# ONE-PAGE PLACE ASSESSMENT: REGINA, SASKATCHEWAN, CANADA

LOCATED IN THE WASCANA CREEK SUBWATERSHED WITHIN THE HUDSON BAY WATERSHED

## SUN

⚐ 1

LATITUDE 50.45°

ELEVATION 1,873 FT / 571 m

| | MAR 21 | JUN 21 | SEP 21 | DEC 21 |
|---|---|---|---|---|
| DEGREES N or S of DUE EAST THE SUN RISES[1] | 0° | 40°N | 0° | 37°S |
| DEGREES N or S of DUE WEST THE SUN SETS[1] | 0° | 40°N | 0° | 37°S |
| SOLAR-NOON ALTITUDE ANGLE (ABOVE HORIZON)[a,1,2] | 40° | 63° | 40° | 16° |

SOLAR-NOON WINTER-SOLSTICE SHADOW RATIO[b] 1 : 3.46 ...AND AZIMUTH[c] 0°

10AM & 2PM WINTER-SOLSTICE SHADOW RATIO[b,1] 1 : 4.88 ...AND AZIMUTH[c,1] 28°

## CLIMATE

⚐ 2

AVERAGE HIGH & LOW TEMPERATURES[d] *1951 – 2010*

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANNUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| °C HIGH | -10.93 | -7.27 | -0.94 | 10.48 | 18.35 | 22.77 | 25.97 | 25.33 | 18.83 | 11.46 | 0.15 | -7.40 | 8.92 |
| °C LOW | -21.63 | -18.04 | -11.62 | -2.42 | 3.98 | 9.25 | 11.81 | 10.57 | 4.58 | -1.94 | -10.47 | -17.85 | -3.67 |
| °F HIGH | 12.3 | 18.9 | 30.3 | 50.9 | 65.0 | 73.0 | 78.7 | 77.6 | 65.9 | 52.6 | 32.3 | 18.7 | 48.1 |
| °F LOW | -6.9 | -0.5 | 11.1 | 27.6 | 39.2 | 48.7 | 53.3 | 51.0 | 40.2 | 28.5 | 13.2 | -0.1 | 25.4 |

RECORD HIGH[5] 43.3° C | 110° F | *July 5, 1937* RECORD LOW[6] -50.0° C | -58° F | *January 1, 1885*

## WIND

⚐ 3

MAX SPEED[7] 100 kmh / 62 MPH

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

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANNUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SE | SE | SE | SE | SE | SE | SE | SE | SE | SE | SE | SE | SE |
| kmh | 19.09 | 18.68 | 19.63 | 20.17 | 20.39 | 18.31 | 15.97 | 16.30 | 17.83 | 18.62 | 17.63 | 18.44 | 18.42 |
| MPH | 11.9 | 11.6 | 12.2 | 12.5 | 12.7 | 11.4 | 9.9 | 10.1 | 11.1 | 11.6 | 11.0 | 11.5 | 11.4 |

## WATER

⚐ 4

AVERAGE RAINFALL (GAIN)[d] *1951 – 2010*

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANNUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 7.79 | 5.11 | 10.90 | 19.20 | 47.43 | 75.27 | 60.10 | 44.82 | 33.89 | 17.95 | 7.78 | 8.22 | 338.44 |
| INCHES | 0.31 | 0.20 | 0.43 | 0.76 | 1.87 | 2.96 | 2.37 | 1.76 | 1.33 | 0.71 | 0.31 | 0.32 | 13.32 |

AVERAGE PAN EVAPORATION (POTENTIAL LOSS)[e,4] *1981 – 2010*

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANNUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 0.00 | 0.00 | 0.00 | 0.00 | 221.34 | 243.60 | 252.34 | 225.06 | 152.70 | 82.15 | 0.00 | 0.00 | 1,177.19 |
| INCHES | 0.00 | 0.00 | 0.00 | 0.00 | 8.71 | 9.59 | 9.93 | 8.86 | 6.01 | 3.23 | 0.00 | 0.00 | 46.35 |

WETTEST YEAR'S RAIN[8] 604 mm | 23.78 INCHES | *1954* DRIEST YEAR'S RAIN[8] 102 mm | 4.02 INCHES | *1885*

LONGEST PERIOD WITH NO MEASURABLE PRECIPITATION[9]
*68 DAYS: October 4 – December 10, 1898*

RAINFALL INCOME[f] 747 lcd / 197.4 GPCD

AREA[g,10] 182.4 km² / 70.4 SQ MILES

POPULATION[g,10] 226,404 *2021*

UTILITY-WATER USE[h,11] 300 lcd / 79.3 GPCD

HISTORICAL 32.8 m | 107.6 FT | *1984* DEPTH TO GROUNDWATER[i,12] 29.2 m | 95.8 FT | *2023* CURRENT

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

## WATERGY

⚐ 5

KWH OF ENERGY USED IN ONE YEAR TO MOVE & TREAT REGINA'S WATER[j,13] 12,798,993

## TOTEM SPECIES

⚐ 6

AMPHIBIAN: Boreal Chorus Frog *(Pseudacris maculata)* MAMMAL: Mountain Cottontail *(Sylvilagus nuttallii)*

REPTILE: Greater Short-Horned Lizard *(Phrynosoma hernandesi)* PLANT: Rusty Cord-Moss *(Entosthodon rubiginosus)*

BIRD: Sprague's Pipit *(Anthus spragueii)* FISH: Lake Sturgeon *(Acipenser fulvescens)* INSECT: Western Bumble Bee *(Bombus occidentalis)* 14

## 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.

## REGINA 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 0°. 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.** Climate normals for Regina International Airport from 1951–1980 (see ref. 3) and 1981–2010 (see ref. 4) were averaged to yield the average high and low temperatures shown herein. Climate normals for Regina are not yet available beyond 2010.

**e.** 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. Pan evaporation normals for the 1981–2010 period were presented as daily means by month rather than a mean of total monthly evaporation. To convert from daily means to monthly means, the daily values were multiplied by the number of days in each month, as directed by a government climate source. Compare average rainfall (water gain) to potential water loss via evaporation by checking 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.

**f.** Calculated in situ with average rainfall, area, & population**.** GPCD figure is given in U.S. gallons (not Imperial).

**g.** City proper

**h.** Usage excludes Regina's sub-client usage (per reference 9). Usage categories (e.g., residential, commercial, industrial, municipal, etc.) are not further specified. GPCD figure is given in U.S. gallons (not Imperial).

**i.** Data from observation well Regina 530, located within the Regina Aquifer. Depths to groundwater were calculated by subtracting water-level elevations above sea level (as shown on hydrograph) from ground-level elevation above sea level at top of well (shown on well record). "In the past, the City of Regina relied heavily on groundwater from several well fields and aquifers to meet its water requirements. However, this use began to decline in the late 1980s and by the late 1990s had virtually ceased. Water levels in WSA Regina 530 reached a record low of about 557 metres [above sea level] in 1984, which was followed by an increasing water level trend coincidental with the reduction in withdrawals by the city. This has led to high water levels that are now fluctuating at just over 560 metres [above sea level]. *Industrial use of groundwater from the Regina Aquifer continues* and is probably still affecting the water level in the observation well" (www.wsask.ca/wells/wsa-regina-530). While the overall groundwaterwater-level trend in Regina Aquifer's other observation well (Regina Firehall) is roughly similar to Regina 530's, the hydrographs for the seven observation wells in the Zehner Aquifer (Regina 96-01, 96-02, D1-86, D4-86, TH81-2, 2010-04 LF, and 2010-04 UF) show a gradual decline in groundwater levels over the past 5–12 years, with *seasonal fluctuations attributable to other pumping wells in the area.* "A sudden decrease [6–10 metres within one month] in the water level [in the Zehner Aquifer observation wells] occurred in 2015 and was due to emergency groundwater use by the City of Regina" (www.wsask.ca/wells/regina-96-01). For a representative example of this downward trend, see the 96-01 hydrograph at www.wsask.ca/wp-content/uploads/2023/06/96-01Hydrograph.pdf. Condie Aquifer has one lone Regina observation well (TH6-85) whose unique hydrograph represents "a combination of seasonal fluctuations and impact of dewatering within the gravel pits" (www.wsask.ca/wells/regina-th6-85).

**j.** In 2022, Buffalo Pound Water Treatment Plant, the facility that sources, treats, and sells potable water to Regina, Moose Jaw, and SaskWater Corporation, spent $1,962,957 on electricity. Applying their reported rate of $0.12931 per kWh yields a figure of 15,180,241 kWh of electricty used by BPWTP. Of its 2022 total of 33,961.62 megalitres of potable water sold, 28,634.23 megalitres, or 84.3135%, was sold to Regina. Based on the foregoing, Regina's water's share of BPWTP's electricty usage was calculated to be 12,798,993 kWh for 2022 (see ref. 13).

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

## REGINA PLACE-ASSESSMENT REFERENCES


**1.** Rainwater Harvesting for Drylands & Beyond, Vol 1, or esrl.noaa.gov/gmd/grad/solcalc, accessed 1/5/2024

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

**3.** Regina International Airport station, 1951–1980, climate.weather.gc.ca/doc/En56-60-2-1982.pdf, accessed 1/7/2024

**4.** Regina International Airport station (#4016560), 1981–2010, climate-change.canada.ca/climate-data/#/climate-normals, accessed 1/5/2024

**5.** Daily Data Report for July 1937, Regina International Airport, Max Temp, climate.weather.gc.ca/climate_data/daily_data_e.html, accessed 1/19/2024

**6.** Regina, Saskatchewan, Climate, en.wikipedia.org/wiki/Regina,_Saskatchewan, accessed 1/19/2024

**7.** Record Wind Speed, myforecast.co/bin/climate.m?city=54283&metric=true, accessed 1/23/2024

**8.** Most Yearly Precipitation in Regina History, extremeweatherwatch.com/cities/regina/most-yearly-precipitation, accessed 1/23/2024

**9.** Number of Consecutive Days Precipitation < .01 for Regina International Airport, scacis.rcc-acis.org, accessed 1/23/2024

**10.** Regina History & Facts, www.regina.ca/about-regina/regina-history-facts, accessed 1/7/2024

**11.** Saskatchewan Community Water Use Records 2008 to 2022, Saskatchewan Water Security Agency, www.wsask.ca/wp-content/uploads/2023/10/2022-Community-Water-Use-Records.pdf, accessed 1/7/2024

**12.** Observation Well Network, www.wsask.ca/water-info/ground-water/observation-well-network, accessed 1/23/2024

**13.** Buffalo Pound Water 2022 Annual Report, www.buffalopoundwtp.ca/images/docs/2022_buffalo_pound_annual_report.pdf, accessed 1/29/2024

**14.** Customized biodiversity report, explorer.natureserve.org/pro, accessed 1/27/2024