

<b>NWS FORM E-5</b> (11-88) (PRES. by NWS Instruction 10-924)	<b>U.S. DEPARTMENT OF COMMERCE</b> NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION NATIONAL WEATHER SERVICE	HYDROLOGIC SERVICE AREA (HSA)	
		<b>Tulsa, Oklahoma (TSA)</b>	
<b>MONTHLY REPORT OF RIVER AND FLOOD CONDITIONS</b>		REPORT FOR:	MONTH                      YEAR
		<b>May</b>	<b>2011</b>
TO: Hydrometeorological Information Center, W/OH2 NOAA / National Weather Service 1325 East West Highway, Room 7230 Silver Spring, MD 20910-3283		SIGNATURE	
		<b>Steven F. Piltz</b> (Meteorologist-in-Charge)	
		DATE	
		<b>June 6, 2011</b>	

*When no flooding occurs, include miscellaneous river conditions, such as significant rises, record low stages, ice conditions, snow cover, droughts, and hydrologic products issued (NWS Instruction 10-924)*

An "X" in the box indicates no flood stages were reached in this Hydrologic Service Area (HSA) during the month above.

May 2011 was marked by more heavy rainfall, flash flooding, and river flooding, primarily across far eastern and southeast OK and northwest AR. Large, deadly tornadoes also affected the area this month. Normal precipitation ranges from 4.4 inches in Washington (OK) County to 6.4 inches in Le Flore County. The Ozark region of northwest Arkansas averages 5.1 inches for the month.

**Monthly Summary**

Using the radar-derived estimated observed precipitation from the RFCs (Fig. 1a), rainfall totals for May 2011 ranged from around 2" across the western portion of the HSA to over 10" across portions of southeast OK and northwest AR. Most of the HSA east of the Hwy 75 corridor received 5" to over 10" of rain this month (see Fig. 1a), which equates to 125% to near 300% of the normal May rainfall (Fig. 1b). However, locations along and west of Hwy 75 received 50% to 90% of the normal May rainfall (see Fig. 1b).

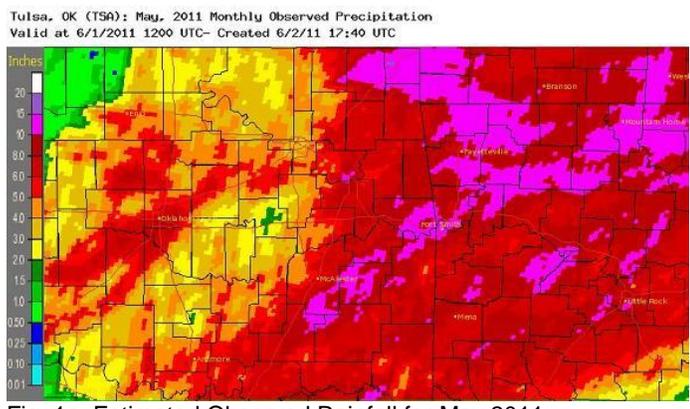
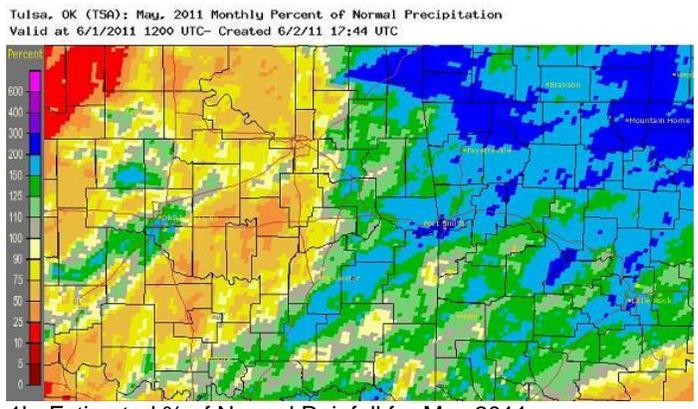


Fig. 1a. Estimated Observed Rainfall for May 2011



1b. Estimated % of Normal Rainfall for May 2011

Tulsa, OK, May 2011 ranked as the 48<sup>th</sup> coldest May (68.6°F; since records began in 1905) and the 36<sup>th</sup> driest May (3.58"; since records began in 1888). Fort Smith, AR was the 53<sup>rd</sup> coldest May (69.1°F) and the 4<sup>th</sup> wettest May (11.91") since records began in 1883.

For Spring (Mar-Apr-May), Tulsa, OK ranked as the 23<sup>rd</sup> warmest Spring (61.5°F; since records began in 1905, tied with 1967, 1933, 1930, 1929) and the 38<sup>th</sup> driest Spring (9.99"; since records began in 1888). Fort Smith, AR was the 16<sup>th</sup> warmest Spring (63.3°F, tied with 2007, 1977) and the 6<sup>th</sup> wettest Spring (22.26") since records began in 1883. For Fort Smith, March 2011 was the 5<sup>th</sup> driest, April 2011 was the 3<sup>rd</sup> wettest, and May 2011 was the 4<sup>th</sup> wettest on record. The dry March (only 0.80" of rain) kept the Spring total from being even higher.

Some of the larger precipitation reports (in inches) for May 2011 included:

St. Paul, AR (coop)	12.58	Vinita, OK (meso)	12.52	Miami, OK (meso)	12.31
Fort Smith, AR (ASOS)	11.91	Fayetteville, AR (ASOS)	11.50	Mountainburg, AR 2NE (coop)	10.70
Wilburton, OK (meso)	10.23	NW AR Regional Aprt (ASOS)	10.07	Berryville, AR 5NW (coop)	10.05

According to the [U.S. Drought Monitor](#) (USDM) from May 31, 2011, all but the far western portion of the area was drought free this month due to the heavy rain and flooding in May. Abnormally dry (D0) conditions still lingered across far western Osage, Pawnee, Creek, and western Okfuskee Counties (see Figs. 2 & 3). Interestingly, drought conditions go from the highest category of exceptional drought to no drought conditions as one moves from west to east across the state of Oklahoma. While in the east, people are begging for the rain to stop, those living in the west are praying for rain.

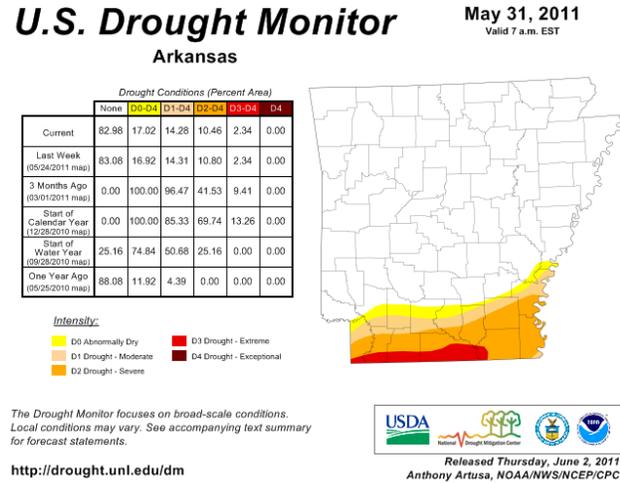
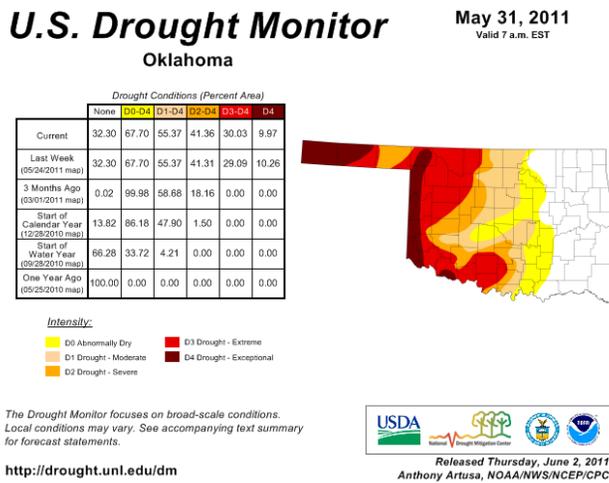


Fig. 2. Drought Monitor for Oklahoma

Fig. 3. Drought Monitor for Arkansas

According to statistics from the [Oklahoma Climatological Survey](#) (OCS):

Rank since 1921 ("Last XX days" ending May 31, 2011)	May 1-30, 2011	Spring 2011 (Mar 1, 2011 – May 31, 2011)	Last 60 days (Apr 2, 2011 – May 31, 2011)	Year-to-Date (Jan 1, 2011 – May 31, 2011)	Water Year (Oct 1, 2010 – May 31, 2011)	Last 365 Days (Jun 1, 2010 – May 31, 2011)
Northeast OK	26 <sup>th</sup> wettest	27 <sup>th</sup> wettest	15 <sup>th</sup> wettest	36 <sup>th</sup> wettest	30 <sup>th</sup> driest	39 <sup>th</sup> wettest
East Central OK	32 <sup>nd</sup> wettest	13 <sup>th</sup> wettest	4 <sup>th</sup> wettest	28 <sup>th</sup> wettest	35 <sup>th</sup> driest	44 <sup>th</sup> driest
Southeast OK	19 <sup>th</sup> wettest	24 <sup>th</sup> wettest	8 <sup>th</sup> wettest	42 <sup>nd</sup> driest	24 <sup>th</sup> driest	14 <sup>th</sup> driest
Statewide	43 <sup>rd</sup> driest	18 <sup>th</sup> driest	39 <sup>th</sup> driest	12 <sup>th</sup> driest	9 <sup>th</sup> driest	16 <sup>th</sup> driest

The heavy rain during May once again caused several of the major reservoirs in the Tulsa HSA to go into flood control operations, though many reservoirs were within ±5% of conservation pool by the end of the month. Skiatook Lake was the only reservoir reporting a conservation pool deficit as of May 31, 2011, with 83% conservation pool. As of May 31, 2011, the following reservoirs were reporting flood control storage: Beaver Lake 90% (with a maximum of 122% of flood control pool utilized on May 24), Fort Gibson Lake 33%, Wister Lake 31%, Tenkiller Lake 27%, Pensacola/Grand Lake 23%, Eufaula Lake 18%, Hudson Lake 15%, and Oologah Lake 15%.

### Outlooks

The [Climate Prediction Center](#) (CPC) outlook for June 2011 (issued May 31, 2011) indicates a slightly enhanced chance for above average temperatures and an equal chance for above, near, and below median precipitation across eastern OK and northwest AR. For the 3-month period Jun-Jul-Aug 2011, CPC is

forecasting an equal chance for above, near, and below average temperatures and equal chances for above, near, and below median precipitation across eastern OK and northwest AR (outlook issued May 19, 2011).

According to CPC, La Niña conditions continue to weaken and ENSO neutral conditions were observed at the end of May as negative sea surface temperature anomalies continued to warm in parts of the Pacific Ocean. The direct impact of La Niña is expected to be minimal on the U.S. in June as residual atmospheric effects continue for the next few weeks. Current computer models indicate ENSO-neutral conditions by the end June 2011.

## Summary of Precipitation Events

### May 1 – 15:

May 2011 got off to a wet start as a cold front stalled across southeast OK. A persistent low-level jet and several upper-level disturbances led to convective development along and north of the front on the 1<sup>st</sup> and into the 2<sup>nd</sup>. Very high precipitable water values of around 1.5" (~175% of normal) was pooled near the front, leading to high rainfall totals across southeast OK and west central AR. While all of the HSA received from around 0.25" to near 1" of rainfall, locations southeast of a McAlester to Sallisaw to Huntsville line had 1.5" to near 7" (see Fig. 4). This heavy rainfall, on top of the record flooding that occurred near the end of April, caused additional flooding across portions of southeast OK and northwest AR. In addition, this additional rainfall led to moderate flooding along the Poteau River near Panama, with the river cresting during the afternoon of the 3<sup>rd</sup> (see E3 report for details). The Poteau River near Poteau crested barely under flood stage, while the Kiamichi River near Antlers exceeded action stage but remained below flood stage.

A shortwave trough and weak cold front moved across the region on the 5<sup>th</sup>, though with limited moisture available, only brought a few hundredths to around 0.25" of rain to far northeast OK and northwest AR. A quick moving upper-level disturbance brought another round of rain to Benton, Carroll, and Madison Counties late on the 6<sup>th</sup>. Rainfall totals were generally around 0.10" to 0.25", with isolated areas near 0.50".

Storms that developed across central OK during the evening of the 10<sup>th</sup> moved into western Osage and Pawnee Counties. Overall rainfall was light, though a few areas received around 0.50" of rain. Thunderstorms again developed west of the HSA on the 11<sup>th</sup> and moved into eastern OK during the afternoon hours and into western AR during the evening. Widespread 0.25" to 1" of rain occurred across eastern OK, with lesser amounts in AR (see Fig. 5). The highest precipitation totals occurred across Osage, Pawnee, and Washington Counties, where 1.5" to 2.5" inches fell. Bowing structures within the convection led to several reports of wind damage in eastern OK. A brief EF0 tornado occurred near Locust Grove during this event as well.

Tulsa, OK (TSA): 5/2/2011 1-Day Observed Precipitation  
Valid at 5/2/2011 1200 UTC- Created 5/4/11 23:31 UTC



Fig. 4. Estimated Observed Rainfall ending 7am 5/2/2011

Tulsa, OK (TSA): 5/12/2011 1-Day Observed Precipitation  
Valid at 5/12/2011 1200 UTC- Created 5/14/11 23:31 UTC



Fig. 5. Estimated Observed Rainfall ending 7am 5/12/2011

Tulsa, OK (TSA): 5/13/2011 1-Day Observed Precipitation  
 Valid at 5/13/2011 1200 UTC - Created 5/15/11 23:31 UTC

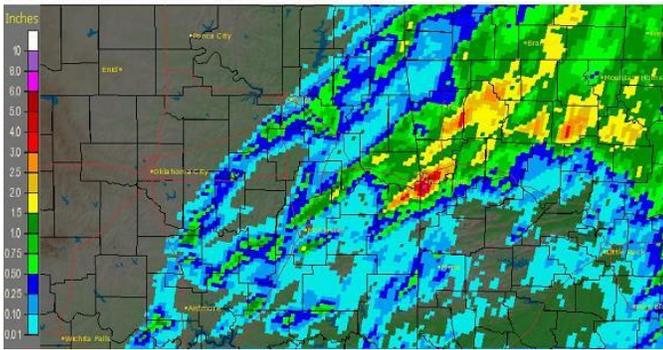


Fig. 6. Estimated Observed Rainfall ending 7am 5/13/2011

Showers and thunderstorms developed during the afternoon and evening of the 12<sup>th</sup> along a cold front. The initial storms occurred along and south of I-44 during the afternoon, with thunderstorm activity developing further east ahead of the front across east central OK and northwest AR during the evening hours. Heavy rainfall accompanied the storms in west central and northwest AR, with rainfall totals of 1.5" to near 5" (see Fig. 6). This heavy rain caused street flooding in several areas of Crawford and Le Flore Counties. The Fort Smith Airport measured 3.64" in 2 hours (from 8-10pm), causing major street flooding in Fort Smith and leading to water rescues. Large hail over 1.75" (and as high as 3"! ) also occurred with the strongest thunderstorms.

**May 16 – 31 (including the May 22, 23, and 24 events):**

Showers and thunderstorms developed late on the 17<sup>th</sup> and continued into the morning of the 18<sup>th</sup> in response to a mid-level short wave and a strengthening low-level jet. This activity affected primarily eastern OK and far northwest AR. Rainfall totals remained light, with the highest totals of 0.75" to near 1.5" occurring in localized areas of northeast OK.

A linear MCS that developed across southwest OK moved into eastern OK during the morning of the 20<sup>th</sup>. The MCS affected the entire HSA as it continued to move east into western AR during the early afternoon hours. A second round of convection developed across north central TX and moved north into southeast OK and west central AR during the afternoon and evening hours. Rainfall totals were generally around 0.5" to 2" across the region, though higher amounts of 3"-5" occurred across east central and southeast OK (see Fig. 7, 8).

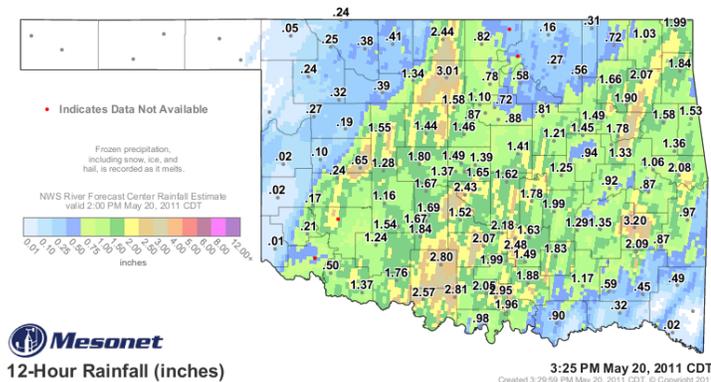


Fig. 7. 12-hour rainfall ending at 3:25pm 5/20/11.

Tulsa, OK (TSA): 5/21/2011 1-Day Observed Precipitation  
 Valid at 5/21/2011 1200 UTC - Created 5/23/11 18:33 UTC



Fig. 8. 24-hour rainfall ending at 7am 5/21/11.

**May 22, 2011**

A dryline extended from southeast KS into southwest OK on the afternoon of May 22, 2011. An extremely unstable airmass, with CAPE values near 5000 j/kg, was in place ahead of the dryline across eastern OK and northwest AR. Several thunderstorms developed along the boundary across northeast OK by early evening, with more isolated convection occurring further south in southeast OK. These storms quickly became severe, and rotating supercells produced large hail (tennis ball to baseball sized hail occurred at the NWS office in Tulsa), wind damage, and 11 tornadoes as they tracked east across eastern OK and northwest AR (this system was responsible for the EF5 Joplin, MO tornado). An EF2 tornado severely damaged homes in the Fiddlers Bend area on the Illinois River, which only one month prior experienced record flooding. Later in the evening,

additional severe thunderstorms developed along outflow boundaries that had been produced by the early storms. Flash flooding occurred across northwest AR where the highest rainfall totals were 1" to 4" (see Fig. 9). The NWS COOP observer 10N Hindsville, AR measured 3.08" from 7am 5/22 – 7am 5/23. More information on the May 22-23 severe weather and flooding can be found at [http://www.srh.noaa.gov/tsa/?n=weather-event\\_2011may22](http://www.srh.noaa.gov/tsa/?n=weather-event_2011may22)

Tulsa, OK (TSA): 5/23/2011 1-Day Observed Precipitation  
Valid at 5/23/2011 1200 UTC- Created 5/24/11 17:33 UTC

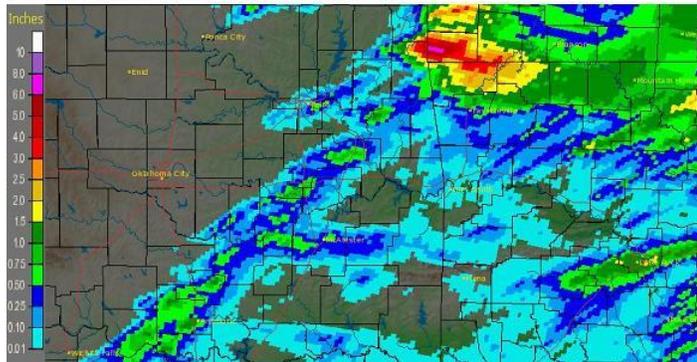


Fig. 9. 6-hour rainfall ending 1:45pm 5/23/11.

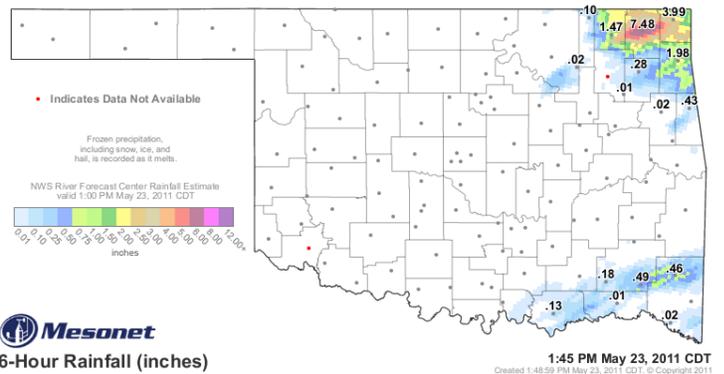


Fig. 10. 6-hour rainfall ending 1:45pm 5/23/11.

Tulsa, OK (TSA): 5/24/2011 1-Day Observed Precipitation  
Valid at 5/24/2011 1200 UTC- Created 5/24/11 17:41 UTC

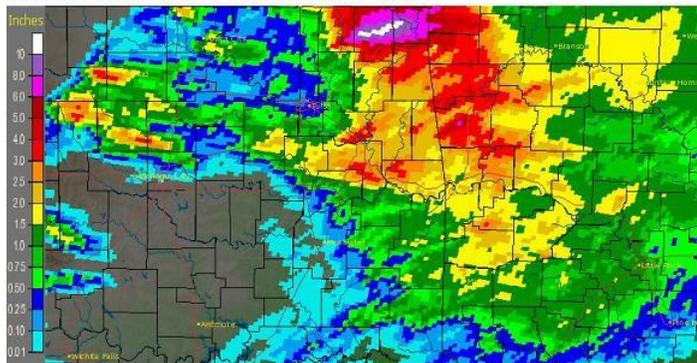


Fig. 11. 24-hour rainfall ending 7am 5/24/11.

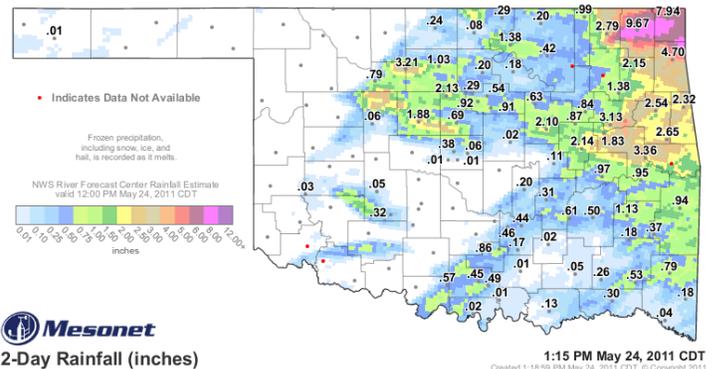


Fig. 12. 48-hour rainfall ending 1:15pm 5/24/11.

Tulsa, OK (TSA): 5/25/2011 1-Day Observed Precipitation  
Valid at 5/25/2011 1200 UTC- Created 5/25/11 15:41 UTC



Fig. 13. 24-hour rainfall ending 7am 5/25/11.

### May 23, 2011

An outflow boundary from the storms on the 22<sup>nd</sup> lingered across northeast OK and northwest AR on the 23<sup>rd</sup>. Training of thunderstorms along and north of this boundary led to very heavy rainfall and extreme flash flooding. These storms eventually developed in a MCS. This complex moved through east central OK and west central AR and produced wind damage along its path. Rainfall totals for Nowata, Craig, and Ottawa Counties were 3" to 10" (see Figs. 11, 12).

The mesonet site in Vinita measured 7.48" of rain in only 5 hours (see Fig. 10)! For context, according to the USGS Depth-Duration Frequency of Precipitation for Oklahoma map, the 0.2% annual chance (500-year) 6-hour rainfall for Vinita is approximately 7". The Craig County Sheriff's Office reported that virtually all county

roads south of Vinita were closed due to high water. Vinita Fire Department crews saved nine people during five water rescues on the evening of the 23<sup>rd</sup>. A total of 10-15 people were rescued after driving into high water across the county. In addition, 20 homes were evacuated in Vinita. In Ottawa County, four water rescues were performed on the evening of the 23<sup>rd</sup>, and many roads were either flooded or damaged in the county, including the City of Miami. A couple of residences in a Miami housing addition were damaged by high water from Tar Creek. Roads, as well as creeks and streams, remained flooded in these areas for several days.

Very heavy rain also occurred in northwest AR. 3.07" of rain was measured in 1 hour at the Fayetteville/Drake Field airport (KFYV) between 3 and 4pm on the 23<sup>rd</sup>. The Prairie Grove COOP observer measured 6.62" during the 24-hour period from 7am 5/23-7am 5/24. Widespread 3" to 5" affected Benton and Washington Counties in AR, with much of the remainder of the HSA receiving 0.5" to 3" of rain (see Figs. 11, 12). Unfortunately, 4 fatalities (2 women, a 5-year-old child, and a 2-month-old child) occurred on the evening of the 23<sup>rd</sup>. Authorities believe that 4 feet of water washed their car into Butler Creek on Shinn Spring Rd. south of Gallatin, AR in Benton County (near Highway 412). The car was recovered in Butler Creek on the afternoon of the 25<sup>th</sup>, just upstream of its confluence with the Illinois River and about 1 mile downstream of where the car entered the creek. More information on the May 22-23 severe weather and flooding can be found at [http://www.srh.noaa.gov/tsa/?n=weather-event\\_2011may22](http://www.srh.noaa.gov/tsa/?n=weather-event_2011may22)

All of this rainfall led to river flooding as well. Major flooding occurred along the Illinois River near Watts, with the river cresting at 25.19' at 7am CDT 5/24/11. This is approximately 3' lower than the record crest that occurred only one month ago, and ranks as the 3<sup>rd</sup> highest crest on record. As the flood wave moved downstream, the Illinois River near Tahlequah also had major flooding, with a crest of 21.12' at 4am CDT 5/25/11. Two families in Fiddlers Bend were rescued by boat after the Illinois River crested there on the morning of the 24<sup>th</sup>. Minor to moderate flooding also occurred along the Neosho River near Commerce, the Spring River near Quapaw, the Baron Fork at Eldon, Lee Creek near Van Buren, the Arkansas River near Van Buren, and the Poteau River near Panama (see E3 report for details). Action stage was exceeded along Flint Creek near Kansas.

Due to the heavy rainfall in April, as well as needing to hold back water due to flooding along the Mississippi River, Beaver Lake was nearly full (~1129.1', top of flood pool is 1130') prior to the end of May rains. Although releases were increased out of the dam on the 20<sup>th</sup>, the heavy rainfall on the 23<sup>rd</sup> across the White River Basin caused the lake to rise above the top of the flood pool, with a peak pool elevation of 1131.8' ~2:30 pm CDT May 24 (122% full). This pool elevation was slightly higher than the 1131.7' (119% full) that occurred in April. This in turn led to significant increases out of Beaver Dam which once again caused flooding along the White River between Beaver Dam and Table Rock Lake. Tailwater readings at Beaver Dam reached a maximum of ~947.2' on May 24-25 during the period of highest releases.

### **May 23, 2011**

A significant and deadly tornado outbreak occurred on May 24<sup>th</sup> as a powerful upper-level storm system moved into the central plains. As a dryline moved east into western OK, the atmosphere became extremely unstable by late afternoon. Mean layer CAPE values of 3000-4000 J/KG, coupled with very strong 60-70 kt deep layer shear and storm relative helicity values in excess of 300 m<sup>2</sup>/s<sup>2</sup> indicated a high potential for supercells capable of producing violent long-track tornadoes. Severe thunderstorms rapidly developed along the dryline in western and central OK during the afternoon of the 24<sup>th</sup> and moved east into eastern OK by early evening. Large tornadoes occurred with the initial supercells in central OK (including an EF5 tornado in Binger/Guthrie), then continued into eastern OK and west central AR overnight with several tornadoes reported. Damaging straight-line winds also occurred with some of the stronger bow segments. Several Oklahoma Mesonet sites measured wind speeds in excess of 65 mph.

As the storms moved into western AR during the late night hours, a large EF4 tornado struck the Etna and Denning, AR area of southeast Franklin County (WFO Little Rock HSA, WFO Tulsa CWA), killing 2 people (at the time of this writing). In total, 10 tornadoes (with one additional still pending) occurred within the CWA. Due to the fairly quick movement of these storms, rainfall totals across the area were not excessive. However, additional flash flooding did occur across northeast OK and northwest AR due to the ongoing areal flooding from the heavy rain on the 23<sup>rd</sup>. Most of the HSA received 0.5" to 1.5" of rain, with localized areas of 1.5" to 2.5" (see Fig. 13). As the upper low moved across eastern KS on the 25<sup>th</sup>, scattered wrap around showers affected northeast OK and northwest AR, bringing an additional few hundredths to around 0.25" of rain to portions of

northeast OK and northwest AR. More information on the May 24 severe weather event can be found at [http://www.srh.noaa.gov/tsa/?n=weather-event\\_2011may24](http://www.srh.noaa.gov/tsa/?n=weather-event_2011may24)

A few elevated showers and thunderstorms brought around 0.10" of rain to far northeast OK and locations along the AR/MO state line on the 27<sup>th</sup>. Finally, a few hundredths of an inch of rain occurred from isolated showers during the morning of the 31<sup>st</sup> as a weak cold front moved through the region.

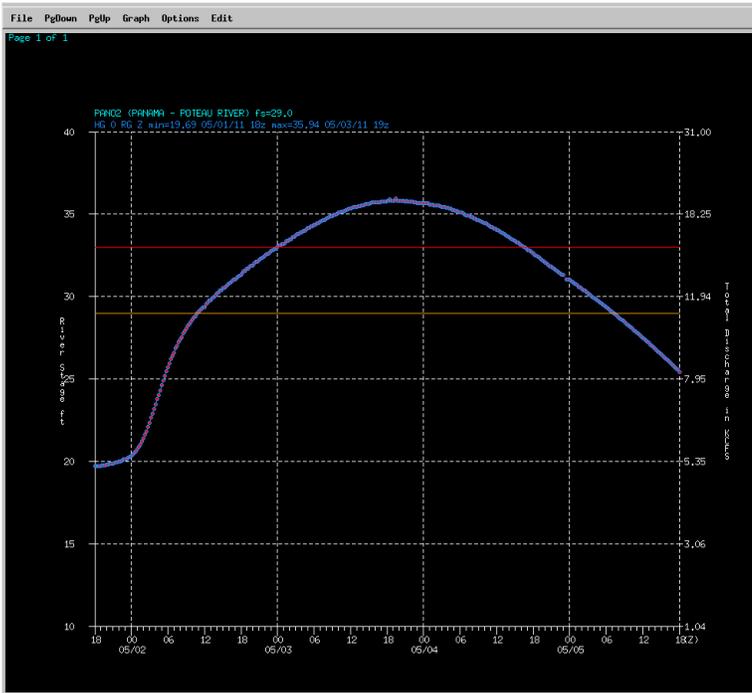
Written by:

Nicole M<sup>c</sup>Gavock,  
Service Hydrologist  
WFO Tulsa

Products issued:

- 16 River Flood Warnings (FLW)
- 72 River Flood Statements (FLS)
- 2 River Flood Advisories (FLS) (13 Advisory FLS CON/EXT/CAN)
- 0 River Flood Watches (FFA) (0 Watch FFA CON/EXT/CAN)
- 0 River Statements (RVS)
- 1 Hydrologic Outlooks (ESF)
- 1 Drought Information Statements (DGT)

**Preliminary Hydrographs for May 2011:**



Left: Poteau River near Panama

