

RECORD DROUGHT CONDITIONS AND EFFECTS ON MISSISSIPPI STREAMS AND LAKES

David L. Hardin, Jr. and Lloyd G. Long
Office of Land and Water Resources
Mississippi Department of Environmental Quality

INTRODUCTION

Beginning in January 1999 and continuing through November 2000, the state of Mississippi experienced one of the worst, and arguably the worst, droughts ever for the state. While the effects of this drought were experienced throughout the state, the southern part was especially hard hit. The drought of 1952-1953 is considered the "drought of record" for Mississippi. The cumulative rainfall deficits for 1999-2000 were comparable to those recorded for 1952-1953.

For the streams and rivers in all areas of the state, the rainfall deficit for 1999-2000 resulted in record low flows, both daily and all-time lows. The low flows in the streams and rivers caused hardships for individuals and industries dependent on surface water. Cease pumping orders were issued on numerous streams because of low flow conditions.

RAINFALL

Table 1 shows the rainfall recorded for the Jackson station. The columns to the **left** show the normal rainfall and cumulative totals. The middle columns show the recorded rainfall and cumulative totals for 1952-1953. The right hand columns show the recorded rainfall and cumulative totals for 1999-2000. The cumulative deficit through October 2000 was slightly less than 28 inches, which was very similar to the 27.45 inches of deficit for 1952-1953. The time frame that is critical to review is November through March for each comparison. The normal cumulative total for November through March is 26.48 inches. The cumulative amount recorded for 1952-1953 was 26.11 inches, which is nearly normal even for this drought period. The cumulative amount recorded for 1999-2000 was 11.97 inches, which is 14.5 inches

below normal. This November through March time period is when the shallow aquifers normally receive recharge from winter rains. With all vegetation dormant, rainfall would normally go into storage in the shallow aquifers and therefore be available to provide **baseflow** to streams during the summer and fall. The extremely low rainfall during this time period is possibly the main factor in the low water levels measured in the streams later in the year.

STREAMS AND LAKES

Indications that 2000 would be a dry year for the streams in the state began in late winter. Streams began setting new daily low flows by large amounts. Table 2 shows streamflows for selected sites on February 11, 2000. The new daily lows for these streams ranged from 42% to 80% of the previous low flow on any February 11. The difference between flows on February 11, 2000 and the average flow for any February 11 is even more dramatic. These range from 5% to 12% of the average flow. These and other streams continued to set daily records throughout the spring, summer, and fall.

Table 3 shows streamflows for selected sites on September 20, 2000. By this time of the year streams were beginning to set all-time lows for the period of record. These streamflows were 42% to 75% of the 7dayQ10 for the streams and 8% to 38% of the average flow for the stream on any September 20. These streams, located in the Pascagoula, Tombigbee, Big Black and Pearl River basins demonstrate the wide spread effects of the drought. **All** areas of the state were effected by the drought. Sixty percent (60%) of the gaging stations in the state recorded flows below their 7dayQ10. Fifty percent (50%) of the gaging stations recorded all-time record low flows.

The Leaf River at Hattiesburg was below 7dayQ10 for 112 out of 147 days and for 31 consecutive days. The Pascagoula River at Merrill was below 7dayQ10 for 101 out of 122 days and for 52 consecutive days. The Bogue Chitto River near Tylertown was below 7dayQ10 for 126 out of 163 days and for 25 consecutive days. The Buttahatchie River near Aberdeen was below 7dayQ10 for 90 out of 107 days and for 88 consecutive days. The Bowie Creek near Hattiesburg was below 7dayQ10 for 63 out of 87 days and for 36 consecutive days. The Big Black River at West was below 7dayQ10 for 67 out of 103 days and for 33 consecutive days.

Bowie Creek near Hattiesburg maintained its base flow longer and did not show as much reduced flow as other streams in the Pascagoula River basin. Studies have begun to determine if this was a result of geologic formations the Bowie cuts across, agricultural practices, land use practices, or a combination of factors.

Naturally occurring lakes in the Mississippi Delta are required by law to have an established minimum average lake level. When the water level in the lakes fall below this minimum level, all withdrawals from these lakes must cease. In early April 2000, water levels in the Delta lakes were already near their minimum average lake level in several areas of the Delta. Letters were prepared to warn permit holders of possible cease pumping orders for these lakes. Because of the extremely dry conditions, farmers needed to irrigate and to be able to plant. Fortunately, the area received enough rainfall to fill these lakes over a two-day period and cease-pumping orders were not necessary at this time (Table 4).

PERMITS

Mississippi statute authorizes the permitting of water of any stream only in excess of the established minimum flow (7dayQ10) for the stream. As with naturally occurring lakes in the Mississippi Delta, when stream flows go below their minimum level (7dayQ10) withdrawals for consumptive use must cease. Consumptive use is defined as water withdrawn from a stream and not returned to the stream. Non-consumptive

users could request a variance to their surface water permit and continue to withdraw water as long as they returned substantially the same amount and did not impair stream standards set under the pollution control laws of the state. There were two industries that requested and received permit variances and were required to do additional water quality monitoring and reporting. There were 54 cease-pumping orders issued throughout the state (Table 5). The Pascagoula River basin was the hardest hit area with 33 cease-pumping orders. While some of the orders were for industrial use the majority of the orders were to agricultural users for irrigation.

CONCLUSIONS

The drought of 1999-2000 was very similar to the drought of 1952-1953 with regard to cumulative rainfall deficits, but the recent drought had much more effect on the flow in the streams of the state and levels in the lakes in the Mississippi Delta. It is believed that rainfall deficit from November to March was the principle factor influencing the lack of shallow groundwater contribution during the summer months. Ongoing studies are attempting to identify possible ways of predicting if and/or when low stream conditions may occur.

REFERENCES

- Southern Regional Climate Center, Baton Rouge, LA
- United States Geological Survey, Water Resources Division, Web site

Table 1. COMPARISON OF HISTORIC RAINFALL TO CURRENT RAINFALL IN SELECTED YEARS
NATIONAL WEATHER SERVICE, JACKSON STATION (Rainfall in inches)

	Normal Precip.	Cum. Totals	Recorded Precip.	Cum. Precip.	Recorded Precip.	Cum. Precip.
			<u>1952</u>		<u>1999</u>	
January	5.24	5.24	2.08	2.08	8.47	8.47
February	4.70	9.94	2.24	4.32	2.04	10.51
March	5.82	15.76	3.58	7.90	4.65	15.16
April	5.57	21.33	2.21	10.11	2.09	17.25
May	5.05	26.38	6.22	16.33	2.66	19.91
June	3.18	29.56	1.59	17.92	4.34	24.25
July	4.51	34.07	1.40	19.32	4.41	28.66
August	3.77	37.84	1.51	20.83	1.71	30.37
September	3.55	41.39	2.10	22.93	2.48	32.85
October	3.26	44.65	0.00	22.93	5.74	38.59
November	4.81	49.46	2.61	25.54	1.74	40.33
December	5.91	55.37	6.16	31.70	2.62	42.95
			<u>1953</u>		<u>2000</u>	
January	5.24	60.61	4.61	36.31	1.91	44.86
February	4.70	65.31	7.85	44.16	1.29	46.15
March	5.82	71.13	4.88	49.04	4.41	50.56
April	5.57	76.70	8.44	57.48	7.52	58.08
May	5.05	81.75	7.12	64.60	1.63	59.71
June	3.18	84.93	1.36	65.96	5.32	65.03

Table 2. Streamflows on February 11, 2000 in Selected Streams
(All flows are in cubic feet per second)

Gaging Station/Location	Previous Lowest Flow of Record	Recorded 02/11/2000	Average Flow	Years of Record
Pascagoula River at Merrill	4,060	2,189*	18,100	67
Leaf River at Hattiesburg	945	594*	4,850	61
Chickasawhay River at Enterprise	268	214'	2,640	59
Pearl River at Carthage	638	265*	3,940	35
Pearl River at Monticello	1,220	872*	13,200	58
Big Black River at West	290	166*	3,740	29
Big Black River at Bovina	693	407*	7,560	62

*Lowest flow of record on any February 11th

Source: U.S. Geological Survey

Table 3. Streamflows on September 20, 2000 in Selected Streams
(All flows are in cubic feet per second)

Gaging Station/Location	Previous Record Low Flow (Date)	Recorded 09/20/2000	Average Flow	7 Day Q ₁₀	Years of Record
Leaf River at Hattiesburg	318 (10/22/63)	239	1,205	374	61
Buttahatchie near Aberdeen	90 (8/31/88)	53	321	117	34
Big Black River at West	14 (10/06/87)	11	147	26	29
Bogue Chitto at Tylertown	177 (10/31/63)	143	377	192	55

Table 4. COMPARISON OF HISTORIC RAINFALL TO CURRENT RAINFALL IN SELECTED YEARS NATIONAL WEATHER SERVICE, STONEVILLE EXPERIMENT STATION (Rainfall in inches)

	Normal Precip.	Cum. Totals	1952		1999	
			Recorded Precip.	Cum. Precip.	Recorded Precip.	Cum. Precip.
January	4.50	4.50	4.27	4.27	13.82	13.82
February	4.72	9.22	4.04	8.31	1.28	15.10
March	5.45	14.67	4.87	13.18	3.99	19.09
April	4.83	19.50	4.19	17.37	4.81	23.90
May	4.77	24.27	2.63	20.00	5.69	29.59
June	3.92	28.19	1.42	21.42	2.63	32.22
July	3.83	32.02	1.78	23.20	1.03	33.25
August	2.38	34.40	1.23	24.43	0.23	33.48
September	3.23	37.63	1.47	25.90	1.72	35.20
October	3.17	40.80	0.00	25.90	1.21	36.41
November	5.51	46.31	2.92	28.82	4.92	41.33
December	5.75	52.06	5.68	34.50	3.44	44.77
Cumulative Totals		104.12		-23.80		-4.34

	Normal Precip.	Cum. Totals	1953		2000	
			Recorded Precip.	Cum. Precip.	Recorded Precip.	Cum. Precip.
January	4.50	56.56	3.62	38.12	3.53	48.30
February	4.72	61.28	6.44	44.56	1.60	49.90
March	5.45	66.73	6.73	51.29	7.72	57.62
April	4.83	71.56	5.90	57.19	11.09	68.71
May	4.77	76.33	8.56	65.75	6.93	75.64
June	3.92	80.25	1.39	67.14	6.13	81.77
July	3.83	84.08	1.83	68.97	0.60	82.37
August	2.38	86.46	1.57	70.54	0.00	82.37
September	3.23	89.69	2.00	72.54	2.59	84.96
October	3.17	92.86	0.79	73.33	0.61	85.57
November	5.51	98.37	2.01	75.34	11.10	96.67
December	5.75	104.12	4.98	80.32	6.11	102.78
Cumulative Totals		104.12		-23.80		-4.34

Table 5. MISSISSIPPI STREAMS WATER USE PERMIT
ENFORCEMENT ACTIONS TO DATE

RIVER BASIN	STREAM	NO. PERMITS
Pascagoula Basin	Black Creek & Tributaries	7
	Red Creek & Tributaries	1
	Leaf River & Tributaries	11
	Okatoma Creek & Tributaries	6
	Bowie River & Tributaries	10
Coastal Streams	Little Biloxi	1
Pearl Basin	Bogue Chitto River & Tributaries	2
	Strong River & Tributaries	6
Tombigbee Basin	Buttahatchee River & Tributaries	4
Big Black Basin	Big Black River & Tributaries	2
Delta Lakes		6

Total Number of Permits:

56

