

**Exceedance Probability Analysis for the Phoenix, AZ Rainfall Event,
19 August 2014**



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The Hydrometeorological Design Studies Center (HDSC) analyzed annual exceedance probabilities (AEPs) for the rainfall event north of Phoenix, AZ that occurred on 19 August 2014. AEP is probability of exceeding a given amount of rainfall at least once in any given year at a given location. It is an indicator of the rarity of rainfall amounts and is used as the basis of hydrologic design. The Phoenix event delivered rainfall amounts that exceeded 7 inches in 12 hours in some locations, causing extreme flash flooding.

The rarity of this event is illustrated in two figures below. Figure 1 shows how the maximum observed rainfall amounts compared to corresponding rainfall frequency estimates for AEPs from 1/2 (50%) to 1/1000 (0.1%) for durations from 15 minutes to 72 hours for a rain gauge north of the Phoenix area - AFRA3, Agua Fria River (34.01556°N, -112.16722°W, 1800 ft elevation). The AFRA3 gauge was obtained from the Hydrometeorological Automated Data System (HADS). The AEPs are estimates from NOAA Atlas 14, Volume 1, Version 5. The upper bound of the 90% confidence interval for 1/1000 AEP is also shown in the figure to illustrate uncertainty associated with the calculation of AEPs, which increase as the AEP becomes smaller. As can be seen from Figure 1, probabilities are less than 1/1000 for durations between approximately 4-hour and 18-hour. Both 6-hour and 12-hour amounts approach or exceed the upper bound of the 90% confidence interval of corresponding 1/1000 estimates.

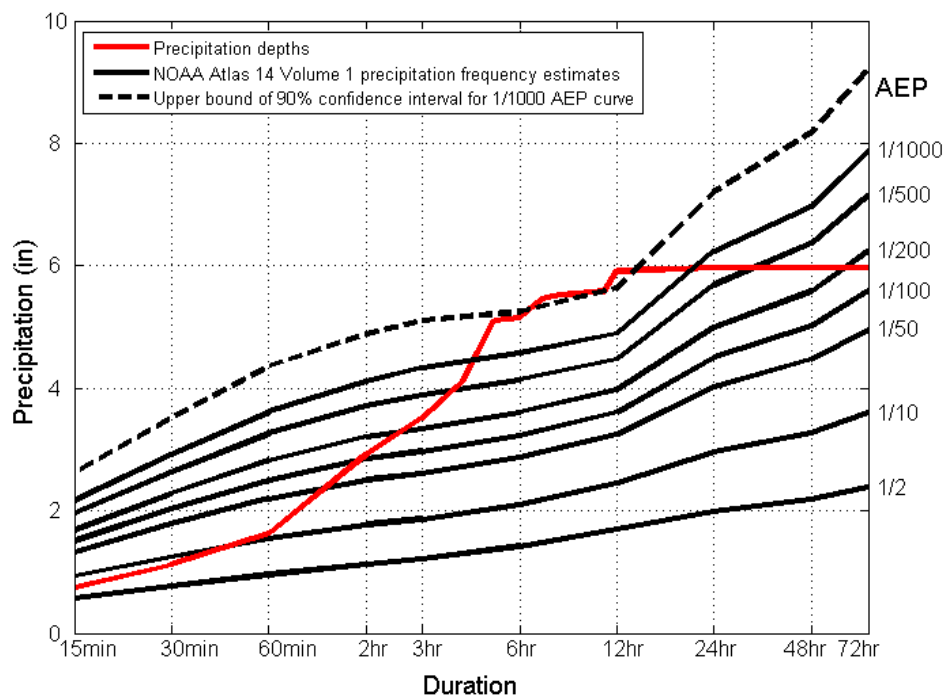


Figure 1. Maximum observed rainfall amounts in relationship to corresponding precipitation frequency estimates for the AFRA3 gauge.

The map in Figure 2 shows the areas that experienced rainfall magnitudes with AEPs ranging from 1/10 (10%) to smaller than 1/1000 (0.1%) for the 12-hour duration. Rainfall amounts are dual-polarization quantitative precipitation estimates (QPE) from the Phoenix, AZ (KIWA) radar. Rainfall frequency estimates are from NOAA Atlas 14, Volume 1, Version 5. The 12-hour duration was selected because it showed the smallest AEPs for the largest area. Note that the beginning and ending of the worst case observation period is not necessarily the same for each location. As a result, this map does not represent isohyets at any particular point in time, but rather the whole event.

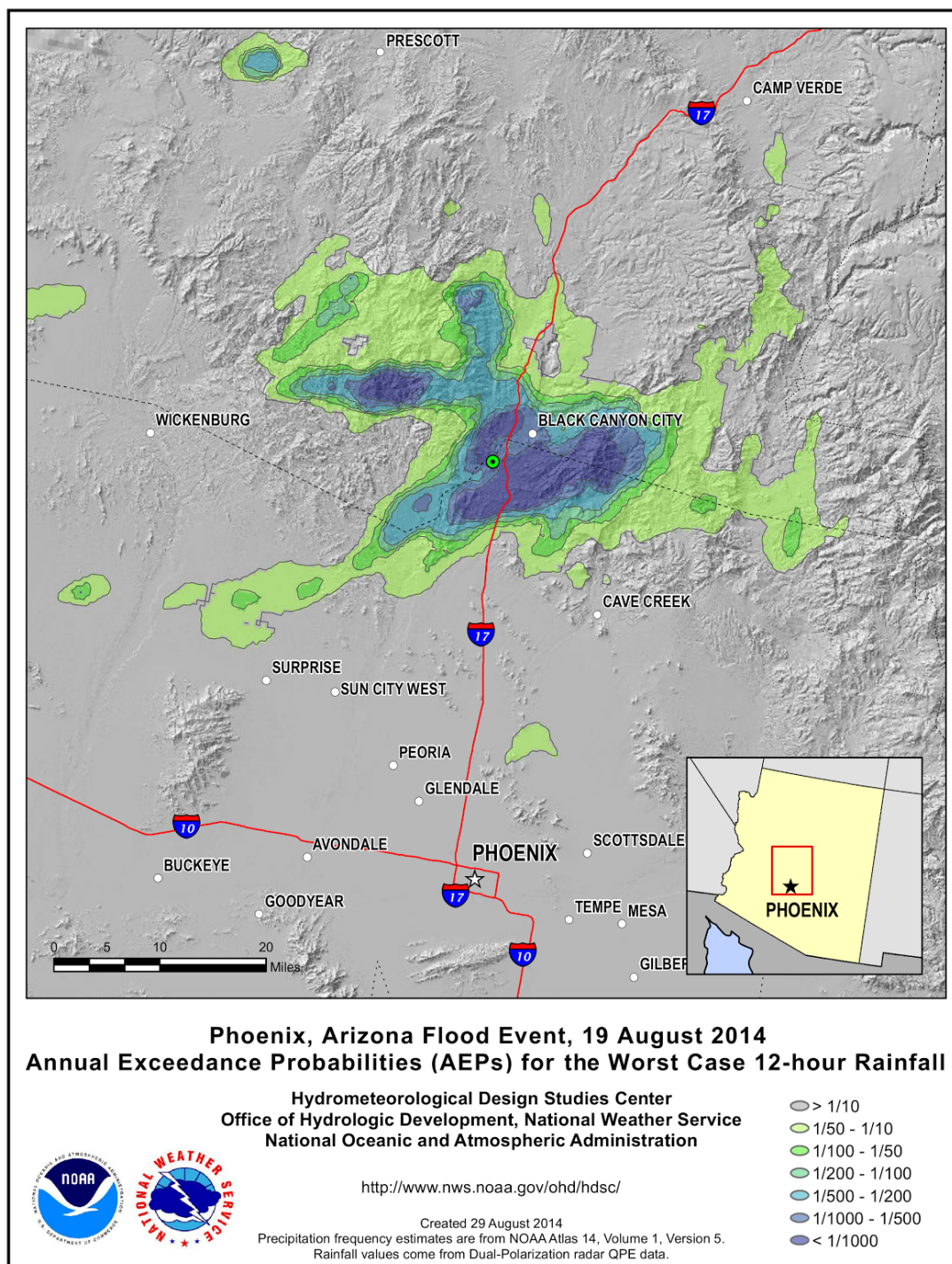


Figure 2. Annual exceedance probability for the worst case 12-hour rainfall. The green dot to the southwest Black Canyon City is the AFRA3 gauge depicted in Fig 1.