ONE-PAGE PLACE ASSESSMENT: BOZEMAN, MONTANA

LOCATED IN THE BOZEMAN CREEK SUBWATERSHED WITHIN THE MISSOURI RIVER WATERSHED

SUN
1

LATITUDE: 45.7°

ELEVATION: 4,843 FT / 1,477 m

	MAR 21	JUN 21	SEP 21	DEC 21
DEGREES N or S of DUE EAST THE SUN RISES[1]	0°	36°N	0°	34°S
DEGREES N or S of DUE WEST THE SUN SETS[1]	0°	36°N	0°	34°S
SOLAR-NOON ALTITUDE ANGLE (ABOVE HORIZON)[a,1,2]	44°	68°	44°	21°

SOLAR-NOON WINTER-SOLSTICE SHADOW RATIO[b]: 1 : 2.62 …AND AZIMUTH[c]: 0°

10AM & 2PM WINTER-SOLSTICE SHADOW RATIO[b,1]: 1 : 3.54 …AND AZIMUTH[c,1]: 28°

CLIMATE
2

AVERAGE HIGH & LOW TEMPERATURES[3] *1892 – 2022*

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
°F HIGH	32.0	35.5	43.1	54.0	63.2	71.8	81.6	80.4	69.6	57.6	42.4	33.7	55.5
°F LOW	12.3	15.2	21.7	30.4	38.5	45.4	51.3	49.7	41.4	32.9	22.3	14.5	31.3
°C HIGH	0.0	1.9	6.2	12.2	17.3	22.1	27.6	26.9	20.9	14.2	5.8	0.9	13.1
°C LOW	-10.9	-9.3	-5.7	-0.9	3.6	7.4	10.7	9.8	5.2	0.5	-5.4	-9.7	-0.4

RECORD HIGH[3]: 105° F | 40.6° C | *July 31, 1892*

RECORD LOW[3]: -43° F | -41.7° C | *February 8, 1936*

WIND
3

MAX SPEED[5]: 81 MPH | 130 km/h

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

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
	S	S/SE	SE	W/SE	W/SE	SE	S	S	SE	SE	S	S	S/SE
MPH	5.3	5.8	6.5	7.5	7.1	6.6	6.4	6.5	6.2	5.9	5.5	5.5	6.2
km/h	8.5	9.3	10.5	12.1	11.4	10.6	10.3	10.5	10.0	9.5	8.8	8.8	10.0

WATER
4

AVERAGE TOTAL PRECIPITATION (GAIN)[3] *1892 – 2022*

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
INCHES	0.87	0.75	1.35	1.94	2.90	2.90	1.33	1.26	1.71	1.56	1.13	0.90	18.67
mm	22.1	19.1	34.3	49.3	73.7	73.7	33.8	32.0	43.4	39.6	28.7	22.9	472.4

AVERAGE PAN EVAPORATION (POTENTIAL LOSS)[d,6] *1892 – 2005*

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
INCHES	0.00	0.00	0.00	3.34	5.58	6.03	8.34	7.17	4.57	2.62	0.00	0.00	37.65
mm	0.0	0.0	0.0	84.8	141.7	153.2	211.8	182.1	116.1	66.5	0.0	0.0	956.3

WETTEST YEAR'S PRECIP[3]: 25.57 INCHES | 649 mm | *1997*

DRIEST YEAR'S PRECIP[3]: 10.54 INCHES | 268 mm | *1934*

LONGEST PERIOD WITH NO MEASURABLE PRECIPITATION[7]: 40 DAYS: *OCTOBER 27, 1894 – DECEMBER 5, 1894*

RAINFALL INCOME[e]: 344 GPCD / 1,301 lpcd

AREA[f,8]: 20.6 SQ MILES / 53.3 km²

POPULATION[f,8]: 53,293 / *2020*

UTILITY-WATER USE[9]: 95 GPCD / 360 lpcd

DEPTH TO GROUNDWATER[g,10]: HISTORICAL 1.00 FT | 0.30 m | *2005* — CURRENT 2.08 FT | 0.63 m | *2022*

CURRENT GROUNDWATER EXTRACTION [ ] NATURAL GROUNDWATER RECHARGE[h,11]

WATERGY
5

% OF MUNICIPAL ENERGY CONSUMPTION USED TO MOVE & TREAT WATER[i,12]:

TOTEM SPECIES
6

AMPHIBIAN:

MAMMAL:

FISH:

BIRD:

REPTILE:

PLANT:

MEGAFAUNA:

FOR MORE INFORMATION & HOW TO APPLY IT

- **1.** For more SUN information, see chapters 2 & 4 and appendices 5 & 7 of *Rainwater Harvesting for Drylands and Beyond (RWHDB), Volume 1, 2nd Edition*
- **2.** For more CLIMATE information, see the introduction; chapters 1, 2, & 4; and appendix 5
- **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.

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

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 10 am & 2 pm winter-solstice azimuth indicates the sun's deviation, in degrees, east/west of due south at those times (–/+ 2 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 precipitation (water gain) to potential water loss via evaporation by checking pan-evaporation rates for your area. If pan-evaporation rates exceed precipitation 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 precipitation, area, & population

f. City proper

g. USGS Well ID # 454043110005101 02S06E08BDCD01 BZN-03, located at latitude 45°40'43.1", longitude 111°00'51.3". Given readings were taken August 10, 2005, and August 8, 2022. This is one of three closely clustered wells with very similar data and periods of record, and which are at this time the only three actively monitored USGS wells in Bozeman.

h.

i.

Note: Groundwater pumping can be reduced with the on-site harvest of free on-site waters as advocated in this book. In addition, energy conservation and renewable on-site power production can reduce groundwater pumping associated with thermoelectric-energy production. See appendix 9 to compare the costs of our water and energy options.

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

BOZEMAN PLACE-ASSESSMENT REFERENCES

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8. QuickFacts: Bozeman city, Montana; United States, www.census.gov/quickfacts, accessed 8/25/2022

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11.

12.

13.