GLOBAL WEATHER AND CLIMATE CONSULTING, LLC

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EXPERT WITNESS REPORT OF TODD MORRIS
CERTIFIED CONSULTING METEOROLOGIST (CCM)

Maddox

v.

Holderman

Florence Flood Events
Florence, AZ
2017-2018

Jun 11, 2020

Date/Time of Incidents	February 2017 – September 2018
Location:	21380 E Soledad Lane, Florence, AZ
Prepared for:	David Curl Curl, Glasson & Patrascioiu, PLC Case: Maddox v. Holderman

Assignment

I was tasked with reviewing the weather and rainfall records for the area of Florence, AZ and providing a comparison between 2017 and 2018 with regard to flooding and flooding potential. I also was tasked with evaluating the rainfall event of 21-22 Feb 2019 and comparing it to events between Feb-Oct 2017.

Methodology

I began by collecting and evaluating pertinent weather records for the period of time of the incidents for the given subject location. These records included:

- Maricopa County Automated Local Evaluation in Real-Time (ALERT) rainfall data for all known observations within a 12-mile radius for Oct 2015 – Sep 2018
- Pinal County ALERT rainfall data for all known observations within a 12-mile radius for Oct 2015 – Sep 2018
- National Weather Service (NWS) certifiable Storm Data (including local storm reports) for Oct 2015 – Sep 2018
- NWS certifiable Climatological Data (CD) publications for Oct 2016 – Sep 2018 plus the Annual CDs for 2016-2018
- NWS certifiable Daily Weather Maps for rainfall events greater than 1.00 inches daily occurring between Oct 2015 – Sep 2018
- NWS certifiable WSR-88D Weather Radar data (base reflectivity) for rainfall events greater than 1.00 inches daily and events with rainfall rates exceeding 0.40 inches per hour and occurring between Oct 2015 – Sep 2018
- Citizen Weather Observer Program (CWOP) surface weather observations for all known observations within a 12-mile radius for Oct 2015 – Sep 2018
- United States Forest Service (USFS) Remote Automated Weather Station (RAWS) surface weather observations for all known observations within a 12-mile radius for Oct 2015 – Sep 2018

I examined related archived photos/video from network media as well as archived postings on social media such as Facebook and Twitter.

Background

Climatologically, the Florence, AZ area, like the rest of central AZ, experience two distinct rainfall peak periods – Dec-Mar associated with passing synoptic scale winter storms and Jul-Sep associated with the North American Monsoon[1]. In fact, typically August is the wettest month of the year followed closely by January and July. April-June are typically the driest months of the year. See Figure 1 below.

So as to not split these rainy seasons in any way, hydrologists at all levels/entities have mutually defined a water year (WY) to run from Oct to Sep. This explains the arrangement of months found in Figure 1.

[1] https://www.wrh.noaa.gov/twc/monsoon/monsoon_NA.php

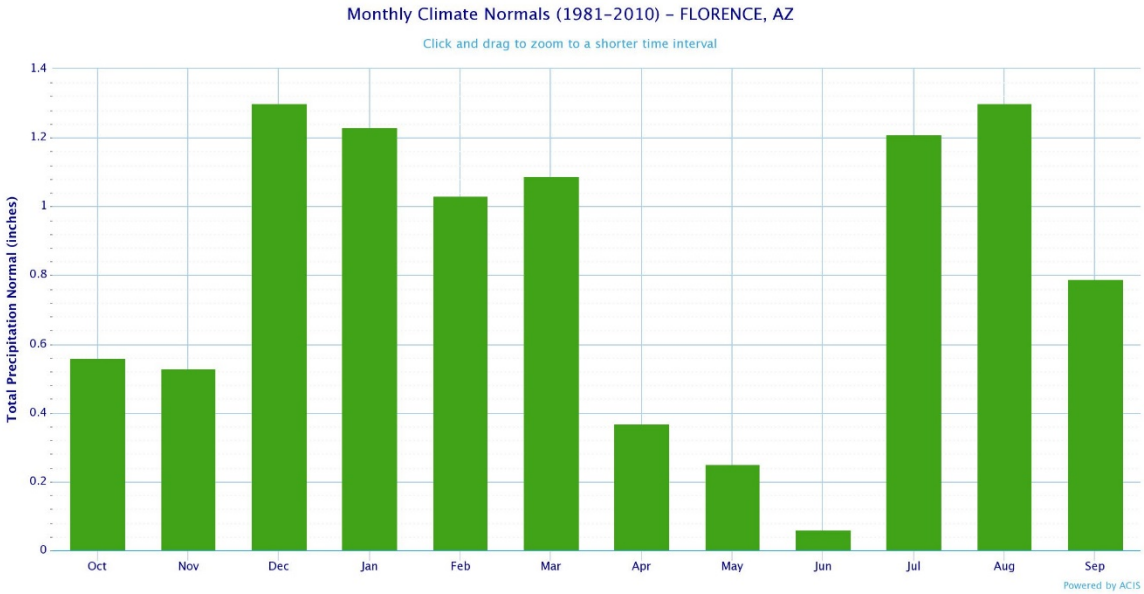

Fig. 1 – Monthly Normal Rainfall in a Typical Water Year – Florence, AZ

While normal rainfall is determined by averaging monthly values over a 30-year period, actual monthly rainfall can vary greatly (and very greatly from site to site). This is especially true in the desert and we will see this is especially true during WY 2016-2018.

The subject location is 3.7 miles to the SE of Florence, AZ and situated in the Cactus Forest Floodplain, a subset of the larger Florence Watershed of the Gila River. At an elevation of 1687 ft above MSL, rain falling in this part of the watershed (as well as areas to the south and east) naturally travels from SE to NW toward the town of Florence at an elevation of 1494 ft above MSL. The Pinal County Flood Control District recently completed a hydraulic analysis and floodplain mapping of this area[2]

A search for representative and reliable surrounding rain gages to make my comparison led to the list found in Fig 2. All six gages used had reliable daily data for the period in question. Five of the six gages used had sub-hourly data for rainfall rate comparisons.

METADATA						
NAME	ID	TYPE	LAT	LON	ELEV	DIST
Incident Location			32.9986	-111.3370	1687	
K9SCH Florence	AS628	CWOP	32.9568	-111.3195	1813	3.1SSE
Florence Black Hill #720	FBHP	ALERT	33.0136	-111.2833	1845	3.3E
Magma FRS #42300	MFRS	ALERT	33.1195	-111.4025	1627	9.2NNW
Florence Abbot #710	FAP	ALERT	32.9756	-111.1694	2520	9.9E
Coolidge Yard #737	CYP	ALERT	32.9788	-111.5147	1450	10.4W
Casa Grande Nat Mon	GRAA3	RAWS	32.9918	-111.5326	1414	11.4W

Fig. 2 – List of Rain Gages Used in Comparison

[2] https://www.pinalcountyaz.gov/PublicWorks/FloodControl/Pages/PublicInformation.aspx

A map of the rain gage locations, relative to the incident location, can be found in Fig 3.

Fig. 3 – Map of Rain Gages Used in Comparison

Rainfall, as it relates to flooding, can be evaluated by either intensity or duration or a combination of both. Long duration low intensity rainfall events can lead to flooding, especially if the antecedent conditions are such that the soils are saturated. This is a more typical condition that is found during the winter months but is not that common in Arizona. Short duration high intensity rainfall events more frequently lead to flooding, especially in Arizona and especially during the summer monsoon. This is often regardless of antecedent soil conditions/types.[3]

Methodology

For purposes of this comparison, daily rainfall amounts were logged for each day in the respective water year (WY) for each of the six stations. For daily rainfall amounts in excess of 0.40 inches, the maximum hourly rainfall rate was calculated. This proved to be very variable from station to station due in part to the nature of convective storms but also due to the distance between stations. The daily rainfall amounts and timing at each station was compared to archived NWS NEXRAD radar data. In the end, the closest rain gage to the incident location was determined to be the most representative of the actual rainfall intensity, duration, and daily amounts at the incident location.

[3] https://www.nssl.noaa.gov/education/svrwx101/floods/types/

Analysis

Figures 4-6 show the daily Florence, AZ rainfall for each of the WY 2016-2018. The total for each month is tallied and additional statistics are provided. Individual days with rainfall amounts in excess of 1.00 inches are highlighted. Monthly totals are highlighted based upon whether the monthly total is above, below, or within 10% of normal for the month.

The data[4][5] clearly shows 1 day in Jan 2016, 1 day in Aug 2016, and 1 day in Jun 2018 where the daily rainfall was in excess of 1.00 inches. The data also shows that there were no days in 2017 where the daily rainfall was over 1.00 inches and in fact there was not a day between Feb 1, 2017 and Jan 31, 2018 where the daily rainfall was over 0.43 inches. The data further shows from a monthly perspective that from Feb 2017 all the way to May 2018, rainfall in the Florence, AZ area was at or mostly below climatological normal rainfall (12 of 16 months).

The data goes on to tell the story that after May 2018, the pattern of successive dry months interspersed with a few near normal months had come to an end. Three of the next four months experienced above normal rainfall and at least 1 day with more than 1.00 inches of rainfall – June 16, 2018.

[4] https://mesowest.utah.edu/
[5] https://xmacis.rcc-acis.org/

K9SCH Florence											Water-Year 2016	
Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.01	0.00	0.05	0.03	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
3	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00
4	0.00	0.06	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00
5	0.14	0.01	0.00	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.28	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.03	0.00	0.00	1.13	0.00	0.00	0.08	0.04	0.00	0.00	0.00	0.13
8	0.00	0.00	0.00	0.10	0.00	0.00	0.13	0.02	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.27	0.00
11	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.82	0.00
12	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.03	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.00
21	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.01
28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.00	0.13
30	0.08	0.00	0.00	0.00		0.00	0.03	0.00	0.09	0.00	0.00	0.00
31	0.00		0.00	0.02		0.00		0.00		0.00	0.00	
Total	**0.95**	**0.72**	**0.61**	**2.18**	**0.17**	**0.00**	**0.51**	**0.07**	**0.12**	**0.41**	**3.57**	**0.33**
Accum	0.95	1.67	2.28	4.46	4.63	4.63	5.14	5.21	5.33	5.74	9.31	9.64
Max	0.28	0.30	0.28	1.13	0.17	0.00	0.27	0.04	0.09	0.36	1.82	0.13
Count	9	5	3	6	1	0	4	3	2	2	8	5
Normal	0.56	0.53	1.30	1.23	1.03	1.09	0.37	0.25	0.06	1.21	1.30	0.79
									Source: https://mesowest.utah.edu/			
									Soure: https://xmacis.rcc-acis.org/			

Maximum Daily Rainfall:	**1.82**
Maximum Monthly Rainfall:	**3.57**
Monsoon Total (6/15/-9/30):	**4.23**
Annual Total (10/1 - 9/30):	**9.64**
Ratio to Annual Mean	**0.99**
Number of Days with Rain:	**48**

Fig. 4 – Daily Rainfall for Florence, AZ for WY 2016

K9SCH Florence										Water-Year 2017		
Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00
2	0.07	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
4	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36
8	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.11	0.00	0.43
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00
14	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
15	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00
16	0.00	0.00	0.05	0.03	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
17	0.00	0.00	0.09	0.01	0.00	0.00	0.00	0.00	0.00	0.37	0.00	0.00
18	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.06	0.00	0.00
19	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.73	0.00	0.30	0.00	0.00	0.00	0.00	0.01	0.00
24	0.05	0.00	0.18	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	0.00	0.14	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0.00	0.00
29	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	0.00	0.00	0.09	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	0.00		0.10	0.00		0.00		0.00		0.00	0.00	
Total	**0.20**	**1.04**	**1.36**	**2.37**	**0.45**	**0.30**	**0.00**	**0.21**	**0.00**	**0.83**	**0.37**	**0.79**
Accum	0.20	1.24	2.60	4.97	5.42	5.72	5.72	5.93	5.93	6.76	7.13	7.92
Max	0.08	0.82	0.53	0.87	0.19	0.30	0.00	0.18	0.00	0.37	0.26	0.43
Count	3	5	8	8	4	1	0	3	0	6	6	2
Normal	0.56	0.53	1.30	1.23	1.03	1.09	0.37	0.25	0.06	1.21	1.30	0.79

Source: https://mesowest.utah.edu/
Source: https://xmacis.rcc-acis.org/

Maximum Daily Rainfall:	**0.87**
Maximum Monthly Rainfall:	**2.37**
Monsoon Total (6/15/-9/30):	**1.99**
Annual Total (10/1 - 9/30):	**7.92**
Ratio to Annual Mean	**0.81**
Number of Days with Rain:	**46**

Fig. 5 – Daily Rainfall for Florence, AZ for WY 2017

K9SCH Florence										Water-Year 2018		
Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.67
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.51	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00
9	0.00	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.56	0.00	0.00
10	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.02	0.19	0.00
11	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.11	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.03	0.00	0.70	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.07	0.05	0.00	0.00
17	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.60
20	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.03	0.00	0.00
30	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.02
31	0.00		0.00	0.00		0.00		0.00		0.00	0.00	
Total	**0.00**	**0.00**	**0.14**	**0.59**	**1.12**	**0.04**	**0.00**	**0.03**	**1.10**	**1.17**	**1.45**	**1.30**
Accum	0.00	0.00	0.14	0.73	1.85	1.89	1.89	1.92	3.02	4.19	5.64	6.94
Max	0.00	0.00	0.14	0.28	0.65	0.04	0.00	0.02	1.07	0.56	0.70	0.67
Count	0	0	1	3	5	1	0	2	2	9	5	4
Normal	0.56	0.53	1.30	1.23	1.03	1.09	0.37	0.25	0.06	1.21	1.30	0.79

Source: https://mesowest.utah.edu/
Source: https://xmacis.rcc-acis.org/

Maximum Daily Rainfall:	**1.07**
Maximum Monthly Rainfall:	**1.45**
Monsoon Total (6/15/-9/30):	**5.02**
Annual Total (10/1 - 9/30):	**6.94**
Ratio to Annual Mean	**0.71**
Number of Days with Rain:	**32**

Fig. 6 – Daily Rainfall for Florence, AZ for WY 2018

I then looked at the possibility of short duration high intensity rainfall events that more frequently lead to flooding, especially in Arizona and especially during the summer monsoon, that may not have been reflected in the monthly or even daily data. I used the rainfall threshold of 0.50 inches per hour to conduct my analysis since this is typically the minimum threshold used by the NWS, in the absence of burn scares and steep terrain where minimum thresholds may be lower. Figure 7 is a list of those dates and the corresponding calculated maximum rainfall rate for the day.

- 09/02/18 - Max Rain Rate = 0.65/hr
- 08/07/18 - Max Rain Rate = 0.51/hr
- 07/09/18 - Max Rain Rate = 0.57/hr

- 06/16/18 - Max Rain Rate = 0.81/hr
- 11/03/16 - Max Rain Rate = 0.64/hr
- 08/20/16 - Max Rain Rate = 0.97/hr
- 08/11/16 - Max Rain Rate = 1.17/hr

Fig. 7 – Dates and Max Rain Rates in WY 2016-2018

As you can see from the list, there is not one day in calendar year 2017 on this list where the rainfall rate exceeded minimum flash flood threshold guidance.

To further validate this analysis and the method used, I examined an extra event in which both parties in this matter were witness to. This event occurred Feb 21-22, 2019 in which 1.50-2.00 inches of rain fell over the 2 days at the 6 stations used in the analysis. The closest and most comparative station reported 1.00 inches and 0.93 inches respectively for a 2-day total of 1.93 inches of rain. See Figure 8.

METADATA		REPORTED RAINFALL			
NAME	DIST	21-Feb-19	22-Feb-19	2-Day Total	Peak Rate
Incident Location					
K9SCH Florence	3.1SSE	1.00	0.93	1.93	0.24
Florence Black Hill #720	3.3E	0.90	0.83	1.73	0.20
Magma FRS #42300	9.2NNW	1.00	0.64	1.64	0.24
Florence Abbot #710	9.9E	1.14	0.91	2.05	0.60
Coolidge Yard #737	10.4W	0.98	0.63	1.61	0.20
Casa Grande Nat Mon	11.4W	1.07	0.64	1.71	0.17

Fig. 8 – Rainfall for 21-22 Feb 2019 Event

The data in Figure 8 show a widespread significant 2-day rainfall event occurred with peak rainfall rates generally around 0.24 inches per hour. A single higher rainfall rate occurred in the foothills to the east (note higher elevation location), reaching as high as 0.60 inches per hour. In this event, both parties reported no flooding in the Florence, AZ area and not at the incident location.

Conclusion/Opinion

Based upon the provided data, and reviewing all the available official and unofficial information, it is my professional opinion that:

1. If no flooding was reported in the 21-22 Feb 2019 event, and
2. There were no high intensity (flash flood threshold) rainfall events in 2017, and
3. There were no long-duration heavy rainfall events with antecedent saturated soils due to above normal monthly rainfall in 2017

Then there were no flooding events that occurred at the subject location during 2017. The higher daily rainfall, more frequent rainfall days, higher individual storm intensities in 2016 and 2018 is simply a reflection of the diversity of the rainfall in Arizona both in time and space.

Certification

I certify that the above information contained in this report is true and accurate to the best of my ability and that all analysis and findings expressed in this report were made with accuracy as a professional meteorologist within a reasonable degree of meteorological certainty.

Todd Morris

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