



Afternoon Monsoon thunderstorm looking south from San Tan Valley, 09-06-2013, D. Henz

## **Flood Control District of Maricopa County**

**Engineering Division, Flood Warning Branch**

### **MSP Verification Report & Season Recap: Monsoon Season 2013**



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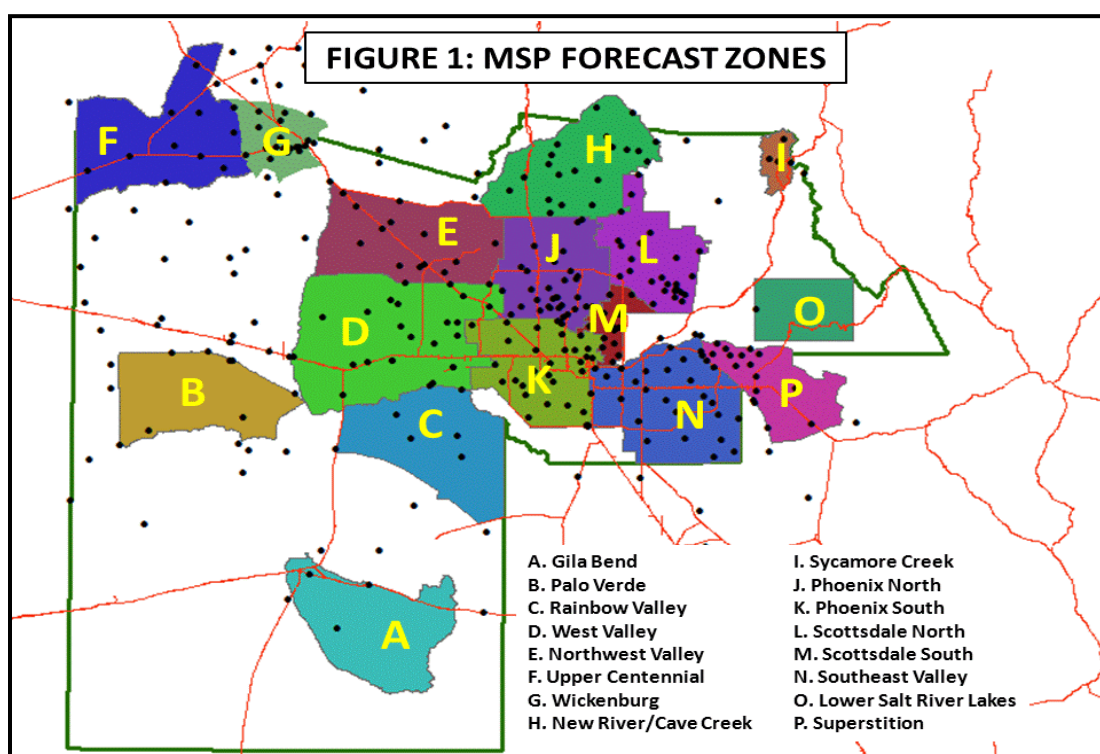
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## INTRODUCTION

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 15<sup>th</sup>- September 30<sup>th</sup>. 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, fax, and occasionally via pager. 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 16 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 October 15. 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](#)*

## 2013 MONSOON SEASON RECAP

The summer of 2013 was the hottest summer on record in Phoenix according to the National Weather Service (NWS). Despite a dry start and conclusion to the monsoon season, above average rainfall was still recorded at Sky Harbor Airport for the second consecutive season. The official rainfall total as reported by the NWS Phoenix office was 2.99", only 0.01" less than the 2012 season and 0.28" above the normal value of 2.71". Figure 2 below offers a more comprehensive picture of the rainfall distribution across the MSP forecast area. This figure was generated using FCDMC ALERT rain gage data from around the county. The shaded contours depict precipitation totals from June 15<sup>th</sup> – September 30<sup>th</sup>.

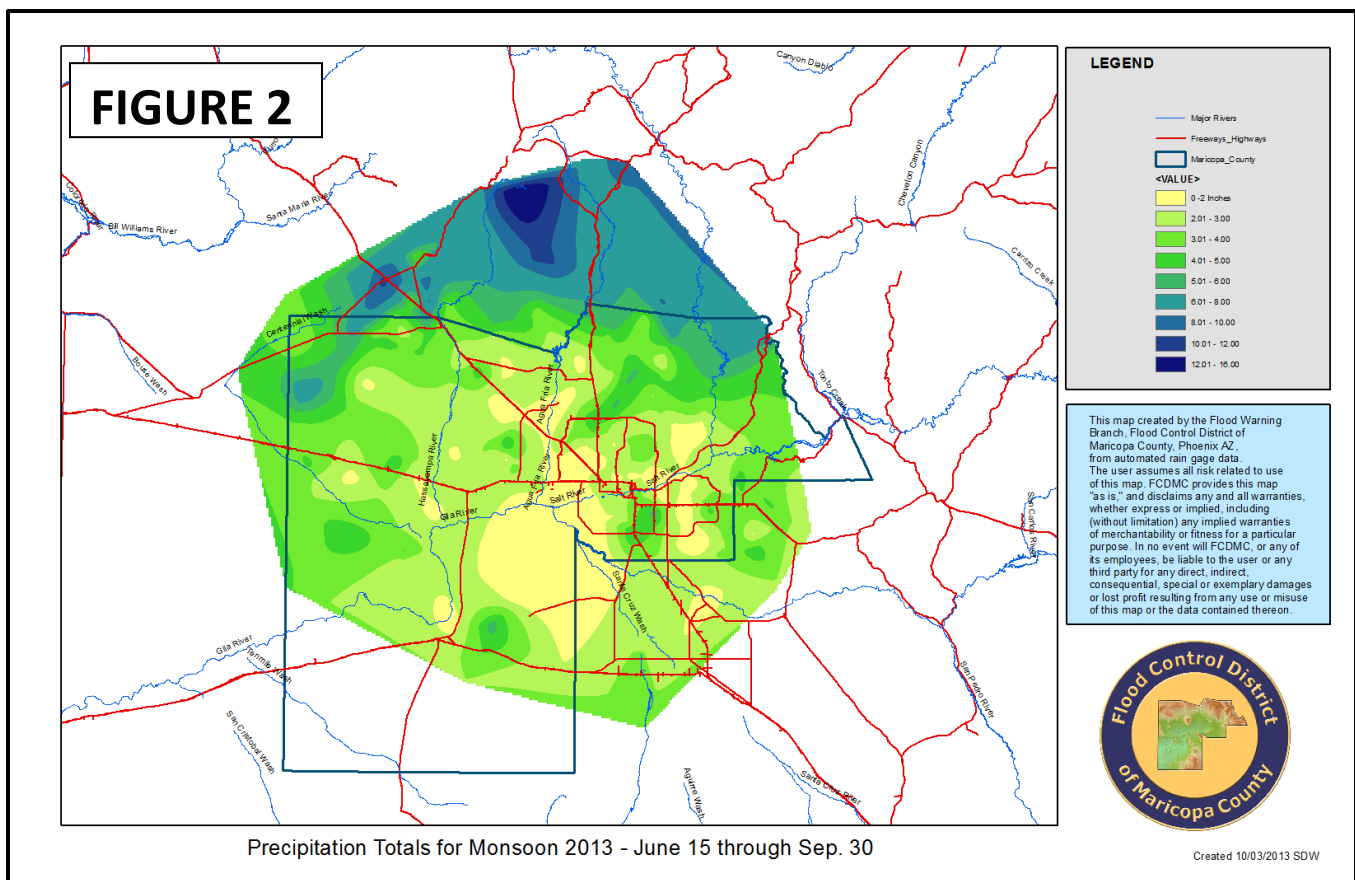
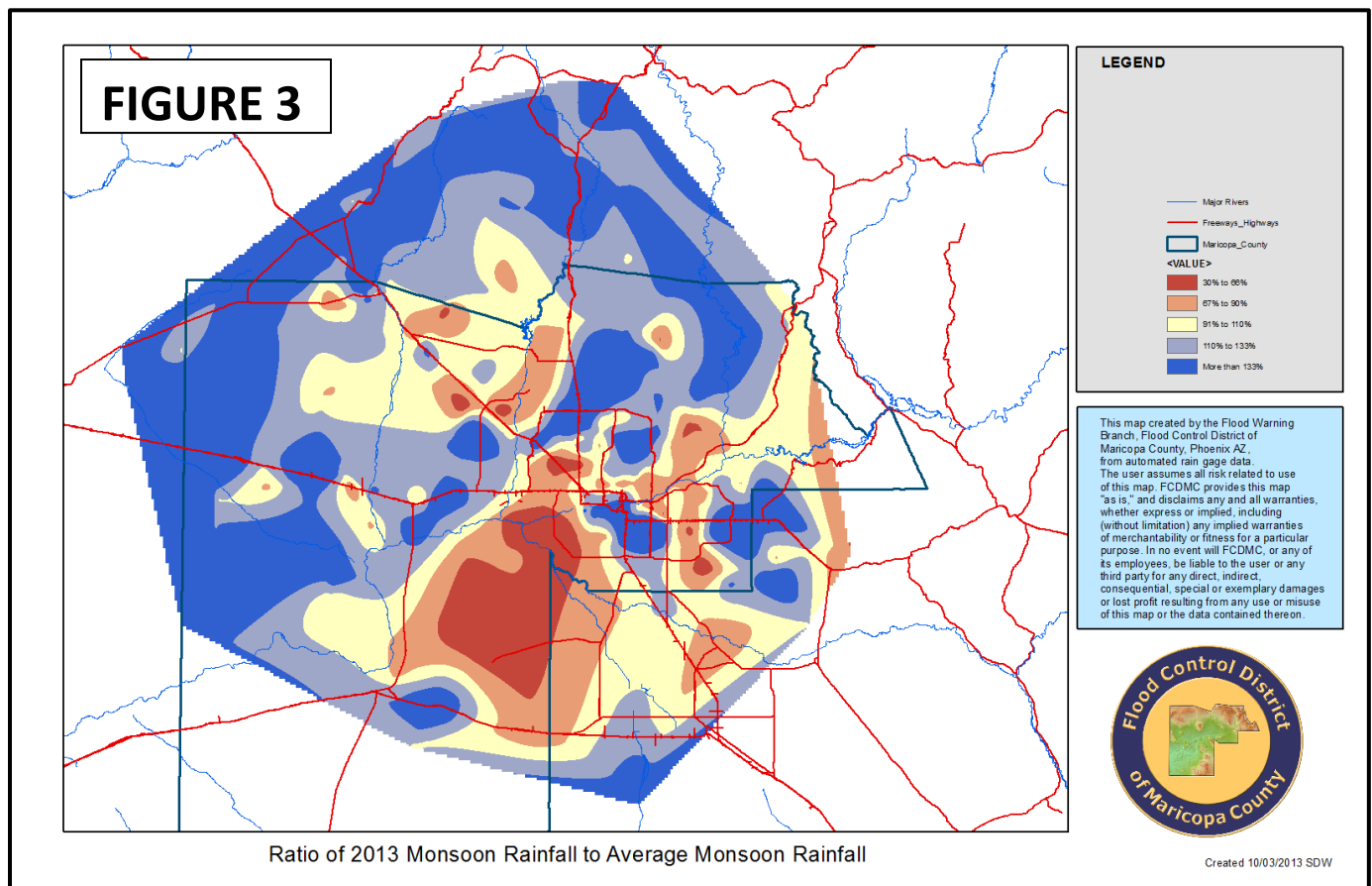


Figure 3 on the next page shows the ratio of 2013 monsoon precipitation versus average monsoon precipitation. Similar to Figure 2, contours were generated using FCDMC ALERT rain gage data from around the county. Above average rainfall totals for the season are denoted by gray and blue contours. Conversely, below normal rainfall totals for the season are denoted by orange and red contours. Areas highlighted by the light yellow contour were right around season normals. These two figures serve as a strong reminder to the importance of having a widely distributed rain gage network in order to fully understand the distribution of monsoon rains.

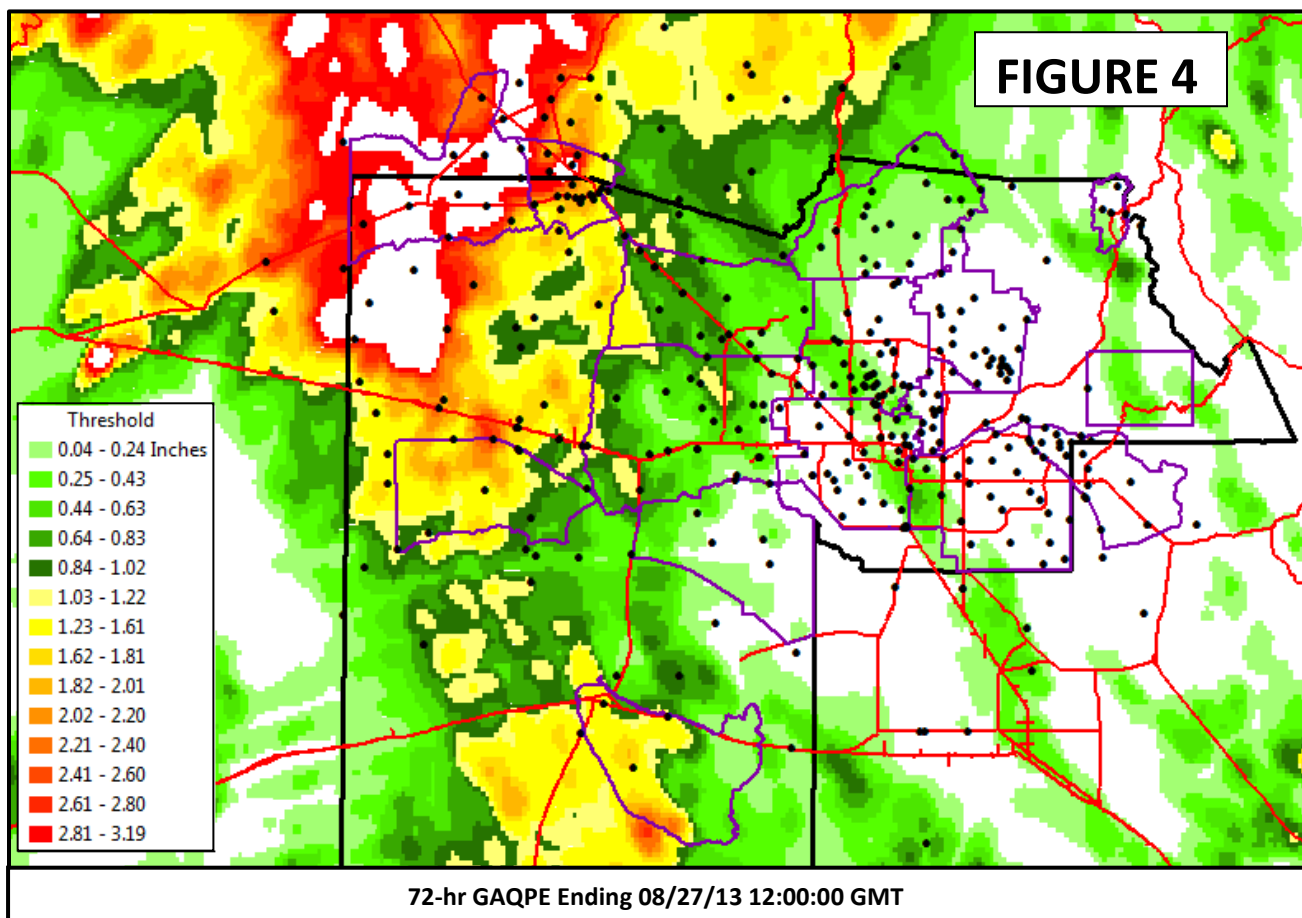




Similar to last year, the monsoon season got off to a slow start rain-wise across south-central AZ with excessive heat dominating the second half of June (2<sup>nd</sup> warmest average temperature for the month on record narrowly beating out 2012 and 1990) and continuing through the first week in July. The first MSP message was issued on July 6<sup>th</sup>, but was then followed by a week-long lull in activity other than several nocturnal dust storm events. The first active multi-day period of rainfall producing t-storms within the county came July 14<sup>th</sup>-17<sup>th</sup>, which was highlighted by heavy rains and an intense wet microburst on July 15<sup>th</sup> over portions of the southeast Valley. An unseasonably strong upper level easterly wave moved through Arizona July 19<sup>th</sup>-21<sup>st</sup>. On July 21<sup>st</sup>, anywhere from 1.00"-2.25" of rain fell over large portions of the county. Daily thunderstorm occurrences then continued through July 26<sup>th</sup> over far eastern and western portions of the county, before a "break" period to the monsoon which lasted through the end of the month.

The first three weeks of August were very quiet weather-wise around the county. The subtropical ridge spent much of this time rebuilding over the center of the state promoting hot temperatures and unseasonably dry west/southwesterly flow over the lower deserts of south-central Arizona. The only exceptions to this break period occurred on the 17<sup>th</sup> and 18<sup>th</sup> where heavy rains fell across Rainbow Valley, Palo Verde, and Gila Bend areas.

A major pattern shift across Arizona began after August 20<sup>th</sup> as the subtropical ridge shifted east into the Lower Great Plains allowing for moisture rich south/southeasterly flow to redevelop over the state and the East Pacific became ripe with tropical cyclone activity. Remnants from Tropical Storm Ivo moved north out of the Baja of California in the form of a gulf surge from August 24<sup>th</sup>-26<sup>th</sup>. Torrential rains fell across the western half of the county during the early morning hours of August 24<sup>th</sup> prompting flash flood warnings for the Wickenburg and Upper Centennial forecast zones. A flash flood watch remained in effect through August 26<sup>th</sup> when another round of strong thunderstorms moved northwest through the county affecting nearly every forecast zone with heavy rainfall. The 24<sup>th</sup> and 26<sup>th</sup> tied for most active operational weather days for the season with 18 District messages issued both days respectively. Figure 4 below shows the 72-hr gage corrected radar rainfall estimates covering this time period. The white areas within the red were higher than the scale maximum of 3.19".



Another gulf surge of moisture associated with the remnants of Tropical Storms Juliette and to a lesser extent Kiko moved north out of the Baja and into southern Arizona August 28<sup>th</sup>-30<sup>th</sup> leading to another active 72-hr period. Heavy rain fell across the west Valley the evening of the 28<sup>th</sup> leading to widespread flooding around Luke Air Force Base and the closing of Loop 303. The following night torrential rains fell north of the Wickenburg area causing widespread flash flooding and large flows within Martinez Creek. The three day event concluded with drenching



rains stretching from the Lake Pleasant area southeast through Mesa and Apache Junction areas the during the late afternoon of the 30<sup>th</sup>.

September started off rather slow with a return to drier and hotter conditions. Phoenix tied a daily record of 111°F on September 6<sup>th</sup> and set a record high low earlier in the morning at 89°F. Remnants from Tropical Storm Lorena aided by an unseasonably strong cutoff low out of the Pacific Northwest lead to a rather active two day period September 9<sup>th</sup> and 10<sup>th</sup>. A slow moving early morning Meso-scale Convective Complex moved north through the heart of Maricopa County on the 9<sup>th</sup> leading to widespread rainfall totals anywhere from 1.00"-2.25" from the southeast Valley north through Wickenburg and Cave Creek/New River areas. The center of the cutoff low then moved through northwestern portions of the county the following morning leading to an additional 1.00"-2.00" over the Wickenburg and Upper Centennial regions where there were widespread reports of flash flooding. The cooler air associated with the upper level disturbance lead to a record low high temperature for Phoenix of only 86°F that day which was 16°F cooler than the normal high of 102°F! For the remainder of September the subtropical ridge remained suppressed south of the US/Mexico border and the monsoon season existed in name only with dry conditions to its official finish on the 30<sup>th</sup>.

### MSP Issued Products Recap:

A total of 137 forecast zone-specific messages were issued by the MSP spread across twenty-four 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.

<b>TABLE 1: MSP Messages Issued - 2013 Monsoon Season</b>					
<b>Forecast Zone</b>	<b>June</b>	<b>July</b>	<b>August</b>	<b>September</b>	<b>Total</b>
Gila Bend	0	4	7	3	<b>14</b>
Palo Verde	0	4	8	4	<b>16</b>
Rainbow Valley	0	2	4	0	<b>6</b>
West Valley	0	3	6	1	<b>10</b>
Northwest Valley	0	3	4	1	<b>8</b>
Upper Centennial	0	3	6	3	<b>12</b>
Wickenburg	0	6	12	3	<b>21</b>
New River/Cave Creek	0	2	2	3	<b>7</b>
Sycamore Creek	0	5	1	1	<b>7</b>
Phoenix North	0	0	1	1	<b>2</b>
Phoenix South	0	3	1	1	<b>5</b>
Scottsdale North	0	2	1	2	<b>5</b>
Scottsdale South	0	0	1	1	<b>2</b>
Southeast Valley	0	5	4	1	<b>10</b>
Lower Salt River Lakes	0	1	1	1	<b>3</b>
Superstition	0	5	3	1	<b>9</b>
<b>All Zones</b>	<b>0</b>	<b>48</b>	<b>62</b>	<b>27</b>	<b>137</b>

Of the 137 Messages issued, ninety-six were Message-1 Alerts, thirteen were Message-2 Flash Flood Watches, twenty-four were Message-3 Flash Flood Warnings and the remaining four were Message-4 Cancels. Table 2 below shows the monthly break down by forecast zone of Lake Alerts issued including season totals. Fifty-six Lake Alert statements were issued for the County Lakes Program including Lake Pleasant, Bartlett Lake, Horseshoe Lake, Saguaro Lake, Canyon Lake, and Apache Lake. The Alert Operation Center (AOC) was not 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.

<b>TABLE 2: MSP Lake Alerts Issued - 2013 Monsoon Season</b>					
<b>Recreational Zone</b>	<b>June</b>	<b>July</b>	<b>August</b>	<b>September</b>	<b>Total</b>
Lake Pleasant	0	4	3	2	<b>9</b>
Horseshoe Lake	0	0	0	0	<b>0</b>
Bartlett Lake	0	8	6	0	<b>14</b>
Saguaro Lake	0	6	2	0	<b>8</b>
Canyon Lake	0	7	2	0	<b>9</b>
Apache Lake	0	9	5	2	<b>16</b>
<b>All Zones</b>	<b>0</b>	<b>34</b>	<b>18</b>	<b>4</b>	<b>56</b>

## 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 2013 monsoon season. This chapter is broken down into five sections: Outlooks, Messages, Lake Alerts, Peak Intensity, 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.

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:

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

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

$$(4) \% \text{ Error} = \left( \frac{\text{Forecast} - \text{Observed}}{\text{Observed}} \right) \times 100$$

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.

*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.

*Probability  $\geq 40\%$  and QPF  $\geq 0.50"$  **AND** Observed Rain  $< 0.50"$   
 Probability = 30% and QPF  $\geq 1.00"$  **AND** Observed Rain  $< 0.50"$*

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

*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.

*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.

*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](#).*

## QPF PEAK RAINFALL INTENSITY:

### Forecast Accuracy:

Only message statements where QPF peak rainfall intensity was provided were evaluated. Observational data used for this verification included Maricopa County ALERT rain gages and/or local storm reports. Either a hit or a miss was selected for each 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 D](#).*

## **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 quite good at 79.8%. The forecast accuracy for only two FZs fell below 75% on the season: Superstition and Lower Salt River Lakes. This was somewhat expected given the forecast challenges associated with predicting storm potential and rainfall output over these mainly high terrain regions. Over-forecasting rain totals was a noticeable reason as to the lower accuracy and was easily visible when comparing with the false alarm rate, discussed below.

<b>TABLE 3: MSP Weather Outlook Verification - SEASON TOTALS, 2013</b>						
<b>Forecast Zone</b>	<b>Accurate Forecasts</b>	<b>AOF (%)</b>	<b>Sig. Events Detected</b>	<b>POD (%)</b>	<b>False Alarms</b>	<b>FAR (%)</b>
Gila Bend	84/108	77.8%	11/13	84.6%	5	4.6%
Palo Verde	90/108	83.3%	9/12	75.0%	4	3.7%
Rainbow Valley	92/108	85.2%	4/8	50.0%	5	4.6%
West Valley	88/108	81.5%	7/9	77.8%	3	2.8%
Northwest Valley	91/108	84.2%	9/11	81.8%	3	2.8%
Upper Centennial	90/108	83.3%	17/24	70.8%	5	4.6%
Wickenburg	86/108	79.6%	17/21	81.0%	8	7.4%
New River/Cave Creek	87/108	80.6%	15/17	88.2%	9	8.3%
Sycamore Creek	83/108	76.9%	13/15	86.7%	10	9.3%
Phoenix North	86/108	79.6%	5/7	71.4%	8	7.4%
Phoenix South	88/108	81.5%	7/9	77.8%	2	1.9%
Scottsdale North	86/108	77.8%	7/9	77.8%	9	8.3%
Scottsdale South	86/108	79.6%	5/6	83.3%	3	2.8%
Southeast Valley	88/108	81.5%	8/10	80.0%	7	6.5%
Lower Salt River Lakes	75/108	69.4%	5/6	83.3%	15	13.9%
Superstition	79/108	73.2%	5/6	83.3%	11	10.2%
<b>All Zones</b>	<b>1379/1728</b>	<b>79.8%</b>	<b>144/183</b>	<b>78.7%</b>	<b>107</b>	<b>6.2%</b>

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 78.7%. In general, a POD of over 50% is considered sufficient and over 75% excellent in the forecast community. All FZs were at or above the 50% accuracy threshold with thirteen meeting or exceeding the 75% accuracy threshold.

The final metric included in Table 2 was False Alarm Rate (FAR). It is important to keep track of how often MSP forecasters predicted an operationally significant flooding 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 very low at 6.2% with none of the forecast zones exceeding 14%.

## 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 and B-2](#). There were 137 messages issued over the length of the season. Forecast accuracy for all FZs combined, over the length of the season, was exceptional at 88.0%. Fourteen of the sixteen FZs met or exceeded the 75% accuracy threshold with the other two at or above the 50% accuracy threshold. As stated earlier, 50% accuracy is considered sufficient and 75% or above is considered excellent within the forecast community.

No messages were issued in June for any of the FZs with the onset of the monsoon season holding off until July. Forty-eight messages were issued in July and forecast accuracy for the month for all FZs combined was 81.3%. Five out of the nine misses for the month occurred on July 20<sup>th</sup> where significant rainfall was expected but did not end up occurring until the following early morning on the 21<sup>st</sup>. Four of the misses were a result to a Flash Flood Watch that been issued for five of the FZs around the county.

August was the busiest month with 62 messages issued. Overall forecast accuracy increased to 90.0%. August included the two most active days of the entire season (the 24<sup>th</sup> and 26<sup>th</sup>), with eighteen statements issued both days respectively. Remnants of Tropical Storm Ivo lead to a gulf surge into south-central AZ during the 24<sup>th</sup>-26<sup>th</sup> timeframe which produced widespread heavy rain producing thunderstorms across the western half of the county. Thirty-two of the thirty-six messages issued during that seventy-two hour period verified.

September saw another marked rise in overall forecast accuracy to 96.0%. There were only four operationally significant days and all four occurred within the first ten days of the month. Twenty-seven messages were issued during these four event days with only one message not verifying. September 9<sup>th</sup> and 10<sup>th</sup> accounted for twenty-two of the twenty-seven messages issued for the month as another gulf surge associated with Tropical Storm Elena combined with an unseasonably strong cutoff low which moved across south-central Arizona.

**TABLE 4: MSP Issued Statements Verification, broken down by month and Forecast Zone - Monsoon Season 2013**

	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	3/4	75.0%	6/7	86.0%	3/3	100.0%	<b>12/14</b>	<b>85.7%</b>
Palo Verde	0/0	n/a	2/4	50.0%	8/8	100.0%	4/4	100.0%	<b>14/16</b>	<b>87.5%</b>
Rainbow Valley	0/0	n/a	2/2	100.0%	3/4	75.0%	0/0	n/a	<b>5/6</b>	<b>83.3%</b>
West Valley	0/0	n/a	2/3	66.7%	6/6	100.0%	1/1	100.0%	<b>9/10</b>	<b>90.0%</b>
Northwest Valley	0/0	n/a	1/3	33.3%	4/4	100.0%	1/1	100.0%	<b>6/8</b>	<b>75.0%</b>
Upper Centennial	0/0	n/a	3/3	100.0%	6/6	100.0%	3/3	100.0%	<b>12/12</b>	<b>100.0%</b>
Wickenburg	0/0	n/a	6/6	100.0%	11/12	92.0%	3/3	100.0%	<b>20/21</b>	<b>95.2%</b>
New River/Cave Creek	0/0	n/a	2/2	100.0%	1/2	50.0%	3/3	100.0%	<b>5/6</b>	<b>83.3%</b>
Sycamore Creek	0/0	n/a	5/5	100.0%	0/1	0.0%	1/1	100.0%	<b>6/7</b>	<b>85.7%</b>
Phoenix North	0/0	n/a	0/0	n/a	1/1	100.0%	1/1	100.0%	<b>2/2</b>	<b>100.0%</b>
Phoenix South	0/0	n/a	2/3	66.7%	1/1	100.0%	0/1	0.0%	<b>3/5</b>	<b>60.0%</b>
Scottsdale North	0/0	n/a	2/2	100.0%	1/1	100.0%	2/2	100.0%	<b>5/5</b>	<b>100.0%</b>
Scottsdale South	0/0	n/a	0/0	n/a	0/1	0.0%	1/1	100.0%	<b>1/2</b>	<b>50.0%</b>
Southeast Valley	0/0	n/a	4/5	80.0%	4/4	100.0%	1/1	100.0%	<b>9/10</b>	<b>90.0%</b>
Lower Salt River Lakes	0/0	n/a	1/1	100.0%	1/1	100.0%	1/1	100.0%	<b>3/3</b>	<b>100.0%</b>
Superstition	0/0	n/a	4/5	80.0%	3/3	100.0%	1/1	100.0%	<b>8/9</b>	<b>88.9%</b>
<b>All Zones</b>	<b>0/0</b>	<b>n/a</b>	<b>39/48</b>	<b>81.3%</b>	<b>56/62</b>	<b>90.0%</b>	<b>26/27</b>	<b>96.0%</b>	<b>121/137</b>	<b>88.0%</b>

## 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 56 lake alerts issued over the length of the season with the majority of the events occurring in July and August (52 of 56). No statements were issued for the Horseshoe Lake recreational zone due to a lack of water behind the reservoir. Forecast accuracy for all recreational zones combined, over the length of the season, was exceptional at 89.3%. All five zones exceeded the 75% accuracy threshold with the lowest forecast accuracy of 77.8% recorded at Lake Pleasant. As stated earlier, 50% accuracy is considered sufficient and 75% or above is considered excellent within the forecast community.

<b>TABLE 5: MSP Lake Alerts Issued - 2013 Monsoon Season</b>										
<b>Recreational Zone</b>	<b>June</b>		<b>July</b>		<b>August</b>		<b>September</b>		<b>Season Totals</b>	
	<b>Correct Alerts</b>	<b>AOF (%)</b>	<b>Correct Alerts</b>	<b>AOF (%)</b>	<b>Correct Alerts</b>	<b>AOF (%)</b>	<b>Correct Alerts</b>	<b>AOF (%)</b>	<b>Correct Alerts</b>	<b>AOF (%)</b>
Lake Pleasant	0/0	n/a	3/4	75.0%	2/3	66.7%	2/2	100.0%	<b>7/9</b>	<b>77.8%</b>
Horseshoe Lake	0/0	n/a	0/0	n/a	0/0	n/a	0/0	n/a	<b>0/0</b>	<b>n/a</b>
Bartlett Lake	0/0	n/a	7/8	87.5%	6/6	100.0%	0/0	n/a	<b>13/14</b>	<b>92.9%</b>
Saguaro Lake	0/0	n/a	6/6	100.0%	1/2	50.0%	0/0	n/a	<b>7/8</b>	<b>87.5%</b>
Canyon Lake	0/0	n/a	7/7	100.0%	2/2	100.0%	0/0	n/a	<b>9/9</b>	<b>100.0%</b>
Apache Lake	0/0	n/a	8/9	88.9%	4/5	80.0%	2/2	100.0%	<b>14/16</b>	<b>87.5%</b>
<b>All Zones</b>	<b>0/0</b>	<b>n/a</b>	<b>31/34</b>	<b>91.2%</b>	<b>15/18</b>	<b>83.3%</b>	<b>4/4</b>	<b>100.0%</b>	<b>50/56</b>	<b>89.3%</b>

## QPF PEAK RAINFALL INTENSITY VERIFICATION

The MSP has recently 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 rainfall intensity that will likely accompany thunderstorms moving through a FZ is intended to help clients make well-informed and proactive decisions.

Figure 5 below is a scatter plot depicting forecast versus observed rainfall intensity for all qualifying events during the length of the monsoon season. 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. These plots are commonly used within the forecast community to visually inspect how well forecast values correspond to the observed values. There were sixty-nine qualifying messages events that counted towards the verification of the QPF peak rainfall intensity and forty events fell within the error threshold.

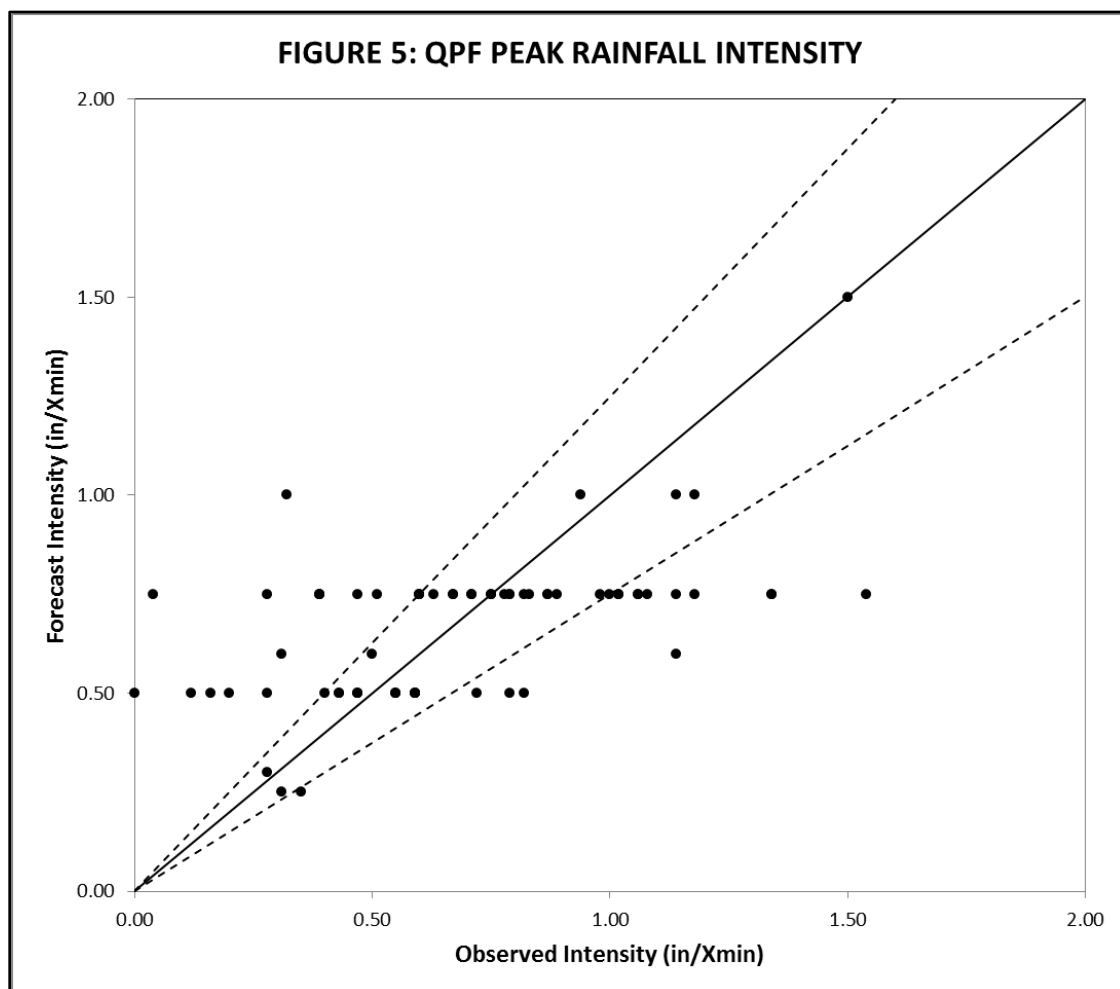




Table 6 below shows the issued message verification broken down by FZ and month. Complete data tables for each FZ can be viewed in [Appendix D](#): Table D-1. Forecast accuracy for all FZs combined, over the length of the season, was at 58.0%. When looking at the forecast accuracy broken down by month, August was much lower at 51.9% than either July or August (both ~ 62%). This drop in forecast skill was directly attributable to the under forecasting of rainfall rates over the northwestern FZs during the rain events that occurred on August 26<sup>th</sup> and 28<sup>th</sup>. Six of the thirteen incorrect QPF intensity forecasts for the month occurred in the Wickenburg and Upper Centennial FZs.

<b>TABLE 6: QPF Peak Rainfall Intensity Verification - Monsoon Season 2013</b>										
	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	0/1	0.0%	1/3	33.3%	0/0	n/a	1/4	25.0%
Palo Verde	0/0	n/a	1/1	100.0%	3/3	100.0%	1/2	50.0%	5/6	83.3%
Rainbow Valley	0/0	n/a	0/2	0.0%	1/2	50.0%	0/0	n/a	1/4	25.0%
West Valley	0/0	n/a	1/2	50.0%	2/4	50.0%	1/1	100.0%	4/7	57.1%
NW Valley	0/0	n/a	2/3	66.7%	2/3	66.7%	0/1	0.0%	4/7	57.1%
Upper Centennial	0/0	n/a	0/0	n/a	0/2	0.0%	1/2	50.0%	1/4	25.0%
Wickenburg	0/0	n/a	3/4	75.0%	0/4	0.0%	1/1	100.0%	4/9	44.4%
New River/Cave Creek	0/0	n/a	1/1	100.0%	0/0	n/a	0/0	n/a	1/1	100.0%
Sycamore Creek	0/0	n/a	3/3	100.0%	0/0	n/a	1/1	100.0%	4/4	100.0%
Phoenix North	0/0	n/a	0/0	n/a	1/1	100.0%	0/1	0.0%	1/2	50.0%
Phoenix South	0/0	n/a	2/3	66.7%	1/1	100.0%	1/1	100.0%	4/5	80.0%
Scottsdale North	0/0	n/a	0/0	n/a	0/0	n/a	2/2	100.0%	2/2	100.0%
Scottsdale South	0/0	n/a	0/0	n/a	0/1	0.0%	0/1	0.0%	0/2	0.0%
Southeast Valley	0/0	n/a	2/5	40.0%	3/3	100.0%	0/0	n/a	5/8	62.5%
Lower Salt River Lakes	0/0	n/a	0/1	0.0%	0/0	n/a	0/0	n/a	0/1	0.0%
Superstition	0/0	n/a	3/3	100.0%	0/0	n/a	0/0	n/a	3/3	100.0%
<b>All Zones</b>	<b>0/0</b>	<b>n/a</b>	<b>18/29</b>	<b>62.1%</b>	<b>14/27</b>	<b>51.9%</b>	<b>8/13</b>	<b>61.5%</b>	<b>40/69</b>	<b>58.0%</b>

It is important to remember observed rainfall intensity data is gathered from either ALERT rain gages or provided from local storm reports. In either case, accurate measurements of peak rainfall intensity are contingent upon a thunderstorm rain core directly passing over a gage site. Often times the main rain core will move in between or only partially clip a gage site. This can be a noteworthy source of error especially over FZs with greater spatial gaps in between gage sites. This source of error may help explain some of the lower forecast accuracy for FZs with a poor spatial distribution of gage sites (ex. Gila Bend, Palo Verde, Upper Centennial, Lower Salt River Lakes, etc).

## QPF STORM TOTAL PRECIPITATION VERIFICATION

The MSP has recently 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 fifty-four qualifying messages events that counted towards the verification of the STP forecasts and thirty-nine events fell within the error threshold.

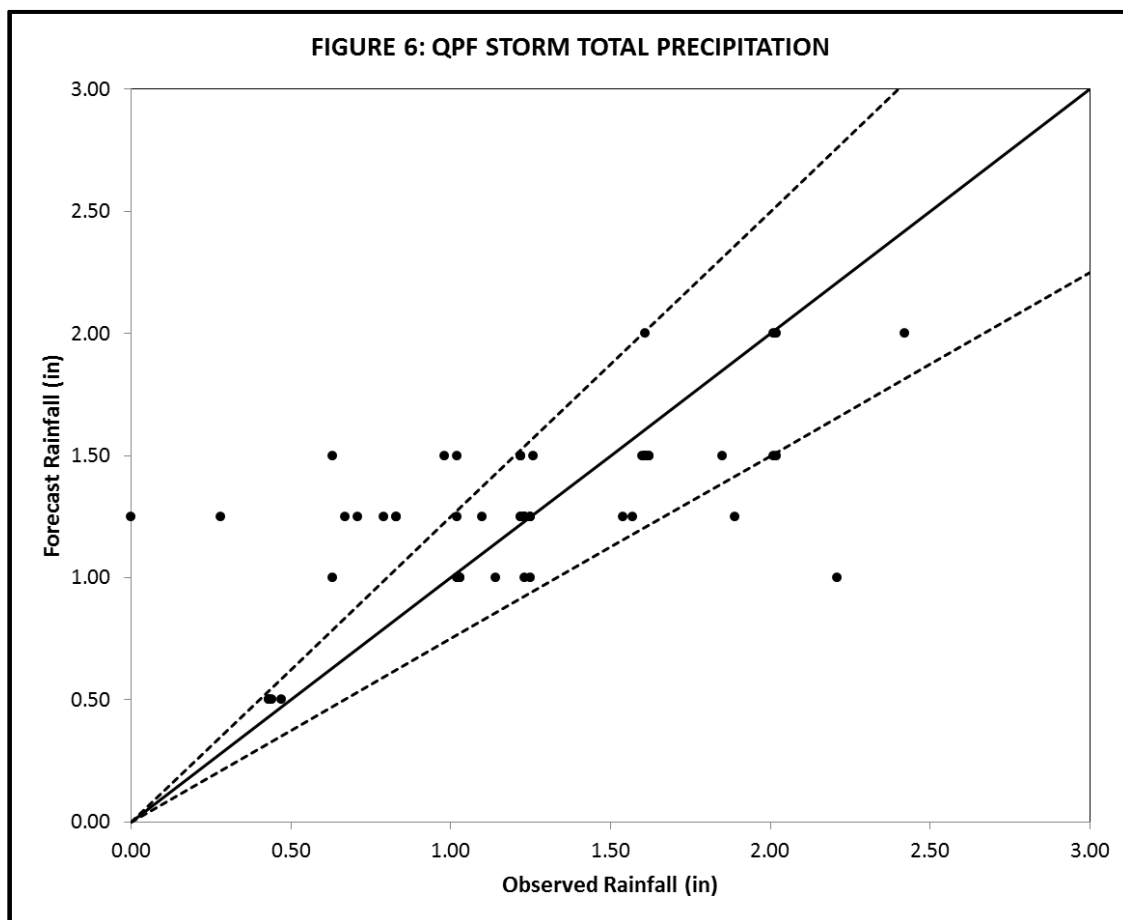


Figure 5 clearly shows that the majority of missed events over the course of the monsoon season tended to be over-forecasted (forecast rainfall value > observed rainfall value) by the MSP intimating a forecast bias towards conservatism.

Table 6 below 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 72.2%. When looking at the forecast accuracy broken down by month, July and September were very similar (~69%) in terms of forecast skill. On the other hand, forecast skill was much better during the month of August coming in just shy of 79%.

The end of the previous section covered possible sources of error in peak rainfall intensity due to spatial gaps in reporting gages within certain FZs. In this case, observed storm total precipitation data was gathered from ALERT rain gages, local storm reports, and gage corrected radar rainfall estimation (e.g. GAQPE). Radar rainfall estimates were able to fill in the gaps that would otherwise be missed in the aforementioned FZs. Forecast accuracy over the length of the monsoon season for Gila Bend, Palo Verde, Upper Centennial, and the Lower Salt River Lakes FZs was exceptional at 78.6%.

<b>TABLE 7: QPF Storm Total Precipitation Verification - Monsoon Season 2013</b>										
	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	1/1	100.0%	2/2	100.0%	0/0	n/a	<b>3/3</b>	<b>100.0%</b>
Palo Verde	0/0	n/a	0/0	n/a	2/2	100.0%	1/2	50.0%	<b>3/4</b>	<b>75.0%</b>
Rainbow Valley	0/0	n/a	0/2	0.0%	0/1	0.0%	0/0	n/a	<b>0/3</b>	<b>0.0%</b>
West Valley	0/0	n/a	1/1	100.0%	1/1	100.0%	1/1	100.0%	<b>3/3</b>	<b>100.0%</b>
NW Valley	0/0	n/a	1/2	50.0%	2/3	66.7%	1/1	100.0%	<b>4/6</b>	<b>66.7%</b>
Upper Centennial	0/0	n/a	0/0	n/a	1/2	50.0%	1/2	50.0%	<b>2/4</b>	<b>50.0%</b>
Wickenburg	0/0	n/a	2/3	66.7%	3/4	75.0%	1/1	100.0%	<b>6/8</b>	<b>75.0%</b>
New River/Cave Creek	0/0	n/a	1/1	100.0%	1/1	100.0%	0/0	n/a	<b>2/2</b>	<b>100.0%</b>
Sycamore Creek	0/0	n/a	2/3	66.7%	0/0	n/a	0/0	n/a	<b>2/3</b>	<b>66.7%</b>
Phoenix North	0/0	n/a	0/0	n/a	0/0	n/a	1/1	100.0%	<b>1/1</b>	<b>100.0%</b>
Phoenix South	0/0	n/a	1/3	33.3%	0/0	n/a	0/1	0.0%	<b>1/4</b>	<b>25.0%</b>
Scottsdale North	0/0	n/a	0/0	n/a	0/0	n/a	1/1	100.0%	<b>1/1</b>	<b>100.0%</b>
Scottsdale South	0/0	n/a	0/0	n/a	0/0	n/a	0/1	0.0%	<b>0/1</b>	<b>0.0%</b>
Southeast Valley	0/0	n/a	3/3	100.0%	1/1	100.0%	0/0	n/a	<b>4/4</b>	<b>100.0%</b>
Lower Salt River Lakes	0/0	n/a	1/1	100.0%	1/1	100.0%	1/1	100.0%	<b>3/3</b>	<b>100.0%</b>
Superstition	0/0	n/a	2/2	100.0%	1/1	100.0%	1/1	100.0%	<b>4/4</b>	<b>100.0%</b>
<b>All Zones</b>	<b>0/0</b>	<b>n/a</b>	<b>15/22</b>	<b>68.2%</b>	<b>15/19</b>	<b>78.9%</b>	<b>9/13</b>	<b>69.2%</b>	<b>39/54</b>	<b>72.2%</b>

## 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 2013 monsoon season. Outlooks, Messages, Lake Alerts, QPF Peak Intensity, and QPF Storm Total Precipitation were the five products analyzed in this report.

Verification of daily outlooks was conducted using three metrics: forecast accuracy, probability of detection, and false alarm rate. When comparing all forecast zones combined over the length of the monsoon season, forecast accuracy was 79.8%, probability of detection was 78.7%, and the false alarm rate was 6.2%. Each metric fell into the “excellent” category when equating these results with accepted values within the forecast community. When comparing to last year's verification, forecast accuracy dropped slightly by 0.4%. Both probability of detection and false alarm rate improved by 4.8% and 2.7% respectively.

Verification of messages was conducted using forecast accuracy. When comparing all forecast zones combined over the length of the monsoon season, forecast accuracy was 88.0%. Any value of over 75% is considered “excellent” within the forecast community. When comparing to last year's verification, forecast accuracy improved slightly by 1.7%. As was the case last year, the main trend common to all verification metrics on both outlooks and messages was general improvement in the percentages over the length of the season. This trend highlights the fact that forecaster skill and confidence continued to improve as the season wore on.

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 89.3%. 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.

Verification of QPF peak rainfall intensity 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 58.0%. The forecast accuracy for August was much lower at 51.9% than either July or August (both ~ 62%) which was directly attributable to the under forecasting of rainfall rates over the northwestern FZs during events that occurred on August 26<sup>th</sup> and 28<sup>th</sup>.

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 72.2%. Forecast accuracy for both July and September was sufficient around ~69%, but August was significantly better coming in at 78.9%. The addition of gage corrected radar rainfall estimation in the verification process proved to be critical for FZs with greater spatial gaps in between gage sites.

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. In addition, future MSP Verification Reports may be expanded to include:

1. Lead time as a metric for determining verification for issued statements.
2. A greater historical comparison between current and previous year's verification statistics as the seasonal data sets continue to grow.

## 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 2013 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 2013														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
	GILA BEND							PALO VERDE						
06/15/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/23/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/24/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/25/12	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 2013**

Date	Forecast Zone Data				Verification			Date	Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR		Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
06/26/12	0	0.00	0.00	0.00	h	-	-	06/26/12	0	0.00	0.00	0.00	h	-	-
06/27/12	0	0.00	0.00	0.00	h	-	-	06/27/12	0	0.00	0.00	0.00	h	-	-
06/28/12	0	0.00	0.00	0.00	h	-	-	06/28/12	0	0.00	0.00	0.00	h	-	-
06/29/12	0	0.00	0.00	0.00	h	-	-	06/29/12	0	0.00	0.00	0.00	h	-	-
06/30/12	0	0.00	0.00	0.00	h	-	-	06/30/12	0	0.00	0.00	0.00	h	-	-
<b>16 days</b>					<b>16/16*</b>	<b>0.00</b>	<b>0</b>	<b>16 days</b>					<b>16/16*</b>	<b>0.00</b>	<b>0</b>
07/01/12	10	0.15	0.08	0.04-0.24	h	-	-	07/01/12	0	0.00	0.00	0.04-0.24	h	-	-
07/02/12	0	0.00	0.00	0.25-0.43	m	-	-	07/02/12	0	0.00	0.00	0.00	h	-	-
07/03/12	0	0.00	0.00	0.00	h	-	-	07/03/12	0	0.00	0.00	0.00	h	-	-
07/04/12	0	0.00	0.00	0.00	h	-	-	07/04/12	0	0.00	0.00	0.00	h	-	-
07/05/12	0	0.00	0.00	0.00	h	-	-	07/05/12	0	0.00	0.00	0.00	h	-	-
07/06/12	20	0.10	0.00	0.00	h	-	-	07/06/12	0	0.00	0.00	0.00	h	-	-
07/07/12	0	0.00	0.00	0.00	h	-	-	07/07/12	0	0.00	0.00	0.00	h	-	-
07/08/12	0	0.00	0.00	0.00	h	-	-	07/08/12	0	0.00	0.00	0.00	h	-	-
07/09/12	20	0.10	0.00	0.04-0.24	h	-	-	07/09/12	20	0.10	0.00	0.00	h	-	-
07/10/12	20	0.50	0.28	0.64-0.83	h	h	-	07/10/12	20	0.35	0.08	0.04-0.24	h	-	-
07/11/12	20	0.75	0.04	0.00	m	-	-	07/11/12	20	0.75	0.16	0.04-0.24	m	-	-
07/12/12	20	0.75	0.00	0.25-0.43	h	-	-	07/12/12	20	0.75	0.00	0.00	m	-	-
07/13/12	20	0.50	0.00	0.00	m	-	-	07/13/12	0	0.00	0.00	0.00	h	-	-
07/14/12	0	0.00	0.00	0.00	h	-	-	07/14/12	0	0.00	0.94	2.21-2.40	m	m	-
07/15/12	20	0.35	0.16	0.44-0.63	h	-	-	07/15/12	20	0.35	0.04	0.04-0.24	h	-	-
07/16/12	20	0.35	0.08	0.00	h	-	-	07/16/12	20	0.35	0.00	0.00	m	-	-
07/17/12	20	0.25	0.00	0.00	m	-	-	07/17/12	10	0.25	0.00	0.00	h	-	-
07/18/12	20	0.25	0.00	0.00	h	-	-	07/18/12	0	0.00	0.00	0.00	h	-	-
07/19/12	20	1.25	0.00	0.04-0.24	m	-	-	07/19/12	20	1.25	0.47	1.03-1.22	h	h	-
07/20/12	50	1.25	0.04	0.25-0.43	m	-	x	07/20/12	50	1.25	0.31	0.04-0.24	m	-	x
07/21/12	30	0.50	2.32	2.02-2.20	m	m	-	07/21/12	30	0.50	0.39	0.25-0.43	h	-	-
07/22/12	40	1.00	0.08	0.44-0.63	h	h	-	07/22/12	40	1.00	0.00	0.00	m	-	x

**TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2013**

Date	Forecast Zone Data				Verification			Date	Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR		Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
07/23/12	10	0.50	0.00	0.00	h	-	-	07/23/12	0	0.00	0.00	0.00	h	-	-
07/24/12	20	0.25	0.00	0.00	m	-	-	07/24/12	10	0.25	0.00	0.00	h	-	-
07/25/12	10	0.75	0.20	1.23-1.61	h	h	-	07/25/12	10	0.75	0.31	0.25-0.43	h	-	-
07/26/12	10	0.75	0.00	0.00	h	-	-	07/26/12	10	0.75	0.00	0.00	h	-	-
07/27/12	0	0.00	0.00	0.04-0.24	h	-	-	07/27/12	0	0.00	0.00	0.00	h	-	-
07/28/12	0	0.00	0.00	0.00	h	-	-	07/28/12	0	0.00	0.00	0.00	h	-	-
07/29/12	0	0.00	0.00	0.00	h	-	-	07/29/12	0	0.00	0.00	0.00	h	-	-
07/30/12	0	0.00	0.00	0.00	h	-	-	07/30/12	0	0.00	0.00	0.00	h	-	-
07/31/12	0	0.00	0.00	0.00	h	-	-	07/31/12	0	0.00	0.00	0.00	h	-	-
<b>31 days</b>					<b>23/31*</b>	<b>3/4*</b>	<b>1</b>	<b>31 days</b>					<b>25/31*</b>	<b>1/2*</b>	<b>2</b>
08/01/12	0	0.00	0.00	0.04-0.24	m	-	-	08/01/12	0	0.00	0.00	0.00	h	-	-
08/02/12	0	0.00	0.00	0.00	h	-	-	08/02/12	0	0.00	0.00	0.00	h	-	-
08/03/12	10	0.25	0.00	0.04-0.24	h	-	-	08/03/12	0	0.00	0.00	0.00	h	-	-
08/04/12	10	0.25	0.00	0.00	h	-	-	08/04/12	0	0.00	0.00	0.00	h	-	-
08/05/12	20	0.25	0.00	0.00	m	-	-	08/05/12	20	0.15	0.08	0.00	h	-	-
08/06/12	30	0.15	0.00	0.00	m	-	-	08/06/12	30	0.15	0.00	0.04-0.24	h	-	-
08/07/12	0	0.00	0.00	0.00	h	-	-	08/07/12	0	0.00	0.00	0.00	h	-	-
08/08/12	0	0.00	0.00	0.00	h	-	-	08/08/12	0	0.00	0.00	0.00	h	-	-
08/09/12	0	0.00	0.00	0.00	h	-	-	08/09/12	0	0.00	0.00	0.00	h	-	-
08/10/12	0	0.00	0.00	0.00	h	-	-	08/10/12	0	0.00	0.00	0.00	h	-	-
08/11/12	0	0.00	0.00	0.00	h	-	-	08/11/12	0	0.00	0.00	0.00	h	-	-
08/12/12	0	0.00	0.00	0.00	h	-	-	08/12/12	0	0.00	0.00	0.00	h	-	-
08/13/12	0	0.00	0.00	0.00	h	-	-	08/13/12	0	0.00	0.00	0.00	h	-	-
08/14/12	0	0.00	0.00	0.00	h	-	-	08/14/12	0	0.00	0.00	0.00	h	-	-
08/15/12	0	0.00	0.00	0.00	h	-	-	08/15/12	0	0.00	0.00	0.00	h	-	-
08/16/12	10	0.20	0.00	0.04-0.24	h	-	-	08/16/12	0	0.00	0.00	0.00	h	-	-
08/17/12	20	0.75	0.00	0.84-1.02	h	h	-	08/17/12	20	0.50	0.35	0.25-0.43	h	-	-
08/18/12	30	0.75	0.31	0.84-1.02	h	h	-	08/18/12	20	0.60	1.14	1.23-1.61	h	h	-

**TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2013**

	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
08/19/12	10	0.40	0.00	0.00	m	-	-	10	0.20	0.00	0.00	h	-	-
08/20/12	0	0.00	0.00	0.24-0.43	m	-	-	0	0.00	0.00	0.00	h	-	-
08/21/12	20	0.15	0.00	0.00	h	-	-	20	0.10	0.00	0.00	m	-	-
08/22/12	20	0.75	0.04	0.04-0.24	m	-	-	20	0.50	0.00	0.00	m	-	-
08/23/12	20	0.30	0.00	0.00	m	-	-	20	0.20	0.00	1.03-1.22	m	m	-
08/24/12	60	1.00	0.00	0.64-0.83	h	h	-	60	1.00	0.79	1.23-1.61	h	h	-
08/25/12	70	0.50	0.12	0.04-0.24	m	-	x	70	0.50	0.12	0.04-0.24	m	-	x
08/26/12	40	0.60	1.02	1.62-1.81	m	h	-	40	0.60	0.91	0.84-1.02	h	h	-
08/27/12	10	0.25	0.04	0.44-0.63	h	m	-	10	0.25	0.00	0.00	h	-	-
08/28/12	10	1.00	0.31	0.44-0.63	h	h	-	10	0.75	1.02	1.23-1.61	h	h	-
08/29/12	50	1.00	0.55	0.44-0.63	h	h	-	40	0.75	0.39	0.44-0.63	h	h	-
08/30/12	10	0.30	0.00	0.25-0.43	h	-	-	10	0.30	1.02	0.64-0.83	m	m	-
08/31/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
31 days					22/31*	6/7*	1					26/31*	5/7*	1
09/01/12	10	0.15	0.00	0.00	h	-	-	10	0.15	0.00	0.00	h	-	-
09/02/12	40	0.40	0.00	0.00	m	-	-	30	0.40	0.00	0.00	m	-	-
09/03/12	50	0.50	0.00	0.04-0.24	m	-	x	50	0.30	0.00	0.00	m	-	-
09/04/12	10	0.10	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
09/05/12	20	0.25	0.00	0.00	m	-	-	10	0.25	0.00	0.00	h	-	-
09/06/12	60	0.75	1.02	1.23-1.61	h	h	-	40	0.75	0.63	1.23-1.61	h	h	-
09/07/12	50	0.75	0.04	0.00	m	-	x	40	0.50	0.04	0.00	m	-	x
09/08/12	30	0.75	0.00	0.04-0.24	m	-	-	30	0.50	0.00	0.00	m	-	-
09/09/12	30	0.75	0.16	0.44-0.63	h	h	-	30	0.50	1.89	2.02-2.20	m	h	-
09/10/12	40	0.75	0.00	0.00	m	-	x	70	1.50	0.71	0.44-0.63	m	h	-
09/11/12	10	0.15	0.00	n/a	m	-	-	30	0.25	0.00	n/a	m	-	-
09/12/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/13/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/14/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-

**TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2013**

	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
09/15/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/16/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
30 days					23/30*	2/2*	3					23/30*	3/3*	1
	Rainbow Valley							West Valley						
06/15/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/23/12	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 2013**

Date	Forecast Zone Data				Verification			Date	Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR		Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
06/24/12	0	0.00	0.00	0.00	h	-	-	06/24/12	0	0.00	0.00	0.00	h	-	-
06/25/12	0	0.00	0.00	0.00	h	-	-	06/25/12	0	0.00	0.00	0.00	h	-	-
06/26/12	0	0.00	0.00	0.00	h	-	-	06/26/12	0	0.00	0.00	0.00	h	-	-
06/27/12	0	0.00	0.00	0.00	h	-	-	06/27/12	0	0.00	0.00	0.00	h	-	-
06/28/12	0	0.00	0.00	0.00	h	-	-	06/28/12	0	0.00	0.00	0.00	h	-	-
06/29/12	0	0.00	0.00	0.00	h	-	-	06/29/12	0	0.00	0.00	0.00	h	-	-
06/30/12	0	0.00	0.00	0.00	h	-	-	06/30/12	0	0.00	0.00	0.00	h	-	-
<b>16 days</b>					<b>16/16*</b>	<b>0.00</b>	<b>0</b>						<b>16/16*</b>	<b>0.00</b>	<b>0</b>
07/01/12	0	0.00	0.00	0.00	h	-	-	07/01/12	0	0.00	0.00	0.04-0.24	h	-	-
07/02/12	0	0.00	0.00	0.00	h	-	-	07/02/12	0	0.00	0.00	0.00	h	-	-
07/03/12	0	0.00	0.00	0.00	h	-	-	07/03/12	0	0.00	0.00	0.00	h	-	-
07/04/12	0	0.00	0.00	0.00	h	-	-	07/04/12	0	0.00	0.00	0.00	h	-	-
07/05/12	0	0.00	0.00	0.00	h	-	-	07/05/12	0	0.00	0.00	0.00	h	-	-
07/06/12	0	0.00	0.00	0.00	h	-	-	07/06/12	0	0.00	0.00	0.00	h	-	-
07/07/12	0	0.00	0.00	0.00	h	-	-	07/07/12	0	0.00	0.00	0.00	h	-	-
07/08/12	0	0.00	0.00	0.00	h	-	-	07/08/12	0	0.00	0.00	0.00	h	-	-
07/09/12	0	0.00	0.00	0.00	h	-	-	07/09/12	0	0.00	0.00	0.00	h	-	-
07/10/12	10	0.35	0.24	0.04-0.24	h	-	-	07/10/12	10	0.50	0.31	0.25-0.43	h	-	-
07/11/12	30	0.75	0.04	0.00	m	-	-	07/11/12	30	0.75	0.00	0.00	m	-	-
07/12/12	30	0.75	0.08	0.00	m	-	-	07/12/12	30	0.75	0.00	0.04-0.24	m	-	-
07/13/12	10	0.50	0.00	0.00	h	-	-	07/13/12	0	0.00	0.00	0.00	h	-	-
07/14/12	0	0.00	0.16	2.21-2.40	m	m	-	07/14/12	10	0.15	0.55	1.03-1.22	m	m	-
07/15/12	20	0.35	0.04	0.84-1.02	m	m	-	07/15/12	20	0.50	0.31	0.25-0.43	h	-	-
07/16/12	30	0.35	0.00	0.04-0.24	h	-	-	07/16/12	30	0.75	0.20	0.64-0.83	h	h	-
07/17/12	10	0.25	0.00	0.00	h	-	-	07/17/12	20	0.35	0.00	0.25-0.43	h	-	-
07/18/12	0	0.00	0.00	0.04-0.24	h	-	-	07/18/12	0	0.00	0.00	0.00	h	-	-
07/19/12	20	1.25	0.00	0.04-0.24	m	-	-	07/19/12	20	0.75	1.46-1.73	1.23-1.61	h	h	-
07/20/12	50	1.50	0.12	0.04-0.24	m	-	x	07/20/12	50	1.25	0.12	0.00	m	-	x

**TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2013**

Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
07/21/12	30	0.50	0.63	0.44-0.63	h	h	-	40	0.50	0.67	0.64-0.83	h	h	-
07/22/12	40	1.00	0.12	0.64-0.83	h	h	-	40	0.75	0.00	0.00	m	-	x
07/23/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/24/12	10	0.35	0.00	0.00	h	-	-	10	0.35	0.00	0.00	h	-	-
07/25/12	10	0.75	0.04	0.00	h	-	-	10	1.00	0.24	0.04-0.24	h	-	-
07/26/12	10	0.75	0.00	0.00	h	-	-	10	1.00	0.20	0.00	h	-	-
07/27/12	0	0.00	0.24	0.04-0.24	m	-	-	0	0.00	0.24	0.25-0.43	m	-	-
07/28/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/29/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/30/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/31/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
<b>31 days</b>					<b>24/31*</b>	<b>2/4*</b>	<b>1</b>					<b>25/31*</b>	<b>3/4*</b>	<b>2</b>
08/01/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/02/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/03/12	0	0.00	0.00	0.25-0.43	h	-	-	0	0.00	0.00	0.00	h	-	-
08/04/12	10	0.25	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/05/12	20	0.15	0.04	0.00	h	-	-	10	0.10	0.08	0.00	h	-	-
08/06/12	30	0.15	0.08	0.04-0.24	h	-	-	30	0.25	0.08	0.04-0.24	h	-	-
08/07/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/10/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/11/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/12/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/13/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/14/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.08	0.04-0.24	m	-	-
08/15/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/16/12	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 2013**

Date	Forecast Zone Data				Verification			Date	Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR		Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
08/17/12	20	0.50	0.16	0.25-0.43	h	-	-	08/17/12	20	0.50	0.35	0.64-0.83	h	h	-
08/18/12	20	0.50	0.08	0.25-0.43	h	-	-	08/18/12	10	0.40	0.08	0.04-0.24	h	-	-
08/19/12	10	0.20	0.00	0.00	h	-	-	08/19/12	0	0.00	0.00	0.00	h	-	-
08/20/12	0	0.00	0.00	0.00	h	-	-	08/20/12	0	0.00	0.00	0.00	h	-	-
08/21/12	10	0.10	0.00	0.00	h	-	-	08/21/12	10	0.10	0.00	0.00	h	-	-
08/22/12	20	0.50	0.00	0.00	h	-	-	08/22/12	0	0.00	0.00	0.04-0.24	m	-	-
08/23/12	20	0.20	0.20	0.44-0.63	h	m	-	08/23/12	10	0.15	0.94	1.23-1.61	m	m	-
08/24/12	60	0.75	0.08	0.04-0.24	m	-	x	08/24/12	60	0.75	0.79	1.03-1.22	h	h	-
08/25/12	60	0.50	0.00	0.00	m	-	x	08/25/12	60	0.50	0.16	0.04-0.24	m	-	x
08/26/12	40	0.40	0.43	0.44-0.63	h	-	-	08/26/12	30	0.30	0.47	0.44-0.63	h	-	-
08/27/12	10	0.15	0.24	0.84-1.02	m	m	-	08/27/12	0	0.00	0.00	0.00	h	-	-
08/28/12	10	0.50	0.24	0.44-0.63	h	h	-	08/28/12	10	0.50	1.42	1.62-1.81	m	h	-
08/29/12	40	0.75	0.47	0.64-0.83	h	h	-	08/29/12	30	0.50	0.04	0.04-0.24	m	-	-
08/30/12	20	0.30	0.00	0.04-0.24	h	-	-	08/30/12	30	0.30	0.08	0.04-0.24	h	-	-
08/31/12	10	0.25	0.00	0.00	h	-	-	08/31/12	10	0.50	0.04	0.00	m	-	-
<b>31 days</b>					<b>28/31*</b>	<b>2/4*</b>	<b>2</b>						<b>24/31*</b>	<b>3/4*</b>	<b>1</b>
09/01/12	0	0.00	0.00	0.00	h	-	-	09/01/12	0	0.00	0.00	0.00	h	-	-
09/02/12	30	0.30	0.00	0.00	m	-	-	09/02/12	30	0.20	0.00	0.00	m	-	-
09/03/12	40	0.50	0.00	0.00	m	-	x	09/03/12	40	0.40	0.00	0.00	m	-	-
09/04/12	10	0.10	0.00	0.00	h	-	-	09/04/12	10	0.10	0.00	0.00	h	-	-
09/05/12	0	0.00	0.00	0.00	h	-	-	09/05/12	0	0.00	0.00	0.00	h	-	-
09/06/12	30	0.75	0.04	0.25-0.43	h	-	-	09/06/12	10	0.50	0.12	0.25-0.43	h	-	-
09/07/12	40	0.50	0.00	0.00	m	-	x	09/07/12	40	0.30	0.00	0.00	m	-	-
09/08/12	30	0.50	0.08	0.04-0.24	m	-	-	09/08/12	40	0.50	0.16	0.25-0.43	h	-	-
09/09/12	30	0.50	0.47	0.44-0.63	h	-	-	09/09/12	50	0.50	1.06	1.03-1.22	m	h	-
09/10/12	60	0.75	0.16	0.04-0.24	m	-	-	09/10/12	70	1.25	0.55	0.25-0.43	m	-	-
09/11/12	20	0.25	0.00	n/a	m	-	-	09/11/12	20	0.25	0.00	n/a	m	-	-
09/12/12	0	0.00	0.00	n/a	h	-	-	09/12/12	0	0.00	0.00	n/a	h	-	-

**TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2013**

	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
09/13/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/14/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.12	n/a	m	-	-
09/15/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/16/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
30 days					24/30*	0	2					23/30*	1/1*	0
	Northwest Valley							Upper Centennial						
06/15/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/12	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 2013**

Date	Forecast Zone Data				Verification			Date	Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR		Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
06/22/12	0	0.00	0.00	0.00	h	-	-	06/22/12	0	0.00	0.00	0.00	h	-	-
06/23/12	0	0.00	0.00	0.00	h	-	-	06/23/12	0	0.00	0.00	0.00	h	-	-
06/24/12	0	0.00	0.00	0.00	h	-	-	06/24/12	0	0.00	0.00	0.00	h	-	-
06/25/12	0	0.00	0.00	0.00	h	-	-	06/25/12	0	0.00	0.00	0.00	h	-	-
06/26/12	0	0.00	0.00	0.00	h	-	-	06/26/12	0	0.00	0.00	0.00	h	-	-
06/27/12	0	0.00	0.00	0.00	h	-	-	06/27/12	0	0.00	0.00	0.00	h	-	-
06/28/12	0	0.00	0.00	0.00	h	-	-	06/28/12	0	0.00	0.00	0.00	h	-	-
06/29/12	0	0.00	0.00	0.00	h	-	-	06/29/12	0	0.00	0.00	0.00	h	-	-
06/30/12	0	0.00	0.00	0.00	h	-	-	06/30/12	0	0.00	0.00	0.00	h	-	-
<b>16 days</b>					<b>16/16*</b>	<b>0.00</b>	<b>0</b>						<b>16/16*</b>	<b>0.00</b>	<b>0</b>
07/01/12	0	0.00	0.00	0.00	h	-	-	07/01/12	10	0.10	0.00	0.00	h	-	-
07/02/12	10	0.10	0.00	0.00	h	-	-	07/02/12	10	0.10	0.00	0.00	h	-	-
07/03/12	0	0.00	0.00	0.00	h	-	-	07/03/12	0	0.00	0.00	0.00	h	-	-
07/04/12	0	0.00	0.00	0.00	h	-	-	07/04/12	0	0.00	0.00	0.00	h	-	-
07/05/12	0	0.00	0.00	0.00	h	-	-	07/05/12	0	0.00	0.00	0.00	h	-	-
07/06/12	0	0.00	0.00	0.00	h	-	-	07/06/12	0	0.00	0.00	0.00	h	-	-
07/07/12	0	0.00	0.00	0.00	h	-	-	07/07/12	0	0.00	0.00	0.00	h	-	-
07/08/12	0	0.00	0.00	0.00	h	-	-	07/08/12	0	0.00	0.00	0.00	h	-	-
07/09/12	0	0.00	0.00	0.00	h	-	-	07/09/12	0	0.00	0.00	0.00	h	-	-
07/10/12	20	0.50	0.24	0.25-0.43	h	-	-	07/10/12	20	0.50	0.00	0.00	m	-	-
07/11/12	30	0.75	0.08	0.00	m	-	-	07/11/12	30	1.00	0.51	0.04-0.24	h	h	-
07/12/12	30	0.75	0.04	0.00	m	-	-	07/12/12	30	1.00	0.00	0.00	m	-	x
07/13/12	0	0.00	0.00	0.00	h	-	-	07/13/12	0	0.00	0.00	0.00	h	-	-
07/14/12	10	0.25	0.12	0.04-0.24	h	-	-	07/14/12	20	0.25	0.16	0.64-0.83	m	m	-
07/15/12	30	0.75	0.04	0.04-0.24	m	-	-	07/15/12	30	0.50	0.28	0.64-0.83	h	h	-
07/16/12	40	0.75	0.20	0.25-0.43	h	-	-	07/16/12	30	0.75	0.04	0.04-0.24	m	-	-
07/17/12	20	0.50	0.12	0.25-0.43	h	-	-	07/17/12	30	0.50	0.04	0.64-0.83	h	h	-
07/18/12	10	0.10	0.00	0.00	h	-	-	07/18/12	10	0.25	0.00	0.00	h	-	-

**TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2013**

Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
07/19/12	20	0.75	0.91-1.06	1.23-1.61	h	h	-	40	1.25	0.24	0.44-0.63	h	h	-
07/20/12	40	1.25	0.00	0.00	m	-	x	50	1.50	0.94	1.23-1.61	h	h	-
07/21/12	40	0.75	0.16	0.25-0.43	m	-	x	40	1.25	1.93	2.61-2.80	h	h	-
07/22/12	30	0.75	0.00	0.04-0.24	m	-	-	30	1.00	0.00	0.25-0.43	m	-	x
07/23/12	10	0.50	0.00	0.00	h	-	-	10	0.50	0.00	0.00	h	-	-
07/24/12	20	0.50	0.00	0.25-0.43	h	-	-	20	0.35	0.47	0.64-0.83	h	-	-
07/25/12	10	1.00	0.00	0.00	h	-	-	20	1.00	0.08	0.44-0.63	h	h	-
07/26/12	10	1.00	0.28	0.04-0.24	h	-	-	20	1.00	0.83	1.23-1.61	h	h	-
07/27/12	10	0.15	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/28/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/29/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/30/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/31/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
<b>31 days</b>					<b>25/31*</b>	<b>1/1*</b>	<b>2</b>					<b>26/31*</b>	<b>8/9*</b>	<b>2</b>
08/01/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/02/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/03/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/04/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/05/12	10	0.15	0.08	0.00	h	-	-	20	0.25	0.04	0.00	h	-	-
08/06/12	40	0.35	0.16	0.04-0.24	h	-	-	30	0.25	0.04	0.04-0.24	h	-	-
08/07/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/10/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/11/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/12/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/13/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/14/12	0	0.00	0.04	0.00	m	-	-	0	0.00	0.00	0.00	h	-	-

**TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2013**

Date	Forecast Zone Data				Verification			Date	Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR		Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
08/15/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
08/16/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.84-1.02	m	m	-
08/17/12	20	0.50	0.00	0.04-0.24	h	-	-	30	0.33	0.71	1.82-2.01	1.82-2.01	m	m	-
08/18/12	20	0.40	0.00	0.04-0.24	h	-	-	20	0.33	0.16	0.44-0.63	0.44-0.63	h	-	-
08/19/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
08/20/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
08/21/12	20	0.15	0.00	0.00	m	-	-	10	0.15	0.00	0.25-0.43	0.25-0.43	h	-	-
08/22/12	10	0.50	0.00	0.00	h	-	-	20	0.75	0.43	1.23-1.61	1.23-1.61	h	h	-
08/23/12	10	0.30	0.63	1.03-1.22	m	m	-	20	0.30	0.20	1.62-1.81	1.62-1.81	m	m	-
08/24/12	60	1.00	0.83	1.03-1.22	h	h	-	60	1.00	2.28	2.41-2.60	2.41-2.60	m	h	-
08/25/12	60	0.75	0.08	0.24-0.43	m	-	-	70	1.00	0.47	1.03-1.22	1.03-1.22	h	h	-
08/26/12	30	0.60	0.59	0.44-0.63	h	h	-	40	0.60	1.30	1.23-1.61	1.23-1.61	m	h	-
08/27/12	0	0.00	0.00	0.00	h	-	-	10	0.15	0.04	0.00	0.00	h	-	-
08/28/12	10	0.50	0.16	0.84-1.02	h	h	-	0	0.00	0.43	1.23-1.61	1.23-1.61	m	m	-
08/29/12	30	0.50	0.00	0.00	m	-	-	30	0.75	1.38	1.23-1.61	1.23-1.61	h	h	-
08/30/12	40	0.75	1.30	1.23-1.61	h	h	-	40	0.75	0.04	1.62-1.81	1.62-1.81	m	h	-
08/31/12	20	0.75	0.04	0.84-1.02	h	h	-	20	0.75	0.28	0.84-1.02	0.84-1.02	h	h	-
<b>31 days</b>					<b>26/31*</b>	<b>5/6*</b>	<b>0</b>						<b>24/31*</b>	<b>7/11*</b>	<b>0</b>
09/01/12	20	0.35	0.00	0.00	m	-	-	20	0.35	0.04	0.44-0.63	0.44-0.63	h	-	-
09/02/12	20	0.20	0.00	0.00	m	-	-	20	0.20	0.63	1.23-1.61	1.23-1.61	m	m	-
09/03/12	50	0.60	0.00	0.00	m	-	x	50	0.50	0.00	0.00	0.00	m	-	x
09/04/12	10	0.10	0.00	0.00	h	-	-	10	0.20	0.00	0.00	0.00	h	-	-
09/05/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
09/06/12	0	0.00	0.28	0.44-0.63	m	m	-	0	0.00	0.79	1.23-1.61	1.23-1.61	m	m	-
09/07/12	40	0.30	0.00	0.00	m	-	-	50	0.75	0.00	0.04-0.24	0.04-0.24	m	-	x
09/08/12	40	0.75	0.20	0.44-0.63	h	h	-	40	0.75	0.04	0.25-0.43	0.25-0.43	m	-	x
09/09/12	50	0.75	1.26	0.84-1.02	h	h	-	50	1.00	1.34	1.62-1.81	1.62-1.81	h	h	-
09/10/12	70	1.50	1.77	1.23-1.61	h	h	-	80	2.00	1.97	2.21-2.40	2.21-2.40	h	h	-

**TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2013**

	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
09/11/12	20	0.25	0.00	n/a	m	-	-	30	0.50	0.00	n/a	m	-	-
09/12/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/13/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/14/12	0	0.00	0.08	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/15/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/16/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
30 days					24/30*	3/4*	1					24/30*	2/4*	3
	Wickenburg							New River Cave Creek						
06/15/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/12	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 2013**

Date	Forecast Zone Data				Verification			Date	Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR		Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
06/20/12	0	0.00	0.00	0.00	h	-	-	06/20/12	0	0.00	0.00	0.00	h	-	-
06/21/12	0	0.00	0.00	0.00	h	-	-	06/21/12	0	0.00	0.00	0.00	h	-	-
06/22/12	0	0.00	0.00	0.00	h	-	-	06/22/12	0	0.00	0.00	0.00	h	-	-
06/23/12	0	0.00	0.00	0.00	h	-	-	06/23/12	0	0.00	0.00	0.00	h	-	-
06/24/12	0	0.00	0.00	0.00	h	-	-	06/24/12	0	0.00	0.00	0.00	h	-	-
06/25/12	0	0.00	0.00	0.00	h	-	-	06/25/12	0	0.00	0.00	0.00	h	-	-
06/26/12	0	0.00	0.00	0.00	h	-	-	06/26/12	0	0.00	0.00	0.00	h	-	-
06/27/12	0	0.00	0.00	0.00	h	-	-	06/27/12	0	0.00	0.00	0.00	h	-	-
06/28/12	0	0.00	0.00	0.00	h	-	-	06/28/12	0	0.00	0.00	0.00	h	-	-
06/29/12	0	0.00	0.00	0.00	h	-	-	06/29/12	0	0.00	0.00	0.00	h	-	-
06/30/12	0	0.00	0.00	0.00	h	-	-	06/30/12	0	0.00	0.00	0.00	h	-	-
<b>16 days</b>					<b>16/16*</b>	<b>0.00</b>	<b>0</b>						<b>16/16*</b>	<b>0.00</b>	<b>0</b>
07/01/12	10	0.10	0.00	0.00	h	-	-	07/01/12	10	0.15	0.00	0.00	h	-	-
07/02/12	10	0.10	0.00	0.00	h	-	-	07/02/12	20	0.15	0.00	0.00	h	-	-
07/03/12	0	0.00	0.00	0.00	h	-	-	07/03/12	20	0.20	0.00	0.00	h	-	-
07/04/12	0	0.00	0.00	0.00	h	-	-	07/04/12	0	0.00	0.00	0.00	h	-	-
07/05/12	0	0.00	0.00	0.00	h	-	-	07/05/12	0	0.00	0.00	0.00	h	-	-
07/06/12	0	0.00	0.00	0.00	h	-	-	07/06/12	0	0.00	0.00	0.00	h	-	-
07/07/12	0	0.00	0.00	0.00	h	-	-	07/07/12	0	0.00	0.00	0.00	h	-	-
07/08/12	0	0.00	0.00	0.00	h	-	-	07/08/12	0	0.00	0.00	0.00	h	-	-
07/09/12	0	0.00	0.00	0.00	h	-	-	07/09/12	10	0.10	0.00	0.00	h	-	-
07/10/12	20	0.50	0.00	0.00	m	-	-	07/10/12	30	0.75	0.00	0.00	m	-	-
07/11/12	30	1.00	0.00	0.00	m	-	x	07/11/12	50	1.25	0.00	0.00	m	-	x
07/12/12	30	1.00	0.12	0.04-0.24	m	-	x	07/12/12	50	1.00	0.04	0.00	m	-	x
07/13/12	0	0.00	0.00	0.00	h	-	-	07/13/12	20	0.75	0.00	0.00	m	-	-
07/14/12	20	0.25	0.16	0.44-0.63	h	-	-	07/14/12	20	0.25	0.04	0.00	h	-	-
07/15/12	30	0.50	0.83	1.03-1.22	h	h	-	07/15/12	30	0.75	1.26	1.23-1.61	h	h	-
07/16/12	40	0.75	0.16	0.24-0.43	m	-	x	07/16/12	40	1.00	0.75	0.84-1.02	h	h	-

**TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2013**

Date	Forecast Zone Data				Verification			Date	Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR		Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
07/17/12	30	0.75	0.71	1.03-1.22	h	h	-	07/17/12	40	0.75	0.12	0.04-0.24	m	-	x
07/18/12	10	0.25	0.12	0.00	h	-	-	07/18/12	20	0.15	0.04	0.00	h	-	-
07/19/12	40	1.25	0.67	0.64-0.83	h	h	-	07/19/12	40	1.25	0.79	1.03-1.22	h	h	-
07/20/12	50	1.50	0.04	0.64-0.83	h	h	-	07/20/12	60	1.50	0.20	0.25-0.43	m	-	x
07/21/12	40	1.25	0.04	0.64-0.83	h	h	x	07/21/12	60	1.00	1.65-2.01	1.23-1.61	h	h	-
07/22/12	30	1.00	1.30-1.57	1.23-1.61	h	h	-	07/22/12	40	1.00	0.75	0.25-0.43	h	h	-
07/23/12	10	0.50	0.00	0.00	h	-	-	07/23/12	20	0.50	0.00	0.00	h	-	-
07/24/12	30	0.50	0.47	0.84-1.02	h	h	-	07/24/12	30	0.75	0.35	0.44-0.63	h	h	-
07/25/12	20	1.00	0.04	0.00	m	-	-	07/25/12	30	1.25	0.00	0.00	m	-	x
07/26/12	20	1.00	0.79	0.84-1.02	h	h	-	07/26/12	30	1.25	1.42	1.03-1.22	h	h	-
07/27/12	0	0.00	0.04	0.00	h	-	-	07/27/12	10	0.15	0.04	0.00	h	-	-
07/28/12	0	0.00	0.00	0.00	h	-	-	07/28/12	0	0.00	0.00	0.00	h	-	-
07/29/12	0	0.00	0.00	0.00	h	-	-	07/29/12	0	0.00	0.00	0.00	h	-	-
07/30/12	0	0.00	0.00	0.00	h	-	-	07/30/12	0	0.00	0.00	0.00	h	-	-
07/31/12	0	0.00	0.00	0.00	h	-	-	07/31/12	20	0.15	0.00	0.00	m	-	-
<b>31 days</b>					<b>26/31*</b>	<b>8/8*</b>	<b>4</b>						<b>23/31*</b>	<b>7/7*</b>	<b>5</b>
08/01/12	0	0.00	0.00	0.00	h	-	-	08/01/12	20	0.40	0.00	0.00	m	-	-
08/02/12	0	0.00	0.00	0.00	h	-	-	08/02/12	10	0.40	0.00	0.00	h	-	-
08/03/12	0	0.00	0.00	0.00	h	-	-	08/03/12	0	0.00	0.00	0.00	h	-	-
08/04/12	0	0.00	0.00	0.00	h	-	-	08/04/12	0	0.00	0.00	0.00	h	-	-
08/05/12	20	0.25	0.00	0.00	h	-	-	08/05/12	20	0.20	0.00	0.00	m	-	-
08/06/12	40	0.25	0.04	0.04-0.24	h	-	-	08/06/12	60	0.50	0.35	0.64-0.83	h	h	-
08/07/12	0	0.00	0.00	0.00	h	-	-	08/07/12	0	0.00	0.00	0.00	h	-	-
08/08/12	0	0.00	0.00	0.00	h	-	-	08/08/12	0	0.00	0.00	0.00	h	-	-
08/09/12	0	0.00	0.00	0.00	h	-	-	08/09/12	0	0.00	0.00	0.00	h	-	-
08/10/12	0	0.00	0.00	0.00	h	-	-	08/10/12	0	0.00	0.00	0.00	h	-	-
08/11/12	0	0.00	0.00	0.00	h	-	-	08/11/12	10	0.15	0.00	0.00	h	-	-
08/12/12	0	0.00	0.00	0.00	h	-	-	08/12/12	0	0.00	0.00	0.00	h	-	-



**TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2013**

Date	Forecast Zone Data				Verification			Date	Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR		Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
08/13/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
08/14/12	0	0.00	0.04	0.04-0.24	m	-	-	0	0.00	0.00	0.00	0.00	h	-	-
08/15/12	0	0.00	0.00	0.00	h	-	-	10	0.15	0.24	0.04-0.24	0.04-0.24	h	-	-
08/16/12	10	0.25	0.28	1.03-1.22	m	m	-	10	0.25	0.59	1.23-1.61	1.23-1.61	m	m	-
08/17/12	30	0.33	0.67	1.23-1.61	m	m	-	40	1.25	0.12	0.04-0.24	0.04-0.24	m	-	x
08/18/12	20	0.33	0.12	0.25-0.43	h	-	-	30	0.60	0.00	0.00	0.00	m	-	-
08/19/12	0	0.00	0.00	0.00	h	-	-	10	0.20	0.00	0.00	0.00	h	-	-
08/20/12	0	0.00	0.00	0.00	h	-	-	10	0.10	0.04	0.00	0.00	h	-	-
08/21/12	20	0.15	0.00	0.00	m	-	-	30	0.25	0.16	0.00	0.00	h	-	-
08/22/12	20	0.75	0.24	0.64-0.83	h	h	-	30	0.75	0.00	0.04-0.24	0.04-0.24	m	-	-
08/23/12	20	0.30	0.67	2.21-2.40	m	m	-	30	0.50	0.67	1.03-1.22	1.03-1.22	h	h	-
08/24/12	60	1.00	1.97	2.02-2.20	m	h	-	60	0.75	0.20	0.04-0.24	0.04-0.24	m	-	x
08/25/12	70	1.00	0.16	0.25-0.43	m	-	x	60	0.75	0.16	0.25-0.43	0.25-0.43	h	-	x
08/26/12	40	0.60	1.54	0.84-1.02	m	h	-	40	0.50	0.39	0.25-0.43	0.25-0.43	h	-	-
08/27/12	10	0.15	0.08	0.00	h	-	-	10	0.25	0.00	0.04-0.24	0.04-0.24	h	-	-
08/28/12	0	0.00	0.31	0.44-0.63	m	-	-	20	0.67	0.43	0.64-0.83	0.64-0.83	h	h	-
08/29/12	30	0.75	1.89	1.62-1.81	m	h	-	40	1.00	0.55	0.04-0.24	0.04-0.24	m	m	-
08/30/12	50	0.75	0.63	0.64-0.83	h	h	-	50	1.25	0.63	1.23-1.61	1.23-1.61	h	h	-
08/31/12	30	0.75	0.12	1.03-1.22	h	h	-	30	0.75	0.63	0.84-1.02	0.84-1.02	h	h	-
<b>31 days</b>					<b>21/31*</b>	<b>6/9*</b>	<b>1</b>						<b>23/31*</b>	<b>5/7*</b>	<b>3</b>
09/01/12	20	0.35	0.04	0.00	m	-	-	20	0.35	0.00	0.00	0.00	m	-	-
09/02/12	20	0.25	0.04	0.84-1.02	m	m	-	30	0.30	0.16	0.04-0.24	0.04-0.24	h	-	-
09/03/12	50	0.50	0.00	0.00	m	-	x	60	1.00	0.04	0.04-0.24	0.04-0.24	m	-	x
09/04/12	10	0.20	0.00	0.00	h	-	-	10	0.10	0.00	0.00	0.00	h	-	-
09/05/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
09/06/12	0	0.00	0.59	0.44-0.63	m	h	-	30	0.75	0.12	0.25-0.43	0.25-0.43	h	-	-
09/07/12	50	0.75	0.00	0.00	m	-	x	30	0.50	0.04	0.00	0.00	m	-	-
09/08/12	40	0.75	0.16	0.00	m	-	x	70	1.25	2.44	0.64-0.83	0.64-0.83	h	h	-

**TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2013**

	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
09/09/12	50	1.00	1.34	0.64-0.83	h	h	-	70	1.50	1.77-2.01	2.02-2.20	h	h	-
09/10/12	80	2.00	2.28	2.61-2.80	h	h	-	70	1.50	0.75	0.44-0.63	h	h	-
09/11/12	30	0.50	0.00	n/a	m	-	-	20	0.25	0.00	n/a	m	-	-
09/12/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/13/12	0	0.00	0.00	n/a	h	-	-	10	0.15	0.00	n/a	h	-	-
09/14/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.16	n/a	m	-	-
09/15/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/16/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
30 days					23/30*	3/4*	3					25/30*	3/3*	1
	Sycamore Creek							Phoenix North						
06/15/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/12	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 2013**

Date	Forecast Zone Data				Verification			Date	Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR		Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
06/18/12	0	0.00	0.00	0.00	h	-	-	06/18/12	0	0.00	0.00	0.00	h	-	-
06/19/12	0	0.00	0.00	0.00	h	-	-	06/19/12	0	0.00	0.00	0.00	h	-	-
06/20/12	0	0.00	0.00	0.00	h	-	-	06/20/12	0	0.00	0.00	0.00	h	-	-
06/21/12	0	0.00	0.00	0.00	h	-	-	06/21/12	0	0.00	0.00	0.00	h	-	-
06/22/12	0	0.00	0.00	0.00	h	-	-	06/22/12	0	0.00	0.00	0.00	h	-	-
06/23/12	0	0.00	0.00	0.00	h	-	-	06/23/12	0	0.00	0.00	0.00	h	-	-
06/24/12	0	0.00	0.00	0.00	h	-	-	06/24/12	0	0.00	0.00	0.00	h	-	-
06/25/12	0	0.00	0.00	0.00	h	-	-	06/25/12	0	0.00	0.00	0.00	h	-	-
06/26/12	0	0.00	0.00	0.00	h	-	-	06/26/12	0	0.00	0.00	0.00	h	-	-
06/27/12	0	0.00	0.00	0.00	h	-	-	06/27/12	0	0.00	0.00	0.00	h	-	-
06/28/12	0	0.00	0.00	0.00	h	-	-	06/28/12	0	0.00	0.00	0.00	h	-	-
06/29/12	0	0.00	0.00	0.00	h	-	-	06/29/12	0	0.00	0.00	0.00	h	-	-
06/30/12	0	0.00	0.00	0.00	h	-	-	06/30/12	0	0.00	0.00	0.00	h	-	-
<b>16 days</b>					<b>16/16*</b>	<b>0.00</b>	<b>0</b>						<b>16/16*</b>	<b>0.00</b>	<b>0</b>
07/01/12	20	0.15	0.00	0.00	h	-	-	07/01/12	0	0.00	0.00	0.00	h	-	-
07/02/12	20	0.15	0.00	0.00	h	-	-	07/02/12	0	0.00	0.00	0.00	h	-	-
07/03/12	20	0.20	0.00	0.00	h	-	-	07/03/12	0	0.00	0.00	0.00	h	-	-
07/04/12	0	0.00	0.00	0.00	h	-	-	07/04/12	0	0.00	0.00	0.00	h	-	-
07/05/12	0	0.00	0.00	0.00	h	-	-	07/05/12	0	0.00	0.00	0.00	h	-	-
07/06/12	0	0.00	0.00	0.00	h	-	-	07/06/12	0	0.00	0.00	0.00	h	-	-
07/07/12	0	0.00	0.00	0.00	h	-	-	07/07/12	0	0.00	0.00	0.00	h	-	-
07/08/12	20	0.15	0.04	0.04-0.24	h	-	-	07/08/12	0	0.00	0.00	0.00	h	-	-
07/09/12	20	0.10	0.00	0.00	h	-	-	07/09/12	0	0.00	0.00	0.00	h	-	-
07/10/12	30	0.75	0.00	0.00	m	-	-	07/10/12	20	0.50	0.00	0.00	m	-	-
07/11/12	50	1.25	0.00	0.00	m	-	x	07/11/12	40	1.25	0.00	0.00	m	-	x
07/12/12	50	1.00	0.55	0.44-0.63	h	h	-	07/12/12	40	1.00	0.00	0.00	m	-	x
07/13/12	30	1.00	0.00	0.00	m	-	x	07/13/12	10	0.50	0.00	0.00	h	-	-
07/14/12	20	0.25	0.04	0.00	h	-	-	07/14/12	10	0.10	0.00	0.00	h	-	-

**TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2013**

	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
07/15/12	30	0.75	0.47	0.44-0.63	h	h	-	20	0.50	0.00	0.00	m	-	-
07/16/12	40	1.00	0.79	1.03-1.22	h	h	-	30	0.50	0.12	0.44-0.63	h	h	-
07/17/12	40	0.75	0.00	0.00	m	-	x	20	0.40	0.00	0.00	h	-	-
07/18/12	20	0.15	1.10	0.44-0.63	m	m	-	0	0.00	0.00	0.00	h	-	-
07/19/12	50	1.25	0.59	0.64-0.83	h	h	-	30	1.00	0.87	1.23-1.61	h	h	-
07/20/12	70	1.75	0.24	0.25-0.43	m	-	x	40	1.25	0.04	0.00	m	-	x
07/21/12	60	1.00	0.67	0.64-0.83	h	h	-	60	0.75	1.02-1.97	1.23-1.61	h	h	-
07/22/12	40	1.00	0.00	0.00	m	-	x	30	0.75	0.00	0.00	m	-	x
07/23/12	20	0.50	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/24/12	30	0.75	0.79	0.25-0.43	h	h	-	20	0.35	0.28	0.04-0.24	h	-	-
07/25/12	30	1.25	0.94	0.84-1.02	h	h	-	30	1.25	0.20	0.00	m	-	x
07/26/12	100	1.00	0.91	0.25-0.43	h	h	-	30	1.25	0.16	0.04-0.24	m	-	x
07/27/12	10	0.15	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/28/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/29/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/30/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/31/12	20	0.15	0.00	0.00	m	-	-	10	0.05	0.00	0.00	h	-	-
31 days					23/31*	8/9*	5					23/31*	3/3*	6
08/01/12	30	0.50	0.00	0.00	m	-	-	10	0.15	0.00	0.00	h	-	-
08/02/12	20	0.50	0.00	0.00	m	-	-	0	0.00	0.00	0.00	h	-	-
08/03/12	10	0.40	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/04/12	10	0.40	0.04	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/05/12	20	0.20	0.00	0.00	m	-	-	10	0.10	0.00	0.00	h	-	-
08/06/12	60	0.50	0.04	0.04-0.24	m	-	-	60	0.40	0.04	0.04-0.24	m	-	-
08/07/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/08/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/09/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/10/12	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 2013**

Date	Forecast Zone Data				Verification			Date	Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR		Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
08/11/12	10	0.25	0.00	0.00	h	-	-	08/11/12	10	0.10	0.00	0.00	h	-	-
08/12/12	0	0.00	0.00	0.00	h	-	-	08/12/12	0	0.00	0.00	0.00	h	-	-
08/13/12	0	0.00	0.00	0.00	h	-	-	08/13/12	0	0.00	0.00	0.00	h	-	-
08/14/12	0	0.00	0.00	0.00	h	-	-	08/14/12	0	0.00	0.16	0.04-0.24	m	-	-
08/15/12	10	0.15	0.00	0.04-0.24	h	-	-	08/15/12	0	0.00	0.00	0.00	h	-	-
08/16/12	10	0.25	0.04	1.23-1.61	m	m	-	08/16/12	0	0.00	0.00	0.00	h	-	-
08/17/12	50	1.25	0.00	0.00	m	-	x	08/17/12	40	0.75	0.08	0.04-0.24	m	-	x
08/18/12	30	0.60	0.00	0.00	m	-	-	08/18/12	0	0.00	0.00	0.00	h	-	-
08/19/12	10	0.20	0.00	0.00	h	-	-	08/19/12	0	0.00	0.00	0.00	h	-	-
08/20/12	10	0.10	0.00	0.00	h	-	-	08/20/12	0	0.00	0.00	0.00	h	-	-
08/21/12	30	0.25	0.12	0.00	h	-	-	08/21/12	10	0.10	0.24	0.25-0.43	m	-	-
08/22/12	30	0.75	0.51	0.84-1.02	h	h	-	08/22/12	20	0.50	0.00	0.00	m	-	-
08/23/12	30	0.50	0.08	0.00	m	-	-	08/23/12	20	0.15	1.22	1.03-1.22	m	m	-
08/24/12	60	0.75	0.00	0.00	m	-	x	08/24/12	50	0.40	0.04	0.00	m	-	-
08/25/12	60	0.75	0.04	0.04-0.24	m	-	x	08/25/12	40	0.40	0.04	0.00	m	-	-
08/26/12	40	0.50	0.08	0.44-0.63	h	-	-	08/26/12	30	0.30	0.43	0.25-0.43	h	-	-
08/27/12	10	0.25	0.04	0.00	h	-	-	08/27/12	0	0.00	0.00	0.00	h	-	-
08/28/12	20	0.67	0.00	0.25-0.43	h	-	-	08/28/12	50	0.40	0.59	0.44-0.63	h	m	-
08/29/12	50	1.00	0.24	1.23-1.61	h	h	-	08/29/12	30	0.50	0.04	0.00	m	-	-
08/30/12	50	1.25	0.00	0.00	m	-	x	08/30/12	30	0.60	0.51	1.23-1.61	h	h	-
08/31/12	30	0.75	0.20	0.00	m	-	-	08/31/12	20	0.50	0.04	0.25-0.43	h	-	-
<b>31 days</b>					<b>19/31*</b>	<b>2/3*</b>	<b>4</b>						<b>22/31*</b>	<b>1/3*</b>	<b>1</b>
09/01/12	20	0.35	0.00	0.00	m	-	-	09/01/12	0	0.00	0.00	0.00	h	-	-
09/02/12	30	0.30	0.00	0.04-0.24	h	-	-	09/02/12	10	0.10	0.12	0.00	h	-	-
09/03/12	60	1.00	0.51	0.44-0.63	h	h	-	09/03/12	40	0.40	0.00	0.00	m	-	-
09/04/12	10	0.10	0.00	0.00	h	-	-	09/04/12	0	0.00	0.00	0.00	h	-	-
09/05/12	0	0.00	0.00	0.00	h	-	-	09/05/12	0	0.00	0.00	0.00	h	-	-
09/06/12	30	0.67	0.00	0.00	m	-	-	09/06/12	20	0.50	0.12	0.04-0.24	m	-	-

**TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2013**

	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
09/07/12	30	0.50	0.00	0.00	m	-	-	20	0.35	0.00	0.00	m	-	-
09/08/12	70	1.25	0.91	0.25-0.43	h	h	-	50	0.75	0.75	0.25-0.43	h	h	-
09/09/12	70	1.50	1.38	1.23-1.61	h	h	-	60	0.75	2.48	2.51-2.68	m	m	-
09/10/12	60	1.00	0.39	0.04-0.24	m	-	x	50	0.75	0.35	0.25-0.43	m	-	x
09/11/12	20	0.25	0.00	n/a	m	-	-	10	0.25	0.00	n/a	h	-	-
09/12/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/13/12	10	0.15	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/14/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/15/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/16/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
30 days					25/30*	3/3*	1					25/30*	1/2*	1
	Phoenix South							Scottsdale North						
06/15/12	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 2013**

Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
06/16/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/23/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/24/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/25/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/29/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/30/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
<b>16 days</b>					<b>16/16*</b>	<b>0.00</b>	<b>0</b>					<b>16/16*</b>	<b>0.00</b>	<b>0</b>
07/01/12	0	0.00	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
07/02/12	0	0.00	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
07/03/12	0	0.00	0.00	0.00	h	-	-	10	trace	0.00	0.00	h	-	-
07/04/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/09/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/10/12	20	0.50	0.24	0.04-0.24	h	-	-	20	0.50	0.04	0.00	m	-	-
07/11/12	30	0.75	0.00	0.00	m	-	-	40	1.25	0.00	0.00	m	-	x
07/12/12	30	0.75	0.00	0.00	m	-	-	40	1.00	0.00	0.00	m	-	x

**TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2013**

Date	Forecast Zone Data				Verification			Date	Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR		Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
07/13/12	20	0.75	0.00	0.00	m	-	-	07/13/12	20	0.75	0.00	0.00	m	-	-
07/14/12	10	0.10	0.00	0.00	h	-	-	07/14/12	10	0.10	0.16	0.04-0.24	h	-	-
07/15/12	20	0.50	0.71	1.03-1.22	h	h	-	07/15/12	30	0.50	0.16	0.04-0.24	h	-	-
07/16/12	30	0.50	0.39	0.25-0.43	h	-	-	07/16/12	30	0.75	0.31	0.25-0.43	h	-	-
07/17/12	20	0.40	0.00	0.00	m	-	-	07/17/12	30	0.75	0.00	0.00	m	-	-
07/18/12	0	0.00	0.04	0.04-0.24	h	-	-	07/18/12	0	0.00	0.04	0.00	h	-	-
07/19/12	20	0.75	0.83	0.64-0.83	h	h	-	07/19/12	30	1.00	0.71-1.18	0.84-1.02	h	h	-
07/20/12	30	0.75	0.67	0.44-0.63	h	h	-	07/20/12	40	1.25	1.18-1.42	1.23-1.61	h	h	-
07/21/12	60	0.75	1.02	0.84-1.02	h	h	-	07/21/12	60	0.75	0.87	1.03-1.22	h	h	-
07/22/12	30	0.75	0.00	0.00	m	-	x	07/22/12	30	0.75	0.00	0.00	m	-	x
07/23/12	0	0.00	0.00	0.00	h	-	-	07/23/12	0	0.00	0.00	0.00	h	-	-
07/24/12	10	0.35	0.08	0.04-0.24	h	-	-	07/24/12	20	0.50	0.20	0.04-0.24	h	-	-
07/25/12	20	0.75	0.75	0.25-0.43	h	h	-	07/25/12	30	1.25	0.12	0.04-0.24	m	-	x
07/26/12	20	0.75	0.16	0.00	m	-	-	07/26/12	30	1.25	0.31	0.00	m	-	x
07/27/12	0	0.00	0.08	0.00	m	-	-	07/27/12	0	0.00	0.00	0.00	h	-	-
07/28/12	0	0.00	0.00	0.00	h	-	-	07/28/12	0	0.00	0.00	0.00	h	-	-
07/29/12	0	0.00	0.00	0.00	h	-	-	07/29/12	0	0.00	0.00	0.00	h	-	-
07/30/12	0	0.00	0.00	0.00	h	-	-	07/30/12	0	0.00	0.00	0.00	h	-	-
07/31/12	10	0.05	0.00	0.00	h	-	-	07/31/12	10	0.05	0.00	0.00	h	-	-
<b>31 days</b>					<b>24/31*</b>	<b>5/5*</b>	<b>1</b>						<b>23/31*</b>	<b>3/3*</b>	<b>5</b>
08/01/12	10	0.25	0.00	0.00	h	-	-	08/01/12	10	0.25	0.00	0.00	h	-	-
08/02/12	0	0.00	0.00	0.00	h	-	-	08/02/12	10	0.40	0.00	0.00	h	-	-
08/03/12	0	0.00	0.00	0.00	h	-	-	08/03/12	0	0.00	0.00	0.00	h	-	-
08/04/12	0	0.00	0.00	0.00	h	-	-	08/04/12	0	0.00	0.00	0.00	h	-	-
08/05/12	10	0.10	0.03	0.00	h	-	-	08/05/12	10	0.10	0.00	0.00	h	-	-
08/06/12	40	0.30	0.07	0.04-0.24	h	-	-	08/06/12	50	0.50	0.59	0.64-0.83	h	h	-
08/07/12	0	0.00	0.00	0.00	h	-	-	08/07/12	0	0.00	0.00	0.00	h	-	-
08/08/12	0	0.00	0.00	0.00	h	-	-	08/08/12	0	0.00	0.00	0.00	h	-	-



**TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2013**

Date	Forecast Zone Data				Verification			Date	Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR		Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
08/09/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
08/10/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
08/11/12	0	0.00	0.00	0.00	h	-	-	10	0.15	0.00	0.00	0.00	h	-	-
08/12/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
08/13/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
08/14/12	0	0.00	0.08	0.04-0.24	m	-	-	0	0.00	0.00	0.00	0.24-0.43	m	-	-
08/15/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
08/16/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.04-0.24	h	-	-
08/17/12	20	0.60	0.15	0.04-0.24	m	-	-	40	0.75	0.00	0.00	0.04-0.24	m	-	x
08/18/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
08/19/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
08/20/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
08/21/12	10	0.10	0.00	0.00	h	-	-	10	0.10	0.00	0.00	0.00	h	-	-
08/22/12	0	0.00	0.00	0.00	h	-	-	20	0.50	0.00	0.00	0.00	m	-	-
08/23/12	10	0.10	0.31	0.64-0.83	m	m	-	20	0.15	0.04	0.04	0.04-0.24	h	-	-
08/24/12	50	0.40	0.04	0.00	m	-	-	50	0.50	0.16	0.16	0.00	m	-	x
08/25/12	50	0.30	0.00	0.00	m	-	-	40	0.40	0.04	0.04	0.00	m	-	-
08/26/12	30	0.30	0.75	0.64-0.83	m	-	-	30	0.30	0.00	0.00	0.00	m	-	-
08/27/12	0	0.00	0.00	0.00	h	-	-	0	0.00	1.06	0.84	1.02	m	m	-
08/28/12	0	0.00	0.28	0.25-0.43	m	-	-	50	0.40	0.43	0.43	0.25-0.43	h	-	-
08/29/12	30	0.50	0.00	0.00	m	-	-	40	0.75	0.16	0.16	0.04-0.24	m	-	x
08/30/12	30	0.40	0.71	1.03-1.22	m	m	-	50	0.50	0.67	0.67	0.44-0.63	h	h	-
08/31/12	10	0.50	0.00	0.00	h	-	-	20	0.50	0.08	0.08	1.62-1.81	m	m	-
<b>31 days</b>					<b>22/31*</b>	<b>0/2*</b>	<b>0</b>						<b>22/31*</b>	<b>2/4*</b>	<b>3</b>
09/01/12	0	0.00	0.00	0.00	h	-	-	20	0.25	0.00	0.00	0.00	m	-	-
09/02/12	20	0.20	0.35	0.00	h	-	-	20	0.20	0.00	0.00	0.00	m	-	-
09/03/12	40	0.40	0.00	0.00	m	-	-	50	0.60	0.12	0.12	0.04-0.24	m	-	x
09/04/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-

**TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2013**

Date	Forecast Zone Data				Verification			Date	Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR		Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
09/05/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
09/06/12	0	0.00	0.24	0.25-0.43	m	-	-	20	0.50	0.12	0.00	0.00	m	-	-
09/07/12	20	0.35	0.00	0.00	m	-	-	30	0.50	0.08	0.00	0.00	m	-	-
09/08/12	50	0.75	0.39	0.64-0.83	h	h	-	70	1.00	0.91	0.64-0.83	0.64-0.83	h	h	-
09/09/12	60	0.75	1.34	0.84-1.02	h	h	-	70	1.00	1.54	1.23-1.61	1.23-1.61	h	h	-
09/10/12	40	0.50	0.08	0.00	m	-	x	50	0.75	0.43	0.25-0.43	0.25-0.43	h	-	-
09/11/12	0	0.00	0.00	n/a	h	-	-	10	0.25	0.00	n/a	n/a	h	-	-
09/12/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	n/a	h	-	-
09/13/12	0	0.00	0.00	n/a	h	-	-	10	0.15	0.00	n/a	n/a	h	-	-
09/14/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	n/a	h	-	-
09/15/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	n/a	h	-	-
09/16/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
09/17/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
09/18/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
09/19/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
09/20/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
09/21/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
09/22/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
09/23/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
09/24/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
09/25/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
09/26/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
09/27/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
09/28/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
09/29/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
09/30/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	0.00	h	-	-
<b>30 days</b>					<b>26/30*</b>	<b>2/2*</b>	<b>1</b>						<b>25/30*</b>	<b>2/2*</b>	<b>1</b>

**TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2013**

Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
	Scottsdale South							Southeast Valley						
06/15/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/23/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/24/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/25/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/29/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/30/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
<b>16 days</b>					<b>16/16*</b>	<b>0.00</b>	<b>0</b>					<b>16/16*</b>	<b>0.00</b>	<b>0</b>
07/01/12	0	0.00	0.00	0.00	h	-	-	10	trace	0.00	0.00	h	-	-
07/02/12	0	0.00	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
07/03/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/04/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/12	0	0.00	0.00	0.00	h	-	-	10	trace	0.00	0.00	h	-	-
07/07/12	0	0.00	0.00	0.00	h	-	-	10	trace	0.00	0.00	h	-	-
07/08/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/09/12	10	Trace	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
07/10/12	20	0.50	0.00	0.00	m	-	-	30	0.50	0.00	0.00	m	-	-

**TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2013**

	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
07/11/12	30	0.75	0.00	0.00	m	-	-	30	0.75	0.12	0.04-0.24	h	-	-
07/12/12	30	0.75	0.08	0.00	m	-	-	60	0.75	0.28	0.04-0.24	m	-	x
07/13/12	20	0.75	0.00	0.00	m	-	-	20	0.75	0.00	0.00	m	-	-
07/14/12	10	0.10	0.16	0.04-0.24	h	-	-	10	0.10	0.08	0.04-0.24	h	-	-
07/15/12	20	0.50	0.08	0.00	m	-	-	20	0.75	0.91	0.64-0.83	h	h	-
07/16/12	30	0.50	0.67	0.25-0.43	h	h	-	30	0.75	0.31	0.25-0.43	h	-	-
07/17/12	20	0.40	0.00	0.00	m	-	-	20	0.50	0.00	0.00	m	-	-
07/18/12	0	0.00	0.04	0.04-0.24	h	-	-	10	0.10	0.24	0.04-0.24	h	-	-
07/19/12	20	0.75	0.87	0.44-0.63	h	h	-	20	0.50	0.08	0.00	m	-	-
07/20/12	30	0.75	0.51	0.44-0.63	h	h	-	30	0.75	0.67-0.98	0.64-0.83	h	h	-
07/21/12	60	0.75	1.69-1.97	1.03-1.22	h	h	-	70	0.75	0.94	0.44-0.63	h	h	-
07/22/12	30	0.75	0.00	0.00	m	-	x	30	0.75	0.00	0.00	m	-	x
07/23/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/24/12	10	0.50	0.12	0.00	h	-	-	10	0.50	0.00	0.00	h	-	-
07/25/12	20	0.75	1.38	0.25-0.43	m	m	-	20	0.75	1.38	0.25-0.43	m	m	-
07/26/12	20	0.75	0.00	0.00	m	-	-	20	0.75	0.67	0.25-0.43	h	h	-
07/27/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/28/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/29/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/30/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/31/12	10	0.05	0.00	0.00	h	-	-	10	0.05	0.00	0.00	h	-	-
31 days					22/31*	4/5*	1					24/31*	4/5*	2
08/01/12	10	0.25	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
08/02/12	0	0.00	0.00	0.00	h	-	-	20	0.30	0.00	0.00	m	-	-
08/03/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/04/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/05/12	10	0.10	0.00	0.00	h	-	-	10	0.15	0.28	0.00	h	-	-
08/06/12	40	0.30	0.24	0.04-0.24	h	-	-	50	0.30	0.35	0.25-0.43	h	-	-

**TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2013**

Date	Forecast Zone Data				Verification			Date	Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR		Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
08/07/12	0	0.00	0.00	0.00	h	-	-	08/07/12	0	0.00	0.00	0.00	h	-	-
08/08/12	0	0.00	0.00	0.00	h	-	-	08/08/12	0	0.00	0.00	0.00	h	-	-
08/09/12	0	0.00	0.00	0.00	h	-	-	08/09/12	0	0.00	0.00	0.00	h	-	-
08/10/12	0	0.00	0.00	0.00	h	-	-	08/10/12	0	0.00	0.00	0.00	h	-	-
08/11/12	0	0.00	0.00	0.00	h	-	-	08/11/12	0	0.00	0.00	0.00	h	-	-
08/12/12	0	0.00	0.00	0.00	h	-	-	08/12/12	0	0.00	0.00	0.00	h	-	-
08/13/12	0	0.00	0.00	0.00	h	-	-	08/13/12	0	0.00	0.00	0.00	h	-	-
08/14/12	0	0.00	0.08	0.04-0.24	m	-	-	08/14/12	0	0.00	0.12	0.25-0.43	m	-	-
08/15/12	0	0.00	0.00	0.00	h	-	-	08/15/12	0	0.00	0.00	0.00	h	-	-
08/16/12	0	0.00	0.00	0.00	h	-	-	08/16/12	0	0.00	0.00	0.00	h	-	-
08/17/12	20	0.60	0.04	0.04-0.24	m	-	-	08/17/12	30	0.65	0.08	0.04-0.24	m	-	-
08/18/12	0	0.00	0.00	0.00	h	-	-	08/18/12	10	0.33	0.00	0.00	m	-	-
08/19/12	0	0.00	0.00	0.00	h	-	-	08/19/12	0	0.00	0.00	0.00	h	-	-
08/20/12	0	0.00	0.08	0.00	m	-	-	08/20/12	0	0.00	0.00	0.00	h	-	-
08/21/12	10	0.10	0.00	0.00	h	-	-	08/21/12	10	0.10	0.00	0.00	h	-	-
08/22/12	0	0.00	0.00	0.00	h	-	-	08/22/12	0	0.00	0.00	0.00	h	-	-
08/23/12	10	0.10	0.04	0.00	h	-	-	08/23/12	10	0.15	0.00	0.04-0.24	h	-	-
08/24/12	50	0.40	0.16	0.00	m	-	-	08/24/12	50	0.50	0.08	0.00	m	-	x
08/25/12	40	0.30	0.04	0.00	m	-	-	08/25/12	40	0.50	0.00	0.00	m	-	x
08/26/12	30	0.30	0.43	0.25-0.43	h	-	-	08/26/12	30	0.50	0.75	0.64-0.83	h	h	-
08/27/12	0	0.00	0.00	0.00	h	-	-	08/27/12	0	0.00	0.08	0.04-0.24	m	-	-
08/28/12	0	0.00	0.35	0.04-0.24	m	-	-	08/28/12	0	0.00	0.55	0.00	m	m	-
08/29/12	30	0.50	0.04	0.00	m	-	-	08/29/12	40	0.75	0.00	0.00	m	-	x
08/30/12	30	0.40	0.00	0.00	m	-	-	08/30/12	30	0.50	0.91	1.03-1.22	h	h	-
08/31/12	10	0.50	0.04	0.00	h	-	-	08/31/12	10	0.50	0.04	0.00	m	-	-
<b>31 days</b>					<b>23/31*</b>	<b>0/0*</b>	<b>0</b>						<b>21/31*</b>	<b>2/3*</b>	<b>3</b>
09/01/12	0	0.00	0.00	0.00	h	-	-	09/01/12	10	0.25	0.00	0.00	h	-	-
09/02/12	20	0.20	0.08	0.00	m	-	-	09/02/12	20	0.25	0.35	0.04-0.24	h	-	-

**TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2013**

Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
09/03/12	40	0.40	0.00	0.00	m	-	-	50	0.75	0.16	0.04-0.24	m	-	x
09/04/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/05/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/12	0	0.00	0.24	0.04-0.24	m	-	-	10	0.50	0.20	0.25-0.43	h	-	-
09/07/12	20	0.35	0.04	0.00	m	-	-	30	0.50	0.00	0.00	m	-	-
09/08/12	50	0.75	0.35	0.25-0.43	h	-	x	50	1.00	0.91	0.44-0.63	h	h	-
09/09/12	50	0.75	0.87	0.44-0.63	h	h	-	60	1.00	1.38-2.32	1.03-1.22	h	h	-
09/10/12	40	0.50	0.08	0.04-0.24	m	-	x	40	0.75	0.00	0.00	m	-	x
09/11/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/12/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/13/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/14/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/15/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/16/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/12	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 2013**

	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
30 days					25/30*	1/1*	2					27/30*	2/2*	2
	Lower Salt River Lakes							Superstition						
06/15/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/23/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/24/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/25/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/26/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/29/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/30/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
16 days					16/16*	0.00	0					16/16*	0.00	0
07/01/12	10	0.15	0.00	0.00	h	-	-	10	0.15	0.00	0.00	h	-	-
07/02/12	20	0.10	0.00	0.00	h	-	-	20	0.10	0.00	0.00	h	-	-
07/03/12	10	0.05	0.00	0.00	h	-	-	10	0.05	0.00	0.00	h	-	-
07/04/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/12	10	0.10	0.00	0.00	h	-	-	10	0.10	0.31	0.44-0.63	m	-	-
07/07/12	10	0.10	0.00	0.00	h	-	-	10	0.10	0.00	0.00	h	-	-
07/08/12	20	0.15	0.00	0.00	h	-	-	20	0.15	0.04	0.04-0.24	h	-	-

**TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2013**

Date	Forecast Zone Data				Verification			Date	Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR		Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
07/09/12	20	0.15	0.00	0.00	h	-	-	07/09/12	20	0.15	0.00	0.00	h	-	-
07/10/12	30	0.75	0.04	0.04-0.24	m	-	-	07/10/12	30	0.75	0.00	0.04-0.24	m	-	-
07/11/12	30	1.00	0.00	0.00	m	-	x	07/11/12	30	1.00	0.00	0.00	m	-	x
07/12/12	60	1.00	0.00	0.25-0.43	m	-	x	07/12/12	60	1.00	0.59	0.64-0.83	h	h	-
07/13/12	20	1.00	0.00	0.00	m	-	-	07/13/12	20	1.00	0.00	0.00	m	-	-
07/14/12	20	0.25	0.00	0.04-0.24	h	-	-	07/14/12	20	0.25	0.39	0.25-0.43	h	-	-
07/15/12	30	0.75	0.00	0.04-0.24	h	-	-	07/15/12	30	0.75	0.28	0.04-0.24	h	-	-
07/16/12	40	1.00	0.00	0.25-0.43	m	-	x	07/16/12	40	1.00	0.04	0.00	m	-	x
07/17/12	30	0.50	0.00	0.00	m	-	-	07/17/12	30	0.50	0.00	0.00	m	-	-
07/18/12	20	0.15	0.00	0.04-0.24	h	-	-	07/18/12	20	0.15	0.31	0.04-0.24	h	-	-
07/19/12	30	0.75	0.00	0.00	m	-	x	07/19/12	30	1.00	0.20	0.04-0.24	m	-	x
07/20/12	40	1.25	0.08	0.44-0.63	h	h		07/20/12	40	1.00	0.47-0.59	0.64-0.83	h	h	-
07/21/12	80	1.00	0.71	1.03-1.22	h	h		07/21/12	80	1.00	1.14-1.30	1.03-1.22	h	h	-
07/22/12	40	1.00	0.00	0.00	m	-	x	07/22/12	30	1.00	0.00	0.00	m	-	x
07/23/12	10	0.50	0.00	0.00	h	-	-	07/23/12	10	0.50	0.00	0.00	h	-	-
07/24/12	30	0.50	0.00	0.00	m	-	-	07/24/12	20	0.50	0.00	0.00	m	-	-
07/25/12	20	1.00	0.04	0.25-0.43	m	-	-	07/25/12	20	1.00	0.04	0.00	m	-	-
07/26/12	100	1.00	0.00	0.04-0.24	m	-	x	07/26/12	20	1.00	1.22	0.25-0.43	h	h	-
07/27/12	10	0.15	0.00	0.00	h	-	-	07/27/12	10	0.15	0.04	0.00	h	-	-
07/28/12	0	0.00	0.00	0.00	h	-	-	07/28/12	0	0.00	0.00	0.00	h	-	-
07/29/12	0	0.00	0.00	0.00	h	-	-	07/29/12	0	0.00	0.00	0.00	h	-	-
07/30/12	0	0.00	0.00	0.00	h	-	-	07/30/12	0	0.00	0.00	0.00	h	-	-
07/31/12	20	0.15	0.00	0.00	m	-	-	07/31/12	10	0.15	0.00	0.00	h	-	-
<b>31 days</b>					<b>19/31*</b>	<b>2/2*</b>	<b>6</b>						<b>21/31*</b>	<b>4/4*</b>	<b>4</b>
08/01/12	30	0.50	0.00	0.00	m	-	-	08/01/12	20	0.40	0.00	0.00	m	-	-
08/02/12	20	0.40	0.00	0.00	m	-	-	08/02/12	20	0.30	0.00	0.00	m	-	-
08/03/12	0	0.00	0.00	0.00	h	-	-	08/03/12	0	0.00	0.00	0.00	h	-	-
08/04/12	10	0.40	0.00	0.00	h	-	-	08/04/12	0	0.00	0.00	0.00	h	-	-



**TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2013**

Date	Forecast Zone Data				Verification			Date	Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR		Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
08/05/12	20	0.20	0.00	0.00	m	-	-	08/05/12	20	0.20	0.12	0.00	h	-	-
08/06/12	60	0.50	0.12	0.00	m	-	-	08/06/12	60	0.50	0.16	0.04-0.24	m	-	-
08/07/12	0	0.00	0.00	0.00	h	-	-	08/07/12	0	0.00	0.00	0.00	h	-	-
08/08/12	0	0.00	0.00	0.00	h	-	-	08/08/12	0	0.00	0.00	0.00	h	-	-
08/09/12	0	0.00	0.00	0.00	h	-	-	08/09/12	0	0.00	0.00	0.00	h	-	-
08/10/12	0	0.00	0.00	0.00	h	-	-	08/10/12	0	0.00	0.00	0.00	h	-	-
08/11/12	10	0.15	0.00	0.00	h	-	-	08/11/12	10	0.10	0.00	0.00	h	-	-
08/12/12	0	0.00	0.00	0.00	h	-	-	08/12/12	0	0.00	0.00	0.00	h	-	-
08/13/12	0	0.00	0.00	0.00	h	-	-	08/13/12	0	0.00	0.00	0.00	h	-	-
08/14/12	0	0.00	0.00	0.00	h	-	-	08/14/12	0	0.00	0.00	0.00	h	-	-
08/15/12	10	0.15	0.00	0.44-0.63	m	m	-	08/15/12	10	0.10	0.00	0.00	h	-	-
08/16/12	10	0.25	0.00	0.25-0.43	h	-	-	08/16/12	10	0.25	0.00	0.04-0.24	h	-	-
08/17/12	40	1.00	0.00	0.00	m	-	x	08/17/12	40	0.75	0.08	0.04-0.24	m	-	x
08/18/12	20	0.50	0.00	0.00	m	-	-	08/18/12	10	0.40	0.00	0.00	m	-	-
08/19/12	10	0.20	0.00	0.00	h	-	-	08/19/12	10	0.15	0.00	0.00	h	-	-
08/20/12	10	0.10	0.00	0.00	h	-	-	08/20/12	0	0.00	0.04	0.00	h	-	-
08/21/12	30	0.25	0.00	0.00	m	-	-	08/21/12	20	0.15	0.00	0.00	m	-	-
08/22/12	20	0.75	0.00	0.64-0.83	h	h	-	08/22/12	10	0.50	0.00	0.00	h	-	-
08/23/12	20	0.40	0.00	0.00	m	-	-	08/23/12	10	0.30	0.28	0.04-0.24	h	-	-
08/24/12	40	0.50	0.00	0.00	m	-	x	08/24/12	40	0.50	0.00	0.00	m	-	x
08/25/12	50	0.50	0.00	0.00	m	-	x	08/25/12	50	0.50	0.00	0.00	m	-	x
08/26/12	40	0.50	0.00	0.44-0.63	h	h	-	08/26/12	40	0.50	0.00	0.00	m	-	x
08/27/12	10	0.25	0.00	0.00	h	-	-	08/27/12	0	0.00	0.24	0.04-0.24	m	-	-
08/28/12	50	0.75	0.04	0.00	m	-	x	08/28/12	10	0.67	0.16	0.00	m	-	-
08/29/12	60	1.00	0.08	0.25-0.43	m	-	x	08/29/12	50	0.75	0.04	0.04-0.24	m	-	x
08/30/12	50	1.00	0.00	0.44-0.63	m	-	x	08/30/12	30	0.75	1.81	1.82-2.01	m	m	-
08/31/12	30	0.75	0.00	0.00	m	-	-	08/31/12	20	0.75	0.00	0.00	m	-	-
<b>31 days</b>					<b>16/31*</b>	<b>2/3*</b>	<b>6</b>						<b>17/31*</b>	<b>0/1*</b>	<b>5</b>

**TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon Season 2013**

	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
Date	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
09/01/12	20	0.25	0.00	0.00	m	-	-	10	0.15	0.00	0.00	h	-	-
09/02/12	30	0.50	0.00	0.04-0.24	h	-	-	20	0.30	0.00	0.00	m	-	-
09/03/12	60	0.75	0.00	0.04-0.24	m	-	x	60	0.75	0.16	0.44-0.63	h	-	-
09/04/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/05/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/12	20	0.67	0.00	0.00	m	-	-	20	0.67	0.24	0.04-0.24	m	-	-
09/07/12	30	0.50	0.00	0.00	m	-	-	30	0.50	0.00	0.00	m	-	-
09/08/12	60	1.00	0.24	0.00	m	-	x	60	1.00	0.43	0.25-0.43	m	-	x
09/09/12	60	1.00	1.61	2.02-2.20	h	h	-	60	1.00	1.93	1.82-2.01	h	h	-
09/10/12	50	0.75	0.00	0.00	m	-	x	50	0.75	0.00	0.00	m	-	x
09/11/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/12/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/13/12	10	0.15	0.00	n/a	h	-	-	10	0.15	0.00	n/a	h	-	-
09/14/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/15/12	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
09/16/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/12	10	0.25	0.00	0.00	h	-	-	10	0.25	0.00	0.00	h	-	-
09/18/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/12	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/12	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 2013**

Date	Forecast Zone Data				Verification				Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR		Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FAR
09/30/12	0	0.00	0.00	0.00	h	-	-		0	0.00	0.00	0.00	h	-	-
30 days					24/30*	1/1*	3						25/30*	1/1*	2

**TABLE A-2:** This table shows the verification data of MSP issued precipitation forecasts contained in the daily Outlooks for the 2013 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.

<b>TABLE A-2: MSP Weather Outlook Verification</b>						
<b>Forecast Zone</b>	<b>Accurate Forecasts</b>	<b>AOF (%)</b>	<b>Sig. Events Detected</b>	<b>POD (%)</b>	<b>False Alarms</b>	<b>FAR (%)</b>
<b>JUNE</b>						
Gila Bend	16/16	100.0%	0/0	n/a	0	0.0%
Palo Verde	16/16	100.0%	0/0	n/a	0	0.0%
Rainbow Valley	16/16	100.0%	0/0	n/a	0	0.0%
West Valley	16/16	100.0%	0/0	n/a	0	0.0%
Northwest Valley	16/16	100.0%	0/0	n/a	0	0.0%
Upper Centennial	16/16	100.0%	0/0	n/a	0	0.0%
Wickenburg	16/16	100.0%	0/0	n/a	0	0.0%
New River/Cave Creek	16/16	100.0%	0/0	n/a	0	0.0%
Sycamore Creek	16/16	100.0%	0/0	n/a	0	0.0%
Phoenix North	16/16	100.0%	0/0	n/a	0	0.0%
Phoenix South	16/16	100.0%	0/0	n/a	0	0.0%
Scottsdale North	16/16	100.0%	0/0	n/a	0	0.0%
Scottsdale South	16/16	100.0%	0/0	n/a	0	0.0%
Southeast Valley	16/16	100.0%	0/0	n/a	0	0.0%
Lower Salt River Lakes	16/16	100.0%	0/0	n/a	0	0.0%
Superstition	16/16	100.0%	0/0	n/a	0	0.0%

<b>TABLE A-2: MSP Weather Outlook Verification</b>						
<b>Forecast Zone</b>	<b>Accurate Forecasts</b>	<b>AOF (%)</b>	<b>Sig. Events Detected</b>	<b>POD (%)</b>	<b>False Alarms</b>	<b>FAR (%)</b>
<b>All Zones</b>	<b>256/256</b>	<b>100.0%</b>	<b>0/0</b>	<b>n/a</b>	<b>0</b>	<b>0.0%</b>
<b>JULY</b>						
Gila Bend	23/31	74.2%	3/4	75.0%	1	3.2%
Palo Verde	25/31	80.6%	1/2	50.0%	2	6.5%
Rainbow Valley	24/31	77.4%	2/4	50.0%	1	3.2%
West Valley	25/31	80.6%	3/4	75.0%	2	6.5%
Northwest Valley	25/31	80.6%	1/1	100.0%	2	6.5%
Upper Centennial	26/31	83.9%	8/9	88.9%	2	6.5%
Wickenburg	26/31	83.9%	8/8	100.0%	4	12.9%
New River/Cave Creek	23/31	74.2%	7/7	100.0%	5	16.1%
Sycamore Creek	23/31	74.2%	8/9	88.9%	5	16.1%
Phoenix North	23/31	74.2%	3/3	100.0%	6	19.4%
Phoenix South	24/31	77.4%	5/5	100.0%	1	3.2%
Scottsdale North	23/31	74.2%	3/3	100.0%	5	16.1%
Scottsdale South	22/31	71.0%	4/5	80.0%	1	3.2%
Southeast Valley	24/31	77.4%	4/5	80.0%	2	6.5%
Lower Salt River Lakes	19/31	61.3%	2/2	100.0%	6	19.4%
Superstition	21/31	67.7%	4/4	100.0%	4	12.9%
<b>All Zones</b>	<b>376/496</b>	<b>75.8%</b>	<b>66/75</b>	<b>88.0%</b>	<b>49</b>	<b>9.9%</b>
<b>AUGUST</b>						
Gila Bend	22/31	71.0%	6/7	85.7%	1	3.2%
Palo Verde	26/31	83.9%	5/7	71.4%	1	3.2%
Rainbow Valley	28/31	83.9%	2/4	50.0%	2	6.5%
West Valley	24/31	77.4%	3/4	75.0%	1	3.2%
Northwest Valley	26/31	83.9%	5/6	83.3%	0	0.0%
Upper Centennial	24/31	77.4%	7/11	63.6%	0	0.0%
Wickenburg	21/31	67.7%	6/9	66.7%	1	3.2%
New River/Cave Creek	23/31	74.2%	5/7	71.4%	3	9.7%
Sycamore Creek	19/31	61.3%	2/3	66.7%	4	12.9%

<b>TABLE A-2: MSP Weather Outlook Verification</b>						
<b>Forecast Zone</b>	<b>Accurate Forecasts</b>	<b>AOF (%)</b>	<b>Sig. Events Detected</b>	<b>POD (%)</b>	<b>False Alarms</b>	<b>FAR (%)</b>
Phoenix North	22/31	71.0%	1/3	33.3%	1	3.2%
Phoenix South	22/31	71.0%	0/2	0.0%	0	0.0%
Scottsdale North	22/31	71.0%	2/4	50.0%	3	9.7%
Scottsdale South	23/31	74.2%	0/0	n/a	0	0.0%
Southeast Valley	21/31	67.7%	2/3	66.7%	3	9.7%
Lower Salt River Lakes	16/31	51.6%	2/3	66.7%	6	19.4%
Superstition	17/31	54.8%	0/1	0.0%	5	16.1%
<b>All Zones</b>	<b>356/496</b>	<b>71.8%</b>	<b>48/74</b>	<b>64.9%</b>	<b>31</b>	<b>6.3%</b>
<b>SEPTEMBER</b>						
Gila Bend	23/30	76.7%	2/2	100.0%	3	10.0%
Palo Verde	23/30	76.7%	3/3	100.0%	1	3.3%
Rainbow Valley	24/30	80.0%	0/0	n/a	2	6.7%
West Valley	23/30	76.7%	1/1	100.0%	0	0.0%
Northwest Valley	24/30	80.0%	3/4	75.0%	1	3.3%
Upper Centennial	24/30	80.0%	2/4	50.0%	3	10.0%
Wickenburg	23/30	76.7%	3/4	75.0%	3	10.0%
New River/Cave Creek	25/30	83.3%	3/3	100.0%	1	3.3%
Sycamore Creek	25/30	83.3%	3/3	100.0%	1	3.3%
Phoenix North	25/30	83.3%	1/2	50.0%	1	3.3%
Phoenix South	26/30	86.7%	2/2	100.0%	1	3.3%
Scottsdale North	25/30	83.3%	2/2	100.0%	1	3.3%
Scottsdale South	25/30	83.3%	1/1	100.0%	2	6.7%
Southeast Valley	27/30	90.0%	2/2	100.0%	2	6.7%
Lower Salt River Lakes	24/30	80.0%	1/1	100.0%	3	10.0%
Superstition	25/30	83.3%	1/1	100.0%	2	6.7%
<b>All Zones</b>	<b>391/480</b>	<b>81.5%</b>	<b>30/35</b>	<b>85.7%</b>	<b>27</b>	<b>5.6%</b>

## APPENDIX B: MSP MESSAGES - VERIFICATION TABLES

**TABLE B-1:** This table shows each of the individual MSP Statements issued during the 2013 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 2013							
Statement Details						Forecast Rain	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Intensity (in/min)	STP (in)
07/06/13	22:28	Superstition	1	Henz	Now-1130pm	0.30-0.60/30min	-
07/14/13	18:24	W Valley	1	Henz	Now-715pm	0.50/30min	-
07/14/13	19:16	Palo Verde	1	Henz	Now-830pm	0.50/30min	-
07/14/13	19:55	Palo Verde	1U	Henz	Now-930pm	-	-
07/14/13	20:11	Rainbow Valley	1	Henz	Now-930pm	0.50/30min	1.00
07/15/13	13:27	Wickenburg	1	Henz	Now-245pm	0.50/30min	1.25
07/15/13	14:07	Wickenburg	1U	Henz	Now-330pm	-	-
07/15/13	15:15	Wickenburg	1U	Henz	Now-5pm	-	-
07/15/13	17:00	Phx South	1	Henz	Now-630pm	0.50/30min	1.00
07/15/13	17:23	SE Valley	1	Henz	Now-645pm	0.50/30min	1.00
07/17/13	16:08	Wickenburg	1	Henz	Now-530pm	0.50/30min	-
07/18/13	23:20	Sycamore Creek	1	Henz	Now-130am	0.75/20-30min	1.25
07/19/13	18:30	SE Valley	1	Waters	Now-730pm	-	-
07/19/13	18:30	Superstition	1	Waters	Now-730pm	-	-
07/19/13	22:53	NW Valley	1	Henz	Now-1230am	0.50-0.75/20min	1.25
07/19/13	22:53	West Valley	1	Henz	Now-1230am	0.50-0.75/20min	1.25
07/19/13	22:53	Phoenix South	1	Henz	Now-1230am	0.50-0.75/20min	1.25

<b>TABLE B-1: MSP Statements Issued - Monsoon Season 2013</b>							
<b>Statement Details</b>						<b>Forecast Rain</b>	
<b>Date</b>	<b>LST</b>	<b>MSP Forecast Zone</b>	<b>Message</b>	<b>Forecaster</b>	<b>Valid Time</b>	<b>Intensity (in/min)</b>	<b>STP (in)</b>
07/19/13	23:42	Wickenburg	1	Henz	Now-130am	0.50-0.75/30min	1.25
07/20/13	13:30	Palo Verde	2	Waters	4pm-12am	-	-
07/20/13	13:30	West Valley	2	Waters	4pm-12am	-	-
07/20/13	13:30	NW Valley	2	Waters	4pm-12am	-	-
07/20/13	13:30	Upper Cent.	2	Waters	4pm-12am	-	-
07/20/13	15:50	Upper Cent.	1	Waters	Now-5pm	-	-
07/20/13	16:05	Upper Cent.	3	Waters	Now-7pm	-	-
07/20/13	17:05	Palo Verde	1	Waters	Now-6pm	-	-
07/20/13	19:55	North Scot	1	Waters	Now-9pm	-	-
07/20/13	20:15	SE Valley	1	Waters	Now-930pm	0.75/30min	-
07/21/13	7:20	Gila Bend	3	Waters	Now-10am	-	-
07/21/13	12:51	Lower Salt Lakes	1	Henz	Now-230pm	1.00/30min	2.00
07/21/13	13:13	NR/CC	3	Henz	Now-4pm	0.75-1.00/20-30min	1.50
07/21/13	13:13	North Scot	3	Henz	Now-4pm	0.75-1.00/20-30min	1.50
07/21/13	13:50	SE Valley	1	Waters	Now-330pm	-	0.50-0.75
07/21/13	15:55	Gila Bend	1	Waters	4pm-6pm	-	-
07/22/13	11:48	Rainbow Valley	1	Henz	Now-2pm	0.50/15-30min	1.25
07/22/13	12:50	Phoenix South	1	Henz	Now-230pm	0.50-0.75/15-30min	1.25
07/22/13	17:03	Wickenburg	1	Henz	Now-730pm	0.50/20min	1.00
07/24/13	15:16	Sycamore Creek	1	Henz	Now-445pm	0.75/20-30min	1.25
07/25/13	16:00	Sycamore Creek	1	Waters	Now-5pm	1.00/20-30min	1.50
07/25/13	16:20	Sycamore Creek	3	Waters	445-630pm	-	-
07/25/13	16:45	Gila Bend	1	Waters	Now-6pm	0.75-1.00/45-60min	1.25
07/25/13	17:05	Gila Bend	3	Waters	630-9pm	-	-
07/25/13	18:35	Sycamore Creek	4	Waters	Now	-	-
07/26/13	14:20	Superstition	1	Henz	Now-430pm	0.75/15min	1.50
07/26/13	15:02	Superstition	1U	Henz	Now-430pm	-	-
07/26/13	22:20	NR/CC	1	Waters	Now-12am	0.75/30min, 1/1hr	1.25



TABLE B-1: MSP Statements Issued - Monsoon Season 2013							
Statement Details						Forecast Rain	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Intensity (in/min)	STP (in)
07/26/13	22:55	NW Valley	1	Waters	Now-12am	0.75/30min, 1/1hr	1.25
07/26/13	23:45	SE Valley	1	Waters	Now-1am	0.25/15min	0.50
07/26/13	23:45	Superstition	1	Waters	Now-1am	0.25/15min	0.50
08/17/13	21:00	Rainbow Valley	1	Waters	Now-1030pm	-	0.50
08/17/13	21:00	Palo Verde	1	Waters	Now-1030pm	-	0.50
08/18/13	18:50	Gila Bend	1	Waters	Now-730pm	-	-
08/18/13	18:30	Palo Verde	1	Waters	Now-8pm	1.00/1hr	1.00
08/18/13	20:15	Palo Verde	1U	Waters	Now-930pm	-	-
08/18/13	20:55	Palo Verde	3	Waters	Now-11pm	-	-
08/18/13	22:00	Palo Verde	4	Waters	Now	-	-
08/18/13	22:40	Wickenburg	1	Waters	Now-1130pm	0.50-0.75/30min	-
08/24/13	4:55	West Valley	1	Henz	Now-630am	0.50-0.75/20min	1.50
08/24/13	4:55	NW Valley	1	Henz	Now-630am	0.50-0.75/20min	1.50
08/24/13	5:04	Wickenburg	1	Henz	Now-7am	0.50-0.75/20min	1.50
08/24/13	5:17	Upper Cent.	1	Henz	Now-7am	0.50-0.75/20min	1.50
08/24/13	5:52	Wickenburg	3	Henz	Now-730am	-	-
08/24/13	6:13	Upper Cent.	3	Henz	Now-730am	-	-
08/24/13	7:05	Wickenburg	3U	Henz	Now-730am	-	-
08/24/13	7:19	Upper Cent.	3U	Henz	Now-12pm	-	-
08/24/13	7:22	Wickenburg	3U	Henz	Now-10am	-	-
08/24/13	11:04	Gila Bend	2	Henz	12pm-12pm 8/27	-	-
08/24/13	11:04	Palo Verde	2	Henz	12pm-12pm 8/27	-	-
08/24/13	11:04	Rainbow Valley	2	Henz	12pm-12pm 8/27	-	-
08/24/13	11:04	West Valley	2	Henz	12pm-12pm 8/27	-	-
08/24/13	11:04	NW Valley	2	Henz	12pm-12pm 8/27	-	-
08/24/13	11:04	Upper Cent.	2	Henz	12pm-12pm 8/27	-	-
08/24/13	11:04	Wickenburg	2	Henz	12pm-12pm 8/27	-	-
08/24/13	11:04	NR/CC	2	Henz	12pm-12pm 8/27	-	-

TABLE B-1: MSP Statements Issued - Monsoon Season 2013							
Statement Details						Forecast Rain	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Intensity (in/min)	STP (in)
08/24/13	11:04	Sycamore Creek	2	Henz	12pm-12pm 8/27	-	-
08/26/13	15:59	Lower Salt Lakes	1	Henz	Now-530pm	-	1.00-1.50
08/26/13	17:52	Gila Bend	1	Henz	Now-730pm	0.75/20min	1.25
08/26/13	18:18	SE Valley	1	Henz	Now-745pm	0.75/20min	1.50
08/26/13	18:31	Rainbow Valley	1	Henz	Now-745pm	0.75/20min	1.50
08/26/13	18:42	Gila Bend	3	Henz	Now-830pm	-	-
08/26/13	18:50	SE Valley	1U	Henz	Now-745pm	-	-
08/26/13	18:55	West Valley	1	Henz	Now-830pm	0.75/20min	1.50
08/26/13	18:55	Phoenix South	1	Henz	Now-830pm	0.75/20min	1.50
08/26/13	18:55	South Scot	1	Henz	Now-830pm	0.75/20min	1.50
08/26/13	19:13	Phoenix North	1	Henz	Now-845pm	0.50-0.75/20min	1.25
08/26/13	19:53	Palo Verde	1	Henz	Now-930pm	0.50-0.75/20min	1.50
08/26/13	20:18	Gila Bend	3U	Henz	Now-10pm	-	-
08/26/13	20:22	NW Valley	1	Henz	Now-930pm	0.50-0.75/20min	1.00
08/26/13	20:33	Wickenburg	1	Henz	Now-10pm	0.50-0.75/20min	1.25
08/26/13	20:33	Upper Cent.	1	Henz	Now-10pm	0.50-0.75/20min	1.25
08/26/13	20:54	Wickenburg	3	Henz	Now-1130pm	-	-
08/26/13	21:05	Upper Cent.	3	Henz	Now-1130pm	-	-
08/26/13	21:31	Wickenburg	3U	Henz	Now-1130pm	-	-
08/27/13	14:01	North Scot	1	Waters	Now-330pm	-	-
08/28/13	20:24	West Valley	1	Waters	Now-845pm	0.60/20min	-
08/28/13	20:49	Gila Bend	1	Waters	Now-930pm	0.60/30min	-
08/28/13	20:57	Palo Verde	1	Henz	Now-1030pm	0.50-0.75/20min	1.50
08/28/13	21:58	West Valley	1U	Henz	Now-1030pm	-	-
08/28/13	22:11	West Valley	1U	Henz	Now-1130pm	-	-
08/29/13	16:17	Gila Bend	1	Henz	Now-6pm	0.75/20min	1.25-1.75
08/29/13	17:07	Rainbow Valley	1	Henz	Now-630pm	0.75/20min	1.50
08/29/13	17:56	Wickenburg	1	Henz	Now-715pm	0.50-0.75/20min	1.50

TABLE B-1: MSP Statements Issued - Monsoon Season 2013							
Statement Details						Forecast Rain	
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	Intensity (in/min)	STP (in)
08/29/13	18:20	Wickenburg	3	Henz	Now-8pm	-	-
08/29/13	19:47	Wickenburg	3U	Henz	Now-10pm	-	-
08/29/13	21:35	Wickenburg	4	Henz	Now	-	-
08/30/13	16:27	NR/CC	1	Henz	Now-6pm	-	1.00-1.50
08/30/13	16:50	NW Valley	1	Henz	Now-615pm	0.75/20min	1.50-2.00
08/30/13	16:55	Superstition	1	Henz	Now-615pm	-	1.00-2.00
08/30/13	17:11	Superstition	1U	Henz	Now-615pm	-	-
08/30/13	17:24	SE Valley	1	Henz	Now-645pm	0.75/20min	1.25-1.75
08/30/13	17:56	SE Valley	1U	Henz	Now-645pm	-	-
08/30/13	18:15	Superstition	3	Henz	Now-8pm	-	-
09/03/13	15:50	Sycamore Creek	1	Henz	Now-5pm	0.50-0.75/20min	-
09/06/13	13:49	Gila Bend	1	Waters	Now-230pm	-	-
09/06/13	14:04	Gila Bend	3	Waters	Now-4pm	-	-
09/06/13	15:39	Palo Verde	1	Waters	Now-430pm	-	-
09/06/13	17:56	Gila Bend	4	Waters	Now	-	-
09/09/13	7:05	NR/CC	1	Henz	Now-830am	-	-
09/09/13	11:08	SE Valley	1	Henz	Now-1230pm	-	-
09/09/13	11:15	Superstition	1	Henz	Now-1230pm	-	1.00-1.50
09/09/13	11:33	NR/CC	1	Henz	Now-130pm	-	-
09/09/13	11:44	Phoenix North	1	Henz	Now-130pm	0.50-0.75/30min	1.50-2.00
09/09/13	11:44	Phoenix South	1	Henz	Now-130pm	0.50-0.75/30min	1.50-2.00
09/09/13	11:44	North Scot	1	Henz	Now-130pm	0.50-0.75/30min	1.50-2.00
09/09/13	11:44	South Scot	1	Henz	Now-130pm	0.50-0.75/30min	1.50-2.00
09/09/13	11:55	Upper Cent.	1	Henz	Now-130pm	0.50-0.75/30min	1.50
09/09/13	12:06	Lower Salt Lakes	1	Henz	Now-130pm	-	1.00-2.00
09/09/13	12:51	NR/CC	3	Henz	Now-230pm	-	-
09/09/13	12:54	Palo Verde	1	Henz	Now-230pm	0.50-0.75/30min	1.50
09/09/13	14:41	Palo Verde	1U	Henz	Now-4pm	-	-

<b>TABLE B-1: MSP Statements Issued - Monsoon Season 2013</b>							
<b>Statement Details</b>						<b>Forecast Rain</b>	
<b>Date</b>	<b>LST</b>	<b>MSP Forecast Zone</b>	<b>Message</b>	<b>Forecaster</b>	<b>Valid Time</b>	<b>Intensity (in/min)</b>	<b>STP (in)</b>
09/09/13	16:19	West Valley	1	Henz	Now-530pm	0.50-0.75/30min	1.00-1.25
09/10/13	10:27	Palo Verde	1	Henz	Now-12pm	0.50-0.75/30min	1.25
09/10/13	10:33	Wickenburg	1	Henz	Now-1230pm	0.50-0.75/30min	1.25
09/10/13	10:33	Upper Cent.	1	Henz	Now-1230pm	0.50-0.75/30min	1.25
09/10/13	10:57	NW Valley	1	Henz	Now-1230pm	0.50-0.75/30min	1.50
09/10/13	11:54	Wickenburg	3	Henz	Now-2pm	-	-
09/10/13	12:01	Upper Cent.	3	Henz	Now-2pm	-	-
09/10/13	13:43	North Scot	1	Henz	Now-245pm	0.50-0.75/30min	-
09/10/13	14:05	Wickenburg	3U	Henz	Now-5pm	-	-

**TABLE B-2:** This table shows the raw verification data of MSP issued Messages for the 2012 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 and Forecast Zone.

**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.

<b>TABLE B-2: MSP Statements Issued - Monsoon Season 2013</b>										
<b>Statement Details</b>		<b>Forecast Rain</b>		<b>Rain Observations (in)</b>			<b>Alarms</b>			<b>Verification</b>
<b>Date</b>	<b>MSP Forecast Zone</b>	<b>Intensity (in/min)</b>	<b>STP (in)</b>	<b>ALERT</b>	<b>GAQPE</b>	<b>LSRs</b>	<b>Rain</b>	<b>Stream</b>	<b>Dam</b>	<b>Hit/Miss</b>
07/06/13	Superstition	0.30-0.60/30min	-	0.16-0.31	0.30-0.75	-	-	-	-	Hit
07/14/13	W Valley	0.50/30min	-	0.55	1.03-1.22	-	-	-	-	Hit
07/14/13	Palo Verde	0.50/30min	-	0.51-0.94	2.21-2.40	-	X	-	-	Hit
07/14/13	Palo Verde	-	-	-	-	-	-	-	-	Hit
07/14/13	Rainbow Valley	0.50/30min	1.00	0.16	2.21-2.40	-	-	-	-	Hit
07/15/13	Wickenburg	0.50/30min	1.25	0.83	1.23-1.61	-	-	-	-	Hit
07/15/13	Wickenburg	-	-	-	-	-	-	-	-	Hit
07/15/13	Wickenburg	-	-	-	-	-	-	-	-	Hit
07/15/13	Phx South	0.50/30min	1.00	0.71	1.03-1.22	-	-	-	-	Hit
07/15/13	SE Valley	0.50/30min	1.00	0.55-0.91	0.84-1.02	-	X	-	-	Hit
07/17/13	Wickenburg	0.50/30min	-	0.31-0.67	1.03-1.22	-	-	-	-	Hit
07/18/13	Sycamore Creek	0.75/20-30min	1.25	1.10	0.44-0.63	-	X	-	-	Hit
07/19/13	SE Valley	-	-	0.00	0.00	-	-	-	-	Miss

**TABLE B-2: MSP Statements Issued - Monsoon Season 2013**

Statement Details		Forecast Rain		Rain Observations (in)			Alarms			Verification
Date	MSP Forecast Zone	Intensity (in/min)	STP (in)	ALERT	GAQPE	LSRs	Rain	Stream	Dam	Hit/Miss
07/19/13	Superstition	-	-	0.20	0.04-0.24	-	-	-	-	Miss
07/19/13	NW Valley	0.50-0.75/20min	1.25	1.06	1.23-1.61	1.25-1.50	X	-	-	Hit
07/19/13	West Valley	0.50-0.75/20min	1.25	1.69	1.23-1.61	-	X	-	-	Hit
07/19/13	Phoenix South	0.50-0.75/20min	1.25	0.83	0.64-0.83	-	-	-	-	Hit
07/19/13	Wickenburg	0.50-0.75/30min	1.25	0.67	0.44-0.63	-	-	-	-	Hit
07/20/13	Palo Verde	-	-	-	-	-	-	-	-	Miss
07/20/13	West Valley	-	-	-	-	-	-	-	-	Miss
07/20/13	NW Valley	-	-	-	-	-	-	-	-	Miss
07/20/13	Upper Cent.	-	-	-	-	-	-	-	-	Hit
07/20/13	Upper Cent.	-	-	0.91	1.23-1.61	-	-	-	-	Hit
07/20/13	Upper Cent.	-	-	0.91	1.23-1.61	-	-	-	-	Hit
07/20/13	Palo Verde	-	-	0.00	0.04-0.24	-	-	-	-	Miss
07/20/13	North Scot	-	-	1.14-1.38	1.23-1.61	1.25-1.50	X	-	-	Hit
07/20/13	SE Valley	0.75/30min	-	0.63-0.94	0.84-1.02	1.00	X	-	-	Hit
07/21/13	Gila Bend	-	-	0.91-2.32	2.02-2.20	0.58	X	X		Hit
07/21/13	Lower Salt Lakes	1.00/30min	2.00	0.51-0.67	1.03-1.22	-	-	-	-	Hit
07/21/13	NR/CC	0.75-1.00/20-30min	1.50	0.20	1.23-1.61	-	X	X	-	Hit
07/21/13	North Scot	0.75-1.00/20-30min	1.50	0.20	1.23-1.61	-	-	X	-	Hit
07/21/13	SE Valley	-	0.50-0.75	0.24	0.44-0.63	-	-	X	-	Hit
07/21/13	Gila Bend	-	-	0.00	2.02-2.20	-	-	-	-	Miss
07/22/13	Rainbow Valley	0.50/15-30min	1.25	0.20	0.64-0.83	-	-	-	-	Hit
07/22/13	Phoenix South	0.50-0.75/15-30min	1.25	0.00	0.00	-	-	-	-	Miss
07/22/13	Wickenburg	0.50/20min	1.00	1.30-1.42	1.23-1.61	-	X	X	-	Hit
07/24/13	Sycamore Creek	0.75/20-30min	1.25	0.71	0.25-0.43	-	X	-	-	Hit
07/25/13	Sycamore Creek	1.00/20-30min	1.50	0.94	1.03-1.22	-	X	X	-	Hit
07/25/13	Sycamore Creek	-	-	0.94	1.03-1.22	-	X	X	-	Hit
07/25/13	Gila Bend	0.75-1.00/45min-1hr	1.25	0.04	1.23-1.61	-	-	-	-	Hit
07/25/13	Gila Bend	-	-	0.04	1.23-1.61	-	-	-	-	Hit

**TABLE B-2: MSP Statements Issued - Monsoon Season 2013**

Statement Details		Forecast Rain		Rain Observations (in)			Alarms			Verification
Date	MSP Forecast Zone	Intensity (in/min)	STP (in)	ALERT	GAQPE	LSRs	Rain	Stream	Dam	Hit/Miss
07/25/13	Sycamore Creek	-	-	-	-	-	-	-	-	Hit
07/26/13	Superstition	0.75/15min	1.50	0.75	1.30-1.60	0.50	-	-	-	Hit
07/26/13	Superstition	-	-	0.75	1.30-1.60	0.50	-	-	-	Hit
07/26/13	NR/CC	0.75/30min, 1/1hr	1.25	0.75-1.30	1.03-1.22	-	X	X	-	Hit
07/26/13	NW Valley	0.75/30min, 1/1hr	1.25	0.28	0.04-0.24	-	-	-	-	Miss
07/26/13	SE Valley	0.25/15min	0.50	0.67	0.25-0.43	-	-	-	-	Hit
07/26/13	Superstition	0.25/15min	0.50	0.67	0.44-0.63	-	-	-	-	Hit
08/17/13	Rainbow Valley	-	0.50	0.16	0.25-0.43	-	-	-	-	Hit
08/17/13	Palo Verde	-	0.50	0.35	0.25-0.43	-	-	-	-	Hit
08/18/13	Gila Bend	-	-	0.31	0.84-1.02	-	-	-	-	Hit
08/18/13	Palo Verde	1.00/1hr	1.00	1.14	1.23-1.61	-	X	-	-	Hit
08/18/13	Palo Verde	-	-	1.14	1.23-1.61	-	X	-	-	Hit
08/18/13	Palo Verde	-	-	1.14	1.23-1.61	-	X	-	-	Hit
08/18/13	Palo Verde	-	-	-	-	-	-	-	-	Hit
08/18/13	Wickenburg	0.50-0.75/30min	-	0.12	0.25-0.43	-	-	-	-	Miss
08/24/13	West Valley	0.50-0.75/20min	1.50	0.94-1.26	1.03-1.22	-	X	X	-	Hit
08/24/13	NW Valley	0.50-0.75/20min	1.50	0.43-0.75	1.03-1.22	-	X	X	-	Hit
08/24/13	Wickenburg	0.50-0.75/20min	1.50	1.26-2.24	2.02-2.20	-	X	X	-	Hit
08/24/13	Upper Cent.	0.50-0.75/20min	1.50	1.26-2.01	2.41-2.60	-	X	X	-	Hit
08/24/13	Wickenburg	-	-	1.26-2.24	2.02-2.22	-	X	X	-	Hit
08/24/13	Upper Cent.	-	-	1.26-2.02	2.41-2.60	-	X	X	-	Hit
08/24/13	Wickenburg	-	-	-	-	-	-	-	-	Hit
08/24/13	Upper Cent.	-	-	-	-	-	-	-	-	Hit
08/24/13	Wickenburg	-	-	-	-	-	-	-	-	Hit
08/24/13	Gila Bend	-	-	-	-	-	-	-	-	Hit
08/24/13	Palo Verde	-	-	-	-	-	-	-	-	Hit
08/24/13	Rainbow Valley	-	-	-	-	-	-	-	-	Hit
08/24/13	West Valley	-	-	-	-	-	-	-	-	Hit

**TABLE B-2: MSP Statements Issued - Monsoon Season 2013**

Statement Details		Forecast Rain		Rain Observations (in)			Alarms			Verification
Date	MSP Forecast Zone	Intensity (in/min)	STP (in)	ALERT	GAQPE	LSRs	Rain	Stream	Dam	Hit/Miss
08/24/13	NW Valley	-	-	-	-	-	-	-	-	Hit
08/24/13	Upper Cent.	-	-	-	-	-	-	-	-	Hit
08/24/13	Wickenburg	-	-	-	-	-	-	-	-	Hit
08/24/13	NR/CC	-	-	-	-	-	-	-	-	Miss
08/24/13	Sycamore Creek	-	-	-	-	-	-	-	-	Miss
08/26/13	Lower Salt Lakes	-	1.00-1.50	0.00	0.80-1.25	-	-	-	-	Hit
08/26/13	Gila Bend	0.75/20min	1.25	0.98-1.54	1.62-1.81	-	X	X	-	Hit
08/26/13	SE Valley	0.75/20min	1.50	0.51-0.75	0.64-0.83	-	-	-	-	Hit
08/26/13	Rainbow Valley	0.75/20min	1.50	0.39	0.44-0.63	-	-	-	-	Miss
08/26/13	Gila Bend	-	-	0.98-1.54	1.62-1.81	-	X	X	-	Hit
08/26/13	SE Valley	-	-	-	-	-	-	-	-	Hit
08/26/13	West Valley	0.75/20min	1.50	0.39-0.51	0.64-0.83	-	-	X	-	Hit
08/26/13	Phoenix South	0.75/20min	1.50	0.75	0.64-0.83	-	-	-	-	Hit
08/26/13	South Scot	0.75/20min	1.50	0.31-0.43	0.25-0.43	-	-	-	-	Miss
08/26/13	Phoenix North	0.50-0.75/20min	1.25	0.35-0.43	0.25-0.43	-	-	X	-	Hit
08/26/13	Palo Verde	0.50-0.75/20min	1.50	0.51-0.83	0.84-1.02	-	X	X	-	Hit
08/26/13	Gila Bend	-	-	-	-	-	-	-	-	Hit
08/26/13	NW Valley	0.50-0.75/20min	1.00	0.51-0.59	0.44-0.63	-	-	X	-	Hit
08/26/13	Wickenburg	0.50-0.75/20min	1.25	0.94-1.57	0.84-1.02	-	X	X	X	Hit
08/26/13	Upper Cent.	0.50-0.75/20min	1.25	0.67-1.50	1.23-1.61	-	X	-	-	Hit
08/26/13	Wickenburg	-	-	0.94-1.57	0.84-1.02	-	X	X	X	Hit
08/26/13	Upper Cent.	-	-	0.67-1.30	1.23-1.61	-	X	-	-	Hit
08/26/13	Wickenburg	-	-	-	-	-	-	-	-	Hit
08/27/13	North Scot	-	-	1.06	0.84-1.02	-	X	-	-	Hit
08/28/13	West Valley	0.60/20min	-	1.34-1.42	1.62-1.81	0.76-2.00	X	X	X	Hit
08/28/13	Gila Bend	0.60/30min	-	0.31	0.44-0.63	-	-	-	-	Miss
08/28/13	Palo Verde	0.50-0.75/20min	1.50	0.67-1.22	1.23-1.61	-	X	X	-	Hit
08/28/13	West Valley	-	-	-	-	-	-	-	-	Hit



**TABLE B-2: MSP Statements Issued - Monsoon Season 2013**

Statement Details		Forecast Rain		Rain Observations (in)			Alarms			Verification
Date	MSP Forecast Zone	Intensity (in/min)	STP (in)	ALERT	GAQPE	LSRs	Rain	Stream	Dam	Hit/Miss
08/28/13	West Valley	-	-	-	-	-	-	-	-	Hit
08/29/13	Gila Bend	0.75/20min	1.25-1.75	0.55-0.91	0.64-0.83	-	X	X	-	Hit
08/29/13	Rainbow Valley	0.75/20min	1.50	0.47-0.98	0.64-0.83	-	-	-	-	Hit
08/29/13	Wickenburg	0.50-0.75/20min	1.50	1.89	1.62-1.81	-	X	X	-	Hit
08/29/13	Wickenburg	-	-	1.89	1.62-1.81	-	X	X	-	Hit
08/29/13	Wickenburg	-	-	-	-	-	-	-	-	Hit
08/29/13	Wickenburg	-	-	-	-	-	-	-	-	Hit
08/30/13	NR/CC	-	1.00-1.50	0.28	1.23-1.61	-	-	-	-	Hit
08/30/13	NW Valley	0.75/20min	1.50-2.00	0.87-1.30	1.23-1.61	-	-	X	-	Hit
08/30/13	Superstition	-	1.00-2.00	1.34-2.44	1.82-2.01	-	X	-	-	Hit
08/30/13	Superstition	-	-	-	-	-	-	-	-	Hit
08/30/13	SE Valley	0.75/20min	1.25-1.75	0.47-0.79	1.03-1.22	0.89	-	X	-	Hit
08/30/13	SE Valley	-	-	-	-	-	-	-	-	Hit
08/30/13	Superstition	-	-	1.34-2.44	1.81-2.01	-	X	-	-	Hit
09/03/13	Sycamore Creek	0.50-0.75/20min	-	0.51	0.44-0.63	-	X	-	-	Hit
09/06/13	Gila Bend	-	-	1.02	1.23-1.61	-	-	-	-	Hit
09/06/13	Gila Bend	-	-	1.02	1.23-1.61	-	-	-	-	Hit
09/06/13	Palo Verde	-	-	0.63	1.23-1.61	-	X	-	-	Hit
09/06/13	Gila Bend	-	-	-	-	-	-	-	-	Hit
09/09/13	NR/CC	-	-	0.94-1.77	2.02-2.20	-	X	-	-	Hit
09/09/13	SE Valley	-	-	1.38-2.32	1.23-1.61	1.00	X	X	X	Hit
09/09/13	Superstition	-	1.00-1.50	1.02-1.61	1.82-2.01	0.90	X	X	X	Hit
09/09/13	NR/CC	-	-	1.77-2.01	2.02-2.20	-	X	X	-	Hit
09/09/13	Phoenix North	0.50-0.75/30min	1.50-2.00	1.65-2.32	2.41-2.60	2.42	X	X	X	Hit
09/09/13	Phoenix South	0.50-0.75/30min	1.50-2.00	1.02	0.84-1.02	-	-	-	-	Miss
09/09/13	North Scot	0.50-0.75/30min	1.50-2.00	0.67-1.26	1.23-1.61	-	-	-	-	Hit
09/09/13	South Scot	0.50-0.75/30min	1.50-2.00	0.63	0.44-0.63	-	-	X	-	Hit
09/09/13	Upper Cent.	0.50-0.75/30min	1.50	0.63-1.10	1.62-1.81	-	X	X	-	Hit

**TABLE B-2: MSP Statements Issued - Monsoon Season 2013**

Statement Details		Forecast Rain		Rain Observations (in)			Alarms			Verification
Date	MSP Forecast Zone	Intensity (in/min)	STP (in)	ALERT	GAQPE	LSRs	Rain	Stream	Dam	Hit/Miss
09/09/13	Lower Salt Lakes	-	1.00-2.00	1.46	2.02-2.20	-	X	-	-	Hit
09/09/13	NR/CC	-	-	1.38-1.81	2.02-2.20	-	X	X	-	Hit
09/09/13	Palo Verde	0.50-0.75/30min	1.50	0.98-1.85	2.02-2.20	-	X	X	-	Hit
09/09/13	Palo Verde	-	-	-	-	-	-	-	-	Hit
09/09/13	West Valley	0.50-0.75/30min	1.00-1.25	0.63-0.91	1.03-1.22	-	-	-	-	Hit
09/10/13	Palo Verde	0.50-0.75/30min	1.25	0.59-0.79	0.44-0.63	-	X	X	-	Hit
09/10/13	Wickenburg	0.50-0.75/30min	1.25	0.91-1.26	2.41-2.60	1.25	X	X	-	Hit
09/10/13	Upper Cent.	0.50-0.75/30min	1.25	1.22-1.89	2.21-2.40	-	X	X	-	Hit
09/10/13	NW Valley	0.50-0.75/30min	1.50	1.77	1.23-1.61	-	X	X	-	Hit
09/10/13	Wickenburg	-	-	1.14-1.77	2.41-2.60	-	X	X	-	Hit
09/10/13	Upper Cent.	-	-	1.22-1.89	2.21-2.40	-	X	X	-	Hit
09/10/13	North Scot	0.50-0.75/30min	-	0.39-0.43	0.25-0.43	-	-	-	-	Hit
09/10/13	Wickenburg	-	-	-	-	-	-	-	-	Hit

## APPENDIX C: MSP LAKE ALERTS - VERIFICATION TABLES

**TABLE C-1:** This table shows each of the individual MSP Lake Alerts issued during the 2013 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).

**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 2013								
Statement Details					Observations			Verification
Date	LST	Lake	Forecaster	Valid Time	Lightning	Wind > 30mph	Hail/Heavy Rain	Hit/Miss
07/01/13	16:53	Apache Lake	Henz	Now-530pm	-	-	-	Miss
07/12/13	13:30	Apache Lake	Waters	-	X	X	-	Hit
07/12/13	13:30	Canyon Lake	Waters	-	X	X	-	Hit
07/14/13	18:10	Bartlett Lake	Henz	Now-645pm	X	-	-	Hit
07/14/13	19:08	Apache Lake	Henz	Now -815pm	X	X	-	Hit
07/14/13	19:08	Canyon Lake	Henz	Now -815pm	X	X	-	Hit
07/14/13	19:43	Saguaro Lake	Henz	Now-8:30pm	X	X	X	Hit
07/15/13	16:00	Bartlett Lake	Henz	Now-5pm	X	X	X	Hit
07/15/13	17:20	Apache Lake	Henz	Now-615pm	X	-	-	Hit
07/15/13	17:20	Canyon Lake	Henz	Now-615pm	X	-	-	Hit
07/16/13	15:39	Lake Pleasant	Henz	Now-5:45pm	X	-	-	Hit
07/16/13	17:04	Bartlett Lake	Henz	Now-630pm	-	-	-	Miss
07/16/13	17:58	Apache Lake	Henz	Now-7pm	X	-	-	Hit
07/16/13	17:58	Canyon Lake	Henz	Now-7pm	X	-	-	Hit

TABLE C-1: MSP Lake Alerts Issued - Monsoon Season 2013								
Statement Details					Observations			Verification
Date	LST	Lake	Forecaster	Valid Time	Lightning	Wind > 30mph	Hail/Heavy Rain	Hit/Miss
07/16/13	17:58	Saguaro Lake	Henz	Now-7pm	X	-	-	Hit
07/16/13	15:45	Lake Pleasant	Henz	Now -445pm	-	-	-	Miss
07/18/13	16:43	Lake Pleasant	Henz	Now-445pm	X	-	-	Hit
07/18/13	23:15	Bartlett Lake	Henz	Now-1230am	X	-	-	Hit
07/18/13	23:34	Apache Lake	Henz	Now-1230am	X	-	-	Hit
07/18/13	23:34	Canyon Lake	Henz	Now-1230am	X	-	-	Hit
07/18/13	23:34	Saguaro Lake	Henz	Now-1230am	X	-	-	Hit
07/20/13	17:01	Lake Pleasant	Waters	Now-6pm	X	-	-	Hit
07/20/13	17:00	Apache Lake	Waters	630pm-730pm	X	-	-	Hit
07/20/13	17:00	Canyon Lake	Waters	6pm-7pm	X	-	-	Hit
07/20/13	17:00	Saguaro Lake	Waters	Now-630pm	X	-	-	Hit
07/20/13	18:30	Bartlett Lake	Waters	Now-730pm	X	-	X	Hit
07/22/13	14:14	Bartlett Lake	Henz	Now-315pm	X	-	X	Hit
07/24/13	15:57	Bartlett Lake	Henz	Now-515pm	X	-	-	Hit
07/24/13	16:07	Apache Lake	Henz	Now-6pm	X	-	-	Hit
07/25/13	15:55	Saguaro Lake	Waters	Now-515pm	X	-	-	Hit
07/25/13	15:55	Canyon Lake	Waters	Now-515pm	X	-	-	Hit
07/25/13	16:10	Bartlett Lake	Waters	Now-515pm	X	-	X	Hit
07/26/13	12:15	Apache Lake	Waters	Now-130pm	X	-	-	Hit
07/26/13	14:33	Saguaro Lake	Henz	Now-330pm	X	-	-	Hit
08/15/13	17:03	Apache Lake	Henz	Now-6pm	X	-	-	Hit
08/15/13	18:11	Bartlett Lake	Henz	Now-710pm	X	-	-	Hit
08/16/13	15:41	Bartlett Lake	Waters	Now-415pm	X	-	-	Hit
08/16/13	17:52	Canyon Lake	Waters	Now-630pm	X	-	-	Hit
08/16/13	17:52	Apache Lake	Waters	Now-630pm	X	-	-	Hit
08/23/13	14:05	Apache Lake	Henz	Now-230pm	X	-	-	Hit
08/26/13	16:05	Saguaro Lake	Henz	Now-500pm	X	-	-	Hit
08/26/13	16:05	Canyon Lake	Henz	Now-430pm	X	-	-	Hit

**TABLE C-1: MSP Lake Alerts Issued - Monsoon Season 2013**

Statement Details					Observations			Verification
Date	LST	Lake	Forecaster	Valid Time	Lightning	Wind > 30mph	Hail/Heavy Rain	Hit/Miss
08/26/13	16:05	Apache Lake	Henz	Now-430pm	X	-	-	Hit
08/26/13	17:01	Bartlett Lake	Henz	Now-540pm	X	X	-	Hit
08/26/13	19:48	Lake Pleasant	Henz	Now-830pm	-	-	-	Miss
08/28/13	15:34	Bartlett Lake	Waters	Now-415pm	X	X	-	Hit
08/29/13	19:20	Saguaro Lake	Henz	Now-830pm	-	-	-	Miss
08/30/13	13:34	Lake Pleasant	Henz	Now-215pm	X	-	-	Hit
08/30/13	14:29	Bartlett Lake	Henz	Now-330pm	X	-	-	Hit
08/30/13	16:04	Apache Lake	Henz	Now-510pm	-	-	-	Miss
08/31/13	13:32	Bartlett Lake	Henz	Now-230pm	X	X	-	Hit
08/31/13	14:19	Lake Pleasant	Henz	Now-315pm	-	X	X	Hit
09/02/13	14:05	Apache Lake	Henz	Now-315pm	X	-	-	Hit
09/03/13	14:12	Apache Lake	Henz	Now-330pm	X	-	-	Hit
09/06/13	18:40	Lake Pleasant	Waters	Now-630pm	-	X	-	Hit
09/10/13	12:51	Lake Pleasant	Henz	Now-2pm	X	X	-	Hit

## APPENDIX D: QPF PEAK RAINFALL INTENSITY - VERIFICATION TABLES

**TABLE D-1:** This table shows each of the individual qualifying MSP Messages issued during the 2013 Monsoon season including the detailed forecast rainfall information. The table is broken down by statement details, peak rainfall intensity, 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 Rainfall Intensity** – Rain information including forecast and observed rainfall intensity. Observed rainfall intensities include rain gage type and number (if ALERT data). Data is pulled directly from issued Message. Observations are gathered the ALERT database and NWS local storm reports.

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

TABLE D-1: MSP QPF Peak Intensity Verification - Monsoon Season 2013						
Statement Details		Peak Rainfall Intensity			Verification	
Date	MSP Forecast Zone	QPF (in/min)	Observed (in/min) *	Gage Type	(%) Error	Hit/Miss
07/06/13	Superstition	0.30/30min	0.28	ALERT 6720, 759	7.1	Hit
07/14/13	W Valley	0.50/30min	0.55	ALERT 5440	-9.1	Hit
07/14/13	Palo Verde	0.50/30min	0.47	ALERT 5075	6.4	Hit
07/14/13	Rainbow Valley	0.50/30min	0.16	ALERT 6840	212.5	Miss
07/15/13	Wickenburg	0.50/30min	0.47	ALERT 7060, 7120	6.4	Hit
07/15/13	Phx South	0.50/30min	0.55	ALERT 6535	-9.1	Hit
07/15/13	SE Valley	0.50/30min	0.79	ALERT 6520, 6590	-36.7	Miss
07/15/13	SE Valley	0.50/30min	0.72	LSR NWS	-30.6	Miss
07/17/13	Wickenburg	0.50/30min	0.40	ALERT 5270	25.0	Hit
07/18/13	Sycamore Creek	0.75/30min	0.79	ALERT 5875	-5.1	Hit
07/19/13	NW Valley	0.75/20min	0.78	ALERT 5470	-3.8	Hit
07/19/13	NW Valley	1.50/45min	1.50	LSR NWS	0.0	Hit
07/19/13	West Valley	0.75/20min	1.08	ALERT 5440	-30.6	Miss
07/19/13	Phoenix South	0.75/20min	0.82	ALERT 4780	-8.5	Hit

<b>TABLE D-1: MSP QPF Peak Intensity Verification - Monsoon Season 2013</b>						
<b>Statement Details</b>		<b>Peak Rainfall Intensity</b>			<b>Verification</b>	
<b>Date</b>	<b>MSP Forecast Zone</b>	<b>QPF (in/min)</b>	<b>Observed (in/min) *</b>	<b>Gage Type</b>	<b>(%) Error</b>	<b>Hit/Miss</b>
07/19/13	Wickenburg	0.50/30min	0.59	ALERT 5270	-15.3	Hit
07/20/13	SE Valley	0.75/30min	0.75	ALERT 6540	0.0	Hit
07/20/13	SE Valley	0.75/30min	1.00	LSR NWS	-25.0	Hit
07/21/13	Lower Salt Lakes	1.00/30min	0.32	ALERT 6780	212.5	Miss
07/22/13	Rainbow Valley	0.50/15min	0.20	ALERT 6965	150.0	Miss
07/22/13	Phoenix South	0.50/30min	0.00	-	-	Miss
07/22/13	Wickenburg	0.50/20min	0.82	ALERT 7040, 7090	-39.0	Miss
07/24/13	Sycamore Creek	0.75/30min	0.71	ALERT 5880	5.6	Hit
07/25/13	Sycamore Creek	1.00/30min	0.94	ALERT 5880	6.4	Hit
07/25/13	Gila Bend	0.75/45min	0.04	ALERT 6960	1775.0	Miss
07/26/13	Superstition	0.75/15min	0.67	ALERT 6695	11.9	Hit
07/26/13	NR/CC	1.00/60min	1.18	ALERT 4960	-15.3	Hit
07/26/13	NW Valley	0.75/30min	0.28	ALERT 5480	167.9	Miss
07/26/13	SE Valley	0.25/15min	0.35	ALERT 6570	-28.6	Miss
07/26/13	Superstition	0.25/15min	0.31	ALERT 6685	-19.4	Hit
08/18/13	Palo Verde	1.00/60min	1.14	ALERT 5045	-12.3	Hit
08/18/13	Wickenburg	0.50/30min	0.12	ALERT 7165	316.7	Miss
08/24/13	West Valley	0.50/20min	0.59	ALERT 5440	-15.3	Hit
08/24/13	NW Valley	0.50/20min	0.59	ALERT 5510	-15.3	Hit
08/24/13	Wickenburg	0.75/20min	1.02	ALERT 7165	-26.5	Miss
08/24/13	Upper Cent.	0.75/20min	1.06	ALERT 5175	-29.2	Miss
08/26/13	Gila Bend	0.75/20min	0.51	ALERT 6960	47.1	Miss
08/26/13	SE Valley	0.75/20min	0.60	ALERT 6500	25.0	Hit
08/26/13	Rainbow Valley	0.75/20min	0.39	ALERT 6835	92.3	Miss
08/26/13	West Valley	0.75/20min	0.39	ALERT 5400	92.3	Miss
08/26/13	Phoenix South	0.75/20min	0.60	ALERT 6500	25.0	Hit
08/26/13	South Scot	0.75/20min	0.39	ALERT 4805	92.3	Miss
08/26/13	Phoenix North	0.50/20min	0.43	ALERT 4830	16.3	Hit

<b>TABLE D-1: MSP QPF Peak Intensity Verification - Monsoon Season 2013</b>						
<b>Statement Details</b>		<b>Peak Rainfall Intensity</b>			<b>Verification</b>	
<b>Date</b>	<b>MSP Forecast Zone</b>	<b>QPF (in/min)</b>	<b>Observed (in/min) *</b>	<b>Gage Type</b>	<b>(%) Error</b>	<b>Hit/Miss</b>
08/26/13	Palo Verde	0.75/20min	0.79	ALERT 5115	-5.1	Hit
08/26/13	NW Valley	0.50/20min	0.59	ALERT 5455	-15.3	Hit
08/26/13	Wickenburg	0.75/20min	1.18	ALERT 7035	-36.4	Miss
08/26/13	Upper Cent.	0.75/20min	1.06	ALERT 5175	-29.2	Miss
08/28/13	West Valley	0.60/20min	1.14	ALERT 6810	-47.4	Miss
08/28/13	West Valley	0.60/20min	0.50	LSR NWS	20.0	Hit
08/28/13	Gila Bend	0.60/30min	0.31	ALERT 6910	93.5	Miss
08/28/13	Palo Verde	0.75/20min	0.71	ALERT 5040	5.6	Hit
08/29/13	Gila Bend	0.75/20min	0.75	ALERT 6955	0.0	Hit
08/29/13	Rainbow Valley	0.75/20min	0.63	ALERT 6890	19.0	Hit
08/29/13	Wickenburg	0.75/20min	1.34	ALERT 7030	-44.0	Miss
08/30/13	NW Valley	0.75/20min	0.47	ALERT 5450	59.6	Miss
08/30/13	SE Valley	0.75/20min	0.60	ALERT 6690	25.0	Hit
08/30/13	SE Valley	0.75/20min	0.89	LSR NWS	-15.7	Hit
09/03/13	Sycamore Creek	0.50/20min	0.47	ALERT 5875	6.4	Hit
09/09/13	Phoenix North	0.75/30min	1.34	ALERT 4900	-44.0	Miss
09/09/13	Phoenix South	0.75/30min	0.83	ALERT 6535	-9.6	Hit
09/09/13	North Scot	0.50/30min	0.55	ALERT 4860	-9.1	Hit
09/09/13	South Scot	0.50/30min	0.28	ALERT 4765	78.6	Miss
09/09/13	Upper Cent.	0.75/30min	0.87	ALERT 5145	-13.8	Hit
09/09/13	Palo Verde	0.75/30min	1.14	ALERT 5040	-34.2	Miss
09/09/13	West Valley	0.75/30min	0.87	ALERT 5400	-13.8	Hit
09/10/13	Palo Verde	0.75/30min	0.67	ALERT 5120	11.9	Hit
09/10/13	Wickenburg	0.75/30min	0.98	ALERT 7060	-23.5	Hit
09/10/13	Upper Cent.	0.75/30min	1.54	ALERT 7140	-51.3	Miss
09/10/13	NW Valley	0.75/30min	1.02	ALERT 5475	-26.5	Miss
09/10/13	North Scot	0.50/30min	0.43	ALERT 4860	16.3	Hit
<i>* Data in the Observed column was fit to match QPF Intensity time scale.</i>						



## APPENDIX E: QPF STORM TOTAL PRECIPITATION - VERIFICATION TABLES

**TABLE E-1:** This table shows each of the individual MSP Lake Alerts issued during the 2013 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 2013											
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
07/14/13	Rainbow Valley	1.00	0.16	2.21	2.40	-	525.00	-54.75	-58.33	-	Miss
07/15/13	Wickenburg	1.25	0.83	1.23	1.61	-	50.60	1.63	-22.36	-	Hit
07/15/13	Phx South	1.00	0.55	1.03	1.22	-	81.82	-2.91	-18.03	-	Hit
07/15/13	SE Valley	1.00	0.91	0.84	1.02	0.72	9.89	19.05	-1.96	38.89	Hit
07/18/13	Sycamore Creek	1.25	1.10	0.44	0.63	-	13.64	184.09	98.41	-	Hit
07/19/13	NW Valley	1.25	1.06	1.23	1.61	1.25	17.92	1.63	-22.36	0.00	Hit
07/19/13	West Valley	1.25	1.69	1.23	1.61	-	-26.04	1.63	-22.36	-	Hit
07/19/13	Phoenix South	1.25	0.83	0.64	0.83	-	50.60	95.31	50.60	-	Miss
07/19/13	Wickenburg	1.25	0.67	0.44	0.63	-	86.57	184.09	98.41	-	Miss
07/21/13	Lower Salt Lakes	2.00	1.30	1.23	1.61	-	53.85	62.60	24.22	-	Hit
07/21/13	SE Valley	0.50	0.24	0.44	0.63	-	108.33	13.64	-61.90	-	Hit

**TABLE E-1: MSP QPF Peak Storm Total Rainfall Verification - Monsoon Season 2013**

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
07/22/13	Rainbow Valley	1.25	0.20	0.64	0.83	-	525.00	95.31	50.60	-	Miss
07/22/13	Phoenix South	1.25	0.00	0.00	0.00	-	n/a	n/a	n/a	-	Miss
07/22/13	Wickenburg	1.00	1.41	1.23	1.61	-	-29.08	-18.70	-37.89	-	Hit
07/24/13	Sycamore Creek	1.25	0.71	0.25	0.43	-	76.06	400.00	190.70	-	Miss
07/25/13	Sycamore Creek	1.50	0.94	1.03	1.22	-	59.57	45.63	22.95	-	Hit
07/25/13	Gila Bend	1.25	0.04	1.23	1.61	-	3025.00	1.63	-22.36	-	Hit
07/26/13	Superstition	1.50	0.75	1.30	1.60	0.50	100.00	15.38	-6.25	200.00	Hit
07/26/13	NR/CC	1.25	1.30	1.03	1.22	-	-3.85	21.36	2.46	-	Hit
07/26/13	NW Valley	1.25	0.28	0.04	0.24	-	346.43	3025.00	420.83	-	Miss
07/26/13	SE Valley	0.50	0.67	0.25	0.43	-	-25.37	100.00	16.28	-	Hit
07/26/13	Superstition	0.50	0.47	0.44	0.63	-	6.38	13.64	-20.63	-	Hit
08/18/13	Palo Verde	1.00	1.14	1.23	1.61	-	-12.28	-18.70	-37.89	-	Hit
08/18/13	Wickenburg	0.50	0.12	0.25	0.43	-	316.67	100.00	16.28	-	Hit
08/24/13	West Valley	1.50	1.26	1.03	1.22	-	19.05	45.63	22.95	-	Hit
08/24/13	NW Valley	1.50	0.75	1.03	1.22	-	100.00	45.63	22.95	-	Hit
08/24/13	Wickenburg	1.50	2.24	2.02	2.20	-	-33.04	-25.74	-31.82	-	Miss
08/24/13	Upper Cent.	1.50	2.01	2.41	2.60	-	-25.37	-37.76	-42.31	-	Miss
08/26/13	Lower Salt Lakes	1.00	0.00	0.8	1.25	-	n/a	25.00	-20.00	-	Hit
08/26/13	Gila Bend	1.25	1.54	1.62	1.81	-	-18.83	-22.84	-30.94	-	Hit
08/26/13	NW Valley	1.00	0.59	0.44	0.63	-	69.49	127.27	58.73	-	Miss
08/26/13	Wickenburg	1.25	1.57	0.84	1.02	-	-20.38	48.81	22.55	-	Hit
08/26/13	Upper Cent.	1.25	1.50	1.23	1.61	-	-16.67	1.63	-22.36	-	Hit
08/28/13	Palo Verde	1.50	1.22	1.23	1.61	-	22.95	21.95	-6.83	-	Hit
08/29/13	Gila Bend	1.25	0.91	0.84	1.02	-	37.36	48.81	22.55	-	Hit
08/29/13	Rainbow Valley	1.50	0.98	0.64	0.83	-	53.06	134.38	80.72	-	Miss
08/29/13	Wickenburg	1.50	1.89	1.62	1.81	-	-20.63	-7.41	-17.13	-	Hit
08/30/13	NR/CC	1.50	0.28	1.23	1.61	-	435.71	21.95	-6.83	-	Hit
08/30/13	NW Valley	1.50	1.30	1.23	1.61	-	15.38	21.95	-6.83	-	Hit

**TABLE E-1: MSP QPF Peak Storm Total Rainfall Verification - Monsoon Season 2013**

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
08/30/13	Superstition	2.00	2.44	1.82	2.01	-	-18.03	9.89	-0.50	-	Hit
08/30/13	SE Valley	1.25	0.79	1.03	1.22	-	58.23	21.36	2.46	-	Hit
09/09/13	Superstition	1.50	1.61	1.82	2.01	-	-6.83	-17.58	-25.37	-	Hit
09/09/13	Phoenix North	2.00	2.32	2.41	2.60	2.42	-13.79	-17.01	-23.08	0.17	Hit
09/09/13	Phoenix South	1.50	1.02	0.84	1.02	-	47.06	78.57	47.06	-	Miss
09/09/13	North Scot	1.50	1.26	1.23	1.61	-	19.05	21.95	-6.83	-	Hit
09/09/13	South Scot	1.50	0.63	0.44	0.63	-	138.10	240.91	138.10	-	Miss
09/09/13	Upper Cent.	1.50	1.10	1.62	1.81	-	36.36	-7.41	-17.13	-	Hit
09/09/13	Lower Salt Lakes	2.00	1.46	2.02	2.20	-	36.99	-0.99	-9.09	-	Hit
09/09/13	Palo Verde	1.50	1.85	2.02	2.20	-	-18.92	-25.74	-31.82	-	Hit
09/09/13	West Valley	1.00	0.91	1.03	1.22	-	9.89	-2.91	-18.03	-	Hit
09/10/13	Palo Verde	1.25	0.79	0.44	0.63	-	58.23	184.09	98.41	-	Miss
09/10/13	Wickenburg	1.25	1.26	2.41	2.60	1.25	-0.79	-48.13	-51.92	0.00	Hit
09/10/13	Upper Cent.	1.25	1.89	2.21	2.40	-	-33.86	-43.44	-47.92	-	Miss
09/10/13	NW Valley	1.50	1.77	1.23	1.61	-	-15.25	21.95	-6.83	-	Hit

\* GAQPE (Radar) estimated data given in ranges: (LT) Lower Total and (UT) Upper Total