ONE-PAGE PLACE ASSESSMENT: JOSHUA TREE, CALIFORNIA

LOCATED IN THE SOUTHERN MOJAVE SUBWATERSHED WITHIN THE CALIFORNIA WATERSHED

CLIMATE ⚑1

AVERAGE HIGH & LOW TEMPERATURES[1] *1935 – 2012*

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
°F HIGH	62.8	67.4	73.9	81.7	90.7	99.9	105.0	103.1	97.1	85.3	71.6	63.0	83.5
°F LOW	36	38.9	43.2	49.5	57.5	65.1	72.1	70.8	63.9	52.8	41.8	36.0	52.3
°C HIGH	17.1	19.7	23.3	27.6	32.6	37.7	40.6	39.5	36.2	29.6	22.0	17.2	28.6
°C LOW	2.2	3.8	6.2	9.7	14.2	18.4	22.3	21.6	17.7	11.6	5.4	2.2	11.3

RECORD HIGH[1]: 118° F | 47.8° C | *July 11, 1961* — RECORD LOW[1]: 10° F | -12.2° C | *December 23, 1990*

SUN ⚑2

LATITUDE: 34.2°

ELEVATION: 3,560 FT / 1,085 m

	MAR 21	JUN 21	SEP 21	DEC 21
DEGREES N or S of DUE EAST THE SUN RISES[2]	0°	29°N	0°	28°S
DEGREES N or S of DUE WEST THE SUN SETS[2]	0°	29°N	0°	28°S
SOLAR-NOON ALTITUDE ANGLE (ABOVE HORIZON)[a,2,3]	56°	79°	56°	32°

SOLAR-NOON WINTER-SOLSTICE SHADOW RATIO[b]: 1 : 1.58 ...AND AZIMUTH[c]: 0°

9AM & 3PM WINTER-SOLSTICE SHADOW RATIO[b,2]: 1 : 3.02 ...AND AZIMUTH[c,2]: 43°

WIND ⚑3

MAX SPEED[d]: 59 MPH | 95 km/h

PREVAILING WIND DIRECTION (FROM WHERE) & AVERAGE SPEED[d,4]

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
	NW	WNW	WNW	WNW	WNW	WNW	SW	SW	W	WNW	WNW	WNW	WNW
MPH	6.8	7.5	8.6	9.9	9.6	8.8	7.9	7.2	6.3	6.4	6.2	6.7	7.7
km/h	11	12	14	16	15	14	13	12	10	10	10	11	12

WATER ⚑4

AVERAGE RAINFALL (GAIN)[6] *1959 – 2012*

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
INCHES	0.62	0.48	0.39	0.13	0.17	0.01	0.33	0.50	0.33	0.33	0.61	0.79	4.69
mm	15.7	12.2	9.9	3.3	4.3	0.3	8.4	12.7	8.4	8.4	15.5	20.1	119.1

AVERAGE PAN EVAPORATION (POTENTIAL LOSS)[e,7] *1948 – 2001*

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
INCHES	3.10	3.73	4.99	5.23	7.60	9.31	10.97	10.66	8.85	6.53	5.16	3.95	80.08
mm	78.7	94.7	126.7	132.8	193.0	236.5	278.6	270.8	224.8	165.9	131.1	100.3	2,034.0

WETTEST YEAR'S RAIN[6]: 8.18 INCHES | 208 mm | *2010* — DRIEST YEAR'S RAIN[6]: 2.33 INCHES | 59 mm | *2009*

LONGEST PERIOD WITH NO MEASURABLE PRECIPITATION[8]: 161 DAYS: *DECEMBER 28, 1971 – JUNE 6, 1972*

RAINFALL INCOME[f]: 1,116 GPCD | 4,223 lpcd

AREA[6,9]: 37.04 SQ MILES | 95.9 km²

POPULATION[6,9]: 7,414 *2010*

UTILITY-WATER USE[10]: 151 GPCD | 572 lpcd

HISTORICAL | DEPTH TO GROUNDWATER[h,11] | CURRENT

CURRENT GROUNDWATER EXTRACTION > NATURAL GROUNDWATER RECHARGE[i,12]

WATERGY ⚑5

% of JOSHUA TREE'S MUNICIPAL ENERGY CONSUMPTION USED TO MOVE & TREAT WATER[13]

TOTEM SPECIES ⚑6

BIRD: Least Bell's Vireo *(Vireo bellii pusillus)* AMPHIBIAN: Arroyo Toad *(Anaxyrus californicus)* [14]

FISH: Colorado Pikeminnow *(Ptychocheilus lucius)* PLANT: Joshua Tree *(Yucca brevifolia)* REPTILE: Desert Tortoise *(Gopherus agassizii)*

INSECT: Delhi Sands Flower-loving Fly *(Rhaphiomidas terminatus abdominalis)* MAMMAL: San Bernardino Kangaroo Rat *(Dipodomys merriami parvus)*

FOR MORE INFORMATION & HOW TO APPLY IT

1. For more CLIMATE information, see the introduction, chapters 1, 2, & 4, and appendix 5 of *Rainwater Harvesting for Drylands and Beyond (RWHDB), Volume 1, 2nd Edition*

2. For more SUN information, see chapters 2 & 4 and appendices 5 & 7

3. For more WIND information, see chapters 2 & 4 and appendices 5 & 9

4. For more WATER information, see the introduction, chapters 1–4, and appendices 1–5

5. For more WATERGY information, see chapters 2 & 4 and appendix 9

6. For more TOTEM SPECIES information: the ethics, principles, and strategies throughout *RWHDB* help us shift from a negative to a positive impact on these species and their habitats and ecosystems, on which our quality of life also depends.

JOSHUA TREE PLACE-ASSESSMENT NOTES

a. The solar-noon altitude angle (a.k.a., solar-noon elevation angle) refers to the number of degrees the sun is located above the equator-facing horizon at solar noon on the given date. In the northern hemisphere, the equator-facing horizon is to the south. In the southern hemisphere, the equator-facing horizon is to the north.

b. The solar-noon winter-solstice shadow ratio is the object's height : length of object's shadow cast on December 21 at noon (the longest noontime shadow of the year). The ratio is 1 : x, where x = 1 ÷ tangent (90 - (latitude + 23.44)).

c. Azimuth is the angle formed between a reference direction (here, due south) to the point on the horizon directly below a given object. Solar noon is the time on any day when the sun's azimuth is 0º. The 9 am & 3 pm winter-solstice azimuth indicates the sun's deviation, in degrees, east/west of due south at those times (–/+ 3 hours from solar noon) on December 21.

d. Complete available period of record is used and number of direction bins is set to 16. Change settings to 8 bins to get more-general results or 32 if more-specific wind-direction results are desired. There are different benefits to each approach.

e. An evaporation pan holds water whose depth is measured daily as water evaporates. Such data allow us to determine evaporation rates at a given location. Compare average rainfall to potential water loss via evaporation by looking up pan-evaporation rates for an area. According to one definition, a dryland environment is where pan-evaporation exceeds rainfall Another definition is that drylands are "land areas where the mean annual precipitation is less than two thirds of potential evapotranspiration (potential evaporation from soil plus transpiration by plants), excluding polar regions & some high mountain areas which meet this criterion but have completely different ecological characteristics" (Greenfacts.org). The higher the ratio of potential evaporation to rainfall, the more important evaporation-reducing strategies (*e.g.*, mulch, windbreaks, shading, & covered water storage) become.

f. Calculated in situ w/ average rainfall, area, & population

g. Data for CDP (census designated place)

h.

i. "Within the Joshua Tree Basin, long-term water level declines in excess of 50 feet are evident south of the Pinto Mountain Fault throughout the Indian Cove and Fortynine Palms Sub-basins. Water level declines of more than 85 feet have occurred near pumping centers of both sub-basins. Long-term historic declines have also occurred in the Eastern Sub-basin near the District's wellfield. These declines have ranges between 20 to 40 feet" (ref. 12).

j.

CREDITS: Brad Lancaster, Resource concept & oversight **| Megan Hartman,** Resource creation & research

JOSHUA TREE PLACE-ASSESSMENT REFERENCES

1. Twentynine Palms station (#049099), wrcc.dri.edu, accessed 7/5/2015. This station was used due to the poor metadata for the Joshua Tree station's temperature data. Due to Twentynine Palms' lower elevation (~2,000 ft), temperatures are expected to be slightly lower at the Howling Rose site (elevation ~3,550–3,570 ft).

2. Rainwater Harvesting for Drylands & Beyond, Vol 1, or esrl.noaa.gov/gmd/grad/solcalc, accessed 7/12/2015

3. RWHDB Vol 1, or Mar 21 = 90–latitude, Jun 21 = 90–(latitude–23.44), Sep 21 = 90–latitude, Dec 21 = 90–(latitude+23.44)

4. Custom Wind Rose Plots, mesonet.agron.iastate.edu/sites/dyn_windrose.phtml?station=NXP&network=CA_ASOS, accessed 7/12/2015

5. Maximum recorded wind gust, weatherspark.com/history/31079/2013/Twentynine-Palms-California-United-States, accessed 7/12/2015

6. Joshua Tree station (#044405), wrcc.dri.edu, accessed 7/5/2015

7. Monthly Average Pan Evaporation, Beaumont 1 E station (#040606), www.wrcc.dri.edu/htmlfiles/westevap.final.html#CALIFORNIA, accessed 7/12/2015. This station's data was used given its relative proximity to Joshua Tree, its similar temperatures and wind speeds, and nearest match in elevation among stations with pan-evaporation data.

8. Michelle Breckner, Service Climatologist, WRCC, via email 7/13/2015. Data for Joshua Tree station (ref. 6). Twentynine Palms' station (ref. 1) saw 241 days with no rain from December 30, 1971, through August 27, 1972.

9. Census.gov, accessed 7/12/2015

10. Joshua Basin Water District Minutes of the Regular Meeting of the Board of Directors, September 21, 2011. www.jbwd.com, accessed 7/12/2015

11.

12. Groundwater Management Plan Update, December 2008, www.29palmswater.net/files/64955341.pdf, p. 8. Accessed 7/12/2015.

13.

14. Species By County report, ecos.fws.gov/tess_public/reports/species-by-current-range-county?fips=06071, accessed 7/14/2015