

HYDROLOGIC DATA BRIEF FOR THE EDWARDS AQUIFER THROUGH APRIL 2017

Prepared by

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UVALDE COUNTY RAINFALL (in inches) for 2017

| | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---------------------------|-------|------|------|------|------|------|------|------|-------|------|------|------|
| Monthly Rainfall (2017) | 0.80 | 1.58 | 1.92 | 2.67 | | | | | | | | |
| 1981-2010 Climate Normals | 1.18 | 1.25 | 1.76 | 1.71 | 3.03 | 2.97 | 2.79 | 1.81 | 2.59 | 2.88 | 1.54 | 1.09 |
| Difference | -0.38 | 0.33 | 0.16 | 0.96 | | | | | | | | |

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|--|-------|
| 30-year Normal Average | 24.60 |
| Total for January - April 2017 | 6.97 |
| 30-year Normal Average January - April 2017 | 5.90 |
| Total Difference for Year to Date | 1.07 |
| Percent of 30-year Normal Average Year to Date | 118% |

Rainfall Data provided by National Weather Service (NWS) rainfall station located at Garner Field Airport.

MEDINA COUNTY RAINFALL (in inches) for 2017

| | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---------------------------|-------|-------|-------|------|------|------|------|------|-------|------|------|------|
| Monthly Rainfall (2017) | 0.41 | 1.31 | 1.78 | 2.71 | | | | | | | | |
| 1981-2010 Climate Normals | 1.38 | 1.49 | 2.13 | 1.98 | 3.38 | 3.49 | 2.09 | 1.67 | 2.60 | 3.31 | 1.58 | 1.14 |
| Difference | -0.97 | -0.18 | -0.35 | 0.73 | | | | | | | | |

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| 30-year Normal Average | 26.24 |
| Total for January - April 2017 | 6.21 |
| 30-year Normal Average January - April 2017 | 6.98 |
| Total Difference for Year to Date | -0.77 |
| Percent of 30-year Normal Average Year to Date | 89% |

Rainfall Data provided by NWS rainfall station located at Hondo Municipal Airport.

1981-2010 Climate Normals are NCDC's latest three-decade averages of climatological variables, including temperature and precipitation. This new product replaces the 1971-2000 Climate Normals product, which remains available as historical data.

SOURCE: <https://www.ncdc.noaa.gov/cdo-web/datatools/normals>

BEXAR COUNTY RAINFALL (in inches) for 2017

| | Jan. | Feb. | Mar. | Apr. | May. | Jun. | Jul. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---------------------------|------|------|-------|------|------|------|------|------|-------|------|------|------|
| Monthly Rainfall (2017) | 2.72 | 3.61 | 2.09 | 2.89 | | | | | | | | |
| 1981-2010 Climate Normals | 1.76 | 1.79 | 2.31 | 2.10 | 4.01 | 4.14 | 2.74 | 2.09 | 3.03 | 4.11 | 2.28 | 1.91 |
| Difference | 0.96 | 1.82 | -0.22 | 0.79 | | | | | | | | |

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|--|-------|
| 30-year Normal Average | 32.27 |
| Total for January - April 2017 | 11.31 |
| 30-year Normal Average January - April 2017 | 7.96 |
| Total Difference for Year to Date | 3.35 |
| Percent of 30-year Normal Average Year to Date | 142% |

Rainfall Data provided by NWS rainfall station located at San Antonio International Airport.

COMAL COUNTY RAINFALL (in inches) for 2017

| | Jan. | Feb. | Mar. | Apr. | May. | Jun. | Jul. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---------------------------|------|------|------|------|------|------|------|------|-------|------|------|------|
| Monthly Rainfall (2017) | 2.78 | 2.33 | 3.30 | 4.40 | | | | | | | | |
| 1981-2010 Climate Normals | 1.86 | 2.02 | 2.66 | 2.28 | 3.97 | 4.78 | 2.62 | 1.95 | 3.09 | 4.25 | 2.87 | 2.27 |
| Difference | 0.92 | 0.31 | 0.64 | 2.12 | | | | | | | | |

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|--|-------|
| 30-year Normal Average | 34.62 |
| Total for January - April 2017 | 12.81 |
| 30-year Normal Average January - April 2017 | 8.82 |
| Total Difference for Year to Date | 3.99 |
| Percent of 30-year Normal Average Year to Date | 145% |

Rainfall Data provided by NWS rainfall station located at New Braunfels Municipal Airport.

1981-2010 Climate Normals are NCDC's latest three-decade averages of climatological variables, including temperature and precipitation. This new product replaces the 1971-2000 Climate Normals product, which remains available as historical data.

SOURCE: <https://www.ncdc.noaa.gov/cdo-web/datatools/normals>

HAYS COUNTY RAINFALL (in inches) for 2017

| | Jan. | Feb. | Mar. | Apr. | May. | Jun. | Jul. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---------------------------|------|------|------|------|------|------|------|------|-------|------|------|------|
| Monthly Rainfall (2017) | 2.46 | 2.66 | 3.04 | 6.54 | | | | | | | | |
| 1981-2010 Climate Normals | 2.06 | 1.92 | 2.48 | 2.72 | 4.13 | 4.64 | 2.5 | 2.19 | 3.42 | 4.33 | 3.05 | 2.29 |
| Difference | 0.40 | 0.74 | 0.56 | 3.82 | | | | | | | | |

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|---|--------------|
| 30-year Normal Average | 35.73 |
| Total for January - April 2017 | 14.70 |
| 30-year Normal Average January - April 2017 | 9.18 |
| Total Difference for Year to Date | 5.52 |
| Percent of 30-year Normal Average Year to Date | 160% |

Rainfall Data provided by NWS rainfall station located in San Marcos.

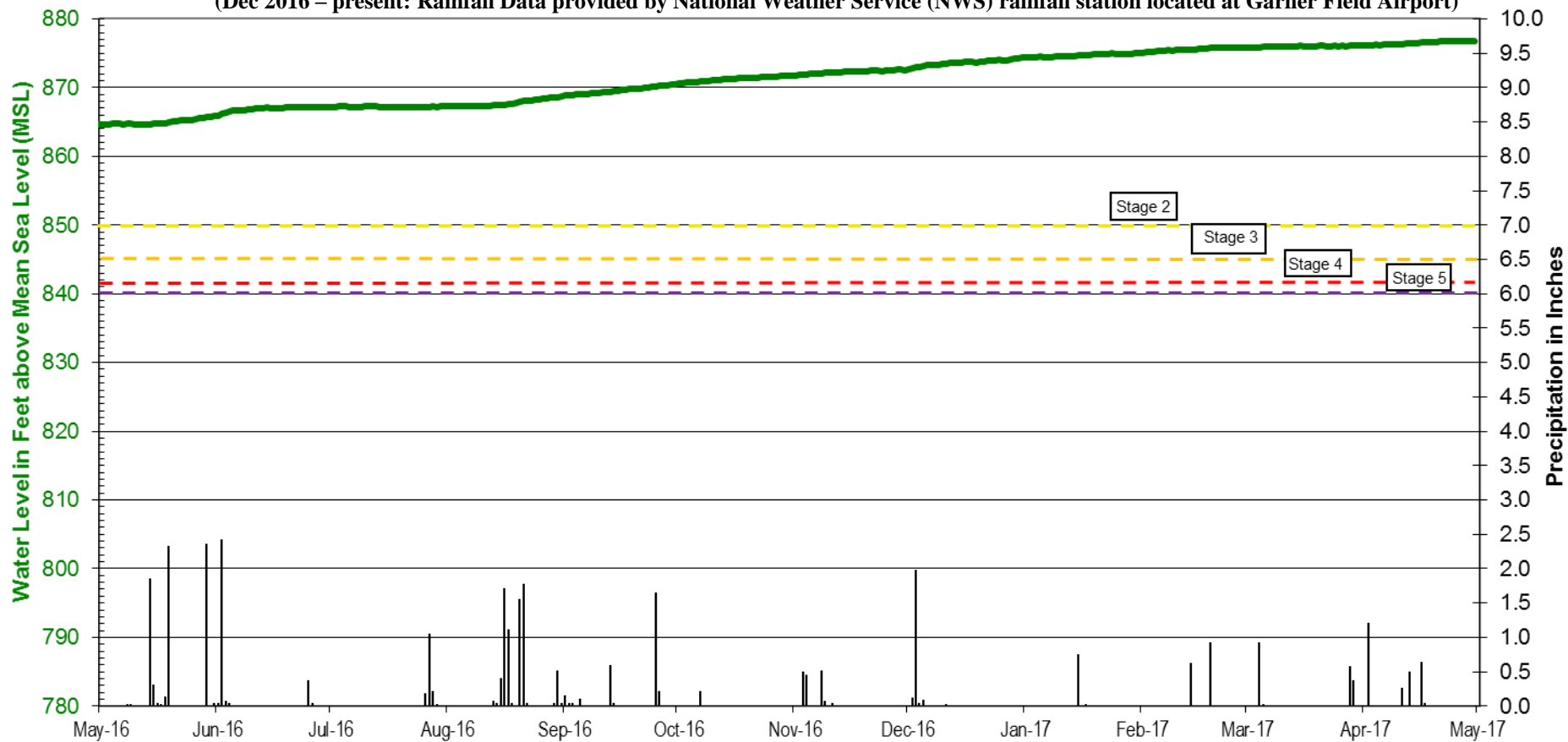
Rainfall Data provided by EAA Gauge HA158 located about 0.25 miles west of Bobcat Stadium.
NWS Rainfall Station at San Marcos Airport-out of service

1981-2010 Climate Normals are NCDC's latest three-decade averages of climatological variables, including temperature and precipitation. This new product replaces the 1971-2000 Climate Normals product, which remains available as historical data.
SOURCE: <https://www.ncdc.noaa.gov/cdo-web/datatools/normals>

Hydrograph of the Uvalde County Index Well (J-27) and Precipitation at Uvalde

(Feb – Nov 2016: Rainfall Data provided by EAA Rain Gauge UV033 located 4.4 miles south of the City of Uvalde)

(Dec 2016 – present: Rainfall Data provided by National Weather Service (NWS) rainfall station located at Garner Field Airport)



- Stage 1 - None
- Stage 2 - Critical Period - 10-day avg. < 850' MSL
- Stage 3 - Critical Period - 10-day avg. < 845' MSL
- Stage 4 - Critical Period - 10-day avg. < 842' MSL
- Stage 5 - Critical Period - 10-day avg. < 840' MSL

Date

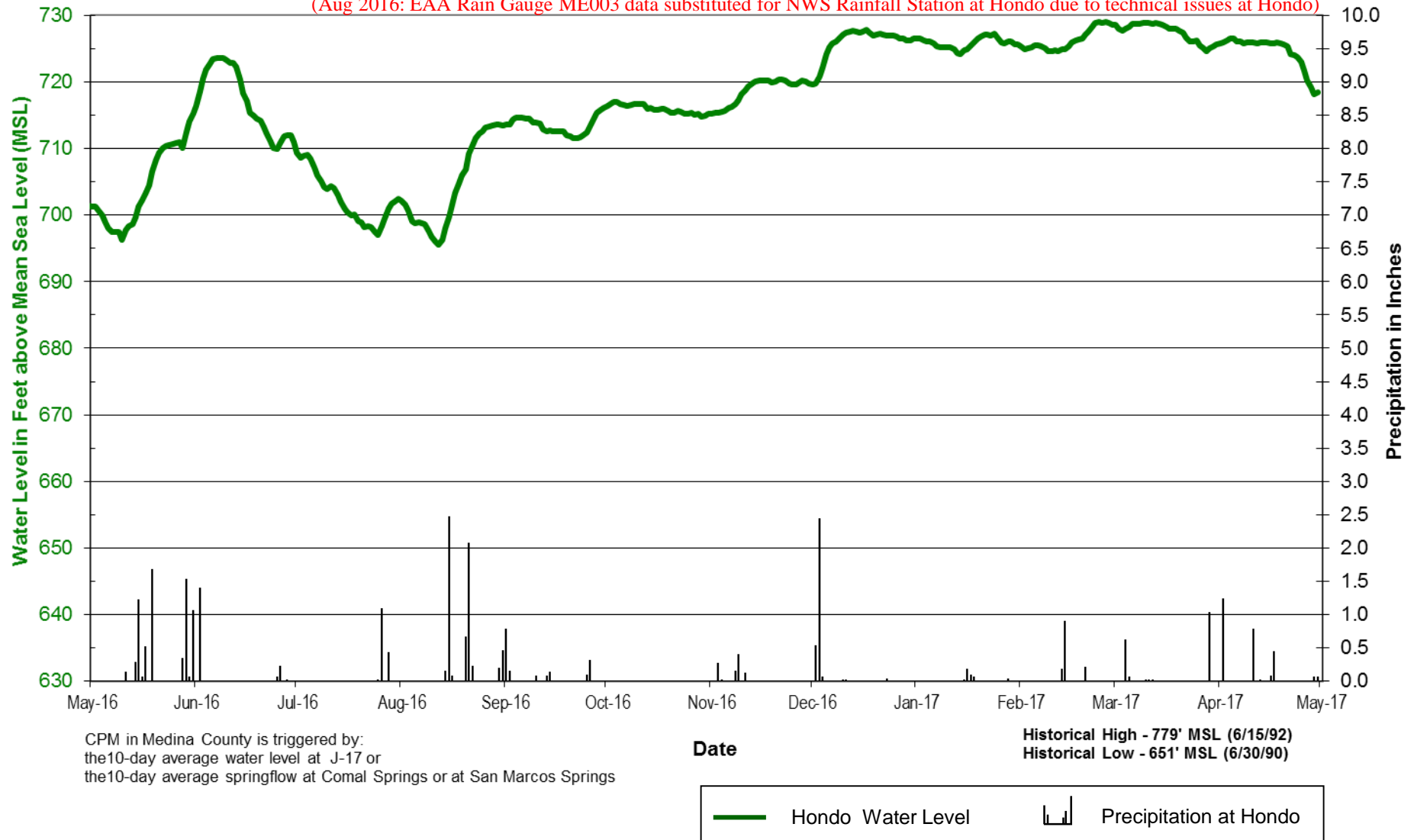
Historical High - 889' MSL (6/15/87)
Historical Low - 811' MSL (4/13/57)



Hydrograph of the Medina County Hondo City Well and Precipitation at Hondo

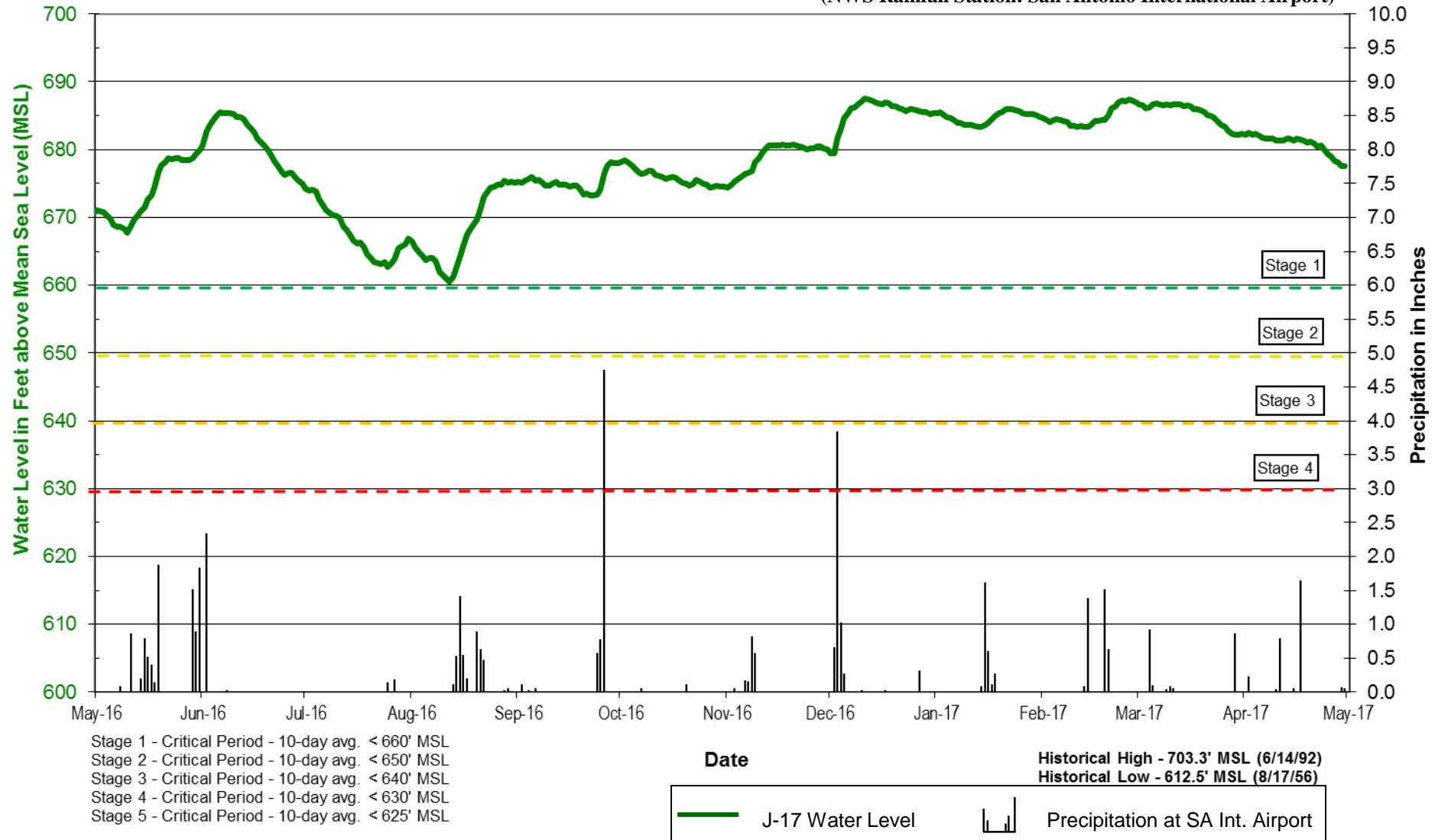
(NWS Rainfall Station: Hondo Municipal Airport)

(Aug 2016: EAA Rain Gauge ME003 data substituted for NWS Rainfall Station at Hondo due to technical issues at Hondo)



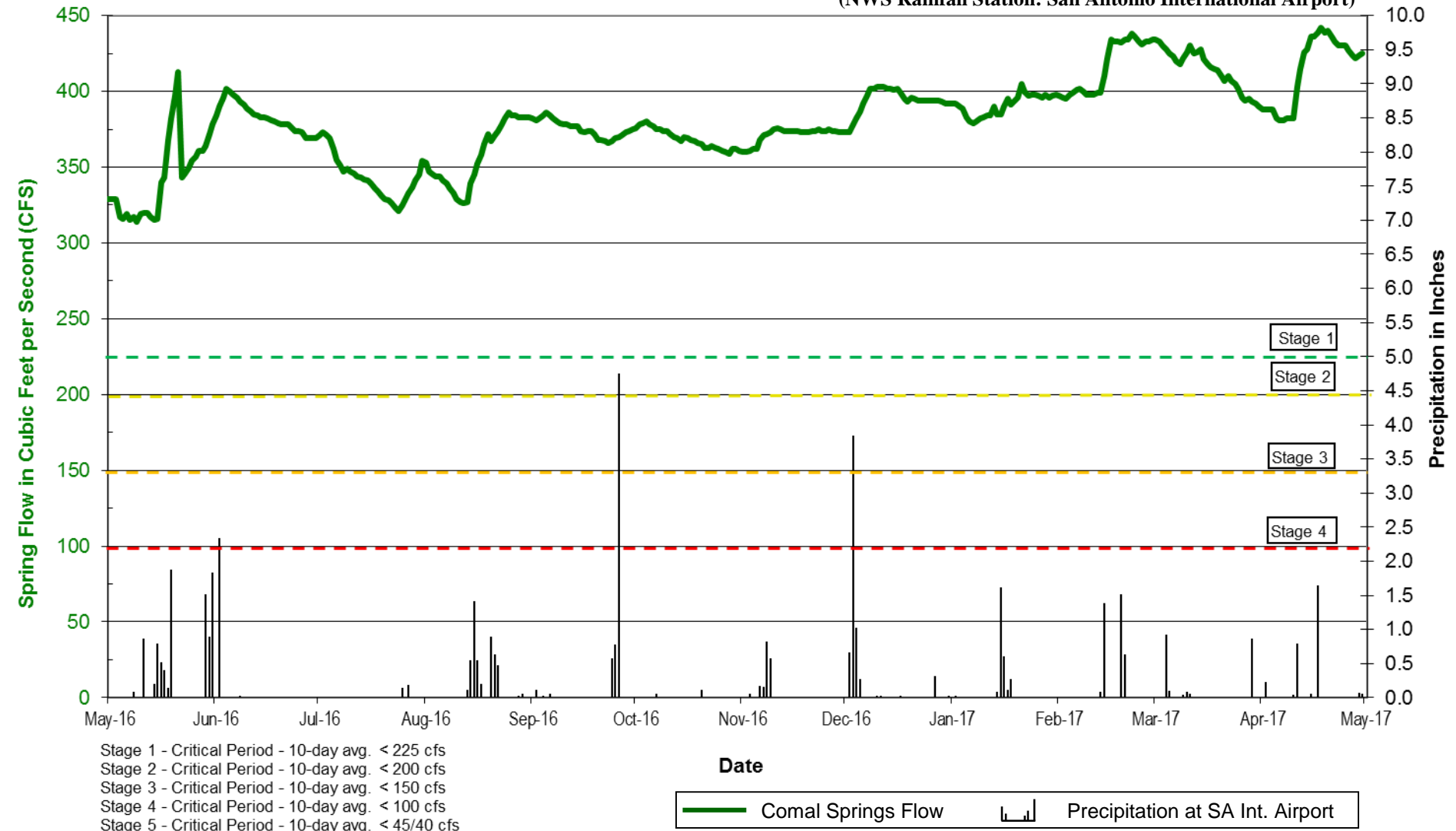
Hydrograph of the Bexar County Index Well (J-17) and Precipitation at San Antonio

(NWS Rainfall Station: San Antonio International Airport)



Hydrograph of the Comal Springs Discharge and Precipitation at San Antonio

(NWS Rainfall Station: San Antonio International Airport)

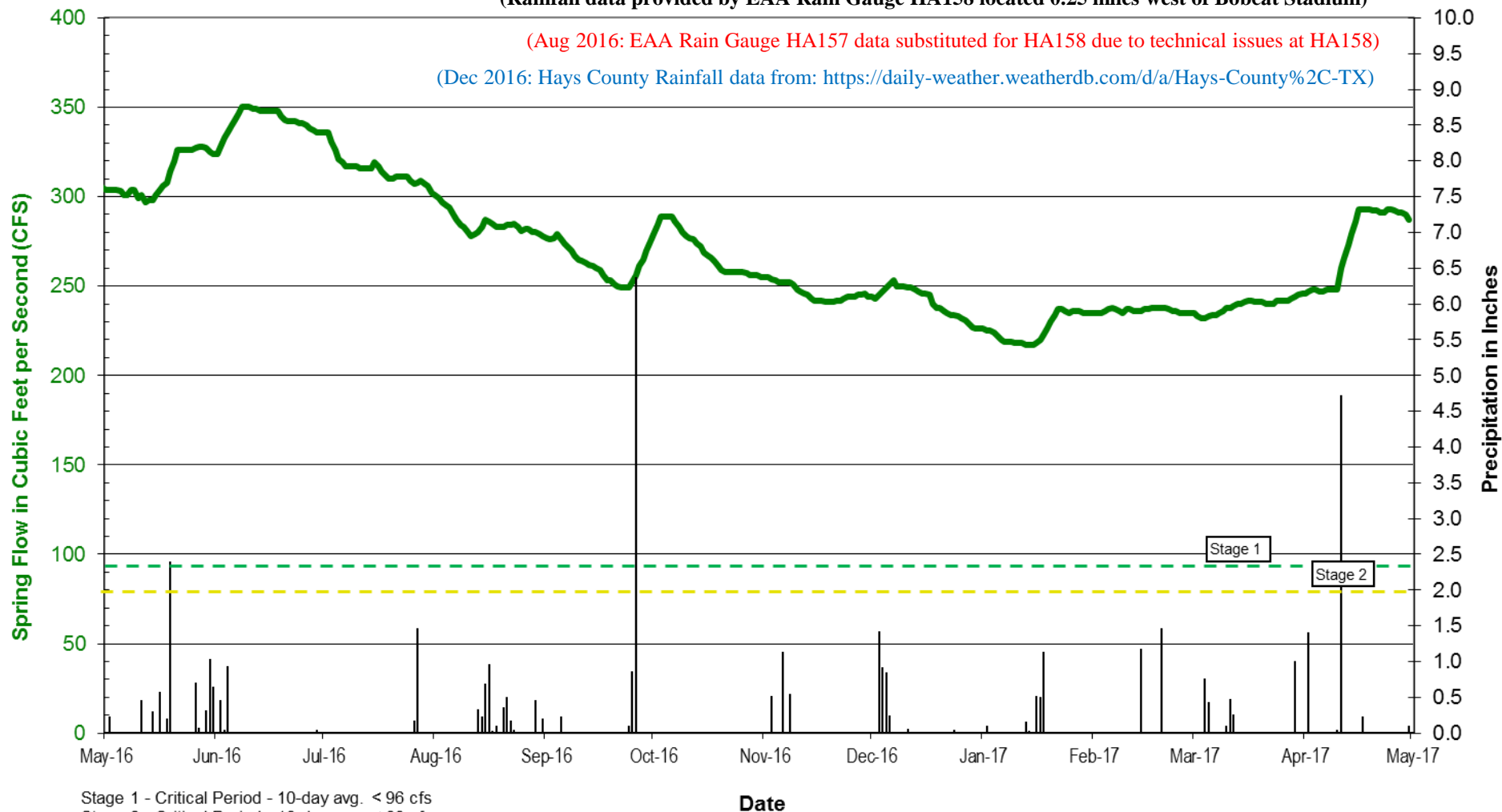


Hydrograph of the San Marcos Springs Discharge and Precipitation at San Marcos

(Rainfall data provided by EAA Rain Gauge HA158 located 0.25 miles west of Bobcat Stadium)

(Aug 2016: EAA Rain Gauge HA157 data substituted for HA158 due to technical issues at HA158)

(Dec 2016: Hays County Rainfall data from: <https://daily-weather.weatherdb.com/d/a/Hays-County%2C-TX>)



Stage 1 - Critical Period - 10-day avg. < 96 cfs
 Stage 2 - Critical Period - 10-day avg. < 80 cfs
 Stage 3 - None
 Stage 4 - None
 Stage 5 - None

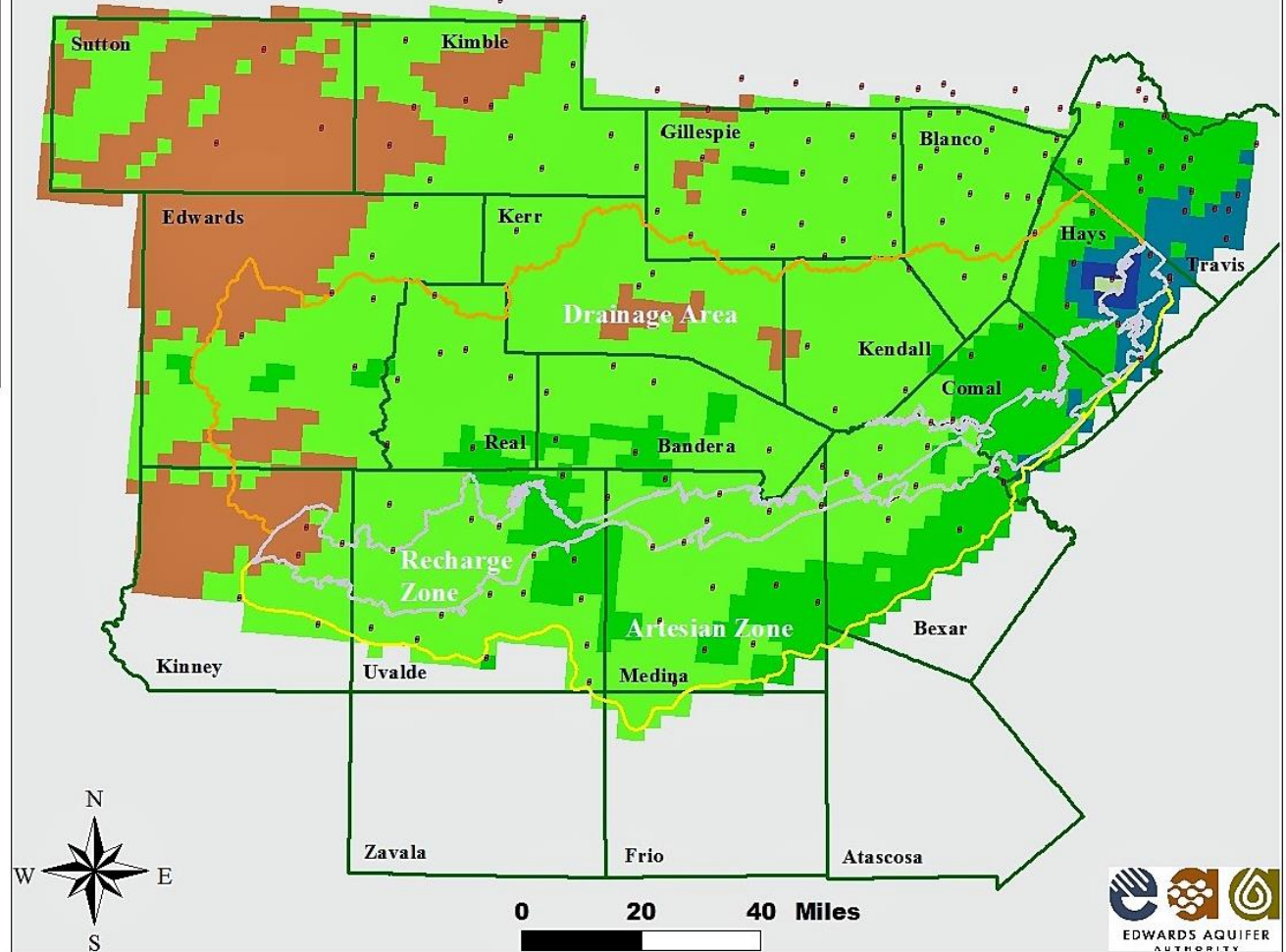
— San Marcos Springs Flow █ Precipitation at San Marcos

Calibrated March 2017 Rainfall Totals

- Rain Gauge
- County Line
- Artesian Zone
- Drainage Area
- Recharge Zone

Rainfall Total (Inches)

- 5 - 6
- 4 - 5
- 3 - 4
- 2 - 3
- 1 - 2
- 0 - 1



Real-time Precipitation Gauging System and Hydrologic Data Collection

The Edwards Aquifer Authority (EAA) operates 74 “real-time” precipitation gauges that record data on six-minute intervals and transmit these data to the EAA’s office via a radio-telemetry system. Rain gauges are located on the Edwards Aquifer Contributing Zone, Recharge Zone, and Artesian Zone. Acquired data have many uses including aquifer recharge calculations, production of rainfall maps, and in a variety of research projects. The EAA also collects water level data from a series of aquifer monitor wells in the region, including two index wells: Well J-27, in Uvalde County and Well J-17, in Bexar County. Water level data from the Hondo City well in Medina County are also included in this data brief. Through a cooperative agreement with the U.S. Geological Survey, the EAA monitors the discharge at Comal Springs and San Marcos Springs.

Rainfall Evaluation – March 2017 Vieux & Associates Doppler Rainfall Map

The calibrated March 2017 Rainfall Totals Map was prepared by Vieux & Associates for the EAA using NEXRAD Doppler Radar and the EAA’s precipitation gauge data. Calibrating the NEXRAD data with the EAA’s precipitation gauge data improves the accuracy of the precipitation maps and is calculated using a four-kilometer grid system. Rain gauge locations are indicated on the map.

Although March may be categorized as having “normal” rainfall, most of the heaviest rains occurred in the far northeastern area of the region. The most significant rainfall occurred in central Hays County along the Contributing Zone / Recharge Zone border where between 4 and 6 inches was recorded. In the Contributing Zone of the Edwards Aquifer system, the bulk of the rainfall occurred from the Bexar/Comal County border northeast to the Hays/Travis County border. Here, between 2 and 6 inches was recorded. Elsewhere in the Contributing Zone, between 0 and 3 inches was recorded. The Recharge Zone recorded anywhere between 0 and 5 inches; the most occurring in central Hays County where between 3 and 5 inches was recorded. The Artesian Zone had recorded amounts of between 1 and 4 inches; the most occurring in southeastern Hays County where between 3 and 4 inches was recorded.

Rain Evaluation – Precipitation Gauge Data – April 2017

Most rainfall in April was associated with thunderstorms that provided much of the region with above average rainfall. Hence, the April 2017 maximum monthly total rainfall amounts in the EAA's gauges ranged from 0.29 to 6.54 inches. The highest reported 24-hour rainfall events from the EAA's precipitation gauge network in April, by county, were as follows: Bandera, 1.74 inches; Bexar, 1.05 inches; Blanco, 1.90 inches; Comal, 1.87 inches; Edwards, 2.56 inches; Hays, 4.73 inches; Kendall, 1.37 inches; Kinney, 3.43 inches; Medina, 2.35 inches; Real, 2.51 inches; and Uvalde County, 3.20 inches. The highest 24-hour rain event recorded in the region was 4.73 inches of rain that occurred on April 11th at a gauge located on the northwest side of Loop 82/Branch 81 (Aquarena Springs Drive), about a 1/4 mile northeast from the intersection of Aquarena Springs Drive and Charles Austin Drive in Hays County.

Evaluation of April 2017 Aquifer Levels and Spring Discharge

The response of aquifer levels is a function of local and regional rainfall events, water withdrawal and Springflow. The San Antonio Pool Index Well (J-17) *decreased* 4.7 feet to 677.6 feet above mean sea level (msl) while the City of Hondo Well *decreased* 7.1 feet to 718.5 feet msl. However, the Uvalde Pool Well (J-27), *increased* 0.6 feet to 876.7 feet msl.

The April daily average springflow for Comal Springs *increased* 44 cubic feet per second (cfs) to 425 cfs, which is 128 cfs *above* the April monthly average discharge of 297 cfs. Likewise, the daily average springflow for San Marcos Springs *increased* 41 cfs to 287 cfs, which is 112 cfs *above* the monthly average discharge of 175 cfs for April. Please note that the discharge amounts are estimates and may be adjusted up or down as more direct flow measurements are obtained.

Summary of Current Aquifer Levels and Spring Discharges – May 2017

The official daily high water level for the Uvalde Pool Index Well (J-27) was 876.6 ft. msl on Wednesday, May 3, 2017, which is 9.8 ft. *above* the J-27 May monthly average of 866.8 ft. msl. The daily high water level at the San Antonio Pool Index Well (J-17) was 675.9 ft. msl on May 3, 2017; 10.4 ft. *above* the J-17 May monthly average of 665.5 ft. msl. The daily average discharge at Comal Springs on Tuesday, May 2, 2017, was reported to be 419 cfs, 125 cfs *above* the May average of 294 cfs while the daily average discharge at San Marcos Springs on May 2, 2017 was reported to be 285 cfs, 103 cfs *above* the May average of 182 cfs. Please note that the discharge values are estimates and may be adjusted up or down as more direct flow measurements are obtained.

Summary of Current Regional Aquifer Conditions

While above normal temperatures continue, the prediction (and occurrence) of at or above normal precipitation provides relief from dry periods of the recent past. Thus, the Edwards Aquifer region continues to remain above Critical Period Management (CPM) thresholds. The U.S. Department of Agriculture - U.S. Drought Monitor Index indicated that abnormally dry to moderate drought conditions exist along the Texas/Louisiana border counties from the Nacogdoches area north and westward to Grayson County along the Oklahoma border. As a result, only about 10% of Texas is experiencing some form of seasonal or short-term drought condition.

The Climate Prediction Center (CPC) reported that, “ENSO (El Niño /Southern Oscillation) – neutral conditions are favored to continue through at least the Northern Hemisphere spring 2017, with increasing chances for El Niño development by late summer and fall.” The US Seasonal Drought Outlook still shows drought conditions virtually absent in most areas with removal likely in small areas of northeast Texas. The NWS - Climate Prediction Center’s Long Range Outlook continues to forecast above normal temperatures, but equal chances of above, below, or normal precipitation for most of central to west Texas, and slightly above normal precipitation from central to eastern and coastal Texas into July 2017.