



NATIONAL WEATHER SERVICE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

MAY 2019 FLOODS

Nicole McGavock

Service Hydrologist / Meteorologist

U.S. National Weather Service

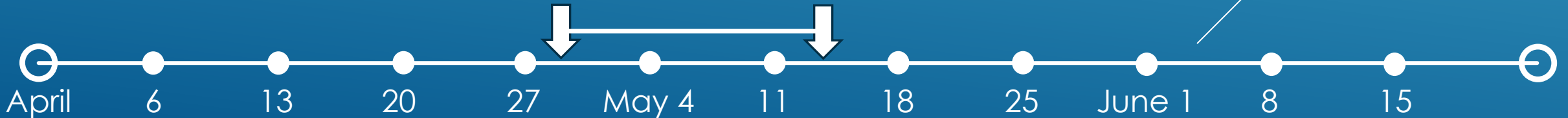
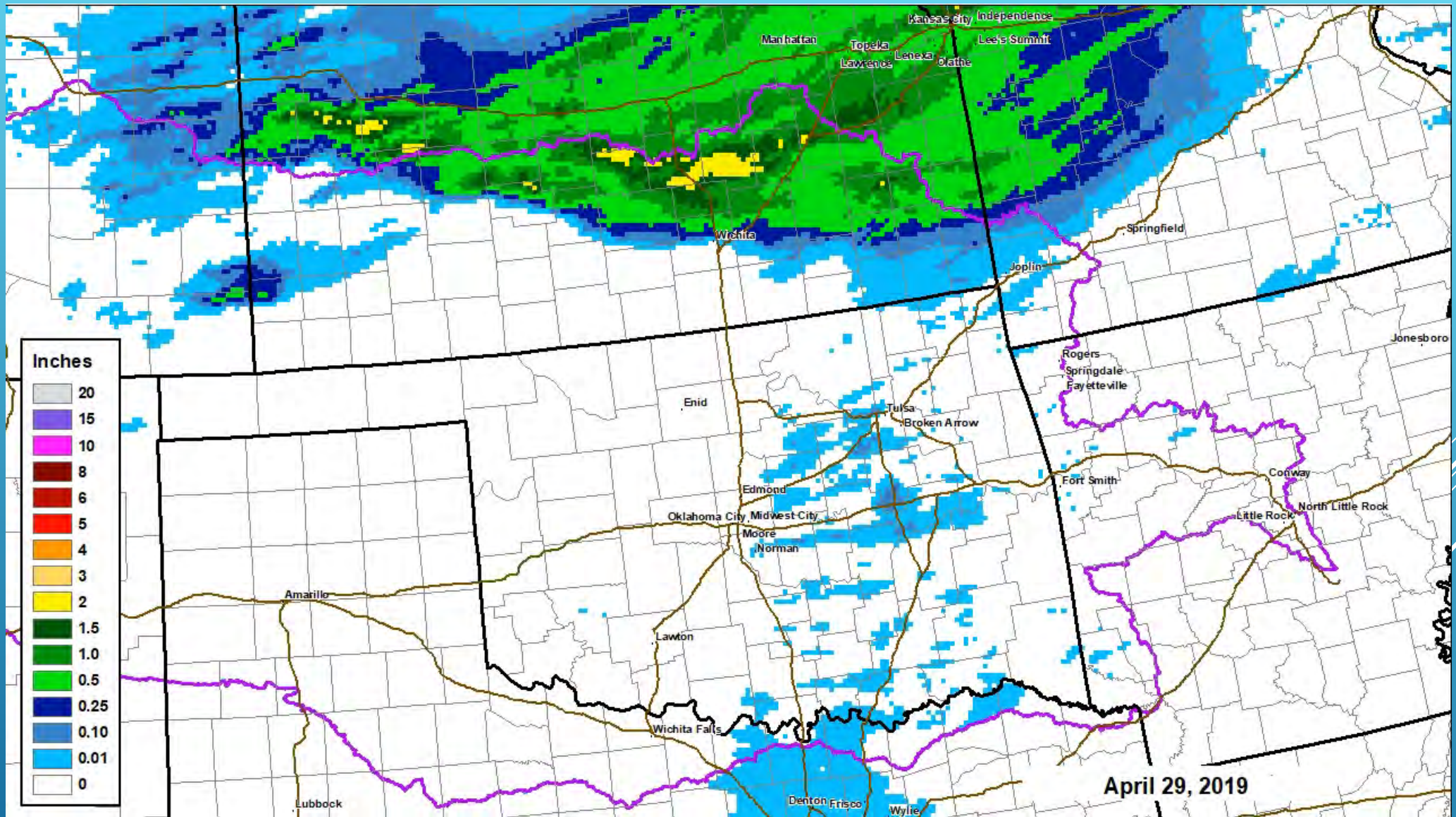
Tulsa, OK

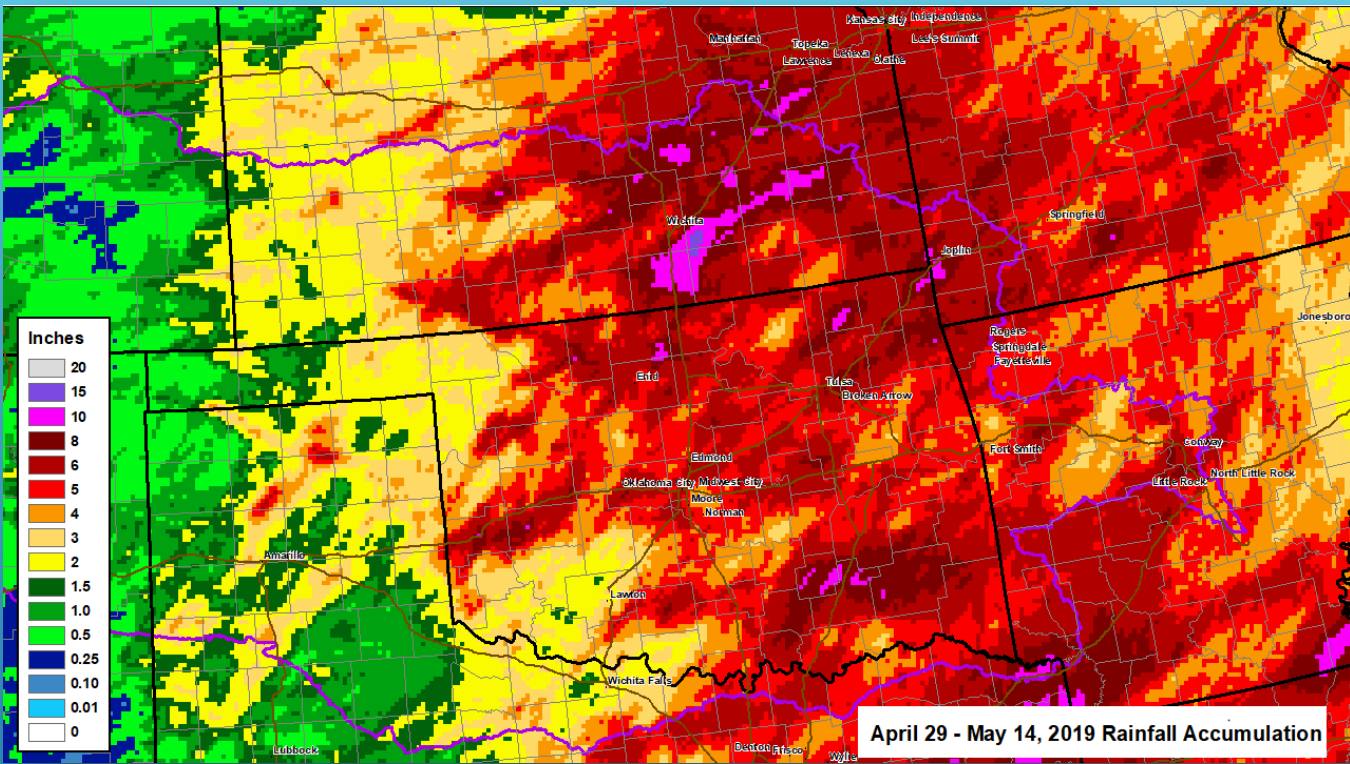
nicole.mcgavock@noaa.gov

SAME Resiliency Workshop
15 October 2019
USACE Tulsa District

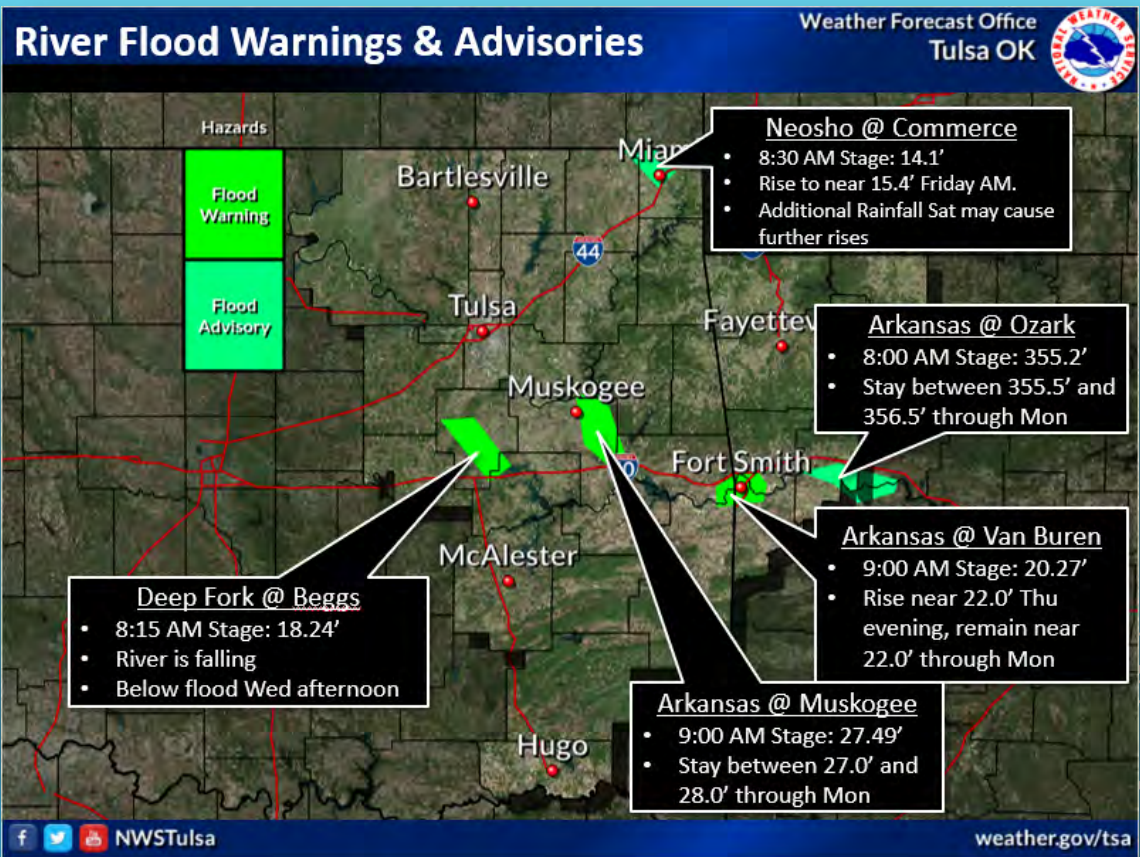
Daily rainfall
accumulation

APRIL 29
– MAY 14



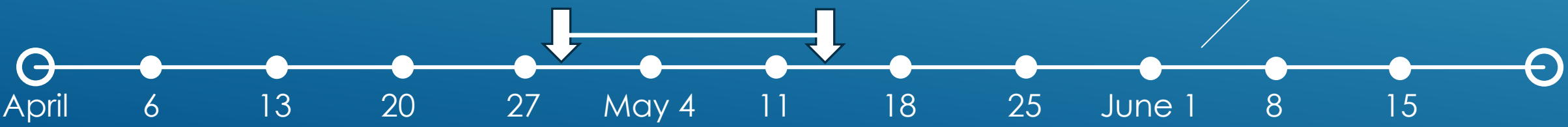


**Widespread 5"-8" of rain April 29-May 14
10"-15" in south central Kansas**

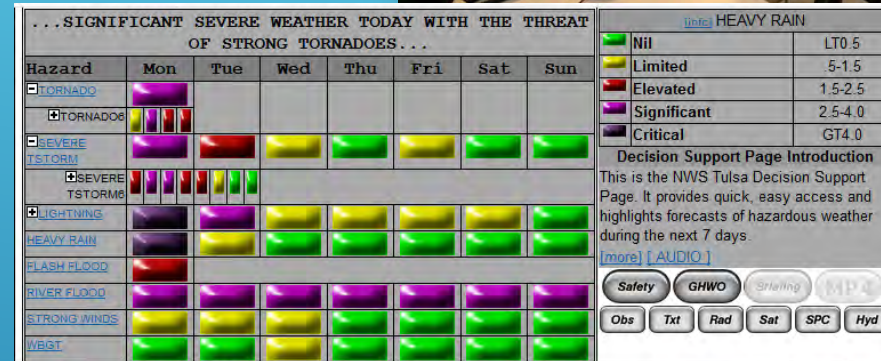


**May 15: Arkansas River near Flood Stage from
Muskogee, OK to Van Buren, AR**

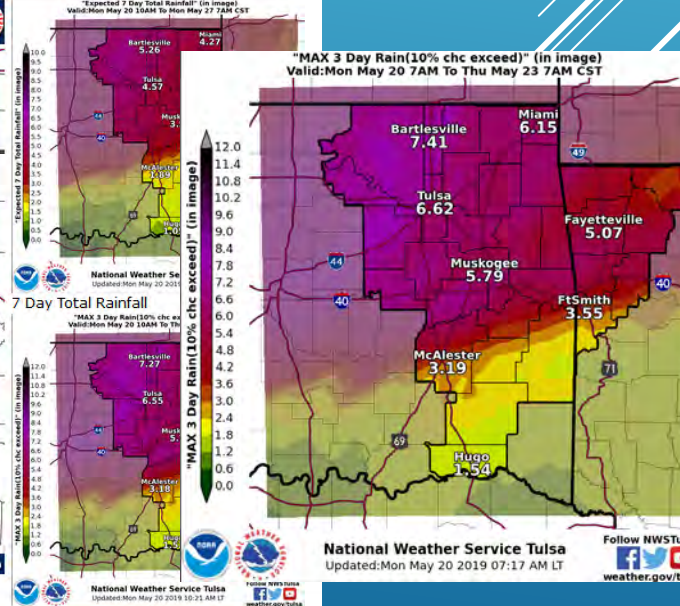
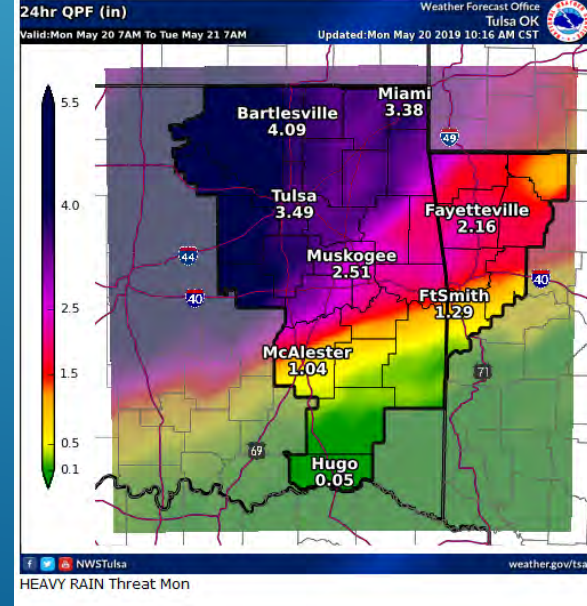
APRIL 29 – MAY 14

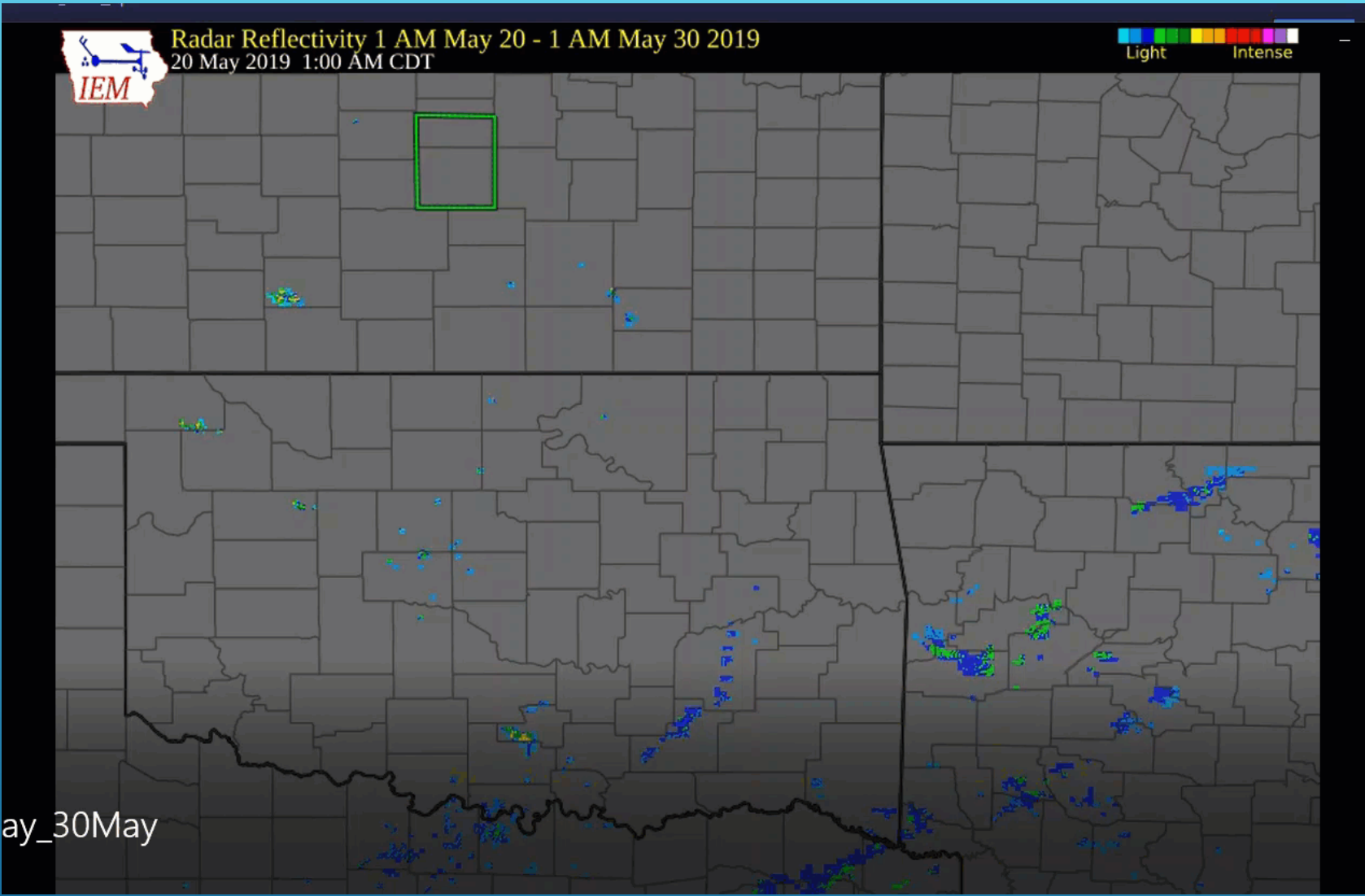


- At this point, the release from Keystone is increased to 100,000 cfs, which is a pre-defined trigger for the TAEMA. However, this release isn't resulting in flooding.
- Further downstream, from Muskogee through west central AR, the Arkansas River is hovering right around flood stage.
- During this time, there are no NWS Tulsa initiated conference calls since the heavy rain has been in Kansas and north central OK, and there isn't any significant flooding forecast. Information is going out via Flood Warnings + other routine hazard products/webpages.
- City of Tulsa requests NWS briefings May 14-17 as part of hazard mitigation plan being activated.
- NWS Tulsa begins increased services May 18, and a conference call is held on May 19 to address severe weather + heavy rain potential on May 20-21.



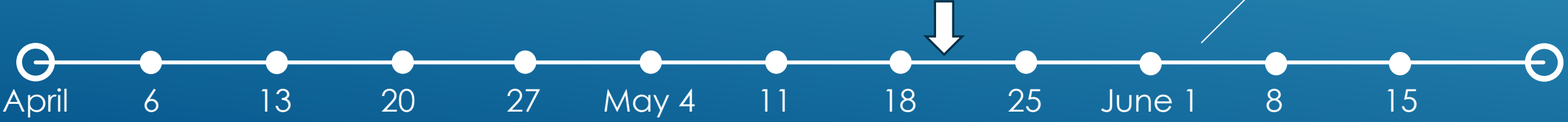
County: ALL MouseOver ShowAll PermaLink Updated 11:35 AM

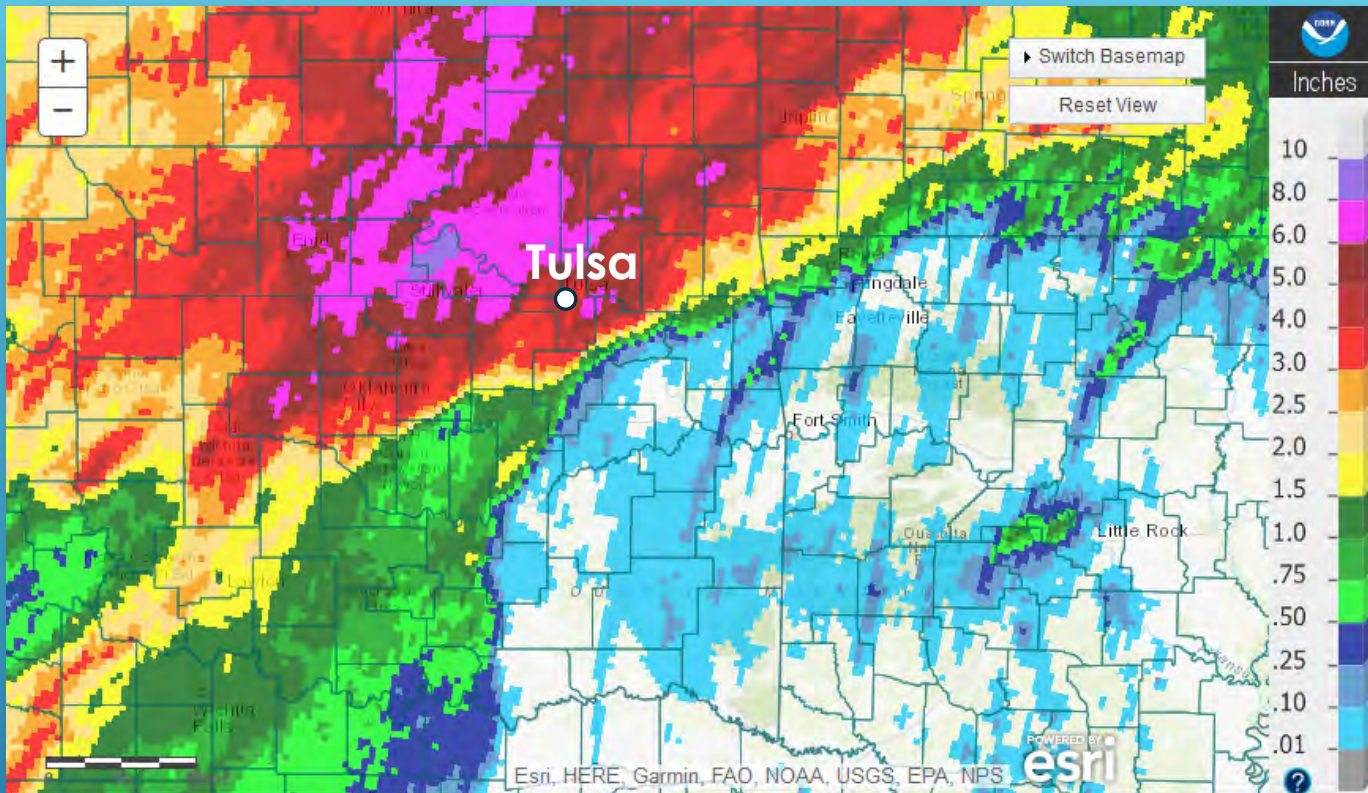




- Video: 44-hour radar reflectivity loop from 1am May 20 - 9pm May 21
- 3 Rounds of Heavy Rainfall + Severe Weather

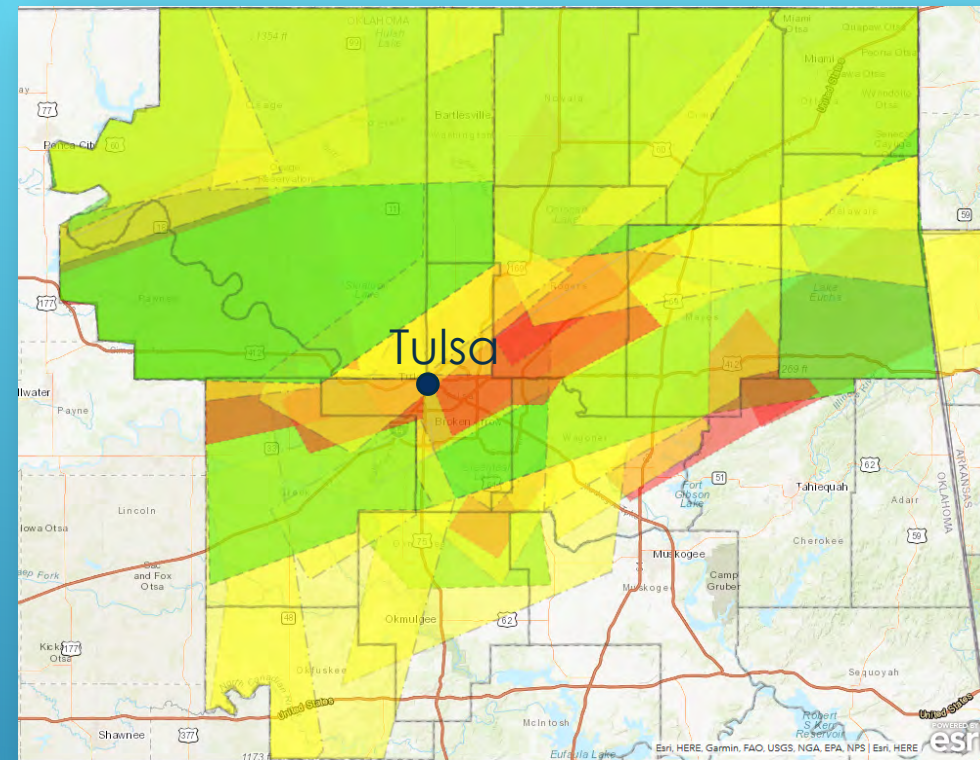
THE BIG RAIN – MAY 20-21





Tulsa, OK: May 21, 2019 1-Day Observed Precipitation
Valid on: May 21, 2019 12:00 UTC

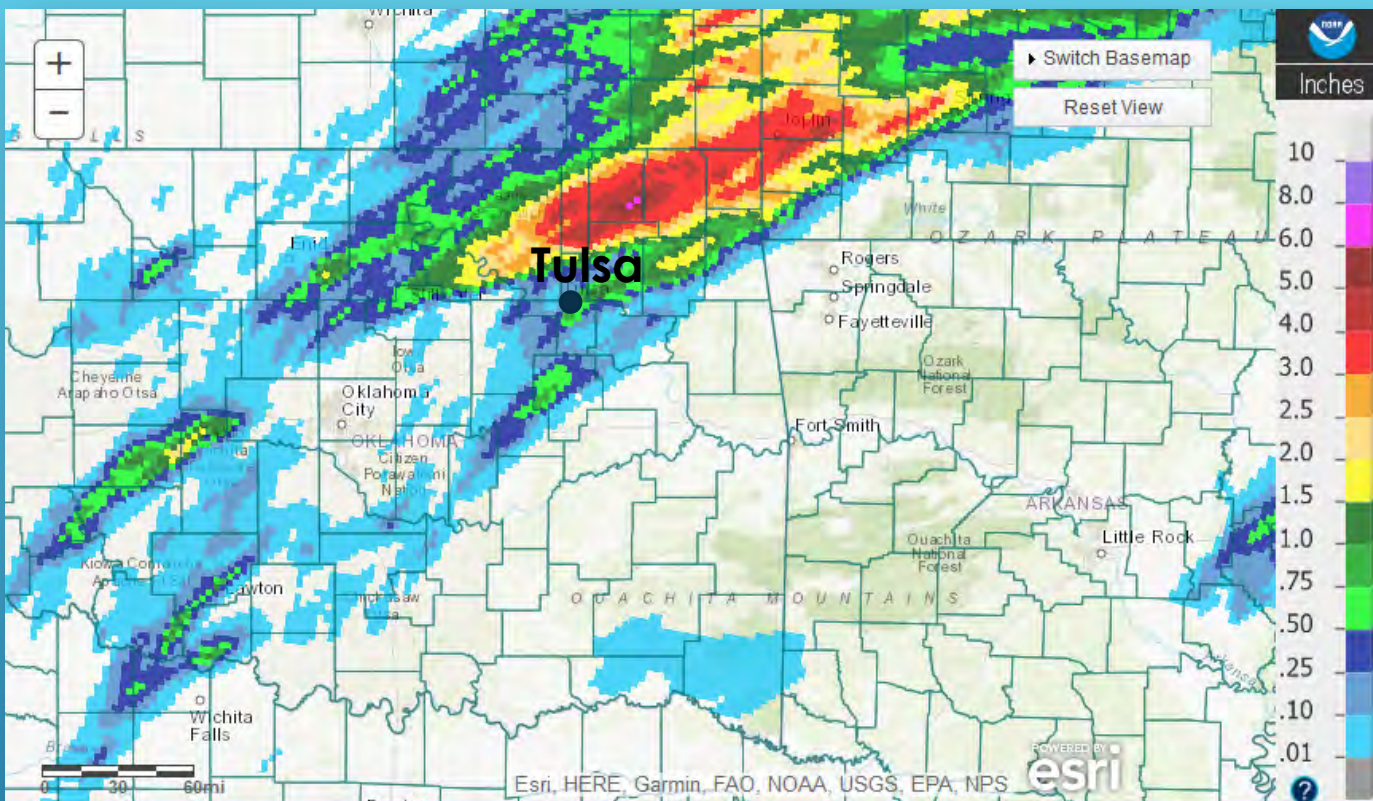
24-hour Rainfall ending at 7 am May 21, 2019



- **Widespread 4" - 10" of rain by 7 am 5/21**
- **Widespread Flash Flooding, River Flooding**
- **4 Tornadoes in Tulsa Co. + 1 Tornado in Creek Co. 6-7 am 5/21**
- **NWS Tulsa issued:**
 - **12 Tornado Warnings**
 - **26 Severe Thunderstorm Warnings**
 - **14 Flash Flood Warnings**

THE BIG RAIN – MAY 20-21

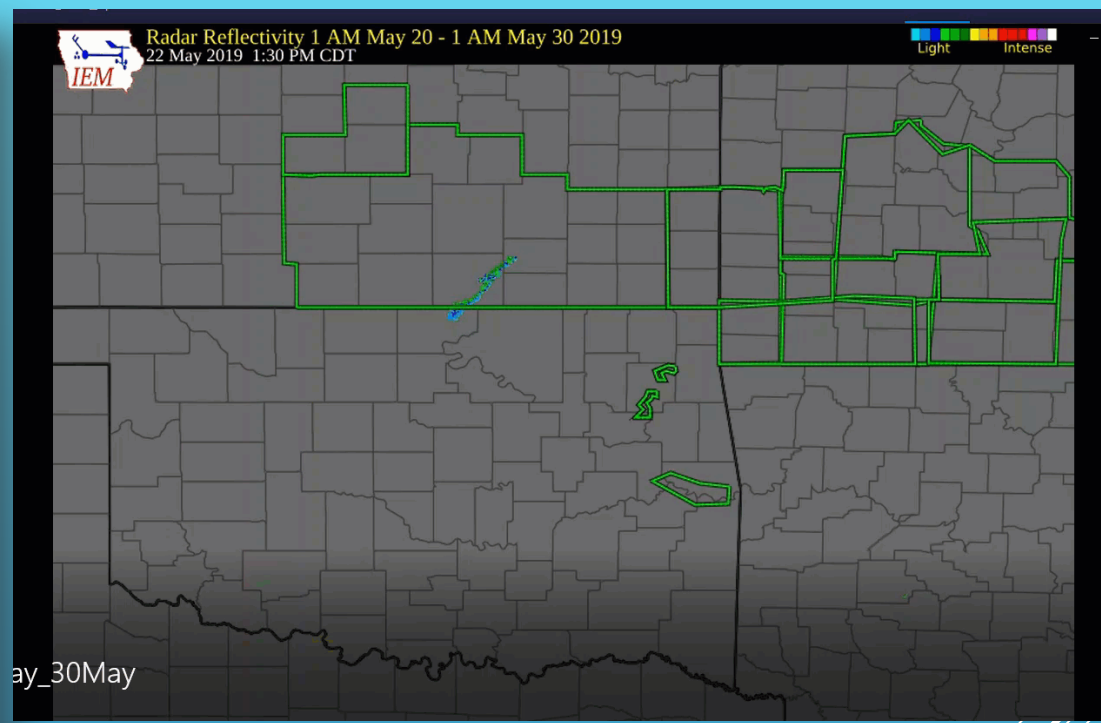




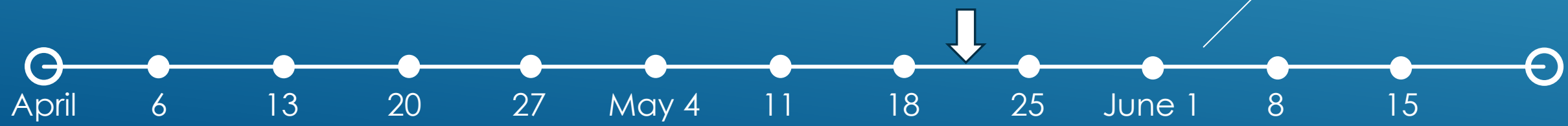
Tulsa, OK: May 23, 2019 1-Day Observed Precipitation
Valid on: May 23, 2019 12:00 UTC

24-hour Rainfall ending at 7 am May 23, 2019

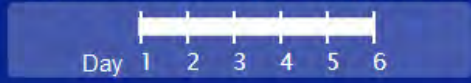
MAY 22



- Video: 20-hour radar reflectivity loop from 1:30 pm May 22 - 9 am May 23
- Widespread 1.5"-6" of rain by 7 am 5/23
- More Tornado Warnings for Tulsa Co.

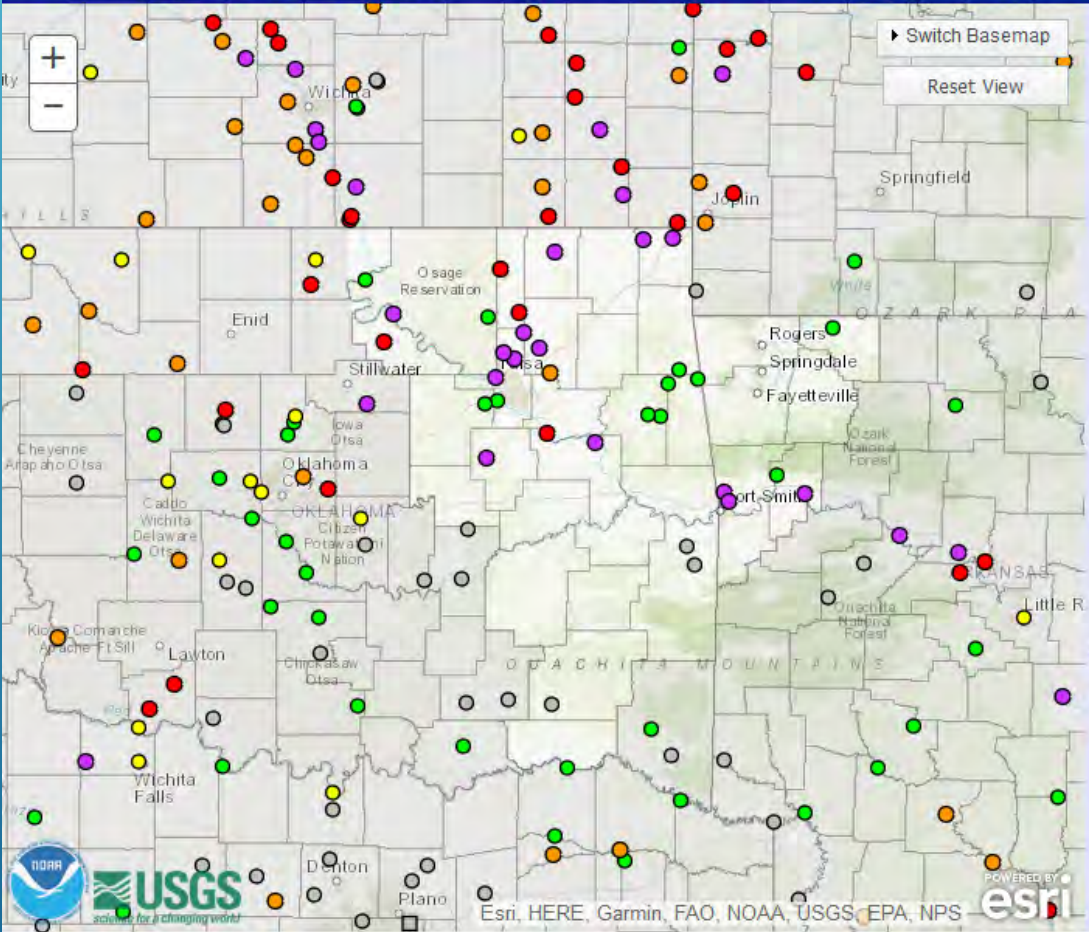


Maximum Forecast Flood Category Through: 05/29/2019 20:45:00 UTC

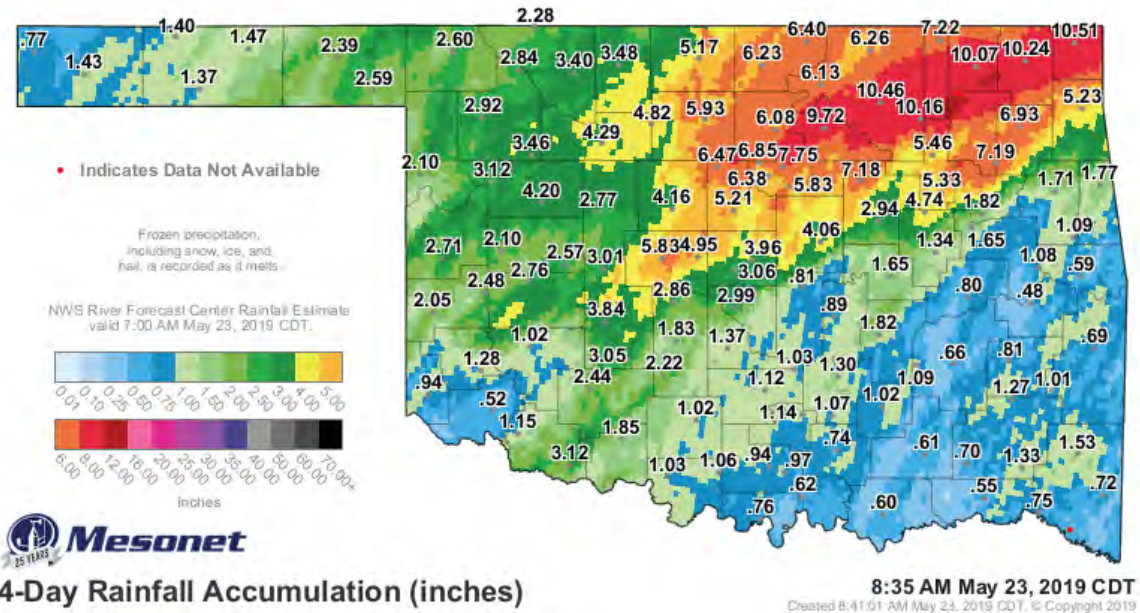


Entire Period

187 total gauges 87 gauges in flood



Map controls: Switch Basemap, Reset View, Last map update: 05/23/2019 at 03:43:09 pm CDT, 05/23/2019 at 20:43:09 UTC, What is UTC time?, Map Help, Disclaimer, NOAA, USGS, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NPS logos.



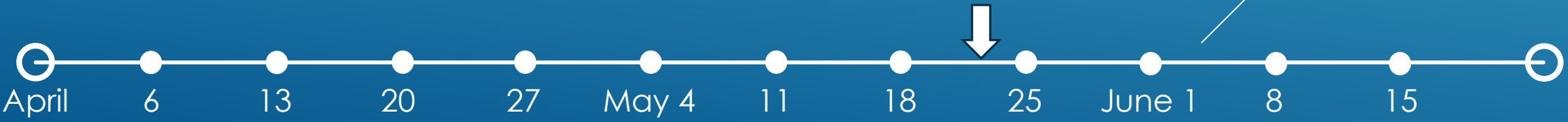
4-Day Rainfall Accumulation (inches)

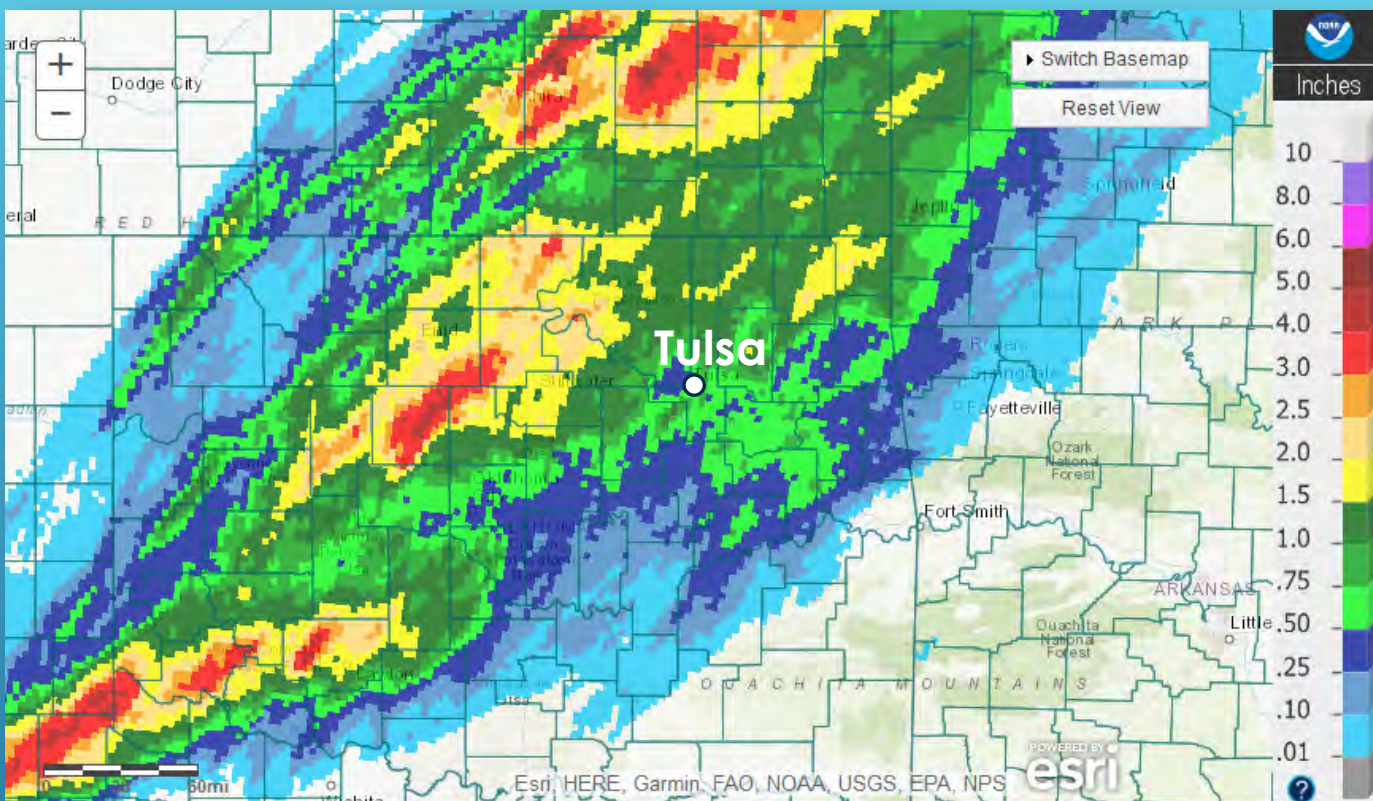
8:35 AM May 23, 2019 CDT

4-day Rainfall ending at 8:35 am May 23, 2019

- 4-day total: 5"-12" of rain by 5/23 morning
- Major River Flooding occurring or forecast along most of Arkansas River from south central KS through central AR

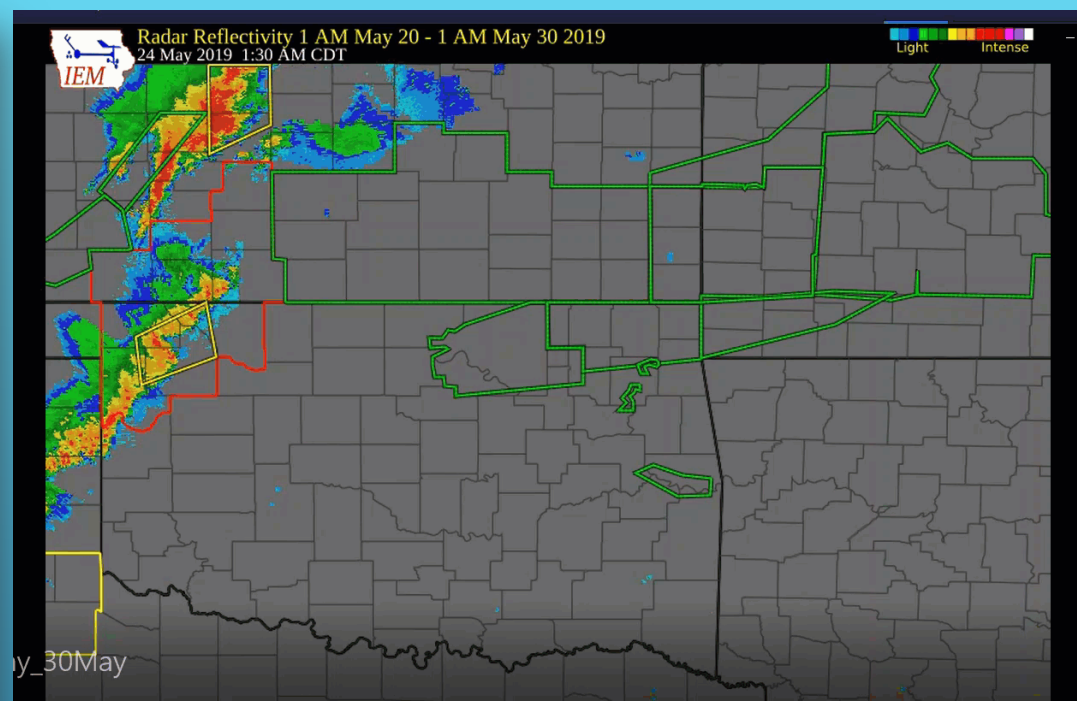
NWS River Flood Forecast Category 3:45 pm 5/23





Tulsa, OK: May 25, 2019 1-Day Observed Precipitation
Valid on: May 25, 2019 12:00 UTC

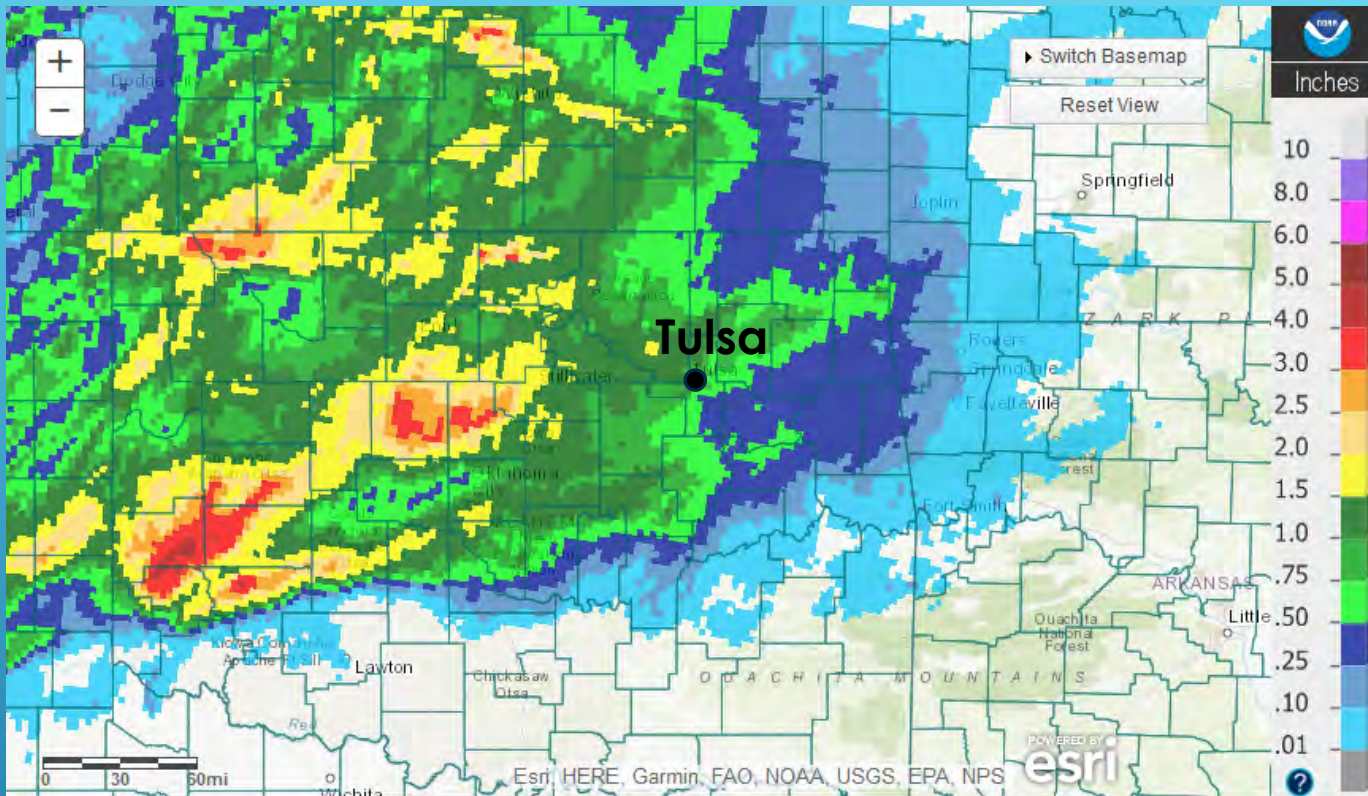
24-hour Rainfall ending at 7 am May 25, 2019



- Video: 30-hour radar reflectivity loop from 1:30 am May 24 - 7 am May 25
- Widespread 1.5"-4" of rain by 7 am 5/25

MAY 24

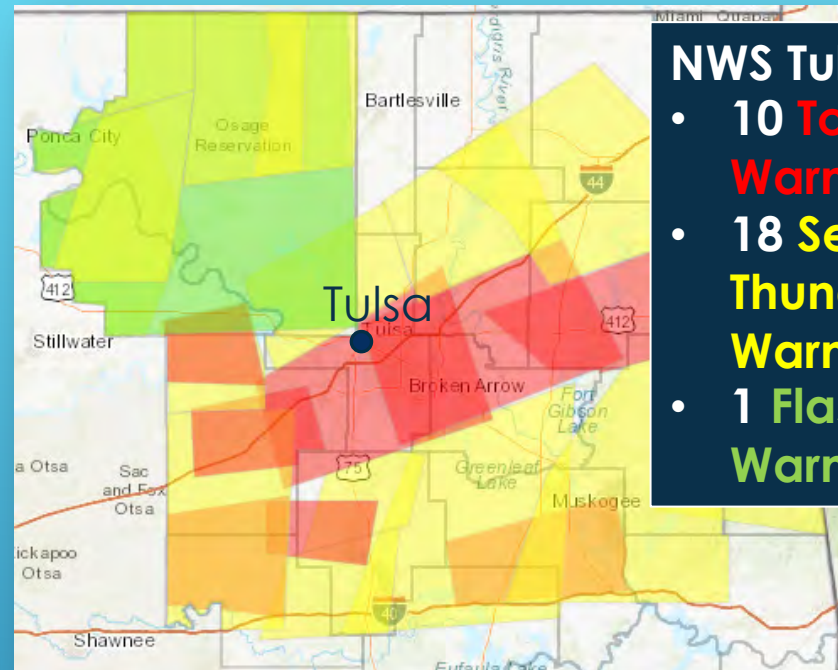




Tulsa, OK: May 26, 2019 1-Day Observed Precipitation
Valid on: May 26, 2019 12:00 UTC

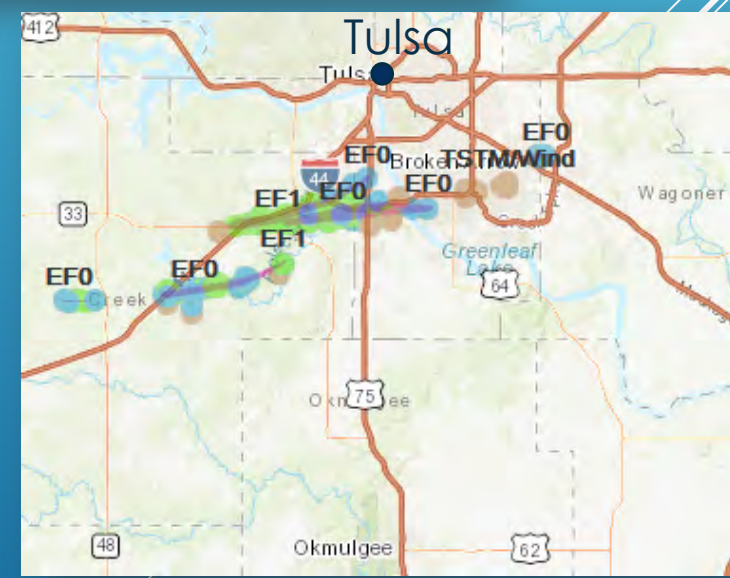
24-hour Rainfall ending at 7 am May 26, 2019

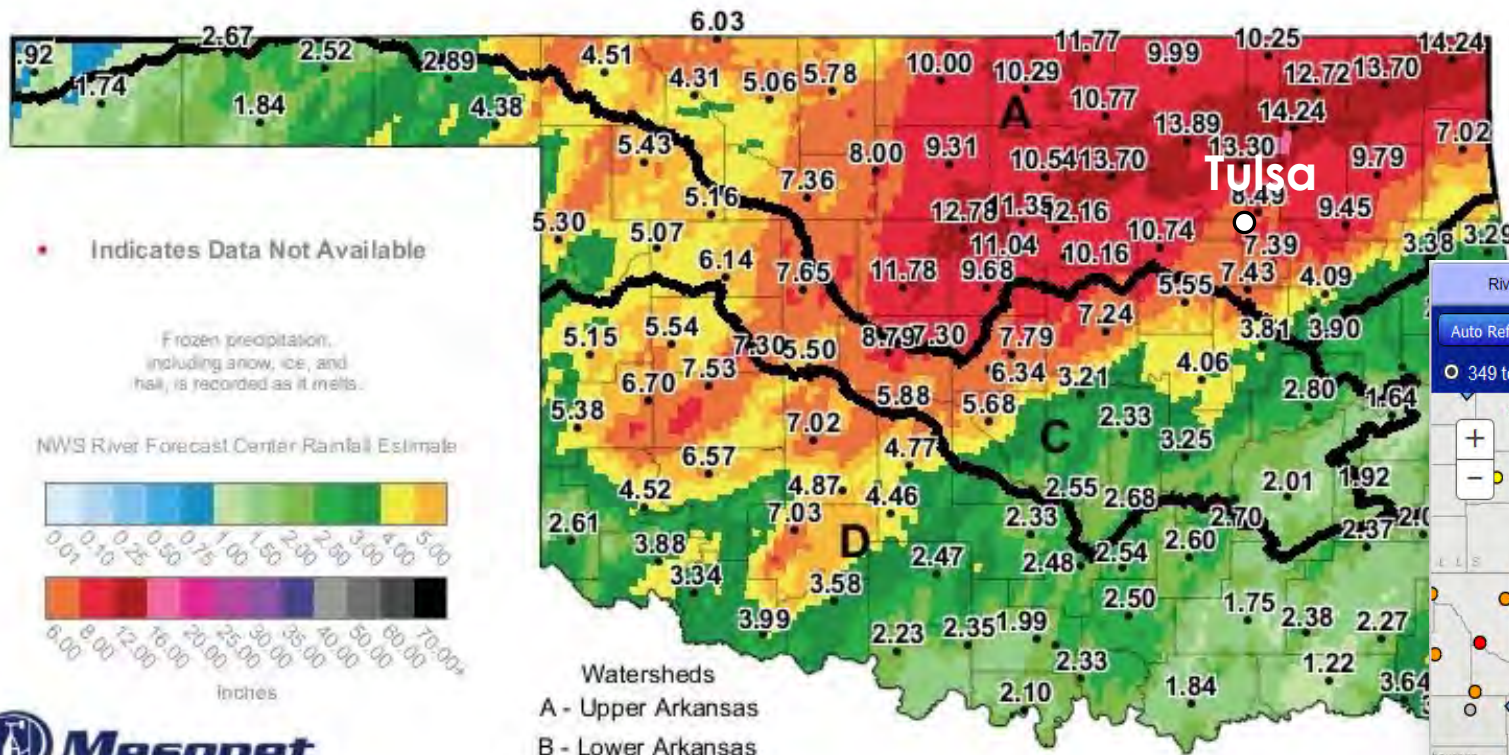
MAY 25



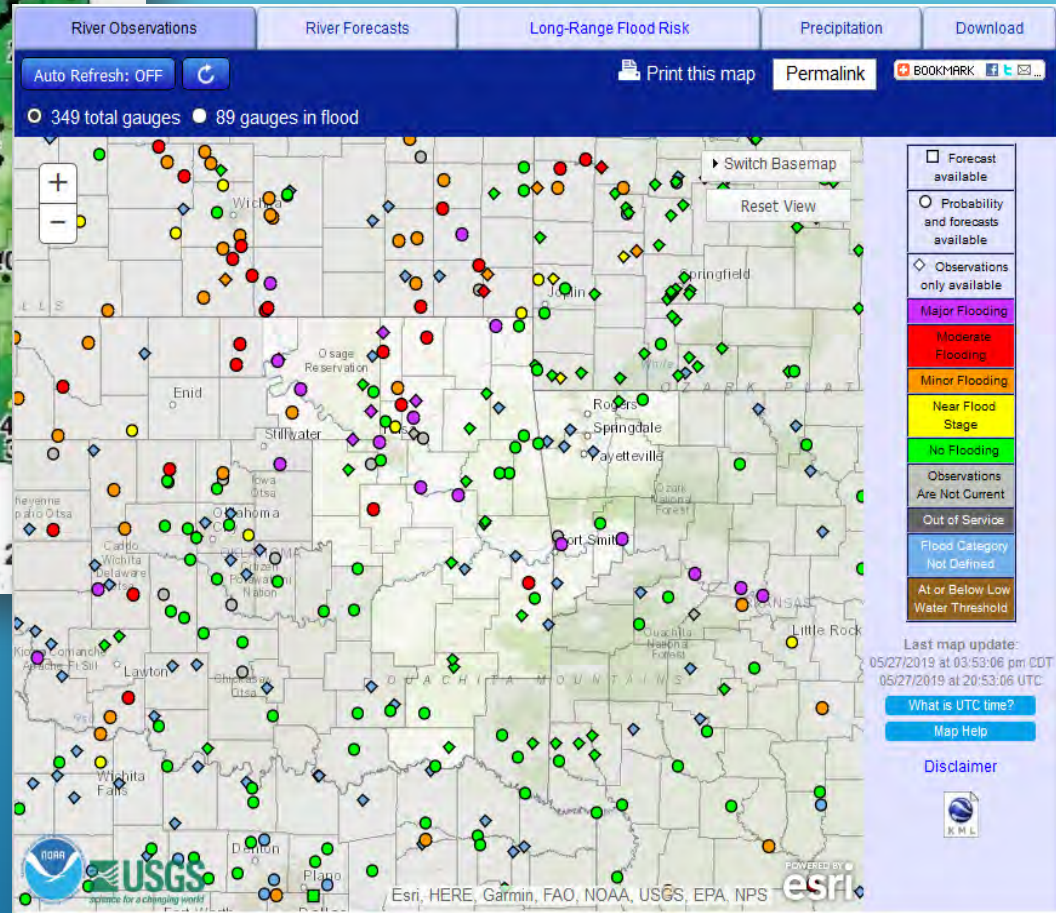
- NWS Tulsa issued:**
- 10 **Tornado Warnings**
 - 18 **Severe Thunderstorm Warnings**
 - 1 **Flash Flood Warning**

- **Widespread 1"-4" of rain by 7 am 5/26 upstream of Keystone**
- **3 Tornadoes in Tulsa Co. midnight – 1 am 5/26**

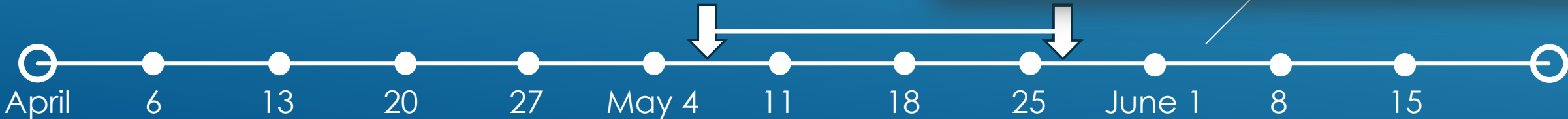


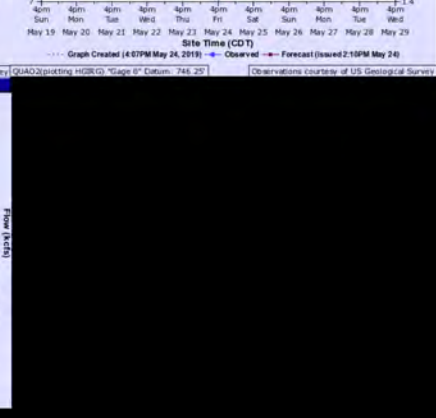
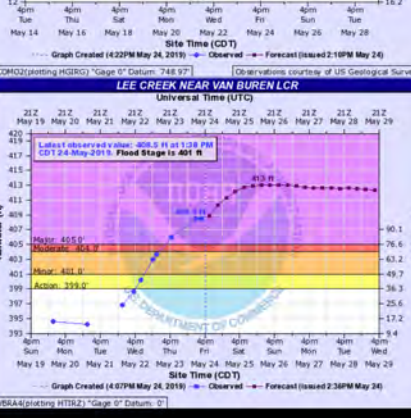
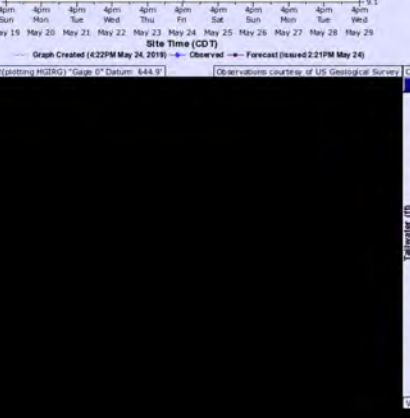
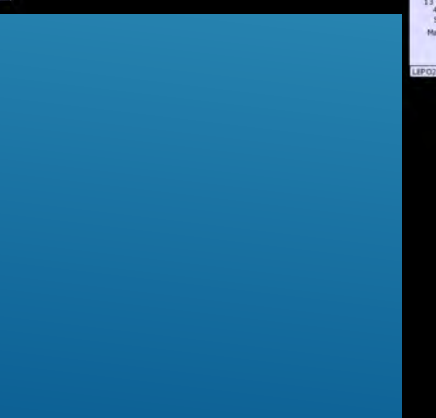
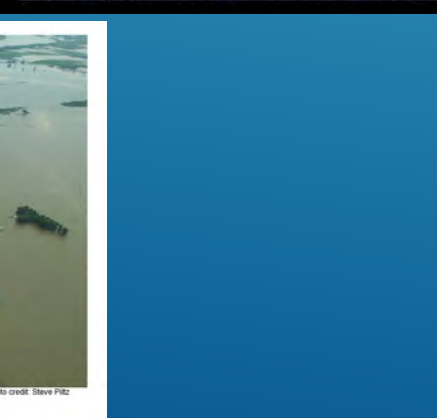
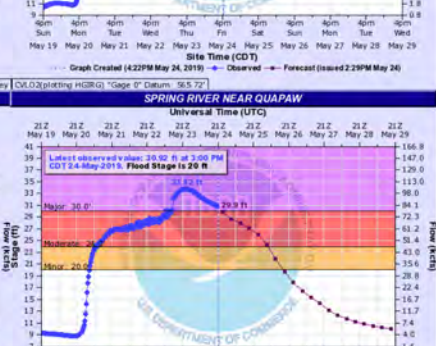
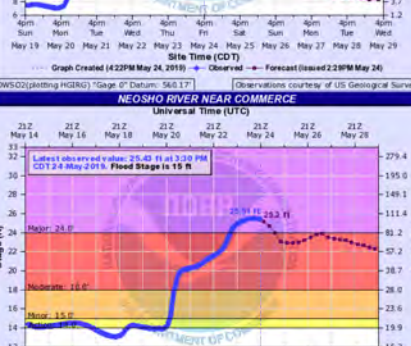
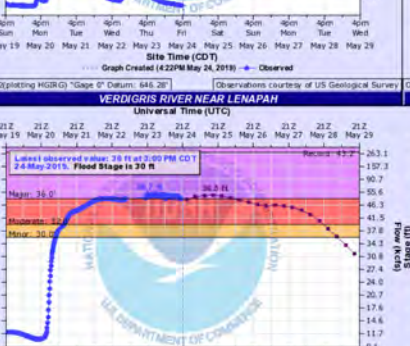
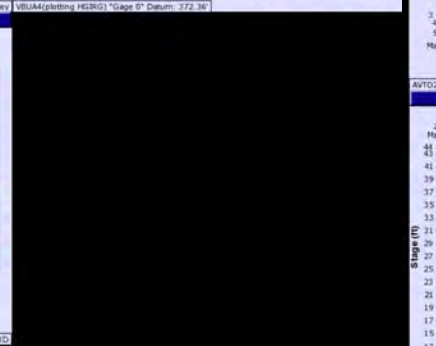
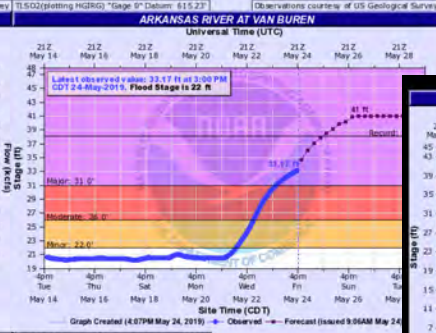
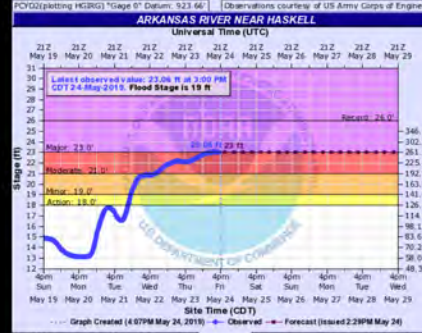
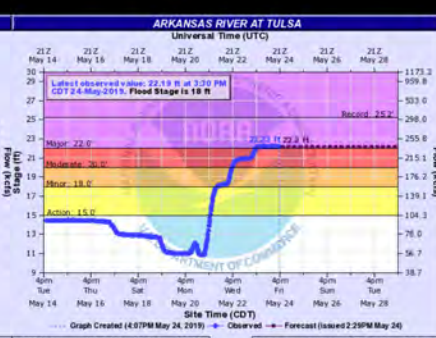
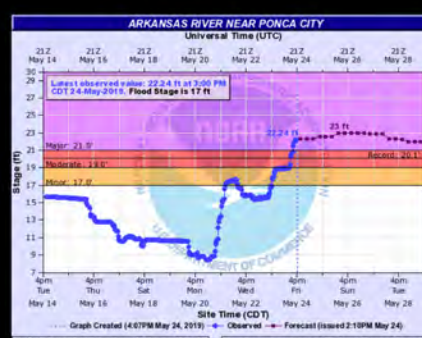


Actual River Flood Categories 4 pm May 27

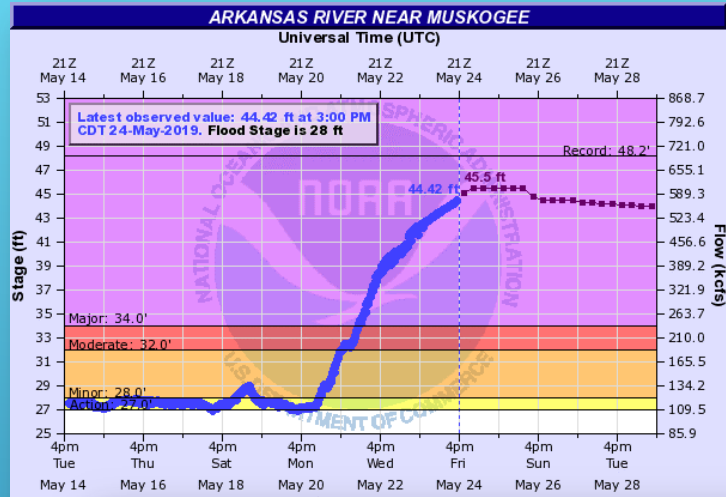


Widespread 8"-16" of rain by 10 am 5/26 upstream of Muskogee, OK





- NWS Tulsa is issuing hazardous weather warnings via normal emergency communication systems 24/7.
- NWS Arkansas-Red River Forecast Center in near constant contact with USACE Tulsa + Little Rock Districts water control managers.
- Phone calls to EMs to notify of Major flood forecast/updates.
- NWChat + Briefings
- Coordination with EMs for Civil Emergency Messages to communicate evacuation requests
- NWS + USGS communication on flood measurements and rapidly deployed gage for Muskogee



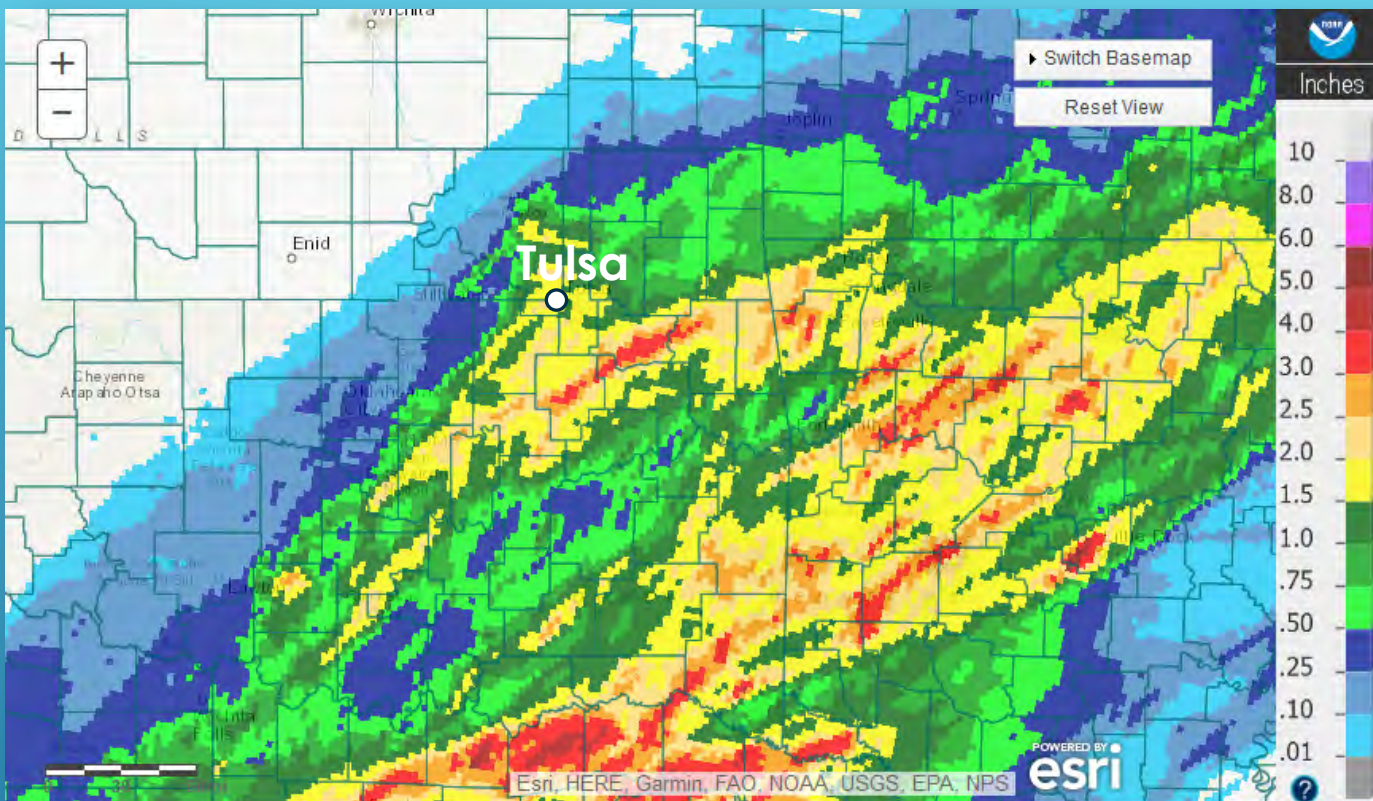
Clear Room Log - Print Log - View As HTML - Hide RSSBot - Mike Sowards

Message -

(8:23 PM) nwsbot: TSA extends [Flood Warning](#) for the Caney River at Bartlesville [OK] till May 30, 9:40 PM CDT
 (8:23 PM) nwsbot: TSA extends [Flood Warning](#) for the Caney River near Ramona [OK] till Jun 01, 7:00 AM CDT
 (8:23 PM) nwsbot: TSA extends [Flood Warning](#) for the Caney River near Collinsville [OK] till Jun 02, 1:27 PM CDT
 (8:28 PM) nwsbot: TSA continues [Flood Warning](#) for the Verdigris River near Claremore [OK] till further notice
 (8:32 PM) nwsbot: TSA continues [Flood Warning](#) for the Verdigris River near Inola [OK] till Jun 03, 4:00 PM CDT
 (8:34 PM) nwsbot: TSA continues [Flood Warning](#) for the Arkansas River near Muskogee [OK] till further notice
 (8:36 PM) nwsbot: TSA issues [Flood Advisory](#) for the Flint Creek near Kansas [OK] till May 31, 8:35 AM CDT
 (8:39 PM) nwsbot: TSA continues [Flood Advisory](#) for the Illinois River near Tahlequah [OK] till Jun 01, 10:00 PM CDT
 (8:41 PM) nwsbot: TSA continues [Flood Warning](#) for the Deep Fork River near Beggs [OK] till further notice
 (8:43 PM) nwsbot: TSA continues [Flood Warning](#) for the Poteau River near Panama [OK] till further notice
 (8:45 PM) nwsbot: TSA continues [Flood Warning](#) for the Lee Creek near Van Buren [AR] till further notice
 (8:48 PM) nwsbot: TSA continues [Flood Warning](#) for the Arkansas River at Van Buren [AR] till further notice
 (8:49 PM) media-garrett.lewis: Before I forget and for future reference/historical record for Nicole (but hopeful at a future time when I'm not around lol) At 38:62 at ybus4 Highway 64 between Roland and Fort Smith was closed and the Garrison Bridge leaving Fort Smith was closed. One lane of eastbound 64 was closed at 3:36. At 39:96 140 Midland Bridge was closed and subsequently examined by state engineers and later reopened by ARDOT since "as long as water isn't over the white line the lanes can stay open". The 2% Corps inundation layer was filled in most locations in Fort Smith. In some areas it exceed the 2% probabilities with backwater flooding in NE FSM as well as E FSM
 (8:53 PM) nwsbot: TSA continues [Flood Warning](#) for the Arkansas River at Ozark Lock and Dam [AR] till further notice
 (8:59 PM) media-james.d.aydelott: Garrett? Are you the most organized person in tv?
 (9:01 PM) media-garrett.lewis: No but I do like pineapples on my pizza and beans on my chili. Are we still friends?
 (9:03 PM) nws-robert.darby: I don't like pineapples on my pizza, but I will pass it on to Nicole)
 (9:04 PM) media-garrett.lewis: rrr)
 (9:05 PM) nwsbot: TSA issues [Hazardous Weather Outlook \(HWO\)](#)
 (9:06 PM) nws-robert.darby: EM called and said they were going to close highway 64 near Ozark
 (9:09 PM) media-garrett.lewis: rrr I think that's where Hicks creek & Gar creek flow into the Arkansas. Lots of drainage from today. Appreciate it
 (9:09 PM) nwsbot: TSA cancels [Flash Flood Watch](#) for Benton, Carroll, Crawford, Franklin, Madison, Sebastian, Washington [AR] and Adair.

434
 WGUS54 KTSA 210444
 FFWTSA
 OKC097-113-131-143-145-211045-
 /0.NEW.KTSA.FF.W.0018.19052110444Z-190521T1045Z/
 /00000.0.ER.00000T0000Z.00000T0000Z.00000T0000Z.00/
 BULLETIN - EAS ACTIVATION REQUESTED
 Flash Flood Warning
 National Weather Service Tulsa OK
 1144 PM CDT Mon May 20 2019
 ...FLASH FLOOD EMERGENCY FOR TULSA...BROKEN ARROW...
 COLLINSVILLE...INOLA...PRYOR...
 The National Weather Service in Tulsa has issued a
 * Flash Flood Warning for...
 Rogers County in northeastern Oklahoma...
 Southeastern Osage County in northeastern Oklahoma...
 Western Mayes County in northeastern Oklahoma...
 Northern Wagoner County in northeastern Oklahoma...
 Tulsa County in northeastern Oklahoma...
 * until 545 AM CDT Tuesday.
 * At 1139 PM CDT, emergency management reported numerous closed roadways, water rescues, and homes being evacuated. Three to five inches of rain have fallen, and additional heavy rainfall will move into the area soon. Widespread flash flooding is already occurring.
 THIS IS A FLASH FLOOD EMERGENCY FOR TULSA...BROKEN ARROW...
 COLLINSVILLE...INOLA...AND PRYOR. This is a PARTICULARLY DANGEROUS SITUATION. SEEK HIGHER GROUND NOW!
 * Some locations that may experience flooding include...
 Tulsa... Broken Arrow...
 Sand Springs... Claremore...
 Pryor... Owasso...
 Bixby... Jenks...
 Glenpool... Coweta...
 Pryor Creek... Skiatook...

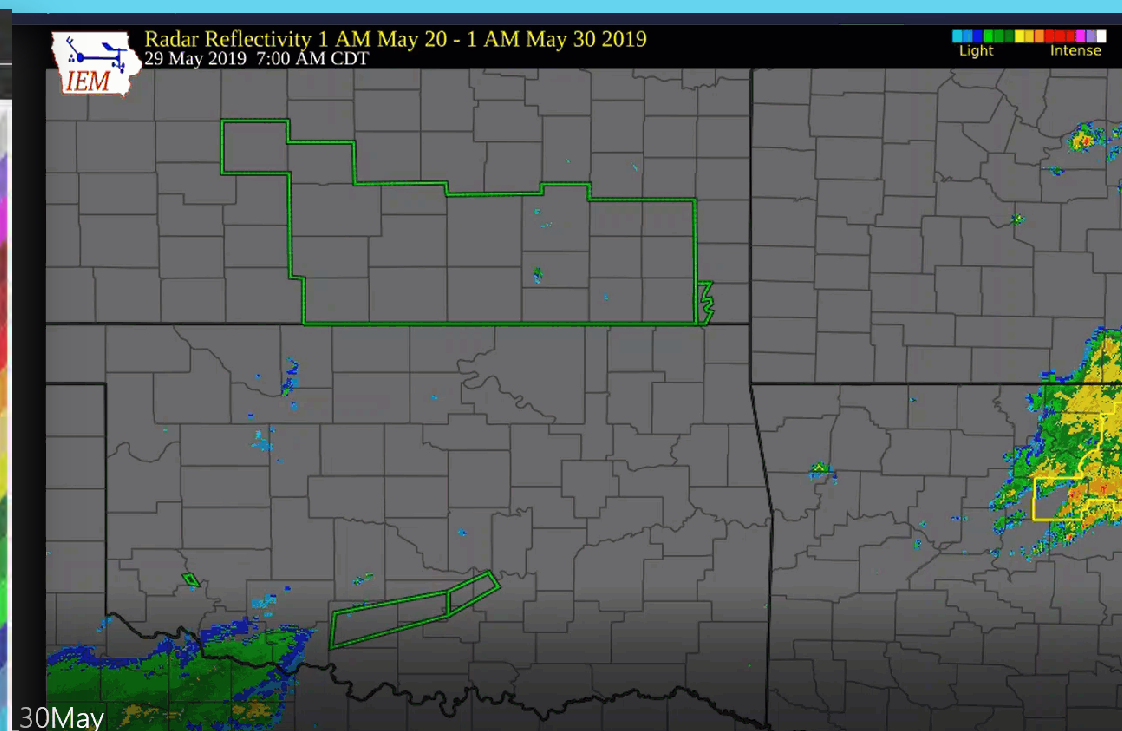
802
 WGUS84 KTSA 250239
 FLSTSA
 Flood Statement
 National Weather Service Tulsa OK
 939 PM CDT Fri May 24 2019
 ...The Flood Warning continues for the following rivers in Oklahoma...
 Arkansas River near Muskogee affecting Muskogee County.
 OKC101-251038-
 /0.CON.KTSA.FL.W.0032.00000T0000Z-00000T0000Z/
 /MKG02.3.ER.190519T0539Z.190525T1800Z.00000T0000Z.NO/
 939 PM CDT Fri May 24 2019
 ...This is a dangerous and life threatening situation...
 The Flood Warning continues for
 The Arkansas River near Muskogee.
 * until further notice.
 * At 9:00 PM Friday, the stage was 44.95 feet.
 * Flood stage is 28.0 feet.
 * Major flooding is occurring and Major flooding is forecast.
 * Forecast...The Arkansas River near Muskogee will continue rising to near 45.5 feet Saturday morning and remain near that level through Sunday night. The river is then expected to fall to near 44.5 feet by Monday afternoon and remain above 44 feet through Wednesday.
 * Impact...At 37.0 feet, very severe flooding occurs along the Arkansas River near Muskogee. Buildings on the OG&E power plant are flooded. The flood of October 6, 1986 reached 39.6 feet. This is an extremely dangerous and life threatening situation.
 &&
 LAT...LON 3583 9520 3552 9507 3547 9515 3559 9532 3583 9537
 \$\$



Tulsa, OK: May 30, 2019 1-Day Observed Precipitation
Valid on: May 30, 2019 12:00 UTC

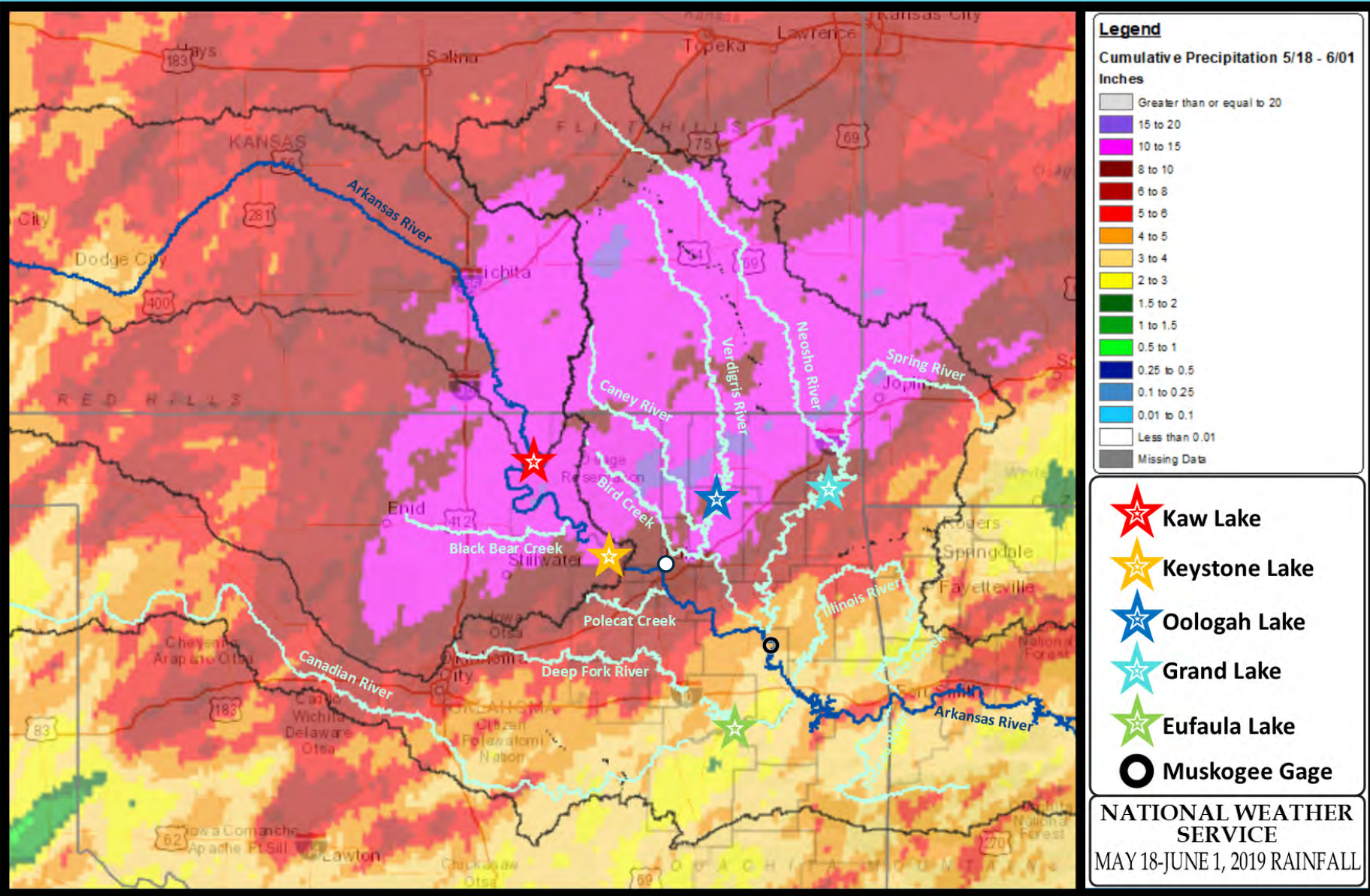
24-hour Rainfall ending at 7 am May 30, 2019

MAY 29

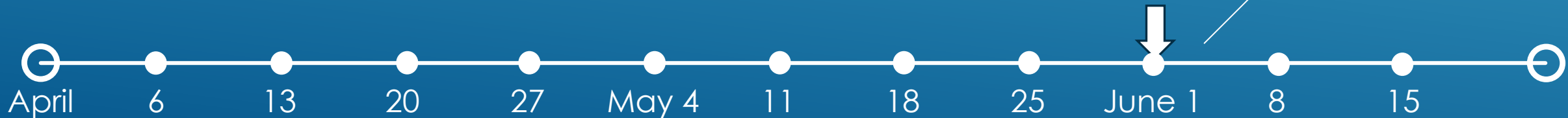


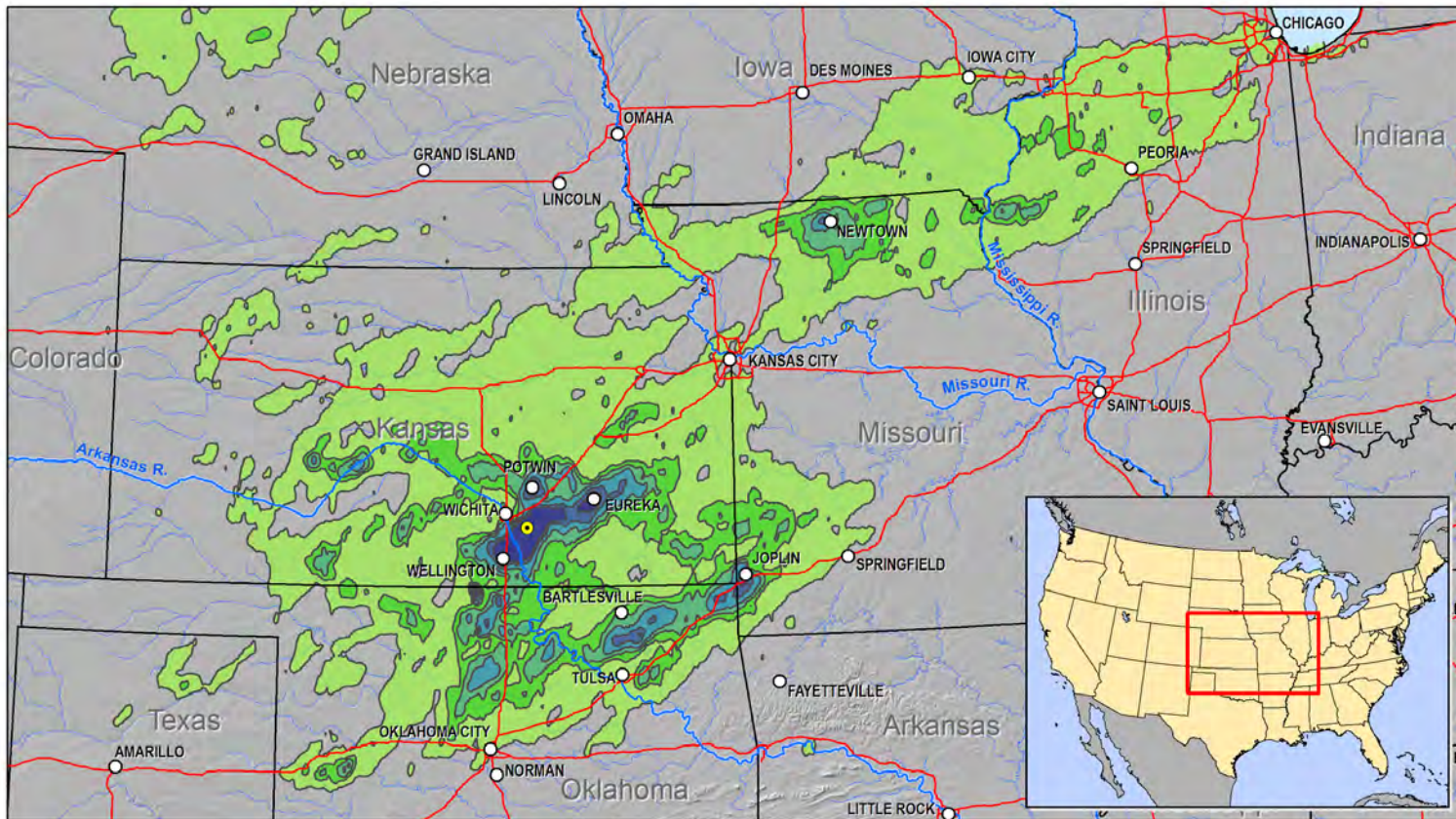
- **Video: 18-hour radar reflectivity loop from 7 am May 29 - 1 am May 30**
- **Widespread 1.5"-4" of rain by 7 am 5/30**
- **Rapid onset flash flooding**



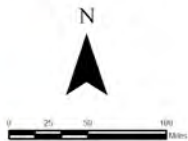


- **Widespread 10"-16"** fell in the southern KS + northern OK area bounded by Kingfisher, OK - Tulsa, OK - Miami, OK - Emporia, KS - Wichita, KS in 15 days
- PLUS: a record number of tornadoes (48) occurred in the NWS Tulsa area May 18-26, 2019 (most tornadoes for May and most tornadoes in any month).





Arkansas River Basin, 29 April - 30 May 2019
Annual Exceedance Probabilities (AEPs) for the Highest 30-day Rainfall Period



Hydrometeorological Design Studies Center
 Office of Water Prediction, National Weather Service
 National Oceanic and Atmospheric Administration

<https://www.nws.noaa.gov/ohd/hdsc>

Created 30 May 2019
 Precipitation frequency estimates are from NOAA Atlas 14
 Rainfall values come from 6-hour Stage IV multi-sensor data.

- > 1/10
- 1/50 - 1/10
- 1/100 - 1/50
- 1/200 - 1/100
- 1/500 - 1/200
- 1/1000 - 1/500
- < 1/1000



- Rainfall frequency of 1/200 to 1/1000 for parts of northern OK
- In other words: 0.5% to 0.1% annual chance of occurrence
- Locations along and northwest of I-44 had at least a 1/50 annual exceedance probability (2% annual chance of occurrence).
- A portion of south central Kansas had <1/1000 annual exceedance probability (<0.1%, or greater than a 1000-year rainfall event)!





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