STATE CLIMATE EXTREMES COMMITTEE MEMORANDUM

From: Tennessee 24-hour Precipitation State Climate Extreme Committee

Contents:

Summary:

Several rounds of thunderstorms impacted western Middle Tennessee on 21 August 2021. The rain began shortly after midnight and continued unabated through noon. A second round of rainfall developed between 7:00pm and 9:00pm CDT. The heaviest, most persistent storms, and the vast majority of the rainfall occurred between 5:00am and 8:00am CDT.

The following observation was reviewed to determine whether this was a new Tennessee 24-hour precipitation record:

• Location: McEwen, TN Wastewater Treatment Plant

• Date: 21 August 2021

• Value: 20.73 inches

After considerable discussion and deliberation, this value was confirmed unanimously to be the new statewide 24-hour precipitation record for Tennessee. It replaces the previous value of 13.6 inches near Milan on 13 September 1982. As in the case of the recent Michigan 24-hour rainfall record (19 September 2019), the SCEC again confirms a non-network observation as a state record. The SCEC acknowledges that while not preferred, several compelling factors support this. We also expect this to become a more common occurrence, and touch upon this issue in our recommendations.

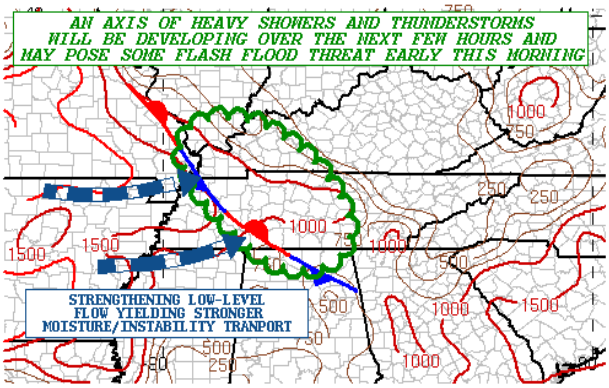
About the SCEC

This State Climate Extremes Committee (SCEC) was composed of members representing five bodies: the National Weather Service (NWS) Weather Forecast Office in Nashville, TN (WFO OHX), the NWS Southern Region Climate Program Manager, the State Climate Office for the state of Tennessee located at East Tennessee State University, the Southern Regional Climate Center, and the National Centers for Environmental Information. It is convened to adjudicate potential records for validity, according to the practices defined in NWS Instruction 10-1004. If validated, the observation is considered the state record for that record type. More details about the SCEC are available at the NCEI website.

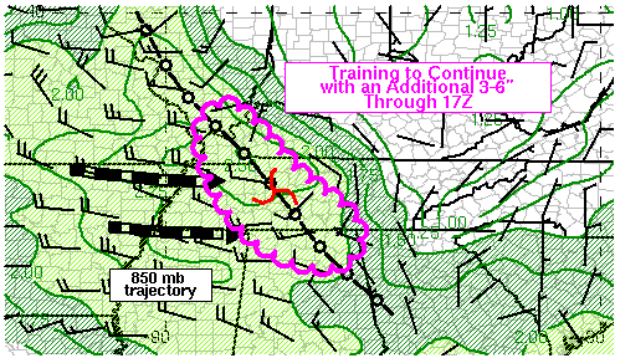
Meteorological Background and Storm Environment

Catastrophic flash flooding occurred specifically in Waverly, TN (Humphreys County) as well as surrounding areas including Hickman, Houston, and Dickson Counties on Saturday, 21 August 2021. Western portions of Middle Tennessee recorded a widespread 8 to 12 inches of rain including locally higher amounts of 15 to 20+ inches. Some of the rainfall amounts that were observed were roughly 20% - 40% of the TOTAL rainfall amounts seen in a year with the bulk of that falling in an 8–12-hour window. The incredible rainfall rates/amounts on 21 August were partly attributable to a Precipitable Water value of 2.37 inches, which was recorded by the 12Z sounding from WFO Nashville, which is well above the historical maximum of 2.21 inches for 21 August.

The NWS Weather Prediction Center issued four Mesoscale Precipitation Discussions relevant to the OHX forecast area during the heavy rain event (Fig. 1 & Fig. 2).



RAP32 ML CAPE (lowest 90MB) j/kg 210821/0500f000
WPC MPD #0847



RAP32 PRECIP WATER 210821/1100f001
RAP32 850 MB WINDS 210821/1100f000
WPC MPD #0848

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Mesoscale Precipitation Discussion 0847
NWS Weather Prediction Center College Park MD
220 AM EDT Sat Aug 21 2021

Areas affected...Portions of the Lower OH Valley and Mid-South

Concerning...Heavy rainfall...Flash flooding possible

Valid 210620Z - 211220Z

SUMMARY...An axis of heavy showers and thunderstorms is expected
to develop over the next few hours. Some localized repeating of
cells may result in some potential for areas of flash flooding
early this morning.
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Mesoscale Precipitation Discussion 0848
NWS Weather Prediction Center College Park MD
827 AM EDT Sat Aug 21 2021

Areas affected...far southeastern IL into western KY/TN and
northern AL

Concerning...Heavy rainfall...Flash flooding likely

Valid 211226Z - 211735Z

SUMMARY...An axis of heavy thunderstorms will likely continue to
train for at least another 2-4 hours across western KY into
west-central TN. Propagation into northern AL is expected later in
the morning. Flash flooding, which may be fairly significant, is
expected to continue from additional rainfall totals of 3-6 inches
through 17Z.
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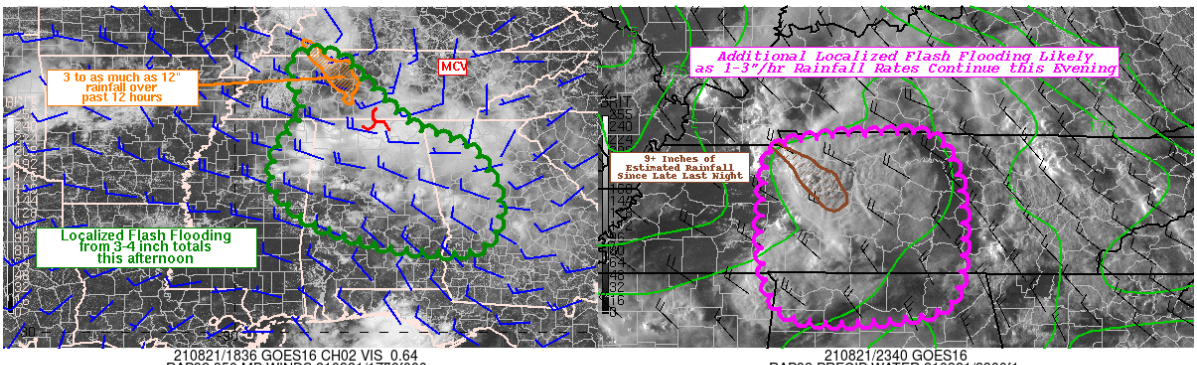
Fig. 1. Mesoscale Precipitation Discussion (MPD) graphics, with partial text, issued by the NWS/NCEP Weather Prediction Center, germane to this report. These were (a) MPD 0847, issued at 2:20 am, and (b) MPD 0848, issued at 8:27 am, both local time, on 21 August 2021. The images and text have been reformatted to fit the window. Full text available here: MPD 0847, MPD 0848.

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Mesoscale Precipitation Discussion 0849
NWS Weather Prediction Center College Park MD
244 PM EDT Sat Aug 21 2021

Areas affected...portions of the TN Valley into MS/AL/GA

Concerning...Heavy rainfall...Flash flooding possible

Valid 211844Z - 220015Z

SUMMARY...Peak rainfall rates of 2-3 in/hr are expected across
parts of the TN Valley into MS/AL/GA. Brief training of these
heavy rates may support localized flash flooding through the
afternoon.
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Mesoscale Precipitation Discussion 0851
NWS Weather Prediction Center College Park MD
811 PM EDT Sat Aug 21 2021

Areas affected...Middle Tennessee...Far Northern Alabama

Concerning...Heavy rainfall...Flash flooding likely

Valid 220010Z - 220510Z

Summary...Isolated instances of flash flooding are likely as
1-3"/hr rainfall rates allow for additional localized totals of
2-5 inches.
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Fig. 2. Mesoscale Precipitation Discussion (MPD) graphics, with partial text, issued by the NWS/NCEP Weather Prediction Center, germane to this report. These were (a) MPD 0849, issued at 2:44 pm, and (b) MPD 0851, issued at 8:11 pm, both local time, on 21 August 2021. The images and text have been reformatted to fit the window. Full text available here: MPD 0849, MPD 0851.

The NWS Nashville WFO issued a very rare Flash Flood Emergency during the event (Figure 3).

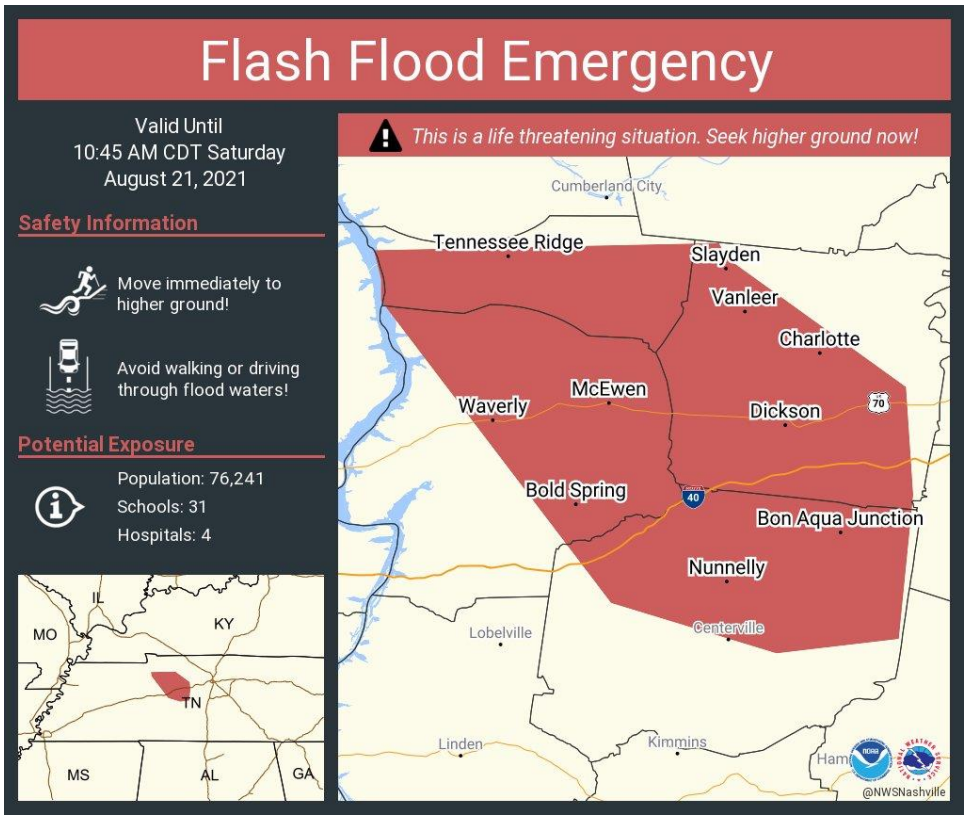


Fig. 3. Flash Flood Emergency including Dickson TN, Waverly TN, White Bluff TN until 10:45 AM CDT (issued by NWS Nashville WFO on 21 August 2021).

Validating Against Other Data Sources

A gauge operated by the McEwen Wastewater Treatment Plant measured 20.73 inches in a 24-hour period. This gauge records data every 5 minutes and measured 0.55 inches of rain between 5:30 and 5:35 am, which equates to a rate of 6.60 inches per hour. Between 6:30 and 6:35am the gauge measured 0.56 inches of rain, which equates to a rate of 6.72 inches per hour. The peak 1-hour rainfall amount was 4.29 inches between 6:30 and 7:30am, and the peak 3-hour amount was 10.92 inches measured between 4:40 and 7:40am.

Neighboring Rain Gauge Reports

A gauge operated by Tennessee Valley Authority (TVA) measured 17.02 inches also in McEwen. This gauge records precipitation every 15 minutes and measured 1.14 inches between 6:45 and 7:00am, which equates to a rainfall rate of 4.56 inches per hour. This gauge also measured 9.34 inches of rain in 3 hours (5:00 to 8:00am) with a 3inch per hour rainfall rate. A CoCoRaHS observer in Hickman County southeast of McEwen reported 17.26 inches of rain as well. The observer experienced substantial flooding and infrastructure damage (see description from observer below).

> *Fog, 72 degrees, overcast. Adjacent Piney River crested in early afternoon, now well below bank. Unfortunately, after 5,000 plus reports this will be the last from this station. The flood took the deck and rain gauge down river, then wrecked the interior, and finally collapsed the brick back side of the house, leaving open framework. Just one of many structures the flood ruined. Piney River*

charts go back to about 1897. I believe the 13.00" total from the 2:45 a.m. onset may be the largest one-day rainfall in the this particular river's records. The May 2010 floods unfolded over two days, totaling roughly 16 inches here. Hope to return to CoCoRaHS after relocation. CoCoRaHS and participants are very much appreciated and perform a valuable service.

Data in XM-ACIS show there were twelve other rain gauges (COOP and CoCoRaHS) in the four-county area that reported rainfall on 21-22 August, but no station within Humphreys County reported on these dates (there is one COOP station in ACIS for Humphreys County, but it was missing data for this time period) (Table 1, Figure 4). All of the reporting stations were COOP or CoCoRaHS stations with data submission around 7:00am local time, therefore station totals for the extreme rainfall event are spread over reports from 21 August (rainfall from midnight to 7:00am 21 August) and 22 August (7:00am – 9:00pm 21 August); however, radar estimated rainfall and automated rain gauges show that no rain occurred in this area from 7:00am 20 August until just after midnight 21 August, and no rainfall occurred after 12:01am 22 August, so the combined total rainfall from the two days of reports all occurred on 21 August. The table below shows the station name, station type, county, and total rainfall reported from 21 to 22 August 2021.

Table 1. Data available from XM-ACIS include reports from twelve rain gauges. None are located in the core of heaviest precipitation southeast of McEwen with Centerville being the closest and reporting 17.26 inches.

Station Name	Station Type	County	Total Rainfall (Inches)
CENTERVILLE 9.5 N	CoCoRaHS	Hickman	17.26
DICKSON 6.3 WSW	CoCoRaHS	Dickson	13.76
DICKSON	COOP	Dickson	11.6
DICKSON 5.8 NW	CoCoRaHS	Dickson	11.03
TENNESSEE RIDGE 3.0 S	CoCoRaHS	Houston	9.9
DICKSON 12.7 NW	CoCoRaHS	Dickson	9.79
CENTERVILLE 4NE	COOP	Hickman	9.72
BON AQUA 3.0 ESE	CoCoRaHS	Hickman	8.29
VANLEER 2.8 SE	CoCoRaHS	Dickson	7.99
ERIN 5.4 ESE	CoCoRaHS	Houston	7.21
MONTGOMERY BELL STATE PARK	COOP	Dickson	5
CHARLOTTE 1.3 NW	CoCoRaHS	Dickson	4.98

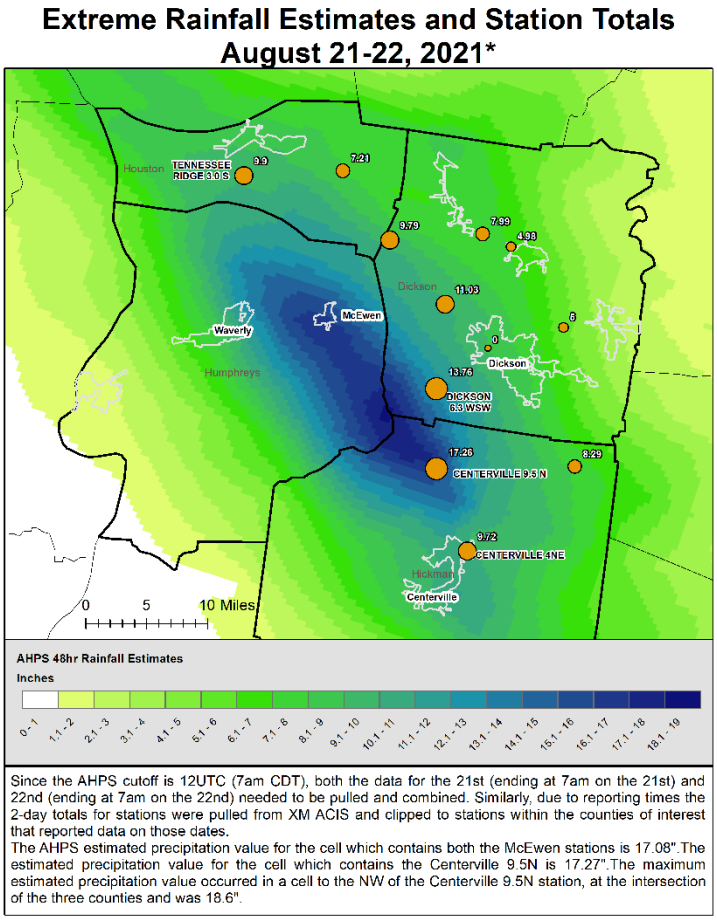


Fig. 4. Rainfall totals from stations listed in XM-ACIS along with AHPS estimated rainfall (again this is a two-day total due to the timing of the data refresh, but all rain fell on 21 August 2021).

Multi-Radar, Multi-Sensor (MRMS) Reflectivity Composite

The 48-hour precipitation total ending at 7:00 am 22 August 2021 is provided as Figure 5. A large area of 10-plus inch estimated totals stretches across Humphreys, Dickson, and Hickman counties. A smaller area, predominantly in southeast Humphreys County, indicates 15 to almost 20 inches of rain, including in the area of the potential record observation.

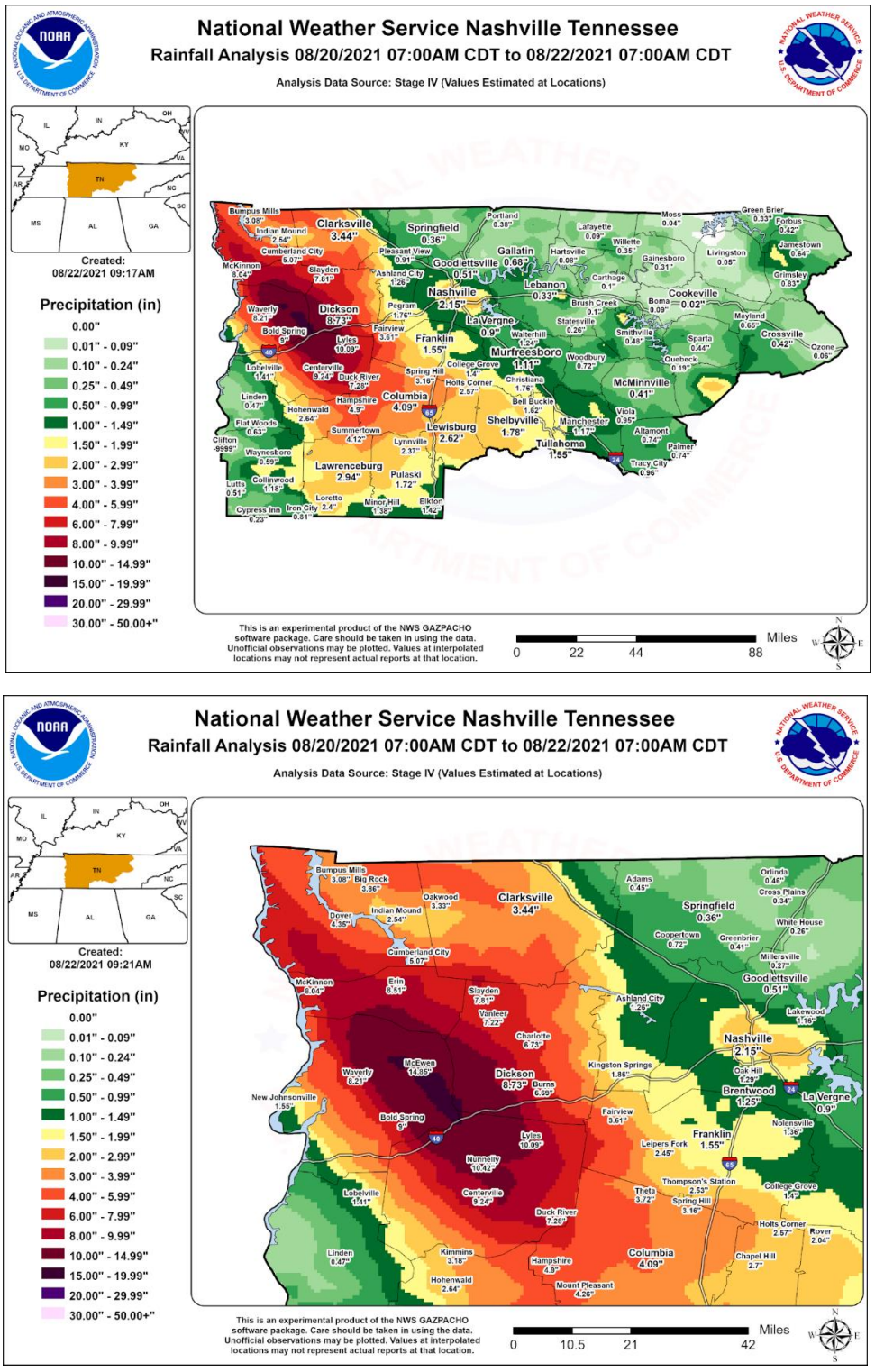


Fig. 5. The top map shows MRMS rainfall estimates across the OHX (Nashville) region and the bottom map shows the area of highest rainfall in western Middle Tennessee. While the composite covers a 48-hour period, all rain fell on 21 August 2021.

Additional radar estimates (Figure 6) show small areas exceeding 17 inches of rain with a maximum pixel value of 20.43 inches.

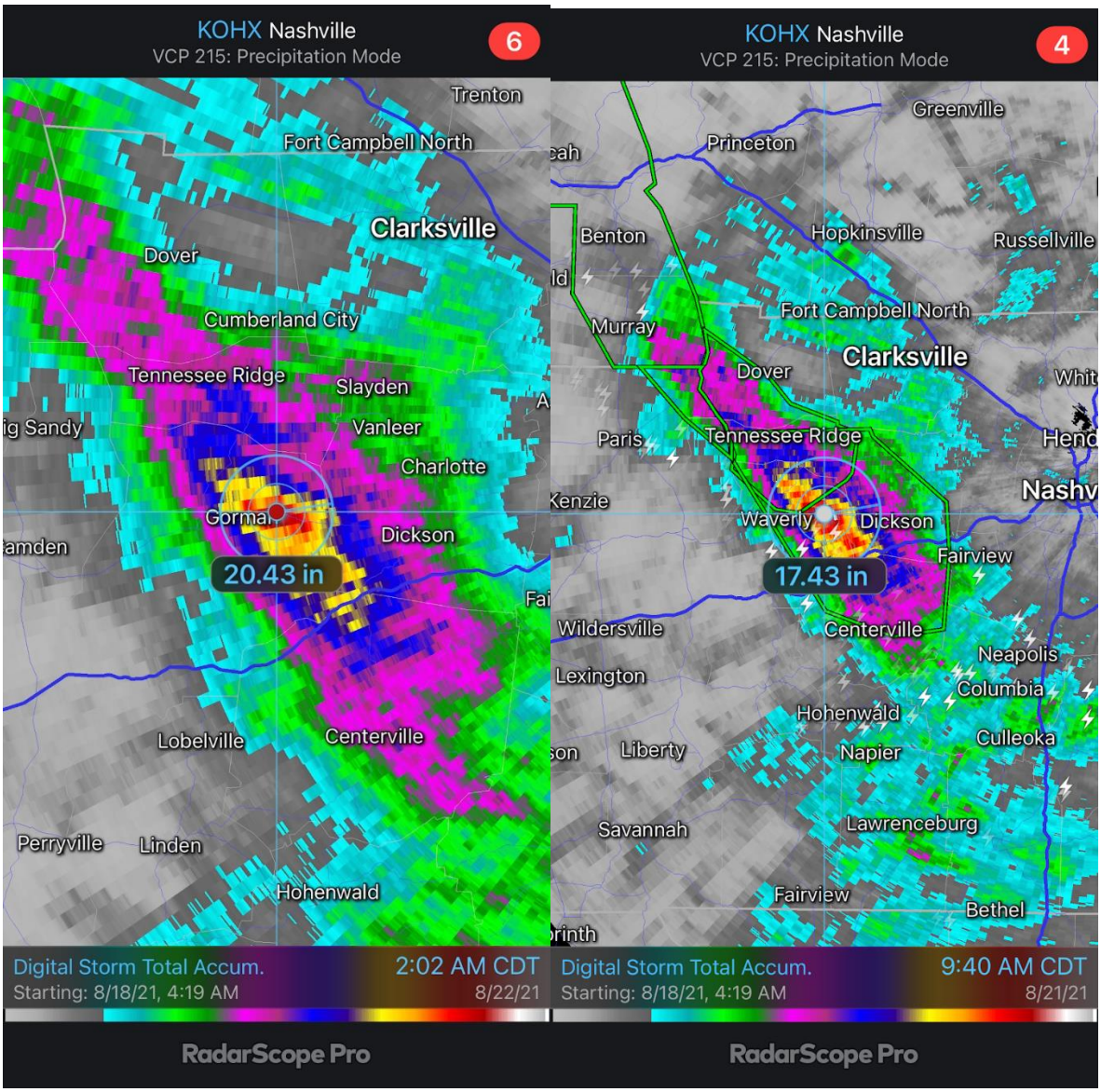


Fig. 6. MRMS radar estimates showed a swath of 14 inches of rainfall with a few pixels over 17 inches and a maximum value of 20.43 inches, only 0.3 inches below the potential record observation.

Other Unofficial Reports

At least three other local reports from back-yard or other unofficial rain gauges in McEwen corroborated reports of 20-inch rainfall totals.

Hydrologic Impacts and Survey

Numerous roads including I-40 were shut down or washed away during this event. Even though the heaviest rains occurred to the east of Waverly, TN, Trace Creek which runs through the town drained the area with highest rainfall totals, leading to major flooding. At one point, there was only one way in and

out of Waverly, TN which was Highway 13. The entire town was cut off from the world as there was no electricity, water, sewer, internet, or cell service. Much of the town was completely destroyed/flooded including their 911 center at the height of the event.

FLASH (Flooded Locations And Simulated Hydrographs Project) showed that the heaviest rainfall over McEwen overwhelmed Trace Creek and a flood wave went westward down the creek into Waverly causing the rapid water rise (Figure 7). There is an elevation difference of around 300-400ft over a distance of 7 miles from McEwen to Waverly, so the water rapidly moved westward downhill.

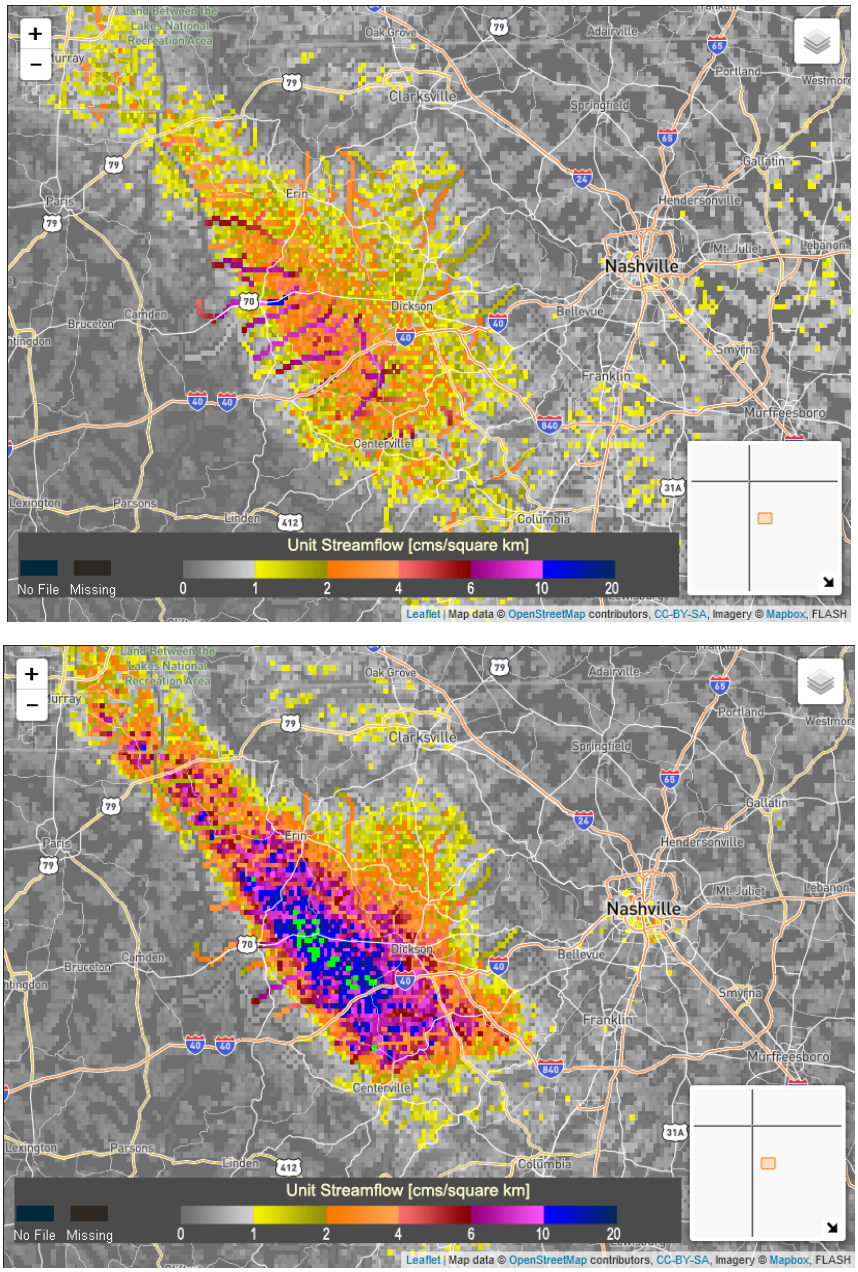


Fig. 7. FLASH uses rainfall forcing from MRMS/Q3 to produce flash flood forecasts at 1-km/5-min resolution through direct, forward simulation. The resulting CREST (Coupled Routing and Excess Storage)

hydrologic model shows estimated extreme streamflow moving westward (downstream) towards Waverly.

Record flooding occurred at Piney River near Vernon, in northern Hickman County (Figure 8). This gauge has peak streamflow records dating back to 1926 but has been at its current location since 1972. Since the gauge was moved it has only reached or exceeded 20 feet 3 times - 20.08 feet in 2019, 24.42 feet in 1991, and 27.78 feet in 2010. The water level at the gauge rose 27 feet in 5 hours between 6:00am and 11:00am CDT, with a peak crest of 32.36 feet measured at 12:15pm CDT.

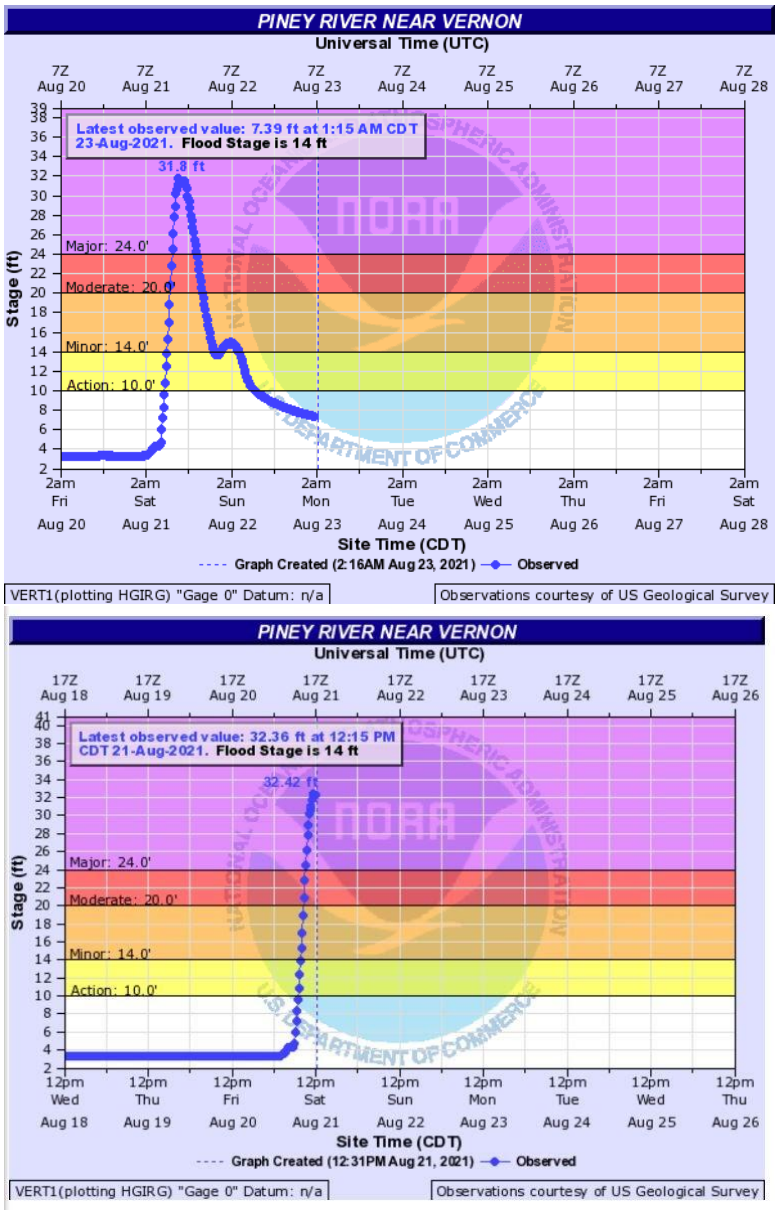


Fig. 8. The USGS stream gauge on the Piney River near Vernon, TN set a new peak crest record on 21 August 2021. A rapid rise of over 27 feet occurred in just 5 hours.

The Duck River at Centerville (Hickman County) near the southeastern end of the most extreme precipitation also rose quickly from about 11 feet at midnight 21 August to about 20 feet by noon, which

was in the Action stage for the river (Figure 9). Farther downstream, the Duck River near Hurricane Mills (Humphreys County) peaked in Moderate flood stage in the morning hours of 22 August (Figure 9).

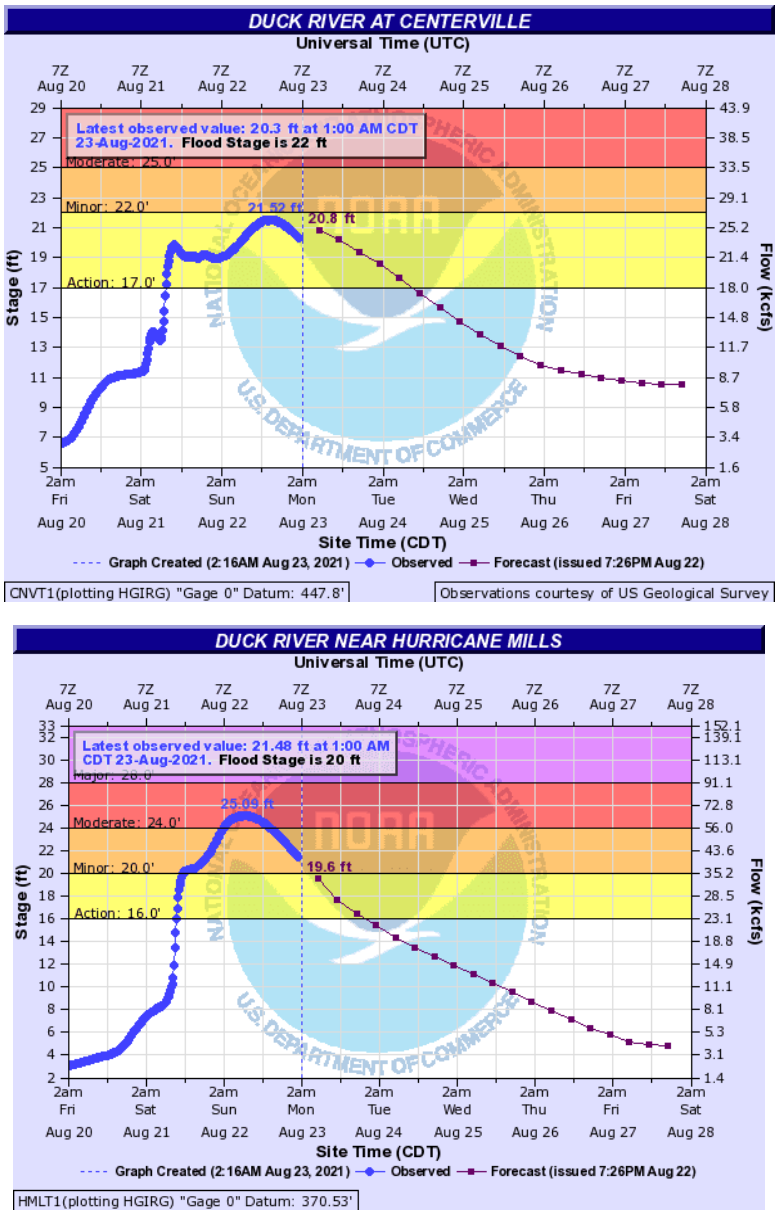


Fig. 9. The USGS stream gauges along the Duck River (top graph: Centerville, bottom graph: Hurricane Mills), show rapid increases in water level, although not as extreme as that recorded at the Piney River gauge near Vernon, TN.

The National Water Center evaluated the Waverly and Vernon, TN event from 21 August 2021. The figures below show the 12-hour (Figure 10) and 24-hour (Figure 11) annual exceedance probability for rainfall totals, confirming that the event exceeded a 0.001 (one in one thousand) annual chance of recurrence for an 800 – 1,000 square mile area centered in eastern Humphreys County, southwest Dickson County, and north-central Hickman County.

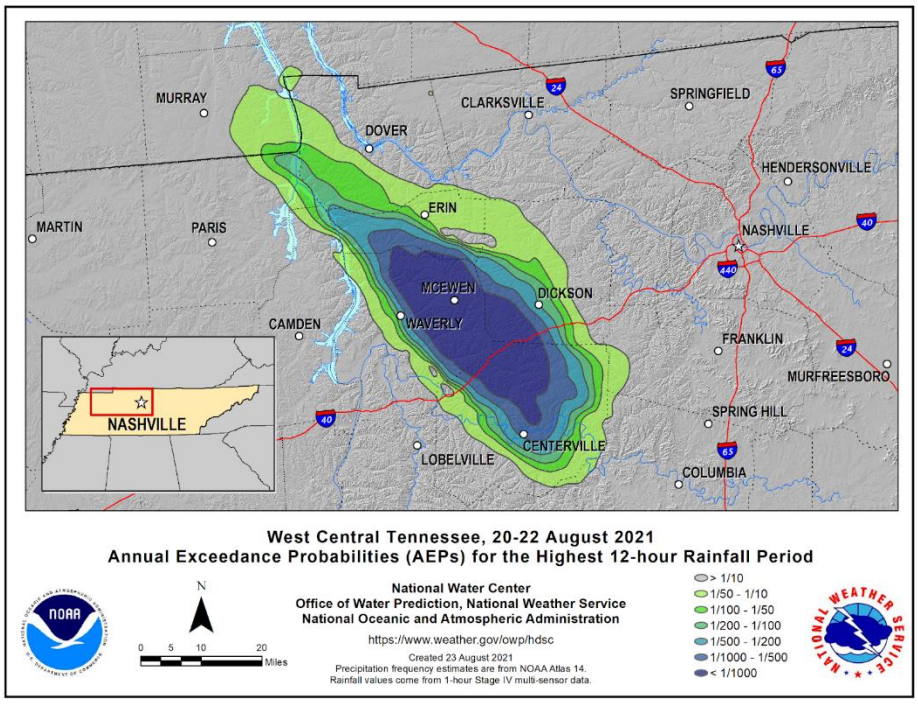


Fig. 10. Annual exceedance probabilities for the highest 12-hour rainfall period in western Middle Tennessee.

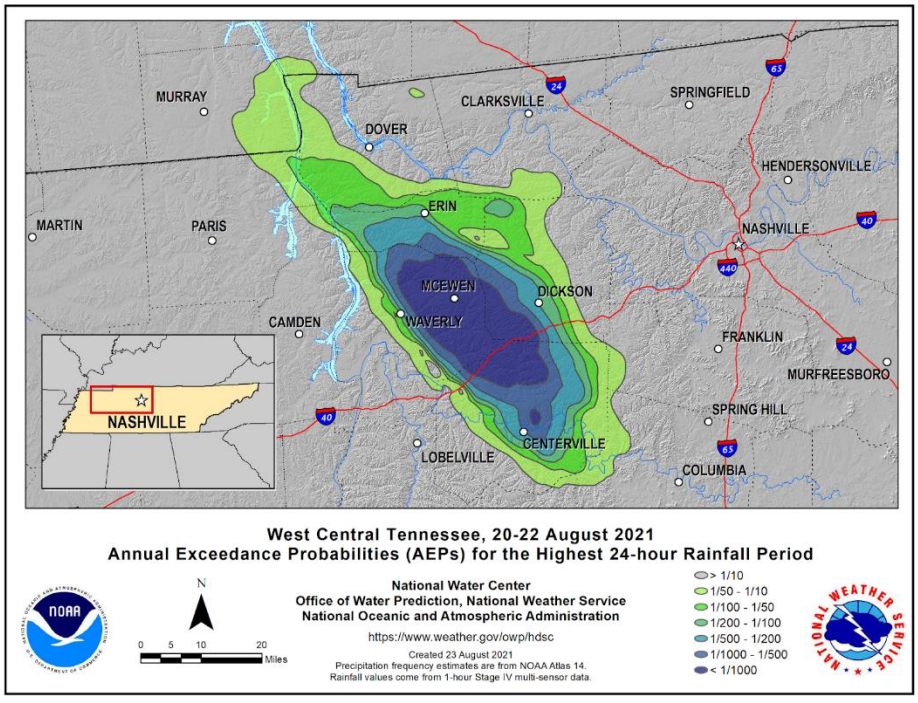


Fig. 11. Annual exceedance probabilities for the highest 24-hour rainfall period in western Middle Tennessee.

Using the WWTP station in McEwen, a rainfall depth-duration frequency (DDF) curve for this event was created. The DDF curve illustrated observed precipitation values compared to the 1- to 1,000-year DDF accumulations for this location from NOAA Atlas 14 (Figure 12).

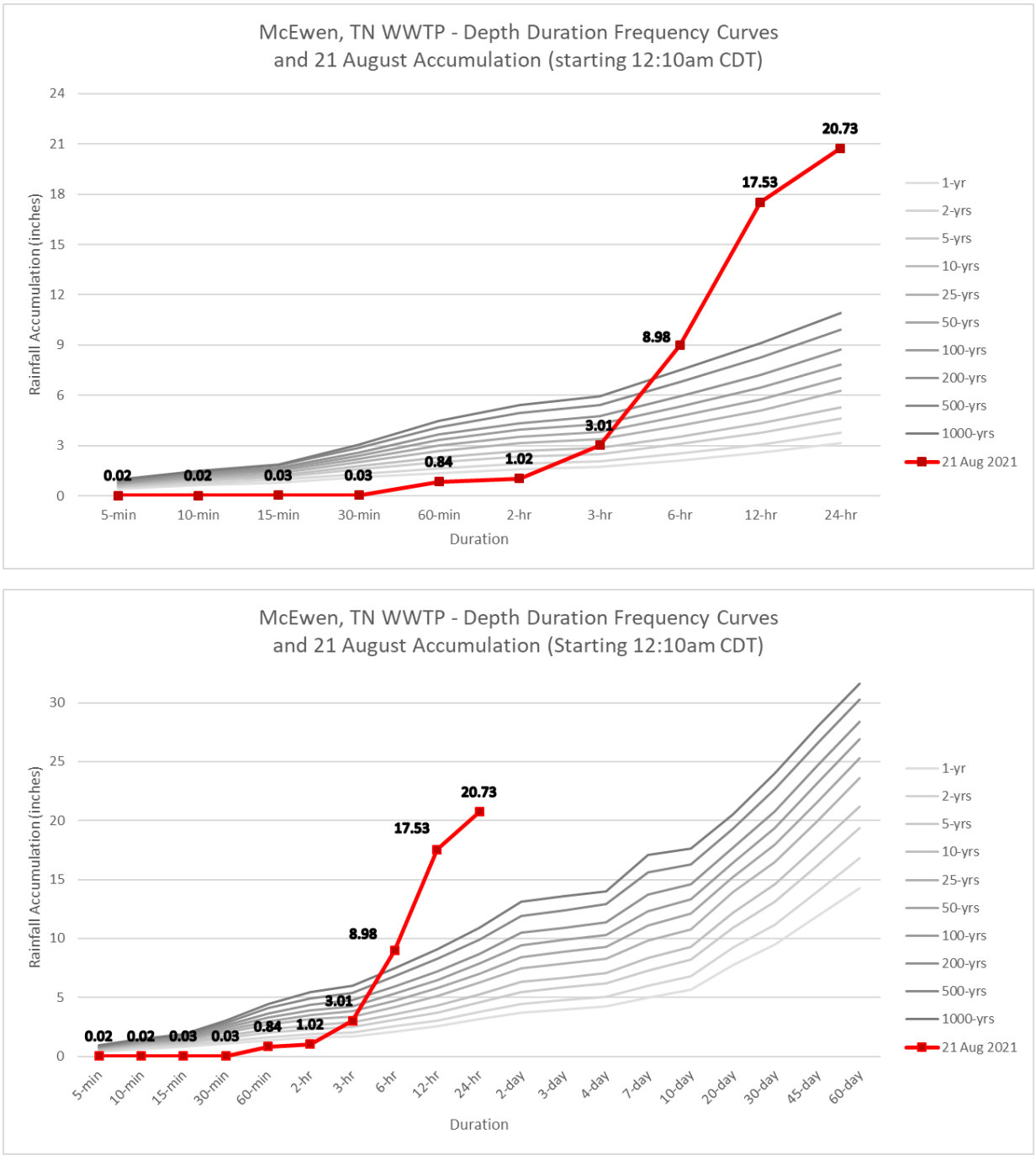


Fig. 12. Depth-duration frequency (DDF) curve showing accumulated rainfall over the 24-hour period, compared to the 1- to 1,000-year DDF accumulations for this location from NOAA Atlas 14 (top chart). The total accumulation (20.73 inches) is roughly equivalent to a 1,000-year 20-day event (bottom chart).

This analysis used 1-hour Stage IV precipitation data from 13Z 20 August to 12Z 22 August. The event exceeded the expected rainfall accumulation of a 1,000-year event at each time interval from 2-hrs to 28-hours.

The flooding in Waverly, TN on Trace Creek was exacerbated as the extreme rainfall drained quickly into channels picking up debris that was then caught in the channel causing a temporary dam, then as that temporary debris dam released, it washed and collected more debris down to the next obstacle, and so on. In essence, this was like an inland, debris-laden tsunami.

Site Survey and Instrument Post-Calibration

Members of the NWS Nashville WFO conducted a site survey of rain gauges in McEwen at the TVA and Waste Water Treatment Plant (WWTP). The AcuRite 5-in-1 weather station at the McEwen WWTP was perfectly sited on level ground, far from obstacles that would deflect or channel rain or bump the sensor, and the station had been installed and calibrated in June 2021 (Figure 13).

Fig. 13. Siting of the AcuRite 5-in-1 weather station where 20.73 inches of rain fell.

To calibrate the rain gauge, AcuRite instructs the user to slowly pour 1 cup (8 oz.) of water into the rain gauge over a time span of at least 20 minutes (Figure 14). The rain gauge should display 1.06 inches of rainfall. The gauge was initially calibrated by the McEwen WWTP operator, yielding 1.04 inches. Representatives from WFO Nashville calibrated the gauge upon a visit on 23 September and their attempt also yielded 1.04 inches.

Fig. 14. The 5-in1 AcuRite station was calibrated on 23 September 2021 by representatives from the NWS Nashville WFO.

The TVA rain gauge was decently sited, but could not be directly inspected as it was behind a locked chain link fence. From outside the facility the gauge did not appear to be as well monitored or maintained as the new weather station at the McEwen WWTP (Figure 15). A statistical comparison of the AcuRite and TVA gauge data indicated excellent agreement in the timing of variations of precipitation intensity, but the TVA gauge values were systematically lower than the AcuRite values.

Fig. 15. Siting of the TVA rain gauge, approximately 1 mile from the WWTP, which recorded 17.02 inches of rain.

Committee Findings:

After considering the observation, the state and condition of the observing equipment, and the meteorological environment in which the observation was recorded, **the SCEC has determined, unanimously by a 5-0 vote, that the 20.73 inches observed at the McEwen Waste Water Treatment Plant station on 21 August 2021 is indeed valid and constitutes a record 24-hour precipitation total for Tennessee**. The SCEC made this final determination on 27 October 2021.

Extenuating Factors

Given this is a non-NOAA sanctioned observation, the committee's perspective is to balance the 10-1004 requirements with the preponderance of evidence from this particular event. The 10-1004 instruction does not factor in such preponderance of evidence, but nevertheless must be factored in our decision.

The McEwen WWTP observation of 20.73 inches is plausible, and based on extensive site inspection and post-event station calibration from the NWS Nashville WFO team we have no reason to doubt the accuracy of the measurement.

The State Climate Extremes Committee (SCEC) notes that the property is suburban and representative of its surrounding area and the station siting is sufficient. Precedent has already been set by the National Climate Extremes Committee to accommodate observations from networks not sanctioned by NOAA. The new national 24-hour precipitation record was set by a non-NOAA observation in Hawaii in April 2018. A similar state record in Fountain, Michigan was set in July 2020. The Hawaii observation featured the following:

- non-NOAA platform
- The gauge was slightly tilted and not 100% level
- No permanent archive of the long-term record
- Post-event calibration by NOAA personnel
- No archive of the metadata

Public Interests

The SCEC recognizes that using a non-network value as an established state record is unorthodox – and should be – generally discouraged. However, the magnitude of the event greatly exceeded the previously established record over a large area, and is consistent with long term regional trends towards heavier and more frequent extreme precipitation events in recent decades. According to currently recognized state records, this would become the largest 24-hour precipitation record in any non-coastal state. Local impacts in the area were extreme (see Appendix I), and tragic, and this event should remain in the collective consciousness of Tennessee NWS personnel and public safety partners. Collectively, the SCEC determined it was in the public interest for preparedness and engineering concerns, to acknowledge this event and give the non-network observation due consideration.

Committee Members:

- Krissy Hurley, Warning Coordination Meteorologist, NWS WFO Nashville, Tennessee
- Dr. Andrew Joyner, Tennessee State Climatologist, East Tennessee State University
- Victor Murphy, NWS Southern Region Climate Services Program Manager
- Dr. John Nielsen-Gammon, Director, Southern Regional Climate Center
- Karin Gleason, Monitoring Section, National Centers for Environmental Information.

Expertise participants/content providers (non-voting):

- William Tollefson, Tennessee Climate Office, East Tennessee State University
- Sam Shamburger, Lead Meteorologist, NWS WFO Nashville, Tennessee
- James LaRosa, Service Hydrologist, NWS WFO Nashville, Tennessee
- Mark Rose, Meteorologist, NWS WFO Nashville, Tennessee
- Matt Reagan, Meteorologist NWS

Recommendations

The SCEC, echoing the recommendations from the July 2020 Michigan SCEC report, strongly recommends that NWS Directive 10-1004 be revisited to provide clearer guidance for non-network stations. The SCEC further recommends that this guidance:

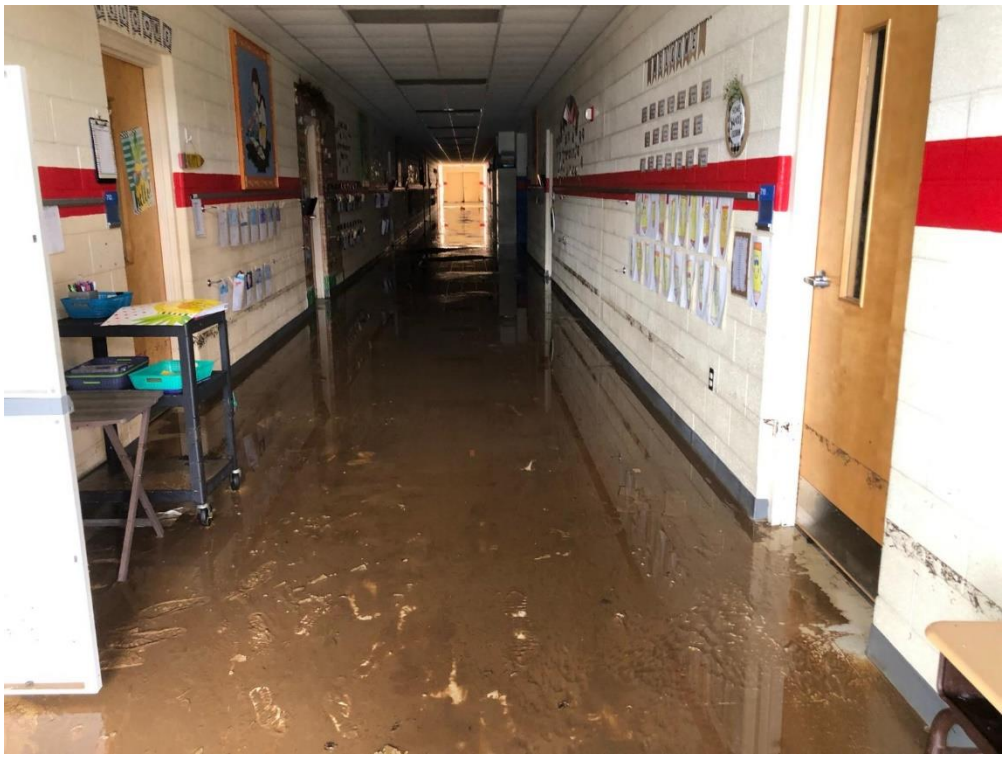
- Reinforce the primacy of known-network observations, and that non-network observations need much more post-event scrutiny, but:
- Provide guidance and advice for situations in which the evidence (i.e., field survey, calibration of equipment, surrounding reports, MRMS, etc.) clearly supports the validity of a non-network observation, to help balance the public interest in understanding known extremes with the public interest in long-term discoverability of data;

- For example, in this Tennessee 24-hour rainfall case, the SCEC's confidence in the validity that the observation exceeded the previous record and the nearby TVA gauge observation by a significant amount, were determined to outweigh the potentially disqualifying non-network status of the observation.

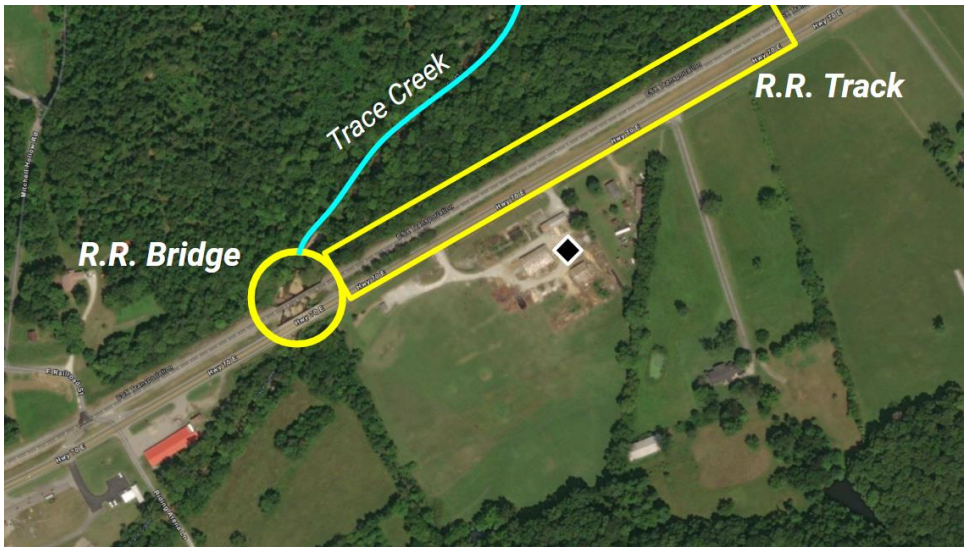
NCEI Climate Monitoring Chief Decision

Approved	Not approved
as recommended in boldface above:	returned to SCEC with no action taken:
VOSE.RUSSELL.STEPHEN.1365831471 Digitally signed by VOSE.RUSSELL.STEPHEN.1365831471 Date: 2021.12.18 09:43:41 -05'00'	

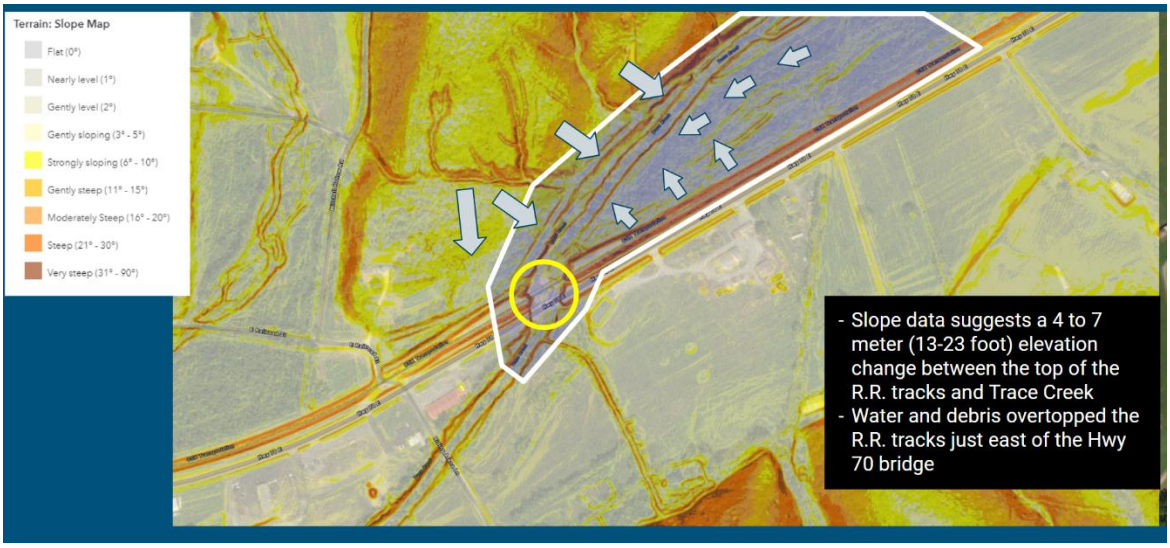
Appendix I. Additional Damage and Impacts Photos




NEWS4 INVESTIGATES
DEADLY
FLOODING
DRONE 4 SHOWS BREACH IN EARTH BENEATH RAILROAD


Trace Creek
R.R. Track
R.R. Bridge


Trace Creek


Terrain: Slope Map
Flat (0°)
Nearly level (1°)
Gently level (2°)
Gently sloping (3° - 5°)
Strongly sloping (6° - 10°)
Gently steep (11° - 15°)
Moderately Steep (16° - 20°)
Steep (21° - 30°)
Very steep (31° - 90°)
- Slope data suggests a 4 to 7 meter (13-23 foot) elevation change between the top of the R.R. tracks and Trace Creek
- Water and debris overtopped the R.R. tracks just east of the Hwy 70 bridge


2021
2010

Appendix II. Additional Post-Event Calibration Images

Appendix III. McEwen Wastewater Treatment Plant 5-minute Accumulation Data

Observation Date/Time (CDT)	Total Accumulated Rainfall (inches)
8/21/2021 0:00	0
8/21/2021 0:05	0
8/21/2021 0:10	0
8/21/2021 0:15	0.02
8/21/2021 0:20	0.02
8/21/2021 0:25	0.03
8/21/2021 0:30	0.03
8/21/2021 0:35	0.03
8/21/2021 0:40	0.03
8/21/2021 0:45	0.04
8/21/2021 0:50	0.15
8/21/2021 0:55	0.22
8/21/2021 1:00	0.42
8/21/2021 1:05	0.73
8/21/2021 1:10	0.84
8/21/2021 1:15	0.85
8/21/2021 1:20	0.85
8/21/2021 1:25	0.85
8/21/2021 1:30	0.85
8/21/2021 1:35	0.85
8/21/2021 1:40	0.87
8/21/2021 1:45	0.87
8/21/2021 1:50	0.87
8/21/2021 1:55	0.88
8/21/2021 2:00	0.92
8/21/2021 2:05	0.96
8/21/2021 2:10	1.02
8/21/2021 2:15	1.06
8/21/2021 2:20	1.18
8/21/2021 2:25	1.38
8/21/2021 2:30	1.68
8/21/2021 2:35	1.8
8/21/2021 2:40	1.92
8/21/2021 2:45	2.1

Observation Date/Time (CDT)	Total Accumulated Rainfall (inches)
8/21/2021 2:50	2.15
8/21/2021 2:55	2.22
8/21/2021 3:00	2.52
8/21/2021 3:05	2.87
8/21/2021 3:10	3.01
8/21/2021 3:15	3.11
8/21/2021 3:20	3.15
8/21/2021 3:25	3.26
8/21/2021 3:30	3.49
8/21/2021 3:35	3.54
8/21/2021 3:40	3.6
8/21/2021 3:45	3.61
8/21/2021 3:50	3.62
8/21/2021 3:55	3.67
8/21/2021 4:00	3.69
8/21/2021 4:05	3.72
8/21/2021 4:10	3.74
8/21/2021 4:15	3.84
8/21/2021 4:20	3.87
8/21/2021 4:25	3.88
8/21/2021 4:30	3.88
8/21/2021 4:35	3.89
8/21/2021 4:40	3.95
8/21/2021 4:45	4.33
8/21/2021 4:50	4.69
8/21/2021 4:55	4.95
8/21/2021 5:00	5.1
8/21/2021 5:05	5.36
8/21/2021 5:10	5.55
8/21/2021 5:15	5.7
8/21/2021 5:20	6.01
8/21/2021 5:25	6.4
8/21/2021 5:30	6.74
8/21/2021 5:35	7.29
8/21/2021 5:40	7.64
8/21/2021 5:45	7.98
8/21/2021 5:50	8.23
8/21/2021 5:55	8.48
8/21/2021 6:00	8.61
8/21/2021 6:05	8.8

Observation Date/Time (CDT)	Total Accumulated Rainfall (inches)
8/21/2021 6:10	8.98
8/21/2021 6:15	9.15
8/21/2021 6:20	9.41
8/21/2021 6:25	9.64
8/21/2021 6:30	9.97
8/21/2021 6:35	10.53
8/21/2021 6:40	10.99
8/21/2021 6:45	11.44
8/21/2021 6:50	11.78
8/21/2021 6:55	12.04
8/21/2021 7:00	12.39
8/21/2021 7:05	12.82
8/21/2021 7:10	13.17
8/21/2021 7:15	13.35
8/21/2021 7:20	13.55
8/21/2021 7:25	13.89
8/21/2021 7:30	14.26
8/21/2021 7:35	14.51
8/21/2021 7:40	14.87
8/21/2021 7:45	15.15
8/21/2021 7:50	15.41
8/21/2021 7:55	15.61
8/21/2021 8:00	15.74
8/21/2021 8:05	15.94
8/21/2021 8:10	16.08
8/21/2021 8:15	16.24
8/21/2021 8:20	16.37
8/21/2021 8:25	16.46
8/21/2021 8:30	16.52
8/21/2021 8:35	16.58
8/21/2021 8:40	16.63
8/21/2021 8:45	16.7
8/21/2021 8:50	16.72
8/21/2021 8:55	16.78
8/21/2021 9:00	16.94
8/21/2021 9:05	17.16
8/21/2021 9:10	17.26
8/21/2021 9:15	17.31
8/21/2021 9:20	17.34
8/21/2021 9:25	17.35

Observation Date/Time (CDT)	Total Accumulated Rainfall (inches)
8/21/2021 9:30	17.36
8/21/2021 9:35	17.37
8/21/2021 9:40	17.37
8/21/2021 9:45	17.38
8/21/2021 9:50	17.38
8/21/2021 9:55	17.39
8/21/2021 10:00	17.39
8/21/2021 10:05	17.39
8/21/2021 10:10	17.4
8/21/2021 10:15	17.4
8/21/2021 10:20	17.4
8/21/2021 10:25	17.4
8/21/2021 10:30	17.4
8/21/2021 10:35	17.42
8/21/2021 10:40	17.44
8/21/2021 10:45	17.45
8/21/2021 10:50	17.46
8/21/2021 10:55	17.48
8/21/2021 11:00	17.49
8/21/2021 11:05	17.5
8/21/2021 11:10	17.5
8/21/2021 11:15	17.51
8/21/2021 11:20	17.51
8/21/2021 11:25	17.51
8/21/2021 11:30	17.51
8/21/2021 11:35	17.51
8/21/2021 11:40	17.52
8/21/2021 11:45	17.53
8/21/2021 11:50	17.53
8/21/2021 11:55	17.53
8/21/2021 12:00	17.53
8/21/2021 12:05	17.53
8/21/2021 12:10	17.53
8/21/2021 12:15	17.53
8/21/2021 12:20	17.53
8/21/2021 12:25	17.53
8/21/2021 12:30	17.53
8/21/2021 12:35	17.53
8/21/2021 12:40	17.53
8/21/2021 12:45	17.53

Observation Date/Time (CDT)	Total Accumulated Rainfall (inches)
8/21/2021 12:50	17.53
8/21/2021 12:55	17.53
8/21/2021 13:00	17.53
8/21/2021 13:05	17.53
8/21/2021 13:10	17.53
8/21/2021 13:15	17.53
8/21/2021 13:20	17.53
8/21/2021 13:25	17.53
8/21/2021 13:30	17.53
8/21/2021 13:35	17.53
8/21/2021 13:40	17.53
8/21/2021 13:45	17.53
8/21/2021 13:50	17.53
8/21/2021 13:55	17.53
8/21/2021 14:00	17.53
8/21/2021 14:05	17.53
8/21/2021 14:10	17.53
8/21/2021 14:15	17.53
8/21/2021 14:20	17.53
8/21/2021 14:25	17.53
8/21/2021 14:30	17.53
8/21/2021 14:35	17.53
8/21/2021 14:40	17.53
8/21/2021 14:45	17.53
8/21/2021 14:50	17.53
8/21/2021 14:55	17.53
8/21/2021 15:00	17.53
8/21/2021 15:05	17.53
8/21/2021 15:10	17.53
8/21/2021 15:15	17.53
8/21/2021 15:20	17.53
8/21/2021 15:25	17.53
8/21/2021 15:30	17.53
8/21/2021 15:35	17.53
8/21/2021 15:40	17.53
8/21/2021 15:45	17.53
8/21/2021 15:50	17.53
8/21/2021 15:55	17.53
8/21/2021 16:00	17.53
8/21/2021 16:05	17.53

Observation Date/Time (CDT)	Total Accumulated Rainfall (inches)
8/21/2021 16:10	17.53
8/21/2021 16:15	17.53
8/21/2021 16:20	17.53
8/21/2021 16:25	17.53
8/21/2021 16:30	17.53
8/21/2021 16:35	17.53
8/21/2021 16:40	17.53
8/21/2021 16:45	17.53
8/21/2021 16:50	17.53
8/21/2021 16:55	17.53
8/21/2021 17:00	17.53
8/21/2021 17:05	17.53
8/21/2021 17:10	17.53
8/21/2021 17:15	17.53
8/21/2021 17:20	17.53
8/21/2021 17:25	17.53
8/21/2021 17:30	17.53
8/21/2021 17:35	17.53
8/21/2021 17:40	17.53
8/21/2021 17:45	17.53
8/21/2021 17:50	17.53
8/21/2021 17:55	17.53
8/21/2021 18:00	17.65
8/21/2021 18:05	17.83
8/21/2021 18:10	18.16
8/21/2021 18:15	18.6
8/21/2021 18:20	19.22
8/21/2021 18:25	19.48
8/21/2021 18:30	19.55
8/21/2021 18:35	19.55
8/21/2021 18:40	19.72
8/21/2021 18:45	19.96
8/21/2021 18:50	20.17
8/21/2021 18:55	20.36
8/21/2021 19:00	20.53
8/21/2021 19:05	20.67
8/21/2021 19:10	20.7
8/21/2021 19:15	20.71
8/21/2021 19:20	20.71
8/21/2021 19:25	20.71

Observation Date/Time (CDT)	Total Accumulated Rainfall (inches)
8/21/2021 19:30	20.72
8/21/2021 19:35	20.72
8/21/2021 19:40	20.73
8/21/2021 19:45	20.73
8/21/2021 19:50	20.73
8/21/2021 19:55	20.73
8/21/2021 20:00	20.73
8/21/2021 20:05	20.73
8/21/2021 20:10	20.73
8/21/2021 20:15	20.73
8/21/2021 20:20	20.73
8/21/2021 20:25	20.73
8/21/2021 20:30	20.73
8/21/2021 20:35	20.73
8/21/2021 20:40	20.73
8/21/2021 20:45	20.73
8/21/2021 20:50	20.73
8/21/2021 20:55	20.73
8/21/2021 21:00	20.73
8/21/2021 21:05	20.73
8/21/2021 21:10	20.73
8/21/2021 21:15	20.73
8/21/2021 21:20	20.73
8/21/2021 21:25	20.73
8/21/2021 21:30	20.73
8/21/2021 21:35	20.73
8/21/2021 21:40	20.73
8/21/2021 21:45	20.73
8/21/2021 21:50	20.73
8/21/2021 21:55	20.73
8/21/2021 22:00	20.73
8/21/2021 22:05	20.73
8/21/2021 22:10	20.73
8/21/2021 22:15	20.73
8/21/2021 22:20	20.73
8/21/2021 22:25	20.73
8/21/2021 22:30	20.73
8/21/2021 22:35	20.73
8/21/2021 22:40	20.73
8/21/2021 22:45	20.73

Observation Date/Time (CDT)	Total Accumulated Rainfall (inches)
8/21/2021 22:50	20.73
8/21/2021 22:55	20.73
8/21/2021 23:00	20.73
8/21/2021 23:05	20.73
8/21/2021 23:10	20.73
8/21/2021 23:15	20.73
8/21/2021 23:20	20.73
8/21/2021 23:25	20.73
8/21/2021 23:30	20.73
8/21/2021 23:35	20.73
8/21/2021 23:40	20.73
8/21/2021 23:45	20.73
8/21/2021 23:50	20.73
8/21/2021 23:55	20.73