POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

KINGSTON, TENNESSEE (40-4871) 35.8581 N 84.5275 W 777 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 2, Version 3
G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2004

Extracted: Thu Jan 29 2009

Confidence Limits | Seasonality | Location Maps | Other Info | GIS data | Maps | Docs | Return to State Map

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.35	0.55	0.69	0.95	1.18	1.39	1.51	1.88	2.34	2.84	3.47	3.97	4.84	5.53	7.63	9.38	11.79	14.16
2	0.41	0.65	0.82	1.13	1.42	1.67	1.81	2.23	2.77	3.39	4.15	4.75	5.77	6.56	9.02	11.02	13.80	16.55
5	0.48	0.77	0.97	1.38	1.77	2.08	2.23	2.72	3.36	4.13	5.05	5.75	6.92	7.80	10.47	12.61	15.65	18.70
10	0.55	0.88	1.11	1.60	2.09	2.44	2.62	3.16	3.88	4.72	5.76	6.51	7.78	8.74	11.53	13.74	16.98	20.23
25	0.64	1.01	1.28	1.90	2.53	2.96	3.16	3.77	4.60	5.52	6.73	7.50	8.89	9.96	12.84	15.12	18.58	22.06
50	0.71	1.13	1.43	2.15	2.92	3.41	3.62	4.30	5.20	6.15	7.50	8.27	9.72	10.90	13.78	16.10	19.71	23.34
100	0.78	1.25	1.57	2.41	3.32	3.89	4.12	4.86	5.83	6.80	8.28	9.03	10.54	11.81	14.67	17.00	20.73	24.48
200	0.86	1.37	1.72	2.68	3.76	4.41	4.65	5.46	6.49	7.46	9.06	9.78	11.34	12.71	15.49	17.81	21.66	25.50
500	0.97	1.53	1.93	3.07	4.40	5.16	5.42	6.31	7.41	8.34	10.13	10.77	12.36	13.87	16.49	18.78	22.74	26.69
1000	1.06	1.67	2.10	3.40	4.96	5.81	6.09	7.03	8.18	9.03	10.96	11.50	13.11	14.72	17.19	19.44	23.48	27.48

* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.

*** Upper bound of the 90% confidence interval**
Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.38	0.61	0.76	1.04	1.30	1.52	1.65	2.04	2.52	3.02	3.70	4.23	5.14	5.85	8.02	9.81	12.31	14.76
2	0.45	0.72	0.90	1.24	1.56	1.82	1.98	2.42	3.00	3.61	4.42	5.05	6.13	6.94	9.48	11.53	14.41	17.27
5	0.53	0.84	1.07	1.51	1.94	2.26	2.43	2.94	3.62	4.39	5.39	6.11	7.35	8.25	11.01	13.18	16.33	19.50
10	0.60	0.96	1.21	1.75	2.28	2.66	2.84	3.41	4.18	5.01	6.14	6.91	8.25	9.24	12.11	14.36	17.71	21.11
25	0.69	1.10	1.40	2.07	2.76	3.21	3.42	4.07	4.94	5.85	7.16	7.97	9.43	10.54	13.49	15.81	19.39	23.01
50	0.77	1.23	1.55	2.34	3.17	3.70	3.92	4.64	5.60	6.52	7.97	8.79	10.31	11.53	14.49	16.83	20.58	24.35
100	0.85	1.35	1.71	2.62	3.61	4.21	4.45	5.24	6.27	7.20	8.80	9.60	11.18	12.50	15.42	17.77	21.65	25.56
200	0.94	1.49	1.88	2.92	4.09	4.78	5.04	5.88	6.99	7.90	9.64	10.40	12.03	13.46	16.30	18.63	22.63	26.65
500	1.05	1.67	2.10	3.34	4.79	5.60	5.88	6.81	7.99	8.85	10.79	11.46	13.13	14.70	17.37	19.65	23.79	27.91
1000	1.16	1.82	2.29	3.71	5.41	6.32	6.62	7.61	8.85	9.58	11.69	12.25	13.93	15.63	18.13	20.36	24.58	28.77

* The upper bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are greater than.
** These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.

Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

*** Lower bound of the 90% confidence interval**
Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.32	0.51	0.64	0.87	1.09	1.28	1.40	1.75	2.18	2.68	3.25	3.74	4.57	5.23	7.26	8.98	11.31	13.59
2	0.38	0.60	0.75	1.04	1.31	1.54	1.67	2.08	2.58	3.21	3.89	4.47	5.45	6.22	8.58	10.56	13.24	15.88
5	0.44	0.71	0.89	1.27	1.63	1.91	2.06	2.52	3.12	3.90	4.73	5.41	6.53	7.39	9.96	12.07	15.00	17.94
10	0.50	0.80	1.01	1.47	1.91	2.24	2.41	2.92	3.60	4.45	5.39	6.12	7.33	8.27	10.96	13.15	16.26	19.40
25	0.58	0.92	1.17	1.73	2.30	2.69	2.88	3.47	4.24	5.19	6.29	7.04	8.37	9.41	12.20	14.45	17.78	21.14
50	0.64	1.02	1.29	1.94	2.63	3.08	3.28	3.93	4.77	5.78	6.98	7.74	9.14	10.27	13.08	15.37	18.85	22.34
100	0.70	1.11	1.41	2.16	2.97	3.48	3.69	4.41	5.31	6.36	7.68	8.43	9.88	11.10	13.90	16.20	19.80	23.41
200	0.76	1.21	1.53	2.38	3.33	3.90	4.13	4.90	5.87	6.95	8.39	9.11	10.60	11.92	14.66	16.96	20.67	24.36
500	0.84	1.34	1.68	2.68	3.84	4.50	4.74	5.58	6.62	7.74	9.32	9.97	11.51	12.94	15.56	17.86	21.67	25.47
1000	0.92	1.44	1.81	2.93	4.28	4.99	5.24	6.13	7.22	8.34	10.03	10.61	12.17	13.70	16.19	18.45	22.33	26.19

* The lower bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are less than.

STS | AECOM

Calculation Sheet

Project	KINGSTON RCA			Subject	Rain and Sluicing Ash in Cell 2		
Originated By	Date	Checked By	Date	STS Job No.	Scale		Sheet No.
WHW	6/1/09	EED	6/6/09	60095742	—		1 of 2

EST. 1.28" OF RAIN 12/20 to 21/08 - Kingston Fossil Rain Gage.

EST.: 0.83" OF RAIN BETWEEN 12/20-21/08 TVA Rain Gage AT LDFL

- HEO OFFICE 0.20" GAGE NO. #2 12/28
- DAILY MONITORING LOG = 0.63" 12/21/08 @ Baseball Field Trailer

use SUM: 0.93 in.

CELL 2 - 31 Acres ✓ TVA Recorder (email from Missy

Volume of Rainfall on 12/20 to 12/21 STORM

$$31 \text{ Acres} \times 0.83'' \times \frac{1 \text{ ft}}{12 \text{ inch}} = 2.1 \text{ Acre-feet} ✓$$

$$31 \text{ Acres} \times 1.28'' \times \frac{1 \text{ ft}}{12 \text{ inch}} = 3.3 \text{ Acre-feet} ✓$$

Volume of Water & Solids Dredged to cell on 12/15 (One DAY)

$$V = \frac{5000 \text{ gal}}{\text{min}} \times \frac{60 \text{ min}}{1 \text{ hour}} \times \frac{10 \text{ hour}}{1 \text{ day of pumping}} \times \frac{1 \text{ cu ft}}{7.48 \text{ gal}} \times \frac{1 \text{ Acre}}{43{,}560 \text{ ft}^2}$$

$$\frac{2.1}{9.2} \times 100 \cong 23\% \quad ; \quad \frac{3.3}{9.2} \times 100 \cong 35\%$$

$$V = 9.2 \text{ Acre-feet} \quad \begin{matrix} > 1.9 \text{ Acre-feet} \\ > 3.3 \text{ Acre-feet} \end{matrix}$$

$$V = 400{,}752 \text{ ft}^3/\text{day} \times \frac{1}{27} = 14{,}842 \text{ CY/day} ✓$$

STS | AECOM

Calculation Sheet

Project	Subject					
KINGSTON	Rain and Sluiced Ash into Cell 2					
Originated By	Date	Checked By	Date	STS Job No.	Scale	Sheet No.
WAW	6/1/09	EED	6/6/09	60095742	–	2 of 2

20 DAYS ≡ 50,000 CY, PER HED

TOTAL VOLUME PUMPED IN 20 DAYS.

14,842 CY/day × 20 days = 296,840 CY/month ✓

$$\% \text{ SOLIDS} = \frac{50{,}000 \text{ cy}}{296{,}840 \text{ cy}} \times 100$$

16.8 % ≈ 17 % SOLIDS

USE 15 % to 20 % SOLIDS,

or 85 % to 80 % WATER

$$\frac{50{,}000 \text{ CY}}{} \times \frac{27 \text{ ft}^3}{1 \text{ CY}} \times \frac{1 \text{ ACRE}}{43{,}560 \text{ ft}^2} = 30.99 \text{ Acre-feet}$$

$$H = \frac{30.99 \text{ Acre-ft}}{31 \text{ Acre}} = 1.0 \text{ ft of Pond Raising per month at Cell 2}$$

cell 2 from TVA

STS | AECOM

Calculation Sheet

Project	KINGSTON RCA			Subject	RAINFALL DATA	
Originated By	Date	Checked By	Date	STS Job No.	Scale	Sheet No.
EED	6/6/09	[illegible]	6/7/09	60095742	—	1 of 1

KINGSTON FOSSIL (0712) Hourly Precipitation Record

11/20/2008 through 12/21/2008 7.95 inches of precip.

12/20/2008 1.28 inches precip. from 1400 – 2300 hours

12/21/2008 0.00 inches precip.

KINGSTON HED OFFICE (GAUGE NO. 2)

12/21/2008 0.63 inches

DREDGE CELL FOREMAN (DAILY LOG)

12/20/2008 0.2 inches

12/21/2008 0.63 inches

Σ = 0.83 inches

Σ = 7.51 inches (11/20 through 12/21/2008

Note: Kingston Fossil shows measurable precip. on 12/20 vs. 12/21/08, although totals for 11/20 through 12/21/08 are similar to Dredge Cell Foreman records (7.95 vs. 7.51 in.)

HEU Office Trailer Ball field Area
Kingston Fossil Plant

DAILY RAINFALL GAUGE RECORD

Inspect rainfall gage(s) daily and record inches of rain or none in measured rainfall column. Sign sheet for each day and present to designated TVA site representative when sheet has been filled and/or construction is complete. If 0.5 inch rainfall event or prolonged storm event, perform erosion control device check and record results on inspection form. Maintain a copy of this form and provide a copy to the Kingston PA(E) when the form is complete.

Gage Number	Date	Measured Rainfall (inches)	Inspector's Signature
#1	11/20/08	0	James Lillie
#2	11/21/08	0	James Lillie
#2	11/22/08	0	James Lillie
~~#2~~ #2	11/23/08	0	James Lillie
#1	11/24/08	Trace	James Lillie
#1	11/25/08	.18"	James Lillie
#1	11/26/08	0	James Lillie
#2	11/27/08	0	James Lillie
#2	11/28/08	Trace	James Lillie
#2	11/29/08	.51"	James Lillie
#2	11/30/08	.55"	James Lillie
#1	12/01/08	.18"	James Lillie
#1	12/02/08	0	James Lillie
#1	12/03/08	0	James Lillie
#1	12/04/08	.08"	James Lillie
#2	12/05/08	0	James Lillie
#2	12/06/08	0	James Lillie
#2	12/07/08	0	James Lillie
#1	12/08/08	0	James Lillie
#1	12/09/08	0	James Lillie
#1	12/10/08	2.2"	James Lillie
#1	12/11/08	2.3"	James Lillie
#2	12/12/08	0	James Lillie
#2	12/13/08	0	James Lillie
#2	12/14/08	0	James Lillie
#1	12/15/08	Trace	James Lillie
#1	12/16/08	.2"	James Lillie
#1	12/17/08	.3"	James Lillie

HEU Office Trailer
Kingston Fossil Plant

DAILY RAINFALL GAUGE RECORD

Inspect rainfall gage(s) daily and record inches of rain or none in measured rainfall column. Sign sheet for each day and present to designated TVA site representative when sheet has been filled and/or construction is complete. If 0.5 inch rainfall event or prolonged storm event, perform erosion control device check and record results on inspection form. Maintain a copy of this form and provide a copy to the Kingston PA(E) when the form is complete.

Gage Number	Date	Measured Rainfall (inches)	Inspector's Signature
#1	12/18/08	.18"	James Sitts
#2	12/19/08	Trace	James Sitts
#2	12/20/08	.2"	James Sitts
#2	12/21/08	.63"	James Sitts
#1	12/22/08	Ø	James Sitts
#1	12/23/08	Ø	James Sitts
#1	12/24/08	Ø	James Sitts
#1	12/25/08	.28"	James Sitts
#1	12/26/08	Ø	James Sitts
#1	12/27/08	.28"	James Sitts
#1	12/28/08	.16"	James Sitts
#1	12/29/08	Ø	James Sitts
#1	12/30/08	Ø	James Sitts
#1	12/31/08	Ø	James Sitts
#1	01/01/09	Ø	James Sitts
#1	01/02/09	.04"	James Sitts
#1	01/03/09	.04	James Sitts
#1	01/04/09	.28"	James Sitts
#1	01/05/09	Ø	James Sitts
#1	01/06/09	2.36"	James Sitts

STORM WATER POLLUTION PREVENTION INSPECTION AND MAINTENANCE REPORT FORM

Storm water inspections must be performed and documented a minimum of twice per week with the minimal time between inspections being at least 72 hours. Daily inspections are suggested during prolonged periods of rain and should include a "P" with the date. USE A SEPARATE SHEET FOR EACH AREA OR CONTROL BEING INSPECTED, SUCH AS VEHICULAR ACCESS POINTS, SILT FENCES, MATERIAL STORAGE AREAS, ROUTINE LITTER PICKUP, ETC. Record the date of inspection, the date and amount of rain recorded if inspection is after a storm event, include the inspector's name and the condition of the area or device being inspected. Document the corrective actions taken or repairs made.

Present to TVA Construction Manager once per month, when sheet has been filled and/or construction is complete. TVA Construction Manager will need to provide a copy to the site Program Administrator (Environmental) when complete or on a monthly basis.

Area or control device being inspected:	Kingston Dike project and Lower areas & #1 & #2 cells

Date Of Inspection	Time Inspection Performed	Describe Condition of Control Device	Repairs Needed	Date Repairs Done*	Inspector's Signature/Title
12/08/08	0750	Rip Rap ditches and pond water levels appear okay	None	NA	Foreman
12/10/08	0735	Rip Rap ditches and pond water levels appear okay	None	NA	Foreman
12/11/08	0745	Rip Rap ditches and pond water levels appear okay	None	NA	Foreman
12/15/08	0740	Rip Rap ditches and pond water levels appear okay	None	NA	Foreman
12/18/08	0750	Rip Rap ditches and pond water levels appear okay	None	NA	Foreman
12/21/08	12:15	Rip Rap ditches and pond water levels appear okay	None	NA	Foreman
12/22/08	0100	Almost total collapse of ditch system	~~[illegible]~~ NOT Repairable	Clean up Planned	Foreman
12/23/08	0700	Cleaning of Sewer pond rd started	Recieving equip and personnel	Cleaning started	Foreman
12/29/08	0740	Clean up of Sewerpond rd & other areas continue	Removed from Roadway and Railroad	Clean up continues	Foreman
01/02/09	07:15	Clean up continues on roads on RR	Victoria Removed Roads, River & RR	Clean up continues	Foreman

*Repairs must be completed within 7 days or before the next rainfall.

DAILY MONITORING LOG

Site Name: TVA Kingston Fossil Plant (KIF) - Dredge Cell Seep Repair Area

ection Date and Time: 12/21/09 12:15

ected By: [illegible]

ther Conditions: [illegible], PC, 1.83" Rain

Monitoring Point	Water Level Relative to Ground Surface (Visual Observation or Actual Measurement)	Visible Evidence of Standing/Surface Water (Yes or No)	Visible Evidence of Surface Erosion (Yes or No)	Visible Evidence of Settlement (Yes or No)	Visible Evidence of Slope Movement (Yes or No)	Visible Evidence of Water Seeps (Yes or No)	Visible Evidence of Soil Piping (Yes or No)	Notes/Remarks
WP01		no	no	no	no	no	no	
WP02		Yes				Yes		
WP03		No				No		
WP04								
WP05								
WP06								
WP07								
WP08								
WP09								
WP10								
WP11								
WP12								
WP13								
WP14								
WP15								
WP16								
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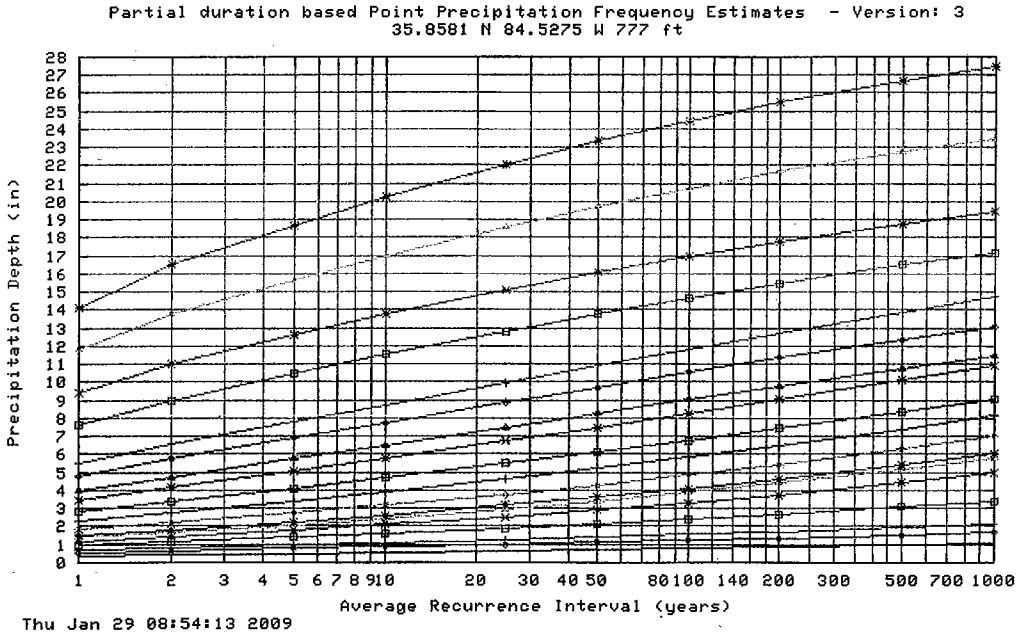
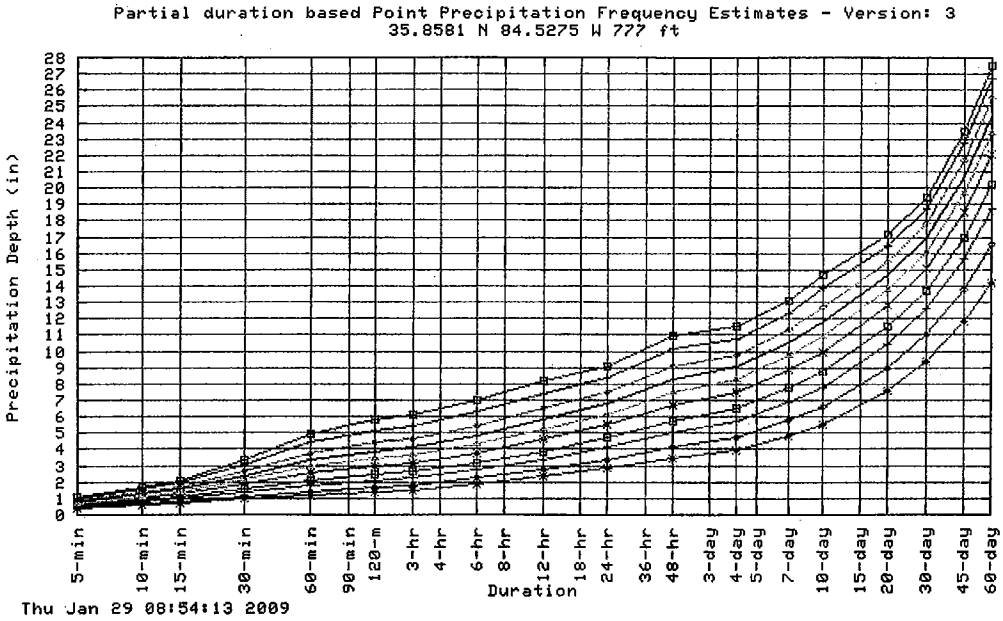
PZ33								
PZ34								
[illegible]35								
[illegible]a								
[illegible] perimeter [illegible]rth. seep								
[illegible]W1								
MW2								
MW3B								

** These precipitation frequency estimates are based on a partial duration maxima series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

Text version of tables

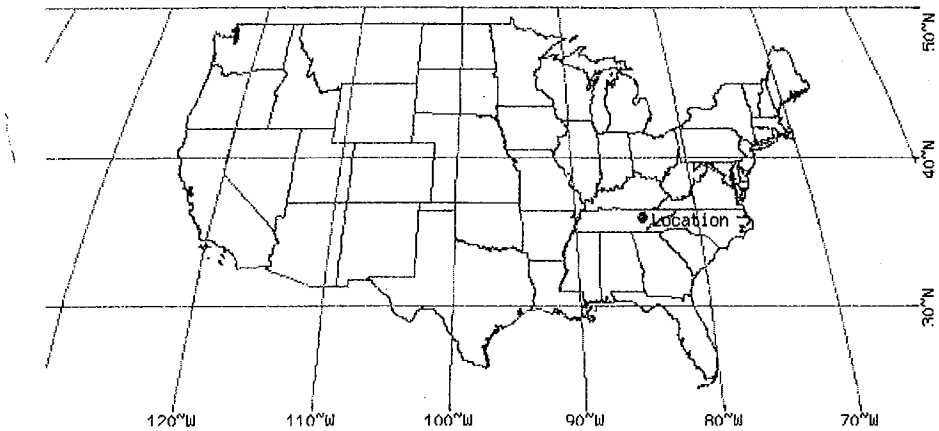


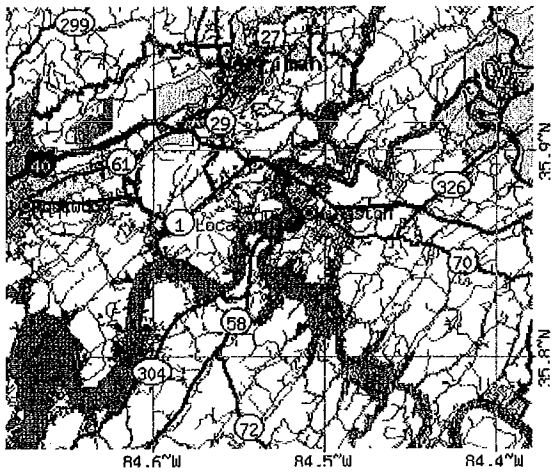
Duration			
5-min	120-m	48-hr	30-day
10-min	3-hr	4-day	45-day
15-min	6-hr	7-day	60-day
30-min	12-hr	10-day	
60-min	24-hr	20-day	



Average Recurrence Interval (years)	
1	50
2	100
5	200
10	500
25	1000

Maps -





These maps were produced using a direct map request from the U.S. Census Bureau Mapping and Cartographic Resources Tiger Map Server.

Please read disclaimer for more information.

LEGEND

State	Connector
County	Stream
Indian Resv	Military Area
Lake/Pond/Ocean	National Park
Street	Other Park
Expressway	City
Highway	County

Scale 1:228583 0 2 4 6 8 mi; 0 2 4 6 8 10 km

*average--true scale depends on monitor resolution

Other Maps/Photographs -

View USGS digital orthophoto quadrangle (DOQ) covering this location from TerraServer; **USGS Aerial Photograph** may also be available from this site. A DOQ is a computer-generated image of an aerial photograph in which image displacement caused by terrain relief and camera tilts has been removed. It combines the image characteristics of a photograph with the geometric qualities of a map. Visit the USGS for more information.

Watershed/Stream Flow Information -

Find the Watershed for this location using the U.S. Environmental Protection Agency's site.

Climate Data Sources -

Precipitation frequency results are based on data from a variety of sources, but largely NCDC. The following links provide general information about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study, please refer to NOAA Atlas 14 Document.

Using the **National Climatic Data Center's (NCDC)** station search engine, locate other climate stations within:

+/-30 minutes ...OR... +/-1 degree of this location (35.8581/-84.5275). Digital ASCII data can be obtained directly from **NCDC**.

Hydrometeorological Design Studies Center
DOC/NOAA/National Weather Service
1325 East-West Highway
Silver Spring, MD 20910

(301) 713-1669
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Kingston Fossil (0712) Last KIF rain gauge calibration 10/29/08

Date/Time	Precipitation, inches
10/30/2008 6:00	0.00
10/30/2008 7:00	0.00
10/30/2008 8:00	0.00
10/30/2008 9:00	0.00
10/30/2008 10:00	0.00
10/30/2008 11:00	0.00
10/30/2008 12:00	0.00
10/30/2008 13:00	0.00
10/30/2008 14:00	0.00
10/30/2008 15:00	0.00
10/30/2008 16:00	0.00
10/30/2008 17:00	0.00
10/30/2008 18:00	0.00
10/30/2008 19:00	0.00
10/30/2008 20:00	0.00
10/30/2008 21:00	0.00
10/30/2008 22:00	0.00
10/30/2008 23:00	0.00
10/31/2008 0:00	0.00
10/31/2008 1:00	0.00
10/31/2008 2:00	0.00
10/31/2008 3:00	0.00
10/31/2008 4:00	0.00
10/31/2008 5:00	0.00
10/31/2008 6:00	0.00
10/31/2008 7:00	0.00
10/31/2008 8:00	0.00
10/31/2008 9:00	0.00
10/31/2008 10:00	0.00
10/31/2008 11:00	0.00
10/31/2008 12:00	0.00
10/31/2008 13:00	0.00
10/31/2008 14:00	0.00
10/31/2008 15:00	0.00
10/31/2008 16:00	0.00
10/31/2008 17:00	0.00
10/31/2008 18:00	0.00
10/31/2008 19:00	0.00
10/31/2008 20:00	0.00
10/31/2008 21:00	0.00
10/31/2008 22:00	0.00
10/31/2008 23:00	0.00
11/1/2008 0:00	0.00
11/1/2008 1:00	0.00
11/1/2008 2:00	0.00
11/1/2008 3:00	0.00
11/1/2008 4:00	0.00
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11/25/2008 2:00	0.00	_
11/25/2008 3:00	0.00	_
11/25/2008 4:00	0.00	_
11/25/2008 5:00	0.00	_

11/25/2008 6:00	0.00 _
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11/27/2008 9:00	0.00 _

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12/1/2008 16:00	0.00	_
12/1/2008 17:00	0.00	_

$\Sigma = 3.3$ inches Nov. 2008

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12/1/2008 23:00	0.00 _
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12/14/2008 17:00	0.00 _

12/14/2008 18:00	0.00	_
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12/14/2008 20:00	0.00	_
12/14/2008 21:00	0.00	_
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12/15/2008 4:00	0.00	_
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12/15/2008 8:00	0.00	_
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12/15/2008 11:00	0.00	_
12/15/2008 12:00	0.00	_
12/15/2008 13:00	0.00	_
12/15/2008 14:00	0.00	_
12/15/2008 15:00	0.00	_
12/15/2008 16:00	0.00	_
12/15/2008 17:00	0.00	_
12/15/2008 18:00	0.03	X
12/15/2008 19:00	0.01	X
12/15/2008 20:00	0.01 e	X
12/15/2008 21:00	0.08 e	X
12/15/2008 22:00	0.00 e	
12/15/2008 23:00	0.00 e	
12/16/2008 0:00	0.00 e	
12/16/2008 1:00	0.00 e	
12/16/2008 2:00	0.02 e	X
12/16/2008 3:00	0.00	
12/16/2008 4:00	0.00	
12/16/2008 5:00	0.00	_
12/16/2008 6:00	0.00	_
12/16/2008 7:00	0.00	_
12/16/2008 8:00	0.00	_
12/16/2008 9:00	0.00	_
12/16/2008 10:00	0.05	X
12/16/2008 11:00	0.22	X
12/16/2008 12:00	0.04	X
12/16/2008 13:00	0.02	X
12/16/2008 14:00	0.03	X
12/16/2008 15:00	0.00	_
12/16/2008 16:00	0.00	_
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12/16/2008 20:00	0.06	X
12/16/2008 21:00	0.02	X

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12/17/2008 2:00	0.00	_
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12/17/2008 5:00	0.01	X
12/17/2008 6:00	0.00	_
12/17/2008 7:00	0.00	_
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12/17/2008 11:00	0.01	X
12/17/2008 12:00	0.05	X
12/17/2008 13:00	0.09	X
12/17/2008 14:00	0.09	X
12/17/2008 15:00	0.00	_
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12/17/2008 17:00	0.00	_
12/17/2008 18:00	0.00	_
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12/18/2008 12:00	0.00	_
12/18/2008 13:00	0.00	_
12/18/2008 14:00	0.00	_
12/18/2008 15:00	0.00	_
12/18/2008 16:00	0.00	_
12/18/2008 17:00	0.01	X
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12/18/2008 22:00	0.00	_
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12/19/2008 1:00	0.00	_

12/19/2008 2:00	0.00	_
12/19/2008 3:00	0.00	_
12/19/2008 4:00	0.00	_
12/19/2008 5:00	0.00	_
12/19/2008 6:00	0.00	_
12/19/2008 7:00	0.00	_
12/19/2008 8:00	0.00	_
12/19/2008 9:00	0.00	_
12/19/2008 10:00	0.00	_
12/19/2008 11:00	0.01	x
12/19/2008 12:00	0.03	x
12/19/2008 13:00	0.04	x
12/19/2008 14:00	0.00	_
12/19/2008 15:00	0.00	_
12/19/2008 16:00	0.00	_
12/19/2008 17:00	0.00	_
12/19/2008 18:00	0.00	_
12/19/2008 19:00	0.00	_
12/19/2008 20:00	0.00	_
12/19/2008 21:00	0.00	_
12/19/2008 22:00	0.00	_
12/19/2008 23:00	0.00	_
12/20/2008 0:00	0.00	_
12/20/2008 1:00	0.00	_
12/20/2008 2:00	0.00	_
12/20/2008 3:00	0.00	_
12/20/2008 4:00	0.00	_
12/20/2008 5:00	0.00	_
12/20/2008 6:00	0.00	_
12/20/2008 7:00	0.00	_
12/20/2008 8:00	0.00	_
12/20/2008 9:00	0.00	_
12/20/2008 10:00	0.00	_
12/20/2008 11:00	0.00	_
12/20/2008 12:00	0.00	_
12/20/2008 13:00	0.00	_
12/20/2008 14:00	0.01	x
12/20/2008 15:00	0.08	x
12/20/2008 16:00	0.03	x
12/20/2008 17:00	0.05	x
12/20/2008 18:00	0.00	_
12/20/2008 19:00	0.00	_
12/20/2008 20:00	0.31	x
12/20/2008 21:00	0.56	x
12/20/2008 22:00	0.03	x
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12/21/2008 0:00	0.00	_
12/21/2008 1:00	0.00	_
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12/21/2008 3:00	0.00	_
12/21/2008 4:00	0.00	_
12/21/2008 5:00	0.00	_

1.28 inches
12/20/08

12/21/2008 6:00	0.00	
12/21/2008 7:00	0.00	
12/21/2008 8:00	0.00	
12/21/2008 9:00	0.00	
12/21/2008 10:00	0.00	
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12/21/2008 12:00	0.00	
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12/21/2008 20:00	0.00	
12/21/2008 21:00	0.00	
12/21/2008 22:00	0.00	
12/21/2008 23:00	0.00	
12/22/2008 0:00	0.00	Σ = 6.48 in. through 12/21/08
12/22/2008 1:00	0.00	
12/22/2008 2:00	0.00	
12/22/2008 3:00	0.00	
12/22/2008 4:00	0.00	
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12/22/2008 6:00	0.00	
12/22/2008 7:00	0.00	
12/22/2008 8:00	0.00	
12/22/2008 9:00	0.00	
12/22/2008 10:00	0.00	
12/22/2008 11:00	0.00	
12/22/2008 12:00	0.00	
12/22/2008 13:00	0.00	
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12/22/2008 15:00	0.00	
12/22/2008 16:00	0.00	
12/22/2008 17:00	0.00	
12/22/2008 18:00	0.00	
12/22/2008 19:00	0.00	
12/22/2008 20:00	0.00	
12/22/2008 21:00	0.00	
12/22/2008 22:00	0.00	
12/22/2008 23:00	0.00	
12/23/2008 0:00	0.00	
12/23/2008 1:00	0.00	
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12/23/2008 4:00	0.00	
12/23/2008 5:00	0.00	
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12/23/2008 10:00	0.00	_
12/23/2008 11:00	0.00	_
12/23/2008 12:00	0.00	_
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12/24/2008 20:00	0.01	_
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12/26/2008 3:00	0.00 _
12/26/2008 4:00	0.05 _
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12/26/2008 6:00	0.07 _
12/26/2008 7:00	0.01 _
12/26/2008 8:00	0.00 _
12/26/2008 9:00	0.01 _
12/26/2008 10:00	0.00 _
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12/31/2008 23:00	0.00 _
1/1/2009 0:00	0.00 _

HEU Office Trailer Ball field Area
Kingston Fossil Plant

DAILY RAINFALL GAUGE RECORD

Inspect rainfall gage(s) daily and record inches of rain or none in measured rainfall column. Sign sheet for each day and present to designated TVA site representative when sheet has been filled and/or construction is complete. If 0.5 inch rainfall event or prolonged storm event, perform erosion control device check and record results on inspection form. Maintain a copy of this form and provide a copy to the Kingston PA(E) when the form is complete.

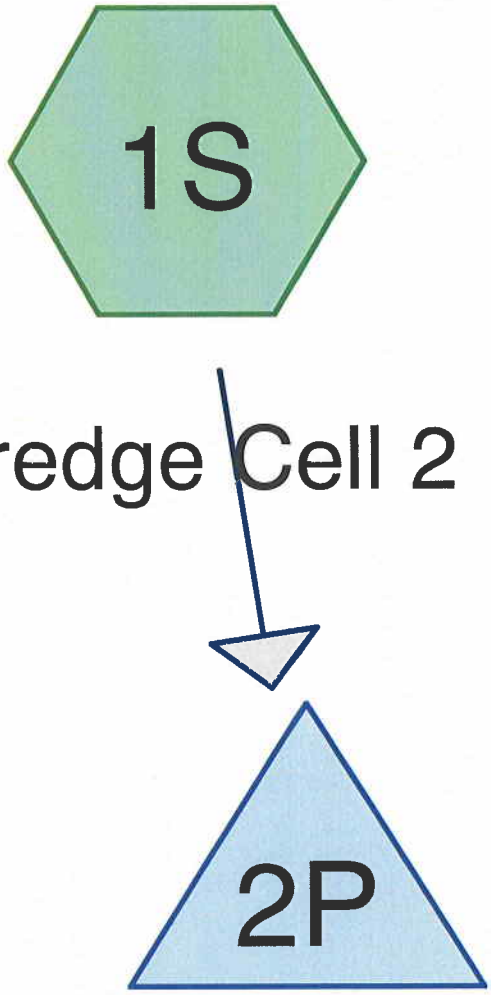
Gage Number	Date	Measured Rainfall (inches)	Inspector's Signature
#1	11/20/08	Ø	James Lotter
#2	11/21/08	Ø	James Lotter
#2	11/22/08	Ø	James Lotter
~~#2~~ #2	11/23/08	Ø	James Lotter
#1	11/24/08	Trace	James Lotter
#1	11/25/08	.18"	James Lotter
#1	11/26/08	Ø	James Lotter
#2	11/27/08	Ø	James Lotter
#2	11/28/08	Trace	James Lotter
#2	11/29/08	.51"	James Lotter
#2	11/30/08	.55"	James Lotter
#1	12/01/08	.18"	James Lotter
#1	12/02/08	Ø	James Lotter
#1	12/03/08	Ø	James Lotter
#1	12/04/08	.08"	James Lotter
#2	12/05/08	Ø	James Lotter
#2	12/06/08	Ø	James Lotter
#2	12/07/08	Ø	James Lotter
#1	12/08/08	Ø	James Lotter
#1	12/09/08	Ø	James Lotter
#1	12/10/08	2.2"	James Lotter
#1	12/11/08	2.3"	James Lotter
#2	12/12/08	Ø	James Lotter
#2	12/13/08	Ø	James Lotter
#2	12/14/08	Ø	James Lotter
#1	12/15/08	Trace	James Lotter
#1	12/16/08	.2"	James Lotter
#1	12/17/08	.3"	James Lotter

HE&I Office Trailer
Kingston Fossil Plant

DAILY RAINFALL GAUGE RECORD

Inspect rainfall gage(s) daily and record inches of rain or none in measured rainfall column. Sign sheet for each day and present to designated TVA site representative when sheet has been filled and/or construction is complete. If 0.5 inch rainfall event or prolonged storm event, perform erosion control device check and record results on inspection form. Maintain a copy of this form and provide a copy to the Kingston PA(E) when the form is complete.

Gage Number	Date	Measured Rainfall (inches)	Inspector's Signature
#1	12/19/08	.18"	[illegible]
#2	12/19/08	Trace	[illegible]
#2	12/20/08	.2"	[illegible]
#2	12/21/08	.63"	[illegible]
#1	12/22/08	0	[illegible]
#1	12/23/08	0	[illegible]
#1	12/24/08	0	[illegible]
#1	12/25/08	.28"	[illegible]
#1	12/26/08	0	[illegible]
#1	12/27/08	.28"	[illegible]
#1	12/28/08	.16"	[illegible]
#1	12/29/08	0	[illegible]
#1	12/30/08	0	[illegible]
#1	12/31/08	0	[illegible]
#1	01/01/09	0	[illegible]
#1	01/02/09	.04"	[illegible]
#1	01/03/09	.04	[illegible]
#1	01/04/09	.28"	[illegible]
#1	01/05/09	0	[illegible]
#1	01/06/09	2.36"	[illegible]



Drainage Diagram for TVA_Kingston
Prepared by AECOM 5/27/2009
HydroCAD® 8.00 s/n 004996 © 2006 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcats)
21.670	98	ash (1S)
21.670		

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Dredge Cell 2 Runoff Area=21.670 ac Runoff Depth>2.98"
Flow Length=1,000' Slope=0.0025 '/' Tc=18.0 min CN=98 Runoff=71.72 cfs 5.387 af

Pond 2P: DC 2 Peak Elev=812.38' Storage=5.382 af Inflow=71.72 cfs 5.387 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 21.670 ac Runoff Volume = 5.387 af Average Runoff Depth = 2.98"
0.00% Pervious Area = 0.000 ac 100.00% Impervious Area = 21.670 ac

Subcatchment 1S: Dredge Cell 2

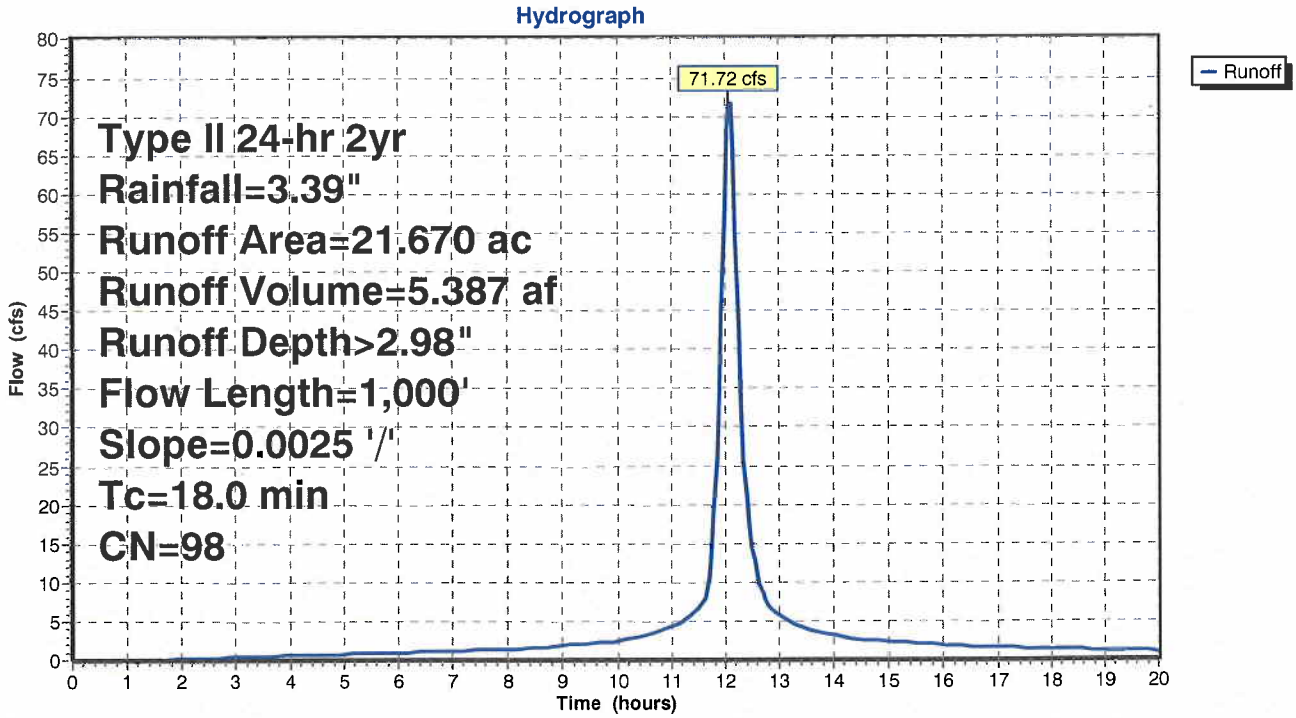
Runoff = 71.72 cfs @ 12.09 hrs, Volume= 5.387 af, Depth> 2.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.39"

Area (ac)	CN	Description
21.670	98	ash
21.670		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	300	0.0025	0.77		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.39"
11.5	700	0.0025	1.02		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
18.0	1,000	Total			

Subcatchment 1S: Dredge Cell 2



Hydrograph for Subcatchment 1S: Dredge Cell 2

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	13.00	2.62	2.39	5.66
0.25	0.01	0.00	0.00	13.25	2.67	2.44	4.67
0.50	0.02	0.00	0.00	13.50	2.71	2.48	4.05
0.75	0.03	0.00	0.00	13.75	2.75	2.52	3.54
1.00	0.04	0.00	0.00	14.00	2.78	2.55	3.14
1.25	0.05	0.00	0.00	14.25	2.81	2.58	2.80
1.50	0.05	0.00	0.03	14.50	2.84	2.61	2.62
1.75	0.06	0.00	0.10	14.75	2.87	2.64	2.49
2.00	0.07	0.00	0.16	15.00	2.89	2.66	2.36
2.25	0.08	0.01	0.23	15.25	2.92	2.69	2.23
2.50	0.10	0.01	0.29	15.50	2.94	2.71	2.10
2.75	0.11	0.02	0.34	15.75	2.96	2.73	1.97
3.00	0.12	0.02	0.40	16.00	2.98	2.75	1.84
3.25	0.13	0.03	0.45	16.25	3.00	2.77	1.72
3.50	0.14	0.03	0.49	16.50	3.02	2.79	1.66
3.75	0.15	0.04	0.54	16.75	3.04	2.81	1.61
4.00	0.16	0.05	0.58	17.00	3.06	2.82	1.56
4.25	0.17	0.05	0.63	17.25	3.07	2.84	1.52
4.50	0.19	0.06	0.68	17.50	3.09	2.86	1.47
4.75	0.20	0.07	0.73	17.75	3.11	2.87	1.43
5.00	0.21	0.08	0.78	18.00	3.12	2.89	1.38
5.25	0.23	0.09	0.83	18.25	3.14	2.90	1.33
5.50	0.24	0.10	0.88	18.50	3.15	2.92	1.29
5.75	0.26	0.11	0.93	18.75	3.17	2.93	1.24
6.00	0.27	0.12	0.98	19.00	3.18	2.95	1.20
6.25	0.29	0.13	1.03	19.25	3.19	2.96	1.15
6.50	0.30	0.15	1.08	19.50	3.20	2.97	1.10
6.75	0.32	0.16	1.13	19.75	3.22	2.98	1.06
7.00	0.34	0.17	1.18	20.00	**3.23**	**2.99**	1.01
7.25	0.35	0.19	1.23				
7.50	0.37	0.20	1.28				
7.75	0.39	0.22	1.32				
8.00	0.41	0.23	1.37				
8.25	0.43	0.25	1.43				
8.50	0.45	0.27	1.58				
8.75	0.47	0.29	1.76				
9.00	0.50	0.32	1.94				
9.25	0.53	0.34	2.10				
9.50	0.55	0.37	2.15				
9.75	0.58	0.39	2.21				
10.00	0.61	0.42	2.44				
10.25	0.65	0.46	2.75				
10.50	0.69	0.50	3.15				
10.75	0.74	0.54	3.62				
11.00	0.80	0.60	4.29				
11.25	0.87	0.66	5.15				
11.50	0.96	0.75	6.67				
11.75	1.31	1.10	14.23				
12.00	2.25	2.02	**57.63**				
12.25	2.39	2.17	**42.85**				
12.50	2.49	2.26	14.68				
12.75	2.56	2.33	7.79				

Pond 2P: DC 2

Inflow Area = 21.670 ac, Inflow Depth > 2.98" for 2yr event
Inflow = 71.72 cfs @ 12.09 hrs, Volume= 5.387 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

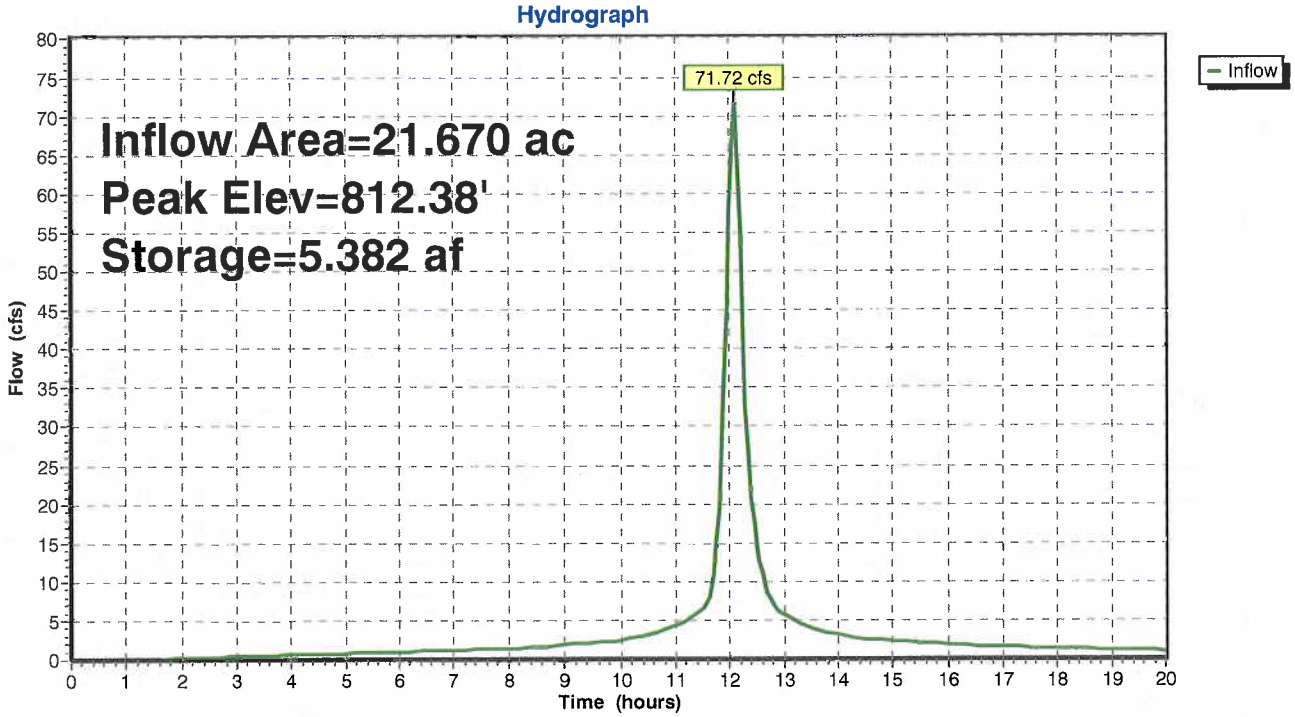
Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 812.38' @ 20.00 hrs Surf.Area= 6.937 ac Storage= 5.382 af

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	809.00'	29.094 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
809.00	0.176	0.000	0.000
810.00	0.679	0.428	0.428
811.00	1.174	0.927	1.354
812.00	3.079	2.126	3.481
813.00	13.239	8.159	11.640
814.00	21.670	17.455	29.094

Pond 2P: DC 2



Hydrograph for Pond 2P: DC 2

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)
0.00	0.00	0.000	809.00
0.25	0.00	0.000	809.00
0.50	0.00	0.000	809.00
0.75	0.00	0.000	809.00
1.00	0.00	0.000	809.00
1.25	0.00	0.000	809.00
1.50	0.03	0.000	809.00
1.75	0.10	0.002	809.01
2.00	0.16	0.004	809.02
2.25	0.23	0.008	809.04
2.50	0.29	0.014	809.07
2.75	0.34	0.020	809.10
3.00	0.40	0.028	809.13
3.25	0.45	0.036	809.17
3.50	0.49	0.046	809.20
3.75	0.54	0.057	809.24
4.00	0.58	0.068	809.28
4.25	0.63	0.081	809.32
4.50	0.68	0.094	809.36
4.75	0.73	0.109	809.40
5.00	0.78	0.125	809.44
5.25	0.83	0.141	809.48
5.50	0.88	0.159	809.52
5.75	0.93	0.178	809.56
6.00	0.98	0.198	809.60
6.25	1.03	0.218	809.65
6.50	1.08	0.240	809.69
6.75	1.13	0.263	809.73
7.00	1.18	0.287	809.77
7.25	1.23	0.312	809.82
7.50	1.28	0.338	809.86
7.75	1.32	0.365	809.90
8.00	1.37	0.392	809.95
8.25	1.43	0.421	809.99
8.50	1.58	0.452	810.04
8.75	1.76	0.487	810.08
9.00	1.94	0.525	810.14
9.25	2.10	0.567	810.19
9.50	2.15	0.611	810.25
9.75	2.21	0.656	810.30
10.00	2.44	0.704	810.36
10.25	2.75	0.757	810.42
10.50	3.15	0.818	810.49
10.75	3.62	0.888	810.56
11.00	4.29	0.969	810.65
11.25	5.15	1.066	810.74
11.50	6.67	1.187	810.85
11.75	14.23	1.370	811.01
12.00	**57.63**	2.031	811.43
12.25	**42.85**	3.318	811.95
12.50	14.68	3.837	812.10
12.75	7.79	4.056	812.15
13.00	5.66	4.191	812.18
13.25	4.67	4.298	812.20
13.50	4.05	4.387	812.22
13.75	3.54	4.466	812.23
14.00	3.14	4.535	812.24
14.25	2.80	4.596	812.25
14.50	2.62	4.652	812.26
14.75	2.49	4.704	812.27
15.00	2.36	4.754	812.28
15.25	2.23	4.802	812.29
15.50	2.10	4.846	812.30
15.75	1.97	4.888	812.30
16.00	1.84	4.928	812.31
16.25	1.72	4.965	812.32
16.50	1.66	4.999	812.32
16.75	1.61	5.033	812.33
17.00	1.56	5.066	812.33
17.25	1.52	5.098	812.34
17.50	1.47	5.129	812.34
17.75	1.43	5.159	812.35
18.00	1.38	5.188	812.35
18.25	1.33	5.216	812.36
18.50	1.29	5.243	812.36
18.75	1.24	5.269	812.36
19.00	1.20	5.294	812.37
19.25	1.15	5.318	812.37
19.50	1.10	5.341	812.37
19.75	1.06	5.364	812.38
20.00	1.01	**5.385**	**812.38**

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Dredge Cell 2 Runoff Area=21.670 ac Runoff Depth>7.08"
Flow Length=1,000' Slope=0.0025 '/' Tc=18.0 min CN=98 Runoff=165.02 cfs 12.792 af

Pond 2P: DC 2 Peak Elev=813.08' Storage=12.785 af Inflow=165.02 cfs 12.792 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 21.670 ac Runoff Volume = 12.792 af Average Runoff Depth = 7.08"
0.00% Pervious Area = 0.000 ac 100.00% Impervious Area = 21.670 ac

Subcatchment 1S: Dredge Cell 2

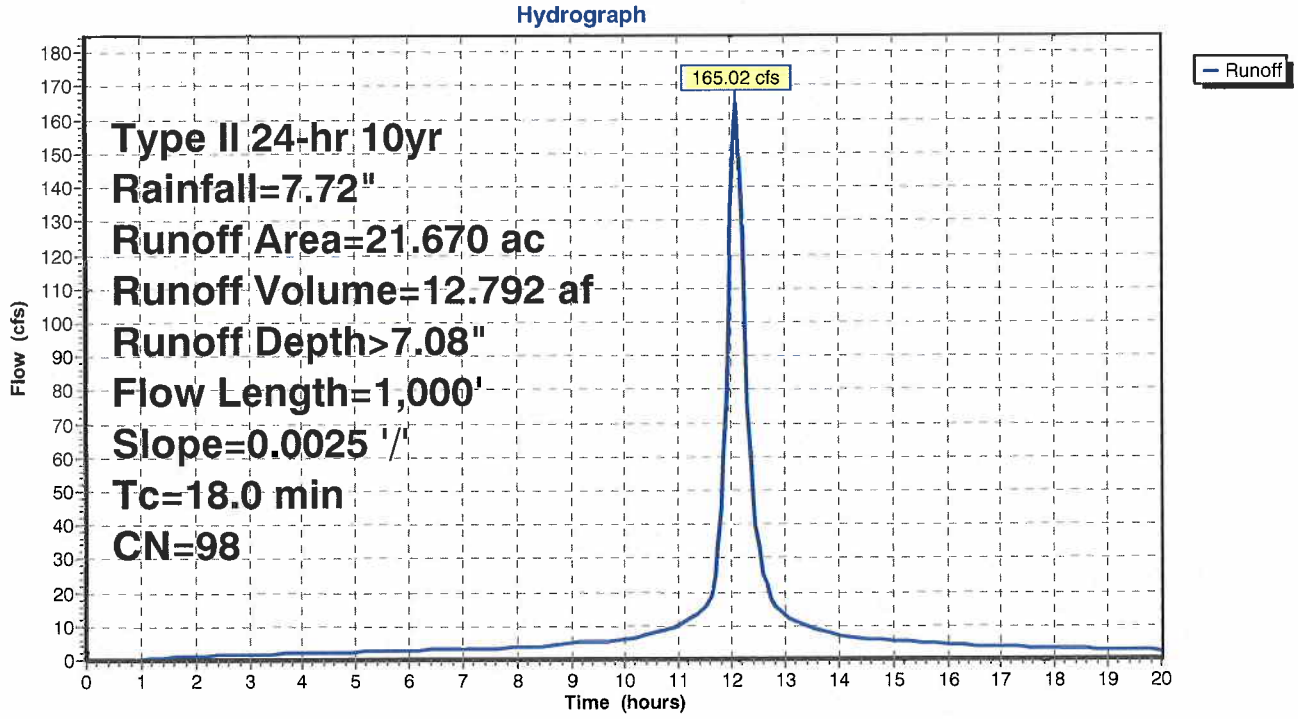
Runoff = 165.02 cfs @ 12.09 hrs, Volume= 12.792 af, Depth> 7.08"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=7.72"

Area (ac)	CN	Description
21.670	98	ash
21.670		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	300	0.0025	0.77		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.39"
11.5	700	0.0025	1.02		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
18.0	1,000	Total			

Subcatchment 1S: Dredge Cell 2



Hydrograph for Subcatchment 1S: Dredge Cell 2

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	13.00	5.96	5.72	12.95
0.25	0.02	0.00	0.00	13.25	6.07	5.83	10.69
0.50	0.04	0.00	0.00	13.50	6.17	5.93	9.26
0.75	0.06	0.00	0.04	13.75	6.25	6.02	8.10
1.00	0.08	0.01	0.27	14.00	6.33	6.09	7.18
1.25	0.10	0.01	0.53	14.25	6.40	6.16	6.41
1.50	0.12	0.02	0.75	14.50	6.47	6.23	5.99
1.75	0.15	0.04	0.94	14.75	6.53	6.29	5.68
2.00	0.17	0.05	1.10	15.00	6.59	6.35	5.38
2.25	0.19	0.07	1.25	15.25	6.65	6.41	5.09
2.50	0.22	0.08	1.37	15.50	6.70	6.46	4.79
2.75	0.24	0.10	1.49	15.75	6.75	6.51	4.50
3.00	0.27	0.12	1.59	16.00	6.79	6.55	4.21
3.25	0.29	0.14	1.69	16.25	6.84	6.60	3.94
3.50	0.32	0.16	1.77	16.50	6.88	6.64	3.79
3.75	0.34	0.18	1.86	16.75	6.92	6.68	3.68
4.00	0.37	0.20	1.93	17.00	6.96	6.72	3.57
4.25	0.40	0.23	2.01	17.25	7.00	6.76	3.47
4.50	0.43	0.25	2.11	17.50	7.04	6.80	3.36
4.75	0.46	0.28	2.22	17.75	7.07	6.84	3.26
5.00	0.49	0.31	2.32	18.00	7.11	6.87	3.15
5.25	0.52	0.33	2.42	18.25	7.14	6.91	3.05
5.50	0.55	0.36	2.52	18.50	7.18	6.94	2.94
5.75	0.58	0.39	2.62	18.75	7.21	6.97	2.84
6.00	0.62	0.43	2.72	19.00	7.24	7.00	2.73
6.25	0.65	0.46	2.82	19.25	7.27	7.03	2.62
6.50	0.69	0.49	2.91	19.50	7.30	7.06	2.52
6.75	0.73	0.53	3.01	19.75	7.32	7.08	2.41
7.00	0.76	0.56	3.11	20.00	**7.35**	**7.11**	2.31
7.25	0.80	0.60	3.20				
7.50	0.84	0.64	3.29				
7.75	0.88	0.68	3.39				
8.00	0.93	0.72	3.48				
8.25	0.97	0.76	3.62				
8.50	1.02	0.81	3.96				
8.75	1.08	0.86	4.37				
9.00	1.13	0.92	4.79				
9.25	1.20	0.98	5.16				
9.50	1.26	1.04	5.26				
9.75	1.32	1.11	5.38				
10.00	1.40	1.18	5.90				
10.25	1.48	1.26	6.61				
10.50	1.57	1.35	7.54				
10.75	1.68	1.46	8.63				
11.00	1.81	1.59	10.16				
11.25	1.98	1.75	12.16				
11.50	2.18	1.96	15.66				
11.75	2.99	2.76	33.20				
12.00	5.12	4.88	**132.98**				
12.25	5.45	5.21	**98.39**				
12.50	5.67	5.44	33.63				
12.75	5.83	5.59	17.84				

Pond 2P: DC 2

Inflow Area = 21.670 ac, Inflow Depth > 7.08" for 10yr event
Inflow = 165.02 cfs @ 12.09 hrs, Volume= 12.792 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

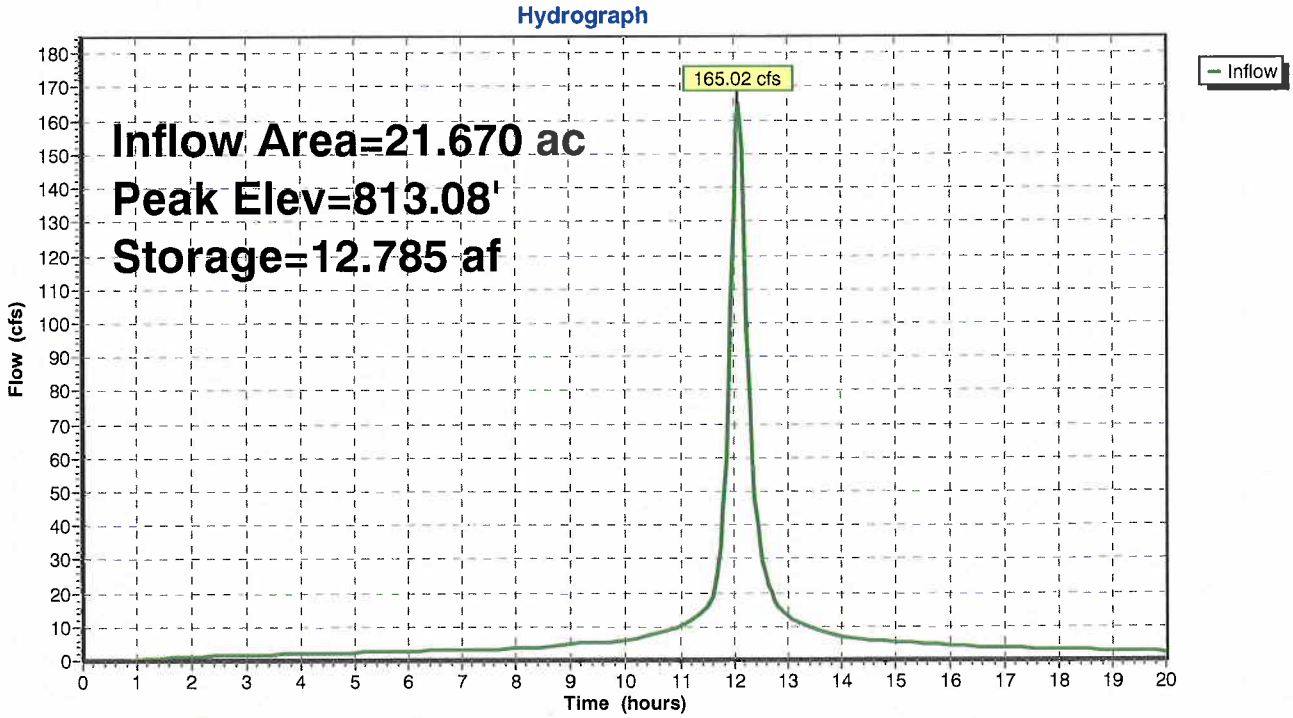
Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 813.08' @ 20.00 hrs Surf.Area= 13.950 ac Storage= 12.785 af

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	809.00'	29.094 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
809.00	0.176	0.000	0.000
810.00	0.679	0.428	0.428
811.00	1.174	0.927	1.354
812.00	3.079	2.126	3.481
813.00	13.239	8.159	11.640
814.00	21.670	17.455	29.094

Pond 2P: DC 2



Hydrograph for Pond 2P: DC 2

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)
0.00	0.00	0.000	809.00
0.25	0.00	0.000	809.00
0.50	0.00	0.000	809.00
0.75	0.04	0.000	809.00
1.00	0.27	0.003	809.02
1.25	0.53	0.011	809.06
1.50	0.75	0.025	809.12
1.75	0.94	0.042	809.19
2.00	1.10	0.063	809.26
2.25	1.25	0.088	809.34
2.50	1.37	0.115	809.41
2.75	1.49	0.144	809.48
3.00	1.59	0.176	809.56
3.25	1.69	0.210	809.63
3.50	1.77	0.246	809.70
3.75	1.86	0.283	809.77
4.00	1.93	0.323	809.84
4.25	2.01	0.363	809.90
4.50	2.11	0.406	809.97
4.75	2.22	0.451	810.03
5.00	2.32	0.498	810.10
5.25	2.42	0.546	810.17
5.50	2.52	0.598	810.23
5.75	2.62	0.651	810.30
6.00	2.72	0.706	810.36
6.25	2.82	0.763	810.43
6.50	2.91	0.822	810.49
6.75	3.01	0.884	810.56
7.00	3.11	0.947	810.62
7.25	3.20	1.012	810.69
7.50	3.29	1.079	810.75
7.75	3.39	1.148	810.82
8.00	3.48	1.219	810.88
8.25	3.62	1.292	810.95
8.50	3.96	1.370	811.01
8.75	4.37	1.456	811.08
9.00	4.79	1.551	811.15
9.25	5.16	1.654	811.22
9.50	5.26	1.762	811.28
9.75	5.38	1.871	811.34
10.00	5.90	1.987	811.41
10.25	6.61	2.116	811.47
10.50	7.54	2.262	811.54
10.75	8.63	2.428	811.61
11.00	10.16	2.622	811.69
11.25	12.16	2.851	811.78
11.50	15.66	3.137	811.88
11.75	33.20	3.564	812.03
12.00	**132.98**	5.097	812.34
12.25	**98.39**	8.057	812.69
12.50	33.63	9.247	812.80
12.75	17.84	9.751	812.85
13.00	12.95	10.060	812.87
13.25	10.69	10.302	812.89
13.50	9.26	10.507	812.91
13.75	8.10	10.687	812.93
14.00	7.18	10.844	812.94
14.25	6.41	10.984	812.95
14.50	5.99	11.112	812.96
14.75	5.68	11.232	812.97
15.00	5.38	11.347	812.98
15.25	5.09	11.455	812.99
15.50	4.79	11.557	812.99
15.75	4.50	11.653	813.00
16.00	4.21	11.743	813.01
16.25	3.94	11.827	813.01
16.50	3.79	11.907	813.02
16.75	3.68	11.984	813.03
17.00	3.57	12.059	813.03
17.25	3.47	12.131	813.04
17.50	3.36	12.202	813.04
17.75	3.26	12.270	813.05
18.00	3.15	12.336	813.05
18.25	3.05	12.400	813.06
18.50	2.94	12.462	813.06
18.75	2.84	12.522	813.07
19.00	2.73	12.579	813.07
19.25	2.62	12.635	813.07
19.50	2.52	12.688	813.08
19.75	2.41	12.739	813.08
20.00	2.31	**12.788**	**813.08**

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Dredge Cell 2 Runoff Area=21.670 ac Runoff Depth>6.21"
Flow Length=1,000' Slope=0.0025 '/' Tc=18.0 min CN=98 Runoff=145.24 cfs 11.218 af

Pond 2P: DC 2 Peak Elev=812.97' Storage=11.211 af Inflow=145.24 cfs 11.218 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 21.670 ac Runoff Volume = 11.218 af Average Runoff Depth = 6.21"
0.00% Pervious Area = 0.000 ac 100.00% Impervious Area = 21.670 ac

Subcatchment 1S: Dredge Cell 2

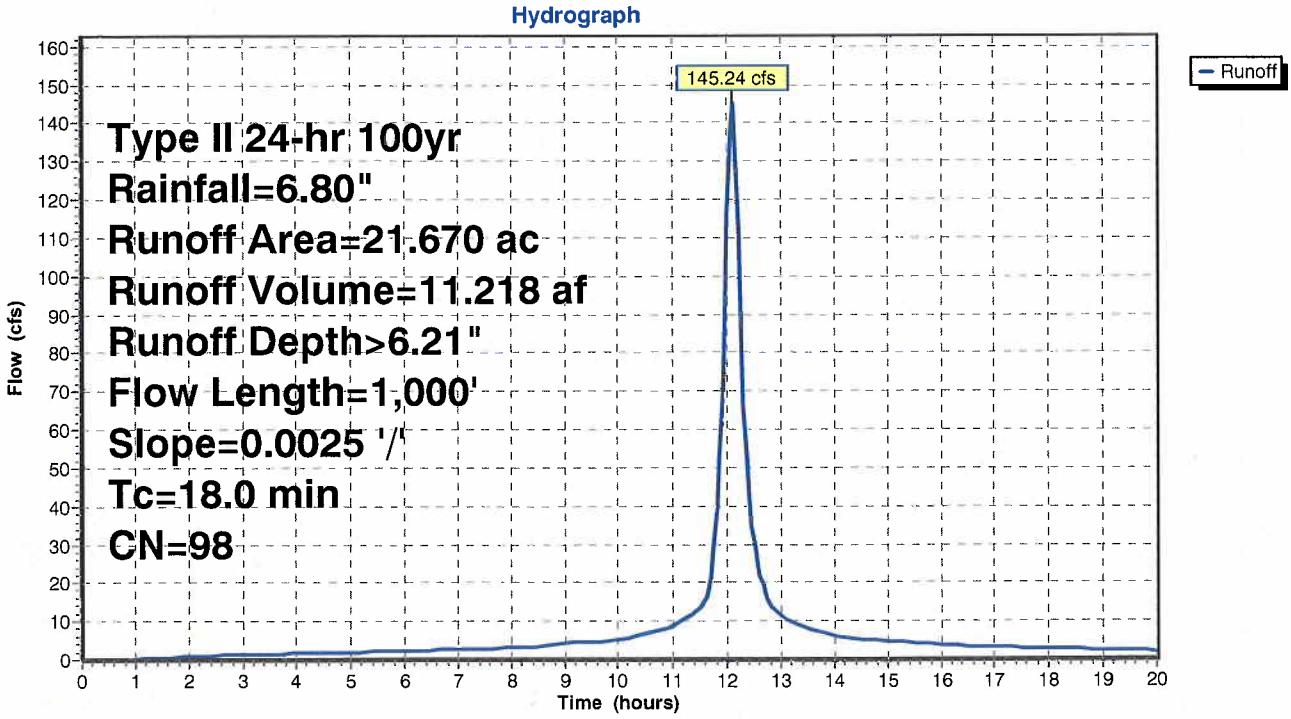
Runoff = 145.24 cfs @ 12.09 hrs, Volume= 11.218 af, Depth> 6.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100yr Rainfall=6.80"

Area (ac)	CN	Description
21.670	98	ash
21.670		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	300	0.0025	0.77		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.39"
11.5	700	0.0025	1.02		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
18.0	1,000	Total			

Subcatchment 1S: Dredge Cell 2



Hydrograph for Subcatchment 1S: Dredge Cell 2

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	13.00	5.25	5.01	11.40
0.25	0.02	0.00	0.00	13.25	5.35	5.11	9.41
0.50	0.03	0.00	0.00	13.50	5.43	5.20	8.16
0.75	0.05	0.00	0.01	13.75	5.51	5.27	7.14
1.00	0.07	0.00	0.16	14.00	5.58	5.34	6.33
1.25	0.09	0.01	0.37	14.25	5.64	5.40	5.64
1.50	0.11	0.02	0.56	14.50	5.70	5.46	5.27
1.75	0.13	0.03	0.73	14.75	5.75	5.51	5.00
2.00	0.15	0.04	0.88	15.00	5.80	5.57	4.74
2.25	0.17	0.05	1.01	15.25	5.85	5.62	4.48
2.50	0.19	0.06	1.12	15.50	5.90	5.66	4.22
2.75	0.21	0.08	1.23	15.75	5.94	5.71	3.96
3.00	0.23	0.09	1.33	16.00	5.98	5.75	3.70
3.25	0.26	0.11	1.41	16.25	6.02	5.78	3.47
3.50	0.28	0.13	1.49	16.50	6.06	5.82	3.34
3.75	0.30	0.15	1.57	16.75	6.10	5.86	3.24
4.00	0.33	0.17	1.64	17.00	6.13	5.89	3.15
4.25	0.35	0.19	1.72	17.25	6.17	5.93	3.05
4.50	0.38	0.21	1.80	17.50	6.20	5.96	2.96
4.75	0.40	0.23	1.90	17.75	6.23	5.99	2.87
5.00	0.43	0.25	1.99	18.00	6.26	6.02	2.78
5.25	0.46	0.28	2.08	18.25	6.29	6.05	2.68
5.50	0.48	0.30	2.17	18.50	6.32	6.08	2.59
5.75	0.51	0.33	2.26	18.75	6.35	6.11	2.50
6.00	0.54	0.36	2.35	19.00	6.38	6.14	2.40
6.25	0.58	0.39	2.44	19.25	6.40	6.16	2.31
6.50	0.61	0.42	2.53	19.50	6.43	6.19	2.22
6.75	0.64	0.45	2.62	19.75	6.45	6.21	2.13
7.00	0.67	0.48	2.70	20.00	**6.47**	**6.23**	2.03
7.25	0.71	0.51	2.79				
7.50	0.74	0.54	2.87				
7.75	0.78	0.58	2.95				
8.00	0.82	0.61	3.04				
8.25	0.86	0.65	3.16				
8.50	0.90	0.69	3.46				
8.75	0.95	0.74	3.82				
9.00	1.00	0.79	4.19				
9.25	1.05	0.84	4.51				
9.50	1.11	0.90	4.61				
9.75	1.17	0.95	4.71				
10.00	1.23	1.02	5.17				
10.25	1.30	1.09	5.79				
10.50	1.39	1.17	6.61				
10.75	1.48	1.26	7.58				
11.00	1.60	1.38	8.92				
11.25	1.74	1.52	10.68				
11.50	1.92	1.70	13.76				
11.75	2.63	2.40	29.19				
12.00	4.51	4.27	**117.02**				
12.25	4.80	4.57	**86.61**				
12.50	5.00	4.76	29.61				
12.75	5.13	4.90	15.71				

Pond 2P: DC 2

Inflow Area = 21.670 ac, Inflow Depth > 6.21" for 100yr event
Inflow = 145.24 cfs @ 12.09 hrs, Volume= 11.218 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

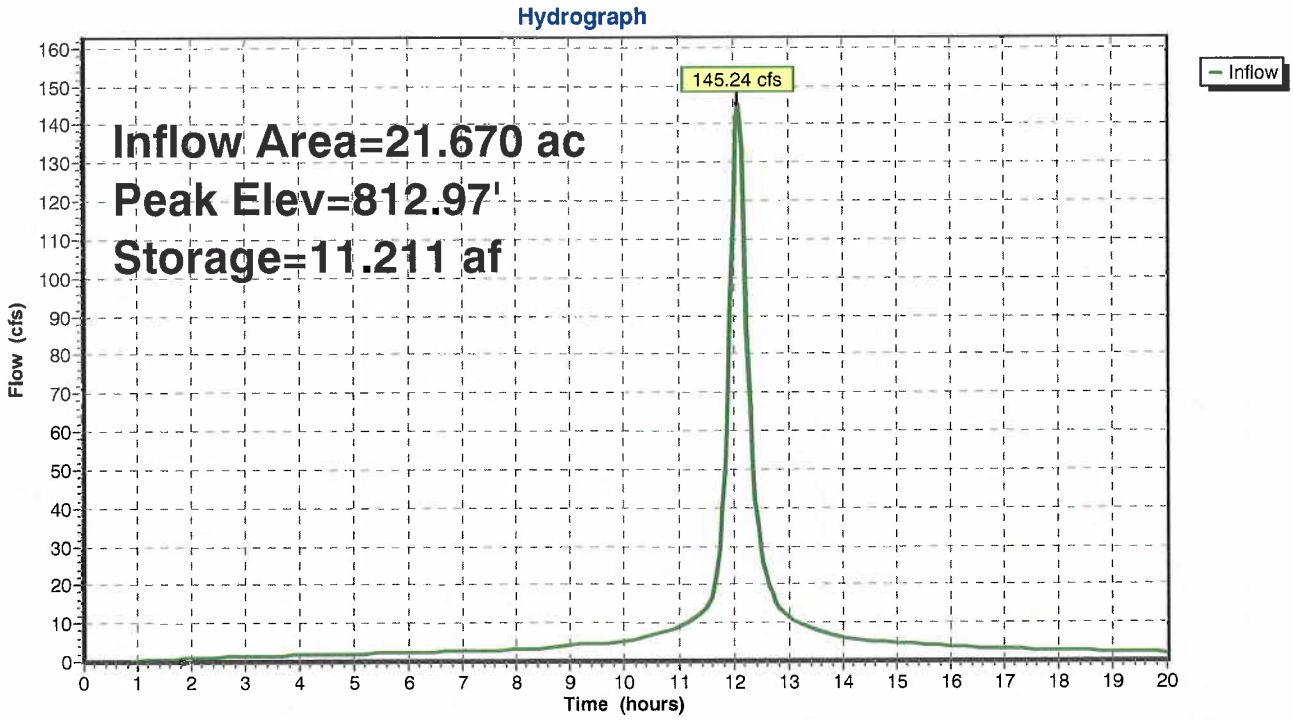
Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 812.97' @ 20.00 hrs Surf.Area= 12.906 ac Storage= 11.211 af

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	809.00'	29.094 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
809.00	0.176	0.000	0.000
810.00	0.679	0.428	0.428
811.00	1.174	0.927	1.354
812.00	3.079	2.126	3.481
813.00	13.239	8.159	11.640
814.00	21.670	17.455	29.094

Pond 2P: DC 2



Hydrograph for Pond 2P: DC 2

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)
0.00	0.00	0.000	809.00
0.25	0.00	0.000	809.00
0.50	0.00	0.000	809.00
0.75	0.01	0.000	809.00
1.00	0.16	0.001	809.01
1.25	0.37	0.007	809.04
1.50	0.56	0.017	809.08
1.75	0.73	0.030	809.14
2.00	0.88	0.047	809.21
2.25	1.01	0.066	809.27
2.50	1.12	0.088	809.34
2.75	1.23	0.113	809.41
3.00	1.33	0.139	809.47
3.25	1.41	0.167	809.54
3.50	1.49	0.197	809.60
3.75	1.57	0.229	809.67
4.00	1.64	0.262	809.73
4.25	1.72	0.297	809.79
4.50	1.80	0.333	809.85
4.75	1.90	0.372	809.91
5.00	1.99	0.412	809.98
5.25	2.08	0.454	810.04
5.50	2.17	0.498	810.10
5.75	2.26	0.544	810.16
6.00	2.35	0.591	810.22
6.25	2.44	0.641	810.28
6.50	2.53	0.692	810.35
6.75	2.62	0.746	810.41
7.00	2.70	0.800	810.47
7.25	2.79	0.857	810.53
7.50	2.87	0.916	810.59
7.75	2.95	0.976	810.65
8.00	3.04	1.038	810.71
8.25	3.16	1.101	810.77
8.50	3.46	1.169	810.84
8.75	3.82	1.245	810.90
9.00	4.19	1.327	810.98
9.25	4.51	1.418	811.05
9.50	4.61	1.512	811.12
9.75	4.71	1.608	811.19
10.00	5.17	1.710	811.25
10.25	5.79	1.823	811.32
10.50	6.61	1.951	811.39
10.75	7.58	2.097	811.46
11.00	8.92	2.267	811.54
11.25	10.68	2.468	811.63
11.50	13.76	2.719	811.73
11.75	29.19	3.094	811.87
12.00	**117.02**	4.443	812.23
12.25	**86.61**	7.048	812.59
12.50	29.61	8.096	812.70
12.75	15.71	8.539	812.74
13.00	11.40	8.811	812.76
13.25	9.41	9.025	812.78
13.50	8.16	9.206	812.80
13.75	7.14	9.363	812.81
14.00	6.33	9.502	812.83
14.25	5.64	9.625	812.84
14.50	5.27	9.738	812.85
14.75	5.00	9.844	812.86
15.00	4.74	9.945	812.86
15.25	4.48	10.040	812.87
15.50	4.22	10.130	812.88
15.75	3.96	10.214	812.89
16.00	3.70	10.293	812.89
16.25	3.47	10.367	812.90
16.50	3.34	10.438	812.91
16.75	3.24	10.506	812.91
17.00	3.15	10.571	812.92
17.25	3.05	10.636	812.92
17.50	2.96	10.698	812.93
17.75	2.87	10.758	812.93
18.00	2.78	10.816	812.94
18.25	2.68	10.873	812.94
18.50	2.59	10.927	812.94
18.75	2.50	10.980	812.95
19.00	2.40	11.030	812.95
19.25	2.31	11.079	812.96
19.50	2.22	11.126	812.96
19.75	2.13	11.171	812.96
20.00	2.03	**11.213**	**812.97**

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Dredge Cell 2 Runoff Area=21.670 ac Runoff Depth>6.84"
Flow Length=1,000' Slope=0.0025 '/' Tc=18.0 min CN=98 Runoff=159.43 cfs 12.347 af

Pond 2P: DC 2 Peak Elev=813.05' Storage=12.342 af Inflow=159.43 cfs 12.347 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 21.670 ac Runoff Volume = 12.347 af Average Runoff Depth = 6.84"
0.00% Pervious Area = 0.000 ac 100.00% Impervious Area = 21.670 ac

Subcatchment 1S: Dredge Cell 2

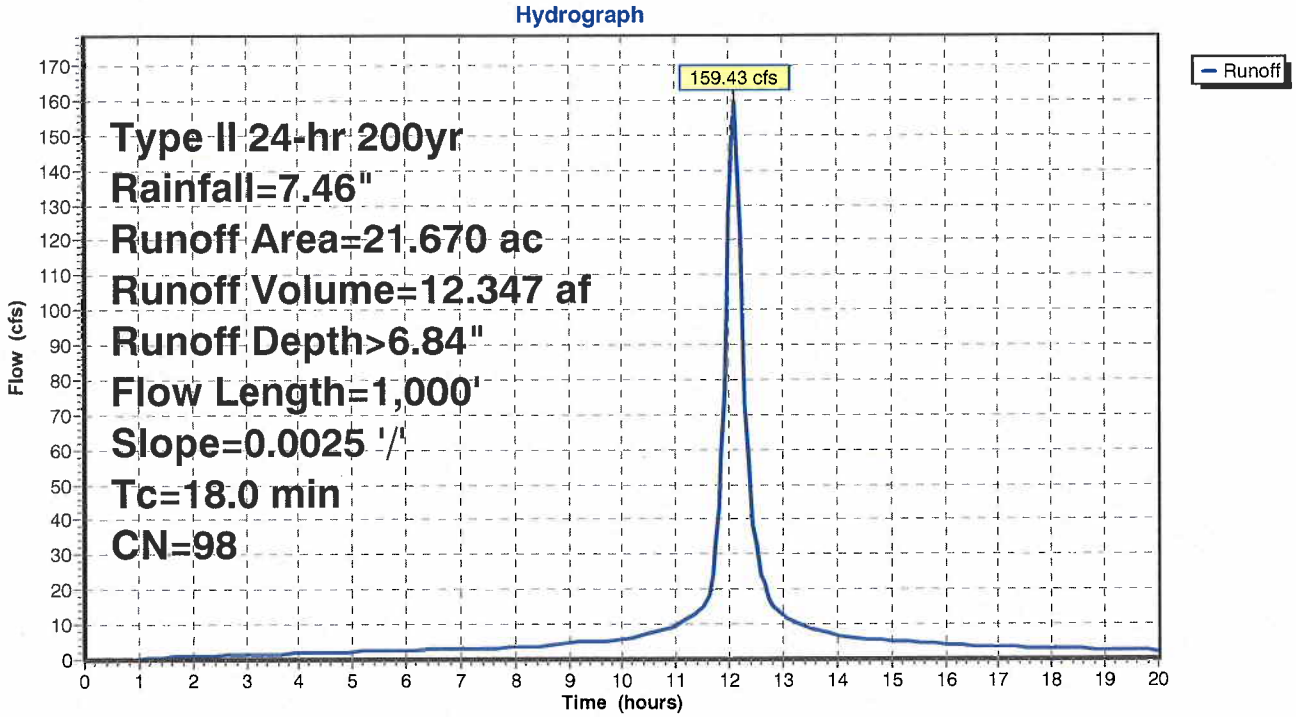
Runoff = 159.43 cfs @ 12.09 hrs, Volume= 12.347 af, Depth> 6.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 200yr Rainfall=7.46"

Area (ac)	CN	Description
21.670	98	ash
21.670		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	300	0.0025	0.77		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.39"
11.5	700	0.0025	1.02		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
18.0	1,000	Total			

Subcatchment 1S: Dredge Cell 2



Hydrograph for Subcatchment 1S: Dredge Cell 2

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	13.00	5.76	5.52	12.51
0.25	0.02	0.00	0.00	13.25	5.87	5.63	10.33
0.50	0.04	0.00	0.00	13.50	5.96	5.72	8.95
0.75	0.06	0.00	0.03	13.75	6.04	5.81	7.83
1.00	0.08	0.01	0.24	14.00	6.12	5.88	6.94
1.25	0.10	0.01	0.48	14.25	6.18	5.95	6.19
1.50	0.12	0.02	0.70	14.50	6.25	6.01	5.79
1.75	0.14	0.03	0.88	14.75	6.31	6.07	5.49
2.00	0.16	0.05	1.04	15.00	6.37	6.13	5.20
2.25	0.19	0.06	1.18	15.25	6.42	6.18	4.92
2.50	0.21	0.08	1.30	15.50	6.47	6.23	4.63
2.75	0.23	0.09	1.41	15.75	6.52	6.28	4.35
3.00	0.26	0.11	1.52	16.00	6.56	6.33	4.06
3.25	0.28	0.13	1.61	16.25	6.61	6.37	3.80
3.50	0.31	0.15	1.70	16.50	6.65	6.41	3.66
3.75	0.33	0.17	1.78	16.75	6.69	6.45	3.55
4.00	0.36	0.19	1.85	17.00	6.73	6.49	3.45
4.25	0.38	0.22	1.93	17.25	6.76	6.53	3.35
4.50	0.41	0.24	2.02	17.50	6.80	6.56	3.25
4.75	0.44	0.26	2.13	17.75	6.84	6.60	3.15
5.00	0.47	0.29	2.23	18.00	6.87	6.63	3.05
5.25	0.50	0.32	2.33	18.25	6.90	6.66	2.94
5.50	0.53	0.35	2.42	18.50	6.94	6.70	2.84
5.75	0.56	0.38	2.52	18.75	6.97	6.73	2.74
6.00	0.60	0.41	2.62	19.00	7.00	6.76	2.64
6.25	0.63	0.44	2.71	19.25	7.02	6.78	2.54
6.50	0.67	0.47	2.81	19.50	7.05	6.81	2.43
6.75	0.70	0.50	2.90	19.75	7.08	6.84	2.33
7.00	0.74	0.54	2.99	20.00	**7.10**	**6.86**	2.23
7.25	0.78	0.58	3.08				
7.50	0.82	0.61	3.17				
7.75	0.85	0.65	3.26				
8.00	0.90	0.69	3.35				
8.25	0.94	0.73	3.49				
8.50	0.99	0.78	3.82				
8.75	1.04	0.83	4.22				
9.00	1.10	0.88	4.62				
9.25	1.16	0.94	4.98				
9.50	1.22	1.00	5.08				
9.75	1.28	1.06	5.19				
10.00	1.35	1.13	5.70				
10.25	1.43	1.21	6.38				
10.50	1.52	1.30	7.27				
10.75	1.63	1.41	8.33				
11.00	1.75	1.53	9.81				
11.25	1.91	1.68	11.74				
11.50	2.11	1.88	15.13				
11.75	2.89	2.66	32.07				
12.00	4.95	4.71	**128.47**				
12.25	5.27	5.03	**95.06**				
12.50	5.48	5.25	32.50				
12.75	5.63	5.40	17.23				

Pond 2P: DC 2

Inflow Area = 21.670 ac, Inflow Depth > 6.84" for 200yr event
Inflow = 159.43 cfs @ 12.09 hrs, Volume= 12.347 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

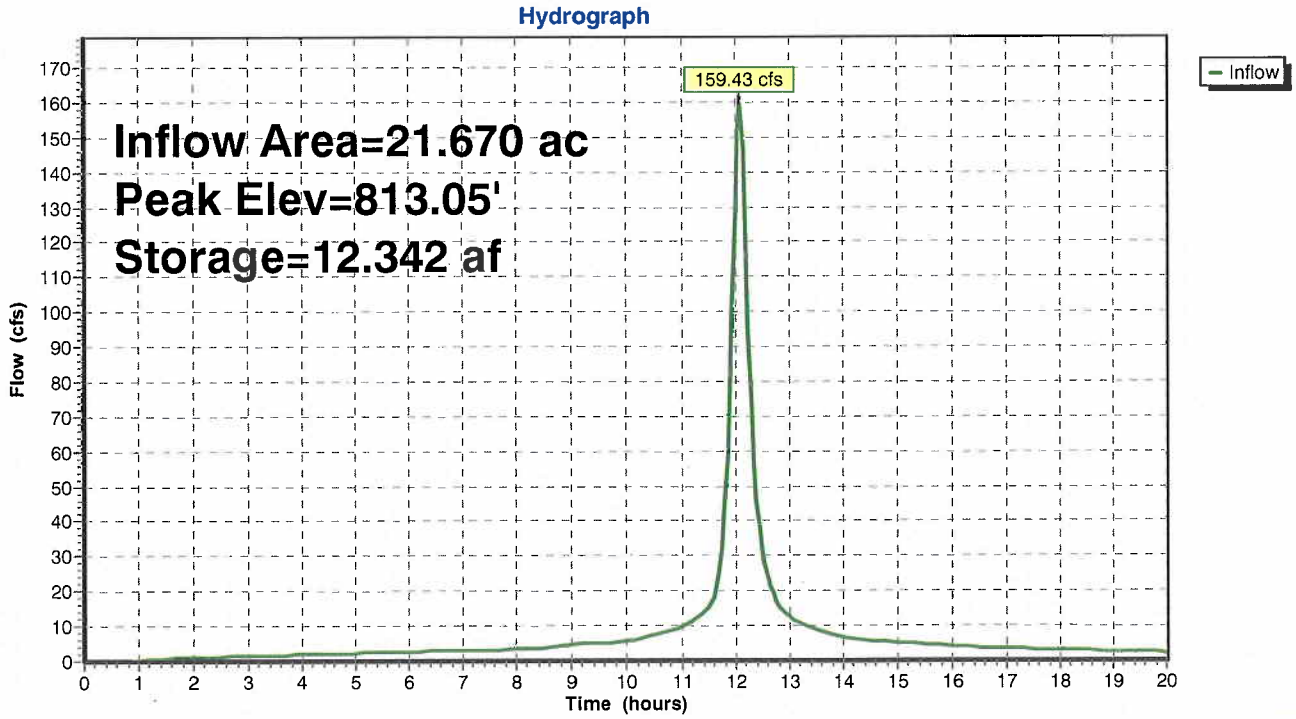
Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 813.05' @ 20.00 hrs Surf.Area= 13.679 ac Storage= 12.342 af

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	809.00'	29.094 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
809.00	0.176	0.000	0.000
810.00	0.679	0.428	0.428
811.00	1.174	0.927	1.354
812.00	3.079	2.126	3.481
813.00	13.239	8.159	11.640
814.00	21.670	17.455	29.094

Pond 2P: DC 2



Hydrograph for Pond 2P: DC 2

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)
0.00	0.00	0.000	809.00
0.25	0.00	0.000	809.00
0.50	0.00	0.000	809.00
0.75	0.03	0.000	809.00
1.00	0.24	0.003	809.01
1.25	0.48	0.010	809.05
1.50	0.70	0.022	809.11
1.75	0.88	0.039	809.18
2.00	1.04	0.059	809.25
2.25	1.18	0.082	809.32
2.50	1.30	0.107	809.39
2.75	1.41	0.135	809.46
3.00	1.52	0.166	809.53
3.25	1.61	0.198	809.60
3.50	1.70	0.232	809.67
3.75	1.78	0.268	809.74
4.00	1.85	0.305	809.81
4.25	1.93	0.344	809.87
4.50	2.02	0.385	809.94
4.75	2.13	0.428	810.00
5.00	2.23	0.473	810.07
5.25	2.33	0.520	810.13
5.50	2.42	0.569	810.19
5.75	2.52	0.620	810.26
6.00	2.62	0.673	810.32
6.25	2.71	0.728	810.39
6.50	2.81	0.785	810.45
6.75	2.90	0.844	810.52
7.00	2.99	0.905	810.58
7.25	3.08	0.968	810.64
7.50	3.17	1.033	810.71
7.75	3.26	1.099	810.77
8.00	3.35	1.167	810.84
8.25	3.49	1.238	810.90
8.50	3.82	1.313	810.96
8.75	4.22	1.396	811.03
9.00	4.62	1.487	811.10
9.25	4.98	1.587	811.17
9.50	5.08	1.691	811.24
9.75	5.19	1.797	811.30
10.00	5.70	1.909	811.36
10.25	6.38	2.033	811.43
10.50	7.27	2.174	811.50
10.75	8.33	2.335	811.57
11.00	9.81	2.522	811.65
11.25	11.74	2.742	811.74
11.50	15.13	3.018	811.84
11.75	32.07	3.431	811.98
12.00	**128.47**	4.912	812.31
12.25	**95.06**	7.772	812.66
12.50	32.50	8.922	812.78
12.75	17.23	9.408	812.82
13.00	12.51	9.707	812.84
13.25	10.33	9.941	812.86
13.50	8.95	10.140	812.88
13.75	7.83	10.313	812.90
14.00	6.94	10.465	812.91
14.25	6.19	10.600	812.92
14.50	5.79	10.723	812.93
14.75	5.49	10.840	812.94
15.00	5.20	10.950	812.95
15.25	4.92	11.055	812.95
15.50	4.63	11.154	812.96
15.75	4.35	11.246	812.97
16.00	4.06	11.333	812.98
16.25	3.80	11.414	812.98
16.50	3.66	11.491	812.99
16.75	3.55	11.566	812.99
17.00	3.45	11.638	813.00
17.25	3.35	11.709	813.01
17.50	3.25	11.777	813.01
17.75	3.15	11.843	813.02
18.00	3.05	11.907	813.02
18.25	2.94	11.969	813.02
18.50	2.84	12.028	813.03
18.75	2.74	12.086	813.03
19.00	2.64	12.142	813.04
19.25	2.54	12.195	813.04
19.50	2.43	12.246	813.05
19.75	2.33	12.296	813.05
20.00	2.23	**12.343**	**813.05**

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Dredge Cell 2 Runoff Area=21.670 ac Runoff Depth>7.67"
Flow Length=1,000' Slope=0.0025 '/' Tc=18.0 min CN=98 Runoff=178.34 cfs 13.854 af

Pond 2P: DC 2 Peak Elev=813.16' Storage=13.847 af Inflow=178.34 cfs 13.854 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 21.670 ac Runoff Volume = 13.854 af Average Runoff Depth = 7.67"
0.00% Pervious Area = 0.000 ac 100.00% Impervious Area = 21.670 ac

Subcatchment 1S: Dredge Cell 2

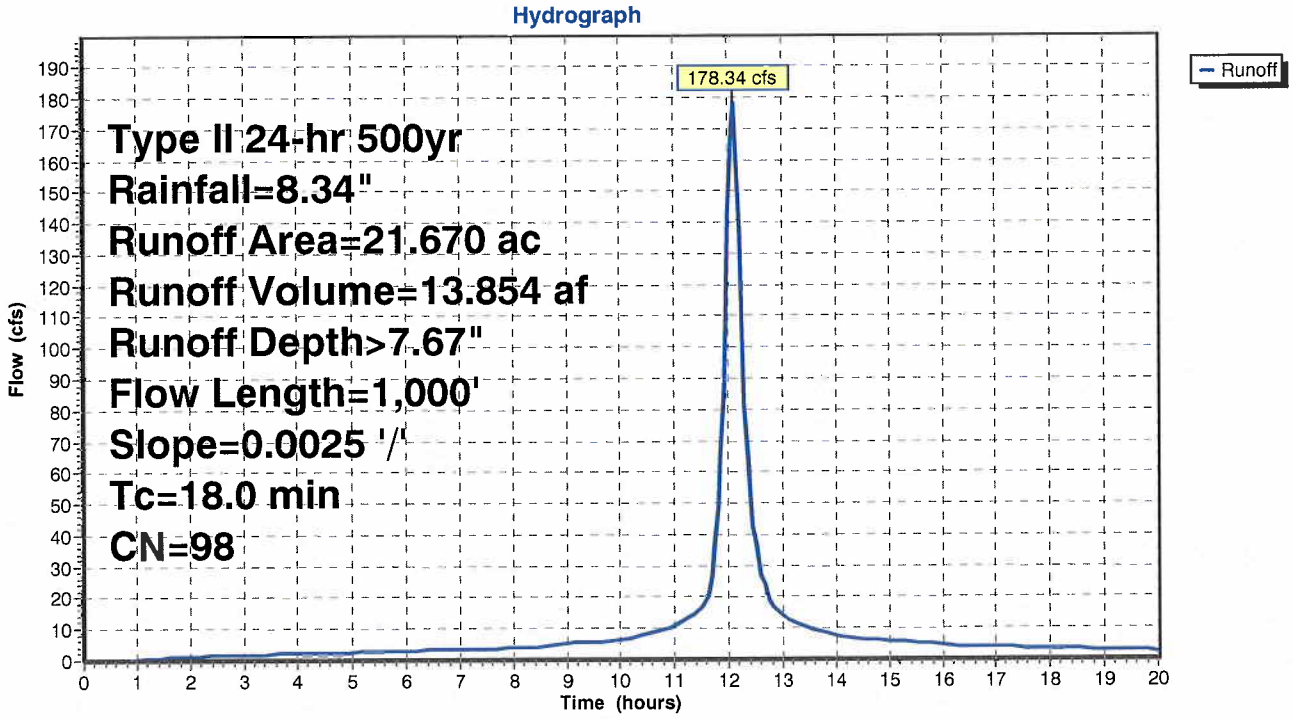
Runoff = 178.34 cfs @ 12.09 hrs, Volume= 13.854 af, Depth> 7.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 500yr Rainfall=8.34"

Area (ac)	CN	Description
21.670	98	ash
21.670		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	300	0.0025	0.77		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.39"
11.5	700	0.0025	1.02		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
18.0	1,000	Total			

Subcatchment 1S: Dredge Cell 2



Hydrograph for Subcatchment 1S: Dredge Cell 2

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	13.00	6.44	6.20	13.99
0.25	0.02	0.00	0.00	13.25	6.56	6.32	11.55
0.50	0.04	0.00	0.00	13.50	6.66	6.42	10.01
0.75	0.06	0.00	0.07	13.75	6.76	6.52	8.76
1.00	0.09	0.01	0.36	14.00	6.84	6.60	7.76
1.25	0.11	0.02	0.64	14.25	6.91	6.68	6.92
1.50	0.13	0.03	0.88	14.50	6.99	6.75	6.47
1.75	0.16	0.04	1.09	14.75	7.05	6.81	6.14
2.00	0.18	0.06	1.26	15.00	7.12	6.88	5.82
2.25	0.21	0.08	1.41	15.25	7.18	6.94	5.50
2.50	0.23	0.09	1.54	15.50	7.24	7.00	5.18
2.75	0.26	0.11	1.66	15.75	7.29	7.05	4.86
3.00	0.29	0.14	1.77	16.00	7.34	7.10	4.54
3.25	0.32	0.16	1.87	16.25	7.39	7.15	4.25
3.50	0.34	0.18	1.96	16.50	7.43	7.19	4.09
3.75	0.37	0.20	2.05	16.75	7.48	7.24	3.97
4.00	0.40	0.23	2.13	17.00	7.52	7.28	3.86
4.25	0.43	0.26	2.21	17.25	7.56	7.32	3.75
4.50	0.46	0.28	2.32	17.50	7.60	7.36	3.63
4.75	0.49	0.31	2.43	17.75	7.64	7.40	3.52
5.00	0.53	0.34	2.54	18.00	7.68	7.44	3.41
5.25	0.56	0.37	2.65	18.25	7.72	7.48	3.29
5.50	0.59	0.40	2.75	18.50	7.75	7.51	3.18
5.75	0.63	0.44	2.86	18.75	7.79	7.55	3.06
6.00	0.67	0.47	2.97	19.00	7.82	7.58	2.95
6.25	0.71	0.51	3.07	19.25	7.85	7.61	2.84
6.50	0.74	0.55	3.17	19.50	7.88	7.64	2.72
6.75	0.78	0.58	3.28	19.75	7.91	7.67	2.61
7.00	0.83	0.62	3.38	20.00	**7.94**	**7.70**	2.49
7.25	0.87	0.66	3.48				
7.50	0.91	0.71	3.58				
7.75	0.96	0.75	3.68				
8.00	1.00	0.79	3.78				
8.25	1.05	0.84	3.93				
8.50	1.10	0.89	4.30				
8.75	1.16	0.95	4.74				
9.00	1.23	1.01	5.20				
9.25	1.29	1.08	5.59				
9.50	1.36	1.14	5.70				
9.75	1.43	1.21	5.83				
10.00	1.51	1.29	6.39				
10.25	1.60	1.38	7.15				
10.50	1.70	1.48	8.16				
10.75	1.82	1.60	9.34				
11.00	1.96	1.73	11.00				
11.25	2.14	1.91	13.16				
11.50	2.36	2.13	16.94				
11.75	3.23	2.99	35.90				
12.00	5.53	5.29	**143.74**				
12.25	5.89	5.65	**106.33**				
12.50	6.13	5.89	36.34				
12.75	6.30	6.06	19.27				

Pond 2P: DC 2

Inflow Area = 21.670 ac, Inflow Depth > 7.67" for 500yr event
Inflow = 178.34 cfs @ 12.09 hrs, Volume= 13.854 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

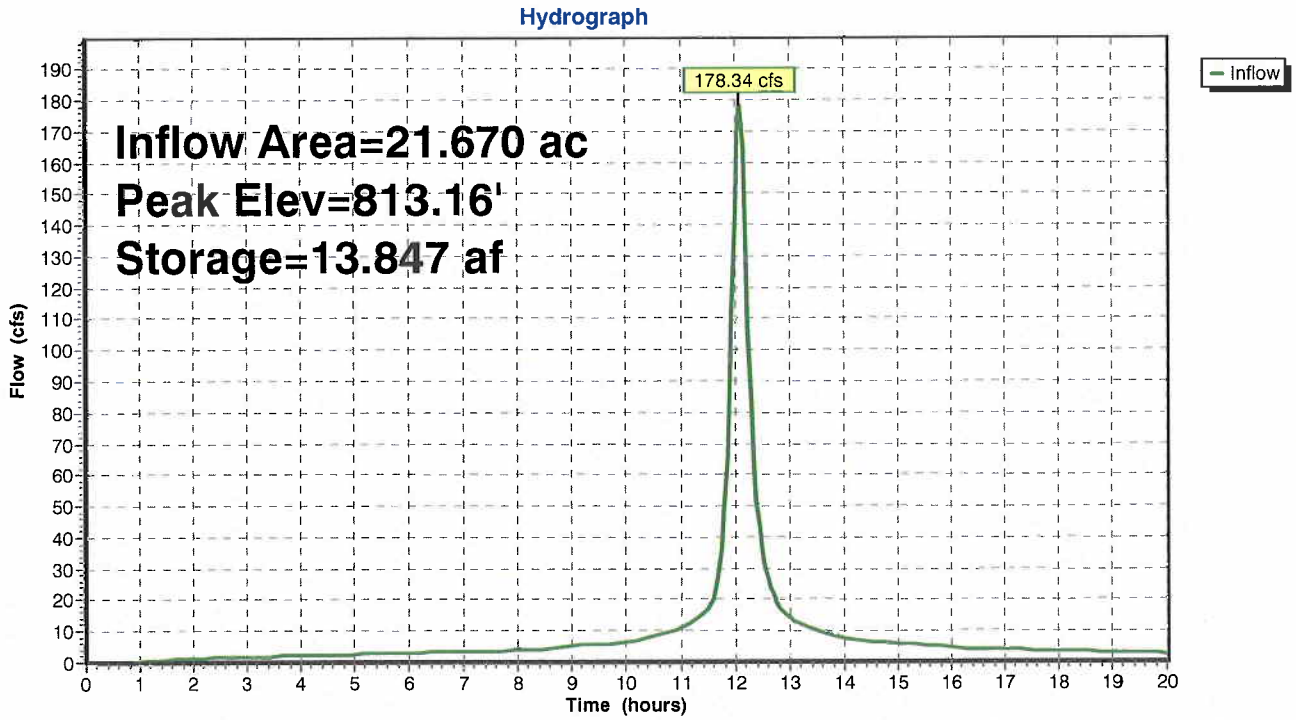
Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 813.16' @ 20.00 hrs Surf.Area= 14.577 ac Storage= 13.847 af

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	809.00'	29.094 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

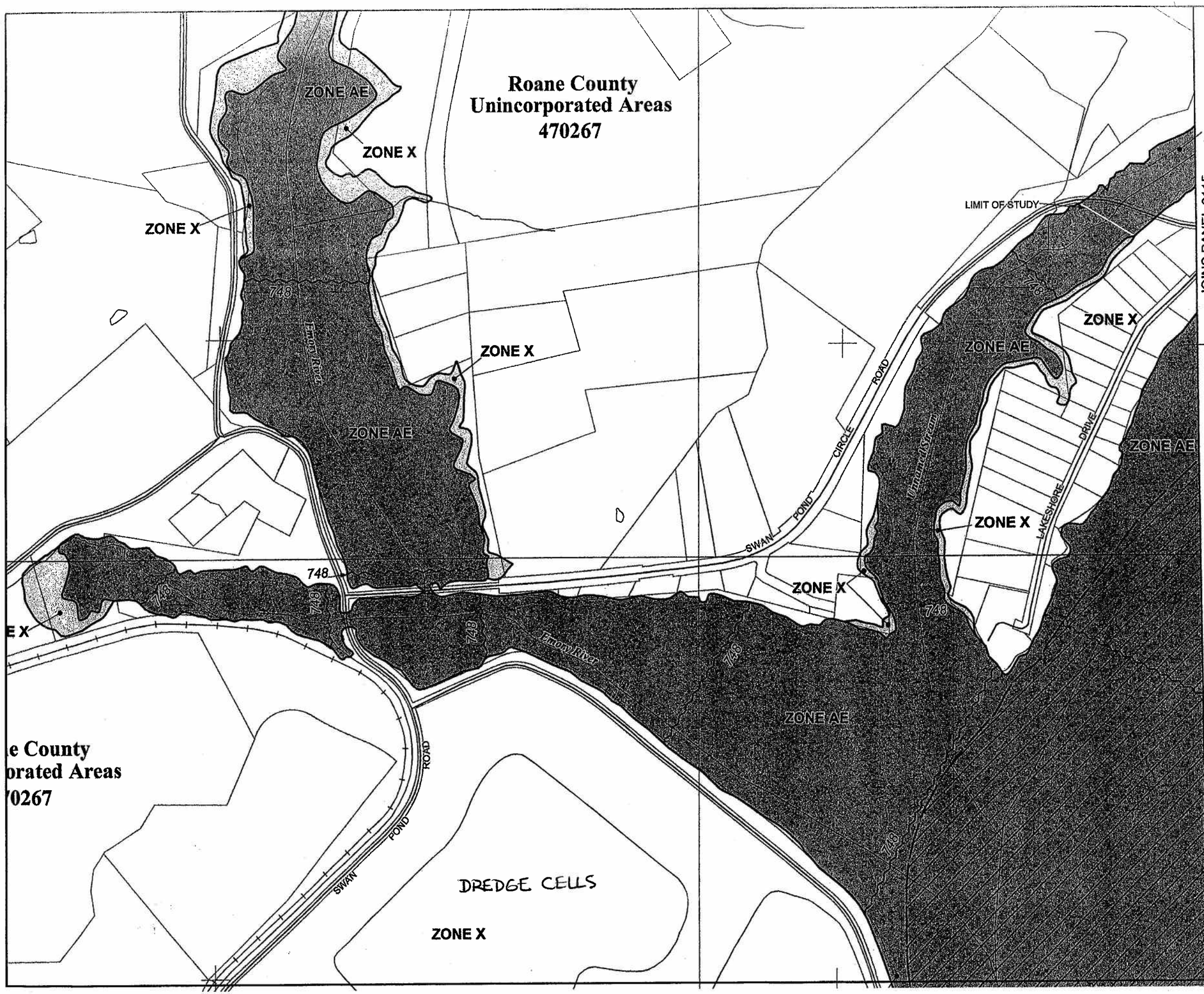
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
809.00	0.176	0.000	0.000
810.00	0.679	0.428	0.428
811.00	1.174	0.927	1.354
812.00	3.079	2.126	3.481
813.00	13.239	8.159	11.640
814.00	21.670	17.455	29.094

Pond 2P: DC 2



Hydrograph for Pond 2P: DC 2

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)
0.00	0.00	0.000	809.00
0.25	0.00	0.000	809.00
0.50	0.00	0.000	809.00
0.75	0.07	0.000	809.00
1.00	0.36	0.005	809.02
1.25	0.64	0.015	809.08
1.50	0.88	0.031	809.14
1.75	1.09	0.051	809.22
2.00	1.26	0.076	809.30
2.25	1.41	0.103	809.38
2.50	1.54	0.134	809.46
2.75	1.66	0.167	809.54
3.00	1.77	0.202	809.61
3.25	1.87	0.240	809.69
3.50	1.96	0.280	809.76
3.75	2.05	0.321	809.83
4.00	2.13	0.364	809.90
4.25	2.21	0.409	809.97
4.50	2.32	0.456	810.04
4.75	2.43	0.505	810.11
5.00	2.54	0.556	810.18
5.25	2.65	0.610	810.25
5.50	2.75	0.666	810.31
5.75	2.86	0.724	810.38
6.00	2.97	0.784	810.45
6.25	3.07	0.846	810.52
6.50	3.17	0.911	810.59
6.75	3.28	0.977	810.65
7.00	3.38	1.046	810.72
7.25	3.48	1.117	810.79
7.50	3.58	1.190	810.86
7.75	3.68	1.265	810.92
8.00	3.78	1.342	810.99
8.25	3.93	1.421	811.05
8.50	4.30	1.506	811.12
8.75	4.74	1.599	811.18
9.00	5.20	1.702	811.25
9.25	5.59	1.814	811.31
9.50	5.70	1.931	811.38
9.75	5.83	2.049	811.44
10.00	6.39	2.175	811.50
10.25	7.15	2.314	811.56
10.50	8.16	2.472	811.63
10.75	9.34	2.653	811.70
11.00	11.00	2.862	811.78
11.25	13.16	3.110	811.87
11.50	16.94	3.419	811.98
11.75	35.90	3.881	812.11
12.00	**143.74**	5.538	812.40
12.25	**106.33**	8.737	812.76
12.50	36.34	10.023	812.87
12.75	19.27	10.567	812.92
13.00	13.99	10.901	812.94
13.25	11.55	11.163	812.96
13.50	10.01	11.385	812.98
13.75	8.76	11.578	813.00
14.00	7.76	11.749	813.01
14.25	6.92	11.900	813.02
14.50	6.47	12.038	813.03
14.75	6.14	12.168	813.04
15.00	5.82	12.292	813.05
15.25	5.50	12.409	813.06
15.50	5.18	12.519	813.06
15.75	4.86	12.623	813.07
16.00	4.54	12.720	813.08
16.25	4.25	12.811	813.09
16.50	4.09	12.897	813.09
16.75	3.97	12.980	813.10
17.00	3.86	13.061	813.10
17.25	3.75	13.139	813.11
17.50	3.63	13.216	813.11
17.75	3.52	13.290	813.12
18.00	3.41	13.361	813.12
18.25	3.29	13.430	813.13
18.50	3.18	13.497	813.13
18.75	3.06	13.561	813.14
19.00	2.95	13.624	813.14
19.25	2.84	13.683	813.15
19.50	2.72	13.741	813.15
19.75	2.61	13.796	813.16
20.00	2.49	**13.849**	**813.16**



MAP SCALE 1" = 500'

500 1000 FEET

0 150 300 METERS

FIRM
FLOOD INSURANCE RATE MAP
ROANE COUNTY, TENNESSEE
AND INCORPORATED AREAS

PANEL 92 OF 335
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ROANE COUNTY	470267	0092	F

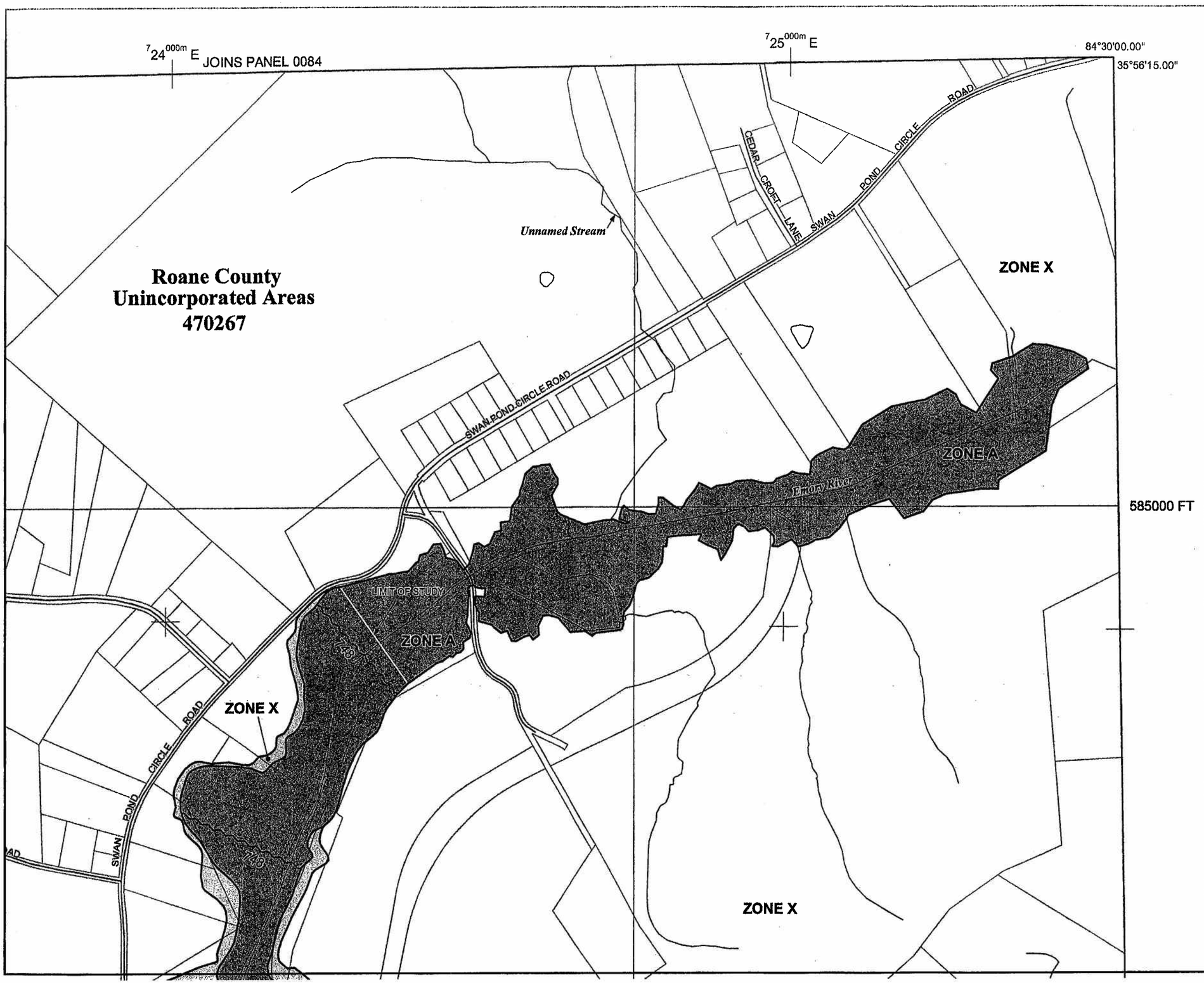
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
47145C0092F

EFFECTIVE DATE
SEPTEMBER 28, 2007

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



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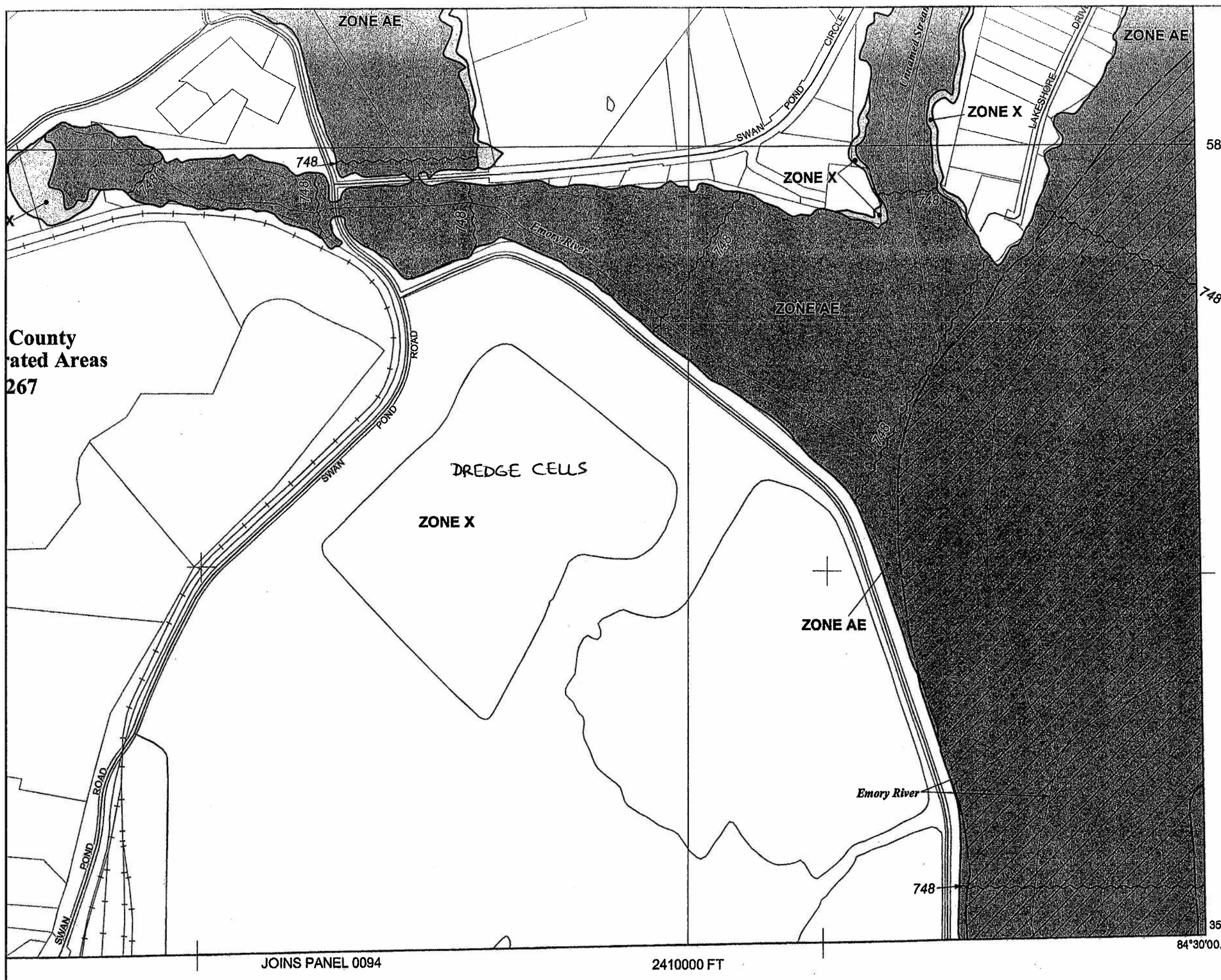

MAP SCALE 1" = 500'

500 1000 FEET

0 150 300 METERS

FIRM

FLOOD INSURANCE RATE MAP

ROANE COUNTY, TENNESSEE

AND INCORPORATED AREAS

PANEL 92 OF 335

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

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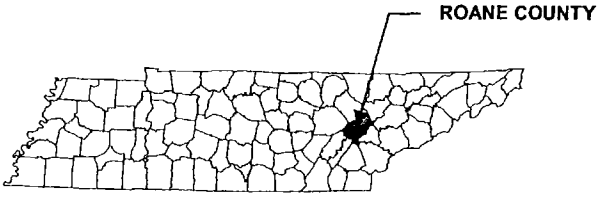
FLOOD INSURANCE STUDY

ROANE COUNTY, TENNESSEE,
AND INCORPORATED AREAS



COMMUNITY NAME	COMMUNITY NUMBER
HARRIMAN, CITY OF	475427
KINGSTON, CITY OF	470274
OAK RIDGE, CITY OF	475441
ROCKWOOD, CITY OF	475443
ROANE COUNTY (UNINCORPORATED AREAS)	470267

September 28, 2007

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
47145CV000A

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Part or all of this FIS may be revised and republished at any time. In addition, part of this FIS may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current FIS components.

Former flood hazard zone designations have been changed as follows:

Old Zone(s)	New Zone
Al through A30	AE
B	X
C	X

Initial Countywide FIS Effective Date: September 28, 2007

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EXHIBITS

Exhibit 1 - Flood Profiles

Black Creek	Panels 01-05P
Black Creek Side Channel	Panel 06P
Caney Creek	Panel 07P
Clinch River	Panel 08P
East Fork Black Creek	Panel 09P
East Fork Poplar Creek	Panels 10P-11P
Emory River	Panels 12P-14P
Indian Creek	Panels 15P-16P
Little Emory River	Panels 17P-18P
Middle Fork Black Creek	Panel 19P
North Fork Black Creek	Panel 20P
Pawpaw Creek	Panels 21P-22P
Poplar Creek	Panels 23P-24P
Tennessee River	Panel 25P
Tributary No. 3 to Indian Creek	Panel 26P
Whites Creek	Panels 27P-28P

Exhibit 2 - Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY

ROANE COUNTY, TENNESSEE, AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in the geographic area of Roane County, Tennessee, including the Cities of Harriman, Kingston, Oak Ridge, Rockwood and unincorporated areas of Roane County (hereinafter referred to collectively as Roane County). The FIS aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates. This information will also be used by Roane County to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP), and by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the NFIP are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

Please note that the Town of Oliver Springs is geographically located in Anderson and Roane Counties. The Town of Oliver Springs is included in its entirety in the Anderson County FIS report.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study report are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

This FIS was prepared to include the unincorporated areas of, and incorporated communities within, Roane County in a countywide format. Information on the authority and acknowledgments for each jurisdiction included in this countywide FIS, as compiled from their previously printed FIS reports, is shown below.

Harriman, City of:	the hydrologic and hydraulic analyses for the March 1984 FIS report were performed by the Tennessee Valley Authority (TVA) for the Federal Emergency Management Agency (FEMA), under Interagency Agreement EMW-E-0771, Project Order 1. This study was completed in June 1982.
Oak Ridge, City of:	for the original, November 15, 1984, FIS report and the May 15, 1985, FIRM (hereinafter referred to as the 1985 FIS), the hydrologic and

hydraulic analyses for East Fork Poplar Creek, Gamble Valley Creek, Ernies Creek, and Emory Valley Creek were performed by the Tennessee Valley Authority (TVA) for the Federal Emergency Management Agency (FEMA), under Interagency Agreement EMW-E-0771, Project Order 1. This study was completed in December 1982. The hydrologic and hydraulic analyses for the Clinch River were performed by TVA in 1975, independently of the aforementioned contract.

For the July 1998 FIS report revision, the hydrologic and hydraulic analyses for Emory Valley Creek were prepared by the U.S. Army Corps of Engineers (USACE), Nashville District, for FEMA, under Inter-Agency Agreement No. EMW-95-3-4759. This work was completed in May 1996. The hydrologic and hydraulic analyses for Brushy Fork Poplar Creek were taken from the unincorporated areas of Anderson County FIS (Reference 1).

Rockwood, City of: for the August 2003 FIS report, the hydrologic and hydraulic analyses for Black Creek, North Fork Black Creek, Middle Fork Black Creek, and East Fork Black Creek were prepared by the TVA for FEMA under Inter-Agency Agreement No. EMW-96-IA-0450. This work was completed in September 1999. The hydrologic and hydraulic analyses for Black Creek Side Channel were prepared by Dewberry & Davis LLC for FEMA. This work was completed in April 2001.

Roane County (Unincorporated Areas): the hydrologic and hydraulic analyses for the July 1984 FIS report were prepared by the Tennessee Valley Authority (TVA), for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. IAA-H-7-77, Project Order Nos. 3, 3A3, and 3A4. This study was completed in June 1978.

The hydrologic and hydraulic analyses for the remaining streams were taken from previous Flood Insurance Studies for the unincorporated areas of Roane County, the Cities of Harriman, Oak Ridge and Rockwood (References 2-5).

The authority and acknowledgments for the City of Kingston is not available because a FIS report was not published for that community.

For this countywide FIS, floodplain boundaries were redelineated based on more detailed and up-to-date topography submitted by Roane County. The work for this study was performed by the Watershed IV Alliance, for the Federal Emergency Management Agency (FEMA), under Contract No. EMA-2002-CO0011A.

Basemap data was provided by the State of Tennessee Office for Information Resources, GIS Services, as part of the Tennessee Base Mapping Program.

312 8th Avenue North
16th Floor, WRS Tennessee Tower
Nashville, TN 37243-0288
http://gis.state.tn.us/mapping.html

The basemap data was provided in GCS_North_American_1983 coordinate system and Lambert_Conformal_Conic State Plane Tennessee FIPS 4100 Feet projection. The datum was North American Datum 1983.

1.3 Coordination

An initial Consultation Coordination Officer's (CCO) meeting is held with representatives from FEMA, the community, and the study contractor to explain the nature and purpose of a FIS, and to identify the streams to be studied by detailed methods. A final CCO meeting is held with representatives from FEMA, the community, and the study contractor to review the results of the study. All problems raised in the meeting have been addressed in this study.

The dates of the initial and final CCO meetings held for the communities within the boundaries of Roane County are shown in Table 1, "CCO Meeting Dates."

For this countywide FIS, an initial CCO meeting was held with representatives of the impacted communities on July 8, 2004.

On September 19, 2006 the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the USACE, FEMA, and the community.

Table 1- CCO Meeting Dates

Community Name	Initial CCO Date	Final CCO Date
City of Harriman	*	September 27, 1983
City of Oak Ridge	*	February 22, 1984
City of Oak Ridge (Revised July 6, 1998)	October 10, 1995	*
Town of Oliver Springs	September 22, 1976	April 18, 1979
Unincorporated Areas of Roane County	September 22, 1976	April 10, 1979

*Data not available

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the geographic area of Roane County, Tennessee, including the incorporated communities listed in Section 1.1.

Floodplain boundaries of streams that have been previously studied by detailed methods were redelineated based on more detailed and up-to-date topographic mapping. These streams are shown in Table 2, "Scope of Study."

Table 2 - Scope of Study

Black Creek	Middle Fork Black Creek
Caney Creek East	North Fork Black Creek
Clinch River	Pawpaw Creek
East Fork Black Creek	Poplar Creek
East Fork Poplar Creek	Tennessee River
Emory River	Tributary No. 3 to Indian Creek
Indian Creek	Whites Creek
Little Emory River	

2.2 Community Description

Roane County is located in east Tennessee, approximately 35 miles west of Knoxville, and has a total land area of 361 square miles. It is bordered on the north by Morgan and Anderson Counties, Tennessee; on the east by Cumberland and Rhea Counties, Tennessee; on the south by Meigs and McMinn Counties, Tennessee; and on the west by Loudon County, Tennessee. The 2000 population of the county was 51,910 (Reference 7).

Roane County was first settled in 1791 on the present site of Kingston at the junction of the Tennessee and Clinch Rivers. The settlement was known as the South West Point which marked the upper limit of early navigation on the Tennessee River.
The original Roane County was formed from Knox County by an act of the legislature in

1801. The original county did not extend south of the confluence of the Tennessee and Clinch Rivers. Since Kingston was the upper limit of navigation, it became an important river port, trading center, and a manufacturing center.

In the early days iron mining and smelting were the important industries in the county, but now only the smelting operation continues.

Roane County is part of the great valley of east Tennessee which is characterized by a series of alternating ridge and valleys that extend in a southwest-northeast direction. The county is underlain by sedimentary rocks that were deposited during the Paleozoic Era. The ridges are underlain by cherty dolomite or interbedded shale and sandstone (Reference 8).

Drainage within the county is well developed; all streams eventually reach the Tennessee River with fairly well defined trellis drainage patterns.

The following types of soils are found in the county (Reference 8).

Wolfever silt loam – Low terrace, subject to flooding
Huntington silt loam – Occupies the first bottom, subject to flooding
Clarksville cherty silt loam – Scattered over cherty ridges

The county is predominantly rural with residential and commercial development located near the major towns and highways.

All the residential and commercial development along the Tennessee and Clinch Rivers is restricted from being built below the TVA Structural Profile (El. 750 NGVD).

The Tennessee River (Watts Bar Lake) is the principal waterway flowing through the county. Its shoreline is dotted with summer homes and resorts but void of industry. Watts Bar Lake, controlled by Watts Bar Dam, is an integral part of the TVA flood control and navigation system. The Tennessee River watershed contains a total of 17,000 square miles as it flows out of Roane County.

The downstream four miles of the Clinch River, the second largest stream in Roane County, is in backwater from Watts Bar Lake. The Clinch River originates in southwest Virginia and passes through TVA's Norris and Melton Hill Dams before entering Roane County. The Clinch River's watershed in Roane County is mainly wooded except for the Oak Ridge Gaseous Diffusion and TVA Kingston Steam Plants. A total of 4,413 square miles of drainage area comprises the Clinch River watershed at its mouth near Kingston, Tennessee.

The Emory River, a tributary to the Clinch River, originates on the Cumberland Plateau region northwest of Roane County and flows through rugged undeveloped land before entering Roane County near the City of Harriman. Approximately 780 square miles of drainage area feeds the Emory River at Harriman. The Little Emory River joins the Emory River north of Kingston and flow through mostly forested watershed that contains a total of 42 square miles.

Whites Creek, a tributary of the Tennessee River, is contained in a natural gorge above mile 6. There is a total of 120 square miles of drainage area, 0.3 miles below Black Creek. Black Creek flows through the City of Rockwood before entering the unincorporated areas

Roane County. It flows through pasture land as it parallels U.S. Highway 72. The Black Creek's watershed contains approximately 12 square miles of drainage area at its mouth. Caney and Pawpaw Creek, tributaries to the Clinch River, flow through undeveloped land before entering the Clinch River and have a total of 3 and 9 square miles of drainage area, respectively.

Indian Creek heads along the southern slope of the Cumberland Plateau divide around elevation 790 ft NGVD at the northern edge of the Town of Oliver Springs (Reference 9 OS 4). Indian Creek flows through a restrictive gap just upstream of Mineral Springs Branch (Reference 10 OS 5). The watershed above the gap is heavily strip mined so flood flows on Indian Creek are heavily laden with silt which contributes to increased flood damage and significant stream channel sedimentation.

Poplar Creek heads out of Walden Ridge northeast of the Town of Oliver Springs and flows south parallel to Tennessee Highway 118 before entering the Town of Oliver Springs (Reference 9 OS 4). The total drainage area of Poplar Creek at the upstream limits of the study is 26.6 square miles (Reference 10 OS 5). On the Oliver Springs side of Poplar Creek, the floodplain is mainly agricultural with housing well above the 100-year flood and commercial development inside the floodway at Tennessee Highway 61 and 62 bridges.

East Fork Poplar Creek has its origin on Chestnut Ridge, south of the residential area of Oak Ridge. The creek flows generally northwesterly into Oak Ridge and parallels State Route 62 in this reach. Near the intersection of State Routes 95 and 62, at an elevation of approximately 850 ft NGVD, it is joined by a tributary that drains the western portion of the populated section of Oak Ridge. From here, the main stream flows approximately 12.5 miles southwest to enter Poplar Creek approximately 5.5 miles above its mouth in Watts Bar Reservoir backwater.

The temperature is Roane County range from a high of about 100 degrees F to a low of about -2 degrees F. The average temperature is 56.7 degrees F and the average annual precipitation is 51 inches (Reference 11).

2.3 Principal Flood Problems

The main sources of flooding in Roane County are as follows: Tennessee River, Clinch River, Emory River, Little Emory River, Whites Creek, Black Creek, Caney Creek, Pawpaw Creek, Poplar Creek, Indian Creek, and East Fork Poplar Creek.

Tennessee River – The March 1973 flood is the greatest flood to occur on the Tennessee River since TVA system development began in 1936. The flood reached a water-surface elevation of 746.41 ft NGVD at the Kingston gage, river mile 568.2, 1.41 feet above the top of gates at Watts Bar Dam and had a recurrence interval of about 200 years (Reference 12). Prior to impoundment, the flood of March 1867 was the largest flood on the Tennessee River with a water-surface elevation of 746.10 ft NGVD and a recurrence interval of over 100 years (Reference 12). Other floods of importance that occurred prior to impoundment were 1886, 1887, 1917, and 1920. Since impoundment large floods have occurred in 1950, 1957, and 1963. Damage from the March 1973 flood in Roane County was minimal because crest elevations were below the TVA structural profile.

Clinch River – Stream flow conditions on the Clinch River have changed with the closure of Norris Dam in March 1936 and Watts Bar Dam in 1942. Melton Hill Dam on the Clinch River has little effect on flood discharge as compared to the other dams. The March 23, 1929 flood was a large flood to occur on the Clinch River. Under present conditions this flood would have reached an elevation of 750.4 ft NGVD at mile 6.3 and had a recurrence interval of over 100 years (Reference 12). No significant damage occurred from this flood at Kingston.

Emory River – Since 1902 the highest known flood to occur on the Emory River at the City of Harriman was on March 23, 1929. At mile 12.1 the crest reached 776.9 ft NGVD with a peak discharge of 195,000 cfs and a recurrence interval of over 100 years. Twenty-three people lost their lives and property damage exceeded $3 million from the March 1929 flood. If that flood had occurred under present conditions the crest could have been reduced more than 6 feet by TVA system regulation. The second highest flood occurring at the City of Harriman was the May 28, 1973 flood. The flood crested at 763.8 ft NGVD at mile 12.1 and had a recurrence interval of 60 years with a peak discharge of 170,000 cfs. Damage resulting from the flood was about $300,000 at the Mead Corporation Plant and $47,000 damage to Harriman Utility Board equipment (Reference 12). The February 1948 flood crested at 758.4 ft NGVD at mile 12.1 having a recurrence interval of 20 years and a peak discharge of 101,000 cfs. A total of $146,000 property damage was estimated to have resulted from this flood (Reference 13).

The December 30, 1969 flood crested at 757.7 ft NGVD at mile 12.1 with a recurrence interval of 15 years. A total of $75,000 property damage occurred to commercial and industrial plants on the left bank of the Emory River.

Little Emory River, Caney, and Pawpaw Creeks – No flood information is available.

Whites Creek – The greatest flood on record (1929-1977) for Whites Creek occurred on March 23, 1929. The peak discharge of 60,000 cfs was recorded at the USGS gage at mile 6.7. This flood had a recurrence interval of 160 years. No property damage resulted but 13 boy scouts camping at mile 6.10 lost their lives (Reference 13). The second highest flood occurred on May 27, 1973 with a discharge of 62,500 cfs having a recurrence interval of 140 years. The April 4, 1977 flood crested at 789.4 ft NGVD (mile 7.0) and had a recurrence interval of 16 years (Reference 13).

Black Creek – Discharge and crest elevations are not available for the May 27, 1973 flood.

Poplar Creek – Since 1902 the June 29, 1928 flood is the highest known flood on Poplar Creek. The estimated discharge was 17,000 cfs at the ESGS gage at mile 13.8 with a recurrence interval of 40 years (Reference 13). On September 29, 1944 a sever flood on Poplar Creek caused extensive damage to crops in the flood plain. The estimated discharge was 13,000 cfs with a recurrence interval of 25 years at the Highway 61 Bridge. The Highway 61 Bridge was blocked by floodwaters (Reference 13).
During July 5-7, 1967 a total of 9.5 to 11 inches of rain fell on Oliver Springs. Field crops and gardens were heavily damaged and roads were badly washed. At the USGS gaging station at Highway 61 and 62 the flood crest on July 6, 1967 was 3.8 feet below the June 1928 flood (Reference 14). The flood crest on July 12, 1967 was 2.2 feet lower than the July 6, 1967 crest, and the July 29, 1967 crest was 4.4 feet below the July 6, 1967 crest (Reference 14).

On November 26-28, 1973, a total of 8.7 inches of rain fell on the Oak Ridge gage producing the highest gage reading of record (27.1 feet or elevation 770.6 ft NGVD) at the USGS stream gage at mile 13.94. At Highway 61 and 62 this flood was about 1.8 feet below the June 1928 and 2 feet higher than the July 1973 floods (Reference 14).

Indian Creek – Since the July 1967 flood Indian Creek was channelized to improve flow conditions from mile 2.73 to 3.83. The July 11, 1967 flood crested at 773.1 ft NGVD at mile 2.03 and had a recurrence interval of 200 years. There was extensive property damage in Oliver Springs but only minor agricultural losses.

Approximately $30,000 in agricultural damage occurred during the August 10, 1970 flood which crested at 770.8 ft NGVD at mile 2.03 and had a recurrence interval of 45 years (Reference 15).

East Fork Poplar Creek – Major floods occurred on June 29, 1928, September 29, 1944, November 28, 1973 and April 4, 1977. Elevations, discharges and recurrence intervals for the 1928 and 1944 floods are not cited because they cannot be compared directly to flooding under current conditions due to channel changes and watershed urbanization (Reference 16). The November 28, 1973 and April 4, 1977 floods were about equal in magnitude. These floods reached an elevation of 770.2 ft NGVD with a recurrence interval of approximately 30 years at the USGS gage at mile 3.3. Only minor damage occurred as a result of these floods (References 17 and 18).

East Fork Black Creek – A major flood occurred on May 27, 1973, which caused one fatality and was near 100-year flood levels in the downtown area of the City of Rockwood (Reference 12).

2.4 Flood Protection Measures

The TVA system of tributary and mainstream dams and reservoirs insure a reasonable level of flood protection along the Tennessee River. The enforcement of the TVA structural profiles controlled by the Watts Bar Dam in Roane County for the Tennessee, Clinch, and Emory Rivers restricts development below a specific elevation which exceeds the 100-year flood elevations.

As a result of the July 1967 flood, TVA, the Department of Housing and Urban Development (HUD), and the Town of Oliver Springs joined in the Oliver Springs Redevelopment Program. TVA constructed an improved channel for Indian Creek approximately 1.2 miles long though the Town of Oliver Springs. Inadequate bridges were replaced, channel bends were removed, and substandard housing was removed. The improved channel has stabilized banks and provides 50-year flood protection. Land immediately adjacent to the new channel has been improved for use as recreation, industrial, and low-income housing sites, the latter designed to replace the substandard and flood-threatened housing that was located in the floodplain (Reference 19).

Following the flood of May 1973 the City of Rockwood and the TVA worked together to find solutions to flood damage. A new municipal complex built in the late 1970s near Middle Fork Black Creek was elevated on fill to raise the first floor elevations above the 100-year flood level. Through the next two decades the City of Rockwood and the TVA have completed several projects to improve floodplain conditions and reduce flood damages. The most significant of these is an engineered stream channel for Black Creek

from Rathburn Street downstream through the Scandlyn Lumber Company driveway bridge, which accounts for some flood elevation reduction in this area.

Norris Dam, part of the TVA flood control system, is located on the Clinch River at mile 79.8, approximately 26 miles upstream of the City of Oak Ridge. Regulation by the dam reduces most floods on the Clinch River to the non-damaging stage in the vicinity of the City of Oak Ridge.

Norris Reservoir has a flood storage reservation that varies throughout the year. It is highest in January when the possibility of flood occurrence is the greatest. The reservation is reduced gradually until approximately March 15, the end of the winter flood season, after which the reservoir may be filled to the spillway crest level by about May 1. Even at this level, however, a substantial reservation is made for control of summer floods.

In spite of the storage of flood waters in the Norris Reservoir, large floods can still be produced along the lower Clinch River as a result of storm runoff from the uncontrolled watershed below Norris Dam. This area totals 156 square miles at the upper end of the City of Oak Ridge reach and 620 square miles at mile 7 below the junction with Poplar Creek.

Melton Hill Dam, on the Clinch River, is downstream of Norris Dam in the City of Oak Ridge vicinity. Its dual purpose is to extend the navigable channel of the Tennessee River system up the Clinch River and to produce hydroelectric power. It does not have a flood control function. The City of Oak Ridge is in the upper reached of the Melton Hill Reservoir.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the community.

Pre-countywide Analyses

Each community within Roane County has a previously printed FIS report narrative. The hydrologic analyses described in those narratives have been compiled and are summarized below.

Tennessee River discharges for the study limits mile 543.6-583.8 and the lower end of Clinch River have been progressively altered by the closure of upstream main river and tributary dams. Further regulation will be attained with the closure of Tellico Dam on the Little Tennessee River at mile 0.3. Frequency is based upon anticipated post Tellico conditions.

The standard log-Pearson Type III statistical analysis was not used for the Tennessee River and Clinch River frequency studies because the method is not applicable to elevations data or where there is regulation from upstream dams.

Clinch River flows have been regulated by Norris Dam, Clinch River mile 79.8 since closure in March 1936. Closure of Melton Hill Dam, mile 23.1, in May 1963 has not altered discharge probabilities.

The Clinch River flow-frequency relationships were determined from graphical analysis of records from 1941-1966 at the USGS gaging station at Scarboro, Tennessee, mile 29.0, and from graphic analysis of unpublished TVA records of Melton Hill Dam discharge from 1964-1973 (References 20&21).

Downstream from the Melton Hill Dam to the mouth of the Clinch River elevation-frequency was determined by backwater computations. Analysis began at the mouth of the Clinch River with elevations determined from records at the TVA gaging station near Kingston from 1944 to 1973 (Reference 22).

The Tennessee River study reach is in Watts Bar Reservoir; consequently, elevations are influenced by both discharge and Watts Bar Dam headwater elevations. Elevation-frequency for this reach was determined by standard step method backwater analysis using a computer program developed by the TVA similar to, but with some alteration, the USACE HEC-2 backwater program (Reference 23) and by elevation-frequency curves determined graphically from the following records (Table 3):

Table 3 - Periods of Record for Tennessee River

Location	Mile	Drainage Area (Square Miles)	Period of Record	Agency
At Fort Loudoun Dam Tailwater, Tennessee (unpublished)	602.3	9,550	1944-1973	TVA
At Lenoir City, Tennessee (Reference 21)	600.5	12,200	1944-1955	USGS
At Loudon, Tennessee (Reference 22)	591.6	12,220	1944-1955	USGS
Near Kingston, Tennessee (Reference 21)	568.2	12,470	1944-1973	TVA

The above four gages do not have gate numbers.

To determine a principal base for estimating flow frequency for Caney Creek and Whites Creek, USGS gaging station Nos. 03538130 and 3541500, respectively.

U.S. Geological Survey gaging station No. 03540500, Emory River at Oakdale, Tennessee, at mile 18.3 was the principal source of data for estimating flow frequency. The gage has been in operation since 1929.

The USGS gaging stations 03538225 on Poplar Creek near Oak Ridge and 035382200 on Poplar Creek at Oliver Springs were the principal database for defining flow-frequency relationships for Poplar Creek. Discharge frequency estimates for intermediate locations were determined by straight line interpolation between gage stations on a log-log plot of drainage area versus discharge.

East Fork Poplar Creek flood information was obtained from records of USGS gage No. 03538250 at mile 3.3 (1961-81). A second USGS gage, No. 03538242 at mile 10.0 (1962-70), was not directly used because of the short period of record. Discharge-frequency at the gages was determined using the procedures outlined in Bulletin No. 17B (Reference 24). At locations above the gage at mile 3.3 estimates were made using the USGS procedure for urban floods (Reference 25).

No formal stream gaging stations have been maintained on Little Emory River, Indian Creek, Pawpaw Creek, Black Creek, Tributary to Indian Creek and Emory River downstream of mile 18.3. Because stream gage records are insufficient, discharge-frequency data were estimated using relationships between peak discharge and drainage area developed from analyzing records at gaging stations on nearby streams having similar hydrologic characteristics.

Frequency curves for gaging stations were computed using Bulletin 17 USGS procedures (Reference 26), including the skew map of Plat I and adjustment for historic flood information where available. Peak discharge rates for Black Creek were increased for urbanization using equations (Reference 27) which relate discharge at selected frequencies to watershed and climatic factors and percent imperviousness. The percent impervious was estimated using ratios of imperviousness to urban area; urban areas were determined from topographic maps (Reference 28).

Table 3 lists stream gaging records, which were used in the regional peak discharge relationships in previous FIS reports. Table 4 lists current USGS gages located within Roane County.

Table 4 - USGS Gages in Roane County, TN

USGS Gage #	Location
03538800	OBED RIVER TRIBUTARY NEAR CROSSVILLE, TENNESSEE
03541200	FORKED CREEK NEAR OAKDALE, TENNESSEE
03469010	MILLICAN CREEK NEAR DOUGLAS DAM, TENNESSEE
03538300	ROCK CREEK NEAR SUNBRIGHT, TENNESSEE
03538130	CANEY CREEK NEAR KINGSTON, TENNESSEE
03538250	EAST FORK POPLAR CREEK NEAR OAK RIDGE, TENNESSEE
03544500	RICHLAND CREEK NEAR DAYTON, TENNESSEE
03538200	POPLAR CREEK NEAR OLIVER SPRINGS, TENNESSEE
03538225	POPLAR CREEK NEAR OAK RIDGE, TENNESSEE
03538500	EMORY RIVER NEAR WARTBURG, TENNESSEE
03541500	WHITES CREEK NEAR GLEN ALICE, TENNESSEE
03540500	EMORY RIVER AT OAKDALE, TENNESSEE

The adopted peak flow-drainage area relationships for this study differ from those developed by USGS and the Tennessee Department of Transportation 1976 (Reference 28). This difference results in part from the greater length of record, including the 1977 flood, available at the gaged locations but, more importantly, from the greater weight given to gaged watersheds near the study areas.

The computed frequency profiles for the Emory River were verified against an elevation-frequency curve determined by graphical analysis of stage records from 1942-75 from the former TVA gage at mile 12.1 (Reference 21).

Indian Creek has limited historical flood information and only the 1928 and 1967 floodmarks were used in this study.

For the City of Rockwood FIS, the regression equations for Roane County, originally developed by the TVA as part of the Roane County FIS (Reference 2), were updated. The equations were updated using methods established by USGS (Reference 23) to reflect current periods of record for the stream gages involved. Streams studied as part of the City of Rockwood FIS include Black Creek, Black Creek Side Channel, East Fork Black Creek, Middle Fork Black Creek and North Fork Black Creek. These equations are given in Table 5.

Table 5 - TVA Valley and Ridge Regression Equations (1999)

Recurrence Interval	**Discharge (cfs)**
10-year	$Q_{10} = 350.29 \times A^{0.827}$
50-year	$Q_{50} = 516.13 \times A^{0.845}$
100-year	$Q_{100} = 595.70 \times A^{0.850}$
500-year	$Q_{500} = 798.78 \times A^{0.863}$

Discharge values from the TVA equations above were compared with the USGS equations for Tennessee Region I (Reference 29). Discharges from the TVA equations ranged from about 30% higher at the mouth of the tributaries to nearly equal in the upper reaches of the tributaries. The TVA equations were used in this hydrologic analysis because they are consistent with published data on streams in surrounding Roane County, including the lower reach of Black Creek, and the resulting flood profiles calibrated well with the observed floodmarks.

Because regional relationships do not account for increased discharges resulting from urbanization, the peak discharge values were adjusted using a basin development factor (BDF) index approach established by the USGS in determining the characteristics of urban watersheds (Reference 30). The BDF assesses impacts of four characteristics of urban watersheds; stream channel improvements, stream channel linings, storm drains or storm sewers, and curbs and gutters along streets. A field inspection was carried out to asses BDF factors, and parts of each of the Rockwood streams displayed some of these urban characteristics. The BDF factors were then combined with the results of the regression equations above to produce urbanized peak discharges.

There are no stream gages on any of the City of Rockwood streams studied. Calibration of these models was carried out by comparing profiles with surveyed floodmarks from the significant floods observed in the downtown area of the City of Rockwood in December 1969 and again in May 1973.

This Countywide Analysis

A summary of the drainage area-peak discharge relationships for the streams previously studied by detailed methods and have been redelineated for this study are shown in Table 6, "Summary of Discharges."

Table 6 – Summary of Discharges

		Peak Discharges (cubic feet per second)			
Flooding Source and Location	Drainage Area (square miles)	10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
Black Creek					
At Mouth	11.8	3,250	5,100	6,400	8,500
About 0.02 mile upstream of Mountainview Road	8.0	2,400	3,900	4,800	6,600
About 0.02 mile downstream of US Route 70	5.9	1,900	3,100	3,800	5,500
At U.S. Route 70 Bridge	6.00	1,660	2,486	2,915	3,930
At Rathburn Street	3.53	1,185	1,737	2,023	2,683
At confluence of Middle Fork Black Creek and East Fork Black Creek	2.99	1,036	1,512	1,758	2,323
Black Creek Side Channel					
At confluence with Black Creek	*	168	412	541	844

*Data not available

Table 6 – Summary of Discharges

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
Caney Creek					
At Mouth	8.27	2,300	3,050	3,300	4,500
About 0.07 mile upstream of Buttermilk Road	7.80	2,200	2,400	3,200	4,300
About 0.04 mile downstream of Eblen Cave Road	6.55	1,950	2,550	2,800	3,800
Clinch River					
At Mouth	4,413	120,000	185,000	220,000	300,000
Just below confluence with Emory River	4,405	120,000	185,000	22,000	300,000
Just above confluence with Emory River	3,540	42,750	52,750	56,500	82,500
East Fork Black Creek					
At confluence with Black Creek	1.33	536	769	885	1,150
At Gateway Avenue	0.74	321	457	522	672
At North Front Avenue	0.38	181	255	289	367
East Fork Poplar Creek					
About 3.3 miles above mouth	19.5	3,000	4,660	5,500	7,800
At U.S. Department of Energy boundary	18.1	2,900	4,600	5,400	7,350
Just above Gum Hollow Branch	14.6	2,650	4,000	4,800	6,550
Just above Mill Branch	9.27	1,950	3,000	3,500	5,000
At upstream Oak Ridge Turnpike Crossing	6.59	1,500	2,300	2,700	3,900
At Tulsa Road	3.48	900	1,400	1,650	2,100
Emory River					
At mouth	865	112,000	172,000	205,000	285,000
Just above confluence with Little Emory River	811	107,000	163,000	197,000	275,000
About 0.05 mile downstream of Harriman Corporate Limits Extended	802	107,000	163,000	197,000	275,000
About 0.15 mile upstream of Southern Railway	785	107,000	163,000	197,000	275,000
Indian Creek					
At Mouth	22.6	5,400	9,700	12,000	17,000
About 1.4 miles above mouth	21.1	5,200	9,100	11,200	16,500

Table 6 – Summary of Discharges

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
Little Emory River					
At Mouth	41.7	6,300	9,900	11,500	16,500
About 0.02 mile upstream of Clacks Gap Road	40.6	6,000	9,400	11,100	16,000
About 0.1 mile downstream of Southern Railway	35.7	5,500	8,700	10,100	14,900
About 0.04 mile downstream of County Boundary	34.3	5,300	8,500	9,800	14,500
Middle Fork Black Creek					
At confluence with Black Creek	1.66	632	925	1,068	1,394
At Strang Street	1.55	607	874	1,007	1,314
North Fork Black Creek					
At confluence with Black Creek	0.54	249	352	400	511
At Lenoir Avenue	0.46	212	299	340	433
Pawpaw Creek					
At Mouth	10.3	2,250	3,650	4,300	6,200
At Buttermilk Road	8.71	2,000	3,200	3,800	5,500
About 0.01 mile downstream of Pawpaw Plains Road	5.20	1,400	2,250	2,690	3,900
Poplar Creek					
About 0.52 mile downstream of the confluence with Indian Creek	82.5	9,800	15,200	17,800	24,800
At the County Boundary	58.5	7,800	12,500	14,500	21,000
Below the confluence with Brushy Fork	55.4	4,500	12,000	14,000	20,000
Tennessee River					
At the confluence with Whites Creek	16,980	164,000	190,000	200,000	260,000
About 7.4 miles upstream of confluence with Smith Creek	12,360	88,000	130,000	150,000	220,000
Tributary No. 3 to Indian Creek					
At mouth	1.36	530	830	1,050	1,500

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
EMORY RIVER								
A	0.10	980	27,790	7.4	746.3	746.1[2]	747.1	1.0
B	2.00	1,180	24,309	8.4	747.7	747.7	748.5	0.8
C	3.52	1,150	25,496	8.0	749.1	749.1	750.0	0.9
D	5.10	650	16,810	12.2	750.4	750.4	751.2	0.8
E	5.94	630	18,357	10.7	752.2	752.2	752.8	0.6
F	7.46	680	20,240	9.7	755.7	755.7	756.1	0.4
G	9.29	595	15,205	13.0	760.0	760.0	760.5	0.5
H	10.30	660	19,809	9.9	763.2	763.2	763.7	0.5
I	11.20	590	20,482	9.6	764.8	764.8	765.3	0.5
J	12.13	455	16,755	11.8	766.4	766.4	767.2	0.8
K	12.47	510	19,658	10.0	768.9	768.9	769.8	0.9
L	12.50	700	23,173	8.3	769.4	769.4	770.3	0.9
M	12.80	530	20,296	9.7	770.5	770.5	771.5	1.0
N	13.54	450	16,893	11.7	772.2	772.2	772.5	0.3
O	14.58	420	17,178	11.5	774.7	774.7	775.0	0.3

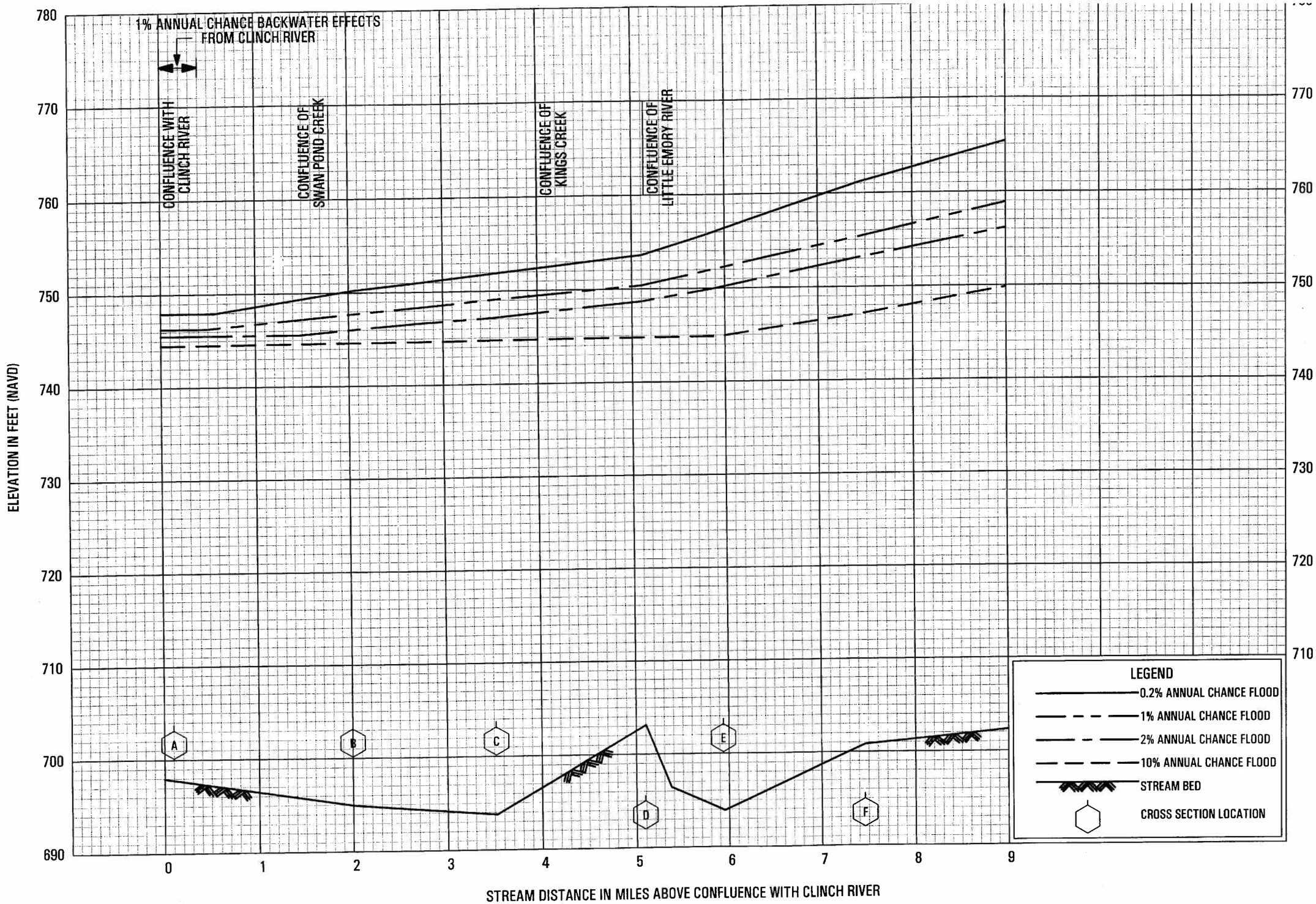
[1]MILES ABOVE MOUTH
[2]ELEVATION COMPUTED WITHOUT CONSIDERATION OF BACKWATER EFFECTS

TABLE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY
ROANE COUNTY, TN
AND INCORPORATED AREAS

FLOODWAY DATA

EMORY RIVER



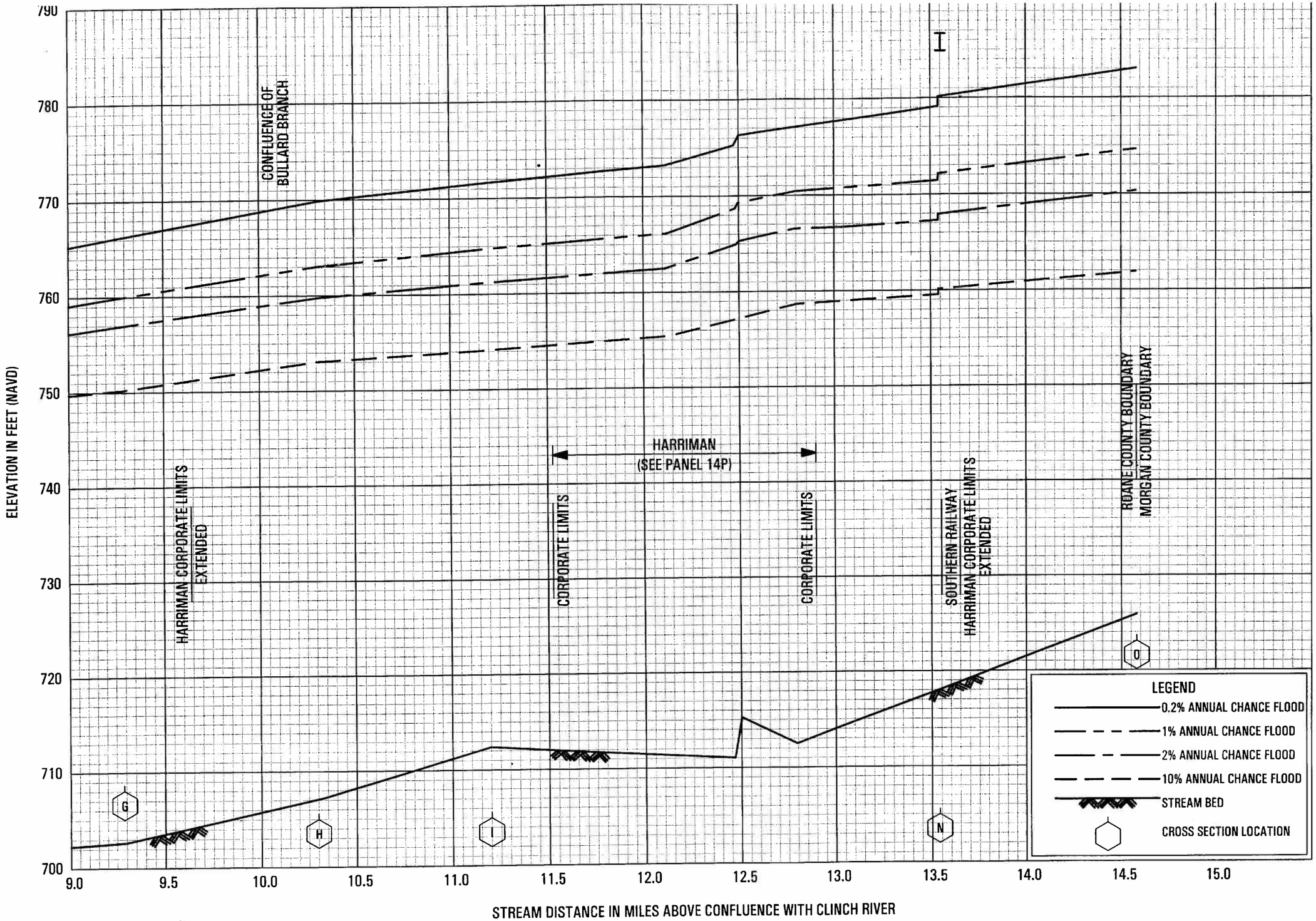
FLOOD PROFILES

EMORY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROANE COUNTY, TN

AND INCORPORATED AREAS



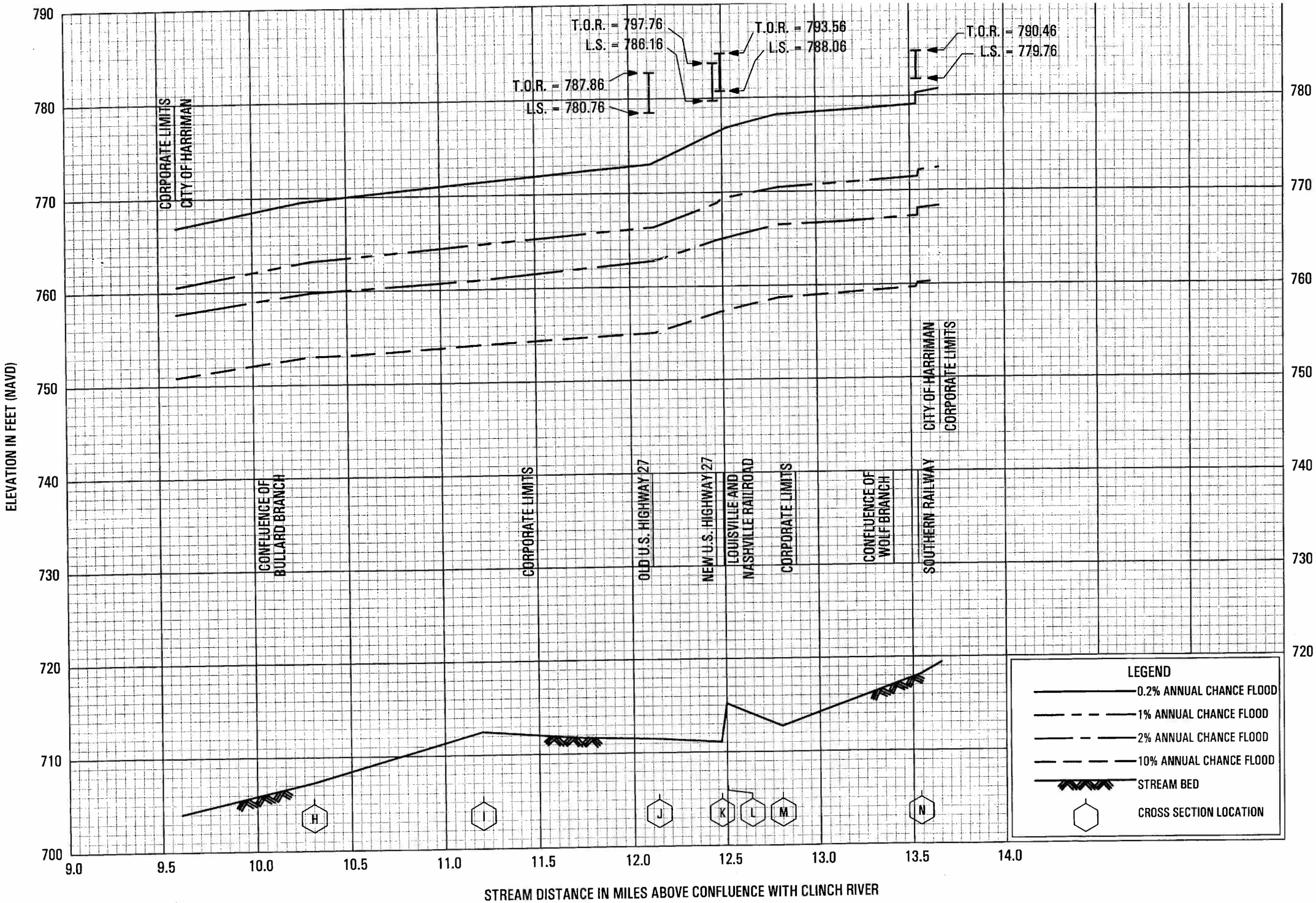
FLOOD PROFILES

EMORY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROANE COUNTY, TN

AND INCORPORATED AREAS



FLOOD PROFILES

EMORY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

ROANE COUNTY, TN

AND INCORPORATED AREAS

RIVER SCHEDULING – HISTORIC

TVA OPERATED RESERVOIR SYSTEM
ANNUAL MAXIMUM AND MINIMUM ELEVATIONS, IN ORDER OF MAGNITUDE
FROM DATE OF RESERVOIR CLOSURE THROUGH 2008

WATTS BAR

MAXIMUM					MINIMUM				
ORDER	ELEVATION	YEAR	MONTH	DAY	ORDER	ELEVATION	YEAR	MONTH	DAY
1	747.35 %	2003	MAY	7	1	701.80 *	1942	JAN.	1
2	746.48	1984	MAY	10	2	733.44	1945	MAR.	20
3	745.40 #	1973	MAR.	17	3	734.02	1963	FEB.	25
4	745.28	1994	MAR.	29	4	734.37	1949	DEC.	29
5	745.12	1942	MAR.	9	5	734.50	1951	DEC.	31
6	745.03	1989	JUNE	20	6	734.56	1947	FEB.	3
7	744.90	1950	MAY	15	7	734.61	1962	MAR.	18
8	744.89	1998	APR.	20	8	734.68	1950	DEC.	18
9	744.71	1949	MAY	2	9	734.69	1952	JAN.	1
10	744.57	1959	APR.	23	10	734.69	1968	JAN.	19
11	744.57	1970	APR.	28	11	734.70	1964	JAN.	13
12	744.51	1977	APR.	5	12	734.77	1967	DEC.	26
13	744.45	1957	NOV.	19	13	734.80	1970	MAR.	11
14	744.43	1963	MAY	2	14	734.80	1971	MAR.	2
15	744.40	1958	APR.	27	15	734.80	1976	JAN.	24
16	744.36	2002	MAR.	19	16	734.80	2002	MAR.	11
17	744.32	2004	SEP.	18	17	734.81	1954	FEB.	23
18	744.19	1953	MAY	2	18	734.81	1958	JAN.	3
19	743.88	1966	MAY	3	19	734.82	1944	JAN.	24
20	743.84	1990	DEC.	23	20	734.82	1959	JAN.	3
21	743.82	1967	JULY	7	21	734.82	1973	JAN.	8
22	743.60	1964	APR.	15	22	734.83	1977	JAN.	31
23	743.55	1948	APR.	26	23	734.84	1946	DEC.	20
24	743.51	1999	JULY	13	24	734.84	1960	JAN.	23
25	743.46	1956	APR.	17	25	734.85	1966	FEB.	13
26	743.42	1969	DEC.	31	26	734.85	1972	MAR.	16
27	743.23	1965	APR.	29	27	734.86	1969	JAN.	31
28	743.17	1971	MAY	13	28	734.87	1948	JAN.	19
29	743.05	1972	APR.	23	29	734.89	1953	JAN.	6
30	743.03 %	1943	APR.	24	30	734.89	1974	MAR.	12
31	743.03	1983	MAY	22	31	734.90	1975	DEC.	30
32	743.00	1976	MAY	17	32	734.92	1978	FEB.	13
33	742.97	1979	JULY	22	33	734.93	1965	JAN.	8
34	742.93	1997	JUNE	15	34	734.95	1955	FEB.	5
35	742.89	1996	DEC.	1	35	734.95	1961	DEC.	16
36	742.80	1975	MAR.	14	36	734.95	1999	JAN.	31
37	742.75	1946	MAY	15	37	734.98	1956	DEC.	24
38	742.75	1954	DEC.	30	38	734.99	2003	JAN.	2
39	742.74	2000	APR.	5	39	735.00	1980	FEB.	23
40	742.62	1968	MAY	11	40	735.00	1982	DEC.	11
41	742.56	1952	MAY	2	41	735.00	1983	FEB.	1
42	742.54	1960	MAY	11	42	735.00	1984	MAR.	14
43	742.54	1961	APR.	18	43	735.00	1998	DEC.	22
44	742.53	1991	DEC.	3	44	735.02	1943	JAN.	8
45	742.51	1981	JUNE	11	45	735.02	1979	JAN.	17
46	742.50	1951	MAY	6	46	735.03	2000	JAN.	31

RIVER SCHEDULING

TVA OPERATED RESERVOIR SYSTEM
ANNUAL MAXIMUM AND MINIMUM ELEVATIONS, IN ORDER OF MAGNITUDE
FROM DATE OF RESERVOIR CLOSURE THROUGH 2008

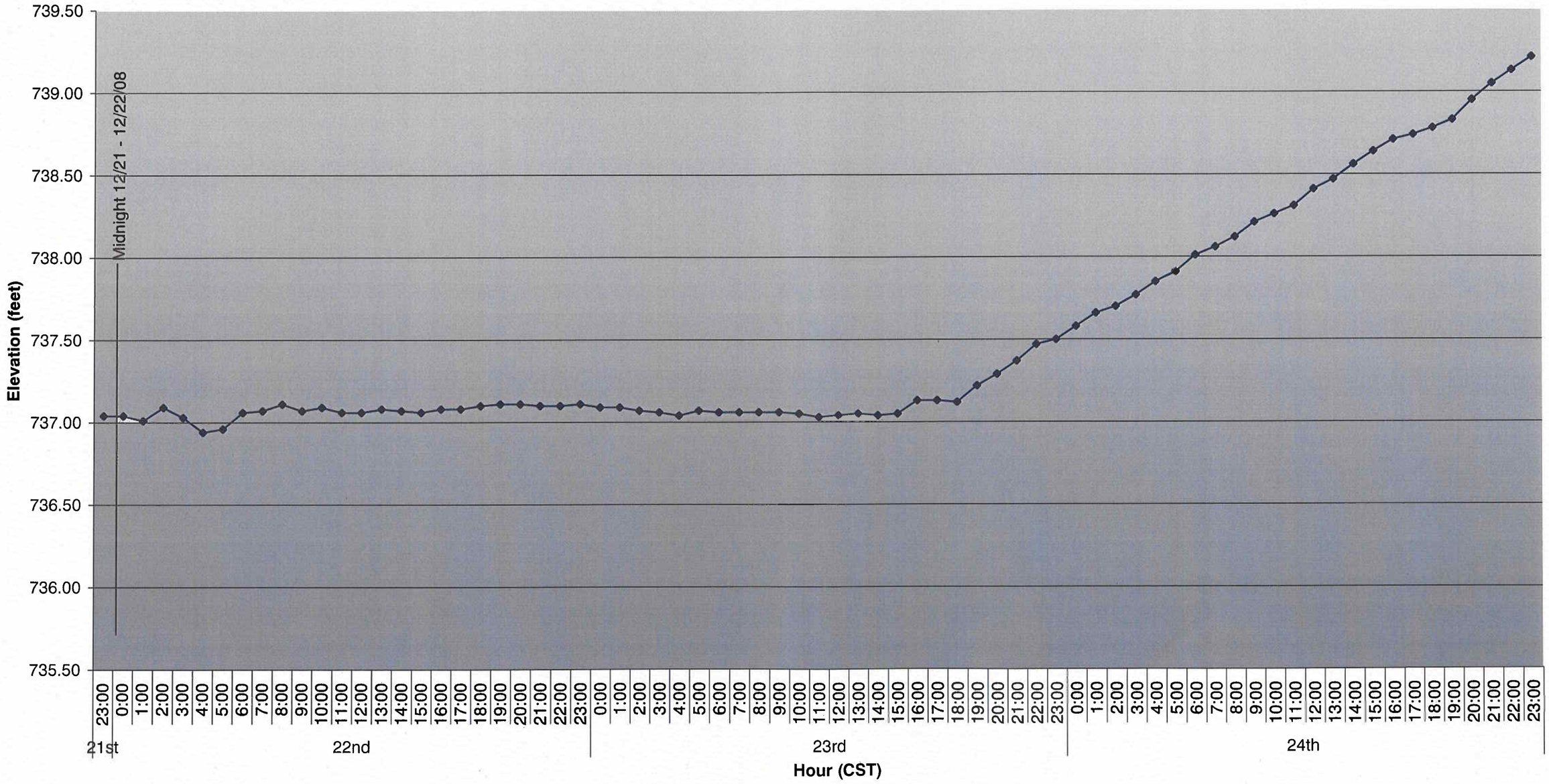
WATTS BAR

MAXIMUM					MINIMUM				
ORDER	ELEVATION	YEAR	MONTH	DAY	ORDER	ELEVATION	YEAR	MONTH	DAY
47	742.44	1962	APR.	12	47	735.05	1957	JAN.	11
48	742.40	1978	JUNE	9	48	735.07	2007	FEB.	21
49	742.18	1988	JULY	18	49	735.08	1991	JAN.	28
50	742.13	1947	MAY	23	50	735.10	1992	JAN.	15
51	742.12	2007	MAY.	8	51	735.11	1985	JAN.	12
52	742.10	1955	MAY	31	52	735.12	2005	DEC.	21
53	742.07 %	2005	MAY	20	53	735.12	2006	MAR.	8
54	741.97	1974	MAY	25	54	735.13	1997	JAN.	22
55	741.97	2001	JULY	31	55	735.15	2001	DEC.	30
56	741.88	1987	APR.	26	56	735.19	1981	FEB.	7
57	741.84	1944	APR.	12	57	735.19	1988	DEC.	30
58	741.80	1992	JULY	4	58	735.19	2004	DEC.	22
59	741.78	1982	SEP.	2	59	735.22	1994	MAR.	10
60	741.77	1985	AUG.	18	60	735.25	1987	MAR.	16
61	741.77	2006	APR.	24	61	735.26	1993	FEB.	11
62	741.45	1980	MAY	24	62	735.27	1986	MAR.	7
63	741.37	1995	OCT.	6	63	735.33	1989	MAR.	31
64	741.33 %	1993	MAY	5	64	735.35	1996	DEC.	26
65	741.24	2008	JUN.	7	65	735.37	1990	FEB.	2
66	741.18	1986	JULY	21	66	735.44	1995	FEB.	15
67	740.74 #	1945	APR.	25	67	735.58	2008	FEB.	29

* MIDNIGHT ELEVATION ON CLOSURE DATE
# ESTIMATED
% MIDNIGHT ELEVATION
TOP-OF-GATES ELEVATION 745

Watts Bar Reservoir Elevation over Time

(at Watts Bar Dam) ~ 44.25 miles downstream from KIF Dredge Cells



Watts Bar DAM RESERVOIR GAGE

Date /TIME	HWE (Feet)
12/1/2008 1:00	736.87
12/1/2008 2:00	736.72
12/1/2008 3:00	736.63
12/1/2008 4:00	736.61
12/1/2008 5:00	736.64
12/1/2008 6:00	736.69
12/1/2008 7:00	736.73
12/1/2008 8:00	736.70
12/1/2008 9:00	736.63
12/1/2008 10:00	736.62
12/1/2008 11:00	736.73
12/1/2008 12:00	736.82
12/1/2008 13:00	736.84
12/1/2008 14:00	736.75
12/1/2008 15:00	736.62
12/1/2008 16:00	736.56
12/1/2008 17:00	736.59
12/1/2008 18:00	736.59
12/1/2008 19:00	736.63
12/1/2008 20:00	736.68
12/1/2008 21:00	736.66
12/1/2008 22:00	736.72
12/1/2008 23:00	736.76
12/2/2008 0:00	736.78
12/2/2008 1:00	736.84
12/2/2008 2:00	736.80
12/2/2008 3:00	736.63
12/2/2008 4:00	736.58
12/2/2008 5:00	736.56
12/2/2008 6:00	736.56
12/2/2008 7:00	736.63
12/2/2008 8:00	736.66
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12/2/2008 12:00	736.82
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12/2/2008 14:00	736.80
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12/2/2008 16:00	736.65
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12/3/2008 1:00	736.91
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12/3/2008 7:00	736.72
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12/3/2008 9:00	736.79
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12/3/2008 11:00	736.89
12/3/2008 12:00	736.89
12/3/2008 13:00	736.89
12/3/2008 14:00	736.84
12/3/2008 15:00	736.73
12/3/2008 16:00	736.68
12/3/2008 17:00	736.65
12/3/2008 18:00	736.65
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12/4/2008 13:00	736.92
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12/4/2008 15:00	736.76
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12/18/2008 9:00	737.91
12/18/2008 10:00	737.94
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12/21/2008 7:00	736.88
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12/22/2008 12:00	737.06

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12/22/2008 22:00	737.10
12/22/2008 23:00	737.11
12/23/2008 0:00	737.09
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12/23/2008 2:00	737.07
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12/24/2008 19:00	738.83
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12/25/2008 2:00	739.23
12/25/2008 3:00	739.22
12/25/2008 4:00	739.20
12/25/2008 5:00	739.25
12/25/2008 6:00	739.25
12/25/2008 7:00	739.21
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12/25/2008 9:00	739.19
12/25/2008 10:00	739.19
12/25/2008 11:00	739.20
12/25/2008 12:00	739.21
12/25/2008 13:00	739.19
12/25/2008 14:00	739.19
12/25/2008 15:00	739.19
12/25/2008 16:00	739.19
12/25/2008 17:00	739.17
12/25/2008 18:00	739.17
12/25/2008 19:00	739.18
12/25/2008 20:00	739.18
12/25/2008 21:00	739.18
12/25/2008 22:00	739.18
12/25/2008 23:00	739.17
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12/26/2008 1:00	739.18
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12/26/2008 3:00	739.17
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12/26/2008 6:00	739.20
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12/26/2008 10:00	739.19
12/26/2008 11:00	739.19
12/26/2008 12:00	739.18
12/26/2008 13:00	739.18
12/26/2008 14:00	739.20
12/26/2008 15:00	739.19
12/26/2008 16:00	739.17
12/26/2008 17:00	739.18
12/26/2008 18:00	739.16
12/26/2008 19:00	739.16
12/26/2008 20:00	739.16

12/26/2008 21:00	739.16
12/26/2008 22:00	739.16
12/26/2008 23:00	739.16
12/27/2008 0:00	739.16
12/27/2008 1:00	739.17
12/27/2008 2:00	739.18
12/27/2008 3:00	739.17
12/27/2008 4:00	739.16
12/27/2008 5:00	739.16
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12/27/2008 7:00	739.15
12/27/2008 8:00	739.14
12/27/2008 9:00	739.14
12/27/2008 10:00	739.15
12/27/2008 11:00	739.15
12/27/2008 12:00	739.15
12/27/2008 13:00	739.13
12/27/2008 14:00	739.11
12/27/2008 15:00	739.09
12/27/2008 16:00	739.08
12/27/2008 17:00	739.10
12/27/2008 18:00	739.10
12/27/2008 19:00	739.09
12/27/2008 20:00	739.07
12/27/2008 21:00	739.06
12/27/2008 22:00	739.06
12/27/2008 23:00	739.06
12/28/2008 0:00	739.07
12/28/2008 1:00	739.04
12/28/2008 2:00	739.01
12/28/2008 3:00	739.00
12/28/2008 4:00	739.03
12/28/2008 5:00	739.07
12/28/2008 6:00	739.05
12/28/2008 7:00	739.08
12/28/2008 8:00	739.05
12/28/2008 9:00	739.06
12/28/2008 10:00	739.07
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12/28/2008 12:00	739.08
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12/28/2008 14:00	739.06
12/28/2008 15:00	739.06
12/28/2008 16:00	739.07
12/28/2008 17:00	739.04
12/28/2008 18:00	739.02
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12/28/2008 20:00	739.03
12/28/2008 21:00	739.03
12/28/2008 22:00	739.03
12/28/2008 23:00	739.03
12/29/2008 0:00	739.01

12/29/2008 1:00	739.01
12/29/2008 2:00	739.01
12/29/2008 3:00	739.03
12/29/2008 4:00	739.02
12/29/2008 5:00	739.01
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12/29/2008 8:00	739.02
12/29/2008 9:00	739.00
12/29/2008 10:00	739.00
12/29/2008 11:00	738.98
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12/29/2008 17:00	738.96
12/29/2008 18:00	738.96
12/29/2008 19:00	738.93
12/29/2008 20:00	738.91
12/29/2008 21:00	738.91
12/29/2008 22:00	738.90
12/29/2008 23:00	738.89
12/30/2008 0:00	738.91
12/30/2008 1:00	738.95
12/30/2008 2:00	738.98
12/30/2008 3:00	738.99
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12/30/2008 5:00	738.99
12/30/2008 6:00	738.98
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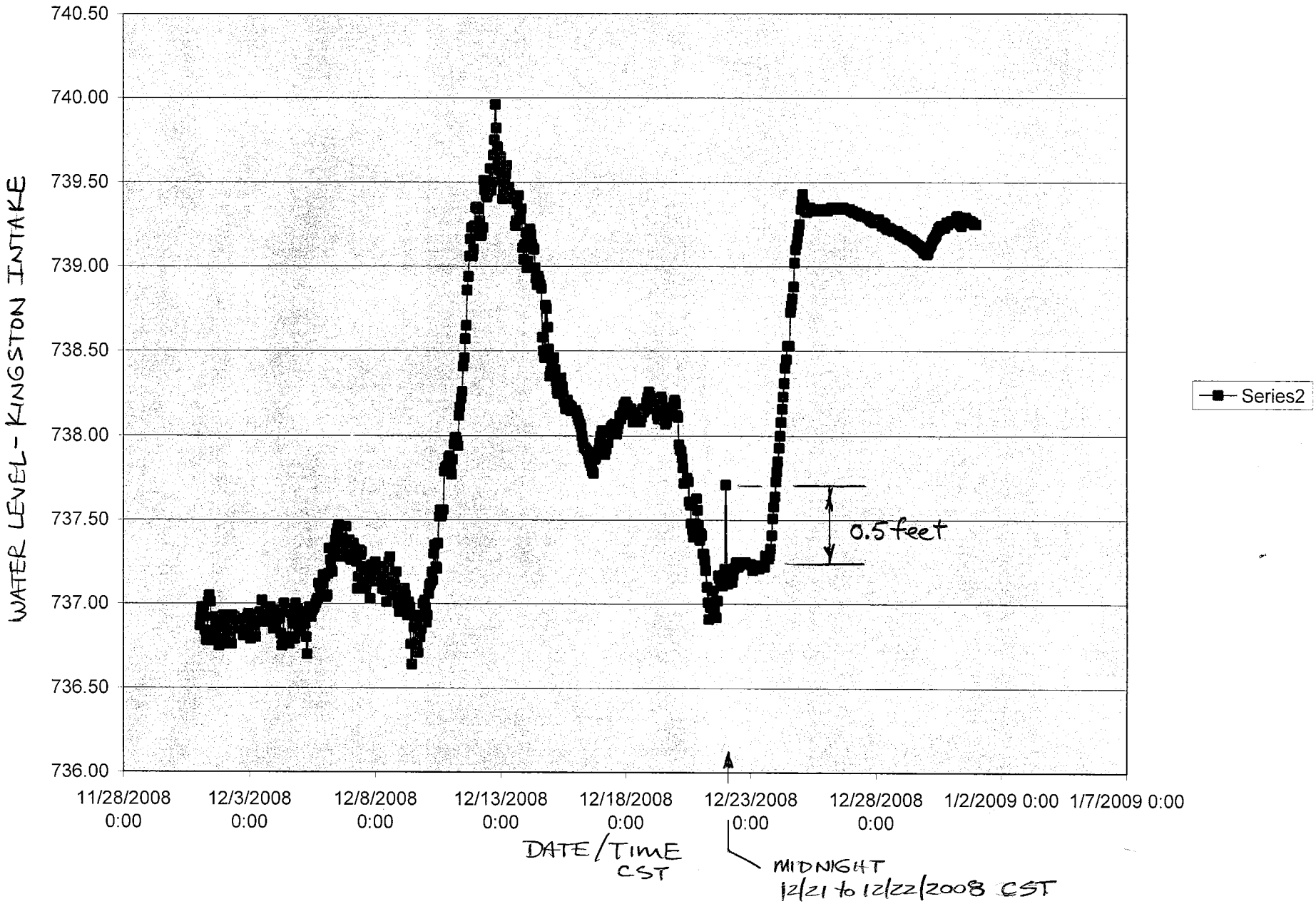
12/30/2008 10:00	739.05
12/30/2008 11:00	739.04
12/30/2008 12:00	739.07
12/30/2008 13:00	739.07
12/30/2008 14:00	739.09
12/30/2008 15:00	739.05
12/30/2008 16:00	739.06
12/30/2008 17:00	739.09
12/30/2008 18:00	739.08
12/30/2008 19:00	739.09
12/30/2008 20:00	739.10
12/30/2008 21:00	739.10
12/30/2008 22:00	739.10
12/30/2008 23:00	739.11
12/31/2008 0:00	739.11
12/31/2008 1:00	739.10
12/31/2008 2:00	739.11
12/31/2008 3:00	739.13
12/31/2008 4:00	739.13

12/31/2008 5:00	739.14
12/31/2008 6:00	739.19
12/31/2008 7:00	739.17
12/31/2008 8:00	739.15
12/31/2008 9:00	739.16
12/31/2008 10:00	739.17
12/31/2008 11:00	739.17
12/31/2008 12:00	739.18
12/31/2008 13:00	739.17
12/31/2008 14:00	739.17
12/31/2008 15:00	739.17
12/31/2008 16:00	739.19
12/31/2008 17:00	739.15
12/31/2008 18:00	739.15
12/31/2008 19:00	739.15
12/31/2008 20:00	739.14
12/31/2008 21:00	739.14
12/31/2008 22:00	739.14
12/31/2008 23:00	739.13
1/1/2009 0:00	739.12

WATER LEVEL VS. TIME – KINGSTON PLANT INTAKE



Tenn nr Kingston

Date	Stage	Elevation
12/1/2008 1:00	36.87	736.87
12/1/2008 2:00	36.92	736.92
12/1/2008 3:00	36.98	736.98
12/1/2008 4:00	36.96	736.96
12/1/2008 5:00	36.92	736.92
12/1/2008 6:00	36.84	736.84
12/1/2008 7:00	36.78	736.78
12/1/2008 8:00	36.83	736.83
12/1/2008 9:00	37.01	737.01
12/1/2008 10:00	37.05	737.05
12/1/2008 11:00	37.01	737.01
12/1/2008 12:00	36.79	736.79
12/1/2008 13:00	36.78	736.78
12/1/2008 14:00	36.84	736.84
12/1/2008 15:00	36.92	736.92
12/1/2008 16:00	36.88	736.88
12/1/2008 17:00	36.85	736.85
12/1/2008 18:00	36.82	736.82
12/1/2008 19:00	36.75	736.75
12/1/2008 20:00	36.84	736.84
12/1/2008 21:00	36.85	736.85
12/1/2008 22:00	36.89	736.89
12/1/2008 23:00	36.93	736.93
12/2/2008 0:00	36.92	736.92
12/2/2008 1:00	36.76	736.76
12/2/2008 2:00	36.77	736.77
12/2/2008 3:00	36.83	736.83
12/2/2008 4:00	36.89	736.89
12/2/2008 5:00	36.86	736.86
12/2/2008 6:00	36.80	736.80
12/2/2008 7:00	36.76	736.76
12/2/2008 8:00	36.93	736.93
12/2/2008 9:00	36.91	736.91
12/2/2008 10:00	36.92	736.92
12/2/2008 11:00	36.89	736.89
12/2/2008 12:00	36.91	736.91
12/2/2008 13:00	36.85	736.85
12/2/2008 14:00	36.87	736.87
12/2/2008 15:00	36.88	736.88
12/2/2008 16:00	36.91	736.91
12/2/2008 17:00	36.89	736.89
12/2/2008 18:00	36.81	736.81
12/2/2008 19:00	36.84	736.84
12/2/2008 20:00	36.89	736.89
12/2/2008 21:00	36.88	736.88
12/2/2008 22:00	36.92	736.92
12/2/2008 23:00	36.94	736.94
12/3/2008 0:00	36.85	736.85
12/3/2008 1:00	36.79	736.79

12/3/2008 2:00	36.81	736.81
12/3/2008 3:00	36.88	736.88
12/3/2008 4:00	36.92	736.92
12/3/2008 5:00	36.86	736.86
12/3/2008 6:00	36.80	736.80
12/3/2008 7:00	36.92	736.92
12/3/2008 8:00	36.93	736.93
12/3/2008 9:00	36.94	736.94
12/3/2008 10:00	36.95	736.95
12/3/2008 11:00	36.93	736.93
12/3/2008 12:00	37.02	737.02
12/3/2008 13:00	36.89	736.89
12/3/2008 14:00	36.90	736.90
12/3/2008 15:00	36.94	736.94
12/3/2008 16:00	36.96	736.96
12/3/2008 17:00	36.97	736.97
12/3/2008 18:00	36.93	736.93
12/3/2008 19:00	36.91	736.91
12/3/2008 20:00	36.98	736.98
12/3/2008 21:00	36.95	736.95
12/3/2008 22:00	36.96	736.96
12/3/2008 23:00	36.85	736.85
12/4/2008 0:00	36.86	736.86
12/4/2008 1:00	36.87	736.87
12/4/2008 2:00	36.90	736.90
12/4/2008 3:00	36.96	736.96
12/4/2008 4:00	36.93	736.93
12/4/2008 5:00	36.91	736.91
12/4/2008 6:00	36.82	736.82
12/4/2008 7:00	36.75	736.75
12/4/2008 8:00	36.76	736.76
12/4/2008 9:00	37.00	737.00
12/4/2008 10:00	36.97	736.97
12/4/2008 11:00	36.96	736.96
12/4/2008 12:00	36.95	736.95
12/4/2008 13:00	36.78	736.78
12/4/2008 14:00	36.76	736.76
12/4/2008 15:00	36.80	736.80
12/4/2008 16:00	36.94	736.94
12/4/2008 17:00	36.92	736.92
12/4/2008 18:00	36.88	736.88
12/4/2008 19:00	36.79	736.79
12/4/2008 20:00	37.00	737.00
12/4/2008 21:00	36.97	736.97
12/4/2008 22:00	36.97	736.97
12/4/2008 23:00	36.90	736.90
12/5/2008 0:00	36.83	736.83
12/5/2008 1:00	36.88	736.88
12/5/2008 2:00	36.93	736.93
12/5/2008 3:00	36.95	736.95
12/5/2008 4:00	36.90	736.90
12/5/2008 5:00	36.88	736.88

12/5/2008 6:00	36.80	736.80
12/5/2008 7:00	36.70	736.70
12/5/2008 8:00	36.93	736.93
12/5/2008 9:00	36.98	736.98
12/5/2008 10:00	36.96	736.96
12/5/2008 11:00	36.92	736.92
12/5/2008 12:00	36.96	736.96
12/5/2008 13:00	36.97	736.97
12/5/2008 14:00	36.98	736.98
12/5/2008 15:00	37.00	737.00
12/5/2008 16:00	37.02	737.02
12/5/2008 17:00	37.03	737.03
12/5/2008 18:00	37.12	737.12
12/5/2008 19:00	37.10	737.10
12/5/2008 20:00	37.09	737.09
12/5/2008 21:00	37.12	737.12
12/5/2008 22:00	37.17	737.17
12/5/2008 23:00	37.17	737.17
12/6/2008 0:00	37.16	737.16
12/6/2008 1:00	37.04	737.04
12/6/2008 2:00	37.05	737.05
12/6/2008 3:00	37.18	737.18
12/6/2008 4:00	37.33	737.33
12/6/2008 5:00	37.26	737.26
12/6/2008 6:00	37.20	737.20
12/6/2008 7:00	37.19	737.19
12/6/2008 8:00	37.29	737.29
12/6/2008 9:00	37.34	737.34
12/6/2008 10:00	37.38	737.38
12/6/2008 11:00	37.42	737.42
12/6/2008 12:00	37.45	737.45
12/6/2008 13:00	37.47	737.47
12/6/2008 14:00	37.32	737.32
12/6/2008 15:00	37.28	737.28
12/6/2008 16:00	37.30	737.30
12/6/2008 17:00	37.39	737.39
12/6/2008 18:00	37.37	737.37
12/6/2008 19:00	37.33	737.33
12/6/2008 20:00	37.46	737.46
12/6/2008 21:00	37.37	737.37
12/6/2008 22:00	37.36	737.36
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12/7/2008 3:00	37.36	737.36
12/7/2008 4:00	37.33	737.33
12/7/2008 5:00	37.28	737.28
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12/7/2008 7:00	37.09	737.09
12/7/2008 8:00	37.16	737.16
12/7/2008 9:00	37.32	737.32

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12/7/2008 12:00	37.19	737.19
12/7/2008 13:00	37.10	737.10
12/7/2008 14:00	37.09	737.09
12/7/2008 15:00	37.13	737.13
12/7/2008 16:00	37.22	737.22
12/7/2008 17:00	37.19	737.19
12/7/2008 18:00	37.13	737.13
12/7/2008 19:00	37.03	737.03
12/7/2008 20:00	37.23	737.23
12/7/2008 21:00	37.21	737.21
12/7/2008 22:00	37.20	737.20
12/7/2008 23:00	37.19	737.19
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12/8/2008 3:00	37.16	737.16
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12/8/2008 7:00	37.09	737.09
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12/8/2008 9:00	37.15	737.15
12/8/2008 10:00	37.08	737.08
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12/8/2008 13:00	37.25	737.25
12/8/2008 14:00	37.28	737.28
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12/8/2008 16:00	37.05	737.05
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12/8/2008 18:00	37.16	737.16
12/8/2008 19:00	37.11	737.11
12/8/2008 20:00	37.19	737.19
12/8/2008 21:00	37.08	737.08
12/8/2008 22:00	37.00	737.00
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12/9/2008 2:00	36.97	736.97
12/9/2008 3:00	37.07	737.07
12/9/2008 4:00	37.09	737.09
12/9/2008 5:00	37.05	737.05
12/9/2008 6:00	36.98	736.98
12/9/2008 7:00	36.93	736.93
12/9/2008 8:00	37.01	737.01
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12/9/2008 12:00	36.76	736.76
12/9/2008 13:00	36.86	736.86

12/9/2008 14:00	36.93	736.93
12/9/2008 15:00	36.87	736.87
12/9/2008 16:00	36.77	736.77
12/9/2008 17:00	36.71	736.71
12/9/2008 18:00	36.85	736.85
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12/9/2008 20:00	36.85	736.85
12/9/2008 21:00	36.93	736.93
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12/10/2008 2:00	36.93	736.93
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12/10/2008 4:00	37.11	737.11
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12/10/2008 10:00	37.22	737.22
12/10/2008 11:00	37.21	737.21
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12/10/2008 16:00	37.53	737.53
12/10/2008 17:00	37.56	737.56
12/10/2008 18:00	37.79	737.79
12/10/2008 19:00	37.81	737.81
12/10/2008 20:00	37.82	737.82
12/10/2008 21:00	37.82	737.82
12/10/2008 22:00	37.87	737.87
12/10/2008 23:00	37.88	737.88
12/11/2008 0:00	37.82	737.82
12/11/2008 1:00	37.77	737.77
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12/11/2008 3:00	37.95	737.95
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12/11/2008 6:00	37.97	737.97
12/11/2008 7:00	37.94	737.94
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12/11/2008 9:00	38.17	738.17
12/11/2008 10:00	38.22	738.22
12/11/2008 11:00	38.26	738.26
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12/11/2008 13:00	38.46	738.46
12/11/2008 14:00	38.57	738.57
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12/11/2008 17:00	38.94	738.94

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12/11/2008 20:00	39.23	739.23
12/11/2008 21:00	39.06	739.06
12/11/2008 22:00	39.10	739.10
12/11/2008 23:00	39.24	739.24
12/12/2008 0:00	39.35	739.35
12/12/2008 1:00	39.35	739.35
12/12/2008 2:00	39.34	739.34
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12/12/2008 4:00	39.27	739.27
12/12/2008 5:00	39.18	739.18
12/12/2008 6:00	39.19	739.19
12/12/2008 7:00	39.23	739.23
12/12/2008 8:00	39.51	739.51
12/12/2008 9:00	39.45	739.45
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12/12/2008 11:00	39.41	739.41
12/12/2008 12:00	39.44	739.44
12/12/2008 13:00	39.50	739.50
12/12/2008 14:00	39.58	739.58
12/12/2008 15:00	39.45	739.45
12/12/2008 16:00	39.50	739.50
12/12/2008 17:00	39.66	739.66
12/12/2008 18:00	39.75	739.75
12/12/2008 19:00	39.96	739.96
12/12/2008 20:00	39.82	739.82
12/12/2008 21:00	39.71	739.71
12/12/2008 22:00	39.60	739.60
12/12/2008 23:00	39.57	739.57
12/13/2008 0:00	39.65	739.65
12/13/2008 1:00	39.51	739.51
12/13/2008 2:00	39.40	739.40
12/13/2008 3:00	39.45	739.45
12/13/2008 4:00	39.51	739.51
12/13/2008 5:00	39.55	739.55
12/13/2008 6:00	39.60	739.60
12/13/2008 7:00	39.45	739.45
12/13/2008 8:00	39.47	739.47
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12/13/2008 11:00	39.42	739.42
12/13/2008 12:00	39.40	739.40
12/13/2008 13:00	39.42	739.42
12/13/2008 14:00	39.24	739.24
12/13/2008 15:00	39.27	739.27
12/13/2008 16:00	39.37	739.37
12/13/2008 17:00	39.42	739.42
12/13/2008 18:00	39.29	739.29
12/13/2008 19:00	39.28	739.28
12/13/2008 20:00	39.34	739.34
12/13/2008 21:00	39.11	739.11

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12/13/2008 23:00	39.13	739.13
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12/14/2008 1:00	38.99	738.99
12/14/2008 2:00	39.03	739.03
12/14/2008 3:00	39.16	739.16
12/14/2008 4:00	39.22	739.22
12/14/2008 5:00	39.19	739.19
12/14/2008 6:00	39.13	739.13
12/14/2008 7:00	39.11	739.11
12/14/2008 8:00	39.10	739.10
12/14/2008 9:00	38.99	738.99
12/14/2008 10:00	38.93	738.93
12/14/2008 11:00	38.89	738.89
12/14/2008 12:00	38.94	738.94
12/14/2008 13:00	38.92	738.92
12/14/2008 14:00	38.89	738.89
12/14/2008 15:00	38.87	738.87
12/14/2008 16:00	38.58	738.58
12/14/2008 17:00	38.50	738.50
12/14/2008 18:00	38.46	738.46
12/14/2008 19:00	38.77	738.77
12/14/2008 20:00	38.75	738.75
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12/14/2008 23:00	38.35	738.35
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12/15/2008 5:00	38.32	738.32
12/15/2008 6:00	38.27	738.27
12/15/2008 7:00	38.25	738.25
12/15/2008 8:00	38.31	738.31
12/15/2008 9:00	38.34	738.34
12/15/2008 10:00	38.34	738.34
12/15/2008 11:00	38.29	738.29
12/15/2008 12:00	38.24	738.24
12/15/2008 13:00	38.20	738.20
12/15/2008 14:00	38.16	738.16
12/15/2008 15:00	38.17	738.17
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12/15/2008 17:00	38.17	738.17
12/15/2008 18:00	38.18	738.18
12/15/2008 19:00	38.15	738.15
12/15/2008 20:00	38.17	738.17
12/15/2008 21:00	38.15	738.15
12/15/2008 22:00	38.15	738.15
12/15/2008 23:00	38.15	738.15
12/16/2008 0:00	38.15	738.15
12/16/2008 1:00	38.13	738.13

12/16/2008 2:00	38.11	738.11
12/16/2008 3:00	38.09	738.09
12/16/2008 4:00	38.07	738.07
12/16/2008 5:00	38.05	738.05
12/16/2008 6:00	38.00	738.00
12/16/2008 7:00	37.96	737.96
12/16/2008 8:00	37.93	737.93
12/16/2008 9:00	37.93	737.93
12/16/2008 10:00	37.92	737.92
12/16/2008 11:00	37.91	737.91
12/16/2008 12:00	37.89	737.89
12/16/2008 13:00	37.86	737.86
12/16/2008 14:00	37.84	737.84
12/16/2008 15:00	37.82	737.82
12/16/2008 16:00	37.79	737.79
12/16/2008 17:00	37.78	737.78
12/16/2008 18:00	37.86	737.86
12/16/2008 19:00	37.87	737.87
12/16/2008 20:00	37.90	737.90
12/16/2008 21:00	37.90	737.90
12/16/2008 22:00	37.92	737.92
12/16/2008 23:00	37.96	737.96
12/17/2008 0:00	38.00	738.00
12/17/2008 1:00	38.03	738.03
12/17/2008 2:00	38.00	738.00
12/17/2008 3:00	37.93	737.93
12/17/2008 4:00	37.89	737.89
12/17/2008 5:00	37.92	737.92
12/17/2008 6:00	37.98	737.98
12/17/2008 7:00	37.96	737.96
12/17/2008 8:00	38.01	738.01
12/17/2008 9:00	38.02	738.02
12/17/2008 10:00	38.05	738.05
12/17/2008 11:00	38.06	738.06
12/17/2008 12:00	38.06	738.06
12/17/2008 13:00	38.07	738.07
12/17/2008 14:00	38.03	738.03
12/17/2008 15:00	38.01	738.01
12/17/2008 16:00	38.04	738.04
12/17/2008 17:00	38.07	738.07
12/17/2008 18:00	38.12	738.12
12/17/2008 19:00	38.10	738.10
12/17/2008 20:00	38.12	738.12
12/17/2008 21:00	38.14	738.14
12/17/2008 22:00	38.18	738.18
12/17/2008 23:00	38.19	738.19
12/18/2008 0:00	38.20	738.20
12/18/2008 1:00	38.18	738.18
12/18/2008 2:00	38.14	738.14
12/18/2008 3:00	38.13	738.13
12/18/2008 4:00	38.13	738.13
12/18/2008 5:00	38.16	738.16

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12/18/2008 7:00	38.08	738.08
12/18/2008 8:00	38.14	738.14
12/18/2008 9:00	38.14	738.14
12/18/2008 10:00	38.13	738.13
12/18/2008 11:00	38.12	738.12
12/18/2008 12:00	38.10	738.10
12/18/2008 13:00	38.08	738.08
12/18/2008 14:00	38.08	738.08
12/18/2008 15:00	38.11	738.11
12/18/2008 16:00	38.16	738.16
12/18/2008 17:00	38.14	738.14
12/18/2008 18:00	38.15	738.15
12/18/2008 19:00	38.16	738.16
12/18/2008 20:00	38.20	738.20
12/18/2008 21:00	38.23	738.23
12/18/2008 22:00	38.26	738.26
12/18/2008 23:00	38.24	738.24
12/19/2008 0:00	38.22	738.22
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12/19/2008 5:00	38.17	738.17
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12/19/2008 9:00	38.21	738.21
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12/19/2008 11:00	38.21	738.21
12/19/2008 12:00	38.15	738.15
12/19/2008 13:00	38.09	738.09
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12/19/2008 17:00	38.14	738.14
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12/19/2008 19:00	38.15	738.15
12/19/2008 20:00	38.15	738.15
12/19/2008 21:00	38.17	738.17
12/19/2008 22:00	38.20	738.20
12/19/2008 23:00	38.21	738.21
12/20/2008 0:00	38.19	738.19
12/20/2008 1:00	38.12	738.12
12/20/2008 2:00	38.11	738.11
12/20/2008 3:00	37.95	737.95
12/20/2008 4:00	37.92	737.92
12/20/2008 5:00	37.91	737.91
12/20/2008 6:00	37.87	737.87
12/20/2008 7:00	37.81	737.81
12/20/2008 8:00	37.72	737.72
12/20/2008 9:00		

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12/20/2008 12:00	37.73	737.73
12/20/2008 13:00	37.61	737.61
12/20/2008 14:00	37.59	737.59
12/20/2008 15:00	37.48	737.48
12/20/2008 16:00	37.44	737.44
12/20/2008 17:00	37.40	737.40
12/20/2008 18:00	37.42	737.42
12/20/2008 19:00	37.48	737.48
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12/20/2008 22:00	37.47	737.47
12/20/2008 23:00	37.38	737.38
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12/21/2008 1:00	37.41	737.41
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12/21/2008 3:00	37.30	737.30
12/21/2008 4:00	37.26	737.26
12/21/2008 5:00	37.20	737.20
12/21/2008 6:00	37.10	737.10
12/21/2008 7:00	37.01	737.01
12/21/2008 8:00	36.91	736.91
12/21/2008 9:00	36.98	736.98
12/21/2008 10:00	37.01	737.01
12/21/2008 11:00	37.08	737.08
12/21/2008 12:00	37.08	737.08
12/21/2008 13:00	36.98	736.98
12/21/2008 14:00	36.92	736.92
12/21/2008 15:00	36.92	736.92
12/21/2008 16:00	37.02	737.02
12/21/2008 17:00	37.17	737.17
12/21/2008 18:00	37.15	737.15
12/21/2008 19:00	37.13	737.13
12/21/2008 20:00	37.11	737.11
12/21/2008 21:00	37.11	737.11
12/21/2008 22:00	37.16	737.16
12/21/2008 23:00	37.21	737.21
12/22/2008 0:00	37.71	737.71
12/22/2008 1:00	37.16	737.16
12/22/2008 2:00	37.12	737.12
12/22/2008 3:00	37.15	737.15
12/22/2008 4:00	37.17	737.17
12/22/2008 5:00	37.20	737.20
12/22/2008 6:00	37.13	737.13
12/22/2008 7:00	37.17	737.17
12/22/2008 8:00	37.21	737.21
12/22/2008 9:00	37.22	737.22
12/22/2008 10:00	37.25	737.25
12/22/2008 11:00	37.23	737.23
12/22/2008 12:00	37.22	737.22
12/22/2008 13:00	37.23	737.23

12/22/2008 14:00	37.24	737.24
12/22/2008 15:00	37.24	737.24
12/22/2008 16:00	37.25	737.25
12/22/2008 17:00	37.24	737.24
12/22/2008 18:00	37.25	737.25
12/22/2008 19:00	37.25	737.25
12/22/2008 20:00	37.24	737.24
12/22/2008 21:00	37.24	737.24
12/22/2008 22:00	37.24	737.24
12/22/2008 23:00	37.24	737.24
12/23/2008 0:00	37.24	737.24
12/23/2008 1:00	37.23	737.23
12/23/2008 2:00	37.20	737.20
12/23/2008 3:00	37.22	737.22
12/23/2008 4:00	37.23	737.23
12/23/2008 5:00	37.22	737.22
12/23/2008 6:00	37.22	737.22
12/23/2008 7:00	37.22	737.22
12/23/2008 8:00	37.21	737.21
12/23/2008 9:00	37.22	737.22
12/23/2008 10:00	37.22	737.22
12/23/2008 11:00	37.23	737.23
12/23/2008 12:00	37.23	737.23
12/23/2008 13:00	37.22	737.22
12/23/2008 14:00	37.29	737.29
12/23/2008 15:00	37.29	737.29
12/23/2008 16:00	37.27	737.27
12/23/2008 17:00	37.27	737.27
12/23/2008 18:00	37.29	737.29
12/23/2008 19:00	37.33	737.33
12/23/2008 20:00	37.41	737.41
12/23/2008 21:00	37.51	737.51
12/23/2008 22:00	37.58	737.58
12/23/2008 23:00	37.64	737.64
12/24/2008 0:00	37.73	737.73
12/24/2008 1:00	37.79	737.79
12/24/2008 2:00	37.85	737.85
12/24/2008 3:00	37.93	737.93
12/24/2008 4:00	38.00	738.00
12/24/2008 5:00	38.08	738.08
12/24/2008 6:00	38.16	738.16
12/24/2008 7:00	38.23	738.23
12/24/2008 8:00	38.31	738.31
12/24/2008 9:00	38.40	738.40
12/24/2008 10:00	38.45	738.45
12/24/2008 11:00	38.53	738.53
12/24/2008 12:00	38.53	738.53
12/24/2008 13:00	38.53	738.53
12/24/2008 14:00	38.73	738.73
12/24/2008 15:00	38.77	738.77
12/24/2008 16:00	38.81	738.81
12/24/2008 17:00	38.88	738.88

12/24/2008 18:00	39.02	739.02
12/24/2008 19:00	39.10	739.10
12/24/2008 20:00	39.13	739.13
12/24/2008 21:00	39.17	739.17
12/24/2008 22:00	39.21	739.21
12/24/2008 23:00	39.25	739.25
12/25/2008 0:00	39.34	739.34
12/25/2008 1:00	39.39	739.39
12/25/2008 2:00	39.43	739.43
12/25/2008 3:00	39.37	739.37
12/25/2008 4:00	39.35	739.35
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