NATIONAL CLIMATE EXTREMES COMMITTEE MEMORANDUM

FROM: National Climate Extremes Committee (Arndt, Zdrojewski, Chu)
DATE: 14 December 2018
SUBJ: National Record 24-Hour Precipitation at Waipā Garden, Hawai'i

ARNDT.DEREK.SHANE.1384496519 Digitally signed by ARNDT.DEREK.SHANE.1384496519 Date: 2018.12.19 14:25:09 -05'00'

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Summary

Heavy rains and convection across eastern and northern parts of the island of Kauai, Hawai'i resulted in multiple reports of very heavy rainfall and flooding on 14-15 April 2018. The following observation came to light in the days immediately following the event. It was examined by the National Climate Extremes Committee (NCEC) to determine its validity and potential status of the greatest 24-hour rainfall total directly observed in the United States:

- Location: **Waipā Garden, Kauai, Hawaii**
- Date / Time: **The 24-hr period ending 1245 HST 15 April 2018**
- Amount: **49.69"**

After considering the observation and the various surrounding factors, the ***NCEC determined the Waipā Garden observation to be valid, and it now stands as the 24-hour record precipitation for the United States***. This value supersedes the previous record of 43.00" occurring 25-26 July 1979 at Alvin, Texas.

About the NCEC

The National Climate Extremes Committee (NCEC) is composed of members representing three bodies: NOAA's National Centers for Environmental Information, National Weather Service Climate Services Branch, and the American Association of State Climatologists. It is convened to adjudicate potential records for validity. If validated, the observation is considered the national record for that record type. More details are available in Horvitz, et al. (2000) and Cerveny et al. (2007).

Observer and Observation

The rain gauge at the center of this analysis, hereafter called "Waipā Garden" is installed on the premises of and operated by the non-profit Waipā Foundation, just west of the town of Hanalei in northern Kauai. It is a tipping-bucket type rain gauge located in a grassy meadow about 300 yards inland from Hanalei Bay, at less than 10 feet above mean sea level (Fig. 1). The current equipment and location were established in August 2011; for about five years prior to that, a different gauge was operated about 100 yards from the current station. More complete siting and instrumentation details are provided in Appendix A.

Fig. 1. An August 2014 photo of the Waipā Garden station. Photo courtesy of the Waipā Foundation.

Although the Waipā Garden station is not part of the NWS official observing network, the station was known to the local NWS Weather Forecast Office prior to April 2018 as an occasional provider of data for hydrological analysis and post-analysis purposes. Moreover, the lead observer, Mr. Matt Rosener, has collaborated with the Hawaii State Climatologist (and NCEC member for this event) on a hydrological journal article in the past. The station and the observer are considered reliable and generally accurate by both parties.

During the two-day period spanning the calendar dates 14-15 April 2018, the station recorded 54.37 inches of rainfall. The greatest 24-hour total from the 15-minute incremental observations was 49.69 inches, for the 24-hour period ending 1245 HST 15 April 2018. Although some precipitation occurred through most of the period, the primary contributors to the very large 24-hour total occurred in three bursts (see Fig. 2), spanning roughly

- 1300-1900 HST on the 14th, when just under 20 inches of rain was recorded
- 0000-0500 on the 15th, when about 18 inches of rain was recorded
- 1030-1245 on the 15th, when about 8 inches of rain was recorded

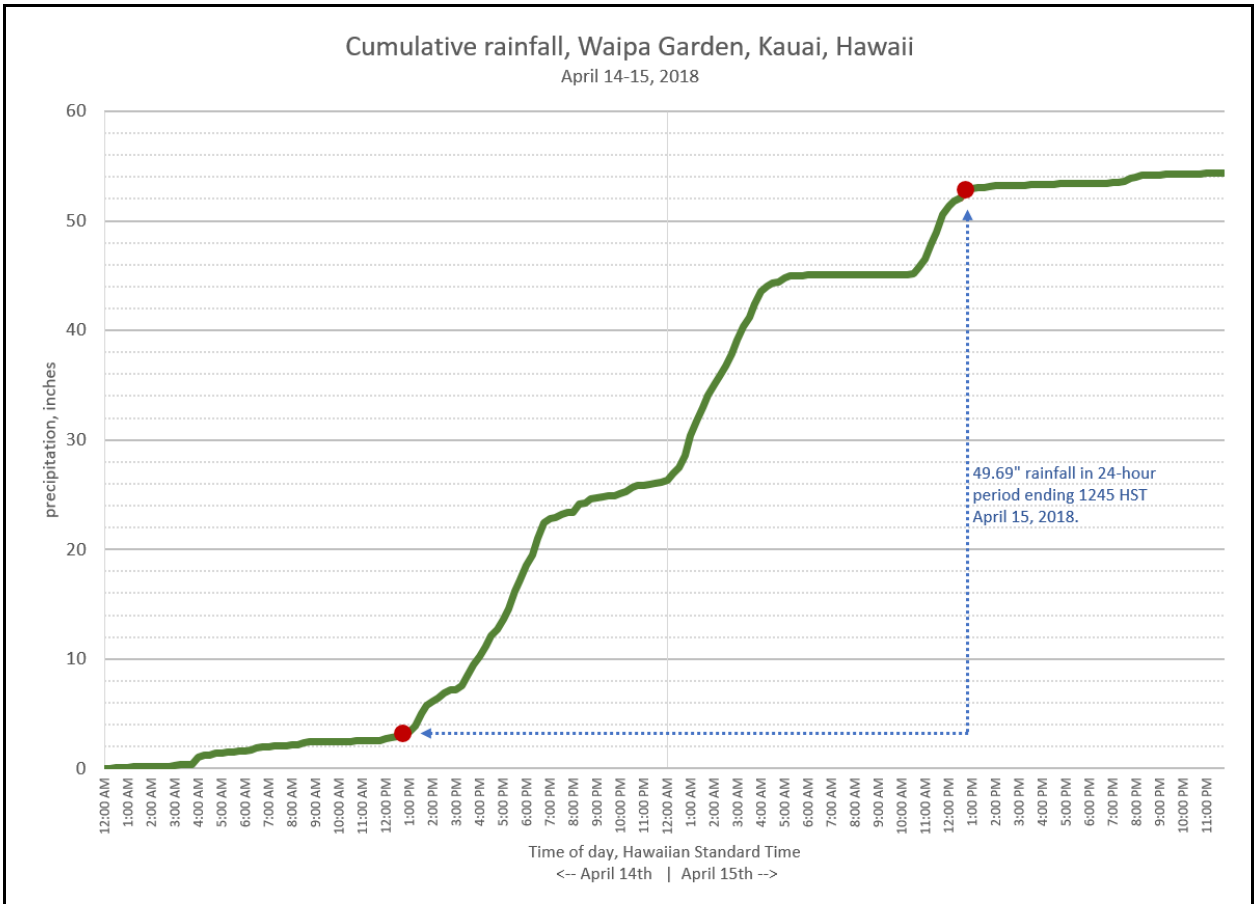

Fig. 2. Rainfall accumulation at Waipā Garden during 14-15 April 2018. The observations bracketing the 24-hour period in question are noted in red. Data courtesy of the Waipā Foundation.

Storm Environment & Meteorological Plausibility

Regionally, 14-15 April 2018 was marked by several ingredients conducive to very heavy rainfall. A warm, unstable surface layer and deep moisture prevailed across the region. An upper level low west of the Hawaiian Islands (Fig. 3), combined with a subtle mid-level trough nearer to Kauai, acted to further destabilize the atmosphere. This, combined with the absence of any notable inversion layer in the region, further enabled deep convection as a mode of precipitation. Breezy trade wind flow advected moisture to and through the region, maintaining a supply of warm, moist surface air to fuel convection.

Any national or state record precipitation value is by nature unanticipated. However, heavy rain, with embedded deep, sustained convection, was anticipated and observed across much of Kauai during the 14th and 15th. Flash flood warnings were numerous, and significant to catastrophic flooding was documented across much of the island.

"Wet and unstable conditions remain in place. An upper level low parked several hundred miles west of Kauai is generating the instability along with a shield of high clouds blanketing much of the state. The afternoon soundings continued to show no inversion, and recent satellite data revealed precipitable water (PW) values holding in the 1.5 to 1.8 inch range, which is well above the roughly 1.25 inch April normal. A strong surface high passing far north of the state is driving the breezy and gusty trades, while a subtle mid level trough appears to stretch from northeast to southwest just west of Kauai. It is this subtle trough that has been focusing heavy showers and thunderstorms over the Garden Isle …"
An excerpt of the Area Forecast Discussion issued by the Honolulu Weather Forecast Office at 3:54pm HST, 14 April 2018. "Garden Isle" refers to the island of Kauai.

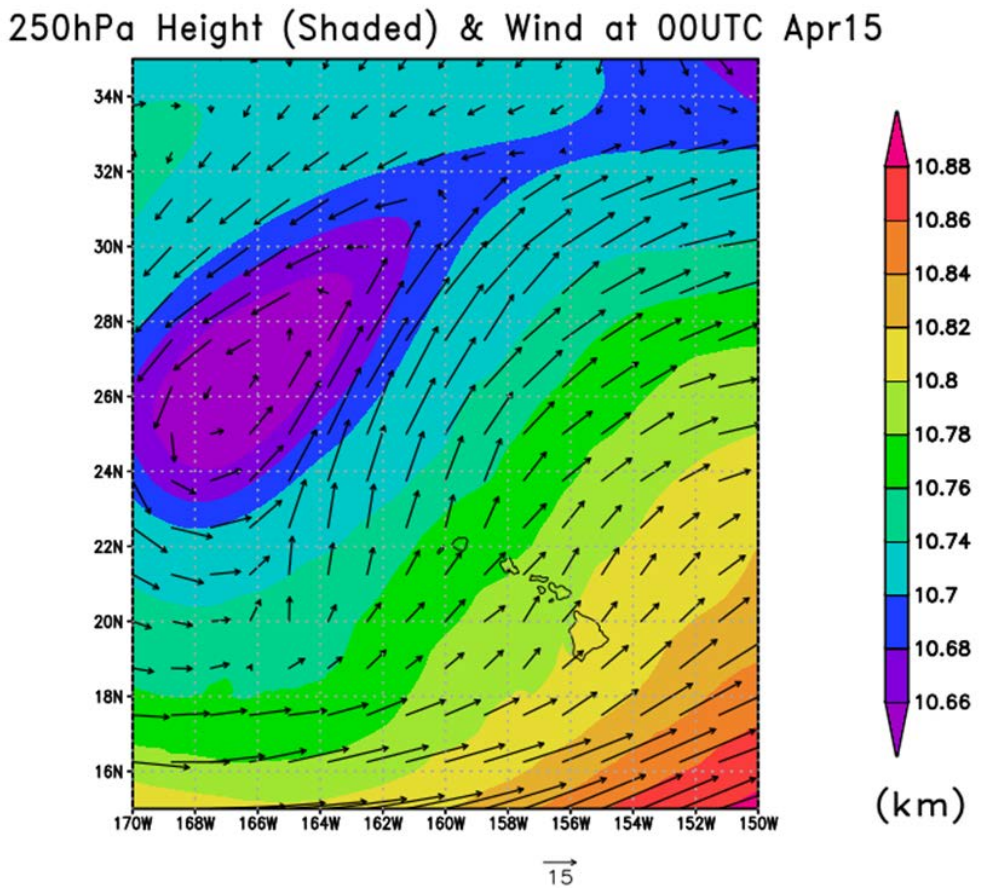

Fig. 3. Upper level analysis in the Hawai'ian region at 1400 HST 14 April 2018. The colors indicate the height of the 250 hPa level, in meters, while the arrows represent wind speed and direction. The upper level trough is indicated by the area of lower heights (purple colors) and counter-clockwise wind flow northwest of the Hawai'ian Islands.

Radar coverage for northern Kauai is insufficient to provide estimates for meaningful rainfall intercomparisons. Stations in the vicinity of the Waipā location collected one-day, two-day and 24-hour totals approaching and exceeding 30 inches (Fig 4.). A nearby volunteer observer from the Community Collaborative Rain Hail and Snow (CoCoRaHS) network recorded 39.45" over the two-day period, with 36.49" of that total observed on the 15th. An automated observing station in Hanalei recorded 28.15" of rainfall in the 24-hour period ending 0200 HST 15 April 2018 before ultimately failing during the event. This total is generally supportive of the 34.85" observed at the Waipā gauge during the same period.

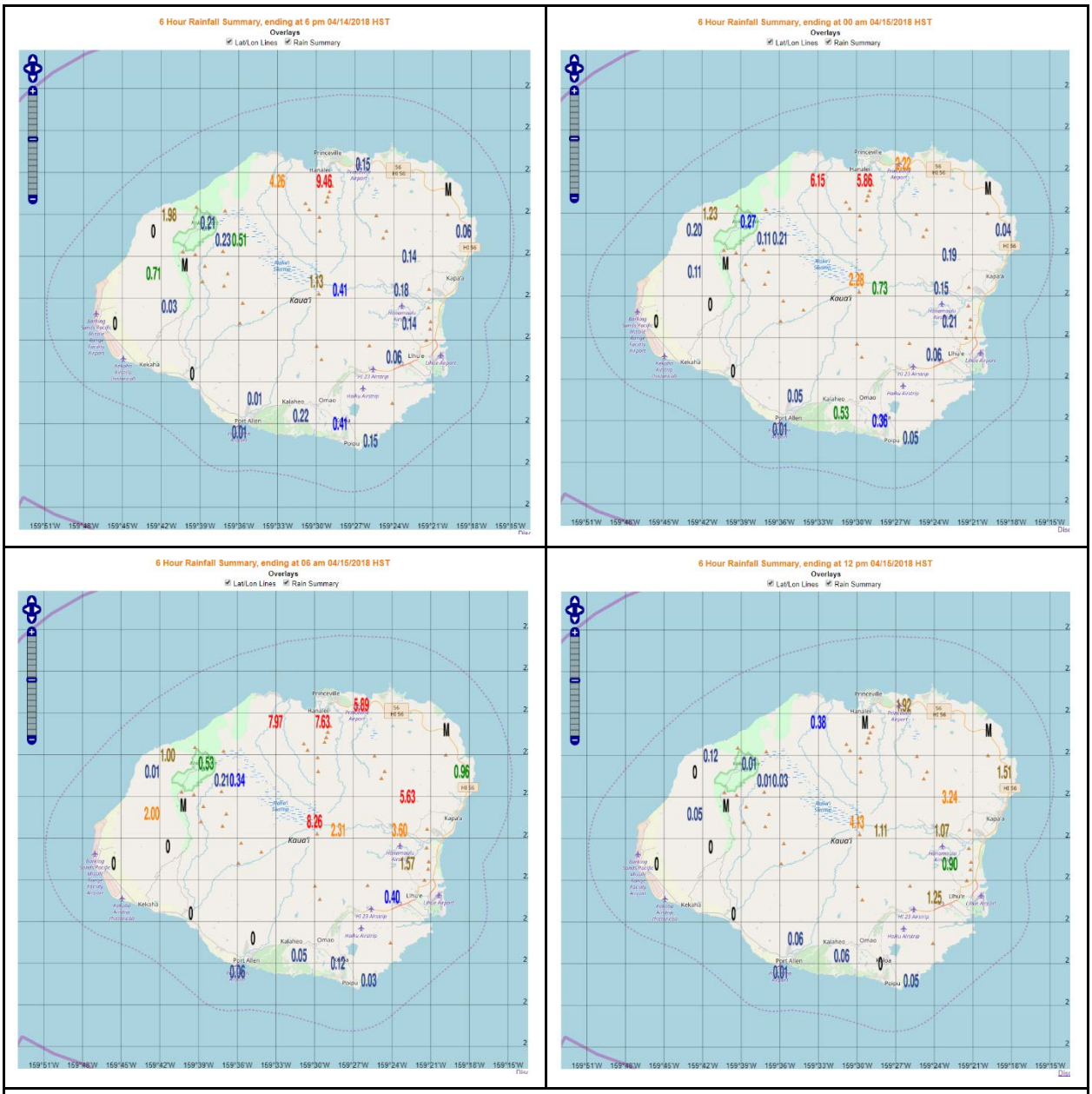

Fig. 4. Six-hour rainfall totals, in inches, for a subset of automated stations on Kauai for the periods ending (a) 1800 HST 14 April 2018; (b) 0000 HST 15 April 2018; (c) 0600 HST 15 April 2018; (d) 1200 HST 15 April 2018. “M” denotes missing data for all or part of that time period. Maps generated using the Graphical Rainfall Summary tool of the Honolulu NWS Weather Forecast Office: http://www.prh.noaa.gov/hnl/pages/rain_summary.php

Observing practices and equipment

A thorough examination of the siting, condition, and performance of the Waipā Garden gauge was conducted by NWS Honolulu personnel on 2 August 2018. The site was found to be properly sited within a grassy meadow, with appropriate and representative exposure in all directions from the gauge. The condition of the gauge and its siting was deemed to be “excellent” by the investigators.

Even when accounting for wind-related losses, tipping-bucket rain gauges are generally known to undercatch during very large rain rates, as some precipitation making its way through the instrument is lost during the tipping of the bucket device.

The instrument and data logger were put through several calibration tests using equipment designed or adapted for the purpose of analyzing gauge performance under high rainfall rates. Six trials, representing rainfall rates of two inches per hour to 26 inches per hour, showed that the gauge performed within expected tolerances. The highest trial rate, which likely considerably exceeded rates observed during the April event, demonstrated an undercatch of about 11%. Other rates revealed undercatch of less than 10% and for the lightest rate, about 1%. These are all consistent with expectations of a properly reporting gauge, and together strongly support the notion that the gauge did not over-report during the event.

The complete examination and calibration regimen is fully documented as Appendix A.

Previous Record

The previous U.S. 24-hour precipitation record was 43 inches, near Alvin, Texas, on 25-26 July 1979, in association with landfall of Tropical Storm Claudette. This rainfall record, already familiar to the applied climatology community, was established by the NCEC when originally constituted in 2000.

As is the case with the Waipā Garden observation, the Alvin observation was recorded by an unofficial observer, but one known to and trusted by the local NWS forecast office. This event was variously memorialized as 42" (the value adopted by the Texas State Climate Extremes Committee) and 43" (as adopted by the National Climate Extremes Committee). The cause for the discrepancy is unknown. It is possible that the additional inch accounts for rainfall lost to observation during periods when the observer's direct-read rain gauge overflowed its 10" capacity. More details are available in Cerveny et al. (2007) and Shein et al. (2012).

Considerations and concerns

An expressed concern of the committee is its non-status as part of an observing system operationally used or archived by NOAA. Therefore, it lacks permanent archival of the long-term record at this station, as well as the station's attendant metadata. This criterion is intended to preserve the observations and their provenance for future researchers to review.

Notably, the previous record (1979 at Alvin) similarly arose from an independent (i.e., not archived or maintained by official authorities) weather or climate monitoring station. However, like the Alvin observation, the Waipā Garden value resulted from direct, purposeful sampling of the phenomenon. Additionally, the station underwent subsequent field testing, and there is high confidence the gauge and datalogger were functioning properly.

Specific observations at 15-minute intervals are available for the Waipā Garden observation, and saved here as Appendix B. While this does not provide all of the benefits and provenance of a formal archive, it does preserve the constituent observations for future reference.

The field calibration and access to the constituent data mark some improvement in provenance, relative to the Alvin record.

Finding of committee

After considering the observation, the state and condition of the observing equipment, and the meteorological environment in which the observation was recorded, **the NCEC has determined, unanimously, that the 49.69 inches of rainfall observed at Waipā Garden is indeed valid, and constitutes a new 24-hour record precipitation value for the United States**. The NCEC made this final determination on 14 December 2018.

Committee Members:

- Deke Arndt (chair), Chief, Monitoring Section, National Centers for Environmental Information
- Jim Zdrojewski, Climate Services Branch, National Weather Service
- Dr. Pao-Shin Chu, University of Hawai'i at Manoa and Hawai'i State Climatologist

Recommendations

The passing of Dr. Kelly Redmond, who was instrumental to previous National Climate Extremes Committee investigations, exposed the need to re-codify the composition of the NCEC, so that future investigations can be conducted expediently. NCEC members Arndt and Zdrojewski will work with NWS and NCEI leadership, as well as the leadership of the American Association of State Climatologists, to formally update the NCEC composition.

Acknowledgments

The NCEC thanks Waipā Foundation hydrologist Matt Rosener, the installer and chief observer at Waipā Garden for his insight and collaboration during the course of the investigation.

The NCEC is indebted to the National Weather Service's Honolulu Weather Forecast Office (HFO) and the Lihue Data Collection Office (DCO Lihue) for conducting field examinations of the station. In particular, we thank Senior Service Hydrologist Kevin Kodama (HFO), and Electronics Technician Casey Thoenen (DCO Lihue) for their expertise and time.

We also thank Chris Fiebrich of the Oklahoma Mesonet / Oklahoma Climatological Survey for sharing the Oklahoma Mesonet's rain gauge calibration practices and procedures for consideration and use on this investigation.

We also thank Boyi Lu (University of Hawai'i at Manoa), who provided the upper level analysis chart.

References

Cerveny, R.S., J. Lawrimore, R. Edwards, and C. Landsea, 2007: Extreme Weather Records. *Bull. Amer. Meteor. Soc.,* **88**, 853–860, https://doi.org/10.1175/BAMS-88-6-853

Horvitz, A., R. Leffler, M. Changery, and G. Taylor, 2000: The National Climate Extremes Committee. 2nd Symposium on Environmental Applications, American Meteorological Society, 9-14 January 2000, Long Beach, CA.

Shein, K.A., D.P. Todey, F.A. Akyuz, J.R. Angel, T.M. Kearns, and J.L. Zdrojewski, 2012: Evaluating Statewide Climate Extremes for the United States. *J. Appl. Meteor. Climatol.,* **51**, 2047–2059, https://doi.org/10.1175/JAMC-D-11-0226.1

Appendix A: Waipā Garden Rain Gage Test Results

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE OFFICE
2525 Correa Road Suite 250
Honolulu, Hawaii 96822

August 6, 2018

MEMORANDUM FOR: National Climate Extremes Committee

FROM: HFO/SSH - Kevin Kodama KODAMA.KEVIN.R.1180362408 Digitally signed by KODAMA.KEVIN.R.1180362408 Date: 2018.08.06 08:42:59 -10'00'

SUBJECT: Waipa Garden Rain Gage Test Results

On August 2, 2018, I conducted a tipping bucket calibration and site condition assessment of the Waipa Garden rain gage site on the island of Kauai. Casey Thoenen, the electronics technician at the Data Collection Office – Lihue assisted me throughout the test. Emmaleah Stauber, a staff member at the Waipa Foundation, hosted us and graciously provided a pop-up canopy, a table, and several chairs which really made things easier. We moved the canopy over the gage during the test to prevent the passing showers from contaminating the results.

The Waipa Garden tipping bucket is a Hydrological Services America TB4 which measures 0.01 inches of rainfall per tip. A HOBO data logger is used by the Waipa Foundation to log the rainfall data. The data logger is stored inside the outer collector can. The outer collector funnel diameter is 200 mm. The tipping buckets are set by the manufacturer to tip at 6.8 milliliters. We tested the gage "as is", meaning that we conducted all test trials without moving the gage from its existing mounting. The only alteration was the removal of the outer aluminum enclosure to check the condition of the internal components and to directly test the capacities of the tipping buckets.

Conditions at the rain gage are excellent for sampling rainfall. The gage is mounted on a PVC pipe strapped to a fence post (Figure 1). This is in the middle of a flat, grassy field. Several Java plum trees of medium height were roughly 15 to 30 yards away from the gage from the east clockwise through the west. Most of these trees were less than 30 feet high. The northern semicircle is open with no obstructions. There is nothing in the area that would suggest an unrealistic accumulation of rainfall occurred. The outer enclosure was in good shape with no debris in the collection funnel. The interior was also clean. An examination of the bubble level showed the gage was slightly tilted (Figure 2). Additional figures (3 through 6) have been attached to show views to the north, east, south, and west of the gage site.

I was provided with a copy of the "Oklahoma Mesonet calibration procedure" to follow. Since this was a field test, we could not do the lab calibration portion with a burette. Instead, I checked the static volume of the buckets using a calibrated syringe. Multiple tip volume tests resulted in a volume range of 6.9 to 7.8 mL with the expected tip volume at 6.8 mL. For some reason one bucket had a tighter range (6.9 to 7.0 mL) than the other (6.9 to 7.8 mL).

The dynamic calibration was performed using a Novalynx Model No. 260-2595 tipping bucket calibrator. The calibrator has four different nozzles to simulate flow rates of 2-, 6-, 12-, and 26-inches per hour. The test prescribes filling the water bottle with 946 mL of water. For a 200 mm diameter collector, I should get 1.18 inches of rain using the prescribed volume of water in each

pour. Six trials were conducted. Two each were done using the 2-inch and 6-inch per hour nozzles. One trial each was conducted using the 12-inch and 26-inch per hour nozzles. During each trial, the calibrator pours water directly into the outer collector funnel. I manually counted the tips for each trial. Additionally, the HOBO data logger tracked each trial in its operational configuration. The trial results based on my manual tracking are below. The numbers in the square brackets are the amounts from the HOBO logger.

Trial 1 (2"/hr): 1.16" [n/a]
Trial 2 (6"/hr): 1.10" [1.10"]
Trial 3 (12"/hr): 1.09" [1.08"]
Trial 4 (26"/hr): 1.05" [1.05"]
Trial 5 (6"/hr): 1.11" [1.11"]
Trial 6 (2"/hr): 1.18" [1.17"]

The HOBO data logger value for Trial 1 was not available because the logger was inadvertently set with delayed start to the next 15-minute increment and did not start logging accumulations until the middle of the trial.

Based on the results of the test, I see no reason to believe that the 49.69 inches recorded on 1245 HST, April 14 through 1245 HST, April 15, 2018 is not a new U.S. 24-hour record. If anything, the results show that the total should have been slightly higher.

Figure 1. View of Waipa Garden tipping bucket rain gage mounted on PVC post. Enclosure has been removed in the image. Java plum trees are in the background and do not interfere with rainfall catch.

Figure 2. Close up of tipping buckets in operational configuration. Note bubble level indicates gage is slightly tilted.

Figure 3. View of gage site facing north. Pop-up canopy was set up by the Waipa Foundation for the test. The canopy was moved over the gage during the test to protect it from passing showers.

Figure 4. View of the gage facing east.

Figure 5. View of gage facing slightly east of south. A direct southward view was not attempted due to the barbed wire enclosure.

Figure 6. View facing west from the gage.

Appendix B: Waipā Garden 15-minute precipitation observations

The fifteen-minute precipitation observations taken at Waipā Garden on 14-15 April 2018, as retrieved from the data logger. Accumulations are not zeroed each day; the first value (23.30”) represents cumulative precipitation since the prior reset. The observations bracketing the 24-hour total under consideration are highlighted.

Date/Time	Rain (in)
4/14/18 12:00 AM	23.30
4/14/18 12:15 AM	23.32
4/14/18 12:30 AM	23.34
4/14/18 12:45 AM	23.39
4/14/18 1:00 AM	23.40
4/14/18 1:15 AM	23.42
4/14/18 1:30 AM	23.43
4/14/18 1:45 AM	23.44
4/14/18 2:00 AM	23.46
4/14/18 2:15 AM	23.46
4/14/18 2:30 AM	23.46
4/14/18 2:45 AM	23.47
4/14/18 3:00 AM	23.56
4/14/18 3:15 AM	23.63
4/14/18 3:30 AM	23.63
4/14/18 3:45 AM	23.68
4/14/18 4:00 AM	24.33
4/14/18 4:15 AM	24.47
4/14/18 4:30 AM	24.51
4/14/18 4:45 AM	24.69
4/14/18 5:00 AM	24.73
4/14/18 5:15 AM	24.76
4/14/18 5:30 AM	24.83
4/14/18 5:45 AM	24.89
4/14/18 6:00 AM	24.91
4/14/18 6:15 AM	24.94
4/14/18 6:30 AM	25.14
4/14/18 6:45 AM	25.26
4/14/18 7:00 AM	25.29
4/14/18 7:15 AM	25.32
4/14/18 7:30 AM	25.33
4/14/18 7:45 AM	25.39
4/14/18 8:00 AM	25.41
4/14/18 8:15 AM	25.49
4/14/18 8:30 AM	25.60
4/14/18 8:45 AM	25.74
4/14/18 9:00 AM	25.74
4/14/18 9:15 AM	25.74
4/14/18 9:30 AM	25.74
4/14/18 9:45 AM	25.74
4/14/18 10:00 AM	25.74
4/14/18 10:15 AM	25.77
4/14/18 10:30 AM	25.78
4/14/18 10:45 AM	25.79
4/14/18 11:00 AM	25.82
4/14/18 11:15 AM	25.86
4/14/18 11:30 AM	25.86
4/14/18 11:45 AM	25.86

Date/Time	Rain (in)
4/14/18 12:00 PM	26.06
4/14/18 12:15 PM	26.16
4/14/18 12:30 PM	26.22
4/14/18 12:45 PM	26.41
4/14/18 1:00 PM	26.60
4/14/18 1:15 PM	27.15
4/14/18 1:30 PM	28.28
4/14/18 1:45 PM	29.04
4/14/18 2:00 PM	29.42
4/14/18 2:15 PM	29.72
4/14/18 2:30 PM	30.24
4/14/18 2:45 PM	30.45
4/14/18 3:00 PM	30.48
4/14/18 3:15 PM	30.89
4/14/18 3:30 PM	31.91
4/14/18 3:45 PM	32.78
4/14/18 4:00 PM	33.50
4/14/18 4:15 PM	34.42
4/14/18 4:30 PM	35.39
4/14/18 4:45 PM	35.97
4/14/18 5:00 PM	36.93
4/14/18 5:15 PM	37.84
4/14/18 5:30 PM	39.46
4/14/18 5:45 PM	40.52
4/14/18 6:00 PM	41.81
4/14/18 6:15 PM	42.77
4/14/18 6:30 PM	44.32
4/14/18 6:45 PM	45.69
4/14/18 7:00 PM	46.12
4/14/18 7:15 PM	46.24
4/14/18 7:30 PM	46.47
4/14/18 7:45 PM	46.68
4/14/18 8:00 PM	46.72
4/14/18 8:15 PM	47.48
4/14/18 8:30 PM	47.58
4/14/18 8:45 PM	47.88
4/14/18 9:00 PM	47.97
4/14/18 9:15 PM	48.14
4/14/18 9:30 PM	48.16
4/14/18 9:45 PM	48.24
4/14/18 10:00 PM	48.34
4/14/18 10:15 PM	48.57
4/14/18 10:30 PM	48.96
4/14/18 10:45 PM	49.14
4/14/18 11:00 PM	49.16
4/14/18 11:15 PM	49.28
4/14/18 11:30 PM	49.33
4/14/18 11:45 PM	49.47

Date/Time	Rain (in)
4/15/18 12:00 AM	49.66
4/15/18 12:15 AM	50.14
4/15/18 12:30 AM	50.80
4/15/18 12:45 AM	51.88
4/15/18 1:00 AM	53.65
4/15/18 1:15 AM	55.06
4/15/18 1:30 AM	56.22
4/15/18 1:45 AM	57.39
4/15/18 2:00 AM	58.31
4/15/18 2:15 AM	59.10
4/15/18 2:30 AM	60.03
4/15/18 2:45 AM	61.15
4/15/18 3:00 AM	62.45
4/15/18 3:15 AM	63.66
4/15/18 3:30 AM	64.54
4/15/18 3:45 AM	65.76
4/15/18 4:00 AM	66.83
4/15/18 4:15 AM	67.30
4/15/18 4:30 AM	67.63
4/15/18 4:45 AM	67.76
4/15/18 5:00 AM	68.06
4/15/18 5:15 AM	68.26
4/15/18 5:30 AM	68.27
4/15/18 5:45 AM	68.31
4/15/18 6:00 AM	68.34
4/15/18 6:15 AM	68.34
4/15/18 6:30 AM	68.34
4/15/18 6:45 AM	68.34
4/15/18 7:00 AM	68.34
4/15/18 7:15 AM	68.34
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4/15/18 8:45 AM	68.34
4/15/18 9:00 AM	68.34
4/15/18 9:15 AM	68.34
4/15/18 9:30 AM	68.34
4/15/18 9:45 AM	68.35
4/15/18 10:00 AM	68.36
4/15/18 10:15 AM	68.38
4/15/18 10:30 AM	68.51
4/15/18 10:45 AM	69.04
4/15/18 11:00 AM	69.82
4/15/18 11:15 AM	71.18
4/15/18 11:30 AM	72.22
4/15/18 11:45 AM	73.92

Date/Time	Rain (in)
4/15/18 12:00 PM	74.67
4/15/18 12:15 PM	75.07
4/15/18 12:30 PM	75.41
4/15/18 12:45 PM	76.10
4/15/18 1:00 PM	76.24
4/15/18 1:15 PM	76.30
4/15/18 1:30 PM	76.32
4/15/18 1:45 PM	76.45
4/15/18 2:00 PM	76.52
4/15/18 2:15 PM	76.54
4/15/18 2:30 PM	76.55
4/15/18 2:45 PM	76.55
4/15/18 3:00 PM	76.55
4/15/18 3:15 PM	76.56
4/15/18 3:30 PM	76.61
4/15/18 3:45 PM	76.64
4/15/18 4:00 PM	76.64
4/15/18 4:15 PM	76.66
4/15/18 4:30 PM	76.66
4/15/18 4:45 PM	76.69
4/15/18 5:00 PM	76.70
4/15/18 5:15 PM	76.71
4/15/18 5:30 PM	76.71
4/15/18 5:45 PM	76.71
4/15/18 6:00 PM	76.71
4/15/18 6:15 PM	76.71
4/15/18 6:30 PM	76.72
4/15/18 6:45 PM	76.75
4/15/18 7:00 PM	76.80
4/15/18 7:15 PM	76.83
4/15/18 7:30 PM	76.93
4/15/18 7:45 PM	77.21
4/15/18 8:00 PM	77.30
4/15/18 8:15 PM	77.51
4/15/18 8:30 PM	77.52
4/15/18 8:45 PM	77.52
4/15/18 9:00 PM	77.52
4/15/18 9:15 PM	77.53
4/15/18 9:30 PM	77.54
4/15/18 9:45 PM	77.54
4/15/18 10:00 PM	77.54
4/15/18 10:15 PM	77.54
4/15/18 10:30 PM	77.57
4/15/18 10:45 PM	77.59
4/15/18 11:00 PM	77.63
4/15/18 11:15 PM	77.65
4/15/18 11:30 PM	77.67
4/15/18 11:45 PM	77.67