0						ESSN ubwate							00
	SUN		$P_1$							MAR 21	JUN 21	SEP 21	DEC 21
					DEGREE	ES N or S o	of DUE EA	ST THE SU	JN RISES <sup>1</sup>	0°	32°N	0°	31°S
LAT	ITUDE	40.0°				ES N or S o				0°	32°N	0°	30°S
				SOLAR-N		TITUDE AI	NGLE (ABC	ove hori	ZON) <sup>a,1,2</sup>	50°	73°	50°	27°
ELEVATION 5,309 FT 1619 m SOLAR-NOON WINTER-SOLSTICE SHADOW RATIO <sup>b</sup> 1 : 2.00AND AZIMUT										IMUTH <sup>c</sup>	0°		
10AM & 2PM WINTER-SOLSTICE SHADOW RATIO <sup>b,1</sup> 1 : 2.65AND AZIMU											IMUTH <sup>c,1</sup>	29°	
CLIMATE   P 2   AVERAGE HIGH & LOW TEMPERATURES <sup>3</sup> 1893 - 2023													
AV										1893 – 2023			
<b>9- - - - - - - - - -</b>	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
°F HIGH	45.2	47.1	53.6	62.0	70.4	80.9	86.5	84.9	77.5	66.2	54.2	46.3	64.6
°F LOW °C HIGH	20.5 7.3	22.2 8.4	27.9 12.0	35.5 16.7	44.1 21.3	52.6 27.2	58.5 30.3	57.4 29.4	49.1 25.3	38.9 19.0	28.8 12.3	22.1 7.9	38.2 18.1
°C LOW		-5.4	-2.3	1.9	6.7	11.4	14.7	14.1	9.5	3.8	-1.8	-5.5	3.4
	DRD HIC		1	40.0° C		3, <i>1954</i>		ORD LOW			6.1° C		<u> </u>
				40.0 C	JUNE 2	<b>3, 1994</b>	RECC		-33	<b>F</b> -3			
\	NINE	)	$P_3$								MAX	SPEED <sup>5</sup>	147 237
Ι.						ECTION							MPH km/h
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
MPH	W 4.8	W 5.9	W, N 5.6	W 5.9	N 4.6	W, SW 4.4	N, W 4.0	W, SW 4.0	W, SW 3.6	SW, W 3.9	W 4.6	W 4.8	W 4.7
km/h	7.7	9.5	9.0	9.5	7.4	7.1	6.4	6.4	5.8	6.3	7.4	7.7	7.6
KIII/ II	/./	2.5	2.0	2.5	/	/	0.1	0.1	5.0	0.5			7.0
۱ ۸		D											1
V	VATE	R	$P_4$		AVER	RAGE RAI	NFALL (G	AIN) <sup>3</sup>		18	893 – 20.	23	
V	VATE JAN	FEB	P <sub>4</sub> Mar	APR	AVER MAY	RAGE RAI	NFALL (G JUL	AIN) <sup>3</sup> AUG	SEP	<i>18</i> ОСТ	<i>893 – 20.</i> NOV	2 <i>3</i> DEC	ANNUAL
INCHES	JAN 0.61	FEB 0.85	MAR 1.71	2.66	MAY 3.11	JUN 1.84	JUL 1.80	AUG 1.52	1.64	OCT 1.47	NOV 1.00	DEC 0.79	19.14
	JAN	FEB	MAR	1	MAY	JUN	JUL	AUG		OCT	NOV	DEC	
INCHES	JAN 0.61	FEB 0.85	MAR 1.71 43.4	2.66 67.6	MAY 3.11 79.0	JUN 1.84	JUL 1.80 45.7	AUG 1.52 38.6	1.64 41.7	OCT 1.47 37.3	NOV 1.00	DEC 0.79 20.1	19.14
INCHES	JAN 0.61 15.5	FEB 0.85	MAR 1.71 43.4	2.66 67.6	MAY 3.11 79.0	JUN 1.84 46.7	JUL 1.80 45.7	AUG 1.52 38.6	1.64 41.7	OCT 1.47 37.3	NOV 1.00 25.4	DEC 0.79 20.1	19.14
INCHES mm	JAN 0.61 15.5	FEB 0.85 21.6	MAR 1.71 43.4	2.66 67.6 VERAGE	MAY 3.11 79.0 PAN EV	JUN 1.84 46.7 APORATI	JUL 1.80 45.7 ON (POT	AUG 1.52 38.6 ENTIAL I	1.64 41.7 -OSS) <sup>d,6</sup>	OCT 1.47 37.3	NOV 1.00 25.4 900 – 20	DEC 0.79 20.1 05	19.14 482.6
INCHES mm INCHES mm	JAN 0.61 15.5 0.00 0.0	FEB 0.85 21.6 0.00	MAR 1.71 43.4 2.50 63.5	2.66 67.6 VERAGE 4.52	MAY 3.11 79.0 PAN EV 5.42 137.7	JUN 1.84 46.7 APORATI 6.32 160.5	JUL 1.80 45.7 ON (POT 6.92 175.8	AUG 1.52 38.6 ENTIAL I 6.07 154.2	1.64 41.7 -OSS) <sup>d,6</sup> 4.74	OCT 1.47 37.3 19 3.07 78.0	NOV 1.00 25.4 900 – 20 1.48 37.6	DEC 0.79 20.1 05 0.00	19.14 482.6 41.04
INCHES mm INCHES mm	JAN 0.61 15.5 0.00 0.0 EST YE	FEB 0.85 21.6 0.00 0.0 AR'S RA	MAR 1.71 43.4 <i>4</i> 2.50 63.5 IN <sup>3</sup> 34.	2.66 67.6 VERAGE 4.52 114.8 15 INCHE	MAY 3.11 79.0 PAN EV 5.42 137.7 S 867	JUN 1.84 46.7 APORATI 6.32 160.5 mm 20	JUL 1.80 45.7 ON (POT 6.92 175.8 13 DF	AUG 1.52 38.6 ENTIAL I 6.07 154.2 RIEST YEA	1.64 41.7 -OSS) <sup>d,6</sup> 4.74 120.4 R'S RAIN	OCT 1.47 37.3 19 3.07 78.0 <sup>3</sup> 10.911	NOV 1.00 25.4 200 – 20 1.48 37.6 NCHES	DEC 0.79 20.1 05 0.00 0.0 277 mm	19.14 482.6 41.04 1,042.4
INCHES mm INCHES mm	JAN 0.61 15.5 0.00 0.0 EST YE	FEB 0.85 21.6 0.00 0.0 AR'S RA	MAR 1.71 43.4 / 2.50 63.5 IN <sup>3</sup> 34. ERIOD V	2.66 67.6 VERAGE 4.52 114.8 15 INCHE	MAY 3.11 79.0 PAN EV 5.42 137.7 S 867 MEASUR	JUN 1.84 46.7 APORATI 6.32 160.5	JUL 1.80 45.7 ON (POT 6.92 175.8 175.8 CIPITAT	AUG 1.52 38.6 ENTIAL I 6.07 154.2 RIEST YEA	1.64 41.7 -OSS) <sup>d,6</sup> 4.74 120.4 R'S RAIN	OCT 1.47 37.3 19 3.07 78.0 <sup>3</sup> 10.911	NOV 1.00 25.4 900 – 20 1.48 37.6	DEC 0.79 20.1 05 0.00 0.0 277 mm	19.14 482.6 41.04 1,042.4 <i>1954</i>
INCHES mm INCHES mm	JAN 0.61 15.5 0.00 0.0 EST YE/	FEB 0.85 21.6 0.00 0.0 AR'S RA VGEST P 55 E	MAR 1.71 43.4 2.50 63.5 IN <sup>3</sup> 34. ERIOD W DAYS: <i>SE</i>	2.66 67.6 VERAGE 4.52 114.8 15 INCHE VITH NO PTEMBER	MAY 3.11 79.0 PAN EV 5.42 137.7 S 867 MEASUR 27 – NOV	JUN 1.84 46.7 APORATI 6.32 160.5 mm 20 ABLE PRI <i>(EMBER 20</i>	JUL 1.80 45.7 ON (POT 6.92 175.8 13 DF CIPITAT 0, 1934	AUG 1.52 38.6 ENTIAL I 6.07 154.2 RIEST YEA TION <sup>7</sup>	1.64 41.7 -OSS) <sup>d,6</sup> 4.74 120.4 .R'S RAIN RAI	OCT 1.47 37.3 19 3.07 78.0 <sup>3</sup> 10.91 I NFALL IN	NOV 1.00 25.4 200 – 20 1.48 37.6 NCHES 200 1.48 1.4	DEC 0.79 20.1 05 0.00 0.0 277 mm 222 839	19.14 482.6 41.04 1,042.4 <i>1954</i> GPCD Ipcd
INCHES mm INCHES mm	JAN 0.61 15.5 0.00 0.0 EST YE/ LON	FEB 0.85 21.6 0.00 0.0 AR'S RA VGEST P 55 D	MAR 1.71 43.4 / 2.50 63.5 IN <sup>3</sup> 34. ERIOD V	2.66 67.6 VERAGE 4.52 114.8 15 INCHE VITH NO PTEMBER	MAY 3.11 79.0 PAN EV 5.42 137.7 S 867 I MEASUR 27 – NOV DPULAT	JUN 1.84 46.7 APORATI 6.32 160.5 mm 20 ABLE PRI <i>CEMBER 20</i> ION <sup>f,8</sup>	JUL 1.80 45.7 ON (POT 6.92 175.8 175.8 0, 1934 108,250 2020	AUG 1.52 38.6 ENTIAL I 6.07 154.2 RIEST YEA TON <sup>7</sup> 0	1.64 41.7 -OSS) <sup>d,6</sup> 4.74 120.4 .R'S RAIN RAI	OCT 1.47 37.3 19 3.07 78.0 <sup>3</sup> 10.911	NOV 1.00 25.4 200 – 20 1.48 37.6 NCHES 200 1.48 1.4	DEC 0.79 20.1 05 0.00 0.0 277 mm 222	19.14 482.6 41.04 1,042.4 <i>1954</i> GPCD
INCHES mm INCHES mm	JAN 0.61 15.5 0.00 0.0 EST YEA LON A <sup>t,8</sup> 20 6	FEB 0.85 21.6 0.00 0.0 AR'S RA VGEST P 55 D	MAR 1.71 43.4 / 2.50 63.5 IN <sup>3</sup> 34. ERIOD W DAYS: <i>SE</i>	2.66 67.6 VERAGE 4.52 114.8 15 INCHE VITH NO PTEMBER	MAY 3.11 79.0 PAN EV 5.42 137.7 S 867 I MEASUR 27 – NOV DPULAT	JUN 1.84 46.7 APORATI 6.32 160.5 mm 20 ABLE PRI <i>(EMBER 20</i>	JUL 1.80 45.7 ON (POT 6.92 175.8 175.8 0, 1934 108,250 2020	AUG 1.52 38.6 ENTIAL I 6.07 154.2 RIEST YEA TON <sup>7</sup> 0	1.64 41.7 -OSS) <sup>d,6</sup> 4.74 120.4 .R'S RAIN RAI	OCT 1.47 37.3 19 3.07 78.0 <sup>3</sup> 10.91 I NFALL IN	NOV 1.00 25.4 200 – 20 1.48 37.6 NCHES 200 1.48 1.4	DEC 0.79 20.1 05 0.00 0.0 277 mm 222 839 130 492	19.14 482.6 41.04 1,042.4 <i>1954</i> GPCD Ipcd GPCD
INCHES mm INCHES mm WETT	JAN 0.61 15.5 0.00 0.0 EST YE/ LON A <sup>t,8</sup> 20 6 PRICAL	FEB 0.85 21.6 0.00 0.0 AR'S RA NGEST P 55 D 5.33 8.2 ki	MAR 1.71 43.4 / 2.50 63.5 IN <sup>3</sup> 34. ERIOD V DAYS: <i>SE</i> Q MILES m <sup>2</sup>	2.66 67.6 VERAGE 4.52 114.8 15 INCHE VITH NO PTEMBER	MAY       3.11       79.0       PAN EV       5.42       137.7       S     867 m       MEASUR       27 - NOV       OPULAT       DEPT	JUN 1.84 46.7 APORATI 6.32 160.5 mm 20 ABLE PRI <i>(EMBER 20</i> ION <sup>f,8</sup>	JUL 1.80 45.7 ON (POT 6.92 175.8 175.8 0 DF CIPITAT 0, 1934 108,250 2020 OUNDW	AUG 1.52 38.6 ENTIAL I 6.07 154.2 RIEST YEA TON <sup>7</sup> 0 ATER <sup>h,10</sup>	1.64 41.7 -OSS) <sup>d,6</sup> 4.74 120.4 .R'S RAIN RAI	OCT 1.47 37.3 19 3.07 78.0 <sup>3</sup> 10.911 NFALL IN Y-WATEI	NOV 1.00 25.4 200 – 20 1.48 37.6 NCHES COME <sup>e</sup> R USE <sup>g,9</sup>	DEC 0.79 20.1 05 0.00 0.0 277 mm 2222 839 130 492 c	19.14 482.6 41.04 1,042.4 <i>1954</i> GPCD Ipcd GPCD Ipcd
INCHES mm INCHES mm WETT ARE HISTC	JAN 0.61 15.5 0.00 0.0 EST YE/ LON A <sup>t,8</sup> 20 6 PRICAL	FEB 0.85 21.6 0.00 0.0 AR'S RA AGEST P 55 E 5.33 8.2 ki JRRENT	MAR 1.71 43.4 / 2.50 63.5 IN <sup>3</sup> 34. ERIOD V DAYS: <i>SE</i> Q MILES m <sup>2</sup>	2.66 67.6 VERAGE 4.52 114.8 15 INCHE VITH NO <i>PTEMBER</i> PC	MAY       3.11       79.0       PAN EV       5.42       137.7       S     867 m       MEASUR       27 - NOV       OPULAT       DEPT       EXTRAC	JUN 1.84 46.7 APORATI 6.32 160.5 mm 20 ABLE PRI <i>(EMBER 20</i> ION <sup>f,8</sup>	JUL 1.80 45.7 ON (POT 6.92 175.8 175.8 0 175.8 0 0 0 0 0 0 0 0 0 0 0 0 0	AUG 1.52 38.6 ENTIAL I 6.07 154.2 RIEST YEA ION <sup>7</sup> 0 ATER <sup>h,10</sup> JRAL GRO	1.64 41.7 -OSS) <sup>d,6</sup> 4.74 120.4 .R'S RAIN RAI UTILIT	OCT 1.47 37.3 19 3.07 78.0 <sup>3</sup> 10.911 NFALL IN Y-WATEI ATER REC	NOV 1.00 25.4 900 – 20 1.48 37.6 NCHES 2 ICOME <sup>e</sup> R USE <sup>g,9</sup> COME <sup>i,</sup>	DEC 0.79 20.1 05 0.00 0.0 277 mm 222 839 130 492 11	19.14 482.6 41.04 1,042.4 <i>1954</i> GPCD Ipcd GPCD Ipcd
INCHES mm INCHES mm WETT ARE HISTC	JAN 0.61 15.5 0.00 0.0 EST YE/ LON A <sup>t,8</sup> 20 6 PRICAL C CU	FEB 0.85 21.6 0.00 0.0 AR'S RA VGEST P 55 E 5.33 SV 8.2 ki URRENT GY	MAR 1.71 43.4 / 2.50 63.5 IN <sup>3</sup> 34. ERIOD V DAYS: <i>SE</i> 0 AYS: <i>SE</i> 0 MILES m <sup>2</sup> GROUN P 5	2.66 67.6 VERAGE 4.52 114.8 15 INCHE VITH NO <i>PTEMBER</i> PC DWATER KWH OF	MAY       3.11       79.0       PAN EV/       5.42       137.7       S     867       MEASUR       27 - NOV       OPULAT       DEPT       EXTRAC	JUN 1.84 46.7 APORATI 6.32 160.5 mm 20 ABLE PRI <i>CEMBER 20</i> ION <sup>1,8</sup> TH TO GR TION J JSED IN O	JUL 1.80 45.7 ON (POT 6.92 175.8 175.8 0.175.8 0.175.8 0.00 0.	AUG 1.52 38.6 ENTIAL I 6.07 154.2 RIEST YEA TON <sup>7</sup> 0 0 JRAL GRO	1.64 41.7 -OSS) <sup>d,6</sup> 4.74 120.4 R'S RAIN RAI UTILIT UTILIT	OCT 1.47 37.3 19 3.07 78.0 <sup>3</sup> 10.911 NFALL IN Y-WATEI NFALL IN Y-WATEI BOULDEI	NOV 1.00 25.4 900 – 20 1.48 37.6 NCHES COME <sup>e</sup> R USE <sup>g,9</sup> COME <sup>i,</sup>	DEC 0.79 20.1 05 0.00 0.0 277 mm 222 839 130 492 130 492 11 R <sup>j,12</sup> 3	19.14 482.6 41.04 1,042.4 <i>1954</i> GPCD Ipcd GPCD Ipcd URRENT
INCHES mm INCHES mm WETT ARE HISTC	JAN 0.61 15.5 0.00 0.0 EST YE/ LON A <sup>t,8</sup> 20 6 PRICAL 6 CU CU ATER	FEB 0.85 21.6 0.00 0.0 AR'S RA AGEST P 55 E 5.33 8.2 JRRENT GY CIES	$ \begin{array}{r}   MAR \\   1.71 \\   43.4 \\   2.50 \\   63.5 \\   63.5 \\   IN3 34. \\   eRIOD V \\   OAYS: 5E, \\   Q MILES \\   m2 \\   GROUN \\   \hline   F 5 \\   F 6 E $	2.66 67.6 VERAGE 4.52 114.8 15 INCHE VITH NO PTEMBER PC DWATER KWH OF	MAY       3.11       79.0       PAN EV/       5.42       137.7       S     867 m       MEASUR       27 - NOV       OPULAT       DEPT       EXTRAC       ENERGY L	JUN 1.84 46.7 APORATI 6.32 160.5 mm 20 ABLE PRI <i>(EMBER 20</i> ION <sup>1,8</sup>	JUL 1.80 45.7 ON (POT 6.92 175.8 213 DF CIPITAT 0, 1934 108,259 2020 OUNDW NATU NE YEAR	AUG 1.52 38.6 ENTIAL I 6.07 154.2 RIEST YEA TON <sup>7</sup> O D ATER <sup>h,10</sup> JRAL GRO TO MOVE hypugaea)	1.64 41.7 -OSS) <sup>d,6</sup> 4.74 120.4 R'S RAIN RAI UTILIT UUNDWA E & TREAT	OCT 1.47 37.3 19 3.07 78.0 <sup>3</sup> 10.911 NFALL IN Y-WATEI NFALL IN Y-WATEI BOULDEI MAL: North	NOV 1.00 25.4 200 – 20 1.48 37.6 NCHES COME <sup>e</sup> R USE <sup>g,9</sup> COME <sup>i,</sup> R USE <sup>g,9</sup> COME <sup>i,</sup> R USE <sup>g,9</sup> COME <sup>i,</sup>	DEC 0.79 20.1 05 0.00 0.0 277 mm 222 839 130 492 11 R <sup>j,12</sup> 3 eaver (Casto	19.14 482.6 41.04 1,042.4 1,042.4 GPCD Ipcd GPCD Ipcd URRENT ,750,000
INCHES mm INCHES mm WETT ARE HISTO	JAN 0.61 15.5 0.00 0.0 EST YE/ LON A <sup>t,8</sup> 20 6 0 CU A <sup>t,8</sup> 20 6 CU A <sup>t,8</sup> 20 6 CU	FEB 0.85 21.6 0.00 0.0 AR'S RA VGEST P 55 E 5.33 8.2 VI ST ST ST ST ST ST ST ST ST ST	$ \begin{array}{r}   MAR \\   1.71 \\   43.4 \\   2.50 \\   63.5 \\   63.5 \\   IN3 34. \\   eRIOD V \\   OAYS: 5E, \\   Q MILES \\   m2 \\   GROUN \\   \hline   F 5 \\   F 6 E $	2.66 67.6 VERAGE 4.52 114.8 15 INCHE VITH NO PTEMBER PC DWATER KWH OF BIRD: Wester (Lithobates)	MAY 3.11 79.0 PAN EV 5.42 137.7 S 867 m MEASUR 27 – NOV OPULAT DEPT EXTRAC ENERGY L em Burrowing pipiens)	JUN 1.84 46.7 APORATI 6.32 160.5 mm 20 ABLE PRI <i>CEMBER 20</i> ION <sup>1,8</sup> TH TO GR TION J JSED IN O	JUL 1.80 45.7 ON (POT 6.92 175.8 13 DF CIPITAT 0, 1934 108,250 2020 OUNDW NATU NE YEAR FISH:	AUG 1.52 38.6 ENTIAL I 6.07 154.2 RIEST YEA TON <sup>7</sup> O ATER <sup>h,10</sup> JRAL GRO TO MOVE hypugaea) Greenback	1.64 41.7 -OSS) <sup>d,6</sup> 4.74 120.4 R'S RAIN RAI UTILIT UTILIT	OCT 1.47 37.3 19 3.07 78.0 <sup>3</sup> 10.911 NFALL IN Y-WATEI NFALL IN Y-WATEI BOULDEF MAL: North rout (Onco	NOV       1.00       25.4       200 – 20       1.48       37.6       NCHES       NCHES       INCOME       R       USE       g.9       IHARGE       American Berthynchus classes	DEC 0.79 20.1 05 0.00 0.0 277 mm 222 839 130 492 11 R <sup>j,12</sup> 3 eaver ( <i>Casto</i> arki stomias)	19.14 482.6 41.04 1,042.4 1,042.4 0 1954 GPCD 1pcd GPCD 1pcd URRENT ,750,000
INCHES mm INCHES mm WETT ARE HISTO	JAN 0.61 15.5 0.00 0.0 EST YE/ LON A <sup>t,8</sup> 20 6 0 CU A <sup>t,8</sup> 20 6 CU A <sup>t,8</sup> 20 6 CU	FEB 0.85 21.6 0.00 0.0 AR'S RA VGEST P 55 E 5.33 8.2 VI ST ST ST ST ST ST ST ST ST ST	MAR 1.71 43.4 P 2.50 63.5 IN <sup>3</sup> 34. ERIOD V DAYS: <i>SE</i> OAYS: <i>SE</i> OAYS: <i>SE</i> OAYS: <i>SE</i> DAYS: <i>SE</i> DAYS: <i>SE</i> 0 DAYS: <i>SE</i>	2.66 67.6 VERAGE 4.52 114.8 15 INCHE VITH NO PTEMBER PC DWATER KWH OF BIRD: Wester (Lithobates, i) INSEC	MAY 3.11 79.0 PAN EV 5.42 137.7 S 867 m MEASUR 27 – NOV OPULAT OPULAT EXTRAC ENERGY L em Burrowing pipiens) T: Hunt's B	JUN 1.84 46.7 APORATI 6.32 160.5 mm 20 ABLE PRI <i>CEMBER 20</i> ION <sup>†,8</sup> TH TO GR TION 5 JSED IN O	JUL 1.80 45.7 ON (POT 6.92 175.8 13 DF CIPITAT 0, 1934 108,250 2020 OUNDW NATU NE YEAR FISH: Bombus hur	AUG 1.52 38.6 ENTIAL I 6.07 154.2 RIEST YEA TON <sup>7</sup> O D ATER <sup>h,10</sup> JRAL GRO TO MOVE hypugaea) Greenback htii) F	1.64 41.7 -OSS) <sup>d,6</sup> 4.74 120.4 R'S RAIN RAI UTILIT UTILIT E & TREAT MAM/ Cutthroat T REPTILE: Cc	OCT 1.47 37.3 19 3.07 78.0 <sup>3</sup> 10.911 NFALL IN Y-WATEI NFALL IN Y-WATEI ATER REC BOULDEI MAL: North rout (Oncommon Gar	NOV 1.00 25.4 200 – 20 1.48 37.6 NCHES COME <sup>e</sup> RUSE <sup>g,9</sup> COME <sup>i</sup> R'S WATE American Bu American Bu chynchus cla ter Snake (1)	DEC 0.79 20.1 05 0.00 0.0 277 mm 222 839 130 492 11 R <sup>j,12</sup> 3 eaver ( <i>Casto</i> arki stomias)	19.14 482.6 41.04 1,042.4 1954 GPCD Ipcd GPCD Ipcd URRENT

## 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
- $\square$  2. For more CLIMATE information, see the introduction; chapters 1, 2, & 4; and appendix 5
- $\square$  3. For more WIND information, see chapters 2 & 4 and appendices 5 & 9
- $\square$  **4.** For more WATER information, see the introduction, chapters 1–4, and appendices 1–5
- igap 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.

## **BOULDER 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.** 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. 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. All-sector indoor & outdoor usage for 2022 (incl. residential, municipal, commercial, industrial, institutional, and unaccounted-for wa per interpretation of data made in consultation with information from City of Boulder 2016 Water Efficiency Plan, p. 34; bouldercolorado.gov/media/9063/download?inline, accessed 6/18/2023
- **h.** Relevant depth to groundwater in Boulder unavailable through our usual USGS source; "The City of Boulder does not use groundwa to meet municipal demand and thus does not track depth to groundwater or groundwater extraction rates."
- i. Information not readily available; see note h
- J. This figure does not likely include the energy used to move water from the Western Slope over the Continental Divide for Boulder's consumption. "Boulder's water delivery system is largely gravity fed. The city used approximately 3.75 million kWh in 2022 for water treatment and delivery. Water delivery to two treatment plants and through the distribution system moves through eight hydroelectric facilities, which generated 41 million kWh in 2022."

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

## **BOULDER PLACE-ASSESSMENT REFERENCES**

- 1. Rainwater Harvesting for Drylands & Beyond, Vol 1, or esrl.noaa.gov/gmd/grad/solcalc, accessed 6/17/2023
- 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. Boulder station (#050848), wrcc.dri.edu/my, accessed 6/17/2023
- 4. Custom Wind Rose Plots, CO\_ASOS, Boulder Municipal Airport 2010-2023, 8-bin, mesonet.agron.iastate.edu, accessed 6/18/2023
- 5. Boulder wind info, psl.noaa.gov/boulder/wind.html, accessed 6/18/2023
- 6. Average Pan Evaporation Data by State, Colorado, Fort Collins; wrcc.dri.edu/Climate/comp\_table\_show.php?stype=pan\_evap\_avg accessed 6/17/2023
- 7. Number of Consecutive Days Precipitation < 0.01, Boulder station (#050848); scacis.rcc-acis.org, accessed 6/17/2023
- 8. QuickFacts: Boulder city, Colorado; United States, www.census.gov/quickfacts, accessed 6/17/2023
- **9.** Boulder's Annual and Per Capita Treated Water Use, 1983-2022, Fig. 2 in Rozaklis and Associates report dated 1/17/2023; image provided in email communication dated 6/28/2023 from Robby Glenn, Senior Civil Engineering Project Manager, City of Boulder
- 10., 11., & 12. Email communication from City of Boulder Utilities Department Deputy Director Chris Douville, dated 6/29/2023
- **13.** Mammal, fish, and reptile species for Denver per Jason Gerhardt, Real Earth Design, via email 2/4 & 2/5/2012; Bird, amphibian, plant, and insect species for Boulder per Rella Abernathy, Senior Ecologist, City of Boulder, via email 6/28/2023