ONE-PAGE PLACE ASSESSMENT: ALPINE, TEXAS

LOCATED IN THE COYANOSA-HACKBERRY DRAWS SUBWATERSHED WITHIN THE RIO GRANDE-LOWER PECOS WATERSHED

CLIMATE ⚐1

AVERAGE HIGH & LOW TEMPERATURES[a,1] *1900 – 2012*

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
°F HIGH	60.5	64.5	70.9	78.7	85.4	90.8	89.4	88.5	83.8	77.8	67.8	61.5	76.6
°F LOW	32.7	35.2	40.1	47.5	55.5	62.7	64.0	63.1	58.0	49.5	39.3	33.9	48.5
°C HIGH	15.8	18.1	21.6	25.9	29.7	32.7	31.9	31.4	28.8	25.4	19.9	16.4	24.8
°C LOW	0.4	1.8	4.5	8.6	13.1	17.1	17.8	17.3	14.4	9.7	4.1	1.1	9.2

RECORD HIGH[1] 107° F | 41.7° C | *June 26, 1972*   RECORD LOW[1] -3° F | -19.4° C | *December 29, 1983*

SUN ⚐2

LATITUDE 30.4°

ELEVATION 4,481 FT / 1,366 m

	MAR 21	JUN 21	SEP 21	DEC 21
DEGREES N or S of DUE EAST THE SUN RISES[2]	0°	28°N	0°	27°S
DEGREES N or S of DUE WEST THE SUN SETS[2]	0°	28°N	0°	27°S
SOLAR-NOON ALTITUDE ANGLE (ABOVE HORIZON)[b,2,3]	60°	83°	60°	36°

SOLAR-NOON WINTER-SOLSTICE SHADOW RATIO[c] 1 : 1.37 ...AND AZIMUTH[d] 0°

9AM & 3PM WINTER-SOLSTICE SHADOW RATIO[c,2] 1 : 2.59 ...AND AZIMUTH[d,2] 44°

WIND ⚐3

MAX SPEED[e,5] 39 MPH | 63 km/h

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

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW	
MPH	8.4	9.2	9.1	9.5	8.8	8.1	6.8	6.1	6.2	7.2	7.9	8.8	8.0
km/h	14	15	15	15	14	13	11	10	10	12	13	14	13

WATER ⚐4

AVERAGE RAINFALL (GAIN)[a,1] *1900 – 2012*

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
INCHES	0.53	0.48	0.36	0.50	1.24	2.30	2.75	2.65	2.57	1.30	0.51	0.60	15.79
mm	13.5	12.2	9.1	12.7	31.5	58.4	69.9	67.3	65.3	33.0	13.0	15.2	401.1

AVERAGE PAN EVAPORATION (POTENTIAL LOSS)[f,6] *1940 – 1955*

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
INCHES	2.86	3.81	6.55	8.26	9.04	10.16	9.77	9.03	6.93	5.23	3.73	2.87	78.24
mm	72.6	96.8	166.4	209.8	229.6	258.1	248.2	229.4	176.0	132.8	94.7	72.9	1,987.3

WETTEST YEAR'S RAIN[a,1] 33.09 INCHES | 840.5 mm | *1941*   DRIEST YEAR'S RAIN[a,1] 3.17 INCHES | 80.5 mm | *2011*

LONGEST PERIOD WITH NO MEASURABLE PRECIPITATION[a,7]
101 DAYS: *January 19 – April 30, 1955*

RAINFALL INCOME[g] 582 GPCD / 2,205 lpcd

AREA[h,8] 4.69 SQ MILES / 12.1 km²

POPULATION[h,8] 6,054 *2013 est.*

UTILITY-WATER USE[i,9] 198 GPCD / 750 lpcd

HISTORICAL 56 FT | 17.1 m | *1939*   DEPTH TO GROUNDWATER[j,10] 30 FT | 9.1 m | *2006* CURRENT

CURRENT GROUNDWATER EXTRACTION   NATURAL GROUNDWATER RECHARGE[k,11]

WATERGY ⚐5

% of ALPINE'S MUNICIPAL ENERGY CONSUMPTION USED TO MOVE & TREAT WATER[12]

TOTEM SPECIES ⚐6

FISH: Chihuahua shiner *(Notropis chihuahua)*   MAMMAL: Mexican long-nosed bat *(Leptonycteris nivalis)*

BIRD: Common black hawk *(Buteogallus anthracinus)*   REPTILE: Chihuahuan mud turtle *(Trimorphodon vilkinsonii)* [13]

MOLLUSK: Texas hornshell *(Popenaias popeii)*   PLANT: Hinckley's oak *(Quercus hinckleyi)*   MEGAFAUNA: White-nosed coati *(Nasua narica)*

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.

ALPINE PLACE-ASSESSMENT NOTES

a. The data set for the Alpine weather station contains a higher percentage of missed observations than is ideal for our purposes; however, considering the long period of record and the absence of a known resource with a higher percentage of completeness, we have opted to use the data presented herein. Note that the longest period of no measurable precipitation includes not more than one missed observation.

b. 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.

c. 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)).

d. 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 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.

e. Given is maximum sustained wind speed (June 7, 2004, at 23:45 and July 7, 2005, at 21:09, from 320º (NW) and 350º (NNW), respectively). Highest recorded gust was 53 mph (April 5, 2005 at 20:47, from 270º (W)). Period of record: 4/2004–9/2014 (ref. 5).

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 checking 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. The given pan-evaporation data are from Balmorhea, the most comparable station with such data available. Balmorhea Station is about 45 miles north of Alpine at an elevation of 3,220', about 1,230' lower than Alpine's with average annual high temperatures 3.5ºF higher. Per E.L. Peck's report (ref. 8), "Pan evaporation for ... open locations on top of major ridges and along their southern slopes and on sites subject to strong night time drainage winds were found to have no discernable variation with elevation. For protected sites and those on northern slopes, pan evaporation showed a small decrease with increasing elevation. The effect of elevation (atmosphere pressure) independently on evaporation rates was investigated through the use of data from stations where the other meteorological factors involved, other than pressure, were the same. The study indicated that pan evaporation increases with increase in pressure, all other factors considered being the same." Alpine's rainfall:evaporation ratio is about 1:5.

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

h. City proper

i. Alpine's municipal water usage is not tracked by category of end use. Whereas we prefer to report residential-only gpcd data, we are not able to do so in this case. This statistic was calculated with 1.2 million gallons per day (ref. 9) ÷ 6,054 people (ref. 8), and represents water used for all customer types (residential, municipal, industrial, commercial, etc).

j. City of Alpine's East Well #5243308 located at 30º21'39", -103º38'42", selected for its longest-available period of record. Level in 1939 was taken on June 17; level in 2006 was taken on January 1 (ref. 10).

k.

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

ALPINE PLACE-ASSESSMENT REFERENCES

1. Alpine station (#410174), wrcc.dri.edu, accessed 9/15/2014

2. Rainwater Harvesting for Drylands & Beyond, Vol 1, or esrl.noaa.gov/gmd/grad/solcalc, accessed 9/15/2014

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

4. Custom Wind Rose Plots, mesonet.agron.iastate.edu/sites/site.php?station=E38&network=TX_ASOS, accessed 9/15/2014

5. Kyle Brehe, User Services Climatologist, Southern Regional Climate Center, via email 9/17/2014

6. NOAA Technical Report NWS 34: Mean Monthly, Seasonal, and Annual Pan Evaporation for the United States, www.nws.noaa.gov/oh/hdsc/PMP_related_studies/TR34.pdf, accessed 9/16/2014

7. Michelle Breckner, Service Climatologist, WRCC, via phone 9/15/2014
8. Census.gov, accessed 9/16/2014
9. Virgil Clark, Director of Utilities, City of Alpine, via telephone 9/16/2014
10. Texas Water Development Board's Groundwater Database, wiid.twdb.texas.gov/ims/wwm_drl/viewer.htm, accessed 9/17/2014
11.

12.

13. Rare, Threatened, and Endangered Species of Texas, www.tpwd.state.tx.us/gis/ris/es/, accessed 9/19/2014