

SECTION IV.—RIVERS AND FLOODS.

RIVERS AND FLOODS, MAY, 1915.

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[Dated: Washington, D. C., June 25, 1915.]

The last decade of May, 1915, was generally a rainy period over the greater portions of the country, with heavy to excessive rainfalls over the Middle and Lower Mississippi Valley, the Gulf and South Atlantic States, and the California Valley. Owing to the protracted dry weather previous, however, the resulting river stages were somewhat lower than ordinarily obtain in consequence of like amounts of rainfall.

Mississippi River.—No material rises were caused in the Mississippi, owing to the previous dry period, until after the 26th, on which date heavy to excessive rains set in over the watersheds of the Lower Missouri, Des Moines, and Illinois Rivers. On May 31 freshet stages were reached along the Mississippi River from Quincy, Ill., to Cape Girardeau, Mo., while at Hannibal, Mo., a stage of 13.5 feet—0.5 feet above flood stage—was reached at 8 a. m. on the 31st.

The first advisory or flood-warning messages were disseminated by the St. Louis Weather Bureau office on May 26. By the 31st all the streams in the St. Louis River district, except the Gasconade, were either in flood or were rapidly approaching flood stage.

Since this flood period extends into the following month, a further discussion will appear in the next issue.

Missouri River.—Flood stages above Kansas City were not reached, although freshet stages prevailed in practically all tributaries in Kansas, Iowa, and Nebraska. Below Kansas City, however, flood stages obtained generally from the 28th, with a continuous rise to the end of the month. As a result of these bank-full stages in the lower reaches of the river, lowlands were inundated; but, owing to the higher elevation of most of the land under cultivation, no material damage to crops was sustained except at a few places. Railroad traffic was tied up in Kansas City and elsewhere, generally over the flooded sections, although the damage to tracks and bridges was local, and the greatest damage suffered by the shipping interests was the delay occasioned to traffic and transportation.

At Pattonsburg, Mo., Grand River overflowed its banks submerging the entire town. Families in one-story buildings and all merchandise were moved to upper stories for safety. Train service was completely cut off for some time.

At Lexington, Mo., the damage caused to crops in that vicinity and in Ray County amounted to thousands of dollars. Loss to bridges amounted approximately to \$150,000.

At Bagnell, Mo., great damage was caused by the overflowing of the Osage River.

The following table gives the stages at and above flood stage at points along the Missouri River from Kansas City to the mouth, up to the end of the month:

Station.	River.	Flood stage.	First reached flood.		Highest stage.	
			Stage.	Date.	Stage.	Date.
		<i>Feet.</i>	<i>Feet.</i>		<i>Feet.</i>	
Kansas City, Mo.....	Missouri.....	22.0	22.3	May 28	25.2	May 30
Waverly, Mo.....	do.....	22.0	22.2	May 28	23.1	May 31
Chillicothe, Mo.....	Grand.....	18.0	19.7	May 27	30.1	May 30
Boonville, Mo.....	Missouri.....	21.0	22.0	May 29	24.0	May 31
Osceola, Mo.....	Osage.....	20.0	20.3	May 28	21.5	May 31
Hermann, Mo.....	Missouri.....	21.0	22.2	May 29	24.8	May 31

Since the crest of the flood in the lower Missouri was not reached at the end of the month, a further report thereon will be made in the next issue.

Arkansas River and tributaries.—In the Fort Smith River district the most destructive flood since 1908 began on May 25, and continued until June 3. This flood was due to frequent showers over Oklahoma and eastern Kansas from the 19th to the 23d, which thoroughly saturated the soil over the watersheds of the Arkansas, Verdigris, and Neosho Rivers, producing a steady though not rapid rise to stages considerably above normal in all of the larger tributaries. Heavy rains for four successive days then followed.

The Neosho River passed flood stage at Fort Gibson, Okla., during the night on May 24; the Verdigris, at North Muskogee, Okla., on the 27th; and the Arkansas River, at Fort Smith, on the 26th; and at Tulsa, Okla., on the 27th. The Arkansas remained above flood stage at Fort Smith from May 26 to June 2, inclusive. Although the flood stage was not reached at Wyandotte, Okla., the Neosho River overflowed its banks above and below that station. A flood warning for the Neosho River, and the Arkansas from the mouth of the Neosho to Fort Smith was issued on the 24th, and another for the Arkansas above the mouth of the Neosho on the 25th. The warnings were timely and well disseminated and nearly all property that could be protected was saved. The great bulk of the losses sustained were to unprotected farm lands, and even a considerable acreage of lands of this nature was saved by the construction of temporary levees after the receipt of the flood warnings.

The losses in the Fort Smith River district alone, as indicated by the receipt of a considerable number of reports, were as follows:

Tangible property, including buildings, municipal plants, highways and bridges.....	\$50,000
Loss of crops.....	200,000
Loss of prospective crops (20,000 acres involved).....	250,000
Loss of live stock and other movable property.....	10,000
Railroad bridges and roadbeds.....	50,000

Total loss..... 560,000
 Money value of property saved by Weather Bureau warnings. 75,000

In the lower Arkansas and White Rivers flood stages prevailed from the 28th or 29th, extending into the month of June.

The most disastrous effects of the flood in the upper river districts were probably in the watershed of the Neosho River, in the vicinities of Iola, and Horseshoe Bend, Kans., and were due in large measure to the breaking of levees in the vicinity of Horseshoe Bend on the morning of May 22. As a result, hundreds of acres of growing crops were flooded, and many fields of grain and vegetables were completely destroyed. Water stood on low farms from 5 to 15 feet deep. The estimated losses in Horseshoe Bend alone were placed at \$3,800, while the total damages in the vicinities of Horseshoe Bend and Iola amounted, in the aggregate, to more than \$10,000. Owing to the timely warnings issued by the Weather Bureau, however, farmers were on the lookout and in readiness for the flood, and not a single accident or loss of stock was reported.

Overflowing of the Arkansas at Great Bend and Nickerson, Kans., and of the small tributaries in the vicinity of Wichita, caused some slight damages to crops in the low lands, and to bridges.

The following table gives some of the highest stages in the Arkansas and its tributaries during the month:

Some of the highest stages in the Arkansas, May, 1915.

Station.	River.	Flood stage.	Crest stage.	Date of crest.
		<i>Fect.</i>	<i>Fect.</i>	
Dodge City, Kans.	Arkansas	5.0		
North Muskogee, Okla.	Verdigris	21.3	21.7	May 27
Emporia, Kans.	Cottonwood	19.5	19.5	May 23
Neosho Rapids, Kans.	Neosho	22.0	22.1	May 21
Le Roy, Kans.	do	24.0	24.0	May 20
Iola, Kans.	do	10.0	11.3	May 21
Oswego, Kans.	do	20.0	20.1	May 27
Fort Gibson, Okla.	Grand	22.0	24.3	May 25
Canton, Okla.	North Canadian	3.0	4.6	May 25
Fort Smith, Ark.	do	22.0	23.0	May 24
Dardanelle, Ark.	do	20.0	20.3	May 23
Little Rock, Ark.	do	23.0	23.2	May 28
Pine Bluff, Ark.	do	25.0	25.0	May 29
Calico Rock, Ark.	White	18.0	21.0	May 28
Batesville, Ark.	do	18.0	21.0	May 29
Georgetown, Ark.	do	22.0		

Red River and tributaries.—On April 23 heavy rains set in over portions of the upper watershed of the Red River and continued through the 26th, extending generally over the entire watershed. The resulting flood was the worst over this district since 1908. Aside from the damages due to the interruption of train service and traffic, conservative estimates place the actual losses occasioned by the flood at not less than one and one-half million dollars. Considerable losses extended from Oklahoma City to below Shreveport, La., but the heaviest losses were sustained in Lafayette, Miller, Hempstead, and Little River Counties, Ark., and in Bowie County, Texas.

The flood period extended over the latter part of April and the first days of May. The highest stages in feet and the dates of occurrence were as follows:

Station.	River.	Flood stage.	Crest stage.	Date of crest.
		<i>Fect.</i>	<i>Fect.</i>	
Denison, Tex.	Red	22.0	19.0	Apr. 28.
Arthur City, Tex.	do	27.0	30.5	Apr. 29.
Fulton, Ark.	do	28.0	34.1	May 2.
Springbank, Ark.	do	29.0	33.5	May 6-7.
Shreveport, La.	do	29.0	29.1	May 9.
Alexandria, La.	do	36.0	36.1	May 17-18.
Whitecliffs, Ark.	Little	28.0	28.2	Apr. 29.
Ringo Crossing, Tex.	Sulphur	20.0	21.0	Apr. 25-27.
Finley, Tex.	do	24.0	31.4	Apr. 28.
Jefferson, Tex.	Cypress	18.0	23.6	Apr. 28-29.

Statistics of money losses resulting from the flood have been carefully compiled from over 100 written reports and are as follows:

Loss of tangible property, mostly to highways, bridges, fences, levees, pipe lines, houses, and land lost by caving banks.....	\$255,000
Corn and cotton for seed.....	25,000
Prospective crops (150,000 acres involved).....	1,000,000
Live stock, implements, etc.....	70,000
Loss due to suspension of business.....	190,000
Total loss.....	1,540,000
Money value of property saved by Weather Bureau warnings, largely live stock.....	750,000

The timely warnings issued by the Weather Bureau at the earliest possible moment were based almost entirely upon scattered heavy rains and prepared people in advance of the flood to move their property and stock to places of safety.

Rivers of Mississippi.—Excessive general rains on May 7 and 8 caused sudden and sharp rises in the Chickasawhay River at Shubuta and Enterprise, Miss., in the Pascagoula River at Merrill, Miss., and in the Pearl River at Edinburg and Jackson, Miss. Flood stages were reached at Edinburg on May 7 and continued through the 18th, with a crest of 20 feet on the 15th. At Jackson a crest stage of 19.8 feet prevailed on the 15th and 16th. The stages were due to additional heavy rains on the 11th and 12th. None of the other streams reached flood stage. No damage was sustained in the basins of the Chickasawhay and Pascagoula Rivers, but at Jackson, on the Pearl, nominal damages and much inconvenience resulted from an overflow of Town Creek on May 7.

The advices of sudden rises furnished by the Weather Bureau were useful to the lumbering interests as well as to the agricultural interests.

Rivers of Alabama.—A flood of comparatively small extent in the Tombigbee River below Demopolis, Ala., inundating only the lowest river bottoms, occurred during May. The river at Demopolis was above flood stage from the 12th to the 18th, inclusive, with a crest of 40.8 feet on the 14th. A stage of 42.4 feet (0.6 foot below flood stage) was reached at Tuscaloosa, Ala., on the Black Warrior River on May 8. Timely warnings were issued by the Weather Bureau.

Statistics relative to the flood on the Tombigbee River, based upon data collected from reports by the public, are as follows:

Loss of prospective crops (1,430 acres involved).....	\$1,200
Loss due to suspension of business.....	20
No other losses reported.	
Money value of property saved by the issuance of flood warnings by the Weather Bureau.....	48,000

This relatively great protection to property is explained by the fact that over 1,200 head of live stock were moved from lowlands in advance of the flood.

Rivers of South Carolina.—Freshet stages occurred in the Black and the Santee Rivers of South Carolina, due to heavy local rains in scattered sections of the respective watersheds, but no material damages were reported. The Black River was above flood stage at Kingtree, S. C., from the 15th to the 17th, inclusive, with a crest stage of 12.7 feet on the 16th. The Santee River was above flood stage at Ferguson, S. C., from the 12th to the 19th, inclusive, with a crest stage of 12.8 feet on the 15th, 16th, and 17th, and at Rimini, S. C., from the 10th to the 16th, inclusive, with a crest stage of 12.9 feet on the 15th.

Rivers of California.—Freshet stages occurred in the rivers of California, with flood stages as follows: At Sacra-

mento, Cal., on the Sacramento River; at Carters ranch, Cal., on the Kaweah River; at Piedra, Cal., on the Kings River.

In the California Valley the generally heavy rainfalls were beneficial to crops of grain, while the only damage of consequence was suffered by the Southern Pacific Company by the suspension of traffic and the washing away of tracks and bridges. An estimate of the probable damages sustained, however, is not as yet available.

Rivers of Texas.—Flood stages occurred in the rivers of Texas during the early part of May as follows: Sabine River, at Logansport, La.; Trinity River, Long Lake, Tex.; Liberty, Tex.; Fort Worth, Tex.; Dallas, Tex.; Brazos River, at Washington, Tex.; Rosenberg, Tex.; Hempstead, Tex.; Nueces River, at Cotulla, Tex.; Neches River, at Rockland, Tex.; Guadalupe River, at Victoria, Tex. A report of the floods of Texas during the latter part of April and the first part of May will be found in the April, 1915, REVIEW.

Freshet stages occurred in the rivers of Iowa, Illinois, and Indiana, attended with some slight damages to crops in the lowlands due to the overflowing of small streams. In the vicinity of Springfield, Ill., considerable damage and inconvenience was caused by the overflowing of the Sangamon River, due to unusually excessive rainfall.

The Penobscot River, at West Enfield, Me., reached flood stage on May 2 and 3, with a crest of 12.6 feet on the 2d.

Recapitulation of flood loss.—The greatest damages caused by the floods of May seem to have been sustained in the watersheds of the Arkansas and Red Rivers. The estimated damages in these two river valleys alone exceeds \$2,000,000, while the losses elsewhere over the country, though somewhat more local in extent, will increase the foregoing figures. Since the crest in the Lower Missouri did not occur until the following month, the losses, if any, are not included in the above.

These heavy losses were, in the main, unpreventable, and were sustained largely by the farming, shipping, and transportation interests. The money value of property, mainly live stock, saved by the timely warnings of the Weather Bureau in these two river valleys alone, is conservatively estimated at \$825,000, while in the Tombigbee Valley the saving of live stock is estimated at \$48,000.

Hydrographs for typical points on several principal rivers are shown on Chart I. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.

MEAN LAKE LEVELS DURING MAY, 1915.

By UNITED STATES LAKE SURVEY.

[Dated: Detroit, Mich., June 5, 1915.]

The following data are reported in the "Notice to Mariners" of the above date:

Data.	Lakes.			
	Superior.	Michigan and Huron.	Erie.	Ontario.
Mean level during May, 1915:				
Above mean sea level at New York.....	Feet. 601.65	Feet. 579.64	Feet. 571.69	Feet. 245.15
Above or below—				
Mean stage of April, 1915.....	+0.31	+0.16	+0.24	+0.11
Mean stage of May, 1914.....	-0.58	-0.68	-1.21	-1.80
Average stage for May, last 10 years...	-0.30	-1.07	-1.12	-1.76
Highest recorded May stage.....	-1.40	-3.88	-2.73	-3.80
Lowest recorded May stage.....	+0.83	+0.08	+0.33	+0.19
Probable change during June, 1915.....	+0.3	+0.3	+0.2	+0.1