Stormwater Division

MEMORANDUM

DATE: March 13, 2010

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

FROM: Jo Anna Ripley, Stormwater

PO: 270712

RE: Files Approved for Scanning

General File ID or BMP ID: PC009

PIN: 3740300001A

Subdivision, Tract, Business or Owner Name (if known): Powhatan Plantation

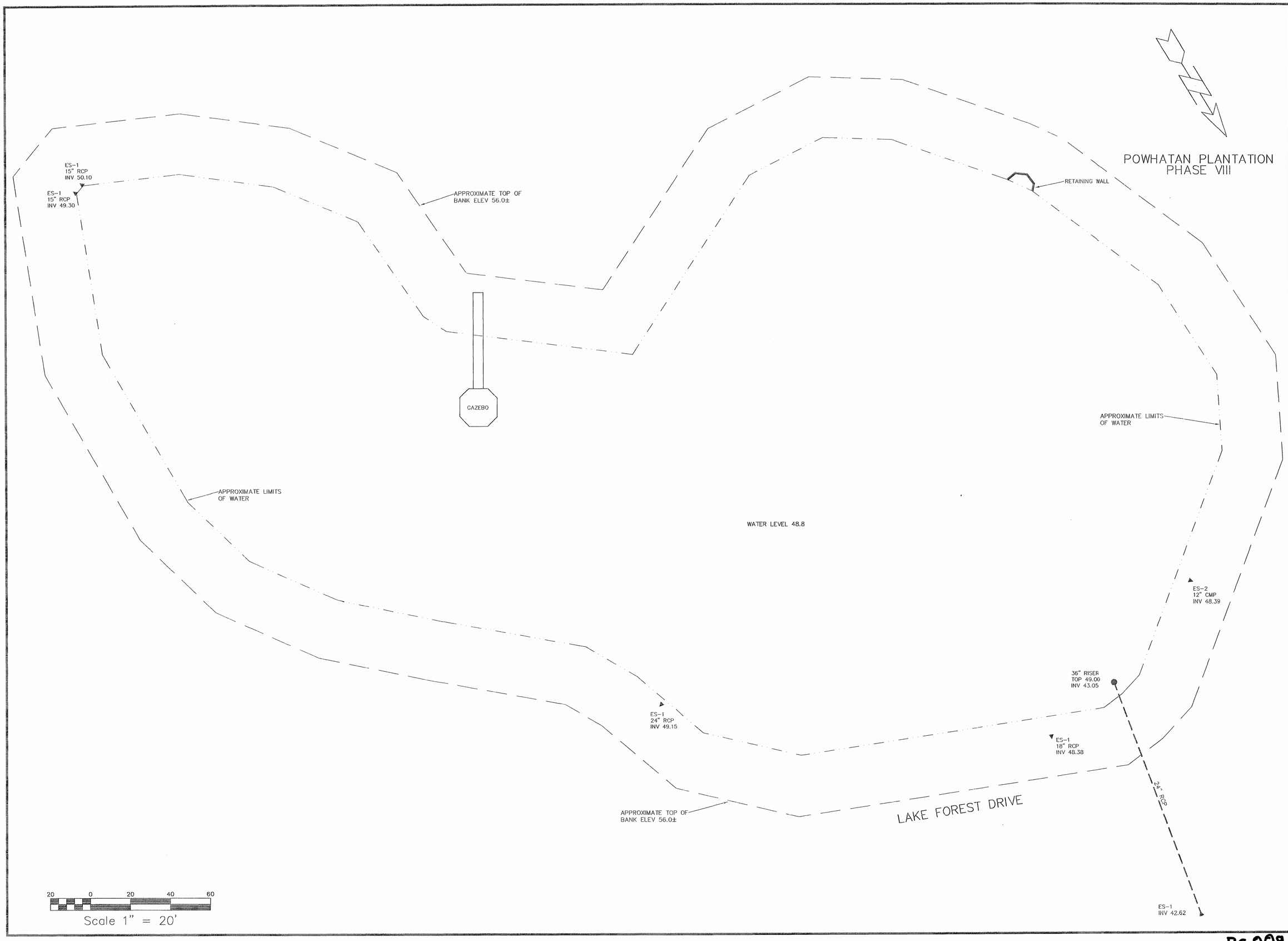
Property Description: Timeshare common area

Site Address: 4300 Fithian LN

(For internal use only) **Box** 4 **Drawer:** 3

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

Comments



Rickmond Engineering, Inc.

1643-C Merrimac Trail
Williamsburg VA 23185
(757)229-1776

Civil Engineering
Environmental Engineering
Land Surveying

Designed By:	Drawn By:	Scale:	Date:	Job No.:	File Name:
KMJ	KMJ	1"=20'	2/2/99	99703	99703AB

No.	By	Revision	App.	Date

POWHATAN PLANTATION PHASE VIII RETENTION POND

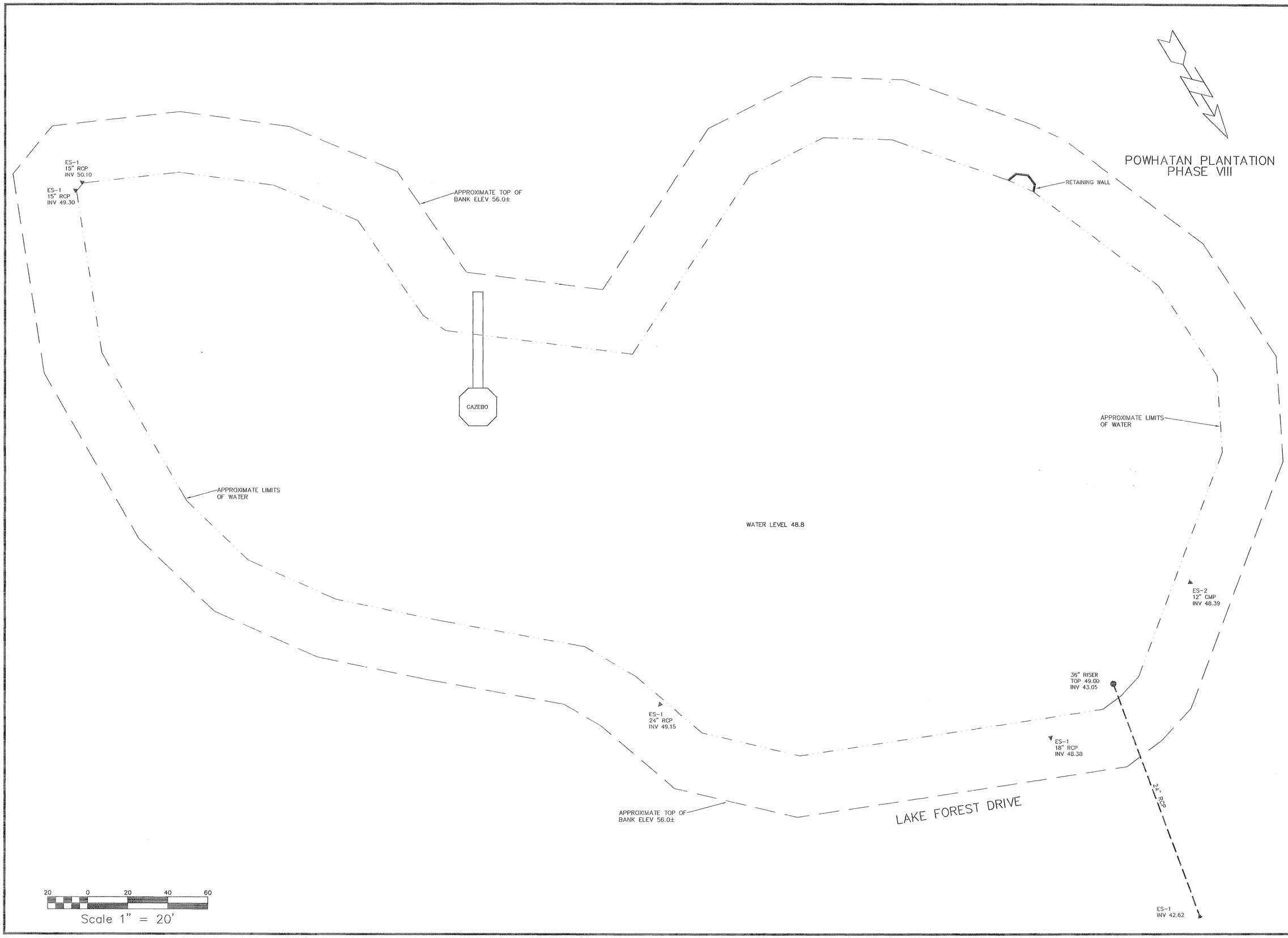
RECORD DRAWINGS

JAMES CITY COUNTY VIRGINIA

Job Number	Sheet No.
99703	C1

PC009

PC009_POWHATAN_PLANTATION_PHASE_6_POND_F_WET_POND - 002



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Civil Engineering
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Designed By:	Drawn By:	Scale:	Date:	Job No.:	File Name:
KMJ	KMJ	1"=20'	2/2/99	99703	99703AB

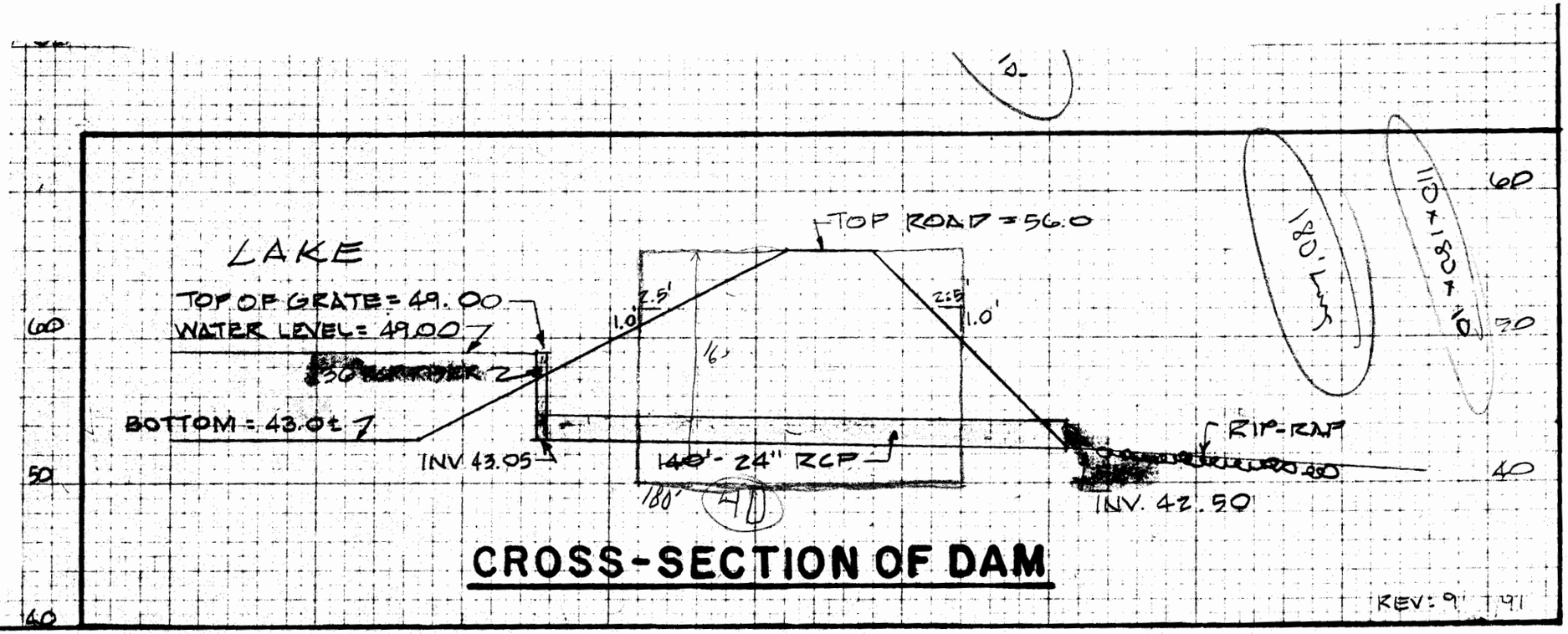
No.	By	Revision	App.	Date

POWHATAN PLANTATION
PHASE VIII
RETENTION POND
RECORD DRAWINGS
JAMES CITY COUNTY VIRGINIA

Job Number	Sheet No.
99703	C1

I:\99703\99703AB Thu Feb 04 08:13:40 1999

PC009_POWHATAN_PLANTATION_PHASE_6_POND_F_WET_POND - 003



CROSS-SECTION OF DAM

REV: 9/91

ROFILES - POWHATAN PLANTATION, PHASE VI

SCALE: 1" = 50' HORZ.
1" = 10' VERT.

SHEET 6 OF 9

POWHATAN PLANTATION

PHASE VIII A and VIII B

BMP and Drainage Calculations

Rickmond Engineering, Inc.
1643 Merrimac Trail
Williamsburg, Virginia 23185
(804) 229-1776

Project No. 94179 and 94196

October 27, 1994

COMMONWEALTH OF VIRGINIA
K.M. JENKINS II
No.022872
10/28/94
PROFESSIONAL ENGINEER

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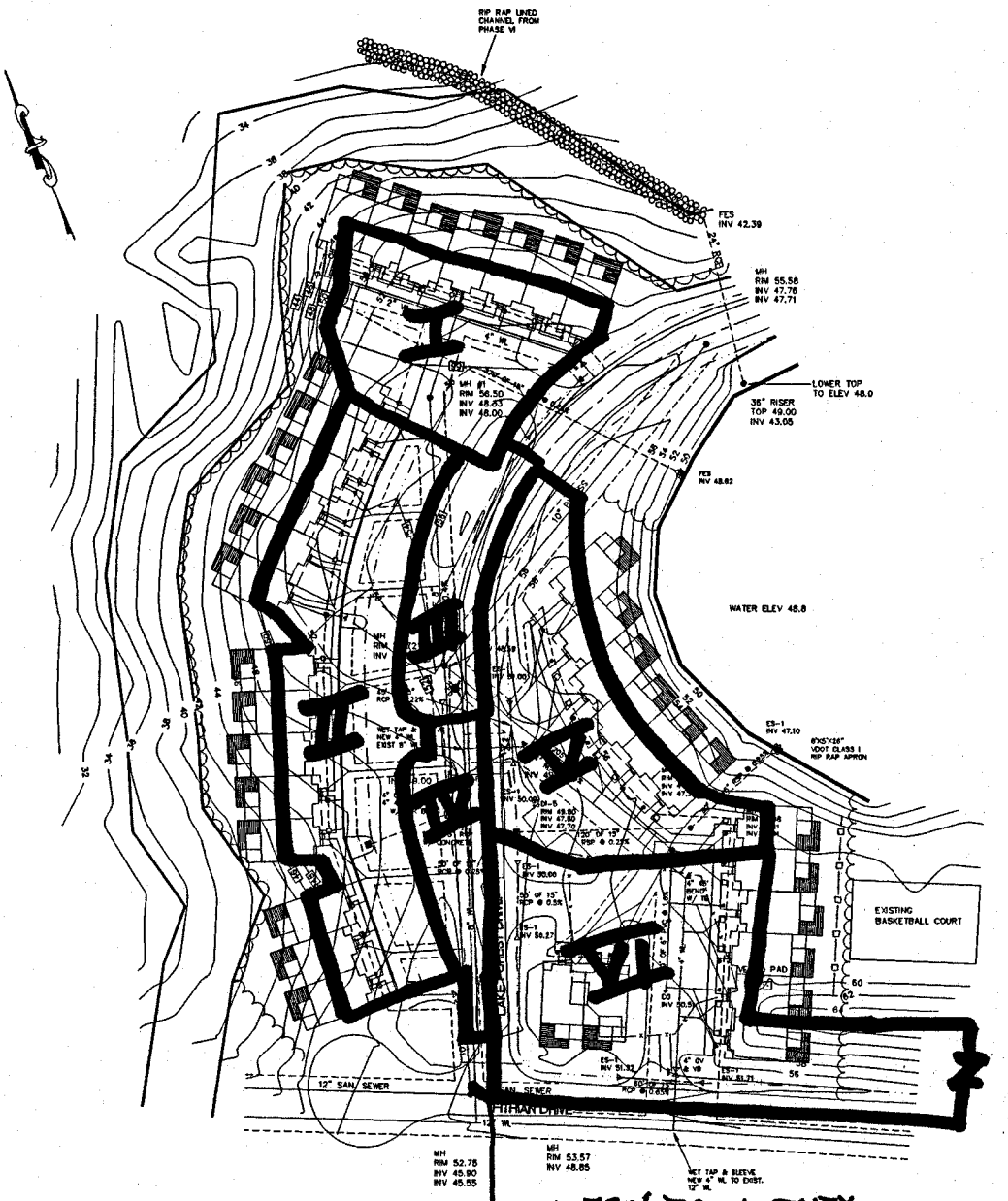
Preface

The following BMP and drainage calculations pertain to Powhatan Plantation Phase VIII A and VIII B located in James City County.

Currently the site consists of 4.24 acres of woods, with approximately 3.62 acres sloping to Powhatan Creek and the remaining .62 acres draining to an existing onsite BMP wet pond. After development the site will contain 35 units with associated parking lot, sidewalks, and landscaping. The stormwater drainage is handled by two outfalls which both combine to drain all the impervious area to the BMP wet pond. With the development of this area an additional 1.63 acres is being treated by the BMP wet pond due to rerouting of the drainage flow. There are no stormwater management or BMP requirements for this site as they were designed and approved in the Powhatan Plantation Master BMP Plan.



750' FROM INTX
TO ATHLETIC FACILITY ENT.

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(804)229-1776 or 898-4149
Civil Engineering
Environmental Engineering
Land Surveying

Designed By: KMJ | Drawn By: KMJ | Scale: 1"=40' | Date: 9/15/94 | Job No.: 94196 | File Name: 94196UP

No.	By	Revision	Apr.	Date

POWHATAN PLANTATION, PH. VIIIB
UTILITY PLAN
JAMES CITY COUNTY VIRGINIA

Job Number 94196 | Sheet No. C4

RICKMOND ENGINEERING, INC.
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(804) 229-1776

JOB 94179
SHEET NO. 2 OF
CALCULATED BY KMJ DATE 9/26/94
CHECKED BY DATE
SCALE

DA- 1

c= .72
A= .47 Ac:

	C	A	CA
Road/Roof	.90	.33	.30
Grass	.20	.13	.03
		.46	.33

OVERLAND FLOW

L= 80 ft.
S= 3.4 %
Tc= 5 min.

CHANNEL FLOW

H= 1.25 ft.
L= 135 ft.
Tc= .5 min.

Tc= 5.5 min.

i_{10}= 7.1 in/hr

Q=CAi=(.72)(.47 Ac.)(7.1 in/hr)(C_f 1.0)

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

Q= 2.40 cfs

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JOB 94179
SHEET NO. 3 OF
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SCALE

DA- 2

c= .72
A= .85 Ac:

	C	A	CA
Roof / Road	.90	.63	.57
Grass	.20	.22	.04
		.85	.61

OVERLAND FLOW

L= — ft.
S= — %
Tc= — min.

CHANNEL FLOW

H= 6.5 ft.
L= 300 ft.
Tc= .5 min.

Tc= .5 min.

i_{10}= 7.2 in/hr

Q=CAi=(.72)(.85 Ac.)(7.2 in/hr)(C_f 1.0)

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

Q= 4.41 cfs

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SHEET NO. 4 OF
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CHECKED BY DATE
SCALE

DA- 3

c= .43
A= .35 Ac:

	C	A	CA
Road	.90	.11	.10
Grass	.20	.24	.05
		.35	.15

OVERLAND FLOW

L= 20 ft.
S= 2.50 %
Tc= 5 min.

CHANNEL FLOW

H= 5.75 ft.
L= 165 ft.
Tc= 1.5 min.

Tc= 6.5 min.

i_{10}= 6.9 in/hr

Q=CAi=(.43)(.35 Ac.)(6.9 in/hr)(C_f 1.0)

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

Q= 1.04 cfs

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JOB 94179
SHEET NO. 5 OF
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CHECKED BY DATE
SCALE

DA- 4

c= .43
A= .33 Ac:

	C	A	CA
Road	.90	.10	.09
Grass	.20	.23	.05
		.33	.14

OVERLAND FLOW

L= — ft.
S= — %
Tc= — min.

CHANNEL FLOW

H= 4 ft.
L= 250 ft.
Tc= 2.5 min.

Tc= 2.5 min.

i_{10}= 7.2 in/hr

Q=CAi=(.43)(.33 Ac.)(7.2 in/hr)(C_f 1.0)

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

Q= 1.02 cfs

PRODUCT 204-1 NCEBS Inc., Groton, Mass. 01471

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JOB 94196
SHEET NO. 6 OF
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CHECKED BY DATE
SCALE

DA- 5

c= .56
A= 0.57 Ac:

	C	A	CA
Road/Roof	.90	.30	.27
Grass	.20	.27	.05
		0.57	.32

OVERLAND FLOW

L= 160 ft.
S= 4.75 %
Tc= 8 min.

CHANNEL FLOW

H= — ft.
L= — ft.
Tc= — min.

Tc= 8 min.

i_{10}= 6.4 in/hr

Q=CAi=(.56)(.57 Ac.)(6.4 in/hr)(C_f 1.0)

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

Q= 2.04 cfs

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JOB 94196
SHEET NO. 7 OF
CALCULATED BY KMJ DATE 10/26/94
CHECKED BY DATE
SCALE

DA- 6

c= .51
A= 1.69 Ac:

	C	A	CA
Road/Roof	.90	.74	.67
Grass	.20	.95	.19
		1.69	.86

OVERLAND FLOW

L= 50 ft.
S= 16.0 %
Tc= — min.

CHANNEL FLOW

H= 5.5 ft.
L= 925 ft.
Tc= 10.5 min.

Tc= 10.5 min.

i_{10}= 5.95 in/hr

Q=CAi=(.51)(1.69 Ac.)(5.95 in/hr)(C_f 1.0)

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

Q= 5.13 cfs

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JOB 94196
SHEET NO. 8 OF
CALCULATED BY KMJ DATE 10/26/94
CHECKED BY DATE
SCALE

CULVERT DESIGN
Lake Forest Dr.
Sta 2+50
DA-5

c= .56
A= .57 Ac.

OVERLAND FLOW

L= 160 ft.
S= 4.75 %
Tc= 8 min.

CHANNEL FLOW

H= — ft.
L= — ft.
Tc= — min.

Tc= 8 min

i_{10}= 6.4 in/hr

Q=CAi=(.56)(.57 Ac.)(6.4 in/hr)

Q= 2.04 cfs
L= 45 ft.
S= 2.22 %
HW= 2.25 ft.

Inv_i= 51.00
Inv_o= 50.00

INLET CONTROL

D= 15 in. or 1.25 ft.

HW/D= .65

HW=(1.25 ft.)(.65)= .81 ft. < 2.25 ft.

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(804) 875-1785

JOB 94196
SHEET NO. 9 OF
CALCULATED BY KMS DATE 10/26/94
CHECKED BY DATE
SCALE

OUTLET CONTROL

$d_c = .57$

$h_o = \frac{d_c}{2} + D = \frac{.57}{2} + 1.25 = .91$

$S_o L = (.0222)(45) = 1.0$

$d_n = .39$

$\frac{d}{D} = .31$ $\frac{r}{D} = .1755$ P.E. Manual Pg 3-43

$R = .22$

$v = 6.22$ fps

$H = (1 + k_e + \frac{29n^2 L}{R^{4/3}}) \frac{v^2}{2g} = 1.89$

$HW = H + h_o - S_o L = 1.80' < 2.25'$

Outlet Control Governs

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JOB 94196
SHEET NO. 10 OF
CALCULATED BY KWJ DATE 10/26/94
CHECKED BY DATE
SCALE

CULVERT DESIGN
Lake Forest Dr
Sta 1+41
DA-6

c= .51
A= 1.69 Ac.

OVERLAND FLOW

L= 50 ft.
S= 16.0 %
Tc= — min.

CHANNEL FLOW

H= 5.5 ft.
L= 925 ft.
Tc= 10.5 min.

Tc= 10.5 min

i_{10}= 5.95 in/hr

Q=CAi=(.51)(1.69 Ac.)(5.95 in/hr)

Q= 5.13 cfs
L= 55 ft.
S= 0.5 %
HW= 2.25 ft.

Inv_i= 50.27
Inv_o= 50.00

INLET CONTROL

D= 15 in. or 1.25 ft.

HW/D= 1.15

HW=(1.25 ft.)(1.15)= 1.44 ft. < 2.25 ft.

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JOB 94196
SHEET NO. 11 OF
CALCULATED BY KMJ DATE 10/26/94
CHECKED BY DATE
SCALE

OUTLET CONTROL

$d_c = 1.25$

$h_o = \frac{d_c + D}{2} = \frac{1.25 + 1.25}{2} = 1.25$

$S_o L = (.005)(55) = .27$

$d_n = 1.25$

$\frac{d}{D} = 1.0$ $\frac{r}{D} = .25$ P.E. Manual Pg 3-43

$R = .31$

$v = 4.17$ fps

$H = (1 + k_e + \frac{29 n^2 L}{R^{4/3}}) \frac{v^2}{2g} = .75$

$HW = H + h_o - S_o L = 1.73' < 2.25'$

Outlet Control Governs

Since this culvert is adequate the culvert upstream at Sta 1+15 on Fitnian Drive is also adequate.

RICKMOND ENGINEERING, INC.
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JOB 94196
SHEET NO. 12 OF
CALCULATED BY KMJ DATE 10/27/94
CHECKED BY DATE
SCALE

Determine Elev of 2yr Storm
in Wet Pond "F"

Drainage Area = 14.45 ac (From Master BMP Plan)
Additional Acerage = 1.63 ac
New Drainage Area = 16.08ac

Surface Area of Lake = 2.82 ac = 122,800 sf (CN = ~~0~~ 99)
Area of D.A. Developed = 13.26ac (CN = 90)

D.A. CN = (90 × 13.26) = $\frac{1193.40}{16.08}$ = ~~74~~ 92

Direct Runoff Q = ~~1.2~~ 2.5 inches (From TR-55, Fig 2-1)

Volume of Runoff = $\frac{1.2\,\cancel{in}}{} \left| \frac{.0833\,ft}{1\,\cancel{in}} \right| \frac{122{,}800\,sf}{}$ = 12,275 cf 25,000 ft³

2yr Storm Raises WL = $\frac{12{,}275\ cf}{122{,}800\ sf}$ = ~~.10'~~ .2

2yr Storm Rises to Elev 48.10' 48.2

POWHATAN PLANTATION
PHASE VIIIA & VIII B
STORM SEWER DESIGN

MH From	MH To	Area Ac	C	A x C	Total Section A.R.	Total Trunk A.R.	Inten. D/Hr	Q CFS	Length of Pipe	Size Pipe in	Slope ft/ft	Fall in Feet	M.H. Drop	Invert Up Stream	Invert Down Stream	Actual cap. CFS	Vel FPS	Time Sect Min	Time Accum Min	
1	FES	.47	.72	.34			7.1	2.40	270	15	.0037	1.0		48.50	48.70	4.23	3.36	1.34	6.84	5.5
2	H	.85	.72	.61			7.2	4.41	55	15	.0025	.14		48.17	48.03	3.47	3.58	.25	.75	.5
4	3	.35	.43	.15																
		.33	.43	.14	.90	.90	6.9	6.21	50	15	.0025	.13	.10	47.93	47.80	3.47	5.05	.17	6.67	6.5
3	5	.57	.56	.32																
		1.69	.51	.86	2.08	2.08	5.95	12.38	120	15	.0025	.30	.10	47.70	47.40	3.47	10.07	.20	10.7	10.5
5	FES							12.38	80	15	.0025	.20	.10	47.30	47.10	3.47	10.07	.13	10.83	

POWHATAN PLANTATION
PHASE VII A & VIII B
HYDRAULIC CALCULATION SHEET

M.H.	Inv.	D	W.S.	RIM	A	K	V	Q	$\frac{V^2}{2g}$	E.G.	S_f	Ave S_f	L	h_f	h_b	h_j	h_{mh}	h_c	E.G.
FES	47.50	15	48.10				3.36	2.40	.18	48.28		.0037	270	1.0					
1	48.50	15	49.10	51.50															
FES	47.10	15	48.10				10.07	12.38	1.57	49.67		.0025	80	.20	.38				
5	47.30	15	48.68	57.00			10.07	12.38	1.57	50.25		.0025	120	.30	.11				
3	47.70	15	49.09	49.80			5.05	6.21	.40	49.49		.0025	50	.13		.39			
4	47.93	15	49.61	50.03			3.58	4.41	.20	50.33		.0025	55	.14					
2	48.17	15	49.75	50.17															

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JOB 94179
SHEET NO. 15 OF
CALCULATED BY KMJ DATE 9/26/94
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SCALE

DESIGN DI #1

$Q = 2.40$ cfs
$n = .015$
$S = .01$ ft/ft
$S_x = .01$ ft/ft
$T = 2.5'$
$W = 2.5'$
$L = 2.5'$

From Chart 10A: $\frac{S_w}{S_x} = 1$, $\frac{W}{T} = \frac{2.5}{2.5'} = 1.0$ $E_o = 1.0$

From Chart 11: $V_n = .045$ ft/s $V = \frac{.045}{.015} = 3.0$ fps

From Chart 12: $R_f = 1.0$

From Chart 13: $R_s = .075$

$Q_i = Q(R_f E_o + R_s(1 - E_o)) = 2.40((1.0)(1.0) + .075(1-1))$

$Q_i = 2.40$ cfs <u>OK</u>

USE VDOT DI-1

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JOB 94179
SHEET NO. 16 OF
CALCULATED BY KMS DATE 9/26/94
CHECKED BY DATE
SCALE

DESIGN DI #2

$Q = 4.41$ cfs
$S_x = .0208$ ft/ft
$W = 2.5$ ft
$L = 2.5$ ft

$P = 2(W+L) = 2(2.5+2.5) = 10$

From Chart 14: $d = .28'$

$T = \frac{d}{S_x} = \frac{.28}{.0208} = 13.5'$ OK

USE VDOT DI-1

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JOB 94196
SHEET NO. 17 OF
CALCULATED BY KMJ DATE 10/27/94
CHECKED BY DATE
SCALE

DESIGN DI #3

Q = 7.02 cfs
W = 3.0'
L = 3.33'

P = 2(W+L) = 2(6.33) = 12.66'

From Chart 14: d = .32'

USE VDOT DI-5

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JOB 94179
SHEET NO. 18 OF
CALCULATED BY KMJ DATE 9/26/94
CHECKED BY DATE
SCALE

DESIGN DI #4

Q = 1.02 cfs
W = 3.0'
L = 3.33'

P = 2(W + L) = 2(6.33) = 12.66

From Chart 14: d = 0.1'

USE VDOT DI-5

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JOB 94196
SHEET NO. 19 OF
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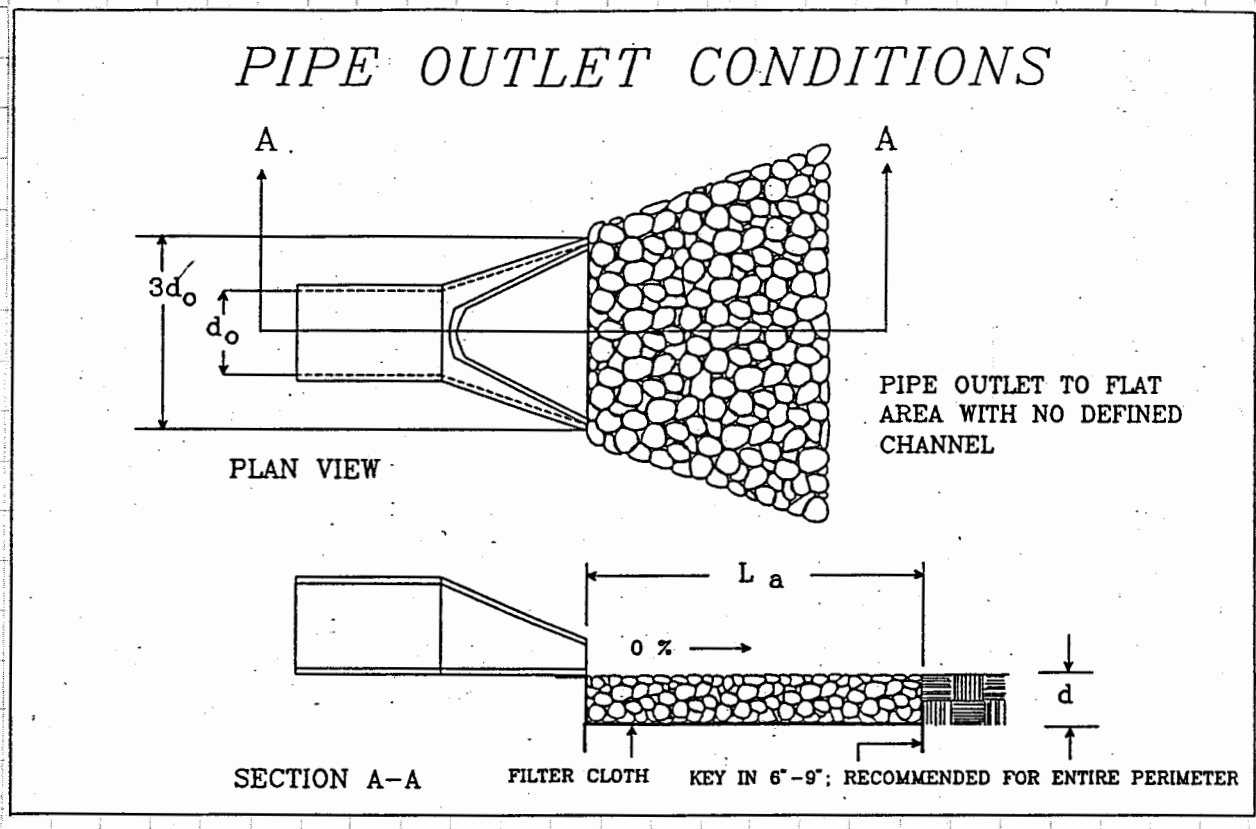
SCALE

OUTLET PROTECTION DESIGN
FROM OI #1



$Q = 2.40$ cfs
Plate 3.18-4
$D_o = 1.25'$
$3D_o = 3.75'$
$L_a = 4'$
$W = D_o + .4L_a = 1.25 + 1.60 = 2.85'$
$d_{50} = .1'$

USE 4'x4'x26"
VDOT CLASS I
RIP RAP APRON

RICKMOND ENGINEERING, INC.
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JOB 94196
SHEET NO. 20 OF
CALCULATED BY KMT DATE 10/26/94
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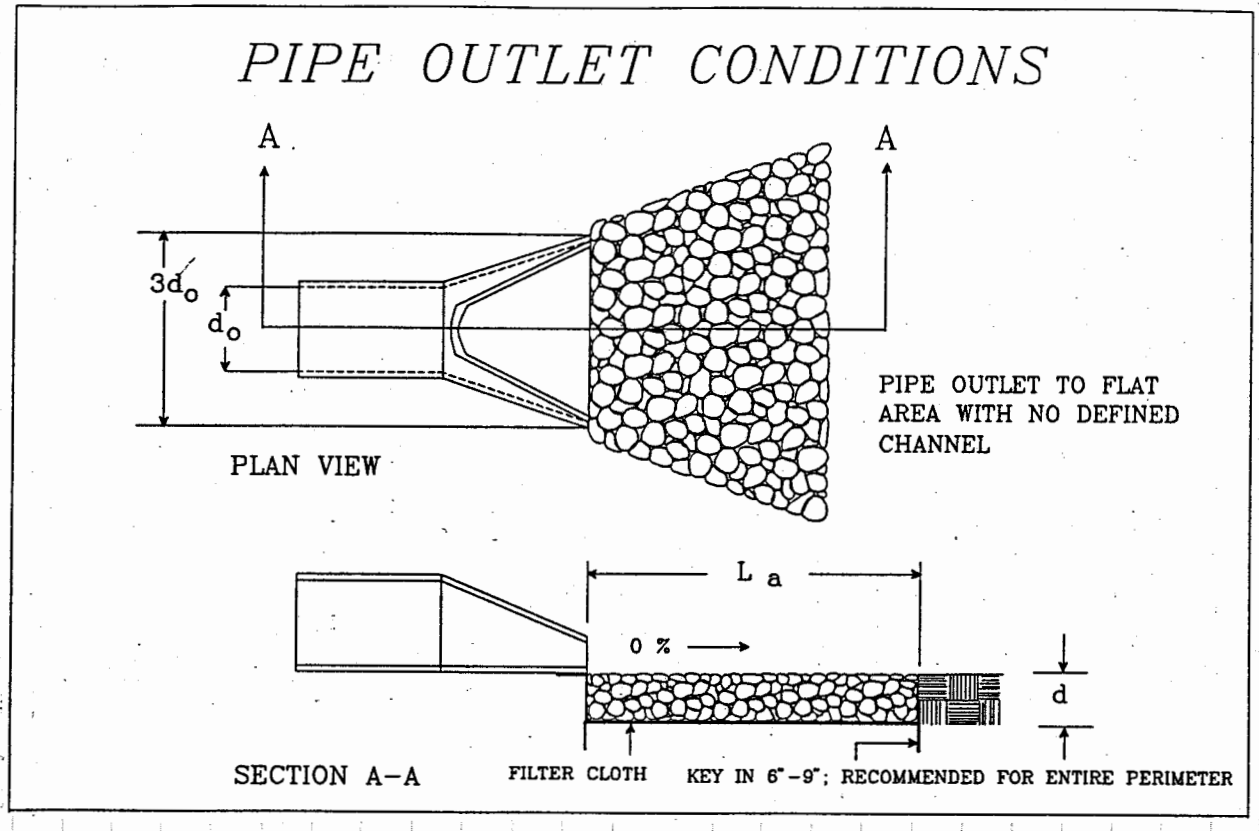
SCALE

OUTLET PROTECTION DESIGN
FROM MH #5



Q = 12.38 cfs
From Plate 3.18-4
$D_o = 1.25'$
$3D_o = 3.75'$
$L_a = 26'$
$W = D_o + .4L_a = 1.25 + .4(26) = 11.65'$
$d_{50} = .3'$

USE 4'x4'x26" VDOT
CLASS I RIP RAP
APRON AS DESIGNED FOR THE PREVIOUS OUTLET PROTECTION BECAUSE THE OUTLET IS SUBMERGED, THUS IT DOES REQUIRE AS MUCH OUTLET PROTECTION.

Powhatan Plantation

Phase VI

BMP Calculations

- For Ph VI + Preceeding Phases

Rickmond Engineering, Inc.
1643-C Merrimac Trail
Williamsburg, VA 23185

Project No. 91198
October 1991

INTRODUCTION

The following BMP calculations pertain to Powhatan Plantation, Phase VI located in James City County, Virginia.

The calculations are used to show that after the completion of Phase VI the entire Powhatan Plantation site (excluding DA-"G" which drains to Future Pond G) will achieve the 10 point BMP requirement. These calculations show that the site may be developed to include all developable land except that draining to Future Pond "G" and still achieve the 10 BMP requirement of the County.

Note: Since DA-"G" is not included in the total area calculations because it will be treated by a Future Pond, the total area is 169.97 acres, not 183 acres as stated in the Powhatan Plantation Master BMP Plan calculations.

TABLE 2

BMP POINT SYSTEM FOR EVALUATION ACCEPTABLE STRUCTURAL BMPS

		Acceptable BMP	Average Total P Removal Efficiency	BMP Points
A.	EXTENDED DRY DETENTION			
	(1)	Design 2 (6-12 hrs):	20%	4
	(2)	Design 3 (24 hrs):	30%	6
	(3)	Design 4 (shallow marsh):	50%	9
B.	WET POND			
	(1)	Design 5 (0.5 in/imp. ac):	35%	6
	(2)	Design 6 (2.5 V):	40%-45%	8
	(3)	Design 7 (4.0 V):	50%	9
C.	INFILTRATION (TRENCH, BASIN, POROUS PAVEMENT)			
	(1)	Design 8 (0.5 in/imp. ac):	50%	9
	(2)	Design 9 (1.0 in/imp. ac):	65%	10
	(3)	Design 10 (2-yr storm):	70%	11
D.	GRASSED SWALE			
	(1)	Design 15 (check dams)	10%-20%	2
E.	WATER QUALITY INLET			
	(1)	Design 11 (400 cu ft/imp. ac):	*	2

* To be used upstream of dentention basin or infiltration system to enhance pollutant removal.

NOTE: A weighted total of 10 points is required for the development plan to achieve BMP compliance.

WORKSHEET FOR BMP POINT SYSTEM

Through Phase VI
Completion
Total Area = 169.97 Ac (Excluding OA-G)

A. STRUCTURAL BMP POINT ALLOCATION

BMP	BMP POINTS		Fraction of Site Served by BMP		Weighted BMP Points
Wet Pond A,B,C Design 7	9	x	.31 ✓	=	2.79
Wet Pond D Design 7	9	x	.05 ✓	=	0.45
Dry Pond E Design 2	4	x	.07 ✓	=	0.28
Wet Pond F Design 7	9	x	.09 ✓	=	0.81

TOTAL WEIGHTED STRUCTURAL BMP POINTS: 4.33

B. NATURAL OPEN SPACE CREDIT

100.26
~~0~~0.26 Ac.

Fraction of Site		Natural Open Space Credit		Points for Natural Open Space
.590	x	10	=	5.90

C. TOTAL WEIGHTED POINTS

4.33	+	5.90	=	10.23
Structural BMP Points		Natural Open Space Points		TOTAL

A,B,C $\frac{26.6 + 3.1 + 22.9}{169.97} = 0.31$ ✓

Need to show where 100.26 ac of Nat Open Space are

Powhatan Plantation

Phase VI

PC 009

Drainage Calculations

Rickmond Engineering, Inc.
1643-C Merrimac Trail
Williamsburg, VA 23185

Project No. 91198
July 30, 1991

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Preface

The following drainage calculations pertain to Powhatan Plantation, Phase VI located in James City County, Virginia.

The site currently consists of 42 acres of field and woodlands eventually draining to Powhatan Creek. After development the site will consist of 59 two story dwelling units with adjacent roads, parking spaces, and sidewalks.

The storm water runoff from this phase drains to existing Pond "C" and proposed Pond "F" (see Powhatan Plantation, Master BMP Plan). The ponds have been designed as Wet Ponds (Design 7) according to James City County BMP point system.

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SHEET NO. 1 OF
CALCULATED BY KMJ DATE 7/23/91
CHECKED BY RCS DATE 7/31/91
SCALE

POND "F"
Phase VI
Elevation - Storage Table

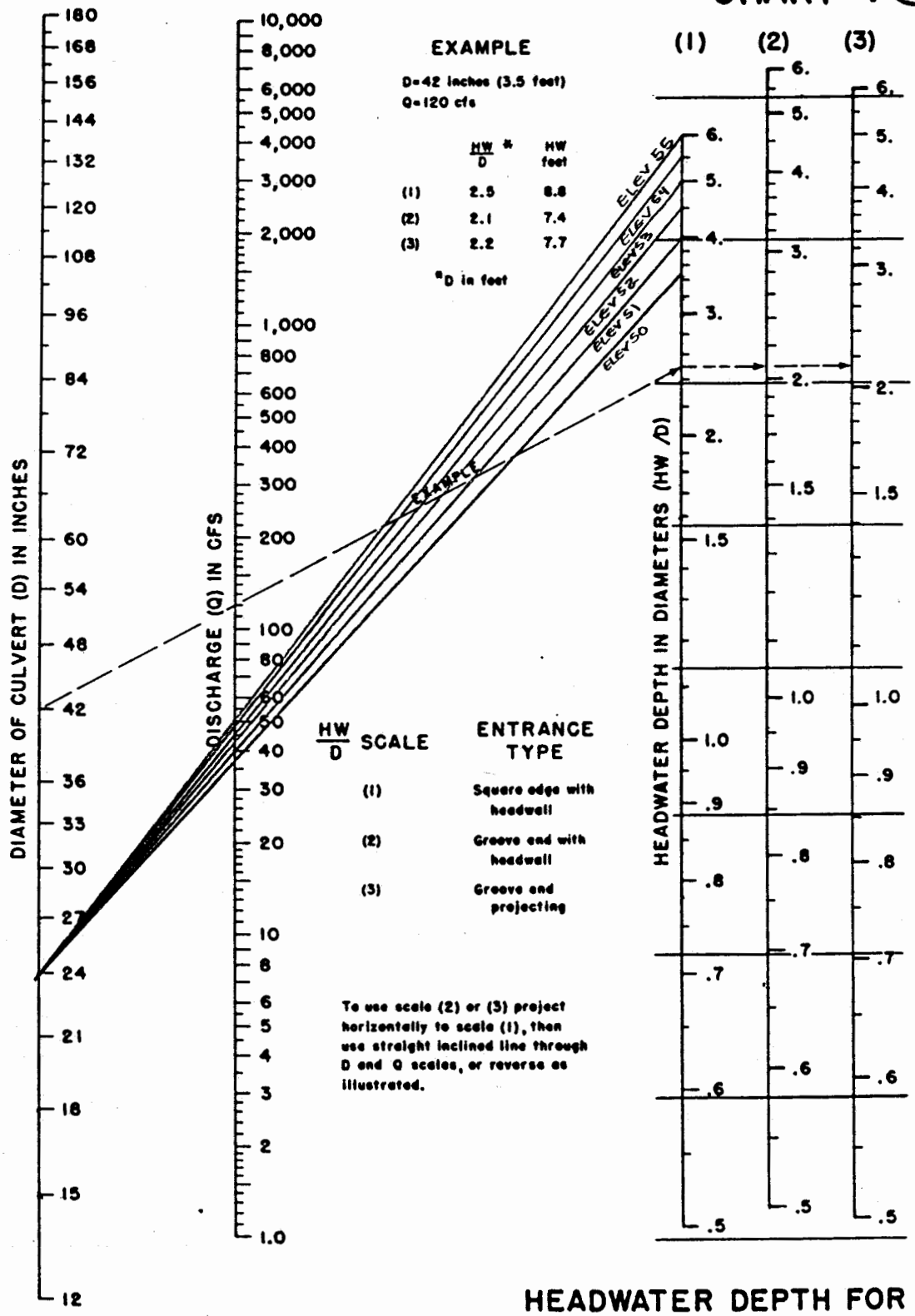
Elev (ft)	Surface Area* (ft^2)	Elev Difference (ft)	Internal Stor (ft^3)	Accum Stor (ft^3)
		0	0	
44	51,664			0
		1	53,326	
45	55,008			53,326
		1	57,944	
46	60,880			111,270
		1	63,072	
47	65,264			174,342
		1	67,632	
48	70,000			241,974
		1	73,176	
49	76,352			315,150

* Measured from finished contours as designed by Freeman & Associates on sheets 1 & 2 of plans dated Jan 27, 91 / revised July 22, 91.

POND "F"
24" Culvert

2

CHART 1



HEADWATER SCALES 2&3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

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SHEET NO. 3 OF
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SCALE

POND "F"
24" Culvert
Outlet Control

24" RCP, 140', n=.015, s=.0036

Q	d_n	d_c	y_n	R	H	h_o	LS_o	HW	(Elev) HW
0	—	—	—	—	—	—	—	—	43.0
5	.86	.80	3.49	.45	.78	1.40	.50	1.68	44.68
10	1.42	1.04	4.19	.59	.91	1.52	.50	1.93	44.93
15	2.0	1.40	4.78	.50	1.35	1.70	.50	2.55	45.55
20	2.0	1.60	6.37	.50	2.39	1.80	.50	3.69	46.69
25	2.0	1.80	7.96	.50	3.74	1.90	.50	5.14	48.14
30	2.0	2.0	9.55	.50	5.38	2.0	.50	6.88	49.88
35	2.0	2.0	11.14	.50	7.32	2.0	.50	8.82	51.82
40	2.0	2.0	12.74	.50	9.57	2.0	.50	11.07	54.07
41	2.0	2.0	13.06	.50	10.05	2.0	.50	11.55	54.55
42	2.0	2.0	13.38	.50	10.55	2.0	.50	12.05	55.05

Outlet Control Governs with road being overtopped at Q = 42 cfs

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JOB 91198
SHEET NO. 4 OF
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SCALE

Design Riser Pond "F"

Size Riser for Q=45 cfs with H=6' so that 24" RCP Barrel is the controling mechanism of the outlet structure.

$Q = 45 cfs$
$h = 6'$

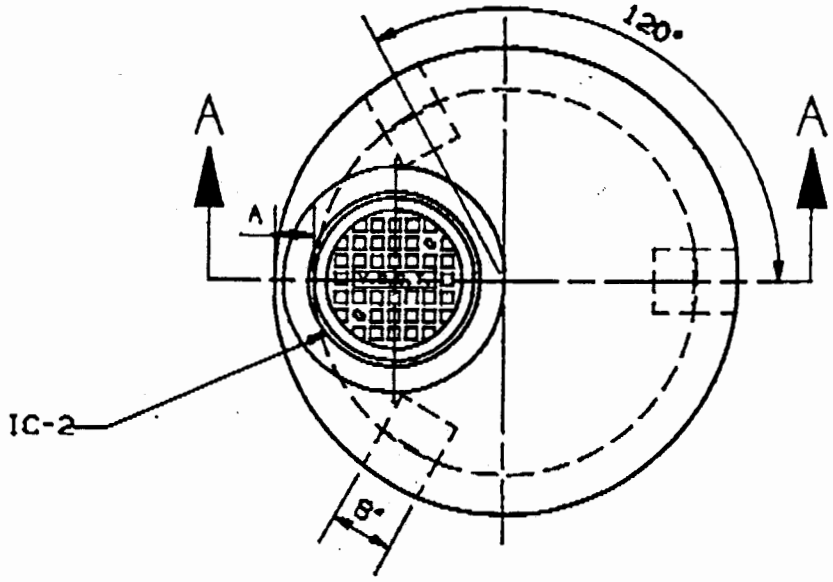
$Q = CLH^{3/2}$

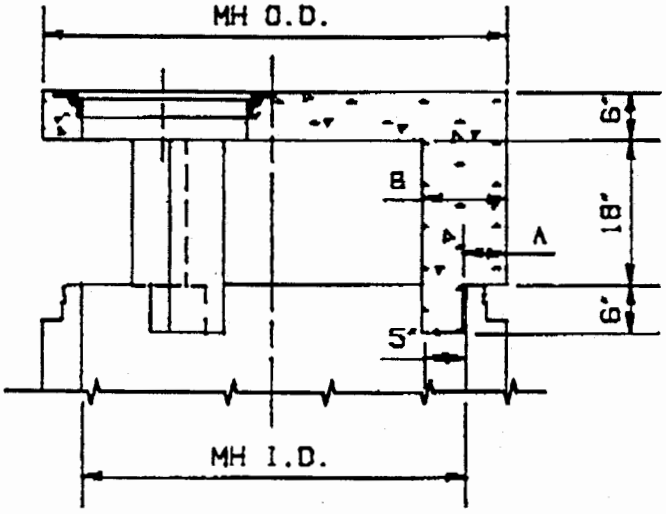
$45 = (3.1)(L)(6)^{3/2}$

$L = .98 = 2\pi r$

$r = .15'$

Use 48" Riser with 58" Anti-Vortex Top
(See Next Sheet)





MH I.D.	MH O.D.	A	B
48"	58"	$5\frac{3}{8}$"	$10\frac{3}{8}$"
60"	$73\frac{1}{2}$"	$7\frac{1}{8}$"	$12\frac{1}{8}$"
72"	$87\frac{1}{2}$"	$8\frac{1}{8}$"	$13\frac{1}{8}$"
84"	$101\frac{1}{2}$"	$9\frac{1}{8}$"	$14\frac{1}{8}$"
96"	114"	$9\frac{3}{8}$"	$14\frac{3}{8}$"
108"	128"	$10\frac{3}{8}$"	$15\frac{3}{8}$"
126"	147"	$10\frac{7}{8}$"	$15\frac{7}{8}$"

TYPICAL ANTI-VORTEX TOP

CRP

CONCRETE PIPE & PRODUCTS CO.,INC.

DATE 05-29-91

XXXXXXXXXX

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JOB 91198
SHEET NO. 6 OF
CALCULATED BY KMJ DATE 7/24/91
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SCALE

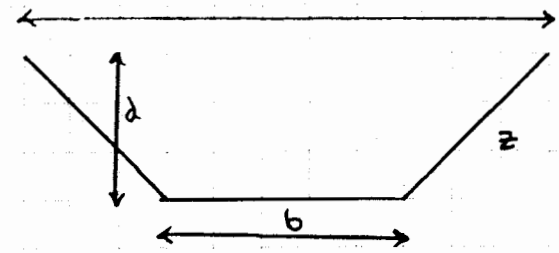
TRAPEZOIDAL-DITCH DESIGN

Pond "F" Outlet Channel

Sta 0+00 (Outlet) to Sta 1+00 (ELEV 41.0)

Q= 42.0 cfs
S= 1.5 %
L= 100 ft.

T= 10 ft.
d= 1.0 ft.
b= 6.0



$$R = \frac{bd + zd^2}{b + 2d(z^2 + 1)^{1/2}} = \frac{(6\ ft)(1\ ft) + (2)(1\ ft)^2}{(6\ ft) + 2(1\ ft)(5)^{1/2}} = .76\ ft$$

n= .028 RIP RAP

$$A = bd + zd^2 = (6\ ft)(1\ ft) + (2)(1\ ft)^2 = 8\ ft^2$$

$$Q = \frac{1.49}{n} R^{2/3} S^{1/2} A$$

$$Q = \frac{1.49}{.028} (.76)^{2/3} (.015)^{1/2} (8)$$

Q = 43.4 cfs > 42.0 cfs OK

$$V = \frac{Q}{A} = \frac{42.0}{8}$$

V = 5.25 fps

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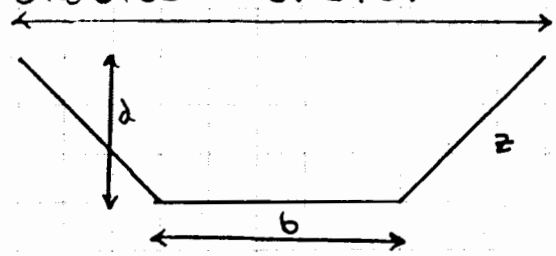
SCALE

TRAPEZOIDAL-DITCH DESIGN

Pond "F" Outlet Channel

Q= 42.0 cfs
S= 3.78 %
L= 450 ft.

Sta 1+00 (ELEV 41.0) to Sta 5+50 (ELEV 24.0)



T= ____ ft.
d= 1.5 ft.
b=6.0

$$R=\frac{bd + zd^2}{b + 2d(z^2 + 1)^{1/2}} = \frac{(6\ ft)(1.5\ ft) + (2)(1.5ft)^2}{(6\ ft) + 2(1.5\ ft)(5)^{1/2}} = 1.06\ ft$$

n= ____

$$A=bd + zd^2=(6\ ft)(1.5\ ft) + (2)(1.5\ ft)^2 = 13.5\ ft^2$$

$V \times R = (4)(1.06) = 4.24$ Grass Ditch

n = .065 (class B)
n = .041 (class C)

$$Q= \frac{1.49}{n} R^{2/3} S^{1/2} A = \frac{1.49}{.065}(1.06)^{2/3}(.0378)^{1/2}(13.5)$$

Q = 62.5 cfs > 42.0 cfs

$$AR^{2/3} = \frac{Qn}{1.49 S^{1/2}} = \frac{(42)(.041)}{1.49(.0378)^{1/2}} = 5.94$$

d = 1.0	A = 8	R = .76	$AR^{2/3}$ = 6.65
d = .95	A = 7.51	R = .73	$AR^{2/3}$ = 6.09

NO GOOD

$$V= \frac{Q}{A} = \frac{42.0}{7.51} = 5.59\ fps$$

Use RIP RAP DITCH

Powhatan Plantation
Phase VI
11/14/91

PC009

WORKSHEET FOR BMP POINT SYSTEM
TOTAL AREA = 26.30

A. STRUCTURAL BMP POINT ALLOCATION

BMP	BMP POINTS		Fraction of Site Served by BMP		Weighted BMP Points
WET POND C Design 7	9	X	.16	=	1.44
WET POND F Design 7	9	X	.40	=	3.59
		X		=	
		X		=	

TOTAL WEIGHTED STRUCTURAL BMP POINTS: 5.03

B. NATURAL OPEN SPACE CREDIT

Fraction of Site		Natural Open Space Credit		Points for Natural Open Space
.830	X	10	=	8.3

21.82 Ac

C. TOTAL WEIGHTED POINTS

5.03	+	8.3	=	13.33
Structural BMP Points		Natural Open Space Points		TOTAL

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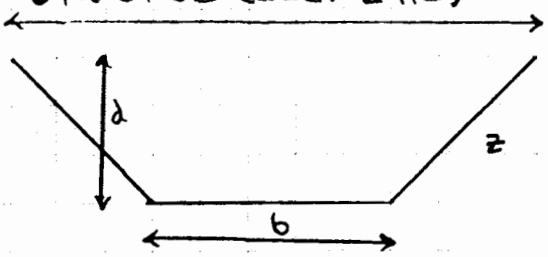
TRAPEZOIDAL-DITCH DESIGN

Pond "F" Outlet Channel

Sta 1+00 (ELEV 41.0) to Sta 5+50 (ELEV 24.0)

Q= 42.0 cfs
S= 3.78 %
L= 450 ft.



T= ____ ft.
d= 1.0 ft.
b= 6.0'

$$R = \frac{bd + zd^2}{b + 2d(z^2 + 1)^{1/2}} = \frac{(6\ ft)(1\ ft) + (2)(1\ ft)^2}{(6\ ft) + 2(1\ ft)(5)^{1/2}} = .76\ ft$$

n= .028 RIP RAP

$$A = bd + zd^2 = (6\ ft)(1\ ft) + (2)(1\ ft)^2 = 8\ ft^2$$

$$Q = \frac{1.49}{n} R^{2/3} S^{1/2} A$$

$$Q = \frac{1.49}{.028} (.76)^{2/3} (.0378)^{1/2} (8)$$

Q = 68.9 cfs > 42.0 cfs OK

$$AR^{2/3} = \frac{Qn}{1.49 S^{1/2}} = \frac{(42)(.028)}{1.49(.0378)^{1/2}} = 4.06$$

d = .8 A = 6.08 R = .63 $AR^{2/3}$ = 4.48
d = .75 A = 5.63 R = .60 $AR^{2/3}$ = 4.01

$$V = \frac{Q}{A} = \frac{42.0}{5.63} = 7.46\ fps$$ Use RIP RAP CHANNEL

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Size Rip Rap for Outfall Channel
E+S STD + SPEC 1.37

1) From Plate 1.37b → $d_{50} = 0.25'$

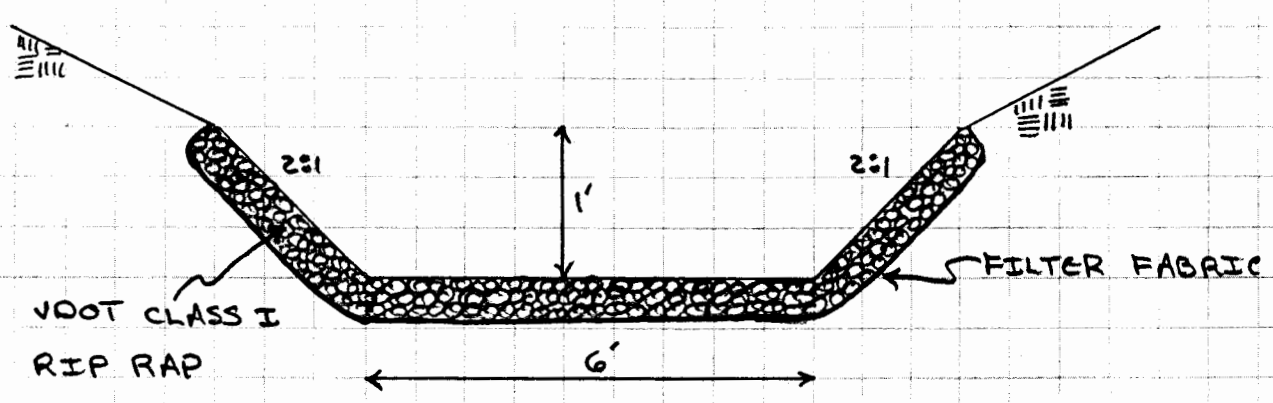
2) From Plate 1.37c → $B/d = 6/1 = 6$, $z = 2$ ∴ $K_1 = .78$

3) From Plate 1.37d → $d_{50} = 3''$ ∴ $\phi = 40°$

4) From Plate 1.37e → $z = 2$, $\phi = 40°$ ∴ $K_2 = .72$

5) $d_{50} \times \frac{K_1}{K_2} = d_{50}' = (.25)\left(\frac{.78}{.73}\right) = .27'$

USE VDOT CLASS I RIP RAP



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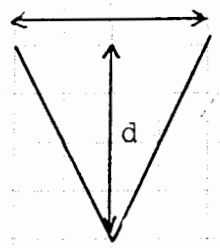
V-DITCH DESIGN

Drainage Area II

Q= .48 cfs Roadside Ditch Elev 59.0 to CB #2 (Elev 53.6)

S= 2.45 %

L= 220 ft.



T= 6.0 ft.

d= 1.0 ft.

$R = \frac{zd}{2(z^2+1)^{1/2}} = \frac{(3)(1\ ft.)}{2(10)^{1/2}} = .45$ ft.

$A = zd^2 = (3)(1\ ft.)^2 = 3\ ft.^2$

$V \times R = 5 \times .45 = 2.25$

n= .091 (class B)
n= .053 (class C)

Check Q: $Q = \frac{1.49}{n} R^{2/3} S^{1/2} A = \frac{1.49}{.091}(.67)^{2/3}(.0245)^{1/2}(3)$

Q = 5.88 cfs > .48 cfs OK

Check V: $AR^{2/3} = \frac{Qn}{1.49 S^{1/2}} = \frac{(.48)(.053)}{1.49(.0245)^{1/2}} = .11$

d= .25	A= .19	R= .12	$AR^{2/3}$ = .05
d= .35	A= .37	R= .17	$AR^{2/3}$ = .11

$V = \frac{Q}{A} = \frac{.48}{.37} = 1.30$ fps Use Grass Ditch

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JOB 91198
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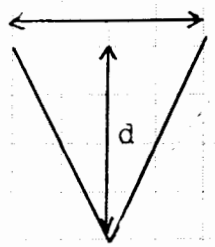
V-DITCH DESIGN

Drainage Area III

Q= .66 cfs Roadside Ditch Elev 59.0 to CB # 3 (Elev 53.6)

S= 2.45%

L= 220 ft.



T= 6.0 ft.

d= 1.0 ft.

$$R = \frac{zd}{2(z^2+1)^{1/2}} = \frac{(3)(1\text{ ft.})}{2(10)^{1/2}} = .45\text{ ft.}$$

$$A = zd^2 = (3)(1\text{ ft.})^2 = 3\text{ ft.}^2$$

$V \times R = 5 \times .45 = 2.25$

n=.091 (class B)
n=.053 (class C)

Check Q: $Q = \frac{1.49}{n} R^{2/3} S^{1/2} A = \frac{1.49}{.091}(.67)^{2/3}(.0245)^{1/2}(3)$

Q=5.88 cfs > .66 cfs OK

Check V: $AR^{2/3} = \frac{Qn}{1.49 S^{1/2}} = \frac{(.66)(.053)}{1.49\,(.0245)^{1/2}} = .15$

d=.40 A=.48 R=.19 $AR^{2/3}$=.15

$V = \frac{Q}{A} = \frac{.66}{.48} = 1.38$ fps

Use Grass Ditch

PRODUCT 204-1 NEBS Inc. Golden, Mass. 81471

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SCALE

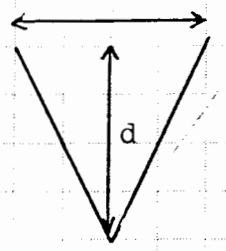
V-DITCH DESIGN

Drainage Area VI

Q= 0.94 cfs Roadside Ditch Elev 63.0 to CB # 7 (elev 57.2)

S= 1.29 %

L= 450 ft.



T= 6.0 ft.

d= 1.0 ft.

$$R=\frac{zd}{2(z^2+1)^{1/2}}=\frac{(3)(1\ \text{ft.})}{2(10)^{1/2}}=.45\ \text{ft.}$$

$$A=zd^2=(3)(1\ \text{ft.})^2=3\ \text{ft.}^2$$

$V \times R = 5 \times .45 = 2.25$

n= .091 (class B)
n= .053 (class C)

Check Q: $Q=\frac{1.49}{n}R^{2/3}S^{1/2}A=\frac{1.49}{.091}(.45)^{2/3}(.0129)^{1/2}(3)$

Q= 3.27 cfs > 0.94 cfs OK

Check V: $AR^{2/3}=\frac{Qn}{1.49S^{1/2}}=\frac{(0.94)(.053)}{1.49(.0129)^{1/2}}=.29$

d= .75	A= 1.69	R= .36	$AR^{2/3}$ = .84
d= .50	A= .75	R= .24	$AR^{2/3}$ = .29

$V=\frac{Q}{A}=\frac{.94}{.75}=1.25$ fps Use Grass Ditch

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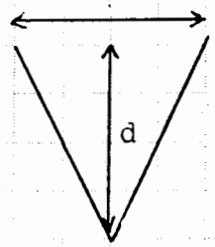
V-DITCH DESIGN

Drainage Area VII

Q= .73 cfs Roadside Ditch Elev 63.0 to CB #8 (Elev 57.2)

S= 1.29 %

L= 450 ft.



T= 6.0 ft.

d= 1.0 ft.

$R = \frac{zd}{2(z^2+1)^{1/2}} = \frac{(3)(1\ ft.)}{2(10)^{1/2}} = .45$ ft.

$A = zd^2 = (3)(1\ ft.)^2 = 3\ ft.^2$

$V \times R = 5 \times .45 = 2.25$

n= .091 (class B)

n= .053 (class C)

Check Q: $Q = \frac{1.49}{n} R^{2/3} S^{1/2} A = \frac{1.49}{.091}(.45)^{2/3}(.0129)^{1/2}(3)$

Q= 3.27 cfs > .73 cfs OK

Check V: $AR^{2/3} = \frac{Qn}{1.49 S^{1/2}} = \frac{(.73)(.053)}{1.49(.0129)^{1/2}} = .23$

d=.45 A=.61 R=.21 $AR^{2/3}$ = .22

$V = \frac{Q}{A} = \frac{.73}{.61} = 1.20$ fps Use Grass Ditch

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SHEET NO. 14 OF
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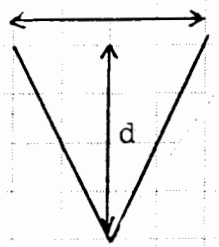
V-DITCH DESIGN

Drainage Area IX

Q= .62 cfs Roadside Ditch Elev 63.0 to CB # 12 (Elev 61.0)

S= 0.73 %

L= 275 ft.



T= 6.0 ft.

d= 1.0 ft.

$$R = \frac{zd}{2(z^2+1)^{1/2}} = \frac{(3)(1\text{ ft.})}{2(10)^{1/2}} = .45\text{ ft.}$$

$$A = zd^2 = (3)(1\text{ ft.})^2 = 3\text{ ft.}^2$$

$V \times R = 5 \times .45 = 2.25$

n=.091 (class B)
n=.053 (class C)

Check Q: $\frac{1.49}{n} R^{2/3} S^{1/2} A = \frac{1.49}{.091}(.45)^{2/3}(.0073)^{1/2}(3)$

$Q = 2.45$ cfs $> .62$ cfs **OK**

Check V: $AR^{2/3} = \frac{Qn}{1.49 S^{1/2}} = \frac{(.62)(.053)}{1.49(.0073)^{1/2}} = .26$

$d = .48$ $A = .69$ $R = .23$ $AR^{2/3} = .26$

$V = \frac{Q}{A} = \frac{.62}{.69} = .90$ fps **USE GRASS DITCH**

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1643 Merrimac Trail
WILLIAMSBURG, VIRGINIA 23185
(804) 229-1776

JOB 91198
SHEET NO. 15 OF
CALCULATED BY KMJ DATE 7/29/91
CHECKED BY DATE
SCALE

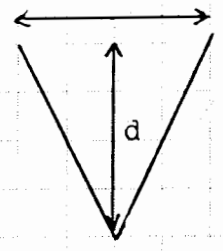
V-DITCH DESIGN

Drainage Area X

Q= .69 cfs Roadside Ditch Elev 63.0 to CB # 13 (Elev 61.0)

S= 0.73 %

L= 275 ft.



T= 6.0 ft.

d= 1.0 ft.

$$R = \frac{zd}{2(z^2+1)^{1/2}} = \frac{(3)(1\ \text{ft.})}{2(10)^{1/2}} = .45\ \text{ft.}$$

$$A = zd^2 = (3)(1\ \text{ft.})^2 = 3\ \text{ft.}^2$$

$V \times R = 5 \times .45 = 2.25$

n = .091 (class B)
n = .053 (class C)

Check Q: $Q = \frac{1.49}{n} R^{2/3} S^{1/2} A = \frac{1.49}{.091} (.45)^{2/3} (.0073)^{1/2} (3)$

Q = 2.45 cfs > .69 cfs OK

Check V: $AR^{2/3} = \frac{Qn}{1.49 S^{1/2}} = \frac{(.69)(.053)}{1.49 (.0073)^{1/2}} = .29$

d = .50 A = .75 R = .24 $AR^{2/3}$ = .29

$V = \frac{Q}{A} = \frac{.69}{.75} = .92$ fps USE GRASS DITCH

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JOB 91198
SHEET NO. 16 OF
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SCALE

CULVERT DESIGN
24" Culvert
Drainage Area XI

c= .20
A= 1.17 Ac.

OVERLAND FLOW

L= 200 ft.
S= 5.0 %
Tc= ___ min.

CHANNEL FLOW

H= — ft.
L= — ft.
Tc= — min.

Tc= 18 min

i_{10}= 4.6 in/hr

Q=CAi=(.20)(1.17 Ac.)(4.6 in/hr)

Q= 1.08 cfs
L= 41 ft.
S= 1.63 %
HW= 2.0 ft.

Inv_i=49.83
Inv_o=49.16

INLET CONTROL

D= 24 in. or 2 ft.

HW/D= .5

HW=(2 ft.)(.5)=1.0 ft. < 2.0 ft. OK

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JOB 91198
SHEET NO. 17 OF
CALCULATED BY KMJ DATE 7/29/91
CHECKED BY DATE
SCALE

OUTLET CONTROL

$d_c = .34$

$h_o = \frac{d_o}{2} + D = \frac{.34 + 2.0}{2} = 1.17$

$S_o L = (.0163)(41) = .67$

$d_n = .27$

$\frac{d}{D} = .14$ $\frac{r}{D} = .0871$ P.E. Manual Pg 3-43

$R = .17$

$v = 3.87$ fps

$H = (1 + k_e + \frac{29 n^2 L}{R^{4/3}}) \frac{v^2}{2g} = 1.01$

$HW = H + h_o - S_o L = 1.51$

Outlet Control Governs

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SHEET NO. ____ OF ____
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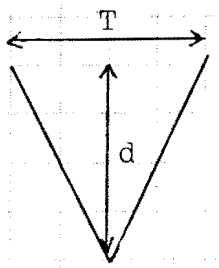
CHECKED BY ____ DATE ____
SCALE ____

V-DITCH DESIGN

Outfall
Drainage Area XI

Q= 1.08 cfs
S= 6.33 %
L= 300 ft.

T= 6.0 ft.
d= 1.0 ft.



$$R=\frac{zd}{2(z^2+1)^{1/2}}=\frac{(3)(1\ \text{ft.})}{2(10)^{1/2}}=.47\ \text{ft.}$$

$$A=zd^2=(3)(1\ \text{ft.})^2=3\ \text{ft.}^2$$

$V \times R = 4 \times .47 = 1.90$ Grass Ditch

n= .10 (class B)
n= .057 (class C)

Check Q:

$$Q=\frac{1.49}{n}R^{2/3}S^{1/2}A=\frac{1.49}{.10}(.47)^{2/3}(.0633)^{1/2}(3)$$

Q= 6.78 cfs > 1.08 cfs

Check V:

$$AR^{2/3}=\frac{Qn}{1.49S^{1/2}}=\frac{(1.08)(.057)}{1.49(.0633)^{1/2}}=.16$$

d= .25	A= .19	R= .12	$AR^{2/3}$= .05
d= .40	A= .48	R= .19	$AR^{2/3}$= .16

$$V=\frac{Q}{A}=\frac{1.08}{.48}=2.25\ \text{fps} < 4.0\ \text{fps}$$ Grass Ditch

PRODUCT 204-1 NEBS Inc., Groton, Mass. 01471.

Date Record Created: [redacted]

Created By: [redacted]

WS_BMPNO: PC009

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WATERSHED	PC
BMP ID NO	009
PLAN NO	
TAX PARCEL	
PIN NO	3740300001A
CONSTRUCTION DATE	11/14/1991
PROJECT NAME	Powhatan Plantation Ph 6
FACILITY LOCATION	NW Corner Lake Forest Drive
CITY-STATE	
CURRENT OWNER	Powhatan Plantation Owners Association
OWNER ADDRESS	4029 Ironbound Road
OWNER ADDRESS 2	
CITY-STATE-ZIP CODE	Williamsburg, VA 23188
OWNER PHONE	
MAINT AGREEMENT	Yes
EMERG ACTION PLAN	No

MAINTENANCE PLAN	No
SITE AREA acre	254.6
LAND USE	COMM
old BMP TYP	Wet Pond
JCC BMP CODE	A2 Wet Pond
POINT VALUE	9
SVC DRAIN AREA acres	14.45
SERVICE AREA DESCRI	All Preceding Phases
IMPERV AREA acres	
RECV STREAM	Powhatan Creek
EXT DET-WQ-CTRL	No
WTR QUAL VOL acre-ft	0
CHAN PROT CTRL	No
CHAN PROT VOL acre-ft	0
SW/FLOOD CONTROL	No
GEOTECH REPORT	No

CTRL STRUC DESC	RCP Riser
CTRL STRUC SIZE inches	48
OTLT BARRL DESC	RCP Barrel
OTLT BARRL SIZE inch	24
EMERG SPILLWAY	No
DESIGN HW ELEV	
PERM POOL ELEV	
2-YR OUTFLOW cfs	
10-YR OUTFLOW cfs	
REC DRAWING	No
CONSTR CERTIF	No

LAST INSP DATE 10/5/2000 Inspected by: [redacted]

INTERNAL RATING 3

MISC/COMMENTS

Pond F. Wet Pond Design 7. Road is embankment

Get Last BMP No | Return to Menu | Print Record

Additional Comments: [redacted]