Final Report

Inflow Design Flood Study
Jackson Bluff Hydroelectric Project
FERC Project No. 2891



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May 2005

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Inflow Design Flood Study
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1. Introduction

This study was conducted to identify the Inflow Design Flood (IDF) for the Jackson Bluff Hydroelectric Project under Federal Energy Regulatory Commission (FERC) criteria. This IDF study parallels the study performed by R.W. Beck in 1983, but follows the current FERC *Engineering Guidelines for the Evaluation of Hydropower Projects* for breach assumptions.

This study includes an updated dam failure analysis using the National Weather Service DAMBRK dynamic-routing model and breach parameters currently required by the FERC. Downstream structure locations and elevations were identified by the City of Tallahassee and dam failures were simulated for a range of overtopping conditions, beginning with an outflow of 152,000 cubic feet per second (cfs) – the flow that would overtop the dam by 0.1 foot. An outflow of 152,000 cfs is associated with an inflow hydrograph peaking at 155,000 cfs, which is 50 percent of the Probable Maximum Flood (PMF). Results from the model runs showed that if the dam failed at the maximum pool outflow of 152,000 cfs, the increase in downstream flood hazard would not be significant. Therefore, the IDF of the project is equal to its current value of 155,000 cfs (50 percent of the PMF), and the current spillway capacity of the dam meets FERC IDF criteria.

2. Description of Project

Jackson Bluff Dam is located on the Ochlockonee River about 66 miles upstream from its mouth at the Gulf of Mexico and approximately 20 miles west-southwest of the City of Tallahassee. The dam consists of three major structural elements – a powerhouse, a 199-foot-long gated spillway, and a 3,600-foot-long earth embankment. The crest of the embankment is at elevation 77 feet and the typical embankment height is about 40 feet.[1] A 950-foot-long emergency spillway and a 562-foot-long fuse plug, constructed in 1984, are located on the right end of the earth embankment. The emergency spillway crest elevation is 72.3 feet, and the fuse plug is designed to deploy at a reservoir elevation of 74.3 feet. The concrete sill of the fuse plug is at elevation 68.3 feet. The reservoir upstream of the dam, known as Lake Talquin, has a surface area of about 10,200 acres and a gross volume of about 150,000 acre-feet at the normal maximum water surface elevation of 68.5 feet.

Subsequent to a 1978 inspection report for Jackson Bluff Dam, the U.S. Army Corps of Engineers (USACE) determined that the appropriate spillway capacity was one-half the PMF. This finding resulted in the construction of the fuse plug and the emergency spillway. The 1983 *Dam Breach Study*, prepared by R. W. Beck, concluded that with the fuse plug and the emergency spillway in operation, there would be no incremental hazard for a dam failure at the peak of a 58-percent PMF event compared with the same flood event without dam failure. With the fuse plug functioning, an inflow of 58 percent of the PMF (179,000 cfs) would overtop the embankment crest elevation of 77 feet by 1 foot. Based on these analyses, it was concluded that the spillway capacity was adequate. The Beck study's assumptions about breach dimensions and the depth of overtopping that would occur before a breach developed were commonly used at the time of that study, but are not consistent with current FERC criteria.

Mead & Hunt recomputed the spillway rating curve as part of this study. According to the computation, the spillway can pass 148,000 cfs at the top-of-dike elevation of 77 feet after the fuse plug deploys. An outflow of 149,700 cfs (including 1,700 cfs of turbine flow, which is about one-third of the plant's hydraulic capacity at normal headwater and tailwater levels) corresponds to a peak inflow of 153,000 cfs, which is 49.5 percent of the PMF. The computation of the spillway rating curve is attached as Appendix A. Mead & Hunt's computed spillway capacity is slightly less than the capacity of 155,000 cfs presented in earlier reports, primarily because of a transition to orifice flow at the spillway which was not included in the rating curve computed by the USACE.

The vicinity map of the Jackson Bluff Hydroelectric Project is shown in Appendix B, and the layout of the Project is shown in Appendix C.

[1] All elevations in this report pertaining to the project are given in feet and referenced to mean sea level.

3. Flood Hydrographs

The PMF hydrograph used in this study, originally developed by the USACE to test the existing spillway capacity in the 1978 inspection report, was obtained from the 1983 dam breach study. The PMF developed by the USACE was based on an analysis of the flood that occurred in the project area in 1948 and a Probable Maximum Precipitation (PMP) that was obtained from the U. S. Weather Service Hydrometeorological Report No. 51. The peak PMF inflow derived was 309,000 cfs. A small amount of attenuation of the inflow hydrograph occurs in the reservoir, so that the peak outflow for any of the scaled hydrographs is roughly 98 to 99 percent of the inflow peak. For comparison, the flood of record at the USGS gage just downstream of the dam for water years 1926 to present is 89,400 cfs, which was recorded on September 25, 1969.

The PMF hydrograph was scaled down to produce possible IDF hydrographs. The scaled inflow hydrograph was run through the model with no failure of the dam; then a second run was made in which the dam was assumed to fail at the peak stage reached by the reservoir for the non-failure case. With-failure and no-failure profiles were compared to identify the incremental flooding caused by the failure of the dam. Inflow hydrographs are plotted in Appendix D.

4. Flood-Routing Model

The National Weather Service DAMBRK model (BOSS version) was used for this study. The DAMBRK program computes a breach outflow hydrograph and uses the dynamic wave method to route the outflow hydrograph downstream. The model computes water surface elevations, flow rates, time to peak flow, and outflow hydrographs at different locations along the river. An electronic copy of the DAMBRK model accompanies this report.

A. Cross Sections

Twenty-one cross sections were chosen from 23 miles upstream of the Jackson Bluff Dam to approximately 34 miles downstream of the dam, giving a total model reach length of approximately 57 miles. For model calibration purposes, one cross section was located at the U.S. Geological Survey (USGS) gage station No. 02330000 (Ochlockonee River near Bloxham, Florida) just downstream of the dam, and 11 were located to be consistent with cross sections in the 1983 *Dam Breach Study*. Overbank geometry of the cross sections was measured from the USGS 7.5-minute topographic maps. A triangle shape was assumed for the reservoir and the main channel of the river. The bottom of the channel was estimated based on the 1983 *Dam Breach Study Report* and the USGS topographic maps.

Index maps are included in this report as Appendix E.

B. Manning's Roughness Coefficients

The Manning's roughness coefficients (Manning's "n") for the river channel and its overbank areas were estimated based on field pictures, and adjusted by calibrating the model to match the known stage–discharge relationship at the USGS gage station located just downstream of the Jackson Bluff Dam. The Manning's "n" value was determined to be 0.03 for the main channel and 0.095 for the overbank areas. Composite roughness coefficients were used in the model.

C. Lateral Inflows

A number of tributaries enter the river downstream of the Jackson Bluff Dam. However, the incremental drainage area between the dam and the downstream end of the routing reach is only about 20 percent of the area above the dam, and these tributaries would not necessarily experience flooding simultaneously with a large flood originating upstream of the dam. Therefore, to provide conservative estimates of the incremental rise due to failure, potential tributary inflows in the downstream routing reach were not considered.

D. Boundary Condition and Calibration of the Model

Channel control was chosen as the downstream boundary condition. The known stage-discharge relationship at the USGS gage station just downstream of the dam was used to calibrate the model. The water surface elevations were calibrated to be within 1.5 feet of the difference with the measured stages at the gage station at floods ranging from 6,870 to 89,400 cfs.

E. Breach Assumptions

A breach was assumed to occur in the highest part of the earthen embankment dam when the water level in the reservoir dam reached the peak of the no-failure stage hydrograph. The breach parameters were selected based on FERC criteria, to represent a very severe dambreak scenario. The dam was assumed to fail down to the foundation elevation of 37 feet, with an average breach width of 5 times the height of the dam (40 feet) and a breach side slope of 1:1. Because of the large size of the reservoir, the water level in the reservoir would draw down slowly and the peak outflow is not sensitive to breach formation time. Therefore, the breach time was assumed to be 1 hour. A schematic drawing of the breach is shown in Appendix F.

5. Results of Analysis

This study assumed that the fuse plug deployed when the reservoir level reached the elevation of 74.3 feet, breaching down to the concrete sill at elevation of 68.3 feet. Under these conditions, the dam would be overtopped by 0.1 foot during an inflow hydrograph peaking at 155,000 cfs, which is equal to 50 percent of the PMF. If the dam failed under these conditions, the incremental rise caused by the assumed breach would exceed 2 feet for a distance of approximately 14 miles downstream of the dam. The model input and output summaries are attached as Appendix G.

Table 1
Summary of Downstream Flow Conditions at 50-Percent PMF
Peak Inflow = 155,000 cfs

Cross Section No.	Location Downstream of Dam (miles)	Peak Elevation Without Failure (feet)	Peak Elevation With Failure (feet)	Incremental Rise (feet)	Peak Flow After Failure (cfs)
40.15 (Jackson Bluff Dam TW)	0.07	57.5	60.7	2	252,100
40.5 (ED and Bernice's Fish Camp)	0.42	56.8	59.9	3.1	243,200
40.76 (USGS Gage Station)	0.68	56.0	59.0	3.0	239,800
45	4.92	48.4	51.0	2.6	208,800
49.7(Langston – Chason Area)	9.62	40.7	43.0	2.3	201,400
56.645 (Jack Langston Road – East Street)	16.57	31.5	33.4	1.9	190,600
58.7 (Cox Road)	18.62	29.8	31.7	1.9	187,100
67.7 (Roberts Landing Road)	27.60	24.7	26.2	1.5	173,800
70.3 (Marshal Lakes Area)	30.20	23.3	24.6	1.3	172,200
74.4	34.30	18.6	19.9	1.3	170.400

These results indicate that if a severe breach forms in the deepest section of the earthen dam immediately upon overtopping, the incremental rise due to the failure would exceed the 2-foot criterion between the dam and the Langston-Chason Area, which is located approximately 9.6 miles downstream of the dam.

6. Downstream Development

The City of Tallahassee surveyed the structures downstream of the Jackson Bluff Dam to determine their locations and floor and ground elevations. The survey results show that there are some developments approximately half a mile downstream of the dam – a fish camp, a mobile home park, and a road with 45 resident homes. The floor elevations of the structures in this area vary from 47.33 feet to 60.71 feet, and the ground elevations vary from 43.37 feet to 51.15 feet, with the exception of a business at the fish camp. The ground elevation of the business structure is about 56.0 feet, approximately 10 feet above the campground. However, the access road to the fish camp is at approximately the same elevation as the campground.

More developments exist between the Langston – Chason Area, approximately 9.6 miles downstream of the dam, and the downstream end of the study reach. There are six structures in the Langston – Chason Area. The floor elevations of the structures vary from 33.9 feet to 44.9 feet, and the ground elevations vary from 38.69 feet to 47.03 feet.

Ground elevations of the structures immediately below the dam area and structures at the Langston – Chason Area are summarized in Table 2, and compared to the pre-breach flood elevations.

Table 2
Comparison of Ground Elevations and Pre-Breach Flood Elevation at Developments Just Downstream of the Jackson Bluff Dam

Developments	Cross Section No.	Location Downstream of Dam (miles)	Peak Elevation Without Failure at 50-Percent PMF (feet)	Highest Ground Elevation at a structure (feet)	Difference Between Highest Ground Elevation and Flood Elevation (feet)
ED and Bernice's Fish Camp	~ 40.5*	0.42	56.76	47.4	9.36
R J's House of Catfish	~ 40.5*	0.42	56.76	56.0	0.76
Lula Bradwell Reveis Mobile Home Park	~ 40.76*	0.68	55.98	47.8	8.18
Crooked Road	~ 40.76*	0.68	55.98	51.16	4.82
Langston – Chason Area	~ 49.7*	9.62	40.68	44.9	- 4.22

** Locations of developments are estimated based on the USGS topographic maps.*

7. Discussions and Conclusions

The model results (Table 1) indicate that if the dam failed immediately upon overtopping at an inflow of 50-percent PMF (155,000 cfs), the incremental rise in the Langston-Chason Area would slightly exceed the 2-foot rise criterion (2.3 feet), and the area downstream of the Langston – Chason developments would experience incremental rises equal to or less than 2 feet. For the developments a half mile downstream of the Jackson Bluff Dam, the incremental rise would be significantly greater than 2 feet, but the pre-failure flood would inundate the "at-risk" structures and their access road by 5 to 9 feet. Furthermore, the flood would have been rising slowly to this level over a period of several days. Therefore, it is highly probable that all residents would be evacuated and the incremental rise due to a dam failure, although exceeding 2 feet, would not significantly increase the flood hazard. Given the very severe breach assumptions, the catastrophic nature of pre-failure flooding (which would exceed the flood of record by about 75 percent), and the fact that the maximum incremental rise at an "at-risk" structure only slightly exceeds the 2-foot criterion, we conclude that the failure of the dam during a flood of 155,000 cfs would not significantly increase the downstream flood hazard. Therefore, the combined capacity of the existing spillway structures is adequate.

8. Sensitivity Studies

Sensitivity of this DAMBRK model was tested assuming a wider breach and a longer breach formation time. Assumptions used in the sensitivity studies are compared to those used in the regular runs in Table 3. Incremental rises at the Langston – Chason Area at 50-percent PMF using different breach assumptions are also compared in Table 3.

Table 3
Comparison of Breach Assumptions

	Breach Side Slope	Breach Bottom Elevation (feet)	Breach Base Width (feet)	Time of Breach Formation (hours)	Incremental Rise at Langston – Chason, Mile 49.7, 50 percent PMF (feet)
Sensitivity Runs	1:1	37.0	320	2	3.6
Base Case Runs	1:1	37.0	160	1	2.3

The sensitivity studies showed that a wider breach and longer breach formation time would result in larger incremental rises at all locations downstream of the dam. The model is sensitive to values of the breach parameters. However, since all the assumptions in this study are conservative, results from this study are considered to be conservative and representative to the actual condition of the project.

References

R.W. Beck and Associates. *Dam Breach Study for the Jackson Bluff Hydroelectric Project,* FERC Project No. 2891, City of Tallahassee, Florida, April 1983.

Federal Energy Regulatory Commission, *Engineering Guidelines for the Evaluation of Hydropower Projects*.

U.S. Army Corps of Engineers. *Jackson Bluff Dam, Phase 1 – Inspection Report*, National Dam Safety Program, Jacksonville District, Jacksonville, Florida, June 1978.

U.S. Army Corps of Engineers letter (James Adams) to Florida Governor Askew, September 20, 1978.

U. S. Weather Service Hydrometeorological Report No. 51.

Appendix A. Spillway Rating Curve Computation

JACKSON BLUFF DAM SPILLWAY RATING CURVE

Controlled Spillway

TAINTER GATE									
ASSUMED DESIGN HEAD	19.5	feet	WEIR BOTTOM	16	feet(ngvd)				
CREST ELEVATION	52	feet(ngvd)	WEIR HEIGHT	36	feet				
CREST LENGTH	175	feet	U/S FACE SLOPE	1.09					
GATE FULL OPENING	19.5	feet	P/H_0	1.85					
NUMBER OF BAYS	7		C_0[1]	3.93					
			U/S FACE SLOPE CORREC.[1]	0.99					
			PIER CONTRACTION COEFF.	0.02					
			ABUTMENT CONTR. COEFF.	0.1					

Uncontrolled

	Emergency Spillway	Fuse Plug Spillway	
CREST ELEVATION	72.3	74.3	feet(ngvd)
LENGTH OF WEIR	950	562	feet
DISCHARGE COEFF.	2.6	2.6	feet
CONCRETE SILL ELEVATION		68.3	feet

RESERVOIR ELEVATION feet (NGVD)	HEAD OVER CREST feet	HEAD OVER GATE feet	He/H_O	C/C_0[1]	Effective Weir Length	C_{WEIR}	FLOW cfs	ORIFICE[5,6] FLOW cfs	GATE FLOW cfs	HEAD OVER TOP OF GATE FEET	FLOW OVER Emergency cfs	FLOW OVER Fuse Plug cfs	TOTAL FLOW[8] w/fuse Plug cfs	TOTAL FLOW w/o fuse Plug
52.00	0.00	0.00	0.00	0.800	175	3.11	0.00	0.00	0.00	0.00	0.00	0.00	0	0
52.50	0.50	0.00	0.03	0.800	174.78	3.11	192.34	0.00	192.34	0.00	0.00	0.00	192	192
53.00	1.00	0.00	0.05	0.801	174.56	3.11	543.68	0.00	543.68	0.00	0.00	0.00	544	544
53.50	1.50	0.00	0.08	0.811	174.34	3.15	1010.32	0.00	1010.32	0.00	0.00	0.00	1010	1010
54.00	2.00	0.00	0.10	0.821	174.12	3.19	1573.18	0.00	1573.18	0.00	0.00	0.00	1573	1573
54.50	2.50	0.00	0.13	0.831	173.9	3.23	2223.24	0.00	2223.24	0.00	0.00	0.00	2223	2223
55.00	3.00	0.00	0.15	0.841	173.68	3.27	2953.04	0.00	2953.04	0.00	0.00	0.00	2953	2953
55.50	3.50	0.00	0.18	0.848	173.46	3.30	3746.75	0.00	3746.75	0.00	0.00	0.00	3747	3747
56.00	4.00	0.00	0.21	0.855	173.24	3.33	4608.72	0.00	4608.72	0.00	0.00	0.00	4609	4609
56.50	4.50	0.00	0.23	0.862	173.02	3.35	5536.27	0.00	5536.27	0.00	0.00	0.00	5536	5536
57.00	5.00	0.00	0.26	0.868	172.8	3.38	6527.31	0.00	6527.31	0.00	0.00	0.00	6527	6527
57.50	5.50	0.00	0.28	0.875	172.58	3.41	7580.12	0.00	7580.12	0.00	0.00	0.00	7580	7580
58.00	6.00	0.00	0.31	0.882	172.36	3.43	8688.25	0.00	8688.25	0.00	0.00	0.00	8688	8688
58.50	6.50	0.00	0.33	0.887	172.14	3.45	9841.02	0.00	9841.02	0.00	0.00	0.00	9841	9841
59.00	7.00	0.00	0.36	0.892	171.92	3.47	11047.56	0.00	11047.56	0.00	0.00	0.00	11048	11048
59.50	7.50	0.00	0.38	0.897	171.7	3.49	12306.80	0.00	12306.80	0.00	0.00	0.00	12307	12307
60.00	8.00	0.00	0.41	0.902	171.48	3.51	13617.81	0.00	13617.81	0.00	0.00	0.00	13618	13618
60.50	8.50	0.00	0.44	0.907	171.26	3.53	14979.78	0.00	14979.78	0.00	0.00	0.00	14980	14980
61.00	9.00	0.00	0.46	0.912	171.04	3.55	16391.95	0.00	16391.95	0.00	0.00	0.00	16392	16392
61.50	9.50	0.00	0.49	0.918	170.82	3.57	17860.80	0.00	17860.80	0.00	0.00	0.00	17861	17861
62.00	10.00	0.00	0.51	0.922	170.6	3.59	19356.68	0.00	19356.68	0.00	0.00	0.00	19357	19357
62.50	10.50	0.00	0.54	0.927	170.38	3.61	20898.71	0.00	20898.71	0.00	0.00	0.00	20899	20899
63.00	11.00	0.00	0.56	0.931	170.16	3.62	22486.34	0.00	22486.34	0.00	0.00	0.00	22486	22486
63.50	11.50	0.00	0.59	0.935	169.94	3.64	24119.06	0.00	24119.06	0.00	0.00	0.00	24119	24119
64.00	12.00	0.00	0.62	0.940	169.72	3.66	25796.39	0.00	25796.39	0.00	0.00	0.00	25796	25796
64.50	12.50	0.00	0.64	0.944	169.5	3.67	27517.90	0.00	27517.90	0.00	0.00	0.00	27518	27518
65.00	13.00	0.00	0.67	0.949	169.28	3.69	29283.20	0.00	29283.20	0.00	0.00	0.00	29283	29283
65.50	13.50	0.00	0.69	0.953	169.06	3.71	31091.89	0.00	31091.89	0.00	0.00	0.00	31092	31092
66.00	14.00	0.00	0.72	0.957	168.84	3.72	32943.64	0.00	32943.64	0.00	0.00	0.00	32944	32944
66.50	14.50	0.00	0.74	0.962	168.62	3.74	34838.12	0.00	34838.12	0.00	0.00	0.00	34838	34838
67.00	15.00	0.00	0.77	0.966	168.4	3.76	36775.03	0.00	36775.03	0.00	0.00	0.00	36775	36775
67.50	15.50	0.00	0.79	0.971	168.18	3.78	38754.07	0.00	38754.07	0.00	0.00	0.00	38754	38754
68.00	16.00	0.00	0.82	0.975	167.96	3.79	40774.98	0.00	40774.98	0.00	0.00	0.00	40775	40775
68.50	16.50	0.00	0.85	0.979	167.74	3.81	42843.91	0.00	42843.91	0.00	0.00	155.83	42844	42844
69.00	17.00	0.00	0.87	0.983	167.52	3.82	44903.46	0.00	44903.46	0.00	0.00	1020.34	44903	44903
69.50	17.50	0.00	0.90	0.986	167.3	3.84	47000.31	0.00	47000.31	0.00	0.00	2290.18	47000	47000
70.00	18.00	0.00	0.92	0.990	167.08	3.85	49134.17	0.00	49134.17	0.00	0.00	3861.64	49134	49134
70.50	18.50	0.00	0.95	0.993	166.86	3.86	51304.78	0.00	51304.78	0.00	0.00	5685.02	51305	51305
71.00	19.00	0.00	0.97	0.997	166.64	3.88	53511.87	0.00	53511.87	0.00	0.00	7729.36	53512	53512
71.50	19.50	0.00	1.00	1.000	166.42	3.89	55755.17	0.00	55755.17	0.00	0.00	9972.93	55755	55755
72.00	20.00	0.50	1.03	1.003	166.2	3.90	58034.47	0.00	58034.47	0.00	0.00	12399.40	58034	58034
72.30	20.30	0.80	1.04	1.008	166.068	3.92	59562.33	0.00	59562.33	0.00	0.00	13937.60	59562	59562
72.50	20.50	1.00	1.05	1.007	165.98	3.92	60349.51	0.00	60349.51	0.20	220.92	14995.88	60570	60570
73.00	21.00	1.50	1.08	1.010	165.76	3.93	62700.07	0.00	62700.07	0.70	1446.59	17751.90	64147	64147
73.50	21.50	2.00	1.10	1.014	165.54	3.94	65085.94	0.00	65085.94	1.20	3246.90	20658.70	68333	68333
74.00	22.00	2.50	1.13	1.018	165.32	3.96	67539.06	0.00	67539.06	1.70	5474.83	23708.84	73014	73014
74.30	22.30	2.80	1.14	1.019	165.188	3.97	68985.90	0.00	68985.90	2.00	6986.21	25605.01	101577	75972
74.50	22.50	3.00	1.15	1.020	165.1	3.97	69956.92	0.00	69956.92	2.20	8059.92	26895.87	104913	78017
75.00	23.00	3.50	1.18	1.023	164.88	3.98	72406.98	0.00	72406.98	2.70	10958.29	30214.14	113579	83365
75.50	23.50	4.00	1.21	1.026	164.66	3.99	74889.01	0.00	74889.01	3.20	14139.11	33658.65	122687	89028
76.00	24.00	4.50	1.23	1.029	164.44	4.00	77402.79	0.00	77402.79	3.70	17579.22	37224.95	132207	94982
76.50	24.50	5.00	1.26	1.032	164.22	4.01	79948.12	0.00	79948.12	4.20	21260.37	40908.99	142117	101208
77.00	25.00	5.50	1.28	1.035	164	4.03	82524.80	78068.06	78068.06	4.70	25167.71	44707.14	147943	103236
77.50	25.50	6.00	1.31	1.038	163.78	4.04	85132.61	79337.54	79337.54	5.20	29288.83	48616.06	157242	108626
78.00	26.00	6.50	1.33	1.040	163.56	4.05	87771.36	80587.03	80587.03	5.70	33613.15	52632.70	166833	114200

NOTES:

[1] Obtained from "Design of Small Dams", Bureau of Reclamation

[2] Obtained from "Hydraulic Design of Spillways", 1990, U.S. Army Corps of Engineers, Plate 6-1

[3] Obtained from "Hydraulic Design of Spillways", 1990, U.S. Army Corps of Engineers, Plate 3-6

[4] Obtained from "Hydraulic Design of Spillways", 1990, U.S. Army Corps of Engineers, Plate 3-11

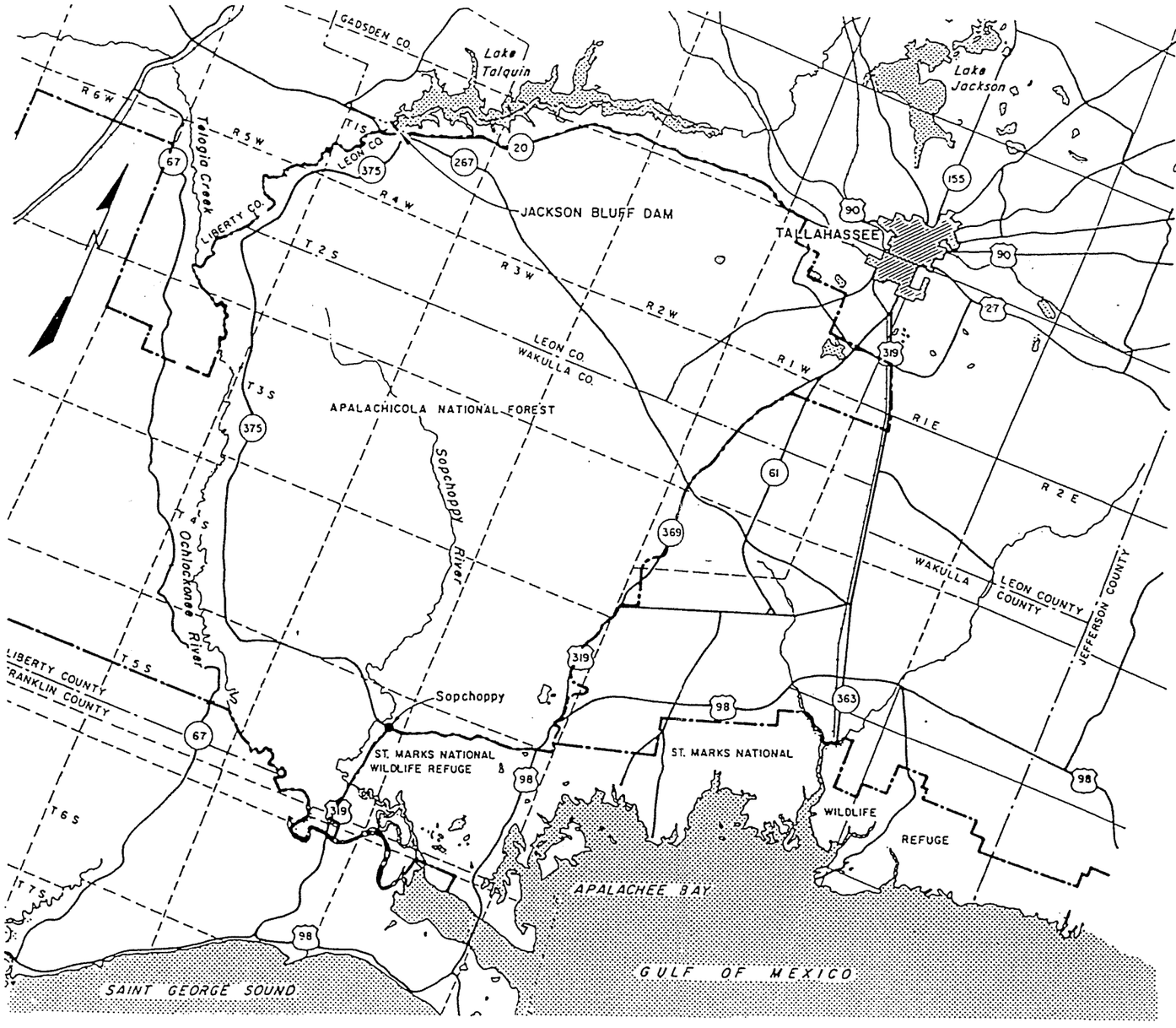
[5] Computed using Equation 6-1, "Hydraulic Design of Spillways", 1990, U.S. Army Corps of Engineers

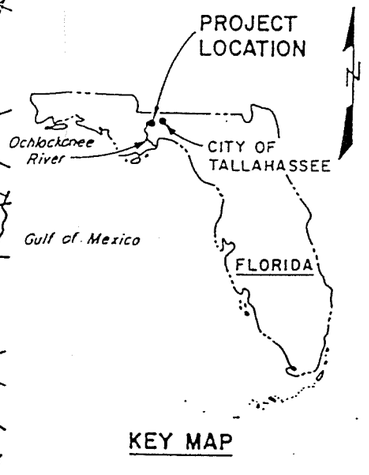
[6] For transition between the weir flow to orifice flow see "Hydraulic Design of Spillway", 1965, U.S. Army Corps of Engineers

[7] Gate opening in feet, minimum distance from gate lip to crest boundary, "Hydraulic Design of Spillways", 1990, U.S. Army Corps of Engineers, Equation

[8] Fuse plug deploys when reservoir level is at elevation 74.3 feet, and breaches down to the concrete sill elevation of 68.3 feet.

Appendix B. Vicinity Map





KEY MAP

LEGEND

- (67) State Route
- (319) U.S. Highway
- County boundary
- National Forest and Wildlife boundary

5 miles 0 5
Scale

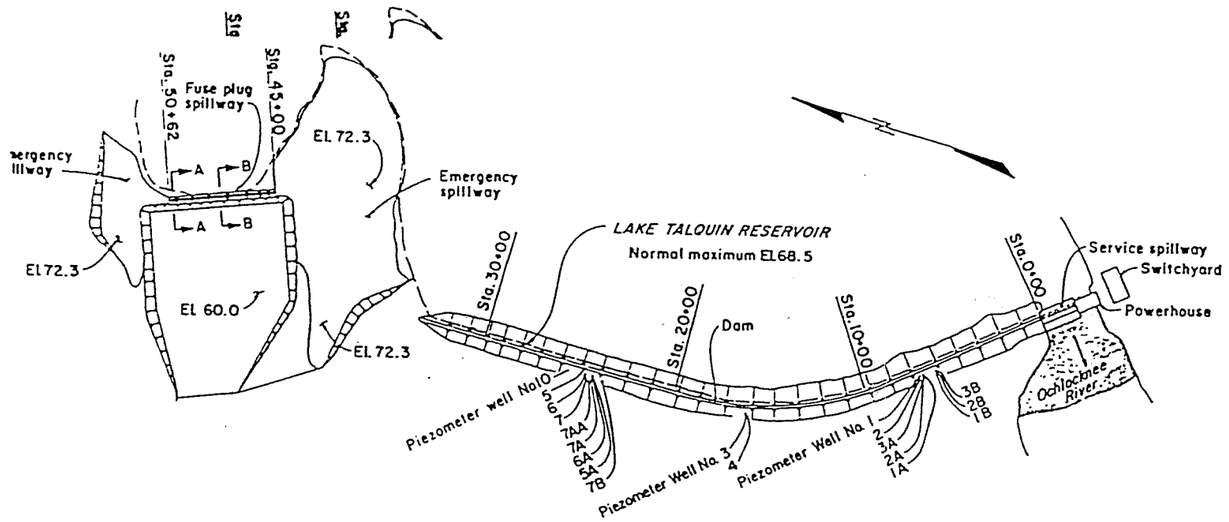
CITY OF TALLAHASSEE

JACKSON BLUFF HYDROELECTRIC PROJECT

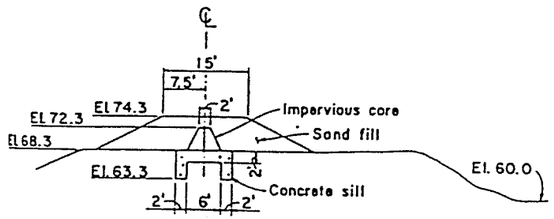
VICINITY MAP

RAYTHEON INFRASTRUCTURE, INC. | EXHIBIT II-1

Appendix C. Project Layout

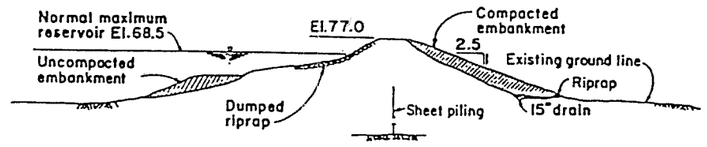


PLAN

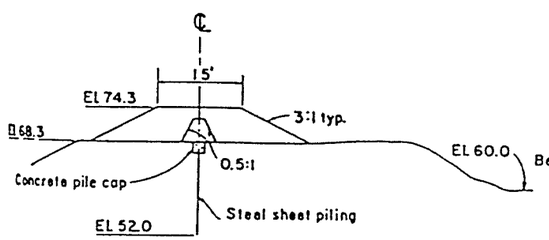


SECTION A-A

(Sta. 45+00 To Sta. 46+47.5)
(Sta. 49+22.5 To Sta.50+60)

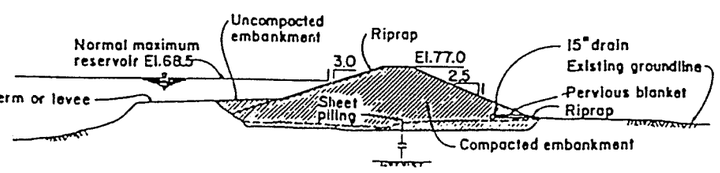


BOLSTERED SECTION



SECTION B-B

(Sta. 46+47.5 To Sta. 49+22.5)



REBUILT SECTION

STATION	WORK UNDERTAKEN FOLLOWING 1957 FAILURE
0+00 to 10+50 ±	Bolstered section
10+50 to 35+70 ±	Rebuilt section

LEGEND

38· Piezometer well number and location

Embankment placed following failure of original embankment in December of 1957. Work was completed in 1958.

NOTES

1. Elevations based on Mean Sea Level datum.
2. All project features shown are existing.
3. This drawing is a compilation from Federal Power Commission license exhibits (Project No. 682) and drawings prepared by other for the Florida Power Corporation.

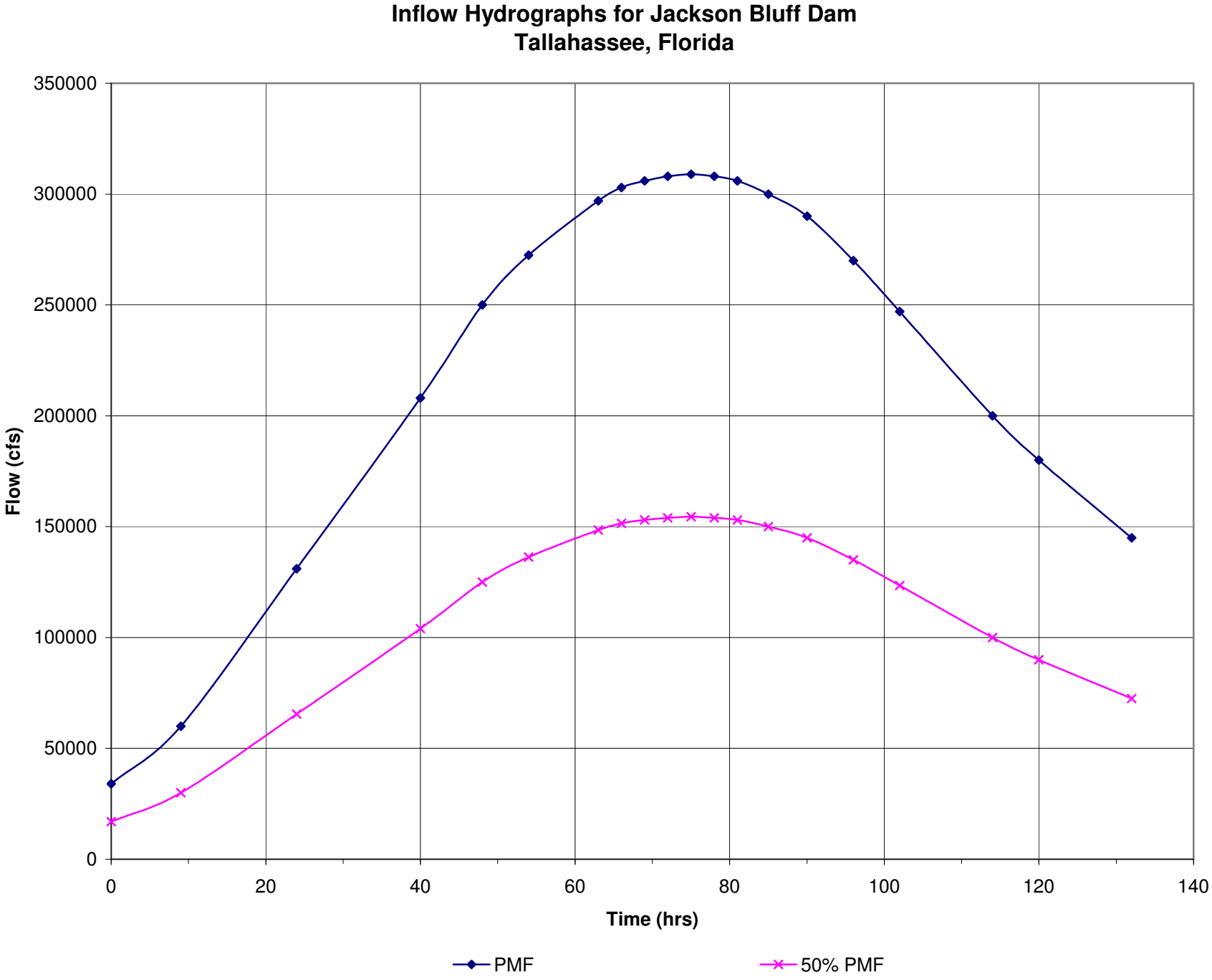
CITY OF TALLAHASSEE

JACKSON BLUFF HYDROELECTRIC PROJECT

EMBANKMENT DAM, SADDLE DAM AND FUSE PLUG PLAN AND PROFILE

RAYTHEON INFRASTRUCTURE, INC. | EXHIBIT II-2

Appendix D. Inflow Hydrographs

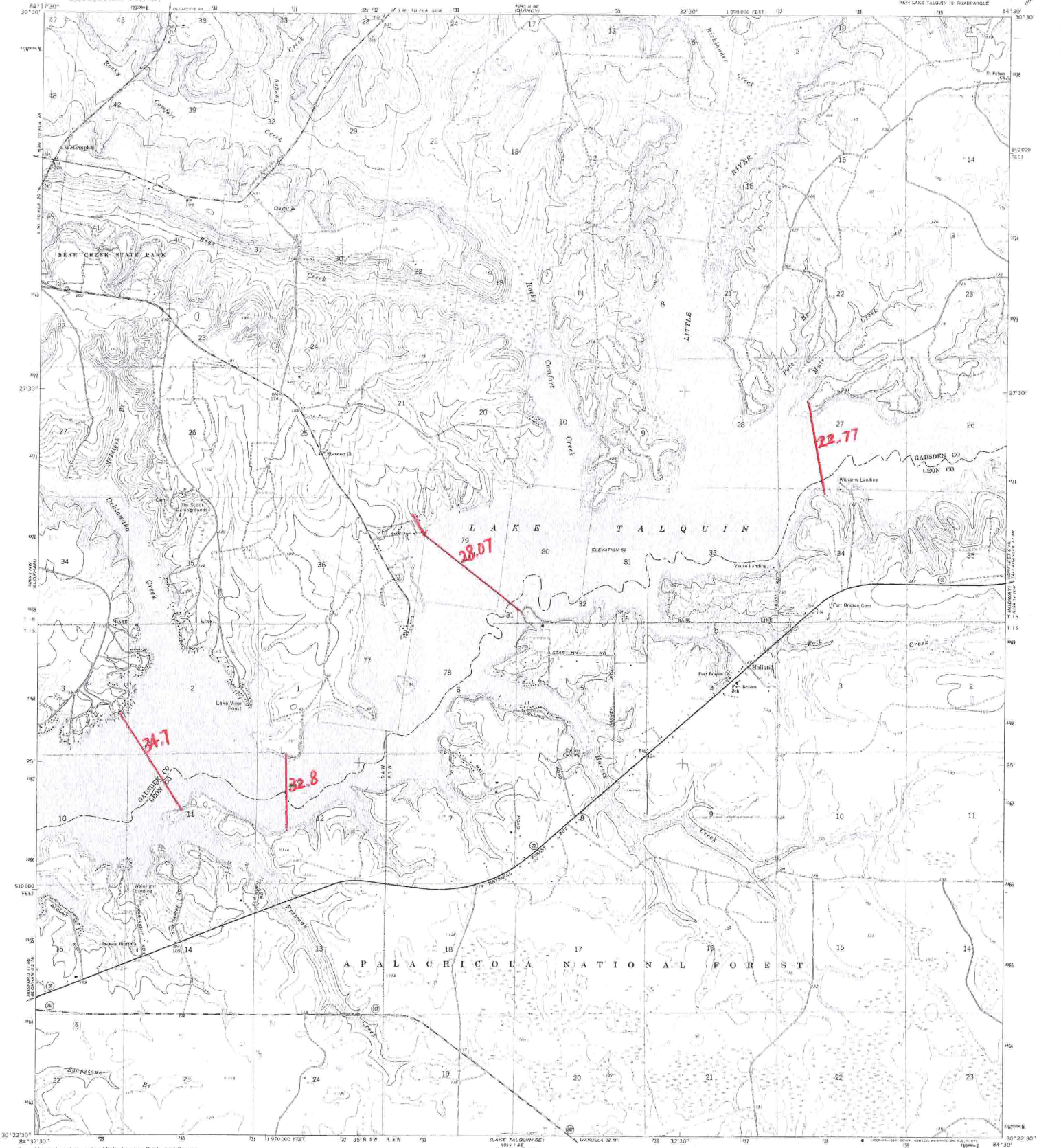

Inflow Hydrographs for Jackson Bluff Dam
Tallahassee, Florida
Flow (cfs)
350000
300000
250000
200000
150000
100000
50000
0
0
20
40
60
80
100
120
140
Time (hrs)
PMF
50% PMF

Appendix E. Index Maps

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF FLORIDA

LAKE TALQUIN QUADRANGLE
FLORIDA
7.5 MINUTE SERIES (TOPOGRAPHIC)
ME/4 LAKE TALQUIN 15' QUADRANGLE



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken January 1970. Field checked 1972

Projection and 10,000-foot grid ticks: Florida coordinate system, north zone (Lambert conformal conic)
1000-meter Universal Transverse Mercator grid ticks, zone 16, shown in blue. 1927 North American datum

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

Dotted land lines established by private subdivision of the Forbes Purchase

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1972 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION

Primary highway, hard surface — Light duty road, hard or improved surface
Secondary highway, hard surface — Unimproved road
Interstate Route — U. S. Route — State Route

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY
DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUINCY 1 LOCATION

LAKE TALQUIN, FLA.
ME/4 LAKE TALQUIN 15' QUADRANGLE
N3022.5—W8430/7.5

1972

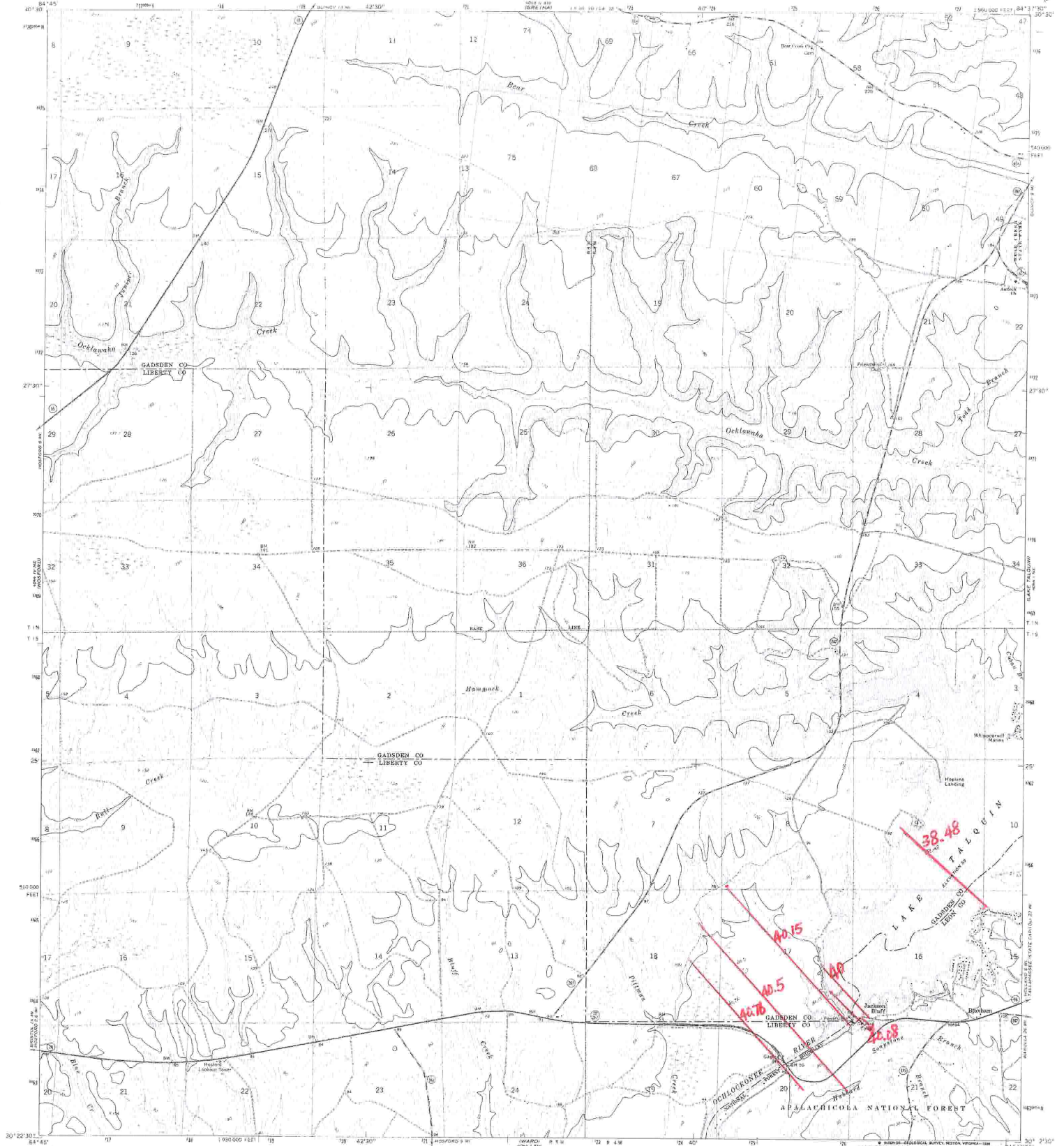
AMS 4044 I NE—SERIES V847

SHEET 1 OF 6

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF FLORIDA

BLOXHAM QUADRANGLE
FLORIDA
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken January 1970. Field checked 1972

Projection and 10,000-foot grid ticks: Florida coordinate system, north zone (Lambert conformal conic)
1000-meter Universal Transverse Mercator grid ticks, zone 16, shown in blue. 1927 North American datum

Dotted land lines established by private subdivision of the Forbes Purchase

To place on the predicted North American Datum 1983, move the projection lines 19 meters south and 9 meters west as shown by dashed corner ticks

SCALE 1:24000

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1972 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION

Primary highway, hard surface — Light-duty road, hard or improved surface
Secondary highway, hard surface — Unimproved road
Interstate Route — U. S. Route — State Route

BLOXHAM, FLA.
30084-D6-TF-024
1972
DMA 4044 I NW—SERIES V847

SHEET 2 OF 6

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF FLORIDA

WARD QUADRANGLE
FLORIDA
7.5 MINUTE SERIES (TOPOGRAPHIC)
SW/4 LAKE TALQUIN 15' QUADRANGLE

42.65

45

47.9

51.5

A P A L A C H I C O L A

N A T I O N A L F O R E S T

LIBERTY CO
LEON CO
WAKULLA CO

Ward

OCHLOCKONEE RIVER

Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken January 1970. Field checked 1972

Projection and 10,000-foot grid ticks: Florida coordinate system, north zone (Lambert conformal conic)
1000-meter Universal Transverse Mercator grid (ticks, zone 16, shown in blue. 1927 North American datum

Dotted land lines established by private subdivision of the Forbes Purchase

To place on the predicted North American Datum 1983 move the projection lines 19 meters south and 9 meters west as shown by dashed corner ticks

SCALE 1:24000

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1972 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY
DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION

Primary highway, hard surface
Light duty road, hard or improved surface
Secondary highway, hard surface
Unimproved road
Interstate Route
U S Route
State Route

WARD, FLA.
SW/4 LAKE TALQUIN 15' QUADRANGLE
30084-C6-TF-024

1972

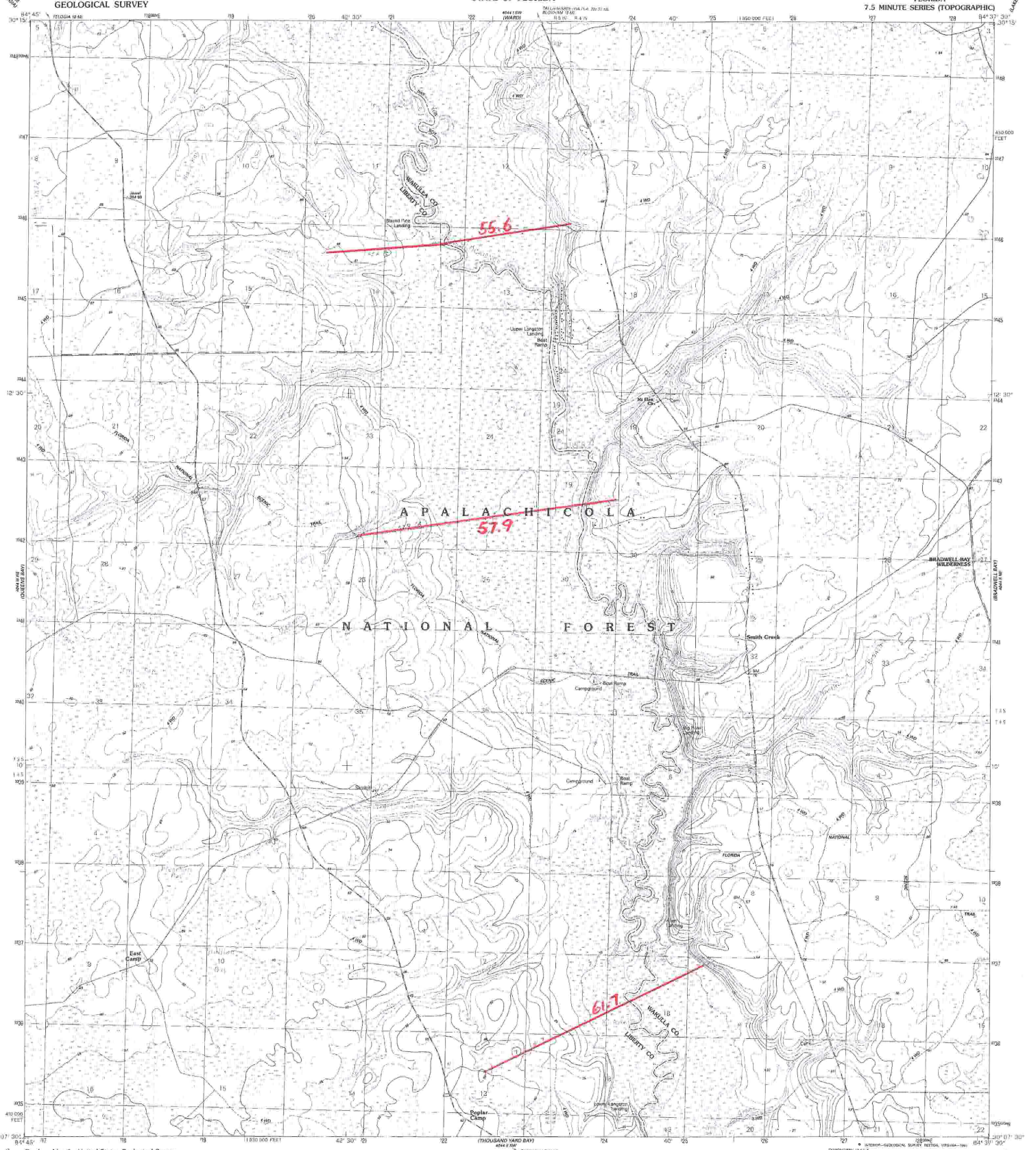
OMA 404 4 | SW—SERIES V847

SHEET 3 OF 6

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF FLORIDA

SMITH CREEK QUADRANGLE
FLORIDA
7.5 MINUTE SERIES (TOPOGRAPHIC)



Produced by the United States Geological Survey
in cooperation with State of Florida agencies
Control by USGS and NOS/NOAA
Topography by photogrammetric methods from aerial photographs taken 1975. Revised from aerial photographs taken 1984
Field checked 1989. Map edited 1990
Supersedes map dated 1943-44
Projection and 10,000-foot grid ticks: Florida coordinate system, north zone (Lambert conformal conic)
1000-meter Universal Transverse Mercator grid, zone 16
1927 North American Datum
To place on the predicted North American Datum 1983, move the projection lines 19 meters south and 9 meters west as shown by dashed corner ticks
There may be private inholdings within the boundaries of the National or State reservations shown on this map
Dotted land lines established by private subdivision of the Forbes Purchase

UTM GRID AND 1990 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

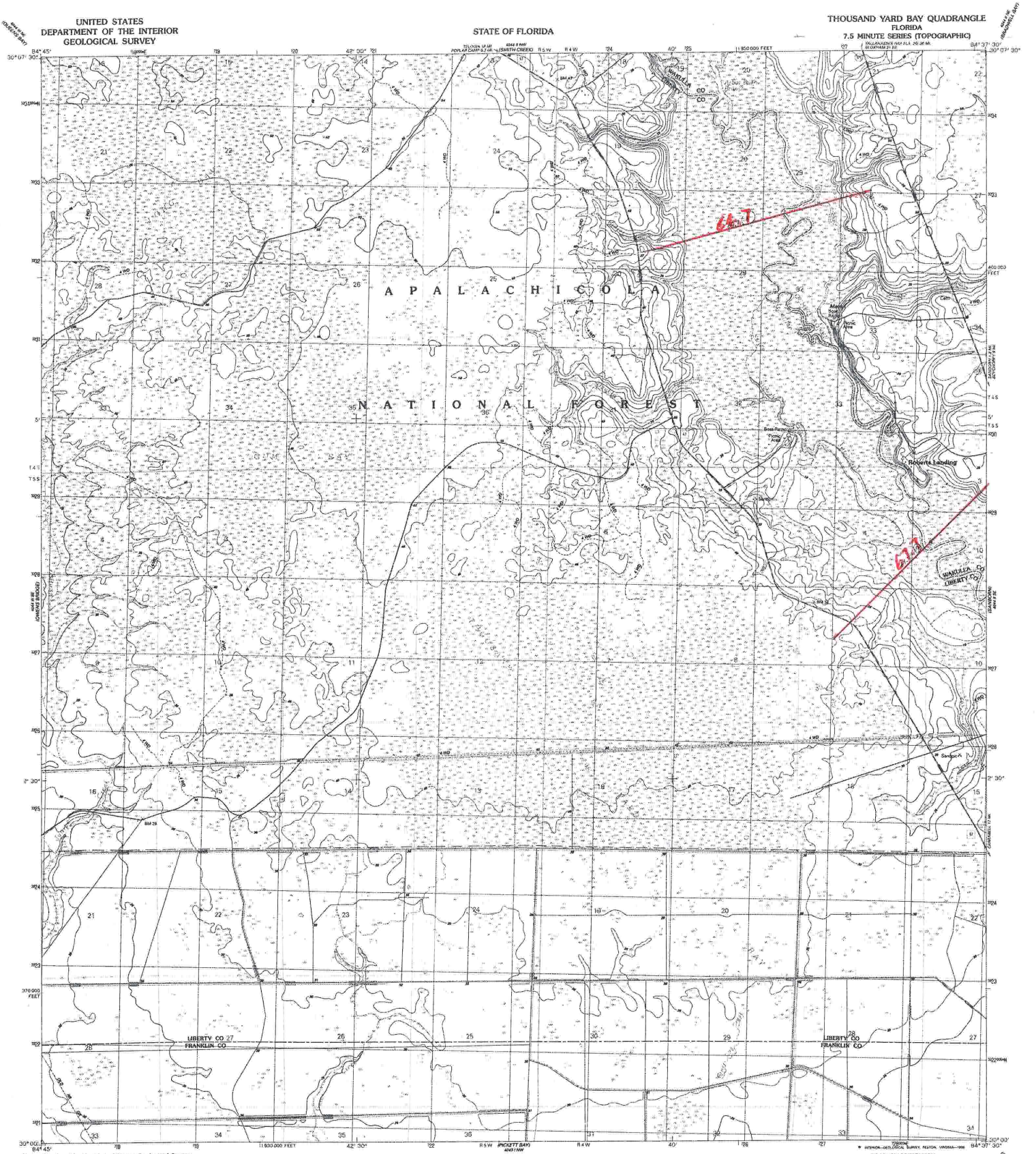
FLORIDA
QUADRANGLE LOCATION

ROAD CLASSIFICATION

Primary highway, hard surface — Light-duty road, hard or improved surface
Secondary highway, hard surface — Unimproved road
Interstate Route — U. S. Route — State Route
County Route

SMITH CREEK, FLA.
30084-B6-TF-024
1990
DMA 4044 II NW-SERIES V847

SHEET 4 OF 6



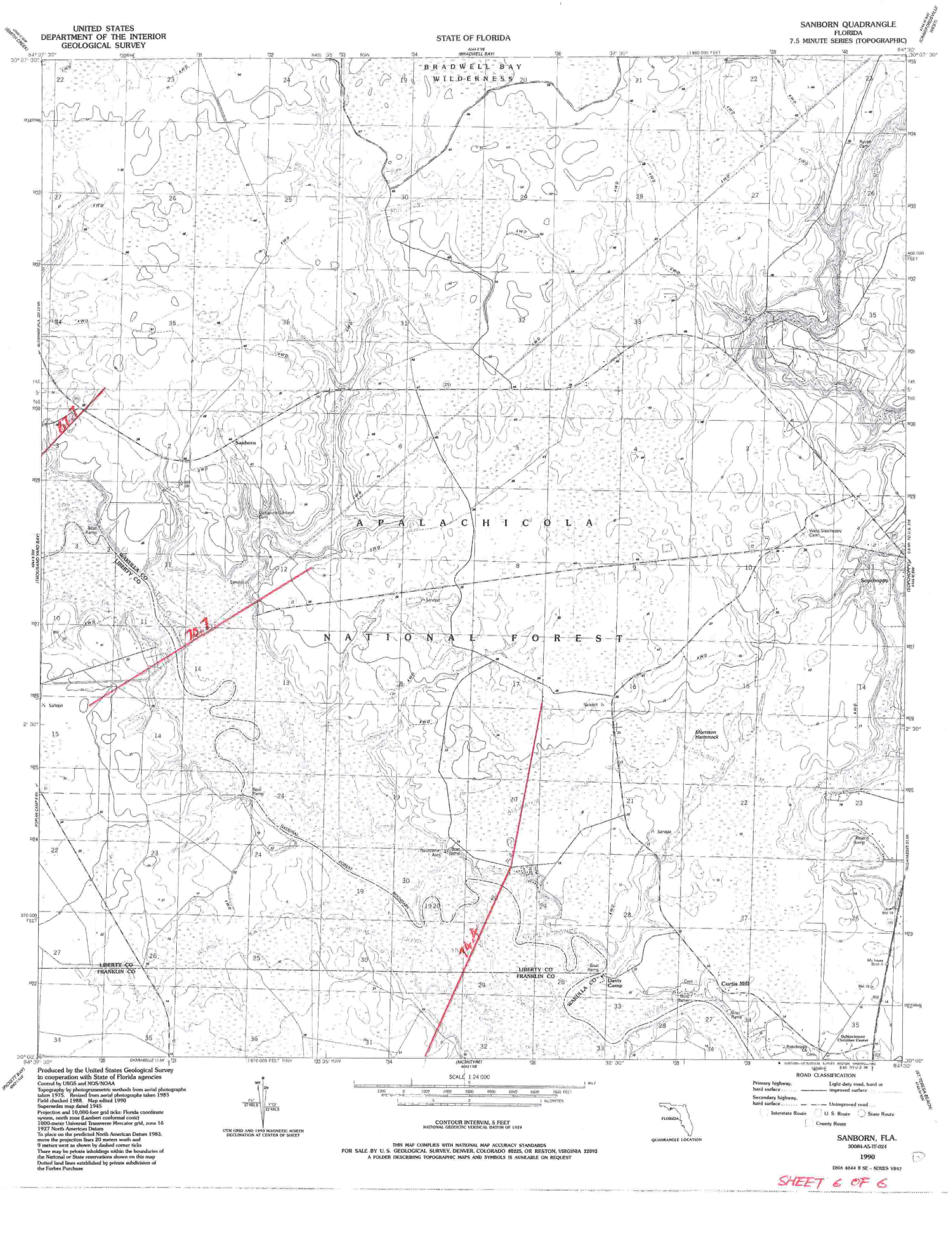
Produced by the United States Geological Survey
In cooperation with State of Florida agencies
Control by USGS and NOS/NOAA
Topography by photogrammetric methods from aerial photographs taken 1975. Revised from aerial photographs taken 1984
Field checked 1989. Map edited 1990
Supersedes map dated 1945
Projection and 10,000-foot grid ticks: Florida coordinate system, north zone (Lambert conformal conic)
1000-meter Universal Transverse Mercator grid, zone 16
1927 North American Datum
To place on the predicted North American Datum 1983, move the projection lines 20 meters south and 9 meters west as shown by dashed corner ticks
There may be private inholdings within the boundaries of the National or State reservations shown on this map
Dotted land lines established by private subdivision of the Forbes Purchase

UTM GRID AND 1990 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUADRANGLE LOCATION

SHEET 5 OF 6


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
STATE OF FLORIDA
SANBORN QUADRANGLE
FLORIDA
7.5 MINUTE SERIES (TOPOGRAPHIC)
BRADWELL BAY
WILDERNESS
APALACHICOLA
NATIONAL FOREST
Sanborn
Sanborn Cem
Boat Ramp
Sandpit
West Sopchoppy Cem
Sopchoppy
Morrison Hammock
Curtis Mill
Davis Camp
Hausmann Airst
Boat Ramp
Ochlockonee Christian Center
LIBERTY CO
FRANKLIN CO
WAKULLA CO
NATIONAL FOREST ROADWAY
14.5
Produced by the United States Geological Survey
in cooperation with State of Florida agencies
Control by USGS and NOS/NOAA
Topography by photogrammetric methods from aerial photographs taken 1975. Revised from aerial photographs taken 1983
Field checked 1988. Map edited 1990
Supersedes map dated 1945
Projection and 10,000-foot grid ticks: Florida coordinate system, north zone (Lambert conformal conic)
1000-meter Universal Transverse Mercator grid, zone 16
1927 North American Datum
To place on the predicted North American Datum 1983, move the projection lines 20 meters south and 9 meters west as shown by dashed corner ticks
There may be private inholdings within the boundaries of the National or State reservations shown on this map
Dotted land lines established by private subdivision of the Forbes Purchase
UTM GRID AND 1990 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
SCALE 1:24 000
CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST
FLORIDA
QUADRANGLE LOCATION
ROAD CLASSIFICATION
Primary highway, hard surface
Light-duty road, hard or improved surface
Secondary highway, hard surface
Unimproved road
Interstate Route
U. S. Route
State Route
County Route
SANBORN, FLA.
30084-A5-TF-024
1990
DMA 6044 II SE - SERIES V847
SHEET 6 OF 6

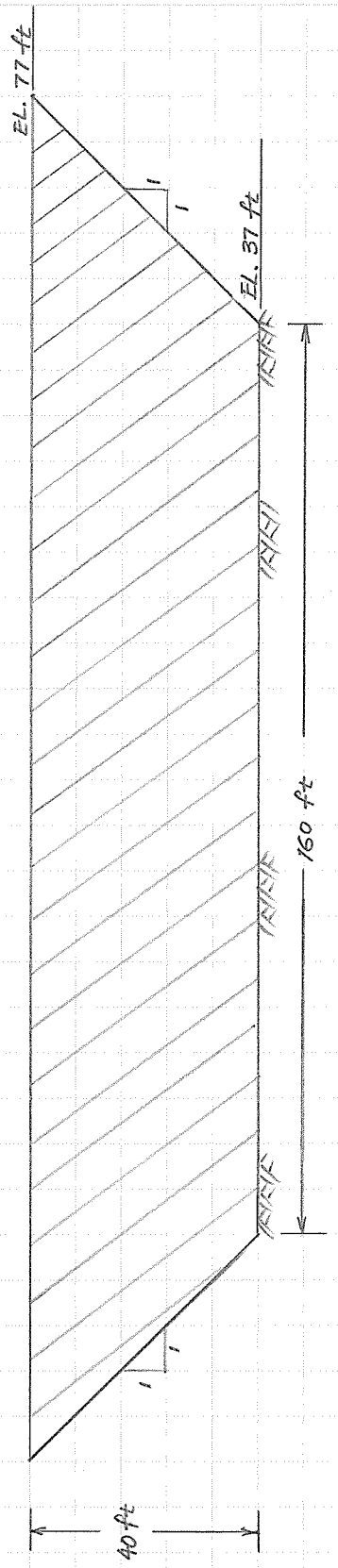
Appendix F. Schematic Drawing of Breach

MEAD & HUNT

Mead & Hunt, Inc.
Offices nationwide

Job No. 19363-00-046 Sheet 1 of 1
Job Name Jackson Bluff Dam IDF Study
Task
Calculated by YX Date 04-2005
Checked by Date

JACKSON BLUFF DAM
BREACH ASSUMPTIONS



Appendix G. BOSS DAMBRK Input and Output Summaries

Peak Inflow = 50% PMF (155,000 cfs)
With failure

==========
B O S S D A M B R K (tm)
==========

Copyright (C) 1988-92 Boss Corporation
All Rights Reserved

Version : 3.00
Serial Number : 0010000.200

PROGRAM ORIGIN :

Boss Dambrk (tm) is an enhanced version of Professor D. L. Fread's 1991 NWS DAMBRK program.

DISCLAIMER :

Boss Dambrk (tm) is a complex program which requires engineering expertise to use correctly. Boss Corporation assumes absolutely no responsibility for the correct use of this program. All results obtained should be carefully examined by an experienced professional engineer to determine if they are reasonable and accurate.

Although Boss Corporation has endeavored to make Boss Dambrk error free, the program is not and cannot be certified as infallible. Therefore, Boss Corporation makes no warranty, either implicit or explicit, as to the correct performance or accuracy of this software.

In no event shall Boss Corporation be liable to anyone for special, collateral, incidental, or consequential damages in connection with or arising out of purchase or use of this software. The sole and exclusive liability to Boss Corporation, regardless of the form of action, shall not exceed the purchase price of this software.

PROJECT DESCRIPTION :

PROJECT TITLE : Jackson Bluff Dam IDF Study
PROJECT NUMBER : 19363-04002
DESCRIPTION : Tallahassee, FL
ENGINEER : Y. Xiong
DATE OF RUN : 4/15/2005
TIME OF RUN : 2:18 pm

Peak Inflow = 50% PMF (155,000 cfs)
With failure

INPUT DATA SUMMARY :

INPUT CONTROL PARAMETERS :

Problem Specification Option	11	
Number of Dynamic Routing Reaches (KKN)	1	
Type of Reservoir Routing (KUI)	1	(dynamic routing)
Number of multiple dams/bridges (MULDAM)	1	
No. of Reservoir Inflow Hydrograph Points (ITEH)	20	
No. of Informational Cross-Sections (NPRT)	5	
Flood-Plain Routing (KFLP)	0	(no)

SEQUENTIAL CROSS-SECTION NUMBERS (NPT) :

1 4 36 55 102

Peak Inflow = 50% PMF (155,000 cfs)
With failure

CROSS-SECTION NUMBERS COINCIDENT
WITH UPSTREAM DAM FACE (IDAM) :

8

Peak Inflow = 50% PMF (155,000 cfs)
With failure

DAM NUMBER : 1

RESERVOIR AND BREACH PARAMETERS :

Initial Elevation of Water Surface (YO, ft MSL)		62.00
Breach Side Slope (Z)	1:	1.00
Breach Bottom Elevation (YBMIN, ft MSL)		37.00
Breach Base Width (BB, ft)		160.00
Time of Breach Formation (TFH, hr)		1.00

RESERVOIR DESCRIPTION :

Water Surface Elevation at Time of Breach (HF, ft MSL)	77.09
Top of Dam Crest Elevation (HD, ft MSL)	77.00
Uncontrolled Spillway Crest Elevation (HSP, ft MSL)	72.30
Spillway Gate Center Elevation (HGT, ft MSL)	60.50
Uncontrolled Spillway Discharge Coefficient (CS)	2470.00
Spillway Gate Discharge Coefficient (CG)	0.00
Dam Overtopping Discharge Coefficient (CDO)	9703.20
Turbine Discharge (QT, cfs)	1700.00

SPILLWAY/GATE RATING CURVE :

Head HEAD(1) (ft)	Flow QSPILL(1) (cfs)
0.00	0.0
0.50	16391.9
1.00	17860.8
5.00	31091.9
11.50	58034.5
13.80	94590.9
16.50	122775.2
17.50	133219.7

Peak Inflow = 50% PMF (155,000 cfs)
With failure

BOUNDARY CONDITIONS :

Hydrograph Time Intervals (DHF, hr)	0.00
Routing Period (TEH, hr)	132.00
Breach Development Exponent (BREX)	0.00
Mud/Debris Flow Parameter (MUD)	0
Dry Bed Routing Parameter (IWF)	0
Hydraulic Radius Computation Parameter (KPRES)	0 (R=A/B)
Landslide Simulation (KSL)	0 (none)
Critical Flow Froude Number (DFR)	0.950

INFLOW HYDROGRAPH DESCRIPTION :

Time Elapsed TI(K) (hr)	Upstream Inflow QI(K) (cfs)
0.00	17000.0
9.00	30000.0
24.00	65500.0
40.00	104000.0
48.00	125000.0
54.00	136250.0
63.00	148500.0
66.00	151500.0
69.00	153000.0
72.00	154000.0
75.00	154500.0
78.00	154000.0
81.00	153000.0
85.00	150000.0
90.00	145000.0
96.00	135000.0
102.00	123500.0
114.00	100000.0
120.00	90000.0
132.00	72500.0

Peak Inflow = 50% PMF (155,000 cfs)
With failure

SUMMARY OF PROGRAM CONTROL PARAMETERS :

Problem Specification Option (KKN, KUI, MULDAM, IDAM)	11	
Number of Cross-Sections Entered (NS)	22	
Number of Top Widths Entered (NCS)	8	
Number of Cross-Sectional Hydrographs to Plot (NTT)	6	
Flow Type Parameter (KSUPC)	0	(subcritical)
Number of Lateral Inflow Hydrographs (LQ)	0	
Number of Points in Gate Control Curve (KCG)	0	

CROSS-SECTIONS WHERE HYDROGRAPH REQUESTED :
(maximum allowed = 6)

6 8 9 10 17 21

WARNING: River bottom elevation (HS) at cross-section 8
is greater than or equal to river bottom elevation
at cross-section 7. This adverse slope may cause
problems later in the routing computations, particularly
if the base flow is small.

CHANNEL-VALLEY BOUNDARY CONDITIONS :

Max Discharge at Downstream End (QMAXD, cfs)	300000.0
Max Lateral Outflow due to Flood Wave (QLL, cfs/ft)	0.0000
Initial Time-Step Size (DTHM, hr)	0.1000
Time at which Dam Starts to Fail (TFI, hr)	0.0000
Theta Weighting Factor (F1I)	0.600
Stage Convergence Criterion (EPSY, ft)	0.000
Downstream Boundary Type Paramter (YDN)	0.00
Slope of Channel Downstream of Dam (SOM, ft/mi)	0.0000

CROSS-SECTION NUMBER : 1 Lake Talquin

Cross-Section Location (XS(I), mi) 17.080

Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 1

Reach Contraction-Expansion Coefficient (FKC) 0.000

Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.200

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)
43.00	0.0	0.0300	0.0
50.00	759.6	0.0300	0.0
55.00	1302.2	0.0300	0.0
60.00	1844.8	0.0300	0.0
70.00	2930.0	0.0300	0.0
75.00	3015.0	0.0300	0.0
80.00	3100.0	0.0300	0.0
90.00	3300.0	0.0300	0.0

CROSS-SECTION NUMBER : 2 Lake Talquin

Cross-Section Location (XS(I), mi) 22.770

Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 2

Reach Contraction-Expansion Coefficient (FKC) 0.000

Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.200

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)
41.50	0.0	0.0300	0.0
45.50	411.2	0.0300	0.0
50.50	925.3	0.0300	0.0
59.50	1850.5	0.0300	0.0
69.50	2878.6	0.0300	0.0
70.50	2938.5	0.0300	0.0
80.50	3110.0	0.0300	0.0
90.50	3300.0	0.0300	0.0

CROSS-SECTION NUMBER : 3 Lake Talquin

Cross-Section Location (XS(I), mi) 28.070

Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 3

Reach Contraction-Expansion Coefficient (FKC) 0.000

Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.200

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)
40.10	0.0	0.0300	0.0
69.10	4946.5	0.0300	0.0
70.10	5110.1	0.0300	0.0
75.10	5617.6	0.0300	0.0
79.10	6023.6	0.0300	0.0
80.10	6115.1	0.0300	0.0
89.10	6128.6	0.0300	0.0
90.10	6130.0	0.0300	0.0

CROSS-SECTION NUMBER : 4 Lake Talquin

Cross-Section Location (XS(I), mi) 32.800

Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 4

Reach Contraction-Expansion Coefficient (FKC) 0.000

Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.200

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)
38.90	0.0	0.0300	0.0
49.90	1046.9	0.0300	0.0
59.90	1998.7	0.0300	0.0
69.90	2950.5	0.0300	0.0
70.90	2970.8	0.0300	0.0
79.90	3078.8	0.0300	0.0
80.90	3090.8	0.0300	0.0
89.90	3198.8	0.0300	0.0

CROSS-SECTION NUMBER : 5 Lake Talquin

Cross-Section Location (XS(I), mi) 34.700

Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 5

Reach Contraction-Expansion Coefficient (FKC) 0.000

Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.200

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)
38.40	0.0	0.0300	0.0
50.40	1708.9	0.0300	0.0
60.40	3132.9	0.0300	0.0
69.40	4414.6	0.0300	0.0
70.40	4503.0	0.0300	0.0
80.40	4578.0	0.0300	0.0
89.40	4645.5	0.0300	0.0
90.40	4650.0	0.0300	0.0

CROSS-SECTION NUMBER : 6 Lake Talquin

Cross-Section Location (XS(I), mi) 38.480

Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 6

Reach Contraction-Expansion Coefficient (FKC) 0.000

Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.200

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)
37.40	0.0	0.0300	0.0
50.00	1712.2	0.0300	0.0
60.00	3071.1	0.0300	0.0
70.00	4430.0	0.0300	0.0
75.00	4465.0	0.0300	0.0
80.00	4500.0	0.0300	0.0
85.00	4500.0	0.0300	0.0
90.00	4500.0	0.0300	0.0

CROSS-SECTION NUMBER : 7 Lake Talquin

Cross-Section Location (XS(I), mi) 40.000

Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 7

Reach Contraction-Expansion Coefficient (FKC) 0.000

Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.200

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)
37.00	0.0	0.0300	0.0
47.00	724.2	0.0300	0.0
57.00	1448.5	0.0300	0.0
60.00	1665.8	0.0300	0.0
65.00	2027.9	0.0300	0.0
70.00	2390.0	0.0300	0.0
80.00	2460.0	0.0300	0.0
90.00	2460.0	0.0300	0.0

CROSS-SECTION NUMBER : 8 Jackson Bluff Dam US

Cross-Section Location (XS(I), mi) 40.080

Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 8

Reach Contraction-Expansion Coefficient (FKC) 0.000

Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.200

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)
37.00	0.0	0.0300	0.0
47.00	424.2	0.0300	0.0
57.00	848.5	0.0300	0.0
60.00	975.8	0.0300	0.0
65.00	1187.9	0.0300	0.0
70.00	1400.0	0.0300	0.0
80.00	1500.0	0.0300	0.0
90.00	1500.0	0.0300	0.0

CROSS-SECTION NUMBER : 9 Jackson Bluff Dam DS (ful

Cross-Section Location (XS(I), mi) 40.150

Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 9

Reach Contraction-Expansion Coefficient (FKC) 0.000

Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.200

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)
24.71	0.0	0.0300	0.0
39.71	863.3	0.0400	0.0
40.71	1254.2	0.0450	0.0
49.71	5997.2	0.0820	0.0
50.71	6213.9	0.0850	0.0
59.71	7023.9	0.0880	0.0
69.71	7603.5	0.0900	0.0
80.00	7620.0	0.0920	0.0

CROSS-SECTION NUMBER : 10 1983 DAMBRK CS1

Cross-Section Location (XS(I), mi) 40.500

Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 10

Reach Contraction-Expansion Coefficient (FKC) 0.000

Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.200

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)
24.70	0.0	0.0300	0.0
29.70	98.0	0.0350	0.0
39.70	294.1	0.0400	0.0
44.70	3096.5	0.0750	0.0
49.70	6071.5	0.0850	0.0
59.70	6605.7	0.0880	0.0
69.70	6972.3	0.0900	0.0
79.70	6999.5	0.0930	0.0

CROSS-SECTION NUMBER : 11 USGS Gage 02330000

Cross-Section Location (XS(I), mi) 40.760

Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 11

Reach Contraction-Expansion Coefficient (FKC) 0.000

Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.200

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)
24.69	0.0	0.0300	0.0
39.69	244.9	0.0400	0.0
49.69	5550.4	0.0850	0.0
50.69	6060.4	0.0880	0.0
51.69	6075.4	0.0890	0.0
60.69	6210.4	0.0900	0.0
69.69	6345.4	0.0920	0.0
79.69	6398.5	0.0930	0.0

CROSS-SECTION NUMBER : 12

Cross-Section Location (XS(I), mi) 42.650

Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 12

Reach Contraction-Expansion Coefficient (FKC) 0.000

Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.200

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)
23.30	0.0	0.0300	0.0
34.30	235.0	0.0320	0.0
36.30	4645.5	0.0450	0.0
38.30	4715.5	0.0600	0.0
42.30	6647.5	0.0720	0.0
47.30	8314.5	0.0750	0.0
70.30	10629.5	0.0800	0.0
75.30	10700.0	0.0870	0.0

CROSS-SECTION NUMBER : 13 1983 DAMBRK CS2

Cross-Section Location (XS(I), mi) 45.000

Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 13

Reach Contraction-Expansion Coefficient (FKC) 0.000

Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.200

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)
21.90	0.0	0.0300	0.0
24.90	290.3	0.0300	0.0
29.90	339.2	0.0350	0.0
39.90	5406.1	0.0550	0.0
54.90	5946.3	0.0600	0.0
55.90	6711.6	0.0650	0.0
59.90	7207.6	0.0750	0.0
69.90	9327.2	0.0830	0.0

CROSS-SECTION NUMBER : 14 1983 DAMBRK CS3

Cross-Section Location (XS(I), mi) 47.900

Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 14

Reach Contraction-Expansion Coefficient (FKC) 0.000

Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.200

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)
19.40	0.0	0.0300	0.0
28.40	281.2	0.0350	0.0
35.40	4285.6	0.0550	0.0
39.40	4766.2	0.0600	0.0
40.40	5064.0	0.0650	0.0
49.40	5191.5	0.0700	0.0
55.40	6354.0	0.0800	0.0
65.40	6500.0	0.0880	0.0

CROSS-SECTION NUMBER : 15 1983 DAMBRK CS4

Cross-Section Location (XS(I), mi) 51.500

Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 15

Reach Contraction-Expansion Coefficient (FKC) 0.000

Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.200

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)
16.80	0.0	0.0300	0.0
23.80	182.6	0.0300	0.0
24.80	4517.6	0.0400	0.0
25.80	5653.3	0.0450	0.0
39.80	6586.7	0.0600	0.0
49.80	7676.0	0.0650	0.0
54.80	8026.4	0.0800	0.0
59.80	9038.4	0.0930	0.0

CROSS-SECTION NUMBER : 16 1983 DAMBRK CS5

Cross-Section Location (XS(I), mi) 55.600

Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 16

Reach Contraction-Expansion Coefficient (FKC) 0.000

Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.200

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)
13.80	0.0	0.0300	0.0
19.80	241.9	0.0320	0.0
24.80	6058.0	0.0500	0.0
29.80	6722.4	0.0550	0.0
34.80	7162.4	0.0600	0.0
39.80	8245.6	0.0700	0.0
44.80	10085.2	0.0800	0.0
49.80	10294.4	0.0850	0.0

CROSS-SECTION NUMBER : 17 1983 DAMBRK CS6

Cross-Section Location (XS(I), mi) 57.900

Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 17

Reach Contraction-Expansion Coefficient (FKC) 0.000

Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.200

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)
12.20	0.0	0.0300	0.0
14.20	574.3	0.0300	0.0
16.20	4340.0	0.0350	0.0
20.20	6064.0	0.0600	0.0
34.20	7036.0	0.0650	0.0
35.20	7428.0	0.0700	0.0
40.20	8172.0	0.0800	0.0
50.20	10900.0	0.0930	0.0

CROSS-SECTION NUMBER : 18 1983 DAMBRK CS7

Cross-Section Location (XS(I), mi) 61.700

Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 18

Reach Contraction-Expansion Coefficient (FKC) 0.000

Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.200

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)
9.50	0.0	0.0300	0.0
10.50	4745.0	0.0600	0.0
15.50	5635.0	0.0720	0.0
25.50	6336.7	0.0750	0.0
35.50	7140.0	0.0800	0.0
40.50	8282.0	0.0810	0.0
45.50	9968.0	0.0840	0.0
50.50	10400.0	0.0850	0.0

CROSS-SECTION NUMBER : 19 1983 DAMBRK CS8

Cross-Section Location (XS(I), mi) 64.700

Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 19

Reach Contraction-Expansion Coefficient (FKC) 0.000

Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.200

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)
7.30	0.0	0.0300	0.0
9.30	2235.0	0.0300	0.0
10.30	6774.0	0.0500	0.0
15.30	7189.0	0.0620	0.0
20.30	7836.0	0.0650	0.0
30.30	8916.8	0.0700	0.0
40.30	9521.0	0.0750	0.0
45.30	9850.0	0.0800	0.0

CROSS-SECTION NUMBER : 20 1983 DAMBRK CS9

Cross-Section Location (XS(I), mi) 67.700

Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 20

Reach Contraction-Expansion Coefficient (FKC) 0.000

Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.200

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)
4.50	0.0	0.0300	0.0
5.50	1718.7	0.0300	0.0
6.50	5006.0	0.0350	0.0
14.50	5678.0	0.0550	0.0
19.50	6368.0	0.0600	0.0
22.50	7345.0	0.0650	0.0
35.50	10720.0	0.0750	0.0
45.50	13270.0	0.0870	0.0

CROSS-SECTION NUMBER : 21 1983 DAMBRK CS10

Cross-Section Location (XS(I), mi) 70.700

Flooding Elevation (FSTG(I), ft MSL) 0.000

DOWNSTREAM REACH NUMBER : 21

Reach Contraction-Expansion Coefficient (FKC) 0.000

Minimum Distance Between Interpolated Cross-Sections (DXM, mi) 0.200

CROSS-SECTION and REACH DESCRIPTION :

Elevation HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Channel Manning n CM(K,I)	Storage Top Width BSS(K,I) (ft)
3.00	0.0	0.0300	0.0
5.00	900.0	0.0350	0.0
6.00	4795.0	0.0500	0.0
19.00	5470.0	0.0700	0.0
21.00	7160.0	0.0800	0.0
25.00	7700.0	0.0850	0.0
30.00	11750.0	0.0880	0.0
38.00	12600.0	0.0930	0.0

CROSS-SECTION NUMBER : 22 1983 DAMBRK CS11

Cross-Section Location (XS(I), mi) 74.400

Flooding Elevation (FSTG(I), ft MSL) 0.000

CROSS-SECTION DESCRIPTION :

HS(K,I) (ft MSL)	Channel Top Width BS(K,I) (ft)	Storage Top Width BSS(K,I) (ft)
1.80	0.0	0.0
3.80	318.2	0.0
4.80	5990.0	0.0
14.80	8368.0	0.0
19.80	13968.0	0.0
24.80	16356.0	0.0
29.80	19184.0	0.0
34.80	19492.0	0.0

Peak Inflow = 50% PMF (155,000 cfs)
With failure

WARNING: At cross-section reach 7 the distance between
interpolated cross-sections (DXM) should be changed
to 0.000 due to change of slope criteria

DISTANCE BETWEEN INTERPOLATED CROSS-SECTIONS
(DXM) THAT WILL BE USED IN COMPUTATIONS :

Down Stream Reach Number I=1,NS1	Interp. Cross Section Distance DXM(I) (mi)
1	0.2000
2	0.2000
3	0.2000
4	0.2000
5	0.2000
6	0.2000
7	0.2000
8	101.0000
9	0.2000
10	0.2000
11	0.2000
12	0.2000
13	0.2000
14	0.2000
15	0.2000
16	0.2000
17	0.2000
18	0.2000
19	0.2000
20	0.2000
21	0.2000

Total number of cross-sections (original+interpolated) 281

Maximum number of cross-sections allowed 300

OUTPUT DATA SUMMARY :

CROSS-SECTION and REACH SUMMARY :

Cross Section Number	Cross Section Location (mi)	Bottom Elevation (ft MSL)	Reach Number	Reach Length (mi)	Reach Slope (ft/mi)
1	17.080	43.000			
2	22.770	41.500	1	5.690	0.264
3	28.070	40.100	2	5.300	0.264
4	32.800	38.900	3	4.730	0.254
5	34.700	38.400	4	1.900	0.263
6	38.480	37.400	5	3.780	0.265
7	40.000	37.000	6	1.520	0.263
8	40.080	37.000	7	0.080	0.000
9	40.150	24.710	8	0.070	175.572

WARNING: Slopes greater than 50 ft/mi may cause supercritical flow

10	40.500	24.700	9	0.350	0.029
11	40.760	24.690	10	0.260	0.038
12	42.650	23.300	11	1.890	0.735
13	45.000	21.900	12	2.350	0.596
14	47.900	19.400	13	2.900	0.862
15	51.500	16.800	14	3.600	0.722
16	55.600	13.800	15	4.100	0.732
17	57.900	12.200	16	2.300	0.696
18	61.700	9.500	17	3.800	0.711
19	64.700	7.300	18	3.000	0.733
20	67.700	4.500	19	3.000	0.933
21	70.700	3.000	20	3.000	0.500
22	74.400	1.800	21	3.700	0.324

RE-NUMBERED DAM/BRIDGE CROSS-SECTIONS :

Dam/ Bridge	Revised Cross Section Number
1	113

Number of Intermediate Cross-Sections (NN(NS)) 281

Number of Time Steps (NNU) 20

Peak Inflow = 50% PMF (155,000 cfs)
With failure

FLOOD CREST SUMMARY :

Cross Section Location (mi)	Maximum Stage Elevation (ft MSL)	Maximum Flow (cfs)	Time To Maximum Stage (hr)	Maximum Flow Velocity (ft/sec)	Flood Elevation (ft MSL)	Time To Flood Elevation (hr)	Flood Wave Arrival Time (hr)
17.080	79.80	154499	81.099	2.37	0.00	0.00	11.00
17.283	79.76	154460	81.099	2.38	0.00	0.00	11.00
17.486	79.73	154420	81.099	2.39	0.00	0.00	11.00
17.690	79.69	154380	81.199	2.39	0.00	0.00	11.00
17.893	79.66	154343	81.199	2.40	0.00	0.00	11.00
18.096	79.63	154306	81.299	2.40	0.00	0.00	11.00
18.299	79.59	154955	81.299	2.41	0.00	0.00	11.00
18.503	79.56	155659	81.399	2.42	0.00	0.00	11.00
18.706	79.52	156364	81.399	2.42	0.00	0.00	12.00
18.909	79.49	157067	81.399	2.43	0.00	0.00	12.00
19.112	79.45	157769	81.499	2.44	0.00	0.00	12.00
19.315	79.42	158469	81.499	2.44	0.00	0.00	12.00
19.519	79.39	159166	81.499	2.45	0.00	0.00	12.00
19.722	79.35	159860	81.599	2.46	0.00	0.00	12.00
19.925	79.32	160550	81.599	2.46	0.00	0.00	12.00
20.128	79.28	161236	81.699	2.47	0.00	0.00	12.00
20.331	79.25	161934	81.699	2.48	0.00	0.00	13.00
20.535	79.21	162632	81.799	2.48	0.00	0.00	13.00
20.738	79.18	163327	81.799	2.49	0.00	0.00	13.00
20.941	79.14	164019	81.899	2.50	0.00	0.00	13.00
21.144	79.11	164708	81.899	2.51	0.00	0.00	13.00
21.348	79.08	165392	81.999	2.51	0.00	0.00	13.00
21.551	79.04	166072	82.099	2.52	0.00	0.00	13.00
21.754	79.01	166746	82.099	2.53	0.00	0.00	13.00
21.957	78.97	167414	82.099	2.54	0.00	0.00	14.00
22.160	78.94	168075	82.199	2.54	0.00	0.00	14.00
22.364	78.90	168729	82.199	2.55	0.00	0.00	14.00
22.567	78.87	169376	82.299	2.56	0.00	0.00	14.00
22.770	78.83	170013	82.299	2.57	0.00	0.00	14.00
22.974	78.81	170655	82.299	2.46	0.00	0.00	14.00
23.178	78.78	171310	82.299	2.36	0.00	0.00	14.00
23.382	78.76	171977	82.299	2.28	0.00	0.00	14.00
23.585	78.74	172656	82.299	2.21	0.00	0.00	15.00
23.789	78.72	173365	82.299	2.15	0.00	0.00	15.00
23.993	78.70	174145	82.299	2.09	0.00	0.00	15.00
24.197	78.68	174939	82.299	2.04	0.00	0.00	15.00
24.401	78.67	175745	82.299	1.99	0.00	0.00	15.00
24.605	78.65	176563	82.299	1.94	0.00	0.00	15.00
24.808	78.63	177392	82.299	1.90	0.00	0.00	15.00
25.012	78.62	178231	82.299	1.87	0.00	0.00	15.00
25.216	78.61	179080	82.299	1.84	0.00	0.00	15.00
25.420	78.59	179938	82.299	1.81	0.00	0.00	15.00
25.624	78.58	180807	82.299	1.78	0.00	0.00	15.00
25.828	78.56	181721	82.299	1.76	0.00	0.00	15.00
26.032	78.55	182726	82.299	1.74	0.00	0.00	15.00
26.235	78.54	183739	82.299	1.72	0.00	0.00	15.00
26.439	78.53	184760	82.299	1.70	0.00	0.00	15.00
26.643	78.51	185787	82.299	1.68	0.00	0.00	15.00

FLOOD CREST SUMMARY :

Cross Section Location (mi)	Maximum Stage Elevation (ft MSL)	Maximum Flow (cfs)	Time To Maximum Stage (hr)	Maximum Flow Velocity (ft/sec)	Flood Elevation (ft MSL)	Time To Flood Elevation (hr)	Flood Wave Arrival Time (hr)
26.847	78.50	186821	82.299	1.67	0.00	0.00	15.00
27.051	78.49	187857	82.199	1.66	0.00	0.00	15.00
27.255	78.48	188893	82.199	1.65	0.00	0.00	15.00
27.458	78.47	189928	82.199	1.64	0.00	0.00	15.00
27.662	78.45	191094	82.199	1.64	0.00	0.00	15.00
27.866	78.44	192277	82.199	1.63	0.00	0.00	15.00
28.070	78.43	193454	82.199	1.62	0.00	0.00	15.00
28.276	78.42	194615	82.199	1.65	0.00	0.00	15.00
28.481	78.41	195733	82.199	1.68	0.00	0.00	16.00
28.687	78.39	196809	82.199	1.71	0.00	0.00	16.00
28.893	78.38	197842	82.199	1.74	0.00	0.00	16.00
29.098	78.37	198834	82.199	1.77	0.00	0.00	16.00
29.304	78.35	199819	82.199	1.81	0.00	0.00	16.00
29.510	78.34	200881	82.099	1.84	0.00	0.00	16.00
29.715	78.32	201890	82.099	1.88	0.00	0.00	16.00
29.921	78.31	202846	82.099	1.93	0.00	0.00	16.00
30.127	78.29	203750	82.099	1.97	0.00	0.00	16.00
30.332	78.28	204604	82.099	2.02	0.00	0.00	16.00
30.538	78.26	205409	82.099	2.08	0.00	0.00	16.00
30.743	78.24	206169	82.099	2.14	0.00	0.00	16.00
30.949	78.23	206885	82.099	2.20	0.00	0.00	16.00
31.155	78.21	207561	82.099	2.27	0.00	0.00	16.00
31.360	78.19	208201	82.099	2.35	0.00	0.00	16.00
31.566	78.16	208890	81.999	2.43	0.00	0.00	16.00
31.772	78.14	209563	81.999	2.52	0.00	0.00	16.00
31.977	78.11	210186	81.999	2.63	0.00	0.00	16.00
32.183	78.09	210760	81.999	2.74	0.00	0.00	16.00
32.389	78.06	211291	81.999	2.87	0.00	0.00	16.00
32.594	78.02	211781	81.999	3.02	0.00	0.00	16.00
32.800	77.99	212236	81.999	3.18	0.00	0.00	16.00
33.011	77.96	212693	81.999	3.02	0.00	0.00	16.00
33.222	77.94	213169	81.999	2.87	0.00	0.00	16.00
33.433	77.92	213838	81.999	2.74	0.00	0.00	16.00
33.644	77.91	214549	81.999	2.62	0.00	0.00	16.00
33.856	77.89	215281	81.899	2.52	0.00	0.00	16.00
34.067	77.88	216031	81.899	2.42	0.00	0.00	16.00
34.278	77.86	216795	81.899	2.33	0.00	0.00	16.00
34.489	77.85	217570	81.899	2.25	0.00	0.00	16.00
34.700	77.84	218386	81.899	2.17	0.00	0.00	16.00
34.910	77.82	219255	81.899	2.18	0.00	0.00	16.00
35.120	77.81	220107	81.899	2.19	0.00	0.00	16.00
35.330	77.80	221389	81.899	2.20	0.00	0.00	16.00
35.540	77.78	222802	81.899	2.21	0.00	0.00	16.00
35.750	77.77	224122	81.899	2.22	0.00	0.00	16.00
35.960	77.76	225347	81.899	2.23	0.00	0.00	16.00
36.170	77.74	226478	81.899	2.24	0.00	0.00	16.00
36.380	77.73	228177	81.799	2.25	0.00	0.00	16.00
36.590	77.71	229958	81.799	2.27	0.00	0.00	16.00

FLOOD CREST SUMMARY :

Cross Section Location (mi)	Maximum Stage Elevation (ft MSL)	Maximum Flow (cfs)	Time To Maximum Stage (hr)	Maximum Flow Velocity (ft/sec)	Flood Elevation (ft MSL)	Time To Flood Elevation (hr)	Flood Wave Arrival Time (hr)
36.800	77.70	231608	81.799	2.29	0.00	0.00	16.00
37.010	77.69	233116	81.799	2.31	0.00	0.00	16.00
37.220	77.67	234473	81.799	2.33	0.00	0.00	17.00
37.430	77.66	235677	81.799	2.34	0.00	0.00	17.00
37.640	77.64	237238	81.799	2.35	0.00	0.00	17.00
37.850	77.63	239341	81.799	2.37	0.00	0.00	17.00
38.060	77.62	241255	81.799	2.40	0.00	0.00	17.00
38.270	77.60	242947	81.799	2.42	0.00	0.00	17.00
38.480	77.59	244391	81.799	2.43	0.00	0.00	17.00
38.697	77.57	245561	81.699	2.61	0.00	0.00	17.00
38.914	77.55	246667	81.699	2.81	0.00	0.00	17.00
39.131	77.52	248930	81.699	3.06	0.00	0.00	17.00
39.349	77.49	250718	81.699	3.36	0.00	0.00	17.00
39.566	77.45	251911	81.699	3.73	0.00	0.00	17.00
39.783	77.40	252337	81.699	4.19	0.00	0.00	17.00
40.000	77.33	251725	81.699	4.76	0.00	0.00	17.00
40.080	77.09	252101	81.699	8.42	0.00	0.00	17.00
40.150	60.71	252101	83.599	2.36	0.00	0.00	20.00
40.500	59.85	243245	83.899	2.59	0.00	0.00	21.00
40.760	58.98	239819	84.099	2.85	0.00	0.00	22.00
40.970	58.18	237521	84.499	2.77	0.00	0.00	22.00
41.180	57.44	235585	84.799	2.68	0.00	0.00	21.00
41.390	56.74	233739	85.199	2.58	0.00	0.00	22.00
41.600	56.11	231830	85.399	2.48	0.00	0.00	24.00
41.810	55.54	229851	85.699	2.37	0.00	0.00	25.00
42.020	55.05	227805	85.899	2.24	0.00	0.00	26.00
42.230	54.62	225685	86.099	2.10	0.00	0.00	26.00
42.440	54.26	223594	86.199	1.94	0.00	0.00	26.00
42.650	53.96	221500	86.399	1.79	0.00	0.00	24.00
42.864	53.75	219524	86.499	1.83	0.00	0.00	25.00
43.077	53.52	217778	86.499	1.86	0.00	0.00	26.00
43.291	53.28	216214	86.599	1.91	0.00	0.00	26.00
43.505	53.03	214817	86.699	1.96	0.00	0.00	26.00
43.718	52.75	213620	86.799	2.01	0.00	0.00	26.00
43.932	52.46	212529	86.899	2.07	0.00	0.00	26.00
44.145	52.16	211536	86.999	2.12	0.00	0.00	26.00
44.359	51.87	210709	87.099	2.16	0.00	0.00	25.00
44.573	51.59	210004	87.099	2.20	0.00	0.00	25.00
44.786	51.32	209360	87.199	2.25	0.00	0.00	26.00
45.000	51.03	208759	87.299	2.31	0.00	0.00	26.00
45.207	50.82	208217	87.399	2.32	0.00	0.00	27.00
45.414	50.61	207712	87.399	2.33	0.00	0.00	28.00
45.621	50.39	207243	87.499	2.34	0.00	0.00	28.00
45.829	50.17	206805	87.499	2.35	0.00	0.00	28.00
46.036	49.93	206405	87.599	2.37	0.00	0.00	29.00
46.243	49.68	206035	87.599	2.39	0.00	0.00	29.00
46.450	49.41	205692	87.699	2.41	0.00	0.00	29.00
46.657	49.13	205374	87.799	2.44	0.00	0.00	29.00

FLOOD CREST SUMMARY :

Cross Section Location (mi)	Maximum Stage Elevation (ft MSL)	Maximum Flow (cfs)	Time To Maximum Stage (hr)	Maximum Flow Velocity (ft/sec)	Flood Elevation (ft MSL)	Time To Flood Elevation (hr)	Flood Wave Arrival Time (hr)
46.864	48.83	205078	87.799	2.48	0.00	0.00	30.00
47.071	48.51	204801	87.899	2.52	0.00	0.00	30.00
47.279	48.17	204540	87.999	2.57	0.00	0.00	30.00
47.486	47.81	204295	88.099	2.63	0.00	0.00	30.00
47.693	47.42	204059	88.199	2.70	0.00	0.00	30.00
47.900	47.00	203829	88.299	2.79	0.00	0.00	31.00
48.100	46.53	203604	88.399	2.76	0.00	0.00	31.00
48.300	46.05	203368	88.499	2.74	0.00	0.00	31.00
48.500	45.58	203127	88.699	2.72	0.00	0.00	32.00
48.700	45.12	202873	88.799	2.70	0.00	0.00	32.00
48.900	44.67	202608	88.999	2.67	0.00	0.00	32.00
49.100	44.22	202329	89.099	2.65	0.00	0.00	33.00
49.300	43.79	202037	89.299	2.62	0.00	0.00	33.00
49.500	43.37	201736	89.399	2.59	0.00	0.00	34.00
49.700	42.96	201423	89.599	2.56	0.00	0.00	34.00
49.900	42.57	201097	89.699	2.53	0.00	0.00	35.00
50.100	42.19	200760	89.899	2.49	0.00	0.00	36.00
50.300	41.83	200412	89.999	2.45	0.00	0.00	36.00
50.500	41.49	200056	90.199	2.40	0.00	0.00	36.00
50.700	41.16	199696	90.299	2.35	0.00	0.00	37.00
50.900	40.86	199337	90.399	2.30	0.00	0.00	37.00
51.100	40.57	198976	90.599	2.25	0.00	0.00	36.00
51.300	40.31	198616	90.699	2.19	0.00	0.00	36.00
51.500	40.06	198259	90.799	2.13	0.00	0.00	35.00
51.705	39.85	197900	90.899	2.13	0.00	0.00	35.00
51.910	39.63	197549	90.999	2.14	0.00	0.00	34.00
52.115	39.41	197208	91.099	2.14	0.00	0.00	34.00
52.320	39.19	196876	91.199	2.14	0.00	0.00	34.00
52.525	38.96	196553	91.299	2.15	0.00	0.00	34.00
52.730	38.73	196236	91.399	2.15	0.00	0.00	34.00
52.935	38.49	195926	91.499	2.16	0.00	0.00	33.00
53.140	38.25	195624	91.599	2.17	0.00	0.00	33.00
53.345	38.01	195326	91.699	2.18	0.00	0.00	33.00
53.550	37.75	195033	91.899	2.18	0.00	0.00	34.00
53.755	37.49	194746	91.999	2.19	0.00	0.00	34.00
53.960	37.23	194461	92.199	2.21	0.00	0.00	34.00
54.165	36.96	194177	92.299	2.22	0.00	0.00	34.00
54.370	36.68	193896	92.499	2.24	0.00	0.00	34.00
54.575	36.39	193619	92.699	2.25	0.00	0.00	35.00
54.780	36.10	193340	92.899	2.27	0.00	0.00	35.00
54.985	35.79	193056	93.099	2.30	0.00	0.00	36.00
55.190	35.48	192766	93.299	2.32	0.00	0.00	37.00
55.395	35.15	192474	93.599	2.35	0.00	0.00	38.00
55.600	34.82	192182	93.899	2.38	0.00	0.00	40.00
55.809	34.48	191876	94.199	2.35	0.00	0.00	40.00
56.018	34.17	191560	94.499	2.31	0.00	0.00	41.00
56.227	33.89	191233	94.799	2.27	0.00	0.00	41.00
56.436	33.62	190897	95.099	2.22	0.00	0.00	41.00

FLOOD CREST SUMMARY :

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56.645	33.38	190554	95.399	2.17	0.00	0.00	41.00
56.855	33.16	190205	95.599	2.12	0.00	0.00	41.00
57.064	32.95	189852	95.799	2.07	0.00	0.00	41.00
57.273	32.76	189498	96.099	2.02	0.00	0.00	41.00
57.482	32.59	189142	96.299	1.97	0.00	0.00	40.00
57.691	32.43	188788	96.499	1.92	0.00	0.00	39.00
57.900	32.29	188436	96.599	1.86	0.00	0.00	38.00
58.100	32.13	188101	96.799	1.86	0.00	0.00	39.00
58.300	31.97	187767	96.999	1.86	0.00	0.00	41.00
58.500	31.82	187434	97.199	1.86	0.00	0.00	42.00
58.700	31.66	187101	97.399	1.86	0.00	0.00	43.00
58.900	31.51	186768	97.599	1.85	0.00	0.00	44.00
59.100	31.36	186436	97.699	1.84	0.00	0.00	44.00
59.300	31.21	186105	97.899	1.84	0.00	0.00	45.00
59.500	31.07	185774	98.099	1.83	0.00	0.00	45.00
59.700	30.93	185445	98.199	1.81	0.00	0.00	46.00
59.900	30.80	185117	98.399	1.80	0.00	0.00	46.00
60.100	30.66	184791	98.599	1.79	0.00	0.00	46.00
60.300	30.53	184467	98.699	1.77	0.00	0.00	46.00
60.500	30.41	184146	98.799	1.75	0.00	0.00	45.00
60.700	30.29	183827	98.999	1.74	0.00	0.00	45.00
60.900	30.18	183512	99.099	1.72	0.00	0.00	45.00
61.100	30.07	183199	99.199	1.70	0.00	0.00	44.00
61.300	29.96	182890	99.299	1.67	0.00	0.00	43.00
61.500	29.86	182585	99.499	1.65	0.00	0.00	43.00
61.700	29.76	182285	99.599	1.63	0.00	0.00	42.00
61.900	29.62	181984	99.699	1.61	0.00	0.00	42.00
62.100	29.47	181680	99.899	1.60	0.00	0.00	41.00
62.300	29.33	181373	99.999	1.58	0.00	0.00	41.00
62.500	29.18	181062	100.199	1.56	0.00	0.00	41.00
62.700	29.04	180747	100.299	1.54	0.00	0.00	41.00
62.900	28.89	180428	100.499	1.53	0.00	0.00	41.00
63.100	28.75	180107	100.599	1.51	0.00	0.00	42.00
63.300	28.61	179782	100.799	1.49	0.00	0.00	42.00
63.500	28.47	179450	100.899	1.46	0.00	0.00	42.00
63.700	28.33	179116	100.999	1.44	0.00	0.00	42.00
63.900	28.20	178779	101.199	1.42	0.00	0.00	43.00
64.100	28.07	178441	101.299	1.39	0.00	0.00	43.00
64.300	27.94	178104	101.399	1.37	0.00	0.00	44.00
64.500	27.82	177768	101.499	1.34	0.00	0.00	44.00
64.700	27.71	177435	101.599	1.32	0.00	0.00	45.00
64.900	27.62	177110	101.699	1.32	0.00	0.00	46.00
65.100	27.54	176798	101.799	1.32	0.00	0.00	46.00
65.300	27.45	176500	101.899	1.33	0.00	0.00	47.00
65.500	27.36	176215	101.899	1.33	0.00	0.00	47.00
65.700	27.27	175942	101.999	1.34	0.00	0.00	47.00
65.900	27.18	175683	102.099	1.34	0.00	0.00	47.00
66.100	27.09	175435	102.199	1.35	0.00	0.00	48.00

FLOOD CREST SUMMARY :

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66.300	26.99	175199	102.199	1.35	0.00	0.00	48.00
66.500	26.89	174973	102.299	1.36	0.00	0.00	48.00
66.700	26.79	174757	102.399	1.36	0.00	0.00	48.00
66.900	26.69	174549	102.399	1.37	0.00	0.00	48.00
67.100	26.58	174349	102.499	1.38	0.00	0.00	48.00
67.300	26.47	174158	102.599	1.39	0.00	0.00	48.00
67.500	26.36	173974	102.699	1.39	0.00	0.00	48.00
67.700	26.24	173799	102.699	1.40	0.00	0.00	48.00
67.900	26.14	173631	102.799	1.41	0.00	0.00	48.00
68.100	26.02	173472	102.899	1.42	0.00	0.00	49.00
68.300	25.91	173321	102.999	1.43	0.00	0.00	49.00
68.500	25.79	173178	102.999	1.44	0.00	0.00	49.00
68.700	25.67	173043	103.099	1.45	0.00	0.00	49.00
68.900	25.55	172916	103.199	1.46	0.00	0.00	49.00
69.100	25.43	172795	103.199	1.47	0.00	0.00	49.00
69.300	25.30	172681	103.299	1.49	0.00	0.00	50.00
69.500	25.17	172575	103.399	1.50	0.00	0.00	50.00
69.700	25.03	172475	103.499	1.52	0.00	0.00	50.00
69.900	24.90	172381	103.499	1.53	0.00	0.00	50.00
70.100	24.76	172294	103.599	1.55	0.00	0.00	50.00
70.300	24.62	172213	103.699	1.57	0.00	0.00	50.00
70.500	24.48	172136	103.699	1.59	0.00	0.00	51.00
70.700	24.34	172062	103.799	1.61	0.00	0.00	51.00
70.905	24.08	171987	103.999	1.58	0.00	0.00	51.00
71.111	23.82	171909	104.099	1.55	0.00	0.00	51.00
71.317	23.57	171829	104.299	1.52	0.00	0.00	52.00
71.522	23.31	171747	104.399	1.50	0.00	0.00	52.00
71.728	23.06	171664	104.599	1.48	0.00	0.00	52.00
71.933	22.80	171579	104.799	1.46	0.00	0.00	53.00
72.139	22.54	171492	105.099	1.44	0.00	0.00	53.00
72.344	22.29	171404	105.399	1.42	0.00	0.00	53.00
72.550	22.03	171316	105.899	1.41	0.00	0.00	54.00
72.756	21.77	171225	106.499	1.39	0.00	0.00	54.00
72.961	21.53	171135	110.999	1.38	0.00	0.00	54.00
73.167	21.29	171043	111.499	1.37	0.00	0.00	55.00
73.372	21.06	170950	111.899	1.36	0.00	0.00	55.00
73.578	20.83	170857	112.299	1.35	0.00	0.00	55.00
73.783	20.59	170762	112.699	1.35	0.00	0.00	56.00
73.989	20.36	170660	113.099	1.34	0.00	0.00	56.00
74.194	20.13	170548	113.399	1.34	0.00	0.00	56.00
74.400	19.91	170427	113.799	1.33	0.00	0.00	57.00

END OF OUTPUT