Table 2.4-14 Floods From Postulated Seismic Failure of Upstream Dams (Plant Grade is Elevation 728)

		Watts Bar Nuclear Plant Elevation
OBE Failures With One-half Probable Maximum Flood		
1.	Norris and Tellico	728.67
2.	Cherokee, Douglas, and Tellico	729.07
3.	Fontana[a] and Tellico	720.65
4.	Fontana [a], Tellico, Hiwassee, Apalachia, and Blue Ridge	722.01
SSE Failures with 25-Year Flood		
5.	Norris, Cherokee, Douglas and Tellico [b]	731.17

a. Includes failure of four ALCOA and one Duke Energy dams--Nantahala (Duke Energy formerly ALCOA), upstream; Santeetlah, on a downstream tributary, and Cheoah, Calderwood, and Chilhowee, downstream. Fort Loudoun gates are inoperable in open position.

b. Gate opening at Fort Loudoun prevented by bridge failure.

Table 2.4-15 Well and Spring Inventory Within 2-mile Radius of Watts Bar Nuclear Plant Site (1972 Survey Only) (Page 1 of 4)

Map Ident No.	Location Latitude	Location Longitude	Depth	Estimated Elevation Ground (feet)	Estimated Elevation Water Surface (feet)	Casing Size	Pump Data
1	35°36'08"	87°47'03"	200+	743	712	0.5	*No pump
2	35°36'24"	84°47'41"	59	726	723	0.5	*No pump
3	35°36'10"	84°47'50"	102	721	704	0.5	*No pump
4	35°36'00"	84°47'48"	43.5	730	718	0.5	*No pump
5	35°35'42"	84°47'49"	45	710	687	0.5	*No pump
6	35°35'55"	84°47'48"	6	705	705	2.5	*No pump
7	35°36'04"	84°48'16"	107	710	684	0.5	*No pump
8	35°36'11"	84°48'16"	30	702	684	4.0	*No pump
9	35°36'23"	84°48'06"	**	-	740	-	No pump
10	35°37'15"	84°49'04"	99	742	696	0.5	1/3 hp
11	35°37'06"	84°49'10"	87	753	Unknown	0.5	1/2 hp
12	35°37'03"	84°49'04"	150	704	700	0.5	1/2 hp
13	35°37'05"	84°49'02"	175	704	698	0.5	1 hp
14	35°37'15"	84°49'01"	140	740	720	0.5	1 hp
15	35°37'03"	84°48'48"	83	729	693	0.5	Hand pump
16	35°36'46'	84°48'18"	205	780	665	0.5	Submerged, Unknown
17	35°36'34"	84°48'13"	28	768	768	0.5	1 hp
18	35°36'30"	84°48'20"	95	794	777	0.5	1 hp
19	35°35'35"	84°48'52"	111	713	715	0.6	No pump, 1 gpm
20	35°36'54"	84°49'10"	68	710	Unknown	0.5	Unknown
21	35°36'18"	84°49'24"	125	725	695	0.5	1/2 hp
22	35°36'20"	84°49'20"	130	729	655	0.5	3/4 hp
23	35°35'20"	84°48'55"	225	730	715	0.5	1 hp
24	35°35'15"	84°48'56"	79	715	705	0.5	1/2 hp
25	35°35'44"	84°49'07"	14	805	804	8.0	No pump
26	35°35'46"	84°49'31"	385	718	Unknown	0.5	1/2 hp
27	35°35'29"	84°49'16"	240	770	600	Unknown	Unknown
28	35°37'14"	84°47'04"	***	-	Watts Bar Lake 735 - 745	-	2, 50 hp=500 gpm
29	35°37'19"	84°45'57"	100	706	660	0.5	1 hp
30	35°36'39"	84°45'59"	65	714	unknown	0.5	1/2 hp
31	35°35'49"	84°46'15"	Spring	-	710	-	No pump

Table 2.4-15 Well and Spring Inventory
Within 2-mile Radius of Watts Bar Nuclear Plant Site (Continued)
(1972 Survey Only)
(Page 2 of 4)

Map Ident No.	Location Latitude	Longitude	Depth	Estimated Elevation Ground (feet)	Water Surface (feet)	Casing Size	Pump Data
32	35°36'19"	84°45'21"	32.5	747	740	2'-10" Square	Windlass and bucket, no pump
33	35°35'26"	84°46'44"	Spring	-	800	-	No pump
34	35°35'25"	84°47'02"	120	725	705	Unknown	4 hp
35	35°35'12"	84°47'15"	225	730	710	0.5	No pump
36	35°35'19"	84°47'25"	110	734	715	0.5	3/4 hp
37	35°35'15"	84°47'25"	175	730	710	0.7	No pump
38	35°35'14"	84°47'27"	100	730	710	0.7	3/4 hp
39	35°37'26"	84°45'50"	40	710	702	0.5	1/4 hp
40	35°35'16"	84°47'28"	165	725	705	0.5	3/4 hp
41	35°35'19"	84°47'30"	110	734	695	0.5	3/4 hp
42	35°35'14"	84°47'28"	73	724	724	0.5	No pump
43	35°35'14"	84°47'22"	105	724	720	0.5	1/2 hp
44	35°35'12"	84°47'29"	Spring	-	710	-	1/2 hp
45	35°35'15"	84°47'16"	125	730	690	0.5	1/2 hp
46	35°35'09"	84°47'31"	105	730	722	0.5	1-1/2 hp
47	35°35'14"	84°47'41"	164	764	755	0.5	1-1/2 hp
48	35°36'55"	84°45'35"	Spring	-	720	-	3/4 hp
49	35°35'00"	84°47'50"	100	748	708	0.5	1-1/2 hp
50	35°34'48"	84°47'42"	80	710	688	0.5	3/4 hp
51	35°35'02"	84°47'38"	100	750	720	0.5	1/2 hp
52	35°34'58"	84°47'34"	99	722	711	0.5	2 hp
53	35°34'55"	84°47'37"	54	719	691	0.5	3/4 hp
54	35°34'44"	84°47'48"	52	718	703	3.0	Not used
55	35°34'39"	84°47'50"	257	720	692	0.5	5 gpm for five houses, lowered well 20 feet
56	35°34'39"	84°47'29"	56	701	691	0.5	1hp
57	35°34'37"	84°47'32"	252	714	602	0.5	125 gph, 1 hp
58	35°34'59"	84°47'33"	Spring	-	710	-	Not used
59	35°35'03"	84°47'38"	Spring	-	730	-	Cattle pond
60	35°35'04"	84°47'58"	Spring	-	710	-	Not used

Investigation made on January 10-11, 1972.
* Residence purchased for Watts Bar Nuclear Plant construction.
** Spring fed pond of approximately 50 feet in diameter.
*** Watts Bar Dam, Steam Plant, and Pete Smith Resort water supply taken from Watts Bar Lake.

Table 2.4-15 Well and Spring Inventory
Within 2-mile Radius of Watts Bar Nuclear Plant Site (Continued)
(1972 Survey Only)
(Page 3 of 4)

Map Ident No.	Location Latitude	Longitude	Depth	Estimated Elevation Ground (feet)	Water Surface (feet)	Casing Size	Pump Data
61	35°36'58"	84°45'22"	NA*	750	NA	NA	NA
62	35°36'50"	84°45'24"	NA	710	NA	NA	NA
63	35°35'42"	84°47'32"	150	742	INK**	0.5	Yes
64	35°37'16"	84°49'00"	100	740	50	0.33	Yes
65	35°36'29"	84°48'20"	200	710	19	0.5	Yes
66	35°36'52"	84°49'08"	70-83	700	INK	0.5	Yes
67	35°36'50"	84°49'08"	70-83	700	INK	0.5	Yes
68	35°36'49"	84°49'09"	70-83	700	INK	0.5	Yes
69	35°36'47"	84°49'10"	70-83	700	INK	0.5	Yes
70	35°37'03"	84°49'09"	NA	750	NA	NA	No
71	35°37'05"	84°49'10"	NA	750	NA	Hand dug	No
72	35°35'41"	84°49'16"	NA	720	NA	NA	NA
73	35°35'43"	84°48'48"	NA	800	NA	NA	NA
74	35°36'53"	84°48'49"	INK	720	INK	INK	Yes
75	35 35'07"	84°47'58"	100+	760	Below River	INK	Yes
76	35°35'07"	84°48'00"	INK	740	INK	INK	Yes
77	35 35'06"	84°48'01"	NA	720	NA	NA	NA
78	35°35'08"	84°48'01"	NA	720	NA	NA	NA
79	35°35'09"	84°47'54"	NA	800	NA	NA	NA
80	35°35'11"	84°47'42"	NA	760	NA	NA	NA
81	35 35'14"	84°47'41"	NA	760	NA	NA	NA
82	35°35'13"	84°47'37"	400+	760	INK	0.5	Yes
83	35°35'14"	84°47'37"	300+	760	INK	0.5	Yes
84	35°35'10"	84°47'34"	NA	740	NA	NA	NA
85	35°35'14"	84°47'31"	NA	720	NA	NA	NA
86	35-35'18"	84°47'26"	450	720	20	0.125	Yes
87	35°35'24"	84°47'14"	300	740	INK	INK	Yes
88	35°35'17"	84°47'15"	300	730	INK	0.5	Yes
89	35°35'19"	84°47'12"	265	730	INK	0.5	Yes
90	35°35'18"	84°47'12"	150	730	INK	0.5	Yes
91	35°35'17"	84°47'09"	NA	730	NA	NA	NA
92	35°35'14"	84°47'13"	NA	720	NA	NA	NA
93	35°35'06"	84°47'17"	210	720	20	0.5	Yes

Table 2.4-15 Well and Spring Inventory
Within 2-mile Radius of Watts Bar Nuclear Plant Site (Continued)
(1972 Survey Only)
(Page 4 of 4)

Map Ident No.	Location Latitude	Location Longitude	Depth	Estimated Elevation Ground (feet)	Estimated Elevation Water Surface (feet)	Casing Size	Pump Data
94	35°35'08"	84°46'58"	130	760	15	0.5	Yes
95	35°35'08"	84°46'55"	NA	800	NA	NA	NA
96	35°35'19"	84°46'41"	80	990	20	0.5	Yes
97	35°35'22"	84°46'34"	600	960	INK	0.5	Yes
98	35°35'39"	84°46'34"	INK	740	INK	INK	Yes
S-99	35°37'04"	84°48'59"	Spring	710	-	-	No
S-100	35°35'45"	84°49'04"	Spring	840	-	-	No
S-101	35°35'40'	84°49'14"	Spring	730	-	-	No
S-102	35°35'16"	84°46'44"	Spring	980	-	-	No
S-103	35°35'06"	84°46'57"	Spring	800	-	-	No

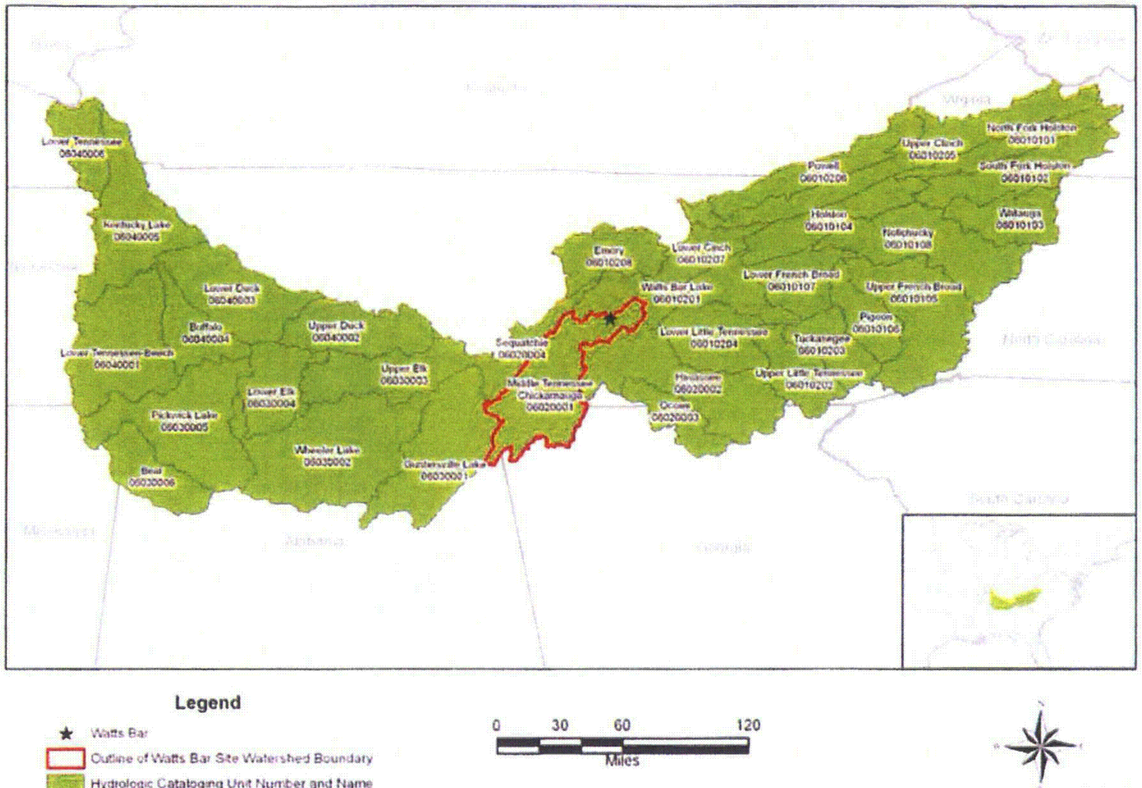
* none available, many of these residences appeared to be summer houses, 2-3 attempts to locate home owners in the evening hours and on the weekend were unsuccessful.
**Information not known by homeowner.
***No pump sizes were known by current homeowners.

ENCLOSURE 1

EVALUATION OF PROPOSED CHANGES

ATTACHMENT 3

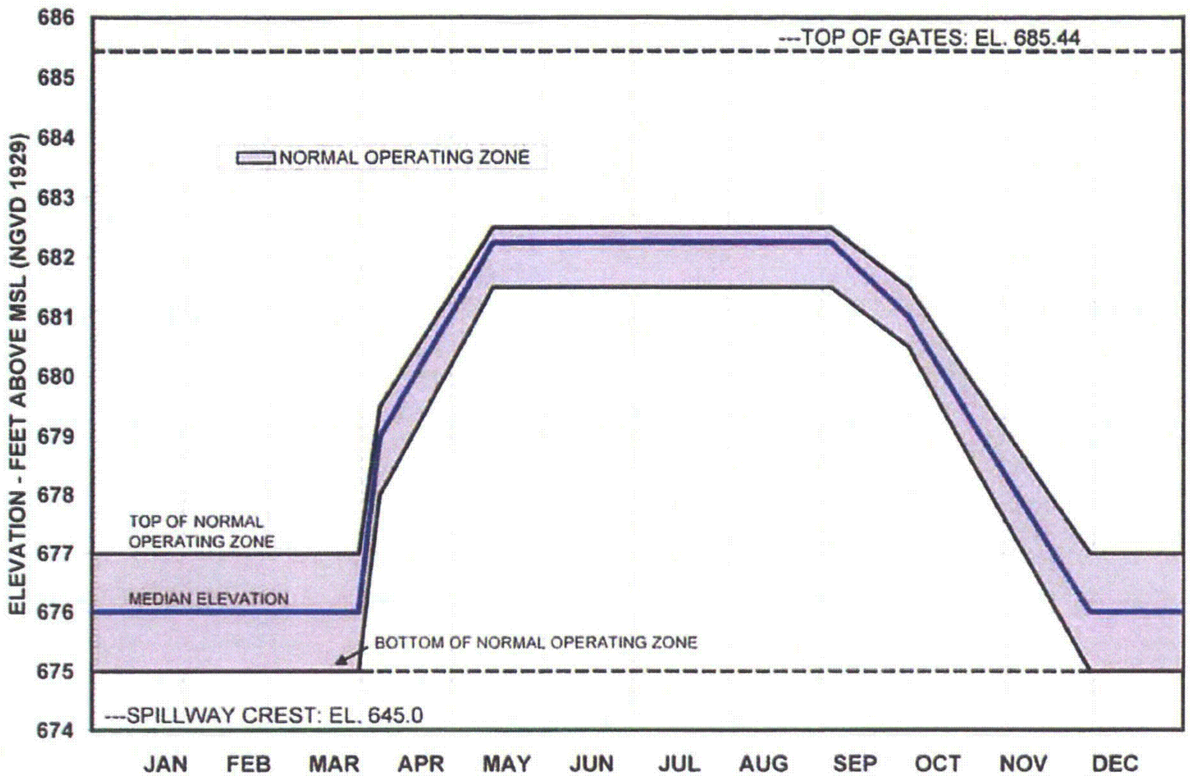
Proposed WBN Unit 1 UFSAR Figures (Public)



WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
USGS Hydrologic Units within the Tennessee River Watershed Figure 2.4-1

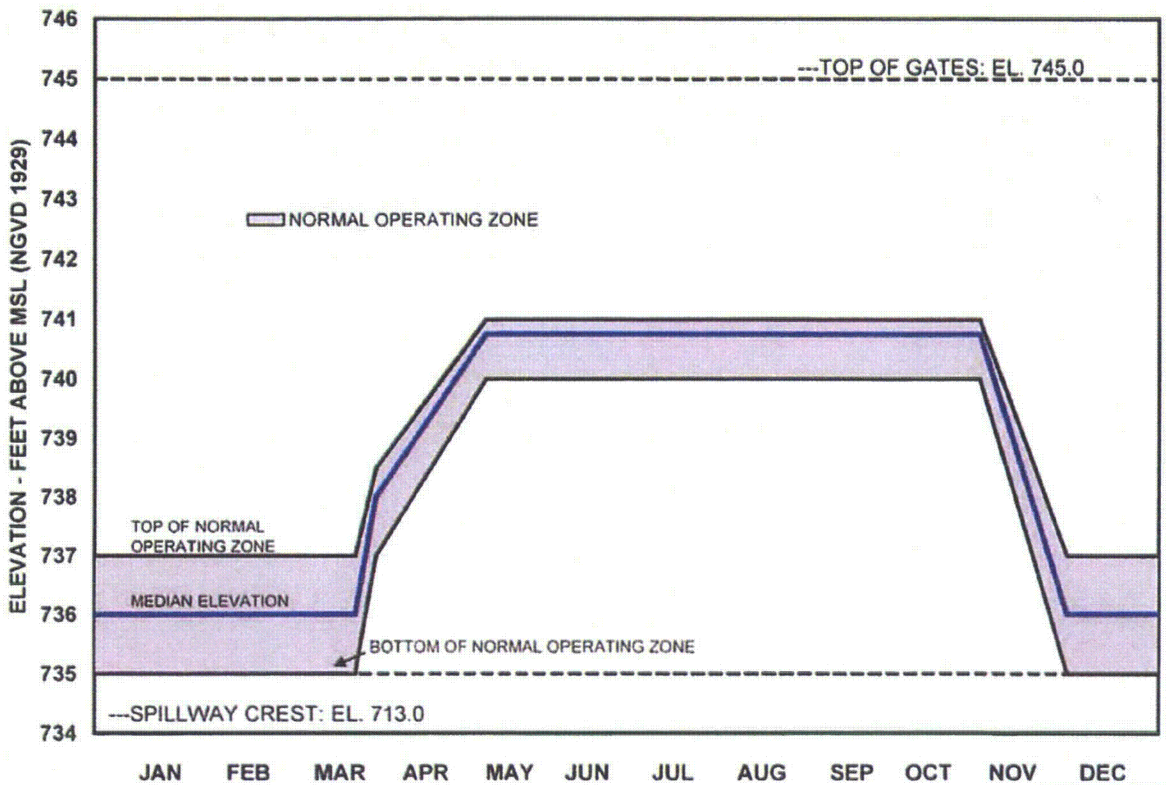
Figure 2.4-1 USGS Hydrologic Units within the Tennessee River Watershed

Figure 2.4-2 TVA Water Control System



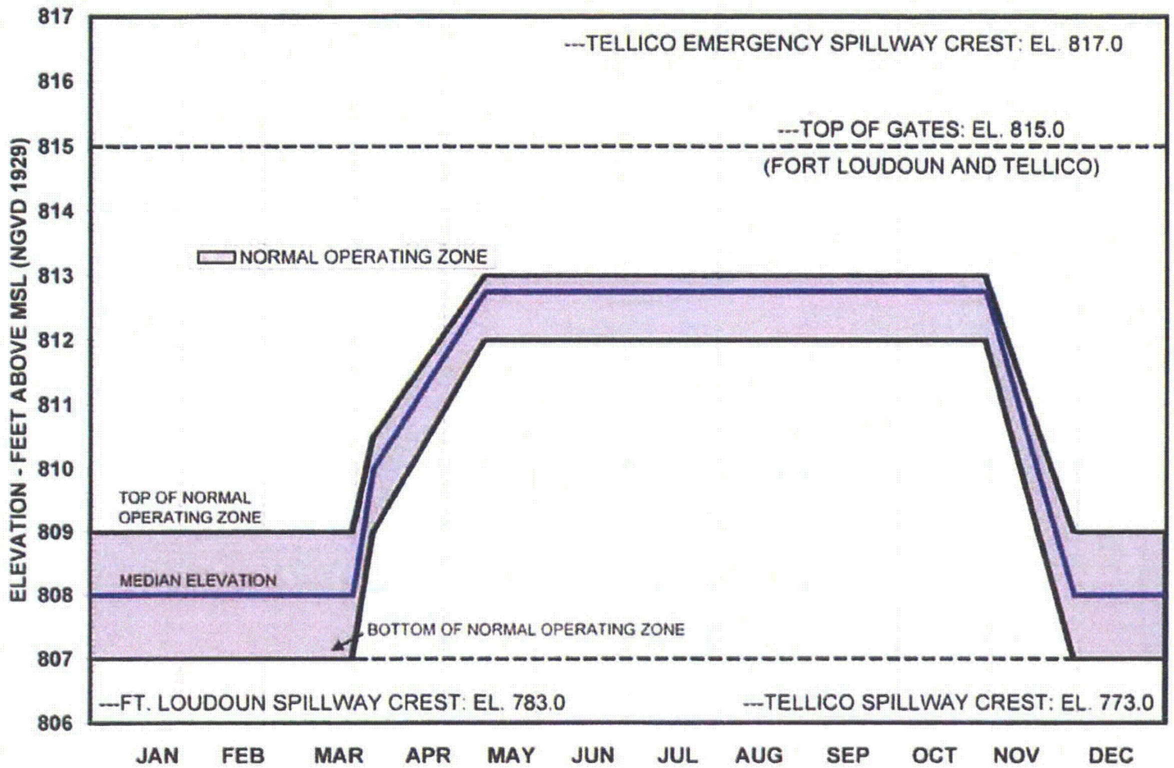
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Seasonal Operating Curve, Chickamauga Figure 2.4-3 (Sheet 1 of 12)

Figure 2.4-3 Seasonal Operating Curve, Chickamauga (Sheet 1 of 12)



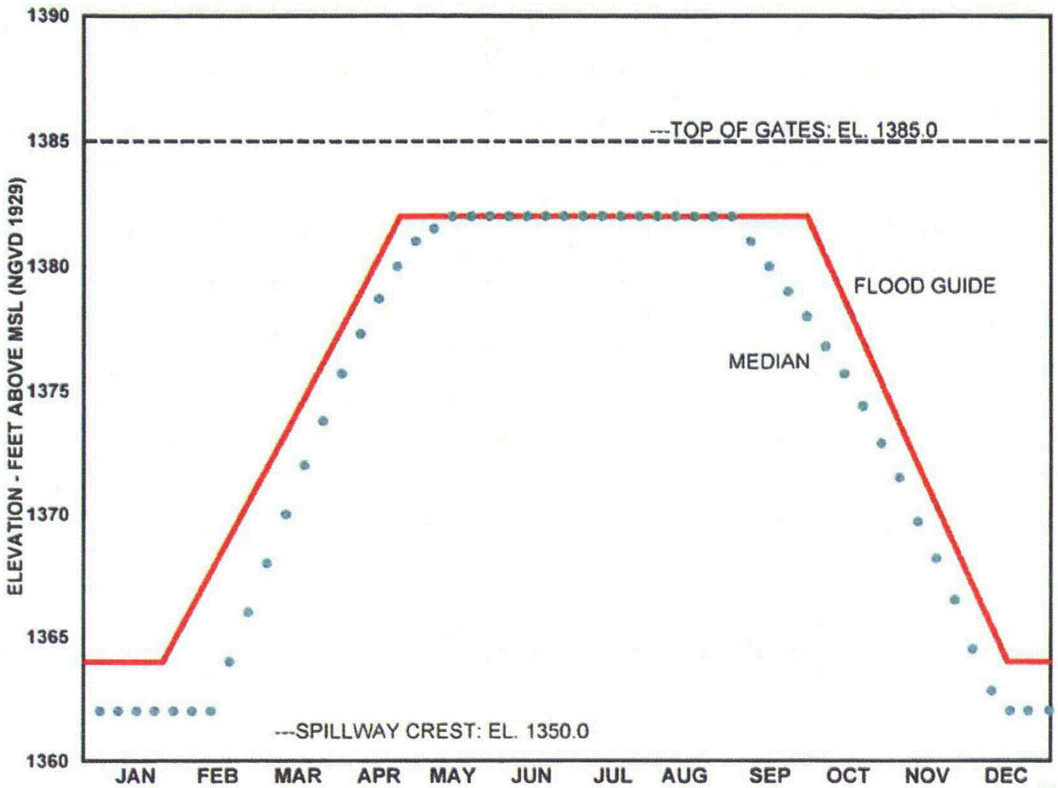
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Seasonal Operating Curve, Watts Bar Figure 2.4-3 (Sheet 2 of 12)

Figure 2.4-3 Seasonal Operating Curve, Watts Bar (Sheet 2 of 12)



WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Seasonal Operating Curve, Fort Loudoun - Tellico Figure 2.4-3 (Sheet 3 of 12)

Figure 2.4-3 Seasonal Operating Curve, Fort Loudoun - Tellico (Sheet 3 of 12)

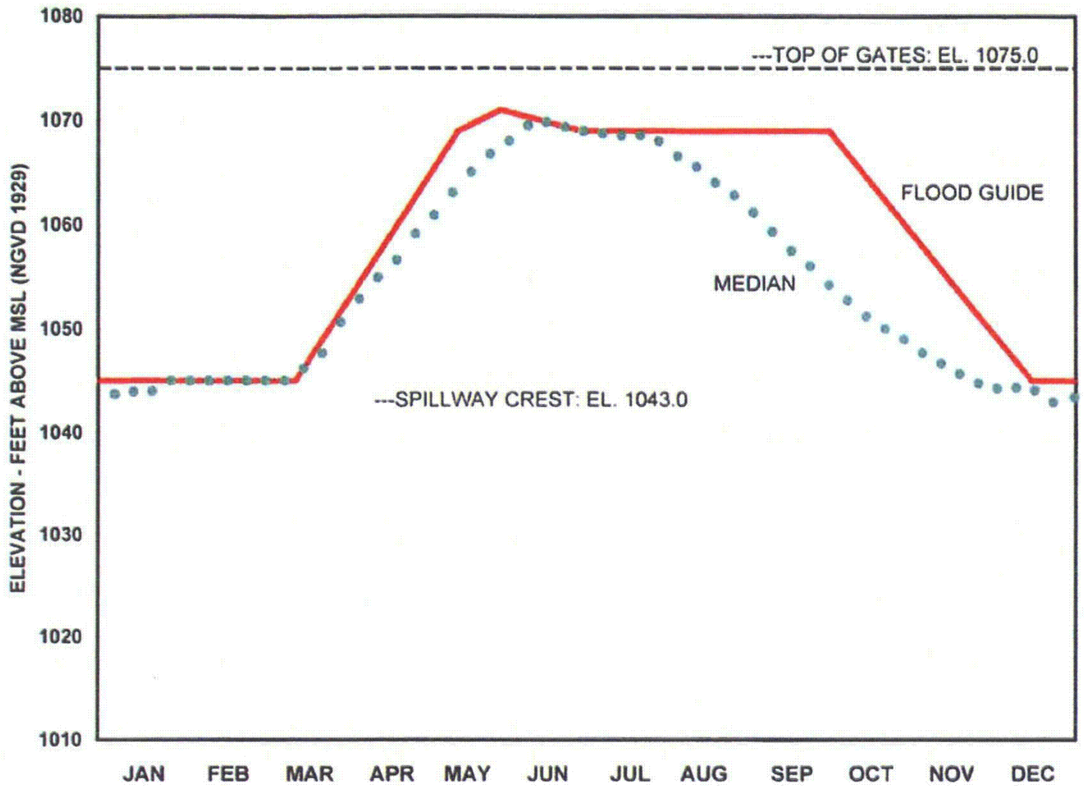


WATTS BAR NUCLEAR PLANT
FINAL SAFETY
ANALYSIS REPORT

Seasonal Operating Curve, Boone

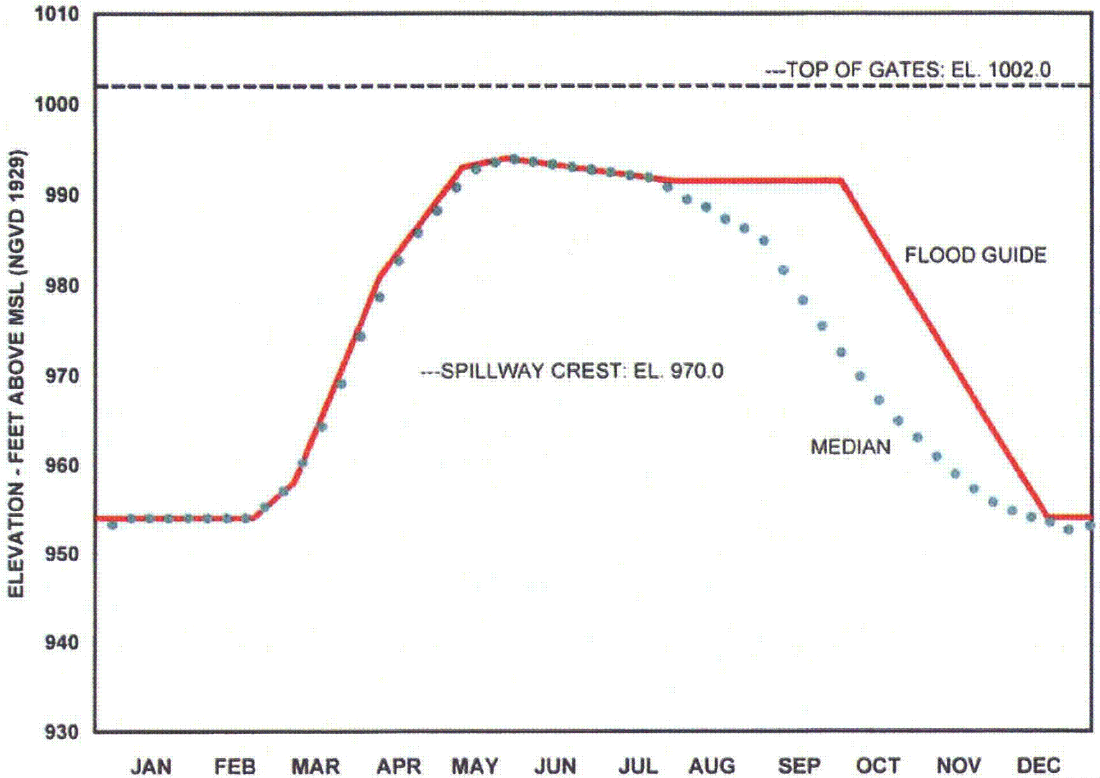
Figure 2.4-3 (Sheet 4 of 12)

Figure 2.4-3 Seasonal Operating Curve, Boone (Sheet 4 of 12)



WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Seasonal Operating Curve, Cherokee Figure 2.4-3 (Sheet 5 of 12)

Figure 2.4-3 Seasonal Operating Curve, Cherokee (Sheet 5 of 12)

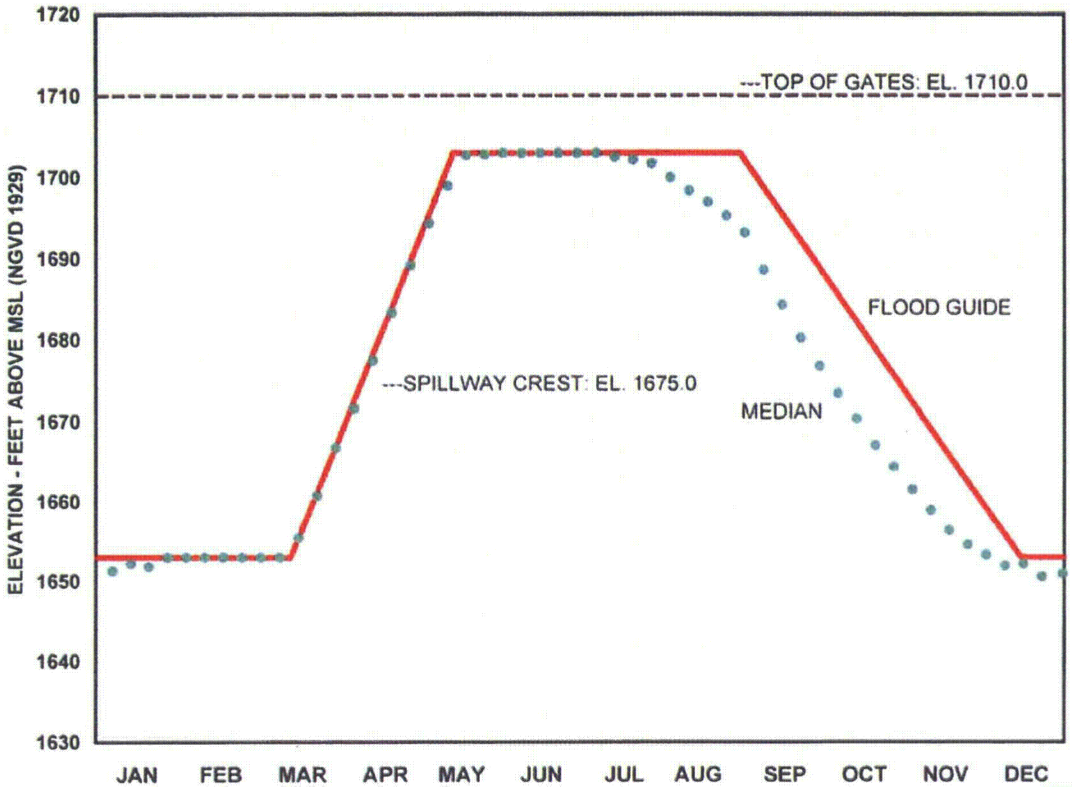


WATTS BAR NUCLEAR PLANT
FINAL SAFETY
ANALYSIS REPORT

Seasonal Operating Curve, Douglas

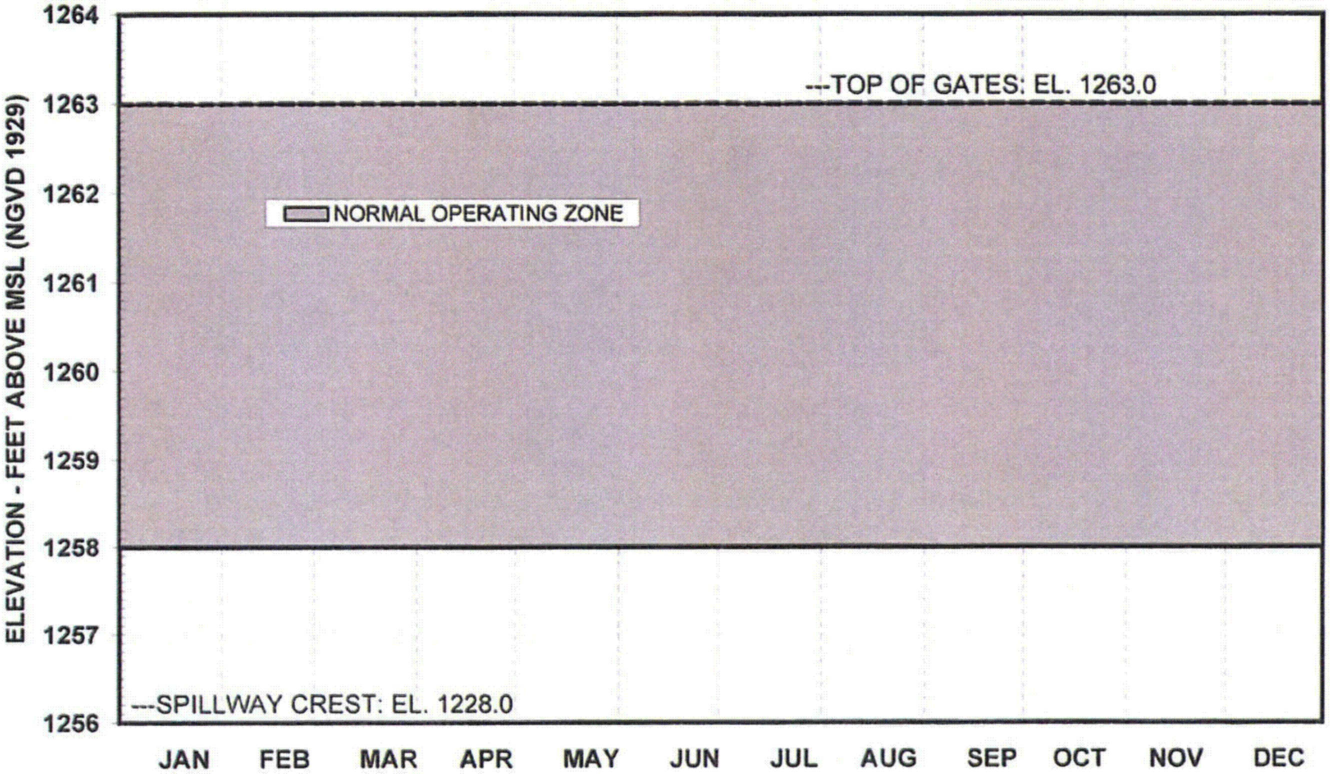
Figure 2.4-3 (Sheet 6 of 12)

Figure 2.4-3 Seasonal Operating Curve, Douglas (Sheet 6 of 12)



WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Seasonal Operating Curve, Fontana Figure 2.4-3 (Sheet 7 of 12)

Figure 2.4-3 Seasonal Operating Curve, Fontana (Sheet 7 of 12)



WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Seasonal Operating Curve, Fort Patrick Henry Figure 2.4-3 (Sheet 8 of 12)

Figure 2.4-3 Seasonal Operating Curve, Fort Patrick Henry (Sheet 8 of 12)

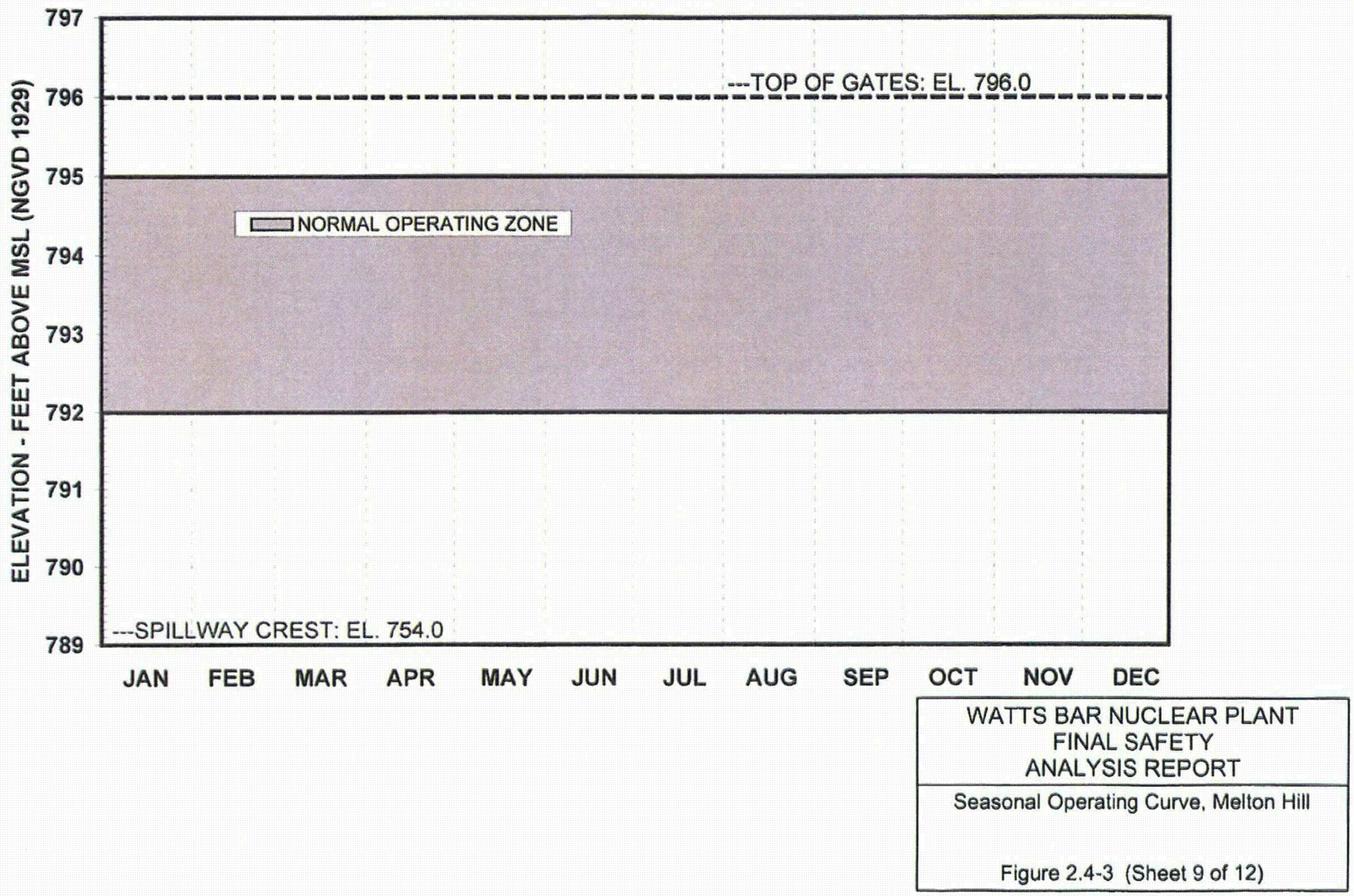
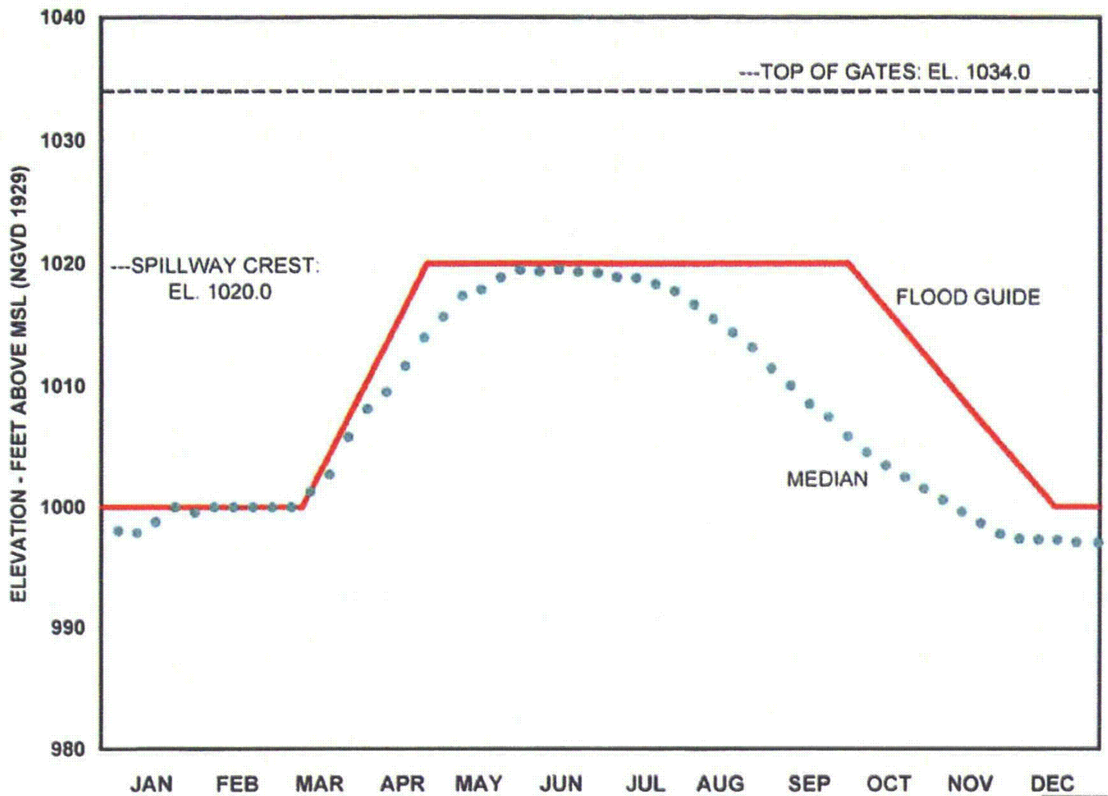
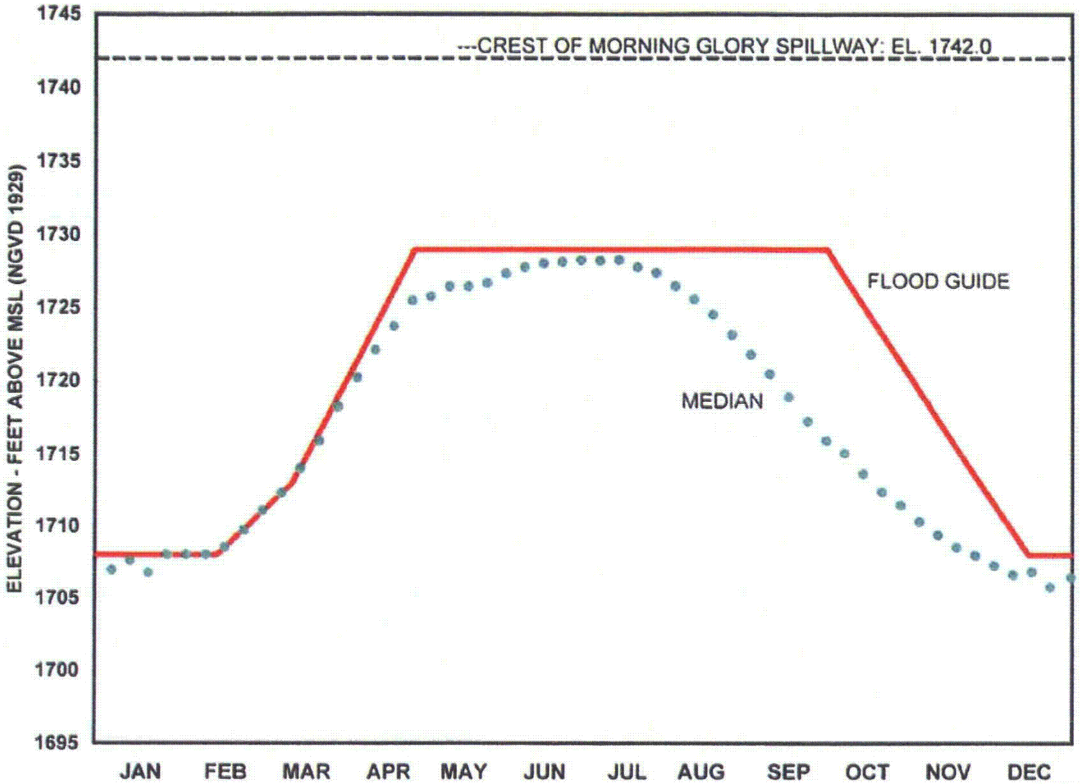


Figure 2.4-3 Seasonal Operating Curve, Melton Hill (Sheet 9 of 12)



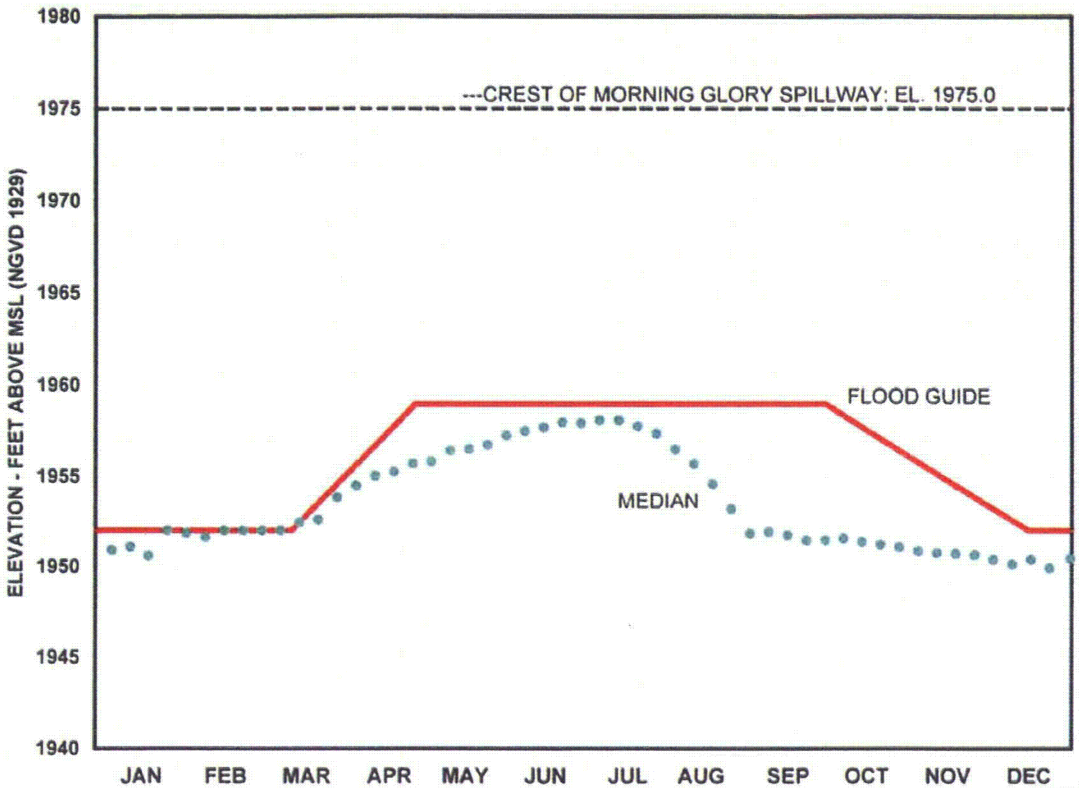
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Seasonal Operating Curve, Norris Figure 2.4-3 (Sheet 10 of 12)

Figure 2.4-3 Seasonal Operating Curve, Norris (Sheet 10 of 12)



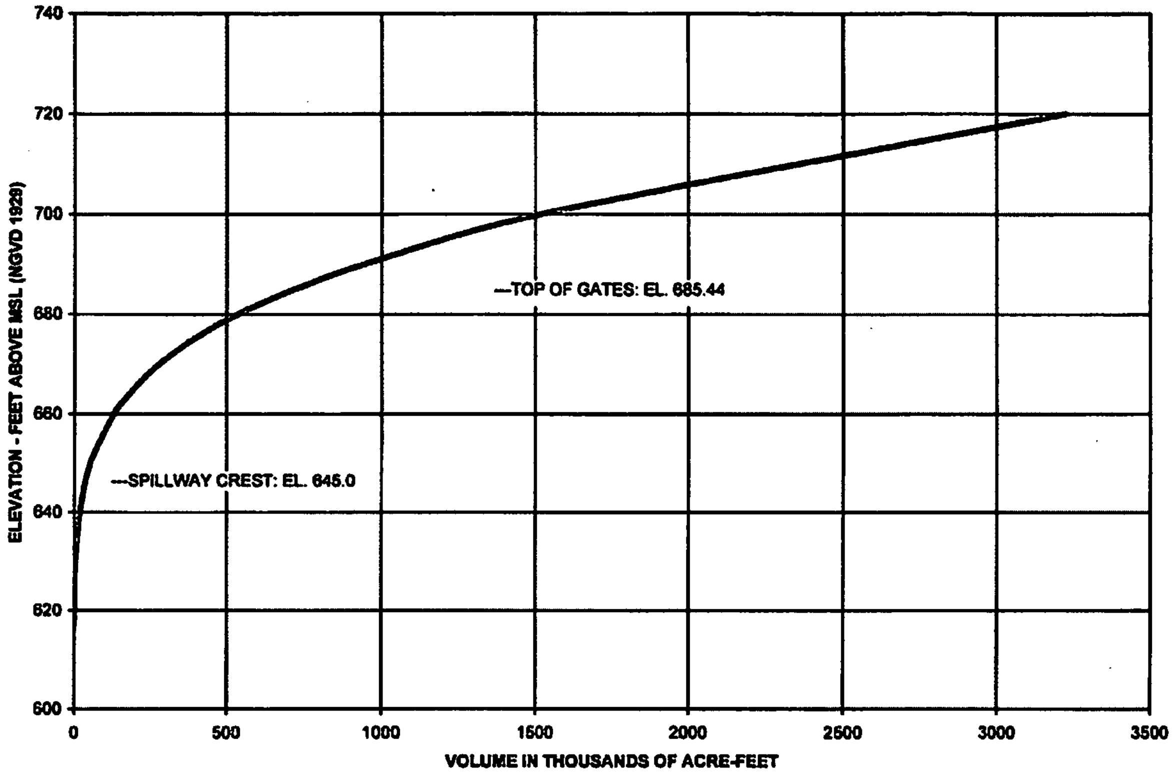
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Seasonal Operating Curve, South Holston
Figure 2.4-3 (Sheet 11 of 12)

Figure 2.4-3 Seasonal Operating Curve, South Holston (Sheet 11 of 12)



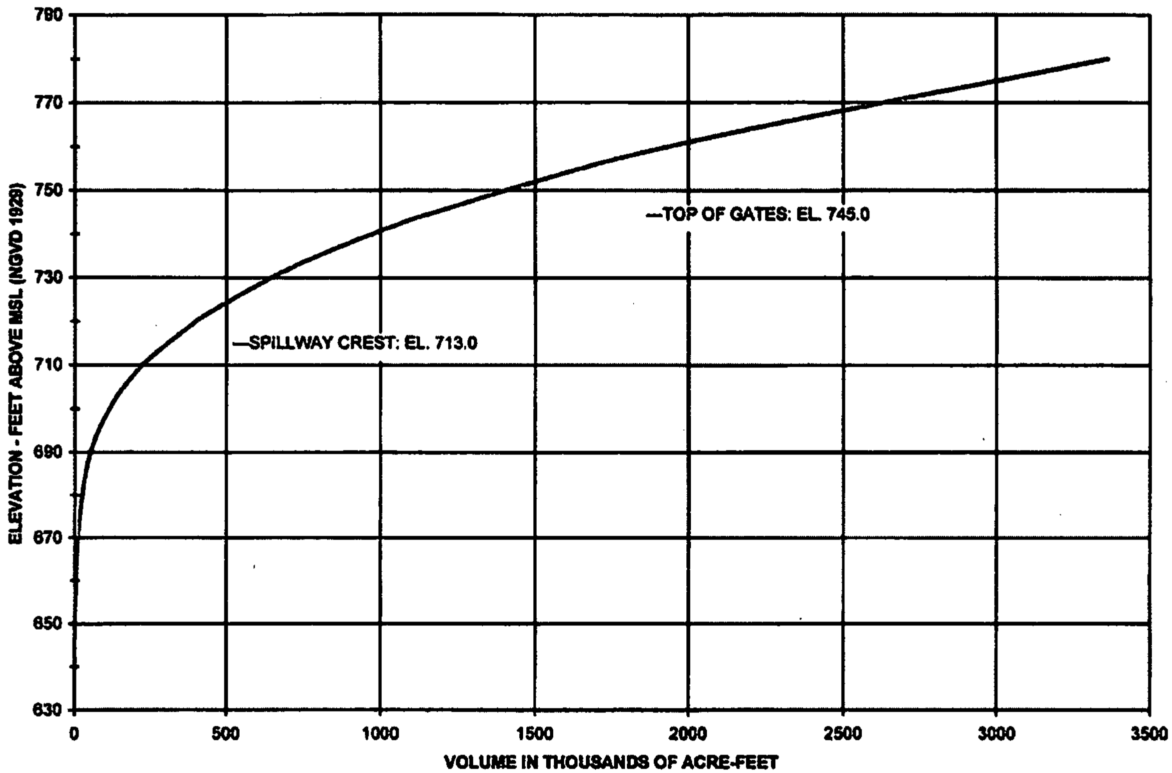
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Seasonal Operating Curve, Watauga Figure 2.4-3 (Sheet 12 of 12)

Figure 2.4-3 Seasonal Operating Curve, Watauga (Sheet 12 of 12)



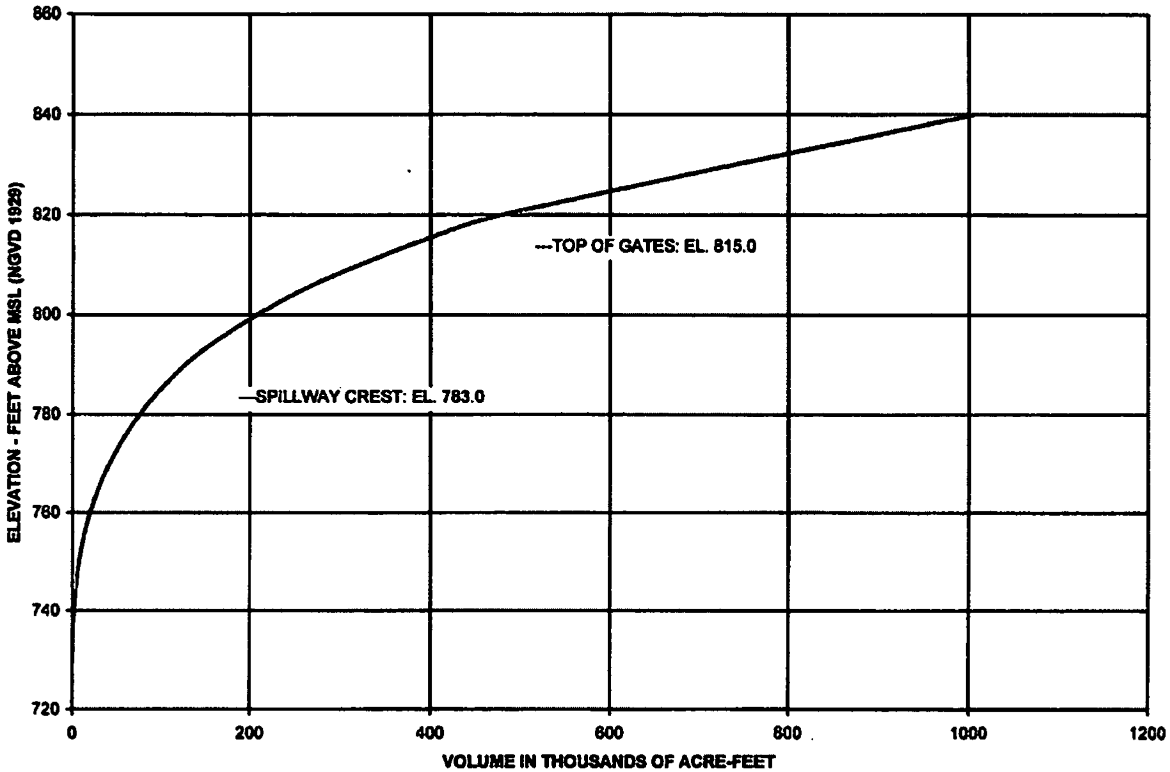
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Reservoir Elevation - Storage Relationship, Chickamauga Figure 2.4-4 (Sheet 1 of 13)

Figure 2.4-4 Reservoir Elevation - Storage Relationship, Chickamauga (Sheet 1 of 13)



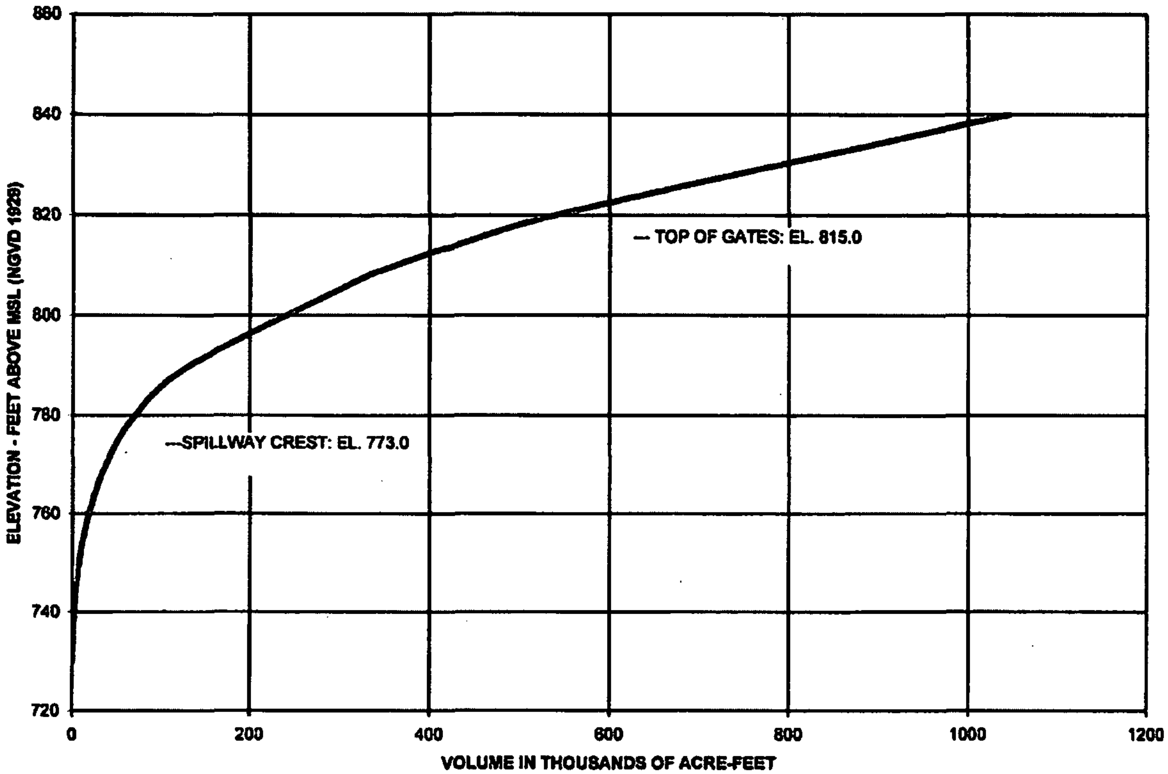
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Reservoir Elevation - Storage Relationship, Watts Bar Figure 2.4-4 (Sheet 2 of 13)

Figure 2.4-4 Reservoir Elevation - Storage Relationship, Watts Bar (Sheet 2 of 13)



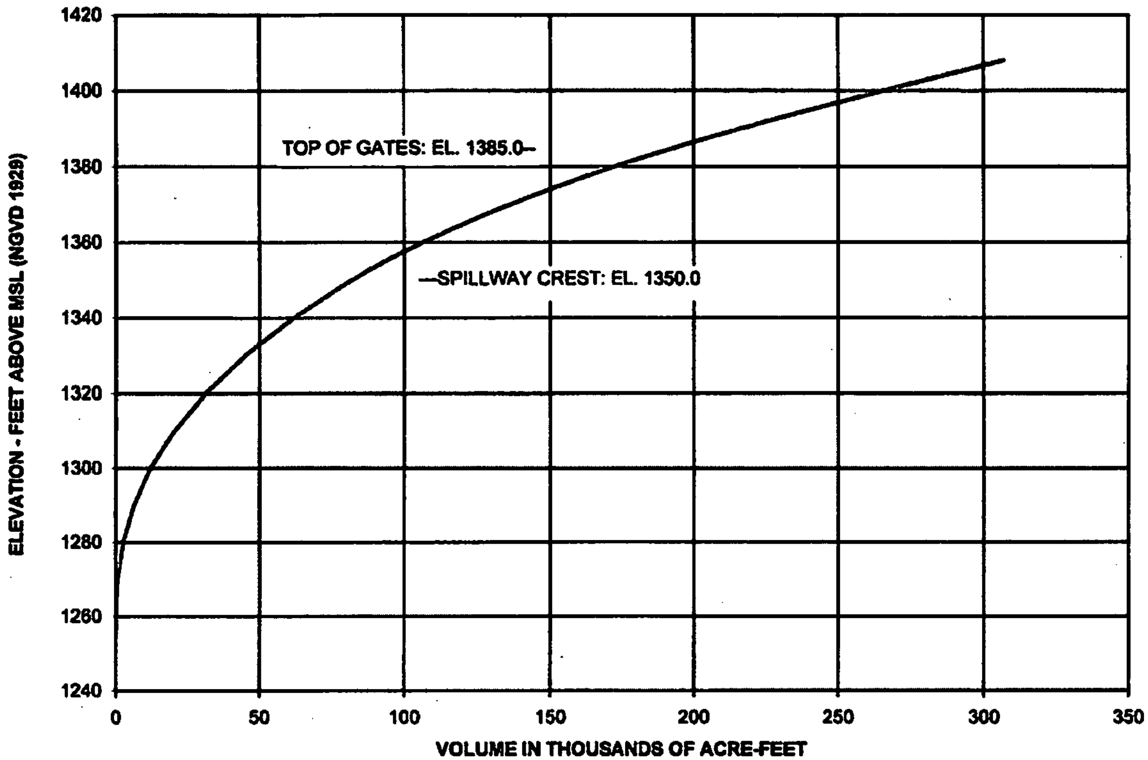
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Reservoir Elevation - Storage Relationship, Fort Loudoun Figure 2.4-4 (Sheet 3 of 13)

Figure 2.4-4 Reservoir Elevation - Storage Relationship, Fort Loudoun (Sheet 3 of 13)



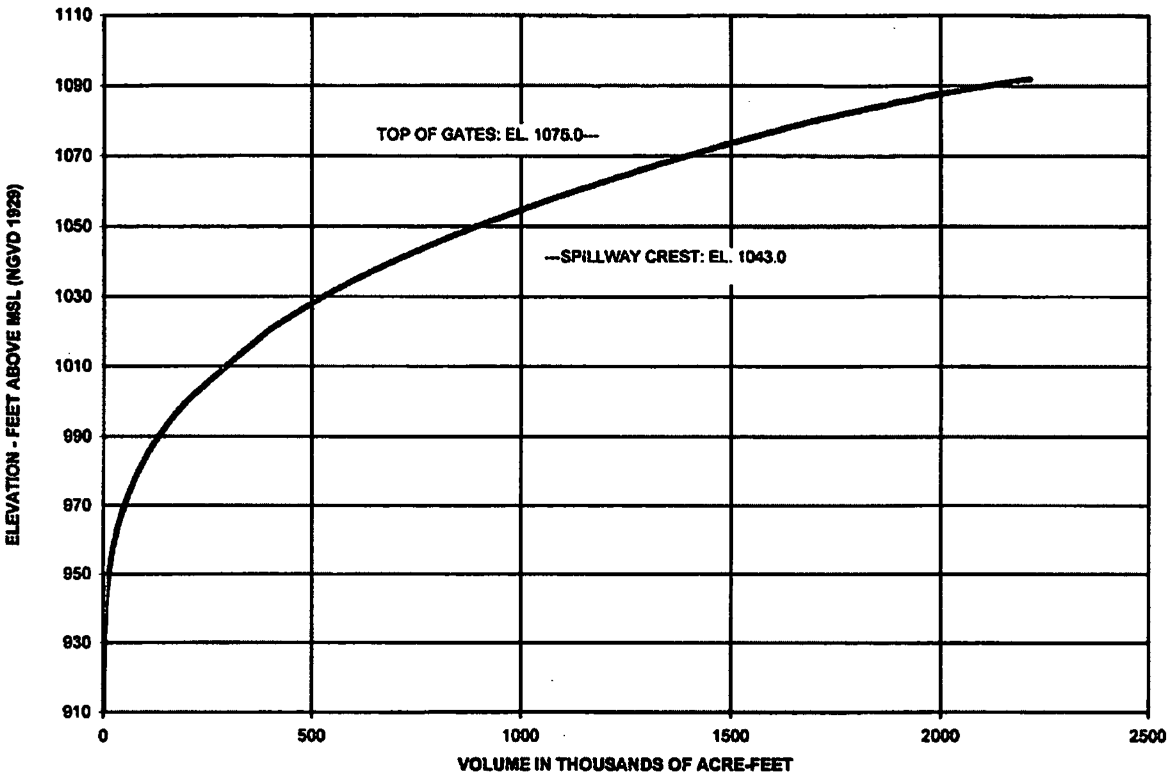
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Reservoir Elevation - Storage Relationship, Tellico Figure 2.4-4 (Sheet 4 of 13)

Figure 2.4-4 Reservoir Elevation - Storage Relationship, Tellico (Sheet 4 of 13)



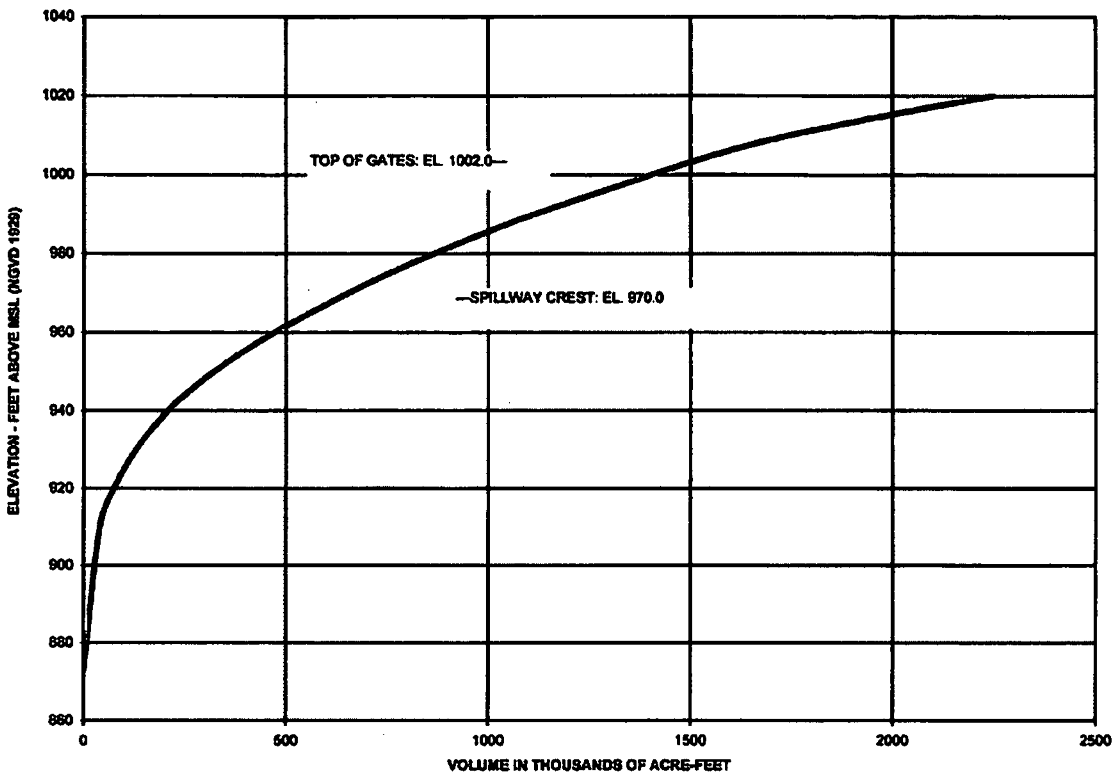
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Reservoir Elevation - Storage Relationship, Boone Figure 2.4-4 (Sheet 5 of 13)

Figure 2.4-4 Reservoir Elevation - Storage Relationship, Boone (Sheet 5 of 13)



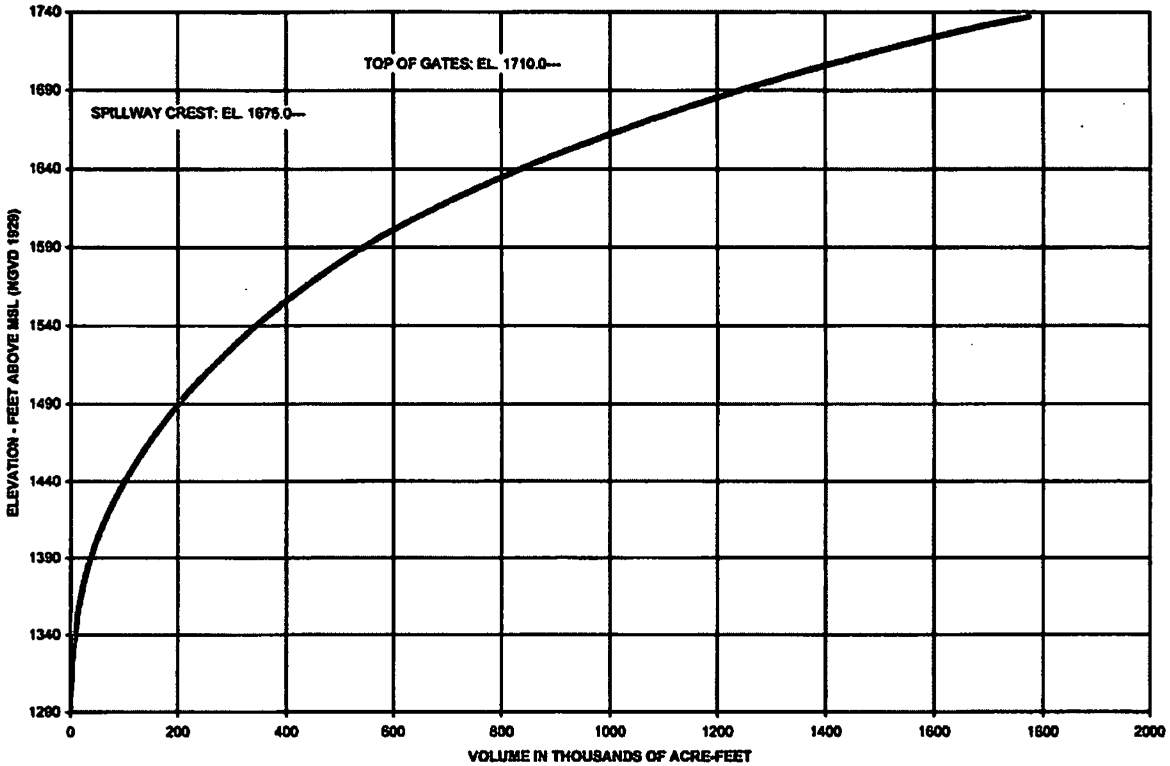
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Reservoir Elevation - Storage Relationship, Cherokee Figure 2.4-4 (Sheet 6 of 13)

Figure 2.4-4 Reservoir Elevation - Storage Relationship, Cherokee (Sheet 6 of 13)



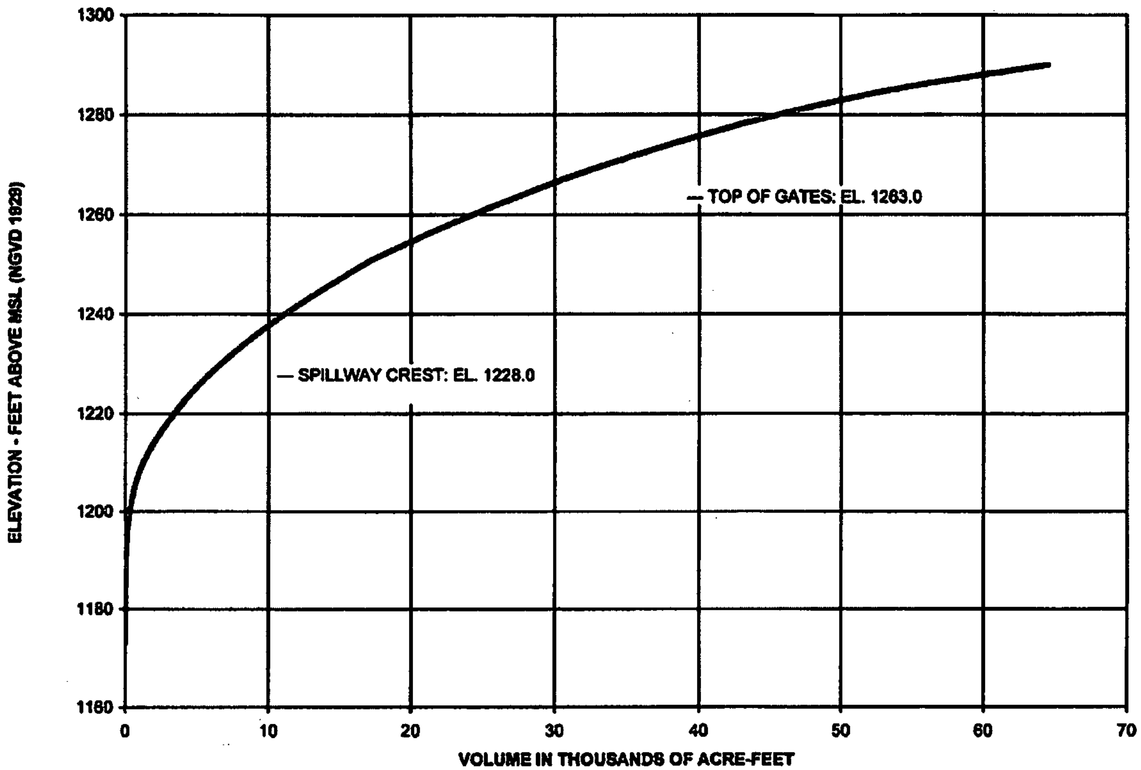
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Reservoir Elevation - Storage Relationship, Douglas Figure 2.4-4 (Sheet 7 of 13)

Figure 2.4-4 Reservoir Elevation - Storage Relationship, Douglas (Sheet 7 of 13)



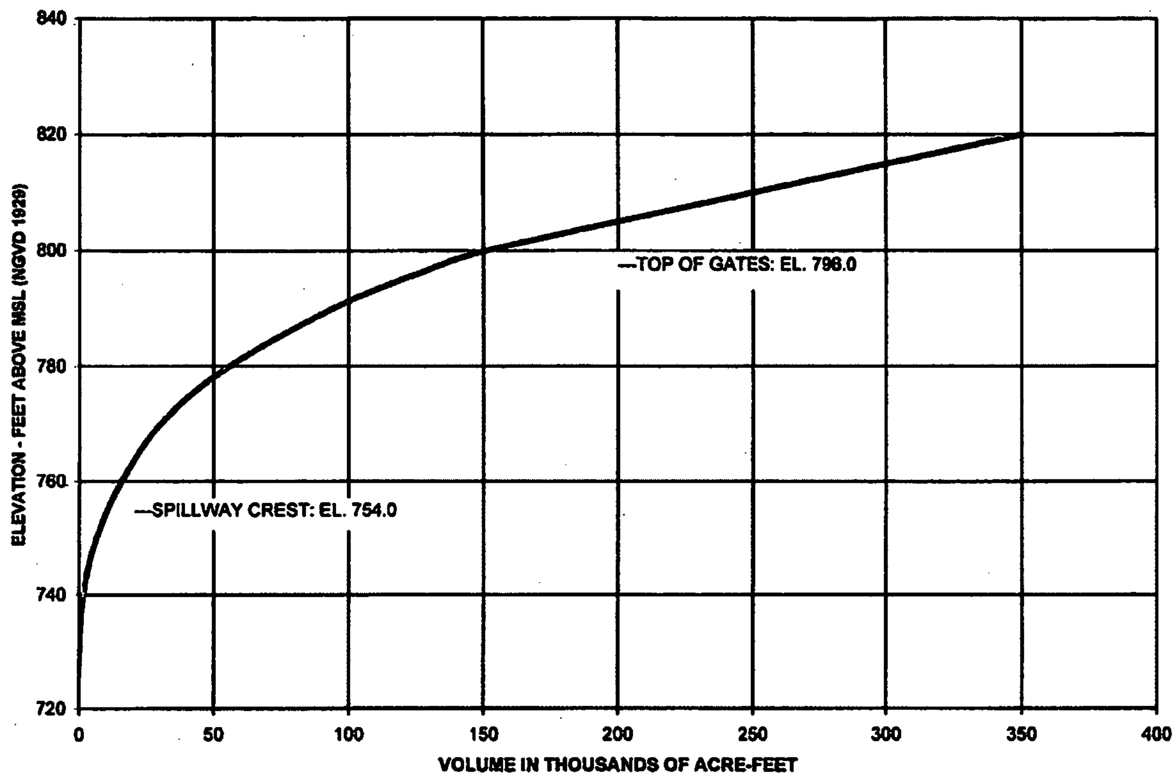
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Reservoir Elevation - Storage Relationship, Fontana Figure 2.4-4 (Sheet 8 of 13)

Figure 2.4-4 Reservoir Elevation - Storage Relationship, Fontana (Sheet 8 of 13)



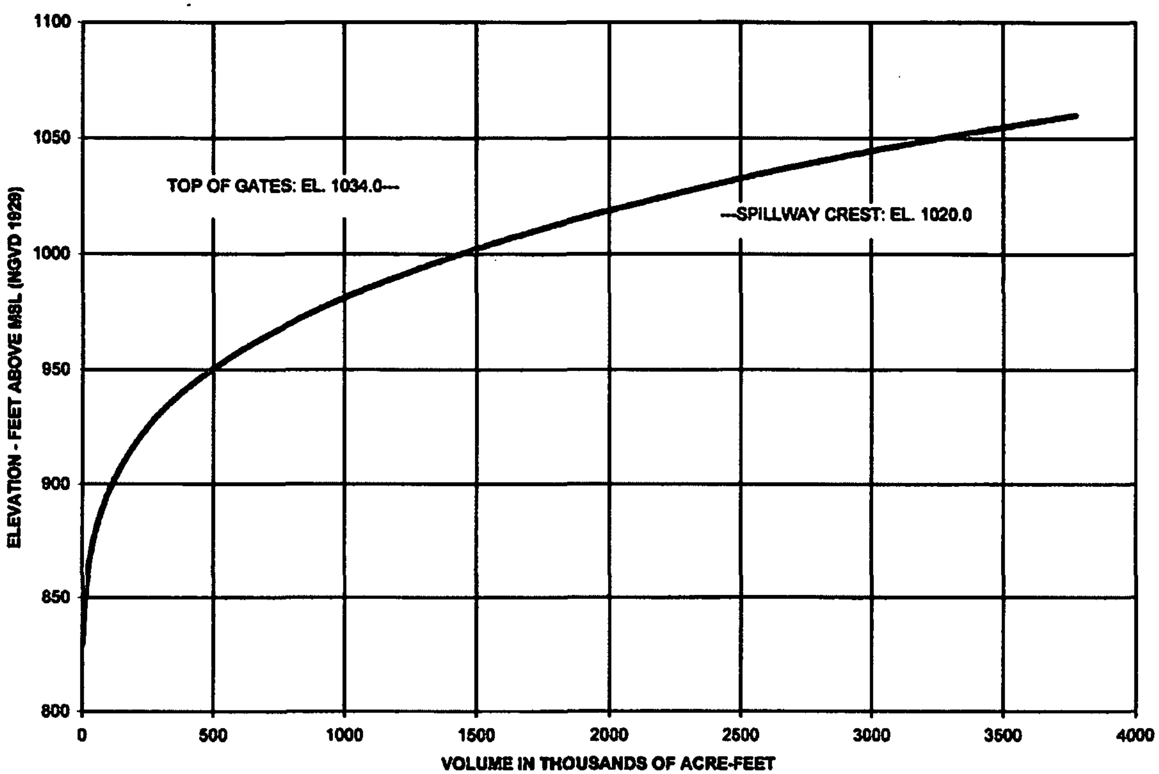
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Reservoir Elevation - Storage Relationship, Fort Patrick Henry Figure 2.4-4 (Sheet 9 of 13)

Figure 2.4-4 Reservoir Elevation - Storage Relationship, Fort Patrick Henry (Sheet 9 of 13)



WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Reservoir Elevation - Storage Relationship, Melton Hill Figure 2.4-4 (Sheet 10 of 13)

Figure 2.4-4 Reservoir Elevation - Storage Relationship, Melton Hill (Sheet 10 of 13)

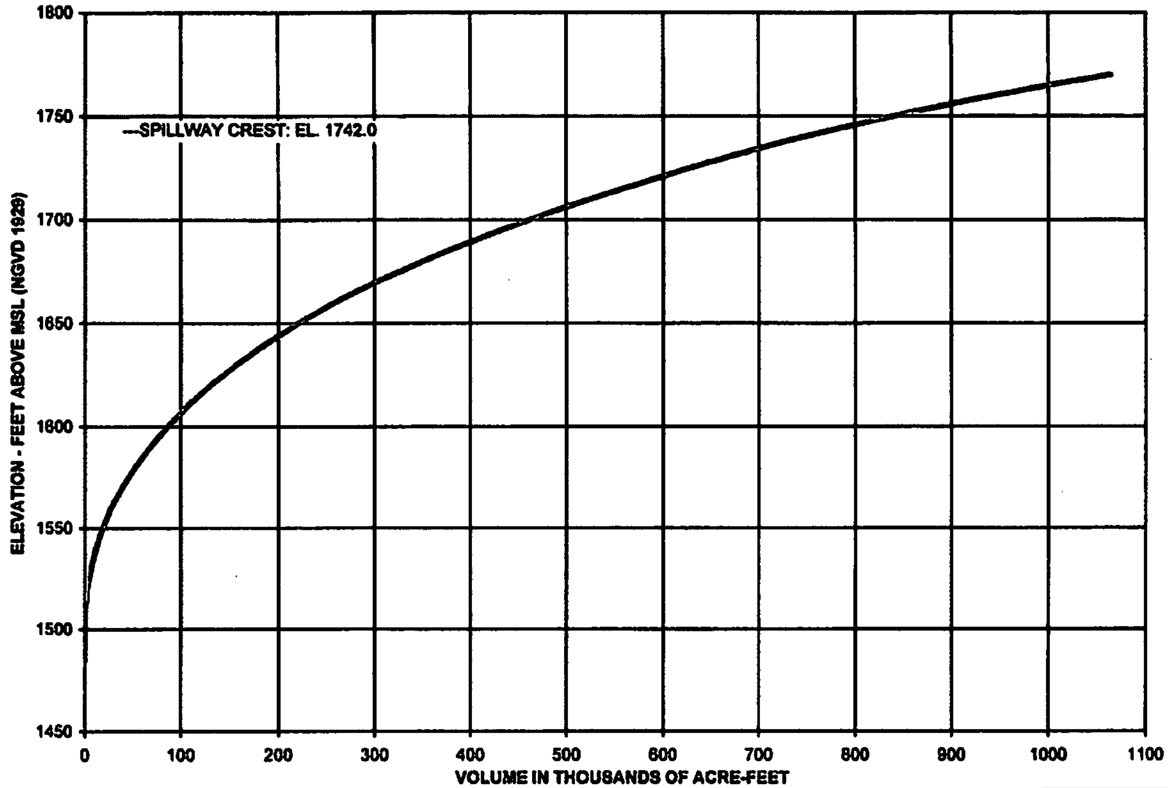


WATTS BAR NUCLEAR PLANT
FINAL SAFETY
ANALYSIS REPORT

Reservoir Elevation - Storage
Relationship, Norris

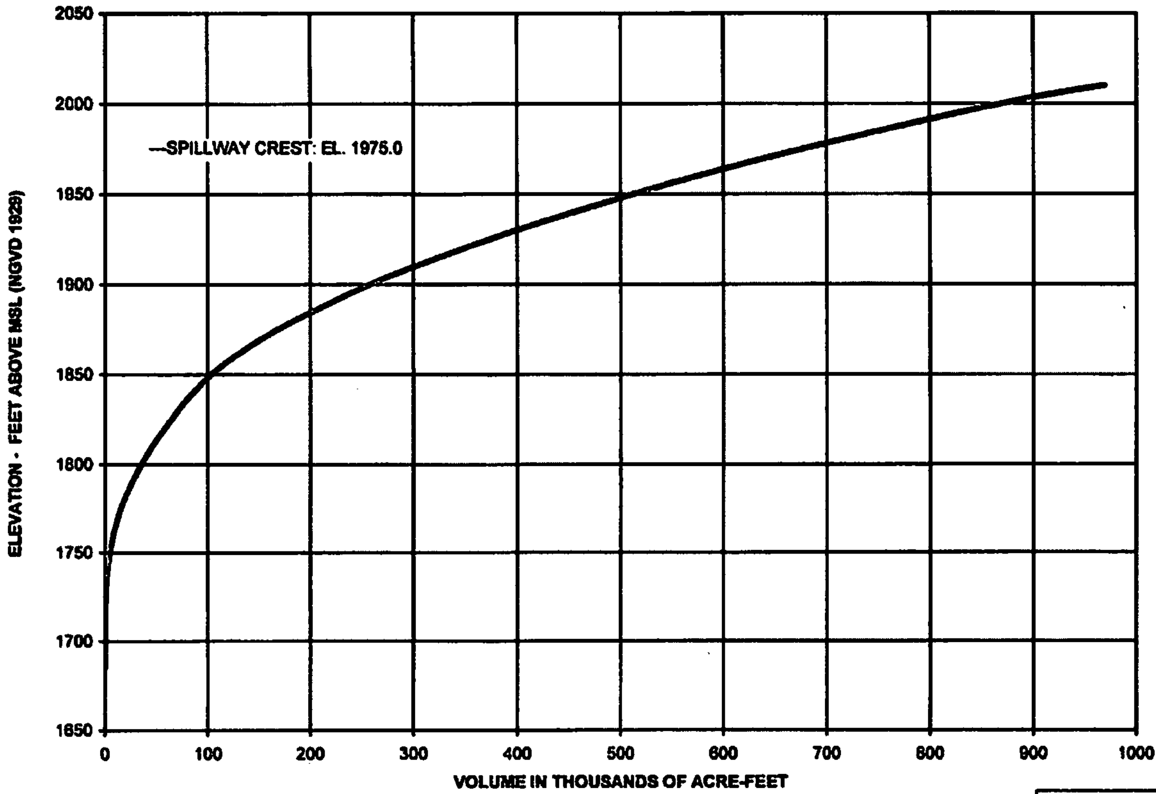
Figure 2.4-4 (Sheet 11 of 13)

Figure 2.4-4 Reservoir Elevation - Storage Relationship, Norris (Sheet 11 of 13)



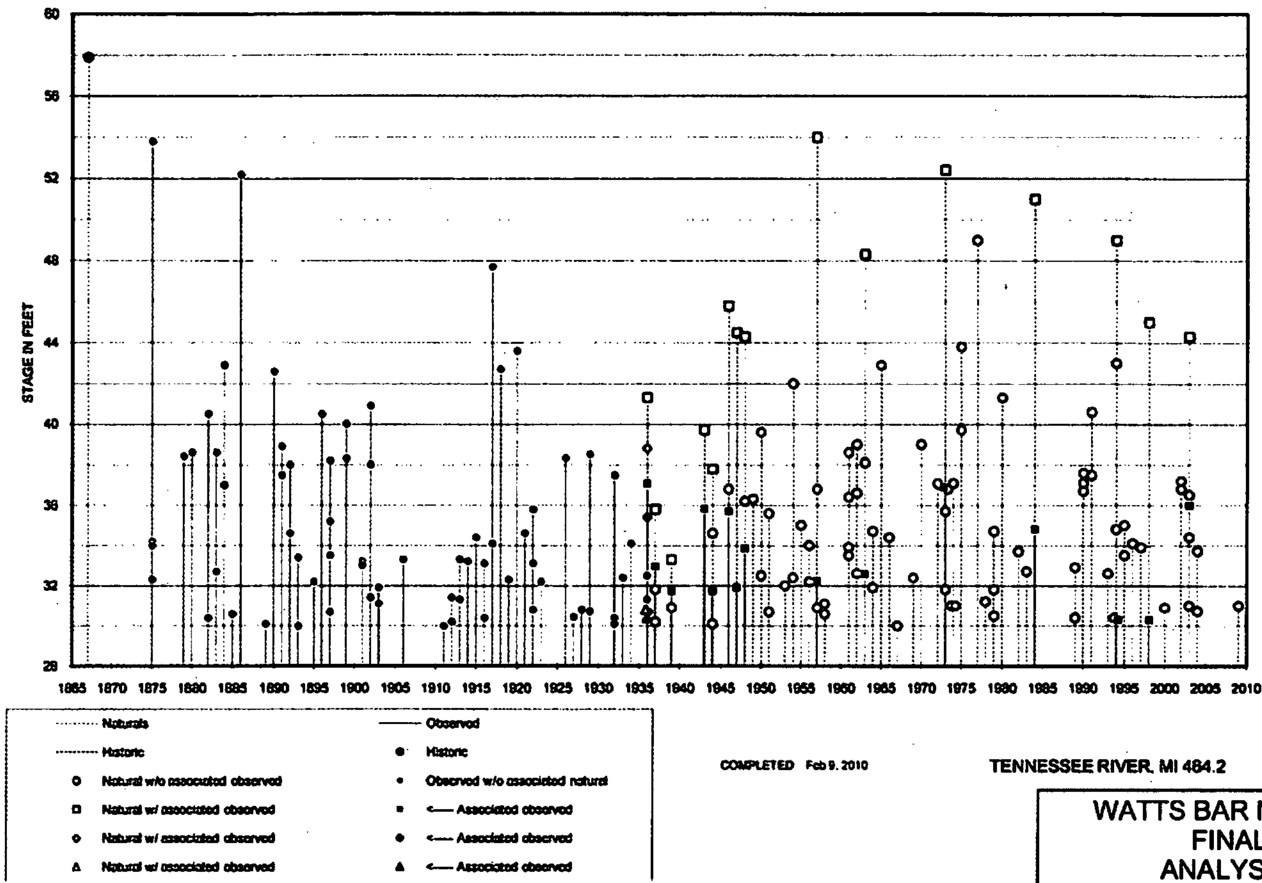
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Reservoir Elevation - Storage Relationship, South Holston Figure 2.4-4 (Sheet 12 of 13)

Figure 2.4-4 Reservoir Elevation - Storage Relationship, South Holston (Sheet 12 of 13)



WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Reservoir Elevation - Storage Relationship, Watauga Figure 2.4-4 (Sheet 13 of 13)

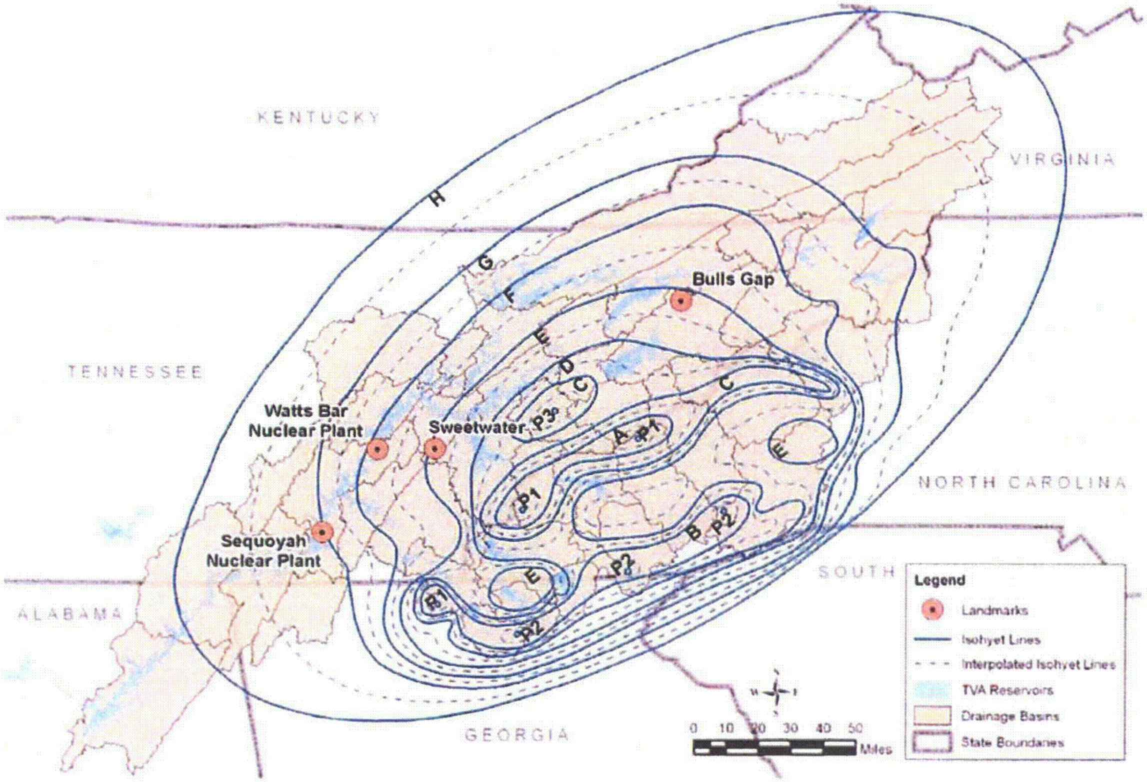
Figure 2.4-4 Reservoir Elevation - Storage Relationship, Watauga (Sheet 13 of 13)



WATTS BAR NUCLEAR PLANT
FINAL SAFETY
ANALYSIS REPORT

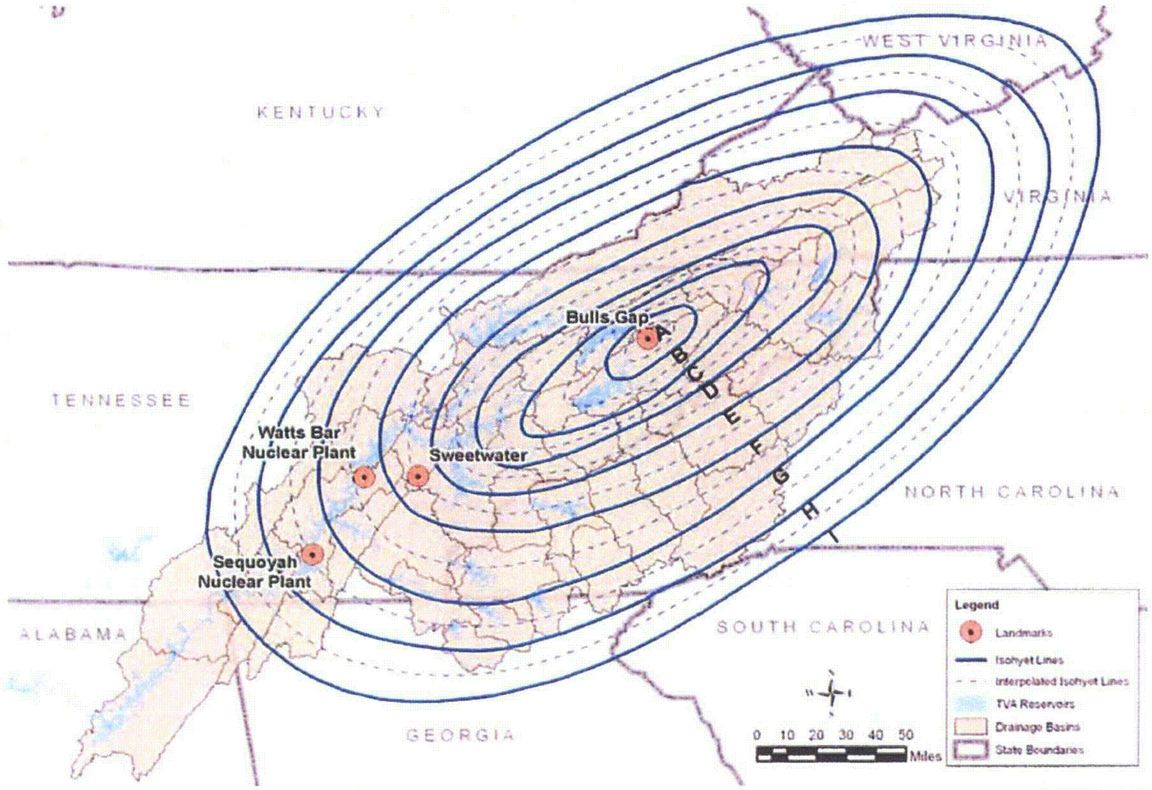
Tennessee River Mile 464.2 -
Distribution of Floods at
Chattanooga, Tennessee
Figure 2.4-5

Figure 2.4-5 Tennessee River Mile 464.2 - Distribution of Floods at Chattanooga, Tennessee



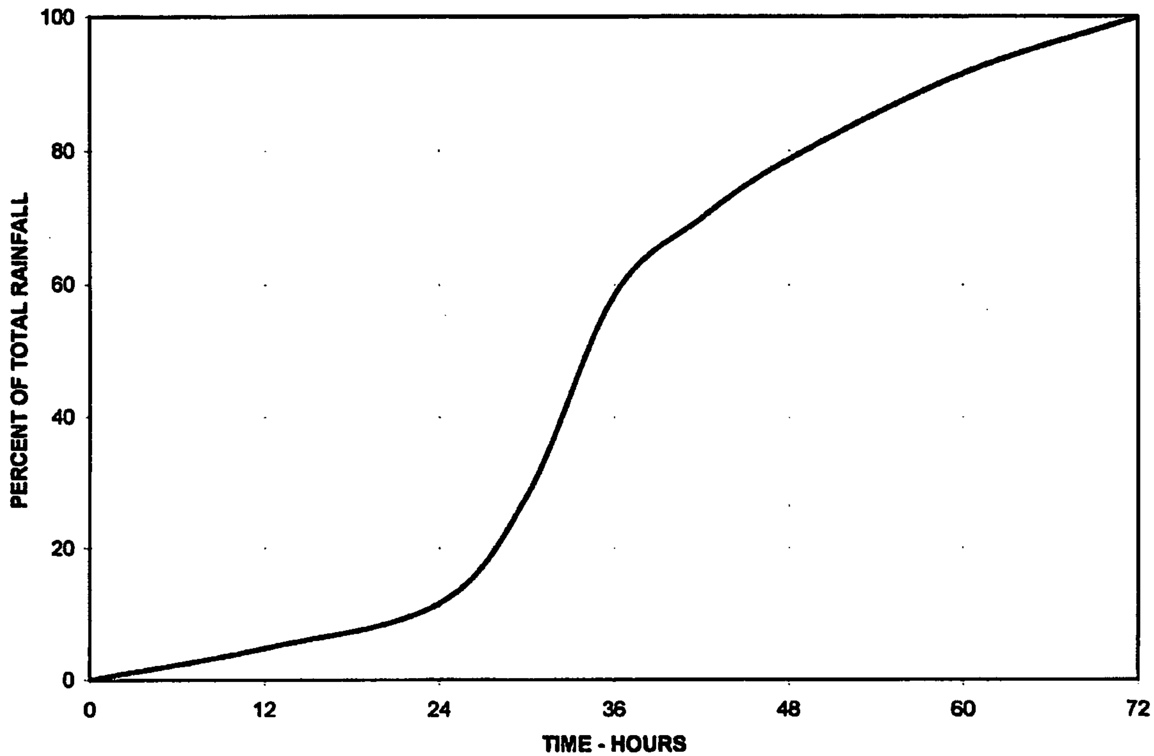
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Probable Maximum Precipitation Isohyets for 21,400 Sq. Mi. Event, Downstream Placement Figure 2.4-6

Figure 2.4-6 Probable Maximum Precipitation Isohyets for 21,400 Sq. Mi. Event, Downstream Placement



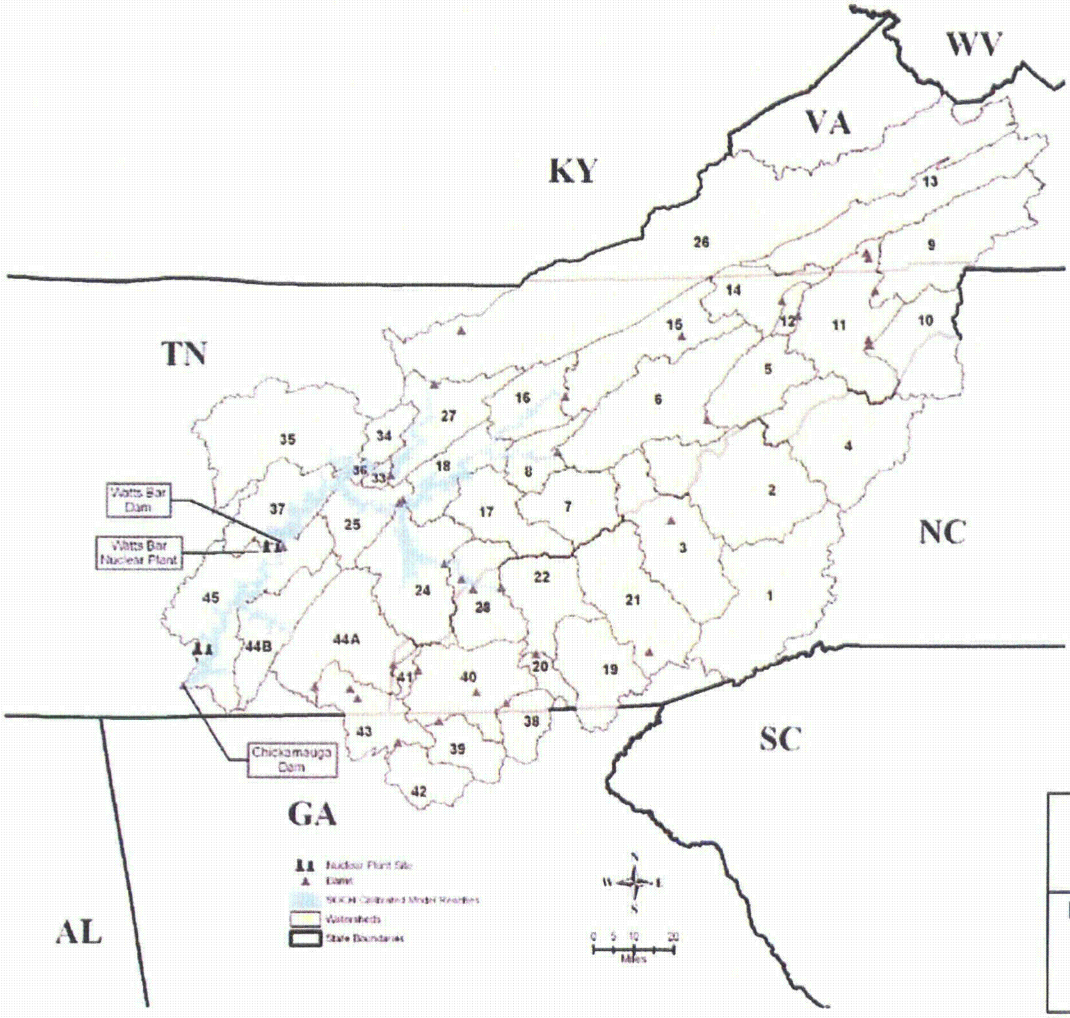
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Probable Maximum Precipitation Isohyets for 7980 Sq. Mi. Event, Centered at Bulls Gap, TN Figure 2.4-7

Figure 2.4-7 Probable Maximum Precipitation Isohyets for 7980 Sq. Mi. Event, Centered at Bulls Gap, TN



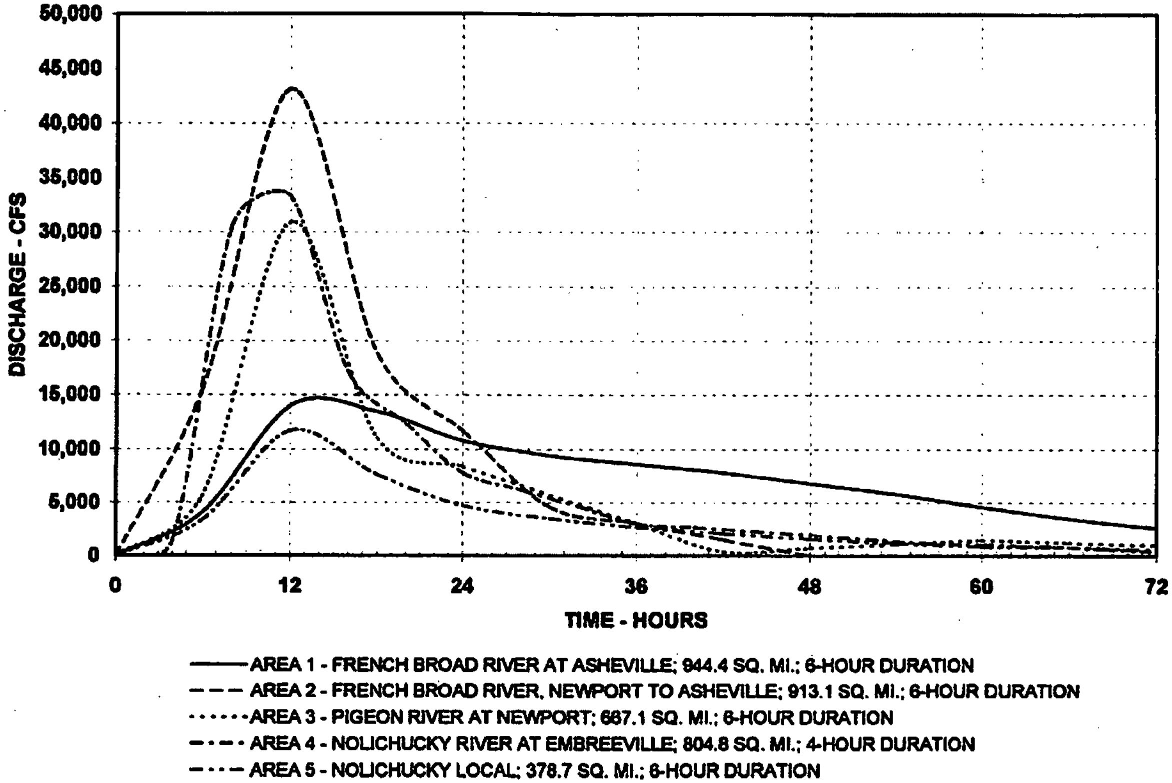
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Rainfall Time Distribution - Typical Mass Curve Figure 2.4-8

Figure 2.4-8 Rainfall Time Distribution - Typical Mass Curve



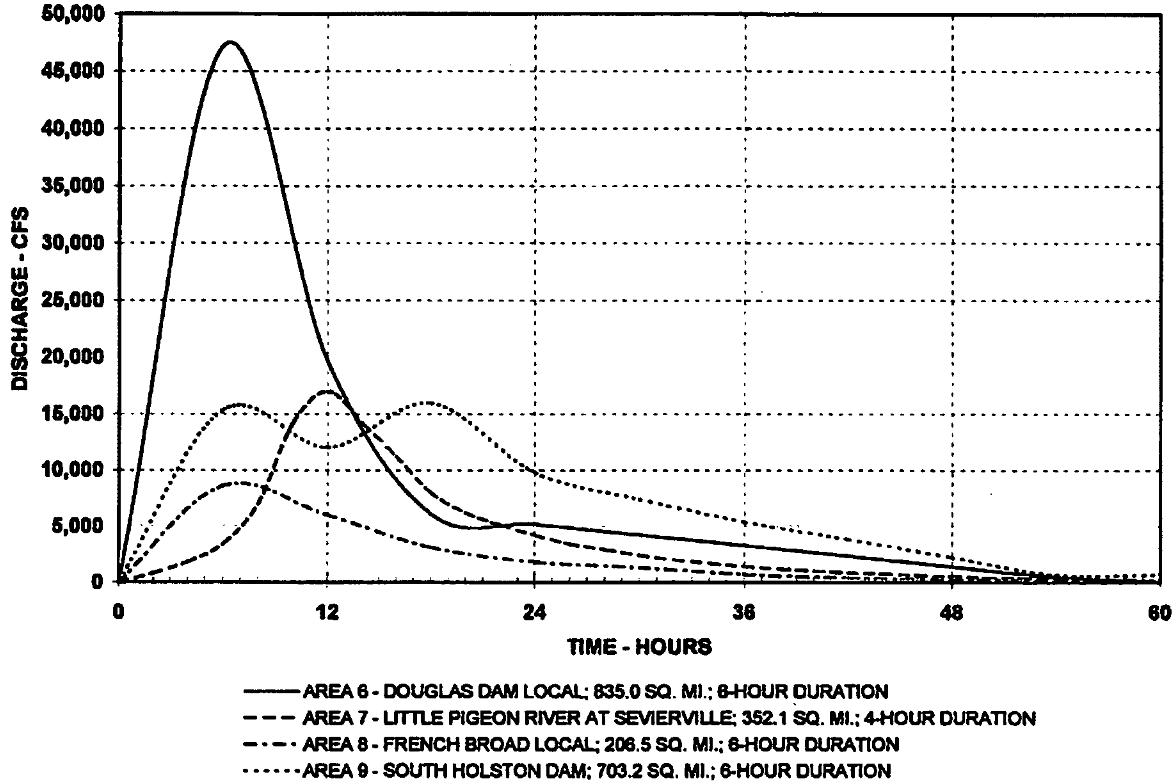
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Drainage Areas above Chickamauga Dam Figure 2.4-9

Figure 2.4-9 Drainage Areas above Chickamauga Dam



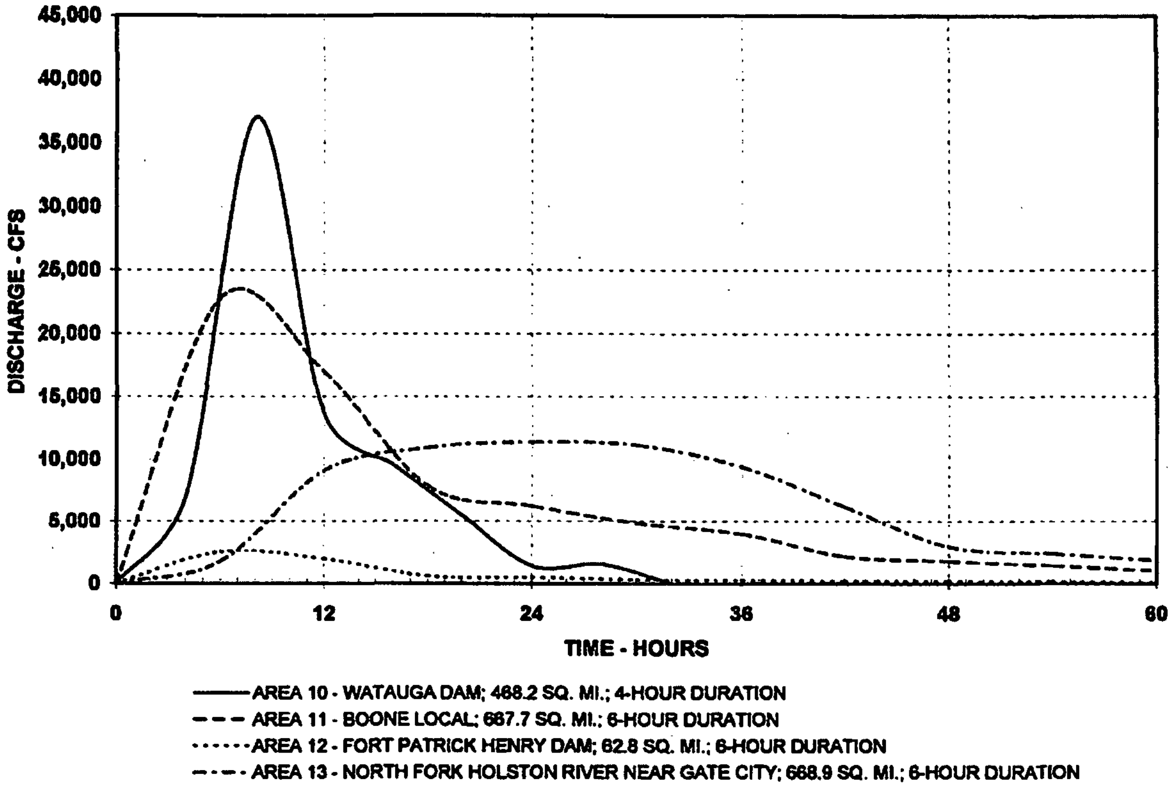
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Unit Hydrographs, Areas 1-5
Figure 2.4-10 (Sheet 1 of 11)

Figure 2.4-10 Unit Hydrographs, Areas 1–5 (Sheet 1 of 11)



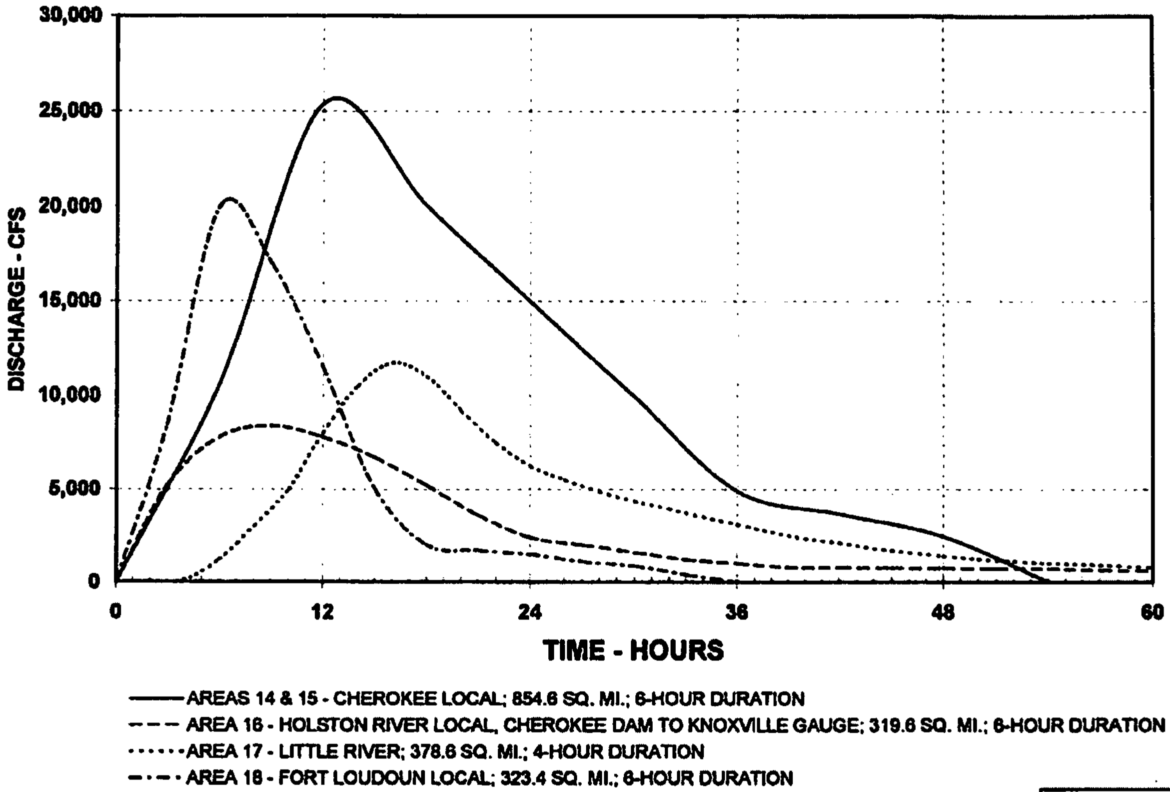
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Unit Hydrographs, Areas 6-9
Figure 2.4-10 (Sheet 2 of 11)

Figure 2.4-10 Unit Hydrographs, Areas 6–9 (Sheet 2 of 11)



WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Unit Hydrographs, Areas 10-13
Figure 2.4-10 (Sheet 3 of 11)

Figure 2.4-10 Unit Hydrographs, Areas 10–13 (Sheet 3 of 11)



WATTS BAR NUCLEAR PLANT
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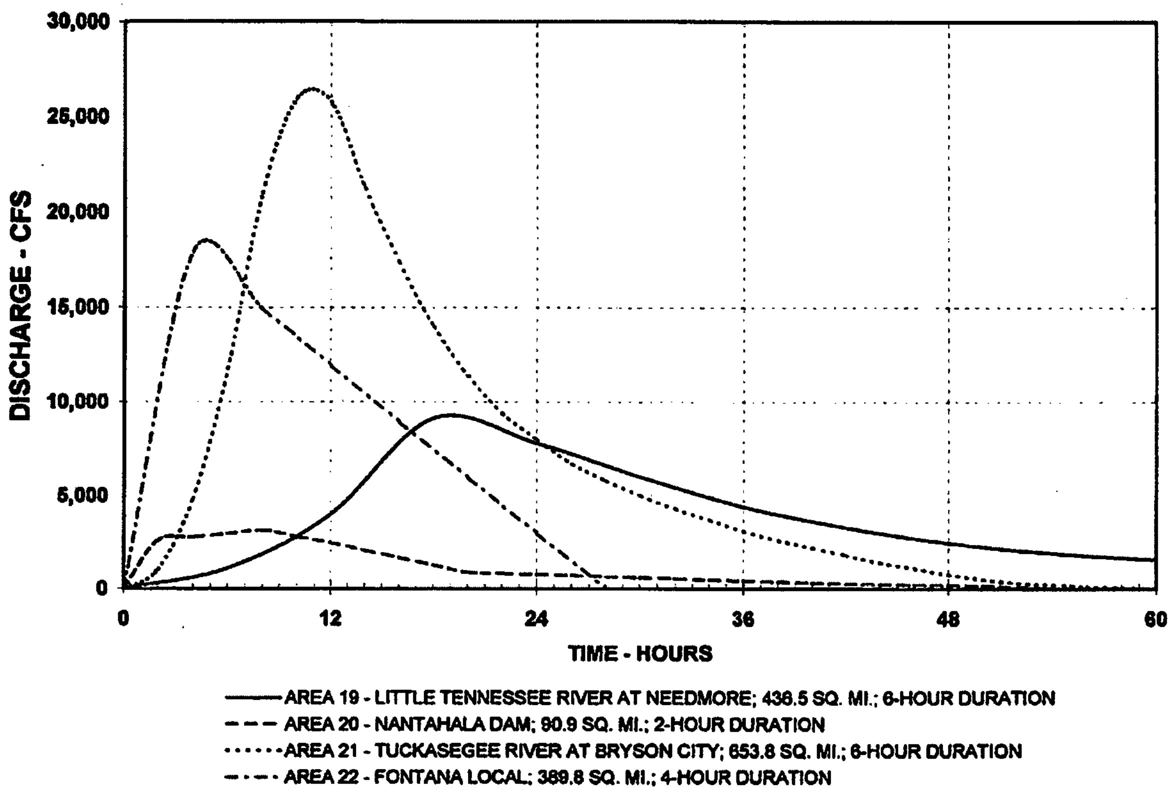
Unit Hydrographs, Areas 14-18

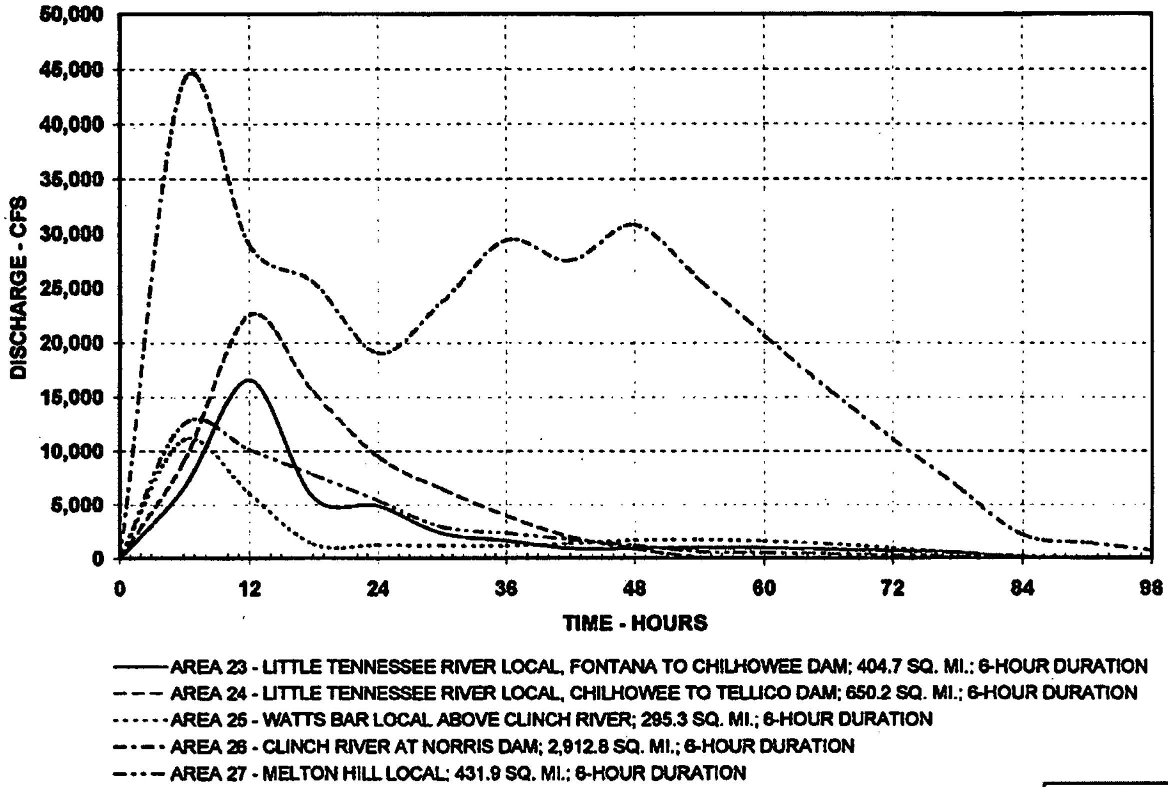
Figure 2.4-10 (Sheet 4 of 11)

Figure 2.4-10 Unit Hydrographs, Areas 14–18 (Sheet 4 of 11)



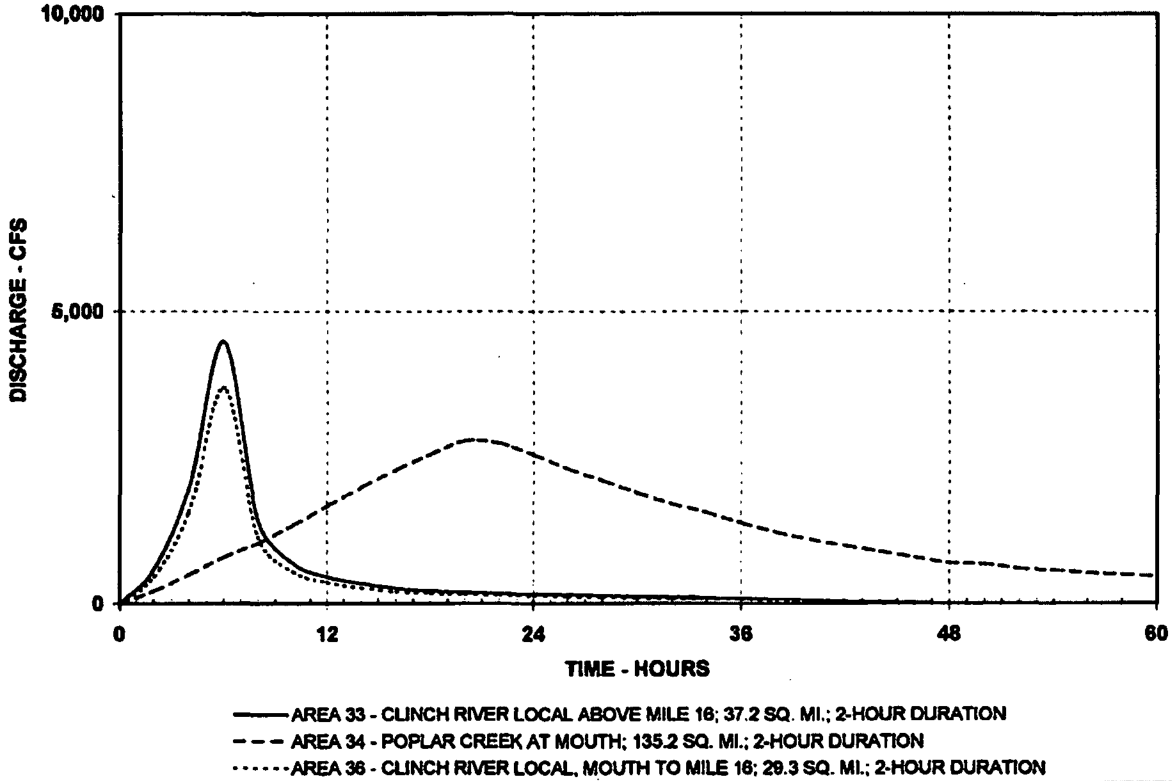
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Unit Hydrographs, Areas 19-22 Figure 2.4-10 (Sheet 5 of 11)

Figure 2.4-10 Unit Hydrographs, Areas 19–22 (Sheet 5 of 11)



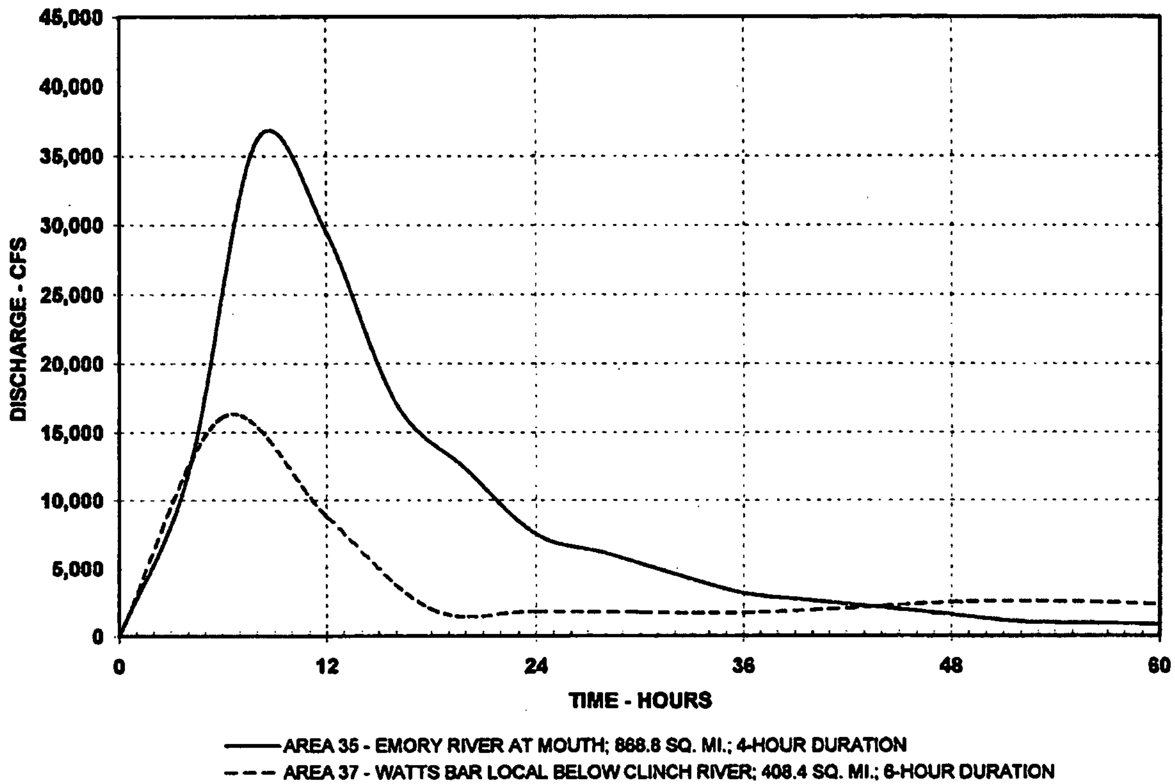
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Unit Hydrographs, Areas 23-27 Figure 2.4-10 (Sheet 6 of 11)

Figure 2.4-10 Unit Hydrographs, Areas 23–27 (Sheet 6 of 11)



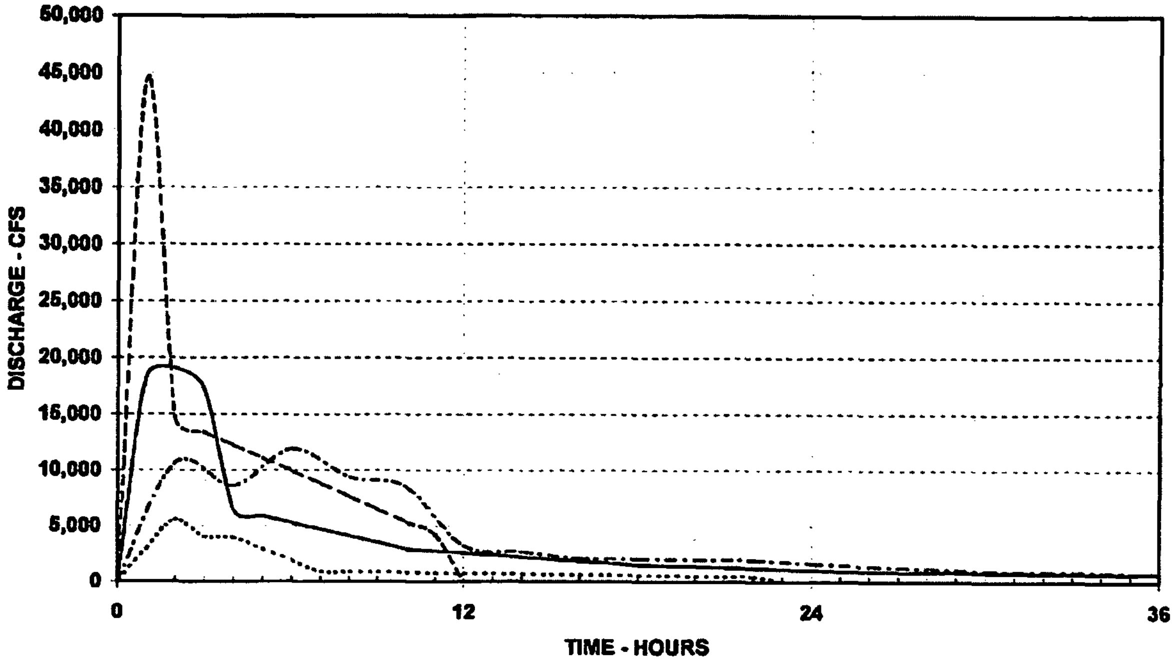
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Unit Hydrographs, Areas 33, 34, 36
Figure 2.4-10 (Sheet 7 of 11)

Figure 2.4-10 Unit Hydrographs, Areas 33, 34, 36 (Sheet 7 of 11)



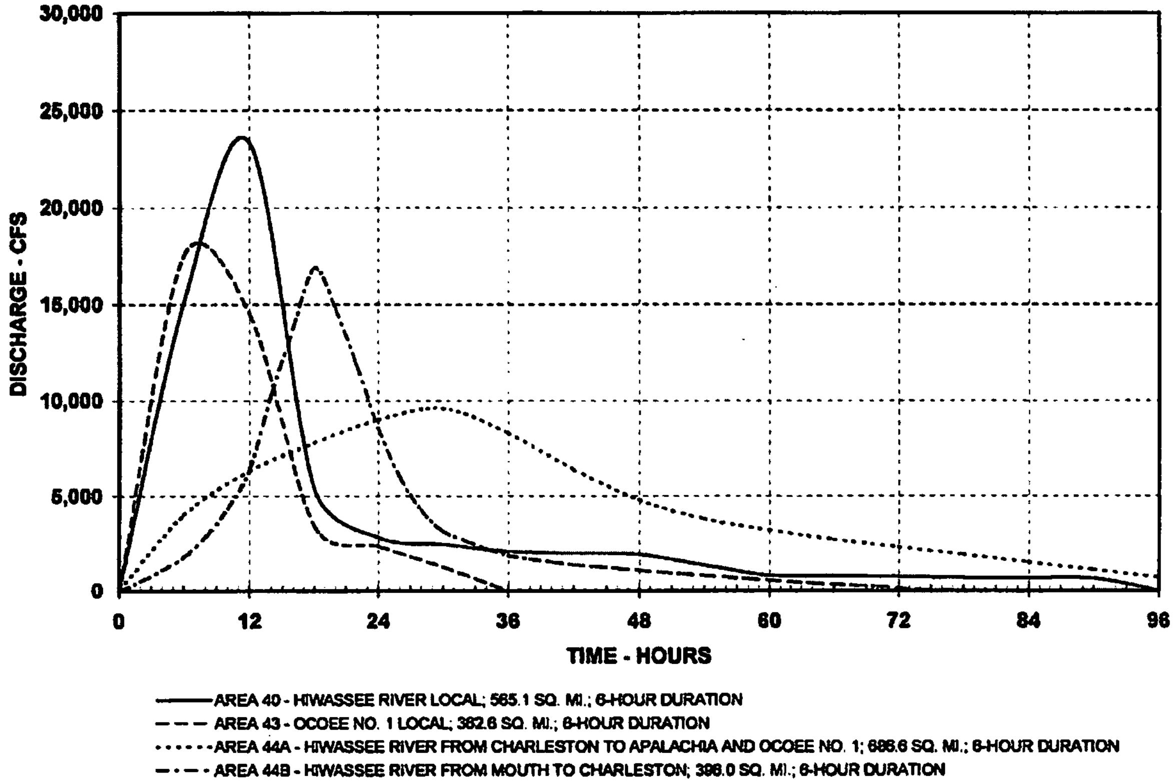
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Unit Hydrographs, Areas 35, 37
Figure 2.4-10 (Sheet 8 of 11)

Figure 2.4-10 Unit Hydrographs, Areas 35, 37 (Sheet 8 of 11)



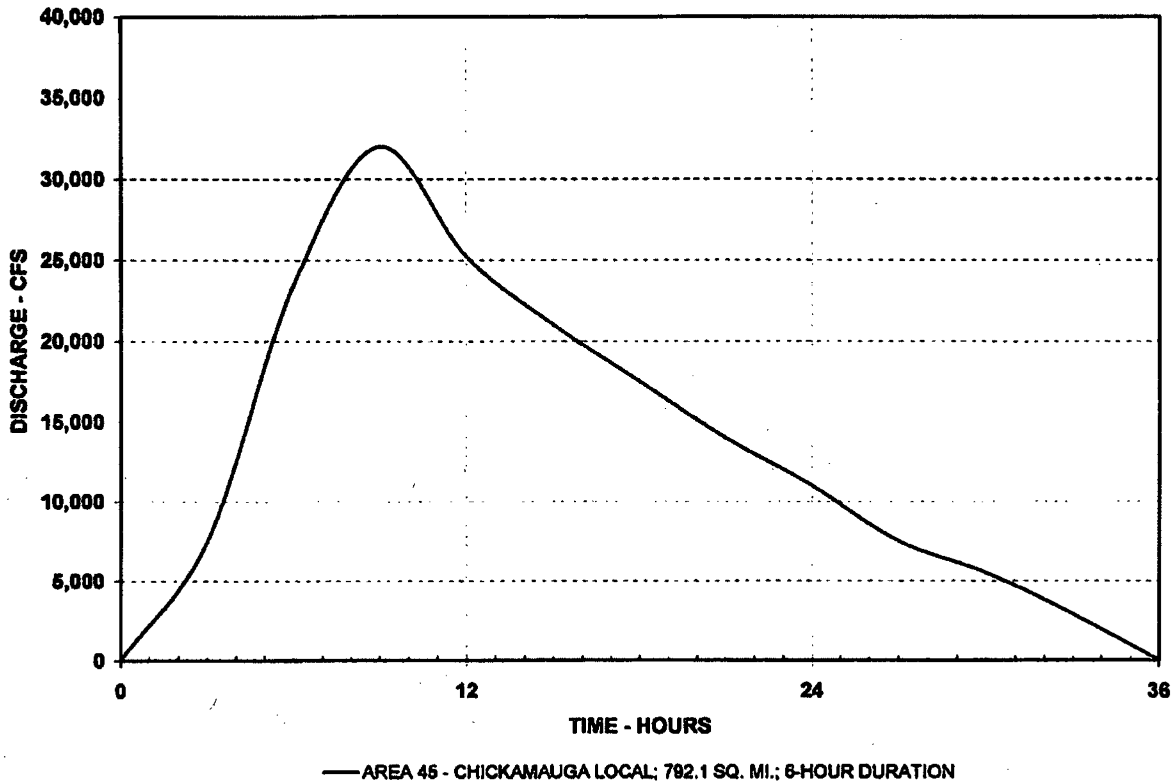
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Unit Hydrographs, Areas 38, 39, 41, 42
Figure 2.4-10 (Sheet 9 of 11)

Figure 2.4-10 Unit Hydrographs, Areas 38, 39, 41, 42 (Sheet 9 of 11)



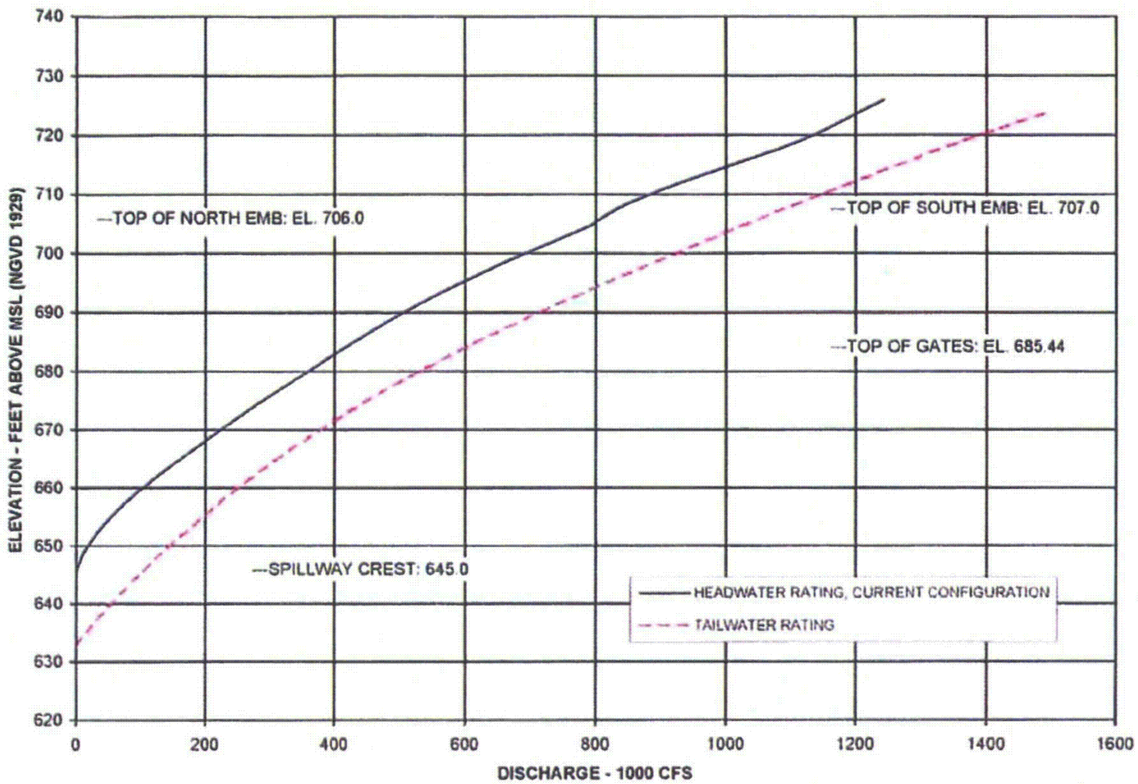
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Unit Hydrographs, Areas 40, 43, 44A, 44B Figure 2.4-10 (Sheet 10 of 11)

Figure 2.4-10 Unit Hydrographs, Areas 40, 43, 44A, 44B (Sheet 10 of 11)



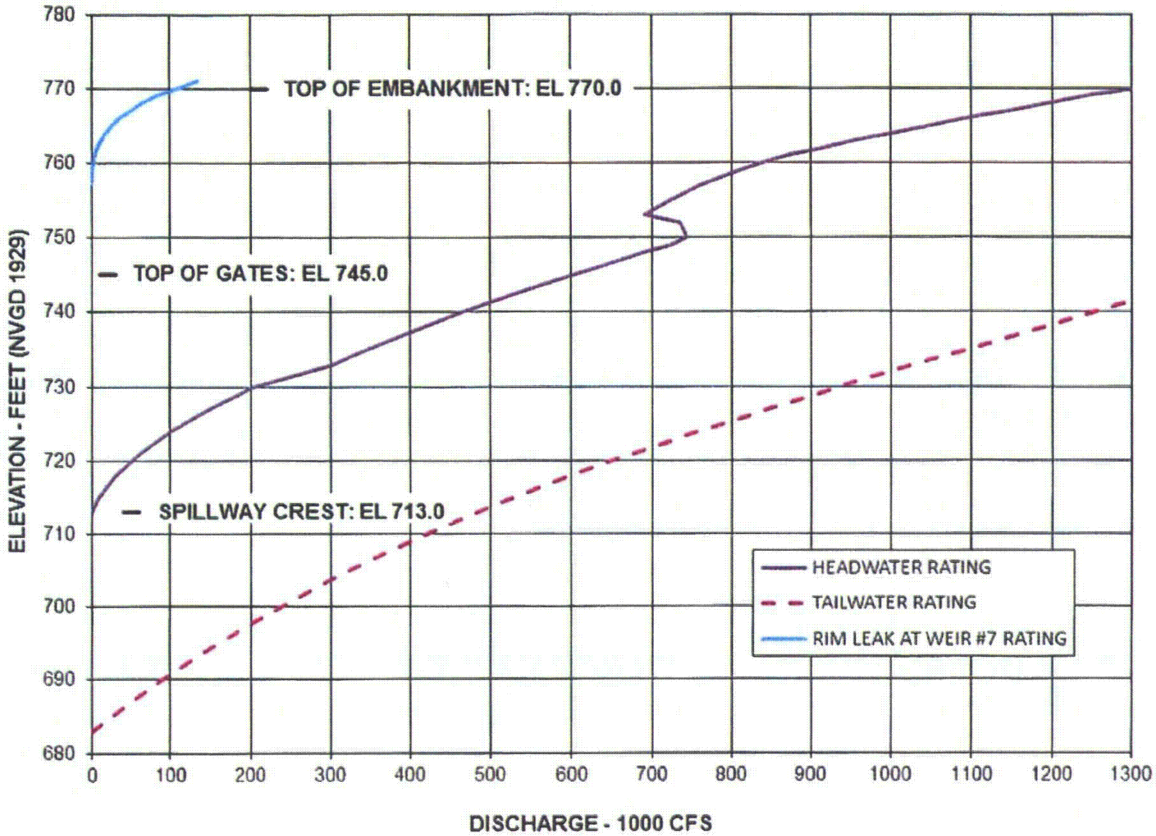
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Unit Hydrographs, Area 45
Figure 2.4-10 (Sheet 11 of 11)

Figure 2.4-10 Unit Hydrographs, Area 45 (Sheet 11 of 11)



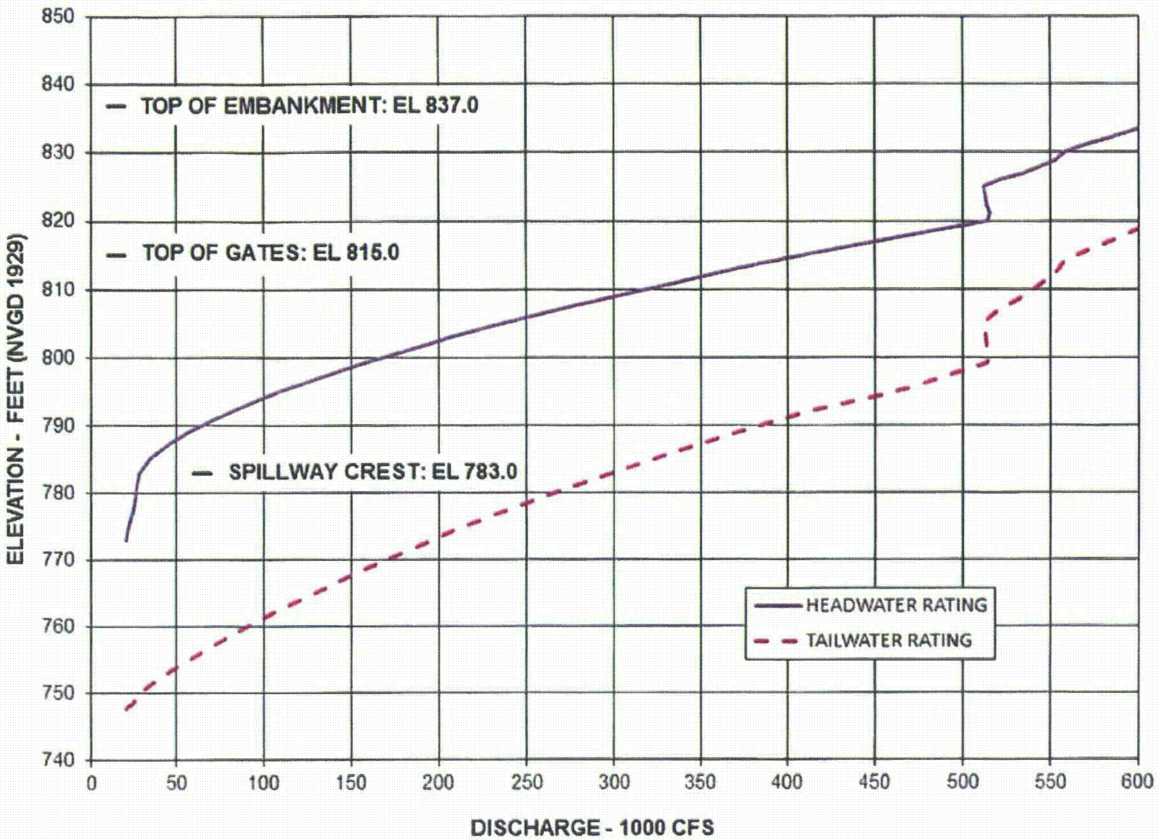
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Discharge Rating Curve, Chickamauga Dam Figure 2.4-11 (Sheet 1 of 13)

Figure 2.4-11 Discharge Rating Curve, Chickamauga Dam (Sheet 1 of 13)



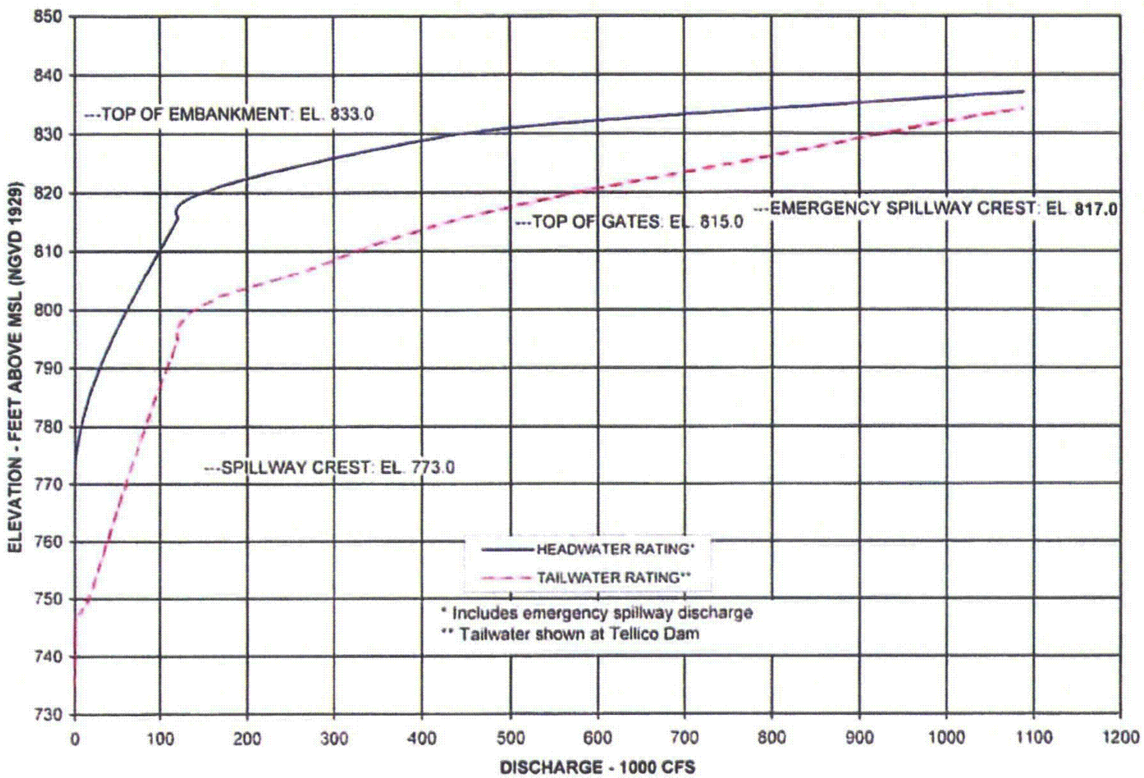
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Discharge Rating Curve, Watts Bar Dam Figure 2.4-11 (Sheet 2 of 13)

Figure 2.4-11 Discharge Rating Curve, Watts Bar Dam (Sheet 2 of 13)



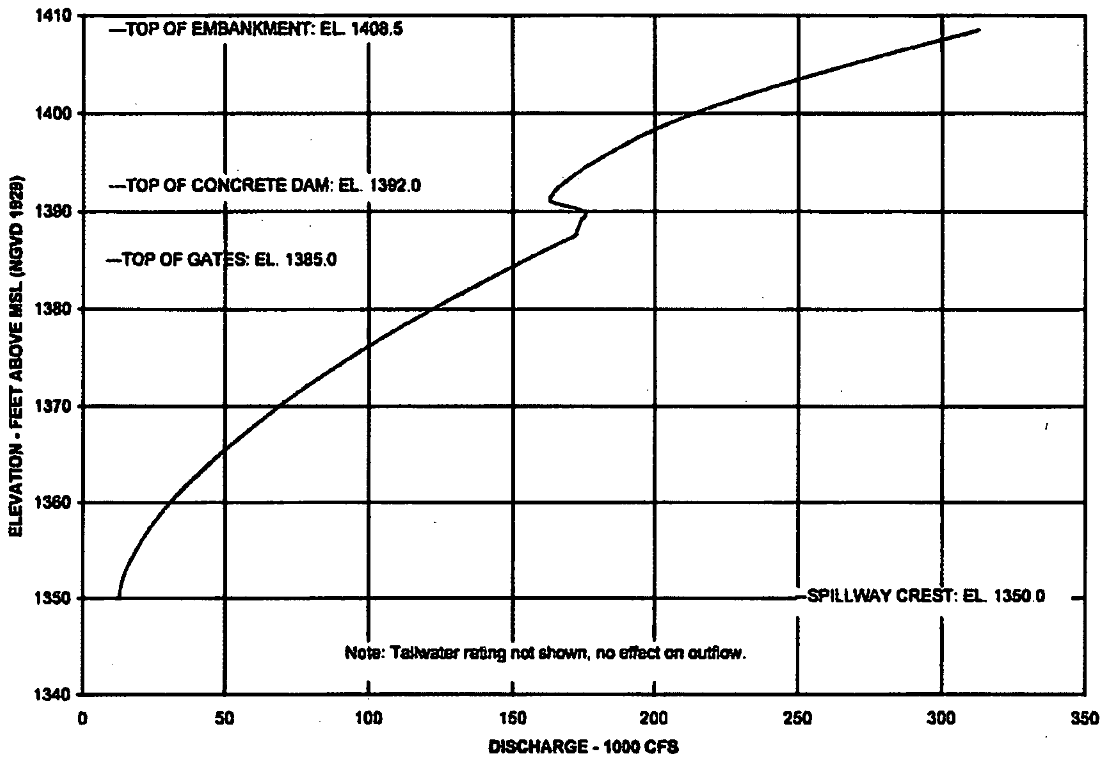
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Discharge Rating Curve, Fort Loudoun Dam Figure 2.4-11 (Sheet 3 of 13)

Figure 2.4-11 Discharge Rating Curve, Fort Loudoun Dam (Sheet 3 of 13)



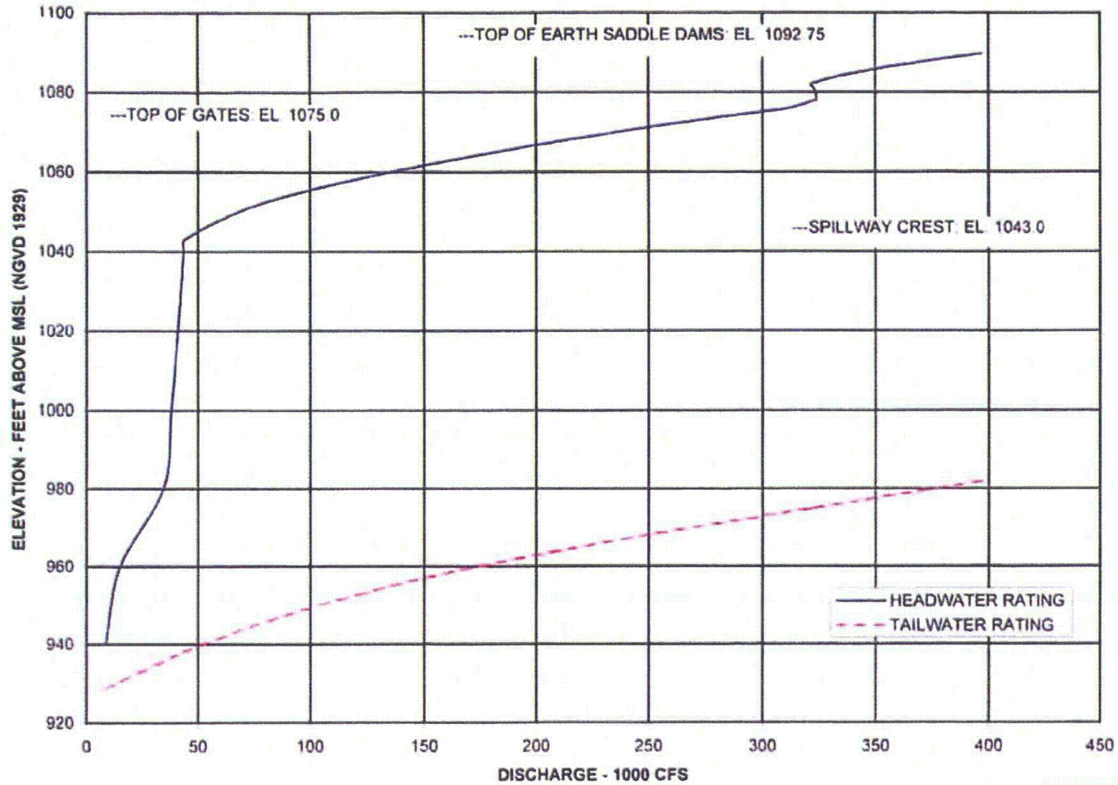
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Discharge Rating Curve, Tellico Dam Figure 2.4-11 (Sheet 4 of 13)

Figure 2.4-11 Discharge Rating Curve, Tellico Dam (Sheet 4 of 13)



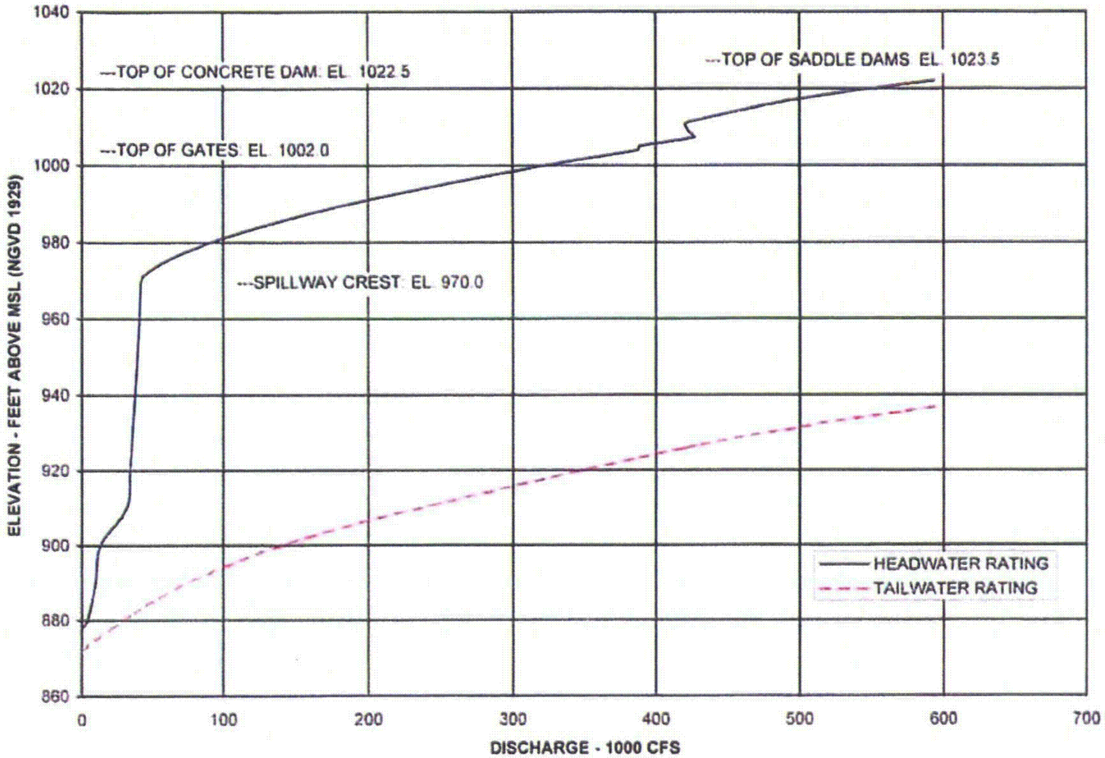
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Discharge Rating Curve, Boone Dam Figure 2.4-11 (Sheet 5 of 13)

Figure 2.4-11 Discharge Rating Curve, Boone Dam (Sheet 5 of 13)



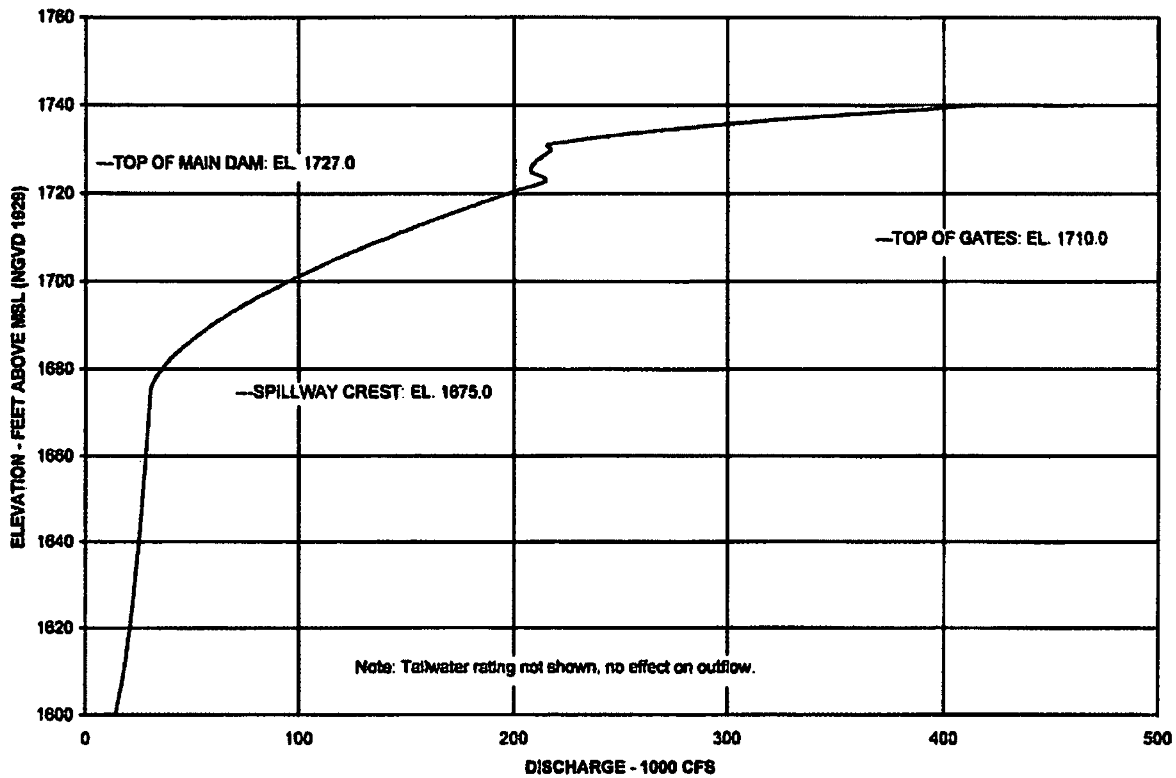
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Discharge Rating Curve, Cherokee Dam Figure 2.4-11 (Sheet 6 of 13)

Figure 2.4-11 Discharge Rating Curve, Cherokee Dam (Sheet 6 of 13)



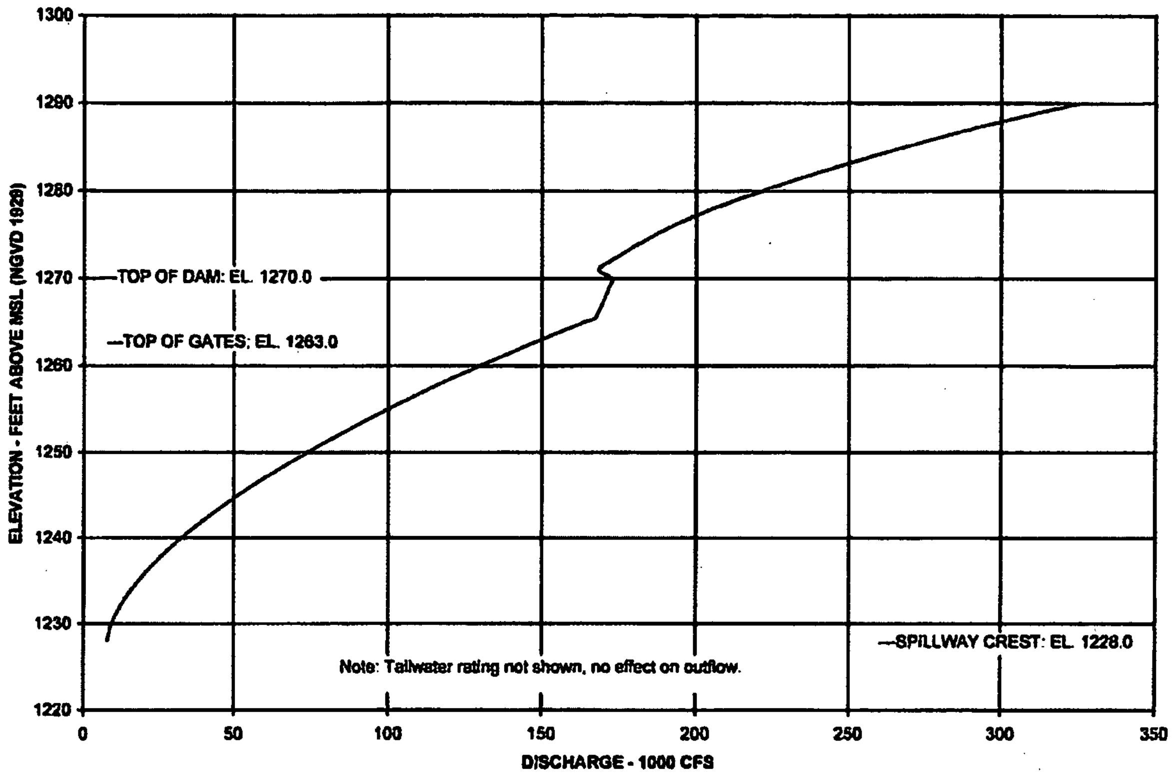
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Discharge Rating Curve, Douglas Dam Figure 2.4-11 (Sheet 7 of 13)

Figure 2.4-11 Discharge Rating Curve, Douglas Dam (Sheet 7 of 13)



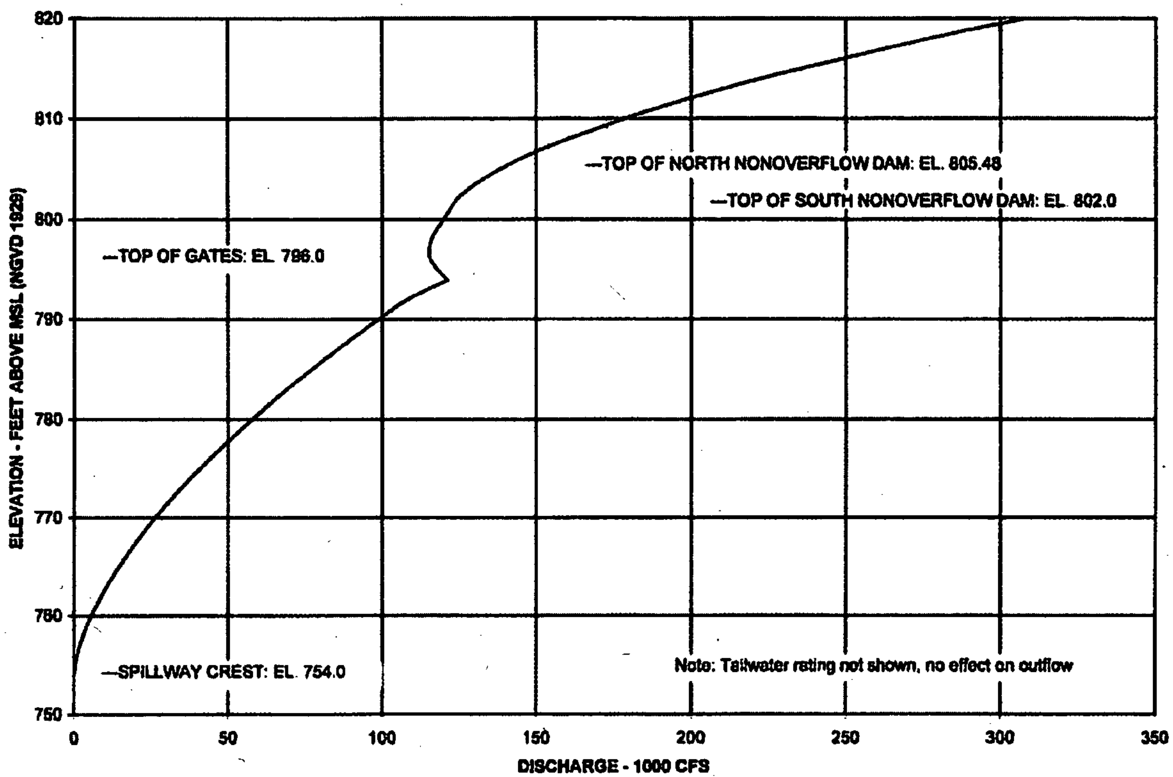
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Discharge Rating Curve, Fontana Dam
Figure 2.4-11 (Sheet 8 of 13)

Figure 2.4-11 Discharge Rating Curve, Fontana Dam (Sheet 8 of 13)



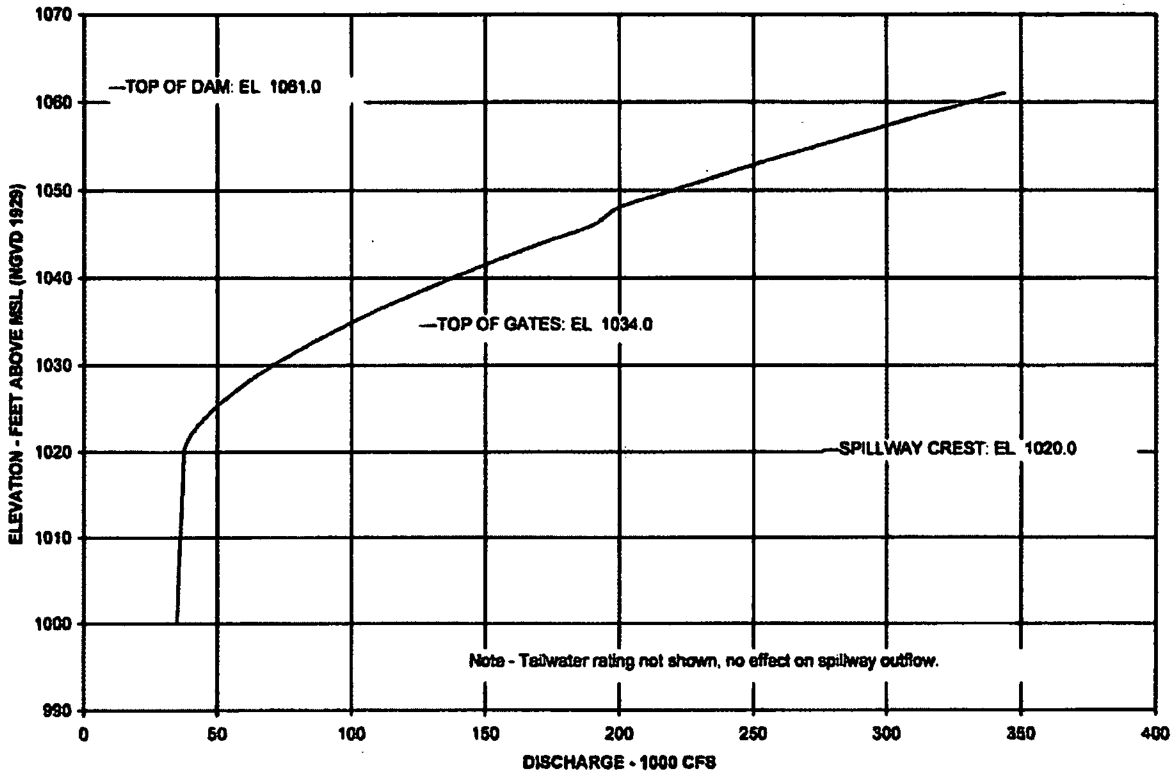
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Discharge Rating Curve, Fort Patrick Henry Dam Figure 2.4-11 (Sheet 9 of 13)

Figure 2.4-11 Discharge Rating Curve, Fort Patrick Henry Dam (Sheet 9 of 13)



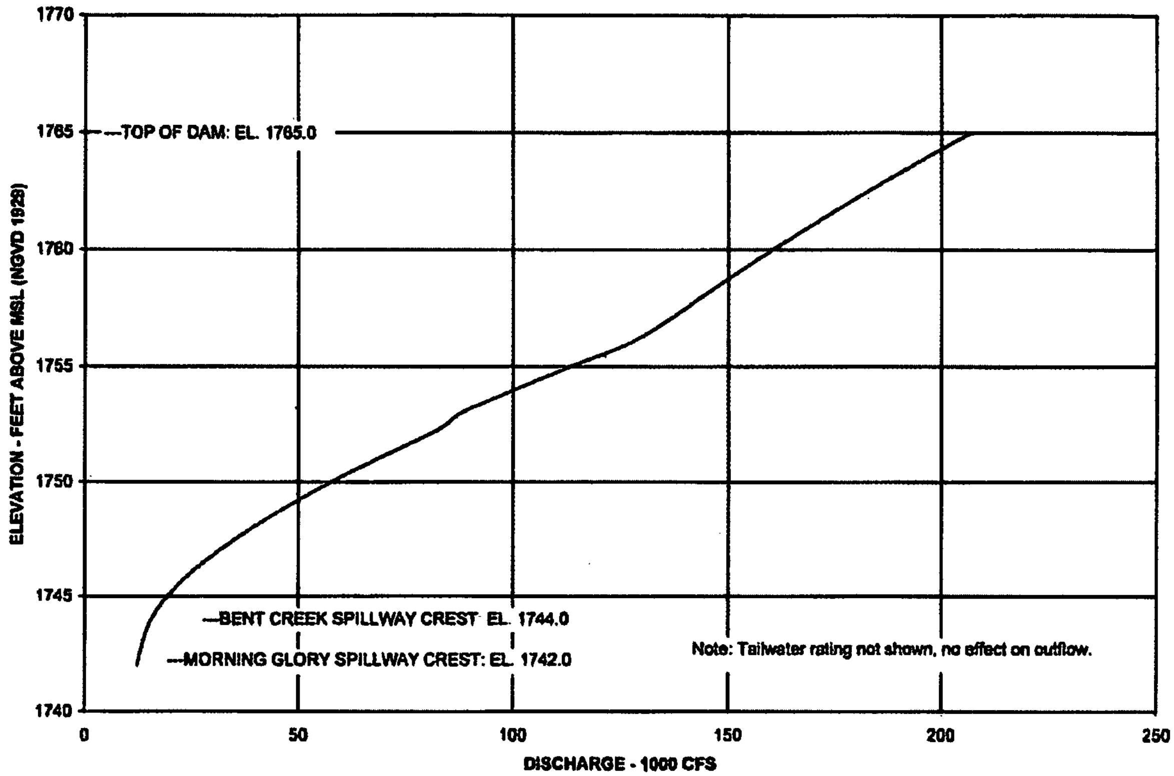
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Discharge Rating Curve, Melton Hill Dam Figure 2.4-11 (Sheet 10 of 13)

Figure 2.4-11 Discharge Rating Curve, Melton Hill Dam (Sheet 10 of 13)



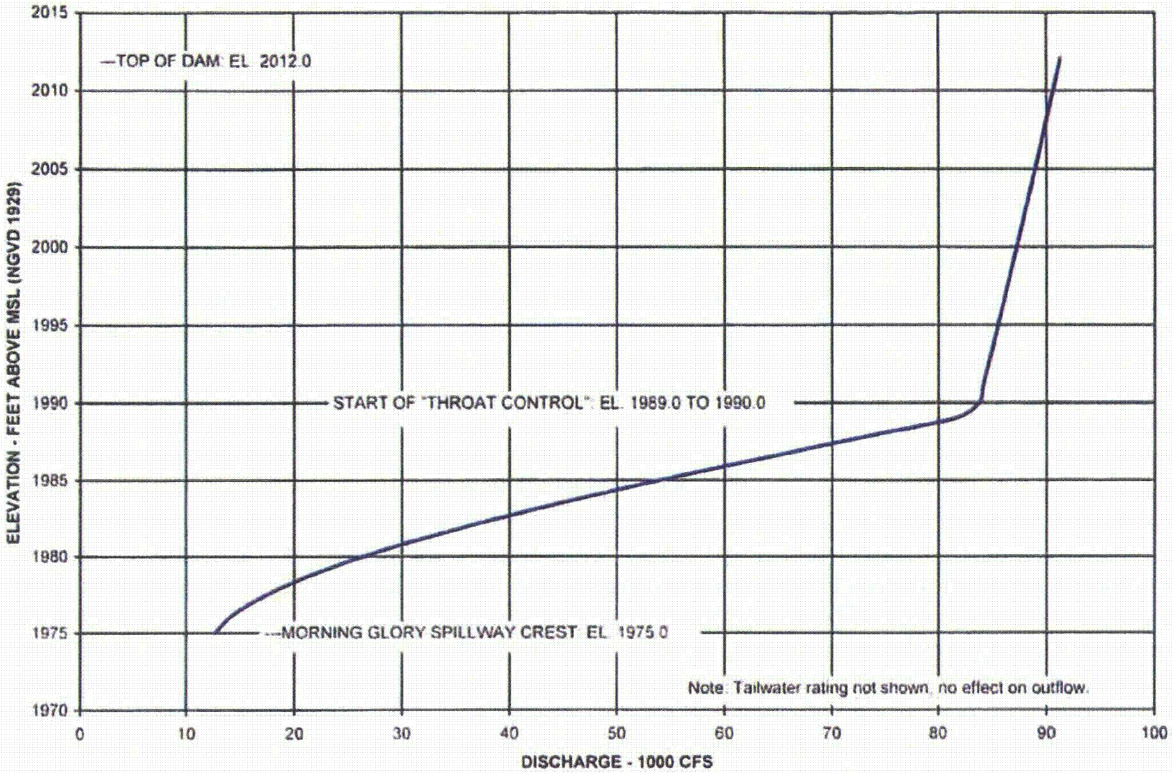
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Discharge Rating Curve, Norris Dam Figure 2.4-11 (Sheet 11 of 13)

Figure 2.4-11 Discharge Rating Curve, Norris Dam (Sheet 11 of 13)



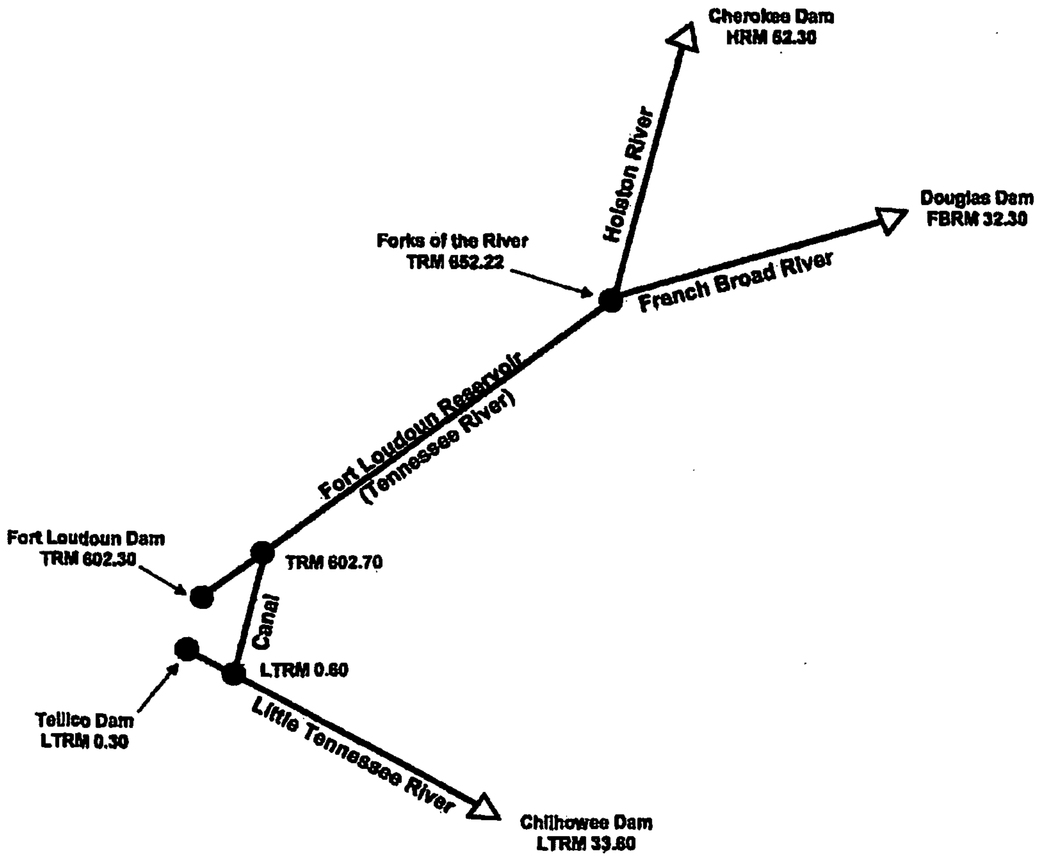
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Discharge Rating Curve, South Holston Dam Figure 2.4-11 (Sheet 12 of 13)

Figure 2.4-11 Discharge Rating Curve, South Holston Dam (Sheet 12 of 13)



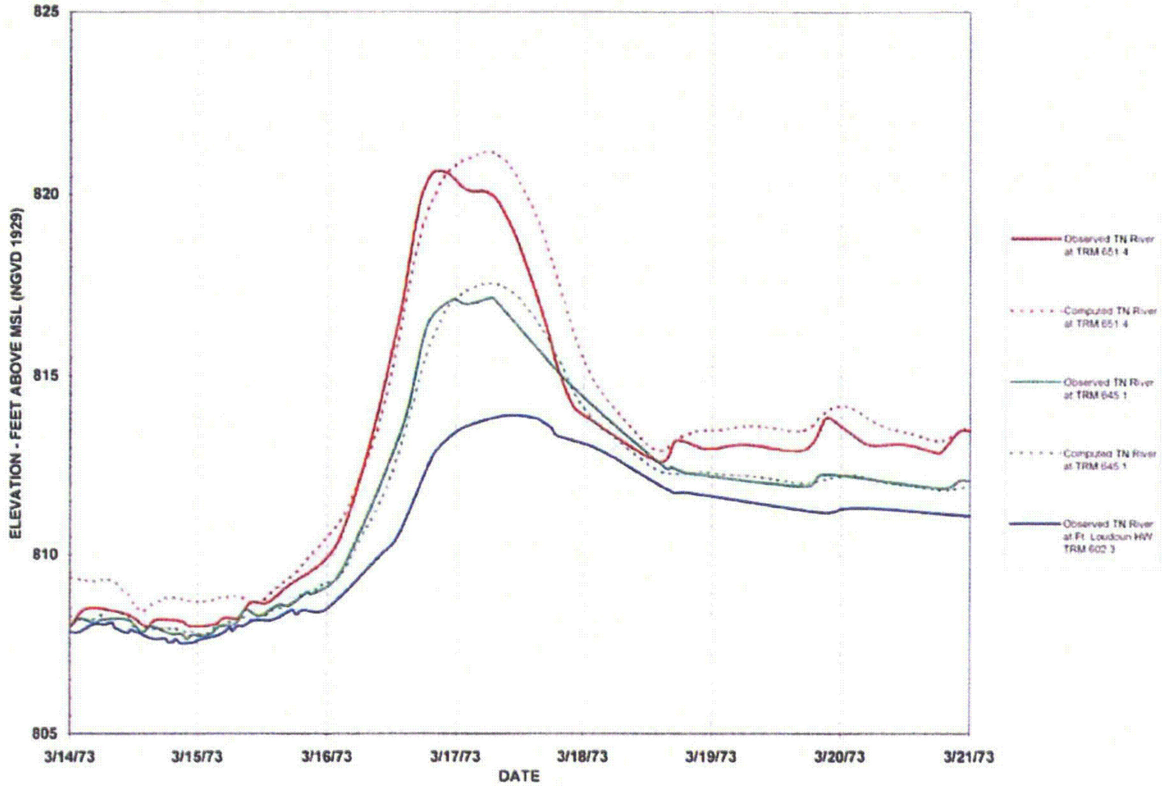
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Discharge Rating Curve, Watauga Dam Figure 2.4-11 (Sheet 13 of 13)

Figure 2.4-11 Discharge Rating Curve, Watauga Dam (Sheet 13 of 13)



WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Fort Loudoun - Tellico SOCH Unsteady Flow Model Schematic Figure 2.4-12

Figure 2.4-12 Fort Loudoun - Tellico SOCH Unsteady Flow Model Schematic

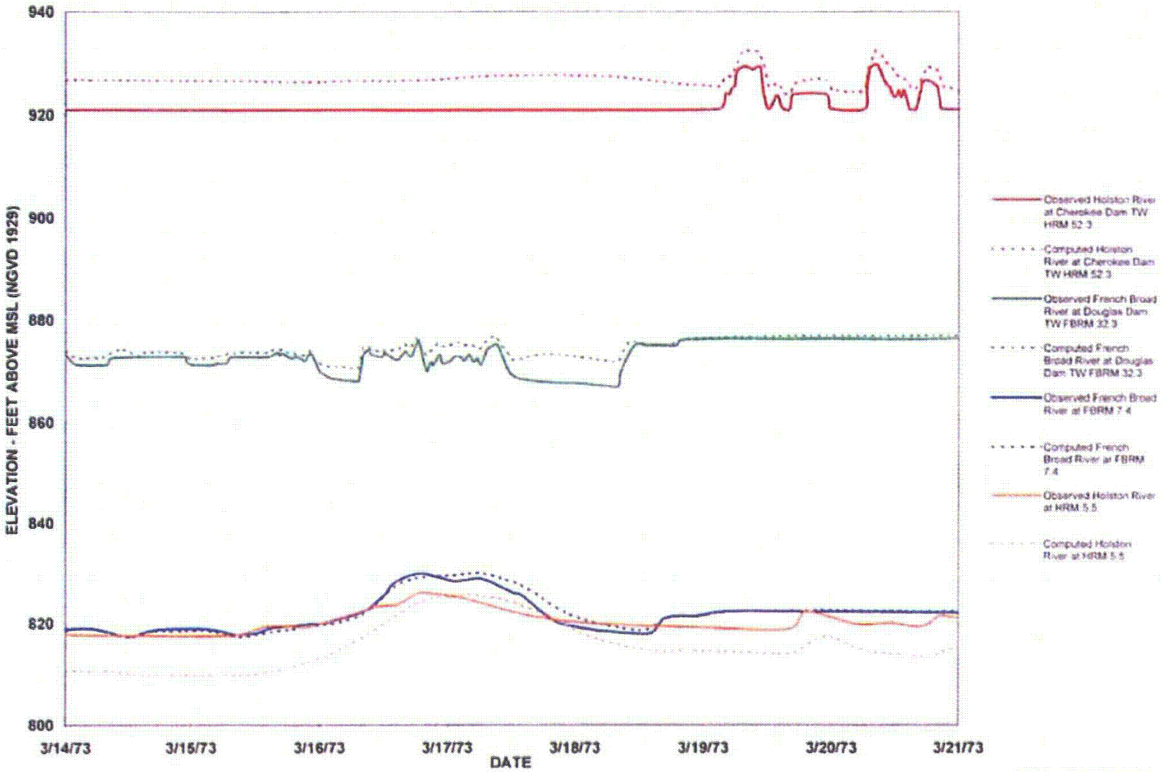


WATTS BAR NUCLEAR PLANT
FINAL SAFETY
ANALYSIS REPORT

Unsteady Flow Model Fort Loudoun Reservoir March 1973 Flood

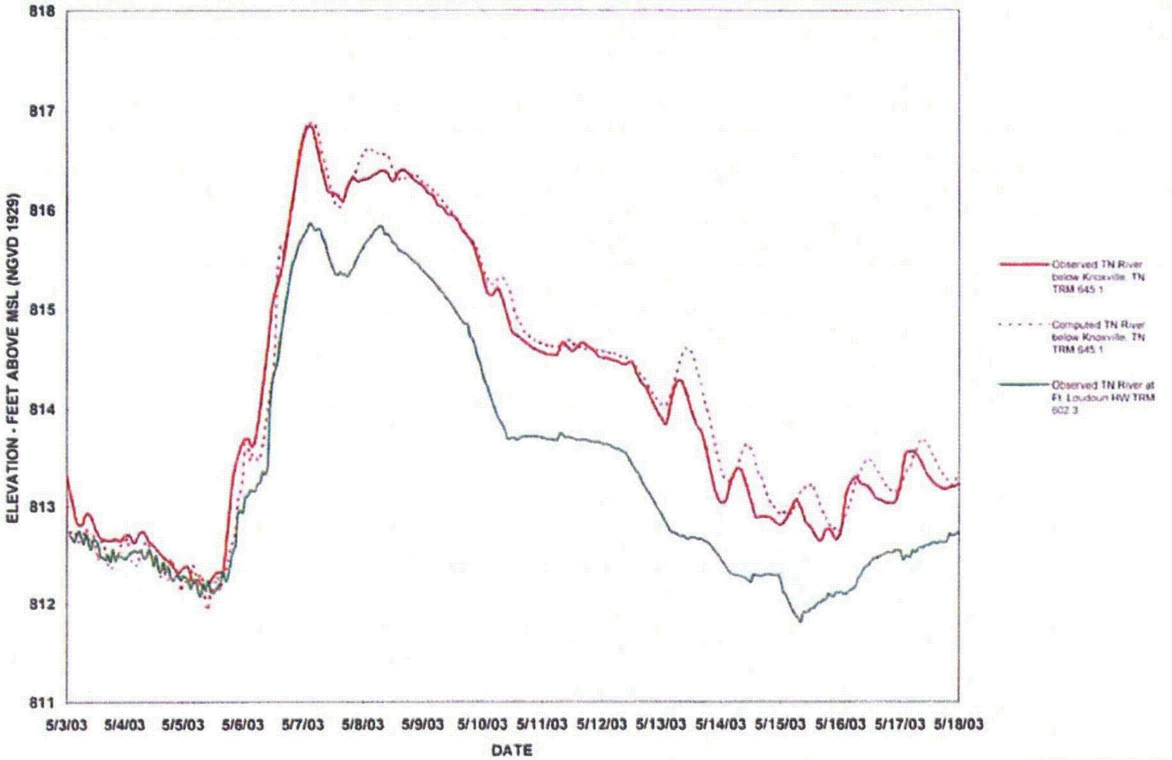
Figure 2.4-13 (Sheet 1 of 2)

Figure 2.4-13 Unsteady Flow Model Fort Loudoun Reservoir March 1973 Flood (Sheet 1 of 2)



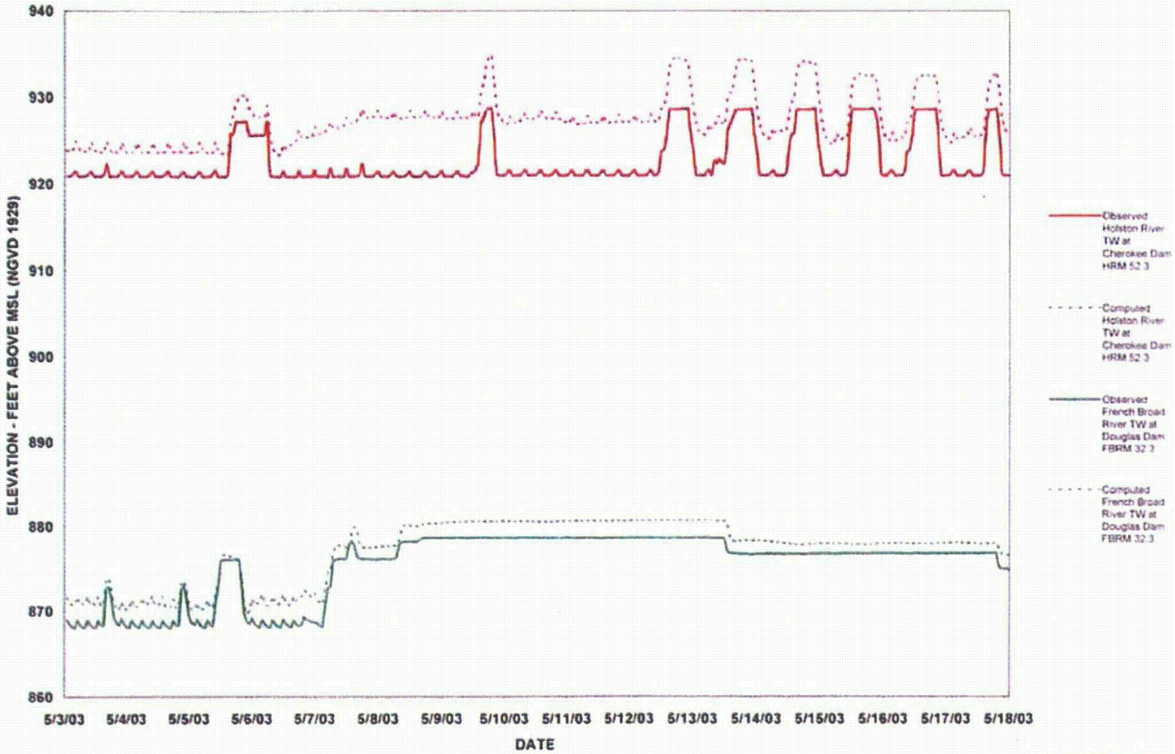
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Unsteady Flow Model Fort Loudoun Reservoir March 1973 Flood Figure 2.4-13 (Sheet 2 of 2)

Figure 2.4-13 Unsteady Flow Model Fort Loudoun Reservoir March 1973 Flood (Sheet 2 of 2)



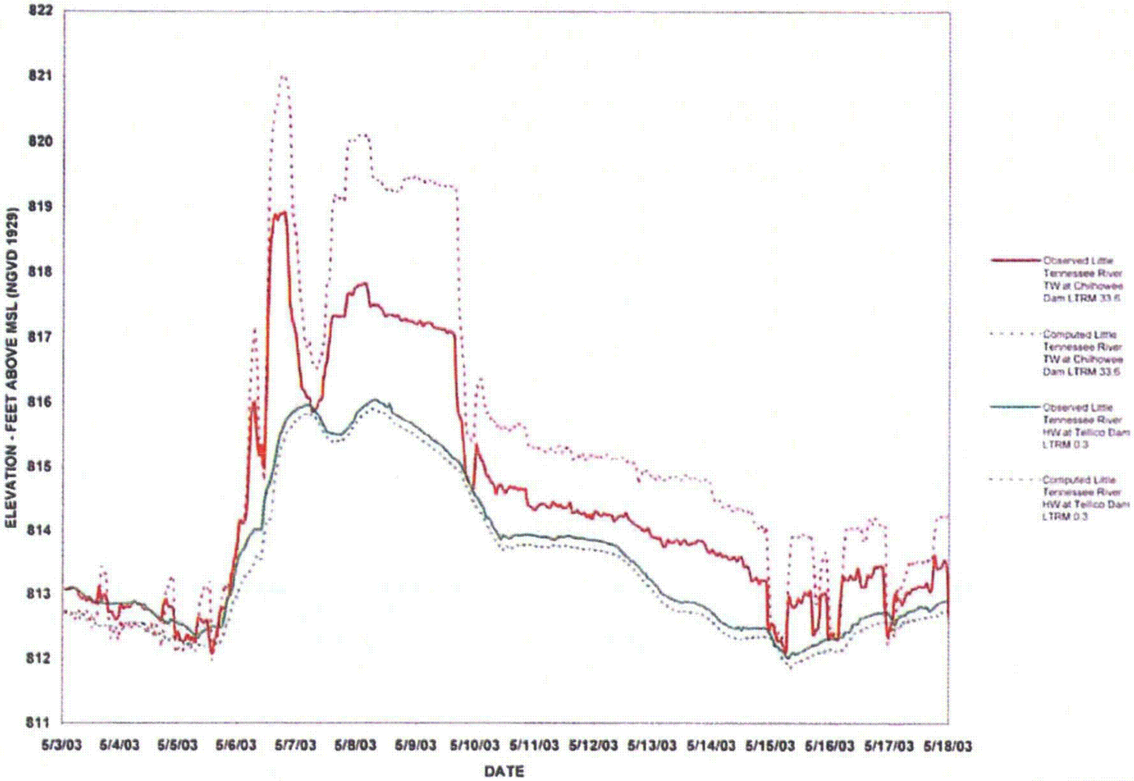
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Unsteady Flow Model Fort Loudoun - Tellico Reservoir May 2003 Flood Figure 2.4-14 (Sheet 1 of 3)

Figure 2.4-14 Unsteady Flow Model Fort Loudoun - Tellico Reservoir May 2003 Flood (Sheet 1 of 3)



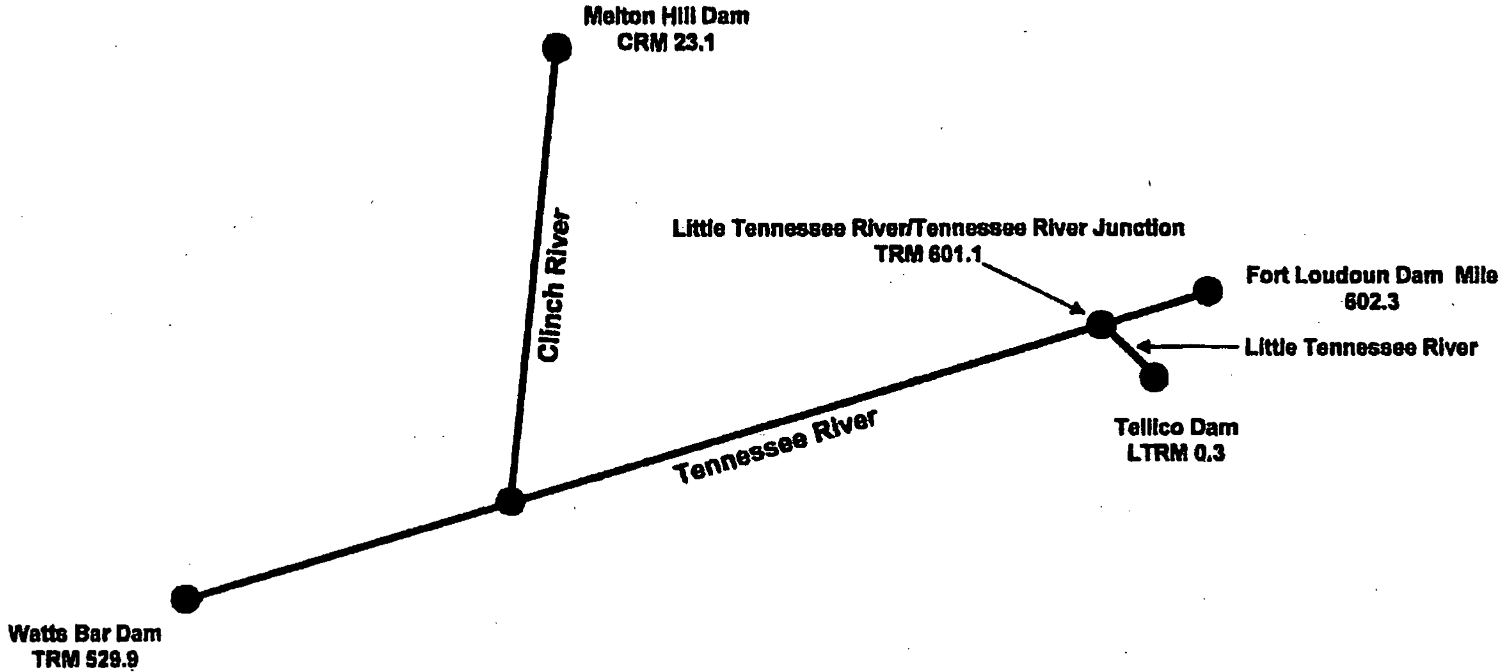
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Unsteady Flow Model Fort Loudoun - Tellico Reservoir May 2003 Flood Figure 2.4-14 (Sheet 2 of 3)

Figure 2.4-14 Unsteady Flow Model Fort Loudoun - Tellico Reservoir May 2003 Flood (Sheet 2 of 3)



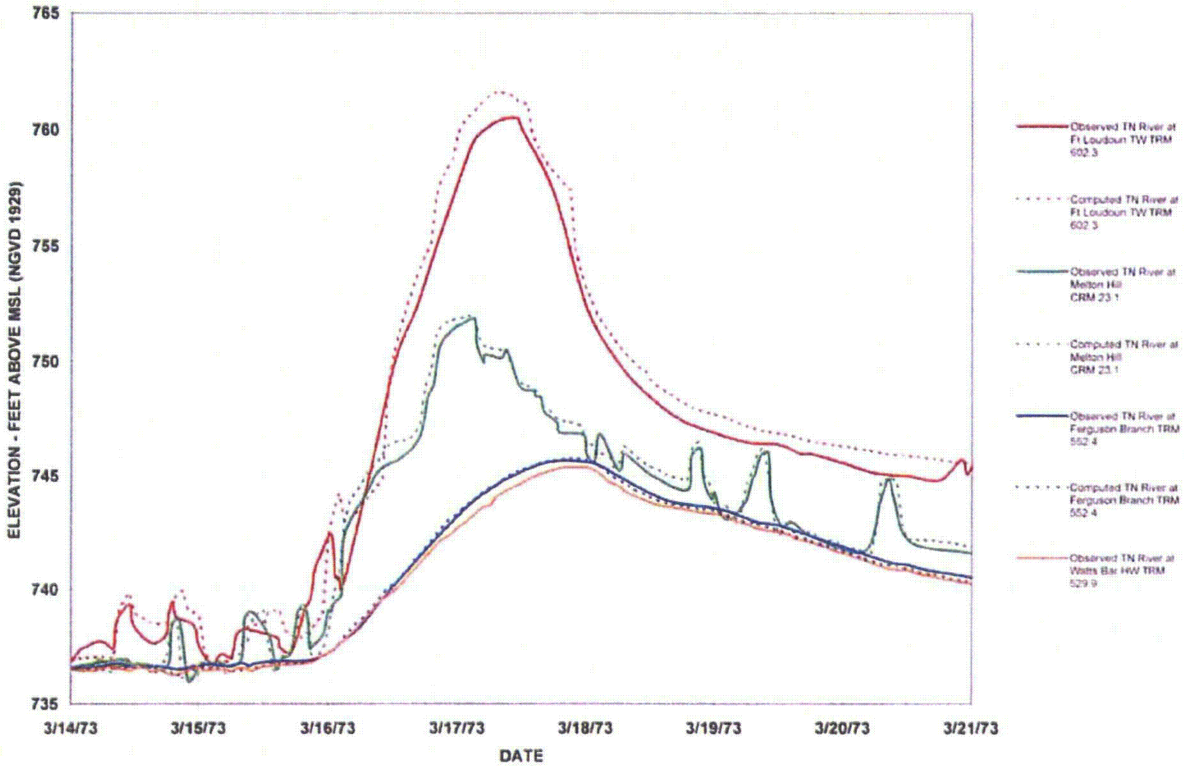
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Unsteady Flow Model Fort Loudoun - Tellico Reservoir May 2003 Flood Figure 2.4-14 (Sheet 3 of 3)

Figure 2.4-14 Unsteady Flow Model Fort Loudoun - Tellico Reservoir May 2003 Flood (Sheet 3 of 3)



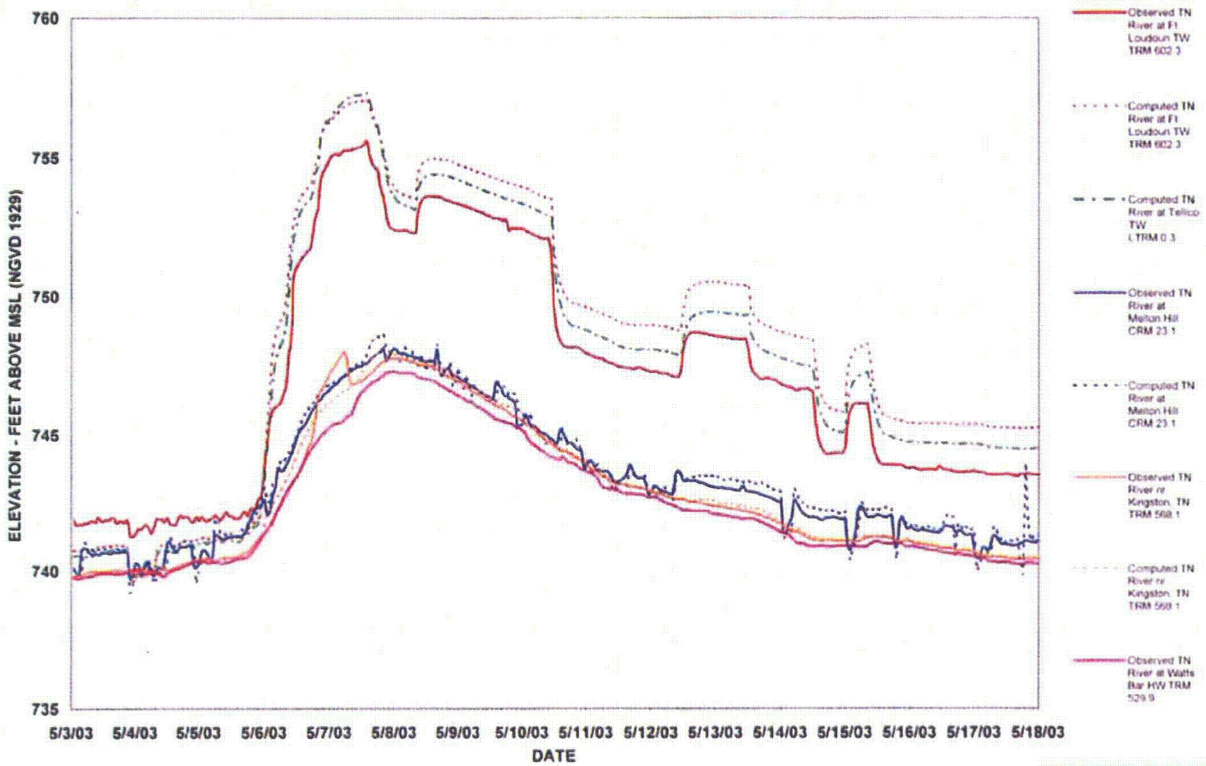
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Watts Bar SOCH Unsteady Flow Model Schematic Figure 2.4-15

Figure 2.4-15 Watts Bar SOCH Unsteady Flow Model Schematic



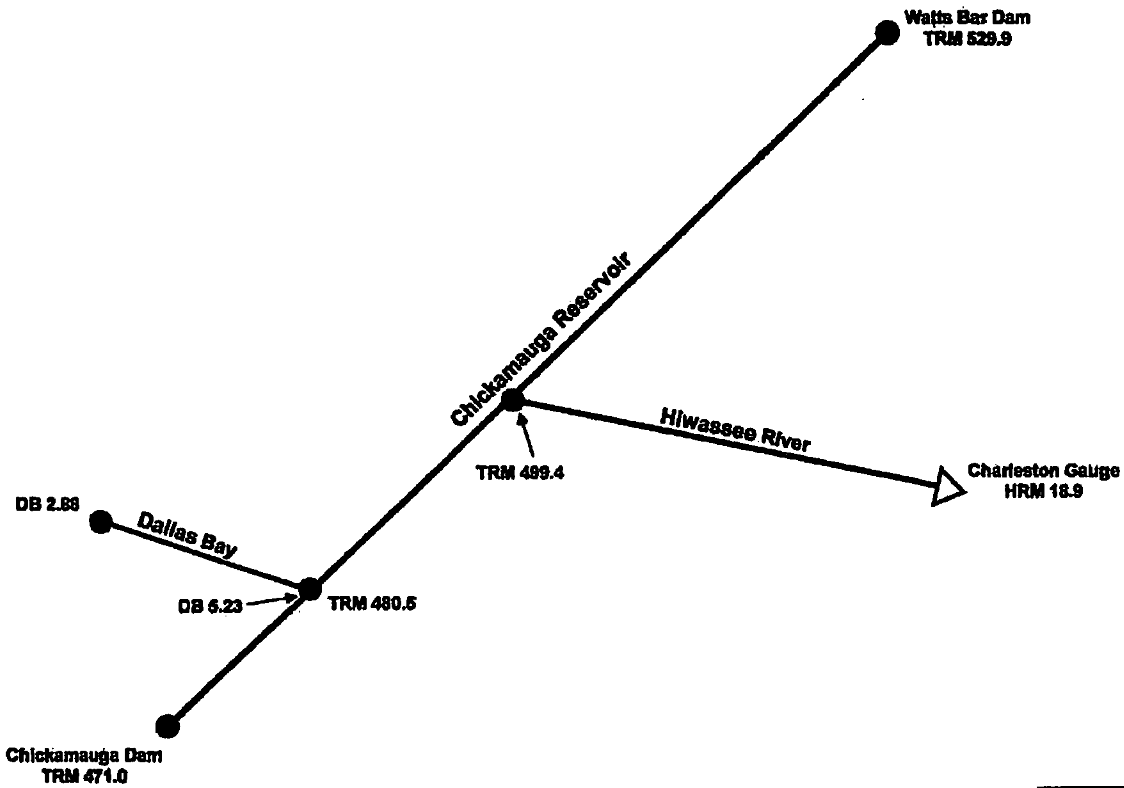
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Unsteady Flow Model Watts Bar Reservoir March 1973 Flood Figure 2.4-16

Figure 2.4-16 Unsteady Flow Model Watts Bar Reservoir March 1973 Flood



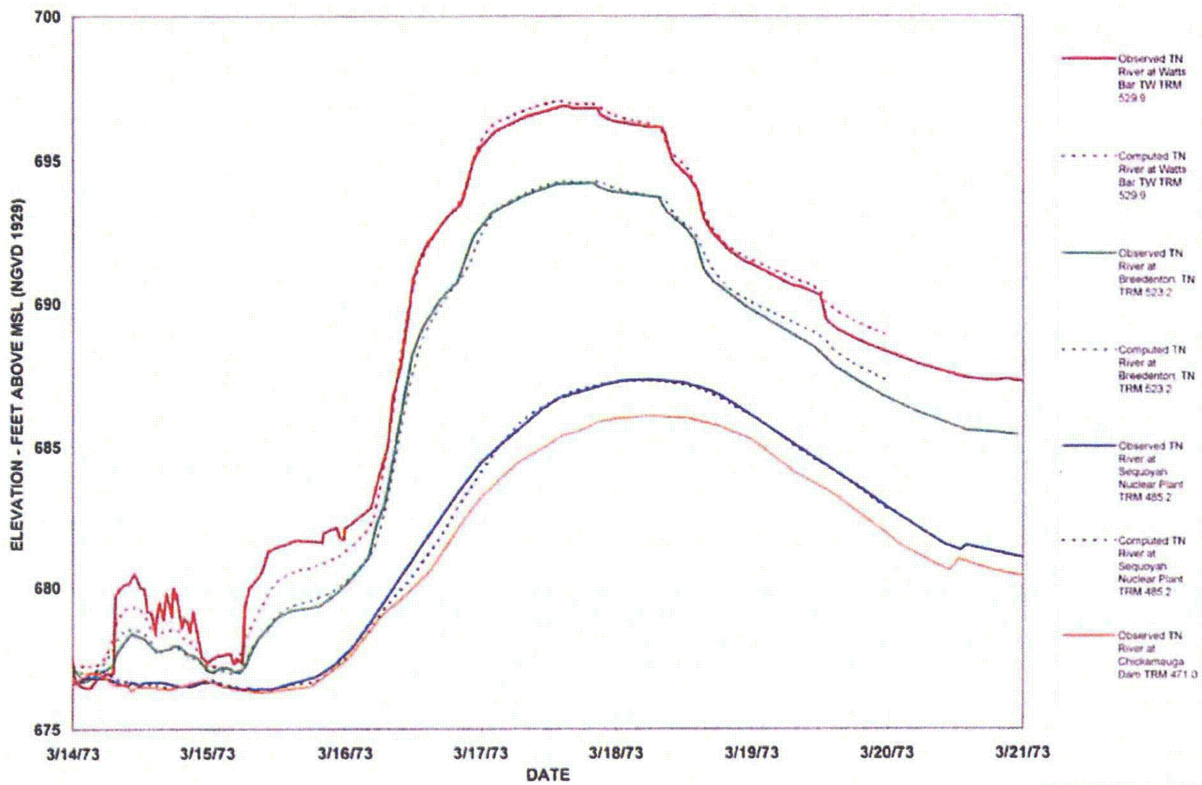
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Unsteady Flow Model Watts Bar Reservoir May 2003 Flood Figure 2.4-17

Figure 2.4-17 Unsteady Flow Model Watts Bar Reservoir May 2003 Flood



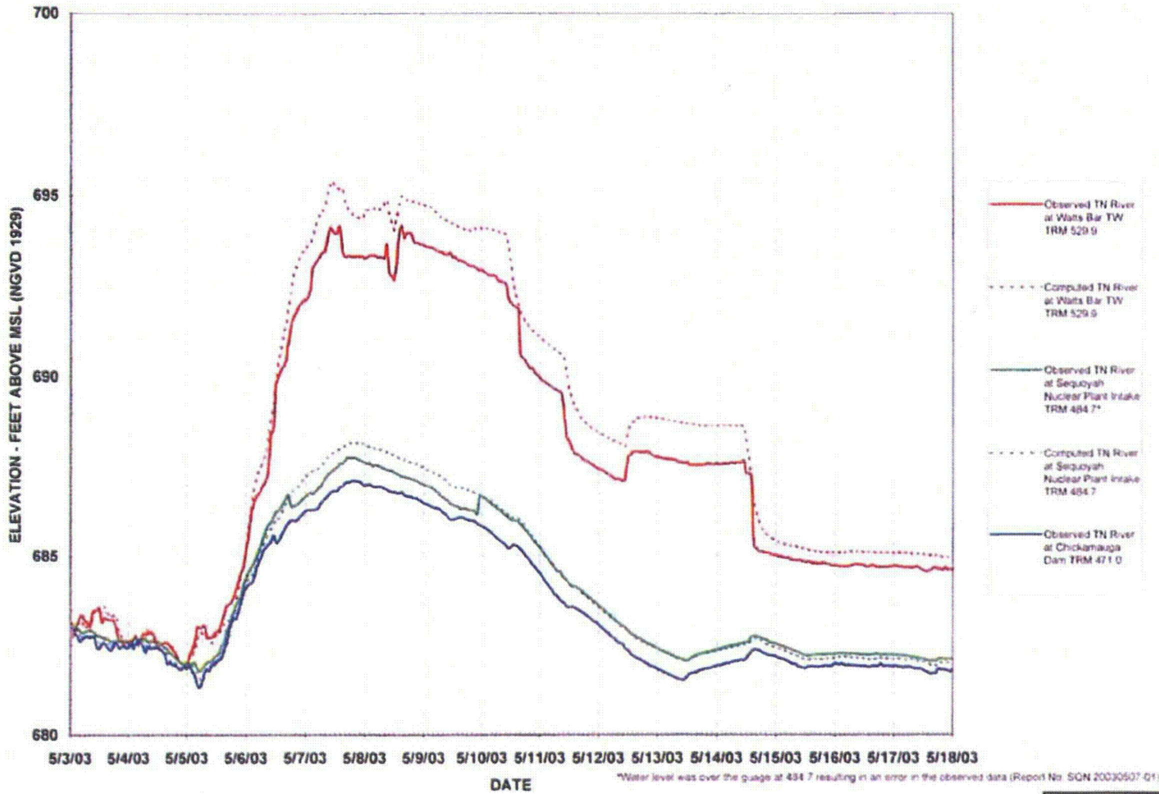
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Chickamauga SOCH Unsteady Flow Model Schematic Figure 2.4-18

Figure 2.4-18 Chickamauga SOCH Unsteady Flow Model Schematic



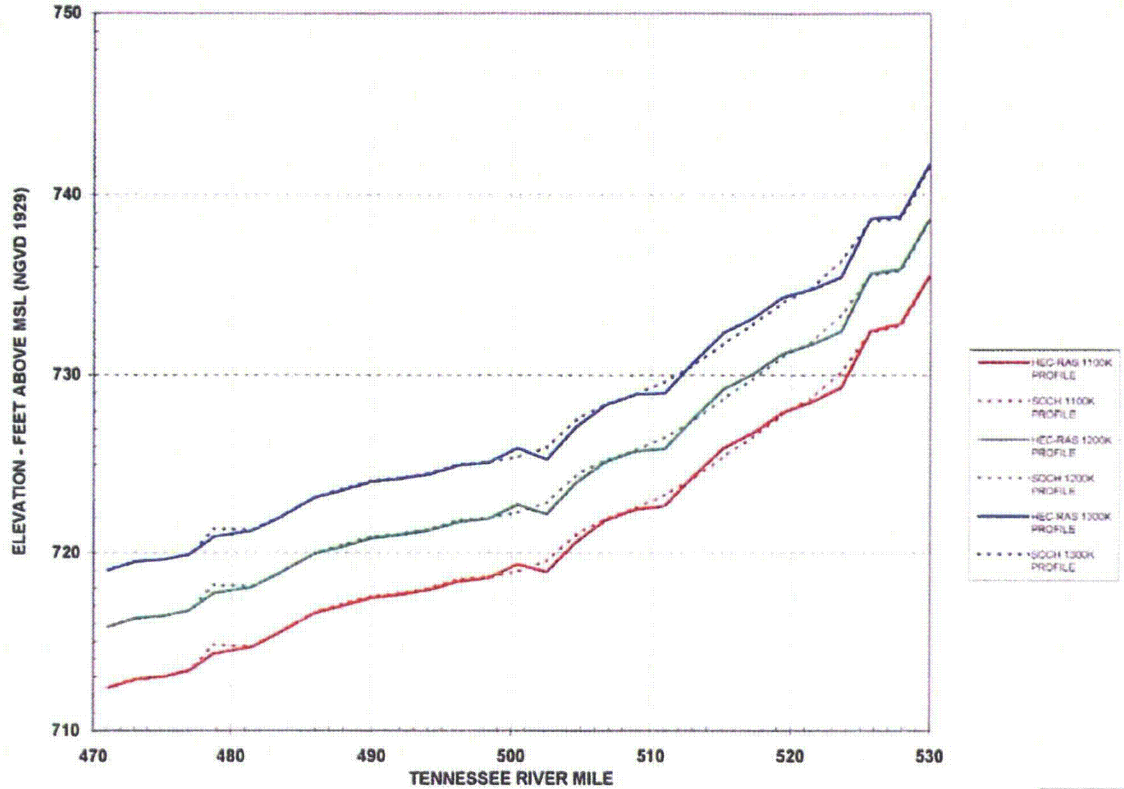
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Unsteady Flow Model Chickamauga Reservoir March 1973 Flood Figure 2.4-19

Figure 2.4-19 Unsteady Flow Model Chickamauga Reservoir March 1973 Flood



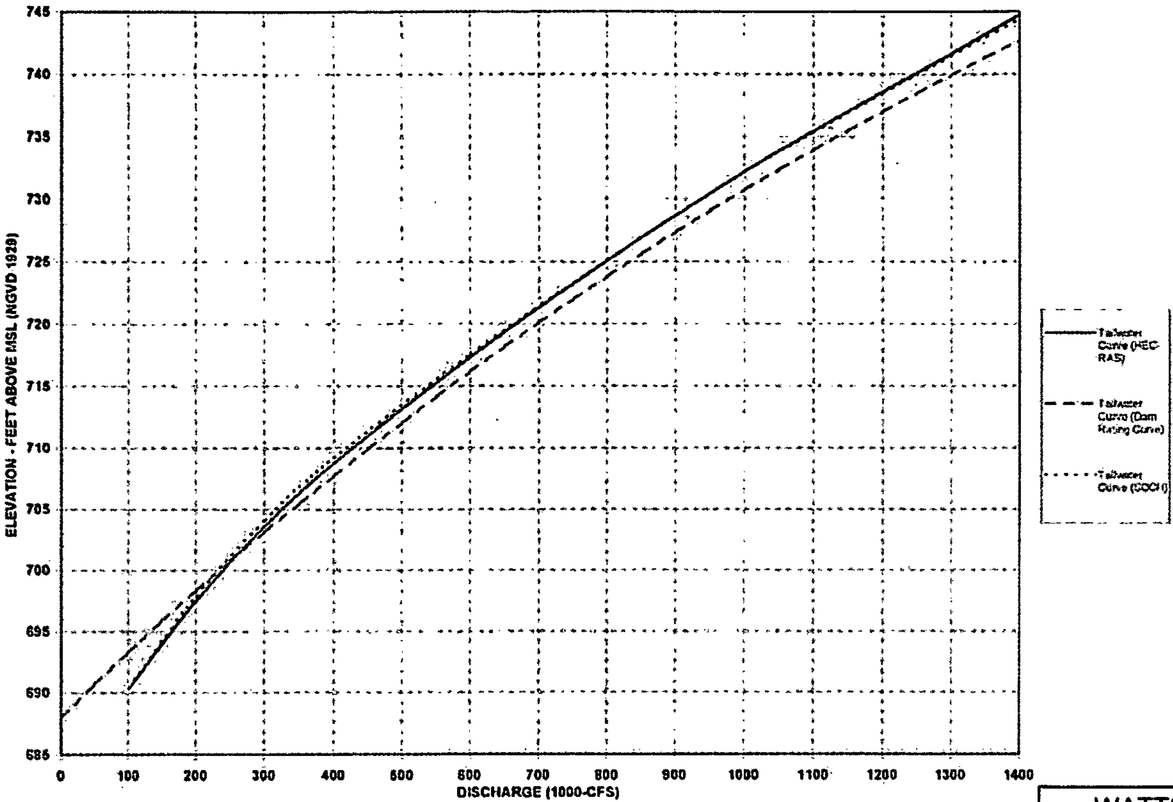
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Unsteady Flow Model Chickamauga Reservoir May 2003 Flood Figure 2.4-20

Figure 2.4-20 Unsteady Flow Model Chickamauga Reservoir May 2003 Flood



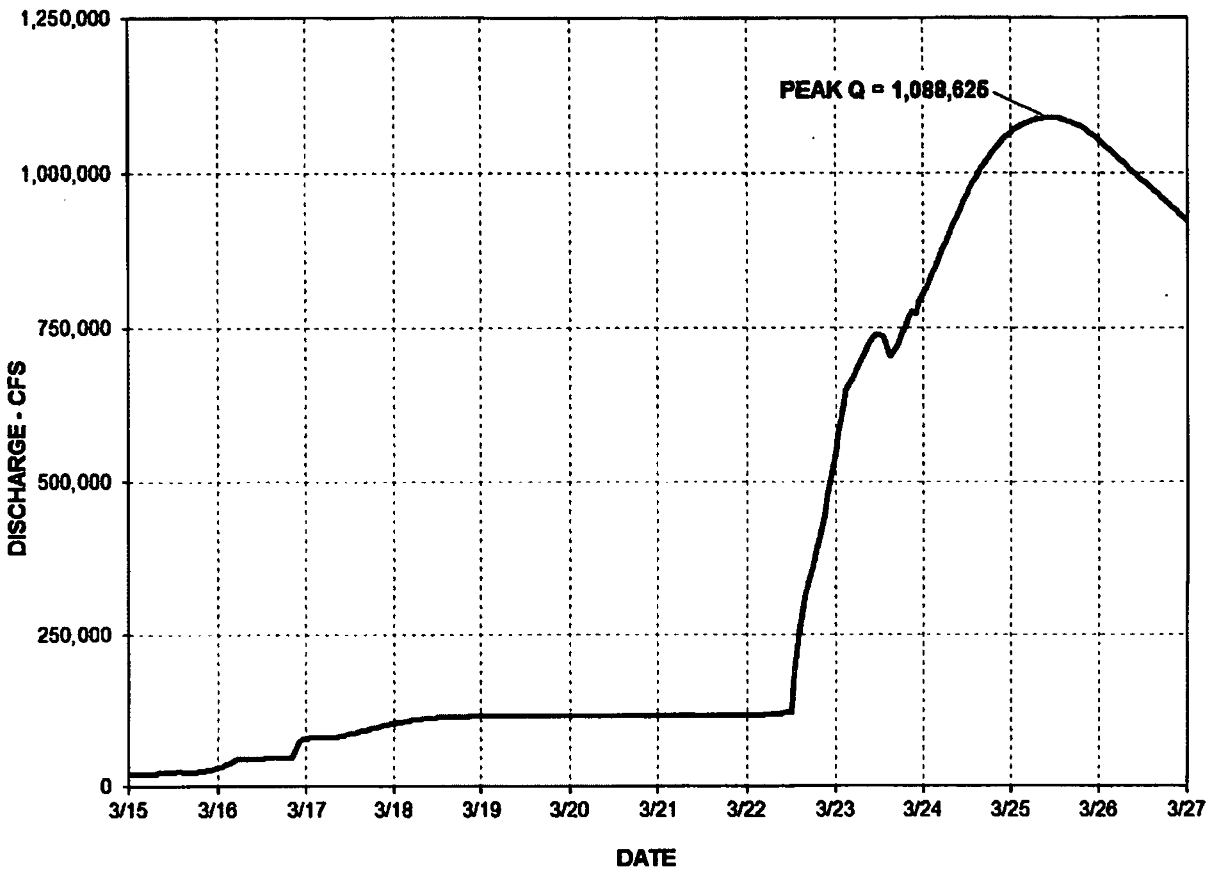
WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Chickamauga Steady State Profile Comparisons Figure 2.4-21

Figure 2.4-21 Chickamauga Steady State Profile Comparisons



WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Tailwater Rating Curve, Watts Bar Dam Figure 2.4-22

Figure 2.4-22 Tailwater Rating Curve, Watts Bar Dam

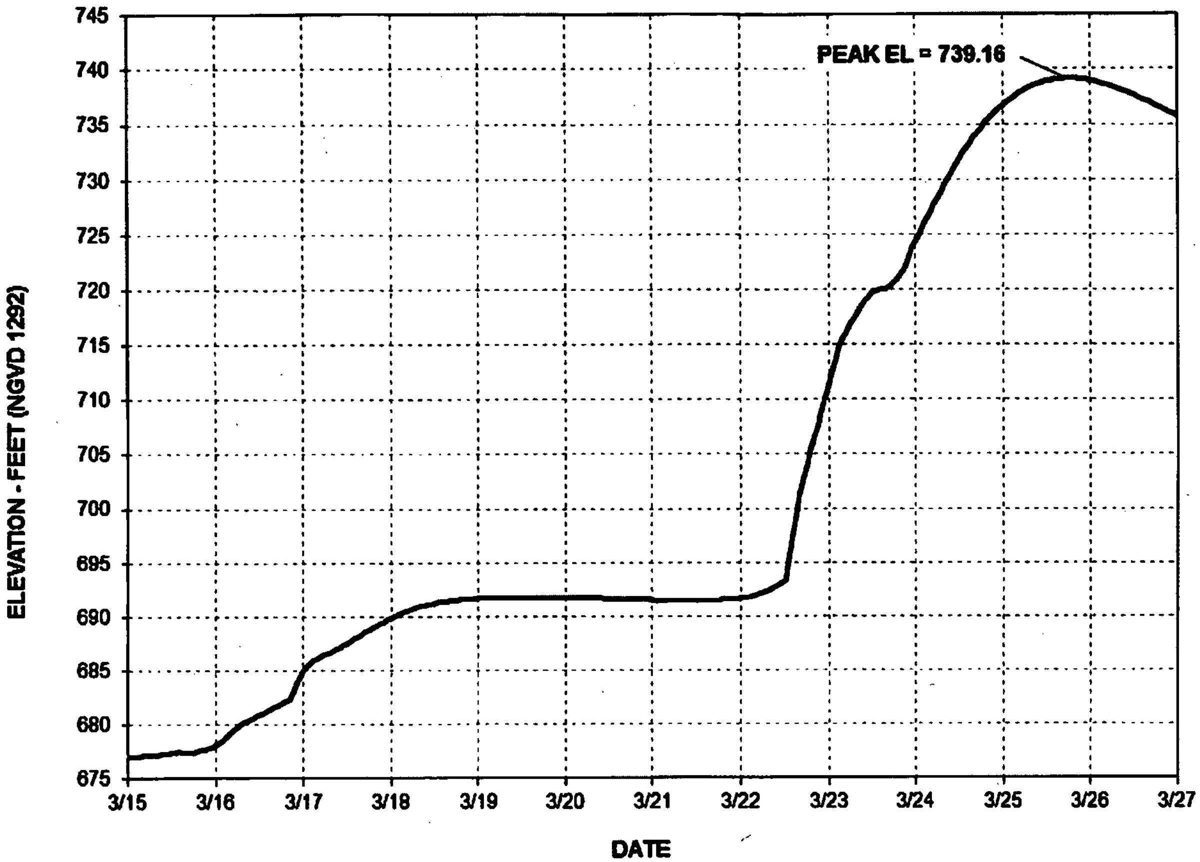


WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
PMF Discharge Hydrograph at Watts Bar Nuclear Plant Figure 2.4-23

Figure 2.4-23 PMF Discharge Hydrograph at Watts Bar Nuclear Plant

Security-Related Information - Withheld Under 10CFR2.390

Figure 2.4-24 West Saddle Dike Location Plan and Section

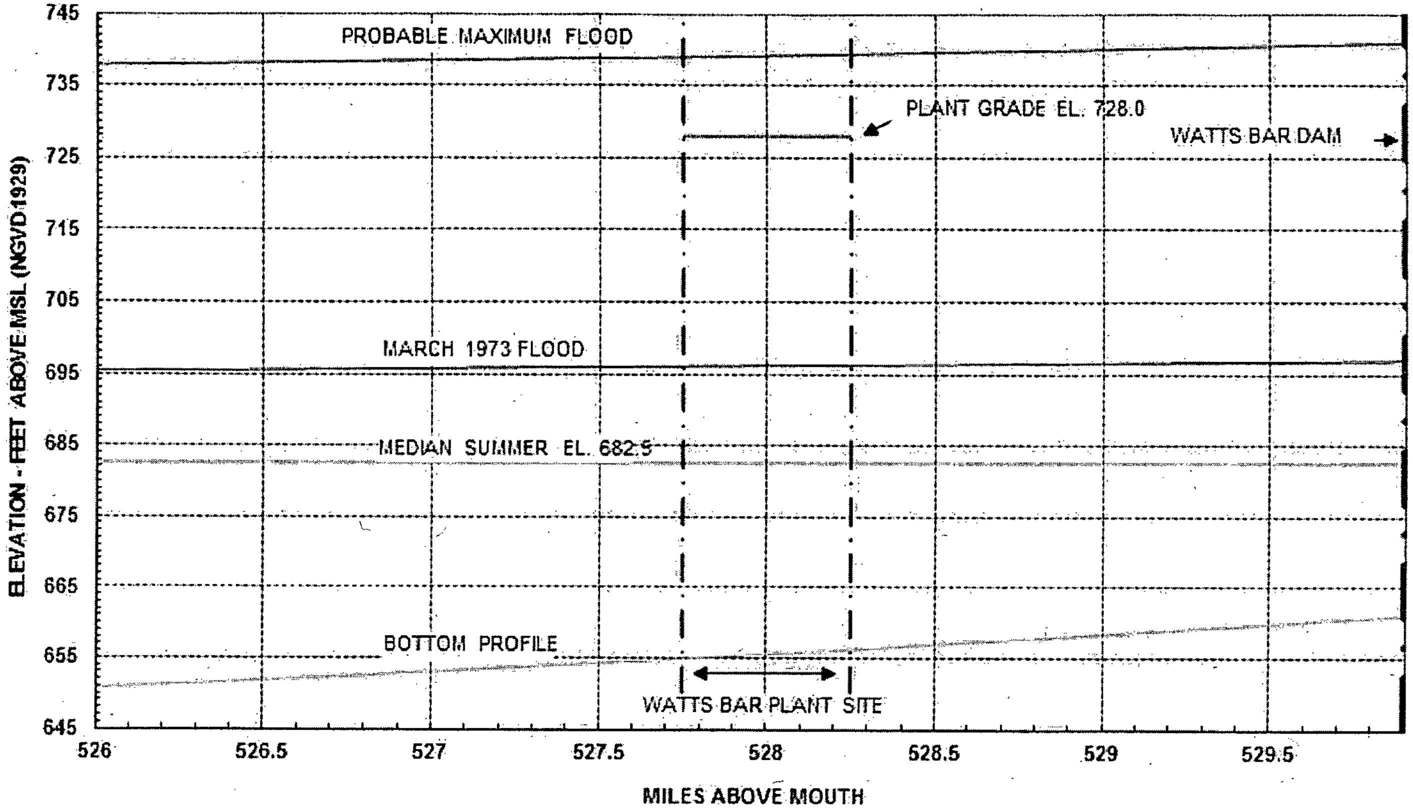


WATTS BAR NUCLEAR PLANT
FINAL SAFETY
ANALYSIS REPORT

PMF Elevation Hydrograph at
Watts Bar Nuclear Plant

Figure 2.4-25

Figure 2.4-25 PMF Elevation Hydrograph at Watts Bar Nuclear Plant

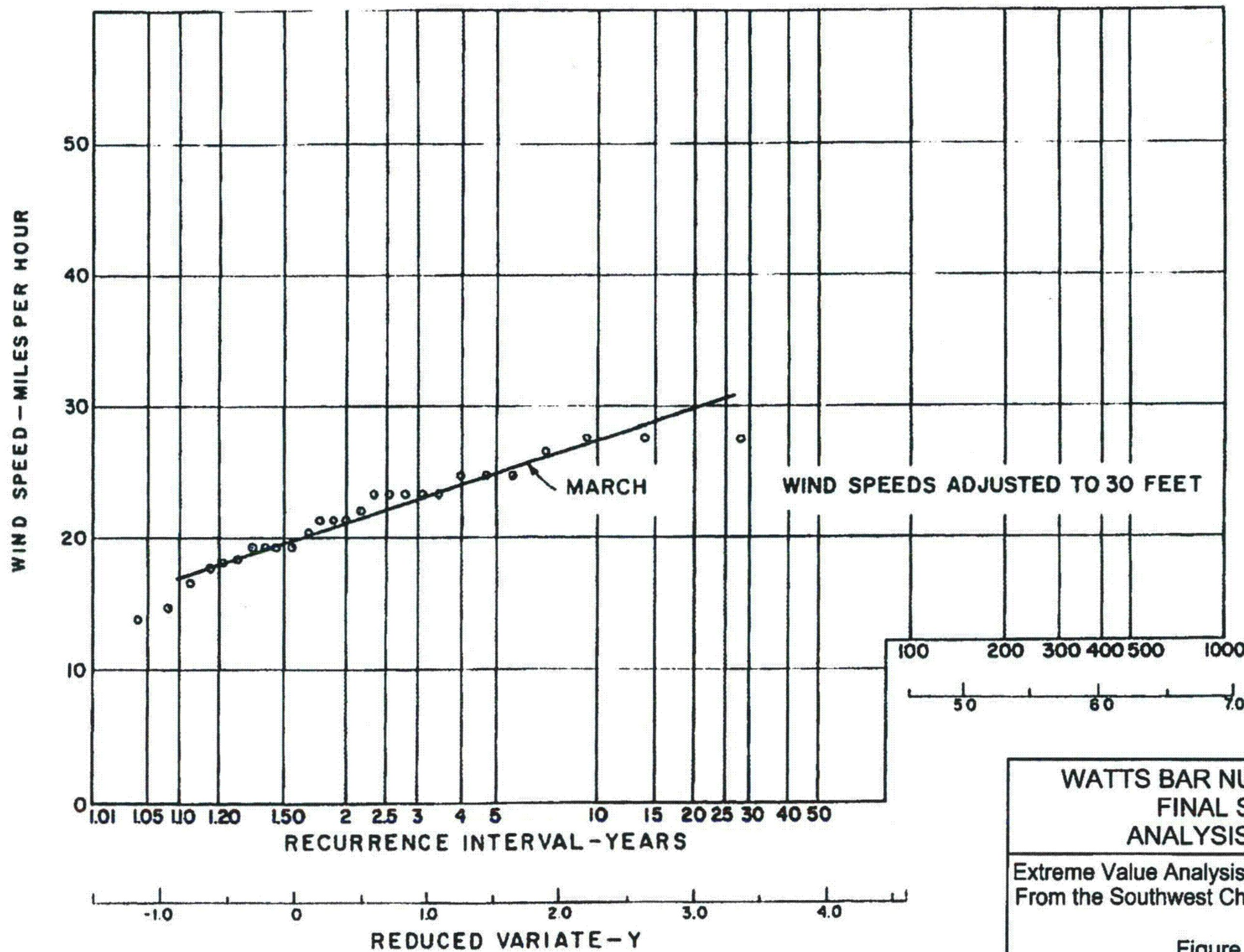


WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
Probable Maximum Flood and Bottom Profiles Figure 2.4-26

Figure 2.4-26 Probable Maximum Flood and Bottom Profiles

Figure 2.4-27 Main Plant General Grading Plan

Figure 2.4-28 Watts Bar Nuclear Plant Wind Wave Fetch



WATTS BAR NUCLEAR PLANT
FINAL SAFETY
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Extreme Value Analysis 30-Minute Wind Speed From the Southwest Chattanooga, TN 1948-74

Figure 2.4-29

Figure 2.4-29 Extreme Value Analysis 30-Minute Wind Speed From the Southwest Chattanooga, TN 1948–74

Figure 2.4-30 thru Figure 2.4-40 Are Not Used

Security-Related Information - Withheld Under 10CFR2.390

Figure 2.4-40a Main Plant Site Grading And Drainage System For Flood Studies Sheet 1

Figure 2.4-40b Main Plant General Plan

Security-Related Information - Withheld Under 10CFR2.390

Security-Related Information - Withheld Under 10CFR2.390

Figure 2.4-40c Yard Site Grading and Drainage System For Flood Studies

Security-Related Information - Withheld Under 10CFR2.390

Figure 2.4-40d Main Plant Plant Perimeter Roads Plan and Profile - Sheet 1

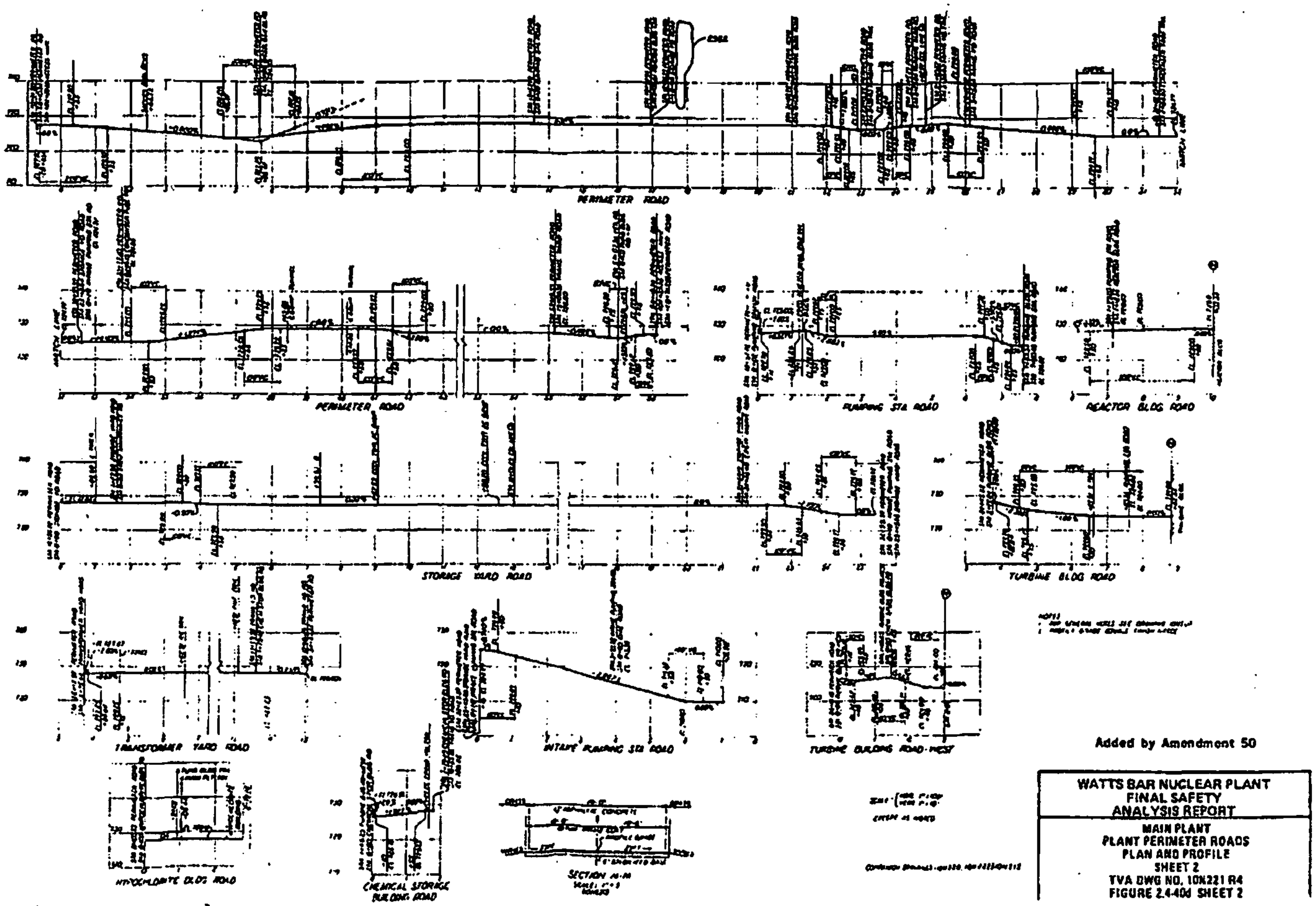


Figure 2.4-40d Main Plant Plant Perimeter Roads Plan and Profile - Sheet 2

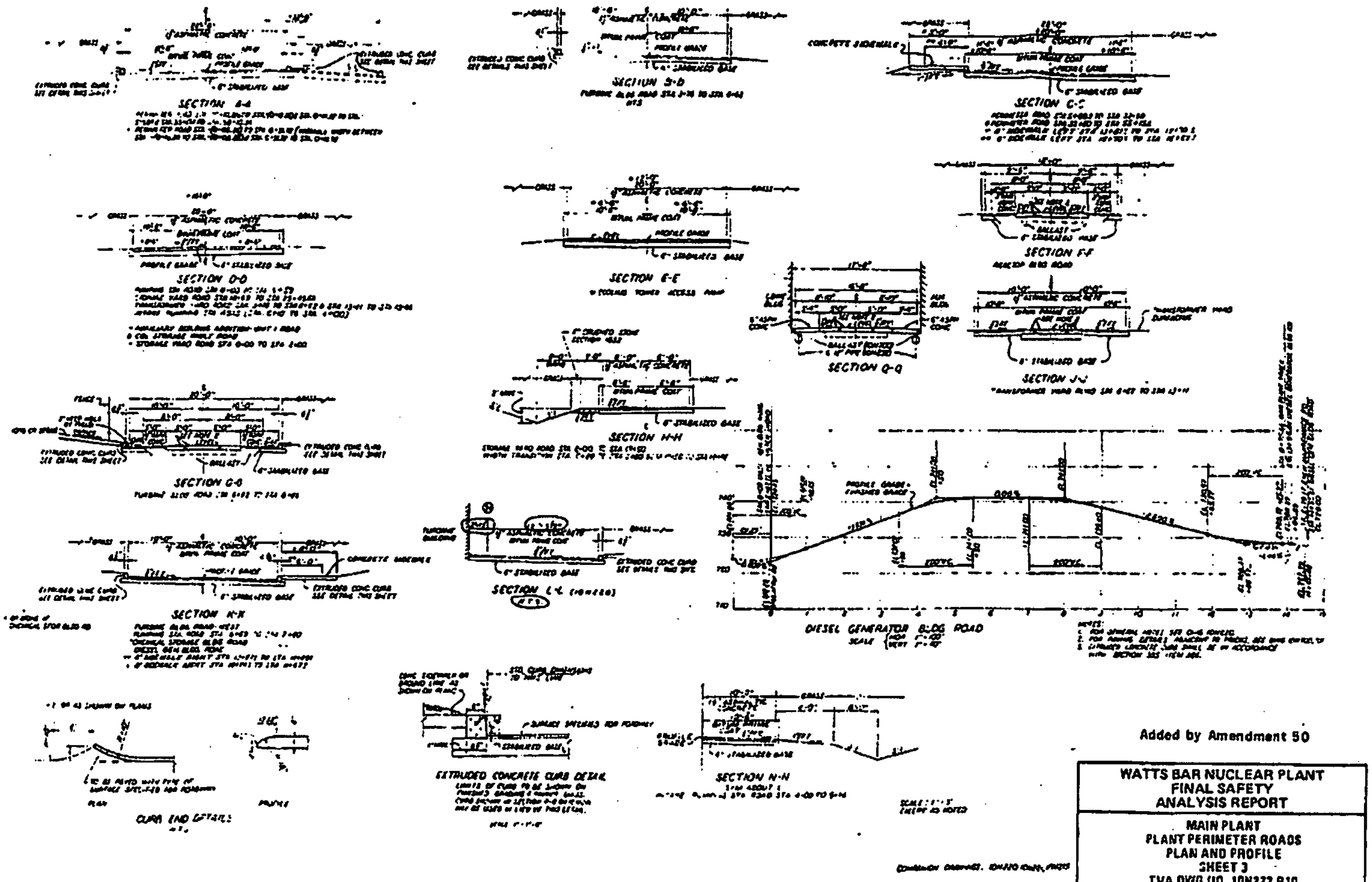


Figure 2.4-40d Main Plant Plant Perimeter Roads Plan and Profile - Sheet 3

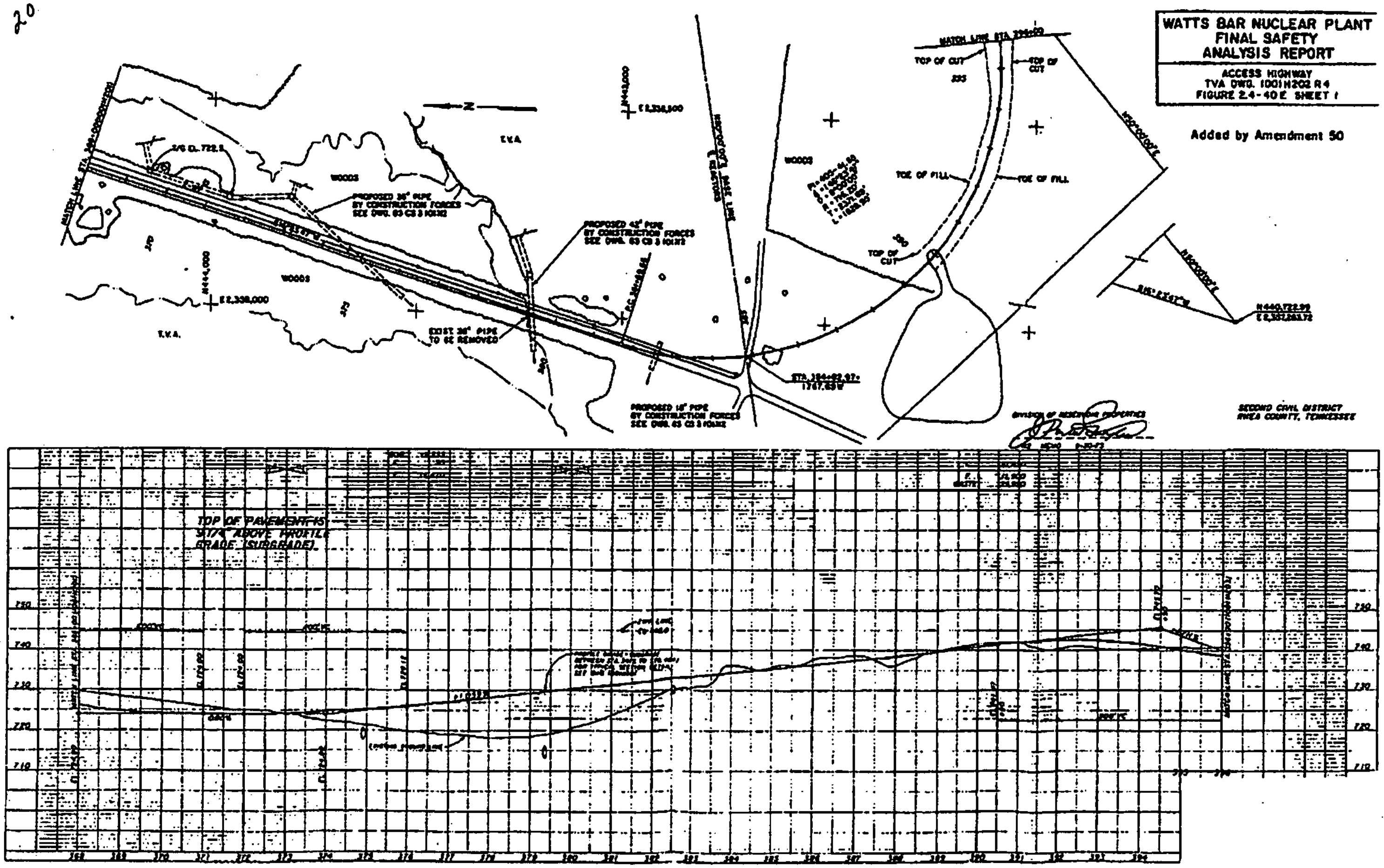


Figure 2.4-40e Access Highway TVA DWG 1001H202 R4 - Sheet 1

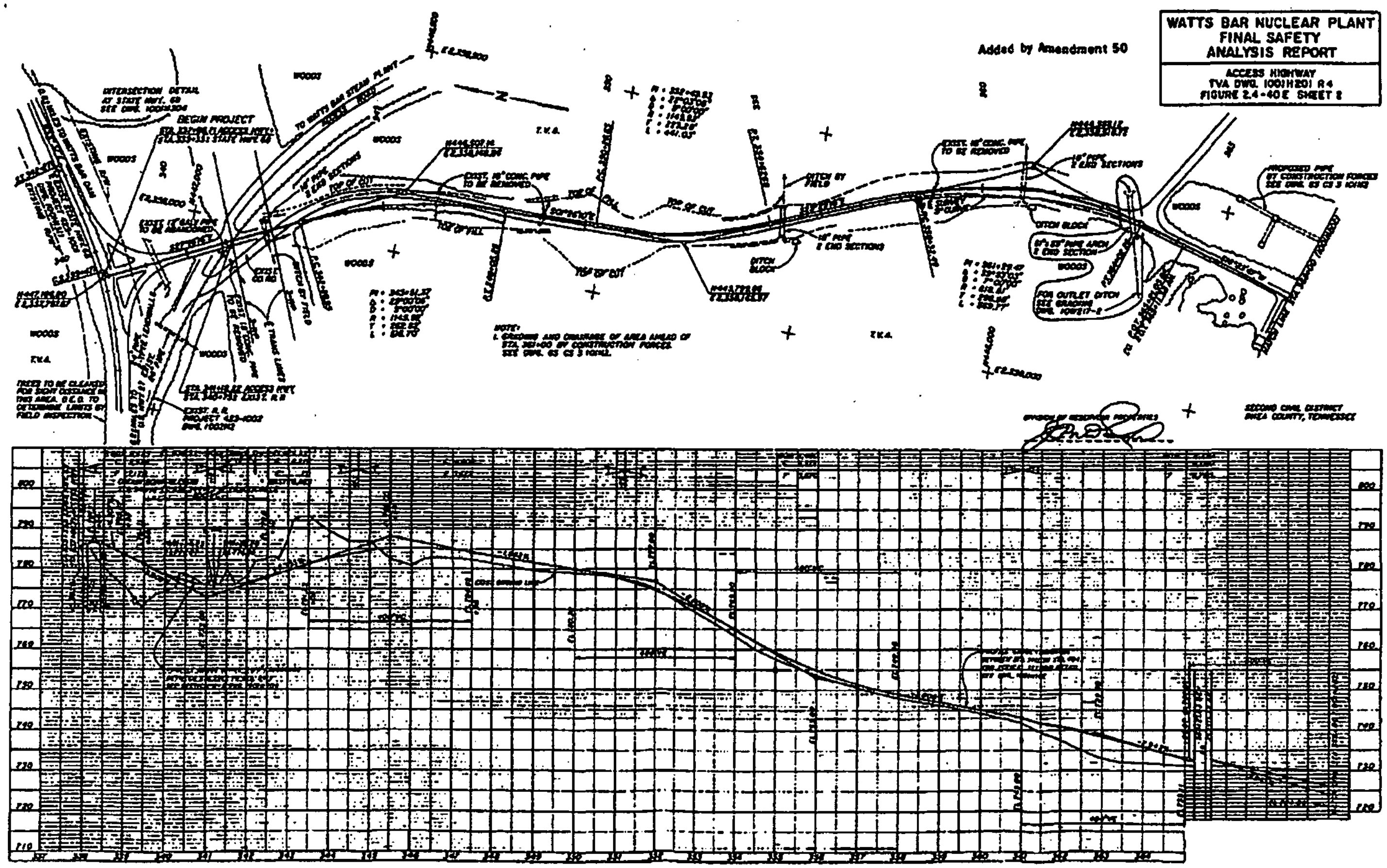


Figure 2.4-40e Access Highway TVA DWG. 1001H201 R4 - Sheet 2

Security-Related Information - Withheld Under 10CFR2.390

Figure 2.4-40f Main Plant Tracks Plan - Sheet 1

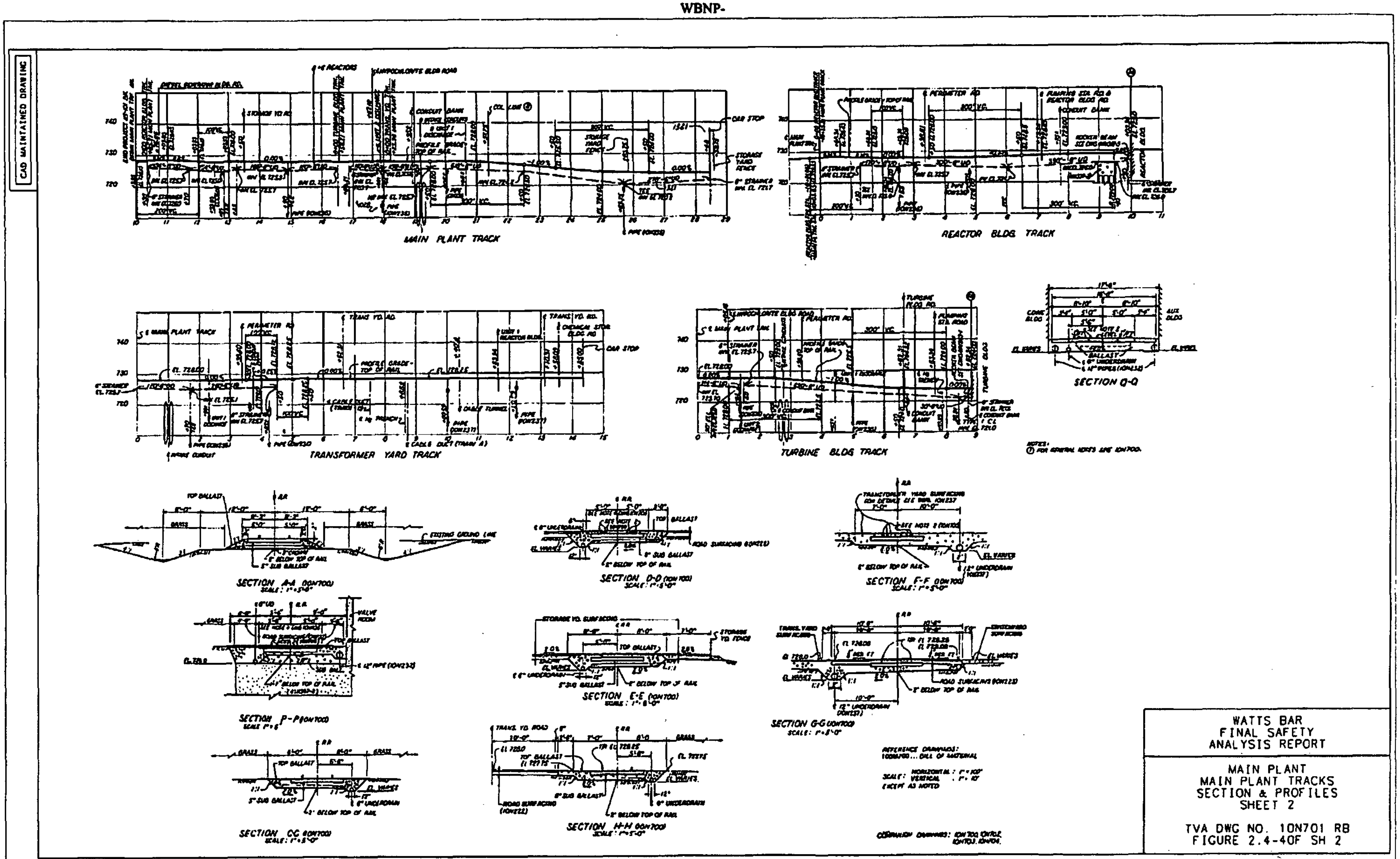
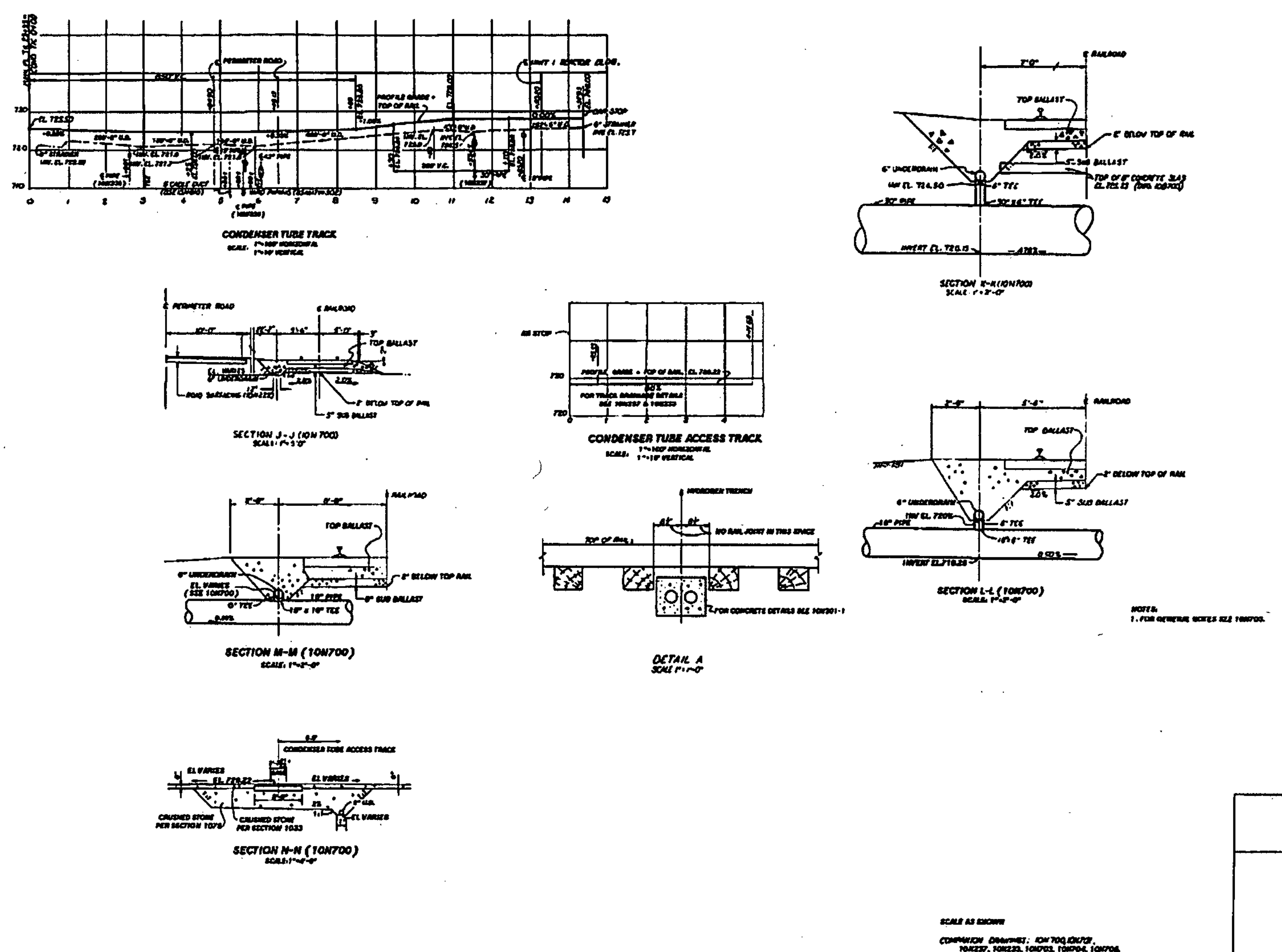


Figure 2.4-40f Main Plant Tracks Sections & Profiles - Sheet 2

CAD MAINTAINED DRAWING



WATTS BAR
FINAL SAFETY
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MAIN PLANT
MAIN PLANT TRACKS
SECTIONS & PROFILES
SHEET 3

TVA DWG NO. 10N702 RB
FIGURE 2.4-40F SH 3

Figure 2.4-40f Main Plant Tracks Sections & Profiles - Sheet 3

Security-Related Information - Withheld Under 10CFR2.390

Figure 2.4-40g Yard, Grading Drainage and Surfacing Transformer & Switchyard - Sheet 1

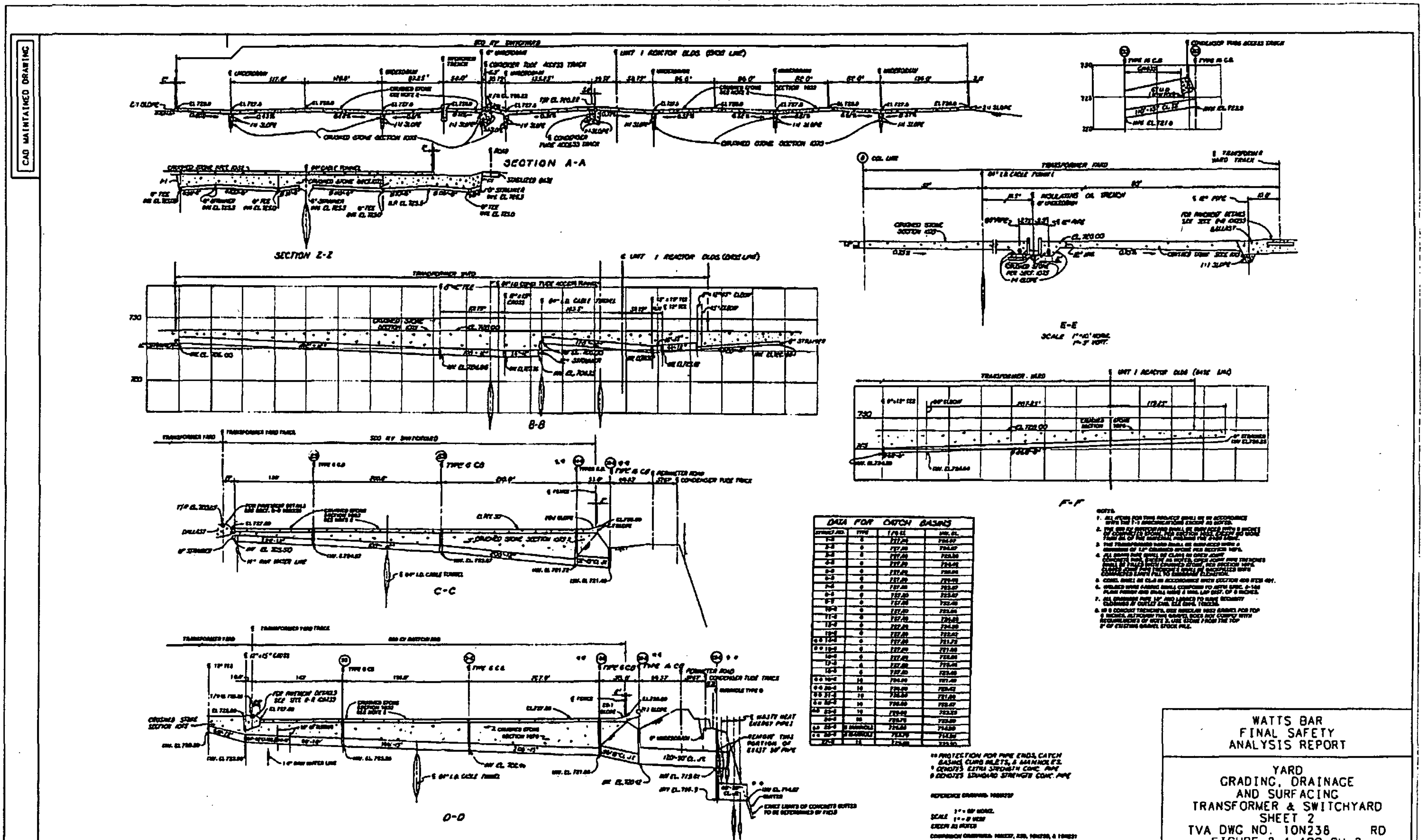

Figure 2.4-40g Yard, Grading Drainage and Surfacing Transformer & Switchyard - Sheet 2

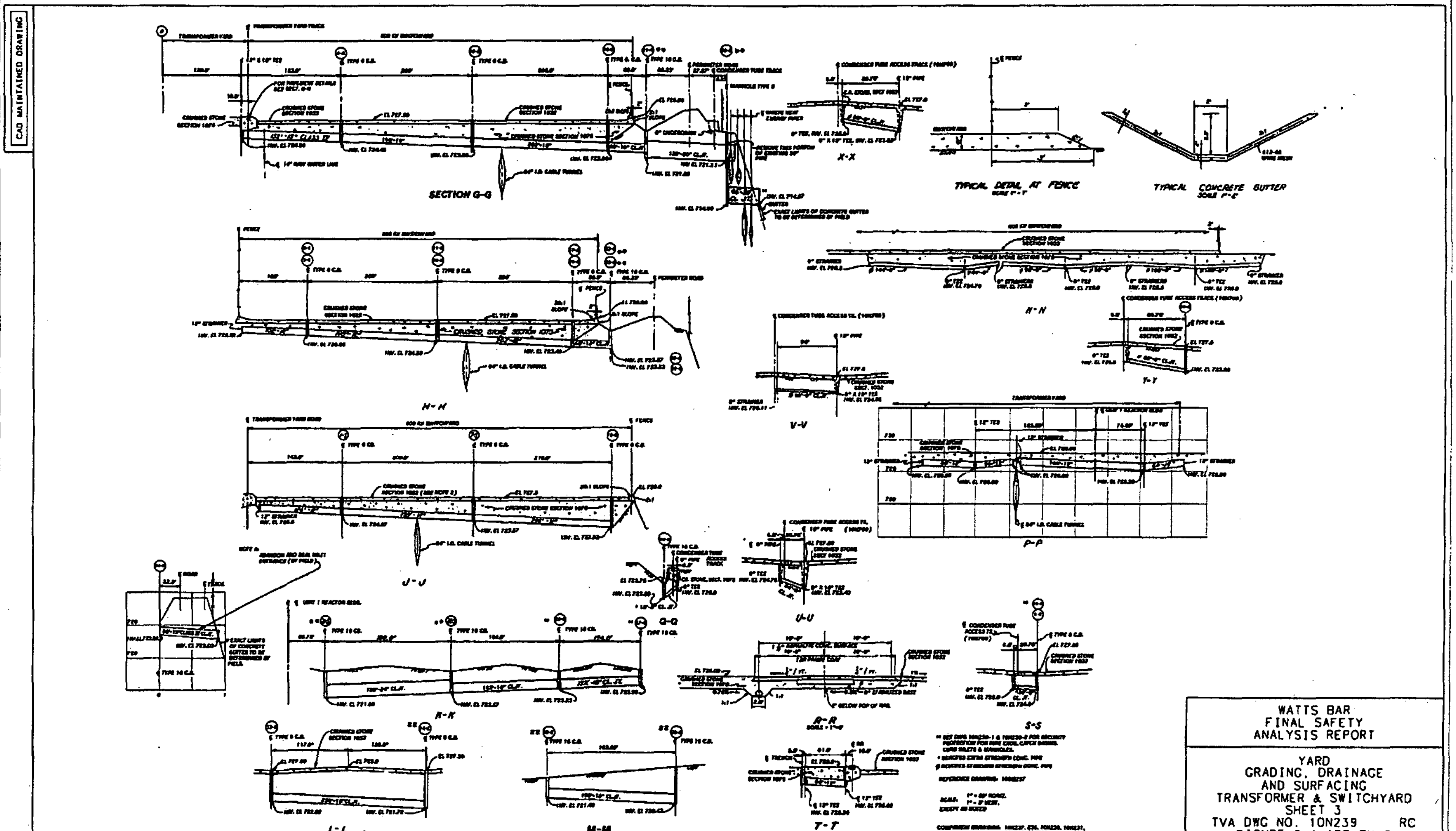

Figure 2.4-40g Yard, Grading Drainage and Surfacing Transformer & Switchyard - Sheet 3

PROBABLE MAXIMUM PRECIPITATION
BASED ON HYDROMETEOROLOGICAL REPORT NO. 56

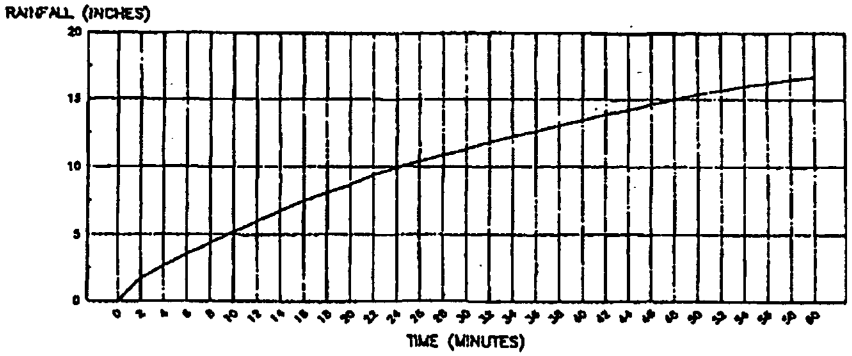

Figure 2.4-40h Probable Maximum Precipation Point Rainfall

WATTS BAR NUCLEAR PLANT
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ANALYSIS REPORT

PROBABLE MAXIMUM PRECIPATION
• POINT RAINFALL

FIGURE 2.4-40h

AMENDMENT 83

Figure 2.4-41 thru Figure 2.4-60 Are Not Used

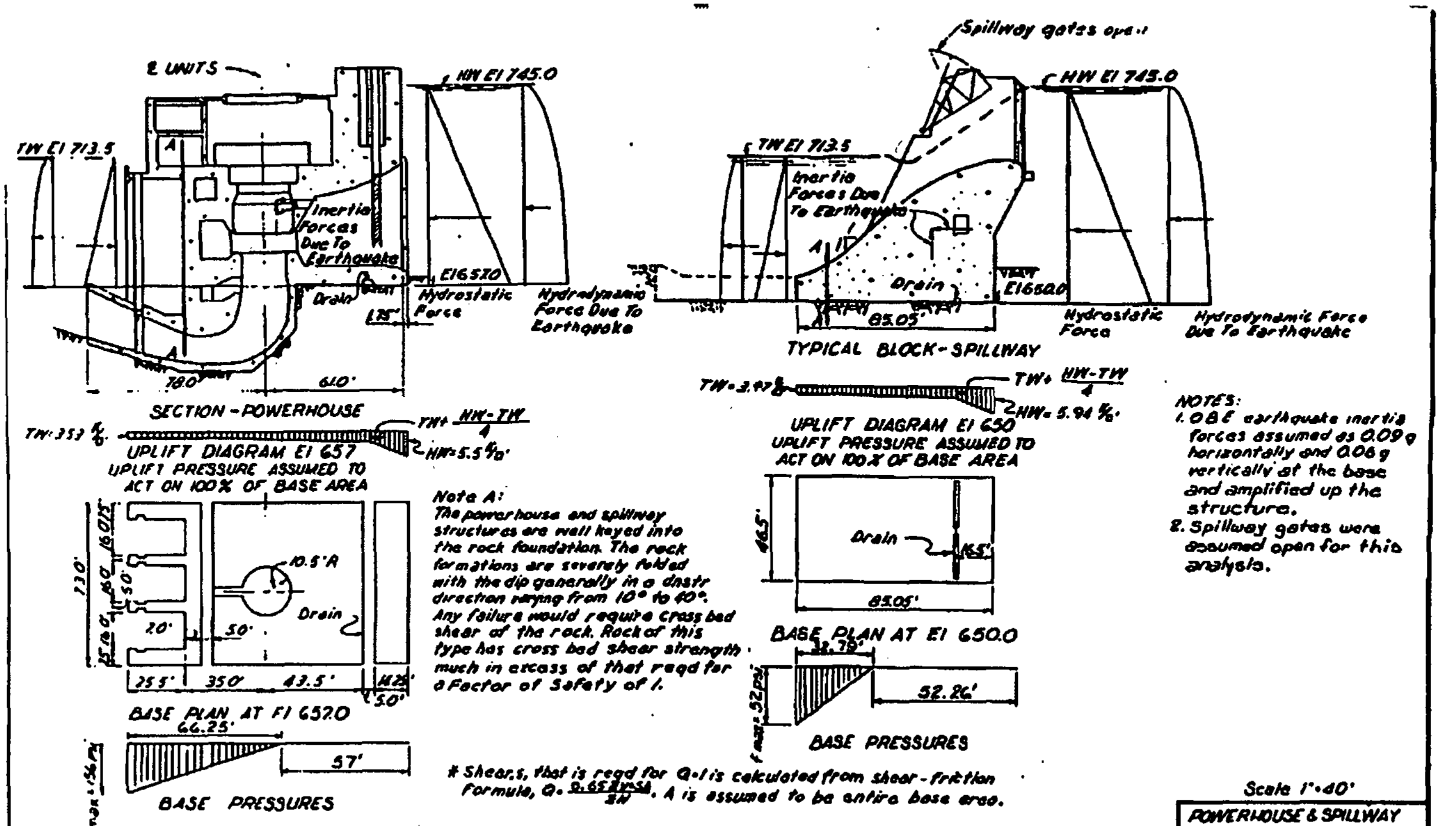
Figure 2.4-61 Is Not Used

Figure 2.4-62 Is Not Used

Figure 2.4-63 Is Not Used

Figure 2.4-64 Is Not Used

Figure 2.4-65 through Figure 2.4-67 Are Not Used



* Shear, S, that is reqd for Q=1 is calculated from shear-friction formula, $Q = \frac{0.65 \Sigma V + SA}{\Sigma H}$. A is assumed to be entire base area.

ΣV	ΣH	ΣH/ΣV	Avg Shear, S	S Reqd For Q=1	f max	FS=ΣMR/ΣMo	Vertical Shear on Plane A-A
77,207	76,232	0.96	22.6 psi	Note A, 9 psi* (21.5 psi)**	156 psi	1.21	47.2 psi

ΣV	ΣH	ΣH/ΣV	Avg. Shear, S	S Reqd for Q=1	f max	FS=ΣMR/ΣMo	Vertical Shear on Plane A-A
5686K	13,493K	2.37	24 psi	Note A 17.2 psi* (46.7 psi)**	52 psi	1.04	29 psi

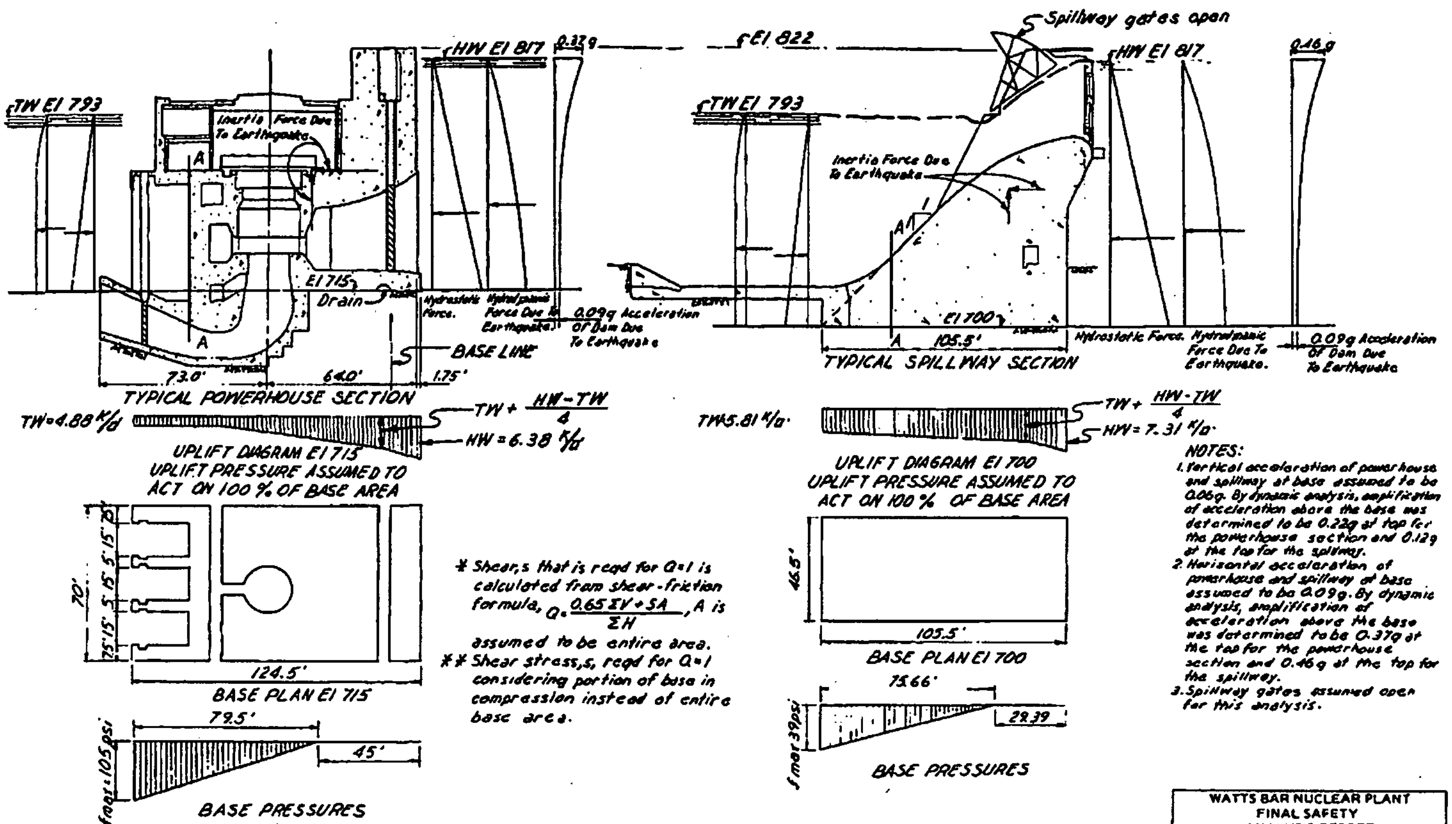
** Shear, S, reqd for Q=1 considering portion of base in compression (no tension), instead of entire base area.

Amendment 63

Figure 2.4-68 Powerhouse & Spillway Results of Analysis For Operating Basis Earthquake - Watts Bar Dam

Figure 2.4-69 is Not Used

Figure 2.4-70 Is Not Used



ΣV	ΣH	$\frac{\Sigma H}{\Sigma V}$	Avg shear	S reqd for Q=1	f max	$F.S. = \frac{\Sigma M_R}{\Sigma M_O}$	Vertical shear on plane A-A
22,762K	22,541K	0.99	24.2psi (entire base)	8.3psi * (14.6psi) **	105psi	1.18	26psi

ΣV	ΣH	$\frac{\Sigma H}{\Sigma V}$	Avg shear	S reqd for Q=1	f max	$F.S. = \frac{\Sigma M_R}{\Sigma M_O}$	Vertical shear on plane A-A
19,498K	14,382K	0.75	20psi (entire base)	2.38psi * (3.30psi) **	39psi	1.26	17psi

WATTS BAR NUCLEAR PLANT
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POWERHOUSE & SPILLWAY
RESULTS OF ANALYSIS FOR
OPERATING BASIS EARTHQUAKE
Fort Loudoun Dam
Figure 2.4-71

Figure 2.4-71 Powerhouse & Spillway Results of Analysis For Operating Basis Earthquake - Fort Loudoun Dam

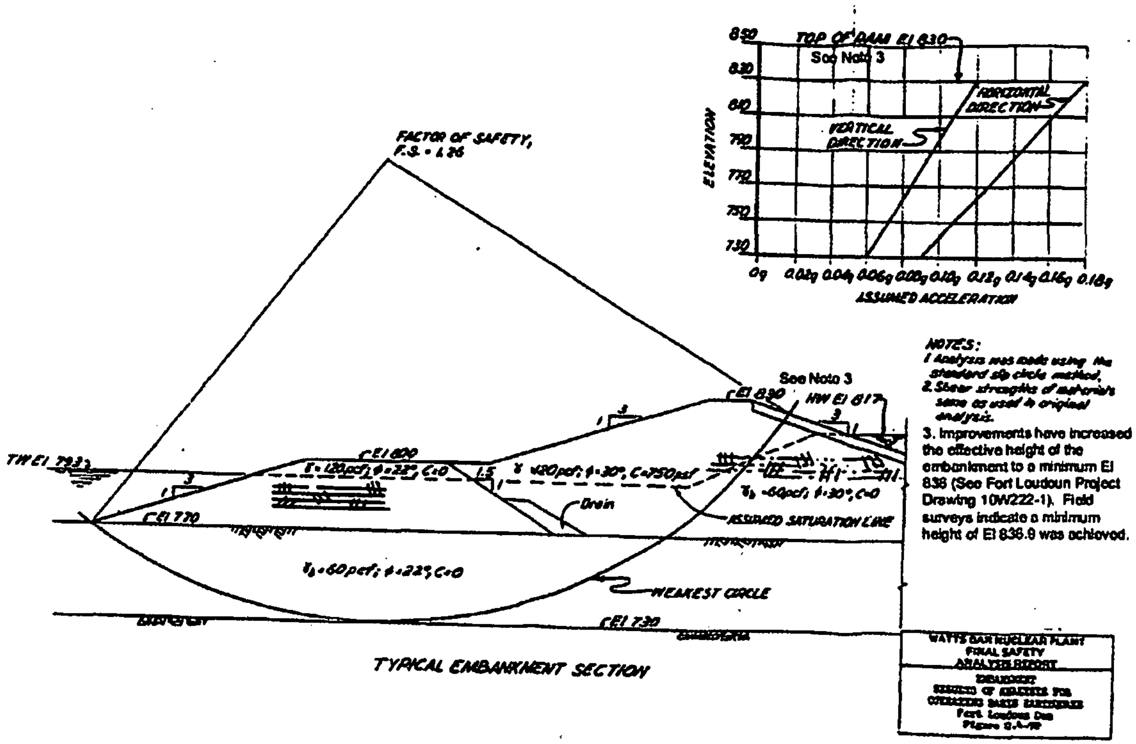


Figure 2.4-72 Embankment Results Of Analysis For Operating Basis Earthquake - Fort Loudoun Dam

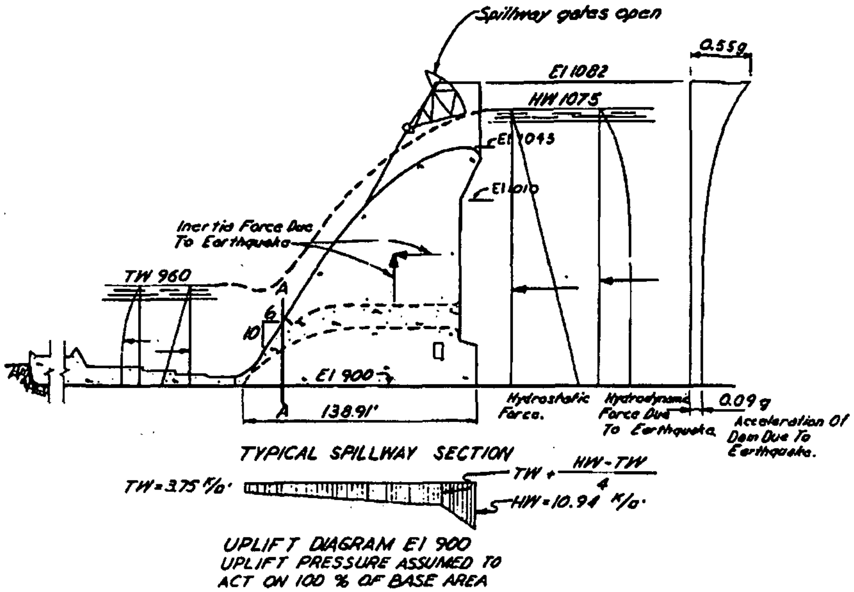
Figure 2.4-73 Is Not Used

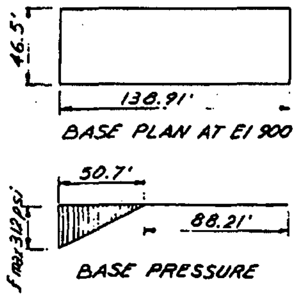
Figure 2.4-74 Is Not Used

Figure 2.4-75 Is Not Used

Security-Related Information - Withheld Under 10CFR2.390

Figure 2.4-76 Analysis For OBE & 1/2 PMF Assumed Condition of Dam After Failure Norris Dam





* Shear, s, that is reqd for Q=1 is calculated from shear-friction formula, $Q = \frac{0.65\Sigma V + SA}{\Sigma H}$, A is assumed to be entire area.

** Shear stress, s, reqd for Q=1 considering portion of base in compression instead of entire base area.

ΣV	ΣH	ΣH/ΣV	Avg Shear, S	S Reqd For Q=1	f max	FS = ΣMR/ΣMo	Vertical Shear on Plane A-A
53,007K	57,276K	1.08	61 psi (entire base)	25psi* (67psi)**	312psi	1.13	173psi

NOTES:

1. Vertical acceleration of the spillway at the base assumed to be 0.06 g. By dynamic analysis, amplification of acceleration above the base was determined to be 0.11 g at the top.
2. Horizontal acceleration of the spillway at the base assumed to be 0.09g. By dynamic analysis, amplification of acceleration above the base was determined to be 0.55 g at the top.
3. Spillway gates assumed open for this analysis.

WATTS BAR NUCLEAR PLANT
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Figure 2.4-77 Spillway & Nonoverflow Results of Analysis For Operating Basis Earthquake -Cherokee Dam

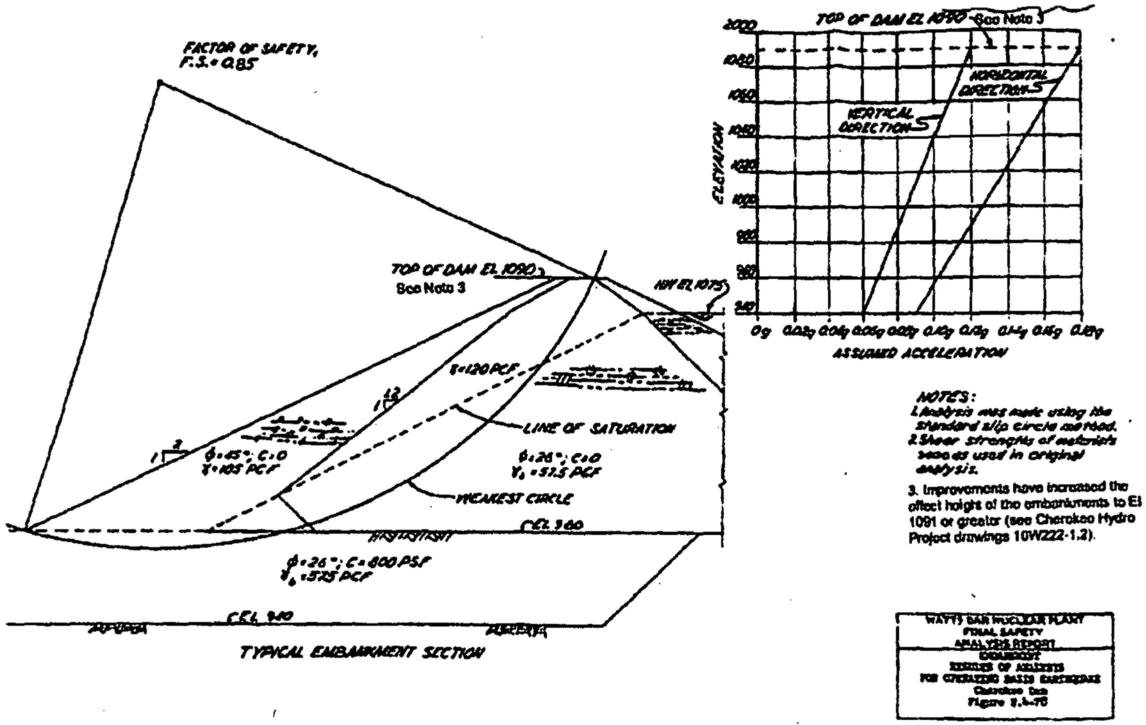
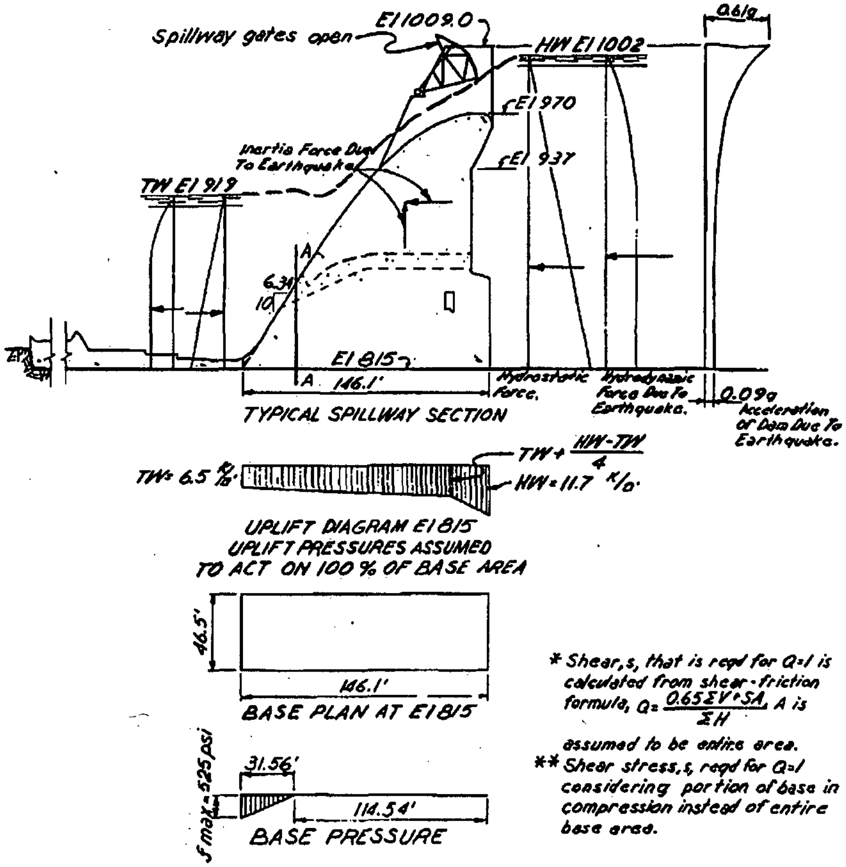


Figure 2.4-78 Embankment Results of Analysis For Operating Basis Earthquake - Cherokee Dam

Figure 2.4-79 Assumed Condition of Dam After Failure OBE And 1/2 Probable Max Flood - Cherokee Dam

Security-Related Information - Withheld Under 10CFR2.390



ΣV	ΣH	$\frac{\Sigma H}{\Sigma V}$	Avg Shear, s	S Reqd For Q=1	f max	FS = $\frac{\Sigma M_R}{\Sigma M_O}$	Vertical Shear on Plane A-A
55,403K	60,245K	1.09	61.6 psi (entire base)	25 psi* (170 psi)**	525 psi	1.06	156 psi

NOTES:

1. Vertical acceleration of the spillway at the base assumed to be 0.06 g. By dynamic analysis, amplification of acceleration above the base was determined to be 0.13 g at the top.
2. Horizontal acceleration of the spillway at the base assumed to be 0.09 g. By dynamic analysis, amplification of acceleration above the base was determined to be 0.61 g at the top.
3. Spillway gates assumed open for this analysis.

WATTS BAR NUCLEAR PLANT
FINAL SAFETY ANALYSIS REPORT

SPILLWAY & NONOVERFLOW
RESULTS OF ANALYSIS FOR
OPERATING BASIS EARTHQUAKE
Douglas Dam
Figure 2.4-80

Figure 2.4-80 Spillway & Nonoverflow Results of Analysis For Operating Basis Earthquake - Douglas Dam

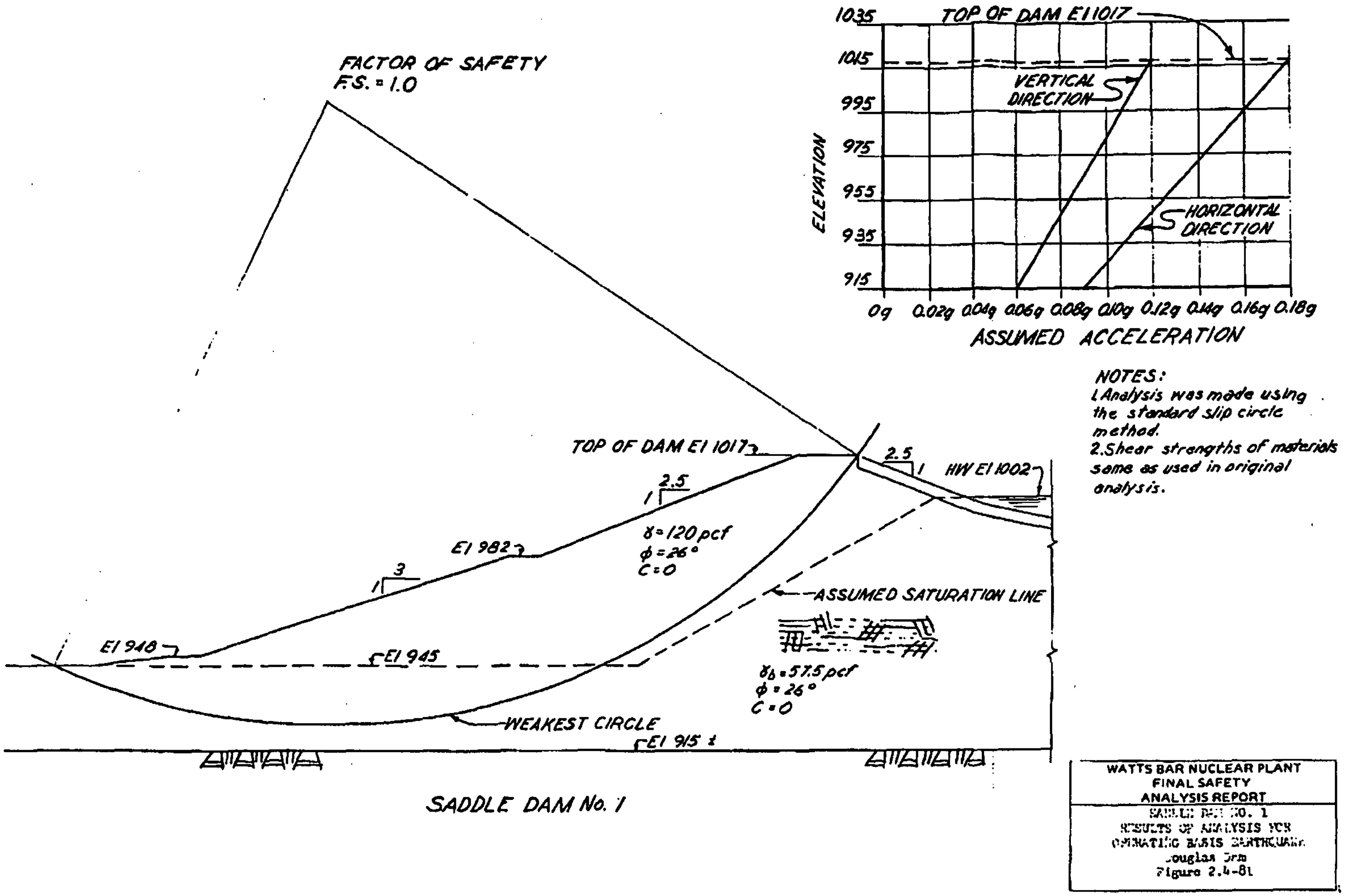


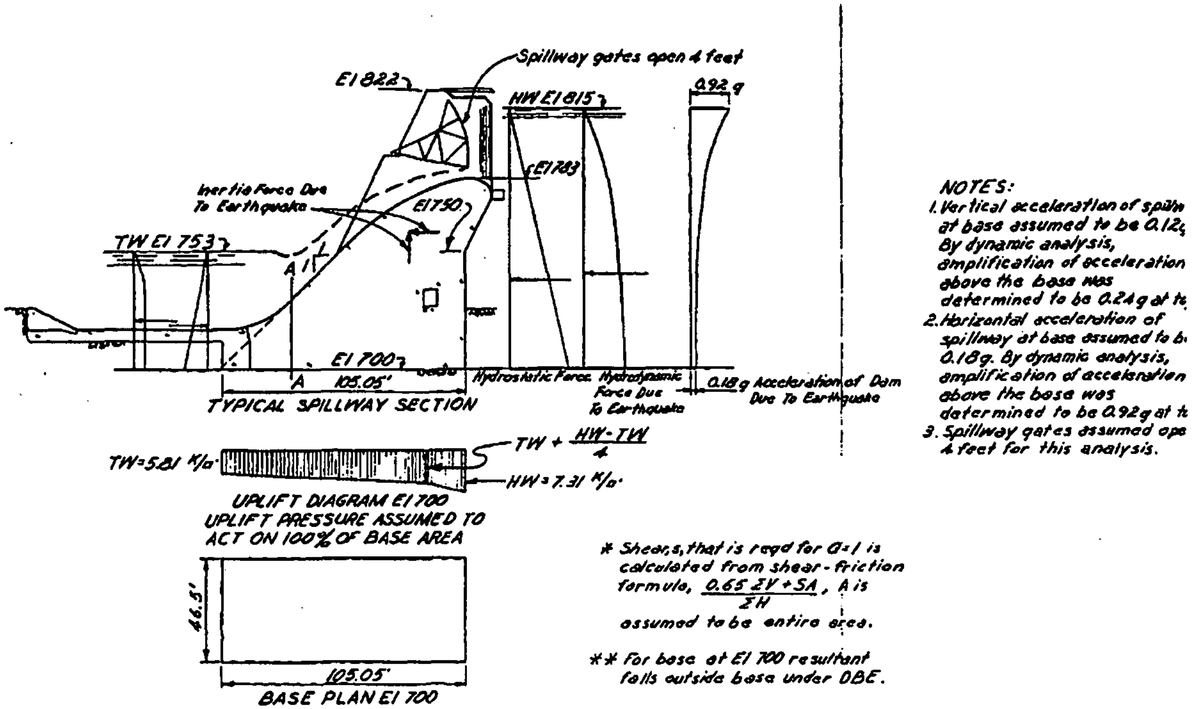
Figure 2.4-81 Saddle Dam No. 1 Results of Analysis For Operating Basis Earthquake - Douglas Dam

Security-Related Information - Withheld Under 10CFR2.390

Figure 2.4-82 Douglas Dam Assumed Condition of Dam After Failure OBE And 1/2 Probable Maximum Flood - Douglas Project

Figure 2.4-83 Fontana Dam Assumed Condition of Dam after Failure OBE And 1/2 Probable Maximum Flood

Figures 2.4-84 and 2.4-85 Are Not Used



BASE PRESSURE**

ΣV	ΣH	ΣH / ΣV	Avg shear	S reqd for Q=1	f max	FS ΣMR / ΣMo
18,254K	29,534K	1.62	42 psi (entire base)	25psi*	**	0.9

WATTS BAR NUCLEAR PLANT
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SUMMARY
RESULTS OF ANALYSIS FOR
SSE EARTHQUAKE
Fort Loudoun Dam
Figure 2.4-86

Figure 2.4-86 Spillway Results of Analysis For SSE Earthquake Fort Loudoun Dam

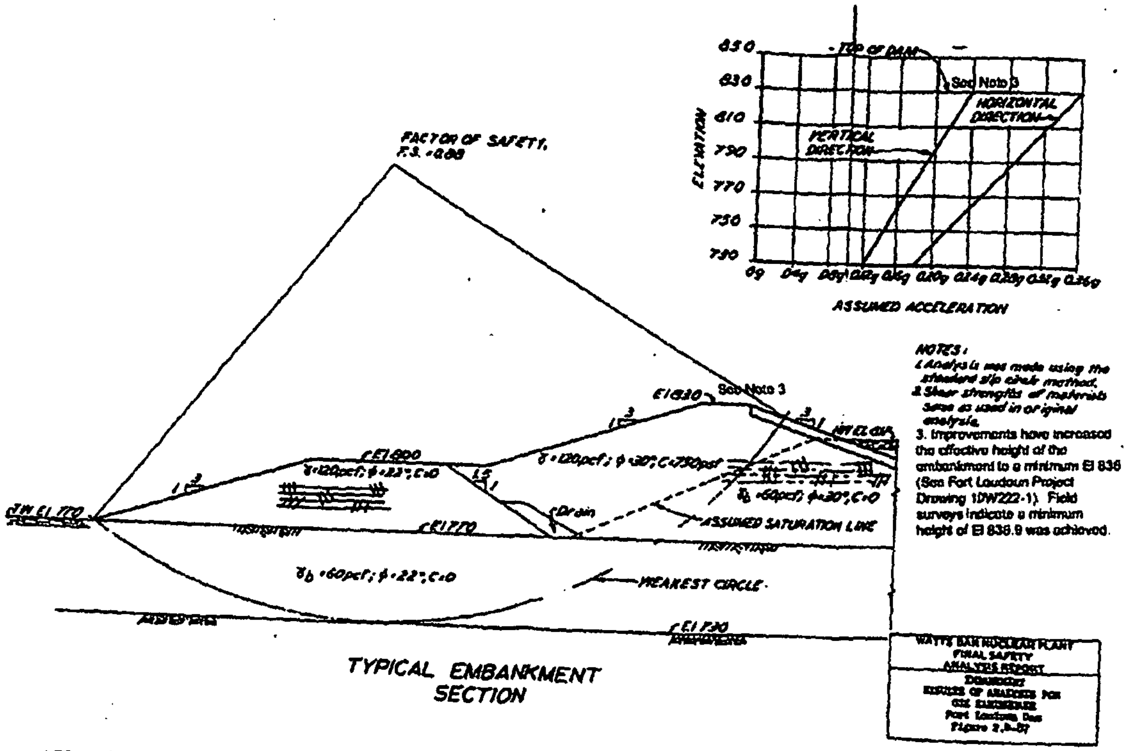


Figure 2.4-87 Embankment Results of Analysis For SSE Earthquake Fort Loudoun Dam

Security-Related Information - Withheld Under 10CFR2.390

Figure 2.4-88 Fort Loudoun Dam Assumed Condition of Dam After Failure SSE Combined With a 25 Year Flood - Fort Loudoun Dam

Security-Related Information - Withheld Under 10CFR2.390

Figure 2.4-89 Tellico Dam Assumed Condition of Dam After Failure SSE Combined With a 25 Year Flood Tellico Project

Figure 2.4-90 Norris Dam SSE + 25 Year Flood Judged Condition of Dam After Failure - Norris Dam

Security-Related Information - Withheld Under 10CFR2.390

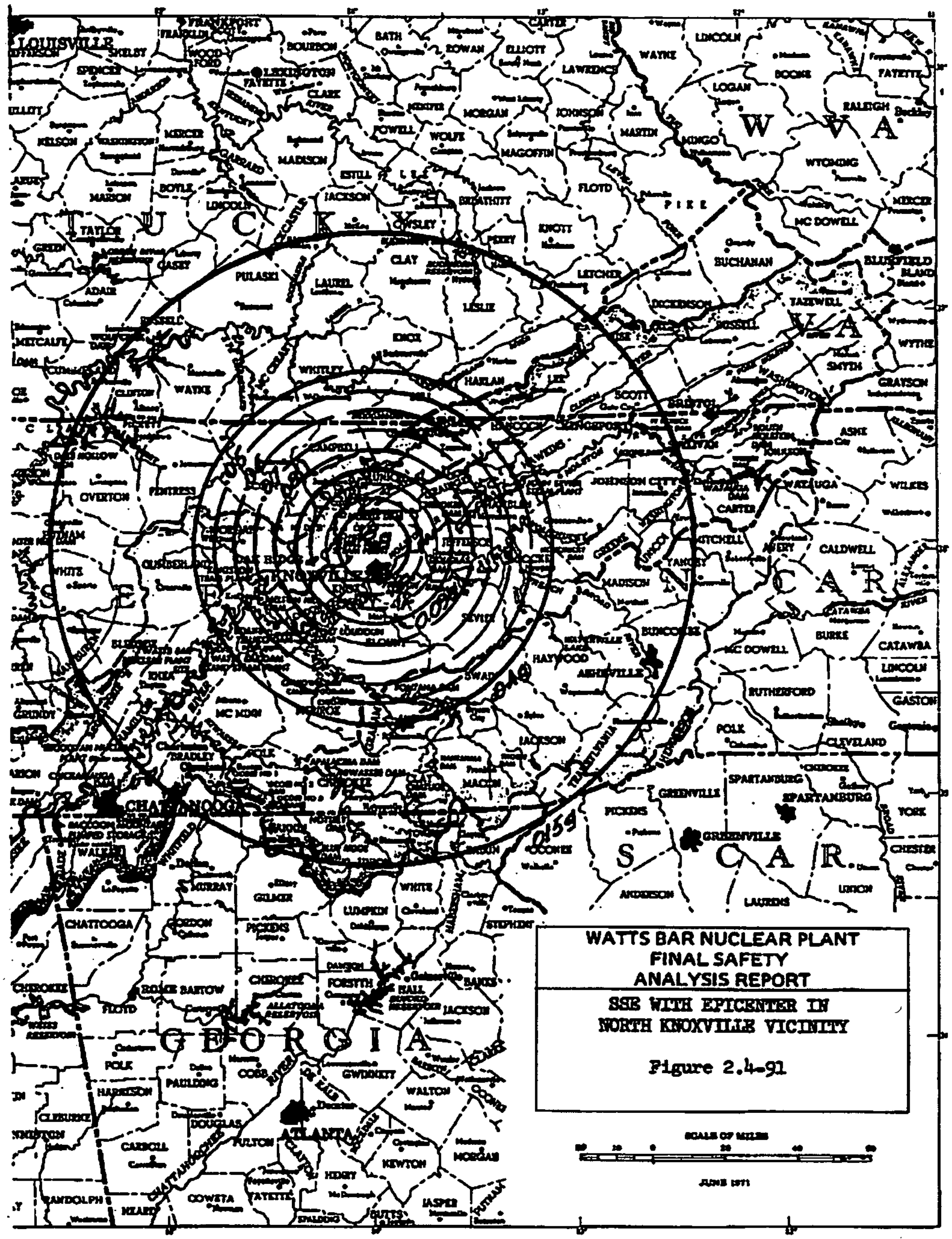


Figure 2.4-91 SSE With Epicenter In North Knoxville Vicinity

Figure 2.4-92 is Not Used

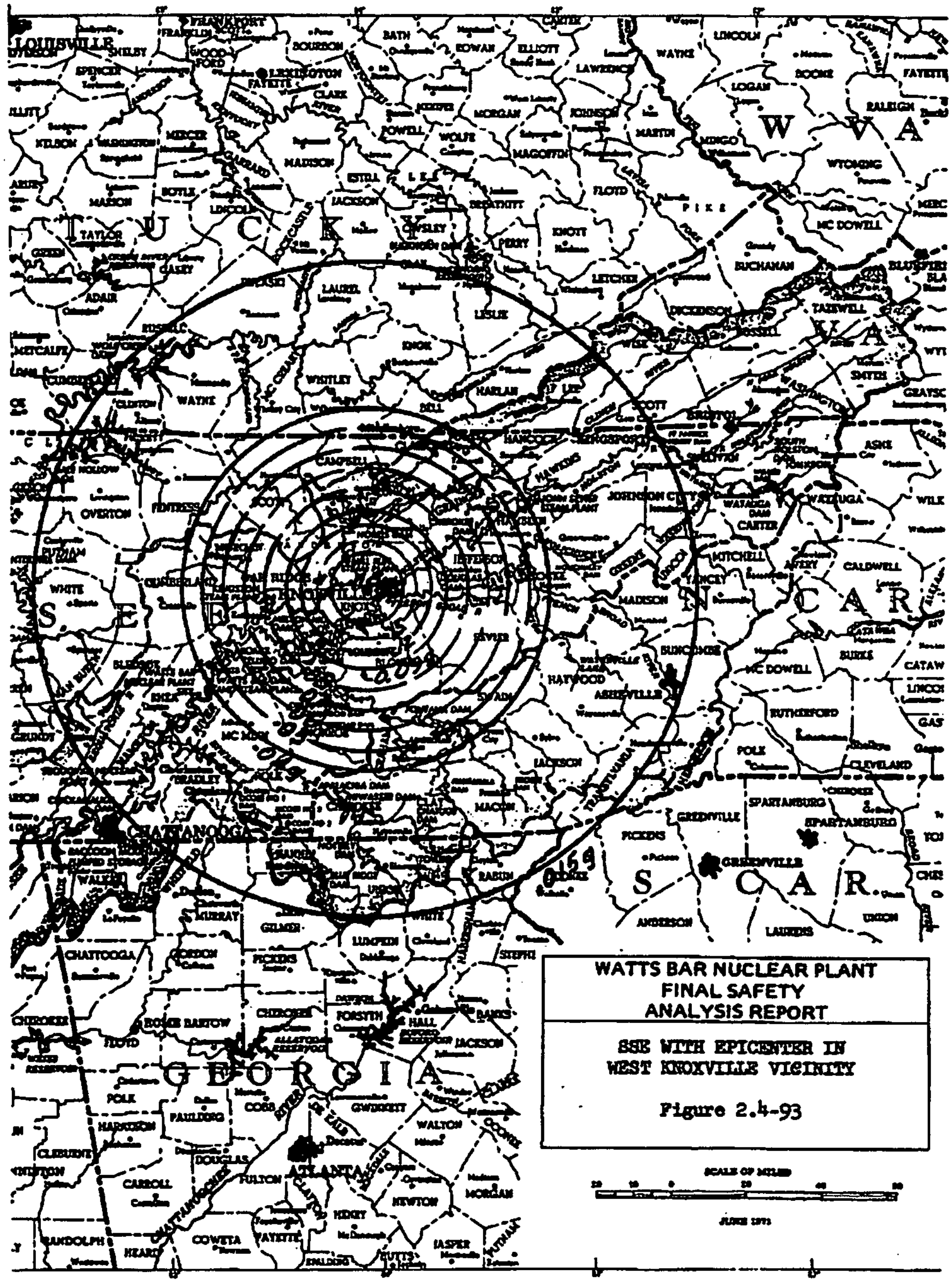


Figure 2.4-93 SSE With Epicenter In West Knoxville Vicinity

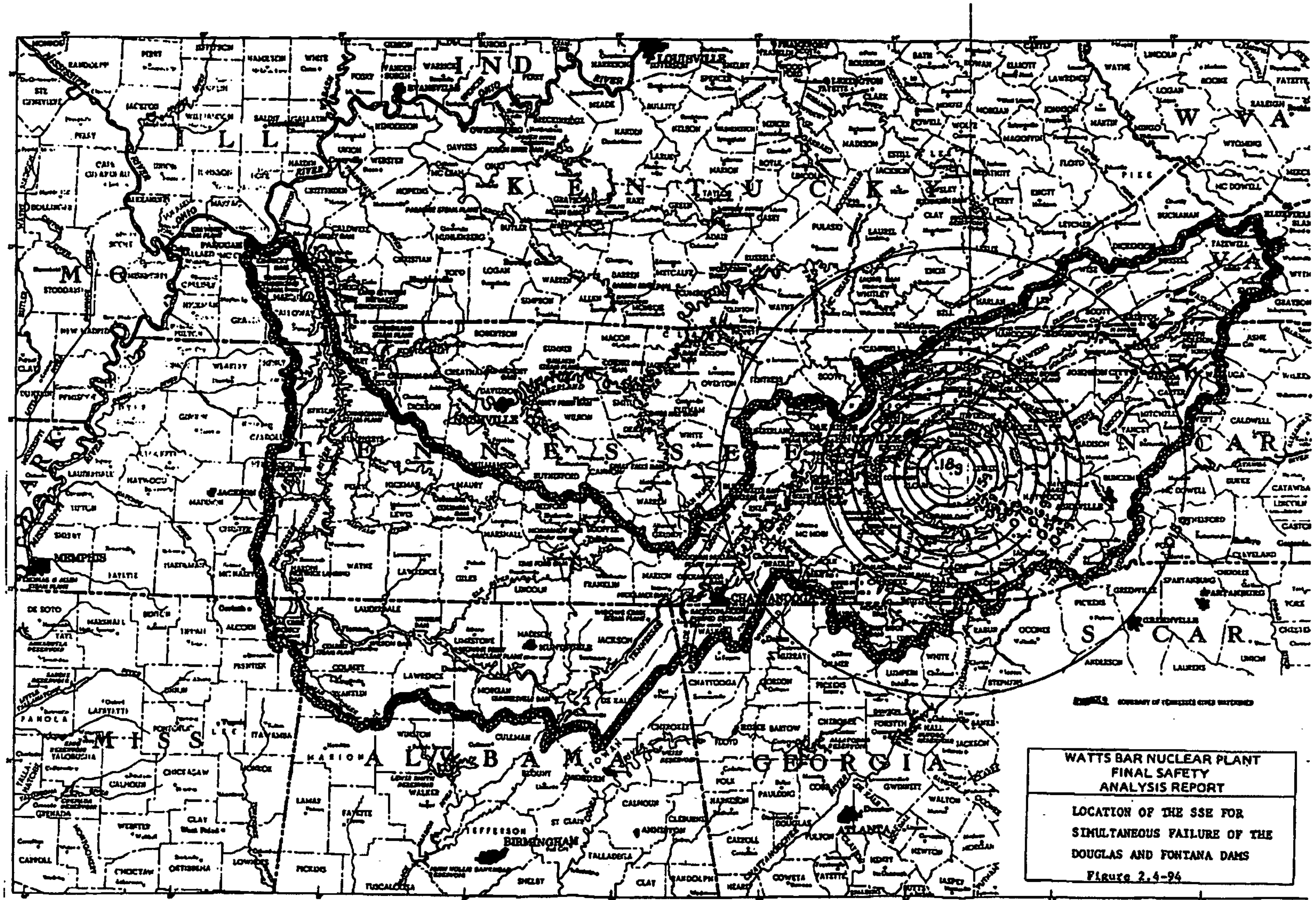


Figure 2.4-94 Location of SSE For Simultaneous Failure of The Douglas and Fontana Dams

Figures 2.4-95 through 2.4-98 Are Not Used

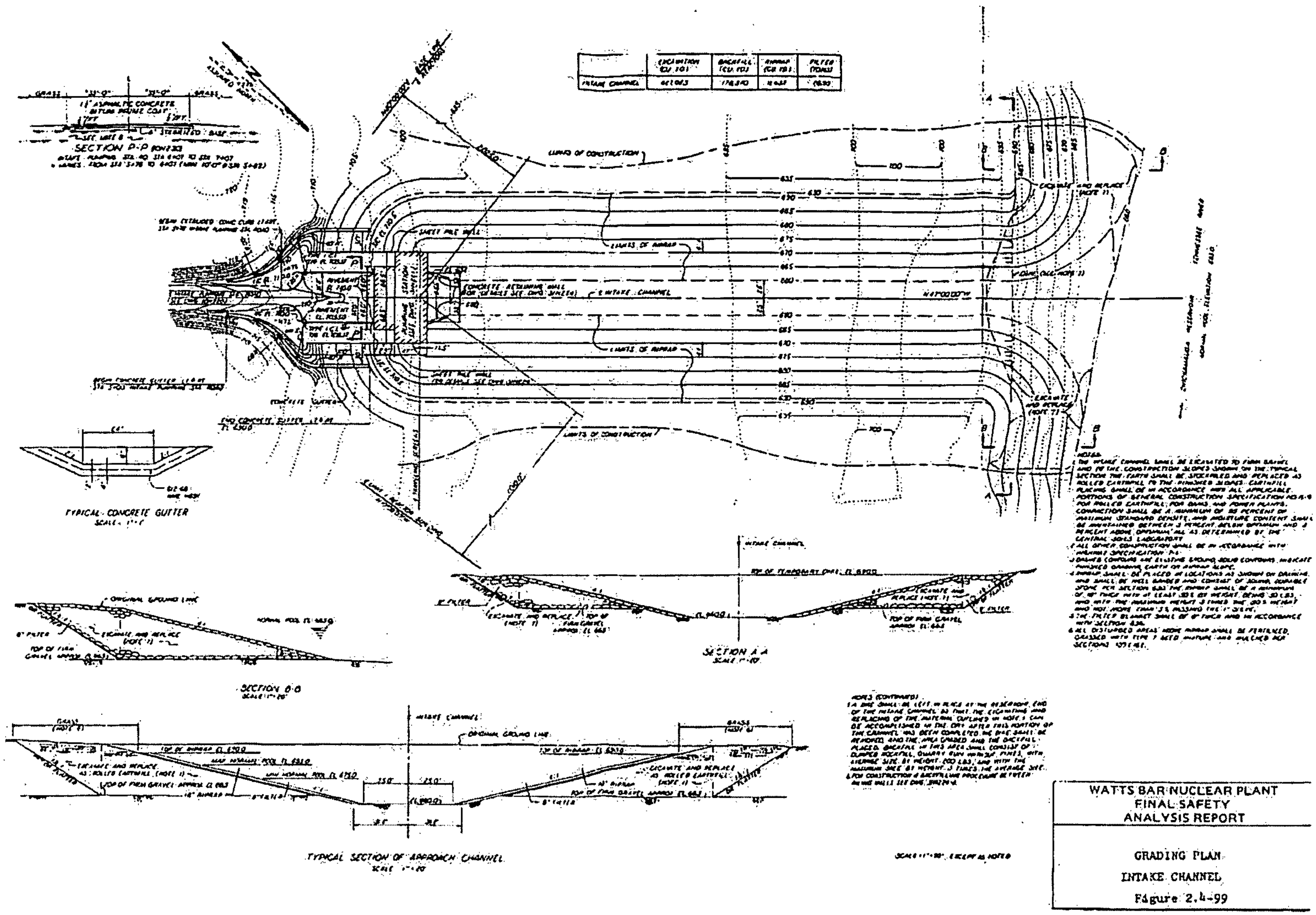
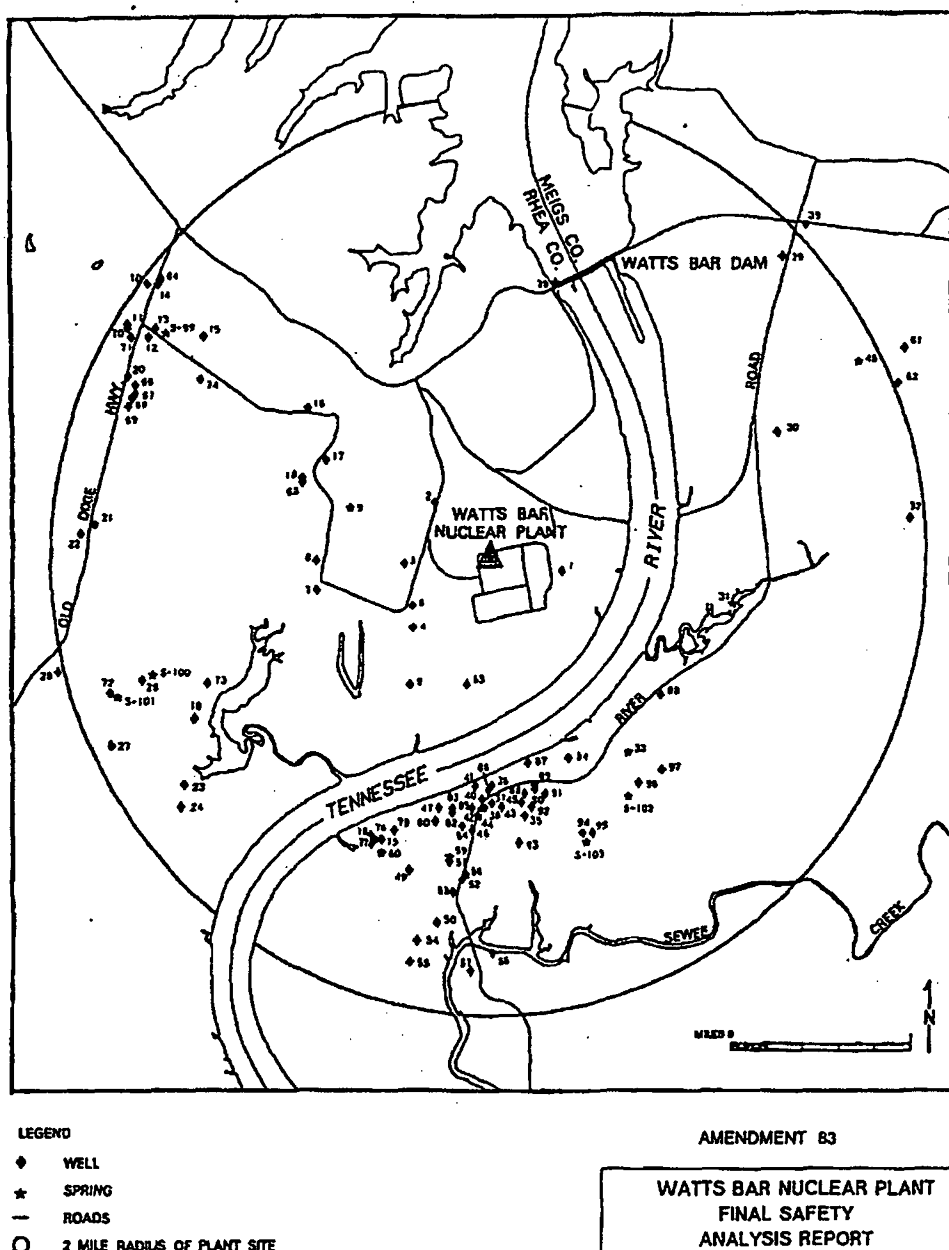


Figure 2.4-99 Grading Plan Intake Channel

Figures 2.4-100 and 2.4-101 Are Not Used



AMENDMENT 83

WATTS BAR NUCLEAR PLANT
FINAL SAFETY
ANALYSIS REPORT

WELL AND SPRING INVENTORY
WITHIN 2 MILE RADIUS OF WATTS BAR
NUCLEAR PLANT SITE
FSAR FIG 2.4-102

Figure 2.4-102 Wells And Spring Inventory Within 2-Mile Radius of Watts Bar Nuclear Plant Site

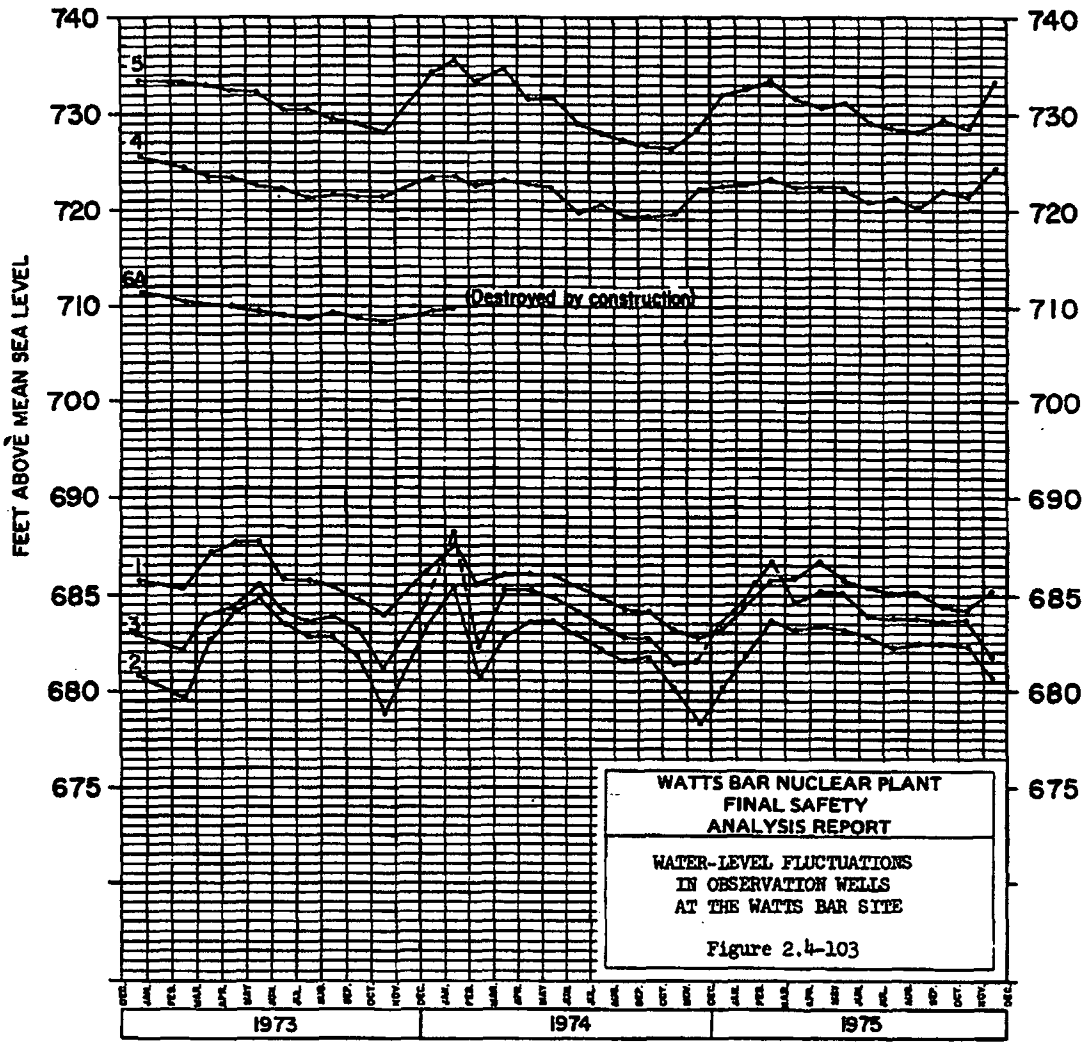
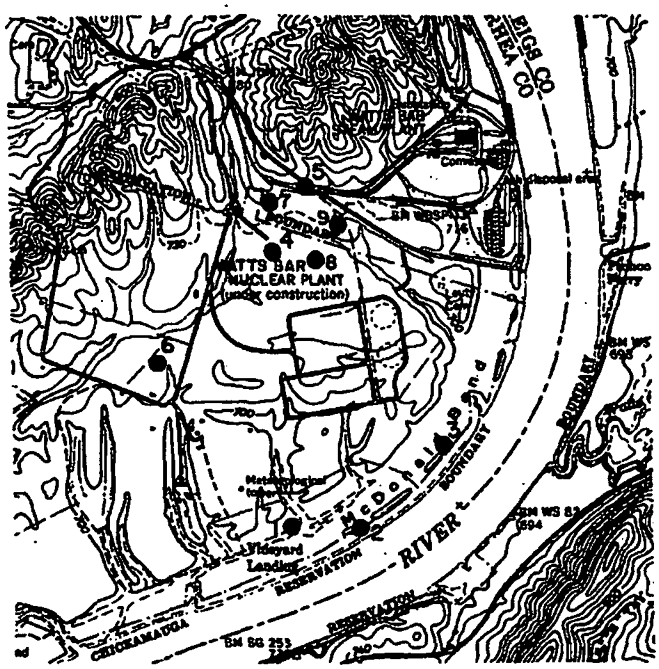


Figure 2.4-103 Water-Level Fluctuations In Observation Wells at The Watts Bar Site



NOTE:

Topographic base from U.S.G.S - T.V.A. 7.5 minute quadrangle, Decatur, Tenn., 118-SE, Contour interval 20 feet.

LEGEND:

●2 — Ground-water observation well showing number.

SCALE:

1000 0 1000 2000 Feet

Revised by Amendment 50

WATTS BAR NUCLEAR PLANT FINAL SAFETY ANALYSIS REPORT
LOCATIONS OF GROUND - WATER OBSERVATION WELLS FIGURE 2.4-104

Figure 2.4-104 Locations of Ground - Water Observation Wells

EXPLANATION:

—700— – Water table contour, in feet above mean sea level.

– General direction of ground-water movement.

SCALE:

2000 0 4000 Feet

Revised by Amendment 50

WATTS BAR NUCLEAR PLANT
FINAL SAFETY
ANALYSIS REPORT

GENERALIZED WATER-TABLE
CONTOUR MAP

Figure 2.4-105

Figure 2.4-105 Generalized Water-Table Contour Map January 1972

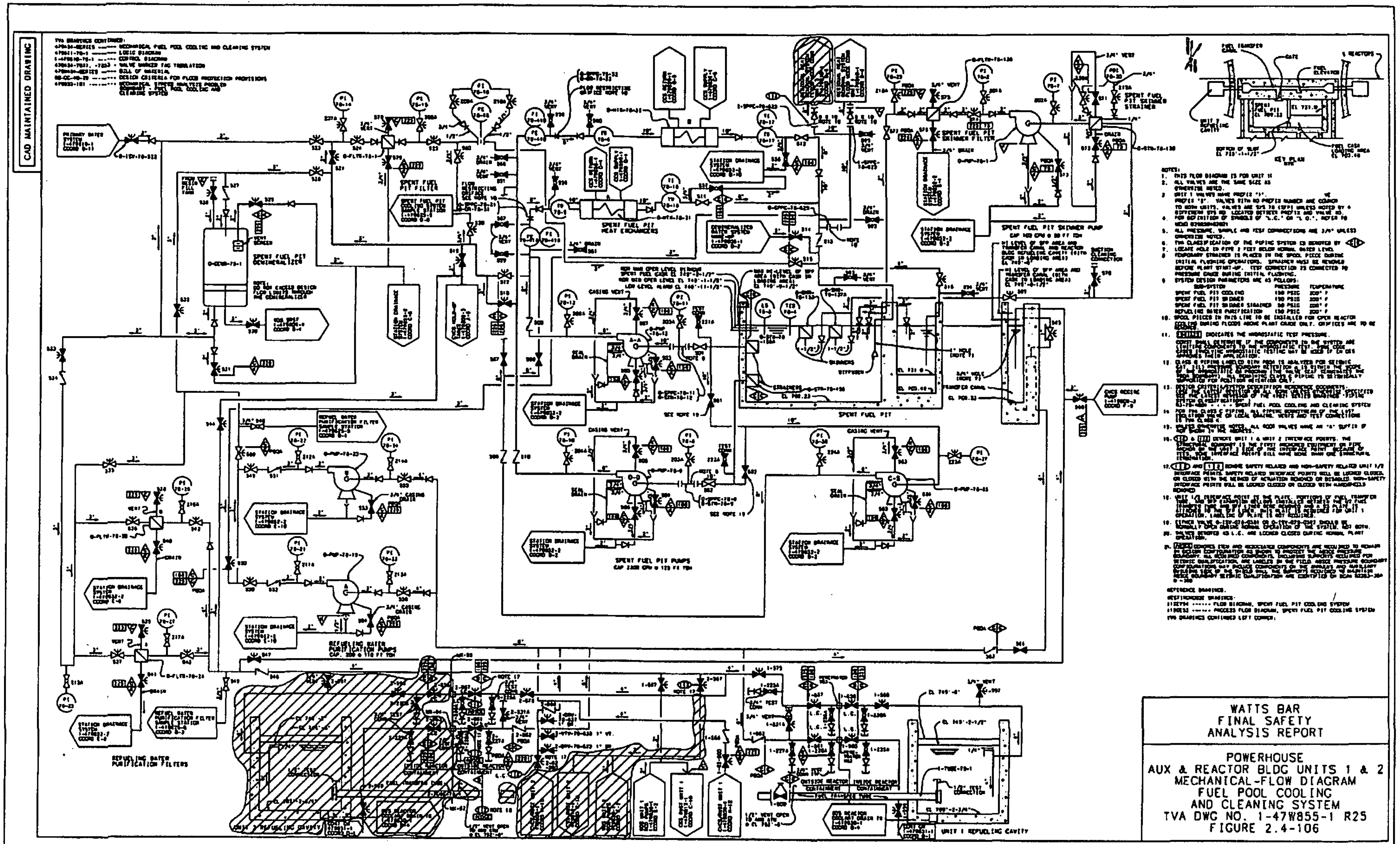


Figure 2.4-106 Mechanical - Flow Diagram Fuel Pool Cooling and Cleaning System

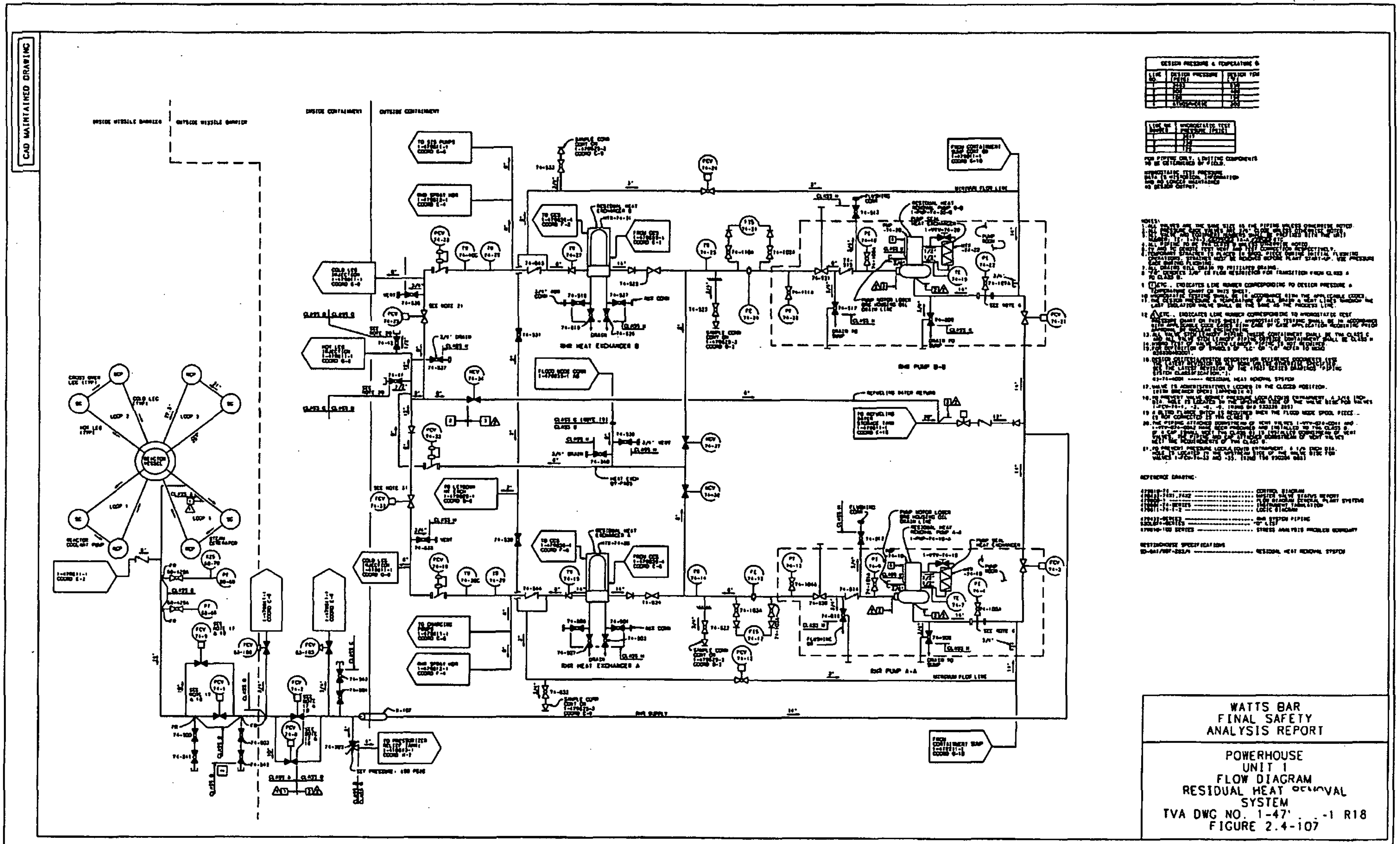
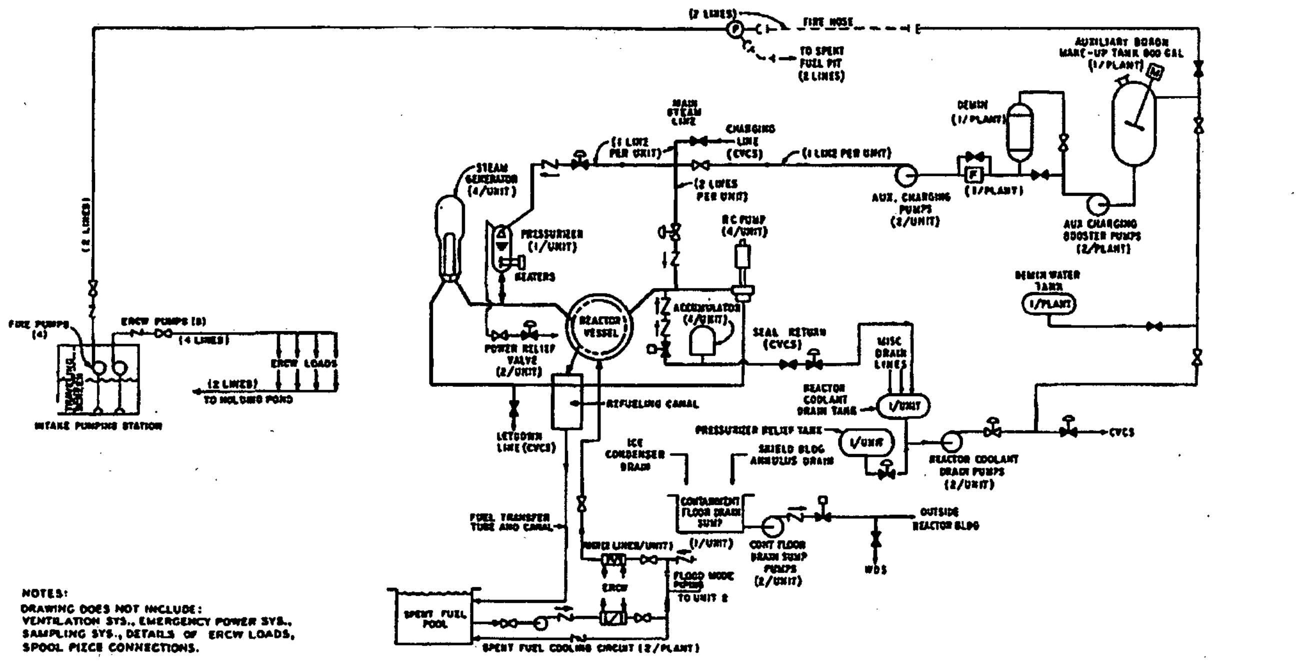


Figure 2.4-107 Powerhouse Units 1 & 2 Flow Diagram - Residual Heat Removal System



WATTS BAR NUCLEAR PLANT
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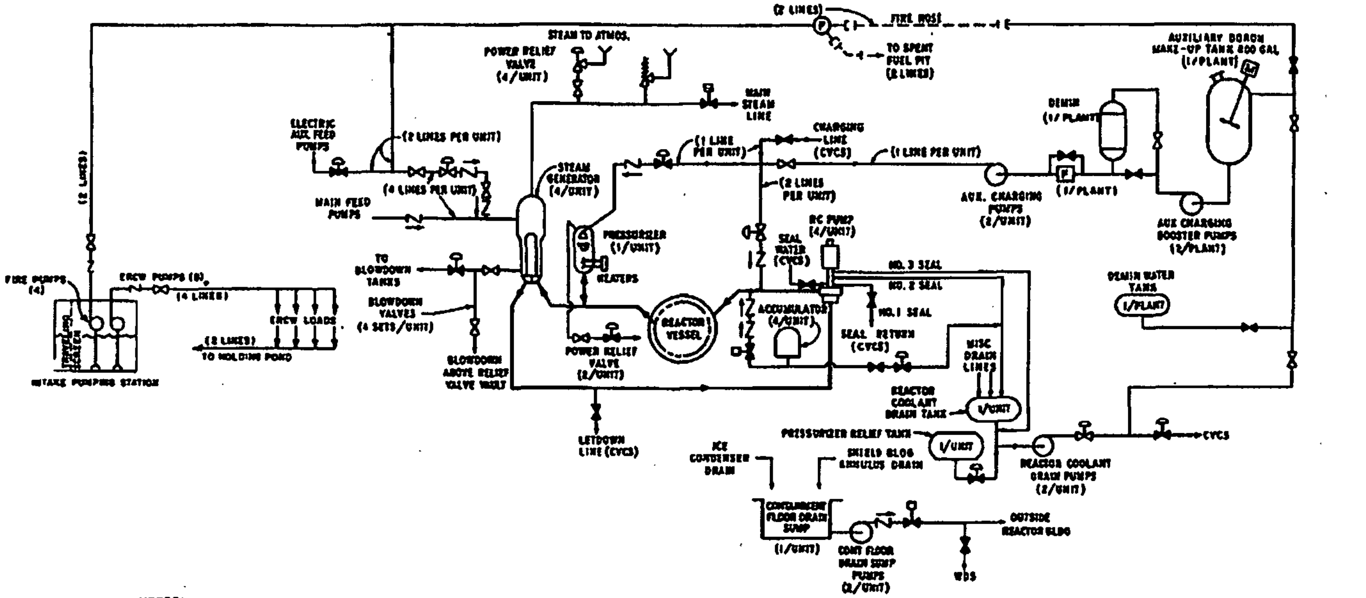
SCHEMATIC FLOW DIAGRAM
FLOOD PROTECTION PROVISIONS
OPEN REACTOR COOLING
(unit 1 shown, unit 2 similar)
Figure 2.4-108

Figure 2.4-108 Schematic Flow Diagram Flood Protection Provisions Open Reactor Cooling (Unit 1 Shown, Unit 2 Similar)



NOTES:
DRAWING DOES NOT INCLUDE:
VENTILATION SYS., EMERGENCY POWER SYS.,
SAMPLING SYS., DETAILS OF ERCW LOADS,
SPOOL PIECE CONNECTIONS.

WATTS BAR NUCLEAR PLANT
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SCHEMATIC FLOW DIAGRAM
FLOOD PROTECTION PROVISIONS
NATURAL CONVECTION COOLING
(unit 1 shown, unit 2 similar)
Figure 2.4-109

Figure 2.4-109 Schematic Flow Diagram Flood Protection Provisions Natural Convection Cooling (Unit 1 Shown, Unit 2 Similar)

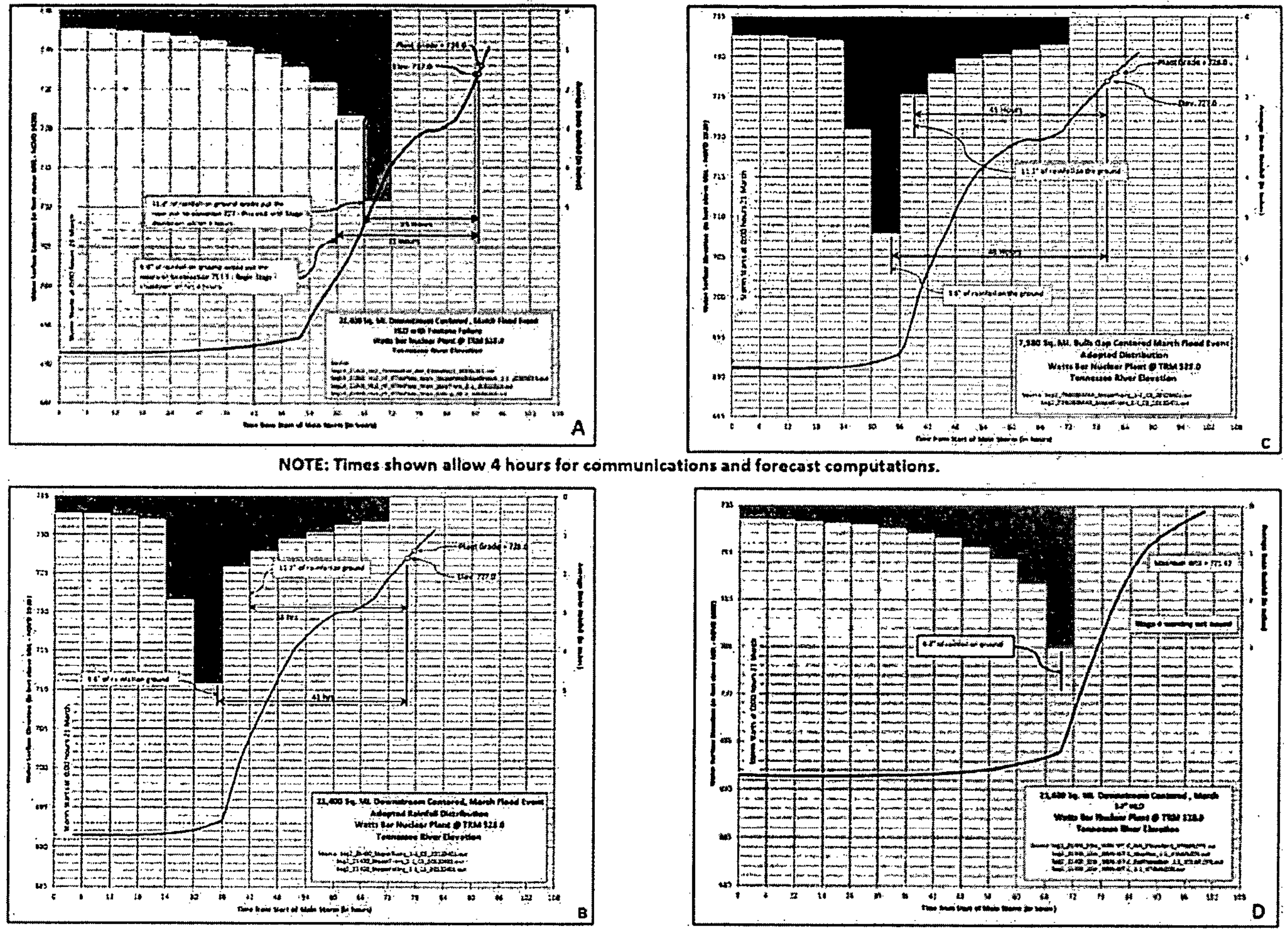
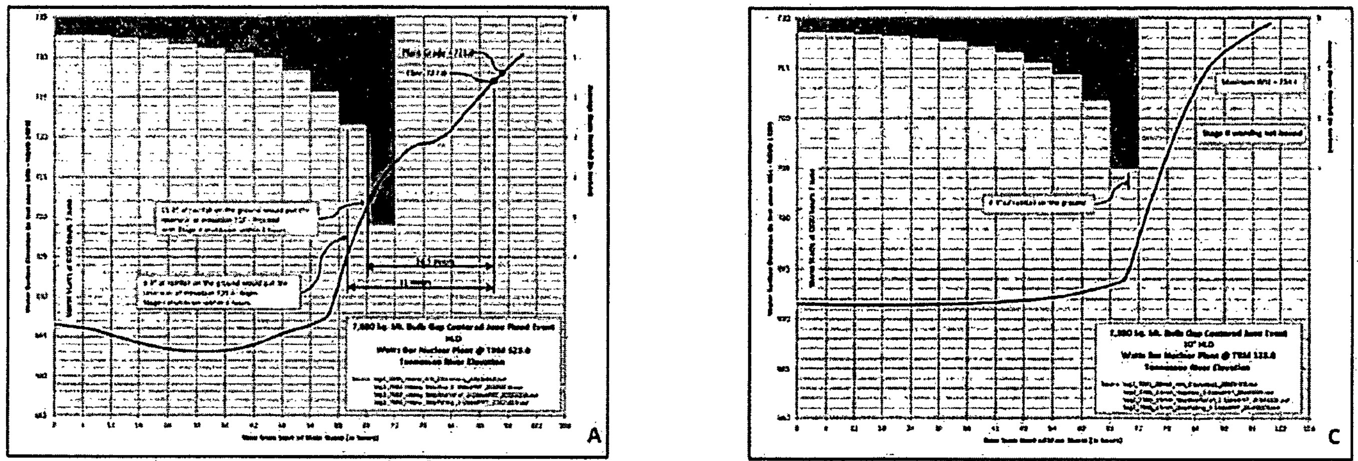


Figure 2.4-110 (Sheet 1) Watts Bar Nuclear Plant Rainfall Flood Warning Time Basis For Safe Shutdown For Plant Flooding - Winter Events



NOTE: Times shown allow 4 hours for communications and forecast computations.

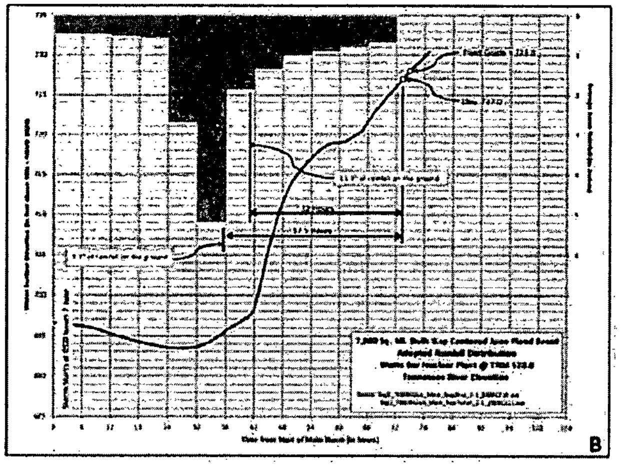


Figure 2.4-110 (Sheet 2) Watts Bar Nuclear Plant Rainfall Flood Warning Time Basis For Safe Shutdown For Plant Flooding - Summer Events

Figure 2.4-111 Is Not Used

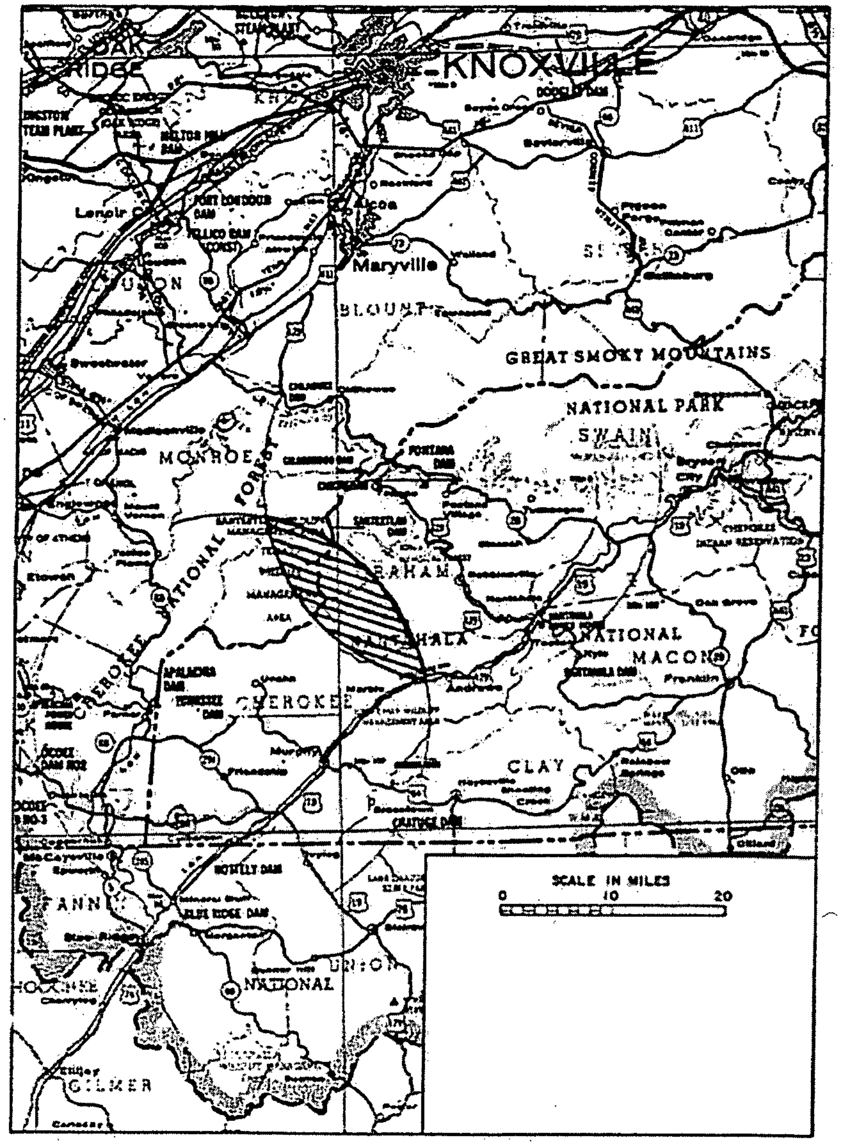


Figure 2.4-112 OBE with Epicenter Within Area Shown

Figure 2.4-113 is Not Used

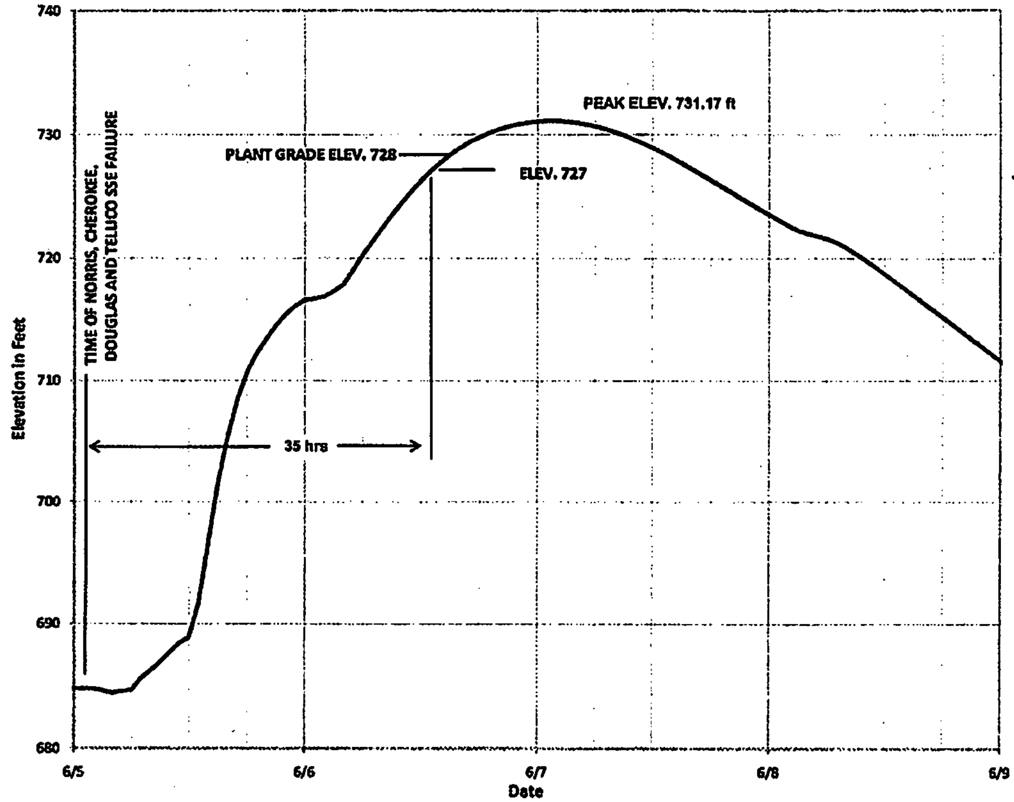


Figure 2.4-114 SSE Failure of Norris, Cherokee, Douglas, and Tellico Dams with 25-Year Flood Failure Wave at Watts Bar Nuclear Plant

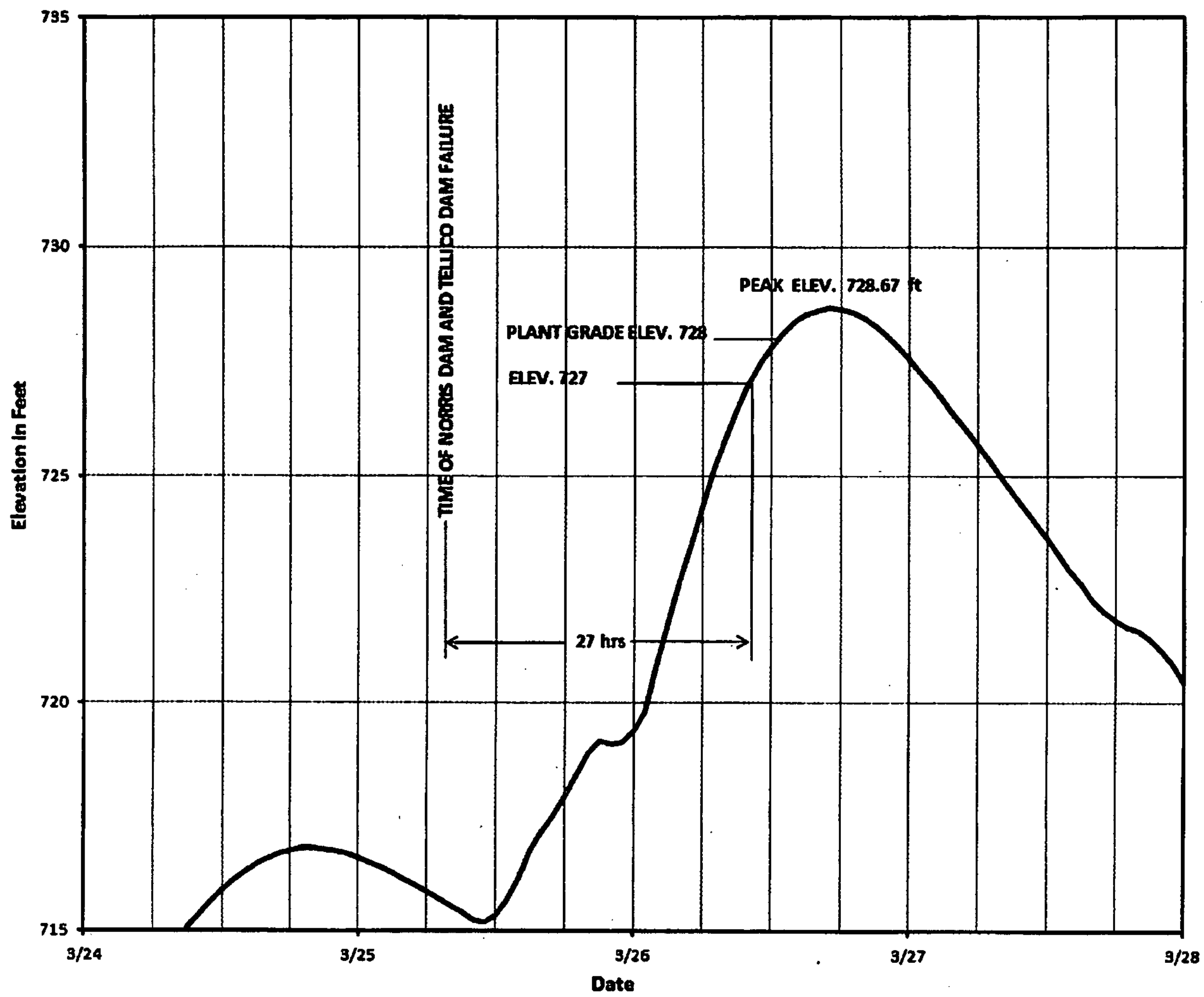


Figure 2.4-115 OBE Failure of Norris and Tellico Dams with 1/2 PMF Event Failure Wave at Watts Bar Nuclear Plant

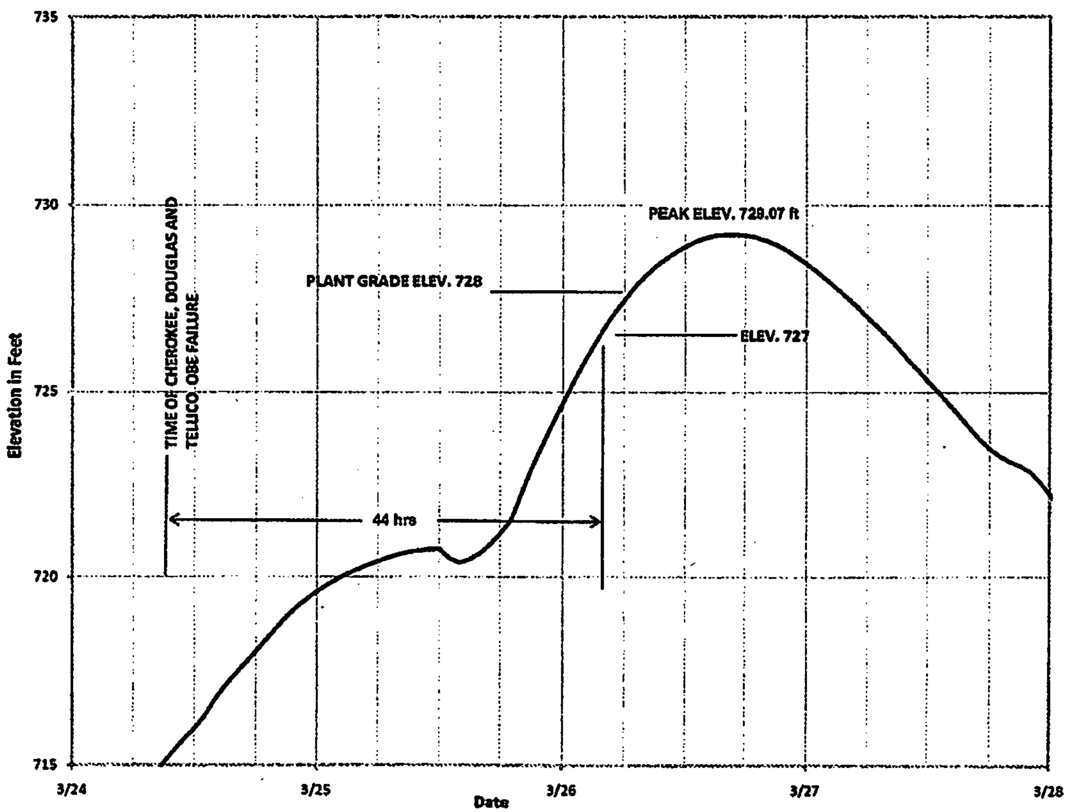


Figure 2.4-116 OBE Failure of Cherokee, Douglas and Tellico Dams with 1/2 PMF Event Failure Wave at Watts Bar Nuclear Plant

ENCLOSURE 2

EVALUATION OF ISSUES FROM PRE-APPLICATION MEETING

On March 29, 2012, a Category 1 public meeting was held between the U.S. Nuclear Regulatory Commission (NRC) and representatives of the Tennessee Valley Authority (TVA) at NRC Headquarters, One White Flint North, 11555 Rockville Pike, Rockville, Maryland. The purpose of the meeting was to discuss TVA's planned submittal of a license amendment request to revise the licensing and design basis for hydrologic engineering as described in the Watts Bar Nuclear Plant (WBN), Unit 1 Updated Final Safety Analysis Report (UFSAR).

Following this pre-application meeting, the NRC Staff published a meeting summary, "Summary of March 29, 2012, Pre-Application Meeting with Tennessee Valley Authority on Changing the Licensing Basis for Hydrologic Engineering (TAC No. ME8200)," dated April 11, 2012 (ADAMS Accession No. ML12097A306). In this letter, the NRC Staff recommended that TVA consider addressing the following issues in the submittal.

1. **The chronology and basis for the changes made to the hydrologic engineering design basis from 1995 to 1998 to 2009.**

   The probable maximum flood (PMF) for WBN Unit 1 at the time of Operating License issuance was elevation 738.1 ft, and included assumptions based on the existing understanding of dam structural stability and capability during seismic and extreme flood events in the 1970's. In the 1980's and 1990's, TVA implemented a Dam Safety Program (DSP) that resulted in dam safety modifications that increased dam structural stability and capability Between 1995 and 1998, TVA completed a hydrologic reanalysis to credit the results of the dam safety modifications that had been completed. This reanalysis resulted in lowering the WBN Unit 1 calculated PMF to elevation 734.9 ft, but no physical changes to WBN Unit 1 site flooding protection features were implemented as a result of the decreased design basis flood (DBF) elevations. In 2009, TVA completed a hydrologic reanalysis to address closure of issues involving the hydrologic analysis for the application for a combined operating license (COLA) for the proposed Bellefonte Nuclear Plant (BLN) Units 3 and 4, in accordance with 10 CFR 52. This reanalysis resulted in raising the WBN Unit 1 calculated PMF to elevation 738.8 ft. Although this was higher than the original and earlier revised PMF, no physical changes to WBN Unit 1 site flooding protection features were required. This is described in Section 1.0 of Enclosure 1, Summary Description.

2. **An update of the status of TVA's resolution of long-term hydrology issues, per the staffs request in the NRC letter dated January 25, 2012.**

   On May 31, 2012, a Category 1 public meeting was held between the NRC staff and representatives of the TVA at NRC Headquarters, Two White Flint North, 11545 Rockville Pike, Rockville, Maryland. The purpose of the meeting was to discuss (1) the current licensing basis for flooding at WBN Unit 1 and Sequoyah Nuclear Plant, Units 1 and 2 (SON), (2) the status of TVA's current licensing basis reanalysis, (3) flood protection and flood mode operation at WBN and SON, (4) modular flood barriers at TVA dams, and (5) TVA's flooding reevaluation plan regarding the NRC's Fukushima 50.54(f) letter dated March 12, 2012.

   Following this senior management meeting, the NRC Staff published a meeting summary, "Summary of May 31, 2012, Senior Management Meeting with Tennessee Valley Authority on the Licensing Basis for Flooding/Hydrology," dated June 6, 2012 (ADAMS Accession No. ML12157A457). The TVA slide presentation is provided in ADAMS Accession No.

ML12156A076. In the meeting summary, the NRC Staff acknowledged the following related to the status of TVA's resolution of long-term hydrology issues:

a. TVA discussed the challenges faced with the complexities of the revised hydrology modeling used for the licensing basis re-analysis, and TVA acknowledged the lack of timeliness in resolving the flooding issue.

b. TVA discussed the management commitment for regaining safety margin for flooding and updating the current licensing basis through a high quality analysis, ensuring plant operability, and improved timeliness.

c. TVA answered questions from the NRC Staff based on TVA's slide presentation with support from the TVA staff present, noting that, based on their draft re-analysis results, the PMF level at the WBN site will raise an additional 0.4 feet to 739.2 feet. At that level, some safety-related flood mitigation equipment will be flooded without compensatory measures. TVA stated that their current operability determinations will be reevaluated once the re-analysis is completed. These operability determinations have now been completed and appropriate actions have been taken in accordance with established corrective action program requirements.

d. TVA made a number of commitments at the end of the presentation. These commitments have now been formalized in the TVA Submittal to NRC Document Control Desk, "Commitments Related to Updated Hydrologic Analysis Results for Sequoyah Nuclear Plant, Units 1 and 2, and Watts Bar Nuclear Plant, Unit 1," dated June 13, 2012 (ADAMS Accession No. ML12171A053).

Therefore, the NRC Staff including senior management has been provided an updated status based on the TVA presentation, responses provided by TVA during the presentation, and the commitments provided by TVA regarding future actions to complete the hydrologic analysis and applicable permanent plant and dam embankment modifications. With the exception of implementing the commitments provided to the NRC, there are no other actions required for this issue for WBN Unit 1.

3. The relationship and use of the 25-year flood level versus the May 2003 flood level in TVA's new analysis.

As described in the second paragraph of Section 3.2 of Enclosure 1, Uncertainties, per NUREG/CR-7046 the only manner to address the uncertainty in the hydrologic analysis is through calibration of the model to historic flood events or sensitivity analyses. TVA calibrated the model to historic flood events using the two highest recent flood events where data exists. The floods used for calibration are March 1973 and May 2003 with elevations at WBN of approximately 697 ft and 694 ft for those two storms. The May 2003 flood event was a much larger flood than the 25-year flood. The May 2003 flood reached a maximum elevation of 657.2 feet on May 8, 2003 on the Tennessee River at the Walnut Street gage at Tennessee River Mile (TRM) 464.2. This compares with the March 1973 flood, the maximum flood of record since regulation by the TVA system, which reached a maximum elevation of 658.06 feet on March 18, 1973. Based on the flood frequency elevations at the Walnut Street gage the May 2003 flood was about a 100-year event as shown in the tabulation below.

The flood frequency elevations at the Walnut Street gage TRM 464.2 are as follows:

Flood	Elevation (ft.)[1]
1-year	644.0
2-year	649.2
5-year	650.6
10-year	653.4
50-year	655.9
100-year	657.0
500-year	663.6

[1] National Geodetic Vertical Datum (NGVD) 1929

Based on review of observed elevations at key locations in the vicinity of WBN, the May 2003 flood event was about a 100-year event over the reach of interest with May 2003 maximum elevations exceeding flood of record elevations at some locations. A comparison of the maximum elevations reached during the May 2003 flood at key locations is shown in the tabulation below.

Location	Maximum Elevation (ft.) NGVD 1929	
	Flood of Record	May 2003
Chickamauga Dam Headwater	686.99 5/9/84	687.13 5/7/2003
Watts Bar Dam Tailwater	696.95 3/17/1973	694.17 5/7/2003

Using the calibrated model based upon the two highest recent flood events where data exists (i.e., March 1973 and May 2003), the 25-year flood event specified in RG 1.59 was used for application with the postulated Safe Shutdown Earthquake (SSE) failure of upstream dams as described in Section 2.1 of Enclosure 1, Proposed Changes, under the subheading Section 2.4.4, Potential Dam Failures, Seismically Induced. The 25-year flood magnitude was developed using flood volume frequency relationships. The inflow hydrographs were developed using the March 1973 flood, the flood of record, and a large regional flood, scaled by the ratio of the 25-year volume to the 1973 volume. This provides an estimate of the 25-year flood based on historical watershed experience.

4. The justification for the proposed combinations of dam failure scenarios used in TVA's new analysis.

The methodology used to develop the controlling seismic/flood condition at WBN is the same as previously followed for the site evaluations described in the WBN Unit 1 UFSAR as follows:

1. A ground motion attenuation function was generated to describe the peak horizontal acceleration of rock at the free surface versus distance from the epicenter.

2. Using the attenuation relationship, the seismic base accelerations for various dams having large stored inventory (reservoir storage) and low spatial separation were determined.

3. The seismic stability of the dams for the seismic event centered at the dam (maximum base acceleration) and seismic events which cause dam failures at adjacent dams (less than maximum base acceleration) were then determined.

4. Based on the predicted seismic stability of the dams (individually and in combination) and reservoir storage, the potential seismic failure/flooding combinations were screened to identify the controlling case for WBN.

5. Hydrological routing for the potential controlling cases was then performed.

The ground motion attenuation functions to permit evaluation of simultaneous failure of two or more dams were based on the attenuation characteristics of an Operating Basis Earthquake (OBE) and a SSE occurring in the geographic area encompassing the Tennessee Valley above Guntersville dam. Utilizing historical earthquake data from locations near the Tennessee Valley, an attenuation curve was developed. Using this OBE/SSE relationship, a representation of the earthquake was developed in the form of concentric circles radiating from a center 0.09g (OBE) or 0.18g (SSE) acceleration with each circle representing decreasing levels of base acceleration as the distance from the epicenter increased. The concentric circles centered at an acceleration of 0.09g/0.18g were then strategically moved around the dams above Guntersville Dam to determine potential multi-site critical base acceleration levels.

The dams above Guntersville were examined for seismic stability based on base acceleration level. During the period from 1970 to 1988, the initial seismic stability analyses were performed on the concrete dam sections and the earth embankments of critical dams. In this evaluation, some of the concrete dams such as Apalachia, Fort Patrick Henry, Melton Hill and Ocoee No. 3 were not analyzed due to their relatively small storage volume and were postulated to fail. In other cases, more detailed seismic evaluations were performed, such as at Norris Dam. The more detailed evaluation of Norris dam concluded that the dam would not fail in OBE (coincident with one-half PMF) or SSE (coincident with 25-year flood). However, for purposes of the seismic failure combinations Norris dam was conservatively postulated to fail with only the resulting debris field impeding flow.

Using the dam base accelerations and seismic stability evaluations (or failure assumptions) as screening criteria, various flood-seismic failure combinations were identified. Cases to be evaluated further were selected based on the potential reservoir flood volume released in seismic failures, the relative timing of those releases, and in some cases results of previous flood routing analysis.

The impact of multiple failures of the large reservoir dams identified in the screening evaluations bound the effects of a single dam failure. Thus, single dam failures were not further evaluated.

Using the earthquake attenuation function, the seismic stability determinations, reservoir volume, flood wave timing, and informal routing methods, the following cases were defined as having the potential to control at WBN for OBE coincident with one-half PMF:

1. Simultaneous failure of Norris and Tellico Dams: Melton Hill Dam located below Norris Dam is not failed with the OBE in this scenario to maximize the downstream impact of

the seismic failure wave from Norris Dam that overtops and fails Melton Hill Dam which is judged to be more critical.

2. Simultaneous partial failure of Fontana Dam and complete failure of Hiwassee, Apalachia, Blue Ridge, and Tellico Dams due to an OBE at a location between Hiwassee and Fontana: Fort Loudoun and Watts Bar Dams are seismically stable at OBE base accelerations for this epicenter.

3. Simultaneous partial failure of Fontana Dam and complete failure of Tellico Dam: Fort Loudoun and Watts Bar Dams are seismically stable at base OBE accelerations.

At least three other failure combinations evaluated in the original WBN Unit 1 UFSAR studies and judged not to be controlling were not re-evaluated as a part of the new analysis since they were not controlling in the original analysis.

The following failure combinations for the SSE coincident with the 25-year flood were defined as having the potential to control at WBN using the evaluation criteria:

1. Simultaneous failure of Norris, Cherokee, Douglas and Tellico Dams with SSE epicenter located in the North Knoxville vicinity: For this combination, Fort Loudoun, Watts Bar and Fontana Dams do not fail since the attenuated base acceleration at these dams is less than the base acceleration for which the dams are seismically stable. Melton Hill Dam is not failed seismically to maximize the downstream impact by allowing Melton Hill Dam to overtop and fail due to the Norris Dam failure wave.

2. Simultaneous failure of Norris, Douglas, Fort Loudoun and Tellico Dams: For this combination, Cherokee, Fontana and Watts Bar Dams do not fail since the attenuated base acceleration at these dams is less than the base acceleration for which the dams are seismically stable. Melton Hill Dam is not failed seismically to maximize the downstream impact by allowing Melton Hill to overtop and fail due to the Norris Dam failure wave.

At least seven other failure combinations evaluated in the original WBN Unit 1 UFSAR studies and judged not to be controlling were not re-evaluated as a part of the new analysis.

Flood simulations for the five failure combinations described above were performed to define the maximum bounding elevation at WBN. This is further described in Section 2.1 of Enclosure 1, Proposed Changes, under the subheading Section 2.4.4, Potential Dam Failures, Seismically Induced.

5. The purpose of the finite element analysis on the Fontana Dam.

As part of TVA's DSP and consistent with the Federal Guidelines for Dam Safety, TVA performed a review of Fontana Dam in the mid-1980s to determine if the dam was capable of withstanding a maximum credible earthquake (MCE) (Reference: Fontana Project Dam Safety Analysis Report, April 1986). The evaluation determined that Fontana Dam was capable of safely passing the PMF but the dam's ability to withstand earthquake loading was not assured. As a result of this finite element analysis, reinforcement of the upper portion of the non-overflow dam was recommended and subsequently implemented to ensure the dam would remain stable for the MCE.

Since this original finite element analysis did not consider the alkali aggregate reaction (AAR) expansion issues at Fontana Dam, additional analysis were performed to evaluate the seismic/hydrostatic stability of the dam and the impacts of stresses associated with AAR expansion in the dam structure.

Patterned cracking was first observed in the dam in 1949. Also, it was noted that the dam was beginning to tilt in the upstream direction at that time. In 1972, cracking was observed in the walls of the drainage gallery in the curved concrete blocks of dam. A six-inch wide slot with a depth of about 95 feet was cut between November 1975 and July 1976 at the joint of Blocks 32/33 to relieve some of the stress. The slot had completely closed at the top of dam by October 1983. The top third (35 feet) of this slot required re-cutting to a width of five inches between October 1983 and January 1984. Slot closure measurements indicated that the slot closed gradually over time and require re-cutting in the next several years. The third slot cutting to a width of six inches was performed between February - May 1999 and January – May 2000.

Clearance problems were first detected in the spillway gates of the main spillway in 1967. Pier tilting due to concrete growth was causing binding of the gates when they were being opened. The gates were trimmed four times between 1967 and 1989. In the late 1990's, it was concluded that slot cuts on each end of the spillway would help reduce the tilting of the end piers of the spillway. Two slots with same width of about 0.6 inches, and the depths of 82 and 57 feet at joint Blocks 34/35 and 41/42 respectively, were cut in January 1999. In November 1999, re-cutting of the spillway slots was undertaken. However, slots 34/35 and 41/42 had closed during the summer season at the top of the slot by 2001.

In summary, three slots have been cut in Fontana Dam (Blocks 32/33, Blocks 34/35, and Blocks 41/42) to address problems associated with AAR. The first slot was cut at Blocks 32/33 in 1975. The slot was required to eliminate the longitudinal force from the long straight portion of dam. The longitudinal force was tending to push the curved blocks upstream, thus creating the observed cracks. The two spillway slots located at each end of the spillway (Blocks 34/35 and Blocks 41/42) were installed to help control tilting of piers into the spillway.

A finite element analysis was used to evaluate the existing slots in either open or closed condition, the effects of cutting deeper slots, the effects of cutting additional slots, and to provide recommendations for long-term slot cutting strategy for best management of the Fontana Dam AAR problem. An August 2006 seismic/hydrostatic stability analysis performed by Acres International which considered the combined impacts of stresses associated with AAR expansion of the dam structure concluded that although the minimum sliding factor of safety is less than 1.0 for the critical section (FS = 0.814) when subjected to a sustained acceleration of 0.26g, the post-earthquake stability of the dam is acceptable.

6. **Discuss whether approvals for the dam and river operations modifications are required from other agencies (e.g., U.S. Army Corps of Engineers).**

TVA was created as a Federal agency by the Tennessee Valley Authority Act of 1933 with specific responsibilities for the unified development of the Tennessee River system. Approval is not required from other agencies for TVA's modifications to its dam and river system operations. However, modifications must be consistent with procedures set forth by

the National Environmental Policy Act (NEPA), which are the same requirement for all federal agencies.

As a procedural act, NEPA calls for Federal agencies to make informed decisions, consider alternatives, to have decision-making processes that consider the environmental impacts of their proposed actions, and requires full disclosure of the process as applied. The level of environmental review required for a given action depends on the expected impact on the environment and/or when the proposed action is likely to be controversial.

The most recent environmental reviews that effected modification of the TVA river system were completed as Environmental Impact Statements (EIS) as follows:

1. Tennessee River and Reservoir System Operation and Planning Review, TVA, December 1990. Record of Decision issued February 1991.

2. Reservoir Operations Study, TVA, February 2004. Record of Decision issued May 2004. The U.S. Army Corps of Engineers (USACE) and U.S. Fish and Wildlife Service were cooperating agencies on this EIS.

As a part of the NEPA process, other Federal agencies and the public are invited to participate in the process. Consistent with the NEPA process, the final decision on any action to be taken as a result of the environmental review rests with the initiating Federal agency. In the case of all reviews that have potential impact on modification of Tennessee River system operation, TVA makes the final decision on what actions are adopted for implementation.

The Act further gave TVA the power to construct dams and reservoirs on the Tennessee River and its tributaries to provide for navigation and control floods on the Tennessee and Mississippi River basins. To date, TVA has either acquired or constructed 49 dams located in seven different states as a part of the unified development of the region. The power given to TVA for construction of dams and reservoirs in the Tennessee River basin is much like the authority given to the USACE on other river systems.

TVA has had a DSP since the first dams were acquired and/or built. Dam safety ensures that the impoundments and dams are designed, constructed, operated and maintained as safely and reliable as is practical. The DSP was formalized in 1982 to ensure consistency with the Federal Guidelines for Dam Safety which was issued in 1979. The guidelines apply to management practices for dam safety of all Federal agencies responsible for the planning, design, construction, operation, or regulation of dams. Today, the Dam Safety Governance (DSG) procedures define TVA's dam safety responsibilities to ensure compliance with the Federal guidelines.

Since the DSP was formalized in 1982, TVA has systematically evaluated all of its dams for hydrologic and seismic adequacy which has resulted in several dams being physically modified. These modifications and operational changes as described above have been completed consistent with NEPA procedures.

The one location on the TVA system where an operational change would require the concurrence of the USACE is at Kentucky Dam. Kentucky Dam, located about 23.0 miles above the confluence of the Tennessee River with the Ohio River, is connected by a

navigation canal located just above each dam to Barkley Reservoir, owned by the USACE. Thus, the Kentucky and Barkley Dams have to be operated in tandem. Further, the USACE has the authority to direct the operation of Kentucky reservoir during critical flood operations on the lower Ohio and Mississippi Rivers. The physical location and the large flood storage available allows Kentucky reservoir to provide significant flood reduction benefits on the lower Ohio and Mississippi Rivers.

There have been no operational changes proposed at Kentucky Dam that would require TVA to obtain concurrence from the USACE.

7. **Discuss the overall uncertainties in TVA's revised analysis calculations.**

The primary standards followed for development of the PMF are the American National Standard ANSI/ANS 2.8 and RG 1.59. These guidance documents state that the PMF be derived from the combination of circumstances that collectively represent a risk probability that is acceptable for nuclear plant accidents. Each element in the development of the PMF is based on best available data including PMP estimates from the National Weather Service, rain-runoff relationships developed from historical storms, time distribution of PMP consistent with storms in the region, seasonal and areal considerations of rainfall, current reservoir operations, and verification of runoff and stream course models against large historic floods. Per regulatory guidance, the design-basis flood for nuclear power plants is an estimation. The calculations which support the PMF analysis document all assumptions and approaches which are consistent with regulatory guidance. The PMF analysis is a best estimate and is consistent with current guidelines. However, it is realized that various elements of the analysis can result in different elevations, some higher and some lower, and those elements are discussed in further detail in Section 3.2 of Enclosure 1, Uncertainties, in order to explain why the PMF analysis is a reasonable best estimate.

8. **Justification for the use of any compensatory measures as a result of TVA's revised analysis.**

The updated DBF analysis for WBN indicated that some upstream dam earth embankments could be overtopped during the PMF. Four dams were identified as having embankments that could be overtopped during the PMF: Cherokee; Fort Loudoun; Tellico; and Watts Bar. Once these earth embankment overtopping events were identified, actions were taken to prevent overtopping to ensure continued WBN operability. An evaluation of temporary flood barriers that could be installed in a short period of time and had a proven performance record for dependability led to the use of HESCO Concertainer units filled with stone. A total of approximately 18,000 feet of temporary flood barriers are installed at Cherokee, Fort Loudoun, Tellico and Watts Bar Dams. This installation was completed by the end of December 2009. The temporary flood barriers are located on the top of the earth embankments and/or on saddle dams as appropriate at each of the four dams. The temporary flood barrier configuration consists of HESCO Concertainer units from three feet in height to HESCO Concertainer units stacked based on manufacture recommendation up to seven feet.

The maintenance of the temporary flood barriers and closure of openings during emergency events is a River Operations (RO) – Asset Owner (AO) responsibility, as defined by Dam Safety procedure RO-SPP-27.0. The purpose of the Dam Safety procedure is to protect upstream and downstream lives and property by ensuring that impoundments and dams are

designed, constructed, operated and maintained as safely and reliable as is practical. This procedure describes the methods by which the RO Senior Vice-President (AO) will accomplish compliance with Federal Guidelines for Dam Safety and DSG.

As a part of the RO DSP, the temporary flood barriers are inspected on a regular basis. They are inspected during plant monthly and quarterly inspections and during the 15 month comprehensive site inspections. Any noted damage to the HESCO Concertainer units from these inspections that would compromise the structural integrity or functionality of the temporary flood barriers is repaired promptly. Since completion of installation in December 2009, only minor repairs such as small holes up to three inches in diameter have had to be repaired. Also, as committed to in the TVA Submittal to NRC Document Control Desk, "Commitments Related to Updated Hydrologic Analysis Results for Sequoyah Nuclear Plant, Units 1 and 2, and Watts Bar Nuclear Plant, Unit 1," dated June 13, 2012 (ADAMS Accession No. ML12171A053), TVA's Nuclear Power Group will issue and initially perform procedures for semi-annual inspections of the temporary HESCO flood barriers installed at Cherokee, Fort Loudoun, Tellico, and Watts Bar reservoirs by August 31, 2012. These inspections will:

a. Ensure the temporary HESCO flood barriers remain in place and are not structurally degraded as specified by the manufacturer's written specifications and recommendations;

b. Verify the inventory and staging of the material required to fill the gaps that exist; and

c. Ensure that adequate physical security (e.g., fences and locks) is provided for the staged material against theft.

These inspections will continue until a permanent modification is implemented to prevent overtopping the Cherokee, Fort Loudoun, Tellico, and Watts Bar dams due to the PMF.

For each of the dams, Cherokee; Fort Loudoun; Tellico; and Watts Bar Dams, where the temporary flood barriers have been installed, a supplement to the project Emergency Action Plan (EAP) has been issued which describes the emergency notification responsibilities and procedures. The River Forecast Center has responsibility for identification of events which could exceed critical elevations at each dam consistent with their Emergency Notification procedure and notification to the AO of the flooding condition. The AO declares a Dam Safety emergency which following the Dam Safety procedure (RO-SPP-27.0) implements the Project PMF Barrier Closure Plan. Each of the four dams has openings in the temporary flood barriers which have to be closed. The EAP supplement details the methods to be used by TVA's construction partner GUBMK for closure of the openings. The closure of the opening can be accomplished by setup of the HESCO Concertainer units linked to the existing HESCO Concertainer units already in place or by overlap of the temporary flood barriers at a given location as appropriate. At each dam where material for closure of the temporary flood barriers is required, the materials (HESCO Concertainer units and stone) are stockpiled in a designated fenced enclosure as described in the supplement to the EAP.

Experience data on the use of the selected temporary flood barriers during historic floods and the vendor documentation on barrier testing were evaluated prior to selection and use. The U.S. Army Corp of Engineers (USACE) has also tested the HESCO Concertainer units by performing hydrostatic testing, wave-induced hydrodynamic testing, overtopping testing,

and structural debris impact testing with a floating log. The debris impact testing was based on two different log sizes: 12 inch and 17 inch diameter logs (12 feet long) with an impact speed of five mph. The results of the laboratory testing showed that the HESCO Concertainer units were not damaged by the loading conditions used in the testing program.

Stability analysis of the temporary flood barriers was performed for seismic and hydrostatic (PMF) loadings. The analysis showed that the temporary flood barriers are stable under the seismic and PMF loading conditions. This is described in the proposed revision to WBN Unit 1 UFSAR Subsection 2.4.3.4, which states that while the flood barriers are temporary structures, there is a structural analysis for the headwater loading behind the temporary flood barriers that verifies that failure would not occur. Additionally, a seismic evaluation completed on the flood barriers (without headwater behind the barriers) verifies that failure of the temporary flood barriers would not occur.

The U.S. Army Corp of Engineers (USACE) has also tested the HESCO Concertainer units by performing hydrostatic testing, wave-induced hydrodynamic testing, overtopping testing, and structural debris impact testing with a floating log. The debris impact testing was based on two different log sizes: 12 inch and 17 inch diameter logs (12 feet long) with an impact speed of five mph. The results of the laboratory testing showed that the HESCO Concertainer units were not damaged by the loading conditions used in the testing program.

A potential exists for runaway barges to float downstream and impact the temporary flood barriers at two of the four dams where the barriers are in place. Barges along these reservoirs are typically tied off at barge terminals or mooring cells during high flow events, such as a PMF event. The mooring facilities, however, are not designed for PMF elevations and velocities, so the barges could break loose. There is no barge traffic on Cherokee Reservoir, so no potential for impact exists. The Fort Loudoun Reservoir has limited to moderate barge traffic. Using typical barge dimensions, the barge would have to weigh less than 70-80% of full load capacity in order to strike the barriers. However, the earthen embankments of the dam where the temporary flood barriers are placed are located at a distance from the main channel. The stream flow during a high flow event is directed toward the concrete overflow portion of the dam, and the barges would be carried by the current away from the temporary flood barriers. At the Tellico Reservoir, there is very infrequent barge traffic. Conservatively assuming there will be a barge on the reservoir, and using typical barge dimensions, the barge would have to weigh less than 40-50% of full load capacity in order to strike the barriers. However, the earthen embankments of the dam where the temporary flood barriers are placed are located at a distance from the main channel. The stream flow during a high flow event is directed toward the concrete overflow portion of the dam, and the barges would be carried by the current away from the temporary flood barriers. There is limited to moderate barge traffic at the Watts Bar Reservoir. An evaluation using typical barge dimensions for the Tennessee River, and conservatively assuming barges are empty (less draft allows for the barge to run closer to the top of the dam), demonstrates that barges are not likely to impact the temporary flood barriers. A spatial analysis shows that the closest edge of the temporary flood barrier would have to be at least 9.0 ft away from the upstream edge of the earthen embankment in order to prevent impact. The temporary flood barriers are located at least this distance from the edge of the earthen embankment, ensuring that there is no potential for barge impact.

As discussed in the NRC letter to TVA, "Tennessee Valley Authority (TVA) Long-Term Hydrology Issues for Operating Nuclear Plants - Browns Ferry Nuclear Plant, Units 1, 2, and

3 (TAC Nos. ME5026, ME5027, and ME5028); Sequoyah Nuclear Plant, Units 1 and 2 (TAC Nos. ME5029 and ME5030); and Watts Bar Nuclear Plant, Unit 1 (TAC No. ME5031), dated January 25, 2012, Accession No. ML11241A166, the NRC Staff found that the sand baskets [temporary flood barriers] are not capable of resisting debris impact. The NRC Staff further states that "documents [provided by TVA] neither discuss the ability of sand baskets to withstand debris impact, or mention whether the baskets are designed for impact of debris loads. The NRC staff is unable to conclude that these sand baskets were designed to withstand impacts from large debris during a ·flood. If a design flood were to occur, there is a high likelihood that significant debris would accompany the flood waters which could impact the baskets. There is the potential for this debris to damage the baskets or push the individual baskets apart causing a breach. There would be no time to repair the baskets because the flood would already be in progress. Therefore, sand baskets that are not designed and constructed to withstand impacts from large debris are not acceptable as a long-term solution."

To resolve this issue, as committed to in the TVA Submittal to NRC Document Control Desk, "Commitments Related to Updated Hydrologic Analysis Results for Sequoyah Nuclear Plant, Units 1 and 2, and Watts Bar Nuclear Plant, Unit 1," dated June 13, 2012 (ADAMS Accession No. ML12171A053), TVA will implement permanent modifications to prevent overtopping of the embankments of the Cherokee, Fort Loudoun, Tellico, and Watts Bar Dams due to the PMF. The final solution will be established in an evaluation conducted in compliance with the National Environmental Policy Act (NEPA) Environmental Impact Statement (EIS). Based on the current NEPA EIS schedule, these permanent modifications are scheduled to be installed by October 31, 2015.

Based on TVA RO procedures for the maintenance of the temporary flood barriers and closure of openings during emergency events; TVA RO and TVA's Nuclear Power Group periodic inspections of the temporary flood barriers and additional materials required for closure of openings; experience data on the use of the HESCO temporary flood barriers during historic floods; stability analysis of the temporary flood barriers for seismic and hydrostatic (PMF) loadings; USACE tests of the HESCO Concertainer units including hydrostatic testing, wave-induced hydrodynamic testing, overtopping testing, and structural debris impact testing with a floating log; and TVA's qualitative assessment of the potential for runaway barges to float downstream and impact the temporary flood barriers; it is concluded that use of the temporary flood barriers for the period of time required to implement the permanent modifications to prevent overtopping of the embankments of the Cherokee, Fort Loudoun, Tellico, and Watts Bar Dams is adequate.

The use of the temporary flood barriers is described in Section 2.1 of Enclosure 1, Proposed Changes, under subheading Subsection 2.4.3.4, Probable Maximum Flood (PMF) on Streams and Rivers. The credit or lack of credit for the temporary flood barriers in the hydrologic analysis is described in Section 2.1 of Enclosure 1, Proposed Changes, under subheadings Subsection 2.4.3.3, Runoff and Stream Course Model, and Subsection 2.4.4.1, Dam Failure Permutations, respectively. In the proposed WBN Unit 1 UFSAR Subsection 2.4.3.3, the increase in the height of the embankments are included in the discharge rating curves for Cherokee, Fort Loudoun, Tellico, and Watts Bar Dams that are used in the hydrologic analysis for rainfall-induced PMF events. Increasing the height of embankments at these four dams prevents embankment overflow and failure of the embankment. The vendor supplied temporary flood barriers were shown to be stable for the most severe PMF headwater/tailwater conditions using vendor recommended base friction values. In the

proposed WBN Unit 1 UFSAR Subsection 2.4.4.1, the temporary flood barriers are assumed to fail in the hydrologic analysis for seismically-induced dam failures for the cases where reservoir levels would increase to the top of the embankments, and are thus not credited for increasing the height of the embankments.

9. Discuss the temporary modification to the thermal barrier booster pump flood barrier protection in the UFSAR.

Temporary Modification (TACF) 1-09-0006-070 is a temporary barrier around the WBN Unit 1 Thermal Barrier Booster (TBB) Pump Motors that has been designed to be installed around the TBB Pump Motors prior to the event of a Stage I flood warning. Installation of the temporary flood protection barrier is in progress at WBN Unit 1. The barrier encompasses the TBB Pump Motors providing approximately 0.8 ft of margin above the DBF surge level. There are seven major components that are part of the barrier (three end attachment units and four panels), with two end attachment units that attach the L-shaped barrier to the West and South walls that are permanently attached to the surrounding structure walls. This compensatory measure is discussed in Section 3.3 of Enclosure 1, Margins.

As committed to in the TVA Submittal to NRC Document Control Desk, "Commitments Related to Updated Hydrologic Analysis Results for Sequoyah Nuclear Plant, Units 1 and 2, and Watts Bar Nuclear Plant, Unit 1," dated June 13, 2012 (ADAMS Accession No. ML12171A053), TVA will install a permanent plant modification to provide flood protection with respect to the DBF level for the WBN, Unit 1 TBB Pump Motors by March 31, 2013.

10. Discuss any impact on TVA's individual plant examination of external events or final environmental impact statement due to the revised flood analysis.

The WBN Units 1 Individual Plant Examination of External Events (IPEEE) Final Report for external flooding (Reference: TVA Letter to NRC Document Control Desk, Watts Bar Nuclear Plant (WBN) Unit 1 Generic Letter 88-20, Supplements 4 and 5 - Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities (TAC No. M83693), dated February 17, 1998, Accession Nos. ML073240218 and ML073460335) and the WBN Unit 2 IPEEE in support of WBN Unit 2 licensing (Reference: TVA Letter to NRC Document Control Desk, Watts Bar Nuclear Plant (WBN) Unit 2 – Individual Plant Examination of External Events Design Report, dated April 30, 2010, Accession No. ML101240992) are both based on an assessment using the guidance in NUREG-1407, Procedural and Submittal Guidance for the Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities. This guidance describes steps of a progressive screening approach which represent a series of analyses in increasing levels of detail, effort, and resolution. The screening approach consists of the following steps:

1. Review plant-specific hazard data and licensing bases.

2. Identify significant changes since the operating license was issued (or in the case of WBN Unit 2 utilize the proposed design basis).

3. Determine if the plant and facilities design meets the 1975 Standard Review Plan (SRP) criteria.

ENCLOSURE 2

EVALUATION OF ISSUES FROM PRE-APPLICATION MEETING

Per NUREG-1407, the purpose of this screening approach is to determine if flooding should be further evaluated if the plant design basis does not meet the 1975 SRP criteria. NUREG-1407 further states that: "For plants designed against current criteria as described in RG 1.59 and applicable Standard Review Plan sections, particularly Section 2.4, floods pose no significant threat of a severe accident because the exceedance frequency of the design basis flood, excluding floods due to failure of upstream dams, is judged to be less than 10^{-5} per year (Chery, 1985), and the conditional core damage frequency for a design basis flood is judged to be less than 10^{-1}. Thus core damage frequencies are estimated to be less than 10^{-8} per year for a plant designed against NRC's current criteria. However, the latest probable maximum precipitation (PMP) criteria published by the National Weather Service (NWS) call for higher rainfall intensities over shorter time intervals and smaller areas than have previously been considered; this could result in higher site flooding levels and greater roof ponding loads than have been used in previous design bases (GI 103). Licensees are requested to assess the effects of applying these new criteria to their plants in terms of onsite flooding and roof ponding. Also, some older plants may have higher potential risk and need systematic examinations for plant-specific vulnerabilities."

The design basis of WBN Units 1 and 2 conforms with the Regulatory Position 2 of RG 1.59, Revision 2, August 1977, which specifies that at least those structures, systems, and components necessary for cold shutdown and maintenance thereof are designed with hardened protective features to remain functional while withstanding the entire range of flood conditions up to and including the worst site-related flood probable (e.g., PMF, seismically induced flood, hurricane, surge, seiche, heavy local precipitation) with coincident wind-generated wave action as discussed in Regulatory Position 1 of the RG.

With respect to the revised DBF levels described in the proposed changes to the WBN Unit 1 UFSAR for the limiting large rainfall and seismically induced dam failure floods, there are only two distinct changes to the physical flooding protection features of WBN Unit 1 required. All other safety-related systems, structures, and components identified in Regulatory Guide 1.29 are designed to withstand the flood conditions associated with the updated DBF elevations, and would remain functional during external floods. The UFSAR currently requires the Reactor Building and Diesel Generator Building to remain dry during flood mode. No barriers for these structures would be breached due to the revised flood elevations. In addition, the Intake Pumping Station (IPS) is designed to have the Essential Raw Cooling Water (ERCW) System and the High Pressure Fire Protection (HPFP) System remain fully function for the DBF. As discussed further in Section 3.2 of Enclosure 1, TVA's established corrective action program requirements are being implemented to address the need for additional compensatory measures necessary to provide flood protection for the IPS internal systems and components, including the need for permanent plant modifications. The Service, Turbine, Auxiliary, and Control Buildings are permitted to flood as the water exceeds the plant level entrances. No permanent barriers to specifically protect flood sensitive plant equipment exist in any of these structures although, as discussed further in Section 3.2 of Enclosure 1, temporary compensatory measures are in place to ensure adequate flood protection if a PMF event were to occur, and permanent plant modifications are planned to restore or gain additional margin between the revised DBF elevations and limiting safety-related systems, structures, and components in the Auxiliary Building. Therefore, the design basis of WBN Units 1 and 2 continues to conform to the Regulatory Position 2 of RG 1.59, Revision 2, August 1977.

For the WBN Unit 1 IPEEE, continuing conformance with the Regulatory Position 2 of RG 1.59, Revision 2, August 1977, is consistent with the WBN Unit 1 IPEEE Final Report (Reference: TVA Letter to NRC Document Control Desk, Watts Bar Nuclear Plant (WBN) Unit 1 Generic Letter 88-20, Supplements 4 and 5 - Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities (TAC No. M83693), dated February 17, 1998, Accession Nos. ML073240218 and ML073460335), and no update to the WBN Unit 1 IPEEE is required. The conformance to Regulatory Position 2 of RG 1.59, Revision 2, August 1977, is assured by the updated hydrologic analysis and commitments for permanent plant modifications where necessary to provide flooding protection features for safety-related systems, structures, and components affected by the revised DBF elevations.

For the WBN Unit 2 IPEEE, it was recognized when the IPEEE Design Report was provided to the NRC (Reference: TVA Letter to NRC Document Control Desk, Watts Bar Nuclear Plant (WBN) Unit 2 – Individual Plant Examination of External Events Design Report, dated April 30, 2010, Accession No. ML101240992) that "Probable maximum flood (PMF) levels are currently being re-established by a TVA hydrology for all sites. The results of this ongoing hydrology study indicate that flood levels at WBN may increase. Any changes in PMF elevation are going to be handled by TVA as a WBN2 design issue; no further discussion is provided in this report." Based on the final PMF elevation, TVA will review the IPEEE conclusions and determine if any additional measures are required. This review will consider the results of the validation activities for evaluating the IPEEE Design Report conclusions for the actual as-built WBN Unit 2, and will be completed prior to fuel load, a final IPEEE Design Report will be submitted following certain validation activities as described in the IPEEE Design Report, including evaluation of external flooding hazards.

The Final Environmental Statement (FES) related to the operation of WBN Units 1 and 2 (NUREG-0498, Supplement 1, November 1994, Accession No. ML073470585), and the WBN Unit 2 Draft Final Environmental Impact Statement (FEIS), (Draft NUREG-0498, Supplement 2, September 2011, Accession Nos. ML11298A094 and ML11298A095), Subsection 2.2.1.1, Surface-Water Hydrology, describes the surface resources and hydrologic processes in and around the WBN site including existing water use and water quality in the environment in the vicinity of WBN Units 1 and 2. These descriptions of the affected environment for WBN Units 1 and 2 include recent citations to TVA provided information, and are not expected to be affected by the most current hydrologic information used in the updated hydrologic analysis. However, TVA will review the information contained in the updated hydrologic analysis and determine if any information provided in the 1994 FES or the 2011 Draft FEIS is affected, and the results of this review will be provided to the NRC, by September 30, 2012.

11. Discuss whether any flood barriers at the plant are impacted by the revised PMF level.

Only two distinct changes to the physical flooding protection features of WBN Unit 1 are required.

The IPS is designed to have the Essential Raw Cooling Water (ERCW) System and the High Pressure Fire Protection (HPFP) System remain fully function for the DBF. As discussed in Section 3.1 of Enclosure 1, Technical Evaluation, under subheading Section 2.4.14, Flooding Protection Requirement, the revised DBF elevation for the critical face of the IPS results in the possibility of flooding of the IPS possibly impacting internal systems and components required to be available during a plant flood. In addition, as discussed in

Section 3.3 of Enclosure 1, the IPS structure contains various equipment required to support the ERCW and HPFP systems. The IPS contains the ERCW and HPFP pumps, travelling water screens and support equipment including screen wash pumps, ERCW strainers and support equipment including backwash valves and pressure indicators, and HPFP strainers and support equipment including backwash valves and pressure indicators. During a DBF event, surge is accounted for by considering the sum of the wind wave and runup on the critical face of the IPS combined with the PMF stillwater elevation, which conservatively results in an internal flood elevation of 741.7 ft for the IPS. While this does not wet any flood-sensitive equipment on elevation 741.0 ft, the ERCW strainers and support equipment are located on elevation 722.0 ft of the IPS, connected to elevation 741.0 ft via stairwells and doors W001 and W002 at elevation 741.0 ft. The critical elevation of flood-sensitive equipment located on elevation 722.0 ft is several feet above the floor elevation. Doors W001 and W002 both have 0.5 ft concrete berms at the opening to elevation 741.0 ft, which raises the critical elevation for floodwaters to be capable of wetting elevation 722.0 ft to elevation 741.5 ft. As a result of this increase, a compensatory measure of staged sandbags to be constructed into a berm at any time prior to or during the event of a Stage I flood warning has been implemented. These sandbags will be constructed into a berm at least 12 inches in height to prevent water intrusion to elevation 722.0 ft. Additionally, two non-safety related sump pumps in each of the ERCW Train A and B strainer rooms, connected to safety-related power sources, are available to expel water leakage to this elevation outside the structure. TVA's established corrective action program requirements are being implemented to address the need for additional compensatory measures necessary to provide flood protection for the IPS internal systems and components, including the need for permanent plant modifications.

The Service, Turbine, Auxiliary, and Control Buildings are permitted to flood as the water exceeds the plant level entrances. No permanent barriers to specifically protect flood sensitive plant equipment exist in any of these structures although, as discussed further in Section 3.3 of Enclosure 1, Margins, temporary compensatory measures are in place to ensure adequate flood protection for the TBB Pump Motors if a PMF event were to occur. Also, permanent plant modifications are planned to restore or gain additional margin between the revised DBF elevations and limiting safety-related systems, structures, and components in the Auxiliary Building.

As committed to in the TVA Submittal to NRC Document Control Desk, "Commitments Related to Updated Hydrologic Analysis Results for Sequoyah Nuclear Plant, Units 1 and 2, and Watts Bar Nuclear Plant, Unit 1," dated June 13, 2012 (ADAMS Accession No. ML12171A053), TVA will install a permanent plant modification to provide flood protection with respect to the DBF level for the WBN, Unit 1 TBB Pump Motors by March 31, 2013.

12. Discuss the use and control of sand baskets (e.g., at the WBN recreational area).

Refer to the response to Issue 8 for more detailed description of use of the HESCO Concertainer units as a temporary flood barrier.

The temporary flood barriers installed in the vicinity of the recreational area at Watts Bar Dam are in place to prevent overtopping of the earth embankment during a PMF. There are three locations where closure of the access openings in the temporary flood barrier would be required to complete the floodwall in advance of a PMF event. A supplement to the

Emergency Action Plan for Watts Bar Dam has been issued to address procedures to be followed during such an event.

The HESCO Concertainer units (20-3x3x15 baskets) and stone (approximately 210 tons) needed to complete closure of the floodwall are stored in a designated fenced area near the campground and in proximity to the access points where they would be used. The HESCO Concertainer units are stored on pallets in a folded position.

The TVA River Forecast Center has responsibility for identification of events which could exceed critical elevations at the dam consistent with their Emergency Notification procedure and notification to the RO Senior Vice-President (AO) of the flooding condition. The AO declares a dam safety emergency which following the procedures implements the Watts Bar Dam PMF Barrier Installation Plan. The supplement details the methods, material and equipment to be used by TVA's construction partner GUBMK for closure of the openings through the floodwall. The closure of the opening can be accomplished by setup of the HESCO Concertainer units linked to the existing HESCO Concertainer units already in place or by overlap of the temporary flood barriers at a given location as appropriate.

Similar requirements for the use and control of the HESCO temporary flood barriers exist for Cherokee, Fort Loudoun, and Tellico Dams.

The use of the temporary flood barriers, and credit or lack of credit for the temporary flood barriers in the hydrologic analysis, is discussed further in the response to Issue 8.

As committed to in the TVA Submittal to NRC Document Control Desk, "Commitments Related to Updated Hydrologic Analysis Results for Sequoyah Nuclear Plant, Units 1 and 2, and Watts Bar Nuclear Plant, Unit 1," dated June 13, 2012 (ADAMS Accession No. ML12171A053), TVA will implement permanent modifications to prevent overtopping of the embankments of the Cherokee, Fort Loudoun, Tellico, and Watts Bar Dams due to the PMF. The final solution will be established in an evaluation conducted in compliance with the National Environmental Policy Act (NEPA) Environmental Impact Statement (EIS). Based on the current NEPA EIS schedule, these permanent modifications are scheduled to be installed by October 31, 2015.

13. Discuss the impact on any safety-related equipment other than the thermal barrier booster pumps.

As discussed in the response to Issue 11, the IPS is designed to have the ERCW System and the HPFP System remain fully function for the DBF. As discussed in Section 3.1 of Enclosure 1, Technical Evaluation, under subheading Section 2.4.14, Flooding Protection Requirement, the revised DBF elevation for the critical face of the IPS results in the possibility of flooding of the IPS possibly impacting internal systems and components required to be available during a plant flood. In addition, as discussed in Section 3.3 of Enclosure 1, the IPS structure contains various equipment required to support the ERCW and HPFP systems. The IPS contains the ERCW and HPFP pumps, travelling water screens and support equipment including screen wash pumps, ERCW strainers and support equipment including backwash valves and pressure indicators, and HPFP strainers and support equipment including backwash valves and pressure indicators. During a DBF event, surge is accounted for by considering the sum of the wind wave and runup on the critical face of the IPS combined with the PMF stillwater elevation, which conservatively

results in an internal flood elevation of 741.7 ft for the IPS. While this does not wet any flood-sensitive equipment on elevation 741.0 ft, the ERCW strainers and support equipment are located on elevation 722.0 ft of the IPS, connected to elevation 741.0 ft via stairwells and doors W001 and W002 at elevation 741.0 ft. The critical elevation of flood-sensitive equipment located on elevation 722.0 ft is several feet above the floor elevation. Doors W001 and W002 both have 0.5 ft concrete berms at the opening to elevation 741.0 ft, which raises the critical elevation for floodwaters to be capable of wetting elevation 722.0 ft to elevation 741.5 ft. As a result of this increase, a compensatory measure of staged sandbags to be constructed into a berm at any time prior to or during the event of a Stage I flood warning has been implemented. These sandbags will be constructed into a berm at least 12 inches in height to prevent water intrusion to elevation 722.0 ft. Additionally, two non-safety related sump pumps in each of the ERCW Train A and B strainer rooms, connected to safety-related power sources, are available to expel water leakage to this elevation outside the structure. TVA's established corrective action program requirements are being implemented to address the need for additional compensatory measures necessary to provide flood protection for the IPS internal systems and components, including the need for permanent plant modifications.

14. Discuss the impact of TVA's five proposed combinations of dam failure scenarios within its revised flood analysis.

As discussed in the response to Issue 4, the methodology used to develop the controlling seismic/flood condition at WBN is the same as previously followed for the site evaluations described in the WBN Unit 1 UFSAR. This is further described in Section 2.1 of Enclosure 1, Proposed Changes, under the subheading Section 2.4.4, Potential Dam Failures, Seismically Induced.

ENCLOSURE 3

LIST OF COMMITMENTS

1. The proposed technical changes to the Watts Bar Nuclear Plant (WBN) Unit 1 Updated Final Safety Analysis Report (UFSAR) described in Enclosure 1 include changes that incorporate updates previously submitted in support of the initial licensing of WBN Unit 2 as well as more recently discovered input information. Given that the WBN Unit 1 UFSAR and Unit 2 Final Safety Analysis Report (FSAR) are separate documents at this time, TVA will submit an update to the affected sections of the WBN Unit 2 FSAR on or before August 30, 2012 to assure that the hydrology licensing bases are consistent.

2. For the Watts Bar Nuclear Plant (WBN Unit 2 Individual Plant Examination of External Events (IPEEE), it was recognized when the IPEEE Design Report was provided to the NRC (Reference: TVA Letter to NRC Document Control Desk, Watts Bar Nuclear Plant (WBN) Unit 2 – Individual Plant Examination of External Events Design Report, dated April 30, 2010, Accession No. ML101240992) that "Probable maximum flood (PMF) levels are currently being re-established by a TVA hydrology for all sites. The results of this ongoing hydrology study indicate that flood levels at WBN may increase. Any changes in PMF elevation are going to be handled by TVA as a WBN2 design issue; no further discussion is provided in this report." Based on the final PMF elevation, TVA will review the WBN Unit 2 IPEEE conclusions and determine if any additional measures are required. This review will consider the results of the validation activities for evaluating the IPEEE Design Report conclusions for the actual as-built WBN Unit 2, and will be completed prior to fuel load, a final IPEEE Design Report will be submitted following certain validation activities as described in the IPEEE Design Report, including evaluation of external flooding hazards.

3. The Final Environmental Statement (FES) related to the operation of WBN Units 1 and 2 (NUREG-0498, Supplement 1, November 1994, Accession No. ML073470585), and the WBN Unit 2 Draft Final Environmental Impact Statement (FEIS), (Draft NUREG-0498, Supplement 2, September 2011, Accession Nos. ML11298A094 and ML11298A095), Subsection 2.2.1.1, Surface-Water Hydrology, describes the surface resources and hydrologic processes in and around the WBN site including existing water use and water quality in the environment in the vicinity of WBN Units 1 and 2. These descriptions of the affected environment for WBN Units 1 and 2 include recent citations to TVA provided information, and are not expected to be affected by the most current hydrologic information used in the updated hydrologic analysis. However, TVA will review the information contained in the updated hydrologic analysis and determine if any information provided in the 1994 FES or the 2011 Draft FEIS is affected, and the results of this review will be provided to the NRC, by September 30, 2012.