Appendix A. Current and historical Park Lake aerial views

Image from Google Earth, October 2016 (accessed 9 March 2016)

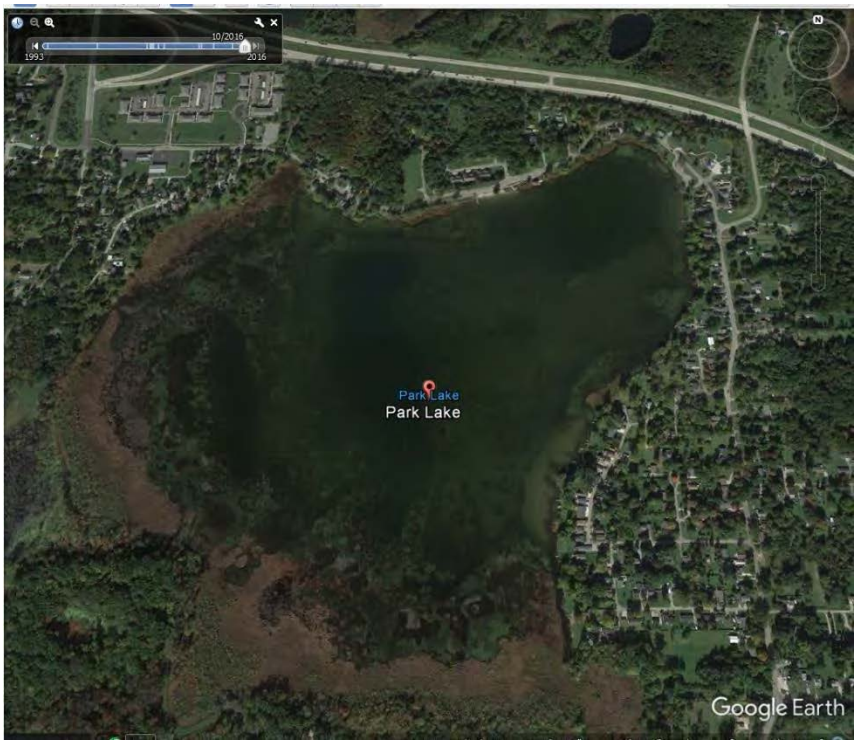


Image from Google Earth, April 2013 (accessed Feb 2015)

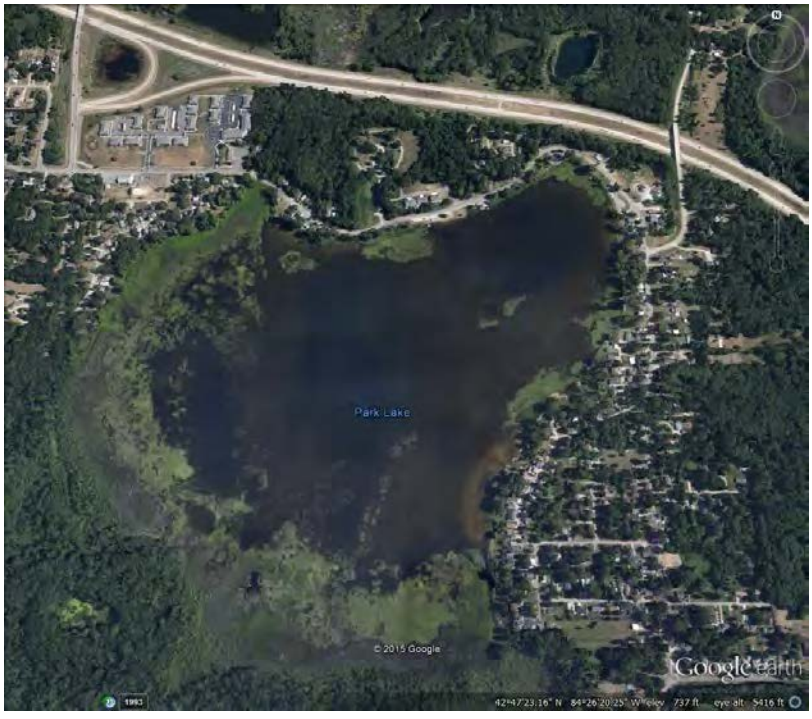
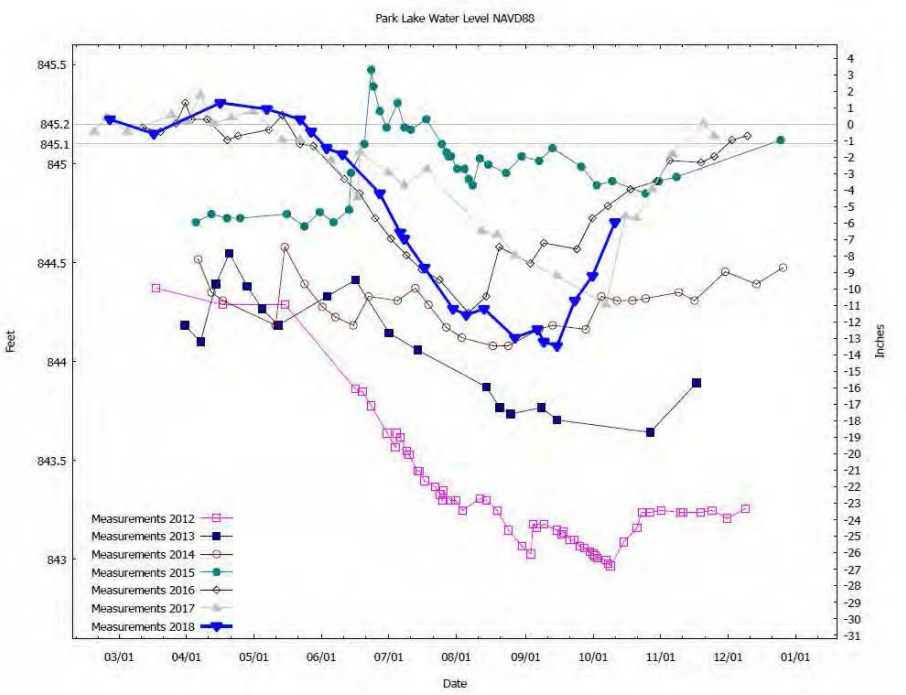
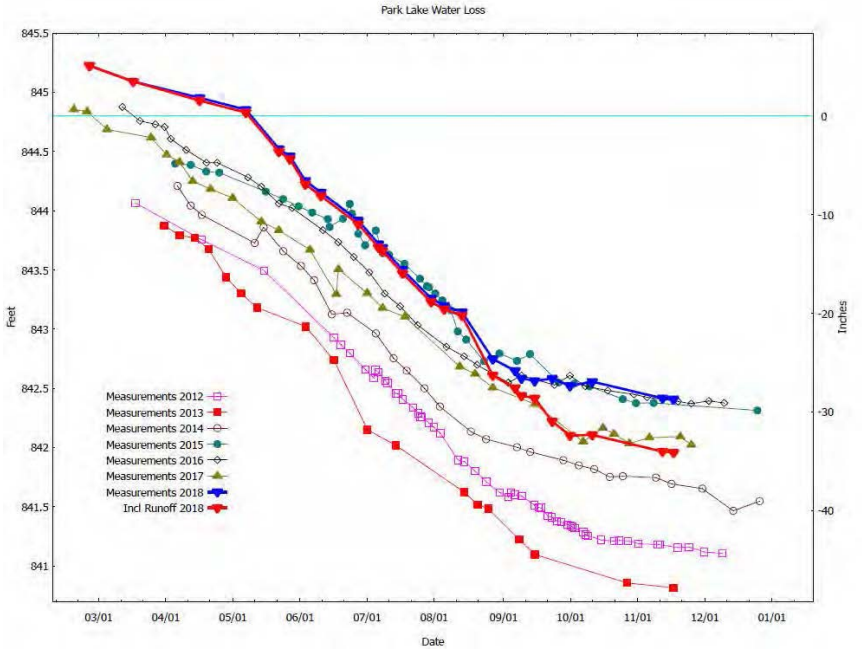


Image from Google Earth May 2005 (accessed Feb 2015)

Appendix B. Park Lake water levels and water loss (data provided by John Yurkon).





Appendix C. Park Lake water clarity, 2012 - 2018. The Secchi disk depth is the depth at which the disk disappears from sight as it is lowered into the lake. Deeper Secchi disk readings (meaning more negative numbers) indicate clearer water. Data collection sponsored by Friends of Park Lake. Data collected by Don Parkey, Dan Hayes, John Yurkon, Emily Galassini, J. B. McCombs and Corey Higley.

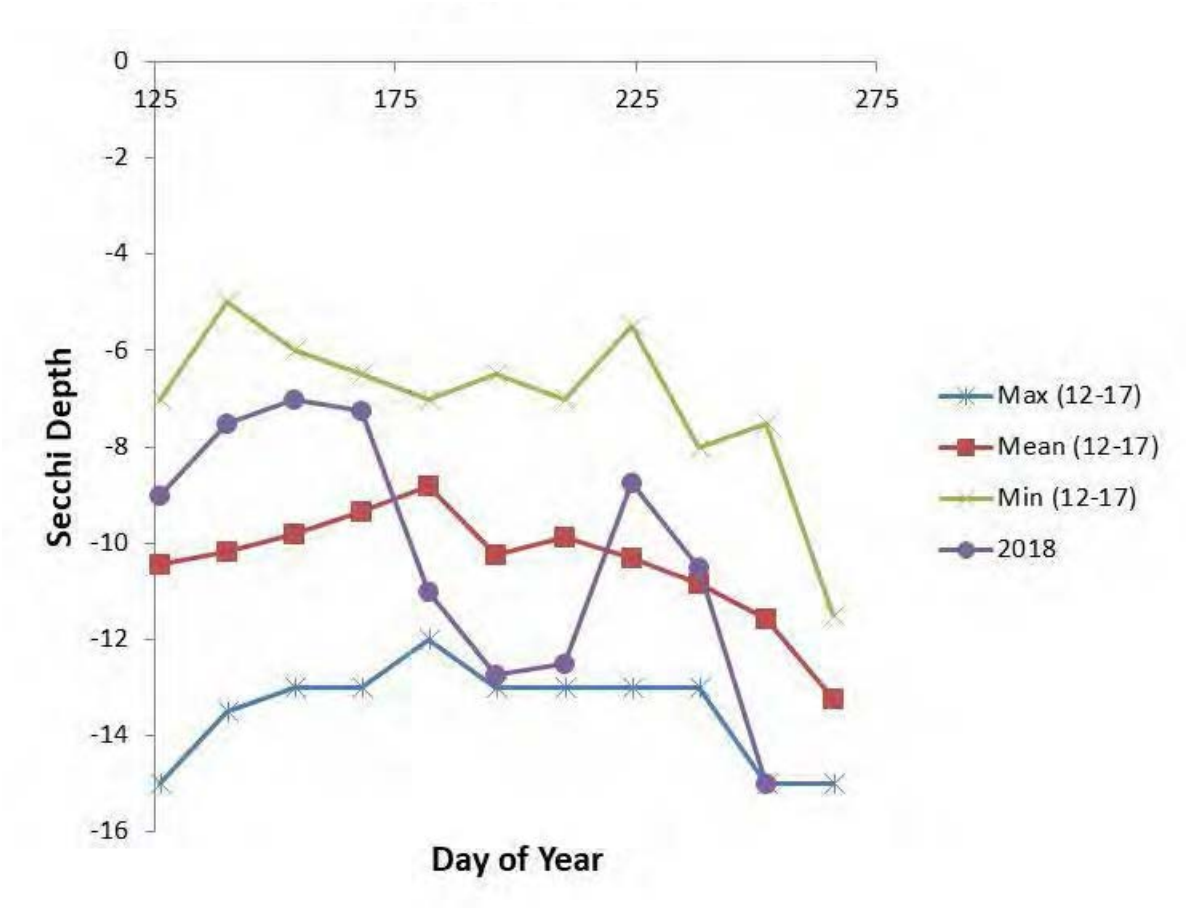


Table of mean Secchi clarity (ft), May 15 – Sept 15.

Year	Mean clarity (ft)
2012	9.8
2013	9.7
2014	11.1
2015	11.1
2016	8.5
2017	9.9
2018	10.1

Appendix D. Aquatic Plants observed in Park Lake as part of exotic plant watch survey as part of the Citizen's Lake Monitoring Program, Friends of Park Lake. Conducted by Don Parkey and Dan Hayes, 1 July 2012; Dan Hayes, Elle Gulotty, and Chaoqun Su 14 August and 8 September 2013; Dan Hayes, John Yurkon, Emi Fergus, Angela DePalma-Dow 4-6 August 2014; Dan Hayes, Hollie Lane, Tim Klifman, Erick Elgin, Dwight Washington 8-10 August 2016; Dan Hayes, Dwight Washington, Mike Vasievich 15 August, 2017; Dan Hayes, Hollie Lane, Gary Schafer 23 July, 2018.

		Percent of sites					
Common Name	Genus	2012	2013	2014	2016	2017	2018
Muskgrass	Chara	65%	71%	75%	83%	69%	71%
White water lily	Nymphaea	63%	32%	29%	31%	36%	45%
Pondweed	Potamogeton	60%	59%	86%	35%	77%	78%
Eelgrass	Valisneria	52%	71%	32%	33%	38%	22%
Bladderwort	Utricularia	33%	8%	39%	50%	21%	31%
* Eurasian water milfoil	Myriophyllum	29%	59%	21%	0%	15%	49%
Yellow water lily	Nuphar	17%	4%	11%	10%	3%	6%
* Spiny naiad	Najas (minor?)	8%	3%	0%	0%	5%	6%
Coontail	Ceratophyllum	4%	*	14%	0%	3%	8%
* Starry Stonewort	Nitellopsis	2%	26%	18%	65%	85%	80%
Bushy pondweed	Najas (gracillima?)	2%	45%	50%	0%	21%	12%
Native milfoil	Myriophyllum	*	8%	43%	6%	18%	33%
Elodea (?)	Elodea	0%	1%	0%	0%	3%	4%
Water bulrush (?)	Schoenoplectus subterminalis	-	-	18%	17%	15%	12%
Slender naiad	Najas flexilis	-	-	7%	0%	3%	4%

Notes:

* Non-native species highlighted in yellow.

Extensive growth of water lilies in all years prevented some areas with particularly heavy growth of white and yellow water lilies from being sampled, and thus may lead to an under estimate of the prevalence of these species.

Sampling in 2014 was focused somewhat on the southern and western side of the lake, and as such percentages may not be directly comparable to other years.

Appendix E. Map of starry stonewort distribution 2012-2017.

Starry Stonewort Distribution (red circles) 2012

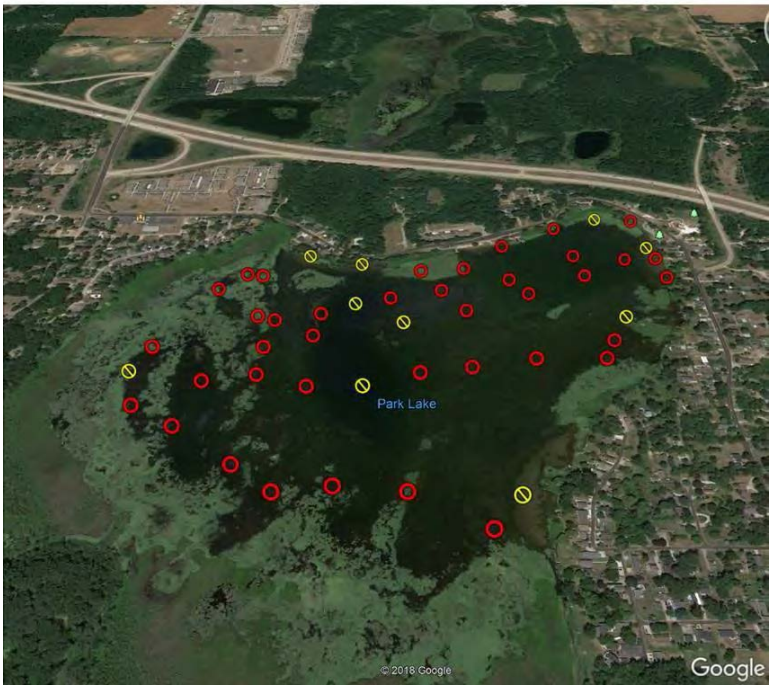
Starry Stonewort Distribution (red circles) 2013

Starry Stonewort Distribution (red circles) 2014

Starry Stonewort Distribution (red circles) 2016

Starry Stonewort Distribution (red circles) 2017

Starry Stonewort Distribution (red circles) 2018



Appendix F. Results of water quality sampling conducted by Friends of Park Lake as part of the MICorps program (Michigan Clean Water Corps)

Date Sampled		Phosphorus (ug P/L)
2006-09-16	Late Summer	18
2012-04-07	Spring Overturn	33
2012-09-15	Late Summer	22
2013-04-21	Spring Overturn	18
2013-09-12	Late Summer	15
2014-05-05	Spring Overturn	15
2014-09-22	Late Summer	15
2015-04-01	Spring Overturn	14
2015-09-21	Late Summer	13
2016-03-20	Spring Overturn	17
2016-09-19	Late Summer	17
2017-04-02	Spring Overturn	26
2017-09-19	Late Summer	13
2018-05-17	Spring Overturn	14
2018-09-15	Late Summer	17

Date Sampled	Chlorophyll (mg/L)
2013-05-19	< 1.0
2013-06-19	3.9
2013-07-11	4.3
2013-08-11	3.5
2013-09-12	2.8
2014-05-14	1.1
2014-06-18	3.3
2014-07-15	5.7
2014-08-13	3.1
2014-09-22	1.9
2015-06-15	2.4
2015-07-15	9.7
2015-08-19	2.1
2015-09-21	2.5
2016-05-11	4.9
2016-06-17	4.0
2016-07-13	1.0
2016-08-14	3.4
2016-09-18	4.2
2017-05-10	1.7
2017-06-17	<1.0
2017-07-11	1.1
2017-08-10	1.3
2017-09-14	<1.0
2018-05-16	4
2018-06-16	5.1
2018-07-11	3.1
2018-08-13	17.0
2018-09-11	1.8

Appendix G. Michigan DNR Fisheries Division prescription for Park Lake

Michigan Department of Natural Resources
Fisheries Division

Printed: 02/17/2011
Page: 1

FISHERY MANAGEMENT PRESCRIPTION

Watershed **Grand**
Sub-Watershed **Looking Glass River**

Water **PARK LAKE**

PRESCRIPTION IDENTIFICATION

Unit **Southern Lake Michigan**
Number **2330**
Date **01/05/2011**

WATER IDENTIFICATION

Primary County **Clinton**

Prepared By **Scott Hanshue**
Valid From **02/01/2011**
Expires **01/31/2017**
Status **Approved**
Replaces No. **1205**
Dated **11/22/2004**

T / R / S **05N 01W 29**

Area (Ac) **185.0**

Last Yr. Surveyed **2004**

I. PROBLEM/OPPORTUNITY LIST

1. Bluegills in Park Lake were historically very small with slow growth rates. Since the introduction of channel catfish the bluegill population size structure has improved. Opportunity to further improve the bluegill fishery and provide angling opportunities for channel catfish.

II. ACTION LIST AND SCHEDULE

		Begin Date	End Date	EA Excl	GL Issue	Mark/ Tag
A.	Continue to stock yearling channel catfish at the rate of 10/acre on an alternate year basis.	01/01/2011	12/31/2016	Y	N	N

III. EXPECTED RESULTS, BENEFITS, AND LONGEVITY

Park Lake is a 185 acre lake located in Clinton County east of the City of Lansing in an area with few fishing lakes. It has a maximum depth of 25 feet, but half of the lake is less than 5 feet deep. It has a long history of small, slow growing bluegills. In 1994, adult channel catfish were transferred into the lake to control the stunted bluegill population. This management action was followed by alternate year plants of yearling catfish starting in 1999. Since the introduction of channel catfish the growth rates of bluegill have increased and the population size structure has improved. Bluegill collected during the 2004 survey included ages 0-IX and ranged in size from one to eight inches. Bluegill growth rates were slightly less than the state average.

The 2004 survey also showed that other fish species are doing well. The channel catfish ranged in size from 8 to 27 inches. Largemouth bass caught were 3-15 inches and northern pike were 19-31 inches. Black crappies were 5-12 inches and pumpkinseed sunfish were 2-8 inches.

It is unlikely that the channel catfish will reproduce naturally. But the survival of the planted fish appears to be good and their introduction has had a positive effect on the fish community and the fishery. Continuation of the alternate year stocking is recommend to maintain the fishery.

IV. ALTERNATIVE ACTIONS AND REASONS NOT SELECTED

A. Discontinue stocking of yearling channel catfish.

Reason Not Selected:
The size structure of the bluegill population would decline and a popular channel catfish fishery would be lost.

V. RESOURCE REQUIREMENTS - Fish Stocking, Capital Outlay, Other

Activity	Cost (All Years)
Capital Outlay	$0.
Fish Stocking	$833.

FISHERY MANAGEMENT PRESCRIPTION

Watershed **Grand**
Water **PARK LAKE**
Sub-Watershed **Looking Glass River**

PRESCRIPTION IDENTIFICATION
Unit **Southern Lake Michigan**
Number **2330**
Date **01/05/2011**

WATER IDENTIFICATION
Primary County
Clinton

V. RESOURCE REQUIREMENTS - Fish Stocking, Capital Outlay, Other

Activity	Cost (All Years)
Other	$0.

VI. ENVIRONMENTAL CONSIDERATIONS

1. Threatened/Endangered Species	N	11. Farm and Forest Land	N
2. Designated Wild or Scenic Area	N	12. Federal Land	N
3. Historical	N	13. Habitat Alteration	N
4. Socio-Economic Considerations	N	14. Flood Plain	N
5. Public Opposition or Concern	N	15. Wetland	N
6. Health & Safety	N	16. Bottomland/Shoreland	N
7. Construction or Modification	N	17. Discharge	N
8. Toxicant	N	18. Energy	N
9. Species Introduction	N	19. Cumulative Impacts	N
10. Land Manager Approval Needed	N	20. State Forest Implication	N

VII. ENVIRONMENTAL ASSESSMENT

Prescription is Categorically Excluded (Y/N?):	Y
Public Involved and Supportive (Y/N?):	Y

VIII. COORDINATION OR OUTSIDE ASSISTANCE NEEDED (Specify and Describe)

Will need to coordinate with an out-of-state hatchery in St. Marys, Ohio.

IX. ATTACHMENTS

Stocking Request Number	984
E.A.R. (Y/N)	N
Public Involvement Plan (Y/N)	N
Maps (Y/N)	N
Plans (Y/N)	N
Other (List)	N/A

XI. APPROVALS

Approval Level	Approved By	Approval Date
FMU Approval	Jay Wesley	02/01/2011

FISHERY MANAGEMENT PRESCRIPTION

Watershed **Grand**
Sub-Watershed **Looking Glass River**

Water **PARK LAKE**

PRESCRIPTION IDENTIFICATION
Unit **Southern Lake Michigan**
Number **2330**
Date **01/05/2011**

WATER IDENTIFICATION
Primary County **Clinton**

PRESCRIPTION COMMENTS

FMU Review Comments — III. EXPECTED RESULTS, BENEFITS, AND LONGEVITY — SOM_waybrantj 01/10/2011 10:04:00

I recommend approval.

Statewide Comments — X. PRESCRIPTION COMMENTS — SOM_lesagec 01/27/2011 16:46:00

Sounds like a good plan. In other places, channel cat survival has been so good that eventually a stocking reduction has been needed because of the high predation on panfish. Just something to consider.

Statewide Comments — X. PRESCRIPTION COMMENTS — SOM_lesagec 01/28/2011 16:47:00

All set. I recommend approval.

Appendix H. Summary of fish seen or captured in Park Lake by MSU students in FW101L (Introduction to Fish and Wildlife Lab) and FW474 (Field Techniques in Fisheries and Limnology).

Fish Species	2011	2012	2013	2014	2015	2016	2017	2018
Bowfin	X		X	X	X		Not recorded	
Common Carp	X	Seen	X	Seen	Seen			X
Black chinned shiner					X			
Minnows		X	X	X		X		X
Golden Shiner	X				X			
Lake Chubsucker	X				X	X		
White Sucker					X	X		
Channel Catfish	Seen	Seen	X	Seen	X	X		X
Yellow Bullhead	X				X			X
Brown Bullhead					X	X		
Grass Pickerel	X		X	X	X	X		
Northern Pike	X	X			X	X		X
Largemouth Bass	X	X	X	X	X	X		X
Bluegill	X	X	X	X	X	X		X
Pumpkinseed	X	X	X	X	X	X		X
Warmouth	X	X	X	X	X	X		X
Black Crappie	X	X	X	X	X	X		X
Yellow Perch	X	X	X	X	X	X		X
Iowa Darter					X			

Appendix I. Roster of the Park Lake Advisory Board.

Year	Chair	Secretary	Committee Members
2012	Rick Price	Dan Hayes	Ray Kotke, Don Parkey, Leon Puttler, John Yurkon
2013	Dan Hayes	Cheryl Murphy	Ray Kotke, Don Parkey, Rick Price, Leon Puttler, John Yurkon
2014	Dan Hayes	Cheryl Murphy	Ray Kotke, Don Parkey, Rick Price, Leon Puttler, John Yurkon
2015	Dan Hayes	Emi Fergus	Ray Kotke, Don Parkey, Rick Price, Leon Puttler, John Yurkon
2016	Dan Hayes	Emi Fergus, Cheryl Murphy	Ray Kotke, Don Parkey, Rick Price, Leon Puttler, John Yurkon
2017	Dan Hayes	Cheryl Murphy	Ray Kotke, Don Parkey, Rick Price, Denise McCrimmon, John Yurkon
2018	Dan Hayes	Cheryl Murphy	Ray Kotke, Don Parkey, Rick Price, Denise McCrimmon, John Yurkon

Appendix J. Climatological record for Lansing area, 2018. Accessed through https://w2.weather.gov/climate/index.php?wfo=grr , selecting for annual climate report (CLA).

...THE LANSING MI CLIMATE SUMMARY FOR THE YEAR OF 2018...

CLIMATE NORMAL PERIOD 1981 TO 2010
CLIMATE RECORD PERIOD 1864 TO 2019

WEATHER	OBSERVED VALUE	DATE(S)	NORMAL VALUE	DEPART FROM NORMAL	LAST YEAR`S VALUE	DATE(S)
TEMPERATURE (F)						
RECORD						
HIGH	103	07/06/2012				
LOW	-37	02/02/1868				
HIGHEST	95	08/05	MM	MM	95	09/21
		07/04				06/12
LOWEST	-8	01/05	MM	MM	-9	12/28
AVG. MAXIMUM	57.7		57.5	0.2	59.9	
AVG. MINIMUM	40.0		39.1	0.9	40.9	
MEAN	48.9		48.3	0.6	50.4	
DAYS MAX >= 90	17		7.0	10.0	14	
DAYS MAX <= 32	44		51.0	-7.0	44	
DAYS MIN <= 32	154		131.0	23.0	114	
DAYS MIN <= 0	5		7.6	-2.6	6	
PRECIPITATION (INCHES)						
RECORD						
MAXIMUM	41.45	2013				
MINIMUM	27.75	2010				
TOTALS	37.77		31.77	6.00	39.62	
DAILY AVG.	0.10		0.09	0.01	0.11	
DAYS >= .01	148		136.8	11.2	142	
DAYS >= .10	76		69.0	7.0	78	
DAYS >= .50	25		19.3	5.7	23	
DAYS >= 1.00	6		5.2	0.8	7	
GREATEST						
24 HR. TOTAL	2.43	MM				
SNOWFALL (INCHES)						
RECORDS						
TOTAL	86.3	2008				
24 HR TOTAL	9.5	01/05/2014 TO 01/05/2014				
SNOW DEPTH	19	02/19/2014				
		02/18/2014				
TOTALS	48.7		51.1	-2.4	31.9	
SINCE 7/1	13.2		16.8	-3.6	17.8	
SNOWDEPTH AVG.	1		MM	MM	0	
DAYS >= TRACE	81		44.7	36.3	57	

DAYS >= 1.0	15		16.3	-1.3	11	
GREATEST						
SNOW DEPTH	11	02/12			8	12/16
		02/11				
24 HR TOTAL	6.6	MM				
DEGREE_DAYS						
HEATING TOTAL	6670		6711	-41	6004	
SINCE 7/1	MM		2552	MM	MM	
COOLING TOTAL	922		623	299	782	
SINCE 1/1	922		625	297	782	

FREEZE DATES			
RECORD			
EARLIEST	08/03/1894		
LATEST	07/15/1863		
EARLIEST		10/01	
LATEST		05/10	

WIND (MPH)			
AVERAGE WIND SPEED		8.4	
RESULTANT WIND SPEED/DIRECTION		2/246	
HIGHEST WIND SPEED/DIRECTION		44/250	DATE 05/04
HIGHEST GUST SPEED/DIRECTION		63/230	DATE 05/09

SKY COVER	
POSSIBLE SUNSHINE (PERCENT)	MM
AVERAGE SKY COVER	0.50
NUMBER OF DAYS FAIR	143
NUMBER OF DAYS PC	100
NUMBER OF DAYS CLOUDY	122

AVERAGE RH (PERCENT)	74

- INDICATES NEGATIVE NUMBERS.
R INDICATES RECORD WAS SET OR TIED.
MM INDICATES DATA IS MISSING.
T INDICATES TRACE AMOUNT.

Appendix K. Water quality testing results from samples collected in 2014, 2016, 2017, and 2018.

Date	Geometric Mean E. coli /100 ml
11 June 2014	75.2
6 July 2016	53.0
27 June 2017	32.9
5 July 2018	89.9

Environmental &Molecular Microbiology Laboratory

MICHIGAN STATE UNIVERSITY

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Summary Report: July 6, 2018 *Esherichia coli (E.coli)*

Sample ID	Site Location	Date Collected	Organism	Total Organisms Detected MPN/100ml	95% confidence interval	
					Lower	Upper
1	Park Lake Beach - Right	7-5-2018	*E.coli*	107.1	78.5	142.7
2	Park Lake Beach - Center	7-5-2018	*E.coli*	67.0	47.7	91.5
3	Park Lake Beach - Left	7-5-2018	*E.coli*	101.4	74.3	136.1

[a] " > " symbol indicates that the concentration of the sample exceeds the detection maximum of the method.

Note: DEQ guidance is that water is safe for swimming as long as no count is greater than 300, and the geometric mean less than 130. http://www.michigan.gov/deq/0,4561,7-135-3313_3681_3686_3730-11005--,00.html

Appendix L. Approximate annual payments for Park Lake management by Bath Township

Year	Cost	Notes
2009	$9,731	Includes plant harvesting and vegetation survey, but not DEQ permit
2010	$17,069	Includes plant harvesting and vegetation survey, and DEQ permit
2011	$11,097	Itemized listing not available
2012	$10,888	Includes treatment, vegetation suvery, and DEQ permit
2013	$15,767	Includes treatment, vegetation suvery, and DEQ permit
2014	$15,630	Includes treatment, vegetation suvery, and DEQ permit
2015	$7,338	Includes treatment, vegetation suvery, and DEQ permit
2016	$20,409	Includes regular treatment plus whole-lake milfoil treatment, veg. survey, and DEQ permit
2017	$3,352	Includes treatment, vegetation suvery, but not DEQ permit. Costs much lower due to whole lake treatment previous year
2018	$6,303	Includes costs of treatment, vegetation survey, and DEQ permit paid to PLLM, and cost of lake survey by Restorative Lake Sciences.
2019	$25,000	Township budget allocated

Appendix M. Water temperature and dissolved oxygen profiles, 15 August 2018. Sampling conducted by Daniel Hayes and Susan Macias.

Deep Site: Latitude 42.790961 Longitude 84.441035					
	Dissolved Oxygen (ppm)			Temperature (°F)	
Depth (ft)	6:00 AM	6:00 PM		6:00 AM	6:00 PM
0	8.5	8.9		79.3	82.8
-3	8.4	8.7		80.4	82.8
-6	8.2	8.6		80.8	82.4
-9	5.3	4.7		79.7	79.9
-12	0.2	0.3		75.4	76.5
-15	0			71.4	
Shallow Site: Latitude 42.792083 Longitude 84.435203					
	Dissolved Oxygen (ppm)			Temperature (°F)	
Depth (ft)	6:00 AM	6:00 PM		6:00 AM	6:00 PM
0	9.3	10.1		80.8	82.8
-3	9.2	10.9		81.5	82.9