



Standing water on Vulture Mine Road (~20 miles south of Wickenburg) after recent monsoon heavy rains (June 28<sup>th</sup>, 2024).

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

**Flood Warning Branch**

### **MSP Verification Report & Season Recap: Monsoon Season 2024**



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## 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.

Lake Alerts:

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

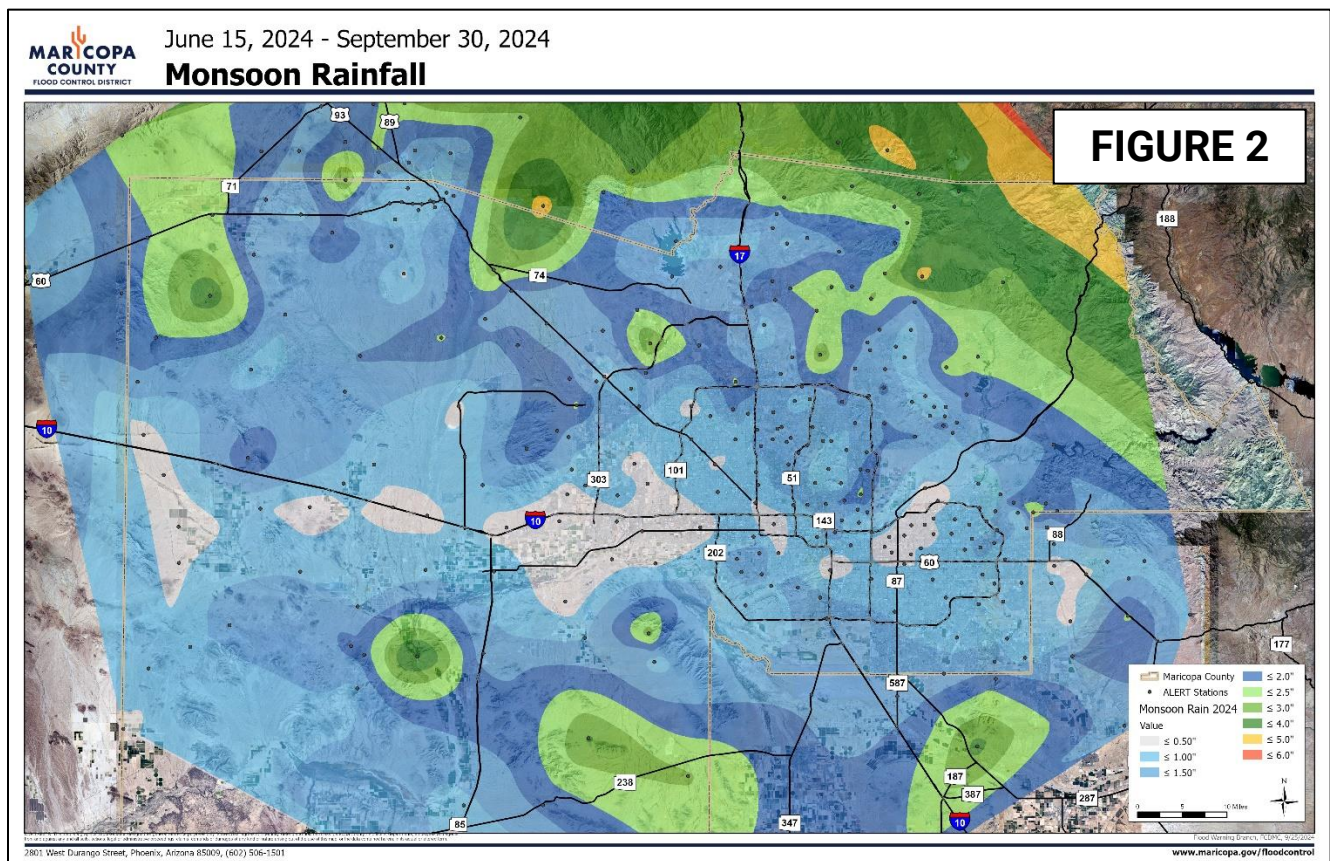
Additional Products:

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, 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](#)*

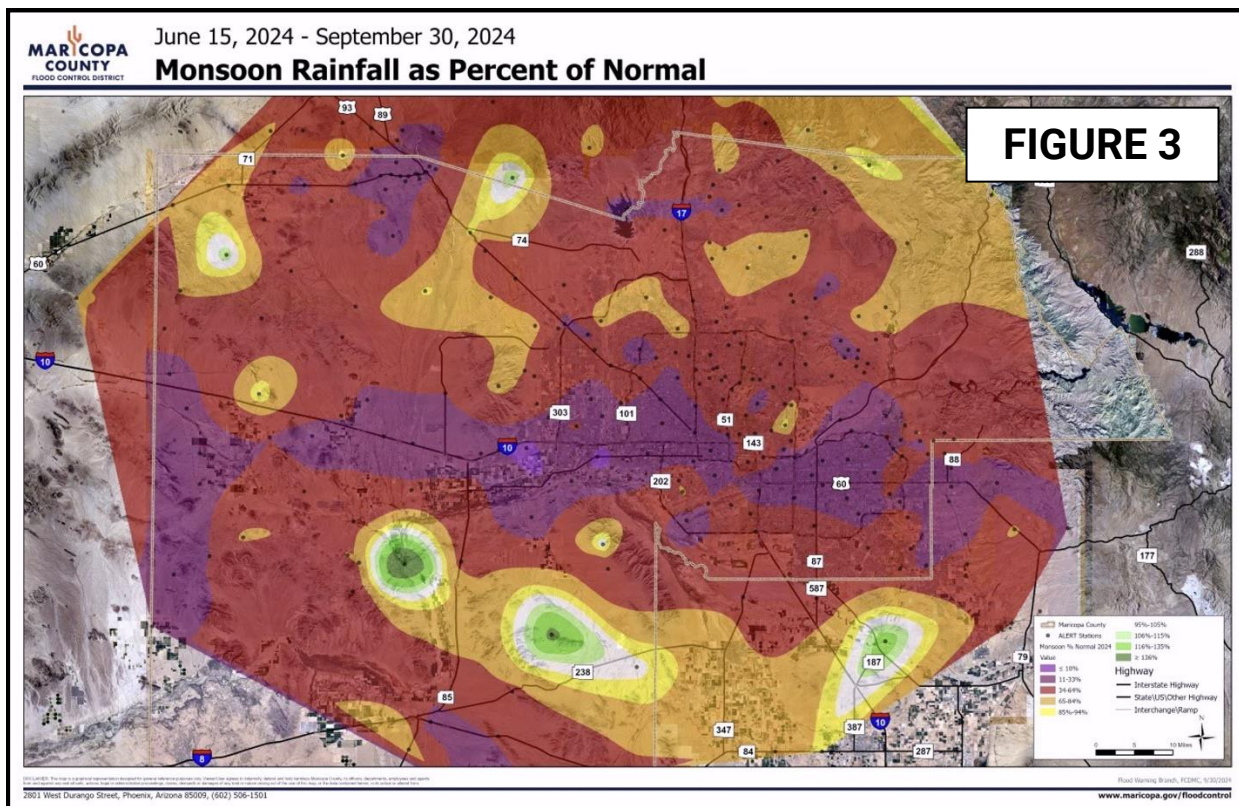
## 2024 MONSOON SEASON RECAP

According to the FCDMC ALERT rain gauge network, the 2024 monsoon season was characterized as being much drier than normal. When averaged across 297 of the oldest County rain gages, 1.43” of rain fell which was 46% of the mean value of 2.97” and ranked as third driest on record. An image showing a 44-year period of record can be viewed [here](#). It’s worth noting that only seven measurable rain days resulted in 0.74” of rainfall recorded at Phoenix Sky Harbor Airport (the official NWS station with precipitation records dating back to 1896), which was far below long-term monsoon average of 2.43” of and tied 2007 for the seventh driest monsoon. Click [here](#) to see a technical summary plot from Sky Harbor Airport covering the monsoon season courtesy of the University of Arizona CSAP/CLIMAS organization. Figure 2, below, offers a more comprehensive picture of the rainfall distribution across the MSP forecast area. This figure was generated using FCDMC ALERT rain gauge data from around the County. The shaded contours depict precipitation totals from June 15<sup>th</sup> – September 30<sup>th</sup>. The largest rainfall totals fell across the higher terrain of northern and southwestern portions of Maricopa County.



Totals quickly trended downward entering the foothills and populated valley portions of the Phoenix Metropolitan area. Figure 3, below, shows the ratio of 2024 monsoon precipitation versus normal monsoon precipitation. Similar to Figure 2, contours were generated using FCDMC ALERT rain gauge data from around the County. Only very isolated portions of

southwestern Maricopa County benefited from above normal rainfall (green shading). A vast majority of the County was characterized being abnormally dry achieving 50% or less of normal monsoon precipitation (red/purple shading). As noted above, most of the greater Phoenix urban corridor was particularly dry registering much below normal having 30% or less of normal summer rainfall. The lack of widespread storm propagation from surrounding higher terrain storm activity into the Phoenix Metropolitan area and other lower desert zones of County was a common theme throughout Monsoon 2024 and accounts for the below average seasonal totals observed at many individual monitoring sites. Data shown by Figures 2 and 3 serve as a strong reminder to the importance of having a widely distributed rain gauge network to fully capture the distribution of monsoon convective rains. A graphical representation showing the progression of ALERT average rainfall throughout Monsoon 2024 compared to prior seasons can be viewed [here](#).



### June Recap/Notable Events:

- Monsoon 2024 for the Desert Southwest had an unusual early start with local thunderstorm activity becoming evident by June 21<sup>st</sup>. Remnants of Tropical Storm Alberto, originating in the Gulf of Mexico and making landfall on the east coast of Mexico, was the source of abundant moisture. Clockwise flow around a broad high pressure circulation building over the southern Great Plains helped direct moisture into the southwestern United States.
- Based on the legacy 3-day 55°F dewpoint average methodology, the 2024 monsoon at Phoenix Sky Harbor began early (June 21-23). For perspective using the same methodology, Monsoon 2023 started more than two weeks later July 11<sup>th</sup>-13<sup>th</sup>.

Monsoon statistics (e.g., daily dewpoint trends) for Phoenix Sky Harbor can be found [here](#).

- Much of the region benefitted receiving measurable rainfall during the latter half of the month; however, strongest thunderstorms bringing heavier rain totals 1-2+ inches between June 21-25 and 29-30 were mostly restricted to the NW, far south, and NE portions of the County. There were a few instances of localized flash flooding in those areas, including near the town of Aguila on the 23<sup>rd</sup>, for rural areas northeast of Scottsdale both on the 23<sup>rd</sup> and 24<sup>th</sup>, along the rural Maricopa/Yavapai County border between Wickenburg and Lake Pleasant on the 25<sup>th</sup>, and southeast of Gila Bend the 29<sup>th</sup> near the Maricopa/Pima County border.
- The interior lower deserts of southcentral AZ, including metro Phoenix, saw isolated instances of heavier rainfall between 0.50"-1.00". However, most locations had monthly rainfall totals of 0.25" or less. Phoenix Sky Harbor registered only 0.01" of measurable rain. Strong to severe wind related impacts were observed primarily related to bouts of thunderstorm outflow winds (50+ mph) entering the lower deserts that were accompanied at times by dense blowing dust, particularly on the 21<sup>st</sup> for the Southeast Valley, the 24<sup>th</sup> for metro Phoenix, and again directed at the Southeast Valley on the 30<sup>th</sup>.
- Increased subtropical moisture from Mexico arriving in AZ during the late spring and start of summer transition combined with building heat from an anomalously strong monsoon ridge. Consequently, a hot and humid air mass exacerbated local heat-related health concerns. The dangerous humid June heatwave for the lower deserts is highlighted by the following temperature stats recorded at Phoenix Sky Harbor (according to the NWS Phoenix WFO):
  - The entire month had daily highs reaching a minimum of 100°F (a streak beginning on May 27<sup>th</sup>).
  - There were 14 days over 110°F (mean daily amount since 2000 is 7 days).
  - A peak monthly temp of 117°F on June 21<sup>st</sup>.
  - Average daily temperature for the month of June registered at 97.0°F (all-time warmest), which was 5.6°F above normal.
  - Average daily minimum temperature was 84.6°F (all-time warmest and 6.0 degrees above normal).
  - Average daily maximum temperature was 109.4°F (all-time hottest and 5.2 degrees above normal)
  - A total of 2 new daily high temperature and 6 warm low temperature records were set.

## July Recap/Notable Events:

- July 1<sup>st</sup> had strong to severe afternoon thunderstorms with locally heavy rainfall ranging between 0.50"-1.50" focused over far eastern portions of Maricopa County including: Horseshoe, Bartlett, and Lower Salt River Lakes recreational areas.
- July 14<sup>th</sup> was the month's next busier evening affecting much of the Valley. A cluster of strong afternoon storms developing over Pinal County sent a robust and expansive outflow north and west across Maricopa County. The gusty outflow initially caused a dust storm to sweep into Phoenix but was then quickly followed by a few strong to severe thunderstorms leading to localized heavy rainfall amounts (around 0.50" to 1.25").
- On the evening of July 16<sup>th</sup>, a concentrated area of heavy rain (1.65" observed) caused flash flooding over the recent Wildcat Fire burn scar (wildfire occurred late spring of 2024) between Camp Creek and west of Bartlett Lake. MCDOT was notified to barricade the impacted road.
- A relatively unstable and moist monsoon air mass (precipitable water values near 1.50" in southcentral AZ) led to more localized heavy rainfall/flooding the evening of the 19<sup>th</sup> over portions of Northwest Valley, West Valley, and Gila Bend areas (~0.50" to 1.75" amounts).
- A "Rim to Valley" monsoon pattern setup on July 21<sup>st</sup> was supportive of severe thunderstorms in central and southern AZ. The NOAA/NWS Storm Prediction Center (SPC) issued a "Severe Thunderstorm Watch" product covering the afternoon and evening period. Widespread gusty winds 35-50+ mph along an outflow boundary originating from severe mountain storms created blowing dust for large portions of the lower deserts, but there was limited storm development along the vigorous outflow wind boundary sweeping the Phoenix Valley.
- On July 25<sup>th</sup> a cluster of strong to severe thunderstorms moved south out of Yavapai County during the late afternoon to impact the western half of Maricopa County through much of the evening, including the Wickenburg area, West Valley, and ending north of the Gila Bend area. During the event, localized and very heavy rainfall impacted the Gillespie Dam monitoring site (southwest of Buckeye) where 2.24" was observed in a 60-minute span. An impressive 112-year return period characterized the observed rainfall intensity.
- There existed a sharp precipitation gradient of total monthly rainfall amounts between the populated interior Phoenix Valley and surrounding higher terrain of southcentral AZ. It was a common theme for persistent and high values of convective inhibition ("CIN") making it difficult for passing/colliding outflow wind boundaries from mountain storms to provide enough lift to generate widespread new storm activity across the lower deserts, despite having adequate monsoon moisture. Consequently, Phoenix Sky Harbor had only 0.38" of rainfall for the month, which is around 50 percent of climatological normal.

- A hot and humid air mass dominated the month of July to continue the unrelenting and hazardous heatwave extending since June, especially for the urbanized lower desert communities. The following excessive heat stats were recorded at Phoenix Sky Harbor (according to the NWS Phoenix WFO):
  - Similar to June, every day had daily max temperatures reaching a minimum of 100°F (a streak beginning on May 27<sup>th</sup>).
  - There were 25 days over 110°F (mean daily amount since 2000 is 11 days).
  - A peak monthly temp of 118°F (July 5<sup>th</sup> and 8<sup>th</sup>).
  - Average daily temperature for the month of July registered at 101.1°F, which was 5.6°F above normal.
  - Average daily minimum temperature was 89.8°F (5.3 degrees above normal).
  - Average daily maximum temperature was 112.3°F (5.8 degrees above normal)
  - A total of 5 new daily high temperature and 7 warm low temperature records were set.

### August Recap/Notable Events:

- The mean center positioning of the monsoon circulation for the month of August was generally found over eastern New Mexico/western Texas. The resultant monsoon pattern was favorable for sustained southeasterly low and midlevel moisture transport into the southern half of AZ through August 23<sup>rd</sup>.
- From August 6-8 a pronounced inverted trough (IT) moving west across northern Mexico and far southern AZ assisted with an active storm period, particularly on the 6<sup>th</sup> during the evening where pockets of heavier rain (between 0.50"-1.25") developed over the populated areas of South Phoenix, South Scottsdale, and the Southeast Valley. Additionally, flooding was observed southwest of Phoenix near Mobile, which prompted temporary closer of SR 238. Furthermore, a severe downburst event (estimated 60-70+ mph) occurred over portions of Scottsdale that caused various storm related damages, including uprooting numerous trees. Click [here](#) for more comprehensive storm details provided by the NWS Phoenix.
- Another round of severe thunderstorms and localized heavy rain occurred on August 22<sup>nd</sup>. Intense storms hit parts of the Valley following lift from a potent westward moving outflow boundary (and dust storm) originating from a cluster of strong to severe storms impacting NE Pinal County, the SE Valley, and Lower Salt River Lakes recreational areas. The bullseye for very heavy rain, up to nearly 2.00", was found over the Downtown Scottsdale area. Flowing water was observed within the Indian Bend Wash (IBW). Blowing dust, heavy rain between 0.25"-0.75", and damaging winds in excess of 60 mph were also observed at Phoenix Sky Harbor and extending east and south to include parts of Mesa and Chandler as new storms were triggered. Click [here](#) for more comprehensive storm details provided by the NWS Phoenix.
- Although the convective environment was more favorable during the month of August compared to July, the seasonal precipitation disparity between the Phoenix Valley and

surrounding higher terrain continued with only a few localized exceptions. Phoenix Sky Harbor received 0.35" of rainfall (August normal is 0.58").

- A hot and humid air mass for August extended the excessive heatwave beginning in June. The following excessive heat stats were recorded at Phoenix Sky Harbor (according to the NWS Phoenix WFO):
  - Everyday had daily max temperatures reaching a minimum of 100°F to continue the streak since May 27<sup>th</sup>.
  - There were 15 days reaching at least 110°F (normal since 2000 is 7 days).
  - A peak monthly temp of 116°F was observed on August 3<sup>rd</sup> and 4<sup>th</sup>.
  - Average daily temperature for the month of August registered at 98.7°F, which was 4.3°F above normal.
  - Average daily minimum temperature was 88.1°F (all-time warmest and 4.5 degrees above normal).
  - Average daily maximum temperature was 109.4°F (5.8 degrees above normal)
  - A total of 2 new daily high temperature and 6 warm low temperature records were set.

### September Recap/Notable Events:

- Overall, the month of September started off active on the 1<sup>st</sup> but quickly became much quieter in terms of opportunities for storms after a very dry air mass settled into the region. Ultimately, a lack of deep subtropical moisture available on many days precluded a thunderstorm threat, particularly at the lower elevations, including the Phoenix Metropolitan area.
- Temporary heat relief arrived mid-September due to persistent and anonymously cool low pressure troughing becoming established over the Desert Southwest. Storm activity was largely restricted east/southeast of Phoenix during this period.
- A brief return of marginal moisture and atmospheric instability on September 30<sup>th</sup> led to scattered high-based thundershower activity with localized gusty/dusty outflow winds and very little measurable rainfall reaching the surface.
- Despite intermittent storm/rain opportunities throughout September, Phoenix Sky Harbor did not record measurable rain for the month. Only a trace amount was recorded on the 16<sup>th</sup>.
- Temperatures for September were variable starting off seasonably hot, becoming unseasonably cool by the middle of the month, and then turning historically hot to finish due to strong/dry high pressure ridging over the southwestern United States. September and the latest monsoon period in general were unprecedentedly hot across the southcentral AZ concerning temperatures experienced and duration of heatwaves. The following is a summary of Phoenix Sky Harbor heat records/statistics for September and the overall summer season (according to the NWS Phoenix WFO):
  - Daily high of 117°F on September 28<sup>th</sup> was an all-time monthly high.
  - Total of 12 days in September at least 110°F (normal 2 days).

- Average daily temperature for the month of September registered at 94.6°F (all-time warmest), which was 5.4°F above normal.
- Average daily minimum temperature was 82.5°F (all-time warmest and 4.4 degrees above normal).
- Average daily maximum temperature was 106.6°F (all-time hottest and 6.2 degrees above normal)
- A total of 9 new daily high temperature and 9 warm low temperature records were set for September.
- Total of 62 days at or above 110°F (new annual record - normal 27 days).
- Total of 12 days at or above 115°F (normal 4 days since 2000).
- Total of 39 days at or above 90°F for overnight lows (normal 12 days since 2000).
- 113-day streak of temperatures reaching a minimum of 100°F starting May 27<sup>th</sup> and continuing through September 16<sup>th</sup> (previous record was 76 consecutive days in 1993).
- Latest observed 110°F+ reading during the year (113°F – September 29<sup>th</sup>; previously established September 19<sup>th</sup>, 2010).
- All-time warmest average monsoon period temperature of 98.3°F (previous 96.9°F in 2023).
- Hottest meteorological summer average temperature on record at 98.9°F (June through August).
- A total of 18 new daily high temperature and 28 warm low temperature records were set between June and September 2024.

**MSP Issued Products Recap:**

A total of 29 forecast zone-specific messages were issued by the MSP spread across ten 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. Of the 29 Messages issued, 29 Message-1 Alerts, 0 were Message-2 Flash Flood Watches, 0 were Message-3 Flash Flood Warnings, and 0 Message-4 Cancel. 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>Forecast Zone</b>	<b>June</b>	<b>July</b>	<b>August</b>	<b>September</b>	<b>Total</b>
Gila Bend	0	0	0	0	<b>0</b>
Gila River	0	0	0	0	<b>0</b>
Palo Verde	0	1	0	0	<b>1</b>
Rainbow Valley	0	2	0	0	<b>2</b>
West Valley	0	0	0	0	<b>0</b>
Northwest Valley	0	1	0	0	<b>1</b>
Upper Centennial	1	0	0	0	<b>1</b>
Wickenburg	0	1	0	0	<b>1</b>

<b>TABLE 1: MSP Messages Issued – Monsoon 2024</b>					
<b>Forecast Zone</b>	<b>June</b>	<b>July</b>	<b>August</b>	<b>September</b>	<b>Total</b>
New River/Cave Creek	0	1	1	0	2
Phoenix North	0	2	0	0	2
Phoenix South	0	2	2	0	4
Scottsdale North	2	0	1	0	3
Scottsdale South	0	0	2	0	2
East Valley	0	3	1	0	4
Southeast Valley	0	1	1	0	2
Lower Salt River Lakes	0	1	0	0	1
Superstition	0	2	1	0	3
<b>All Zones</b>	<b>3</b>	<b>17</b>	<b>9</b>	<b>0</b>	<b>29</b>

Table 2, below, shows the monthly break down of Lake Alerts issued including season totals. There were 52 Lake Alert statements were issued for the County Lakes Program including Lake Pleasant, Horseshoe Lake, Bartlett Lake, Saguaro Lake, Canyon Lake, Apache Lake.

<b>TABLE 2: MSP Lake Alerts Issued – Monsoon 2024</b>					
<b>Recreational Zone</b>	<b>June</b>	<b>July</b>	<b>August</b>	<b>September</b>	<b>Total</b>
Lake Pleasant	2	1	0	0	3
Horseshoe Lake	0	4	1	0	5
Bartlett Lake	1	4	3	0	8
Saguaro Lake	2	3	4	1	10
Canyon Lake	2	5	4	1	12
Apache Lake	2	7	4	1	14
<b>All Zones</b>	<b>9</b>	<b>24</b>	<b>16</b>	<b>3</b>	<b>52</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 2024 monsoon season. This chapter is broken down into five sections: Outlooks, Messages, Lake Alerts, and Storm Total Precipitation. Each section discusses the verification metrics used and the criteria followed to compute the statistics displayed in the summary chapter sections. A list of frequently used terms including definitions and acronyms as used throughout this report is listed below.

Observed Rainfall: the amounts of total rainfall gathered from either ALERT rain gages, gauge corrected radar estimations, or local storm reports (LSRs). Note that “Trace” amounts of precipitation (observed or forecast) are not considered measurable for verification purposes.

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

Hit: considered a correct forecast.

Miss: considered an incorrect forecast.

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

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

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

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

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

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

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

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

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

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

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

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

Quantitative Precipitation Forecast (QPF): forecast zone or basin specific rainfall forecast including a rainfall amount or range given in inches and/or intensity. Additionally, a probability of measurable precipitation (“PoP”) is given as a percent that could occur within a forecast zone or basin, usually given in conjunction with a QPF.

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

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

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

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

## **OUTLOOKS:**

### Forecast Accuracy:

Either a hit or a miss was selected for each day. A hit was assigned when observed rainfall was within the QPF range. A miss was assigned when rainfall was observed and no QPF was made (and vice versa) or if observed rainfall failed to reasonably meet the QPF (within 25 percent of the upper or lower bound QPF range, as appropriate). In some cases, a hit was assigned when the QPF was not reasonably met by observed rainfall. In these cases, the probability of occurrence was 30% or less and the QPF was below the OSE threshold. Values were then populated for each forecast zone and all zones combined. Forecast accuracy was then calculated by month.

### Probability of Detection:

A dash was assigned to all days when observed rainfall was below the OSE threshold. On days when observed rainfall met or exceeded the OSE threshold either a hit or a miss was assigned. A hit was selected when the observed rainfall reasonably met the QPF. A miss was assigned when observed rainfall greatly exceeded the QPF or if no QPF was issued. Values were then

populated for each forecast zone and all zones combined. A probability of detection was calculated by month and season total.

False Alarm Rate:

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

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

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

Threat Score:

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

*Tables containing all 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 or GAQPE rainfall amount occurring in the warned Forecast Zone reached minimum OSE threshold (i.e.,  $\geq 0.50$ ”). Conversely a miss was assigned if neither of these two criteria were met. Values were then populated for each forecast zone and all zones combined. Forecast accuracy was then calculated by month and season total.

Lead Time:

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

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

## LAKE ALERTS:

### Forecast Accuracy:

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

### Lead Time:

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

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

## STORM TOTAL PRECIPITATION:

### Forecast Accuracy:

Only message statements where a QPF storm total precipitation (STP) amount was provided were evaluated (i.e., only includes issued M-1 type statements). 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 when the observed maximum observed rainfall during a message statement period falls within the 25 percent error range determined by the lower and maximum forecast storm QPF, otherwise the over or under QPF is a “miss”. Values were then populated for each forecast zone and all zones combined. Forecast accuracy was then calculated by month and season.

Please note that 2024 verification for QPF “storm total precipitation” is now based on a maximum GAQPE versus a radar estimated maximum range of precipitation (e.g., 1.00” – 1.50” bin, etc.) used in verification metrics year’s prior. Evaluation using a maximum GAQPE will provide an improvement to QPF STP forecast accuracy precision. More information on the previous QPF STP verification methodology may be found in prior MSP Verification reports available [here](#).

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

## 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 69.6%. Forecast accuracy for the season was largely “satisfactory” ranging between 56.5-73.1% at 11 FZs, while 6 FZs met the “excellent” category being equal or greater than the 75% threshold. The Gila Bend FZ had the highest accuracy of the 2024 season at 76.9%, while the Lower Salt River Lakes had the least accuracy of 56.5%. The relative diminished seasonal accuracy for the Lower Salt River Lakes FZ was largely affected by a tendency to forecast measurable but light rainfall impacts (under 0.50”) when none or trace amounts (based on radar estimations) were observed. A prominent and recurring subsidence capping inversion over southcentral AZ limited storm propagation from mountain storm activity into the lower elevations. Overall, there was a forecast bias to overpredict the spatial threat of measurable rain that affected accuracy at many FZs during Monsoon 2024.

<b>TABLE 3: MSP Weather Outlook Verification – Monsoon 2024</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>TS (%)</b>
Gila Bend	81/108	75%	11/13	84.6%	4/108	3.7%	74.1%
Gila River	80/108	74.1%	6/10	60.0%	2/108	1.9%	72.7%
Palo Verde	82/108	75.9%	3/4	75.0%	5/108	4.6%	72.6%
Rainbow Valley	75/108	69.4%	4/10	40.0%	2/108	1.9%	68.2%
West Valley	76/108	70.4%	4/11	36.4%	3/108	2.8%	69.4%
Northwest Valley	79/108	73.1%	5/9	55.6%	2/108	1.9%	71.8%
Upper Centennial	74/108	68.5%	11/17	64.7%	3/108	2.8%	66.7%
Wickenburg	75/108	69.4%	6/9	66.7%	8/108	7.4%	64.7%
New River/Cave Creek	66/108	61.1%	14/20	70%	8/108	7.4%	56.9%
Phoenix North	83/108	76.9%	7/9	77.8%	1/108	0.9%	76.1%
Phoenix South	72/108	66.7%	5/9	55.6%	2/108	1.9%	65.5%
Scottsdale North	82/108	75.9%	6/10	60%	2/108	1.9%	74.5%
Scottsdale South	81/108	75%	3/3	100%	2/108	1.9%	73.6%
East Valley	76/108	70.4%	7/11	63.6%	1/108	0.9%	69.7%
Southeast Valley	72/108	66.7%	2/7	28.6%	3/108	2.8%	64.9%
Lower Salt River Lakes	61/108	56.5%	7/10	70%	12/108	11.1%	50.8%
Superstition	72/108	66.7%	4/5	80%	7/108	6.5%	62.6%
<b>All Zones</b>	<b>1280/1836</b>	<b>69.6%</b>	<b>101/158</b>	<b>63.9%</b>	<b>67/1836</b>	<b>3.7%</b>	<b>67.3%</b>

The second metric computed was Probability of Detection (POD). 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 63.9%,

which was an improvement from season prior (59%). In general, a POD of over 50% is considered sufficient and over 75% excellent in the forecast community. Five out of the seventeen FZs were at or above the 75% accuracy threshold with the remaining FZs ranging between 28.6% and 70%. Similar to Monsoon 2023, there were an unusually low number of operationally significant heavy rain opportunities compared to recent wetter monsoon regimes like 2021 and 2022. From a statistical analysis standpoint, the limited sample size in general likely contributed to more variable FZ specific POD percentages.

The third metric included in Table 3 was False Alarm Rate (FAR). It is important to keep track of how often MSP forecasters predicted an operationally significant day that did not occur. Too many false alarms can degrade user confidence in the forecasts. In general, a FAR below 50% is sufficient and below 25% is considered excellent within the forecast community. The overall FAR for all zones during the length of the monsoon season was exceptional at 3.7% with thirteen of the FZs having a FAR under 5%.

The final metric included in Table 3 was Threat Score (TS). The monsoon season officially runs from June 15<sup>th</sup> through September 30<sup>th</sup> of each year, yet the operational season (active weather days) tends to be much shorter beginning sometime in early July and finishing by mid-September. TS is thought to serve as a better metric for overall forecast skill as it removes correct negatives that are not important when computing forecast accuracy (i.e., dry days before and after the active monsoon season). Overall, forecast skill was good at 67.3% averaged for all FZs over the length of the active season. One of the seventeen FZs exceeded the 75% accuracy threshold (Phoenix North with 76.1%), while the remaining FZs had a TS ranging from 50.8% to 74.5%.

## 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.

Table 4, below, shows the issued message verification broken down by FZ and month. Complete data tables for each FZ can be viewed in [Appendix B](#): Tables B-1, B-2, and B-3. There were 29 qualifying messages (updates and M-4s not included) issued over the length of the season. Forecast accuracy for all FZs combined, over the length of the season, was very good at 89.7%. Only 14 of the 17 FZs had messages issued (none for Gila Bend, Gila River, and West Valley FZs). In total, the one message issued for the Wickenburg FZ during the season, one of three messages for the Superstition FZ, a one of four for the East Valley FZ did not verify. This resulted in 11 out of 15 FZs achieving 100% accuracy, while the East Valley FZ met the 75% accuracy threshold.

Overall, the area experienced an average monsoon with limited rainfall opportunities for interior sections of Maricopa County, including Metro Phoenix. As a result, the total number of qualifying messages issued on the season (29) was significantly lower than the seasonal average of one hundred thirty-two (based on MSP Verification Reports since 2012). With the early onset, three messages were issued during the month of June. July was the busiest month overall for thunderstorm activity with 17 total messages being issued for 11 different FZs over four operationally significant days (July 14<sup>th</sup>, 19<sup>th</sup>, 24<sup>th</sup>, and 25<sup>th</sup>). Forecast message accuracy was 17 out of 20 (85%), which was above the 75% threshold. August was less active with nine messages issued spread out across four operationally significant days (August 6<sup>th</sup>, 18<sup>th</sup>, 22<sup>nd</sup>, and 31<sup>st</sup>). A forecast accuracy of 100% for the month across all FZs combined was excellent. A significant decrease in monsoon storm activity was observed in September with no messages issued. Lead time was the final metric included for message statement verification this year. The average lead time (data in [Appendix B](#), Table B-3) for all M-1 Alerts combined over the length of the monsoon season was just over twenty-four minutes.

**TABLE 4: MSP Issued Statements Verification, broken down by month and Forecast Zone – Monsoon 2024**

	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	0/0	n/a	0/0	n/a	0/0	n/a	0/0	n/a
Gila River	0/0	n/a	0/0	n/a	0/0	n/a	0/0	n/a	0/0	n/a
Palo Verde	0/0	n/a	1/1	100%	0/0	n/a	0/0	n/a	1/1	100%
Rainbow Valley	0/0	n/a	2/2	100%	0/0	n/a	0/0	n/a	2/2	100%
West Valley	0/0	n/a	0/0	n/a	0/0	n/a	0/0	n/a	0/0	n/a
Northwest Valley	0/0	n/a	1/1	100%	0/0	n/a	0/0	n/a	1/1	100%
Upper Centennial	1/1	100%	0/0	n/a	0/0	n/a	0/0	n/a	1/1	100%
Wickenburg	0/0	n/a	0/1	0%	0/0	n/a	0/0	n/a	0/1	0%
New River/Cave Creek	0/0	n/a	1/1	100%	1/1	100%	0/0	n/a	2/2	100%
Phoenix North	0/0	n/a	2/2	100%	0/0	n/a	0/0	n/a	2/2	100%
Phoenix South	0/0	n/a	2/2	100%	2/2	100%	0/0	n/a	4/4	100%
Scottsdale North	2/2	100%	0/0	n/a	1/1	100%	0/0	n/a	3/3	100%
Scottsdale South	0/0	n/a	0/0	n/a	2/2	100%	0/0	n/a	2/2	100%
East Valley	0/0	n/a	2/3	66.7%	1/1	100%	0/0	n/a	3/4	75%
Southeast Valley	0/0	n/a	1/1	100%	1/1	100%	0/0	n/a	2/2	100%
Lower Salt River Lakes	0/0	n/a	1/1	100%	0/0	n/a	0/0	n/a	1/1	100%
Superstition	0/0	n/a	2/3	50%	1/1	100%	0/0	n/a	2/3	66.7%
<b>All Zones</b>	<b>3/3</b>	<b>100%</b>	<b>14/17</b>	<b>82.4%</b>	<b>9/9</b>	<b>100%</b>	<b>0/0</b>	<b>n/a</b>	<b>26/29</b>	<b>89.7%</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 52 Lake Alerts issued over the length of the season with the majority of them occurring in July with 24. Forecast accuracy for the recreational zones combined, over the length of the season, was 96.2%. The Lake Pleasant and Canyon Lake zones met or exceeded the 75% accuracy threshold with the other four zones ranging between 20% and 66.7%. As stated earlier, 50% accuracy is considered sufficient and 75% and above is considered excellent within the forecast community. The average lead time (not shown) for all lakes/reservoirs combined over the length of the monsoon season was just over 17 minutes.

<b>TABLE 5: MSP Lake Alerts Issued - Monsoon 2024</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	2/2	100%	1/1	100%	0/0	n/a	0/0	n/a	<b>3/3</b>	<b>100%</b>
Horseshoe Lake	0/0	n/a	4/4	100%	1/1	100%	0/0	n/a	<b>5/5</b>	<b>100%</b>
Bartlett Lake	1/1	100%	$\frac{3}{4}$	75%	3/3	100%	0/0	n/a	<b>7/8</b>	<b>87.5%</b>
Saguaro Lake	2/2	100%	3/3	100%	4/4	100%	1/1	100%	<b>10/10</b>	<b>100%</b>
Canyon Lake	2/2	100%	5/5	100%	$\frac{3}{4}$	75%	1/1	100%	<b>11/12</b>	<b>91.7%</b>
Apache Lake	2/2	100%	7/7	100%	4/4	100%	1/1	100%	<b>14/14</b>	<b>100%</b>
<b>All Zones</b>	<b>9/9</b>	<b>100%</b>	<b>23/24</b>	<b>95.8%</b>	<b>15/16</b>	<b>93.8%</b>	<b>3/3</b>	<b>100%</b>	<b>50/52</b>	<b>96.2%</b>

## QPF STORM TOTAL PRECIPITATION VERIFICATION

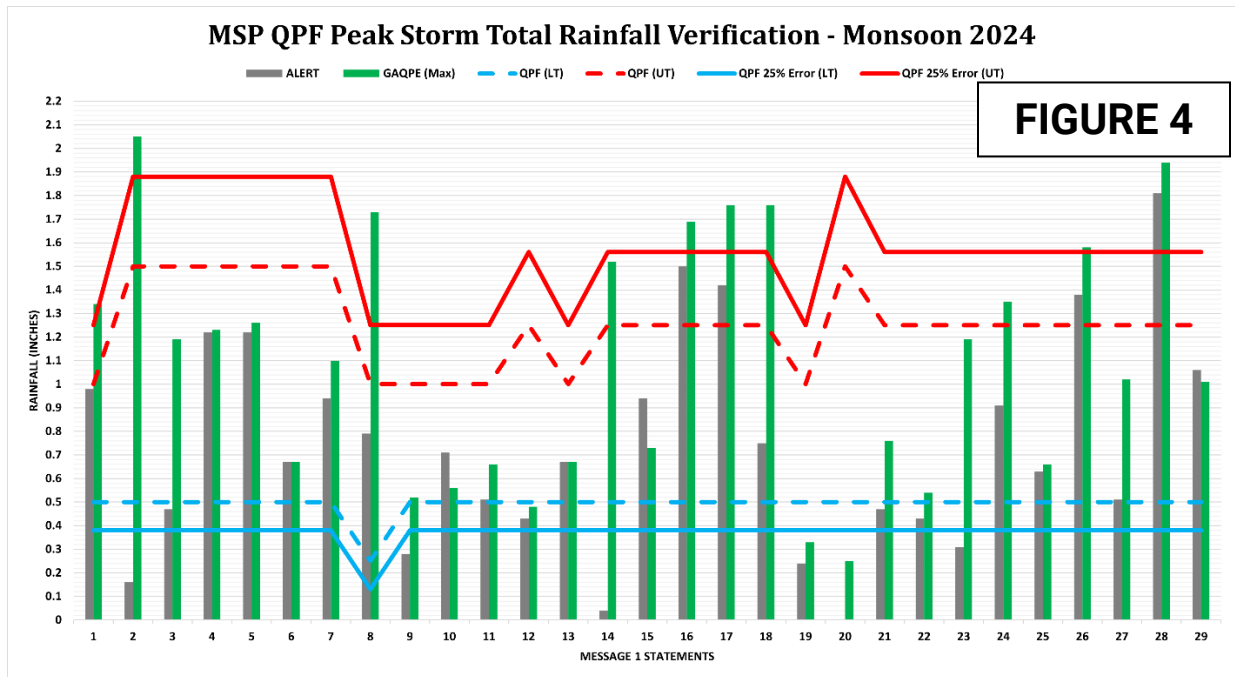
The MSP has placed added emphasis on including QPF information within message statements, specifically M-1 Alerts. These messages are normally issued before the onset of rain events and precede warning issuance in order to maximize lead time for affected locations. Providing STP that will likely accompany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

Table 6, 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 D](#): Table D-1. Forecast accuracy for all FZs combined, over the length of the season, was 65.5%. The majority of missed events over the course of the monsoon tended to be under-forecast by the MSP (i.e., forecast rainfall value less than observed rainfall value). Overall, a marked reduction in qualifying events were observed in 2024 (29) compared to 2023 (66). Additionally, the month of September was not as active with no events to assess in 2024. Accuracy in June came in at 33.3% across three qualifying events impacting two FZs spread over two storm days to start the monsoon period. Accuracy in July was 58.8% across 17 events spread across four storm days in 10 of 17 FZs. Forecast accuracy improved to 77.8% in August with an additional nine events over four operationally active days. A majority of FZs did not have a qualifying event in August (10 of 17). For the 2024 season, qualifying events in any given FZ were limited ranging between none to a maximum of four events. A summary of verification for all 2024 qualifying events are shown in Figure 4 (as discussed in the [MSP Verification Metrics and Criteria](#) section, a forecast verified if the peak observed rainfall fell within a 25% error range of the upper and lower bound QPF).

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

**TABLE 6: QPF Storm Total Precipitation Verification - Monsoon 2024**

Forecast Zone	June		July		August		September		Season Totals	
	Correct QPF	AOF (%)	Correct QPF	AOF (%)	Correct QPF	AOF (%)	Correct QPF	AOF (%)	Correct QPF	AOF (%)
Gila Bend	0/0	n/a	0/0	n/a	0/0	n/a	0/0	n/a	n/a	n/a
Gila River	0/0	n/a	0/0	n/a	0/0	n/a	0/0	n/a	n/a	n/a
Palo Verde	0/0	n/a	0/1	0%	0/0	n/a	0/0	n/a	0/1	0%
Rainbow Valley	0/0	n/a	2/2	100%	0/0	n/a	0/0	n/a	2/2	100%
West Valley	0/0	n/a	0/0	n/a	0/0	n/a	0/0	n/a	n/a	n/a
NW Valley	0/0	n/a	0/1	0%	0/0	n/a	0/0	n/a	0/1	0%
Upper Centennial	0/1	0%	0/0	n/a	0/0	n/a	0/0	n/a	0/1	0%
Wickenburg	0/0	n/a	0/1	0%	0/0	n/a	0/0	n/a	0/1	0%
New River/Cave Creek	0/0	n/a	1/1	100%	1/1	100%	0/0	n/a	2/2	100%
Phoenix North	0/0	n/a	2/2	100%	0/0	n/a	0/0	n/a	2/2	100%
Phoenix South	0/0	n/a	2/2	100%	1/2	50%	0/0	n/a	3/4	75%
Scottsdale North	1/2	50%	0/0	n/a	1/1	100%	0/0	n/a	2/3	66.7%
Scottsdale South	0/0	n/a	0/0	n/a	1/2	50%	0/0	n/a	1/2	50%
East Valley	0/0	n/a	3/3	100%	1/1	100%	0/0	n/a	4/4	100%
Southeast Valley	0/0	n/a	0/1	0%	1/1	100%	0/0	n/a	1/2	50%
Lower Salt River Lakes	0/0	n/a	1/1	100%	0/0	n/a	0/0	n/a	1/1	100%
Superstition	0/0	n/a	0/2	0%	1/1	100%	0/0	n/a	1/3	33.3%
<b>All Zones</b>	<b>1/3</b>	<b>33.3%</b>	<b>11/17</b>	<b>58.8%</b>	<b>7/9</b>	<b>77.8%</b>	<b>0/0</b>	<b>n/a</b>	<b>19/29</b>	<b>65.5%</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 2024 monsoon season. Outlooks, Messages, Lake Alerts, and QPF Storm Total Precipitation were the four products analyzed in this report.

Verification of Forecast Zone (FZ) daily outlooks was conducted using four metrics: Forecast Accuracy (FA), Probability of Detection (POD), False Alarm Rate (FAR), and Threat Score (TS). When comparing all FZs combined over the length of the monsoon season, FA was 69.7%, POD was 63.9%, the FAR was 3.7%, and the TS was 67.3%. Forecast Accuracy, Probability of Detection, and Threat Score were still considered "satisfactory" when equating these results with accepted values within the forecast community, while the very low False Alarm Rate is considered excellent.

Forecast message statement accuracy was 89.7% for all forecast zones over the length of the monsoon. Forecast skill stayed consistently above the excellent 75% threshold each month for June (100%), July (82.4%), and August (100%). There were no message statements issued for the month of September. Like the 2023 monsoon, 2024 had an unusual low number of total seasonal messages issued (29) due to diminished monsoonal storm activity in general affecting the FZs. The average lead time for all Message 1 Alerts (M-1) over the length of the season was around twenty-four minutes, which is shorter than Monsoon 2023's forty-minute average. There were no flood watch (M-2) or flood warning (M-3) related statements issued during the 2024 season.

Verification of Lake Alerts showed an excellent combined accuracy of 96.2%, marking a significant improvement compared to Monsoon 2023's 52.4% overall issuance accuracy. The average lead time for all lakes/reservoirs combined over the length of the season was around eighteen minutes, which was a reduction from last summer's thirty-two minutes.

An updated verification methodology was used to evaluate QPF storm total precipitation forecast accuracy (as discussed in the [MSP Verification Metrics and Criteria](#) section of this report). Accuracy was determined using a 25% error range for the upper and lower bound QPF compared to available datasets representing observed rainfall in specific FZs (i.e., maximum GAQPE, ALERT rain gauges, local storm reports). When comparing all forecast zones

combined over the length of the monsoon, forecast accuracy was adequate at 65.5% with a forecast bias to overpredict storm total rainfall amounts.

<b>TABLE 7: Historic Monsoon Verification Comparison</b>										
	<b>Outlooks</b>				<b>Messages</b>		<b>Lake Alerts</b>		<b>QPF STP</b>	
<b>Year</b>	<b>AOF</b>	<b>POD</b>	<b>FAR</b>	<b>TS</b>	<b>Events</b>	<b>AOF</b>	<b>Events</b>	<b>AOF</b>	<b>Events</b>	<b>AOF</b>
2012	79.1%	79.6%	8.9%	n/a	102	86.3%	n/a	n/a	n/a	n/a
2013	79.8%	78.7%	6.2%	n/a	137	88.0%	56	89.3%	54	72.2%
2014	77.7%	76.9%	7.1%	67.4%	263	80.2%	57	84.2%	76	72.4%
2015	74.8%	60.3%	2.8%	67.9%	118	75.4%	40	95%	56	82.1%
2016	84.9%	78%	2.6%	77.5%	112	90.2%	46	82.6%	53	88.7%
2017	83.1%	77.9%	1.8%	72.4%	111	86.5%	53	90.6%	67	93.1%
2018	86.1%	82.2%	1.6%	75.6%	129	89.9%	41	82.9%	110	84.5%
2019	90.1%	72.9%	0.7%	80.9%	78	92.3%	18	83.3%	46	80.4%
2020	92.4%	67.1%	0.4%	84.2%	54	92.6%	17	82.4%	36	97.2%
2021	83.0%	85.5%	3.5%	72.5%	219	92.7%	32	87.5%	122	82.8%
2022	79.3%	78.7%	3.5%	71.8%	206	96.6%	47	87.2%	169	92.9%
2023	83.6%	59.0%	1.1%	68.6%	66	83.3%	42	52.4%	57	86.0%
2024	69.6%	63.9%	3.7%	67.3%	29	89.7%	52	96.2%	29	65.5%
<b>AVG</b>	<b>81.8%</b>	<b>73.9%</b>	<b>3.4%</b>	<b>73.3%</b>	<b>124.9</b>	<b>88%</b>	<b>40.8</b>	<b>83.4%</b>	<b>72.9</b>	<b>83.2%</b>

Table 7 was included to add historical perspective in the verification process. Verification metrics for Outlooks, Messages, Lake Alerts, and QPF STP were included for all previous years. For the 2024 monsoon season, Outlook Forecast Accuracy was the lowest in program history. The False Alarm Rate remained near the MSP average since 2012; however, Probability of Detection ranked 4<sup>th</sup> lowest and the aggregate Threat Score metric was the lowest. This monsoon was historically dry (3<sup>rd</sup> driest on record for the ALERT rain gauge network) resulting in operationally significant events, storm days, and products issued being much lower than typical. Overall, a forecast bias to overpredict FZ max QPF and daily spatial measurable rain potential affected combined FZ Outlook accuracy for Monsoon 2024.

Forecast skill for issued message statements continued to exceed the 75% threshold since record keeping began in the 2012 season. This was the least active season on record for issued messages. Forecast accuracy for Lake Alerts was the highest in MSP’s history. The number of alerts issued for Monsoon 2024 ranked fourth highest. Discussion on improvements of techniques for observing and documenting lightning, heavy rainfall, and wind measurement will continue to assist with the post-event verification process. Finally, the QPF STP skill of 75.7% was below the long-term MSP program average of 84% and was the third lowest in program history. Qualifying monsoon QPF STP events for 2024 were at a historical low, which can decrease this season’s statistical robustness of verification results.

When all was said and done, the 2024 monsoon season was considered well below normal in terms of active days and below average for rainfall at a majority of observation sites. The

season also recorded the least number of products issued (messages and Lake Alerts combined) by the MSP. It is hoped that this report will serve as quantifiable tool used to evaluate forecast performance on a year-to-year basis. This report will be continued in subsequent years focusing not only the present year's statistical data but will also serve as a historical comparison to measure future year's performance.

## APPENDIX A: MSP OUTLOOKS – VERIFICATION TABLES

**TABLE A-1:** This table shows the raw verification data of MSP issued precipitation forecasts contained in the daily Outlooks for the 2024 monsoon season. The valid period for rainfall each day is from 12 PM same day through 12 PM the following day. The table is broken down by date and MSP Forecast Zone (FZ). For brevity two FZs are included for each day. The columns from left to right are defined as follows:

**Prob.** – Percent probability of measurable 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 gauge 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”.

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
	<b>Gila Bend</b>							<b>Gila River</b>						
06/15/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/24	20	Trace-0.04	0.00	0.10	h	-	-	0	0.00	0.00	0.01	h	-	-
06/22/24	20	Trace-0.25	0.00	0.25	h	-	-	20	Trace-0.25	0.00	0.45	h	-	-
06/23/24	30	Trace-0.25	0.00	0.08	h	-	-	10	Trace	0.00	0.00	h	-	-
06/24/24	30	Trace-0.50	0.00	0.82	m	h	-	10	Trace-0.10	0.51	1.62	m	m	-
06/25/24	20	Trace-0.50	0.00	0.35	h	-	-	10	Trace-0.10	0.00	0.02	h	-	-
06/26/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/24	0	0.00	0.00	0.00	h	-	-	10	Trace-0.25	0.00	0.00	m	-	-
06/29/24	20	Trace-0.25	0.00	0.45	h	-	-	10	Trace-0.10	0.00	0.02	h	-	-
06/30/24	60	0.50-1.50	0.04	0.28	m	-	x	50	0.50-1.00	0.00	0.17	m	-	x
<b>16 days</b>					<b>14</b>	<b>1/1</b>	<b>1</b>					<b>13</b>	<b>0/1</b>	<b>1</b>
07/01/24	30	Trace-0.50	0.28	0.61	h	h	-	20	Trace-0.50	0.00	0.02	h	-	-
07/02/24	30	Trace-0.50	0.00	0.08	h	-	-	10	Trace-0.10	0.00	0.08	h	-	-
07/03/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/04/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/09/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/10/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/11/24	10	Trace-0.10	0.00	0.13	h	-	-	0	0.00	0.00	0.23	m	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
07/12/24	10	Trace-0.25	0.00	0.21	h	-	-	10	Trace-0.25	0.00	0.35	h	-	-
07/13/24	10	Trace-0.10	0.00	0.33	h	-	-	0	0.00	0.00	0.00	h	-	-
07/14/24	30	0.25-0.75	0.16	1.02	m	h	-	20	Trace-0.25	0.04	0.47	h	-	-
07/15/24	10	Trace-0.25	0.00	0.03	h	-	-	0	0.00	0.00	0.38	m	-	-
07/16/24	0	0.00	0.00	0.03	m	-	-	0	0.00	0.00	0.00	h	-	-
07/17/24	20	Trace-0.25	0.00	0.10	h	-	-	<10	Trace-0.25	0.00	0.22	h	-	-
07/18/24	10	Trace-0.25	0.00	0.15	h	-	-	20	Trace-0.25	0.00	0.00	m	-	-
07/19/24	20	Trace-0.25	0.67	1.77	m	m	-	20	Trace-0.25	0.00	0.04	h	-	-
07/20/24	50	Trace-0.10	0.00	0.05	h	-	-	30	Trace-0.10	0.00	0.00	m	-	x
07/21/24	70	0.25-0.50	0.08	0.64	m	h	-	50	0.25-0.50	0.20	0.84	m	h	-
07/22/24	10	Trace-0.25	0.00	0.00	m	-	-	20	Trace-0.25	0.00	0.03	h	-	-
07/23/24	10	Trace-0.25	0.00	0.09	h	-	-	0	0.00	0.00	0.00	h	-	-
07/24/24	30	0.25-0.75	0.00	0.11	m	-	-	20	Trace-0.50	0.00	0.54	h	h	-
07/25/24	30	0.25-0.75	0.00	0.75	h	h	-	20	Trace-0.50	0.28	0.53	h	h	-
07/26/24	10	Trace-0.25	0.00	0.02	h	-	-	10	Trace-0.25	0.00	0.10	h	-	-
07/27/24	20	Trace-0.25	0.00	0.28	h	-	-	<10	Trace-0.05	0.00	0.00	m	-	-
07/28/24	0	0.00	0.00	0.02	m	-	-	0	0.00	0.00	0.10	m	-	-
07/29/24	30	Trace-0.50	0.00	0.67	m	h	-	<10	Trace-0.10	0.00	0.03	h	-	-
07/30/24	20	Trace-0.50	0.00	0.24	h	-	-	0	0.00	0.00	0.00	h	-	-
07/31/24	30	0.50-1.00	0.28	n/a	h	-	x	20	Trace-0.25	0.00	n/a	m	-	-
<b>31 days</b>					<b>23</b>	<b>5/6</b>	<b>1</b>					<b>23</b>	<b>3/3</b>	<b>1</b>
08/01/24	10	Trace-0.25	0.00	n/a	h	-	-	10	Trace-0.10	0.00	n/a	m	-	-
08/02/24	20	Trace-0.25	0.00	n/a	h	-	-	<10	0.00	0.00	n/a	h	-	-
08/03/24	20	Trace-0.50	0.04	2.18	m	h	-	10	Trace-0.10	0.00	1.58	m	m	-
08/04/24	30	0.25-0.75	0.00	n/a	m	-	x	20	Trace-0.50	0.04	n/a	h	-	-
08/05/24	10	Trace	0.00	0.26	h	-	-	10	Trace-0.10	0.00	0.06	h	-	-
08/06/24	40	0.50-1.00	0.12	0.64	h	h	-	30	0.50-1.00	0.43	3.03	m	h	-
08/07/24	20	Trace-0.25	0.00	0.00	h	-	-	20	Trace-0.25	0.00	0.72	m	m	-
08/08/24	30	0.25-0.75	0.35	1.02	m	h	-	20	0.25-0.75	0.00	0.81	h	h	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
08/09/24	10	Trace-0.25	0.00	0.00	m	-	-	0	0.00	0.00	0.00	h	-	-
08/10/24	40	0.50-1.00	0.20	1.95	m	h	-	20	Trace-0.50	0.00	0.30	h	-	-
08/11/24	30	Trace-0.50	0.00	0.00	m	-	-	<10	0.00	0.00	0.00	h	-	-
08/12/24	30	0.25-0.75	0.00	0.00	m	-	-	10	Trace-0.50	0.00	0.26	h	-	-
08/13/24	0	0.00	0.00	0.00	h	-	-	10	Trace-0.25	0.00	0.00	m	-	-
08/14/24	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
08/15/24	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
08/16/24	10	Trace-0.50	0.00	0.00	m	-	-	0	0.00	0.00	0.00	h	-	-
08/17/24	20	Trace-0.50	0.35	1.91	m	h	-	30	Trace-0.50	0.20	1.33	m	h	-
08/18/24	0	0.00	0.00	0.01	h	-	-	0	0.00	0.00	0.00	h	-	-
08/19/24	10	Trace-0.50	0.00	0.01	m	-	-	0	0.00	0.00	0.01	m	-	-
08/20/24	10	Trace-0.50	0.00	0.41	h	-	-	10	Trace-0.25	0.00	0.13	h	-	-
08/21/24	50	Trace-0.50	0.00	0.12	h	-	x	20	Trace-0.50	0.00	0.16	h	-	-
08/22/24	0	0.00	0.00	0.01	h	-	-	20	Trace-0.25	0.00	0.78	m	m	-
08/23/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.01	h	-	-
08/24/24	0	0.00	0.00	0.03	m	-	-	0	0.00	0.00	0.46	m	-	-
08/25/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/26/24	0	0.00	0.00	0.01	h	-	-	0	0.00	0.00	0.47	m	-	-
08/27/24	20	Trace-0.25	0.00	0.05	h	-	-	10	Trace-0.10	0.00	0.16	h	-	-
08/28/24	10	Trace-0.10	0.00	0.00	m	-	-	10	Trace-0.10	0.00	0.00	m	-	-
08/29/24	20	Trace-0.25	0.00	0.51	m	m	-	0	0.00	0.00	0.00	h	-	-
08/30/24	10	Trace-0.25	0.00	0.18	h	-	-	0	0.00	0.00	0.10	m	-	-
08/31/24	10	Trace-0.25	0.00	0.67	m	-	-	10	Trace-0.25	0.00	0.00	m	-	-
<b>31 days</b>					<b>17</b>	<b>5/6</b>	<b>2</b>					<b>18</b>	<b>3/6</b>	<b>0</b>
09/01/24	10	Trace-0.25	0.00	0.30	h	-	-	10	Trace-0.25	0.00	0.13	h	-	-
09/02/24	0	0	0.00	0.00	h	-	-	0	0	0.00	0.00	h	-	-
09/03/24	0	0	0.00	0.00	h	-	-	0	0	0.00	0.00	h	-	-
09/04/24	0	0	0.00	0.00	h	-	-	0	0	0.00	0.00	h	-	-
09/05/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
09/06/24	20	Trace-0.50	0.00	0.00	m	-	-	0	0.00	0.00	0.00	h	-	-
09/07/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/08/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/09/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/24	0	0.00	0.00	0.00	h	-	-	10	Trace-0.25	0.00	0.00	m	-	-
09/15/24	0	0.00	0.00	0.01	m	-	-	20	Trace-0.25	0.00	0.00	m	-	-
09/16/24	0	0.00	0.00	0.01	m	-	-	0	0.00	0.00	0.20	m	-	-
09/17/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.10	m	-	-
09/21/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
<b>30 days</b>					<b>27</b>	<b>0/0</b>	<b>0</b>					<b>26</b>	<b>0/0</b>	<b>0</b>
	<b>Palo Verde</b>							<b>Rainbow Valley</b>						
06/15/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
06/16/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.05	h	-	-
06/22/24	10	Trace-0.10	0.00	0.00	m	-	-	10	Trace-0.10	0.00	0.02	h	-	-
06/23/24	10	Trace	0.04	0.22	m	-	-	10	Trace	0.00	0.15	m	-	-
06/24/24	10	Trace-0.10	0.00	0.06	h	-	-	10	Trace-0.10	0.16	0.56	m	m	-
06/25/24	10	Trace-0.10	0.24	0.49	h	-	-	10	Trace-0.10	0.00	0.09	h	-	-
06/26/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/29/24	10	Trace-0.10	0.00	0.01	h	-	-	10	Trace-0.10	0.00	0.00	m	-	-
06/30/24	50	0.25-0.75	0.04	0.08	m	-	x	50	0.25-0.75	0.08	0.38	h	-	x
<b>16 days</b>					<b>13</b>	<b>0/0</b>	<b>1</b>					<b>13</b>	<b>0/1</b>	<b>1</b>
07/01/24	0	0.00	0.00	0.06	m	-	-	20	Trace-0.50	0.08	0.15	h	-	-
07/02/24	0	0.00	0.00	0.00	h	-	-	10	Trace-0.10	0.00	0.10	h	-	-
07/03/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/04/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/09/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/10/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/11/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.03	m	-	-
07/12/24	10	Trace-0.25	0.00	0.00	m	-	-	10	Trace-0.25	0.00	0.01	m	-	-
07/13/24	10	Trace-0.10	0.00	0.00	m	-	-	0	0.00	0.00	0.00	m	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
07/14/24	20	Trace-0.50	0.12	0.29	h	-	-	20	Trace-0.25	1.22	1.47	m	m	-
07/15/24	0	0.00	0.00	0.01	h	-	-	0	0.00	0.00	0.00	h	-	-
07/16/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.02	m	-	-
07/17/24	10	Trace-0.15	0.04	0.40	h	-	-	10	Trace-0.10	0.08	0.55	m	m	-
07/18/24	10	Trace-0.10	0.00	0.05	h	-	-	10	Trace-0.10	0.00	0.04	h	-	-
07/19/24	20	Trace-0.25	0.00	0.00	m	-	-	20	Trace-0.25	0.00	0.06	h	-	-
07/20/24	20	Trace-0.10	0.00	0.00	m	-	-	20	Trace-0.10	0.00	0.01	m	-	-
07/21/24	50	0.25-0.50	0.00	0.32	h	-	x	50	0.25-0.50	0.00	0.50	h	h	-
07/22/24	10	Trace-0.25	0.00	0.00	m	-	-	10	Trace-0.25	0.00	0.00	m	-	-
07/23/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/24/24	20	Trace-0.50	0.00	0.33	h	-	-	20	Trace-0.50	0.16	0.47	h	-	-
07/25/24	20	Trace-0.50	1.22	1.76	m	h	-	20	Trace-0.50	0.71	0.92	m	h	-
07/26/24	<10	0.00	0.00	0.00	h	-	-	<10	0.00	0.00	0.00	h	-	-
07/27/24	<10	Trace-0.05	0.00	0.00	m	-	-	<10	Trace-0.05	0.00	0.00	m	-	-
07/28/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/29/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/30/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/31/24	10	Trace-0.10	0.00	n/a	m	-	-	20	Trace-0.50	0.00	n/a	m	-	-
<b>31 days</b>					<b>22</b>	<b>1/1</b>	<b>1</b>					<b>20</b>	<b>2/4</b>	<b>0</b>
08/01/24	10	Trace	0.12	n/a	m	-	-	10	Trace	0.04	n/a	m	-	-
08/02/24	<10	0.00	0.00	n/a	h	-	-	<10	0.00	0.00	n/a	h	-	-
08/03/24	0	0.00	0.00	0.69	m	m	-	10	Trace-0.10	0.00	0.67	m	m	-
08/04/24	20	Trace-0.50	0.47	n/a	h	-	-	20	Trace-0.50	0.12	n/a	h	-	-
08/05/24	10	Trace-0.10	0.00	0.02	h	-	-	10	Trace	0.00	0.00	h	-	-
08/06/24	30	0.50-1.00	0.12	0.42	h	-	x	30	0.50-1.00	0.00	2.23	m	h	-
08/07/24	20	Trace-0.25	0.00	0.52	m	h	-	20	Trace-0.25	1.06	1.44	m	m	-
08/08/24	30	0.25-0.75	0.28	0.61	h	h	-	20	0.25-0.75	0.35	1.31	m	h	-
08/09/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/10/24	40	0.50-1.00	0.00	0.21	m	-	x	30	0.25-0.75	0.00	0.08	h	-	x

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
08/11/24	10	Trace-0.25	0.00	0.00	m	-	-	10	Trace-0.25	0.00	0.00	m	-	-
08/12/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.03	m	-	-
08/13/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/14/24	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
08/15/24	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
08/16/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/17/24	10	Trace	0.04	0.44	m	-	-	20	Trace-0.25	0.08	0.67	m	m	-
08/18/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.03	m	-	-
08/19/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/20/24	10	Trace-0.25	0.00	0.00	m	-	-	10	Trace-0.25	0.00	0.10	h	-	-
08/21/24	30	Trace-0.50	0.00	0.06	h	-	x	30	Trace-0.50	0.00	0.30	h	-	-
08/22/24	0	0.00	0.00	0.00	h	-	-	20	Trace-0.25	0.00	0.28	h	-	-
08/23/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.06	m	-	-
08/24/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.46	m	-	-
08/25/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/26/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.09	m	-	-
08/27/24	10	Trace-0.10	0.00	0.01	m	-	-	0	0.00	0.00	0.06	m	-	-
08/28/24	10	Trace-0.10	0.00	0.00	m	-	-	10	Trace-0.10	0.00	0.00	m	-	-
08/29/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.03	m	-	-
08/30/24	0	0.00	0.16	1.21	m	m	-	0	0.00	0.00	0.09	m	-	-
08/31/24	10	Trace-0.25	0.00	0.00	m	-	-	10	Trace-0.25	0.00	0.03	h	-	-
<b>31 days</b>					<b>20</b>	<b>2/3</b>	<b>3</b>					<b>15</b>	<b>2/5</b>	<b>1</b>
09/01/24	10	Trace-0.25	0.00	0.00	m	-	-	10	Trace-0.25	0.08	0.90	h	m	-
09/02/24	0	0	0.00	0.00	h	-	-	0	0	0.00	0.00	h	-	-
09/03/24	0	0	0.00	0.00	h	-	-	0	0	0.00	0.00	h	-	-
09/04/24	0	0	0.00	0.00	h	-	-	0	0	0.00	0.00	h	-	-
09/05/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/24	10	Trace-0.10	0.00	0.00	m	-	-	10	Trace-0.10	0.00	0.00	m	-	-
09/07/24	<10	Trace-0.10	0.00	0.00	m	-	-	0	0.00	0.00	0.00	h	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
09/08/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/09/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/24	0	0.00	0.00	0.00	h	-	-	10	Trace-0.25	0.00	0.00	m	-	-
09/15/24	0	0.00	0.00	0.00	h	-	-	10	Trace0.25	0.00	0.00	m	-	-
09/16/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.07	h	-	-
09/17/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
<b>30 days</b>					<b>27</b>	<b>0/0</b>	<b>0</b>					<b>27</b>	<b>0/1</b>	<b>0</b>
	<b>West Valley</b>							<b>Northwest Valley</b>						
06/15/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
06/18/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/24	0	0.00	0.00	0.01	m	-	-	0	0.00	0.00	0.03	h	-	-
06/22/24	10	Trace-0.10	0.00	0.02	h	-	-	10	Trace-0.10	0.00	0.79	m	m	-
06/23/24	10	Trace	0.04	0.83	m	m	-	10	Trace	0.12	0.26	h	-	-
06/24/24	10	Trace-0.25	0.63	0.93	m	m	-	20	Trace-0.25	0.79	1.16	m	m	-
06/25/24	10	Trace-0.10	0.71	1.16	m	m	-	20	Trace-0.50	1.14	3.07	m	h	-
06/26/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/29/24	10	Trace-0.10	0.00	0.01	m	-	-	20	Trace-0.10	0.00	0.02	h	-	-
06/30/24	50	0.25-0.75	0.04	0.20	h	-	x	60	0.50-1.50	0.31	0.39	h	-	x
<b>16 days</b>					<b>11</b>	<b>0/3</b>	<b>1</b>					<b>13</b>	<b>1/3</b>	<b>1</b>
07/01/24	0	0.00	0.00	0.06	m	-	-	0	0.00	0.00	0.00	h	-	-
07/02/24	0	0.00	0.00	0.03	m	-	-	0	0.00	0.00	0.00	h	-	-
07/03/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/04/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/09/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/10/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/11/24	0	0.00	0.00	0.17	m	-	-	10	Trace-0.10	0.00	0.00	m	-	-
07/12/24	10	Trace-0.25	0.00	0.02	h	-	-	10	Trace-0.25	0.00	0.15	h	-	-
07/13/24	<10	0.00	0.00	0.00	h	-	-	<10	0.00	0.00	0.00	h	-	-
07/14/24	20	Trace-0.25	0.12	0.53	m	m	-	20	Trace-0.50	0.28	0.39	h	-	-
07/15/24	<10	0.00	0.00	0.00	h	-	-	<10	0.00	0.00	0.00	h	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
07/16/24	0	0.00	0.00	0.01	h	-	-	0	0.00	0.00	0.08	m	-	-
07/17/24	10	Trace-0.10	0.12	0.53	m	m	-	10	Trace-0.25	0.00	0.38	h	-	-
07/18/24	20	Trace-0.25	0.00	0.01	h	-	-	10	Trace-0.10	0.00	0.01	h	-	-
07/19/24	20	Trace-0.25	0.59	0.91	m	m	-	20	Trace-0.25	0.83	1.76	m	m	-
07/20/24	20	Trace-0.10	0.00	0.02	h	-	-	30	Trace-0.10	0.00	0.09	h	-	-
07/21/24	80	0.25-0.75	0.28	0.82	h	h	-	100	0.50-1.00	0.35	0.79	h	h	-
07/22/24	10	Trace-0.25	0.00	0.00	m	-	-	30	0.25-0.75	0.00	0.00	m	-	-
07/23/24	10	Trace-0.10	0.00	0.00	m	-	-	20	Trace-0.50	0.04	0.00	h	-	-
07/24/24	20	Trace-0.50	0.51	1.14	m	h	-	30	Trace-0.50	0.04	0.50	h	h	-
07/25/24	20	Trace-0.50	0.43	0.86	m	h	-	30	Trace-0.50	0.04	0.72	m	h	-
07/26/24	<10	0.00	0.00	0.00	h	-	-	20	Trace-0.25	0.00	0.00	m	-	-
07/27/24	<10	Trace-0.05	0.00	0.00	m	-	-	<10	Trace-0.05	0.00	0.00	m	-	-
07/28/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/29/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/30/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/31/24	10	Trace-0.10	0.00	n/a	m	-	-	10	Trace-0.10	0.00	n/a	m	-	-
<b>31 days</b>					<b>19</b>	<b>3/6</b>	<b>0</b>					<b>23</b>	<b>3/4</b>	<b>0</b>
08/01/24	10	Trace	0.12	n/a	h	-	-	20	Trace-0.10	0.00	n/a	m	-	-
08/02/24	<10	0.00	0.00	n/a	h	-	-	<10	0.00	0.00	n/a	h	-	-
08/03/24	0	0.00	0.00	0.07	m	-	-	0	0.00	0.00	0.02	m	-	-
08/04/24	20	Trace-0.50	0.55	n/a	h	-	-	20	Trace-0.50	0.08	n/a	h	-	-
08/05/24	10	Trace	0.00	0.03	h	-	-	10	Trace-0.25	0.00	0.16	h	-	-
08/06/24	30	0.50-1.00	0.16	0.18	m	-	x	40	0.50-1.00	0.12	0.22	m	-	x
08/07/24	20	Trace-0.25	0.00	0.22	h	-	-	30	Trace-0.50	0.00	0.12	h	-	-
08/08/24	20	0.25-0.75	0.28	1.63	m	h	-	30	0.25-0.75	0.94	1.42	m	h	-
08/09/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/10/24	30	0.25-0.75	0.00	0.06	m	-	x	30	0.25-0.75	0.00	0.04	m	-	-
08/11/24	10	Trace-0.25	0.00	0.00	m	-	-	10	Trace-0.25	0.00	0.00	m	-	-
08/12/24	0	0.00	0.04	0.15	m	-	-	0	0.00	0.00	0.11	m	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
08/13/24	0	0.00	0.00	0.01	h	-	-	0	0.00	0.00	0.00	h	-	-
08/14/24	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
08/15/24	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
08/16/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.07	m	-	-
08/17/24	10	Trace-0.25	0.43	0.97	m	m	-	10	Trace-0.25	1.77	2.20	m	m	-
08/18/24	0	0.00	0.00	0.01	m	-	-	0	0.00	0.00	0.01	m	-	-
08/19/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.03	m	-	-
08/20/24	10	Trace-0.25	0.24	0.23	h	-	-	10	Trace-0.25	0.12	0.20	h	-	-
08/21/24	20	Trace-0.50	0.16	0.45	h	-	-	10	Trace-0.50	0.00	0.06	h	-	-
08/22/24	30	Trace-0.50	0.00	0.30	h	-	-	30	Trace-0.50	0.00	0.10	h	-	-
08/23/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/24/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/25/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/26/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/27/24	0	0.00	0.00	0.09	m	-	-	0	0.00	0.00	0.03	m	-	-
08/28/24	10	Trace-0.10	0.00	0.00	m	-	-	10	Trace-0.10	0.00	0.00	m	-	-
08/29/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/30/24	0	0.00	0.00	0.11	m	-	-	10	Trace-0.10	0.20	0.44	m	-	-
08/31/24	10	Trace-0.25	0.00	0.03	h	-	-	20	Trace-0.25	0.00	0.02	h	-	-
<b>31 days</b>					<b>20</b>	<b>1/2</b>	<b>2</b>					<b>17</b>	<b>1/2</b>	<b>1</b>
09/01/24	10	Trace-0.25	0.00	0.35	h	-	-	20	Trace-0.25	0.00	0.00	m	-	-
09/02/24	0	0	0.00	0.00	h	-	-	0	0	0.00	0.00	h	-	-
09/03/24	0	0	0.00	0.00	h	-	-	0	0	0.00	0.00	h	-	-
09/04/24	0	0	0.00	0.00	h	-	-	0	0	0.00	0.00	h	-	-
09/05/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/24	0	0.00	0.00	0.07	m	-	-	0	0.00	0.00	0.11	m	-	-
09/07/24	10	Trace-0.10	0.00	0.00	m	-	-	20	Trace-0.25	0.00	0.08	h	-	-
09/08/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/09/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
09/10/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/24	10	Trace-0.25	0.00	0.00	m	-	-	10	Trace-0.25	0.00	0.00	m	-	-
09/15/24	0	Trace	0.00	0.00	h	-	-	10	Trace-0.25	0.00	0.00	m	-	-
09/16/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/24	0	0.00	0.00	0.00	h	-	-	10	Trace-0.10	0.00	0.06	h	-	-
09/21/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/24	0	0.00	0.00	0.00	m	-	-	0	0.00	0.00	0.00	h	-	-
<b>30 days</b>					<b>26</b>	<b>0/0</b>	<b>0</b>					<b>26</b>	<b>0/0</b>	<b>0</b>
	<b>Upper Centennial</b>							<b>Wickenburg</b>						
06/15/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
06/20/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/22/24	10	Trace-0.25	0.00	0.43	m	-	-	10	Trace-0.25	0.00	0.02	h	-	-
06/23/24	30	Trace-0.25	0.55	3.04	m	m	-	30	Trace-0.25	0.16	0.80	m	m	-
06/24/24	30	Trace-0.50	0.63	2.31	m	h	-	30	Trace-0.50	0.00	1.11	m	h	-
06/25/24	40	Trace-0.50	1.10	2.11	m	h	-	40	Trace-0.50	0.55	1.23	m	h	-
06/26/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/29/24	30	Trace-0.25	0.00	0.00	m	-	-	30	Trace-0.25	0.00	0.00	m	-	-
06/30/24	60	0.50-1.50	0.12	0.45	h	-	x	60	0.50-1.50	0.16	0.34	m	-	x
<b>16 days</b>					<b>11</b>	<b>2/3</b>	<b>1</b>					<b>11</b>	<b>2/3</b>	<b>1</b>
07/01/24	0	0.00	0.00	0.01	h	-	-	0	0.00	0.00	0.00	h	-	-
07/02/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/03/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/04/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.01	h	-	-
07/06/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/09/24	0	0.00	0.00	0.08	m	-	-	0	0.00	0.00	0.02	m	-	-
07/10/24	10	Trace-0.10	0.00	0.00	m	-	-	10	Trace-0.10	0.00	0.09	h	-	-
07/11/24	10	Trace-0.10	0.00	0.00	m	-	-	10	Trace-0.10	0.00	0.00	m	-	-
07/12/24	10	Trace-0.25	0.00	0.02	h	-	-	10	Trace-0.25	0.00	0.05	h	-	-
07/13/24	10	Trace-0.10	0.00	0.01	h	-	-	10	Trace-0.10	0.00	0.00	m	-	-
07/14/24	30	0.25-0.75	1.38	2.08	m	h	-	30	0.25-0.75	0.47	1.83	m	h	-
07/15/24	10	Trace-0.25	0.00	0.00	m	-	-	10	Trace-0.25	0.00	0.00	m	-	-
07/16/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.05	m	-	-
07/17/24	20	Trace-0.25	0.04	0.27	h	-	-	20	Trace-0.25	0.00	0.13	h	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
07/18/24	10	Trace-0.25	0.00	0.01	h	-	-	10	Trace-0.25	0.00	0.00	m	-	-
07/19/24	20	Trace-0.25	0.00	0.00	h	-	-	20	Trace-0.25	0.00	0.19	h	-	-
07/20/24	20	Trace-0.10	0.00	0.04	h	-	-	30	Trace-0.10	0.00	0.01	h	-	-
07/21/24	100	0.25-0.75	0.08	0.59	h	-	-	100	0.50-1.00	0.67	1.32	m	h	-
07/22/24	40	0.50-1.00	0.16	1.40	m	h	-	40	0.50-1.00	0.00	0.02	m	-	x
07/23/24	30	Trace-0.50	0.79	1.40	m	h	-	30	Trace-0.50	0.00	0.79	m	h	-
07/24/24	30	0.25-0.75	0.00	0.53	h	h	-	30	0.25-0.75	0.08	0.21	h	-	-
07/25/24	30	0.25-0.75	0.04	0.53	h	h	-	40	0.25-0.75	0.00	0.25	h	-	x
07/26/24	20	Trace-0.25	0.63	0.00	m	m	-	20	Trace-0.25	0.12	0.00	h	-	-
07/27/24	<10	Trace-0.05	0.00	0.00	m	-	-	<10	Trace-0.05	0.00	0.00	m	-	-
07/28/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/29/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/30/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/31/24	10	Trace-0.10	0.00	n/a	m	-	-	10	Trace-0.10	0.00	n/a	m	-	-
<b>31 days</b>					<b>21</b>	<b>5/6</b>	<b>0</b>					<b>19</b>	<b>3/3</b>	<b>2</b>
08/01/24	20	Trace-0.20	0.00	n/a	m	-	-	20	Trace-0.10	0.00	n/a	m	-	-
08/02/24	20	Trace-0.25	0.04	n/a	m	-	-	20	Trace-0.25	0.00	n/a	m	-	-
08/03/24	10	Trace-0.25	0.43	1.17	m	m	-	10	Trace-0.25	0.20	0.60	m	m	-
08/04/24	40	0.50-1.00	0.39	n/a	h	-	x	40	0.50-1.00	0.16	n/a	m	-	x
08/05/24	20	Trace-0.25	0.00	0.53	m	m	-	20	Trace-0.25	0.00	0.06	h	-	-
08/06/24	50	0.75-1.50	0.47	1.05	h	h	-	50	0.75-1.50	0.28	0.37	m	-	x
08/07/24	40	0.50-1.00	0.00	0.09	m	-	x	40	0.50-1.00	0.04	0.12	m	-	x
08/08/24	40	0.25-0.75	0.35	2.08	m	h	-	40	0.25-0.75	0.04	0.11	m	-	x
08/09/24	10	Trace-0.25	0.00	0.00	m	-	-	<10	0.00	0.00	0.00	h	-	-
08/10/24	40	0.50-1.00	0.12	0.87	h	h	-	40	0.25-75	0.00	0.04	m	-	x
08/11/24	20	Trace-0.50	0.00	0.00	m	-	-	10	Trace-0.25	0.00	0.00	m	-	-
08/12/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/13/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.01	h	-	-
08/14/24	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
08/15/24	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
08/16/24	0	0.00	0.04	0.00	m	-	-	0	0.00	0.00	0.01	m	-	-
08/17/24	10	Trace	0.00	0.03	m	-	-	10	Trace	0.24	0.39	h	-	-
08/18/24	0	0.00	0.00	0.02	m	-	-	0	0.00	0.00	0.02	m	-	-
08/19/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/20/24	10	Trace-0.25	0.00	0.01	m	-	-	10	Trace-0.25	0.00	0.02	h	-	-
08/21/24	20	Trace-0.50	0.20	0.62	h	h	-	20	Trace-0.50	0.08	0.41	h	-	-
08/22/24	10	Trace-0.25	0.00	0.00	m	-	-	20	Trace-0.50	0.00	0.00	m	-	-
08/23/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/24/24	10	Trace-0.25	0.00	0.04	m	-	-	0	0.00	0.00	0.02	m	-	-
08/25/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/26/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/27/24	0	0.00	0.00	0.02	m	-	-	0	0.00	0.00	0.01	h	-	-
08/28/24	10	Trace-0.10	0.00	0.00	m	-	-	10	Trace-0.10	0.00	0.00	m	-	-
08/29/24	<10	0.00	0.00	0.04	m	-	-	<10	0.00	0.00	0.29	m	-	-
08/30/24	20	Trace-0.25	0.12	1.22	m	m	-	20	Trace-0.25	0.08	0.35	h	-	-
08/31/24	20	Trace-0.50	0.08	0.40	h		-	20	Trace-0.50	0.04	0.26	h	-	-
<b>31 days</b>					<b>13</b>	<b>4/7</b>	<b>2</b>					<b>16</b>	<b>0/1</b>	<b>5</b>
09/01/24	20	Trace-0.50	0.00	0.01	h	-	-	20	Trace-0.50	0.00	0.41	h	-	-
09/02/24	0	0	0.00	0.00	h	-	-	0	0	0.00	0.00	h	-	-
09/03/24	0	0	0.00	0.00	h	-	-	0	0	0.00	0.00	h	-	-
09/04/24	0	0	0.00	0.00	h	-	-	0	0	0.00	0.00	h	-	-
09/05/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/24	0	0.00	0.43	0.89	m	m	-	0	0.00	0.31	0.62	m	m	-
09/07/24	20	Trace-0.50	0.28	0.59	h	-	-	20	Trace-0.50	0.04	0.59	h	h	-
09/08/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/09/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
09/12/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/15/24	0	0.00	0.00	0.00	h	-	-	10	Trace	0.00	0.00	h	-	-
09/16/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/17/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/21/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
<b>30 days</b>					<b>29</b>	<b>0/1</b>	<b>0</b>					<b>29</b>	<b>1/2</b>	<b>0</b>
	<b>New River/Cave Creek</b>							<b>Phoenix North</b>						
06/15/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/24	0	0.00	0.00	0.06	m	-	-	0	0.00	0.00	0.02	m	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
06/22/24	30	Trace-0.50	0.00	0.40	h	-	-	20	Trace-0.25	0.00	0.01	h	-	-
06/23/24	30	Trace-0.25	0.43	1.22	m	m	-	10	Trace	0.00	0.21	m	-	-
06/24/24	30	Trace-0.50	0.67	1.16	m	h	-	20	Trace-0.25	0.75	1.09	m	m	-
06/25/24	40	Trace-0.50	0.20	0.28	h	-	x	20	Trace-0.50	0.12	0.35	h	-	-
06/26/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/29/24	30	Trace-0.25	0.00	0.11	h	-	-	20	Trace-0.10	0.00	0.00	m	-	-
06/30/24	60	0.50-1.50	0.39	0.55	h	h	-	60	0.50-1.25	0.35	0.77	h	h	-
<b>16 days</b>					<b>13</b>	<b>2/3</b>	<b>1</b>					<b>12</b>	<b>1/2</b>	<b>0</b>
07/01/24	20	Trace-0.50	0.47	1.10	m	h	-	10	Trace-0.50	0.00	0.01	h	-	-
07/02/24	0	0.00	0.00	0.01	m	-	-	0	0.00	0.00	0.06	m	-	-
07/03/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/04/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/24	0	0.00	0.00	0.01	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/09/24	0	0.00	0.00	0.04	m	-	-	0	0.00	0.00	0.00	h	-	-
07/10/24	10	Trace-0.10	0.00	0.29	h	-	-	0	0.00	0.00	0.00	h	-	-
07/11/24	10	Trace-0.10	0.00	0.06	h	-	-	10	Trace-0.10	0.00	0.00	m	-	-
07/12/24	10	Trace-0.25	0.08	0.33	h	-	-	10	Trace-0.25	0.04	0.33	h	-	-
07/13/24	10	Trace-0.10	0.00	0.00	m	-	-	0	0.00	0.00	0.00	h	-	-
07/14/24	40	0.50-1.00	0.63	1.23	h	h	-	30	Trace-0.50	1.22	1.26	m	h	-
07/15/24	20	Trace-0.25	0.51	0.85	m	m	-	10	Trace-0.10	0.00	0.03	h	-	-
07/16/24	10	Trace-0.10	0.16	0.80	m	m	-	0	0.00	0.00	0.47	m	-	-
07/17/24	20	Trace-0.25	0.00	0.02	h	-	-	10	Trace-0.10	0.00	0.07	h	-	-
07/18/24	30	Trace-0.50	0.00	0.00	m	-	-	20	Trace-0.25	0.00	0.18	h	-	-
07/19/24	40	Trace-0.50	0.16	0.74	m	h	-	30	Trace-0.25	0.00	0.06	h	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
07/20/24	50	Trace-0.10	0.00	0.05	h	-	-	30	Trace-0.10	0.00	0.08	h	-	-
07/21/24	100	0.50-1.00	1.06	1.31	m	h	-	100	0.50-1.00	0.12	0.58	h	h	-
07/22/24	30	0.50-1.00	0.00	0.30	m	-	x	10	Trace-0.25	0.00	0.00	m	-	-
07/23/24	30	Trace-0.50	0.00	0.00	m	-	-	10	Trace-0.10	0.00	0.00	m	-	-
07/24/24	40	0.25-0.75	0.00	0.16	m	-	x	30	Trace-0.50	0.71	0.56	m	h	-
07/25/24	40	0.25-0.75	0.28	0.98	m	h	-	30	Trace-0.50	0.04	0.17	h	-	-
07/26/24	40	0.25-0.75	0.16	0.00	m	-	x	20	Trace-0.25	0.00	0.00	m	-	-
07/27/24	<10	Trace-0.05	0.00	0.00	m	-	-	<10	Trace-0.05	0.00	0.00	m	-	-
07/28/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/29/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/30/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/31/24	10	Trace-0.10	0.00	n/a	m	-	-	10	Trace-0.10	0.00	n/a	m	-	-
<b>31 days</b>					<b>15</b>	<b>5/7</b>	<b>3</b>					<b>21</b>	<b>3/3</b>	<b>0</b>
08/01/24	20	Trace-0.25	0.00	n/a	m	-	-	10	Trace-0.10	0.00	n/a	m	-	-
08/02/24	20	Trace-0.25	0.00	n/a	m	-	-	<10	0.00	0.00	n/a	h	-	-
08/03/24	10	Trace-0.25	0.00	0.61	m	m	-	0	0.00	0.00	0.00	h	-	-
08/04/24	30	0.25-0.75	0.16	n/a	m	-	-	10	Trace-0.25	0.28	n/a	h	-	-
08/05/24	20	Trace-0.25	0.00	0.04	h	-	-	10	Trace-0.10	0.00	0.01	h	-	-
08/06/24	60	0.75-1.50	0.00	0.28	m	-	x	40	0.50-1.00	0.43	0.41	h	-	x
08/07/24	50	0.50-1.00	0.04	0.27	m	-	x	30	Trace-0.50	0.00	0.16	h	-	-
08/08/24	40	0.25-0.75	1.42	2.45	m	h	-	30	0.25-0.75	0.35	0.86	h	h	-
08/09/24	10	Trace-0.25	0.00	0.01	m	-	-	0	0.00	0.00	0.00	h	-	-
08/10/24	40	0.25-0.75	0.28	0.52	h	h	-	20	Trace-0.50	0.00	0.01	m	-	-
08/11/24	10	Trace-0.25	0.00	0.00	m	-	-	<10	0.00	0.00	0.00	h	-	-
08/12/24	0	0.00	0.00	0.13	m	-	-	0	0.00	0.24	0.54	m	m	-
08/13/24	10	Trace-0.50	0.00	0.00	m	-	-	10	Trace-0.25	0.00	0.00	m	-	-
08/14/24	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
08/15/24	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
08/16/24	0	0.00	0.04	0.13	m	-	-	0	0.00	0.00	0.04	m	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
08/17/24	20	Trace-0.50	0.98	1.06	m	h	-	20	Trace-0.50	1.38	1.55	m	h	-
08/18/24	0	0.00	0.00	0.08	m	-	-	0	0.00	0.00	0.00	h	-	-
08/19/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/20/24	10	Trace-0.25	0.08	0.55	m	m	-	10	Trace-0.25	0.24	0.38	h	-	-
08/21/24	20	Trace-0.50	0.00	0.01	h	-	-	10	Trace-0.50	0.00	0.15	h	-	-
08/22/24	40	0.50-1.00	0.08	0.62	h	h	-	30	Trace-0.50	0.12	0.33	h	-	-
08/23/24	0	0.00	0.04	0.00	m	-	-	0	0.00	0.00	0.00	h	-	-
08/24/24	0	0.00	0.00	0.03	m	-	-	0	0.00	0.00	0.00	h	-	-
08/25/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/26/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/27/24	0	0.00	0.00	0.03	m	-	-	0	0.00	0.00	0.12	m	-	-
08/28/24	10	Trace-0.10	0.00	0.01	m	-	-	10	Trace-0.10	0.00	0.01	m	-	-
08/29/24	10	Trace-0.25	0.16	0.82	m	m	-	0	0.00	0.00	0.00	m	-	-
08/30/24	40	0.25-0.75	0.00	0.20	h	-	x	10	Trace-0.10	0.00	0.21	h	-	-
08/31/24	30	Trace-0.50	1.06	1.55	m	h	-	20	Trace-0.50	0.16	0.30	h	-	-
<b>31 days</b>					<b>10</b>	<b>5/8</b>	<b>3</b>					<b>22</b>	<b>2/3</b>	<b>1</b>
09/01/24	30	Trace-0.50	0.04	0.60	h	h	-	20	Trace-0.50	0.16	0.51	h	h	-
09/02/24	0	0	0.00	0.00	h	-	-	0	0	0.00	0.00	h	-	-
09/03/24	0	0	0.00	0.00	h	-	-	0	0	0.00	0.00	h	-	-
09/04/24	0	0	0.00	0.00	h	-	-	0	0	0.00	0.00	h	-	-
09/05/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.09	m	-	-
09/07/24	30	Trace-0.50	0.91	3.14	m	h	-	10	Trace-0.25	0.00	0.02	h	-	-
09/08/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/09/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
09/14/24	10	Trace-0.25	0.00	0.00	m	-	-	10	Trace-0.25	0.00	0.00	m	-	-
09/15/24	40	0.25-0.75	0.00	0.01	m	-	x	30	Trace-0.50	0.00	0.00	m	-	-
09/16/24	20	Trace-0.25	0.00	0.09	h	-	-	10	Trace-0.10	0.00	0.08	h	-	-
09/17/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/24	20	Trace-0.10	0.04	0.15	h	-	-	10	Trace-0.10	0.00	0.11	h	-	-
09/21/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
<b>30 days</b>					<b>27</b>	<b>2/2</b>	<b>1</b>					<b>27</b>	<b>1/1</b>	<b>0</b>
	<b>Phoenix South</b>							<b>Scottsdale North</b>						
06/15/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/24	0	0.00	0.00	0.04	m	-	-	0	0.00	0.00	0.10	m	-	-
06/22/24	10	Trace-0.10	0.00	0.00	m	-	-	20	Trace-0.25	0.00	0.08	h	-	-
06/23/24	10	Trace	0.00	0.45	m	-	-	10	Trace	0.98	1.19	m	m	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
06/24/24	10	Trace-0.25	0.51	0.86	m	m	-	20	Trace-0.25	0.59	1.35	m	m	-
06/25/24	10	Trace-0.10	0.04	0.22	h	-	-	20	Trace-0.50	0.16	0.40	h	-	-
06/26/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/28/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/29/24	10	Trace-0.10	0.00	0.00	m	-	-	20	Trace-0.10	0.00	0.01	h	-	-
06/30/24	50	0.25-0.75	0.16	0.29	h	-	x	60	0.50-1.25	0.28	0.40	h	-	x
<b>16 days</b>					<b>11</b>	<b>0/1</b>	<b>1</b>					<b>13</b>	<b>0/2</b>	<b>1</b>
07/01/24	10	Trace-0.50	0.00	0.05	h	-	-	10	Trace-0.50	0.00	0.14	h	-	-
07/02/24	0	0.00	0.00	0.16	m	-	-	0	0.00	0.00	0.03	m	-	-
07/03/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/04/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/09/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/10/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/11/24	0	0.00	0.00	0.01	h	-	-	10	Trace-0.10	0.00	0.00	m	-	-
07/12/24	10	Trace-0.25	0.00	0.11	h	-	-	10	Trace-0.25	0.12	0.27	h	-	-
07/13/24	0	0.00	0.00	0.00	m	-	-	0	0.00	0.00	0.00	h	-	-
07/14/24	20	Trace-0.25	0.67	0.67	m	m	-	30	0.25-0.75	0.35	0.61	h	h	-
07/15/24	<10	0.00	0.00	0.01	m	-	-	10	Trace-0.10	0.00	0.01	m	-	-
07/16/24	0	0.00	0.00	0.01	h	-	-	0	0.00	0.24	1.51	m	m	-
07/17/24	10	Trace-0.10	0.08	0.37	h	-	-	10	Trace-0.10	0.00	0.14	h	-	-
07/18/24	20	Trace-0.25	0.12	0.22	h	-	-	30	Trace-0.50	0.00	0.13	h	-	-
07/19/24	20	Trace-0.25	0.00	0.00	m	-	-	30	Trace-0.50	0.00	0.17	h	-	-
07/20/24	20	Trace-0.10	0.00	0.01	m	-	-	30	Trace-0.10	0.00	0.06	h	-	-
07/21/24	70	0.25-0.50	0.12	0.25	h	-	x	100	0.50-1.00	0.24	0.66	h	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
07/22/24	10	Trace-0.10	0.00	0.00	m	-	-	20	Trace-0.50	0.04	0.02	h	-	-
07/23/24	10	Trace-0.10	0.00	0.00	m	-	-	20	Trace-0.25	0.00	0.04	h	-	-
07/24/24	20	Trace-0.50	0.51	0.66	m	h	-	20	Trace-0.50	0.39	0.55	h	h	-
07/25/24	20	Trace-0.50	0.16	0.36	h	-	-	30	0.25-0.75	0.08	0.60	h	h	-
07/26/24	10	Trace-0.25	0.00	0.00	m	-	-	20	Trace-0.50	0.00	0.00	m	-	-
07/27/24	<10	Trace-0.05	0.00	0.00	m	-	-	<10	Trace-0.05	0.00	0.00	m	-	-
07/28/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/29/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/30/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/31/24	10	Trace-0.10	0.00	n/a	m	-	-	10	Trace-0.10	0.00	n/a	m	-	-
<b>31 days</b>					<b>19</b>	<b>1/2</b>	<b>1</b>					<b>24</b>	<b>3/4</b>	<b>0</b>
08/01/24	10	Trace	0.00	n/a	m	-	-	20	Trace-0.25	0.00	n/a	m	-	-
08/02/24	<10	0.00	0.00	n/a	m	-	-	<10	0.00	0.00	n/a	m	-	-
08/03/24	10	Trace-0.10	0.00	0.00	m	-	-	0	0.00	0.00	0.00	h	-	-
08/04/24	20	Trace-0.50	0.08	n/a	h	-	-	10	Trace-0.25	0.39	n/a	h	-	-
08/05/24	10	Trace	0.00	0.05	h	-	-	20	Trace-0.10	0.00	0.00	m	-	-
08/06/24	30	Trace-0.50	0.47	0.76	m	h	-	40	0.50-1.00	0.00	0.00	m	-	x
08/07/24	20	Trace-0.25	0.28	1.07	m	m	-	30	0.25-0.75	0.00	0.15	m	-	-
08/08/24	20	0.25-0.75	0.12	0.65	h	h	-	30	0.25-0.75	0.67	1.02	m	h	-
08/09/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/10/24	20	Trace-0.50	0.00	0.04	h	-	-	20	Trace-0.50	0.00	0.46	h	-	-
08/11/24	10	Trace-0.25	0.00	0.00	m	-	-	<10	0.00	0.00	0.00	h	-	-
08/12/24	0	0.00	0.35	0.33	m	-	-	20	Trace-0.50	0.16	0.32	h	-	-
08/13/24	10	Trace-0.25	0.00	0.00	m	-	-	10	Trace-0.25	0.20	0.20	h	-	-
08/14/24	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
08/15/24	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
08/16/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.04	0.16	m	-	-
08/17/24	20	Trace-0.50	0.63	0.78	m	h	-	20	Trace-0.50	1.10	1.53	m	h	-
08/18/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
08/19/24	0	0.00	0.20	0.13	m	-	-	0	0.00	0.51	0.00	m	-	-
08/20/24	10	Trace-0.25	0.20	0.26	h	-	-	10	Trace-0.25	0.16	0.25	h	-	-
08/21/24	20	Trace-0.50	0.00	0.04	h	-	-	10	Trace-0.50	0.00	0.01	m	-	-
08/22/24	30	Trace-0.50	1.02	1.76	m	h	-	40	0.25-0.75	0.16	0.57	h	h	-
08/23/24	0	0.00	0.00	0.01	h	-	-	0	0.00	0.00	0.00	h	-	-
08/24/24	0	0.00	0.00	0.21	m	-	-	0	0.00	0.00	0.00	h	-	-
08/25/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/26/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/27/24	0	0.00	0.00	0.28	m	-	-	0	0.00	0.00	0.07	m	-	-
08/28/24	10	Trace-0.10	0.00	0.00	m	-	-	10	Trace-0.10	0.00	0.00	m	-	-
08/29/24	0	0.00	0.00	0.01	h	-	-	10	Trace-0.25	0.00	0.20	h	-	-
08/30/24	0	0.00	0.12	0.26	m	-	-	10	Trace-0.25	0.00	0.03	h	-	-
08/31/24	10	Trace-0.25	0.00	0.18	h	-	-	20	Trace-0.25	0.00	0.51	m	-	-
<b>31 days</b>					<b>16</b>	<b>4/5</b>	<b>0</b>					<b>18</b>	<b>3/3</b>	<b>1</b>
09/01/24	10	Trace-0.25	0.00	0.73	m	m	-	20	Trace-0.25	0.55	1.08	m	m	-
09/02/24	0	0	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/03/24	0	0	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/04/24	0	0	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/05/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/24	0	0.00	0.00	0.02	m	-	-	0	0.00	0.00	0.00	h	-	-
09/07/24	<10	Trace-0.10	0.00	0.03	h	-	-	20	Trace-0.25	0.00	0.00	m	-	-
09/08/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/09/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/24	10	Trace-0.25	0.00	0.00	m	-	-	10	Trace-0.25	0.00	0.00	m	-	-
09/15/24	20	Trace-0.25	0.00	0.00	m	-	-	30	0.25-0.75	0.00	0.10	m	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
09/16/24	<10	Trace	0.08	0.17	m	-	-	20	Trace-0.25	0.20	0.48	h	-	-
09/17/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/24	0	0.00	0.00	0.00	h	-	-	10	Trace-0.10	0.08	0.46	h	-	-
09/21/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
<b>30 days</b>					<b>25</b>	<b>0/1</b>	<b>0</b>					<b>26</b>	<b>0/1</b>	<b>0</b>
	<b>Scottsdale South</b>							<b>East Valley</b>						
06/15/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/21/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.15	m	-	-
06/22/24	10	Trace-0.10	0.00	0.06	h	-	-	20	Trace-0.25	0.00	0.06	h	-	-
06/23/24	10	Trace	0.00	0.00	h	-	-	10	Trace	0.00	0.00	h	-	-
06/24/24	10	Trace-0.25	0.08	0.38	h	-	-	20	Trace-0.25	0.20	0.81	m	m	-
06/25/24	10	Trace-0.25	0.00	0.11	h	-	-	10	Trace-0.25	0.00	0.06	h	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
06/26/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.03	h	-	-
06/27/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	m	-	-
06/28/24	0	0.00	0.00	0.00	h	-	-	10	Trace-0.25	0.00	0.00	m	-	-
06/29/24	10	Trace-0.10	0.00	0.00	m	-	-	20	Trace-0.10	0.00	0.00	m	-	-
06/30/24	50	0.25-0.75	0.28	0.49	h	-	x	50	0.25-0.75	0.12	0.64	h	h	-
<b>16 days</b>					<b>15</b>	<b>0/0</b>	<b>1</b>					<b>11</b>	<b>1/2</b>	<b>0</b>
07/01/24	20	Trace-0.50	0.00	0.08	h	-	-	20	Trace-0.50	0.00	0.10	h	-	-
07/02/24	0	0.00	0.00	0.02	m	-	-	10	Trace-0.10	0.00	0.12	h	-	-
07/03/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/04/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/05/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/06/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/07/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/09/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/10/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/11/24	0	0.00	0.00	0.01	h	-	-	10	Trace-0.10	0.04	0.62	m	m	-
07/12/24	10	Trace-0.25	0.04	0.22	h	-	-	10	Trace-0.25	0.08	0.17	h	-	-
07/13/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/14/24	20	Trace-0.50	0.47	0.43	h	-	-	20	Trace-0.50	0.12	0.68	m	h	-
07/15/24	<10	0.00	0.00	0.00	h	-	-	<10	0.00	0.00	0.01	h	-	-
07/16/24	0	0.00	0.00	0.04	m	-	-	0	0.00	0.00	0.01	m	-	-
07/17/24	<10	Trace	0.08	0.16	m	-	-	<10	Trace	0.04	0.11	m	-	-
07/18/24	20	Trace-0.25	0.00	0.08	h	-	-	30	Trace-0.50	0.00	0.02	h	-	-
07/19/24	20	Trace-0.25	0.00	0.00	m	-	-	20	Trace-0.50	0.00	0.03	h	-	-
07/20/24	30	Trace-0.10	0.00	0.02	h	-	-	30	Trace-0.10	0.00	0.06	h	-	-
07/21/24	80	0.25-0.75	0.00	0.16	m	-	x	80	0.25-0.75	0.00	0.22	h	-	x
07/22/24	20	Trace-0.25	0.00	0.00	m	-	-	20	Trace-0.50	0.00	0.00	m	-	-
07/23/24	10	Trace-0.10	0.00	0.01	m	-	-	10	Trace-0.10	0.00	0.00	m	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
07/24/24	20	Trace-0.50	0.04	0.37	h	-	-	20	Trace-0.50	0.28	0.53	h	h	-
07/25/24	30	Trace-0.50	0.00	0.24	h	-	-	20	Trace-0.50	0.67	0.67	m	h	-
07/26/24	20	Trace-0.50	0.00	0.00	m	-	-	20	Trace-0.50	0.00	0.03	h	-	-
07/27/24	<10	Trace-0.05	0.00	0.00	m	-	-	<10	Trace-0.05	0.00	0.00	m	-	-
07/28/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.03	m	-	-
07/29/24	0	0.00	0.00	0.00	h	-	-	<10	Trace-0.10	0.00	0.00	m	-	-
07/30/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/31/24	10	Trace-0.10	0.00	n/a	m	-	-	10	Trace-0.10	0.00	n/a	m	-	-
<b>31 days</b>					<b>21</b>	<b>0/0</b>	<b>1</b>					<b>20</b>	<b>3/4</b>	<b>1</b>
08/01/24	10	Trace	0.00	n/a	h	-	-	20	Trace-0.10	0.00	n/a	m	-	-
08/02/24	<10	0.00	0.00	n/a	h	-	-	<10	0.00	0.00	n/a	h	-	-
08/03/24	0	0.00	0.00	0.00	h	-	-	10	Trace-0.10	0.00	0.09	h	-	-
08/04/24	10	Trace-0.25	0.00	n/a	m	-	-	20	Trace-0.50	0.04	n/a	h	-	-
08/05/24	10	Trace	0.00	0.00	h	-	-	10	Trace-0.10	0.00	0.00	m	-	-
08/06/24	30	0.25-0.75	0.51	0.54	h	h	-	30	0.25-0.75	0.04	0.71	h	h	-
08/07/24	20	Trace-0.25	0.00	0.01	m	-	-	20	Trace-0.25	0.00	0.13	h	-	-
08/08/24	20	0.25-0.75	0.00	0.18	h	-	-	30	0.25-0.75	0.16	0.28	h	-	-
08/09/24	0	0.00	0.00	0.00	h	-	-	<10	0.00	0.00	0.01	m	-	-
08/10/24	20	Trace-0.50	0.04	0.25	h	-	-	20	Trace-0.50	0.20	0.40	h	-	-
08/11/24	<10	0.00	0.00	0.00	h	-	-	<10	0.00	0.00	0.00	h	-	-
08/12/24	0	0.00	0.00	0.03	m	-	-	20	Trace-0.50	0.00	0.02	h	-	-
08/13/24	10	Trace-0.25	0.00	0.00	m	-	-	10	Trace-0.25	0.00	0.00	m	-	-
08/14/24	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
08/15/24	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
08/16/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/17/24	20	Trace-0.50	0.55	1.45	m	h	-	20	Trace-0.50	0.63	1.05	m	h	-
08/18/24	0	0.00	0.00	0.02	m	-	-	0	0.00	0.00	0.00	h	-	-
08/19/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.01	m	-	-
08/20/24	10	Trace-0.25	0.20	0.31	h	-	-	10	Trace-0.25	0.04	0.36	h	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
08/21/24	10	Trace-0.50	0.00	0.00	m	-	-	20	Trace-0.50	0.04	0.07	h	-	-
08/22/24	30	Trace-0.50	1.89	2.00	m	h	-	30	Trace-0.50	0.71	0.70	m	h	-
08/23/24	0	0.00	0.00	0.00	h	-	-	<10	Trace-0.25	0.00	0.11	h	-	-
08/24/24	0	0.00	0.00	0.00	h	-	-	10	Trace-0.10	0.00	0.16	h	-	-
08/25/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/26/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.01	h	-	-
08/27/24	0	0.00	0.00	0.11	m	-	-	10	Trace-0.10	0.00	0.68	m	m	-
08/28/24	10	Trace-0.10	0.00	0.01	m	-	-	10	Trace-0.10	0.00	0.01	h	-	-
08/29/24	0	0.00	0.00	0.07	m	-	-	<10	0.00	0.00	0.06	m	-	-
08/30/24	0	0.00	0.00	0.01	m	-	-	<10	0.00	0.00	0.03	m	-	-
08/31/24	10	Trace-0.25	0.00	0.02	h	-	-	20	Trace-0.25	0.00	0.35	h	-	-
<b>31 days</b>					<b>19</b>	<b>3/3</b>	<b>0</b>					<b>21</b>	<b>3/4</b>	<b>0</b>
09/01/24	10	Trace-0.25	0.08	0.17	h	-	-	20	Trace-0.25	0.51	1.13	m	m	-
09/02/24	0	0	0.00	0.00	h	-	-	0	0	0.00	0.00	h	-	-
09/03/24	0	0	0.00	0.00	h	-	-	0	0	0.00	0.00	h	-	-
09/04/24	0	0	0.00	0.00	h	-	-	0	0	0.00	0.00	h	-	-
09/05/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/07/24	<10	Trace-0.10	0.00	0.06	h	-	-	0	0.00	0.00	0.05	m	-	-
09/08/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.01	m	-	-
09/09/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.01	m	-	-
09/10/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/24	10	Trace-0.25	0.00	0.00	m	-	-	10	Trace-0.25	0.00	0.00	m	-	-
09/15/24	20	Trace-0.25	0.00	0.00	m	-	-	30	Trace-0.50	0.00	0.00	m	-	-
09/16/24	<10	Trace	0.04	0.29	m	-	-	10	Trace-0.10	0.12	0.27	h	-	-
09/17/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
09/18/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/20/24	0	0.00	0.00	0.09	m	-	-	0	0.00	0.00	0.01	m	-	-
09/21/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
<b>30 days</b>					<b>26</b>	<b>0/0</b>	<b>0</b>					<b>23</b>	<b>0/1</b>	<b>0</b>
	<b>Southeast Valley</b>							<b>Lower Salt River Lakes</b>						
06/15/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/16/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/17/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/18/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/19/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/20/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.53	m	m	-
06/21/24	0	0.00	0.12	0.35	m	-	-	30	0.04-0.25	0.00	0.06	h	-	-
06/22/24	20	Trace-0.25	0.00	0.05	h	-	-	40	Trace-0.50	0.00	0.01	h	-	x
06/23/24	10	Trace	0.00	0.00	h	-	-	30	Trace-0.25	0.00	0.25	h	-	-
06/24/24	20	Trace-0.25	0.28	1.66	m	m	-	30	Trace-0.50	0.00	0.35	h	-	-
06/25/24	10	Trace-0.25	0.00	0.00	m	-	-	20	Trace-0.50	0.00	0.00	m	-	-
06/26/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
06/27/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
06/28/24	0	Trace-0.25	0.04	0.97	m	m	-	0	Trace-0.25	0.00	0.00	m	-	-
06/29/24	20	Trace-0.10	0.00	0.02	h	-	-	30	Trace-0.25	0.00	0.22	h	-	-
06/30/24	50	0.50-1.00	0.00	0.26	m	-	x	60	0.50-1.50	0.00	0.51	h	h	-
<b>16 days</b>					<b>11</b>	<b>0/2</b>	<b>1</b>					<b>13</b>	<b>1/2</b>	<b>1</b>
07/01/24	20	Trace-0.50	0.00	0.02	h	-	-	30	Trace-0.50	0.00	1.27	m	h	-
07/02/24	20	Trace-0.10	0.00	0.02	h	-	-	30	Trace-0.50	0.00	0.01	m	-	-
07/03/24	0	0.00	0.00	0.04	m	-	-	0	0.00	0.00	0.03	m	-	-
07/04/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.02	m	-	-
07/05/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.03	m	-	-
07/06/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.02	m	-	-
07/07/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/08/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/09/24	0	0.00	0.00	0.02	m	-	-	0	0.00	0.00	0.00	h	-	-
07/10/24	0	0.00	0.00	0.01	h	-	-	10	Trace-0.10	0.00	0.00	m	-	-
07/11/24	10	Trace-0.10	0.04	0.50	m	m	-	10	Trace-0.10	0.00	0.89	m	m	-
07/12/24	10	Trace-0.25	0.00	0.01	m	-	-	10	Trace-0.25	0.00	0.12	h	-	-
07/13/24	0	0.00	0.00	0.00	h	-	-	10	Trace-0.10	0.00	0.00	m	-	-
07/14/24	20	Trace-0.50	0.00	0.01	m	-	-	40	0.50-1.00	0.00	0.01	m	-	x
07/15/24	<10	0.00	0.00	0.01	m	-	-	20	Trace-0.25	0.00	0.00	m	-	-
07/16/24	0	0.00	0.00	0.05	m	-	-	10	Trace-0.10	0.00	0.00	m	-	-
07/17/24	<10	Trace	0.04	0.06	m	-	-	10	Trace-0.25	0.00	0.15	h	-	-
07/18/24	30	Trace-0.50	0.00	0.05	h	-	-	40	Trace-0.50	0.00	0.01	h	-	x
07/19/24	20	Trace-0.50	0.00	0.20	h	-	-	30	Trace-0.50	0.00	0.17	h	-	-
07/20/24	30	Trace-0.10	0.04	0.76	m	m	-	50	Trace-0.10	0.00	0.37	h	-	-
07/21/24	80	0.25-0.75	0.04	0.40	h	-	x	100	0.50-1.00	0.00	0.45	h	-	x
07/22/24	20	0.25-0.75	0.00	0.04	m	-	-	30	0.25-0.75	0.00	0.00	m	-	-
07/23/24	10	Trace-0.10	0.00	0.01	m	-	-	20	Trace-0.25	0.00	0.00	m	-	-
07/24/24	20	Trace-0.50	0.20	0.43	h	-	-	40	0.25-0.75	0.00	0.03	m	-	x
07/25/24	20	Trace-0.50	0.67	1.76	m	h	-	40	0.25-0.75	0.08	1.58	m	h	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
07/26/24	20	Trace-0.50	0.00	0.29	h	-	-	40	0.25-0.75	0.00	0.00	m	-	x
07/27/24	<10	Trace-0.05	0.00	0.00	m	-	-	<10	Trace-0.05	0.00	0.00	m	-	-
07/28/24	0	0.00	0.00	0.29	m	-	-	0	0.00	0.00	0.00	h	-	-
07/29/24	<10	Trace-0.10	0.00	0.05	h	-	-	10	Trace-0.25	0.00	0.00	m	-	-
07/30/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
07/31/24	20	Trace-0.25	0.00	n/a	m	-	-	10	Trace-0.10	0.00	n/a	m	-	-
<b>31 days</b>					<b>16</b>	<b>1/2</b>	<b>1</b>					<b>11</b>	<b>1/2</b>	<b>5</b>
08/01/24	20	Trace	0.00	n/a	m	-	-	20	Trace-0.25	0.00	n/a	m	-	-
08/02/24	<10	0.00	0.00	n/a	m	-	-	20	Trace-0.25	0.00	n/a	m	-	-
08/03/24	10	Trace-0.10	0.00	0.00	m	-	-	20	Trace-0.50	0.00	0.00	m	-	-
08/04/24	20	Trace-0.50	0.31	n/a	h	-	-	20	Trace-0.50	0.00	n/a	m	-	-
08/05/24	10	Trace-0.10	0.00	0.00	m	-	-	20	Trace-0.25	0.00	0.00	m	-	-
08/06/24	30	0.25-0.75	1.57	2.57	m	h	-	40	0.75-1.50	0.00	0.17	m	-	x
08/07/24	20	Trace-0.25	0.39	0.23	h	-	-	40	0.25-0.75	0.00	0.11	m	-	x
08/08/24	30	0.25-0.75	0.00	0.20	h	-	x	40	0.25-0.75	0.08	1.41	m	h	-
08/09/24	<10	0.00	0.00	0.05	m	-	-	20	Trace-0.25	0.00	0.12	h	-	-
08/10/24	20	Trace-0.50	0.00	0.33	h	-	-	30	0.25-0.75	0.00	0.01	m	-	-
08/11/24	<10	0.00	0.00	0.00	h	-	-	10	Trace-0.25	0.00	0.00	m	-	-
08/12/24	20	Trace-0.50	0.00	0.08	h	-	-	30	0.50-1.00	0.00	0.33	m	-	x
08/13/24	10	Trace-0.25	0.00	0.07	h	-	-	20	0.50-1.00	0.00	0.06	m	-	x
08/14/24	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
08/15/24	0	0.00	0.00	n/a	h	-	-	0	0.00	0.00	n/a	h	-	-
08/16/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.18	m	-	-
08/17/24	30	Trace-0.30	0.63	1.43	m	m	-	30	Trace-0.50	0.08	1.08	m	h	-
08/18/24	0	0.00	0.00	0.04	m	-	-	0	0.00	0.00	0.00	h	-	-
08/19/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/20/24	10	Trace-0.25	0.00	0.03	h	-	-	10	Trace-0.25	0.00	0.03	h	-	-
08/21/24	20	Trace-0.50	0.00	0.18	h	-	-	40	Trace-0.50	0.00	0.00	m	-	x
08/22/24	30	Trace-0.50	0.04	0.29	h	-	-	40	0.50-1.00	0.00	1.02	h	h	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
08/23/24	<10	Trace-0.25	0.00	0.43	h	-	-	20	Trace-0.50	0.05	0.81	m	h	-
08/24/24	10	Trace-0.10	0.00	0.00	m	-	-	10	Trace-0.25	0.00	0.00	m	-	-
08/25/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
08/26/24	0	0.00	0.00	0.02	m	-	-	0	0.00	0.00	0.00	h	-	-
08/27/24	10	Trace-0.10	0.04	0.48	h	-	-	20	Trace-0.25	0.00	0.00	m	-	-
08/28/24	10	Trace-0.10	0.00	0.08	h	-	-	10	Trace-0.10	0.00	0.00	m	-	-
08/29/24	20	Trace-0.25	0.00	0.00	m	-	-	20	Trace-0.25	0.00	0.10	h	-	-
08/30/24	<10	0.00	0.00	0.06	m	-	-	20	Trace-0.50	0.00	0.05	h	-	-
08/31/24	20	Trace-0.25	0.00	0.24	h	-	-	30	Trace-0.50	0.31	2.63	m	-	-
<b>31 days</b>					<b>19</b>	<b>1/2</b>	<b>1</b>					<b>11</b>	<b>4/4</b>	<b>5</b>
09/01/24	20	Trace-0.25	0.35	1.74	m	m	-	30	Trace-0.50	0.87	3.62	m	h	-
09/02/24	0	0	0.00	0.02	m	-	-	0	0	0.00	0.00	h	-	-
09/03/24	0	0	0.00	0.00	h	-	-	0	0	0.00	0.00	h	-	-
09/04/24	0	0	0.00	0.00	h	-	-	0	0	0.00	0.00	h	-	-
09/05/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/06/24	0	0.00	0.00	0.00	h	-	-	10	Trace-0.10	0.00	0.00	m	-	-
09/07/24	0	0.00	0.00	0.01	h	-	-	0	0.00	0.00	0.01	h	-	-
09/08/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/09/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/10/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/11/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/12/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/13/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/14/24	10	Trace-0.25	0.00	0.00	m	-	-	10	Trace-0.25	0.00	0.00	m	-	-
09/15/24	30	Trace-0.50	0.00	0.03	m	-	-	50	0.50-1.00	0.00	0.02	m	-	x
09/16/24	10	Trace-0.10	0.00	0.07	h	-	-	30	Trace-0.25	0.00	0.66	h	m	-
09/17/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/18/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/19/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-

<b>TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024</b>														
<b>Date</b>	<b>Forecast Zone Data</b>				<b>Verification</b>			<b>Forecast Zone Data</b>				<b>Verification</b>		
	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>	<b>Prob. (%)</b>	<b>QPF (in)</b>	<b>ALERT (in)</b>	<b>GAQPE (in)</b>	<b>AOF</b>	<b>POD</b>	<b>FA</b>
09/20/24	0	0.00	0.00	0.02	m	-	-	0	0.00	0.04	0.45	m	-	-
09/21/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/22/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/23/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/24/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/25/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/26/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/27/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/28/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/29/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
09/30/24	0	0.00	0.00	0.00	h	-	-	0	0.00	0.00	0.00	h	-	-
<b>30 days</b>					<b>25</b>	<b>0/1</b>	<b>0</b>					<b>25</b>	<b>1/2</b>	<b>1</b>
	<b>Superstition</b>													
06/15/24	0	0.00	0.00	0.00	h	-	-							
06/16/24	0	0.00	0.00	0.00	h	-	-							
06/17/24	0	0.00	0.00	0.00	h	-	-							
06/18/24	0	0.00	0.00	0.00	h	-	-							
06/19/24	0	0.00	0.00	0.00	h	-	-							
06/20/24	0	0.00	0.00	0.41	m	-	-							
06/21/24	30	0.04-0.25	0.67	1.09	h	-	-							
06/22/24	30	Trace-0.50	0.00	0.02	h	-	-							
06/23/24	30	Trace-0.25	0.00	0.01	m	-	-							
06/24/24	30	Trace-0.50	0.12	0.36	h	-	-							
06/25/24	20	Trace-0.50	0.00	0.05	h	-	-							
06/26/24	0	0.00	0.00	0.00	h	-	-							
06/27/24	0	0.00	0.00	0.00	h	-	-							
06/28/24	0	Trace-0.25	0.00	0.01	m	-	-							
06/29/24	30	Trace-0.25	0.08	0.33	h	-	-							

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
06/30/24	60	0.50-1.50	0.08	0.28	m	-	x							
<b>16 days</b>					<b>12</b>	<b>0/0</b>	<b>1</b>							
07/01/24	30	Trace-0.50	0.39	0.74	m	h	-							
07/02/24	30	Trace-0.25	0.00	0.02	h	-	-							
07/03/24	0	0.00	0.00	0.01	h	-	-							
07/04/24	0	0.00	0.04	0.01	m	-	-							
07/05/24	0	0.00	0.00	0.00	h	-	-							
07/06/24	0	0.00	0.00	0.01	h	-	-							
07/07/24	0	0.00	0.00	0.00	h	-	-							
07/08/24	0	0.00	0.00	0.00	h	-	-							
07/09/24	0	0.00	0.00	0.01	h	-	-							
07/10/24	0	0.00	0.00	0.00	h	-	-							
07/11/24	10	Trace-0.10	0.04	0.61	m	m	-							
07/12/24	10	Trace-0.25	0.20	0.49	h	-	-							
07/13/24	0	0.00	0.00	0.02	m	-	-							
07/14/24	30	0.25-0.75	0.04	0.06	m	-	-							
07/15/24	10	Trace-0.25	0.00	0.01	h	-	-							
07/16/24	0	Trace-0.10	0.00	0.04	h	-	-							
07/17/24	10	Trace-0.10	0.00	0.20	h	-	-							
07/18/24	30	Trace-0.50	0.00	0.01	m	-	-							
07/19/24	20	Trace-0.50	0.00	0.10	h	-	-							
07/20/24	30	Trace-0.10	0.00	0.26	h	-	-							
07/21/24	100	0.25-0.75	0.00	0.44	h	-	x							
07/22/24	30	0.25-0.75	0.04	0.45	h	-	-							
07/23/24	10	Trace-0.10	0.00	0.00	m	-	-							
07/24/24	40	0.25-0.75	0.12	0.42	h	-	x							
07/25/24	30	0.25-0.75	1.69	1.82	m	h	-							
07/26/24	20	Trace-0.50	0.04	0.11	h	-	-							
07/27/24	<10	Trace-0.05	0.00	0.14	h	-	-							

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
07/28/24	0	0.00	0.04	0.11	m	-	-							
07/29/24	10	Trace-0.25	0.00	0.00	m	-	-							
07/30/24	0	0.00	0.00	0.00	h	-	-							
07/31/24	10	Trace-0.10	0.00	n/a	m	-	-							
<b>31 days</b>					<b>20</b>	<b>1/2</b>	<b>2</b>							
08/01/24	20	Trace-0.10	0.00	n/a	m	-	-							
08/02/24	<10	0.00	0.31	n/a	m	-	-							
08/03/24	10	Trace-0.25	0.00	0.02	h	-	-							
08/04/24	20	Trace-0.50	0.12	n/a	h	-	-							
08/05/24	20	Trace-0.25	0.00	0.00	m	-	-							
08/06/24	40	0.50-1.00	0.00	0.31	m	-	x							
08/07/24	30	0.25-0.75	0.00	0.01	m	-	x							
08/08/24	30	0.25-0.75	0.00	0.07	m	-	x							
08/09/24	<10	0.00	0.00	0.11	m	-	-							
08/10/24	20	Trace-0.50	0.00	0.04	h	-	-							
08/11/24	<10	0.00	0.00	0.02	m	-	-							
08/12/24	30	0.25-0.75	0.00	0.01	m	-	-							
08/13/24	10	Trace-0.25	0.00	0.00	m	-	-							
08/14/24	0	0.00	0.00	n/a	h	-	-							
08/15/24	0	0.00	0.00	n/a	h	-	-							
08/16/24	0	0.00	0.00	0.05	m	-	-							
08/17/24	30	Trace-0.50	0.63	0.92	m	h	-							
08/18/24	0	0.00	0.28	0.02	m	-	-							
08/19/24	0	0.00	0.00	0.01	m	-	-							
08/20/24	10	Trace-0.25	0.12	0.16	h	-	-							
08/21/24	20	Trace-0.50	0.00	0.03	h	-	-							
08/22/24	40	0.25-0.75	0.51	1.02	m	h	-							
08/23/24	10	Trace-0.50	0.00	0.13	h	-	-							
08/24/24	10	Trace-0.25	0.00	0.00	m	-	-							

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
08/25/24	0	0.00	0.00	0.00	h	-	-							
08/26/24	0	0.00	0.00	0.03	m	-	-							
08/27/24	20	Trace-0.25	0.00	0.19	h	-	-							
08/28/24	10	Trace-0.10	0.00	0.03	h	-	-							
08/29/24	10	Trace-0.25	0.00	0.07	h	-	-							
08/30/24	10	Trace-0.10	0.00	0.03	h	-	-							
08/31/24	20	Trace-0.50	0.51	1.18	m		-							
<b>31 days</b>					<b>13</b>	<b>2/2</b>	<b>3</b>							
09/01/24	20	Trace-0.50	0.71	1.20	m	h	-							
09/02/24	0	0	0.00	0.00	h	-	-							
09/03/24	0	0	0.00	0.00	h	-	-							
09/04/24	0	0	0.00	0.00	h	-	-							
09/05/24	0	0.00	0.00	0.00	h	-	-							
09/06/24	10	Trace-0.10	0.00	0.13	h	-	-							
09/07/24	0	0.00	0.00	0.01	m	-	-							
09/08/24	0	0.00	0.00	0.00	h	-	-							
09/09/24	0	0.00	0.00	0.00	h	-	-							
09/10/24	0	0.00	0.00	0.00	h	-	-							
09/11/24	0	0.00	0.00	0.00	h	-	-							
09/12/24	0	0.00	0.00	0.00	h	-	-							
09/13/24	0	0.00	0.00	0.00	h	-	-							
09/14/24	10	Trace-0.25	0.00	0.00	m	-	-							
09/15/24	40	0.25-0.75	0.00	0.13	m	-	x							
09/16/24	20	Trace-0.25	0.00	0.40	h	-	-							
09/17/24	0	0.00	0.00	0.00	h	-	-							
09/18/24	0	0.00	0.00	0.00	h	-	-							
09/19/24	0	0.00	0.00	0.00	h	-	-							
09/20/24	0	0.00	0.04	0.32	m	-	-							
09/21/24	0	0.00	0.00	0.00	h	-	-							

TABLE A-1: MSP Outlooks Issued, Daily Verification Table - Monsoon 2024														
Date	Forecast Zone Data				Verification			Forecast Zone Data				Verification		
	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA	Prob. (%)	QPF (in)	ALERT (in)	GAQPE (in)	AOF	POD	FA
09/22/24	0	0.00	0.00	0.00	h	-	-							
09/23/24	0	0.00	0.00	0.00	h	-	-							
09/24/24	0	0.00	0.00	0.00	h	-	-							
09/25/24	0	0.00	0.00	0.00	h	-	-							
09/26/24	0	0.00	0.00	0.00	h	-	-							
09/27/24	0	0.00	0.00	0.00	h	-	-							
09/28/24	0	0.00	0.00	0.00	h	-	-							
09/29/24	0	0.00	0.00	0.00	h	-	-							
09/30/24	0	0.00	0.00	0.00	h	-	-							
<b>30 days</b>					<b>25</b>	<b>1/1</b>	<b>1</b>							

**TABLE A-2:** This table shows the verification data of MSP issued precipitation forecasts contained in the daily Outlooks for the 2024 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 – Monsoon 2024</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	14/16	87.5%	1/1	0%	1/16	6.3%
Gila River	13/16	81.3%	0/1	n/a	1/16	6.3%
Palo Verde	13/16	81.3%	0/0	n/a	1/16	6.3%
Rainbow Valley	13/16	81.3%	0/1	0%	1/16	6.3%
West Valley	11/16	68.8%	0/3	0%	1/16	6.3%
Northwest Valley	13/16	81.3%	1/3	33.3%	1/16	6.3%
Upper Centennial	11/16	68.8%	2/3	66.7%	1/16	6.3%
Wickenburg	11/16	68.8%	2/3	66.7%	1/16	6.3%
New River/Cave Creek	14/16	87.5%	2/3	66.7%	1/16	6.3%
Phoenix North	13/16	81.3%	1/2	50%	0/16	0%
Phoenix South	12/16	75%	0/1	0%	1/16	6.3%
Scottsdale North	14/16	87.5%	0/2	0%	1/16	6.3%
Scottsdale South	15/16	93.8%	0/0	n/a	1/16	6.3%
East Valley	12/16	75%	1/2	50%	0/16	0%
Southeast Valley	12/16	75%	0/2	0%	1/16	6.3%
Lower Salt River Lakes	14/16	87.5%	1/1	100%	1/16	6.3%
Superstition	13/16	81.3%	0/0	n/a	1/16	6.3%
<b>All Zones</b>	<b>218/272</b>	<b>80.1%</b>	<b>11/28</b>	<b>39.2%</b>	<b>15/272</b>	<b>5.5%</b>
<b>JULY</b>						
Gila Bend	23/31	74.2%	5/6	83.3%	1/31	3.2%
Gila River	23/31	74.2%	3/3	100%	1/31	3.2%
Palo Verde	22/31	71%	1/1	100%	1/31	3.2%
Rainbow Valley	20/31	64.5%	2/4	50%	0/31	0%
West Valley	19/31	61.3%	3/6	50%	0/31	0%
Northwest Valley	23/31	74.2%	3/4	75%	0/31	0%
Upper Centennial	21/31	67.7%	5/6	83.3%	0/31	0%
Wickenburg	19/31	61.3%	3/3	100%	2/31	6.5%
New River/Cave Creek	15/31	48.4%	5/7	71.4%	3/31	9.7%

<b>TABLE A-2: MSP Weather Outlook Verification – Monsoon 2024</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	21/31	67.7%	3/3	100%	0/31	0%
Phoenix South	19/31	61.3%	1/2	50%	1/31	3.2%
Scottsdale North	24/31	77.4%	3/4	75%	0/31	0%
Scottsdale South	21/31	67.7%	0/0	0%	1/31	3.2%
East Valley	20/31	64.5%	3/4	75%	1/31	3.2%
Southeast Valley	16/31	51.6%	1/2	50%	1/31	3.2%
Lower Salt River Lakes	11/31	35.5%	1/2	50%	5/31	16.1%
Superstition	20/31	64.5%	1/2	50%	2/31	6.5%
<b>All Zones</b>	<b>337/527</b>	<b>63.9%</b>	<b>43/59</b>	<b>72.9%</b>	<b>18/527</b>	<b>3.4%</b>
<b>AUGUST</b>						
Gila Bend	17/31	54.8%	5/6	83.3%	2/31	6.5%
Gila River	18/31	58.1%	3/6	50%	0/31	0%
Palo Verde	20/31	64.5%	2/3	66.7%	3/31	9.7%
Rainbow Valley	15/31	48.4%	2/5	40%	1/31	3.2%
West Valley	20/31	64.5%	1/2	50%	2/31	6.5%
Northwest Valley	17/31	54.8%	1/2	50.0%	1/31	3.2%
Upper Centennial	13/31	41.9%	4/7	57.1%	2/31	6.5%
Wickenburg	16/31	51.8%	0/1	0%	5/31	16.1%
New River/Cave Creek	10/31	32.2%	5/8	62.5%	3/31	9.7%
Phoenix North	22/31	71.0%	2/3	66.7%	1/31	3.2%
Phoenix South	16/31	51.6%	4/5	80%	0/31	0%
Scottsdale North	18/31	58.1%	3/3	100%	1/31	3.2%
Scottsdale South	21/31	67.7%	3/3	100%	0/31	0%
East Valley	21/31	67.7%	3/4	75%	0/31	0%
Southeast Valley	19/31	61.3%	1/2	50%	1/31	3.2%
Lower Salt River Lakes	11/31	35.5%	4/4	100%	5/31	16.1%
Superstition	13/31	41.9%	2/2	100%	3/31	9.7%
<b>All Zones</b>	<b>285/527</b>	<b>54.1%</b>	<b>45/66</b>	<b>68.2%</b>	<b>30/527</b>	<b>5.7%</b>
<b>SEPTEMBER</b>						

<b>TABLE A-2: MSP Weather Outlook Verification – Monsoon 2024</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	29/30	96.7%	0/0	n/a	0/30	0%
Gila River	27/30	90%	0/0	n/a	0/30	0%
Palo Verde	27/30	90%	0/0	n/a	0/30	0%
Rainbow Valley	27/30	90%	0/1	0%	0/30	0%
West Valley	27/30	90%	0/0	n/a	0/30	0%
Northwest Valley	26/30	86.7%	0/0	n/a	0/30	0%
Upper Centennial	29/30	96.7%	0/1	0%	0/30	0%
Wickenburg	29/30	96.7%	1/2	50%	0/30	0%
New River/Cave Creek	27/30	90%	2/2	100%	1/30	3.3%
Phoenix North	27/30	90%	1/1	100%	0/30	0%
Phoenix South	25/30	83.3%	0/1	0%	0/30	0%
Scottsdale North	26/30	86.7%	0/1	0%	0/30	0%
Scottsdale South	27/30	90%	0/0	n/a	0/30	0%
East Valley	24/30	80%	0/1	0%	0/30	0%
Southeast Valley	26/30	86.7%	0/1	0%	0/30	0%
Lower Salt River Lakes	26/30	86.7%	1/2	50%	1/30	3.3%
Superstition	26/30	86.7%	1/1	100%	1/30	3.3%
<b>All Zones</b>	<b>455/510</b>	<b>89.2%</b>	<b>6/14</b>	<b>42.9%</b>	<b>3/510</b>	<b>0.1%</b>

## APPENDIX B: MSP MESSAGES – VERIFICATION TABLES

**TABLE B-1:** This table shows each of the individual MSP Statements issued during the 2024 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 storm total precipitation (STP) 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).

<b>TABLE B-1: MSP Statements Issued - Monsoon 2024</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>STP (in)</b>
06/23/24	23:26	Scottsdale North	1	Malloy	Now-1:00am	0.50-0.75/1.00
06/23/24	21:55	Upper Centennial	1	Malloy	Now-12:00am	0.50-1.00/1.50
06/24/24	18:19	Scottsdale North	1	Henz	Now-8:00pm	0.50-0.75/1.00-1.50
07/14/24	21:58	New River/Cave Creek	1	Henz	Now-11:30pm	0.50-1.00/1.50
07/14/24	21:31	Phoenix North	1	Henz	Now-11:30pm	0.50-1.00/1.50
07/14/24	21:14	Phoenix South	1	Henz	Now-11:30pm	0.50-1.00/1.50
07/14/24	23:31	Rainbow Valley	1	Henz	Now-1:00am	0.50-1.00/1.50
07/19/24	19:28	Northwest Valley	1	Malloy	Now-9:00pm	0.25-0.75/1.00
07/24/24	22:09	East Valley	1	Malloy	Now-11:30pm	0.50-0.75/1.00
07/24/24	21:17	Phoenix North	1	Malloy	Now-10:30pm	0.50-0.75/1.00
07/24/24	21:17	Phoenix South	1	Malloy	Now-10:30pm	0.50-0.75/1.00
07/25/24	21:13	East Valley	1	Malloy	Now-11:00pm	0.50-0.75/1.00
07/25/24	18:37	East Valley	1	Malloy	Now-8:30pm	0.50-1.00/1.25
07/25/24	18:06	Lower Salt River Lakes	1	Malloy	Now-8:00pm	0.50-1.00/1.25
07/25/24	18:47	Palo Verde	1	Malloy	Now-8:30pm	0.50-1.00/1.25
07/25/24	19:47	Rainbow Valley	1	Malloy	Now-10:00pm	0.50-1.00/1.25
07/25/24	20:44	Southeast Valley	1	Malloy	Now-11:00pm	0.50-0.75/1.25
07/25/24	18:06	Superstition	1	Malloy	Now-8:00pm	0.50-1.00/1.25
07/25/24	21:13	Superstition	1	Malloy	Now-11:00pm	0.50-0.75/1.00

TABLE B-1: MSP Statements Issued - Monsoon 2024						
Statement Details						Forecast Rain
Date	LST	MSP Forecast Zone	Message	Forecaster	Valid Time	STP (in)
07/25/24	16:19	Wickenburg	1	Malloy	Now-6:00pm	0.50-1.00/1.50
08/06/24	21:06	Phoenix South	1	Henz	Now-10:30pm	0.50-0.75/1.25
08/06/24	21:06	Scottsdale South	1	Henz	Now-10:30pm	0.50-0.75/1.25
08/06/24	19:54	Southeast Valley	1	Henz	Now-9:30pm	0.50-0.75/1.25
08/18/24	3:19	Scottsdale North	1	Henz	Now-5:00am	0.50-0.75/1.25
08/22/24	17:12	East Valley	1	Henz	Now-6:45pm	0.50-0.75/1.25
08/22/24	17:12	Phoenix South	1	Henz	Now-6:45pm	0.50-0.75/1.25
08/22/24	17:12	Scottsdale South	1	Henz	Now-6:45pm	0.50-0.75/1.25
08/22/24	16:29	Superstition	1	Henz	Now-6:15pm	0.50-0.75/1.25
08/31/24	17:54	New River/Cave Creek	1	Henz	Now-7:30pm	0.50-0.75/1.25

**TABLE B-2:** This table shows the raw verification data of MSP issued Messages for the 2024 Monsoon Season. The valid period for rainfall for each Message can be found in Table B-1. The table is broken down by date and MSP Message. The columns from left to right are defined as follows:

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

**Forecast Rain** – Rain information including forecast storm total precipitation (STP) 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, gauge adjusted radar rainfall totals, and local storm reports submitted to NWS Phoenix WFO.

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

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

**TABLE B-2: MSP Statements Issued - Monsoon 2024**

Statement Details			Forecast Rain	Rain Observations (in)			Alarms			Verification
Date	MSP Forecast Zone	Message	STP (in)	ALERT	GAQPE	LSRs	Rain	Stream	Dam	Hit/Miss
06/23/24	Scottsdale North	1	0.50-0.75/1.00	0.98	1.34	-	x	-	-	Hit
06/23/24	Upper Centennial	1	0.50-1.00/1.50	0.16	2.05	-	-	-	-	Hit
06/24/24	Scottsdale North	1	0.50-0.75/1.00-1.50	0.47	1.19	-	-	-	-	Hit
07/14/24	New River/Cave Creek	1	0.50-1.00/1.50	1.22	1.23		x			Hit
07/14/24	Phoenix North	1	0.50-1.00/1.50	1.22	1.26			x		Hit
07/14/24	Phoenix South	1	0.50-1.00/1.50	0.67	0.67		x			Hit
07/14/24	Rainbow Valley	1	0.50-1.00/1.50	0.94	1.10					Hit
07/19/24	Northwest Valley	1	0.25-0.75/1.00	0.79	1.73					Hit
07/24/24	East Valley	1	0.50-0.75/1.00	0.28	0.52					Hit
07/24/24	Phoenix North	1	0.50-0.75/1.00	0.71	0.56					Hit
07/24/24	Phoenix South	1	0.50-0.75/1.00	0.51	0.66					Hit
07/25/24	East Valley	1	0.50-0.75/1.00	0.67	0.67					Hit
07/25/24	East Valley	1	0.50-1.00/1.25	0.43	0.48					Miss
07/25/24	Lower Salt River Lakes	3	0.50-1.00/1.25	0.04	1.52					Hit
07/25/24	Palo Verde	1	0.50-1.00/1.25	1.42	1.76			x		Hit
07/25/24	Rainbow Valley	1	0.50-1.00/1.25	0.94	0.73					Hit
07/25/24	Southeast Valley	2	0.50-0.75/1.25	0.75	1.76					Hit
07/25/24	Superstition	2	0.50-1.00/1.25	1.50	1.69					Hit
07/25/24	Superstition	2	0.50-0.75/1.00	0.24	0.33					Miss
07/25/24	Wickenburg	2	0.50-1.00/1.50	0.00	0.25					Miss
08/06/24	Phoenix South	2	0.50-0.75/1.25	0.47	0.76					Hit
08/06/24	Scottsdale South	2	0.50-0.75/1.25	0.43	0.54					Hit
08/06/24	Southeast Valley	2	0.50-0.75/1.25	0.31	1.19					Hit
08/18/24	Scottsdale North	1	0.50-0.75/1.25	0.91	1.35		x	x		Hit
08/22/24	East Valley	1	0.50-0.75/1.25	0.63	0.66					Hit
08/22/24	Phoenix South	1	0.50-0.75/1.25	1.38	1.58					Hit
08/22/24	Scottsdale South	1	0.50-0.75/1.25	1.81	1.94		x	x		Hit
08/22/24	Superstition	1	0.50-0.75/1.25	0.51	1.02					Hit
08/31/24	New River/Cave Creek	1	0.50-0.75/1.25	1.06	1.01		x			Hit

**TABLE B-3:** This table shows the lead time data of MSP issued Messages for the Monsoon 2024 Season. The table is broken down by Statement details and lead time. The columns from left to right are defined as follows:

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

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

<b>TABLE B-3: MSP Statement Lead Time - Monsoon 2024</b>							
<b>Statement Details</b>						<b>Statement Lead Time</b>	
<b>Date</b>	<b>LST</b>	<b>MSP Forecast Zone</b>	<b>Message</b>	<b>Forecaster</b>	<b>Valid Time</b>	<b>Alarm Triggered</b>	<b>Lead Time (min)</b>
06/23/24	23:26	Scottsdale North	1	Malloy	Now-1:00am	23:25	0
07/14/24	21:14	Phoenix South	1	Henz	Now-11:30pm	23:22	128
07/14/24	21:58	New River/Cave Creek	1	Henz	Now-11:30pm	22:09	11
07/14/24	21:31	Phoenix North	1	Henz	Now-11:30pm	22:00	29
07/25/24	18:47	Palo Verde	1	Malloy	Now-8:30pm	19:14	27
08/18/24	3:19	Scottsdale North	1	Henz	Now-5:00am	3:04	0
08/22/24	17:12	Scottsdale South	1	Henz	Now-6:45pm	17:06	0
08/31/24	17:54	New River/Cave Creek	1	Henz	Now-7:30pm	17:49	0

## APPENDIX C: MSP LAKE ALERTS – VERIFICATION TABLES

**TABLE C-1:** This table shows each of the individual MSP Lake Alerts issued during the Monsoon 2024 season. The table is broken down by statement Details, observations, and verification. The columns from left to right are defined as follows:

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

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

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

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

<b>TABLE C-1: MSP Lake Alerts Issued - Monsoon 2024</b>									
<b>Statement Details</b>					<b>Observations</b>			<b>Lead Time</b>	<b>Verification</b>
<b>Date</b>	<b>LST</b>	<b>Lake</b>	<b>Forecaster</b>	<b>Valid Time</b>	<b>Lightning</b>	<b>Wind &gt; 30mph</b>	<b>Hail/Heavy Rain</b>	<b>1st Obs.</b>	<b>Hit/Miss</b>
06/20/24	15:10	Apache	Henz	Now-5:30pm	x	-	-	6	Hit
06/20/24	15:10	Canyon	Henz	Now-5:30pm	x	-	-	6	Hit
06/20/24	15:10	Saguaro	Henz	Now-5:30pm	x	-	-	6	Hit
06/24/24	16:47	Bartlett	Henz	Now-6:00pm	x	-	-	8	Hit
06/24/24	16:42	Pleasant	Henz	Now-6:00pm	x	-	-	13	Hit
06/25/24	18:00	Pleasant	Malloy	Now-7:00pm	x	-	-	8	Hit
06/30/24	19:36	Apache	Malloy	Now-9:00pm	x	-	-	15	Hit
06/30/24	19:36	Canyon	Malloy	Now-9:00pm	x	-	-	15	Hit
06/30/24	19:36	Saguaro	Malloy	Now-9:00pm	x	-	-	15	Hit
07/01/24	13:53	Apache	Henz	Now-4:00pm	x	-	-	0	Hit
07/01/24	13:53	Canyon	Henz	Now-4:00pm	x	-	-	0	Hit
07/11/24	19:13	Apache	Malloy	Now-8:00pm	x	-	-	30	Hit

<b>TABLE C-1: MSP Lake Alerts Issued - Monsoon 2024</b>									
<b>Statement Details</b>					<b>Observations</b>			<b>Lead Time</b>	<b>Verification</b>
<b>Date</b>	<b>LST</b>	<b>Lake</b>	<b>Forecaster</b>	<b>Valid Time</b>	<b>Lightning</b>	<b>Wind &gt; 30mph</b>	<b>Hail/Heavy Rain</b>	<b>1st Obs.</b>	<b>Hit/Miss</b>
07/11/24	19:13	Canyon	Malloy	Now-8:00pm	x	-	-	30	Hit
06/20/24	15:10	Apache	Henz	Now-5:30pm	x	-	-	6	Hit
06/20/24	15:10	Canyon	Henz	Now-5:30pm	x	-	-	6	Hit
06/20/24	15:10	Saguaro	Henz	Now-5:30pm	x	-	-	6	Hit
06/24/24	16:47	Bartlett	Henz	Now-6:00pm	x	-	-	8	Hit
06/24/24	16:42	Pleasant	Henz	Now-6:00pm	x	-	-	13	Hit
06/25/24	18:00	Pleasant	Malloy	Now-7:00pm	x	-	-	8	Hit
06/30/24	19:36	Apache	Malloy	Now-9:00pm	x	-	-	15	Hit
06/30/24	19:36	Canyon	Malloy	Now-9:00pm	x	-	-	15	Hit
06/30/24	19:36	Saguaro	Malloy	Now-9:00pm	x	-	-	15	Hit
07/01/24	13:53	Apache	Henz	Now-4:00pm	x	-	-	0	Hit
07/01/24	13:53	Canyon	Henz	Now-4:00pm	x	-	-	0	Hit
07/11/24	19:13	Apache	Malloy	Now-8:00pm	x	-	-	30	Hit
07/11/24	19:13	Canyon	Malloy	Now-8:00pm	x	-	-	30	Hit
07/11/24	19:13	Saguaro	Malloy	Now-8:00pm	x	-	-	30	Hit
07/19/24	18:56	Apache	Malloy	Now-8:00pm	x	-	-	1	Hit
07/19/24	18:56	Canyon	Malloy	Now-8:00pm	x	-	-	1	Hit
07/20/24	18:38	Apache	Malloy	Now-7:30pm	x	-	-	20	Hit
07/21/24	14:03	Apache	Malloy	Now-3:30pm	x	-	-	28	Hit
07/21/24	13:38	Bartlett	Malloy	Now-3:00pm	x	-	-	49	Hit
07/21/24	14:03	Canyon	Malloy	Now-3:30pm	x	-	-	29	Hit
07/21/24	13:38	Horseshoe	Malloy	Now-3:00pm	x	-	-	34	Hit
07/21/24	15:06	Pleasant	Malloy	Now-4:30pm	-	x	-	40	Hit
07/21/24	14:03	Saguaro	Malloy	Now-3:30pm	x	-	-	64	Hit
07/24/24	17:30	Bartlett	Malloy	Now-6:30pm	x	-	-	14	Hit
07/24/24	17:30	Horseshoe	Malloy	Now-6:30pm	x	-	-	8	Hit
07/25/24	15:38	Apache	Malloy	Now-5:30pm	x	-	-	2	Hit
07/25/24	17:49	Bartlett	Malloy	Now-6:45pm	x	-	-	9	Hit
07/25/24	17:45	Canyon	Malloy	Now-6:45pm	x	-	-	14	Hit

<b>TABLE C-1: MSP Lake Alerts Issued - Monsoon 2024</b>									
<b>Statement Details</b>					<b>Observations</b>			<b>Lead Time</b>	<b>Verification</b>
<b>Date</b>	<b>LST</b>	<b>Lake</b>	<b>Forecaster</b>	<b>Valid Time</b>	<b>Lightning</b>	<b>Wind &gt; 30mph</b>	<b>Hail/Heavy Rain</b>	<b>1st Obs.</b>	<b>Hit/Miss</b>
07/25/24	16:10	Horseshoe	Malloy	Now-5:30pm	x	-	-	5	Hit
07/25/24	17:45	Saguaro	Malloy	Now-6:45pm	x	-	-	14	Hit
07/26/24	15:31	Apache	Malloy	Now-4:30pm	-	x	-	9	Hit
07/26/24	17:16	Bartlett	Malloy	Now-6:15pm	-	-	-	-	Miss
07/26/24	17:01	Horseshoe	Malloy	Now-6:00pm	x	x	-	14	Hit
08/04/24	15:29	Bartlett	Malloy	Now-4:30pm	x	-	-	7	Hit
08/08/24	16:42	Apache	Henz	Now-6:00pm	x	-	-	0	Hit
08/08/24	16:23	Bartlett	Henz	Now-6:00pm	x	-	-	28	Hit
08/08/24	16:42	Canyon	Henz	Now-6:00pm	x	-	-	33	Hit
08/08/24	16:42	Saguaro	Henz	Now-6:00pm	x	-	-	78	Hit
08/10/24	17:35	Bartlett	Malloy	Now-7:00pm	x	-	-	20	Hit
08/10/24	18:20	Horseshoe	Malloy	Now-7:15pm	x	-	-	17	Hit
08/13/24	23:33	Apache	Malloy	Now-1:00pm	x	-	-	0	Hit
08/13/24	23:33	Canyon	Malloy	Now-1:00pm	x	-	-	19	Hit
08/22/24	16:05	Apache	Henz	Now-6:00pm	x	-	-	0	Hit
08/22/24	16:05	Canyon	Henz	Now-6:00pm	x	-	-	32	Hit
08/22/24	16:05	Saguaro	Henz	Now-6:00pm	x	-	-	44	Hit
08/23/24	17:57	Apache	Malloy	Now-7:00pm	x	-	-	0	Hit
08/23/24	17:57	Canyon	Malloy	Now-7:00pm	-	-	-	-	Miss
08/23/24	17:57	Saguaro	Malloy	Now-7:00pm	x	-	-	14	Hit
08/31/24	18:02	Saguaro	Henz	Now-7:30pm	x	-	-	9	Hit
09/01/24	15:00	Apache	Henz	Now-4:30pm	x	-	-	0	Hit
09/01/24	15:00	Canyon	Henz	Now-4:30pm	x	-	-	19	Hit
09/01/24	15:00	Saguaro	Henz	Now-4:30pm	x	-	-	30	Hit

## APPENDIX D: QPF STORM TOTAL PRECIPITATION – VERIFICATION TABLES

**TABLE D-1:** This table shows each of the individual MSP Message Alerts issued during the Monsoon 2024 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** – The 25 percent error threshold range based on both the QPF STP lower and upper range values, as 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.

<b>TABLE D-1: MSP QPF Peak Storm Total Rainfall Verification - Monsoon 2024</b>										
Statement Details		Peak STP (in)					25% Error Threshold Range			Verification
Date	MSP Forecast Zone	QPF (LT)	QPF (UT)	ALERT	GAQPE (Max)	LSRs	QPF (LT)	QPF (UT)	LSRs	Hit/Miss
06/23/24	Scottsdale North	0.50	1.00	0.98	1.34	-	0.38	1.25	-	Miss
06/23/24	Upper Centennial	0.50	1.50	0.16	2.05	-	0.38	1.88	-	Miss
06/24/24	Scottsdale North	0.50	1.50	0.47	1.19	-	0.38	1.88	-	Hit
07/14/24	New River/Cave Creek	0.50	1.50	1.22	1.23	-	0.38	1.88	-	Hit
07/14/24	Phoenix North	0.50	1.50	1.22	1.26	-	0.38	1.88	-	Hit
07/14/24	Phoenix South	0.50	1.50	0.67	0.67	-	0.38	1.88	-	Hit
07/14/24	Rainbow Valley	0.50	1.50	0.94	1.10	-	0.38	1.88	-	Hit
07/19/24	Northwest Valley	0.25	1.00	0.79	1.73	-	0.13	1.25	-	Miss
07/24/24	East Valley	0.50	1.00	0.28	0.52	-	0.38	1.25	-	Hit
07/24/24	Phoenix North	0.50	1.00	0.71	0.56	-	0.38	1.25	-	Hit
07/24/24	Phoenix South	0.50	1.00	0.51	0.66	-	0.38	1.25	-	Hit
07/25/24	East Valley	0.50	1.25	0.43	0.48	-	0.38	1.56	-	Hit

<b>TABLE D-1: MSP QPF Peak Storm Total Rainfall Verification - Monsoon 2024</b>										
<b>Statement Details</b>		<b>Peak STP (in)</b>					<b>25% Error Threshold Range</b>			<b>Verification</b>
<b>Date</b>	<b>MSP Forecast Zone</b>	<b>QPF (LT)</b>	<b>QPF (UT)</b>	<b>ALERT</b>	<b>GAQPE (Max)</b>	<b>LSRs</b>	<b>QPF (LT)</b>	<b>QPF (UT)</b>	<b>LSRs</b>	<b>Hit/Miss</b>
07/25/24	East Valley	0.50	1.00	0.67	0.67	-	0.38	1.25	-	Hit
07/25/24	Lower Salt River Lakes	0.50	1.25	0.04	1.52	-	0.38	1.56	-	Hit
07/25/24	Rainbow Valley	0.50	1.25	0.94	0.73	-	0.38	1.56	-	Hit
07/25/24	Superstition	0.50	1.25	1.50	1.69	-	0.38	1.56	-	Miss
07/25/24	Palo Verde	0.50	1.25	1.42	1.76	-	0.38	1.56	-	Miss
07/25/24	Southeast Valley	0.50	1.25	0.75	1.76	-	0.38	1.56	-	Miss
07/25/24	Superstition	0.50	1.00	0.24	0.33	-	0.38	1.25	-	Miss
07/25/24	Wickenburg	0.50	1.50	0.00	0.25	-	0.38	1.88	-	Miss
08/06/24	Phoenix South	0.50	1.25	0.47	0.76	-	0.38	1.56	-	Hit
08/06/24	Scottsdale South	0.50	1.25	0.43	0.54	-	0.38	1.56	-	Hit
08/06/24	Southeast Valley	0.50	1.25	0.31	1.19	-	0.38	1.56	-	Hit
08/18/24	Scottsdale North	0.50	1.25	0.91	1.35	-	0.38	1.56	-	Hit
08/22/24	East Valley	0.50	1.25	0.63	0.66	-	0.38	1.56	-	Hit
08/22/24	Phoenix South	0.50	1.25	1.38	1.58	-	0.38	1.56	-	Hit
08/22/24	Superstition	0.50	1.25	0.51	1.02	-	0.38	1.56	-	Miss
08/22/24	Scottsdale South	0.50	1.25	1.81	1.94	-	0.38	1.56	-	Miss
08/31/24	New River/Cave Creek	0.50	1.25	1.06	1.01	-	0.38	1.56	-	Hit