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BRISTOL FISH AND GAME CLUB DAM
CT-00299
1981

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NATIONAL DAM INSPECTION PROGRAM
CORPS OF ENGINEERS

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CT 00299	2. GOVT ACCESSION NO. AD-A144201	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Bristol Fish and Game Club Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE April 1981
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18. SUPPLEMENTARY NOTES Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Quinnipiac River Basin Town of Wolcott		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Bristol Fish and Game Club Dam is located on Cussgutter Brook in a rural area. The dam is an earth embankment founded on bedrock and measuring approximately 600 feet long, 22.5 ft. high and 12 feet wide at the top. Based on the visual inspection the project is assessed as being in good condition.		

LOW HAZARD



PHASE I INSPECTION REPORT
NATIONAL PROGRAM OF INSPECTION OF DAMS

Name of Dam: BRISTOL FISH AND GAME CLUB DAM
Inventory Number: CT 00299
State: CONNECTICUT
County: NEW HAVEN
Town: WOLCOTT
Stream: CUSSGUTTER
Owner: BRISTOL FISH AND GAME CLUB
Date of Inspection: APRIL 29, 1981
Inspection Team: PETER M. HEYNEN, P.E.
MURALI ATLURU, P.E.
JAY A. COSTELLO

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A/1	

Bristol Fish and Game Club Dam is located on Cussgutter Brook (Quinnipiac River Basin) in a rural area in the Town of Wolcott, County of New Haven, State of Connecticut. The dam is shown on the Bristol USGS Quadrangle Map, having coordinates latitude N41°37.5' and longitude W72 56.0'. The drainage area is approximately 0.2 square miles and the maximum impoundment to the top of the dam is 130 acre-feet. Elevations given below are not NGVD, but correspond to elevations given on existing plans.

As shown on Sheet B-1, the dam is an earth embankment founded on bedrock and measuring approximately 600 feet long, 22.5 feet high (26.5 structural height), and 12 feet wide at the top. The elevation at the top of the dam is 738.5, which is 4.5 feet above the principal spillway crest. A 5 foot wide by 16 foot high bentonite clay core extends for the length of the dam. This core is placed on the bedrock foundation (elevation 712.0) and rises to elevation 728.0 along the upstream side of the cutoff trench. The upstream slope of the dam is inclined at 3 horizontal to 1 vertical and the downstream slope is inclined at 2 horizontal to 1 vertical. The slopes and top of the embankment have a grass cover, with some riprap along the waterline.

The principal spillway is a concrete drop inlet located on the upstream slope approximately 225 feet from the left end of the dam. This inlet consists of a 4 foot by 1.5 foot (I.D.) concrete riser and a 16 inch reinforced concrete outlet pipe, extending from the riser to the toe of the embankment. The riser has a crest elevation of 734.0, a bottom elevation of 720.3 and the pipe outlets at invert elevation 716.8. There are two vertical 4 foot by 1 foot openings at the top of the riser structure, which allow water to flow into the chamber and out the 16 inch RCP. The low-level outlet, also part of this spillway structure, consists of a 15 inch ACCMP which

extends 20 feet from the riser chamber to the toe of the upstream slope, at invert elevation 121.0. A 14 inch low-level intake valve is located just upstream of the concrete riser, and can be operated with the stem which extends to the riser hood, along the downstream side of the riser chamber.

The emergency spillway is a grass lined channel extending around the right end of the dam. The channel measures approximately 20 feet wide, with side slopes of 3 horizontal to 1 vertical and a crest elevation of 735.0. A small earth dike, measuring about 3 feet high by 80 long, extends along the left side of the spillway.

Based upon the visual inspection performed April 29, 1981, the project is assessed as being in good condition. The following features which could influence the future condition and/or stability of the dam were identified.

1. If the seepage at the toe of the dam is coming through the embankment, it could begin to carry material from the interior of the dam, creating a piping situation and thereby threatening the safety of the structure.
2. The lack of proper riprap protection on the upstream slope will lead to further sloughing and erosion of this slope, which may provide an area for overtopping during flood conditions.
3. Spalling of the concrete at the upstream and downstream sides of the riser hood at the drop inlet openings (Photo 3), could lead to failure of the hood or riser structure, possibly blocking the spillway during periods of high flows.
4. Animal burrows can provide seepage paths through the impervious core, which can promote piping and possibly lead to failure of the dam.

It is recommended that the owner retain a registered professional engineer qualified in dam design and inspection to perform services pertaining to the following items. The engineer should establish recommended corrective procedures which should then be promptly implemented by the owner.

1. Monitoring and evaluation of seepage at the toe of the embankment to determine its origin, affect on the safety of the structure, and any necessary corrective action.

2. Regrading of the upstream slope and placement of sufficient riprap to protect against erosion and sloughing of this slope by wave action. This riprap should be placed between expected high and low water elevations, and should extend around the right end of the embankment to protect against erosion should the emergency spillway be activated.
3. Repairing spalled concrete at the sides of the riser structure hood, along the waterline where water enters the drop inlet.
4. Removing trees to a distance of 10 feet from the toe of the dam with proper backfilling and replacement of protective cover.
5. Elimination of burrowing animals in the embankment, backfilling the burrows and replacement of protective cover.

Also, the owner should initiate a formal program of operation and maintenance procedures, including a monthly inspection by the owner or owner representative and proper documentation to provide accurate records for future reference. A comprehensive program of inspection by a registered professional engineer qualified in dam design and inspection should be instituted on a biennial basis.



OVERVIEW PHOTO
(April, 1981)

US ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

CAHN ENGINEERS INC.
WALLINGFORD, CONN.
ENGINEER

NATIONAL PROGRAM OF
INSPECTION OF
NON-FED DAMS

Bristol Fish & Game Club Dam

Cussgutter Brook

Wolcott

CONNECTICUT

DATE June 1981

CE # 27785KH

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**VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION**

PROJECT Eristol Fish & Game Club Dam DATE: April 29, 1971
 TIME: 12:30 PM - 2:30 PM
 WEATHER: Cloudy, 70°F
 W.S. ELEV. 734.2 U.S. 114 DN. S

<u>PARTY:</u>	<u>INITIALS:</u>	<u>DISCIPLINE:</u>
1. <u>Peter M. Heynen</u>	<u>PMH</u>	<u>Cann - Geotechnical</u>
2. <u>Murali Atluru</u>	<u>MA</u>	<u>DTC - H/H</u>
3. <u>Jay A. Castello</u>	<u>JAC</u>	<u>Cann - Geotechnical</u>
4. _____	_____	_____
5. _____	_____	_____
6. _____	_____	_____

<u>PROJECT FEATURE</u>	<u>INSPECTED BY</u>	<u>REMARKS</u>
1. <u>Embankment</u>	<u>PMH, JAC, MA</u>	<u>A-2</u>
2. <u>Principal Spillway (Drop Inlet)</u>	<u>PMH, JAC, MA</u>	<u>A-3</u>
3. <u>Auxiliary Spillway</u>	<u>PMH, JAC, MA</u>	<u>A-4</u>
4. <u>Outlet Structure and Channel</u>	<u>PMH, JAC, MA</u>	<u>A-5</u>
5. _____	_____	_____
6. _____	_____	_____
7. _____	_____	_____
8. _____	_____	_____
9. _____	_____	_____
10. _____	_____	_____
11. _____	_____	_____
12. _____	_____	_____

PERIODIC INSPECTION CHECK LIST

Page 4-2

PROJECT Brick Hill & Game Club Dam

DATE Apr 29 1988

PROJECT FEATURE Earth Embankment

BY Bill J. ...

AREA EVALUATED	CONDITION
<u>DAM EMBANKMENT</u>	
Crest Elevation	738.5
Current Pool Elevation	734.2
Maximum Impoundment to Date	Unknown
Surface Cracks	None Observed - The original surface is in good condition
Pavement Condition	N/A
Movement or Settlement of Crest	None Observed
Lateral Movement	None Observed
Vertical Alignment	Appears Good
Horizontal Alignment	Appears Good
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	4/5 slope at riser structure
Sloughing or Erosion of Slopes or Abutments	Sloughing along waterline and 4/5 slope at riser structure
Rock Slope Protection-Riprap Failures	Insufficient riprap at waterline
Unusual Movement or Cracking at or Near Toes	None Observed
Unusual Embankment or Downstream Seepage	Seepage less than 5 gpm; 20' left of outlet and 25' d/s of outlet
Piping or Boils	None Observed
Foundation Drainage Features	None Observed
Toe Drains	None Observed
Instrumentation System	None Observed

PERIODIC INSPECTION CHECK LIST

Page

PROJECT Bristol Fish & Game Dock

DATE Apr 2002

PROJECT FEATURE Drop Inlet Riser Structure

BY PM - JAL

AREA EVALUATED	CONDITION
<u>OUTLET WORKS-CONTROL TOWER</u>	Concrete riser structure, crest elevation = 7.4+0
a) <u>Concrete and Structural</u>	
General Condition	Fair
Condition of Joints	Good
Spalling	At each end near waterline - aggregate visible
Visible Reinforcing	None Observed
Rusting or Staining of Concrete	None Observed
Any Seepage or Efflorescence	None Observed
Joint Alignment	Appears Good
Unusual Seepage or Leaks in Gate Chamber	Not Observed
Cracks	None observed
Rusting or Corrosion of Steel	Rusting of trash rack bar
b) <u>Mechanical and Electrical</u>	
Air Vents	N/A
Float Wells	N/A
Crane Hoist	N/A
Elevator	N/A
Hydraulic System	N/A
Service Gates	30 foot long, 15 inch ACCMP intake with 14 inch valve enters u/s side of riser chamber at this base.
Emergency Gates	Outlets by 16 inch RCP at d/s side of riser chamber.
Lightning Protection System	N/A
Emergency Power System	N/A
Wiring and Lighting System	N/A

PERIODIC INSPECTION CHECK LIST

Page 1 of 2

PROJECT Orinok Fish & Game Control Dam

DATE April 24, 88

PROJECT FEATURE Anybody's Spillway

BY SMS JAMES

AREA EVALUATED	CONDITION
<p><u>OUTLET WORKS-SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u></p>	<p>Gross lined earth channel @ right end of dam</p>
<p>a) <u>Approach Channel</u></p> <p>General Condition</p> <p>Loose Rock Overhanging Channel</p> <p>Trees Overhanging Channel</p> <p>Floor of Approach Channel</p>	<p>Good</p> <p>None</p> <p>Flat- free of debris</p>
<p>b) <u>Weir and Training Walls</u></p> <p>General Condition of Concrete</p> <p>Rust or Staining</p> <p>Spalling</p> <p>Any Visible Reinforcing</p> <p>Any Seepage or Efflorescence</p> <p>Drain Holes</p>	<p>N/A- earth channel</p> <p>grass cover - good condition, side slopes - good</p> <p>earth dike left side - good</p> <p>no riprap at right end dam embankment</p>
<p>c) <u>Discharge Channel</u></p> <p>General Condition</p> <p>Loose Rock Overhanging Channel</p> <p>Trees Overhanging Channel</p> <p>Floor of Channel</p> <p>Other Obstructions</p>	<p>channel discharges to woods at right end of dam. Discharge then flows to outlet channel.</p>

PERIODIC INSPECTION CHECK LIST

Page A-5

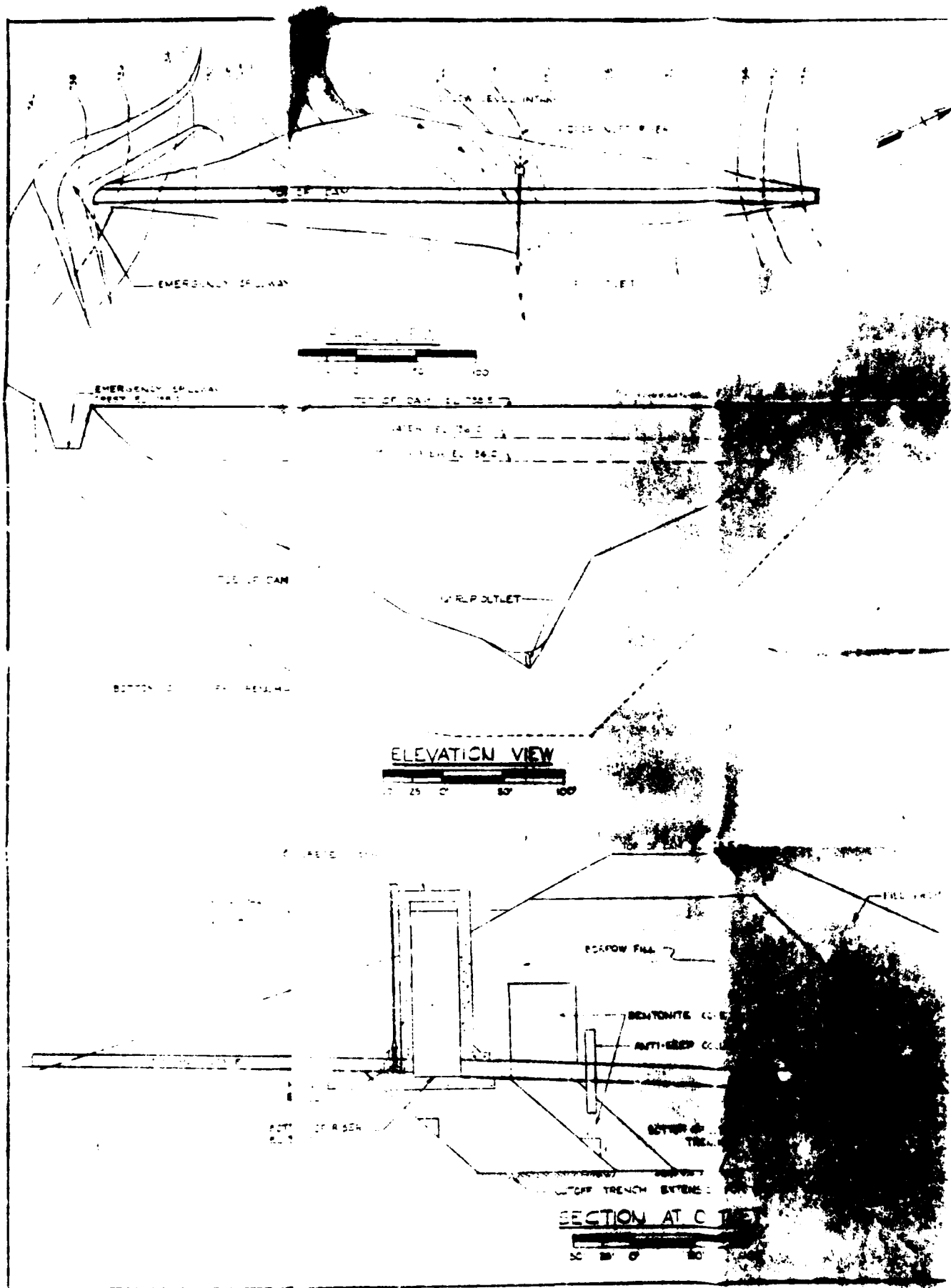
PROJECT Bruce Fish & Game Club Dam

DATE Apr 21 1988

PROJECT FEATURE 16" RCP Outlet

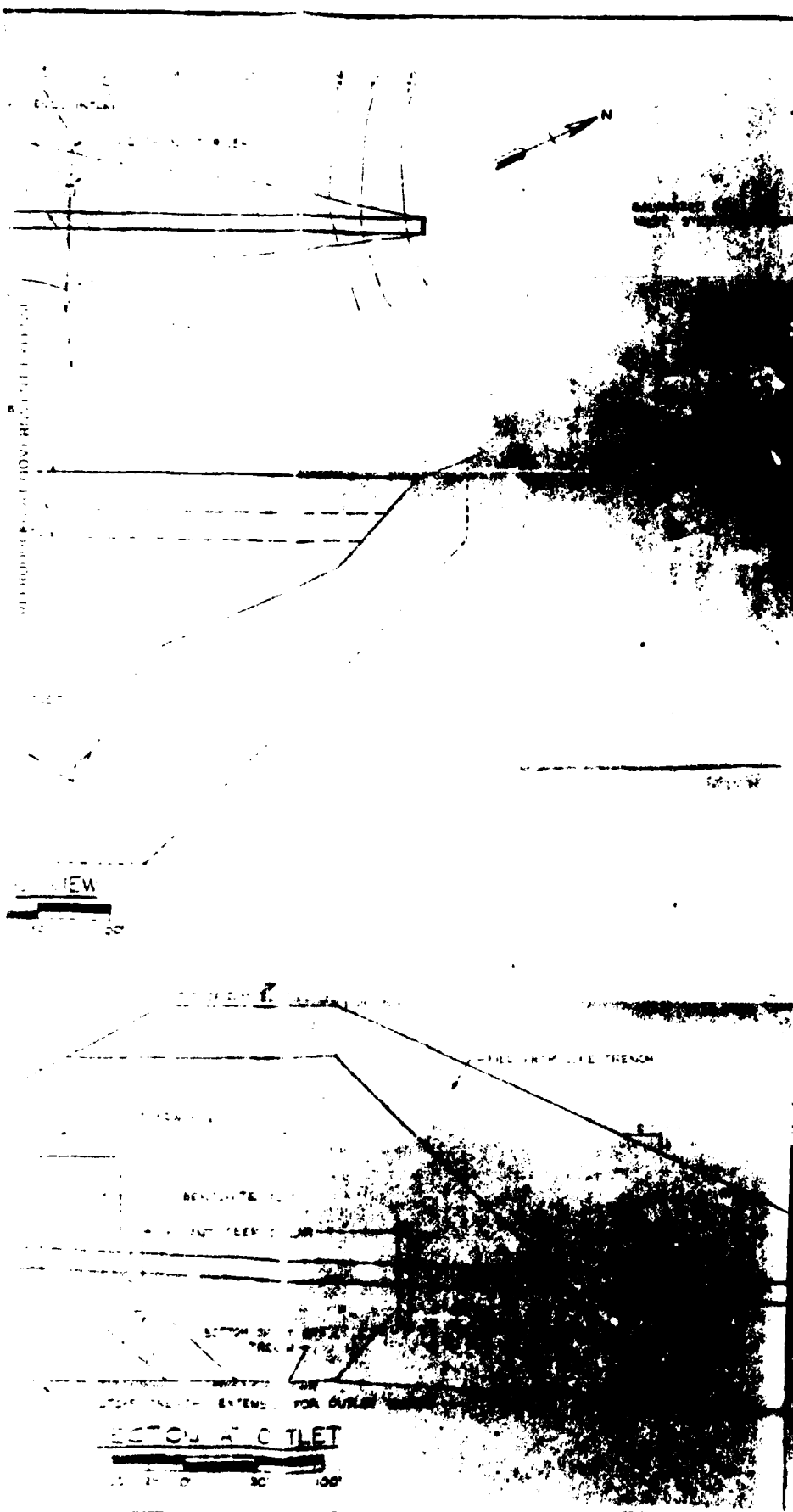
BY PKH, FA, VL

AREA EVALUATED	CONDITION
<u>OUTLET WORKS-OUTLET STRUCTURE AND OUTLET CHANNEL</u>	16" RCP from riser chamber to d/s toe of embankment (71±')
General Condition of Concrete	Pipe appears in good cond + str.
Rust or Staining	hard to observe
Spalling	}
Erosion or Cavitation	N/A
Visible Reinforcing	}
Any Seepage or Efflorescence	}
Condition at Joints	Could not be observed
Drain Holes	N/A
Channel	
Loose Rock or Trees Overhanging Channel	Some small trees
Condition of Discharge Channel	Narrow, natural stream bed. fair condition



SECTION B

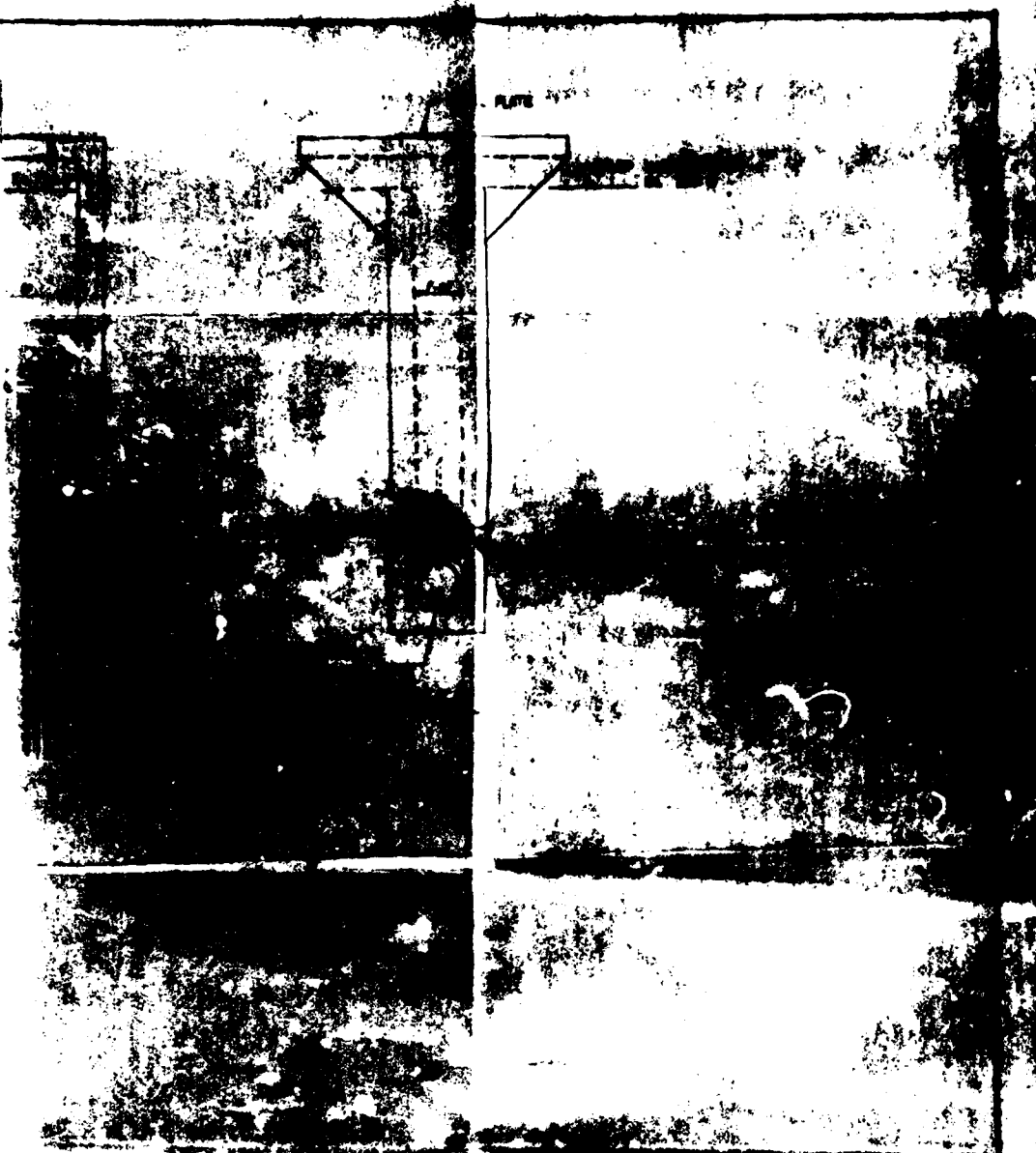
1 of 3



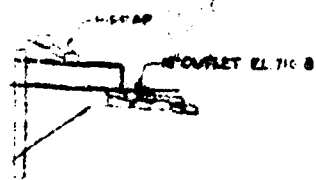
20f3

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PLATE



- 1. THIS DRAWING WAS DERIVED FROM EXISTING PLANS DRAWN BY THE U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE OFFICE J. ASH HILL (PROVIDED SEPT. 1958) AND SUPPLEMENTAL DATA OBTAINED BY THE CAHN ENGINEERS INSPECTION ON APRIL 29 1961.
- 2. NO N.S.V.D. ELEVATIONS ARE AVAILABLE FOR THIS DAM. THE ELEVATIONS IN THIS DRAWING CORRESPOND TO ELEVATIONS USED ON THE EXISTING DESIGN DRAWINGS. NO CONVERSION TO N.S.V.D. IS KNOWN.



CAHN ENGINEERS INC WILLINGFORD, CONNECTICUT ENGINEER	U.S. ARMY ENGINEER DIV. AREA 2 CORPS OF ENGINEERS WALTHAM, MASS.
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS PLAN, ELEVATION & SECTION	
WATER AND GAME CLUB	
NO. 17. PROJECT NO. 10000-10-1000	
DATE: 1/61	BY: JAC

3 of 3 B

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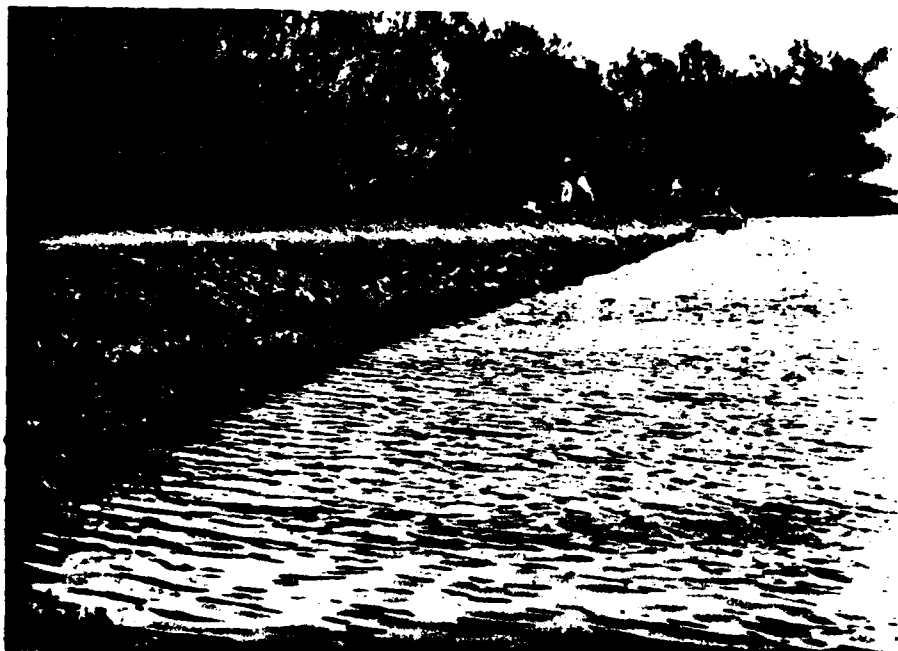


Photo 1 - Upstream slope from left abutment. Minor sloughing of the upstream slope is occurring at the water-line. Drop inlet can be seen at center of dam (April, 1981).



Photo 2 - Top of dam and downstream slope from left abutment (April, 1981).

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NON-FED. DAMS

BRISTOL FISH & GAME CLUB
CUSSGUTTER BROOK
WOLCOTT, CT
CE# 27785 KH
DATE JUNE 1981 PAGE C-1



Photo 3 - Top of concrete riser structure. Casing for low-level outlet valve stem is located on upstream side of riser (April, 1981).



Photo 4 - Emergency spillway at right end of dam (April, 1981).

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CUSSGUTTER BROOK
WOLCOTT, CT
CE# 27785 KH
DATE JUNE '81 PAGE C-2



Photo 5 - 16 inch RCP which discharges flows from the concrete riser chamber. These flows may be from the drop inlet or from the low-level intake (April, 1981).



Photo 6 - Close-up of riser structure and spalling of concrete at waterline (April, 1981).

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NON-FED. DAMS

BRISTOL FISH & GAME CLUB
CUNNINGHAM BROOK
WOLCOTT, CT.
CE# 27795KH
DATE JUNE '81 PAGE C-3



Photo 7 - Erosion and sloughing of upstream slope near drop inlet. Note sparse riprap at waterline (April, 1981).



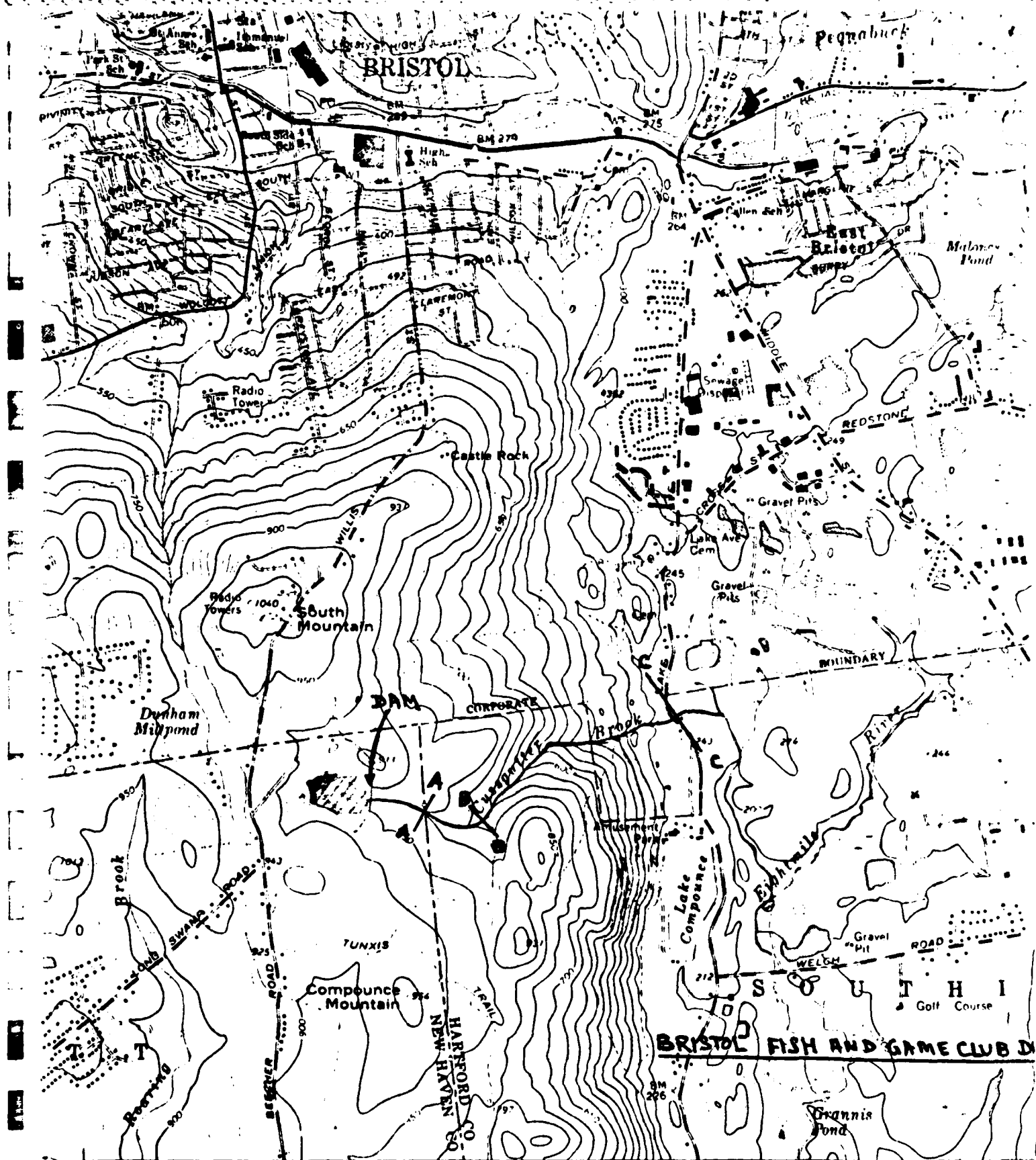
Photo 8 - Seepage at right side of outlet discharge channel. Seepage flows from wet area at toe of embankment to the right of the outlet pipe (April, 1981).

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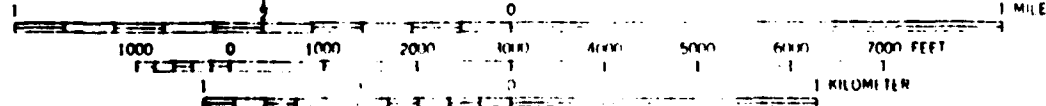
NATIONAL PROGRAM OF
INSPECTION OF
NON-FED. DAMS

BRISTOL FISH & GAME CLUB
CUSHGUTTER BROOK
WOLCOTT, CT.
CE# 87705KH
DATE JUNE '81 PAGE C-4



57° 30' S. 61 7 MI 671 (SOUTHINGTON) 6667 III SW 673 55' 674 000 E 4 2 MI

SCALE 1 24000



CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

BRISTOL QUAD

PROJECT NON FEDERAL DAM INSPECTION PROJECT NO. 81-20-11 SHEET 1 OF 20
NEW ENGLAND DIVISION COMPUTED BY J. A. [unclear] DATE 11/1/74
BRISTOL FISH AND GAME CLUB DAM CHECKED BY E. Butcher [unclear] DATE 11/1/74

PERFORMANCE AT PEAK FLOOD CONDITIONS

PROBABLE MAXIMUM FLOOD (PMF) DETERMINATION-

DRAINAGE AREA - 0.18 SQ. MI. PLANIMETERED FROM
BRISTOL QUAD. SHEET (REV. 1972)

WATERSHED CLASSIFICATION - "ROLLING" TO "MOUNTAINOUS"
BASED UPON USGS MAP AND SITE VISIT.

PMF PEAK INFLOW-

FOR SMALL DRAINAGE AREAS (< 2 SQ. MI.) THE CORPS
OF ENGINEERS RECOMMENDS CSM VALUES TO BE NOT
GREATER THAN 2500 CFS/SQ. MI FOR THE ABOVE
WATERSHED CONDITIONS.

PEAK FLOW RATE SELECTED = 2500 CFS/SQ. MI.

\therefore PMF PEAK INFLOW = $2500 \times 0.18 = 450$ CFS

SIZE CLASSIFICATION-

FOR THE PURPOSE OF DETERMINING PROJECT SIZE, THE
MAXIMUM STORAGE ELEVATION IS CONSIDERED EQUAL TO
THE STORAGE AT TOP OF DAM

TOP OF DAM ELVN = 865.5*

TOE OF DAM ELVN = 843.0

HEIGHT OF DAM 22.5 FT

* The normal w.s. elevation of the Pond is not indicated on
the USGS map. However, examining the contours on
the USGS map as well as elevations given in the
1958 design drawings prepared by SCS, the
normal pond elevation is Assumed to be 861 NGVD
and is assumed to be the same for the principal
spillway crest. All other elevations are referenced to this
assumed elevation and are obtained from the 1958
SCS drawings. Cohn Inc field checked some of the
Key Information

PROJECT NON FEDERAL DAM INSPECTION PROJECT NO. 81-20-11 SHEET 2 OF 20
NEW ENGLAND DIVISION COMPUTED BY [Signature] DATE 2/15/41
BRISTOL FISH AND GAME CLUB DAM CHECKED BY E. Butcher B. In DATE 5/1/41

PLANIMETERING FROM USGS MAP FOR POND SURFACE AREAS —
 AT EL. 861 (PR. SPILLWAY CREST) = 12 ACRES
 AT EL. 870 = 15 ACRES
 AT EL. 880 = 21 ACRES

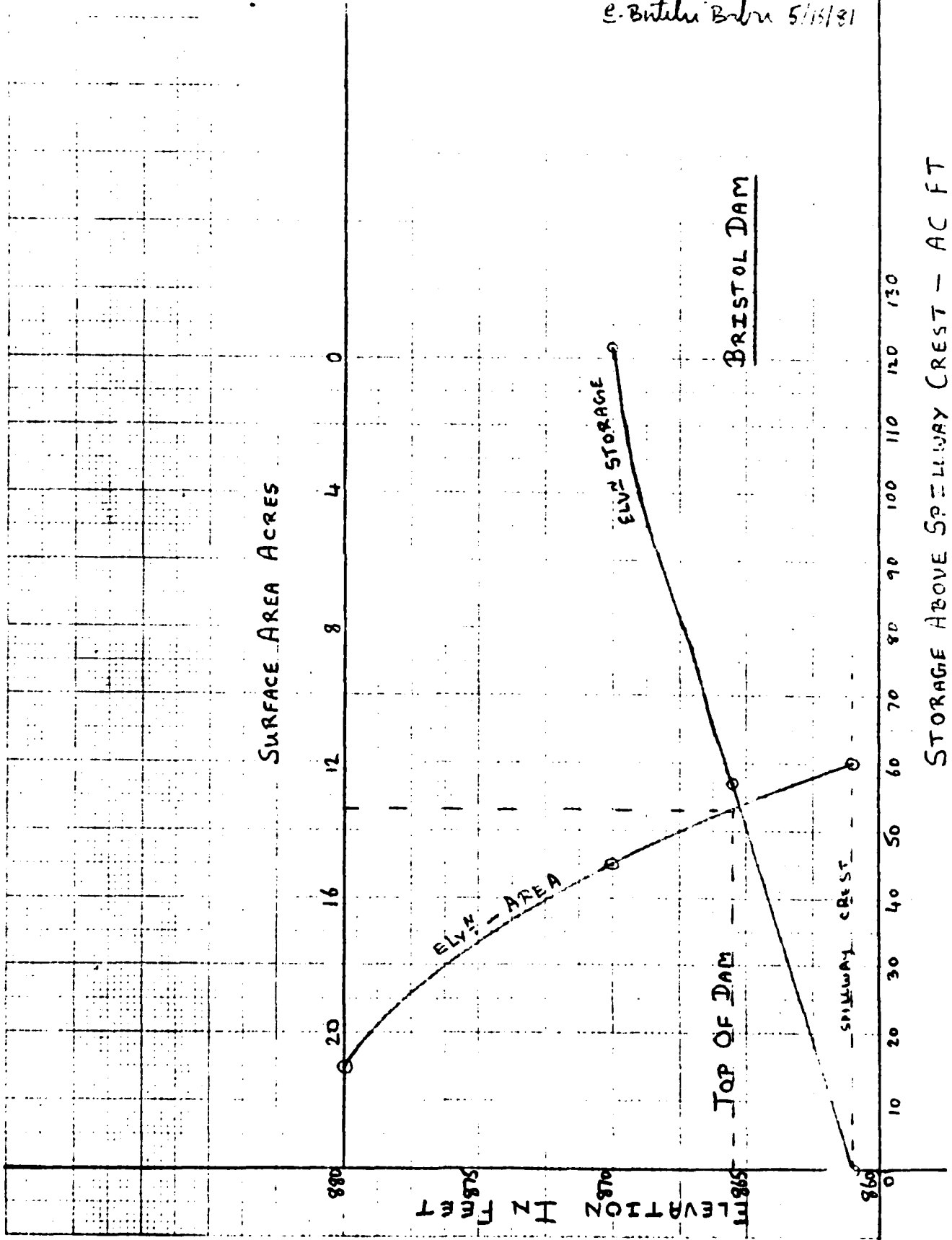
A STAGE-POND AREA CURVE IS PLOTTED (SHEET 3)
 FROM THIS CURVE, POND AREA AT TOP OF DAM = 13.4 AC.
 AVERAGE POND AREA BETWEEN PR. SPILLWAY
 CREST AND TOP OF DAM = 12.7 AC.
 ∴ STORAGE BETWEEN PRINCIPAL SPILLWAY CREST
 AND TOP OF DAM = $4.5 \times 12.7 \approx 57$ AC. FT.
 STORAGE BETWEEN PRINCIPAL SPILLWAY
 CREST AND POND AT EL. 870 = 121.5 AC. FT.
 EST. STORAGE BELOW PR. SPILLWAY CREST = $\frac{1}{3}bh$
 = $\frac{1}{3} \times 12 \times 18 = 72$ AC. FT.

($b = 12, h = EL. 861 - EL. 843 = 18'$)
 ∴ MAXIMUM IMPOUNDMENT TO TOP OF DAM = $57 + 72$
 = 129 AC. FT.

A STAGE-STORAGE CURVE IS PLOTTED ON SHEET 3
 THUS, ACCORDING TO CORPS OF ENGINEERS GUIDE
 LINES TABLE 1, THE BRISTOL CLUB DAM IS
 CLASSIFIED SMALL BASED UPON THE STORAGE
 CAPACITY OF 129 AC. FT. (< 1000 AND ≥ 50)
 AND THE HEIGHT OF THE DAM IS ONLY
 22.5 FT.

Hand. by 5/15/31

e. Butcher B. 5/15/31



BRISTOL DAM

STORAGE ABOVE SPILLWAY CREST - AC FT

2-7

PROJECT NON FEDERAL DAM INSPECTION PROJECT NO. 81-20-11 SHEET 4 OF 20
NEW ENGLAND DIVISION COMPUTED BY James D. ... DATE 5/15/77
BRISTOL FISH AND GAME CLUB DAM CHECKED BY E. Butler B. ... DATE 5/16/77

HAZARD POTENTIAL - LOW

HAZARD POTENTIAL BASED UPON DAM BREACH ANALYSIS AND ACTIVITIES BELOW THE DAM. A DETAILED DISCUSSION OF HAZARD POTENTIAL IS INCLUDED AT THE END OF BREACH ANALYSIS SECTION OF APPENDIX D.

SELECTION OF TEST FLOOD -

FOR THE SMALL SIZE AND LOW HAZARD POTENTIAL CLASSIFICATION, TABLE 3 OF CORPS OF ENGINEERS RECOMMENDED GUIDELINES, THE TEST FLOOD COULD BE IN THE 50 YEAR TO 100 YEAR FREQUENCY RANGE.

BASED UPON THE INVOLVED RISK POTENTIAL DOWNSTREAM OF THE DAM, A TEST FLOOD = 100 YR IS SELECTED.

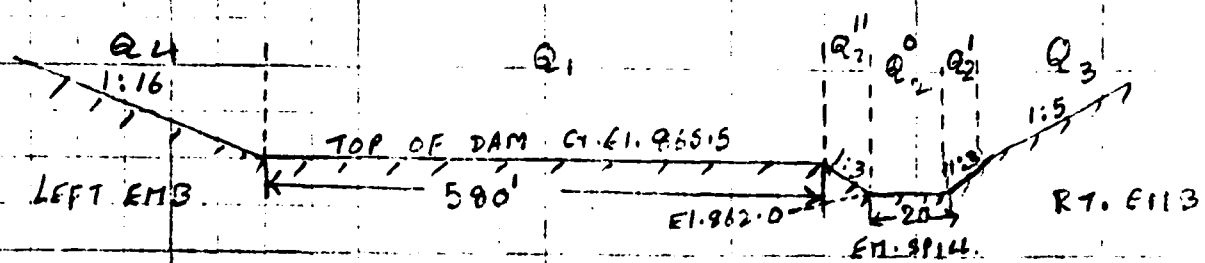
$$\therefore \text{TEST FLOOD PEAK INFLOW} = \frac{5}{19} \times 450$$

$$\approx \underline{120 \text{ CFS}}$$

NOTE: PMF OF 450 CFS IS ESTIMATED TO RESULT FROM 19" RUN-OFF AND A 100 YEAR FLOOD IN CONNECTICUT IS ESTIMATED TO RESULT FROM APPROXIMATELY 5" RUN-OFF.

PROJECT NON FEDERAL DAM INSPECTION PROJECT NO. 81-20-11 SHEET 5 OF 20
NEW ENGLAND DIVISION COMPUTED BY [Signature] DATE 5/15/81
BRISTOL FISH AND GAME CLUB DAM CHECKED BY E. B. Johnson DATE 5/16/81

COMPOSITE DISCHARGE RATING CURVE



APPROXIMATE POTENTIAL OVERFLOW PROFILE

BASED ON DESIGN DRAWINGS & CAHN INC'S FIELD INFORMATION
(LOOKING DOWNSTREAM)

DAM

$$Q_1 = CLH^{3/2} = 1624 H^{3/2}$$

$C = 2.8$ ASSUMED (LEATHEREN)
 $L = 580'$, $CY \cdot EL = 965.5$

EMERGENCY SPILLWAY

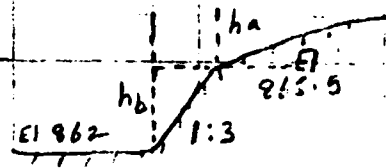
$$Q_2^0 = CLH^{3/2} = 56 H^{3/2}$$

$C = 2.8$ ASSUMED (GRASS)
 $L = 20'$, $CY \cdot EL = 962.0$

$$Q_2^1 = \frac{2}{5} \frac{CL}{(h_b - h_a)} \left(h_b^{5/2} - h_a^{5/2} \right) *$$

$$= 0.4 \times 2.8 \times 3 \times h_b^{5/2} \text{ upto EL. 965.5}$$

$$= 3.36 h_b^{5/2}$$



SIMILARLY $Q_2'' = 3.36 h_b^{5/2}$
 $\therefore Q_2^1 + Q_2'' = 6.72 h_b^{5/2}$

*NOTE: USGS RECOMMENDED FORMULA FOR MORE PRECISE DISCHARGE OVER INCLINED DAM/EMBANKMENT CREST (REF: MEASUREMENT OF PEAK DISCHARGES AT DAM BY INDIRECT METHODS. USGS BOOK 3, CHAPTER A 5, PAGE 3-4, 1968)

PROJECT NON FEDERAL DAM INSPECTION PROJECT NO. 81-20-11 SHEET 6 OF 20
NEW ENGLAND DIVISION COMPUTED BY [Signature] DATE 5/15/81
BRISTOL FISH AND GAME CLUB DAM CHECKED BY [Signature] DATE 5/16/81

PRINCIPAL SPILLWAY:

PIPE SPILLWAY WITH DROF INLET

$$Q_{ps} = a \sqrt{\frac{2gH}{1 + K_e + K_b + K_f L}}$$

(Ref: "Hand Book of Applied Hydrology" by Ven Te Chow P - 21 - 63)

FOR CONCRETE PIPE

Pipe diameter = 16"

$n = 0.015, K_e = 0.5$

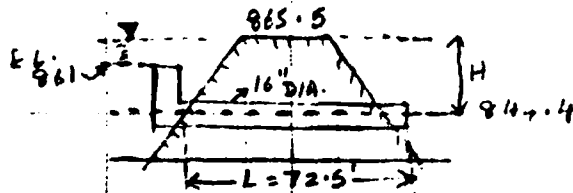
Area of cross section of pipe

$K_b = 0, K_f = 0.0201, L = 72.5'$

$= 1.37 \text{ sq. ft.}$

FOR FULL FLOW CONDITION

$Q = 5.91 H^{1/2}$

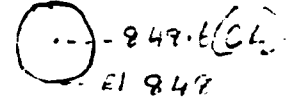


LOW LEVEL OUTLET

$Q_o = CA \sqrt{2gH}$
 $= 8.51 H^{1/2}$

= 250 CFS FOR POOL AT TOP OF DAM

14" PIPE

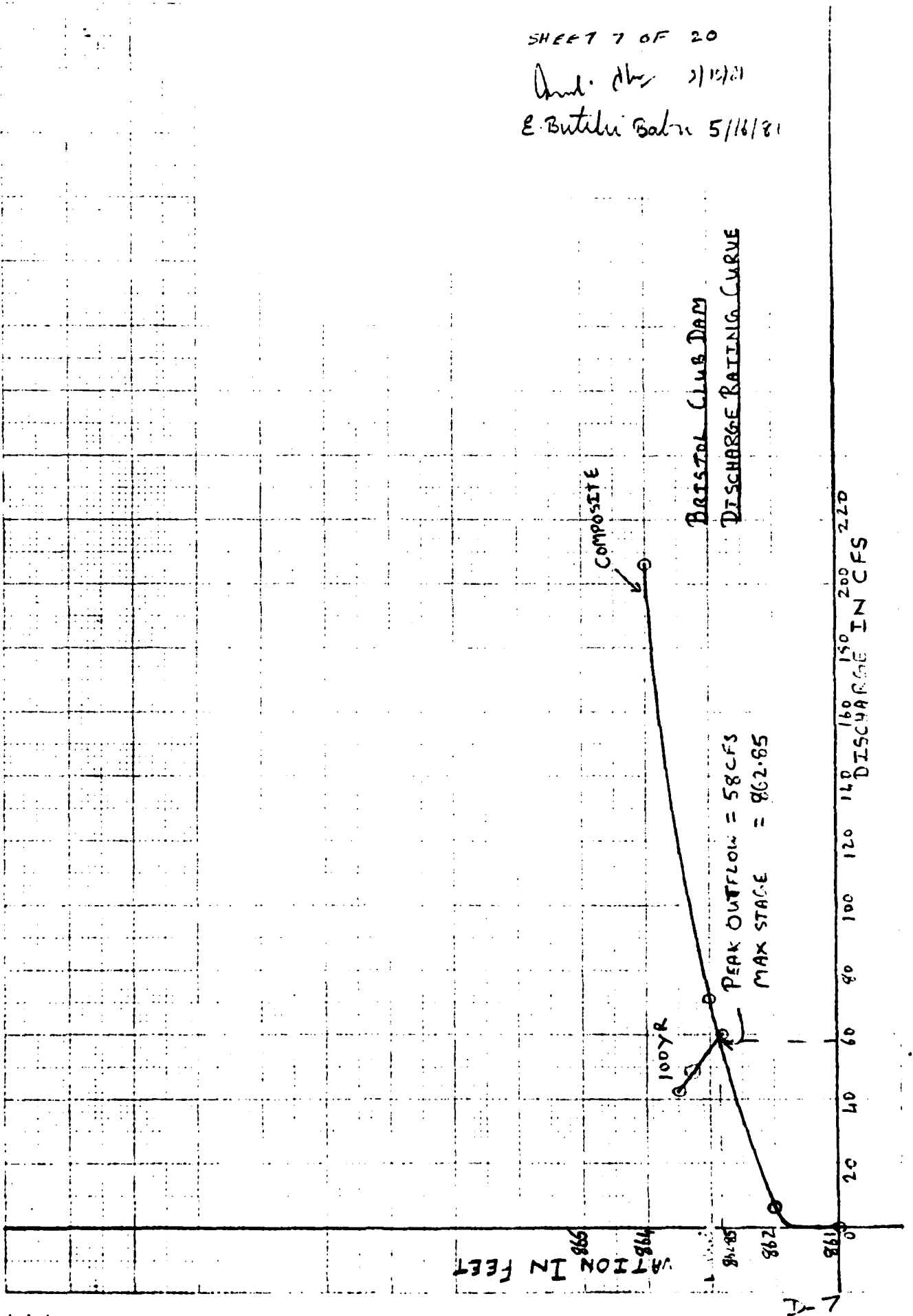


THE LOW LEVEL OUTLET IS PART OF THE PRINCIPAL SPILLWAY STRUCTURE AND ITS EFFECT ON THE DISCHARGE CAPACITY OF THE SPILLWAY IS NEGLECTED. THE FLOW THROUGH THE LOW LEVEL OUTLET IS CONSIDERED INCONSEQUENTIAL IN THIS ANALYSIS, WHILE THE PRINCIPAL SPILLWAY IS OPERATING.

TABULATION OF DISCHARGE RATES (CFS)

ELVN NGVD	DAM @1	EMER. SPILLWAY			PRINCIPAL SP. WAY Qps	TOTAL Q
		Q2	Q2' + Q2''	Q2		
PR. SPILL 861	0	0	0	0	0	
862	0	0	0	6	6	
TEST FLOW 862.95	0	45	5	50	59	
863	0	56	7	63	72	
864	0	158	38	196	206	

And. No. 2/15/81
E. Buteli Baln 5/16/81



PROJECT NON FEDERAL DAM INSPECTION PROJECT NO. 81-20-11 SHEET 8 OF 20
NEW ENGLAND DIVISION COMPUTED BY D. J. [Signature] DATE 5/15/81
BRISTOL FISH AND GAME CLUB DAM CHECKED BY E. Butcher [Signature] DATE 5/16/81

DETERMINATION OF PEAK OUTFLOW -

SHORTCUT ROUTING OF POND
 CORPS OF ENGINEERS GUIDELINES SURCHARGE STORAGE
 ROUTING ALTERNATIVE METHOD USED
 FOR 120 CFS (100 YR) THE DISCHARGE RATING CURVE
 GIVES ELVN = 863.5
 AND FROM STAGE-STORAGE CURVE FOR THIS ELVN
 STORAGE = 31 AC.FT.

STOR_i = $\frac{31 \times 12}{0.18 \times 640} = 3.23$ " RUN-OFF.

$Q_{Pi} = Q_{Pi} \left(1 - \frac{STOR_i}{5} \right)$

① STOR _i INCHES	② $\left(1 - \frac{STOR_i}{5} \right)$	③ STOR _i AC.FT $\frac{0.18 \times 640}{12}$	④ Q _{Pi} CFS ① × 120	⑤ ELVN FROM STORAGE CURVE USING ②
2.5	0.5	24	60	862.85
3.00	0.4	29	48	863.25
3.23	0.35	31	42	863.5

COLUMNS ④ & ⑤ ARE PLOTTED ON DISCHARGE RATING CURVE AND

PEAK OUTFLOW Q = 58 CFS
MAXIMUM STAGE = 862.85 NGVD
TOP OF DAM = 865.5 NGVD

∴ THE DAM IS NOT OVERTOPPED.

PROJECT NON FEDERAL DAM INSPECTION PROJECT NO. 81-20-11 SHEET 9 OF 20
NEW ENGLAND DIVISION COMPUTED BY [Signature] DATE 2/14/61
BRISTOL FISH AND GAME CLUB DAM CHECKED BY E. Butcher DATE 5/15/61

BREACH ANALYSIS - DOWNSTREAM FAILURE HAZARD

BASED UPON CORPS OF ENGINEERS "RULE OF THUMB"
GUIDANCE FOR ESTIMATING DIS DAM FAILURE
HYDROGRAPHS

BREACH OUTFLOW $Q_b = \frac{8}{27} \times W_b \times \sqrt{g} \times Y_0^{3/2}$

HEIGHT FROM CHANNEL BED TO POOL @ TOP OF DAM Y_0
= 22.5 FT.

ESTIMATED BREACH WIDTH $W_b = 40\%$ OF MID-HT LENGTH
OF DAM = $0.4 \times 265 = 106$ FT

(MID HEIGHT LENGTH IS BASED UPON SES DESIGN DRAWINGS)

$\therefore Q_b = \frac{8}{27} \times 106 \times \sqrt{32.2} \times (22.5)^{3/2} \approx 19,020$ CFS

IT IS PRESUMED THAT THE BREACH OCCURS IN DEEPEST
SECTION OF THE DAM. THIS SECTION INCLUDES THE
PRINCIPAL SPILLWAY AS WELL AS THE LOW LEVEL OUTLET.
THE ESTIMATED DISCHARGE THROUGH EMERGENCY
SPILLWAY WITH POOL AT TOP OF THE DAM = 521 CFS

\therefore PEAK FAILURE OUTFLOW $Q_p = 19,020 + 521 \approx 19,600$ CFS

ESTIMATED FAILURE FLOOD DEPTH $\approx 0.44 Y_0$
IMMEDIATELY D/S FROM DAM ≈ 10 FT



PROJECT NON FEDERAL DAM INSPECTION PROJECT NO. 81-20-11 SHEET 10 OF 20
NEW ENGLAND DIVISION COMPUTED BY [Signature] DATE 5/15/81
BRISTOL FISH AND GAME CLUB DAM CHECKED BY [Signature] DATE 5/15/81

PERFORM DIS ROUTING OF PEAK FAILURE OUTFLOW
SECTION AA IS SELECTED AT 1000 FT DIS OF DAM

$$Q = \frac{1.486}{n} \times A \times R^{2/3} \times S^{1/2}$$
 Where $n = 0.06$ assumed (stones, windy)
 and $S = 0.043$ Est. from USGS map.

A AND R ARE ESTIMATED BASED UPON USGS MAP INFORM.

ELVN	A SQ. FT	P	R	R ^{2/3}	Q - CFS
800	0	-	-	-	0
802	38	38.2	0.995	0.997	195
805	237.5	95.5	2.49	1.838	2242
808	614	154.3	3.98	2.513	7925
810	950	191	4.97	2.914	14,218
811	1151	213.1	5.40	3.08	18,208
812	1372	233	5.9	3.3	23,255

FROM STAGE-AREA AND STAGE DISCHARGE CURVES
 FOR $Q_1 = 19,600$ CFS, ELVN = 811.25, AREA = 1206 SQ FT

VOLUME OF REACH $V_1 = \frac{1000 \times 1206}{43.560} \approx 28$ AC. FT.

TRIAL $Q_2 = Q_1 \left(1 - \frac{V_1}{S}\right) = 19,600 \left(1 - \frac{28}{129}\right) \approx 15,350$ CFS

FOR THIS Q_2 THE STAGE-DISCHARGE CURVE GIVES ELVN = 810.25

AND AREA = 998 SQ. FT.

VOLUME OF REACH $V_2 = \frac{1000 \times 998}{43.560} \approx 23$ AC. FT.

RECOMPUTING $Q_2 = 19,600 \left(1 - \frac{28.723}{129}\right) \approx 15,725$ CFS

PEAK OUTFLOW $Q_2 = 15,725$ CFS

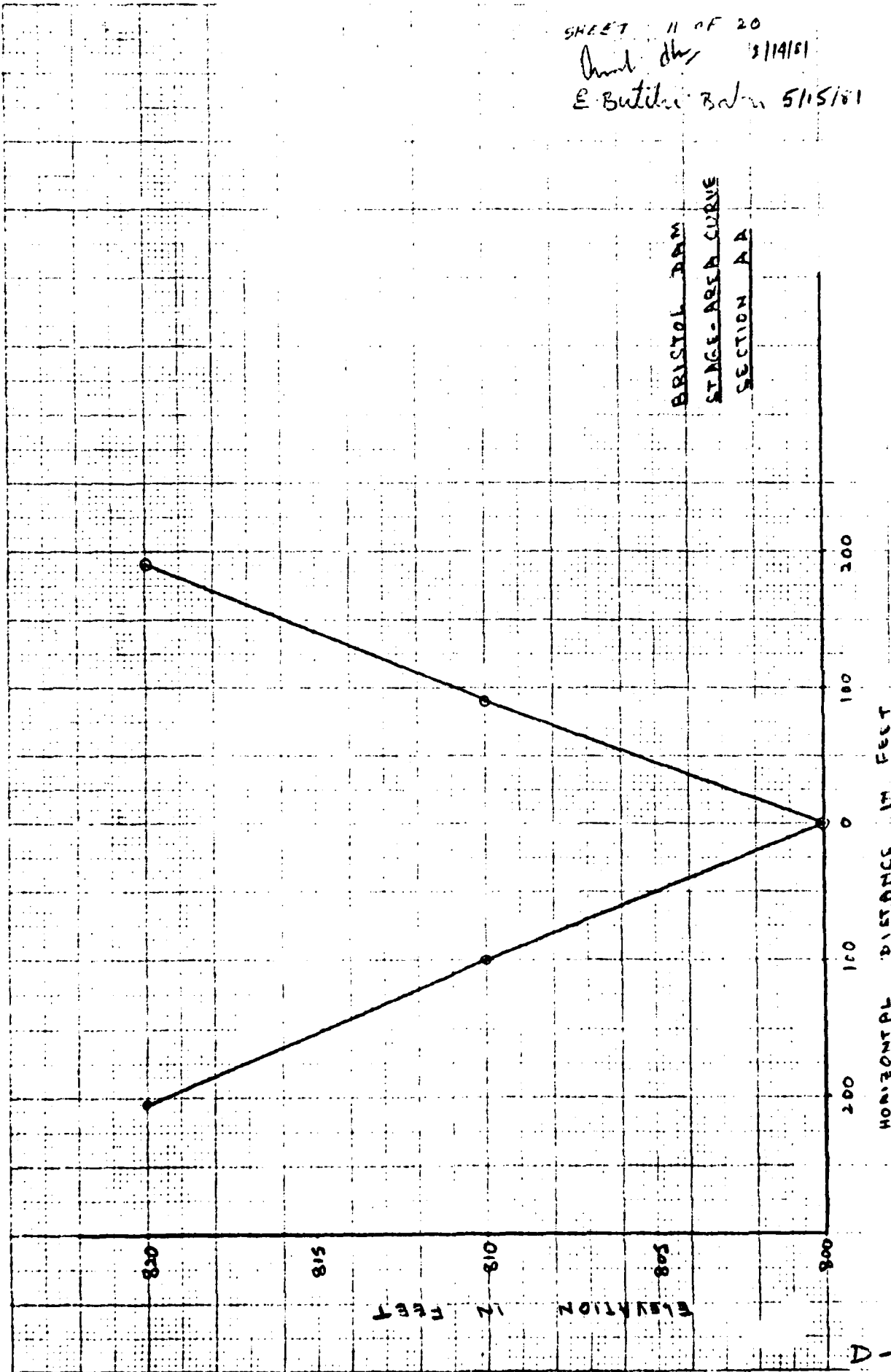
FLOOD STAGE AT SECTION AA = 810.4 NGVD

FLOOD DEPTH AT SECTION AA = 810.4 - 800 = 10.4 FT

VELOCITY AT SECTION AA = $\frac{15,725}{1028} \approx 15$ FPS

SHEET 11 OF 20
Amel. ch. 3/14/81
E. Butler B. W. 5/15/81

BRISTOL DAM
STAGE-AREA CURVE
SECTION A-A



HORIZONTAL DISTANCE IN FEET
LOOKING DOWNSTREAM

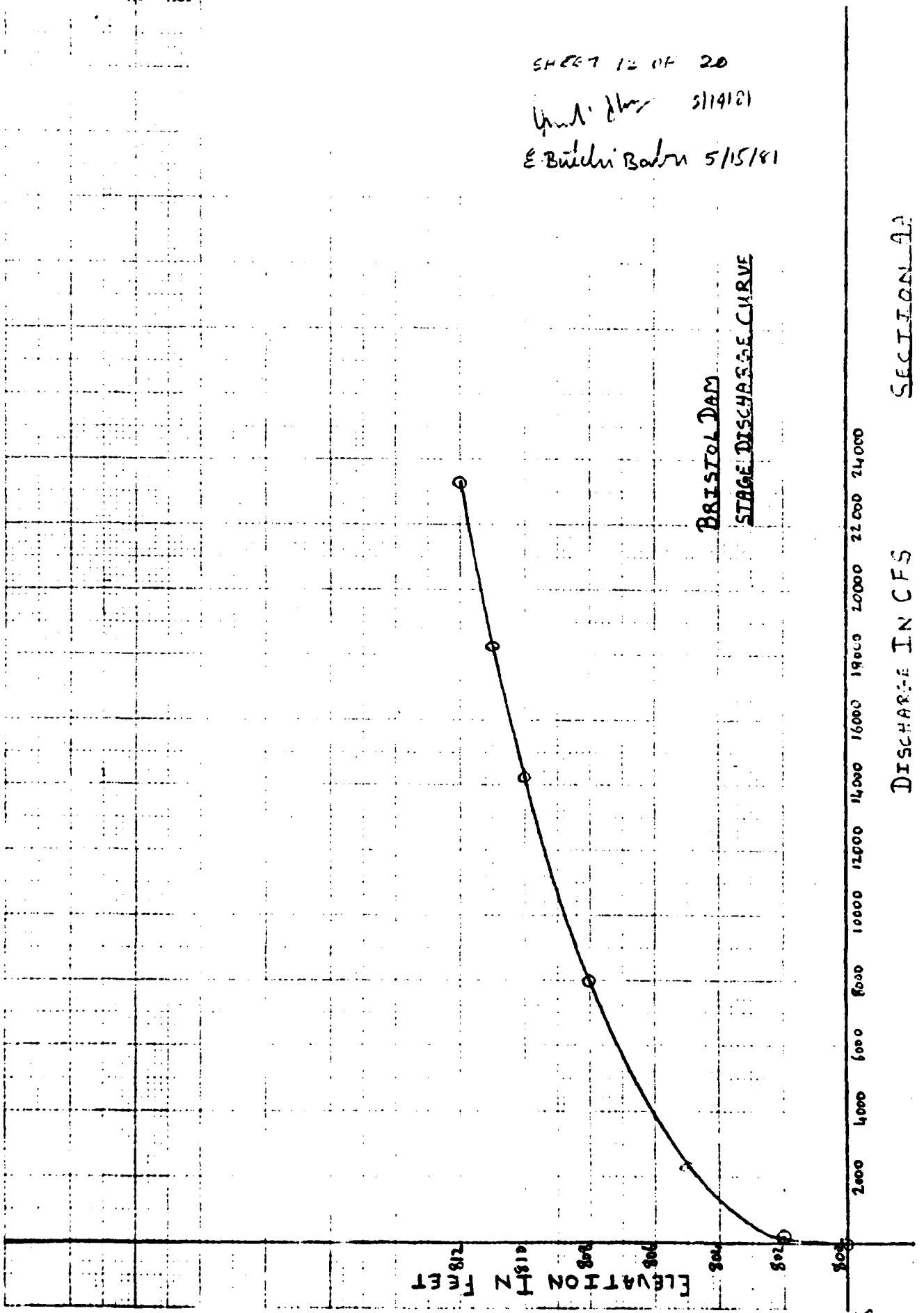
ELEVATION
IN FEET

D-11

SHEET 12 OF 20

Unit No. 5114121

E. Büchli Baden 5/15/81



BRISTOL DAM
STAGE DISCHARGE CURVE

DISCHARGE IN CFS SECTION A-A

DIVERSIFIED TECHNOLOGIES CORP.

CONSULTING ENGINEERS
NORTH HAVEN, CONN.

PROJECT NON FEDERAL DAM INSPECTION PROJECT NO. 81-20-11 SHEET 13 OF 20
NEW ENGLAND DIVISION COMPUTED BY [Signature] DATE 5/15/71
BRISTOL FISH AND GAME CLUB DAM CHECKED BY E. Butcher DATE 5/15/71

SELECTING A SECTION BB 900' DIS OF SECTION AA

$$Q = \frac{1.486}{n} \times A \times R^{2/3} \times S^{1/2} \quad \text{Where } n = 0.06 \text{ assumed}$$

$$A = 0.07 \text{ based on USGS map}$$

$$= \underline{6.553 A R^{2/3}}$$

ELVN	A	P	R	R ^{2/3}	Q
730	0	-	-	-	0
734	185	92.95	1.992	1.584	1920
736	418.5	140.02	2.989	2.076	5693
738	740	185.7	3.985	2.515	12,196
740	1150	230.9	4.991	2.918	21,990

STAGE AREA AND STAGE DISCHARGE CURVES ARE PLOTTED -
 FOR $Q_{P1} = 15,725$ CFS, ELVN = 738.8, AND AREA = 899 SQ. FT.

$$\text{VOLUME OF REACH } V_1 = \frac{900 \times 899}{43,560} \approx 18.5 \text{ AC} \cdot \text{FT}$$

$$\text{TRIAL } Q_{P2} = Q_{P1} \left(1 - \frac{V_1}{S}\right) = 15,725 \left(1 - \frac{18.5}{129}\right) = 13,470 \text{ CFS}$$

FOR 13,470 CFS, ELVN = 738.35 AND AREA = 810 SQ. FT.

$$\text{VOLUME OF REACH } V_2 = \frac{900 \times 810}{43,560} \approx 16.75 \text{ AC} \cdot \text{FT}$$

$$\text{RECOMPUTING } Q_{P2} = 15,725 \left(1 - \frac{18.5 + 16.75}{2 \times 129}\right) \approx 13,575 \text{ CFS}$$

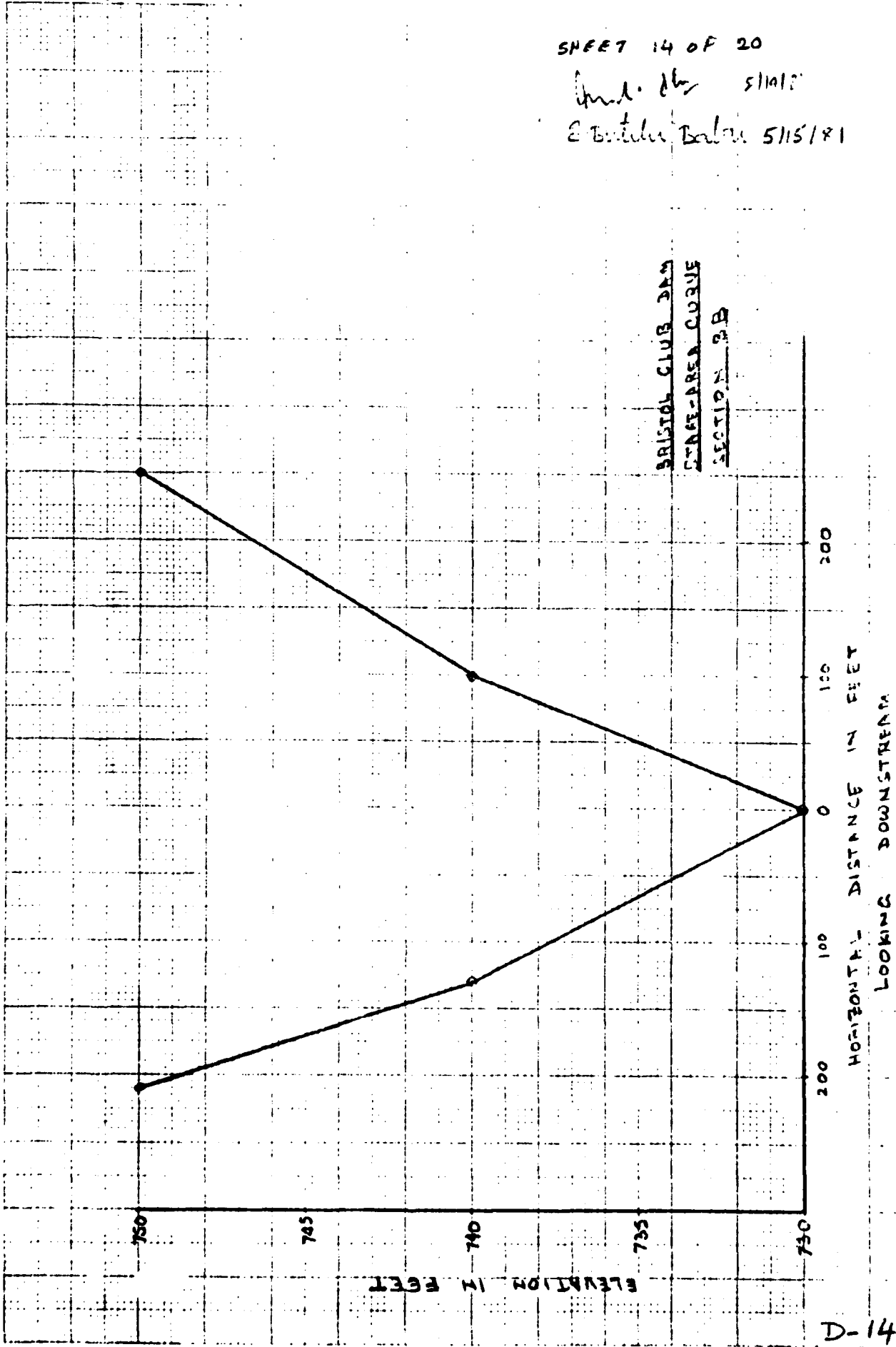
PEAK OUTFLOW $Q_{P2} = 13,575$ CFS

FLOOD STAGE AT SECTION BB = 738.4 NGVD

FLOOD DEPTH AT SECTION BB = 738.4 - 730 = 8.4 FT

VELOCITY AT SECTION BB = $\frac{13,575}{819} \approx 16.5$ FPS

SHEET 14 OF 20
April 26 511412
E. Butler Baber 5/15/81

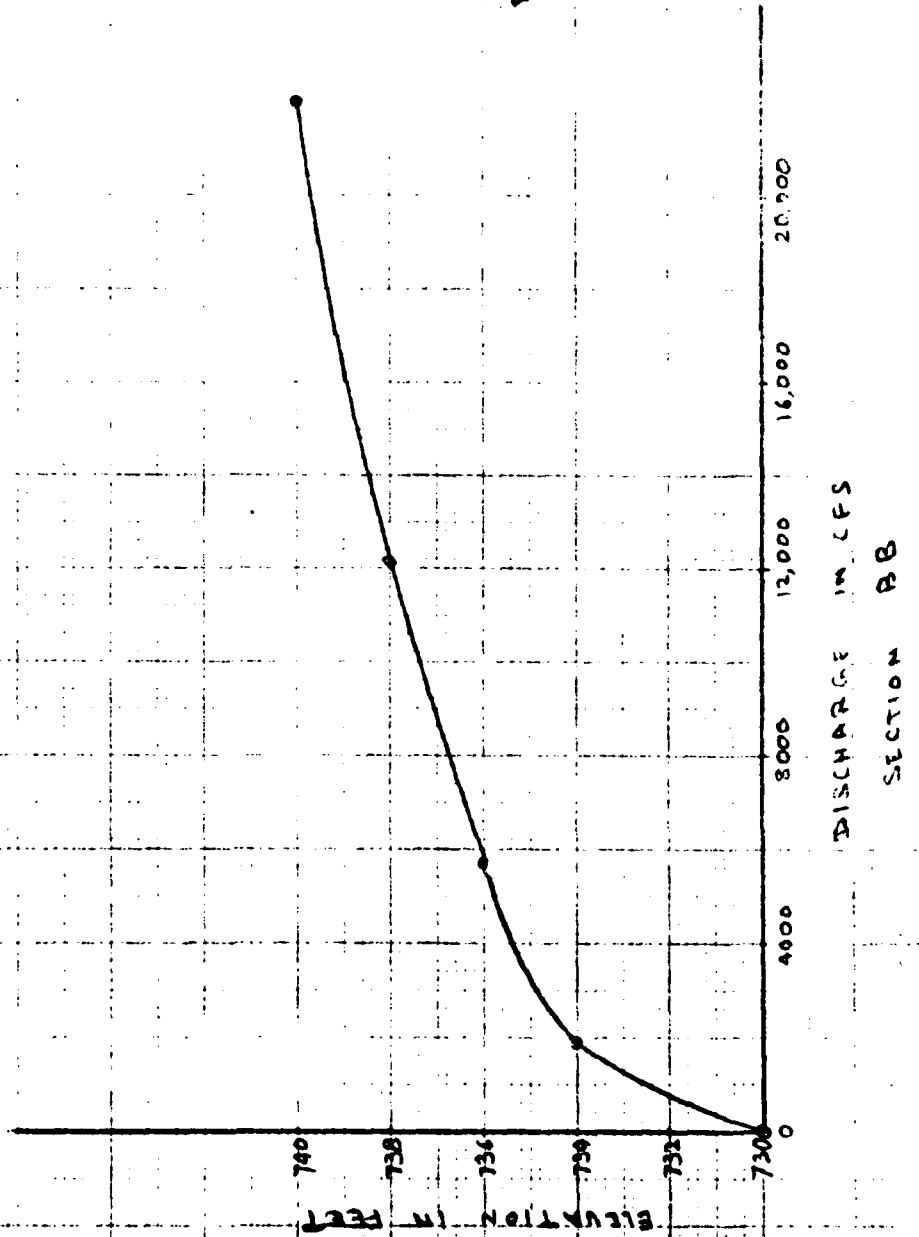


SHEET 15 OF 20

April 16 5/11/21

E. Britton 5/11/21

BRISTOL CURB DAM
STAGE-DISCHARGE CURVE



DISCHARGE IN CFS
SECTION AB

D-15

PROJECT NON FEDERAL DAM INSPECTION PROJECT NO. 81-20-11 SHEET 16 OF 20
NEW ENGLAND DIVISION COMPUTED BY [Signature] DATE 5/15/81
BRISTOL FISH AND GAME CLUB DAM CHECKED BY [Signature] DATE 5/15/81

SELECT A SECTION CC 3700' D/S OF SECTION BB

A CONSIDERABLE REACH LENGTH (3300'±) BELOW SECTION BB IS EXTREMELY STEEP AND NARROW. THEREFORE, ATTENUATION OF STORAGE VOLUME IS CONSIDERED NEGLIGIBLE. THE REACH LENGTH USED IN THIS ANALYSIS IS THEREFORE 400'.

$$Q = \frac{1.486}{n} \times A \times R^{2/3} \times A^{1/2}$$

$$= \underline{6.443} A R^{2/3}$$

Where $n = 0.05$ assumed
 $\rho = 0.047$ Est. from USGS map.

ELVN	A SQ. FT	P	R	R ^{2/3}	Q CFS
230	0	—	—	—	—
232	210	210	1	1	1350
234	820	410	2	1.59	8400
235	1312	525	2.5	1.84	15,555

STAGE AREA AND STAGE DISCHARGE CURVES ARE PLOTTED FOR $Q_{P1} = 13,575$ CFS, ELVN = 234.75 & AREA = 1188 SQ. FT.
 VOLUME OF REACH $V_1 = \frac{400 \times 1188}{43.560} \approx 11$ AC. FT.

TRIAL $Q_{P2} = Q_{P1} \left(1 - \frac{V_1}{S}\right) = 13,575 \left(1 - \frac{11}{129}\right) \approx 12,400$ CFS
 FOR 12,400 CFS, ELVN = 234.6 & AREA = 1104 SQ. FT.
 \therefore VOLUME OF REACH $V_2 = \frac{400 \times 1104}{43.560} \approx 10$ AC. FT.

RECOMPUTING $Q_{P2} = 13,575 \left(1 - \frac{10}{129}\right) \approx 12,400$ CFS.

PEAK OUTFLOW $Q_{P2} = 12,400$ CFS

FLOOD STAGE AT SECTION CC = 234.6 NGVD

FLOOD DEPTH AT SECTION CC = 234.6 - 230 = 4.6 FT.

VELOCITY AT SECTION CC = $\frac{12,400}{1104} \approx 11$ FPS

SHEET 17 OF 20

Amel. No. 5114/81

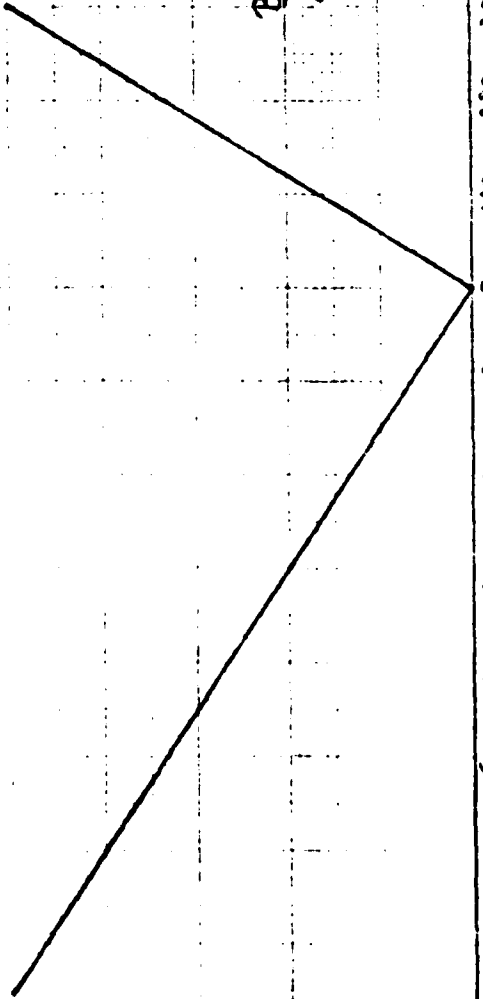
E. B. T. Babu. 5115/81

BRISTOL CLAR DAM
STAGE AREA CURVE
SECTION CC

ELEVATION IN FEET
230
232
234
236
238
240

700 600 500 400 300 200 100 0 100 200 300

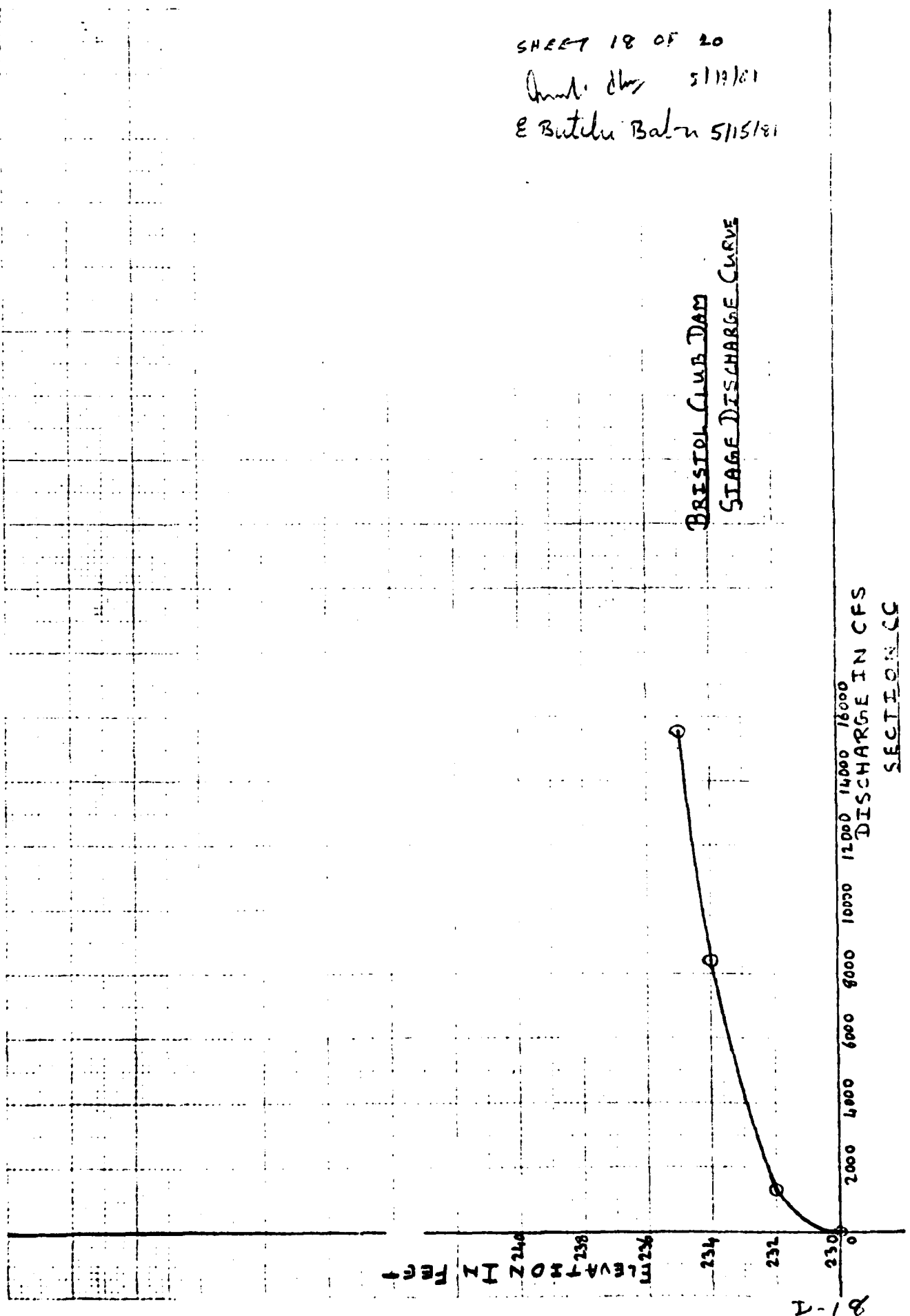
HORIZONTAL DISTANCE IN FEET LOOKING DOWNSTREAM



SHEET 18 OF 20

And. day 5/19/01
E Butcher Balon 5/15/01

BRISTOL CLUB DAM
STAGE DISCHARGE CURVE



DISCHARGE IN CFS
SECTION CC

8-1-1

PROJECT NON FEDERAL DAM INSPECTION

PROJECT NO. 81-20-11 SHEET 19 OF 2

NEW ENGLAND DIVISION

COMPUTED BY J. J. [unclear]

DATE 11/1/81

BRISTOL FISH AND GAME CLUB DAM

CHECKED BY E. Butler [unclear]

DATE 11/1/81

FAILURE HAZARD POTENTIAL

BASED UPON THE EXISTING INFORMATION, THE LOWEST SECTION OF THE DAM APPEARS TO BE IN THE VICINITY OF THE PRINCIPAL SPILLWAY WITH LOW LEVEL OUTLET AND HENCE IT IS PRESUMED THAT BREACH OF THE DAM WOULD OCCUR IN THIS VICINITY.

THE FAILURE ANALYSIS WAS PERFORMED WITH POOL AT TOP OF DAM (EL. 865.5 NGVD).

SUMMARY OF BREACH ANALYSIS RESULTS:

LOCATION	DISTANCE FROM DAM, FT	PEAK FLOW RATE, CFS	FLOOD STAGE, NGVD	FLOOD DEPTH, FT	VELOCITY FPS
DAM	0	19,600	853.0	10.0	—
AA	1000	15,725	810.4	10.4	15
BB	1900	13,575	732.4	8.4	16.5
CC	5600	12,400	234.6	4.6	11

A CONSIDERABLE PORTION OF THE CUSSEGUTTER BROOK DOWNSTREAM OF THE DAM TRAVERSES THROUGH THE BRISTOL FISH AND GAME CLUB PROPERTY AND HUNTING, FISHING AND HIKING ACTIVITIES TAKE PLACE IN THIS REACH. AT DAM BREACH CONDITION, THE FLOOD DEPTHS IN THIS REACH IS ESTIMATED TO BE 10.4 FT (SECTION AA) AND 8.4 FT (SECTION BB) WITH VERY HIGH VELOCITIES (15-16.5 FPS).

FURTHER, DOWNSTREAM, THE BRIDGE ON LAKE AVE. WITH AN OPENING OF 3' X 11' IS LIKELY TO BE IMPACTED WITH HIGH VELOCITY (11 FPS) FLOW OF 12,400 CFS. IN ADDITION, THERE ARE 3 HOUSES ADJACENT TO THE BROOK ON LAKE AVE. WITH 1ST FLOOR ELEVATIONS BETWEEN 7' TO 8.5', WHICH COULD HAVE SOME CELLAR FLOODING.

SINCE, OVERNIGHT CAMPING ON CLUB PROPERTY IS NOT PERMITTED, LOSS OF LIFE FROM DAM FAILURE IS UNLIKELY. HENCE, A HAZARD POTENTIAL OF LOW MAGNITUDE IS CONSIDERED LIKELY.

PROJECT NON FEDERAL DAM INSPECTION PROJECT NO. 81-20-11 SHEET 20 OF 20
NEW ENGLAND DIVISION COMPUTED BY [Signature] DATE 1/1/61
BRISTOL FISH AND GAME CLUB DAM CHECKED BY [Signature] DATE 1/1/61

SUMMARY- HYDRAULIC/HYDROLOGIC COMPUTATIONS

PERFORMANCE AT PEAK FLOOD CONDITIONS

TEST FLOOD	100 YR
PEAK INFLOW	120 CFS
PEAK OUTFLOW	58 CFS
PRINC. SPILL. CAP TO TOP OF DAM (EL. 865.5 NGVD)	27 CFS
PRINC. SP. CAP. TO TOP OF DAM % OF PEAK OUTFLOW	47
PRINC. SP. CAP. TO PEAK FLOOD ELVN 862.85 NGVD	8 CFS
PRINC. SP. CAP. TO PEAK FLOOD ELVN % OF PEAK OUTFLOW	14
EMERGENCY SP. CAP. TO PEAK FLOOD ELVN	50 CFS
EMERGENCY SP. CAP. TO PEAK FLOOD EL % OF PEAK OUTFLOW	86

PERFORMANCE:

MAXIMUM POOL ELVN	862.85 NGVD
MAX. SURCHARGE HEIGHT ABOVE PRINC. SP. CREST	1.85 FT
NON-OVERFLOW SECTION OF THE DAM OVERTOPPED	NO

DOWNSTREAM FAILURE CONDITIONS

PEAK FAILURE OUTFLOW	19,600 CFS
FLOOD DEPTH IMMEDIATELY D/S FROM DAM	10 FT
CONDITIONS AT THE IMPACT AREA: SECTION CC (LAKE AVE)	
(STREAM BED EL. 230)	
EST. STAGE BEFORE FAILURE	230.4 NGVD
EST. STAGE AFTER FAILURE WITH 12,400 CFS	234.6 NGVD
EST. RAISE IN STAGE AFTER FAILURE ΔY_1	4.2 FT

0
178
298
9-1-85
178
998
ATION IN FEET

to the top

7-7

END

FILMED

10-84

DTIC