ONE-PAGE PLACE ASSESSMENT: BOSTON, MASSACHUSETTS

LOCATED IN THE CHARLES SUBWATERSHED WITHIN THE NEW ENGLAND WATERSHED

CLIMATE ⚐1

AVERAGE HIGH & LOW TEMPERATURES[1] — 1920 – 2012

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
°F HIGH	36.5	38.1	45.7	56.1	66.7	76.3	81.6	79.8	72.6	62.5	51.8	40.7	59.0
°F LOW	22.2	23.3	31.0	40.2	49.8	59.1	65.1	64.0	56.9	46.8	37.8	27.0	43.6
°C HIGH	2.5	3.4	7.6	13.4	19.3	24.6	27.6	26.6	22.6	16.9	11.0	4.8	15.0
°C LOW	-5.4	-4.8	-0.6	4.6	9.9	15.1	18.4	17.8	13.8	8.2	3.2	-2.8	6.4

RECORD HIGH[1]	103° F	39.4° C	*July 22, 1926*	RECORD LOW[1]	-18° F	-27.8° C	*February 9, 1934*

SUN ⚐2

LATITUDE 42.4°

ELEVATION 34 FT / 10 m

	MAR 21	JUN 21	SEP 21	DEC 21
DEGREES N or S of DUE EAST THE SUN RISES[2]	0°	34°N	0°	32°S
DEGREES N or S of DUE WEST THE SUN SETS[2]	0°	34°N	0°	32°S
SOLAR-NOON ALTITUDE ANGLE (ABOVE HORIZON)[a,2,3]	48°	71°	48°	24°

SOLAR-NOON WINTER-SOLSTICE SHADOW RATIO[b] 1 : 2.23 ...AND AZIMUTH[c] 0°

9AM & 3PM WINTER-SOLSTICE SHADOW RATIO[b,2] 1 : 4.59 ...AND AZIMUTH[c,2] 42°

WIND ⚐3

MAX SPEED[5] 54 MPH / 87 km/h

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

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
	WNW	WNW	WNW	WNW	E	WSW	WSW	SW	SW	WNW	WNW	WNW	WNW
MPH	12.8	12.8	13.1	12.4	11.2	10.7	10.3	10.1	10.5	11.4	11.9	12.7	11.6
km/h	20.6	20.6	21.1	20.0	18.0	17.2	16.6	16.3	16.9	18.3	19.1	20.4	18.7

WATER ⚐4

AVERAGE RAINFALL (GAIN)[1] — 1920 – 2012

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
INCHES	3.61	3.32	3.94	3.66	3.33	3.41	3.08	3.43	3.28	3.37	3.92	3.87	42.22
mm	91.7	84.3	100.1	93.0	84.6	86.6	78.2	87.1	83.3	85.6	99.6	98.3	1,072.4

AVERAGE POTENTIAL EVAPOTRANSPIRATION (POTENTIAL LOSS)[d,6] — 1975 – 2004

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
INCHES	0.38	0.58	1.15	1.94	3.14	3.63	4.03	3.42	2.29	1.38	0.65	0.38	22.97
mm	9.7	14.7	29.2	49.3	79.8	92.2	102.4	86.9	58.2	35.1	16.5	9.7	583.4

WETTEST YEAR'S RAIN[1]	62.14 INCHES	1,578 mm	*1954*	DRIEST YEAR'S RAIN[1]	23.71 INCHES	602 mm	*1965*

LONGEST PERIOD WITH NO MEASURABLE PRECIPITATION[7]: 44 DAYS: *October 9 – November 21, 1924*

RAINFALL INCOME[e]: 150 GPCD / 569 lpcd

AREA[f,8]: 48.28 SQ MILES / 125.0 km²

POPULATION[f,8]: 645,966 *2013 est.*

UTILITY-WATER USE[9]: 41 GPCD / 155 lpcd

HISTORICAL	23.13 FT	7.05 m	*1960*	DEPTH TO GROUNDWATER[g,10]	25.09 FT	7.65 m	*1997*	CURRENT

CURRENT GROUNDWATER EXTRACTION [ ] NATURAL GROUNDWATER RECHARGE[h,11]

WATERGY ⚐5

% of BOSTON'S TOTAL MUNICIPAL ENERGY USED TO MOVE & TREAT WATER[i,12]

TOTEM SPECIES ⚐6

PLANT: Pale Green Orchis *(Platanthera flava* var. *herbiola)* MAMMAL:

INSECT: Mocha emerald *(somatochlora linearis)* BIRD: Peregrine falcon *(Falco peregrinus)* MUSSEL: Eastern Pondmussel *(Ligumia nasuta)*

AMPHIBIAN: Blue-spotted Salamander *(Ambystoma laterale)* MEGAFAUNA: [j,13]

Available online at HarvestingRainwater.com/one-page-place-assessments

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.

BOSTON 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. Potential evapotranspiration is how much water could be lost to an environment as a result of a combined process of both evaporation from soil and plant surfaces and transpiration through plant canopies. In the evapotranspiration process, the water is transferred from the soil and plant surfaces into the atmosphere in the form of water vapor. Compare average rainfall (water gain) to potential water loss via evaporation (not including loss from plant surfaces) or evapotranspiration by looking up such rates for your area. According to one definition, if pan-evaporation rates exceed rainfall rates, you are in a dryland enironment. Another definition states that drylands are "land areas where the mean annual precipitation is less than two thirds of potential evapotranspiration, 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/evapotranspiration to rainfall, the more important evaporation-reducing strategies such as mulch, windbreaks, shading, and covered water storage become.

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

f. City proper

g. USGS Well ID 422133071033801 MA-BGW 925, located at 42°21'33"N, 71°03'38"W (at Suffolk County Superior Court). This is the only USGS-listed well in Suffolk County with more than one reading (over 700 readings are listed for this particular well).

h.

i.

j. Species selected from town list for Boston

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

BOSTON PLACE-ASSESSMENT REFERENCES

1. Boston Logan Airport station (#190770), wrcc.dri.edu, accessed 1/12/2015

2. Rainwater Harvesting for Drylands & Beyond, Vol 1, or esrl.noaa.gov/gmd/grad/solcalc, accessed 1/12/2015

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. Boston Logan, mesonet.agron.iastate.edu/sites/dyn_windrose.phtml?station=BOS&network=MA_ASOS, accessed 1/12/2015

5. Maximum Wind Speed, 1986–2008, NE Regional Climate Center, www.nrcc.cornell.edu/ccd/maxwnd.html, accessed 1/11/2015

6. Monthly average PET (potential evapotranspiration) estimates in inches, www.nrcc.cornell.edu/PET.pdf, accessed 1/12/2015

7. Samantha Borisoff, Climatologist, NRCC, via email 1/12/2015

8. Census.gov, accessed 1/12/2015

9. Residential-only gpcd for Boston Water & Sewer Commission for 2013 provided by Leo Norton, Rates Manager, Massachusetts Water Resources Authority, via phone 1/15/2015

10. Groundwater Levels for the Nation, USGS, nwis.waterdata.usgs.gov/nwis/gwlevels, accessed 1/20/2015

11.

12.

13. Natural Heritage & Endangered Species Program, Massachusetts Division of Fisheries & Wildlife, www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/species-information-and-conservation/town-species-viewer.html, accessed 1/20/2015