



2014

Big Chino Sub-basin Water Monitoring Project Monsoon Season Report: July 1 – September 30



Upper Big Chino Wash – 7/14/2014



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Contents

| | |
|--|----|
| Introduction | 2 |
| Background and Rating Development | 2 |
| Site Maintenance and Data Processing | 2 |
| Seasonal Flow Events Summary..... | 3 |
| Location Summaries..... | 6 |
| Upper Big Chino Wash (UBCW)..... | 6 |
| Big Chino Wash below Partridge Creek (BCWPC)..... | 8 |
| Pine Creek (PC)..... | 10 |
| Lower Walnut Creek at Charney Property (LWCCP) | 12 |
| Williamson Valley Wash at XU Ranch (WVWXU)..... | 14 |
| Lower Williamson Valley Wash (LWVW) | 16 |
| Lower Big Chino Wash (LBCW)..... | 18 |
| Upper Walnut Creek at Bridge (UWCB) | 20 |
| Upper Walnut Creek at Forest Service (UWCFS) | 21 |
| Conclusion..... | 22 |

Introduction

The purpose of the Big Chino Sub-Basin Ephemeral Stream Flow Monitoring Project is to collect additional surface water hydrologic data for use in the development of a numerical groundwater flow model. The streamflow data is part of a larger long-term data collection program. This monsoon season report is being developed for the CA1 Monitoring Committee as part of the Big Chino Sub-basin Water Monitoring Project in collaboration with the City of Prescott, Town of Prescott Valley, and Salt River Project (SRP). Under an independent contractor's agreement approved in 2013, SRP Water Measurement was selected to provide the installation, maintenance, and data collection at nine stream-flow sites within the Big Chino Sub-basin. A summary of flow events recorded during the 2014 monsoon season (July 1 to September 30, 2014) at each location are documented within this report.

Two additional stream gages located in the Big Chino Sub-basin are not detailed in this report. Williamson Valley Wash near Paulden gage is operated and maintained by the USGS with funding contributions from the CA1 Monitoring Committee. Prior to October 2014 this gage was funded by the Yavapai County Water Advisory Committee through member contributions, including from Prescott and Prescott Valley. This site has a period of record ranging from 3/26/1965 to 9/30/1985 and from 8/03/2001 to present. The other gage is Verde Headwaters located on the Verde River at Campbell Ranch installed and operated by SRP to measure low flows since 4/13/2005. Operation and maintenance of this gage is also now funded by the CA1 Monitoring Committee and is briefly discussed in this report for general comparison purposes with stream-flow sites within the Big Chino Sub-basin.

Background and Rating Development

As part of this monitoring effort, SRP Flowtophography™ equipped stream-flow monitoring locations were installed between December 2013 and June 2014. SRP Flowtophography™ is a system of hardware combined with back-office processes that improves knowledge of hydrologic and operation site information. The system utilizes time-lapse high resolution photography coupled with a fixed event gage within the frame of the image collected and specific to the condition being monitored. Standard configuration at most monitoring locations include upstream and downstream event gages equipped with pressure transducers (to collect stage values) and a flowtophography camera mounted on the stream bank that records images of the upstream event gage. Surveys were conducted to determine the channel cross sections for event gages at each monitoring location. Using the Slope-Area Method and preliminary survey data collected in the field, an illustrative detailed estimate of flow prediction was calculated for channel stages. The collected survey information was further used by inputting into Hec-Ras. A rating table, a rating curve and a rating equation were generated using the Hec-Ras model for the upstream and downstream cross sections.

Site Maintenance and Data Processing

A number of site visits were required to perform routine maintenance and non-routine servicing. Routine maintenance included collection of upstream and downstream transducer data, collection of flowtophography images from cameras, general cleaning of each site, and verification of general site operation. Several non-routine servicing (break-fix events) were also required and included replacing transducers and event gages damaged by flash flood events, troubleshooting camera issues and wireless

modern operation, debris removal, and additional survey and site investigation required for data processing. Specifics on site visits for each location are discussed in the Location Summaries section.

Data processing of stage values and rating curves were completed using Aquarius (version 3.5) time series software. Stage values (feet) collected from the upstream transducer serve as the primary data source (downstream transducer serve as secondary). Offsets to stage values were applied based on the depth of the transducer below stream channel and then compared with visual determination of stage values from flowtophography images. For instances when the event gage was obstructed or missing from the flowtophography images, stage level overlays were created using a tag line reference at each location (see Figure 1 and Figure 2).

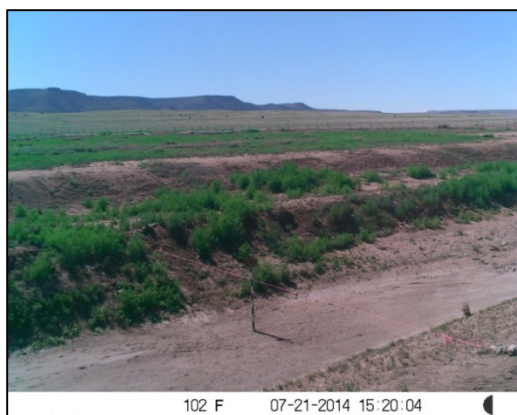


Figure 1. Upper Big Chino Wash tagline reference.

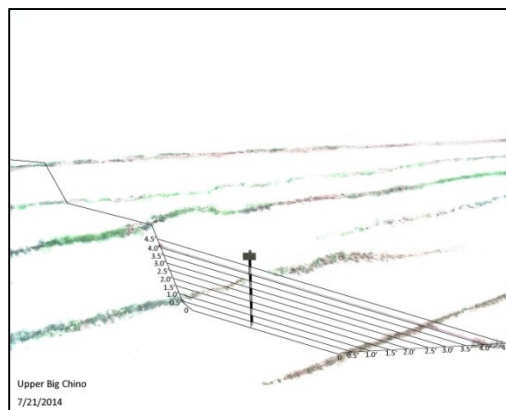


Figure 2. Upper Big Chino Wash stage level overlay.

The developed ratings were used to generate discharge values in cubic-feet per second (CFS) for each stage value. The hourly mean CFS was used to calculate the total volume of water in acre-feet (AF) for each flow event. Data and images are stored and maintained by SRP and are available to the CA1 monitoring committee via a secure SRP hosted web portal.

Seasonal Flow Events Summary

During the 2014 monsoon season, July 1 through September 30, 2014, a total of 17 storm events resulting in surface water flow were recorded in the Big Chino Sub-basin. The number of sites with flow, magnitude of flow, and duration of flow during these events varied throughout the sub-basin. Monsoon season flow event totals (AF) at each location are outlined in Table 1 and Figure 3.

Pine Creek and Lower Williamson Valley Wash recorded the highest number of events (10) while Lower Big Chino Wash and Lower Walnut Creek at Charney Property recorded the fewest events (5). The average duration of flow events and overall flow time of events at each location varied throughout the sub-basin. The highest average duration of events and total duration of flow during the monsoon season occurred at Lower Williamson Valley Wash (21.6 hours per event, 216 total hours of flow). The longest duration event at Lower Williamson Valley Wash lasted 53 hours and yielded 27.9 AF of water for the entire event. The shortest average duration of events and total duration of flow occurred at Lower Walnut Creek at Charney Property (2.3 hours per event, 11.5 total hours of flow).

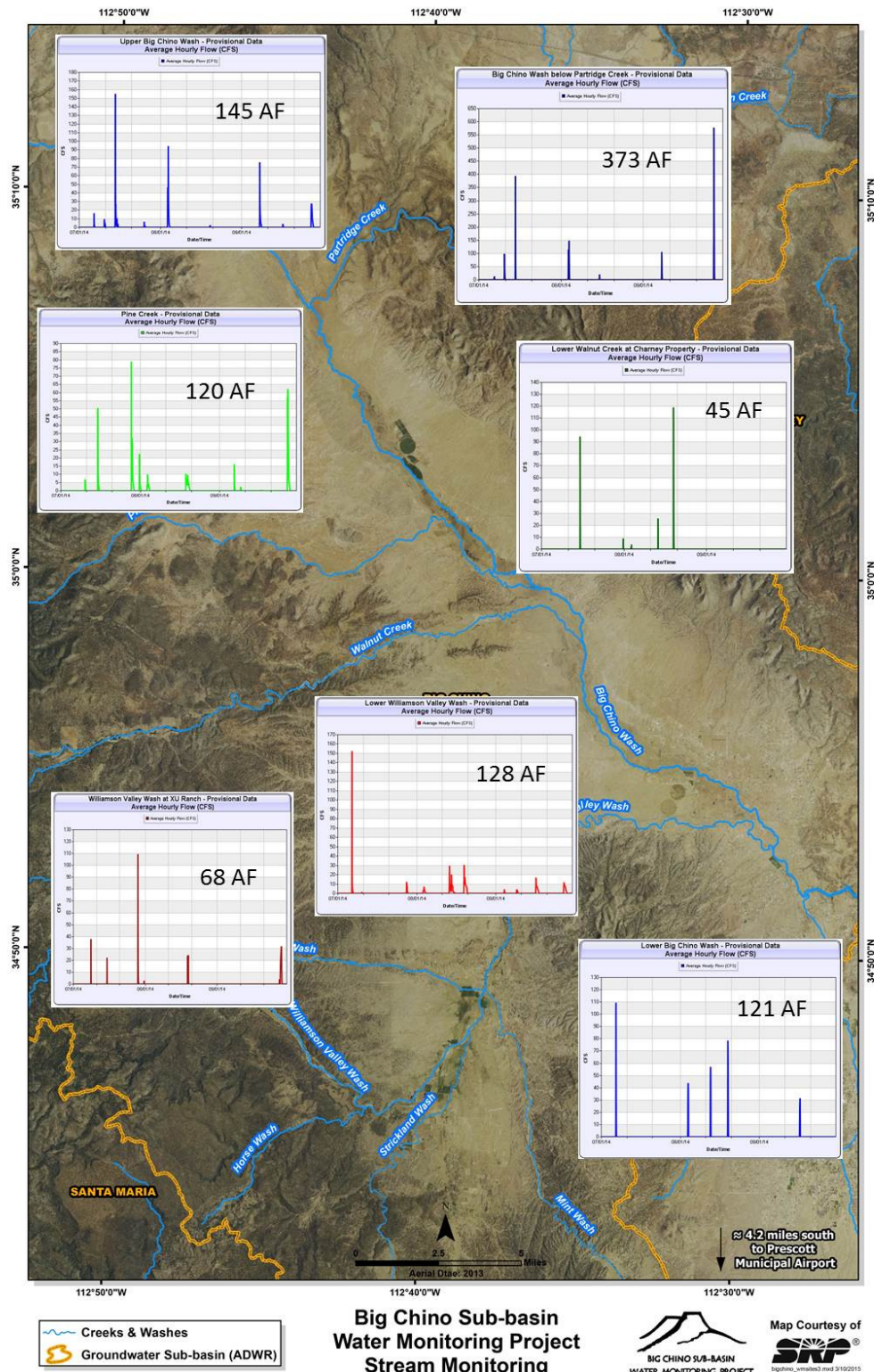
Big Chino Wash below Partridge Creek recorded the highest single event flow and total highest flow throughout the monsoon season. Maximum peak discharge recorded at the site was 640 CFS on 9/27/2014 resulting in 174.47 AF for the event. A total of 373.64 AF of water flowed through the Big Chino Wash below Partridge Creek location during the monsoon season. It should be noted that flow at the Upper Big Chino Wash location would most likely also contribute to the Big Chino Wash below Partridge Creek location in addition to flow contributions from Partridge Creek. The lowest total volume of water to flow through a site during the 2014 monsoon season was 45.46 AF at the Lower Walnut Creek at Charney Property location. A total volume of 121.79 AF was estimated to flow through the Lower Big Chino Wash location just upstream of Sullivan Dam. Sullivan Dam was not monitored during the 2014 monsoon season therefore it was not determined whether water spilled to the Verde River Canyon.

Table 1: Big Chino Sub-basin Locations - 2014 Monsoon Season Flow Event Totals in acre-feet (AF)

| Start Date* | Upper Big Chino Wash | Big Chino Wash below Partridge Creek | Pine Creek | Lower Walnut Creek at Charney Property | Williamson Valley Wash at XU Ranch | Lower Williamson Valley Wash | Lower Big Chino Wash |
|--------------------|-----------------------------|---|-------------------|---|---|-------------------------------------|-----------------------------|
| 7/6/2014 | 3.86 | 3.39 | 0 | 0 | 0 | 25.09 | 28.87 |
| 7/8/2014 | 0 | 0 | 0 | 0 | 4.2 | 0 | 0 |
| 7/10/2014 | 4.52 | 25.33 | 2.09 | 0 | 0 | 0.16 | 0 |
| 7/14/2014 | 48.77 | 64.98 | | 0 | 0 | 0 | 0 |
| 7/15/2014 | 0 | 0 | 10.97 | 14.71 | 3.31 | 0 | 0 |
| 7/25/2014 | 2.48 | 0 | 0 | 0 | | 0 | 0 |
| 7/28/2014 | 0 | 0 | 27.62 | 0 | 20.43 | 6.34 | 0 |
| 7/31/2014 | 0 | 0 | 6.26 | 0.82 | 0.31 | 0 | 0 |
| 8/3/2014 | 38.55 | 72.05 | 6.76 | 0.47 | 0 | 5.31 | 22.65 |
| 8/13/2014 | 0 | 0 | 0 | 0 | 0 | 27.97 | 24.98 |
| 8/15/2014 | 0 | 4.49 | 0 | 3.82 | 0 | 0 | 0 |
| 8/19/2014 | 0.78 | 0 | 15.94 | 25.64 | 8.81 | 28.10 | 31.17 |
| 9/4/2014 | 0 | 0 | 0 | 0 | 0 | 1.33 | 0 |
| 9/7/2014 | 22.84 | 28.93 | 3.46 | 0 | 0 | 0 | 0 |
| 9/9/2014 | 0 | 0 | 0.83 | 0 | 0 | 3.1 | 0 |
| 9/16/2014 | 1.17 | 0 | 0.05 | 0 | 0 | 15.14 | 14.12 |
| 9/27/2014 | 22.85 | 174.47 | 46.49 | 0 | 31.61 | 15.88 | 0 |
| | 145 | 373 | 120 | 45 | 68 | 128 | 121 |

*Note: Flow events may continue into the next day or start just prior to indicated date in some instances

**Figure 3: Big Chino Sub-basin SRP Flowtography™ Stream-flow Monitoring Locations
2014 Monsoon Season Flow Events – July 1 to September 30, 2014**



Location Summaries

Upper Big Chino Wash (UBCW)

A total of 9 flow events were recorded at Upper Big Chino Wash during the period from July 1, 2014 through September 30, 2014. Peak discharge ranged from 2.75 CFS on 8/19/2014 to 319 CFS on 7/14/2014. Total volume of each event ranged from 0.78 AF to 48.77 AF, respectively. A total volume of 145.82 AF was estimated to flow through the UBCW location during the 2014 monsoon season.

Total duration of the events ranged from 5.75 hours on 9/16/2014 to 31.25 hours on 7/14/2014. Average event flow duration was 18.69 hours and total flow duration was 168.25 hours for the 2014 monsoon season. Table 2 below summarizes the flow events at the UBCW location and Figure 4 displays hydrographs and flowtopography images of flow events.

Table 2: Upper Big Chino Wash - 2014 Monsoon Flow Events

| Start Date | Start Time* | Duration (hours) | Peak Stage (feet) | Peak Discharge (CFS) | Total Volume (AF) |
|--------------|-------------|------------------|-------------------|----------------------|-------------------|
| 7/6/2014 | 15:30 | 13.5 | 1 | 29.4 | 3.86 |
| 7/10/2014 | 13:30 | 10.25 | 0.62 | 13.8 | 4.52 |
| 7/14/2014** | 16:45 | 31.25 | 3.53 | 319 | 48.77 |
| 7/25/2014 | 14:30 | 21 | 0.64 | 7.18 | 2.48 |
| 8/3/2014 | 17:00 | 27.25 | 2.31 | 125 | 38.55 |
| 8/19/2014*** | 10:00 | 13.25 | 0.32 | 2.75 | 0.78 |
| 9/7/2014 | 21:00 | 23 | 2.08 | 109 | 22.84 |
| 9/16/2014 | 15:45 | 5.75 | 0.29 | 4.97 | 1.17 |
| 9/27/2014 | 11:15 | 23 | 1.06 | 32.6 | 22.85 |
| Average | | 18.69 | 1.31 | 71.52 | 16.20 |
| Total | | 168.25 | | | 145.82 |

* Start times are approximate within 15 minutes and events may continue into the next day

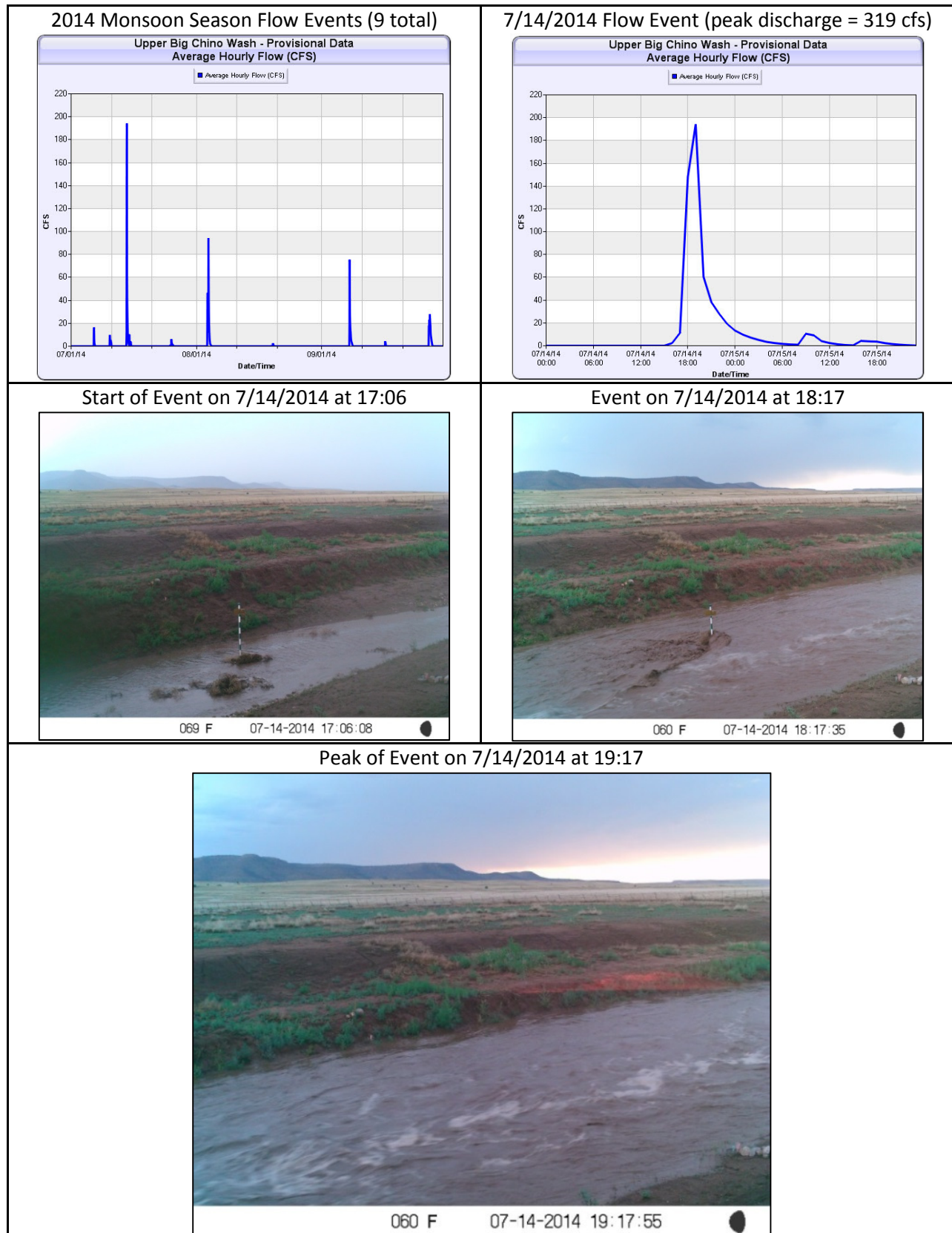
**Event gage damaged during flow event

*** Duration only when flowing. Period of no flow within event.

The UBCW location was visited a total of three times during the monsoon season with additional visits for post monsoon related activities. In addition to routine maintenance and collection, the following adjustments were required at the site:

- Repaired and replaced the two event gages that were knocked over during the 7/14/2014 flow event
- Replaced filter screen on upstream event gage and cleared vegetation from banks that obstruct flowtopography view
- Took photos with tagline (reference) to determine stage level in images without event gage or with obstructed view of event gage

Figure 4: Upper Big Chino Wash Hydrographs and Flowtography Flow Event Images



Big Chino Wash below Partridge Creek (BCWPC)

A total of 7 flow events were recorded at Big Chino Wash below Partridge Creek (BCWPC) during the period from July 1, 2014 through September 30, 2014. Peak discharge during events ranged from 12.3 CFS on 7/06/2014 to 640 CFS on 9/27/2014. Total volume of each event ranged from 3.39 AF to 174.47 AF, respectively. Flow measured at the BCWPC location includes both portions of flow measured at the UBCW location and additional flow contributions from Partridge Creek. When compared with flows at UBCW, estimated flow contributions from Partridge Creek can be inferred. For example during the 9/27/2014 flow event total 174.47 AF of water at BCWPC, only 22.85 AF of water was measured at UBCW, indicating the majority of flow occurred from Partridge Creek during this flow event.

A total volume of 373.64 AF was estimated to flow through the BCWPC location during the 2014 monsoon season. Total duration of the events ranged from 5.5 hours on 7/14/2014 to 11 hours on 8/3/2014. Average event flow duration was 8.14 hours and total flow duration was 57 hours for the 2014 monsoon season. Note that flow duration and volume estimated at this location does not include pooled or static water that collects at the site and only physical flow is used in calculations (water flowing past the downstream control). Table 3 below summarizes the flow events at BCWPC location and Figure 5 displays hydrographs and flowtography images of flow events.

Table 3: Big Chino Wash below Partridge Creek – 2014 Monsoon Flow Events

| Start Date | Start Time* | Duration (hours) | Peak Stage (feet) | Peak Discharge (CFS) | Total Volume (AF) |
|-------------|-------------|------------------|-------------------|----------------------|-------------------|
| 7/6/2014 | 22:00 | 5.75 | 1.28 | 12.3 | 3.39 |
| 7/10/2014** | 14:30 | 10.5 | 3 | 123 | 25.33 |
| 7/14/2014 | 18:30 | 5.5 | 4.8 | 420 | 64.98 |
| 8/3/2014 | 17:45 | 11 | 3.27 | 155 | 72.05 |
| 8/15/2014 | 10:45 | 6 | 1.69 | 26.9 | 4.49 |
| 9/7/2014 | 21:30 | 9 | 2.86 | 108 | 28.93 |
| 9/27/2014 | 12:15 | 9.25 | 5.63 | 640 | 174.47 |
| Average | | 8.14 | 3.22 | 212.17 | 53.38 |
| Total | | 57 | | | 373.64 |

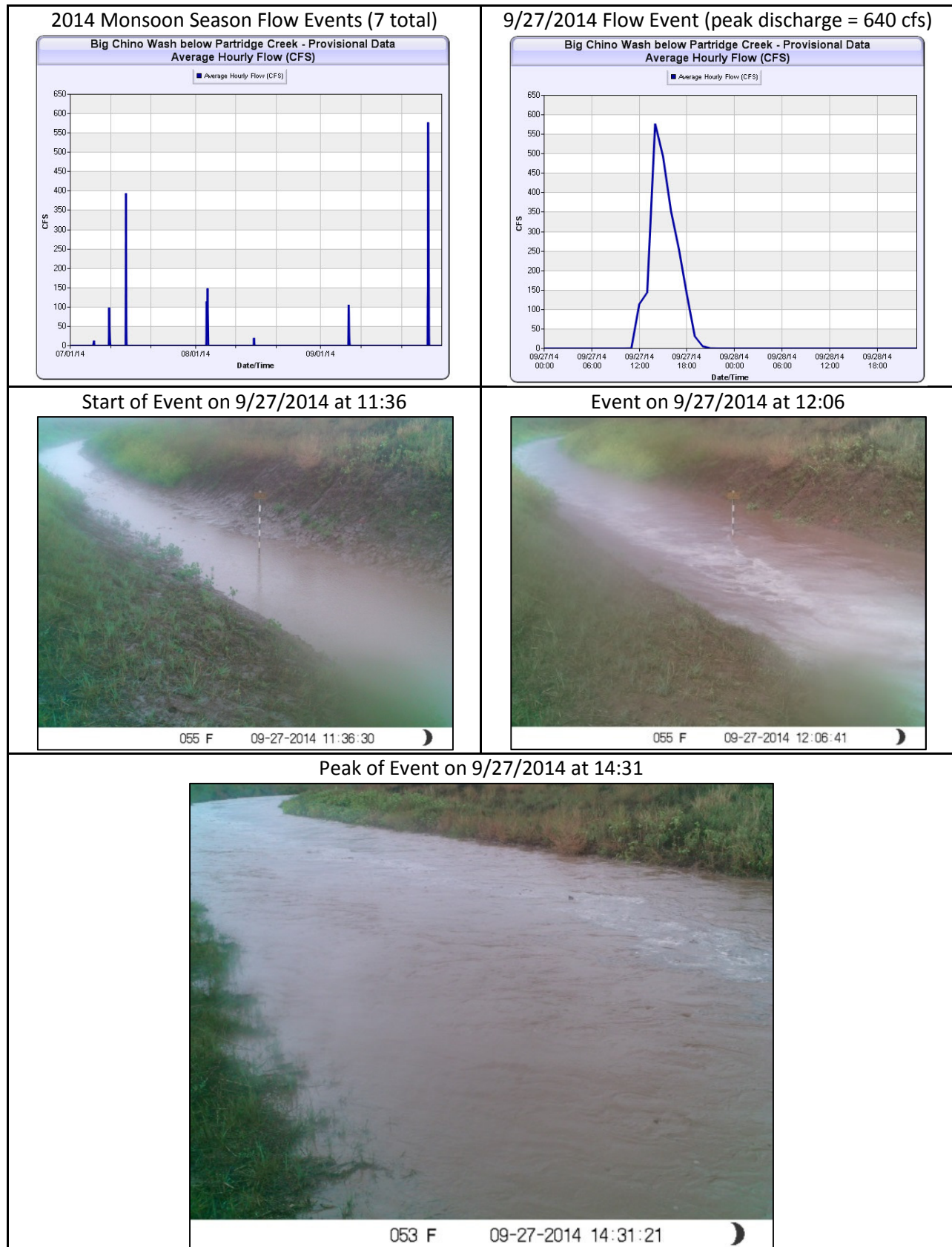
* Start times are approximate within 15 minutes and events may continue into the next day

**Event gage damaged during flow event

The BCWPC location was visited a total of four times during the monsoon season with additional visits for post monsoon related activities. In addition to routine maintenance and collection, the following adjustments were required at the site:

- Replaced the two event gages that were damaged during the 7/10/2014 flow event
- Replaced transducers and cleared vegetation from banks that obstruct flowtography view
- Took photos with tagline (reference) to determine stage level in images
- Investigated and surveyed downstream of event gage in order to adjust rating equation

Figure 5: Big Chino Wash below Partridge Creek Hydrographs and Flowtography Flow Event Images



Pine Creek (PC)

A total of 10 flow events were recorded at Pine Creek (PC) location during the period from July 1, 2014 through September 30, 2014. Peak discharge during events ranged from 0.51 CFS on 9/16/2014 to 84.7 CFS on 9/27/2014. Total volume of each event ranged from 0.05 AF to 46.49 AF, respectively. A total volume of 120.47 AF was estimated to flow through the PC location during the 2014 monsoon season.

Total duration of the events ranged from 1.75 hours on 9/16/2014 to 27.75 hours on 7/28/2014. Average event flow duration was 17.35 hours and total flow duration was 173.5 hours for the 2014 monsoon season. Table 4 below summarizes the flow events at PC location and Figure 6 displays hydrographs and flowtopography images of flow events.

Table 4: Pine Creek - 2014 Monsoon Flow Events

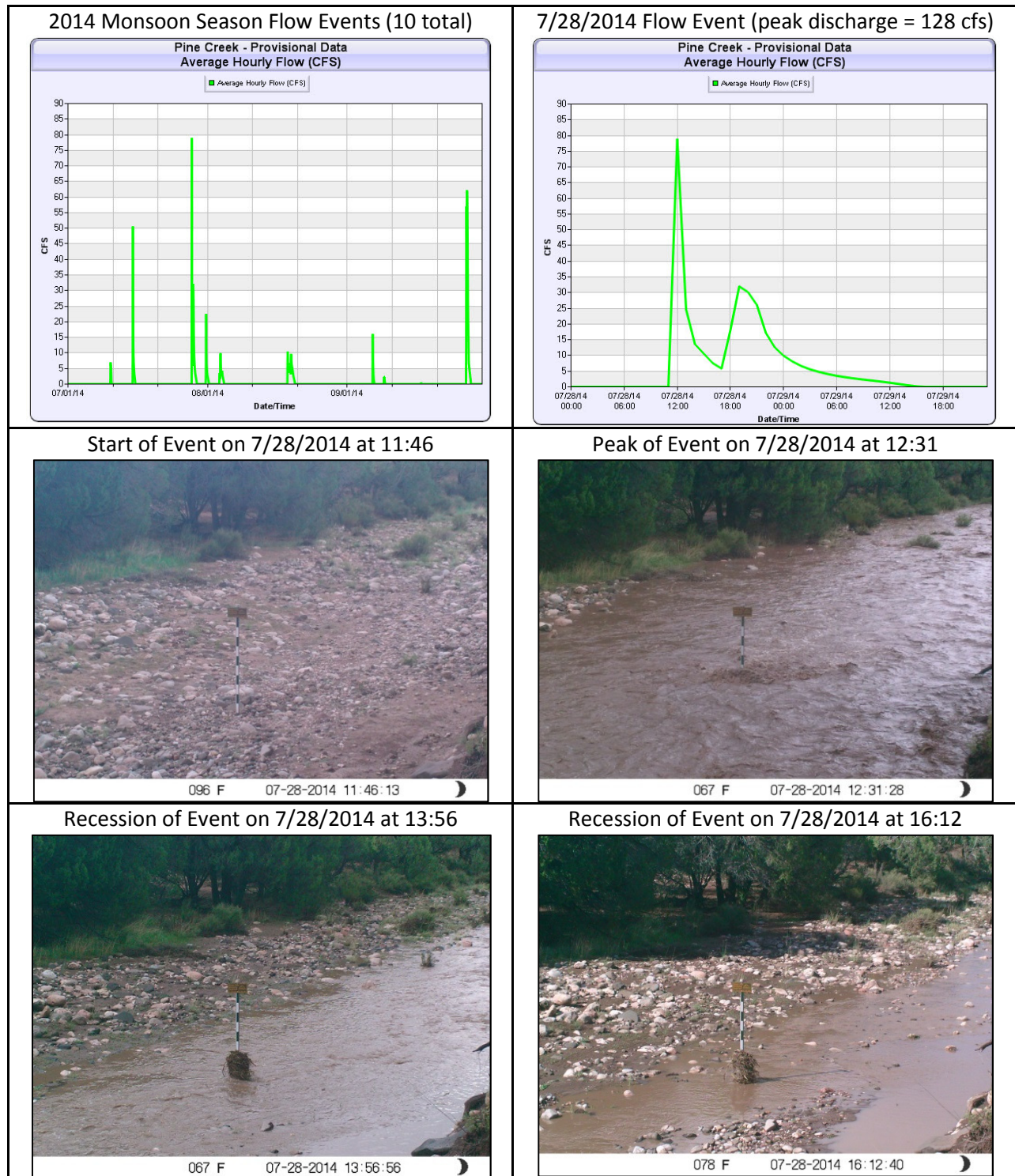
| Start Date | Start Time* | Duration (hours) | Peak Stage (feet) | Peak Discharge (CFS) | Total Volume (AF) |
|------------|-------------|------------------|-------------------|----------------------|-------------------|
| 7/10/2014 | 10:45 | 5.25 | 0.3 | 8.43 | 2.09 |
| 7/15/2014 | 10:00 | 13.75 | 1.22 | 82.3 | 10.97 |
| 7/28/2014 | 12:15 | 27.75 | 1.5 | 128 | 27.62 |
| 7/31/2014 | 15:45 | 17 | 0.71 | 30.5 | 6.26 |
| 8/3/2014 | 15:45 | 25 | 0.39 | 12.3 | 6.76 |
| 8/18/2015 | 18:15 | 41 | 0.37 | 11.37 | 15.94 |
| 9/6/2014 | 16:30 | 9.5 | 0.73 | 31.5 | 3.46 |
| 9/9/2014 | 3:15 | 7.75 | 0.11 | 2.64 | 0.83 |
| 9/16/2014 | 9:45 | 1.75 | 0.02 | 0.51 | 0.05 |
| 9/27/2014 | 11:00 | 24.75 | 1.23 | 84.7 | 46.49 |
| Average | | 17.35 | 0.66 | 39.23 | 12.05 |
| Total | | 173.5 | | | 120.47 |

* Start times are approximate within 15 minutes and events may continue into the next day

The PC location was visited a total of four times during the monsoon season with additional visits for post monsoon related activities. In addition to routine maintenance and collection, the following adjustments were required at the site:

- Cleaned debris from event gages and removed vegetation from banks that obstruct flowtopography view
- Took photos with tagline (reference) to determine stage level in images with obstructed gage

Figure 6: Pine Creek Hydrographs and Flowtopgraphy Flow Event Images



Lower Walnut Creek at Charney Property (LWCCP)

A total of 5 flow events were recorded at Lower Walnut Creek at Charney Property (LWCCP) location during the period from July 1, 2014 through September 30, 2014. Peak discharge during events ranged from 8.35 CFS on 8/3/2014 to 219 CFS on 8/19/2014. Total volume of each event ranged from 0.47 AF to 25.64 AF, respectively. A total volume of 45.46 AF was estimated to flow through the LWCCP location during the 2014 monsoon season.

Total duration of the events ranged from 1 hour on 8/3/2014 to 4.25 hours on 8/19/2014. Average event flow duration was 2.3 hours and total flow duration was 11.5 hours for the 2014 monsoon season. Table 5 below summarizes the flow events at LWCCP location and Figure 7 displays hydrographs and flowtography images of flow events.

Table 5: Lower Walnut Creek at Charney Property – 2014 Monsoon Flow Events

| Start Date | Start Time* | Duration (hours) | Peak Stage (feet) | Peak Discharge (CFS) | Total Volume (AF) |
|-------------|-------------|------------------|-------------------|----------------------|-------------------|
| 7/15/2014 | 11:30 | 3 | 1.26 | 191 | 14.71 |
| 7/31/2014 | 16:00 | 1.75 | 0.28 | 22.5 | 0.82 |
| 8/3/2014*** | 15:15 | 1 | 0.12 | 8.35 | 0.47 |
| 8/15/2015 | 18:30 | 1.5 | 0.46 | 43.6 | 3.82 |
| 8/19/2014 | 13:30 | 4.25 | 1.37 | 219 | 25.64 |
| Average | | 2.30 | 0.70 | 96.89 | 9.09 |
| Total | | 11.5 | | | 45.46 |

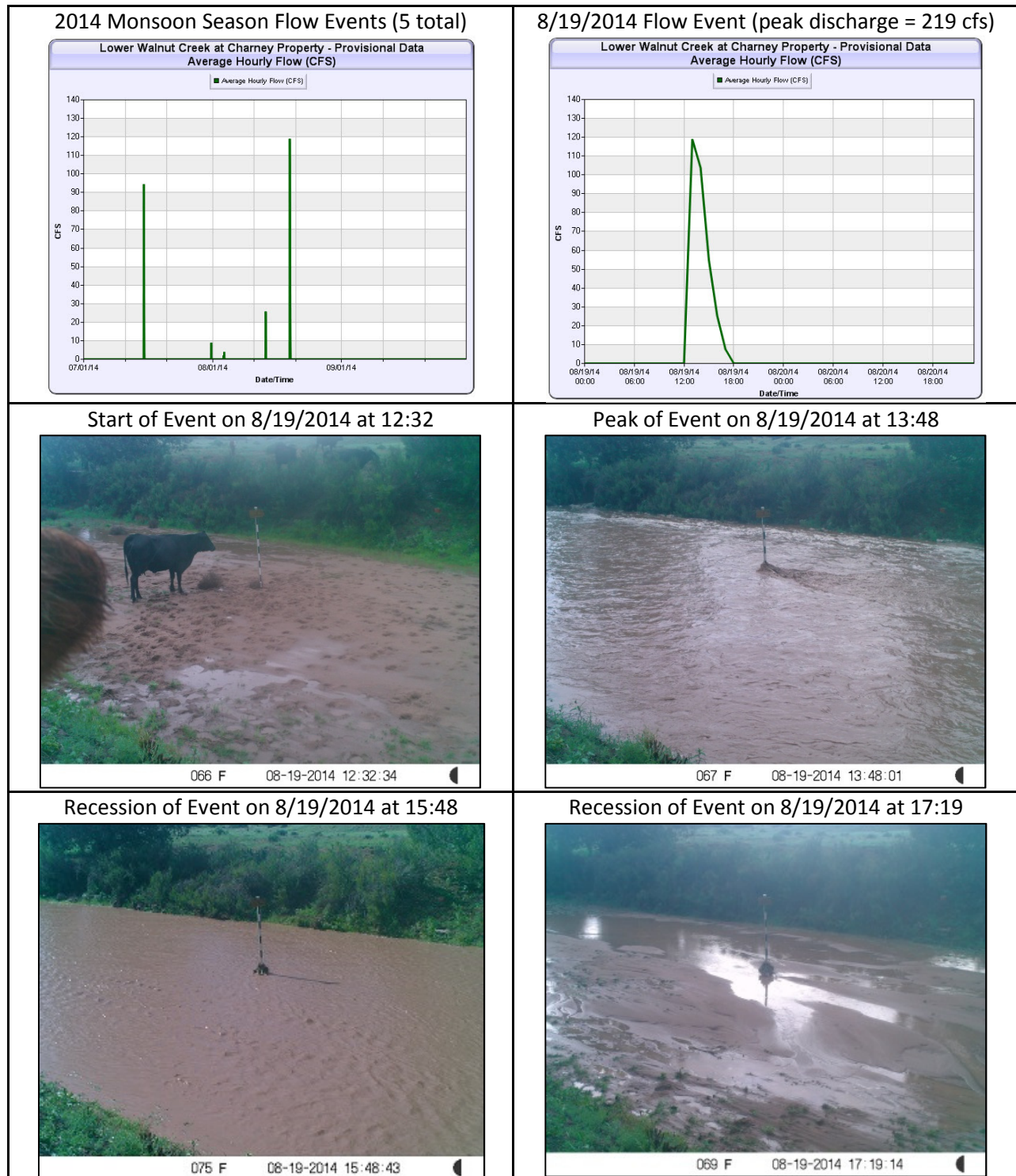
* Start times are approximate within 15 minutes and events may continue into the next day

*** Period(s) of no flow within event. Duration of event indicates only time with flow

The LWCCP location was visited a total of three times during the monsoon season with additional visits for post monsoon related activities. In addition to routine maintenance and collection, the following adjustments were required at the site:

- Cleaned debris from event gages and removed vegetation from banks that obstruct flowtography view
- Took photos with tagline (reference) to determine stage level in images with obstructed gage
- Replaced damaged event gages and transducers (possibly loosened due to cows rubbing against the event gage)
- Base of event gages were scoured out and filled with sand and rocks

Figure 7: Lower Walnut Creek at Charney Property Hydrographs and Flowtography Flow Event Images



Williamson Valley Wash at XU Ranch (WVWXU)

A total of 6 flow events were recorded at Williamson Valley Wash at XU Ranch (WVWXU) location during the period from July 1, 2014 through September 30, 2014. Peak discharge during events ranged from 8.12 CFS on 7/31/2014 to 179 CFS on 7/28/2014. Total volume of each event ranged from 0.31 AF on 7/31/2014 to 31.61 AF on 9/27/2014. A total volume of 68.67 AF was estimated to flow through the WVWXU location during the 2014 monsoon season.

Total duration of the events ranged from 0.75 hour on 7/31/2014 to 27.25 hours on 9/27/2014. Average event flow duration was 8.63 hours and total flow duration was 51.75 hours for the 2014 monsoon season. Table 6 below summarizes the flow events at WVWXU location and Figure 8 displays hydrographs and flowtography images of flow events.

Table 6: Williamson Valley Wash at XU Ranch – 2014 Monsoon Flow Events

| Start Date | Start Time* | Duration (hours) | Peak Stage (feet) | Peak Discharge (CFS) | Total Volume (AF) |
|--------------|-------------|------------------|-------------------|----------------------|-------------------|
| 7/8/2014 | 14:30 | 2.5 | 0.72 | 85.7 | 4.2 |
| 7/15/2014 | 12:30 | 2.5 | 0.48 | 43.1 | 3.31 |
| 7/28/2014 | 19:45 | 10.25 | 1.1 | 179 | 20.43 |
| 7/31/2014 | 12:00 | 0.75 | 0.16 | 8.12 | 0.31 |
| 8/19/2015*** | 5:30 | 8.5 | 0.56 | 55.5 | 8.81 |
| 9/27/2014 | 19:45 | 27.25 | 0.39 | 31.9 | 31.61 |
| Average | | 8.63 | 0.57 | 67.22 | 11.45 |
| Total | | 51.75 | | | 68.67 |

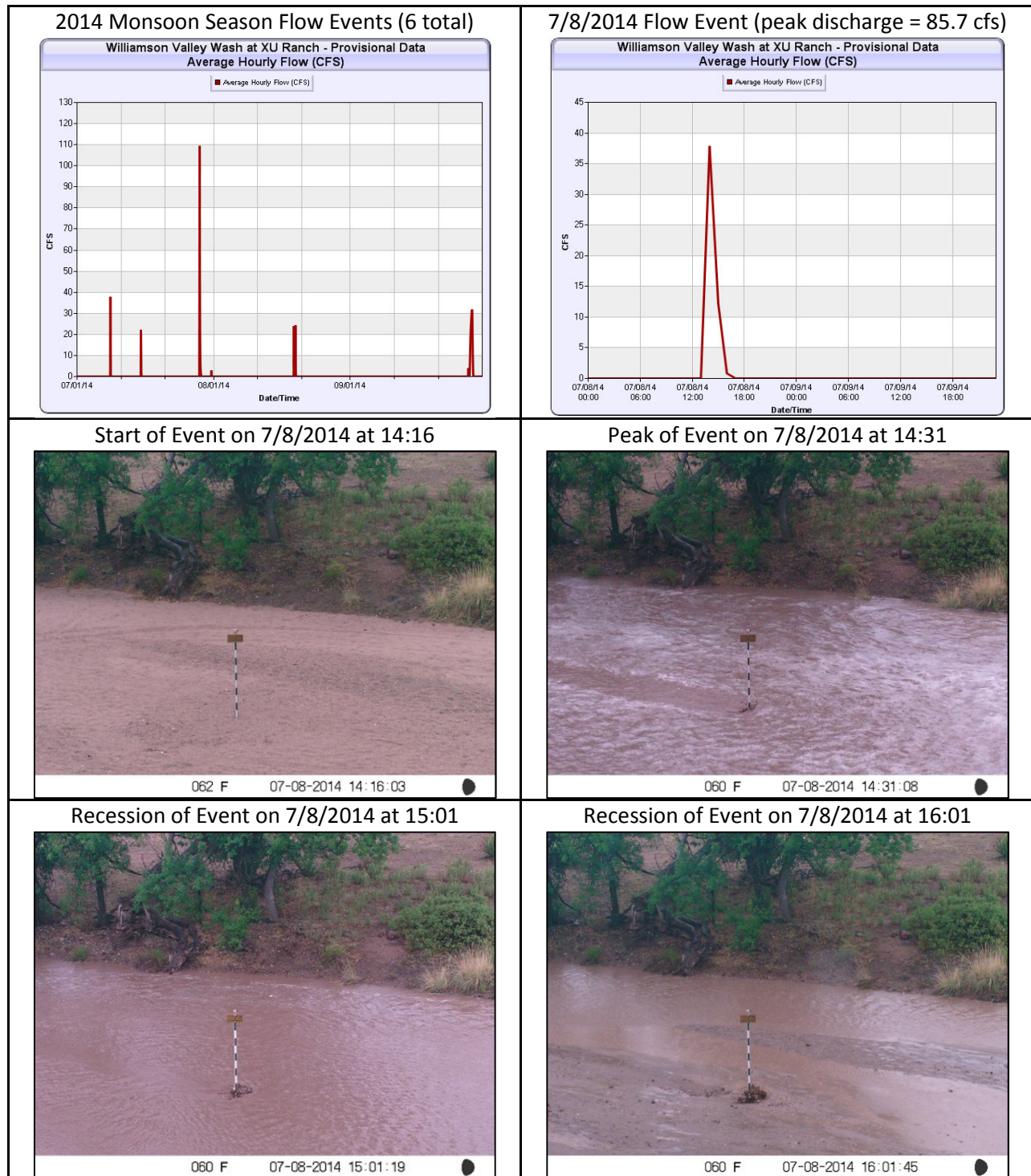
* Start times are approximate within 15 minutes and events may continue into the next day

*** Period(s) of no flow within event. Duration of event indicates only time with flow

The WVWXU location was visited a total of four times during the monsoon season with additional visits for post monsoon related activities. In addition to routine maintenance and collection, the following adjustments were required at the site:

- Cleaned debris from event gages and removed vegetation from banks that obstruct flowtography view
- Took photos with tagline (reference) to determine stage level in images with obstructed event gage

Figure 8: Williamson Valley Wash at XU Ranch Hydrographs and Flowtopgraphy Flow Event Images



Lower Williamson Valley Wash (LWVW)

A total of 10 flow events were recorded at Lower Williamson Valley Wash (LWVW) during the period from July 1, 2014 through September 30, 2014. Peak discharge during events ranged from 4.07 CFS on 7/10/2014 to 281 CFS on 7/6/2014. Total volume of each event ranged from 0.16 AF on 7/10/2014 to 28.1 AF on 8/19/2014. A total volume of 128.23 AF was estimated to flow through the LWVW location during the 2014 monsoon season.

Total duration of the events ranged from 1.0 hour on 7/10/2014 to 53 hours on 8/13/2014. Average event flow duration was 21.6 hours and total flow duration was 216 hours for the 2014 monsoon season. Table 7 below summarizes the flow events at LWVW location and Figure 9 displays hydrographs and flowtopography images of flow events.

Table 7: Lower Williamson Valley Wash – 2014 Monsoon Flow Events

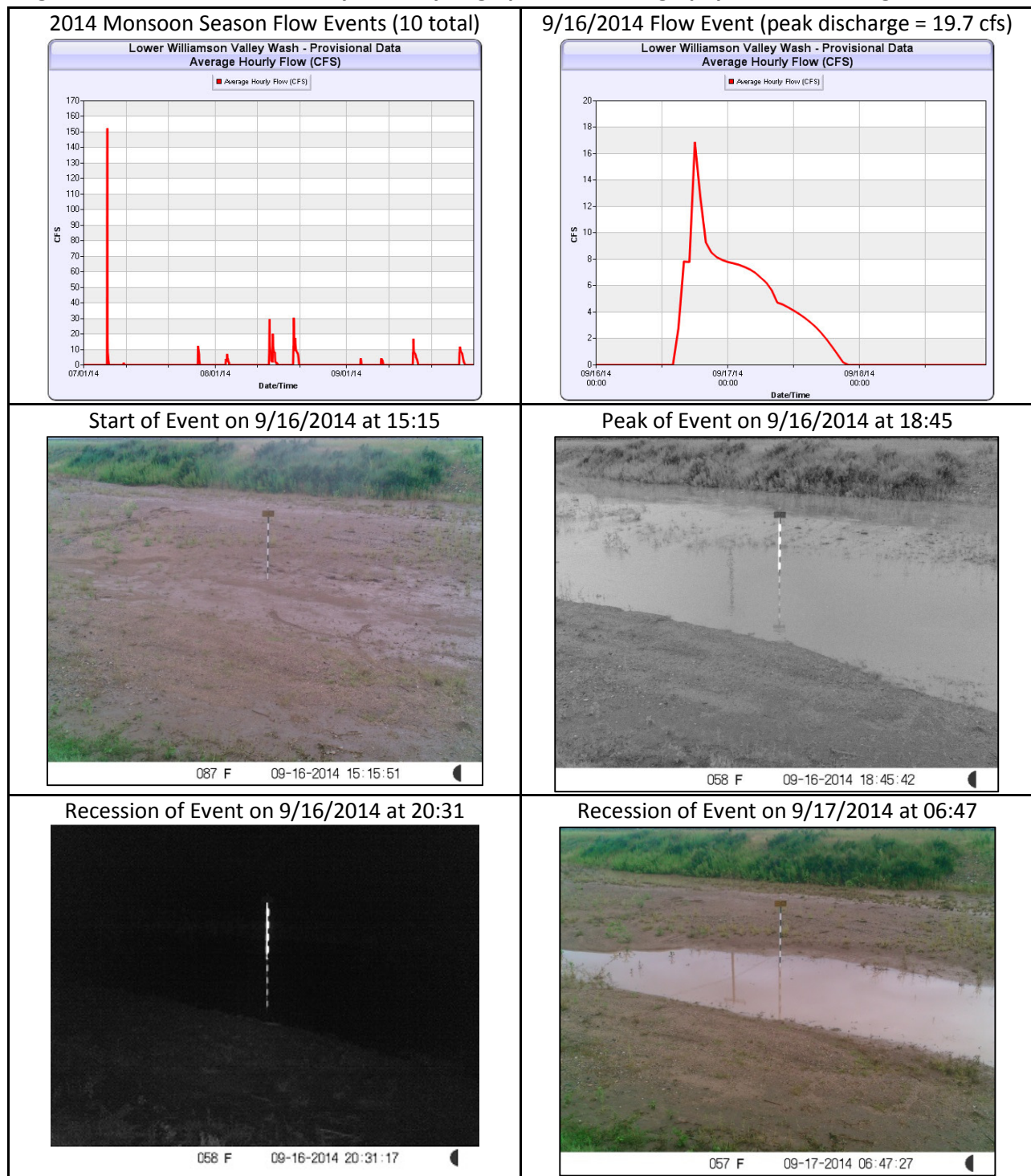
| Start Date | Start Time* | Duration (hours) | Peak Stage (feet) | Peak Discharge (CFS) | Total Volume (AF) |
|-------------------|--------------------|-------------------------|--------------------------|-----------------------------|--------------------------|
| 7/6/2014 | 13:00 | 15 | 1.8 | 281 | 25.09 |
| 7/10/2014 | 11:00 | 1 | 0.1 | 4.07 | 0.16 |
| 7/27/2014 | 23:00 | 11 | 0.66 | 12.8 | 6.34 |
| 8/3/2014 | 12:45 | 20.5 | 0.31 | 7.41 | 5.31 |
| 8/13/2014 | 17:30 | 53 | 0.99 | 39.2 | 27.97 |
| 8/19/2015 | 10:45 | 32.5 | 1.0 | 42.9 | 28.10 |
| 9/4/2014 | 7:00 | 5.75 | 0.11 | 4.50 | 1.33 |
| 9/9/2014 | 3:15 | 13 | 0.11 | 4.53 | 3.10 |
| 9/16/2014 | 15:46 | 30 | 0.79 | 19.7 | 15.14 |
| 9/27/2014 | 14:30 | 34.5 | 0.65 | 12.5 | 15.88 |
| Average | | 21.6 | 0.52 | 42.8 | 12.8 |
| Total | | 216 | | | 128.23 |

* Start times are approximate within 15 minutes and events may continue into the next day

The LWVW location was visited a total of three times during the monsoon season with additional visits for post monsoon related activities. In addition to routine maintenance and collection, the following adjustments were required at the site:

- Cleaned debris from event gages and removed vegetation from banks that obstruct flowtopography view
- Took photos with tagline (reference) to determine stage level in images with obstructed event gage

Figure 9: Lower Williamson Valley Wash Hydrographs and Flowtophography Flow Event Images



Lower Big Chino Wash (LBCW)

A total of 5 flow events were recorded at Lower Big Chino Wash (LBCW) during the period from July 1, 2014 through September 30, 2014. Peak discharge during events ranged from 31.4 CFS on 9/16/2014 to 113 CFS on 7/6/2014. Total volume of each event ranged from 14.12 AF on 9/16/2014 to 31.17 AF on 8/19/2014. A total volume of 121.79 AF was estimated to flow through the Lower Big Chino Wash location during the 2014 monsoon season.

Total duration of the events ranged from 5.5 hours on 7/6/2014 to 18.5 hours on 8/12/2014. Average event flow duration was 9.5 hours and total flow duration was 47.5 hours for the 2014 monsoon season. Note that flow duration and volume estimated at this location does not include pooled or static water that collects at the site and only physical flow is used in calculations (water flowing past the downstream control). Table 8 below summarizes the flow events at Lower Big Chino Wash location and Figure 10 displays hydrographs and flowtopography images of flow events.

Table 8 - Lower Big Chino Wash - 2014 Monsoon Flow Events

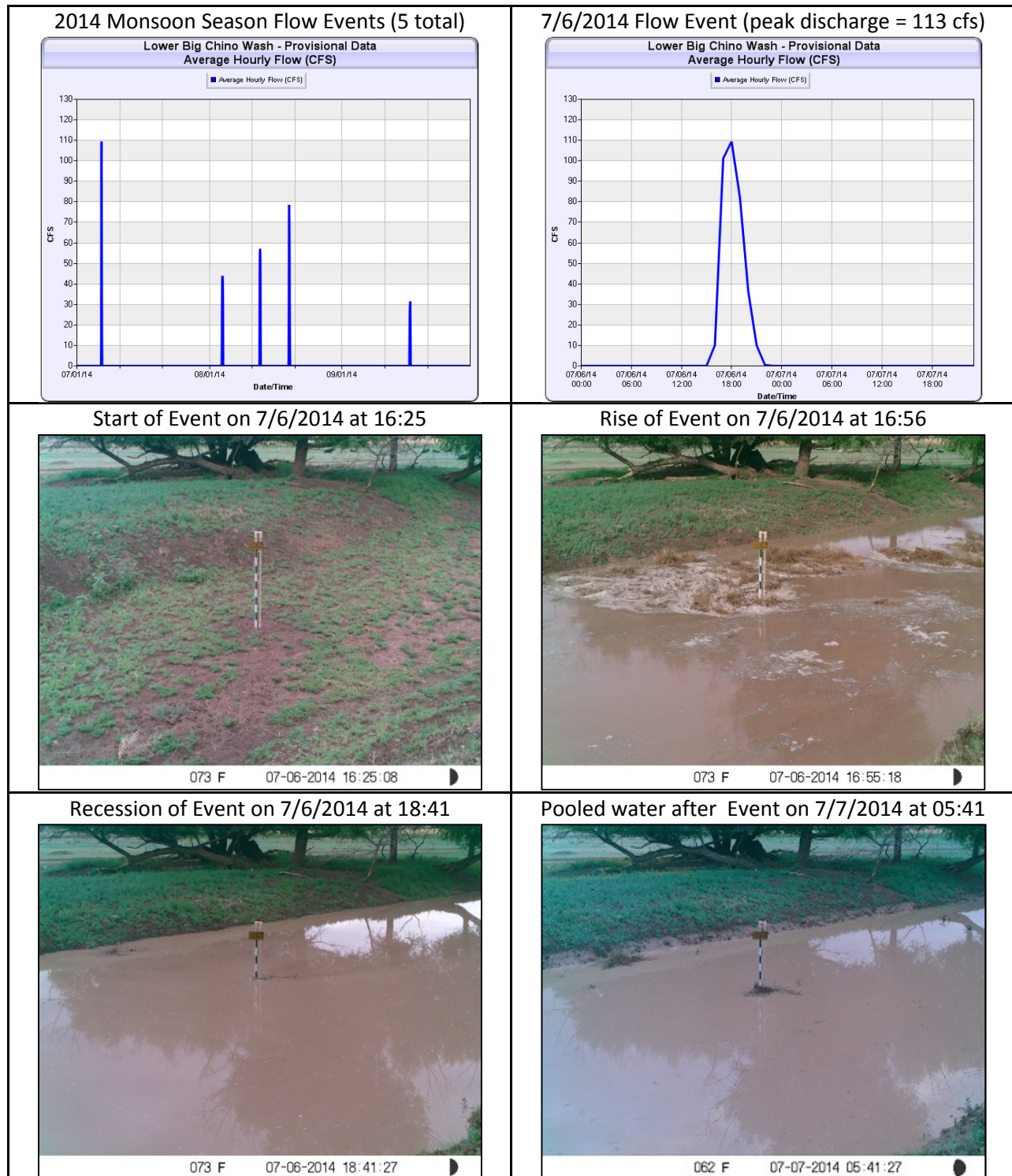
| Start Date | Start Time* | Duration (hours) | Peak Stage (feet) | Peak Discharge (CFS) | Total Volume (AF) |
|-------------------|--------------------|-------------------------|--------------------------|-----------------------------|--------------------------|
| 7/6/2014 | 16:45 | 5.5 | 2.65 | 113 | 28.87 |
| 8/3/2014 | 21:30 | 7.75 | 1.9 | 44.1 | 22.65 |
| 8/12/2015 | 17:15 | 18.5 | 2.07 | 57.5 | 24.98 |
| 8/19/2014 | 12:30 | 8.5 | 2.35 | 81.8 | 31.17 |
| 9/16/2014 | 18:15 | 7.25 | 1.71 | 31.4 | 14.12 |
| Average | | 9.5 | 1.73 | 65.56 | 24.35 |
| Total | | 47.5 | | | 121.79 |

* Start times are approximate within 15 minutes and events may continue into the next day

The LBCW location was visited a total of three times during the monsoon season with additional visits for post monsoon related activities. In addition to routine maintenance and collection, the following adjustments were required at the site:

- Cleaned debris from event gages and removed vegetation from banks that obstruct flowtopography view
- Took photos with tagline (reference) to determine stage level in images with obstructed gage
- Troubleshoot and repair camera issues
- Investigated and surveyed downstream of event gage in order to adjust rating equation to account for pooled water due to downstream control toward Sullivan Lake.

Figure 10: Lower Big Chino Wash Hydrographs and Flowtopgraphy Flow Event Images

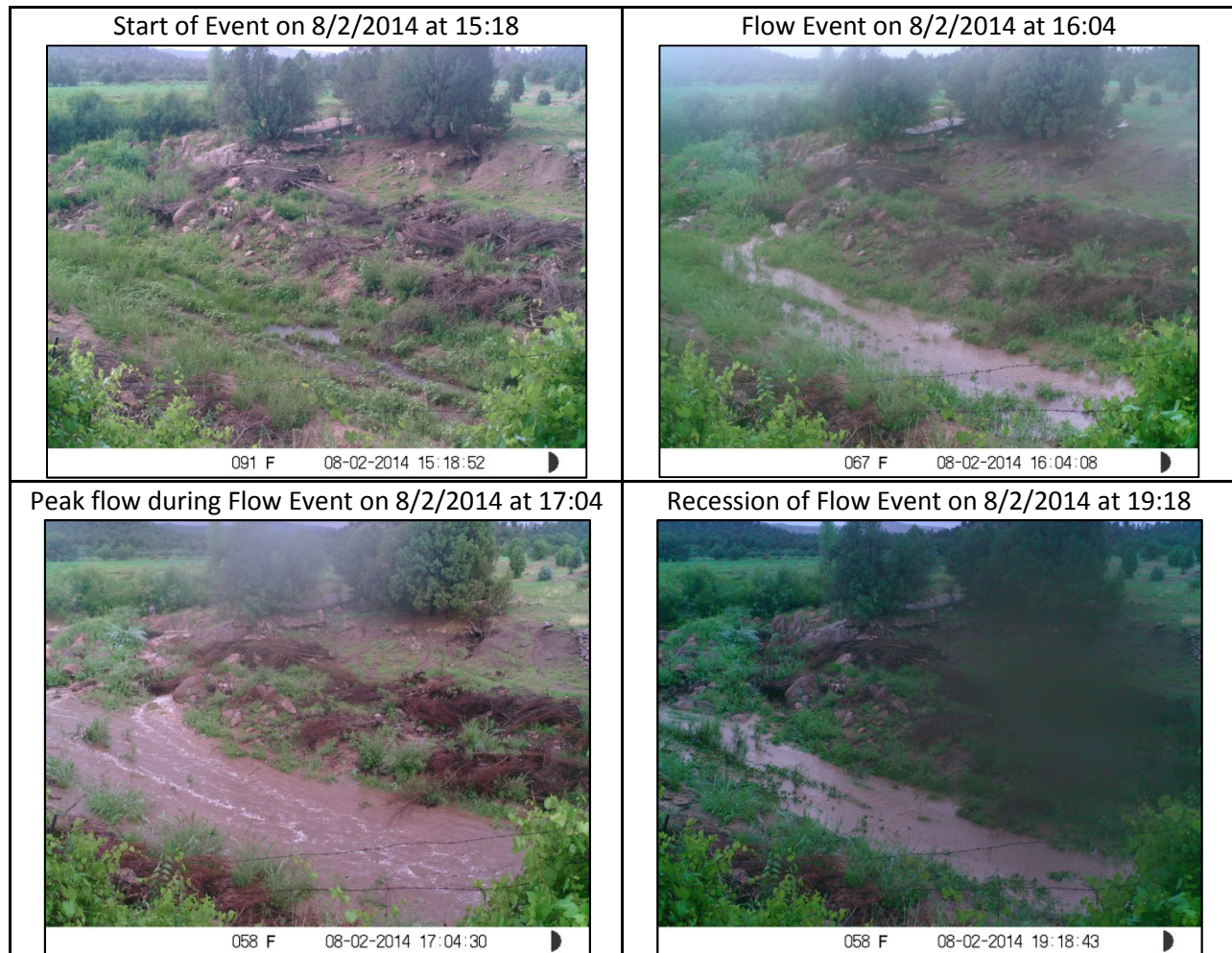


Upper Walnut Creek at Bridge (UWCB)

A total of 6 flow events were recorded at the Upper Walnut Creek at Bridge (UWCB) location during the 2014 Monsoon Season. The UWCB location is only equipped with a flowtography camera. No transducer or event gages exist, therefore stage and discharge data are not available for this location. No flow measurements were made at the UWCB location during the 2014 monsoon season.

Flow events occurred on the following dates and durations: 7/28/2014 (2.25 hours), 8/1/2014 (4 hours), 8/2/2014 (19.25 hours), 8/3/2014 (26 hours), 8/19/2014 (2 hours), and 9/27/2014 (7.5 hours). Average event flow duration was 17.4 hours and total flow duration was 61 hours for the 2014 monsoon season. The UWCB location was not visited during the 2014 monsoon season but was visited before (6/26/2014) and after (10/2/2014) for routine maintenance and flowtography image collection. Figure 11 shows flowtography images during a flow event recorded on 8/2/2014.

Figure 11 – Upper Walnut Creek at Bridge Flow Event Flowtography Images



Upper Walnut Creek at Forest Service (UWCFS)

The Upper Walnut Creek at Forest Service (UWCFS) location monitoring equipment was not installed prior to the 2014 monsoon season and the site was not visited during this period. Installation of a low flow flume (rated for 2.0 CFS max) and flowtography camera at the site occurred on October 2, 2014. Details on the flume installation and data collected at the UWCFS location will be detailed in the 2014/2015 Winter Season Report. Figure 12 shows the UWCFS location on June 5, 2014.

Figure 12 –Upper Walnut Creek at Forest Service Location

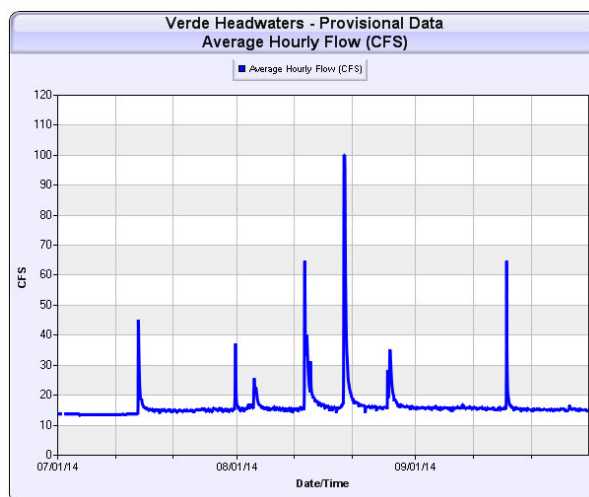


Conclusion

Flow events during the 2014 Monsoon season were typical of summer monsoon flash floods consisting of high flows with a short duration with some sites recording smaller flows. Peak discharge reached as high as 640 CFS (BCWPC) and flows varied by location. Stream stage of approximately four feet (or less due to tumbleweeds stuck on gage) were observed to damage (knock over or loosen) event gages at UBCW, BCWPC, and LWCCP. Several of these sites required additional non-routine maintenance and repair due to damage from monsoon flood events, faulty cameras or weak cellular signals, and damage by animals (i.e. cows at LWCCP). Additionally, due to the short duration and flash flood nature of the flow events, conditions were not conducive to current meter measurements during this period. While stage values are typically accurate during flow events, discharge values are based on estimated ratings developed from the modeled cross sections. Direct current meter measurements of flow would be needed to improve accuracy of discharge values in the future. Shifts to rating equations only occurred at UBCW during periods where channel fill were observed above the zero stage level of the event gage.

During the 2014 Monsoon season a total of 1,000 AF were recorded to flow at the seven SRP Flowtopography™ equipped stream flow monitoring locations recording stage levels within the Big Chino Sub-basin (UWCFS and UWCB excluded). A total of approximately 121 AF were recorded to flow through the LBCW location just upstream of Sullivan Dam near the headwaters of the Verde River. Sullivan Dam was not monitored during this period; therefore it was not determined whether any water recorded at LBCW spilled to the Verde River Canyon (approximately 3 miles upstream of the Verde Headwaters gage location) during the 2014 Monsoon Season. For the five flow events recorded at LBCW, spikes in flow at Verde Headwaters were observed during four of these events on 8/3/2014, 8/12/2014, 8/19/2014, and 9/16/2014 (Figure 13). Without monitoring of Sullivan Dam and Granite Creek, the contributing source of flow seen at Verde Headwaters during events is uncertain. If water did not spill over Sullivan Dam during flow events, it is assumed that surface water flow contributing to spikes in discharge seen at Verde Headwaters would be from Granite Creek and localized runoff below Sullivan Dam.

Figure 13 – Verde Headwaters Hydrograph: 2014 Monsoon Season Flow Events (7 total)



Based on the initial observations from data collected at the current Big Chino Sites during the 2014 monsoon season several additional flowtography (camera only) locations (similar to UWCB) are being proposed to the CA1 committee to be installed to better understand the surface water flow and recharge at various locations within the sub-basin. Potential new flowtography sites include:

- Location at Sullivan Dam to visually record any periods of spill to the Verde River Canyon and potential contributions to the Verde Headwaters gage.
- Location along Granite Creek to visually record periods of potential contribution to the Verde Headwaters gage.
- Location along Big Chino Wash at southern end of Prescott Water Ranch property to visually record amount of surface water exiting the property downstream.
- Locations along Big Chino Wash at or near major confluences (Partridge Creek, Walnut Creek, and Williamson Valley Wash) to visually record flow contributions and provide additional information for downstream gages where pooling occurs (BCWPC and LBCW).

SRP Water Measurement continues to maintain current sites and process transducer data and flowtography images collected at the monitoring locations. Other beneficial uses of flowtography images have also been seen throughout monitoring of the locations such as capturing daytime and night time flow conditions, wildlife and animal activity, and recording of snow depths. The data presented within this report is provisional in nature and is reflective of the best available data at the time this report was written. Results of Winter/Spring flow events (October 1, 2014 – June 30, 2015) will be detailed in the 2014-2015 Winter/Spring Season Report.