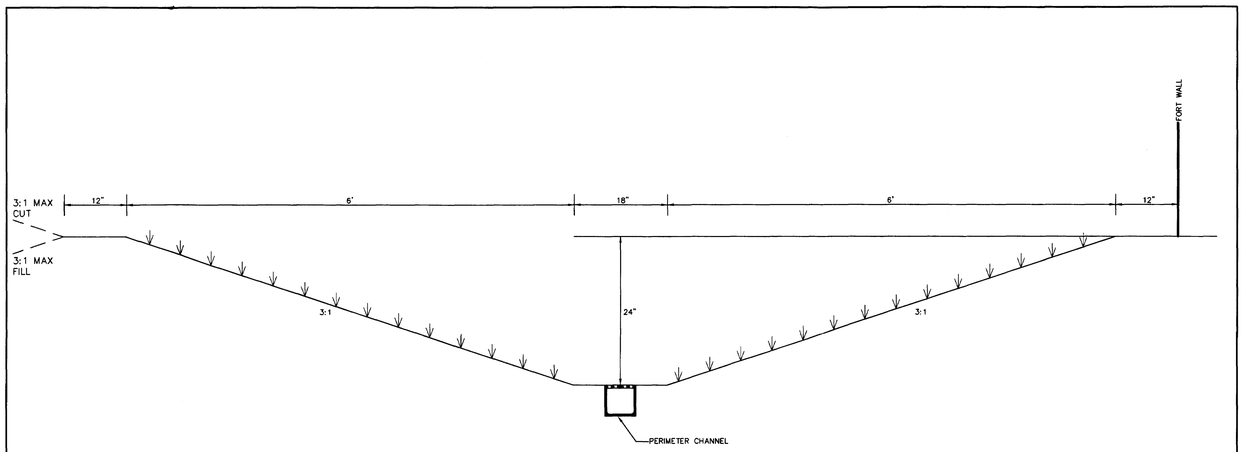
NOT TO SCALE

JAMES FORT PERIMETER DRAINAGE SYSTEM



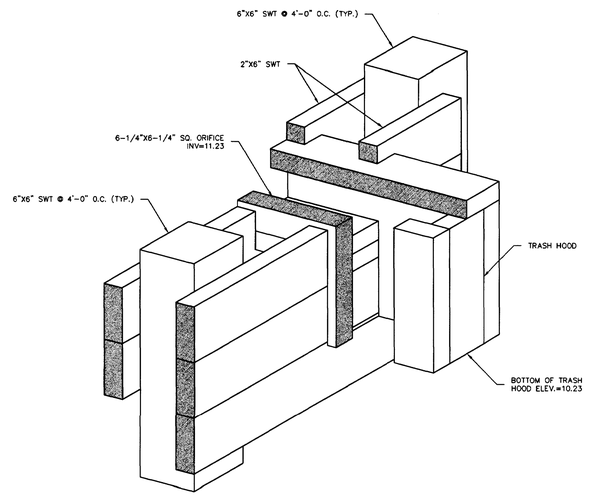
NOT TO SCALE

TIMBER WALL POST DETAIL



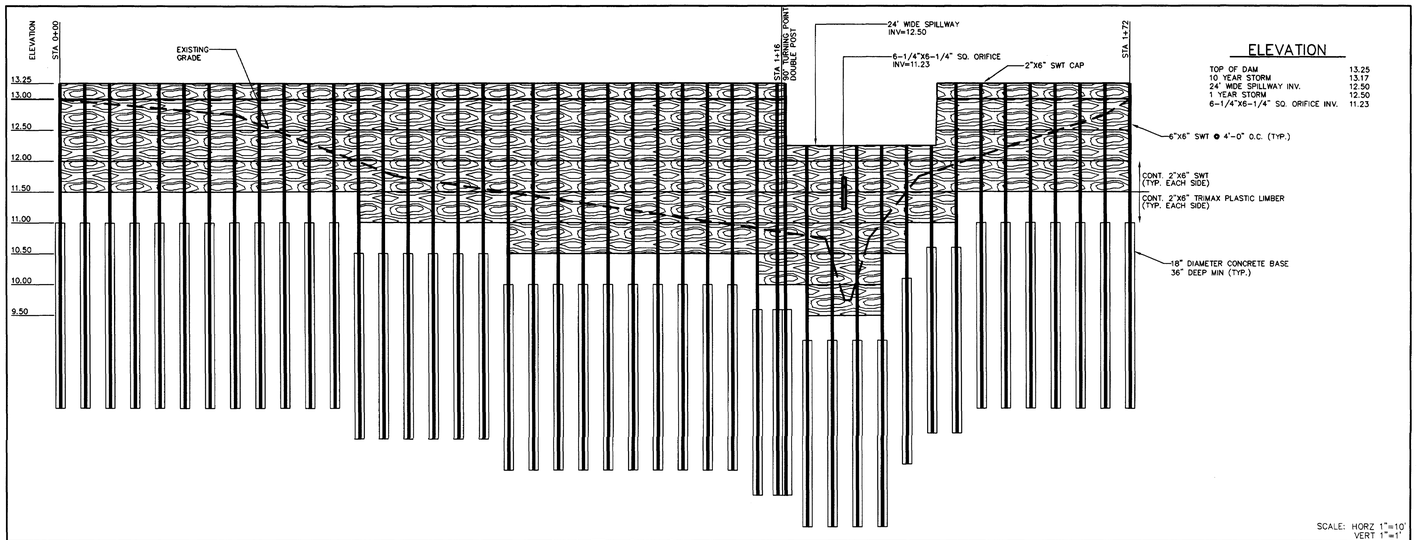
SCALE: 1"=1'

THE JAMES FORT PERIMETER DITCH
CROSS-SECTION



SCALE: NOT TO SCALE

ORIFICE DETAIL



SCALE: HORZ 1"=10'
VERT 1"=1'

TIMBER WALL DETAIL

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207 BUSINESS PARK DRIVE, SUITE 200
VIRGINIA BEACH, VIRGINIA 23462
PHONE: (757) 490-9048
FAX: (757) 490-7061

JAMESTOWN
PHASE I - DRAINAGE IMPROVEMENTS
JAMESTOWN-YORKTOWN FOUNDATION

STORMWATER MAMAGEMENT DETAILS

COMMONWEALTH OF VIRGINIA
KM HOPKINS II
No. 022872
2/4/02
PROFESSIONAL ENGINEER

MARK	DATE
ISSUED FOR:	
PERMIT/PRELIMINARY PLAN SUBMITTAL	5/22/01
1ST POW WORKING DRAWING REVIEW	9/11/001
2ND POW WORKING DRAWING REVIEW	2/4/02

00044.3

C6

CLIENT	JOB #	BORING #	SHEET
HBA ARCHITECTS	N4531	B-1	1 OF 1
PROJECT NAME JAMESTOWN SETTLEMENT BOARDWALKS	ARCHITECT-ENGINEER HBA ARCHITECTS		
SITE LOCATION ROUTE 31 WILLIAMSBURG, VIRGINIA			

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
					ENGLISH UNITS		
					SURFACE ELEVATION		
0	1	SS	24	24	Silty CLAY, With Organics to 2 ft, Gray, Moist, Very Soft to Soft, (CL)		4
	2	SS	24	24			3
5	3	SS	24	24	Silty CLAY, Gray, Moist, Stiff, (CH)		11
	4	SS	24	24			13
	5	SS	24	24	Silty Fine SAND, Light Brown, Wet to Saturated, Loose, (SM)		9
10							
	6	SS	24	24	Silty Fine to Coarse SAND, Light Brown, Wet to Saturated, Medium Dense, (SM)		29
15							
	7	SS	24	24			29
20					END OF BORING @ 20.0'		
25							
30							

CALIBRATED PENETROMETER TONS/FT. ²: 1, 2, 3, 4, 5+

PLASTIC LIMIT % X — WATER CONTENT % — LIQUID LIMIT % △

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

▽WL 12'	WS OR ⓓ	BORING STARTED 12-4-00	TOPSOIL DEPTH 6"
▽WL(AB) ▽WL(AC)		BORING COMPLETED 12-4-00	CAVE IN DEPTH @ 13'-4"
▽WL	RIG	FOREMAN FDI	DRILLING METHOD HSA

CLIENT	JOB #	BORING #	SHEET
HBA ARCHITECTS	N4531	B-2	1 OF 1
PROJECT NAME JAMESTOWN SETTLEMENT BOARDWALKS	ARCHITECT-ENGINEER HBA ARCHITECTS		
SITE LOCATION ROUTE 31 WILLIAMSBURG, VIRGINIA			

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
					ENGLISH UNITS		
					SURFACE ELEVATION		
0	1	SS	24	24	Fine Silty CLAY, With Organics to 2 ft, Light Brown, Dry to Moist, Firm to Hard, (CL)		9
	2	SS	24	24			19
5	3	SS	24	24			33
	4	SS	24	24			44
	5	SS	24	24	Fine Sandy CLAY, Gray and Red, Very Stiff, (CL)		23
10							
	6	SS	24	24	Sandy GRAVEL, Brown, Wet to Saturated, Medium Dense, (GM)		16
15							
	7	SS	24	24			14
20					END OF BORING @ 20.0'		
25							
30							

CALIBRATED PENETROMETER TONS/FT. ²: 1, 2, 3, 4, 5+

PLASTIC LIMIT % X — WATER CONTENT % — LIQUID LIMIT % △

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

▽WL 18'	WS OR ⓓ	BORING STARTED 12-4-00	TOPSOIL DEPTH 10"
▽WL(AB) ▽WL(AC)		BORING COMPLETED 12-4-00	CAVE IN DEPTH @ 12'-1"
▽WL	RIG	FOREMAN FDI	DRILLING METHOD HSA

CLIENT	JOB #	BORING #	SHEET
HBA ARCHITECTS	N4531	B-3	1 OF 1
PROJECT NAME JAMESTOWN SETTLEMENT BOARDWALKS	ARCHITECT-ENGINEER HBA ARCHITECTS		
SITE LOCATION ROUTE 31 WILLIAMSBURG, VIRGINIA			

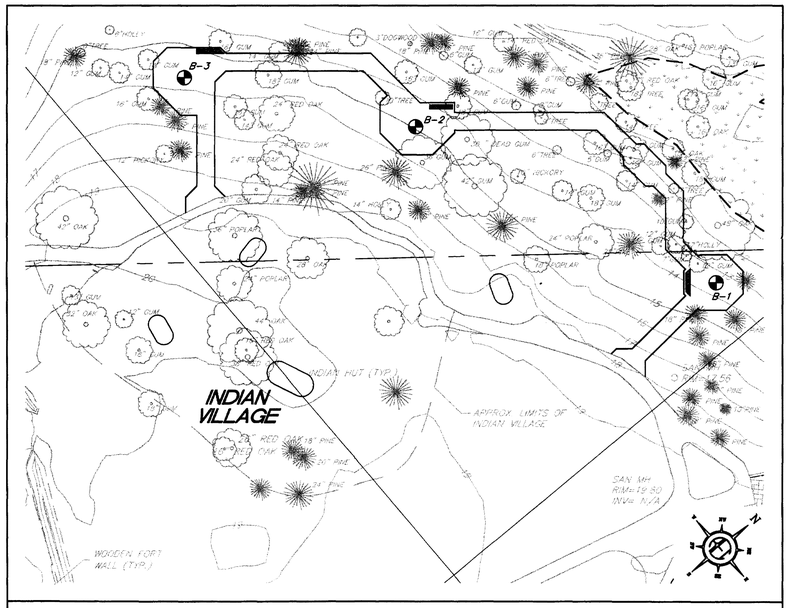
DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	STANDARD PENETRATION BLOWS/FT.
					ENGLISH UNITS		
					SURFACE ELEVATION		
0	1	SS	24	24	Silty CLAY, Light Brown, Dry to Moist, Firm to Hard, (CL)		9
	2	SS	24	24			13
5	3	SS	24	24			21
	4	SS	24	24			50
	5	SS	24	24	Fine Sandy CLAY, Brown and Light Gray, Moist, Very Stiff, (CL)		20
10							
	6	SS	24	24	Silty Fine SAND, Reddish Brown, Wet, Medium Dense, (SM)		10
15							
	7	SS	24	24	Silty Fine to Medium SAND, Reddish Brown, Wet to Saturated, Medium Dense, (SM)		11
20					END OF BORING @ 20.0'		
25							
30							

CALIBRATED PENETROMETER TONS/FT. ²: 1, 2, 3, 4, 5+

PLASTIC LIMIT % X — WATER CONTENT % — LIQUID LIMIT % △

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

▽WL 19'	WS OR ⓓ	BORING STARTED 12-4-00	TOPSOIL DEPTH 6"
▽WL(AB) ▽WL(AC)		BORING COMPLETED 12-4-00	CAVE IN DEPTH @ 10'-2"
▽WL	RIG	FOREMAN FDI	DRILLING METHOD HSA



BORING KEY PLAN

BORINGS FROM ENGINEERING CONSULTING SERVICES, LTD. SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING ANALYSIS (ECS PROJECT NO. 04:4531) DATED MARCH 14, 2001.

Rickmond Engineering, Inc.
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JAMESTOWN
PHASE I - DRAINAGE IMPROVEMENTS
JAMESTOWN-YORKTOWN FOUNDATION

BORING LOG

MARK	DATE
ISSUED FOR:	
PRELIMINARY DESIGN SUBMITTAL	6/22/01
PRELIMINARY DESIGN SUBMITTAL	7/11/01
FOR WORKING DRAWING REVIEW	9/10/01
2ND FOR WORKING DRAWING REVIEW	2/4/02
DRAWING REVIEW	

00044.3

B1

JAMESTOWN SETTLEMENT
POWHATAN INDIAN VILLAGE: STORMWATER MANAGEMENT IMPROVEMENTS

STATE PROJECT NUMBERS: 425-16474-02

JAMES CITY COUNTY, VIRGINIA

STATISTICAL INFORMATION

ZONE	R8
PROJECT AREA	2.36 ACRES
DISTURBED AREA	1.3 ACRES

NOTES

1) THIS PROPERTY APPEARS TO BE IN ZONE "AE" (ELEVATION 8.5) AS SHOWN ON THE FLOOD INSURANCE RATE MAPS FOR JAMES CITY COUNTY, COMMUNITY-PANEL NO. 510201-0040B, DATED JANUARY 6, 1991.

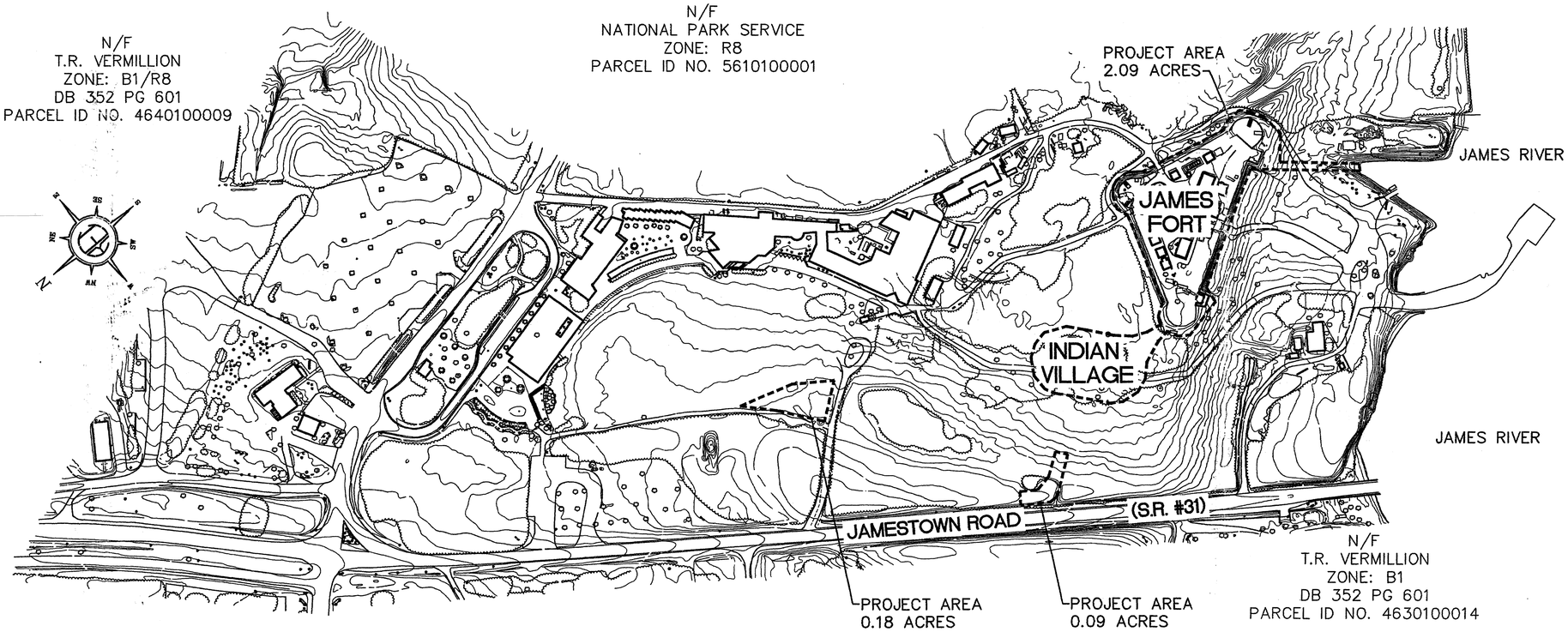
2) UNDERGROUND UTILITIES AS SHOWN HEREON ARE BASED ON AVAILABLE UTILITY MAPS ON FILE WITH JAMES CITY COUNTY AND PRIVATE UTILITY COMPANIES. HORIZONTAL AND VERTICAL LOCATIONS ARE APPROXIMATE AND SHALL BE FIELD VERIFIED BY CONTRACTOR.

3) AERIAL TOPOGRAPHY SHOWN ON SHEET C1 WAS PROVIDED TO RICKMOND ENGINEERING, INC. BY THE JAMESTOWN-YORKTOWN FOUNDATION.

4) THIS SURVEY DID NOT INVESTIGATE THE EXISTENCE OR NONEXISTENCE OF ANY HAZARDOUS MATERIALS OR ENVIRONMENTAL ISSUES THAT MAY AFFECT THE PROJECT.

5) RICKMOND ENGINEERING, INC. DOES NOT GUARANTEE ALL EASEMENTS AND/OR RESTRICTIONS HAVE BEEN SHOWN HEREON.

6) WETLAND DELINEATION PREFORMED BY ENVIRONMENTAL SPECIALTIES GROUP, INC. AND FIELD LOCATED BY RICKMOND ENGINEERING, INC.



LEGEND

EXISTING	DESCRIPTION	NEW
	PROPERTY LINE	
	IRON PIN OR ROD	
	EDGE OF PAVEMENT	
	SIDEWALK	
	FENCE	
	CONTOURS	
13x5	SPOT ELEVATIONS	13x5
	DITCH	
	BUILDINGS	
	EX. WOODS	
	LIMIT OF CLEARING	
	UTILITY POLE	
	SANITARY SEWER	
	STORM SEWER	
	MANHOLE	
	DROP INLET	
	END SECTION	
	WATERLINE	W
	FIRE HYDRANT	
	GATE VALVE	
	WATER METER	
	EVERGREEN TREE	
	DECIDUOUS TREE	
⊕B-1	APPROXIMATE SOIL BORING LOCATIONS	⊕B-1

SITE PLAN

100 0 100 200 300

Scale: 1" = 100'

CIVIL ABBREVIATIONS

APPROX	APPROXIMATE
BMP	BEST MANAGEMENT PRACTICE
CONT	CONTINUOUS
ELEV	ELEVATION
FF	FINISH FLOOR
HDPE	HIGH DENSITY POLYETHYLENE
INV	INVERT
MH	MANHOLE
MIN	MINIMUM
N/F	NOW OR FORMERLY
OC	ON CENTER
PSI	POUNDS PER SQUARE INCH
PVC	POLYVINYL CHLORIDE
SAN	SANITARY
SPEC	SPECIFICATION
STA	STATION
STD	STANDARD
SWT	SALT WATER TREATED
TYP	TYPICAL
VDOT	VIRGINIA DEPARTMENT OF TRANSPORTATION

OWNER/DEVELOPER

JAMESTOWN-YORKTOWN FOUNDATION
P.O. BOX 1607
WILLIAMSBURG, VIRGINIA 23187
(757) 253-4838

BEFORE DIGGING CALL "MISS UTILITY" OF VIRGINIA AT 1 - 800 - 552 - 7001

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FAX: (757) 490-7001

JAMESTOWN
POWHATAN INDIAN VILLAGE: STORMWATER MANAGEMENT IMPROVEMENTS
JAMESTOWN-YORKTOWN FOUNDATION

GENERAL NOTES AND ABBREVIATIONS

VIRGINIA BEACH, VIRGINIA
Preliminary Not Approved For Construction
RICKMOND PROFESSIONAL ENGINEER

MARK:	DATE
ISSUED FOR:	
SCHEMATIC DESIGN SUBMITTAL	3/22/01
PRELIMINARY DESIGN SUBMITTAL	7/11/01
PRELIMINARY PLAN AND DRAWING REVIEW	9/10/01
DRAWING REVIEW	2/4/02

00044.3

C1

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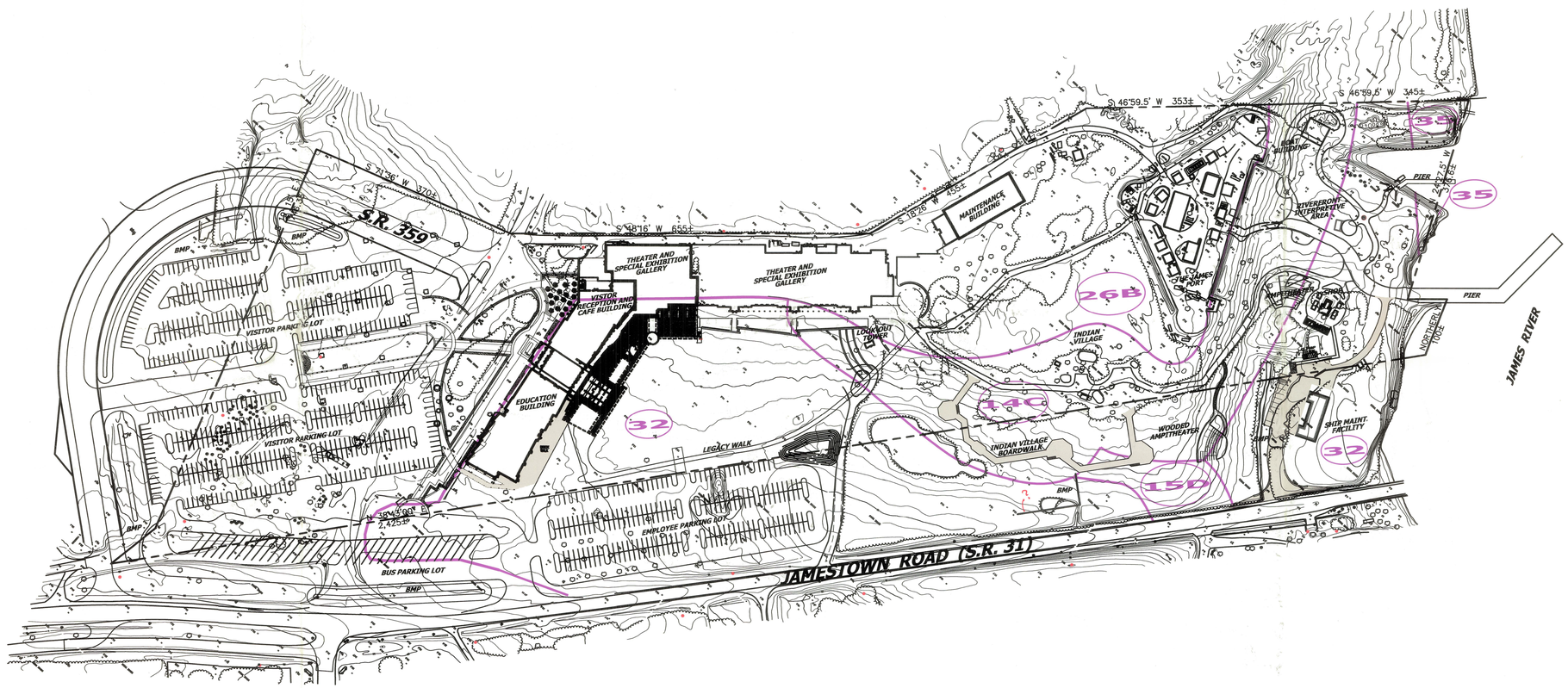
www.rickmond.com
REI PROJECT NO. 00175-025

JAMESTOWN SETTLEMENT
STORMWATER MANAGEMENT MASTER PLAN

JAMES CITY COUNTY, VIRGINIA
JAMESTOWN MAGISTERIAL DISTRICT



NOTES:

1) AERIAL TOPOGRAPHY PROVIDED TO RICKMOND ENGINEERING, INC. BY THE JAMESTOWN–YORKTOWN FOUNDATION AND HAS NOT BEEN FIELD VERIFIED.
2) BOUNDARY SHOWN HEREON IS PER PROPERTY MAP OF JAMESTOWN FESTIVAL PARK, DATED 11–03–1977 AND HAS NOT BEEN FIELD VERIFIED.

SOILS CLASSIFICATION	SOILS NUMBER
EMPORIA (FINE SANDY LOAM)	14C
EMPORIA (COMPLEX)	15D
PAMUNKEY	26B
TETOTUM (SILT LOAM)	32
UDORTHENTS	35

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

OWNER/DEVELOPER

JAMESTOWN–YORKTOWN FOUNDATION
P.O. BOX 1607
WILLIAMSBURG, VIRGINIA 23187

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SOILS MAP

Date: 4/22/02 Project No. 00175 Appendix A

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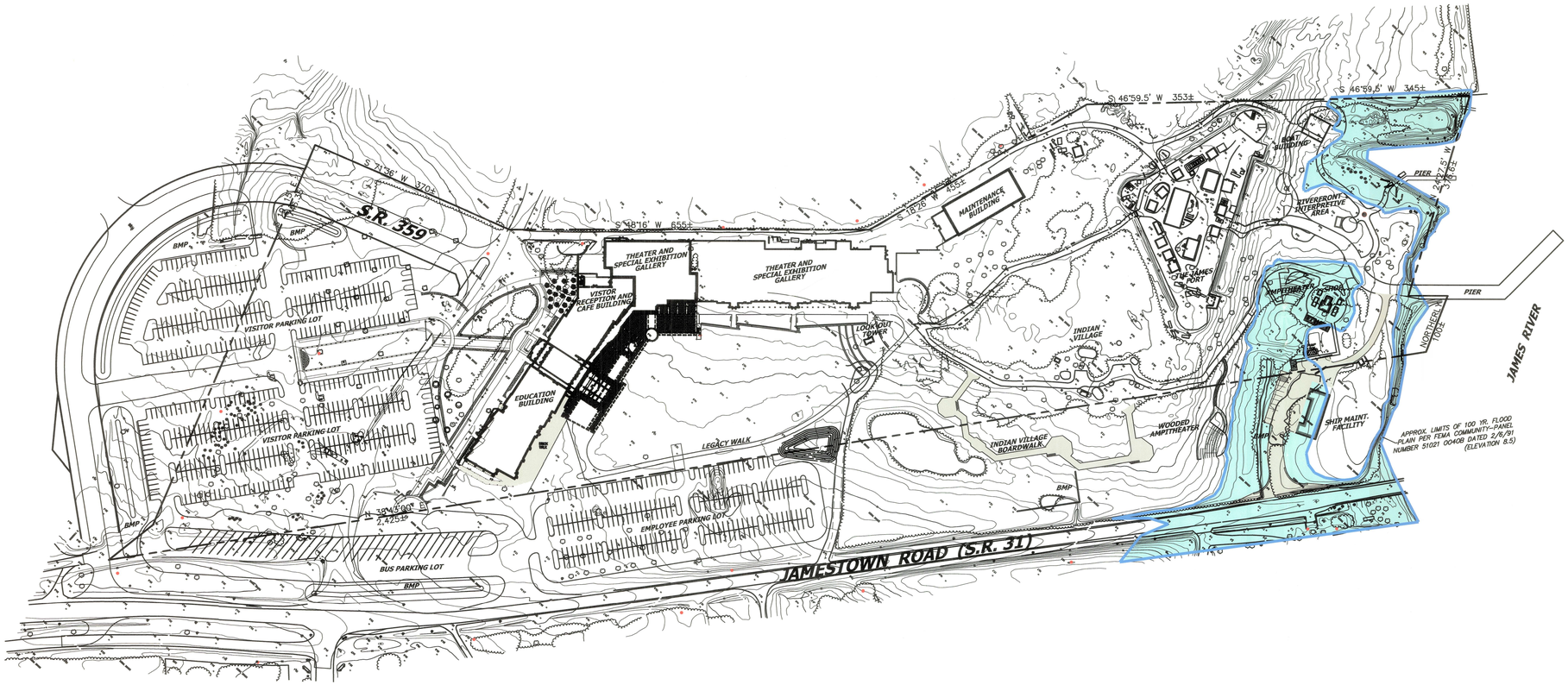
JAMESTOWN SETTLEMENT
STORMWATER MANAGEMENT MASTER PLAN

JAMES CITY COUNTY, VIRGINIA
JAMESTOWN MAGISTERIAL DISTRICT



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OWNER/DEVELOPER

JAMESTOWN-YORKTOWN FOUNDATION
P.O. BOX 1607
WILLIAMSBURG, VIRGINIA 23187

GRAPHIC SCALE

100 0 50 100 200 400
(IN FEET)
1 inch = 100 ft.

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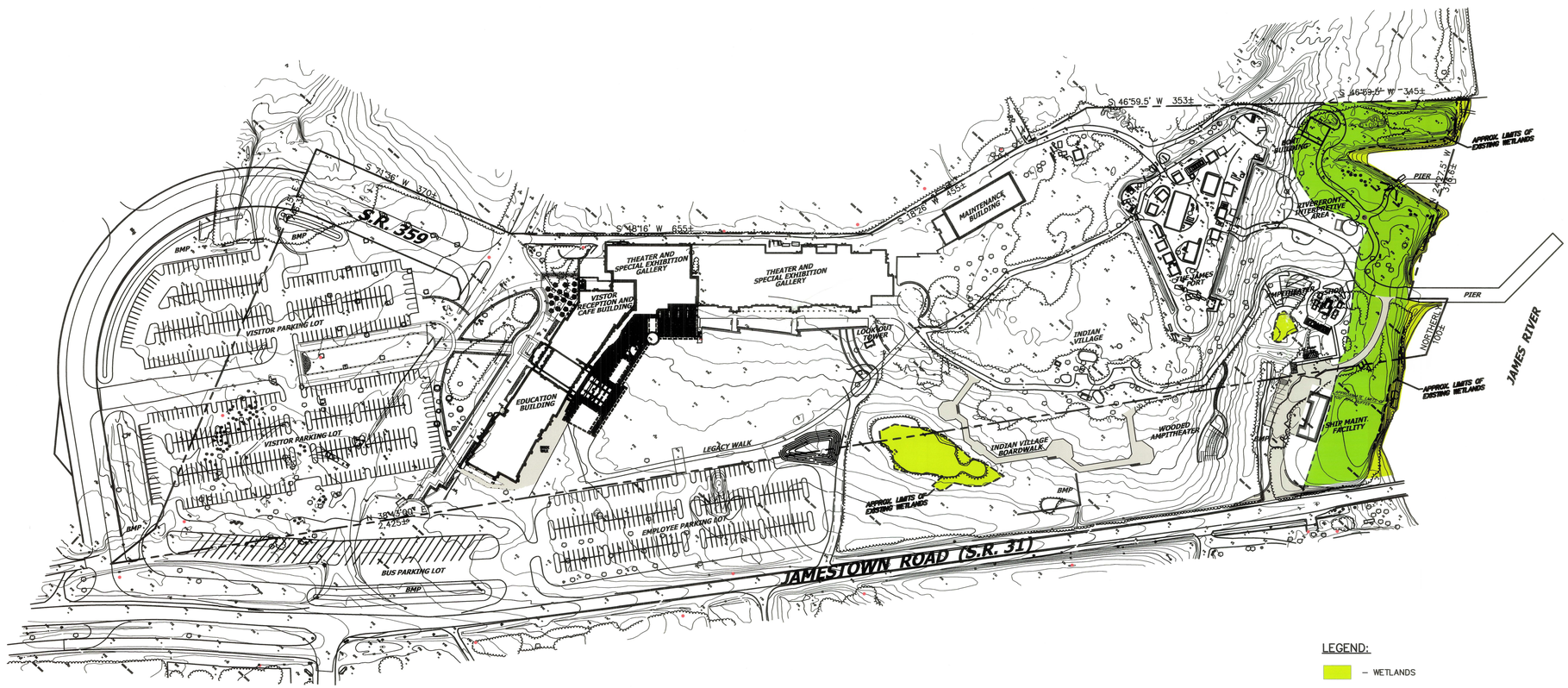
FLOOD PLAIN MAP

Date: 4/22/02 | Project No. 00175 | Appendix B

I:/01198/MASTERPLAN.DWG

JAMESTOWN SETTLEMENT
STORMWATER MANAGEMENT MASTER PLAN

JAMES CITY COUNTY, VIRGINIA
JAMESTOWN MAGISTERIAL DISTRICT



LEGEND:

- WETLANDS
- R.P.A. BUFFER

NOTES:

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2) BOUNDARY SHOWN HEREON IS PER PROPERTY MAP OF JAMESTOWN FESTIVAL PARK, DATED 11-03-1977 AND HAS NOT BEEN FIELD VERIFIED.
3) THE LIMITS OF WETLANDS DEPICTED ARE BASED ON A FIELD SURVEY PERFORMED BY RICKMOND ENGINEERING, INC. OF WETLANDS DELINEATION PERFORMED BY E.S.G., INC. IN NOVEMBER 2000 & REVISED IN JANUARY 2001.
4) THE APPROXIMATE LIMITS OF THE 100-FOOT RESOURCE PROTECTION AREA ARE TAKEN FROM THE JAMES CITY COUNTY TAX MAPS NO. 48-3 AND 54-1.

OWNER/DEVELOPER

JAMESTOWN-YORKTOWN FOUNDATION
P.O. BOX 1607
WILLIAMSBURG, VIRGINIA 23187

GRAPHIC SCALE

100 0 50 100 200 400
(IN FEET)
1 inch = 100 ft.

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Fax: (540)349-7731
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EXISTING WETLANDS AND R.P.A. MAP

Date: 4/22/02 | Project No. 00175 | Appendix C

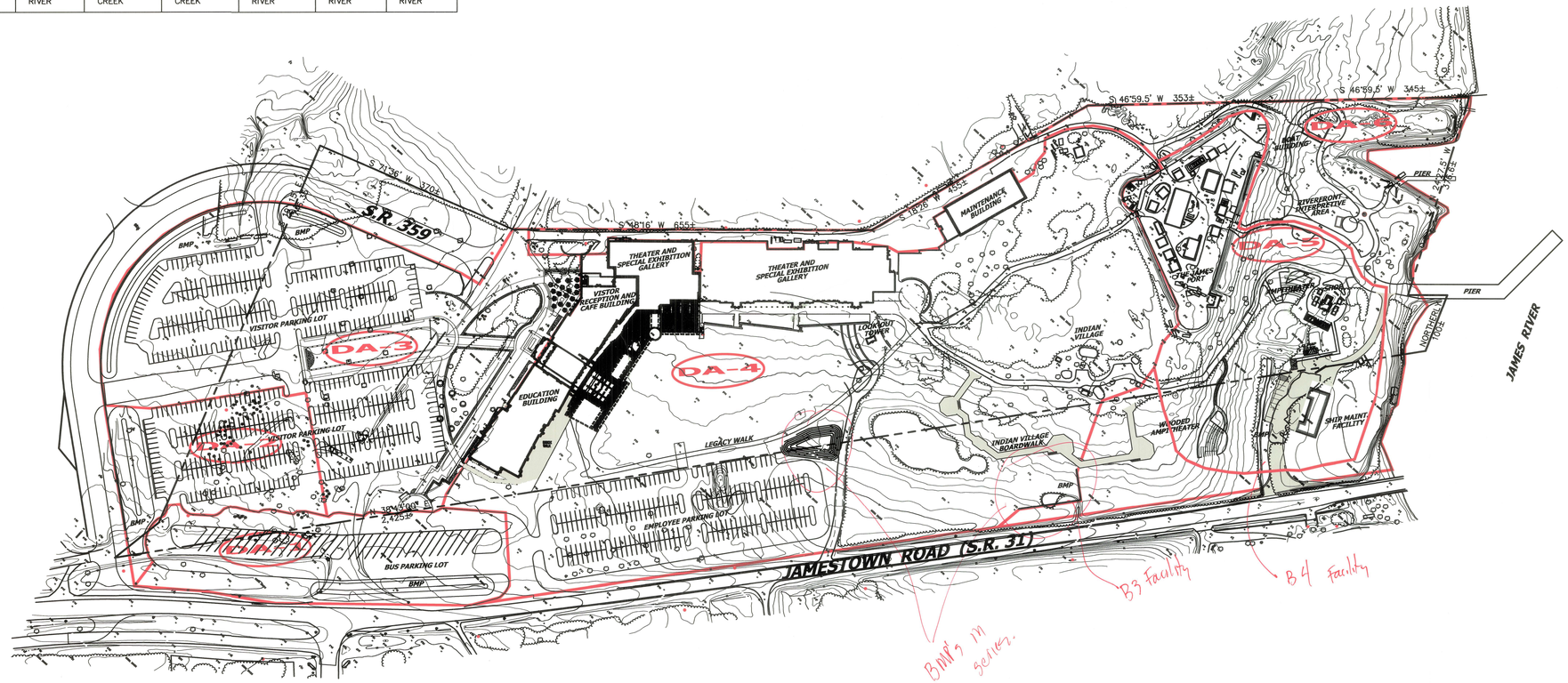
I:/01198/MASTERPLAN.DWG

JAMESTOWN SETTLEMENT
STORMWATER MANAGEMENT MASTER PLAN

JAMES CITY COUNTY, VIRGINIA
JAMESTOWN MAGISTERIAL DISTRICT

DRAINAGE AREA (DA)	1	2	3	4	5	6
AREA	2.53 AC.	1.91 AC.	7.35 AC.	14.72 AC.	4.75 AC.	4.43 AC.
IMPERVIOUS AREA	1.94 AC.	1.28 AC.	4.06 AC.	6.36 AC.	1.23 AC.	0.45 AC.
MAX. IMPERVIOUS AREA TO BMP	1.94 AC.	1.28 AC.	4.06 AC.	9.87 AC.	2.85 AC.	N/A
IMPERVIOUS AREA REMAINING	0.00 AC.	0.00 AC.	0.00 AC.	3.51 AC.	1.62 AC.	N/A
WATERSHED	JAMES RIVER	POWHATAN CREEK	POWHATAN CREEK	JAMES RIVER	JAMES RIVER	JAMES RIVER

– Including all 3 trans from on 7913 Plan



NOTES:

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2) BOUNDARY SHOWN HEREON IS PER PROPERTY MAP OF JAMESTOWN FESTIVAL PARK, DATED 11–03–1977 AND HAS NOT BEEN FIELD VERIFIED.

OWNER/DEVELOPER

JAMESTOWN–YORKTOWN FOUNDATION
P.O. BOX 1607
WILLIAMSBURG, VIRGINIA 23187

GRAPHIC SCALE

100 0 50 100 200 400
(IN FEET)
1 inch = 100 ft.

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DRAINAGE AREA MAP

Date: 4/22/02 Project No. 00175 Appendix D

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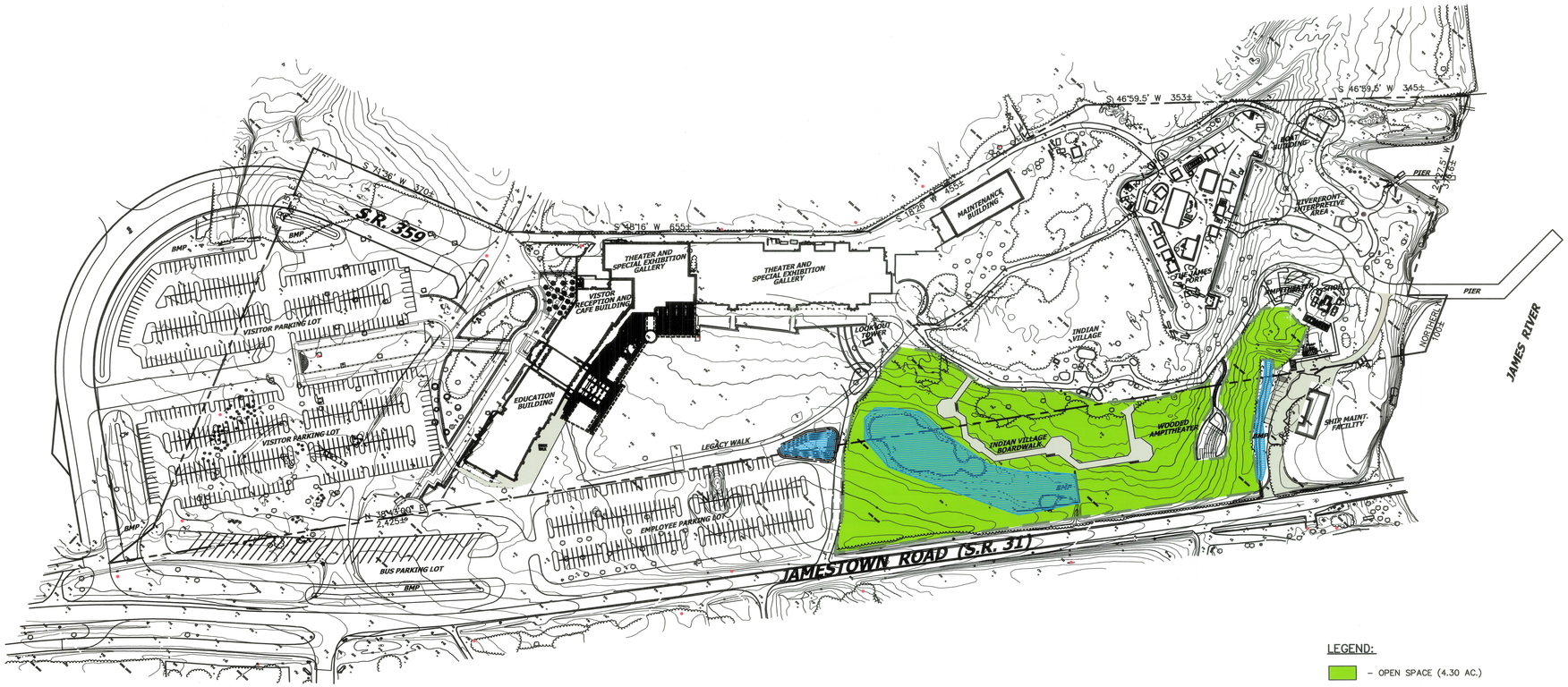
99147_JAMESTOWN_SETTLEMENT - 345

JAMESTOWN SETTLEMENT
STORMWATER MANAGEMENT MASTER PLAN

JAMES CITY COUNTY, VIRGINIA
JAMESTOWN MAGISTERIAL DISTRICT



NOTES:

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2) BOUNDARY SHOWN HEREON IS PER PROPERTY MAP OF JAMESTOWN FESTIVAL PARK, DATED 11-03-1977 AND HAS NOT BEEN FIELD VERIFIED.

LEGEND:

- OPEN SPACE (4.30 AC.)
- B.M.P.

OWNER/DEVELOPER

JAMESTOWN-YORKTOWN FOUNDATION
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WILLIAMSBURG, VIRGINIA 23187

GRAPHIC SCALE

100 0 50 100 200 400
(IN FEET)
1 inch = 100 ft.

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STORMWATER MANAGEMENT FACILITIES MAP

Date: 4/22/02 Project No. 00175 Appendix F

I:/01198/MASTERPLAN.DWG

Open space requirement & criteria may not be met. [4.3ac]

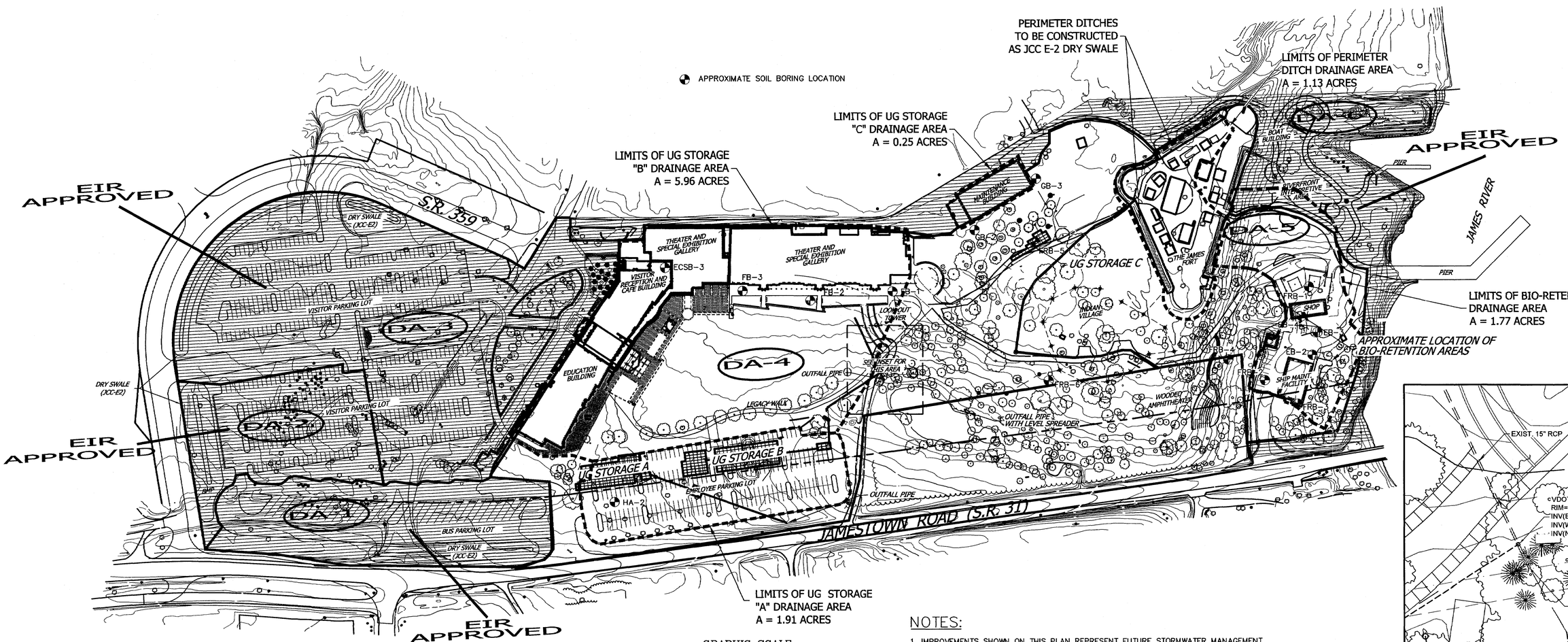
Does not include ampitheatre Bdwk & 10'x180' for BMP const.

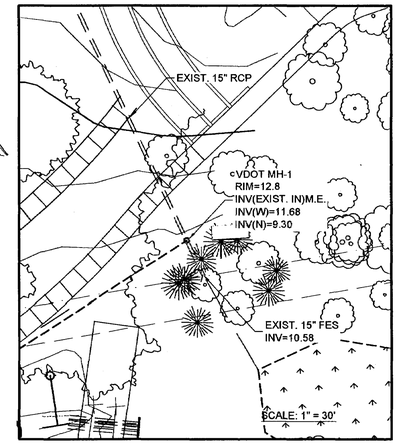
New BMP not designed

Roadway – part water dep.

JAMESTOWN SETTLEMENT
STORMWATER MANAGEMENT MASTER PLAN

JAMES CITY COUNTY, VIRGINIA
JAMESTOWN MAGISTERIAL DISTRICT





INSET

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

DRAINAGE AREA (DA)	DA-1	DA-2	DA-3	DA-4	DA-5	DA-6
AREA	2.53 AC.	1.91 AC.	7.35 AC.	12.23 AC.	5.53 AC.	3.95 AC.
IMPERVIOUS AREA	1.94 AC.	1.28 AC.	4.06 AC.	6.04 AC.	1.23 AC.	0.58 AC.
MAX. IMPERVIOUS AREA TO BMP	1.94 AC.	1.28 AC.	4.06 AC.	7.47 AC.	3.32 AC.	N/A
IMPERVIOUS AREA REMAINING	0.00 AC.	0.00 AC.	0.00 AC.	1.21 AC.	2.09 AC.	N/A
EIR APPROVED	YES	YES	YES	NO	NO	YES
WATERSHED	JAMES RIVER	POWHATAN CREEK	POWHATAN CREEK	JAMES RIVER	JAMES RIVER	JAMES RIVER

NOTES:

1. IMPROVEMENTS SHOWN ON THIS PLAN REPRESENT FUTURE STORMWATER MANAGEMENT FEATURES IN DRAINAGE AREAS 4 AND 5. STORMWATER MANAGEMENT FEATURES SHOWN IN AREAS 1 THROUGH 3 AND 6 HAVE ALREADY BEEN ACCEPTED BY THE STATE. DETAILED CONSTRUCTION PLANS FOR EACH INDIVIDUAL PROPOSED FACILITY WILL BE FORTHCOMING.

2. MAINTENANCE SCHEDULES FOR BIO-RETENTION FACILITIES, DRY SWALE, AND STORM CHAMBER SYSTEMS SHALL BE PROVIDED WITH THE ASSOCIATED DETAILED CONSTRUCTION PLANS.

3. BIO-RETENTION AREAS SHALL BE IN ACCORDANCE WITH THE VIRGINIA STORMWATER MANAGEMENT HANDBOOK AND SHALL TREAT 1" OF RUNOFF PER IMPERVIOUS AREA ASSOCIATED WITH THE RIVERFRONT AMENITIES, SHIPWRIGHT BUILDING, AND PUMP STATION PROJECTS. SQUARE FOOTAGE REQUIRED FOR THE BIO-RETENTION FACILITIES EQUALS 5% OF THE IMPERVIOUS AREA DRAINING TO EACH FACILITY.

4. AERIAL TOPOGRAPHY PROVIDED TO RICKMOND ENGINEERING, INC. BY THE JAMESTOWN-YORKTOWN FOUNDATION AND HAS NOT BEEN FIELD VERIFIED.

5. BOUNDARY SHOWN HEREON IS PER PROPERTY MAP OF JAMESTOWN FESTIVAL PARK, DATED 11-03-1977 AND HAS NOT BEEN FIELD VERIFIED

OWNER/DEVELOPER

JAMESTOWN-YORKTOWN FOUNDATION
P.O. BOX 1607
WILLIAMSBURG, VIRGINIA 23187

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Warrenton, VA 20187
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Fax: (540)349-7731
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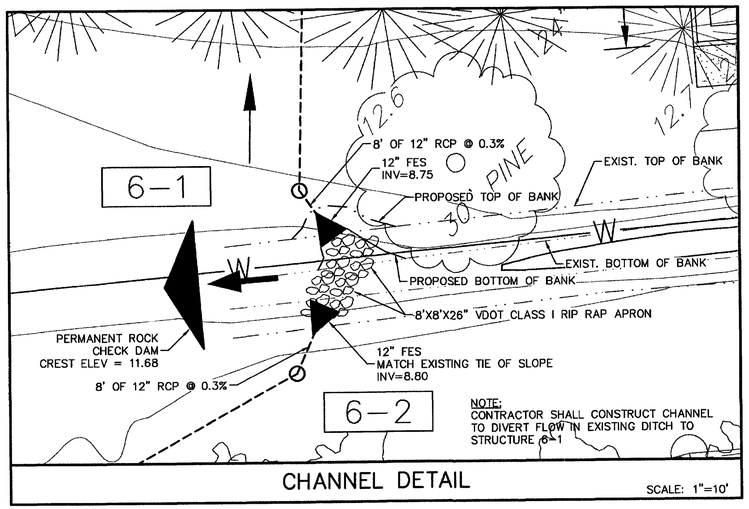
STORMWATER MANAGEMENT MASTER PLAN

Date: 4/22/02 Project No. 01198-255
Revised: 03-09-05



CHANNEL DETAIL

SCALE: 1"=10'

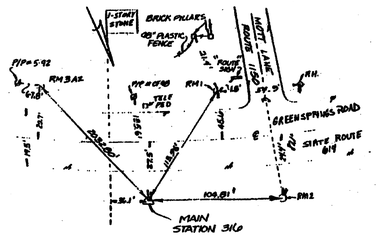
JAMES CITY COUNTY
PRIMARY SERVICE AREA GEODETIC GROUND CONTROL NETWORK
JULY 1990 SURVEY MARK REFERENCE AND RECOVERY DATA

VIRGINIA STATE PLANE COORDINATES–SOUTH ZONE (NAD83)(1986)			
STATION NO.	UNITS	EASTING (X)	NORTHING (Y)
316	Meters	3652024.009	1101738.170
	U.S. Survey Ft.	11981682.102	3614619.314
	Int'l Ft.	11981706.066	3614626.543
STA. AZIMUTH MARK	UNITS	EASTING (X)	NORTHING (Y)
316 RM3 AZ.	Meters	3652270.627	1101169.769
	U.S. Survey Ft.	11982491.214	3612754.483
	Int'l Ft.	11982515.179	3612761.709

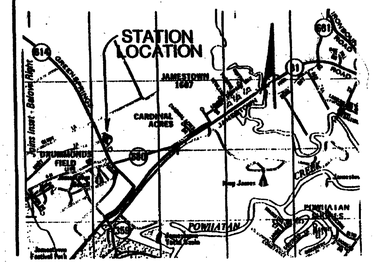
REFERENCE AND AZIMUTH MARK LOCATIONS		
OBJECT	BEARING	DISTANCE (FEET)
RM1	N77°18'25"W	113.56
RM2	N39°22'02"W	104.81
RM3 AZ.	S23°27'18"E	2032.80

VERTICAL DATA	
Elevations refer to National Geodetic Vertical Datum (1929)	
Elevation of Station in Feet = 27.17	
FOR WRITTEN DESCRIPTION & ADDITIONAL DATA SEE REVERSE SIDE	
Elevation of Azimuth Mark in Feet = 25.63	
COUNTY / CITY: JAMES CITY COUNTY	DISTRICT: BERKELEY
STATION NUMBER: 316	FIELD BOOKS: P.S. 363, P. 38-39

LOCATION SKETCH (Not to Scale)



LOCATION MAP (Scale: 1"=2000')

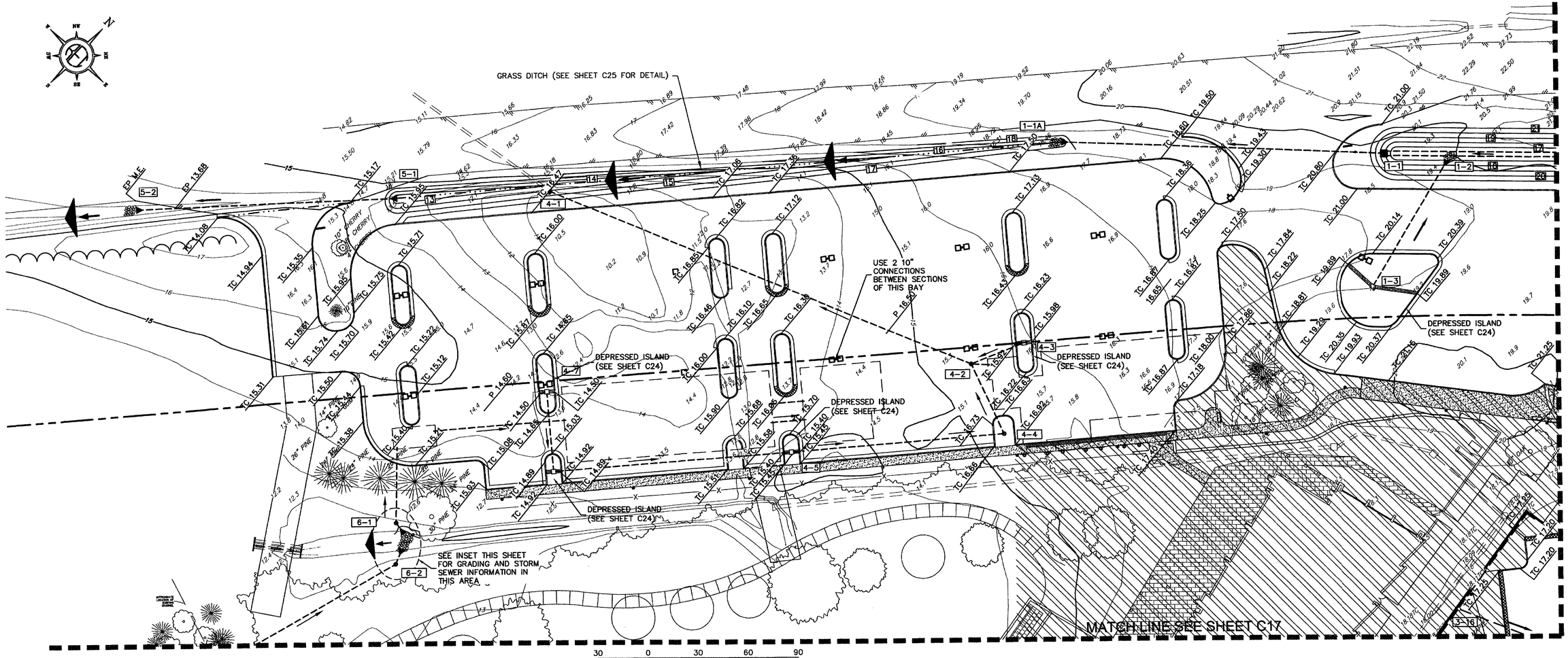


NOTE:

CERTAIN AREAS WITHIN THE EMPLOYEE PARKING LOT WILL REQUIRE SIGNIFICANT AMMOUNTS OF FILL. REFERENCE PROJECT MANUAL (SPEC SECTION 02300 AND GEOTECHNICAL REPORT) FOR INFORMATION ON SUITABILITY OF NATIVE/ON-SITE SOILS FOR RE-USE AS FILL MATERIAL.

SEE LANDSCAPE PLANS FOR GRADING IN THIS AREA

MATCH LINE SEE SHEET C15



Scale 1" = 30'

BEFORE DIGGING CALL "MISS UTILITY" OF VIRGINIA AT 1-800-552-7001

99147_JAMESTOWN_SETTLEMENT - 349

Rickmond Engineering, Inc.
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Surveying
Engineering
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Designed By: MJB | Drawn By: DAS | Scale: 1"=30' | Date: 10/27/03

No.	By	Revision	App.	Date
1	DRD	REVISED TO INCLUDE UG STORAGE BAY	DNJ	12.17.03

JAMESTOWN ENTRANCE PLAZA AND PARKING LOT IMPROVEMENTS

STATE PN: 425-16133

GRADING PLAN

JAMES CITY COUNTY VIRGINIA

Job Number	Sheet No.
01198	C14

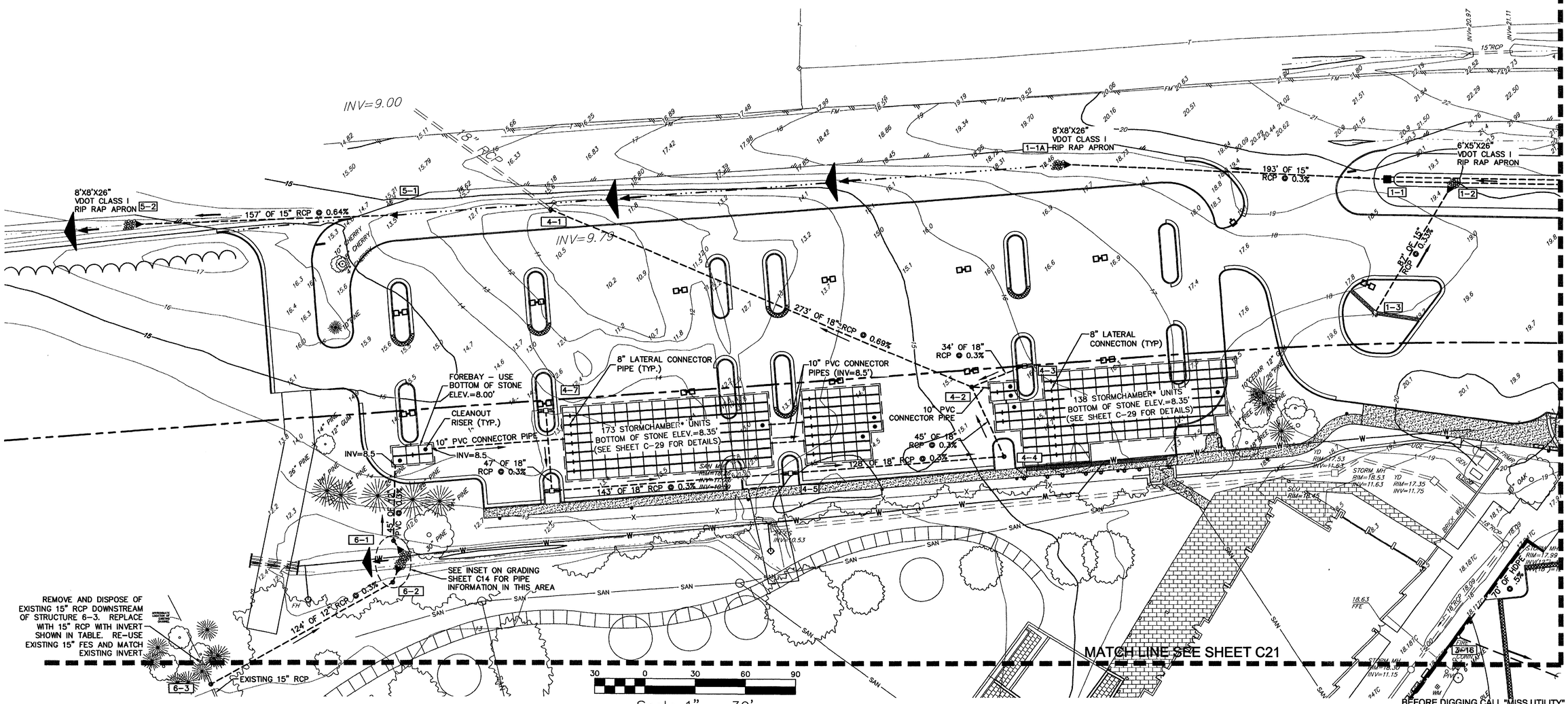
STORM SEWER STRUCTURE TABLE

1-1	SEE DETAIL SHEET C25
1-1A	VDOT ES-1 INV=15.75
1-2	VDOT ES-1 INV=16.5
1-3	VDOT DI-1 RIM=19.73 INV=16.79
3-16	VDOT MH-1 RIM=17.63 INV=12.49
4-1	VDOT MH-1 RIM=14.00 INV(IN)=9.81 IN(OUT)=9.79ME
4-2	VDOT MH-1 RIM=16.20 INV(N)=11.76 INV(NE, 10")=8.6 INV(E)=9.11 INV(OUT)=11.68
4-3	VDOT DI-1 RIM=15.57 INV=11.86
4-4	VDOT MH-1 RIM=17.00 INV(W)=9.25 INV(SW)=9.35
4-5	VDOT DI-1 RIM=15.03 INV(NE)=9.74 INV(SW)=9.84
4-6	VDOT DI-1 RIM=14.55 INV(NE)=10.17 INV(NW)=10.27
4-7	VDOT DI-1 RIM=14.13 INV=10.42
5-1	VDOT ES-1 INV=12.00
5-2	VDOT ES-1 INV=11.00
6-1	VDOT MH-1 RIM=12.20 INV(NW)=8.63 INV(E)=8.73
6-2	VDOT MH-1 RIM=12.1 INV(N)=8.82 INV(S)=8.92
6-3	VDOT MH-1 RIM=12.8 (M.E.) INV(EXIST. IN)=M.E. INV(W)=11.68 INV(N)=9.30

*NOTE:

LAYOUT SHOWN IS BASED ON HYDROLOGIC SOLUTIONS' "STORMCHAMBER" PRODUCT. THE FOLLOWING MANUFACTURER'S PRODUCE AN EQUIVALENT PRODUCT THAT MAY BE USED AS A SUBSTITUTE: 1) CULTEC, INC. AND 2) STORM TECH, LLC.. IF EITHER OF THE ALTERNATE PRODUCTS ARE USED, THE CONTRACTOR SHALL ENSURE THAT A STORAGE VOLUME OF 13,504 CUBIC FEET IS PROVIDED IN THE MAIN STORAGE BAY (THIS IS A TOTAL VOLUME BASED ON STORAGE WITHIN THE CHAMBERS AND STORAGE IN THE VOIDS OF THE AGGREGATE USED). THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AN ALTERNATE LAYOUT IF THE CULTEC, INC. OR STORM TECH, LLC. PRODUCTS ARE SELECTED. CONTACT INFORMATION FOR EACH OF THE THREE APPROVED MANUFACTURERS IS PROVIDED IN SPECIFICATION SECTION 02630-1 "STORMCHAMBER SPECIFICATIONS."

MATCH LINE SEE SHEET C19



99147_JAMESTOWN_SETTLEMENT - 350

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Designed By: MJB | Drawn By: DAS | Scale: 1"=30' | Date: 10/27/03

COMMONWEALTH OF VIRGINIA DONALD N. JENNINGS No. 036800 PROFESSIONAL ENGINEER 12-17-03

No.	By	Revision	App.	Date
1	DRD	REVISED TO INCLUDE UG STORAGE BAY	DNJ	12.17.03

JAMESTOWN ENTRANCE PLAZA AND PARKING LOT IMPROVEMENTS

STATE PN: 425-16133

UTILITY PLAN

JAMES CITY COUNTY VIRGINIA

Job Number 01198 | Sheet No. C18

BEFORE DIGGING CALL "MISS UTILITY" OF VIRGINIA AT 1-800-552-7001

Erosion and Sediment Control Plan

for the

Jamestown Settlement
Drainage Improvements

September 10, 2001
Revised February 1, 2002

Rickmond ENGINEERING, INC.

COMMONWEALTH OF VIRGINIA
K.M. JENKINS II
No.022872
2/1/02
PROFESSIONAL ENGINEER

Project No. 00175-020
State Project Number: 425-16474 –01/425-16474-02/425-2000-02

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SECTION

MAINTENANCE

FIGURES

APPENDICES

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PROJECT DESCRIPTION

The project consists of installation of perimeter drainage structures at the James Fort and the Indian Village and construction of a pond/wetland system BMP at the James Settlement located in James City County. The project site is adjacent to the Colonial National Historic Parkway and Route 31. The facility consists of approximately 24 acres and utilizes approximately 7 additional acres of Virginia Department of Transportation (VDOT) property for a total of 31 acres of partially developed, yet wooded land. A vicinity map depicting the approximate location of the project is provided as FIGURE 1 of this plan.

EXISTING SITE CONDITIONS

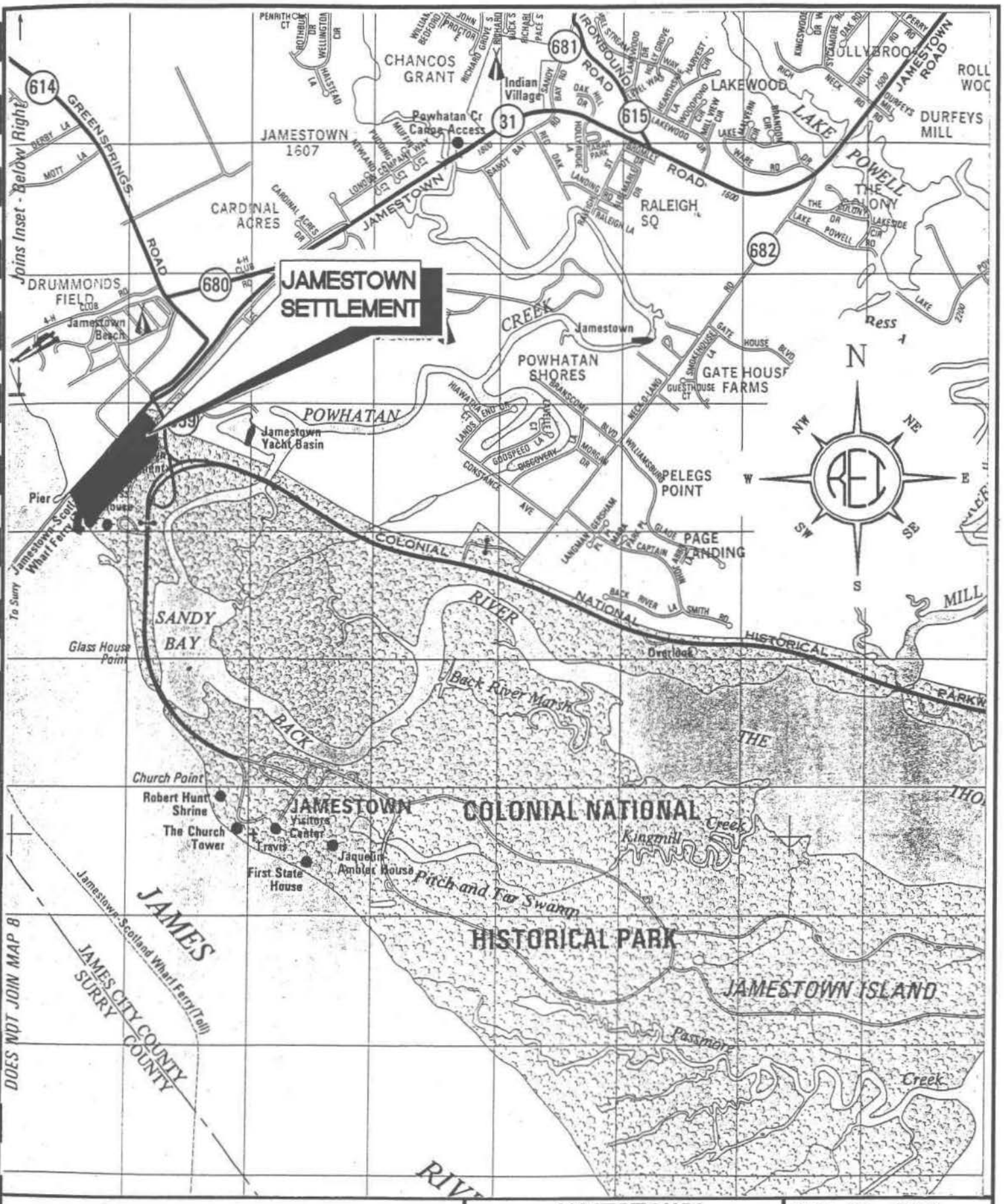
The study area consists of approximately 23.9 acres containing six buildings, an Indian Village, the James Fort, wooded areas, and grassy areas. The facilities topography is relatively flat around the four main buildings and the Fort (Elevation 15) and slopes to the James River at approximately 4 percent.

ADJACENT AREAS

The site is bounded on the west by the James River, on the north by Jamestown Road (Route 31), on the east by vacant land, and on the south by the Colonial National Historic Parkway.

OFF-SITE AREAS

Off-site disturbances include a portion of the perimeter drainage system associated with the Indian Village, construction of a boardwalk, and the timber wall BMP with wet pond which are all located on the Jamestown Road (S.R. #31) right-of-way. Erosion and sediment control measures for these off-site disturbances are provided on the plans.



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JAMESTOWN SETTLEMENT

VICINITY MAP

PROJ. NO.:	00175
DWG:	FIGURE 1
DATE:	02.14.01
SCALE:	1"=2000'
SHEET	1 OF 1

SOILS

According to the "Soil Survey of James City and York Counties and the City of Williamsburg, Virginia" (1985), the facility is located within five classifications of soils. The five soils are Emporia fine sandy loam (14C), Emporia complex (15D), Pamunkey soils (26B), Tetotum silt loam (32), and Udorthents (35).

Emporia Fine Sandy Loam (14C)

Emporia fine sandy loam soil is deep, strongly sloping, and well drained.

Typically, the surface layer of this soil is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is pale brown loam 9 inches thick. The subsoil extends to a depth of 58 inches. It is yellowish brown loam with mostly strong brown mottles in the upper part; yellowish brown, firm sandy clay loam with strong brown and gray mottles in the middle part; and mottled gray and brown, firm sandy clay loam in the lower part. The substratum to a depth of at least 75 inches is variegated gray, brown, and red, firm sandy clay loam.

In this Emporia soil, permeability is moderate in the upper part of the subsoil and moderately slow in the lower part. The erosion hazard is severe.

Emporia Complex (15D)

Emporia complex consists of areas of deep, moderately steep, well-drained Emporia soils and areas of similar soils that formed over layers of fossil shells.

Typically, the surface layer of Emporia soils is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is pale brown loam 7 inches thick. The subsoil extends to a depth of 54 inches. It is yellowish brown loam with mostly strong brown mottles in the upper part; yellowish brown, firm sandy clay loam with strong brown and gray mottles in the middle part; and mottled gray and brown, firm sandy clay loam in the lower part. The substratum is variegated brown, red, and gray, firm sandy clay loam to a depth of at least 75 inches.

In these Emporia soils, permeability is moderate in the upper part of the subsoil and moderately slow in the lower part. The erosion hazard is severe.

Pamunkey Soils (26B)

Pamunkey soils are deep, gently sloping, and well drained.

The texture of the surface layer of these soils is highly variable throughout the survey areas. Typically, the surface layer of the Pamunkey soils is dark grayish brown sandy loam about 4 inches thick. The subsurface layer is brown sandy loam 10 inches thick. The subsoil extends to a depth of 43 inches. It is mostly yellowish brown sandy loam and dark brown sandy clay loam. The substratum is mostly brown and strong brown loamy sand and sand to a depth of at least 75 inches.

The permeability of these Pamunkey soils is moderate, and the erosion hazard is moderate.

Tetotum Silt Loam (32)

Tetotum silt loam soil is deep, nearly level, and moderately well drained.

Typically, the surface layer of this soil is dark grayish brown silt loam about 5 inches thick. The subsurface is mostly yellowish brown silt loam, silty clay loam, clay loam, and loam 41 inches thick. It has gray mottles at a depth of more than 27 inches. The substratum is mottled yellowish brown, gray, and strong brown fine sandy loam to a depth of at least 65 inches.

The permeability of this Tetotum soil is moderate, and the erosion hazard is slight.

Udorthents (35)

Udorthents consist of deep, well-drained and moderately well drained loamy soil material in areas where the soils have been disturbed during excavation and grading. The permeability ranges from moderately rapid to slow and the erosion hazard ranges from slight to severe.

CRITICAL EROSION AREAS

The critical erosion areas associated with this site are considered to be the two wetland pockets and the downstream receiving channels. To prevent sediment from entering these areas, it is imperative that the contractor installs all control measures shown on these plans before any land disturbing activities commence. Regular inspection and maintenance is also required for all erosion and sediment control measures to keep them functioning as designed.

EROSION AND SEDIMENT CONTROL MEASURES

Unless otherwise indicated, all structural and vegetative erosion and sediment control practices shall be constructed and maintained according to minimum standards and specifications of the latest edition of the Virginia Erosion and Sediment Control Handbook (VESCH). The minimum standards shall be adhered to unless otherwise waived or approved by a variance.

STRUCTURAL PRACTICES

Temporary Stone Construction Entrance – 3.02

Temporary stone construction entrances shall be provided at points of vehicular ingress and egress as depicted on the plans.

Silt Fence – 3.05

Silt fence shall be installed along the perimeter of the site as depicted on the plans.

Storm Drain Inlet Protection – 3.07

Storm drain inlet protection shall be provided around existing storm drain drop inlets as depicted on the plans.

Culvert Inlet Protection – 3.08

Culvert inlet protection shall be installed at the inlet to storm sewer culverts as depicted on the plans.

Check Dam – 3.20

Check dams shall be installed as depicted on the plans.

Tree Preservation and Protection – 3.38

Tree preservation and protection shall be provided for the protection of desirable trees from mechanical and other injury during land disturbing and construction activity. These devices shall be installed at the locations indicated on the plans.

VEGETATIVE PRACTICES

Temporary Seeding – 3.31

All denuded areas, which will be left dormant for extended periods of time, shall be seeded with fast germinating temporary vegetation immediately following grading. Selection of the seed mixture will depend on the time of year it is applied.

MANAGEMENT STRATEGIES

- Construction will be sequenced so that grading operations can begin and end as quickly as possible.

- Areas that are not to be disturbed will be clearly marked by survey flagging.

- Sediment trapping measures will be installed as the first step in grading and will be seeded and mulched immediately following installation.

- Temporary seeding or other stabilization will follow immediately after grading.

- The contractor shall be responsible for the installation and maintenance of all erosion and sediment control practices depicted on the plans.

- After achieving adequate stabilization, the temporary controls will be cleaned and removed. Any areas disturbed in the removal process shall be graded, topsoiled, and seeded accordingly.

PERMANENT STABILIZATION

All areas disturbed by construction shall be stabilized with permanent seeding immediately following finish grading. Seeding shall be done with Kentucky 31 Tall Fescue according to Std. And Spec. 3.32, PERMANENT SEEDING, of the handbook. Erosion control blankets will be installed over fill slopes which have been brought to final grade and have been seeded to protect the slopes from rill and gully erosion and to allow seed to germinate properly. Mulch (straw or fiber) will be used on relatively flat areas. In all seeding operations, seed, fertilizer and lime will be applied prior to mulching.

STORMWATER MANAGEMENT

James City County's 10-Point Best Management Practice (BMP) requirements for compliance with the Chesapeake Bay Preservation Act would be satisfied by the combined use of conservation areas and one wetland water quality BMP. A total of 4.99 acres of the 23.9-acre study area are proposed to be preserved as conservation areas. A pond/wetland system BMP (B-3) is proposed to be constructed in DA-2 to receive and treat stormwater runoff from DA-1, 2, and 3. This pond/wetland system BMP would contain a storage volume of 36,000 cubic feet. The combination of conservation areas and structural BMP provide 10.03 points as calculated according to the James City County BMP worksheet provided in APPENDIX E of the Jamestown Settlement Stormwater Management Master Plan for the Jamestown-Yorktown Foundation.

MAINTENANCE

In general, all erosion and sediment control measures will be checked daily and after each significant rainfall. The following items will be checked in particular:

Temporary Stone Construction Entrance – 3.02

The entrance shall be maintained in a condition, which will prevent tracking or flow of mud onto public rights-of-way. This may require periodic top dressing with additional stone or the washing and reworking of existing stone as conditions demand and repair and/or cleanout of any structures used to trap sediment. All materials spilled, dropped, washed, or tracked from vehicles onto roadways or into storm drains must be removed immediately. The use of water trucks to remove materials dropped, washed, or tracked onto roadways will not be permitted under any circumstances.

Silt Fence – 3.05

Silt fences shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs shall be made immediately.

Close attention shall be paid to the repair of damaged silt fence resulting from end runs and undercutting.

Should the fabric on a silt fence decompose or become ineffective prior to the end of the expected usable life and the barrier still is necessary, the fabric shall be replaced promptly.

Sediment deposits should be removed after each storm event. They must be removed when deposits reach approximately one-half the height of the barrier.

Any sediment deposits remaining in place after the silt fence is no longer required should be dressed to conform to the existing grade, prepared and seeded.

Storm Drain Inlet Protection – 3.07

The structure shall be inspected after each rain and repairs made as needed.

Sediment shall be removed and the trap restored to its original dimensions when the sediment has accumulated to one-half the design depth of the trap. Removed sediment shall be deposited in a suitable area and in such a manner that it will not erode.

Structures shall be removed and the area stabilized when the remaining drainage area has been properly stabilized.

Culvert Inlet Protection – 3.08

The structure shall be inspected after each rain and repairs made as needed.

Aggregate shall be replaced or cleaned when inspection reveals that clogged voids are causing ponding problems, which interfere with on-site construction.

Sediment shall be removed and the impoundment restored to its original dimensions when sediment has accumulated to one-half the design depth. Removed sediment shall be deposited in a suitable area and in such a manner that it will not erode and cause sedimentation problems.

Temporary structures shall be removed when they have served their useful purpose but not before the upslope area has been permanently stabilized.

Check Dam – 3.20

Check dams should be checked for sediment accumulation after each runoff-production storm event. Sediment should be removed when it reaches one-half of the original height of the measure.

Regular inspections should be made to ensure that the center of the dam is lower than the edges. Erosion caused by high flows around the edges of the dam should be corrected immediately.

Temporary Seeding – 3.31

The seeded/mulched areas should be checked regularly to ensure that a good stand is established and maintained. Areas should be fertilized, mulched and re-seeded as needed. When it is clear that plants have not germinated on an area or have died, these areas must be re-seeded immediately to prevent erosion damage. However, it is extremely important to determine for what reason germination did not take place and make any corrective action necessary prior to re-seeding the area.

Tree Protection - 3.38

In spite of precautions, some damage to protected trees may occur. In such cases, the following maintenance guidelines should be followed:

Soil Aeration

If the soil has become compacted over the root zone of any tree, the ground shall be aerated by punching holes with an iron bar. The bar shall be driven 1 foot deep and then moved back and forth until the soil is loosened. This procedure shall be repeated every 18 inches until all of the compacted soil beneath the crown of the tree has been loosened.

Repair of Damage

- Any damage to the crown, trunk, or root system of any tree retained on the site shall be repaired immediately.

- Whenever major root or bark damage occurs, remove some foliage to reduce the demand for water and nutrients.

- Damaged roots shall immediately be cut off cleanly inside the exposed or damaged area. Cut surfaces shall be painted with approved tree paint, and moist peat moss, burlap, or topsoil shall be spread over the exposed area.
- To treat bark damage, carefully cut away all loosened bark back into the undamaged area, taper the cut at the top and bottom, and provide drainage at the base of the wound

- All tree limbs damaged during construction or removed for any other reason shall be cut off above the collar at the preceding branch junction.

- Care for serious injuries shall be prescribed by a forester or a tree specialist.

Fertilization

Broadleaf trees that have been stressed or damaged shall receive a heavy application of fertilizer to aid their recovery.

- Trees shall be fertilized in the late fall (after October 1) or the early spring (from the time frost is out of the ground until May 1). Fall applications are preferred, as the nutrients will be made available over a longer period of time.

- Fertilizer shall be applied to the soil over the feeder roots. In no case should it be applied closer than 3 feet to the trunk.

- The root system of conifers extends some distance beyond the drip line. Increase the area to be fertilized by one-fourth the area of the crown.

- Fertilizer shall be applied using approved fertilization methods and equipment.

- Formulations and application rates shall conform to the guidelines given in VESCH.

- Maintain a ground cover of organic mulch around trees that is adequate to prevent erosion, protect roots, and hold water.

CALCULATIONS

The Chesapeake Bay Preservation Act (CBPA) and stormwater management calculations pertain to the proposed perimeter drainage improvements and pond/wetland system BMP associated with the Fort James and the Indian Village. The calculations are divided into three sections. Appendix B contains calculations to support the design of the perimeter drainage improvements for the James Fort, and Appendix C contains information pertaining to the Indian Village. Appendix D contains the design calculations for the pond/wetland system BMP.

The James Fort perimeter drainage improvements consist of a historically accurate perimeter ditch with drain channels along the bottom of the ditch to convey the stormwater runoff to the Indian River perimeter drainage system and directly to the James River.

The Indian Village drainage improvements consist of perimeter drainage basins to convey the stormwater runoff from the village and the James Fort to the proposed pond/wetland system BMP for treatment before it is discharged to the James River.

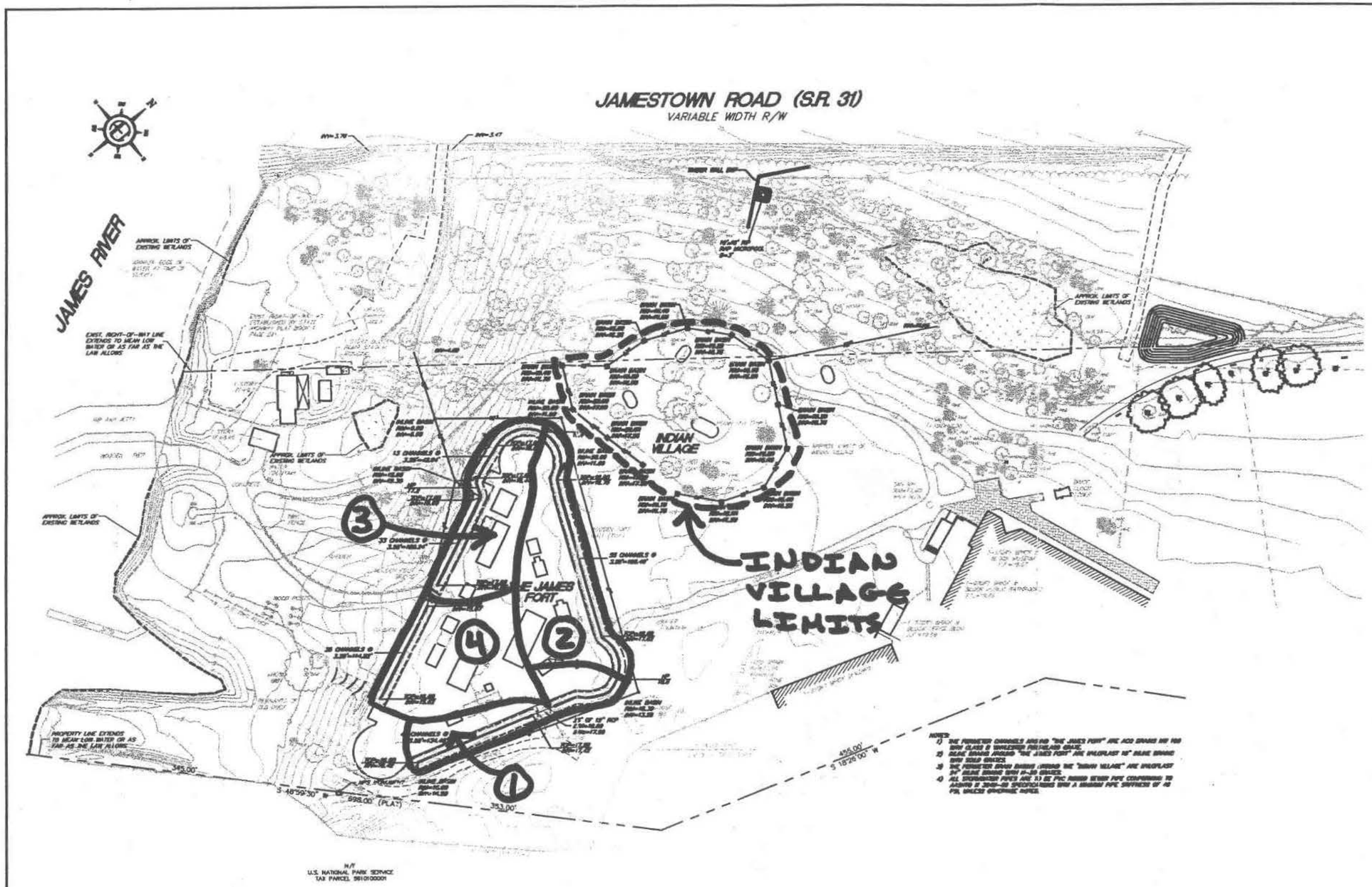
The BMP uses existing wetlands in conjunction with an excavated wet pond upstream of the wetlands and a timber wall dam constructed downstream of the wetlands to create a pond/wetland system. The BMP also meets the James City County stream channel protection requirement of providing for 24-hour detention of the runoff generated by the 1-year, 24-hour duration storm event. The 10-year storm post-development storm of 67.36 cfs is released at a peak rate of 46.70 cfs, which is less than the pre-development rate of 47.18 cfs.

The appropriate calculations associated with this project are located in Appendices B, C and D.

APPENDIX A

4.

Watershed map



DRAINAGE AREA MAP

N/F
VERMILLION
NE: B1/R8
352 PG 601
) NO. 4640100009

N/F
NATIONAL PARK SERVICE
ZONE: R8
PARCEL ID NO. 5610100001

PROJECT AREA
2.09 ACRES

JAMES
FORT

INDIAN
VILLAGE

JA

JAMES

JAMESTOWN ROAD (S.R. #31)

PROJECT AREA
0.18 ACRES

PROJECT AREA
0.09 ACRES

N/F
T.R. VERMILLION
ZONE: B1
DB 352 PG 601
PARCEL ID NO. 4630100014

Tc Map

APPENDIX B

RICKMOND ENGINEERING, INC.
1643 Merrimac Trail
WILLIAMSBURG, VIRGINIA 23185
(804) 229-1776

JOB 00175-020
SHEET NO. _____ OF _____
CALCULATED BY KWJ DATE 4/16/01
CHECKED BY _____ DATE _____
SCALE _____

DA- 1 James Fort

c= .60
A= .22 Ac:

OVERLAND FLOW

L= — ft.
S= — %
Tc= — min.

CHANNEL FLOW

H= 2.6 ft.
L= 240 ft.
Tc= 3 min.

Tc= 3 min.

i_{10}= 7.2 in/hr

Q=CAi=(.60)(.22 Ac.)(7.2 in/hr)(C_f 1.0)

C_f for storms 25 yr+
(VDOT Manual Pg. 1-11)

Q=0.95 cfs

RICKMOND ENGINEERING, INC.
1643 Merrimac Trail
WILLIAMSBURG, VIRGINIA 23185
(804) 229-1776

JOB 0075-020
SHEET NO. _____ OF _____
CALCULATED BY KMJ DATE 4/16/01
CHECKED BY _____ DATE _____
SCALE _____

DA- 2 James Fort

c= .60
A= .39 Ac.

OVERLAND FLOW

L= 100 ft.
S= 1.5 %
Tc= 8 min.

CHANNEL FLOW

H= 2 ft.
L= 230 ft.
Tc= 3 min.

Tc= 11 min.

i_{10}= 5.8 in/hr

Q=CAi=(.60)(.39 Ac.)(5.8 in/hr)(C_f 1.0) C_f for storms 25 yr+ (VDOT Manual Pg. 1-11)

Q= 1.36 cfs

RICKMOND ENGINEERING, INC.
1643 Merrimac Trail
WILLIAMSBURG, VIRGINIA 23185
(804) 229-1776

JOB 00175-020
SHEET NO. _____ OF _____
CALCULATED BY KMJ DATE 4/17/01
CHECKED BY _____ DATE _____
SCALE _____

DA- 3 James Fort

c= .60
A= .31 Ac.

OVERLAND FLOW

L= 80 ft.
S= 5.0 %
Tc= 6 min.

CHANNEL FLOW

H= .70 ft.
L= 110 ft.
Tc= 1 min.

Tc= 7 min.

i_{10} = 6.6 in/hr

Q=CAi=(.60)(.31 Ac.)(6.6 in/hr)(C_f 1.0)

C_f for storms 25 yr+
(VDOT Manual Pg. 1-11)

Q= 1.23 cfs

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WILLIAMSBURG, VIRGINIA 23185
(804) 229-1776

JOB 00175-020
SHEET NO. _____ OF _____
CALCULATED BY KMJ DATE 4/17/01
CHECKED BY _____ DATE _____
SCALE _____

DA- 4 James Fort

c= .60
A= .32 Ac.

OVERLAND FLOW

L= 175 ft.
S= 2.3 %
Tc= 9 min.

CHANNEL FLOW

H= .55 ft.
L= 115 ft.
Tc= 1 min.

Tc= 10 min.

i_{10}= 6.0 in/hr

Q=CAi=(.60)(.32 Ac.)(6.0 in/hr)(C_f 1.0)

C_f for storms 25 yr+
(VDOT Manual Pg. 1-11)

Q= 1.15 cfs

Rickmond Engineering, Inc.

Storm Drainage Design

Phone: (757) 229-1776 Fax: (757) 229-4683

Project Manager: Kenny Jenkins
Project Engineer. Kenny Jenkins

For Tc Accumulation, Use VELOCITY (1) from Pipe Slope or (2) V=Q/A : *1*

Project Number: ***00175*** *Project:* ***JAMES FORT*** Year Storm: *10*

Structure		Rational Formula: Q = CiA									Pipe Data					Mannings Formula				
				CA		Inlet Time Tc (min)			Runoff, Q (cfs)		Inverts					Velocity (ft/sec)				
								(in/hr)					(ft)	%	(in)					N
From	To	Area "A" (ac)	Coefficient "C"	Incremental	Cumulative	Incremental	Cumulative	Rain	Incremental	Cumulative	UPstream	DOWN-stream	Length	Slope	Diameter	Based on Q/A	Based on pipe slope	Capacity (cfs)	Flow Time (min)	Manning's
From	To	Area	C	CAInc	CaCum	TimeInc	TimeCum	Rain	QInc	Qcum	InvertUp	InvertDown	Length	Slope	Diameter	VelocityQA	VelocityS	Capacity	FlowTime	ManningsN
1	*2*	*0.22*	*0.6*	0.13	0.13	*3*	3.00	7.47	0.99	**0.99**	*14.00*	*13.00*	*70*	1.43%	*8*	2.83	4.14	1.44	0.28	*0.013*
2	*3*	*0.00*	*0.0*	0.00	0.13	*0*	3.28	7.39	0.00	**0.98**	*13.00*	*9.00*	*90*	4.44%	*8*	2.80	7.30	2.55	0.21	*0.013*
3	*ES*	*0.63*	*0.6*	0.38	0.51	*10*	10.00	5.93	2.24	**3.02**	*9.00*	*3.50*	*120*	4.58%	*12*	3.85	9.71	7.63	0.21	*0.013*
ES																				

Rickmond Engineering, Inc. **Hydraulic Grade Line (HGL) Calculations**

Project Number: *00175*
Project: *JAMES FORT*
Date: 8.9.01

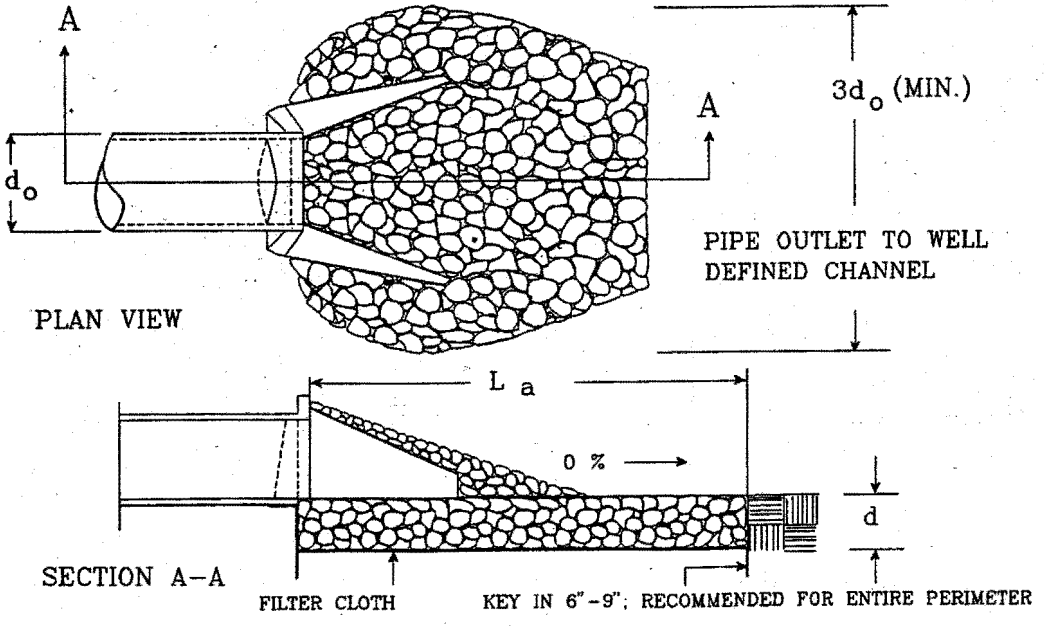
From Structure	HGL Slope (%)	HGL Fall (ft)	Velocity Head V²/2g (ft)	Invert Shaped?	Surface Flow?	~~~~~~ STRUCTURE LOSSES ~~~~~~ Bend Losses Angle (deg)	Bend Losses @ To (ft)	Bend Losses @ From (ft)	ENTRANCE @ To (ft)	ENTRANCE @ From (ft)	EXIT (ft)	TOTAL (ft)	HGL @ FROM	Performance Checks & Intermediate Computations: Rim/Flowline (Max. Allow. Elevation)	"Freeboard" (ft)	Elev., top of pipe @ From	Structure #'s: FROM-TO	TC plus Pipe Flow Tim	Elevation at 80% Full Flow	Too Shallow?	Computed Pipe Dia.
	HGLSlope	HGLFall	VelocityHead	Shaped	Surface	BendAngle	BendsTo	BendsFrom	EntranTo	EntranFrom	Exit	TotalSinuc	HGLatFrom	RimElev	Freeboard	PipeTopEl	FromTo	TCplusPipeTime	FlowRatio	Control	DiaComp
1	0.667%	0.467	0.12	*Y*	*Y*	*45*	0.045	0.000	0.031	0.000	0.043	0.028	14.53	*16.00*	1.47	14.81	1-2	3.28	14.53	80% D	6.9
2	0.653%	0.588	0.12	*Y*	*Y*	*90*	0.087	0.045	0.030	0.031	0.042	0.077	13.53	*16.50*	2.97	13.81	2-3	3.49	13.53	80% D	5.6
3	0.721%	0.865	0.23	*Y*	*Y*	*90*	0.166	0.087	0.058	0.030	0.081	0.129	9.80	*12.00*	2.20	10.17	3-ES	10.21	9.80	80% D	8.5

Tailwater Elevation at Outfall point # ES): *4.30*

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

JOB 00175-020
SHEET NO. _____ OF _____
CALCULATED BY KMJ DATE 4/17/01
CHECKED BY _____ DATE _____
SCALE _____

DESIGN OUTLET PROTECTION



NOTES: 1. APRON LINING MAY BE RIPRAP, GROUTED RIPRAP, GABION BASKET, OR CONCRETE.
2. La IS THE LENGTH OF THE RIPRAP APRON AS CALCULATED USING PLATES 3.18-3 AND 3.18-4.
3. d = 1.5 TIMES THE MAXIMUM STONE DIAMETER, BUT NOT LESS THAN 6 INCHES.

Plate: 3.18-3
$Q = 4.23$ cfs
$d = 1.25'$
$3d = 4'$
$L_a = 6'$
$W = d + L_a = 8'$
$d_{50} = .2'$

USE 6' x 8' x 26"
VDOT CLASS I
RIP RAP APRON

APPENDIX C

RICKMOND ENGINEERING, INC.
1643 Merrimac Trail
WILLIAMSBURG, VIRGINIA 23185
(804) 229-1776

JOB 00175-020
SHEET NO. _____ OF _____
CALCULATED BY KMJ DATE 4/16/01
CHECKED BY _____ DATE _____
SCALE _____

DA- Indian Village (Typical Drainage Area)

c= 0.60
A= 0.07 Ac.

OVERLAND FLOW

L= 100 ft.
S= 2.0 %
Tc= 7.5 min.

CHANNEL FLOW

H= — ft.
L= — ft.
Tc= — min.

Tc= 7.5 min.

i_{10} = 6.5 in/hr

Q=CAi=(.60)(.07 Ac.)(6.5 in/hr)(C_f 1.0)

C_f for storms 25 yr+
(VDOT Manual Pg. 1-11)

Q= 0.27 cfs

Rickmond Engineering, Inc.

Storm Drainage Design

Phone: (757) 229-1776 Fax: (757) 229-4683

Project Manager: Kenny Jenkins
Project Engineer. Kenny Jenkins

For Tc Accumulation, Use VELOCITY (1) from Pipe Slope or (2) V=Q/A : *1*

Project Number: 00175 *Project: INDIAN VILLAGE-EAST* Year Storm: *10*

Structure		Rational Formula: Q = CiA									Pipe Data					Mannings Formula				
				CA		Inlet Time Tc (min)		(in/hr)	Runoff, Q (cfs)		Inverts		(ft)	%	(in)	Velocity (ft/sec)				
From	To	Area "A" (ac)	Coefficient "C"	Incremental	Cumulative	Incremental	Cumulative	Rain	Incremental	Cumulative	UPstream	DOWN-stream	Length	Slope	Diameter	Based on Q/A	Based on pipe slope	Capacity (cfs)	Flow Time (min)	N Manning's
From	To	Area	C	CAInc	CaCum	TimeInc	TimeCum	Rain	Qinc	Qcum	InvertUp	InvertDown	Length	Slope	Diameter	VelocityQA	VelocityS	Capacity	FlowTime	ManningsN
A	B	0.07	0.6	0.04	0.04	8	7.50	6.40	0.27	**0.27**	14.75	14.50	50	0.50%	12	0.34	3.21	2.52	0.26	0.013
B	C	1.76	0.6	1.13	1.17	8	7.76	6.35	7.15	**7.42**	14.50	14.25	50	0.50%	15	6.04	3.72	4.57	0.22	0.013
C	D	0.07	0.6	0.04	1.21	8	7.98	6.30	0.26	**7.63**	14.25	14.00	50	0.50%	15	6.22	3.72	4.57	0.22	0.013
D	E	0.07	0.6	0.04	1.25	8	8.21	6.26	0.26	**7.84**	14.00	13.75	50	0.50%	15	6.39	3.72	4.57	0.22	0.013
E	N	0.07	0.6	0.04	1.29	8	8.43	6.22	0.26	**8.05**	13.75	13.50	50	0.50%	18	4.55	4.20	7.43	0.20	0.013
N	ES	0.63	0.6	0.38	1.67	8	8.63	6.18	2.34	**10.33**	13.50	11.00	180	1.39%	18	5.85	7.01	12.38	0.43	0.013
ES																				

Rickmond Engineering, Inc. **Hydraulic Grade Line (HGL) Calculations**

Project Number: *00175*
Project: *INDIAN VILLAGE-EAST*
Date: 8.9.01

From Structure	HGL Slope (%)	HGL Fall (ft)	Velocity Head V²/2g (ft)	Invert Shaped?	Surface Flow?	~~~~~~ STRUCTURE LOSSES ~~~~~~ Bend Losses Angle (deg)	Bend @ To (ft)	Bend @ From (ft)	ENTRANCE @ To (ft)	ENTRANCE @ From (ft)	EXIT (ft)	TOTAL (ft)	HGL @ FROM	Performance Checks & Intermediate Computations: Rim/Flowline (Max. Allow. Elevation)	Freeboard" (ft)	Elev., top of pipe @ From	Structure #'s: FROM-TO	TC plus Pipe Flow Tim	Elevation at 80% Full Flow	Too Shallow?	Computed Pipe Dia.
HGLSlope	HGLFall	VelocityHead	Shaped	Surface	BendAngle	BendatTo	BendatFrom	EntratTo	EntratFrom	Exit	TotalStruc	HGLatFrom	RimElev	Freeboard	PipeTopEl	FromTo	TCplusPipeTime	FlowRatio	Control	DiaComp
A	0.006%	0.003	0.00	*Y*	*Y*	*0*	0.000	0.000	0.000	0.000	0.001	0.000	18.37	*19.10*	0.73	15.92	A-B	7.76	15.55	HGL	5.2
B	1.320%	0.660	0.57	*Y*	*Y*	*25*	0.113	0.000	0.142	0.000	0.199	0.129	18.36	*18.90*	0.54	15.94	B-C	7.98	15.50	HGL	18.0
C	1.397%	0.698	0.60	*Y*	*Y*	*45*	0.216	0.113	0.150	0.142	0.210	0.303	17.58	*18.40*	0.82	15.69	C-D	8.21	15.25	HGL	18.2
D	1.475%	0.737	0.63	*Y*	*Y*	*45*	0.228	0.216	0.158	0.150	0.222	0.382	16.57	*18.80*	2.23	15.44	D-E	8.43	15.00	HGL	18.4
E	0.587%	0.294	0.32	*Y*	*Y*	*0*	0.000	0.228	0.080	0.158	0.113	0.325	15.46	*19.20*	3.74	15.46	E-N	8.63	14.95	HGL	18.5
N	0.969%	1.744	0.53	*Y*	*Y*	*90*	0.382	0.000	0.133	0.080	0.186	0.173	14.84	*18.50*	3.66	15.21	N-ES	9.06	14.70	HGL	16.8

Tailwater Elevation at Outfall point # ES): *12.92*

Rickmond Engineering, Inc.

Storm Drainage Design

Phone: (757) 229-1776 Fax: (757) 229-4683

Project Manager: Kenny Jenkins
Project Engineer. Kenny Jenkins

For Tc Accumulation, Use VELOCITY (1) from Pipe Slope or (2) V=Q/A : **1**

Project Number: **00175** *Project:* **INDIAN VILLAGE-WEST** Year Storm: **10**

Structure		Rational Formula: Q = CiA									Pipe Data									Mannings Formula
				CA		Inlet Time Tc (min)		(in/hr)	Runoff, Q (cfs)		Inverts		(ft)	%	(in)	Velocity (ft/sec)				N
From	To	Area "A" (ac)	Coefficient "C"	Incremental	Cumulative	Incremental	Cumulative	Rain	Incremental	Cumulative	UPstream	DOWN-stream	Length	Slope	Diameter	Based on Q/A	Based on pipe slope	Capacity (cfs)	Flow Time (min)	Manning's
From	To	Area	C	CAInc	CaCum	TimeInc	TimeCum	Rain	QInc	Qcum	InvertUp	InvertDown	Length	Slope	Diameter	VelocityQA	VelocityS	Capacity	FlowTime	ManningsN
F	G	0.07	0.6	0.04	0.04	8	7.50	6.40	0.27	**0.27**	16.25	16.00	50	0.50%	12	0.34	3.21	2.52	0.26	0.013
G	H	0.46	0.6	0.29	0.34	8	7.76	6.35	1.87	**2.14**	16.00	15.75	50	0.50%	12	2.72	3.21	2.52	0.26	0.013
H	I	0.07	0.6	0.04	0.38	8	8.02	6.30	0.26	**2.38**	15.75	15.50	50	0.50%	12	3.03	3.21	2.52	0.26	0.013
I	J	0.07	0.6	0.04	0.42	8	8.28	6.25	0.26	**2.63**	15.50	15.25	50	0.50%	12	3.34	3.21	2.52	0.26	0.013
J	K	0.07	0.6	0.04	0.46	8	8.54	6.20	0.26	**2.87**	15.25	15.00	50	0.50%	12	3.65	3.21	2.52	0.26	0.013
K	L	0.07	0.6	0.04	0.50	8	8.80	6.15	0.26	**3.10**	15.00	14.75	50	0.50%	12	3.95	3.21	2.52	0.26	0.013
L	M	0.07	0.6	0.04	0.55	8	9.06	6.10	0.26	**3.33**	14.75	14.50	50	0.50%	12	4.24	3.21	2.52	0.26	0.013
M	N	0.07	0.6	0.04	0.59	8	9.32	6.05	0.25	**3.56**	14.50	13.50	50	2.00%	12	4.53	6.42	5.04	0.13	0.013
N																				

Rickmond Engineering, Inc. **Hydraulic Grade Line (HGL) Calculations**

Project Number: *00175*
Project: *INDIAN VILLAGE-WEST*
Date: 8.9.01

From Structure	HGL Slope (%)	HGL Fall (ft)	Velocity Head $V^2/2g$ (ft)	Invert Shaped?	Surface Flow?	Bend Losses Angle (deg)	Bend Losses @ To (ft)	Bend Losses @ From (ft)	ENTRANCE @ To (ft)	ENTRANCE @ From (ft)	EXIT (ft)	TOTAL (ft)	HGL @ FROM	Performance Checks & Intermediate Computations: Rim/Flowline (Max. Allow. Elevation)	"Freeboard" (ft)	Elev., top of pipe @ From	Structure #'s: FROM-TO	TC plus Pipe Flow Tim	Elevation at 80% Full Flow	Too Shallow?	Computed Pipe Dia.
	HGLSlope	HGLFall	VelocityHead	Shaped	Surface	BendAngle	BendatTo	BendatFrom	EntratTo	EntratFrom	Exit	TotalStruc	HGLatFrom	RimElev	Freeboard	PipeTopEl	FromTo	TCplusPipeTime	FlowRatio	Control	DiaComp
F	0.006%	0.003	0.00	Y	Y	0	0.000	0.000	0.000	0.000	0.001	0.000	17.97	19.50	1.53	17.42	F-G	7.76	17.05	HGL	5.2
G	0.360%	0.180	0.11	Y	Y	135	0.124	0.000	0.029	0.000	0.040	0.026	17.97	20.00	2.03	17.17	G-H	8.02	16.80	HGL	11.3
H	0.448%	0.224	0.14	Y	Y	35	0.040	0.124	0.036	0.029	0.050	0.132	17.76	20.00	2.24	16.92	H-I	8.28	16.55	HGL	11.8
I	0.544%	0.272	0.17	Y	Y	105	0.146	0.040	0.043	0.036	0.061	0.089	17.41	19.40	1.99	16.67	I-J	8.54	16.30	HGL	12.2
J	0.647%	0.324	0.21	Y	Y	35	0.058	0.146	0.052	0.043	0.072	0.170	17.05	19.80	2.75	16.42	J-K	8.80	16.05	HGL	12.6
K	0.758%	0.379	0.24	Y	Y	15	0.029	0.058	0.060	0.052	0.085	0.126	16.55	18.80	2.25	16.17	K-L	9.06	15.80	HGL	13.0
L	0.876%	0.438	0.28	Y	Y	20	0.045	0.029	0.070	0.060	0.098	0.122	16.05	18.40	2.35	15.92	L-M	9.32	15.55	HGL	13.3
M	1.000%	0.500	0.32	Y	Y	20	0.051	0.045	0.080	0.070	0.112	0.147	15.49	18.20	2.71	15.67	M-N	9.45	15.30	HGL	10.5

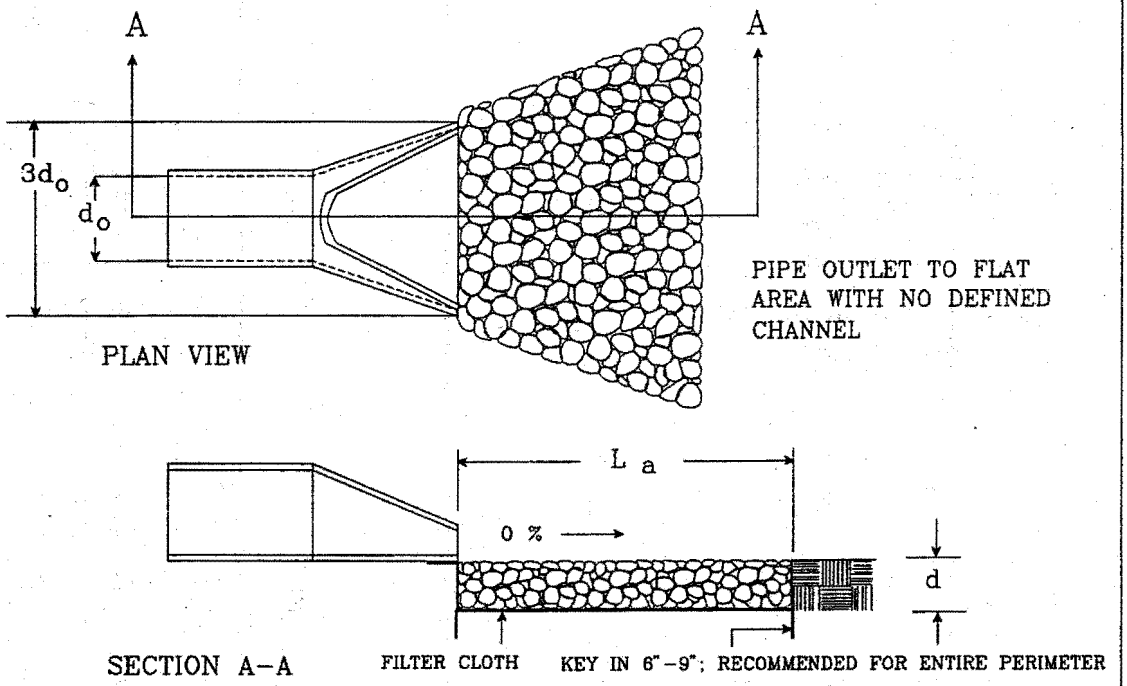
Tailwater Elevation at Outfall point # N): *14.84*

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

JOB 00175-020
SHEET NO. _____ OF _____
CALCULATED BY KMJ DATE 4/17/01
CHECKED BY _____ DATE _____
SCALE _____

DESIGN OUTLET PROTECTION

PIPE OUTLET CONDITIONS



Pipe: 3.18-3
Q = 3.63 cfs
D = 1.25'
3D = 4'
L_a = 6'
W = L_a + D = 8'
d_{50} = .2

USE 6' x 8' x 26"
VDOT CLASS I
RIP RAP APRON

APPENDIX D

Worksheet 2: Runoff curve number and runoff

Project Jamestown Settlement By KWS Date 3/9/01

Location James City County, Va. Checked ____ Date ____

Circle one: (Present) Developed BMP (B-1) DA-1,2,+3

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☒ acres ☐ mi² ☐ %	Product of CN x area
Emporia Tetotum C	Roof/Road	98			0.61	59.78
Emporia Tetotum C	Grass	74			4.37	323.38
Emporia Tetotum C	Woods	70			8.15	570.50
Pamunkey B	Roof	98			1.65	161.70
Pamunkey B	Grass	69			0.57	39.33
Pamunkey B	Woods	60			1.10	66.00
Pamunkey B	James Fort (Dirt)	82			0.39	31.98
				Totals =	16.84	1252.67

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{1252.67}{16.84} = 74.4$; Use CN = 74

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr	1	10	
Rainfall, P (24-hour) ..... in	2.8	6.0	
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	0.8	3.1	

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

Project Jamestown Settlement By KWJ Date 3/9/01

Location James City County, Va. Checked ____ Date ____

Circle one: (Present) Developed BMP (B-1) " DA- 1,2,+3

Circle one: (T_c) T_t through subarea

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

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

Sheet flow (Applicable to T_c only)	Segment ID	AB	BC
1. Surface description (table 3-1)		PAVED	GRASS
2. Manning's roughness coeff., n (table 3-1)		.011	0.15
3. Flow length, L (total L ≤ 300 ft)	ft	110	275
4. Two-yr 24-hr rainfall, P_2	in	3.5	3.5
5. Land slope, s	ft/ft	.010	.020
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	.03 +	.35 = .38

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

Channel flow	Segment ID	CD	
12. Cross sectional flow area, a	ft^2	33.00	
13. Wetted perimeter, p_w	ft	18.42	
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft	1.79	
15. Channel slope, s	ft/ft	.010	
16. Manning's roughness coeff., n		.035	
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	6.26	
18. Flow length, L	ft	425	
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	.02 +	= .02
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr		.40

Worksheet 5a: Basic watershed data

Project Jamestown Settlement Location James City County, Va. By KMJ Date 3/9/01

Circle one: (Present) Developed BMP (B-1) DA 1,2,+3 Frequency (yr) _____ Checked _____ Date _____

Subarea name	Drainage area A_m (mi^2)	Time of concentration T_c (hr)	Travel time through subarea T_t (hr)	Downstream subarea names	Travel time summation to outlet ΣT_t (hr)	24-hr Rainfall P (in)	Runoff curve number CN	Runoff Q (in)	$A_m Q$ (mi^2-in)	Initial abstraction I_a (in)	I_a/P
1	.0263	0.40				2.8	74	0.8	.0210	0.703	.25
10	.0263	0.40				6.0	74	3.1	.0815	0.703	.12

From worksheet 3 | From worksheet 2 | From table 5-1

(210-VI-TR-55, Second Ed., June 1986)

Worksheet 5b: Tabular hydrograph discharge summary

Project Jamestown Settlement Location James City County, Va. By KHS Date 3/9/01

Circle one: (Present) Developed BMP (B-1) DA 1,2,+3 Frequency (yr) _____ Checked _____ Date _____

Subarea name	Basic watershed data used 1/				Select and enter hydrograph times in hours from exhibit 5-II 2/											
	Sub-area T_c (hr)	ΣT_t to outlet (hr)	I_a/P	A_mQ (mi^2-in)				12.3	12.4							
					Discharges at selected hydrograph times 3/ (cfs)											
1	.40		.25	.0210					10.40							
10	.40		.12	.0815				48.25								
Composite hydrograph at outlet																

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

Worksheet 2: Runoff curve number and runoff

Project Jamestown Settlement By KWS Date 3/9/01

Location James City County, Va. Checked ____ Date ____

Circle one: Present (Developed) BMP (B-1) DA-1,2,43

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☒ acres ☐ mi² ☐ %	Product of CN x area
Emporia Tetotum C	Roof/Road	98			7.87	771.26
Emporia Tetotum C	Grass	74			2.63	194.62
Emporia Tetotum C	Woods	70			2.63	184.10
Pamunkey B	Roof	98			2.00	196.00
Pamunkey B	Grass	69			0.57	39.33
Pamunkey B	Woods	60			0.75	45.00
Pamunkey B	James Fort (Dirt)	82			0.39	31.98
				Totals =	16.84	1462.29

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{1462.29}{16.84} = 86.8$; Use CN = 87

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr	1	10	
Rainfall, P (24-hour)	in	2.8	6.0	
Runoff, Q (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in	1.6	4.5	

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

Project Jamestown Settlement By RMS Date 3/9/01

Location James City County, Va. Checked ____ Date ____

Circle one: Present (Developed) BMP (B-1) DA-1,2,+3

Circle one: (T_c) T_t through subarea

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

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

		Segment ID	AB	BC	
Sheet flow (Applicable to T_c only)					
1.	Surface description (table 3-1)		PAVED	GRASS	
2.	Manning's roughness coeff., n (table 3-1)		.011	0.15	
3.	Flow length, L (total L ≤ 300 ft)	ft	110	275	
4.	Two-yr 24-hr rainfall, P_2	in	3.5	3.5	
5.	Land slope, s	ft/ft	.010	.020	
6.	$T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	.03	+ .35	= .38
Shallow concentrated flow		Segment ID			
7.	Surface description (paved or unpaved)				
8.	Flow length, L	ft			
9.	Watercourse slope, s	ft/ft			
10.	Average velocity, V (figure 3-1)	ft/s			
11.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	=
Channel flow		Segment ID	CD		
12.	Cross sectional flow area, a	ft^2	33.00		
13.	Wetted perimeter, p_w	ft	18.42		
14.	Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft	1.79		
15.	Channel slope, s	ft/ft	.010		
16.	Manning's roughness coeff., n		.035		
17.	$V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	6.26		
18.	Flow length, L	ft	425		
19.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr	.02	+	= .02
20.	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr			.40

Worksheet 5a: Basic watershed data

Project Jamestown Settlement Location James City County, Va. By KWJ Date 3/9/01

Circle one: Present (Developed) BMP (B-1) DA-1,2,3 Frequency (yr) _____ Checked _____ Date _____

Subarea name	Drainage area A_m (mi^2)	Time of concentration T_c (hr)	Travel time through subarea T_t (hr)	Downstream subarea names	Travel time summation to outlet ΣT_t (hr)	24-hr Rainfall P (in)	Runoff curve number CN	Runoff Q (in)	$A_m Q$ (mi^2-in)	Initial abstraction I_a (in)	I_a/P
1	.0263	.40				2.8	87	1.6	.0421	0.299	.11
10	.0263	.40				6.0	87	4.5	.1184	0.299	.05

From worksheet 3 | From worksheet 2 | From table 5-1

(210-VI-TR-55, Second Ed., June 1986)

Worksheet 5b: Tabular hydrograph discharge summary

Project Jamestown Settlement Location James City County, Va, By KWJ Date 3/9/01

Circle one: Present (Developed) BMP (CB-1) DA-1,2,+3 Frequency (yr) _____ Checked _____ Date _____

Subarea name	Basic watershed data used 1/				Select and enter hydrograph times in hours from exhibit 5-II 2/											
	Sub-area T_c (hr)	ΣT_t to outlet (hr)	I_a/P	$A_m Q$ (mi^2-in)				12.3								
					Discharges at selected hydrograph times 3/ -(cfs)-											
1	.40		.11	.0421				24.92								
10	.40		.05	.1184				70.09								
Composite hydrograph at outlet																

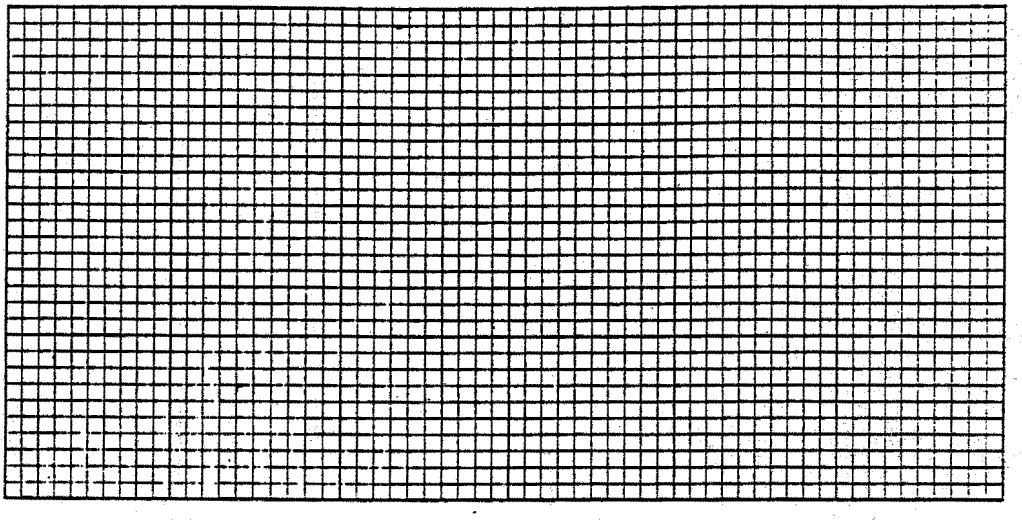
1/ Worksheet 5a. Rounded as needed for use with exhibit 5.
2/ Enter rainfall distribution type used.
3/ Hydrograph discharge for selected times is $A_m Q$ multiplied by tabular discharge from appropriate exhibit 5.

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

Project Jamestown Settlement By KMJ Date 3/9/01

Location James City County, Va. Checked ____ Date ____

Circle one: Present Developed QMP (B-1) DA-1,2,+3



Detention basin storage

1. Data:
   Drainage area ..... A_m = .0263 mi^2
   Rainfall distribution type (I, IA, II, III) = II

	1st stage	2nd stage
2. Frequency ..... yr	1	10
3. Peak inflow discharge, q_i .... cfs (From worksheet 4 or 5b)	24.92	70.09
4. Peak outflow discharge, q_o .... cfs 1/	10.40	48.25
5. Compute $\frac{q_o}{q_i}$	.42	.69
6. $\frac{V_s}{V_r}$ ..... (Use $\frac{q_o}{q_i}$ with figure 6-1)	.31	.21
7. Runoff, Q ..... in (From worksheet 2)	1.6	4.5
8. Runoff volume, V_r ..... ac-ft ($V_r = QA_m 53.33$)	2.24	6.31
9. Storage volume, V_s ..... ac-ft ($V_s = V_r(\frac{V_s}{V_r})$)	0.69 (30,000 cf)	1.33 (58,000 cf)
10. Maximum stage, E_{max} (From plot)		

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

1-Year Hydrograph

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering
Date: 08/09/2001 Thursday
Time: 13:36:24
Input: JSB11.IN
Output: JSB11.OUT

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

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

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

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

The SCS DIMENSIONLESS UNIT HYDROGRAPH is used in all runoff computations.
The peak rate factor (PRF) for all unit hydrographs is 484 (U.S. Customary units) or 2.08356 (Metric units).

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering
Date: 08/09/2001 Thursday
Time: 13:36:24
Input: JSB11.IN
Output: JSB11.OUT

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

SUBAREA ID NO	AREA (mi2)	TIME OF CONCENTRATION (hrs)	CURVE NUMBER	BASEFLOW (cfs)	DOWNSTREAM CHANNELS
1	.0263	.400	87.00	.0	

Composite Watershed Curve Number = 87.00
Minimum Subarea Time of Concentration = .400 hours.

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering
Date: 08/09/2001 Thursday
Time: 13:36:24
Input: JSB11.IN
Output: JSB11.OUT

RETURN PERIOD (yrs): 1

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

RAINFALL HYETOGRAPH: SCS TYPE II
RAINFALL DURATION: 24.00 Hours
RAINFALL DEPTH: 2.80 Inches

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

.000,	.00	2.000,	.06	4.000,	.13	6.000,	.22
7.000,	.27	8.000,	.34	8.500,	.37	9.000,	.41
9.500,	.46	9.750,	.48	10.000,	.51	10.500,	.57
11.000,	.66	11.500,	.79	11.750,	1.00	12.000,	1.86
12.500,	2.06	13.000,	2.16	13.500,	2.24	14.000,	2.30
16.000,	2.46	20.000,	2.67	24.000,	2.80		

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

PROJECT: JAMESTOWN SETTLEMENT
Input: JSB11.IN
Output: JSB11.OUT

RETURN PERIOD (yrs): 1

SUBAREA 1 SUBAREA 1 SUBAREA 1 SUBAREA 1

AREA (square miles) : .0263
TIME OF CONCENTRATION (hrs): .40
RUNOFF CURVE NUMBER : 87.00
BASEFLOW (cfs) : .00
DOWNSTREAM CHANNELS :

SUBAREA RUNOFF (cfs)

TIME: (hrs)	+.00 hrs	+.10 hrs	+.20 hrs	+.30 hrs	+.40 hrs	+.50 hrs	+.60 hrs	+.70 hrs	+.80 hrs	+.90 hrs
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
6.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
7.00	.00	.00	.00	.00	.00	.00	.00	.01	.01	.02
8.00	.02	.03	.04	.05	.07	.08	.09	.10	.12	.13
9.00	.14	.16	.17	.19	.21	.23	.24	.27	.29	.31
10.00	.33	.36	.40	.45	.49	.53	.57	.65	.74	.81
11.00	.88	.97	1.13	1.34	1.52	1.66	2.06	3.08	5.25	10.18
12.00	18.09	24.18	23.22	17.72	12.34	9.28	7.42	5.95	4.74	3.90
13.00	3.43	3.12	2.79	2.50	2.30	2.20	2.11	1.99	1.85	1.75
14.00	1.70	1.67	1.66	1.65	1.62	1.57	1.52	1.46	1.40	1.34
15.00	1.28	1.23	1.18	1.13	1.09	1.05	1.01	.98	.95	.93
16.00	.91	.89	.88	.86	.85	.85	.84	.83	.82	.82
17.00	.81	.80	.80	.79	.78	.78	.77	.76	.76	.75
18.00	.74	.73	.73	.72	.71	.71	.70	.69	.69	.68
19.00	.67	.67	.66	.65	.64	.64	.63	.62	.62	.61
20.00	.60	.60	.59	.58	.58	.57	.56	.56	.55	.54
21.00	.54	.53	.53	.52	.52	.51	.51	.50	.50	.49

22.00	.49	.48	.48	.48	.47	.47	.47	.46	.46	.46
23.00	.46	.45	.45	.45	.45	.45	.45	.44	.44	.44
24.00	.44	.41	.32	.21	.12	.07	.04	.02	.01	.01
25.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
26.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
27.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
28.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
29.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

PEAK RUNOFF (cfs): 24.18
TIME TO PEAK (hrs): 12.10

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering
Date: 08/09/2001 Thursday
Time: 13:36:24
Input: JSB11.IN
Output: JSB11.OUT

RETURN PERIOD (yrs): 1

========== DOWNSTREAM HYDROGRAPH ==========

DISCHARGE (cfs)

TIME: (hrs)	+.00 hrs	+.10 hrs	+.20 hrs	+.30 hrs	+.40 hrs	+.50 hrs	+.60 hrs	+.70 hrs	+.80 hrs	+.90 hrs
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
6.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
7.00	.00	.00	.00	.00	.00	.00	.00	.01	.01	.02
8.00	.02	.03	.04	.05	.07	.08	.09	.10	.12	.13
9.00	.14	.16	.17	.19	.21	.23	.24	.27	.29	.31
10.00	.33	.36	.40	.45	.49	.53	.57	.65	.74	.81
11.00	.88	.97	1.13	1.34	1.52	1.66	2.06	3.08	5.25	10.18
12.00	18.09	24.18	23.22	17.72	12.34	9.28	7.42	5.95	4.74	3.90
13.00	3.43	3.12	2.79	2.50	2.30	2.20	2.11	1.99	1.85	1.75
14.00	1.70	1.67	1.66	1.65	1.62	1.57	1.52	1.46	1.40	1.34
15.00	1.28	1.23	1.18	1.13	1.09	1.05	1.01	.98	.95	.93
16.00	.91	.89	.88	.86	.85	.85	.84	.83	.82	.82
17.00	.81	.80	.80	.79	.78	.78	.77	.76	.76	.75
18.00	.74	.73	.73	.72	.71	.71	.70	.69	.69	.68
19.00	.67	.67	.66	.65	.64	.64	.63	.62	.62	.61
20.00	.60	.60	.59	.58	.58	.57	.56	.56	.55	.54
21.00	.54	.53	.53	.52	.52	.51	.51	.50	.50	.49
22.00	.49	.48	.48	.48	.47	.47	.47	.46	.46	.46
23.00	.46	.45	.45	.45	.45	.45	.45	.44	.44	.44
24.00	.44	.41	.32	.21	.12	.07	.04	.02	.01	.01
25.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
26.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
27.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
28.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
29.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

PEAK DISCHARGE (cfs): 24.18
TIME TO PEAK (hrs): 12.10
Hydrograph Saved In: JSB11.DAT

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering

Date: 08/09/2001 Thursday
Time: 13:36:24
Input: JSB11.IN
Output: JSB11.OUT

RETURN PERIOD (yrs): 1

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

SCS TYPE II Hyetograph.
SCS DIMENSIONLESS UNIT HYDROGRAPH was used.
APPLIED RAINFALL DEPTH (inches): 2.80

	VOLUME OF RAINFALL APPLIED (ac-ft)	VOLUME OF RUNOFF (ac-ft)	RAINFALL LOSSES (percent)	PEAK DISCHARGE (cfs)	PEAK DISCHARGE (cfs/ac)
SUBAREA 1	3.9275	2.1923	44.18	24.185	1.437
TOTAL WATERSHED	3.9275	2.1923	44.18	24.185	1.437

TOTAL WATERSHED AREA (square miles): .0263
TOTAL VOLUME OF DISCHARGE LEAVING WATERSHED (ac-ft): 2.1923
COMPOSITE WATERSHED CURVE NUMBER: 87.00
MINIMUM SUBAREA TIME OF CONCENTRATION: .400 hours.

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

1

10-Year Hydrograph

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering
Date: 08/09/2001 Thursday
Time: 13:38:31
Input: JSB110.IN
Output: JSB110.OUT

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

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

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

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

The SCS DIMENSIONLESS UNIT HYDROGRAPH is used in all runoff computations.
The peak rate factor (PRF) for all unit hydrographs is 484 (U.S. Customary units) or 2.08356 (Metric units).

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering
Date: 08/09/2001 Thursday
Time: 13:38:31
Input: JSB110.IN
Output: JSB110.OUT

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

SUBAREA ID NO	AREA (mi2)	TIME OF CONCENTRATION (hrs)	CURVE NUMBER	BASEFLOW (cfs)	DOWNSTREAM CHANNELS
1	.0263	.400	87.00	.0	

Composite Watershed Curve Number = 87.00
Minimum Subarea Time of Concentration = .400 hours.

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering
Date: 08/09/2001 Thursday
Time: 13:38:31
Input: JSB110.IN
Output: JSB110.OUT

RETURN PERIOD (yrs): 10

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

RAINFALL HYETOGRAPH: SCS TYPE II
RAINFALL DURATION: 24.00 Hours
RAINFALL DEPTH: 6.00 Inches

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

.000,	.00	2.000,	.13	4.000,	.29	6.000,	.48
7.000,	.59	8.000,	.72	8.500,	.80	9.000,	.88
9.500,	.98	9.750,	1.03	10.000,	1.09	10.500,	1.22
11.000,	1.41	11.500,	1.70	11.750,	2.14	12.000,	3.98
12.500,	4.41	13.000,	4.63	13.500,	4.79	14.000,	4.92
16.000,	5.28	20.000,	5.71	24.000,	6.00		

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

PROJECT: JAMESTOWN SETTLEMENT
Input: JSB110.IN
Output: JSB110.OUT

RETURN PERIOD (yrs): 10

SUBAREA 1 SUBAREA 1 SUBAREA 1 SUBAREA 1

AREA (square miles) : .0263
TIME OF CONCENTRATION (hrs): .40
RUNOFF CURVE NUMBER : 87.00
BASEFLOW (cfs) : .00
DOWNSTREAM CHANNELS :

SUBAREA RUNOFF (cfs)

TIME: (hrs)	+.00 hrs	+.10 hrs	+.20 hrs	+.30 hrs	+.40 hrs	+.50 hrs	+.60 hrs	+.70 hrs	+.80 hrs	+.90 hrs
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4.00	.00	.00	.00	.00	.01	.02	.04	.06	.07	.09
5.00	.11	.13	.15	.17	.18	.20	.22	.23	.25	.27
6.00	.28	.30	.33	.35	.38	.40	.42	.44	.46	.48
7.00	.49	.52	.56	.61	.65	.69	.72	.74	.77	.79
8.00	.81	.84	.89	.96	1.01	1.06	1.10	1.14	1.20	1.24
9.00	1.28	1.32	1.39	1.47	1.54	1.59	1.65	1.73	1.82	1.90
10.00	1.95	2.04	2.20	2.39	2.55	2.66	2.81	3.09	3.41	3.68
11.00	3.87	4.15	4.74	5.44	6.04	6.43	7.70	11.05	17.85	32.22
12.00	53.71	68.93	64.64	48.56	33.40	24.74	19.50	15.47	12.22	9.98
13.00	8.72	7.86	7.00	6.24	5.74	5.48	5.26	4.94	4.60	4.34
14.00	4.20	4.13	4.10	4.07	3.99	3.87	3.73	3.58	3.43	3.29
15.00	3.14	3.01	2.89	2.77	2.66	2.56	2.47	2.39	2.32	2.26
16.00	2.21	2.17	2.13	2.10	2.08	2.06	2.04	2.02	2.00	1.99
17.00	1.97	1.95	1.93	1.92	1.90	1.88	1.86	1.85	1.83	1.81
18.00	1.79	1.78	1.76	1.74	1.73	1.71	1.69	1.67	1.66	1.64
19.00	1.62	1.60	1.59	1.57	1.55	1.54	1.52	1.50	1.48	1.47
20.00	1.45	1.43	1.41	1.40	1.38	1.36	1.35	1.33	1.32	1.30
21.00	1.29	1.27	1.26	1.25	1.23	1.22	1.21	1.20	1.19	1.18

22.00	1.17	1.16	1.15	1.14	1.13	1.12	1.12	1.11	1.10	1.10
23.00	1.09	1.08	1.08	1.07	1.07	1.07	1.06	1.06	1.06	1.06
24.00	1.05	.98	.77	.50	.28	.16	.09	.05	.03	.02
25.00	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00
26.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
27.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
28.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
29.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

PEAK RUNOFF (cfs): 68.93
TIME TO PEAK (hrs): 12.10

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering
Date: 08/09/2001 Thursday
Time: 13:38:31
Input: JSB110.IN
Output: JSB110.OUT

RETURN PERIOD (yrs): 10

========== DOWNSTREAM HYDROGRAPH ==========

DISCHARGE (cfs)

TIME: (hrs)	+.00 hrs	+.10 hrs	+.20 hrs	+.30 hrs	+.40 hrs	+.50 hrs	+.60 hrs	+.70 hrs	+.80 hrs	+.90 hrs
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4.00	.00	.00	.00	.00	.01	.02	.04	.06	.07	.09
5.00	.11	.13	.15	.17	.18	.20	.22	.23	.25	.27
6.00	.28	.30	.33	.35	.38	.40	.42	.44	.46	.48
7.00	.49	.52	.56	.61	.65	.69	.72	.74	.77	.79
8.00	.81	.84	.89	.96	1.01	1.06	1.10	1.14	1.20	1.24
9.00	1.28	1.32	1.39	1.47	1.54	1.59	1.65	1.73	1.82	1.90
10.00	1.95	2.04	2.20	2.39	2.55	2.66	2.81	3.09	3.41	3.68
11.00	3.87	4.15	4.74	5.44	6.04	6.43	7.70	11.05	17.85	32.22
12.00	53.71	68.93	64.64	48.56	33.40	24.74	19.50	15.47	12.22	9.98
13.00	8.72	7.86	7.00	6.24	5.74	5.48	5.26	4.94	4.60	4.34
14.00	4.20	4.13	4.10	4.07	3.99	3.87	3.73	3.58	3.43	3.29
15.00	3.14	3.01	2.89	2.77	2.66	2.56	2.47	2.39	2.32	2.26
16.00	2.21	2.17	2.13	2.10	2.08	2.06	2.04	2.02	2.00	1.99
17.00	1.97	1.95	1.93	1.92	1.90	1.88	1.86	1.85	1.83	1.81
18.00	1.79	1.78	1.76	1.74	1.73	1.71	1.69	1.67	1.66	1.64
19.00	1.62	1.60	1.59	1.57	1.55	1.54	1.52	1.50	1.48	1.47
20.00	1.45	1.43	1.41	1.40	1.38	1.36	1.35	1.33	1.32	1.30
21.00	1.29	1.27	1.26	1.25	1.23	1.22	1.21	1.20	1.19	1.18
22.00	1.17	1.16	1.15	1.14	1.13	1.12	1.12	1.11	1.10	1.10
23.00	1.09	1.08	1.08	1.07	1.07	1.07	1.06	1.06	1.06	1.06
24.00	1.05	.98	.77	.50	.28	.16	.09	.05	.03	.02
25.00	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00
26.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
27.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
28.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
29.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

PEAK DISCHARGE (cfs): 68.93
TIME TO PEAK (hrs): 12.10
Hydrograph Saved In: JSB110.DAT

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering

Date: 08/09/2001 Thursday
Time: 13:38:31
Input: JSB110.IN
Output: JSB110.OUT

RETURN PERIOD (yrs): 10

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

SCS TYPE II Hyetograph.
SCS DIMENSIONLESS UNIT HYDROGRAPH was used.
APPLIED RAINFALL DEPTH (inches): 6.00

	VOLUME OF RAINFALL APPLIED (ac-ft)	VOLUME OF RUNOFF (ac-ft)	RAINFALL LOSSES (percent)	PEAK DISCHARGE (cfs)	PEAK DISCHARGE (cfs/ac)
SUBAREA 1	8.4160	6.3248	24.85	68.927	4.095
TOTAL WATERSHED	8.4160	6.3248	24.85	68.927	4.095

TOTAL WATERSHED AREA (square miles): .0263
TOTAL VOLUME OF DISCHARGE LEAVING WATERSHED (ac-ft): 6.3248
COMPOSITE WATERSHED CURVE NUMBER: 87.00
MINIMUM SUBAREA TIME OF CONCENTRATION: .400 hours.

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

1

100-Year Hydrograph

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering
Date: 08/09/2001 Thursday
Time: 13:39:45
Input: JSB1100.IN
Output: JSB1100.OUT

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

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

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

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

The SCS DIMENSIONLESS UNIT HYDROGRAPH is used in all runoff computations.
The peak rate factor (PRF) for all unit hydrographs is 484 (U.S. Customary units) or 2.08356 (Metric units).

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering
Date: 08/09/2001 Thursday
Time: 13:39:45
Input: JSB1100.IN
Output: JSB1100.OUT

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

SUBAREA ID NO	AREA (mi2)	TIME OF CONCENTRATION (hrs)	CURVE NUMBER	BASEFLOW (cfs)	DOWNSTREAM CHANNELS
1	.0263	.400	87.00	.0	

Composite Watershed Curve Number = 87.00
Minimum Subarea Time of Concentration = .400 hours.

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering
Date: 08/09/2001 Thursday
Time: 13:39:45
Input: JSB1100.IN
Output: JSB1100.OUT

RETURN PERIOD (yrs): 100

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

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

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

.000,	.00	2.000,	.18	4.000,	.38	6.000,	.64
7.000,	.78	8.000,	.96	8.500,	1.06	9.000,	1.18
9.500,	1.30	9.750,	1.38	10.000,	1.45	10.500,	1.63
11.000,	1.88	11.500,	2.26	11.750,	2.86	12.000,	5.30
12.500,	5.88	13.000,	6.18	13.500,	6.39	14.000,	6.56
16.000,	7.04	20.000,	7.62	24.000,	8.00		

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

PROJECT: JAMESTOWN SETTLEMENT
Input: JSB1100.IN
Output: JSB1100.OUT

RETURN PERIOD (yrs): 100

SUBAREA 1 SUBAREA 1 SUBAREA 1 SUBAREA 1

AREA (square miles) : .0263
TIME OF CONCENTRATION (hrs): .40
RUNOFF CURVE NUMBER : 87.00
BASEFLOW (cfs) : .00
DOWNSTREAM CHANNELS :

SUBAREA RUNOFF (cfs)

TIME: (hrs)	+.00 hrs	+.10 hrs	+.20 hrs	+.30 hrs	+.40 hrs	+.50 hrs	+.60 hrs	+.70 hrs	+.80 hrs	+.90 hrs
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3.00	.00	.00	.00	.00	.01	.02	.03	.05	.07	.09
4.00	.12	.14	.17	.21	.24	.28	.31	.34	.37	.39
5.00	.42	.45	.47	.50	.52	.55	.57	.60	.62	.64
6.00	.66	.69	.73	.78	.82	.85	.88	.91	.93	.96
7.00	.98	1.02	1.09	1.17	1.25	1.30	1.34	1.38	1.41	1.44
8.00	1.47	1.51	1.59	1.69	1.78	1.84	1.90	1.97	2.05	2.11
9.00	2.16	2.23	2.33	2.45	2.55	2.63	2.71	2.82	2.96	3.07
10.00	3.15	3.27	3.51	3.79	4.04	4.19	4.41	4.81	5.29	5.69
11.00	5.95	6.36	7.21	8.25	9.10	9.65	11.48	16.32	26.08	46.38
12.00	76.26	97.01	90.52	67.78	46.49	34.33	26.98	21.35	16.83	13.73
13.00	11.97	10.79	9.59	8.55	7.86	7.49	7.19	6.76	6.29	5.93
14.00	5.73	5.64	5.60	5.56	5.45	5.29	5.09	4.89	4.68	4.48
15.00	4.29	4.11	3.94	3.78	3.63	3.50	3.37	3.26	3.17	3.08
16.00	3.01	2.95	2.90	2.87	2.83	2.80	2.78	2.75	2.73	2.70
17.00	2.68	2.66	2.63	2.61	2.58	2.56	2.54	2.51	2.49	2.46
18.00	2.44	2.42	2.39	2.37	2.35	2.32	2.30	2.27	2.25	2.23
19.00	2.20	2.18	2.16	2.13	2.11	2.09	2.06	2.04	2.02	1.99
20.00	1.97	1.95	1.92	1.90	1.88	1.85	1.83	1.81	1.79	1.77
21.00	1.75	1.73	1.71	1.69	1.68	1.66	1.64	1.63	1.61	1.60

22.00	1.58	1.57	1.56	1.55	1.54	1.52	1.51	1.50	1.49	1.49
23.00	1.48	1.47	1.46	1.46	1.45	1.45	1.44	1.44	1.44	1.43
24.00	1.43	1.34	1.05	.68	.39	.22	.12	.07	.04	.02
25.00	.01	.01	.00	.00	.00	.00	.00	.00	.00	.00
26.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
27.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
28.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
29.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

PEAK RUNOFF (cfs): 97.01
TIME TO PEAK (hrs): 12.10

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering
Date: 08/09/2001 Thursday
Time: 13:39:45
Input: JSB1100.IN
Output: JSB1100.OUT

RETURN PERIOD (yrs): 100

========== DOWNSTREAM HYDROGRAPH ==========

DISCHARGE (cfs)

TIME: (hrs)	+.00 hrs	+.10 hrs	+.20 hrs	+.30 hrs	+.40 hrs	+.50 hrs	+.60 hrs	+.70 hrs	+.80 hrs	+.90 hrs
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3.00	.00	.00	.00	.00	.01	.02	.03	.05	.07	.09
4.00	.12	.14	.17	.21	.24	.28	.31	.34	.37	.39
5.00	.42	.45	.47	.50	.52	.55	.57	.60	.62	.64
6.00	.66	.69	.73	.78	.82	.85	.88	.91	.93	.96
7.00	.98	1.02	1.09	1.17	1.25	1.30	1.34	1.38	1.41	1.44
8.00	1.47	1.51	1.59	1.69	1.78	1.84	1.90	1.97	2.05	2.11
9.00	2.16	2.23	2.33	2.45	2.55	2.63	2.71	2.82	2.96	3.07
10.00	3.15	3.27	3.51	3.79	4.04	4.19	4.41	4.81	5.29	5.69
11.00	5.95	6.36	7.21	8.25	9.10	9.65	11.48	16.32	26.08	46.38
12.00	76.26	97.01	90.52	67.78	46.49	34.33	26.98	21.35	16.83	13.73
13.00	11.97	10.79	9.59	8.55	7.86	7.49	7.19	6.76	6.29	5.93
14.00	5.73	5.64	5.60	5.56	5.45	5.29	5.09	4.89	4.68	4.48
15.00	4.29	4.11	3.94	3.78	3.63	3.50	3.37	3.26	3.17	3.08
16.00	3.01	2.95	2.90	2.87	2.83	2.80	2.78	2.75	2.73	2.70
17.00	2.68	2.66	2.63	2.61	2.58	2.56	2.54	2.51	2.49	2.46
18.00	2.44	2.42	2.39	2.37	2.35	2.32	2.30	2.27	2.25	2.23
19.00	2.20	2.18	2.16	2.13	2.11	2.09	2.06	2.04	2.02	1.99
20.00	1.97	1.95	1.92	1.90	1.88	1.85	1.83	1.81	1.79	1.77
21.00	1.75	1.73	1.71	1.69	1.68	1.66	1.64	1.63	1.61	1.60
22.00	1.58	1.57	1.56	1.55	1.54	1.52	1.51	1.50	1.49	1.49
23.00	1.48	1.47	1.46	1.46	1.45	1.45	1.44	1.44	1.44	1.43
24.00	1.43	1.34	1.05	.68	.39	.22	.12	.07	.04	.02
25.00	.01	.01	.00	.00	.00	.00	.00	.00	.00	.00
26.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
27.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
28.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
29.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

PEAK DISCHARGE (cfs): 97.01
TIME TO PEAK (hrs): 12.10
Hydrograph Saved In: JSB1100.DAT

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering

Date: 08/09/2001 Thursday
Time: 13:39:45
Input: JSB1100.IN
Output: JSB1100.OUT

RETURN PERIOD (yrs): 100

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

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

	VOLUME OF RAINFALL APPLIED (ac-ft)	VOLUME OF RUNOFF (ac-ft)	RAINFALL LOSSES (percent)	PEAK DISCHARGE (cfs)	PEAK DISCHARGE (cfs/ac)
SUBAREA 1	11.221	9.0307	19.52	97.012	5.764
TOTAL WATERSHED	11.221	9.0307	19.52	97.012	5.764

TOTAL WATERSHED AREA (square miles): .0263
TOTAL VOLUME OF DISCHARGE LEAVING WATERSHED (ac-ft): 9.0307
COMPOSITE WATERSHED CURVE NUMBER: 87.00
MINIMUM SUBAREA TIME OF CONCENTRATION: .400 hours.

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

1

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

JOB 00175-020
SHEET NO. _____ OF _____
CALCULATED BY KMJ DATE 3/9/01
CHECKED BY _____ DATE _____
SCALE _____

DESIGN POND/WETLAND SYSTEM
BMP (CB-3)
10 POINT BMP
DA-1,2,+3

Design Criteria - 1 inch per impervious acre for water quality volume

Proposed Impervious Area - 9.87 acre

Treatment Volume - 1 inch / impervious acre

$$V = \frac{9.87\,ac}{1} \left| \frac{43{,}560\,sf}{1\,ac} \right| \frac{1\,in}{12\,in} \left| \frac{1\,ft}{} \right| = 36{,}000\,cf$$

RICKMOND ENGINEERING, INC.
1643 Merrimac Trail
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Fax Number (757) 229-4683
E-mail: rickmond@tni.net
www.rickmond.com

JOB 00175-020
SHEET NO. _____ OF _____
CALCULATED BY KMJ DATE 8/9/01
CHECKED BY _____ DATE _____
SCALE _____

Compute Stream Channel Protection Volume (CPv):

Step 1. Develope site hydrologic & TR-55 Input Parameters

Condition	CN	Tc	Q_a, 1-YR ST	Q 1-YR	Q 10-YR
		hrs	inches	cfs	cfs
PRE-DEVELOP.	74	.40	0.8	10.40	24.92
DEVELOPED	87	.40	1.6	48.25	70.09

Step 2. Utilize HDE Method to compute Storage Volume

Initial Abstraction (Ia) for CN of 87 is 0.299

Ia/P = 0.299/2.8 = .11
Tc = 0.40 hrs

From TR-55, Exhibit 4-II
q_u = 590 csm/in

Q_o/Q_i = 0.031

From TR-55, Figure 6.1
For Type II Rainfall Distribution,

$$V_s/V_r = 0.683 - 1.43(Q_o/Q_i) + 1.64(Q_o/Q_i)^2 - 0.804(Q_o/Q_i)^3$$
$$V_s/V_r = 0.683 - 1.43(.031) + 1.64(.031)^2 - 0.804(.031)^3$$
$$V_s/V_r = 0.683 - 0.044 + .002 - 0$$
$$V_s/V_r = 0.64$$

$V_s = 0.64(1.6)(1/12)(16.84\,ac) = 1.44$ ac-ft

Step 3. Define the average ED Release Rate

Q_i = 48.25 cfs
$Q_o = (Q_o/Q_i)\,Q_i = .031(48.25) = 1.5$ cfs

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JOB 00175-020
SHEET NO. _____ OF _____
CALCULATED BY KMJ DATE 3/9/01
CHECKED BY _____ DATE _____
SCALE _____

WETLAND STAGE-STORAGE

ELEV (ft)	ΔELEV (ft)	SA (ft²)	STORAGE (cf)	ACCUM STORAGE (cf)
10.0		1532		0
	1.0		12,847	
11.0		24,162		12,847
	1.0		34,133	
12.0		44,104		46,980
	1.0		51,232	
13.0		58,360		98,212

11.23 → 20,698 ft³ => 60%

POND STAGE-STORAGE

ELEV (ft)	ΔELEV (ft)	SA (ft²)	STORAGE (cf)	ACCUM STORAGE (cf)
6.0		1120		0
	1.0		1401	
7.0		1682		1401
	1.0		1995	
8.0		2308		3396
	1.0		2654	
9.0		3000		6050
	1.0		3374	
10.0		3748		9424
	1.0		4149	
11.0		4550		13,573
	1.0		4965	
12.0		5380		18,538

11.23 → 14,712 ft³ => 40%

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

JOB 00175
SHEET NO. _____ OF _____
CALCULATED BY KWJ DATE 4/16/01
CHECKED BY _____ DATE _____
SCALE _____

POND/WETLAND STAGE - STORAGE

ELEV (ft)	ΔELEV (ft)	SA (ft²)	STORAGE (cf)	ACCUM STORAGE (cf)
6.0		1120		0
	1.0		1401	
7.0		1682		1401
	1.0		1995	
8.0		2308		3396
	1.0		2654	
9.0		3000		6050
	1.0		4140	
10.0		5280		10,190
	1.0		16,996	
11.0		28,712		27,186
	1.0		39,098	
12.0		49,484		66,284
	1.0		53,922	
13.0		58,360		120,206
	.25		14,917	
13.25		60,977		135,123

Water Quality Elevation = 11.23 → 36,178

Channel Protection Elevation = 12.60

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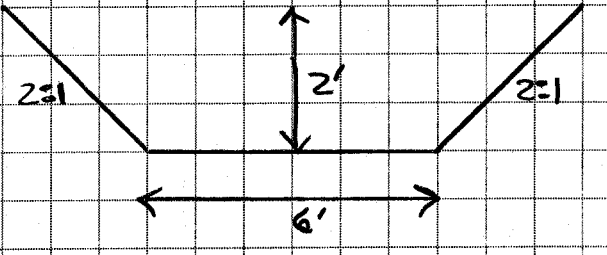
Fax Number (757) 229-4683

JOB 00175-020
SHEET NO. _____ OF _____
CALCULATED BY KMS DATE 3/28/01
CHECKED BY _____ DATE _____
SCALE _____

USE EXISTING DITCH UPLANDS OF BMP B-1 AS FOREBAY

- Drainage Area to Forebay = 8.23 ac.
- Impervious Area @ Buildout = (8.23ac)(0.60) = 4.94 ac
- Forebay Volume Required = $\frac{.1\text{in}}{} \left| \frac{4.94\text{ac}}{} \right| \frac{43{,}560\text{sf}}{1\text{ac}} \left| \frac{1\text{ft}}{12\text{in}} \right.$

  = 1800 cf
- Determine Forebay Volume:



DITCH/FOREBAY CROSS-SECTION

- Forebay Cross-Section Area = 20 ft^2
- Forebay Length = 425 ft^2
- Forebay Volume = 8500 ft^2

Conclusion: Existing ditch upland of BMP B-1 has adequate storage to act as forebay

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www.rickmond.com

JOB 00175-020
SHEET NO. _____ OF _____
CALCULATED BY KMJ DATE 8/13/01
CHECKED BY _____ DATE _____
SCALE _____

DESIGN ORIFICE TO PASS 14R POST-DEVELOPMENT STORM OVER 24 HOURS

$Q = 0.6 A\sqrt{2gh}$ - orifice equation

orifice invert @ Elev 11.23

$Q = 1.50$ cfs

$H = 12.60 - 11.23 = 1.37$

$1.50 = .6 A\sqrt{2(32.2)(1.37)}$

$A = \pi r^2 = 0.266$

$r = .29'$

USE 6.25"x6.25" SQUARE ORIFICE AT ELEV 11.23 $A = 0.267$ ft2

Elev	H	Q
11.23	0	0
12.00	.77	1.13
13.00	1.77	1.71
13.25	2.02	1.83

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JOB 00175-020
SHEET NO. _____ OF _____
CALCULATED BY KMJ DATE 4/16/01
CHECKED BY _____ DATE _____
SCALE _____

DESIGN WEIR TO PASS 10-YR. POST-DEVELOPMENT STORM AT PRE-DEVELOPMENT RATE

$Q = 3.367(b)H^{3/2}$ - Cipoletti weir equation

Weir invert @ Elev 12.50

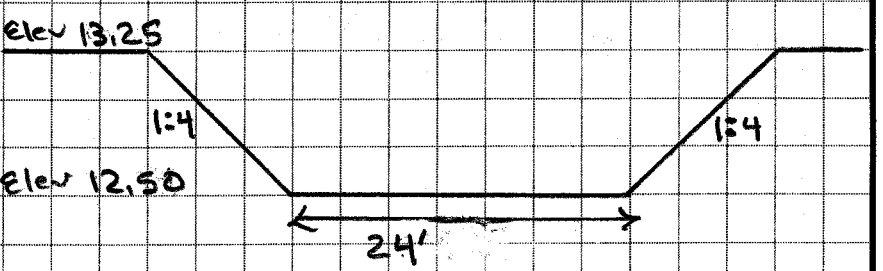
Q = 47.18 cfs (10 YEAR PREDEVELOPMENT)

$H = 13.00 - 12.50 = .50$

$47.18 = 3.367(b)(.5)^{3/2}$

$b = 24'$

Weir Cross-Section:



Elev	H	Q
12.50	0	0
13.00	.5	28.57
13.25	.75	52.49

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Fax Number (757) 229-4683

JOB 0075-020
SHEET NO. _____ OF _____
CALCULATED BY KMJ DATE 4/16/01
CHECKED BY _____ DATE _____
SCALE _____

STAGE - STORAGE - DISCHARGE

ELEV (ft)	SURFACE AREA (ac-ft)	DISCHARGE (cfs)
11.23	0.7688	0
12.00	1.1360	1.13
12.50	1.2379	1.45
13.00	1.3398	30.28
13.25	1.3998	54.32

1-Year Routing

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering
Date: 08/13/2001 Monday
Time: 11:50:10
Output: JSB1P1.OUT

SOLUTION FOR 1 STORMS.

TIME INCREMENT: .100 Hours

STORM NUMBER	HYDROGRAPH IN FILE:
1	JSB11.DAT

STORM NUMBER	PEAK INFLOW (cfs)	ALLOWABLE PEAK DISCHARGE (cfs)	DURATION (min)	RUNOFF VOLUME (ft3)	TAILWATER STAGE (ft)
1	24.185	N/A	1794.00	.9550E+05	11.230

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering
Date: 08/13/2001 Monday
Time: 11:50:10
Output: JSB1P1.OUT

Stage-Area-Discharge
Filename: JSB1POND.DAT

TAILWATER STAGE: 11.230 feet.
INITIAL STAGE: 11.230 feet.

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

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

STAGE (ft)	STORAGE VOLUME (ac-ft)	DISCHARGE (cfs)
11.230	.0000	.0000
12.000	.7288	1.130
12.500	1.322	1.450
13.000	1.966	30.28
13.250	2.309	54.32

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering
Date: 08/13/2001 Monday

Time: 11:50:10
Output: JSB1P1.OUT

TAILWATER STAGE: 11.230 feet.
INITIAL STAGE: 11.230 feet.

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

MAXIMUM ELEVATION: 12.50 feet.
MAXIMUM INFLOW: 24.18 cfs.
MAXIMUM OUTFLOW: 1.449 cfs.
MAXIMUM STORAGE: 1.321 acre-feet.

CONTINUITY ERROR: .528E-03 percent.

TIME (min)	INFLOW RATE (cfs)	OUTFLOW RATE (cfs)	POND SURFACE ELEVATION (ft)
0	.000	.000	11.230
6	.000	.000	11.230
12	.000	.000	11.230
18	.000	.000	11.230
24	.000	.000	11.230
30	.000	.000	11.230
36	.000	.000	11.230
42	.000	.000	11.230
48	.000	.000	11.230
54	.000	.000	11.230
60	.000	.000	11.230
66	.000	.000	11.230
72	.000	.000	11.230
78	.000	.000	11.230
84	.000	.000	11.230
90	.000	.000	11.230
96	.000	.000	11.230
102	.000	.000	11.230
108	.000	.000	11.230
114	.000	.000	11.230
120	.000	.000	11.230
126	.000	.000	11.230
132	.000	.000	11.230
138	.000	.000	11.230
144	.000	.000	11.230
150	.000	.000	11.230
156	.000	.000	11.230
162	.000	.000	11.230
168	.000	.000	11.230
174	.000	.000	11.230
180	.000	.000	11.230
186	.000	.000	11.230
192	.000	.000	11.230
198	.000	.000	11.230
204	.000	.000	11.230
210	.000	.000	11.230
216	.000	.000	11.230
222	.000	.000	11.230
228	.000	.000	11.230
234	.000	.000	11.230
240	.000	.000	11.230
246	.000	.000	11.230
252	.000	.000	11.230
258	.000	.000	11.230
264	.000	.000	11.230
270	.000	.000	11.230
276	.000	.000	11.230
282	.000	.000	11.230
288	.000	.000	11.230
294	.000	.000	11.230
300	.000	.000	11.230
306	.000	.000	11.230
312	.000	.000	11.230

318	.000	.000	11.230
324	.000	.000	11.230
330	.000	.000	11.230
336	.000	.000	11.230
342	.000	.000	11.230
348	.000	.000	11.230
354	.000	.000	11.230
360	.000	.000	11.230
366	.000	.000	11.230
372	.000	.000	11.230
378	.000	.000	11.230
384	.000	.000	11.230
390	.000	.000	11.230
396	.000	.000	11.230
402	.000	.000	11.230
408	.000	.000	11.230
414	.000	.000	11.230
420	.000	.000	11.230
426	.000	.000	11.230
432	.000	.000	11.230
438	.000	.000	11.230
444	.000	.000	11.230
450	.000	.000	11.230
456	.002	.000	11.230
462	.005	.000	11.230
468	.011	.000	11.230
474	.017	.000	11.230
480	.024	.001	11.230
486	.033	.001	11.231
492	.043	.001	11.231
498	.055	.002	11.231
504	.066	.003	11.232
510	.078	.004	11.232
516	.089	.005	11.233
522	.102	.006	11.234
528	.115	.007	11.235
534	.129	.009	11.236
540	.141	.010	11.237
546	.155	.012	11.238
552	.172	.014	11.239
558	.192	.016	11.241
564	.211	.018	11.243
570	.227	.021	11.244
576	.245	.024	11.246
582	.267	.027	11.248
588	.291	.030	11.250
594	.314	.033	11.253
600	.334	.037	11.255
606	.360	.041	11.258
612	.401	.045	11.261
618	.449	.050	11.264
624	.493	.056	11.268
630	.529	.061	11.272
636	.574	.068	11.276
642	.648	.074	11.281
648	.735	.082	11.286
654	.815	.091	11.292
660	.877	.101	11.299
666	.966	.111	11.306
672	1.133	.123	11.314
678	1.337	.137	11.324
684	1.520	.154	11.335
690	1.658	.172	11.347
696	2.056	.193	11.362
702	3.075	.224	11.382
708	5.253	.274	11.417
714	10.181	.369	11.481
720	18.090	.544	11.601
726	24.185	.806	11.779
732	23.224	1.098	11.978
738	17.724	1.205	12.117
744	12.344	1.266	12.213
750	9.279	1.309	12.279
756	7.419	1.340	12.328
762	5.950	1.364	12.366

768	4.742	1.382	12.393
774	3.905	1.395	12.414
780	3.433	1.405	12.429
786	3.117	1.413	12.442
792	2.788	1.420	12.453
798	2.495	1.425	12.462
804	2.300	1.430	12.468
810	2.198	1.433	12.474
816	2.113	1.437	12.479
822	1.988	1.439	12.483
828	1.854	1.442	12.487
834	1.752	1.443	12.489
840	1.695	1.444	12.491
846	1.669	1.445	12.493
852	1.661	1.446	12.494
858	1.649	1.447	12.496
864	1.620	1.448	12.497
870	1.572	1.449	12.498
876	1.516	1.449	12.499
882	1.457	1.449	12.499
888	1.397	1.449	12.499
894	1.338	1.449	12.498
900	1.282	1.448	12.497
906	1.229	1.447	12.496
912	1.179	1.446	12.494
918	1.132	1.445	12.492
924	1.089	1.444	12.490
930	1.049	1.442	12.487
936	1.013	1.440	12.485
942	.981	1.438	12.481
948	.952	1.436	12.478
954	.927	1.434	12.475
960	.906	1.432	12.471
966	.889	1.429	12.467
972	.875	1.427	12.464
978	.864	1.424	12.460
984	.855	1.422	12.456
990	.846	1.419	12.452
996	.839	1.417	12.448
1002	.832	1.414	12.444
1008	.825	1.411	12.440
1014	.818	1.409	12.436
1020	.811	1.406	12.432
1026	.804	1.403	12.427
1032	.797	1.401	12.423
1038	.790	1.398	12.419
1044	.783	1.395	12.415
1050	.776	1.393	12.410
1056	.769	1.390	12.406
1062	.762	1.387	12.402
1068	.756	1.384	12.397
1074	.749	1.382	12.393
1080	.742	1.379	12.389
1086	.735	1.376	12.384
1092	.728	1.373	12.380
1098	.721	1.370	12.375
1104	.714	1.367	12.371
1110	.707	1.364	12.366
1116	.700	1.361	12.361
1122	.693	1.358	12.357
1128	.686	1.355	12.352
1134	.679	1.352	12.348
1140	.672	1.349	12.343
1146	.665	1.346	12.338
1152	.659	1.343	12.333
1158	.651	1.340	12.329
1164	.645	1.337	12.324
1170	.638	1.334	12.319
1176	.631	1.331	12.314
1182	.624	1.328	12.309
1188	.617	1.325	12.304
1194	.610	1.322	12.299
1200	.603	1.318	12.294
1206	.596	1.315	12.289
1212	.589	1.312	12.284

1218	.582	1.309	12.279
1224	.575	1.305	12.274
1230	.568	1.302	12.269
1236	.562	1.299	12.264
1242	.555	1.296	12.259
1248	.549	1.292	12.254
1254	.543	1.289	12.248
1260	.537	1.286	12.243
1266	.531	1.282	12.238
1272	.526	1.279	12.233
1278	.520	1.276	12.228
1284	.515	1.272	12.222
1290	.510	1.269	12.217
1296	.505	1.265	12.212
1302	.501	1.262	12.206
1308	.496	1.259	12.201
1314	.492	1.255	12.196
1320	.488	1.252	12.190
1326	.484	1.248	12.185
1332	.480	1.245	12.180
1338	.476	1.242	12.174
1344	.473	1.238	12.169
1350	.470	1.235	12.164
1356	.467	1.231	12.158
1362	.464	1.228	12.153
1368	.461	1.225	12.148
1374	.458	1.221	12.143
1380	.456	1.218	12.137
1386	.454	1.214	12.132
1392	.452	1.211	12.127
1398	.450	1.208	12.121
1404	.448	1.204	12.116
1410	.447	1.201	12.111
1416	.445	1.198	12.106
1422	.444	1.194	12.100
1428	.443	1.191	12.095
1434	.443	1.188	12.090
1440	.442	1.184	12.085
1446	.413	1.181	12.079
1452	.323	1.177	12.074
1458	.210	1.173	12.067
1464	.119	1.169	12.060
1470	.067	1.164	12.053
1476	.038	1.159	12.045
1482	.022	1.154	12.037
1488	.012	1.149	12.030
1494	.007	1.144	12.022
1500	.004	1.139	12.014
1506	.002	1.134	12.006
1512	.001	1.126	11.997
1518	.000	1.112	11.988
1524	.000	1.098	11.978
1530	.000	1.084	11.968
1536	.000	1.070	11.959
1542	.000	1.056	11.950
1548	.000	1.043	11.941
1554	.000	1.030	11.932
1560	.000	1.016	11.923
1566	.000	1.004	11.914
1572	.000	.991	11.905
1578	.000	.978	11.897
1584	.000	.966	11.888
1590	.000	.953	11.880
1596	.000	.941	11.871
1602	.000	.929	11.863
1608	.000	.917	11.855
1614	.000	.906	11.847
1620	.000	.894	11.839
1626	.000	.883	11.832
1632	.000	.872	11.824
1638	.000	.861	11.816
1644	.000	.850	11.809
1650	.000	.839	11.802
1656	.000	.828	11.794
1662	.000	.818	11.787

1668	.000	.807	11.780
1674	.000	.797	11.773
1680	.000	.787	11.766
1686	.000	.777	11.759
1692	.000	.767	11.752
1698	.000	.757	11.746
1704	.000	.747	11.739
1710	.000	.738	11.733
1716	.000	.728	11.726
1722	.000	.719	11.720
1728	.000	.710	11.714
1734	.000	.701	11.708
1740	.000	.692	11.702
1746	.000	.683	11.696
1752	.000	.675	11.690
1758	.000	.666	11.684
1764	.000	.657	11.678
1770	.000	.649	11.672
1776	.000	.641	11.667
1782	.000	.633	11.661
1788	.000	.625	11.656
1794	.000	.617	11.650
1800	.000	.609	11.645
1806	.000	.601	11.640
1812	.000	.593	11.634
1818	.000	.586	11.629
1824	.000	.578	11.624
1830	.000	.571	11.619
1836	.000	.564	11.614
1842	.000	.557	11.609
1848	.000	.549	11.604
1854	.000	.543	11.600
1860	.000	.536	11.595
1866	.000	.529	11.590
1872	.000	.522	11.586
1878	.000	.515	11.581
1884	.000	.509	11.577
1890	.000	.502	11.572
1896	.000	.496	11.568
1902	.000	.490	11.564
1908	.000	.483	11.559
1914	.000	.477	11.555
1920	.000	.471	11.551
1926	.000	.465	11.547
1932	.000	.459	11.543
1938	.000	.453	11.539
1944	.000	.448	11.535
1950	.000	.442	11.531
1956	.000	.436	11.527
1962	.000	.431	11.524
1968	.000	.425	11.520
1974	.000	.420	11.516
1980	.000	.415	11.512
1986	.000	.409	11.509
1992	.000	.404	11.505
1998	.000	.399	11.502
2004	.000	.394	11.498
2010	.000	.389	11.495
2016	.000	.384	11.492
2022	.000	.379	11.488
2028	.000	.374	11.485
2034	.000	.369	11.482
2040	.000	.365	11.478
2046	.000	.360	11.475
2052	.000	.355	11.472
2058	.000	.351	11.469
2064	.000	.346	11.466
2070	.000	.342	11.463
2076	.000	.338	11.460
2082	.000	.333	11.457
2088	.000	.329	11.454
2094	.000	.325	11.451
2100	.000	.321	11.449
2106	.000	.317	11.446
2112	.000	.313	11.443

2118	.000	.309	11.440
2124	.000	.305	11.438
2130	.000	.301	11.435
2136	.000	.297	11.432
2142	.000	.293	11.430
2148	.000	.290	11.427
2154	.000	.286	11.425
2160	.000	.282	11.422
2166	.000	.279	11.420
2172	.000	.275	11.417
2178	.000	.272	11.415
2184	.000	.268	11.413
2190	.000	.265	11.410
2196	.000	.261	11.408
2202	.000	.258	11.406
2208	.000	.255	11.404
2214	.000	.251	11.401
2220	.000	.248	11.399
2226	.000	.245	11.397
2232	.000	.242	11.395
2238	.000	.239	11.393
2244	.000	.236	11.391
2250	.000	.233	11.389
2256	.000	.230	11.387
2262	.000	.227	11.385
2268	.000	.224	11.383
2274	.000	.221	11.381
2280	.000	.218	11.379
2286	.000	.216	11.377
2292	.000	.213	11.375
2298	.000	.210	11.373
2304	.000	.207	11.371
2310	.000	.205	11.370
2316	.000	.202	11.368
2322	.000	.200	11.366
2328	.000	.197	11.364
2334	.000	.195	11.363
2340	.000	.192	11.361
2346	.000	.190	11.359
2352	.000	.187	11.358
2358	.000	.185	11.356
2364	.000	.183	11.354
2370	.000	.180	11.353
2376	.000	.178	11.351
2382	.000	.176	11.350
2388	.000	.173	11.348
2394	.000	.171	11.347
2400	.000	.169	11.345
2406	.000	.167	11.344
2412	.000	.165	11.342
2418	.000	.163	11.341
2424	.000	.161	11.339
2430	.000	.159	11.338
2436	.000	.157	11.337
2442	.000	.155	11.335
2448	.000	.153	11.334
2454	.000	.151	11.333
2460	.000	.149	11.331
2466	.000	.147	11.330
2472	.000	.145	11.329
2478	.000	.143	11.328
2484	.000	.141	11.326
2490	.000	.139	11.325
2496	.000	.138	11.324
2502	.000	.136	11.323
2508	.000	.134	11.321
2514	.000	.132	11.320
2520	.000	.131	11.319
2526	.000	.129	11.318
2532	.000	.128	11.317
2538	.000	.126	11.316
2544	.000	.124	11.315
2550	.000	.123	11.314
2556	.000	.121	11.313
2562	.000	.120	11.311

2568	.000	.118	11.310
2574	.000	.117	11.309
2580	.000	.115	11.308
2586	.000	.114	11.307
2592	.000	.112	11.306
2598	.000	.111	11.305
2604	.000	.109	11.304
2610	.000	.108	11.304
2616	.000	.107	11.303
2622	.000	.105	11.302
2628	.000	.104	11.301
2634	.000	.103	11.300
2640	.000	.101	11.299
2646	.000	.100	11.298
2652	.000	.099	11.297
2658	.000	.097	11.296
2664	.000	.096	11.296
2670	.000	.095	11.295
2676	.000	.094	11.294
2682	.000	.093	11.293
2688	.000	.091	11.292
2694	.000	.090	11.291
2700	.000	.089	11.291
2706	.000	.088	11.290
2712	.000	.087	11.289
2718	.000	.086	11.288
2724	.000	.085	11.288
2730	.000	.084	11.287
2736	.000	.082	11.286
2742	.000	.081	11.285
2748	.000	.080	11.285
2754	.000	.079	11.284
2760	.000	.078	11.283
2766	.000	.077	11.283
2772	.000	.076	11.282
2778	.000	.075	11.281
2784	.000	.074	11.281
2790	.000	.073	11.280
2796	.000	.073	11.279
2802	.000	.072	11.279
2808	.000	.071	11.278
2814	.000	.070	11.278
2820	.000	.069	11.277
2826	.000	.068	11.276
2832	.000	.067	11.276
2838	.000	.066	11.275
2844	.000	.065	11.275
2850	.000	.065	11.274
2856	.000	.064	11.273
2862	.000	.063	11.273
2868	.000	.062	11.272
2874	.000	.061	11.272
2880	.000	.061	11.271
2886	.000	.060	11.271
2892	.000	.059	11.270
2898	.000	.058	11.270
2904	.000	.058	11.269
2910	.000	.057	11.269
2916	.000	.056	11.268
2922	.000	.055	11.268
2928	.000	.055	11.267
2934	.000	.054	11.267
2940	.000	.053	11.266
2946	.000	.053	11.266
2952	.000	.052	11.265
2958	.000	.051	11.265
2964	.000	.051	11.265
2970	.000	.050	11.264
2976	.000	.049	11.264
2982	.000	.049	11.263
2988	.000	.048	11.263
2994	.000	.048	11.262
3000	.000	.047	11.262
3006	.000	.046	11.262
3012	.000	.046	11.261

3018	.000	.045	11.261
3024	.000	.045	11.260
3030	.000	.044	11.260
3036	.000	.043	11.260
3042	.000	.043	11.259
3048	.000	.042	11.259
3054	.000	.042	11.258
3060	.000	.041	11.258
3066	.000	.041	11.258
3072	.000	.040	11.257
3078	.000	.040	11.257
3084	.000	.039	11.257
3090	.000	.039	11.256
3096	.000	.038	11.256
3102	.000	.038	11.256
3108	.000	.037	11.255
3114	.000	.037	11.255
3120	.000	.036	11.255
3126	.000	.036	11.254
3132	.000	.035	11.254
3138	.000	.035	11.254
3144	.000	.035	11.254
3150	.000	.034	11.253
3156	.000	.034	11.253
3162	.000	.033	11.253
3168	.000	.033	11.252
3174	.000	.032	11.252
3180	.000	.032	11.252
3186	.000	.032	11.251
3192	.000	.031	11.251
3198	.000	.031	11.251
3204	.000	.030	11.251
3210	.000	.030	11.250
3216	.000	.030	11.250
3222	.000	.029	11.250
3228	.000	.029	11.250
3234	.000	.028	11.249
3240	.000	.028	11.249
3246	.000	.028	11.249
3252	.000	.027	11.249
3258	.000	.027	11.248
3264	.000	.027	11.248
3270	.000	.026	11.248
3276	.000	.026	11.248
3282	.000	.026	11.248
3288	.000	.025	11.247
3294	.000	.025	11.247
3300	.000	.025	11.247
3306	.000	.024	11.247
3312	.000	.024	11.246
3318	.000	.024	11.246
3324	.000	.023	11.246
3330	.000	.023	11.246
3336	.000	.023	11.246
3342	.000	.023	11.245
3348	.000	.022	11.245
3354	.000	.022	11.245
3360	.000	.022	11.245
3366	.000	.021	11.245
3372	.000	.021	11.244
3378	.000	.021	11.244
3384	.000	.021	11.244
3390	.000	.020	11.244
3396	.000	.020	11.244
3402	.000	.020	11.244
3408	.000	.020	11.243
3414	.000	.019	11.243
3420	.000	.019	11.243
3426	.000	.019	11.243
3432	.000	.019	11.243
3438	.000	.018	11.243
3444	.000	.018	11.242
3450	.000	.018	11.242
3456	.000	.018	11.242
3462	.000	.017	11.242

3468	.000	.017	11.242
3474	.000	.017	11.242
3480	.000	.017	11.241
3486	.000	.017	11.241
3492	.000	.016	11.241
3498	.000	.016	11.241
3504	.000	.016	11.241
3510	.000	.016	11.241
3516	.000	.016	11.241
3522	.000	.015	11.240
3528	.000	.015	11.240
3534	.000	.015	11.240
3540	.000	.015	11.240
3546	.000	.015	11.240
3552	.000	.014	11.240
3558	.000	.014	11.240
3564	.000	.014	11.240
3570	.000	.014	11.239
3576	.000	.014	11.239
3582	.000	.014	11.239
3588	.000	.013	11.239
3594	.000	.013	11.239
3600	.000	.013	11.239
3606	.000	.013	11.239
3612	.000	.013	11.239
3618	.000	.013	11.239
3624	.000	.012	11.238
3630	.000	.012	11.238
3636	.000	.012	11.238
3642	.000	.012	11.238
3648	.000	.012	11.238
3654	.000	.012	11.238
3660	.000	.011	11.238
3666	.000	.011	11.238
3672	.000	.011	11.238
3678	.000	.011	11.238
3684	.000	.011	11.237
3690	.000	.011	11.237
3696	.000	.011	11.237
3702	.000	.010	11.237
3708	.000	.010	11.237
3714	.000	.010	11.237
3720	.000	.010	11.237
3726	.000	.010	11.237
3732	.000	.010	11.237
3738	.000	.010	11.237
3744	.000	.010	11.237
3750	.000	.009	11.236
3756	.000	.009	11.236
3762	.000	.009	11.236
3768	.000	.009	11.236
3774	.000	.009	11.236
3780	.000	.009	11.236
3786	.000	.009	11.236
3792	.000	.009	11.236
3798	.000	.009	11.236
3804	.000	.008	11.236
3810	.000	.008	11.236
3816	.000	.008	11.236
3822	.000	.008	11.236
3828	.000	.008	11.235
3834	.000	.008	11.235
3840	.000	.008	11.235
3846	.000	.008	11.235
3852	.000	.008	11.235
3858	.000	.008	11.235
3864	.000	.007	11.235
3870	.000	.007	11.235
3876	.000	.007	11.235
3882	.000	.007	11.235
3888	.000	.007	11.235
3894	.000	.007	11.235
3900	.000	.007	11.235
3906	.000	.007	11.235
3912	.000	.007	11.235

3918	.000	.007	11.235
3924	.000	.007	11.234
3930	.000	.006	11.234
3936	.000	.006	11.234
3942	.000	.006	11.234
3948	.000	.006	11.234
3954	.000	.006	11.234
3960	.000	.006	11.234
3966	.000	.006	11.234
3972	.000	.006	11.234
3978	.000	.006	11.234
3984	.000	.006	11.234
3990	.000	.006	11.234
3996	.000	.006	11.234
4002	.000	.006	11.234
4008	.000	.005	11.234
4014	.000	.005	11.234
4020	.000	.005	11.234
4026	.000	.005	11.234
4032	.000	.005	11.234
4038	.000	.005	11.233
4044	.000	.005	11.233
4050	.000	.005	11.233
4056	.000	.005	11.233
4062	.000	.005	11.233
4068	.000	.005	11.233
4074	.000	.005	11.233
4080	.000	.005	11.233
4086	.000	.005	11.233
4092	.000	.005	11.233
4098	.000	.004	11.233
4104	.000	.004	11.233
4110	.000	.004	11.233
4116	.000	.004	11.233
4122	.000	.004	11.233
4128	.000	.004	11.233
4134	.000	.004	11.233
4140	.000	.004	11.233
4146	.000	.004	11.233
4152	.000	.004	11.233
4158	.000	.004	11.233
4164	.000	.004	11.233
4170	.000	.004	11.233
4176	.000	.004	11.233
4182	.000	.004	11.233
4188	.000	.004	11.233
4194	.000	.004	11.232
4200	.000	.004	11.232
4206	.000	.004	11.232
4212	.000	.004	11.232
4218	.000	.003	11.232
4224	.000	.003	11.232
4230	.000	.003	11.232
4236	.000	.003	11.232
4242	.000	.003	11.232
4248	.000	.003	11.232
4254	.000	.003	11.232
4260	.000	.003	11.232
4266	.000	.003	11.232
4272	.000	.003	11.232
4278	.000	.003	11.232
4284	.000	.003	11.232
4290	.000	.003	11.232
4296	.000	.003	11.232
4302	.000	.003	11.232
4308	.000	.003	11.232
4314	.000	.003	11.232
4320	.000	.003	11.232

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering
Date: 08/13/2001 Monday

Time: 11:50:10
Output: JSB1P1.OUT

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

STORM NUMBER	PEAK STAGE (ft)	PEAK STORAGE (ac-ft)	PEAK INFLOW (cfs)	PEAK OUTFLOW (cfs)
1	12.499	1.32	24.185	1.449

10-Year Routing

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

 PROJECT: JAMESTOWN SETTLEMENT
    User: Rickmond Engineering
    Date: 08/13/2001    Monday
    Time: 11:56:36
  Output: JSB1P10.OUT


 SOLUTION FOR  1  STORMS.


 TIME INCREMENT:   .100  Hours


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

   1      JSB110.DAT
```

STORM NUMBER	PEAK INFLOW (cfs)	ALLOWABLE PEAK DISCHARGE (cfs)	DURATION (min)	RUNOFF VOLUME (ft3)	TAILWATER STAGE (ft)
1	68.927	N/A	1794.00	.2755E+06	11.230

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

 PROJECT: JAMESTOWN SETTLEMENT
    User: Rickmond Engineering
    Date: 08/13/2001    Monday
    Time: 11:56:36
  Output: JSB1P10.OUT


 Stage-Area-Discharge
 Filename: JSB1POND.DAT

           TAILWATER STAGE:   11.230 feet.
             INITIAL STAGE:   11.230 feet.

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

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

STAGE (ft)	STORAGE VOLUME (ac-ft)	DISCHARGE (cfs)
11.230	.0000	.0000
12.000	.7288	1.130
12.500	1.322	1.450
13.000	1.966	30.28
13.250	2.309	54.32

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

 PROJECT: JAMESTOWN SETTLEMENT
    User: Rickmond Engineering
    Date: 08/13/2001    Monday
```

Time: 11:56:36
Output: JSB1P10.OUT

TAILWATER STAGE: 11.230 feet.
INITIAL STAGE: 11.230 feet.

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

MAXIMUM ELEVATION: 13.17 feet.
MAXIMUM INFLOW: 68.93 cfs.
MAXIMUM OUTFLOW: 46.70 cfs.
MAXIMUM STORAGE: 2.200 acre-feet.

CONTINUITY ERROR: .312E-03 percent.

TIME (min)	INFLOW RATE (cfs)	OUTFLOW RATE (cfs)	POND SURFACE ELEVATION (ft)
0	.000	.000	11.230
6	.000	.000	11.230
12	.000	.000	11.230
18	.000	.000	11.230
24	.000	.000	11.230
30	.000	.000	11.230
36	.000	.000	11.230
42	.000	.000	11.230
48	.000	.000	11.230
54	.000	.000	11.230
60	.000	.000	11.230
66	.000	.000	11.230
72	.000	.000	11.230
78	.000	.000	11.230
84	.000	.000	11.230
90	.000	.000	11.230
96	.000	.000	11.230
102	.000	.000	11.230
108	.000	.000	11.230
114	.000	.000	11.230
120	.000	.000	11.230
126	.000	.000	11.230
132	.000	.000	11.230
138	.000	.000	11.230
144	.000	.000	11.230
150	.000	.000	11.230
156	.000	.000	11.230
162	.000	.000	11.230
168	.000	.000	11.230
174	.000	.000	11.230
180	.000	.000	11.230
186	.000	.000	11.230
192	.000	.000	11.230
198	.000	.000	11.230
204	.000	.000	11.230
210	.000	.000	11.230
216	.000	.000	11.230
222	.000	.000	11.230
228	.000	.000	11.230
234	.000	.000	11.230
240	.000	.000	11.230
246	.000	.000	11.230
252	.001	.000	11.230
258	.003	.000	11.230
264	.011	.000	11.230
270	.023	.000	11.230
276	.039	.001	11.230
282	.056	.001	11.231
288	.074	.002	11.231
294	.093	.003	11.232
300	.111	.004	11.233
306	.129	.006	11.234
312	.147	.008	11.235

318	.165	.009	11.236
324	.183	.012	11.238
330	.200	.014	11.239
336	.217	.016	11.241
342	.234	.019	11.243
348	.250	.022	11.245
354	.267	.025	11.247
360	.282	.028	11.249
366	.301	.031	11.251
372	.325	.035	11.254
378	.352	.039	11.256
384	.378	.043	11.259
390	.400	.047	11.262
396	.421	.052	11.265
402	.440	.057	11.269
408	.458	.062	11.272
414	.475	.067	11.276
420	.492	.072	11.279
426	.517	.078	11.283
432	.559	.084	11.287
438	.609	.090	11.291
444	.654	.097	11.296
450	.689	.104	11.301
456	.718	.112	11.306
462	.744	.120	11.312
468	.767	.128	11.317
474	.789	.136	11.323
480	.810	.145	11.329
486	.841	.153	11.334
492	.894	.162	11.341
498	.957	.172	11.347
504	1.013	.182	11.354
510	1.056	.193	11.362
516	1.096	.205	11.369
522	1.144	.216	11.377
528	1.196	.228	11.386
534	1.241	.241	11.394
540	1.278	.254	11.403
546	1.322	.267	11.412
552	1.392	.281	11.422
558	1.471	.296	11.432
564	1.541	.311	11.442
570	1.593	.327	11.453
576	1.648	.344	11.464
582	1.729	.361	11.476
588	1.818	.379	11.488
594	1.896	.398	11.501
600	1.954	.417	11.514
606	2.039	.437	11.528
612	2.198	.458	11.542
618	2.389	.482	11.558
624	2.552	.507	11.576
630	2.664	.534	11.594
636	2.812	.562	11.613
642	3.086	.592	11.634
648	3.409	.626	11.657
654	3.683	.663	11.682
660	3.868	.703	11.709
666	4.153	.745	11.738
672	4.736	.792	11.770
678	5.443	.847	11.807
684	6.038	.909	11.850
690	6.430	.977	11.896
696	7.700	1.055	11.949
702	11.047	1.141	12.017
708	17.852	1.200	12.109
714	32.223	1.306	12.275
720	53.709	4.338	12.550
726	68.927	22.123	12.859
732	64.642	38.612	13.087
738	48.564	46.703	13.171
744	33.400	44.130	13.144
750	24.739	37.357	13.074
756	19.500	30.504	13.002
762	15.466	26.372	12.932

768	12.216	22.461	12.864
774	9.982	18.915	12.803
780	8.716	15.929	12.751
786	7.865	13.545	12.710
792	7.000	11.637	12.677
798	6.243	10.072	12.650
804	5.744	8.799	12.627
810	5.478	7.804	12.610
816	5.257	7.043	12.597
822	4.941	6.436	12.586
828	4.601	5.917	12.577
834	4.343	5.466	12.570
840	4.197	5.093	12.563
846	4.128	4.802	12.558
852	4.103	4.588	12.554
858	4.070	4.431	12.552
864	3.993	4.306	12.550
870	3.873	4.190	12.548
876	3.731	4.069	12.545
882	3.581	3.940	12.543
888	3.431	3.805	12.541
894	3.285	3.665	12.538
900	3.145	3.525	12.536
906	3.012	3.385	12.534
912	2.887	3.249	12.531
918	2.771	3.118	12.529
924	2.663	2.993	12.527
930	2.564	2.875	12.525
936	2.475	2.764	12.523
942	2.395	2.661	12.521
948	2.324	2.567	12.519
954	2.262	2.481	12.518
960	2.210	2.405	12.517
966	2.166	2.337	12.515
972	2.132	2.278	12.514
978	2.104	2.228	12.513
984	2.080	2.186	12.513
990	2.059	2.150	12.512
996	2.040	2.118	12.512
1002	2.022	2.091	12.511
1008	2.004	2.067	12.511
1014	1.986	2.044	12.510
1020	1.968	2.023	12.510
1026	1.951	2.003	12.510
1032	1.933	1.984	12.509
1038	1.916	1.966	12.509
1044	1.899	1.947	12.509
1050	1.881	1.929	12.508
1056	1.864	1.912	12.508
1062	1.846	1.894	12.508
1068	1.829	1.876	12.507
1074	1.812	1.859	12.507
1080	1.794	1.842	12.507
1086	1.777	1.824	12.506
1092	1.760	1.807	12.506
1098	1.742	1.789	12.506
1104	1.725	1.772	12.506
1110	1.708	1.755	12.505
1116	1.690	1.737	12.505
1122	1.673	1.720	12.505
1128	1.656	1.703	12.504
1134	1.639	1.685	12.504
1140	1.621	1.668	12.504
1146	1.604	1.651	12.503
1152	1.587	1.634	12.503
1158	1.570	1.616	12.503
1164	1.552	1.599	12.503
1170	1.535	1.582	12.502
1176	1.518	1.564	12.502
1182	1.501	1.547	12.502
1188	1.484	1.530	12.501
1194	1.466	1.513	12.501
1200	1.449	1.496	12.501
1206	1.432	1.478	12.500
1212	1.415	1.461	12.500

1218	1.398	1.450	12.500
1224	1.381	1.450	12.499
1230	1.365	1.449	12.499
1236	1.349	1.449	12.498
1242	1.333	1.448	12.498
1248	1.318	1.448	12.497
1254	1.303	1.447	12.496
1260	1.288	1.447	12.495
1266	1.274	1.446	12.494
1272	1.261	1.445	12.492
1278	1.248	1.444	12.491
1284	1.235	1.443	12.490
1290	1.222	1.442	12.488
1296	1.211	1.441	12.486
1302	1.199	1.440	12.485
1308	1.188	1.439	12.483
1314	1.178	1.438	12.481
1320	1.167	1.437	12.479
1326	1.158	1.436	12.478
1332	1.148	1.434	12.476
1338	1.139	1.433	12.474
1344	1.131	1.432	12.472
1350	1.123	1.430	12.469
1356	1.115	1.429	12.467
1362	1.108	1.428	12.465
1368	1.101	1.426	12.463
1374	1.095	1.425	12.461
1380	1.089	1.423	12.458
1386	1.084	1.422	12.456
1392	1.079	1.420	12.454
1398	1.074	1.419	12.451
1404	1.070	1.417	12.449
1410	1.066	1.416	12.446
1416	1.063	1.414	12.444
1422	1.060	1.412	12.441
1428	1.058	1.411	12.439
1434	1.056	1.409	12.436
1440	1.054	1.408	12.434
1446	.984	1.406	12.431
1452	.771	1.404	12.428
1458	.501	1.400	12.422
1464	.284	1.396	12.415
1470	.161	1.391	12.407
1476	.091	1.385	12.398
1482	.052	1.379	12.389
1488	.029	1.373	12.380
1494	.016	1.367	12.371
1500	.009	1.361	12.361
1506	.005	1.355	12.352
1512	.002	1.349	12.342
1518	.000	1.343	12.333
1524	.000	1.337	12.324
1530	.000	1.331	12.314
1536	.000	1.325	12.305
1542	.000	1.319	12.296
1548	.000	1.313	12.287
1554	.000	1.308	12.278
1560	.000	1.302	12.268
1566	.000	1.296	12.259
1572	.000	1.290	12.250
1578	.000	1.285	12.241
1584	.000	1.279	12.233
1590	.000	1.273	12.224
1596	.000	1.267	12.215
1602	.000	1.262	12.206
1608	.000	1.256	12.197
1614	.000	1.251	12.188
1620	.000	1.245	12.180
1626	.000	1.240	12.171
1632	.000	1.234	12.163
1638	.000	1.229	12.154
1644	.000	1.223	12.145
1650	.000	1.218	12.137
1656	.000	1.212	12.128
1662	.000	1.207	12.120

1668	.000	1.201	12.112
1674	.000	1.196	12.103
1680	.000	1.191	12.095
1686	.000	1.185	12.087
1692	.000	1.180	12.078
1698	.000	1.175	12.070
1704	.000	1.170	12.062
1710	.000	1.165	12.054
1716	.000	1.159	12.046
1722	.000	1.154	12.038
1728	.000	1.149	12.030
1734	.000	1.144	12.022
1740	.000	1.139	12.014
1746	.000	1.134	12.006
1752	.000	1.126	11.998
1758	.000	1.112	11.988
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1770	.000	1.084	11.969
1776	.000	1.070	11.959
1782	.000	1.057	11.950
1788	.000	1.043	11.941
1794	.000	1.030	11.932
1800	.000	1.017	11.923
1806	.000	1.004	11.914
1812	.000	.991	11.905
1818	.000	.978	11.897
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1830	.000	.954	11.880
1836	.000	.941	11.872
1842	.000	.929	11.863
1848	.000	.918	11.855
1854	.000	.906	11.847
1860	.000	.894	11.839
1866	.000	.883	11.832
1872	.000	.872	11.824
1878	.000	.861	11.816
1884	.000	.850	11.809
1890	.000	.839	11.802
1896	.000	.828	11.794
1902	.000	.818	11.787
1908	.000	.807	11.780
1914	.000	.797	11.773
1920	.000	.787	11.766
1926	.000	.777	11.759
1932	.000	.767	11.753
1938	.000	.757	11.746
1944	.000	.748	11.739
1950	.000	.738	11.733
1956	.000	.729	11.726
1962	.000	.719	11.720
1968	.000	.710	11.714
1974	.000	.701	11.708
1980	.000	.692	11.702
1986	.000	.683	11.696
1992	.000	.675	11.690
1998	.000	.666	11.684
2004	.000	.658	11.678
2010	.000	.649	11.672
2016	.000	.641	11.667
2022	.000	.633	11.661
2028	.000	.625	11.656
2034	.000	.617	11.650
2040	.000	.609	11.645
2046	.000	.601	11.640
2052	.000	.594	11.634
2058	.000	.586	11.629
2064	.000	.579	11.624
2070	.000	.571	11.619
2076	.000	.564	11.614
2082	.000	.557	11.609
2088	.000	.550	11.605
2094	.000	.543	11.600
2100	.000	.536	11.595
2106	.000	.529	11.590
2112	.000	.522	11.586

2118	.000	.516	11.581
2124	.000	.509	11.577
2130	.000	.502	11.572
2136	.000	.496	11.568
2142	.000	.490	11.564
2148	.000	.484	11.559
2154	.000	.477	11.555
2160	.000	.471	11.551
2166	.000	.465	11.547
2172	.000	.459	11.543
2178	.000	.454	11.539
2184	.000	.448	11.535
2190	.000	.442	11.531
2196	.000	.436	11.527
2202	.000	.431	11.524
2208	.000	.425	11.520
2214	.000	.420	11.516
2220	.000	.415	11.513
2226	.000	.409	11.509
2232	.000	.404	11.505
2238	.000	.399	11.502
2244	.000	.394	11.498
2250	.000	.389	11.495
2256	.000	.384	11.492
2262	.000	.379	11.488
2268	.000	.374	11.485
2274	.000	.369	11.482
2280	.000	.365	11.479
2286	.000	.360	11.475
2292	.000	.355	11.472
2298	.000	.351	11.469
2304	.000	.347	11.466
2310	.000	.342	11.463
2316	.000	.338	11.460
2322	.000	.333	11.457
2328	.000	.329	11.454
2334	.000	.325	11.451
2340	.000	.321	11.449
2346	.000	.317	11.446
2352	.000	.313	11.443
2358	.000	.309	11.440
2364	.000	.305	11.438
2370	.000	.301	11.435
2376	.000	.297	11.432
2382	.000	.293	11.430
2388	.000	.290	11.427
2394	.000	.286	11.425
2400	.000	.282	11.422
2406	.000	.279	11.420
2412	.000	.275	11.417
2418	.000	.272	11.415
2424	.000	.268	11.413
2430	.000	.265	11.410
2436	.000	.261	11.408
2442	.000	.258	11.406
2448	.000	.255	11.404
2454	.000	.252	11.401
2460	.000	.248	11.399
2466	.000	.245	11.397
2472	.000	.242	11.395
2478	.000	.239	11.393
2484	.000	.236	11.391
2490	.000	.233	11.389
2496	.000	.230	11.387
2502	.000	.227	11.385
2508	.000	.224	11.383
2514	.000	.221	11.381
2520	.000	.218	11.379
2526	.000	.216	11.377
2532	.000	.213	11.375
2538	.000	.210	11.373
2544	.000	.208	11.371
2550	.000	.205	11.370
2556	.000	.202	11.368
2562	.000	.200	11.366

2568	.000	.197	11.364
2574	.000	.195	11.363
2580	.000	.192	11.361
2586	.000	.190	11.359
2592	.000	.187	11.358
2598	.000	.185	11.356
2604	.000	.183	11.354
2610	.000	.180	11.353
2616	.000	.178	11.351
2622	.000	.176	11.350
2628	.000	.173	11.348
2634	.000	.171	11.347
2640	.000	.169	11.345
2646	.000	.167	11.344
2652	.000	.165	11.342
2658	.000	.163	11.341
2664	.000	.161	11.339
2670	.000	.159	11.338
2676	.000	.157	11.337
2682	.000	.155	11.335
2688	.000	.153	11.334
2694	.000	.151	11.333
2700	.000	.149	11.331
2706	.000	.147	11.330
2712	.000	.145	11.329
2718	.000	.143	11.328
2724	.000	.141	11.326
2730	.000	.139	11.325
2736	.000	.138	11.324
2742	.000	.136	11.323
2748	.000	.134	11.321
2754	.000	.133	11.320
2760	.000	.131	11.319
2766	.000	.129	11.318
2772	.000	.128	11.317
2778	.000	.126	11.316
2784	.000	.124	11.315
2790	.000	.123	11.314
2796	.000	.121	11.313
2802	.000	.120	11.312
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2814	.000	.117	11.309
2820	.000	.115	11.308
2826	.000	.114	11.307
2832	.000	.112	11.306
2838	.000	.111	11.305
2844	.000	.109	11.305
2850	.000	.108	11.304
2856	.000	.107	11.303
2862	.000	.105	11.302
2868	.000	.104	11.301
2874	.000	.103	11.300
2880	.000	.101	11.299
2886	.000	.100	11.298
2892	.000	.099	11.297
2898	.000	.097	11.296
2904	.000	.096	11.296
2910	.000	.095	11.295
2916	.000	.094	11.294
2922	.000	.093	11.293
2928	.000	.091	11.292
2934	.000	.090	11.291
2940	.000	.089	11.291
2946	.000	.088	11.290
2952	.000	.087	11.289
2958	.000	.086	11.288
2964	.000	.085	11.288
2970	.000	.084	11.287
2976	.000	.082	11.286
2982	.000	.081	11.285
2988	.000	.080	11.285
2994	.000	.079	11.284
3000	.000	.078	11.283
3006	.000	.077	11.283
3012	.000	.076	11.282

3018	.000	.075	11.281
3024	.000	.074	11.281
3030	.000	.074	11.280
3036	.000	.073	11.279
3042	.000	.072	11.279
3048	.000	.071	11.278
3054	.000	.070	11.278
3060	.000	.069	11.277
3066	.000	.068	11.276
3072	.000	.067	11.276
3078	.000	.066	11.275
3084	.000	.065	11.275
3090	.000	.065	11.274
3096	.000	.064	11.273
3102	.000	.063	11.273
3108	.000	.062	11.272
3114	.000	.061	11.272
3120	.000	.061	11.271
3126	.000	.060	11.271
3132	.000	.059	11.270
3138	.000	.058	11.270
3144	.000	.058	11.269
3150	.000	.057	11.269
3156	.000	.056	11.268
3162	.000	.055	11.268
3168	.000	.055	11.267
3174	.000	.054	11.267
3180	.000	.053	11.266
3186	.000	.053	11.266
3192	.000	.052	11.265
3198	.000	.051	11.265
3204	.000	.051	11.265
3210	.000	.050	11.264
3216	.000	.049	11.264
3222	.000	.049	11.263
3228	.000	.048	11.263
3234	.000	.048	11.262
3240	.000	.047	11.262
3246	.000	.046	11.262
3252	.000	.046	11.261
3258	.000	.045	11.261
3264	.000	.045	11.260
3270	.000	.044	11.260
3276	.000	.043	11.260
3282	.000	.043	11.259
3288	.000	.042	11.259
3294	.000	.042	11.258
3300	.000	.041	11.258
3306	.000	.041	11.258
3312	.000	.040	11.257
3318	.000	.040	11.257
3324	.000	.039	11.257
3330	.000	.039	11.256
3336	.000	.038	11.256
3342	.000	.038	11.256
3348	.000	.037	11.255
3354	.000	.037	11.255
3360	.000	.036	11.255
3366	.000	.036	11.254
3372	.000	.035	11.254
3378	.000	.035	11.254
3384	.000	.035	11.254
3390	.000	.034	11.253
3396	.000	.034	11.253
3402	.000	.033	11.253
3408	.000	.033	11.252
3414	.000	.032	11.252
3420	.000	.032	11.252
3426	.000	.032	11.251
3432	.000	.031	11.251
3438	.000	.031	11.251
3444	.000	.030	11.251
3450	.000	.030	11.250
3456	.000	.030	11.250
3462	.000	.029	11.250

3468	.000	.029	11.250
3474	.000	.028	11.249
3480	.000	.028	11.249
3486	.000	.028	11.249
3492	.000	.027	11.249
3498	.000	.027	11.248
3504	.000	.027	11.248
3510	.000	.026	11.248
3516	.000	.026	11.248
3522	.000	.026	11.248
3528	.000	.025	11.247
3534	.000	.025	11.247
3540	.000	.025	11.247
3546	.000	.024	11.247
3552	.000	.024	11.246
3558	.000	.024	11.246
3564	.000	.023	11.246
3570	.000	.023	11.246
3576	.000	.023	11.246
3582	.000	.023	11.245
3588	.000	.022	11.245
3594	.000	.022	11.245
3600	.000	.022	11.245
3606	.000	.021	11.245
3612	.000	.021	11.244
3618	.000	.021	11.244
3624	.000	.021	11.244
3630	.000	.020	11.244
3636	.000	.020	11.244
3642	.000	.020	11.244
3648	.000	.020	11.243
3654	.000	.019	11.243
3660	.000	.019	11.243
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3678	.000	.018	11.243
3684	.000	.018	11.242
3690	.000	.018	11.242
3696	.000	.018	11.242
3702	.000	.017	11.242
3708	.000	.017	11.242
3714	.000	.017	11.242
3720	.000	.017	11.241
3726	.000	.017	11.241
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3744	.000	.016	11.241
3750	.000	.016	11.241
3756	.000	.016	11.241
3762	.000	.015	11.240
3768	.000	.015	11.240
3774	.000	.015	11.240
3780	.000	.015	11.240
3786	.000	.015	11.240
3792	.000	.014	11.240
3798	.000	.014	11.240
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3828	.000	.013	11.239
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3846	.000	.013	11.239
3852	.000	.013	11.239
3858	.000	.013	11.239
3864	.000	.012	11.238
3870	.000	.012	11.238
3876	.000	.012	11.238
3882	.000	.012	11.238
3888	.000	.012	11.238
3894	.000	.012	11.238
3900	.000	.011	11.238
3906	.000	.011	11.238
3912	.000	.011	11.238

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3936	.000	.011	11.237
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3948	.000	.010	11.237
3954	.000	.010	11.237
3960	.000	.010	11.237
3966	.000	.010	11.237
3972	.000	.010	11.237
3978	.000	.010	11.237
3984	.000	.010	11.237
3990	.000	.009	11.236
3996	.000	.009	11.236
4002	.000	.009	11.236
4008	.000	.009	11.236
4014	.000	.009	11.236
4020	.000	.009	11.236
4026	.000	.009	11.236
4032	.000	.009	11.236
4038	.000	.009	11.236
4044	.000	.008	11.236
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4056	.000	.008	11.236
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4092	.000	.008	11.235
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4110	.000	.007	11.235
4116	.000	.007	11.235
4122	.000	.007	11.235
4128	.000	.007	11.235
4134	.000	.007	11.235
4140	.000	.007	11.235
4146	.000	.007	11.235
4152	.000	.007	11.235
4158	.000	.007	11.235
4164	.000	.007	11.234
4170	.000	.006	11.234
4176	.000	.006	11.234
4182	.000	.006	11.234
4188	.000	.006	11.234
4194	.000	.006	11.234
4200	.000	.006	11.234
4206	.000	.006	11.234
4212	.000	.006	11.234
4218	.000	.006	11.234
4224	.000	.006	11.234
4230	.000	.006	11.234
4236	.000	.006	11.234
4242	.000	.006	11.234
4248	.000	.005	11.234
4254	.000	.005	11.234
4260	.000	.005	11.234
4266	.000	.005	11.234
4272	.000	.005	11.234
4278	.000	.005	11.233
4284	.000	.005	11.233
4290	.000	.005	11.233
4296	.000	.005	11.233
4302	.000	.005	11.233
4308	.000	.005	11.233
4314	.000	.005	11.233
4320	.000	.005	11.233

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering
Date: 08/13/2001 Monday

Time: 11:56:36
Output: JSB1P10.OUT

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

STORM NUMBER	PEAK STAGE (ft)	PEAK STORAGE (ac-ft)	PEAK INFLOW (cfs)	PEAK OUTFLOW (cfs)
1	13.171	2.20	68.927	46.703

100-Year Routing

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

 PROJECT: JAMESTOWN SETTLEMENT
    User: Rickmond Engineering
    Date: 08/13/2001    Monday
    Time: 11:58:13
  Output: JSB1P100.OUT


 SOLUTION FOR  1  STORMS.


 TIME INCREMENT:   .100  Hours


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

   1      JSB1100.DAT
```

STORM NUMBER	PEAK INFLOW (cfs)	ALLOWABLE PEAK DISCHARGE (cfs)	DURATION (min)	RUNOFF VOLUME (ft3)	TAILWATER STAGE (ft)
1	97.012	N/A	1794.00	.3934E+06	11.230

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

 PROJECT: JAMESTOWN SETTLEMENT
    User: Rickmond Engineering
    Date: 08/13/2001    Monday
    Time: 11:58:13
  Output: JSB1P100.OUT


 Stage-Area-Discharge
 Filename: JSB1POND.DAT

          TAILWATER STAGE:   11.230 feet.
            INITIAL STAGE:   11.230 feet.

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

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

STAGE (ft)	STORAGE VOLUME (ac-ft)	DISCHARGE (cfs)
11.230	.0000	.0000
12.000	.7288	1.130
12.500	1.322	1.450
13.000	1.966	30.28
13.250	2.309	54.32

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

 PROJECT: JAMESTOWN SETTLEMENT
    User: Rickmond Engineering
    Date: 08/13/2001    Monday
```

Time: 11:58:13
Output: JSB1P100.OUT

TAILWATER STAGE: 11.230 feet.
INITIAL STAGE: 11.230 feet.

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

MAXIMUM ELEVATION: 13.47 feet.
MAXIMUM INFLOW: 97.01 cfs.
MAXIMUM OUTFLOW: 75.17 cfs.
MAXIMUM STORAGE: 2.606 acre-feet.

CONTINUITY ERROR: .235E-03 percent.

TIME (min)	INFLOW RATE (cfs)	OUTFLOW RATE (cfs)	POND SURFACE ELEVATION (ft)
0	.000	.000	11.230
6	.000	.000	11.230
12	.000	.000	11.230
18	.000	.000	11.230
24	.000	.000	11.230
30	.000	.000	11.230
36	.000	.000	11.230
42	.000	.000	11.230
48	.000	.000	11.230
54	.000	.000	11.230
60	.000	.000	11.230
66	.000	.000	11.230
72	.000	.000	11.230
78	.000	.000	11.230
84	.000	.000	11.230
90	.000	.000	11.230
96	.000	.000	11.230
102	.000	.000	11.230
108	.000	.000	11.230
114	.000	.000	11.230
120	.000	.000	11.230
126	.000	.000	11.230
132	.000	.000	11.230
138	.000	.000	11.230
144	.000	.000	11.230
150	.000	.000	11.230
156	.000	.000	11.230
162	.000	.000	11.230
168	.000	.000	11.230
174	.000	.000	11.230
180	.000	.000	11.230
186	.000	.000	11.230
192	.000	.000	11.230
198	.001	.000	11.230
204	.006	.000	11.230
210	.017	.000	11.230
216	.033	.001	11.230
222	.052	.001	11.231
228	.072	.002	11.231
234	.094	.003	11.232
240	.115	.004	11.233
246	.140	.006	11.234
252	.171	.008	11.235
258	.207	.010	11.237
264	.243	.013	11.239
270	.276	.016	11.241
276	.308	.019	11.243
282	.338	.023	11.246
288	.366	.027	11.249
294	.395	.032	11.252
300	.422	.037	11.255
306	.449	.042	11.258
312	.475	.047	11.262

318	.500	.053	11.266
324	.525	.059	11.270
330	.549	.065	11.274
336	.573	.071	11.278
342	.596	.077	11.283
348	.619	.084	11.287
354	.641	.091	11.292
360	.663	.098	11.297
366	.690	.106	11.302
372	.730	.113	11.307
378	.776	.122	11.313
384	.818	.130	11.319
390	.852	.139	11.325
396	.882	.148	11.331
402	.909	.158	11.338
408	.933	.168	11.344
414	.957	.178	11.351
420	.979	.188	11.358
426	1.017	.198	11.365
432	1.087	.209	11.372
438	1.171	.220	11.380
444	1.245	.233	11.389
450	1.300	.246	11.398
456	1.342	.260	11.407
462	1.378	.274	11.417
468	1.410	.288	11.426
474	1.439	.303	11.436
480	1.466	.317	11.446
486	1.511	.332	11.456
492	1.594	.348	11.467
498	1.694	.364	11.478
504	1.781	.382	11.490
510	1.844	.400	11.503
516	1.902	.419	11.515
522	1.973	.438	11.529
528	2.049	.458	11.542
534	2.114	.479	11.556
540	2.165	.500	11.571
546	2.228	.522	11.585
552	2.332	.544	11.601
558	2.451	.567	11.617
564	2.554	.592	11.633
570	2.627	.618	11.651
576	2.706	.644	11.669
582	2.823	.671	11.687
588	2.955	.699	11.706
594	3.068	.728	11.726
600	3.147	.759	11.747
606	3.269	.790	11.768
612	3.508	.823	11.791
618	3.795	.859	11.815
624	4.036	.898	11.842
630	4.194	.939	11.870
636	4.408	.982	11.899
642	4.813	1.028	11.930
648	5.293	1.079	11.965
654	5.692	1.132	12.003
660	5.951	1.153	12.035
666	6.359	1.175	12.070
672	7.214	1.200	12.109
678	8.248	1.229	12.155
684	9.105	1.262	12.206
690	9.649	1.298	12.263
696	11.475	1.339	12.327
702	16.323	1.395	12.414
708	26.079	3.788	12.541
714	46.376	13.913	12.716
720	76.262	28.709	12.973
726	97.012	54.069	13.247
732	90.516	71.921	13.433
738	67.776	75.170	13.467
744	46.491	67.058	13.382
750	34.330	55.074	13.258
756	26.979	44.091	13.144
762	21.347	35.129	13.050

768	16.829	28.638	12.972
774	13.729	24.469	12.899
780	11.970	20.842	12.836
786	10.787	17.888	12.785
792	9.590	15.485	12.743
798	8.548	13.483	12.709
804	7.860	11.835	12.680
810	7.495	10.537	12.658
816	7.189	9.540	12.640
822	6.755	8.739	12.626
828	6.289	8.047	12.614
834	5.935	7.443	12.604
840	5.735	6.941	12.595
846	5.638	6.550	12.588
852	5.604	6.260	12.583
858	5.557	6.048	12.580
864	5.451	5.878	12.577
870	5.286	5.719	12.574
876	5.092	5.554	12.571
882	4.887	5.378	12.568
888	4.681	5.192	12.565
894	4.481	5.001	12.562
900	4.289	4.809	12.558
906	4.108	4.619	12.555
912	3.937	4.432	12.552
918	3.777	4.253	12.549
924	3.630	4.081	12.546
930	3.495	3.920	12.543
936	3.373	3.768	12.540
942	3.263	3.628	12.538
948	3.166	3.499	12.536
954	3.082	3.382	12.534
960	3.010	3.277	12.532
966	2.951	3.185	12.530
972	2.904	3.104	12.529
978	2.865	3.036	12.528
984	2.833	2.977	12.526
990	2.804	2.928	12.526
996	2.778	2.885	12.525
1002	2.753	2.848	12.524
1008	2.728	2.814	12.524
1014	2.703	2.783	12.523
1020	2.679	2.755	12.523
1026	2.655	2.727	12.522
1032	2.631	2.701	12.522
1038	2.608	2.676	12.521
1044	2.584	2.651	12.521
1050	2.560	2.626	12.520
1056	2.536	2.602	12.520
1062	2.512	2.577	12.520
1068	2.488	2.553	12.519
1074	2.465	2.529	12.519
1080	2.441	2.505	12.518
1086	2.417	2.482	12.518
1092	2.393	2.458	12.517
1098	2.370	2.434	12.517
1104	2.346	2.410	12.517
1110	2.322	2.386	12.516
1116	2.299	2.363	12.516
1122	2.275	2.339	12.515
1128	2.251	2.315	12.515
1134	2.228	2.292	12.515
1140	2.204	2.268	12.514
1146	2.181	2.244	12.514
1152	2.157	2.221	12.513
1158	2.133	2.197	12.513
1164	2.110	2.174	12.513
1170	2.086	2.150	12.512
1176	2.063	2.127	12.512
1182	2.039	2.103	12.511
1188	2.016	2.080	12.511
1194	1.992	2.056	12.511
1200	1.969	2.033	12.510
1206	1.946	2.009	12.510
1212	1.922	1.986	12.509

1218	1.899	1.962	12.509
1224	1.876	1.939	12.508
1230	1.854	1.916	12.508
1236	1.832	1.893	12.508
1242	1.811	1.871	12.507
1248	1.790	1.849	12.507
1254	1.770	1.827	12.507
1260	1.750	1.806	12.506
1266	1.731	1.786	12.506
1272	1.712	1.766	12.505
1278	1.694	1.746	12.505
1284	1.677	1.727	12.505
1290	1.660	1.709	12.504
1296	1.644	1.691	12.504
1302	1.628	1.674	12.504
1308	1.613	1.657	12.504
1314	1.599	1.641	12.503
1320	1.585	1.626	12.503
1326	1.571	1.611	12.503
1332	1.559	1.597	12.503
1338	1.547	1.583	12.502
1344	1.535	1.570	12.502
1350	1.524	1.557	12.502
1356	1.514	1.545	12.502
1362	1.504	1.534	12.501
1368	1.495	1.523	12.501
1374	1.486	1.513	12.501
1380	1.478	1.503	12.501
1386	1.471	1.494	12.501
1392	1.464	1.486	12.501
1398	1.458	1.478	12.500
1404	1.452	1.471	12.500
1410	1.447	1.464	12.500
1416	1.443	1.458	12.500
1422	1.439	1.453	12.500
1428	1.435	1.450	12.500
1434	1.433	1.450	12.500
1440	1.430	1.450	12.500
1446	1.336	1.450	12.499
1452	1.046	1.448	12.497
1458	.680	1.446	12.493
1464	.386	1.442	12.487
1470	.218	1.437	12.479
1476	.123	1.431	12.470
1482	.070	1.425	12.461
1488	.039	1.419	12.452
1494	.022	1.413	12.442
1500	.012	1.407	12.432
1506	.006	1.400	12.422
1512	.002	1.394	12.413
1518	.001	1.388	12.403
1524	.000	1.382	12.393
1530	.000	1.376	12.384
1536	.000	1.370	12.374
1542	.000	1.363	12.365
1548	.000	1.357	12.355
1554	.000	1.351	12.346
1560	.000	1.345	12.336
1566	.000	1.339	12.327
1572	.000	1.333	12.318
1578	.000	1.327	12.309
1584	.000	1.322	12.299
1590	.000	1.316	12.290
1596	.000	1.310	12.281
1602	.000	1.304	12.272
1608	.000	1.298	12.263
1614	.000	1.292	12.254
1620	.000	1.287	12.245
1626	.000	1.281	12.236
1632	.000	1.275	12.227
1638	.000	1.270	12.218
1644	.000	1.264	12.209
1650	.000	1.258	12.201
1656	.000	1.253	12.192
1662	.000	1.247	12.183

1668	.000	1.242	12.174
1674	.000	1.236	12.166
1680	.000	1.231	12.157
1686	.000	1.225	12.149
1692	.000	1.220	12.140
1698	.000	1.214	12.132
1704	.000	1.209	12.123
1710	.000	1.203	12.115
1716	.000	1.198	12.106
1722	.000	1.193	12.098
1728	.000	1.187	12.090
1734	.000	1.182	12.082
1740	.000	1.177	12.073
1746	.000	1.172	12.065
1752	.000	1.166	12.057
1758	.000	1.161	12.049
1764	.000	1.156	12.041
1770	.000	1.151	12.033
1776	.000	1.146	12.025
1782	.000	1.141	12.017
1788	.000	1.136	12.009
1794	.000	1.131	12.001
1800	.000	1.117	11.991
1806	.000	1.103	11.982
1812	.000	1.089	11.972
1818	.000	1.075	11.963
1824	.000	1.062	11.953
1830	.000	1.048	11.944
1836	.000	1.035	11.935
1842	.000	1.022	11.926
1848	.000	1.009	11.917
1854	.000	.996	11.909
1860	.000	.983	11.900
1866	.000	.971	11.891
1872	.000	.958	11.883
1878	.000	.946	11.875
1884	.000	.934	11.866
1890	.000	.922	11.858
1896	.000	.910	11.850
1902	.000	.899	11.842
1908	.000	.887	11.835
1914	.000	.876	11.827
1920	.000	.865	11.819
1926	.000	.854	11.812
1932	.000	.843	11.804
1938	.000	.832	11.797
1944	.000	.822	11.790
1950	.000	.811	11.783
1956	.000	.801	11.776
1962	.000	.791	11.769
1968	.000	.781	11.762
1974	.000	.771	11.755
1980	.000	.761	11.748
1986	.000	.751	11.742
1992	.000	.742	11.735
1998	.000	.732	11.729
2004	.000	.723	11.723
2010	.000	.714	11.716
2016	.000	.705	11.710
2022	.000	.696	11.704
2028	.000	.687	11.698
2034	.000	.678	11.692
2040	.000	.669	11.686
2046	.000	.661	11.680
2052	.000	.652	11.675
2058	.000	.644	11.669
2064	.000	.636	11.663
2070	.000	.628	11.658
2076	.000	.620	11.652
2082	.000	.612	11.647
2088	.000	.604	11.642
2094	.000	.596	11.636
2100	.000	.589	11.631
2106	.000	.581	11.626
2112	.000	.574	11.621

2118	.000	.567	11.616
2124	.000	.559	11.611
2130	.000	.552	11.606
2136	.000	.545	11.602
2142	.000	.538	11.597
2148	.000	.531	11.592
2154	.000	.525	11.588
2160	.000	.518	11.583
2166	.000	.511	11.578
2172	.000	.505	11.574
2178	.000	.498	11.570
2184	.000	.492	11.565
2190	.000	.486	11.561
2196	.000	.480	11.557
2202	.000	.474	11.553
2208	.000	.468	11.549
2214	.000	.462	11.545
2220	.000	.456	11.541
2226	.000	.450	11.537
2232	.000	.444	11.533
2238	.000	.438	11.529
2244	.000	.433	11.525
2250	.000	.427	11.521
2256	.000	.422	11.518
2262	.000	.417	11.514
2268	.000	.411	11.510
2274	.000	.406	11.507
2280	.000	.401	11.503
2286	.000	.396	11.500
2292	.000	.391	11.496
2298	.000	.386	11.493
2304	.000	.381	11.490
2310	.000	.376	11.486
2316	.000	.371	11.483
2322	.000	.366	11.480
2328	.000	.362	11.477
2334	.000	.357	11.473
2340	.000	.353	11.470
2346	.000	.348	11.467
2352	.000	.344	11.464
2358	.000	.339	11.461
2364	.000	.335	11.458
2370	.000	.331	11.455
2376	.000	.327	11.453
2382	.000	.322	11.450
2388	.000	.318	11.447
2394	.000	.314	11.444
2400	.000	.310	11.441
2406	.000	.306	11.439
2412	.000	.302	11.436
2418	.000	.299	11.433
2424	.000	.295	11.431
2430	.000	.291	11.428
2436	.000	.287	11.426
2442	.000	.284	11.423
2448	.000	.280	11.421
2454	.000	.276	11.418
2460	.000	.273	11.416
2466	.000	.269	11.414
2472	.000	.266	11.411
2478	.000	.263	11.409
2484	.000	.259	11.407
2490	.000	.256	11.404
2496	.000	.253	11.402
2502	.000	.250	11.400
2508	.000	.246	11.398
2514	.000	.243	11.396
2520	.000	.240	11.394
2526	.000	.237	11.392
2532	.000	.234	11.389
2538	.000	.231	11.387
2544	.000	.228	11.385
2550	.000	.225	11.383
2556	.000	.222	11.381
2562	.000	.220	11.380

2568	.000	.217	11.378
2574	.000	.214	11.376
2580	.000	.211	11.374
2586	.000	.209	11.372
2592	.000	.206	11.370
2598	.000	.203	11.369
2604	.000	.201	11.367
2610	.000	.198	11.365
2616	.000	.196	11.363
2622	.000	.193	11.362
2628	.000	.191	11.360
2634	.000	.188	11.358
2640	.000	.186	11.357
2646	.000	.183	11.355
2652	.000	.181	11.353
2658	.000	.179	11.352
2664	.000	.177	11.350
2670	.000	.174	11.349
2676	.000	.172	11.347
2682	.000	.170	11.346
2688	.000	.168	11.344
2694	.000	.166	11.343
2700	.000	.163	11.341
2706	.000	.161	11.340
2712	.000	.159	11.339
2718	.000	.157	11.337
2724	.000	.155	11.336
2730	.000	.153	11.334
2736	.000	.151	11.333
2742	.000	.149	11.332
2748	.000	.148	11.331
2754	.000	.146	11.329
2760	.000	.144	11.328
2766	.000	.142	11.327
2772	.000	.140	11.326
2778	.000	.138	11.324
2784	.000	.137	11.323
2790	.000	.135	11.322
2796	.000	.133	11.321
2802	.000	.131	11.320
2808	.000	.130	11.318
2814	.000	.128	11.317
2820	.000	.127	11.316
2826	.000	.125	11.315
2832	.000	.123	11.314
2838	.000	.122	11.313
2844	.000	.120	11.312
2850	.000	.119	11.311
2856	.000	.117	11.310
2862	.000	.116	11.309
2868	.000	.114	11.308
2874	.000	.113	11.307
2880	.000	.111	11.306
2886	.000	.110	11.305
2892	.000	.108	11.304
2898	.000	.107	11.303
2904	.000	.106	11.302
2910	.000	.104	11.301
2916	.000	.103	11.300
2922	.000	.102	11.299
2928	.000	.100	11.298
2934	.000	.099	11.298
2940	.000	.098	11.297
2946	.000	.097	11.296
2952	.000	.095	11.295
2958	.000	.094	11.294
2964	.000	.093	11.293
2970	.000	.092	11.293
2976	.000	.091	11.292
2982	.000	.090	11.291
2988	.000	.088	11.290
2994	.000	.087	11.289
3000	.000	.086	11.289
3006	.000	.085	11.288
3012	.000	.084	11.287

3018	.000	.083	11.286
3024	.000	.082	11.286
3030	.000	.081	11.285
3036	.000	.080	11.284
3042	.000	.079	11.284
3048	.000	.078	11.283
3054	.000	.077	11.282
3060	.000	.076	11.282
3066	.000	.075	11.281
3072	.000	.074	11.280
3078	.000	.073	11.280
3084	.000	.072	11.279
3090	.000	.071	11.278
3096	.000	.070	11.278
3102	.000	.069	11.277
3108	.000	.068	11.277
3114	.000	.068	11.276
3120	.000	.067	11.275
3126	.000	.066	11.275
3132	.000	.065	11.274
3138	.000	.064	11.274
3144	.000	.063	11.273
3150	.000	.063	11.273
3156	.000	.062	11.272
3162	.000	.061	11.272
3168	.000	.060	11.271
3174	.000	.059	11.270
3180	.000	.059	11.270
3186	.000	.058	11.269
3192	.000	.057	11.269
3198	.000	.056	11.268
3204	.000	.056	11.268
3210	.000	.055	11.267
3216	.000	.054	11.267
3222	.000	.054	11.267
3228	.000	.053	11.266
3234	.000	.052	11.266
3240	.000	.052	11.265
3246	.000	.051	11.265
3252	.000	.050	11.264
3258	.000	.050	11.264
3264	.000	.049	11.263
3270	.000	.048	11.263
3276	.000	.048	11.263
3282	.000	.047	11.262
3288	.000	.047	11.262
3294	.000	.046	11.261
3300	.000	.045	11.261
3306	.000	.045	11.261
3312	.000	.044	11.260
3318	.000	.044	11.260
3324	.000	.043	11.259
3330	.000	.043	11.259
3336	.000	.042	11.259
3342	.000	.041	11.258
3348	.000	.041	11.258
3354	.000	.040	11.258
3360	.000	.040	11.257
3366	.000	.039	11.257
3372	.000	.039	11.257
3378	.000	.038	11.256
3384	.000	.038	11.256
3390	.000	.037	11.256
3396	.000	.037	11.255
3402	.000	.036	11.255
3408	.000	.036	11.255
3414	.000	.036	11.254
3420	.000	.035	11.254
3426	.000	.035	11.254
3432	.000	.034	11.253
3438	.000	.034	11.253
3444	.000	.033	11.253
3450	.000	.033	11.252
3456	.000	.033	11.252
3462	.000	.032	11.252

3468	.000	.032	11.252
3474	.000	.031	11.251
3480	.000	.031	11.251
3486	.000	.031	11.251
3492	.000	.030	11.251
3498	.000	.030	11.250
3504	.000	.029	11.250
3510	.000	.029	11.250
3516	.000	.029	11.249
3522	.000	.028	11.249
3528	.000	.028	11.249
3534	.000	.028	11.249
3540	.000	.027	11.249
3546	.000	.027	11.248
3552	.000	.026	11.248
3558	.000	.026	11.248
3564	.000	.026	11.248
3570	.000	.025	11.247
3576	.000	.025	11.247
3582	.000	.025	11.247
3588	.000	.025	11.247
3594	.000	.024	11.247
3600	.000	.024	11.246
3606	.000	.024	11.246
3612	.000	.023	11.246
3618	.000	.023	11.246
3624	.000	.023	11.245
3630	.000	.022	11.245
3636	.000	.022	11.245
3642	.000	.022	11.245
3648	.000	.022	11.245
3654	.000	.021	11.245
3660	.000	.021	11.244
3666	.000	.021	11.244
3672	.000	.021	11.244
3678	.000	.020	11.244
3684	.000	.020	11.244
3690	.000	.020	11.243
3696	.000	.019	11.243
3702	.000	.019	11.243
3708	.000	.019	11.243
3714	.000	.019	11.243
3720	.000	.019	11.243
3726	.000	.018	11.242
3732	.000	.018	11.242
3738	.000	.018	11.242
3744	.000	.018	11.242
3750	.000	.017	11.242
3756	.000	.017	11.242
3762	.000	.017	11.242
3768	.000	.017	11.241
3774	.000	.016	11.241
3780	.000	.016	11.241
3786	.000	.016	11.241
3792	.000	.016	11.241
3798	.000	.016	11.241
3804	.000	.015	11.241
3810	.000	.015	11.240
3816	.000	.015	11.240
3822	.000	.015	11.240
3828	.000	.015	11.240
3834	.000	.015	11.240
3840	.000	.014	11.240
3846	.000	.014	11.240
3852	.000	.014	11.240
3858	.000	.014	11.239
3864	.000	.014	11.239
3870	.000	.013	11.239
3876	.000	.013	11.239
3882	.000	.013	11.239
3888	.000	.013	11.239
3894	.000	.013	11.239
3900	.000	.013	11.239
3906	.000	.012	11.238
3912	.000	.012	11.238

3918	.000	.012	11.238
3924	.000	.012	11.238
3930	.000	.012	11.238
3936	.000	.012	11.238
3942	.000	.012	11.238
3948	.000	.011	11.238
3954	.000	.011	11.238
3960	.000	.011	11.238
3966	.000	.011	11.237
3972	.000	.011	11.237
3978	.000	.011	11.237
3984	.000	.011	11.237
3990	.000	.010	11.237
3996	.000	.010	11.237
4002	.000	.010	11.237
4008	.000	.010	11.237
4014	.000	.010	11.237
4020	.000	.010	11.237
4026	.000	.010	11.237
4032	.000	.010	11.236
4038	.000	.009	11.236
4044	.000	.009	11.236
4050	.000	.009	11.236
4056	.000	.009	11.236
4062	.000	.009	11.236
4068	.000	.009	11.236
4074	.000	.009	11.236
4080	.000	.009	11.236
4086	.000	.008	11.236
4092	.000	.008	11.236
4098	.000	.008	11.236
4104	.000	.008	11.236
4110	.000	.008	11.235
4116	.000	.008	11.235
4122	.000	.008	11.235
4128	.000	.008	11.235
4134	.000	.008	11.235
4140	.000	.008	11.235
4146	.000	.007	11.235
4152	.000	.007	11.235
4158	.000	.007	11.235
4164	.000	.007	11.235
4170	.000	.007	11.235
4176	.000	.007	11.235
4182	.000	.007	11.235
4188	.000	.007	11.235
4194	.000	.007	11.235
4200	.000	.007	11.235
4206	.000	.007	11.234
4212	.000	.006	11.234
4218	.000	.006	11.234
4224	.000	.006	11.234
4230	.000	.006	11.234
4236	.000	.006	11.234
4242	.000	.006	11.234
4248	.000	.006	11.234
4254	.000	.006	11.234
4260	.000	.006	11.234
4266	.000	.006	11.234
4272	.000	.006	11.234
4278	.000	.006	11.234
4284	.000	.006	11.234
4290	.000	.005	11.234
4296	.000	.005	11.234
4302	.000	.005	11.234
4308	.000	.005	11.234
4314	.000	.005	11.234
4320	.000	.005	11.234

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering
Date: 08/13/2001 Monday

Time: 11:58:13
Output: JSB1P100.OUT

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

STORM NUMBER	PEAK STAGE (ft)	PEAK STORAGE (ac-ft)	PEAK INFLOW (cfs)	PEAK OUTFLOW (cfs)
1	13.467	2.61	97.012	75.170

APPENDIX E

10-Year Hydrograph

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering
Date: 08/13/2001 Monday
Time: 13:47:37
Input: JSFP10.IN
Output: JSFP10.OUT

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

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

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

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

The SCS DIMENSIONLESS UNIT HYDROGRAPH is used in all runoff computations.
The peak rate factor (PRF) for all unit hydrographs is 484 (U.S. Customary units) or 2.08356 (Metric units).

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering
Date: 08/13/2001 Monday
Time: 13:47:37
Input: JSFP10.IN
Output: JSFP10.OUT

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

SUBAREA ID NO	AREA (mi2)	TIME OF CONCENTRATION (hrs)	CURVE NUMBER	BASEFLOW (cfs)	DOWNSTREAM CHANNELS
1	.0131	.400	88.00	.0	

Composite Watershed Curve Number = 88.00
Minimum Subarea Time of Concentration = .400 hours.

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering
Date: 08/13/2001 Monday
Time: 13:47:37
Input: JSFP10.IN
Output: JSFP10.OUT

RETURN PERIOD (yrs): 10

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

RAINFALL HYETOGRAPH: SCS TYPE II
RAINFALL DURATION: 24.00 Hours
RAINFALL DEPTH: 6.00 Inches

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

.000,	.00	2.000,	.13	4.000,	.29	6.000,	.48
7.000,	.59	8.000,	.72	8.500,	.80	9.000,	.88
9.500,	.98	9.750,	1.03	10.000,	1.09	10.500,	1.22
11.000,	1.41	11.500,	1.70	11.750,	2.14	12.000,	3.98
12.500,	4.41	13.000,	4.63	13.500,	4.79	14.000,	4.92
16.000,	5.28	20.000,	5.71	24.000,	6.00		

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

PROJECT: JAMESTOWN SETTLEMENT
Input: JSFP10.IN
Output: JSFP10.OUT

RETURN PERIOD (yrs): 10

SUBAREA 1 SUBAREA 1 SUBAREA 1 SUBAREA 1

AREA (square miles) : .0131
TIME OF CONCENTRATION (hrs): .40
RUNOFF CURVE NUMBER : 88.00
BASEFLOW (cfs) : .00
DOWNSTREAM CHANNELS :

SUBAREA RUNOFF (cfs)

TIME: (hrs)	+.00 hrs	+.10 hrs	+.20 hrs	+.30 hrs	+.40 hrs	+.50 hrs	+.60 hrs	+.70 hrs	+.80 hrs	+.90 hrs
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4.00	.00	.00	.01	.02	.03	.04	.05	.06	.07	.08
5.00	.09	.10	.11	.11	.12	.13	.14	.15	.16	.17
6.00	.17	.18	.20	.21	.23	.24	.25	.26	.27	.28
7.00	.28	.30	.32	.35	.37	.39	.40	.42	.43	.44
8.00	.45	.47	.49	.53	.56	.58	.60	.62	.65	.67
9.00	.69	.72	.75	.79	.83	.86	.88	.93	.97	1.01
10.00	1.04	1.08	1.17	1.27	1.35	1.41	1.48	1.62	1.79	1.93
11.00	2.03	2.17	2.47	2.84	3.14	3.34	3.99	5.71	9.19	16.50
12.00	27.36	35.01	32.77	24.59	16.90	12.50	9.84	7.80	6.16	5.03
13.00	4.39	3.96	3.52	3.14	2.89	2.75	2.64	2.48	2.31	2.18
14.00	2.11	2.07	2.06	2.04	2.01	1.95	1.87	1.80	1.72	1.65
15.00	1.58	1.51	1.45	1.39	1.34	1.29	1.24	1.20	1.17	1.14
16.00	1.11	1.09	1.07	1.06	1.04	1.03	1.02	1.01	1.01	1.00
17.00	.99	.98	.97	.96	.95	.94	.94	.93	.92	.91
18.00	.90	.89	.88	.87	.87	.86	.85	.84	.83	.82
19.00	.81	.80	.80	.79	.78	.77	.76	.75	.74	.74
20.00	.73	.72	.71	.70	.69	.68	.68	.67	.66	.65
21.00	.65	.64	.63	.63	.62	.61	.61	.60	.60	.59

22.00	.59	.58	.58	.57	.57	.56	.56	.56	.55	.55
23.00	.55	.54	.54	.54	.54	.53	.53	.53	.53	.53
24.00	.53	.49	.39	.25	.14	.08	.05	.03	.01	.01
25.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
26.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
27.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
28.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
29.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

PEAK RUNOFF (cfs): 35.01
TIME TO PEAK (hrs): 12.10

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering
Date: 08/13/2001 Monday
Time: 13:47:37
Input: JSFP10.IN
Output: JSFP10.OUT

RETURN PERIOD (yrs): 10

========== DOWNSTREAM HYDROGRAPH ==========

DISCHARGE (cfs)

TIME: (hrs)	+.00 hrs	+.10 hrs	+.20 hrs	+.30 hrs	+.40 hrs	+.50 hrs	+.60 hrs	+.70 hrs	+.80 hrs	+.90 hrs
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4.00	.00	.00	.01	.02	.03	.04	.05	.06	.07	.08
5.00	.09	.10	.11	.11	.12	.13	.14	.15	.16	.17
6.00	.17	.18	.20	.21	.23	.24	.25	.26	.27	.28
7.00	.28	.30	.32	.35	.37	.39	.40	.42	.43	.44
8.00	.45	.47	.49	.53	.56	.58	.60	.62	.65	.67
9.00	.69	.72	.75	.79	.83	.86	.88	.93	.97	1.01
10.00	1.04	1.08	1.17	1.27	1.35	1.41	1.48	1.62	1.79	1.93
11.00	2.03	2.17	2.47	2.84	3.14	3.34	3.99	5.71	9.19	16.50
12.00	27.36	35.01	32.77	24.59	16.90	12.50	9.84	7.80	6.16	5.03
13.00	4.39	3.96	3.52	3.14	2.89	2.75	2.64	2.48	2.31	2.18
14.00	2.11	2.07	2.06	2.04	2.01	1.95	1.87	1.80	1.72	1.65
15.00	1.58	1.51	1.45	1.39	1.34	1.29	1.24	1.20	1.17	1.14
16.00	1.11	1.09	1.07	1.06	1.04	1.03	1.02	1.01	1.01	1.00
17.00	.99	.98	.97	.96	.95	.94	.94	.93	.92	.91
18.00	.90	.89	.88	.87	.87	.86	.85	.84	.83	.82
19.00	.81	.80	.80	.79	.78	.77	.76	.75	.74	.74
20.00	.73	.72	.71	.70	.69	.68	.68	.67	.66	.65
21.00	.65	.64	.63	.63	.62	.61	.61	.60	.60	.59
22.00	.59	.58	.58	.57	.57	.56	.56	.56	.55	.55
23.00	.55	.54	.54	.54	.54	.53	.53	.53	.53	.53
24.00	.53	.49	.39	.25	.14	.08	.05	.03	.01	.01
25.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
26.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
27.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
28.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
29.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

PEAK DISCHARGE (cfs): 35.01
TIME TO PEAK (hrs): 12.10
Hydrograph Saved In: JSFP10.DAT

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering

Date: 08/13/2001 Monday
Time: 13:47:37
Input: JSFP10.IN
Output: JSFP10.OUT

RETURN PERIOD (yrs): 10

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

SCS TYPE II Hyetograph.
SCS DIMENSIONLESS UNIT HYDROGRAPH was used.
APPLIED RAINFALL DEPTH (inches): 6.00

	VOLUME OF RAINFALL APPLIED (ac-ft)	VOLUME OF RUNOFF (ac-ft)	RAINFALL LOSSES (percent)	PEAK DISCHARGE (cfs)	PEAK DISCHARGE (cfs/ac)
SUBAREA 1	4.1920	3.2262	23.04	35.009	4.176
TOTAL WATERSHED	4.1920	3.2262	23.04	35.009	4.176

TOTAL WATERSHED AREA (square miles): .0131
TOTAL VOLUME OF DISCHARGE LEAVING WATERSHED (ac-ft): 3.2262
COMPOSITE WATERSHED CURVE NUMBER: 88.00
MINIMUM SUBAREA TIME OF CONCENTRATION: .400 hours.

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

1

Worksheet 2: Runoff curve number and runoff

Project Jamestown Settlement By KWS Date 8/13/01

Location James City County, Va. Checked ____ Date ____

Circle one: Present (Developed) Forebay Pond

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☒ acres ☐ mi² ☐ %	Product of CN x area
Pamunkey B	Roof / Road	98			1.39	136.22
Emporia Tetotum C	Roof / Road	98			3.62	354.76
Emporia Tetotum C	Grass (Good Condition)	74			3.35	247.90
	Totals =				8.36	738.88

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{738.88}{8.36} = 88.4$; Use CN = 88

2. Runoff

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

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

Project Jamestown Settlement By KWS Date 8/13/01

Location James City County, Va. Checked ____ Date ____

Circle one: Present (Developed) Forebay Pond

Circle one: (T_c) T_t through subarea

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

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

Sheet flow (Applicable to T_c only)	Segment ID	AB	BC
1. Surface description (table 3-1)		PAVED	GRASS
2. Manning's roughness coeff., n (table 3-1)		.011	0.15
3. Flow length, L (total L ≤ 300 ft)	ft	110	275
4. Two-yr 24-hr rainfall, P_2	in	3.5	3.5
5. Land slope, s	ft/ft	.010	.020
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	.03	+ .35 = .38

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

Channel flow	Segment ID	CD	
12. Cross sectional flow area, a	ft^2	33.00	
13. Wetted perimeter, p_w	ft	18.42	
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft	1.79	
15. Channel slope, s	ft/ft	.010	
16. Manning's roughness coeff., n		.033	
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	6.26	
18. Flow length, L	ft	425	
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	.02	+ = .02
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr		0.40

RICKMOND ENGINEERING, INC.
1643 Merrimac Trail
Williamsburg, Virginia 23185-5624
(757) 229-1776 or (757) 898-7007
Fax Number (757) 229-4683
E-mail: rickmond@tni.net
www.rickmond.com

JOB 00175-020
SHEET NO. _____ OF _____
CALCULATED BY KMS DATE 8/13/01
CHECKED BY _____ DATE _____
SCALE _____

OUTLET BARREL

35' of 15" RCP @ 0.91%

INV_{IN} = 10.28
INV_{OUT} = 9.96

Q	dn	dc	v_n	R	H	h_o	LS_o	HW	HW ELEV
0	—	—	—	—	—	—	—	—	10.28
2	0.49	0.56	4.48	.26	0.79	.91	.32	1.38	11.66
4	0.73	0.81	5.34	.34	0.98	1.03	.32	1.69	11.97
6	1.00	0.99	5.72	.38	1.08	1.12	.32	1.88	12.16
8	1.25	1.25	6.50	.31	1.52	1.25	.32	2.45	12.73
10	1.25	1.25	8.13	.31	2.38	1.25	.32	3.31	13.59
12	1.25	1.25	9.76	.31	3.42	1.25	.32	4.35	14.63

USE 3-15" ACP UNDER GRAVEL ACCESS ROAD

RICKMOND ENGINEERING, INC.
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JOB 00175-020
SHEET NO. _____ OF _____
CALCULATED BY KMJ DATE 8/13/01
CHECKED BY _____ DATE _____
SCALE _____

FOREBAY POND
STAGE - STORAGE - DISCHARGE

ELEV (FT)	SURFACE AREA (acre-ft)	DISCHARGE (cfs)
10.28	.0912	0
11.00	.1045	0
12.00	.1235	0
13.00	.2336	0
14.00	.3942	32.37

10-Year Routing

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

 PROJECT: JAMESTOWN SETTLEMENT
    User: Rickmond Engineering
    Date: 08/13/2001    Monday
    Time: 13:48:38
  Output: JSFPP10.OUT


 SOLUTION FOR  1  STORMS.


 TIME INCREMENT:   .100  Hours


 STORM
 NUMBER   HYDROGRAPH IN FILE:
 ______   ____________________________________________________________

   1      JSFP10.DAT



                                ALLOWABLE
                     PEAK         PEAK                      RUNOFF      TAILWATER
          STORM     INFLOW     DISCHARGE    DURATION       VOLUME        STAGE
          NUMBER     (cfs)       (cfs)       (min)         (ft3)         (ft)
          ______   _________   _________   _________   ____________   _________

            1        35.009       N/A       1794.00    .1405E+06       13.170

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

 PROJECT: JAMESTOWN SETTLEMENT
    User: Rickmond Engineering
    Date: 08/13/2001    Monday
    Time: 13:48:38
  Output: JSFPP10.OUT


 Stage-Area-Discharge
 Filename: JSFPOND.DAT

          TAILWATER STAGE:   13.170 feet.
            INITIAL STAGE:   13.170 feet.

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

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

                              STORAGE
                STAGE         VOLUME          DISCHARGE
                (ft)          (ac-ft)           (cfs)
               _________   _____________   _____________

                 10.280        .0000            .0000
                 11.000        .7040E-01        .0000
                 12.000        .1843            .0000
                 13.000        .3599            .0000
                 13.170        .4019            .0000
                 14.000        .6719          32.37
1*********************************      PONDOPT      *********************************
 *********************************   Version 1.83   *********************************
 ******************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   ******************

 PROJECT: JAMESTOWN SETTLEMENT
    User: Rickmond Engineering
```

Date: 08/13/2001 Monday
Time: 13:48:38
Output: JSFPP10.OUT

TAILWATER STAGE: 13.170 feet.
INITIAL STAGE: 13.170 feet.

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

MAXIMUM ELEVATION: 13.98 feet.
MAXIMUM INFLOW: 35.01 cfs.
MAXIMUM OUTFLOW: 31.49 cfs.
MAXIMUM STORAGE: .6646 acre-feet.

CONTINUITY ERROR: -.521E-05 percent.

TIME (min)	INFLOW RATE (cfs)	OUTFLOW RATE (cfs)	POND SURFACE ELEVATION (ft)
0	.000	.000	13.170
6	.000	.000	13.170
12	.000	.000	13.170
18	.000	.000	13.170
24	.000	.000	13.170
30	.000	.000	13.170
36	.000	.000	13.170
42	.000	.000	13.170
48	.000	.000	13.170
54	.000	.000	13.170
60	.000	.000	13.170
66	.000	.000	13.170
72	.000	.000	13.170
78	.000	.000	13.170
84	.000	.000	13.170
90	.000	.000	13.170
96	.000	.000	13.170
102	.000	.000	13.170
108	.000	.000	13.170
114	.000	.000	13.170
120	.000	.000	13.170
126	.000	.000	13.170
132	.000	.000	13.170
138	.000	.000	13.170
144	.000	.000	13.170
150	.000	.000	13.170
156	.000	.000	13.170
162	.000	.000	13.170
168	.000	.000	13.170
174	.000	.000	13.170
180	.000	.000	13.170
186	.000	.000	13.170
192	.000	.000	13.170
198	.000	.000	13.170
204	.000	.000	13.170
210	.000	.000	13.170
216	.000	.000	13.170
222	.000	.000	13.170
228	.000	.000	13.170
234	.000	.000	13.170
240	.001	.001	13.170
246	.005	.002	13.170
252	.010	.006	13.170
258	.018	.011	13.170
264	.028	.019	13.170
270	.038	.028	13.171
276	.047	.038	13.171
282	.058	.047	13.171
288	.067	.057	13.171
294	.077	.067	13.172
300	.087	.077	13.172
306	.096	.087	13.172

312	.106	.096	13.172
318	.115	.106	13.173
324	.124	.115	13.173
330	.133	.124	13.173
336	.141	.133	13.173
342	.150	.141	13.174
348	.158	.150	13.174
354	.166	.158	13.174
360	.174	.166	13.174
366	.184	.175	13.174
372	.197	.185	13.175
378	.212	.198	13.175
384	.226	.212	13.175
390	.237	.225	13.176
396	.248	.236	13.176
402	.257	.247	13.176
408	.266	.257	13.177
414	.275	.266	13.177
420	.284	.275	13.177
426	.296	.285	13.177
432	.319	.300	13.178
438	.346	.322	13.178
444	.370	.346	13.179
450	.389	.368	13.179
456	.404	.387	13.180
462	.417	.402	13.180
468	.429	.416	13.181
474	.440	.428	13.181
480	.450	.439	13.181
486	.466	.452	13.182
492	.494	.471	13.182
498	.527	.497	13.183
504	.557	.527	13.184
510	.579	.554	13.184
516	.600	.577	13.185
522	.625	.600	13.185
528	.651	.625	13.186
534	.674	.650	13.187
540	.693	.672	13.187
546	.716	.694	13.188
552	.752	.720	13.188
558	.793	.755	13.189
564	.829	.792	13.190
570	.855	.825	13.191
576	.884	.855	13.192
582	.925	.888	13.193
588	.971	.928	13.194
594	1.011	.970	13.195
600	1.041	1.007	13.196
606	1.084	1.044	13.197
612	1.167	1.098	13.198
618	1.266	1.177	13.200
624	1.350	1.264	13.202
630	1.407	1.340	13.204
636	1.483	1.410	13.206
642	1.625	1.505	13.209
648	1.792	1.640	13.212
654	1.933	1.788	13.216
660	2.027	1.915	13.219
666	2.173	2.038	13.222
672	2.473	2.227	13.227
678	2.837	2.511	13.234
684	3.142	2.828	13.243
690	3.340	3.102	13.250
696	3.990	3.475	13.259
702	5.708	4.386	13.282
708	9.187	6.414	13.334
714	16.496	10.673	13.444
720	27.365	18.132	13.635
726	35.009	26.783	13.857
732	32.773	31.493	13.978
738	24.593	29.631	13.930
744	16.898	23.743	13.779
750	12.502	17.751	13.625
756	9.844	13.393	13.513

762	7.801	10.365	13.436
768	6.158	8.122	13.378
774	5.029	6.446	13.335
780	4.389	5.295	13.306
786	3.958	4.552	13.287
792	3.522	4.014	13.273
798	3.140	3.561	13.261
804	2.888	3.199	13.252
810	2.755	2.949	13.246
816	2.643	2.783	13.241
822	2.484	2.637	13.238
828	2.313	2.479	13.234
834	2.183	2.326	13.230
840	2.109	2.207	13.227
846	2.074	2.131	13.225
852	2.062	2.089	13.224
858	2.045	2.065	13.223
864	2.006	2.039	13.222
870	1.946	1.997	13.221
876	1.875	1.939	13.220
882	1.799	1.871	13.218
888	1.724	1.798	13.216
894	1.650	1.724	13.214
900	1.580	1.652	13.212
906	1.513	1.582	13.211
912	1.450	1.515	13.209
918	1.391	1.453	13.207
924	1.337	1.394	13.206
930	1.288	1.340	13.204
936	1.243	1.290	13.203
942	1.202	1.245	13.202
948	1.167	1.205	13.201
954	1.136	1.169	13.200
960	1.109	1.138	13.199
966	1.088	1.112	13.199
972	1.070	1.090	13.198
978	1.056	1.072	13.197
984	1.044	1.058	13.197
990	1.034	1.045	13.197
996	1.024	1.034	13.197
1002	1.015	1.024	13.196
1008	1.006	1.015	13.196
1014	.997	1.006	13.196
1020	.988	.997	13.196
1026	.979	.988	13.195
1032	.970	.979	13.195
1038	.962	.970	13.195
1044	.953	.962	13.195
1050	.944	.953	13.194
1056	.935	.944	13.194
1062	.927	.935	13.194
1068	.918	.927	13.194
1074	.909	.918	13.194
1080	.900	.909	13.193
1086	.892	.900	13.193
1092	.883	.892	13.193
1098	.874	.883	13.193
1104	.865	.874	13.192
1110	.857	.866	13.192
1116	.848	.857	13.192
1122	.839	.848	13.192
1128	.831	.839	13.192
1134	.822	.831	13.191
1140	.813	.822	13.191
1146	.805	.813	13.191
1152	.796	.805	13.191
1158	.787	.796	13.190
1164	.779	.787	13.190
1170	.770	.779	13.190
1176	.761	.770	13.190
1182	.753	.762	13.190
1188	.744	.753	13.189
1194	.735	.744	13.189
1200	.727	.736	13.189
1206	.718	.727	13.189

1212	.710	.718	13.188
1218	.701	.710	13.188
1224	.693	.701	13.188
1230	.684	.693	13.188
1236	.676	.685	13.188
1242	.669	.677	13.187
1248	.661	.669	13.187
1254	.653	.661	13.187
1260	.646	.654	13.187
1266	.639	.646	13.187
1272	.632	.639	13.186
1278	.626	.632	13.186
1284	.619	.626	13.186
1290	.613	.619	13.186
1296	.607	.613	13.186
1302	.601	.607	13.186
1308	.596	.601	13.185
1314	.590	.596	13.185
1320	.585	.591	13.185
1326	.580	.585	13.185
1332	.576	.581	13.185
1338	.571	.576	13.185
1344	.567	.571	13.185
1350	.563	.567	13.185
1356	.559	.563	13.184
1362	.556	.559	13.184
1368	.552	.556	13.184
1374	.549	.552	13.184
1380	.546	.549	13.184
1386	.543	.546	13.184
1392	.541	.544	13.184
1398	.539	.541	13.184
1404	.536	.539	13.184
1410	.535	.537	13.184
1416	.533	.535	13.184
1422	.531	.533	13.184
1428	.530	.532	13.184
1434	.529	.530	13.184
1440	.529	.529	13.184
1446	.493	.517	13.183
1452	.387	.466	13.182
1458	.251	.369	13.179
1464	.143	.255	13.177
1470	.080	.160	13.174
1476	.046	.096	13.172
1482	.026	.056	13.171
1488	.014	.032	13.171
1494	.008	.018	13.170
1500	.004	.010	13.170
1506	.002	.006	13.170
1512	.001	.003	13.170
1518	.000	.001	13.170
1524	.000	.001	13.170
1530	.000	.000	13.170

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

PROJECT: JAMESTOWN SETTLEMENT
User: Rickmond Engineering
Date: 08/13/2001 Monday
Time: 13:48:38
Output: JSFPP10.OUT

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

PEAK PEAK PEAK PEAK

STORM NUMBER	STAGE (ft)	STORAGE (ac-ft)	INFLOW (cfs)	OUTFLOW (cfs)
1	13.978	.665	35.009	31.493

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WORKSHEET B: REDEVELOPMENT

1. Compile site-specific data and determine site imperviousness (I_{site}).

		PRE-DEVELOPMENT		POST-DEVELOPMENT	
A*		= 1.09	acres	= 1.09	acres
I_a:**	structures and asphalt lot	= 0.15	acres	= 0.15	acres
	gravel lot (C=0.6)	=	acres	=	acres
		=	acres	=	acres
		=	acres	=	acres
		=	acres	=	acres
		=	acres	=	acres
	total I_a	= 0.2	acres	= 0.2	acres
	I = (total I_a / A) X 100	= 14	(% expressed in whole numbers)	= 14	(% expressed in whole numbers)
	R_v = 0.05 + (0.009 X I)	0.17	unitless	= 0.17	unitless
	C: I ≥ 20 = 1.08 mg/l I < 20 = 0.26 mg/l	= 0.26	mg/l	0.26	mg/l

* Although the area subject to regulations may be only the area actually in a CBPA, some localities may require all of the site to comply with criteria.

2. Set Constants.

P_j = unitless rainfall correction factor
= 0.9 for all of Tidewater Virginia

P = annual rainfall depth in inches
= 40 in. for Northern Virginia area
= 43 in. for Richmond Metro. area
= 45 in. for Hampton Roads area

12 and 2.72 are used in the equation as unit conversion factors.

3. Calculate the pre-development load (L_{pre}).

L_{pre} = $P \times P_j \times R_{v(pre)} \times C_{pre} \times A \times 2.72 / 12$
= 0.45 pounds per year

4. Calculate the post-development load (L_{post}).

L_{post} = $P \times P_j \times R_{v(post)} \times C_{post} \times A \times 2.72 / 12$
= 0.45 pounds per year

5. Calculate the pollutant removal requirement (RR).

RR = L_{post} - (0.9 X L_{pre})
= 0.05 pounds per year

%RR = RR / L_{post} X 100
= 10 %

JAMESTOWN SETTLEMENT
DA-4

A. STRUCTURAL BMP POINT ALLOCATION

BMP	BMP Points		Fraction of Site Served by BMP		Weighted BMP Points
UG STORAGE	10 (INFILTRATION)	x	$\frac{5.36+1.91}{12.23} = 0.65$	=	6.5
		x		=	
		x		=	
		x		=	

TOTAL WEIGHTED STRUCTURAL BMP POINTS: _____

B. NATURAL OPEN SPACE CREDIT

Fraction of Site		Natural Open Space Credit		Points for Natural Open Space
	x	_____ (0.1 per 1%)	=	
	x	_____ (0.15 per 1%)	=	

TOTAL NATURAL OPEN SPACE CREDIT: _____

C. TOTAL WEIGHTED POINTS

Structural BMP Points	+	Natural Open Space Points	=	6.5 Total

A. STRUCTURAL BMP POINT ALLOCATION

BMP	BMP Points		Fraction of Site Served by BMP		Weighted BMP Points
BIO-RETENTION	10	x	1.82 / 5.55 = 0.32	=	3.2
SCC E-2 SHINGLE	10	x	1.1 / 5.55 = 0.20	=	2.0
		x		=	
		x		=	

TOTAL WEIGHTED STRUCTURAL BMP POINTS: 5.2

B. NATURAL OPEN SPACE CREDIT

Fraction of Site		Natural Open Space Credit		Points for Natural Open Space
	x	(0.1 per 1%)	=	
	x	(0.15 per 1%)	=	

TOTAL NATURAL OPEN SPACE CREDIT: _____

C. TOTAL WEIGHTED POINTS

Structural BMP Points	+	Natural Open Space Points	=	5.2 Total

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PROJECT NO. 01198
PROJECT NAME
SHEET NO. OF
CALCULATED BY KMS DATE 2/28/02
CHECKED BY DATE
SCALE

DESIGN BMP E-2
DRY SWALE

Treatment Volume - 1 inch / impervious acre

Post-Development Impervious Area = 7.28 ac

$WQ_v = \frac{7.28\,ac}{} \left| \frac{1\,in}{12\,in} \right| \frac{1\,ft}{} \left| \frac{43,560\,sf}{1\,ac} \right| = 26,600\,cf$

Jamestown Settlement

8/20/02

- Portion of site existed prior to adoption of Ches Bay
- ∴ redevelopment criteria applies

need to reduce existing pollutant load by 10% below levels existing in 1990 before adoption of Ordin.

Area of Site = 24.0 acres

DAs 4, 5+6 = 23.9 ac ≈ 24.0

Existing Imp Area = 6.36 + 1.23 + 0.45 = 8.04 ac

Max Imp Area = 9.87 + 2.85 + .45 = 13.17 ac

Buildout = 43% × 24 = 10.32 ac

Open Space Area – $\frac{4.3 ac}{24} \times .1 =$ 1.79 pts

Structural Points – 7.32 pts

Total = 9.11 pts

Shortfall = 0.89 pts

Assume – ½ of imp cover existed prior to adoption of Ches Bay

or 3.18 ac in DA 4

now to be treated in 50% eff. BMP

$\frac{3.18}{6.36} \times 50\% = .25$ or 25% reduction in load

$25\% \times \frac{14.72}{24} = 15\frac{1}{3}\%$ red. in existing load

Consider 3.2 ac as offsite area – ex. imp. cover estimate

new site area = 20.8 ac

$$\left(\frac{14.7 - 3.2}{20.8} \times 10\right) + \left(\frac{3.2}{20.8} \times 10\right) + \left(\frac{4.75}{20.8} \times 6\right) + \frac{4.3}{20.8} \times 10 =$$

$$5.53 + 1.54 + 1.37 + 2.07 = 10.5 \text{ pts}$$

Jamestown Settlement (cont)

Impervious Cover - Prior To 1990 (Pre Ches Bay)

Total Site Area = 26.0 acres. - per Kenny Jenkins

Impervious Cover = 10.52 ac

DA's 4,5, +6 - Ex. Imp. 3.0 ac
1,2,3 - " " 7.52
10.52 ac

Revise Pt. Calc from previous page

Consider Site Area to be 24.0 - 3.0 (ex. imp) = 21.0

Pt Calc $\left(\frac{14.7-3.0}{21.0}\right)10 + \left(\frac{3.0}{21.0}\right)10 + \left(\frac{4.75}{21.0}\right)6 + \frac{4.3}{21.0} \times 10 =$ 10.4 pts

∴ 10 Pt criteria is met for DA: 4,5, +6

Redevelopment Criteria

3.0 ac of imp cover existed prior to Ches Bay w/ no BMP
- now it will be treated in 50% eff BMP

6.36 ac imp - buildout per this plan

Pollutant load related to impervious area = 3

Post Devel - 6.36 × 50% + 1.23 × 60% = 3.9

% Imp = $\frac{3}{24}$ = 12.5% (pre)

% Imp = $\frac{8.06}{24}$ = 33.6% (post)

From SWM Manual - Pond/Wetland System - adeq. for 38-66% Imp Cover
Const Wetland - adeq for 22-37% Imp Cover

JAMESTOWN-YORKTOWN FOUNDATION
JAMESTOWN SETTLEMENT

STORMWATER MANAGEMENT MASTER PLAN

February 14, 2001
Revised May 2, 2002
Revised July 3, 2002

Rickmond
ENGINEERING, INC.

Project No. 00175-020

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JAMESTOWN-YORKTOWN FOUNDATION
JAMESTOWN SETTLEMENT

STORMWATER MANAGEMENT MASTER PLAN
REI PROJECT NUMBER: 00175-020

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FIGURES

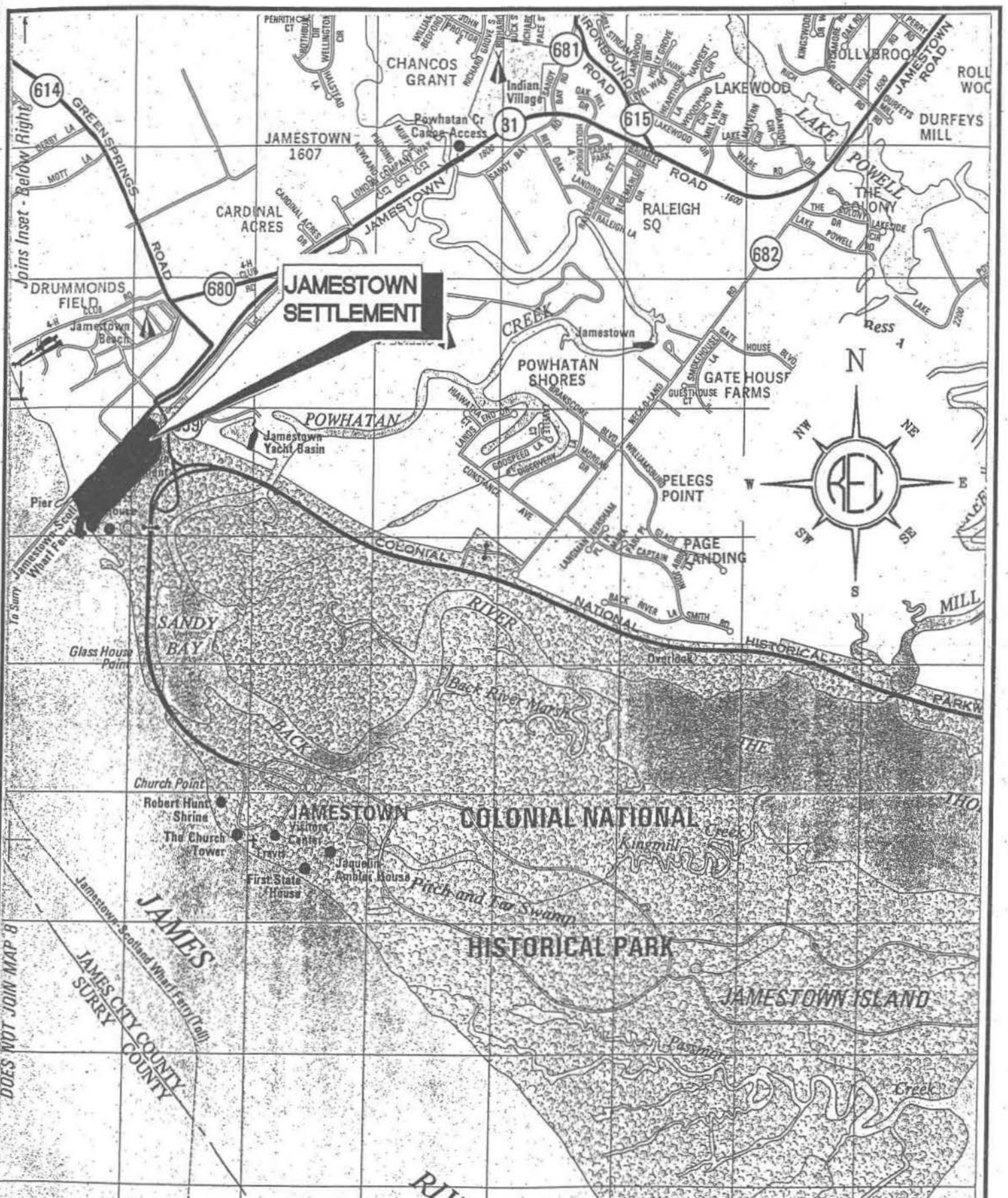
APPENDICES

INTRODUCTION

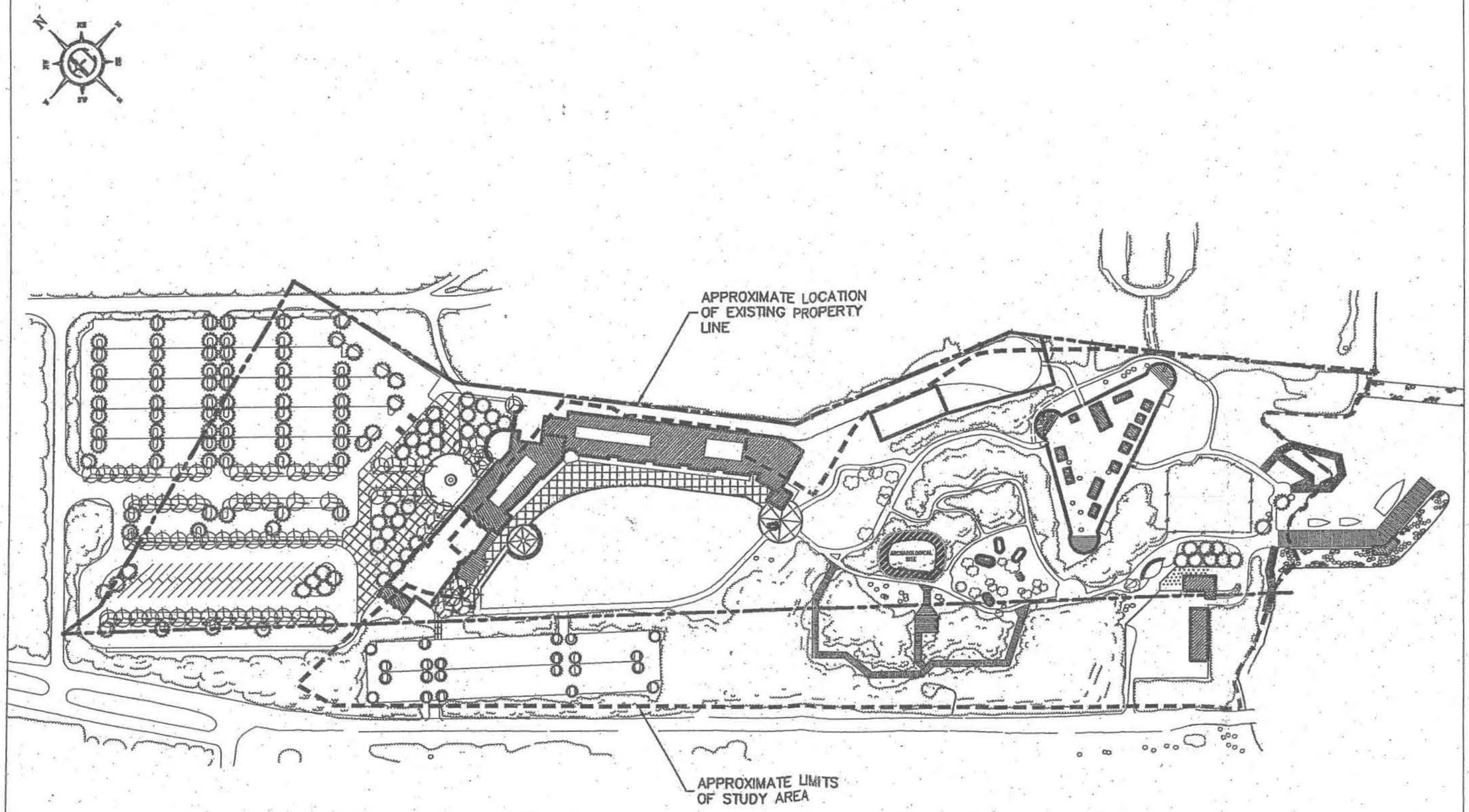
The Jamestown Settlement facility is located in James City County, Virginia adjacent to the Colonial National Historical Parkway and Route 31. The facility is owned by the State of Virginia and is operated by the J-YF. The facility consists of approximately 26 acres and utilizes approximately 10 additional acres of Virginia Department of Transportation (VDOT) property for a total of approximately 36 acres of partially developed, yet wooded land. A vicinity map depicting the location of the site is provided as Figure 1 of this report.

The Jamestown-Yorktown Foundation (J-YF) has commissioned Rickmond Engineering, Inc. as a consultant to HBA Architects to prepare a Stormwater Management Master Plan (SMMP) or the southwest portion of the site to aid in planning short- and long-term improvements to the facility. To that end, Rickmond Engineering has compiled the necessary data and conducted the appropriate field investigations relevant to the 24-acre study area. This evaluation also included the collection and evaluation of existing public data and reports commissioned by agencies other than the J-YF. This report has been prepared in accordance with the general criteria outlined in the unofficial General Submission Guidelines for a Stormwater Management/Drainage Concept Plan prepared by the James City County Environmental Division (JCCED) and the applicable sections of the Chesapeake Bay Preservation Act (CBPA).

This report will present viable improvement options and draw the appropriate conclusions and recommendations for proceeding with the stormwater management aspects of continued responsible development of the study area. It is anticipated that this report will also serve as the basis of final design for potential study area improvements. A study area map depicting the master plan conditions, the existing property line, and the approximate limits of the study area is provided as Figure 2 of this report. It should be noted that the northeast portion of the property to include the future parking lot improvements and public roadway re-alignment is excluded from the study area. The J-YF, working in conjunction with the VDOT, has initiated preliminary design efforts to provide the required stormwater management facilities for this area.



Rickmond Engineering, Inc. Engineering Surveying Land Planning 1643 Merrimac Trail, Williamsburg, VA 23185 Voice: (757)229-1776 Fax: (757)229-4883 Vint Hill • P.O. Box 861647, Warrenton, VA 20187 Voice: (540)349-7730 Fax: (540)349-7731 www.rickmond.com	JAMESTOWN SETTLEMENT VICINITY MAP	PROJ. NO.: 00175 DWG: FIGURE 1 DATE: 02.14.01 SCALE: 1"=2000' SHEET 1 OF 1



NOTE:

THE PLANIMETRIC INFORMATION SHOWN WAS PROVIDED BY THE JAMESTOWN-YORKTOWN FOUNDATION AS PREPARED BY WILSON MORETH CONNOCK, DATED 10.26.98.

JAMESTOWN SETTLEMENT STORMWATER MANAGEMENT MASTER PLAN

JAMES CITY COUNTY, VIRGINIA
JAMESTOWN MAGISTERIAL DISTRICT

PROJ. NO.: 00175-200
DWG: FIGURE 2
DATE: 02.14.01
SCALE: NOT TO SCALE
SHEET 1 OF 1

Rickmond Engineering, Inc.
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Fax: (757)229-4683 Fax: (540)349-7731
www.rickmond.com

FIGURE 2.

SOILS

According to the "Soil Survey of James City and York Counties and the City of Williamsburg, Virginia" (1985), the facility is located within 5 classifications of soils. The approximate locations of these classifications are depicted in Appendix A of this report, and include; Emporia fine sandy loam (14C), Emporia complex (15D), Pamunkey soils (26B), Tetotum silt loam (32), and Udorthents (35).

Emporia Fine Sandy Loam (14C)

Emporia fine sandy loam soil is deep, strongly sloping, and well drained.

Typically, the surface layer of this soil is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is pale brown loam 9 inches thick. The subsoil extends to a depth of 58 inches. It is yellowish brown loam with mostly strong brown mottles in the upper part; yellowish brown, firm sandy clay loam with strong brown and gray mottles in the middle part; and mottled gray and brown, firm sandy clay loam in the lower part. The substratum to a depth of at least 75 inches is variegated gray, brown, and red, firm sandy clay loam.

In this Emporia soil, permeability is moderate in the upper part of the subsoil and moderately slow in the lower part. The erosion hazard is severe.

Emporia Complex (15D)

Emporia complex consists of areas of deep, moderately steep, well-drained Emporia soils and areas of similar soils that formed over layers of fossil shells.

Typically, the surface layer of Emporia soils is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is pale brown loam 7 inches thick. The subsoil extends to a depth of 54 inches. It is yellowish brown loam with mostly strong brown mottles in the upper

part; yellowish brown, firm sandy clay loam with strong brown and gray mottles in the middle part; and mottled gray and brown, firm sandy clay loam in the lower part. The substratum is variegated brown, red, and gray, firm sandy clay loam to a depth of at least 75 inches.

In these Emporia soils, permeability is moderate in the upper part of the subsoil and moderately slow in the lower part. The erosion hazard is severe.

Pamunkey Soils (26B)

Pamunkey soils are deep, gently sloping, and well drained.

The texture of the surface layer of these soils is highly variable throughout the survey areas. Typically, the surface layer of the Pamunkey soils is dark grayish brown sandy loam about 4 inches thick. The subsurface layer is brown sandy loam 10 inches thick. The subsoil extends to a depth of 43 inches. It is mostly yellowish brown sandy loam and dark brown sandy clay loam. The substratum is mostly brown and strong brown loamy sand and sand to a depth of at least 75 inches.

The permeability of these Pamunkey soils is moderate, and the erosion hazard is moderate.

Tetotum Silt Loam (32)

Tetotum silt loam soil is deep, nearly level, and moderately well drained.

Typically, the surface layer of this soil is dark grayish brown silt loam about 5 inches thick. The subsurface is mostly yellowish brown silt loam, silty clay loam, clay loam, and loam 41 inches thick. It has gray mottles at a depth of more than 27 inches. The substratum is mottled yellowish brown, gray, and strong brown fine sandy loam to a depth of at least 65 inches.

The permeability of this Tetotum soil is moderate, and the erosion hazard is slight.

Udorthents (35)

Udorthents consist of deep, well-drained and moderately well drained loamy soil material in areas where the soils have been disturbed during excavation and grading. The permeability ranges from moderately rapid to slow and the erosion hazard ranges from slight to severe.

RECEIVING WATERS

The primary receiving waters of the Jamestown Settlement study area is the James River.

HYDRIC SOIL AND CRITICAL EROSION AREAS

hydric soils are not determined from the tax maps.

Based on the James City County Tax Maps 46-3 and 54-1, there are no anticipated hydric soils on-site. The following soils, Emporia fine sandy loam (14C) and Emporia complex (15D) potentially have a severe erosion hazard; and Udorthents (35) has an erosion hazard characteristic that ranges from slight to severe. These 3-soil footprints can be found on the map in Appendix A of this report. ~~Not provided~~ See large map.

FLOOD PLAIN

The site appears to be located in a 100-year flood hazard zone "AE" (elevation 8.5 feet) per Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map, Community-Panel No. 510201-0040B, dated January 6, 1991. The approximate location of the 100-year flood zone is depicted on the map provided as Appendix B of this report. See large map

RESOURCE PROTECTION AREA

Environmental Specialties Group, Inc. (ESG) of Newport News is in the process of preparing a wetlands delineation. This delineation is being performed in accordance with the 1987 Army Corps of Engineers (ACOE) Wetland Delineation Manual. The resource protection area (RPA) is defined as a 100-foot inland buffer adjacent to the delineated wetlands. Wetlands and RPA are

See attached large map

depicted on the map provided in Appendix C of this report. Copies of the ESG Wetland Delineation documentation, to include the ACOE confirmation, are also provided in Appendix C of this report.

DRAINAGE AREAS

The study area consists of the 2 existing drainage areas which drain to the James River. It should be noted that the scope of this master plan was only for the 24-acre southwest portion of the site and did not include the 12-acre northeast portion of site. However, in order to provide a full description of the entire 36-acre site, a brief discussion will be provided.

The entire 36-acre site consists of six drainage areas after buildout of the master-planned improvements. Drainage areas (DAs) No. 1, 2, and 3 are located on the northeast side of the site and are not part of the master plan. DAs No. 4, 5, and 6 are located on the southwest side of the site and are the focus of the SMMP.

DAs No. 1, 2, and 3 are currently under design, under a separate contract, to include the new bus parking lot (DA No. 1) and the new visitor parking lot (DAs No. 2 and 3). Each of the 3 drainage areas contain a James City County Dry Swale 10-Point Best Management Practice (BMP) that treats 100 percent of each drainage area. DA No. 1 is located in the James River watershed and DAs No. 2 and 3 are located in the Powhatan Creek watershed. It should be noted that the dry swale BMPs in DAs No. 2 and 3 discharge into the VDOT BMP designed in conjunction with the realignment of State Route No. 359 before ultimately discharging into Powhatan Creek.

DA No. 4 discharges to a James City County Pond/Wetland System 10-Point BMP before ultimately discharging into the James River, DA No. 5 discharges to a James City County Pocket Wetland 6-Point BMP before discharging into the James River and DA No. 6 sheet flows directly to the James River. The drainage areas, including acreages and impervious areas, are depicted on the map provided as Appendix D of this report.

See large map

EXISTING SITE CONDITIONS

The study area consists of approximately 24 acres containing 6 buildings: an Indian Village, the James Fort, wooded areas, and grassy areas. The facility's topography is relatively flat around the 4 main buildings and the fort (Elevation 15) and slopes to the James River at approximately 4 percent. The site is bounded on the west by the James River, on the north by Jamestown Road (Route 31), on the east by vacant land, and on the south by the Colonial National Historic Parkway.

PROPOSED SITE CONDITIONS

A master plan of the entire Jamestown Settlement site has been compiled from the various consultants and is depicted on the map provided as Appendix D of this report.

See large map

PROPOSED STORMWATER MANAGEMENT FACILITIES

It is the desire of the J-YF to analyze the study area and draw reasonable conclusions regarding the construction of stormwater management facilities that will comply with the current James City County criteria. As stated in the James City County Guidelines for Design and Construction of Stormwater BMPs, October 1999, "to achieve compliance, an SMMP must attain at least 10 BMP points through a combination of structural BMPs and preservation of natural open space". The applicable excerpts from these guidelines are provided as Appendix E of this report.

The potential structural BMPs are grouped into 6 categories: (1) wet ponds, (2) wetlands, (3) infiltration, (4) filtering systems, (5) open channel systems, and (6) extended dry detention. Placement of the BMP on the site is one of the major selection criteria in determining which BMP has the acceptable design criteria to fit the site conditions. After reviewing the proposed improvements for the site, it was determined that the best location for BMPs is in the low-lying wooded areas adjacent to Jamestown Road (Route 31). After considering the 6 structural BMP options available, the wetlands category that consists of various design criteria was selected as the most viable scenario for the existing site.

Wet ponds were not selected due to the extensive clearing of trees and wetlands disturbance that would be required to create a pond with the necessary surface area. Infiltration methods are not feasible due to the poor infiltration rates of the soils located in the proposed BMP location. Filtering systems were not considered acceptable due to the extensive clearing of trees and wetlands disturbance required and a potential high water table in the low-lying area. Open channel systems and extended dry detention were eliminated due to the clearing of woods and wetlands disturbance required to construct the channel and the large drainage (greater than 5 acres) upland of the BMP location. Therefore, wetlands were determined to be the most viable BMP for the site due to the existing wetlands on-site and the low-lying wooded area, which could easily be converted to a stormwater management facility. ← clearing or construction conversion of vegetation type.

James City County's 10-Point BMP requirements for compliance with the CBPA would be satisfied by the combined use of a conservation area and (1)2 wetland water quality BMP. A total of 4.30 acres of the 24-acre study area are proposed to be preserved as a conservation area. A Pond/Wetland System BMP (B-3) is proposed to be constructed in DA No. 4 to receive and treat stormwater runoff from DA No. 4. A Pocket Wetland BMP (B-4) is proposed to be constructed in DA No. 5 to receive and treat stormwater runoff from DA No. 5. The combination of a conservation area and structural BMPs will provide 10.01 points as calculated according to the James City County BMP worksheet and are provided in Appendix E of this report. A map of the approximate limits of the proposed conservation area and wetland water quality BMP location is provided as Appendix F of this report. See large map

EROSION AND SEDIMENT CONTROL MEASURES

It is anticipated that the erosion and sediment (E & S) control practices for the potential improvements would be designed in accordance with the current editions of the James City County Erosion and Sediment Control Ordinance and the Virginia Erosion and Sediment Control Handbook. The Contractor is typically required to secure a copy of each publication and thoroughly familiarize themselves with all applicable practices contained therein that may be pertinent to their project. The purpose of such practices, including but not limited to those listed below, shall be to preclude the transport of all waterborne or airborne sediments resulting from

construction activities entering onto adjacent properties or into state waters. All sediment must be confined to the project site. Protection of existing natural vegetation from needless disturbance is essential. All construction personnel should be cautioned to avoid damage to existing trees and vegetation during construction activities.

The following E & S control measures may potentially be used on-site during future facility improvements:

- A construction entrance installed at the facility entrance to reduce the amount of mud transported onto paved public roads by motor vehicles and runoff.

- Silt fences installed around the limits of clearing to intercept and detain small amounts of sediment from disturbed areas during construction operations and to direct sediment laden runoff to sediment traps.

- Inlet protection installed at all drainage inlets to prevent sediment from entering the storm drainage systems prior to permanent stabilization of the disturbed area.

- Sediment traps and basins installed to detain sediment laden runoff from upstream disturbed areas long enough to allow the majority of the sediment to settle out.

- Soil stabilization matting installed on all slopes steeper than 3:1 to aid in controlling erosion by providing a microclimate that protects young vegetation and promotes its establishment.

- Diversion dikes installed to divert sediment-laden runoff from a disturbed area to a sediment trap.

- Tree protection installed to protect desirable trees during land disturbing activities.

In general, all E.& S control measures will be checked daily and after each significant rainfall. The following items should be checked in particular:

- The sediment traps and basins should be checked regularly for sediment cleanout.

- The gravel outlets should be checked regularly for a sediment buildup that will prevent drainage. If the gravel outlets are clogged by sediment, it shall be removed and cleaned or replaced.

- The silt fence barrier should be checked regularly for undermining or deterioration of the fabric. Sediment shall be removed when the level of sediment deposition reaches half way to the barrier.

- The seeded areas should be checked regularly to ensure that a good stand of vegetation is maintained. Areas should be fertilized, mulched, and reseeded as needed.

- The diversion dikes should be checked after every storm and repairs made to the dike, flow channel, outlet, or sediment trapping facility, as necessary.

Once every two weeks, whether a storm event has occurred or not, the measures should be inspected and repairs made if needed. Damages caused by construction traffic or other activity must be repaired before the end of each working day. Site-specific E & S control plans will be developed for each component of the master-planned improvements under a separate contract.

CHANNEL ADEQUACY

There are no anticipated areas where stream channel protection or channel adequacy computations are required as the study area drains directly to the James River. However, should they become necessary, channel adequacy calculations would be performed as part of the final design.

PERMITS

As outlined in the James City County Environmental Division General Submission Guidelines for Stormwater Management Drainage Concept and Plan, the following permits may potentially be required: United States Army Corps of Engineers (USACOE) wetlands permit, James City County land disturbing permit, VDOT CE-7 permit, archaeological permit, and historical permit. The extent to which these or other permits are required will be determined once preliminary construction plans for the proposed improvements have been developed.

CONCLUSIONS AND RECOMMENDATIONS

The J-YF is preparing for future development at the Jamestown Settlement facility located in James City County, Virginia. To comply with the pollutant removal requirements of the CBPA, the study area must be designed to obtain a minimum of 10 points as calculated according to the James City County criteria. The SMMP has developed a design approach that achieves a total of 10.01 BMP points through a combination of 4.30 acres of conservation areas and 2 wetland water quality BMPs.

The wetland water quality BMP storage volume has been preliminarily designed to accommodate 9.87 acres of impervious cover in DA No. 4 and 2.85 acres of impervious cover in DA No. 5.

At buildout, the Jamestown Settlement study area will consist of approximately 43 percent impervious area. The buildout impervious area will be less than the 60 percent maximum allowed by the County and therefore is considered acceptable.

Therefore, based on this investigation, it is recommended that the J-YF proceed with the delineation of the conservation area and developing the final design for construction of the wetland water quality BMPs and associated appurtenances. Following the delineation of the conservation area and the construction of the BMPs, the Jamestown Settlement would have stormwater management facilities in place to accommodate increased impervious area associated

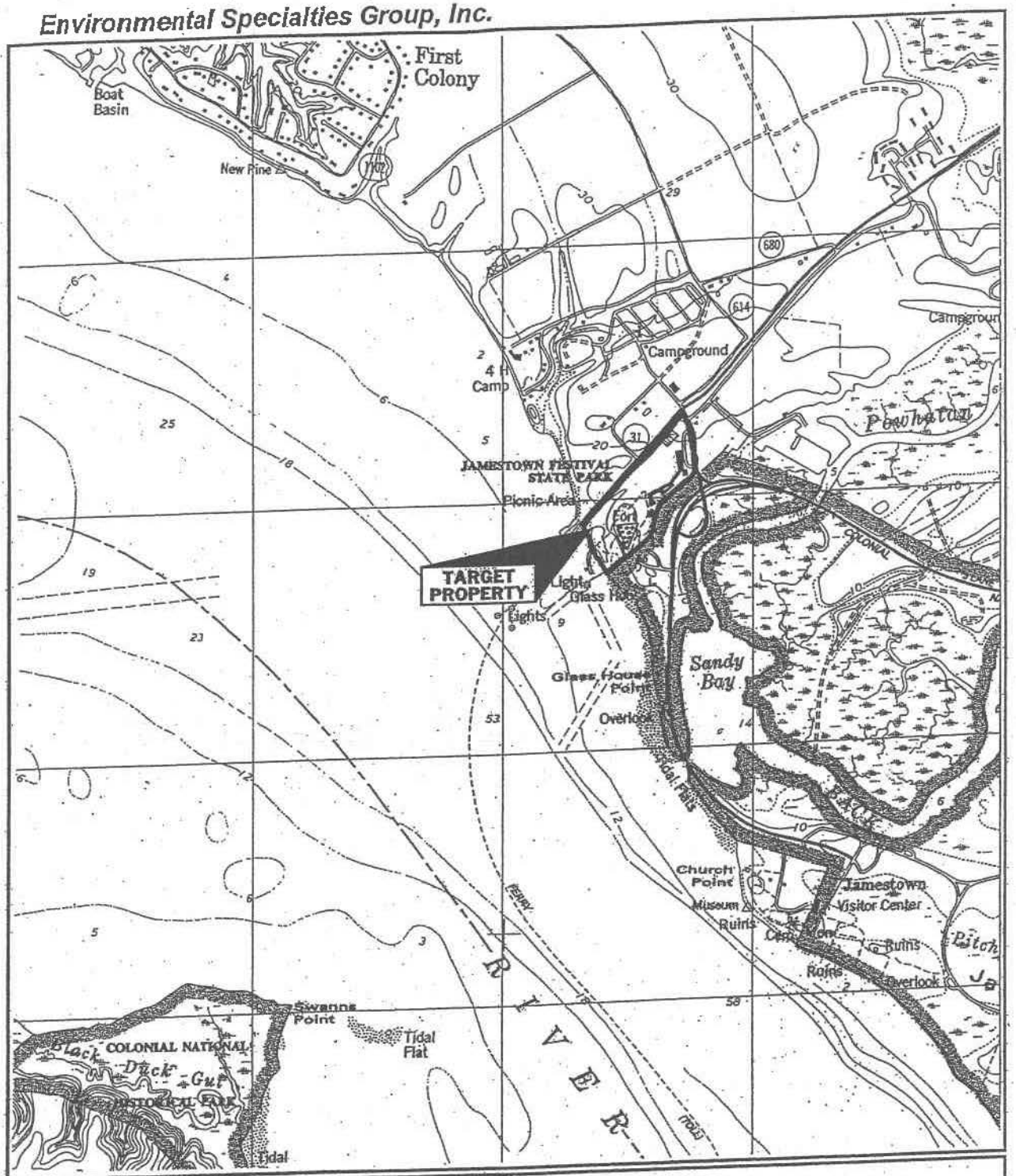
with the future master-planned development. The facilities, as proposed, would allow the J-YF to continue to responsibly develop historically accurate educational facilities without having to invest time and resources to construct future BMPs or preserve additional conservation areas.

APPENDIX A
SOILS MAP

APPENDIX B
FLOOD PLAIN MAP

APPENDIX C
EXISTING WETLANDS AND R.P.A. MAP

Environmental Specialties Group, Inc.



Vicinity Map

Jamestown Settlement
Site Improvements
James City County, Virginia

November 2000

Source: U.S.G.S 7.5 Minute Series
Topographic Map

Surry, Virginia

ESG Project #6720

Scale 1"=2000'

Total nontidal wetland area: ± 0.45 acres

Note:
- Wetlands were delineated based upon the methodology outlined in the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual (TR Y-87-1).

Wetland Delineation

Jamestown Settlement
James City County, Virginia

ENVIRONMENTAL SPECIALTIES GROUP, INCORPORATED
729 Thimble Shoals Boulevard, Suite 1B
Newport News, Virginia 23606
(757) 599-7581

NO.	DATE	DESCRIPTION	BY

DESIGN
DRAWN BC
CHECKED MAR
DATE 12-05-00
SCALE 1"=90'
SHEET 1 OF 1
JOB NO. 6720
FILE NO.

Legend
- Wetland
- Tree Line
- Topo Line
- Pathway
- •1 Data Station

Data Station 1

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

oject/Site:	Jamestown Settlement	Date:	11/13/00
plicant/Owner:	Jamestown-Yorktown Foundation	County:	James City County
estigator:	Mertig/Roth	State:	Virginia

normal circumstances exist on site?	(Yes)	No	Community ID:	
the site significantly disturbed (Atypical situation)?	Yes	(No)	Transect ID:	
the area a potential problem area?	Yes	(No)	Plot ID:	
(if needed, explain on reverse)				

EGETATION

ominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
Populus deltoides	C	fac	9. *Campsis radicans*	V	fac
Liquidambar styraciflua	C	fac	10 *Toxicodendron radicans*	V	fac
Populus deltoides	Sc	fac	11.		
Cephalanthus occidentalis	S	obl	12.		
Persea borbonia	S	facw	13.		
Carex glaucescens	H	obl	14.		
Campsis radicans	H	fac	15.		
Boehmeria cylindrica	H	facw+	16.		

rcent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100 percent.

emarks: Greater than 50% of the dominant species are OBL, FACW, or FAC.

YDROLOGY

Recorded data (describe in remarks):
- ____ Stream, Lake or Tide Gauge
- ____ Aerial Photographs
- ____ Other
- No Recorded Data Available

Wetland Hydrology Indicators:

Primary Indicators:
- ____ Inundated
- X Saturated in Upper 12 inches
- X Water Marks
- ____ Drift Lines
- ____ Sediment Deposits
- ____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ____ Oxidized Root Channels in Upper 12 inches
- X Water-Stained Leaves
- ____ Local Soil Survey Data
- X FAC-Neutral Test
- ____ Other (Explain in Remarks)

ld Observations:

Depth of Surface Water:	____
Depth of Free Water in Pit:	<12"
Depth to Saturated Soil:	6"

Remarks: Evidence of wetland hydrology is present.

Data Station 1

DATA FORM
ROUTINE WETLAND DETERMINATION
(Continued)

SOILS

Map Unit Name (Series and Phase): N/A

Drainage Class: N/A

Taxonomy (Subgroup): N/A

Field Observations
Confirmed Mapped Type? Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, structures, etc.
0-6"	A	10YR 4/1	N/A	N/A	silt loam
6-12"	B	10YR 4/1	N/A	N/A	silt loam

Hydric Soil Indicators:

	Histosol		Concretions
	Histic Epipedon		High Organic Content in Surface Layer in Sandy Soils
	Sulfidic Odor		Organic Streaking in Sandy Soils
	Aquic Moisture Regime		Listed on Local Hydric Soils List
	Reducing Conditions		Listed on National Hydric Soils List
X	Gleyed or Low-Chroma Colors		Other (Explain in Remarks)

Remarks: This is a hydric soil.

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes)	No			
Wetland Hydrology Present?	(Yes)	No			
Hydric Soils Present?	(Yes)	No	Is this Sampling Point Within a Wetland?	(Yes)	No

Remarks: This data point is in a wetland, as all three wetland parameters have been met.

admn-jpw.137

Approved by HQUSACE 3/92

Data Station 2

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Jamestown Settlement	Date:	11/13/00
Applicant/Owner:	Jamestown-Yorktown Foundation	County:	James City County
Investigator:	Mertig/Roth	State:	Virginia

Do normal circumstances exist on site?	(Yes)	No	Community ID:
Is the site significantly disturbed (Atypical situation)?	Yes	(No)	Transect ID:
Is the area a potential problem area? (if needed, explain on reverse)	Yes	(No)	Plot ID:

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Quercus falcata*	C	facu-	9. *Hedera helix*	H	obl-upland
2. *Liquidambar styraciflua*	C	fac	10 *Lonicera japonica*	H	fac-
3. *Pinus taeda*	C	fac-	11 *Hedera helix*	V	obl-upland
4. *Ulmus rubra*	Sc	fac	12 *Lonicera japonica*	V	fac-
5. *Ligustrum sinense*	S	facu	13 *Toxicodendron radicans*	V	fac
6. *Euonymus americanus*	S	fac	14.		
7. *Prunus serotina*	S	facu	15.		
8. *Ligustrum sinense*	H	facu	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). Approximately 31 percent.

Remarks: Less than 50% of the dominant species are OBL, FACW, or FAC.

HYDROLOGY

___ Recorded data (describe in remarks):
- ___ Stream, Lake or Tide Gauge
- ___ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Field Observations:

Depth of Surface Water: _____

Depth of Free Water in Pit: _____

Depth to Saturated Soil: _____

Remarks: No field indicators of hydrology are observed.

Data Station 2

DATA FORM
ROUTINE WETLAND DETERMINATION
(Continued)

SOILS

Map Unit Name (Series and Phase): N/A

Drainage Class: N/A

Taxonomy (Subgroup): N/A

Field Observations
Confirmed Mapped Type? Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, structures, etc.
0-12"+	A	2.5Y 4/3	N/A	N/A	sandy loam

Hydric Soil Indicators:

____ Histosol	____ Concretions
____ Histic Epipedon	____ High Organic Content in Surface Layer in Sandy Soils
____ Sulfidic Odor	____ Organic Streaking in Sandy Soils
____ Aquic Moisture Regime	____ Listed on Local Hydric Soils List
____ Reducing Conditions	____ Listed on National Hydric Soils List
____ Gleyed or Low-Chroma Colors	____ Other (Explain in Remarks)

Remarks: No indicators of hydric soils were observed.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes (No)
Wetland Hydrology Present? Yes (No)
Hydric Soils Present? Yes (No)

Is this Sampling Point Within a Wetland? Yes (No)

Remarks: This data point is in an upland, as none of the three required parameters have been met.

admn-jpw:137

Approved by HQUSACE 3/92

Data Station 3

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

roject/Site:	Jamestown Settlement	Date:	11/13/00
Applicant/Owner:	Jamestown-Yorktown Foundation	County:	James City County
vestigator:	Mertig/Roth	State:	Virginia

o normal circumstances exist on site?	(Yes)	No	Community ID:
s the site significantly disturbed (Atypical situation)?	Yes	(No)	Transect ID:
the area a potential problem area?	Yes	(No)	Plot ID:
(if needed, explain on reverse)			

'EGETATION

ominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
Quercus falcata var pagodaefolia	C	facw	9. *Polystichum acrostichoides*	H	facu-
Liquidambar styraciflua	C	fac	10 *Hedera helix*	V	obl-upland
Pinus taeda	C	fac-	11 *Lonicera japonica*	V	fac-
Cornus florida	S	facu-	12.		
Ilex opaca	S	facu+	13.		
Ulmus rubra	S	fac	14.		
Hedera helix	H	obl-upland	15.		
Lonicera japonica	H	fac-	16.		

ercent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). Approximately 18 percent.

Remarks: Less than 50% of the dominant species are OBL, FACW, or FAC.

HYDROLOGY

_ Recorded data (describe in remarks):
- ____ Stream, Lake or Tide Gauge
- ____ Aerial Photographs
- ____ Other

_ No Recorded Data Available

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Field Observations:

Depth of Surface Water: ____

Depth of Free Water in Pit: ____

Depth to Saturated Soil: ____

Remarks: No field indicators of hydrology are observed.

Data Station 3

DATA FORM
ROUTINE WETLAND DETERMINATION
(Continued)

SOILS

Map Unit Name (Series and Phase): N/A

Drainage Class: N/A

Taxonomy (Subgroup): N/A

Field Observations
Confirmed Mapped Type? Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, structures, etc.
0-12"+	A	2.5Y 4/3	N/A	N/A	sandy loam

Hydric Soil Indicators:

_____ Histosol
_____ Histic Epipedon
_____ Sulfidic Odor
_____ Aquic Moisture Regime
_____ Reducing Conditions
_____ Gleyed or Low-Chroma Colors
_____ Concretions
_____ High Organic Content in Surface Layer in Sandy Soils
_____ Organic Streaking in Sandy Soils
_____ Listed on Local Hydric Soils List
_____ Listed on National Hydric Soils List
_____ Other (Explain in Remarks)

Remarks: No indicators of hydric soils were observed.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes (No)
Wetland Hydrology Present? Yes (No)
Hydric Soils Present? Yes (No)

Is this Sampling Point Within a Wetland? Yes (No)

Remarks: This data point is in an upland, as none of the three required parameters have been met.

admn-jpw.137

Approved by HQUSACE 3/92

Data Station 4

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

oject/Site:	Jamestown Settlement	Date:	11/13/00
Applicant/Owner:	Jamestown-Yorktown Foundation	County:	James City County
vestigator:	Mertig/Roth	State:	Virginia

normal circumstances exist on site?	(Yes)	No	Community ID:
s the site significantly disturbed (Atypical situation)?	Yes	(No)	Transect ID:
the area a potential problem area?	Yes	(No)	Plot ID:
(if needed, explain on reverse)			

EGETATION

ominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
Quercus phellos	C	fac+	9.		
2. *Ligustrum sinense*	S	facu	10.		
Populus deltoides	S	fac	11.		
Myrica cerifera	S	fac	12.		
Dullichium arundinaceum	H	obl	13.		
Aster sp.	H		14.		
Carex glaucescens	H	obl	15.		
			16.		

ercent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). Approximately 83 percent.

Remarks: Greater than 50% of the dominant species are OBL, FACW, or FAC.

HYDROLOGY

Recorded data (describe in remarks):
- ___ Stream, Lake or Tide Gauge
- ___ Aerial Photographs
- ___ Other
- ___ No Recorded Data Available

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 Inches
- X Water-Stained Leaves
- ___ Local Soil Survey Data
- X FAC-Neutral Test
- ___ Other (Explain in Remarks)

Field Observations:

Depth of Surface Water: _____

Depth of Free Water in Pit: _____

Depth to Saturated Soil: _____

Remarks: Evidence of wetland hydrology is present.

Data Station 4

DATA FORM
ROUTINE WETLAND DETERMINATION
(Continued)

SOILS

Map Unit Name (Series and Phase): N/A

Drainage Class: N/A

Taxonomy (Subgroup): N/A

Field Observations
Confirmed Mapped Type? Yes No

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, structures, etc.
0-12"+	A	10YR 3/2	10YR 3/6	distinct/20%	sandy loam

Hydric Soil Indicators:

	Histosol		Concretions
	Histic Epipedon		High Organic Content in Surface Layer in Sandy Soils
	Sulfidic Odor		Organic Streaking in Sandy Soils
	Aquic Moisture Regime		Listed on Local Hydric Soils List
	Reducing Conditions		Listed on National Hydric Soils List
X	Gleyed or Low-Chroma Colors		Other (Explain in Remarks)

Remarks: This is a hydric soil.

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes)	No			
Wetland Hydrology Present?	(Yes)	No			
Hydric Soils Present?	(Yes)	No	Is this Sampling Point Within a Wetland?	(Yes)	No

Remarks: This data point is in a wetland, as all of the three required parameters have been met.

admin-jpw.137

Approved by HQUSACE 3/92

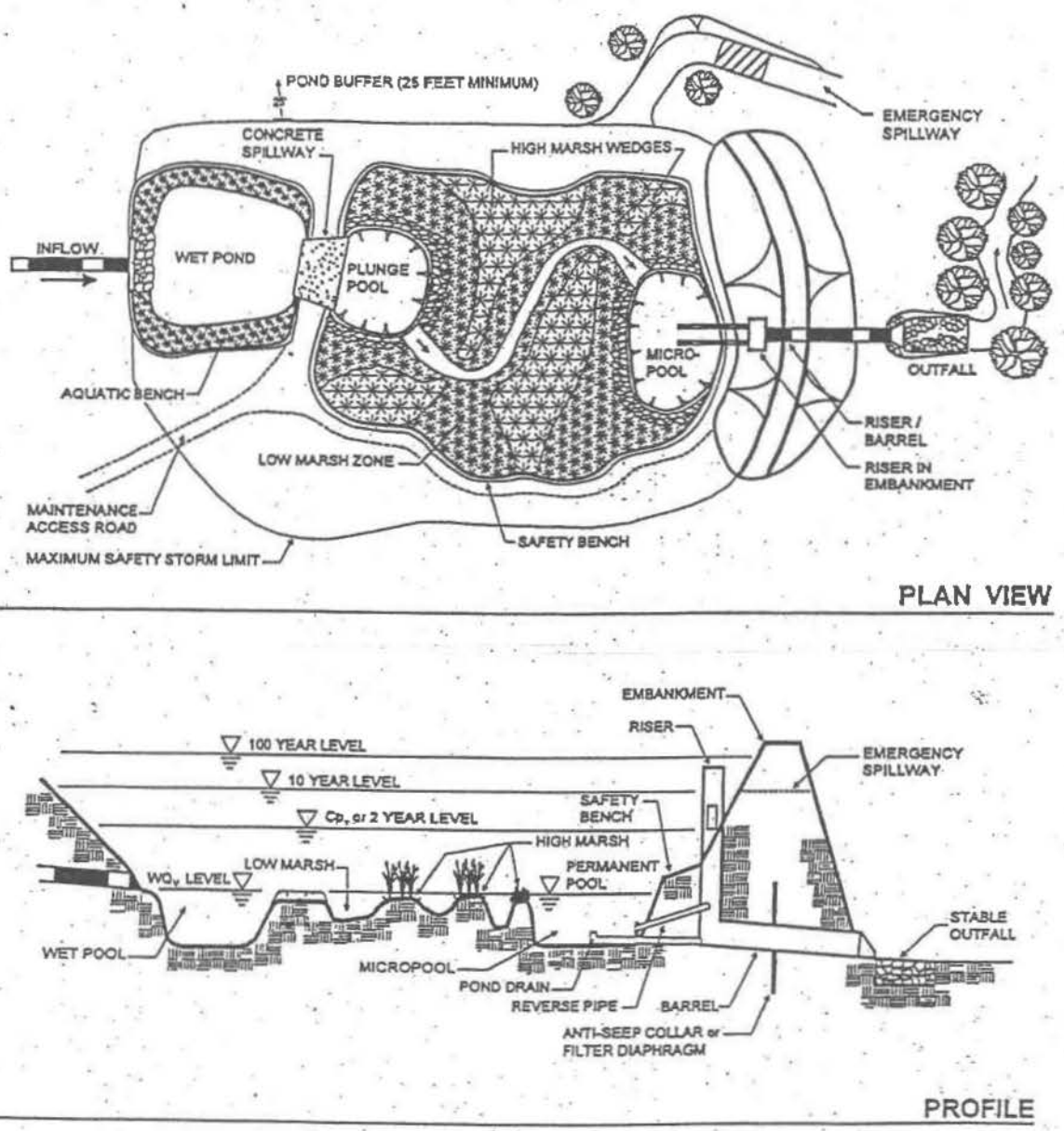
APPENDIX D
DRAINAGE AREA MAP

APPENDIX E
EXCERPTS FROM JAMES CITY COUNTY BMP GUIDELINES

Table 1: BMP Point System for evaluating acceptable water quality BMPs and preservation of open space

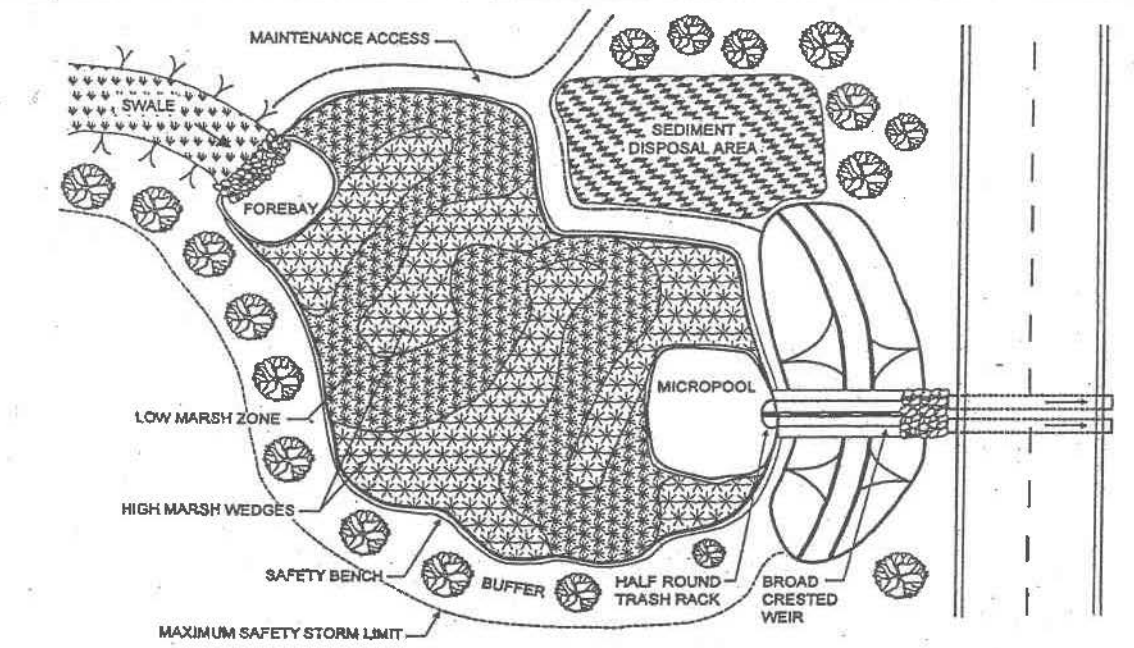
BMP		Treatment Volume (WQ_v)	Average Total P Removal Efficiency	Points
A.	**WET POND**			
1.	Small Wet Pond	1.5 in / imp acre	40%	6
2.	Wet Pond	2.0 in / imp acre	50%	8
3.	Wet ED Pond	2.0 in / imp acre	60%	10
B.	**WETLANDS**			
1.	Shallow Marsh	1.0 in / imp acre	40%	6
2.	ED Shallow Wetland	1.0 in / imp acre	40%	6
3.	Pond/Wetland System	1.0 in / imp acre	60%	10
4.	Pocket Wetland	1.0 in / imp acre	40%	6
C.	**INFILTRATION (TRENCH OR BASIN)**			
1.	Infiltration Trench	0.5 in / imp acre	50%	8
2.	Infiltration Trench	1.0 in / imp acre	60%	10
3.	Infiltration Basin	0.5 in / imp acre	50%	8
4.	Infiltration Basin	1.0 in / imp acre	60%	10
D.	**FILTERING SYSTEMS**			
1.	Bioretention	1.0 in / imp acre	50%	8
2.	Surface Sand Filter	1.0 in / imp acre	50%	8
3.	Underground Sand Filter	1.0 in / imp acre	50%	8
4.	Perimeter Sand Filter	1.0 in / imp acre	50%	8
5.	Organic Filter	1.0 in / imp acre	50%	8
6.	Pocket Sand Filter	1.0 in / imp acre	40%	6
E.	**OPEN CHANNEL SYSTEMS**			
1.	Wet Swale (check dams)	1.0 in / imp acre	30%	4
2.	Dry Swale	1.0 in / imp acre	60%	10
3.	Biofilters	1.0 in / imp acre	30%	4
F.	**EXTENDED DRY DETENTION**			
1.	Timber Walls	1.0 in / imp acre	30%	4
2.	Dry ED with forebay	1.0 in / imp acre	30%	4
G.	**OPEN SPACE CONSERVATION EASEMENTS**			
1.	Accepts and treats stormwater runoff from the development site per design specification		0.15 per 1% of site area	
2.	Adjacent to a wetland, mature forest, or RPA		0.15 per 1% of site area	
3.	All other open space		0.10 per 1% of site area	

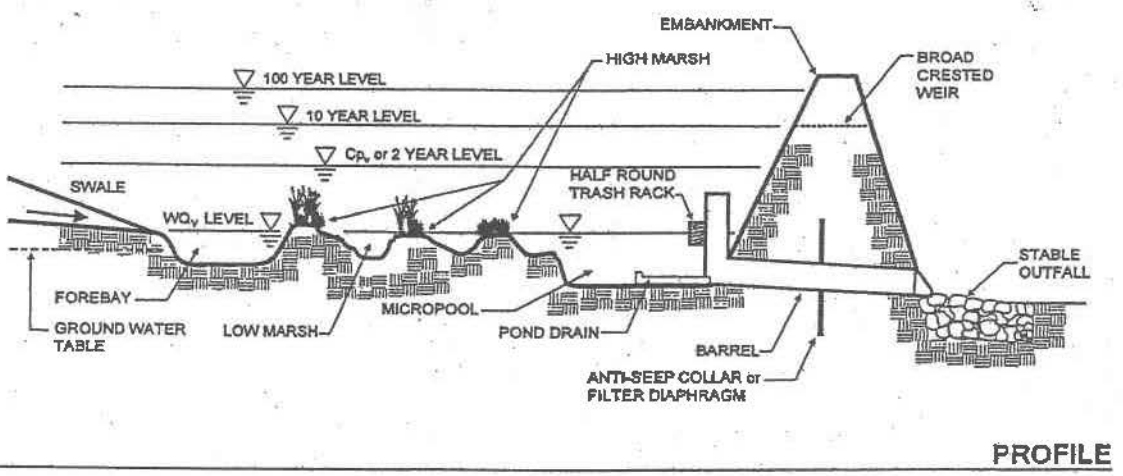
B-3	Figure 5 Example of a Pond/Wetland System	B-3



In this BMP, a deep permanent pool is placed before the shallow wetland.

B-4 | **Figure 6** Example of a Pocket Wetland | B-4





A high water table or groundwater interception helps maintain the shallow marsh pool in a pocket wetland.

Worksheet for BMP Point System

A. STRUCTURAL BMP POINT ALLOCATION Area = 24.0 ac.

BMP	BMP Points		Fraction of Site Served by BMP		Weighted BMP Points
B-3	10	x	(14.72 ac).613	=	6.13
B-4	6	x	(4.75 ac).198	=	1.19
		x		=	
		x		=	

TOTAL WEIGHTED STRUCTURAL BMP POINTS: 7.32

B. NATURAL OPEN SPACE CREDIT

Fraction of Site		Natural Open Space Credit		Points for Natural Open Space
	x	(0.1 per 1%)	=	
(4.30 ac) 17.92	x	.15 (0.15 per 1%)	=	2.69

TOTAL NATURAL OPEN SPACE CREDIT: 2.69

C. TOTAL WEIGHTED POINTS

7.32	+	2.69	=	10.01
Structural BMO Points		Natural Open Space Points		TOTAL

APPENDIX F
STORMWATER MANAGEMENT FACILITIES MAP

ENVIRONMENTAL IMPACT REPORT

FOR

JAMESTOWN SETTLEMENT: RIVERFRONT AMENITIES AND SHIPWRIGHT BUILDING

STATE PN: 425 - 16469

Prepared for:

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January 2002

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LIST OF FIGURES

1.0 PROJECT PURPOSE AND DESCRIPTION

The Jamestown-Yorktown Foundation (Foundation) proposes to continue improving their facilities at the Jamestown Settlement (Jamestown) in James City County, Virginia. Currently, a new theater, special exhibition hall, and exhibition gallery are under construction. The Foundation now proposes to renovate the waterfront area of Jamestown Settlement, which is known as the Riverfront. The development of the new facilities will include a new Riverfront Rest Area, Shipwright (maintenance) building, two amphitheater's, and an outdoor group area.

The purpose of the project is to better utilize the existing area for the public. The existing Riverfront area is of antiquated design that no longer meets the needs of the public. The proposed project entails demolishing the existing Shipwright building, restrooms, and sewage pump building. The existing Shipwright building consists of a dilapidated one-story building occupying approximately 1,500 square feet. The building was built in the 1970's and has concrete floors, wooden walls, and a tin roof. The building is used solely for maintenance purposes and is not seen by the public. The rest rooms are located adjacent to the existing shipwright building. This approximate 600 square foot facility was built in the 1990's. The restroom building is brick with a wooden shingled roof. The old sewage pump building, approximately 286 square feet, is a brick building built in the 1950's. Another brick building adjacent to the pump house is expected to be demolished. This brick building is currently unoccupied. Photographs of the exterior of the existing structures are included within Appendix A.

As area to known as the Riverfront Rest Area is proposed to be located along the visitor's path that leads from the entrance to Jamestown west to the waterfront. The proposed rest area will include a snack stand that is primarily vending machines, an open-air gift shop, restrooms, and a storage area. The proposed restrooms will be approximately 1,280 square feet while the combined gift shop and food service area will be approximately 1,065 square feet. Tables and bench seating will be built surrounding the shops to accommodate the rest area. To provide an aesthetic rest area the area will be landscaped with ornamental vegetation. These proposed facilities will be located around the existing pump station in areas where the existing facilities are currently located.

The proposed shipwright building is designed as a two-story structure with approximately 4,000 square feet on the first floor and 2,720 square feet on the second floor. This structure will be located approximately 60 feet north of rear of the buildings associated with the outdoor rest area. The building will be used for maintenance and storage and will not be accessible by the public. The first

floor will accommodate an indoor work area, office, and storage area. To provide additional workspace, an adjacent outdoor work area is also proposed. The second floor will include a loft area that is open to the first floor. The proposed ship maintenance building will result in an increase in impervious area of approximately 4,000 square feet. Currently the site for the proposed structure is cleared with a few trees and is used to store wooden planks. Due to the increase in size and capacity of the shipwright building, fifteen parking spaces have been added to the existing parking area. This area is currently cleared due to the existing parking facility.

Two amphitheaters are proposed to be located near natural areas to function as educational tools. One amphitheater, expected to seat approximately 75 to 100 people, will overlook a forested wetland. The second amphitheater is smaller and expected to seat approximately 50 to 125 people. This amphitheater will be located north of the Riverfront area in an existing wooded area. To provide an observation area along the waterfront, an open space area is also being provided.

2.0 AFFECTED ENVIRONMENT

The project site is located within the southern portion of James City County, east of Route 31 (Jamestown Road) and along the James River (Figure 2-1). This area is located in the middle Atlantic Coastal Plain which stretches from Massachusetts to Florida and is characterized by little topographic relief extending from the Atlantic Ocean west to the fall line. The topography of the project area is nearly level or gently sloping toward the James River (Figure 2-2). Adjacent properties consist of the Jamestown Fort located to the east, the James River to the west, and a wooded area to the north. The existing conditions on the project site were constructed in the late 1950's when the Jamestown Settlement was first erected as a tourist attraction and educational facility. The Jamestown Settlement is a living history museum recalling the early days of the Jamestown Colony. Adjacent to the existing Riverfront area are several interpretive centers which consist of a mock colonial village, a mock Indian village and reproductions of the three ships that initially landed at Jamestown in 1607.

2.4 MILES 1.2 0 MILES 2.4 MILES

SCALE: 1 INCH = 2.4 MILES

SOURCE: VIRGINIA ATLAS AND GAZETTEER, DeLORME MAPPING CO., 1995.

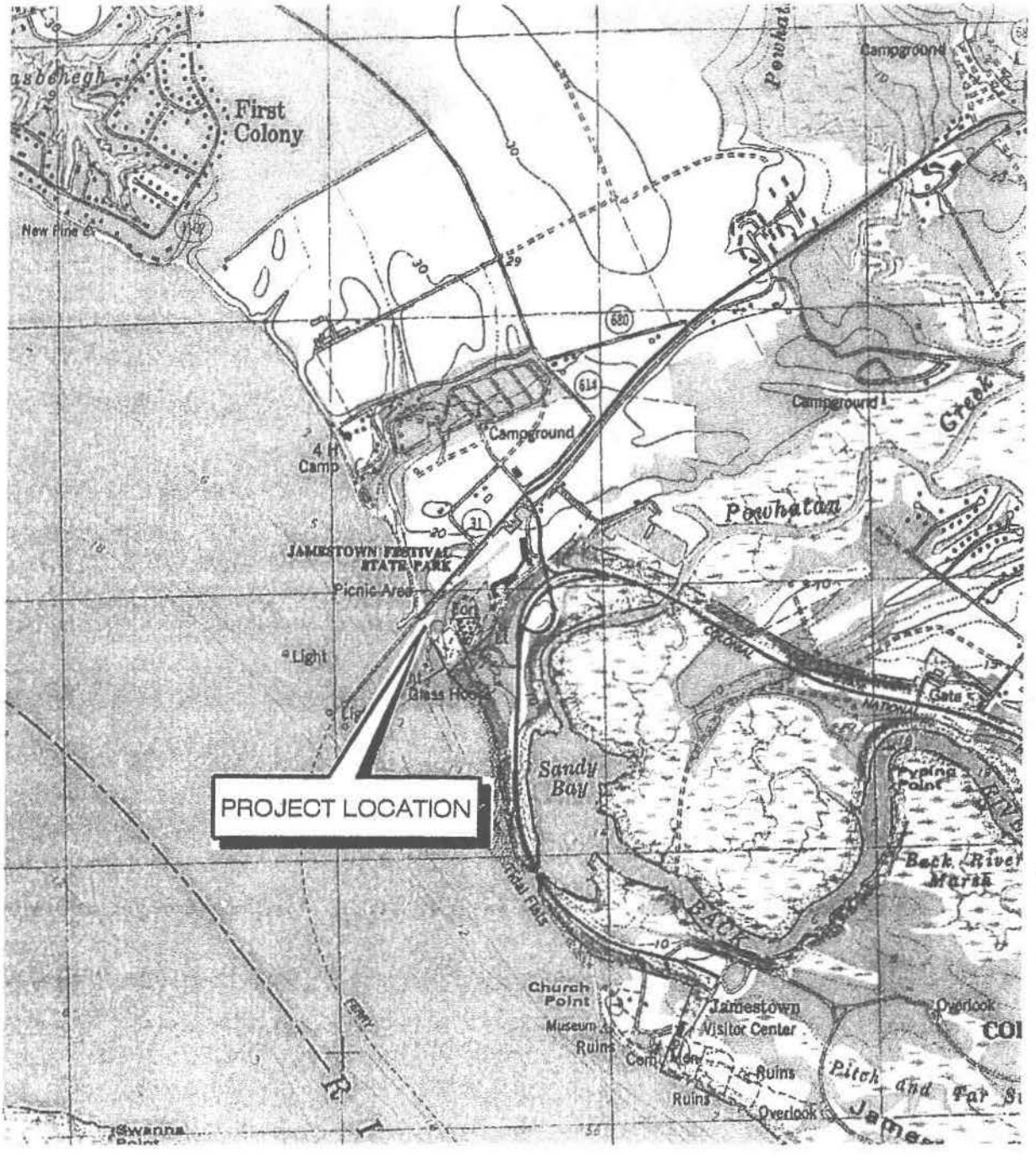
WILLIAMSBURG ENVIRONMENTAL GROUP, INC.

FIGURE 2-1

PROJECT VICINITY MAP

JAMESTOWN SETTLEMENT

JAMES CITY CO., VA	AUGUST 2001



2000' 1000' 0' 2000'

SCALE: 1 INCH = 2000 FEET

LATITUDE: 37°13'21"
LONGITUDE: 76°47'15"

SOURCE: USGS 7.5 MINUTE SERIES TOPOGRAPHIC MAP, SURRY, VA QUADRANGLE, 1983.

WILLIAMSBURG ENVIRONMENTAL GROUP, INC.

FIGURE 2-2

PROJECT LOCATION MAP

JAMESTOWN SETTLEMENT

JAMES CITY CO., VA	AUGUST 2001

3.0 IMPACTS OF THE PROJECT

The following section describes the direct and indirect environmental impacts resulting from the proposed demolition and subsequent construction of new buildings in the same location.

3.1 ENDANGERED, THREATENED, OR RARE PLANTS, ANIMALS OR INSECTS

The Virginia Department of Conservation and Recreation's Division of Natural Heritage (DCR) and the Virginia Department of Agriculture and Consumer Services were contacted to obtain information regarding known occurrences of endangered, threatened, or rare plants, animals or insects at or near the project site. In addition, the Virginia Department of Agriculture and Consumer Services is under a memorandum of agreement and whose comments are represented by DCR. Based on information received from DCR, no adverse impacts are expected as a result of the proposed project (see correspondence within Appendix B).

3.2 STORAGE TANKS

One aboveground storage tank is currently located on the subject property east of the existing Riverfront rest area. The tank is located inside the old pump house that is proposed for demolition and was used for sewage purposes. This tank will be removed during the demolition of the pump house. No storage tanks are proposed to be utilized in association with the new facilities.

3.3 HISTORICAL OR ARCHAEOLOGICAL SITES

Jamestown is rich in historical significance. The island of Jamestown, which houses the Colonial National Historic Park, is located southeast of the project site and is the site of the first permanent English settlement established in 1607. The remains of a glasshouse built in 1608 still exist within the National Park and archaeologists have recently unearthed the foundations of the original James Fort.

The project site is also located within the limits of the Governor's Land Archaeological District. This Archaeological District is on the National Register of Historic Places. It is roughly bounded on the southeast and east by Powhatan Creek, on the northeast by a tributary of Powhatan Creek, on the northwest by the boundaries of the National Park Service property, and on the west by the First Colony subdivision and the James River. Located within this archaeological district is a concentration of known structure sites dating from the seventeenth and eighteenth centuries. These

structure sites are expected to yield information important to the understanding of life in Virginia's first century of colonization. The nearest historic standing structure is the Amblers on the James site located approximately 2,000 feet northwest of the project site.

The demolition of the existing structures and construction of the new facilities should have no impact on the known historic and archaeological resources of the area. The new facilities will not impact known archaeological sites nor disrupt the view-shed of existing historic structures or known archaeological sites.

3.4 WILDLIFE

Wildlife is dependent upon the habitat in which they thrive. The major vegetation communities within the project site include an open grass area, a wetland area, and upland forest. Due to the presence of the existing structures, habitat for specific wildlife species such as deer is limited. The adjacent properties do not contain significant amounts of wildlife species due to the presence of the development of Jamestown and the number of visitors drawn throughout the area throughout the year.

3.5 VEGETATION

Vegetation on the project site consists of various ornamental trees, shrubs and herbaceous plantings, wetland species and forest. Mature upland forest is present on the project site and includes willow oak (*Quercus phellos*), northern red oak (*Quercus rubra*), sweetgum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), and loblolly pine (*Pinus taeda*). Small areas of partially wooded area will be removed with the construction of the new buildings.

The dominant species found in the nontidal wetland area located within the limits of the project site include willow oak (*Quercus phellos*), cottonwood (*Populus deltoides*), red maple (*Acer rubrum*), sweet gum (*Liquidambar styraciflua*), highbush blueberry (*Vaccinium corybosum*), netted chain fern (*Woodwardia areolata*), and southern waxy sedge (*Carex glaucescens*). No wetlands are expected to be impacted within the limits of this approximate 0.4 acre area.

3.6 TIDAL AND NONTIDAL WETLANDS

A nontidal wetland, approximately 0.04 acres, associated with the James River is present within the project site between the existing amphitheater and the Riverfront rest area. The wetlands were delineated by the Environmental Specialties Group, Inc. in December 2000 according to the methodology outlined in the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual (TR Y-87-1). The wetlands will be not be impacted, alternatively the wetlands will be enhanced in an effort to support increased vegetation and wildlife. The proposed demolition of the existing structures and construction of the new facility will not cause impacts to the nontidal or tidal wetlands.

3.7 STREAMS, RIVERS, LAKES, AND PONDS ON OR NEAR THE SITE

The James River is present approximately 120 feet west of the project site. A path from the project site extends to a dock that overlooks the James River. The nearest stream is Powhatan Creek located approximately 1,100 feet south-southeast of the project site. The proposed project will not cause impacts to these aquatic resources.

3.8 WATERSHEDS OF SIGNIFICANT IMPORTANCE FOR PUBLIC WATER SUPPLIES

The project site is located entirely within the James River drainage basin. The James River is not used as a public water supply source in the area of the project site. All potable water is provided by James City Service Authority. The demolition of the existing facility and construction of the proposed facility will have no expected affect on sensitive watersheds or public water supplies.

3.9 CHESAPEAKE BAY RESOURCE PROTECTION AREA

The project site is located adjacent to the Resource Protection Area (RPA) of the James River. The proposed project conditions will not occur within the RPA line, with exception to the group area that will be located along the path to the pier. This portion of the RPA is currently cleared and therefore the proposed bench seating will not adversely affect the RPA area. James City County (JCC) classifies all land area outside of RPA's as Resource Management Area (RMA) features, which includes the subject property.

The demolition of the existing structure and construction of the proposed facility will be accomplished in accordance with the JCC reviewed and approved plans. The proposed action will, therefore, have a minimal affect on the Chesapeake Bay Resource Protection Areas.

3.10 100-YEAR FLOODPLAIN

A portion of the subject site is located within the James River 100-year flood hazard zone "AE" (elevation 8.5 feet) per the Federal Emergency Management Act (FEMA), Flood Insurance Map, Community Panel No. 510201-0040B, dated January 6, 1991. There is no construction proposed within this floodzone. All demolition and subsequent construction will be completed in accordance with the JCC reviewed and approved plans.

3.11 GROUNDWATER RESOURCES

Groundwater is an important resource of the James-York Peninsula that historically has provided a major part of the Peninsula's freshwater supply. Sediment of the James-York Peninsula forms a layered sequence of aquifers and intervening confining units. One water-table aquifer, seven confined aquifers, and intervening confining units have been identified in the area. The aquifers from youngest to oldest are: the Columbia, the only aquifer which is confined throughout its entire extent; the Yorktown-Eastover; the Chickahominy-Piney Point, the Aquia, and the upper, middle, and lower Potomac aquifers. Groundwater is withdrawn primarily from the Chickahominy-Piney Point and upper and middle Potomac aquifers in the central portion of the James-York Peninsula. The Chickahominy-Piney Point aquifer contains water with high concentrations of chloride, sodium, dissolved solids, and fluoride. The middle and upper Potomac aquifers contain water with elevated concentrations of chloride, sodium, and dissolved solids and are the aquifers most often used for potable water supplies in this region.

The Jamestown-Yorktown Foundation currently utilizes JCC waterlines for all potable water. Therefore, the construction of the proposed facility will have no impact on groundwater resources.

3.12 PARKS AND RECREATION AREAS

The subject property is located within the existing Jamestown Settlement, which is a museum complex funded by the Commonwealth of Virginia. Jamestown is located north of the Colonial National Historic Park and south of the Jamestown Festival State Park. Due to the locations of these parks, no adverse impacts are expected as a result of the proposed construction.

3.13 IMPORTANT NATURAL AREAS

The Powhatan Creek natural area is located within 5 miles of the project area. This is one of the most important natural areas on the Virginia Peninsula. This project will not adversely affect the Powhatan Creek natural area.

3.14 IMPORTANT SCENERY AND SCENIC RESOURCES

The project area is located at the southern terminus of the Colonial National Historical Parkway that traverses the Peninsula from Yorktown through Williamsburg to Jamestown Island. The existing and proposed facilities are, and will continue to be, shielded from the Parkway by the stand of mature trees located between Jamestown and the Colonial Parkway. Therefore, the project is not expected to have a negative effect on the scenic resources of the area.

3.15 AIR QUALITY

The project site is located in James City County, within the Virginia Department of Environmental Quality Region 6. The region consists of counties in the James-York Peninsula and southeast Virginia. Ambient air quality is monitored by the DEQ at several locations within Region 6, for comparison to the National Ambient Air Quality Standards (NAAQS) for: sulfur oxides, nitrogen oxides, suspended particulates, lead, ozone, and carbon monoxide (CO). The NAAQS, as promulgated by the U. S. Environmental Protection Agency (EPA), provide a basis for determining how healthy the ambient air is in a particular region. Region 6 is currently listed as an attainment area.

No long-term impacts are anticipated on the local and regional air quality as a result of the proposed action. A very slight increase in Total Suspended Particulates may result from fugitive dust generated by construction activities; however, due to the limited surface area disturbance and given the physical characteristics of the soil, any impact would be negligible. This development will not cause a significant increase in traffic to the area, or an increase in the number of gasoline-powered vehicles in the area.

3.16 SOLID WASTE DISPOSAL FACILITIES

Several forms of solid waste and wastewater will be produced onsite. Each will be handled in a specific manner.

All construction waste material not designated for re-use will become the property of the contractor and will be removed from the site. Solid waste (i.e., paper, wood) generated at the facility will be carried to a landfill by a commercial waste hauling company. No solid waste will be disposed of or burned onsite.

Sewage generated by the site during the construction and operation of the Riverfront Rest Area and Shipwright building will be handled by the Hampton Roads Sanitation District wastewater treatment plant. It is anticipated that the wastewater generated during the operation of the new facility will be approximately the same or less than the amount currently used. This is a result of the installation of more water efficient fixtures. The facilities will be connected to the sewer force main by way of an eight-inch sewer main. The wastewater utilities will conform to the requirements of the Virginia Sewerage Regulations.

Any lead based paint and asbestos containing materials will be removed and disposed of during demolition in a manner consistent with applicable state and federal regulations. No known hazardous materials will be generated by the construction or operation of the new facility.

3.17 POTABLE WATER SUPPLIES

Potable water is currently supplied by the James City Service Authority.

4.0 ALTERNATIVES ANALYSIS

Three alternatives for providing the needed Riverfront Rest Area, Shipwright building, and outdoor entertainment and educational areas at Jamestown include: 1.) utilizing the existing facilities; 2.) renovating the existing facilities; and 3.) demolishing the existing facilities and constructing new facilities.

4.1 NO ACTION ALTERNATIVE

Due to the age of the existing shipwright building, it is dilapidated and near collapse. The current Riverfront Rest Area consists only of restrooms and a water fountain. The facilities are too small to accommodate the reception of the volume of individuals and groups that currently visit the Jamestown Settlement. In addition, there is currently to sufficient group area for educational programs planned at Jamestown Settlement. The No Action Alternative will not accomplish the project purpose, which is to better utilize the existing area by providing better-quality Riverfront facilities and a Shipwright building. Due to the layout, age, and location of the existing buildings, they are of limited value to other state agencies, as well.

4.2 RENOVATION OF THE EXISTING FACILITY

In order to renovate the existing facility, the buildings would need to be completely gutted in order to remove all asbestos-containing materials and lead-based paint materials. Renovation of the facility would not solve the problem of insufficient public space. In addition, the Shipwright building the structure is not constructed to support a multi-level building. Renovation of the existing facilities would also not provide additional utility to other state agencies. There is no parking to provide for additional staff from another institution and the location of the building, away from centers of urban activity, makes access by others inconvenient. Cost analysis for renovation also indicates that renovation will cost approximately the same as constructing a new facility, while not reaching the necessary goals of the facility upgrade.

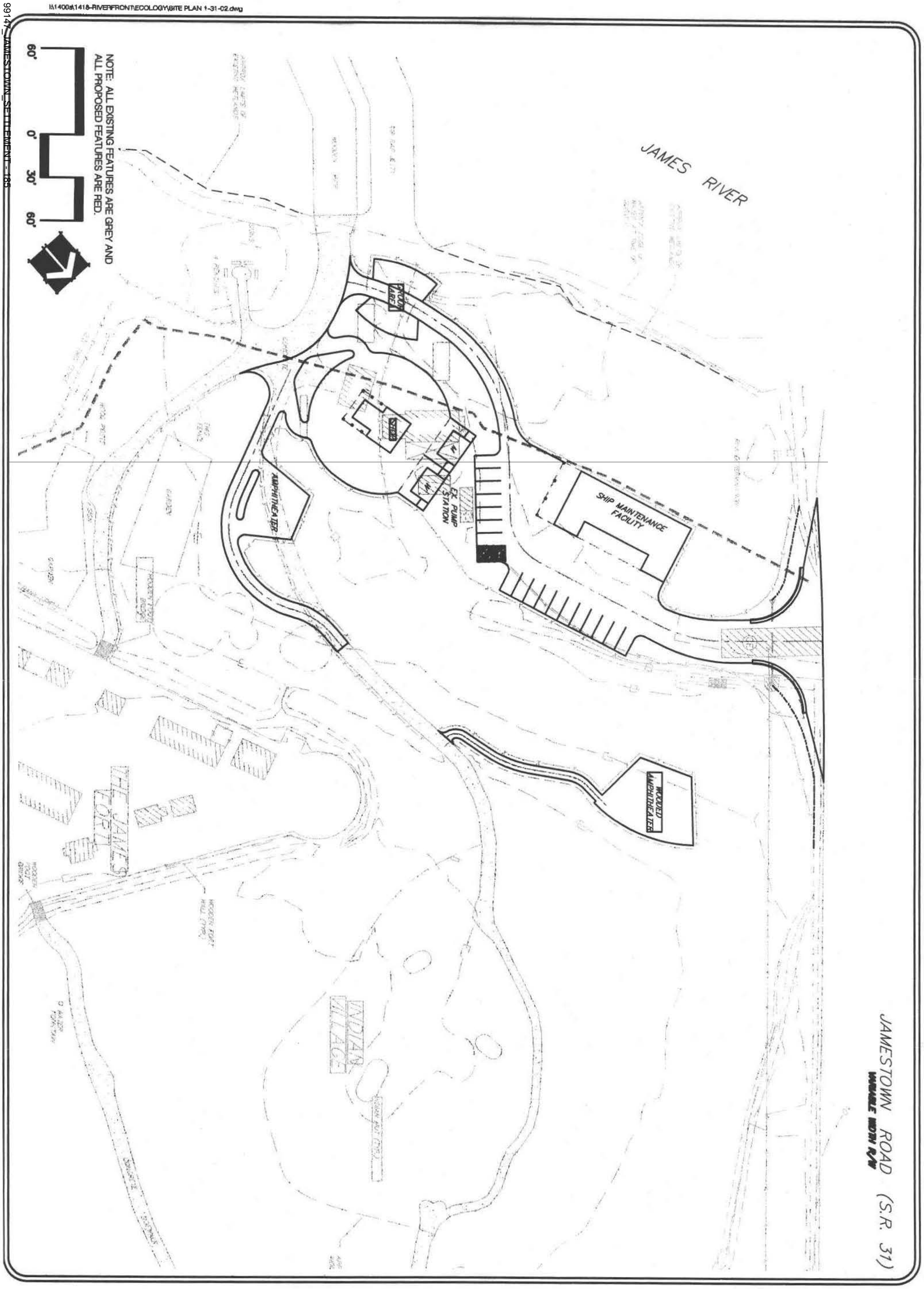
4.3 SELECTED ALTERNATIVE, DEMOLITION AND NEW CONSTRUCTION

A new facility at the existing project site will meet the project goals of providing adequate space to accommodate the needs of the individuals and groups that currently visit and are projected to visit the Jamestown Settlement. In addition, the new Riverfront rest area has been designed to better

serve the needs of existing and future patrons. A conceptual site plan for the amphitheaters, group area, vending and shop complex, and Shipwright building facility is shown in Figure 4-1. In addition, detailed plans supplied by the architect, Guernsey & Tingle, are included in Map Pocket A.

I:\1400s\1418-RIVERFRONT\ECOLOGY\SITE PLAN 1-31-02.dwg

9914_JAMESTOWN_SETTLEMENT_185



DATE: JANUARY 31, 2001

JOB NUMBER: 1434

SCALE: 1 INCH = 60 FEET

SOURCE: BASE MAP PROVIDED BY RICKMOND

FIGURE 4-1
SITE PLAN
JAMESTOWN RIVERFRONT
JAMES CITY COUNTY, VIRGINIA

WILLIAMSBURG ENVIRONMENTAL GROUP, INC.

3000 Ewell Circle
Williamsburg, Virginia 23188
(757) 220-0809

7325 Beaufont Springs Drive, Suite 100
Richmond, Virginia 23225
(804) 267-3474

45000 Manekin Plaza, Suite 150
Sterling, Virginia 20166
(703) 406-1390

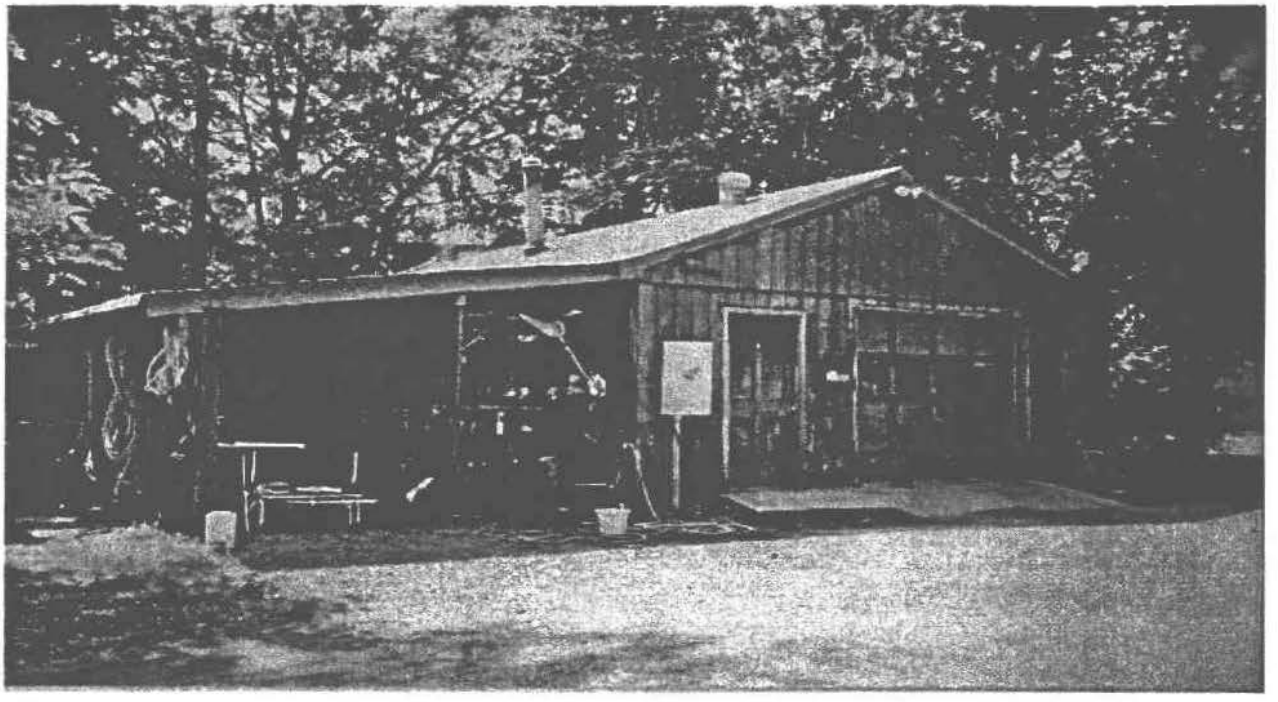
Environmental Consultants

5.0 IRREVERSIBLE ENVIRONMENTAL CHANGES

Every effort has been made to blend the proposed facility with the other Jamestown structures by utilizing similar building materials and designing a conservative structure that will not detract from the other museum exhibits. The new structure, however, will irreversibly change the scenery at the project site. Due to the chosen design and the buildings' placement outside the area used for public consumption, the irreversible environmental change will be minimal.

APPENDIX A

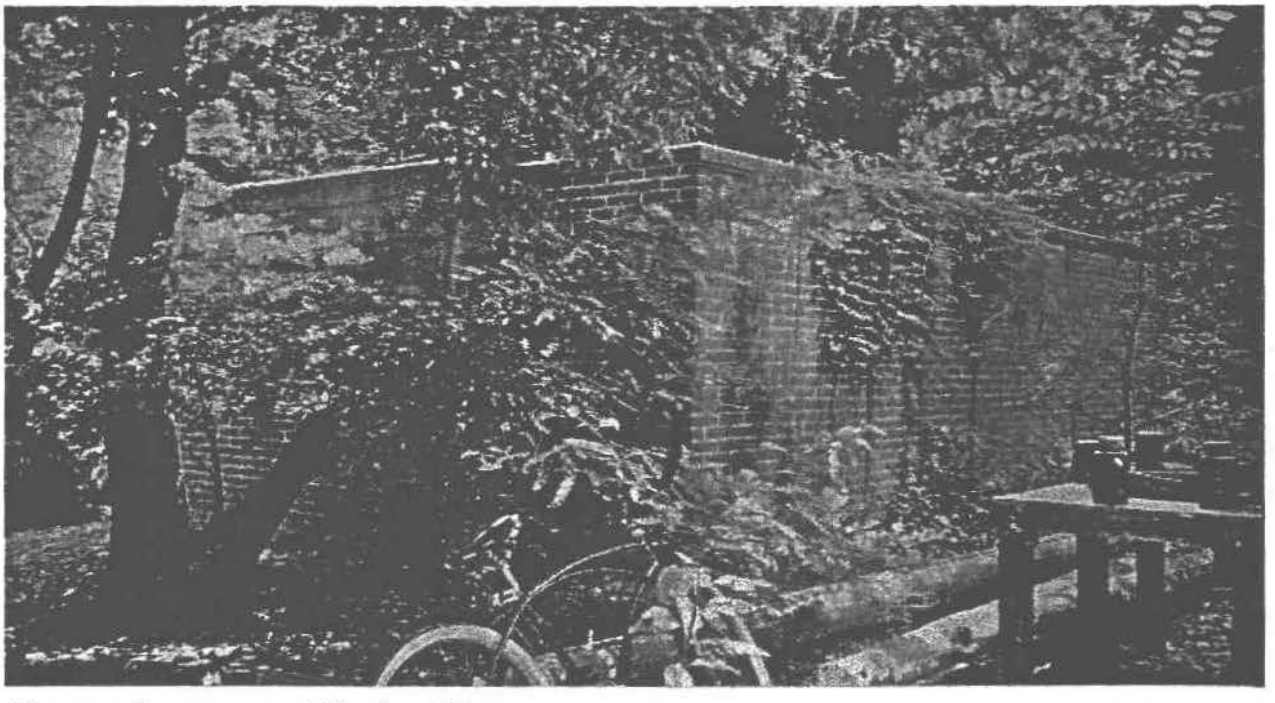
Exterior Photographs of the Existing Conditions



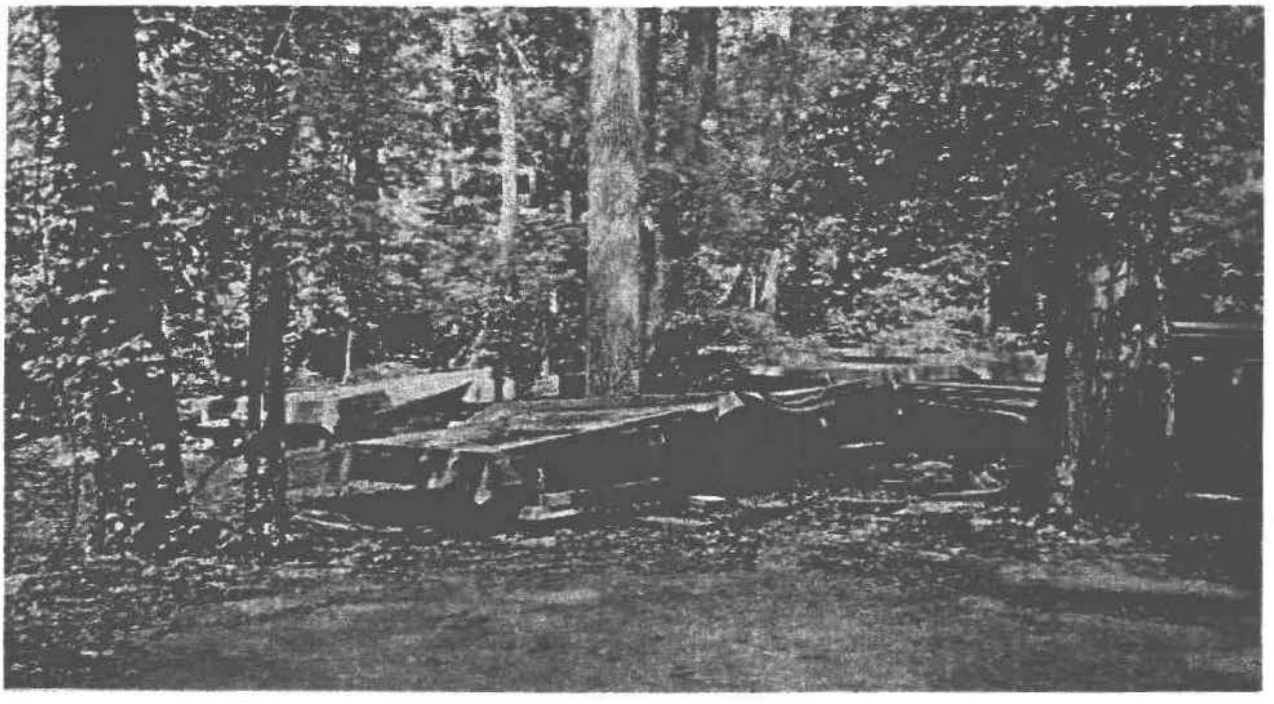
The existing Shipwright building. This will be demolished.

The existing restroom, these will be demolished to make room for new and updated facilities.

The existing pump house that is to remain.

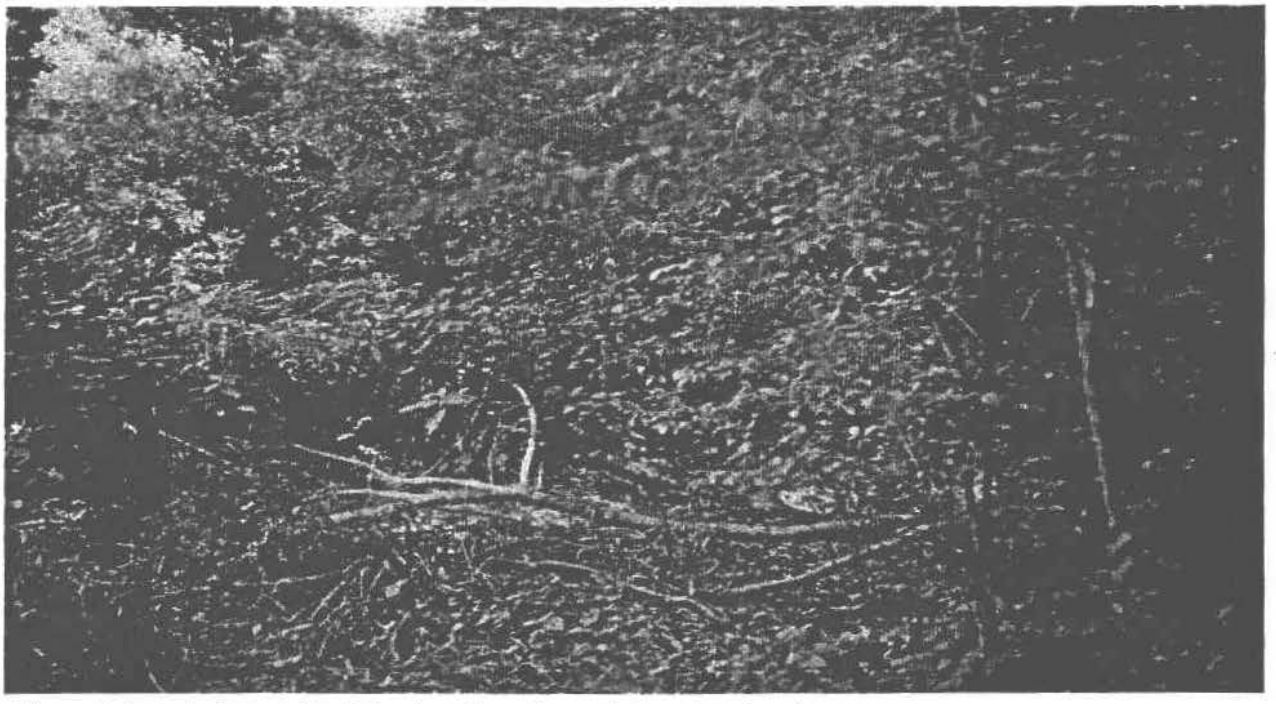


The pump house proposed for demolition.



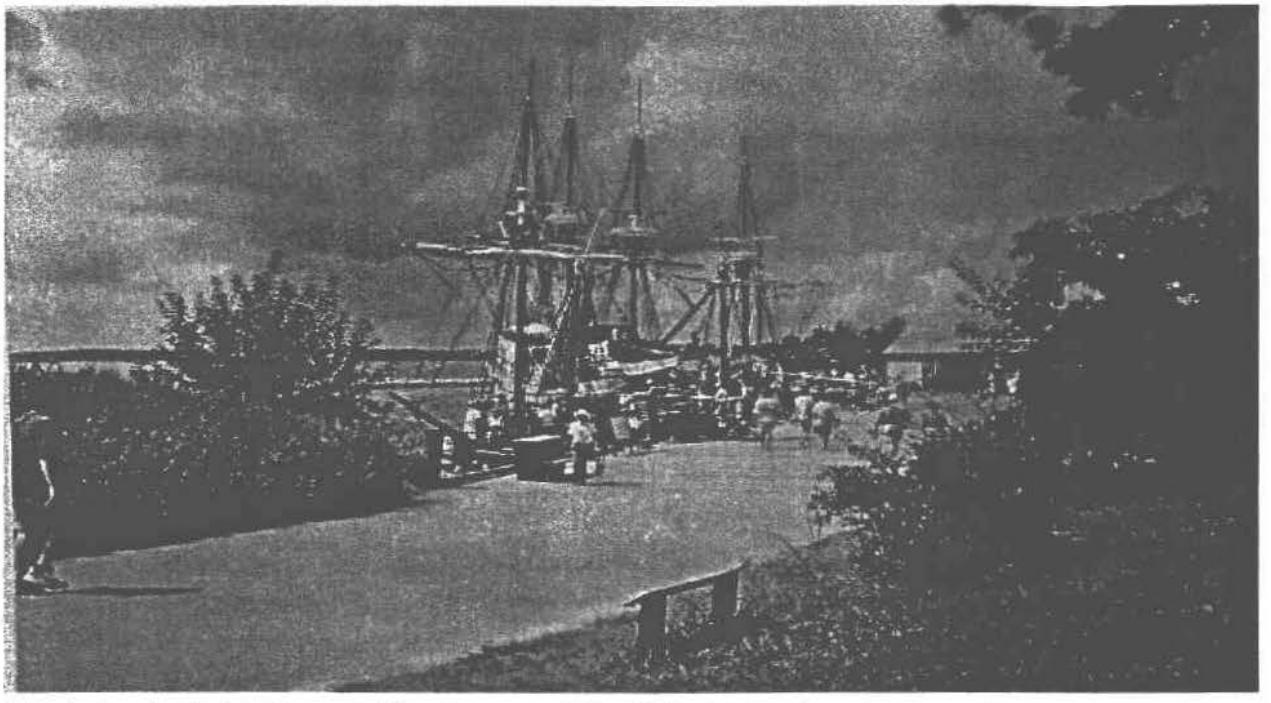
The area proposed for the new Shipwright building.

The proposed amphitheater site adjacent to the existing forested wetland.

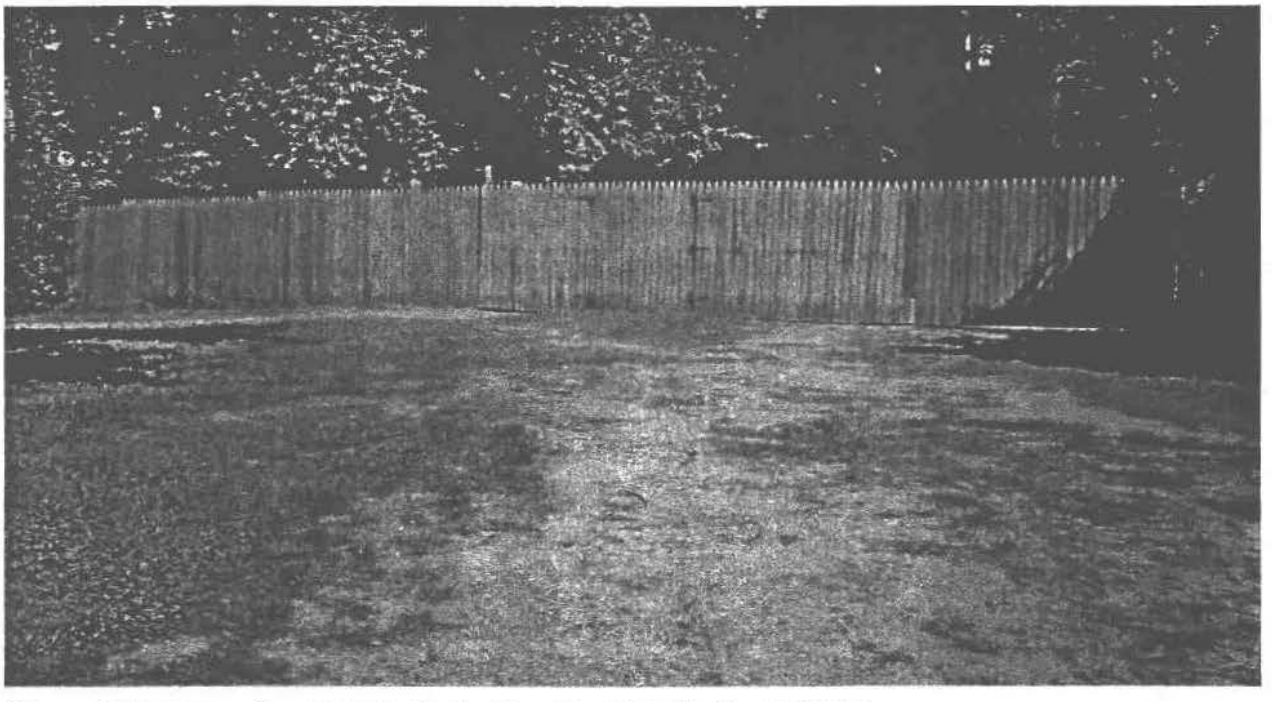


View of the existing wetland that is to be enhanced for educational purposes.

The proposed amphitheater site for the amphitheater to be located in a forested area.



The dock and colonial ships at the Riverfront area. This will be the view from the proposed group area.



View of the proposed group area site that is adjacent to the James River.

APPENDIX B

Agency Correspondence

ENVIRONMENTAL IMPACT REPORT
JAMESTOWN SETTLEMENT
BOAT-BUILDING STRUCTURE

Project # 425-01-02

James City County, Virginia

Prepared for:

Jamestown-Yorktown Foundation
Facilities Management
David Wolfe Kent
Rt. 313 and Rt. 359
Williamsburg, Virginia 23185
757.253.4883
757.253.3299 (facsimile)

Prepared by:

Williamsburg Environmental Group, Inc.
3000 Easter Circle
Williamsburg, Virginia 23188
(757) 220-6869

September 7, 2001

TABLE OF CONTENTS

LIST OF FIGURES

1.0 PROJECT PURPOSE AND DESCRIPTION

The Jamestown-Yorktown Foundation (Foundation) proposes to continue improving their facilities at the Jamestown Settlement in James City County, Virginia. Currently, a new theater, special exhibition hall, and exhibition gallery are under construction. The Foundation now proposes to renovate the Riverfront area of the Jamestown Settlement. The proposed development will include a 17th century boat-building shed. The wooden structure will be open-aired to allow visitors to watch colonial style small wooden boat construction.

The purpose of the project is to better utilize the existing area for the public. The boat-building shed will enhance the Riverfront area for Jamestown visitors. The existing conditions at the project site consist of a cleared grass area adjacent to the James River. Photographs of the proposed project site and the surrounding conditions of the project area are included within Appendix A.

The proposed boat-building shed will be located along the visitors path that leads to the pier along the James River where the colonial ships are docked. The structure will be approximately 41 feet wide and 36-1/2 feet long with clapboard roofing and earthen floors. There will be no walls on this building except for a small storage area which will be approximately 117.4 square feet, with brick flooring and clapboard siding. The elevation of the wooden posts will be approximately 8 feet high with concrete bases. The elevation to the highest point on the roof will be approximately 22 feet. The impervious area associated with the roofing of the building is approximately 1500 square feet. A conceptual site plan for placement of the proposed building is shown in Figure 1-1. Figure 1-2 shows the conceptual building plan.

I:\1400s\1433-JAMESTOWN BOAT\SITE PLAN.dwg

99147_JAMESTOWN_SETTLEMENT - 198

DATE: SEPTEMBER 10, 2001

JOB NUMBER: 1433

SCALE: 1 INCH = 100 FEET

SOURCE: BASE MAP PROVIDED BY RICKMOND

FIGURE 1-1
SITE PLAN
JAMESTOWN BOAT BUILDING SHED
JAMES CITY COUNTY, VIRGINIA

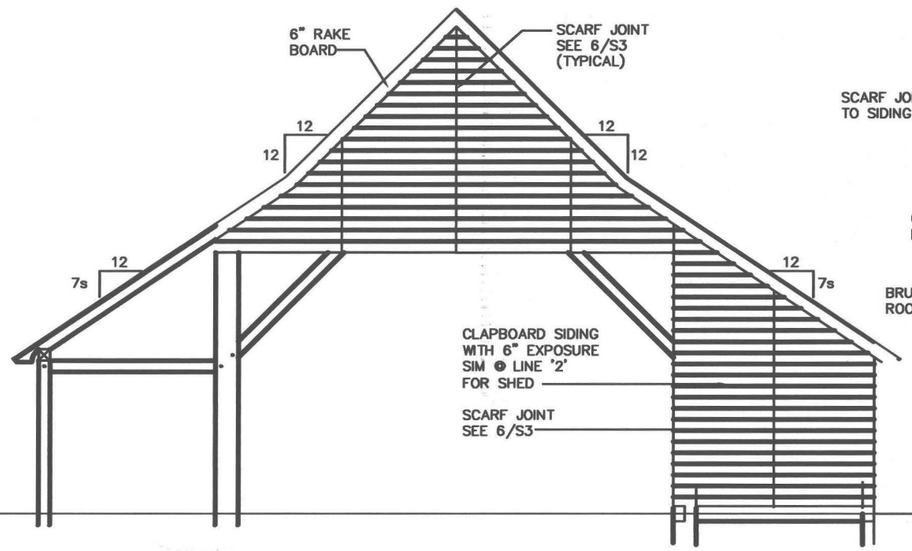
WILLIAMSBURG ENVIRONMENTAL GROUP, INC.

3000 Easter Circle
Williamsburg, Virginia 23188
(757) 220-6869

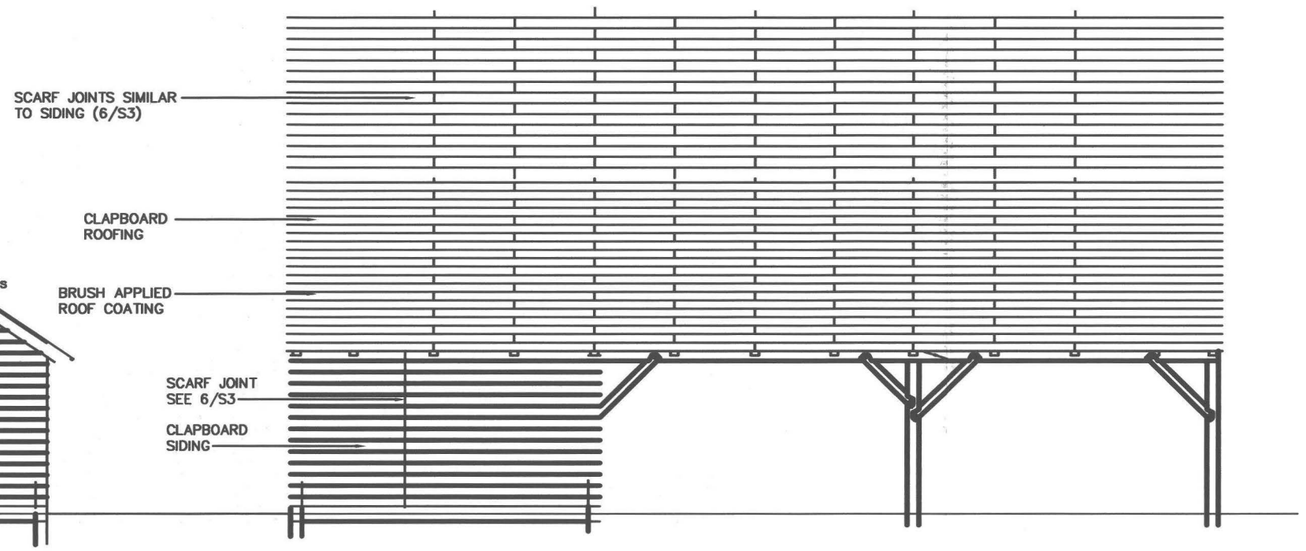
7325 Beaufont Springs Drive, Suite 100
Richmond, Virginia 23225
(804) 267-3474

46030 Manekin Plaza, Suite 160
Sterling, Virginia 20166
(703) 406-1390

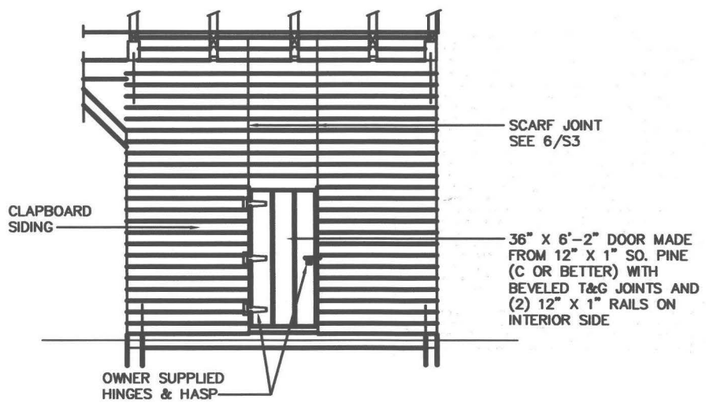
Environmental Consultants



GABLE END ELEVATION



SIDE ELEVATION



INTERIOR EVEVATION

NOT TO SCALE

WILLIAMSBURG ENVIRONMENTAL GROUP, INC.
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3000 Easter Circle
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(757) 220-6869
7325 Beaufont Springs Drive, Suite 100
Richmond, Virginia 23225
(804) 267-3474
46030 Manekin Plaza, Suite 160
Sterling, Virginia 20166
(703) 406-1390

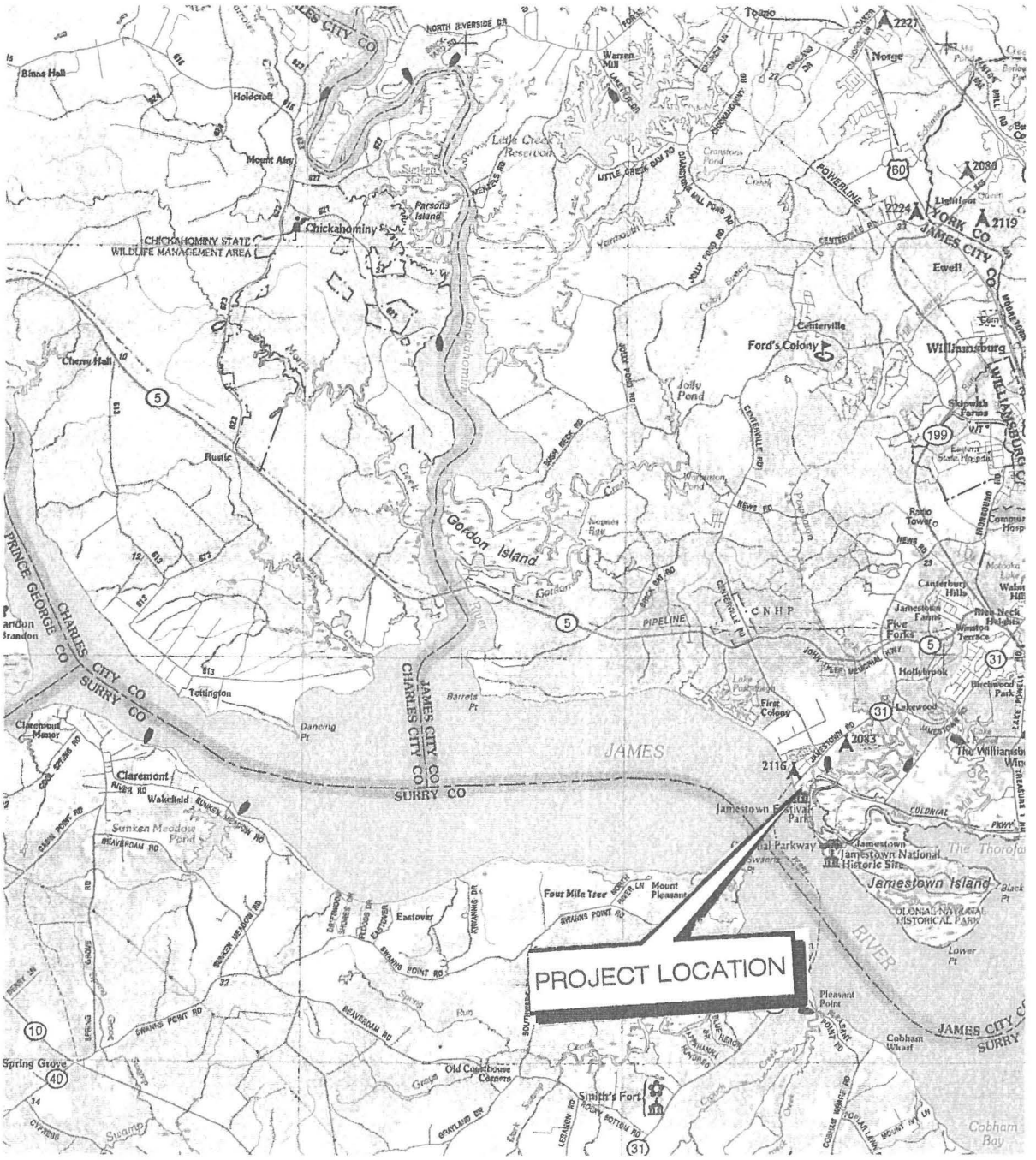
FIGURE 1-2
CONCEPTUAL BUILDING PLAN
JAMESTOWN BOAT BUILDING SHED
JAMES CITY COUNTY, VIRGINIA

DATE: SEPTEMBER 10, 2001
JOB NUMBER: 1433
SCALE: NOT TO SCALE
SOURCE: BASE MAP PROVIDED BY RICKMOND

I:\1400s\1433-JAMESTOWN BOAT\Boatshed.dwg

2.0 AFFECTED ENVIRONMENT

The project site is located within the central portion of James City County, east of Route 31, and along the James River (Figure 2-1). This area is located in the middle Atlantic Coastal Plain which stretches from Massachusetts to Florida and is characterized by little topographic relief extending from the Atlantic Ocean west to the fall line. The topography of the project area is nearly level or gently sloping towards the James River (Figure 2-2). The Jamestown Settlement was first erected in the late 1950's as a tourist attraction and educational facility. The Jamestown Settlement is currently a living history museum recalling the early days of the Jamestown Colony. Adjacent to the existing Riverfront area are several interpretive centers which consist of a mock Colonial village, a mock Indian village, and reproductions of the three ships which initially landed at Jamestown in 1607. Adjacent properties to the project area consist of James Fort located to the northeast, the James River and a wooded area to the west, and the Riverfront visitor's area to the south. The existing conditions on the project site consist of a cleared fallow field. No structures will be demolished in the construction of the boat-building shed.



2.4 MILES 1.2 0 MILES 2.4 MILES

SCALE: 1 INCH = 2.4 MILES

SOURCE: VIRGINIA ATLAS AND GAZETTEER, DeLORME MAPPING CO., 1995.

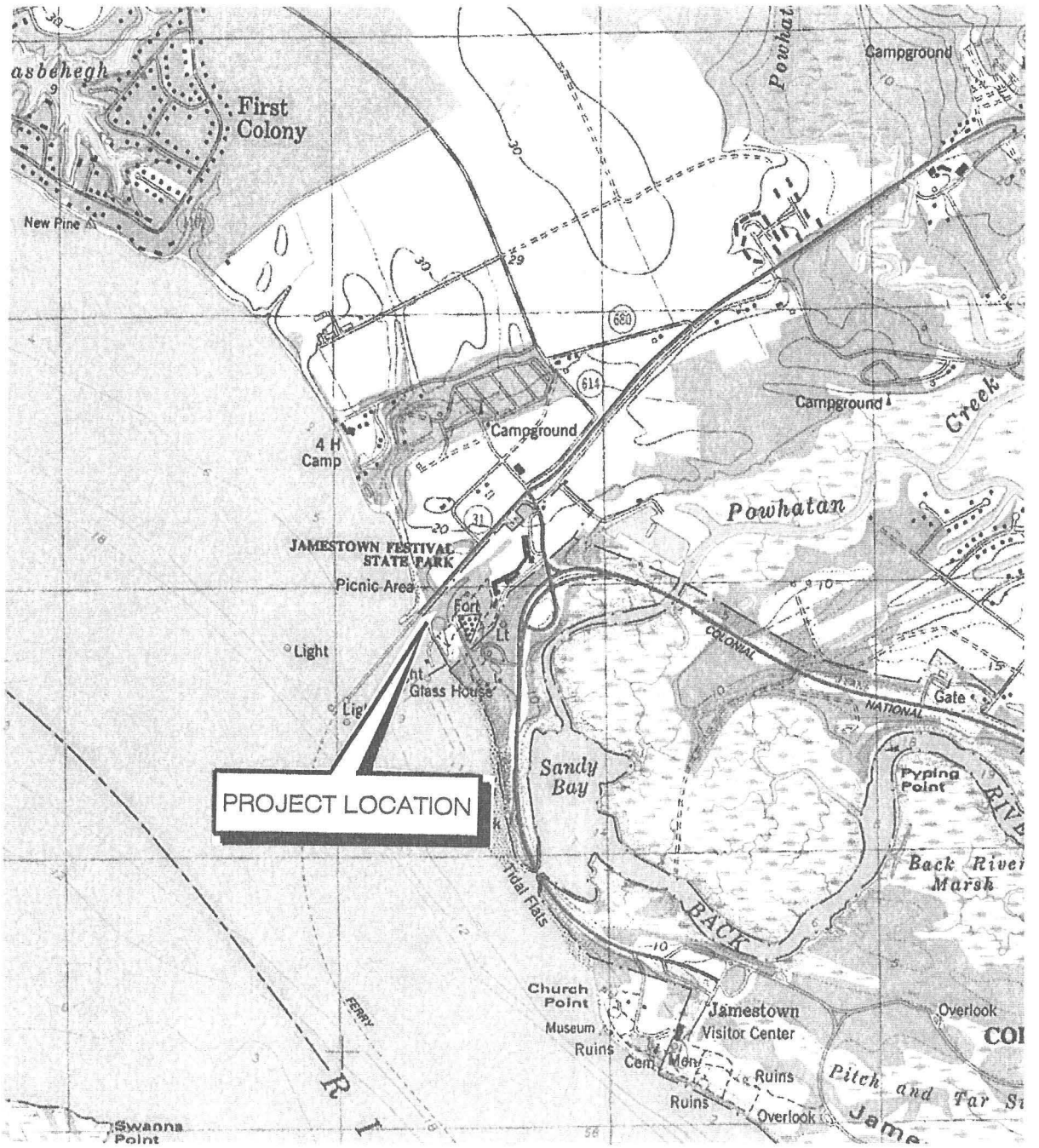
WILLIAMSBURG ENVIRONMENTAL GROUP, INC.

FIGURE 2-1

PROJECT VICINITY MAP

JAMESTOWN BOAT BUILDING SHED

JAMES CITY CO., VA	SEPTEMBER 2001



2000' 1000' 0' 2000'

SCALE: 1 INCH = 2000 FEET

LATITUDE: 37°13'21"
LONGITUDE: 76°47'15"

SOURCE: USGS 7.5 MINUTE SERIES TOPOGRAPHIC MAP, SURRY, VA QUADRANGLE, 1983.

WILLIAMSBURG ENVIRONMENTAL GROUP, INC.

FIGURE 2-2

PROJECT LOCATION MAP

JAMESTOWN BOAT BUILDING SHED

JAMES CITY CO., VA | SEPTEMBER 2001

3.0 IMPACTS OF THE PROJECT

The following sections describe the direct and indirect environmental impacts of the proposed construction of the new building in the Riverfront area in Jamestown Settlement.

3.1 ENDANGERED, THREATENED, OR RARE PLANTS, ANIMALS OR INSECTS

The Virginia Department of Conservation and Recreation's Division of Natural Heritage was contacted to obtain information regarding known occurrences of threatened or endangered rare plants, animals, or insects at or near the project site (see correspondence within Appendix B). In addition, the Virginia Department of Agriculture and Consumer Services is under a memorandum of agreement and whose comments are represented by DCR. According to correspondence received from DCR, there are no adverse impacts expected as a result of the proposed project.

3.2 STORAGE TANKS

No storage tanks are proposed or are expected to be utilized in association with the new boat-building shed or its construction.

3.3 HISTORICAL OR ARCHAEOLOGICAL SITES

Jamestown is rich in historical significance. The project site is located northwest of the Jamestown-Colonial National Historical Park, which is a federally owned property. The island of Jamestown, located southeast of the project site, is the site of the first permanent English settlement established in 1607. The remains of a glasshouse built in 1608 exist within the National Park and archaeologists have recently unearthed the foundations of the original James Fort.

The project site is also located within the boundaries of the Governor's Land Archaeological District. This Archaeological District is on the National Register of Historic Places. It is roughly bounded on the southeast and east by Powhatan Creek, on the northeast by a tributary of Powhatan Creek, on the northwest by the boundaries of the National Park Service property, and on the west by the First Colony subdivision and the James River. Within this archaeological district is located a concentration of known structure sites dating from the

seventeenth and eighteenth centuries. These structure sites are expected to yield information important to the understanding of life in Virginia's first century of colonization. The nearest historic standing structure is the Amblers on the James site, located approximately 2,000 feet northwest of the project site.

The construction of the new structure should have no impact on the historic and archaeological resources of the area. The new facility will not impact known archaeological sites nor disrupt the view-shed of existing historic structures or known archaeological sites.

3.4 WILDLIFE

Wildlife is dependent upon the habitat in which they thrive. The major vegetation community within the project site includes an open grass area. Due to the presence of the surrounding structures, however, habitat for wildlife is severely limited. The adjacent properties do not contain significant amounts of wildlife species due to the presence of the numerous visitors to the project site throughout the year.

3.5 VEGETATION

Vegetation on the project site consists of native grasses and native hardwood and pine species shoots. Mature upland forest is present south/southwest as well as west of the project site and includes such species as willow oak (*Quercus phellos*), northern red oak (*Quercus rubra*), sweetgum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), and loblolly pine (*Pinus taeda*). The area northwest of the project area includes tidal wetland grass species along the James River inlet. The area to the east is fallow field and James Fort. There is no vegetation within the boundaries of the Fort that will be affected by the construction. There are also examples of English Agricultural Fields located to the north/northeast of the subject site. These will not be adversely affected either.

3.6 TIDAL AND NONTIDAL WETLANDS

A tidal wetland, approximately 0.02 acres, associated with the James River is present northwest of the project site located between the proposed structure and the James River. The wetland area includes the fringe along the banks of the James River. The wetlands were delineated by the Environmental Specialties Group, Inc. in December 2000 according to the

methodology outlined in the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual (TR Y-87-1). The proposed construction of the new building will not cause impacts to the tidal wetlands (Figure 1-1).

3.7 STREAMS, RIVERS, LAKES, AND PONDS ON OR NEAR THE SITE

The James River is present west and northwest of the project site. A path from the project site extends to a pier that extends over the James River. The nearest stream is Powhatan Creek located approximately 1,000 feet east of the project site. The minimal construction associated with the proposed boat building shed will not cause impacts to any aquatic environments. Measures will be taken to ensure no secondary impacts will occur to these waters.

3.8 WATERSHEDS OF SIGNIFICANT IMPORTANCE FOR PUBLIC WATER SUPPLIES

The project site is located entirely within the James River drainage basin. The James River is not used as a public water supply source in the area of the project site. All potable water is provided by James City Service Authority. The construction of the proposed structure will have no effect on sensitive watersheds or public water supplies, as no water will be run to the structure.

3.9 CHESAPEAKE BAY RESOURCE PROTECTION AREA

The project site is currently a grass field located adjacent to the James River within the Resource Protection Area (RPA) as defined in the Chesapeake Bay Preservation Ordinance. The James River is present approximately 40 feet west of the project site. The proposed conditions will consist only of a small open-aired wooden structure that will minimally effect the RPA area. The construction of the proposed building will be accomplished in accordance with County reviewed and approved plans. The construction of the boat building shed within the RPA will require a waiver or exception from the Chesapeake Bay Preservation Ordinance administered by James City County (Figure 1-1).

3.10 100-YEAR FLOODPLAIN

The subject site is located within the James River 100-year flood hazard zone "AE" (elevation 8.5 feet) per the Federal Emergency Management Act (FEMA), Flood Insurance Map,

Community Panel No. 510201-0040B, dated January 6, 1991. The proposed conditions will consist only of a small open-aired wooden building and will have minimal adverse effects on the 100-year floodplain. The construction of the proposed building will be accomplished in accordance with County reviewed and approved plans (Figure 1-1).

3.11 GROUNDWATER RESOURCES

Groundwater is an important resource of the York-James Peninsula that historically has provided a major part of the Peninsula's freshwater supply. Sediment of the York-James Peninsula forms a layered sequence of aquifers and intervening confining units. One water-table aquifer, seven confined aquifers, and intervening confining units have been identified in the area. The aquifers from youngest to oldest are: the Columbia, the only aquifer which is confined throughout its entire extent; the Yorktown-Eastover; the Chickahominy-Piney Point, the Aquia, and the upper, middle, and lower Potomac aquifers. Groundwater is withdrawn primarily from the Chickahominy-Piney Point and upper and middle Potomac aquifers in the central portion of the James-York Peninsula. The Chickahominy-Piney Point aquifer contains water with high concentrations of chloride, sodium, dissolved solids, and fluoride. The middle and upper Potomac aquifers contain water with elevated concentrations of chloride, sodium, and dissolved solids and are the aquifers used the most in this region for potable water supplies.

Jamestown-Yorktown Foundation currently utilizes James City County waterlines for all potable water. Therefore, the construction of the proposed building will have no impact on groundwater resources.

3.12 PARKS AND RECREATION AREAS

The subject property is located at the Jamestown Settlement, which is a living museum complex funded by the Commonwealth of Virginia. The boat-building shed will enhance the Riverfront area for Jamestown visitors. The proposed boat-building shed will be located along the visitor's path that leads to the pier along the James River where the colonial ships are docked.

3.13 IMPORTANT NATURAL AREAS

The Powhatan Creek natural area is located within 5 miles of the project area. This is one of the most important natural areas on the Virginia Peninsula. This project will not adversely affect the Powhatan Creek natural area.

3.14 IMPORTANT SCENERY AND SCENIC RESOURCES

The project area is located at the southern terminus of the Colonial National Historical Parkway that traverses the Peninsula from Yorktown through Williamsburg to Jamestown Island. The existing and proposed facility are, and will continue to be, shielded from the Parkway by the stand of mature trees located between the Jamestown Settlement buildings and the roadway (Route 639). Therefore, the subject project will not have an adverse effect on the scenic resources of the area.

3.15 AIR QUALITY

The project site is located in James City County, which is within the Virginia Department of Environmental Quality Region 6, which consists of the James-York Peninsula and southeast Virginia counties. Ambient air quality is monitored by the DEQ at several locations within Region 6, for comparison to the National Ambient Air Quality Standards (NAAQS) for: sulfur oxides, nitrogen oxides, suspended particulates, lead, ozone, and carbon monoxide (CO). The NAAQS, as promulgated by the U. S. Environmental Protection Agency (EPA), provide a basis for determining how healthy the ambient air is in a particular region. Region 6 is currently listed as an attainment area.

No long-term impacts are anticipated on the local and regional air quality as a result of the proposed action. A very slight increase in Total Suspended Particulates may result from fugitive dust generated by construction activities, however, due to the limited surface area disturbance and given the physical characteristics of the soil, any impact would be negligible. The addition of the boat building structure will not cause a significant increase in traffic to Jamestown Settlement, or an increase in the number of gasoline-powered vehicles to the area.

3.16 SOLID WASTE DISPOSAL FACILITIES

All construction waste material not designated for re-use will become the property of the contractor and will be removed from the site. Solid waste (i.e., paper, wood) generated at the facility will be carried to a landfill by a commercial waste hauling company. No solid waste will be disposed of or burned onsite.

The proposed structure will not contain plumping therefore no wastewater will be generated by the facility. The structure will be supplied with electrical power. In addition, no known hazardous materials will be generated by the construction or operation of the new facility.

3.17 POTABLE WATER SUPPLIES

The James City Service Authority currently supplies potable water.

4.0 ALTERNATIVES ANALYSIS

Three alternatives for providing the needed enhancement of the Riverfront at the Jamestown Settlement, including the boat-building shed are: 1) no action alternative, 2) renovating an existing facility, and 3) constructing a new facility.

4.1 NO ACTION ALTERNATIVE

The current Riverfront area consists only of restrooms, a water fountain, and a pathway leading to the pier overlooking the James River and colonial ships. The proposed colonial boat-building shed will enhance the educational exhibits; as a result the facility will be better suited to accommodate the reception of the volume of individuals and groups that currently visit the Jamestown Settlement. The structure will be used as an educational tool that will allow visitors to witness colonial style small boat construction. The No Action Alternative will not accomplish the project purpose, which is to better utilize the existing area by providing better quality Riverfront facilities at the Jamestown Settlement.

4.2 RENOVATION OF AN EXISTING FACILITY

In order to renovate an existing facility, the design plan of the building would need to be completely altered in order to create the 17th century open-aired style building. The open-aired style is necessary for visitors to view boat construction in an authentic colonial manner. Currently, no such building exists with such specifications. In addition, the Jamestown Settlement was first erected in the late 1950's. Therefore, most if the current buildings would need to be completely gutted in order to remove all asbestos-containing materials and lead-based paint materials. Renovation of an existing facility would not solve the problem of insufficient public space. Cost analysis for renovation also indicates that renovation will cost approximately the same as constructing a new facility. In addition, due to the age of the buildings, removal of possible lead-based paint and asbestos containing materials may be necessary.

4.3 SELECTED ALTERNATIVE, NEW CONSTRUCTION

The expansion of the Riverfront area with the proposed structure will meet the overall project goals of providing adequate space and educational opportunities to accommodate the current and projected needs of the individuals and groups that visit Jamestown Settlement. In

addition, the new boat-building shed will enhance the Riverfront area and serve as an educational tool providing insight on the lifestyle in colonial times. The building will be constructed based upon authentic colonial building style. A conceptual site plan for the proposed structure is shown in Figure 1-2.

5.0 IRREVERSIBLE ENVIRONMENTAL CHANGES

Every effort has been made to blend the proposed facility with the other Jamestown structures by utilizing similar building materials and designing a conservative structure that will not detract from the other museum exhibits. The new structure, however, will irreversibly change the scenery at the project site. Due to the chosen design and the buildings' placement the irreversible environmental change will be minimal.

6.0 MITIGATION CONCEPTS

Means to mitigate and/or monitor adverse environmental impacts are discussed in the sections below. Mitigation measures in the form of avoidance, design modification, rehabilitation, and preservation or compensation is considered for unavoidable impacts to the environment caused by the proposed action.

Appropriate erosion and sediment controls would be utilized during the construction phase of this project to minimize any potential sedimentation impacts. The potential for soil erosion will be minimal from construction of this project. Mitigation measures to assure minimal impacts to the environment from soil disturbance would be incorporated in the design and construction of the facility. These measures include:

1. Implementing Best Management Practices (BMPs) and soil erosion control measures in accordance with Virginia Erosion and Sediment Control Regulations. Specifically:

    a. Permanent or temporary soil stabilization shall be applied to denuded areas within seven days after final grade is reached on any portion of the site.

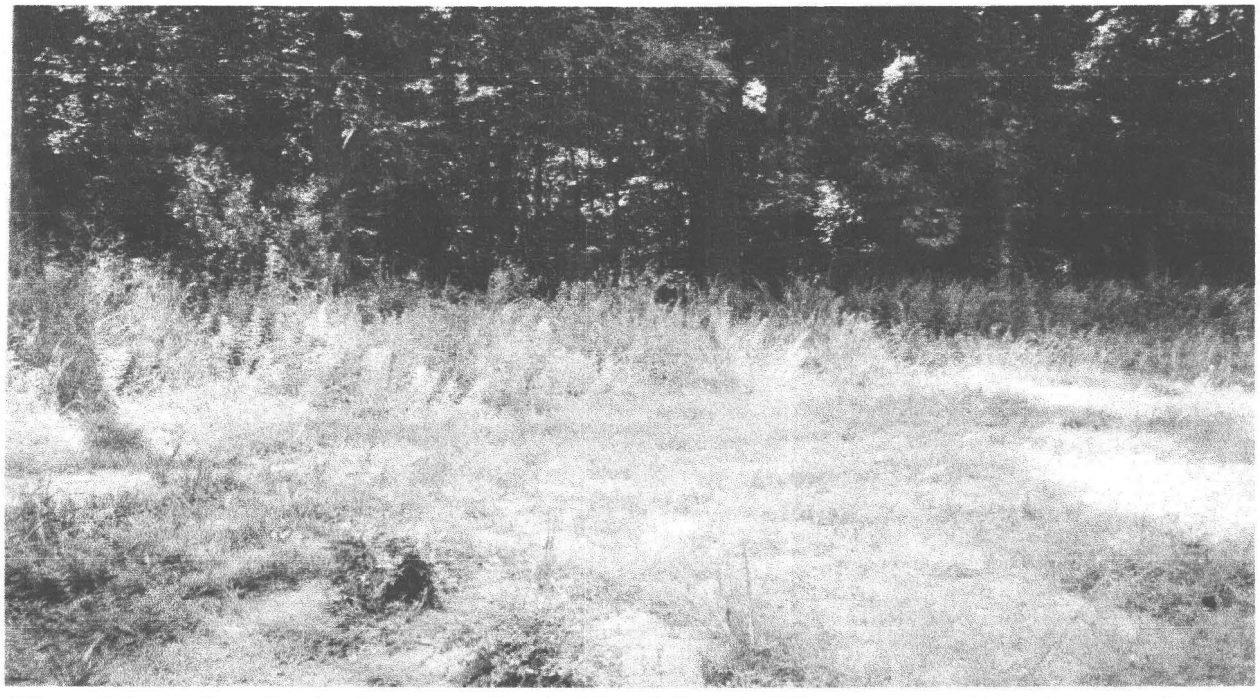
    b. During construction of the project, soil stockpiles shall be stabilized or protected with sediment trapping measures.

    c. Sediment basins and traps, perimeter dikes, sediment barriers, and other measures intended to trap sediment shall be constructed as a first step in any land-disturbing activity.

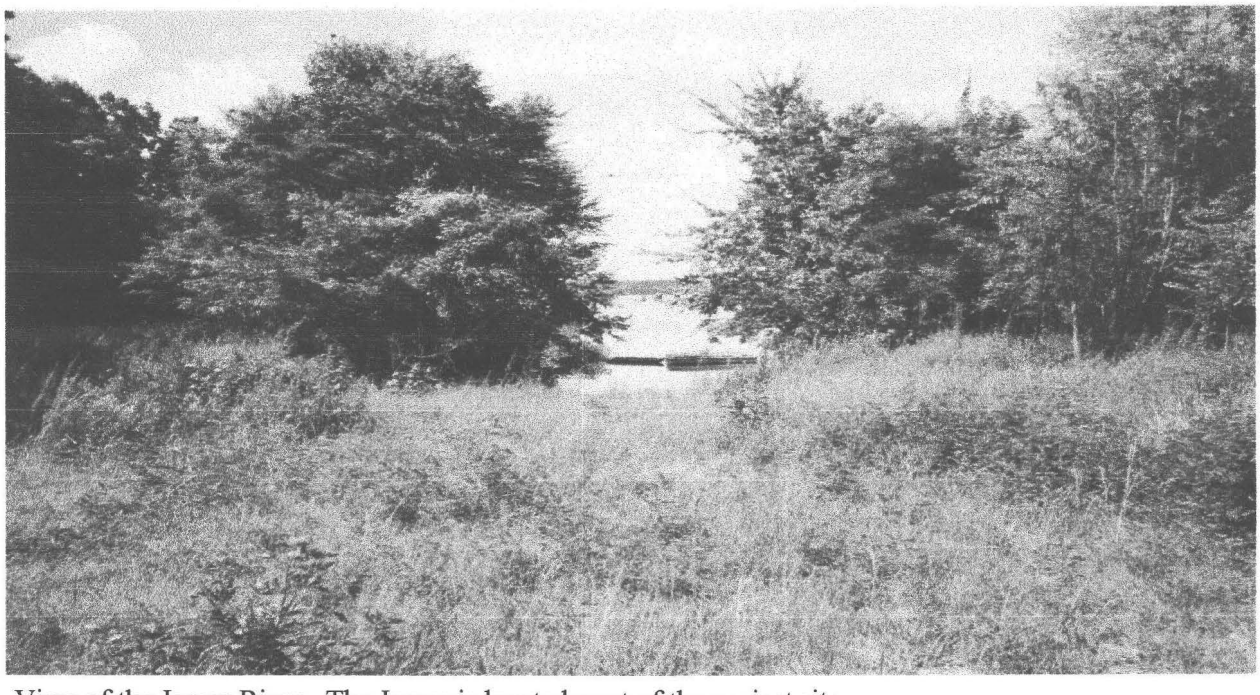
Erosion control practices would be in accordance with the Virginia Erosion and Sediment Control Handbook prepared by the Virginia Soil and Water Conservation Commission. Proper landscaping after construction will also minimize soil loss that could occur before establishment of permanent vegetation on the proposed site.

APPENDIX A

Photographs of Existing Conditions

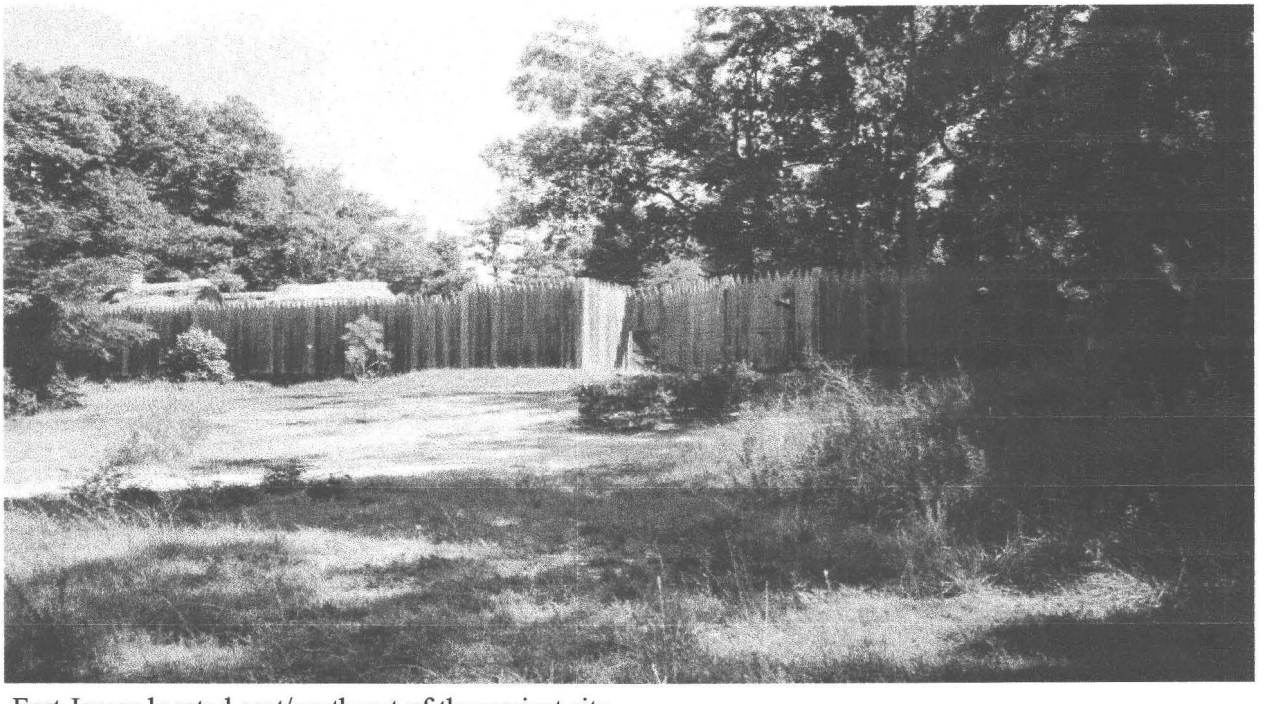


View of the project site for the proposed colonial style boat building structure. The site currently consists of a fallow area that extends to the treeline.



View of the James River. The James is located west of the project site.

View of the wooded and fallow areas located to the south and southwest of the subject site. Note the James River beyond these areas.



Fort James located east/northeast of the project site.

APPENDIX B

Agency Correspondence

RECEIVED
MAR 13 2001
DEQ-Office of Environmental Impact Review

DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR PROGRAM COORDINATION

DOCUMENT REVIEW CHECKLIST

TO: Charles H. Ellis III

DATE: 3/12/01 **DEQ-OEIA PROJECT NUMBER:** 01-026S

__X__ **STATE EIR** ___ **FEDERAL EA/FONSI** ___ **FEDERAL EIS** ___ **GRANT/SCC**
___ **SCOPING NOTICE FOR EIS & PROGRAM**

PROJECT TITLE: Proposed Improvements to the Jamestown Settlement

PROJECT SPONSOR: Jamestown-Yorktown Foundation

AIR PROGRAM COORDINATION DIVISION FINDINGS:

___ CONCURS WITH THE FONSI ___ CONCURS WITH THE CONSISTENCY DETERMINATION

__X__ SEE APPLICABLE REGULATORY REQUIREMENTS ___ NO COMMENTS

THE PROJECT SITE IS LOCATED IN A:

___ OZONE NONATTAINMENT AREA

__X__ OZONE MAINTENANCE AREA

__X__ STATE VOLATILE ORGANIC COMPOUND & NITROGEN OXIDES EMISSION CONTROL (VOC/NO_xEC) AREA

REGULATORY REQUIREMENTS MAY APPLY TO:

__X__ CONSTRUCTION ___ OPERATION

STATE AIR POLLUTION CONTROL BOARD REGULATIONS FOR THE CONTROL AND ABATEMENT OF AIR POLLUTION THAT MAY APPLY:

1. ___ 9 VAC 5-40-5200 C and 9 VAC 5-40-5220 E - Stage I.

2. ___ 9 VAC 5-40-5200 C and 9 VAC 5-40-5220 F - Stage II Vapor Recovery.

3. __X__ 9 VAC 5-40-5490 et seq. - Cut-back Asphalt Usage Restriction.

4. X 9 VAC 5-40-5600 et seq. - Open Burning.

5. X 9 VAC 5-50-60 et seq. - Fugitive Dust Emissions.

6. ___ 9 VAC 5-50-130 et seq. - Odorous Emissions; applicable to the _____.

7. ___ 9 VAC 5-50-160 et seq. - Standards of Performance for Toxic Pollutants.

8. ___ 9 VAC 5-50-400 Subpart ___, Standards of Performance for New Stationary Sources, designates standards of performance for the _____.

9. ___ 9 VAC 5-80-10 et seq. of the regulations - Permits for Stationary Sources.

10. ___ 9 VAC 5-80-1700 et seq. of the regulations - Major or Modified Sources located in PSD areas. This rule may be applicable to the _____ _____.

11. ___ 9 VAC 5-80-2000 et seq. of the regulations - New and Modified Sources located in nonattainment areas.

12. ___ 9 VAC 5-80-800 et seq. of the regulations - Operating Permits and Exemptions. This rule may be applicable to _____.

OTHER REQUIREMENTS (R) AND/OR CONSIDERATIONS (C):

(C) Since the project is located in an ozone maintenance area, all reasonable precautions to limit emissions of volatile organic compounds (VOCs) and oxides of nitrogen (NOx) should be taken.

PLEASE CONTACT THE _____ OFFICE FOR ANY TECHNICAL AND/OR PERMIT ASSISTANCE.

James P. Ponticello
Office of Air Data Analysis

3/12/01
Date

JAMESTOWN-YORKTOWN FOUNDATION
JAMESTOWN SETTLEMENT

STORMWATER MANAGEMENT MASTER PLAN

February 14, 2001
Revised May 2, 2002
Revised July 3, 2002

Richmond
ENGINEERING, INC.

Project No. 00175-020

1643 Merrimac Trail
Williamsburg, VA 23185
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Fax: 757-229-4683

Vint Hill • P.O.Box 861647
Warrenton, VA 20187
Phone: 540-349-7730
Fax: 540-349-7731

www.rickmond.com

Conservation and Recreation's James East Watershed Office depends, in part, on the Foundation's ownership of the land for which the Plan is submitted. We agree that:

- the Foundation must either acquire the land in question from VDOT, or obtain VDOT permission to use it to construct the parking lot and/or any stormwater facilities contemplated for the Stormwater Management Plan project and the Jamestown Settlement Maintenance Building; and

- the Foundation needs to develop an alternative stormwater management plan and get it approved in case the transfer of property, or permission to use it for the intended purposes, cannot be obtained from VDOT.

With regard to the proposed Riverfront Amenities and Shipwright Building (DEQ-02-030S), you agreed that all buildings in that project would be located outside the Resource Protection Area (RPA). A screening fence would be allowed inside the Resource Protection Area, provided that the Foundation plants vegetation between it and the landward boundary of the RPA. An emergency access road to the pier would be allowed within the RPA. Also, you stated that details regarding the "wetland enhancement area" would be provided to our office and to DEQ's Tidewater Regional Office. Details that the Foundation should include in the description are all alterations planned for the existing wetland area, including any soil disturbance, and types and numbers of plants to be removed and/or planted.

These projects must be consistent with James City County's Chesapeake Bay Preservation Area program developed pursuant to the Chesapeake Bay Preservation Act of 1988 (*Virginia Code* section 10.1-2100 et seq.). CBLAD staff intends to work with the County as well as with the Foundation in developing ideas for open space crediting and other ways to ensure the projects' compliance with County and CBLAD rules on stormwater management.

You indicated at the meeting that the proposed maintenance building addition is to be constructed on top of pre-existing asphalt. The EIR indicates that "no trees are expected to be removed, no wetlands will be impacted, and the addition will not affect surrounding wildlife communities (page 13, section 5.0). It also includes a photograph of the building and the paved area where the addition is proposed (Appendix A). However, it is not entirely clear that no additional land area outside the paved surface will be affected by the project.

Next Steps

Jamestown-Yorktown Foundation:

1. Work with DCR to determine appropriate on-site stormwater management requirements for the proposed Theatre and Exhibit Hall project. On-site treatment, either permanent or temporary pending incorporation into the regional stormwater plan, would appear to be the best course of action in this regard. In addition:

   (a) It will be necessary for the Foundation to own the land in question;
   (b) The wetland area should not be used as the location of a stormwater pond;
   (c) All construction projects must comply with stormwater requirements.

2. Work with CBLAD and consultants to develop two alternative stormwater management plans for the Settlement projects including the Maintenance building. Either alternative must meet local Chesapeake Bay Preservation Act criteria:

(a) A plan using the property, presently owned by VDOT, that we discussed on August 7 as a conservation easement and stormwater management area; and
(b) A plan that does not use the property presently owned by VDOT.

3. In completing item 2 above, ensure that items 1 and 2 of DEQ's July 31 letter to the Foundation are satisfied, and take into account items 3 through 5 in developing BMP credits.

4. Notify DEQ of completion of items 1 and 2.

Chesapeake Bay Local Assistance Department:

1. Render guidance and assistance as necessary to the Foundation in designing its stormwater management alternatives to meet Chesapeake Bay Preservation Act state and local requirements.

2. Serve as liaison to James City County if needed in helping the Foundation design its stormwater management requirements.

3. Determine whether and when the design meets the requirements of the Act and of the local Chesapeake Bay ordinance.

4. Notify DEQ of findings relative to the Stormwater Management Plan.

Department of Conservation and Recreation, James Watershed Office:

1. Review on-site and regional Stormwater Management Plan submissions as appropriate, and determine whether these meet specifications for approval.

2. Notify DEQ of findings.

Department of Environmental Quality:

Upon receipt of findings from CBLAD and DCR, complete the EIR process.


GRAPHIC SCALE (IN FEET)
200
100
0
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200
400
GAS
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GAS
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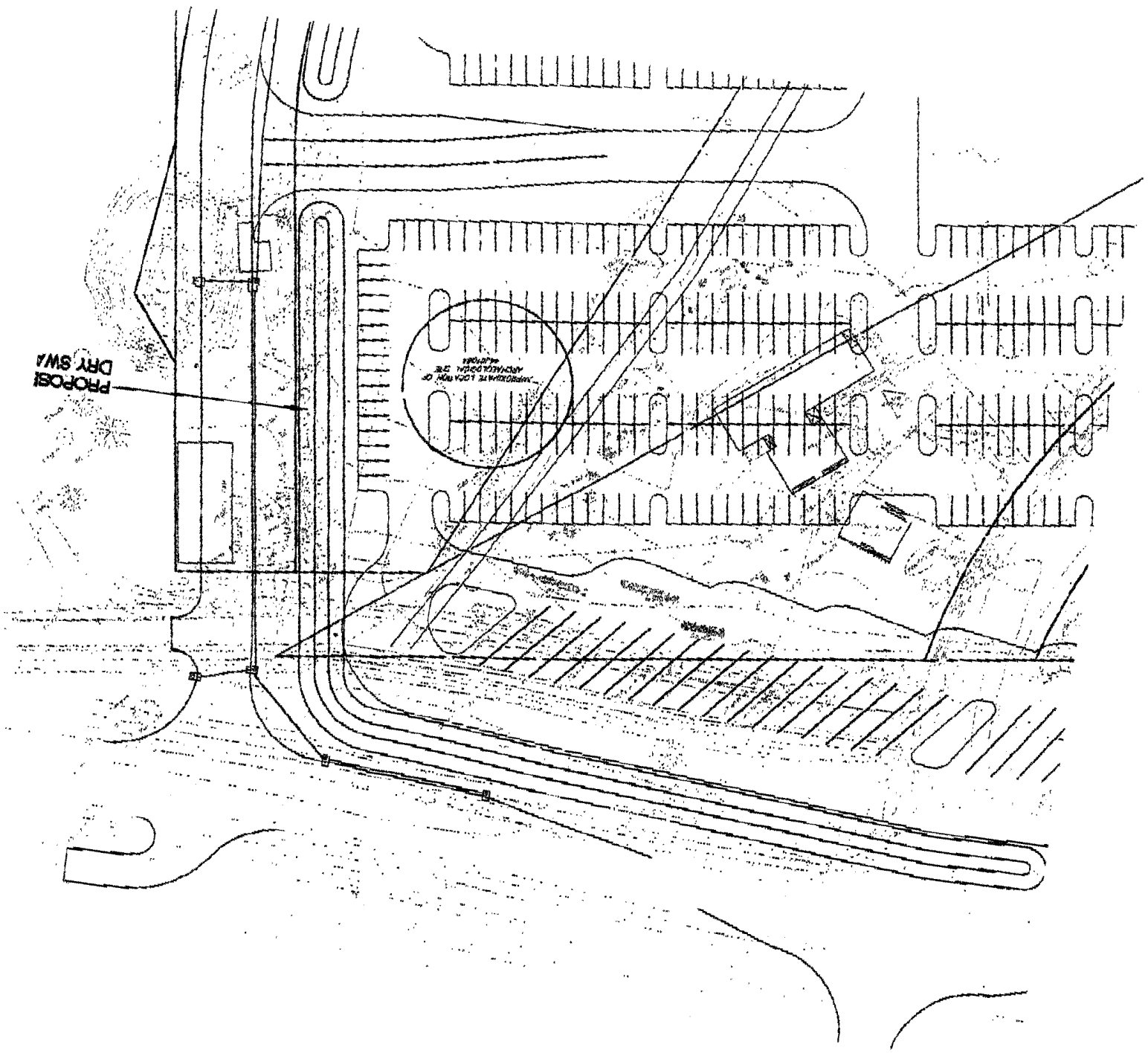
reduced
NTS

reduced
NTS



Worksheet for BMP Point System

A. STRUCTURAL BMP POINT ALLOCATION

BMP	BMP Points		Fraction of Site Served by BMP		Weighted BMP Points
E-2	10	x	1.0	=	10.0
		x		=	
		x		=	
		x		=	

TOTAL WEIGHTED STRUCTURAL BMP POINTS: 10.0

B. NATURAL OPEN SPACE CREDIT

Fraction of Site		Natural Open Space Credit		Points for Natural Open Space
	x	(0.1 per 1%)	=	
	x	(0.15 per 1%)	=	

TOTAL NATURAL OPEN SPACE CREDIT: —

C. TOTAL WEIGHTED POINTS

Structural BMP Points		Natural Open Space Points		Total
10.0	+	0.0	=	10.0

BMP usually applied in res. settings (3 units/acre) - Would/Does JCC give full credit for pkg lot use? VSWM H suggest 16-21% Imp. single-family watersh

WQ s walks → I 37%
Infiltration → 66%

RICKMOND ENGINEERING, INC.
1643 Merrimac Trail
Williamsburg, VA 23185-5624
Phone: 757-229-1776
Fax: 757-229-4683
e-mail: rei@rickmond.com

PROJECT NO. 01198
PROJECT NAME
SHEET NO. OF
CALCULATED BY KMS DATE 2/28/02
CHECKED BY DATE
SCALE

Compute Stream Channel Protection Volume (Cpv):

Step 1. Develop site hydrologic + TR-55 Input Parameters

Condition	CN	Tc hrs	Qa, 1-YR ST. Inches	Q 1-YR cfs
PRE-DEVELOPED	88	.08	1.8	32.52
DEVELOPED	89	.08	1.9	34.34

Step 2. Utilize MDE Method to compute storage volume

Initial Abstraction (Da) for CN 89 is 0.222

Da/P = 0.222/2.8 = .08
Tc = .08 hrs

From TR-55, Exhibit 4-II
qu = 1000 csm/in

Qo/Qi = .018

For Type F Rainfall Distribution

$V_s/V_r = 0.682 - 1.43(Q_o/Q_i) + 1.64(Q_o/Q_i)^2 - 0.804(Q_o/Q_i)^3$
$V_s/V_r = 0.682 - 1.43(0.018) + 1.64(0.018)^2 - 0.804(0.018)^3$
$V_s/V_r = 0.682 - 0.026 + 0.0 - 0.0$
$V_s/V_r = 0.657$

$V_s = (0.657)(1.9\,in)(1/12)(1.45\,ac) = 1.19\,ac\text{-}ft = 52,000\,cf$

Step 3. Define average 5D Release Rate

$Q_a = \frac{52,000 - 26,500\,cf}{24\,hr} \left| \frac{1\,hr}{60\,min} \right| \frac{1\,min}{60\,s} = 0.295\,cfs$

Kimley-Horn and Associates, Inc
501 Independence Pkwy, Suite 300
Chesapeake, Virginia 23320
TEL 757 548 7300
FAX 757 548 7301

KHA Project: Jamestown Gateway
KHA Project No.: 016079007
Date: 1/29/02

Runoff Contribution Calculations - Jamestown Gateway

Parcel	Gross Area (acres)	Impervious Area (ac) (C=0.9)	Pervious Area (ac) (C=0.3)	Contributing Impervious Area (%)	Weighted Rational Coefficient	Contributing Runoff (%)
Jamestown Yorktown Foundation	11.5	10.9	0.6	70.6% → 10.3	0.87 ✓	66.2% ✓
Virginia Dept. of Transportation	3.2	1.8	1.4	11.8% → 11.6	0.84	13.6% ✓
National Park Service	0.9	0.5	0.5	2.9% → 3.2	0.60	3.6% ✓
Vermillion Property	3.8	2.3	1.5	14.7% → 14.8	0.66	16.6% ✓
TOTALS==>	*19.4*	*15.5*	*3.9*	*100.0%*	0.78	*100.0%*

$Q = CIA$
$\Sigma CA = .87 \times 11.5 = 10.0$
$\Sigma CA = 15.13$
$\frac{10.0}{15.13} \Rightarrow 66.1$ ✓

Cost Allocation

SWM Pond Construction	$60,000.00
Annual Maintenance of SWM Facilties	$7,100.00

– 11.8% cost seems high

OPTION #1:

Parcel	Contributing Impervious Area (%)	*SWM Pond Construction Cost Share ($)*	*Annual Maintenance of SWM Facilties*	*Total First Year Contribution ($)*
Jamestown Yorktown Foundation	70.6%	$42,335.19	$5,009.66	***$47,344.86***
Virginia Dept. of Transportation	11.8%	$7,085.85	$838.49	***$7,924.34***
National Park Service	2.9%	$1,743.78	$206.35	***$1,950.13***
Vermillion Property	14.7%	$8,835.17	$1,045.50	***$9,880.67***
	100.0%	$60,000	$7,100	***$67,100.00***

OPTION #2:

Parcel	Contributing Runoff (%)	*SWM Pond Construction Cost Share ($)*	*Annual Maintenance of SWM Facilties*	*Total First Year Contribution ($)*
Jamestown Yorktown Foundation	66.2%	$39,728.28	$4,701.18	***$44,429.46***
Virginia Dept. of Transportation	13.6%	$8,168.59	$966.62	***$9,135.21***
National Park Service	3.6%	$2,144.26	$253.74	***$2,397.99***
Vermillion Property	16.6%	$9,958.87	$1,178.47	***$11,137.34***
	100.0%	$60,000	$7,100	***$67,100.00***

Kimley-Horn and Associates, Inc.
501 Independence Pkwy. Suite 300
Chesapeake, Virginia 23320
TEL 757 548 7300
FAX 757 548 7301

KHA Project: Jamestown Gateway
KHA Project No.: 016079007
Date: 1/29/02

SWM Improvements for Jamestown Gateway

Mobilization	1.0	LUMP SUM	$5,000.00	$5,000.00
Excavation (Pond 1) - Stockpile On-site	3300.0	C.Y.	$4.00	$13,200.00
Excavation (Pond 2) - Stockpile On-site	4000.0	C.Y.	$4.00	$16,000.00
Storm Pipe	275.0	L.F.	$40.00	$11,000.00
E & S Measures	1.0	LUMP SUM	$3,000.00	$3,000.00
Regular Seed Mix	0.3	ACRES	$6,000.00	$1,500.00
Clearing and Grubbing	0.5	ACRES	$4,000.00	$2,000.00
Pond Construction Subtotal				**$51,700.00**
15% Contingency				**$7,755.00**
Opinion of Probable Cost				***$60,000.00***

Probable Pond Maintenance Costs					***Anticipated Annual Cost***
Mow Grass/Vegetation Control - Annual Cost	4.0	LUMP SUM	$1,000.00	$4,000.00	$4,000.00
Future Dredging (Approx. Every 10 yrs)	1600.0	C.Y.	$12.00	$19,200.00	$1,920.00
Repairs to Concrete Pipe (Approx. Every 25 Yrs)	275.0	L.F.	$107.00	$29,425.00	$1,177.00
Probable Annual Pond Maintenance Costs					***$7,100.00***

Kimley-Horn and Associates, Inc
501 Independence Pkwy. Suite 300
Chesapeake, Virginia 23320
TEL 757 548 7300
FAX 757 548 7301

KHA Project: Jamestown Galeway
KHA Project No.: 016079007
Date: 1/29/02

Estimate Volume of BMP

Avg End Area= 1/2(A1+A2)*(E2-E1)

Pond #1

2:1 Sideslopes

			Average End Area Method			
Elevation	Area (sf)	Area (ac)	Incremental Volume (ac-ft)	Total Volume (ac-ft)	Total Volume (ft^3)	Total Volume (CY)
5	6534	0.15	0.00	0.00	0	0
10	10019	0.23	0.95	0.95	41,382	1,533
14	13939	0.32	1.10	2.05	89,298	3,307

Pond #2

2:1 Sideslopes

			Average End Area Method			
Elevation	Area (sf)	Area (ac)	Incremental Volume (ac-ft)	Total Volume (ac-ft)	Total Volume (ft^3)	Total Volume (CY)
5	6534	0.15	0.00	0.00	0	0
10	12632	0.29	1.10	1.10	47,916	1,775
14	17860	0.41	1.40	2.50	108,900	4,033

To: Charles H. Ellis@OCS@DEQ
From: Arthur L. Kapell@OTA@DEQ
Cc:
Subject: Proposed improvements to the Jamestown Settlement
Attachment:
Date: 3/19/01 7:30 AM

Charlie,

The project, Proposed improvements to the Jamestown Settlement (01-026S) appears to have minimal potential impacts with regards to the creation or handling of hazardous or solid waste. I have no comments to make on this project.

Hope all's well and that you didn't get drowned on your return home last Thursday.

Artie Kapell
Office of Waste Programs
DEQ, Richmond, VA
804 698-4251

If you cannot meet the deadline, please notify CHARLIE ELLIS at 804/698-4488 prior to the date given. Arrangements will be made to extend the date for your review if possible. An agency will not be considered to have reviewed a document if no comments are received (or contact is made) within the period specified.

REVIEW INSTRUCTIONS:

A. Please review the document carefully. If the proposal has been reviewed earlier (i.e. if the document is a federal Final EIS or a state supplement), please consider whether your earlier comments have been adequately addressed.

B. Prepare your agency's comments in a form which would be acceptable for responding directly to a project proponent agency.

C. Use your agency stationery or the space below for your comments. **IF YOU USE THE SPACE BELOW, THE FORM MUST BE SIGNED AND DATED.**

Please return your comments to:

MR.CHARLES H. ELLIS III
DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF ENVIRONMENTAL IMPACT REVIEW
629 EAST MAIN STREET, SIXTH FLOOR
RICHMOND, VA 23219
FAX #804/698-4319

Charles H. Ellis III
Environmental Program Planner

COMMENTS

No Comment

(signed) Alan Weber (date) 3-1-01

(title)

(agency) VDH

PROJECT # 01-026S 8/98

If you cannot meet the deadline, please notify CHARLIE ELLIS at 804/698-4488 prior to the date given. Arrangements will be made to extend the date for your review if possible. An agency will not be considered to have reviewed a document if no comments are received (or contact is made) within the period specified.

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629 EAST MAIN STREET, SIXTH FLOOR
RICHMOND, VA 23219
FAX #804/698-4319

Charles H. Ellis III
Environmental Program Planner

COMMENTS

(signed) Eugene B. Tabor (date) 02/20/01

(title) Geologist Manager

(agency) DMME/DMR

PROJECT # 01-026S 8/98

If you cannot meet the deadline, please notify CHARLIE ELLIS at 804/698-4488 prior to the date given. Arrangements will be made to extend the date for your review if possible. An agency will not be considered to have reviewed a document if no comments are received (or contact is made) within the period specified.

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Please return your comments to:

MR.CHARLES H. ELLIS III
DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF ENVIRONMENTAL IMPACT REVIEW
629 EAST MAIN STREET, SIXTH FLOOR
RICHMOND, VA 23219
FAX #804/698-4319

Charles H. Ellis III
Environmental Program Planner

COMMENTS

Removal of the marine railway, per se, may not require Authorization from this Agency; However, the use of forced water to excavate to 3 to 4 feet below the sediments may require authorization from this Agency.

(signed) Tracie West (date) 2/28/01

(title) Environmental Engineer Sr

(agency) VMRC.

PROJECT # 01-026S 8/98

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 10009, Richmond, Virginia 23240
Fax (804) 698-4500 TDD (804) 698-4021
www.deq.state.va.us

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

Robert G. Burnley
Director

(804) 698-4000
1-800-592-5482

August 2, 2002

MEMORANDUM

TO: Catherine Harold, CBLAD
Robert Cooper, DCR-James Watershed Office
Ethel Eaton, DHR
John Horne, James City County
Dorothy Geyer, NPS

FROM: Charlie Ellis

SUBJECT: Jamestown-Yorktown Foundation Projects: New Stormwater Management Master Plan, dated July 3

We have received copies of a new Stormwater Management Master Plan from the Jamestown-Yorktown Foundation. I am passing your copies along. (CBLAD and DCR received copies separately from the Foundation.)

MEMORANDUM

To: Richard White, Jamestown-Yorktown Settlement Facilities Management

cc: John T. P. Horne, Development Manager
Darryl Cook, Director of the Environmental Division

From: Wayland N. Bass, County Engineer

Subject 100 Ft Wide RPA Buffer at Jamestown Settlement

Date: October 17, 2000

The buffer between the pedestrian ramp to the ships and the ship view area / benches is satisfactory.

These same types of plants at this same density are to be planted to create a 100 ft wide buffer from the water as discussed on 10/11/2000 on site with you and two other staff.

The 100 ft wide buffer shall be measured from the waters edge and extend from the ship viewing area to the head of the cove toward the glass house from the viewing area.

The buffer shall be a no-mowing area. All plant material in the buffer shall be installed by November 15, 2000.

In the meantime, I will call you periodically for progress reports and to see if you have any questions. The County cannot approve plans for any additional development until the buffer is established by the Foundation and approved by the County.

If you have any questions, please do not hesitate to call me at (757) 253-6671.

ENVIRONMENTAL SPECIALTIES GROUP, INC.

FILE

December 7, 2000

Mr. Nick Konchuba
Assignment Chief
U.S. Army Corps of Engineers
Regulatory Branch
803 Front Street
Norfolk, Virginia 23510

RE: Jamestown – Yorktown Foundation
Jamestown Settlement
Wetland Delineation
ESG Project Number 0720-01

Dear Mr. Konchuba:

ESG has completed a wetland delineation on the ±15 acre Jamestown – Yorktown Foundation property located at the Jamestown Settlement and would like to request a confirmation site visit. The property is located immediately southeast of the Jamestown Ferry on Route 31 in James City County, Virginia. The site is bordered by Route 31 to the northwest, the James River to the south, and other Foundation property to the east and north. Currently the site is developed as an educational historic attraction.

Wetlands on-site were delineated based on the methodology outlined in the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual (TR Y-87-1). This manual requires the independent verification of three parameters; vegetation, soils, and hydrology, to determine and delineate jurisdictional wetlands. Wetlands have been delineated in the field using pink and black striped flagging. Prior to field investigations, research on the site was performed using the National Wetland Inventory (NWI) maps, the Soil Survey for James City and York Counties and the City of Williamsburg, Virginia, aerial photos, and the U.S.G.S. Topographic Maps.

Wetlands on the property include both tidal and nontidal areas as indicated on the enclosed wetland map. Additionally, we have noted the areas that contain ripraped tidal shoreline. The wetland/upland boundaries are generally located along vegetative breaks throughout the site. In general, the upland areas are vegetated by facultative upland and facultative species. Dominant species include loblolly pine (*Pinus taeda*), white oak (*Quercus alba*), red maple (*Acer rubrum*), sweet gum (*Liquidambar styraciflua*), dogwood (*Cornus florida*), sassafras (*Sassafras albidum*),

729 Thimble Shoals Boulevard, Suite 1B • Newport News, VA 23606-4248 • (757) 599-7501 • Fax (757) 599-7509 • EnvSpGroup@aol.com

and English ivy (*Hedera helix*). Soils in the uplands are predominantly high chroma (3 and higher) sandy loams. Hydrology is not evident in these upland areas.

As previously mentioned, the nontidal wetland areas on the property are located along vegetative breaks. Dominant species observed in the wetland areas include willow oak (*Quercus phellos*), cotton wood (*Populus deltoides*), red maple (*Acer rubrum*), sweet gum (*Liquidambar styraciflua*), highbush blueberry (*Vaccinium corymbosum*), netted chain fern (*Woodwardia areolata*), and southern waxy sedge (*Carex glaucescens*). Soils in these wetland areas ranged from chroma 2, mottled, sandy clays to chroma 1 silty loams. Evidence of hydrology was observed as saturation within 12 inches of the soil surface, water stained leaves, and drainage patterns within wetland areas.

We have also delineated the tidal shoreline along the James River. The majority of the shoreline is armored in riprap, except for the upper reaches of the small cove near the boat launch.

In conclusion, the ±15 acre Jamestown Settlement Site contains approximately 0.45 acres of headwater wetland areas and approximately 0.02 acres of tidal wetlands. The remainder of the site boundary along the James River is ripraped tidal shoreline. The wetland limits shown on this map have been surveyed in conjunction with the boundary survey of the site. At this time we are requesting your confirmation of our delineation. We have included a vicinity map and completed data station forms for your use. Please contact me to schedule an on-site inspection of this property to confirm this delineation.

Sincerely,

Matthew Roth
Ecologist

Enclosures

c:\6720-01-rec.m62

U.S. Army Corps of Engineers
Norfolk District, Western Virginia Regulatory Section
803 Front Street
Norfolk, Virginia 23510

March 8, 2001
6720

Project Number: 00-R2647

Waterway: James River

1. Participant:
Jamestown-Yorktown Foundation
Commonwealth of Virginia
c/o J. Jeffery Lunsford
Route 31 South, P. O. Box 1607
Williamsburg, VA. 23187

2. Authorized Agent:
Environmental Specialties Group Inc.
729 Thimble Shoals Boulevard, Suite 1B
Newport News, VA 23606-4248

3. Address of Job Site:
At the end of Jamestown Road (Route 31).

4. Project Description:
Verification of a consultants wetland delineation on a 15 acre parcel.

5. Findings

Robert Berg of my staff met Matt Roth with Environmental Specialties Group, Inc. on the property described above on March 1, 2001. The wetlands delineation as flagged on site and roughly shown on the site plan entitled "Wetland Delineation, Jamestown Settlement, James City County, Virginia" and dated 12/5/00 is hereby verified for a period of 5 years from the date of this letter unless new information warrants revision of the delineation prior to the expiration date. Our basis for this determination is the application of the Corps' 1987 Wetland Delineation Manual and the positive indicators of wetland hydrology, hydric soils, and hydrophytic vegetation. The wetland is a waters of the United States and is part of a tributary system to interstate waters (33 CFR 328.3(a)).

This letter does not authorize any impacts to jurisdictional wetlands on this property. Any mechanized landclearing (such as with a bulldozer or rootrake) and/or filling in the jurisdictional areas on this property will require a Department of the Army permit prior to such activities occurring. Should all wetland impacts be avoided for this proposal, no permit would be required from our office.

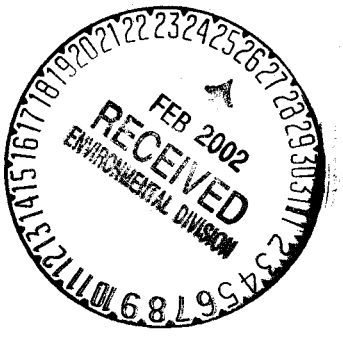
This wetland delineation verification does not relieve your responsibility to comply with local requirements pursuant to the Chesapeake Bay Preservation Act (CBPA), nor does it supercede local government authority and responsibilities pursuant to the Act. You should contact your local government before you begin work to find out how the CBPA applies to your project.

6. Corps Contact: Robert Berg at (757) 441-7793.

Bruce F. Williams
Acting Chief, Western Virginia Regulatory Section

NAO FL 13 REVISED DEC 90

TRANSMITTAL



DATE:	February 25, 2002
TO:	Environmental JCSA County Engineer John Horne
FROM:	Dave Anderson, Planner
SUBJECT:	Case No. C-032-02 Jamestown Settlement Riverfront Amenities Area
ITEMS ATTACHED:	Conceptual Plan Environmental Impact Report Review Request Letter
INSTRUCTIONS:	Please review and comment
RETURN REQUESTED BY:	March 11, 2002
AGENCY COMMENTS:	

Is this development served by Newport News Water Works? _____ *(JCSA please check if yes)*

If checked, PLANNER please fax copy of *preliminary approval letter* with *Fire Department comments*, and the *JCSA completed water data sheet* to Newport News Water Works - Chief Engineer as soon as all three are available (Fax # 247-2334)

John Hare/mc

COMMONWEALTH of VIRGINIA

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

DEPARTMENT OF ENVIRONMENTAL QUALITY
Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 10009, Richmond, Virginia 23240
Fax (804) 698-4500 TDD (804) 698-4021
http://www.deq.state.va.us

Robert G. Burnley
Director

(804) 698-4000
1-800-592-5482

FEB 20 2002

FEB 2002

February 12, 2002

Mr. Sanford B. Wanner, Administrator
James City County
P.O. Box 8784
Williamsburg, VA 23187-8784

Environmental Impact Review: **Jamestown Settlement: Riverfront Amenities & Shipwright Bldg.**
Project Sponsor: **Jamestown-Yorktown Foundation** DEQ Project #: **02-030S**

Dear Mr. Wanner:

The Department of Environmental Quality solicits your comments on the attached Environmental Impact Report for the referenced project. Virginia Code § 10.1-1188 requires each state agency to prepare a report for any construction or acquisition for construction project that exceeds $100,000. DEQ must review the project and forward comments to the Governor within 60 days of receiving the report. Virginia Code § 15.2-2202 provides an opportunity for review and comment by local officials as we conduct our review. In order for us to complete our comments in a timely manner I request that you return your comments to us by **March 20, 2002**. Please return comments to:

Virginia Department of Environmental Quality
Office of Environmental Impact Review
Post Office Box 10009
Richmond, Virginia 23240-0009

If you wish to comment but cannot return comments by the date specified, please contact me at (804) 698-4135 prior to the deadline. If possible, we will extend the date for comment to accommodate your special needs. This EIR has also been circulated to State agencies and to the Hampton Roads Planning District Commission for review and comment.

Thank you for your attention to this matter.

Sincerely,

Anne B. Newsom
Environmental Impact Review Coordinator

1418
permit

David G. Brickley
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION
217 Governor Street, 3rd Floor
TDD (804) 786-2121 Richmond, Virginia 23219 (804) 786-7951 FAX (804) 371-2674
http://www.state.va.us/~dcr/vaher.html

July 24, 2001

Holly Galavotti
Williamsburg Environmental Group
3000 Easter Circle
Williamsburg, VA 23188

Re: Jamestown Settlement – Riverfront Development Demolition and Reconstruction

Dear Ms. Galavotti:

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biological and Conservation Data System (BCD) for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

BCD documents the presence of natural heritage resources in the project area. However, due to the scope of the activity and the distance to the resources, we do not anticipate that this project will adversely impact these natural heritage resources. In addition, our files do not indicate the presence of any State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the Virginia Department of Conservation and Recreation (DCR), DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

The absence of data may indicate that the project area has not been surveyed, rather than confirm that the area lacks natural heritage resources. DCR's Biological and Conservation Data System is constantly growing and revised. Please contact DCR for an update on this natural heritage information if a significant amount of time passes before it is utilized.

A fee of $50.00 has been assessed for the service of providing this information. Please find enclosed an invoice for that amount. Please return one copy of the invoice along with your remittance made payable to the Treasurer of Virginia, Department of Conservation and

Recreation, 203 Governor Street, Suite 402, Richmond, VA 23219, ATTN: Cashier. Payment is due within thirty days of the invoice date.

Thank you for the opportunity to comment on this project.

Sincerely,

S. René Hypes

S. René Hypes
Project Review Coordinator

FILE

COMMONWEALTH of VIRGINIA

CHESAPEAKE BAY LOCAL ASSISTANCE DEPARTMENT

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

James Monroe Building
101 North 14th Street, 17th Floor
Richmond, Virginia 23219
FAX: (804) 225-3447

C. Scott Crafton
Acting Executive Director

(804) 225-3440
1-800-243-7229 Voice/TDD

February 25, 2003

Mr. Richard T. White, Facilities Manager
Jamestown-Yorktown Foundation
P.O. Box 1607
Williamsburg, Virginia 23187-1607

RE: Stormwater Management Master Plan
CBLAD Project Review No. SSPR-JYF-05(E)-01

Dear Mr. White:

We have reviewed a revised conceptual stormwater plan for the proposed improvements at the Jamestown Settlement, which was sent from Rickmond Engineering, Inc. We discussed the plan with Robert Cooper at the Department of Conservation and Recreation. In general, the plan appears conceptually reasonable and provided that the final design meets the Performance Criteria of the Chesapeake Bay Preservation Area Designation and Management Regulations as implemented through James City County's Bay Act Ordinance it would be consistent with the Chesapeake Bay Preservation Act.

The proposed plan relies on ground infiltration for treatment of stormwater. As currently planned, a series of underground storm chambers would be utilized in combination with dry swales (JCC-E2), which is similar to the water quality swale design in the Virginia Stormwater Management Handbook. Based upon the soils information provided, it does not appear that ground water will be a limiting factor. However, suitable soils for infiltration are non consistent across the site. It will be necessary to conduct site-specific soil investigations to ensure that adequate permeability exists for the infiltration BMPs proposed. Otherwise the soils beneath the chambers will need to be engineered to achieve the requisite permeability.

We discussed some additional alternatives with Donald Jennings of Rickmond in a conference call on February 20, 2003. We suggested the possibility of biofiltration techniques. This would involve some temporary above ground storage, which he indicated was not desirable or compatible with facility layout and movement of people. We also discussed another subsurface alternative, which would use a trench drain system in lieu of the chambers. Regardless of which design is chosen, perforated pipe should be used for conveyances to the BMPs, where possible, to promote additional infiltration.

We discussed switching the position of the forebay with the upgradient underground storage chambers particularly since this will collect runoff from the large employee parking lot. In

addition, the parking lots should have oil/grit separators as a form of pretreatment. This will extend the longevity of the BMPs as well as extend the time between maintenance of the BMPs.

The plan should incorporate pre-treatment upgradient of the BMPs. While there are several approaches for this, Minimum Standard 3.10E in the Virginia Stormwater Management Handbook addresses how the underground chambers can be utilized for pretreatment. The BMPs should not be set up in series, because that would result in the most BMP being overwhelmed from the volume of runoff passing through the upstream BMPs.

On previous occasions, we indicated that steps should be taken to reduce the amount of impervious cover on the site, as required by the performance criteria in the Bay Act Regulations. These comments were in response to the expansive parking areas shown on previous iterations of the master plan. The consultants and Foundation staff have indicated that the 212 proposed parking spaces are necessary for the employee parking area. Therefore, we highly recommend the use of permeable surfaces in the parking lot areas. This will address the performance criteria in addition to promoting infiltration and lessening runoff velocities and volumes. To further promote source control, we recommend the use of depressed bioretention areas in the parking lots instead of raised planting islands.

We look forward to reviewing the final design plans for this project. You are also welcome to submit draft plans as you progress with the design. Please be sure to submit final plans to the Department of Conservation and Recreation for their evaluation and approvals in accordance with the Virginia Erosion and Sediment Control Law and Virginia Stormwater Management Act.

We appreciate the opportunity to provide our comments on this project. Please do not hesitate to contact us at 1-800-CHESBAY should you have any questions.

Sincerely,

Catherine M. Harold
Environmental Engineer

Douglas G. Wetmore
Principal Environmental Planner

Cc: Scott Crafton, CBLAD
Robert Cooper, DCR
Donald Jennings, Rickmond
Darryl Cook, James City County
Ellie Irons, DEQ

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1433
permit

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural Resources

David G. Brickley
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

217 Governor Street, 3rd Floor
TDD (804) 786-2121 Richmond, Virginia 23219 (804) 786-7951 FAX (804) 371-2674
http://www.state.va.us/~dcr/vaher.html

August 10, 2001

Ms. Holly Galavotti
Williamsburg Environmental Group, Inc.
3000 Easter Circle
Williamsburg, Virginia 23188

Re: Jamestown Settlement-Boat Building Shed

Dear Ms. Galavotti:

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biological and Conservation Data System (BCD) for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

BCD documents the presence of natural heritage resources in the project area. However, due to the scope of the activity and the distance to the resources, we do not anticipate that this project will adversely impact these natural heritage resources. In addition, our files do not indicate the presence of any State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

Under the Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the Department of Conservation and Recreation (DCR), DCR has the authority to report for VDACS on state-listed plant and insect species. The current activity will not affect any documented state-listed plants or insects.

New and updated information is continually added to BCD. Please contact DCR for an update on this natural heritage information if a significant amount of time passes before it is utilized.

A fee of $ 50.00 has been assessed for the service of providing this information. Please find enclosed an invoice for that amount. Please return one copy of the invoice along with your remittance made payable to the Treasurer of Virginia, Department of Conservation and Recreation, 203 Governor Street, Suite 402, Richmond, VA 23219, ATTN: Cashier. Payment is due within thirty days of the invoice date.

Should you have any questions or concerns, feel free to contact me at 804-371-2708. Thank you for the opportunity to comment on this project.

Sincerely,

S. René Hypes

S. René Hypes
Project Review Coordinator

APR 11 2003

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 10009, Richmond, Virginia 23240
Fax (804) 698-4500 TDD (804) 698-4021
www.deq.state.va.us

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

Robert G. Burnley
Director

(804) 698-4000
1-800-592-5482

April 7, 2003

Mr. Richard T. White
Facilities Manager
Jamestown-Yorktown Foundation
P.O. Box 1607
Williamsburg, Virginia 23187

RE: Jamestown-Yorktown Foundation
Proposed Improvements to the Jamestown Settlement, revised as the Stormwater Improvements and Boardwalk (agency 425, project code 16474), reviewed under DEQ-01-026S

Dear Mr. White:

Pursuant to *Virginia Code* sections 10.1-1188 et seq., the Department of Environmental Quality (DEQ) has completed its review of the Environmental Impact Report for the proposed project described above. DEQ's comments on this project are attached for your guidance. These comments are being reviewed by the Secretary of Administration on behalf of the Governor. The project must be approved by the Secretary of Administration, following her review of these comments, before it may be carried out.

Thank you for the opportunity to review this project.

Sincerely,

Charles H. Ellis III
Environmental Impact Review Coordinator

Enclosures
cc: (next page)

cc: The Honorable Sandra D. Bowen
Lewis R. McCabe, DOA
William W. Scott, DGS-DEB
Jonathan G. Howe, DPB
Brian D. Moyer, DGIF
Keith R. Tignor, DACS
Derral Jones, DCR
Alan D. Weber, VDH
Ethel R. Eaton, DHR
Thomas D. Modena, DEQ-OWP
Harold J. Winer, DEQ-TRO
Traycie L. West, MRC
Kotur S. Narasimhan, DEQ-DAPC
Martin G. Ferguson, DEQ-WPS
David V. Grimes, VDOT
Catherine M. Harold, CBLAD
Robert E. Cooper, DCR
Arthur L. Collins, Hampton Roads PDC
John T. P. Horne, James City County

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

Joseph H. Maroon
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

DIVISION OF SOIL & WATER CONSERVATION
JAMES WATERSHED OFFICE
3800 Stillman Pkwy, Suite 102, Richmond, VA 23233
804.527.4484, 804.527.4483 fax

3/28/2003

Charles H. Ellis III
Environmental Impact Review Coordinator
P.O. Box 10009
Richmond, Virginia 23240

RE: Jamestown-Yorktown Foundation-Stormwater Management Master Plan

Dear Mr. Ellis:

On February 20, 2003 Catherine Harold and myself reviewed the revised conceptual stormwater management master plan for the proposed improvements at the Jamestown Settlement. Based on this review and additional alternatives discussed with Mr. Jennings of Rickmond Engineering during a conference call, the Department of Conservation and Recreation is in agreement with this conceptual plan. Basically, the plan proposed the used of infiltration as the main practice for meeting the state's water quality requirements. During the conference call, the consultant agreed with DCR and CBLAD that if the existing soils were not suitable then the necessary material would be transported in to meet infiltration design specifications.

The approval of the conceptual plan by this agency is only a first step in the process. Plans must be submitted to DCR for a land disturbance permit. Stormwater and
Erosion and Sediment control plans must be approved before any land disturbance activity can begin.

If you need any further help in this matter please contact either Robert E.Cooper at (804)786-1359 or David Beale at (804) 443-8237.

Sincerely:

Robert E.Cooper, P.E
Urban Programs Engineer

Cc: Jack Frye-DCR
Catherine Harold-CBLAD
David Beale-DCR

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural Resources

David G. Brickley
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

203 Governor Street, Suite 326
TDD (804) 786-2121 Richmond, Virginia 23219-2010 (804) 786-2556 FAX (804) 371-7899

MEMORANDUM

DATE: 24 May, 2001

TO: Ellie Irons, Department of Environmental Quality

FROM: Derral Jones, Planning Bureau Manager

SUBJECT: **Revised Comments** for DEQ#01-026S: Proposed Improvements to the Jamestown Settlement, James City County

The Department of Conservation and Recreation (DCR) has searched its Biological and Conservation Data System (BCD) for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

After a careful review of the submitted photos and site plans, DCR would like to revise initial comments made on 6 December 2000. If suitable habitat is present, small whorled pogonia (*Isotria medeoloides*, G2G3/S2/LT/LE) could occur on site. Small whorled pogonia grows in a variety of woodland habitats in Virginia, but tends to favor mid-aged woodland habitats on gently north or northeast facing slopes often within small draws. It is quite natural for plants of this species to remain dormant in the soil for long periods of time. Direct destruction as well as habitat loss and alteration are principle reasons for the species' decline (Ware, 1991). Please note that small whorled pogonia is currently classified by the United States Fish & Wildlife Service (USFWS) and as an endangered species by the Virginia Department of Agriculture and Consumer Services (VDACS).

The Virginia Department of Agriculture and Consumer Services (VDACS), which has regulatory authority to conserve rare and endangered plant and insect species through the Virginia Endangered Plant and Insect Species Act, has established a Memorandum of Agreement with the Virginia Department of Conservation and Recreation (DCR). Under this agreement, DCR in consultation with VDACS, represents VDACS in its comments and recommendations regarding the potential impact of reviewed projects or activities on state-listed plant and insect species. Since it has been determined that this project or activity may impact small whorled pogonia a state-protected plant, VDACS will respond directly to ensure compliance with Virginia's Endangered Plant and Insect Species Act. Further correspondence regarding the potential impacts of this project or activity on state-listed plant and insect species should be directed to VDACS.

Any absence of data may indicate that the project area has not been surveyed, rather than confirm that the area lacks natural heritage resources. New and updated information is continually added to BCD. Please contact DCR for an update on this natural heritage information if a significant amount of time passes before it is utilized.

For soil and water conservation issues on this project, be aware that state agency projects that involve a land-disturbing activity of 10,000 square feet or more must prepare a project-specific *Erosion and* Sediment Control plan for review and approval by DCR's Division of Soil and Water Conservation (DSWC). An approved plan is required prior to initiation of any land-disturbing activity at the project site. All plans must be prepared in accordance with the current version of the *Virginia Erosion & Sediment Control Handbook*, Virginia Erosion & Sediment Control Law (VESCL) and Regulations (VESCR). *Note that projects undertaken in Chesapeake Bay Preservation Areas (CBPA) may be subject to requirements that are more stringent. The agency is encouraged to consult with the Chesapeake Bay Local Assistance Department (CBLAD) and/or the appropriate local jurisdiction to confirm parallel ESC plan requirements under the Chesapeake Bay Preservation Act.* ESC plans should be submitted directly to the DCR Watershed Office that serves the area where the project will be undertaken. *[Reference: VESCL §10.1-560, §10.1-564; VESCR §4VAC50-30-50, §4VAC50-30-100]*

Similarly, state agency projects that involve a land use conversion activity of 1 acre or more must prepare a project-specific SWM plan for review and approval by DCR's DSWC. An approved plan is required prior to initiation of any regulated activities at the project site. All plans must be prepared in accordance with the current version of the Virginia Stormwater Management Law (VSWML) and Regulations (VSWMR). *Note that projects undertaken in Chesapeake Bay Preservation Areas (CBPA) may be subject to requirements that are more stringent. The agency is encouraged to consult with the Chesapeake Bay Local Assistance Department (CBLAD) and/or the appropriate local jurisdiction to confirm parallel SWM plan requirements under the Chesapeake Bay Preservation Act.* It is recommended that this project be considered with any other existing or proposed land use conversion or expansion plans for the property to adequately address the cumulative impacts on the receiving drainage or environmental systems, as well as, to identify the most appropriate strategy for reducing the nonpoint source pollution from the developed and developing areas of the site. The agency may submit a draft plan or other preliminary information to DCR's DSWC for review and assistance in identifying specific practices, regional strategies, and/or regulatory requirements that may apply to this project. Requests for assistance and/or plans should be directed to the DCR Watershed Office that serves the area where the project will be undertaken. *[Reference: VSWML§10.1-603.5; VSWMR§4VAC-3-20-210 - 245]*

For use in directing project-specific ESC and SWM plans and requests for assistance to the appropriate DCR Watershed Office, a copy of the guidance document *DCR Urban Programs Contact Information,* is available http://www.dcr.state.va.us/sw/e&s.htm

The maps in the EIR identify the settlement as the Jamestown Settlement Park. The use of "State Park" implies the site is a unit of DCR's State Park System. To prevent such confusion, a new nomenclature should be used for identifying the settlement. Perhaps, just the removal of the label "state" from the name, leaving Jamestown Settlement Park, would suffice.

Thank you for the opportunity to comment on this project.

Kim Marbain, USFWS
Keith Tignor, VDACS

Literature Cited

Ware, D. M. E. 1991. Small whorled pogonia. In Virginia's Endangered Species: Proceedings of a symposium. K. Terwilliger ed. The McDonald and Woodward Publishing Company, Blacksburg, Virginia.

Ellis,Charles

From: Brian Moyer [bmoyer@dgif.state.va.us]
Sent: Friday, June 14, 2002 4:33 PM
To: Ellis,Charles
Subject: Jamestown-Yorktown Foundation Entry Plaza Parking Lot

Charlie:

According to our records, there is a federally and state *threatened* bald eagle, *Haliaeetus leucocephalus*, nest approximately one mile from the project site. Considering the scope and location of the project, we do not anticipate significant adverse impacts to bald eagle nesting as a result of the proposed project.

Brian D. Moyer
Department of Game and Inland Fisheries
Environmental Services Section
4010 West Broad Street
Richmond, VA 23230
(804) 367-2733
(804) 367-2427 (fax)

informal memo July 29, 2002

TO: File

FROM: C. Ellis

SUBJECT: Jamestown-Yorktown Foundation's Jamestown Settlement Improvements Project (DEQ-01-026S), Entrance Plaza and Parking Lot Improvements project (DEQ-01-039S), and Maintenance Building (DEQ-02-029S)

I had a follow-up conversation with Keith Tignor, DACS today and he indicated his satisfaction with the endangered plant survey that the Foundation had previously submitted, and with its conclusions to the effect that no endangered plants would be affected by these projects.

COMMONWEALTH of VIRGINIA

DEPARTMENT OF TRANSPORTATION
1401 EAST BROAD STREET
RICHMOND, VIRGINIA 23219-2000

PHILIP A. SHUCET
COMMISSIONER

EARL T. ROBB
STATE ENVIRONMENTAL ADMINISTRATOR

March 14, 2003

Ms Ellie Irons
DEQ - OEIR
629 East Main St.
Richmond, VA 23219

Dear Ms Irons:

This letter responds to your March 6, 2003, letter requesting the status of VDOT's discussions with the Jamestown-Yorktown Foundation concerning their use of land in VDOT's right-of-way. After speaking with Mr. Jeff Lunsford from the Foundation and Mr. John Neal (VDOT's Hampton Roads District Construction Engineer) I was able to determine that the Foundation no longer has need of the VDOT right-of-way in order to create a conservation easement. However, the Foundation continues to have a need for portions of the VDOT right-of-way in order to construct parking facilities and buildings. Mr. Neal's office is currently in the process of negotiating the terms of a right-of-way lease, and possible transfer, with the Foundation that will allow the Foundation to proceed with their proposed projects.

If you have any questions, please contact me at (804) 786-6678 should you have any additional questions.

Sincerely,

David Grimes
Environmental Specialist II
VDOT
1401 East Broad St.
Richmond, VA 23219
804-786-6678 - O
804-786-7401 - FAX

COMMONWEALTH of VIRGINIA

CHESAPEAKE BAY LOCAL ASSISTANCE DEPARTMENT

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

James Monroe Building
101 North 14th Street, 17th Floor
Richmond, Virginia 23219
FAX: (804) 225-3447

C. Scott Crafton
Acting Executive Director

(804) 225-3440
1-800-243-7229 Voice/TDD

February 25, 2003

Mr. Richard T. White, Facilities Manager
Jamestown-Yorktown Foundation
P.O. Box 1607
Williamsburg, Virginia 23187-1607

RE: Stormwater Management Master Plan
CBLAD Project Review No. SSPR-JYF-05(E)-01

Dear Mr. White:

We have reviewed a revised conceptual stormwater plan for the proposed improvements at the Jamestown Settlement, which was sent from Rickmond Engineering, Inc. We discussed the plan with Robert Cooper at the Department of Conservation and Recreation. In general, the plan appears conceptually reasonable and provided that the final design meets the Performance Criteria of the Chesapeake Bay Preservation Area Designation and Management Regulations as implemented through James City County's Bay Act Ordinance it would be consistent with the Chesapeake Bay Preservation Act.

The proposed plan relies on ground infiltration for treatment of stormwater. As currently planned, a series of underground storm chambers would be utilized in combination with dry swales (JCC-E2), which is similar to the water quality swale design in the Virginia Stormwater Management Handbook. Based upon the soils information provided, it does not appear that ground water will be a limiting factor. However, suitable soils for infiltration are non consistent across the site. It will be necessary to conduct site-specific soil investigations to ensure that adequate permeability exists for the infiltration BMPs proposed. Otherwise the soils beneath the chambers will need to be engineered to achieve the requisite permeability.

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We discussed switching the position of the forebay with the upgradient underground storage chambers particularly since this will collect runoff from the large employee parking lot. In

addition, the parking lots should have oil/grit separators as a form of pretreatment. This will extend the longevity of the BMPs as well as extend the time between maintenance of the BMPs.

The plan should incorporate pre-treatment upgradient of the BMPs. While there are several approaches for this, Minimum Standard 3.10E in the Virginia Stormwater Management Handbook addresses how the underground chambers can be utilized for pretreatment. The BMPs should not be set up in series, because that would result in the most BMP being overwhelmed from the volume of runoff passing through the upstream BMPs.

On previous occasions, we indicated that steps should be taken to reduce the amount of impervious cover on the site, as required by the performance criteria in the Bay Act Regulations. These comments were in response to the expansive parking areas shown on previous iterations of the master plan. The consultants and Foundation staff have indicated that the 212 proposed parking spaces are necessary for the employee parking area. Therefore, we highly recommend the use of permeable surfaces in the parking lot areas. This will address the performance criteria in addition to promoting infiltration and lessening runoff velocities and volumes. To further promote source control, we recommend the use of depressed bioretention areas in the parking lots instead of raised planting islands.

We look forward to reviewing the final design plans for this project. You are also welcome to submit draft plans as you progress with the design. Please be sure to submit final plans to the Department of Conservation and Recreation for their evaluation and approvals in accordance with the Virginia Erosion and Sediment Control Law and Virginia Stormwater Management Act.

We appreciate the opportunity to provide our comments on this project. Please do not hesitate to contact us at 1-800-CHESBAY should you have any questions.

Sincerely,

Catherine M. Harold
Environmental Engineer

Douglas G. Wetmore
Principal Environmental Planner

Cc: Scott Crafton, CBLAD
Robert Cooper, DCR
Donald Jennings, Rickmond
Darryl Cook, James City County
Ellie Irons, DEQ ✓

COMMONWEALTH of VIRGINIA

CHESAPEAKE BAY LOCAL ASSISTANCE DEPARTMENT

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

James Monroe Building
101 North 14th Street, 17th Floor
Richmond, Virginia 23219
FAX: (804) 225-3447

C. Scott Crafton
Acting Executive Director

(804) 225-3440
1-800-243-7229 Voice/TDD

July 25, 2002

Ms. Ellie Irons
Department of Environmental Quality
Office of Environmental Impact Review
629 East Main Street, Sixth Floor
Richmond, VA 23219

RE: Jamestown: SWM Improvements, and Boardwalk (425-16474)
CBLAD Project Review No. SSPR-JYF-05(C)-01

Dear Ms. Irons:

We were recently copied on a letter addressed to you (dated 7/1/02) from the Jamestown-Yorktown Foundation and have reviewed the Jamestown Settlement's working drawings for the Stormwater Management Improvements. We have a number of concerns with the proposed stormwater management plan that remain outstanding as well as some new concerns with the details of the plan. Several of these concerns have been repeatedly raised in earlier correspondence, phone discussions, and meetings, most recently in our letter to you dated June 5, 2002. I believe the Department of Conservation and Recreation may also have concerns with the proposed stormwater plan as well. You may recall that we discussed some of these issues at our meeting with the Foundation held in our office on June 11, 2002. Because many of the proposed projects rely on providing satisfactory stormwater management for the overall site, resolution of the stormwater plan is the critical path for approval of these other projects.

Some of the concerns we have with the BMP are with the establishment of a conservation easement on the open space area, accounting issues with the BMP credits claimed, an adequate channel analysis below the BMP outfall, whether any trees will be cleared in the area upslope of the timber wall, a hydraulic routing of the BMP, how runoff from impervious surfaces are to be conveyed to the BMP that is presumably serving these

areas, and whether the permitting agencies have concerns with the placement of a BMP in a wetland area.

We appreciate the opportunity to provide our comments on this project. Please do not hesitate to contact us at 1-800-CHESBAY should you have any questions.

Sincerely,

Catherine M. Harold
Environmental Engineer

Douglas G. Wetmore
Principal Environmental Planner

Cc:

Scott Crafton, CBLAD
Charles Ellis, DEQ
Robert Cooper, DCR
David Beale, DCR
Darryl E. Cook, JCC

COMMONWEALTH of VIRGINIA

CHESAPEAKE BAY LOCAL ASSISTANCE DEPARTMENT

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

James Monroe Building
101 North 14th Street, 17th Floor
Richmond, Virginia 23219
FAX: (804) 225-3447

C. Scott Crafton
Acting Executive Director

(804) 225-3440
1-800-243-7229 Voice/TDD

June 5, 2002

Ms. Ellie Irons
Department of Environmental Quality
Office of Environmental Impact Review
629 East Main Street, Sixth Floor
Richmond, VA 23219

RE: Jamestown: Entrance Plaza/Parking Lot Renovation (425-16133)
Jamestown: SWM Improvements, and Boardwalk (425-16474)
Jamestown: Riverfront Amenities/Shipwright Building (425-16469)
Jamestown: Maintenance Building Renovation/Expansion (425-16473)
Jamestown: Interpretive Pathway (425-01425-04)

CBLAD Project Review No. SSPR-JYF-05(B)-01

Dear Ms. Irons:

We were recently copied on two letters (dated 5/14/02, 4/21/02) addressed to you from the Jamestown-Yorktown Foundation and have reviewed the Jamestown Settlement Master Plan (dated 4/22/02) and the revised Stormwater Management Master Plan (dated 5/2/02) for the Jamestown-Yorktown Settlement sent to us with these letters. The following is a discussion of the status of these projects with respect to consistency with the Chesapeake Bay Preservation Area Designation and Management Regulations (Regulations). We have several remaining concerns with the proposed plans. Most of these concerns were raised in earlier correspondence, phone discussions, and meetings. For purposes of clarity between our former comments and these it should be noted that the drainage areas (DAs) have been redrawn and renumbered accordingly. Former DAs 1, 2, and 3 are now group together as drainage area 4. Former drainage areas 4, 5, and portions of former drainage areas 2 and 3 are now grouped together as drainage area 5. The parking lot and entrance plaza are now denoted and numbered as drainage areas 1, 2, and 3.

Entrance Plaza/Parking Lot Renovation:

The revised stormwater master plan indicates that the parking lot and entry plaza areas (DAs 1, 2, and 3) are to be addressed separately from the master plan. Attached are comments we made in a letter dated March 27, 2002 to Rickmond Engineering, Inc. regarding the stormwater

management plan for the parking lot and entry plaza. The revised stormwater management plan indicates that 100 percent of the parking lot and entry plaza will be served by the 3 dry swales. **The full credit (10 BMP points) for these BMPs can be applied provided that pretreatment is incorporated into the design (see CBLAD March 27, 2002 letter attached). Provided this condition is met, the project would be consistent with the Regulations.**

SWM Improvements, and Boardwalk, Riverfront Amenities/Shipwright Building, Maintenance Building Renovation/Expansion, Interpretive Pathway:

These four projects are tied to the stormwater management master plan, for which we have remaining concerns. Other concerns have also not been addressed. For example, the "group area" denoted in the Resource Protection Area (RPA) is not water-dependent and needs to be relocated out of the RPA. Also, grading for the ship maintenance build extends into the RPA. The design of the riverfront interpretive pathway does not reflect the changes per the last correspondence between CBLAD and the Foundation. The Building should be shifted back out of the RPA. The concession area ("shop") is still within the RPA and needs to be shifted back out of the RPA as it is not water-dependent. **These encroachments need to be removed before the projects are consistent with the Regulations.**

The proposed open space area has been reduced in size since the last stormwater management plan we reviewed. The reduction appears to be due to encroachments of the employee parking lot, an amphitheater, and boardwalk into this area. The following describes several concerns we have regarding the use of this area as credit towards the 10-point BMP Credits needed for the project:

- The County's BMP guidance for the use of open space towards this credit requires that a conservation easement or other enforceable instrument that ensures perpetual protection of the area. From the mapping provided it appears that this area is not within the Foundation's property boundaries. **Without a permanent protective mechanism this area cannot be credited towards the needed BMP credits.**

- To receive open space BMP credit the open space area cannot be disturbed during project construction (i.e., cleared or graded). It appears the conservation area also includes areas that would be disturbed by the construction of a substantial boardwalk through the area. Also, the plans indicate a BMP design detail, which will require alteration of the open space area, potentially including the wetland for the requisite plunge pool, micropool and outlet structure. **The disturbed areas including the boardwalk, and BMP area should not be counted in the area measure of the conservation area if the area will be disturbed.**

We have several concerns with how the water calculations were prepared, which are as follows:

- The master plan indicates that the total site area is 35.69 acres. For purposes of the calculations, only DAs 4 and 5 (24 acres) were considered as the site area. We have no problem with separating out the DAs 1, 2, and 3 (entrance plaza and parking lot) from DAs 4 and 5, provided that DAs 1, 2, and 3 also achieve 10 BMP points separately. The calculations indicate that the fraction of the site served by BMP #B-3 is 0.74 (14.72/19.89). Assuming that 24 acres is the site area, the denominator

(19.89) in this equation appears to have been derived at by subtracting out the conservation area. For this to be a true fraction **both sides of the equation should include the conservation area. Thus, the fraction of the site served would be 0.61 (14.72/24) yielding 6.1 BMP points.**

Given the need for additional BMP credit and the numerous concerns with use of an area for open space credit that is currently not on the Jamestown-Yorktown Foundation's property, we suggest that the Foundation explore the idea of making easement arrangements off site. This would involve the payment of an off-set fee such that James City County or an approved land trust may purchase developable land as natural open space off-site. We would be available to meet with the Foundation, James City County and any other party to discuss the possibilities regarding these alternatives.

Another possibility for achieving additional BMP credits would be to explore the idea of providing another structural BMP. There appears to be a drainage swale between the ship maintenance facility and wooded amphitheater that might serve both of these areas the nearby parking, concession stand, and the other amphitheater. The Foundation's drainage consultant should investigate whether this would be feasible from a water quality treatment perspective and whether there would be any constraints to using this area for this purpose.

We appreciate the opportunity to provide our comments on this project. Please do not hesitate to contact us at 1-800-CHESBAY should you have any questions.

Sincerely,

Catherine M. Harold
Environmental Engineer

William D. Beisch, Jr., P.E.
Senior Environmental Engineer

Cc: Douglas G. Wetmore
Scott Crafton, CBLAD
Shawn E. Smith, CBLAD
Charles Ellis, DEQ
Robert Cooper, DCR
Darryl E. Cook, JCC

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COMMONWEALTH of VIRGINIA

CHESAPEAKE BAY LOCAL ASSISTANCE DEPARTMENT

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March 5, 2001

Mr. Charles H. Ellis, III
Department of Environmental Quality
Office of Environmental Impact Review
629 East Main Street, Sixth Floor
Richmond, VA 23219

RE: Jamestown Settlement Proposed Improvements EIR
CBLAD Project Review No. SSPR-JYF-03-01

Dear Mr. Ellis:

As you requested, we have reviewed the Environmental Impact Report (EIR) for the proposed improvements at the Jamestown Settlement. The following are our comments and recommendations.

As described in the EIR, it does not appear that the proposed improvements will add impervious surfaces to the site. However, the Site Master Plan indicates that a number of planned improvements may add additional impervious surfaces. If either the immediate planned improvements (addressed in the EIR) or the master plan elements to be constructed prior to the 400th anniversary celebration will involve redevelopment or new development of impervious surfaces (the boardwalk would not be considered impervious) the projects will need to comply with the performance standards of the Chesapeake Bay Preservation Area Designation and Management Regulations (Regulations) including the stormwater management criteria.

We recommend that the Foundation address the stormwater quality requirements early in the planning stages so that the master plan can accommodate BMP features and perhaps maximize the efficiencies of BMPs that may be required. Also, since much of the landscaping is planned now it may be possible to incorporate soft vegetative BMPs into the plans at this point in time. We are available to meet with the Jamestown-Yorktown

Foundation and/or its consultant to discuss the master plan and any needed stormwater quality controls that may be required for compliance with the Regulations.

We appreciate the opportunity to provide our comments on this project. Please do not hesitate to contact us at 1-800-CHESBAY should you have any questions.

Sincerely,

Catherine M. Harold
Environmental Engineer

Doug Wetmore
Principal Environmental Planner

Cc: Scott Crafton, CBLAD
Martha H. Little, CBLAD

COMMONWEALTH of VIRGINIA

Department of Historic Resources

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Secretary of Natural Resources

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Director

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July 18, 2002

Mr. Charles Ellis
Department of Environmental Quality
Office of Environmental Impact Review
629 East Main Street, Sixth Floor
Richmond, Virginia 23219

Re: Jamestown Settlement Master Plan Addendum
Entry Plaza and Parking Lot Improvements/Realignment of Route 356
Stormwater Management System
DEQ Project Numbers 01-026-S/01-039-S
DHR File Numbers 2001-0641/2001-0436/2001-0478

Dear Mr. Ellis:

Thank you for requesting our comments on the Jamestown Settlement Master Plan Addendum and accompanying maps.

We are pleased to see that the revised map dated July 5, 2002 addresses several issues of concern to us. The new alignment of Route 359 allows improved access to the Colonial Parkway. Further, there appears to be room for a 50-foot buffer along the outer edge of Route 359. We requested review of any landscape design plans in February of 2001, however, and we have not yet received any more detailed plans on the landscape design for the parking lot other than those showing the alignment of Route 359 and the proposed location of parking spaces and bus drop off points. In order to achieve the protection of a significant historic property, we continue to recommend a fifty foot buffer supplemented by appropriate vegetative planting to preserve the viewshed from the Colonial Parkway along Route 359. In addition, as we discussed in our on-site meeting with the Foundation staff on May 17, 2001, we continue to recommend that consideration be given to green-space within the parking lot in order to reduce the visual effects of the parking lot on the Parkway as it crosses Powhatan Creek. We encourage the Foundation to consider archaeological sites, landscape

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features and adjacent historic properties in determining the final alignment and design of Route 359 and the final landscape plan for the entry plaza and parking lot.

One archeological site, 44JC1084, has been identified within the footprint of the parking lot. An Evaluation (Phase II) archeological survey of that site has been completed to determine conclusively the site's significance and we are currently reviewing the report. Our staff are willing to advise the Foundation on appropriate treatment, if the site is found eligible.

No survey has yet been conducted, however, for the proposed the stormwater management plan for the Settlement. We continue to recommend a survey to identify the full range of historic properties that may be affected by the plan, including architectural, landscape and archaeological resources. management plan. The survey should be conducted by qualified professionals in accordance with our state *Guidelines For Conducting Cultural Resource Survey In Virginia: Additional Guidance for the Implementation of the Federal Standards Entitled Archaeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines (48 FR 44742, September 29, 1983)* 1999, rev. 2000.

Finally, as we have previously stated, if a Corps of Engineers permit is required for the proposed facilities, further consultation with our Department and other consulting parties will be needed in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended through 1992.

If you have any questions or if we can be of any further assistance do not hesitate to contact me at (804) 367-2323 ext. 140 or lrichards@dhr.state.va.us.

Sincerely,

Lily A. Richards
Archaeologist and Historian

c. Philip G. Emerson, Jamestown-Yorktown Foundation
Sandy Rives, Jamestown 2007 Project

COMMONWEALTH of VIRGINIA

Department of Historic Resources

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June 15, 2001

Mr. Charles Ellis
Department of Environmental Quality
Department of Environmental Impact Review
629 East Main Street, Sixth Floor
Richmond, Virginia 23219

Re: Proposed Improvements to Jamestown Settlement
DEQ Project Number 01-026-S
DHR File Number 2001-0641

Dear Mr. Ellis:

This letter supercedes any previous letter from the DHR regarding the referenced project. We have reviewed project and offer the following comments:

- The DHR continues to recommend a cultural resources survey of the project area. This survey should be conducted by qualified professionals in accordance with the federal standards entitled *Archeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines (48* FR 44716-44742, September 29, 1983) and our state *Guidelines for Preparing Identification and Evaluation Reports for Submission Pursuant to Sections 106 and 110, National Historic Preservation Act, Environmental Impact Reports of State Agencies, Virginia Appropriations Act, 1992 Session Amendments* (June 1992). The survey should identify the full range of effects of the project on historic properties present in the project's area of potential effects, including architectural, archaeological, and historic landscape resources. This survey should be conducted prior to any ground breaking activities (please note that this work will require a permit to conduct archaeological investigations on state lands which can be obtained through our office).
- Please understand that if the proposed storm water facilities are located in a wetlands area, a permit from the US Army Corps of Engineers will be required. Issuance of a permit is an undertaking subject to Section 106 of the National Historic Preservation Act of 1966, as amended through 1992. All Corps permit actions, including non-reporting nationwide permits, require consideration of historic properties (condition 12). Any discussions with the Corps or requests for verification of nationwide status should include information provided by DHR and the National Park Service on the archeological sensitivity of the area and the presence of the CNHP. In addition, the Corps' Area of Potential Effect (APE) may include other projects currently planned by the Foundation. If this is the case, then the Corps may have to consider the cumulative effects of these projects with concern to historic properties. Should the National Park Service request consulting party status in the 106 process, the Service would then have the opportunity to express its views on the cumulative effects on the CNHP of all Foundation projects located within the Corps' APE.

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Proposed Improvements to Jamestown Settlement, 01-026-S; 2001-0641

Thank you again for the opportunity to review and comment on this project. If we can be of any further assistance do not hesitate to contact me at (804) 367-2323 ext. 140.

Sincerely,

Lily A. Richards
Archaeologist and Historian
Division of Resource Services and Review

Cc. Heather Huyck, NPS
Jeff Lunsford, Jamestown Yorktown Foundation

COMMONWEALTH of VIRGINIA

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Dennis H. Treacy
Director

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MEMORANDUM

TO: Charles H. Ellis III, Environmental Program Planner; Office of Environmental Impact Review

FROM: Dave Davis, Environmental Specialist II; Office of Water Permit Programs

SUBJECT: Environmental Impact Review; Proposed Improvements to Jamestown Settlement
Jamestown-Yorktown Foundation
James City County, Virginia
Project No. 01-026S

DATE: 9 March 2001

I have reviewed the information provided by Environmental Specialties Group, Inc. concerning the above-referenced project. Site activities include the demolition of an existing marine railway, construction of a wetland educational boardwalk, drainage improvements to the Native American Village and the fort areas, and general landscaping and soil stabilization improvements throughout the site.

The EIR states that nontidal, forested wetlands were delineated in depressional areas on the site. Additionally, vegetated tidal wetlands occur in the vicinity of the marine railway that is proposed for demolition. The report states that a delineation confirmation request has been submitted to the U.S. Army Corps of Engineers (the Corps). The construction of a wetland educational boardwalk will occur in the wetland areas, but the report does not quantify the extent of proposed impacts. Once the Corps confirms the wetland delineation and proposed wetland impacts are quantified, then we can determine if a Virginia Water Protection Permit will be required for the proposed activities.

Direct and non-direct impacts to wetlands in the vicinity of the project site should be avoided and minimized to the extent practicable. It is also suggested that vegetated buffers around wetland areas be left intact to protect water quality. This program also encourages the use of erosion and sediment control measures and careful construction practices to minimize temporary impacts to State waters during site construction activities.

Thank you for the opportunity to comment on this project.

COMMONWEALTH of VIRGINIA

James S. Gilmore, III
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Secretary of Natural Resources

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Dennis H. Treacy
Director

Francis L. Daniel
Tidewater Regional Director

MEMORANDUM

TO: Charles H. Ellis, III - Office of Environmental Impact Review

FROM: Sheri Kattan - Tidewater Regional Office

DATE: March 28, 2001

SUBJECT: Review of the Environmental Impact Report for "Proposed Improvements to the Jamestown Settlement", Jamestown-Yorktown Foundation, Project Number 01-026S.

The Tidewater Regional Office has completed its review of this Environmental Impact Report (EIR) and we are submitting the following comments. Thank you for the opportunity to participate in the review process.

WETLANDS/WATER QUALITY: It is not clear from the EIR drawings where the marine railway is located with respect to the vegetated emergent wetlands. If vegetated or nonvegetated wetlands are to be disturbed during the marine railway removal process, then submittal of a joint permit application to the Virginia Marine Resources Commission (VMRC) may be required for dissemination to the state, federal and local regulatory agencies for review. Use of turbidity curtains and silt fences to protect wetlands and State waters from siltation is strongly encouraged. The nontidal wetland areas on site appear to have a hydrologic connection to surface water and will likely be considered jurisdictional by the Army Corps of Engineers. The proposed open-pile boardwalk in these areas will, therefore, require submittal of a joint permit application to VMRC for dissemination to the appropriate state and federal regulatory agencies for review. The boardwalk should be configured to avoid and minimize impacts to the wetlands and the sensitive vernal pond habitat to the maximum extent practicable. As stated in the EIR, surveys for small whorled begonia and sensitive joint-vetch should be conducted to determine if these species are present in the areas proposed for improvement. It is suggested that the marine railway work be performed outside the breeding season for the State sensitive great egret to avoid adverse impacts to the designated Species of Concern.

Addition of stormwater treatment ponds is an excellent way to reduce pollutant and sediment loadings to the James River and adjacent wetlands, and we encourage the Foundation's efforts in this area.

All construction projects must incorporate proper erosion control measures as outlined in the most recent edition of the DCR's "The Virginia Erosion and Sediment Control Handbook". Precautions should be taken to preclude the entry of any contaminants or sediment into adjacent wetlands and waters of the State.

The master plan included in the EIR includes a Marine Ecology Area that will result in additional work/impacts in State waters. Since this area is included in the 15-acre are covered by the EIR, shouldn't these impacts be assessed as well?

STORM WATER: As the project proposes impacts to 5 or more acres of land surface, a Stormwater General Permit for Construction Activities (9 VAC 25-180-10 et. seq.) will be required. This permit will require implementation of a Stormwater Pollution Prevention Plan.

GROUND WATER: No comments were solicited from our Groundwater Program staff as impacts to groundwater are not anticipated.

UNDERGROUND STORAGE TANKS: No comments were solicited from our Underground Storage Tank (UST) Program staff as impacts from USTs are not anticipated.

WASTE: All waste generated during any construction or demolition activities must be handled and disposed in accordance with all applicable federal, state, and local environmental regulations.

AIR: No comments or concerns were generated from our Air Program staff during review of this EIR.

cc: file

RECEIVED

MAR 22 2001

DEQ-Office of Environmental Impact Review

HAMPTON ROADS
PLANNING DISTRICT COMMISSION

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Jackson C. Tuttle, II, *City Manager*
Jeanne Zeidler, *Mayor*

YORK COUNTY
Sheila S. Noll, *Board Member*
Daniel M. Stuck, *County Administrator*

March 21, 2001

Mr. Charles H. Ellis III
EIR Coordinator
Department of Environmental Quality
Post Office Box 10009
Richmond, Virginia 23219

Re: Proposed Improvements to the Jamestown Settlement
DEQ #01-026S (ENV:GEN)

Dear Mr. Ellis:

Pursuant to your request of February 15, 2000, the staff of the Hampton Roads Planning District Commission has reviewed the Environmental Impact Review for the Proposed Improvements to the Jamestown Settlement. We have contacted James City County concerning the project.

Based on this review, James City County has identified some outstanding concerns. These concerns pertain to the project's Stormwater Management Master Plan and the County's requirements for Chesapeake Bay Preservation Areas. A copy of a letter outlining the County's outstanding issues with the project is attached. It is advised that the applicant work with the County to resolve these issues. Until the County approves the Stormwater Plan, the proposal is not consistent with the local Chesapeake Bay Preservation Ordinance.

We appreciate the opportunity to review this project. If you have any questions, please do not hesitate to call.

Sincerely,

Arthur L. Collins
Executive Director/Secretary

HRV:fh

Attachment

cc: Mr. Wayland Bass, JCC

DEVELOPMENT MANAGEMENT

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March 12, 2001

Mr. Charles H. Ellis, III
Environmental Impact Review Coordinator
Commonwealth of Virginia
Department of Environmental Quality
P. O. Box 10009
Richmond VA 23240

Dear Mr. Elis:

The Environmental Impact Review for Jamestown Settlement refers to stormwater ponds. The CSMP does not show these ponds. The draft Stormwater Management Master plan was submitted separately for County review. The Environmental Division's comments are attached. Until the BMP Master Plan receives County approval, Jamestown Settlement does not comply with our Local Chesapeake Bay Ordinance.

The wetlands boardwalk as shown on the CSMP seems to include excessive amounts of clearing in an area that may be needed for natural open space bmp points. This concern could be addressed by requiring JCC approval of boardwalk construction plans. This area is infested with invasive ivy which will kill the trees in this area and cover the board walk. Perhaps this is an educational point to be made about invasive plants. Please show the 150 foot Community Character Buffer along Jamestown Road..

Before removing the marine railway please obtain JCC approval regarding protection and /or restoration of the RPA.

Sincerely,

Wayland N. Bass
County Engineer

WNB/chp

cc: Mr. Darryl Cook, Environmental Division

DEVELOPMENT MANAGEMENT

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August 29, 2002

Mr. Charles H. Ellis, III
Environmental Impact Review Coordinator
Office of Environmental Impact Review
Department of Environmental Quality
P.O. Box 10009
Richmond, Virginia 23240

RE: Jamestown-Yorktown Foundation Projects: New Stormwater Management Master Plan, dated July 3, 2002

Dear Mr. Ellis:

On August 2, 2002, a memo, which included copies of a new Stormwater Management Master Plan from the Jamestown-Yorktown Foundation, was forwarded to me. Although no instructions or requests were included in your memo, James City County has taken the opportunity to review the revised materials and our comments are enclosed for your use.

We appreciate the opportunity to review these materials. If I can be of further assistance, please contact me.

Sincerely,

John T.P. Horne
Development Manager

enclosure

cc: Darryl Cook, JCC
Paul Holt, JCC
Alec Gould, NPS

DEVELOPMENT MANAGEMENT

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March 12, 2001

Mr. Charles H. Ellis, III
Environmental Impact Review Coordinator
Commonwealth of Virginia
Department of Environmental Quality
P. O. Box 10009
Richmond VA 23240

Dear Mr. Elis:

The Environmental Impact Review for Jamestown Settlement refers to stormwater ponds. The CSMP does not show these ponds. The draft Stormwater Management Master plan was submitted separately for County review. The Environmental Division's comments are attached. Until the BMP Master Plan receives County approval, Jamestown Settlement does not comply with our Local Chesapeake Bay Ordinance.

The wetlands boardwalk as shown on the CSMP seems to include excessive amounts of clearing in an area that may be needed for natural open space bmp points. This concern could be addressed by requiring JCC approval of boardwalk construction plans. This area is infested with invasive ivy which will kill the trees in this area and cover the board walk. Perhaps this is an educational point to be made about invasive plants. Please show the 150 foot Community Character Buffer along Jamestown Road..

Before removing the marine railway please obtain JCC approval regarding protection and /or restoration of the RPA.

Sincerely,

Wayland N. Bass
County Engineer

WNB/chp

cc: Mr. Darryl Cook, Environmental Division

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

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Robert G. Burnley
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July 31, 2002

Mr. David Wolfe Kent, AIA
Project Administrator
Jamestown-Yorktown Foundation
P.O. Box 1607
Williamsburg, Virginia 23187

RE: Environmental Impact Reports for Jamestown-Yorktown Foundation Projects:
(1) Jamestown Settlement Improvements/Stormwater Improvements and Boardwalk (project code 16474), DEQ-01-026S, and
(2) Jamestown Settlement Maintenance Building (project code 16473), DEQ-02-029S

Dear Mr. Kent:

In the course of our review of the Environmental Impact Report (EIR), the stormwater management master plan, and the revised stormwater management plans you submitted for these projects, we have identified several issues that continue to need resolution before we can recommend either project for approval to the Governor, pursuant to *Virginia Code* sections 10.1-1189 and 10.1-1190 (Environmental Impact Reports of State Agencies) and Executive Order 88(01). Accordingly, we are suspending our 60-day review of the revised information we received on June 3, pending receipt of additional information. A new 60-day review period will begin upon our receipt of the information requested. We will, of course, respond as quickly as possible once the new information is received.

If the issues raised in this letter cannot be satisfactorily resolved and the stormwater management plan is not revised to comply with the Chesapeake Bay Preservation Act, DEQ may find it necessary to recommend against approval of these two projects.

The Chesapeake Bay Local Assistance Department (CBLAD), in reviewing these two projects and the information submitted as of June 3, indicated several concerns with

the Stormwater Management Master Plan (hereinafter the "Plan") submitted earlier by the Foundation. Both these projects are tied to the Plan. CBLAD indicates that it has corresponded previously with the Foundation regarding these concerns. They are as follows.

(1) The "group area" denoted in the Resource Protection Area (RPA) is not water-dependent and needs to be relocated out of the RPA.

(2) The concession area ("shop") needs to be shifted out of the RPA, since it is not water-dependent.

These encroachments into the RPA need to be removed before either project can be consistent with the Chesapeake Bay Preservation Area Designation and Management Regulations (9 VAC 10-20-10 et seq.).

The proposed open space area has been reduced in size since submission of the last stormwater management plan reviewed by CBLAD. The reductions appear to be attributable to encroachments of the employee parking lot, an amphitheatre, and the boardwalk into this area. According to CBLAD, using this area as credit toward the 10-point BMP Credits needed for the projects presents the following concerns (we are numbering consecutively to aid you in addressing the items in this letter):

(3) The County's BMP guidance for the use of open space toward this credit requires a conservation easement, or other enforceable instrument, to ensure perpetual protection of the area. From the mapping given, it appears that this area is not within the Foundation's property boundaries. As CBLAD states, **without a permanent protective mechanism, this area cannot be credited toward the needed BMP credits.**

(4) To receive open-space BMP credit, the open space cannot be disturbed during construction activities (i.e., it cannot be cleared or graded). The conservation area appears to include areas that would be disturbed by construction of a substantial boardwalk through the area. The plans also indicate a BMP design detail which will require alteration of the open space, potentially including the wetland, for the requisite plunge pool, micropool, and outlet structure. **The disturbed areas, including the boardwalk, and BMP area should not be counted in the area measure of the conservation area if that area will be disturbed.**

In addition, CBLAD has indicated concerns with the way the water calculations were prepared. These are as follows.

(5) The master plan indicates a total site area of 35.69 acres. For purposes of calculations, only DAs 4 and 5 (24 acres) were considered as the site area. Separating out DAs 1, 2, and 3 (the Entrance Plaza and Parking Lot, DEQ-01-039S) from DAs 4 and 5 presents no problem, provided that these also achieve 10 BMP points separately. The calculations indicate that the fraction of the site served by BMP #B-3 is 0.74 (14.72/19.89). Assuming that the site area is 24 acres, the denominator (19.89) appears to have been derived by subtracting the conservation area. For this to be a true fraction, **both sides of the equation should include the conservation area. Thus the fraction of the site served would be 0.61 (14.72/24), yielding 6.1 BMP points.**

CBLAD suggests two possible ways to achieve additional BMP credits. First, given the need for them, and the numerous concerns with use of an area for open space that is not part of the Foundation's property, CBLAD recommends consideration of the idea of making easement arrangements off-site. This would involve the payment of an off-set fee, such that the County or an approved land trust may purchase developable land as natural open space off the project site. Secondly, another structural BMP might be provided, as follows. There appears to be a drainage swale between the ship maintenance facility and the wooded amphitheatre that might serve both these areas, the other amphitheatre, the nearby parking, and the concession stand. CBLAD recommends that the drainage consultant investigate whether using this area would be feasible.

We ask that the Foundation address issues #1 through 5 above, and consider how to ensure that the stormwater management plan covering these projects meets the Regulations cited above. The information submitted thus far does not remedy these concerns. We recommend that the Foundation and its consultants meet with representatives of CBLAD, this office, and the Department of Conservation and Recreation's Division of Soil and Water Conservation as a pre-requisite to submitting further stormwater management plans. We recommend that you invite the National Park Service and James City County staff as well. The meeting could be in Richmond, Jamestown, or Williamsburg.

In the course of addressing the issues above, we also recommend that the Foundation commit itself to an archaeological survey of the areas to be affected by the final stormwater management design. The Department of Historic Resources recommends such as survey, pre-requisite to any ground disturbance, because one archaeological site has been found in the parking lot area (as discussed in our response on the proposed Entrance Plaza and Parking Lot Expansion, DEQ-01-039S). There may be other such sites in the area of the proposed Jamestown Settlement Improvements or the Maintenance Building that would be affected by the final stormwater management plan. While the survey must be completed and reviewed prior to any ground disturbance, it

COMMONWEALTH of VIRGINIA

CHESAPEAKE BAY LOCAL ASSISTANCE DEPARTMENT

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

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C. Scott Crafton
Acting Executive Director

(804) 225-3440
1-800-243-7229 Voice/TDD

June 5, 2002

Ms. Ellie Irons
Department of Environmental Quality
Office of Environmental Impact Review
629 East Main Street, Sixth Floor
Richmond, VA 23219

RE: Jamestown: Entrance Plaza/Parking Lot Renovation (425-16133)
Jamestown: SWM Improvements, and Boardwalk (425-16474)
Jamestown: Riverfront Amenities/Shipwright Building (425-16469)
Jamestown: Maintenance Building Renovation/Expansion (425-16473)
Jamestown: Interpretive Pathway (425-01425-04)

CBLAD Project Review No. SSPR-JYF-05(B)-01

Dear Ms. Irons:

We were recently copied on two letters (dated 5/14/02, 4/21/02) addressed to you from the Jamestown-Yorktown Foundation and have reviewed the Jamestown Settlement Master Plan (dated 4/22/02) and the revised Stormwater Management Master Plan (dated 5/2/02) for the Jamestown-Yorktown Settlement sent to us with these letters. The following is a discussion of the status of these projects with respect to consistency with the Chesapeake Bay Preservation Area Designation and Management Regulations (Regulations). We have several remaining concerns with the proposed plans. Most of these concerns were raised in earlier correspondence, phone discussions, and meetings. For purposes of clarity between our former comments and these it should be noted that the drainage areas (DAs) have been redrawn and renumbered accordingly. Former DAs 1, 2, and 3 are now group together as drainage area 4. Former drainage areas 4, 5, and portions of former drainage areas 2 and 3 are now grouped together as drainage area 5. The parking lot and entrance plaza are now denoted and numbered as drainage areas 1, 2, and 3.

Entrance Plaza/Parking Lot Renovation:

The revised stormwater master plan indicates that the parking lot and entry plaza areas (DAs 1, 2, and 3) are to be addressed separately from the master plan. Attached are comments we made in a letter dated March 27, 2002 to Rickmond Engineering, Inc. regarding the stormwater

management plan for the parking lot and entry plaza. The revised stormwater management plan indicates that 100 percent of the parking lot and entry plaza will be served by the 3 dry swales. **The full credit (10 BMP points) for these BMPs can be applied provided that pretreatment is incorporated into the design (see CBLAD March 27, 2002 letter attached). Provided this condition is met, the project would be consistent with the Regulations.**

SWM Improvements, and Boardwalk, Riverfront Amenities/Shipwright Building, Maintenance Building Renovation/Expansion, Interpretive Pathway:

These four projects are tied to the stormwater management master plan, for which we have remaining concerns. Other concerns have also not been addressed. For example, the "group area" denoted in the Resource Protection Area (RPA) is not water-dependent and needs to be relocated out of the RPA. Also, grading for the ship maintenance build extends into the RPA. The design of the riverfront interpretive pathway does not reflect the changes per the last correspondence between CBLAD and the Foundation. The Building should be shifted back out of the RPA. The concession area ("shop") is still within the RPA and needs to be shifted back out of the RPA as it is not water-dependent. **These encroachments need to be removed before the projects are consistent with the Regulations.**

The proposed open space area has been reduced in size since the last stormwater management plan we reviewed. The reduction appears to be due to encroachments of the employee parking lot, an amphitheater, and boardwalk into this area. The following describes several concerns we have regarding the use of this area as credit towards the 10-point BMP Credits needed for the project:

- The County's BMP guidance for the use of open space towards this credit requires that a conservation easement or other enforceable instrument that ensures perpetual protection of the area. From the mapping provided it appears that this area is not within the Foundation's property boundaries. **Without a permanent protective mechanism this area cannot be credited towards the needed BMP credits.**

- To receive open space BMP credit the open space area cannot be disturbed during project construction (i.e., cleared or graded). It appears the conservation area also includes areas that would be disturbed by the construction of a substantial boardwalk through the area. Also, the plans indicate a BMP design detail, which will require alteration of the open space area, potentially including the wetland for the requisite plunge pool, micropool and outlet structure. **The disturbed areas including the boardwalk, and BMP area should not be counted in the area measure of the conservation area if the area will be disturbed.**

We have several concerns with how the water calculations were prepared, which are as follows:

- The master plan indicates that the total site area is 35.69 acres. For purposes of the calculations, only DAs 4 and 5 (24 acres) were considered as the site area. We have no problem with separating out the DAs 1, 2, and 3 (entrance plaza and parking lot) from DAs 4 and 5, provided that DAs 1, 2, and 3 also achieve 10 BMP points separately. The calculations indicate that the fraction of the site served by BMP #B-3 is 0.74 (14.72/19.89). Assuming that 24 acres is the site area, the denominator

(19.89) in this equation appears to have been derived at by subtracting out the conservation area. For this to be a true fraction **both sides of the equation should include the conservation area. Thus, the fraction of the site served would be 0.61 (14.72/24) yielding 6.1 BMP points.**

Given the need for additional BMP credit and the numerous concerns with use of an area for open space credit that is currently not on the Jamestown-Yorktown Foundation's property, we suggest that the Foundation explore the idea of making easement arrangements off site. This would involve the payment of an off-set fee such that James City County or an approved land trust may purchase developable land as natural open space off-site. We would be available to meet with the Foundation, James City County and any other party to discuss the possibilities regarding these alternatives.

Another possibility for achieving additional BMP credits would be to explore the idea of providing another structural BMP. There appears to be a drainage swale between the ship maintenance facility and wooded amphitheater that might serve both of these areas the nearby parking, concession stand, and the other amphitheater. The Foundation's drainage consultant should investigate whether this would be feasible from a water quality treatment perspective and whether there would be any constraints to using this area for this purpose.

We appreciate the opportunity to provide our comments on this project. Please do not hesitate to contact us at 1-800-CHESBAY should you have any questions.

Sincerely,

Catherine M. Harold
Environmental Engineer

William D. Beisch, Jr., P.E.
Senior Environmental Engineer

Cc: Douglas G. Wetmore
Scott Crafton, CBLAD
Shawn E. Smith, CBLAD
Charles Ellis, DEQ
Robert Cooper, DCR
Darryl E. Cook, JCC

COMMONWEALTH of VIRGINIA

CHESAPEAKE BAY LOCAL ASSISTANCE DEPARTMENT

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Acting Executive Director

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1-800-243-7229 Voice/TDD

July 25, 2002

Ms. Ellie Irons
Department of Environmental Quality
Office of Environmental Impact Review
629 East Main Street, Sixth Floor
Richmond, VA 23219

RE: Jamestown: SWM Improvements, and Boardwalk (425-16474)
CBLAD Project Review No. SSPR-JYF-05(C)-01

Dear Ms. Irons:

We were recently copied on a letter addressed to you (dated 7/1/02) from the Jamestown-Yorktown Foundation and have reviewed the Jamestown Settlement's working drawings for the Stormwater Management Improvements. We have a number of concerns with the proposed stormwater management plan that remain outstanding as well as some new concerns with the details of the plan. Several of these concerns have been repeatedly raised in earlier correspondence, phone discussions, and meetings, most recently in our letter to you dated June 5, 2002. I believe the Department of Conservation and Recreation may also have concerns with the proposed stormwater plan as well. You may recall that we discussed some of these issues at our meeting with the Foundation held in our office on June 11, 2002. Because many of the proposed projects rely on providing satisfactory stormwater management for the overall site, resolution of the stormwater plan is the critical path for approval of these other projects.

Some of the concerns we have with the BMP are with the establishment of a conservation easement on the open space area, accounting issues with the BMP credits claimed, an adequate channel analysis below the BMP outfall, whether any trees will be cleared in the area upslope of the timber wall, a hydraulic routing of the BMP, how runoff from impervious surfaces are to be conveyed to the BMP that is presumably serving these

areas, and whether the permitting agencies have concerns with the placement of a BMP in a wetland area.

We appreciate the opportunity to provide our comments on this project. Please do not hesitate to contact us at 1-800-CHESBAY should you have any questions.

Sincerely,

Catherine M. Harold
Environmental Engineer

Douglas G. Wetmore
Principal Environmental Planner

Cc:

Scott Crafton, CBLAD
Charles Ellis, DEQ
Robert Cooper, DCR
David Beale, DCR
Darryl E. Cook, JCC

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

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W. Tayloe Murphy, Jr.
Secretary of Natural Resources

Robert G. Burnley
Director

(804) 698-4000
1-800-592-5482

August 14, 2002

MEMORANDUM

TO: David Kent, Jamestown-Yorktown Foundation

FROM: Ellie Irons, DEQ-OEIR

SUBJECT: August 7, 2002 Meeting on Stormwater Issues relative to Jamestown-Yorktown Foundation Projects: (1) Jamestown Settlement Stormwater Master Plan, DEQ-01-026S; (2) Jamestown Settlement Maintenance Building Addition, DEQ-02-029S; and (3) Riverfront Amenities and Shipwright Building, DEQ-02-030S

Copies: Charlie Ellis, DEQ-OEIR
Anne Newsom, DEQ-OEIR
Matt Roth, ESG
Catherine Harold, CBLAD
Kenny Jenkins, Rickmond Engineering
Robert Cooper, DCR-James Watershed

Thank you for attending the August 7 meeting on these projects. This memo is intended to summarize conclusions we reached and reflect our common understanding of the next steps to be taken in the environmental review pursuant to *Virginia Code* sections 10.1-1188 et seq. (the state Environmental Impact Reports law). These long-standing issues must be resolved prior to completion of the environmental review process for any project which contemplates using the regional stormwater facility. Please contact Charlie Ellis (telephone (804) 698-4488, or e-mail address chellis@deq.state.va.us) or me (telephone (804) 698-4325, e-mail elirons@deq.state.va.us) if your understanding differs from what is presented here.

First, the Master Plan contemplates use of an area along the southeast side of Route 31, southwest of the proposed parking area toward the James River, as a site for stormwater management facilities and possibly a conservation easement in order to accommodate stormwater flow and to meet Chesapeake Bay Preservation Act (CBPA) requirements. This area is currently owned by the Department of Transportation (VDOT). In the absence of a transfer of the land by VDOT to the Foundation, or of permission from VDOT, the Foundation may not alter the area for purposes of stormwater management or development; nor may it use the area as a conservation easement. Approval of the Regional Stormwater Management Plan by the Department of

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

Joseph H. Maroon
Director

REPLY TO:
Albemarle, Chowan & Coastal Watersheds Office
1548A Holland Road Ste 200
Suffolk, Virginia 23434
Telephone (757) 925-2468
FAX (757) 925-2388

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

203 Governor Street, Suite 206
Richmond, Virginia 23219
Phone: (804) 786-2064 Fax: (804) 786-1798

March 31, 2005

Mr. Michael S. Shuflat, Capital Outlay Administrator
Jamestown-Yorktown Foundation
P.O. Box 1607
Williamsburg, VA 23187

RE: **Jamestown Settlement Stormwater Management Master Plan**

Dear Mr. Shuflat:

Thank you for having your consultant submit a revised stormwater management master plan for the Jamestown Settlement. We have reviewed the plan and deem it consistent with the *Virginia Stormwater Management Act* and attendant regulations. Two (2) signed copies of the approved plan are enclosed for your use. Please note that detailed plans for the stormwater management features proposed in the master plan must be approved prior to construction. In addition, future project development plans should reference the approved master plan.

If you have any questions regarding this matter, please do not hesitate to contact me at (757) 925-6048.

Sincerely,

Jeffrey T. Hancock, P.E.
Urban Programs Engineer

cc: Eric Capps – DCR
Brad Belo – DCR
Matt Criblez – DCR
Mike Vanlandingham – DCR
Darryl Cook, P.E. – James City County
Don Jennings, P.E. – Rickmond+Bury

DEVELOPMENT MANAGEMENT

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INTEGRATED PEST MANAGEMENT
(757) 253-2620

April 1, 2002

Mr. Douglas Wetmore
Principal Environmental Planner
Chesapeake Bay Local Assistance Department
James Monroe Building
101 North 14th Street, 17th Floor
Richmond, VA 23219

RE: Jamestown Settlement Entry Plaza and Parking Lot Improvements
CBLAD No. SSPR-JYF-04(B)-01

Dear Mr. Wetmore:

We have reviewed your comments dated March 27, 2002, regarding the above referenced project and generally concur with your analysis and recommendations. The dry swale with the modifications you have described would be an acceptable approach to provide stormwater management for the entry plaza and parking lot. The pretreatment of the concentrated flows entering the dry swale through the use of forebays is very important as is maximizing the amount of flow that enters the swales in a sheet flow manner. However, as you point out, soil testing needs to be performed to evaluate the feasibility of using the dry swale in this location before further design. If the groundwater table is too high, an alternate BMP type will be required.

The information you provided us did not show the discharge point of the facility. It is important that an acceptable discharge point be identified. One consideration would be that if the facility outlets directly into tidal waters, the channel protection volume will not be required in the BMP. Another important issue to us is regional stormwater management. We encourage the use of one larger facility to provide stormwater management for several projects rather than the use of multiple facilities that only serve one project. Therefore, we have encouraged and continue to encourage the Jamestown-Yorktown Foundation to work with the Virginia Department of Transportation and Mr. Vermillion, the adjacent private property owner, to determine if one stormwater facility can be provided to meet the requirements for the their individual projects. We encourage you as representatives of a state agency to help facilitate this cooperation between the two state agencies.

Please contact me at 757-253-6670 if you have any further questions.

Sincerely,

Darryl E Cook

Darryl E. Cook, PE
Environmental Director

COMMONWEALTH of VIRGINIA

CHESAPEAKE BAY LOCAL ASSISTANCE DEPARTMENT

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Secretary of Natural Resources

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Richmond, Virginia 23219
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C. Scott Crafton
Acting Executive Director

(804) 225-3440
1-800-243-7229 Voice/TDD

March 27, 2002

Mr. Kenneth M. Jenkins, P.E.
Project Engineer
Rickmond Engineering, Inc.
1643 Merrimack Trail
Williamsburg, Virginia 23185-5624

where is discharge point?
no regional BMP anymore

RE: Jamestown Settlement Entry Plaza and Parking Lot Improvements
CBLAD Project Review No. SSPR-JYF-04(B)-01

Dear Mr. Jenkins:

As you requested, we have reviewed the conceptual revised drawings for the proposed parking lot serving the Jamestown Settlement. The following are our comments and recommendations.

We have some concerns with the use of a dry swale BMP design as presently designed and recommend some modifications to address these concerns. The selected design is more typically used in lower density settings with less imperviousness in the contributing drainage area. The siting guidance for water quality swales in Virginia Stormwater Management Handbook (VSWMH) Minimum Standard 3.13 indicates that this type of BMP is appropriate in settings where the imperviousness of the watershed is between 16-37%. The James City County (JCC) BMP Guidelines suggests that such BMPs be applied in low to moderate density developments (maximum density of 3 dwelling units/acre). However, given that the BMPs will wrap around most of the parking lot and with some modifications we feel that this design may be acceptable.

The design should address the rate and delivery points of stormwater to the BMPs. Concentrated runoff delivered to the swales should be pretreated in a sediment forebay first. This would also help to throttle down flow rates and lessen the possible resuspension of sediment particles in the swales themselves. We also suggest that as much area as possible be delivered to the swales via sheet flow.

Despite our foregoing comments, an altogether different BMP approach might be necessary if it turns out that the groundwater table is too high. If a subsurface investigation has not already been conducted, we recommend that this be initiated as soon as possible before a commitment is made to a final BMP design. The JCC BMP Guidelines indicates that for proper BMP functioning, the water table should be at least 2 feet below the bottom of a dry swale. The Virginia Stormwater Management Handbook recommends a 2 to 4-foot separation between the bottom of an infiltration facility and the water table and that subsurface soil have a permeability between 0.52 inches per hour and 8.27 inches per hour. The JCC BMP Guidelines suggest a 4-foot separation for infiltration facilities.

As a side note, you should probably coordinate the design with VDOT as well. It is our understanding that a VDOT is currently studying the realignment of the Route 31 connector road. We are not certain if this will have any bearing on the parking lot design.

We appreciate the opportunity to provide our comments on this project. Please do not hesitate to contact us at 1-800-CHESBAY should you have any questions.

Sincerely,

Catherine M. Harold
Environmental Engineer

Douglas G. Wetmore
Principal Environmental Planner

Cc: Scott Crafton, CBLAD
Shawn E. Smith, CBLAD
Daryl Cook, JCC
David Beale, DCR
David Kent, JYF

FAX TRANSMISSION

CHESAPEAKE BAY LOCAL ASSISTANCE DEPT.
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Richmond, VA 23219
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TO: Daryl Cook AGENCY/FIRM: JCC

FAX # _____ TELEPHONE # (757) 253-6673

FROM: Catherine Harold TELEPHONE # (804) 371-7501

6 # PAGES, INCLUDING THIS COVERSHEET

COMMENTS:

Some info re: Conceptual redesign @ JYF Settlement Pkg lot.

IF YOU DO NOT RECEIVE ALL PAGES, PLEASE CALL (804)225-3440

MEMO

To: John Horne, Development Manager
From: Darryl E. Cook, Environmental Director DEC
Subject: Jamestown Settlement Gateway BMP
Date: February 5, 2002

I reviewed the information regarding the construction of a BMP facility to serve the Foundation, VDOT, National Park Service, and the Vermillions. Concerning the construction cost, $60,000 appears to be reasonable if it is strictly for construction. Thought needs to be given as to how the 7300 cubic yards of soil excavated for the BMP will be disposed of. If it is a suitable material, it can be used (lost) onsite by raising the grade of the parking lot. This would be the most economical disposal. Trucking the material offsite would be very expensive unless a ready buyer was available. So some consideration needs to be given to that aspect of the project although it could be assumed the costs would be shared proportionally between the four parties.

The maintenance cost of $7100 per year seems a little high. This represents 11.8% of the construction cost. When we had the BMP maintenance costs estimated for us by the Center for Watershed Protection, the annual maintenance cost they used was 5% of the total construction cost. In this case, that would be $3000. In reviewing their analysis, the dredging costs seem to be high. I would not anticipate that 1600 cyds or 22% of the BMP volume would need to be dredged every 10 years especially with forebays that should be built into this facility. Also, mowing and vegetation control costs would probably be less than $4000 as the general upkeep of the site area would probably include most of this work. It would seem reasonable that the annual costs would be between $4000 and $5000. However, if the intent is to develop a conservative estimate and as it is lumped in together with the construction costs, I have no issue with the first year contribution costs developed.

Concerning the two options for contribution, either allocation method is valid. To be consistent with what most utility calculations are based on, impervious area would be the better basis for allocation.

One final point is that if the basin discharges into a tidal area, there would be no requirement to provide quantity control, only water quality control. If the basin has been designed including quantity control and it outfalls into a tidal area, then it could be reduced in size and costs of course would be reduced.

DEVELOPMENT MANAGEMENT

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(757) 253-2620

April 30, 2002

Mr. Kenny Jenkins
Rickmond Engineering, Inc.
1643 Merrimac Trail
Williamsburg, VA 23185

RE: Jamestown Settlement Stormwater Management Plan

Dear Mr. Jenkins:

I have reviewed the most recent submission of the above referenced plan and all the technical comments relating to the plan have been addressed. The only outstanding issue is that a 4.99 acre conservation easement needs to be established in order for the site to fully meet the James City County stormwater management requirements. The conservation easement in conjunction with the proposed stormwater management facility will satisfy the County's requirements. However, this letter is written with the understanding that the County will not be issuing any permits for the project and will not be inspecting the site for compliance with the approved plans.

I understand that there may be legal issues with the establishment of a conservation easement by the state to the County. This issue will need to be addressed in some manner before the plan can be determined to be consistent with the County's Chesapeake Bay Preservation Ordinance. Please contact me at 253-6670 if you have any questions.

Sincerely,

Darryl E Cook

Darryl E. Cook, P.E.
Environmental Director

DC/WB FYI

John H - FYI

DEQ -

FILE - Jamestown Settlement

HAMPTON ROADS
PLANNING DISTRICT COMMISSION

March 22, 2002

Mr. Charles H. Ellis III
EIR Coordinator
Department of Environmental Quality
Post Office Box 10009
Richmond, Virginia 23219

Re: Jamestown Settlement:
Riverfront Amenities and
Shipwright Building
DEQ #02-030S (ENV:GEN)

Dear Mr. Ellis:

Pursuant to your request of February 12, 2002, the staff of the Hampton Roads Planning District Commission has reviewed the Environmental Impact Report for Jamestown Settlement: Riverfront Amenities and Shipwright Building. We have contacted James City County concerning the project.

James City County has identified several items that need to be addressed before we can consider the project to be consistent with local plans and policies. These items are identified in a separate letter to you from the County. For your convenience, we have attached a copy of the County's comments. We recommend that the applicant work with the County to address local planning, environmental, and utilities issues identified in its letter.

We appreciate the opportunity to review this project. If you have any questions, please do not hesitate to call.

Sincerely,

Arthur L. Collins
Executive Director/Secretary

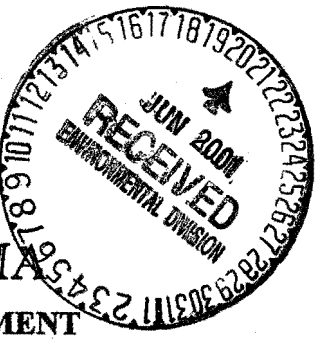
HRV:fh

Attachment

Copy: Mr. Marvin Sowers, JCC

99147_JAMESTOWN_SETTLEMENT - 291

FILE - Jamestown Settlement



COMMONWEALTH of VIRGINIA

CHESAPEAKE BAY LOCAL ASSISTANCE DEPARTMENT

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Michael D. Clower
Executive Director

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1-800-243-7229 Voice/TDD

June 19, 2001

Mr. Richard T. White
Jamestown-Yorktown Foundation
P.O. Box 1607
Williamsburg, Virginia 23187-1607

RE: Jamestown Settlement Stormwater Management Master Plan
CBLAD Project Review No. SSPR-JYF-05-01

Dear Mr.White:

Following our recent review of your proposed stormwater management plan, we have had a discussion with Daryl Cook and Wayland Bass of James City County Public Works Department regarding this project and wanted to provide additional comments to those we made in our letter to you on May 23, 2001. We apologize for any confusion regarding our comments as they relate to the local program requirements in James City County.

According to Messers Cook and Bass, who have had the advantage of reviewing more detailed plans for the proposed stormwater management pond, there would be very little disturbance to the existing wetlands (essentially a shallow timber dam at the lower end of the wetland). They also indicated that there would be a wet pond with a forebay feature as an upgradient pretreatment facility located on the north side of a road immediately above this wetland. This would allay our concern regarding the placement of a BMP in an existing wetland, which appears to be indicated in Appendix F (Stormwater Management Facilities Map) of the Stormwater Master Plan for the Jamestown Settlement. Much of Drainage Areas 1 and 2 would be directed through this pond. However, it is not clear how runoff from Drainage Area 3 would be directed to this pond or treated in some other way.

We remain concerned with the lack of a conservation easement or other enforceable protective instrument for the proposed open space area. We would like to reiterate that a land protection mechanism that would be binding in perpetuity is necessary in order for

the area to qualify for the open space BMP credit. The construction plans should also include notes as to how this area will be protected from disturbances during construction activities (to qualify for open space credit the area cannot be disturbed during project construction).

We request that the Foundation keep this agency abreast of the development plans and stormwater management plans for development activities planned at the Settlement property. The final stormwater management plan should clearly show what areas will drain towards the open space area via overland flow. Based on our recent discussions with the County, the Foundation should attempt to incorporate low impact development design techniques into future site designs where landscaping and topography permits, particularly in Drainage Areas 4 and 5, where no stormwater treatment is currently proposed.

We are also available to meet with the Foundation and/or its consultant to discuss the master plan and options for stormwater control. Please do not hesitate to contact us at 1-800-CHESBAY should you have any questions.

Sincerely,

for William D. Beisch, Jr., P.E.
Senior Environmental Engineer

Catherine M. Harold
Environmental Engineer

Cc: Scott Crafton, CBLAD
Shawn E. Smith, CBLAD
Doug Wetmore, CBLAD
Darryl E. Cook, P.E., James City County
Wayland Bass, James City County
Charles H. Ellis, DEQ
Robert Cooper, DCR
Steven W. Stafford, P.E., Rickmond Engineering, Inc.

C:\cmh\misc projects\SJYF05_1 revised1.doc

COMMONWEALTH of VIRGINIA

CHESAPEAKE BAY LOCAL ASSISTANCE DEPARTMENT

James S. Gilmore, III
Governor
John Paul Woodley, Jr.
Secretary of Natural Resources

James Monroe Building
101 North 14th Street, 17th Floor
Richmond, Virginia 23219
FAX: (804) 225-3447

Michael D. Clower
Executive Director

(804) 225-3440
1-800-243-7229 Voice/TDD

May 23, 2001

Mr. Richard T. White
Jamestown-Yorktown Foundation
P.O. Box 1607
Williamsburg, Virginia 23187-1607

RE: Jamestown Settlement Stormwater Management Master Plan
CBLAD Project Review No. SSPR-JYF-05-01

Dear Mr.White:

We have reviewed the stormwater master plan for the improvements at the Jamestown Settlement, which was sent to us by Rickmond Engineering, Inc. The following are our comments and recommendations.

We are pleased to see that the first steps in planning for stormwater has attempted to look at the subdrainage areas of the property. However, we have overall concerns with the BMP planned for the southern portion of the property. The Master Plan should also evaluate stormwater needs for the northern portion of the property as well.

A major concern we have with the plan is that only one BMP is contemplated, the construction of a pond/wetland BMP in a location that is already a forested wetland. The plan claims that this BMP and surrounding greenspace will achieve all of the requisite stormwater credits needed for all future development projects in the southern portion of the property. ~~The placement of a BMP in forested wetlands is strongly discouraged.~~ Theoretically, the net removal efficiency of a pond/wetland BMP placed in an existing wetland would need to take into account the fact that the existing wetlands currently provide some measure of pollutant removal. Construction of some buildings is currently underway at the Settlement and it is not clear whether the water quality criteria for this construction have already been addressed. Another concern we have with the overall plan is that no stormwater BMPs are planned for Drainage Areas 4 and 5.

The open space credit proposed for this project is not entirely consistent with the County's BMP Guidelines. The credits claimed appear to include the area measure of the BMP for which BMP credits were already accounted for. The land area identified includes wetlands that are already protected under state and federal regulations. To qualify for open space credit the area cannot be disturbed during project construction (BMP construction is currently proposed in this open space area). It is not clear whether the runoff from the development site will be conveyed to this area in a connected or disconnected manner. Given that the BMP is credited with treating 16.45 acres, it is presumed that delivery to the BMP would largely be via a connected drainage system. The County's guidance for open space credit only allows for 0.15 points per 1% of the total site area where the area receives runoff from disconnected impervious surfaces.

With respect to the use of open space credit, the County's BMP guidance also requires that the area be located within a conservation easement or other enforceable instrument that ensures perpetual protection of the proposed area. The May 3, 2001 Rickmond Engineering letter to the County indicates that the Foundation would be unable to dedicate a formal easement around these areas. Figure 2 of the stormwater plan suggests that much of the area proposed as open space is not presently under the Foundation's ownership. This requirement for the legal instrument with respect to providing open space credit and the perpetual protection of the area cannot be overemphasized. Based on the information provided, and the foregoing comments the higher Open Space BMP credit of 0.15 points cannot be used for this area.

The stormwater management criteria of the Chesapeake Bay Preservation Area Designation and Management Regulations (Regulations) require that for any new development, the post-development nonpoint source pollution runoff load shall not exceed the pre-development load based upon average land cover conditions. Redevelopment of any site not currently served by water quality best management practices shall achieve at least a 10% reduction of nonpoint source pollution in runoff compared to the existing runoff load from the site. Post-development runoff from any area to be redeveloped that is currently served by water quality best management practices shall not exceed the existing load of nonpoint source pollution in surface runoff. It appears that some of the areas planned for improvements may actually meet the definition of redevelopment. In accordance with these requirements James City County developed a jurisdiction-wide stormwater management program, which the Chesapeake Bay Local Assistance Board has approved. The County's nonpoint source control requirements are based upon a BMP point system.

We highly encourage the Foundation to incorporate low impact development design techniques as it plans for future development at the Settlement. Many of these techniques could attractively blend in with the rustic atmosphere of the Settlement. It has been found that many of these techniques are also less costly than traditional pond type of stormwater BMPs. We would be glad to meet with the Foundation and/or its consultant to discuss the master plan and alternative options for stormwater control.

In the Chesapeake 2000 Bay Agreement, the Governor committed the agencies of the Commonwealth to a number of sound land use and stormwater quality controls. The Governor additionally committed the agencies to lead by example with respect to controlling nutrient, sediment and chemical contaminant runoff from state properties. The Chesapeake Executive Council is expected to issue a directive soon, to address specific charges for agencies to lead by example with respect to stormwater control. It is anticipated that the directive will charge state facilities to showcase innovative stormwater designs that could also serve to educate the public as well. The Governor also committed the Commonwealth to enhancing interpretation materials that promote stewardship at natural, recreational, historical and cultural public access points.

The May 3, 2001 letter from Rickmond Engineering to the County had a question as to the role of the Chesapeake Bay Local Assistance Department in the review of this project. The Department is the agency responsible for ensuring that state agencies comply fully with local zoning and subdivision ordinances adopted pursuant to the Bay Act.

We appreciate the opportunity to provide our comments on this project. Please do not hesitate to contact us at 1-800-CHESBAY should you have any questions.

Sincerely,

Catherine M. Harold
Environmental Engineer

Cc: Scott Crafton, CBLAD
Shawn E. Smith, CBLAD
Doug Wetmore, CBLAD
Darryl E. Cook, P.E., James City County
Charles H. Ellis, DEQ
Robert Cooper, DCR
Steven W. Stafford, P.E., Rickmond Engineering, Inc.

Rickmond
ENGINEERING, INC.

Memo

To: Mr. Darryl E. Cook, P.E.
James City County Environmental Division

From: Steven W. Stafford, P.E.
Civil Department Manager SWS 05.03.2001

Subject: Jamestown-Yorktown Foundation
Jamestown Settlement Stormwater Management Master Plan
REI Project No. 00175-020

Date: May 3, 2001

On behalf of the Owner, Rickmond Engineering, Inc. is pleased to submit the enclosed revised master plan for the subject project. This plan has been revised to incorporate the review comments dated March 9, 2001 from the previous submittal and are provided for your review and approval. To that end, the following information consists of the Environmental Division comment followed by the appropriate response that describes the action taken:

Comment No. 1: The master plan proposes the dedication of conservation easements to the County. There was a question raised previously about the ability of the State to grant an easement to the County. Has that question been answered?

Response: The Stormwater Management Master Plan (SWMMP) has identified the proposed conservation areas that will be maintained by the Jamestown-Yorktown Foundation. At this time, it appears that the Foundation will be unable to dedicate a formal easement around these areas. However, the Foundation maintains the position that it is their desire to comply in as much as practical with the local criteria. A more detailed response to this issue is being prepared by the Foundation and will be provided to your office under a separate cover.

Comment No. 2: An Open Space Easement is proposed for the area adjacent to the river, which is an RPA. The area currently has some development in it as well as some areas that do not have the three layers of vegetation required to qualify as open space. In order to credit this area as Natural Open Space under the 10-point system, the size of the proposed easement will need to be reduced to include only the vegetated, natural areas. Additional points can be obtained by increasing the size of the other proposed conservation easement.

Response: The proposed conservation areas and Best Management Practice (BMP) design have been revised to facilitate the removal of the Research Protection Area (RPA) from the BMP calculation.

Comment No. 3: The parking lot to the north of the site is to be expanded and the entrance road relocated to the perimeter of the expanded parking lot. VDOT is proposing the construction of a BMP near the Jamestown Marina to control the road runoff. In earlier meetings, it was proposed to control the parking lot expansion in the same facility. This should be addressed in the master plan as well.

Response: The appropriate revisions to the SWMMP have been made to indicate the parking lot and BMP improvements that are to be designed in cooperation with the Virginia Department of Transportation (VDOT).

Comment No. 4: Concerning calculation of the open space credit, 0.15 was used as the credit amount. This higher value is to be used for areas adjacent to wetlands, RPAs or mature forests. It should not be used for the RPA itself and any mature forested area that is adjacent to a conservation easement must be protected against development in some manner. These issues will need to be looked at in more detail to determine if the open space areas would be eligible for this additional credit.

Response: The proposed conservation areas and BMP design have been revised to facilitate the removal of the RPA from the BMP calculation.

It should be noted that at this time the role of Department of Conservation and Recreation (DCR) and the Chesapeake Bay Local Assistance Department (CBLAD) as it relates to project review and approval is unclear. Therefore, by copy of this memorandum, we are submitting a copy of the revised SWMMP to DCR and CBLAD for their review and approval, if required. Should you have any questions or require additional information, please contact our office.

SWS/jdf

Enclosures

I:\00175\020\Correspondence\Memos\Cook.ResLtr.SWS.5.3.01.doc

DEVELOPMENT MANAGEMENT

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(757) 253-6671 Fax: (757) 253-6850 E-MAIL: devtman@james-city.va.us

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PLANNING
(757) 253-6685
planning@james-city.va.us

COUNTY ENGINEER
(757) 253-6678

INTEGRATED PEST MANAGEMENT
(757) 253-2620

March 12, 2001

Mr. Charles H. Ellis, III
Environmental Impact Review Coordinator
Commonwealth of Virginia
Department of Environmental Quality
P. O. Box 10009
Richmond VA 23240

Dear Mr. Elis:

The Environmental Impact Review for Jamestown Settlement refers to stormwater ponds. The CSMP does not show these ponds. The draft Stormwater Management Master plan was submitted separately for County review. The Environmental Division's comments are attached. Until the BMP Master Plan receives County approval, Jamestown Settlement does not comply with our Local Chesapeake Bay Ordinance.

The wetlands boardwalk as shown on the CSMP seems to include excessive amounts of clearing in an area that may be needed for natural open space bmp points. This concern could be addressed by requiring JCC approval of boardwalk construction plans. This area is infested with invasive ivy which will kill the trees in this area and cover the board walk. Perhaps this is an educational point to be made about invasive plants. Please show the 150 foot Community Character Buffer along Jamestown Road..

Before removing the marine railway please obtain JCC approval regarding protection and /or restoration of the RPA.

Sincerely,

Wayland N. Bass
County Engineer

WNB/chp

cc: Mr. Darryl Cook, Environmental Division

JAMESTOWN SETTLEMENT

YORKTOWN VICTORY CENTER

Jamestown-Yorktown Foundation

P.O. Box 1607, Williamsburg, Virginia 23187-1607
757 253-4838 757 253-5299 Fax 757 253-7236 TDD *www.historyisfun.org*

February 21, 2001

SUBJECT: Jamestown Settlement: Stormwater Management Master Plan, State PN: 425-16475

James City County
Environmental Division
Attn: Mr. Daryl Cook
101 – E Mounts Bay Road
Williamsburg, VA 23187

Dear Mr. Cook:

Due to the extensive amount of construction planned for the Jamestown 400TH Anniversary, and in accordance with the "Stormwater Management / Drainage Concept Plan" (and Chapter 24 Zoning, Article III Site Plans, Section 24-144(d)(11)) I am hereby submitting for your review and approval two (2) copies of the Jamestown Settlement Stormwater Management Master Plan (as prepared by Rickmond Engineering, dated February 14, 2001).

The Master Plan has been developed using the James City County Guidelines for Design and Construction of Stormwater Management BMP's Manual (effective January 1, 2000). Your immediate attention to this Master Plan will be greatly appreciated.

Please do not hesitate to contact me (Tel: 757.253.4883, Email: dkent@jyf.state.va.us) if you have nay questions or comments.

Sincerely,

David Wolfe Kent, AIA
PROJECT EXECUTIVE

Attachment

D:\JAMESTOWN - JAMES FORT RENOVATION\JAMESTOWN - STORMWATER MASTE PLAN\JCC - Submit SWM Master PLan (#1).doc

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ENVIRONMENTAL DIVISION REVIEW COMMENTS
Jamestown Festival Park Drainage Improvements
E&S-06-01 DEC
August 3, 2001

Note: *These comments are based on the understanding that this project is only being reviewed for compliance with the James City County Chesapeake Bay program requirements but that the work will not actually be permitted by the County.*

Chesapeake Bay Preservation Ordinance:

(1.) There are extensive gravel walks and what appear to be observation areas and a shelter proposed to be located in the Resource Protection Area (RPA). These are located near the boat docking area and proposed for Phase III of the project. Unless an item is a water dependent feature, the Ordinance only provides for the location of passive recreation features in the RPA. While trails and walkways are permitted in the RPA, the observation areas, shelter, and the wide gravel walks may be in conflict with the Ordinance. This is also the area where fairly extensive plantings have recently occurred in the RPA buffer in an attempt to restore some of its water quality function. Discussion will need to occur regarding these items before a determination can be made as to their ability to be located as shown.

still large areas of walkways in RPA

✓2. Show on the plan the location of the RPA.

(3.) There is a 4.99 acre portion of the site that is to be placed in a conservation easement to satisfy in part the stormwater management requirements for the site. It is still an unresolved issue as to whether the Jamestown-Yorktown Foundation can dedicate an easement to the County. If it cannot, then an alternate method of preserving the area in perpetuity needs to be developed.

Temporary approval for peak years 2007 - then reduce size afterwards

Stormwater Management / Drainage:

(4.) The criteria to be used for the channel protection aspect of the BMP is the 24-hour detention of the runoff generated from the 1-year, 24 hour storm. This detention time is determined by the difference in the center of the mass for the inflow and outflow hydrographs. An alternate method is to compute the release assuming the basin fills immediately with the runoff and then is released over 24 hours. The volume of runoff for the 1-year storm is 2.14 ac-ft. Based on this volume, the release should be about 1.1 cfs. Using the calculation procedure in the County's BMP manual, the release rate would be 1.4 cfs. What has been designed only limits the 1-year storm to about 5.7 cfs and only stores about 0.9 ac-ft of volume. Please revise the design to obtain the 24 hour detention required. There is additional information contained in the state's Stormwater Management Manual regarding this calculation procedure. ~~Does D12 of JamesFore drain their pond? What about any release for the SWM only controls to pre-dev't levels - need to revise water quality volume?~~

Does pond volume include forebay? Not forebay behind rock ck. dam

(5.) Provide more information regarding the pond portion of the BMP. The upstream invert of the pipe needs to be specified and provided with a headwall or flared end section, something to support and protect the end of the pipe. ~~FR @ outlet?~~ Discuss modeling w/ K. Jenkins

Pond routed separately for outlet system, pond inc. w/ wetland for routing

(6.) Provide a rock check dam above the pond in the existing ditch to establish its use as a forebay for the pond/wetland system. ~~Add dimensions on plan~~

✓7. Provide a map that shows the flow path used for calculation of the time of concentration.

✓8. The calculations and the narrative information for the project state that only drainage areas

DA-1, 2, and 3 are controlled by the BMP. However, the drainage plan shows that a large portion of the James Fort will be piped to the BMP. Please insure that that this drainage and impervious cover have been included in the design of the BMP facility.

9. As the 2-foot wide weir is nested within the 17-foot wide weir, the flow for the full weir has been overestimated. The flow for the smaller weir should not be added to the calculation for the larger weir except for the portion of the flow below elevation 12.14.

(10) Please provide an analysis of how the pond discharge will function in relation to the remainder of the BMP. There is a concern that the 15" pipe will not be adequate to convey the flows from the upstream area without overtopping the road berm that separates the two areas of the BMP, especially when considering the backwater effect on the pipe. A routing that considers the tailwater conditions on the pipe's discharge needs to be performed.

Prob. ok - discuss w/ Engr.

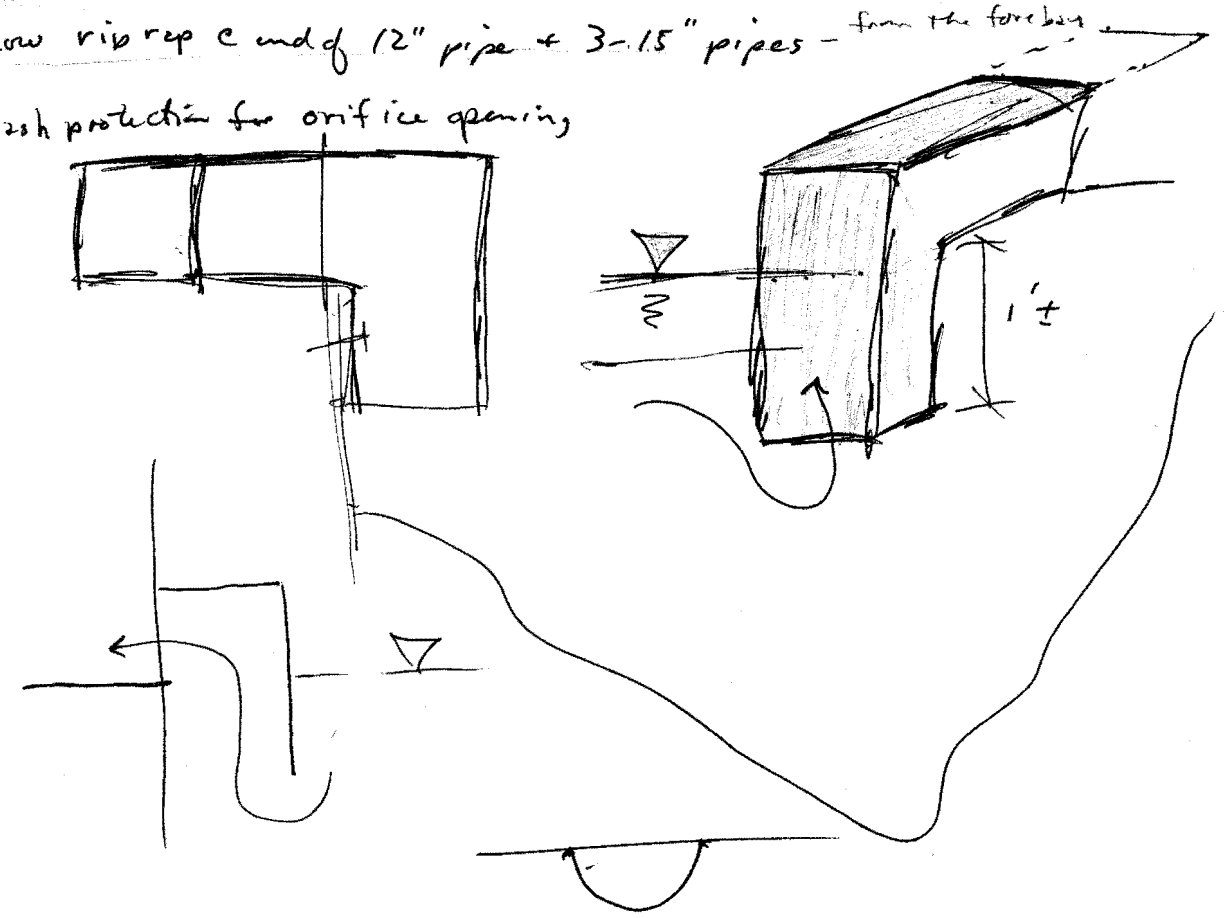
what about w/q release

- Rip rap dim. needed several places
- Protection for 7" opening

(1) - Level spreader @ end of 18" pipe w/ ~~level spreader~~ pyramet

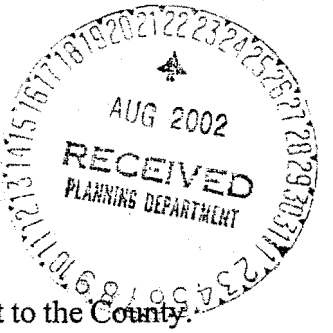
(2) - Show rip rap @ end of 12" pipe + 3-15" pipes - from the forebay

(3) - trash protection for orifice opening



(4)

C-020-01



ENVIRONMENTAL DIVISION REVIEW COMMENTS
Jamestown Settlement Master Stormwater Plan
August 21, 2002 MDW/DEC

1. The master plan proposes the dedication of a 4.3 acre conservation easement to the County. There was a question raised previously about the ability of the state to grant an easement to the County. To date, that question has not been answered. The viability of the stormwater master plan is dependent on the preservation of natural open space areas in easements. In addition, the area proposed for the easement is located on land not owned by the Foundation. Based on both these considerations, it may be necessary to consider options to onsite open space dedication and pursue an offsite option. The County is open to considering offsite options.

2. A portion of the proposed open space is currently an open field. Once it is placed in a conservation easement, it will need to be allowed to revert to a wooded/forested condition; all maintenance activities will need to cease. Also, the area may need protection from pedestrians and maintenance workers while it is in the process of succession from field to forest.

3. The overall stormwater management plan is acceptable assuming the open space dedication can be resolved. The new proposed wetland BMP has not been designed but design of facilities is typically not required at the master plan stage. The master plan is approved for the *concept* of providing the proposed BMPs and open space shown on this plan thereby achieving the required 10 BMP points. At the time of site plan submission and approval for the improvements that drain to the BMPs, final design and construction drawings will need to be provided.

4. The stormwater management plan proposed a long linear forebay that was located just upstream of the pond/wetland BMP. The proposed parking lot appears to infringe on this feature. Provide assurances that the forebay will be installed and not eliminated by the parking lot; water should not be piped to the pond /wetland BMP.

5. The use of straw bale barriers instead of silt fence is strongly discouraged due to the high maintenance costs of these features. The effective lifespan of a straw bale barrier is three months and the entire length of straw bale barriers would need to be replaced every three months as well as normal maintenance. The effective lifespan of silt fence is eighteen months and would need normal maintenance.

ENVIRONMENTAL DIVISION REVIEW COMMENTS
Jamestown Settlement
SWM-01-01; Master Stormwater Management Plan DEC
March 9, 2001

1. The master plan proposes the dedication of conservation easements to the County. There was a question raised previously about the ability of the state to grant an easement to the County. Has that question been answered?

2. An Open Space Easement is proposed for the area adjacent to the river, which is an RPA. The area currently has some development in it as well as some areas that do not have the three layers of vegetation required to qualify as open space. In order to credit this area as Natural Open Space under the 10-point system, the size of the proposed easement will need to be reduced to include only the vegetated, natural areas. Additional points can be obtained by increasing the size of the other proposed conservation easement.

3. The parking lot to the north of the site is to be expanded and the entrance road relocated to the perimeter of the expanded parking lot. VDOT is proposing the construction of a BMP near the Jamestown Marina to control the road runoff. In earlier meetings, it was proposed to control the parking lot expansion in the same facility. This should be addressed in the master plan as well.

4. Concerning calculation of the open space credit, 0.15 was used as the credit amount. This higher value is to be used for areas adjacent to wetlands, RPAs or mature forests. It should not be used for the RPA itself and any mature forested area that is adjacent to a conservation easement must be protected against development in some manner. These issues will need to be looked at in more detail to determine if the open space areas would be eligible for this additional credit.

ENVIRONMENTAL DIVISION REVIEW COMMENTS
Jamestown Festival Park Drainage Improvements
E&S-06-01 DEC
August 3, 2001

Note: These comments are based on the understanding that this project is only being reviewed for compliance with the James City County Chesapeake Bay program requirements but that the work will not actually be permitted by the County.

Chesapeake Bay Preservation Ordinance:

KMJ 1. There are extensive gravel walks and what appear to be observation areas and a shelter proposed to be located in the Resource Protection Area (RPA). These are located near the boat docking area and proposed for Phase III of the project. Unless an item is a water dependent feature, the Ordinance only provides for the location of passive recreation features in the RPA. While trails and walkways are permitted in the RPA, the observation areas, shelter, and the wide gravel walks may be in conflict with the Ordinance. This is also the area where fairly extensive plantings have recently occurred in the RPA buffer in an attempt to restore some of its water quality function. Discussion will need to occur regarding these items before a determination can be made as to their ability to be located as shown. shelter has been eliminated walkway & observation areas are passive recreation. See sheets C2+C3

KMJ 2. Show on the plan the location of the RPA. Provided on sheet C2+C3

KMJ 3. There is a 4.99 acre portion of the site that is to be placed in a conservation easement to satisfy in part the stormwater management requirements for the site. It is still an unresolved issue as to whether the Jamestown-Yorktown Foundation can dedicate an easement to the County. If it cannot, then an alternate method of preserving the area in perpetuity needs to be developed. Issue is being handled by the owner

Stormwater Management / Drainage:

KMJ 4. The criteria to be used for the channel protection aspect of the BMP is the 24-hour detention of the runoff generated from the 1-year, 24 hour storm. This detention time is determined by the difference in the center of the mass for the inflow and outflow hydrographs. An alternate method is to compute the release assuming the basin fills immediately with the runoff and then is released over 24 hours. The volume of runoff for the 1-year storm is 2.14 ac-ft. Based on this volume, the release should be about 1.1 cfs. Using the calculation procedure in the County's BMP manual, the release rate would be 1.4 cfs. What has been designed only limits the 1-year storm to about 5.7 cfs and only stores about 0.9 ac-ft of volume. Please revise the design to obtain the 24 hour detention required. There is additional information contained in the state's Stormwater Management Manual regarding this calculation procedure. Calculations revised

KMJ 5. Provide more information regarding the pond portion of the BMP. The upstream invert of the pipe needs to be specified and provided with a headwall or flared end section, something to support and protect the end of the pipe. Provided on sheet C2

KMJ 6. Provide a rock check dam above the pond in the existing ditch to establish its use as a forebay for the pond/wetland system. Provided on sheet C2

KMJ 7. Provide a map that shows the flow path used for calculation of the time of concentration. Provided in Appendix A

KMJ 8. The calculations and the narrative information for the project state that only drainage areas

DA-1, 2, and 3 are controlled by the BMP. However, the drainage plan shows that a large portion of the James Fort will be piped to the BMP. Please insure that this drainage and impervious cover have been included in the design of the BMP facility. Calcs revised to include 0.39 ac from James Fort that drains to BMP

Kurt 9.

As the 2-foot wide weir is nested within the 17-foot wide weir, the flow for the full weir has been overestimated. The flow for the smaller weir should not be added to the calculation for the larger weir except for the portion of the flow below elevation 12.14. Smaller weir eliminated, Calculations revised

Kurt 10.

Please provide an analysis of how the pond discharge will function in relation to the remainder of the BMP. There is a concern that the 15" pipe will not be adequate to convey the flows from the upstream area without overtopping the road berm that separates the two areas of the BMP, especially when considering the backwater effect on the pipe. A routing that considers the tailwater conditions on the pipe's discharge needs to be performed.

2 additional 15" RCP added. See Calculations in Appendix "E"

JAMES CITY COUNTY ENVIRONMENTAL DIVISION

Surety Tracking Sheet Date: 9/22/08 Due Date: _____

Project Name: Jamestown Settlement Stormwater Management Plan

Requested By: _____ Phone #: SWM-C-01

Date Notified: _____ **Case Number:** C-032-02

Siltation Surety: Original $ Ø Current $ Ø Needed $ Ø

*maximum reduction of 80% of original bond amount unless project is to be released

☐Calculate ☐Evaluate/Reduce ☐Release

Work to be completed for SILTATION Surety

☐ Stabilization of all disturbed areas

☐ Removal of temporary erosion control measures

☐ Submission of as-built drawings for stormwater management facility

☐ Submission of construction certification for the stormwater management facility

☐ Completion of field-related BMP items

☐ Other –

☐ Comments- SEE BELOW

Subdivision Surety: Original $_____ Current $_____ Needed$ Ø

*maximum reduction of 80% of original bond amount unless project is to be released

☐Calculate ☐Evaluate/Reduce ☐Release

Work to be completed for SUBDIVISION Surety

☐ Paving of streets

VDOT

☐ Dedication of streets to Virginia Dept of Transportation Amount Needed $ Ø

JCSA

☐ Completion of water and sewer systems Amount Needed $ Ø

☐ Completion of water and sewer punchlist items

☐ Submission of as-built drawings for water and sewer systems

---

☐ Installation of street lights and street signs

☐ Other –

☐ Comments- Project was state project. Project complete ok to close No surety Associated with project.

INDICATE YOUR APPROVAL BY INITIALING THE APPROPRIATE BLANK:

INSP _____ INSP SUPV _____ CHF ENG WAE 10/20/08 DIR _____ 10-20-08 RELEASE PROJECT _____

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 10009, Richmond, Virginia 23240
Fax (804) 698-4500 TDD (804) 698-4021
www.deq.state.va.us

Robert G. Burnley
Director

(804) 698-4000
1-800-592-5482

COMMENTS OF THE DEPARTMENT OF ENVIRONMENTAL QUALITY

concerning the Environmental Impact Report (EIR) for the Jamestown-Yorktown Foundation's Proposed Improvements to the Jamestown Settlement, revised as the Stormwater Improvements and Boardwalk (agency 425, project code 16474), reviewed under DEQ-01-026S.

The Department of Environmental Quality has determined that the Environmental Impact Report (EIR) for this project, in conjunction with requested follow-up information provided by the Jamestown-Yorktown Foundation (hereinafter "Foundation"), provides the information necessary for evaluation of the project's environmental impacts. The Department (DEQ) has completed its review. The following agencies, planning district commission, and locality joined in this review:

Department of Environmental Quality
Department of Agriculture and Consumer Services
Department of Game and Inland Fisheries
Department of Conservation and Recreation
Department of Health
Marine Resources Commission
Department of Historic Resources
Department of Transportation
Department of Mines, Minerals, and Energy
Chesapeake Bay Local Assistance Department
Hampton Roads Planning District Commission
James City County.

In addition, the National Park Service contributed to this review.

Project Description

As originally contemplated, this project involved a number of changes to approximately 15 acres of land area in the northwestern portion of the Foundation's Jamestown Settlement along the James River. The Foundation proposes to demolish the existing marine railway system, construct a boardwalk through wetlands, improve

drainage at the Indian Village and fort areas, and undertake soil stabilization and landscaping activities. (EIR, page 1.)

The Stormwater Management Master Plan addresses the southwest portion of the site, which is approximately 26 acres overall. That Plan does not include future parking lot improvements or public road realignment to accommodate the parking lot (see the DEQ Comments on the "Entrance Plaza and Parking Lot," DEQ-01-029S, mailed August 1, 2002 as well as the Commonwealth's comments on the National Park Service's Environmental Assessment for "Colonial Parkway Connection to the Realigned Route 359," DEQ-02-106F, dated July 10, 2002). (Plan, page 1.)

Background Information on the Environmental Review Process

As originally submitted on February 13, 2001, the EIR for this project raised a number of questions by reviewing agencies, as a result of which DEQ's Office of Environmental Impact Review (hereinafter "DEQ-OEIR") requested additional information from the Foundation on April 11, 2001. During the course of the multi-agency discussions and correspondence which followed, the nature of this project changed, and its name was changed from "Jamestown Settlement Improvements" to "Stormwater Management Improvements and Boardwalk" to reflect the change in plans. The Foundation provided its last additional information for our coordinated review with a letter dated March 12, 2003.

The issues requiring resolution by the Foundation and reviewing agencies were as follows:

(1) Stormwater Management. The stormwater management discussion in the EIR (pages 8, 12, 14, 17, and Appendix B) drew comments from the National Park Service, which owns and manages properties adjacent to the Jamestown Settlement. DEQ-OEIR shared these comments with the Foundation and with the Department of Conservation and Recreation, the Chesapeake Bay Local Assistance Department, and the Department of Transportation in its April 11, 2001 suspension letter and requested additional efforts on the part of the Foundation to discuss matters with appropriate state agencies and the National Park Service, delineate Chesapeake Bay Resource Protection Areas and adjoining projects on maps, and indicate the results of such discussions. See "Environmental Impacts and Mitigation," item 2 and "Regulatory and Coordination Needs," items 2 and 5, below.

Several efforts to resolve issues relating to stormwater management and protection of Chesapeake Bay Resource Protection Areas (RPAs) followed. Discussions between the Foundation and the Chesapeake Bay Local Assistance Department (CBLAD) concluded with CBLAD letters to DEQ dated June 5 and July 25, 2002 and DEQ's letter to the Foundation dated July 31, 2002 (attached). In the latter, DEQ reflected CBLAD concerns regarding use of RPAs for non-water-dependent activities and discussed additional guidance for securing needed Best Management Practices credits required by the Chesapeake Bay Preservation Area Designation and Management Regulations.

In a meeting convened by DEQ and CBLAD on August 7, 2002 at which the Foundation and the DCR James Watershed Office were also represented, the discussion focused on resolution of outstanding issues and revealed an additional problem, in that some of the land area contemplated for a conservation easement, to meet BMP requirements, belongs to the Department of Transportation (VDOT) and cannot be used for stormwater management absent VDOT permission, under the Stormwater Management Law. The Foundation was faced with a choice between re-designing its Master Plan within the boundaries of Foundation-owned land, obtaining permission from VDOT to use its land for stormwater facilities, or purchasing the land from VDOT.

Following the meeting, the parties agreed that the Foundation would work with CBLAD to develop a stormwater management master plan that meets Chesapeake Bay Preservation Act requirements, with or without the VDOT land, and to satisfactorily resolve with CBLAD the concerns articulated in DEQ's July 31, 2002 letter to the Foundation. This has been achieved. See "Environmental Impacts and Mitigation," item 2, below.

A compromise was reached in which the conservation easement can be created outside of VDOT land, but a lease or lease/purchase agreement is being negotiated for purposes of constructing parking lots and buildings associated with the Master Plan and the Maintenance Building (See March 6, 2003 letter from DEQ to VDOT, and VDOT's March 14, 2003 reply, enclosed).

(2) Historic and Scenic Impacts. DEQ-OEIR shared comments from the Park Service with the Foundation and with the Department of Historic Resources (DHR) and requested that DHR analyze potential impacts of the proposed project, and other Jamestown anniversary endeavors (see "Project Description," below), and respond to this office. See "Environmental Impacts and Mitigation," item 4, below.

(3) Endangered Plant Surveys and Mapping. DEQ-OEIR shared comments from the Department of Conservation and Recreation, and earlier comments from the Department of Agriculture and Consumer Services (reprinted in the EIR) with the Foundation. These comments indicated the need to conduct surveys of the project area for two endangered plants, the small whorled pogonia and the sensitive joint vetch. DEQ-OEIR recommended that the Foundation commission these surveys or make use of prior surveys and indicate survey results to us. This was accomplished. See "Environmental Impacts and Mitigation," item 3, below.

In the intervening time period, the Foundation has completed and submitted the endangered plant surveys and revised stormwater plans. These have been shared with appropriate reviewing agencies.

The documents under consideration in this review include the EIR and also:

(1) Jamestown Settlement Stormwater Management Master Plan, revised May 2, 2002, prepared by Rickmond Engineering Inc. and submitted by the Foundation in mailings ending June 3, 2002. This document contains 13 pages plus appendices including maps.
(2) "Jamestown Settlement Master Plan," Sheet No. C-1, dated 4/22/02, submitted in conjunction with item 1. This is a single folded plan sheet.
(3) Addendum No. 1 to EIR for Jamestown Settlement, "Sensitive Joint Vetch Survey Report; Small Whorled Pogonia Survey Report," dated September 10, 2001, submitted August 28, 2001. This is a document with 4 pages of text and additional appendices;
(4) Conceptual stormwater drawing, submitted with March 12 letter following resolution of issues between the Foundation and CBLAD.

Conclusion

The Department of Environmental Quality (DEQ) has no objection to this project, provided that it is constructed and operated in accordance with all environmental laws and policies of the Commonwealth, and in accordance with the recommendations herein. As currently proposed, this project is unlikely to significantly affect endangered or threatened plant or insect species, air quality, water quality, or endangered or threatened wildlife species. We recommend that approval of this project be made contingent upon the Foundation's continued cooperation with the Chesapeake Bay Local Assistance Department, the Department of Conservation and Recreation, and the Department of Transportation. The final Stormwater Master Plan must be approved by the Chesapeake Bay Local Assistance Department and the Department of Conservation and Recreation prior to any land disturbance at the project site. Further discussion of these recommendations, and the accompanying analysis, are provided in the remainder of these Comments.

Environmental Impacts and Mitigation

1. Water Quality and Wetlands. The EIR, as augmented, now shows the location of the marine railway which is to be demolished. It appears that the project, as adjusted, may affect vegetated emergent wetlands. The non-tidal wetlands on the site appear to be hydrologically connected to surface waters, and are likely to be characterized as jurisdictional wetlands by the Army Corps of Engineers upon its determination, for which the Foundation has asked (EIR, page 7). If the Corps determines that jurisdictional wetlands are present, the project will require a Virginia Water Protection Permit from DEQ, as well as other permits from the Corps and from the Marine Resources Commission. See "Regulatory and Coordination Needs," item 1, below.

We are mindful of the beneficial water quality impacts of the proposed project. Removal of the deteriorating metal and wood components of the marine railway will eliminate one potential source of water pollution for the adjacent wetland areas and for the James River beyond. Similarly, drainage improvements and landscaping will reduce the amount of suspended sediments entering the James River from the Settlement area

during rainstorms; the addition of stormwater treatment ponds is a good way to accomplish this result (EIR, page 12). We recommend the following additional steps, outside of the permitting requirements described below, to protect water quality and wetlands from the impacts of this project:

(a) Configure the proposed educational boardwalk to avoid forests, wetlands, and the sensitive vernal pond habitat, to the maximum extent practicable;

(b) Incorporate effective erosion control measures (see item 2, below) and take precautions to avoid the entry of sediment or contaminants into adjacent wetlands or waterways entering, or bordering, the James River.

(c) Leave intact any vegetated buffer areas around wetland areas

(d) Employ low-impact design techniques to minimize the discharge offsite of additional stormwater created by increased impervious surface areas..

In general, the project must demonstrate compliance with section 404 (b)(1) guidelines of the Clean Water Act and with the Commonwealth's wetlands mitigation policies. Both federal and State guidelines recommend avoidance and minimization of wetlands impacts as the first steps in the mitigation process. For unavoidable impacts, DEQ encourages the following practices to minimize the impacts to wetlands:

- Operate machinery and construction vehicles outside of wetlands; use synthetic mats when wetland work is unavoidable;
- Preserve the top 12 inches of trench material removed from wetlands for use as wetland seed and root-stock in the excavated area.
- Erosion and sedimentation controls should be designed in accordance with the most current edition of the Virginia Erosion and Sediment Control Handbook. These controls should be in place prior to clearing and grading, and maintained in good working order to minimize impacts to wetlands. The controls should remain in place until the area is stabilized.
- Place heavy equipment, located in temporarily impacted wetland areas, on mats, geotextile fabric, or use other suitable measures to minimize soil disturbance, to the maximum extent practicable.
- Restore all temporarily disturbed wetland areas to pre-construction conditions and plant or seed with appropriate wetlands vegetation in accordance with the cover type (emergent, scrub-shrub, or forested). The Foundation should take all appropriate measures to promote re-vegetation of these areas. Stabilization and restoration efforts should occur immediately after the temporary disturbance of each wetland area instead of waiting until the entire project has been completed.

- Place all materials which are temporarily stockpiled in wetlands, designated for use for the immediate stabilization of wetlands, on mats or geotextile fabric in order to prevent entry into wetlands. These materials should be managed in a manner that prevents leachates from entering wetlands and must be entirely removed within thirty days following completion of the construction activity. The disturbed areas should be returned to their original contours, stabilized within thirty days following removal of the stockpile, and restored to the original vegetated state.

2. Chesapeake Bay Preservation Areas. The EIR identifies Chesapeake Bay Preservation Areas on the property (EIR, pages 9-10 and Appendix I), and states that the only impact to a Resource Protection Area will result from removal of the marine railway. The Foundation commits itself to using state- and locally-approved Best Management Practices (BMPs) in the railway's removal (EIR, page 10). If either the improvements contemplated in this EIR or others mentioned in the master plan for the 400th anniversary celebration (see EIR, Appendix B) will involve re-development or new development of impervious surfaces (the proposed boardwalk would not be considered impervious), they will need to comply with the performance standards of the Chesapeake Bay Preservation Area Designation and Management Regulations (9 VAC 10-20-10 et seq.), including the stormwater management criteria therein.

Following extensive efforts stemming from DEQ's July 31, 2002 letter to the Foundation and the August 7, 2002 meeting, the Foundation developed a revised conceptual stormwater plan for the proposed improvements at the Jamestown Settlement. The plan appears conceptually reasonable to both CBLAD (February 25, 2003 letter, enclosed) and to DCR's James Watershed Office (February 28, 2003 letter, enclosed; see next item). The final design must meet the Performance Criteria of the Regulations cited above in order to be consistent with the Chesapeake Bay Preservation Act (*Virginia Code* sections 10.1-2100 et seq.); this will be determined when CBLAD reviews it (see "Regulatory and Coordination Needs," item 2, below).

According to CBLAD, the proposed plan relies on ground infiltration for treatment of stormwater. A series of underground storm chambers would be used in combination with dry swales (JCC-E2), which is similar to the water quality swale design in the *Virginia Stormwater Management Handbook.* Based on the soils information provided, it does not appear to CBLAD that groundwater will be a limiting factor. However, suitable soils for infiltration are not consistent across the site. Site-specific soil investigations will need to be conducted to ensure that adequate permeability exists for the infiltration BMPs proposed. Otherwise, the soils beneath the chambers will need to be engineered to achieve the requisite permeability.

CBLAD suggested additional alternatives in a conference call with a Foundation consultant on February 20, 2003. These include:

- bio-filtration techniques, which would involve some temporary above-ground storage; or

- a sub-surface alternative, using a trench drain system in lieu of the chambers.

In either case, perforated pipe should be used for conveyances to the BMPs, where possible, to promote additional infiltration.

CBLAD also suggested switching the position of the forebay with the up-gradient underground storage chambers, particularly since this will collect runoff from the large employee parking lot. In addition, the parking lots should have oil/grit separators as a form of pre-treatment. This will extend the longevity of the BMPs as well as extending the time intervals for their maintenance.

The plan should incorporate pre-treatment up-gradient of the BMPs, according to CBLAD. While there are several approaches for this, Minimum Standard 3.10E in the *Virginia Stormwater Management Handbook* addresses how the underground chambers can be used for pre-treatment. The BMPs should not be set up in series, because that would result in the last (most down-gradient) BMP being overwhelmed from the volume of runoff passing through upstream BMPs.

CBLAD has indicated in the past, responding to expansive parking areas proposed in previous iterations of the master plan, that steps should be taken to reduce the amount of impervious surfaces on the site. The Foundation and its consultants indicate that the 212 proposed parking spaces are necessary for employee parking. Accordingly, CBLAD highly recommends the use of permeable surfaces in the parking areas. This will address the performance criteria in the Regulations cited above, in addition to promoting infiltration and reducing runoff volumes and velocities. In addition, CBLAD recommends the use of depressed bio-retention areas in the parking lots instead of raised planting islands.

3. Erosion and Sediment Control; Stormwater Management. This project will require an Erosion and Sediment Control Plan, because, as indicated in the foregoing discussions, it will involves a land-disturbing activity of 10,000 square feet or more (2,500 square feet or more in Chesapeake Bay Preservation Areas such as the project site). Accordingly, the Foundation must prepare a project-specific Erosion and Sediment Control plan for review and approval by the Department of Conservation and Recreation's Division of Soil and Water Conservation (DSWC). An approved plan is required prior to initiation of any land-disturbing activity at the project site. See "Regulatory and Coordination Needs," item 5, below.

As revised, the project is in the nature of a stormwater management project. Accordingly, it must be approved before any land disturbance takes place in the project area. See "Regulatory and Coordination Needs," items 2 and 5, below.

DCR's James Watershed Office has participated in the reviewing agencies' discussions of stormwater questions with the Foundation over the past two years (see "Environmental Review Process," item 1, above). On February 20, 2003, that Office joined CBLAD and the Foundation in reviewing the revised conceptual stormwater

management master plan for the proposed improvements at the Jamestown Settlement. Based on this review and subsequent conference call discussions, DCR agrees with the conceptual plan. The plan proposes infiltration as the main practice for meeting the State's water quality requirements. The Foundation's consultant agreed that if the existing soils were not suitable for the proposed stormwater plan, necessary material would be transported to the site to meet infiltration design specifications.

DCR's James Watershed Office reminds the Foundation that final plans must be submitted to DCR for a land disturbance permit. In addition, Erosion and Sediment Control Plans and Stormwater Management Plans must be approved before any land disturbance may begin; see above and also "Regulatory and Coordination Needs," item 5, below.

4. Natural Heritage and Wildlife Resources. According to the Department of Conservation and Recreation, natural heritage resources are documented as present in the vicinity of the project. "Natural heritage resources" are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geological formations. Due to the scope of project activity and the distance to the resources, however, the project is not expected to adversely affect these resources.

Specifically, there is a bald eagle nest approximately one mile from the project site, according to the Department of Game and Inland Fisheries. The bald eagle (*Haliaeetus leucocephalus*) is listed as threatened by both the state and federal governments. The Department of Game and Inland Fisheries indicates, however, that because of the project scope and location, it does not anticipate that the project will give rise to significant adverse impacts upon bald eagle nesting.

The Foundation commissioned the endangered plant survey for the sensitive joint vetch and the small whorled pogonia, and submitted a survey report to DEQ-OEIR, DCR, and the Department of Agriculture and Consumer Services (DACS), which has responsibility for endangered and threatened plant and insect species. DACS has indicated its agreement with the conclusion of the survey report, which is that these two plants are not found at the project site.

5. Historic and Archaeological Resources. With respect to archaeological resources, the Department of Historic Resources (DHR) recommended a cultural resources survey in its June 15, 2001 comments. In addition, DHR indicated then that proposed placement of stormwater facilities in wetlands, an activity subject to Corps of Engineers permitting, would necessitate the Foundation's consultation with DHR, the Army Corps of Engineers, and the National Park Service under Section 106 of the National Historic Preservation Act. The Area of Potential Effect might include other projects planned by the Foundation, in which case the Corps might have to consider cumulative impacts upon historic properties. The Park Service would be able, in such a scenario, to request consulting party status and to express its views on the cumulative

impacts of these projects on all Foundation projects located within the Area of Potential Effect.

DHR recommended that a cultural resources survey be conducted to cover the parts of the project area involving the revised stormwater management plan. This survey should identify the full range of historic properties that may be affected by the plan, including architectural, landscape, and archaeological resources. The survey should be conducted by qualified professionals in accordance with the state *Guidelines for Conducting Cultural Resources Surveys in Virginia: Additional Guidance for the Implementation of the Federal Standards* (see *Secretary of the Interior's Standards and Guidelines* (Volume 48, Federal Register, September 29, 1983, page 44742).

Questions on the consultation requirement may be addressed to the Department of Historic Resources. See "Regulatory and Coordination Needs," item 3, below.

6. Air Quality. James City County is part of an ozone (O_3) maintenance area and an emission control area for the contributors to ozone pollution, which are volatile organic compounds (VOCs) and oxides of nitrogen (NO_x). This has two practical consequences for project development. One is that the Foundation should take all reasonable precautions to limit emissions of VOCs and NO_x, principally by controlling or limiting the burning of fossil fuels. A second precaution, stemming from 9 VAC 5-40-5490 in the Regulations for the Control and Abatement of Air Pollution, is that there are some limitations on the use of "cut-back" asphalt (liquefied asphalt cement, blended with petroleum solvents) that may apply in the construction of the roads or paths associated with the project. The asphalt must be "emulsified" (predominantly cement and water with a small amount of emulsifying agent) except when specified circumstances apply. Moreover, there are time-of-year restrictions on its use during the months of April through October in VOC emission control areas.

During construction, fugitive dust must be kept at a minimum by using control methods outlined in 9 VAC 5-50-60 et seq. of the Regulations for the Control and Abatement of Air Pollution. These precautions include, but are not limited to, the following:

- Use, where possible, of water or chemicals for dust control;
- Installation and use of hoods, fans, and fabric filters to enclose and vent the handling of dusty materials;
- Covering of open equipment for conveying materials; and
- Prompt removal of spilled or tracked dirt or other materials from paved streets and removal of dried sediments resulting from soil erosion.

In addition, if project activities include the burning of construction or demolition material, this activity must meet the requirements for open burning under 9 VAC 5-40-5600 et seq., and it may require a permit (see "Regulatory and Coordination Needs," item 4, below). The regulation provides for, but does not require, the local adoption of a model ordinance concerning open burning; accordingly, we recommend that the

Foundation contact James City County officials to determine what local requirements, if any, exist. Some applicable provisions of the model regulation include, but are not limited to:

- All reasonable effort shall be made to minimize the amount of material burned, with the number and size of the debris piles;
- The material to be burned shall consist of brush, stumps and similar debris waste and clean burning demolition material;
- The burning shall be at least 500 feet from any occupied building unless the occupants have given prior permission, other than a building located on the property on which the burning is conducted;
- The burning shall be conducted at the greatest distance practicable from highways and air fields,
- The burning shall be attended at all times and conducted to ensure the best possible combustion with a minimum of smoke being produced;
- The burning shall not be allowed to smolder beyond the minimum period of time necessary for the destruction of the materials; and
- The burning shall be conducted only when the prevailing winds are away from any city, town or built-up area.

7. Transportation Issues. A consulting firm, under contract to the Department of Rail and Public Transportation, is developing a plan for traffic mitigation for the Jamestown area during the 2007 commemorative activities. Several Department of Transportation (VDOT) representatives are among the state and federal officials involved in the study. Other projects proposed by the Foundation, including the Entrance Plaza and Parking Lot Expansion (DEQ-01-039S, Comments mailed August 1, 2002), are in VDOT's right-of-way, and cannot be constructed until the right-of-way has been properly conveyed, pursuant to approval by the Commonwealth Transportation Board. In a March 14 letter (enclosed), VDOT indicated that the Foundation no longer has need of the VDOT right-of-way in order to create a conservation easement. See preceding discussion of this matter in "Environmental Review Process," item 1, above.

8. Solid and Hazardous Waste Management. The EIR indicated that no generation, storage, or usage of hazardous materials would be involved with this project (page 9). DEQ's Waste Division had no objection to this conclusion.

DEQ recommends that the Foundation reduce solid waste at the source, re-use it, and recycle it to the maximum extent practicable in this and other projects.

9. Pollution Prevention. The DEQ advocates that principles of pollution prevention be used in all construction projects as well as in facility operations. Effective siting, planning, and on-site Best Management Practices (BMPs) will help to ensure that environmental impacts are minimized. However, pollution prevention techniques also include decisions related to construction materials, design, and operational procedures that will facilitate the reduction of wastes at the source. We have several pollution prevention recommendations that may be helpful in constructing or operating this project:

- Consider development of an Environmental Management System (EMS). An effective EMS will ensure that the proposed facility is committed to minimizing its environmental impacts, setting environmental goals, and achieving improvements in its environmental performance. DEQ offers EMS development assistance and recognizes facilities with effective Environmental Management Systems through its Virginia Environmental Excellence Program.
- Consider environmental attributes when purchasing materials. For example, the extent of recycled material content, toxicity level, and amount of packaging should be considered and can be specified in purchasing contracts.
- Consider contractors' commitments to the environment (such as an EMS) when choosing contractors. Specifications regarding raw materials and construction practices can be included in contract documents and requests for proposals.
- Choose sustainable materials and practices for infrastructure and building construction and design. These could include asphalt and concrete containing recycled materials, and integrated pest management in landscaping, among other things.
- Integrate pollution prevention techniques into facility maintenance and operation, to include the following: inventory control (record-keeping and centralized storage for hazardous materials), product substitution (use of non-toxic cleaners), and source reduction (fixing leaks, energy-efficient HVAC and equipment). Maintenance facilities should be designed with sufficient and suitable space to allow for effective inventory control and preventive maintenance.

DEQ's Office of Pollution Prevention provides free information and technical assistance relating to pollution prevention techniques and EMS. If interested, the Foundation may contact that Office (Tom Griffin, telephone (804) 698-4545).

10. Local and Regional Concerns. James City County indicated concerns, in the initial review of this project, over excessive clearing in an area that may be needed for open space BMP points (see item 2, above). The boardwalk area, as originally proposed, is infested with invasive ivy, which may kill the trees in the area and cover the boardwalk. There may be an environmental education opportunity in this regard. The County asks that the Foundation show the 150-foot Community Character Buffer along Jamestown Road.

The County strongly urges the Foundation to allow the National Park Service and the Association for the Preservation of Virginia Antiquities (APVA) to review and comment on plans as they are developed or changed. The Park Service and APVA are directly affected by Foundation projects and have long involvement with the planning process for these projects.

The Hampton Roads Planning District Commission urges that the Foundation work closely with the County in addressing these and other matters.

Regulatory and Coordination Needs

1. Water Quality Regulation. Activities affecting wetlands or waterways may require a Virginia Water Protection Permit from DEQ and a Section 404 permit from the Army Corps of Engineers. Questions in this regard may be addressed to DEQ's Tidewater Regional Office (Harold Winer, Deputy Regional Director, telephone (757) 518-2153).

2. Chesapeake Bay Preservation Areas and BMP Credits. This project must comply with the Chesapeake Bay Preservation Act (*Virginia Code* sections 10.1-2100 et seq.) and its implementing regulations (9 VAC 10-20-10 et seq.). Accordingly, the Foundation must continue to work with the Chesapeake Bay Local Assistance Department (Catherine Harold, telephone (804) 371-7501) to ensure compliance with James City County's ordinance developed pursuant to the Chesapeake Bay Preservation Act.

3. Historic Resources. If there are federal jurisdictional wetlands at the site, the Foundation must comply with section 106 of the National Historic Preservation Act of 1966, as amended. For section 106 consultation and other questions relating to historic resources and archaeological survey needs, the Foundation should consult the Department of Historic Resources (Dr. Ethel Eaton, telephone (804) 367-2323, extension 112).

4. Air Quality Regulation. Open burning of debris or refuse may require a permit from the DEQ's Tidewater Regional Office (see "Environmental Impacts and Mitigation," item 5, above). The Foundation should contact that Office (Jane Workman, Air Permits Manager, telephone (757) 518-2112) for information on this requirement and its applicability to the project .

5. Erosion and Sediment Control Plans; Stormwater Management Plans. Erosion and Sediment Control Plans must be prepared in accordance with the Virginia Erosion & Sediment Control Handbook, Virginia Erosion and Sediment Control Law (*Virginia Code* sections 10.1-560 and 10.1-564) and the Virginia Erosion and Sediment Control Regulations (4 VAC 50-30-30 and 4 VAC 50-30-100). Similarly, the Stormwater Management Plan must meet the requirements of the Virginia Stormwater Management Law (*Virginia Code* section 10.1-603) and the Stormwater Management Regulations (4 VAC 3-20-210 through 3-20-245). Approval of such Plans by the Department of Conservation and Recreation is pre-requisite to any land disturbance in the project area. Questions relating to these Plan requirements may be addressed to the Department of Conservation and Recreation's James East Watershed Office (Robert Cooper, telephone (804) 786-1359).

6. Subaqueous Bed Encroachment. Removal of the marine railway may not require authorization from the Marine Resources Commission. However, the use of forced water to excavate below the sediments may require such authorization, since it may be an encroachment in, on, or under a State-owned bottomland (riverbed). Similarly, activities in wetlands connected to the James River may require a permit from the Marine Resources Commission.

The Marine Resources Commission also coordinates the Joint Federal-State Permit Application (JPA) process for water resources permitting, which involves the DEQ and the Corps of Engineers as well as the Commission. Questions on Commission permit applicability and on the joint process, as well as requests for copies of the Joint Permit Application, may be directed to the Commission (Traycie West, telephone (757) 247-2200).

7. Land Use. As the Department of Transportation (VDOT) indicates, the Foundation no longer needs the VDOT right-of-way in order to create a conservation easement. However, it still needs portions of the right-of-way to construct parking lots and buildings. We recommend that the Foundation continue to work with VDOT's Hampton Roads District construction engineer, John Neal (telephone (757) 925-2508), in this regard.