

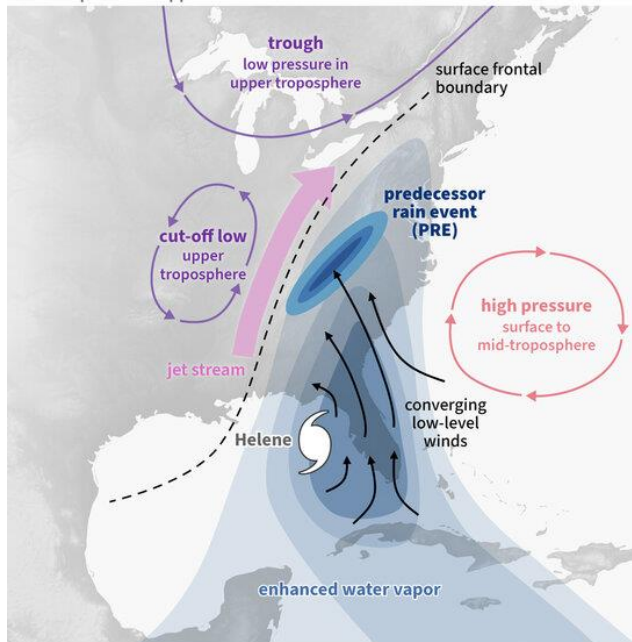


Appendix C: Featured Event - Hurricane Helene

The 2024 Atlantic Ocean hurricane season culminated with Hurricane Helene in late September. Hurricane Helene made landfall the evening of September 26, 2024, on the panhandle of Florida as a Category 4 hurricane with winds more than 120 knots. After making landfall, Hurricane Helene moved quickly through Georgia, South Carolina, North Carolina, and Tennessee. By the morning of September 27, the National Weather Service issued over 34 flash flood emergencies affecting millions of people. By the afternoon, the rainfall ended, and Hurricane Helene dissipated as it quickly moved northwestward leaving behind unprecedented damage.

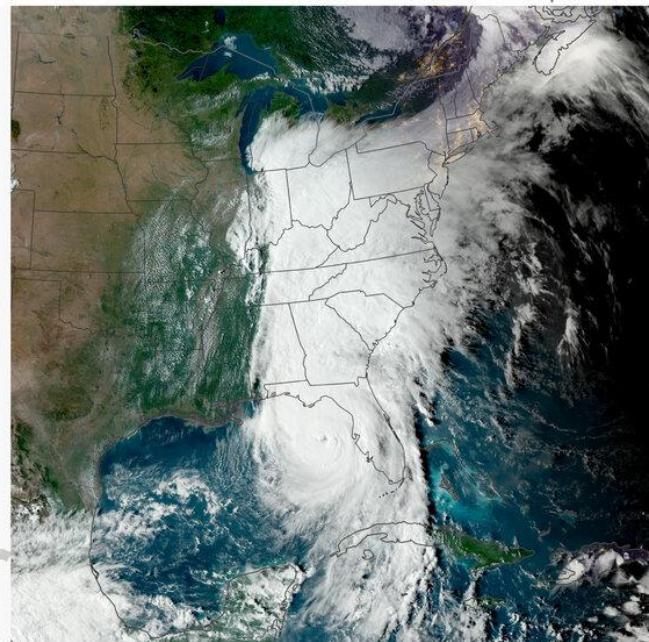
Prior to making landfall, a heavy rainfall event occurred over the Southern Appalachians including the headwaters of the Catawba-Wataree River Basin (the Basin). The rainfall was driven by water vapor from the Gulf of Mexico and resulted in nearly 6 to 8 inches of rainfall prior to the arrival of Hurricane Helene. This amount of rain is well above normal for the month of September and saturated the ground prior to the hurricane, increasing the magnitude of flooding in the region, as shown in Figure 1.

Weather patterns tapped Helene's moisture well before landfall



NOAA Climate.gov
Data: CW3E, adapted from
schematic by J. Cordeira

Clouds and rain stretched hundreds of miles north of Helene on September 26



NOAA Climate.gov
Data: NOAA GOES-16

Figure 1. Hurricane Helene Weather Patterns and Cloud Cover over Southeastern U.S.

Source: NOAA Climate.gov and the Center for Western Weather and Water Extremes (CW3E).

Rainfall

Normal rainfall for the month of September in the Basin ranges from 4.6 inches in the uplands to 3.6 inches in the lower portions of the Basin (Prism Climate Group, 2022). In September 2024, rainfall in the Basin was 4.5 times higher than normal. One weather station in Busick, N.C. (near the headwaters of the Catawba River), recorded 30.78 inches over 4 days ending at 8:00 am on



September 28, 2024 (NOAA, 2025). This equates to the amount of rain that would typically fall over a seven-month period falling instead in just 4 days, with the spatial distribution of rainfall totals illustrated in Figure 2 and the exceedance of historical thresholds shown in Figure 3. This tremendous amount of rainfall overwhelmed natural stream channels, causing unprecedented flows and flooding in the Basin as well as other river systems of the Southeast.

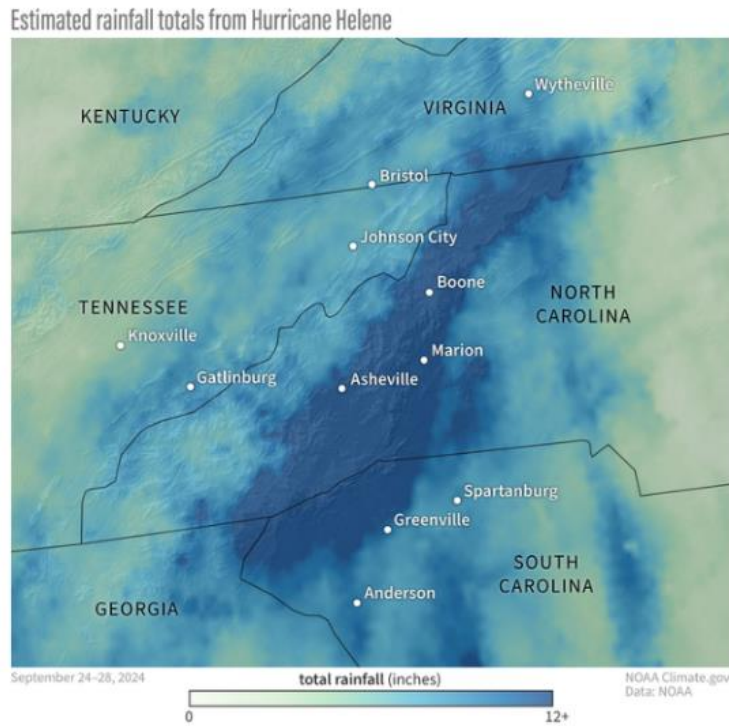


Figure 2. Estimated rainfall total from September 24-28, 2024 (NOAA, 2025).

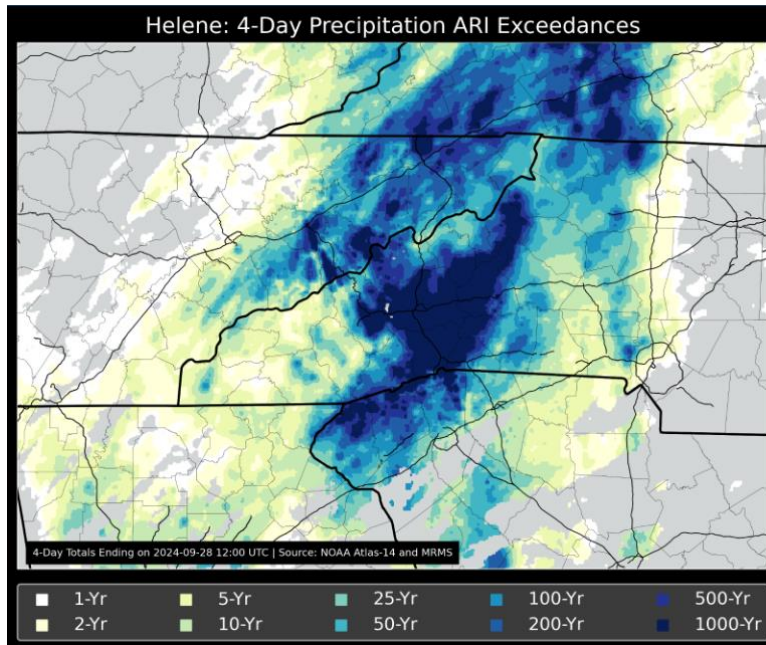


Figure 3. Four-Day precipitation accumulation from NOAA's Multi-Radar/Multi-Sensor System (MRMS), compared against NOAA's Atlas-14 flooding thresholds. Source. NOAA, 2025.

Flooding

The large volume of rainfall, compounded by saturated grounds, caused widespread flooding of rivers and reservoirs, setting record high levels. Areas in the mountainous headwater regions experienced a greater than 1-in-1,000 year flood (NOAA, 2025), consistent with the exceedance patterns shown in Figure 3. This event marked the flood of record for portions of the Catawba River and the reservoirs of Lake James and Cedar Creek Reservoir. While Mountain Island Lake did not reach its flood-of-record level, water levels peaked at approximately 8 feet above its normal full pond late on the evening of September 28. Communities of Mt. Holly, Lucia, and Riverbend Township in Gaston County experienced widespread damage. Further downstream, an additional 89 homes were flooded along the Catawba River in Mecklenburg County. Streamflow response in the upper basin reflects the rapid rise and peak associated with this event, as illustrated by the USGS gage record in Figure 4.

Flooding impacts in the Southeast continued after the rainfall ended and the hurricane dissipated. Large volumes of water were routed through the rivers and reservoirs of the Catawba-Wataeree River system causing a surge of floodwaters downstream into Lake Norman. On September 28, Duke Energy had to open 4 of the 11 flood gates on Cowans Ford Dam on Lake Norman to keep the flood gates from being overtopped amid significant downstream flooding, as shown in Figure 5. Flood-related impacts downstream of Mountain Island Lake were geographically concentrated in several communities, as shown in Figure 6.

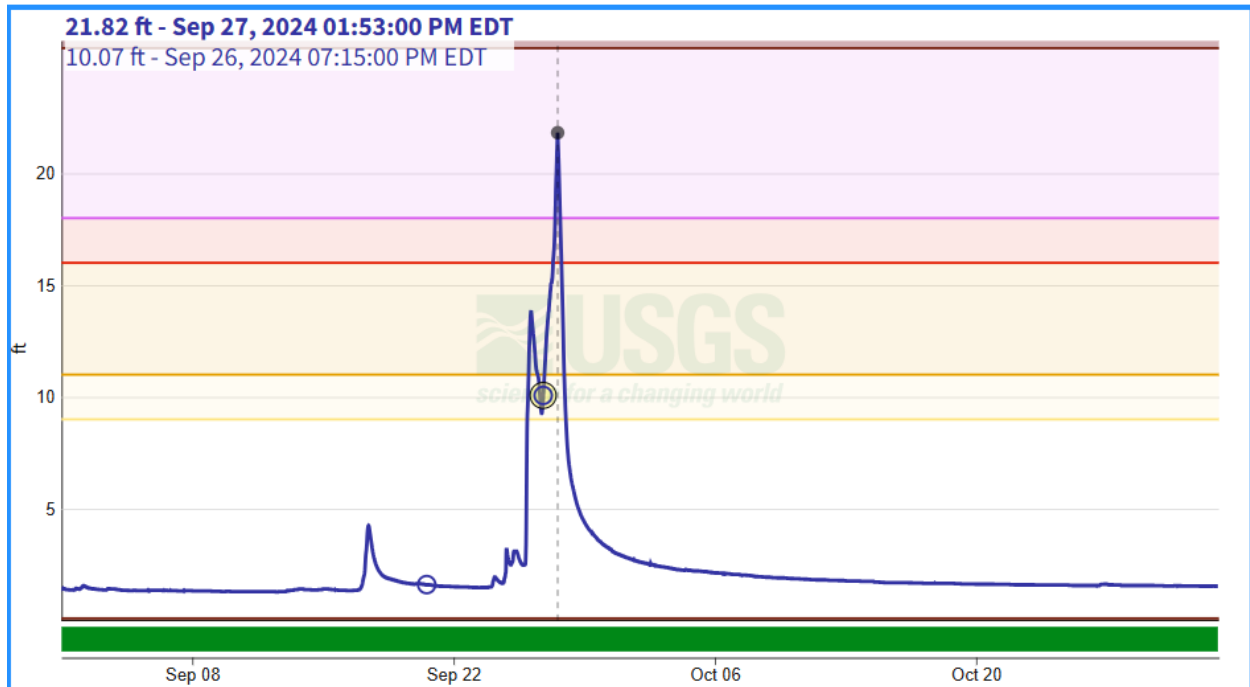


Figure 4. USGS Gage Station 2137727 on the Catawba River near Pleasant Gardens, NC showing peak height greater than 18 feet categorized as a major flow event (Source: USGS).



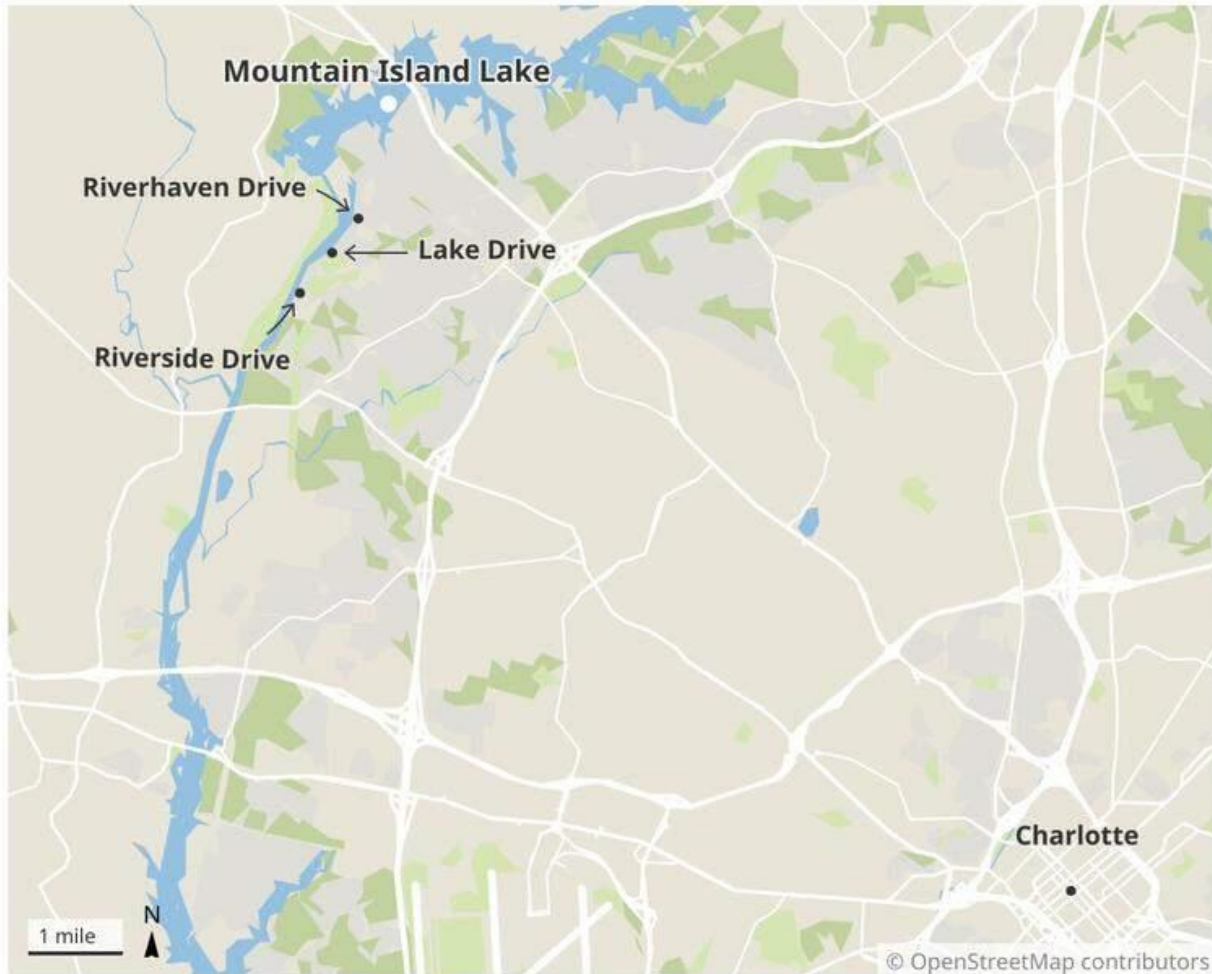
Figure 5. Flooding downstream of Mountain Island Lake, Catawba River

Source: <https://www.yahoo.com/news/photos-reveal-scale-flooding-mountain-214944730.html/>



Helene flood damage: Where it happened

Following Helene, Mecklenburg County Code Enforcement officials inspected about 150 properties on Mountain Island Lake and just south of the lake's dam.



Source: Mecklenburg County Code Enforcement • Map: Gavin Off

Figure 6. Spatial distribution of reported flood-related structural impacts downstream of Mountain Island Lake following Hurricane Helene.

Source: Théoden Janes/Charlotte Observer; [After Helene, flood victims wonder: Should we still be living in this part of Charlotte?](#)



Sources

NOAA, 2025. [Helene in Southern Appalachia](#)

Thomae, Lucas. 2025. Liquid courage: Duke Energy not asking for forgiveness following flooding fiasco. [Duke Energy quietly resolves Catawba flooding fiasco with feds](#). Carolina Public Press.

Thomae, Lucas. 2024. Why NC neighborhoods far from mountains flooded after Helen. [Lake flooding engulfed Charlotte-area homes after Helene](#). Carolina Public Press.

[Our River | Catawba Riverkeeper](#)

U.S. Geological Survey. Water Data for the Nation. [USGS Water Data for the Nation](#)