ONE-PAGE PLACE ASSESSMENT: GROVELAND, CALIFORNIA

LOCATED IN THE UPPER TUOLUMNE SUBWATERSHED WITHIN THE CALIFORNIA WATERSHED

CLIMATE ⚐1

AVERAGE HIGH & LOW TEMPERATURES[1] *1948–2012*

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
°F HIGH	52.1	53.9	58.7	62.6	73.6	82.6	91.0	89.9	84.7	72.5	58.8	51.4	69.3
°F LOW	30.1	31.2	34.0	36.5	43.8	49.6	55.9	54.0	49.3	42.1	33.8	30.2	40.9
°C HIGH	11.2	12.2	14.8	17.0	23.1	28.1	32.8	32.2	29.3	22.5	14.9	10.8	20.7
°C LOW	-1.1	-0.4	1.1	2.5	6.6	9.8	13.3	12.2	9.6	5.6	1.0	-1.0	4.9

RECORD HIGH[1]: 105° F | 40.6° C | *July 23, 2006*

RECORD LOW[1]: 9° F | -12.8° C | *January 13, 2007*

SUN ⚐2

LATITUDE: 37.8°

ELEVATION: 2,816 FT / 859 m

	MAR 21	JUN 21	SEP 21	DEC 21
DEGREES N or S of DUE EAST THE SUN RISES[2]	0°	31°N	0°	29°S
DEGREES N or S of DUE WEST THE SUN SETS[2]	0°	31°N	0°	29°S
SOLAR-NOON ALTITUDE ANGLE (ABOVE HORIZON)[a,2,3]	52°	76°	52°	29°

SOLAR-NOON WINTER-SOLSTICE SHADOW RATIO[b]: 1 : 1.82 ...AND AZIMUTH[c]: 0°

9AM & 3PM WINTER-SOLSTICE SHADOW RATIO[b,2]: 1 : 3.57 ...AND AZIMUTH[c,2]: 42°

WIND ⚐3

MAX SPEED[4]: 62 MPH | 100 km/h

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

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
	N	NE	NE	NE	NE	NE	NE	NE	N	N	N	N	
MPH	3	5	5	5	6	7	6	6	5	3	3	3	4.8
km/h	5	8	8	8	10	11	10	10	8	5	5	5	7.6

WATER ⚐4

AVERAGE RAINFALL (GAIN)[5] *1955–2005*

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
INCHES	7.34	6.72	5.35	3.31	1.21	0.37	0.06	0.13	0.59	1.64	4.62	5.92	37.26
mm	186.4	170.7	135.9	84.1	30.7	9.4	1.5	3.3	15.0	41.7	117.3	150.4	946.4

AVERAGE PAN EVAPORATION (POTENTIAL LOSS)[d,6] *1931–2005*

INCHES	0.00	0.00	0.00	3.84	5.31	7.34	8.78	7.86	5.85	3.23	1.74	0.00	43.95
mm	0.0	0.0	0.0	97.5	134.9	186.4	223.0	199.6	148.6	82.0	44.2	0.0	1,116.3

WETTEST YEAR'S RAIN[5]: 67.0 INCHES | 1,701 mm | *1982*

DRIEST YEAR'S RAIN[5]: 12.3 INCHES | 312 mm | *1976*

LONGEST PERIOD WITH NO MEASURABLE PRECIPITATION[7]: 165 DAYS: *June 17 – November 25, 1995*

RAINFALL INCOME[e]: 28,336 GPCD / 107,262 lpcd

AREA[f,8]: 9.6 SQ MILES / 25 km²

POPULATION[f,9]: 601 *2010*

UTILITY-WATER USE[g,10,11]: 138 GPCD / 521 lpcd

DEPTH TO GROUNDWATER[h,12]: HISTORICAL 0 FT | 0.0 m | ____ CURRENT: 0 FT | 0.0 m | ____

CURRENT GROUNDWATER EXTRACTION: ____

NATURAL GROUNDWATER RECHARGE[i,13]

WATERGY ⚐5

AVG CA HOMES THAT COULD BE POWERED W/ ENERGY USED TO RUN GROVELAND'S WATER PLANTS[j,14,15]: 790

TOTEM SPECIES ⚐6

PLANT: Hoover's Spurge *(Chamaesyce hooveri)* REPTILE: Giant Garter Snake *(Thamnophis gigas)*

FISH: Central Valley Steelhead *(Oncorhynchus mykiss)* CRUSTACEAN: Vernal Pool Tadpole Shrimp *(Lepidurus packardi)* BIRD:

AMPHIBIAN: California Tiger Salamander *(Ambystoma californiense)*[16] MEGAFAUNA: MAMMAL:

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.

GROVELAND 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 ÷ 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. 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. 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.

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

f. City proper

g. GPCD calculated by dividing 466,000 gallons of water per day for service area in year 2000 (ref. 10) by 3,388 residents in combined service-area towns in year 2000 (ref. 11).

h.

i. Groundwater pumping can be reduced with the on-site harvest of free on-site waters as advocated in Brad's books. In addition, energy conservation and renewable on-site power production can reduce groundwater pumping associated with thermoelectric energy production. See appendix 9 of *RWHDB, Vol. 1, 2nd ed.*, to compare costs of our water and energy options.

j. In calendar year 2012, Groveland's two water treatment plants used 5,562 MWh of energy for all operations, including energy-intense UV and other forms of water treatment, analyzers, electricity, and all other uses (ref. 14). To convert 5,562 MWh to kWh, multiply it by 1,000 kWh/MWh to get 5,562,000 kWh. The average California household uses 587 kWh/month (ref. or 7,044 kWh/household/year. Divide total water-plant kWh/year by kWh/household/year to get 790 households.

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

GROVELAND PLACE-ASSESSMENT REFERENCES

1. Groveland 2 station (#043669), wrcc.dri.edu, accessed 6/21/2013. Station metadata is poor, but best available for Groveland's temperature data, and used as per advice of Jim Ashby, Service Climatologist, WRCC, via phone 6/8/2011.

2. Rainwater Harvesting for Drylands & Beyond, Vol 1, or esrl.noaa.gov/gmd/grad/solcalc, accessed 6/21/2013

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. www.myforecast.com/bin/climate.m?city=516084, accessed 6/21/2013

5. Groveland RS station (#043672) used for precipitation due to station metadata for this element being much better than Groveland 2 station's. Accessed at wrcc.dri.edu on 6/21/2013.

6. These data are for Hetch Hetchy, the closest and most-similar location with pan-evaporation data. Hetch Hetchy is at a higher elevation (3,783 ft), but with very similar average annual high and low temperatures (66.6°F and 40.5°F, respectively), and very similar annual precipitation (35.5"), www.wrcc.dri.edu/htmlfiles/westevap.final.html#CALIFORNIA, accessed 6/21/2013.

7. Jim Ashby, Service Climatologist, WRCC, via phone 6/8/2011

8. en.wikipedia.org/wiki/Groveland,_California, accessed 6/21/2013

9. www.census.gov/2010census/popmap/ipmtext.php?fl=06:0631372, accessed 6/21/2013

10. www.gcsd.org/reports/water_master_plan.pdf, p. 10, accessed 6/21/2013

11. en.wikipedia.org/wiki/Groveland-Big_Oak_Flat,_California, accessed 6/21/2013

12.

13.

14. Aaron Randi, Chief Plant Operator, Groveland Community Services District, via phone, 6/21/2013

15. www.eia.gov/cneaf/electricity/esr/table5.html, accessed 6/21/2013

16. www.fws.gov/sacramento/es_species/lists/es_species_lists.cfm, ecos.fws.gov/speciesProfile/profile/speciesProfile.action?s, and en.wikipedia.org