

ONE-PAGE PLACE ASSESSMENT: CALGARY, ALBERTA

LOCATED IN THE BOW RIVER SUBWATERSHED WITHIN THE HUDSON BAY WATERSHED

CLIMATE

☞¹

AVERAGE HIGH & LOW TEMPERATURES¹

1971-2000

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	
C HIGH	-2.8	-0.1	4.0	11.3	16.4	20.2	22.9	22.5	17.6	12.1	2.8	-1.3	10.5	
C LOW	-15.1	-12.0	-7.8	-2.1	3.1	7.3	9.4	8.6	4.0	-1.4	-8.9	-13.4	-2.4	
F HIGH	27.0	31.8	39.2	52.3	61.5	68.4	73.2	72.5	63.7	53.8	37.0	29.7	50.9	
F LOW	4.8	10.4	18.0	28.2	37.6	45.1	48.9	47.5	39.2	29.5	16.0	7.9	27.7	
RECORD HIGH ¹	36.1°C	97.0°F	July 15, 1919					RECORD LOW ¹	-45.0°C	-49.0°F	February 27, 1992			

SUN

☞²

MAR 21 JUN 21 SEP 21 DEC 21

LATITUDE	51.0°	DEGREES N or S of DUE EAST THE SUN RISES ²	0°	40°N	0°	38°S
		DEGREES N or S of DUE WEST THE SUN SETS ²	0°	41°N	0°	38°S
ELEVATION	1,047 m 3,434 FT	SOLAR-NOON ALTITUDE ANGLE (ABOVE HORIZON) ^{2,3}	39°	62°	39°	16°
		SOLAR-NOON WINTER-SOLSTICE SHADOW RATIO ³	1 : 3.59	...	AND AZIMUTH ⁴	0°
		10AM & 2PM WINTER-SOLSTICE SHADOW RATIO ^{3,2}	1 : 5.12	...	AND AZIMUTH ^{3,2}	28°

WIND

☞³

PREVAILING WIND DIRECTION^{d,1} & AVERAGE SPEED¹

MAX SPEED¹ 127 79

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
	W	W	NW	NW	NW	NW	NW	NW	NW	W	W	W	
km/h	14.8	14.6	15.0	16.5	16.6	15.6	14.0	13.2	14.1	14.6	13.7	14.9	14.8
MPH	9.2	9.1	9.3	10.3	10.3	9.7	8.7	8.2	8.8	9.1	8.5	9.3	9.2

WATER

☞⁴

AVERAGE PRECIPITATION (GAIN)^{5,1}

1971-2000

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
mm	11.6	8.8	17.4	23.9	60.3	79.8	67.9	58.8	45.7	13.9	12.3	12.2	412.6
INCHES	0.46	0.35	0.69	0.94	2.37	3.14	2.67	2.31	1.80	0.55	0.48	0.48	16.24

AVERAGE LAKE EVAPORATION (POTENTIAL LOSS)^{5,1}

1971-2000

mm	0	0	0	0	0	153.0	158.1	136.4	96.0	0	0	0	543.5
INCHES	0	0	0	0	0	6.02	6.22	5.37	3.78	0	0	0	21.40

WETTEST YEAR'S RAIN⁴ 878 mm 34.6 INCHES 1902 DRIEST YEAR'S RAIN⁴ 201 mm 7.9 INCHES 1982

LONGEST PERIOD WITH NO MEASURABLE PRECIPITATION⁴ RAINFALL INCOME⁵ 727 lpcd
192 GPCD

AREA^{h,5} 704.5 km² POPULATION^{h,5} 1,095,404 UTILITY-WATER USE^{6,6} 257 lpcd
272 SQ MILES 2011 68 GPCD

HISTORICAL 30.9 m 101.4 ft 1986 DEPTH TO GROUNDWATER^{1,7,8} 27.5 m 90.2 ft 2015 CURRENT

CURRENT GROUNDWATER EXTRACTION NATURAL GROUNDWATER RECHARGE^{3,9,10}

WATERY

☞⁵

% MUNICIPAL ENERGY CONSUMPTION USED TO MOVE & TREAT WATER¹¹ 30%

TOTEM SPECIES

☞⁶

FISH: Long-Nosed Dace (*Rhinichthys cataractae*) MAMMAL:

PLANT:

BIRD: Harlequin Duck (*Histrionicus histrionicus*) REPTILE:

AMPHIBIAN: Leopard Frog (*Lithobates pipiens*)

See note 12 for source. Ideas for other species? Fill in the blanks!

FOR MORE INFORMATION & HOW TO APPLY IT

- P1.** For more CLIMATE information, see the introduction and chapters 1, 2, & 4 of *Rainwater Harvesting for Drylands and Beyond (RWHDB), Volume 1, 2nd Edition*
- P2.** For more SUN information, see chapters 2 & 4 and appendices 5 & 7
- P3.** For more WIND information, see chapters 2 & 4 and appendices 5 & 9
- P4.** For more WATER information, see the introduction, chapters 1–4, and appendices 1–5
- P5.** For more WATERGY information, see chapters 2 & 4 and appendix 9
- P6.** 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.

CALGARY 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 $x = 1 \div \text{tangent}(90 - (\text{latitude} + 23.44))$.
- 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. The direction of a prevailing wind is the direction *from* which the wind blows.
- e. Precipitation refers to the liquid equivalent of all types of precipitation, falling in both liquid and frozen forms. Newly fallen snow is first measured using a snow ruler. At most ordinary stations the liquid equivalent of snowfall is estimated by dividing the measured amount by ten. At principal stations it is usually determined by melting the snow that falls into Nipher gauges.¹
- f. Lake evaporation refers to the evaporation occurring from a small natural open water-body having negligible heat storage and very little heat transfer at its bottom and sides. It represents the water loss from ponds and small reservoirs but not from lakes that have large heat storage capacities. Lake evaporation is calculated using the observed daily values of pan-evaporative water loss, the mean temperatures of the water in the pan and of the nearby air, and the total wind run over the pan. Lake normals for the 1971–2000 period were calculated as means of daily means for a given station rather than a measure of total monthly evaporation. To convert the lake evaporation values from daily means to monthly means, we multiplied the daily by the number of days in each month, as directed by the given source.¹
- g. Rainfall income calculated in situ w/ average rainfall, area, & population. Utility-water use is for 2010 for single-family residences. Calgary's total 2009 water demand (residential, commercial, & municipal water use, divided by population) was 429 lpcd.⁶
- h. City proper
- i. This well, at Okotoks Landfill, located about 50 km south of Fort Calgary, was selected for its proximity to the city and its relatively long period of record among available wells.
- j.

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

CALGARY PLACE-ASSESSMENT REFERENCES

- 1. <http://www.climate.weatheroffice.gc.ca>, accessed 8/23/2012
- 2. *Rainwater Harvesting for Drylands & Beyond*, Vol 1, or esrl.noaa.gov/gmd/grad/solcalc, accessed 8/23/2012
- 3. *RWHDB Vol 1*, or Mar 21 = $90 - \text{latitude}$, Jun 21 = $90 - (\text{latitude} - 23.44)$, Sep 21 = $90 - \text{latitude}$, Dec 21 = $90 - (\text{latitude} + 23.44)$
- 4. Sandy Radecki, Ontario Climate Centre, via email on 8/29/2012
- 5. <http://www.statcan.gc.ca>, accessed 8/23/2012
- 6. "2010 State of the Environment Report," pp. 5 & 37. City of Calgary Environmental & Safety Management, 2011.
- 7. Groundwater Observation Well Network, esrd.alberta.ca/water/programs-and-services/groundwater/groundwater-observation-well-network/default.aspx, accessed 11/18/2015
- 8.
- 9.
- 10.
- 11. Approximation given anonymously by municipal employee
- 12. Mark Bennett, Executive Director, Bow River Basin Council, via phone 8/29/2012