

ONE-PAGE PLACE ASSESSMENT: BOULDER, UTAH

LOCATED IN THE ESCALANTE RIVER SUBWATERSHED WITHIN THE COLORADO RIVER WATERSHED

CLIMATE		AVERAGE HIGH & LOW TEMPERATURES ¹											1954–2013	
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
° F HIGH		39.5	43.7	51.4	59.3	68.8	79.0	84.8	82.0	74.7	63.5	49.8	40.7	61.4
° F LOW		17.3	21.3	27.0	33.3	42.0	51.4	58.6	56.7	49.1	38.6	26.7	18.8	36.7
° C HIGH		4.2	6.5	10.8	15.2	20.4	26.1	29.3	27.8	23.7	17.5	9.9	4.8	16.3
° C LOW		-8.2	-5.9	-2.8	0.7	5.6	10.8	14.8	13.7	9.5	3.7	-2.9	-7.3	2.6
RECORD HIGH ¹	96° F	35.6° C	June 23, 1961				RECORD LOW ¹	-17° F	-27.2° C	February 6, 1989				

SUN		MAR 21 JUN 21 SEP 21 DEC 21					
LATITUDE	37.9°	DEGREES N or S of DUE EAST THE SUN RISES ²		0°	31°N	0°	30°S
		DEGREES N or S of DUE WEST THE SUN SETS ²		0°	31°N	0°	30°S
ELEVATION	6,712 FT 2,046 m	SOLAR-NOON ALTITUDE ANGLE (ABOVE HORIZON) ^{a,2,3}		52°	76°	52°	29°
		SOLAR-NOON WINTER-SOLSTICE SHADOW RATIO ^b		1 : 1.83	...AND AZIMUTH ^c		0°
		9AM & 3PM WINTER-SOLSTICE SHADOW RATIO ^{b,2}		1 : 3.58	...AND AZIMUTH ^{c,2}		42°

WIND		PREVAILING WIND DIRECTION (FROM WHERE) ⁴ & AVERAGE SPEED ⁴											MAX SPEED ⁴			
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	MPH	km/h
		SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW		
MPH		16	15	17	17	17	16	15	15	15	14	15	15	16		
km/h		26	24	27	27	27	26	24	24	24	23	24	24	26		

WATER		AVERAGE RAINFALL (GAIN) ¹											1954–2013	
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
INCHES		0.96	0.88	0.90	0.55	0.69	0.43	1.05	1.54	1.18	1.27	0.72	0.76	10.93
mm		24.4	22.4	22.9	14.0	17.5	10.9	26.7	39.1	30.0	32.3	18.3	19.3	277.6
		AVERAGE PAN EVAPORATION (POTENTIAL LOSS) ^{d,5}											1971–1978	
INCHES		0.00	0.00	0.00	0.00	6.86	7.86	8.07	7.21	5.30	0.00	0.00	0.00	35.30
mm		0.0	0.0	0.0	0.0	174.2	199.6	205.0	183.1	134.6	0.0	0.0	0.0	896.6

WETTEST YEAR'S RAIN ¹	20.0 INCHES	508 mm	1957	DRIEST YEAR'S RAIN ¹	5.6 INCHES	143 mm	1956
LONGEST PERIOD WITH NO MEASURABLE PRECIPITATION ⁶	107 DAYS: December 28, 1971 – April 13, 1972			RAINFALL INCOME ^e	47,911	GPCD	
					181,362	lpcd	
AREA ^{f,7}	20.9	SQ MILES	POPULATION ^{f,8}	227	UTILITY-WATER USE ⁹	185	GPCD
	54	km ²		2011		700	lpcd
HISTORICAL	FEET	meters	year	DEPTH TO GROUNDWATER ^{g,10}	FEET	meters	year
CURRENT GROUNDWATER EXTRACTION vs NATURAL GROUNDWATER RECHARGE? ^{h,i,11}							

WATERGY		# OF UTAH HOMES THAT COULD BE POWERED w/ ENERGY USED TO MOVE & TREAT BOULDER'S WATER ¹²

TOTEM SPECIES ^j	FISH:	Humpback chub (<i>Gila cypha</i>) ¹³	MAMMAL:	Desert bighorn (<i>Ovis canadensis nelsoni</i>) ¹⁴
	BIRD:	Willow flycatcher (<i>Empidonax traillii</i>) ¹³	PLANT:	Jones Cycladenia (<i>Cycladenia humilis jonesii</i>) ¹³
	AMPHIBIAN:	Boreal toad (<i>Bufo boreas boreas</i>) ¹⁴	MEGAFUNA:	Mountain lion (<i>Puma concolor</i>) ¹⁴
			REPTILE:	

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.

BOULDER PLACE-ASSESSMENT NOTES

- a. Altitude angle (a.k.a., elevation angle) refers to the number of degrees the sun is located above the horizon at a given time and date.
- 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 $x = 1 \div \tan(90 - (\text{latitude} + 23.44))$.
- 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 0° . 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. An evaporation pan holds water whose depth is measured daily as water evaporates. These data allow us to determine evaporation rates at a given location. Compare average rainfall (water gain) to potential water loss via evaporation by looking up pan-evaporation rates for your area. If pan-evaporation rates exceed rainfall rates, you are in a dryland environment, where evaporation-reducing strategies such as mulch, windbreaks, shading, and covered water storage are very important.
- e. Calculated in situ w/ average rainfall, area, & population
- f. Town of Boulder
- g.
- h.
- i.
- j. Totem species listed are for Moab, Utah. Which are also totem species for Boulder, and which could be made more local?

CREDITS: Brad Lancaster, Resource concept, research, content oversight | Megan Hartman, Research, Resource creation

BOULDER PLACE-ASSESSMENT REFERENCES

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2. Rainwater Harvesting for Drylands & Beyond, Vol 1, or esrl.noaa.gov/gmd/grad/solcalc, accessed 6/13/2010
3. RWHDB Vol 1, or $\text{Mar } 21 = 90 - \text{latitude}$, $\text{Jun } 21 = 90 - (\text{latitude} - 23.44)$, $\text{Sep } 21 = 90 - \text{latitude}$, $\text{Dec } 21 = 90 - (\text{latitude} + 23.44)$
4. My Forecast, www.myforecast.com/bin/climate.m?city=31352&metric=false, accessed 6/18/2013. Do these data match your own observations about local wind speed and direction? If not, look for resources that more closely represent your reality.
5. Western Regional Climate Center, Monthly Average Pan Evaporation, www.wrcc.dri.edu/htmlfiles/westevap.final.html, accessed 6/18/2013
6. Michelle Breckner, Service Climatologist, Western Regional Climate Center, via phone 6/19/2013
7. en.wikipedia.org/wiki/Boulder,_Utah, accessed 6/18/2013
8. City-Data.com, www.city-data.com/city/Boulder-Utah.html, accessed 6/18/2013
9. Utah's statewide average gpcd of potable water in 2010, per state.awra.org/utah/sites/default/files/AdamsMillis-WaterNeeds.pdf graph on page 8, accessed 6/20/2013
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13. BLM.gov, Threatened & Endangered Species, www.blm.gov/ut/st/en/fo/moab/more/threatened_and_endangered.html, accessed 3/12/2013
14. Brad Lancaster, via email 3/13/2013