



Sunrise over the Valley, looking E from South Mountain Park, 08-06-2017, D. Henz

Flood Control District of Maricopa County

Flood Warning Branch

MSP Verification Report & Season Recap: Monsoon Season 2017



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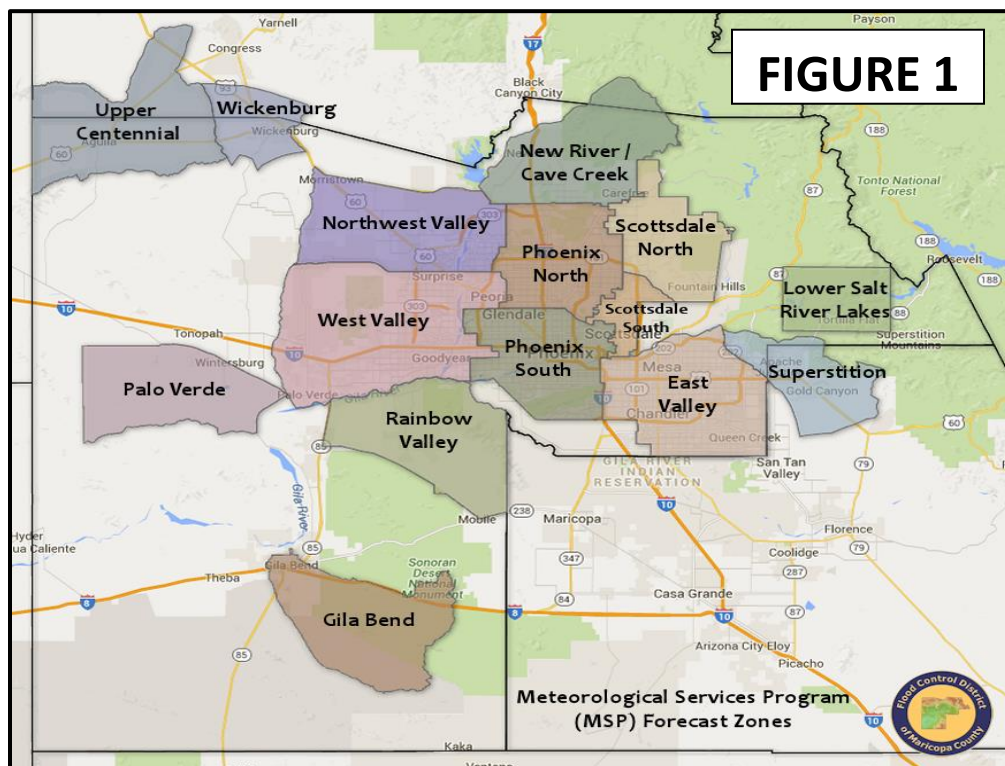
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INTRODUCTION

This report was generated by the Flood Warning Branch of the Flood Control District of Maricopa County (FCDMC). It covers the length of the monsoon season as defined by the National Weather Service Phoenix WFO: June 15th- September 30th. This report includes daily records on Weather Outlooks and Statements issued by the Meteorological Services Program (MSP) as well as a complete verification and summary of these products.

The Flood Warning Branch of the FCDMC operates a year-round MSP that's purpose is to provide detailed meteorological forecasts and support to county, city, and other local agencies. The program covers 5,400 square miles encompassing Maricopa County and surrounding watersheds. The goal of the Flood Control District's MSP is to reduce response time for emergency managers by providing timely and accurate weather information, primarily regarding the potential for flood-producing rainfall. During the length of the Monsoon season the MSP goes on a weekly rotating 24/7 manned schedule. A Duty Officer is selected for each day who is responsible for issuing MSP products, providing support to clients, and serves as the on-call supervisor during non-business hours. A supporting officer is also named and can be available to the duty officer in the case of a significant weather event. All MSP forecast products are disseminated via email and text alerts. Emergency managers may also be notified by telephone to aid in decision making.

The MSP has broken down the 5,400 square mile operational area into 15 forecast zones. These zones are the primary warning areas identified by emergency management officials. A map of the forecast zone locations is shown below in Figure 1.



MSP PRODUCT DESCRIPTION

Weather Outlook:

The Weather Outlook is disseminated to clients daily no later than 2PM during the monsoon season. This product covers the today through tomorrow period and occasionally the following 2-3 days where appropriate. Occasionally, due to unexpected weather pattern changes, Weather Outlooks will be updated throughout the day or first thing the following morning. Weather Outlooks include a synopsis of expected weather conditions; the “probability of occurrence” of rain; the expected “prime time” for the bulk of the rain; and the amount of rain expected during the prime time period. Temperature forecasts and trends are included as well as a forecast of peak wind speeds. Click [here](#) for an example.

Message 1 – Alert:

When it is believed developing weather conditions may lead to heavy rain and/or minor to moderate flooding an Alert is issued. Lead time will generally be less than an hour in advance of the expected event. The Alert will normally identify the affected zone(s), the time frame of the event (valid time), rainfall potential, and the type of areas that will be impacted, such as roads and/or washes. Click [here](#) for an example.

Message 2 – Flash Flood Watch:

When it appears the developing weather event may lead to flash flooding a Watch is issued for the possible affected areas. Lead time will generally be 1 to 2 hours in advance of the expected event, but can stretch to a day or more with reliable guidance. The Watch will include the time frame it will be in effect (valid time), and a section describing what may take place (comments). Click [here](#) for an example.

Message 3 – Flash Flood Warning:

When it appears that significant flash flooding is imminent or has started to take place, a Warning will be issued for the affected areas. Lead time will generally be less than an hour. The Warning will normally identify the affected zone(s), a time frame of the event, rainfall potential, and a section describing what is expected to take place (comments). Click [here](#) for an example.

Message 1, 2 and 3 Update:

This product, issued as needed, will update an existing Alert, Watch or Warning. Click [here](#) for an example.

Message 4 – Cancel:

When an event (Watch or Warning) no longer poses a threat, and the expiration time has not been reached, a Cancel message may be issued. Click [here](#) for an example.

Lake Alerts:

In addition to the above MSP program, weather guidance is provided for Maricopa County lakes/reservoirs from June 15 through September 30. Lake Alerts are issued as needed to inform of approaching adverse weather conditions. Emphasis in these statements is on expected wind gusts and lightning activity. Click [here](#) for an example.

Additional Products:

During the summer months, a program exists to aid the Boy Scouts at Camp Geronimo. Though in Gila County, many of the scouts reside within Maricopa County. The Camp exists below a watershed that was recently burned, and NWS Flagstaff declined a request for localized support. A call is made to the officials at the camp when needed, stating the expected flood problem.

At the request of clients, site specific products may be issued to support unusual or special operations, such as specific wind forecasts to aid in the fighting of fires, or forecasting for special events at the County lakes or parks, or District construction projects.

Additional information and data regarding the FCDMC can be found online [here](#)

2017 MONSOON SEASON RECAP

According to the FCDMC ALERT rain gage network, the 2017 monsoon season was characterized as being normal. When averaged across 277 of the oldest county mesonet rain gages, 2.99" of rain fell which was 101% of the mean value of 2.97". An image showing the full 35 year period of record can be viewed [here](#). It's worth noting below average rainfall was recorded at Sky Harbor Airport for the second season in a row. The official rain total as reported by the NWS Phoenix office was 2.32" which was 0.39" below the period average of 2.71". Click [here](#) to see a technical summary plot from Sky Harbor Airport covering the monsoon season courtesy of the University of Arizona CSAP/CLIMAS organization. Figure 2, below, offers a more comprehensive picture of the rainfall distribution across the MSP forecast area. This figure was generated using preliminary FCDMC ALERT rain gage data from around the county. The shaded contours depict precipitation totals from June 15th – September 30th.

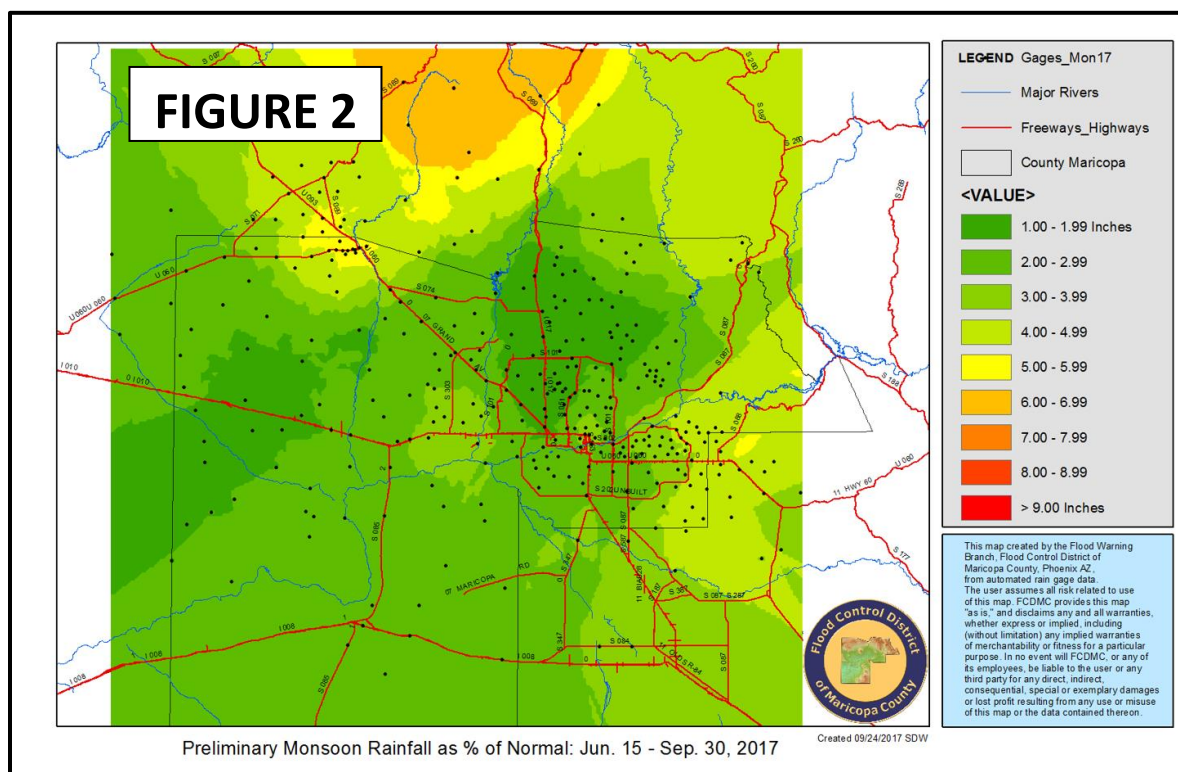
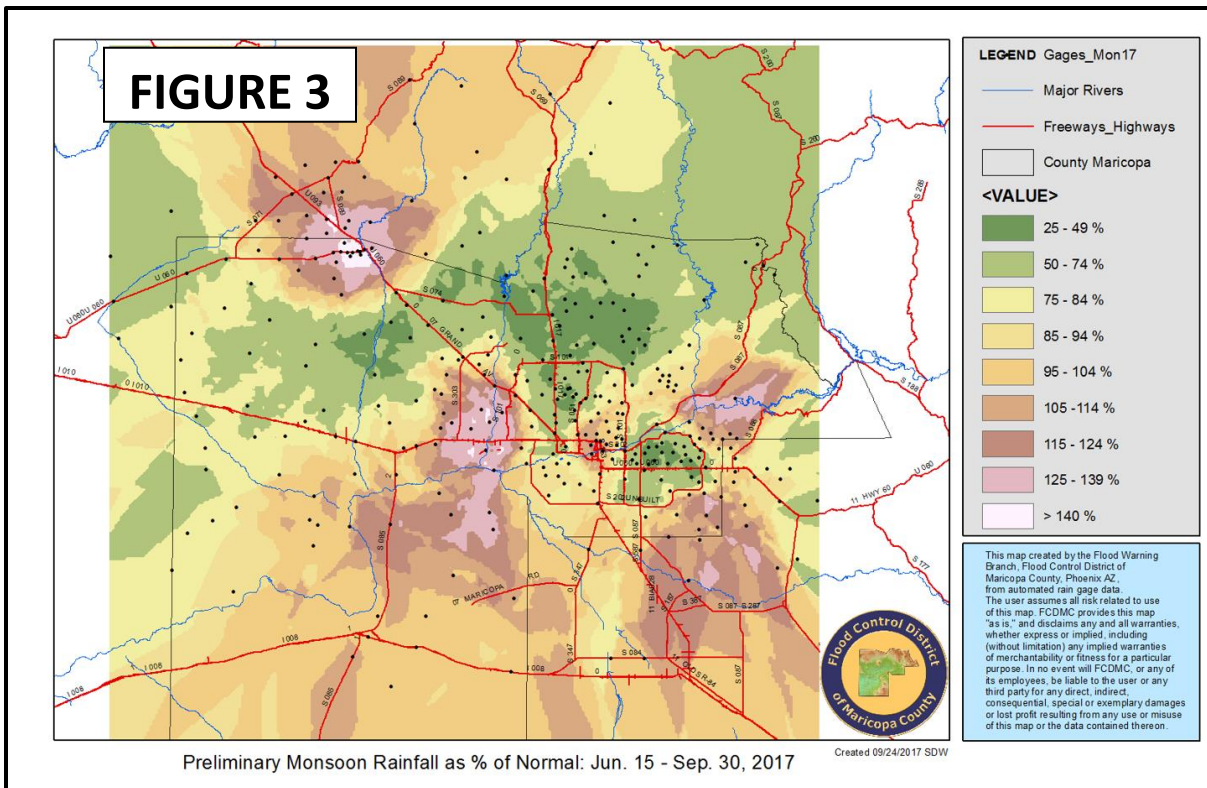
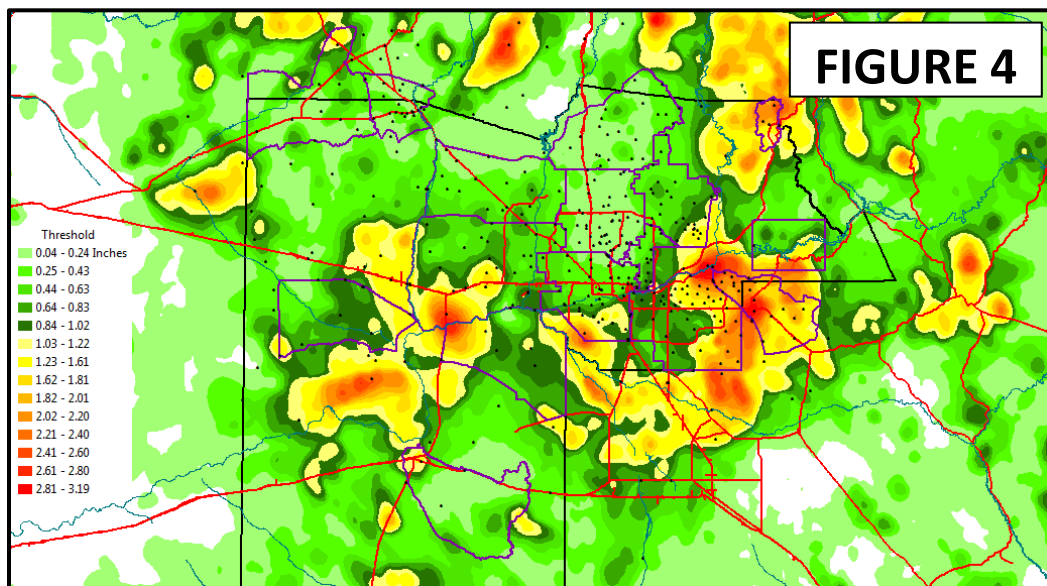


Figure 3, on the next page, shows the ratio of 2017 monsoon precipitation versus average monsoon precipitation. Similar to Figure 2, contours were generated using preliminary FCDMC ALERT rain gage data from around the county. Northcentral Maricopa County extending south down I-17 saw below to well below average rainfall totals for the season. Similarly areas of Tempe, Chandler, and Mesa were equally as dry. Above average rain fell across a large swath of the West Valley, the Wickenburg area, and far-east Mesa. Areas in the Southeast Valley (south of the loop 202 corridor) were also wetter than average. These two figures serve as a strong reminder to the importance of having a widely distributed rain gage network in order to fully capture the distribution of monsoon rains.



When compared to the last five years, the season got off to a slow start rain-wise across south-central AZ with little to no t-storm activity present until the second week of July. Instead, excessive heat dominated the headlines during this time. Daily temperatures met or exceeded the 110°F mark from June 17th -27rd and again from July 1st-8th (excluding July 3rd). New daily record high temperatures of 118°F on June 19th, 119°F on June 20th, 117°F on June 21st, and 118°F on July 7th were observed at Sky Harbor Airport. While extreme heat is not uncommon for late June/early July, official high temperatures at or above 118°F are quite rare. According to Paul Iniguez, NWS Phoenix SOO, "Out of the 44,500+ days of weather obs in Phoenix, only 14 have been 118°F or higher." The Phoenix Valley experienced three more such days as of July 7th! The summer monsoon ridge finally shifted north and settled across the Four Corners region during the second full week of July helping to initiate the operational convective season.

The first MSP message statement was issued on the evening of July 10th for localized strong t-storms across the far Southeast Valley, but another week passed until the first string of active convective days. Following a deep moisture surge July 13th-14th, widespread t-storms dropped heavy rains across the western half of Maricopa County during the afternoon/evening of July 15th. Portions of Wickenburg and the Upper Centennial watershed saw upwards 1.25"-1.75" which led to runoff in area watersheds. The first Flash Flood Watch of the season was issued the following morning, before an organized line of severe storms rolled off the Mogollon Rim and into the heart of Phoenix late in the evening. Most of the greater Phoenix urban corridor picked up anywhere from 0.25"-1.00" of rain. Residents in the West Valley (Litchfield Park, Peoria, and Avondale) were hit the hardest and saw upwards of 2.25". Widespread reports of wind damage and urbanized flooding were recorded across the region. After a down day weather-wise on July 17th, torrential rains fell over the northern half of the county on evening of



July 18th. The Wickenburg area saw another 1.50"-2.25" of rain on saturated watersheds, which lead to localized flooding in area washes. Typical daily t-storm activity continued around the higher terrain peripheries of Phoenix Valley the next four days. The most significant widespread rain event in July unfolded the 23rd-24th as an inverted trough lifted north out of Sonora, Mexico and into southern AZ. A large swath of 1.00"-2.00" rains fell across the Southeast Valley the night of the 23rd from t-storms moving northwest out of Pinal County. The following morning, another band of strong thunderstorms associated with the aforementioned disturbance lifted north into the southern half of the county bringing an additional 1.00"-2.00" from the Apache Junction area west through the town of Buckeye. There were numerous reports of flash flooding across affected areas. Rain totals between both events exceeded 3.00" across portions of east Mesa and farther south in the Town of Queen Creek. Figure 4, above, shows 24-hr gauge adjusted radar rainfall estimates. The final week of July generally remained quiet with only a few isolated rain events.

Convective activity quickly ramped back up to start August off as the monsoon ridge redeveloped across the southern Great Basin. With sufficient moisture in place and favorable easterly steering flow, a line of severe thunderstorms rolled west off the Mogollon Rim into northern portions of the county during the afternoon of the 1st. Heavy rain was recorded in the Cave Creek and New River areas first before storms intensified further west. The towns of Wickenburg and Aguila were hit hardest with damaging wind gusts and rain totaling between 1.50"-2.00". This event was quickly follow up by another heavy rain episode on the 3rd which brought widespread t-storm activity from northwest portions of the county east into the central Phoenix Valley. In particular, a wet microburst dropped just under 2.00" of rain across eastern metro Phoenix, south Scottsdale, and Tempe areas in less than 90min leading to numerous urban flooding and wind damage reports. This complex of storms then raced eastward into the Mesa, Chandler, Gilbert, and Queen Creek areas dropping further heavy rain. Activity quickly came to a halt the following week as the ridge weakened and became suppressed across northern Mexico.

After a brief break period, the monsoon ridge redeveloped across the Arizona/New Mexico border promoting deep southeasterly flow across the region. On the evening of August 10th, t-storms developed along a series of outflow boundary collisions. Heavy rain fell from Gila Bend north through the Waterman Wash watershed and across portions of Buckeye. The largest totals fell across Wickenburg though with gauges reporting 2.05". Following a down day on the 11th, early morning storms on the 12th brought widespread rain from the Estrella Mountains east through Apache Junction with the greatest totals in 0.50"-0.75" range. Activity peaked later that night straight into the morning of the 13th where nearly every central county gauge picked up measurable rainfall. A large swath of totals ranging from 1.25"-2.00" fell from Sun City West, Litchfield Park, Glendale, South Mountain Village, and into portions of Chandler. A final round of t-storms moved across northern Scottsdale, Phoenix, and Cave Creek areas on the morning of the 14th before another drying trend and general break period to the monsoon. The only other noteworthy event in August occurred on the evening of the 23rd as a prominent dust storm followed by scattered t-storms raced across the heart of the county dropping anywhere from 0.50"-1.00" across Phoenix, Scottsdale, and Peoria.

After another pause to the monsoon through the final days of August, activity picked back up again in early September courtesy of enhanced moist southerly flow out of Mexico from a cut-off SoCal disturbance. On the evening of September 7th, 1.00"-2.00" of rain fell across portions of Gila Bend, Palo Verde, and Aguila areas. Colliding outflow boundaries farther east also generated storms across the Southeast Valley, central Scottsdale, and Fountain Hills areas where 0.50"-1.00" fell. Another active day followed on the 8th with widespread rain across the western and eastern thirds of the county. Areas of south of Wickenburg picked up as much as 1.25"-1.50" of rain from slow moving t-storms. Unfortunately, little measurable rain fell across the central portions of the county including Phoenix metro. This two-day event marked the end of the operational monsoon season as no further MSP weather statements were issued. Mainly dry conditions persisted until the official close of the monsoon on September 30th.

MSP Issued Products Recap:

A total of 117 forecast zone-specific messages were issued by the MSP spread across twenty-one different days during the length of the monsoon season. Table 1, below, shows the monthly break down by forecast zone of messages issued including season totals.

TABLE 1: MSP Messages Issued - 2017 Monsoon Season					
Forecast Zone	June	July	August	September	Total
Gila Bend	0	3	0	1	4
Palo Verde	0	2	1	2	5
Rainbow Valley	0	6	2	0	8
West Valley	0	7	1	0	8
Northwest Valley	0	5	0	1	6
Upper Centennial	0	3	3	1	7
Wickenburg	0	5	5	2	12

TABLE 1: MSP Messages Issued - 2017 Monsoon Season					
Forecast Zone	June	July	August	September	Total
New River/Cave Creek	0	5	2	0	7
Phoenix North	0	2	4	0	6
Phoenix South	0	7	4	0	11
Scottsdale North	0	4	4	1	9
Scottsdale South	0	3	3	0	6
Southeast Valley	0	7	5	0	12
Lower Salt River Lakes	0	4	0	0	4
Superstition	0	8	3	1	12
All Zones	0	71	37	9	117

Of the 117 Messages issued, eighty-seven were Message-1 Alerts, eighteen were Message-2 Flash Flood Watches, twelve were Message-3 Flash Flood Warnings, and zero Message-4 Cancel. Table 2, below, shows the monthly break down by forecast zone of Lake Alerts issued including season totals. Fifty-three Lake Alert statements were issued for the County Lakes Program including Lake Pleasant, Bartlett Lake, Saguaro Lake, Canyon Lake, and Apache Lake. The Alert Operation Center (AOC) was not fully activated during this monsoon season as none of the rain events ended up posing any serious threat to county/city dams or District flood control facilities.

TABLE 2: MSP Lake Alerts Issued - 2017 Monsoon Season					
Recreational Zone	June	July	August	September	Total
Lake Pleasant	0	6	2	1	9
Horseshoe Lake	0	0	0	0	0
Bartlett Lake	0	7	2	1	10
Saguaro Lake	0	5	2	2	9
Canyon Lake	0	9	2	2	13
Apache Lake	0	10	2	0	12
All Zones	0	37	10	6	53

MSP VERIFICATION METRICS AND CRITERIA

Several key verification metrics and a clear set of operational based criteria were adopted in order to conduct a thorough and complete verification of MSP products issued during the 2017 monsoon season. This chapter is broken down into five sections: Outlooks, Messages, Lake Alerts, and Storm Total Precipitation. Each section discusses the verification metrics used and the criteria followed to compute the statistics displayed in the summary chapter sections. A list of frequently used terms including definitions and acronyms as used throughout this report is listed below.

Observed Rainfall: the amounts of total rainfall gathered from either ALERT rain gages, gage corrected radar estimations, or local storm reports (LSRs).

Operationally Significant Event (OSE): a rain event within a MSP forecast zone with observed rainfall equal or greater than 0.50”.

Hit: considered a correct forecast.

Miss: considered an incorrect forecast.

Correct Negative: considered a correct forecast ex. no rain forecast and no rain observed.

Forecast Accuracy: a measure of the ability to correctly forecast daily rainfall potential. Given in percent and calculated using Equation 1 below:

$$(1) \text{ Forecast Accuracy} = \left(\frac{\text{Correct Forecasts}}{\text{Total Forecasts}} \right) \times 100$$

Probability of Detection (POD): a measure of the ability to correctly discriminate heavy rain days (OSEs) from non-rain/minor rain days. Given in percent and calculated using Equation 2 below:

$$(2) \text{ POD} = \left(\frac{\text{OSEs Correctly Detected}}{\text{Total OSEs}} \right) \times 100$$

False Alarm: occurs when an OSE is forecast for a location but does not occur.

False Alarm Rate: measures the number of false alarms compared to forecast days i.e. over-forecasting. Given in percent and calculated using the Equation 3 below:

$$(3) \text{ FAR} = \left(\frac{\text{False Alarms}}{\text{Total Forecasts}} \right) \times 100$$

Threat Score: measures the fraction of observed and/or forecast events that were correctly predicted. TS can be thought of as forecast accuracy when correct negatives have been removed from consideration. Given in percent and calculated using Equation 4 below.

$$(4) \quad TS = \left(\frac{Hits}{Hits + Misses + False Alarms} \right) \times 100$$

Percent Error: a measure of relative error given in percent. Calculated using Equation 4 below:

$$(5) \quad \% Error = \left(\frac{Forecast - Observed}{Observed} \right) \times 100$$

Quantitative Precipitation Forecast (QPF): forecast zone or basin specific rainfall forecast including a rainfall amount given in inches and/or intensity.

Rainfall Intensity: the rate at which rain is falling including an amount in inches over a specific time period i.e. 0.50"/30min.

Storm Total Precipitation (STP): total rainfall from an identified storm or storm complex, given in inches.

Probability of Occurrence: forecast confidence, given in percent, that rainfall that could occur within a forecast zone or basin, usually given in conjunction with a QPF.

Gage Adjusted Quantitative Precipitation Estimate (GAQPE): radar estimated rainfall total, product provided by WDT Inc.

Lead Time: the amount of time between when the forecast statement was issued/valid and the onset of the event (observable).

Qualifying Event: an issued statement/QPF that counts in the verification process.

The following five sections explain the development of verification statistics as tabulated in Appendix A-E.

OUTLOOKS:

Forecast Accuracy:

Either a hit or a miss was selected for each day. A hit was assigned when observed rainfall met or exceeded the QPF. A miss was assigned when rainfall was observed and no QPF was made or if observed rainfall failed to reasonably meet the QPF. In some cases a hit was assigned when the QPF was not reasonably met by observed rainfall. In these cases the probability of occurrence was 30% or less and the QPF was below the OSE threshold. Values were then populated for each forecast zone and all zones combined. Forecast accuracy was then calculated by month.

Probability of Detection:

A dash was assigned to all days when observed rainfall was below the OSE threshold. On days when observed rainfall met or exceeded the OSE threshold either a hit or a miss was assigned. A hit was selected when the observed rainfall reasonably met the QPF. A miss was assigned when observed rainfall greatly exceeded the QPF or if no QPF was issued. Values were then populated for each forecast zone and all zones combined. A probability of detection was calculated by month and season total.

False Alarm Rate:

False alarms were denoted by an “x”. A false alarm was assigned on days where the observed rainfall failed to meet the OSE threshold, yet the QPF called for an OSE with a high probability of occurrence. The two relationships below outline the above criteria.

$$\begin{aligned} & \text{Probability} \geq 40\% \text{ and QPF} \geq 0.50'' \text{ AND Observed Rain} < 0.50'' \\ & \text{Probability} = 30\% \text{ and QPF} \geq 1.00'' \text{ AND Observed Rain} < 0.50'' \end{aligned}$$

Values were then populated for each forecast zone and all zones combined. False alarm rate was then calculated by month and season total.

Threat Score:

Similar to Forecast Accuracy, a Threat Score or Critical Success Index was calculated. Threat score is only concerned with forecasts that count (days with observable rain) and assumes correct negatives are not important. Values were populated for each forecast zone and all zones combined for the length of the season.

Tables containing all of the raw data used in generating the verification metrics discussed above for the MSP daily Outlooks can be found in [Appendix A](#).

MESSAGES:Forecast Accuracy:

A hit was assigned if a rain, stream, or dam alarm was triggered during the valid period of the issued Message and/or if observed rainfall reasonably met the QPF during the valid period. Conversely a miss was assigned if neither of these two criteria were met. Values were then populated for each forecast zone and all zones combined. Forecast accuracy was then calculated by month and season total.

Lead Time:

Lead time was calculated for each issued Message when possible. Time was measured from Message issuance to the first ALERT alarm triggered (rain, stream, or impoundment).

Tables containing all of the raw data used in generating the verification metrics discussed above for the MSP Messages can be found in [Appendix B](#).

LAKE ALERTS:

Forecast Accuracy:

A hit was assigned if any of the following observations occurred during the valid period of the issued Lake Alert: lightning within the recreational area boundary, wind > 30mph, or hail/heavy rain. Conversely a miss was assigned if none of these three criteria were observed. Values were then populated for each recreational zone and all zones combined. Forecast accuracy was then calculated by month and season total.

Lead Time:

Lead time was calculated for each issued Lake Alert when possible. Time was measured from the Lake Alert issuance to the first observation (lightning within the recreational area boundary, wind > 30mph, or hail/heavy rain).

Tables containing all of the raw data used in generating the verification metrics discussed above for the MSP Lake Alerts can be found in [Appendix C](#).

STORM TOTAL PRECIPITATION:

Forecast Accuracy:

Only message statements where a QPF storm total precipitation amount was provided were evaluated. Observational data used for this verification included Maricopa County ALERT rain gages, local storm reports, and/or radar GAQPE. Either a hit or a miss was selected for each qualifying event. A hit was assigned if the percent error was less than or equal to 25%. Conversely a miss was assigned if the percent error was greater than 25%. Values were then populated for each forecast zone and all zones combined. Forecast accuracy was then calculated by month and season.

Tables containing all of the raw data used in generating the verification metrics discussed above for the MSP Messages can be found in [Appendix E](#).

OUTLOOK VERIFICATION

Table 3, below, shows the Outlook verification seasonal totals for each Forecast Zone (FZ). Complete data tables for each FZ, separated by month, can be viewed in [Appendix A](#): Table A-1. Overall, Outlook forecast accuracy during the length of the monsoon season for all FZs combined was excellent at 83.1%. Forecast accuracy remained above the 75% threshold for each FZ. Palo Verde and West Valley were the only two FZs to drop below 80%.

TABLE 3: MSP Weather Outlook Verification - SEASON TOTALS, 2017							
Forecast Zone	Accurate Forecasts	AOF (%)	Sig. Events Detected	POD (%)	False Alarms	FAR (%)	TS (%)
Gila Bend	91/108	84.3%	11/16	68.8%	2/108	1.9%	74%
Palo Verde	83/108	76.9%	7/10	70%	3/108	2.7%	62.2%
Rainbow Valley	87/108	80.6%	7/11	63.6%	1/108	0.9%	69.4%
West Valley	86/108	79.6%	8/12	66.7%	1/108	0.9%	68.1%
Northwest Valley	91/108	84.3%	12/14	85.7%	2/108	1.9%	74%
Upper Centennial	89/108	82.4%	14/19	73.7%	4/108	3.7%	69.3%
Wickenburg	92/108	85.2%	13/14	92.9%	4/108	3.7%	73.3%
New River/Cave Creek	94/108	87%	18/21	85.7%	2/108	1.9%	78.1%
Phoenix North	90/108	83.3%	9/11	81.8%	2/108	1.9%	72.6%
Phoenix South	90/108	83.3%	8/10	80%	1/108	0.9%	73.6%
Scottsdale North	96/108	88.9%	11/13	84.6%	1/108	0.9%	81.9%
Scottsdale South	94/108	87%	5/6	83.8%	1/108	0.9%	79.2%
Southeast Valley	87/108	80.6%	8/10	80%	2/108	1.9%	68.5%
Lower Salt River Lakes	89/108	82.4%	11/15	73.3%	1/108	0.9%	72.2%
Superstition	88/108	81.5%	10/13	76.9%	2/108	1.9%	69.9%
All Zones	1347/1620	83.1%	152/195	77.9%	29/1620	1.8%	72.4%

The next metric computed was probability of detection. This metric was quite important because it distinguished how well MSP forecasters detected operationally significant events. Operationally significant events were defined as having 0.50" of rainfall or more. The POD during the length of the monsoon season for all FZs combined was 77.9%. In general, a POD of over 50% is considered sufficient and over 75% excellent in the forecast community. All of the FZs were above the 50% accuracy threshold with nine exceeding the 75% accuracy threshold. The next metric included in Table 3 was False Alarm Rate (FAR). It is important to keep track of how often MSP forecasters predicted an operationally significant day that did not occur. Too many false alarms can degrade user confidence in the forecasts. In general a FAR below 50% is sufficient and below 25% is considered excellent within the forecast community. The overall FAR for all zones during the length of the monsoon season was exceptionally low at 1.8% with none of the forecast zones exceeding 4%. The highest FAR was 3.7% at both Wickenburg and New River/Cave Creek where forecasters consistently over-predicted rainfall totals.

The final metric included in Table 2 was Threat Score (TS). The monsoon season officially runs from June 15th through September 30th of each year, yet the operational season (active weather days) tends to be much shorter beginning sometime in early July and finishing by mid-September. TS is thought to serve as a better metric for overall forecast skill as it removes correct negatives that are not important when computing forecast accuracy i.e. dry days before and after the active monsoon season. This year the operational monsoon season began on July 7th and ended on September 15th. Overall, forecast skill was 72.4% for all FZs over the length of the active season. Three of the fifteen FZs met or exceeded the 75% accuracy threshold, while the remaining twelve FZs remained well above the 50% threshold.

MESSAGE VERIFICATION

The MSP messages carry a higher priority threat-wise than the daily outlooks. These statements (Alerts, Watches, and Warnings) serve as the most critical products issued by the MSP during the monsoon season to our clients. A high level of accuracy is required when forecasting these types of events as the information they provide is directly applicable to the potential or imminent flooding situation. All of the messages issued fall under the category of operationally significant events.

Table 4, on the next page, shows the issued message verification broken down by FZ and month. Complete data tables for each FZ can be viewed in [Appendix B](#): Tables B-1, B-2, and B-3. There were 111 qualifying messages (updates and M-4s not included) issued over the length of the season. Forecast accuracy for all FZs combined, over the length of the season, was exceptional at 86.5%. Fourteen of the fifteen FZs met or exceeded the 75% accuracy threshold. As stated earlier, 50% accuracy is considered sufficient and 75% or above is considered excellent within the forecast community. Palo Verde had the lowest accuracy coming right in at the 60%.

For the first time since the 2014, no messages were issued in June. July was the busiest month with seventy issued messages spread out across eleven operationally significant days. Overall, forecast accuracy for the month for all FZs combined was 88.6%. Twenty-three messages including a flash flood watch and subsequent flash flood warnings were issued on July 16th. Twenty-two of those messages verified. Five of the remaining eight total misses for the month were a result of a Flash Flood Watch being issued for the central county FZs on July 18th which largely ended up being a null event.

Thirty-three messages were issued in August. Messages were spread out across six operationally significant days. Forecast accuracy for the month across all FZs combined improved slightly to 90.9%. August 3rd was the most active day from an operational perspective for the month with fifteen messages being issued across ten FZs. All fifteen messages verified.

September saw a sharp decrease in issued messages (8) and operationally significant days (4) which is typical as the season begins to wind down. Overall forecast accuracy saw a sharp drop to 50%. Three of the four total misses for the month were a result of a Flash Flood Watch being issued for the western County FZs on September 8th, which largely ended up being a null event. No messages were issued after the 9th as the county saw little to no t-storm activity for the remainder of the month.

Lead time was the final metric included for message statement verification this year. The average lead time (data in [Appendix B](#), Table B-3) for all M-1 Alerts and M-3 Flash Flood Warnings combined over the length of the monsoon season was thirty-five minutes. The average lead time for M-2 Flash Flood Watches was just over nineteen hours.

TABLE 4: MSP Issued Statements Verification, broken down by month and Forecast Zone - Monsoon Season 2017

	June		July		August		September		Season Totals	
Forecast Zone	Correct Statements	AOF (%)	Correct Statements	AOF (%)	Correct Statements	AOF (%)	Correct Statements	AOF (%)	Correct Statements	AOF (%)
Gila Bend	0/0	n/a	3/3	100%	0/0	n/a	0/1	0%	3/4	75%
Palo Verde	0/0	n/a	1/2	50%	1/1	100%	1/2	50%	3/5	60%
Rainbow Valley	0/0	n/a	5/6	83.3%	2/2	100%	0/0	n/a	7/8	87.5%
West Valley	0/0	n/a	6/7	85.7%	1/1	100%	0/0	n/a	7/8	87.5%
Northwest Valley	0/0	n/a	5/5	100%	0/0	n/a	0/1	0%	5/6	83.3%
Upper Centennial	0/0	n/a	3/3	100%	2/2	100%	0/1	0%	5/6	83.3%
Wickenburg	0/0	n/a	4/4	100%	4/4	100%	1/1	100%	9/9	100%
New River/Cave Creek	0/0	n/a	5/5	100%	2/2	100%	0/0	n/a	7/7	100%
Phoenix North	0/0	n/a	2/2	100%	2/3	66.7%	0/0	n/a	4/5	80%
Phoenix South	0/0	n/a	6/7	85.7%	3/4	75%	0/0	n/a	9/11	81.8%
Scottsdale North	0/0	n/a	4/4	100%	3/4	75%	1/1	100%	8/9	88.9%
Scottsdale South	0/0	n/a	2/3	66.7%	3/3	100%	0/0	n/a	5/6	83.3%
Southeast Valley	0/0	n/a	5/7	71.4%	4/4	100%	0/0	n/a	9/11	81.8%
Lower Salt River Lakes	0/0	n/a	4/4	100%	0/0	n/a	0/0	n/a	4/4	100%
Superstition	0/0	n/a	7/8	87.5%	3/3	100%	1/1	100%	11/12	91.7%
All Zones	0/0	n/a	62/70	88.6%	30/33	90.9%	4/8	50%	96/111	86.5%

LAKE ALERT VERIFICATION

Weather guidance is provided to Maricopa County lakes/reservoirs and the recreational zones which encompass them in the form of lake alerts. These statements are issued as needed to inform staff/personnel of approaching adverse weather conditions with an emphasis on wind gusts and lightning activity and then to a lesser degree hail/heavy rainfall. A high level of accuracy is required when forecasting these types of events as lake alerts are considered warnings to the recreational community (staff, boaters, hikers, and campers).

Table 5, below, shows the issued lake alert verification broken down by recreational zone and month. Complete data tables for each recreational zone can be viewed in [Appendix C: Table C-1](#). There were fifty-three lake alerts issued over the length of the season with seventy percent of the events occurring in July. No statements were issued for the Horseshoe Lake recreational zone for the entire season due to a lack of water in the reservoir. Forecast accuracy for the remaining five recreational zones combined, over the length of the season, was 90.6%. All of the five zones exceeded the 75% accuracy threshold with the lowest forecast accuracy of 88.9% recorded at Saguaro Lake and Lake Pleasant. As stated earlier, 50% accuracy is considered sufficient and 75% and above is considered excellent within the forecast community. The average lead time (not shown) for all lakes/reservoirs combined over the length of the monsoon season was just over 18 minutes.

TABLE 5: MSP Lake Alerts Issued - 2017 Monsoon Season										
	June		July		August		September		Season Totals	
Recreational Zone	Correct Alerts	AOF (%)	Correct Alerts	AOF (%)	Correct Alerts	AOF (%)	Correct Alerts	AOF (%)	Correct Alerts	AOF (%)
Lake Pleasant	0/0	n/a	5/6	83.3%	2/2	100%	1/1	100%	8/9	88.9%
Horseshoe Lake	0/0	n/a	0/0	n/a	0/0	n/a	0/0	n/a	0/0	n/a
Bartlett Lake	0/0	n/a	6/7	85.7%	2/2	100%	1/1	100%	9/10	90%
Saguaro Lake	0/0	n/a	5/5	100%	1/2	50%	2/2	100%	8/9	88.9%
Canyon Lake	0/0	n/a	8/9	88.9%	2/2	100%	2/2	100%	12/13	92.3%
Apache Lake	0/0	n/a	9/10	90%	2/2	100%	0/0	n/a	11/12	91.7%
All Zones	0/0	n/a	33/37	89.2%	9/10	90%	6/6	100%	48/53	90.6%

QPF STORM TOTAL PRECIPITATION VERIFICATION

The MSP has placed added emphasis on including QPF information within message statements, specifically M-1 Alerts. These messages are normally issued before the onset of rain events and precede warning issuance in order to maximize lead time for affected locations. Providing STP that will likely accompany thunderstorms moving through a FZ is intended to help clients make well-informed and proactive decisions.

Figure 6, below, is a scatter plot depicting forecast versus observed storm total precipitation. An accurate forecast will have points on or near the solid black diagonal line. Two black dashed lines were also included that show the “+/-” 25 percent error thresholds used in the verification process (discussed in the [MSP Verification Metrics and Criteria](#) section). All events that fall between the upper and lower thresholds were considered hits. There were seventy-two qualifying message events that counted towards the verification of the STP forecasts and sixty-seven events fell within the error threshold.

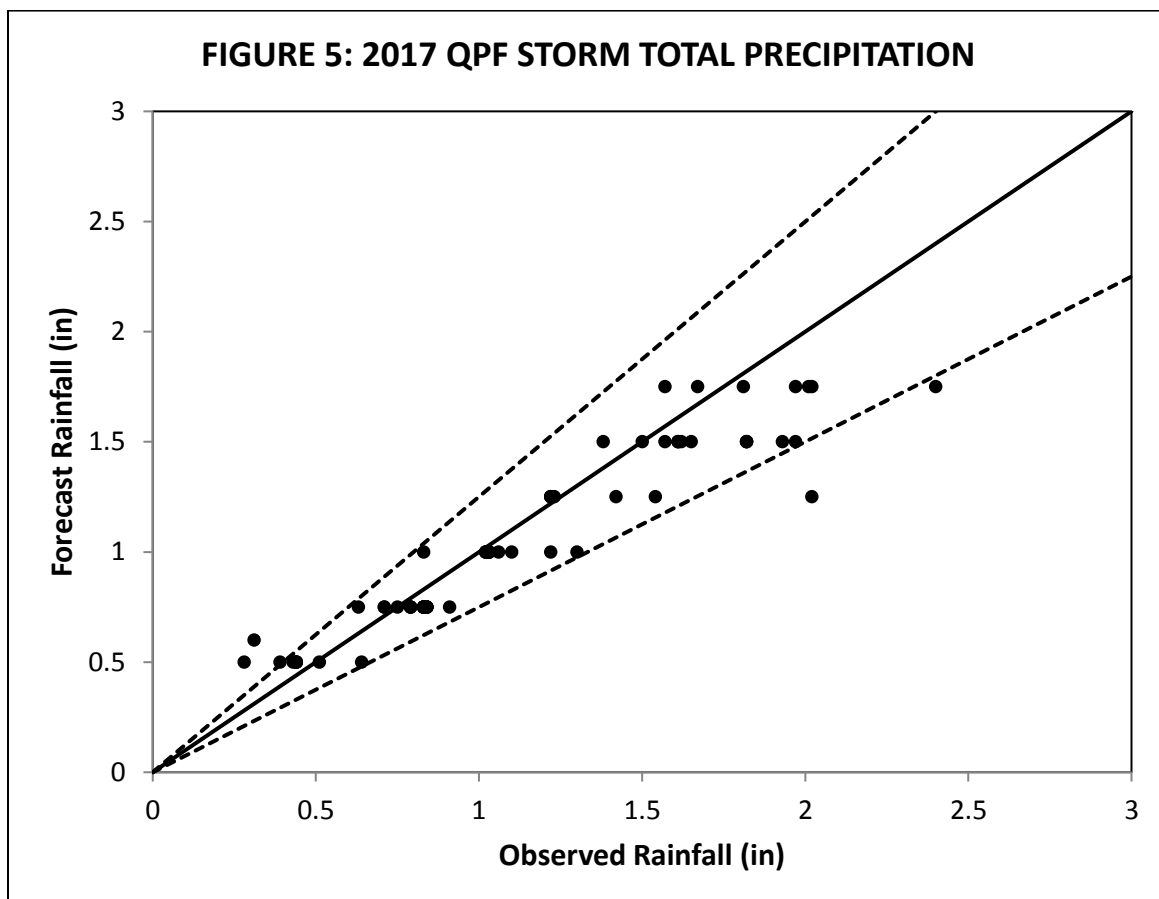


Table 7, on the next page, shows the issued message verification broken down by FZ and month. Complete data tables for each FZ can be viewed in [Appendix E](#): Table E-1. Forecast accuracy for all FZs combined, over the length of the season, was 93.1%. There were no qualifying STP events in June. Accuracy in July came in at 93.6% with forty-seven qualifying

events spread over nine different storm days. July also happened to have the largest number of qualifying events. Accuracy slightly worsened to 90.9% in August spread across twenty-two qualifying STP events. Forecast accuracy was perfect in September. However, there were only three qualifying STP events spread across three days, which is a very small sample size. Forecast accuracy at each of the fifteen FZs was at or above the 75% threshold. Forecast accuracy over the length of the monsoon season for all of the higher terrain FZs (Upper Centennial, Wickenburg, New River/Cave Creek, Sycamore Creek, Lower Salt River Lakes, and Superstition) was exceptional at 90.6% (29/32, correct STP-QPFs).

It is important to remember observed storm total rainfall data is typically gathered from either ALERT rain gages or provided from local storm reports. In either case, accurate measurements of peak rainfall are contingent upon a thunderstorm rain core directly passing over a gage site. In this case, gage adjusted radar rainfall estimates (e.g. GAQPE) were used to fill in the gaps that would otherwise be missed in the FZs.

TABLE 7: QPF Storm Total Precipitation Verification - Monsoon Season 2017

	June		July		August		September		Season Totals	
Forecast Zone	Correct QPF	AOF (%)	Correct QPF	AOF (%)	Correct QPF	AOF (%)	Correct QPF	AOF (%)	Correct QPF	AOF (%)
Gila Bend	0/0	n/a	2/2	100%	0/0	n/a	0/0	n/a	2/2	100%
Palo Verde	0/0	n/a	1/1	100%	1/1	100%	1/1	100%	3/3	100%
Rainbow Valley	0/0	n/a	5/5	100%	1/1	100%	0/0	n/a	6/6	100%
West Valley	0/0	n/a	3/4	75%	0/0	n/a	0/0	n/a	3/4	75%
NW Valley	0/0	n/a	3/4	75%	0/0	n/a	1/1	100%	4/5	80%
Upper Centennial	0/0	n/a	2/2	100%	2/2	100%	0/0	n/a	4/4	100%
Wickenburg	0/0	n/a	2/2	100%	2/3	66.7%	0/0	n/a	4/5	80%
New River/Cave Creek	0/0	n/a	4/4	100%	2/2	100%	0/0	n/a	6/6	100%
Phoenix North	0/0	n/a	1/1	100%	2/2	100%	0/0	n/a	3/3	100%
Phoenix South	0/0	n/a	5/5	100%	1/1	100%	0/0	n/a	6/6	100%
Scottsdale North	0/0	n/a	2/2	100%	2/3	66.7%	1/1	100%	5/6	83.3%
Scottsdale South	0/0	n/a	2/2	100%	2/2	100%	0/0	n/a	4/4	100%
Southeast Valley	0/0	n/a	5/5	100%	2/2	100%	0/0	n/a	7/7	100%
Lower Salt River Lakes	0/0	n/a	3/3	100%	0/0	n/a	0/0	n/a	3/3	100%
Superstition	0/0	n/a	4/5	80%	3/3	100%	0/0	n/a	7/8	87.5%
All Zones	0/0	n/a	44/47	93.6%	20/22	90.9%	3/3	100%	67/72	93.1%

SUMMARY

The Flood Warning Branch of the FCDMC operates a year round Meteorological Services Program (MSP) that's purpose is to provide detailed weather forecasts and support to county, city, and other local agencies encompassing Maricopa County and its contributing watersheds. In particular, during the length of the monsoon season, it is the specific the goal of the MSP to reduce response time for emergency managers by providing timely and accurate weather information, primarily regarding the potential for flood-producing rainfall. This report provides a compiled set of verification statistics based on products issued by the MSP during the length of the 2017 monsoon season. Outlooks, Messages, Lake Alerts, and QPF Storm Total Precipitation were the four products analyzed in this report.

Verification of daily outlooks was conducted using four metrics: forecast accuracy, probability of detection, false alarm rate, and threat score. When comparing all forecast zones combined over the length of the monsoon season, forecast accuracy was 83.1%, probability of detection was 77.9%, the false alarm rate was 1.8%, and the Threat Score was 72.4%. Each metric fell into the "excellent" category when equating these results with accepted values within the forecast community.

Verification of messages was conducted using forecast accuracy. When comparing all forecast zones combined over the length of the monsoon season, forecast accuracy was 86.5%. Any value of over 75% is considered "excellent" within the forecast community. Forecast skill was consistent across each of the months during the length of the season. A large portion of the missed statements during season, ten out of fifteen, was a direct result of null events in FZs during Flash Flood Watches. The average lead time for all M-1 Alerts and M-3 Flash Flood Warnings combined over the length of the Monsoon season was thirty-five minutes. The average lead time for M-2 Flash Flood Watches was just over nineteen hours.

Verification of lake alerts was conducted using forecast accuracy. When comparing all forecast zones combined over the length of the monsoon season, forecast accuracy was 90.6% spread across fifty-three events. Any value over 75% is considered "excellent" within the forecast community. It's worth noting again that no lake alerts were issued for Horseshoe Lake this monsoon season as the reservoir remained mostly empty through the summer months. The average lead time for all lakes/reservoirs combined over the length of the season was just over eighteen minutes.

Verification of QPF storm total precipitation was conducted using forecast accuracy. Forecast accuracy was determined using computed percent error when looking at forecasts versus observational data sets. When comparing all forecast zones combined over the length of the monsoon season, forecast accuracy was 93.1%. The addition of gage corrected radar rainfall estimation and cooperative rain gage sites in the verification process has proven to be critical for FZs with greater spatial gaps between gage sites.

TABLE 8: Historic Monsoon Season Verification Comparison										
	Outlooks				Messages		Lake Alerts		QPF STP	
Year	AOF	POD	FAR	TS	Events	AOF	Events	AOF	Events	AOF
2012	79.1%	79.6%	8.9%	n/a	102	86.3%	n/a	n/a	n/a	n/a
2013	79.8%	78.7%	6.2%	n/a	137	88.0%	56	89.3%	54	72.2%
2014	77.7%	76.9%	7.1%	67.4%	263	80.2%	57	84.2%	76	72.4%
2015	74.8%	60.3%	2.8%	67.9%	118	75.4%	40	95%	56	82.1%
2016	84.9%	78%	2.6%	77.5%	112	90.2%	46	82.6%	53	88.7%
2017	83.1%	77.9%	1.8%	72.4%	111	86.5%	53	90.6%	67	93.1%

Table 8, above, was included to add more historical perspective in the verification process. Verification metrics for Outlooks, Messages, Lake Alerts, and QPF STP were included for all previous years. Outlook forecast accuracy remained steady in 2017 when compared to the 2016 season, but also remained above other previous years. Probability of detection also remained steady when compared to 2016 and near the average of all previous years. False alarm rate came in below any previous year. The final metric, threat score, worsened by roughly 5% from 2016, but remained well above 2014 and 2015.

After seeing the highest forecast skill for issued messages in 2016, forecast accuracy dropped by roughly 4% in 2017, though was above the overall average from previous years. Lead time (not shown) for M-1 Alerts and M-3 Flash Flood Warnings improved by three minutes from the 2015 and 2016 average of thirty-two minutes. M-2 Flash Flood Watch lead time improved dramatically from 2016, and also came in well above the critical six hour requirement at just over nineteen hours. Forecast accuracy for Lake Alerts rebounded significantly from 2016 and came in just below the benchmark set in 2015. STP skill was higher than any previous year and this was directly attributable to continued improvements to the District's QPF program, which supplies hourly and sub-hourly rainfall information to forecasters.

When all was said and done, the 2017 monsoon season was considered normal in terms of rainfall and products issued by the MSP. It is hoped that this report serves as quantifiable tool used to evaluate forecast performance on a year to year basis. This report will be continued in subsequent years focusing not only the present year's statistical data, but will also serve as a historical comparison to measure future year's performance.

APPENDIX A: MSP OUTLOOKS - VERIFICATION TABLES

TABLE A-1: This table shows the raw verification data of MSP issued precipitation forecasts contained in the daily Outlooks for the 2017 monsoon season. The valid period for rainfall each day is from 2PM same day through 12PM the following day. The table is broken down by date and MSP Forecast Zone. For brevity two Forecast Zones are included for each day. The columns from left to right are defined as follows:

Prob. – Percent probability of measureable rain within the Forecast Zone from 0% to 100% over the period.

QPF – Total forecast rainfall in inches within the Forecast Zone over the period.

ALERT – Peak total observed ALERT gage rainfall value in inches within the Forecast Zone over the period.

GAQPE – Radar rainfall estimate (see [Verification Metrics and Criteria](#) section for more details).

AOF – Forecast accuracy, assigned an “h” for a hit and “m” for a miss.

POD – Probability of detection, assigned an “h” for a hit, “m” for a miss, or “-” for non-significant rainfall.

FA – False alarms, assigned an “x”.

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
	GILA BEND							PALO VERDE						
06/15/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/23/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/24/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/25/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
06/27/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/29/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/30/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
16 days					16/16	0	0					16/16	0	0
07/01/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/02/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/03/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/04/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/17	20	0.10	0.00	0.04-0.24	h	-	-	0	0.00	0.00	0.25-0.43	m	-	-
07/08/17	30	0.30	0.08	0.44-0.63	h	-	-	20	0.30	0.08	0.44-0.63	h	-	-
07/09/17	40	0.75	0.00	1.02-1.22	h	h	-	30	0.50	0.28	0.44-0.63	h	h	-
07/10/17	20	0.50	0.00	0.25-0.43	h	-	-	20	0.30	0.00	0.00	m	-	-
07/11/17	10	0.10	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
07/12/17	0	0.00	0.00	0.04-0.24	m	-	-	0	0.00	0.00	0.00	h	-	-
07/13/17	10	0.50	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
07/14/17	30	0.60	0.00	0.00	m	-	-	30	0.60	0.00	0.25-0.43	h	-	-
07/15/17	30	1.00	1.10	2.41-2.60	h	h	-	30	0.50	0.47	1.03-1.22	h	h	-
07/16/17	30	1.50	0.12	0.64-0.83	h	h	-	30	1.00	0.04	0.04-0.24	m	-	x
07/17/17	20	1.00	0.00	0.04-0.24	m	-	-	20	1.00	0.00	0.00	m	-	-
07/18/17	20	1.00	0.16	1.23-1.61	h	h	-	20	1.00	0.00	0.25-0.43	m	-	-
07/19/17	20	0.50	0.16	0.25-0.43	h	-	-	20	0.30	0.00	0.04-0.24	h	-	-
07/20/17	10	0.40	0.00	0.04-0.24	h	-	-	0	0.00	0.04	0.44-0.63	m	-	-
07/21/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.04	0.04-0.24	m	-	-
07/22/17	10	0.20	0.00	0.25-0.43	h	-	-	10	0.20	0.24	0.44-0.63	h	-	-
07/23/17	20	0.30	0.83	1.23-1.61	m	m	-	10	0.30	1.38	1.23-1.61	m	m	-
07/24/17	40	0.75	0.28	0.25-0.43	h	-	x	60	1.00	0.16	0.04-0.24	m	-	x

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
07/25/17	10	0.50	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/27/17	0	0.00	0.00	0.04-0.24	m	-	-	0	0.00	0.00	0.00	h	-	-
07/28/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.31	0.25-0.43	m	-	-
07/29/17	30	0.75	0.20	0.25-0.43	h	-	-	30	0.75	0.67	1.03-1..22	h	h	-
07/30/17	0	0.00	0.35	1.23-1.61	m	m	-	0	0.00	0.24	0.44-0.63	m	-	-
07/31/17	20	0.75	0.00	1.03-1.22	h	h	-	10	0.25	0.31	0.44-0.63	h	-	-
31 days					25/31	5/7	1					20/31	3/4	2
08/01/17	10	0.25	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
08/02/17	30	0.75	0.00	1.23-1.61	h	h	-	30	0.75	0.71	0.04-0.24	h	h	-
08/03/17	10	0.50	0.16	0.44-0.63	h	h	-	10	0.50	0.39	0.84-1.02	h	h	-
08/04/17	10	0.25	0.16	1.03-1.22	m	m	-	10	0.25	0.00	0.00	h	-	-
08/05/17	10	0.15	0.00	0.00	h	-	-	10	0.15	0.00	0.00	h	-	-
08/06/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/07/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/10/17	30	0.60	0.28	0.64-0.83	h	h	-	20	0.30	0.43	0.64-0.83	h	m	-
08/11/17	10	0.25	0.31	0.64-0.83	m	m	-	10	0.25	0.04	0.04-0.24	h	-	-
08/12/17	0	0.00	0.28	1.03-1.22	m	m	-	0	0.00	0.00	0.04-0.24	m	-	-
08/13/17	0	0.00	0.00	0.44-0.63	m	-	-	0	0.00	0.00	0.44-0.63	m	-	-
08/14/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/15/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/16/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/17/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/18/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/19/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/20/17	10	0.10	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
08/21/17	10	0.10	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
08/22/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/23/17	30	0.60	0.43	2.02-2.20	m	h	-	10	0.20	0.00	0.64-0.83	m	m	-
08/24/17	10	0.25	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/25/17	0	0.00	0.00	0.25-0.43	m	-	-	0	0.00	0.00	0.00	h	-	-
08/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/27/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/28/17	10	0.25	0.00	0.04-0.24	h	-	-	0	0.00	0.00	0.00	h	-	-
08/29/17	10	0.25	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/30/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/31/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
31 days					25/31	4/7	0					28/31	2/4	0
09/01/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/02/17	30	0.75	0.35	0.04-0.24	m	-	-	20	0.50	0.47	0.44-0.63	h	-	-
09/03/17	10	0.25	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
09/04/17	10	0.25	0.04	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
09/05/17	10	0.50	0.00	0.04-0.24	m	-	-	10	0.25	0.00	0.00	h	-	-
09/06/17	10	0.50	0.00	0.00	m	-	-	10	0.25	0.00	0.00	h	-	-
09/07/17	40	1.00	0.00	2.61-2.80	h	h	-	30	0.50	0.79	1.23-1.61	h	h	-
09/08/17	80	1.50	0.00	0.44-0.63	m	h	-	70	1.25	0.16	0.64-0.83	h	h	-
09/09/17	40	1.00	0.00	0.25-0.43	m	-	x	40	0.75	0.00	0.00	m	-	x
09/10/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/17	10	0.50	0.00	0.25-0.43	h	-	-	10	0.25	0.00	0.04-0.24	h	-	-
09/12/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/17	10	0.25	0.00	0.04-0.24	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/17	10	0.25	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/15/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/16/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
09/19/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
30 days					25/30	2/2	1					29/30	2/2	1
	Rainbow Valley							West Valley						
06/15/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/23/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/24/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/25/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
06/29/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/30/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
16 days					16/16	0	0					16/16	0	0
07/01/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/02/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/03/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/04/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.04-0.24	h	-	-
07/07/17	0	0.00	0.00	0.04-0.24	m	-	-	0	0.00	0.00	0.04-0.24	m	-	-
07/08/17	20	0.30	0.16	0.25-0.43	h	-	-	20	0.40	0.00	0.04-0.24	h	-	-
07/09/17	30	0.50	0.35	0.44-0.63	h	h	-	30	0.40	0.35	0.44-0.63	h	-	-
07/10/17	20	0.30	0.00	0.00	m	-	-	20	0.20	0.00	0.00	m	-	-
07/11/17	10	0.10	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
07/12/17	10	0.10	0.00	0.00	h	-	-	10	0.10	0.16	0.44-0.63	m	-	-
07/13/17	20	0.25	0.00	0.04-0.24	h	-	-	20	0.25	0.00	0.00	m	-	-
07/14/17	30	0.50	0.00	0.00	m	-	-	30	0.50	0.08	0.84-1.02	h	h	-
07/15/17	20	0.50	0.00	0.44-0.63	h	h	-	20	0.50	0.39	0.44-0.63	h	h	-
07/16/17	20	0.75	0.31	0.64-0.83	h	h	-	20	0.75	2.05	2.02-2.20	m	h	-
07/17/17	20	0.75	0.00	0.00	m	-	-	20	0.75	0.00	0.00	m	-	-
07/18/17	20	1.00	0.39	1.23-1.61	h	h	-	20	1.00	0.12	0.25-0.43	m	-	-
07/19/17	20	0.30	0.55	1.03-1.22	m	m	-	20	0.30	0.55	0.64-0.83	h	m	-
07/20/17	0	0.00	0.04	0.04-0.24	m	-	-	0	0.00	0.12	0.44-0.63	m	-	-
07/21/17	0	0.00	0.00	0.04-0.24	h	-	-	0	0.00	0.04	0.04-0.24	h	-	-
07/22/17	10	0.30	0.00	0.25-0.43	h	-	-	10	0.40	0.59	0.84-1.02	h	m	-
07/23/17	10	0.30	1.38	2.61-2.80	m	m	-	20	0.50	2.56	2.61-2.80	m	h	-
07/24/17	20	0.50	0.16	0.04-0.24	m	-	-	20	0.50	0.08	0.04-0.24	m	-	-
07/25/17	10	0.50	0.00	0.04-0.24	h	-	-	10	0.30	0.00	0.00	h	-	-
07/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
07/27/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/28/17	0	0.00	0.00	0.25-0.43	m	-	-	0	0.00	0.43	0.44-0.63	m	-	-
07/29/17	30	0.75	0.59	0.84-1.02	h	h	-	30	0.75	0.83	1.23-1.61	h	h	-
07/30/17	0	0.00	0.00	0.04-0.24	m	-	-	10	1.00	0.12	0.04-0.24	m	-	-
07/31/17	10	0.50	0.20	0.04-0.24	m	-	-	10	0.25	0.00	0.00	h	-	-
31 days					20/31	5/7	0					19/31	5/7	0
08/01/17	20	0.50	0.00	0.00	m	-	-	20	0.50	0.00	0.00	m	-	-
08/02/17	30	0.75	0.00	0.00	m	-	-	30	0.50	0.00	0.00	m	-	-
08/03/17	10	0.50	0.24	1.03-1.22	m	h	-	20	1.00	0.98	0.64-0.83	h	h	-
08/04/17	10	0.25	0.12	0.25-0.43	h	-	-	10	0.25	0.00	0.00	h	-	-
08/05/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/06/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/07/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/10/17	20	0.30	1.38	1.23-1.61	m	m	-	20	0.50	0.35	0.44-0.63	h	h	-
08/11/17	10	0.25	0.71	1.03-1.22	m	m	-	0	0.00	0.43	0.44-0.63	m	-	-
08/12/17	0	0.00	0.04	0.25-0.43	m	-	-	0	0.00	1.81	2.21-2.40	m	m	-
08/13/17	0	0.00	0.00	0.04-0.24	m	-	-	0	0.00	0.00	0.04-0.24	m	-	-
08/14/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/15/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/16/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/17/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/18/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/19/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/20/17	10	0.10	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
08/21/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/22/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/23/17	20	0.40	0.00	0.04-0.24	h	-	-	10	0.30	0.31	0.84-1.02	m	m	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
08/24/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/25/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.04-0.24	m	-	-
08/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/27/17	0	0.00	0.00	0.04-0.24	m	-	-	0	0.00	0.00	0.04-0.24	m	-	-
08/28/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/29/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/30/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/31/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
31 days					23/31	1/3	0					23/31	2/4	0
09/01/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/02/17	10	0.25	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
09/03/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/04/17	10	0.25	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
09/05/17	10	0.50	0.00	0.00	h	-	-	10	0.50	0.00	0.04-0.24	m	-	-
09/06/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/07/17	30	0.50	0.04	0.64-0.83	h	h	-	30	0.50	0.04	0.25-0.43	h	-	-
09/08/17	60	1.25	0.00	0.00	m	-	x	50	1.25	0.20	0.25-0.43	m	-	x
09/09/17	30	0.50	0.00	0.00	m	-	-	10	0.50	0.00	0.64-0.83	h	h	-
09/10/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/17	10	0.25	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/17	10	0.25	0.04	0.25-0.43	h	-	-	10	0.10	0.00	0.00	h	-	-
09/14/17	10	0.25	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/15/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/16/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
09/21/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
30 days					28/30	1/1	1					28/30	1/1	1
	Northwest Valley							Upper Centennial						
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
06/15/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/23/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/24/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/25/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/29/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/30/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
16 days					16/16	0	0					16/16	0	0
07/01/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/02/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/03/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/04/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/17	10	0.10	0.00	0.00	h	-	-	20	0.20	0.00	0.44-0.63	m	-	-
07/08/17	20	0.50	0.00	0.04-0.24	m	-	-	30	0.60	0.00	0.04-0.24	m	-	-
07/09/17	30	0.20	0.00	0.44-0.63	h	-	-	30	0.20	0.00	0.25-0.43	h	-	-
07/10/17	20	0.30	0.59	1.03-1.22	m	m	-	30	0.40	0.08	0.44-0.63	h	-	-
07/11/17	20	0.10	0.08	0.04-0.24	h	-	-	20	0.10	0.04	1.23-1.61	m	m	-
07/12/17	10	0.10	0.04	0.25-0.43	h	-	-	10	0.10	0.08	0.84-1.03	m	m	-
07/13/17	10	0.25	0.00	0.44-0.63	h	-	-	10	0.50	0.00	0.00	m	-	-
07/14/17	20	0.50	0.94	0.84-1.02	h	h	-	10	0.30	0.00	0.00	h	-	-
07/15/17	40	1.00	0.71	0.84-1.02	h	h	-	20	0.50	1.81	1.62-1.81	m	h	-
07/16/17	40	1.00	0.31	0.44-0.63	h	h	-	40	1.25	0.00	0.00	m	-	x
07/17/17	20	1.00	0.00	0.00	m	-	-	20	1.25	0.04	0.04-0.24	m	-	-
07/18/17	30	1.50	0.08	0.04-0.24	m	-	x	30	1.25	1.15	1.23-1.61	h	h	-
07/19/17	20	0.50	0.43	0.64-0.83	h	h	-	20	0.50	0.63	1.03-1.22	h	h	-
07/20/17	10	0.50	0.20	0.84-1.03	h	h	-	10	0.30	0.55	0.64-0.83	h	m	-
07/21/17	10	0.50	0.24	0.44-0.63	h	h	-	0	0.00	0.04	0.04-0.24	m	-	-
07/22/17	10	0.50	0.55	0.84-1.02	h	h	-	10	0.40	0.04	0.25-0.43	h	-	-
07/23/17	20	0.75	0.75	0.64-0.84	h	h	-	20	0.50	1.57	1.23-1.61	m	h	-
07/24/17	60	0.50	0.16	0.04-0.24	m	-	x	60	1.00	0.35	0.25-0.43	m	-	x
07/25/17	10	0.30	0.00	0.00	h	-	-	10	0.50	0.00	0.00	h	-	-
07/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/27/17	0	0.00	0.00	0.04-0.24	m	-	-	0	0.00	0.00	0.00	h	-	-
07/28/17	10	0.50	0.12	0.25-0.43	h	-	-	20	0.60	0.31	1.23-1.61	h	h	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
07/29/17	40	0.75	0.63	1.03-1.22	h	h	-	40	1.00	0.87	0.84-1.02	h	h	-
07/30/17	10	1.00	0.00	0.00	m	-	-	30	1.00	0.00	0.04-0.24	m	-	x
07/31/17	20	0.50	0.08	0.25-0.43	h	-	-	10	0.50	0.51	1.23-1.61	h	h	-
31 days					24/31	9/10	2					20/31	7/10	3
08/01/17	30	0.75	0.04	0.04-0.24	m	-	-	20	0.75	1.97	2.02-2.20	m	h	-
08/02/17	20	0.50	0.00	0.00	m	-	-	30	0.75	0.08	0.04-0.24	m	-	-
08/03/17	20	1.00	0.35	0.44-0.63	h	h	-	30	1.00	0.83	1.82-2.01	h	h	-
08/04/17	10	0.25	0.08	0.00	h	-	-	10	0.25	0.12	0.84-1.02	m	m	-
08/05/17	0	0.00	0.00	0.00	h	-	-	10	0.15	0.00	0.00	h	-	-
08/06/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/07/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/10/17	20	0.75	0.08	0.25-0.43	h	-	-	20	1.00	1.26	1.23-1.61	h	h	-
08/11/17	0	0.00	0.43	0.44-0.63	m	-	-	0	0.00	0.00	0.00	h	-	-
08/12/17	10	0.50	1.69	1.23-1.61	m	h	-	10	0.50	0.75	1.23-1.61	m	h	-
08/13/17	0	0.00	0.16	0.04-0.24	m	-	-	0	0.00	0.39	0.84-1.02	m	m	-
08/14/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/15/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/16/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/17/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/18/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/19/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/20/17	10	0.25	0.00	0.04-0.24	h	-	-	10	0.25	0.00	0.04-0.24	h	-	-
08/21/17	0	0.00	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
08/22/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/23/17	10	0.20	0.67	2.02-2.20	m	m	-	10	0.20	0.00	0.00	h	-	-
08/24/17	10	0.25	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
08/25/17	0	0.00	0.00	0.25-0.43	m	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
08/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/27/17	0	0.00	0.00	0.04-0.24	m	-	-	10	0.25	0.00	0.04-0.24	h	-	-
08/28/17	10	0.35	0.00	0.00	h	-	-	10	0.35	0.00	0.00	h	-	-
08/29/17	10	0.25	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
08/30/17	10	0.25	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
08/31/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
31 days					23/31	2/3	0					26/31	4/6	0
09/01/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/02/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/03/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/04/17	20	0.50	0.35	0.25-0.43	h	-	-	20	0.50	0.12	0.25-0.43	h	-	-
09/05/17	20	0.50	0.00	0.04-0.24	m	-	-	20	0.50	0.55	0.84-1.02	h	h	-
09/06/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/07/17	30	0.75	0.00	0.25-0.43	h	-	-	30	1.00	0.20	2.02-2.20	h	h	-
09/08/17	50	1.00	0.08	0.84-1.02	h	h	-	80	1.25	0.79	1.62-1.81	h	h	-
09/09/17	10	0.50	0.00	0.04-0.24	m	-	-	30	1.00	0.00	0.04-0.24	m	-	x
09/10/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.04	0.04-0.24	m	-	-
09/12/17	0	0.00	0.00	0.00	h	-	-	10	0.25	0.00	0.25-0.43	h	-	-
09/13/17	10	0.10	0.00	0.00	h	-	-	0	0.00	0.00	0.44-0.63	m	-	-
09/14/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/15/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/16/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
09/23/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
30 days					28/30	1/1	0					27/30	3/3	1
	Wickenburg							New River Cave Creek						
06/15/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/23/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/24/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/25/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/29/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/30/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
16 days					16/16	0	0					16/16	0	0
07/01/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
07/02/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/03/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/04/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/17	20	0.20	0.00	0.00	m	-	-	30	0.30	0.12	0.25-0.43	h	-	-
07/08/17	30	0.60	0.00	0.04-0.24	m	-	-	30	0.50	0.00	0.04-0.24	m	-	-
07/09/17	30	0.20	0.04	0.04-0.24	h	-	-	20	0.30	0.16	0.25-0.43	h	-	-
07/10/17	30	0.50	0.04	0.44-0.63	h	h	-	30	0.60	0.83	1.23-1.61	h	h	-
07/11/17	20	0.10	0.04	0.04-0.24	h	-	-	20	0.30	0.20	0.44-0.63	h	-	-
07/12/17	10	0.10	0.12	0.84-1.03	m	m	-	20	0.50	0.83	1.03-1.22	h	h	-
07/13/17	10	0.50	0.00	0.04-0.24	m	-	-	20	0.75	0.08	0.04-0.24	m	-	-
07/14/17	10	0.30	0.04	0.44-0.63	h	-	-	30	0.60	0.94	0.84-1.02	h	h	-
07/15/17	30	0.75	1.42	1.23-1.61	h	h	-	40	1.00	0.71	0.84-1.02	h	h	-
07/16/17	30	1.50	0.00	0.04-0.24	m	-	x	40	1.50	1.22	1.82-2.01	h	h	-
07/17/17	20	1.50	0.28	0.04-0.24	m	-	-	20	1.50	0.08	0.00	m	-	-
07/18/17	30	1.50	2.20	2.02-2.20	h	h	-	40	1.75	0.94	1.23-1.61	h	h	-
07/19/17	20	0.50	0.08	0.25-0.43	h	-	-	20	1.00	0.16	0.04-0.24	m	-	-
07/20/17	10	0.40	0.00	0.25-0.43	h	-	-	30	1.00	0.20	1.03-1.22	h	h	-
07/21/17	20	0.50	0.28	0.44-0.63	h	-	-	20	1.00	0.24	0.64-0.83	h	h	-
07/22/17	20	0.75	0.08	0.44-0.63	h	-	-	30	0.75	0.59	0.84-1.02	h	h	-
07/23/17	20	0.75	0.51	0.64-0.83	h	h	-	40	1.50	0.43	1.03-1.22	h	h	-
07/24/17	60	1.00	0.12	0.04-0.24	m	-	x	20	0.50	0.04	0.04-0.24	m	-	-
07/25/17	10	0.50	0.00	0.00	h	-	-	10	0.30	0.00	0.00	h	-	-
07/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/27/17	0	0.00	0.00	0.00	h	-	-	10	0.25	0.00	0.04-0.24	h	-	-
07/28/17	20	0.60	0.20	0.25-0.43	h	-	-	20	0.75	0.28	0.64-0.83	h	h	-
07/29/17	40	1.00	0.87	1.03-1.22	h	h	-	50	1.25	0.98	1.23-1.61	h	h	-
07/30/17	30	1.25	0.00	0.04-0.24	m	-	x	30	1.50	0.04	0.25-0.43	m	-	x

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
07/31/17	20	0.50	0.55	0.64-0.83	h	h	-	20	0.50	0.98	1.23-1.61	h	h	-
31 days					23/31	6/7	3					25/31	13/13	1
08/01/17	30	1.00	1.97	2.02-2.20	h	h	-	30	1.00	0.67	0.84-1.02	h	h	-
08/02/17	30	0.75	0.04	0.04-0.24	m	-	-	10	0.25	0.00	0.00	h	-	-
08/03/17	30	1.00	1.30	2.41-2.60	h	h	-	30	1.50	1.02	1.23-1.61	h	h	-
08/04/17	10	0.25	0.00	0.04-0.24	h	-	-	10	0.25	0.08	0.04-0.24	h	-	-
08/05/17	10	0.15	0.00	0.00	h	-	-	10	0.15	0.00	0.00	h	-	-
08/06/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/07/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/10/17	20	1.00	2.05	2.02-2.20	m	h	-	20	0.75	0.00	0.04-0.24	m	-	-
08/11/17	0	0.00	0.00	0.04-0.24	m	-	-	10	0.25	0.12	0.04-0.24	h	-	-
08/12/17	10	0.50	0.75	0.64-0.83	h	h	-	30	0.75	0.67	1.62-1.81	h	h	-
08/13/17	0	0.00	0.04	0.04-0.24	m	-	-	10	0.25	1.14	0.84-1.02	m	m	-
08/14/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/15/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/16/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/17/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/18/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/19/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/20/17	10	0.25	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
08/21/17	10	0.10	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
08/22/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/23/17	20	0.20	0.00	0.00	m	-	-	20	0.30	0.20	1.03-1.22	m	m	-
08/24/17	10	0.25	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
08/25/17	0	0.00	0.00	0.00	h	-	-	10	0.25	0.00	0.25-0.43	h	-	-
08/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.39	0.64-0.83	m	m	-
08/27/17	10	0.25	0.00	0.04-0.24	h	-	-	20	0.50	0.67	0.84-1.02	h	h	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
08/28/17	10	0.35	0.00	0.00	h	-	-	20	0.50	0.00	0.00	m	-	-
08/29/17	10	0.25	0.00	0.00	h	-	-	10	0.50	0.04	0.25-0.43	h	-	-
08/30/17	10	0.25	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
08/31/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
31 days					26/31	4/4	0					26/31	4/7	0
09/01/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/02/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/03/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/04/17	30	0.75	0.20	0.84-1.02	h	h	-	30	0.75	0.39	0.64-0.83	h	h	-
09/05/17	20	0.75	0.28	0.44-0.63	h	h	-	20	0.75	0.35	0.25-0.43	h	-	-
09/06/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/07/17	30	1.00	0.04	0.04-0.24	m	-	x	20	0.50	0.08	0.04-0.24	m	-	-
09/08/17	70	1.25	1.18	1.23-1.61	h	h	-	40	1.00	0.04	0.04-0.24	m	-	x
09/09/17	20	1.00	0.00	0.04-0.24	m	-	-	10	0.50	0.00	0.00	h	-	-
09/10/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.44-0.63	m	-	-
09/11/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/17	10	0.25	0.12	0.25-0.43	h	-	-	10	0.25	0.16	0.25-0.43	h	-	-
09/13/17	0	0.00	0.00	0.04-0.24	m	-	-	10	0.25	0.00	0.00	h	-	-
09/14/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/15/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/16/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
09/25/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
30 days					27/30	3/3	1					27/30	1/1	1
	Phoenix North							Phoenix South						
06/15/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/23/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/24/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/25/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/29/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/30/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
16 days					16/16	0	0					16/16	0	0
07/01/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/02/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/03/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
07/04/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/17	20	0.20	0.00	0.00	m	-	-	0	0.00	0.00	0.04-0.24	m	-	-
07/08/17	30	0.40	0.00	0.04-0.24	h	-	-	20	0.30	0.00	0.00	m	-	-
07/09/17	20	0.30	0.00	0.00	m	-	-	20	0.20	0.00	0.25-0.43	h	-	-
07/10/17	20	0.30	0.00	0.04-0.24	h	-	-	20	0.30	0.12	0.04-0.24	h	-	-
07/11/17	20	0.20	0.00	0.00	m	-	-	10	0.10	0.00	0.00	h	-	-
07/12/17	20	0.40	0.04	0.25-0.43	h	-	-	10	0.25	0.00	0.00	h	-	-
07/13/17	20	0.50	0.00	0.00	m	-	-	10	0.50	0.00	0.00	m	-	-
07/14/17	20	0.50	0.00	0.04-0.24	m	-	-	20	0.50	0.00	0.00	m	-	-
07/15/17	30	0.70	0.71	0.64-0.83	h	h	-	20	0.50	0.35	0.64-0.83	h	h	-
07/16/17	30	1.00	0.98	0.84-1.02	h	h	-	20	0.75	1.18	1.03-1.22	h	h	-
07/17/17	20	1.00	0.04	0.00	m	-	-	20	0.75	0.04	0.04-0.24	m	-	-
07/18/17	30	1.50	0.12	0.04-0.24	m	-	x	30	1.00	0.12	0.04-0.24	m	-	x
07/19/17	20	0.75	0.00	0.00	m	-	-	20	0.50	0.00	0.04-0.24	m	-	-
07/20/17	10	0.60	0.51	0.64-0.83	h	h	-	0	0.00	0.51	0.64-0.83	m	m	-
07/21/17	20	0.60	0.47	0.64-0.83	h	h	-	10	0.50	1.06	0.25-0.43	m	h	-
07/22/17	20	0.50	0.08	0.44-0.63	h	h	-	20	0.50	0.08	0.04-0.24	m	-	-
07/23/17	30	0.75	0.43	0.44-0.63	h	h	-	20	0.50	2.48	2.41-2.60	m	h	-
07/24/17	20	0.50	0.04	0.25-0.43	h	-	-	20	0.50	0.16	0.25-0.43	h	-	-
07/25/17	0	0.00	0.00	0.00	h	-	-	10	0.30	0.00	0.04-0.24	h	-	-
07/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/27/17	10	0.10	0.00	0.04-0.24	h	-	-	10	0.10	0.00	0.04-0.24	h	-	-
07/28/17	10	0.60	0.00	0.04-0.24	m	-	-	0	0.00	0.00	0.00	h	-	-
07/29/17	40	1.00	0.67	0.64-0.83	h	h	-	30	0.75	0.59	0.64-0.83	h	h	-
07/30/17	10	1.00	0.00	0.00	m	-	-	0	0.00	0.00	0.00	h	-	-
07/31/17	10	0.25	0.75	1.03-1.22	m	m	-	10	0.25	0.00	0.04-0.24	h	-	-
31 days					20/31	7/8	1					20/31	5/6	1

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
08/01/17	30	1.00	0.00	0.00	m	-	x	30	0.75	0.00	0.00	m	-	-
08/02/17	10	0.25	0.00	0.00	h	-	-	30	0.75	0.00	0.00	m	-	-
08/03/17	20	1.25	1.22	1.23-1.61	h	h	-	20	1.25	1.89	1.82-2.01	h	h	-
08/04/17	10	0.25	0.00	0.00	h	-	-	10	0.25	0.04	0.04-0.24	h	-	-
08/05/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/06/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/07/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/10/17	20	0.50	0.04	0.04-0.24	m	-	-	20	0.30	0.12	0.04-0.24	h	-	-
08/11/17	10	0.25	0.43	0.25-0.43	h	-	-	10	0.25	0.83	0.84-1.02	m	m	-
08/12/17	20	0.75	0.79	1.82-2.01	m	h	-	10	0.50	2.13	2.81-3.19	m	h	-
08/13/17	10	0.25	0.04	0.04-0.24	h	-	-	10	0.25	0.16	0.04-0.24	h	-	-
08/14/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/15/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/16/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/17/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/18/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/19/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/20/17	10	0.10	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
08/21/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/22/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/23/17	20	0.30	0.59	1.03-1.22	m	m	-	30	0.50	0.39	0.84-1.02	h	h	-
08/24/17	10	0.25	0.04	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/25/17	10	0.25	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/27/17	10	0.25	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/28/17	10	0.25	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
08/29/17	10	0.25	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
08/30/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/31/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
31 days					27/31	2/3	1					27/31	3/4	0
09/01/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/02/17	0	0.00	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
09/03/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/04/17	20	0.50	0.00	0.00	m	-	-	10	0.25	0.00	0.00	h	-	-
09/05/17	20	0.50	0.00	0.04-0.24	m	-	-	10	0.50	0.00	0.04-0.24	m	-	-
09/06/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/07/17	20	0.50	0.04	0.25-0.43	h	-	-	20	0.50	0.00	0.04-0.24	m	-	-
09/08/17	30	0.75	0.00	0.00	m	-	-	30	0.50	0.00	0.00	m	-	-
09/09/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/17	10	0.25	0.00	0.00	h	-	-	10	0.25	0.00	0.25-0.43	h	-	-
09/14/17	0	0.00	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
09/15/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/16/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
09/27/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
30 days					27/30	0/0	0					27/30	0/0	0
	Scottsdale North							Scottsdale South						
06/15/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/23/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/24/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/25/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/29/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/30/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
16 days					16/16	0	0					16/16	0	0
07/01/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/02/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/03/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/04/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
07/06/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/17	20	0.30	0.08	0.25-0.43	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/17	30	0.40	0.04	0.04-0.24	h	-	-	20	0.30	0.00	0.00	m	-	-
07/09/17	20	0.30	0.04	0.44-0.63	h	-	-	20	0.20	0.00	0.00	m	-	-
07/10/17	30	0.40	0.39	0.25-0.43	h	-	-	20	0.30	0.04	0.25-0.43	h	-	-
07/11/17	20	0.20	0.00	0.00	m	-	-	10	0.10	0.00	0.00	h	-	-
07/12/17	20	0.50	1.06	1.03-1.22	m	h	-	10	0.25	0.24	0.64-0.83	m	m	-
07/13/17	20	0.75	0.12	0.64-0.83	h	h	-	10	0.50	0.04	0.04-0.24	m	-	-
07/14/17	20	0.60	0.00	0.44-0.63	h	h	-	20	0.50	0.00	0.00	m	-	-
07/15/17	30	0.85	0.24	0.44-0.63	h	h	-	20	0.50	0.35	0.25-0.43	h	-	-
07/16/17	30	1.00	0.79	0.84-1.02	h	h	-	20	0.75	0.98	1.03-1.22	h	h	-
07/17/17	20	1.00	0.20	0.00	m	-	-	20	0.75	0.00	0.00	m	-	-
07/18/17	30	1.50	0.08	0.04-0.24	m	-	x	30	1.25	0.04	0.04-0.24	m	-	x
07/19/17	20	1.00	0.00	0.00	m	-	-	20	0.50	0.00	0.00	m	-	-
07/20/17	10	0.60	0.12	0.84-1.02	h	h	-	0	0.00	0.39	0.44-0.63	m	-	-
07/21/17	20	0.60	0.43	0.44-0.63	h	h	-	10	0.50	0.39	0.25-0.43	h	-	-
07/22/17	20	0.75	0.24	0.44-0.63	h	h	-	20	0.50	0.12	0.04-0.24	m	-	-
07/23/17	30	1.00	1.54	1.23-1.61	h	h	-	20	0.75	0.91	1.03-1.22	h	h	-
07/24/17	20	0.50	0.04	0.04-0.24	m	-	-	20	0.50	0.04	0.25-0.43	h	-	-
07/25/17	10	0.30	0.00	0.00	h	-	-	10	0.30	0.00	0.00	h	-	-
07/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/27/17	10	0.10	0.00	0.04-0.24	h	-	-	10	0.10	0.00	0.04-0.24	h	-	-
07/28/17	20	0.60	0.00	0.04-0.24	m	-	-	0	0.00	0.00	0.00	h	-	-
07/29/17	40	1.00	0.24	0.44-0.63	h	h	-	30	0.75	0.04	0.04-0.24	m	-	-
07/30/17	10	1.00	0.04	0.04-0.24	m	-	-	0	0.00	0.00	0.00	h	-	-
07/31/17	10	0.25	0.24	0.25-0.43	h	-	-	10	0.25	0.00	0.04-0.24	h	-	-
31 days					23/31	10/10	1					20/31	2/3	1
08/01/17	30	1.00	0.31	0.44-0.63	h	h	-	30	0.75	0.00	0.00	m	-	-
08/02/17	10	0.25	0.00	0.00	h	-	-	20	0.50	0.00	0.00	m	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
08/03/17	20	1.25	0.98	0.84-1.02	h	h	-	20	1.25	1.85	1.82-2.01	h	h	-
08/04/17	10	0.25	0.04	0.04-0.24	h	-	-	10	0.25	0.00	0.00	h	-	-
08/05/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/06/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/07/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/10/17	20	0.30	0.00	0.04-0.24	h	-	-	20	0.30	0.00	0.04-0.24	h	-	-
08/11/17	10	0.25	0.08	0.04-0.24	h	-	-	10	0.25	0.04	0.04-0.24	h	-	-
08/12/17	20	0.75	0.12	0.25-0.43	h	-	-	10	0.50	0.28	0.25-0.43	h	-	-
08/13/17	10	0.25	0.63	1.23-1.61	m	m	-	10	0.25	0.12	0.04-0.24	h	-	-
08/14/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/15/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/16/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/17/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/18/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/19/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/20/17	10	0.25	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
08/21/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/22/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/23/17	20	0.20	0.91	1.03-1.22	m	m	-	30	0.50	0.51	0.44-0.63	h	h	-
08/24/17	10	0.25	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/25/17	10	0.25	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/26/17	0	0.00	0.00	0.04-0.24	m	-	-	0	0.00	0.00	0.00	h	-	-
08/27/17	10	0.25	0.00	0.25-0.43	h	-	-	0	0.00	0.00	0.00	h	-	-
08/28/17	10	0.25	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
08/29/17	10	0.25	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
08/30/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/31/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
31 days					28/31	0/2	0					29/31	2/2	0
09/01/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/02/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/03/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/04/17	20	0.50	0.12	0.25-0.43	h	-	-	10	0.25	0.00	0.00	h	-	-
09/05/17	10	0.50	0.08	0.04-0.24	m	-	-	10	0.25	0.00	0.04-0.24	h	-	-
09/06/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/07/17	20	0.50	0.20	0.64-0.83	h	h	-	20	0.50	0.20	0.84-1.02	h	h	-
09/08/17	30	0.75	0.39	0.44-0.63	h	-	-	30	0.50	0.00	0.00	m	-	-
09/09/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/17	10	0.25	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
09/14/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/15/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/16/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
09/29/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
30 days					29/30	1/1	0					29/30	1/1	0
	Southeast Valley							Lower Salt River Lakes						
06/15/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/17	10	0.10	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
06/21/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/23/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/24/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/25/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/29/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/30/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
16 days					16/16	0	0					16/16	0	0
07/01/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/02/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/03/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/04/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/17	0	0.00	0.04	0.04-0.24	m	-	-	0	0.00	0.00	1.03-1.22	m	m	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
07/08/17	20	0.30	0.00	0.04-0.24	h	-	-	30	0.40	0.00	0.25-0.43	h	-	-
07/09/17	10	0.20	0.00	0.00	h	-	-	10	0.30	0.00	0.00	h	-	-
07/10/17	30	0.60	1.50	1.23-1.61	m	h	-	30	0.50	0.04	0.25-0.43	h	-	-
07/11/17	20	0.20	0.04	0.00	m	-	-	20	0.30	0.00	0.00	m	-	-
07/12/17	20	0.50	0.00	0.00	m	-	-	30	0.50	0.00	1.03-1.22	h	h	-
07/13/17	20	0.50	0.00	0.00	m	-	-	30	0.75	0.00	0.04-0.24	m	-	-
07/14/17	20	0.50	0.00	0.00	m	-	-	30	0.60	0.00	0.44-0.63	h	h	-
07/15/17	30	0.75	0.20	0.04-0.24	m	-	-	40	1.00	0.00	1.03-1.22	h	h	-
07/16/17	30	1.00	1.06	1.03-1.22	h	h	-	40	1.00	0.35	0.84-1.02	h	h	-
07/17/17	20	1.00	0.39	0.44-0.63	h	h	-	20	1.00	0.00	0.04-0.24	m	-	-
07/18/17	30	1.25	0.04	0.04-0.24	m	-	x	40	1.75	0.00	1.23-1.61	h	h	-
07/19/17	30	1.00	0.00	0.00	m	-	x	30	1.00	0.08	0.44-0.63	h	h	-
07/20/17	0	0.00	0.67	0.84-1.02	m	m	-	20	0.60	0.00	0.25-0.43	h	-	-
07/21/17	10	0.50	0.28	0.44-0.63	h	h	-	20	0.60	0.04	0.84-1.02	h	h	-
07/22/17	20	0.75	0.00	0.04-0.24	m	-	-	30	0.75	0.04	0.64-0.83	h	h	-
07/23/17	30	1.00	2.68	2.81-3.19	m	h	-	40	1.50	0.08	2.21-2.40	h	h	-
07/24/17	20	0.50	0.04	0.04-0.24	m	-	-	20	0.50	0.00	0.04-0.24	m	-	-
07/25/17	10	0.30	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/27/17	10	0.10	0.08	0.04-0.24	h	-	-	10	0.25	0.00	0.25-0.43	h	-	-
07/28/17	0	0.00	0.00	0.00	h	-	-	20	0.75	0.00	0.04-0.24	m	-	-
07/29/17	30	1.00	0.55	0.44-0.63	h	h	-	40	1.00	0.00	0.44-0.63	h	h	-
07/30/17	10	0.75	0.00	0.00	m	-	-	10	1.00	0.00	0.04-0.24	m	-	-
07/31/17	10	0.25	0.08	0.25-0.43	h	-	-	10	0.25	0.00	0.84-1.02	m	m	-
31 days					17/31	6/7	2					23/31	10/12	0
08/01/17	30	0.75	0.04	0.04-0.24	m	-	-	30	1.25	0.00	0.25-0.43	m	-	x
08/02/17	30	0.75	0.00	0.00	m	-	-	10	0.25	0.00	0.00	h	-	-
08/03/17	20	1.00	1.69	1.62-1.81	h	h	-	20	1.00	0.08	0.25-0.43	m	-	-
08/04/17	10	0.25	0.24	0.25-0.43	h	-	-	10	0.25	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
08/05/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/06/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/07/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/10/17	30	0.50	0.00	0.04-0.24	m	-	-	30	0.75	0.00	0.04-0.24	m	-	-
08/11/17	10	0.25	0.31	0.44-0.63	h	-	-	10	0.25	0.00	0.04-0.24	h	-	-
08/12/17	20	0.50	1.89	1.82-2.01	m	h	-	20	0.50	0.00	0.04-0.24	m	-	-
08/13/17	10	0.25	0.04	0.04-0.24	h	-	-	10	0.25	0.12	0.44-0.63	h	-	-
08/14/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/15/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/16/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/17/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/18/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/19/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/20/17	10	0.10	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
08/21/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/22/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/23/17	30	0.50	0.43	0.25-0.43	h	-	-	20	0.40	0.00	0.44-0.63	h	-	-
08/24/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.04-0.24	m	-	-
08/25/17	0	0.00	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
08/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	1.03-1.22	m	m	-
08/27/17	0	0.00	0.20	0.44-0.63	m	-	-	10	0.25	0.00	0.25-0.43	h	-	-
08/28/17	10	0.25	0.00	0.00	h	-	-	20	0.50	0.00	0.00	m	-	-
08/29/17	10	0.25	0.00	0.00	h	-	-	10	0.50	0.00	0.00	m	-	-
08/30/17	0	0.00	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
08/31/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
31 days					26/31	2/2	0					23/31	0/1	1
09/01/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
09/02/17	10	0.25	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/03/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/04/17	20	0.50	0.00	0.00	m	-	-	30	0.50	0.00	0.00	m	-	-
09/05/17	10	0.50	0.08	0.04-0.24	m	-	-	20	0.50	0.24	1.03-1.22	h	h	-
09/06/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/07/17	30	0.50	0.20	0.25-0.43	h	-	-	20	0.50	0.00	0.00	m	-	-
09/08/17	20	0.33	0.12	0.44-0.63	h	-	-	20	0.33	0.16	0.84-1.02	m	m	-
09/09/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/17	10	0.25	0.00	0.25-0.43	h	-	-	10	0.25	0.00	0.04-0.24	h	-	-
09/14/17	10	0.10	0.12	0.04-0.24	h	-	-	10	0.25	0.00	0.25-0.43	h	-	-
09/15/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/16/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/17	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
30 days					28/30	0/1	0					27/30	1/2	0
	Superstition													
06/15/17	0	0.00	0.00	0.00	h	-	-							
06/16/17	0	0.00	0.00	0.00	h	-	-							
06/17/17	0	0.00	0.00	0.00	h	-	-							
06/18/17	0	0.00	0.00	0.00	h	-	-							
06/19/17	0	0.00	0.00	0.00	h	-	-							
06/20/17	10	0.10	0.00	0.00	h	-	-							
06/21/17	0	0.00	0.00	0.00	h	-	-							
06/22/17	0	0.00	0.00	0.00	h	-	-							
06/23/17	0	0.00	0.00	0.00	h	-	-							
06/24/17	0	0.00	0.00	0.00	h	-	-							
06/25/17	0	0.00	0.00	0.00	h	-	-							
06/26/17	0	0.00	0.00	0.00	h	-	-							
06/27/17	0	0.00	0.00	0.00	h	-	-							
06/28/17	0	0.00	0.00	0.00	h	-	-							
06/29/17	0	0.00	0.00	0.00	h	-	-							
06/30/17	0	0.00	0.00	0.00	h	-	-							
16 days					16/16	0	0							
07/01/17	0	0.00	0.00	0.00	h	-	-							
07/02/17	0	0.00	0.00	0.00	h	-	-							
07/03/17	0	0.00	0.00	0.00	h	-	-							
07/04/17	0	0.00	0.00	0.00	h	-	-							
07/05/17	0	0.00	0.00	0.00	h	-	-							
07/06/17	0	0.00	0.00	0.00	h	-	-							
07/07/17	0	0.00	0.04	0.25-0.43	m	-	-							
07/08/17	30	0.40	0.00	0.00	m	-	-							
07/09/17	10	0.30	0.00	0.00	h	-	-							

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
07/10/17	30	0.60	0.71	1.23-1.61	h	h	-							
07/11/17	20	0.30	0.04	0.00	m	-	-							
07/12/17	30	0.50	0.00	0.00	m	-	-							
07/13/17	30	0.75	0.00	0.00	m	-	-							
07/14/17	20	0.60	0.00	0.25-0.43	h	-	-							
07/15/17	40	1.00	0.12	0.44-0.63	h	h	-							
07/16/17	40	1.00	0.63	0.64-0.83	h	h	-							
07/17/17	20	1.00	0.35	0.04-0.24	m	-	-							
07/18/17	40	1.75	0.04	0.04-0.24	m	-	x							
07/19/17	30	1.00	0.24	0.25-0.43	m	-	x							
07/20/17	20	0.50	0.59	0.64-0.83	h	h	-							
07/21/17	20	0.50	1.18	0.64-0.83	h	h	-							
07/22/17	30	0.75	0.04	0.04-0.24	m	-	-							
07/23/17	40	1.50	3.46	2.81-3.19	h	h	-							
07/24/17	20	0.50	0.04	0.00	m	-	-							
07/25/17	10	0.30	0.00	0.00	h	-	-							
07/26/17	0	0.00	0.00	0.00	h	-	-							
07/27/17	10	0.25	0.12	0.04-0.24	h	-	-							
07/28/17	10	0.60	0.00	0.04-0.24	m	-	-							
07/29/17	40	1.00	1.06	0.64-0.83	h	h	-							
07/30/17	10	1.00	0.00	0.04-0.24	m	-	-							
07/31/17	10	0.25	0.00	0.04-0.24	h	-	-							
31 days					19/31	7/7	2							
08/01/17	30	1.25	1.69	0.64-0.83	h	h	-							
08/02/17	30	0.75	0.00	0.00	m	-	-							
08/03/17	30	1.00	1.02	0.84-1.02	h	h	-							
08/04/17	10	0.25	0.12	0.04-0.24	h	-	-							
08/05/17	0	0.00	0.00	0.00	h	-	-							
08/06/17	0	0.00	0.00	0.00	h	-	-							

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
08/07/17	0	0.00	0.00	0.00	h	-	-							
08/08/17	0	0.00	0.00	0.00	h	-	-							
08/09/17	0	0.00	0.00	0.00	h	-	-							
08/10/17	30	0.75	0.04	0.04-0.24	m	-	-							
08/11/17	10	0.25	0.24	0.04-0.24	h	-	-							
08/12/17	20	0.50	0.71	0.64-0.83	h	h	-							
08/13/17	10	0.25	0.00	0.00	h	-	-							
08/14/17	0	0.00	0.00	0.00	h	-	-							
08/15/17	0	0.00	0.00	0.00	h	-	-							
08/16/17	0	0.00	0.00	0.00	h	-	-							
08/17/17	0	0.00	0.00	0.00	h	-	-							
08/18/17	0	0.00	0.00	0.00	h	-	-							
08/19/17	0	0.00	0.00	0.00	h	-	-							
08/20/17	10	0.25	0.00	0.00	h	-	-							
08/21/17	0	0.00	0.00	0.00	h	-	-							
08/22/17	0	0.00	0.00	0.00	h	-	-							
08/23/17	30	0.50	0.28	0.25-0.43	h	-	-							
08/24/17	0	0.00	0.00	0.00	h	-	-							
08/25/17	0	0.00	0.00	0.00	h	-	-							
08/26/17	0	0.00	0.51	1.03-1.22	m	m	-							
08/27/17	0	0.00	0.79	0.44-0.63	m	m	-							
08/28/17	20	0.50	0.00	0.00	m	-	-							
08/29/17	10	0.50	0.00	0.00	m	-	-							
08/30/17	10	0.25	0.00	0.00	h	-	-							
08/31/17	0	0.00	0.00	0.00	h	-	-							
31 days					25/31	3/5	0							
09/01/17	0	0.00	0.00	0.00	h	-	-							
09/02/17	0	0.00	0.00	0.00	h	-	-							
09/03/17	0	0.00	0.00	0.00	h	-	-							

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2017														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
09/04/17	20	0.50	0.00	0.00	m	-	-							
09/05/17	20	0.50	0.00	0.25-0.43	h	-	-							
09/06/17	0	0.00	0.00	0.00	h	-	-							
09/07/17	30	0.50	0.04	0.25-0.43	h	-	-							
09/08/17	20	0.33	1.06	0.84-1.02	m	m	-							
09/09/17	0	0.00	0.00	0.00	h	-	-							
09/10/17	0	0.00	0.00	0.00	h	-	-							
09/11/17	0	0.00	0.00	0.00	h	-	-							
09/12/17	0	0.00	0.00	0.00	h	-	-							
09/13/17	10	0.25	0.00	0.00	h	-	-							
09/14/17	10	0.25	0.04	0.04-0.24	h	-	-							
09/15/17	0	0.00	0.00	0.00	h	-	-							
09/16/17	0	0.00	0.00	0.00	h	-	-							
09/17/17	0	0.00	0.00	0.00	h	-	-							
09/18/17	0	0.00	0.00	0.00	h	-	-							
09/19/17	0	0.00	0.00	0.00	h	-	-							
09/20/17	0	0.00	0.00	0.00	h	-	-							
09/21/17	0	0.00	0.00	0.00	h	-	-							
09/22/17	0	0.00	0.00	0.00	h	-	-							
09/23/17	0	0.00	0.00	0.00	h	-	-							
09/24/17	0	0.00	0.00	0.00	h	-	-							
09/25/17	0	0.00	0.00	0.00	h	-	-							
09/26/17	0	0.00	0.00	0.00	h	-	-							
09/27/17	0	0.00	0.00	0.00	h	-	-							
09/28/17	0	0.00	0.00	0.00	h	-	-							
09/29/17	0	0.00	0.00	0.00	h	-	-							
09/30/17	0	0.00	0.00	0.00	h	-	-							
30 days					28/30	0/1	0							

TABLE A-2: This table shows the verification data of MSP issued precipitation forecasts contained in the daily Outlooks for the 2017 Monsoon Season. It is a monthly tally of the data contained in Table A-1. The table is broken down by month and MSP Forecast Zone. The columns from left to right are defined as follows:

Accurate Forecasts – Number of correct forecasts days out of total days in the month.

Accuracy – Accuracy of forecasts in percent.

Op. Sig. Events Detected – Number of operationally significant days detected correctly.

POD – Probability of detection in percent.

False Alarms – Number of false alarms that month.

FAR – False alarm rate in percent.

TABLE A-2: MSP Weather Outlook Verification – Monsoon Season 2017						
Forecast Zone	Accurate Forecasts	AOF (%)	Sig. Events Detected	POD (%)	False Alarms	FAR (%)
JUNE						
Gila Bend	16/16	100%	0/0	n/a	0/16	0%
Palo Verde	16/16	100%	0/0	n/a	0/16	0%
Rainbow Valley	16/16	100%	0/0	n/a	0/16	0%
West Valley	16/16	100%	0/0	n/a	0/16	0%
Northwest Valley	16/16	100%	0/0	n/a	0/16	0%
Upper Centennial	16/16	100%	0/0	n/a	0/16	0%
Wickenburg	16/16	100%	0/0	n/a	0/16	0%
New River/Cave Creek	16/16	100%	0/0	n/a	0/16	0%
Phoenix North	16/16	100%	0/0	n/a	0/16	0%
Phoenix South	16/16	100%	0/0	n/a	0/16	0%
Scottsdale North	16/16	100%	0/0	n/a	0/16	0%
Scottsdale South	16/16	100%	0/0	n/a	0/16	0%
Southeast Valley	16/16	100%	0/0	n/a	0/16	0%
Lower Salt River Lakes	16/16	100%	0/0	n/a	0/16	0%
Superstition	16/16	100%	0/0	n/a	0/16	0%
All Zones	240/240	100%	0/0	n/a	0/240	0%

TABLE A-2: MSP Weather Outlook Verification – Monsoon Season 2017						
Forecast Zone	Accurate Forecasts	AOF (%)	Sig. Events Detected	POD (%)	False Alarms	FAR (%)
JULY						
Gila Bend	25/31	80.6%	5/7	71.4%	1/31	3.2%
Palo Verde	20/31	64.5%	3/4	75%	2/31	6.5%
Rainbow Valley	20/31	64.5%	5/7	71.4%	0/31	0%
West Valley	19/31	61.3%	5/7	71.4%	0/31	0%
Northwest Valley	24/31	77.4%	9/10	90%	2/31	6.5%
Upper Centennial	20/31	64.5%	7/10	70%	3/31	9.7%
Wickenburg	23/31	74.2%	6/7	85.7%	3/31	9.7%
New River/Cave Creek	25/31	80.6%	13/13	100%	1/31	3.2%
Phoenix North	20/31	64.5%	7/8	87.5%	1/31	3.2%
Phoenix South	20/31	64.5%	5/6	83.3%	1/31	3.2%
Scottsdale North	23/31	74.2%	10/10	100%	1/31	3.2%
Scottsdale South	20/31	64.5%	2/3	66.7%	1/31	3.2%
Southeast Valley	17/31	54.8%	6/7	85.7%	2/31	6.5%
Lower Salt River Lakes	23/31	74.2%	10/12	83.3%	0/31	0%
Superstition	19/31	61.3%	7/7	100%	2/31	6.5%
All Zones	318/465	68.4%	100/118	84.7%	20/465	4.3%
AUGUST						
Gila Bend	25/31	80.6%	4/7	57.1%	0/31	n/a
Palo Verde	28/31	90.3%	2/4	50%	0/31	n/a
Rainbow Valley	23/31	74.2%	1/3	33.3%	0/31	n/a
West Valley	23/31	74.2%	2/4	50%	0/31	n/a
Northwest Valley	23/31	74.2%	2/3	66.7%	0/31	n/a
Upper Centennial	26/31	83.9%	4/6	66.7%	0/31	n/a
Wickenburg	26/31	83.9%	4/4	100%	0/31	n/a
New River/Cave Creek	26/31	83.9%	4/7	57.1%	0/31	n/a
Phoenix North	27/31	87.1%	2/3	66.7%	1/31	3.2%
Phoenix South	27/31	87.1%	3/4	75%	0/31	n/a
Scottsdale North	28/31	90.3%	0/2	0%	0/31	n/a

TABLE A-2: MSP Weather Outlook Verification – Monsoon Season 2017						
Forecast Zone	Accurate Forecasts	AOF (%)	Sig. Events Detected	POD (%)	False Alarms	FAR (%)
Scottsdale South	29/31	93.5%	2/2	100%	0/31	n/a
Southeast Valley	26/31	83.9%	2/2	100%	0/31	n/a
Lower Salt River Lakes	23/31	74.2%	0/1	0%	1/31	3.2%
Superstition	25/31	80.6%	3/5	60%	0/31	n/a
All Zones	385/465	82.8%	35/57	61.4%	2/465	0.4%
SEPTEMBER						
Gila Bend	25/30	83.3%	2/2	100%	1/30	3.3%
Palo Verde	29/30	96.7%	2/2	100%	1/30	3.3%
Rainbow Valley	28/30	93.3%	1/1	100%	1/30	3.3%
West Valley	28/30	93.3%	1/1	100%	1/30	3.3%
Northwest Valley	28/30	93.3%	1/1	100%	0/30	0%
Upper Centennial	27/30	90%	3/3	100%	1/30	3.3%
Wickenburg	27/30	90%	3/3	100%	1/30	3.3%
New River/Cave Creek	27/30	90%	1/1	100%	1/30	3.3%
Phoenix North	27/30	90%	0/0	n/a	0/30	0%
Phoenix South	27/30	90%	0/0	n/a	0/30	0%
Scottsdale North	29/30	96.7%	1/1	100%	0/30	0%
Scottsdale South	29/30	96.7%	1/1	100%	0/30	0%
Southeast Valley	28/30	93.3%	0/1	0%	0/30	0%
Lower Salt River Lakes	27/30	90%	1/2	50%	0/30	0%
Superstition	28/30	93.3%	0/1	n/a	0/30	0%
All Zones	414/450	92%	17/19	89.5%	7/450	1.6%

APPENDIX B: MSP MESSAGES - VERIFICATION TABLES

TABLE B-1: This table shows each of the individual MSP Statements issued during the 2017 Monsoon season including the detailed forecast rainfall information. The table is broken down by date and MSP Message. The columns from left to right are defined as follows:

Statement Details – Message information including date, time issued in local standard time, Forecast Zone, Message type, and issuing forecaster. Data is pulled directly from issued Message.

Forecast Rain – Rain information including forecast rainfall intensity and storm total precipitation where applicable. Data is pulled directly from issued Message. It is important to note that not all issued Messages contain forecast rainfall information (noted by an “N/A” in the table).

TABLE B-1: MSP Statements Issued - Monsoon Season 2017							
Statement Details						Forecast Rain	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Intensity (in/min)	STP (in)
07/10/17	21:35	Southeast Valley	1	Henz	Now-1030pm	-	1.00-1.50
07/15/17	13:51	New River/Cave Creek	1	Henz	Now-515pm	-	0.50-0.75/1.00-1.25
07/15/17	16:21	Scottsdale North	1	Henz	Now-545pm	-	0.50-0.75/1.00-1.25
07/15/17	16:56	Northwest Valley	1	Henz	Now-630pm	-	0.50-0.75/1.00-1.25
07/15/17	17:32	Wickenburg	1	Henz	Now-7pm	-	0.50-0.75/1.00-1.25
07/15/17	17:40	West Valley	1	Henz	Now-7pm	-	0.50-0.75/1.00-1.25
07/15/17	17:58	Phoenix South	1	Henz	Now-715	-	0.50-0.75/1.00-1.25
07/15/17	18:22	Wickenburg	1U	Henz	Extended until 8pm	-	-
07/15/17	18:30	Upper Centennial	1	Henz	Now-8pm	-	0.50-0.75/1.25-1.75
07/15/17	19:30	Gila Bend	1	Henz	Now-9pm	-	0.50-0.75/1.00-1.50
07/16/17	12:45	Gila Bend	2	Henz	1pm 7/16-12pm 7/19	-	-
07/16/17	12:45	Palo Verde	2	Henz	1pm 7/16-12pm 7/19	-	-
07/16/17	12:45	Upper Centennial	2	Henz	1pm 7/16-12pm 7/19	-	-
07/16/17	12:45	Wickenburg	2	Henz	1pm 7/16-12pm 7/19	-	-
07/16/17	12:45	Northwest Valley	2	Henz	1pm 7/16-12pm 7/19	-	-
07/16/17	12:45	New River/Cave Creek	2	Henz	1pm 7/16-12pm 7/19	-	-
07/16/17	12:45	Phoenix North	2	Henz	1pm 7/16-12pm 7/19	-	-
07/16/17	12:45	Scottsdale North	2	Henz	1pm 7/16-12pm 7/19	-	-

TABLE B-1: MSP Statements Issued - Monsoon Season 2017

Statement Details						Forecast Rain	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Intensity (in/min)	STP (in)
07/16/17	12:45	Lower Salt River Lakes	2	Henz	1pm 7/16-12pm 7/19	-	-
07/16/17	12:45	Superstition	2	Henz	1pm 7/16-12pm 7/19	-	-
07/16/17	21:01	New River/Cave Creek	1	Henz	Now-1030pm	-	0.50-0.75/1.00-1.50
07/16/17	21:11	Scottsdale North	1	Henz	Now-1030pm	-	0.50-0.75/1.00-1.25
07/16/17	21:35	Scottsdale South	1	Henz	Now-11pm	-	0.50-0.75/1.00-1.50
07/16/17	21:35	Phoenix North	1	Henz	Now-11pm	-	0.50-0.75/1.00-1.50
07/16/17	21:50	Phoenix South	1	Henz	Now-1130pm	-	0.50-0.75/1.00-1.50
07/16/17	21:54	Lower Salt River Lakes	1	Henz	Now-1130pm	-	0.50-0.75/1.00-1.25
07/16/17	21:55	Southeast Valley	1	Henz	Now-1130pm	-	0.50-0.75/1.00-1.50
07/16/17	22:18	Superstition	1	Henz	Now-1130pm	-	0.50-0.75/1.00-1.25
07/16/17	22:30	West Valley	1	Henz	Now-12am	-	0.50-0.75/1.00-1.50
07/16/17	22:55	Rainbow Valley	1	Henz	Now-12am	-	0.50-0.75/1.00-1.50
07/16/17	23:09	Northwest Valley	1	Henz	Now-1230am	-	0.50-0.75/1.00-1.50
07/16/17	23:17	West Valley	3	Henz	Now-130am	-	-
07/16/17	23:45	Gila Bend	1	Henz	Now-130am	-	0.50-0.75/1.00-1.50
07/17/17	23:50	Superstition	1	Henz	Now-115am	-	0.50-0.75/1.00-1.50
07/18/17	0:25	Southeast Valley	1	Henz	Now-145am	-	0.50-0.75/1.00-1.50
07/18/17	11:12	Phoenix South	2	Henz	Now-12pm 7/19	-	-
07/18/17	11:12	Scottsdale South	2	Henz	Now-12pm 7/19	-	-
07/18/17	11:12	Rainbow Valley	2	Henz	Now-12pm 7/19	-	-
07/18/17	11:12	Southeast Valley	2	Henz	Now-12pm 7/19	-	-
07/18/17	11:12	West Valley	2	Henz	Now-12pm 7/19	-	-
07/18/17	16:34	Rainbow Valley	1	Henz	Now-6pm	-	0.50-0.75/1.00-1.50
07/18/17	17:05	New River/Cave Creek	1	Henz	Now-630pm	-	0.50-0.75/1.00-1.50
07/18/17	18:04	Wickenburg	1	Henz	Now-8pm	-	0.50-0.75-1.25-1.75
07/18/17	18:40	Upper Centennial	1	Henz	Now-815pm	-	0.60-0.80-1.25-1.75
07/18/17	18:50	Wickenburg	3	Henz	Now-930pm	-	-
07/19/17	13:00	Rainbow Valley	1	Henz	Now-230pm	-	0.50-0.75/1.00-1.50
07/21/17	17:53	Superstition	1	Waters	Now-630pm	-	0.25-0.50/0.75

TABLE B-1: MSP Statements Issued - Monsoon Season 2017

Statement Details						Forecast Rain	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Intensity (in/min)	STP (in)
07/22/17	15:54	Lower Salt River Lakes	1	Henz	Now-530pm	-	0.50-0.75/1.00-1.50
07/23/17	17:35	Superstition	1	Henz	Now-7pm	-	0.50-0.75-1.25-1.75
07/23/17	17:40	New River/Cave Creek	1	Henz	Now-7pm	-	0.50-0.75-1.25-1.75
07/23/17	17:55	Southeast Valley	1	Henz	Now-730pm	-	0.50-0.75-1.25-1.75
07/23/17	18:09	Lower Salt River Lakes	1	Henz	Now-745pm	-	0.50-0.75-1.25-1.75
07/23/17	18:55	Scottsdale South	1	Henz	Now-830pm	-	0.50-0.75-1.25-1.75
07/23/17	19:15	Superstition	3	Henz	Now-930pm	-	-
07/23/17	19:42	Southeast Valley	3	Henz	Now-930pm	-	-
07/23/17	19:48	Phoenix South	1	Henz	Now-915pm	-	0.50-0.75-1.25-1.75
07/24/17	7:35	Superstition	3	Henz	Now-1030am	-	-
07/24/17	7:44	Scottsdale North	1	Henz	Now-10am	-	-
07/24/17	8:37	West Valley	1	Henz	Now-1030am	-	0.50-0.75-1.25-1.75
07/24/17	8:41	Phoenix South	1	Henz	Now-1030am	-	0.50-0.75-1.25-1.75
07/24/17	8:41	Southeast Valley	1	Henz	Now-1030am	-	0.50-0.75-1.25-1.75
07/24/17	9:10	Rainbow Valley	1	Henz	Now-11am	-	0.50-0.75-1.25-1.75
07/24/17	9:30	West Valley	3	Henz	Now-1230pm	-	-
07/24/17	9:38	Phoenix South	3	Henz	Now-1230pm	-	-
07/24/17	10:12	Palo Verde	1	Henz	Now-1230pm	-	0.75-1.00/1.50-2.00
07/29/17	16:45	Northwest Valley	1	Waters	Now-5:15pm	-	0.75-1.00
07/29/17	16:55	West Valley	1	Waters	Now-530pm	-	0.75-1.00
07/29/17	17:10	Phoenix South	1	Waters	Now-6pm	-	0.75-1.00
07/29/17	17:30	Rainbow Valley	1	Waters	Now-615pm	-	0.75-1.00
07/29/17	18:30	Superstition	1	Waters	Now-7pm	-	0.75-1.00
07/29/17	22:45	Northwest Valley	1	Waters	Now-1115pm	-	0.50-0.75
08/01/17	15:17	New River/Cave Creek	1	Henz	Now-7pm	-	0.50-0.75/1.00-1.50
08/01/17	15:25	Scottsdale North	1	Henz	Now-5pm	-	0.60-0.80/1.00-1.50
08/01/17	16:21	Superstition	1	Henz	Now-6pm	-	0.75-1.00/1.25-1.50
08/01/17	17:16	Wickenburg	1	Henz	Now-645pm	-	0.75-1.00/1.25-1.50
08/01/17	17:47	Upper Centennial	1	Henz	Now-715pm	-	0.75-1.00/1.25-1.75

TABLE B-1: MSP Statements Issued - Monsoon Season 2017

Statement Details						Forecast Rain	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Intensity (in/min)	STP (in)
08/01/17	19:10	Upper Centennial	1U	Henz	Extended until 945pm	-	-
08/01/17	19:10	Wickenburg	1U	Henz	Extended until 945pm	-	-
08/03/17	15:30	Palo Verde	1	Waters	Now-430pm	-	0.75-1.00
08/03/17	15:50	Wickenburg	1	Waters	Now-5pm	-	0.75-1.00
08/03/17	15:50	Upper Centennial	1	Waters	Now-5pm	-	0.75-1.00
08/03/17	15:55	Phoenix North	1	Waters	Now-5pm	-	0.75-1.00
08/03/17	15:55	Scottsdale North	1	Waters	Now-5pm	-	0.75-1.00
08/03/17	16:10	New River/Cave Creek	1	Waters	Now-515pm	-	1.00-1.25
08/03/17	16:30	Scottsdale North	3	Waters	Now-530pm	-	-
08/03/17	17:06	Scottsdale South	1	Henz	Now-630pm	-	1.25-1.50
08/03/17	17:06	Phoenix South	1	Henz	Now-630pm	-	1.25-1.50
08/03/17	17:06	Southeast Valley	1	Henz	Now-630pm	-	1.25-1.50
08/03/17	17:10	Superstition	1	Waters	Now-630pm	-	0.75-1.00
08/03/17	17:10	Phoenix North	1U	Henz	Now-630pm	-	-
08/03/17	17:30	Southeast Valley	1U	Waters	Now-630pm	-	-
08/03/17	17:45	Scottsdale South	3	Waters	Now-630pm	-	-
08/03/17	17:45	Southeast Valley	3	Waters	Now-630pm	-	-
08/10/17	17:30	Wickenburg	1	Henz	Now-7pm	-	1.00-1.25
08/10/17	18:10	Wickenburg	3	Henz	Now-8pm	-	-
08/10/17	21:53	Rainbow Valley	1	Henz	Now-1130pm	-	1.50-1.75
08/12/17	8:50	Rainbow Valley	1	Waters	Now-2pm	-	-
08/12/17	22:15	West Valley	1	Waters	Now-11pm	-	-
08/12/17	22:15	Phoenix North	1	Waters	Now-11pm	-	-
08/12/17	22:15	Phoenix South	1	Waters	Now-11pm	-	-
08/12/17	22:30	Southeast Valley	1	Waters	Now-12am	-	0.50-0.75
08/12/17	22:55	Superstition	1	Waters	Now-12am	-	0.50-0.75
08/13/17	0:45	Southeast Valley	1	Waters	Now-2am	-	-
08/13/17	0:45	Phoenix South	1	Waters	Now-2am	-	-
08/13/17	2:20	Phoenix South	3	Waters	Now-4am	-	-

TABLE B-1: MSP Statements Issued - Monsoon Season 2017

Statement Details						Forecast Rain	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Intensity (in/min)	STP (in)
08/23/17	21:50	Phoenix North	1	Henz	Now-1130pm	-	0.50-0.75/1.00
08/23/17	22:10	Scottsdale North	1	Henz	Now-1130pm	-	0.50-0.75/1.00
08/23/17	22:10	Scottsdale South	1	Henz	Now-1130pm	-	0.50-0.75/1.00
09/04/17	19:12	Northwest Valley	1	Henz	Now-845pm	-	0.50-0.75
09/07/17	17:23	Palo Verde	1	Henz	Now-7pm	-	0.75-1.00/1.50
09/08/17	7:15	Upper Centennial	2	Waters	12pm 9/8-9pm 9/9	-	-
09/08/17	7:15	Palo Verde	2	Waters	12pm 9/8-9pm 9/9	-	-
09/08/17	7:15	Gila Bend	2	Waters	12pm 9/8-9pm 9/9	-	-
09/08/17	17:23	Superstition	1	Waters	Now-8pm	-	-
09/08/17	19:40	Scottsdale North	1	Waters	Now-830pm	-	0.50-0.75
09/09/17	6:20	Wickenburg	1	Waters	Now-8am	-	-
09/09/17	8:30	Wickenburg	1U	Waters	Now-10am	-	-

TABLE B-2: This table shows the raw verification data of MSP issued Messages for the 2017 Monsoon Season. The valid period for rainfall for each Message can be found in Table B-1. The table is broken down by date and MSP Message. The columns from left to right are defined as follows:

Statement Details – Statement information including date, Forecast Zone, and Message type.

Forecast Rain – Rain information including forecast rainfall intensity and forecast storm total precipitation where applicable. It is important to note that not all issued statements contain forecast rainfall information (noted by an “n/a” in the table).

Rain Observations – Observed rainfall amounts within the forecast zone including ALERT rain gages, gage adjusted radar rainfall totals, and local storm reports submitted to NWS Phoenix WFO.

Alarms – Triggered alarms on ALERT gage sensors. These alarms are broken down by alarm type including rain, stream, and dam.

Verification – The verification was broken down by rain and by alarm. Hits and misses were assigned based on thresholds previously discussed in the [MSP Verification Metrics and Criteria](#) section of this report.

TABLE B-2: MSP Statements Issued - Monsoon Season 2017											
Statement Details			Forecast Rain		Rain Observations (in)			Alarms			Verification
Date	MSP Forecast Zone	Message	Intensity (in/min)	STP (in)	ALERT	GAQPE	LSRs	Rain	Stream	Dam	Hit/Miss
07/10/17	Southeast Valley	1	-	1.00-1.50	1.50	1.23-1.61	-	X	-	-	Hit
07/15/17	New River/Cave Creek	1	-	0.50-0.75/1.00-1.25	0.71	0.84-1.02	-	-	-	-	Hit
07/15/17	Scottsdale North	1	-	0.50-0.75/1.00-1.25	0.12	0.44-0.63	-	-	-	-	Hit
07/15/17	Northwest Valley	1	-	0.50-0.75/1.00-1.25	0.71	0.84-1.02	-	-	-	-	Hit
07/15/17	Wickenburg	1	-	0.50-0.75/1.00-1.25	1.54	1.62-1.81	-	X	-	-	Hit
07/15/17	West Valley	1	-	0.50-0.75/1.00-1.25	0.39	0.44-0.63	-	-	-	-	Hit
07/15/17	Phoenix South	1	-	0.50-0.75/1.00-1.25	0.31	0.64-0.83	-	-	-	-	Hit
07/15/17	Wickenburg	1U	-	-	-	-	-	-	-	-	-
07/15/17	Upper Centennial	1	-	0.50-0.75/1.25-1.75	1.81	1.62-1.81	-	-	-	-	Hit
07/15/17	Gila Bend	1	-	0.50-0.75/1.00-1.50	1.10	2.41-2.60	-	-	X	-	Hit
07/16/17	Gila Bend	2	-	-	-	-	-	-	-	-	Hit
07/16/17	Palo Verde	2	-	-	-	-	-	-	-	-	Miss
07/16/17	Upper Centennial	2	-	-	-	-	-	-	-	-	Hit

TABLE B-2: MSP Statements Issued - Monsoon Season 2017

Statement Details			Forecast Rain		Rain Observations (in)			Alarms			Verification
Date	MSP Forecast Zone	Message	Intensity (in/min)	STP (in)	ALERT	GAQPE	LSRs	Rain	Stream	Dam	Hit/Miss
07/16/17	Wickenburg	2	-	-	-	-	-	-	-	-	Hit
07/16/17	Northwest Valley	2	-	-	-	-	-	-	-	-	Hit
07/16/17	New River/Cave Creek	2	-	-	-	-	-	-	-	-	Hit
07/16/17	Phoenix North	2	-	-	-	-	-	-	-	-	Hit
07/16/17	Scottsdale North	2	-	-	-	-	-	-	-	-	Hit
07/16/17	Lower Salt River Lakes	2	-	-	-	-	-	-	-	-	Hit
07/16/17	Superstition	2	-	-	-	-	-	-	-	-	Hit
07/16/17	New River/Cave Creek	1	-	0.50-0.75/1.00-1.50	1.14	1.82-2.01	-	X	-	-	Hit
07/16/17	Scottsdale North	1	-	0.50-0.75/1.00-1.25	0.59	0.84-1.02	-	-	-	-	Hit
07/16/17	Scottsdale South	1	-	0.50-0.75/1.00-1.50	1.14	1.03-1.22	-	-	X	-	Hit
07/16/17	Phoenix North	1	-	0.50-0.75/1.00-1.50	0.83	0.84-1.02	0.86	-	-	-	Hit
07/16/17	Phoenix South	1	-	0.50-0.75/1.00-1.50	1.14	1.62-1.81	0.85	-	-	-	Hit
07/16/17	Lower Salt River Lakes	1	-	0.50-0.75/1.00-1.25	0.16	0.84-1.02	-	-	-	-	Hit
07/16/17	Southeast Valley	1	-	0.50-0.75/1.00-1.50	0.94	1.03-1.22	-	-	-	-	Hit
07/16/17	Superstition	1	-	0.50-0.75/1.00-1.25	0.59	0.64-0.83	-	-	-	-	Hit
07/16/17	West Valley	1	-	0.50-0.75/1.00-1.50	1.93	2.02-2.20	-	X	X	-	Hit
07/16/17	Rainbow Valley	1	-	0.50-0.75/1.00-1.50	0.28	0.64-0.83	-	-	-	-	Hit
07/16/17	Northwest Valley	1	-	0.50-0.75/1.00-1.50	0.31	0.64-0.83	-	-	-	-	Hit
07/16/17	West Valley	3	-	-	1.93	-	-	X	X	-	Hit
07/16/17	Gila Bend	1	-	0.50-0.75/1.00-1.50	0.24	0.64-0.83	-	-	-	-	Hit
07/17/17	Superstition	1	-	0.50-0.75/1.00-1.50	0.28	0.04-0.24	-	-	-	-	Miss
07/18/17	Southeast Valley	1	-	0.50-0.75/1.00-1.50	0.35	0.44-0.63	-	-	-	-	Miss
07/18/17	Phoenix South	2	-	-	-	-	-	-	-	-	Miss
07/18/17	Scottsdale South	2	-	-	-	-	-	-	-	-	Miss
07/18/17	Rainbow Valley	2	-	-	-	-	-	-	-	-	Miss
07/18/17	Southeast Valley	2	-	-	-	-	-	-	-	-	Miss
07/18/17	West Valley	2	-	-	-	-	-	-	-	-	Miss
07/18/17	Rainbow Valley	1	-	0.50-0.75/1.00-1.50	0.39	1.23-1.61	-	-	-	-	Hit
07/18/17	New River/Cave Creek	1	-	0.50-0.75/1.00-1.50	0.94	1.23-1.61	-	X	-	-	Hit

TABLE B-2: MSP Statements Issued - Monsoon Season 2017

Statement Details			Forecast Rain		Rain Observations (in)			Alarms			Verification
Date	MSP Forecast Zone	Message	Intensity (in/min)	STP (in)	ALERT	GAQPE	LSRs	Rain	Stream	Dam	Hit/Miss
07/18/17	Wickenburg	1	-	0.50-0.75-1.25-1.75	2.17	2.02-2.20	1.75	X	X	-	Hit
07/18/17	Upper Centennial	1	-	0.60-0.80-1.25-1.75	1.14	1.23-1.61	-	-	-	-	Hit
07/18/17	Wickenburg	3	-	-	2.17	-	1.75	X	X	-	Hit
07/19/17	Rainbow Valley	1	-	0.50-0.75/1.00-1.50	0.55	1.03-1.22	-	-	-	-	Hit
07/21/17	Superstition	1	-	0.25-0.50/0.75	1.14	0.64-0.83	1.00	-	-	-	Hit
07/22/17	Lower Salt River Lakes	1	-	0.50-0.75/1.00-1.50	0.00	0.64-0.83	-	-	-	-	Hit
07/23/17	Superstition	1	-	0.50-0.75-1.25-1.75	2.56	1.42-1.57	1.20	X	X	X	Hit
07/23/17	New River/Cave Creek	1	-	0.50-0.75-1.25-1.75	0.35	0.83-0.98	-	-	-	-	Hit
07/23/17	Southeast Valley	1	-	0.50-0.75-1.25-1.75	1.46	1.42-1.57	0.50	X	-	-	Hit
07/23/17	Lower Salt River Lakes	1	-	0.50-0.75-1.25-1.75	0.00	1.22-1.38	-	-	-	-	Hit
07/23/17	Scottsdale South	1	-	0.50-0.75-1.25-1.75	0.55	0.63-0.79	0.50	-	X	-	Hit
07/23/17	Superstition	3	-	-	2.56	-	1.20	X	X	X	Hit
07/23/17	Southeast Valley	3	-	-	1.46	-	0.50	X	X	-	Hit
07/23/17	Phoenix South	1	-	0.50-0.75-1.25-1.75	0.59	0.83-0.98	0.99	-	-	-	Hit
07/24/17	Superstition	3	-	-	1.93	1.81-1.97	0.50	-	X	X	Hit
07/24/17	Scottsdale North	1	-	-	1.26	1.02-1.18	-	-	-	-	Hit
07/24/17	West Valley	1	-	0.50-0.75-1.25-1.75	2.40	2.50-2.56	-	-	-	-	Hit
07/24/17	Phoenix South	1	-	0.50-0.75-1.25-1.75	2.36	2.01-2.17	-	X	-	X	Hit
07/24/17	Southeast Valley	1	-	0.50-0.75-1.25-1.75	1.46	1.42-1.67	-	X	X	-	Hit
07/24/17	Rainbow Valley	1	-	0.50-0.75-1.25-1.75	1.30	1.22-1.38	-	X	-	-	Hit
07/24/17	West Valley	3	-	-	2.40	-	-	X	-	-	Hit
07/24/17	Phoenix South	3	-	-	2.36	-	-	X	-	X	Hit
07/24/17	Palo Verde	1	-	0.75-1.00/1.50-2.00	1.42	1.42-1.57	-	-	X	-	Hit
07/29/17	Northwest Valley	1	-	0.75-1.00	0.55	1.03-1.22	-	-	-	-	Hit
07/29/17	West Valley	1	-	0.75-1.00	0.79	1.23-1.61	0.71	-	-	-	Hit
07/29/17	Phoenix South	1	-	0.75-1.00	0.59	0.44-0.63	-	-	-	-	Hit
07/29/17	Rainbow Valley	1	-	0.75-1.00	0.59	0.84-1.02	-	-	-	-	Hit
07/29/17	Superstition	1	-	0.75-1.00	1.06	0.64-0.83	0.24	-	-	-	Hit
07/29/17	Northwest Valley	1	-	0.50-0.75	0.39	1.03-1.22	-	-	-	-	Hit

TABLE B-2: MSP Statements Issued - Monsoon Season 2017

Statement Details			Forecast Rain		Rain Observations (in)			Alarms			Verification
Date	MSP Forecast Zone	Message	Intensity (in/min)	STP (in)	ALERT	GAQPE	LSRs	Rain	Stream	Dam	Hit/Miss
08/01/17	New River/Cave Creek	1	-	0.50-0.75/1.00-1.50	0.67	0.84-1.02	-	-	-	-	Hit
08/01/17	Scottsdale North	1	-	0.60-0.80/1.00-1.50	0.31	0.04-0.24	-	-	-	-	Miss
08/01/17	Superstition	1	-	0.75-1.00/1.25-1.50	1.65	0.64-0.83	-	X	-	-	Hit
08/01/17	Wickenburg	1	-	0.75-1.00/1.25-1.50	1.97	2.02-2.20	-	X	X	-	Hit
08/01/17	Upper Centennial	1	-	0.75-1.00/1.25-1.75	1.97	2.02-2.20	-	X	-	-	Hit
08/01/17	Upper Centennial	1U	-	-	-	-	-	-	-	-	-
08/01/17	Wickenburg	1U	-	-	-	-	-	-	-	-	-
08/03/17	Palo Verde	1	-	0.75-1.00	0.39	0.84-1.02	-	-	X	-	Hit
08/03/17	Wickenburg	1	-	0.75-1.00	1.30	2.41-2.60	-	X	-	-	Hit
08/03/17	Upper Centennial	1	-	0.75-1.00	0.83	1.82-2.01	-	-	-	-	Hit
08/03/17	Phoenix North	1	-	0.75-1.00	1.22	1.23-1.61	-	-	-	-	Hit
08/03/17	Scottsdale North	1	-	0.75-1.00	0.75	0.84-1.02	-	-	-	-	Hit
08/03/17	New River/Cave Creek	1	-	1.00-1.25	1.02	1.03-1.22	-	X	-	-	Hit
08/03/17	Scottsdale North	3	-	-	0.75	0.84-1.02	-	-	-	-	Hit
08/03/17	Scottsdale South	1	-	1.25-1.50	1.85	1.82-2.01	-	X	X	-	Hit
08/03/17	Phoenix South	1	-	1.25-1.50	1.89	1.82-2.01	-	X	X	X	Hit
08/03/17	Southeast Valley	1	-	1.25-1.50	1.69	1.23-1.61	2.35	X	-	-	Hit
08/03/17	Superstition	1	-	0.75-1.00	0.91	0.84-1.02	-	-	-	-	Hit
08/03/17	Phoenix North	1U	-	-	-	-	-	-	-	-	-
08/03/17	Southeast Valley	1U	-	-	-	-	-	-	-	-	-
08/03/17	Scottsdale South	3	-	-	1.85	1.82-2.01	-	X	X	-	Hit
08/03/17	Southeast Valley	3	-	-	1.69	1.23-1.61	2.35	X	-	-	Hit
08/10/17	Wickenburg	1	-	1.00-1.25	2.05	2.02-2.20	-	X	X	X	Hit
08/10/17	Wickenburg	3	-	-	2.05	2.02-2.20	-	X	X	X	Hit
08/10/17	Rainbow Valley	1	-	1.50-1.75	1.38	1.23-1.61	-	X	X	-	Hit
08/12/17	Rainbow Valley	1	-	-	-	-	-	-	X	-	-
08/12/17	West Valley	1	-	-	1.38	2.21-2.40	-	-	X	-	Hit
08/12/17	Phoenix North	1	-	-	0.24	-	-	-	-	-	Miss
08/12/17	Phoenix South	1	-	-	0.43	-	-	-	-	-	Miss

TABLE B-2: MSP Statements Issued - Monsoon Season 2017

Statement Details			Forecast Rain		Rain Observations (in)			Alarms			Verification
Date	MSP Forecast Zone	Message	Intensity (in/min)	STP (in)	ALERT	GAQPE	LSRs	Rain	Stream	Dam	Hit/Miss
08/12/17	Southeast Valley	1	-	0.50-0.75	0.91	-	-	-	-	-	Hit
08/12/17	Superstition	1	-	0.50-0.75	0.63	-	-	-	-	-	Hit
08/13/17	Southeast Valley	1	-	-	1.46	1.82-2.01	-	X	-	-	Hit
08/13/17	Phoenix South	1	-	-	1.89	2.81-3.19	-	X	-	X	Hit
08/13/17	Phoenix South	3	-	-	1.89	2.81-3.19	-	X	-	X	Hit
08/23/17	Phoenix North	1	-	0.50-0.75/1.00	0.59	1.03-1.22	-	-	X	-	Hit
08/23/17	Scottsdale North	1	-	0.50-0.75/1.00	0.91	1.03-1.22	-	-	-	-	Hit
08/23/17	Scottsdale South	1	-	0.50-0.75/1.00	0.51	0.44-0.63	-	-	X	-	Hit
09/04/17	Northwest Valley	1	-	0.50-0.75	0.35	0.25-0.43	-	-	-	-	Miss
09/07/17	Palo Verde	1	-	0.75-1.00/1.50	0.79	1.23-1.61	-	X	X	-	Hit
09/08/17	Upper Centennial	2	-	-	-	-	-	-	-	-	Miss
09/08/17	Palo Verde	2	-	-	-	-	-	-	-	-	Miss
09/08/17	Gila Bend	2	-	-	-	-	-	-	-	-	Miss
09/08/17	Superstition	1	-	-	1.06	0.84-1.02	-	-	-	-	Hit
09/08/17	Scottsdale North	1	-	0.50-0.75	0.39	0.44-0.63	-	-	-	-	Hit
09/09/17	Wickenburg	1	-	-	1.18	1.23-1.61	-	X	-	-	Hit
09/09/17	Wickenburg	1U	-	-	-	-	-	-	-	-	-

TABLE B-3: This table shows the lead time data of MSP issued Messages for the 2017 Monsoon Season. The table is broken down by Statement details and lead time. The columns from left to right are defined as follows:

Statement Details – Statement information including date, issue time, forecast zone, message type, forecaster, and valid time.

Statement Lead time – The first column denotes the time when the first ALERT Alarm (rain, stream, or impoundment) was triggered if any. The second column depicts the calculated lead time based on beginning statement valid time and when the first alarm was triggered.

TABLE B-3: MSP Statement Lead Time - Monsoon Season 2017							
Statement Details						Statement Lead Time	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Alarm Triggered	Lead Time(min)
07/10/17	21:35	Southeast Valley	1	Henz	Now-10:30pm	21:48	13
07/15/17	17:32	Wickenburg	1	Henz	Now-7pm	18:02	30
07/15/17	19:30	Gila Bend	1	Henz	Now-9pm	7/16/2017 0:40	250
07/16/17	12:45	Gila Bend	2	Henz	1pm 7/16-12pm 7/19	7/16/2017 23:45	660
07/16/17	12:45	Upper Centennial	2	Henz	1pm 7/16-12pm 7/19	7/18/2017 18:40	3235
07/16/17	12:45	Wickenburg	2	Henz	1pm 7/16-12pm 7/19	7/18/2017 18:50	3245
07/16/17	12:45	Northwest Valley	2	Henz	1pm 7/16-12pm 7/19	7/16/2017 23:09	624
07/16/17	12:45	New River/Cave Creek	2	Henz	1pm 7/16-12pm 7/19	7/16/2017 21:01	496
07/16/17	12:45	Phoenix North	2	Henz	1pm 7/16-12pm 7/19	7/16/2017 21:35	530
07/16/17	12:45	Scottsdale North	2	Henz	1pm 7/16-12pm 7/19	7/16/2017 21:11	506
07/16/17	12:45	Lower Salt River Lakes	2	Henz	1pm 7/16-12pm 7/19	7/16/2017 21:54	549
07/16/17	12:45	Superstition	2	Henz	1pm 7/16-12pm 7/19	7/16/2017 22:18	573
07/16/17	21:01	New River/Cave Creek	1	Henz	Now-1030pm	21:46	45
07/16/17	21:35	Scottsdale South	1	Henz	Now-11pm	22:30	55
07/16/17	22:30	West Valley	1	Henz	Now-12am	23:04	34
07/18/17	17:05	New River/Cave Creek	1	Henz	Now-630pm	17:16	11
07/18/17	18:04	Wickenburg	1	Henz	Now-8pm	18:36	32
07/23/17	17:35	Superstition	1	Henz	Now-7pm	18:50	75
07/23/17	17:55	Southeast Valley	1	Henz	Now-730pm	18:48	53
07/23/17	18:55	Scottsdale South	1	Henz	Now-830pm	19:52	57

TABLE B-3: MSP Statement Lead Time - Monsoon Season 2017							
Statement Details						Statement Lead Time	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Alarm Triggered	Lead Time(min)
07/24/17	7:35	Superstition	3	Henz	Now-1030am	6:48	0
07/24/17	8:41	Phoenix South	1	Henz	Now-1030am	8:55	14
07/24/17	8:41	Southeast Valley	1	Henz	Now-1030am	6:54	0
07/24/17	9:10	Rainbow Valley	1	Henz	Now-11am	9:42	32
07/24/17	9:30	West Valley	3	Henz	Now-1230pm	8:24	0
07/24/17	10:12	Palo Verde	1	Henz	Now-1230pm	11:36	84
08/01/17	16:21	Superstition	1	Henz	Now-6pm	16:28	7
08/01/17	17:16	Wickenburg	1	Henz	Now-645pm	17:58	42
08/01/17	17:47	Upper Centennial	1	Henz	Now-715pm	18:11	24
08/03/17	15:30	Palo Verde	1	Waters	Now-430pm	15:50	20
08/03/17	15:50	Wickenburg	1	Waters	Now-5pm	15:52	2
08/03/17	16:10	New River/Cave Creek	1	Waters	Now-515pm	15:56	0
08/03/17	17:06	Scottsdale South	1	Henz	Now-630pm	17:15	9
08/03/17	17:06	Phoenix South	1	Henz	Now-630pm	17:08	2
08/03/17	17:06	Southeast Valley	1	Henz	Now-630pm	17:58	52
08/10/17	17:30	Wickenburg	1	Henz	Now-7pm	17:46	16
08/10/17	18:10	Wickenburg	3	Henz	Now-8pm	18:44	34
08/10/17	21:53	Rainbow Valley	1	Henz	Now-1130pm	22:09	16
08/12/17	8:50	Rainbow Valley	1	Waters	Now-2pm	8:41	0
08/12/17	22:15	West Valley	1	Waters	Now-11pm	1:37	202
08/13/17	0:45	Southeast Valley	1	Waters	Now-2am	0:25	0
08/13/17	0:45	Phoenix South	1	Waters	Now-2am	0:25	0
08/13/17	2:20	Phoenix South	3	Waters	Now-4am	1:56	0
08/23/17	21:50	Phoenix North	1	Henz	Now-1130pm	22:37	47
08/23/17	22:10	Scottsdale South	1	Henz	Now-1130pm	22:46	36
09/07/17	17:23	Palo Verde	1	Henz	Now-7pm	17:39	16
09/09/17	6:20	Wickenburg	1	Waters	Now-8am	5:59	0

APPENDIX C: MSP LAKE ALERTS - VERIFICATION TABLES

TABLE C-1: This table shows each of the individual MSP Lake Alerts issued during the 2017 Monsoon season. The table is broken down by statement Details, observations, and verification. The columns from left to right are defined as follows:

Statement Details – Message information including date, time issued in local standard time, lake, issuing forecaster, and valid time. Data is pulled directly from issued Message.

Observations – Rain information including forecast rainfall intensity and storm total precipitation where applicable. Data is pulled directly from issued Message. It is important to note that not all issued Messages contain forecast rainfall information (noted by an “N/A” in the table).

Lead Time – amount of lead time in minutes from when Lake Alert was issued to when first observation occurred.

Verification – Hits and misses were assigned based on thresholds previously discussed in the [MSP Verification Metrics and Criteria](#) section of this report.

TABLE C-1: MSP Lake Alerts Issued - Monsoon Season 2017									
Statement Details					Observations			Lead Time	Verification
Date	LST	Lake	Forecaster	Valid Time	Lightning	Wind > 30mph	Hail/Heavy Rain	1st Obs.	Hit/Miss
07/12/17	15:03	Lake Pleasant	Henz	Now-4pm	-	-	-	-	Miss
07/12/17	16:30	Apache Lake	Henz	Now-530pm	X	-	-	8	Hit
07/12/17	17:40	Canyon Lake	Henz	Now-630pm	X	-	-	39	Hit
07/12/17	17:40	Saguaro Lake	Henz	Now-630pm	X	-	-	39	Hit
07/13/17	16:27	Bartlett Lake	Henz	Now-6pm	X	-	-	32	Hit
07/13/17	17:02	Lake Pleasant	Henz	Now-6pm	X	X	-	0	Hit
07/14/17	16:00	Bartlett Lake	Waters	Now-5pm	X	-	-	-	Hit
07/14/17	16:20	Lake Pleasant	Waters	Now-515pm	X	X	X	10	Hit
07/14/17	16:30	Canyon Lake	Waters	Now-530pm	-	-	-	-	Miss
07/14/17	16:30	Apache Lake	Waters	Now-530pm	-	-	-	-	Miss
07/15/17	15:27	Apache Lake	Henz	Now-5pm	X	-	-	33	Hit
07/15/17	15:27	Canyon Lake	Henz	Now-5pm	X	-	-	33	Hit
07/15/17	16:12	Saguaro Lake	Henz	Now-515pm	X	-	-	22	Hit

TABLE C-1: MSP Lake Alerts Issued - Monsoon Season 2017

Statement Details					Observations			Lead Time	Verification
Date	LST	Lake	Forecaster	Valid Time	Lightning	Wind > 30mph	Hail/Heavy Rain	1st Obs.	Hit/Miss
07/15/17	16:36	Lake Pleasant	Henz	Now-530pm	X	X	-	9	Hit
07/18/17	15:21	Canyon Lake	Henz	Now-5pm	X	-	-	14	Hit
07/18/17	15:21	Apache Lake	Henz	Now-5pm	X	-	-	14	Hit
07/18/17	16:03	Bartlett Lake	Henz	Now-515pm	X	-	-	64	Hit
07/19/17	13:07	Apache Lake	Henz	Now-215pm	X	-	-	0	Hit
07/19/17	13:07	Canyon Lake	Henz	Now-215pm	X	-	-	0	Hit
07/19/17	16:10	Saguaro Lake	Henz	Now-515pm	X	-	-	5	Hit
07/21/17	14:30	Bartlett Lake	Waters	Now-330pm	X	-	-	8	Hit
07/21/17	16:20	Apache Lake	Waters	Now-5pm	X	-	-	19	Hit
07/21/17	16:20	Canyon Lake	Waters	Now-5pm	X	-	-	19	Hit
07/21/17	16:40	Bartlett Lake	Waters	Now-515pm	-	-	X	9	Hit
07/21/17	17:40	Apache Lake	Waters	Now-615pm	-	-	-	24	Hit
07/22/17	14:28	Lake Pleasant	Henz	Now-345pm	X	-	-	60	Hit
07/22/17	14:48	Bartlett Lake	Henz	Now-4pm	X	-	-	16	Hit
07/22/17	15:06	Apache Lake	Henz	Now-415pm	X	-	-	0	Hit
07/22/17	15:43	Canyon Lake	Henz	Now-5pm	X	-	-	36	Hit
07/22/17	15:43	Saguaro Lake	Henz	Now-5pm	X	-	-	36	Hit
07/23/17	17:32	Apache Lake	Henz	Now-7pm	X	-	X	5	Hit
07/23/17	17:32	Canyon Lake	Henz	Now-7pm	X	-	X	37	Hit
07/23/17	17:32	Saguaro Lake	Henz	Now-7pm	X	-	X	37	Hit
07/28/17	18:10	Bartlett Lake	Waters	Now-7pm	-	-	-	-	Miss
07/29/17	15:30	Lake Pleasant	Waters	Now-430pm	X	X	-	30	Hit
07/31/17	17:34	Apache Lake	Henz	Now-630pm	X	-	-	0	Hit
07/31/17	17:34	Canyon Lake	Henz	Now-630pm	X	-	-	0	Hit
08/01/17	14:52	Bartlett Lake	Henz	Now-4pm	X	X	-	5	Hit
08/01/17	15:36	Apache Lake	Henz	Now-515pm	X	-	-	7	Hit
08/01/17	15:36	Canyon Lake	Henz	Now-515pm	X	-	-	39	Hit
08/01/17	16:12	Lake Pleasant	Henz	Now-530pm	X	-	-	-	Hit
08/03/17	16:20	Lake Pleasant	Waters	Now-530pm	X	-	-	9	Hit

TABLE C-1: MSP Lake Alerts Issued - Monsoon Season 2017									
Statement Details					Observations			Lead Time	Verification
Date	LST	Lake	Forecaster	Valid Time	Lightning	Wind > 30mph	Hail/Heavy Rain	1st Obs.	Hit/Miss
08/03/17	16:50	Apache Lake	Waters	Now-530pm	X	-	-	0	Hit
08/03/17	16:50	Canyon Lake	Waters	Now-530pm	X	-	-	0	Hit
08/03/17	16:50	Saguaro Lake	Waters	Now-530pm	X	-	-	0	Hit
08/27/17	17:10	Saguaro Lake	Waters	Now-6pm	-	-	-	-	Miss
08/28/17	15:45	Bartlett Lake	Henz	Now-5pm	X	X	-	10	Hit
09/04/17	18:35	Lake Pleasant	Henz	Now-8pm	X	X	-	10	Hit
09/05/17	17:45	Canyon Lake	Waters	Now-630pm	X	-	-	18	Hit
09/05/17	17:45	Saguaro Lake	Waters	Now-630pm	X	X	X	31	Hit
09/05/17	17:45	Bartlett Lake	Waters	Now-630pm	X	X	-	26	Hit
09/08/17	19:00	Canyon Lake	Waters	Now-8pm	X	-	-	3	Hit
09/08/17	19:00	Saguaro Lake	Waters	Now-8pm	X	-	-	24	Hit

APPENDIX E: QPF STORM TOTAL PRECIPITATION - VERIFICATION TABLES

TABLE E-1: This table shows each of the individual MSP Lake Alerts issued during the 2017 Monsoon season including the detailed forecast rainfall information. The table is broken down by statement Details, observations, and verification. The columns from left to right are defined as follows:

Statement Details – Message information including date and forecast zone. Data is pulled directly from issued Message.

Peak Storm Total Precipitation – Rain information including forecast (QPF), observed (ALERT), radar estimated (GAQPE), and local storm report total (LSR). Data is pulled directly from issued Message. Observations are gathered the ALERT database, WDT Inc radar products, and NWS local storm reports.

Error – Percent error was calculated based on Equation 4 previously discussed in the [MSP Verification Metrics and Criteria](#) section of this report.

Verification – Hits and misses were assigned based on thresholds previously discussed in the [MSP Verification Metrics and Criteria](#) section of this report.

TABLE E-1: MSP QPF Peak Storm Total Rainfall Verification - Monsoon Season 2017											
Statement Details		Peak STP (in)					Error (%)				Verification
Date	MSP Forecast Zone	QPF	ALERT	GAQPE (LT)	GAQPE (UT)	LSRs	ALERT	GAQPE (LT)	GAQPE (UT)	LSRs	Hit/Miss
07/10/17	Southeast Valley	1.50	1.50	1.23	1.61	-	0.00	21.95	-6.83	-	Hit
07/15/17	New River/Cave Creek	0.75	0.71	0.84	1.02	-	5.63	-10.71	-26.47	-	Hit
07/15/17	Scottsdale North	0.50	0.12	0.44	0.63	-	316.67	13.64	-20.63	-	Hit
07/15/17	Northwest Valley	0.75	0.71	0.84	1.02	-	5.63	-10.71	-26.47	-	Hit
07/15/17	Wickenburg	1.25	1.54	1.62	1.81	-	-18.83	-22.84	-30.94	-	Hit
07/15/17	West Valley	0.50	0.39	0.44	0.63	-	28.21	13.64	-20.63	-	Hit
07/15/17	Phoenix South	0.50	0.31	0.64	0.83	-	61.29	-21.88	-39.76	-	Hit
07/15/17	Upper Centennial	1.75	1.81	1.62	1.81	-	-3.31	8.02	-3.31	-	Hit
07/15/17	Gila Bend	1.00	1.10	2.41	2.60	-	-9.09	-58.51	-61.54	-	Hit
07/16/17	New River/Cave Creek	1.50	1.14	1.82	2.01	-	31.58	-17.58	-25.37	-	Hit
07/16/17	Scottsdale North	0.75	0.59	0.84	1.02	-	27.12	-10.71	-26.47	-	Hit
07/16/17	Scottsdale South	1.00	1.14	1.03	1.22	-	-12.28	-2.91	-18.03	-	Hit

TABLE E-1: MSP QPF Peak Storm Total Rainfall Verification - Monsoon Season 2017

Statement Details		Peak STP (in)					Error (%)				Verification
Date	MSP Forecast Zone	QPF	ALERT	GAQPE (LT)	GAQPE (UT)	LSRs	ALERT	GAQPE (LT)	GAQPE (UT)	LSRs	Hit/Miss
07/16/17	Phoenix North	1.00	0.83	0.84	1.02	0.86	20.48	19.05	-1.96	16.28	Hit
07/16/17	Phoenix South	1.50	1.14	1.62	1.81	0.85	31.58	-7.41	-17.13	76.47	Hit
07/16/17	Lower Salt River Lakes	1.00	0.16	0.84	1.02	-	525.00	19.05	-1.96	-	Hit
07/16/17	Southeast Valley	1.00	0.94	1.03	1.22	-	6.38	-2.91	-18.03	-	Hit
07/16/17	Superstition	0.75	0.59	0.64	0.83	-	27.12	17.19	-9.64	-	Hit
07/16/17	West Valley	1.50	1.93	2.02	2.20	-	-22.28	-25.74	-31.82	-	Hit
07/16/17	Rainbow Valley	0.75	0.28	0.64	0.83	-	167.86	17.19	-9.64	-	Hit
07/16/17	Northwest Valley	0.75	0.31	0.64	0.83	-	141.94	17.19	-9.64	-	Hit
07/16/17	Gila Bend	0.75	0.24	0.64	0.83	-	212.50	17.19	-9.64	-	Hit
07/17/17	Superstition	0.50	0.28	0.04	0.24	-	78.57	1150.00	108.33	-	Miss
07/18/17	Southeast Valley	0.50	0.35	0.44	0.63	-	42.86	13.64	-20.63	-	Hit
07/18/17	Rainbow Valley	1.50	0.39	1.23	1.61	-	284.62	21.95	-6.83	-	Hit
07/18/17	New River/Cave Creek	1.50	0.94	1.23	1.61	-	59.57	21.95	-6.83	-	Hit
07/18/17	Wickenburg	1.75	2.17	2.02	2.20	1.75	-19.35	-13.37	-20.45	0.00	Hit
07/18/17	Upper Centennial	1.25	1.14	1.23	1.61	-	9.65	1.63	-22.36	-	Hit
07/19/17	Rainbow Valley	1.00	0.55	1.03	1.22	-	81.82	-2.91	-18.03	-	Hit
07/21/17	Superstition	0.75	1.14	0.64	0.83	1.00	-34.21	17.19	-9.64	-25.00	Hit
07/22/17	Lower Salt River Lakes	0.75	0.00	0.64	0.83		-	17.19	-9.64	-	Hit
07/23/17	Superstition	1.75	2.56	1.42	1.57	1.20	-31.64	23.24	11.46	45.83	Hit
07/23/17	New River/Cave Creek	0.75	0.35	0.83	0.98	-	114.29	-9.64	-23.47	-	Hit
07/23/17	Southeast Valley	1.25	1.46	1.42	1.57	0.50	-14.38	-11.97	-20.38	150.00	Hit
07/23/17	Lower Salt River Lakes	1.25	0.00	1.22	1.38	-	-	2.46	-9.42	-	Hit
07/23/17	Scottsdale South	0.75	0.55	0.63	0.79	0.50	36.36	19.05	-5.06	50.00	Hit
07/23/17	Phoenix South	0.75	0.59	0.83	0.98	0.99	27.12	-9.64	-23.47	-24.24	Hit
07/24/17	West Valley	1.75	2.40	2.50	2.56	-	-27.08	-30.00	-31.64	-	Miss
07/24/17	Phoenix South	1.75	2.36	2.01	2.17	-	-25.85	-12.94	-19.35	-	Hit
07/24/17	Southeast Valley	1.75	1.46	1.42	1.67	-	19.86	23.24	4.79	-	Hit
07/24/17	Rainbow Valley	1.25	1.30	1.22	1.38	-	-3.85	2.46	-9.42	-	Hit
07/24/17	Palo Verde	1.50	1.42	1.42	1.57	-	5.63	5.63	-4.46	-	Hit

TABLE E-1: MSP QPF Peak Storm Total Rainfall Verification - Monsoon Season 2017

Statement Details		Peak STP (in)					Error (%)				Verification
Date	MSP Forecast Zone	QPF	ALERT	GAQPE (LT)	GAQPE (UT)	LSRs	ALERT	GAQPE (LT)	GAQPE (UT)	LSRs	Hit/Miss
07/29/17	Northwest Valley	1.00	0.55	1.03	1.22	-	81.82	-2.91	-18.03	-	Hit
07/29/17	West Valley	0.75	0.79	1.23	1.61	0.71	-5.06	-39.02	-53.42	5.63	Hit
07/29/17	Phoenix South	0.75	0.59	0.44	0.63	-	27.12	70.45	19.05	-	Hit
07/29/17	Rainbow Valley	1.00	0.59	0.84	1.02	-	69.49	19.05	-1.96	-	Hit
07/29/17	Superstition	1.00	1.06	0.64	0.83	0.24	-5.66	56.25	20.48	316.67	Hit
07/29/17	Northwest Valley	0.50	0.39	1.03	1.22	-	28.21	-51.46	-59.02	-	Miss
08/01/17	New River/Cave Creek	0.75	0.67	0.84	1.02	-	11.94	-10.71	-26.47	-	Hit
08/01/17	Scottsdale North	0.60	0.31	0.04	0.24	-	93.55	1400.00	150.00	-	Miss
08/01/17	Superstition	1.50	1.65	0.64	0.83	-	-9.09	134.38	80.72	-	Hit
08/01/17	Wickenburg	1.50	1.97	2.02	2.20	-	-23.86	-25.74	-31.82	-	Hit
08/01/17	Upper Centennial	1.75	1.97	2.02	2.20	-	-11.17	-13.37	-20.45	-	Hit
08/03/17	Palo Verde	0.75	0.39	0.84	1.02	-	92.31	-10.71	-26.47	-	Hit
08/03/17	Wickenburg	1.00	1.30	2.41	2.60	-	-23.08	-58.51	-61.54	-	Hit
08/03/17	Upper Centennial	1.00	0.83	1.82	2.01	-	20.48	-45.05	-50.25	-	Hit
08/03/17	Phoenix North	1.00	1.22	1.23	1.61	-	-18.03	-18.70	-37.89	-	Hit
08/03/17	Scottsdale North	0.75	0.75	0.84	1.02	-	0.00	-10.71	-26.47	-	Hit
08/03/17	New River/Cave Creek	1.25	1.02	1.03	1.22	-	22.55	21.36	2.46	-	Hit
08/03/17	Scottsdale South	1.50	1.85	1.82	2.01	-	-18.92	-17.58	-25.37	-	Hit
08/03/17	Phoenix South	1.50	1.89	1.82	2.01	-	-20.63	-17.58	-25.37	-	Hit
08/03/17	Southeast Valley	1.50	1.69	1.23	1.61	2.35	-11.24	21.95	-6.83	-36.17	Hit
08/03/17	Superstition	1.00	0.91	0.84	1.02	-	9.89	19.05	-1.96	-	Hit
08/10/17	Wickenburg	1.25	2.05	2.02	2.20	-	-39.02	-38.12	-43.18	-	Miss
08/10/17	Rainbow Valley	1.50	1.38	1.23	1.61	-	8.70	21.95	-6.83	-	Hit
08/12/17	Southeast Valley	0.75	0.91	-	-	-	-17.58	-	-	-	Hit
08/12/17	Superstition	0.75	0.63	-	-	-	19.05	-	-	-	Hit
08/23/17	Phoenix North	1.00	0.59	1.03	1.22	-	69.49	-2.91	-18.03	-	Hit
08/23/17	Scottsdale North	1.00	0.91	1.03	1.22	-	9.89	-2.91	-18.03	-	Hit
08/23/17	Scottsdale South	0.50	0.51	0.44	0.63	-	-1.96	13.64	-20.63	-	Hit
09/04/17	Northwest Valley	0.50	0.35	0.25	0.43	-	42.86	100.00	16.28	-	Hit

TABLE E-1: MSP QPF Peak Storm Total Rainfall Verification - Monsoon Season 2017

Statement Details		Peak STP (in)					Error (%)				Verification
Date	MSP Forecast Zone	QPF	ALERT	GAQPE (LT)	GAQPE (UT)	LSRs	ALERT	GAQPE (LT)	GAQPE (UT)	LSRs	Hit/Miss
09/07/17	Palo Verde	0.75	0.79	1.23	1.61	-	-5.06	-39.02	-53.42	-	Hit
09/08/17	Scottsdale North	0.50	0.39	0.44	0.63	-	28.21	13.64	-20.63	-	Hit
* GAQPE (Radar) estimated data given in ranges: (LT) Lower Total and (UT) Upper Total											