ONE-PAGE PLACE ASSESSMENT: LUBBOCK, TEXAS

LOCATED IN THE NORTH FORK DOUBLE MOUNTAIN FORK SUBWATERSHED WITHIN THE TEXAS-GULF WATERSHED

CLIMATE ⚐1

AVERAGE HIGH & LOW TEMPERATURES[1] — 1911 – 2013

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
°F HIGH	54.5	59.8	66.9	75.8	82.8	90.8	92.9	92.1	85.4	75.8	63.6	55.5	74.7
°F LOW	25.6	29.1	34.7	44.3	54.0	62.6	65.5	64.3	57.5	47.2	34.6	27.7	45.6
°C HIGH	12.5	15.4	19.4	24.3	28.2	32.7	33.8	33.4	29.7	24.3	17.6	13.1	23.7
°C LOW	-3.6	-1.6	1.5	6.8	12.2	17.0	18.6	17.9	14.2	8.4	1.4	-2.4	7.6

RECORD HIGH[2]: 114° F | 45.6° C | *June 27, 1994*

RECORD LOW[2]: -17° F | -27.2° C | *February 8, 1933*

SUN ⚐2

LATITUDE: 33.6°

ELEVATION: 3,212 FT / 979 m

	MAR 21	JUN 21	SEP 21	DEC 21
DEGREES N or S of DUE EAST THE SUN RISES[3]	0°	29°N	0°	28°S
DEGREES N or S of DUE WEST THE SUN SETS[3]	0°	29°N	0°	28°S
SOLAR-NOON ALTITUDE ANGLE (ABOVE HORIZON)[a,3,4]	56°	80°	56°	33°

SOLAR-NOON WINTER-SOLSTICE SHADOW RATIO[b]: 1 : 1.54 ...AND AZIMUTH[c]: 0°

9AM & 3PM WINTER-SOLSTICE SHADOW RATIO[b,3]: 1 : 2.95 ...AND AZIMUTH[c,3]: 43°

WIND ⚐3

MAX SPEED[d,2]: 90 MPH | 145 km/h

PREVAILING WIND DIRECTION (FROM WHERE) & AVERAGE SPEED[e,5]

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
	SW	WSW	S	S	S	S	S	S	S	S	S	WSW	
MPH	13	14	15	15	15	14	12	10	11	12	13	13	13
km/h	21	23	24	24	24	23	19	16	18	19	21	21	21

WATER ⚐4

AVERAGE RAINFALL (GAIN)[1] — 1911 – 2013

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
INCHES	0.53	0.57	0.82	1.80	2.63	2.81	2.28	1.70	2.33	2.11	0.58	0.70	18.86
mm	13.5	14.5	20.8	45.7	66.8	71.4	57.9	43.2	59.2	53.6	14.7	17.8	479.0

AVERAGE PAN EVAPORATION (POTENTIAL LOSS)[f,6] — 1956 – 1970

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
INCHES	3.19	3.54	5.67	8.46	10.24	11.02	10.89	9.64	7.33	6.08	4.00	3.12	83.18
mm	81.0	89.9	144.0	214.9	260.1	279.9	276.6	244.9	186.2	154.4	101.6	79.2	2,112.8

WETTEST YEAR'S RAIN[2]: 40.55 INCHES | 1,030 mm | *1941*

DRIEST YEAR'S RAIN[2]: 5.86 INCHES | 149 mm | *2011*

LONGEST PERIOD WITH NO MEASURABLE PRECIPITATION[g,7]: 109 DAYS: *November 1, 2005 – February 18, 2006*

RAINFALL INCOME[h]: 466 GPCD / 1,763 lpcd

AREA[i,8]: 122.41 SQ MILES / 316.9 km²

POPULATION[i,8]: 236,065 *2012 est.*

UTILITY-WATER USE[j,9]: 178 GPCD / 674 lpcd

HISTORICAL: 66 FT | 20.1 m | *1957*

DEPTH TO GROUNDWATER[k,10]: 43 FT | 13.2 m | *2012* CURRENT

CURRENT GROUNDWATER EXTRACTION > NATURAL GROUNDWATER RECHARGE[l,11]

WATERGY ⚐5

of AVG TX HOMES THAT COULD BE POWERED w/kWh USED TO PUMP & TREAT LUBBOCK'S WATER[m]: 947

TOTEM SPECIES ⚐6

MAMMAL: Black-footed ferret *(Mustela nigripes)* MEGAFAUNA: Gray wolf *(Canis lupus)* [n,14,15]

FISH: Smalleye shiner *(Notropis buccula)* REPTILE: Texas horned lizard *(Phrynosoma cornutum)* INSECT:

PLANT: Mexican mud plantain *(Heteranthera mexicana)* BIRD: Whooping crane *(Grus americana)* AMPHIBIAN:

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.

LUBBOCK 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 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. Peak gust on May 9, 1952. Highest one-minute average wind speed = 70 mph, May 9, 1952.

e. Period of record: 1930–1996

f. 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. According to one definition, if pan-evaporation rates exceed rainfall rates, you are in a dryland environment. Another definition states 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 and 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 such as mulch, windbreaks, shading, and covered water storage become.

g. Lubbock 6 NNE weather station (#415408)

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

i. City proper

j. Gallons per capita per day for 2011, Lubbock's driest year on record (ref. 2)

k. Well ID #TX001 333534101535201 SP-23-25-304, located at Latitude 33°35'34", Longitude 101°53'52". Despite the fact that groundwater extraction exceeds natural recharge (note l, ref. 11), the depth to groundwater has decreased presumably due to practice of injecting recharge water into the acquifer. This was done at this well in 1975, 1977, 1978, 1979, and 1981 (ref. 10).

l. "Before the development of irrigation, discharge from the aquifer occurred from both saline & fresh water like basins, from streams, and from seeps & springs located primarily along the eastern escarpment. Some of these still flow today; however, most seeps & springs have ceased to flow due primarily to lowering of the water table as discharge has exceeded natural recharge" (ref. 11).

m. Calculated as follows: 14,813,170 kWh used to pump & treat Lubbock's delivered water in 2012 (ref. 12) ÷ 15,646 kWh/household (137,412,000,000 kWh used by residential sector in TX in 2012 (ref. 13) ÷ 8,782,598 household in TX 2008-2012 (ref. 8) = equivalent electricity usage of 947 average TX households

n. Black-footed ferret's habitat is destroyed by oil & natural-gas exploration (watergy connection)

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

LUBBOCK PLACE-ASSESSMENT REFERENCES

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