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: **MC037**

DATE VERIFIED: **November 26, 2012**

QUALITY ASSURANCE TECHNICIAN: **Leah Hardenbergh**

Leah Hardenbergh

LOCATION: WILLIAMSBURG, VIRGINIA

Stormwater Division

MEMORANDUM

Date: April 4, 2012

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

From: Leah Hardenbergh

PO: 110426

Re: Files Approved for Scanning

General File ID or BMP ID:	**MC037**
PIN:	**4812300001A**
Owner Name (if known):	**LAKE POWELL FOREST**
Legal Property Description:	**CONSERVATION AREA LAKE POWELL FOREST**
Site Address:	**END STRATEGY CT. LOT 53**

(For internal use only):

Box # 4

Agreements (in file as of scan date): Y Book or Doc #: 980000125

MC-037

tents for Stormwater Management Facilities As-built Files

h 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

DECLARATION OF COVENANTS

COPY

INSPECTION/MAINTENANCE OF DRAINAGE SYSTEM

THIS DECLARATION, made this 17 day of December, 19 97, between Boyd Corporation, and all successors in interest, hereinafter referred to as the "COVENANTOR(S)," owner(s) of the following property: Lake Powell Forest _____, Deed Book 777, Page No. 825 or Instrument No. _____, and James City County, Virginia, hereinafter referred to as the "COUNTY."

WITNESSETH:

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

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

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

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

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

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

6. The COVENANTOR(S) shall indemnify and save the COUNTY harmless from any and all claims for damages to persons or property arising from the installation, construction, maintenance, repair, operation or use of the SYSTEM.

7. The COVENANTOR(s) shall promptly notify the COUNTY when the COVENANTOR(S) legally transfers any of the COVENANTOR(S)' responsibilities for the SYSTEM. The COVENANTOR(S)' shall supply the COUNTY with a copy of any document of transfer, executed by both parties.

8. The covenants contained herein shall run with the land and shall bind the COVENANTOR(S) and the COVENANTOR(S)' heirs, executors, administrators, successors and assignees, and shall bind all present and subsequent owners of property served by the SYSTEM.

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

Instrument # 980000125

Recorded 1-6-98

MC037_LAKE_POWELL_FOREST_END_CONSERVATION_AREA - 004

IN WITNESS WHEREOF, the COVENANTOR(S) have executed this DECLARATION OF COVENANTS as of this 17 day of December, 19 97.

COVENANTOR(S)
Boyd Corporation

By: _____

Murden C. Temple, Jr.
Vice President

ATTEST:
Boyd Corporation

By: _____

Frank B. MInschke, II
Secretary

COVENANTOR(S)

_____

ATTEST:

_____

COMMONWEALTH OF VIRGINIA
CITY/COUNTY OF Virginia Beach

I hereby certify that on this 17 day of December, 1997, before the subscribed, a Notary Public of the State of Virginia, and for the County of Virginia Beach, aforesaid personally appeared Murden C. Temple, JR and did acknowledge the aforegoing instrument to be their Act.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal this 17th day of December, 19 97.

Laurie J. Altman
Notary Public

My Commission expires: March 31, 2001

Approved as to form:

Leo P. Rogers
Deputy County Attorney

This Declaration of Covenants prepared by:

JAMES L REECE
(Print Name)

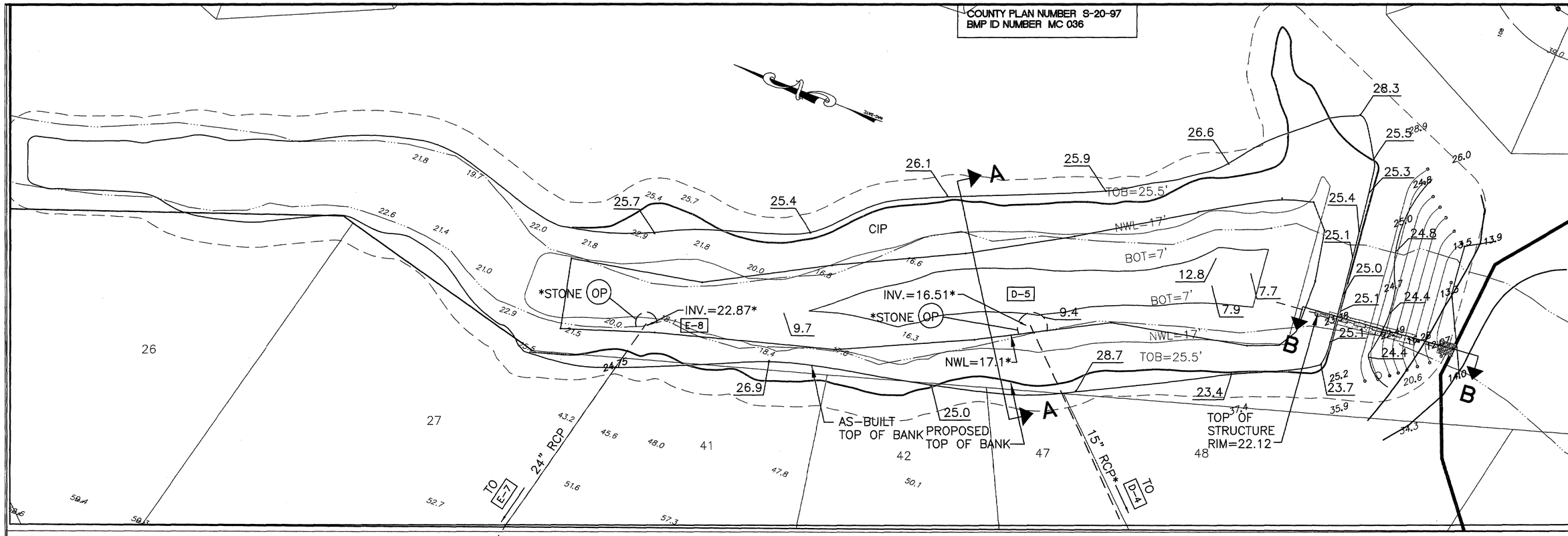
CONSTRUCTION MANAGER
(Title)

396 S. WITCHDUCK RD.
(Address)

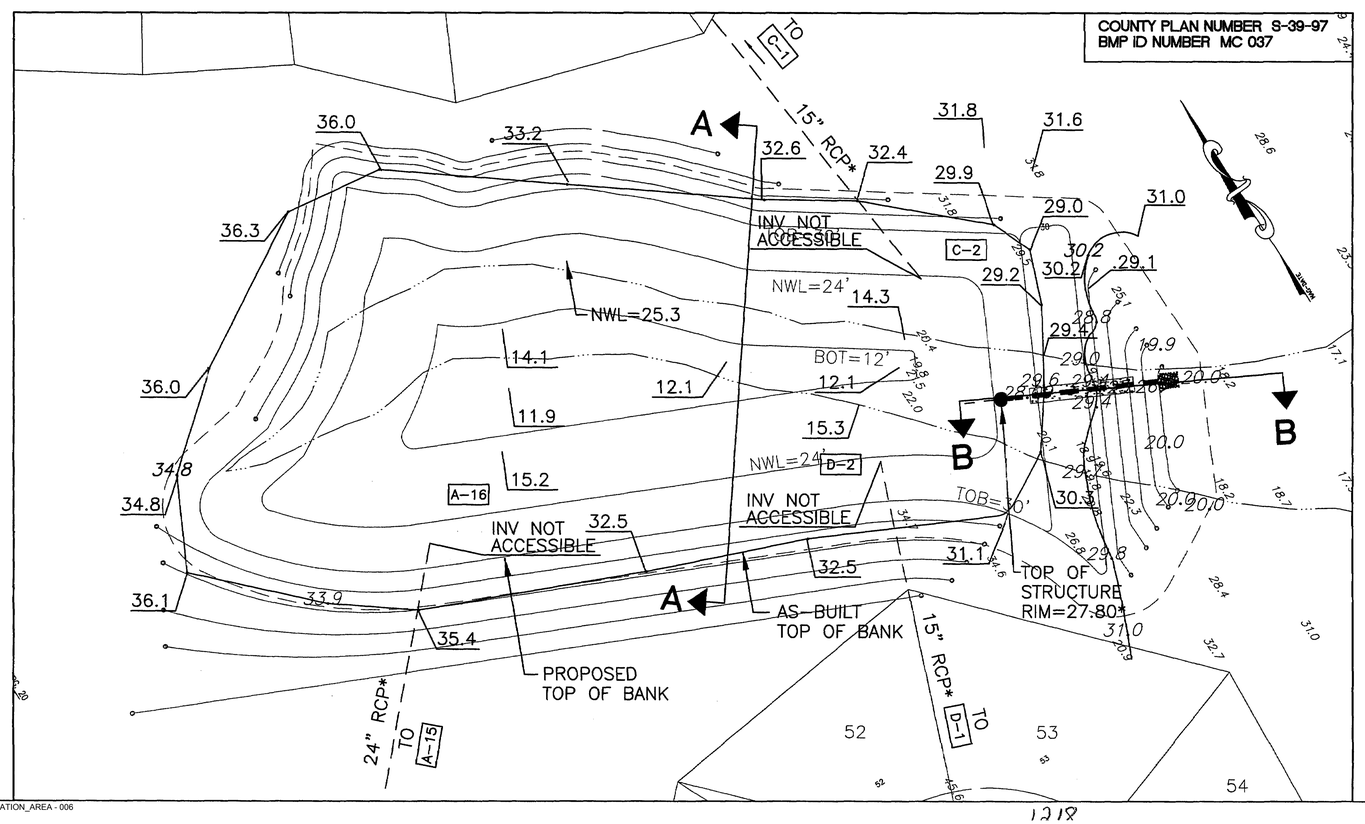
VA. BEACH VA. 23462
(City) (State) (Zip)

drainage.pre
Revised 2/97

MC037_LAKE_POWELL_FOREST_END_CONSERVATION_AREA - 005



LAKE POWELL POINT – WET POND # 1
SEE SHEET 17 FOR DETAILS AND CROSS-SECTIONS



BASED ON THE COMPACTION TESTS AND CERTIFICATION PROVIDED BY MCCALLUM, AND THE AS-BUILT DATA, TO THE BEST OF MY KNOWLEDGE I CERTIFY THESE DAMS HAVE BEEN CONSTRUCTED IN ACCORDANCE WITH THE APPROVED ENGINEERING PLANS.

_____ P.E.

DATE: _____

77cc

XX.XX AS-BUILT GRADE

LAKE POWELL FOREST – WET POND #2
SEE SHEET 17 FOR DETAILS AND CROSS-SECTIONS

NOTES

1. UPON COMPLETION OF THE CONSTRUCTION OF THE DAMS, THEY SHALL EACH BE CERTIFIED BY A PROFESSIONAL ENGINEER WHO HAS INSPECTED THE STRUCTURE DURING CONSTRUCTION.
2. LAKE POWELL POND
   A. CONTRACTOR TO PROVIDE LINER FOR POND FROM ELEVATION 17 FT. TO ELEVATION 25 FT.
   B. LINER TO BE:
      I) 6 INCHES CLAY, OR
      II) PLASTIC LINER
3. DURFEY'S MILL POND
   A. CONTRACTOR TO PROVIDE LINER FOR POND FROM ELEVATION 10 FT. TO ELEVATION 26.5 FT.
   B. LINER TO BE:
      I) 6 INCHES CLAY, OR
      II) PLASTIC LINER

LINER ISSUE

AS-BUILT LAKES 8/29/00

No.	Date	Description
5	8-21-97	REVISED PER COUNTY ENVIRONMENTAL DIVISION
4	7-22-97	REVISED PER COUNTY MEMO 7-17-97
3	7-9-97	REVISED PER COUNTY FACSIMILE 7-9-97
2	7-3-97	REVISED PONDS PER COUNTY LTR 6-10-97
1	5-29-97	REVISED PER COUNTY LTR 4-10-97 AND VDOT LTR 4-3-97

REVISIONS

HORTON & DODD, P.C.
Surveyors Engineers Planners
164 S. George Washington Highway (757) 487-4535 Chesapeake, Virginia 23323

DES. BY: ERF
DRW. BY: RWS
CHK'D BY: IHB

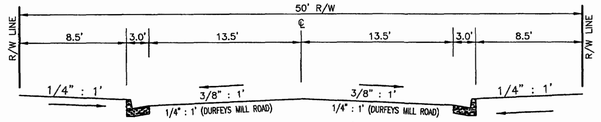
SCALE: 1" = 30'
DATE: 9-5-00
REFERENCE BOOK 1308A\ASB-LAKE2
W.O. 13084
SHEET ___ OF ___ 20

COMMONWEALTH OF VIRGINIA
J. GREGORY DODD
No. 13253
PROFESSIONAL ENGINEER

WET PONDS PLAN SHEET
OF
LAKE POWELL POINTE / LAKE POWELL FOREST
JAMES CITY COUNTY - VIRGINIA

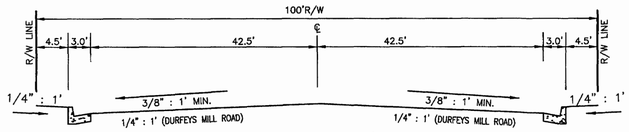
F:\Acad\Dwg\13084\ASB-LAKE2.dwg, 12/17/2003 9:13:30 AM, PAYF.PAYF

MC037_LAKE_POWELL_FOREST_END_CONSERVATION_AREA - 006



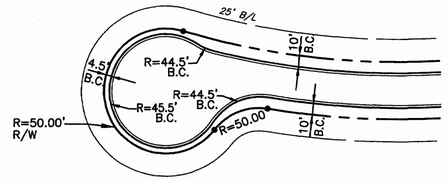
TYPICAL 50' R/W

NOT TO SCALE



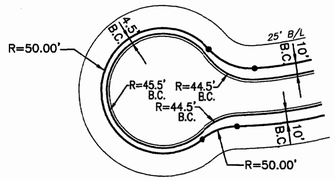
TYPICAL 100' R/W

NOT TO SCALE



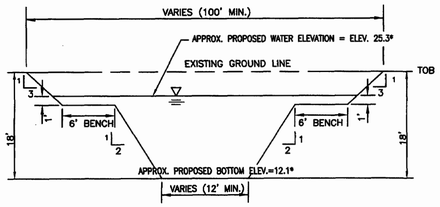
TYPICAL OFFSET CUL-DE-SAC

NOT TO SCALE



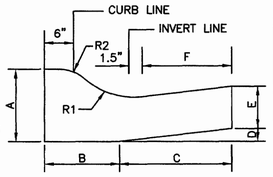
TYPICAL CUL-DE-SAC

NOT TO SCALE



SECTION A - A

N.T.S.



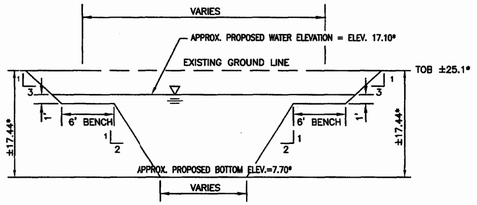
DIMENSIONS	
A	11.5 IN (290 MM)
B	1 FT 0 IN (310 MM)
C	2 FT 0 IN (610 MM)
D	2 IN (50 MM)
E	7 IN (180 MM)
F	1 IN 6 FT (460 MM)
R1	1 FT 6 IN (460 MM)
R2	1 FT 3 IN (380 MM)

NOTE:

1. STONE MUST BE 4" DEEP AND EXTEND 1 FOOT BEHIND THE BACK OF CURB
2. THE STONE UNDER THE CURB AND GUTTER SHALL BE CHECKED BY VDOT PRIOR TO PAVING OR BACKFILLING.

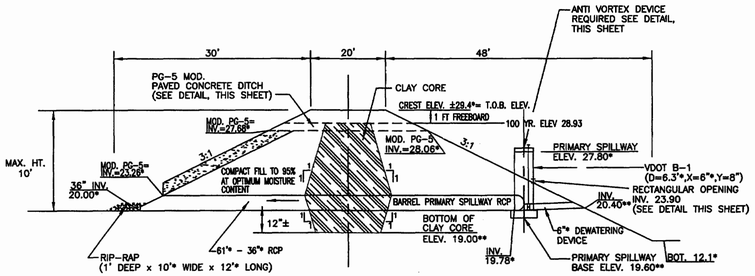
ROLL TOP CURB

NOT TO SCALE



SECTION A - A

N.T.S.



SECTION AT PRIMARY SPILLWAY 'B-B'

N.T.S.

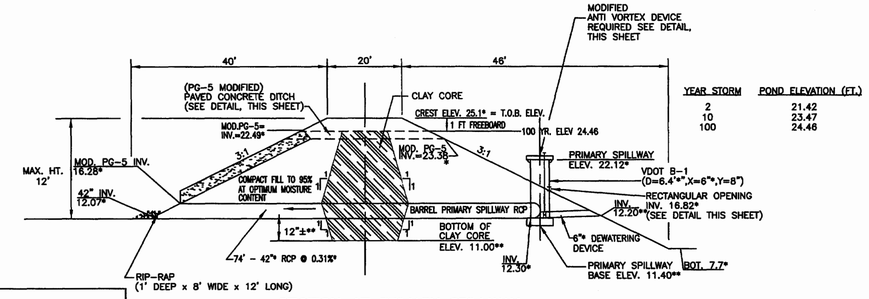
YEAR STORM	POND ELEVATION (FT.)
2	27.24
10	28.38
100	28.93

* AS-BUILT CONDITION

** AS-BUILT INFORMATION INACCESSIBLE

ANTI-VORTEX DEVICE DETAIL - (WET POND #2 - LAKE POWELL FOREST)

N.T.S.



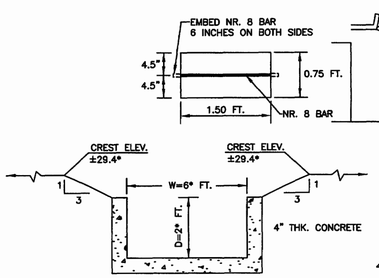
YEAR STORM	POND ELEVATION (FT.)
2	21.42
10	23.47
100	24.46

* AS-BUILT CONDITION

** AS-BUILT INFORMATION INACCESSIBLE

SECTION AT PRIMARY SPILLWAY 'B-B'

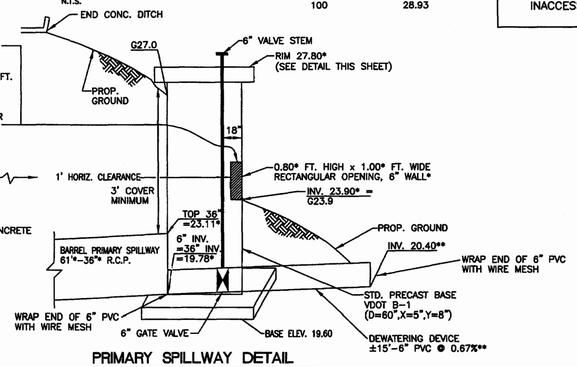
N.T.S.



PG-5 MODIFIED DETAIL

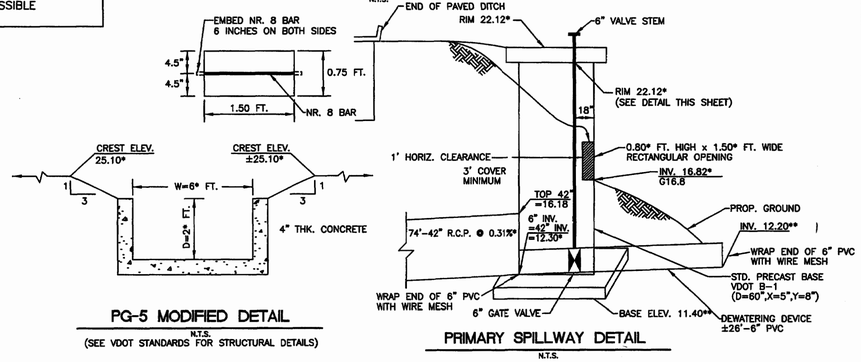
N.T.S.

(SEE VDOT STANDARDS FOR STRUCTURAL DETAILS)



PRIMARY SPILLWAY DETAIL

N.T.S.



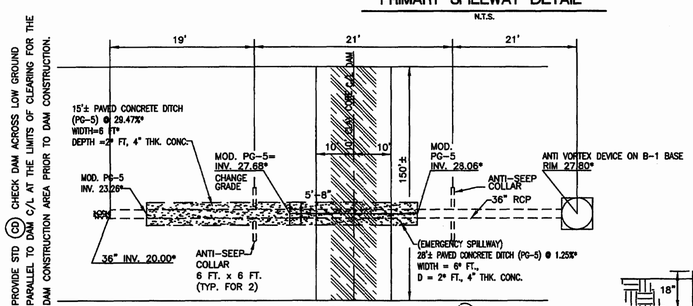
PG-5 MODIFIED DETAIL

N.T.S.

(SEE VDOT STANDARDS FOR STRUCTURAL DETAILS)

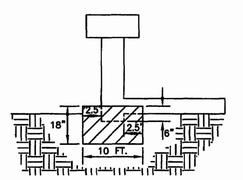
PRIMARY SPILLWAY DETAIL

N.T.S.



PARTIAL DAM PLAN

N.T.S.



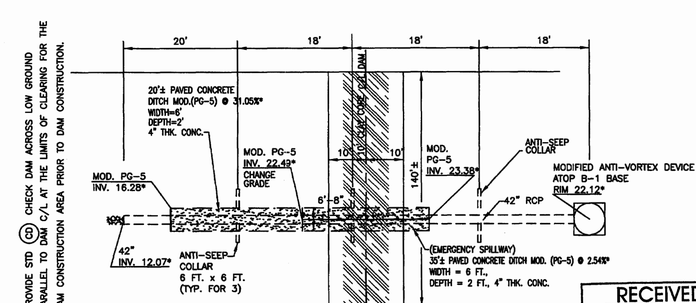
RISER PIPE BASE CONDITIONS

N.T.S.

(MODIFIED)

ANTI-VORTEX DEVICE DETAIL - (WET POND #1 - DURFEY'S MILL)

N.T.S.



PARTIAL DAM PLAN

N.T.S.

RECEIVED

MAR 23 2006

ENVIRONMENTAL DIVISION

MC037

DAM DETAILS (WET POND #2 - LAKE POWELL FOREST)

MC036

DAM DETAILS (WET POND #1 - LAKE POWELL POINTE)

AS-BUILT LAKES 8/29/00

No.	Date	Description
		REVISIONS

HORTON & DODD, P.C.
Surveyors Engineers Planners
164 S. George Washington Highway Chesapeake, Virginia 23323
(757) 487-4535

DES. BY: ERF
DRW. BY: RWS
CHK'D BY: IHB

REFERENCE BOOK AS-BUILTS\DETAILS
W.O. 13084

SCALE: AS SHOWN
DATE: 2-21-97

SHEET 17 OF 20

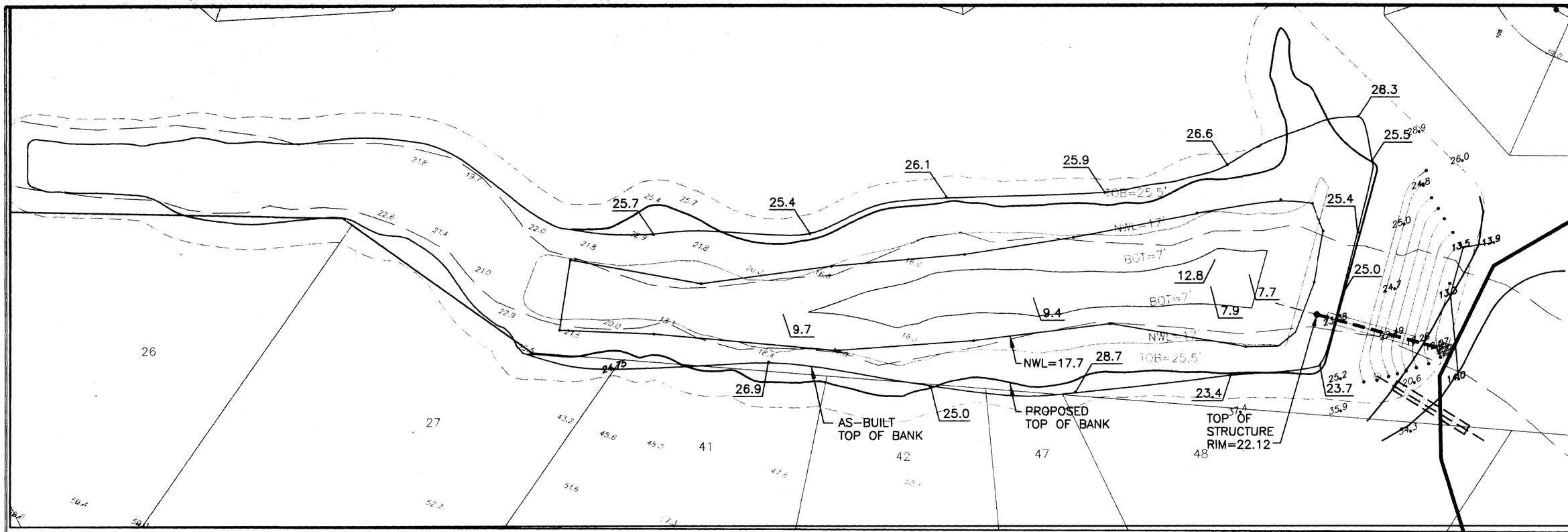
COMMONWEALTH OF VIRGINIA
I. GREGORY DODD
No. 13253
PROFESSIONAL ENGINEER

DETAILS AND NOTES OF LAKE POWELL POINTE / LAKE POWELL FOREST

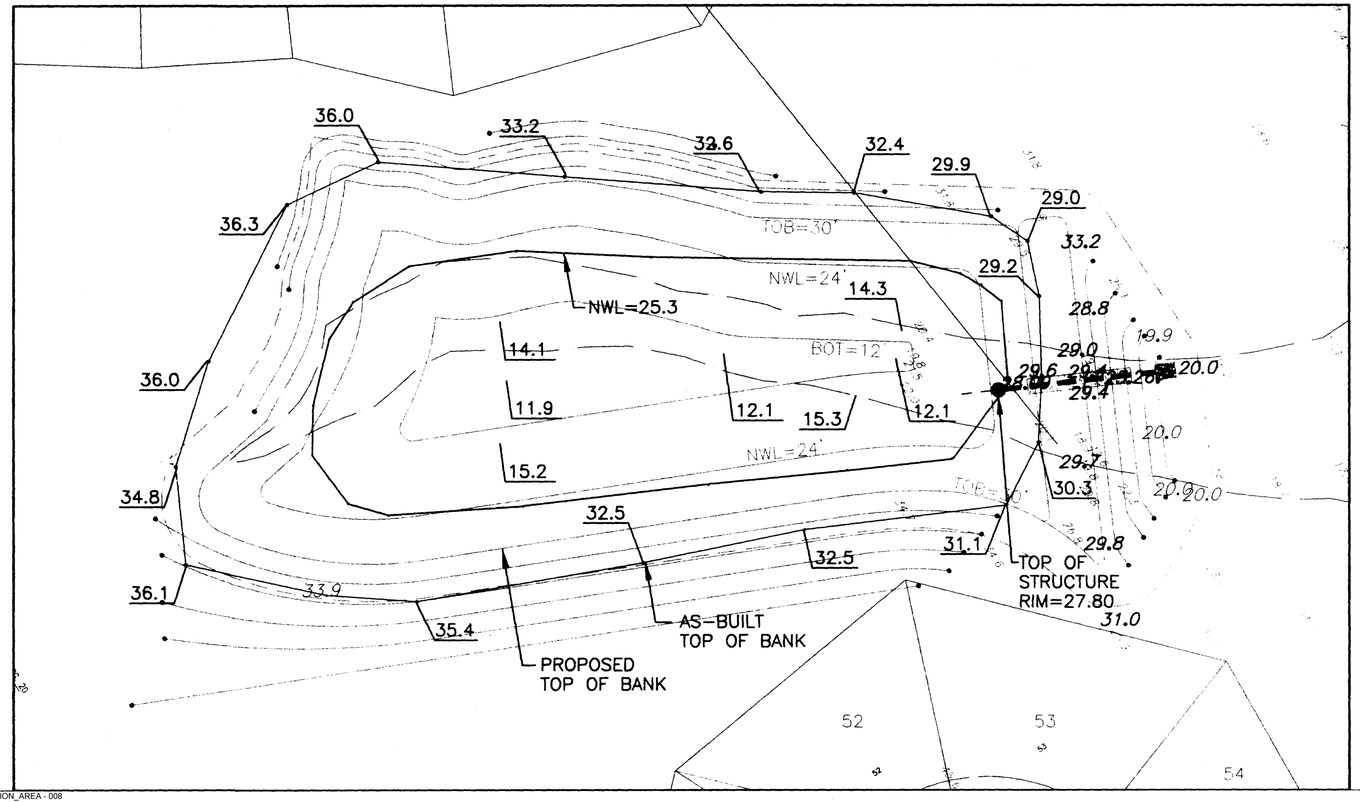
JAMES CITY COUNTY - VIRGINIA

F:\Acad\Dwg\13084\AS-BUILT\ASBDetail3.dwg, 12/17/2003 9:04:19 AM, PAYF,PAYF

MC037_LAKE_POWELL_FOREST_END_CONSERVATION_AREA_007



WET POND FOR DURFEY'S MILL SUBDIVISION
SEE SHEET 17 FOR DETAILS AND CROSS-SECTIONS



XX.XX AS-BUILT GRADE

WET POND FOR LAKE POWELL FOREST,
SEE SHEET 17 FOR DETAILS AND CROSS-SECTIONS

NOTES

1. UPON COMPLETION OF THE CONSTRUCTION OF THE DAMS, THEY SHALL EACH BE CERTIFIED BY A PROFESSIONAL ENGINEER WHO HAS INSPECTED THE STRUCTURE DURING CONSTRUCTION.
2. LAKE POWELL POND
   A. CONTRACTOR TO PROVIDE LINER FOR POND FROM ELEVATION 17 FT. TO ELEVATION 25 FT.
   B. LINER TO BE:
      I) 6 INCHES CLAY, OR
      II) PLASTIC LINER
3. DURFEY'S MILL POND
   A. CONTRACTOR TO PROVIDE LINER FOR POND FROM ELEVATION 10 FT. TO ELEVATION 26.5 FT.
   B. LINER TO BE:
      I) 6 INCHES CLAY, OR
      II) PLASTIC LINER

AS-BUILT LAKES 8/29/00

No.	Date	Description
5	8-21-97	REVISED PER COUNTY ENVIRONMENTAL DIVISION
4	7-22-97	REVISED PER COUNTY MEMO 7-17-97
3	7-9-97	REVISED PER COUNTY FACSIMILE 7-9-97
2	7-3-97	REVISED PONDS PER COUNTY LTR 6-10-97
1	5-29-97	REVISED PER COUNTY LTR 4-10-97 AND VDOT LTR 4-3-97

REVISIONS

HORTON & DODD, P.C.
Surveyors Engineers Planners
164 S. George Washington Highway Chesapeake, Virginia 23323
(757) 487-4535

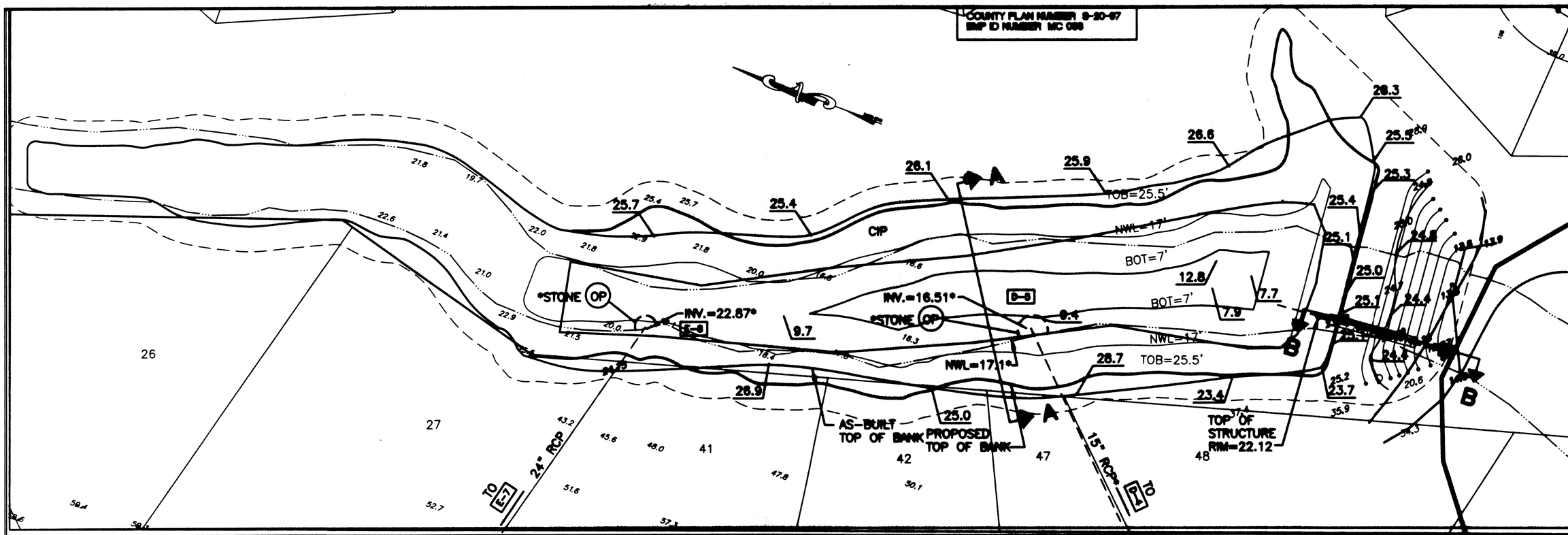
DES. BY: ERF
DRW. BY: RWS
CHK'D BY: IHB
SCALE: 1"= 30'
DATE: 9-5-00
REFERENCE BOOK 13084\ASB-LAKE2
W.O. 13084
SHEET ___ 20 ___ OF ___ 20 ___

WET PONDS PLAN SHEET
OF
DURFEY'S MILL II SUBDIVISION / LAKE POWELL FOREST
JAMES CITY COUNTY - VIRGINIA

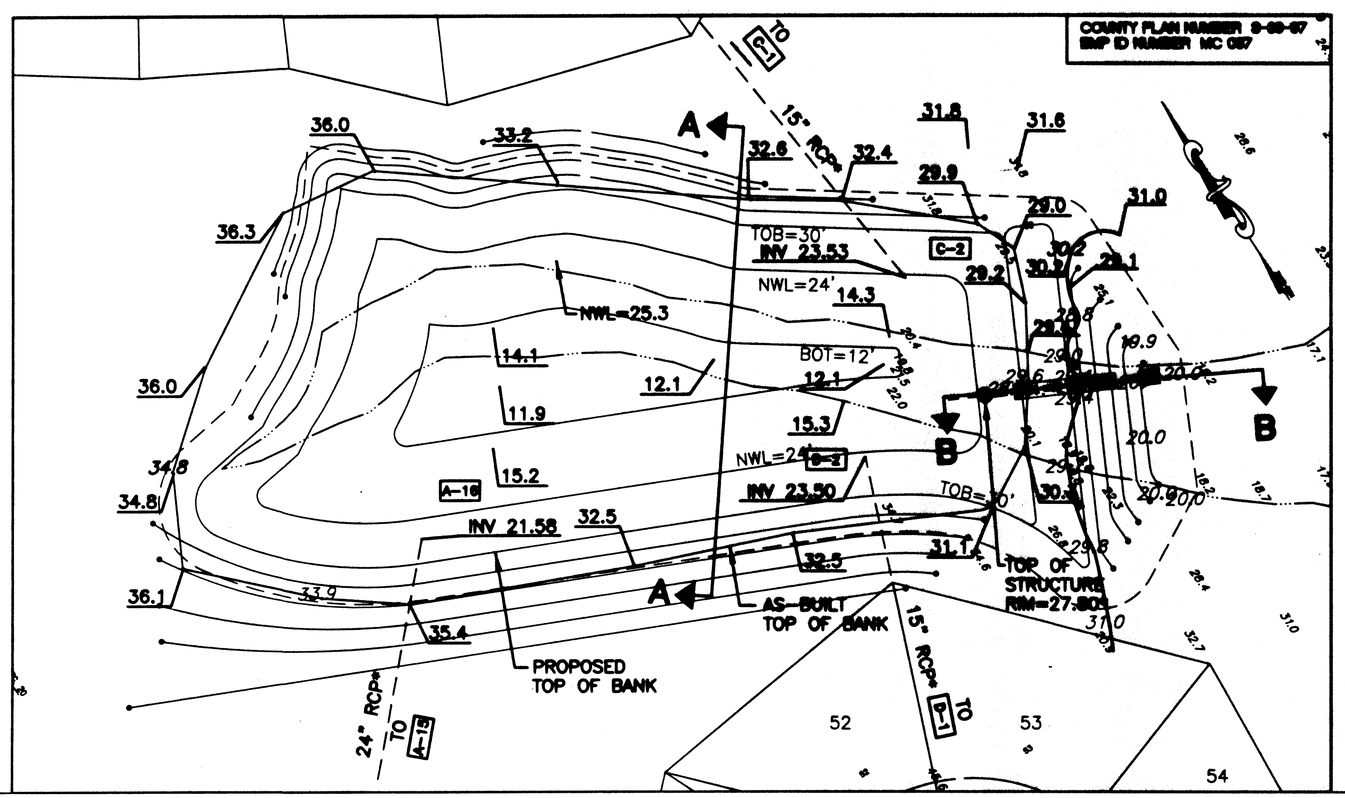
COMMONWEALTH OF VIRGINIA
No. 12851
PROFESSIONAL ENGINEER

F:\Acad\Dwg\13084\ASB-LAKE2.dwg Tue Sep 05 12:04:42 2000

MC037_LAKE_POWELL_FOREST_END_CONSERVATION_AREA - 008



LAKE POWELL POINT – WET POND # 1
SEE SHEET 17 FOR DETAILS AND CROSS-SECTIONS



XX.XX AS-BUILT GRADE

LAKE POWELL FOREST – WET POND #2
SEE SHEET 17 FOR DETAILS AND CROSS-SECTIONS

No.	Date	Description
6	10-8-08	ADDITIONAL LAKE AS-BUILT INFORMATION
5	8-21-97	REVISED PER COUNTY ENVIRONMENTAL DIVISION
4	7-22-97	REVISED PER COUNTY MEMO 7-17-97
3	7-9-97	REVISED PER COUNTY FACSIMILE 7-9-97
2	7-3-97	REVISED PONDS PER COUNTY LTR 6-10-97
1	5-28-97	REVISED PER COUNTY LTR 4-10-97 AND VDOT LTR 4-3-97

REVISIONS

HORTON & DODD, P.C.
Surveyors Engineers Planners
164 S. George Washington Highway (757) 487-4535 Chesapeake, Virginia 23323

DES. BY: DIF
DRW. BY: RWS
CHK'D BY: HHB

SCALE: 1"= 30'
DATE: 9-5-00

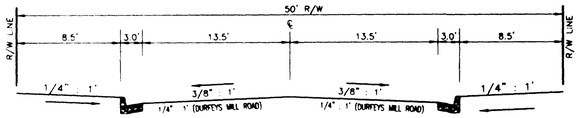
REFERENCE BOOK 13084\VB-LWF2
W.O. 13084

SHEET 20 OF 20

AS-BUILT LAKES 8/29/00

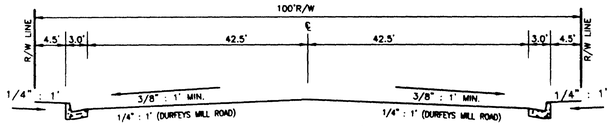
WET PONDS PLAN SHEET
OF
LAKE POWELL POINTE / LAKE POWELL FOREST
JAMES CITY COUNTY - VIRGINIA

MC037_LAKE_POWELL_FOREST_END_CONSERVATION_AREA - 009



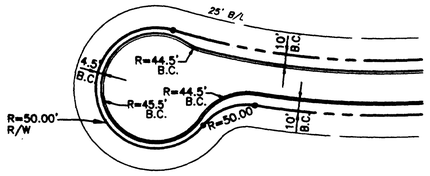
TYPICAL 50' R/W

NOT TO SCALE



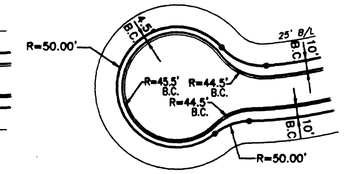
TYPICAL 100' R/W

NOT TO SCALE



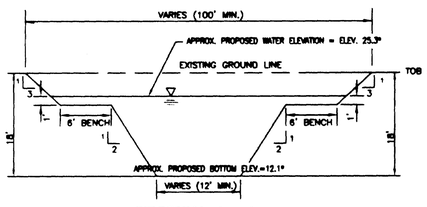
TYPICAL OFFSET CUL-DE-SAC

NOT TO SCALE



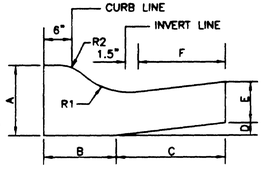
TYPICAL CUL-DE-SAC

NOT TO SCALE



SECTION A - A

N.T.S.



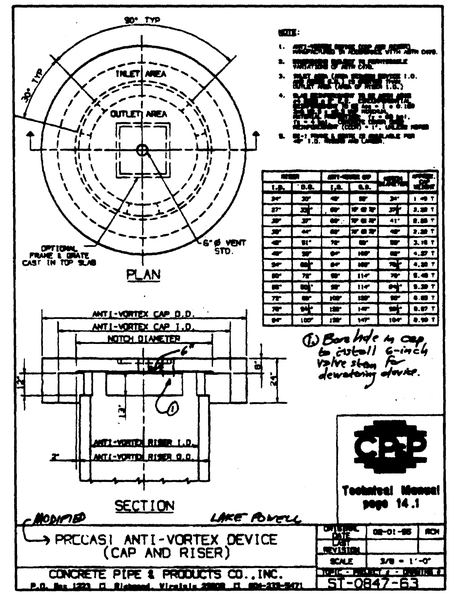
DIMENSIONS	
A	11.5 IN (290 MM)
B	1 FT 0 IN (310 MM)
C	2 FT 0 IN (610 MM)
D	2 IN (50 MM)
E	7 IN (180 MM)
F	1 IN 8 FT (460 MM)
R1	1 FT 6 IN (460 MM)
R2	1 FT 3 IN (380 MM)

NOTE:

1. STONE MUST BE 4" DEEP AND EXTEND 1 FOOT BEHIND THE BACK OF CURB
2. THE STONE UNDER THE CURB AND GUTTER SHALL BE CHECKED BY VDOT PRIOR TO PAVING OR BACKFILLING.

ROLL TOP CURB

NOT TO SCALE



INLET		ANTI-VORTEX CAP		VORTEX RISER	APPROX. WEIGHT
I.D.	O.D.	I.D.	O.D.		
24"	30"	42"	50"	24"	1.40 T
27"	33"	45"	53"	27"	2.30 T
30"	36"	48"	56" 或 58"	30"	2.35 T
33"	39"	51"	59" 或 61"	33"	2.55 T
36"	42"	54"	62" 或 64"	36"	2.85 T
42"	51"	72"	80"	42"	3.15 T
48"	58"	84"	92"	48"	4.25 T
54"	66"	96"	104"	54"	4.35 T
60"	72"	108"	116"	60"	5.45 T
66"	78"	114"	122"	66"	5.55 T
72"	84"	120"	128"	72"	6.65 T
78"	90"	126"	134"	78"	6.75 T
84"	102"	138"	146"	84"	8.10 T

① Bore hole in cap to install 6-inch valve stem for dewatering device.

MODIFIED LAKE POWELL

PRECAST ANTI-VORTEX DEVICE (CAP AND RISER)

ORIGINAL DATE 02-01-96 RCH

LAST REVISION

SCALE 3/8 = 1'-0"

TOPIC - SHEET 2 - POSITION 2

CONCRETE PIPE & PRODUCTS CO., INC.

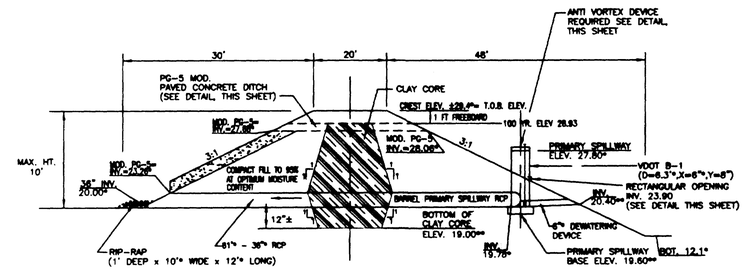
P.O. Box 12013 ☐ Richmond, Virginia 23241 ☐ 804-330-9471

ST-0847-63

ANTI-VORTEX DEVICE DETAIL - (WET POND #2 - LAKE POWELL FOREST)

N.T.S.

- AS-BUILT CONDITION
- ** AS-BUILT INFORMATION INACCESSIBLE

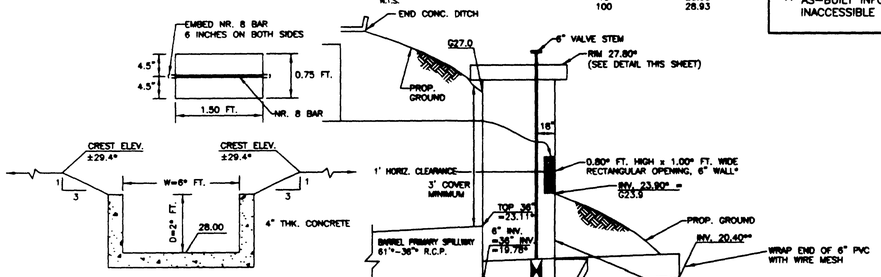


SECTION AT PRIMARY SPILLWAY 'B-B'

N.T.S.

YEAR STORM	POND ELEVATION (FT.)
2	27.24
10	28.38
100	28.93

- AS-BUILT CONDITION
- ** AS-BUILT INFORMATION INACCESSIBLE



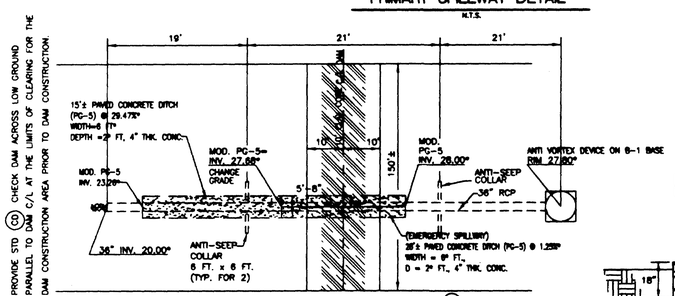
PG-5 MODIFIED DETAIL

N.T.S.

(SEE VDOT STANDARDS FOR STRUCTURAL DETAILS)

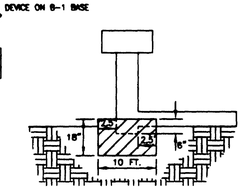
PRIMARY SPILLWAY DETAIL

N.T.S.



PARTIAL DAM PLAN

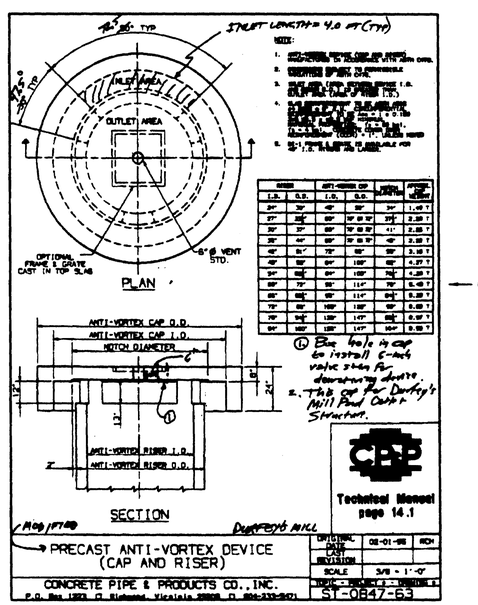
N.T.S.



RISER PIPE BASE CONDITIONS

N.T.S.

DAM DETAILS (WET POND #2 - LAKE POWELL FOREST)



INLET		ANTI-VORTEX CAP		VORTEX RISER	APPROX. WEIGHT
I.D.	O.D.	I.D.	O.D.		
24"	30"	42"	50"	24"	1.40 T
27"	33"	45"	53"	27"	2.30 T
30"	36"	48"	56" 或 58"	30"	2.35 T
33"	39"	51"	59" 或 61"	33"	2.55 T
36"	42"	54"	62" 或 64"	36"	2.85 T
42"	51"	72"	80"	42"	3.15 T
48"	58"	84"	92"	48"	4.25 T
54"	66"	96"	104"	54"	4.35 T
60"	72"	108"	116"	60"	5.45 T
66"	78"	114"	122"	66"	5.55 T
72"	84"	120"	128"	72"	6.65 T
78"	90"	126"	134"	78"	6.75 T
84"	102"	138"	146"	84"	8.10 T

① Bore hole in cap to install 6-inch valve stem for dewatering device.
2. This cap for Durfey's Mill Pond Outlet Structure.

MODIFIED DURFEY'S MILL

PRECAST ANTI-VORTEX DEVICE (CAP AND RISER)

ORIGINAL DATE 02-01-96 RCH

LAST REVISION

SCALE 3/8 = 1'-0"

TOPIC - SHEET 2 - POSITION 2

CONCRETE PIPE & PRODUCTS CO., INC.

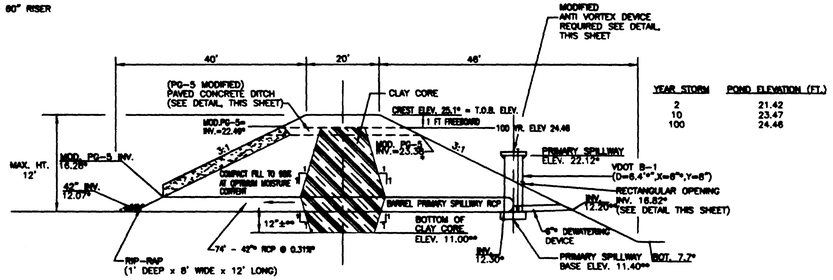
P.O. Box 12013 ☐ Richmond, Virginia 23241 ☐ 804-330-9471

ST-0847-63

(MODIFIED)

ANTI-VORTEX DEVICE DETAIL - (WET POND #1 - DURFEY'S MILL)

N.T.S.

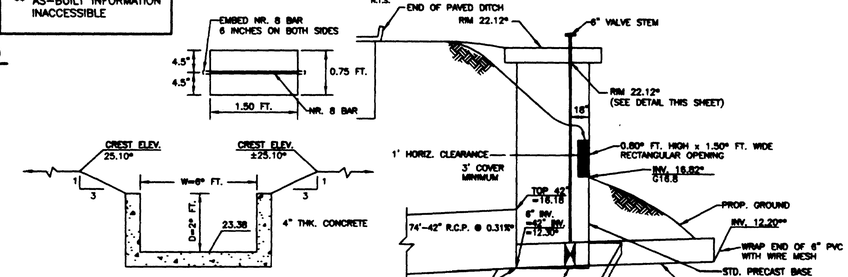


YEAR STORM	POND ELEVATION (FT.)
2	21.42
10	23.47
100	24.46

- AS-BUILT CONDITION
- ** AS-BUILT INFORMATION INACCESSIBLE

SECTION AT PRIMARY SPILLWAY 'B-B'

N.T.S.



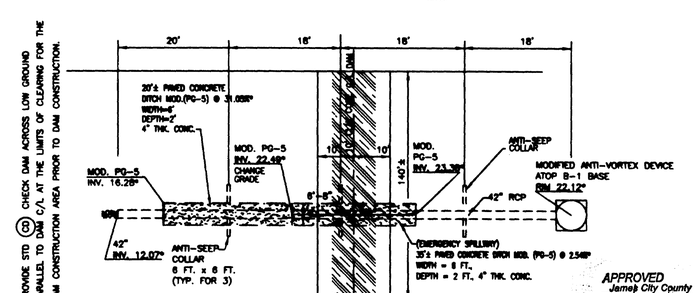
PG-5 MODIFIED DETAIL

N.T.S.

(SEE VDOT STANDARDS FOR STRUCTURAL DETAILS)

PRIMARY SPILLWAY DETAIL

N.T.S.



APPROVED James City County Environmental Division By: _____ Date: _____

PARTIAL DAM PLAN

N.T.S.

DAM DETAILS (WET POND #1 - LAKE POWELL POINTE)

No.	Date	Description
1	10-9-06	ADDITIONAL LAKE AS-BUILT INFORMATION

REVISIONS

HORTON & DODD, P.C.
Surveyors Engineers Planners
(757) 487-4535 Chesapeake, Virginia 23323
164 S. George Washington Highway

DES. BY: ERF
DRW. BY: RWS
CHK'D BY: HHB

SHEET 17 OF 20

REFERENCE BOOK AS-BUILTS\DETAIL3

SCALE: AS SHOWN

DATE: 2-21-97

W.O. 13084

COMMONWEALTH OF VIRGINIA — LICENSED PROFESSIONAL ENGINEER — No. 12025

AS-BUILT LAKES 8/29/00

DETAILS AND NOTES OF LAKE POWELL POINTE / LAKE POWELL FOREST

JAMES CITY COUNTY - VIRGINIA

MC037_LAKE_POWELL_FOREST_END_CONSERVATION_AREA - 010

NOTES
1. THIS SITE IS WOODED
2. VDOT WILL HAVE NO MAINTENANCE RESPONSIBILITY FOR THE PONDS AND SHALL BE SAVED HARMLESS FROM ANY DAMAGE CAUSED BY FAILURE OF THE PONDS AND THEIR OUTFALL STRUCTURES.
3. AS TAKEN FROM JAMES CITY COUNTY SOIL SURVEY, ON SITE SOILS INCLUDE:
A. EMPORIA COMPLEX, 15 -25% SLOPES
B. MUNDEN LOAMY FINE SAND
C. CRAVEN-UCHEE COMPLEX, 6- 10% SLOPES
D. KEMPSVILLE - EMPORIA FINE SANDY LOAMS, 2 - 6% SLOPES
4. ALL PUBLIC DRAINAGE EASEMENTS TO BE DEDICATED TO THE HOME OWNERS ASSOCIATION.
5. A PROPOSED CONSERVATION EASEMENT WILL EXTEND FROM THE LIMITS OF THE 100' RPA TOWARDS THE EDGE OF WATER AS SHOWN ON THE LAYOUT PLAN (SHEET 2). THE PROPOSED CONSERVATION EASEMENT SHALL ALSO INCLUDE COMMON AREAS OUTSIDE THE PROPOSED LOTS (ONLY COMMON AREAS THAT WILL NOT BE CLEARED) FOR MORE PRECISE DELINEATION, PLEASE SEE SUBDIVISION PLAT.
6. LOT GRADING SHOWN IS FOR ILLUSTRATION ONLY. ONLY CLEARING/GRADING ALLOWED IS TO BE WITHIN THE LIMITS OF CLEARING. ACTUAL LOT GRADING TO BE ADDRESSED BY BUILDER FOR EACH LOT.
7. CONSTRUCTION OF THIS SITE SHALL NOT BE PHASED.
8. ALL DRAINAGE STRUCTURES TO BE VDOT STANDARD.
9. CLEARING/CONSTRUCTION ROUTE TO BUILD LAKE POWELL'S POND/DAM: HILLSIDE WAY TO CASTLING CROSSING TO DRAINAGE EASEMENT (BETWEEN LOTS 35 & 36) TO POND.
10. DURFEY'S MILL POND SHALL BE IN PLACE PRIOR TO LAKE POWELL CONSTRUCTION.
11. VDOT STANDARD CONCRETE SAFETY SLAB (SL-1) IS REQUIRED FOR ALL STORM DRAINAGE STRUCTURES IN EXCESS OF TEN FEET.
12. PROPOSED 5 FOOT NATURE TRAIL
A. TO BE CLEARED BY CONTRACTOR, BY HAND.
B. IF MULCH IS USED AS A WALKING TRAIL, NO CLEARING TO BE ALLOWED ALONG NATURE TRAIL FOR PASSAGE OF MULCH TRUCKS OR SIMILAR VEHICLES USED FOR HAULING MATERIALS.
C. EXISTING GRADE TO BE MAINTAINED ALONG NATURE TRAIL UNLESS PROPOSED CONTOURS SHOWN DEPICT OTHERWISE.
13. TEMPORARY STAGING/EQUIPMENT STORAGE AREA AND TEMPORARY SOIL STOCKPILE AREAS TO BE RELOCATED (AS NECESSARY) AS CONSTRUCTION PROGRESSES. THE BULB OF CLEARED CUL-DE-SACS CAN BE BE USED FOR THIS PURPOSE. - CONTRACTOR TO ENSURE INLETS ARE PROTECTED FROM SILTATION.
STORM SEWER STRUCTURE SCHEDULE
SEE SHEET 4 FOR CONTINUATION OF GRADING PLAN
NOTES FOR ARCHAEOLOGICAL AREA
A. A SNOW FENCE WILL BE INSTALLED AROUND THE BOUNDARY OF THE ARCHAEOLOGICAL AREA.
B. NO DISTURBANCE OF ANY KIND IS TO OCCUR WITHIN THESE BOUNDARIES.
SEDIMENT TRAP LOTS 18/19 CONSTRUCTION SEQUENCE
(SEE SHEET 25 FOR DETAILS)
STORM SEWER PIPING SCHEDULE
NOTE:
BEFORE DIGGING CONTACT "MISS UTILITY" AT 1-800-552-7001.
SECTION B-B
(GRASS SWALE)
N.T.S.
MEET EXISTING GROUND
JAMESTOWN ROAD ROUTE 31 (VARIABLE WIDTH R/W)
4/9/98
DRAINAGE AREA MAP
SHT 1 OF 2
DRAINAGE MAP
APR 1998
RECEIVED
PLANNING DEPARTMENT
REVISIONS
No. | Date | Description
4 | 4-2-98 | REVISED IAW COUNTY LTR 12-5-97
3 | 11-17-97 | REVISED PER JAMES CITY COUNTY ENVIRONMENTAL ENGINEER
2 | 10-7-97 | REVISED IAW COUNTY LTR 9-15-97
1 | 8-8-97 | REVISED IAW VDOT LTR 5-23-97 AND COUNTY LTR 6-24-97
HORTON & DODD, P.C.
Surveyors Engineers Planners
(757) 487-4535
300 George Washington Highway North Chesapeake, Virginia 23323
DES. BY: ERF
DRW. BY: RWS
CHK'D BY: ERF
SCALE: 1" = 60'
DATE: 4-29-97
REFERENCE BOOK 13084\PRELIM2
W.O. 13361
SHEET 3 OF 27
COMMONWEALTH OF VIRGINIA
E. RODNEY FLORES
No. 031038
PROFESSIONAL ENGINEER
GRADING, DRAINAGE, AND EROSION AND SEDIMENT CONTROL PLAN
OF
LAKE POWELL FOREST SUBDIVISION
JAMES CITY COUNTY - VIRGINIA

STORM SEWER STRUCTURE SCHEDULE

A-1	D-3G, L=6' INV=59.00	A-9	D-3G, L=6' INV=51.00	B-18	D-1 INV=47.50 INV=45.00	E-1	D-3G, L=0.5' INV=48.00	E-3	D-3G, L=0.5' INV=48.00	G-3	D-3G, L=4' INV=48.88
A-2	D-3G, L=2.5' INV=54.25 INV=50.88	A-10	D-3G, L=6' INV=54.85 INV=50.88	B-12	MH-1 INV=50.84 INV=42.66	E-2	D-3G, L=0.5' INV=48.00 INV=48.00	E-4	D-3G, L=6' INV=50.30 INV=50.30	G-4	MH-1 INV=44.70 INV=42.40
A-3	D-2 W/ TYPE 'B' GRATE INV=53.80 INV=49.00	A-11	D-3G, L=6' INV=50.30 INV=48.00	B-2	D-3CC, L=6' INV=48.00 INV=42.12 INV(E)(TBM)=42.12 INV(W)(EX)=43.00	E-5	MH-1 INV=49.20 INV=47.70	E-5	D-3G, L=6' INV=50.30 INV=48.00	G-5	MH-1 INV=50.37 INV=45.10
A-3A	D-3G, L=6' INV=64.00 INV=60.70	A-12	D-3G, L=6' INV=51.20 INV=51.00	B-3	END 18" RCP (TEMP) INV=53.07	E-6	D-3G, L=0.5' INV=51.70 INV=51.30	E-6	D-3CC, L=6' INV=51.88 INV(E)=36.58 INV(S)(EX)=31.88	G-6	D-3CC, L=6' INV=51.88 INV(E)=36.58 INV(S)(EX)=31.88
A-3B	D-2 W/ TYPE 'B' GRATE INV=52.30	A-13	D-3G, L=6' INV=50.64	B-4	18" CS-1 W/ 3.5' L 90° MAP INV=52.30 INV=50.30	E-7	D-3G, L=2.5' INV=51.30 INV=51.20	E-7	MH-1 INV=54.90 INV=51.30	G-7	MH-1 INV=54.90 INV=51.30
A-4	MH-1 INV=53.24 INV=47.78	A-13A	D-3G, L=2.5' INV=53.10 INV(E)=50.94 INV(W)(EX)=50.94 INV(S)(EX)=50.44 INV(N)(EX)=48.94	B-5	RIP-RAP 10'x10' (WATCH EXIST.)	E-8	D-3G, L=6' INV=51.88 INV(E)=50.80 INV(S)(EX)=50.80	E-8	END 24" R.C.P. INV=4.75	G-8	END 24" R.C.P. INV=4.75
A-5	D-3AA, L=2.5' INV=52.88 INV(E)=48.10 INV(W)(EX)=47.43 INV(S)(EX)=47.43	A-14	D-3G, L=6' INV=53.70 INV=53.50	C-1	D-3G, L=6' INV=48.00 INV=48.00	E-9	D-3G, L=6' INV=51.88 INV(E)=50.80 INV(S)(EX)=50.80	E-9	D-3G, L=6' INV=51.81 INV=50.85	H-1	D-3G, L=6' INV=51.81 INV=50.85
A-5A	D-3G, L=4' INV=52.88 INV=50.80	A-15	MH-1 INV(E)=51.00 INV(W)(EX)=43.14 INV(N)(EX)=31.20	C-2	END 18" R.C.P. INV=15.50	E-10	END 18" R.C.P. INV=11.18	F-1	D-3CC, L=6' INV=15.50 INV=11.18	H-2	D-3G, L=6' INV=6.33 INV=4.33
A-6	D-3CC, L=6' INV(E)=52.80 INV(W)(EX)=47.10 INV(S)(EX)=42.88	A-16	END 27" R.C.P. INV=51.30	D-1	D-3G, L=6' INV=49.00 INV=41.70	F-2	END 18" R.C.P. INV=15.50	F-2	END 18" R.C.P. INV=15.50	H-3	MH-1 INV=57.00 INV(N)(EX)=50.80 INV(S)(EX)=50.80
A-7	D-3G, L=6' INV=54.30 INV=51.00	B-1A	MH-1 INV=50.00 INV=37.50	D-2	END 18" R.C.P. INV=51.50	G-1	D-3G, L=6' INV=48.00 INV=48.00	G-1A	D-3G, L=6' INV=48.00 INV=48.00	I-1	D-3G, L=10' INV=4.50 INV=4.50
A-8	D-3G, L=2.5' INV=53.33 INV=49.33	B-1	D-3G, L=6' INV=49.00 INV=49.00							I-2	MH-1 INV=38.00 INV=32.50

STORM SEWER PIPING SCHEDULE

A-1	TO A-3	18' - 15" R.C.P. @ 3.50%	E-2	TO E-3	222' - 18" R.C.P. @ 1.00%		
A-2	TO A-3	102' - 15" R.C.P. @ 3.41%	E-3	TO E-5	174' - 18" R.C.P. @ 1.00%		
A-3	TO A-4	32' - 15" R.C.P. @ 1.00%	E-3A	TO E-3	48' - 15" R.C.P. @ 16.67%		
A-4	TO A-5	48' - 15" R.C.P. @ 1.00%	E-4	TO E-5	116' - 15" R.C.P. @ 0.50%		
B-1	TO B-2	32' - 18" R.C.P. @ 1.00%	E-5	TO E-4	32' - 18" R.C.P. @ 1.00%		
B-2	TO B-3	199' - 15" R.C.P. @ 2.60%	E-6	TO E-7	228' - 24" R.C.P. @ 1.00%		
B-3	TO B-4	146' - 15" R.C.P. @ 2.80%	E-7	TO E-8	180' - 24" R.C.P. @ 14.31%		
B-4	TO B-8	(TEMP.) 18' - 15" R.C.P. @ 0.50%	F-1A	TO F-1	178' - 15" R.C.P. @ 0.50%		
B-4	TO B-8	112' - 15" R.C.P. @ 1.00%	F-1	TO F-2	106' - 15" R.C.P. @ 0.50%		
C-1	TO C-2	32' - 15" R.C.P. @ 1.00%	F-2	TO F-4	102' - 15" R.C.P. @ 1.00%		
C-2	TO C-3	116' - 18" R.C.P. @ 5.81%	F-3A	TO F-3	90' - 15" R.C.P. @ 1.00%		
C-3	TO C-6	80' - 21" R.C.P. @ 4.76%	F-3	TO F-4	38' - 15" R.C.P. @ 1.00%		
C-4	TO C-5	32' - 18" R.C.P. @ 9.50%	F-4	TO F-6	80' - 18" R.C.P. (CLASS IV) @ 9.50%		
C-5	TO C-6	70' - 18" R.C.P. @ 1.00%	F-5	TO F-6	32' - 15" R.C.P. @ 1.00%		
C-6	TO C-7	102' - 24" R.C.P. @ 3.45%	F-6	TO F-8B	200' - 21" R.C.P. @ 1.00%		
C-7	TO C-8	162' - 24" R.C.P. @ 3.45%	F-6A	TO F-8B	110' - 15" R.C.P. @ 3.30%		
C-8	TO C-9	(TEMP.) 13' - 27" R.C.P. @ 1.00%	F-6B	TO F-6	100' - 21" R.C.P. @ 1.00%		
C-8	TO C-10	136' - 27" R.C.P. @ 0.50%	F-7A	TO F-7	94' - 15" R.C.P. @ 1.00%		
D-1	TO D-2	164' - 15" R.C.P. @ 1.00%	F-7	TO F-8	32' - 15" R.C.P. @ 1.00%		
D-2	TO D-3	100' - 18" R.C.P. @ 1.00%	F-8	TO F-11	131' - 24" R.C.P. @ 1.00%		
D-3	TO D-4	44' - 18" R.C.P. @ 1.00%	F-9	TO F-10	87' - 36" R.C.P. (CLASS IV) @ 3.50%		
D-4	TO D-5	280' - 21" R.C.P. @ 13.46%	F-10A	TO F-10	48' - 18" R.C.P. @ 1.00%		
E-1	TO E-2	32' - 15" R.C.P. @ 1.00%	F-10	TO F-11	32' - 36" R.C.P. (CLASS IV) @ 0.35%		
E-2A	TO E-2	80' - 15" R.C.P. @ 1.00%	F-11	TO F-12	52' - 48" R.C.P. (CLASS IV) @ 0.35%		

NOTES:

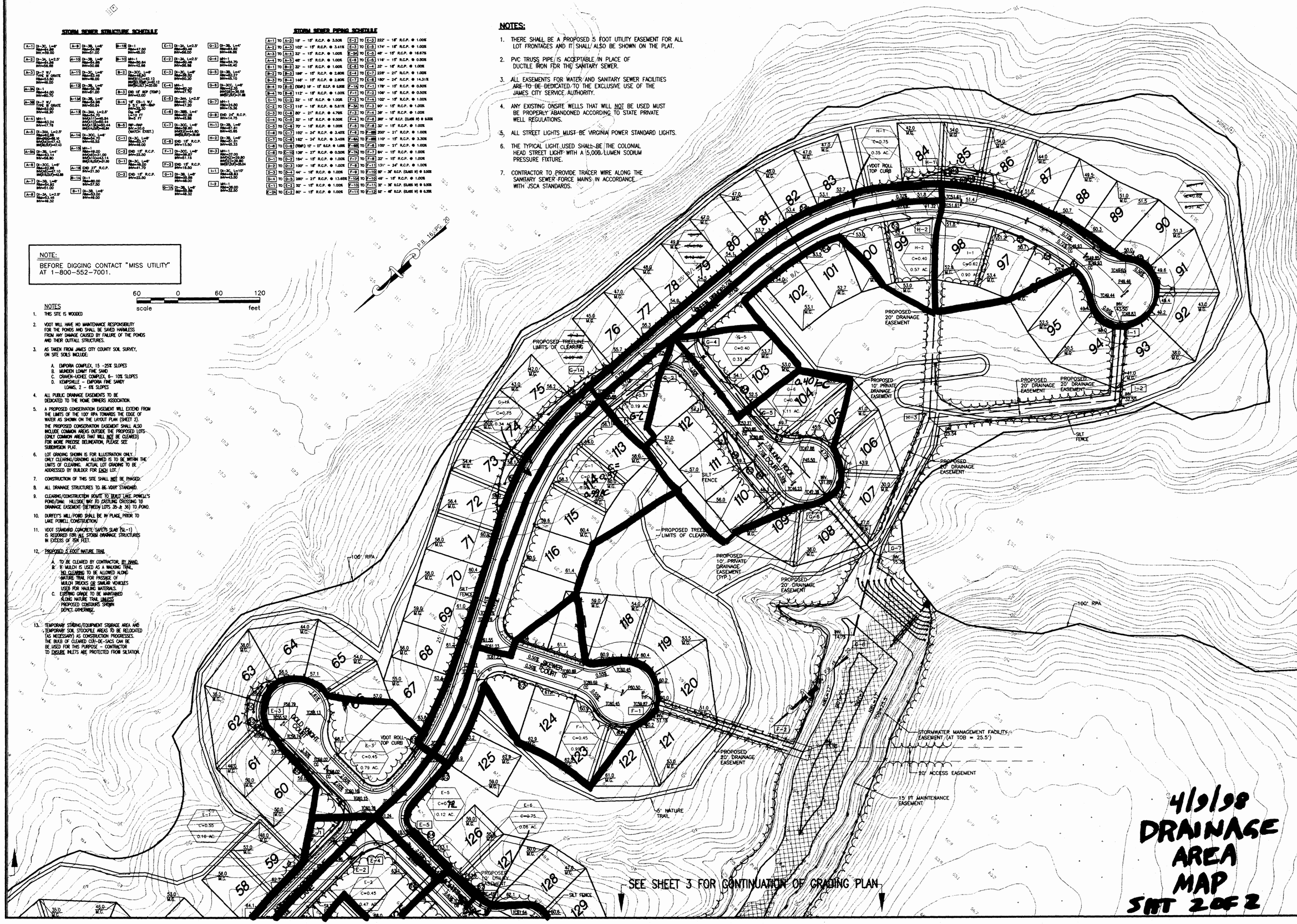
1. THERE SHALL BE A PROPOSED 5 FOOT UTILITY EASEMENT FOR ALL LOT FRONTAGES AND IT SHALL ALSO BE SHOWN ON THE PLAT.
2. PVC TRUSS PIPE IS ACCEPTABLE IN PLACE OF DUCTILE IRON FOR THE SANITARY SEWER.
3. ALL EASEMENTS FOR WATER AND SANITARY SEWER FACILITIES ARE TO BE DEDICATED TO THE EXCLUSIVE USE OF THE JAMES CITY SERVICE AUTHORITY.
4. ANY EXISTING ONSITE WELLS THAT WILL NOT BE USED MUST BE PROPERLY ABANDONED ACCORDING TO STATE PRIVATE WELL REGULATIONS.
5. ALL STREET LIGHTS MUST BE VIRGINIA POWER STANDARD LIGHTS.
6. THE TYPICAL LIGHT USED SHALL BE THE COLONIAL HEAD STREET LIGHT WITH A 15,000 LUMEN SODIUM PRESSURE FIXTURE.
7. CONTRACTOR TO PROVIDE TRACER WIRE ALONG THE SANITARY SEWER FORCE MAINS IN ACCORDANCE WITH JSCA STANDARDS.

NOTE:
BEFORE DIGGING CONTACT "MISS UTILITY" AT 1-800-552-7001.

60 0 60 120
scale feet

NOTES

1. THIS SITE IS WOODED
2. VDOT WILL HAVE NO MAINTENANCE RESPONSIBILITY FOR THE PONDS AND SHALL BE SAVED HARMLESS FROM ANY DAMAGE CAUSED BY FAILURE OF THE PONDS AND THEIR OUTFALL STRUCTURES.
3. AS TAKEN FROM JAMES CITY COUNTY SOIL SURVEY, ON SITE SOILS INCLUDE:
   A. EMPORIA COMPLEX, 15 -25% SLOPES
   B. MUNDEN LOAMY FINE SAND
   C. CRAVEN-UCHEE COMPLEX, 6- -10% SLOPES
   D. KEMPSVILLE - EMPORIA FINE SANDY LOAMS, 2 - 6% SLOPES
4. ALL PUBLIC DRAINAGE EASEMENTS TO BE DEDICATED TO THE HOME OWNERS ASSOCIATION.
5. A PROPOSED CONSERVATION EASEMENT WILL EXTEND FROM THE LIMITS OF THE 100' RPA TOWARDS THE EDGE OF WATER AS SHOWN ON THE LAYOUT PLAN (SHEET 2). THE PROPOSED CONSERVATION EASEMENT SHALL ALSO INCLUDE COMMON AREAS OUTSIDE THE PROPOSED LOTS (ONLY COMMON AREAS THAT WILL NOT BE CLEARED) FOR MORE PRECISE DELINEATION, PLEASE SEE SUBDIVISION PLAT.
6. LOT GRADING SHOWN IS FOR ILLUSTRATION ONLY. ONLY CLEARING/GRADING ALLOWED IS TO BE WITHIN THE LIMITS OF CLEARING. ACTUAL LOT GRADING TO BE ADDRESSED BY BUILDER FOR EACH LOT.
7. CONSTRUCTION OF THIS SITE SHALL NOT BE PHASED.
8. ALL DRAINAGE STRUCTURES TO BE VDOT STANDARD.
9. CLEARING/CONSTRUCTION ROUTE TO BUILD LAKE POWELL'S POND/DAM: HILLSIDE WAY TO CASTLING CROSSING TO DRAINAGE EASEMENT (BETWEEN LOTS 35 & 36) TO POND.
10. DURFEY'S MILL POND SHALL BE IN PLACE PRIOR TO LAKE POWELL CONSTRUCTION.
11. VDOT STANDARD CONCRETE SAFETY SLAB (SL-1) IS REQUIRED FOR ALL STORM DRAINAGE STRUCTURES IN EXCESS OF FOR FEET.
12. PROPOSED 6 FOOT NATURE TRAIL
    A. TO BE CLEARED BY CONTRACTOR, BY HAND.
    B. IF MULCH IS USED AS A WALKING TRAIL, NO CLEARING TO BE ALLOWED ALONG NATURE TRAIL FOR PASSAGE OF MULCH TRUCKS OR SIMILAR VEHICLES USED FOR HAULING MATERIALS.
    C. EXISTING GRADE TO BE MAINTAINED ALONG NATURE TRAIL UNLESS PROPOSED CONTOURS SHOWN DEPICT OTHERWISE.
13. TEMPORARY STAGING/EQUIPMENT STORAGE AREA AND TEMPORARY SOIL STOCKPILE AREAS TO BE RELOCATED (AS NECESSARY) AS CONSTRUCTION PROGRESSES. THE BULK OF CLEARED CUL-DE-SACS CAN BE BE USED FOR THIS PURPOSE - CONTRACTOR TO ENSURE INLETS ARE PROTECTED FROM SILTATION.



4/9/98
DRAINAGE AREA MAP
SHT 2 OF 2

No.	Date	Description
4	4-2-98	REVISED JAW COUNTY LTR 12-5-97
3	11-17-97	REVISED PER JAMES CITY COUNTY ENVIRONMENTAL ENGINEER
2	10-7-97	REVISED JAW COUNTY LTR 9-15-97
1	8-8-97	REVISED JAW VDOT LTR 5-23-97 AND COUNTY LTR 6-24-97

REVISIONS

HORTON & DODD, P.C.
Surveyors Engineers Planners
300 George Washington Highway North Chesapeake, Virginia 23323
(757) 487-4535

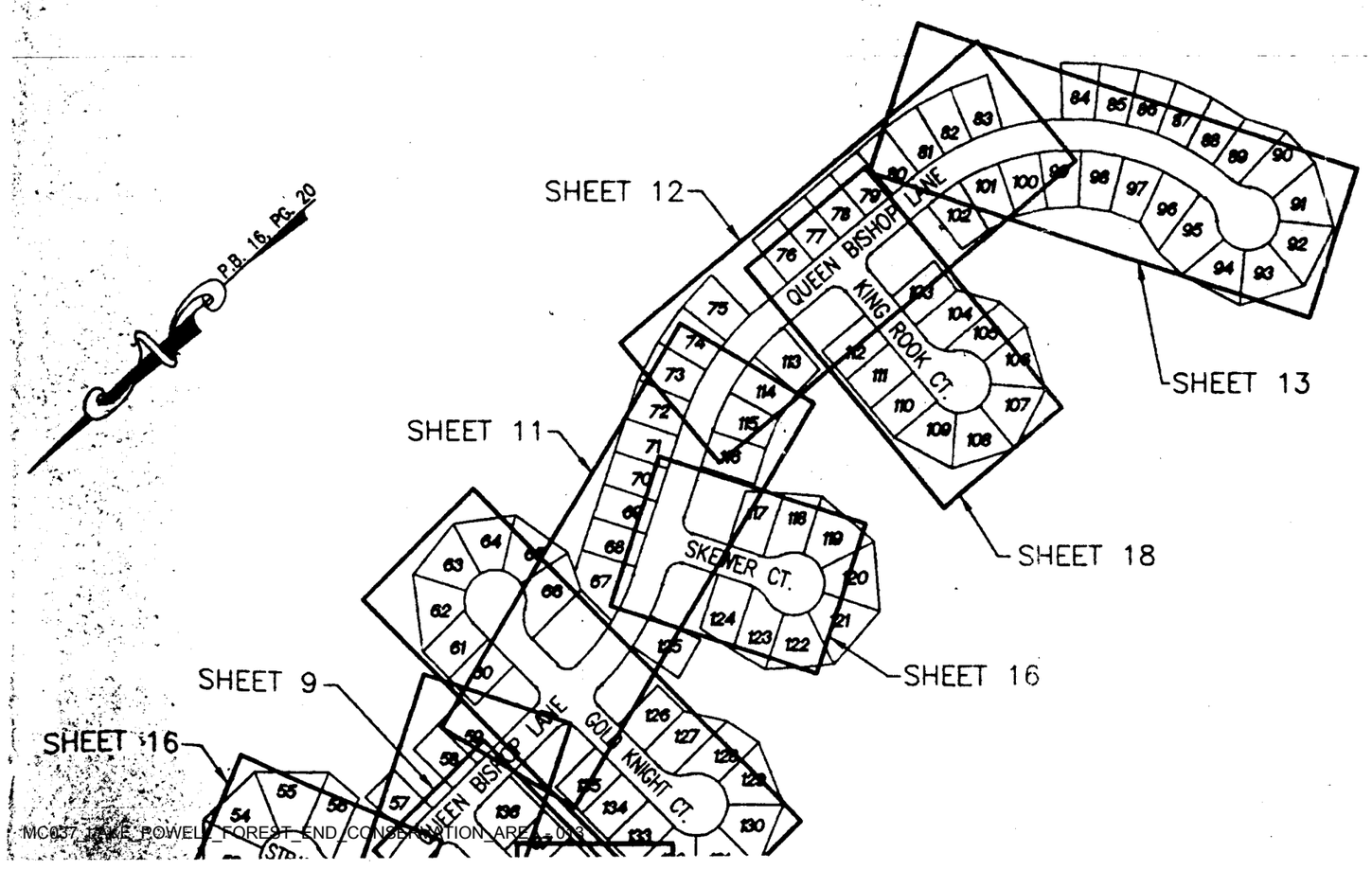
DES. BY: ERF
DRW. BY: RWS
CHK'D BY: ERF
SCALE: 1"= 60'
REFERENCE BOOK 13084\PRELIM2
DATE: 4-29-97
SHEET 6 OF 27
W.O. 13361

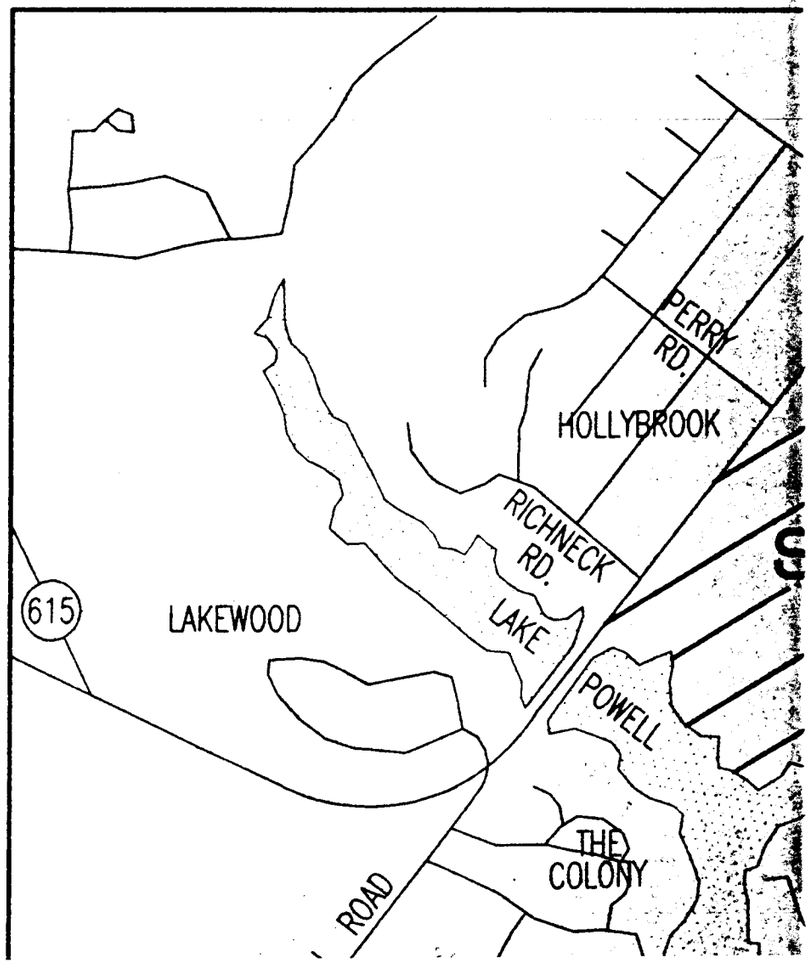
COMMONWEALTH OF VIRGINIA
RODNEY FLORES
No. 039038
PROFESSIONAL ENGINEER

GRADING, DRAINAGE, UTILITY AND EROSION AND SEDIMENT CONTROL PLAN
MASTER PLAN
OF
LAKE POWELL FOREST SUBDIVISION
JAMES CITY COUNTY - VIRGINIA

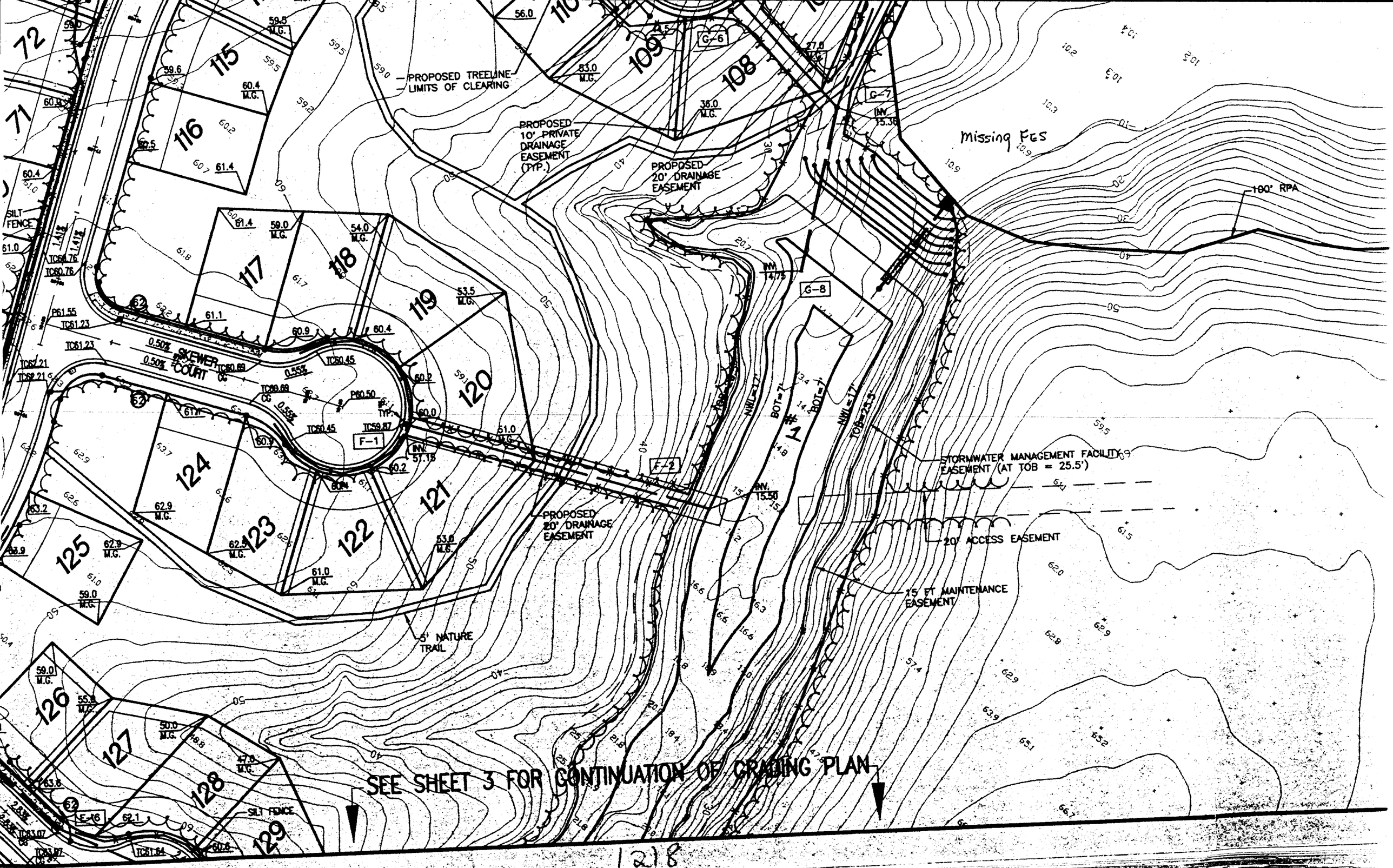
SITE DEVELOPMENT PLANS
OF
LAKE POWELL FOREST SUBDIVISIO
FOR
BOYD CORPORATION
JAMES CITY COUNTY, VIRGINIA

MC037

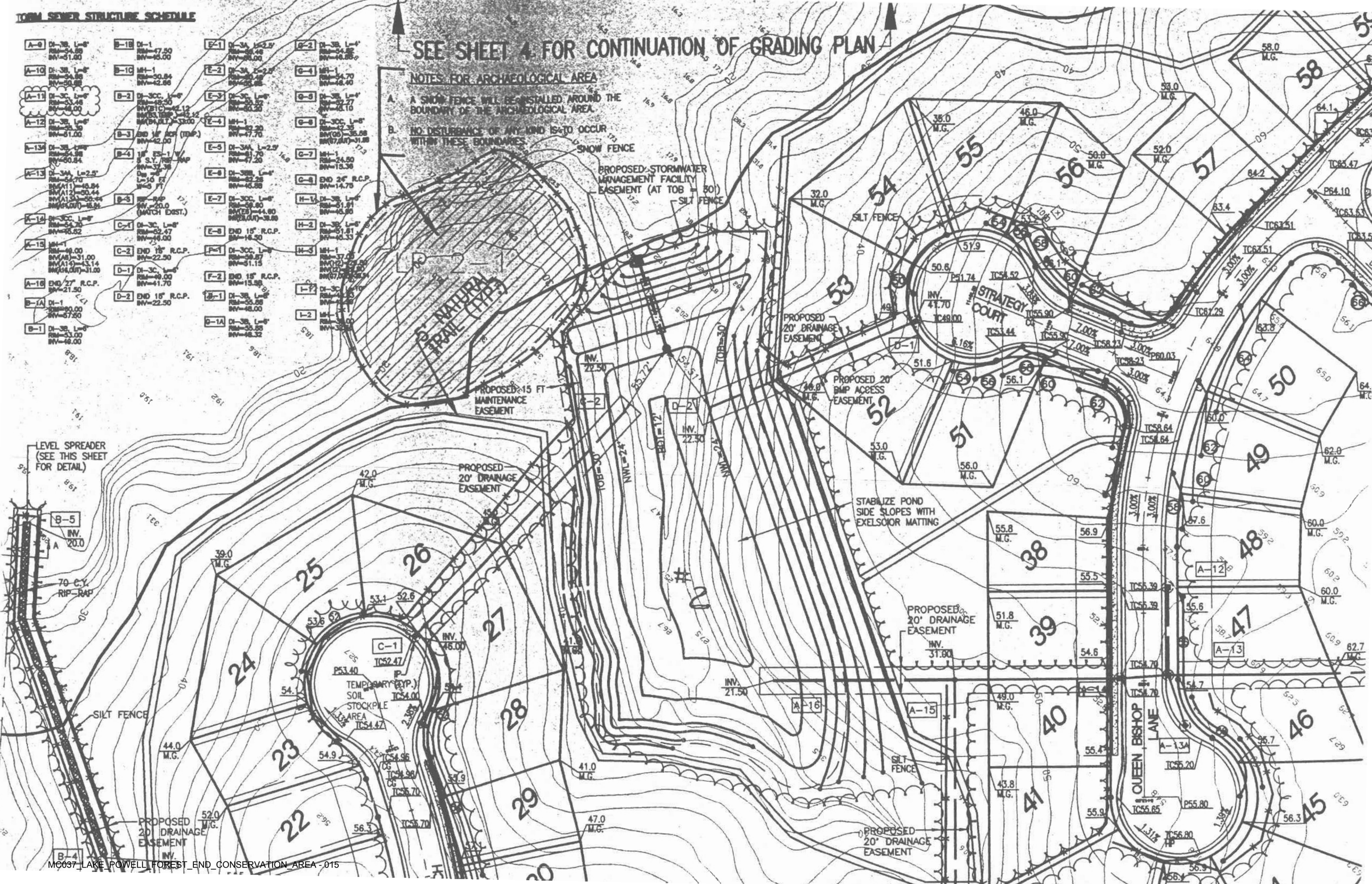


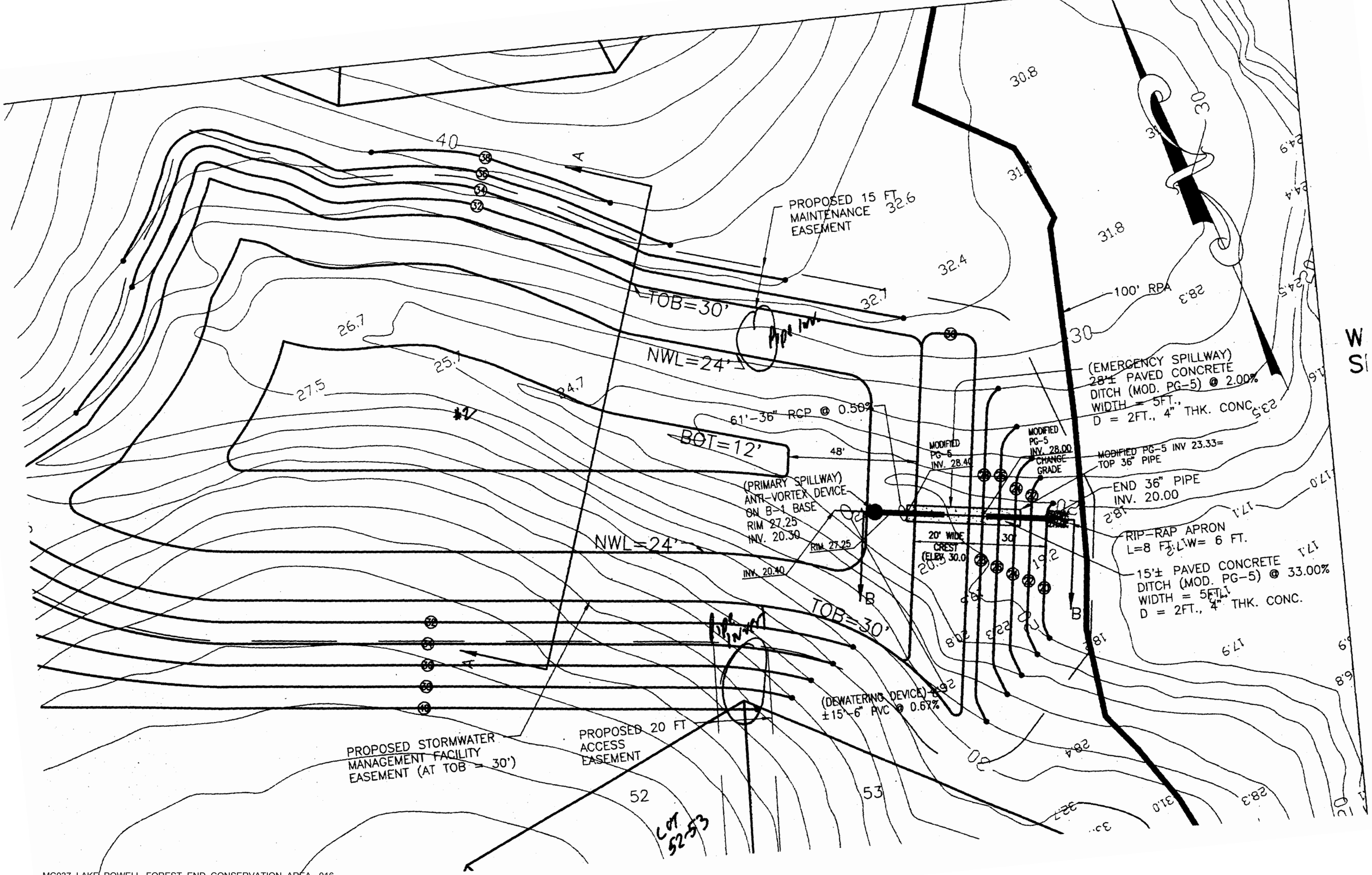


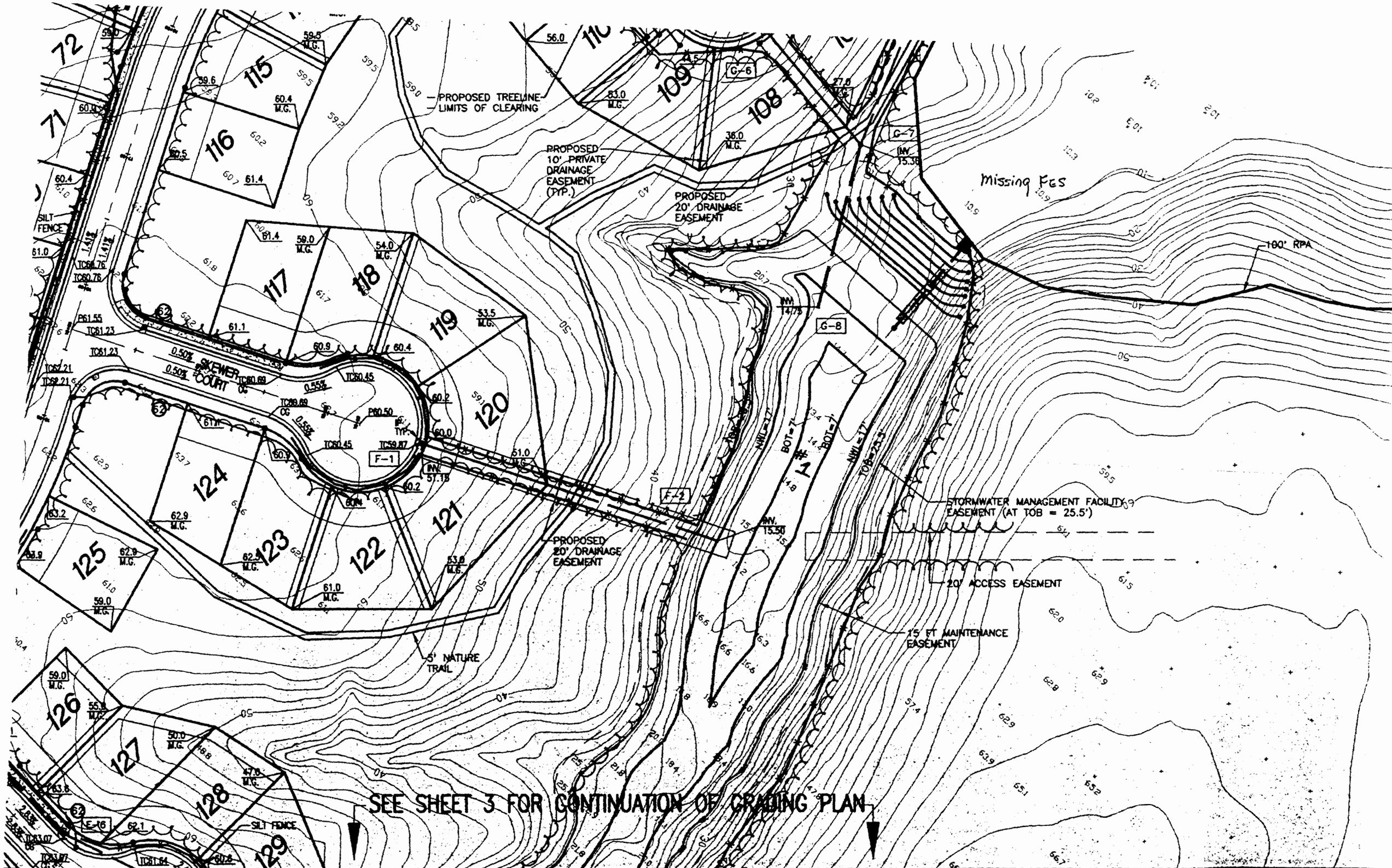
MC037_LAKE_POWELL_FOREST_END_CONSERVATION_AREA_003

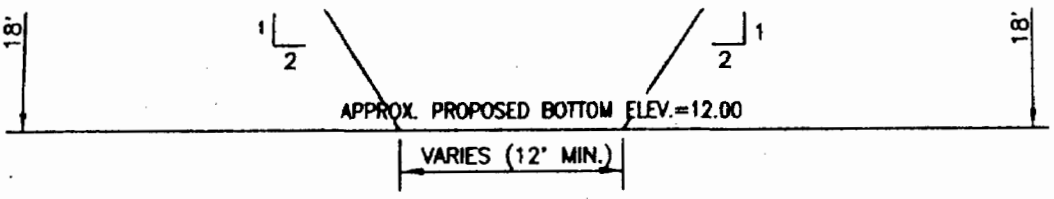

PROPOSED TREELINE
LIMITS OF CLEARING
PROPOSED 10' PRIVATE DRAINAGE EASEMENT (TYP.)
PROPOSED 20' DRAINAGE EASEMENT
Missing FES
100' RPA
SILT FENCE
SKEWER COURT
STORMWATER MANAGEMENT FACILITY EASEMENT (AT TOB = 25.5')
20' ACCESS EASEMENT
15 FT MAINTENANCE EASEMENT
5' NATURE TRAIL
SEE SHEET 3 FOR CONTINUATION OF GRADING PLAN
G-6
G-7
G-8
F-1
F-2
E-16
INV. 15.36
INV. 14.75
INV. 51.18
INV. 15.50
NWL=17'
BOT=7'
TOB=25.5
#1
109
108
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
72
71

1218


TOWN SEWER STRUCTURE SCHEDULE
SEE SHEET 4 FOR CONTINUATION OF GRADING PLAN
NOTES FOR ARCHAEOLOGICAL AREA
A. A SNOW FENCE WILL BE INSTALLED AROUND THE BOUNDARY OF THE ARCHAEOLOGICAL AREA.
B. NO DISTURBANCE OF ANY KIND IS TO OCCUR WITHIN THESE BOUNDARIES.
SNOW FENCE
PROPOSED STORMWATER MANAGEMENT FACILITY EASEMENT (AT TOB = 50)
SILT FENCE
R-2-1
5' NATURAL TRAIL (TYP.)
PROPOSED 15 FT MAINTENANCE EASEMENT
PROPOSED 20' DRAINAGE EASEMENT
PROPOSED 20' BMP ACCESS EASEMENT
STRATEGY COURT
QUEEN BISHOP LANE
LEVEL SPREADER (SEE THIS SHEET FOR DETAIL)
70 C.Y. RIP-RAP
TEMPORARY (TYP.) SOIL STOCKPILE AREA
STABILIZE POND SIDE SLOPES WITH EXELSCIOR MATTING
B-5
C-1
A-12
A-13
A-13A
A-15
A-16
B-4
D-1
D-2
C-2


PROPOSED 15 FT MAINTENANCE EASEMENT
TOB=30'
NWL=24'
BOT=12'
61'-36" RCP @ 0.56%
48'
(PRIMARY SPILLWAY) ANTI-VORTEX DEVICE ON B-1 BASE RIM 27.25 INV. 20.30
RIM 27.25
INV. 20.40
MODIFIED PG-5 INV. 28.40
MODIFIED PG-5 INV. 28.00 CHANGE GRADE
MODIFIED PG-5 INV 23.33= TOP 36" PIPE
END 36" PIPE INV. 20.00
20' WIDE CREST (ELEV. 30.0)
RIP-RAP APRON L=8 FT. W= 6 FT.
15'± PAVED CONCRETE DITCH (MOD. PG-5) @ 33.00% WIDTH = 5FT., D = 2FT., 4" THK. CONC.
(EMERGENCY SPILLWAY) 28'± PAVED CONCRETE DITCH (MOD. PG-5) @ 2.00% WIDTH = 5FT., D = 2FT., 4" THK. CONC.
100' RPA
(DEWATERING DEVICE) ±15'-6" PVC @ 0.67%
PROPOSED STORMWATER MANAGEMENT FACILITY EASEMENT (AT TOB = 30')
PROPOSED 20 FT ACCESS EASEMENT
LOT 52-53
52
53
A
B


PROPOSED TREELINE
LIMITS OF CLEARING
PROPOSED 10' PRIVATE DRAINAGE EASEMENT (TYP.)
PROPOSED 20' DRAINAGE EASEMENT
Missing FES
100' RPA
SKEWER COURT
STORMWATER MANAGEMENT FACILITY EASEMENT (AT TOB = 25.5')
20' ACCESS EASEMENT
15 FT MAINTENANCE EASEMENT
5' NATURE TRAIL
SILT FENCE
SEE SHEET 3 FOR CONTINUATION OF GRADING PLAN



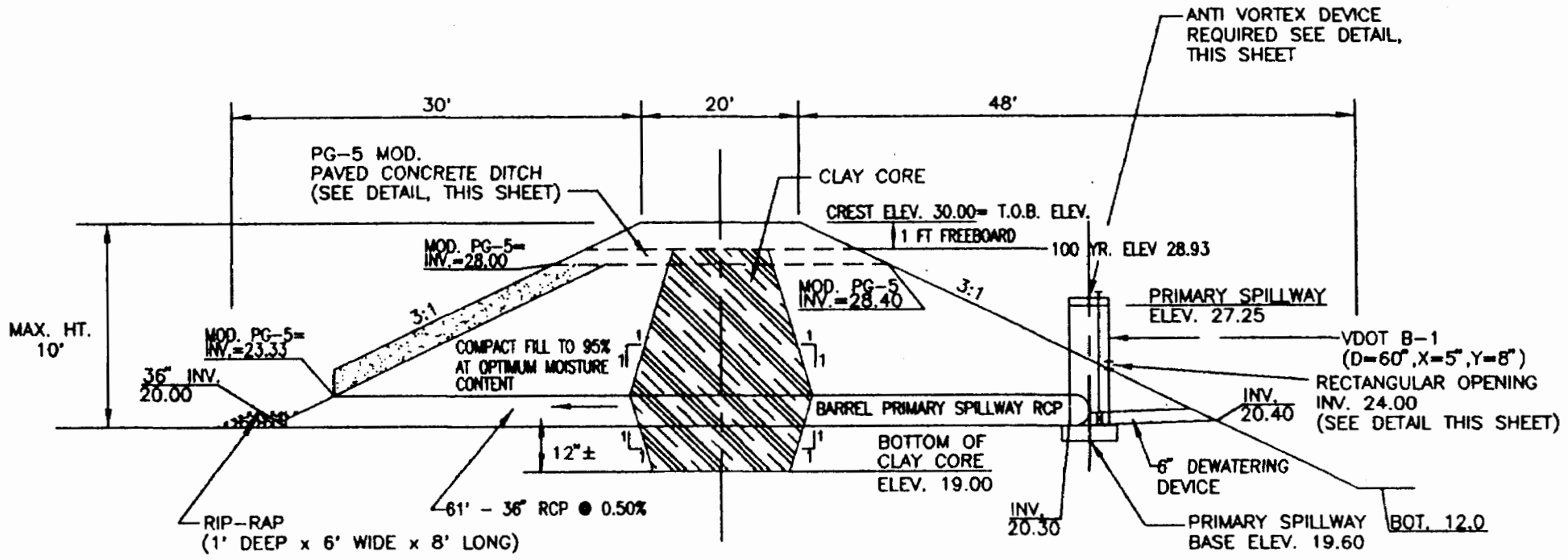
SECTION A - A

N.T.S.

1. STONE MUST BE 4" DEEP AND EXTEND 1 FO BEHIND THE BACK OF CURB
2. THE STONE UNDER THE CURB AND GUTTER S BE CHECKED BY VDOT PRIOR TO PAVING OR

ROLL TOP CURB

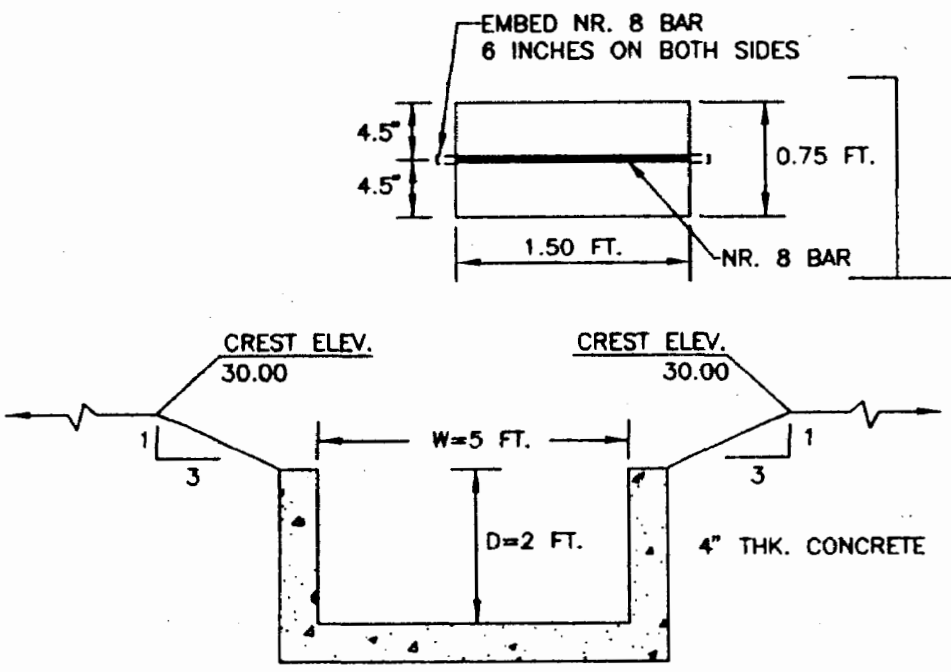
NOT TO SCALE



SECTION AT PRIMARY SPILLWAY 'B-B'

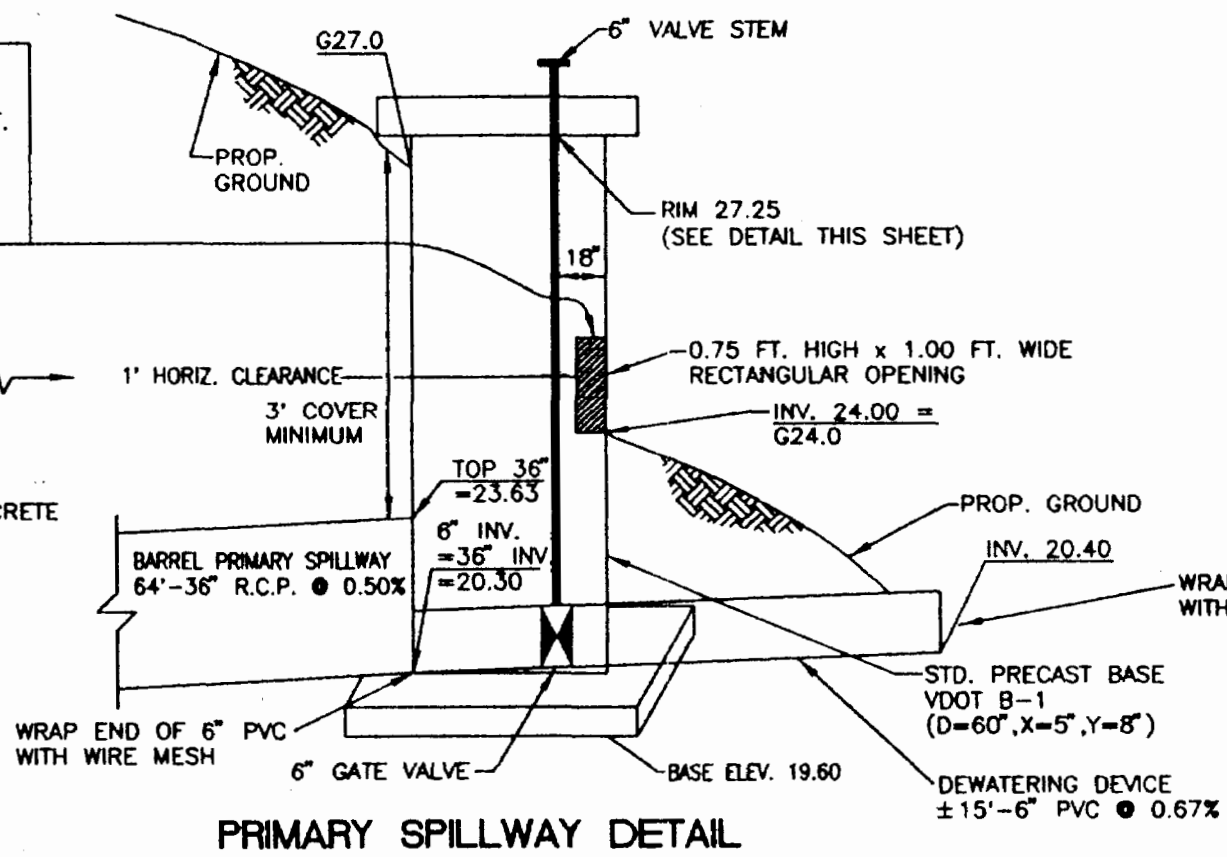
N.T.S.

YEAR STORM	POND ELEVATION (FT.)
2	27.24
10	28.38
100	28.93



PG-5 MODIFIED DETAIL

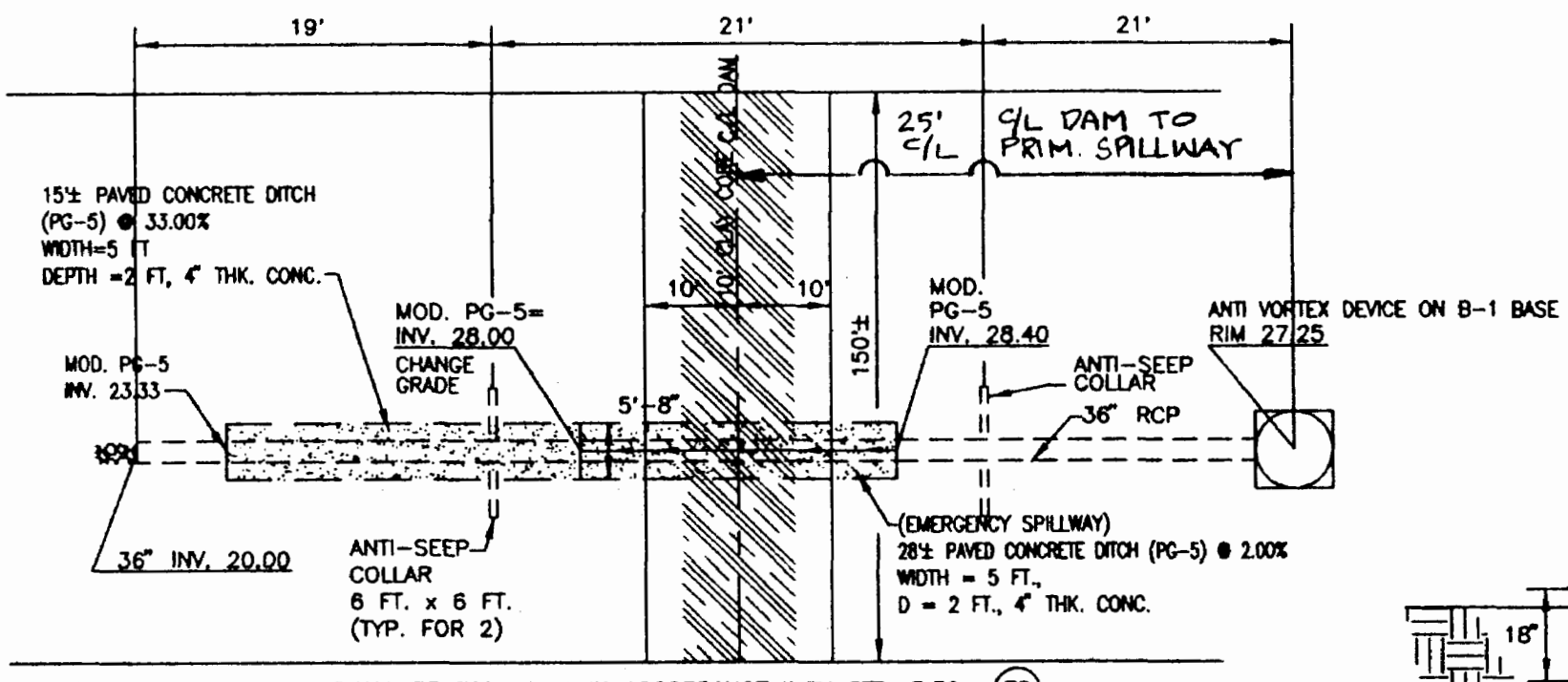
N.T.S.
(SEE VDOT STANDARDS FOR STRUCTURAL DETAILS)



PRIMARY SPILLWAY DETAIL

N.T.S.

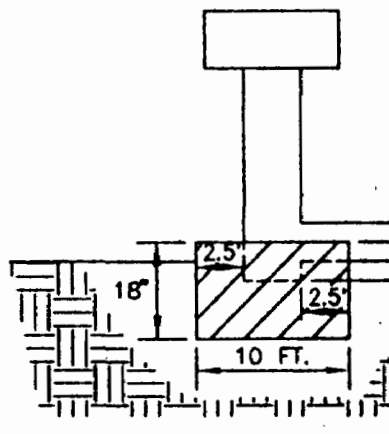
PROVIDE STD (CD) CHECK DAM ACROSS LOW GROUND PARALLEL TO DAM C/L AT THE LIMITS OF CLEARING FOR THE DAM CONSTRUCTION AREA PRIOR TO DAM CONSTRUCTION.



TOP & SLOPES OF DAM SHALL BE TOPSOILED IN ACCORDANCE WITH STD. 3.30 (TO)
AND SEEDED, FERTILIZED & MULCHED IN ACCORDANCE WITH STD. 3.32 (PS)
VIRGINIA EROSION & SEDIMENT CONTROL HANDBOOK 1993 EDITION.

PARTIAL DAM PLAN

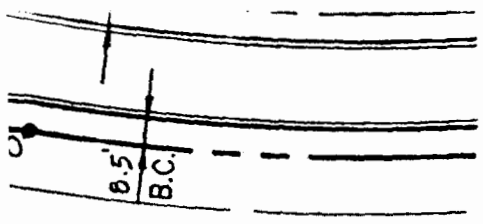
N.T.S.



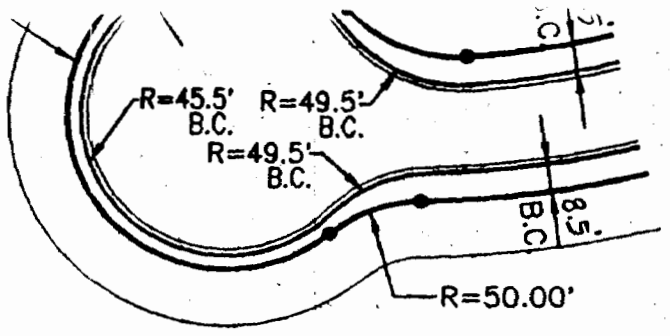
RISER PIPE BASE CON

N.T.S.

DAM DETAILS (WET POND #2 - LAKE POWELL FOREST)

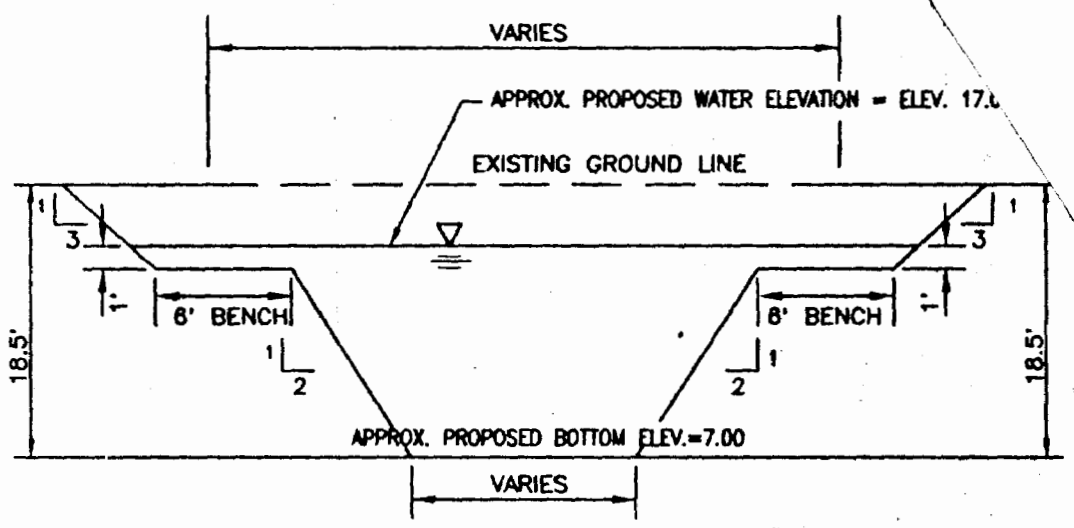


:UL-DE-SAC



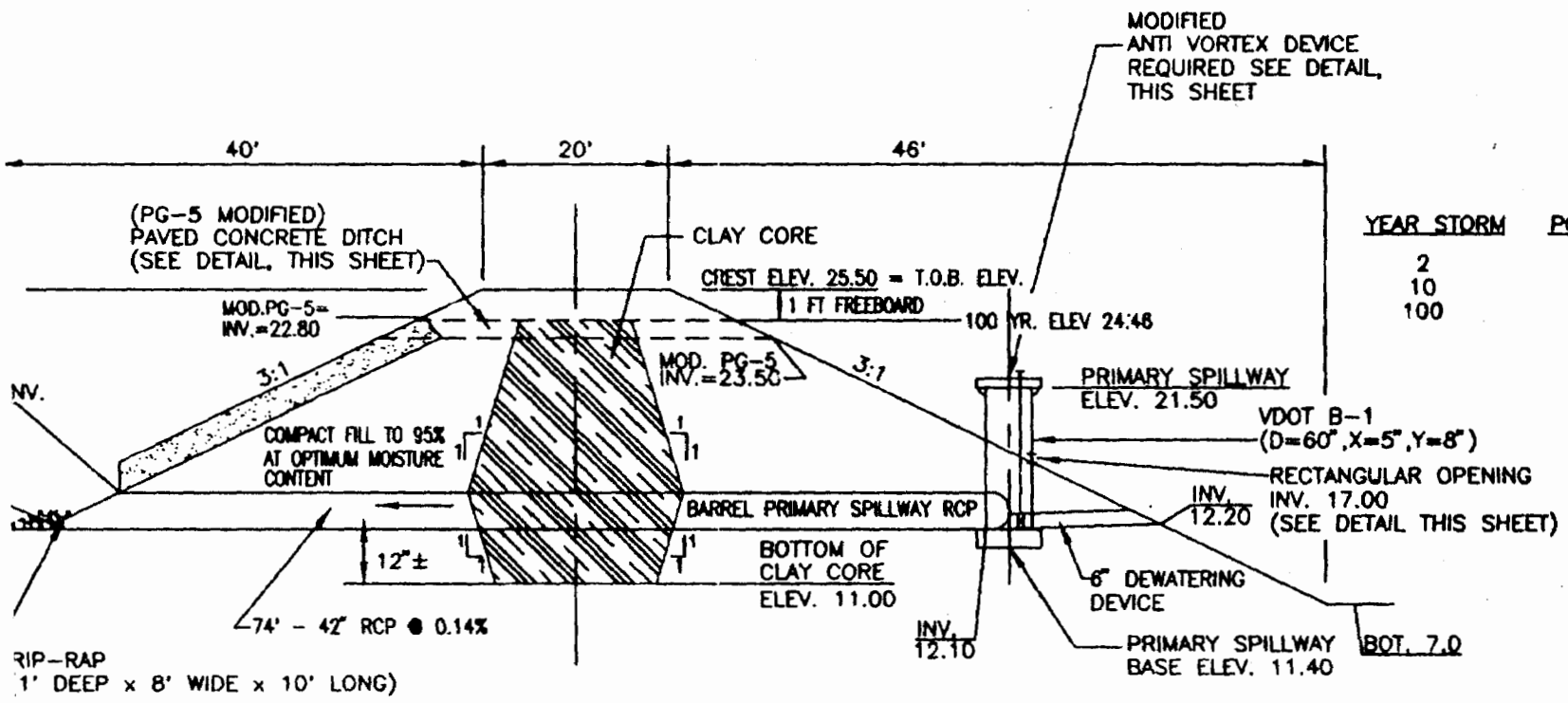
TYPICAL CUL-DE-SAC

NOT TO SCALE



SECTION A - A

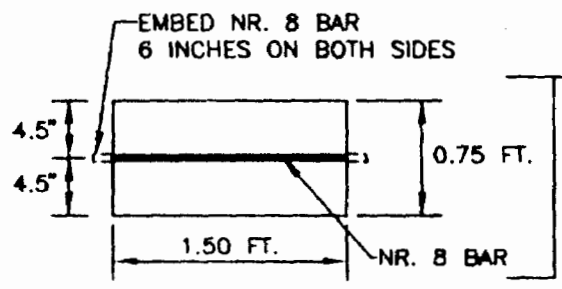
N.T.S.

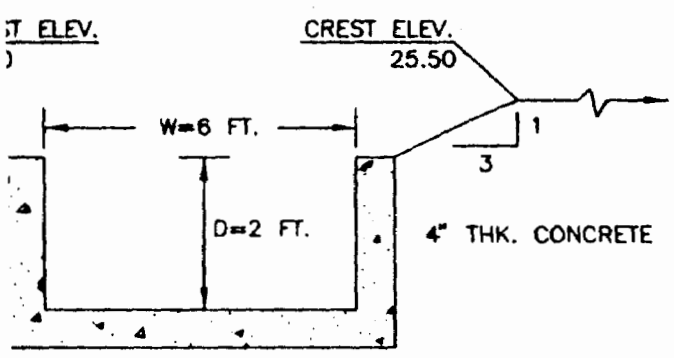


YEAR STORM	POND ELEVATION (FT.)
2	21.42
10	23.47
100	24.46

SECTION AT PRIMARY SPILLWAY
'B-B'

N.T.S.

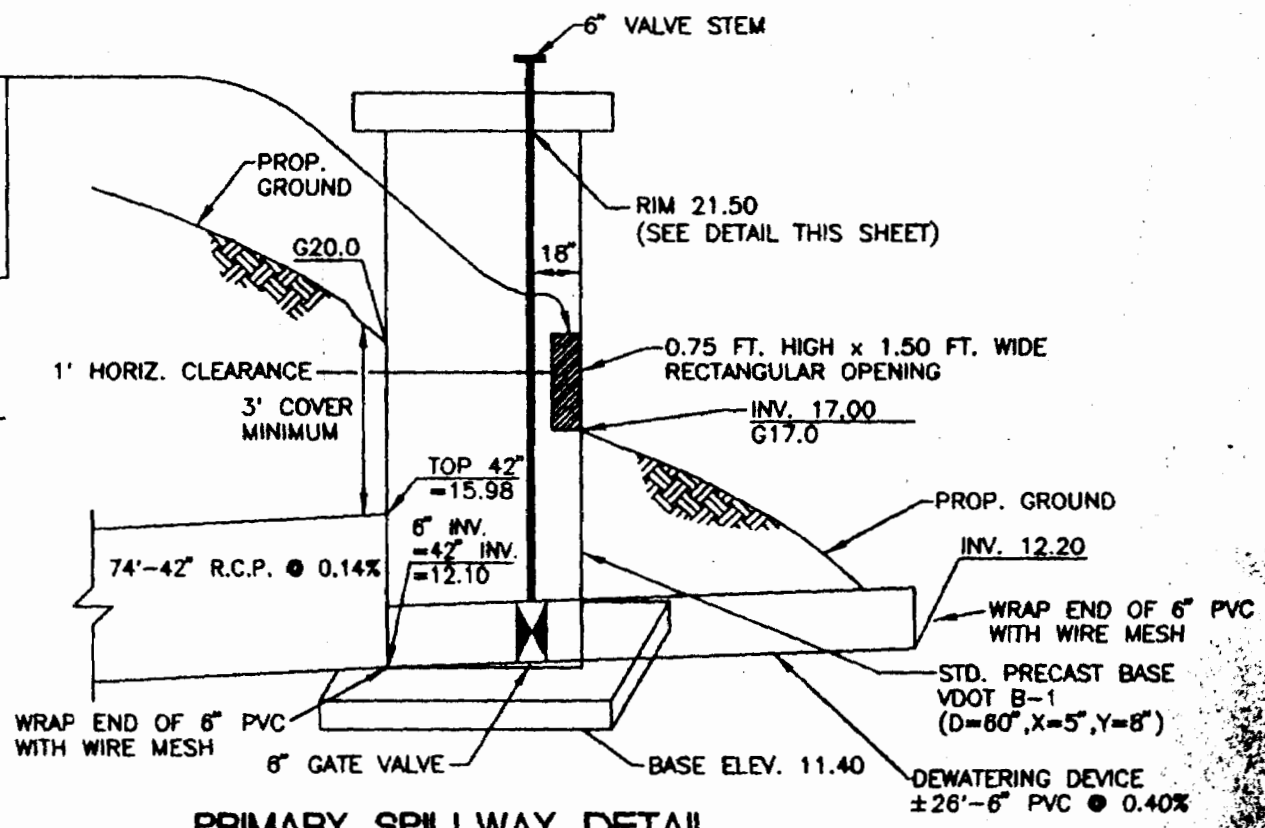




G-5 MODIFIED DETAIL

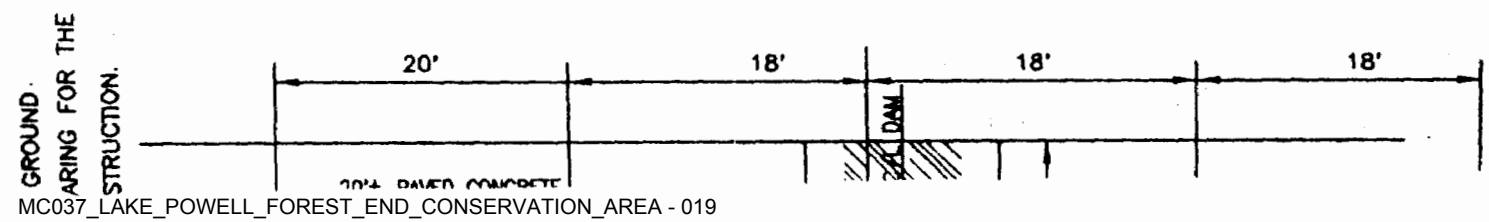
N.T.S.

)OT STANDARDS FOR STRUCTURAL DETAILS)



PRIMARY SPILLWAY DETAIL

N.T.S.



HORTON & DODD, P.C.
Surveyors Engineers Planners
(757) 487-4535
164 S. George Washington Highway

1. These calculations are intended to size the BMPs for Durfey's Mill and Lake Powell. The Lake Powell BMP shall be a wet pond, Design 7 (4.0V), B-3. The Durfey's Mill BMP shall also be a Design 7 wet pond.

2. Pre-Developed: As undeveloped, the entire site drains to the ravines / Lake Powell.

Total Site Area = 109.43 ac, Pre-Devl. Runoff Coefficient = 0.20

See Overland Flow chart for pre-developed T_c = 36 minutes. - low

needs to have ~~overland~~ flow ~~shallow~~ shallow flow, channel flow

Additionally, the offsite drainage of 24.8 ac at C = 0.40 drains to the ravines before our development.

For a 10-year storm, i = 3.20 - only needs to be 2-year storm

$Q = (\Sigma CA) * i = [(0.20)(109.43) + (0.40)(24.8)]\ 3.20$

Q_{PRE} = 101.78 cfs = Q_{ALLOW}, Allowable Post developed discharge.

3. To determine the allowable discharge from each BMP, it is necessary to first determine the discharge contributed by uncontrolled discharge.

Lake Powell: Area to BMPs = (14.55 + 13.43 + 22.48) ac = 50.46 ac

Lake Powell Area = 69.19 ac

Uncontrolled = (69.19 − 50.46) ac = 18.73 ac

Durfey's Mill: Area to BMPs = 18.94 ac

Existing lots = 6.00 ac

Durfey's Mill Area = 46.24 ac

Uncontrolled = 46.24 − 18.94 − 6 = 21.30 ac

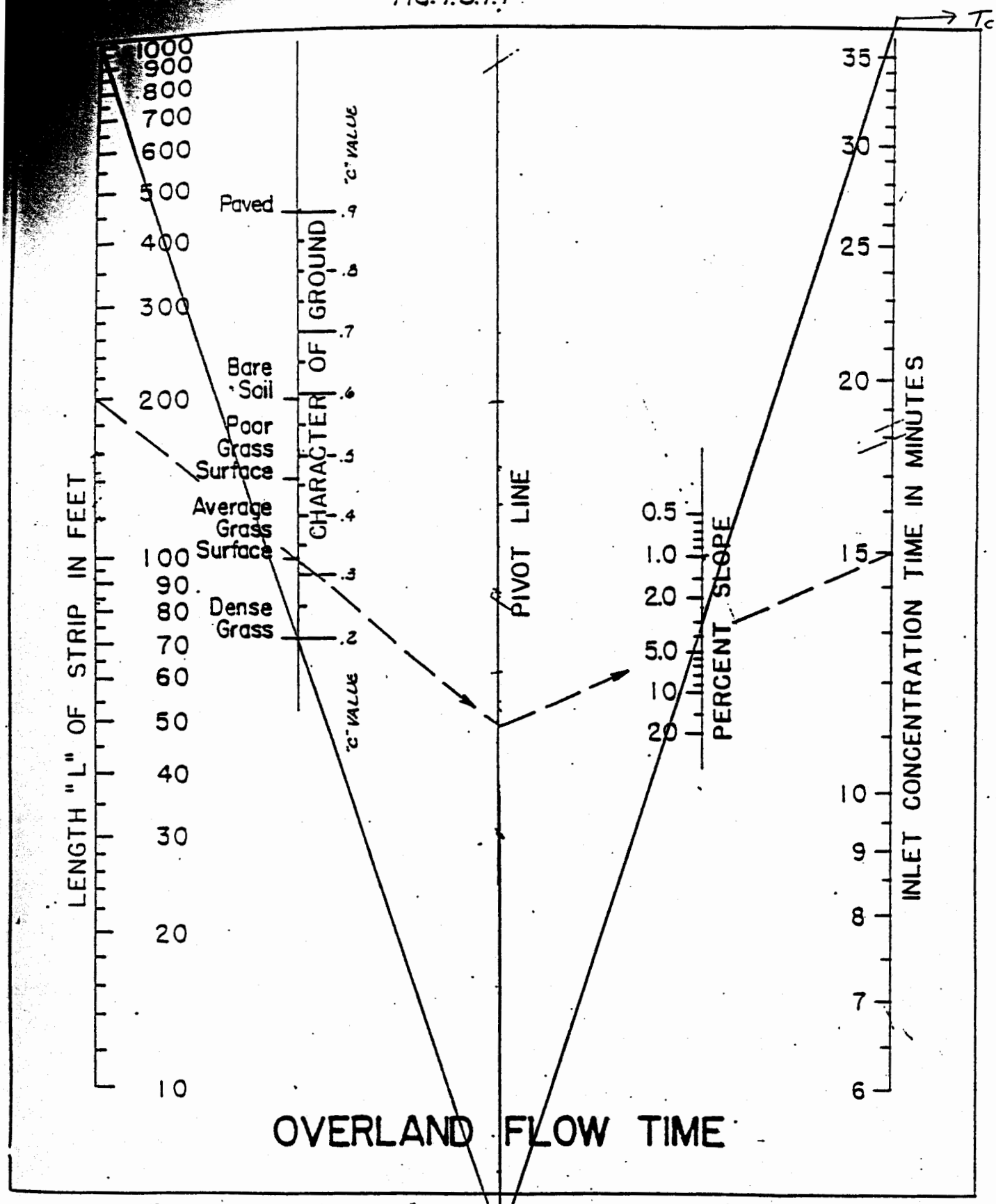
MC037
5-39-97

DURFEY'S MILL/ LAKE POWELL

24

Pre-Developed

FIG. 1.5.1.1



OVERLAND FLOW TIME

REPRINTED WITH PERMISSION FROM "DATA BOOK FOR CIVIL ENGINEERS". VOL. I - DESIGN 2ND EDITION (1951) BY E. E. SEELYE

MC037_LAKE_POWELL_FOREST_END_CONSERVATION_AREA - 021

③. Lake Powell (L.P.): $T_c = 15.5$ min (see attached Overland Flow chart), for a 10-year storm & $C_{COMPOSITE} = 0.32$ (see Composite C calculations)

$Q_{L.P.} = (0.32)(4.98)(18.73) = \underline{29.85 \text{ cfs}}$ Uncontrolled Discharge.

D.M. Durfey's Mill: Assuming a $T_c = 15$ min for the storm sewer system, and with $C_{COMPOSITE} = 0.33$,

$Q_{D.M.} = (0.33)(5.00)(21.30) = 35.14$ cfs

Total Uncontrolled Flow $= (29.85 + 35.14)$ cfs $= 64.99$ cfs

④. Allowable Discharge from BMPs:

$Q_{PRE} = Q_{ALLOW} = 101.78$ cfs

$Q_{UNCONT.} = 64.99$ cfs $\Rightarrow Q_{OUT} = \underline{36.79 \text{ cfs}}$

Lake Powell:

$$\Rightarrow (Q_{OUT})_{L.P.} = \frac{37.98}{(37.98 + 56.22)}(36.79) = \underline{14.83 \text{ cfs}} \leftarrow$$

Durfey's Mill:

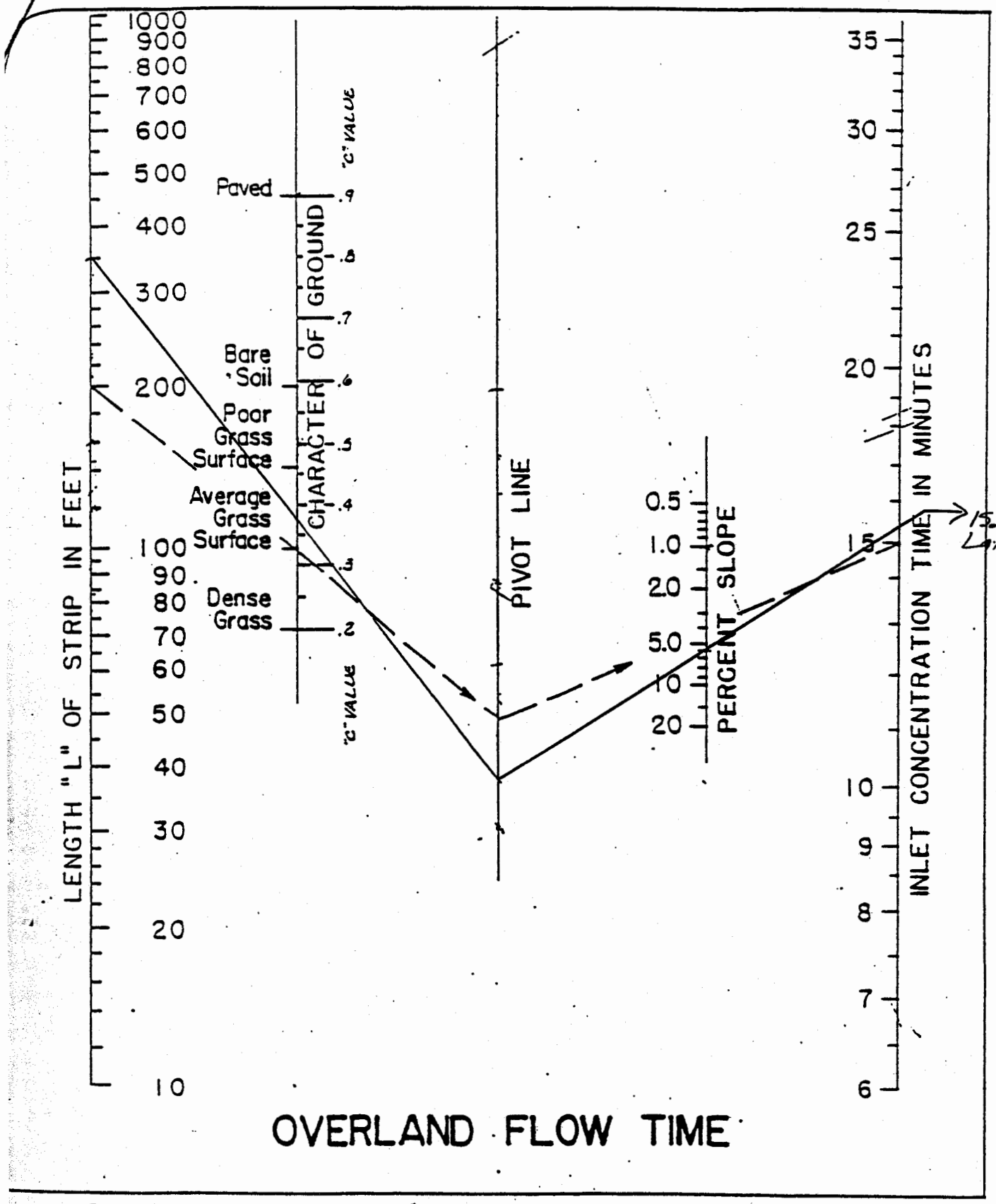
$$\Rightarrow (Q_{OUT})_{D.M.} = \frac{56.22}{(37.98 + 56.22)}(36.79) = \underline{21.96 \text{ cfs}} \leftarrow$$

DURFEY'S MILL / LAKE POW.

POST-DEVELOPED UNCONTROLLED RUNOFF

4/7

FIG. 1.5.1.1



OVERLAND FLOW TIME

REPRINTED WITH PERMISSION FROM "DATA BOOK FOR CIVIL ENGINEERS". VOL. I - DESIGN 2ND EDITION (1951) BY E. E. SEELYE

MC037_LAKE_POWELL_FOREST_END_CONSERVATION_AREA - 023

5/7

TABLE 4

WORKSHEET FOR BMP POINT SYSTEM

A. STRUCTURAL BMP POINT ALLOCATION

	BMP	BMP Points		Fraction of Site Served by BMP		Weighted BMP Points
Lake Powell BMP 2 ←	WET POND (B-3)	9	x	37.98 / 109.43 = 34.7%	=	3.1
			x		=	
Durfey's Mill BMP 1 ←	WET POND (B-3)	9	x	56.22 / 109.43 = 51.4%	=	4.6
			x		=	

TOTAL WEIGHTED STRUCTURAL BMP POINTS: 7.7

B. NATURAL OPEN SPACE CREDIT

Fraction of Site		Natural Open Space Credit		Points for Natural Open Space
41.6 %	x	0.1 per 1%	=	4.1

Cons. Easement

C. TOTAL WEIGHTED POINTS

7.7	+	4.1	=	11.8
Structural BMP Points		Natural Open Space Points		TOTAL

Fraction of Site Served by BMP:

Total Site Area = 109.43 ac

Area to BMP 1:

green
- Offsite = 14.8 ac
- Area from Durfey's = 18.94 ac
- Area from Lake Powell = 22.48 ac

56.22 ac
(Durfey's BMP)

Area to BMP 2:

- Offsite = 10 ac ← red boxed in
- Area from Lake Powell = 14.55 ac ← red boxed in
- Additional Lake Powell acres = 13.43 ac ← blue boxed in, shaded

37.98 ac
(Powell's BMP)

1. These calculations are intended to determine a Composite C for Durfey's Mill & Lake Powell to use with runoff calculations associated with BMP design.

2. Durfey's Mill : Total Area = 46.24 − 6.00 (Existing Lots) = 40.24 ac

Need to use SCS method

Street area : Cul de Sacs = πr^2 * Nr. of cul-de-sacs

$= (3.14)(50)^2 * 7$

$= 54{,}950$ sf = 1.26 ac

Straight aways = Total length * width =

$= 3{,}540 * 30$ ft

$= 106{,}200$ sf = 2.44 ac

House Area : Assuming an 1,800 sf foot-print,

$67 \text{ houses} * \frac{1{,}800 \text{ sf}}{\text{house}} = 120{,}600$ sf = 2.77 ac

Driveways Area : Assuming a double driveway to BSL

$67 \text{ houses} * \frac{(18 \text{ ft})(35 \text{ ft})}{\text{house}} = 42{,}210$ sf = 0.97 ac

Total Impervious area = (1.26 + 2.44 + 2.77 + 0.97) ac = 7.44 ac

7.44 ac (0.90) = 6.70

32.80 ac (0.20) = 6.56

13.26 / 40.24 ⇒ $C_{comp} = 0.33$

③. Lake Powell: Total Area = 69.19 ac

Cul-de-Sacs = $(3.14)(50)^2 * 9$ = 79,650 sf = 1.62 ac

Straight aways = (5,100)(30) = 153,000 sf = 3.51 ac

House Area = 147 houses * $\frac{1,800 \text{ sf}}{\text{house}}$ = 264,600 sf = 6.07 ac

Driveways Area = Assuming a single driveway to BSL

147 houses * $\frac{(25)(9)}{\text{house}}$ = 33,075 sf = 0.76 ac

Total Impervious Area = (1.62 + 3.51 + 6.07 + 0.76) ac = 11.96 ac

11.96 ac (0.9) = 10.76

57.23 ac (0.2) = 11.45

22.21 / 69.19 ⟹ C = 0.32 ←

check 4VR

(1). These calculations are intended to size the wet pond for Durfey's Mill. The pond will be sized for 4.0 V.

$R_v = .009I + .05$
V_R:
$R_v = 0.32$
$I = 38\%$
$4V_R = 221,360\ ft^3 = 6\ acft$

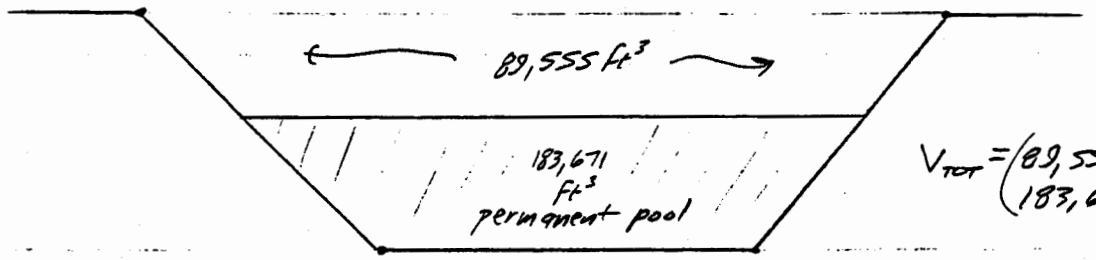
(2). To satisfy the 4.0 V requirement for BMPs:

$$V = 3,630 \frac{ft^3}{ac \cdot in} * 0.9\ in * 56.22\ ac = 183,671\ ft^3\ req'd$$

$(V_R = .45 \times R_v \times A.)$ *4

This is the storage capacity required for the permanent pool.

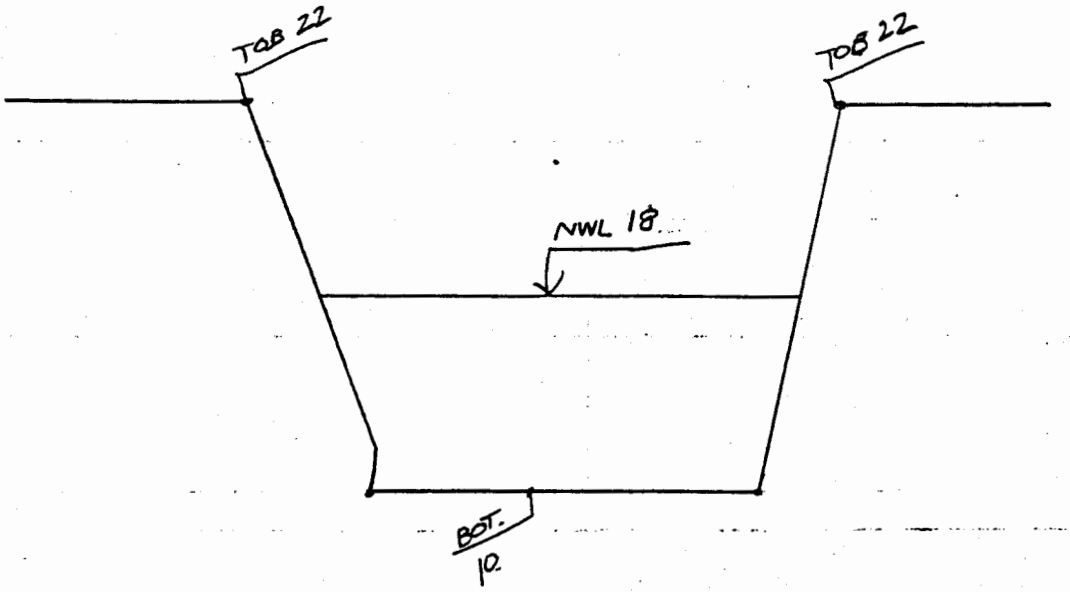
(3). Based upon an allowable outflow of 21.96 cfs, 56.22 ac, C=0.33, and a 10-year storm, the required storage (see attached TR-55 output) = 89,555 ft³.



$V_{TOT} = (89,555 + 183,671)\ ft^3$

$V_{TOT} = 273,226\ ft^3$

Proposed Section



DURFEY'S MILL SINGLE FAMILY / W.O. 13084 / 28 FEB 97 /
WET POND VOLUME CALCULATION /

2/7

CALCULATED 03-03-1997 10:57:09
DISK FILE: DURFEYS .VOL

Planimeter scale: 1 inch = 1 ft.

> 183,671 ft³ req'd for permanent po ok

Elevation (ft)	Planimeter (sq.in.)	Area (sq.ft)	A1+A2+sqr(A1*A2) (sq.ft)	* Volume (cubic-ft)	Volume Sum (cubic-ft)
9.00	12,328.00	12,328	0	0	0
NWL ←18.00	30,884.00	30,884	62,725	188,174	188,174
20.50	*I*	40,654	106,972	89,144	277,317
22.00	47,160.00	47,160	116,208	154,944	343,118

≈ 273,226 ft³ total req'd.

>273,226 ft³ total req'd OK

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

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

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

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

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

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

343,118
− 188,174
154,944 ft³ > 89,555 ft³ req'd for keeping allowable outflow ≤ 21.96 cfs, ok

3/7

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

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

DURFEY'S MILL SINGLE FAMILY / W.O. 13084 / 07 FEB 97 /
WET POND 4.0 V /

```
*********************************************************************
*  RETURN FREQUENCY:  10 yr     |  Allowable Outflow:    21.96 cfs    *
*  'C' Adjustment: 1.000        |  Required Storage:    89,555 cu.ft. *
*-------------------------------------------------------------------*
*  Peak Inflow:   56.05 cfs     |  Inflow .HYD stored: NONE STORED    *
*********************************************************************
```

```
|                Td =  43 minutes                    |  Return Freq:    10 yr
/------- Approx. Duration for Max. Storage ------/  C adj.factor: 1.00
|                                                   |
|                                                   |
|                Tc=   15.00  minutes               |
|                I =   5.170  in/hr                 |  Area (ac):    56.22
|              . Q =   95.92  cfs                   |  Weighted C:    0.33
|             .|.                                   |  Adjusted C:    0.33
F|            .   .                                  |
L|          .  |  .            Required Storage     |
O|        .       .        .--    89,555 cu.ft.    |  Td=      43 minutes
W|      .    |    .        |                       |  I =   3.021 in/hr
|     .     x x x x x x x|x x x x x x x x x x x x  Q =   56.05 cfs
c|    .                   |
f|   .    x                                         x
s|  .                 o o o o o o o o o o o o o o o o o   Q=   21.96 cfs
|  .   x          o   |.                           |x  (Allow.Outflow)
|  .            o     | .                          |
|  .  x    o           |  .       NOT TO SCALE      |   x
| .   o                |   .      ============      |
| o                    |    .                       |      x
`----------------------|----------------------------|------------
                     26.57 minutes                52.12 minutes
```

ck TR-55 Ver.5.22 S/N:1240520042
Executed: 10:11:48 02-07-1997

4/7

DURFEY'S MILL SINGLE FAMILY / W.O. 13084 / 07 FEB 97 /
WET POND 4.0 V /

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

Weighted C = 0.330 Area= 56.220 acres Tc = 15.00 minutes

Adjusted C = 0.330 Td= 43.00 min. I= 3.02 in/hr Qp= 56.05 cfs

RETURN FREQUENCY: 10 year storm Adj.factor = 1.00
Output file: NONE STORED

HYDROGRAPH FOR MAXIMUM STORAGE
For the 10 Year Storm

Time increment = 15.00 Minutes
Time on left represents time for first Q in each row.

Time Minutes				
0.00	0.00	56.05	56.05	48.57

5/7

DURFEY'S MILL SINGLE FAMILY / W.O. 13084 / 07 FEB 97 /
WET POND 4.0 V /

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

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

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

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
COMPOSITE	0.330	56.22						
			15.00	0.330	0.330	5.170	56.22	95.92

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

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

DURFEY'S MILL SINGLE FAMILY / W.O. 13084 / 07 FEB 97 /
WET POND 4.0 V /

Area = 56.22 acres Tc = 15.00 minutes

Frequency (years)	Adjusted 'C'	Duration minutes	Intens. in/hr	Qpeak cfs	Allowable cfs	VOLUMES Inflow (cu.ft.)	VOLUMES Storage (cu.ft.)
10	0.330	43	3.021	56.05	21.96	144,602	89,555

ck TR-55 Ver.5.22 S/N:1240520042
xecuted: 10:11:48 02-07-1997

7/7

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

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

DURFEY'S MILL SINGLE FAMILY / W.O. 13084 / 07 FEB 97 /
WET POND 4.0 V /

RETURN FREQUENCY: 10 yr `C' Adjustment = 1.000 Allowable Q = 21.96 cfs

Hydrograph file: NONE STORED Tc = 15.00 minutes

Weighted `C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (cu.ft.)	Storage (cu.ft.)
0.330	0.330	15	5.170	56.22	95.92	86,325	66,561
0.330	0.330	20	4.580	56.22	84.97	101,965	75,905
0.330	0.330	30	3.730	56.22	69.20	124,562	85,908
0.330	0.330	40	3.150	56.22	58.44	140,258	89,005
********** Storage Maximum							
0.330	0.330	43	3.021	56.22	56.05	144,602	89,555
**********							
0.330	0.330	50	2.720	56.22	50.46	151,389	87,547
0.330	0.330	60	2.400	56.22	44.53	160,294	83,850
0.330	0.330	120	1.400	56.22	25.97	187,010	34,991
0.330	0.330	180	0.980	56.22	18.18	Qpeak < Qallow	

EXECUTED: 03-04-1997 10:18:23 Hydrograph incorporated

(1/3)

```
*************************************************************
*                                                           *
*  DURFEY'S MILL SINGLE FAMILY / W.O. 13084 / 03 MAR 97 /   *
*       WET POND OUTFALL DESIGN / PRIMARY SPILL WAY /       *
*                                                           *
*                                                           *
*                                                           *
*************************************************************
```

Inflow Hydrograph: DURFEYS .HYD
Rating Table file: DURFEYS .PND

----INITIAL CONDITIONS----
Elevation = 18.00 ft
Outflow = 0.00 cfs
Storage = 188,174 cu-ft

GIVEN POND DATA

ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)
18.00	0.0	188,174
18.25	2.1	196,009
18.50	5.8	204,075
18.75	10.0	212,375
19.00	11.6	220,913
19.25	12.9	229,692
19.50	14.2	238,715
19.75	15.3	247,986
20.00	16.4	257,508
20.25	17.4	267,283
20.50	18.3	277,317
20.75	19.2	287,612

INTERMEDIATE ROUTING COMPUTATIONS

2S/t (cfs)	2S/t + O (cfs)
418.2	418.2
435.6	437.7
453.5	459.3
471.9	481.9
490.9	502.5
510.4	523.3
530.5	544.7
551.1	566.4
572.2	588.6
594.0	611.4
616.3	634.6
639.1	658.3

Time increment (t) = 15.0 min.

$< Q_{ALLOW}$ = 21.96 cfs, OK

TOTAL REQ'D STORAGE = 273,226 FT^3

DURFEYS3

Pond File: DURFEYS .PND
Inflow Hydrograph: DURFEYS .HYD
Outflow Hydrograph: OUT .HYD

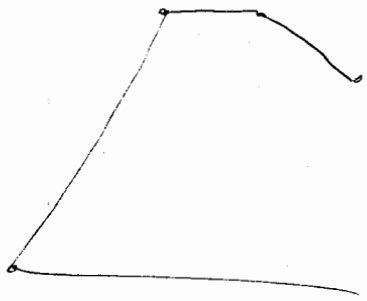
INFLOW HYDROGRAPH

TIME (min)	INFLOW (cfs)
0.0	0.00
15.0	56.05
30.0	56.05
45.0	48.57

ROUTING COMPUTATIONS

I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
-----	418.2	418.2	0.00	18.00
56.1	457.1	474.2	8.57	18.66
112.1	538.3	569.2	15.44	19.78
104.6	605.7	642.9	18.62	20.59

Incomplete hydrograph



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

Pond File: DURFEYS .PND
Inflow Hydrograph: DURFEYS .HYD
Outflow Hydrograph: OUT .HYD

Starting Pond W.S. Elevation = 18.00 ft

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

Peak Inflow = 56.05 cfs
Peak Outflow = 18.62 cfs
Peak Elevation = 20.59 ft ← < TOB = 22.00, OK

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

Initial Storage = 188,174 cu-ft
Peak Storage From Storm = 92,765 cu-ft

Total Storage in Pond = 280,939cu-ft ← >273,276 ft³, OK

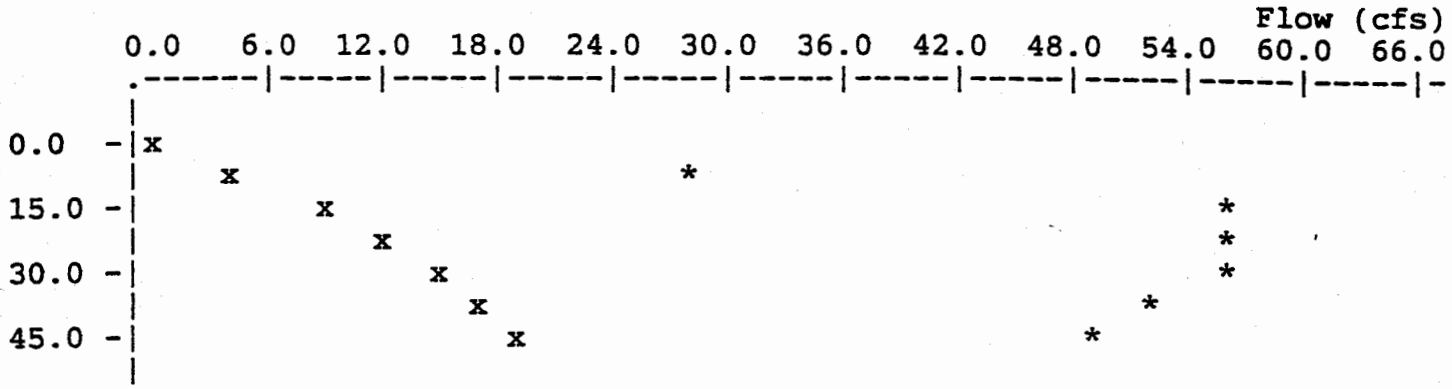
Warning: Inflow hydrograph truncated on right side.

4/7

Pond File: DURFEYS .PND
Inflow Hydrograph: DURFEYS .HYD
Outflow Hydrograph: OUT .HYD

EXECUTED: 03-04-1997
10:18:23

Peak Inflow = 56.05 cfs
Peak Outflow = 18.62 cfs
Peak Elevation = 20.59 ft



* File: DURFEYS .HYD Qmax = 56.0 cfs
x File: OUT .HYD Qmax = 18.6 cfs

(5/7)

HYDROGRAPH FILE
DURFEYS .HYD

03-04-1997 10:20:32

Time (min)	Flow (cfs)	Time (min)	Flow (cfs)
0.0	0.00	30.0	56.05
15.0	56.05	45.0	48.57

6/7

HYDROGRAPH FILE
OUT .HYD

03-04-1997 10:20:32

Time (min)	Flow (cfs)	Time (min)	Flow (cfs)
0.0	0.00	30.0	15.44
15.0	8.57	45.0	18.62

1. The emergency spillway will be designed to pass the 50-year storm.

2. The drainage area to the pond = 56.22 ac.

The composite $C = 0.33$.

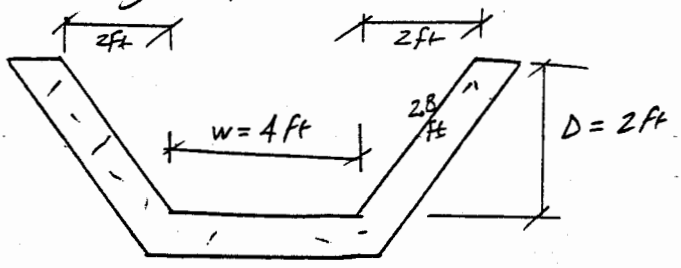
Using $T_c = 16.4$ minutes (from the Storm Drain calculations)

$Q = ciA$, for 50-yr. storm

$Q = (0.33)(6.44)(56.22) \Rightarrow Q_{50} = 119.48$ cfs

3. Using a paved ditch, VDOT PG-5: (Use 4" thick concrete)

(Use 1:1 side slopes)



Check capacity: $Q = \frac{1.49}{n} A R^{2/3} s^{1/2}$

$n = 0.013$ for concrete

$A = (4ft)(2ft) + (2ft)(2ft) = 12 ft^2$

$R = \frac{A}{W.P.} = \frac{12 ft^2}{(2.8 + 4 + 2.8) ft} = 1.25 ft$

$Q = \frac{1.49}{0.013} (12 ft^2)(1.25 ft)^{2/3} s^{1/2}$

$Q = 1,597.1 s^{1/2}$, for $s = 0.01 \Rightarrow$ $Q = 159.7$ cfs > 119.48 cfs, OK

POND-2 Version: 5.10 S/N: 1220510115
Date Executed: Time Executed:

****
DURFEY'S MILL SINGLE FAMILY / W.O. 13084 / 03 MAR 97 /
WET POND OUTFALL DESIGN / PRIMARY SPILL WAY /

****

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

Elevation (ft)	Q (cfs)	Contributing Structures
18.00	0.0	1
18.25	2.1	1
18.50	5.8	1
18.75	10.0	1
19.00	11.6	1
19.25	12.9	1
19.50	14.2	1
19.75	15.3	1
20.00	16.4	1
20.25	17.4	1
20.50	18.3	1
20.75	19.2	1
21.00	0.0	

POND-2 Version: 5.10 S/N: 1220510115
Date Executed: Time Executed:

****
DURFEY'S MILL SINGLE FAMILY / W.O. 13084 / 03 MAR 97 /
WET POND OUTFALL DESIGN / PRIMARY SPILL WAY /

****

Outlet Structure File: DURFEYS3.STR
Planimeter Input File: DURFEYS .VOL
Rating Table Output File: DURFEYS .PND

Min. Elev.(ft) = 18 Max. Elev.(ft) = 21 Incr.(ft) = .25

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

****
SYSTEM CONNECTIVITY
****

Structure	No.	Q Table		Q Table
STAND PIPE	1		->	1

Outflow rating table summary was stored in file:
DURFEYS .PND

Outlet Structure File: DURFEYS3.STR

POND-2 Version: 5.10 S/N: 1220510115
Date Executed: Time Executed:

****
DURFEY'S MILL SINGLE FAMILY / W.O. 13084 / 03 MAR 97 /
WET POND OUTFALL DESIGN / PRIMARY SPILL WAY /

****

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

STAND PIPE
Stand Pipe with weir or orifice flow

E1 elev.(ft)?	18.00
E2 elev.(ft)?	21.00
Crest elev.(ft)?	18.00
Diameter (ft)?	1.75 ← 21" standpipe
Weir coefficient?	3.00
Orifice coefficient?	0.60
Start transition elev.(ft) @ ?	
Transition height (ft)?	

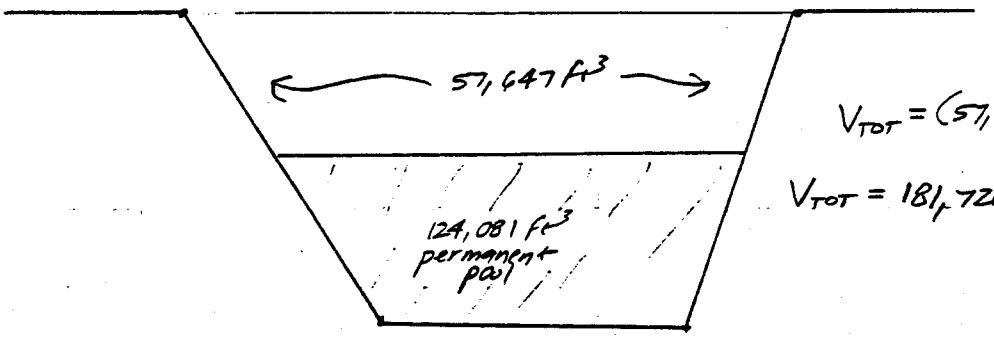
1. These calculations are intended to size the wet pond for Lake Powell. The pond will be sized for 4.0 V.

2. To satisfy the 4.0 V requirement for BMPs:

$$V = 3630 \frac{ft^3}{ac \cdot in} * 0.9\ in * 37.98\ ac = 124{,}081\ ft^3$$

This is the storage capacity required for the permanent pool.

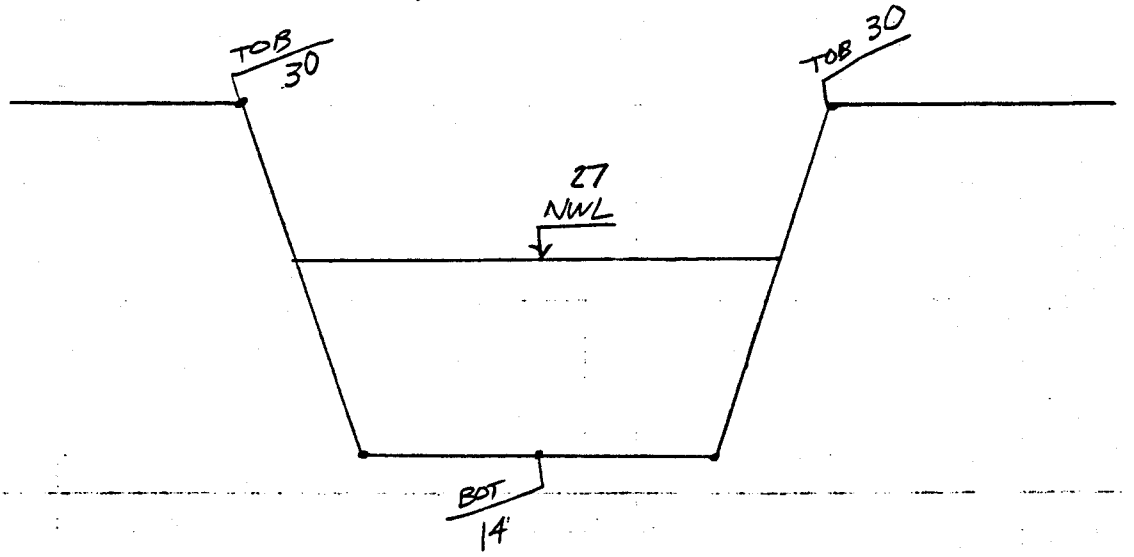
3. Based upon an allowable outflow of 14.83 cfs, 37.98 ac, C = 0.32, and a 10-year storm, the required storage (see attached TR-55 output) = 57,647 ft³.



$V_{TOT} = (57{,}647 + 124{,}081)\ ft^3$

$V_{TOT} = 181{,}728\ ft^3$

Proposed Section:



MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

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

LAKE POWELL CLUSTER DEVELOPMENT / W.O. 13361 / 07 FEB 97 /
WET POND 4.0 V /

```
*****************************************************************
*  RETURN FREQUENCY:  10 yr     |  Allowable Outflow:    14.83 cfs    *
*  'C' Adjustment: 1.000        |  Required Storage:    57,647 cu.ft. *
*---------------------------------------------------------------*
*  Peak Inflow:   40.40 cfs       Inflow .HYD stored: NONE STORED    *
*****************************************************************
```

```
|                Td =  37 minutes                  |  Return Freq:    10 yr
/------- Approx. Duration for Max. Storage ------/  C adj.factor: 1.00
|                                                  |
|                                                  |
|                Tc=   15.50  minutes              |
|                I =   5.111  in/hr                |  Area (ac):    37.98
|              . Q =   62.12  cfs                  |  Weighted C:    0.32
|            .|.                                   |  Adjusted C:    0.32
F           .   .                                  |
L          .  |  .            Required Storage     |
O         .       .        .--    57,647 cu.ft.    |  Td=      37 minutes
W        .    |    .      |                       |  I =   3.324 in/hr
        .     x x x x x x x|x x x x x x x x x x x  Q =   40.40 cfs
c      .                   |
f     .    x                                       x
s    .                 o o o o o o o o o o o o o o o o   Q=   14.83 cfs
    .   x          o   |.                          |x  (Allow.Outflow)
   .           o       | .                         |
  .  x    o             |  .      NOT TO SCALE      |   x
 .   o                  |   .     ============      |
 o                      |    .                      |      x
`-----------------------|---------------------------|------------
                      27.30 minutes              46.81 minutes
```

3/7

LAKE POWELL CLUSTER DEVELOPMENT / W.O. 13361 / 07 FEB 97 /
WET POND 4.0 V /

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

Weighted C = 0.320 Area= 37.980 acres Tc = 15.50 minutes

Adjusted C = 0.320 Td= 37.00 min. I= 3.32 in/hr Qp= 40.40 cfs

RETURN FREQUENCY: 10 year storm Adj.factor = 1.00
Output file: NONE STORED

HYDROGRAPH FOR MAXIMUM STORAGE
For the 10 Year Storm

Time increment = 15.00 Minutes
Time on left represents time for first Q in each row.

Time Minutes				
0.50	1.30	40.40	40.40	18.24

LAKE POWELL CLUSTER DEVELOPMENT / W.O. 13361 / 07 FEB 97 /
WET POND 4.0 V /

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

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

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

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
COMPOSITE	0.320	37.98						
			15.50	0.320	0.320	5.111	37.98	62.12

5/7

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

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

LAKE POWELL CLUSTER DEVELOPMENT / W.O. 13361 / 07 FEB 97 /
WET POND 4.0 V /

Area = 37.98 acres Tc = 15.50 minutes

Frequency (years)	Adjusted 'C'	Duration minutes	Intens. in/hr	Qpeak cfs	Allowable cfs	VOLUMES Inflow (cu.ft.)	Storage (cu.ft.)
10	0.320	37	3.324	40.40	14.83	89,685	57,647

TR-55 Ver.5.22 S/N:1240520042
uted: 10:20:13 02-07-1997

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

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

LAKE POWELL CLUSTER DEVELOPMENT / W.O. 13361 / 07 FEB 97 /
WET POND 4.0 V /

RETURN FREQUENCY: 10 yr `C' Adjustment = 1.000 Allowable Q = 14.83 cfs

Hydrograph file: NONE STORED Tc = 15.50 minutes

Weighted `C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (cu.ft.)	Storage (cu.ft.)
0.320	0.320	16	5.111	37.98	62.12	57,769	43,977
0.320	0.320	20	4.580	37.98	55.66	66,796	49,191
0.320	0.320	30	3.730	37.98	45.33	81,599	55,515
********** Storage Maximum							
0.320	0.320	37	3.324	37.98	40.40	89,685	57,647
**********							
0.320	0.320	40	3.150	37.98	38.28	91,881	57,314
0.320	0.320	50	2.720	37.98	33.06	99,173	56,131
0.320	0.320	60	2.400	37.98	29.17	105,007	53,479
0.320	0.320	120	1.400	37.98	17.02	122,508	20,096
0.320	0.320	180	0.980	37.98	11.91	Qpeak < Qallow	

LAKE POWELL CLUSTER DEVELOPMENT / W.O. 13361 / 28 FEB 97 /
WET POND BMP VOLUME CALCULATION /

CALCULATED 03-04-1997 08:49:13
DISK FILE: POWELL .VOL

Planimeter scale: 1 inch = 1 ft.

≈ tot. vol. req'd

Elevation (ft)	Planimeter (sq.in.)	Area (sq.ft)	A1+A2+sqr(A1*A2) (sq.ft)	* Volume (cubic-ft)	Volume Sum (cubic-ft)
14.00	2,578.00	2,578	0	0	0
18.00	6,562.00	6,562	13,253	17,671	17,671
NWL ← 27.00	19,148.00	19,148	36,919	110,758	128,429
29.40	*I*	26,115	67,624	54,100	182,528
30.00	28,025.00	28,025	70,338	70,338	198,767

> 181,728 ft³ req'd OK

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

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

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

> 124,081 ft³ req'd

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

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

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

198,767
− 128,429
70,338 ft³ > 57,697 ft³ req'd storage for allowable outflow, OK

```
*****************************************************************
*                                                               *
* LAKE POWELL CLUSTER DEVELOPMENT / W.O. 13361 / 04 MAR 97 /    *
*          WET POND OUTFALL DESIGN / PRIMARY SPILL WAY /        *
*                                                               *
*                                                               *
*                                                               *
*****************************************************************
```

Inflow Hydrograph: POWELL .HYD
Rating Table file: POWELL .PND

----INITIAL CONDITIONS----
Elevation = 27.00 ft
Outflow = 0.00 cfs
Storage = 128,429 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + O (cfs)
27.00	0.0	128,429	285.4	285.4
27.25	1.8	133,300	296.2	298.0
27.50	5.0	138,341	307.4	312.4
27.75	7.4	143,556	319.0	326.4
28.00	8.5	148,947	331.0	339.5
28.25	9.5	154,517	343.4	352.9
28.50	10.4	160,269	356.2	366.6
28.75	11.3	166,206	369.3	380.6
29.00	12.0	172,331	383.0	395.0
29.25	12.8	178,646	397.0	409.8
29.50	13.5	185,155	411.5	425.0
29.75	14.1	191,861	426.4	440.5

Time increment (t) = 15.0 min.

$< Q_{ALLOW}$ = 14.83 cfs, OK

TOTAL STORAGE REQ'D = 181,728 FT^3

POWELL

Pond File: POWELL .PND
Inflow Hydrograph: POWELL .HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH

TIME (min)	INFLOW (cfs)
0.5	1.30
15.5	40.40
30.5	40.40
45.5	18.24

ROUTING COMPUTATIONS

I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
-----	285.4	285.4	0.00	27.00
41.7	312.2	327.1	7.46	27.76
80.8	369.2	393.0	11.90	28.97
58.6	400.6	427.8	13.61	29.55

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

Pond File: POWELL .PND
Inflow Hydrograph: POWELL .HYD
Outflow Hydrograph: OUT .HYD

Starting Pond W.S. Elevation = 27.00 ft

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

Peak Inflow = 40.40 cfs
Peak Outflow = 13.61 cfs
Peak Elevation = 29.55 ft ← <TOB = 30.0, OK

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

Initial Storage = 128,429 cu-ft
Peak Storage From Storm = 57,963 cu-ft

Total Storage in Pond = 186,392cu-ft → >181,728 ft³ OK

Warning: Inflow hydrograph truncated on left side.
Warning: Inflow hydrograph truncated on right side.

Pond File: POWELL .PND
Inflow Hydrograph: POWELL .HYD
Outflow Hydrograph: OUT .HYD

EXECUTED: 03-04-1997
11:33:09

Peak Inflow = 40.40 cfs
Peak Outflow = 13.61 cfs
Peak Elevation = 29.55 ft

```
                                                                    Flow (cfs)
      0.0   4.0   8.0  12.0  16.0  20.0  24.0  28.0  32.0  36.0  40.0  44.0
      .------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-
      |
15.5 -|           x                                                   *
      |               x                                               *
30.5 -|                  x                                            *
      |                   x                         *
      |
    TIME
    (min)
```

* File: POWELL .HYD Qmax = 40.4 cfs
x File: OUT .HYD Qmax = 13.6 cfs

POND-2 Version: 5.10
S/N: 1220510115

HYDROGRAPH FILE
POWELL .HYD

03-04-1997 11:34:38

Time (min)	Flow (cfs)	Time (min)	Flow (cfs)
0.5	1.30	30.5	40.40
15.5	40.40	45.5	18.24

HYDROGRAPH FILE
OUT .HYD

03-04-1997 11:34:38

Time (min)	Flow (cfs)	Time (min)	Flow (cfs)
0.5	0.00	30.5	11.90
15.5	7.46	45.5	13.61

1. The emergency spillway will be designed to pass the 50-year storm.

2. The drainage area to the pond = 37.98 ac.

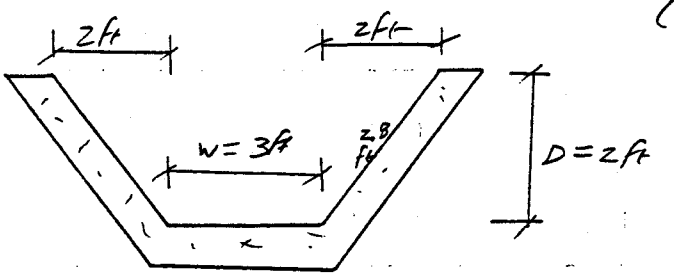
The composite C = 0.32.

Assuming T_c = 15 minutes, Q = CiA, for the 50-year storm,

$Q = (0.32)(6.70)(37.98) \Rightarrow Q_{50} = 81.43$ cfs

3. Using a paved ditch, VDOT P6-5: (Use 4" thick concrete)

(Use 1:1 side slopes)



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

n = 0.013 for concrete

$A = (3ft)(2ft) + (2ft)(2ft) = 10\ ft^2$

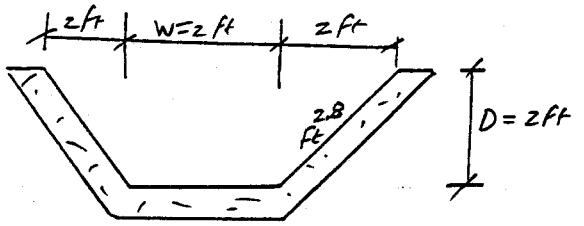
$R = \frac{A}{W.P.} = \frac{10\ ft^2}{(2.8+3+2.8)ft} = 1.16\ ft$

$Q = \frac{1.49}{(0.013)} (10\ ft^2)(1.16\ ft)^{2/3} S^{1/2}$

$Q = 1{,}268.03\ S^{1/2}$, for s = 2% $\Rightarrow Q = 179.33$ cfs >> 81.43 cfs

$\Rightarrow$ Try smaller section

4.



$A = (2ft)(2ft) + (2ft)(2ft) = 8\ ft^2$

$R = \frac{8\ ft^2}{(2.8+2+2.8)ft} = 1.05\ ft$

$Q = \frac{1.49}{(0.013)} (8\ ft^2)(1.05)^{2/3} S^{1/2}$

$Q = 949\ S^{1/2}$, For s = 2%, $\underline{Q = 134\ cfs > 81.43\ cfs, OK}$ $\leftarrow$

TOPS 35500

POND-2 Version: 5.10 S/N: 1220510115
Date Executed: Time Executed:

****
LAKE POWELL CLUSTER DEVELOPMENT / W.O. 13361 / 04 MAR 97 /
WET POND OUTFALL DESIGN / PRIMARY SPILL WAY /

****

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

Elevation (ft)	Q (cfs)	Contributing Structures
27.00	0.0	1
27.25	1.8	1
27.50	5.0	1
27.75	7.4	1
28.00	8.5	1
28.25	9.5	1
28.50	10.4	1
28.75	11.3	1
29.00	12.0	1
29.25	12.8	1
29.50	13.5	1
29.75	14.1	1
30.00	0.0	

Outlet Structure File: POWELL .STR

POND-2 Version: 5.10 S/N: 1220510115
Date Executed: Time Executed:

****
LAKE POWELL CLUSTER DEVELOPMENT / W.O. 13361 / 04 MAR 97 /
WET POND OUTFALL DESIGN / PRIMARY SPILL WAY /

****

Outlet Structure File: POWELL .STR
Planimeter Input File: POWELL .VOL
Rating Table Output File: POWELL .PND

Min. Elev.(ft) = 27 Max. Elev.(ft) = 30 Incr.(ft) = .25

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

****
SYSTEM CONNECTIVITY
****

Structure	No.	Q Table		Q Table
STAND PIPE	1		->	1

Outflow rating table summary was stored in file:
POWELL .PND

POND-2 Version: 5.10 S/N: 1220510115
Date Executed: Time Executed:

****
LAKE POWELL CLUSTER DEVELOPMENT / W.O. 13361 / 04 MAR 97 /
WET POND OUTFALL DESIGN / PRIMARY SPILL WAY /

****

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

STAND PIPE
Stand Pipe with weir or orifice flow

E1 elev.(ft)?	27
E2 elev.(ft)?	30
Crest elev.(ft)?	27
Diameter (ft)?	1.50 ← 18" standpipe
Weir coefficient?	3.00
Orifice coefficient?	0.60
Start transition elev.(ft) @ ?	
Transition height (ft)?	

27, 1996 13084
's Mill / Lake Powell
Drainage Area Map
(200 scale)
D Jan 13, 1997 → Added Add'l areas to BMP
Feb 7, 1997 → Revised Composite C

RAINAGE PLAN

D. These calculations are for the design of the Temporary Sediment Basin that will be located on Lots 57 & 58. Appendix 3.14 a, Design Procedure for Temporary Sediment Basins, from the Virginia E&S Manual is followed below.

(I) Basin Volume

(A). $\frac{134\ yd^3}{ac} * 5.28\ ac * \frac{27\ ft^3}{1\ yd^3} = 19{,}104\ ft^3$ = Total Volume Req'd.

Half volume Permanent Pool = $9{,}552\ ft^3$

Half volume drawdown (dry) area = $9{,}552\ ft^3$

→ From attached Volume Calculation, Total Volume Provided = $19{,}376\ ft^3$

which is $> 19{,}104\ ft^3 \Rightarrow$ ok.

→ NWL will be at Elevation 25.3 ft, Volume = $9{,}655\ ft^3 > 9{,}552\ ft^3 \Rightarrow$ OK.

→ Dry volume provided = $V_{TOT} - V_{WET} = (19{,}376 - 9{,}655)\ ft^3$

$= 9{,}721 > 9{,}552\ ft^3 \Rightarrow$ OK.

(B). Volume of basin is adequate.

Embankment height is not excessive.

Some excavation will be req'd.

(II). Basin Shape: L:W Ratio = $\frac{L}{W_e}$

(A). Where $W_e = \frac{A}{L}$ = Effective Width = $\frac{3{,}784}{77} = 49\ ft$, A = surface area of normal pool.

L:W = $\frac{77\ ft}{49\ ft} = 1.6:1 < 2:1 \Rightarrow$ baffles req'd.

(B). Baffles as shown on plans to obtain ≈ L = 98 ft.

COUNTY COPY

22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS
AMPAD

(III). Separate Emergency Spillway shall be a rip-rap lined channel since the embankment area will be built-up with fill.

(IV). Elevation of crest of Principal Spillway for req'd volume of 134 yd^3/ac = 27.5 ft.

Elevation of Dewatering Orifice at 67 yd^3/ac = 25.3 ft

(V). Estimate elevation of Design High Water & Regd Height of Dam:

(A). Crest Princ. Spill. = 27.50 ft

Crest Emerg. Spill. = 28.50 ft

$\Rightarrow$ 1.0 ft difference $\Rightarrow$ ok

(B). Top of Embankment = 30.00 ft

Elevation of Peak Flow Through Emergency Spillway (Design High Water for 25-Yr. Storm) = 29.00 ft

(C). N/A since Emergency Spillway included.

(D). N/A since Emergency Spillway included.

(VI). From Ch.5, Peak rate of runoff for 25-Year storm.

$Q = ciA$, $C_{composite} = 0.33$, $T_c = 15.4$ min, $i = 5.95$

$Q = (0.33)(5.95)(5.28) \Rightarrow Q_{25} = 10.37$ cfs

(VII). Principal Spillway Design:

(A). Emergency Spillway Included $\Rightarrow$ Princ. Spill. must pass 2-yr

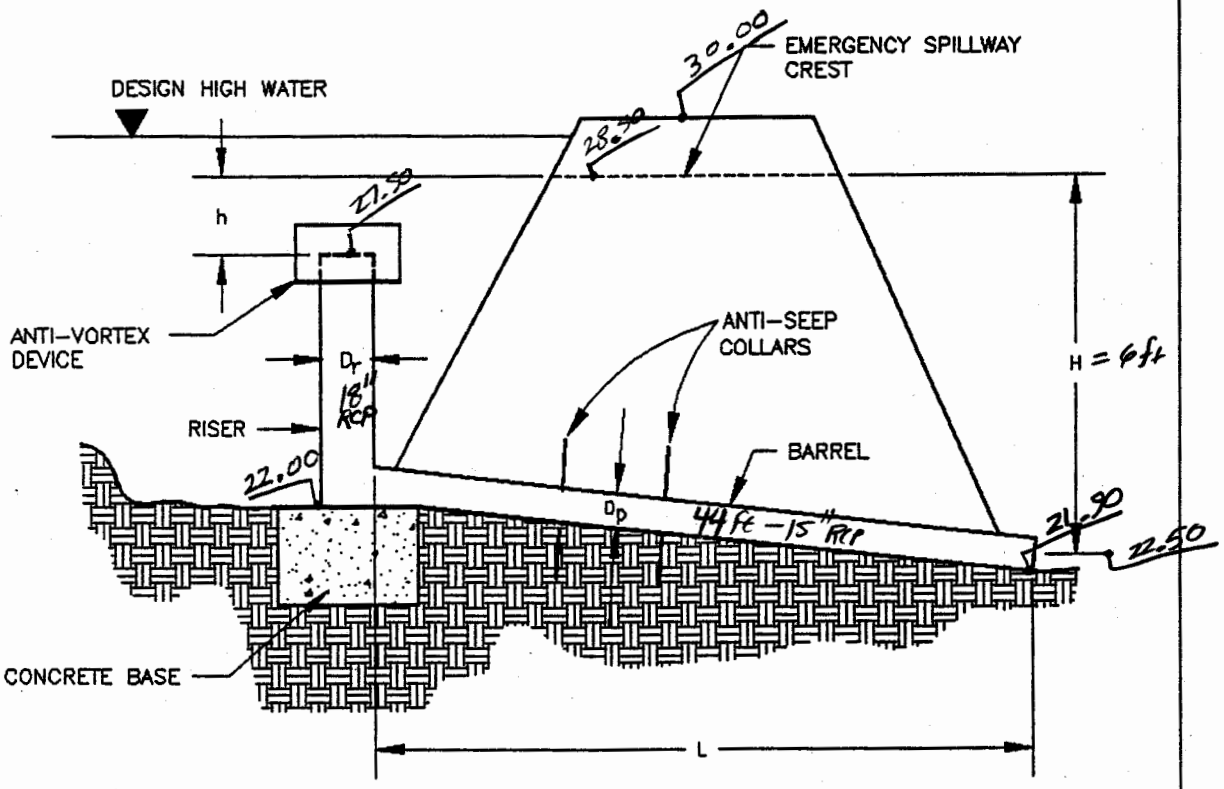
$Q_2 = (0.33)(3.85)(5.28) \Rightarrow Q_2 = 6.71$ cfs $= Q_P$ ←

(B). N/A since Emerg. Spill. included.

22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS
AMPAD

(REVISED 22 JULY 97)

PRINCIPAL SPILLWAY DESIGN

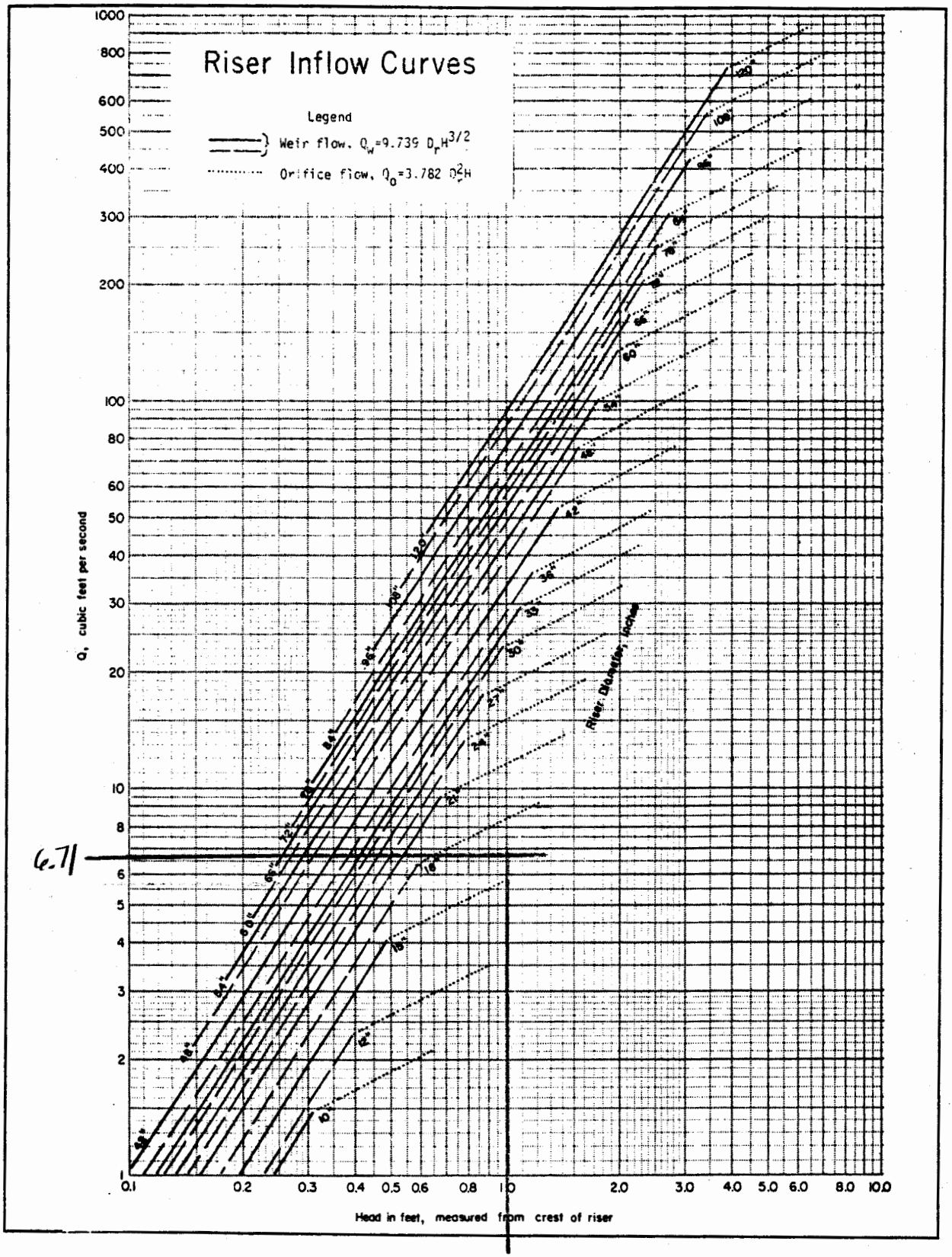


H = HEAD ON PIPE THROUGH EMBANKMENT
h = HEAD OVER RISER CREST
L = LENGTH OF PIPE THROUGH EMBANKMENT
D_p = DIAMETER OF PIPE THROUGH EMBANKMENT
D_r = DIAMETER OF RISER

Source: Va. DSWC

Plate 3.14-7

MC037_LAKE_POWELL_FOREST_END_CONSERVATION_AREA - 064



Source: USDA-SCS

Plate 3.14-8

MC037_LAKE_POWELL_FOREST_END_CONSERVATION_AREA - 065

TABLE 3.14-B
PIPE FLOW CHART, n = 0.013

FOR REINFORCED CONCRETE PIPE INLET $K_m = K_e + K_b = 0.65$ AND 70 FEET OF REINFORCED CONCRETE PIPE CONDUIT (full flow assumed)

Note correction factors for pipe lengths other than 70 feet

diameter of pipe in inches

H, in feet	12"	15"	18"	21"	24"	30"	36"	42"	48"	54"	60"	66"	72"	78"	84"	90"	96"	102"
1	3.22	5.44	8.29	11.8	15.9	26.0	38.6	53.8	71.4	91.5	114	139	167	197	229	264	302	342
2	4.55	7.69	11.7	16.7	22.5	36.8	54.6	76.0	101	129	161	197	236	278	324	374	427	483
3	5.57	9.42	14.4	20.4	27.5	45.0	66.9	93.1	124	159	198	241	289	341	397	458	523	592
4	6.43	10.9	16.6	23.5	31.8	52.0	77.3	108	143	183	228	278	334	394	459	529	604	683
5	7.19	12.2	18.5	26.3	35.5	58.1	86.4	120	160	205	255	311	373	440	513	591	675	764
6	7.88	13.3	20.3	28.8	38.9	63.7	94.6	132	175	224	280	341	409	482	562	647	739	837
7	8.51	14.4	21.9	31.1	42.0	68.8	102	142	189	242	302	368	441	521	607	699	798	904
8	9.10	15.4	23.5	33.3	44.9	73.5	109	152	202	259	323	394	472	557	685	748	854	966
9	9.65	16.3	24.9	35.3	47.7	78.0	116	161	214	275	342	418	500	590	688	793	905	1025
10	10.2	17.2	26.2	37.2	50.2	82.2	122	170	226	289	361	440	527	622	725	836	954	1080
11	10.7	18.0	27.5	39.0	52.7	86.2	128	178	237	304	379	462	553	653	761	877	1001	1133
12	11.1	18.9	28.7	40.8	55.0	90.1	134	186	247	317	395	482	578	682	794	916	1045	1184
13	11.6	19.6	29.9	42.4	57.3	93.7	139	194	257	330	411	502	601	710	827	953	1088	1232
14	12.0	20.4	31.0	44.1	59.4	97.3	145	201	267	342	427	521	624	736	858	989	1129	1278
15	12.5	21.1	32.1	45.6	61.5	101	150	208	277	354	442	539	646	762	888	1024	1169	1323
16	12.9	21.8	33.2	47.1	63.5	104	155	215	286	366	457	557	667	787	917	1057	1207	1367
17	13.3	22.4	34.2	48.5	65.5	107	159	222	294	377	471	574	688	812	946	1090	1244	1409
18	13.7	23.1	35.2	49.9	67.4	110	164	228	303	388	484	591	708	835	973	1121	1280	1450
19	14.0	23.7	36.1	51.3	69.2	113	168	234	311	399	497	607	727	858	1000	1152	1315	1489
20	14.4	24.3	37.1	52.6	71.0	116	173	240	319	409	510	623	746	880	1026	1182	1350	1528
21	14.7	24.9	38.0	53.9	72.8	119	177	246	327	419	523	638	764	902	1051	1211	1383	1566
22	15.1	25.5	38.9	55.2	74.5	122	181	252	335	429	535	653	782	923	1076	1240	1415	1603
23	15.4	26.1	39.8	56.5	76.2	125	186	258	342	439	547	668	800	944	1100	1268	1447	1639
24	15.8	26.7	40.6	57.7	77.8	127	189	263	350	448	559	682	817	964	1123	1295	1478	1674
25	16.1	27.2	41.5	58.9	79.4	130	193	269	357	458	571	696	834	984	1147	1322	1509	1708
26	16.4	27.7	42.3	60.0	81.0	133	197	274	364	467	582	710	850	1004	1169	1348	1539	1742
27	16.7	28.3	43.1	61.2	82.5	135	201	279	371	476	593	723	867	1023	1192	1373	1568	1775
28	17.0	28.8	43.9	62.3	84.1	138	204	285	378	484	604	737	883	1041	1214	1399	1597	1808
29	17.3	29.3	44.7	63.4	85.5	140	208	290	384	493	615	750	898	1060	1235	1423	1625	1840
30	17.6	29.8	45.4	64.5	87.0	142	212	294	391	501	625	763	913	1078	1256	1448	1653	1871
L, in feet	Correction Factors For Other Pipe Lengths																	
20	1.30	1.24	1.21	1.18	1.15	1.12	1.10	1.08	1.07	1.06	1.05	1.05	1.04	1.04	1.03	1.03	1.03	1.03
30	1.22	1.18	1.15	1.13	1.12	1.09	1.08	1.06	1.05	1.05	1.04	1.04	1.03	1.03	1.03	1.02	1.02	1.02
40	1.15	1.13	1.11	1.10	1.08	1.07	1.05	1.05	1.04	1.03	1.03	1.03	1.02	1.02	1.02	1.02	1.02	1.02
50	1.09	1.08	1.07	1.06	1.05	1.04	1.04	1.03	1.03	1.02	1.02	1.02	1.02	1.01	1.01	1.01	1.01	1.01
60	1.04	1.04	1.03	1.03	1.03	1.02	1.02	1.02	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
80	.96	.97	.97	.97	.98	.98	.98	.99	.99	.99	.99	.99	.99	.99	.99	.99	.99	.99
90	.93	.94	.94	.95	.95	.96	.97	.97	.98	.98	.98	.98	.98	.99	.99	.99	.99	.99
100	.90	.91	.92	.93	.93	.95	.95	.96	.97	.97	.97	.98	.98	.98	.98	.98	.98	.99
120	.84	.86	.87	.89	.90	.91	.93	.94	.94	.95	.96	.96	.96	.97	.97	.97	.97	.98
140	.80	.82	.83	.85	.86	.88	.90	.91	.92	.93	.94	.94	.95	.95	.96	.96	.96	.97
160	.76	.78	.80	.82	.83	.86	.88	.89	.90	.91	.92	.93	.94	.94	.95	.95	.95	.96

1.11

Source: USDA-SCS

(VII). Principal Spillway Design

(C). Plate 3.14-7: "h" is difference b/n elevation of crest princ. spill. & crest of emerg. spill. = 1.00 ft.

(D). Plate 3.14-8: Enter with $Q_p = Q_2 = 6.71$ cfs & $h = 1$ ft.

Choosing smallest riser that will pass flow ⇒ Use 18" riser ←

(E). Plate 3.14-7: "H" is difference in elevation of ℄ of outlet of barrel & crest of emerg. spill.

$H = 6$ ft.

L = Length of pipe through embankment = 28 ft.

(F). Table 3.14-B: Enter with $H = 6$ ft & $L = 44$ ft.

Use 15" rcp barrel ←

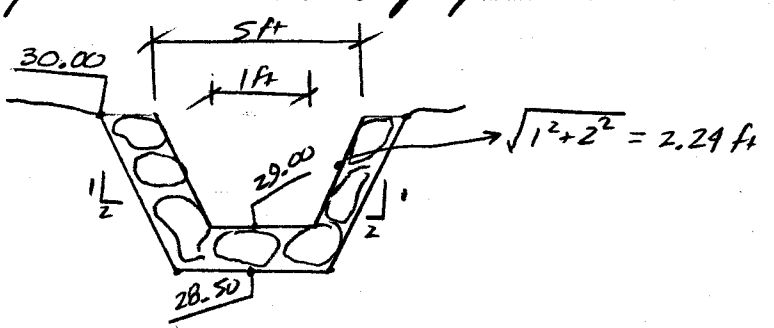
(VIII). Emergency Spillway Design:

(A). Emergency Spillway must pass remainder of Q_{25} not carried by Principal Spillway.

(B). → Assuming Principal Spillway carries only $Q_2 = 6.71$ cfs, Emerg. Spill. must carry $Q_{25} - Q_2 = (10.37 - 6.71)$ cfs $= \underline{3.66 \text{ cfs}}$ Q_e

(C). Since this will not be an earthen channel, Plate 3.14-9 & Table 3.14-C do not apply.

→ A rip-rap lined channel is proposed



22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS
AMPAD

(VIII). Emergency Spillway Design

(D). Checking Capacity of Proposed Rip-Rap Lined Channel

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

$$A = (2ft)(1ft) + (1ft)(1ft) = 3ft^2$$

$$R = \frac{A}{W.P.} = \frac{3\,ft^2}{(2.24 + 1 + 2.24)ft} = 0.547\,ft$$

$s = 1\%$, $n = 0.033$ (for rip-rap)

$$Q = \frac{(1.49)}{0.033}(3\,ft^2)(0.547\,ft)^{2/3}(0.01)^{1/2}$$

$Q_{cap} = 9.04$ cfs > 3.66 cfs, OK.

(IX). Elevation of Design High Water = 29.00 ft

Elevation of Top of Dam = 29.00 ft

→ These elevations are valid since the 134 yd³/ac criteria is satisfied at elevation 27.50 ft & the Emergency Spillway can readily pass the 25-year storm.

(X). Anti Vortex Device & Trash Rack:

Please see details for size.

22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS
AMPAD

(XI.) ANTI-SEEP COLLAR DESIGN

(A.) Determining length of barrel in Saturated zone
(Please see Plate 3.14-11)

Where L_s = length of barrel in saturated zone, (ft)
Y = depth of water at principal spillway crest, (ft)
Z = slope of upstream face of embankment
in Z feet horizontal to one vertical
S = slope of barrel in feet per foot.

$Y = 27.50\,ft - 22\,ft = 5.5\,ft$

$Z = 3:1$, $S = 0.23\%$

$\Rightarrow L_s = 40\,ft$

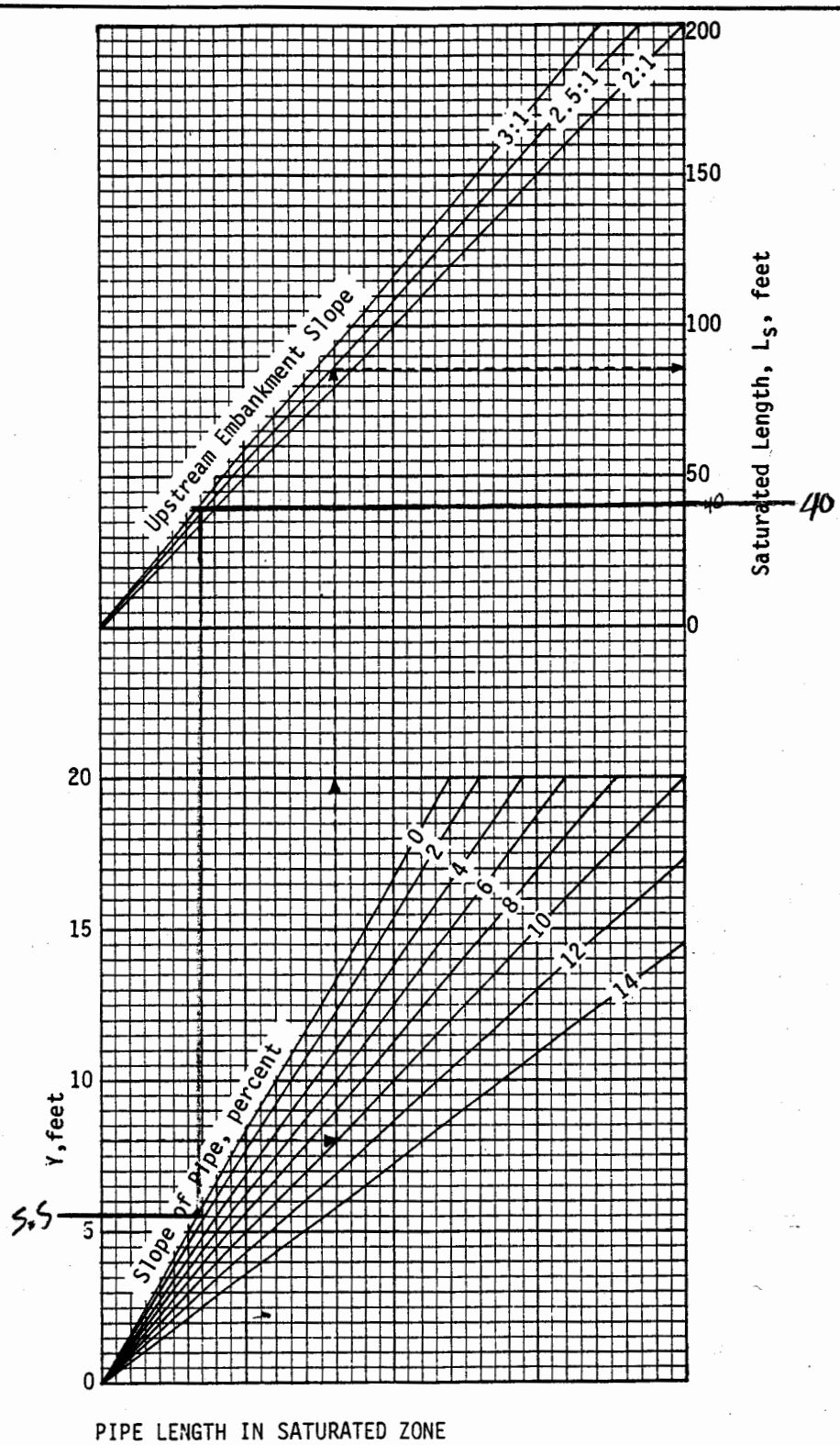
(B.) Entering (Plate 3.14-12) with $L_s = 40\,ft$

Use 3-anti seep collars, sized 3ft x 3ft

(C.) Spacing between Collars

(i.) Spacing should be 14 times projection of collar above barrel. $\Rightarrow$ 3ft collar, 1.25 ft diameter pipe
$\Rightarrow$ (Collar projects 0.875 ft above pipe) * (14) = 12.25 ft

(ii.) Collars not to be located closer than 2 feet to a pipe joint.

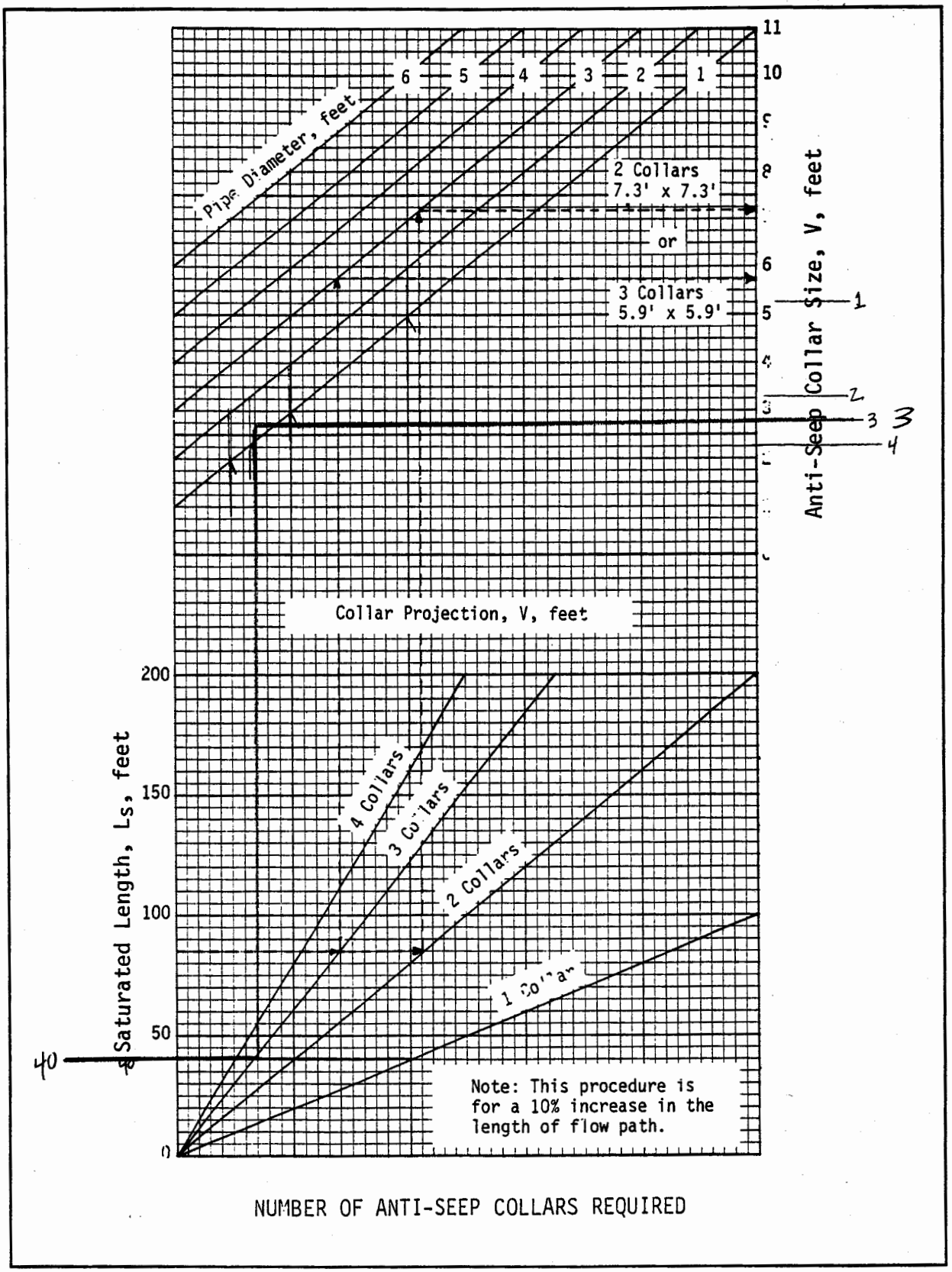


Source: USDA-SCS

Plate 3.14-11

MC037_LAKE_POWELL_FOREST_END_CONSERVATION_AREA - 070

13084 22 JULY 97
DURFEYS MILL

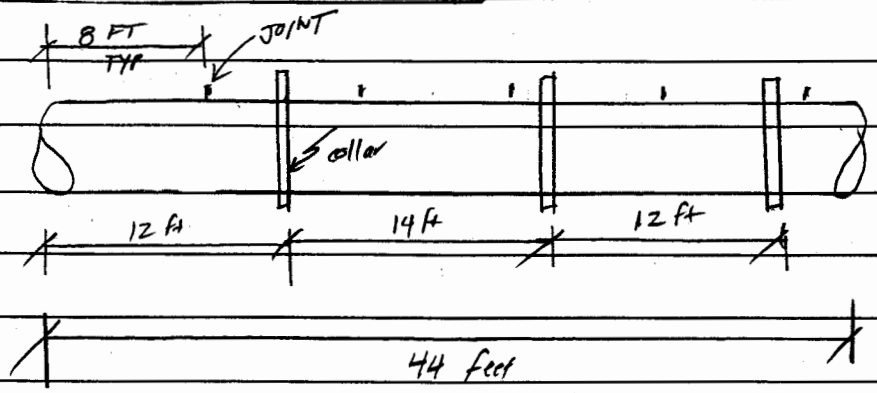


Source: USDA-SCS

Plate 3.14-12

MC037_LAKE_POWELL_FOREST_END_CONSERVATION_AREA - 071

XI. ANTI SEEP COLLAR DESIGN (CONT'D)

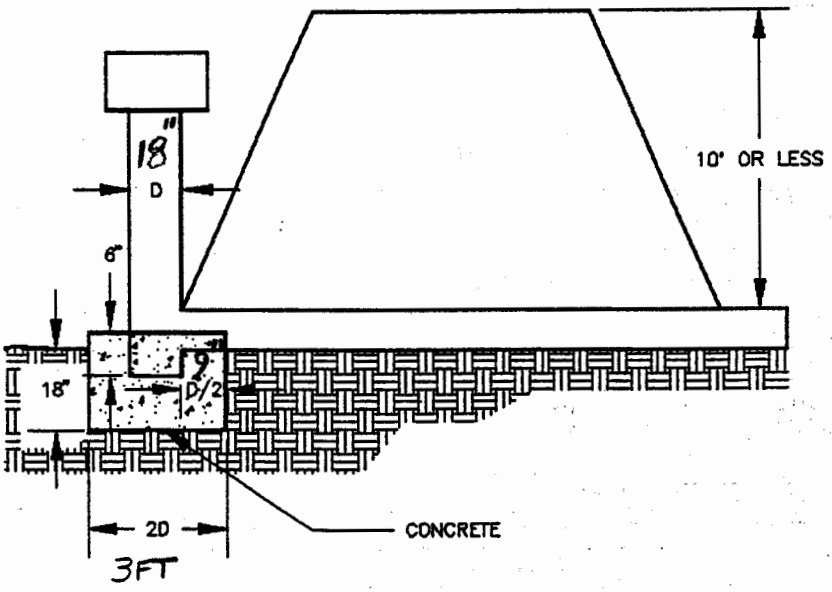


13084 22 JULY 97
DURFEYS MILL

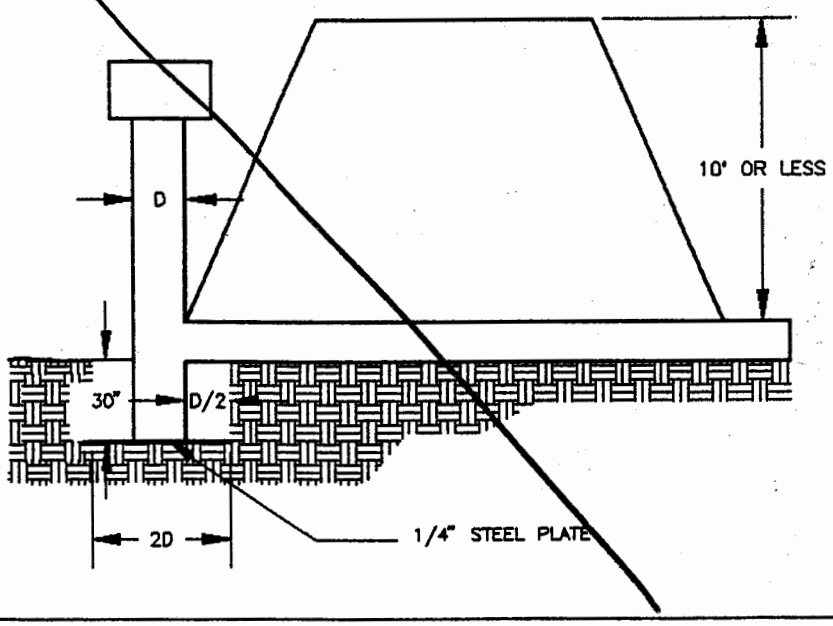
(1/9)

RISER PIPE BASE CONDITIONS FOR EMBANKMENTS LESS THAN 10' HIGH

CONCRETE BASE FOR EMBANKMENT 10' OR LESS IN HEIGHT



STEEL BASE FOR EMBANKMENT 10' OR LESS IN HEIGHT



Source: Va. DSWC

Plate 3.14-14

MC037_LAKE_POWELL_FOREST_END_CONSERVATION_AREA - 073

(XII). Anchoring the Principal Spillway

(A). Firmly anchor to prevent flotation.

(B). N/A since riser not over 10 ft high.

(C). Plate 3.14-14: Methods to anchor Princ. spill.

Use Concrete Base (See Plate for Dimensions) ←

(XIII). Dewatering:

(A). Plate 3.14-15: Details & Orientation.

(B). Calculation of Diameter of Dewatering Device:

$$Q = \frac{S}{21{,}600 \text{ sec}}$$, S = total storage available in dry storage area, ft^3.

$$Q = \frac{9{,}721 \text{ ft}^3}{21{,}600 \text{ sec}} = 0.45 \text{ cfs}$$

$$A = \frac{Q}{\left(64.32 * \frac{h}{2}\right)^{1/2} * 0.6}$$

Q = volumetric flowrate thru orifice to achieve 6-hr drawdown (cfs)

h = average driving head (maximum possible head measured from radius of orifice to crest of princ. spill., divided by 2), in ft.

$(27.5 - 25.3) = 2.2$

$$A = \frac{0.45 \frac{ft^3}{s}}{\left(64.32 * \frac{\frac{2.2 ft}{2}}{2}\right)^{1/2} * 0.6}$$

$$A = 0.126 \text{ ft}^2$$

$$d = 2 * \left(\frac{A}{3.14}\right)^{1/2} = 0.401 \text{ ft} = 4.8 \text{ in}$$

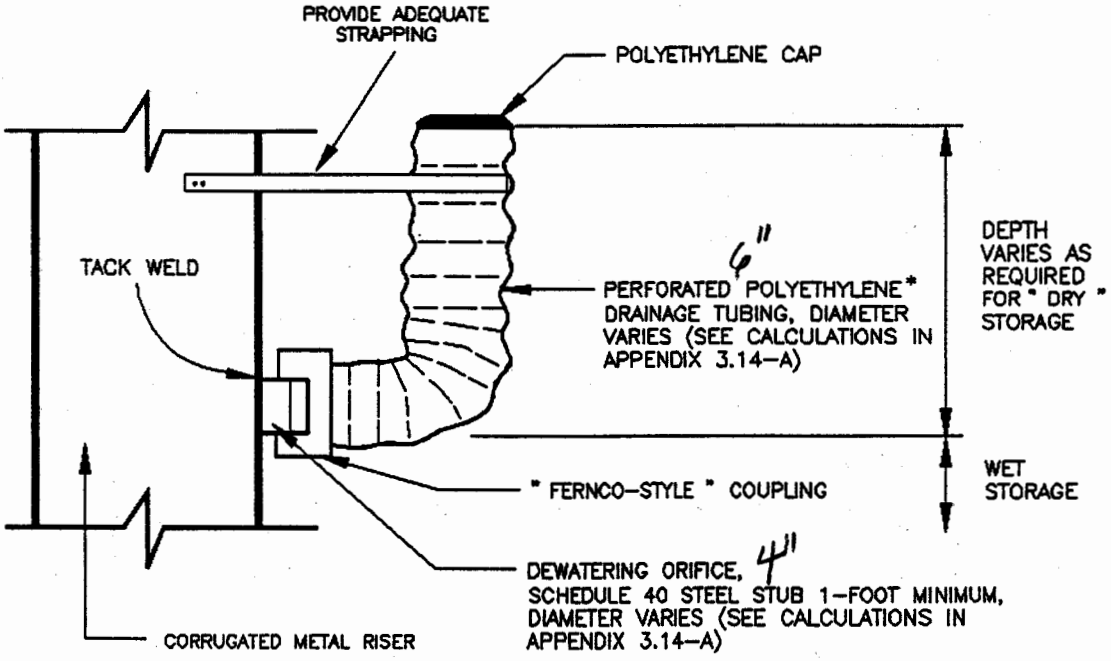
Use d = 4 in.

22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS
AMPAD

DEWATER.DWG

DURFEYS MILL

RECOMMENDED DEWATERING SYSTEM FOR SEDIMENT BASINS



NOTE: WITH CONCRETE RISER, USE PVC SCHEDULE 40 STUB FOR DEWATERING ORIFICE

*DRAINAGE TUBING SHALL COMPLY WITH ASTM F667 AND AASHTO M294

Source: Va. DSWC

Plate 3.14-15

MC037_LAKE_POWELL_FOREST_END_CONSERVATION_AREA - 075

(REVISED 22 JULY 97)

20 MAY 97 13084
DURFEYS MILL

TEMPORARY SEDIMENT BASIN DESIGN DATA SHEET

(with or without an emergency spillway)

Project DURFEY'S MILL SUBDIVISION

Basin # 1 Location LOT 57/LOT 58

Total area draining to basin: 5.28 acres.

Basin Volume Design

Wet Storage:

1. Minimum required volume = 67 cu. yds. x Total Drainage Area (acres).

   67 cu. yds. x 5.28 acres = 354 cu. yds.

2. Available basin volume = 357 cu. yds. at elevation 25.30. (From storage - elevation curve)

3. Excavate 207 cu. yds. to obtain required volume*. (from existing topo.)

   * Elevation corresponding to required volume = invert of the dewatering orifice.

4. Available volume before cleanout required.

   33 cu. yds. x 5.28 acres = 175 cu. yds.

5. Elevation corresponding to cleanout level = 24.00 ft. (≈ 175 yd³)

   (From Storage - Elevation Curve)

6. Distance from invert of the dewatering orifice to cleanout level = 1.30 ft. (Min. = 1.0 ft.)

Dry Storage:

7. Minimum required volume = 67 cu. yds. x Total Drainage Area (acres).

   67 cu. yds. x 5.28 acres = 354 cu. yds.

MC037_LAKE_POWELL_FOREST_END_CONSERVATION_AREA - 076

(REVISED 22 JULY 97) 20 MAY 97 13084 DURFEYS MILL (14/19)

8. Total available basin volume at crest of riser* = 718 cu. yds. at elevation 27.50 ft. (From Storage - Elevation Curve)

* Minimum = 134 cu. yds./acre of total drainage area. $134 \frac{yd^3}{ac} \times 5.28\ ac = 708\ yd$

9. Diameter of dewatering orifice = 4 in.

10. Diameter of flexible tubing = 6 in. (diameter of dewatering orifice plus 2 inches).

Preliminary Design Elevations

11. Crest of Riser = 27.50 ft

Top of Dam = 30.00 ft.

Design High Water = 29.00 ft.

Upstream Toe of Dam = 30.00 ft.

Basin Shape

12. Length of Flow / Effective Width $\frac{L}{We} = \frac{77 ft}{49 ft} = 1.6:1$

If > 2, baffles are not required N/A

If < 2, baffles are required ✓

Runoff

13. Q_2 = 6.71 cfs (From Chapter 5)

14. Q_{25} = 10.37 cfs (From Chapter 5)

Principal Spillway Design

15. With emergency spillway, required spillway capacity $Q_p = Q_2$ = 6.71 cfs. (riser and barrel)

Without emergency spillway, required spillway capacity $Q_p = Q_{25}$ = N/A cfs. (riser and barrel)

MC037_LAKE_POWELL_FOREST_END_CONSERVATION_AREA - 077

22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS
AMPAD

INTRODUCTION

This revised study is done per County comments to address the following:

1. The riser & barrel being the same size, resulting in possible plug flow.
2. The barrel not being modeled in design calculations.
3. Various hydrograph totals/summaries not matching.
4. Routing of the Offsite Drainage areas to the Proper Ponds.

DISCUSSION:

The study was revised to model the Anti-Vortex in the Study, since the Reducer (VDOT R-1) was removed from the plans. The Outfall barrels were also checked with Culvert Calculations to determine if the Headwater they will experience will influence the Pond modeling. The Culvert Calculations were also done to ensure the outfall barrels will be flowing full for the 100-year storm, averting a possible plug flow condition.

The geometry and layout of the ponds themselves did not change, so they still meet all volume requirements.

INFLOW HYDROGRAPHS

For Durfey's Pond, BMP-02, BMP1-02 & OFF1-02 were added to yield the inflow hydrograph. For Powell's pond, Off2-02 and BMP2-02 were added to give the inflow hydrograph. This process was repeated for the 10 & 100 year storms.

2-YEAR

The Durfey's pond had a maximum elevation of 21.42 ft with 10.18 cfs outflow which is close enough to the available outflow of 10 cfs. The Powell pond had a maximum elevation of 27.24 ft with 5.58 cfs which is close enough to the 5 cfs allowable. In both cases, the storm is passed through the rectangular opening.

10-YEAR

The Durfey's pond had a maximum elevation of 23.47 ft, passing totally through the Primary spillway. The Powell pond had a maximum elevation of 28.38 ft, passing totally through the Primary Spillway.

100-YEAR

The Durfey's pond had a maximum elevation of 24.46 ft with 1.04 feet of freeboard. The Powell pond had a maximum elevation of 28.93 ft with 1.07 feet of freeboard.

22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS
AMPAD

CONCLUSIONS

Each pond effectively serves as Stormwater Detention facilities & both can safely pass the 100-year storm.

Both Outfall barrels will flow full under the 100-year storm with no chance of a Plug flow condition.

22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS
AMPAD

Return Frequency: 2 years

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

Executed: 07-21-1997 09:09:43
Watershed file: --> POWLBMP2.MOP
Hydrograph file: --> BMP2-02.HYD

LAKE POWELL
POST DEVELOPED FLOW
RUNOFF TO POWELL'S BMP
(RERAN 21 JUL 97)

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

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used
	18.12	81.0	0.50	0.00	3.50	1.71	I.13 .13

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

Total area = 18.12 acres or 0.02831 sq.mi
Peak discharge = 25 cfs

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

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p Messages
	0.59	0.00	0.50	0.00	Yes	--

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

Return Frequency: 2 years

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

Executed: 07-21-1997 09:09:43
Watershed file: --> POWLBMP2.MOP
Hydrograph file: --> BMP2-02.HYD

LAKE POWELL
POST DEVELOPED FLOW
RUNOFF TO POWELL'S BMP
(RERAN 21 JUL 97)

Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 hr
	1	1	1	2	4	7	14	21	25
Total (cfs)	1	1	1	2	4	7	14	21	25

Subarea Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 hr
	24	19	14	11	7	5	4	3	3
Total (cfs)	24	19	14	11	7	5	4	3	3

Subarea Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 hr
	2	2	2	2	1	1	1	1	1
Total (cfs)	2	2	2	2	1	1	1	1	1

Subarea Description	18.0 hr	19.0 hr	20.0 hr	22.0 hr	26.0 hr
	1	1	1	1	0
Total (cfs)	1	1	1	1	0

73/12c

Return Frequency: 10 years

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

Executed: 07-21-1997 09:09:43
Watershed file: --> POWLBMP2.MOP
Hydrograph file: --> BMP2-10.HYD

LAKE POWELL
POST DEVELOPED FLOW
RUNOFF TO POWELL'S BMP
(RERAN 21 JUL 97)

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

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used
	18.12	81.0	0.50	0.00	6.00	3.88	I.08 .10

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

Total area = 18.12 acres or 0.02831 sq.mi
Peak discharge = 58 cfs

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

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p Messages
	0.59	0.00	0.50	0.00	No	Computed Ia/p < .1

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

74/129

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

Executed: 07-21-1997 09:09:43
Watershed file: --> POWLBMP2.MOP
Hydrograph file: --> BMP2-10.HYD

LAKE POWELL
POST DEVELOPED FLOW
RUNOFF TO POWELL'S BMP
(RERAN 21 JUL 97)

Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 hr
	2	3	4	6	10	19	34	51	58
Total (cfs)	2	3	4	6	10	19	34	51	58

Subarea Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 hr
	56	44	33	25	15	11	8	7	6
Total (cfs)	56	44	33	25	15	11	8	7	6

Subarea Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 hr
	5	5	4	4	3	3	3	2	2
Total (cfs)	5	5	4	4	3	3	3	2	2

Subarea Description	18.0 hr	19.0 hr	20.0 hr	22.0 hr	26.0 hr
	2	2	2	1	0
Total (cfs)	2	2	2	1	0

75/129

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

Executed: 07-21-1997 09:09:43
Watershed file: --> POWLBMP2.MOP
Hydrograph file: --> BMP2-100.HYD

LAKE POWELL
POST DEVELOPED FLOW
RUNOFF TO POWELL'S BMP
(RERAN 21 JUL 97)

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

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used	
	18.12	81.0	0.50	0.00	8.00	5.74	I.06	.10

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

Total area = 18.12 acres or 0.02831 sq.mi
Peak discharge = 86 cfs

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

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p Messages
	0.59	0.00	0.50	0.00	No	Computed Ia/p < .1

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

76/129

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

Executed: 07-21-1997 09:09:43
Watershed file: --> POWLBMP2.MOP
Hydrograph file: --> BMP2-100.HYD

LAKE POWELL
POST DEVELOPED FLOW
RUNOFF TO POWELL'S BMP
(RERAN 21 JUL 97)

Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 hr
	3	4	5	9	15	28	50	76	86
Total (cfs)	3	4	5	9	15	28	50	76	86

Subarea Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 hr
	82	65	48	37	23	16	12	10	9
Total (cfs)	82	65	48	37	23	16	12	10	9

Subarea Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 hr
	8	7	6	5	5	4	4	3	3
Total (cfs)	8	7	6	5	5	4	4	3	3

Subarea Description	18.0 hr	19.0 hr	20.0 hr	22.0 hr	26.0 hr
	3	3	2	2	0
Total (cfs)	3	3	2	2	0

Return Frequency: 2 years

77/129

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

Executed: 07-21-1997 11:38:13
Watershed file: --> PRE-OFF2.MOP
Hydrograph file: --> OFF2-02.HYD

DURFEY'S MILL/LAKE POWELL
PRE DEVELOPED FLOW
(RERAN 21 JUL 97)

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

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used	
	10.00	81.0	0.75	0.00	3.50	1.71	I.13	.13

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

Total area = 10.00 acres or 0.01563 sq.mi
Peak discharge = 11 cfs

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

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p Messages
	0.66	0.00	0.75	0.00	Yes	--

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

78/129

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

Executed: 07-21-1997 11:38:13
Watershed file: --> PRE-OFF2.MOP
Hydrograph file: --> OFF2-02.HYD

DURFEY'S MILL/LAKE POWELL
PRE DEVELOPED FLOW
(RERAN 21 JUL 97)

Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 hr
	0	0	1	1	1	2	3	5	7
Total (cfs)	0	0	1	1	1	2	3	5	7

Subarea Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 hr
	10	11	11	10	7	5	3	3	2
Total (cfs)	10	11	11	10	7	5	3	3	2

Subarea Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 hr
	2	1	1	1	1	1	1	1	1
Total (cfs)	2	1	1	1	1	1	1	1	1

Subarea Description	18.0 hr	19.0 hr	20.0 hr	22.0 hr	26.0 hr
	1	0	0	0	0
Total (cfs)	1	0	0	0	0

79/129

Return Frequency: 10 years

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

Executed: 07-21-1997 11:38:13
Watershed file: --> PRE-OFF2.MOP
Hydrograph file: --> OFF2-10.HYD

DURFEY'S MILL/LAKE POWELL
PRE DEVELOPED FLOW
(RERAN 21 JUL 97)

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

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used	
	10.00	81.0	0.75	0.00	6.00	3.88	I.08	.10

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

Total area = 10.00 acres or 0.01563 sq.mi
Peak discharge = 26 cfs

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

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p Messages
	0.66	0.00	0.75	0.00	No	Computed Ia/p < .1

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

80/129

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

Executed: 07-21-1997 11:38:13
Watershed file: --> PRE-OFF2.MOP
Hydrograph file: --> OFF2-10.HYD

DURFEY'S MILL/LAKE POWELL
PRE DEVELOPED FLOW
(RERAN 21 JUL 97)

Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 hr
	1	1	1	2	3	4	7	12	18
Total (cfs)	1	1	1	2	3	4	7	12	18

Subarea Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 hr
	23	26	25	22	15	10	7	6	4
Total (cfs)	23	26	25	22	15	10	7	6	4

Subarea Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 hr
	4	3	2	2	2	2	1	1	1
Total (cfs)	4	3	2	2	2	2	1	1	1

Subarea Description	18.0 hr	19.0 hr	20.0 hr	22.0 hr	26.0 hr
	1	1	1	1	0
Total (cfs)	1	1	1	1	0

81/120

Return Frequency: 100 years

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

Executed: 07-21-1997 11:38:13
Watershed file: --> PRE-OFF2.MOP
Hydrograph file: --> OFF2-100.HYD

DURFEY'S MILL/LAKE POWELL
PRE DEVELOPED FLOW
(RERAN 21 JUL 97)

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

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used	
	10.00	81.0	0.75	0.00	8.00	5.74	I.06	.10

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

Total area = 10.00 acres or 0.01563 sq.mi
Peak discharge = 38 cfs

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

Subarea Description	Input Values Tc (hr)	Input Values * Tt (hr)	Rounded Values Tc (hr)	Rounded Values * Tt (hr)	Ia/p Interpolated (Yes/No)	Ia/p Messages
	0.66	0.00	0.75	0.00	No	Computed Ia/p < .1

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

82/129

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

Executed: 07-21-1997 11:38:13
Watershed file: --> PRE-OFF2.MOP
Hydrograph file: --> OFF2-100.HYD

DURFEY'S MILL/LAKE POWELL
PRE DEVELOPED FLOW
(RERAN 21 JUL 97)

Composite Hydrograph Summary (cfs)

Subarea Description	11.0 hr	11.3 hr	11.6 hr	11.9 hr	12.0 hr	12.1 hr	12.2 hr	12.3 hr	12.4 hr
	1	2	2	3	4	6	10	17	26
Total (cfs)	1	2	2	3	4	6	10	17	26

Subarea Description	12.5 hr	12.6 hr	12.7 hr	12.8 hr	13.0 hr	13.2 hr	13.4 hr	13.6 hr	13.8 hr
	34	38	37	33	23	15	11	8	7
Total (cfs)	34	38	37	33	23	15	11	8	7

Subarea Description	14.0 hr	14.3 hr	14.6 hr	15.0 hr	15.5 hr	16.0 hr	16.5 hr	17.0 hr	17.5 hr
	5	4	4	3	3	2	2	2	2
Total (cfs)	5	4	4	3	3	2	2	2	2

Subarea Description	18.0 hr	19.0 hr	20.0 hr	22.0 hr	26.0 hr
	2	2	1	1	0
Total (cfs)	2	2	1	1	0

83/12

Executed 07-21-1997 11:45:46

Data directory: *.HYD

File Summary for Composite Hydrograph

Time (min)	OFF2-02 (cfs)	BMP2-02 (cfs)	POWELL2 (Total)
660.00	0.0	1.0	1.0
666.00	0.0	1.0	1.0
672.00	0.0	1.0	1.0
678.00	0.0	1.0	1.0
684.00	0.0	1.0	1.0
690.00	1.0	1.0	2.0
696.00	1.0	1.0	2.0
702.00	1.0	1.0	2.0
708.00	1.0	2.0	3.0
714.00	1.0	2.0	3.0
720.00	1.0	4.0	5.0
726.00	2.0	7.0	9.0
732.00	3.0	14.0	17.0
738.00	5.0	21.0	26.0
744.00	7.0	25.0	32.0
750.00	10.0	24.0	34.0
756.00	11.0	19.0	30.0
762.00	11.0	14.0	25.0
768.00	10.0	11.0	21.0
774.00	8.0	9.0	17.0
780.00	7.0	7.0	14.0
786.00	6.0	6.0	12.0
792.00	5.0	5.0	10.0
798.00	4.0	4.0	8.0
804.00	3.0	4.0	7.0
810.00	3.0	4.0	7.0
816.00	3.0	3.0	6.0
822.00	2.0	3.0	5.0
828.00	2.0	3.0	5.0
834.00	2.0	2.0	4.0
840.00	2.0	2.0	4.0
846.00	2.0	2.0	4.0
852.00	1.0	2.0	3.0
858.00	1.0	2.0	3.0
864.00	1.0	2.0	3.0
870.00	1.0	2.0	3.0
876.00	1.0	2.0	3.0
882.00	1.0	2.0	3.0
888.00	1.0	2.0	3.0
894.00	1.0	2.0	3.0

84/120

Executed 07-21-1997 11:45:46

Data directory: *.HYD

File Summary for Composite Hydrograph

Time (min)	OFF2-02 (cfs)	BMP2-02 (cfs)	POWELL2 (Total)
900.00	1.0	2.0	3.0
906.00	1.0	2.0	3.0
912.00	1.0	2.0	3.0
918.00	1.0	1.0	2.0
924.00	1.0	1.0	2.0
930.00	1.0	1.0	2.0
936.00	1.0	1.0	2.0
942.00	1.0	1.0	2.0
948.00	1.0	1.0	2.0
954.00	1.0	1.0	2.0
960.00	1.0	1.0	2.0
966.00	1.0	1.0	2.0
972.00	1.0	1.0	2.0
978.00	1.0	1.0	2.0
984.00	1.0	1.0	2.0
990.00	1.0	1.0	2.0
996.00	1.0	1.0	2.0
%1002.00	1.0	1.0	2.0
%1008.00	1.0	1.0	2.0
%1014.00	1.0	1.0	2.0
%1020.00	1.0	1.0	2.0
%1026.00	1.0	1.0	2.0
%1032.00	1.0	1.0	2.0
%1038.00	1.0	1.0	2.0
%1044.00	1.0	1.0	2.0
%1050.00	1.0	1.0	2.0
%1056.00	1.0	1.0	2.0
%1062.00	1.0	1.0	2.0
%1068.00	1.0	1.0	2.0
%1074.00	1.0	1.0	2.0
%1080.00	1.0	1.0	2.0
%1086.00	1.0	1.0	2.0
%1092.00	1.0	1.0	2.0
%1098.00	1.0	1.0	2.0
%1104.00	1.0	1.0	2.0
%1110.00	0.0	1.0	1.0
%1116.00	0.0	1.0	1.0
%1122.00	0.0	1.0	1.0
%1128.00	0.0	1.0	1.0
%1134.00	0.0	1.0	1.0
%1140.00	0.0	1.0	1.0

Executed 07-21-1997 11:45:46

Data directory: *.HYD

File Summary for Composite Hydrograph

Time (min)	OFF2-02 (cfs)	BMP2-02 (cfs)	POWELL2 (Total)
%1146.00	0.0	1.0	1.0
%1152.00	0.0	1.0	1.0
%1158.00	0.0	1.0	1.0
%1164.00	0.0	1.0	1.0
%1170.00	0.0	1.0	1.0
%1176.00	0.0	1.0	1.0
%1182.00	0.0	1.0	1.0
%1188.00	0.0	1.0	1.0
%1194.00	0.0	1.0	1.0
%1200.00	0.0	1.0	1.0
%1206.00	0.0	1.0	1.0
%1212.00	0.0	1.0	1.0
%1218.00	0.0	1.0	1.0
%1224.00	0.0	1.0	1.0
%1230.00	0.0	1.0	1.0
%1236.00	0.0	1.0	1.0
%1242.00	0.0	1.0	1.0
%1248.00	0.0	1.0	1.0
%1254.00	0.0	1.0	1.0
%1260.00	0.0	1.0	1.0
%1266.00	0.0	1.0	1.0
%1272.00	0.0	1.0	1.0
%1278.00	0.0	1.0	1.0
%1284.00	0.0	1.0	1.0
%1290.00	0.0	1.0	1.0
%1296.00	0.0	1.0	1.0
%1302.00	0.0	1.0	1.0
%1308.00	0.0	1.0	1.0
%1314.00	0.0	1.0	1.0
%1320.00	0.0	1.0	1.0
%1326.00	0.0	1.0	1.0
%1332.00	0.0	1.0	1.0
%1338.00	0.0	1.0	1.0
%1344.00	0.0	1.0	1.0
%1350.00	0.0	1.0	1.0
%1356.00	0.0	1.0	1.0
%1362.00	0.0	1.0	1.0
%1368.00	0.0	1.0	1.0
%1374.00	0.0	1.0	1.0
%1380.00	0.0	1.0	1.0
%1386.00	0.0	1.0	1.0

Executed 07-21-1997 11:45:46

Data directory: *.HYD

File Summary for Composite Hydrograph

Time (min)	OFF2-02 (cfs)	BMP2-02 (cfs)	POWELL2 (Total)
%1392.00	0.0	1.0	1.0
%1398.00	0.0	1.0	1.0
%1404.00	0.0	1.0	1.0
%1410.00	0.0	1.0	1.0
%1416.00	0.0	1.0	1.0
%1422.00	0.0	1.0	1.0
%1428.00	0.0	1.0	1.0
%1434.00	0.0	1.0	1.0
%1440.00	0.0	0.0	0.0
%1446.00	0.0	0.0	0.0
%1452.00	0.0	0.0	0.0
%1458.00	0.0	0.0	0.0
%1464.00	0.0	0.0	0.0
%1470.00	0.0	0.0	0.0
%1476.00	0.0	0.0	0.0
%1482.00	0.0	0.0	0.0
%1488.00	0.0	0.0	0.0
%1494.00	0.0	0.0	0.0
%1500.00	0.0	0.0	0.0
%1506.00	0.0	0.0	0.0
%1512.00	0.0	0.0	0.0
%1518.00	0.0	0.0	0.0
%1524.00	0.0	0.0	0.0
%1530.00	0.0	0.0	0.0
%1536.00	0.0	0.0	0.0
%1542.00	0.0	0.0	0.0
%1548.00	0.0	0.0	0.0
%1554.00	0.0	0.0	0.0
%1560.00	0.0	0.0	0.0

87/125

Executed 07-21-1997 11:46:29

Data directory: *.HYD

File Summary for Composite Hydrograph

Time (min)	OFF2-10 (cfs)	BMP2-10 (cfs)	POWELL10 (Total)
660.00	1.0	2.0	3.0
666.00	1.0	2.0	3.0
672.00	1.0	3.0	4.0
678.00	1.0	3.0	4.0
684.00	1.0	3.0	4.0
690.00	1.0	4.0	5.0
696.00	1.0	4.0	5.0
702.00	1.0	5.0	6.0
708.00	2.0	5.0	7.0
714.00	2.0	6.0	8.0
720.00	3.0	10.0	13.0
726.00	4.0	19.0	23.0
732.00	7.0	34.0	41.0
738.00	12.0	51.0	63.0
744.00	18.0	58.0	76.0
750.00	23.0	56.0	79.0
756.00	26.0	44.0	70.0
762.00	25.0	33.0	58.0
768.00	22.0	25.0	47.0
774.00	18.0	20.0	38.0
780.00	15.0	15.0	30.0
786.00	12.0	13.0	25.0
792.00	10.0	11.0	21.0
798.00	8.0	9.0	17.0
804.00	7.0	8.0	15.0
810.00	7.0	8.0	15.0
816.00	6.0	7.0	13.0
822.00	5.0	6.0	11.0
828.00	4.0	6.0	10.0
834.00	4.0	6.0	10.0
840.00	4.0	5.0	9.0
846.00	4.0	5.0	9.0
852.00	3.0	5.0	8.0
858.00	3.0	5.0	8.0
864.00	3.0	5.0	8.0
870.00	2.0	4.0	6.0
876.00	2.0	4.0	6.0
882.00	2.0	4.0	6.0
888.00	2.0	4.0	6.0
894.00	2.0	4.0	6.0

88/100

Executed 07-21-1997 11:46:29

Data directory: *.HYD

File Summary for Composite Hydrograph

Time (min)	OFF2-10 (cfs)	BMP2-10 (cfs)	POWELL10 (Total)
900.00	2.0	4.0	6.0
906.00	2.0	4.0	6.0
912.00	2.0	4.0	6.0
918.00	2.0	3.0	5.0
924.00	2.0	3.0	5.0
930.00	2.0	3.0	5.0
936.00	2.0	3.0	5.0
942.00	2.0	3.0	5.0
948.00	2.0	3.0	5.0
954.00	2.0	3.0	5.0
960.00	2.0	3.0	5.0
966.00	2.0	3.0	5.0
972.00	2.0	3.0	5.0
978.00	1.0	3.0	4.0
984.00	1.0	3.0	4.0
990.00	1.0	3.0	4.0
996.00	1.0	3.0	4.0
%1002.00	1.0	3.0	4.0
%1008.00	1.0	2.0	3.0
%1014.00	1.0	2.0	3.0
%1020.00	1.0	2.0	3.0
%1026.00	1.0	2.0	3.0
%1032.00	1.0	2.0	3.0
%1038.00	1.0	2.0	3.0
%1044.00	1.0	2.0	3.0
%1050.00	1.0	2.0	3.0
%1056.00	1.0	2.0	3.0
%1062.00	1.0	2.0	3.0
%1068.00	1.0	2.0	3.0
%1074.00	1.0	2.0	3.0
%1080.00	1.0	2.0	3.0
%1086.00	1.0	2.0	3.0
%1092.00	1.0	2.0	3.0
%1098.00	1.0	2.0	3.0
%1104.00	1.0	2.0	3.0
%1110.00	1.0	2.0	3.0
%1116.00	1.0	2.0	3.0
%1122.00	1.0	2.0	3.0
%1128.00	1.0	2.0	3.0
%1134.00	1.0	2.0	3.0
%1140.00	1.0	2.0	3.0

89/12c

Executed 07-21-1997 11:46:29

Data directory: *.HYD

File Summary for Composite Hydrograph

Time (min)	OFF2-10 (cfs)	BMP2-10 (cfs)	POWELL10 (Total)
%1146.00	1.0	2.0	3.0
%1152.00	1.0	2.0	3.0
%1158.00	1.0	2.0	3.0
%1164.00	1.0	2.0	3.0
%1170.00	1.0	2.0	3.0
%1176.00	1.0	2.0	3.0
%1182.00	1.0	2.0	3.0
%1188.00	1.0	2.0	3.0
%1194.00	1.0	2.0	3.0
%1200.00	1.0	2.0	3.0
%1206.00	1.0	2.0	3.0
%1212.00	1.0	2.0	3.0
%1218.00	1.0	2.0	3.0
%1224.00	1.0	2.0	3.0
%1230.00	1.0	2.0	3.0
%1236.00	1.0	2.0	3.0
%1242.00	1.0	2.0	3.0
%1248.00	1.0	2.0	3.0
%1254.00	1.0	2.0	3.0
%1260.00	1.0	2.0	3.0
%1266.00	1.0	1.0	2.0
%1272.00	1.0	1.0	2.0
%1278.00	1.0	1.0	2.0
%1284.00	1.0	1.0	2.0
%1290.00	1.0	1.0	2.0
%1296.00	1.0	1.0	2.0
%1302.00	1.0	1.0	2.0
%1308.00	1.0	1.0	2.0
%1314.00	1.0	1.0	2.0
%1320.00	1.0	1.0	2.0
%1326.00	1.0	1.0	2.0
%1332.00	1.0	1.0	2.0
%1338.00	1.0	1.0	2.0
%1344.00	1.0	1.0	2.0
%1350.00	1.0	1.0	2.0
%1356.00	1.0	1.0	2.0
%1362.00	1.0	1.0	2.0
%1368.00	1.0	1.0	2.0
%1374.00	1.0	1.0	2.0
%1380.00	1.0	1.0	2.0
%1386.00	1.0	1.0	2.0

90/12c

Executed 07-21-1997 11:46:29

Data directory: *.HYD

File Summary for Composite Hydrograph

Time (min)	OFF2-10 (cfs)	BMP2-10 (cfs)	POWELL10 (Total)
%1392.00	1.0	1.0	2.0
%1398.00	1.0	1.0	2.0
%1404.00	1.0	1.0	2.0
%1410.00	1.0	1.0	2.0
%1416.00	1.0	1.0	2.0
%1422.00	1.0	1.0	2.0
%1428.00	1.0	1.0	2.0
%1434.00	1.0	1.0	2.0
%1440.00	0.0	0.0	0.0
%1446.00	0.0	0.0	0.0
%1452.00	0.0	0.0	0.0
%1458.00	0.0	0.0	0.0
%1464.00	0.0	0.0	0.0
%1470.00	0.0	0.0	0.0
%1476.00	0.0	0.0	0.0
%1482.00	0.0	0.0	0.0
%1488.00	0.0	0.0	0.0
%1494.00	0.0	0.0	0.0
%1500.00	0.0	0.0	0.0
%1506.00	0.0	0.0	0.0
%1512.00	0.0	0.0	0.0
%1518.00	0.0	0.0	0.0
%1524.00	0.0	0.0	0.0
%1530.00	0.0	0.0	0.0
%1536.00	0.0	0.0	0.0
%1542.00	0.0	0.0	0.0
%1548.00	0.0	0.0	0.0
%1554.00	0.0	0.0	0.0
%1560.00	0.0	0.0	0.0

91/120

Executed 07-21-1997 11:47:28

Data directory: *.HYD

File Summary for Composite Hydrograph

Time (min)	OFF2-100 (cfs)	BMP2-100 (cfs)	POWEL100 (Total)
660.00	1.0	3.0	4.0
666.00	1.0	3.0	4.0
672.00	2.0	4.0	6.0
678.00	2.0	4.0	6.0
684.00	2.0	4.0	6.0
690.00	2.0	5.0	7.0
696.00	2.0	5.0	7.0
702.00	2.0	6.0	8.0
708.00	3.0	8.0	11.0
714.00	3.0	9.0	12.0
720.00	4.0	15.0	19.0
726.00	6.0	28.0	34.0
732.00	10.0	50.0	60.0
738.00	17.0	76.0	93.0
744.00	26.0	86.0	112.0
750.00	34.0	82.0	116.0
756.00	38.0	65.0	103.0
762.00	37.0	48.0	85.0
768.00	33.0	37.0	70.0
774.00	28.0	30.0	58.0
780.00	23.0	23.0	46.0
786.00	19.0	20.0	39.0
792.00	15.0	16.0	31.0
798.00	13.0	14.0	27.0
804.00	11.0	12.0	23.0
810.00	10.0	11.0	21.0
816.00	8.0	10.0	18.0
822.00	8.0	9.0	17.0
828.00	7.0	9.0	16.0
834.00	6.0	8.0	14.0
840.00	5.0	8.0	13.0
846.00	5.0	8.0	13.0
852.00	4.0	7.0	11.0
858.00	4.0	7.0	11.0
864.00	4.0	7.0	11.0
870.00	4.0	6.0	10.0
876.00	4.0	6.0	10.0
882.00	4.0	6.0	10.0
888.00	4.0	6.0	10.0
894.00	3.0	5.0	8.0

92/129

Executed 07-21-1997 11:47:28

Data directory: *.HYD

File Summary for Composite Hydrograph

Time (min)	OFF2-100 (cfs)	BMP2-100 (cfs)	POWEL100 (Total)
900.00	3.0	5.0	8.0
906.00	3.0	5.0	8.0
912.00	3.0	5.0	8.0
918.00	3.0	5.0	8.0
924.00	3.0	5.0	8.0
930.00	3.0	5.0	8.0
936.00	3.0	5.0	8.0
942.00	3.0	5.0	8.0
948.00	2.0	4.0	6.0
954.00	2.0	4.0	6.0
960.00	2.0	4.0	6.0
966.00	2.0	4.0	6.0
972.00	2.0	4.0	6.0
978.00	2.0	4.0	6.0
984.00	2.0	4.0	6.0
990.00	2.0	4.0	6.0
996.00	2.0	4.0	6.0
%1002.00	2.0	4.0	6.0
%1008.00	2.0	3.0	5.0
%1014.00	2.0	3.0	5.0
%1020.00	2.0	3.0	5.0
%1026.00	2.0	3.0	5.0
%1032.00	2.0	3.0	5.0
%1038.00	2.0	3.0	5.0
%1044.00	2.0	3.0	5.0
%1050.00	2.0	3.0	5.0
%1056.00	2.0	3.0	5.0
%1062.00	2.0	3.0	5.0
%1068.00	2.0	3.0	5.0
%1074.00	2.0	3.0	5.0
%1080.00	2.0	3.0	5.0
%1086.00	2.0	3.0	5.0
%1092.00	2.0	3.0	5.0
%1098.00	2.0	3.0	5.0
%1104.00	2.0	3.0	5.0
%1110.00	2.0	3.0	5.0
%1116.00	2.0	3.0	5.0
%1122.00	2.0	3.0	5.0
%1128.00	2.0	3.0	5.0
%1134.00	2.0	3.0	5.0
%1140.00	2.0	3.0	5.0

93/12

Executed 07-21-1997 11:47:28

Data directory: *.HYD

File Summary for Composite Hydrograph

Time (min)	OFF2-100 (cfs)	BMP2-100 (cfs)	POWEL100 (Total)
%1146.00	2.0	3.0	5.0
%1152.00	2.0	3.0	5.0
%1158.00	2.0	3.0	5.0
%1164.00	2.0	3.0	5.0
%1170.00	2.0	2.0	4.0
%1176.00	1.0	2.0	3.0
%1182.00	1.0	2.0	3.0
%1188.00	1.0	2.0	3.0
%1194.00	1.0	2.0	3.0
%1200.00	1.0	2.0	3.0
%1206.00	1.0	2.0	3.0
%1212.00	1.0	2.0	3.0
%1218.00	1.0	2.0	3.0
%1224.00	1.0	2.0	3.0
%1230.00	1.0	2.0	3.0
%1236.00	1.0	2.0	3.0
%1242.00	1.0	2.0	3.0
%1248.00	1.0	2.0	3.0
%1254.00	1.0	2.0	3.0
%1260.00	1.0	2.0	3.0
%1266.00	1.0	2.0	3.0
%1272.00	1.0	2.0	3.0
%1278.00	1.0	2.0	3.0
%1284.00	1.0	2.0	3.0
%1290.00	1.0	2.0	3.0
%1296.00	1.0	2.0	3.0
%1302.00	1.0	2.0	3.0
%1308.00	1.0	2.0	3.0
%1314.00	1.0	2.0	3.0
%1320.00	1.0	2.0	3.0
%1326.00	1.0	2.0	3.0
%1332.00	1.0	2.0	3.0
%1338.00	1.0	2.0	3.0
%1344.00	1.0	2.0	3.0
%1350.00	1.0	2.0	3.0
%1356.00	1.0	2.0	3.0
%1362.00	1.0	2.0	3.0
%1368.00	1.0	2.0	3.0
%1374.00	1.0	2.0	3.0
%1380.00	1.0	2.0	3.0
%1386.00	1.0	1.0	2.0

94/129

Executed 07-21-1997 11:47:28

Data directory: *.HYD

File Summary for Composite Hydrograph

Time (min)	OFF2-100 (cfs)	BMP2-100 (cfs)	POWEL100 (Total)
%1392.00	1.0	1.0	2.0
%1398.00	1.0	1.0	2.0
%1404.00	1.0	1.0	2.0
%1410.00	1.0	1.0	2.0
%1416.00	1.0	1.0	2.0
%1422.00	1.0	1.0	2.0
%1428.00	1.0	1.0	2.0
%1434.00	1.0	1.0	2.0
%1440.00	0.0	1.0	1.0
%1446.00	0.0	1.0	1.0
%1452.00	0.0	1.0	1.0
%1458.00	0.0	1.0	1.0
%1464.00	0.0	1.0	1.0
%1470.00	0.0	1.0	1.0
%1476.00	0.0	1.0	1.0
%1482.00	0.0	1.0	1.0
%1488.00	0.0	1.0	1.0
%1494.00	0.0	1.0	1.0
%1500.00	0.0	0.0	0.0
%1506.00	0.0	0.0	0.0
%1512.00	0.0	0.0	0.0
%1518.00	0.0	0.0	0.0
%1524.00	0.0	0.0	0.0
%1530.00	0.0	0.0	0.0
%1536.00	0.0	0.0	0.0
%1542.00	0.0	0.0	0.0
%1548.00	0.0	0.0	0.0
%1554.00	0.0	0.0	0.0
%1560.00	0.0	0.0	0.0

Outlet Structure File: POWELL .STR

POND-2 Version: 5.10 S/N: 1220510115
Date Executed: Time Executed:

****
LAKE POWELL CLUSTER DEVELOPMENT / W.O. 13361 / 04 MAR 97 /
WET POND OUTFALL DESIGN / PRIMARY SPILL WAY /
(REVISED 08 MAY 97- ADDED EMERGENCY SPILLWAY & RAN 2-YR STORM)
REVISED 02 JUL 97 (RERAN 21 JULY 97)
****

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

Elevation (ft)	Q (cfs)	Contributing Structures
24.00	0.0	1
24.25	0.3	1
24.50	0.9	1
24.75	1.5	1
25.00	2.3	1
25.25	2.7	1
25.50	3.2	1
25.75	3.7	1
26.00	4.1	1
26.25	4.4	1
26.50	4.7	1
26.75	5.1	1
27.00	5.3 ←	1
27.25	5.6	1 +2 +3 +4
27.50	10.8	1 +2 +3 +4
27.75	19.9	1 +2 +3 +4
28.00	31.3	1 +2 +3 +4
28.25	44.7 ←	1 +2 +3 +4
28.50	60.0	1 +2 +3 +4 +5
28.75	78.9	1 +2 +3 +4 +5
29.00	100.2	1 +2 +3 +4 +5
29.25	123.2	1 +2 +3 +4 +5
29.50	147.8	1 +2 +3 +4 +5
29.75	173.6	1 +2 +3 +4 +5
30.00	200.4	1 +2 +3 +4 +5
30.25	228.2	1 +2 +3 +4 +5
30.50	256.8	1 +2 +3 +4 +5
30.75	286.1	1 +2 +3 +4 +5
31.00	315.9	1 +2 +3 +4 +5
31.25	346.1	1 +2 +3 +4 +5
31.50	376.8	1 +2 +3 +4 +5
31.75	407.7	1 +2 +3 +4 +5
32.00	438.9	1 +2 +3 +4 +5

96/120

Outlet Structure File: POWELL .STR

POND-2 Version: 5.10 S/N: 1220510115
Date Executed: Time Executed:

```
*************************************************************
  LAKE POWELL CLUSTER DEVELOPMENT / W.O. 13361 / 04 MAR 97 /
        WET POND OUTFALL DESIGN / PRIMARY SPILL WAY /
(REVISED 08 MAY 97- ADDED EMERGENCY SPILLWAY & RAN 2-YR STORM)
             REVISED 02 JUL 97 (RERAN 21 JULY 97)
*************************************************************
```

Outlet Structure File: POWELL .STR
Planimeter Input File: POWELL2 .VOL
Rating Table Output File: POWELL .PND

Min. Elev.(ft) = 24 Max. Elev.(ft) = 32 Incr.(ft) = .25

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

****
SYSTEM CONNECTIVITY
****

Structure	No.	Q Table		Q Table
CULVERT-BX	1		->	1
WEIR-VR	2		->	2
WEIR-VR	3		->	3
WEIR-VR	4		->	4
WEIR-VR	5		->	5

Outflow rating table summary was stored in file:
POWELL .PND

97/12

Outlet Structure File: POWELL .STR

POND-2 Version: 5.10 S/N: 1220510115
Date Executed: Time Executed:

****
LAKE POWELL CLUSTER DEVELOPMENT / W.O. 13361 / 04 MAR 97 /
WET POND OUTFALL DESIGN / PRIMARY SPILL WAY /
(REVISED 08 MAY 97- ADDED EMERGENCY SPILLWAY & RAN 2-YR STORM)
REVISED 02 JUL 97 (RERAN 21 JULY 97)
****

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

CULVERT-BX
Box Culvert (With Inlet Control)

E1 elev.(ft)?	24.00
E2 elev.(ft)?	32.001
Height (ft)?	0.75
Width (ft)?	1.00
Inv. el.(ft)?	24.00
Slope (ft/ft)?	0.005
T1 ratio?	
T2 ratio?	
K Coeff.?	0.56
M Coeff.?	0.667
c Coeff.?	0.0466
Y Coeff.?	0.85
Form 1 or 2?	2
Slope factor?	-0.5

98/12

Outlet Structure File: POWELL .STR

POND-2 Version: 5.10 S/N: 1220510115
Date Executed: Time Executed:

****
LAKE POWELL CLUSTER DEVELOPMENT / W.O. 13361 / 04 MAR 97 /
WET POND OUTFALL DESIGN / PRIMARY SPILL WAY /
(REVISED 08 MAY 97- ADDED EMERGENCY SPILLWAY & RAN 2-YR STORM)
REVISED 02 JUL 97 (RERAN 21 JULY 97)
****

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

WEIR-VR
Weir - Vertical Rectangular

E1 elev.(ft)?	27.25
E2 elev.(ft)?	32.001
Weir coefficient?	2.66
Weir elev.(ft)?	27.25
Length (ft)?	4.97
Contracted/Suppressed (C/S)?	C

Outlet Structure File: POWELL .STR

POND-2 Version: 5.10 S/N: 1220510115
Date Executed: Time Executed:

****
LAKE POWELL CLUSTER DEVELOPMENT / W.O. 13361 / 04 MAR 97 /
WET POND OUTFALL DESIGN / PRIMARY SPILL WAY /
(REVISED 08 MAY 97- ADDED EMERGENCY SPILLWAY & RAN 2-YR STORM)
REVISED 02 JUL 97 (RERAN 21 JULY 97)
****

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

WEIR-VR
Weir - Vertical Rectangular

E1 elev.(ft)?	27.25
E2 elev.(ft)?	32.001
Weir coefficient?	2.66
Weir elev.(ft)?	27.25
Length (ft)?	4.97
Contracted/Suppressed (C/S)?	C

Outlet Structure File: POWELL .STR

POND-2 Version: 5.10 S/N: 1220510115
Date Executed: Time Executed:

****
LAKE POWELL CLUSTER DEVELOPMENT / W.O. 13361 / 04 MAR 97 /
WET POND OUTFALL DESIGN / PRIMARY SPILL WAY /
(REVISED 08 MAY 97- ADDED EMERGENCY SPILLWAY & RAN 2-YR STORM)
REVISED 02 JUL 97 (RERAN 21 JULY 97)
****

>>>>>> Structure No. 4 <<<<<<
(Input Data)

WEIR-VR
Weir - Vertical Rectangular

E1 elev.(ft)?	27.25
E2 elev.(ft)?	32.001
Weir coefficient?	2.66
Weir elev.(ft)?	27.25
Length (ft)?	4.97
Contracted/Suppressed (C/S)?	C

101/12c

Outlet Structure File: POWELL .STR

POND-2 Version: 5.10 S/N: 1220510115
Date Executed: Time Executed:

****
LAKE POWELL CLUSTER DEVELOPMENT / W.O. 13361 / 04 MAR 97 /
WET POND OUTFALL DESIGN / PRIMARY SPILL WAY /
(REVISED 08 MAY 97- ADDED EMERGENCY SPILLWAY & RAN 2-YR STORM)
REVISED 02 JUL 97 (RERAN 21 JULY 97)
****

>>>>>> Structure No. 5 <<<<<<
(Input Data)

WEIR-VR
Weir - Vertical Rectangular

E1 elev.(ft)?	28.40 ←
E2 elev.(ft)?	32.001
Weir coefficient?	3.33
Weir elev.(ft)?	28.40
Length (ft)?	5
Contracted/Suppressed (C/S)?	C

102/129

```
*****************************************************************
*                                                               *
*    LAKE POWELL CLUSTER DEVELOPMENT / W.O. 13361 / 04 MAR 97 /  *
*            WET POND OUTFALL DESIGN / PRIMARY SPILL WAY /      *
*  (REVISED 08 MAY 97- ADDED EMERGENCY SPILLWAY & RAN 2-YR STORM) *
*                REVISED 02 JUL 97 (RERAN 21 JULY 97)           *
*                                                               *
*****************************************************************
```

Inflow Hydrograph: POWELL2 .HYD
Rating Table file: POWELL .PND

----INITIAL CONDITIONS----
Elevation = 24.00 ft
Outflow = 0.00 cfs
Storage = 172,178 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + O (cfs)
24.00	0.0	172,178	956.5	956.5
24.25	0.3	177,688	987.2	987.5
24.50	0.9	183,288	1018.3	1019.2
24.75	1.5	188,979	1049.9	1051.4
25.00	2.3	194,761	1082.0	1084.3
25.25	2.7	200,636	1114.6	1117.3
25.50	3.2	206,603	1147.8	1151.0
25.75	3.7	212,664	1181.5	1185.2
26.00	4.1	218,820	1215.7	1219.8
26.25	4.4	225,199	1251.1	1255.5
26.50	4.7	231,937	1288.5	1293.2
26.75	5.1	239,042	1328.0	1333.1
27.00	5.3	246,524	1369.6	1374.9
27.25	5.6	254,281	1412.7	1418.3
27.50	10.8	262,202	1456.7	1467.5
27.75	19.9	270,290	1501.6	1521.5
28.00	31.3	278,546	1547.5	1578.8
28.25	44.7	286,963	1594.2	1638.9
28.50	60.0	295,536	1641.9	1701.9
28.75	78.9	304,265	1690.4	1769.3
29.00	100.2	313,152	1739.7	1839.9
29.25	123.2	322,199	1790.0	1913.2
29.50	147.8	331,407	1841.2	1989.0
29.75	173.6	340,777	1893.2	2066.8
30.00	200.4	350,311	1946.2	2146.6
30.25	228.2	360,010	2000.1	2228.3
30.50	256.8	369,876	2054.9	2311.7
30.75	286.1	379,909	2110.6	2396.7
31.00	315.9	390,112	2167.3	2483.2
31.25	346.1	400,487	2224.9	2571.0
31.50	376.8	411,033	2283.5	2660.3

103/129

GIVEN POND DATA

ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)
31.75	407.7	421,753
32.00	438.9	432,648

INTERMEDIATE ROUTING COMPUTATIONS

2S/t (cfs)	2S/t + O (cfs)
2343.1	2750.8
2403.6	2842.5

Time increment (t) = 6.0 min.

104/165

Pond File: POWELL .PND
Inflow Hydrograph: POWELL2 .HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH / ROUTING COMPUTATIONS

TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
660.0	1.00	-----	956.5	956.5	0.00	24.00
666.0	1.00	2.0	958.5	958.5	0.02	24.02
672.0	1.00	2.0	960.4	960.5	0.04	24.03
678.0	1.00	2.0	962.3	962.4	0.06	24.05
684.0	1.00	2.0	964.2	964.3	0.08	24.06
690.0	2.00	3.0	967.0	967.2	0.10	24.09
696.0	2.00	4.0	970.7	971.0	0.14	24.12
702.0	2.00	4.0	974.3	974.7	0.18	24.15
708.0	3.00	5.0	978.9	979.3	0.22	24.18
714.0	3.00	6.0	984.3	984.9	0.28	24.23
720.0	5.00	8.0	991.5	992.3	0.39	24.29
726.0	9.00	14.0	1004.3	1005.5	0.64	24.39
732.0	17.00	26.0	1028.1	1030.3	1.11	24.59
738.0	26.00	43.0	1067.1	1071.1	1.98	24.90
744.0	32.00	58.0	1119.5	1125.1	2.82	25.31
750.0	34.00	66.0	1178.1	1185.5	3.70	25.75
756.0	30.00	64.0	1233.5	1242.1	4.29	26.16
762.0	25.00	55.0	1279.2	1288.5	4.66	26.47
768.0	21.00	46.0	1315.1	1325.2	5.02	26.70
774.0	17.00	38.0	1342.7	1353.1	5.20	26.87
780.0	14.00	31.0	1363.1	1373.7	5.29	26.99
786.0	12.00	26.0	1378.3	1389.1	5.40	27.08
792.0	10.00	22.0	1389.4	1400.3	5.48	27.15
798.0	8.00	18.0	1396.3	1407.4	5.52	27.19
804.0	7.00	15.0	1400.2	1411.3	5.55	27.21
810.0	7.00	14.0	1403.1	1414.2	5.57	27.23
816.0	6.00	13.0	1404.9	1416.1	5.58	27.24
822.0	5.00	11.0	1404.8	1415.9	5.58	27.24
828.0	5.00	10.0	1403.6	1414.8	5.58	27.23
834.0	4.00	9.0	1401.5	1412.6	5.56	27.22
840.0	4.00	8.0	1398.4	1409.5	5.54	27.20
846.0	4.00	8.0	1395.4	1406.4	5.52	27.18
852.0	3.00	7.0	1391.4	1402.4	5.49	27.16
858.0	3.00	6.0	1386.5	1397.4	5.46	27.13
864.0	3.00	6.0	1381.6	1392.5	5.42	27.10
870.0	3.00	6.0	1376.9	1387.6	5.39	27.07
876.0	3.00	6.0	1372.1	1382.9	5.36	27.05
882.0	3.00	6.0	1367.5	1378.1	5.32	27.02
888.0	3.00	6.0	1362.9	1373.5	5.29	26.99
894.0	3.00	6.0	1358.4	1368.9	5.27	26.96
900.0	3.00	6.0	1353.9	1364.4	5.25	26.94
906.0	3.00	6.0	1349.4	1359.9	5.23	26.91
912.0	3.00	6.0	1345.0	1355.4	5.21	26.88
918.0	2.00	5.0	1339.6	1350.0	5.18	26.85
924.0	2.00	4.0	1333.3	1343.6	5.15	26.81

105/120

Pond File: POWELL .PND
Inflow Hydrograph: POWELL2 .HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
930.0	2.00	4.0	1327.1	1337.3	5.12	26.78
936.0	2.00	4.0	1320.9	1331.1	5.08	26.74
942.0	2.00	4.0	1314.9	1324.9	5.02	26.70
948.0	2.00	4.0	1309.0	1318.9	4.96	26.66
954.0	2.00	4.0	1303.2	1313.0	4.90	26.62
960.0	2.00	4.0	1297.5	1307.2	4.84	26.59
966.0	2.00	4.0	1291.9	1301.5	4.78	26.55
972.0	2.00	4.0	1286.5	1295.9	4.73	26.52
978.0	2.00	4.0	1281.1	1290.5	4.68	26.48
984.0	2.00	4.0	1275.9	1285.1	4.64	26.45
990.0	2.00	4.0	1270.7	1279.9	4.59	26.41
996.0	2.00	4.0	1265.6	1274.7	4.55	26.38
1002.0	2.00	4.0	1260.5	1269.6	4.51	26.34
1008.0	2.00	4.0	1255.6	1264.5	4.47	26.31
1014.0	2.00	4.0	1250.7	1259.6	4.43	26.28
1020.0	2.00	4.0	1246.0	1254.7	4.39	26.24
1026.0	2.00	4.0	1241.2	1250.0	4.35	26.21
1032.0	2.00	4.0	1236.6	1245.2	4.31	26.18
1038.0	2.00	4.0	1232.1	1240.6	4.28	26.15
1044.0	2.00	4.0	1227.6	1236.1	4.24	26.11
1050.0	2.00	4.0	1223.2	1231.6	4.20	26.08
1056.0	2.00	4.0	1218.9	1227.2	4.16	26.05
1062.0	2.00	4.0	1214.6	1222.9	4.13	26.02
1068.0	2.00	4.0	1210.4	1218.6	4.09	25.99
1074.0	2.00	4.0	1206.4	1214.4	4.04	25.96
1080.0	2.00	4.0	1202.4	1210.4	3.99	25.93
1086.0	2.00	4.0	1198.5	1206.4	3.95	25.90
1092.0	2.00	4.0	1194.7	1202.5	3.90	25.88
1098.0	2.00	4.0	1191.0	1198.7	3.86	25.85
1104.0	2.00	4.0	1187.4	1195.0	3.81	25.82
1110.0	1.00	3.0	1182.8	1190.4	3.76	25.79
1116.0	1.00	2.0	1177.4	1184.8	3.70	25.75
1122.0	1.00	2.0	1172.2	1179.4	3.62	25.71
1128.0	1.00	2.0	1167.1	1174.2	3.54	25.67
1134.0	1.00	2.0	1162.2	1169.1	3.47	25.63
1140.0	1.00	2.0	1157.4	1164.2	3.39	25.60
1146.0	1.00	2.0	1152.8	1159.4	3.32	25.56
1152.0	1.00	2.0	1148.3	1154.8	3.26	25.53
1158.0	1.00	2.0	1143.9	1150.3	3.19	25.49
1164.0	1.00	2.0	1139.6	1145.9	3.12	25.46
1170.0	1.00	2.0	1135.5	1141.6	3.06	25.43
1176.0	1.00	2.0	1131.5	1137.5	3.00	25.40
1182.0	1.00	2.0	1127.6	1133.5	2.94	25.37
1188.0	1.00	2.0	1123.9	1129.6	2.88	25.34
1194.0	1.00	2.0	1120.2	1125.9	2.83	25.31
1200.0	1.00	2.0	1116.7	1122.2	2.77	25.29

106/12c

Pond File: POWELL .PND
Inflow Hydrograph: POWELL2 .HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
1206.0	1.00	2.0	1113.2	1118.7	2.72	25.26
1212.0	1.00	2.0	1109.9	1115.2	2.67	25.23
1218.0	1.00	2.0	1106.6	1111.9	2.63	25.21
1224.0	1.00	2.0	1103.4	1108.6	2.59	25.18
1230.0	1.00	2.0	1100.3	1105.4	2.56	25.16
1236.0	1.00	2.0	1097.3	1102.3	2.52	25.14
1242.0	1.00	2.0	1094.3	1099.3	2.48	25.11
1248.0	1.00	2.0	1091.4	1096.3	2.45	25.09
1254.0	1.00	2.0	1088.6	1093.4	2.41	25.07
1260.0	1.00	2.0	1085.8	1090.6	2.38	25.05
1266.0	1.00	2.0	1083.2	1087.8	2.34	25.03
1272.0	1.00	2.0	1080.5	1085.2	2.31	25.01
1278.0	1.00	2.0	1078.0	1082.5	2.26	24.99
1284.0	1.00	2.0	1075.6	1080.0	2.20	24.97
1290.0	1.00	2.0	1073.4	1077.6	2.14	24.95
1296.0	1.00	2.0	1071.2	1075.4	2.08	24.93
1302.0	1.00	2.0	1069.1	1073.2	2.03	24.92
1308.0	1.00	2.0	1067.2	1071.1	1.98	24.90
1314.0	1.00	2.0	1065.3	1069.2	1.93	24.89
1320.0	1.00	2.0	1063.5	1067.3	1.89	24.87
1326.0	1.00	2.0	1061.8	1065.5	1.84	24.86
1332.0	1.00	2.0	1060.2	1063.8	1.80	24.84
1338.0	1.00	2.0	1058.7	1062.2	1.76	24.83
1344.0	1.00	2.0	1057.3	1060.7	1.73	24.82
1350.0	1.00	2.0	1055.9	1059.3	1.69	24.81
1356.0	1.00	2.0	1054.6	1057.9	1.66	24.80
1362.0	1.00	2.0	1053.3	1056.6	1.63	24.79
1368.0	1.00	2.0	1052.1	1055.3	1.60	24.78
1374.0	1.00	2.0	1051.0	1054.1	1.57	24.77
1380.0	1.00	2.0	1049.9	1053.0	1.54	24.76
1386.0	1.00	2.0	1048.9	1051.9	1.51	24.75
1392.0	1.00	2.0	1047.9	1050.9	1.49	24.75
1398.0	1.00	2.0	1047.0	1049.9	1.47	24.74
1404.0	1.00	2.0	1046.0	1049.0	1.45	24.73
1410.0	1.00	2.0	1045.2	1048.0	1.44	24.72
1416.0	1.00	2.0	1044.3	1047.2	1.42	24.72
1422.0	1.00	2.0	1043.5	1046.3	1.41	24.71
1428.0	1.00	2.0	1042.7	1045.5	1.39	24.70
1434.0	1.00	2.0	1042.0	1044.7	1.38	24.70
1440.0	0.00	1.0	1040.3	1043.0	1.34	24.68
1446.0	0.00	0.0	1037.7	1040.3	1.29	24.66
1452.0	0.00	0.0	1035.2	1037.7	1.25	24.64
1458.0	0.00	0.0	1032.8	1035.2	1.20	24.62
1464.0	0.00	0.0	1030.5	1032.8	1.15	24.61
1470.0	0.00	0.0	1028.3	1030.5	1.11	24.59
1476.0	0.00	0.0	1026.1	1028.3	1.07	24.57

107/129

Pond File: POWELL .PND
Inflow Hydrograph: POWELL2 .HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
1482.0	0.00	0.0	1024.1	1026.1	1.03	24.55
1488.0	0.00	0.0	1022.1	1024.1	0.99	24.54
1494.0	0.00	0.0	1020.2	1022.1	0.95	24.52
1500.0	0.00	0.0	1018.4	1020.2	0.92	24.51
1506.0	0.00	0.0	1016.6	1018.4	0.88	24.49
1512.0	0.00	0.0	1014.9	1016.6	0.85	24.48
1518.0	0.00	0.0	1013.2	1014.9	0.82	24.47
1524.0	0.00	0.0	1011.7	1013.2	0.79	24.45
1530.0	0.00	0.0	1010.2	1011.7	0.76	24.44
1536.0	0.00	0.0	1008.7	1010.2	0.73	24.43
1542.0	0.00	0.0	1007.3	1008.7	0.70	24.42
1548.0	0.00	0.0	1005.9	1007.3	0.68	24.41
1554.0	0.00	0.0	1004.6	1005.9	0.65	24.40
1560.0	0.00	0.0	1003.4	1004.6	0.63	24.39

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

Pond File: POWELL .PND
Inflow Hydrograph: POWELL2 .HYD
Outflow Hydrograph: OUT .HYD

Starting Pond W.S. Elevation = 24.00 ft

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

Peak Inflow	=	34.00 cfs
Peak Outflow	=	5.58 cfs
Peak Elevation	=	27.24 ft

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

Initial Storage	=	172,178 cu-ft
Peak Storage From Storm	=	81,713 cu-ft
Total Storage in Pond	=	253,891cu-ft

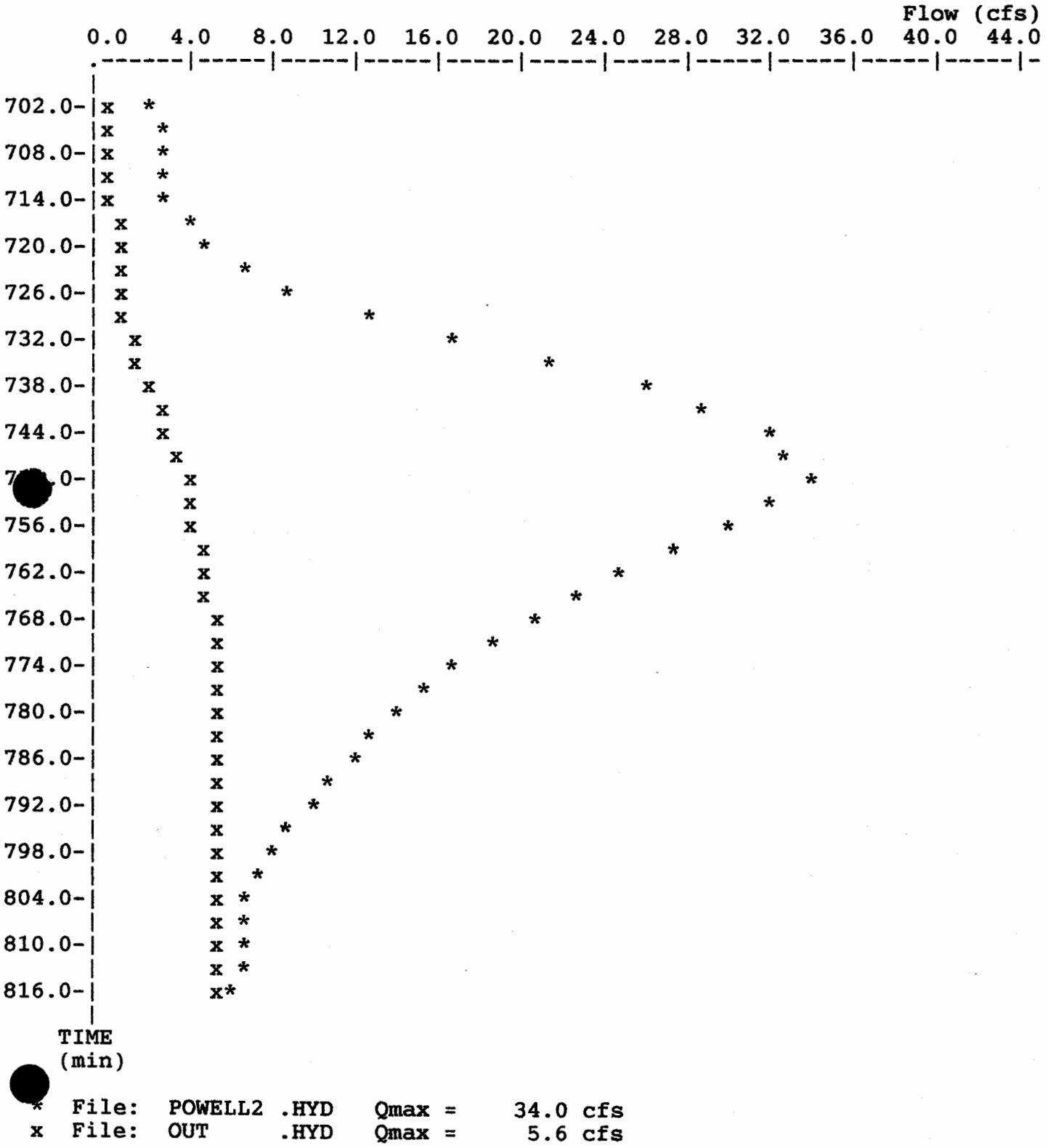
Warning: Inflow hydrograph truncated on left side.

109/129

Pond File: POWELL .PND
Inflow Hydrograph: POWELL2 .HYD
Outflow Hydrograph: OUT .HYD

EXECUTED: 07-21-1997
16:18:26

Peak Inflow = 34.00 cfs
Peak Outflow = 5.58 cfs
Peak Elevation = 27.24 ft



* File: POWELL2 .HYD Qmax = 34.0 cfs
x File: OUT .HYD Qmax = 5.6 cfs

110/120

```
*****************************************************************
*                                                               *
*    LAKE POWELL CLUSTER DEVELOPMENT / W.O. 13361 / 04 MAR 97 /  *
*            WET POND OUTFALL DESIGN / PRIMARY SPILL WAY /      *
*  (REVISED 08 MAY 97- ADDED EMERGENCY SPILLWAY & RAN 2-YR STORM) *
*                REVISED 02 JUL 97 (RERAN 21 JULY 97)           *
*                                                               *
*****************************************************************
```

Inflow Hydrograph: POWELL10.HYD
Rating Table file: POWELL .PND

----INITIAL CONDITIONS----
Elevation = 24.00 ft
Outflow = 0.00 cfs
Storage = 172,178 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + O (cfs)
24.00	0.0	172,178	956.5	956.5
24.25	0.3	177,688	987.2	987.5
24.50	0.9	183,288	1018.3	1019.2
24.75	1.5	188,979	1049.9	1051.4
25.00	2.3	194,761	1082.0	1084.3
25.25	2.7	200,636	1114.6	1117.3
25.50	3.2	206,603	1147.8	1151.0
25.75	3.7	212,664	1181.5	1185.2
26.00	4.1	218,820	1215.7	1219.8
26.25	4.4	225,199	1251.1	1255.5
26.50	4.7	231,937	1288.5	1293.2
26.75	5.1	239,042	1328.0	1333.1
27.00	5.3	246,524	1369.6	1374.9
27.25	5.6	254,281	1412.7	1418.3
27.50	10.8	262,202	1456.7	1467.5
27.75	19.9	270,290	1501.6	1521.5
28.00	31.3	278,546	1547.5	1578.8
28.25	44.7	286,963	1594.2	1638.9
28.50	60.0	295,536	1641.9	1701.9
28.75	78.9	304,265	1690.4	1769.3
29.00	100.2	313,152	1739.7	1839.9
29.25	123.2	322,199	1790.0	1913.2
29.50	147.8	331,407	1841.2	1989.0
29.75	173.6	340,777	1893.2	2066.8
30.00	200.4	350,311	1946.2	2146.6
30.25	228.2	360,010	2000.1	2228.3
30.50	256.8	369,876	2054.9	2311.7
30.75	286.1	379,909	2110.6	2396.7
31.00	315.9	390,112	2167.3	2483.2
31.25	346.1	400,487	2224.9	2571.0
31.50	376.8	411,033	2283.5	2660.3

111/12

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + O (cfs)
31.75	407.7	421,753	2343.1	2750.8
32.00	438.9	432,648	2403.6	2842.5

Time increment (t) = 6.0 min.

112/125

Pond File: POWELL .PND
Inflow Hydrograph: POWELL10.HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
660.0	3.00	-----	956.5	956.5	0.00	24.00
666.0	3.00	6.0	962.4	962.5	0.06	24.05
672.0	4.00	7.0	969.2	969.4	0.13	24.10
678.0	4.00	8.0	976.8	977.2	0.20	24.17
684.0	4.00	8.0	984.2	984.8	0.27	24.23
690.0	5.00	9.0	992.4	993.2	0.41	24.30
696.0	5.00	10.0	1001.2	1002.4	0.58	24.37
702.0	6.00	11.0	1010.7	1012.2	0.77	24.45
708.0	7.00	13.0	1021.7	1023.7	0.98	24.54
714.0	8.00	15.0	1034.3	1036.7	1.23	24.64
720.0	13.00	21.0	1052.1	1055.3	1.59	24.78
726.0	23.00	36.0	1083.4	1088.1	2.35	25.03
732.0	41.00	64.0	1141.1	1147.4	3.15	25.47
738.0	63.00	104.0	1236.5	1245.1	4.31	26.18
744.0	76.00	139.0	1364.9	1375.5	5.30	27.00
750.0	79.00	155.0	1480.6	1519.9	19.62	27.74
756.0	70.00	149.0	1544.4	1629.6	42.63	28.21
762.0	58.00	128.0	1566.7	1672.4	52.83	28.38
768.0	47.00	105.0	1566.4	1671.7	52.67	28.38
774.0	38.00	85.0	1555.9	1651.4	47.72	28.30
780.0	30.00	68.0	1541.2	1623.9	41.36	28.19
786.0	25.00	55.0	1525.8	1596.2	35.18	28.07
792.0	21.00	46.0	1512.0	1571.8	29.92	27.97
798.0	17.00	38.0	1498.9	1550.0	25.57	27.87
804.0	15.00	32.0	1487.3	1530.9	21.76	27.79
810.0	15.00	30.0	1478.9	1517.3	19.20	27.73
816.0	13.00	28.0	1472.1	1506.9	17.45	27.68
822.0	11.00	24.0	1464.8	1496.1	15.61	27.63
828.0	10.00	21.0	1458.0	1485.8	13.89	27.58
834.0	10.00	20.0	1452.9	1478.0	12.58	27.55
840.0	9.00	19.0	1448.8	1471.9	11.54	27.52
846.0	9.00	18.0	1445.3	1466.8	10.73	27.50
852.0	8.00	17.0	1441.8	1462.3	10.26	27.47
858.0	8.00	16.0	1438.3	1457.8	9.78	27.45
864.0	8.00	16.0	1435.5	1454.3	9.40	27.43
870.0	6.00	14.0	1431.7	1449.5	8.90	27.41
876.0	6.00	12.0	1427.1	1443.7	8.28	27.38
882.0	6.00	12.0	1423.5	1439.1	7.80	27.36
888.0	6.00	12.0	1420.7	1435.5	7.42	27.34
894.0	6.00	12.0	1418.4	1432.7	7.12	27.32
900.0	6.00	12.0	1416.7	1430.4	6.88	27.31
906.0	6.00	12.0	1415.3	1428.7	6.70	27.30
912.0	6.00	12.0	1414.2	1427.3	6.55	27.30
918.0	5.00	11.0	1412.5	1425.2	6.33	27.28
924.0	5.00	10.0	1410.4	1422.5	6.05	27.27

113/125

Pond File: POWELL .PND
Inflow Hydrograph: POWELL10.HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
930.0	5.00	10.0	1408.8	1420.4	5.83	27.26
936.0	5.00	10.0	1407.5	1418.8	5.65	27.25
942.0	5.00	10.0	1406.3	1417.5	5.59	27.25
948.0	5.00	10.0	1405.1	1416.3	5.59	27.24
954.0	5.00	10.0	1403.9	1415.1	5.58	27.23
960.0	5.00	10.0	1402.8	1413.9	5.57	27.23
966.0	5.00	10.0	1401.7	1412.8	5.56	27.22
972.0	5.00	10.0	1400.6	1411.7	5.55	27.21
978.0	4.00	9.0	1398.5	1409.6	5.54	27.20
984.0	4.00	8.0	1395.4	1406.5	5.52	27.18
990.0	4.00	8.0	1392.5	1403.4	5.50	27.16
996.0	4.00	8.0	1389.5	1400.5	5.48	27.15
1002.0	4.00	8.0	1386.6	1397.5	5.46	27.13
1008.0	3.00	7.0	1382.7	1393.6	5.43	27.11
1014.0	3.00	6.0	1377.9	1388.7	5.40	27.08
1020.0	3.00	6.0	1373.2	1383.9	5.36	27.05
1026.0	3.00	6.0	1368.6	1379.2	5.33	27.02
1032.0	3.00	6.0	1364.0	1374.6	5.30	27.00
1038.0	3.00	6.0	1359.4	1370.0	5.28	26.97
1044.0	3.00	6.0	1354.9	1365.4	5.25	26.94
1050.0	3.00	6.0	1350.4	1360.9	5.23	26.92
1056.0	3.00	6.0	1346.0	1356.4	5.21	26.89
1062.0	3.00	6.0	1341.6	1352.0	5.19	26.86
1068.0	3.00	6.0	1337.3	1347.6	5.17	26.84
1074.0	3.00	6.0	1333.0	1343.3	5.15	26.81
1080.0	3.00	6.0	1328.7	1339.0	5.13	26.79
1086.0	3.00	6.0	1324.5	1334.7	5.11	26.76
1092.0	3.00	6.0	1320.4	1330.5	5.07	26.73
1098.0	3.00	6.0	1316.3	1326.4	5.03	26.71
1104.0	3.00	6.0	1312.3	1322.3	4.99	26.68
1110.0	3.00	6.0	1308.4	1318.3	4.95	26.66
1116.0	3.00	6.0	1304.6	1314.4	4.91	26.63
1122.0	3.00	6.0	1300.8	1310.6	4.87	26.61
1128.0	3.00	6.0	1297.2	1306.8	4.84	26.59
1134.0	3.00	6.0	1293.6	1303.2	4.80	26.56
1140.0	3.00	6.0	1290.0	1299.6	4.76	26.54
1146.0	3.00	6.0	1286.6	1296.0	4.73	26.52
1152.0	3.00	6.0	1283.2	1292.6	4.69	26.50
1158.0	3.00	6.0	1279.9	1289.2	4.67	26.47
1164.0	3.00	6.0	1276.6	1285.9	4.64	26.45
1170.0	3.00	6.0	1273.3	1282.6	4.62	26.43
1176.0	3.00	6.0	1270.2	1279.3	4.59	26.41
1182.0	3.00	6.0	1267.0	1276.2	4.56	26.39
1188.0	3.00	6.0	1264.0	1273.0	4.54	26.37
1194.0	3.00	6.0	1260.9	1270.0	4.51	26.35
1200.0	3.00	6.0	1257.9	1266.9	4.49	26.33

Pond File: POWELL .PND
Inflow Hydrograph: POWELL10.HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
1206.0	3.00	6.0	1255.0	1263.9	4.47	26.31
1212.0	3.00	6.0	1252.1	1261.0	4.44	26.29
1218.0	3.00	6.0	1249.3	1258.1	4.42	26.27
1224.0	3.00	6.0	1246.5	1255.3	4.40	26.25
1230.0	3.00	6.0	1243.7	1252.5	4.37	26.23
1236.0	3.00	6.0	1241.0	1249.7	4.35	26.21
1242.0	3.00	6.0	1238.4	1247.0	4.33	26.19
1248.0	3.00	6.0	1235.8	1244.4	4.31	26.17
1254.0	3.00	6.0	1233.2	1241.8	4.28	26.15
1260.0	3.00	6.0	1230.7	1239.2	4.26	26.14
1266.0	2.00	5.0	1227.2	1235.7	4.23	26.11
1272.0	2.00	4.0	1222.8	1231.2	4.20	26.08
1278.0	2.00	4.0	1218.5	1226.8	4.16	26.05
1284.0	2.00	4.0	1214.2	1222.5	4.12	26.02
1290.0	2.00	4.0	1210.1	1218.2	4.08	25.99
1296.0	2.00	4.0	1206.0	1214.1	4.03	25.96
1302.0	2.00	4.0	1202.0	1210.0	3.99	25.93
1308.0	2.00	4.0	1198.2	1206.0	3.94	25.90
1314.0	2.00	4.0	1194.4	1202.2	3.90	25.87
1320.0	2.00	4.0	1190.7	1198.4	3.85	25.85
1326.0	2.00	4.0	1187.0	1194.7	3.81	25.82
1332.0	2.00	4.0	1183.5	1191.0	3.77	25.79
1338.0	2.00	4.0	1180.1	1187.5	3.73	25.77
1344.0	2.00	4.0	1176.7	1184.1	3.68	25.74
1350.0	2.00	4.0	1173.4	1180.7	3.63	25.72
1356.0	2.00	4.0	1170.2	1177.4	3.59	25.69
1362.0	2.00	4.0	1167.2	1174.2	3.54	25.67
1368.0	2.00	4.0	1164.2	1171.2	3.50	25.65
1374.0	2.00	4.0	1161.3	1168.2	3.45	25.63
1380.0	2.00	4.0	1158.5	1165.3	3.41	25.60
1386.0	2.00	4.0	1155.7	1162.5	3.37	25.58
1392.0	2.00	4.0	1153.1	1159.7	3.33	25.56
1398.0	2.00	4.0	1150.5	1157.1	3.29	25.54
1404.0	2.00	4.0	1148.0	1154.5	3.25	25.53
1410.0	2.00	4.0	1145.6	1152.0	3.21	25.51
1416.0	2.00	4.0	1143.2	1149.6	3.18	25.49
1422.0	2.00	4.0	1140.9	1147.2	3.14	25.47
1428.0	2.00	4.0	1138.7	1144.9	3.11	25.45
1434.0	2.00	4.0	1136.5	1142.7	3.08	25.44
1440.0	0.00	2.0	1132.5	1138.5	3.01	25.41
1446.0	0.00	0.0	1126.7	1132.5	2.93	25.36
1452.0	0.00	0.0	1121.0	1126.7	2.84	25.32
1458.0	0.00	0.0	1115.5	1121.0	2.75	25.28
1464.0	0.00	0.0	1110.1	1115.5	2.68	25.24
1470.0	0.00	0.0	1104.9	1110.1	2.61	25.20
1476.0	0.00	0.0	1099.8	1104.9	2.55	25.16

Pond File: POWELL .PND
Inflow Hydrograph: POWELL10.HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH

TIME (min)	INFLOW (cfs)
1482.0	0.00
1488.0	0.00
1494.0	0.00
1500.0	0.00
1506.0	0.00
1512.0	0.00
1518.0	0.00
1524.0	0.00
1530.0	0.00
1536.0	0.00
1542.0	0.00
1548.0	0.00
1554.0	0.00
1560.0	0.00

ROUTING COMPUTATIONS

I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.0	1094.8	1099.8	2.49	25.12
0.0	1090.0	1094.8	2.43	25.08
0.0	1085.2	1090.0	2.37	25.04
0.0	1080.6	1085.2	2.31	25.01
0.0	1076.2	1080.6	2.21	24.97
0.0	1072.0	1076.2	2.10	24.94
0.0	1068.0	1072.0	2.00	24.91
0.0	1064.2	1068.0	1.90	24.88
0.0	1060.5	1064.2	1.81	24.85
0.0	1057.1	1060.5	1.72	24.82
0.0	1053.8	1057.1	1.64	24.79
0.0	1050.7	1053.8	1.56	24.77
0.0	1047.7	1050.7	1.49	24.74
0.0	1044.9	1047.7	1.43	24.72

116/129

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

Pond File: POWELL .PND
Inflow Hydrograph: POWELL10.HYD
Outflow Hydrograph: OUT .HYD

Starting Pond W.S. Elevation = 24.00 ft

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

Peak Inflow = 79.00 cfs
Peak Outflow = 52.83 cfs
Peak Elevation = 28.38 ft

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

Initial Storage = 172,178 cu-ft
Peak Storage From Storm = 119,340 cu-ft

Total Storage in Pond = 291,518cu-ft

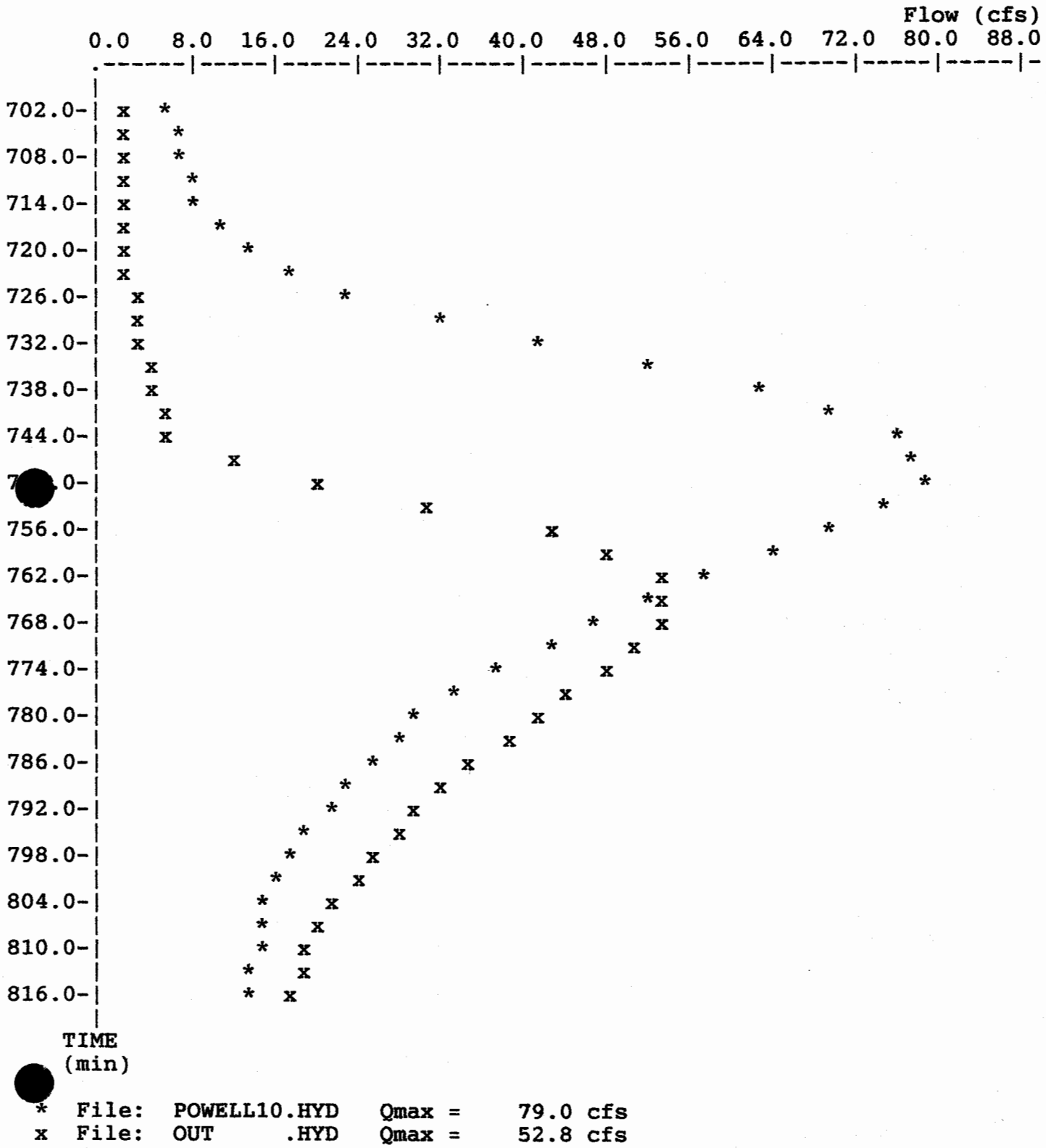
Warning: Inflow hydrograph truncated on left side.

117/12

Pond File: POWELL .PND
Inflow Hydrograph: POWELL10.HYD
Outflow Hydrograph: OUT .HYD

EXECUTED: 07-21-1997
16:18:51

Peak Inflow = 79.00 cfs
Peak Outflow = 52.83 cfs
Peak Elevation = 28.38 ft



* File: POWELL10.HYD Qmax = 79.0 cfs
x File: OUT .HYD Qmax = 52.8 cfs

POND-2 Version: 5.10 S/N: 1220510115
EXECUTED: 07-21-1997 16:19:12

```
*****************************************************************
*                                                               *
*   LAKE POWELL CLUSTER DEVELOPMENT / W.O. 13361 / 04 MAR 97 /  *
*          WET POND OUTFALL DESIGN / PRIMARY SPILL WAY /        *
*  (REVISED 08 MAY 97- ADDED EMERGENCY SPILLWAY & RAN 2-YR STORM) *
*              REVISED 02 JUL 97 (RERAN 21 JULY 97)             *
*                                                               *
*****************************************************************
```

Inflow Hydrograph: POWEL100.HYD
Rating Table file: POWELL .PND

----INITIAL CONDITIONS----
Elevation = 24.00 ft
Outflow = 0.00 cfs
Storage = 172,178 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + O (cfs)
24.00	0.0	172,178	956.5	956.5
24.25	0.3	177,688	987.2	987.5
24.50	0.9	183,288	1018.3	1019.2
24.75	1.5	188,979	1049.9	1051.4
25.00	2.3	194,761	1082.0	1084.3
25.25	2.7	200,636	1114.6	1117.3
25.50	3.2	206,603	1147.8	1151.0
25.75	3.7	212,664	1181.5	1185.2
26.00	4.1	218,820	1215.7	1219.8
26.25	4.4	225,199	1251.1	1255.5
26.50	4.7	231,937	1288.5	1293.2
26.75	5.1	239,042	1328.0	1333.1
27.00	5.3	246,524	1369.6	1374.9
27.25	5.6	254,281	1412.7	1418.3
27.50	10.8	262,202	1456.7	1467.5
27.75	19.9	270,290	1501.6	1521.5
28.00	31.3	278,546	1547.5	1578.8
28.25	44.7	286,963	1594.2	1638.9
28.50	60.0	295,536	1641.9	1701.9
28.75	78.9	304,265	1690.4	1769.3
29.00	100.2	313,152	1739.7	1839.9
29.25	123.2	322,199	1790.0	1913.2
29.50	147.8	331,407	1841.2	1989.0
29.75	173.6	340,777	1893.2	2066.8
30.00	200.4	350,311	1946.2	2146.6
30.25	228.2	360,010	2000.1	2228.3
30.50	256.8	369,876	2054.9	2311.7
30.75	286.1	379,909	2110.6	2396.7
31.00	315.9	390,112	2167.3	2483.2
31.25	346.1	400,487	2224.9	2571.0
31.50	376.8	411,033	2283.5	2660.3

119/

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + O (cfs)
31.75	407.7	421,753	2343.1	2750.8
32.00	438.9	432,648	2403.6	2842.5

Time increment (t) = 6.0 min.

120/125

Pond File: POWELL .PND
Inflow Hydrograph: POWEL100.HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH / ROUTING COMPUTATIONS

TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
660.0	4.00	-----	956.5	956.5	0.00	24.00
666.0	4.00	8.0	964.4	964.5	0.08	24.06
672.0	6.00	10.0	974.0	974.4	0.17	24.14
678.0	6.00	12.0	985.5	986.0	0.29	24.24
684.0	6.00	12.0	996.5	997.5	0.49	24.33
690.0	7.00	13.0	1008.1	1009.5	0.72	24.42
696.0	7.00	14.0	1020.1	1022.1	0.95	24.52
702.0	8.00	15.0	1032.8	1035.1	1.20	24.62
708.0	11.00	19.0	1048.7	1051.8	1.51	24.75
714.0	12.00	23.0	1067.7	1071.7	1.99	24.90
720.0	19.00	31.0	1093.8	1098.7	2.47	25.11
726.0	34.00	53.0	1140.5	1146.8	3.14	25.47
732.0	60.00	94.0	1226.1	1234.5	4.22	26.10
738.0	93.00	153.0	1368.4	1379.1	5.33	27.02
744.0	112.00	205.0	1512.9	1573.4	30.23	27.98
750.0	116.00	228.0	1599.0	1740.9	70.96	28.64
756.0	103.00	219.0	1630.8	1818.0	93.60	28.92
762.0	85.00	188.0	1631.2	1818.8	93.84	28.93
768.0	70.00	155.0	1618.2	1786.2	83.99	28.81
774.0	58.00	128.0	1601.3	1746.2	72.42	28.66
780.0	46.00	104.0	1583.4	1705.3	60.97	28.51
786.0	39.00	85.0	1564.7	1668.4	51.86	28.37
792.0	31.00	70.0	1547.2	1634.7	43.75	28.23
798.0	27.00	58.0	1530.8	1605.2	37.18	28.11
804.0	23.00	50.0	1517.3	1580.8	31.75	28.01
810.0	21.00	44.0	1505.7	1561.3	27.82	27.92
816.0	18.00	39.0	1495.6	1544.7	24.51	27.85
822.0	17.00	35.0	1487.2	1530.6	21.72	27.79
828.0	16.00	33.0	1480.8	1520.2	19.68	27.74
834.0	14.00	30.0	1474.6	1510.8	18.10	27.70
840.0	13.00	27.0	1468.5	1501.6	16.55	27.66
846.0	13.00	26.0	1463.8	1494.5	15.36	27.63
852.0	11.00	24.0	1459.4	1487.8	14.23	27.59
858.0	11.00	22.0	1455.1	1481.4	13.14	27.56
864.0	11.00	22.0	1452.3	1477.1	12.42	27.54
870.0	10.00	21.0	1449.7	1473.3	11.77	27.53
876.0	10.00	20.0	1447.4	1469.7	11.18	27.51
882.0	10.00	20.0	1445.8	1467.4	10.79	27.50
888.0	10.00	20.0	1444.5	1465.8	10.62	27.49
894.0	8.00	18.0	1442.0	1462.5	10.28	27.47
900.0	8.00	16.0	1438.4	1458.0	9.80	27.45
906.0	8.00	16.0	1435.6	1454.4	9.42	27.43
912.0	8.00	16.0	1433.3	1451.6	9.12	27.42
918.0	8.00	16.0	1431.6	1449.3	8.88	27.41
924.0	8.00	16.0	1430.2	1447.6	8.70	27.40

121/120

Pond File: POWELL .PND
Inflow Hydrograph: POWEL100.HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH / ROUTING COMPUTATIONS

TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
930.0	8.00	16.0	1429.1	1446.2	8.55	27.39
936.0	8.00	16.0	1428.2	1445.1	8.43	27.39
942.0	8.00	16.0	1427.5	1444.2	8.34	27.38
948.0	6.00	14.0	1425.4	1441.5	8.06	27.37
954.0	6.00	12.0	1422.2	1437.4	7.62	27.35
960.0	6.00	12.0	1419.6	1434.2	7.28	27.33
966.0	6.00	12.0	1417.6	1431.6	7.01	27.32
972.0	6.00	12.0	1416.0	1429.6	6.80	27.31
978.0	6.00	12.0	1414.7	1428.0	6.63	27.30
984.0	6.00	12.0	1413.8	1426.7	6.50	27.29
990.0	6.00	12.0	1413.0	1425.8	6.39	27.29
996.0	6.00	12.0	1412.4	1425.0	6.31	27.28
1002.0	6.00	12.0	1411.9	1424.4	6.24	27.28
1008.0	5.00	11.0	1410.7	1422.9	6.09	27.27
1014.0	5.00	10.0	1409.0	1420.7	5.86	27.26
1020.0	5.00	10.0	1407.6	1419.0	5.68	27.25
1026.0	5.00	10.0	1406.4	1417.6	5.60	27.25
1032.0	5.00	10.0	1405.3	1416.4	5.59	27.24
1038.0	5.00	10.0	1404.1	1415.3	5.58	27.23
1044.0	5.00	10.0	1403.0	1414.1	5.57	27.23
1050.0	5.00	10.0	1401.8	1413.0	5.56	27.22
1056.0	5.00	10.0	1400.7	1411.8	5.56	27.21
1062.0	5.00	10.0	1399.6	1410.7	5.55	27.21
1068.0	5.00	10.0	1398.6	1409.6	5.54	27.20
1074.0	5.00	10.0	1397.5	1408.6	5.53	27.19
1080.0	5.00	10.0	1396.4	1407.5	5.53	27.19
1086.0	5.00	10.0	1395.4	1406.4	5.52	27.18
1092.0	5.00	10.0	1394.4	1405.4	5.51	27.18
1098.0	5.00	10.0	1393.4	1404.4	5.50	27.17
1104.0	5.00	10.0	1392.4	1403.4	5.50	27.16
1110.0	5.00	10.0	1391.4	1402.4	5.49	27.16
1116.0	5.00	10.0	1390.4	1401.4	5.48	27.15
1122.0	5.00	10.0	1389.5	1400.4	5.48	27.15
1128.0	5.00	10.0	1388.5	1399.5	5.47	27.14
1134.0	5.00	10.0	1387.6	1398.5	5.46	27.14
1140.0	5.00	10.0	1386.7	1397.6	5.46	27.13
1146.0	5.00	10.0	1385.8	1396.7	5.45	27.13
1152.0	5.00	10.0	1384.9	1395.8	5.44	27.12
1158.0	5.00	10.0	1384.0	1394.9	5.44	27.12
1164.0	5.00	10.0	1383.2	1394.0	5.43	27.11
1170.0	4.00	9.0	1381.3	1392.2	5.42	27.10
1176.0	3.00	7.0	1377.5	1388.3	5.39	27.08
1182.0	3.00	6.0	1372.8	1383.5	5.36	27.05
1188.0	3.00	6.0	1368.2	1378.8	5.33	27.02
1194.0	3.00	6.0	1363.6	1374.2	5.30	27.00
1200.0	3.00	6.0	1359.0	1369.6	5.27	26.97

122/12

Pond File: POWELL .PND
Inflow Hydrograph: POWEL100.HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
1206.0	3.00	6.0	1354.5	1365.0	5.25	26.94
1212.0	3.00	6.0	1350.1	1360.5	5.23	26.91
1218.0	3.00	6.0	1345.6	1356.1	5.21	26.89
1224.0	3.00	6.0	1341.3	1351.6	5.19	26.86
1230.0	3.00	6.0	1336.9	1347.3	5.17	26.83
1236.0	3.00	6.0	1332.6	1342.9	5.15	26.81
1242.0	3.00	6.0	1328.4	1338.6	5.13	26.78
1248.0	3.00	6.0	1324.2	1334.4	5.11	26.76
1254.0	3.00	6.0	1320.0	1330.2	5.07	26.73
1260.0	3.00	6.0	1316.0	1326.0	5.03	26.71
1266.0	3.00	6.0	1312.0	1322.0	4.99	26.68
1272.0	3.00	6.0	1308.1	1318.0	4.95	26.66
1278.0	3.00	6.0	1304.3	1314.1	4.91	26.63
1284.0	3.00	6.0	1300.5	1310.3	4.87	26.61
1290.0	3.00	6.0	1296.9	1306.5	4.83	26.58
1296.0	3.00	6.0	1293.3	1302.9	4.80	26.56
1302.0	3.00	6.0	1289.7	1299.3	4.76	26.54
1308.0	3.00	6.0	1286.3	1295.7	4.73	26.52
1314.0	3.00	6.0	1282.9	1292.3	4.69	26.49
1320.0	3.00	6.0	1279.6	1288.9	4.67	26.47
1326.0	3.00	6.0	1276.3	1285.6	4.64	26.45
1332.0	3.00	6.0	1273.1	1282.3	4.61	26.43
1338.0	3.00	6.0	1269.9	1279.1	4.59	26.41
1344.0	3.00	6.0	1266.8	1275.9	4.56	26.39
1350.0	3.00	6.0	1263.7	1272.8	4.54	26.36
1356.0	3.00	6.0	1260.7	1269.7	4.51	26.34
1362.0	3.00	6.0	1257.7	1266.7	4.49	26.32
1368.0	3.00	6.0	1254.8	1263.7	4.47	26.30
1374.0	3.00	6.0	1251.9	1260.8	4.44	26.28
1380.0	3.00	6.0	1249.0	1257.9	4.42	26.27
1386.0	2.00	5.0	1245.3	1254.0	4.39	26.24
1392.0	2.00	4.0	1240.6	1249.3	4.35	26.21
1398.0	2.00	4.0	1236.0	1244.6	4.31	26.17
1404.0	2.00	4.0	1231.4	1240.0	4.27	26.14
1410.0	2.00	4.0	1227.0	1235.4	4.23	26.11
1416.0	2.00	4.0	1222.6	1231.0	4.19	26.08
1422.0	2.00	4.0	1218.3	1226.6	4.16	26.05
1428.0	2.00	4.0	1214.0	1222.3	4.12	26.02
1434.0	2.00	4.0	1209.9	1218.0	4.08	25.99
1440.0	1.00	3.0	1204.8	1212.9	4.02	25.95
1446.0	1.00	2.0	1198.9	1206.8	3.95	25.91
1452.0	1.00	2.0	1193.2	1200.9	3.88	25.86
1458.0	1.00	2.0	1187.5	1195.2	3.82	25.82
1464.0	1.00	2.0	1182.0	1189.5	3.75	25.78
1470.0	1.00	2.0	1176.7	1184.0	3.68	25.74
1476.0	1.00	2.0	1171.4	1178.7	3.60	25.70

123/120

Pond File: POWELL .PND
Inflow Hydrograph: POWEL100.HYD
Outflow Hydrograph: OUT .HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
1482.0	1.00	2.0	1166.4	1173.4	3.53	25.66
1488.0	1.00	2.0	1161.5	1168.4	3.45	25.63
1494.0	1.00	2.0	1156.7	1163.5	3.38	25.59
1500.0	0.00	1.0	1151.1	1157.7	3.30	25.55
1506.0	0.00	0.0	1144.7	1151.1	3.20	25.50
1512.0	0.00	0.0	1138.5	1144.7	3.11	25.45
1518.0	0.00	0.0	1132.5	1138.5	3.01	25.41
1524.0	0.00	0.0	1126.6	1132.5	2.92	25.36
1530.0	0.00	0.0	1120.9	1126.6	2.84	25.32
1536.0	0.00	0.0	1115.4	1120.9	2.75	25.28
1542.0	0.00	0.0	1110.1	1115.4	2.68	25.24
1548.0	0.00	0.0	1104.9	1110.1	2.61	25.20
1554.0	0.00	0.0	1099.8	1104.9	2.55	25.16
1560.0	0.00	0.0	1094.8	1099.8	2.49	25.12

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

Pond File: POWELL .PND
Inflow Hydrograph: POWEL100.HYD
Outflow Hydrograph: OUT .HYD

Starting Pond W.S. Elevation = 24.00 ft

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

Peak Inflow = 116.00 cfs
Peak Outflow = 93.84 cfs
Peak Elevation = 28.93 ft

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

Initial Storage = 172,178 cu-ft
Peak Storage From Storm = 138,321 cu-ft

Total Storage in Pond = 310,499cu-ft

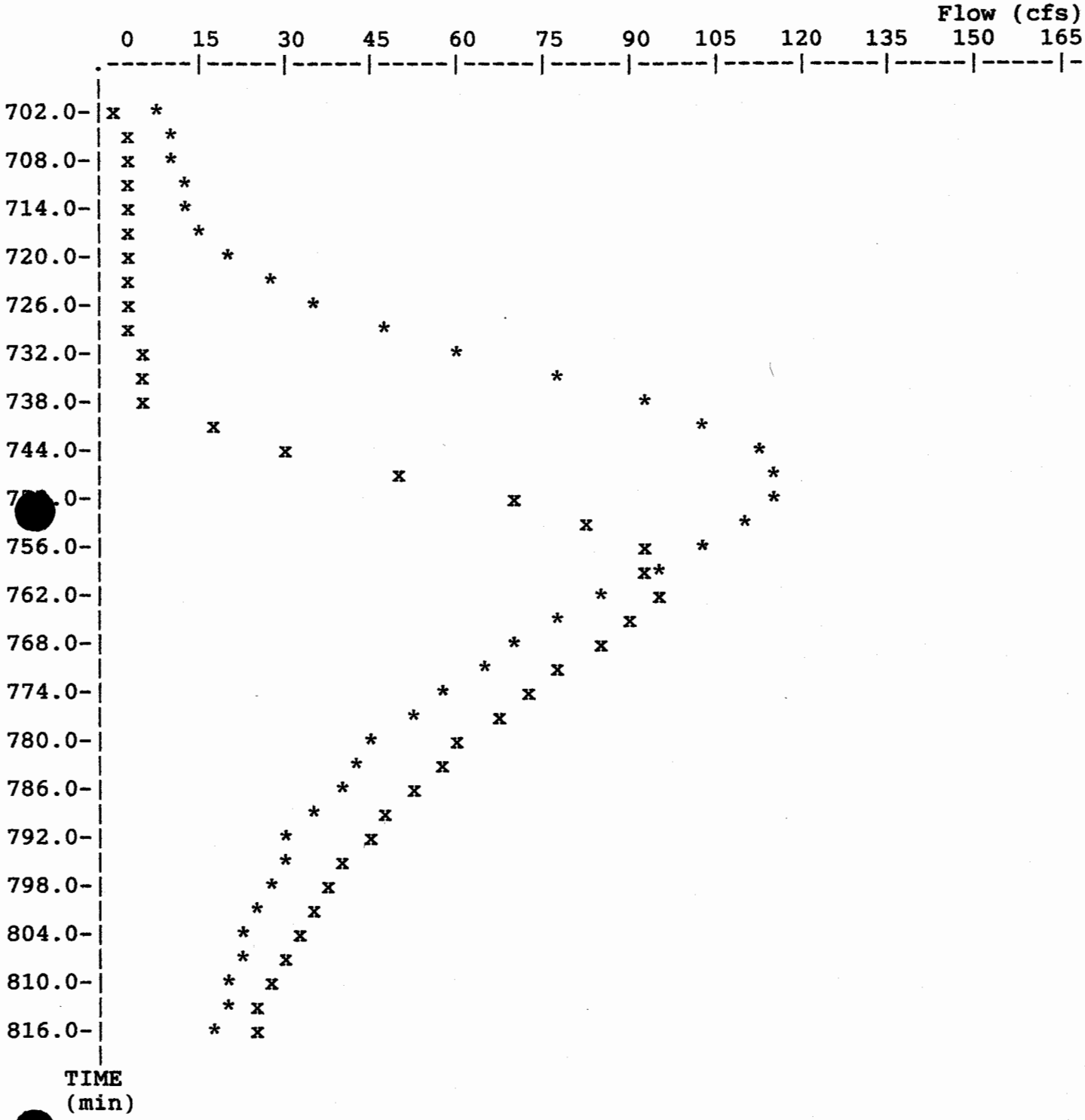
Warning: Inflow hydrograph truncated on left side.

125/126

Pond File: POWELL .PND
Inflow Hydrograph: POWEL100.HYD
Outflow Hydrograph: OUT .HYD

EXECUTED: 07-21-1997
16:19:12

Peak Inflow = 116.00 cfs
Peak Outflow = 93.84 cfs
Peak Elevation = 28.93 ft



* File: POWEL100.HYD Qmax = 116.0 cfs
x File: OUT .HYD Qmax = 93.8 cfs

LD-26
Rev. 3-8

Project _____ Plan Sheet No. _____ Designer _____ Sheet _____ of _____

Rev. Date _____ Date _____

HYDROLOGICAL DATA:

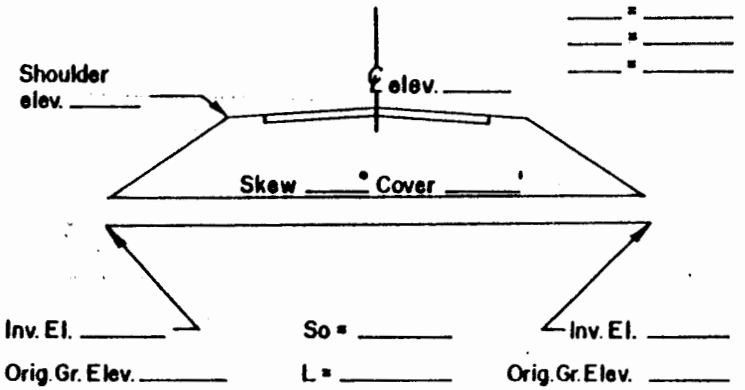
D.A. = _____ AC.

AHW Controls

100 yr. Flood plain _____ elev. _____
Design AHW depth _____ elev. _____
Structures _____ elev. _____

STATION: _____

freq. TW elev.
_____ = _____
_____ = _____
_____ = _____
_____ = _____
_____ = _____



DISCHARGES USED

Q _____ = _____ CFS
Q _____ = _____ CFS
Q _____ = _____ CFS
Q _____ = _____ CFS
Q _____ = _____ CFS

RISK ASSESSMENT ADT _____

Detours Available _____, Length _____
Overtopping Stage _____
Flood Plain Management _____
Criteria and Significant Impact _____

CULVERT TYPE & SIZE	Q	Q/B	HEADWATER COMPUTATIONS: INLET CONT. HW/D	INLET CONT. HW	OUTLET CONTROL Ke	dc	$\frac{dc+D}{2}$	ho	H	LSo	HW	CONT. HW. ELEV.	OUTLET VELOCITY C.M.	OUTLET VELOCITY Smooth	End Treat.	COMMENTS
36" RCP	45	45	1.12	3.36	0.2	2.2	2.6	2.6	1.0	0.32	3.28	3.36				inv 20.30 top HGL = 23.66 < 24, OK top pipe = 23.63

h_o = TW or $\frac{dc+D}{2}$ whichever greater

$HW = H + h_o - LS_o$
$= 1.0 + 2.6 - 0.32$

$S_o = 0.5\%$
$L = 64$ ft

SUMMARY & RECOMMENDATIONS:

Design Flood Exceed. Prob. _____ Elev. _____
Overtop Flood Exceed. Prob. _____ Elev. _____
Base Flood 1% Exceed. Prob. _____ Elev. _____

240 A

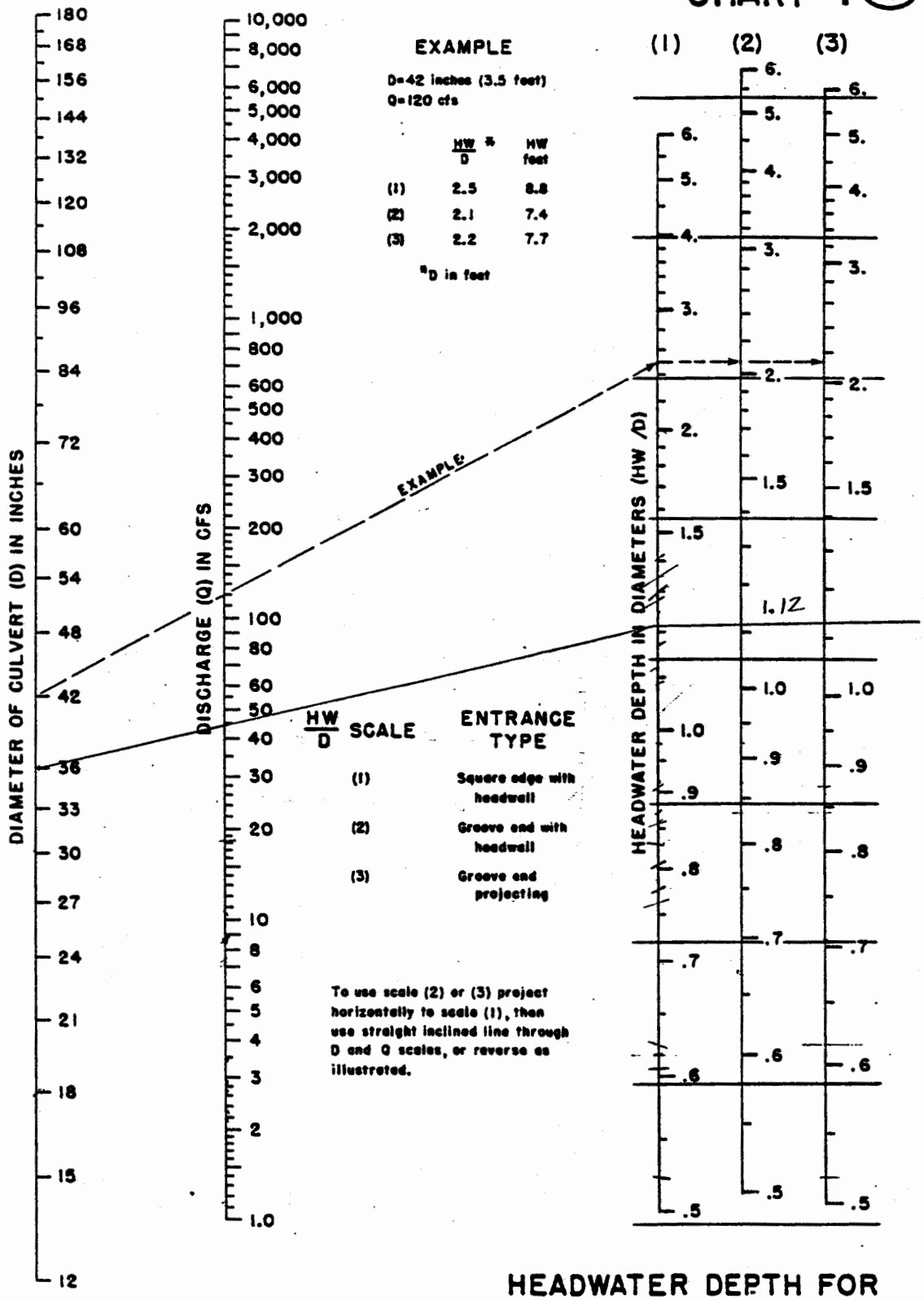
Lake Powell 13361 7/07

126/126

21 July 97 13361
Lake Powell

CHART 1

127/129



HEADWATER SCALES 2&3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

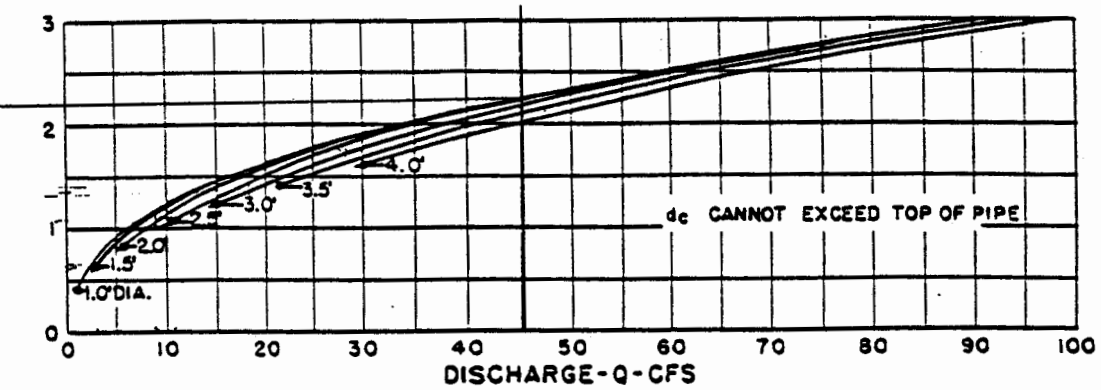
HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

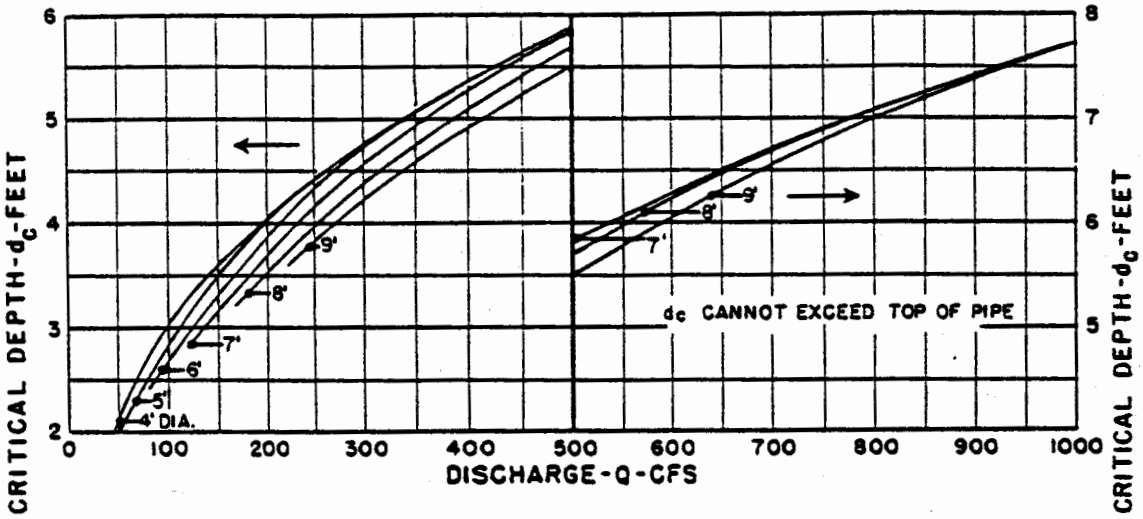
21 July 87 13361
Lake Powell

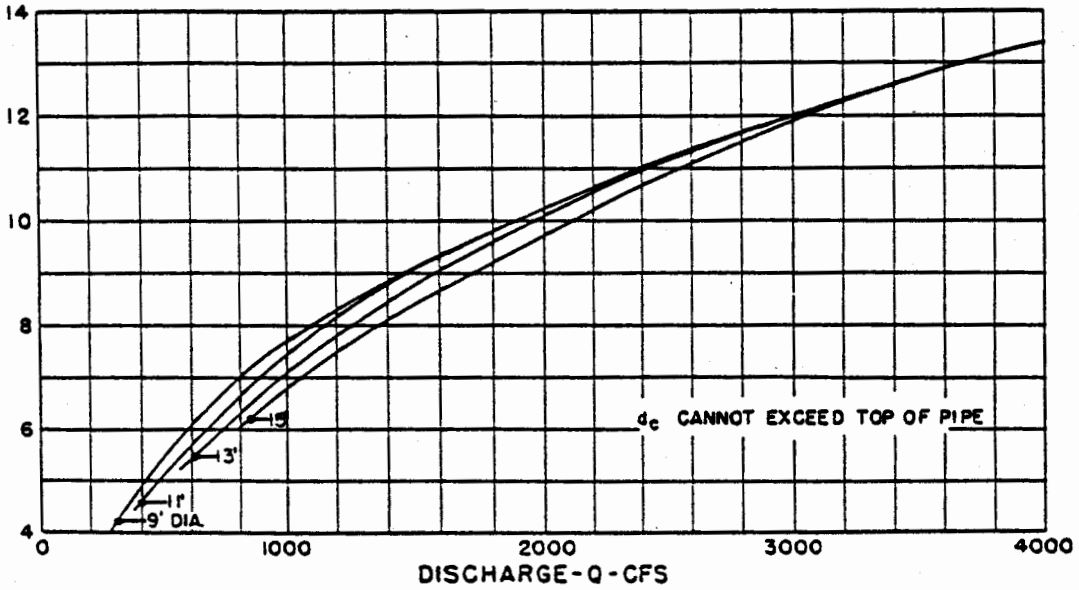
128/129

CHART 4

2.2







BUREAU OF PUBLIC ROADS

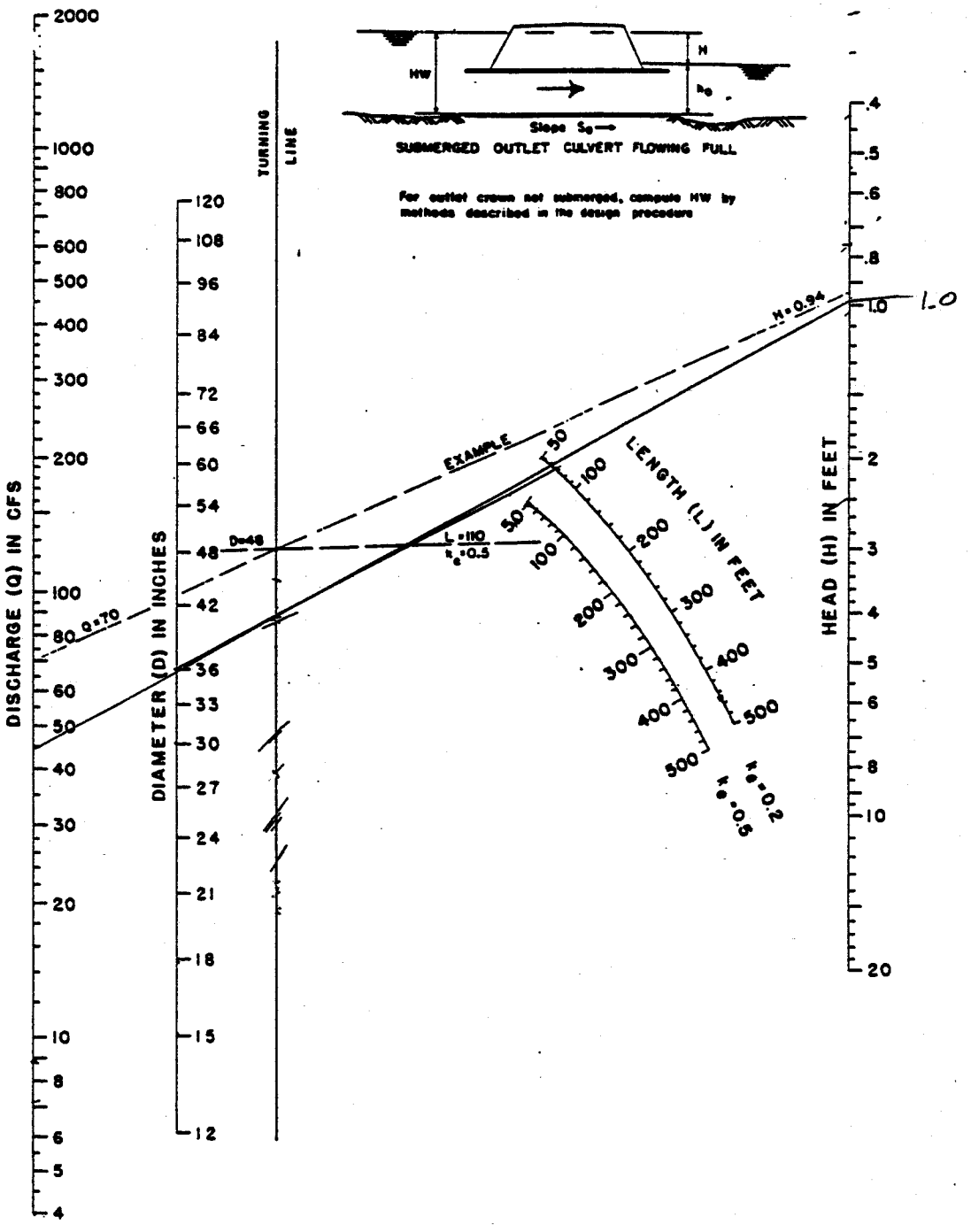
JAN. 1964

CRITICAL DEPTH
CIRCULAR PIPE

21 July 97 13361
Lake Powell

129/129

CHART 5



HEAD FOR
CONCRETE PIPE CULVERTS
FLOWING FULL
n = 0.012

BUREAU OF PUBLIC ROADS JAN. 1963

STORM DRAINAGE COMPUTATIONS

HORTON AND DODD, P.C.
CONSULTING SURVEYORS-ENGINEERS-PLANNERS
CHESAPEAKE, VIRGINIA

Formula: Q=CIA n= 0.013 Job No.: 13361
Yr. Storm: 10 Date: 06 AUG 97
Des. By: ERF PROJECT: LAKE POWELL CLUSTER DEVELOPMENT Revised: 06 OCT 97
Chkd. By: IHB Revised: 23 MAR 98

FROM	TO	AREA ACRES	RUN-OFF COEF	C*A INCR.	C*A ACCU.	INLET TIME MINUTES INCR.	INLET TIME MINUTES SYS.	RAIN-FALL IN.	SY.	RUNOFF 'Q' C.F.S. INCR.	RUNOFF 'Q' C.F.S. ACCU.	PIPE CAPA-CITY	PIPE DIA. IN.	PIPE SLOPE (%)	PIPE LGH. FT.	PIPE VEL. F.P.S.	FLOW TIME MIN.	ELEV. DIFF. FT.	INVERT ELEV UPR.	INVERT ELEV LWR.	RIM
A-1	A-2	1.15	0.40	0.46	0.46	15.0	15.0	5.30	5.30	2.44	2.44	6.5	15	1.00	32	5.26	0.1	0.32	59	58.68	64.86
A-2	A-3B	0.15	0.76	0.11	0.57	15.0	15.1	5.30	5.28	0.60	3.03	23.0	15	12.66	82	18.73	0.1	10.38	58.68	48.30	64.86
A-3A	A-3	0.46	0.45	0.21	0.21	15.0	15.0	5.30	5.30	1.10	1.10	19.4	15	9.00	130	15.79	0.1	11.70	60.70	49.00	64
A-3	A-3B	1.32	0.35	0.46	0.67	15.0	15.1	5.30	5.28	2.45	3.53	22.6	24	1.00	56	7.19	0.1	0.56	49.00	48.44	54
A-3B	A-4	8.55	0.35	2.99	4.24	20.0	20.0	4.70	4.70	14.06	19.91	22.6	24	1.00	54	7.19	0.1	0.54	48.30	47.76	52
A-4	A-5	-	-	0.00	4.24	-	20.1	0.00	4.69	0.00	19.86	22.6	24	1.00	36	7.19	0.1	0.36	47.76	47.41	63.24
A-5A	A-5	0.45	0.40	0.18	0.18	15.0	15.0	5.30	5.30	0.95	0.95	6.5	15	1.00	48	5.26	0.2	0.48	56.60	56.12	63.14
A-5	A-6	0.15	0.75	0.11	4.53	15.0	20.2	5.30	4.68	0.60	21.19	31.0	27	1.00	32	7.80	0.1	0.32	47.41	47.09	62.88
A-6	A-15	0.36	0.75	0.27	4.80	15.0	20.3	5.30	4.68	1.43	22.45	59.4	27	3.67	324	14.93	0.4	11.90	42.88	30.98	62.88
A-7	A-11	0.99	0.40	0.40	0.40	15.0	15.0	5.30	5.30	2.10	2.10	8.4	15	1.69	118	6.84	0.3	2.00	51.00	49.00	54.92
A-8	A-11	0.33	0.75	0.25	0.25	15.0	15.0	5.30	5.30	1.31	1.31	6.5	15	1.00	32	5.26	0.1	0.32	49.32	49.00	53.46
A-9	A-10	0.91	0.32	0.29	0.29	15.0	15.0	5.30	5.30	1.54	1.54	6.5	15	1.00	32	5.26	0.1	0.32	51.00	50.68	54.68
A-10	A-11	0.77	0.40	0.31	0.60	15.0	15.1	5.30	5.28	1.63	3.16	8.3	15	1.65	102	6.76	0.3	1.68	50.68	49.00	54.68
A-11	A-13	0.89	0.35	0.31	1.55	15.0	15.4	5.30	5.24	1.65	8.14	10.5	18	1.00	316	5.94	0.9	3.16	49.00	45.84	53.46
A-12	A-13	0.73	0.38	0.28	0.28	15.0	15.0	5.30	5.30	1.47	1.47	6.5	15	1.00	56	5.26	0.2	0.56	51.00	50.44	55.39
A-13A	A-13	0.70	0.34	0.24	0.24	15.0	15.0	5.30	5.30	1.26	1.26	6.5	15	1.00	40	5.26	0.1	0.40	50.84	50.44	54.98
A-13	A-14	0.33	0.34	0.11	2.18	15.0	16.2	5.30	5.08	0.59	11.08	15.9	21	1.00	32	6.59	0.1	0.32	45.84	45.52	54.7
A-14	A-15	0.55	0.60	0.33	2.51	15.0	16.3	5.30	5.07	1.75	12.73	21.9	21	1.92	124	9.12	0.2	2.38	45.52	43.14	54.7
A-15	A-16	-	-	0.00	7.31	-	20.6	0.00	4.64	0.00	33.92	82.5	27	7.09	134	20.74	0.1	9.50	30.98	21.48	49
B-1A	B-1B	0.43	0.45	0.19	0.19	15.0	15.0	5.30	5.30	1.03	1.03	18.6	15	8.33	150	15.19	0.2	12.49	57.50	45.01	60
B-1B	B-1C	0.78	0.40	0.31	0.51	15.0	15.2	5.30	5.28	1.65	2.67	7.5	15	1.36	172	6.14	0.5	2.34	45.01	42.67	47.5
B-1	B-1C	0.85	0.36	0.31	0.31	15.0	15.0	5.30	5.30	1.62	1.62	23.0	15	12.66	58	18.73	0.1	7.34	50.00	42.66	53
B-1C	B-2	-	-	0.00	0.81	-	15.6	0.00	5.18	0.00	4.20	7.5	15	1.36	40	6.13	0.1	0.54	42.66	42.12	50.64
B-2	B-4	0.85	0.40	0.34	1.15	15.0	15.7	5.30	5.16	1.80	5.94	7.4	18	0.50	154	4.19	0.6	0.76	33.00	32.24	48.5
C-1	C-2	0.81	0.50	0.41	0.41	15.0	15.0	5.30	5.30	2.15	2.15	20.9	15	10.50	224	17.06	0.2	23.52	46.00	22.48	52.47

Draft Copy

STORM DRAINAGE COMPUTATIONS

HORTON AND DODD, P.C.
CONSULTING SURVEYORS-ENGINEERS-PLANNERS
CHESAPEAKE, VIRGINIA

Formula: Q=CIA n= 0.013 Job No.: 13361
Yr. Storm: 10 Date: 06 AUG 97
Des. By: ERF PROJECT: LAKE POWELL CLUSTER DEVELOPMENT Revised: 06 OCT 97
Chkd. IHB Revised: 23 MAR 98

FROM	TO	AREA ACRES	RUN-OFF COEF	C*A INCR.	C*A ACCU.	INLET TIME MINUTES INCR.	INLET TIME MINUTES SYS.	RAIN-FALL IN.	RAIN-FALL SY.	RUNOFF 'Q' C.F.S. INCR.	RUNOFF 'Q' C.F.S. ACCU.	PIPE CAPA-CITY	PIPE DIA. IN.	PIPE SLOPE (%)	PIPE LGH. FT.	PIPE VEL. F.P.S.	FLOW TIME MIN.	ELEV. DIFF. FT.	INVERT ELEV UPR.	INVERT ELEV LWR.	RIM
D-1	D-2	0.69	0.45	0.31	0.31	15.0	15.0	5.30	5.30	1.65	1.65	22.1	15	11.70	164	18.01	0.2	19.20	41.7	22.5	49
E-1	E-2	0.16	0.55	0.09	0.09	15.0	15.0	5.30	5.30	0.47	0.47	6.5	15	1.00	32	5.26	0.1	0.32	56.00	55.68	60.46
E-2	E-4	0.47	0.45	0.21	0.30	15.0	15.1	5.30	5.28	1.12	1.58	20.3	15	9.85	82	16.52	0.1	8.07	55.68	47.61	60.46
E-3	E-4	0.79	0.45	0.36	0.36	15.0	15.0	5.30	5.30	1.88	1.88	6.5	15	1.00	240	5.26	0.8	2.39	50.20	47.81	55.52
E-4	E-5	-	-	0.00	0.66	-	15.8	0.00	5.16	0.00	3.38	6.5	15	1.00	37	5.26	0.1	0.37	47.70	47.33	62.2
E-5	E-6	0.12	0.72	0.09	0.74	15.0	15.9	5.30	5.14	0.46	3.81	6.5	15	1.00	135	5.26	0.4	1.35	47.33	45.99	62.19
E-6	E-7	0.06	0.75	0.05	0.79	15.0	16.3	5.30	5.07	0.24	3.99	6.5	15	1.00	126	5.26	0.4	1.26	45.99	44.73	63.07
E-7	E-8	0.76	0.46	0.35	1.14	15.0	16.7	5.30	5.03	1.85	5.71	18.9	15	8.60	280	15.43	0.3	24.07	39.60	15.53	59.6
F-1	F-2	0.99	0.45	0.45	0.45	15.0	15.0	5.30	5.30	2.36	2.36	25.4	15	15.50	230	20.72	0.2	35.64	51.15	15.51	59.87
G-1A	G-1	0.34	0.75	0.26	0.26	15.0	15.0	5.30	5.30	1.35	1.35	6.5	15	1.00	32	5.26	0.1	0.32	48.32	48.00	55.88
G-1	G-2	0.99	0.37	0.37	0.62	15.0	15.1	5.30	5.28	1.94	3.28	6.5	15	1.00	112	5.26	0.4	1.12	48.00	46.88	55.88
G-2	G-4	0.19	0.37	0.07	0.69	15.0	15.5	5.30	5.22	0.37	3.61	6.5	15	1.00	48	5.26	0.2	0.48	46.88	46.41	54.82
G-4	G-5	-	-	0.00	0.69	-	15.6	0.00	5.18	0.00	3.58	6.5	15	1.00	129	5.26	0.4	1.29	46.40	45.11	54.7
G-5	G-6	0.33	0.40	0.13	0.82	15.0	16.0	5.30	5.10	0.70	4.20	25.1	18	5.70	167	14.19	0.2	9.52	45.11	35.59	52.27
G-6	G-7	1.11	0.40	0.44	1.27	15.0	16.2	5.30	5.08	2.35	6.44	40.3	18	14.75	112	22.83	0.1	16.52	31.88	15.36	42.35
H-1	H-2	0.35	0.75	0.26	0.26	15.0	15.0	5.30	5.30	1.39	1.39	6.5	15	1.00	32	5.26	0.1	0.32	45.65	45.33	51.61
H-2	H-3	0.57	0.40	0.23	0.49	15.0	15.1	5.30	5.28	1.21	2.59	14.7	15	5.18	300	11.98	0.4	15.54	45.33	29.80	51.61
I-1	I-2	0.90	0.62	0.56	0.56	15.0	15.0	5.30	5.30	2.96	2.96	20.4	15	10.00	110	16.65	0.1	11.00	43.50	32.50	48.83
I-2	H-3	-	-	0.00	0.56	-	15.1	0.00	5.28	0.00	2.95	6.5	15	1.00	272	5.26	0.9	2.71	32.50	29.79	38
H-3	G-7	-	-	0.00	1.05	-	16.0	0.00	5.12	0.00	5.37	14.2	15	4.80	212	11.53	0.3	10.17	29.79	19.62	37
G-7	G-8	-	-	0.00	2.32	-	16.3	0.00	5.08	0.00	11.77	16.0	24	0.50	122	5.09	0.4	0.61	15.36	14.75	24.5

HYDRAULIC GRADE LINE CALCULATIONS

HORTON AND DODD, P.C.
CONSULTING SURVEYORS-ENGINEERS-PLANNERS
CHESAPEAKE, VIRGINIA

Yr. Storm: 10
Des. By: ERF
Chkd. By: IHB

PROJECT: LAKE POWELL CLUSTER DEVELOPMENT

Job No.: 13361
Date: 07 AUG 97
Revised: 10/06/97
Revised: 24 MAR 98

n= 0.013

BEND LOSS COEFFICIENTS

H(i)=.35(Vi)2/2g	90	K=0.70	50	K=0.47	20 K=0.16
H(o)=.25(Vo)2/2g	80	K=0.66	40	K=.38	15 K=0.10
H(D)=K(V(I)2/2g)	70	K=0.61	30	K=.28	
FINAL H=Hf+Ht	60	K=0.55	25	K=.22	

H(t)=H(o)+H(i)+H(D)

INLET SHAPING: YES

USE H(t) = H(t) FOR MANHOLES
USE H(t) = 1.3H(t) FOR DROP INLETS
USE H(t) = .5H(t) FOR INLET SHAPING

FR.	TO	OTL WTR ELEV	Do	Qo	Lo	So	Hf	Vo	Ho	Di	Qi	Vi	QiVi	Vi2/2g	Hi	ANG	K	HD	Ht	1.3Ht	.5Ht	.5X1.3 Ht	FINAL H(t)	HF	INLET WATER ELEV.	RIM ELEV.
A-15	A-16	28.38	27	33.92	134	7.09	9.50	8.53	0.28	27.00	22.45	5.65	126.76	0.50	0.03	90.00	0.70	0.35	0.66	0.86	0.33	0.43	0.33	9.83	38.21	49.00
A-6	A-15	38.21	27	22.45	324	3.67	11.89	5.65	0.12	27.00	21.19	5.33	112.93	0.44	0.03	0.00	0.00	0.00	0.03	0.04	0.01	0.02	0.02	11.91	50.12	62.88
A-5	A-6	50.12	27	21.19	32	1.00	0.32	5.33	0.11	24.00	19.86	6.32	125.55	0.62	0.03	70.00	0.61	0.38	0.52	0.68	0.26	0.34	0.34	0.66	50.78	62.88
A-4	A-5	50.78	24	19.86	34	1.00	0.34	6.32	0.16	24.00	19.91	0.04	0.88	0.00	0.00	80.00	0.66	0.00	0.16	0.20	0.08	0.10	0.10	0.44	51.22	63.24
A-3B	A-4	51.22	24	19.91	54	1.00	0.54	6.34	0.16	15.00	3.03	2.47	7.48	0.09	0.01	70.00	0.61	0.06	0.23	0.30	0.11	0.15	0.15	0.60	51.82	52.00
A-2	A-3B	51.82	15	3.03	70	12.66	8.86	2.47	0.02	15.00	2.44	1.99	4.85	0.06	0.01	0.00	0.00	0.00	0.03	0.04	0.02	0.02	0.02	8.88	60.71	64.86
A-1	A-2	60.71	15	2.44	32	1.00	0.32	1.99	0.02	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.01	0.01	0.01	0.33	61.04	64.86
A-5A	A-5	57.12	15	0.95	48	1.00	0.48	0.77	0.00	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	57.60	63.14
A-3	A-3B	51.82	24	3.53	56	1.00	0.56	1.12	0.00	15.00	1.10	0.80	0.88	0.01	0.00	80.00	0.66	0.01	0.02	0.02	0.01	0.01	0.01	0.57	52.39	54.00
A-3A	A-3	52.39	15	1.10	130	9.00	11.60	0.90	0.00	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.60	63.99	64.00
A-14	A-15	44.55	21	12.73	124	1.92	2.38	5.29	0.11	18.00	11.08	6.27	69.47	0.61	0.03	5.00	0.03	0.02	0.16	0.21	0.08	0.10	0.10	2.49	47.04	54.70
A-13	A-14	47.04	21	11.08	32	1.00	0.32	4.61	0.08	18.00	8.14	4.61	37.50	0.33	0.03	0.00	0.00	0.00	0.11	0.14	0.05	0.07	0.07	0.39	47.43	54.70
A-11	A-13	47.43	18	8.14	316	1.00	3.16	4.61	0.08	15.00	3.16	2.57	8.14	0.10	0.01	90.00	0.70	0.07	0.17	0.22	0.08	0.11	0.11	3.27	50.69	53.46
A-10	A-11	50.69	15	3.16	102	1.65	1.68	2.57	0.03	15.00	1.54	1.25	1.93	0.02	0.01	90.00	0.70	0.02	0.05	0.06	0.02	0.03	0.03	1.69	52.38	54.68
A-9	A-10	52.38	15	1.54	32	1.00	0.32	1.25	0.01	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.32	52.71	54.68
A-12	A-13	51.44	15	1.47	56	1.00	0.56	1.20	0.01	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.56	52.00	55.39
A-13A	A-13	51.44	15	1.26	40	1.00	0.40	1.03	0.00	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.40	51.84	54.98
A-7	A-11	50.69	15	2.10	118	1.69	1.99	1.71	0.01	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	2.00	52.70	54.92

HYDRAULIC GRADE LINE CALCULATIONS

HORTON AND DODD, P.C.
CONSULTING SURVEYORS-ENGINEERS-PLANNERS
CHESAPEAKE, VIRGINIA

Yr. Storm: 10
Des. By: ERF
Chkd. By: IHB

PROJECT: LAKE POWELL CLUSTER DEVELOPMENT

Job No.: 13361
Date: 07 AUG 97
Revised: 10/06/97
Revised: 24 Mar 98

n= 0.013

BEND LOSS COEFFICIENTS

H(i)=.35(Vi)2/2g K=0.70 K=0.47 20 K=0.16
H(o)=.25(Vo)2/2g K=0.66 K=.38 15 K=0.10
H(D)=K(V(I)2/2g) K=0.61 K=.28
FINAL H=Hf+Ht K=0.55 K=.22
H(t)=H(o)+H(i)+H(D)

USE H(t) = H(t) FOR MANHOLES
USE H(t) = 1.3H(t) FOR DROP INLETS
USE H(t) = .5H(t) FOR INLET SHAPING

INLET SHAPING: YES

FR.	TO	OTL WTR ELEV	Do	Qo	Lo	So	Hf	Vo	Ho	Di	Qi	Vi	QiVi	Vi2/2g	Hi	ANG	K	HD	Ht	1.3Ht	.5Ht	.5X1.3 Ht	FINAL H(t)	HF	INLET WATER ELEV.	RIM ELEV.
A-8	A-11	50.81	15.00	1.31	32.00	1.00	0.32	1.07	0.00	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.32	51.13	53.46
B-2	B-4	33.44	18.00	5.68	154.00	0.50	0.77	3.21	0.04	15.00	3.94	3.21	12.65	0.16	0.02	15.00	0.10	0.02	0.07	0.10	0.04	0.05	0.05	0.82	34.26	48.50
B-1C	B-2	43.12	15.00	3.94	40.00	1.36	0.54	3.21	0.04	15.00	2.67	2.18	5.81	0.07	0.01	60.00	0.55	0.04	0.09	0.12	0.05	0.06	0.06	0.60	43.72	50.64
B-1B	B-1C	43.72	15.00	2.67	172.00	1.36	2.34	2.18	0.02	15.00	1.03	0.84	0.86	0.01	0.00	90.00	0.70	0.01	0.03	0.04	0.02	0.02	0.02	2.36	46.08	47.50
B-1A	B-1B	46.08	15.00	1.03	150.00	8.33	12.50	0.84	0.00	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.50	58.58	60.00
B-1	B-1C	43.72	15.00	1.35	58.00	12.66	7.34	1.10	0.00	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	7.35	51.07	53.00
C-1	C-2	28.38	15.00	2.15	224.00	10.50	23.52	1.75	0.01	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.01	0.01	0.01	23.53	51.91	52.47
D-1	D-2	28.38	15.00	1.65	164.00	11.70	19.19	1.34	0.01	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	19.19	47.57	49.00
E-7	E-8	23.47	15.00	5.71	280.00	8.60	24.08	4.65	0.08	15.00	3.99	3.25	12.97	0.16	0.02	30.00	0.28	0.05	0.15	0.19	0.07	0.10	0.10	24.18	47.65	59.60
E-6	E-7	47.65	15.00	3.99	126.00	1.00	1.26	3.25	0.04	15.00	3.81	3.10	11.83	0.15	0.02	15.00	0.10	0.01	0.07	0.09	0.04	0.05	0.05	1.31	48.95	63.07
E-5	E-6	48.95	15.00	3.81	135.00	1.00	1.35	3.10	0.04	15.00	3.38	2.75	9.31	0.12	0.01	45.00	0.42	0.05	0.10	0.13	0.05	0.07	0.07	1.42	50.37	62.19
E-4	E-5	50.37	15.00	3.38	37.00	1.00	0.37	2.75	0.03	15.00	1.58	1.29	2.03	0.03	0.01	0.00	0.00	0.00	0.04	0.05	0.02	0.02	0.02	0.39	50.76	62.20
E-2	E-4	50.76	15.00	1.58	82.00	9.85	8.08	1.29	0.01	15.00	0.47	0.38	0.18	0.00	0.00	70.00	0.61	0.00	0.01	0.01	0.00	0.01	0.01	8.08	58.84	60.46

HYDRAULIC GRADE LINE CALCULATIONS

HORTON AND DODD, P.C.
CONSULTING SURVEYORS-ENGINEERS-PLANNERS
CHESAPEAKE, VIRGINIA

Yr. Storm: 10
Des. By: ERF
Chkd. By: IHB

Job No.: 13361
Date: 07 AUG 97
Revised: 10/06/97
Revised: 24 Mar 98

PROJECT: LAKE POWELL CLUSTER DEVELOPMENT

n= 0.013

BEND LOSS COEFFICIENTS

H(i)=.35(Vi)2/2g	90	K=0.70	50	K=0.47	20 K=0.16
H(o)=.25(Vo)2/2g	80	K=0.66	40	K=.38	15 K=0.10
H(D)=K(V(I)2/2g)	70	K=0.61	30	K=.28	
FINAL H=Hf+Ht	60	K=0.55	25	K=.22	
H(t)=H(o)+H(i)+H(D)					

USE H(t) = H(t) FOR MANHOLES
USE H(t) = 1.3H(t) FOR DROP INLETS
USE H(t) = .5H(t) FOR INLET SHAPING

INLET SHAPING: YES

R.	TO	OTL WTR ELEV	Do	Qo	Lo	So	Hf	Vo	Ho	Di	Qi	Vi	QiVi	Vi2/2g	Hi	ANG	K	HD	Ht	1.3Ht	.5Ht	.5X1.3 Ht	FINAL H(t)	HF	INLET WATER ELEV.	RIM ELEV.
	E-2	58.84	15	0.47	32	1.00	0.32	0.38	0.00	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	59.16	60.49
	E-4	50.76	15	1.88	240	1.00	2.40	1.53	0.01	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01	2.41	53.16	55.52
	F-2	23.47	15	2.36	230	15.50	35.65	1.92	0.01	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.01	0.01	0.01	35.66	59.13	59.87
	G-8	23.47	24	11.77	122	0.50	0.61	3.75	0.05	18.00	6.44	3.64	23.47	0.21	0.02	70.00	0.61	0.13	0.20	0.26	0.10	0.13	0.10	0.71	24.18	24.50
	G-7	24.18	18	6.44	112	14.75	16.52	3.64	0.05	18.00	4.20	2.38	9.98	0.09	0.01	0.00	0.00	0.00	0.06	0.08	0.03	0.04	0.04	16.56	40.74	42.35
	G-6	40.74	18	4.20	167	5.70	9.52	2.38	0.02	15.00	3.58	2.92	10.44	0.13	0.02	0.00	0.00	0.00	0.04	0.05	0.02	0.02	0.02	9.54	50.29	52.27
	G-5	50.29	15	3.58	129	1.00	1.29	2.92	0.03	15.00	3.61	2.94	10.62	0.13	0.02	90.00	0.70	0.09	0.14	0.19	0.07	0.09	0.09	1.38	51.67	54.70
	G-4	51.67	15	3.61	48	1.00	0.48	2.94	0.03	15.00	3.28	2.67	8.77	0.11	0.01	5.00	0.03	0.00	0.05	0.07	0.03	0.03	0.03	0.51	52.18	54.82
	G-2	52.18	15	3.28	112	1.00	1.12	2.67	0.03	15.00	1.35	1.10	1.49	0.02	0.01	90.00	0.70	0.01	0.05	0.06	0.02	0.03	0.03	1.15	53.33	55.88
A	G-1	53.33	15	1.35	32	1.00	0.32	1.10	0.00	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.32	53.66	55.88
	G-7	24.18	15	5.37	212	4.80	10.18	4.38	0.07	15.00	2.59	2.11	5.47	0.07	0.01	20.00	0.16	0.01	0.10	0.13	0.05	0.06	0.05	10.22	34.40	37.00
	H-3	34.40	15	2.59	300	3.84	11.52	2.11	0.02	15.00	1.39	1.13	1.57	0.02	0.01	0.00	0.00	0.00	0.02	0.03	0.01	0.02	0.02	11.54	45.94	51.61
	H-2	45.94	15	1.39	32	1.50	0.48	1.13	0.00	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.48	46.42	51.61
	H-3	34.40	15	2.95	272	1.00	2.72	2.40	0.02	15.00	2.96	2.41	7.14	0.09	0.01	60.00	0.55	0.05	0.09	0.11	0.04	0.06	0.04	2.76	37.17	38.00
	I-2	37.17	15	2.96	110	10.00	11.00	2.41	0.02	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.01	0.01	0.01	11.01	48.18	48.83

PROJECT 13361
HEC12 Version: V2.80 Run Date: 03-24-1998

```
==============================================================================
INLET NUMBER 1                LENGTH   6.0        STATION  A-1

DRAINAGE AREA =  0.480 ACRES       C VALUE = .400       CA =  0.192
DRAINAGE AREA =  0.570 ACRES       C VALUE = .400       CA =  0.228

FOR THE FIRST SIDE
SUM CA=   0.192 INT=  3.50  CFS=   0.672  CO=  0.000 GUTTER FLOW=   0.672
FOR THE OTHER SIDE
SUM CA=   0.228 INT=  3.50  CFS=   0.798  CO=  0.000 GUTTER FLOW=   0.798
AT THE INLET

SUM CA=   0.420 INT=  3.50  CFS=   1.470  CO=  0.000 GUTTER FLOW=   1.470

GUTTER SLOPE = 0.0010 FT/FT       PAVEMENT CROSS SLOPE =  0.0208 FT/FT


SPREAD AT A SLOPE OF .001 (ft./ft.) AND   0.80 (cfs) IS  8.06 (ft.)

       XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
    P EFFEC. LENGTH (ft) =  9.60                H (ft) = 0.458
    DEPTH OF WATER (ft) =   0.16          SPREAD (ft)  =  7.89


==============================================================================
INLET NUMBER 2                LENGTH   2.5        STATION  A-2

DRAINAGE AREA =  0.100 ACRES       C VALUE = .760       CA =  0.076
DRAINAGE AREA =  0.050 ACRES       C VALUE = .760       CA =  0.038

FOR THE FIRST SIDE
SUM CA=   0.076 INT=  3.50  CFS=   0.266  CO=  0.000 GUTTER FLOW=   0.266
FOR THE OTHER SIDE
SUM CA=   0.038 INT=  3.50  CFS=   0.133  CO=  0.000 GUTTER FLOW=   0.133
AT THE INLET

SUM CA=   0.114 INT=  3.50  CFS=   0.399  CO=  0.000 GUTTER FLOW=   0.399

GUTTER SLOPE = 0.0010 FT/FT       PAVEMENT CROSS SLOPE =  0.0208 FT/FT


SPREAD AT A SLOPE OF .001 (ft./ft.) AND   0.27 (cfs) IS  4.23 (ft.)

       XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
    P EFFEC. LENGTH (ft) =  6.10                H (ft) = 0.458
    DEPTH OF WATER (ft) =   0.09          SPREAD (ft)  =  4.47
```

```
==========================================================================
INLET NUMBER 3                LENGTH   4.0        STATION  A-5A

DRAINAGE AREA =  0.450 ACRES        C VALUE = .400        CA =  0.180
SUM CA=   0.180 INT=  3.50  CFS=   0.630  CO=  0.000 GUTTER FLOW=   0.630

GUTTER SLOPE = 0.0165 FT/FT        PAVEMENT CROSS SLOPE =  0.0208 FT/FT

SPREAD      W     W/T     SW       SW/SX      Eo      a     S'W     SE
  2.56     2.0    0.78   0.0800    3.8       1.00   3.4    0.143  0.163

      XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
    REQUIRED LENGTH (ft) =  5.8                EFFICIENCY= 0.88
    CFS INTERCEPTED=  0.55                 CFS CARRYOVER=  0.08


==========================================================================
INLET NUMBER 4                LENGTH   2.5        STATION  A-5

DRAINAGE AREA =  0.090 ACRES        C VALUE = .750        CA =  0.068
DRAINAGE AREA =  0.060 ACRES        C VALUE = .750        CA =  0.045

FOR THE FIRST SIDE
SUM CA=   0.068 INT=  3.50  CFS=   0.236  CO=  0.000 GUTTER FLOW=   0.236
FOR THE OTHER SIDE
SUM CA=   0.045 INT=  3.50  CFS=   0.157  CO=  0.080 GUTTER FLOW=   0.237
AT THE INLET

SUM CA=   0.112 INT=  3.50  CFS=   0.394  CO=  0.080 GUTTER FLOW=   0.474

GUTTER SLOPE = 0.0010 FT/FT        PAVEMENT CROSS SLOPE =  0.0208 FT/FT


SPREAD AT A SLOPE OF .001 (ft./ft.) AND   0.24 (cfs) IS  3.87 (ft.)

      XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
    P EFFEC. LENGTH (ft) =  6.10                H (ft) = 0.458
    DEPTH OF WATER (ft) =   0.10          SPREAD (ft)  =  5.02
```

```
==============================================================================
INLET NUMBER 5                LENGTH   6.0        STATION  A-6

DRAINAGE AREA =  0.180 ACRES       C VALUE = .750       CA =  0.135
DRAINAGE AREA =  0.180 ACRES       C VALUE = .750       CA =  0.135

FOR THE FIRST SIDE
SUM CA=   0.135 INT=  3.50  CFS=   0.473  CO=  0.000 GUTTER FLOW=   0.473
FOR THE OTHER SIDE
SUM CA=   0.135 INT=  3.50  CFS=   0.473  CO=  0.000 GUTTER FLOW=   0.473
AT THE INLET

SUM CA=   0.270 INT=  3.50  CFS=   0.945  CO=  0.000 GUTTER FLOW=   0.945

GUTTER SLOPE = 0.0010 FT/FT       PAVEMENT CROSS SLOPE =  0.0208 FT/FT


SPREAD AT A SLOPE OF .001 (ft./ft.) AND   0.47 (cfs) IS  6.12 (ft.)

       XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
    P EFFEC. LENGTH (ft) =  9.60                H (ft) = 0.458
    DEPTH OF WATER (ft) =   0.12          SPREAD (ft)  =  5.88
```

```
==============================================================================
INLET NUMBER 6                LENGTH   8.0        STATION  A-7

DRAINAGE AREA =  0.990 ACRES       C VALUE = .400       CA =  0.396
SUM CA=   0.396 INT=  3.50  CFS=   1.386  CO=  0.000 GUTTER FLOW=   1.386

GUTTER SLOPE = 0.0211 FT/FT       PAVEMENT CROSS SLOPE =  0.0208 FT/FT

SPREAD      W     W/T     SW       SW/SX      Eo      a     S'W     SE
  4.63     2.0    0.43   0.0800    3.8       0.88   3.4    0.143  0.147

       XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
    REQUIRED LENGTH (ft) =  9.3                EFFICIENCY= 0.97
    CFS INTERCEPTED=  1.35                 CFS CARRYOVER=  0.04


==============================================================================
INLET NUMBER 7                LENGTH   2.5        STATION  A-8

DRAINAGE AREA =  0.200 ACRES       C VALUE = .750       CA =  0.150
DRAINAGE AREA =  0.130 ACRES       C VALUE = .750       CA =  0.097

FOR THE FIRST SIDE
SUM CA=   0.150 INT=  3.50  CFS=   0.525  CO=  0.000 GUTTER FLOW=   0.525
FOR THE OTHER SIDE
SUM CA=   0.097 INT=  3.50  CFS=   0.341  CO=  0.050 GUTTER FLOW=   0.391
AT THE INLET

SUM CA=   0.248 INT=  3.50  CFS=   0.866  CO=  0.050 GUTTER FLOW=   0.916

GUTTER SLOPE = 0.0010 FT/FT       PAVEMENT CROSS SLOPE =  0.0208 FT/FT


SPREAD AT A SLOPE OF .001 (ft./ft.) AND   0.53 (cfs) IS  6.50 (ft.)

       XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
    P EFFEC. LENGTH (ft) =  6.10                H (ft) = 0.458
    DEPTH OF WATER (ft) =   0.16           SPREAD (ft)  =  7.79
```

```
==============================================================================
INLET NUMBER 8                LENGTH   8.0        STATION  A-9

DRAINAGE AREA =  0.910 ACRES        C VALUE = .320        CA =  0.291
SUM CA=   0.291 INT=  3.50  CFS=   1.019  CO=  0.000 GUTTER FLOW=   1.019

GUTTER SLOPE = 0.0416 FT/FT        PAVEMENT CROSS SLOPE =  0.0208 FT/FT

SPREAD      W     W/T     SW        SW/SX      Eo      a     S'W     SE
  2.62     2.0    0.76   0.0800     3.8       0.99   3.4    0.143  0.163

      XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
    REQUIRED LENGTH (ft) =  9.4                EFFICIENCY= 0.97
    CFS INTERCEPTED=  0.99                 CFS CARRYOVER=  0.03
```

```
==============================================================================
INLET NUMBER 9                LENGTH   8.0        STATION  A-10

DRAINAGE AREA =  0.770 ACRES       C VALUE = .400       CA =  0.308
SUM CA=   0.308 INT=  3.50  CFS=   1.078  CO=  0.000 GUTTER FLOW=   1.078

GUTTER SLOPE = 0.0416 FT/FT       PAVEMENT CROSS SLOPE =  0.0208 FT/FT

SPREAD      W     W/T     SW       SW/SX      Eo      a     S'W     SE
  2.79     2.0    0.72   0.0800    3.8       0.99   3.4    0.143  0.162

       XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
    REQUIRED LENGTH (ft) =  9.6                EFFICIENCY= 0.96
    CFS INTERCEPTED=  1.03                 CFS CARRYOVER=  0.04


==============================================================================
INLET NUMBER 10               LENGTH   6.0        STATION  A-11

DRAINAGE AREA =  0.450 ACRES       C VALUE = .350       CA =  0.157
DRAINAGE AREA =  0.440 ACRES       C VALUE = .350       CA =  0.154

FOR THE FIRST SIDE
SUM CA=   0.157 INT=  3.50  CFS=   0.551  CO=  0.040 GUTTER FLOW=   0.591
FOR THE OTHER SIDE
SUM CA=   0.154 INT=  3.50  CFS=   0.539  CO=  0.040 GUTTER FLOW=   0.579
AT THE INLET

SUM CA=   0.312 INT=  3.50  CFS=   1.090  CO=  0.080 GUTTER FLOW=   1.170

GUTTER SLOPE = 0.0010 FT/FT       PAVEMENT CROSS SLOPE =  0.0208 FT/FT


SPREAD AT A SLOPE OF .001 (ft./ft.) AND   0.59 (cfs) IS  6.92 (ft.)

       XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
    P EFFEC. LENGTH (ft) =  9.60                H (ft) = 0.458
    DEPTH OF WATER (ft) =   0.14           SPREAD (ft)  =  6.78
```

```
==============================================================================
INLET NUMBER 11              LENGTH   6.0        STATION  A-12

DRAINAGE AREA =  0.730 ACRES       C VALUE = .380       CA =  0.277
SUM CA=   0.277 INT=  3.50  CFS=   0.971  CO=  0.000 GUTTER FLOW=   0.971

GUTTER SLOPE = 0.0300 FT/FT       PAVEMENT CROSS SLOPE =  0.0208 FT/FT

SPREAD      W     W/T     SW       SW/SX      Eo      a     S'W     SE
  2.96     2.0    0.68   0.0800    3.8       0.98   3.4    0.143  0.161

      XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
    REQUIRED LENGTH (ft) =  8.4                EFFICIENCY= 0.90
    CFS INTERCEPTED=  0.87                 CFS CARRYOVER=  0.10
```

```
==============================================================================
INLET NUMBER 12              LENGTH   6.0        STATION  A-13A

DRAINAGE AREA =  0.700 ACRES       C VALUE = .340       CA =  0.238
SUM CA=   0.238 INT=  3.50  CFS=   0.833  CO=  0.000 GUTTER FLOW=   0.833

GUTTER SLOPE = 0.0139 FT/FT       PAVEMENT CROSS SLOPE =  0.0208 FT/FT

SPREAD      W     W/T     SW       SW/SX      Eo      a     S'W     SE
  3.68     2.0    0.54   0.0800    3.8       0.95   3.4    0.143  0.156

      XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
    REQUIRED LENGTH (ft) =  6.4                EFFICIENCY= 0.99
    CFS INTERCEPTED=  0.83                 CFS CARRYOVER=  0.00


==============================================================================
INLET NUMBER 13              LENGTH   2.5        STATION  A-13

DRAINAGE AREA =  0.160 ACRES       C VALUE = .340       CA =  0.054
DRAINAGE AREA =  0.170 ACRES       C VALUE = .340       CA =  0.058

FOR THE FIRST SIDE
SUM CA=   0.054 INT=  3.50  CFS=   0.190  CO=  0.000 GUTTER FLOW=   0.190
FOR THE OTHER SIDE
SUM CA=   0.058 INT=  3.50  CFS=   0.202  CO=  0.100 GUTTER FLOW=   0.302
AT THE INLET

SUM CA=   0.112 INT=  3.50  CFS=   0.393  CO=  0.100 GUTTER FLOW=   0.493

GUTTER SLOPE = 0.0010 FT/FT       PAVEMENT CROSS SLOPE =  0.0208 FT/FT


SPREAD AT A SLOPE OF .001 (ft./ft.) AND   0.30 (cfs) IS  4.63 (ft.)

      XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
    P EFFEC. LENGTH (ft) =  6.10                H (ft) = 0.458
    DEPTH OF WATER (ft) =   0.11           SPREAD (ft)  =  5.15
```

```
==============================================================================
INLET NUMBER 14              LENGTH   6.0        STATION  A-14

DRAINAGE AREA =  0.350 ACRES       C VALUE = .600       CA =  0.210
DRAINAGE AREA =  0.200 ACRES       C VALUE = .600       CA =  0.120

FOR THE FIRST SIDE
SUM CA=   0.210 INT=  3.50  CFS=   0.735  CO=  0.000 GUTTER FLOW=   0.735
FOR THE OTHER SIDE
SUM CA=   0.120 INT=  3.50  CFS=   0.420  CO=  0.000 GUTTER FLOW=   0.420
AT THE INLET

SUM CA=   0.330 INT=  3.50  CFS=   1.155  CO=  0.000 GUTTER FLOW=   1.155

GUTTER SLOPE = 0.0010 FT/FT       PAVEMENT CROSS SLOPE =  0.0208 FT/FT


SPREAD AT A SLOPE OF .001 (ft./ft.) AND   0.74 (cfs) IS  7.74 (ft.)

       XXXXXXXXXX CURB INLET IN A SUMP XXXXXXXXXX
    P EFFEC. LENGTH (ft) =  9.60                H (ft) = 0.458
    DEPTH OF WATER (ft) =   0.14          SPREAD (ft)  =  6.72
```

```
==========================================================================
INLET NUMBER 23              LENGTH   4.0        STATION  E-6

DRAINAGE AREA =  0.060 ACRES       C VALUE = .750       CA =  0.045
SUM CA=   0.045 INT=  3.50  CFS=   0.157  CO=  0.000 GUTTER FLOW=   0.157

GUTTER SLOPE = 0.0283 FT/FT       PAVEMENT CROSS SLOPE =  0.0208 FT/FT

SPREAD      W     W/T     SW       SW/SX      Eo      a     S'W     SE
  1.16     2.0    1.73   0.0800    3.8       1.00   3.4    0.143  0.163

      XXXXXXXXXX CURB INLET ON A CONTINUOUS GRADE XXXXXXXXXX
   REQUIRED LENGTH (ft) =  3.8                EFFICIENCY= 1.00
   CFS INTERCEPTED=  0.16                 CFS CARRYOVER=  0.00
```

POND-2 Version: 5.10
S/N: 1220510115

19/19

DURFEY'S MILL SINGLE FAMILY/ 13084 / 21 FEB 97
BASIN ON LOTS 57&58/
REVISED 20 MAY 97 / (REVISED 22 JUL 97)

CALCULATED 07-22-1997 13:52:01
DISK FILE: 13084E .VOL

Planimeter scale: 1 inch = 1 ft.

	Elevation (ft)	Planimeter (sq.in.)	Area (sq.ft)	A1+A2+sqr(A1*A2) (sq.ft)	* Volume (cubic-ft)	Volume Sum (cubic-ft)
	22.00	2,137.00	2,137	0	0	0
sed. c/o ←	24.00	3,088.00	3,088	7,794	5,196	5,196
	25.00	*I*	3,617	10,047	3,349	8,545
NWL →	25.30	*I*	3,784	10,290	4,459	9,655 ←
	26.00	4,188.00	4,188	10,872	7,248	12,444
PRIM. ←	27.50	*I*	5,068	13,863	6,932	19,376 ←
	28.00	5,380.00	5,380	14,315	9,543	21,987
	30.00	6,885.00	6,885	18,351	12,234	34,221

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

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

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

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

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

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

(REVISED 22 JULY 97) 20 MAY 97 15004 DURFEYS MILL

16. With emergency spillway:

Assumed available head (h) = 1.00 ft. (Using Q_2)

h = Crest of Emergency Spillway Elevation - Crest of Riser Elevation

Without emergency spillway:

Assumed available head (h) = N/A. ft. (Using Q_{25})

h = Design High Water Elevation - Crest of Riser Elevation

17. Riser diameter (D_r) = 18 in. Actual head (h) = 1.00 ft.

(From Plate 3.14-8.)

Note: Avoid orifice flow conditions.

18. Barrel length (l) = 44 ft.

Head (H) on barrel through embankment = 6 ft.

(From Plate 3.14-7).

19. Barrel diameter = 15 in.

(From Plate 3.14-B [concrete pipe] or Plate 3.14-A [corrugated pipe]).

20. Trash rack and anti-vortex device

Diameter = _____ inches. see detail

Height = _____ inches.

(From Table 3.14-D).

Emergency Spillway Design

21. Required spillway capacity $Q_e = Q_{25} - Q_p$ = 3.66 cfs.

22. Bottom width (b) = _____ ft.; the slope of the exit channel (s) = _____ ft./foot; and the minimum length of the exit channel (x) = _____ ft.
(From Table 3.14-C). see Emerg. Spill. Design

(REVISED 22 JULY 97)

20 MAY 97 13089
DURFEIS MILL

18/19

Anti-Seep Collar Design

23. Depth of water at principal spillway crest (Y) = 5.5 ft.

Slope of upstream face of embankment (Z) = 3 :1.

Slope of principal spillway barrel (S_b) = 0.23 %

Length of barrel in saturated zone (L_s) = 40 ft.

24. Number of collars required = 3 dimensions = 12 ft. min. space (from Plate 3.14-12).

Final Design Elevations

25. Top of Dam = 30 ft.

Design High Water = 29 ft.

Emergency Spillway Crest = 28.50 ft

Principal Spillway Crest = 27.50 ft

Dewatering Orifice Invert = 25.30 ft

Cleanout Elevation = 24.00 ft

Elevation of Upstream Toe of Dam or Excavated Bottom of "Wet Storage Area" (if excavation was performed) = 22 ft

McCALLUM
TESTING LABORATORIES, INC.
Geotechnical Engineering, Materials Testing & Environmental Services

January 15, 2001

Boyd Corporation
396 S. Witchduck Road
Virginia Beach, VA 23462

Attention: **Murden Clayton Temple, II**

Subject: **Laboratory Test Results**
Lake Powell Forest
James City County, Virginia
MTL Project 975608

JAN 2001
RECEIVED
ENVIRONMENTAL DIVISION

Dear **Mr. Temple:**

Attached are the results of a Moisture Density Test (ASTM D 698 Procedure C), a Moisture Content Test (ASTM D 2216) and an Aggregate Sieve Analysis (ASTM C 117 & 136) performed on the stone base material sampled by our technician, Al Spik, on December 20, 2000, from the above referenced project. We understand the sample represents material stockpiled on-site.

Should you have any questions concerning this report, please do not hesitate to contact this office at your earliest convenience.

Very truly yours,

McCALLUM TESTING LABORATORIES, INC.

David P. Rediger, E.I.T.
Laboratory Manager

Douglas S. Kihloch, P.E.
Chief Engineer

COMMONWEALTH OF VIRGINIA
DOUGLAS S. KIHLOCH
7960
CERTIFIED PROFESSIONAL ENGINEER

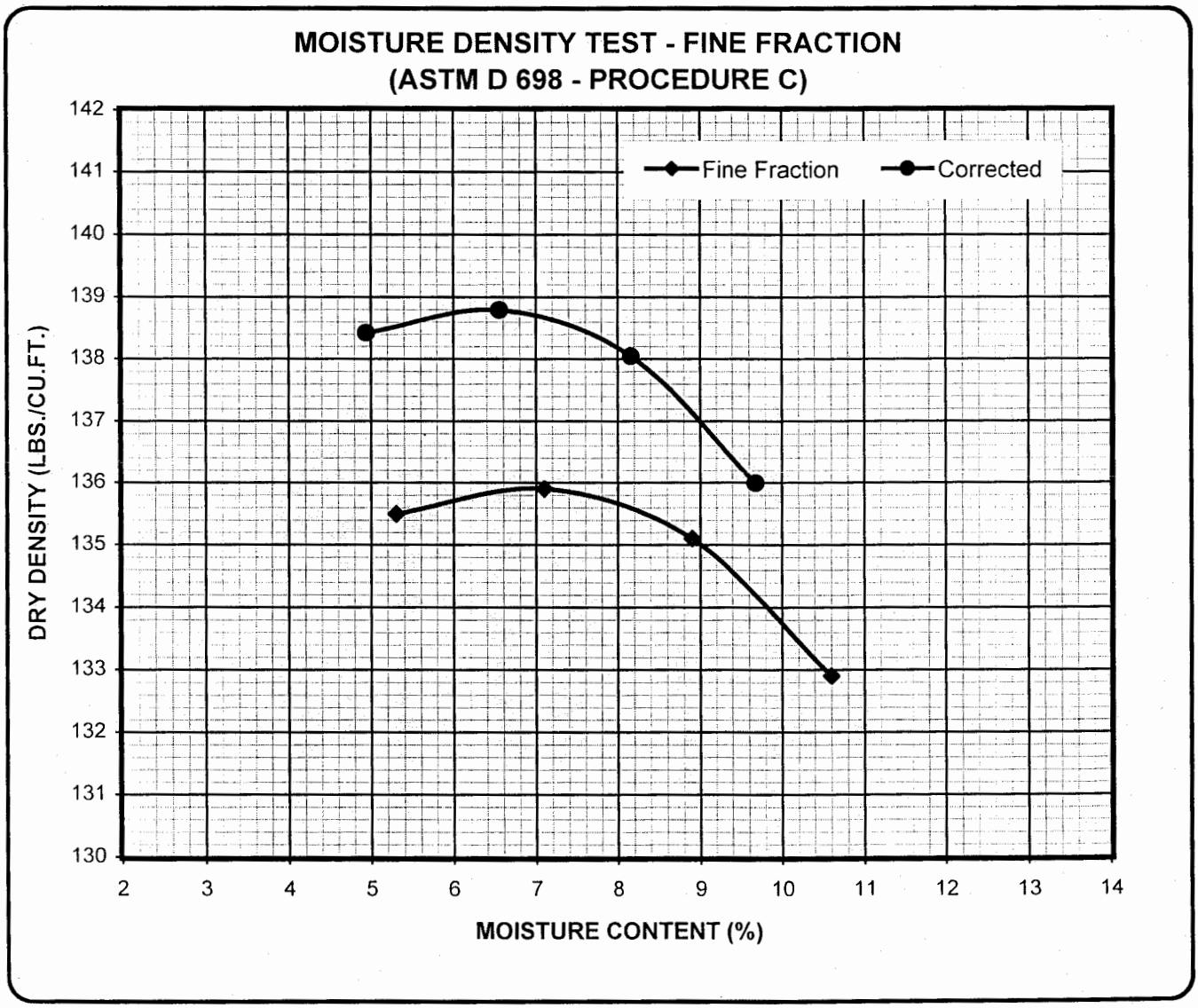
cc: Horton & Dodd, P.C. / Rodney Flores, P.E.
James City County / Mr. Gerald Lewis

1808 HAYWARD AVENUE, CHESAPEAKE, VA 23320 ✦ P.O. BOX 13337, CHESAPEAKE, VA 23325-0337
PHONE (757) 420-2520 ✦ FAX (757) 424-2874

McCALLUM TESTING LABORATORIES, INC.

LABORATORY TEST RESULTS
LAKE POWELL FOREST
JAMES CITY COUNTY, VIRGINIA
MTL PROJECT 97-5608

SAMPLE NO.	SOURCE	DATE RECEIVED	VISUAL CLASSIFICATION
1	On-Site Stockpile Material	12/20/2000	Gray, silty gravel with fine to coarse sand



NATURAL PERCENT MOISTURE (ASTM D 2216)	ASTM C 136 AGGREGATE SIEVE ANALYSIS		ASTM D 4718		SOIL CLASSIFICATION (ASTM D 2487)
	PERCENT RETAINED 3/4" SIEVE	PERCENT RETAINED 3/8" SIEVE	CORRECTED UNIT WEIGHT (LBS./CU.FT.)	CORRECTED OPTIMUM MOISTURE (%)	
6.9	10.7	38.6	138.8	6.5	GP-GM

McCALLUM TESTING LABORATORIES, INC.

LABORATORY TEST RESULTS
LAKE POWELL FOREST
JAMES CITY COUNTY, VIRGINIA
MTL PROJECT 97-5608

AGGREGATE SIEVE ANALYSIS TEST (ASTM C 117 & 136)	
ON SITE STOCKPILE MATERIAL SAMPLED 12/20/00	
SIEVE SIZES	**PERCENT PASSING**
1 1/2" (37.5 mm)	100
1" (25.4 mm)	98.1
3/4" (19.0 mm)	89.3
1/2" (12.7 mm)	70.2
3/8" (9.5 mm)	61.4
#4 (4.75 mm)	46.7
#8 (2.36 mm)	41.6
#10 (2.00 mm)	39.7
#16 (1.18 mm)	35.8
#30 (0.600 mm)	30.5
#40 (0.425 mm)	27.5
#50 (0.300 mm)	24.6
#80 (0.180 mm)	18.8
#100 (0.150 mm)	17.3
#200 (0.075 mm)	11.5

HORTON & DODD, P.C.

300 GEORGE WASHINGTON HIGHWAY N., CHESAPEAKE, VA 23323
TELEPHONE: (757) 487-4535 FAX: (757) 487-9788

OCT 2000
RECEIVED
ENVIRONMENTAL DIVISION

LETTER OF TRANSMITTAL

TO:	James City County Environmental Division	**JOB #:**	13361 & 13084
	101-E Mounts Bay Road		
	Williamsburg, VA 23187	**JOB NAME:**	Lake Powell Forest
			Lake Powell Pointe
ATTN:	Darrly E. Cook	**DATE:**	9-28-00

WE ARE SENDING THE FOLLOWING VIA:

X U. S. Mail
___ Our Messenger
___ Your Messenger
___ Overnight Courier
___ Reproducibles
___ Blueline Prints
X Copy of Letter
___ Check

COPIES	DATE	DESCRIPTION
1	9-28-00	Lake Powell Forest Dam (Dam 2) & Lake Powell Pointe Dam (Dam 1)

THESE ARE TRANSMITTED as checked below:

___ For Approval
___ For Review & Comment
X For Your Use
___ For Your Signature
___ As Requested

REMARKS:

COPY TO:

SIGNED: Sharon D. Hoel, P.E.

McCALLUM
TESTING LABORATORIES, INC.
Geotechnical Engineering, Materials Testing & Environmental Services

March 24, 2000

Boyd Corporation
396 S. Witchduck Road
Virginia Beach, VA 23462

RECEIVED
HORTON & DODD, P.C.
DATE 9/25/00
1.
2.
3.
4. FILE

Attention: **Murden Clayton Temple, II**

Subject: **Lake Powell Forest Dam (Dam #2)**
James City County, Virginia
MTL Project 975657

Dear **Mr. Temple:**

On July 8 and July 13, 1998, our technician was on site to test the compaction of the fill being placed for the Lake Powell Forest dam. During each visit to the site, visual observations were made that confirmed the fill material being utilized was essentially the same as that originally approved. The results of our testing at this site indicated compliance with the project compaction requirements. The results of our compaction testing are attached for your review.

Should you have any questions concerning this matter, please contact this office at your earliest convenience.

Very truly yours,

McCALLUM TESTING LABORATORIES, INC.

DOUGLAS S. KINLOCH

Douglas S. Kinloch, P.E.
Chief Engineer

cc: Horton & Dodd, P.C. / Rodney Flores, P.E.

1808 HAYWARD AVENUE, CHESAPEAKE, VA 23320 ✦ P.O. BOX 13337, CHESAPEAKE, VA 23325-0337
PHONE (757) 420-2520 ✦ FAX (757) 424-2874

McCALLUM
TESTING LABORATORIES INC.
Subsurface Exploration • Geotechnical Engineering

August 13, 1998

Boyd Corporation
396 S. Witchduck Road
Virginia Beach, VA 23462

Compaction Testing - 7/8/98
Durfey's Mill
James City County, Virginia
MTL Project 975657

Attention: Murden Clayton Temple, II

Dear Mr. Temple:

On this date, our technician, Alan Spik, was on site to perform compaction testing of the dam fill for the above referenced project. All tests were performed according to the procedures outlined by ASTM D 2922.

TEST NO.	1	2	3	4	5	6
PROBE DEPTH (IN.)	12	12	12			--
MEASURED MOISTURE (%)	11.9	12.5	17.7			
OPTIMUM MOISTURE (%)*	10.4	10.4	14.0			
MEASURED DRY DENSITY (PCF)	114.9	120.9	110.2			
MAXIMUM DRY DENSITY (PCF)*	117.0	117.0	110.8			
MEASURED COMPACTION (%)	98.2	100+	99.5			
MIN. REQUIRED COMPACTION (%)	95.0	95.0	95.0			

TEST LOCATIONS

1. Dam #2 Bridge Lift, Inner Slope
2. Dam #2 Bridge Lift, Outer Slope
3. Dam #2 Bridge Lift, Core
4.
5.
6.

*ASTM D

McCALLUM TESTING LABORATORIES, INC.

Philip S. Berman
Director of Operations

Douglas S. Kinloch, P.E.
Chief Engineer

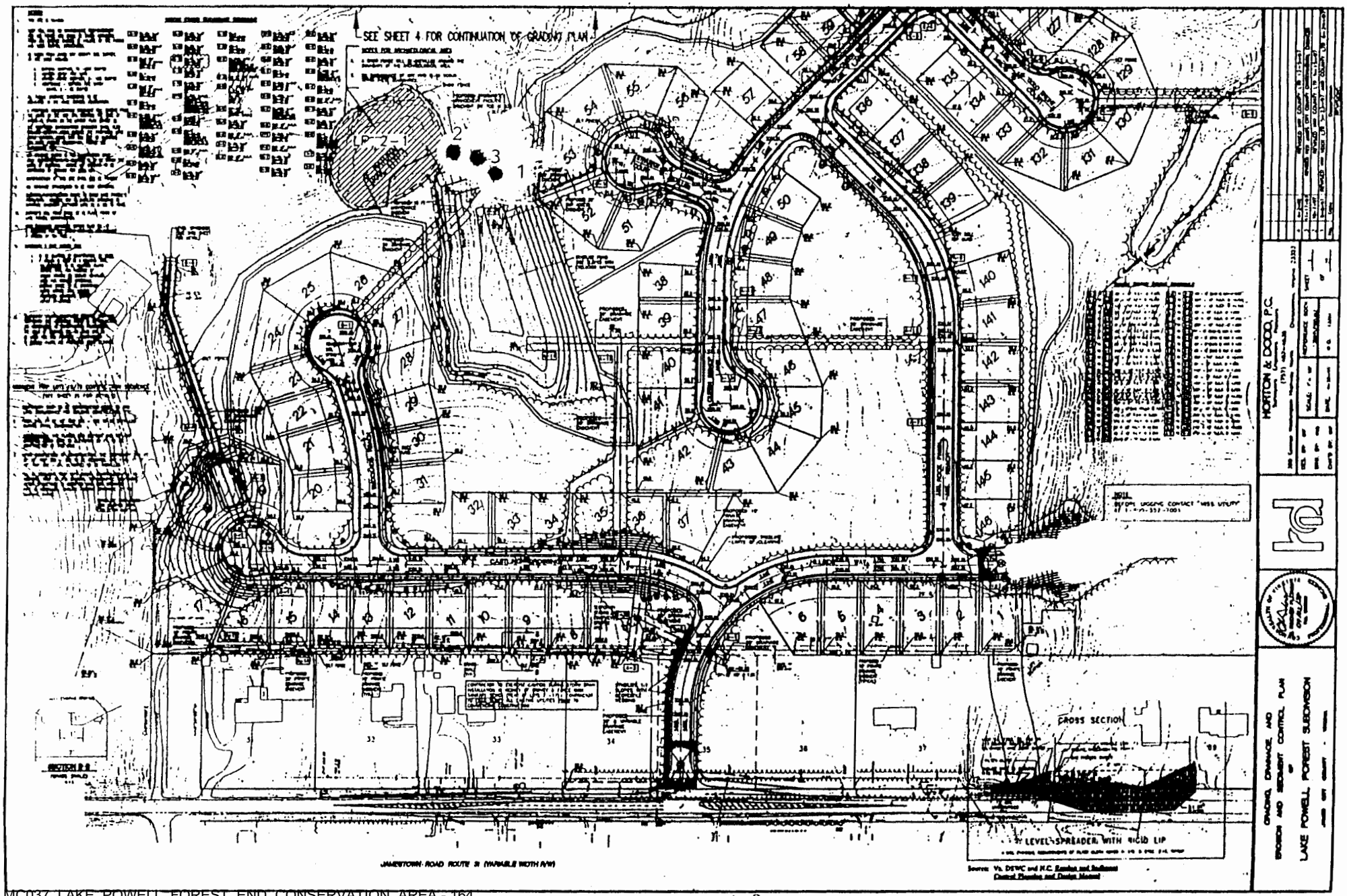
COMMONWEALTH OF VIRGINIA
DOUGLAS S. KINLOCH
No. 7980
CERTIFIED PROFESSIONAL ENGINEER

AUG 14 1998

cc: Horton & Dodd, P.C.

1808 HAYWARD AVENUE P.O. BOX 13337 CHESAPEAKE, VIRGINIA 23325-0337
TELEPHONE (757)420-2520 FAX(757)424-2874

● Compaction Test Locations - 7/8/98



McCALLUM
TESTING LABORATORIES INC.
Subsurface Exploration • Geotechnical Engineering

July 16, 1998

Boyd Corporation
396 S. Witchduck Road
Virginia Beach, VA 23462

Compaction Testing - 7/13/98
Durfey's Mill
James City County, Virginia
MTL Project 975657

Attention: Murden Clayton Temple, II

Dear Mr. Temple:

On this date, our technician, Tom Harman, was on site to perform compaction testing of the dam core for the above referenced project. All tests were performed according to the procedures outlined by ASTM D 2922.

TEST NO.	1	2	3	4	5	6
PROBE DEPTH (IN.)	10	10	10	10		
MEASURED MOISTURE (%)	14.6	14.7	15.2	17.5		
OPTIMUM MOISTURE (%)*	14.3	14.3	14.3	14.3		
MEASURED DRY DENSITY (PCF)	105.3	105.3	109.9	105.3		
MAXIMUM DRY DENSITY (PCF)*	110.8	110.8	110.8	110.8		
MEASURED COMPACTION (%)	95.0	95.0	99.2	95.0		
MIN. REQUIRED COMPACTION (%)	95.0	95.0	95.0	95.0		

TEST LOCATIONS

1. Lift #21, Dam #2 at the South End
2. Lift #22, Dam #2 at the South End
3. Lift #21, Dam #2 at the North End
4. Lift #22, Dam #2 at the North End
5.
6.

*ASTM D 698

McCALLUM TESTING LABORATORIES, INC.

Philip S. Berman
Director of Operations

Douglas S. Kinloch, P.E.
Chief Engineer

JUL 17 1998

cc: Horton & Dodd, P.C.

1808 HAYWARD AVENUE P.O. BOX 13337 CHESAPEAKE, VIRGINIA 23325-0337
TELEPHONE (757)420-2520 FAX(757)424-2874

McCALLUM
TESTING LABORATORIES INC.
Subsurface Exploration • Geotechnical Engineering

December 19, 1997

MC 037
S-20-97
LAKE POWELL
~~POWELL~~ FOREST

Boyd Corporation
396 South Witchduck Road, Suite 200
Virginia Beach, Virginia 23462

Attention: **Murden Clayton Temple, II**

Subject: **SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING**
Durfey's Mill Dams
James City County, Virginia
MTL Project #97-5657

Dear **Mr. Temple**:

McCALLUM TESTING LABORATORIES, INC. is pleased to present this report of subsurface exploration and geotechnical engineering services for the above referenced project. Included in this report are:

1. A brief description of the project;
2. An outline of the services performed;
3. A description of the subsurface conditions encountered; and
4. Our detailed recommendations for the design and construction of the earth dams.

PROJECT INFORMATION

The site for the proposed Durfey's Mill subdivision is located on the east side of Jamestown Road (Route 31), directly north of Lake Powell, in James City County, Virginia. Two ponds, Durfey's Mill Pond and Lake Powell Pond, are to be constructed within the subdivision by building dams across ravines. It is planned to use the upper material that is stripped for the construction of the planned roadways to construct the dams.

The dams are expected to be no more than 10 to 12 ft. in height, 100 ft. wide and approximately 140 ft. long. The project drawings indicate that the dams are to be constructed with a clay core that extends at least 1 ft. deep beneath the bottom of the dam. The embankment slopes are to be constructed at 3(H):1(V). Piping will be installed through the dam to help limit the maximum water level on the upstream side of the dam.

1808 HAYWARD AVENUE P.O. BOX 13337 CHESAPEAKE, VIRGINIA 23325-0337
TELEPHONE (757)420-2520 FAX(757)424-2874

McCallum Testing Laboratories, Inc. previously drilled 35 soil test borings and performed 35 laboratory soil analyses on the upper soils to provide information for the design of the planned roadways (See MTL Project #97-5143). The results of the testing from the previous exploration were reviewed for the preparation of this report.

SCOPE OF SERVICES

The evaluation of the site for the planned dams required both the collection of subsurface data and the performance of various geotechnical analyses. These analyses were based on our experience with local conditions and site preparation methods. All work was directed and supervised by a Professional Engineer specializing in geotechnical design and construction. This written report which describes the exploration and provides our recommendations for site preparation and the design and construction of the earth dams was prepared after reviewing the project information provided to us and analyzing the subsurface data collected for the project.

McCallum Testing Laboratories, Inc. drilled a total of six soil test borings (three at each proposed dam location) extending to depths of 35.5 ft. each beneath the existing ground surface. Standard Penetration Tests (SPT's) were performed at 2 ft. intervals in the upper 10 ft. of boring and at 5 ft. intervals below 10 ft. All drilling and sampling was performed in accordance with applicable ASTM Standards. At the completion of drilling, water level measurements were made within the completed bore holes. All samples obtained from the borings were visually examined by a Geotechnical Engineer and visually classified according to the Unified Soils Classification System.

Boring Location Plans and the detailed results of field sampling and testing for this project are presented in Appendix A. A Boring Location Plan and the results of the field and laboratory testing performed for the previous exploration are included in Appendix B.

MC037_LAKE_POWELL_FOREST_END_CONSERVATION_AREA - 167

SUBSURFACE CONDITIONS

Stratigraphy

Directly beneath the ground surface, the borings encountered Coastal Plain Sediments. A summarization of the subsurface conditions encountered is presented in the following tabulation:

STRATUM	AVERAGE DEPTH (FT)	DESCRIPTION	STANDARD PENETRATION RESISTANCE (BLOWS/FT)
1	0.0 - 12.8	Very loose to medium compact, wet, gray and brown, silty, clayey, fine to medium sand (SM, SC, SP-SM) and medium stiff, wet, gray, silty, fine sandy clay (CL, CH)	3 to 23
2	12.8 - 35.5*	Medium compact to compact, wet, brown to gray, silty, fine to medium sand (SM, SC)	11 to 54

* Maximum Depth of Exploration

Groundwater

Our water level measurements made at the completion of drilling operations indicated the level of groundwater to be approximately 1 to 2 ft. below the existing ground surface. Seasonal groundwater level fluctuations on the order of 2 to 3 ft. are not uncommon in this area. Maximum levels normally occur in late winter and early spring while minimum levels normally occur in late summer and early fall. At the time of our exploration program, we expect groundwater levels were approaching their seasonal high elevations.

POWELL_FOREST_END_CONSERVATION_AREA - 168

RECOMMENDATIONS

Basis

The following recommendations are based on data obtained by this subsurface exploration program, the structural and site orientation data given previously and our past experience within the area. If the project information presented is incorrect or changed in the final design or if site or subsurface conditions encountered during construction differ appreciably from those indicated by this report, this office should be notified to determine the applicability of our recommendations in light of the changed conditions.

Site Preparation

Initially, areas planned to support dam embankments should be stripped of all surface vegetation and topsoil. Stripping should extend at least 10 feet beyond proposed embankment toe lines. At this time, care must be taken to remove all excessively loose and soft soils and all organic materials from beneath the proposed embankments. In the streambed areas, control of groundwater and diversion of surface water will be required to permit the site preparation work to be properly accomplished.

Fill and Compaction

After the successful completion of site preparation operations, fill require to reach finished subgrade elevations can be placed. Embankment fills should be placed in essentially horizontal layers starting with the lowest areas first. General embankment fill should be classified as SM, SC or CL by the Unified Soils Classification System, with at least 35 percent passing the No. 200 sieve. The clay core should be constructed with fill classified as CL having at least 50 percent passing the No. 200 Sieve.

LAKE_POWELL_FOREST_END_CONSERVATION_AREA - 169

Based on the results of previously performed laboratory analyses on the upper soils located within the planned roadway areas, it appears that the majority of the material will be suitable for general embankment fill. The upper soils located at CBR locations CBR-7 through CBR-9, CBR-15, CBR-16 and CBR-20 through CBR-26 meet the requirements for the clay core fill. Due to the variability of the upper soils, it may not be possible to separate the clay core fill from the more sandy material present at the majority of the site. As such, Imported fill for the clay core may be required. All fill materials proposed for use should be tested and approved by the Geotechnical Engineer prior to its placement on site.

All fill placed for the proposed embankments should be compacted in loose lifts of 8 inches or less to a minimum of 95 percent of its maximum dry density as determined by the procedures outlined in ASTM D 698. In the area of the spillway piping, care must be taken to confirm proper compaction is obtained above, below and beside the pipe. Small or hand-held compaction equipment should be utilized to help prevent pipe damage.

Slope Stability

Our calculations indicate that upstream and downstream dam slopes of 3 horizontal to 1 vertical with a minimum crest width of 20 ft. will provide an adequate factor of safety against an embankment slope failure. Our calculations assume the removal of the excessively soft materials from the streambed, and the proper compaction of the recommended fill materials.

Settlement

The weight of the new embankment fills over the existing ground surface can cause a general embankment settlement. Based on the subsurface conditions encountered in our borings, we expect total settlements can be on the order of 1 to 2 inches. Essentially all settlement should have occurred by the completion of the embankment construction. We expect this magnitude and rate of settlement will be tolerable.

MC037_LAKE_POWELL_FOREST_END_CONSERVATION_AREA - 170

Since through embankment piping will likely be installed prior to completion of embankment construction, the piping should be sufficiently flexible to tolerate the anticipated differential movement across the embankment section. Maximum settlements will generally occur at the center of the new embankment section. Minimum settlements will occur at the upstream and downstream embankment toes.

Seepage

A detailed seepage analysis was not performed for this project. However, due to the relatively pervious foundation soils to be located beneath the dam, piping could occur beneath the dam resulting in soil erosion at the toe of the downstream embankment. We recommend that the dam be inspected regularly after construction is completed and lake filling occurs. If seepage is observed at the toe of the downstream embankment, a properly filtered toe drain should be installed. In addition, anti-seep collars should be installed on all piping running through the dam to help prevent the development of seepage channels along the surface of the through-dam piping.

Should you have any questions concerning this report, please do not hesitate to contact this office at your earliest convenience.

Very truly yours,

McCALLUM TESTING LABORATORIES, INC.

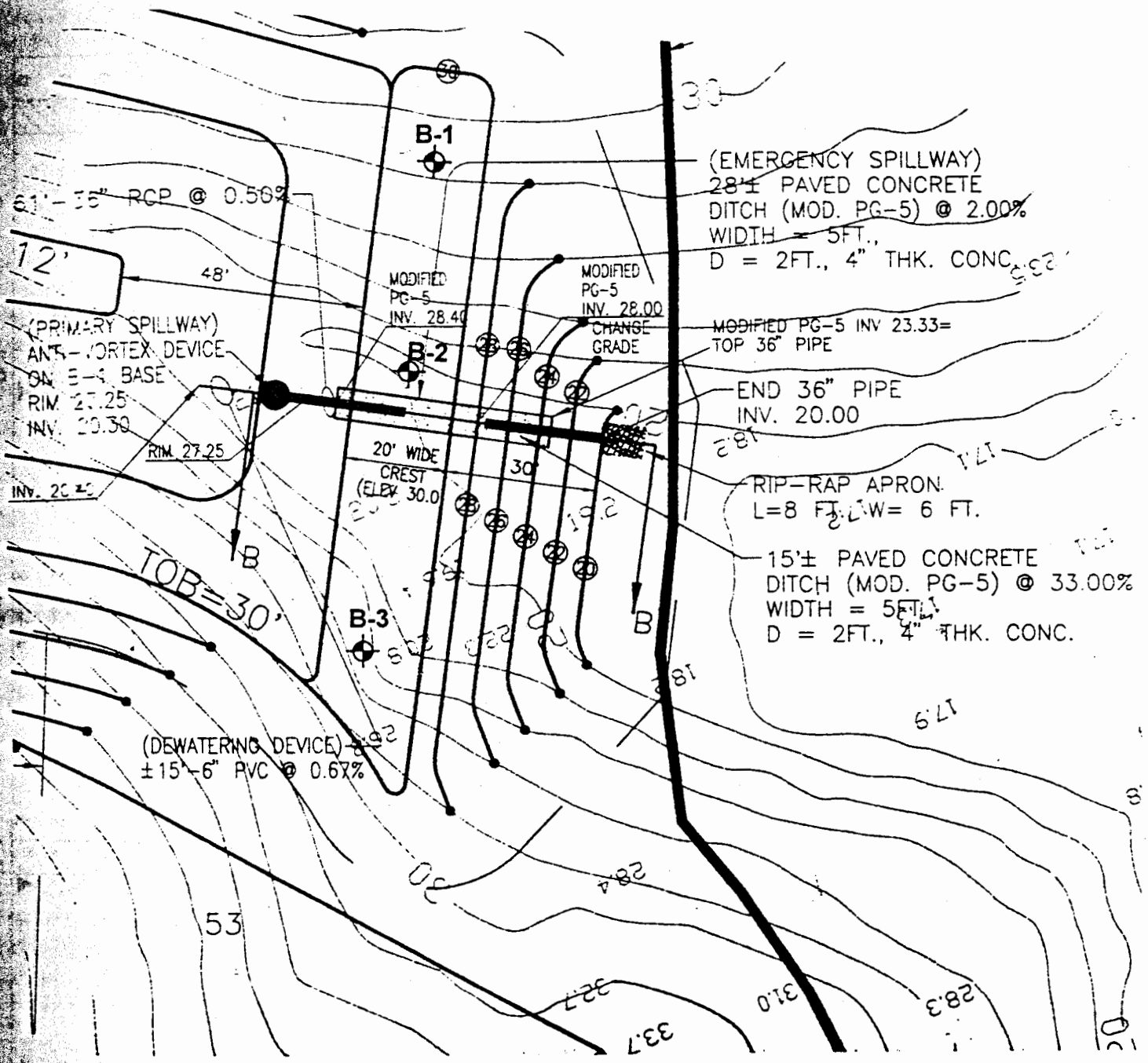
COMMONWEALTH OF VIRGINIA
DOUGLAS S. KINLOCH
No. 7960
CERTIFIED PROFESSIONAL ENGINEER

SCOTT A. DEESE, E.I.T.
GEOTECHNICAL ENGINEER

DOUGLAS S. KINLOCH, P.E.
CHIEF ENGINEER

cc: Horton & Dodd, P.C. / J. Gregory Dodd, P.E.

MG037_LAKE_POWELL_FOREST_END_CONSERVATION_AREA - 171

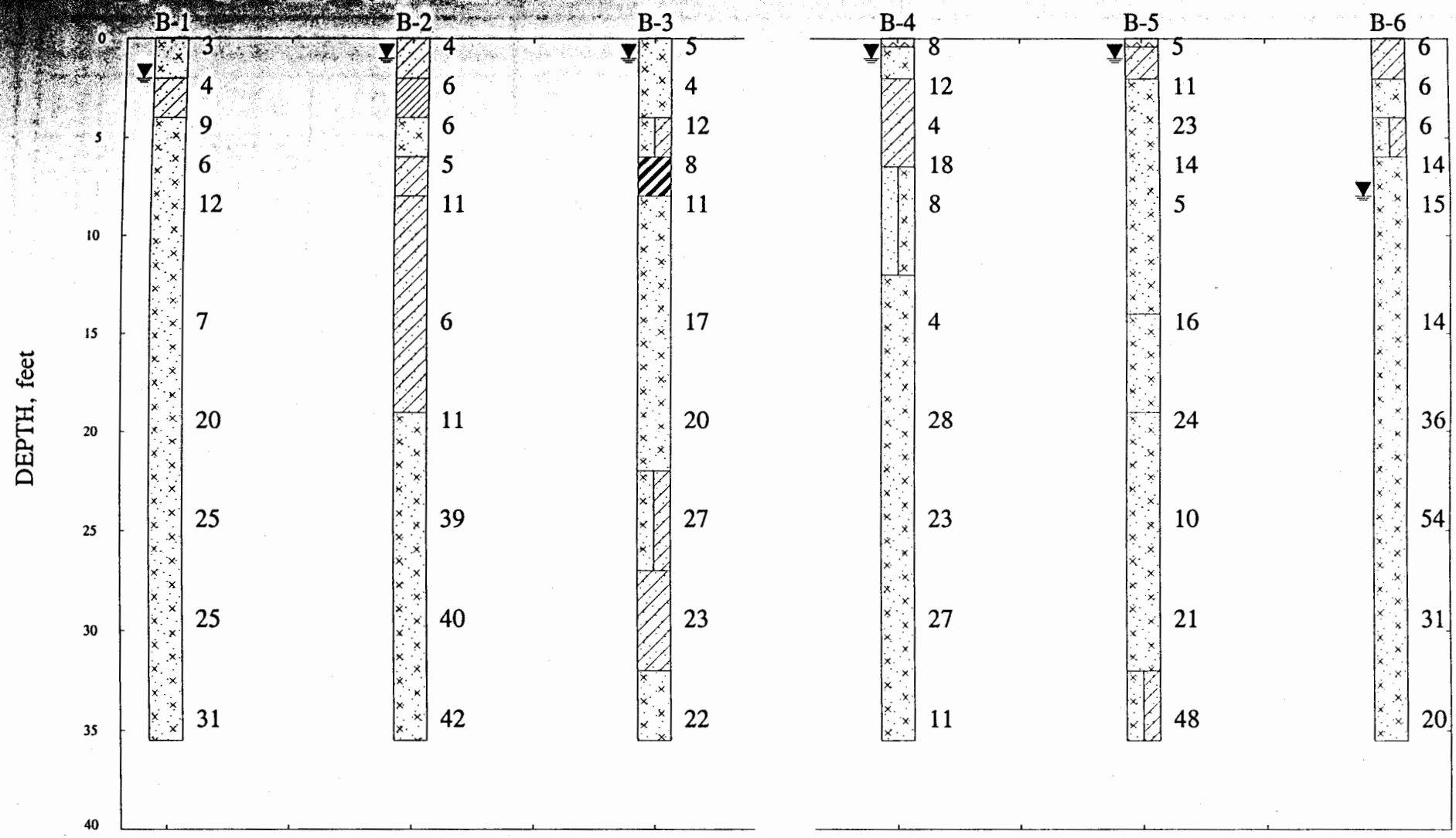


Ref: Original plan prepared by Horton & Dodd, P.C.

McCALLUM TESTING LABORATORIES, INC.

1808 Hayward Avenue
Chesapeake, Virginia 23325-0337

Scale:	≈ 1" = 30'	Approved By:	Douglas S. Kinloch, P.E.	Date:	12/19/97
Project:	Durfey's Mill Dams Lake Powell Forest Pond James City County, Virginia				
Drawing Title:	Boring Location Plan			Drawing Number:	2-97-5657



Subsurface Profile

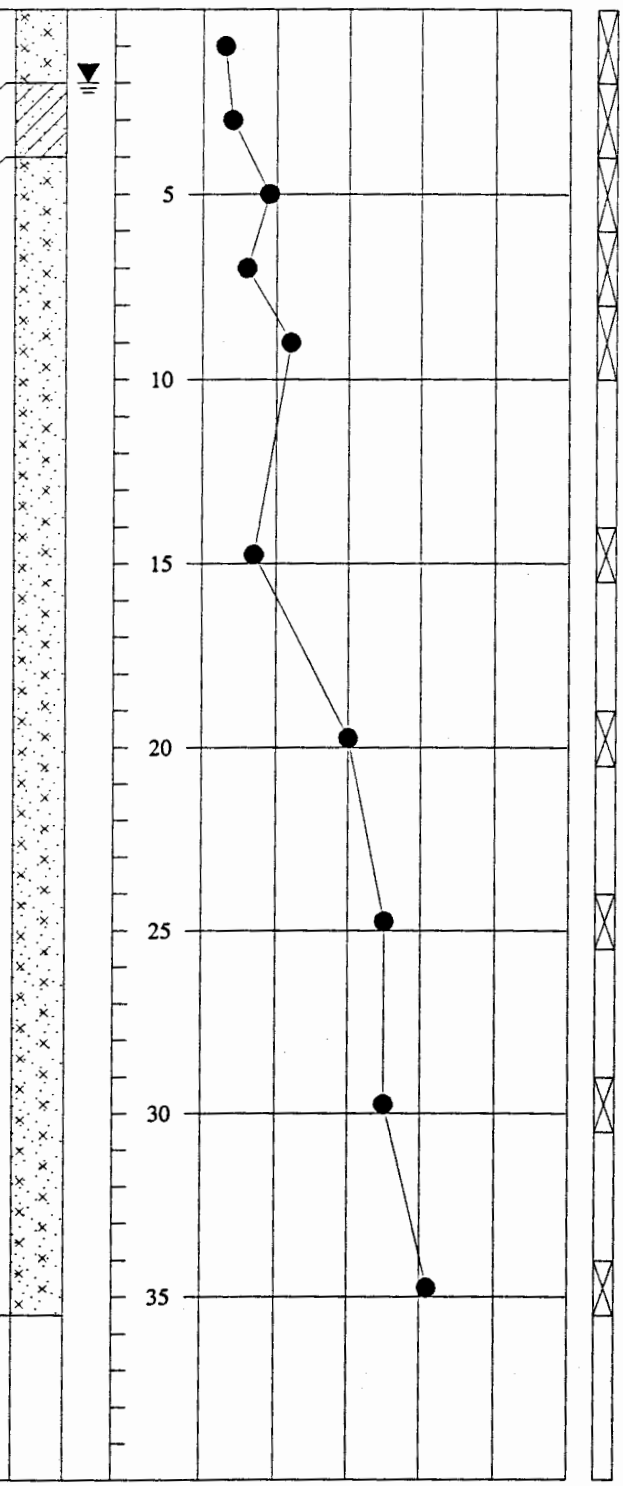
Drawing 3

PROJECT Durfey's Mill Dams

PROJECT NO. 97-5657

McCALLUM TESTING LABORATORIES, INC.

DEPTH (FT.)	DESCRIPTION	STANDARD PENETRATION RESISTANCE (BLOWS/6 IN)
0.0		
	Brown, silty fine to medium sand with traces of clay and root matter, moist, very loose, SM	2-1-2-2
2.0		
	Grey mottled brown, silty clayey fine sand with traces of gravel, shell fragments and organics, wet, very loose, SC	3-2-2-3
4.0		
	Brown, silty fine sand with traces of shell fragments, wet, loose, SM	2-4-5-5
	Same	4-3-3-5
	Same - with traces of fine gravel, medium compact	6-5-7-7
	Same - loose	5-4-3
	Same - no gravel, medium compact	8-9-11
	Same - grey, silty fine sand, no shell fragments	13-16-9
	Same - with traces of shell fragments	14-13-12
35.5	Same - with traces of coarse sand	9-14-17
	Boring Terminated 35.5 ft.	



NOTES:

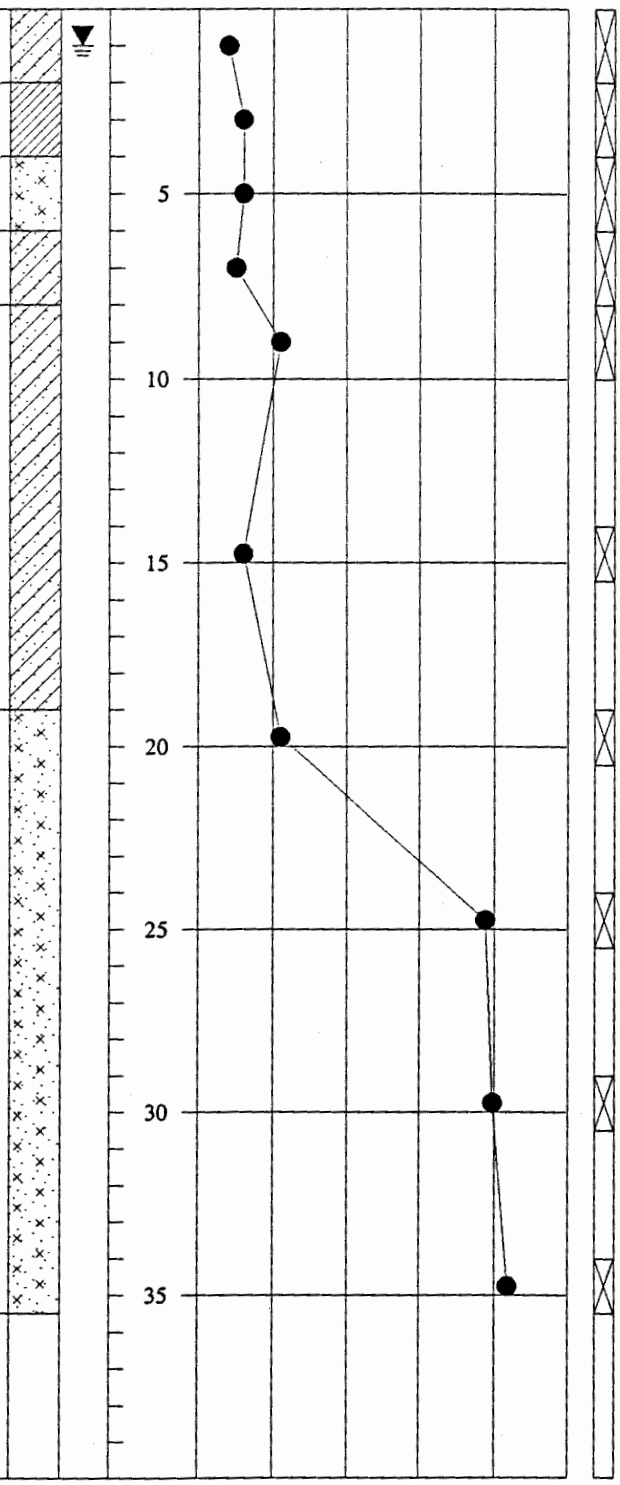
- Gradual Stratum Change
- Approximate Stratum Change
- Penetration Resistance (N - value)
- Standard Penetration Test
- Undisturbed Sample
- Water Table at Time of Boring
- 24 Hour Water Table Reading

TEST BORING RECORD

BORING NUMBER	B-1
DATE DRILLED	December 11, 1997
PROJECT NUMBER	97-5657
PROJECT	Durfey's Mill Dams
LOCATION	James City County, Virginia

McCALLUM TESTING LABORATORIES, INC.

DEPTH (FT.)	DESCRIPTION
0.0	
	Greyish-brown, silty clayey fine to coarse sand with traces of coarse sand, wet, medium compact, SC
2.0	
	Greyish-brown, silty fine sandy clay with traces of root matter, wet, medium compact, CL
4.0	
	Greyish-brown, silty fine sand, wet, loose, SM
6.0	
	Greyish-brown, silty clayey fine sand, wet, loose, SC
8.0	
	Brown, clayey, silty fine sand with traces of shell fragments, wet, medium compact, SC
	Same - brown mottled grey, loose
19.0	
	Brown, silty fine sand with traces of coarse sand and shell fragments, wet, medium compact, SM
	Same - grey, no coarse sand, compact
	Same
35.5	Same - with traces of coarse sand
	Boring Terminated at 35.5 ft.



NOTES:

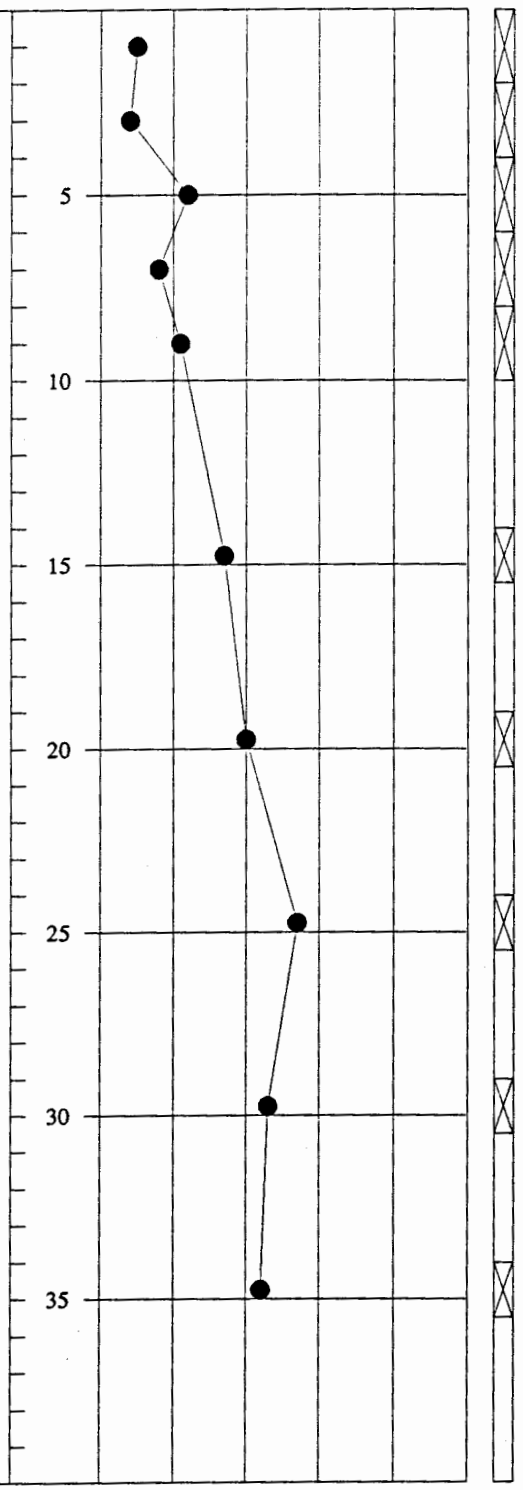
- Gradual Stratum Change
- Approximate Stratum Change
- Penetration Resistance (N - value)
- Standard Penetration Test
- Undisturbed Sample
- Water Table at Time of Boring
- 24 Hour Water Table Reading

TEST BORING RECORD

BORING NUMBER	B-2
DATE DRILLED	December 11, 1997
PROJECT NUMBER	97-5657
PROJECT	Durfey's Mill Dams
LOCATION	James City County, Virginia

McCALLUM TESTING LABORATORIES, INC.

DEPTH (FT.)	DESCRIPTION
0.0	Brown, silty fine to medium sand with traces of coarse sand, clay and root matter, wet, loose, SM
	Same
4.0	Brown, clayey silty fine sand with traces of coarse sand and shell fragments, wet, medium compact, SM-SC
6.0	Brown mottled grey, silty fine sandy clay, wet, medium stiff, CH
8.0	Brown, silty fine sand with traces of shell fragments and gravel, wet, medium compact, SM
	Same
	Same
22.0	Brown, clayey silty fine sand with traces of coarse sand and shell fragments, wet, medium compact, SM-SC
27.0	Dark greyish-brown, silty clayey fine to medium sand, wet, medium compact, SC
32.0	Grey mottled brown, silty fine sand with traces of shell fragments, wet, medium compact, SM
35.5	Boring Terminated at 35.5 ft.



NOTES:

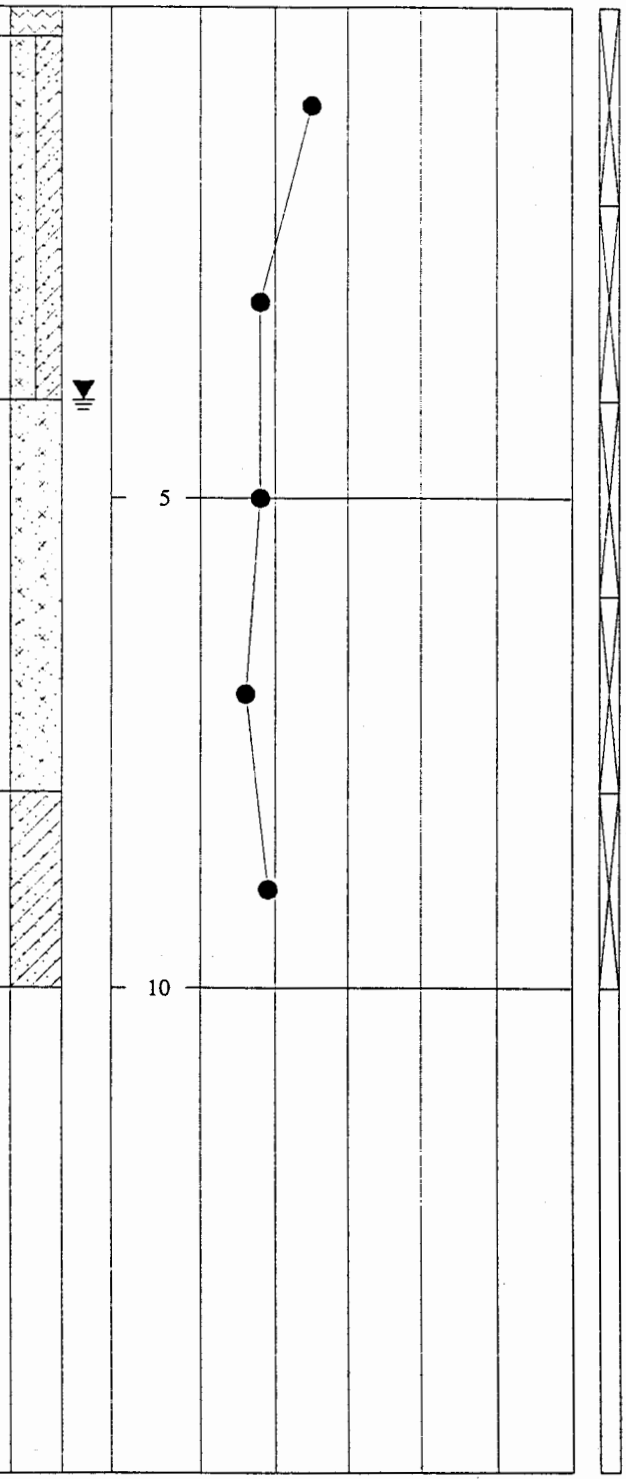
- Gradual Stratum Change
- Approximate Stratum Change
- Penetration Resistance (N - value)
- Standard Penetration Test
- Undisturbed Sample
- Water Table at Time of Boring
- 24 Hour Water Table Reading

TEST BORING RECORD

BORING NUMBER	B-3
DATE DRILLED	December 11, 1997
PROJECT NUMBER	97-5657
PROJECT	Durfey's Mill Dams
LOCATION	James City County, Virginia

McCALLUM TESTING LABORATORIES, INC.

DEPTH (FT.)	DESCRIPTION	STANDARD PENETRATION RESISTANCE (BLOWS/6 IN)
0.0		
0.3	Topsoil 4"	
	Reddish brown, clayey silty fine to medium sand, moist, medium compact, SM-SC	6-7-8-8
	Same - Brown mottled gray, loose	7-4-4-6
4.0		
	Brown, silty fine sand, wet, loose, SM	5-4-4-3
	Same	3-3-3-2
8.0		
	Brown, silty fine sandy clay, wet, loose, SC	4-4-5-4
10.0		
	Boring terminated at 10 feet.	



NOTES: *Boring taken at Location CBR-1.*

- Gradual Stratum Change
- Approximate Stratum Change
- Penetration Resistance (N - value)
- Standard Penetration Test
- Undisturbed Sample
- Water Table at Time of Boring
- 24 Hour Water Table Reading

TEST BORING RECORD

BORING NUMBER	B-1
DATE DRILLED	May 8, 1997
PROJECT NUMBER	97-5143
PROJECT	Proposed Development-Durfey's Mill
LOCATION	James City County, Virginia

McCALLUM TESTING LABORATORIES, INC.

DEPTH (FT.)	DESCRIPTION	STANDARD PENETRATION RESISTA (BLOWS/FT) 0 10 20 30 40 50	(BLOWS/6
0.0			
0.2	Topsoil 1.5"		
	Light brown, silty fine to medium sand with traces of clay, coarse sand and gravel, moist, loose, SM		3-3-4-5
2.0			
	Light brown, silty fine to coarse sand with traces of gravel, moist, medium compact, SP-SM		8-8-6-5
4.0			
	Reddish brown, clayey silty fine to medium sand, moist, medium compact, SM-SC	5	5-7-8-8
6.0			
	Reddish brown, silty fine to medium sandy clay, moist, stiff, CL		8-6-8-7
	Same - Very stiff		9-8-8-8
10.0		10	
	Boring terminated at 10 feet.		

NOTES: *Boring taken at Location CBR-2. Groundwater was not encountered at time of drilling.*

- Gradual Stratum Change
- Approximate Stratum Change
- Penetration Resistance (N - value)
- Standard Penetration Test
- Undisturbed Sample
- Water Table at Time of Boring
- 24 Hour Water Table Reading

TEST BORING RECORD

BORING NUMBER	B-2
DATE DRILLED	May 8, 1997
PROJECT NUMBER	97-5143
PROJECT	Proposed Development-Durfey's Mill
LOCATION	James City County, Virginia

McCALLUM TESTING LABORATORIES, INC.

DEPTH (FT.)	DESCRIPTION	STANDARD PENETRATION RESISTA (BLOWS/FT) 0 10 20 30 40 50	(BLOWS/6 I
0.0			
0.2	Topsoil 2"		
	Brown, silty clayey fine to medium sand, moist, medium compact, SC		12-6-7-7
	Same - Gray mottled brown		5-6-8-11
	Same - Grayish brown, with coarse sand	5	11-13-15-16
	Same		10-9-7-9
	Same - Brown mottled gray, with traces of gravel		17-13-15-14
10.0		10	
	Boring terminated at 10 feet.		

NOTES: *Boring taken at Location CBR-3. Groundwater was not encountered at time of drilling.*

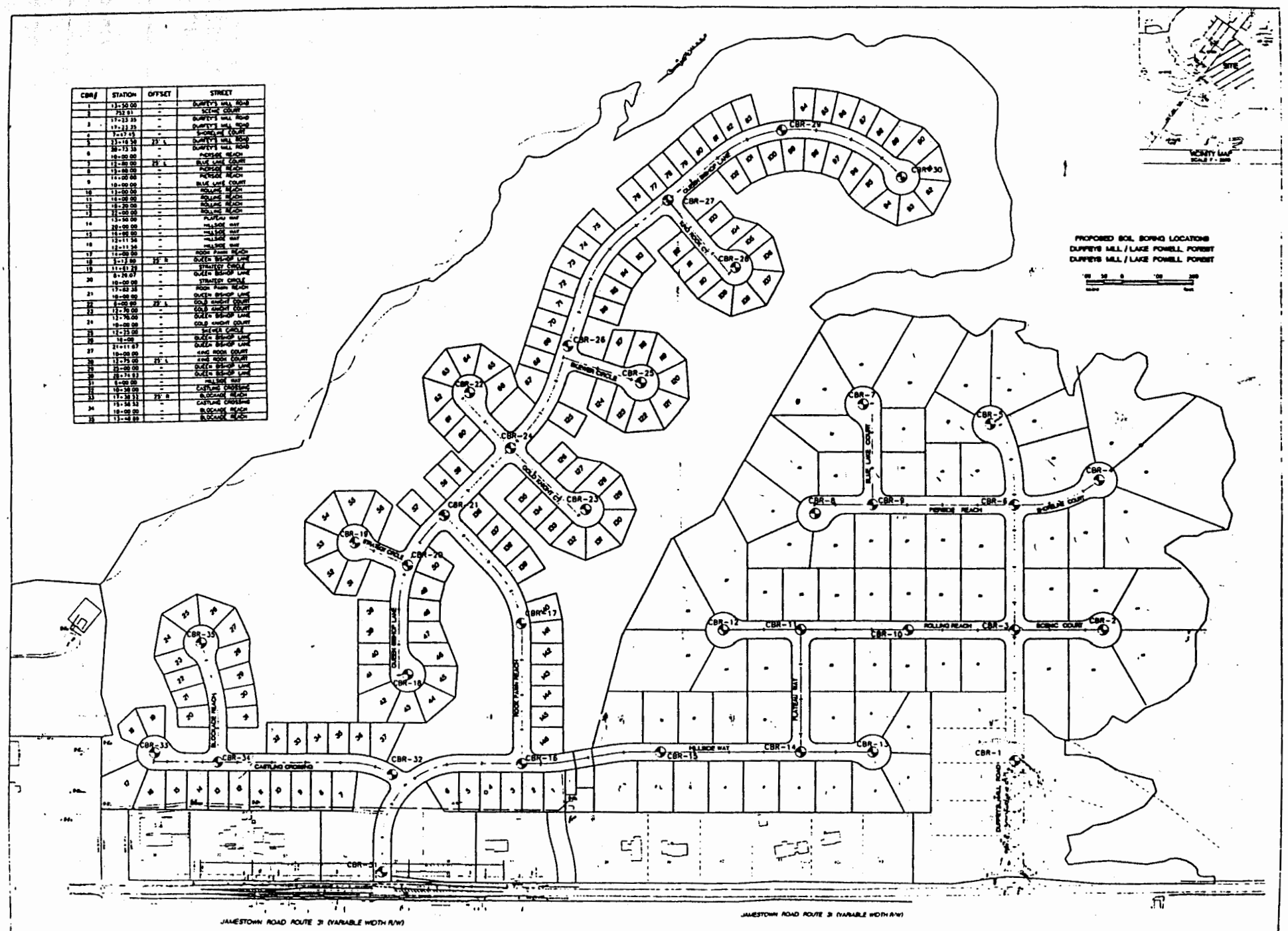
- Gradual Stratum Change
- Approximate Stratum Change
- Penetration Resistance (N - value)
- Standard Penetration Test
- Undisturbed Sample
- Water Table at Time of Boring
- 24 Hour Water Table Reading

TEST BORING RECORD

BORING NUMBER	B-3
DATE DRILLED	May 8, 1997
PROJECT NUMBER	97-5143
PROJECT	Proposed Development-Durfey's Mill
LOCATION	James City County, Virginia

McCALLUM TESTING LABORATORIES, INC.

CBR#	STATION	OFFSET	STREET
1	13+50.00	-	DUFFEY'S MILL ROAD
2	752.81	-	SCENIC COURT
3	17+23.35	-	DUFFEY'S MILL ROAD
	17+23.35	-	DUFFEY'S MILL ROAD
4	7+67.45	-	SCENIC COURT
5	23+16.50	25' L	DUFFEY'S MILL ROAD
6	30+73.35	-	DUFFEY'S MILL ROAD
	10+00.00	-	PIONEER REACH
7	12+80.00	25' L	BLUE LAKE COURT
8	15+00.00	-	PIONEER REACH
	14+00.00	-	PIONEER REACH
9	10+00.00	-	BLUE LAKE COURT
10	13+00.00	-	ROLLING REACH
11	16+00.00	-	ROLLING REACH
12	19+20.00	-	ROLLING REACH
13	22+00.00	-	ROLLING REACH
14	13+50.00	-	PLATEAU WAY
	20+00.00	-	HILLSIDE WAY
15	16+00.00	-	HILLSIDE WAY
16	12+11.56	-	HILLSIDE WAY
	12+11.56	-	HILLSIDE WAY
17	16+00.00	-	ROCK FARM REACH
18	5+12.50	25' R	QUEEN BISHOP LANE
19	11+61.29	-	STRATEGY CIRCLE
20	6+70.07	-	QUEEN BISHOP LANE
	10+00.00	-	STRATEGY CIRCLE
21	17+83.38	-	ROCK FARM REACH
	10+00.00	-	QUEEN BISHOP LANE
22	6+00.00	25' L	COLD KNIGHT COURT
23	12+70.00	-	COLD KNIGHT COURT
24	13+70.00	-	QUEEN BISHOP LANE
	10+00.00	-	COLD KNIGHT COURT
25	12+23.00	-	SUCHER CIRCLE
26	10+00	-	QUEEN BISHOP LANE
27	21+11.63	-	QUEEN BISHOP LANE
	10+00.00	-	KING ROOK COURT
28	12+75.00	25' L	KING ROOK COURT
29	23+00.00	-	QUEEN BISHOP LANE
30	28+74.83	-	QUEEN BISHOP LANE
31	6+00.00	-	HILLSIDE WAY
32	10+38.00	-	CASTLING CROSSING
33	17+38.33	25' R	BLOCKADE REACH
34	15+38.33	-	CASTLING CROSSING
	10+00.00	-	BLOCKADE REACH
35	13+48.89	-	BLOCKADE REACH



HORTON & DODD, P.C.

LAKE POWELL FOREST

1/22/98

Per Conversation w/ Beverly Goodman

- No agmt is needed if embankment is not used as a dam - only has a culvert under the road.

Darryl Cook

Mrs Adsit -

1) Drawing Lake Down

2) How is weir attached

3) How is it opened - slowly - all @ once

- ever been any problems?

LAKE
POWELL
FOREST

5-39-97

(SWM PLAN)

BMP
ID
CODE: MC037

DEVELOPMENT MANAGEMENT

101-E MOUNTS BAY ROAD, P.O. BOX 8784, WILLIAMSBURG, VIRGINIA 23187-8784
(757) 253-6671 Fax: (757) 259-4032 E-MAIL: devtman@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
MOSQUITO CONTROL (757) 259-4116

October 30, 2006

Mr. J. Gregory Dodd, P.E.
Horton & Dodd, P.C.
300 George Washington Highway North
Chesapeake, Va. 23323

Re: Lake Powell Forest
Wet Pond BMP # 2
County Plan No. S-39-97
County BMP ID Code: MC 037

Dear Mr. Dodd:

The Environmental Division is in receipt of your written request dated October 9, 2006 to amend the approved site plan to eliminate the clay or plastic liner from El. 17 to El. 25 and also to waive construction certification requirements for the above referenced BMP facility. The BMP for the project is a 9-point wet pond BMP which services about 38 acres within **Lake Powell Forest**.

Request to Waive Liner

Based on our field inspection of the BMP and a full review of the active file, approved design plan, onsite and offsite adjacent land uses and testing information as provided, it has been determined that for ***this specific review case only***, the liner requirement can be waived. Reasons to support this request include that the pond has maintained a wet pool since it's construction and it does not appear that a liner between El. 17 and El. 25 is necessary to maintain a permanent pool.

Request to Waive Construction Certification

For this specific project, Note # 18 on Sheet 23 of the approved plan set indicated that construction certification of the BMP was required. As this note was present on the approved plans and specifications, it was responsibility of the Owner or Contractor to ensure a professional engineer was present during the construction process to observe construction and to provide proper construction certification once the structure was completed.

Although recently, we have strengthened and provided better definition to the record drawing (as-built) and construction certification process for stormwater management facilities, the requirement for construction certification by a registered professional engineer has not changed since review and approval of this plan.

In full consideration of your request, there appears to be adequate documentation to substantiate that testing was performed on the dam during it's construction; however, there was an apparent failure by the Owner or Contractor to properly retain the services of a professional engineer to provide subsequent construction certification. The basis of the variance request is that testing was performed and that the BMP has functioned adequately during major rainstorm events in 1999 and most recently during September and October of 2006.

Based on our field inspection of the BMP and a full review of the active file, approved design plan, onsite and offsite adjacent land uses and testing information as provided submitted, it has been determined that for ***this specific review case only***, the construction certification requirement will be waived. The primary reasons for granting a waiver for this case are outlined as follows.

- It appears that adequate and proper geotechnical testing was performed during construction of the dam embankment (McCallum Testing Laboratories Inc., March 2000).
- The dam embankment has not exhibited any unusual signs of seepage, stress, malfunction or failure since it's completion, even during Hurricanes Floyd and Isabel and most recently Tropical Storm Ernesto and the Nor'Easter on October 6, 2006. The basin appears to fill and draw down per the intended design.
- Overall, there are no obvious signs indicating threatening conditions to the stormwater function or structural integrity of the stormwater management facility.
- The facility appears to have been reasonably maintained by the Developer/Contractor since completion.
- Recent field-related punch list items as outlined by our Division were completed in a satisfactory manner.

In the meantime, our office will proceed with release of the erosion and sediment control surety in accordance with our usual administrative process. It should be realized that granting of variances of this nature are seldom performed by our Division. Lack of knowledge about the process or overlooking items that are clearly delineated on approved plans are not normally justification to grant a variance. For this specific case, many factors and the overall history and general function of the facility were weighed into the decision.

If you have any additional questions or comments, you can contact me at 253-6639 or the assigned Environmental Division inspector, Mr. Greg Johnson at 757-253-6683. Thank you for your consideration on this matter.

Sincerely,

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

Attachments
SJT/sjt

cc: Greg Johnson (email)
Mike Babashanian (via email)

Asbuilts\Variances\S3997.mc037

HORTON & DODD, P.C.
Surveyors • Engineers • Planners

300 George Washington Highway N.
Chesapeake, Virginia 23323

757/487-4535
FAX-487-9788

John G. Horton, L.S.
J. Gregory Dodd, M.E., P.E.

October 9, 2006

RECEIVED
OCT 10
ENVIRONMENTAL DIVISION

Mr. Scott J. Thomas
James City County
Environmental Division
101-E Mounts Bay Road
P. O. Box 8784
Williamsburg, VA 23187-8784

Re: Lake Powell Forest County Plan No. S-39-97
Stormwater Management/BMP Facility (MC 037) and
Lake Powell Pointe (formerly Durfey's Mill) County Plan No. S-20-97
Stormwater Management/BMP Facility (MC-036)

Dear Mr. Thomas:

Attached please find one reproducible and one black line set of the record drawings for each of the Stormwater Management/BMP Facilities (MC 037) and (MC 036). The record drawings for each of the BMP Facilities has been revised to show the additional information requested by each of your October 25, 2000 letters to this office.

Also, please accept this letter as a request to accept the referenced Stormwater Management BMP Facilities as being a substantial conformance to the plans without the certification from a Professional Engineer stating the dam (BMP) was "observed during construction." As you are aware, although compaction test reports at these sites were located and provided to you, no one can be located that actually "observed" construction of the dams.

Reasons for requesting acceptance without this certification are supported by the following:

1. Several major rain events have taken place (hurricanes) since the construction of the dams was completed. No damage to the dam structures and no overtopping of the dam crests occurred during these rain events. Most notably, hurricane Floyd in September 1999 completely washed out Jamestown Road and the dam holding back Lake Powell. The referenced dams encountered no damage. The northeaster that took place Friday and Saturday October 6, and 7, 2006 provided as much as 10 inches of rainfall. Observation of the dams Monday October 9 did not reveal any damage to the dams.

Sept 2
NOR'EASTER
OCT 6

2. On Thursday September 7, 2006 I inspected the dams with personnel from Boyd Corporation. The following observations were made: No evidence of erosion over the top of the dams, no evidence of erosion due to "piping" along the walls of the outfall barrels or sides of the emergency overflow weir, rip rap at the outfall barrel outlet/flume outlet was sound with no evidence of erosion, the valves in each of the BMP's dewatering devices were opened and closed to test their functionality (both work ok) debris and floatsum that had accumulated at the openings in the anti-vortex devices was removed, sapling trees that has begun to grow along the banks and the tops of the dams were cut and removed to eliminate the possibility the trees would eventually compromise the dam's integrity.

3. Table 1 of Virginia Impounding Structure Regulations, page 5, indicates each of these Stormwater BMP's can be classified as a Class IV Dam since no loss of life or economic loss to others would be expected if these dams are breached. Also, the impoundment for each is much less than 50 acre-feet. Part III, Certificate Requirements, paragraph G, p. 11 of the Virginia Impoundment Structure Regulations states that a Class IV structure will not require an operation and certificate.

Lastly, regarding the original plan requirement for a clay liner along the sides of each of the Stormwater Management BMP's, no liner was installed, nor is a liner required. As you are aware, liners are usually specified when it is desirable to retain a normal water surface for a wet pond when the pond is to be constructed over sandy, porous material and the natural water table is below the desired water elevation. If this situation has been the case at the location of these BMP's, the specified "lining of the sides only" would not have accomplished the desired end results. I can only assume the plan contained a "typo" or the design engineer (who no longer works at this office) was not fully aware of the purpose on the lining. Perhaps he was thinking the lining of the sides only would provide a form of armor to prevent erosion. In any case, as evidenced by the establishment of sustainable normal water levels in each BMP, the lining of the sides of the impoundment is not needed. We are requesting that this requirement be eliminated from the plans.

Please let me know if you require any further information prior to accepting the facilities as being in substantial conformance to the original approved plans.

Sincerely,

HORTON & DODD, P. C.

J. Gregory Dodd, P. E.

Scott Thomas

From: Scott Thomas
Sent: Monday, June 05, 2006 10:56 AM
To: 'gdodd@hdpc.net'
Subject: BMPs in James City County
Attachments: RDCCcov.pdf; RDCC.pdf

Attached in .pdf format is the County requirements for record drawings and construction certification for BMPs. The first file is the cover sheet, the second file is the main body of the document. If you choose to go the route to provide a post-construction certification, I will need pages 1 through 3 filled out.

I will also be faxing you my two letters dated October 25, 2000 as it pertains to the two BMPs in Lake Powell Forest and Lake Powell Pointe.

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

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

Scott Thomas

From: Scott Thomas
Sent: Monday, October 30, 2006 1:20 PM
To: 'gdodd@hdpc.net'; 'Mike Babashanian'
Cc: Greg Johnson
Subject: BMP at Lake Powell Forest (MC 037)
Attachments: S3997.mc037.pdf; BMP.map.jpg

Attached is the approval letter for the request to not construct the pond liner and to waive construction certification for Wet Pond # 2 (Lake Powell Forest). I will send a hard copy on letterhead to Greg Dodd.

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

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

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) 259-4116

October 25, 2000

Horton & Dodge, P.C.
300 George Washington Highway N.
Chesapeake, Va. 23323
Attn: Mr. Charles J. Bodnar, P.E.

Re: Lake Powell Pointe Subdivision (formerly Durfey's Mill)
County Plan No. S-20-97
Stormwater Management/BMP Facility (MC 036)

Dear Mr. Bodnar:

The Environmental Division has reviewed a record drawing as submitted to our office on September 5th 2000 for the above referenced project. The record drawing provides as-built information for two stormwater management/BMP wet pond facilities associated with development of Lake Powell Pointe (Wet Pond # 1) and Lake Powell Forest (Wet Pond # 2). For simplicity, you will receive separate correspondence relative to each of the facilities.

Based on our review of the drawing and a concurrent field observation, the following items must be addressed for the **Lake Powell Pointe** facility prior to release of the developer's surety instrument for the stormwater management/BMP facility:

Construction Certification:

1. In accordance with Note # 18 on Sheet 16 and Note # 1 on Sheet 20 of the approved plan, construction certification for the BMP is required. None was provided. Compaction test report summaries as provided for the dam fill and onsite storm drains supports, but does not fulfill the certification requirements of the facility.

Record Drawing:

2. Add applicable details from Sheet 17 of the approved design plan, annotated as necessary with construction information, to the record drawing set. These details show important information relative to wet pond # 1 for Lake Powell Pointe.

3. Show the following additional information on the record drawing: riser size, crest elevation and invert elevation; rectangular slot elevation and dimensions; invert and size of the pond drain; dimensions (width and depth) and controlling crest elevation of the PG-5 emergency spillway; outlet barrel pipe size, inverts and slope; and outlet protection type and dimensions.

4. Provide additional spot elevations along the top of dam crest at sufficient intervals. It is unclear if constructed top of dam crest elevation is at or above design elevation of 25.50 to maintain 1 foot of freeboard from the 100-year design high water elevation of 24.46.

5. Show construction data for the two primary storm drain inflows located north of the riser at Lots 27-41 and 47-48. Indicate pipe type, size, invert elevation and if outlet protection was provided.

6. Provide a north arrow on the record drawing plan sheet. Also, clarify what the dashed structure is just west of the outlet barrel and embankment area.

7. Note 3 on Sheet 20 of the approved design plan and plan sheet provided for the record drawing set indicates the contractor is to provide a clay or plastic liner from El. 10 to El. 26.5. Please expand further if this feature was constructed, is to be constructed and why the lower installation elevation of 10 does not represent design or constructed pond bottom grade.

8. If possible add the following County identifiers to the Lake Powell Pointe record plan view inset: County Plan Number S-20-97, BMP ID No. MC 036. Also, clearly provide large text reference as Lake Powell Pointe and Wet Pond # 1.

Construction-Related Items:

9. Bare soil areas are present on the downstream embankment and top of dam. Reseed and mulch as necessary.

10. Clear and remove trash, tires, woody debris and sediment at the base of the riser. The rectangular 0.75' x 1.0' slot provided to control the normal pool and discharge storm runoff was not visible at the riser and appears to be substantially blocked with trash, debris and sediment.

11. Clear and remove all trash and woody debris present along the upstream (north) embankment toe.

12. Fallen trees, branches and wood debris from site clearing operations are present along the western, back (north) and eastern shorelines. This material is detrimental to function of the facility and requires removal between the normal pool (El. 17) and design high water pool (El. 24.46).

13. The 18 inch storm drain inflow pipe at Lot 48 is 75 percent blocked at its pond outfall due to sediment deposition. Sediment at the pipe outfall area needs cleaned and removed and erosion around the riprap stabilization needs repaired.

14. The steep slope which was cleared on the west side of the pond at Lot 48 shows evidence of slope erosion, the installed silt fences are in need of maintenance and the slope is not fully stabilized with vegetation/matting. This slope needs to be completed with seeding, mulching and matting as required (stabilized) so silt fence controls can be properly removed.

One reproducible and one blue/black line set of the record drawings are requested once the above items are adequately addressed. Please contact me at 757-253-6639 if you have any further comments relative to record drawing, construction certification or construction-related punch list items for this project.

Sincerely,

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

G:\SWMProg\AsBuilts\SP-20-97.cert

GERRY

HORTON & DODD, P.C.
Surveyors • Engineers • Planners

300 George Washington Highway N.
Chesapeake, Virginia 23323

757/487-4535
FAX-487-9788

John G. Horton, L.S.
J. Gregory Dodd, M.E., P.E.

SEP 2000
RECEIVED

September 5, 2000

Mr. Darryl Cook
James City County
Environmental Division
101-E Mounts Bay Road
Post Office Box 8784
Williamsburg, Virginia 23187-8784

Re: Lake Powell Pointe Subdivision
Lake Powell Forest Subdivision
James City County, Virginia
H&D Work No. 13084

Dear Mr. Cook:

We are pleased to submit, for approval, six (6) copies of the stormwater management basins as-built survey for the above referenced sites. As you may know, these basins had been constructed when the hurricanes came thru last year and no drainage problems were noted.

Please do not hesitate to contact us if there are any questions or comments.

Sincerely,
HORTON & DODD, P.C.

Charles J. Bodnar, P.E.
Project Manager

copy to: Providence Development

MC 037
5-39-97

BOYD HOMES

4/5/05

RECEIVED
APR - 5 2005
ENVIRONMENTAL DIVISION

Ms. Joan Etchberger
Environmental Engineering
James City County

Dear Ms. Etchberger,

Attached are the as built drawings for the BMPs at Lake Powell Pointe. The requested construction certification is being forwarded under separate cover from our engineers, Horton and Dodd.

I believe this will complete the requirements to have the surety for Lake Powell Pointe's Sedimentation Control Agreement (L/C SM207701W with Wachovia Bank) released.

If you have any questions please feel free to contact me at 757-271-0080 or email mikeb@boydhomes.com.

Sincerely,

Mike

Mike Babashanian

MC037 Forest

Met Mike Babashanian 09-05-06. Told Him what I needed for BMPs.

COUNTY INSPECTION + FIELD BMP PUNCHLIST SEPT 14

REINSPECT OCT 20, 2006 OK.

Office: (757) 490-1959 544 Newtown Road, Suite 128 Virginia Beach, VA 23462 Fax: (757) 552-0975

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

Database Inventory No. (if known): MC 037 5-39-97

Name of Facility: LAKE Powell Forest (Wet Pond #2) BMP No.: 1 of 1 Date: 10/25/00

Location: END OF STRATEGY Court (LOT 52-53)

Name of Owner:

Inspector: SJ Thomas

Type of Facility: Wet Embankment Pond

Weather Conditions: Sunny, Mild, High 70's

Emb - South
Pool - North

If an inspection item is not applicable, mark NA, otherwise mark the appropriate column.

O.K. - The item checked is in adequate condition and the maintenance program is currently satisfactory.
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:				
Grass Height		X		40% of D/S Emb; bare soil area
Vegetation Condition		X		Needs Reseed & Mulch
Tree Growth	X			None.
Erosion		X	X	Gully erosion west emb from Lot 53
Trash & Debris	X			Wood debris & logs, minor
Seepage	X			None, Dry Condition. Wet soils
Fencing or Benches	X			at natural toe area.
Interior Landscaping/Planted Areas: ☒ None ☐ Constructed Wetland/Shallow Marsh ☐ Naturally Established Vegetation				
Vegetated Conditions				Wet Pool 1.5' deep @ 6' from riser
Trash & Debris				
Floating Material				
Erosion				
Sediment				
Dead Plant				
Aesthetics				
Other				
Paved streets with roll C&G to inlets → storm drains → pond.				

Facility Item	O.K.	Routine	Urgent	Comments
Water Pools ☒ Permanent Pool (Retention Basin) ☐ Shallow Marsh (Detention Basin) ☐ None (Detention Basin)				
Shoreline Erosion	X			2' EXPOSED.
Algae	X			None.
Trash & Debris	X			Minor woody debris + trash.
Sediment	X			2' depth at riser.
Aesthetics	X			
Other				
Inflow Stuctures (Describe Locations): 2 inflow pipes per plan, channel inflow back (north)				
Condition of Structure		X	X	5' deep gully erosion in channel
Erosion		X	X	inflow back (north). Could not
Trash and Debris				find inflow pipes per plan. Either
Sediment		X	X	submerged, choked with sediment or
Aesthetics		X	X	not installed. Clean Sediments.
Other				Remove Sed; Add Erosion Control.
Principal Flow Control Structure - Intake, Riser, etc. (Describe Location): 60"ϕ RCP w/ 9' conc cap; Rect slot 0.75'x1'				
Condition of Structure	X			No access hatch
Corrosion	X			
Trash and Debris		X	X	Trash, debris + sediment. Clean rect slot. 90% blockage.
Sediment		X		2' deep at riser
Aesthetics		X		Trash, bad appearance.
Other				No sounds of flow in riser.
Principal Outlet Structure - Barrel, Conduit, etc. : 36"ϕ RCP w/ FES and OP 10x10				
Condition of Structure	X			1" depth flow following orif cleaning
Settlement	X			
Trash & Debris	X			Minor bottles, rubble.
Sediment	X			
Erosion	X	X		Erosion, scour under FES. Low
Other				Flows bypass outlet Protections
Emergency Spillway (Overflow): Concrete Rect. Shape 5.75' BW; 2' depth				
Vegetation	X			None.
Lining	X			Conc. Clean
Erosion	X			
Trash & Debris		X		Minor Sands & Leaves westside.
Other				

Facility Item	O.K.	Routine	Urgent	Comments
Nuisance Type Conditions:				
Mosquito Breeding	X			
Animal Burrows	X			
Graffiti	X			
Other	X			
Surrounding Perimeter Conditions:				
Land Uses	X			Entire perimeter Lots + Wood Buffer
Vegetation	X			Wood with sparse ground cover.
Trash & Debris		X		Fallen trees from clear cut operations.
Aesthetics	X			
Access /Maintenance Roads or Paths	X			Lot 52-53 strategy Court Cul-de-sac. Adequate.
Other				

Remarks:

- Reseed + Mulch O/S Embankment bare soil areas.
- Refill, Seed + Mulch erosion gullies west embankment from Lot 53. Continued erosion will erode west embank at natural toe.
- clear trash, debris and sediment within 15' of riser. Rect slot 1/2 clogged with debris (cleaned at time of inspection by SJT.)
- Erosion / scour @ outlet FES. Needs restored.
- Inflow Channel (north) - Severe bank/shore erosion 5' deep. Fill seed + Mulch
- 2 inflow storm sewers - Could not find. Either submerged, not installed or sed blocked.

Note: Low Rect slot was 90% blocked with trash, debris + sed. No flow during inspection. By use of range pool slot was cleaned + flow restored.

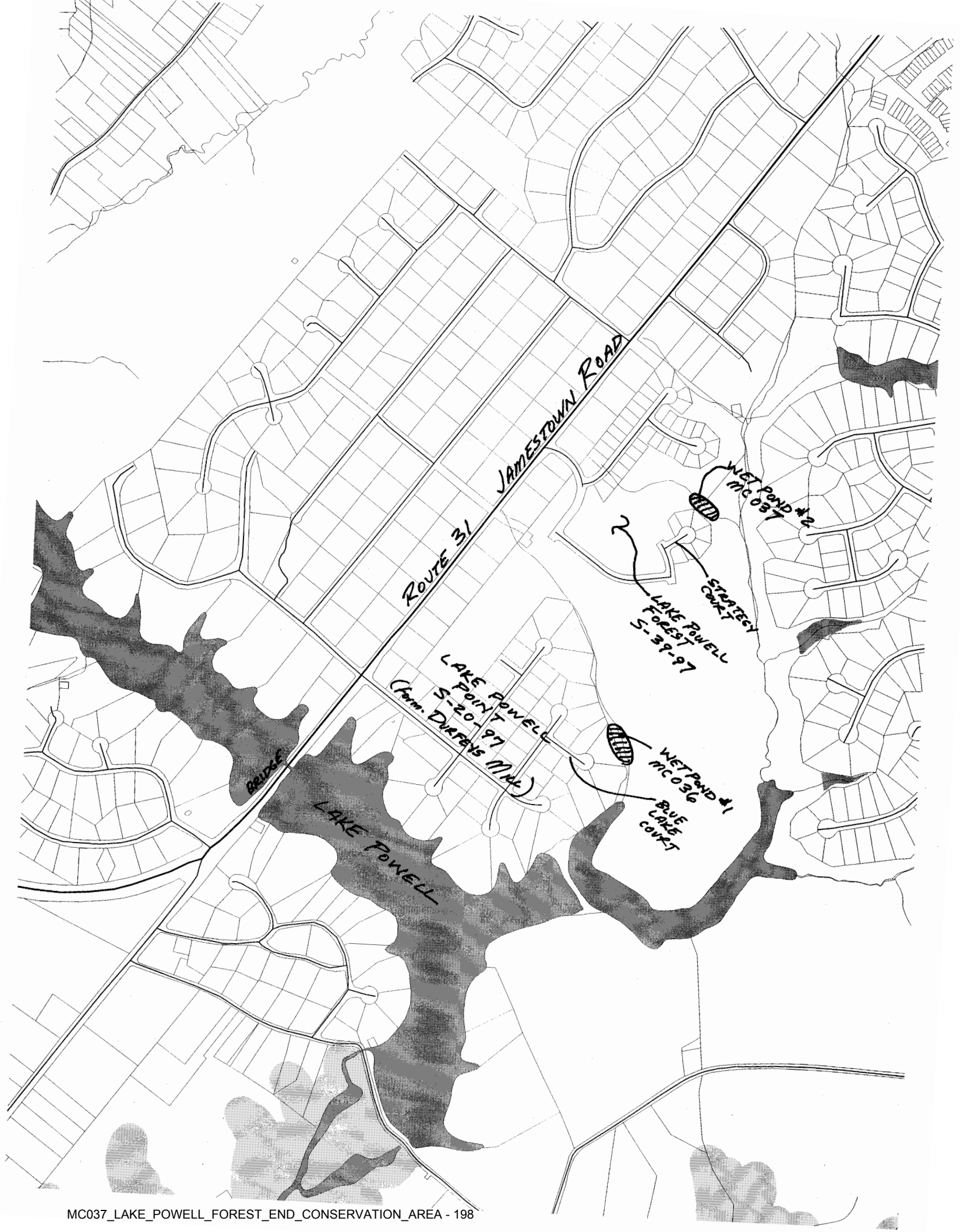
Note: Appears inflow pipes (2) were installed at 1-2' below normal pool. CLEAN SEDIMENT AT BOTH INFLOW PIPE OUTFALLS.

Overall Environmental Division Internal Rating: 3

Signature: [signature] PE. **Date:** 10/26/00

Title: Civil Engineer Environmental Division

SWMProg\BMP\CoInspProg\DetRet.wpd


ROUTE 31
JAMESTOWN ROAD
WET POND #2
MC 037
STRATTEY COURT
LAKE POWELL FOREST
S-39-97
LAKE POWELL POINT
S-20-97
(Form. DUKEYS MH)
WET POND #1
MC 036
BLUE LAKE COURT
BRIDGE
LAKE POWELL

MC037
MC009
MC036
MC024
MC025