

Skunk Creek @ I-17, July 23, 2021 4:07 PM MST, Courtesy FCDMC O & M Division

Flood Control District of Maricopa County

Engineering Division, Flood Warning Branch

Storm Report : July 22-25, 2021

Revision 1, Aug. 19, 2021



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METEOROLOGY

A high-grade monsoon pattern strongly aided by a slow-moving inverted trough led to widespread heavy rain across southcentral Arizona during a four-day period ending on July 25th 2021. Maricopa County rain gages measured event totals anywhere from 1.00"-5.30". Residents in Phoenix, Scottsdale, New River, Glendale, Avondale, Surprise, Buckeye, and many other communities experienced significant flash and urban flooding due to heavy rain from this event.

Synopsis:

In the days leading up to the event, District staff as well as many other Federal agencies kept close tabs on weather model guidance that depicted an upcoming multi-day active period to the North American Monsoon. The setup featured a "Four Corners High" pattern (click [here](#) for more background information) and near record moisture values that were already in place across the Desert Southwest. Additionally, a large upper-level disturbance was forecast to affect the region. These disturbances, also known as inverted troughs (IT), are historically quite common to the region during the summer months. They typically form in the Gulf of Mexico and move east to west bringing enhanced/organized t-storm activity. Please refer to the following [page](#) for more background information.

The IT took shape across central Texas during July 20th and 21st before strengthening as it moved into West TX. The synoptic setup on the morning of July 23rd is shown in Figure 1 (below). The upper-level images (C and D) depict the aforementioned ridge draped across the Four Corners region of the western US and the IT along the TX/NM border. Images A and B depict the moisture rich environment in place across AZ. It's worth noting that the positioning of the ridge and trough during this period created a large area of upper-level divergence (rising motion), which proved to be a strong catalyst for t-storm activity across southcentral AZ (more on this in the next section). Ultimately, the IT slowly traversed west across NM on the 24th and then across Arizona on the 25th. In fact, the circulation center passed through Maricopa County during the late morning hours on Sunday July 25th. This system helped spawn multiple waves of organized thunderstorms that lead to periods of severe weather, heavy rainfall, and flash flooding across six states encompassing the Desert Southwest. A GOES-16 Water Vapor loop showing much of the IT's path can be viewed [here](#).

Mesoscale Analysis and Storm Summary:

Four general waves of storms spanning four days brought widespread rain to most of Maricopa County. While the IT proved to be the larger scale catalyst for the duration of the event, each wave of storm activity had unique mesoscale features and drivers worth discussing. Additional information on the heavy rainfall and flash flooding potential/setup conveyed by the Storm Prediction Center (SPC) and/or Weather Prediction Center (WPC) was also provided. The National Weather Service Phoenix WFO created a radar loop covering most of the event which can be viewed [here](#). This loop provides a visual context to the following summary.

The first wave of thunderstorms began during the evening hours of Thursday July 22nd and continued into the early morning hours Friday. Multiple outflow boundary collisions, generated from late afternoon higher terrain convection, led to the development of severe t-storms across portions of the central Phoenix Valley. More details on the near-storm environment provided by SPC can be found [here](#). Initially, damaging wind gusts were the main impacts from these storms. However, as activity matured a greater flash flood threat emerged over the Phoenix urban corridor. A large cluster of nearly stationary storms dropped 1.00"-2.40" in a ninety-minute period over Scottsdale. There were numerous reports of urban flooding and road closures around Old Town Scottsdale. District gages measured large flows along Indian Bend Wash (IBW) and its tributaries. Additional heavy rain (0.50"-1.50") fell across portions of the southeast Valley including Chandler, Mesa, Queen Creek, and the San Tan Valley. Twelve hour rainfall totals from the ALERT network can be viewed [here](#).

Round two got underway just after dawn on Friday the 23rd and continued into the evening hours. Activity from the night before grew upscale into a mesoscale convective system across central AZ. This feature slowly moved south across Maricopa and Pinal Counties providing a near steady-state environment for training showers and t-storms. A full description of the heavy rain and flash flooding potential was conveyed by the Weather Prediction Center through its mesoscale precipitation discussions [here](#) and [here](#). Rainfall totals in the 1.00"-4.00" range were recorded across northern county watersheds. Notable flows were recorded in New River, Skunk Creek, Cline Creek, and Cave Creek. Additional flooding was reported along IBW and in the Town of Fountain Hills. District dams including New River, Adobe, and Cave Buttes ultimately saw small impoundments due to runoff from this bout of rain. Twelve hour rainfall totals from the ALERT network can be viewed [here](#).

The third wave began just after midnight on Saturday July 24th and continued through the late morning hours. A decaying tropical wave moved south out of Gila and Yavapai Counties and across the eastern-half of Maricopa County. Showers mixed with embedded t-storms brought longer-duration moderate rainfall to Scottsdale, Tempe, Chandler, Mesa, Gilbert, Queen Creek, and Apache Junction. More details on the setup are provided by WPC [here](#). In general, District gages received 0.25"-1.00". This rain combined with already soaked watersheds from the previous day was enough to trigger flows in area washes/channels including Indian Bend Wash, Queen Creek, and the East Maricopa Floodway. District gages also measured small impoundments behind Vineyard and Rittenhouse dams. Twelve hour rainfall totals from the ALERT network can be viewed [here](#).

The fourth wave spanned the late evening of July 24th straight through the afternoon of July 25th. A decaying mesoscale convective vortex with showers and embedded t-storms rolled southwest off the higher terrain into northern and western portions of Maricopa County Saturday night lasting into the pre-dawn hours on Sunday. The District's mesonet recorded anywhere from 0.25"-1.00" with this line which helped soak watersheds. After sunrise, numerous convective t-storms developed across the central and west Valley lasting into the afternoon hours. The main driver of this activity was forcing from the heart of the disturbance as it passed through southcentral AZ. More details on the setup from WPC can be found [here](#). The most notable rain and flooding occurred from the I-17 corridor west through the White

Tank Mountains where communities saw anywhere from 1.00”-3.00”. Numerous reports of urbanized flooding of roads, neighborhoods, channels/basins were recorded in Surprise, Sun City, Avondale and Buckeye. District stream gages also measured flows on Rainbow Wash, Waterman Wash and Bullard Wash. Twenty-four hour rainfall totals from the ALERT network can be viewed [here](#). The IT finally shifted west/northwest out of the region on Sunday evening bringing the event to a close.

4-Panel 12Z (5:00am MST) Synoptic Setup 07/23/2021

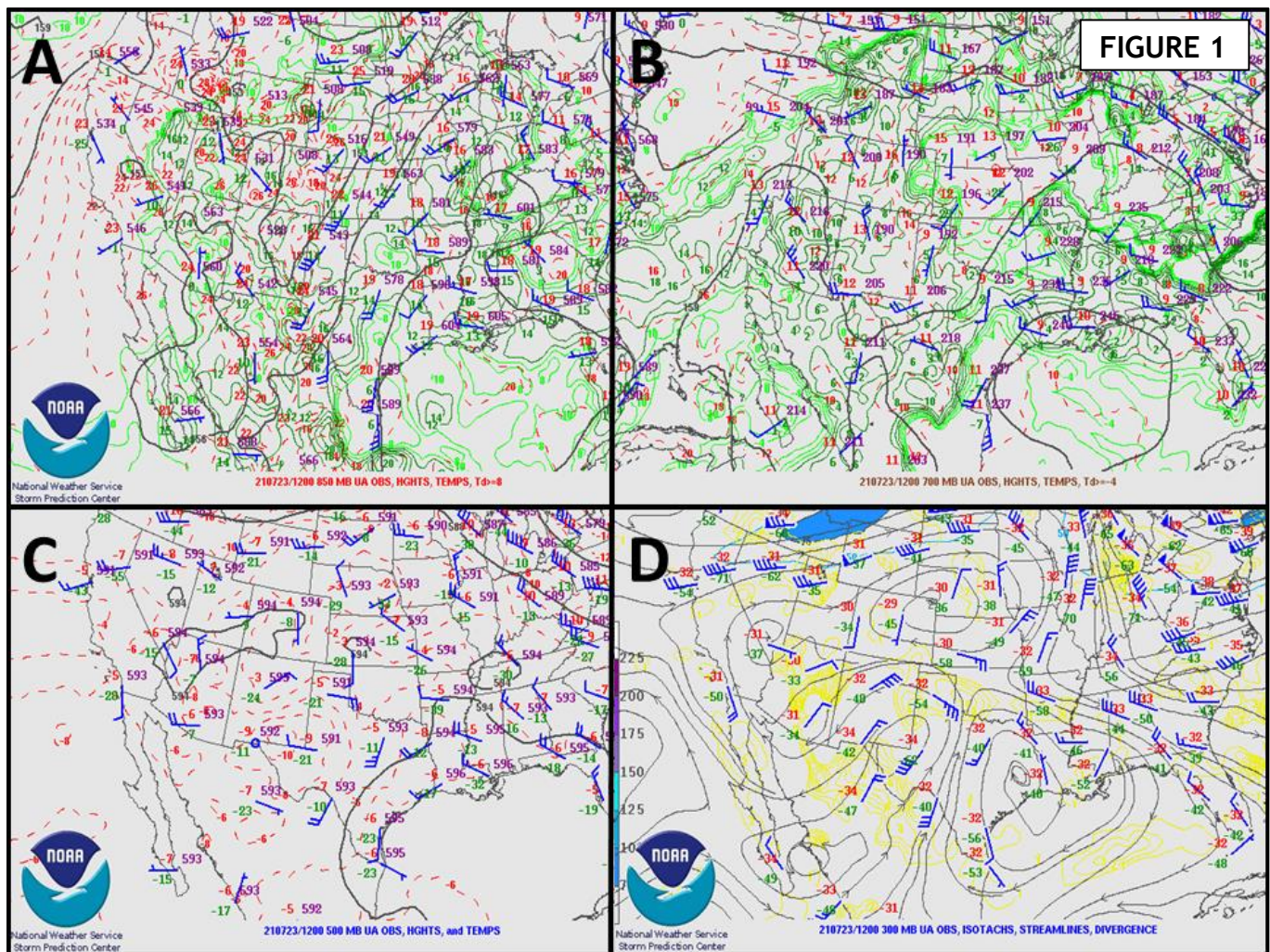


Figure 1: depicts the synoptic setup at 12Z (5:00 AM MST) on July 23rd, 2021. The images are from the Storm Prediction Center upper air maps archive. **A)** is the 850mb map: the black lines are heights, the red dashed lines are isotherms, the green lines are isodrosotherms, blue barbs are wind speed, and station observations are plotted at each available location. **B)** is the 700mb map: variables colored the same as A. **C)** is the 500mb map: variables colored the same as in A. **D)** is the 300mb map: the black lines are stream lines, the yellow lines are divergence, and station observations are plotted at each available location.

PRECIPITATION

Summary Statistics:

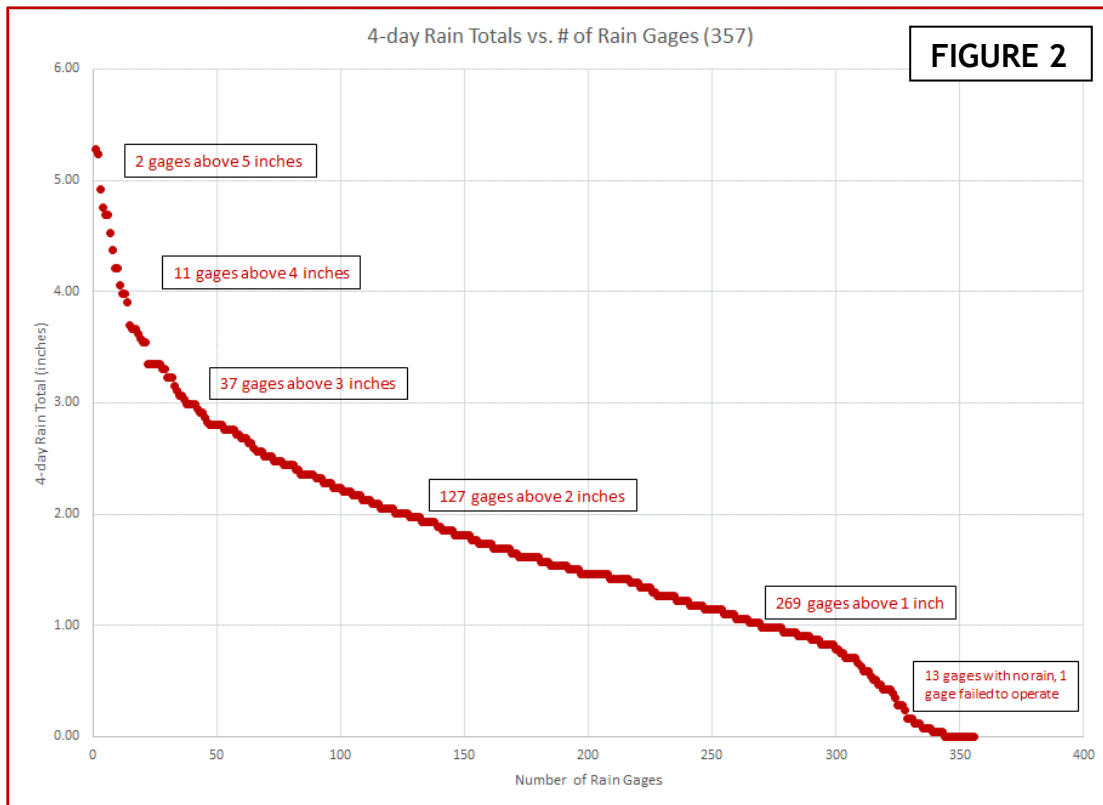


Figure 2 above presents a plot of rainfall amounts for all FCDMC ALERT rain gages for the period 7/22/2021 0:00 through 7/25/2021 24:00. Thirteen gages, mostly in the west and southwest County, recorded no rain, and one gage failed to operate. Tabular hourly data for all gages for the 4-day period is available [here](#).

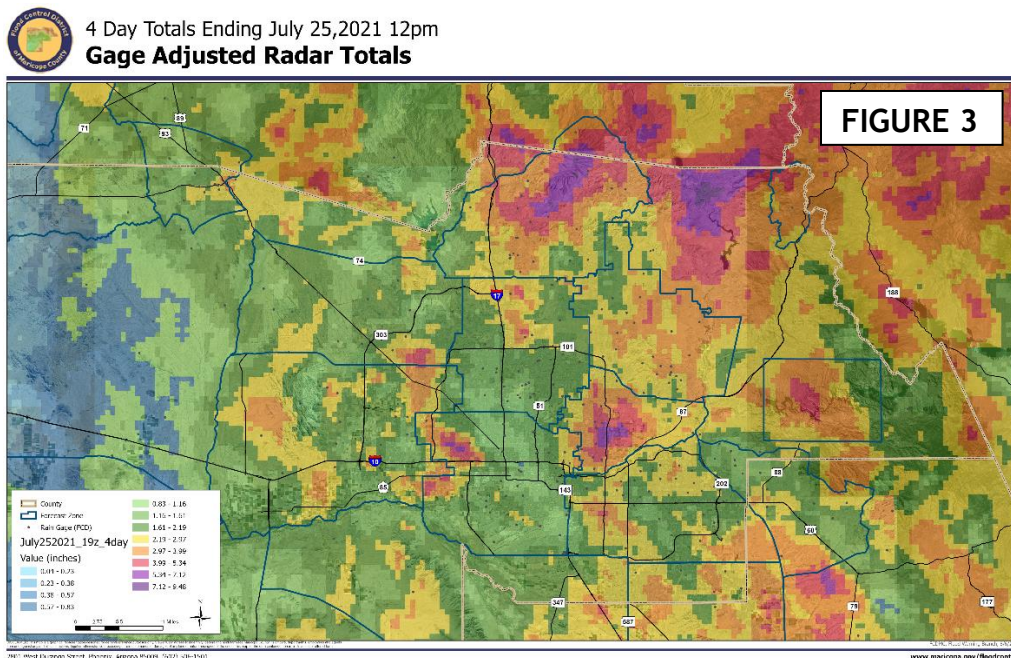


Figure 3 above presents an image of rainfall amounts for all FCDMC ALERT rain gages for the period 7/21/2021 12:00 through 7/25/2021 12:00. Click the image for a full-size view in your browser. Use CTRL +/- to zoom in/out.

Pre-Storm: Rainfall from 7/21/2021 at Noon through 7/22/2021 at Noon

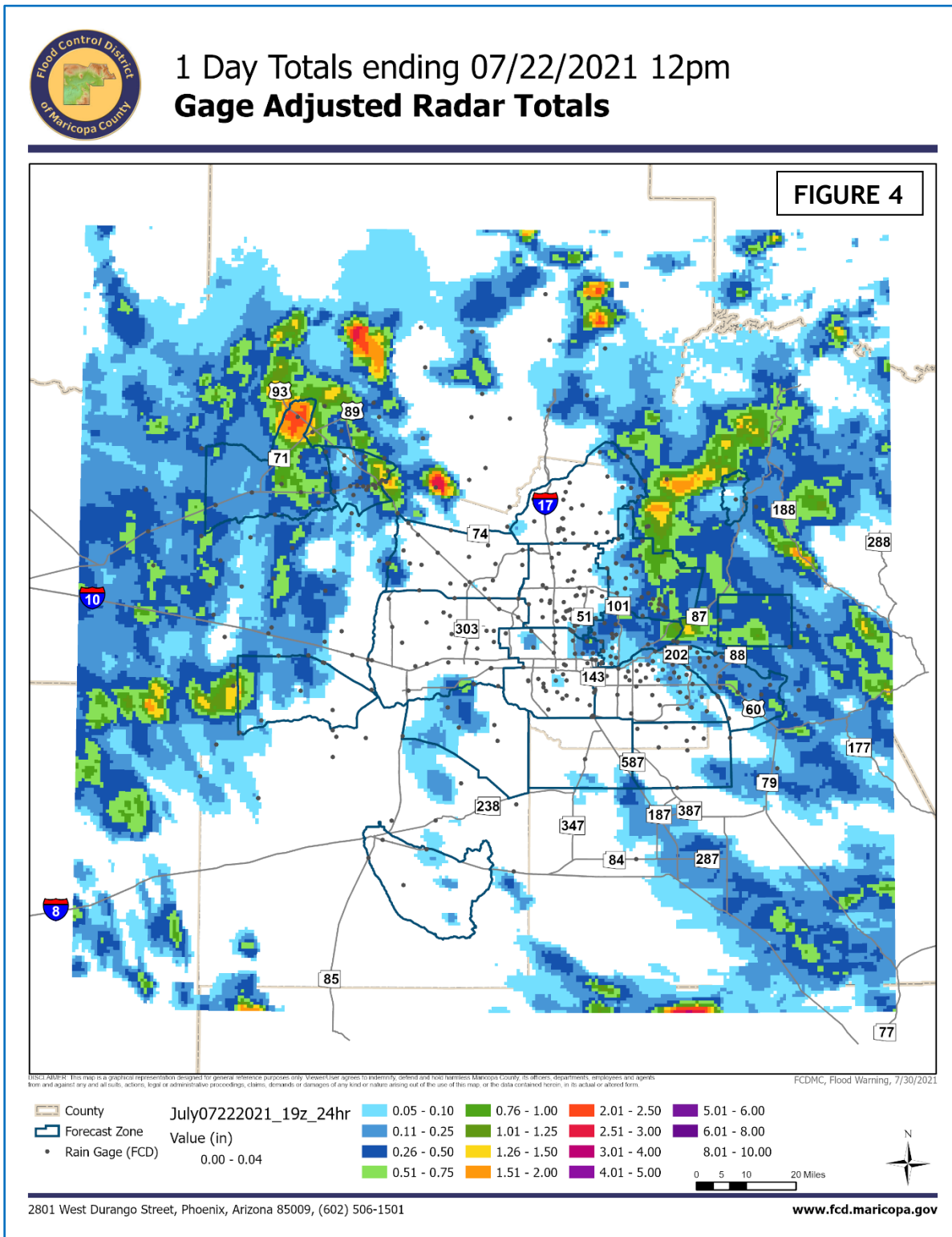


Figure 4 above presents an image of rainfall amounts from gage-adjusted radar rainfall estimates for the period 7/21/2021 12:00 through 7/22/2021 12:00. To see a map of the recorded gage amounts for this period click [here](#).

Rainfall from 7/22/2021 at Noon through 7/23/2021 at Noon

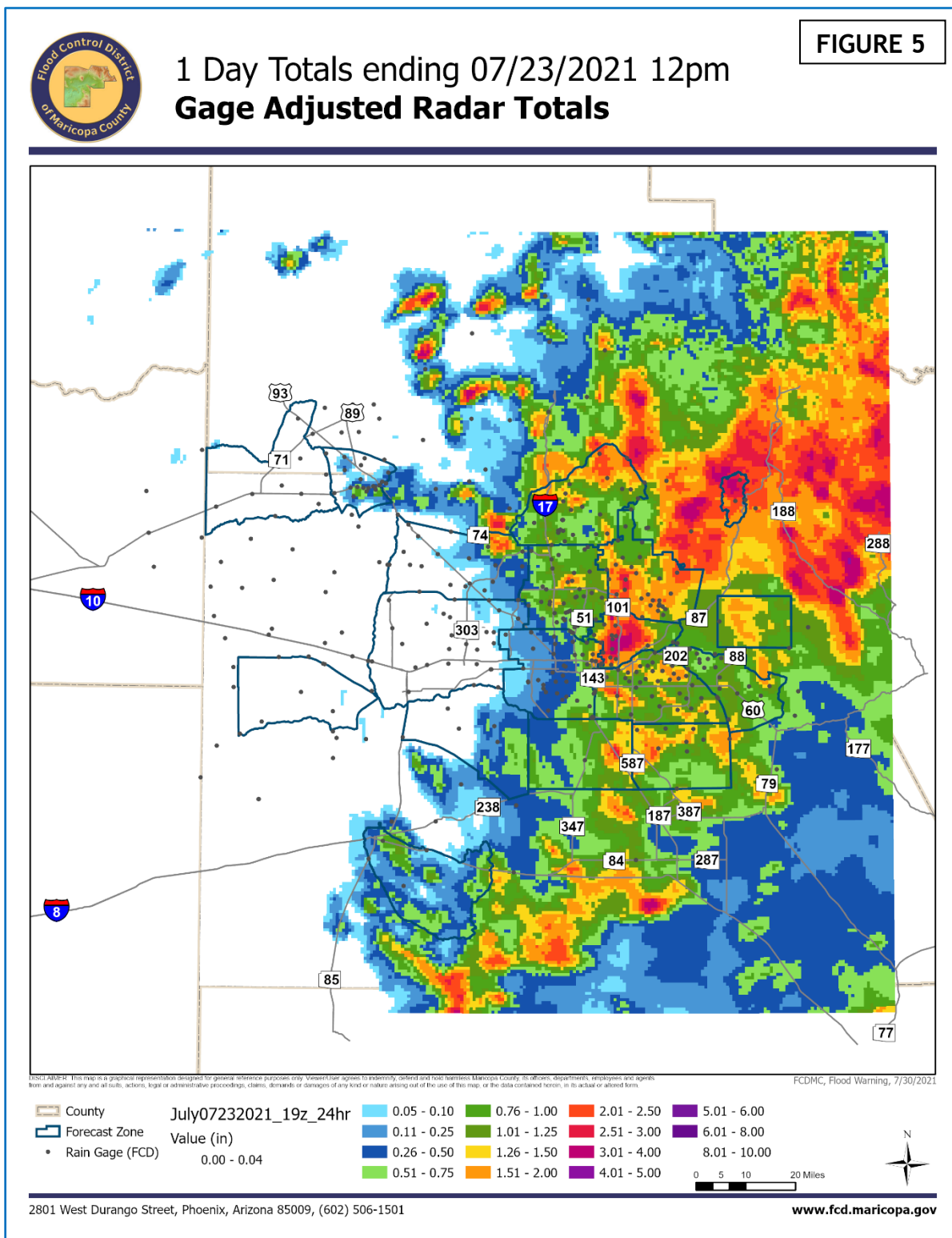


Figure 5 above presents an image of rainfall amounts from gage-adjusted radar rainfall estimates for the period 7/22/2021 12:00 through 7/23/2021 12:00. To see a map of the recorded gage amounts for this period click [here](#).

Rainfall from 7/23/2021 at Noon through 7/24/2021 at Noon

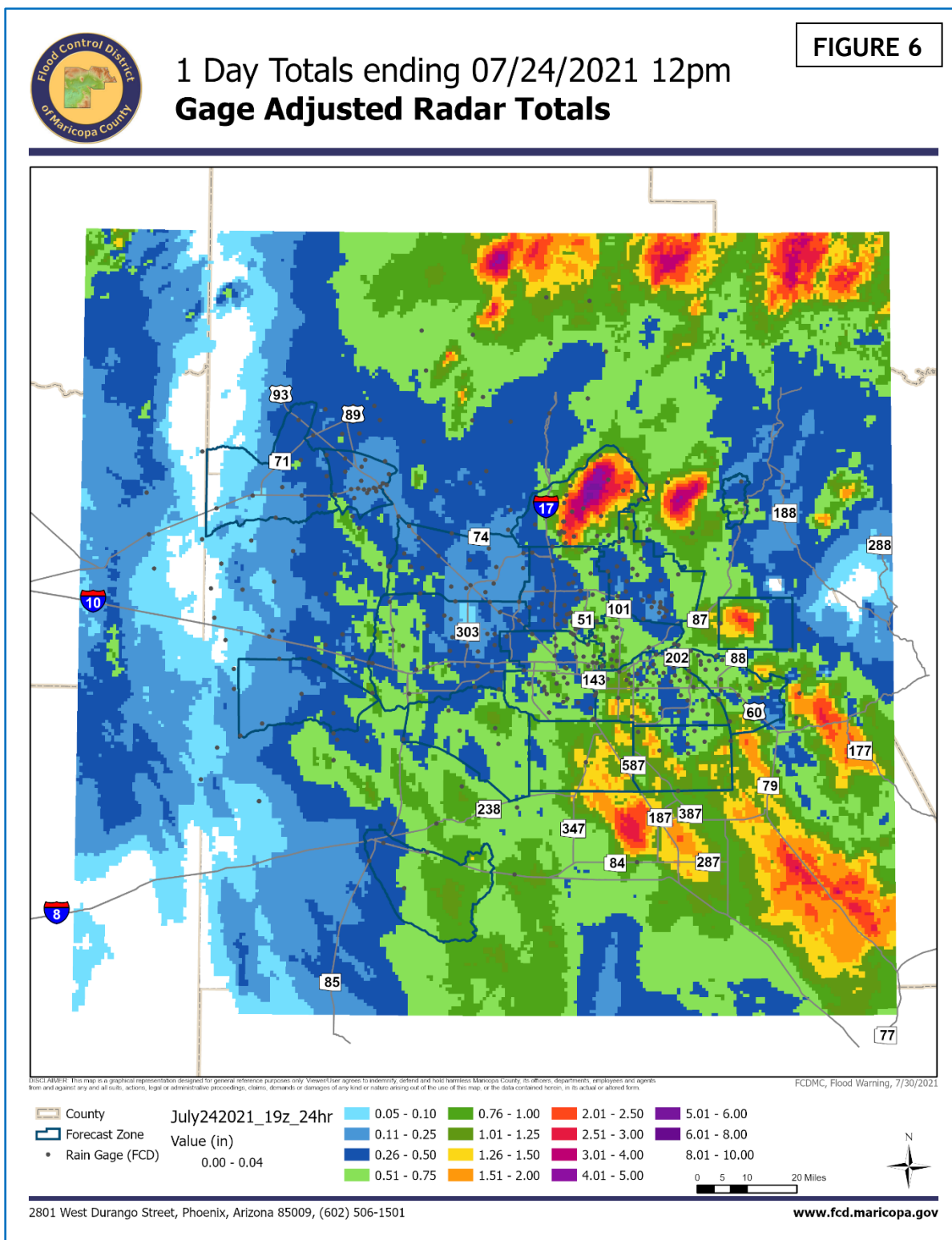


Figure 6 above presents an image of rainfall amounts from gage-adjusted radar rainfall estimates for the period 7/23/2021 12:00 through 7/24/2021 12:00. To see a map of the recorded gage amounts for this period click [here](#).

Rainfall from 7/24/2021 at Noon through 7/25/2021 at Noon

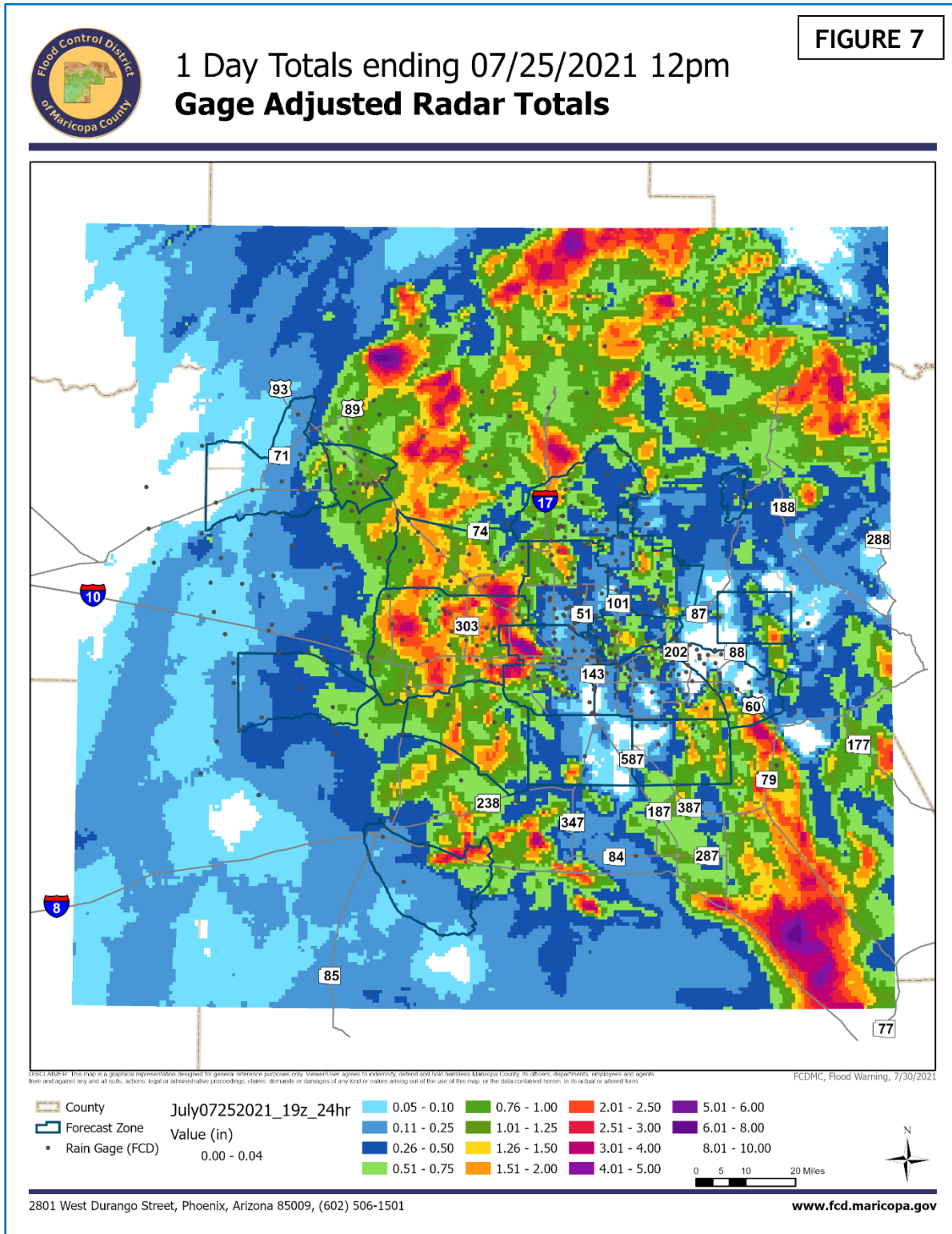


Figure 7 above presents an image of rainfall amounts from gage-adjusted radar rainfall estimates for the period 7/24/2021 12:00 through 7/25/2021 12:00. To see a map of the recorded gage amounts for this period click [here](#).

Post Storm: Rainfall from 7/25/2021 at Noon through 7/26/2021 at Noon

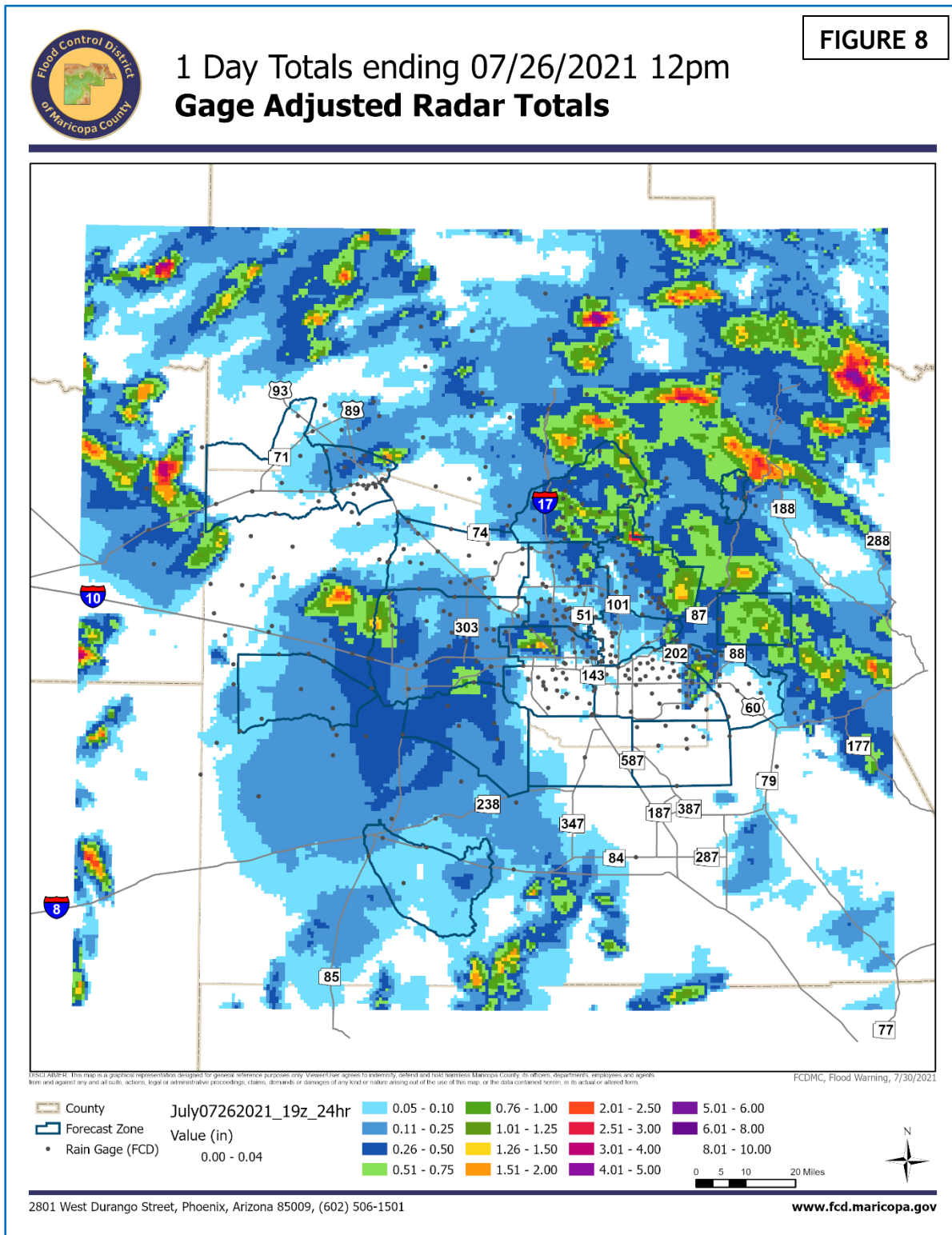


Figure 8 above presents an image of rainfall amounts from gage-adjusted radar rainfall estimates for the period 7/25/2021 12:00 through 7/26/2021 12:00. To see a map of the recorded gage amounts for this period click [here](#).

				Rain in Inches, Return Periods in Years																							
ID	Name	Located	Elev. (ft)	15min Rain	15min Ret.Per.	30min Rain	30min Ret.Per.	1hr Rain	1hr Ret.Per.	2hr Rain	2hr Ret.Per.	3hr Rain	3hr Ret.Per.	6hr Rain	6hr Ret.Per.	12hr Rain	12hr Ret.Per.	1day Rain	1day Ret.Per.	2day Rain	2day Ret.Per.	3day Rain	3day Ret.Per.	4day Rain	4day Ret.Per.		
70700	Gila R. @ 116th Ave.	Avondale	955	0.43	1	0.75	3	1.10	5	1.38	8	1.61	13	1.69	10	1.81	10	1.89	5	2.24	8	2.28	7	2.28	6		
85000	Agua Fria R. @ Buckeye Rd.	Avondale	970	0.35	1	0.59	2	1.02	4	1.61	16	1.85	27	2.13	35	2.20	29	2.28	11	2.44	10	2.44	8	2.44	7		
44600	Camelback Rd. @ Turner Rd.	Buckeye	1,410	0.43	1	0.71	2	0.94	3	1.22	4	1.30	4	2.13	20	2.20	16	2.24	7	2.80	13	2.80	10	2.80	8		
48300	Sun Valley Pkwy. @ Northern	Buckeye	1,400	0.43	1	0.83	3	1.46	11	1.93	25	1.97	22	2.60	55	2.76	51	2.87	22	3.31	31	3.31	22	3.31	11		
48800	Buckeye FRS # 3	Buckeye	1,150	0.28	1	0.35	1	0.55	1	0.98	2	1.38	6	2.01	22	2.17	22	2.24	8	2.72	12	2.72	9	2.72	8		
87800	White Tank FRS # 4	Buckeye	1,035	0.24	1	0.39	1	0.71	1	1.02	3	1.26	5	1.89	20	2.09	24	2.20	8	2.64	12	2.64	9	2.64	8		
18700	Desert Mountain School	Desert Hills	1,810	0.71	4	1.22	11	1.50	10	1.57	8	1.61	7	1.77	7	2.28	12	2.48	8	2.80	8	3.35	12	3.35	9		
19300	Desert Hills Wash	Desert Hills	1,860	0.71	4	0.98	4	1.50	10	1.93	18	2.05	20	2.20	17	2.60	22	2.76	11	3.07	10	4.21	28	4.21	19		
64700	Skunk Tank Wash	Desert Hills	1,865	0.71	4	1.06	6	1.42	8	1.50	6	1.54	5	1.73	5	2.13	7	2.52	7	2.87	7	3.66	13	3.66	10		
42300	Magma FRS	Florence Jctn.	1,605	0.67	5	0.83	4	1.02	3	1.22	4	1.38	6	1.38	3	1.38	2	2.44	9	2.76	10	3.90	34	3.90	25		
77800	Cloudburst Wash	Fountain Hills	2,580	0.79	6	1.18	10	1.38	7	1.57	8	1.61	8	1.73	6	2.01	6	2.09	3	2.44	3	2.80	3	2.80	2		
42000	Gila R. @ Olberg	Gila R. I. C.	1,305	0.35	1	0.39	1	0.67	1	0.83	2	0.83	1	0.83	1	1.18	1	1.30	1	2.05	4	2.80	10	2.80	8		
35100	EMF @ Hunt Hwy.	Gilbert	1,295	0.51	3	0.63	2	0.63	1	0.79	1	0.83	1	1.42	5	1.61	5	1.65	3	2.72	14	2.91	15	2.91	12		
61500	New River @ Glendale Ave.	Glendale	1,060	0.67	6	1.06	10	2.01	86	2.64	273	2.83	312	2.87	219	2.99	209	3.11	52	3.31	42	3.31	30	3.31	23		
85800	Dysart Drain @ Luke AFB	Glendale	1,075	0.51	3	0.91	7	1.22	9	1.34	9	1.61	18	1.73	16	2.05	26	2.17	8	2.24	7	2.24	6	2.24	5		
83300	Waterman Wash @ R. V. Rd.	Goodyear	1,020	0.63	4	0.98	6	1.14	5	1.26	5	1.61	13	2.05	23	2.09	20	2.09	9	2.56	16	2.56	11	2.56	8		
84000	Waterman Wash	Goodyear	1,315	0.24	1	0.35	1	0.63	1	1.14	3	1.65	13	1.73	10	1.81	10	1.81	6	2.32	13	2.48	9	2.48	6		
89500	Bullard Wash @ Indian School	Goodyear	1,025	0.55	3	0.94	7	1.30	10	1.42	11	1.57	15	1.77	17	1.89	16	1.97	5	2.01	4	2.01	4	2.01	3		
31700	Carriage Lane Park	Mesa	1,185	0.87	21	1.18	22	1.22	10	1.22	6	1.22	5	1.22	3	1.46	4	1.81	5	2.76	18	3.07	23	3.07	18		
34200	Greenfield Rd. @ Adobe Rd.	Mesa	1,335	0.39	1	0.63	2	0.71	2	0.83	2	0.91	2	1.30	4	1.61	6	1.93	6	2.20	6	2.72	12	2.72	9		
34500	Williams Field Road	Mesa	1,455	0.87	17	1.06	11	1.06	5	1.06	3	1.06	3	1.61	8	1.89	11	1.93	5	2.60	13	4.06	73	4.06	20		
35800	US 60 @ Ellsworth Rd.	Mesa	1,470	0.51	3	0.51	1	0.83	2	0.91	2	0.91	2	0.94	1	1.02	1	1.18	1	2.13	5	2.99	15	2.99	10		
66200	Skunk Cr. near New River	New River	2,190	0.98	11	1.34	12	1.57	9	1.57	5	1.73	7	2.01	8	2.56	11	3.15	11	3.78	15	5.24	42	5.24	25		
3800	Grand Ave. @ 27th Ave.	Phoenix	1,100	0.91	18	1.46	44	1.57	22	1.57	14	1.57	12	1.57	6	1.57	4	1.61	3	2.09	6	2.24	6	2.24	5		
4300	Phoenix Zoo Dam #3	Phoenix	1,245	0.63	6	0.83	6	1.26	12	1.30	9	1.30	7	1.30	4	1.57	6	2.20	10	2.72	15	3.03	19	3.03	15		
6000	GCU Golf Course	Phoenix	1,110	0.59	3	1.06	10	1.81	45	2.44	155	2.48	124	2.48	67	2.52	52	2.72	29	3.15	35	3.23	30	3.23	24		
6200	Buckeye Rd. @ 75th Ave.	Phoenix	1,025	0.71	7	1.38	34	1.93	66	2.09	65	2.09	49	2.09	27	2.32	34	2.32	13	2.72	17	2.76	14	2.76	12		
14200	Deer Valley Airport	Phoenix	1,480	0.47	1	0.67	2	0.91	2	0.91	1	0.91	1	0.91	1	1.26	2	1.69	2	1.69	2	2.87	10	2.87	8		
36300	Sonoqui Wash near Hawes Rd.	Queen Cr.	1,380	0.55	3	0.75	3	0.75	2	0.75	1	0.75	1	1.22	3	1.46	3	1.46	2	2.01	4	3.15	20	3.15	16		
75500	Asher Hills	Rio Verde	1,660	0.39	1	0.63	2	1.02	3	1.34	6	1.46	7	1.57	5	1.81	5	2.36	6	2.64	6	3.66	15	3.70	12		
56000	Osborn Rd. @ 54th St.	Scottsdale	1,255	0.67	7	0.94	8	1.26	11	1.34	9	1.34	7	1.34	4	1.65	7	2.48	15	3.07	25	3.54	36	3.54	27		
56500	IBW @ Indian School Rd.	Scottsdale	1,240	0.94	30	1.69	152	2.24	238	2.24	122	2.24	82	2.36	62	2.64	82	3.70	140	4.06	112	4.69	171	4.69	116		
56600	El Dorado Park	Scottsdale	1,220	0.51	3	0.94	8	1.57	32	1.57	19	1.57	15	1.61	9	1.97	16	2.72	25	3.31	38	3.98	70	3.98	51		
56800	IBW Interceptor Channel	Scottsdale	1,280	0.98	36	1.26	29	1.38	16	1.38	10	1.38	7	1.42	5	1.85	10	2.95	37	3.19	30	4.21	88	4.21	62		
57500	Granite Reef Wash	Scottsdale	1,195	0.47	2	0.91	7	1.30	13	1.30	8	1.30	6	1.38	5	1.69	7	2.52	18	2.99	23	3.54	39	3.54	29		
57700	Thunderbird Academy	Scottsdale	1,430	0.51	3	0.71	3	0.79	2	0.98	3	1.18	4	1.54	5	1.97	11	2.24	8	2.52	10	2.72	9	2.76	8		
59000	Lake Margherite	Scottsdale	1,325	0.59	4	0.75	4	0.79	2	1.02	3	1.30	5	1.73	10	2.05	16	2.60	19	2.87	18	2.99	15	2.99	10		
87000	Sun City West	Sun City West	1,240	0.43	2	0.67	3	1.06	6	1.69	26	2.01	55	2.01	32	2.36	56	2.72	29	2.80	22	2.80	14	2.80	10		
86500	McMicken Dam South	Surprise	1,360	0.31	1	0.55	1	1.02	5	1.57	16	1.97	43	2.52	115	2.64	100	2.76	24	2.83	17	2.83	11	2.83	9		
86700	Dysart Rd. @ Bell Rd.	Surprise	1,190	0.35	1	0.67	3	1.14	7	1.61	20	1.93	41	1.97	30	2.24	42	2.40	14	2.48	11	2.48	8	2.48	6		
21500	Seven Springs	Tonto NF	4,615	0.47	1	0.91	2	1.38	4	1.54	4	1.57	4	2.05	7	2.95	17	3.07	5	3.46	4	4.61	9	4.69	7		
22000	New River Mesa	Tonto NF	3,960	0.83	4	1.34	9	1.50	6	2.83	62	2.87	54	3.31	73	4.13	127	4.29	25	4.45	15	4.76	13	4.76	9		
65300	Upper Cline Creek	Tonto NF	2,520	1.22	27	1.77	39	2.13	34	2.80	78	2.83	64	3.11	68	3.43	50	4.02	25	4.09	14	5.28	27	5.28	18		
65500	Fig Springs	Tonto NF	2,390	0.71	3	0.98	3	1.02	2	1.02	1	1.02	1	1.26	1	2.05	4	2.56	4	2.87	4	3.98	10	3.98	7		
66000	Cline Creek	Tonto NF	2,170	1.38	59	1.93	73	2.40	75	2.72	76	2.76	64	2.99	62	3.58	81	3.86	29	3.98	19	4.92	30	4.92	19		
82700	Bartlett Lake	Tonto NF	1,780	0.63	3	0.83	3	0.94	2	1.46	17	1.73	11	1.93	10	2.24	9	2.76	7	3.58	10	4.21	14	4.53	14		
1800	White Tank Peak	West Valley	4,010	0.28	1	0.51	2	0.71	3	1.34	6	1.93	16	2.72	50	2.83	30	2.87	10	3.07	8	3.07	6	3.07	5		
86200	Ford Canyon Wash	West Valley	1,470	0.35	1	0.55	1	0.87	2	1.38	8	1.69	16	2.56	89	2.83	97	2.87	22	3.07	19	3.07	12	3.07	9		
87300	White Tank FRS # 3	West Valley	1,215	0.24	1	0.35	1	0.59	1	0.83	2	1.18	5	1.73	15	1.81	12	1.97	5	2.09	4	2.09	4	2.09	3		

Table 1: Return period calculations were performed for all FCD rain gages for the durations shown in the Table above (1 hour – 4 days). Gages with at least a 10-year return period for any duration are listed in the Table. The Table is sorted by the column labeled “Located”. Rain gage elevations are conditionally coded from yellow (955’) to green (4,615’), while return periods are coded from white (1 year) to red (312 years). Click on the Table to download a PDF for detailed viewing. Data from six individual gages are presented on the following pages - the figures include a location map, daily rain totals, selected return periods and an hourly rainfall plot.

FIGURE 9

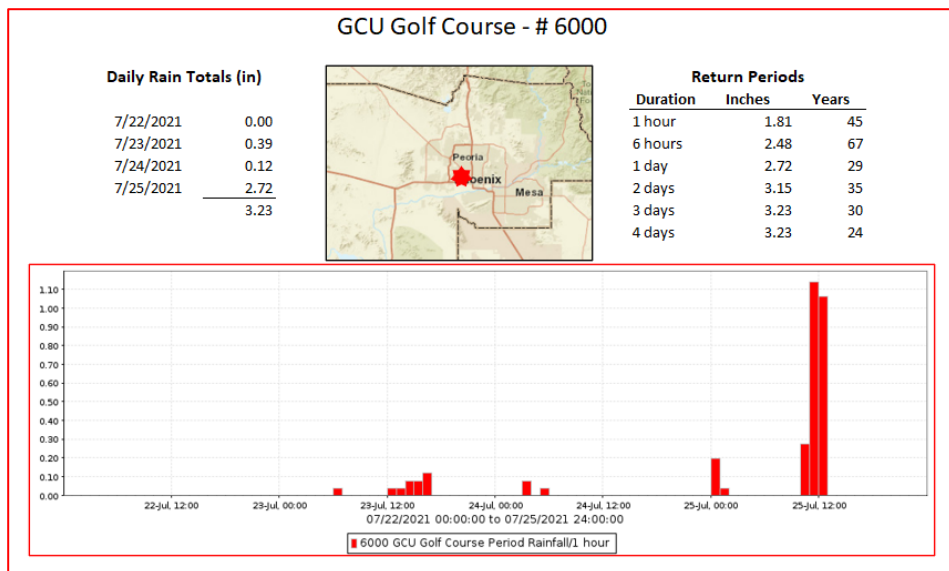


FIGURE 10

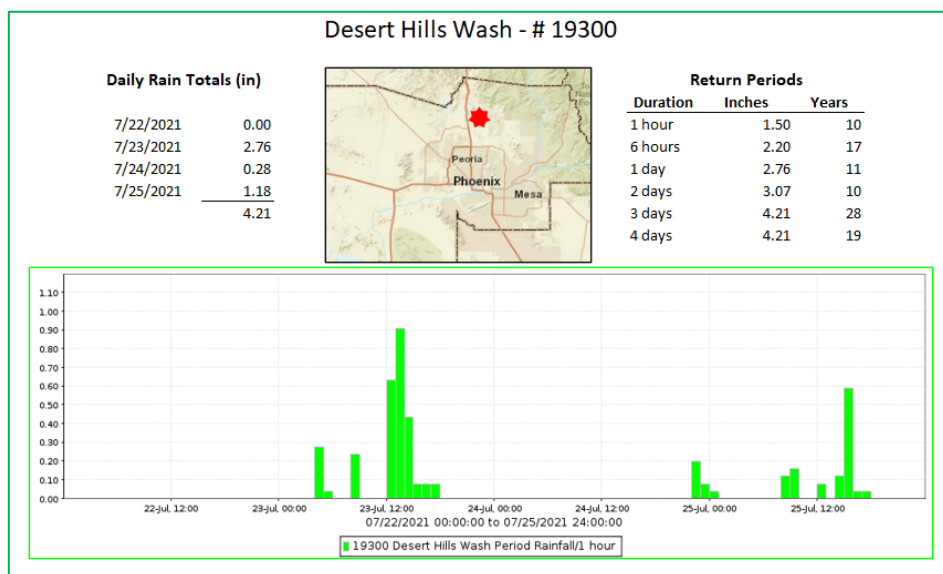


FIGURE 11

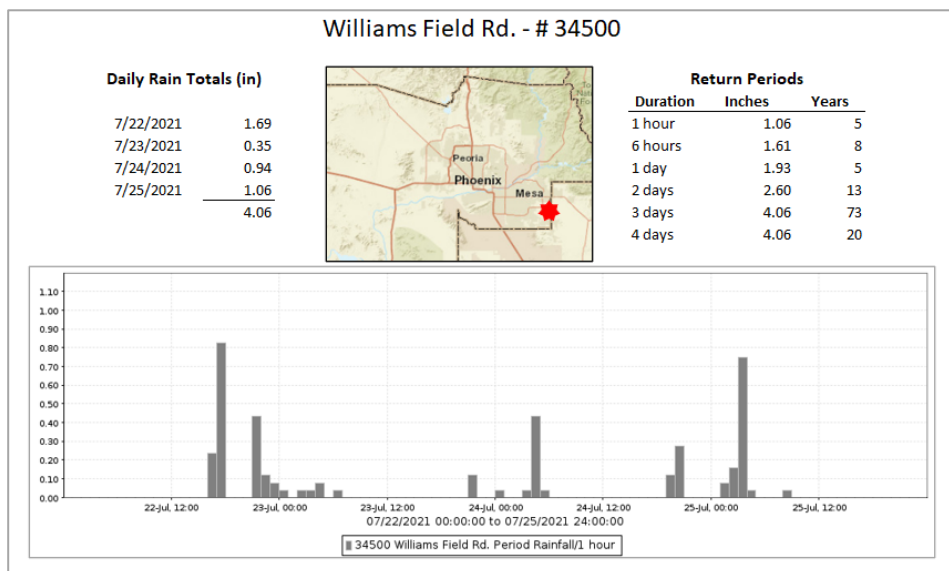


FIGURE 12

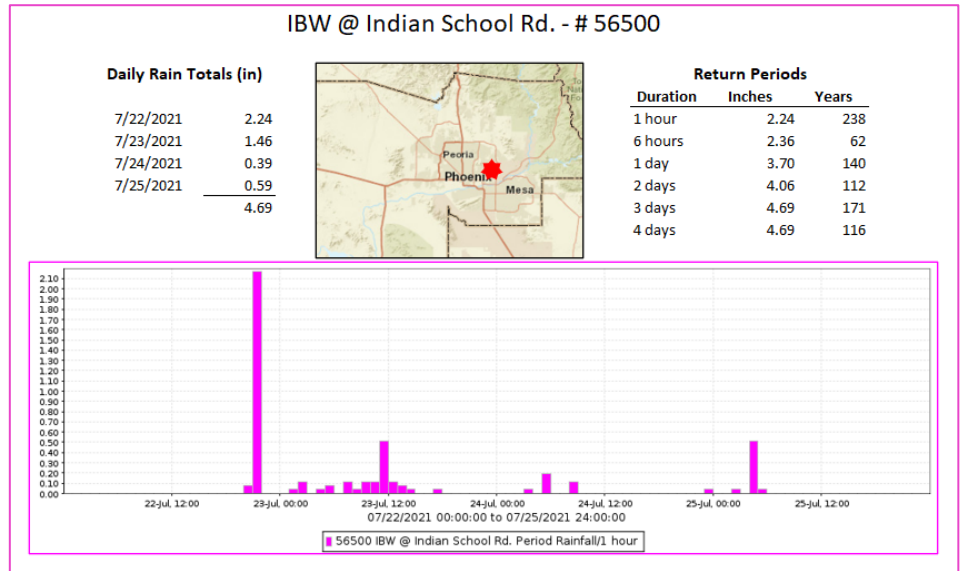


FIGURE 13

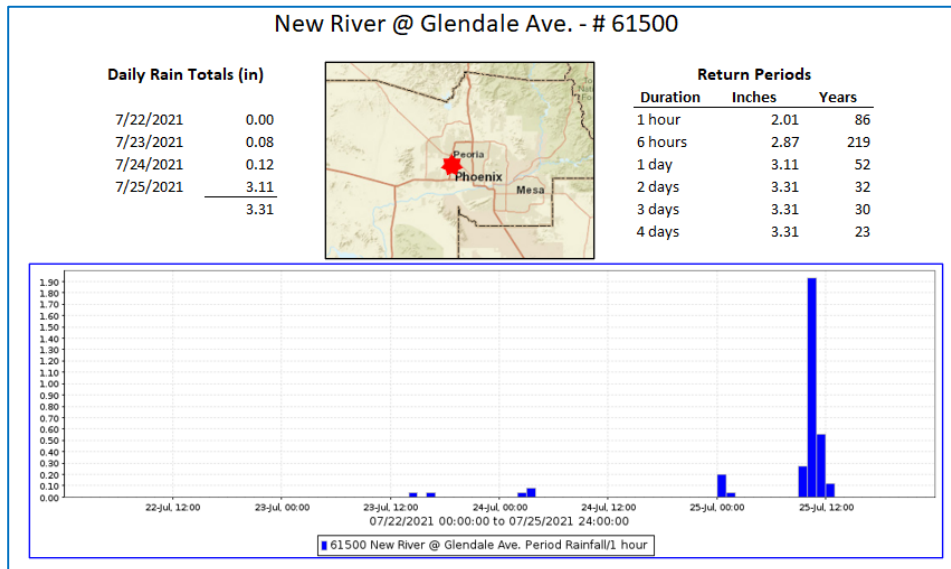
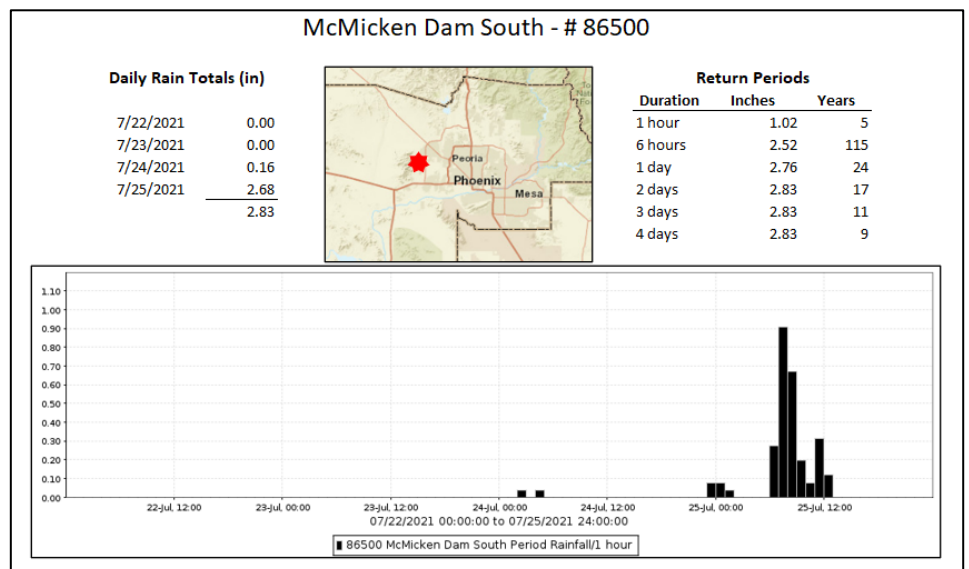


FIGURE 14



Runoff and Impoundment Summary

As discussed in the precipitation section, abundant and excessive rainfall fell across and around Maricopa County from July 22 - 25, 2021 which in turn caused runoff at many locations in the county. This section will discuss runoff on a stream/watershed basis for the three watersheds that were impacted the greatest: Skunk Creek, New River, and Indian Bend Wash. Additional stream gages receiving runoff are discussed after the watershed summaries.

Skunk Creek Watershed

The Skunk Creek watershed is located in north-central Maricopa County and crosses I-17 near the Loop 303. It is surrounded by the New River watershed on the north and west and Cave Creek on the east. Rainfall amounts over 5 inches fell on the upper watershed that caused significant runoff and a minor impoundment at Adobe Dam.

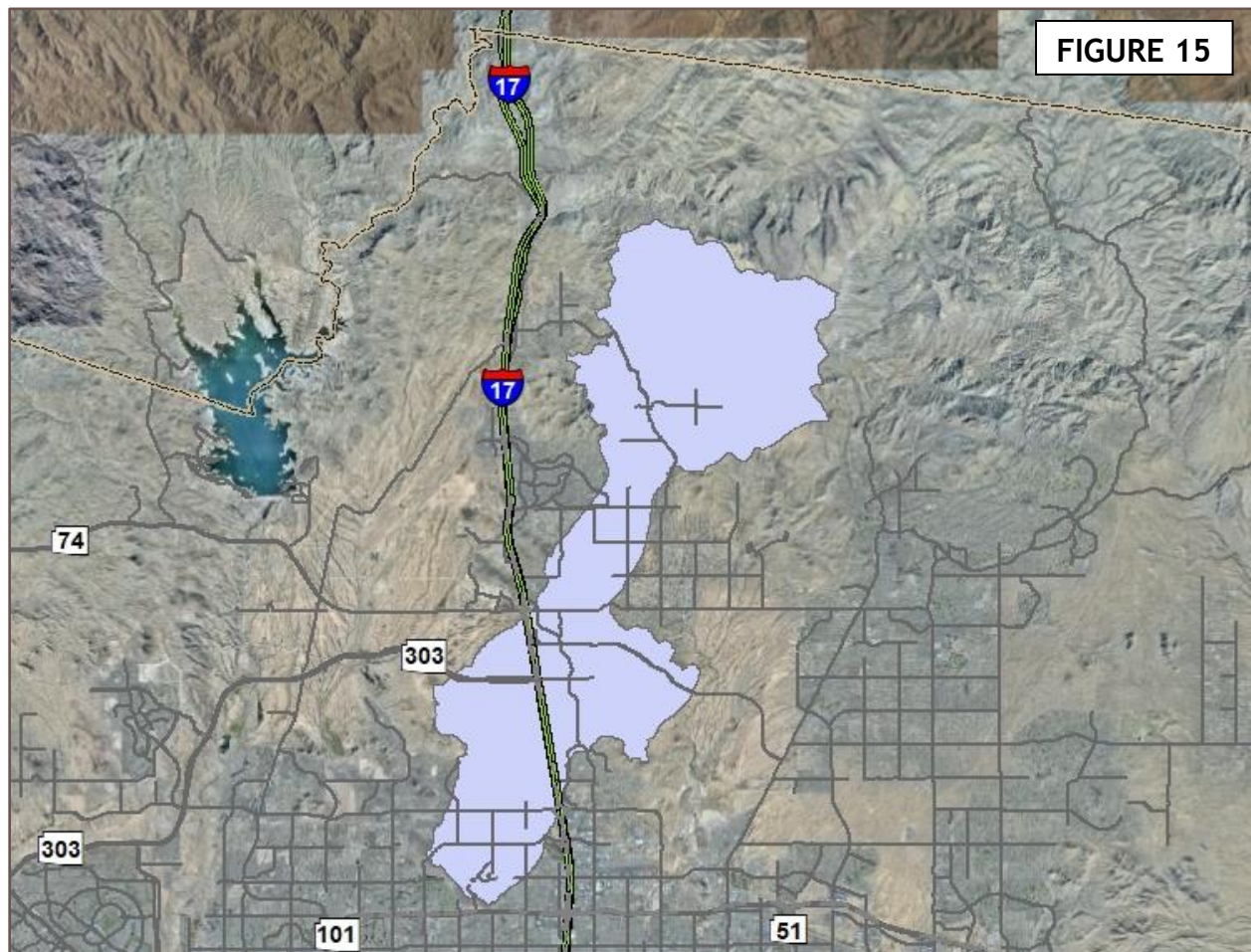


Figure 15 - Skunk Creek watershed above Adobe Dam

Summary of Skunk Creek Flows, July 23, 2021

TABLE 2

Gage	ID	Peak Q (cfs)	Peak Stage (feet, GH)	Return Period (yrs) (1)	Date/Time of Peak
Skunk Creek near New River	66207	395	2.29	3	7/23/2021 12:49
Cline Creek	66007	2,694	6.90	20	7/23/2021 12:55
Skunk Creek at Desert Hills Dr.	64807	6,000 (2)	9.48		7/23/2021 13:47
Skunk Tank Wash	64707	1,278	7.63		7/23/2021 13:34
Skunk Creek at Carefree Hwy.	65707	11,278	6.87	70	7/23/2021 14:26
Skunk Creek at Dixileta Dr.	64907	3,186	6.78		7/23/2021 14:54
Sonoran Wash	65907	79	1.83		7/23/2021 14:16
Skunk Creek at I-17	65807	9,429	5.74	18	7/23/2021 15:42
Adobe Dam Pool	65017	499 ac-ft	10.72		7/23/2021 20:35
Adobe Dam Outlet	65007	460	5.00		7/23/2021 18:40

(1) NOTE: Return Periods are estimated from several sources and are not considered definitive. Sources include Floodplain Delineation Studies, calculations using USGS Bulletin 17B & C, and the USGS StreamStats website. (2) Station was washed away at 6,000 cfs.

Select Hydrographs are shown on the following pages, highlighting the July 23 peak flow event.

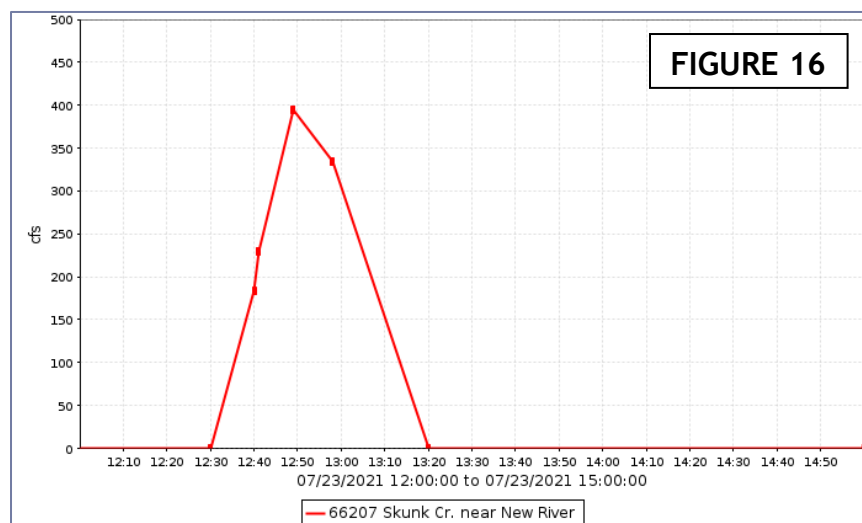


FIGURE 17

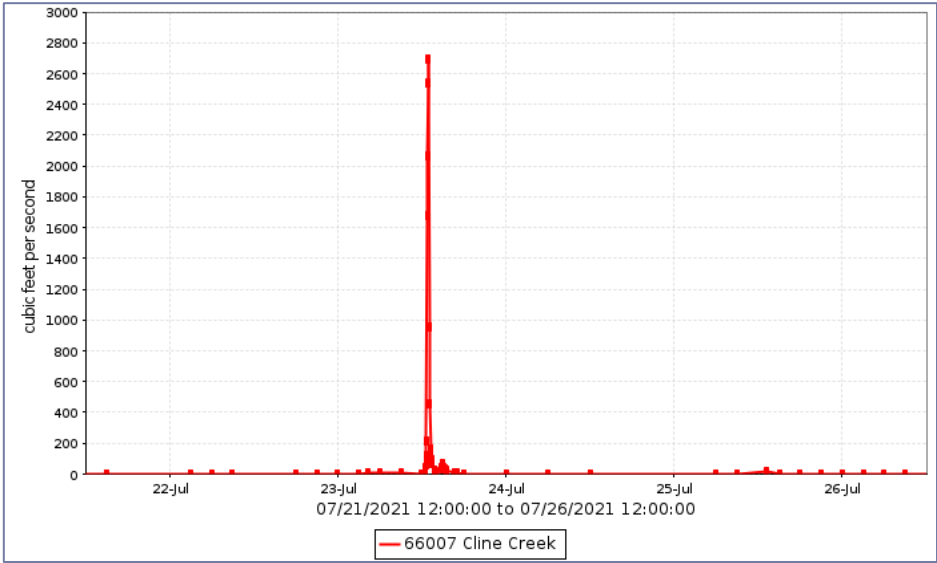
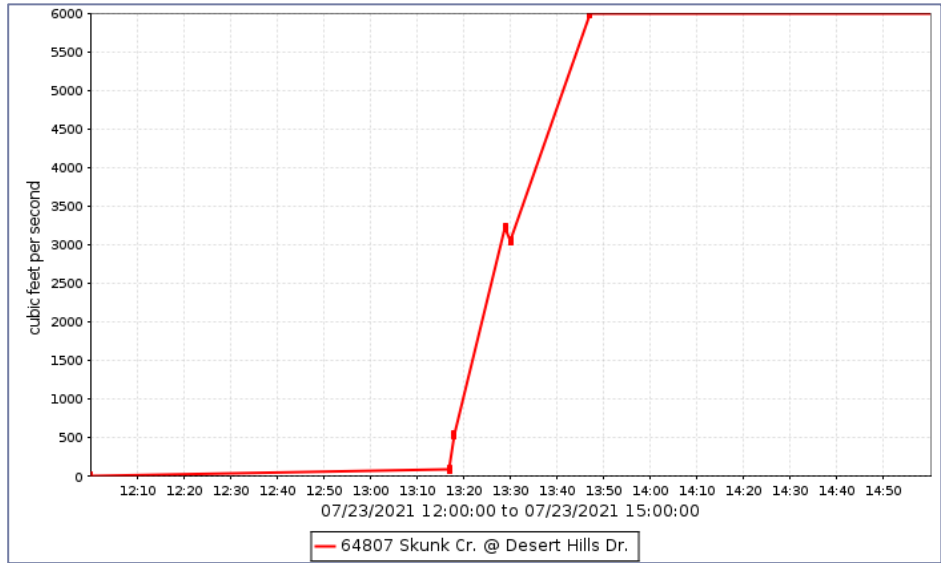
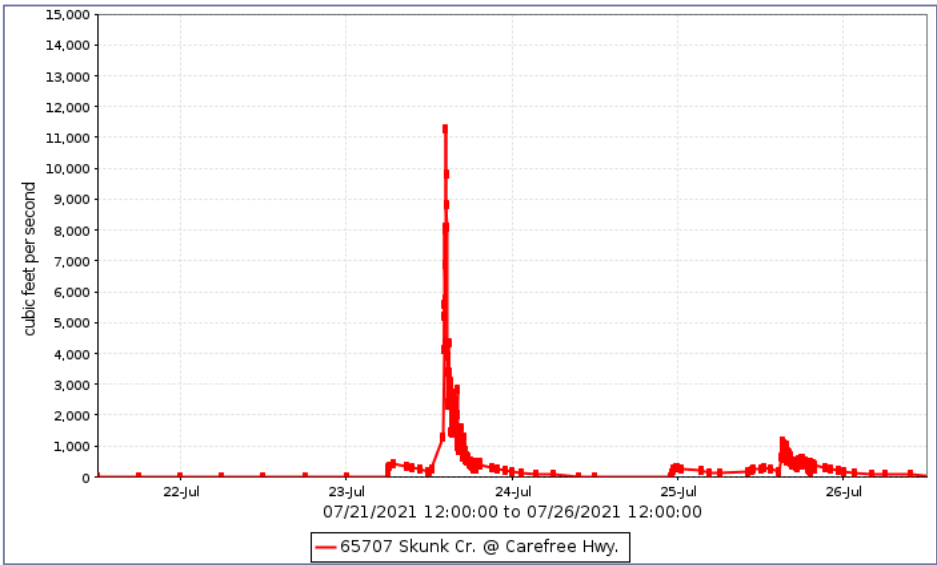


FIGURE 18



This station was washed away at a flow rate of 6,000 cfs.

FIGURE 19



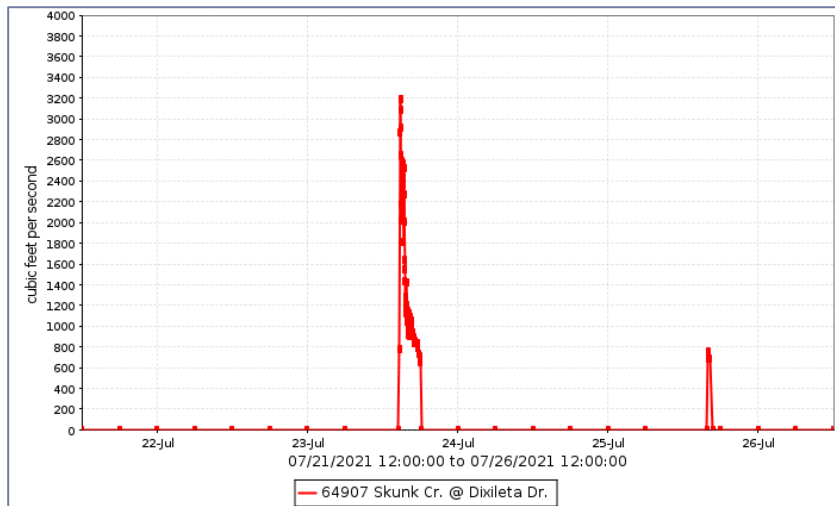


FIGURE 20

FIGURE 21

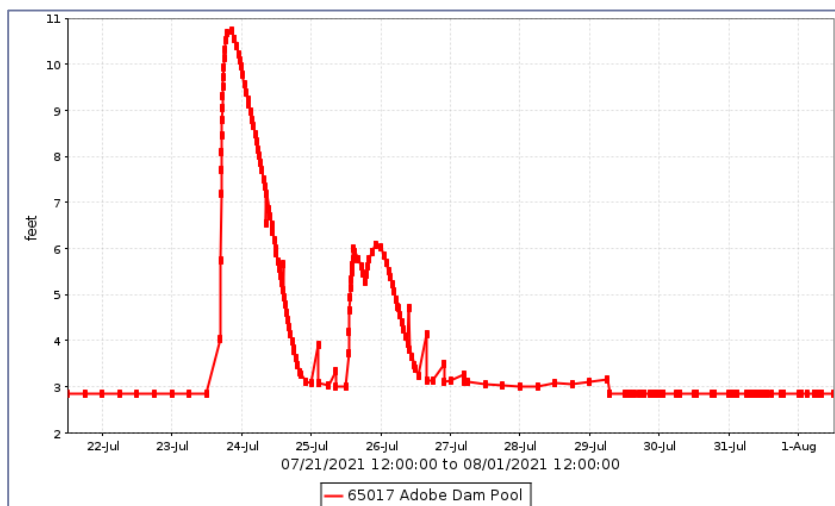
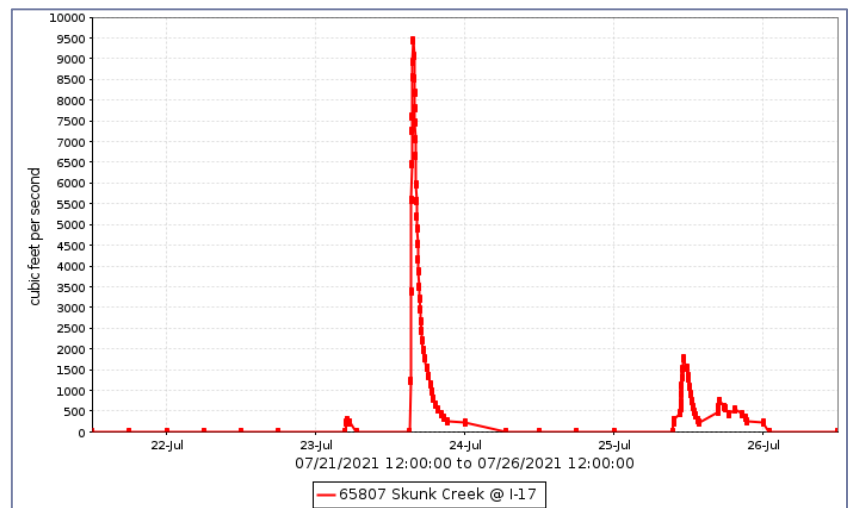
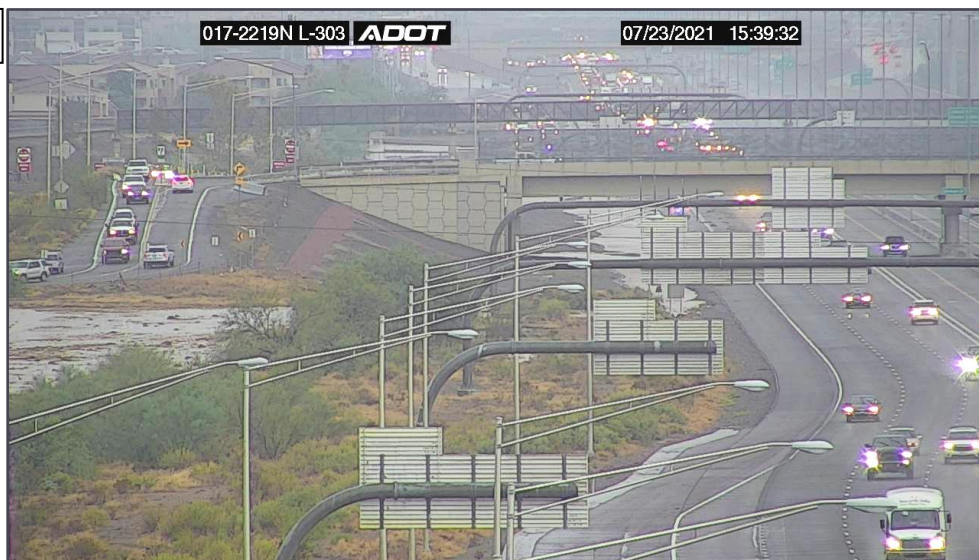


FIGURE 22

Significant runoff occurred in the watershed among the gaged locations. One gage failure occurred at Skunk Creek at Desert Hills Drive (#64807, Fig. 17) The station had been relocated in May 2021, and unfortunately the gage was washed away in the high-water flows, right after the peak of about 6,000 cfs was recorded just before 2 pm on July 23, 2021.

The flow on Skunk Creek was high enough at Dixileta Drive to overtop the roadway and spill west out onto I-17.

FIGURE 23



I-17 Freeway looking at the Dixileta Drive bridge. Source: ADOT camera.

FIGURE 24



Skunk Creek at Dixileta Drive, July 24, 2021.

A smaller magnitude runoff event occurred in the Skunk Creek watershed on July 25, 2021, and its data are included in the hydrographs above (Figs. 16-21) and summarized in the table below. Nevertheless, rainfall produced a record flow at Sonoran Wash.

Summary of Skunk Creek flows, July 25, 2021

TABLE 3

Gage Name	ID	Peak Q	Peak GH	Date/Time of Peak
Skunk Tank Wash	64707	242	5.48	7/25/2021 16:25
Skunk Creek at Carefree Hwy	65707	1,160	3.38	7/25/2021 15:05
Skunk Creek at Dixileta Dr.	64907	752	2.54	7/25/2021 16:05
Sonoran Wash	65907	1,131	5.72	7/25/2021 10:09
Skunk Creek at I-17	65807	1,765	2.63	7/25/2021 11:12

New River Watershed

The New River watershed is located north and west of the Skunk Creek watershed. There are fewer gages on this watershed than Skunk Creek, but it too ends at an impoundment at New River Dam. A very large flow was recorded at the upstream gage, New River Fire.

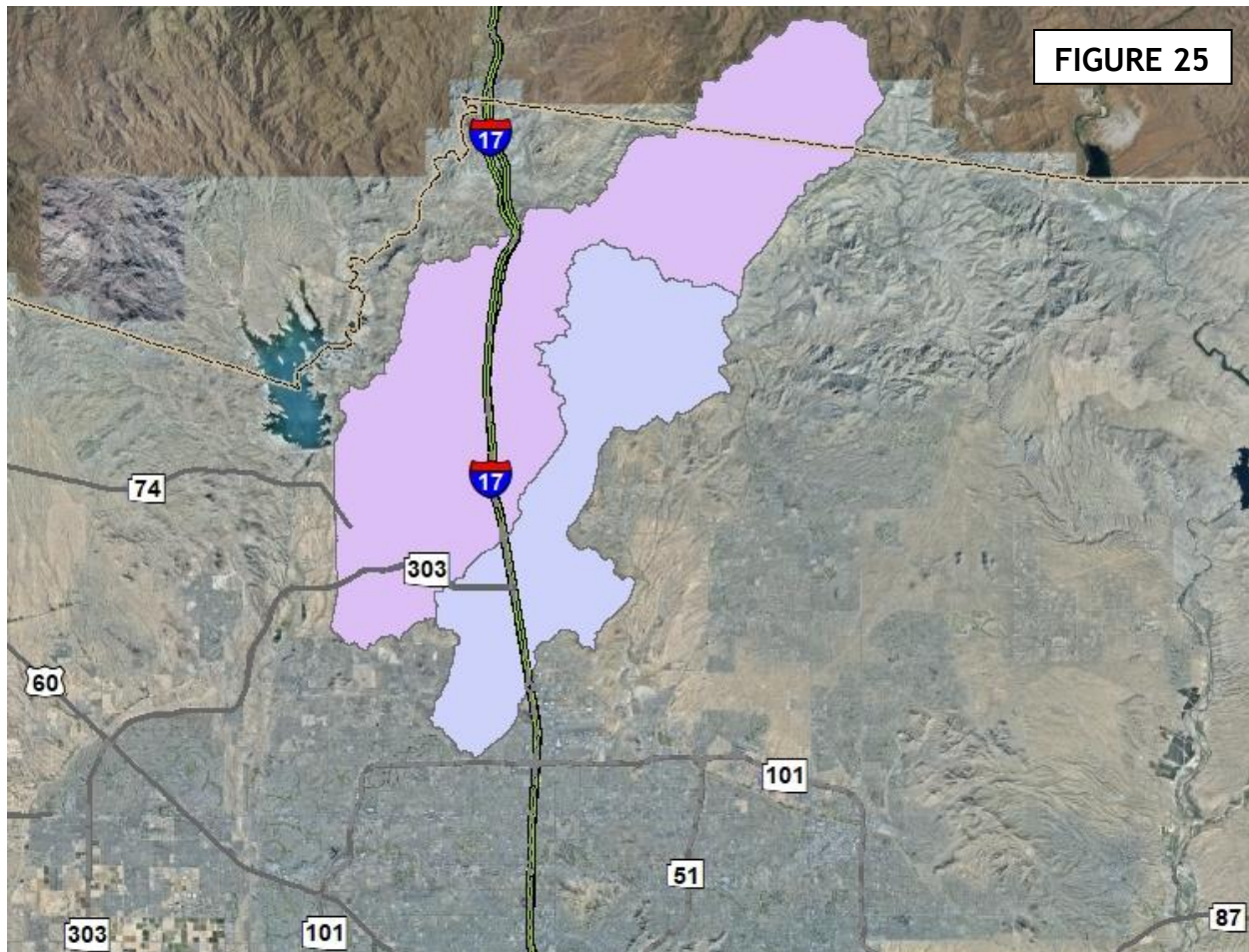


FIGURE 25

Figure 24 - New River Watershed (darker purple) above New River Dam

TABLE 4

Summary of flows on New River, July 23, 2021

Gage Name	ID	Peak Q	Peak GH	Return Period (years)(1)	Date/Time of Peak
New River Fire	62707	15,962	7.88	70	7/23/2021 14:26
New River at SR303L	62213	7,639	5.94	15	7/23/2021 22:00 (est.)
New River Dam Pool	62017	260 ac-ft	6.63		7/24/2021 02:35

(1) NOTE: Return Periods are estimated from several sources and are not considered definitive.

Fields visits indicated that these flows are reasonable. The gage at New River at SR303L failed to operate during the event. The peak stage was recovered from the crest-stage gage at the site. The date and time of peak at that location are estimated and unknown. There were no flows recorded for the July 25, 2021 event. Below are hydrographs for the event.

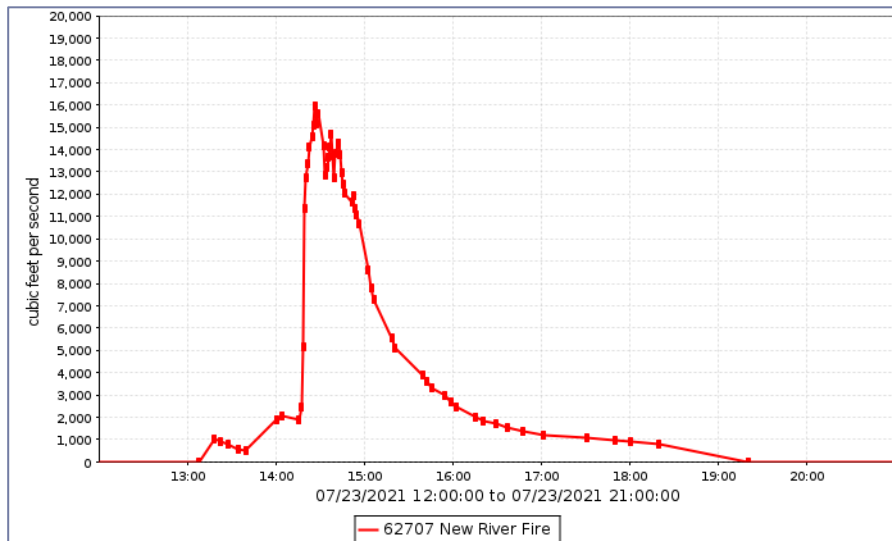
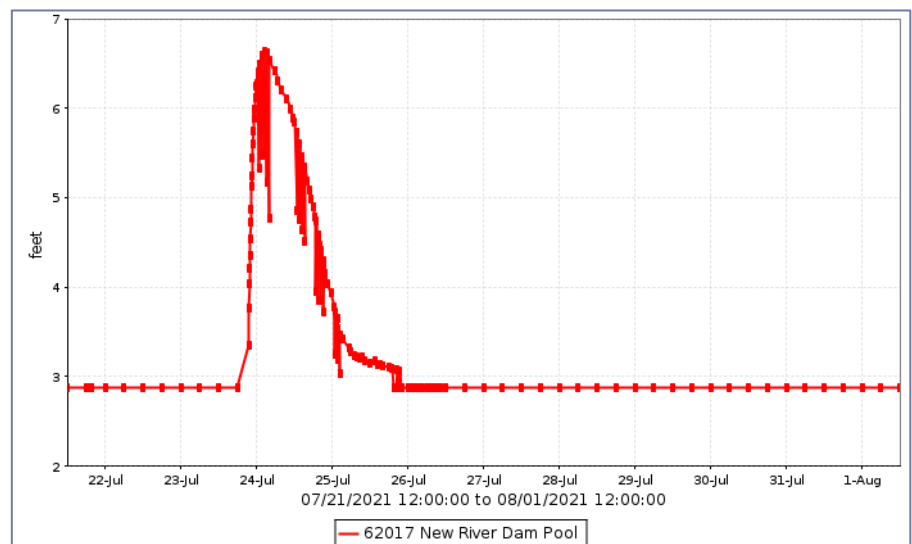


FIGURE 26

FIGURE 27



Flows downstream of New River Dam flow into New River channel to the Agua Fria River near Camelback Road. No significant flow occurred downstream, but several recreation trails in Peoria were likely affected by the runoff below the dam.

Indian Bend Wash below the CAP canal

Indian Bend Wash and the City of Scottsdale experienced significant rainfall and runoff beginning the late evening of July 22, 2021. A second higher magnitude runoff occurred later in the day on July 23, 2021.

The Indian Bend Wash watershed has contributing area below the CAP canal and Reach 11 Dikes, which completely remove the upper watershed from contributing to flows.

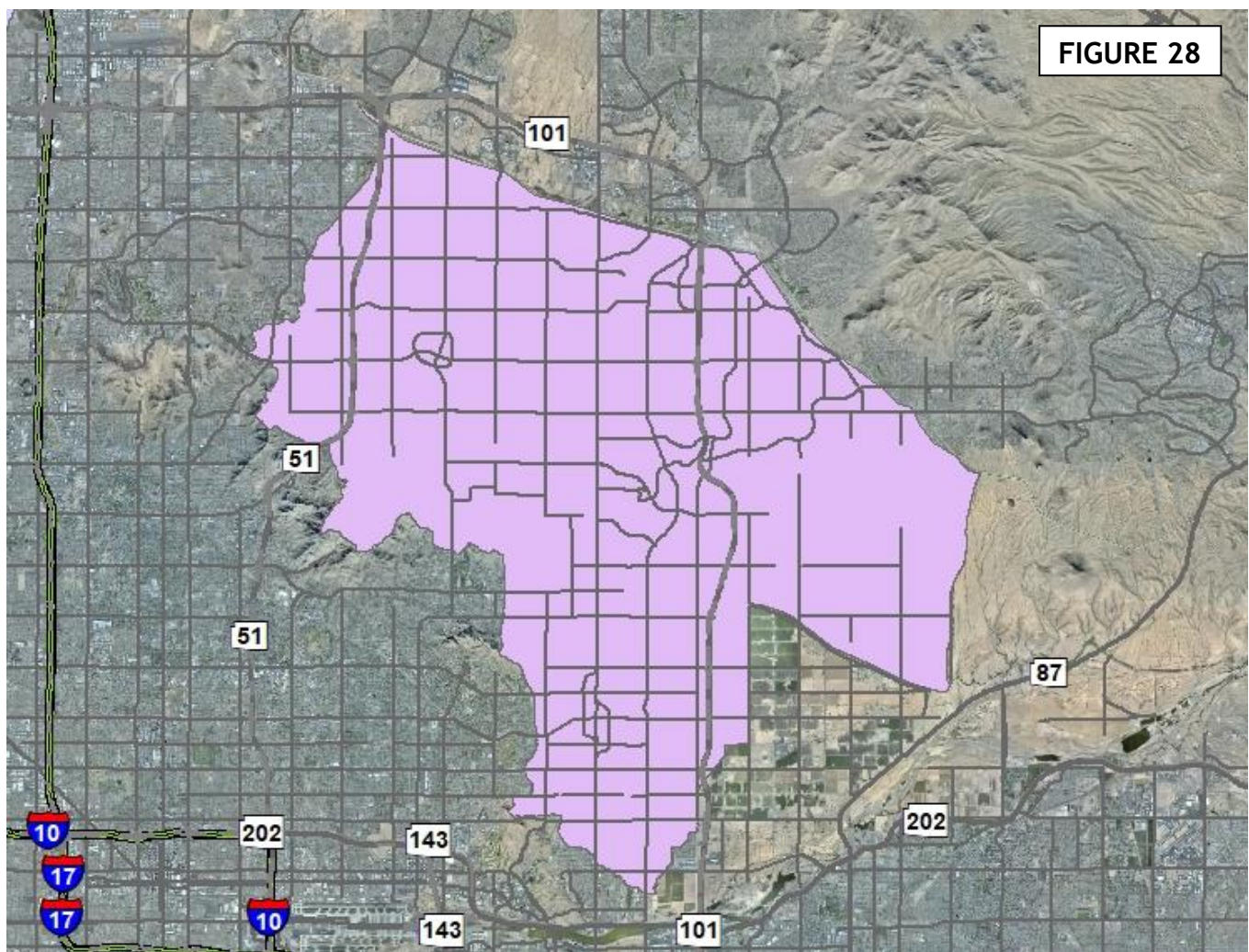


Figure 28 - Indian Bend Wash watershed above McKellips Rd. Gage

A summary of the flows throughout the period are given on the following page.

Summary of flows on Indian Bend Wash, July 23 & 25, 2021

Gage Name	ID	Peak Q	Peak GH	Date/Time of Peak	Peak Q	Peak GH	Date/Time of Peak	Peak Q	Peak GH	Date/Time of Peak
IBW at Sweetwater Ave	58307	272	1.85	7/23/2021 9:22				281	1.9	7/25/2021 1:37
IBW at Shea Blvd	59507	117	1.18	7/23/2021 6:05	1,226	2.45	7/23/2021 11:24	535	1.8	7/25/2021 5:04
Berneil Wash	59207				250	1.07	7/23/2021 12:00	87	0.49	7/25/2021 4:15
Lake Margherite	59007				58	1.10	7/23/2021 11:49			
IBW Interceptor Channel	56807	230	2.56	7/23/2021 0:00	215	2.49	7/23/2021 13:30	37	1.24	7/25/2021 6:00
IBW below Indian Bend Rd	56307	294	2.94	7/23/2021 0:13	900	4.11	7/23/2021 13:10	176	2.49	7/25/2021 5:01
IBW at McDonald Dr	57207	1,170	1.67	7/23/2021 0:57	1,833	2.47	7/23/2021 13:36	517	0.73	7/25/2021 6:00
IBW at Indian School Road	56507	1,738	3.68	7/22/2021 22:00	2,359	4.33	7/23/2021 13:59	700	2.34	7/25/2021 6:00
Granite Reef Wash	57507	219	7.68	7/22/2021 22:10				27	3.57	7/25/2021 5:15
IBW below McKellips Rd	55707	248	1.4	7/23/2021 1:11	484	1.98	7/23/2021 15:41	102	0.92	7/25/2021 12:00

TABLE 5

Flows were nowhere near records, but they did cause unbridged crossings within the City of Scottsdale to be closed for several days. Starting on the next page are hydrographs for each station for the period. The hydrographs are in stream order starting upstream.

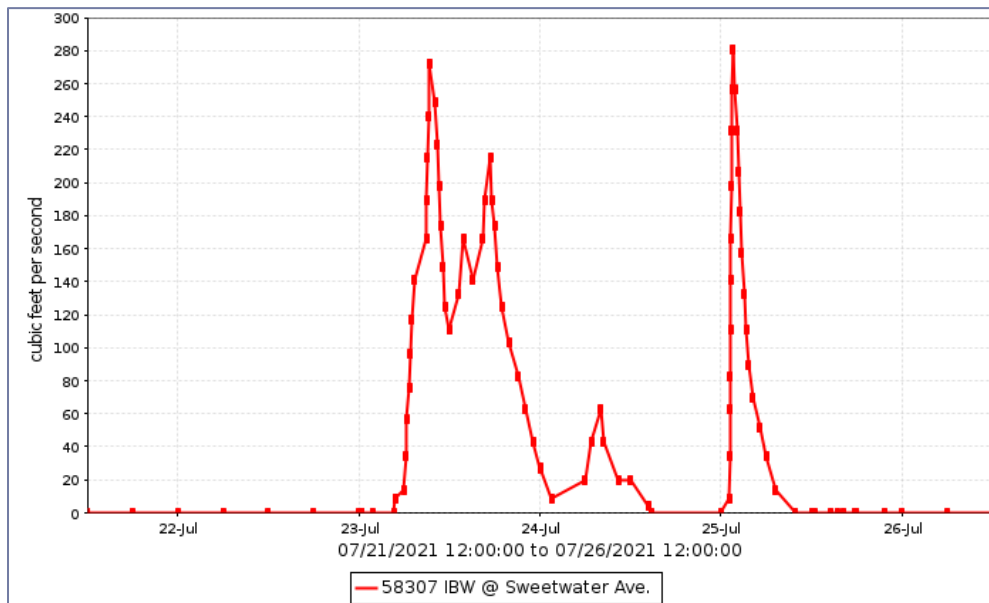


FIGURE 29

FIGURE 30

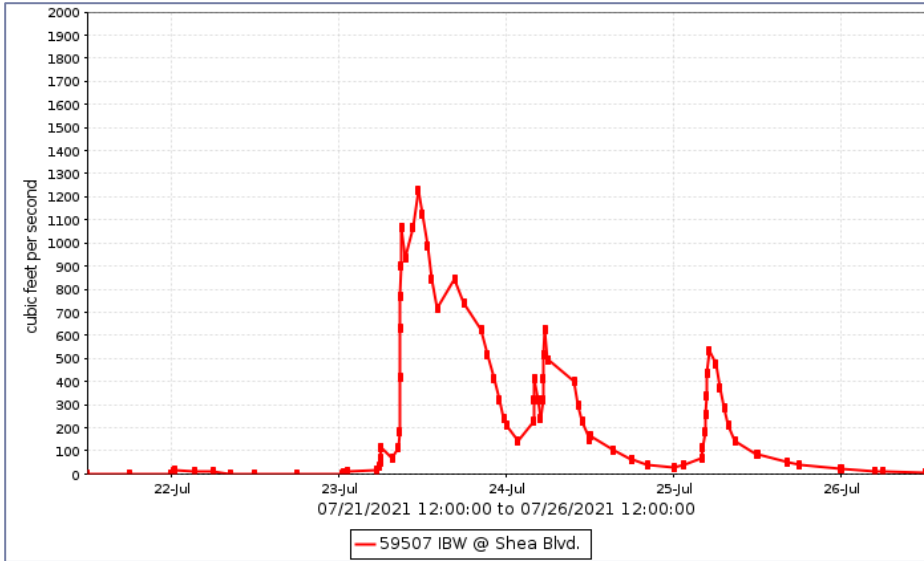


FIGURE 31

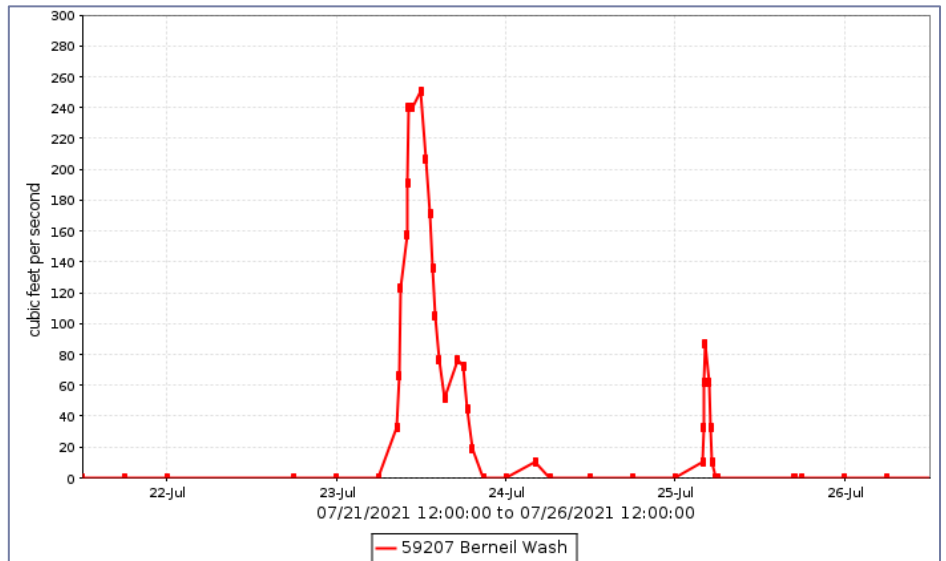


FIGURE 32

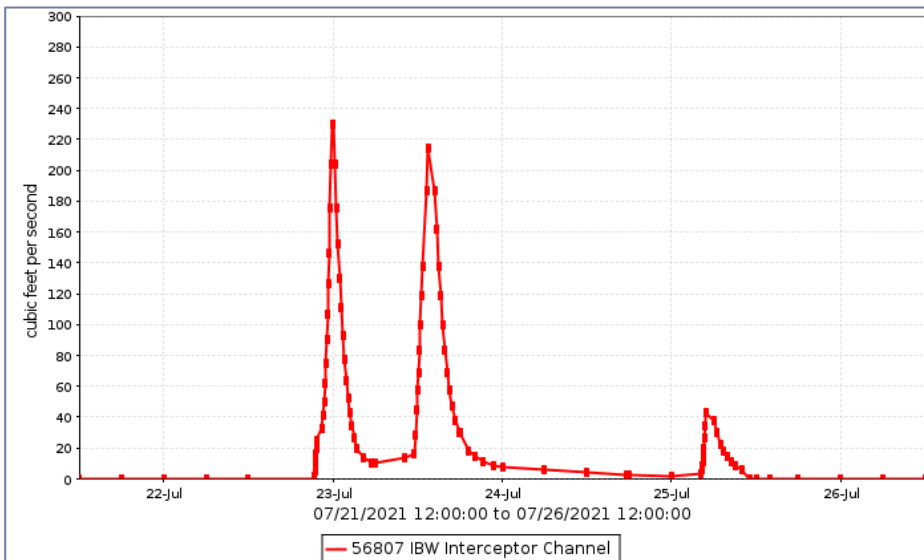


FIGURE 33

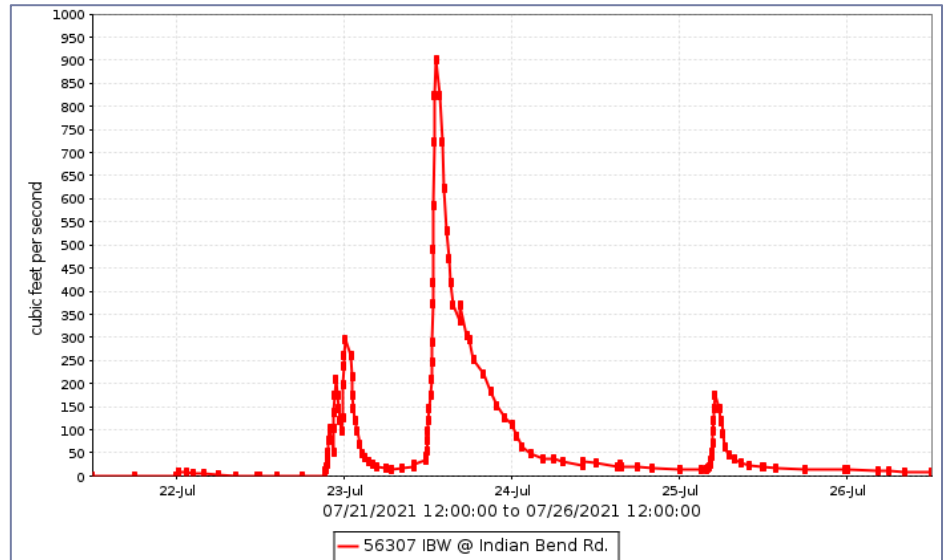


FIGURE 34

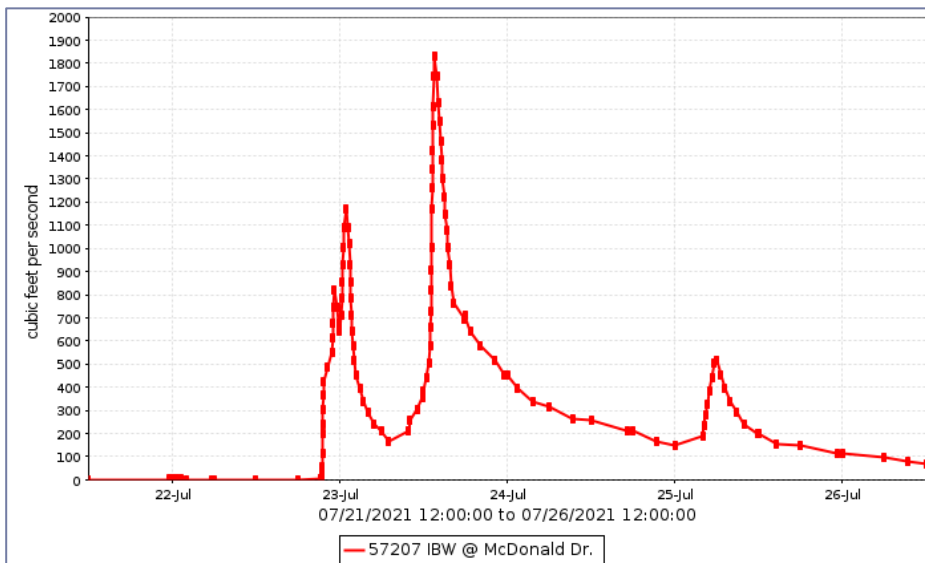


FIGURE 35

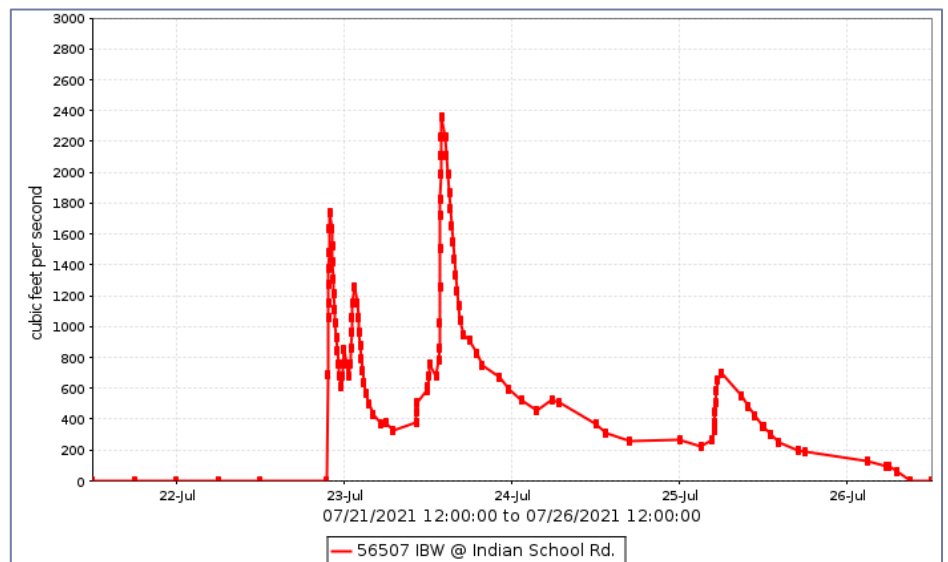


FIGURE 36

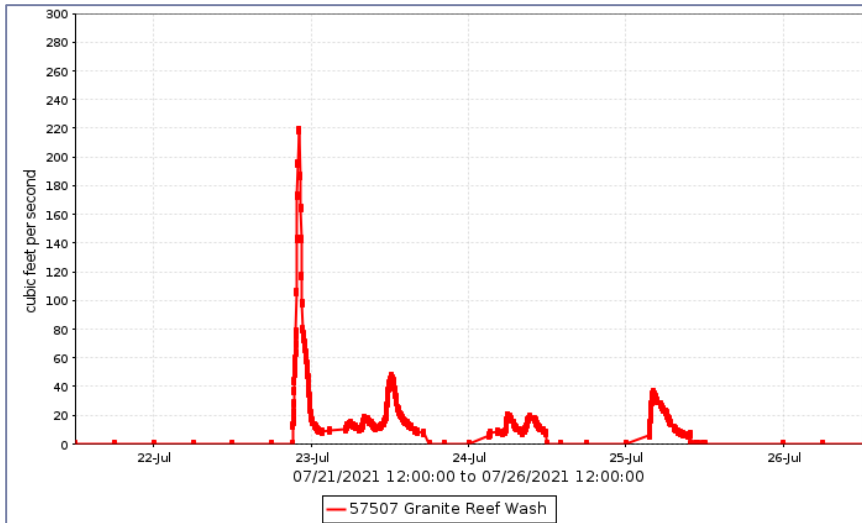
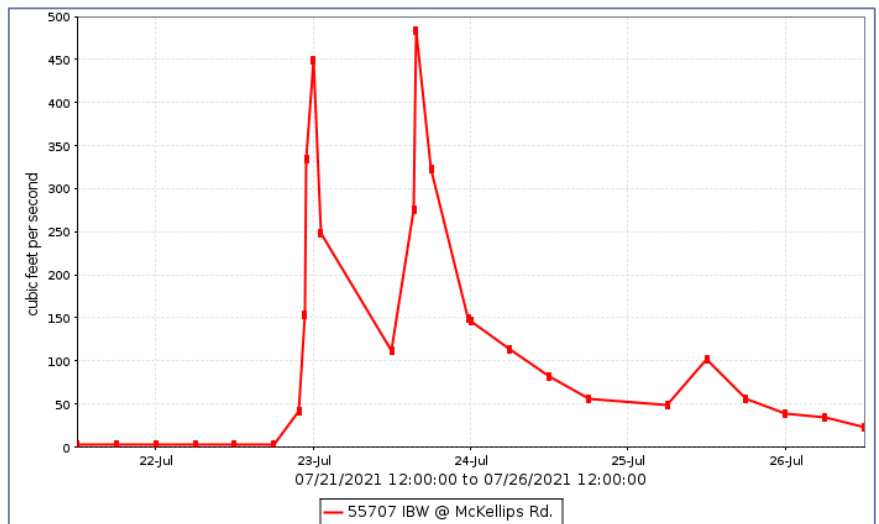
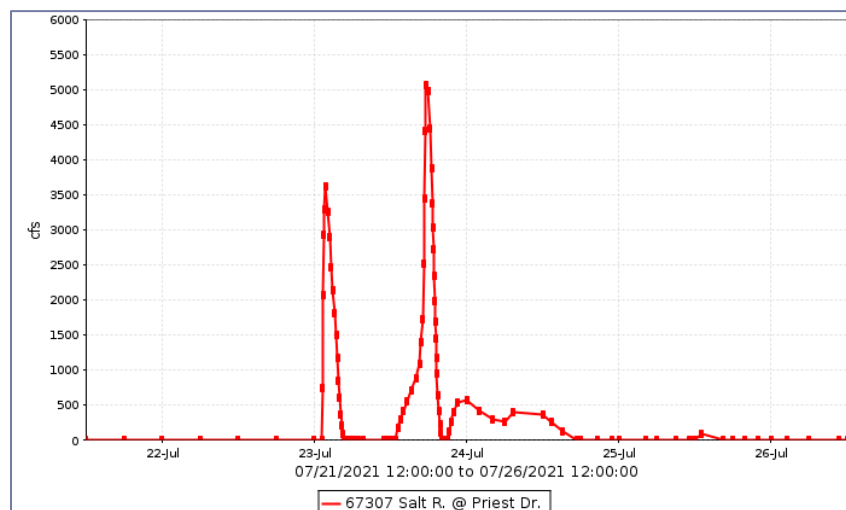


FIGURE 37



Flows from Indian Bend Wash discharge directly into the Salt River and Tempe Town Lake east of Scottsdale Road. These in turn affect the Salt River gage at Priest Drive, just below the Tempe Town Lake dam.

FIGURE 38



Other Significant Runoff

As noted at the beginning of this section, aside from the three specifically discussed watersheds above, there were other runoff and impoundments to note.

The Cave Creek watershed which is east of both Skunk Creek and New River had some runoff, but it was not of the magnitudes received by the two watersheds to the west.

The Agua Fria River at Buckeye Road (#85307) had a rather large flow that was likely the result of flow from the ADOT I-10 drain along the north side of I-10. The gage recorded a peak discharge of 6,176 at a verified peak stage of 1.32 feet on July 25.

Agua Fria at Buckeye Rd.	85307	6,176 cfs	1.32 feet gage height	7/25/2021 14:37
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The Hassayampa River watershed was not largely impacted. The gage on the river at US 60 received some runoff of note.

Gage Name	ID	Peak Q	Peak GH	Date/Time of Peak
Hassayampa R at US60	45707	1,546	1.77	7/21/2021 16:45
Hassayampa R at US60	45707	220	1.02	7/23/2021 20:48
Hassayampa R at US60	45707	2,517	2.14	7/25/2021 13:07

TABLE 6

Another station of note, Blue Tank Wash (#52707, NE of Wickenburg) recorded two small flows, but it was the first recorded runoff since the station was installed in June 2019.

As far as runoff elsewhere, the East Maricopa Floodway (EMF) had some moderate flows along the entire reach. All flows were relatively small with the exception of the station at Queen Creek Road. As of the time of publication, the channel was too wet to perform any type of reconnaissance to verify the discharge values at that station. A field visit did verify that the recorded stages were reasonable. However, the rated peak flow was significantly higher than any upstream or downstream gage and further investigation is warranted.

Impoundments

Several dams received enough runoff to record small impoundments. In the sections above for both Skunk Creek and New River, impoundments at Adobe Dam and New River Dam have already been shown. As mentioned, Indian Bend Wash does not flow to a dam, but rather the Salt River so no impoundment data were part of that discussion.

In the Wickenburg area (Hassayampa River watershed), the three small FCD dams in town all showed small impoundments.

Gage Name	ID	Peak Volume (acre-feet)	Peak Stage (feet GH)	Date/Time of Peak
Casandro Dam	53007	2.0	2.63	7/25/2021 9:13
Sunset FRS	46007	2.8	5.13	7/25/2021 9:19
Sunnycove FRS	46507	0.8	3.93	7/25/2021 10:20

TABLE 7

Along the White Tank Mountains, the two largest structures, White Tank FRS #3 and #4, both had small impoundments.

Gage Name	ID	Peak Volume (acre-feet)	Peak Stage (feet GH)	Date/Time of Peak
White Tank FRS #3	87307	111	1.7	7/25/2021 10:28
White Tank FRS #4	87807	29	4.2	7/25/2021 18:00

TABLE 8

Finally, in the southeast valley, several structures in Pinal County recorded impoundments, with Magma FRS (#42307, operated by Magma FCD) having the second largest impoundment since 2008 when the structure was re-built.

Gage Name	ID	Peak Volume (acre-feet)	Peak Stage (feet GH/feet NAVD88)	Date/Time of Peak
Magma FRS	42307	650.8	12.51 / 1,613.91	7/25/2021 16:02
Rittenhouse FRS	37207	171.7	7.22	7/24/2021 17:21
Vineyard FRS	37007	802.5	3.83	7/25/2021 10:17

TABLE 9

Summary

The weather event of July 22 - 25, 2021 dropped significant precipitation over a wide area, but caused major runoff on two specific watersheds, Skunk Creek and New River, with the upper parts of both watersheds besieged by high runoff. Much of that runoff attenuated before entering their respective impoundment dams. Indian Bend Wash also received significant runoff, enough to close roads and golf courses for several days.

The remainder of the stream gages had flows that were typical of summer monsoon rain and runoff and were not of great magnitude with the noted exception of Magma FRS having its second highest impoundment of record since dam reconstruction in 2008.

Public Outreach Summary

The District has a total of 410 ALERT stations located throughout Maricopa and adjoining Counties. All of the information for these stations is available in real-time on our webpage. During this event (July 22-25) we used social media to help inform the media and the public of current weather and rainfall information.

Our best platform continues to be Twitter @FCDfloodInfo. We are up to 2,560 followers which consist of different agencies, news media and the public. We had a total of 156,524 impressions and 8,050 engagements over this 4-day period. Our top post had over 21,628 impressions.

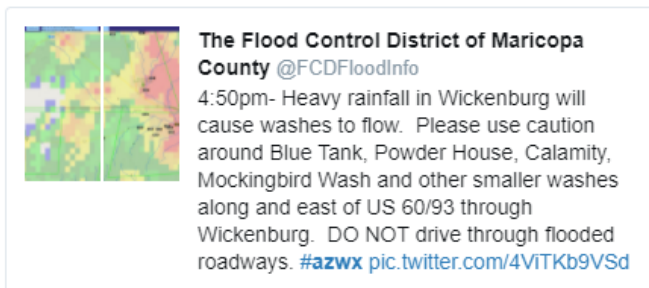


FIGURE 39

Impressions	21,628
Total engagements	397
Media engagements	337
Detail expands	37
Profile clicks	12
Likes	7
Retweets	2
Follows	1
Hashtag clicks	1

Our Facebook page “Flood Control District of Maricopa County” had 4,506 impressions and 740 engagements over this 4-day period. Our top post has a total of 1,024 impressions.

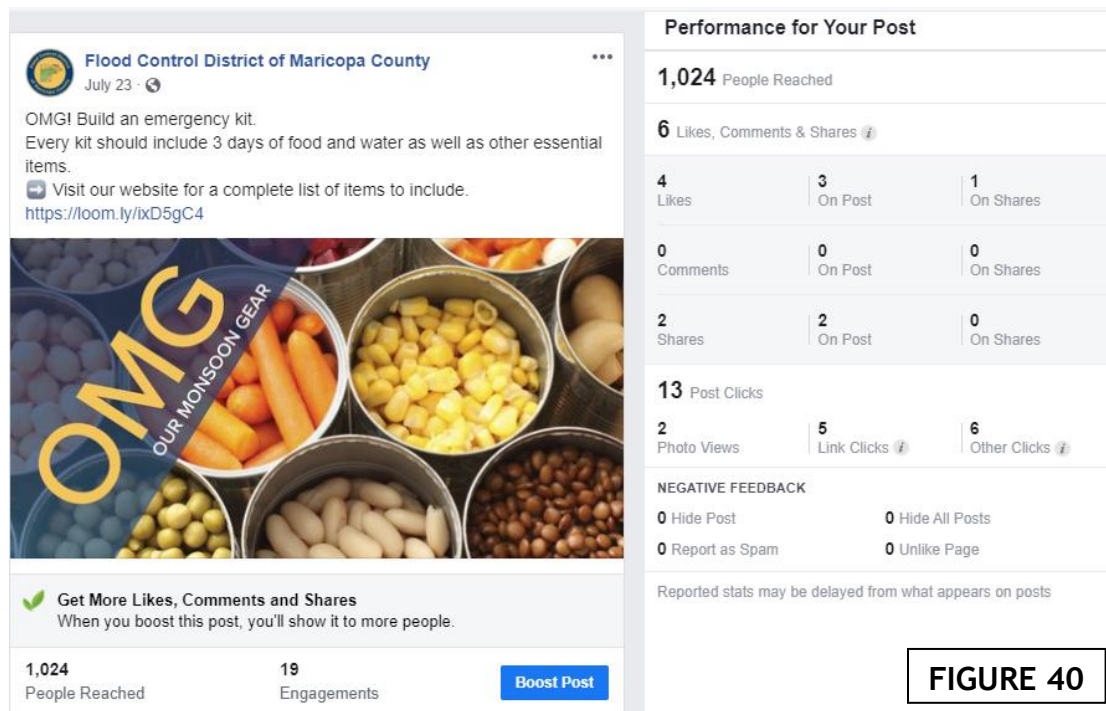
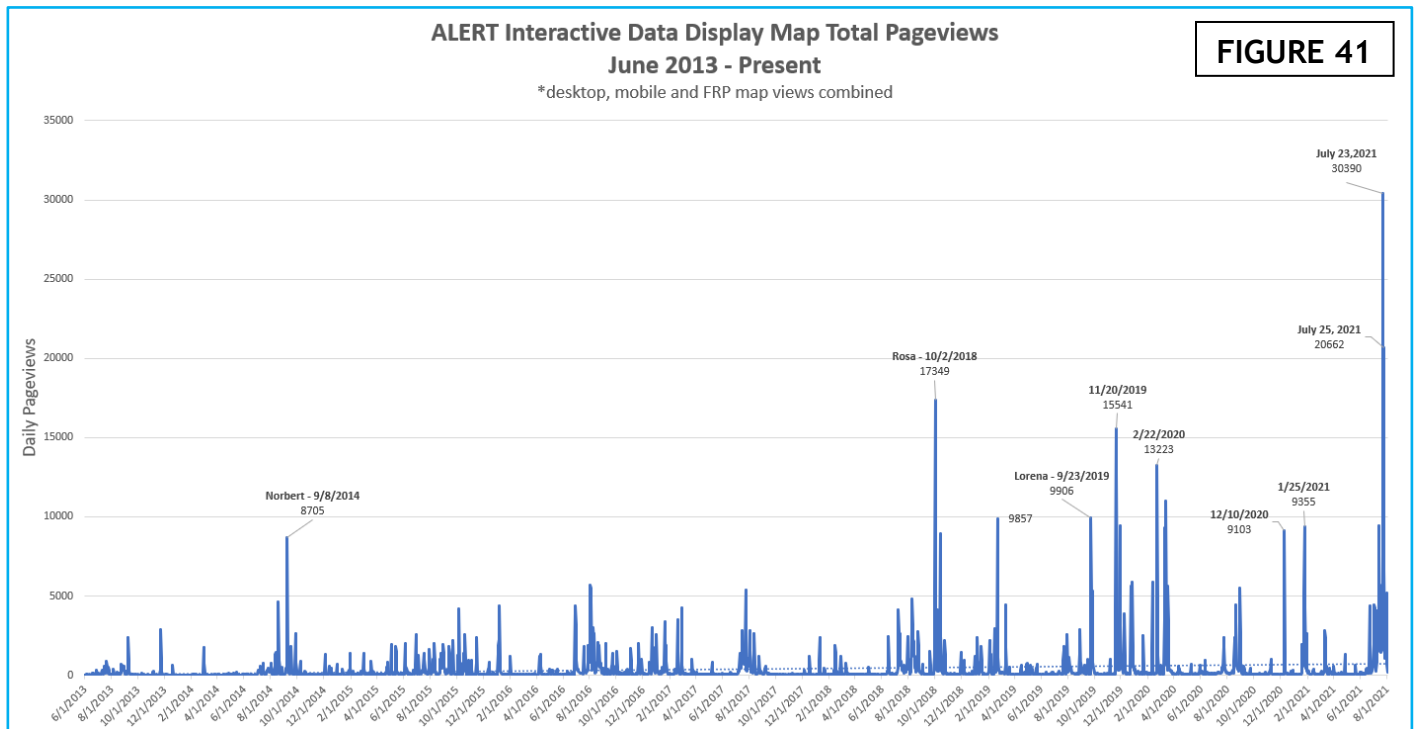


FIGURE 40

Our ALERT Interactive Data Display Map is the primary tool for access to our ALERT data. During this event there were a total of 73,091 sessions for both the desktop, mobile and Flood Response Plan Online Map versions combined. The highest impact day was July 23rd with 30,390 pageviews. That is the highest daily pageviews since we started tracking in June 2013. The second highest was July 25th with 20,662.



Additionally, the Flood Warning Branch and the Information, Outreach and Support Division (IOS) at the Flood Control District contributed to media interviews and stories. These included AZCentral, ABC15, KJZZ, Arizona Radio Company, FOX10 Live, Telemundo and Wittmann Emergency Alerts (online outlet).

IOS made three posts on Instagram, making 281 impressions...



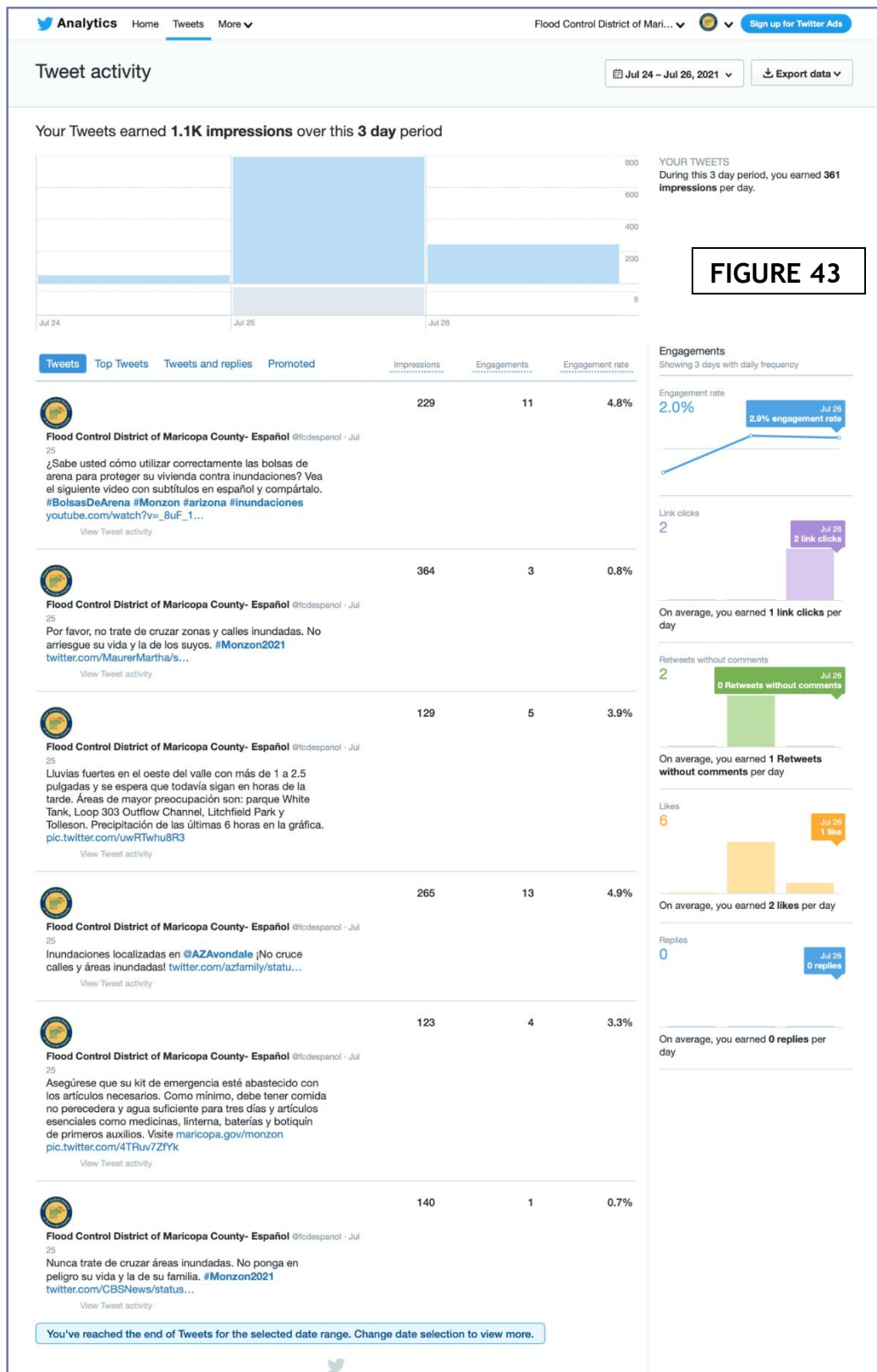
FIGURE 42a

FIGURE 42b



FIGURE 42c

... and six Twitter posts in Spanish that earned 1.1 thousand impressions.



DATA SOURCES

1. NOAA National Severe Storms Laboratory; Multi-Radar Multi-Sensor System, Norman, OK
<http://nmq.ou.edu/>
2. National Weather Service, Storm Prediction Center, Norman, OK:
<http://www.spc.noaa.gov/obswx/maps/>
3. Flood Control District of Maricopa County, Phoenix, AZ
<http://www.maricopa.gov/floodcontrol> and <http://www.reportaflood.org>
4. National Weather Service, National Hurricane Center, Miami, FL:
<http://www.nhc.noaa.gov/?epac>
5. NOAA Atlas 14 Point Precipitation Frequency Data Server,
https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html
6. National Weather Service, Weather Prediction Center, College Park, MD:
<http://www.wpc.ncep.noaa.gov/>
7. National Weather Service, Tucson WFO, Monsoon Tracker, Tucson, AZ:
https://www.wrh.noaa.gov/twc/monsoon/monsoon_patterns.php
8. National Weather Service, Weather Prediction Center, College Park, MD:
<http://www.wpc.ncep.noaa.gov/>
9. National Weather Service, Tucson WFO, Monsoon Tracker, Tucson, AZ:
https://www.wrh.noaa.gov/twc/monsoon/monsoon_patterns.php