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: **CC-005**

DATE VERIFIED: **March 22, 2012**

QUALITY ASSURANCE TECHNICIAN: **Leah Hardenbergh**

Leah Hardenbergh

LOCATION: WILLIAMSBURG, VIRGINIA

Stormwater Division

MEMORANDUM

DATE: March 10, 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: CC005

PIN: 4840100011

Subdivision, Tract, Business or Owner Name (if known): Vineyards at Jockeys Neck
Common Area Landscape and Hardscape Easements and Open Space

Property Description:

Site Address: 2630 Lake Powell Road

(For internal use only) **Box** 10 **Drawer:** 6

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

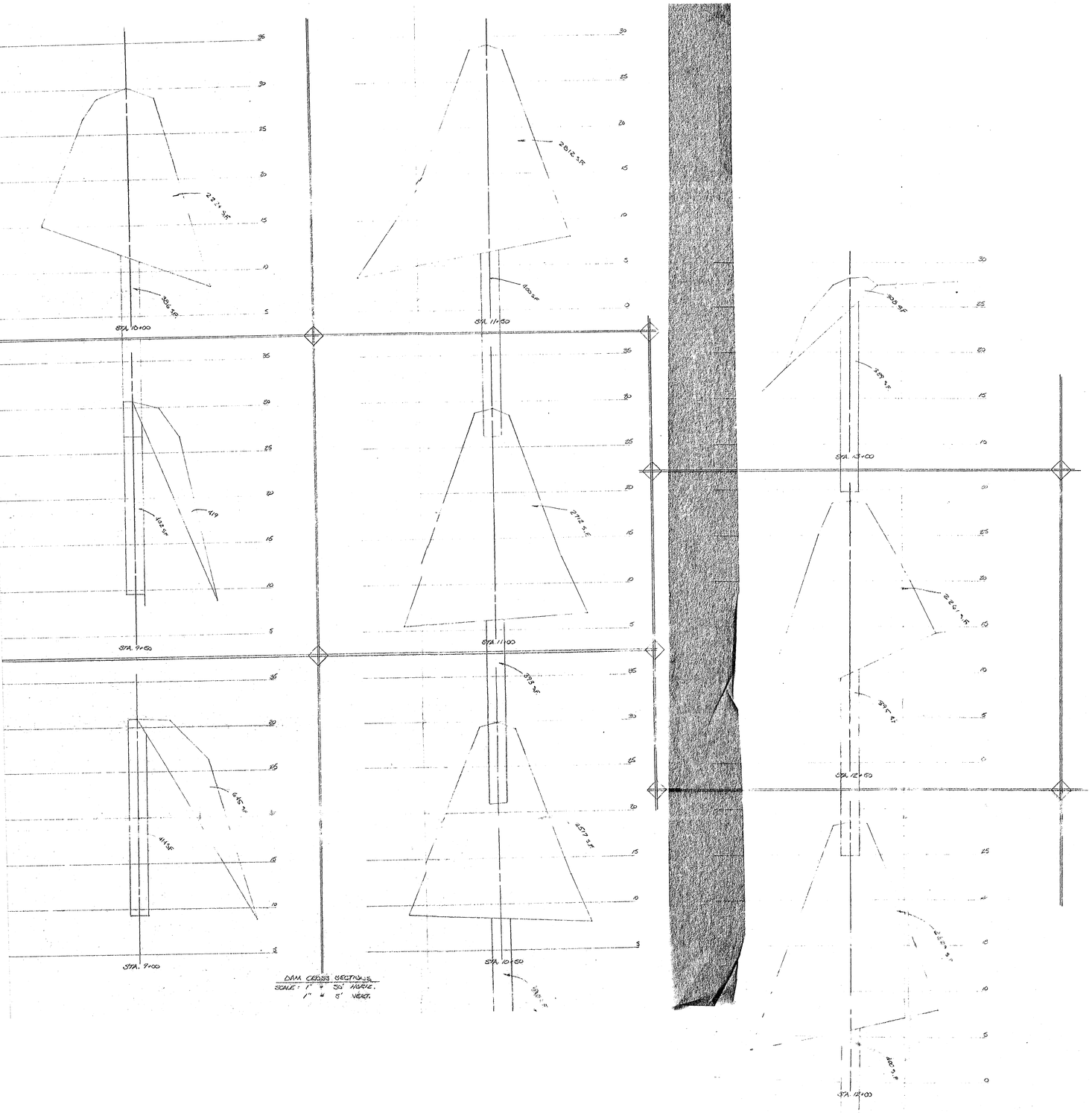
Comments

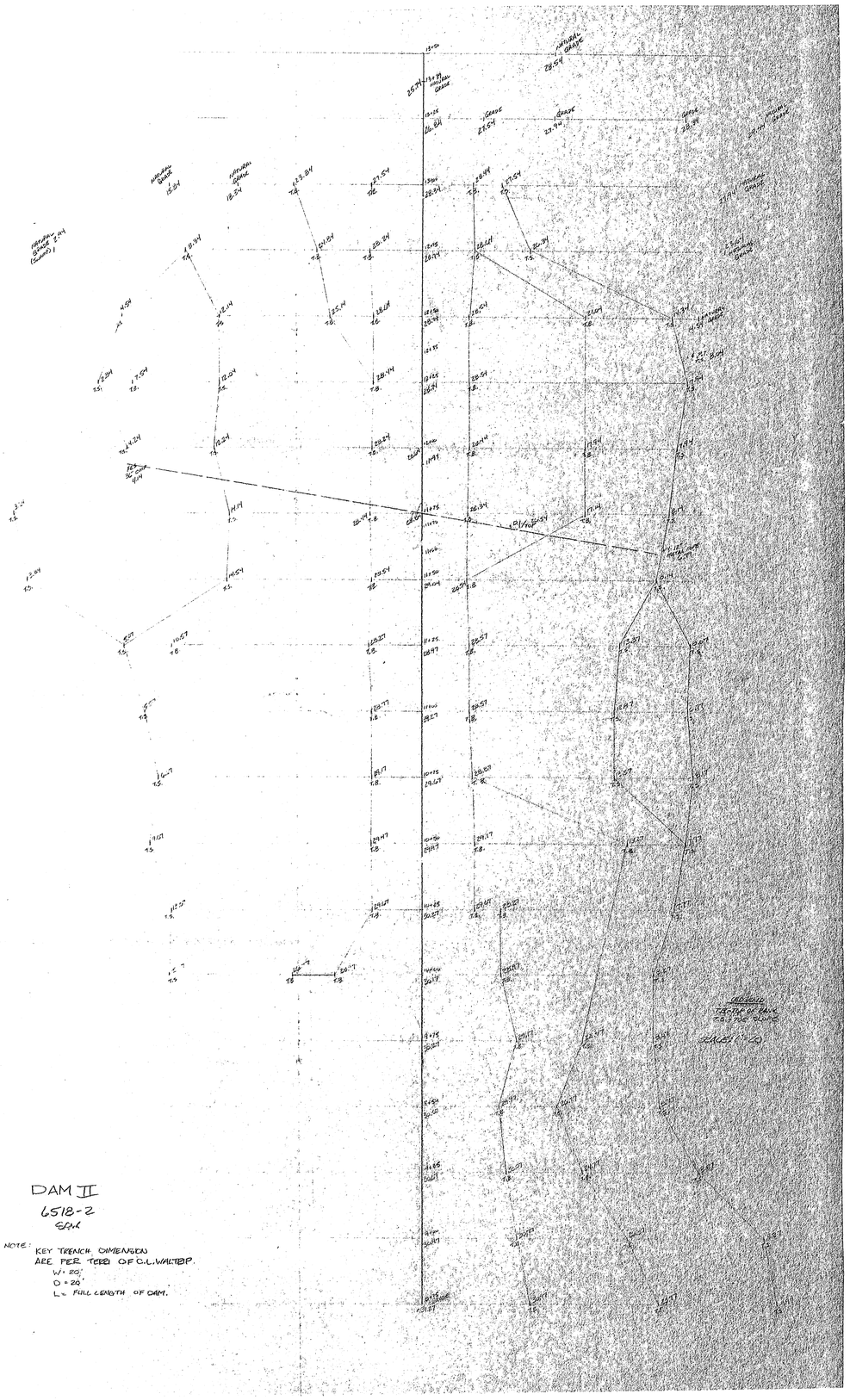
CC005

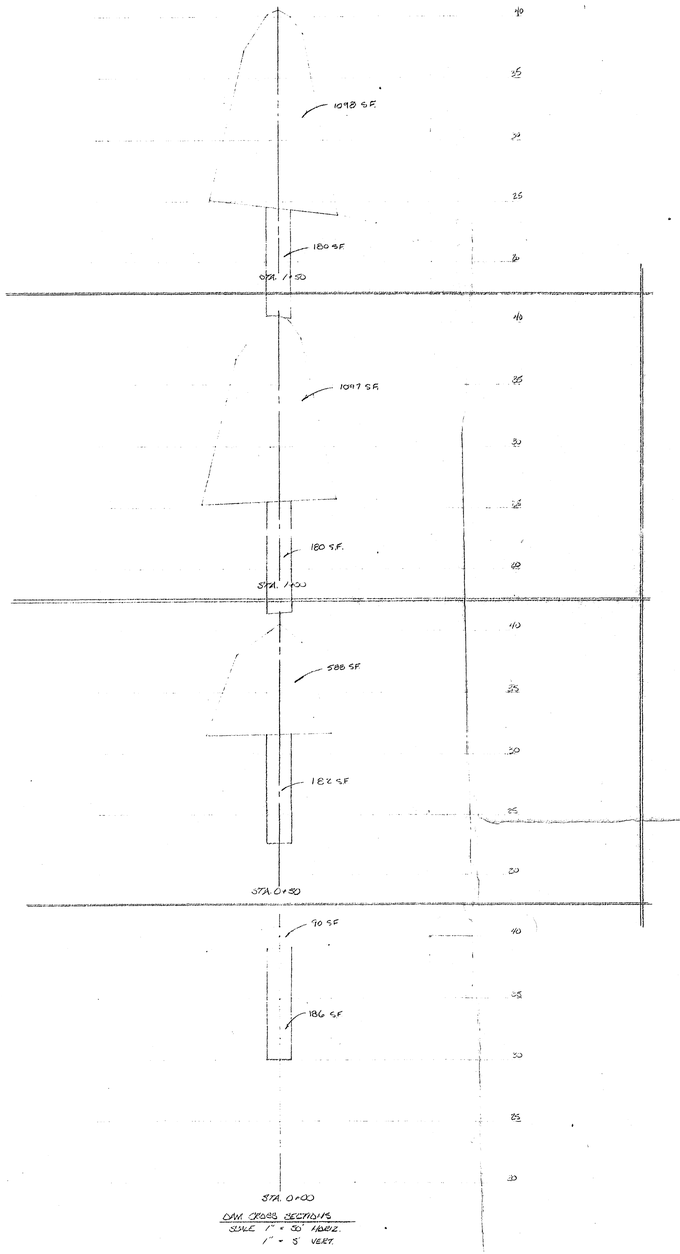
Contents for Stormwater Management Facilities As-built Files

Each file is to contain:

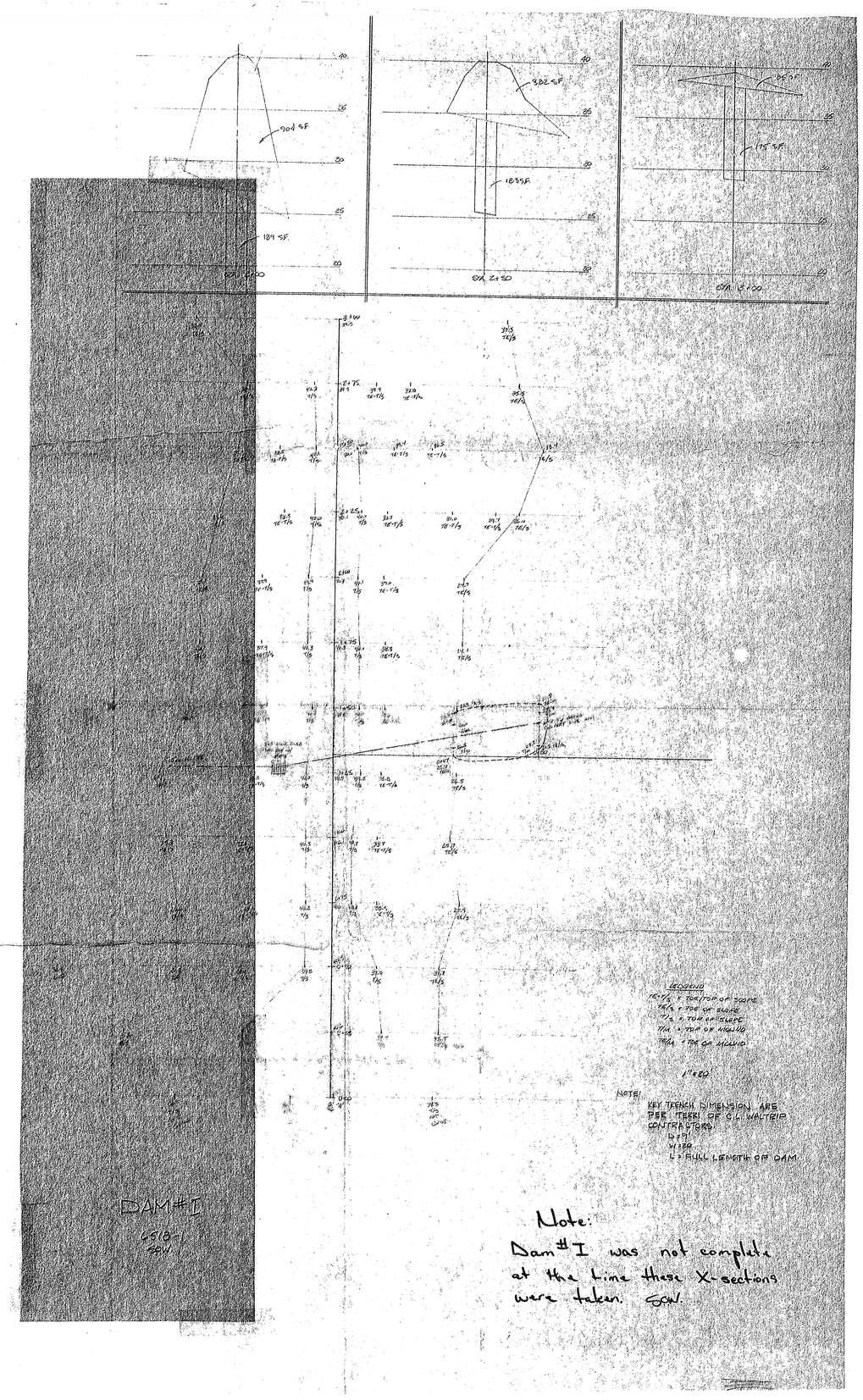
1. As-built plan
2. Completed construction certification
3. Construction Plan
4. Design Calculations
5. Watershed Map
6. Maintenance Agreement
7. Correspondence with owners
8. Inspection Records
9. Enforcement Actions


STA. 9+50
STA. 10+00
STA. 10+50
STA. 11+00
STA. 11+50
STA. 12+00
STA. 12+50
STA. 13+00
DAM CROSS SECTIONS
SCALE: 1" = 5' HORIZ.
1" = 5' VERT.


DAM II
6518-2
GRM
NOTE: KEY TRENCH DIMENSION
ARE PER TEST OF C.L. WALTRP.
W = 20'
D = 20'
L = FULL LENGTH OF DAM.
GEOLOGIC
FROM AS-BUILT
SCALE: 1" = 50'



DAM CROSS SECTIONS
SCALE 1" = 50' HORIZ.
1" = 5' VERT.



GROUTING
TE-1/2 = TOE/TOP OF SLOPE
TR/S = TOE OF SLOPE
T/S = TOE OF SLOPE
T/A = TOP OF HOLLOW
TR/A = TOE OF HOLLOW

1"=50'

NOTE:
KEY TRENCH DIMENSION ARE PER ITEM 1 OF C.L. WALTER CONTRACTORS:
D=7'
W=2'
L= FULL LENGTH OF DAM.

Note:
Dam #I was not complete at the time these X-sections were taken. FOW.

INLET NUMBER 1 LENGTH 4.0 STATION

DRAINAGE AREA = 0.300 ACRES C VALUE = .560 CA = 0.168
SUM CA= 0.168 INT= 3.50 CFS= 0.588 CO= 0.000 GUTTER FLOW= 0.588

GUTTER SLOPE = 0.0080 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
3.81	1.5	0.39	0.0833	2.7	0.80	2.9	0.163	0.162

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 4.2 EFFICIENCY= 1.00
CFS INTERCEPTED= 0.59 CFS CARRYOVER= 0.00

INLET NUMBER 2 LENGTH 0.0 STATION

DRAINAGE AREA = 4.600 ACRES C VALUE = .350 CA = 1.610
DRAINAGE AREA = 5.000 ACRES C VALUE = .350 CA = 1.750

FOR THE FIRST SIDE
SUM CA= 1.610 INT= 3.50 CFS= 5.635 CO= 0.000 GUTTER FLOW= 5.635
FOR THE OTHER SIDE
SUM CA= 1.750 INT= 3.50 CFS= 6.125 CO= 0.000 GUTTER FLOW= 6.125
AT THE INLET

SUM CA= 3.360 INT= 3.50 CFS= 11.760 CO= 0.000 GUTTER FLOW= 11.760

XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX
DEPTH OF WATER (ft)= 0.45 PERIMETER OF GRATE (ft)= 12.83 AREA (sq ft)= 4.13

INLET NUMBER 3 LENGTH 4.0 STATION

DRAINAGE AREA = 0.300 ACRES C VALUE = .560 CA = 0.168
SUM CA= 0.168 INT= 3.50 CFS= 0.588 CO= 0.000 GUTTER FLOW= 0.588

GUTTER SLOPE = 0.0080 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
3.81	1.5	0.39	0.0833	2.7	0.80	2.9	0.163	0.162

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 4.2 EFFICIENCY= 1.00
CFS INTERCEPTED= 0.59 CFS CARRYOVER= 0.00

INLET NUMBER 4 LENGTH 2.5 STATION

DRAINAGE AREA = 0.250 ACRES C VALUE = .350 CA = 0.087
SUM CA= 0.087 INT= 3.50 CFS= 0.306 CO= 0.000 GUTTER FLOW= 0.306

GUTTER SLOPE = 0.0187 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
1.89	1.5	0.79	0.0833	2.7	0.99	2.9	0.163	0.193

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 3.7 EFFICIENCY= 0.87
CFS INTERCEPTED= 0.27 CFS CARRYOVER= 0.04

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INLET NUMBER 5 LENGTH 6.0 STATION

DRAINAGE AREA = 0.150 ACRES C VALUE = .560 CA = 0.084
DRAINAGE AREA = 0.150 ACRES C VALUE = .560 CA = 0.084

FOR THE FIRST SIDE
SUM CA= 0.084 INT= 3.50 CFS= 0.294 CO= 0.040 GUTTER FLOW= 0.334
FOR THE OTHER SIDE
SUM CA= 0.084 INT= 3.50 CFS= 0.294 CO= 0.000 GUTTER FLOW= 0.294
AT THE INLET

SUM CA= 0.168 INT= 3.50 CFS= 0.588 CO= 0.040 GUTTER FLOW= 0.628

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 0.33 (cfs) IS 4.82 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 8.70 H (ft) = 0.460
DEPTH OF WATER (ft) = 0.10 SPREAD (ft) = 3.04

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INLET NUMBER 9 LENGTH 6.0 STATION

DRAINAGE AREA = 0.640 ACRES C VALUE = .500 CA = 0.320
SUM CA= 0.320 INT= 3.50 CFS= 1.120 CO= 0.000 GUTTER FLOW= 1.120

GUTTER SLOPE = 0.0187 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
4.26	1.5	0.35	0.0833	2.7	0.75	2.9	0.163	0.154

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 7.3 EFFICIENCY= 0.96
CFS INTERCEPTED= 1.07 CFS CARRYOVER= 0.05

INLET NUMBER 7 LENGTH 6.0 STATION

DRAINAGE AREA = 0.050 ACRES C VALUE = .560 CA = 0.028
DRAINAGE AREA = 0.350 ACRES C VALUE = .500 CA = 0.175

FOR THE FIRST SIDE
SUM CA= 0.028 INT= 3.50 CFS= 0.098 CO= 0.050 GUTTER FLOW= 0.148
FOR THE OTHER SIDE
SUM CA= 0.175 INT= 3.50 CFS= 0.613 CO= 0.000 GUTTER FLOW= 0.613
AT THE INLET

SUM CA= 0.203 INT= 3.50 CFS= 0.711 CO= 0.050 GUTTER FLOW= 0.761

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 0.61 (cfs) IS 6.34 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 8.70 H (ft) = 0.460
DEPTH OF WATER (ft) = 0.11 SPREAD (ft) = 3.45

==========

INLET NUMBER 8 LENGTH 0.0 STATION

DRAINAGE AREA = 0.460 ACRES C VALUE = .350 CA = 0.161

FOR THE FIRST SIDE
SUM CA= 0.161 INT= 3.50 CFS= 0.563 CO= 0.000 GUTTER FLOW= 0.563
FOR THE OTHER SIDE
SUM CA= 0.000 INT= 3.50 CFS= 0.000 CO= 0.000 GUTTER FLOW= 0.000
AT THE INLET

SUM CA= 0.161 INT= 3.50 CFS= 0.563 CO= 0.000 GUTTER FLOW= 0.563

XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX
DEPTH OF WATER (ft)= 0.06 PERIMETER OF GRATE (ft)= 12.83 AREA (sq ft)= 4.13

==========

INLET NUMBER 10 LENGTH 6.0 STATION

DRAINAGE AREA = 1.100 ACRES C VALUE = .350 CA = 0.385
SUM CA= 0.385 INT= 3.50 CFS= 1.347 CO= 0.000 GUTTER FLOW= 1.347

GUTTER SLOPE = 0.0100 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
5.40	1.5	0.28	0.0833	2.7	0.64	2.9	0.163	0.136

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 7.0 EFFICIENCY= 0.97
CFS INTERCEPTED= 1.31 CFS CARRYOVER= 0.04

INLET NUMBER 11 LENGTH 6.0 STATION

DRAINAGE AREA = 0.820 ACRES C VALUE = .350 CA = 0.287
SUM CA= 0.287 INT= 3.50 CFS= 1.005 CO= 0.040 GUTTER FLOW= 1.044

GUTTER SLOPE = 0.0100 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
4.80	1.5	0.31	0.0833	2.7	0.70	2.9	0.163	0.145

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 6.1 EFFICIENCY= 1.00
CFS INTERCEPTED= 1.04 CFS CARRYOVER= 0.00

==========

INLET NUMBER 12 LENGTH 8.0 STATION

DRAINAGE AREA = 1.240 ACRES C VALUE = .350 CA = 0.434
SUM CA= 0.434 INT= 3.50 CFS= 1.519 CO= 0.000 GUTTER FLOW= 1.519

GUTTER SLOPE = 0.0090 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
5.83	1.5	0.26	0.0833	2.7	0.61	2.9	0.163	0.130

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 7.4 EFFICIENCY= 1.00
CFS INTERCEPTED= 1.52 CFS CARRYOVER= 0.00

==========

INLET NUMBER 14 LENGTH 4.0 STATION

DRAINAGE AREA = 0.380 ACRES C VALUE = .350 CA = 0.133
SUM CA= 0.133 INT= 3.50 CFS= 0.465 CO= 0.000 GUTTER FLOW= 0.465

GUTTER SLOPE = 0.0090 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
3.24	1.5	0.46	0.0833	2.7	0.87	2.9	0.163	0.173

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 3.8 EFFICIENCY= 1.00
CFS INTERCEPTED= 0.47 CFS CARRYOVER= 0.00

INLET NUMBER 17 LENGTH 8.0 STATION

DRAINAGE AREA = 1.900 ACRES C VALUE = .350 CA = 0.665
SUM CA= 0.665 INT= 3.50 CFS= 2.327 CO= 0.000 GUTTER FLOW= 2.327

GUTTER SLOPE = 0.0090 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
7.02	1.5	0.21	0.0833	2.7	0.52	2.9	0.163	0.116

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 9.4 EFFICIENCY= 0.97
CFS INTERCEPTED= 2.25 CFS CARRYOVER= 0.08

==========

INLET NUMBER 16 LENGTH 6.0 STATION

DRAINAGE AREA = 0.050 ACRES C VALUE = .500 CA = 0.025
DRAINAGE AREA = 0.170 ACRES C VALUE = .560 CA = 0.095

FOR THE FIRST SIDE
SUM CA= 0.025 INT= 3.50 CFS= 0.087 CO= 0.080 GUTTER FLOW= 0.168
FOR THE OTHER SIDE
SUM CA= 0.095 INT= 3.50 CFS= 0.333 CO= 0.000 GUTTER FLOW= 0.333
AT THE INLET

SUM CA= 0.120 INT= 3.50 CFS= 0.421 CO= 0.080 GUTTER FLOW= 0.501

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 0.38 (cfs) IS 4.82 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 8.70 H (ft) = 0.460
DEPTH OF WATER (ft) = 0.08 SPREAD (ft) = 2.43

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INLET NUMBER 15 LENGTH 6.0 STATION

DRAINAGE AREA = 0.420 ACRES C VALUE = .350 CA = 0.147
DRAINAGE AREA = 0.250 ACRES C VALUE = .350 CA = 0.087

FOR THE FIRST SIDE
SUM CA= 0.147 INT= 3.50 CFS= 0.515 CO= 0.000 GUTTER FLOW= 0.515
FOR THE OTHER SIDE
SUM CA= 0.087 INT= 3.50 CFS= 0.306 CO= 0.000 GUTTER FLOW= 0.306
AT THE INLET

SUM CA= 0.234 INT= 3.50 CFS= 0.821 CO= 0.000 GUTTER FLOW= 0.821

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 0.51 (cfs) IS 5.88 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 8.70 H (ft) = 0.460
DEPTH OF WATER (ft) = 0.12 SPREAD (ft) = 3.80

INLET NUMBER 19 LENGTH 6.0 STATION .47

DRAINAGE AREA = 0.470 ACRES C VALUE = .560 CA = 0.263
SUM CA= 0.263 INT= 3.50 CFS= 0.921 CO= 0.000 GUTTER FLOW= 0.921

GUTTER SLOPE = 0.0100 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
4.52	1.5	0.33	0.0833	2.7	0.73	2.9	0.163	0.150

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 5.7 EFFICIENCY= 1.00
CFS INTERCEPTED= 0.92 CFS CARRYOVER= 0.00

==========

INLET NUMBER 20 LENGTH 6.0 STATION

DRAINAGE AREA = 0.440 ACRES C VALUE = .560 CA = 0.246
DRAINAGE AREA = 0.210 ACRES C VALUE = .560 CA = 0.118

FOR THE FIRST SIDE
SUM CA= 0.246 INT= 3.50 CFS= 0.862 CO= 0.000 GUTTER FLOW= 0.862
FOR THE OTHER SIDE
SUM CA= 0.118 INT= 3.50 CFS= 0.412 CO= 0.000 GUTTER FLOW= 0.412
AT THE INLET

SUM CA= 0.364 INT= 3.50 CFS= 1.274 CO= 0.000 GUTTER FLOW= 1.274

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 0.86 (cfs) IS 7.33 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 8.70 H (ft) = 0.460
DEPTH OF WATER (ft) = 0.16 SPREAD (ft) = 5.09

==========

INLET NUMBER 22 LENGTH 10.0 STATION

DRAINAGE AREA = 2.450 ACRES C VALUE = .350 CA = 0.858
SUM CA= 0.858 INT= 3.50 CFS= 3.001 CO= 0.000 GUTTER FLOW= 3.001

GUTTER SLOPE = 0.0100 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
7.63	1.5	0.20	0.0833	2.7	0.49	2.9	0.163	0.111

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 11.1 EFFICIENCY= 0.98
CFS INTERCEPTED= 2.95 CFS CARRYOVER= 0.05

INLET NUMBER 23 LENGTH 6.0 STATION

DRAINAGE AREA = 1.120 ACRES C VALUE = .350 CA = 0.392
SUM CA= 0.392 INT= 3.50 CFS= 1.372 CO= 0.050 GUTTER FLOW= 1.422

GUTTER SLOPE = 0.0100 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
5.53	1.5	0.27	0.0833	2.7	0.63	2.9	0.163	0.134

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 7.2 EFFICIENCY= 0.96
CFS INTERCEPTED= 1.36 CFS CARRYOVER= 0.06

==========

INLET NUMBER 24 LENGTH 6.0 STATION

DRAINAGE AREA = 0.500 ACRES C VALUE = .350 CA = 0.175
DRAINAGE AREA = 0.770 ACRES C VALUE = .350 CA = 0.269

FOR THE FIRST SIDE
SUM CA= 0.175 INT= 3.50 CFS= 0.613 CO= 0.060 GUTTER FLOW= 0.673
FOR THE OTHER SIDE
SUM CA= 0.269 INT= 3.50 CFS= 0.943 CO= 0.000 GUTTER FLOW= 0.943
AT THE INLET

SUM CA= 0.444 INT= 3.50 CFS= 1.556 CO= 0.060 GUTTER FLOW= 1.616

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 0.94 (cfs) IS 7.61 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 8.70 H (ft) = 0.460
DEPTH OF WATER (ft) = 0.18 SPREAD (ft) = 5.81

==========

INLET NUMBER 53 LENGTH 6.0 STATION

DRAINAGE AREA = 0.460 ACRES C VALUE = .560 CA = 0.258
SUM CA= 0.258 INT= 3.50 CFS= 0.902 CO= 0.000 GUTTER FLOW= 0.902

GUTTER SLOPE = 0.0080 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
4.72	1.5	0.32	0.0833	2.7	0.71	2.9	0.163	0.146

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 5.3 EFFICIENCY= 1.00
CFS INTERCEPTED= 0.90 CFS CARRYOVER= 0.00

INLET NUMBER 56 LENGTH 6.0 STATION

DRAINAGE AREA = 0.090 ACRES C VALUE = .560 CA = 0.050
DRAINAGE AREA = 0.030 ACRES C VALUE = .560 CA = 0.017

FOR THE FIRST SIDE
SUM CA= 0.050 INT= 3.50 CFS= 0.176 CO= 0.000 GUTTER FLOW= 0.176
FOR THE OTHER SIDE
SUM CA= 0.017 INT= 3.50 CFS= 0.059 CO= 0.000 GUTTER FLOW= 0.059
AT THE INLET

SUM CA= 0.067 INT= 3.50 CFS= 0.235 CO= 0.000 GUTTER FLOW= 0.235

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 0.18 (cfs) IS 3.49 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 8.70 H (ft) = 0.460
DEPTH OF WATER (ft) = 0.05 SPREAD (ft) = 1.65

==========

INLET NUMBER 55 LENGTH 6.0 STATION

DRAINAGE AREA = 0.090 ACRES C VALUE = .560 CA = 0.050
DRAINAGE AREA = 0.310 ACRES C VALUE = .500 CA = 0.155

FOR THE FIRST SIDE
SUM CA= 0.050 INT= 3.50 CFS= 0.176 CO= 0.000 GUTTER FLOW= 0.176
FOR THE OTHER SIDE
SUM CA= 0.155 INT= 3.50 CFS= 0.543 CO= 0.000 GUTTER FLOW= 0.543
AT THE INLET

SUM CA= 0.205 INT= 3.50 CFS= 0.719 CO= 0.000 GUTTER FLOW= 0.719

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 0.54 (cfs) IS 6.01 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 8.70 H (ft) = 0.460
DEPTH OF WATER (ft) = 0.11 SPREAD (ft) = 3.47

==========

INLET NUMBER 61 LENGTH 0.0 STATION

DRAINAGE AREA = 9.800 ACRES C VALUE = .350 CA = 3.430
DRAINAGE AREA = 0.860 ACRES C VALUE = .350 CA = 0.301

FOR THE FIRST SIDE
SUM CA= 3.430 INT= 3.50 CFS= 12.005 CO= 0.000 GUTTER FLOW= 12.005
FOR THE OTHER SIDE
SUM CA= 0.301 INT= 3.50 CFS= 1.053 CO= 0.000 GUTTER FLOW= 1.053
AT THE INLET

SUM CA= 3.731 INT= 3.50 CFS= 13.059 CO= 0.000 GUTTER FLOW= 13.059

XXXXXXXXXX GRATE INLET IN A TRAPEZOIDAL CHANNEL XXXXXXXXXX

INLET NUMBER 62 LENGTH 6.0 STATION

DRAINAGE AREA = 0.290 ACRES C VALUE = .560 CA = 0.162
DRAINAGE AREA = 0.240 ACRES C VALUE = .450 CA = 0.108

FOR THE FIRST SIDE
SUM CA= 0.162 INT= 3.50 CFS= 0.568 CO= 0.000 GUTTER FLOW= 0.568
FOR THE OTHER SIDE
SUM CA= 0.108 INT= 3.50 CFS= 0.378 CO= 0.000 GUTTER FLOW= 0.378
AT THE INLET

SUM CA= 0.270 INT= 3.50 CFS= 0.946 CO= 0.000 GUTTER FLOW= 0.946

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 0.57 (cfs) IS 6.14 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 8.70 H (ft) = 0.460
DEPTH OF WATER (ft) = 0.13 SPREAD (ft) = 4.17

==========

INLET NUMBER 63 LENGTH 6.0 STATION

DRAINAGE AREA = 0.290 ACRES C VALUE = .560 CA = 0.162
DRAINAGE AREA = 0.160 ACRES C VALUE = .560 CA = 0.090

FOR THE FIRST SIDE
SUM CA= 0.162 INT= 3.50 CFS= 0.568 CO= 0.000 GUTTER FLOW= 0.568
FOR THE OTHER SIDE
SUM CA= 0.090 INT= 3.50 CFS= 0.314 CO= 0.000 GUTTER FLOW= 0.314
AT THE INLET

SUM CA= 0.252 INT= 3.50 CFS= 0.882 CO= 0.000 GUTTER FLOW= 0.882

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 0.57 (cfs) IS 6.14 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 8.70 H (ft) = 0.460
DEPTH OF WATER (ft) = 0.12 SPREAD (ft) = 3.98

==========

INLET NUMBER 65 LENGTH 8.0 STATION

DRAINAGE AREA = 0.790 ACRES C VALUE = .350 CA = 0.277
SUM CA= 0.277 INT= 3.50 CFS= 0.968 CO= 0.000 GUTTER FLOW= 0.968

GUTTER SLOPE = 0.0300 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
3.49	1.5	0.43	0.0833	2.7	0.84	2.9	0.163	0.169

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 7.5 EFFICIENCY= 1.00
CFS INTERCEPTED= 0.97 CFS CARRYOVER= 0.00

INLET NUMBER 66 LENGTH 6.0 STATION

DRAINAGE AREA = 0.200 ACRES C VALUE = .560 CA = 0.112
SUM CA= 0.112 INT= 3.50 CFS= 0.392 CO= 0.000 GUTTER FLOW= 0.392

GUTTER SLOPE = 0.0200 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
1.90	1.5	0.79	0.0833	2.7	0.99	2.9	0.163	0.193

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 4.7 EFFICIENCY= 1.00
CFS INTERCEPTED= 0.39 CFS CARRYOVER= 0.00

==========

INLET NUMBER 68 LENGTH 6.0 STATION

DRAINAGE AREA = 0.170 ACRES C VALUE = .560 CA = 0.095
DRAINAGE AREA = 0.460 ACRES C VALUE = .350 CA = 0.161

FOR THE FIRST SIDE
SUM CA= 0.095 INT= 3.50 CFS= 0.333 CO= 0.000 GUTTER FLOW= 0.333
FOR THE OTHER SIDE
SUM CA= 0.161 INT= 3.50 CFS= 0.563 CO= 0.000 GUTTER FLOW= 0.563
AT THE INLET

SUM CA= 0.256 INT= 3.50 CFS= 0.897 CO= 0.000 GUTTER FLOW= 0.897

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 0.56 (cfs) IS 6.12 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 8.70 H (ft) = 0.460
DEPTH OF WATER (ft) = 0.13 SPREAD (ft) = 4.03

==========

INLET NUMBER 25 LENGTH 8.0 STATION

DRAINAGE AREA = 1.630 ACRES C VALUE = .350 CA = 0.571
SUM CA= 0.571 INT= 3.50 CFS= 1.997 CO= 0.000 GUTTER FLOW= 1.997

GUTTER SLOPE = 0.0080 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
6.74	1.5	0.22	0.0833	2.7	0.54	2.9	0.163	0.119

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 8.4 EFFICIENCY= 1.00
CFS INTERCEPTED= 1.99 CFS CARRYOVER= 0.01

INLET NUMBER 26 LENGTH 6.0 STATION

DRAINAGE AREA = 0.390 ACRES C VALUE = .350 CA = 0.136
DRAINAGE AREA = 0.440 ACRES C VALUE = .350 CA = 0.154

FOR THE FIRST SIDE
SUM CA= 0.136 INT= 3.50 CFS= 0.478 CO= 0.010 GUTTER FLOW= 0.488
FOR THE OTHER SIDE
SUM CA= 0.154 INT= 3.50 CFS= 0.539 CO= 0.000 GUTTER FLOW= 0.539
AT THE INLET

SUM CA= 0.290 INT= 3.50 CFS= 1.017 CO= 0.010 GUTTER FLOW= 1.027

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 0.54 (cfs) IS 6.00 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 8.70 H (ft) = 0.460
DEPTH OF WATER (ft) = 0.14 SPREAD (ft) = 4.38

==========

INLET NUMBER 27 LENGTH 6.0 STATION

DRAINAGE AREA = 0.420 ACRES C VALUE = .560 CA = 0.235
DRAINAGE AREA = 0.120 ACRES C VALUE = .560 CA = 0.067

FOR THE FIRST SIDE
SUM CA= 0.235 INT= 3.50 CFS= 0.823 CO= 0.000 GUTTER FLOW= 0.823
FOR THE OTHER SIDE
SUM CA= 0.067 INT= 3.50 CFS= 0.235 CO= 0.000 GUTTER FLOW= 0.235
AT THE INLET

SUM CA= 0.302 INT= 3.50 CFS= 1.058 CO= 0.000 GUTTER FLOW= 1.058

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 0.82 (cfs) IS 7.19 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 8.70 H (ft) = 0.460
DEPTH OF WATER (ft) = 0.14 SPREAD (ft) = 4.50

==========

INLET NUMBER 30 LENGTH 6.0 STATION

DRAINAGE AREA = 0.750 ACRES C VALUE = .350 CA = 0.262
DRAINAGE AREA = 0.400 ACRES C VALUE = .350 CA = 0.140

FOR THE FIRST SIDE
SUM CA= 0.262 INT= 3.50 CFS= 0.919 CO= 0.000 GUTTER FLOW= 0.919
FOR THE OTHER SIDE
SUM CA= 0.140 INT= 3.50 CFS= 0.490 CO= 0.000 GUTTER FLOW= 0.490
AT THE INLET

SUM CA= 0.402 INT= 3.50 CFS= 1.409 CO= 0.000 GUTTER FLOW= 1.409

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 0.92 (cfs) IS 7.53 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX

P EFFEC. LENGTH (ft) = 8.70 H (ft) = 0.460

DEPTH OF WATER (ft) = 0.17 SPREAD (ft) = 5.44

INLET NUMBER 31 LENGTH 6.0 STATION

DRAINAGE AREA = 0.260 ACRES C VALUE = .560 CA = 0.146
DRAINAGE AREA = 0.150 ACRES C VALUE = .560 CA = 0.084

FOR THE FIRST SIDE
SUM CA= 0.146 INT= 3.50 CFS= 0.510 CO= 0.000 GUTTER FLOW= 0.510
FOR THE OTHER SIDE
SUM CA= 0.084 INT= 3.50 CFS= 0.294 CO= 0.000 GUTTER FLOW= 0.294
AT THE INLET

SUM CA= 0.230 INT= 3.50 CFS= 0.804 CO= 0.000 GUTTER FLOW= 0.804

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 0.51 (cfs) IS 5.85 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 8.70 H (ft) = 0.460
DEPTH OF WATER (ft) = 0.12 SPREAD (ft) = 3.74

==========

INLET NUMBER 34 LENGTH 8.0 STATION

DRAINAGE AREA = 2.000 ACRES C VALUE = .350 CA = 0.700
SUM CA= 0.700 INT= 3.50 CFS= 2.450 CO= 0.000 GUTTER FLOW= 2.450

GUTTER SLOPE = 0.0100 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
7.01	1.5	0.21	0.0833	2.7	0.52	2.9	0.163	0.116

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 9.9 EFFICIENCY= 0.95
CFS INTERCEPTED= 2.32 CFS CARRYOVER= 0.13

==========

INLET NUMBER 35 LENGTH 6.0 STATION

DRAINAGE AREA = 0.500 ACRES C VALUE = .560 CA = 0.280
SUM CA= 0.280 INT= 3.50 CFS= 0.980 CO= 0.000 GUTTER FLOW= 0.980

GUTTER SLOPE = 0.0178 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
4.04	1.5	0.37	0.0833	2.7	0.78	2.9	0.163	0.158

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 6.7 EFFICIENCY= 0.98
CFS INTERCEPTED= 0.96 CFS CARRYOVER= 0.02

INLET NUMBER 36 LENGTH 6.0 STATION

DRAINAGE AREA = 0.700 ACRES C VALUE = .350 CA = 0.245
SUM CA= 0.245 INT= 3.50 CFS= 0.857 CO= 0.150 GUTTER FLOW= 1.007

GUTTER SLOPE = 0.0100 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
4.72	1.5	0.32	0.0833	2.7	0.71	2.9	0.163	0.146

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 6.0 EFFICIENCY= 1.00
CFS INTERCEPTED= 1.01 CFS CARRYOVER= 0.00

==========

INLET NUMBER 37 LENGTH 6.0 STATION

DRAINAGE AREA = 0.600 ACRES C VALUE = .500 CA = 0.300
SUM CA= 0.300 INT= 3.50 CFS= 1.050 CO= 0.000 GUTTER FLOW= 1.050

GUTTER SLOPE = 0.0100 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
4.81	1.5	0.31	0.0833	2.7	0.70	2.9	0.163	0.145

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 6.1 EFFICIENCY= 1.00
CFS INTERCEPTED= 1.05 CFS CARRYOVER= 0.00

==========

INLET NUMBER 40 LENGTH 6.0 STATION

DRAINAGE AREA = 1.160 ACRES C VALUE = .350 CA = 0.406
SUM CA= 0.406 INT= 3.50 CFS= 1.421 CO= 0.000 GUTTER FLOW= 1.421

GUTTER SLOPE = 0.0100 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
5.53	1.5	0.27	0.0833	2.7	0.63	2.9	0.163	0.134

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 7.2 EFFICIENCY= 0.96
CFS INTERCEPTED= 1.36 CFS CARRYOVER= 0.06

INLET NUMBER 43 LENGTH 6.0 STATION

DRAINAGE AREA = 0.040 ACRES C VALUE = .560 CA = 0.022
DRAINAGE AREA = 0.510 ACRES C VALUE = .400 CA = 0.204

FOR THE FIRST SIDE
SUM CA= 0.022 INT= 3.50 CFS= 0.078 CO= 0.060 GUTTER FLOW= 0.138
FOR THE OTHER SIDE
SUM CA= 0.204 INT= 3.50 CFS= 0.714 CO= 0.000 GUTTER FLOW= 0.714
AT THE INLET

SUM CA= 0.226 INT= 3.50 CFS= 0.792 CO= 0.060 GUTTER FLOW= 0.852

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 0.71 (cfs) IS 6.77 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 8.70 H (ft) = 0.460
DEPTH OF WATER (ft) = 0.12 SPREAD (ft) = 3.71

==========

INLET NUMBER 41 LENGTH 6.0 STATION

DRAINAGE AREA = 0.300 ACRES C VALUE = .350 CA = 0.105
DRAINAGE AREA = 0.360 ACRES C VALUE = .560 CA = 0.202

FOR THE FIRST SIDE
SUM CA= 0.105 INT= 3.50 CFS= 0.368 CO= 0.000 GUTTER FLOW= 0.368
FOR THE OTHER SIDE
SUM CA= 0.202 INT= 3.50 CFS= 0.706 CO= 0.000 GUTTER FLOW= 0.706
AT THE INLET

SUM CA= 0.307 INT= 3.50 CFS= 1.073 CO= 0.000 GUTTER FLOW= 1.073

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 0.71 (cfs) IS 6.74 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 8.70 H (ft) = 0.460
DEPTH OF WATER (ft) = 0.14 SPREAD (ft) = 4.54

INLET NUMBER 44 LENGTH 8.0 STATION

DRAINAGE AREA = 0.690 ACRES C VALUE = .350 CA = 0.241
DRAINAGE AREA = 0.780 ACRES C VALUE = .350 CA = 0.273

FOR THE FIRST SIDE
SUM CA= 0.241 INT= 3.50 CFS= 0.845 CO= 0.000 GUTTER FLOW= 0.845
FOR THE OTHER SIDE
SUM CA= 0.273 INT= 3.50 CFS= 0.955 CO= 0.000 GUTTER FLOW= 0.955
AT THE INLET

SUM CA= 0.514 INT= 3.50 CFS= 1.801 CO= 0.000 GUTTER FLOW= 1.801

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 0.96 (cfs) IS 7.65 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 10.70 H (ft) = 0.460
DEPTH OF WATER (ft) = 0.17 SPREAD (ft) = 5.58

==========

INLET NUMBER 33 LENGTH 8.0 STATION

DRAINAGE AREA = 0.570 ACRES C VALUE = .560 CA = 0.319
DRAINAGE AREA = 1.700 ACRES C VALUE = .350 CA = 0.595

FOR THE FIRST SIDE
SUM CA= 0.319 INT= 3.50 CFS= 1.117 CO= 0.000 GUTTER FLOW= 1.117
FOR THE OTHER SIDE
SUM CA= 0.595 INT= 3.50 CFS= 2.082 CO= 0.000 GUTTER FLOW= 2.082
AT THE INLET

SUM CA= 0.914 INT= 3.50 CFS= 3.200 CO= 0.000 GUTTER FLOW= 3.200

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 2.08 (cfs) IS 10.49 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 10.70 H (ft) = 0.460
DEPTH OF WATER (ft) = 0.26 SPREAD (ft) = 8.19

INLET NUMBER 45 LENGTH 6.0 STATION

DRAINAGE AREA = 0.340 ACRES C VALUE = .350 CA = 0.119
DRAINAGE AREA = 0.530 ACRES C VALUE = .350 CA = 0.185

FOR THE FIRST SIDE
SUM CA= 0.119 INT= 3.50 CFS= 0.417 CO= 0.000 GUTTER FLOW= 0.417
FOR THE OTHER SIDE
SUM CA= 0.185 INT= 3.50 CFS= 0.649 CO= 0.000 GUTTER FLOW= 0.649
AT THE INLET

SUM CA= 0.304 INT= 3.50 CFS= 1.066 CO= 0.000 GUTTER FLOW= 1.066

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 0.65 (cfs) IS 6.50 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 8.70 H (ft) = 0.460
DEPTH OF WATER (ft) = 0.14 SPREAD (ft) = 4.52

==========

INLET NUMBER 46 LENGTH 6.0 STATION

DRAINAGE AREA = 0.110 ACRES C VALUE = .560 CA = 0.062
DRAINAGE AREA = 0.310 ACRES C VALUE = .560 CA = 0.174

FOR THE FIRST SIDE
SUM CA= 0.062 INT= 3.50 CFS= 0.216 CO= 0.000 GUTTER FLOW= 0.216
FOR THE OTHER SIDE
SUM CA= 0.174 INT= 3.50 CFS= 0.608 CO= 0.000 GUTTER FLOW= 0.608
AT THE INLET

SUM CA= 0.235 INT= 3.50 CFS= 0.823 CO= 0.000 GUTTER FLOW= 0.823

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 0.61 (cfs) IS 6.32 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 8.70 H (ft) = 0.460
DEPTH OF WATER (ft) = 0.12 SPREAD (ft) = 3.80

==========

INLET NUMBER 49 LENGTH 8.0 STATION

DRAINAGE AREA = 1.160 ACRES C VALUE = .350 CA = 0.406
SUM CA= 0.406 INT= 3.50 CFS= 1.421 CO= 0.000 GUTTER FLOW= 1.421

GUTTER SLOPE = 0.0088 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
5.69	1.5	0.26	0.0833	2.7	0.62	2.9	0.163	0.132

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 7.0 EFFICIENCY= 1.00
CFS INTERCEPTED= 1.42 CFS CARRYOVER= 0.00

INLET NUMBER 50 LENGTH 4.0 STATION

DRAINAGE AREA = 0.280 ACRES C VALUE = .560 CA = 0.157
SUM CA= 0.157 INT= 3.50 CFS= 0.549 CO= 0.000 GUTTER FLOW= 0.549

GUTTER SLOPE = 0.0088 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
3.58	1.5	0.42	0.0833	2.7	0.83	2.9	0.163	0.167

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 4.1 EFFICIENCY= 1.00
CFS INTERCEPTED= 0.55 CFS CARRYOVER= 0.00

==========

INLET NUMBER 59 LENGTH 4.0 STATION

DRAINAGE AREA = 0.210 ACRES C VALUE = .560 CA = 0.118
SUM CA= 0.118 INT= 3.50 CFS= 0.412 CO= 0.000 GUTTER FLOW= 0.412

GUTTER SLOPE = 0.0080 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
3.12	1.5	0.48	0.0833	2.7	0.88	2.9	0.163	0.176

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 3.4 EFFICIENCY= 1.00
CFS INTERCEPTED= 0.41 CFS CARRYOVER= 0.00

==========

INLET NUMBER 57 LENGTH 6.0 STATION

DRAINAGE AREA = 0.180 ACRES C VALUE = .560 CA = 0.101
DRAINAGE AREA = 0.210 ACRES C VALUE = .560 CA = 0.118

FOR THE FIRST SIDE
SUM CA= 0.101 INT= 3.50 CFS= 0.353 CO= 0.000 GUTTER FLOW= 0.353
FOR THE OTHER SIDE
SUM CA= 0.118 INT= 3.50 CFS= 0.412 CO= 0.000 GUTTER FLOW= 0.412
AT THE INLET

SUM CA= 0.218 INT= 3.50 CFS= 0.764 CO= 0.000 GUTTER FLOW= 0.764

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 0.41 (cfs) IS 5.32 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 8.70 H (ft) = 0.460
DEPTH OF WATER (ft) = 0.11 SPREAD (ft) = 3.62

INLET NUMBER 53 LENGTH 6.0 STATION

DRAINAGE AREA = 0.030 ACRES C VALUE = .560 CA = 0.017
DRAINAGE AREA = 0.170 ACRES C VALUE = .560 CA = 0.095

FOR THE FIRST SIDE
SUM CA= 0.017 INT= 3.50 CFS= 0.059 CO= 0.000 GUTTER FLOW= 0.059
FOR THE OTHER SIDE
SUM CA= 0.095 INT= 3.50 CFS= 0.333 CO= 0.000 GUTTER FLOW= 0.333
AT THE INLET

SUM CA= 0.112 INT= 3.50 CFS= 0.392 CO= 0.000 GUTTER FLOW= 0.392

GUTTER SLOPE = 0.0010 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD AT A SLOPE OF .001 (ft./ft.) AND 0.33 (cfs) IS 4.82 (ft.)

XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
P EFFEC. LENGTH (ft) = 8.70 H (ft) = 0.460
DEPTH OF WATER (ft) = 0.07 SPREAD (ft) = 2.32

==========

INLET NUMBER 72 LENGTH 8.0 STATION

DRAINAGE AREA = 1.290 ACRES C VALUE = .350 CA = 0.451
SUM CA= 0.451 INT= 3.50 CFS= 1.580 CO= 0.000 GUTTER FLOW= 1.580

GUTTER SLOPE = 0.0080 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
6.09	1.5	0.25	0.0833	2.7	0.59	2.9	0.163	0.127

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 7.3 EFFICIENCY= 1.00
CFS INTERCEPTED= 1.58 CFS CARRYOVER= 0.00

==========

INLET NUMBER 73 LENGTH 4.0 STATION

DRAINAGE AREA = 0.210 ACRES C VALUE = .560 CA = 0.118
SUM CA= 0.118 INT= 3.50 CFS= 0.412 CO= 0.000 GUTTER FLOW= 0.412

GUTTER SLOPE = 0.0080 FT/FT PAVEMENT CROSS SLOPE = 0.0313 FT/FT

SPREAD	W	W/T	SW	SW/SX	Eo	a	S'W	SE
3.12	1.5	0.48	0.0833	2.7	0.88	2.9	0.163	0.176

XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
REQUIRED LENGTH (ft) = 3.4 EFFICIENCY= 1.00
CFS INTERCEPTED= 0.41 CFS CARRYOVER= 0.00

AND YORK COUNTIES AND THE CITY OF WILLIAMSBURG, VIRGINIA — SHEET NUMBER 26

JOB NO. 88-039
DATE 7-29-88 SHEET 1 OF 5
DESIGN FORMULA Q=CIA FREQ 10Yr.

Revised Calculations For The Vineyards
COMPUTED BY RED CHECKED BY

Langley and McDonald
ENGINEERS·PLANNERS·SURVEYORS
WILLIAMSBURG, VIRGINIA

LOCATION		AREA (AC.)	RUNOFF	"A" x "C"		INLET TIME (MIN.)		RAIN INTEN. (IN.)		RUNOFF-Q-(CFS)		PIPE SIZE	CAPACITY	VELOCITY	LENGTH	SLOPE	FALL (FT.)	INVERT ELEVATION		PIPE TIME
STRUCTURE	STRUCTURE	"A"	"C"	INCRE.	ACCUM.	INCRE.	ACCUM.	INCRE.	ACCUM.	INCRE.	ACCUM.	(INCHES)	(CFS)	(FT./SEC.)	(FEET)	(FT./FT.)		UP	DOWN	(MIN)
2	1	9.6	.40	3.84		20		4.5		17.3		21	18.1	7.4	20	.0125	0.25	52.35	52.10	
3	1	.30	.56	0.17		5		7.1		1.21		15	6.5	5.2	40	.0100	0.40	52.50	52.10	
1	4	.30	.56	0.17	4.18	5	20	7.1	4.5	1.21	18.8	24	26.0	8.1	290	.0125	3.62	52.10	48.48	0.6
4	5	.25	.35	0.09	4.27	5		7.1	4.5	0.64	19.2	24	23.0	7.0	225	.0100	2.25	48.48	46.22	0.5 / 1.1
9	7	.64	.50	0.32		5		7.1		2.27		15	6.5	5.2	48	.0100	0.48	47.31	46.83	
8	7	.46	.35	0.16		5		7.1		1.14		15	6.5	5.2	20	.0100	0.20	47.03	46.83	
7	5	.35	.50	0.18		5		7.1		1.28		15	9.3	7.3	30	.0200	0.60	46.83	46.23	
5	6	.30	.56	0.17	5.10	5	21	7.1	4.40	1.21	22.4	24	50	15.5	130	.0479	6.23	46.23	40.00	
10	11	1.1	.35	0.39		13		5.5		2.15		15	7.4	5.8	64	.0125	0.80	36.40	35.6	
11	12	.82	.35	0.29	0.68	12	13	5.67	5.5	1.64	3.74	15	7.4	5.8	190	.0125	2.37	35.6	33.23	
14	12	.38	.35	0.13		5		7.1		0.92		15	6.5	5.2	24	.0100	0.24	32.74	32.50	
15	16	.67	.35	0.23		5		7.1		1.63		15	6.5	5.2	24	.0100	0.24	31.50	31.26	
16	17	.22	.56	0.12	.35	5	5	7.1	7.1	0.85	2.49	15	7.4	5.8	48	.0125	0.60	31.26	30.66	
17	12	1.90	.35	0.67	1.02	10	10	6.0	6.0	4.02	6.12	18	12.0	6.6	222	.0125	2.78	30.66	27.88	
12	13	1.24	.35	0.43	2.26	15	15	5.1	5.1	2.19	11.5	21	17.0	6.7	350	.0110	3.85	27.88	24.03	

JOB NO. 88-039
DATE 7-29-88 SHEET 2 OF 5
DESIGN FORMULA Q=CIA FREQ 10Yr. COMPUTED BY RED CHECKED BY

Langley and McDonald
ENGINEERS PLANNERS SURVEYORS
WILLIAMSBURG, VIRGINIA

LOCATION STRUCTURE	LOCATION STRUCTURE	AREA (AC) "A"	RUNOFF "C"	"A" x "C" INCRE.	"A" x "C" ACCUM.	INLET TIME (MIN) INCRE. / ACCUM.	RAIN INTEN. (IN.) INCRE. / ACCUM.	RUNOFF=Q=(CFS) INCRE. / ACCUM.	PIPE SIZE (INCHES)	CAPACITY (CFS)	VELOCITY (FT./SEC.)	LENGTH (FEET)	SLOPE (FT./FT.)	FALL (FT.)	INVERT ELEVATION UP	INVERT ELEVATION DOWN	PIPE TIME (MIN)
18	19	8.49	.35		2.97	20	4.5	13.4	21	16.0	6.5	30	.0100	0.30	29.30	29.0	
22	19	2.45	.35	0.86		10	6.0	5.16	15	7.4	5.8	30	.0125	0.38	29.38	29.0	
19	20	0.47	.56	0.26	4.09	5 / 20	7.1 / 4.5	1.85 / 18.4	24	26.0	8.0	220	.0125	2.75	29.00	26.25	
23	24	1.12	.35	0.39		7	6.7	2.61	15	7.4	5.8	48	.0125	0.60	27.70	27.10	
24	20	1.27	.35	0.44	0.83	5 / 7	7.1 / 6.7	3.12 / 5.56	18	10.8	5.8	30	.0100	0.30	27.10	26.80	
20	21	0.65	.56	0.36	5.28	5 / 20	7.1 / 4.5	2.56 / 23.8	30	34.8	6.9	54	.0070	0.38	26.25	25.87	
52	53	16.5	.35	5.78		15	5.1	29.5	30	42.0	8.3	52	.0100	0.52	25.99	25.47	
55	56	0.4	.56	0.22		5	7.1	1.56	15	9.1	7.3	24	.0200	0.48	28.68	28.20	
56	53	0.1	.56	0.06		5	7.1	0.46	15	12.8	10.0	72	.0379	2.73	28.20	25.47	
53	54	0.46	.56	0.26	6.32	5 / 15	7.1 / 5.1	1.85 / 32.2	30	42.0	8.3	36	.0100	0.36	25.47	25.11	
61	62	10.7	.35	3.71		20	4.5	16.7	24	23.0	7.1	20.	.0100	0.20	29.70	29.50	
62	63	0.53	.50	0.27	3.98	5	7.1	1.92 / 17.9	24	31.5	10.1	24	.0208	0.50	29.50	29.00	
63	64	0.45	.56	0.25	4.23	5 / 20	7.1 / 4.5	1.78 / 19.1	24	30.0	9.5	130	.0180	2.34	26.34	24.00	

JOB NO. 88-039
DATE 7-29-88 SHEET 3 OF 5
DESIGN FORMULA Q=CIA FREQ 10 Yr COMPUTED BY RED CHECKED BY

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WILLIAMSBURG, VIRGINIA

LOCATION STRUCTURE	LOCATION STRUCTURE	AREA (AC) "A"	RUNOFF "C"	"A" x "C" INCRE.	"A" x "C" ACCUM.	INLET TIME (MIN) INCRE. / ACCUM.	RAIN INTEN. (IN) INCRE. / ACCUM.	RUNOFF=Q=(CFS) INCRE. / ACCUM.	PIPE SIZE (INCHES)	CAPACITY (CFS)	VELOCITY (FT./SEC.)	LENGTH (FEET)	SLOPE (FT./FT.)	FALL (FT.)	INVERT ELEVATION UP	INVERT ELEVATION DOWN	PIPE TIME (MIN)
65	66	0.79	.35	0.28		5	7.1	1.96	15	9.1	7.3	24	.0208	0.50	49.50	49.00	
66	67	0.20	.56	0.11	0.39	5 / 5	7.1 / 7.1	0.78 / 2.77	15	14.0	10.1	230	.0392	9.02	49.02	40.0	
68	69	0.63	.45	0.28		5	7.1	1.99	15	6.5	5.2	160	.0100	1.60	57.5	55.9	
Sheet 3 of 42 From Plans																	
25	26	1.63	.35		0.57	10	6.0	3.42	15	6.5	5.2	48	.0100	0.48	24.48	24.00	
26	27	0.83	.35	0.29	0.86	5 / 10	7.1 / 6.0	2.10 / 5.16	15	6.5	5.2	24	.0100	0.24	24.00	23.76	
27	28	0.54	.56	0.30	1.16	5 / 10	7.1 / 6.0	2.13 / 6.96	15	9.1	7.3	72	.0200	1.44	23.76	22.32	
29	30	10.7	.50		5.35	10	6.0	32.1	30	41.0	8.2	20	.0100	0.20	26.5	26.30	
30	31	1.15	.35	0.40	5.75	5 / 10	7.1 / 6.0	2.84 / 34.5	30	41.0	8.2	30	.0100	0.30	25.05	24.75	
31	32	0.41	.56	0.23	5.98	5 / 10	7.1 / 6.0	1.63 / 35.9	36	43.0	5.8	100	.0040	0.40	22.60	22.20	
34	35	2.00	.35		0.70	10	6.0	4.2	15	6.5	5.2	48	.0100	0.48	26.74	26.26	
35	36	0.50	.56	0.28	0.98	5 / 10	7.1 / 6.0	1.99 / 5.88	15	6.5	5.2	72	.0100	0.72	26.26	25.54	
36	37	0.70	0.35	0.25	1.23	5 / 10	7.1 / 6.0	1.78 / 7.38	15	8.0	6.4	136	.0150	2.04	25.54	23.50	
37	38	0.60	0.50	0.30	1.53	5 / 10	7.1 / 6.0	2.13 / 9.18	18	13.0	7.1	160	.0100	1.60	23.50	21.90	

JOB NO. 88-039

DATE 7-29-88 SHEET 4 OF 5

DESIGN FORMULA Q=CIA FREQ 10 Y. COMPUTED BY RED CHECKED BY

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LOCATION		AREA (AC)	RUNOFF	"A" x "C"		INLET TIME (MIN.)		RAIN INTEN. (IN.)		RUNOFF=Q=(CFS)		PIPE SIZE	CAPACITY	VELOCITY	LENGTH	SLOPE	FALL (FT.)	INVERT ELEVATION		PIPE TIME
STRUCTURE	STRUCTURE	"A"	"C"	INCRE.	ACCUM.	INCRE.	ACCUM.	INCRE.	ACCUM.	INCRE.	ACCUM.	(INCHES)	(CFS)	(FT./SEC.)	(FEET)	(FT./FT.)		UP	DOWN	(MIN.)
39	40	1.7	.35		0.60		5		7.1		4.26	18	22.0	12.0	48	.0429	2.06	16.5±	14.4±	
40	41	1.16	.35	0.41	1.01	5	5	7.1	7.1	2.91	7.17	18	22.0	12.0	68	.0429	2.92	14.4±	11.5±	
43	41	0.55	.50	0.28			5		7.1		1.99	15	6.5	5.2	24	.0100	0.24	21.00	21.76	
41	42	0.66	.50	0.33	1.62	5	5	7.1	7.1	2.34	11.5	18	22.0	12.0	94	.0429	4.03	11.5±	7.5±	
44	70	1.47	.45		0.66		5		7.1		4.69	15	6.5.	5.2	200	.0100	2.00	16.00	14.00	
45	46	0.87	.35		0.30		5		7.1		2.13	15	6.5	5.2	24	.0100	0.24	27.00	26.76	
46	47	0.42	.56	0.24	0.54	5	5	7.1	7.1	1.70	3.84	15	12.0	9.5	80	.0343	2.74	26.76	24.00	
48	49	6.9	.35		2.42		20		4.5		10.9	18	13.1	7.2	20	.0150	0.30	25.20	24.90	
49	50	1.16	.35	0.41	2.83	5	20	7.1	4.5		12.7	18	13.1	7.2	24	.0150	0.36	24.90	24.54	
50	51	0.28	.56	0.16	2.99	5	20	7.1	4.5		13.5	21	19.8	7.9	36	.0150	0.54	24.54	24.00	
51	58	0.39	.56		0.22		5		7.1		1.54	15	6.5	5.2	24	.0100	0.24	31.00	30.76	
58	59	0.20	.56	0.11	0.33	5	5	7.1	7.1	0.78	2.34	15	9.3	7.2	36	.0200	0.72	30.75	30.03	
59	60	0.21	.56	0.12	0.45	5	5	7.1	7.1	0.85	3.20	15	12.2	8.8	200	.0300	6.00	30.03	24.03	

JOB NO. 88-039

DATE 7-29-88 SHEET 1 OF 1

DESIGN FORMULA Q=CIA FREQ 10Yr

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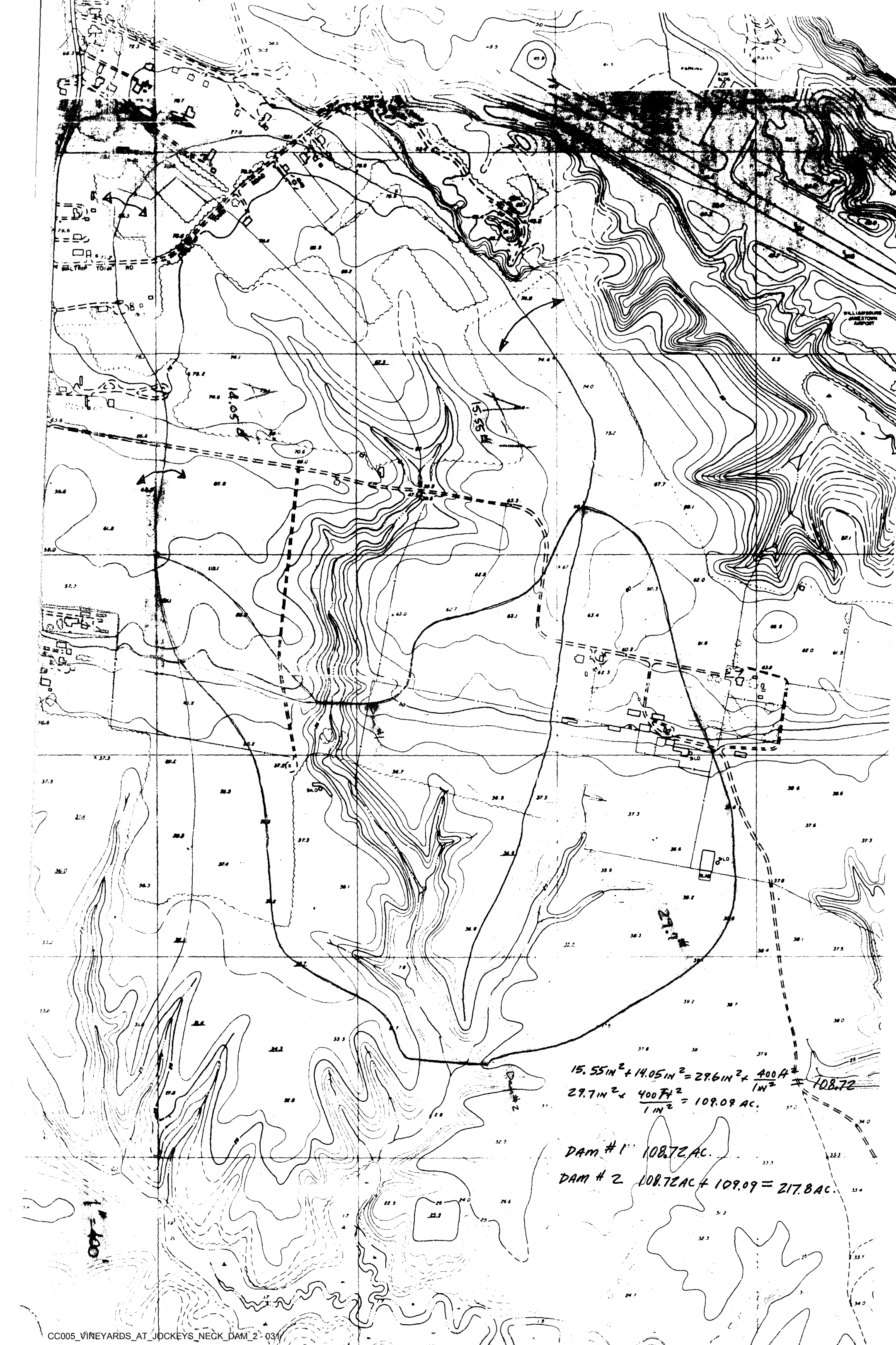
LOCATION		AREA (AC.)	RUNOFF	"A" x "C"		INLET TIME (MIN.)		RAIN INTEN. (IN.)		RUNOFF = Q = (CFS)		PIPE SIZE	CAPACITY	VELOCITY	LENGTH	SLOPE	FALL (FT.)	INVERT ELEVATION		PIPE TIME
STRUCTURE	STRUCTURE	"A"	"C"	INCRE.	ACCUM.	INCRE.	ACCUM.	INCRE.	ACCUM.	INCRE.	ACCUM.	(INCHES)	(CFS)	(FT./SEC.)	(FEET)	(FT./FT.)		UP	DOWN	(MIN)
33	71	2.27	.41		0.93		5		7.1		6.61	18	8.0	4.4	100	.0055	.55	13.55	13.0	
72	73	1.29	.35		0.45		5		7.1		3.20	15	6.5	5.2	24	.0100	.24	28.00	27.76	
73	74	0.21	.56	0.12	0.57	5	5	7.1	7.1	0.85	4.05	15	8.0	6.4	240	.0156	3.76	27.76	24.00	

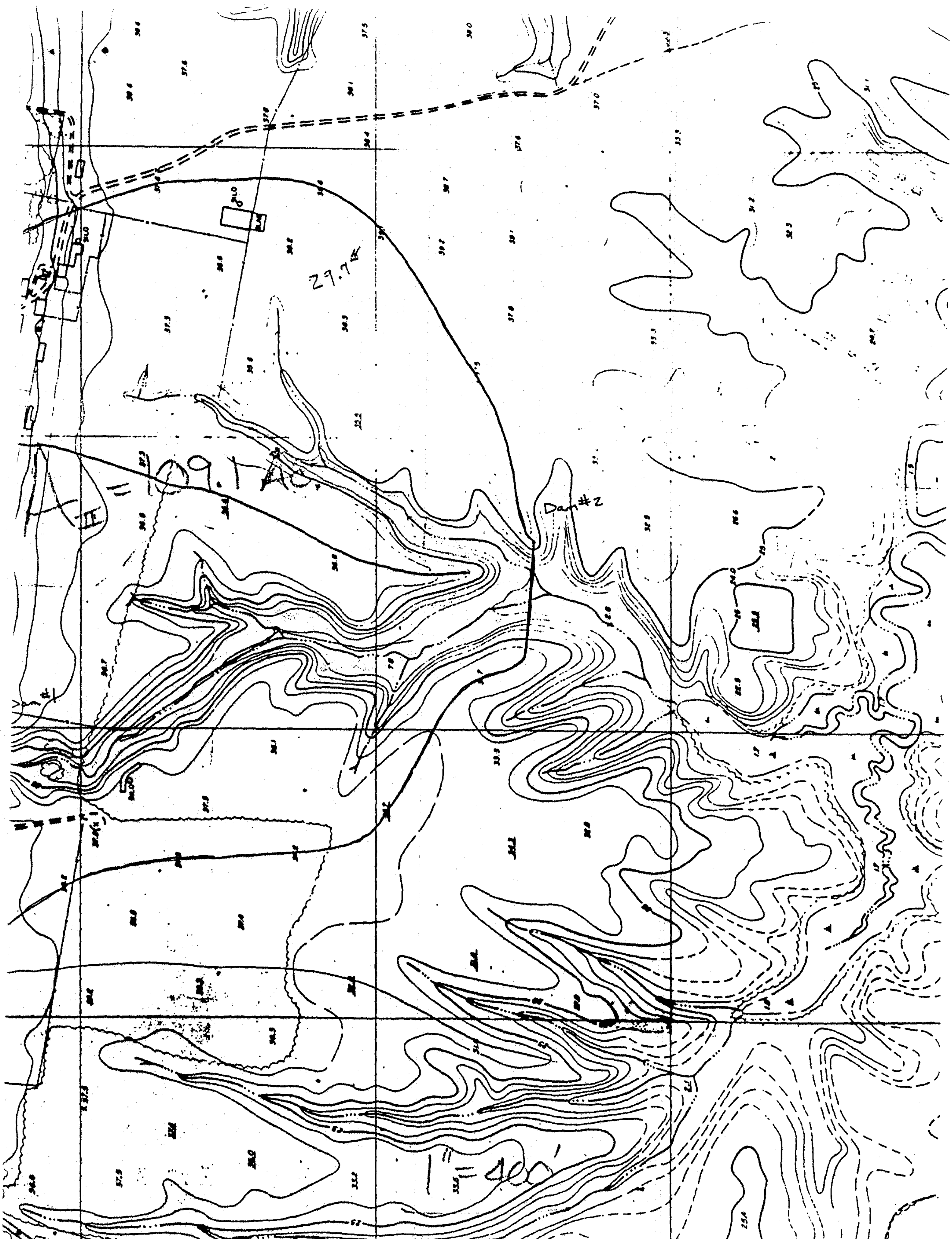


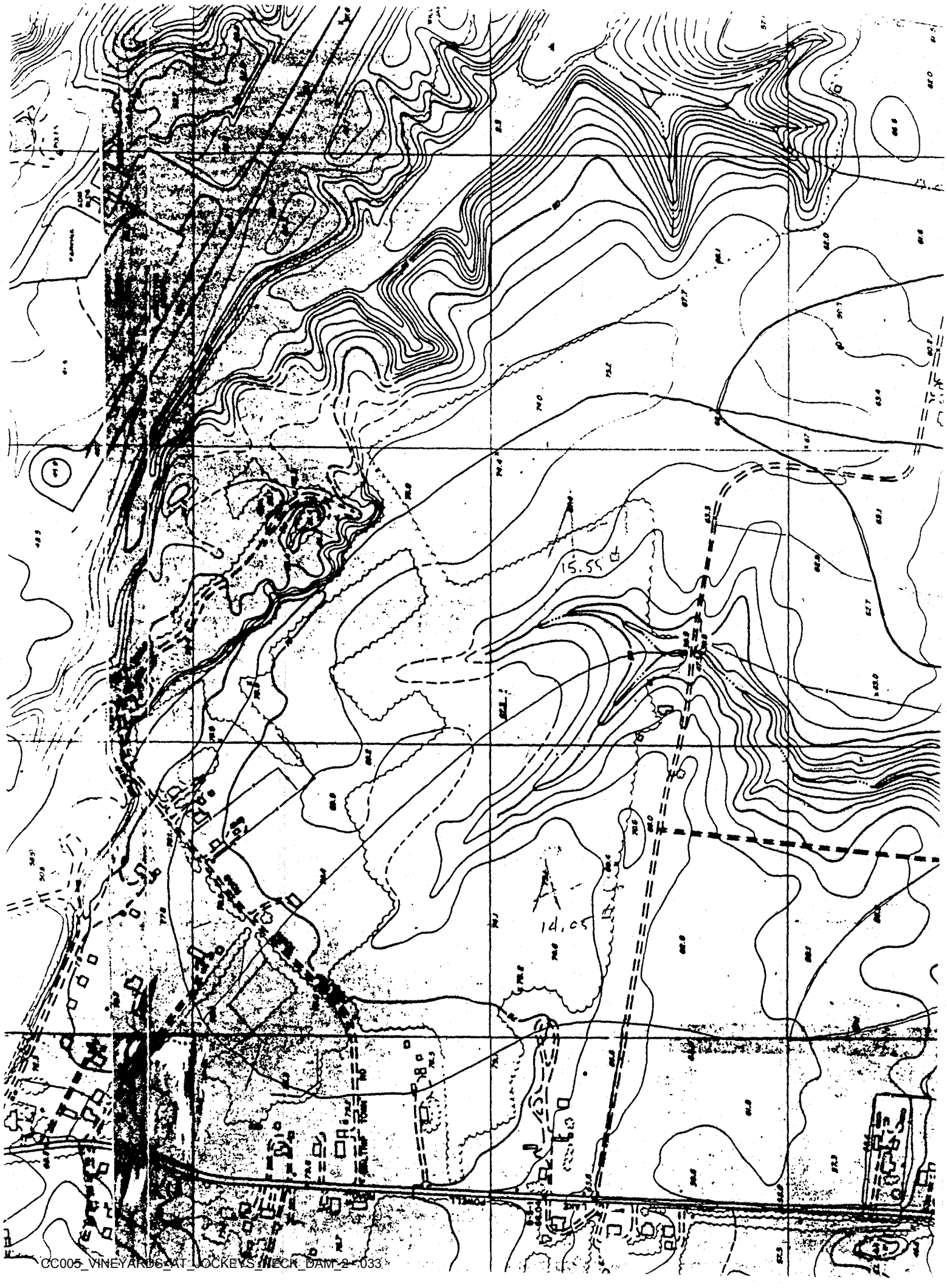
$15.55 IN^2 + 14.05 IN^2 = 29.6 IN^2 + \frac{400 Ft^2}{1 IN^2} = 108.72$

$29.7 IN^2 \times \frac{400 Ft^2}{1 IN^2} = 109.09 AC.$

DAM # 1 108.72 AC.

DAM # 2 108.72AC + 109.09 = 217.8 AC.





CC005_VINEYARD64AT_JOCKEYS_NECK_DAM_2 - 033

Detention Pond Design for Jockey's Neck

(Use "Detention Pond Design For Small Basins")

by Steve Wigley 6/5/86

Limited to T.C.

Pre-development

Drainage Area – A = 108.8 ac (As per J.C.C. Topo)

Composite "C" value – 40% Woodlands C = 0.2
60% Cultivated rows w/crop C = 0.25

Use → C = 0.23

CA = 25.02

Time of Concentration – t_c = 44 min. L = 3520
ΔElev. = 57.4' S = 0.01
(As per Fig. 1.5.11. Crops, Corps Book for Civil Engr. E.E. Eqn.

Intensity – $I = \left(\frac{a}{b + t_c}\right)$ where $a_2 = 130.3$ $b_2 = 18.5$
$a_{10} = 189.2$ $b_{10} = 22.1$

$I_2 = 2.1$ in/hr. $I_{10} = 2.9$ in/hr $I_{100} = 5.0$ in/hr.

$Q_2 = CI_2A = 25.02(2.1) = 52.6$ cfs
$Q_{10} = CI_{10}A = 25.02(2.9) = 72.6$ cfs
$Q_{100} = CI_{100}A = 25.02(5.0) = 125.10$ cfs

Post-development

45% Residential A = 57.6 ac @ C = 0.45 CA = 25.92
55% Undeveloped A = 70.4 ac @ C = 0.23 CA = 16.19

ΣA = 128 ac ΣCA = 42.1

Use → C = 0.33

DAM #1
JOACHIN LAKE
(UPPER LAKE)
CC013

$L = 2900$ L.F. $\quad \Delta Elev. = 57.4'$ $\quad S = 1.98\%$

$t_c = 16$ min.

$I_2 = 3.8$ in/hr., $Q_2 = 160.5$ cfs ... a 304% increase
$I_{10} = 5.0$ in/hr., $Q_{10} = 211.2$ cfs ... a 289% "
$I_{100} = 8.1$ in/hr., $Q_{100} = 342.1$ cfs ... a 274% "

- Critical Storm Duration for 2yr. Post-Development:

$$T_c = \frac{\sqrt{2CAa(b - t_c/4)}}{q_o} - b$$

given: $C = 0.33$, $A = 128$, $t_c = 16$, $a = 130.3$, $b = 18.5$, $q_o = 52.6$

$$T_c = \frac{\sqrt{2(0.33)128(130.3)(18.5 - 16/4)}}{52.6} - 18.5$$

$T_c = 36.6$ min.

$t_c = 16$ min.

- Peak Inflow

$$Q_o = CA\left(\frac{a}{b + T_c}\right) = 0.33\left(\frac{130.3}{18.5 + 36.6}\right)128 = 99.9 \text{ cfs}$$

- Req'd Storage for Critical 2yr. Storm

$$V = \left[Q_o T_c + \frac{Q_o t_c}{4} - \frac{q_o T_c}{2} - \frac{3 q_o t_c}{4}\right] 60$$

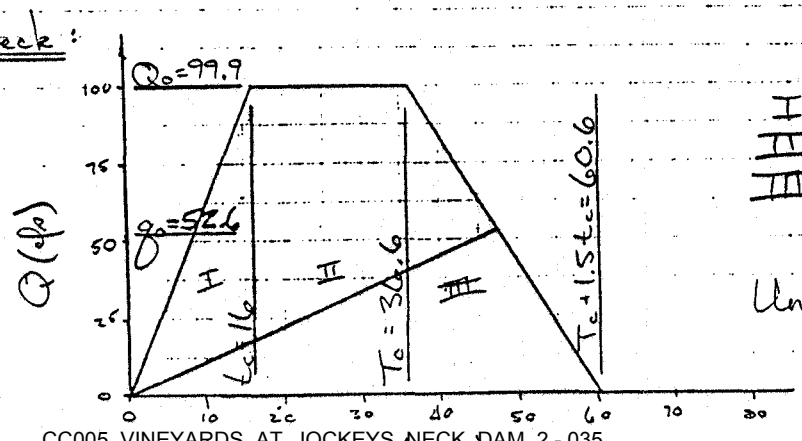
$$= \left[99.9(36.6) + \frac{99.9(16)}{4} - \frac{52.6(36.6)}{2} - \frac{3(52.6)16}{4}\right] 60$$

$V = 147{,}730$ ft^3 $\quad$ Say $150{,}000$ ft^3

- Req'd Sediment Storage Vol.

$V = 67\ cy/Ac\,(128) = 231{,}552$ cf

Check:



	Area
I	$99.9(16)\frac{1}{2} = 799.2$
II	$99.9(20.6) = 2057.9$
III	$99.9(24)\frac{1}{2} = 1198.8$
	4055.9

Unshaded Area
$-52.6(60.6)\frac{1}{2} = -1593.78$

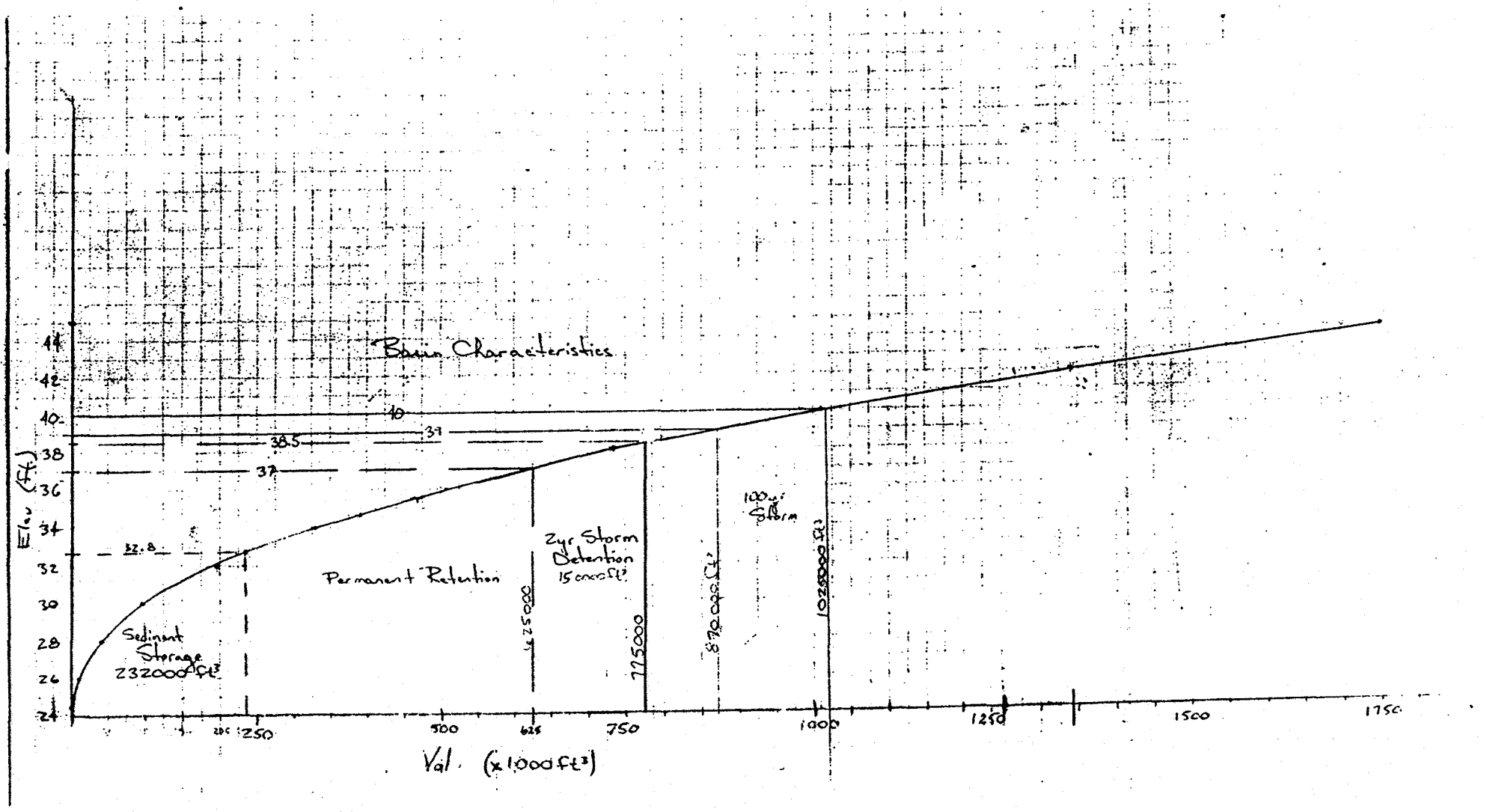
$2462.12(60) = 147730$ cf

Basin Characteristics

Elev.	Area (ft^2)	Incremental Vol. (ft^3)	Elev. (ft^3)
24.5	0		0
		100	
25	200		100
		11075	
26	10875		11175
		29400	
28	18525		40575
		56375	
30	37850		96950
		95425	
32	57575		192375
		137150	
34	79575		329525
		179975	
36	100400		509500
		224625	
38	124225		734125
		273350	
40	149125		1007475
		335375	
42	186250		1342850
		408625	
44	222375		1751475

— See Basin Characteristics Graph —

Basin Characteristics Graph



• Storage Elevations

Sediment Storage of 231552 ft³ → Elev. 24.5 to 32.8 depth 8.3'
Permanent Retention → Elev. 32.8 to 37.0 Vol. = 577000 ft³
Need 150000 ft³ of detention → Elev. 37.0 to 38.5 Vol. = 735000 ft³

• Outlet Structure:

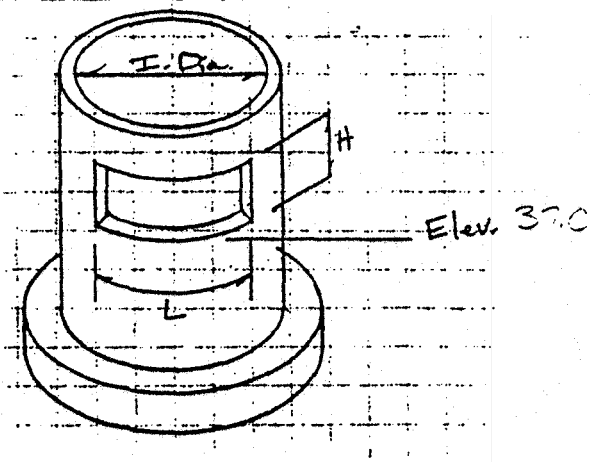
Use Precast Structure w/ Rectangular weir

$$Q = 3.33(L-0.2H)H^{3/2}$$

where: Q = 10.03 cfs (52.6)
H = 1.5 ft

$$L = \left[\frac{Q}{3.33H^{3/2}} + 0.2H\right] = \left[\frac{10.03}{3.33(1.5)^{3/2}} + 0.2(1.5)\right]$$

L = 6.84 ft



Size Structure's Inside Dia. by checking for min. 3H end contraction reg'mt:

Trial & Error Procedure

Try I. Dia = 5.5'
Perimeter = 2πr = 17.27'
∴ 2(3H) = 9' req'd
∴ 17.27 − 6.84 = 10.43' Good

Try I. Dia = 5.0'
Perimeter = 15.71'
∴ 15.71 − 6.84 = 8.87 Close Enough

Assume orifice flow condition occurs after water surface reaches elev. 38.5' (1.5' above 2yr event weir). To route flow use trial & error.

Water Surf Elev. (ft)	Outflow (cfs) Q	
37	0	Weir $Q = 3.33(L-0.2H)H^{3/2}$
38	21.8	L = 6.84' h = 1'
39	69.9	Orifice $Q = 0.6A\sqrt{2gh}$ h = 2' A = 19.6
40	85.7	h = 3'
41	98.8	h = 4'
42	110.5	h = 5

• Determine Hydraulic Performance of structure under 10yr. & 100yr. peak discharge storm conditions.

Q_{10} = 124.2 cfs Q_{100} = 219.0 cfs t_c = 42 min

10 yr. Storm Q_{in} 211.2 cfs

Try Elev. 39' $q_o = 69.9$ cfs

Δstorage = 870000 - 625000 = 245000 ft³

$$V_o = \left[Q_o T_c + \frac{Q_o t_c}{4} - \frac{q_o T_c}{2} - \frac{3 q_o t_c}{4}\right] 60$$

Assume critical storm duration T for a 10 yr. storm equals t_c $\therefore T = t_c = 16$ min.

Then, $V_o = 60 t_c (Q_o + \frac{1}{4} Q_o - \frac{1}{2} q_o - \frac{3}{4} q_o)$

$= 60 t_c (\frac{5}{4} Q_o - \frac{5}{4} q_o)$

$= 75 t_c (Q_o - q_o)$

$V_o = 75(16)(211.2 - 69.9) = 169560$ ft³ Elev. too High

Try Elev. 38.5' $q_o = \left[\frac{21.8 + 69.9}{2}\right] = 45.9$ cfs

Δstorage = 785000 - 625000 = 160000 ft³

$V_o = 75(16)(211.2 - 45.9) = 198360$ ft³ Elev. too Low

Therefore say 10 yr storm is at Elev. 38.75'

100 yr Storm $Q_{in} = 342.1$ cfs

Try Elev. 40' $q_o = 85.7$ cfs

Δstorage = 1025000 - 625000 = 400000 ft³

$V_o = 75(16)(342.1 - 85.7) = 307680$ ft³ Elev. too high

Try Elev. 39.5 $q_o = \left[\frac{85.7 + 69.9}{2}\right] = 77.8$ cfs

Δstorage = 9500000 - 625000 = 325000 ft³

$V_o = 75(16)(342.1 - 77.8) = 317160$ Close enough!

Therefore 100 yr. storm is at Elev. 39.5'

Conclusion

Orifice will pass 77.8 cfs at elev. 39.5 while allowing for 100 yr. storm detention and release at a controlled rate minimizing damage to down stream channel. Provide D.I. to at elev. 40' and allow 1.5' freeboard to 20' emergency spillway, elev. 41.5'. Emergency spillway is designed to operate in excess of 100 yr. frequency storm. Allow 2' more to top of dam for freeboard and construction tolerence, elev. 43.5'. The extra height of dam in combination with a 40' width of dam at the crest is to permit future development of a roadway across the dam.

Outlet Pipe Design

Pipe to pass 77.8 cfs

∴ Use 120' of 36" RCP @ 2.5%

$Q_{cap} = 95$ cfs

Anti-Seep Collar Design ("Design for Small Dams" p. 45)

Design collars to increase the seepage path by 15%

Length of 36" RCP = L = 120 $\quad 120(0.15) = 18'$

18' of verticle displacement of seepage path is needed.

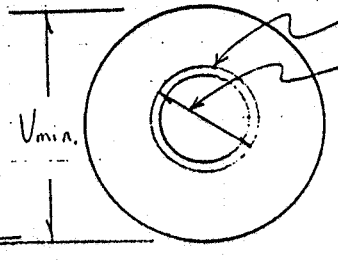
H = height of collar

N = # of collars $\quad N = \frac{18}{2H}$

Try H = 1.5' ∴ N = 6

Try H = 2' ∴ N = 4.5 say 5

Therefore use 5 collars w/ H = 2' above pipe o.c. of 16' (2 joints of pipe)



O.Dia. = 36 + 2(1.75) = 45.5"

Vmin = 45.5 + 2(24) = 93.5"

Use Vmin = 90" = 7.5'

(Rounded down to nearer ½ ft. for ease in prac

Increase in seepage path:

$$\frac{5[2(2)] + 120'}{120} = 1.17$$

∴ 17% Good

Buoyancy Calcs For Inlet Structure

Wt. & Vol. of 18 ft. structure:

Barrel — $Vol. = (A_{OD} - A_{ID})h = \left[\pi\left(\frac{36.75}{12}\right)^2 - \pi\left(\frac{30}{12}\right)^2\right]17 = 167.1\ ft^3$

Top — $Vol = Ah = \pi\left(\frac{36.75}{12}\right)^2 0.5 = 14.7\ ft^3$

Base — $Vol. = AL = \pi\left(\frac{43.75}{12}\right)^2 0.67 = 28\ ft^3$
(extended = 87.5" O.D.)

Total Vol. = 209.8 ft³

$W_{conc.} = 150\ \#/ft^3$

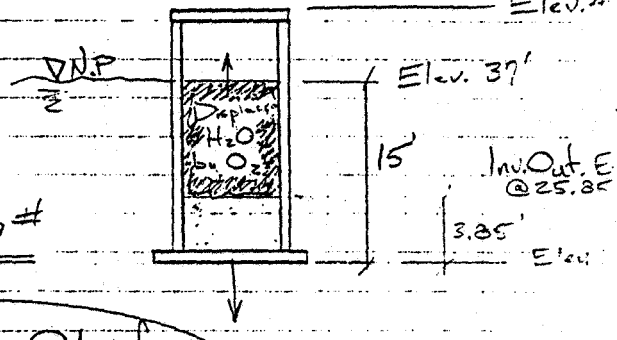
Total Wt = 209.8(150 #/ft³)

$Wt_T = 31470\ \#$

Wt & Vol. of H_2O displaced by Air

$Vol. = (15 - 3.85)\left(\pi\left(\frac{30}{12}\right)^2\right)$

$Vol. = 218.9\ ft^3$



$W_{H_2O} = 62.4\ \#/ft^3$ $\quad Wt_w = 218.9(62.4) = 13659\ \#$

$Wt_T > Wt_w$ ∴ Will not float

∴ Upstream 39 RCP Capacity Calc.

Inv. In

39" RCP
Inv. Elev. = 37.35'

37.35
3.25
40.60' = Top RCP Elev.

Inv. Out

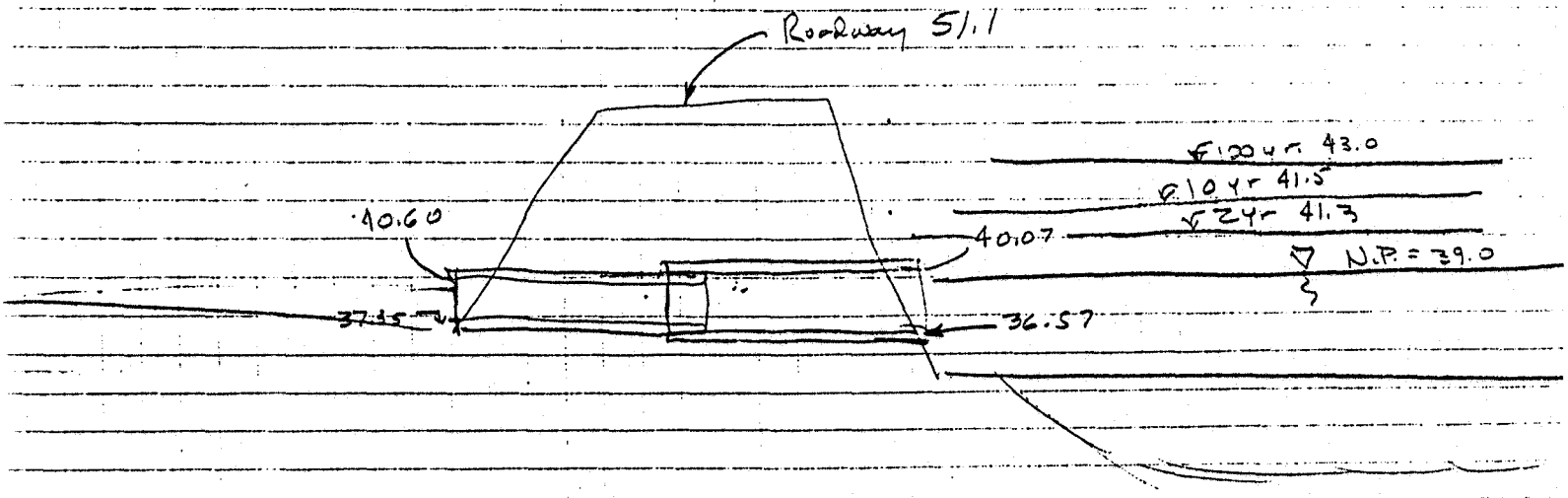
42" RCP
Inv. Elev = 36.57'

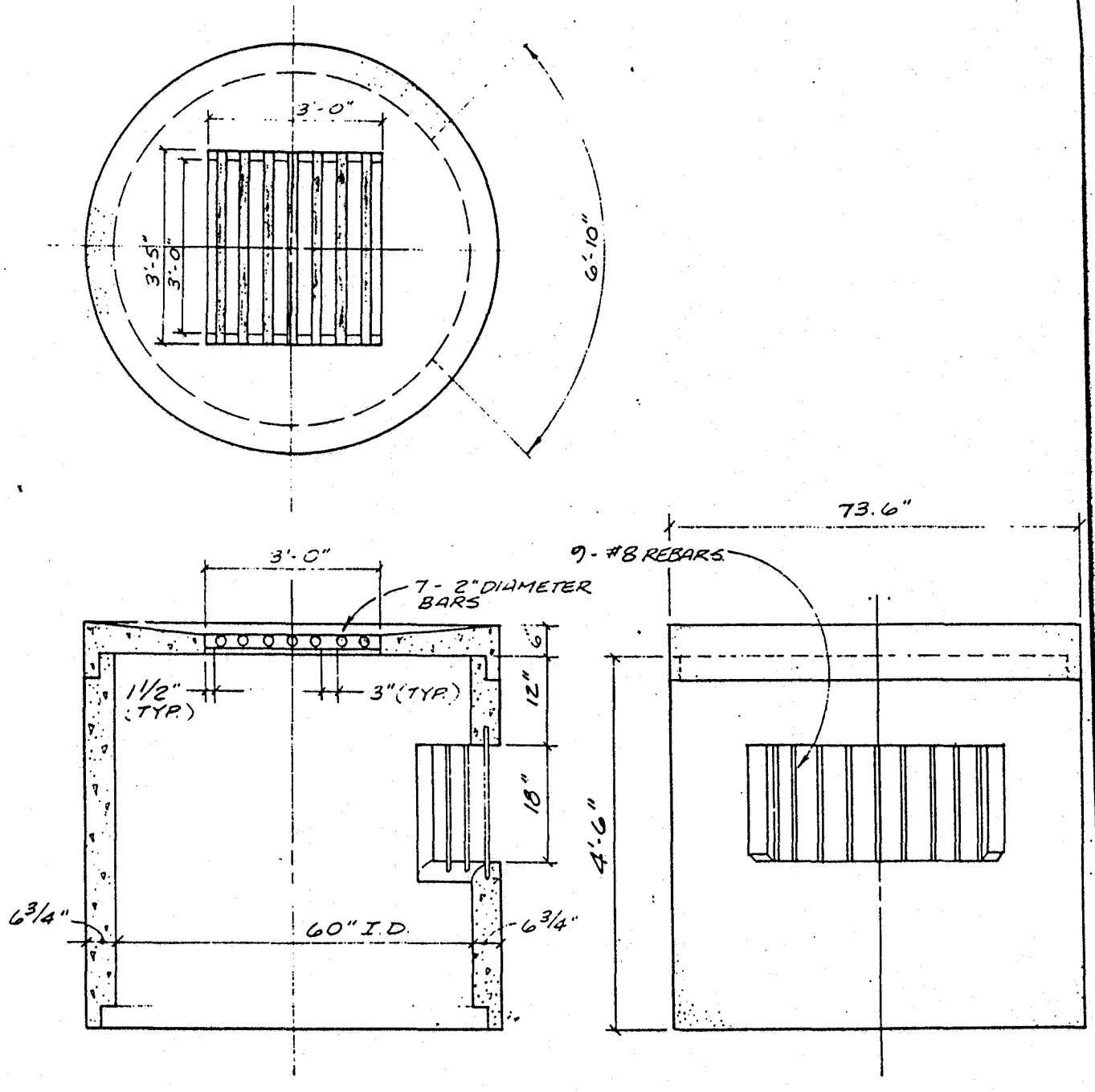
36.57
3.50
40.07' = Top RCP Elev.

Length 65'
Slope = $S = \frac{40.60 - 40.07}{65} = \frac{0.53}{65} = 0.008$ ft/ft.

Normal Pool Elev. = 39'
2yr. storm detention = 41'

@ 41' the culverts will be under water.





SECTION A-A

ELEVATION

PRECAST RISER W/ ORIFICE

N.T.S.

Jockey's Neck
Dam #II

7/21/87
SPW.

DAM #2
AJACAN LAKE
(LOWER LAKE)
CC 005

Pre-development

Drainage Area = 4752000 S.F. = 109.1 Ac.

Composite "C" Value

	Area	C	CA
Woodlands	43.2Ac.	0.2	8.64
Cultivated Fields w/crop	65.9Ac.	0.25	16.48
	109.1		25.12

$C = 25.12/109.1 = 0.23$

L = 3060 L.F. ΔElev. = 61 - 4 = 57'
S = 1.86 %

t_c = 36 min (Fig. 1.5.12.)

I_2 = 2.2 in/hr., Q_2 = 55.2 cfs

I_{10} = 3.6 in/hr., Q_{10} = 90.3 cfs

I_{100} = 5.5 in/hr., Q_{100} = 138.0 cfs

Post-development

Assume surrounding environs developed to:

90% Residential	= 98.2 Ac. @	C=0.40	CA = 39.3
10% Woodlands	= 10.9 Ac. @	C=0.23	CA = 2.5
	ΣA = 109.1 Ac		ΣCA = 41.8

C = 0.38

t_c = 18 min. (fig. 1.5.12)

$I = \frac{a}{b + t_c}$

$a_2 = 130.3$ $a_{10} = 189.2$
$b_2 = 18.5$ $b_{10} = 22.1$

I_2 = 3.57 in/hr., Q_2 = 148.0 cfs — a 268% increase
I_{10} = 4.72 in/hr., Q_{10} = 195.7 cfs — a 216% increase
I_{100} = 7.90 in/hr., Q_{100} = 327.5 cfs — a 237% increase

∴ Critical Storm Duration For 2yr Post-de

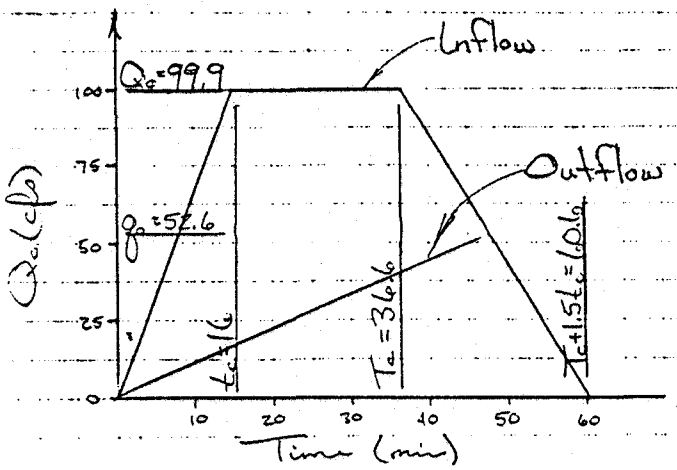
$$T_c = \frac{\sqrt{2CAa(b - t_c/4)}}{q_o} - b$$

given: $C = 0.38$, $A = 109.1$ Ac, $t_c = 18$ min, $a = 130.3$, $b = 18.5$, $q_o = 55.2$ cfs (allowable peak outf.

$$T_c = \frac{\sqrt{2(0.38)109.1(130.3)(18.5 - 18/4)}}{55.2} - 18.5$$

$T_c = 24.6$ min. , $t_c = 18$ min.

- Dam #1 Inflow & Outflow Hydrograph



- Peak Inflow

$$Q_o = CA\left(\frac{a}{b + T_c}\right) = 0.38(109.1)\left(\frac{130.3}{18.5 + 24.6}\right) = 125.3 \text{ cfs}$$

Dam #1 Outflow = 52.6 cfs

Q_o, Peak Inflow = 177.9 cfs

- Req'd Storage for Critical 2yr. Storm

$$V = \left[Q_o T_c + \frac{Q_o t_c}{4} - \frac{q_o T_c}{2} - \frac{3 q_o t_c}{4}\right] 60$$

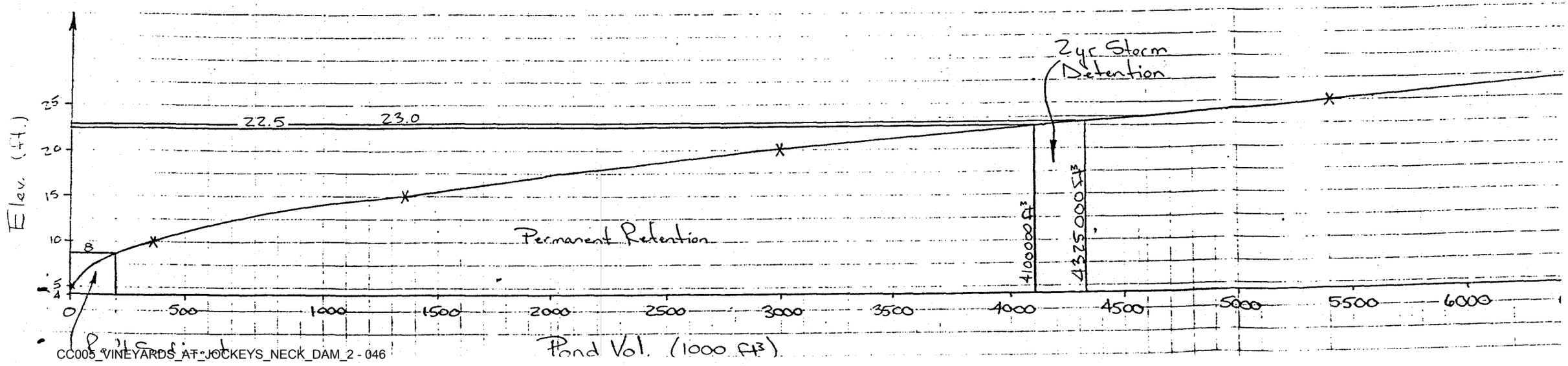
$$= \left[177.9(24.6) + \frac{177.9(18)}{4} - \frac{55.2(24.6)}{2} - \frac{3(55.2)18}{4}\right] 60$$

$= 225164$ ft^3 → say 225000 ft^3

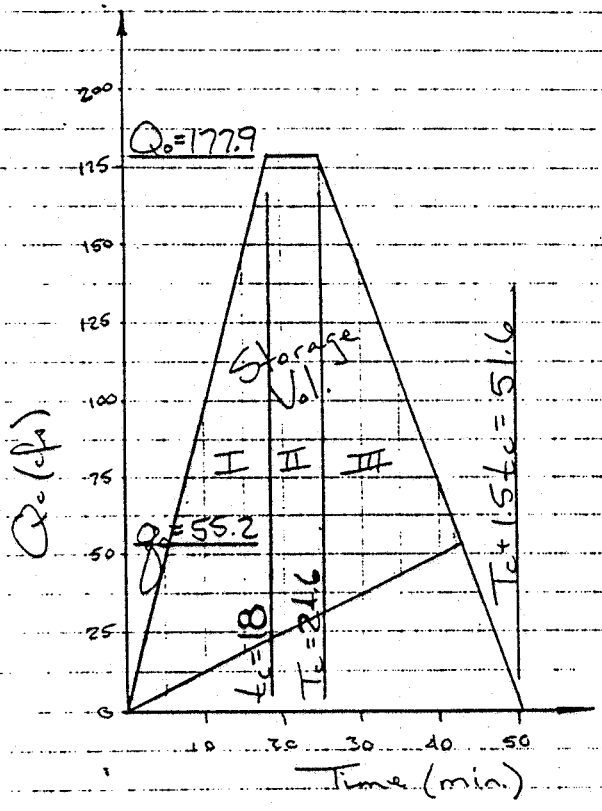
- Req'd Sediment Storage Vol.

$V = 67(109.1)27 = 197362$ ft^3 → say 200000 ft^3

Elev. (ft)	Area (ft^2)	Avg. Area (ft^2)	Depth (ft)	Incremental Vol. (ft^3)	Σ Vol. (ft^3)
4	0				
		6000	1	6000	
5	12000				6000
		72000	5	360000	
10	132000				366000
		198000	5	990000	
15	264000				1356000
		328000	5	1640000	
20	392000				2996000
		484000	5	2420000	
25	576000				5416000



check:



Area

I	177.9(18)½	= 1601
II	177.9(6.6)	= 1174
III	177.9(27)½	= 2402
		5177

Unshaded Area

55.2(51.6)½ = 1424

3753

$V = 3753(60) = 225170$ ft³ checks

- Storage Elevations

	Elev.	Vol. (ft³)
Sediment Storage of 200000 ft³	4' to 8.3'	200000
Permanent Retention	8.3 to 22.5'	4100000

Required 225000 ft³ detention

- Outlet Structure

Use Precast Structure w/ Rectangular Weir

(Weir Eq.n) $Q = 3.33(L-0.2H)H^{3/2}$

where $L = 6.0$ ft

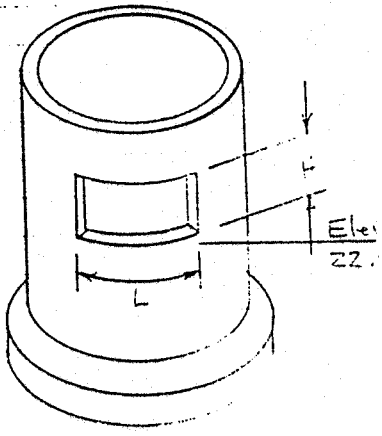
$H = 1.5$ ft

$Q = 3.33[6-0.2(1.5)]1.5^{3/2} = 34.9$ cfs < 55.2 ft³ Good

Assume orifice flow condition occurs after water level reaches elev. 24 ft (1.5 ft above weir inv.)

(Orifice Eq.n) $Q = 0.6A\sqrt{2gh}$ where $A = 9$ ft²

Water Surface Elev. (ft.)	Outflow (cfs)	Equation
22.5	0	Weir
23.0	6.9	L=6, h=0.5
23.5	19.3	L=6, h=1.
24.0	34.9	L=6, h=1.5
24.5	61.3	Orifice A=9, h=2
	108.5	A=9, h=2.5



- Determine Hydraulic Performance of Structure under 10yr & 100yr peak discharge storm conditions

$Q_{10} = 195.7$ cfs $t_c = 18$ min.
$Q_{100} = 327.5$ cfs

10 Yr. Storm $Q_{in} = 195.7$ cfs

Try Elev. = 23.5 $q_o = 19.3$

Δstorage = 4575000 − 4100000 = 475000 ft³
$V_o = 75 t_c (Q_{in} - q_o) = 75(18)(195.7 - 19.3) = 238140$ ft³ Elev too high

Try Elev. 23.0 $q_o = 6.9$

23.0 is the 2yr. storm elev., therefore the 10yr storm event is between 23.0 & 23.5 say → **Elev = 23.25'**

100yr. Storm $Q_{in} = 327.5$ cfs

Try Elev. = 23.5 $q_o = 19.3$

Δstorage = 4750000 ft³
$V_o = 75(18)(327.5 - 19.3) = 416070$ ft³ close enough

Elev. = 23.5 ft

Total Discharge Under 100yr. Storm Conditions
$Q_o = 19.3$ cfs → Use $q_2 = 55.2$ cfs (allowable peak flow)

Use @ 30" RCP @ 2.3% $Q_{cap} = 58$ cfs

Anti-Seep Collar Design

Design Collars to increase the seepage path by 15%

Length of 30" RCP = 128' $128(0.15) = 19.2'$

20' of vertical displacement of seepage path is needed.

H = height of collar
N = # of collars

$N = \frac{20}{2H}$

Try H = 2', then N = 5

Use 5 collars w/ H = 2' above pipe, O.C. of 16' (2 joints of pipe)

Increase in Seepage path:
$5[2(2)] + 128' = 148$ 15% increase

Buoyancy Calcs For Inlet Structure

Wt & Vol. of Conc. Structure:

Barrel - $Vol. = (A_{OD} - A_{ID})h = \left[\pi\left(\frac{36.75}{12}\right)^2 - \pi\left(\frac{30}{12}\right)^2\right]22.5 = 221.2\ ft^3$

Top - $Vol. = Ah = \pi\left(\frac{36.75}{12}\right)^2 0.5 = 14.7\ ft^3$

Base - $Vol. = Ah = \pi\left(\frac{43.75}{12}\right)^2 0.67 = 28\ ft^3$
(extended = 87.5" O.D.)

Total Vol. = 263.9 ft^3

Total Wt. = 263.9 ($150^{\#}/ft^3$)

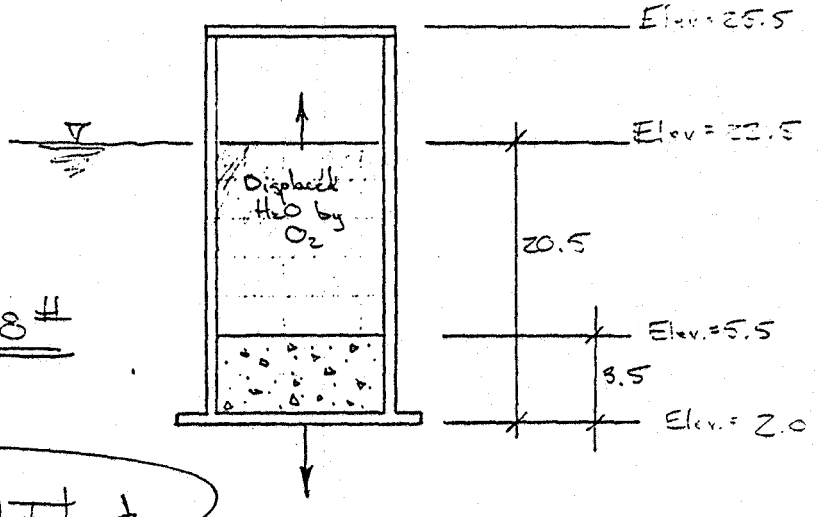
$Wt_T = 39585.0^{\#}$

$W_c = 150^{\#}/ft^3$

Wt & Vol. of H_2O displaced by Air

$Vol. = (20.5 - 3.5)\pi\left(\frac{30}{12}\right)^2$

$Vol. = 333.8\ ft^3$



$W_{H_2O} = 62.4^{\#}/ft^3$

$Wt_w = 333.8\ ft^3 (62.4) = 20828.8^{\#}$

$Wt_T > wt_w$ ∴ Will Not Float

(48-4)(01-11)
2630 JNR 23185

JANUARY 16 2001
Gust Thrimmer

UPPER LAKE JOACHIN DAM #1 CC013

BASE VOL	DESIGN CREST ELEV	HEIGHT OF DAM AT CREST
625,000 CF	43.5	21.0' ✓

A = 108.8 AC.
C = 0.33
T_c = 44 min.

LOWER LAKE AJACAN DAM #2 CC005

BASE VOL	DESIGN CREST EL.	HT. OF DAM AT CREST
4,100,000	28.5	14.5' (23.28')

108.72 + 109.09 =
A = ~~128 AC.~~ 217.8
C = 0.38
~~T_c = 18 min.~~

DAM #1 JOACHIN

42 1342850
43.5 ×
44 1751475

$\frac{43.5-42}{2} = \frac{x-1342850}{1751475-1342850}$

$0.75 = \frac{x-1342850}{408,625}$

x = 1,649,218.75 CF (37.86 AC-FT.)
BASED ON Design SS Curve to Dam Crest

DAM #2

5416 000 CF
EL. 25 (124.33 AC-FT)
ROAD & DIK SPILLWAY COMPS EL 30.

30.00
- 5.22
24.78

PER ORIG DES 28.5 - 4.10 = 24.5
PER AS-BUILT INFO $20^{05} - 5^{22}$ = 23.28
EM SPILL DES. $30^{0} - 5^{22}$ = 24.78

CLOSE TO

AES, A PROFESSIONAL CORPO TION
Engineering And Surveying
~~1761 Jamestown Road~~ 5248 Olde Towne Rd., Suite 1
WILLIAMSBURG, VIRGINIA 23185

(804) 253-0040

LETTER OF TRANSMITTAL

TO V.D.O.T.

DATE	JOB NO.
8-10-89	658

ATTENTION Debbie Lenceski

RE: Jockey's Neck (Williamsburg Winery) Dam I & II

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☒ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☒ Calculations

COPIES	DATE	NO.	DESCRIPTION
1	7-86	2 of 2	Dam & Lake No. 1 Site Plan
1	7-87	1 of 1	Dam & Lake No. 2 Site Plan
1	6-5-86	Copy	Dam # 1 Calculations
1	7-21-87	Copy	Dam # 2 Calculations
1		Copy	Watersheds for Lakes.

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval

☒ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution

☒ As requested ☐ Returned for corrections ☐ Return _____ corrected prints

☐ For review and comment ☐ _____

☐ FOR BIDS DUE _____ 19____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS

If you have any questions please do not hesitate to call!

COPY TO _____ SIGNED: Steven O. Wigley

McCALLUM
TESTING LABORATORIES INC.
Subsurface Exploration • Geotechnical Engineering

VINEYARDS DAM

WILLIAMSBURG, VIRGINIA

FILE 88-39

SAMPLES WILL BE RETAINED FOR 90 DAYS ONLY.
UPON 90 DAYS, SAMPLES WILL BE DISPOSED OF
IN ACCORDANCE WITH STATE REGULATIONS.

1808 HAYWARD AVENUE P.O. BOX 13337 CHESAPEAKE, VIRGINIA 23325-0337
TELEPHONE (804) 420-2520 . FAX (804) 424-2874

McCallum Testing Laboratories, Inc.

CHESAPEAKE, VIRGINIA 23325

LOG OF BORINGS

BORING NO. B-1 | LOCATION Williamsburg, VA | PROJECT Vineyards Dam | SURF. ELEV. _____

OUR FILE NO. L-327-131 | CLIENT'S ORDER _____ | DATE STARTED 6/15/89

WATER ELEV: IMMEDIATE DRY AFTER _____ HRS. _____ DATE COMPLETED 6/15/89

Elev.	Casing Blows	Samp. No.	Std. Pent. (N)*	Depth	Matl. & Color Change	DESCRIPTION
				0		
		1	9-12-13-12	2		Light yellowish brown, silty fine sand with silty clay lenses, moist, medium compact, SM, Possible Fill
		2	9-11-14-13	4	3.0	Same
		3	4-3-5-6	6		Light yellowish brown mottled light grey, fine sandy silty clay, moist, very stiff, CL, Possible Fill Same - stiff
		4	5-4-4-5	8	8.0	Same - stiff
		5	4-4-10-7	10		Yellowish brown mottled brown, fine sandy silty clay, moist, stiff, CL, Possible Fill
		6	10-12-19	15		Same - hard
		7	5-7-7	20		Same
		8	6-7-10	25		Same - with light grey mottles, very stiff

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED.

FORM L-104-A-1 GATLING BUSINESS FORMS CO., INC., NORFOLK, VA. 23502

McCallum Testing Laboratories, Inc.

LOG OF BORINGS CONTINUATION SHEET

BORING NO: B-1 LOCATION: Williamsburg, VA PROJECT IDENTIFICATION: Vineyards Dam

Elev.	Casing Blows	Samp. No.	Std. Pent. (N)*	Depth	Matl. & Color Change	DESCRIPTION
		9	7-10-9	30		Same - with light grey mottles, very stiff
		10	4-5-6	35		Same
		11	6-7-5	40	39.5	Light yellowish brown, silty fine sandy shell hash, wet, medium compact, SM
		12	5-6-6	45	42.0 45.5	Dark greenish grey, silty clayey fine sand with trace of shell fragments, wet, medium compact, SC
				50		Bottom of Boring 45.5 ft.

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED.

McCallum Testing Laboratories, Inc.

CHESAPEAKE, VIRGINIA 23325

LOG OF BORINGS

BORING NO. B-2 | LOCATION Williamsburg, VA | PROJECT Vineyards Dam

OUR FILE NO. L-327-131 | CLIENT'S ORDER | DATE STARTED 6/15/89

SURF. ELEV. | WATER ELEV: IMMEDIATE Dry | AFTER | HRS. | DATE COMPLETED 6/15/89

Elev.	Casing Blows	Samp. No.	Std. Pent. (N)*	Depth	Matl. & Color Change	DESCRIPTION
				0		
		1	10-16-17-16	2		Yellowish brown, silty clayey fine sand, moist, compact, SC, Possible Fill
		2	13-10-8-8	4	4.0	Same - mottled very dark greyish brown, medium compact
		3	10-9-11-14	6		Yellowish brown mottled light grey, fine sandy silty clay, moist, very stiff, CL, Possible Fill
		4	9-9-11-13	8		Same
		5	5-5-10-10	10		Same - without light grey mottles
		6	5-6-8	15		Same - stiff
		7	6-9-9	20		Same
		8	6-9-8	25		Same

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED.

FORM L-104-A-1 GATLING BUSINESS FORMS CO., INC., NORFOLK, VA. 23502

McCallum Testing Laboratories, Inc.

LOG OF BORINGS CONTINUATION SHEET

BORING NO: B-2 LOCATION: Williamsburg, VA PROJECT IDENTIFICATION: Vineyards Dam

Elev.	Casing Blows	Samp. No.	Std. Pent. (N)*	Depth	Matl. & Color Change	DESCRIPTION
		9	6-7-8	30		Same
		10	6-5-3	35		Same - with wood fragments, stiff
		11	7-7-8	40		Same
		12	4-3-3	45	45.0	Same - medium stiff
					47.0	Dark greenish grey mottled dark greyish brown and light yellowish brown, silty clayey fine sand with traces of shell, wet, loose, SC
		13	8-8-9	50	50.5	Dark greenish grey, silty clayey fine sand w/trace of shell fragments, wet, med. compact, SC
						Bottom of Boring 50.5 ft.

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED.

FORM L-106-A-2 GATLING BUSINESS FORMS CO., INC., NORFOLK, VA. 23502

McCallum Testing Laboratories, Inc.

CHESAPEAKE, VIRGINIA 23325

LOG OF BORINGS

BORING NO. B-3 | LOCATION Williamsburg, VA | PROJECT Vineyards Dam | SURF. ELEV. _____

OUR FILE NO. L-327-131 | CLIENT'S ORDER _____ | DATE STARTED 6/27/89

WATER ELEV: IMMEDIATE 9' AFTER _____ HRS. _____ DATE COMPLETED 6/27/89

Elev.	Casing Blows	Samp. No.	Std. Pent. (N)*	Depth	Matl. & Color Change	DESCRIPTION
				0		No Topsoil at this location
		1	4-6-7-8	2		Light yellowish brown, silty clayey fine sand with silty clay lenses, moist, medium compact, SC
		2	5-8-10-12	4	4.0	Same
		3	5-7-8-10	6	6.0	Mottled yellowish brown, light yellowish brown and light grey, fine sandy silty clay, moist, very stiff, CL
		4	9-10-10-11	8		Light yellowish brown, silty clayey fine sand, moist, medium compact, SC-SM
		5	3-3-3-4	10		Same - wet, loose
					12.0	
		6	2-1-1	15		Yellowish brown, silty fine sand, wet, very loose, SM
		7	2-2-3	20		Same - loose
					22.0	
		8	6-7-8	25		Light yellowish brown, silty fine sand with shell fragments, wet, medium compact, SM

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED.

McCallum Testing Laboratories, Inc.

LOG OF BORINGS CONTINUATION SHEET

BORING NO: B-3 LOCATION: Williamsburg, VA PROJECT IDENTIFICATION: Vineyards Dam

Elev.	Casing Blows	Samp. No.	Std. Pent. (N)*	Depth	Matl. & Color Change	DESCRIPTION
					27.0	
		9	4-4-5	30	30.5	Light yellowish brown, silty clayey fine sand, wet, loose, SC
						Bottom of Boring 30.5 ft.
				35		
				40		
				45		
				50		

*STANDARD PENETRATION INDICATED FOR EACH 6 INCHES OF DRIVE OF SPLIT TUBE SAMPLED.

UNIFIED SOIL CLASSIFICATION SYSTEM (U.S.C.S.)

Field Identification Procedures (Excluding particles larger than 75 μm and basing fractions on estimated weights)						Group Symbols [a]	Typical Names	Laboratory Classification Criteria
Coarse-grained soils More than half of material is *larger* than 75 μm sieve size[b]	**Gravels** More than half of coarse fraction is larger than 4 mm sieve size	Clean gravels (little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes			*GW*	Well graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of gravel and sand from grain size curve. Depending on percentage of fines (fraction smaller than 75 μm sieve size) coarse grained soils are classified as follows: Less than 5%: *GW, GP, SW, SP*. More than 12%: *GM, GC, SM, SC*. 5% to 12%: *Borderline* cases requiring use of dual symbols
			Predominantly one size or a range of sizes with some intermediate sizes missing			*GP*	Poorly graded gravels, gravel-sand mixtures, little or no fines	
		Gravels with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures see *ML* below)			*GM*	Silty gravels, poorly graded gravel-sand-silt mixtures	
			Plastic fines (for identification procedures, see *CL* below)			*GC*	Clayey gravels, poorly graded gravel-sand-clay mixtures	
	Sands More than half of coarse fraction is smaller than 4 mm sieve size	Clean sands (little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate particle sizes			*SW*	Well graded sands, gravelly sands, little or no fines	
			Predominantly one size or a range of sizes with some intermediate sizes missing			*SP*	Poorly graded sands, gravelly sands, little or no fines	
		Sands with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures, see *ML* below)			*SM*	Silty sands, poorly graded sand-silt mixtures	
			Plastic fines (for identification procedures, see *CL* below)			*SC*	Clayey sands, poorly graded sand-clay mixtures	
Fine-grained soils More than half of material is *smaller* than 75 μm sieve size (The 75 μm sieve size is about the smallest particle visible to naked eye)	Identification Procedures on Fraction Smaller than 380 μm Sieve Size							
	Silts and clays liquid limit less than 50	Dry Strength (crushing characteristics)	Dilatancy (reaction to shaking)	Toughness (consistency near plastic limit)				
		None to slight	Quick to slow	None		*ML*	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity	
		Medium to high	None to very slow	Medium		*CL*	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
		Slight to medium	Slow	Slight		*OL*	Organic silts and organic silt-clays of low plasticity	
	Silts and clays liquid limit greater than 50	Slight to medium	Slow to none	Slight to medium		*MH*	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
		High to very high	None	High		*CH*	Inorganic clays of high plasticity, fat clays	
		Medium to high	None to very slow	Slight to medium		*OH*	Organic clays of medium to high plasticity	
Highly Organic Soils		Readily identified by colour, odour, spongy feel and frequently by fibrous texture				*Pt*	Peat and other highly organic soils	

Use grain size curve in identifying the fractions as given under field identification

$C_U = \frac{D_{60}}{D_{10}}$ Greater than 4

$C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3

Not meeting all gradation requirements for *GW*

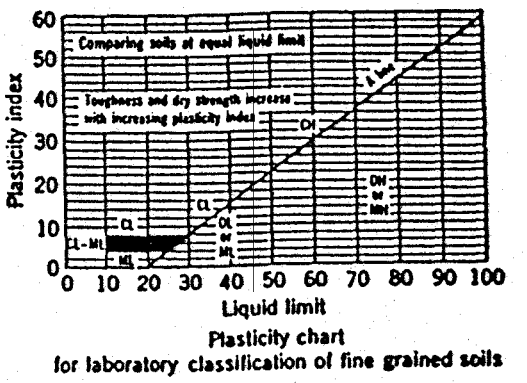
Atterberg limits below "A" line, or *PI* less than 4	Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
Atterberg limits above "A" line, with *PI* greater than 7	

$C_U = \frac{D_{60}}{D_{10}}$ Greater than 6

$C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3

Not meeting all gradation requirements for *SW*

Atterberg limits below "A" line or *PI* less than 5	Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
Atterberg limits below "A" line with *PI* greater than 7	



Plasticity chart
for laboratory classification of fine grained soils

[a] *Boundary classifications*. Soils possessing characteristics of two groups are designated by combinations of group symbols. For example *GW-GC*, well graded gravel-sand mixture with clay binder.
[b] All sieve sizes on this chart are U.S. standard.

DRAINAGE AREA MAP

THE VINEYARDS

SCALE: 1" = 100'

1614
3/2/86

CC005_VINEYARDS_AT_JOCKEYS_NECK_DAM_2 - 060

JAMES CITY COUNTY

48-1

JAMES CITY COUNTY

49-1

B-2

SECTION 48-3

SECTION 48-4

56-1

56-2

57-1

CC005_VINEYARDS_AT_JOCKEYS_NECK_DAM_2 - 061

1/12/99

VINEYARDS

Ches Bay Compliance

DAM II - DA = 109.1 ac

Dam I - DA = 128 ac

TOTAL = 237 ac

1. Pond SIZE -

   Permanent Pool = 4,100,000 ft^3 = 94 ac ft

2. For Storm 0.45" w/ 30% Imp Watershed, 237 ac

   V = 2.84 ac ft

   10V = 28.4 ac ft ⟹ Qualifies as 10 pt BMP

3. VINEYARDS PROJECT -

   661 ac

   113 SF - 17%

   24 Vill Housing - 3.6 %

   30 ac Est Lots - 4.5

   494 ac Open Space, Agric.

Dam I

Detention Pond Design for Jockey's Neck

(Use "Detention Pond Design for Small Basins")

by Steve Wigle
9/5/86
Submitted to I.C.C.
7/22/86 SW

Pre-development

Drainage Area – A = 108.8 ac (As per J.C.C. Tape)

Composite "C" value – 40% Woodlands C = 0.2
60% Cultivated & w/ comp C = 0.25

Use → C = 0.23

CA = 25.02

Time of Concentration – t_c = 44 min

L = 3520
ΔElev. = 57.4' S = 0.017
(As per Fig. 1.5.11. from "Data Book for Civil Eng." E.E. Seely)

Intensity – $I = \left(\frac{a}{b + t_c}\right)^{0.6}$ where $a_2 = 130.3$ $b_2 = 18.5$
$a_{10} = 189.2$ $b_{10} = 22.1$

I_2 = 2.1 in/hr I_{10} = 2.9 in/hr I_{100} = 5.0 in/hr

$Q_2 = CI_2A = 25.02(2.1) = 52.6$ cfs
$Q_{10} = CI_{10}A = 25.02(2.9) = 72.6$ cfs
$Q_{100} = CI_{100}A = 25.02(5.0) = 125.10$ cfs

Post-development

45% Residential A = 57.6 ac @ C = 0.45 CA = 25.92
55% Undeveloped A = 70.4 ac @ C = 0.23 CA = 16.19

ΣA = 128 ac ΣCA = 42.11

Use → C = 0.33

Soils – 14B, 29B > C

RCN – 77 – ½ ac lots ; open space

t_c = .5

Q_2 = 131 → Q_{out} = 50 cfs V_s = 4.7 ac ft = elev 38.7
Q_{10} = 277 → Q_{out} = 80 cfs V_s = 10.6 " " elev
Q_{100} = 527 → Q_{out} = 110 cfs V_s = 23.8 " " elev = 43.5

VJND1.DAT – JCITY Model

Q_2 = 87 cfs Q_{out} = 40 cfs Elev = 38.5 V_s = 4.2 ac ft $DA/_{12}$ = 2.22
Q_{10} = 173 cfs Q_{out} = 79 Elev = 39.9 V_s = 8.8
Q_{25} = 239 cfs Q_{out} = 99 Elev = 41.1 V_s = 13.1
Q_{100} = 319 Q_{out} = 149 Elev 42.2 V_s = 17.7

t_c = 0.25

Elev = 42.3 V_s = 18.2

$L = 2900$ L.F. $\quad \Delta Elev. = 57.4'$ $\quad S = 1.98\%$

$t_c = 16$ min.

$I_2 = 3.8$ in./hr., $Q_2 = 160.5$ cfs ... a 304% increase
$I_{10} = 5.0$ in./hr., $Q_{10} = 211.2$ cfs ... a 289% "
$I_{100} = 8.1$ in./hr., $Q_{100} = 342.1$ cfs ... a 274% "

- Critical Storm Duration for 2yr. Post-Development:

$$T_c = \frac{\sqrt{2CAa(b - t_c/4)}}{Q_o} - b$$

given: $C = 0.33$, $A = 128$, $t_c = 16$, $a = 130.3$, $b = 18.5$, $Q_o = 52.6$

$$T_c = \frac{\sqrt{2(0.33)128(130.3)(18.5 - 16/4)}}{52.6} - 18.5$$

$T_c = 36.6$ min.

$t_c = 16$ min.

- Peak Inflow

$$Q_o = CA\left(\frac{a}{b + T_c}\right) = 0.33\left(\frac{130.3}{18.5 + 36.6}\right)128 = 99.9 \text{ cfs}$$

- Req'd Storage for Critical 2yr. Storm

$$V = \left[Q_o T_c + \frac{Q_o t_c}{4} - \frac{Q_o T_c}{2} - \frac{3 Q_o t_c}{4}\right] 60$$

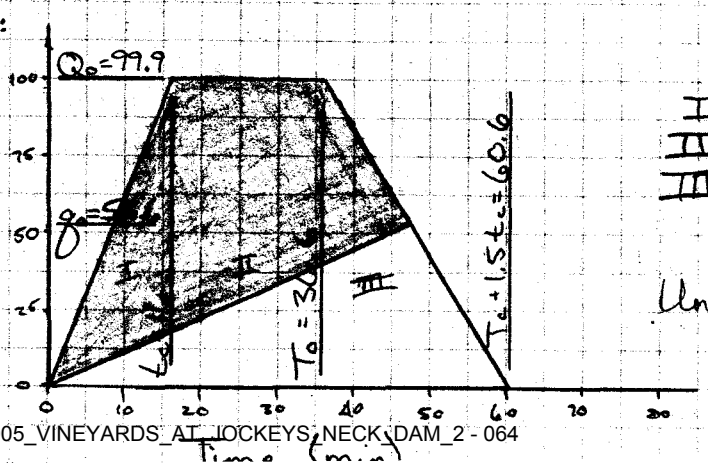
$$= \left[99.9(36.6) + \frac{99.9(16)}{4} - \frac{52.6(36.6)}{2} - \frac{3(52.6)16}{4}\right] 60$$

$V = 147{,}730$ ft^3 Say $150{,}000$ ft^3

- Req'd Sediment Storage Vol.

$V = 67$ cy/Ac $(128) = 231{,}552$ cf

Check:



	Area
I	$99.9(16)\frac{1}{2} = 799.2$
II	$99.9(20.6) = 2057.9$
III	$99.9(24)\frac{1}{2} = 1198.8$
	4055.9

Unshaded Area
$-52.6(60.6)\frac{1}{2} = -1593.78$

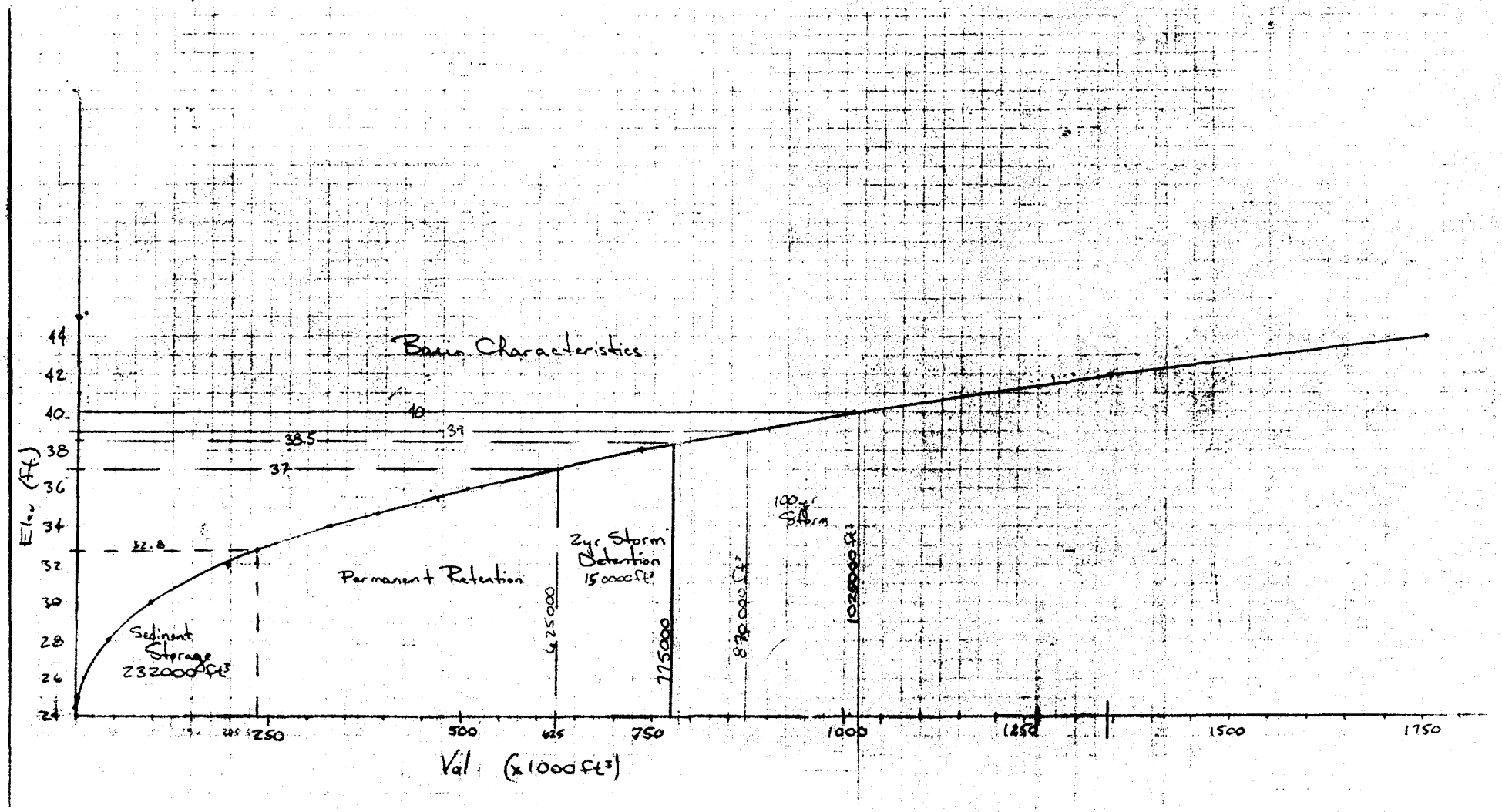
$2462.12(60) = 147730$ ft^3 checks

• Basin Characteristics

Elev.	Area (ft^2)	Incremental Vol. (ft^3)		Σ Vol. (ft^3)	
24.5	0			0	
		100			
25	200			100	
		11075			
26	10875			11175	
		29400			
28	18525			40575	
		56375			
30	37850			96950	
		95425			
32	57575			192375	
		137150			
34	79575			329525	
		179975			
36	100400		Σ Vol	509500	12 ac-ft
37	112,000	224625	0		
38	124225	118,100	118,100	734125	
		273350	391,450		
40	149125		726,825	1007475	
		335375			
42	186250		930,900	1342850	21.7
43	204,500	408625			
44	222375		1,135,450	1751475	26.1 ac-ft

— See Basin Characteristics Graph —

Basin Characteristics Graph



- Storage Elevations:

Sediment Storage of 231552 ft³ → Elev. 24.5 to 32.8 depth 8.3'
Permanent Retention → Elev. 32.8 to 37.0 Vol. = 625000 ft³
Need 150000 ft³ of detention → Elev. 37.0 to 38.5 Vol. = 785000 ft³

- Outlet Structure:

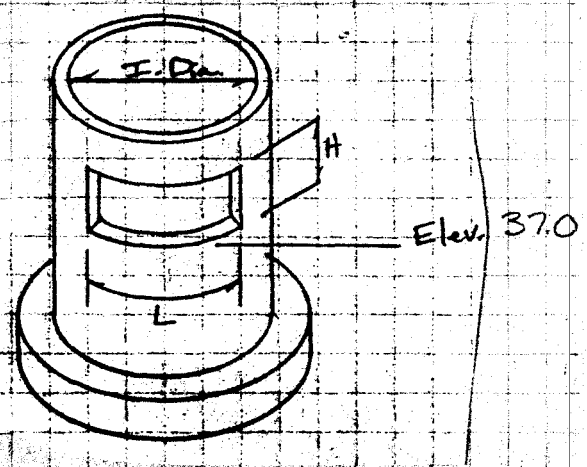
Use Precast Structure w/ Rectangular weir

$$Q = 3.33(L - 0.2H)H^{3/2}$$

where: $Q = 40.03$ cfs (52.6)
$H = 1.5$ ft

$$L = \left[\frac{Q}{3.33H^{3/2}}\right] + 0.2H = \left[\frac{40.03}{3.33(1.5)^{3/2}}\right] + 0.2(1.5)$$

$L = 6.84$ ft (8.97)



Size Structure's Inside Dia. by checking for min. 3H end contraction reg'mt.

Trial & Error Procedure

Try I. Dia = 5.5'
Perimeter = $2\pi r$ = 17.27'
2(3H) = 9' req'd
∴ 17.27 − 6.84 = 10.43' Good

Try I. Dia = 5.0'
Perimeter = 15.71'
∴ 15.71 − 6.84 = 8.87 Close Enough

Assume orifice flow condition occurs after water level reaches elev. 38.5' (1.5' above 2yr event weir). To route flood use trial & error.

Water Surf Elev. (ft)	Outflow (cfs), q_o	
37	0	Weir $Q = 3.33(L - 0.2H)H^{3/2}$
38	21.8	$L = 6.84'$ $h = 1'$
39	69.9	Orifice $Q = 0.6A\sqrt{2gh}$, $h = 2'$ $A = 10.26$ ft²
40	85.7	$h = 3'$
41	98.8	$h = 4'$
42	110.5	$h = 5'$

- Determine Hydraulic Performance of structure under 10yr. & 100yr. peak discharge storm conditions.

$Q_{10} = 124.2$ cfs $Q_{100} = 219.0$ cfs $t_c = 42$ min

10 yr. Storm $Q_{in} = 211.2$ cfs

Try Elev. 39' $q_o = 69.9$ cfs

Δstorage = 870000 - 625000 = 245000 ft³

$$V_o = \left[Q_o T_c + \frac{Q_o t_c}{A} - \frac{q_o T_c}{2} - \frac{3 q_o t_c}{4}\right] 60$$

Assume critical storm duration T for a 10 yr. storm equals t_c $\therefore T = t_c = 16$ min.

Then, $V_o = 60 t_c (Q_o + \frac{1}{4} Q_o - \frac{1}{2} q_o - \frac{3}{4} q_o)$

$= 60 t_c (\frac{5}{4} Q_o - \frac{5}{4} q_o)$

$= 75 t_c (Q_o - q_o)$

$V_o = 75(16)(211.2 - 69.9) = 169560$ ft³ Elev. too High

Try Elev. 38.5' $q_o = \left[\frac{21.8 + 69.9}{2}\right] = 45.9$ cfs

Δstorage = 785000 - 625000 = 160000 ft³

$V_o = 75(16)(211.2 - 45.9) = 198360$ ft³ Elev. too Low

Therefore say 10 yr storm is at Elev. 38.75'

100 yr Storm $Q_{in} = 342.1$ cfs

Try Elev. 40' $q_o = 85.7$ cfs

Δstorage = 1025000 - 625000 = 400000 ft³

$V_o = 75(16)(342.1 - 85.7) = 307680$ ft³ Elev. too high

Try Elev. 39.5 $q_o = \left[\frac{85.7 + 69.9}{2}\right] = 77.8$ cfs

Δstorage = 950000 - 625000 = 325000 ft³

$V_o = 75(16)(342.1 - 77.8) = 317160$ Close enough!

Therefore 100 yr. storm is at Elev. 39.5' N.

• Conclusion

Orifice will pass 77.8 cfs at elev. 39.5 while allowing for 100 yr. storm detention and release at a controlled rate minimizing damage to down stream channel. Provide D.I. to at elev. 40' and allow 1.5' freeboard to 20' emergency spillway, elev. 41.5'. Emergency spillway is designed to operate in excess of 100 yr. frequency storm. Allow 2' more to top of dam, for freeboard and construction tolerence, elev. 43.5'. The extra height of dam in combination with a 40' width of dam at the crest is to permit future development of a roadway across the dam.

Outlet Pipe Design

Pipe to pass 77.8 cfs

∴ Use 120' of 36" RCP @ 2.5%

$Q_{cap} = 95$ cfs

Anti-Seep Collar Design ("Design for Small Dams" Pg. 469)

Design collars to increase the seepage path by 15%

Length of 36" RCP = L = 120 $\quad 120(0.15) = 18'$

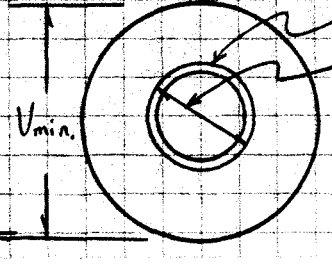
18' of verticle displacement of seepage path is needed.

H = height of collar
N = # of collars

$$N = \frac{18}{2H}$$

Try $H = 1.5'$ ∴ $N = 6$
Try $H = 2'$ ∴ $N = 4.5$ say 5

Therefore use 5 collars w/ $H = 2'$ above pipe o.c. of 16' (2 joints of pipe)



O.Dia. = 36 + 2(4.75) = 15.5"
V_{min} = 15.5 + 2(24) = 93.5"
Use V_{min} = 90" = 7.5'
(Rounded down to even ½ ft for ease in precast)

Increase in seepage path:

$$\frac{5[2(2)] + 120'}{120} = 1.17$$

∴ 17% Good

Buoyancy Calcs for Inlet Structure

Wt. & Vol. of 18 ft. structure:

Barrel — $Vol = (A_{OD} - A_{ID})h = \left[\pi\left(\frac{36.75}{12}\right)^2 - \pi\left(\frac{30}{12}\right)^2\right]17 = 167.1\ ft^3$

Top — $Vol = Ah = \pi\left(\frac{36.75}{12}\right)^2 0.5 = 14.7\ ft^3$

Base (extended = 87.5"o.c.) — $Vol. = Ah = \pi\left(\frac{43.75}{12}\right)^2 0.67 = 28\ ft^3$

Total Vol. = $209.8\ ft^3$

$W_{conc} = 150\ \#/ft^3$

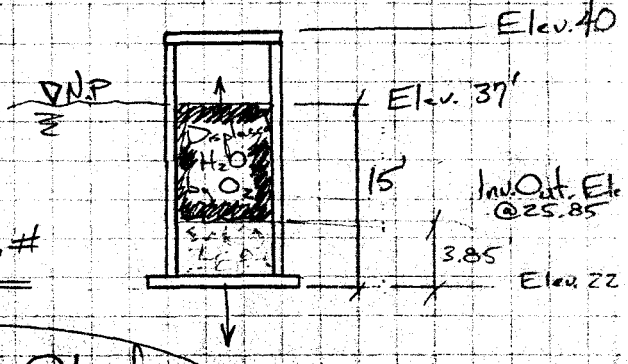
Total Wt = $209.8(150\ \#/ft^3)$

$Wt_T = 31470\ \#$

Wt & Vol. of H_2O displaced by Air

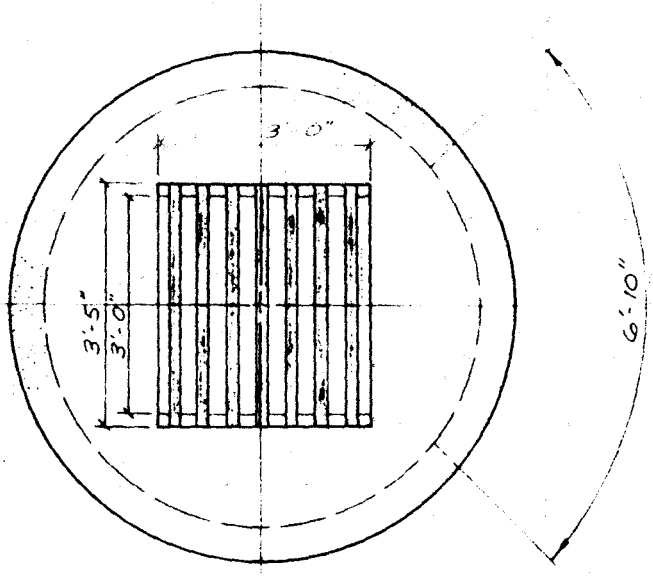
$Vol. = (15 - 3.85)\left[\pi\left(\frac{30}{12}\right)^2\right]$

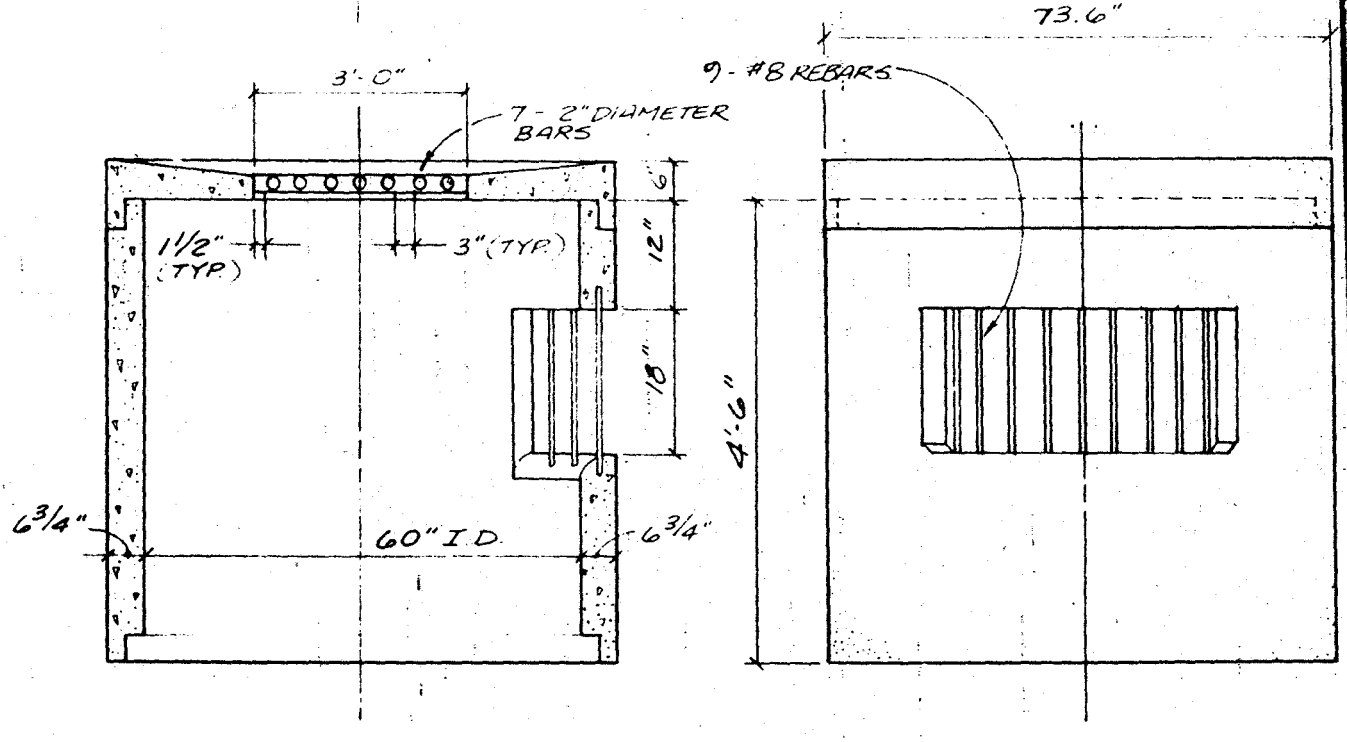
Vol. = $218.9\ ft^3$



$W_{H_2O} = 62.4\ \#/ft^3$ $Wt_w = 218.9(62.4) = 13659\ \#$

$Wt_T > Wt_w$ ∴ Will not float





SECTION A-A

ELEVATION

PRECAST RISER W/ ORIFICE

N.T.S.

Jockey's Neck

[redacted]

7/21/87
SPW.

Pre-development

Drainage Area = 4752000 S.F. = 109.1 Ac.

Composite "C" Value

	Area	C	CA
Woodlands	43.2 Ac.	0.2	8.64
Cultivated Pasture w/crop	65.9 Ac.	0.25	16.48
	109.1		25.12

$C = 25.12/109.1 = 0.23$

L = 3060 L.F. ΔElev. = 61 - 4 = 57'
S = 1.86%

t_c = 36 min. (Fig. 1.5.12.)

I_2 = 2.2 in/hr., Q_2 = 55.2 cfs

I_{10} = 3.6 in/hr., Q_{10} = 90.3 cfs

I_{100} = 5.5 in/hr., Q_{100} = 138.0 cfs

Post-development

Assume surrounding environs developed to:

90% Residential	= 98.2 Ac. @	C = 0.40	CA = 39.3
10% Woodlands	= 10.9 Ac. @	C = 0.23	CA = 2.5
	ΣA = 109.1 Ac		ΣCA = 41.8

C = 0.38

t_c = 18 min. (Fig. 1.5.12)

$I = \frac{a}{b + t_c}$

$a_2 = 130.3$ $a_{10} = 189.2$
$b_2 = 18.5$ $b_{10} = 22.1$

I_2 = 3.57 in/hr., Q_2 = 148.0 cfs — a 268% increase
I_{10} = 4.72 in/hr., Q_{10} = 195.7 cfs — a 216% increase
I_{100} = 7.90 in/hr., Q_{100} = 327.5 cfs — a 237% increase

- Critical Storm Duration For 2yr Post-dev.

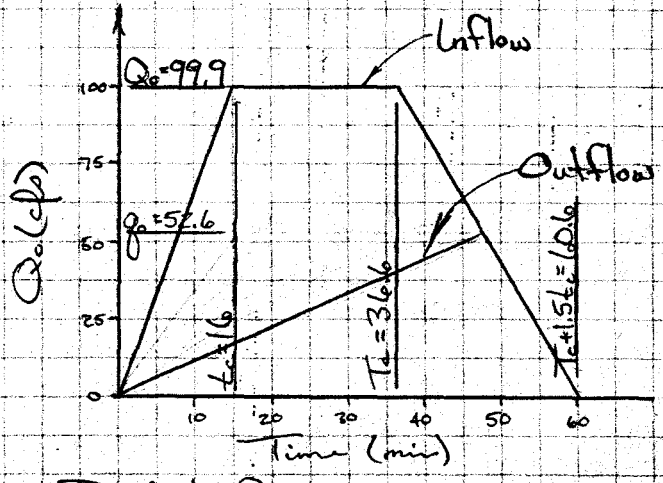
$$T_c = \frac{\sqrt{2CA_a(b - t_c/4)}}{g_o} - b$$

given: $C = 0.38$, $A = 109.1$ Ac, $t_c = 18$ min, $a = 180.3$, $b = 18.5$, $g_o = 55.2$ cfs (allowable peak outf

$$T_c = \frac{\sqrt{2(0.38)109.1(180.3)(18.5 - 18/4)}}{55.2} - 18.5$$

$T_c = 21.6$ min. , $t_c = 18$ min.

- Dam #1 Inflow & Outflow Hydrograph



- Peak Inflow

$$Q_o = CA\left(\frac{a}{b + T_c}\right) = 0.38(109.1)\left(\frac{180.3}{18.5 + 21.6}\right) = 125.3 \text{ cfs}$$

Dam #1 Outflow = 52.6 cfs

Q_o, Peak Inflow = 177.9 cfs

- Req'd Storage for Critical 2yr. Storm

$$V = \left[Q_o T_c + \frac{Q_o t_c}{4} - \frac{g_o T_c}{2} - \frac{3 g_o t_c}{4}\right] 60$$

$$= \left[177.9(21.6) + \frac{177.9(18)}{4} - \frac{55.2(21.6)}{2} - \frac{3(55.2)18}{4}\right] 60$$

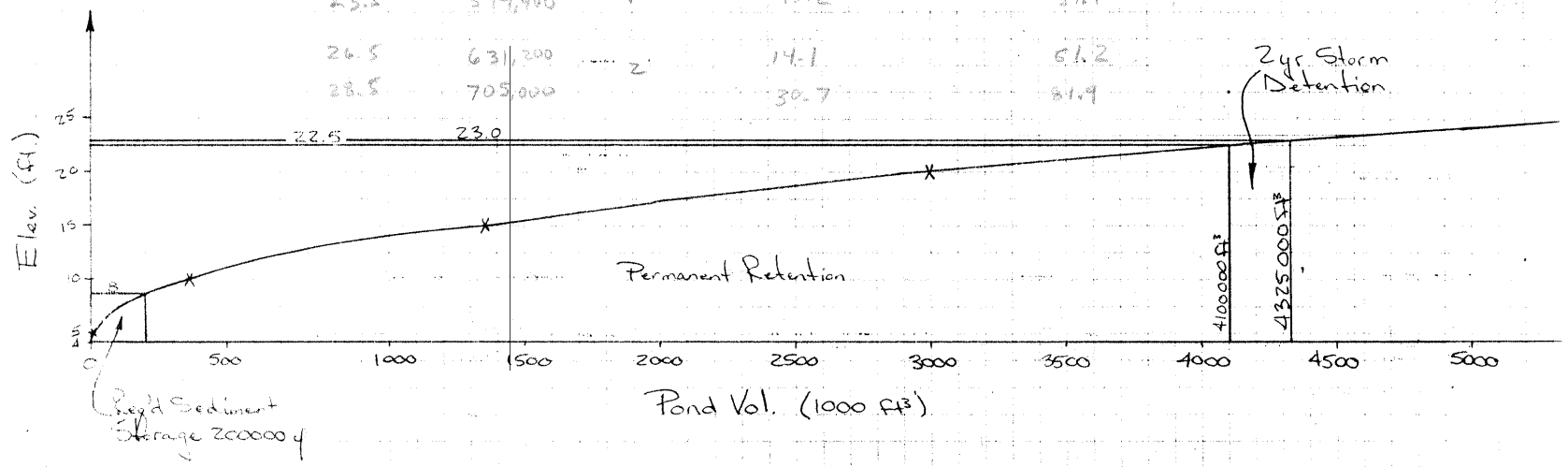
$= 225164$ ft^3 → say 225000 ft^3

- Req'd Sediment Storage Vol.

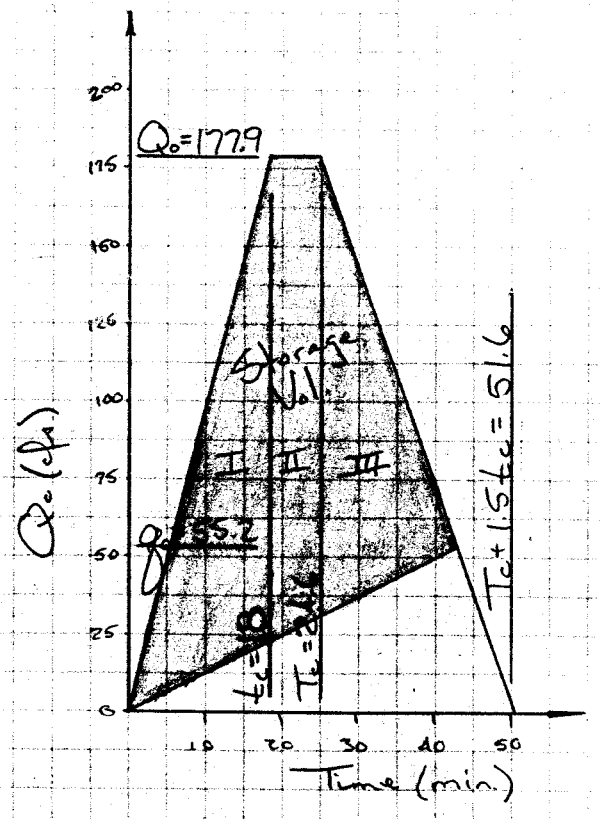
$V = 67(109.1)27 = 197362$ ft^3 → say 200000 ft^3

	Elev. (ft)	Area (ft^2)	Avg. Area (ft^2)	Depth (ft)	Incremental Vol. (ft^3)	Σ Vol. (ft^3)
	4	0				
			6000	1	6000	
	5	12000				6000
			72000	5	360000	
	10	132000				366000
			198000	5	990000	
	15	264000				1356000
			328000	5	1640000	
	20	392000				2996000
			484000	5	2420000	
	25	576000				5416000

	Area	Depth	Inc. Vol	Total Vol
22.5	484,000	1	0	0
		2		
24.5	557,600		23.9	23.9
25.5	594,400	1	13.2	37.1
26.5	631,200	1	14.1	51.2
28.5	705,000	2	30.7	81.9



Check.:



Area

I	177.9(18)½	= 1601
II	177.9(6.6)	= 1174
III	177.9(27)½	= 2402
		5177

Unshaded Area

55.2(51.6)½ = 1424

3753

$V = 3753(60) = 225170\ ft^3$ checks

- Storage Elevations

	Elev.	Vol. (ft^3)
Sediment Storage of 200000 ft^3	4' to 8.3'	200000
Permanent Retention	8.3 to 22.5'	4100000

Required 225000 ft^3 detention

- Outlet Structure

Use Precast Structure w/ Rectangular Weir

(Weir Eq'n) $Q = 3.33(L-0.2H)H^{3/2}$

where $L = 6.0$ ft

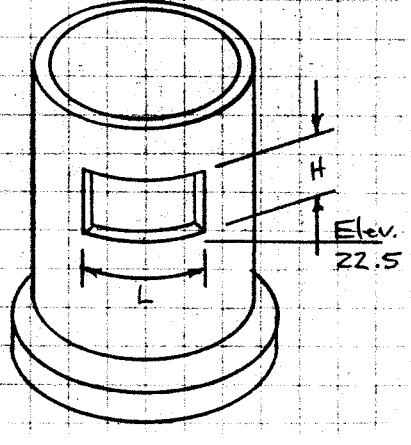
$H = 1.5$ ft

$Q = 3.33[6-0.2(1.5)]1.5^{3/2} = 34.9$ cfs < 55.2 ft^3 Good

Assume orifice flow condition occurs after water level reaches elev. 24 ft (1.5 ft above weir inv.)

(Orifice Eq'n) $Q = 0.6A\sqrt{2gh}$ where $A = 9\ ft^2$

Water Surface Elev. (ft)	Outflow (cfs)	Equation
22.5	0	Weir
23.0	6.9	L=6, h=0.5
23.5	19.3	L=6, h=1
24.0	34.9	L=6, h=1.5
24.5	61.3	Orifice A=9, h=2
25.0	68.5	A=9, h=2.5



- Determine Hydraulic Performance of Structure under 10yr & 100 yr peak discharge storm conditions

$Q_{10} = 195.7$ cfs $t_c = 18$ min.
$Q_{100} = 327.5$ cfs

10 Yr. Storm $Q_{in} = 195.7$ cfs

Try Elev. = 23.5 $q_o = 19.3$

Δstorage = 4575000 − 4100000 = 475000 ft³
$V_o = 75 t_c (Q_{in} - q_o) = 75(18)(195.7 - 19.3) = 238140$ ft³ Elev too High

Try Elev. 23.0 $q_o = 6.9$

23.0 is the 2yr. storm elev., therefore the 10yr storm event is between 23.0 & 23.5 say → **Elev = 23.25'**

100yr. Storm $Q_{in} = 327.5$ cf

Try Elev. = 23.5 $q_o = 19.3$

Δstorage = 475000 ft³
$V_o = 75(18)(327.5 - 19.3) = 416070$ ft³ close enough

Elev. = 23.5 ft

Total Discharge Under 100yr Storm Conditions
$Q_o = 19.3$ cfs → Use $q_2 = 55.2$ cfs (allowable peak flow)

Use @ 30" RCP @ 2.3% $Q_{cap} = 58$ cfs

Anti-Seep Collar Design

Design Collars to increase the seepage path by 15%

Length of 30" RCP = 128' 128(0.15) = 19.2'

20' of verticle displacement of seepage path is needed.

H = height of collar $N = \frac{20}{2H}$
N = # of collars

Try H = 2', then N = 5

Use 5 collars w/ H = 2' above pipe, O.C. of 16' (2 joints of pipe)

Increase in Seepage path:
$\frac{5[2(2)] + 128}{128} = 1.16$ 16% increase

Bouyancy Calcs For Inlet Structure

Wt. & Vol. of 23.5ft. Structure:

Barrel - $Vol. = (A_{out} - A_{in})h = \left[\pi\left(\frac{36.75}{12}\right)^2 - \pi\left(\frac{30}{12}\right)^2\right]22.5 = 221.2\ ft^3$

Top - $Vol. = Ah = \pi\left(\frac{36.75}{12}\right)^2 0.5 = 14.7\ ft^3$

Base - $Vol. = Ah = \pi\left(\frac{43.75}{12}\right)^2 0.67 = 28\ ft^3$

(extended - 87.5' O.C.

Total Vol. = 263.9 ft^3

Total Wt. = 263.9 (150 #/ft^3)

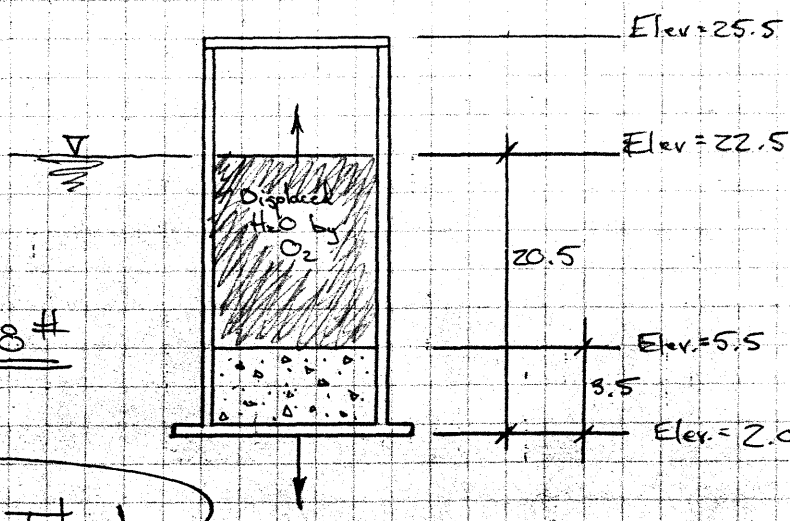
Wt_T = 39585.0 #

W_c = 150 #/ft^3

Wt & Vol. of H_2O displaced by Air

Vol. = (20.5 - 3.5) $\pi\left(\frac{30}{12}\right)^2$

Vol. = 333.8 ft^3



W_{H_2O} = 62.4 #/ft^3

Wt_w = 333.8 ft^3 (62.4) = 20828.8 #

$Wt_T > Wt_w$ ∴ Will Not Float

JCC Model

T_{100} = 627

Q_{OUT} = 115 cfs

Elev = 27.0

Vol = 58.1

Q_{100} = 360 cfs

Q_{OUT} = 41.5

Elev = 25.0

Vol = 30.6 ac ft

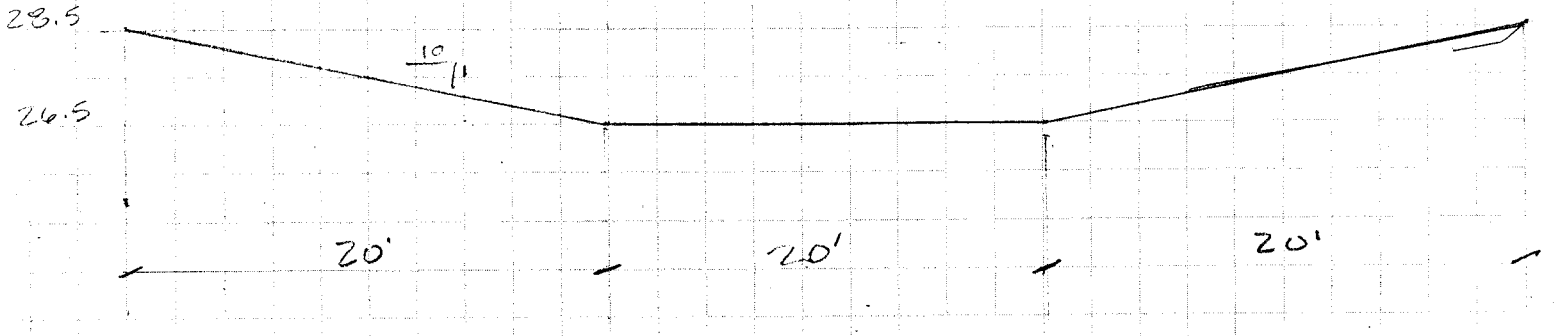
Langley and McDonald
A PROFESSIONAL CORPORATION
ENGINEERS · PLANNERS · SURVEYORS
VIRGINIA BEACH - WILLIAMSBURG, VIRGINIA

Subject REPLACEMENT SPILLWAY
Computed By DSL Checked By

Project No. 88039
Client EMMET
Date 8-11-89 Sheet No. 1/3

NEW ROAD GRADING PROHIBITS USE OF WIER TYPE EMERGENCY SPILLWAY. → REPLACE WITH EQUIVALENT CULVERT(S).

1. DETERMINE FLOW THROUGH ORIGINAL SPILLWAY
L = 30' ∴ HYDRAULICS ARE CLOSE TO CRUMP CHANNEL



grass surface → n = 0.020
minimal slope → S_o = 0.001

100 year flood elev. = 23.5' < 26.5' spillway elev.
∴ check capacity @ 0.25' intervals
per Manning's equation: $Q = A \frac{1.49}{n} S_o^{1/2} R_H^{2/3}$

depth	Area sq ft	P_w ft	$R_H = \frac{A}{P_w}$	V fps	Q c.f.s	Water Elev. ft M.S.L.
0.25	5.625	23.17	0.2428	0.7119	5.20	26.75
0.50	12.5	30.05	0.4160	1.1538	14.41	27.0
0.75	20.62	35.07	0.5880	1.6539	34.12	27.25
1.00	30.00	40.10	0.7481	1.941	58.28	(27.50)
1.25	40.62	45.12	0.9004	2.137	86.8	27.75
1.50	52.5	50.5	1.1222	2.244	117.7	28.0

allows 1' freeboard
use 58 cfs for emergency spillway flow

2) DETERMINE PIPE SIZE FOR REPLACEMENT SPILLWAY
· TRY MULTIPLE HORIZONTAL ELLIPICAL PIPES

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

Subject EMERGENCY SPILLWAY REPLACEMENT PIPES
Computed By DSL Checked By

Project No 88037
Client ELLIETT
Date 2-15-89 Sheet No. 2/3

(FOR ANY PIPE S = MIN FOR 5fps VELOCITY)

PIPE SIZE	TOP OF PIPE*	CROWN	INVERT	FULL FLOW/PIPE cfs	# REQ'D for 58cfs
14 x 23" HE	28.5	28.27	27.10	5.4	11
19 x 30" HE	28.5	28.23	26.65	9.9	6
24 x 38" HE	28.5	28.19	26.19	15.3	4
29 x 45" HE	28.5	28.13	25.71	22.2	3
34 x 53" HE	28.5	28.08	25.25	30.6	2

N.G. → # pipes or pipe size is excessive because of velocity restraints.
ALSO - HERCP culverts would require displacing waterline and Force main.

Try using a junction box to lower pipes under utilities. This will also allow for small steep pipes on the intake and, a flat slow pipe or pipes will be required for outfall - max velocity 5fps

Intake pipes - 3-18"ϕRCP @ S=3% yeild 60cfs @ 14fps

Outfall = 4"ϕRCP @ 0.07% yeild = 58cfs @ 3.5fps

* ROAD ℄ ELEV - MIN. COVER = 30.0 - 1.5 = 28.5 FOR HERCP

Langley and McDonald
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ENGINEERS • PLANNERS • SURVEYORS
VIRGINIA BEACH • WILLIAMSBURG, VIRGINIA

Subject

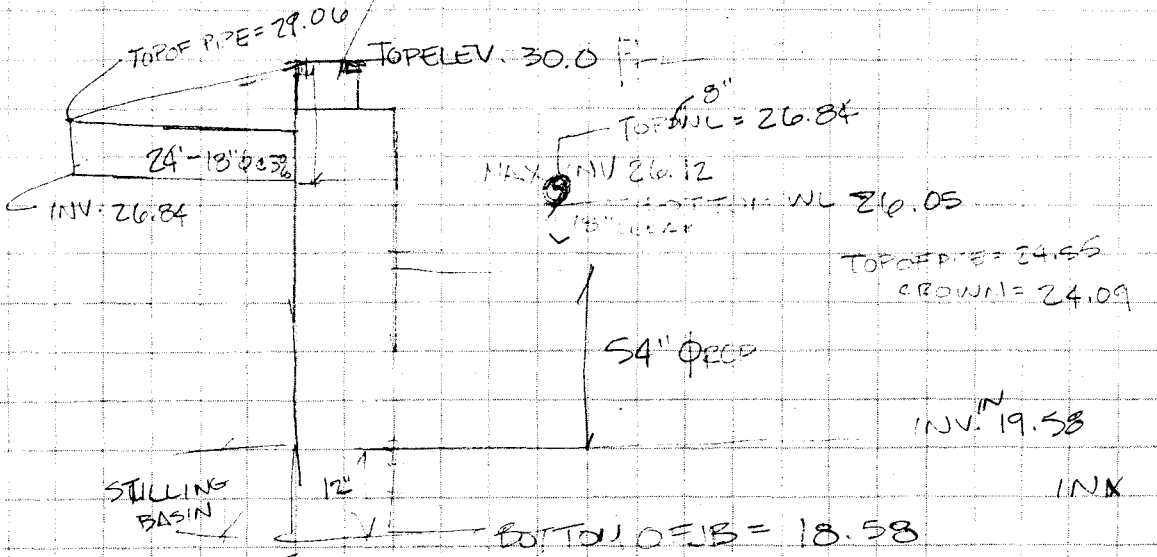
Computed By JSC Checked By

Project No. 88037

Client

Date 8/16/89 Sheet No. 3 of 3

STA. 55+50



NG → 100 deep

pipe

try squeezing pipes over water line → ok see plans

AES, A PROFESSIONAL CORPORATION
Engineering And Surveying
1761 Jamestown Road
WILLIAMSBURG, VIRGINIA 23185

(804) 253-0040

LETTER OF TRANSMITTAL

DATE	JOB NO.
Sept. 2 '88	6518

ATTENTION: Darryl Cook

RE: Jockey's Neck Dam I & II

TO James City County
Public Works & Utilities

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☒ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1		Full Set	Site Plan Dam I
1		1 of 1	Site Plan Dam II
1		Copy	As Built X-sections Dam I (incomplete)
1		Copy	As Built X-sections Dam II
1		Copy	Dam I Calculations
1		Copy	Dam II Calc's
1		Copy	Watersheds for Dam I & II

RECEIVED
9-2-88

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval

☒ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution

☒ As requested ☐ Returned for corrections ☐ Return _____ corrected prints

☐ For review and comment ☐ _____

☐ FOR BIDS DUE _____ 19____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS

If I can be of further assistance please give me a call.

COPY TO _____ SIGNED: Steven O. Wiley

If enclosures are not as noted, kindly notify us at once.

Langley and McDonald Transmittal

ENGINEERS·PLANNERS·SURVEYORS

484 Newtown Road
☐ Virginia Beach, Virginia 23462
(804) 473-2000

☒ 204-C Packets Court
Williamsburg, Virginia 23185
(804) 253-2975

RECEIVED 9-2-88

Project: Vineyards

To: Darryl Cook
J.C.C.

From: Roy Dezern

Date: 9-2-88

Reply requested: ☒ Yes ☐ No

Reply to: Roy Dezern

We are sending you:
☒ Attached
☐ Under separate cover via: _____
☒ Prints
☐ Copy of letter
☐ Plans
☐ Specifications
☐ Shop drawings
☒ other

Transmitted as checked below:
☐ For your use
☐ As requested
☐ For review and comment
☒ For approval
☐ Return for correction
☐ Approved as noted
☐ Approved
☐ _____

Copies	Date	No.	Description
1 set			Subdivision Plans
1			Erosion Sediment Control Bond ($135,000)
1			Power of Attorney
1			Land Disturbing Permit Application

Remarks: Our client would like to obtain a clearing & grading permit as soon as possible

Copies
1. File: 88-039
2. _____
3. _____
4. _____

CC005_VINEYARDS_AT_JOCKEYS_NECK_DAM_2 - 082

Enclosures
☐
☐
☐
☐

Langley and McDonald

By: Roy Dezern

DEVELOPMENT MANAGEMENT

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

CODE COMPLIANCE
(757) 253-6626
codecomp@james-city.va.us

ENVIRONMENTAL DIVISION
(757) 253-6670
environ@james-city.va.us

PLANNING
(757) 253-6685
planning@james-city.va.us

COUNTY ENGINEER
(757) 253-6678

INTEGRATED PEST MANAGEMENT
(757) 253-2620

October 13, 2000

Mr. David Coffield
The Vineyards
2400 Farah Spence
Williamsburg, Va. 23185

Re: The Vineyards at Jockey's Neck
Stormwater Management Facilities

Dear Mr. Coffield:

As discussed, the Environmental Division is willing to meet with you and other association representatives concerning the two wet ponds (lakes) located within the Vineyards at Jockey's Neck.

I have attached some "first contact" information for your use. The information includes some general landscaping tips for stormwater management BMP's (Best Management Practices), a sample maintenance plan for wet (retention) ponds and some general brochures relative to liability and maintenance. Issues related to pond maintenance plans can be expanded upon following field observations, review of design and record plans (if available) and open discussions at the site.

We look forward to meeting with you on Wednesday October 18th at 3:00pm. If you have any questions or comments in the meantime, please contact me at 757-253-6639.

Sincerely,

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

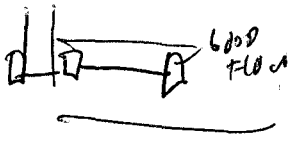
SWMProg\Education\Subdivsions\VIneyards.let1

- Close to transition to HOA.
- Check Vol Dam 2
  Possible - OCR Jurisdiction
- Goals
  Dam Safety. Slide Prisent.
  Algae.
- Hatus - Board
- Winery - Chemical Applications (Concern)
- Covenants

Lake 2 - Floyd over Road. (2-3")

Storm drains & Road Lows ⇒ Ponds

Goodridge Differ - Underground Stream



Lake 1 - (Clearin River Joints?)

400 - #1 mile Homes

- Trib to College Creek.

DEVELOPMENT MANAGEMENT

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

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planning@james-city.va.us

COUNTY ENGINEER
(757) 253-6678

INTEGRATED PEST MANAGEMENT
(757) 259-4116

January 16, 2001

Mr. David Coffield
The Vineyards
2400 Sarah Spence
Williamsburg, Va. 23185

Re: The Vineyards
Dam # 1 Joachin and Dam # 2 Ajacan Lakes
Stormwater Management Facilities
County Plan No. S-52-88; County BMP ID Codes (CC 013 and CC 005)

Dear Mr. Coffield:

At your request, the Environmental Division is forwarding information relative to a meeting held on October 18th for the above referenced facilities. In addition to specific comments as outlined below, the following additional information is also attached for your group's review and use:

- ☐ A 1 inch = 800 ft. scale map showing the general location of the development's two stormwater management facilities (lakes).
- ☐ Current Inspection Reports for the facilities as performed on November 28th 2000.
- ☐ Typical Maintenance Plans prepared for both facilities.
- ☐ General Landscaping Guidance (Tips).
- ☐ Two (2) Informative Brochures published by the Association of State Dam Safety Officials - *Dam Ownership: Responsibility and Liability* and *Dam Ownership: Procuring the Services of a Professional Engineer*.
- ☐ An informational brochure entitled *A Guide for Maintaining and Operating BMP's*. This publication is distributed through our office in response to a cooperative effort from the Hampton Roads Regional Stormwater Management Committee and HR STORM, a regional stormwater education effort coordinated by the Hampton Roads Planning District Commission.
- ☐ Information relative to the Virginia Department of Conservation and Recreation's Dam Safety Program, including summary information from their website and a copy of the Virginia Impounding Structure Regulations (1997).

Currently there are 3 sheets of plan and detail drawings related to design and construction of Dam #1 (Joachin) and Dam # 2 (Ajacan) in our records file. These plans were prepared by AES Consulting Engineers (Project No. 6518) in July of 1986 and 1987. The plan for Dam # 2 reflects an as-built status for the outlet structure dated June 1988. These drawings, as well as any hydrologic and hydraulic maps or computations, are available for sign out and reproduction by your group if desired.

General maintenance plans were prepared and provided for both facilities as a courtesy. The plans were prepared based on our general knowledge of maintenance required for these types of facilities and subsequent to our site specific inspections. It is provided for information and guidance purposes when no other specifically approved maintenance plans are available for use. The plans are not meant to replace or supersede any specific recommendations offered by a qualified professional.

The maintenance plans only address normal structural, stormwater runoff control and aesthetic activities related to safe function of the facility. Landscaping, cosmetic or ornamental features associated with the facility are usually left to the discretion of the Owner, or its designated representative, unless these features deter from the structural integrity or the performance of water quality/quantity controls as designed and constructed for the facility.

Specific Comments about Dam # 1 Joachin (Upper Lake - CC 013):

Based on field observations, the facility appears to be in satisfactory condition for its age. Adequate maintenance mowing is being performed routinely on the top berm of the facility. However, the facility is in need of regular (routine) maintenance typical of most wet pond facilities. From our perspective, main concerns were the presence of trees on and along the downstream fill embankment; debris and tree growth in the vicinity of the riser structure; and minor joint leakage observed in the upper portion of the concrete riser structure.

The pond embankment is steep and high on the downstream face. Large trees to 6-inch diameter, smaller saplings and heavy ground cover and vegetation are present on most of the downstream embankment, especially lower portions of the embankment adjacent to normal pool of Dam # 2 (Ajacan). Several of the larger trees are well-established and roots have penetrated into the embankment zone.

Usually trees, shrubs and woody vegetation are not permitted to grow on any part of pond embankments constructed using engineered (compacted) fills. Saturated roots mats combined with high wind can cause trees to overtop and accelerate soil erosion and embankment failure conditions. In addition, fluctuating water surface elevations in Dam # 2 could potentially cause trees on the lower portion of the embankment to become exposed to saturated conditions, thus increasing the potential to die, overtop and create a structural concern for the Dam # 1embankment. Usually for this type of condition, we recommend that the subject trees be cut to or below ground level and be maintained in that fashion as to not disturb root systems that may already be extensive and efforts be made to replace the tree growth with an established low maintenance grass covering.

There was a considerable amount of trash, debris (leaves, dead tree branches, etc.) and trees and vegetation near and around the vicinity of the riser's DI-7 top grate. It is recommended to clean and remove all debris and trees from within 15 ft. of the riser to prevent unobstructed weir flow into the riser grate and to minimize root growth migration into the riser's joints.

Finally, there was a minor observation of seepage through the joints of the riser in its upper sections. This condition does not currently appear to be a major structural concern to the riser, however, an attempt to correct the condition should be performed concurrently with debris and tree removal operations around the riser. Although it does not appear the riser needs to be reset or replaced at the current time, interior joint sealing with grout should be performed to alleviate this condition. Continued migration of tree root systems through the riser could seriously displace the joints in the riser structure and cause structural instability.

Specific Comments about Dam # 2 Ajacan (Lower Lake - CC 005):

Adequate maintenance and mowing is being performed routinely on the top 1/3 portion of the facility along the paved curb and gutter roadway. However, the facility is in need of regular (routine) maintenance typical of most wet pond facilities and several non-routine maintenance action items were also noted. From our perspective, main concerns were the presence of trees on and along the bottom two-thirds portion of the downstream fill embankment; soft soils and minor seepage on the downstream west toe (emergency spillway side); soft soils and considerable seepage on the downstream east toe; degradation of the interior coating within the primary CMP outlet barrel; severe erosion and undercutting at the outlet barrel outfall; severe erosion and damage to the emergency spillway lining; and debris and tree growth in the vicinity of the riser structure.

Larger 2- to 6-inch trees, smaller saplings and heavy ground cover and vegetation are present on the entire bottom 2/3 portion of the downstream embankment. Several of the larger tree species are pine which pose a distinct threat to the structural integrity of the embankment. Usually trees, shrubs and woody vegetation are not permitted to grow on any part of pond embankments constructed using engineered (compacted) fills. Saturated roots mats combined with high wind can cause trees to overtop and accelerate soil erosion and embankment failure. Usually for this type of condition, we recommend that the subject trees be cut to or below ground level and be maintained in that fashion as to not disturb root systems that may already be extensive and efforts be made to replace the tree growth with an established low maintenance grass covering. For this case, we recommend that the maintenance zone, which is adequate on the upper 1/3 part of the downstream embankment be expanded in the same manner to include the lower 2/3 of the downstream embankment. This expansion can be performed all at once or phased over the next couple of maintenance (tree removal) cycles.

Soft soils and minor seepage was observed along the downstream left (west) embankment toe near the outlet barrel location. Although minor, this condition should be monitored and evaluated on a regular, continuing basis. A more discernible seepage area was observed along the downstream right (east) embankment toe approximately 125 ft. east of the outlet barrel. The seepage area was approximately 20 feet in length, had an approximate 12 inch depth and flow was considerable (estimated at > 1 gpm). Discoloration and an oily film was observed on the surface of the discharge from the seep area. This area should be inspected by a qualified professional engineer and its effect/impact to the structural integrity of embankment properly evaluated. In addition, the seepage area should be monitored in the future on a regular, continuing basis.

At the downstream end of the principal spillway outlet barrel (36-inch CMP), the end section was undercut by erosion into the dam embankment approximately 3 feet. Continued erosion under the barrel threatens the integrity of the outlet barrel and dam embankment toe. Remediation should include removal of the end section, proper placement of compacted soil material, resetting the flared end section and placement of armor protection over the soil to prevent reoccurrence.

The outlet protection pad at the barrel outfall is missing and needs replaced and a large tree (and rootmat) which has fallen at the outlet protection location needs removed.

Based on observation, the bituminous coating within the lower end of the 36-inch outfall barrel appeared worn and flaking, especially in the bottom portion of the pipe up to about ½ pipe depth. Although the inner metal wall of the pipe did not appear corroded, over time a lack of and continued loss of the inner pipe wall coating will tend to lead to premature corrosion and possible failure of the outlet barrel. It is highly suggested that a suitable lining be re-established in the pipe interior where loss has occurred. There are several after market type in-situ lining materials that can be applied to protect the pipe inner wall from further degradation.

There was a considerable amount of trash and wood debris and trees and vegetation near and around the vicinity of the riser's DI-7 top grate and its rectangular weir slot. Clean and removal of all debris and trees from within 15 ft. of the riser is recommended to prevent unobstructed weir flow to the riser grate and to minimize root growth migration into the riser joints. Also, exposed rebar was present on all three - 18 inch diameter emergency spillway overflow pipes on the upstream side of the embankment.

Of primary concern to the integrity of the facility is a severe erosion and undercutting condition observed along the outlet channel portion of the emergency spillway. All erosion protection rock (riprap) which was placed within the channel has displaced and the underlying geotextile is fully exposed and damaged. A 7' wide x 7' long x 4' deep scour hole has formed at the bottom of the spillway. The emergency spillway has fully failed, offers no type of erosion protection for larger storm events and is in need of immediate attention to restore it back to its intended design function. Continued erosion and undercutting along the emergency spillway outlet channel poses a severe threat to the integrity of the downstream embankment.

Interior Storm Drainage System:

Spot checks were performed at several of the inlets/storm drain systems tributary to Dam # 2. In general, these systems are small cross-culvert and collection subsystems which are mainly located at road profile low points. These systems collect "through" (on and offsite) drainage from open channels and roadside drainage via paved roadway and curb and gutter flow. Based on our physical inspection of approximately 6 inlets within 2 of the storm drainage subsystems on the eastern side of Jockey's Neck Trail, the systems appear to be adequate for their intended function and appear to be routinely cleaned and maintained, as no accumulations of leaves, debris, etc. was observed beyond that to be expected during the fall/early seasons.

Other:

Some concern was presented about whether the lower lake, Dam # 2 Ajacan (CC 005) fell under the criteria of a permitted dam facility per the Virginia Dam Safety regulations. These regulations exclude a dam if the downstream embankment is less than 25 feet (as measured from the streambed at the downstream toe to top of the impounding structure) ***and*** creates a maximum impoundment greater than 50 acre-feet. There are also provisions for exclusion of dams constructed, maintained or operated primarily for agricultural purposes which are less than 25 feet in height or which create a maximum impoundment smaller than 100 acre-feet.

Based on our cursory review of file information, design volume to El. 25.0 is approximately 124.33 acre-feet and original design top of dam is at El. 28.5; therefore, there appears to be volume well in excess of either 50 or 100 acre-feet. Original design dam height was approximately 24.5 feet (El. 28.5- El. 4.00 = 24.5 feet). Per as-built information dated June 27th 1988, the actual downstream invert of the outlet barrel was defined as El. 5.22 rather than El. 4.00 per design, thus resulting in a dam height of 23.28 feet (El. 28.5 - 5.22 = 23.28 feet). In August of 1989, computations as performed to size an emergency spillway pipe system across the embankment/roadway reflected a road centerline design elevation at El. 30.0, which would result in a dam height of 24.78 feet (El. 30.0 - El. 5.22 = 24.78 feet). Although it appears the original dam design and modifications would not require the facility to fall under state permitting criteria because of dam height, our records do not reflect any as-built information for the top of the facility; thus it is unclear if 25 feet in vertical distance is present.

It is our recommendation that dam height be confirmed via field survey based methods, and since land-use alterations may have changed original classifications assigned to the dam, determination of permits and classification under the Dam Safety Act requirements, if necessary, be coordinated with the following office:

Department of Conservation and Recreation
Division of Dam Safety
203 Governor Street, Suite 402
Richmond, Va. 23219
Att: Mr. Jon Phillippe
804-786-1369

I have attached some general information from the Virginia dam safety program website at www.dcr.state.va.us/damsafty and my most current copy of the Virginia Impounding Structure regulations for your review.

Hopefully, this material is helpful to your group to understand maintenance associated with both facilities. Please review the attached information and contact us at 757-253-6639 or 757-253-6673, if you have any further questions or comments.

Sincerely,

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

SJT/sjt
Enclosures

cc: Robert Emmett

Shared\SWMProg\Education\Subdivisions\Vineyards.lett1

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

S-52-88
GPIN 4840100011

Database Inventory No. (if known): CC005

Name of Facility: VINEYARDS @ JOCKEYS NECK SEC 1 & 2 DAM #2 AJACAN LAKE BMP No.: 2 OF 2 Date: 11/28/00

Location: JOCKEYS NECK ROAD (NEAR CLUBHOUSE)

Name of Owner:

Inspector: SJ Thomas

Type of Facility: Wet Pond (Dam) VDOT ROAD-EMBANKMENT

Weather Conditions: Sunny, Cool, 50's

If an inspection item is not applicable, mark NA, otherwise mark the appropriate column. (NOTE: LOWER LAKE EMBANK 1's)

O.K. - The item checked is in adequate condition and the maintenance program is currently satisfactory.
Routine - The item checked requires attention, but does not present an immediate threat to the function of the BMP.
Urgent - The item checked requires immediate attention to keep the BMP operational and prevent damage to the facility.

Provide an explanation and details in the comment column, if routine or urgent are marked.

Facility Item	O.K.	Routine	Urgent	Comments
Embankments and Side Slopes:		O/S 2H:1V±		No Trees (med or large) present upper 1/3
Grass Height	X			GRASS ALONG ROAD CURB 8' WIDE
Vegetated Condition	X	X		2'-4' HIGH SAPLINGS, YOUNG / 2-6" TREES O/S HALF
Weed Growth	X	X		1-2' HIGH WEEDS + BRUSH
Erosion	X			None Observed.
Trash & Debris	X			MINOR AT O/S toe (west)
Seepage	X	X		Wet soils at O/S Left (west) NEAR BARREL
Fencing or Benches	N/A			BAD SEEP O/S RIGHT (EAST) SEE NOTE
Constructed Wetlands (Interior Landscaped & Planted) Areas:				NATURAL WET POOL LAKE.
Vegetated Conditions	N/A			
Trash & Debris	N/A			
Floatables	N/A			
Erosion	N/A			
Sediment	N/A			
Dead Plant	N/A			
Aesthetics	N/A			
Other	N/A			

Facility Item	O.K.	Routine	Urgent	Comments
Water Pools ☒ Permanent Pool (Retention Basin) ☐ Shallow Marsh (Detention Basin)				4' DEEP AT RISER
Shoreline Erosion	X			WOODED + LAWN Alternating.
Algae	X			None.
Trash & Debris	X			
Sediment	X			
Aesthetics	X			NATURAL, CLEAN LOOK.
Other	X			SHORELINE CATTAILS, SEDGES, GRASSES
Inflow Stuctures (Describe Locations): VARIOUS OPEN CHANNELS, SHEET FLOW + INLET/STORM DRAINS.				
Condition of Structure	X			
Erosion	X			
Trash and Debris	X			
Sediment	X			
Aesthetics	X			
Other	X			
Principal Flow Control Structure - Intake, Riser, etc. (Describe Location): South Side at VDOT ROAD 6'x1' RECT SLOT				
Condition of Structure	X			MINOR RUST; DI-7 GRATE
Corrosion	X			
Trash and Debris		X		Debris in riser + Rect slot CLEAN + REMOVE
Sediment	X			
Aesthetics	X			
Other	X			4' RCP RISER, 3x3 DI-7 top, 6' ϕ RCP CAP
Principal Outlet Structure - Barrel, Conduit, etc.: 36" ϕ CMP w/ BITUMINOUS COATING w/ CMP END SECT				
Condition of Structure		X		COATING IS FLAKING IN PIPE INTERIOR METAL EXPOSED, BUT INTACT AT MID PIPE.
Settlement				
Trash & Debris		X		Remove trees 15' from outfall.
Sediment	X			
Erosion	/	X	X	Outlet End Section undercut 3'.
Other				FLOW IN PIPE 2", V=1.5 FPS ±
Emergency Spillway (Overflow): TRIPLE 18" ϕ RCP @ RIGHT (WEST) U/S EMBANK - / 54" ϕ RCP D/S OF ROCK 12-18" SIZE.				
Vegetation	X			U/S GRASS;
Lining		X		Rebar exposed on Pipe 1 AND 2 (18")
Erosion		X	X	Severe ES outlet channel erosion.
Trash & Debris	X			See Note.
Other				
NATURAL WETLAND D/S OUTFALL. LOTS/ROADS CURB & GUTTER TO INLET/ STORM DRAIN. VINEYARDS ARE TRIBUTARY TO DAM #2.				

Facility Item	O.K.	Routine	Urgent	Comments
Nuisance Type Conditions:				
Mosquito Breeding	X			
Animal Burrows	X			RESIDENT MENTIONED OTTERS.
Graffiti	X			
Other				GEESE, TYP. WILDLIFE.
Surrounding Perimeter Conditions:				
Land Uses	X			WOODED + LOT/LAWN
Vegetation	X			GOOD SHORELINE BUFFER-WOODED
Trash & Debris	X			MAINTAINED GRASSES.
Aesthetics	X			
Access /Maintenance Roads or Paths	X			DIRECT ACCESS VIA
Other				

Remarks:

- Routine cutting of 2-4' High saplings soon; Also WEEDS + BRUSH. NOTE: Upper 1/3 OF D/S EMBANK APPEARS CUT ON A REG BASIS. Bottom 2/3 OF D/S EMB FULL OF 2-6" Trees + PINES. Suggest extending the maint area toward D/S toe.
- Continue to monitor soft soils at D/S west toe. No seepage.
- SIGNS OF OUTLET BARREL WEAR. COATING IS FLAKED OFF AT MID PIPE DEPTH, METAL EXPOSED BUT NOT CORRODED.
- OUTLET BARREL END SECT. UNDERCUT 3". ROCK OP IS DISPLACED D/S. FALLEN TREE/ROOTMAT AT PIPE OUTFALL NEEDS REMOVED. SIGNS OF OVERTOPPED TREES D/S.
- BAD SEEP: D/S ~~LEFT~~ RIGHT (EAST) EMBANK ≈ 125' FROM BARREL. 12" DEPTH OF SOFT SOILS, DEFINED FLOW AT 1.0 GPM + OIL SUBSTANCE. L=20'.
- REMOVE TREES, DEBRIS + WOODY VEG FROM WITHIN + 15' FROM RISER.
- Rebar exposed Pipe, 2 of 3 EMER. SPILLWAY.
- ES Erosion. D/S outlet channel from ES sev. ERODED. 7'x7'x4' deep SCOUR HOLE. Geotextile exposed + displaced 6' W + Full slope length. Rock LINING 12-18" stone displaced to sides + D/S.

Overall Environmental Division Internal Rating: ____ 1

(Note: RESIDENTS STATED ROAD FLOW 2-3" DURING HURR FLOYD.)

Signature: Scott J Thomas P.E. **Date:** 11/28/00 3:52pm

Title: Civil Engineer Environmental Division

SWMProg\BMP\CoInspProg\DetRet.wpd

DAM SAFETY PROGRAM
DEPARTMENT OF CONSERVATION & RECREATION

Division of Dam Safety
203 Governor Street, Suite 402
Richmond, Virginia 23219-2094

OWNER'S ANNUAL INSPECTION FORM

VINEYARDS @ JOCKEYS NECK SEC 1 & 2

Name of Dam DAM #2 AJACAN LAKE Inventory Number JCC CC 005
Name of Reservoir LOWER LAKE County/City JAMES CITY COUNTY
Owner's Name _____ Hazard Class I, II, III or IV N/A
Address _____ Inspected by SJ THOMAS SR.
_____ Date 11/28/00
Telephone (___) _____

DIRECTIONS: MARK "X" in YES, NO or N/A COLUMN

ITEM	YES	NO	N/A	REMARKS
1. GENERAL CONDITIONS				
A. Alterations to dam?		X		
B. Development in downstream flood plain?		X		
C. Grass cover adequate? (embankment & spillway)	X			
D. Settlements, misalignment, or cracks?		X		
E. Recent high water marks?		X		Elevation:
2. UPSTREAM SLOPE				
A. Erosion?		X		
B. Trees?		X		MINOR TREE & BRUSH REMOVAL.
C. Rodent holes?		X		
D. Cracks, settlement, or bulges?		X		
E. Adequate and sound riprap?			X	
3. INTAKE STRUCTURE X Concrete ☐ Metal				Water Surface Elevation: 22.51
A. Spalling, cracking, scaling?		X		
B. Exposed reinforcement?		X		
C. Corrosion present?		X		
D. Coating adequate?	X			
E. Leakage?		X		
F. Trash rack adequate?	X			
G. Obstacles to inlet?	X			Debris in Riser & Rect. Slot.
H. Drawdown operative? ☐ Closed ☐ Open			X	
4. ABUTMENT CONTACTS				
A. Erosion, cracks or slides?		X		
B. Seepage?	X			~~LEFT (WEST)~~ ~~RIGHT (EAST)~~ Estimated GPM: < ; Est. GPM: 1 GPM
5. EMERGENCY SPILLWAY				
A. Obstructions?		X		
B. Erosion?	X			SEVERE downstream erosion.
C. Rodent holes?		X		
6. DOWNSTREAM SLOPE				D/S 2H:1V ±
A. Erosion?		X		
B. Trees?	X			BOTTOM 2/3, 2-6" TREES & SAPLINGS PINE
C. Rodent holes?		X		

OWNER'S ANNUAL INSPECTION FORM — Inventory Number JCC CC 005

ITEM	YES	NO	N/A	REMARKS
D. Cracks, settlements or bulges?		X		
E. Drains or wells flowing?		X		Estimated GPM:
F. Seepage or boils?	X			Estimated GPM: DS RIGHT (EAST) 1GPM+
7. CONDUIT AND OUTLET ☐ Concrete ☒ Metal	36" DIA			Tail water elevation and flow: BELOW INV OUT.
A. Spalling, cracking, scaling?	X			PIPE INTERIOR TO MID PIPE
B. Exposed reinforcement?			X	
C. Joints displaced or offset?		X		
D. Joint material lost?		X		
E. Leakage?		X		
F. Earth erosion?		X		
G. Conduit misaligned?		X		
H. Outlet channel obstructed?		X		
8. STILLING BASIN				
A. Spalling, cracking, scaling?		X		
B. Exposed reinforcement?			X	
C. Joints displaced or offset?		X		
D. Joint material lost?		X		
E. Joints leak?		X		
F. Rock adequate?		X		Outlet Protection Undercut 3'
G. Dissipators deteriorating?	X			Rock Totally Displaced.
H. Dissipators clean of debris?		X		FALLEN Tree.
9. CONCRETE SPILLWAY			X	Not Applicable.
A. Spalling, cracking, scaling?				VDOT SECOND.
B. Exposed reinforcement?				ROADWAY
C. Joints displaced or offset?				OVER DAM
D. Joint material lost?				EMBANK.
E. Leakage?				JOLKEY'S
F. Dissipators deteriorating?				NECK RD.
G. Dissipators clean of debris?				
H. Earth erosion?				
I. Outlet channel eroding?				
10. GATES			X	NOT APPLICABLE
A. Floodgates broken, bent?				
B. Floodgates eroded or rusted?				
C. Floodgates operational?				
11. RESERVOIR				
A. Development?	X			ROAD + LOT AND NATURAL
B. Slides or erosion on banks?		X		
C. Reservoir managed?	X			Lawn Care & Natural/Wooded.
12. INSTRUMENTS			X	Not Applicable.
A. Is structure instrumented?				
B. Monitoring performed?				
13. SHOULD DAM BE INSPECTED BY ENGINEER?	X			SEEPAGE & EMERG. SPILLWAY EROSION.
14. REEVALUATE HAZARD CLASSIFICATION			X	
15. IS EMERGENCY ACTION PLAN CURRENT?			X	

REMARKS: Refer to Standard JCC Detention + Retention Pond Facility Inspection Report for CC 005 dated 11/28/00. Facility Functional during Flood. Minor depth of flow across VDOT Road.

Date Record Created:

Created By:

WS_BMPNO: CC005

Print Record

PRINTED ON
Wednesday, March 10, 201
2:31:08 PM

WATERSHED	CC
BMP ID NO	005
PLAN NO	S-52-88
TAX PARCEL	(48-4)(1-11)
PIN NO	4840100011
CONSTRUCTION DATE	1/1/1987
PROJECT NAME	Vineyards Dam 2 Ajacan (Lower Lake)
FACILITY LOCATION	2630 Jockeys Neck Trail
CITY-STATE	Williamsburg, Va. 23185
CURRENT OWNER	Wessex Hundred Development, Inc.
OWNER ADDRESS	220 North Boundary St.
OWNER ADDRESS 2	
CITY-STATE-ZIP CODE	Williamsburg, Va. 23185
OWNER PHONE	
MAINT AGREEMENT	No
EMERG ACTION PLAN	No

Get Last BMP No | Return to Menu

MAINTENANCE PLAN	No
SITE AREA acre	661
LAND USE	SF Residential
old BMP TYP	Wet Pond
JCC BMP CODE	A2 Wet Pond
POINT VALUE	
SVC DRAIN AREA acres	217.8
SERVICE AREA DESCRI	SF Lot, Roadways & Offsite Vineyards
IMPERV AREA acres	44.00
RECV STREAM	Pates 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	Yes
GEOTECH REPORT	Yes

CTRL STRUC DESC	RCP Riser
CTRL STRUC SIZE inches	60
OTLT BARRL DESC	CMP
OTLT BARRL SIZE inch	36
EMERG SPILLWAY	Yes
DESIGN HW ELEV	23.5
PERM POOL ELEV	22.5
2-YR OUTFLOW cfs	6.90
10-YR OUTFLOW cfs	13.10
REC DRAWING	No
CONSTR CERTIF	No
LAST INSP DATE	11/28/2000
Inspected by:	
INTERNAL RATING	1

MISC/COMMENTS

Lower Lake. Serious ES Erosion/Seeps.
Possible Dam Safety permit required.

Additional Comments:

W. E. "BILL" ROBERTS
CONSULTANT
AEROSPACE TRAINING SYSTEMS
(DAVID COFFIELD'S ASSISTANT)

2725 JOCKEY'S NECK TRAIL
WILLIAMSBURG, VA 23185
(804) 253-8504 MEMBER: NTSA

CONTACTS:

HOA DAVID COFFIELD
2400 SARAH SPENCE
WILLIAMSBURG, VA 231
(220-5784)

OWNER: Robert Emmett
P.O. Box EJ
Williamsburg VA 2318
(220-1007)

SWM/BMP Maintenance Plan for Dam # 2 Ajacan Lake (CC 005)

(Note: This is a typical Maintenance Plan for your Retention Pond facility. For general use by HOA's, or other designated parties which are responsible for operation, maintenance and inspection of the facility when no other specifically approved plans are available. This is provided as a courtesy by the Environmental Division of James City County for informational purposes only. This plan addresses normal structural and stormwater runoff control aspects of the facility. It does not address landscaping, cosmetic, or ornamental features associated with the facility nor does it replace any specific recommendations offered by a registered professional.)

Maintenance Plan (Retention Pond BMP's)

A maintenance program is required to ensure the Stormwater Management (SWM) / Best Management Practice (BMP) pond facility functions as designed and to provide for reasonable aesthetic conditions. Proper maintenance is encouraged to prevent the introduction of debris and sediment into pretreatment areas, the SWM/BMP itself, its principal inflow and outflow control structures and downstream waterways. Following facility installation, acceptance and establishment of vegetation in disturbed areas, inspections for sediment buildups should be performed at least quarterly. It is anticipated that under normal conditions, sediment removal will be required once every 5 to 10 years. If other construction or related land-disturbing activities are performed upland of the BMP, adequate protection measures should be implemented and inspection frequencies increased to at least once weekly.

The designated party will inspect the SWM/BMP structure after each significant rainfall event or the following working day if a weekend or holiday occurs. A significant rainfall for this structure is defined as one (1) inch or more of gauged rainfall within a 24 hour period. Once per year (more or less) a representative of the County may jointly inspect the structure. Appropriate action will be taken to ensure appropriate maintenance. Keys to locked access points or structures shall be made available to the County upon request and adequate notice should be given to nearby residences of inspection activities that may take place.

Facility Description: Dam # 2 Ajacan Lake is located in the south central portion of Section 1 and 2 of the Vineyards along Jockeys Neck Trail and serves a drainage area of about 217 acres, including area associated with development of the subdivision and offsite area, including that tributary to Dam # 1. The facility is wet-type retention lake facility. A wet-type retention pond has a permanent impoundment which enhances water quality and is normally "wet" even during non-rainfall periods. The facility contains a 60-inch vertical concrete pipe riser, a DI-7 inlet top grate unit, a 36-inch diameter coated corrugated metal pipe outlet barrel and a pipe culvert-type emergency spillway system which is present beneath (across) the Jockeys Neck Trail roadway, which is located along the dam embankment. The emergency spillway system consists of three 18-inch diameter pipes on the inlet side which connect to a larger 54-inch diameter reinforced concrete pipe which outfalls to a rock lined channel on the downstream side of the dam embankment. There is an approximate 6 ft. wide by 18 inch high opening in the riser pipe to provide for draw down and to offer control for larger storm events. During the 100-year storm, the maximum water level should rise to just above the riser structure which is 5 feet from top of dam at design El. 28.5. Higher water levels should draw down in about 24 to 36 hours.

Inspection and Maintenance of the Facility Should Consist of the Following Additional Measures:

1. Inspect for sediment buildup by visual observation and a physical determination of sediment depth within pond's storage area. If sediment reaches a substantial depth above the bottom of pond, removal is required. At the same time, or at least once per year, clean pretreatment devices, the riser bottom and outlet pipes of accumulated sediments. Dispose of sediments removed from the facility at an acceptable disposal area. (Note: Cleanout Elevation is approximately 10 percent of design Water Quality Volume.)

2. Perform maintenance mowing of pond grasses at least twice each year. Grasses such as tall fescue should be mowed in early summer after emergence of the heads on cool season grasses and in late fall to prevent seeds of annual weeds from maturing. Mowing of legumes can be less frequent. Trees, shrubs and woody vegetation are not be permitted to grow on any part of pond embankment that was constructed using engineered (compacted) fills.

3. Perform soil sampling on stabilized pond soil areas at least once every 4 years. Soil sampling and testing should be performed a qualified independent soil testing laboratory such as VPI&SU. Apply additional lime and fertilizer in accordance with test recommendations.

4. In stabilized pond areas, if vegetation covers less than 40 % of soil surfaces, lime, fertilize and seed in accordance with recommendations for new seedlings. If vegetation covers more than 40 % but less than 70 % of soil surfaces, lime, fertilize and over seed in accordance with current seeding recommendations of the Virginia Erosion and Sediment Control Handbook (VESCH).

5. Perform quarterly inspections of the riser section and emergency spillway pipes for the observance of collected trash and debris. Immediately remove any trash or debris that prevents the movement of water. Remove any trash and litter downstream and at storm drain or channel inflow locations to maintain the integrity of the structure and provide an attractive appearance.

6. Perform yearly structural inspections of the facility for damage. Structural inspection shall be performed on the concrete riser, overflow grate, rectangular weirs, outlet barrel and pond embankment. Exposed metal surfaces shall be painted to minimize rust damage or replaced if rust damage is irreversible. If damage is evident, further investigation by a registered professional engineer may be required to assess the integrity of the structure.

7. Perform quarterly inspections of the graded side slopes of the facility for signs of animal/rodent borrows or slope erosion. Immediately perform necessary repairs, refilling or reseeding.

8. Perform yearly observations of perimeter areas surrounding the facility to ensure changes in land use, topography or access have not occurred and do not affect the operation, maintenance, access or safety features provided for the facility. Appropriate action is required to ensure adequacy and to provide a clear, safe passage for maintenance vehicles to the engineered embankment and principal flow control structures.

9. Inspect and exercise pond drain valves, if provided, on a regular basis.

10. Record Keeping. Keep reasonable, accurate written records of inspections and maintenance activities performed for the BMP structure at all times. Records shall document routine maintenance and/or repairs performed. Copies shall be provided to the County upon request.

11. The facility shall not accept additional drainage or be modified in any way without prior consent or approval by the Environmental Division of James City County.

(End)

General Landscaping Guidance for All Stormwater Management BMP's

- ❒ *Trees, shrubs and/or any type of woody vegetation are not allowed on the embankment.*
- ❒ *Keep trees and shrubs at least 15 feet away from the toe of constructed fill slopes.*
- ❒ *Keep trees or shrubs having long taproot systems away from earthen dams or subsurface drains.*
- ❒ *Keep trees and shrubs at least 25 feet away from perforated pipes.*
- ❒ *Keep trees and shrubs at least 25 feet away from principal flow control structures.*
- ❒ *Keep vegetation at least 15 feet from low flow orifice openings.*
- ❒ *Clean trash and debris as necessary from the facility and principal control structures. Only trained or authorized personnel should enter confined spaces or structural components of the facility.*
- ❒ *Keep herbaceous (not woody) embankment plantings limited to ten (10) inches in height.*
- ❒ *Maintain erosion control mats, blankets and fabrics in channels to reduce erosion potential.*
- ❒ *Sod channels that are not stabilized with erosion control mats.*
- ❒ *Keep emergency spillways stabilized with plant material that can withstand strong flows. Root material should be fibrous and substantial but lacking a taproot.*
- ❒ *Seed and mulch bare, exposed or formed erosion gullies. Divert surface runoff from any reseeded and mulched areas until stabilized.*
- ❒ *Check water tolerances of existing native plant materials prior to inundation of pond areas.*
- ❒ *Stabilize aquatic and safety benches with emergent wetland plant species and wet-seed mixes.*
- ❒ *Keep access to embankments or flow control structures free of trees or shrubs. Ensure areas that are planted adjacent to access routes can withstand compaction, damage or vibration that may occur due to passing vehicles or heavy equipment.*
- ❒ *To reduce thermal warming effects, shade inflow and outflow channels as well as southern exposures to the greatest extent possible.*
- ❒ *Avoid plantings that require routine or intensive chemical applications such as turf, etc.*
- ❒ *Use salt tolerant plants if excessive amounts of deicing salt are anticipated in inflow runoff.*
- ❒ *Soil test perimeter areas periodically to determine if soil amendments are necessary. Contact the local Virginia Cooperative Extension for assistance.*
- ❒ *Use native plant species which adapt to local soil and weather conditions over exotic or foreign species.*
- ❒ *Decrease or minimize areas where turf is used. Use low maintenance ground cover to absorb runoff where possible.*
- ❒ *Plant stream and normal pool buffers with trees, shrubs, ornamental grasses and herbaceous material where possible to stabilize banks, provide shade and provide for water quality enhancement.*
- ❒ *Use selective or strategic plantings to minimize access to deeper pools or steeper slopes.*
- ❒ *If warranted, provide educational signs around the perimeter of the facility to indicate that it is a Stormwater Management Area or to designate planting, maintenance or mowing zones.*
- ❒ *Avoid the overuse of any one type of plant material and material with weeds or invasive components.*
- ❒ *Preserve existing, native vegetation to the greatest extent possible unless it deters from structural aspects of the facility.*
- ❒ *Aesthetics and cosmetic characteristics should be a prime consideration. Strive to maintain a natural, scenic character for the BMP that blends well with the community theme, physical location and surrounding land uses and provides for screening, but yet maintains the structural aspects of the facility such as riser pipes, outlet barrels, spillways, trash racks, inlets, inflow channels, etc. Be certain original or enhanced landscaping does not encroach upon public or private roadways, sidewalks, trails or emergency vehicle access routes.*
- ❒ *Refer to the approved design or construction plan for the BMP. Some approved plans provide site specific information related to operation, inspection and maintenance. Please note, however, this is a current requirement of the Environmental Division for stormwater management plans and this information may not necessarily be found on all plans, especially for older facilities. Contact the Environmental Division at **757-253-6670** for additional information.*

FORMS

Dam Safety Program -	Design Report for the Construction/Alteration of Impounding Structures
Dam Safety Program -	Emergency Action Plan for Class I, Class II and Class III Impounding Structures
Dam Safety Program -	Operation and Maintenance Application Class I, II and III Impounding Structures
Dam Safety Program -	As-Built Report for Class, I, II, and III Impounding Structures
Dam Safety Program -	Reinspection Report for Class I and Class II Impounding Structures
Dam Safety Program -	Inventory Report for Class III and Class IV Impounding Structures
Dam Safety Program -	Owner's Annual Inspection Form
Dam Safety Program -	Transfer Application for Impounding Structures
Dam Safety Program -	Agricultural Certification for Impounding Structures

ENVIRONMENTAL DIVISION CITIZEN COMPLAINT RESPONSE FORM

Complainant's Name: MIKE ATALAY

Address: 2408 SARAH SPENCE (THE VINEYARDS) LOT 12, PHASE 2

Telephone No.: H: 258-3556 W: 887-1956 EXT 44 FAX: 887-1943

Date Received: 5/29/02 11:30 AM

Date Assigned: _____

Location of Problem: _____

Type of Complaint

ADJACENT TO AJACAN LAKE, COUNTY BMP ID CODE: CC005

- ☐ Drainage
- ☒ Erosion ← HAS EROSION ON BACK OF LOT NEXT TO LAKE. WANTS TO MEET WITH US TO DISCUSS OPTIONS. START BY MEETING ONSITE TO DETERMINE EXTENT + OPTIONS. IN GENERAL, WOULD BE A "LAKE-SHORELINE" TYPE PROJECT THAT WE WOULD ENCOURAGE WITH HOA/ BMP OWNER APPROVAL (SOFT APPROACH—NATIVE VEGETATION, BIOENGINEERING.)
- ☐ Land Disturbing
- ☐ Tree Removal
- ☐ Sink Hole
- ☐ Street Sign
- ☐ Street Light
- ☐ Other:

Inspector Assigned: _____

Watershed Code: _____

Date Investigated: _____

Complainant Contacted? ☐ Yes ☐ No

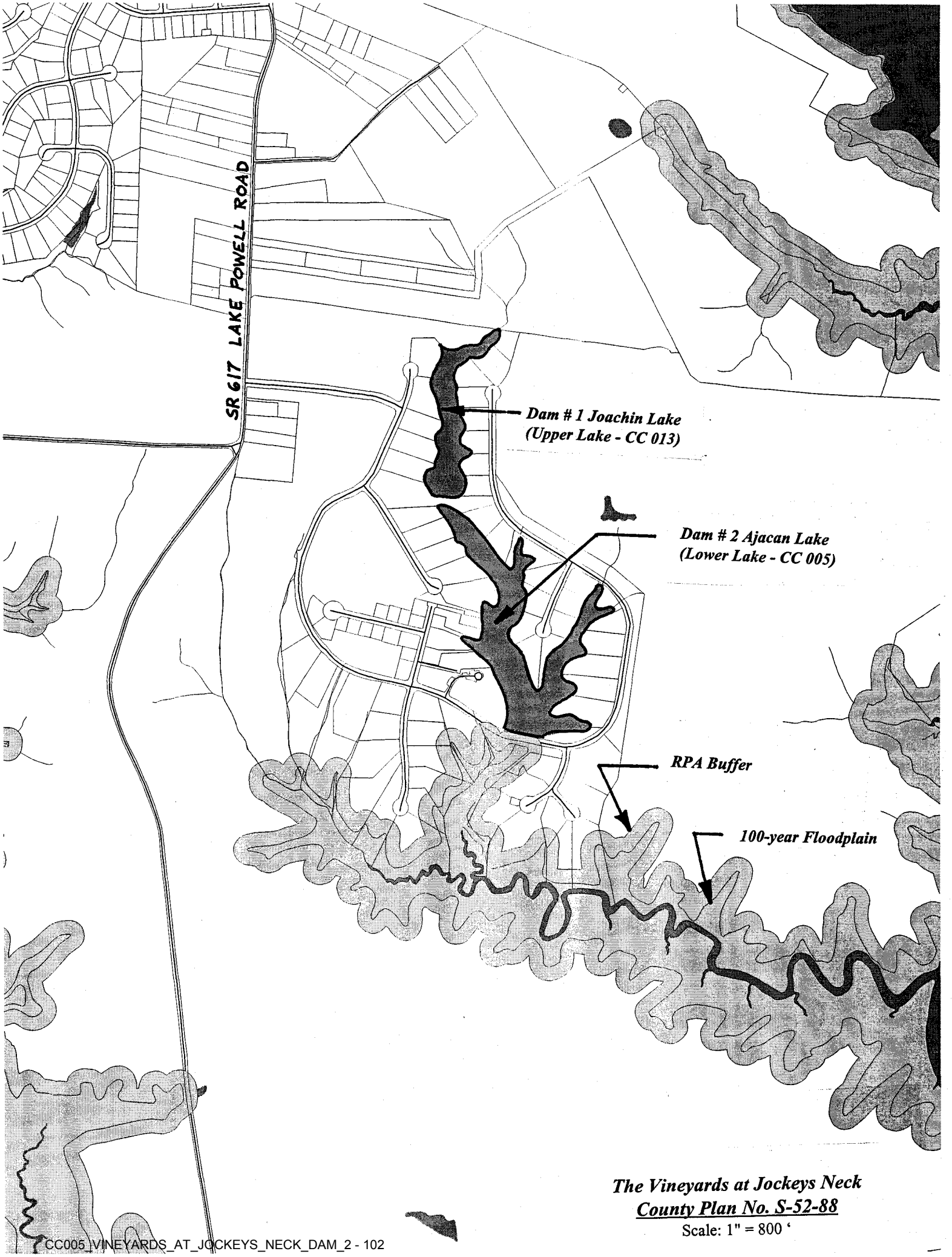
Field Investigation? ☐ Yes ☐ No

Follow up Required? ☐ Yes ☐ No

Results of Investigation:

ENGINEERING & INSPECTOR FOLLOW THRU, CONSISTENT WITH POND BUFFER REQUIREMENTS + DRAFT LAKE-SHORELAND GUIDELINES.

CC005_VINEYARDS_AT_JOCKEYS_NECK_DAM_2 - 101



The Vineyards at Jockeys Neck

<u>County Plan No. S-52-88</u>

Scale: 1" = 800 '

Lake - Shoreland Stabilization Projects in James City County

The following is some preliminary guidance for the James City County Environmental Division's role associated with "Lake-Shoreland Stabilization Projects" which generally would include shoreline stabilization projects along the perimeter of and directly adjacent to stormwater management facilities.

In accordance with page 38 of the *James City County Guidelines for Design and Construction of Stormwater Management BMP's (ie. JCC BMP Manual)*, in general, our division encourages use of natural buffers/setbacks which extend outward a minimum of 25 feet from the maximum water surface elevation of the pond/lake, which is normally the water level for the design 100-year storm event. Existing trees should be preserved in the buffer area during construction. Preferred cover should consist of natural meadow or forest type land. Should landscaping be necessary, it should consist of native trees, shrubs and ground covers rather than managed yard turf.

However, there are some instances where other stabilization techniques could be considered adjacent to stormwater management facilities instead of natural pond buffers/setbacks. However, the basis of for the project must be due to the presence of erosion or other detrimental factors. For erosion, this would include problem soil areas, steep slopes, the inability to maintain native vegetation or where shoreline erosion is present due to water surface fluctuations or wind action across the pond.

The following criteria would generally apply to review of such plans:

1. ***Owner or Homeowner Association Approval.*** Approval must first be secured from the owner of the facility or community regulating body. Owners as such would probably need to establish minimum guidelines/criteria in advance for the types of projects they preferred. The proposed project would need to be consistent not only with the character of the development or community, but also there must be consistency between interconnected property or lots around the lake. For example, three properties along Lake X should not use a bioengineering type repair, then the next two lots a structural type repair, etc. There should be some kind of "master plan or scheme" developed by the owner for what type of and minimum standards for the property owner to follow.

Then the project would come to the County Environmental Division per our normal review process.

2. ***Shoreline Stabilization.*** The project would have to be a ***bonifide shoreline stabilization project*** meaning to provide retrofit or repair to shoreline erosion which is present. Projects based purely on aesthetics or yard beautification purposes would not be justified. Shoreline erosion control due to water level fluctuations, wave action or other forces must be the main cause to initiate the project.

3. ***Water Quality.*** There should be no substantial net loss of shoreline plantings and vegetation which presently serves a water quality purpose. We would not want to see a linear project built which destroys aquatic shelves or perimeter vegetation that provides a distinct benefit for water quality treatment or protection against shoreline erosion.

4. ***Structural.*** The project should not cause an adverse impact to structural aspects of the adjacent stormwater management facility, including embankments, principal flow control structures, emergency spillways and stormwater conveyances into the facility such as channels, storm drains, etc.. Any walls over three (3) feet high would require a seal/design by a qualified Virginia licensed design professional.

5. ***Stormwater Function.*** The project could not cause an adverse impact to the hydraulics of the stormwater management facility including loss of stormwater volume, increase in water surface elevation or by displacing the high water elevation to another property. For most instances, evaluation by a qualified professional would be required unless there was a documented no net increase of fill within the storm water volume pool area of the pond up to design high water (ie. cut/fills quantities negate). Typical cross-sections are necessary.

6. ***Resource Protection Area.*** No impacts to Resource Protection Area (RPA) would be allowed. The project area should not be situated in defined Resource Protection Area. Also, any disturbance to steep slopes (greater than 25 percent) would require a request for waiver, in writing, through the Environmental Division.

7. ***Project Types.*** Non-evasive bioengineering or flexible/rigid (structural) wall systems are the two main choices. Either must following generally accepted methods and practices for shoreline stabilization. Our preference is toward bioengineering-type applications which tend to enhance water quality and provide for erosion control; however, structural-type improvements could be considered, especially if the positives for shoreline erosion outweighed negative water quality aspects. (ie. solving the shoreline erosion was a greater benefit than the general loss of quality vegetation).

8. ***Land-Disturbing Permits.*** Any project would need to follow our criteria for plan review related to land-disturbing, erosion and sediment control and Chesapeake Bay Preservation. Generally, the threshold is for projects over 2,500 square feet disturbed. Land-disturbing includes: clearing, grading, excavating, transporting and filling of land. This includes not only the linear project area, but access paths leading to and along the project area, material stockpile and storage locations, and any yard cut, fill or grading areas. All E&SC plan review and land-disturbing permit applications and minimum standards apply.

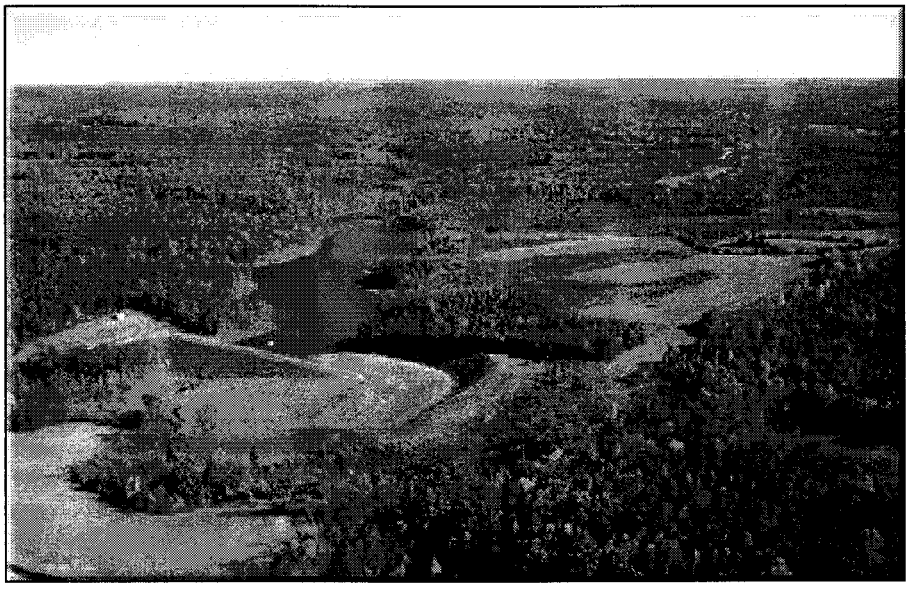
Good References:

University of Minnesota: Shoreland Management Resource Guide for project types and plan requirements. Website is: www.shorelandmanagement.org

UW Extension and Wisconsin Department of Natural Resources, GWQ014 Shoreline Plants and Landscaping, DNR WR-461-94, R-09-99-10M-30-S for alternatives to traditional lawns (natural buffers) including landscaping and plant selection.

Dam Safety Programs

Virginia's Dam Safety Program



Purpose | Authority | Permit Requirements | Dams subject to law | Dam classification | Certificates | Exempt dams | Links | Rodent control | Vegetation, erosion and dams

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Purpose - The program's purpose is to provide for safe design, construction, operation and maintenance of dams to protect public safety.

Authority - The Virginia Dam Safety Act, Article 2, Chapter 6, Title 10.1 (10.1-604 et seq) of the Code of Virginia and Dam Safety Regulations established by the Virginia Soil and Water Conservation Board (VS&WCB). Click here to search state dam safety law and regulations (search for "dams").

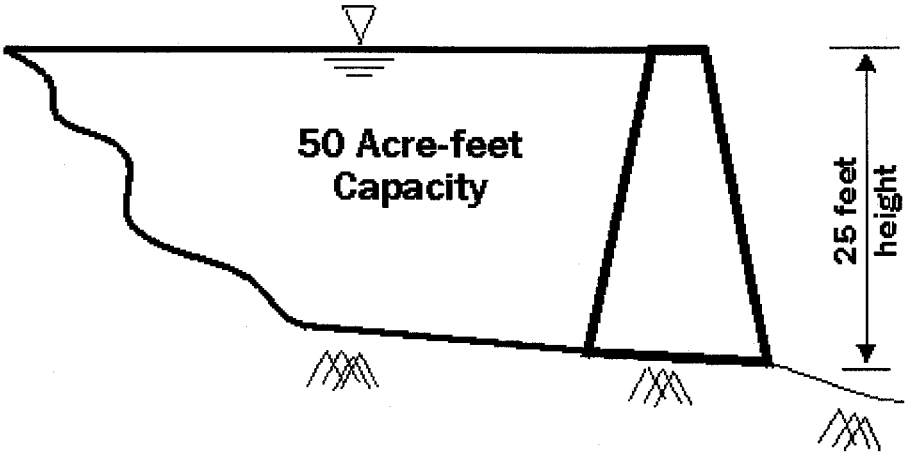
Permit Requirements - No person or entity shall construct, begin to construct, alter or begin to alter an impounding structure until the VS&WCB has issued a construction permit.

Which dams are subject to the law? All dams in Virginia are subject to the Dam Safety Act unless specifically excluded. A dam may be excluded if it:

- is less than 25 feet in height;
- has a capacity less than 50 acre-feet;
- is used for primarily agricultural purposes and has a capacity less than 100 acre-feet;
- is owned or licensed by the Federal Government; or
- is operated for mining purposes under 45.1-222 of the *Code of Virginia*.

The height of a dam is defined as the vertical distance from the streambed at the downstream toe to the top of the dam.

The capacity of a dam is defined as the volume capable of being impounded at the top of the dam.



Hazard Classification of Dams - Dams are classified with a *hazard potential* depending upon the downstream losses anticipated in event of failure. Hazard potential is **not** related to the structural integrity of a dam but strictly to the **potential** for adverse downstream effects *if* the dam were to fail.

- **Class I** - dams which upon failure would cause probable loss of life or excessive economic loss
- **Class II** - dams which upon failure could cause possible loss of life or appreciable economic loss
- **Class III** - dams which upon failure would not likely lead to loss of life or significant economic loss
- **Class IV** - dams which upon failure would not likely lead to loss of life or economic loss to others

Click here to learn more about dam classification.

Certificates - The owner of each regulated Class I, II or III dam is required to apply to the Soil and Water Conservation Board for an operation and maintenance certificate. The application must include an assessment of the dam by a licensed professional engineer along with an operation and maintenance plan and an emergency action plan. The emergency action plan is filed with the appropriate local emergency official and the Department of Emergency Services.

The board issues certificates to the owner for a period of six years. If a dam has some deficiency but does not pose imminent danger, the board may issue a two-year *conditional certificate* during which time the owner is to correct the deficiency.

After a dam is certified by the board, periodic inspections by an engineer are required at the following frequency:

- **Class I** - each two years
- **Class II** - each three years

- **Class III** - each six years upon renewal of the certificate

In addition the owner must inspect the dam in those years when an engineer's inspection is not required.

Certificates are not required for Class IV dams, but the owner must file an inventory report each six years and an inspection report each year. Each owner is fully responsible for the safety of his or her dam and is expected to keep it in a safe operating condition. Permits are issued by the board for construction of new dams and alterations to existing dams.

Examples of exempt dams - Suppose a dam is 30 feet high and has a capacity of 36 acre-feet. The dam is exempt because its capacity is less than 50 acre-feet.

A dam used primarily for agricultural purposes is 28 feet high and has a capacity of 78 acre-feet. This dam is exempt because it is used primarily for agricultural purposes and its capacity is less than 100 acre-feet.

A dam is 21 feet high and has an impounding capacity of 125 acre-feet. This dam is exempt because its height is less than 25 feet.

Links

- Federal Emergency Management Agency (FEMA)
- Association of State Dam Safety Officials (ASDSO)
- State Dam Safety Law, Regulations (search for "dams")

Contact DCR's Dam Safety Program staff at (804) 371-6095 or EMail dam@dcr.state.va.us.

Last modified 8/2/00. Address general inquiries to **pco@dcr.state.va.us**. DCR's central phone number is (804) 786-1712. DCR's street address is:

Department of Conservation and Recreation
203 Governor Street, Suite 213
Richmond, VA 23219-2094

Please address website comments to **webmaster** (shawks@dcr.state.va.us).

2/98

DCR

Department of Conservation & Recreation

CONSERVING VIRGINIA'S NATURAL AND RECREATIONAL RESOURCES

COMMONWEALTH of VIRGINIA
DEPARTMENT OF CONSERVATION AND RECREATION
DIVISION OF DAM SAFETY
203 GOVERNOR STREET, SUITE 206
RICHMOND, VIRGINIA 23219-2094

Virginia Impounding Structures Regulations (Dam Safety)

Virginia Department of
Conservation and Recreation
203 Governor Street, Suite 206
Richmond, Virginia 23219-2094

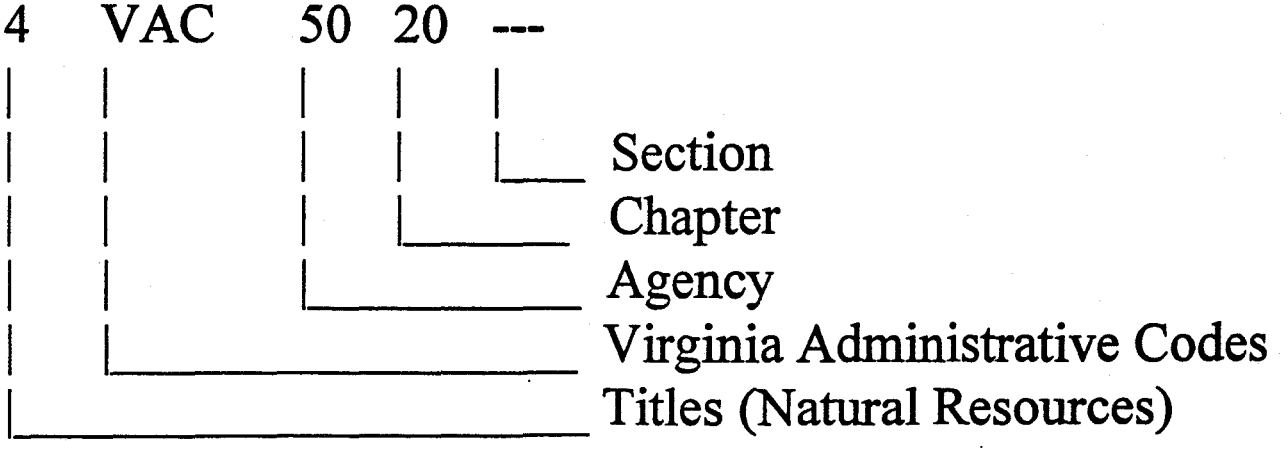
Recodified and Reprinted 1997

Note:

* This reprint contains no substantive changes and is only recodified and reformated.

* This reprint supersedes all reprints prior to July 1997

Codes are read as:



Virginia Soil and Water Conservation Board
Title of Regulation: §4VAC50-20. Impounding Structure Regulations.
Effective Date: February 1, 1989

TABLE OF CONTENTS

PART I - GENERAL

§ 4VAC50-20-10 AUTHORITY.

Statutory Authority §10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §1.1; effective February 1, 1989).

This chapter is promulgated by the Virginia Soil and Water Conservation Board in accordance with the provisions of the Dam Safety Act, Article 2, Chapter 6, Title 10.1 (§10.1-604 et seq.), of the Code of Virginia.

§ 4VAC50-20-20 GENERAL PROVISIONS.

Statutory Authority §10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §1.2; effective February 1, 1989).

A. This chapter provides for the proper and safe design, construction, operation and maintenance of impounding structures to protect public safety. This chapter shall not be construed or interpreted to relieve the owner or operator of any impoundment or impounding structure of any legal duties, obligations or liabilities incident to ownership, design, construction, operation or maintenance.

B. Approval by the board of proposals for an impounding structure shall in no manner be construed or interpreted as approval to capture or store waters. For information concerning approval to capture or store waters, see Chapter 8 (§62.1-107) of Title 62.1 of the Code of Virginia, and other provisions of law as may be applicable.

C. In promulgating this chapter, the board recognizes that no impounding structure can ever be completely "fail-safe," because of incomplete understanding of or uncertainties associated with natural (earthquakes and floods) and manmade (sabotage) destructive forces; with material behavior and response to those forces; and with quality control during construction.

D. Any engineering analysis required by this chapter such as plans, specifications, hydrology, hydraulics and inspections shall be conducted by and bear the seal of a professional engineer licensed to practice in Virginia.

E. The official forms as called for by this chapter are available from the director.

§ 4VAC50-20-30 DEFINITIONS.

Statutory Authority §10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §1.3; effective February 1, 1989).

The following words and terms, when used in this chapter, shall have the following meanings, unless the context clearly indicates otherwise:

"Acre-foot"
means a unit of volume equal to 43,560 cubic feet or 325,853 gallons (one foot of depth over one acre of area).

"Agricultural purpose dams"
means dams which are less than 25 feet in height or which create a maximum impoundment smaller than 100 acre-feet and certified by the owner on official forms as constructed, maintained or operated primarily for agricultural purposes.

"Alteration permit"
means a permit required for changes to an impounding structure that could alter or affect its structural integrity. Alterations requiring a permit include, but are not limited to: changing the height, increasing the normal pool or principal spillway elevation, changing the elevation or physical dimensions of the emergency spillway or removing the impounding structure.

"Board"
means the Virginia Soil and Water Conservation Board.

"Conditional operation and maintenance certificate"
means a certificate required for impounding structures with deficiencies.

"Construction permit"
means a permit required for the construction of a new impounding structure.

"Design flood"
means the calculated volume of runoff and the resulting peak discharge utilized in the evaluation, design, construction, operation and maintenance of the impounding structure.

"Design freeboard"
means the vertical distance between the maximum elevation of the design flood and the top of the impounding structure.

"Director"

means the Director of the Department of Conservation and Recreation or his designee.

"Height"

means the structural height of an impounding structure. If the impounding structure spans a stream or watercourse, height means the vertical distance from the natural bed of the stream or watercourse measured at the downstream toe of the impounding structure to the top of the impounding structure. If the impounding structure does not span a stream or watercourse, height means the vertical distance from the lowest elevation of the outside limit of the barrier to the top of the impounding structure.

"Impounding structure"

means a manmade device, whether a dam across a watercourse or other structure outside a watercourse, used or to be used to retain or store waters or other materials. The term "impounding structure" includes all dams which are equal to or greater than 25 feet in height and which create a maximum impoundment equal to or greater than 50 acre-feet, except (i) dams licensed by the State Corporation Commission that are subject to a dam safety inspection program; (ii) dams owned or licensed by the United States government; (iii) dams constructed, maintained or operated primarily for agricultural purposes which are less than 25 feet in height or which create a maximum impoundment smaller than 100 acre-feet; (iv) water or silt retaining dams approved pursuant to §45.1-222 of the Code of Virginia; or (v) obstructions in a canal used to raise or lower water levels.

"Impoundment"

means a body of water or other materials the storage of which is caused by any impounding structure.

"Inundation zone"

means an area that could be inundated as a result of impounding structure failure and that would not otherwise be inundated to that elevation.

"Life of the impounding structure" and "life of the project"

mean that period of time for which the impounding structure is designed and planned to perform effectively, including the time required to remove the structure when it is no longer capable of functioning as planned and designed.

"Maximum impounding capacity"

means the volume in acre-feet that is capable of being impounded at the top of the impounding structure.

"Normal impounding capacity"
means the volume in acre-feet that is capable of being impounded at the elevation of the crest of the lowest ungated outlet from the impoundment.

"Operation and maintenance certificate"
means a certificate required for the operation and maintenance of all impounding structures.

"Owner"
means the owner of the land on which an impounding structure is situated, the holder of an easement permitting the construction of an impounding structure and any person or entity agreeing to maintain an impounding structure. The term "owner" includes the Commonwealth or any of its political subdivisions, including but not limited to sanitation district commissions and authorities. Also included are any public or private institutions, corporations, associations, firms or companies organized or existing under the laws of this Commonwealth or any other state or country, as well as any person or group of persons acting individually or as a group.

"Top of the impounding structure"
means the lowest point of the nonoverflow section of the impounding structure.

"Watercourse"
means a natural channel having a well-defined bed and banks and in which water flows when it normally does flow.

§ 4VAC50-20-40 CLASSES OF IMPOUNDING STRUCTURES.

Statutory Authority §10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §1.4; effective February 1, 1989).

A. Impounding structures shall be classified in one of four categories according to size and hazard potential, as defined in subsection B of this section and Table 1. Size classification shall be determined either by maximum impounding capacity or height, whichever gives the larger size classification.

B. For the purpose of this chapter, hazards pertain to potential loss of human life or property damage downstream from the impounding structure in event of failure or faulty operation of the impounding structure or appurtenant facilities.

1. Impounding structures in the Class I hazard potential category are located where failure will cause probable loss of life or serious damage to occupied building(s), industrial or commercial facilities, important public utilities, main highway(s) or railroad(s).

2. Impounding structures in the Class II hazard potential category are located where failure could cause possible loss of life or damage to occupied building(s), industrial or commercial facilities, secondary highway(s) or railroad(s) or cause interruption of use or service of relatively important public utilities.

3. Impounding structures in Class III hazard potential category are located where failure may cause minimal property damage to others. No loss of life is expected.

4. Impounding structures in Class IV hazard potential category are located where the failure of the impounding structure would cause no property damage to others. No loss of life is expected.

5. Such size and hazard potential classifications shall be proposed by the owner and shall be subject to approval by the director. Present and projected development of the inundation zones downstream from the impounding structure shall be considered in determining the classification.

6. Impounding structures shall be subject to reclassification as necessary.

§ 4VAC50-20-50 PERFORMANCE STANDARDS REQUIRED FOR IMPOUNDING STRUCTURES.

Statutory Authority §10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §1.5; effective February 1, 1989).

Impounding structures shall be constructed, operated and maintained such that they perform in accordance with their design and purpose throughout the life of the project. For new impounding structures, the spillway(s) capacity shall perform at a minimum to safely pass the appropriate spillway design flood as determined in Table 1.

TABLE I - Impounding Structure Regulations

Class of Dam	Hazzard Potential If Impounding Structure Fails	SIZE CLASSIFICATION Maximum Capacity (Ac-Ft)[a]	Height (Ft)[a]	Spillway Design Flood (SDF)
I	Probable Loss of Life; Excessive Economic Loss	Large ≥ 50,000 Medium ≥1,000 & < 50,000 Small ≥ 50 & <1,000	≥100 ≥40 & <100 ≥25 & <40	PMF[c] PMF ½ PMF to PMF
II	Possible Loss of Life; Appreciable Economic Loss	Large ≥50,000 Medium ≥1,000 & <50,000 Small ≥50 & <1,000	≥100 ≥40 & <100 ≥25 & <40	PMF ½ PMF to PMF 100-YR to ½ PMF
III	No Loss of Life Expected; Minimal Economic Loss	Large ≥50,000 Medium ≥1,000 & <50,000 Small ≥ 50 & <1,000	≥100 ≥40 & <100 ≥25 & <40	½ PMF to PMF 100-YR to ½ PMF 50-YR to 100 YR[e]
IV	No Loss of Life Expected; No Economic Loss to Others	≥50 (non-agricultural) ≥100 (agricultural)	≥25 (both)	50-YR to 100 YR

a. The factor determining the largest size classification shall govern.

b. The spillway design flood (SDF) represents the largest flood that need be considered in the evaluation of the performance for a given project. The impounding structure shall perform so as to safely pass the appropriate SDF. Where a range of SDF is indicated, the magnitude that most closely relates o the involved risk should be selected. The establishment in this chapter of rigid design flood criteria or standards is not intended. Safety must be evaluated in the light of peculiarities and local conditions for each impounding structure and in recognition of the many factors involved, some of which may not be precisely known. Such can only be done by competent, experienced engineering judgment, which the values in Table 1 are intended to supplement, not supplant.

c. PMF: Probable maximum flood. This means the flood that might be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The PMF is derived from the current probable maximum precipitation (PMP) available from the National Weather Service, NOAA. In some cases local topography or meteorological conditions will cause changes from the generalized PMP values; therefore, it is advisable to contact local, state or federal agencies to obtain the prevailing practice in specific cases.

d. 50-Yr: 50-year flood. This means the flood magnitude expected to be equaled or exceeded on the average of once in 50 years. It may also be expressed as an exceedence probability with a 2.0% chance of being equaled or exceeded in any given year.

e. 100-Yr: 100-year flood. This means the flood magnitude expected to be equaled or exceeded on the average of once in 100 years. It may also be expressed as an exceedence probability with a 1.0% chance of being equaled or exceeded in any given year.

PART II-Permit Requirements.

§ 4VAC50-20-60 REQUIRED PERMITS.

Statutory Authority§10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §2.1; effective February 1, 1989).

A. No person or entity shall construct or begin to construct an impounding structure until the board has issued a construction permit.

B. No person or entity shall alter or begin to alter an existing impounding structure in a manner which would potentially affect its structural integrity until the board has issued an alteration permit, or in the case of an emergency, authorization obtained from the director. The permit requirement may be waived if the director determines that the alteration or improvement will not substantially alter or affect the structural integrity of the impounding structure. Alteration does not mean normal operation and maintenance.

C. When the board receives an application for any permit to construct or alter an impounding structure, the director shall inform the government of any jurisdiction which might be affected by the permit application.

D. In evaluating construction and alteration permit applications the director shall use the most current design criteria and standards referenced in 4VAC50-20-320 of this chapter.

§ 4VAC50-20-70 CONSTRUCTION PERMITS.

Statutory Authority §10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §2.2; effective February 1, 1989).

A. Prior to preparing the complete design report for a construction permit, applicants are encouraged to seek approval of the project concept from the director. For this purpose the applicant should submit a general description of items 1 through 4 of subsection B and items 1 and 2 below:

1. Proposed design criteria and a description of the size, ground cover conditions, extent of development of the watershed and the geologic and the geotechnical engineering assumptions used to determine the foundations and materials to be used.

2. Preliminary drawings of a general nature, including cross sections, plans and profiles of the impounding structure, proposed pool levels and types of spillway(s).

B. An applicant for a construction permit shall submit a design report on official forms. The design report shall be prepared in accordance with 4 VAC 50-20-240 of this chapter and shall include the following information:

1. A description of the impounding structure and appurtenances and a proposed classification conforming with this chapter. The description shall include a statement of the purposes for which the impoundment and impounding structure are to be used.

2. A description of properties located in the inundation zone downstream from the site of the proposed impounding structure, including the location and number of residential structures, buildings, roads, utilities and other property that would be endangered should the impounding structure fail.

3. A statement from the governing body of the local political subdivision or other evidence confirming that body is aware of the proposal to build an impounding structure and of the land use classifications applicable to the inundation zone.

4. Maps showing the location of the proposed impounding structure that include: the county or city in which the proposed impounding structure would be located, the location of roads, access to the site and the outline of the impoundment. Existing aerial photographs or existing topographic maps may be used for this purpose.

5. A report of the geotechnical investigations of the foundation soils or bedrock and of the materials to be used to construct the impounding structure.

6. Design assumptions and analyses sufficient to indicate that the impounding structure will be stable during its construction and during the life of the impounding structure under all conditions of reservoir operations, including rapid filling and rapid drawdown of the impoundment.

7. Evaluation of the stability of the reservoir rim area in order to safeguard against reservoir rim slides of such magnitude as to create waves capable of overtopping the impounding structure and confirmation of rim stability during seismic activity.

8. Design assumptions and analyses sufficient to indicate that seepage in, around, through or under the impounding structure, foundation and abutments will be reasonably and practically controlled so that internal or external forces or results thereof will not endanger the stability of the impounding structure.

9. Calculations and assumptions relative to design of the spillway or spillways. Spillway capacity shall conform to the criteria of Table 1.

10. Provisions to ensure that the impounding structure and appurtenances will be protected against deterioration or erosion due to freezing and thawing, wind and rain or any combination thereof.

11. Other pertinent design data, assumptions and analyses commensurate with the nature of the particular impounding structure and specific site conditions, including when required by the director, a plan and profile of the inundation zones.

12. Erosion and sediment control plans to minimize soil erosion and sedimentation during all phases of construction, operation and maintenance. Projects shall be in compliance with local erosion and sediment control ordinances.

13. A description of the techniques to be used to divert stream flow during construction so as to prevent hazard to life, health and property.

14. A plan of quality control testing to confirm that construction materials and methods meet the design requirements set forth in the specifications.

15. A proposed schedule indicating construction sequence and time to completion.

16. Plans and specifications as required by 4VAC50- 20-310 of this chapter.

17. An emergency action plan on official forms and evidence that a copy of such plan has been filed with the local and state Department of Emergency Services. The plan shall include a method of providing notification and warning to persons downstream, other affected persons or property owners and local authorities in the event of a flood hazard or the impending failure of the impounding structure.

18. A proposed impoundment and impounding structure operation and maintenance plan on official forms certified by a professional engineer. This plan shall include a safety inspection schedule and shall place particular emphasis on operating and maintaining the impounding structure in keeping with the project design, so as to maintain its structural integrity and safety during both normal and abnormal conditions which may reasonably be expected to occur during its planned life.

C. The director or the applicant may request a conference to facilitate review of the applicant's proposal.

D. The owner shall certify in writing that the operation and maintenance plan as approved by the board will be adhered to during the life of the project except in cases of unanticipated emergency requiring departure therefrom in order to mitigate hazard to life and property. At such time, the owner's engineer and the director shall be notified.

E. If the submission is not acceptable, the director shall inform the applicant within 60 days and shall explain what changes are required for an acceptable submission.

F. Within 120 days of receipt of an acceptable design report the board shall act on the application.

G. Prior to and during construction the owner shall notify the director of any proposed changes from the approved design, plans, specifications, or operation and maintenance plan. Approval shall be obtained from the director prior to the construction or installation of any changes that will affect the stability of the impounding structure.

H. The construction permit shall be valid for the construction schedule specified in the approved design report. The construction schedule may be amended by the director for good cause at the request of the applicant.

I. Construction must commence within two years after the permit is issued. If construction does not commence within two years after the permit is issued, the permit shall expire, except that the applicant may petition the board for extension of the two-year period and the board may extend such period for good cause.

J. The director may revoke a construction permit if any of the permit terms are violated, or if construction is conducted in a manner hazardous to downstream life or property. The director may order the owner to eliminate such hazardous conditions within a period of time limited by the order. Such corrective measures shall be at the owner's expense. The applicant may petition the board to reissue the permit with such modifications as the board determines to be necessary.

K. The owner's professional engineer shall advise the director when the impounding structure may safely impound water. The director shall acknowledge this statement within 10 days after which the impoundment may be filled under the engineer's supervision. The director's acknowledgement shall act as a temporary operation and maintenance certificate until an operation and maintenance certificate has been applied for and issued in accordance with 4VAC50-20-110 of this chapter.

§ 4VAC50-20-80 ALTERATIONS PERMITS.

Statutory Authority§10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §2.3; effective February 1, 1989).

A. Application for a permit to alter an impounding structure in ways which would potentially affect its structural integrity shall be made on official forms. The application shall clearly describe the proposed work with appropriately detailed plans and specifications.

B. Alterations which would potentially affect the structural integrity of an impounding structure include but are not limited to changing its height, increasing the normal pool or principal spillway elevation, changing the elevation or physical dimensions of the emergency spillway or removing the impounding structure.

C. Where feasible an application for an alteration permit shall also include plans and specifications for a device to allow for draining the impoundment if such does not exist.

D. If the submission is not acceptable, the director shall inform the applicant within 60 days and shall explain what changes are required for an acceptable submission.

E. Within 120 days of receipt of an acceptable application, the board shall act on the application.

§ 4VAC50-20-90 TRANSFER OF PERMITS.

Statutory Authority§10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §2.4; effective February 1, 1989).

Prior to the transfer of ownership of a permitted impounding structure the permittee shall notify the director in writing and the new owner shall file a transfer application on official forms. The new owner shall amend the existing permit application as necessary and shall certify to the director that he is aware of and will comply with all of the requirements and conditions of the permit.

PART III - Certificate Requirements

§ 4VAC50-20-100 OPERATION AND MAINTENANCE CERTIFICATES.

Statutory Authority§10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §3.1; effective February 1, 1989).

A. A Class I Operation and Maintenance Certificate is required for a Class I Hazard potential impounding structure. The certificate shall be for a term of six years. It shall be updated based upon the filing of a new reinspection report certified by a professional engineer every two years.

B. A Class II Operation and Maintenance Certificate is required for a Class II Hazard potential impounding structure. The certificate shall be for a term of six years. It shall be updated based upon the filing of a new reinspection report certified by a professional engineer every three years.

C. A Class III Operation and Maintenance Certificate is required for a Class III Hazard potential impounding structure. The certificate shall be for a term of six years.

D. The owner of a Class I, II or III impounding structure shall provide the director an annual owner's inspection report on official forms in years when no professional reinspection is required and may be done by the owner or his representative.

E. If an Operation and Maintenance Certificate is not updated as required, the board shall take appropriate enforcement action.

F. The owner of a Class I, II or III impounding structure shall apply for the renewal of the six year operation and maintenance certificate 90 days prior to its expiration in accordance with 4VAC50-20-120 of this chapter.

G. A Class IV impounding structure will not require an operation and maintenance certificate. An inventory report is to be prepared as provided in 4VAC50-20-120 B and filed by the owner on a six-year interval, and an owners inspection report filed annually.

H. The owner of any impounding structure, regardless of its hazard classification, shall notify the board immediately of any change in either cultural features downstream from the impounding structure or of any change in the use of the area downstream that would present hazard to life or property in the event of failure.

§ 4VAC50-20-110 OPERATION AND MAINTENANCE CERTIFICATE FOR NEWLY CONSTRUCTED IMPOUNDING STRUCTURES.

Statutory Authority§10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §3.2; effective February 1, 1989).

A. Within 180 days after completion of the construction of an impounding structure, the owner shall submit:

1. A complete set of as-built drawings certified by a professional engineer and an as-built report on official forms.

2. A copy of a certificate from the professional engineer who has inspected the impounding structure during construction certifying that, to the best of his

judgment, knowledge and belief, the impounding structure and its appurtenances were constructed in conformance with the plans, specifications, drawings and other requirements approved by the board.

3. A copy of the operation and maintenance plan and emergency action plan submitted with the design report including any changes required by the director.

B. If the director finds that the operation and maintenance plan or emergency action plan is deficient, he shall return it to the owner within 60 days with suggestions for revision.

C. Within 60 days of receipt of the items listed in subsection A above, if the board finds that adequate provision has been made for the safe operation and maintenance of the impounding structure, the board shall issue an operation and maintenance certificate.

§ 4VAC50-20-120 OPERATION AND MAINTENANCE CERTIFICATES FOR EXISTING IMPOUNDING STRUCTURES.

Statutory Authority §10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §3.3; effective February 1, 1989).

A. Any owner of an impounding structure other than a Class IV impounding structure which has already filed an inventory report that does not have an operation and maintenance certificate or any owner renewing an operation and maintenance certificate shall file an application with the board.

B. The application for an operation and maintenance certificate shall be on official forms and shall include:

1. A reinspection report for Class I and II impounding structures. The reinspection report shall include an update of conditions of the impounding structure based on a Phase I or Phase II inspection as established by the U.S. Army Corps of Engineers, a previous reinspection report or an as-built report.

2. An inventory report for Class III impounding structures. The inventory report shall include:

a. The name and location of the impounding structure and the name of the owner.

b. The description and dimensions of the impounding structure, the spillways, the reservoir and the drainage area.

c. The history of the impounding structure which shall include the design, construction, repairs, inspections and whether the structure has been overtopped.

d. Observations of the condition of the impounding structure, reservoir, and upstream and downstream areas.

e. Any changes in the impounding structure, reservoir, and upstream and downstream areas.

f. Recommendations for remedial work.

3. An impoundment and impounding structure operation and maintenance plan certified by a professional engineer. This plan shall place particular emphasis on operating and maintaining the impounding structure in keeping with the project design in such manner as to maintain its structural integrity and safety during both normal and abnormal conditions which may reasonably be expected to occur during its planned life. The Phase I Inspection Report should be sufficient to serve as the basis for the operation and maintenance plan for a Class I and Class II impounding structure. For a Class III impounding structure, the operation and maintenance plan shall be based on the data provided in the inventory report.

4. An emergency action plan and evidence that a copy of such plan has been filed with the local and state Department of Emergency Services. The plan shall include a method of providing notification and warning to persons downstream, other affected persons or property owners and local authorities in the event of a flood hazard or the impending failure of the impounding structure.

C. The owner shall certify in writing that the operation and maintenance plan approved by the board will be adhered to during the life of the project except in cases of emergency requiring departure therefrom in order to mitigate hazard to life and property, at which time the owner's engineer and the director shall be notified.

D. If the director finds that the operation and maintenance plan or emergency action plan is deficient, he shall return it to the owner within 60 days with suggestions for revision.

E. Within 60 days of receipt of an acceptable application if the board finds that adequate provision has been made for the safe operation and maintenance of the impounding structure, the board shall issue an operation and maintenance certificate.

§ 4VAC50-20-130 EXISTING IMPOUNDING STRUCTURES CONSTRUCTED PRIOR TO JULY 1, 1982.

Statutory Authority§10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §3.4; effective February 1, 1989).

A. Many existing impoundment structures were designed and constructed prior to the enactment of the Dam Safety Act, and may not satisfy current criteria for new construction. The board may issue an operation and maintenance certificate for such structures provided that:

1. Operation and maintenance is determined by the director to be satisfactory and up to date;

2. Annual owner's inspection reports have been filed with and are considered satisfactory by the director;

3. The applicant proves in accordance with the current design procedures and references of 4VAC50-20-320 to the satisfaction of the board that the impounding structure as designed, constructed, operated and maintained does not pose an unreasonable hazard to life and property; and

4. The owner satisfies all special requirements imposed by the board.

B. When appropriate with existing impounding structures only, the spillway design flood requirement may be reduced by the board to the spillway discharge at which dam failure will not significantly increase the downstream hazard existing just prior to dam failure provided that the conditions of 4VAC50-20-130 A have been met.

§ 4VAC50-20-140 EXISTING IMPOUNDING STRUCTURES CONSTRUCTED AFTER JULY 1, 1982.

Statutory Authority§10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §3.5; effective February 1, 1989).

The board may issue an operation and maintenance certificate for an impounding structure having a construction permit issued after July 1, 1982, and shall not require upgrading to meet new more

stringent criteria unless the board determines that the new criteria must be applied to prevent an unreasonable hazard to life or property.

§ 4VAC50-20-150 CONDITIONAL OPERATION AND MAINTENANCE CERTIFICATE.

Statutory Authority§10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §3.6; effective February 1, 1989).

A. During the review of any operation and maintenance application should the director determine that the impounding structure has deficiencies of a nonimminent danger category, the director may recommend that the board issue a conditional operation and maintenance certificate.

B. The conditional operation and maintenance certificate for Class I, II and III impounding structures shall be for a maximum term of two years. This certificate will allow the owner to continue normal operation and maintenance of the impounding structure, and shall require that the owner correct the deficiencies on a schedule determined by the director.

C. A conditional certificate may be renewed in accordance with the procedures of 4VAC50-20-120 provided that annual owner inspection reports are on file, and the board determines that the owner is proceeding with the necessary corrective actions.

D. Once the deficiencies are corrected, the board shall issue an operation and maintenance certificate based upon any required revisions to the original application.

§ 4VAC50-20-160 ADDITIONAL OPERATION AND MAINTENANCE REQUIREMENTS.

Statutory Authority §10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §3.7; eff. February 1, 1989).

A. The owner of an impounding structure shall not, through action or inaction, cause or allow such structure to impound water following receipt of a written report from the owner's engineer that the impounding structure will not safely impound water.

§ 4VAC50-20-170 TRANSFER OF CERTIFICATES.

Statutory Authority§10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §3.8; effective February 1, 1989).

Prior to the transfer of ownership of an impounding structure the certificate holder shall notify the director in writing and the new owner shall file a transfer application on official forms. The new owner may elect to continue the current operation and maintenance certificate for the remaining term or he may apply for a new certificate in accordance with 4VAC50-20-120. If the owner elects to continue the existing certificate he shall amend the existing certificate application as necessary and shall certify to the director that he is aware of and will comply with all of the requirements and conditions of the certificate.

PART IV - Procedures

§ 4VAC50-20-180 INSPECTIONS.

Statutory Authority§10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §4.1; effective. February 1, 1989).

The director may make inspections during construction, alteration or operation and maintenance as deemed necessary to ensure that the impounding structure is being constructed, altered or operated and maintained in compliance with the permit or certificate issued by the board. The director shall provide the owner a copy of the findings of these inspections. This inspection does not relieve the owner from the responsibility of providing adequate inspection during construction or operation and maintenance. Periodic inspections during construction or alteration shall be conducted under the supervision of a professional engineer who shall propose the frequency and nature of the inspections subject to approval by the director. Periodic inspections during operation and maintenance shall be conducted under the supervision of a professional engineer at an interval not greater than that required to update the operation and maintenance certificate. At a minimum, an annual owner's inspection shall be conducted when a professional inspection is not required. Every owner shall provide for an inspection by a professional engineer after overtopping of the impounding structure. A copy of the findings of each inspection with the engineer's recommendations shall be filed with the board within a reasonable period of time not to exceed 30 days subsequent to completion of the inspection.

§ 4VAC50-20-190 RIGHT TO HEARING.

Statutory Authority§10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §4.2; effective February 1, 1989).

Any owner aggrieved by an action taken by the director or by the board without hearing, or by inaction of the director or the board, under the provisions of this chapter, may demand in writing a formal hearing.

§ 4VAC50-20-200 ENFORCEMENT.

Statutory Authority§10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §4.3; effective February 1, 1989).

Any owner refusing to obey any order of the board or the director pursuant to this chapter may be compelled to obey and comply with such provisions by injunction or other appropriate remedy obtained in a court proceeding. Such proceeding shall be instituted by the board or in the case of an emergency, by the director in the court which granted approval to the owner to impound waters or, if such approval has not been granted, the proceeding shall be instituted in any appropriate court.

§ 4VAC50-20-210 CONSULTING BOARDS.

Statutory Authority §10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §4.4; effective February 1, 1989).

A. When the board needs to satisfy questions of safety regarding plans and specifications, construction or operation and maintenance, or when requested by the owner, the board may appoint a consulting board to report to it with respect to those questions of the safety of an impounding structure. Such a board shall consist of two or more consultants, none of whom have been associated with the impounding structure.

B. The costs and expenses incurred by the consulting board, if appointed at the request of an owner, shall be paid by the owner.

C. The costs and expenses incurred by the consulting board, if initiated by the board, shall be paid by the board.

§ 4VAC50-20-220 UNSAFE CONDITIONS.

Statutory Authority§10.1-605 of the Code of Virginia.
(Historical Notes: Derived from VR625-01-00 §4.5; effective February 1, 1989).

A. No owner shall have the right to maintain an impounding structure which unreasonably threatens the life or property of another person. The owner of any impounding structure found to have deficiencies which could threaten life or property if uncorrected shall take the corrective actions needed to remove such deficiencies within a reasonable period of time.

B. Imminent danger.

When the director finds that an impounding structure is unsafe and consititutes an imminent danger to life or property, he shall immediately notify the state Department of Emergency Services and confer with the owner. The owner of an impounding structure found to constitute an imminent danger to life or property shall take immediate corrective action to remove the imminent danger as required by §10.1-608 of the Code of Virginia.

C. Nonimminent danger.

The owner of an impounding structure who has been issued a report by the director containing findings and recommendations for the correction of deficiencies which threaten life or property if not corrected, shall undertake to implement the recommendations for correction of deficiencies according to a schedule of implementation contained in that report as required by §10.1-609 of the Code of Virginia.

§ 4VAC50-20-230 COMPLAINTS.

Statutory Authority §10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §4.6; effective. February 1, 1989).

A. Upon receipt of a complaint alleging that the person or property of the complainant is endangered by the construction, maintenance or operation of impounding structure, the director shall cause an inspection of the structure, unless the data, records and inspection reports on file with the board are found adequate to determine if the complaint is valid.

B. If the director finds that an unsafe condition exists, the director shall proceed under the provisions of §10.1-608 and §10.1-609 of the Code of Virginia to render the extant condition safe.

PART V - Design Requirements

§ 4VAC50-20-240 DESIGN OF STRUCTURES.

Statutory Authority§10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §5.1; effective February 1, 1989).

A. The owner shall complete all necessary investigations prior to submitting the design report. The scope and degree of precision required is a matter of engineering judgment based on the complexities of the site and the hazard potential classification of the proposed structure.

B. Surveys shall be made with sufficient accuracy to locate the proposed construction site and to define the total volume of storage in the impoundment. Locations of center lines and other horizontal and vertical controls shall be shown on a map of the site. The area downstream and upstream from the proposed impounding structure shall be investigated in order to delineate the areas and extent of potential damage in case of failure or backwater due to flooding.

C. The drainage area shall be determined. Present, projected and potential future land-use conditions shall be considered in determining the runoff characteristics of the drainage area. The most severe of these conditions shall be included in the design calculations which shall be submitted as part of the design report.

D. The geotechnical engineering investigation shall consist of borings, test pits and other subsurface explorations necessary to adequately define the existing conditions. The investigations shall be performed so as to define the soil, rock and ground water conditions.

E. All construction materials shall be adequately selected so as to ensure that their properties meet design criteria. If on-site materials are to be utilized, they shall be located and determined to be adequate in quantity and quality.

§ 4VAC50-20-250 DESIGN FLOOD.

Statutory Authority§10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §5.2; effective February 1, 1989).

The minimum design flood to be utilized in impounding structure evaluation, design, construction, operation and maintenance shall be commensurate with the size and hazard potential of the particular impounding structure as determined in 4VAC50-20-50 and Table 1. Competent, experienced, professional engineering judgment shall be used in applying those design and evaluation procedures referenced in 4VAC50-20-320 of this chapter.

§ 4VAC50-20-260 EMERGENCY SPILLWAY DESIGN.

Statutory Authority§10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §5.3; effective February 1, 1989).

A. Every impounding structure shall have a spillway system with adequate capacity to discharge the design flood without endangering the safety of the impounding structure.

B. An emergency spillway shall be required.

C. Vegetated earth or unlined emergency spillway may be approved when the applicant demonstrates that it will pass the spillway design flood without jeopardizing the safety of the impounding structure.

D. Lined emergency spillways shall include design criteria calculations, plans and specifications for open channel, drop, ogee and chute spillways that include crest structures, walls, panel lining and miscellaneous details. All joints shall be reasonably water-tight and placed on a foundation capable of sustaining applied loads without undue deformation. Provision shall be made for handling leakage from the channel or under seepage from the foundation which might adversely affect the structural integrity and structural stability of the impounding structure.

§ 4VAC50-20-270 PRINCIPAL SPILLWAYS AND OUTLET WORKS.

Statutory Authority§10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §5.4; effective February 1, 1989).

A. It will be assumed that principal spillways and regulating outlets provided for special functions will operate to normal design discharge capabilities during the spillway design flood, provided appropriate analyses show:

1. That control gates and structures are suitably designed to operate reliably under maximum heads for durations likely to be involved and risks of blockage by debris are minimal;

2. That access roads and passages to gate regulating controls would be safely passable by operating personnel under spillway design flood conditions; and

3. That there are no other substantial reasons for concluding that outlets would not operate safely to full design capacity during the spillway design flood.

B. If there are reasons to doubt that any of the above basic requirements might not be adequately met under spillway design flood conditions, the "dependable" discharge capabilities of regulating outlets shall be assumed to be less than 100% of design capabilities, generally as outlined in the following subsections C through G of this section.

C. Any limitations in safe operating heads, maximum velocities to be permitted through structures or approach channels, or other design limitations shall be observed in establishing "dependable" discharge rating curves to be used in routing the spillway design flood hydrograph through the reservoir.

D. If intakes to regulating outlets are likely to be exposed to dangerous quantities of floating drift, sediment depositions or ice hazards prior to or during major floods, the dependable discharge capability during the spillway design flood shall be assumed to be zero.

E. If access roads or structural passages to operating towers or controls are likely to be flooded or otherwise unusable during the spillway design flood, the dependable discharge capability of regulating outlets will be assumed to be zero for those periods of time during which such conditions might exist.

F. Any deficiencies in discharge performance likely to result from delays in the operation of gates before attendants could be reasonably expected to reach the control under spillway design flood conditions shall be accounted for in estimating "dependable" discharge capabilities to be assumed in routing the spillway design flood through reservoir. Reports on design studies shall indicate the allowances made for possible delays in initiating gate operations. Normally, for projects located in small basins, where critical spillway design flood inflows may occur within several hours after intense precipitation, outflows through any regulating outlets that must be opened after the flood begins shall be assumed to be zero for an appropriate period of time subsequent to the beginning of intense rainfall.

G. All gates, valves, conduits and concrete channel outlets shall be designed and constructed to prevent significant erosion or damage to the impounding structure or to the downstream outlet or channel.

§ 4VAC50-20-280 DRAIN REQUIREMENTS.

Statutory Authority §10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §5.5; effective February 1, 1989).

All new impounding structures regardless of their hazard potential classification, shall include a device to permit draining of the impoundment within a reasonable period of time as determined by the owner's professional engineer, subject to approval by the director.

§ 4VAC50-20-290 LIFE OF THE IMPOUNDING STRUCTURE.

Statutory Authority§10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §5.6; effective February 1, 1989).

Components of the impounding structure, the impoundment, the outlet works, drain system and appurtenances shall be durable in keeping with the design and planned life of the impounding structure.

§ 4VAC50-20-300 ADDITIONAL DESIGN REQUIREMENTS.

Statutory Authority§10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §5.7; effective February 1, 1989).

A. Flood routings shall start at or above the elevation of the crest of the lowest ungated outlet.

B. All elements of the impounding structure and impoundments shall conform to sound engineering practice. Safety factors, design standards and design references that are used shall be included with the design report.

C. Inspection devices may be required by the director for use by inspectors, owners or the director in conducting inspections in the interest of structural integrity during and after completion of construction and during the life of the impounding structure.

§ 4VAC50-20-310 PLANS AND SPECIFICATIONS.

Statutory Authority§10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §5.8; effective February 1, 1989).

The plans and specifications for a proposed impounding structure shall consist of a detailed engineering design report that includes engineering drawings and specifications, with the following as a minimum:

1. The name of the project; the name of the owner; classification of the impounding structure as set forth in this chapter; designated access to the project and the location with respect to highways, roads, streams and existing impounding structures and impoundments that would affect or be affected by the proposed impounding structure.

2. Cross-sections, profiles, logs of test borings, laboratory and in situ test data, drawings of principal and emergency spillways and other additional drawings in sufficient detail to indicate clearly the extent and complexity of the work to be performed.

3. The technical provisions, as may be required to describe the methods of the construction and construction quality control for the project.

4. Special provisions, as may be required to describe technical provisions needed to ensure that the impounding structure is constructed according to the approved plans and specifications.

§ 4VAC50-20-320 ACCEPTABLE DESIGN PROCEDURES AND REFERENCES.

Statutory Authority §10.1-605 of the Code of Virginia.
(Historical Notes:Derived from VR625-01-00 §5.9; effective February 1, 1989).

The following are acceptable as design procedures and references:

1. The design procedures, manuals and criteria used by the United States Army Corps of Engineers.

2. The design procedures, manuals and criteria used by the United States Department of Agriculture, Soil Conservation Service.

3. The design procedures, manuals and criteria used by the United States Department or Interior, Bureau of Reclamation.

4. The design procedures, manuals and criteria used by the United States Department of Commerce, National Weather Service.

5. Other design procedures, manuals and criteria that are accepted as current, sound engineering practices, as approved by the director prior to the design of the impounding structure.