Lake Lacawac, Bruce R. Hargreaves, Lehigh University (brh0@lehigh.edu, http://www.lehigh.edu/~brh0) 41°22.5'N 75°17.3'W elevation 428m

24 Marchl 2012: platform moved to lake center, 12-1:00pm 3Nov 2012: platform move to dock by 12N

The water level sensor (referenced to dock) settles for several days after moving platform to lake center and thus underestimates water level during this period.

Dec11: Tw12 appears to be failing (drifting upward); need to check or replace when possible

H310 sensor depth & Lake level are based on differential pressure sensor with ca 0.1mm resolution & vertical position referenced to bottom of lake. Sensor PSIG converted to depth using density of water at 4oC (1.43321 psi/m) Lake level is referenced also to lower frame of dock at SE corner (2003-May2005) (Actual water level at dock varies seasonally with density of water column and hourly from precip, runoff, evaporation, seepage & outflow. Outflow also varies with status of beaver dam).

5280 ft/mile

rain sum (in.) Aug-Sep2011=> 12.41 1609.3 m/mile

Std pressure at sea level =1 atm=760 mm Hg=29.92" Hg=1013.2 mbars

Std pressure at 428m elevation =724 mm Hg, 29.61 in. Hg, (965.2 mbars)

	Tair avg F	Tair max F	Tair min F		Rain-in	WS-mph	WS max mph					Tw 0.1m F	Tw 0.5m F	Tw 1m F	Tw 2m F	Tw 3m F	Tw 4m F	Tw 5m F	Tw 6m F	Tw 8m F	Tw 10m F	Tw 12m F						
	31.3	51.8	10.5		1.69	5.3	30					34.9	39.6	39.6	39.3	39.3	39.3	39.6	39.4	39.5	39.9	39.5						
Month summa avg Tw	Tair avg-C	Tair Hi-C	Tair Min-C	RHair-%	Rain-mm	WS-m/s	WS Max-m/s	WDIR-deg	Barom-mb	Sum Rad W/m2	Sum PAR uM/m2/s	Tw 0.1m	Tw 0.5m	Tw 1m	Tw 2m	Tw 3m	Tw 4m	Tw 5m	Tw 6m	Tw 8m	Tw02.2m	Tw02.7m	H310_z (m)	Lakelevel-mm (4oC)	cumul. rain-mm	Batt min-V	RH% CR10 enc	RH% MUX enc
4.2	-0.4	11.0	-12.0	81.2	42.8	2.4	13.6	252.1	960.6	84266852	170	1.6	4.2	4.2	4.0	4.1	4.0	4.2	4.1	4.1	4.4	4.2	2.3	62.2	42.8	12.6	13.4	15.1

month (All)

Data

Location	% records	Date	Day of Yr	Tair avg-C	Tair Hi-C	Tair Min-C	RHair-%	Rain-mm	WS-m/s	WS Max m/s	WDIR-deg	Barom-mb	Sum Rad J/m2	Sum PAR Mol/m2	Tw 0.1m	Tw 0.5m	Tw 1m	Tw 2m	TW3m	TW4m	TW5m	TW6m	TW8m	TW H310-C	TW12m	H310 depth-m (4oC)	Lakelevel-mm (4oC)	cumul. rain-mm	Batt min-V	RH% CR10 enc	RH% MUX enc
ND	100%	3/1/2013	60	-0.2	1.4	-2.2	92.5	0.1	3.1	8.1	322	953.8	1059713	2	0.22	3.64	3.63	3.51	3.54	3.54	3.81	3.74	3.83	3.8	3.87	2.2	40.3	0.100	12.7	13.2	14.4
ND	100%	3/2/2013	61	-3.5	-2.6	-4.9	89.5	0.0	3.3	7.7	323	955.9	1554513	3	0.24	3.63	3.62	3.48	3.52	3.56	3.81	3.75	3.80	3.8	3.86	2.2	38.7	0.100	12.7	13.7	14.8
ND	100%	3/3/2013	62	-5.1	-3.2	-6.4	83.8	0.0	3.7	9.0	327	954.7	1942417	4	0.28	3.66	3.64	3.51	3.55	3.57	3.80	3.73	3.83	3.8	3.86	2.2	37.1	0.100	12.7	14.1	15.3
ND	100%	3/4/2013	63	-4.2	-0.9	-6.3	79.6	0.0	4.4	11.0	319	957.5	3131953	6	0.37	3.71	3.69	3.56	3.59	3.61	3.80	3.75	3.85	3.9	3.87	2.2	35.7	0.100	12.6	15.6	15.0
ND	100%	3/5/2013	64	-1.8	3.1	-4.1	82.5	0.0	2.4	8.2	199	962.5	3609300	7	0.35	3.82	3.81	3.66	3.72	3.74	3.94	3.87	3.95	4.0	3.93	2.2	38.2	0.100	12.7	13.7	14.7
ND	100%	3/6/2013	65	0.7	2.4	-1.5	85.4	0.0	3.8	11.2	87	960.8	878701	2	0.42	3.88	3.88	3.80	3.87	3.87	4.03	3.95	4.00	4.1	4.01	2.2	36.4	0.100	12.7	13.0	14.1
ND	100%	3/7/2013	66	0.0	2.5	-2.0	81.2	0.0	3.3	8.4	174	965.0	2575253	5	0.38	3.98	3.98	3.94	3.98	3.96	4.14	4.04	4.04	4.2	4.04	2.2	34.4	0.100	12.6	13.0	14.0
ND	100%	3/8/2013	67	-1.5	2.6	-4.2	91.0	3.4	3.4	9.8	334	967.4	1963499	4	0.37	4.11	4.11	3.97	4.02	3.99	4.17	4.06	4.07	4.3	4.05	2.2	38.7	3.500	12.7	13.4	17.4
ND	100%	3/9/2013	68	1.2	10.4	-5.5	72.4	0.0	1.3	5.5	277	972.5	4848842	9	0.34	4.10	4.10	3.95	3.98	3.98	4.20	4.07	4.05	4.3	4.06	2.2	39.1	3.500	12.7	13.1	21.6
ND	100%	3/10/2013	69	3.2	11.0	-4.1	71.6	0.0	0.5	5.2	207	972.1	3539869	7	0.46	4.24	4.21	4.07	4.07	4.06	4.24	4.13	4.15	4.4	4.14	2.2	37.8	3.500	12.7	12.6	14.7
ND	100%	3/11/2013	70	4.7	8.4	0.6	89.6	0.0	0.9	5.1	137	967.5	1617967	3	0.65	4.31	4.30	4.16	4.16	4.13	4.33	4.20	4.21	4.5	4.26	2.2	37.4	3.500	12.7	12.2	13.7
ND	100%	3/12/2013	71	7.8	10.4	2.4	102.7	23.0	1.8	8.1	249	957.7	664590	2	0.75	4.27	4.31	4.17	4.18	4.11	4.30	4.19	4.16	4.5	4.21	2.3	56.2	26.500	12.7	12.1	19.4
ND	100%	3/13/2013	72	0.9	3.6	-2.0	90.9	0.1	1.7	8.3	297	958.0	3056377	6	0.92	4.40	4.29	4.12	4.11	4.08	4.31	4.16	4.14	4.5	4.16	2.3	85.3	26.600	12.7	15.3	15.2
ND	100%	3/14/2013	73	-3.5	-0.1	-6.6	64.7	0.0	4.6	13.6	312	959.3	3819575	7	2.42	4.53	4.41	4.27	4.26	4.22	4.35	4.22	4.20	4.5	4.24	2.3	89.9	26.600	12.7	14.0	15.2
ND	100%	3/15/2013	74	-1.6	2.6	-6.1	74.4	0.0	2.6	9.1	290	957.7	1464257	3	2.43	4.45	4.41	4.25	4.27	4.23	4.40	4.28	4.28	4.6	4.29	2.3	88.4	26.600	12.7	13.4	14.7
ND	100%	3/16/2013	75	-2.3	0.6	-3.9	85.2	1.4	1.1	9.4	158	956.4	1138639	2	1.74	4.40	4.35	4.17	4.21	4.16	4.39	4.24	4.22	4.5	4.21	2.3	87.1	28.000	12.7	13.5	14.6
ND	100%	3/17/2013	76	-4.0	-1.5	-7.2	76.4	0.0	2.0	7.8	272	965.4	2905914	6	1.46	4.38	4.33	4.13	4.15	4.11	4.34	4.20	4.24	4.5	4.27	2.3	85.8	28.000	12.6	13.8	15.1
ND	100%	3/18/2013	77	-6.0	-1.9	-12.0	82.3	0.0	1.7	7.4	137	970.0	1732939	4	1.26	4.35	4.30	4.16	4.15	4.12	4.33	4.24	4.25	4.5	4.27	2.3	83.6	28.000	12.7	14.5	15.7
ND	100%	3/19/2013	78	-0.5	5.4	-4.4	96.0	11.8	1.9	9.8	187	956.0	2126395	5	1.30	4.30	4.29	4.17	4.17	4.13	4.35	4.25	4.23	4.5	4.29	2.3	92.2	39.800	12.6	13.1	14.4
ND	100%	3/20/2013	79	-1.7	1.6	-3.8	71.2	0.0	2.5	9.0	289	956.6	4100520	8	1.83	4.22	4.23	4.11	4.14	4.09	4.31	4.23	4.21	4.4	4.24	2.3	89.8	39.800	12.6	13.3	14.7
ND	100%	3/21/2013	80	-4.9	-2.2	-9.1	75.9	0.0	1.6	8.4	300	954.0	3439149	7	1.55	4.23	4.25	4.09	4.13	4.10	4.31	4.22	4.20	4.5	4.21	2.3	85.3	39.800	12.7	14.1	15.2
ND	100%	3/22/2013	81	-2.9	0.1	-6.4	74.1	0.0	2.8	8.4	298	955.0	2566885	5	1.64	4.29	4.29	4.15	4.18	4.13	4.33	4.24	4.22	4.5	4.28	2.3	81.1	39.800	12.7	13.6	14.8
ND	100%	3/23/2013	82	-0.8	1.8	-2.7	69.9	0.0	3.7	9.9	308	958.8	2728677	6	2.02	4.29	4.33	4.17	4.21	4.16	4.31	4.22	4.18	4.5	4.25	2.3	76.4	39.800	12.7	13.1	14.4
ND	100%	3/24/2013	83	-0.6	2.9	-4.5	72.4	0.0	2.1	7.2	209	957.8	4618579	9	2.54	4.41	4.36	4.14	4.20	4.17	4.36	4.24	4.19	4.5	4.27	2.3	72.0	39.800	12.7	13.1	14.5
ND	100%	3/25/2013	84	0.3	2.6	-1.8	83.0	0.6	2.0	8.3	156	949.5	2020886	4	2.13	4.35	4.36	4.16	4.20	4.18	4.39	4.26	4.23	4.5	4.28	2.3	69.0	40.400	12.7	14.7	14.1
ND	100%	3/26/2013	85	1.6	4.8	-0.6	82.4	0.0	2.0	9.3	299	954.8	3745654	8	2.37	4.36	4.33	4.12	4.15	4.12	4.33	4.23	4.21	4.5	4.26	2.3	66.1	40.400	12.7	12.8	13.9
ND	100%	3/27/2013	86	1.2	4.9	-1.5	83.1	0.2	2.3	9.4	300	960.7	4261815	8	3.47	4.49	4.40	4.20	4.23	4.19	4.37	4.26	4.24	4.5	4.27	2.3	64.0	40.600	12.7	12.8	13.9
ND	100%	3/28/2013	87	2.0	4.3	-0.1	84.8	0.0	2.9	7.9	324	964.4	2223586	5	3.92	4.46	4.41	4.22	4.27	4.24	4.41	4.31	4.28	4.6	4.33	2.3	62.3	40.600	12.7	12.6	13.8
ND	100%	3/29/2013	88	3.0	5.8	-0.3	79.4	0.0	2.2	8.3	300	967.7	2836197	6	3.72	4.47	4.39	4.17	4.21	4.19	4.37	4.29	4.26	4.5	4.29	2.3	60.7	40.600	12.7	12.5	13.6
ND	100%	3/30/2013	89	3.5	9.9	-1.5	69.9	0.0	1.4	7.9	275	967.5	5693038	11	4.37	4.66	4.55	4.30	4.31	4.30	4.47	4.35	4.34	4.6	4.38	2.3	59.5	40.600	12.7	12.5	13.9
ND	100%	3/31/2013	90	3.5	10.2	-2.7	80.3	2.2	0.9	7.4	147	961.4	2401154	5	4.43	4.57	4.49	4.25	4.26	4.23	4.42	4.31	4.27	4.6	4.28	2.3	58.9	42.800	12.7	12.5	13.9

Lake water & energy budget daily summary from hourly data (negative values: loss from lake; runoff & seepage term is residual after adjusting lake level change for all others)

Ratio of lake watershed to lake area: 2.6176758 Runoff & seepage as % of watershed area precip: #DIV/0!

																												1.000	<=SCALE ADJ (1.0=no adjustment)
																												4.184	joule/calorie (= joule/degree for 1cm3)
Grand sum/avg	-0.37	1.62	4.22	4.20	4.04	4.06	4.04	2.1	84266852	-18724	19.4	42.8	29.9	-25.5	0.0	0.0												-0.7	-6.0
															SumTerrevap2=AirVPD,mbar*WS,m/s*s														
Nominal diffuse %R from water=7%									-16852.0	61516.2	21%																		
																											4.184	<=CONVERT HEAT TO DEGREES												
																											6000000	cm3/m2 (for 0-4m integrated depth)												
																													slope
																													intercept
																													r2

Data

DATE	DayOfYr	AvgTair C	AvgTw 0.1m	AvgTw0.5 m	Avg Tw1m	Avg Tw2m	Avg Tw3m	Avg Tw4m	AvgWS CSI m/s	SumRad J/m2	SumH Evap (*0.9=KJ/m2)	Sum Lk_lvl chg (mm)	SumRain mm	Sum Runoff & seepage, mm	SumLake evap (mm)	Sum Terrevap2	7%	0.9			4.184					4.184	
																	Solar Heat input (absorbed from solar rad), KJ/m2)	Sum H evap ((KJ/m^2))	solar heat absorbed - evap loss ((kJ/m^2))	% of absorbed solar heat lost via evap	Solar Heat input (absorbed from solar rad), Tw 0-6m)	starting Tw (0-6m)	ending Tw (0-6m)	actual dTw, 0-6m	RESID1: NON-SOLAR FLUX (Heat flux to offset absorbed solar to match dTw)	evap loss (degC 0-6m)	RESID2: NON-SOLAR FLUX to offset absorbed solar to match dTw LESS EVAP (degC 0-6m)
3/1/2013	60	-0.25	0.22	3.64	3.63	3.51	3.54	3.54	2.9	1059713	-229	-1.613	0.1	-1.3	-0.3	0.0	986	-206	780	20.9%	0.04	3.51	3.52	0.00	(0.04)	-0.01	(0.03)
3/2/2013	61	-3.51	0.24	3.63	3.62	3.48	3.52	3.56	3.1	1554513	-725	-1.339	0.0	-0.2	-1.0	0.0	1446	-652	793	45.1%	0.06	3.52	3.52	0.00	(0.05)	-0.03	(0.03)
3/3/2013	62	-5.05	0.28	3.66	3.64	3.51	3.55	3.57	3.5	1942417	-1118	-1.867	0.0	-0.2	-1.5	0.0	1806	-1006	800	55.7%	0.07	3.52	3.55	0.03	(0.04)	-0.04	(0.00)
3/4/2013	63	-4.19	0.37	3.71	3.69	3.56	3.59	3.61	4.1	3131953	-1284	2.954	0.0	0.4	4.8	-1.7	2913	-1155	1757	39.7%	0.12	3.55	3.61	0.06	(0.06)	-0.05	(0.01)
3/5/2013	64	-1.78	0.35	3.82	3.81	3.66	3.72	3.74	2.2	3609300	-553	-1.803	0.0	-0.9	-0.8	0.0	3357	-498	2859	14.8%	0.13	3.61	3.80	0.19	0.05	-0.02	0.07
3/6/2013	65	0.72	0.42	3.88	3.88	3.80	3.87	3.87	3.5	878701	-299	-2.054	0.0	-1.5	-0.4	0.0	817	-269	548	32.9%	0.03	3.80	3.88	0.08	0.05	-0.01	0.06
3/7/2013	66	-0.05	0.38	3.98	3.98	3.94	3.98	3.96	2.9	2575253	-493	-0.482	0.0	0.3	-0.7	0.0	2395	-444	1951	18.5%	0.10	3.88	3.99	0.11	0.01	-0.02	0.03
3/8/2013	67	-1.49	0.37	4.11	4.11	3.97	4.02	3.99	3.2	1963499	-477	5.285	3.4	2.7	-0.6	0.0	1826	-429	1397	23.5%	0.07	3.99	3.93	(0.06)	(0.13)	-0.02	(0.11)
3/9/2013	68	1.20	0.34	4.10	4.10	3.95	3.98	3.98	1.1	4848842	-269	-1.608	0.0	-1.1	-0.4	0.0	4509	-242	4267	5.4%	0.18	3.93	3.98	0.05	(0.13)	-0.01	(0.12)
3/10/2013	69	3.21	0.46	4.24	4.21	4.07	4.07	4.06	0.2	3539869	-112	-1.053	0.0	-0.8	-0.2	0.0	3292	-101	3191	3.1%	0.13	3.98	4.14	0.16	0.03	0.00	0.03
3/11/2013	70	4.70	0.65	4.31	4.30	4.16	4.16	4.13	0.4	1617967	141	0.927	0.0	0.9	0.2	0.0	1505	127	1631	-8.4%	0.06	4.14	4.11	(0.03)	(0.09)	0.01	(0.09)
3/12/2013	71	7.81	0.75	4.27	4.31	4.17	4.18	4.11	1.1	664590	780	41.508	23.0	17.7	1.1	0.0	618	702	1320	-113.6%	0.02	4.11	4.10	(0.02)	(0.04)	0.03	(0.07)
3/13/2013	72	0.85	0.92	4.40	4.29	4.12	4.11	4.08	1.5	3056377	-179	9.151	0.1	11.9	-0.2	0.0	2842	-161	2682	5.7%	0.11	4.10	4.23	0.14	0.02	-0.01	0.03
3/14/2013	73	-3.50	2.42	4.53	4.41	4.27	4.26	4.22	4.2	3819575	-2173	-0.232	0.0	5.0	-3.0	0.0	3552	-1956	1596	55.1%	0.14	4.23	4.24	0.01	(0.13)	-0.08	(0.06)
3/15/2013	74	-1.56	2.43	4.45	4.41	4.25	4.27	4.23	2.3	1464257	-936	-1.587	0.0	2.1	-1.3	0.0	1362	-843	519	61.9%	0.05	4.24	4.23	(0.01)	(0.07)	-0.03	(0.03)
3/16/2013	75	-2.26	1.74	4.40	4.35	4.17	4.21	4.16	0.9	1138639	-451	0.020	1.4	1.7	-0.6	0.0	1059	-406	653	38.3%	0.04	4.23	4.12	(0.11)	(0.15)	-0.02	(0.13)
3/17/2013	76	-3.95	1.46	4.38	4.33	4.13	4.15	4.11	1.8	2905914	-891	-3.658	0.0	0.1	-1.2	0.0	2703	-802	1900	29.7%	0.11	4.12	4.19	0.07	(0.04)	-0.03	(0.01)
3/18/2013	77	-5.99	1.26	4.35	4.30	4.16	4.15	4.12	1.5	1732939	-768	5.706	0.0	9.5	-1.0	0.0	1612	-691	920	42.9%	0.06	4.19	4.17	(0.02)	(0.08)	-0.03	(0.05)
3/19/2013	78	-0.55	1.30	4.30	4.29	4.17	4.17	4.13	1.7	2126395	-283	2.400	11.8	-6.8	-0.4	0.0	1978	-255	1723	12.9%	0.08	4.17	4.16	(0.01)	(0.09)	-0.01	(0.08)
3/20/2013	79	-1.70	1.83	4.22	4.23	4.11	4.14	4.09	2.1	4100520	-917	-4.658	0.0	-1.1	-1.2	0.0	3813	-825	2988	21.6%	0.15	4.16	4.09	(0.07)	(0.22)	-0.03	(0.19)
3/21/2013	80	-4.91	1.55	4.23	4.25	4.09	4.13	4.10	1.5	3439149	-867	-4.166	0.0	-0.4	-1.2	0.0	3198	-781	2418	24.4%	0.13	4.09	4.16	0.07	(0.06)	-0.03	(0.03)
3/22/2013	81	-2.89	1.64	4.29	4.29	4.15	4.18	4.13	2.6	2566885	-1021	-4.414	0.0	-0.1	-1.4	0.0	2387	-919	1468	38.5%	0.10	4.16	4.18	0.02	(0.08)	-0.04	(0.04)
3/23/2013	82	-0.81	2.02	4.29	4.33	4.17	4.21	4.16	3.4	2728677	-1248	-4.937	0.0	-3.1	-1.7	0.0	2538	-1123	1414	44.3%	0.10	4.18	4.19	0.01	(0.09)	-0.04	(0.04)
3/24/2013	83	-0.55	2.54	4.41	4.36	4.14	4.20	4.17	1.8	4618579	-763	-3.677	0.0	-2.5	-1.0	0.0	4295	-687	3608	16.0%	0.17	4.19	4.23	0.04	(0.13)	-0.03	(0.11)
3/25/2013	84	0.32	2.13	4.35	4.36	4.16	4.20	4.18	1.9	2020886	-472	-2.590	0.6	-2.4	-0.6	0.0	1879	-425	1455	22.6%	0.07	4.23	4.18	(0.05)	(0.12)	-0.02	(0.11)
3/26/2013	85	1.65	2.37	4.36	4.33	4.12	4.15	4.12	1.9	3745654	-393	-2.523	0.0	-1.9	-0.5	0.0	3483	-354	3129	10.2%	0.14	4.18	4.21	0.03	(0.11)	-0.01	(0.09)
3/27/2013	86	1.24	3.47	4.49	4.40	4.20	4.23	4.19	2.1	4261815	-608	-1.736	0.2	-1.0	-0.8	0.0	3963	-547	3416	13.8%	0.16	4.21	4.32	0.10	(0.05)	-0.02	(0.03)
3/28/2013	87	1.99	3.92	4.46	4.41	4.22	4.27	4.24	2.7	2223586	-688	-1.842	0.0	-0.8	-0.9	0.0	2068	-619	1449	29.9%	0.08	4.32	4.26	(0.05)	(0.14)	-0.02	(0.11)
3/29/2013	88	2.98	3.72	4.47	4.39	4.17	4.21	4.19	2.0	2836197	-518	-1.258	0.0	-0.4	-0.7	0.0	2638	-466	2172	17.7%	0.11	4.26	4.33	0.07	(0.03)	-0.02	(0.02)
3/30/2013	89	3.51	4.37	4.66	4.55	4.30	4.31	4.30	1.2	5693038	-621	-1.378	0.0	-0.4	-0.8	0.0	5295	-559	4736	10.6%	0.21	4.33	4.48	0.14	(0.07)	-0.02	(0.04)
3/31/2013	90	3.49	4.43	4.57	4.49	4.25	4.26	4.23	0.4	2401154	-289	1.954	2.2	0.3	-0.4	0.0	2233	-260	1973	11.7%	0.09	4.48	-	(4.48)	(4.57)	-0.01	(4.56)