361
PINE SWAMP RESERVOIR #1

PINE SWAMP RESERVOIR NO. 1 DAM, SCITUATE (361)

Pine Swamp Reservoir No. 1 Dam (Figure 1) has historically been classified by DEM as having a **Low Hazard** potential. No supporting information regarding the determination of the hazard classification was found in the reports in DEM files.

1.00 SUMMARY OF SITE AND POTENTIAL DOWNSTREAM IMPACT AREA

In addition to compiling background information and GIS mapping data, GZA performed field reconnaissance of the dam and its associated downstream area (Figure 2). GZA representatives Peter H. Baril and David M. Leone, accompanied by DEM senior engineer Paul Guglielmino, P.E., visited the site and the downstream river valley on January 29, 2004. A field checklist from the reconnaissance is provided in **Attachment I** and selected photographs are provided in **Attachment II**.

1.10 Site Description

Pine Swamp Reservoir No. 1 Dam is located in the Brandy Brook in the Town of Scituate, Providence County, Rhode Island (See Locus Map, Figure 1). The following identification numbers are associated with the dam:

- Army Corps of Engineers Number RI04301
- DEM ID Number 361

The dam has a total length of approximately 50 feet, and a maximum height of approximately 8 feet. The dam is an earthen embankment structure which appears to have partially breached. A 10-ft long spillway is located near the dam's left abutment, situated within an eroded section of the dam. Snow present on the dam during GZA's field visit hindered observation of the breach section and spillway. Pine Swamp Reservoir No. 2 Dam, which also impounds Pine Swamp Reservoir, is located north of the dam. Pertinent engineering data, as obtained from the DEM dam information database, is provided in **Table 1**.

The purpose of the dam and its impoundment is unknown. The vicinity adjacent to the dam consists of low density residential development and woodlands.

TABLE 1. Pertinent Engineering Data

Dam	
Type	Earth Embankment
Length	Approximately 50 feet
Height	8 feet
Drainage Area	1 sq.mi.
Elevation (feet above approximate MSL)	
Normal Pool (Spillway)	Unknown
Top of Dam	Unknown
Storage (Acre-feet)	
Normal Pool	18
Top of Dam	30
Spillway	
Type	Broad Crested / Earthen
Length of Weir	10 ft

1.20 Downstream Description

Pine Swamp Reservoir No. 1 Dam is located on the Brandy Brook in the Town of Scituate. The immediate downstream area is primarily wooded and there is one residence located near the right bank of the brook about 400 ft downstream, about 5 to 10 feet above the channel.

1.21 Downstream Dams

Shoestring Mill Dam (648) is an approximately 20-ft high earth embankment dam located about 0.5 miles downstream. The spillway capacity of Shoestring Mill Dam is unknown; no spillway was observed during GZA's field reconnaissance. Scituate Reservoir (impounded by Gainer Dam) is located about 4,000 ft (0.75 miles) downstream.

1.22 Downstream Bridges

A culvert beneath Brandy Brook Road is located about 400 ft downstream. Central Avenue and East Road (Route 116) cross the brook downstream of Shoestring Mill Dam, about 3,200 ft and 3,400 ft downstream of Pine Swamp Reservoir Dam No. 1.

1.23 Downstream Development

The banks of the Brandy Brook are wooded. Residential development along Brandy Brook Road appeared to be about 8 to 10 ft above the channel. Further downstream, the floodplain of Brandy Brook is wooded and uninhabited to the Scituate Reservoir.

2.00 DAM HAZARD POTENTIAL ASSESSMENT

To further evaluate the extent of flooding due to a potential dam failure, GZA performed a limited hydraulic investigation of the hypothetical dam break flood. The analysis was performed with the National Weather Service (NWS) Simplified Dam Break (SMPDBK) model, which estimates the peak dam break flood outflow, peak water surface elevations, and the timing of the flood wave as it travels downstream, given breach characteristics specific to the dam and the geometry of the downstream channel and overbank. SMPDBK output summaries are provided in **Attachment III**.

Please note that the approximate extent of hypothetical dam break flooding generated with SMPDBK is not applicable for emergency planning nor other hydraulic design purposes. Detailed hydraulic modeling using state-of-the-practice unsteady flow models such as the NWS DAMBRK or FLDWAV computer programs, which is not in the scope of this study, should be performed when generating inundation maps for Emergency Action Plans or for use in spillway design / inflow design flood (IDF) studies.

2.10 Potential Dam Failure Mechanisms and Breach Description

As specified by the DEM, the simplified hypothetical dam failure analysis assumed starting pool elevations in the impoundment coincident with the top of dam elevation and average stream flow conditions prevailing (i.e., assumed about 1 to 2 cfs per square mile of drainage area). Dam breach parameters such as time of breach formation, breach shape, and the average width of the breach were selected according to these conditions and based upon the type of materials used in constructing the dam, in accordance with the recommended range of values published in the Federal Energy Regulatory Committee (FERC) guidelines and based on engineering judgment. For Pine Swamp Reservoir No. 1 Dam, primarily an earth embankment structure, a time to failure of 0.5 hrs and a trapezoidal breach shape (0.5 H : 1.0 V) was utilized. Such an earthen embankment dam is assumed to fail due to piping under fair weather circumstances. The average breach width was assumed to equal three times the height of the dam, or about 24 feet.

Note that the observed condition of the dam as of GZA's field visit on January 29, 2004 indicates that the criteria assumed by DEM for hazard classification is unlikely to be achieved in this instance. The earthen breach / spillway section at the dam would likely continue to erode in the event of increased water surface elevations, limiting the elevation of the impoundment.

2.20 Estimated Peak Outflow from Dam Break

The peak outflow from the hypothetical dam break was estimated using the breach outflow approximation equation developed by the National Weather Service as part of their SMPDBK computer model (see Attachment III), using the breach parameters described above and top-of-dam pool reservoir characteristics. The estimated peak breach outflow is

above and top-of-dam pool reservoir characteristics. The estimated peak breach outflow is approximately 1,380 cfs. Although there is no published FEMA 100-yr or 500-yr flood estimate for Brandy Brook in the vicinity of Pine Swamp Reservoir No. 1 Dam, the peak dam break outflow is expected to be several times larger than either the 100-yr or 500-yr floods, given the dam's small contributory watershed area of about 1 square mile.

2.30 Estimated Approximate Flood Impact Area

Several riverine cross sections, developed by GZA from USGS 7.5 minute quadrangle maps, were input into the SMPDBK model to preliminarily estimate approximate peak water surface elevations. The results of the analysis are provided as the approximate inundation area depicted in **Figure 2**.

2.31 Downstream Extent of Flooding

The Brandy Brook downstream of Pine Swamp Reservoir No. 1 Dam is relatively gently sloping. Typical Mannings "n" roughness coefficients used in the analysis were 0.04 for the channel areas, and 0.08 for the overbank areas. The hypothetical dam failure flood wave is expected to dissipate within Scituate Reservoir.

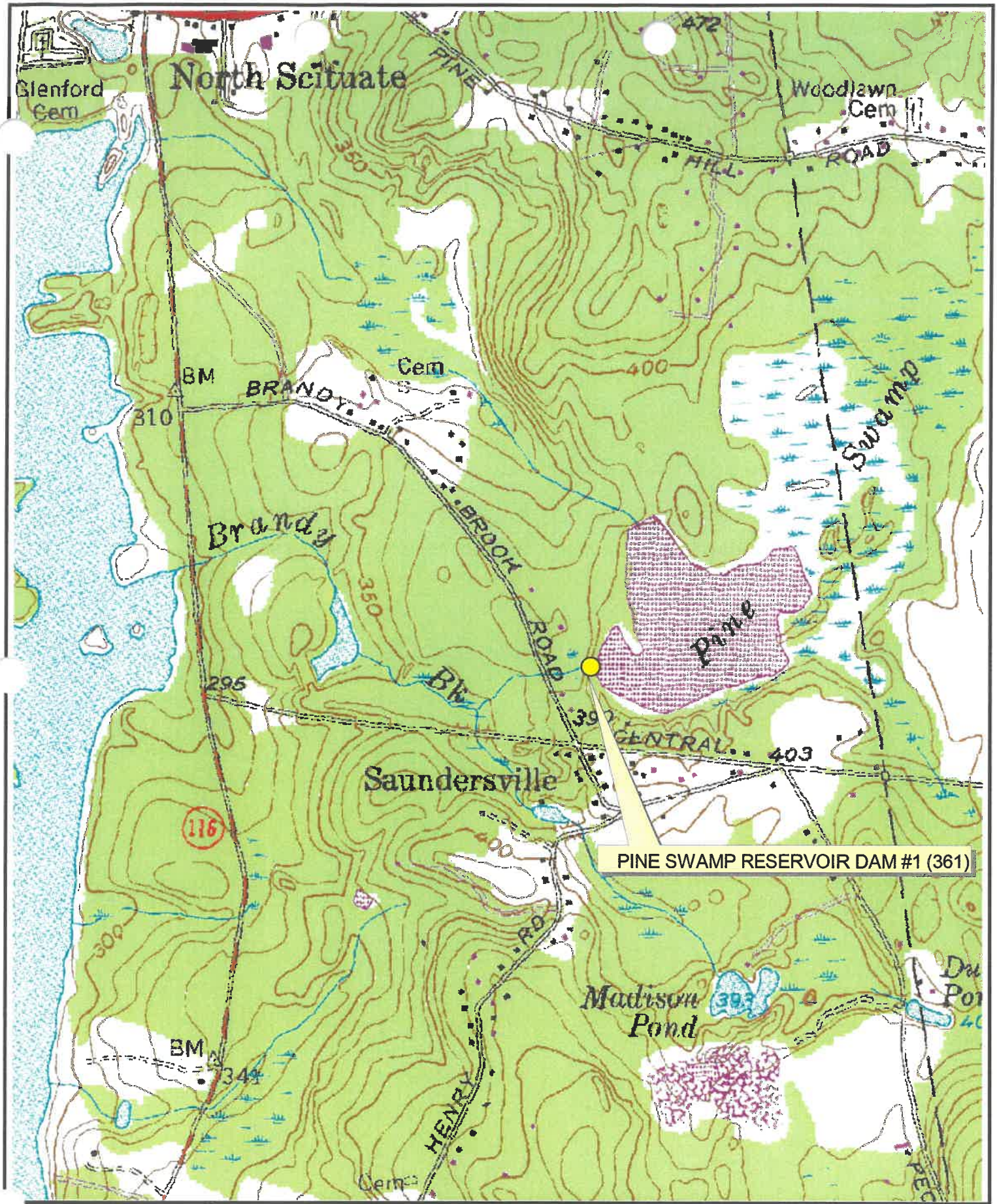
2.32 Potential Effects of Dam Break

Results of the analysis indicate a peak flood depth at the immediate toe of the dam of about 6 feet. As the flood wave progresses downstream, it is expected to attenuate. Peak flood depths just upstream of Scituate Reservoir, approximately 0.75 miles downstream of Pine Swamp Reservoir No. 1 Dam, are predicted to decrease to approximately 3.75 feet. Peak flood depths are expected to further decrease to less than 0.5 feet within Scituate Reservoir Dam. The extent of flooding due to the hypothetical dam break likely does not include residences along Brandy Brook Road, but could overtop roadway crossings and Shoestring Mill Dam. GZA has recommended Shoestring Mill Dam be classified as a ***Significant Hazard*** structure.

2.40 Recommended Hazard Potential Classification

GZA recommends that Pine Swamp Reservoir No. 1 Dam be classified as ***Significant Hazard*** based on the aforementioned analyses, site / downstream valley reconnaissance, site-specific GIS mapping and other existing data, and professional judgment. A potential dam failure of Pine Swamp Reservoir No. 1 Dam would likely result in no probable loss of human life, but may result in major economic losses, including the overtopping and potential washout of Brandy Brook Road, East Road (Route 116), and Central Avenue. Shoestring Mill Dam may also be overtopped and breached.

FIGURES



SOURCE: RIGIS

FIGURE 1. LOCUS MAP
PINE SWAMP RESERVOIR DAM #1 (361)
SCITUATE, RI

SCALE
500 0 500 1000 1500 Feet

RHODE ISLAND DEM
OFFICE OF COMPLIANCE & INSPECTION

GZA

Note: The following data presented on this figure was obtained from RIGIS and was not checked for accuracy: Road names, bridges, schools, public safety buildings, hospitals, water supply withdrawals and dams.

SOURCE RIGIS

DATE OF MAP: APRIL 1997

SCALE 0 250 500 1,000 Feet

GZA

DAM HAZARD POTENTIAL CLASSIFICATION MAP

PINE SWAMP RESERVOIR NO. 1 DAM
SCITUATE, RHODE ISLAND

GZA NO. 17085.10

FIGURE 2

ATTACHMENT I

FIELD RECONNAISSANCE CHECKLIST

DAM HAZARD POTENTIAL FIELD CHECKLIST

Name of Dam: PINE SWAMP RESERVOIR NO. 1 DAM — RI DEM ID NO. 361

Location: Scituate (Town) — Brandy Brook (River or Stream)

Scituate (Downstream Communities) — Scituate Reservoir (Major Confluence)

Classification Data: Small (Size) — (Date Built)

PHYSICAL DATA:

Earth Embankment (Type of Dam)	about 8 ft (Height of Dam)	50 ft (Length of Dam)
Broad Crested / Earthen (Type of Spillway)	10 ft (Length of Spillway)	
Unknown (Purpose of Dam)	Near spillway crest (Pool at Inspection)	18 ac-ft (Normal Pool Storage Capacity)
U/S: 2:1 D/S: 2:1 (Embankment Slopes (H:V))	Likely bedrock (Foundation (if known, note rock/soil surroundings))	30 ac-ft (Maximum Pool Storage Capacity)

Name	Title/Position	Representing
Peter H. Baril	Associate Principal / Hydrologist	GZA GeoEnvironmental, Inc.
David M. Leone	Asst. Project Mgr / Hydrologist	GZA GeoEnvironmental, Inc.
Paul W. Guglielmino	DEM Dam Safety Senior Engineer	RIDEM Office of Compliance & Inspection

DATE OF INSPECTION: 1/29/2004

WEATHER: Partly Cloudy — TEMPERATURE: 25 deg. F

Name of Dam: PINE SWAMP RESERVOIR NO. 1 DAM I.D. No.: 361 Inspection Date: 29-Jan-04

STRUCTURAL CONDITION	1	Concrete Condition	Obscured by snow and ice
	2	Outlet Condition	Obscured by snow and ice
	3	Unusual Movement	Spillway in earthen breach section near centerline; water elevation unlikely to reach top of dam.
	4	Seepage / Wet Area	Obscured by snow and ice
	5	Embankment Slides/Erosion	Obscured by snow and ice
	6	Vegetation / Pest Control	Obscured by snow and ice
DAM & IMMEDIATE DOWNSTREAM AREA	7	Vicinity Description	Wooded / Low density residential area owned by public water utility
	8	Dam Roads & Utilities	None at dam
	9	Discharge Channel	To small natural channel (Brandy Brook)
	10	Structures (Gatehouses, etc.)	None at dam
	11	Adjacent Land Use	Wooded / Residential.
	12	Adjacent Population Density	Low
	13	Downstream Constrictions	Brandy Brook culvert about 400 ft downstream
	14	Downstream Access / Use	Access to dam via private residential property
	15	Property / Infrastructure / Utility Description & Distance	Residence at Brandy Brook Road about 400 ft downstream; approximately 10 ft above channel thalweg
GENERAL DOWNSTREAM AREA	17	Land Use Classification	Wooded (watershed protection area tributary to Scituate Reservoir)
	18	Population Density	Low to none
	19	Property / Infrastructure	Primarily wooded; two roadways cross Brandy Brook (see 22)
	21	Downstream Dams	Shoestring Mill Dam (648), about 0.5 miles downstream Scituate Reservoir (Gainer Memorial Dam). Reservoir headwaters about 4,000 ft downstream
	22	Downstream Bridges	Brandy Brook Road, East Road (Rt 116), and Central Avenue.
	23	Upstream Dams	N/A
	24	Channel Description (depth, Manning's n, width, overbank)	Small natural earthen channel. Typical Mannings "n".

ADDITIONAL COMMENTS: REFER TO ITEM NO. IF APPLICABLE

3. Unclear from snow and ice accumulation; Erosion near and around spillway indicate previous overtopping and loss of dam material. It appears likely that the dam would (continue to) erode / fail if water surface elevations rise. Impoundment is present, but appears shallow (emergent vegetation)

ATTACHMENT II

FIELD PHOTOGRAPHS

Description: Photo 1. View of spillway and breach-like section near dam's left abutment

Description: Photo 2. Close-up of spillway.

Description: Photo 3. Residential development above the right bank of Brandy Brook, about 400 ft downstream.

Description: Photo 4. Brandy Brook Road culvert, about 400 ft downstream of the dam.

ATTACHMENT III

SMPDBK OUTPUT SUMMARY

SIMPLIFIED DAMBREAK MODEL (SMPDBK) VERSION: 9/91
BY D.L. FREAD, J.M. LEWIS, & J.N. WETMORE - PHONE: (301) 427-7640
NWS HYDROLOGIC RESEARCH LAB W/OH3, 1325 EAST-WEST HIGHWAY,
SILVER SPRING, MD 20910

***** DISTANCE TO PRIMARY POINT OF INTEREST MOVED TO THE CROSS SECTION
***** CLOSEST TO THIS LOCATION (MI .49)

THE DATA FOR THIS DAM IS AS FOLLOWS:

TYPE OF DAM (IDAM)	EARTH	
DAM BREACH ELEVATION (HDE)	390.00	FT
FINAL BREACH ELEVATION (BME)	382.00	FT
SURFACE AREA OF RESERVOIR (SA)	40.00	ACRES
FINAL BREACH WIDTH (BW)	24.00	FT
TIME OF DAM FAILURE (TFM)	30.00	MINUTES
NON-BREACH FLOW (QO)	1.00	CFS
DISTANCE TO PRIMARY PT OF INTEREST (DISTTN)	.49	MILES
DEAD STORAGE EQUIV. MANN. N (CMS)	.50	

CROSS SECTION NO. 1

FLOOD DEPTH (FLD)	5.00 FT			
ELEV.(FT) (HS)	382.0	385.0	390.0	400.0
TWIDTHS(FT) (BS)	24.0	24.0	700.0	2000.0
INACTIVE TW(FT) (BSS)	.0	.0	.0	.0
MANNING N (CM)	.040	.040	.080	.080

CROSS SECTION NO. 2

REACH LENGTH (D)	.01 MI			
FLOOD DEPTH (FLD)	5.00 FT			
ELEV.(FT) (HS)	381.9	385.0	390.0	400.0
TWIDTHS(FT) (BS)	24.0	24.0	700.0	2000.0
INACTIVE TW(FT) (BSS)	.0	.0	.0	.0
MANNING N (CM)	.040	.040	.080	.080

CROSS SECTION NO. 3

REACH LENGTH (D)	.27 MI			
FLOOD DEPTH (FLD)	5.00 FT			
ELEV.(FT) (HS)	356.0	359.0	360.0	370.0
TWIDTHS(FT) (BS)	.0	10.0	350.0	800.0
INACTIVE TW(FT) (BSS)	.0	.0	.0	.0
MANNING N (CM)	.040	.040	.080	.080

CROSS SECTION NO. 4

REACH LENGTH (D)	.49 MI			
FLOOD DEPTH (FLD)	5.00 FT			
ELEV.(FT) (HS)	345.0	350.0	360.0	370.0
TWIDTHS(FT) (BS)	275.0	300.0	500.0	700.0
INACTIVE TW(FT) (BSS)	.0	.0	.0	.0
MANNING N (CM)	.080	.080	.080	.080

AN ASTERISK (*) BESIDE A PARAMETER IMPLIES THAT A DEFAULT VALUE WAS COMPUTED

NAME OF DAM: PINE SWAMP RESERVOIR NAME OF RIVER: BRANDY BROOK

RVR MILE FROM DAM	MAX FLOW (CFS)	MAX ELEV (FT-MSL)	MAX DEPTH (FT)	TIME(HR) MAX DEPTH	TIME(HR) FLOOD	TIME(HR) DEFLOOD	FLOOD DEPTH(FT)
.00	1375.	387.86	5.86	.50	.27	1.57	5.00
.01	1053.	387.29	5.39	.51	.38	1.34	5.00
.27	1042.	360.09	4.09	.65	.00	.00	5.00
.49	1031.	346.54	1.54	.66	.00	.00	5.00

ANALYSIS IS COMPLETE

SHOESTRING MILL DAM BREACH (DOMINO FAILURE FROM PINE SWAMP #1 BREACH)

SIMPLIFIED DAMBREAK MODEL (SMPDBK) VERSION: 9/91
BY D.L. FREAD, J.M. LEWIS, & J.N. WETMORE - PHONE: (301) 427-7640
NWS HYDROLOGIC RESEARCH LAB W/OH3, 1325 EAST-WEST HIGHWAY,
SILVER SPRING, MD 20910

***** DISTANCE TO PRIMARY POINT OF INTEREST MOVED TO THE CROSS SECTION
***** CLOSEST TO THIS LOCATION (MI 1.12)

THE DATA FOR THIS DAM IS AS FOLLOWS:

TYPE OF DAM (IDAM)	EARTH	
DAM BREACH ELEVATION (HDE)	350.00	FT
FINAL BREACH ELEVATION (BME)	330.00	FT
VOLUME OF RESERVOIR (VOL)	30.	ACRE-FT *
SURFACE AREA OF RESERVOIR (SA)	3.00	ACRES
FINAL BREACH WIDTH (BW)	60.00	FT
TIME OF DAM FAILURE (TFM)	30.00	MINUTES
NON-BREACH FLOW (QO)	1031.00	CFS
DISTANCE TO PRIMARY PT OF INTEREST (DISTTN)	1.12	MILES
DEAD STORAGE EQUIV. MANN. N (CMS)	.50	

CROSS SECTION NO. 1
FLOOD DEPTH (FLD) 5.00 FT

ELEV.(FT) (HS)	330.0	340.0	350.0	360.0
TWIDTHS(FT) (BS)	45.0	250.0	300.0	500.0
INACTIVE TW(FT) (BSS)	.0	.0	.0	.0
MANNING N (CM)	.040	.040	.080	.080

CROSS SECTION NO. 2
REACH LENGTH (D) .01 MI
FLOOD DEPTH (FLD) 329.90 FT

ELEV.(FT) (HS)	329.9	340.0	350.0	360.0
TWIDTHS(FT) (BS)	.0	250.0	300.0	500.0
INACTIVE TW(FT) (BSS)	.0	.0	.0	.0
MANNING N (CM)	.040	.040	.040	.080

CROSS SECTION NO. 3
REACH LENGTH (D) .25 MI
FLOOD DEPTH (FLD) 5.00 FT

ELEV.(FT) (HS)	285.0	287.0	290.0	300.0
TWIDTHS(FT) (BS)	.0	10.0	300.0	900.0
INACTIVE TW(FT) (BSS)	.0	.0	.0	.0
MANNING N (CM)	.040	.040	.080	.080

CROSS SECTION NO. 4
REACH LENGTH (D) 1.12 MI
FLOOD DEPTH (FLD) 1.00 FT

ELEV.(FT) (HS)	284.0	290.0	300.0	310.0
TWIDTHS(FT) (BS)	2800.0	2900.0	3000.0	3100.0
INACTIVE TW(FT) (BSS)	.0	.0	.0	.0
MANNING N (CM)	.040	.080	.080	.080

AN ASTERISK (*) BESIDE A PARAMETER IMPLIES THAT A DEFAULT VALUE WAS COMPUTED

NAME OF DAM: SHOESTRING MILL DAM NAME OF RIVER: BRANDY BR

RVR MILE FROM DAM	MAX FLOW (CFS)	MAX ELEV (FT-MSL)	MAX DEPTH (FT)	TIME(HR) MAX DEPTH	TIME(HR) FLOOD	TIME(HR) DEFLOOD	FLOOD DEPTH(FT)
.00	1085.	334.00	4.00	.50	.00	.00	5.00
.01	1048.	334.00	4.10	.50	.00	.00	329.90
.25	1038.	288.79	3.79	.55	.00	.00	5.00
1.12	338.	284.42	.42	1.62	.00	.00	1.00

ANALYSIS IS COMPLETE