

**The Potential Occurrence of Zebra Mussel, *Dreissena polymorpha*,
in Inland Lakes in Michigan**

Prepared for Michigan Sea Grant Extension

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When zebra mussels appeared in the Great Lakes, the possibilities of changes in the ecosystem caused widespread concern. Although zebra mussels have successfully invaded Michigan's Great Lakes, adults have been found in only 14 lakes as of November 1994. The purpose of this study was to determine which of Michigan's inland lakes have the potential of being invaded by the zebra mussel.

Researchers found that pH and calcium are the determining factors that best predict the appearance of the species in fresh water lakes (Ramcharan et al. 1992). Areas high in calcium (i.e., 10 to 12 milligrams per liter), which is needed for shell production, and water with pH values above 6.5, support growth of zebra mussels. The mollusc cannot survive in areas that do not meet these requirements because of the negative effect on its metabolism.

The study used a model developed by Ramcharan et al. (1992) which predicts occurrence using the following equation:

$$A = 1.246[\text{pH}] + 0.045[\text{Ca}] - 11.696$$

The model predicts the presence of zebra mussels if $A > -0.638$ and has an overall success rate of 73.3 percent when estimating the absence or presence of zebra mussels in lakes.

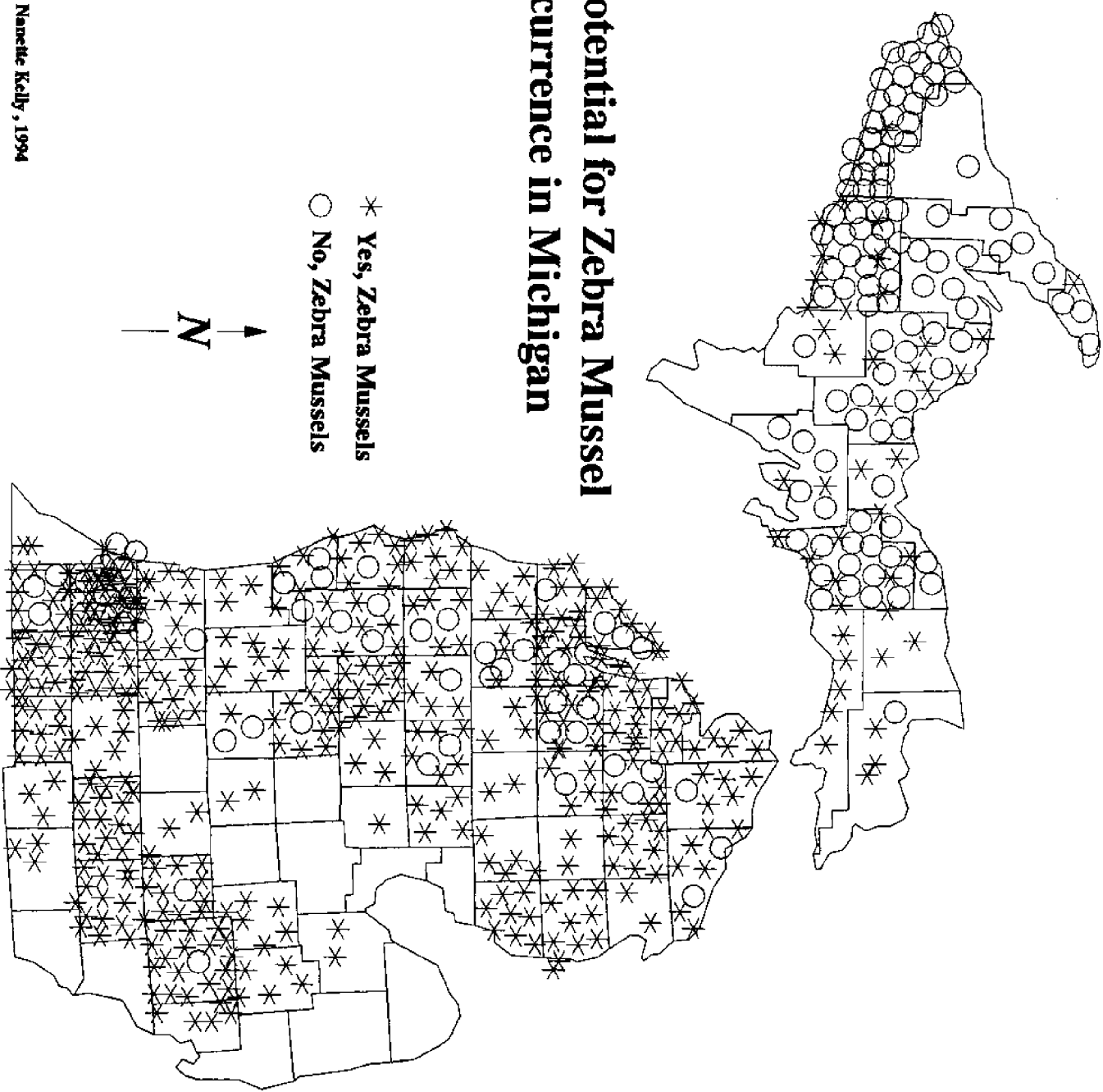
The model was used with STORET data from the Environmental Protection Agency which provided total calcium in (mg tot Ca/L) and pH data for 600 lakes from both Upper and Lower Michigan. This sample represents almost six percent of the 11,000 lakes in Michigan. Note, that this study could not take into account that pH can change significantly during a season and even during one day. Instead, pH levels measured early in the season or early in the day, and nearest to the surface of the water, were selected.

The study results indicate that 443, or 74 percent, of the 600 lakes have the potential of being invaded by the zebra mussel (refer to attachment for details).

LITERATURE CITED

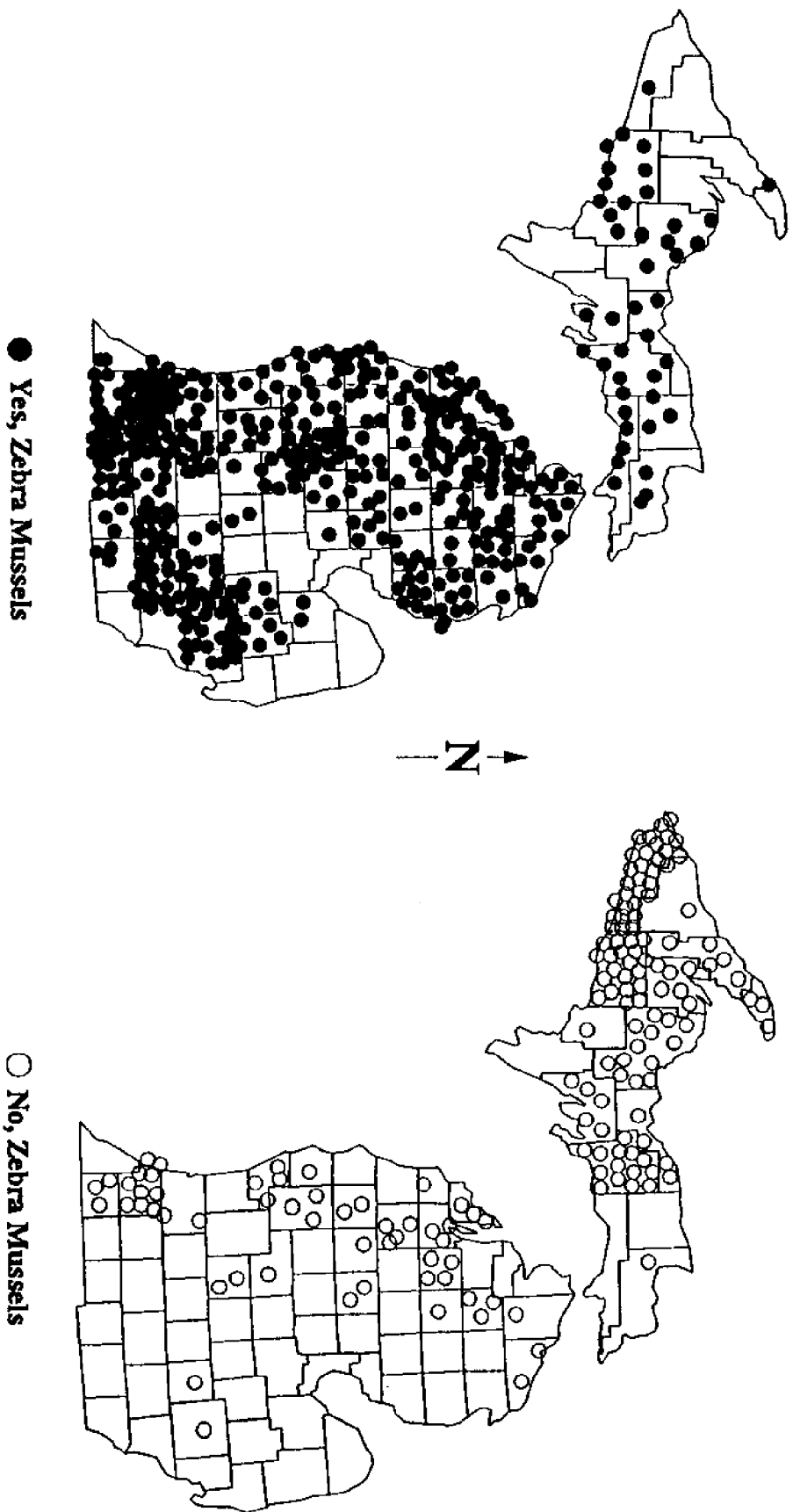
- Ramcharan, C. W., and D. K., Padilla. 1992. Models to predict potential occurrence and density of the zebra mussel, *Dreissena polymorpha*. *Ca, J. Fish. Aquat. Sci.* 49: 2611-2620.

The Potential for Zebra Mussel Occurrence in Michigan



Nanette Kelly, 1994

The Potential for Zebra Mussel Occurrence in Michigan



APPENDIX

POTENTIAL ZEBRA MUSSEL OCCURRENCE

Lake	County	pH	Tot Ca	A	Potential Occurrence	Y=yes N=no
ALCONA DAM POND	ALCONA	8.2	40	0.3212	Y	
CEDAR	ALCONA	8.5	37.7	0.5915	Y	
CROOKED	ALCONA	8.6	25.5	0.1671	Y	
HORTH	ALCONA	8.2	23.8	-0.4078	Y	
HUBBARD	ALCONA	8.3	39.5	0.4233	Y	
HUBBARD	ALCONA	8.2	43.7	0.4877	Y	
JEWELL	ALCONA	8.7	30	0.4942	Y	
OBRIEN	ALCONA	8	49.1	0.4815	Y	
VAIGHN	ALCONA	8.3	28	-0.0942	Y	
AUTRAIN	ALGER	8.5	26.8	0.101	Y	
BEATON	ALGER	8.3	20.7	-0.4227	Y	
BEAVER	ALGER	7.9	24	-0.7726	N	
CHAPEL	ALGER	7.9	23	-0.8176	N	
GRAND SABLE	ALGER	8.3	13.8	-0.7332	N	
KINGSTON	ALGER	7.2	12	-2.1848	N	
BASELINE	ALLEGAN	7.9	40	-0.0526	Y	
BIG LAKE	ALLEGAN	7.7	20	-1.2018	N	
DUCK	ALLEGAN	7.8	30	-0.6272	Y	
EAGLE	ALLEGAN	7.9	30	-0.5026	Y	
HUTCHINS	ALLEGAN	8.1	35	-0.0284	Y	
KALAMAZOO	ALLEGAN	8.45	52.1	1.1772	Y	
LAKE ALLEGAN	ALLEGAN	8.2	48.8	0.7172	Y	
LOWER SCOTT	ALLEGAN	7.9	20	-0.9526	N	
MINER	ALLEGAN	7.4	55	-0.0006	Y	
OSTERHOUT	ALLEGAN	8.1	30	-0.2534	Y	
SWAN CREEK POND	ALLEGAN	8.1	35	-0.0284	Y	
BEAVER	ALPENA	8.3	38.4	0.3738	Y	
FLETCHER POND	ALPENA	8.3	42.5	0.5583	Y	
BELLAIRE	ANTRIM	8.3	41.3	0.5043	Y	
BIRCH	ANTRIM	8.5	34	0.425	Y	
CLAM	ANTRIM	7.7	45	-0.0768	Y	
EATON	ANTRIM	7.8	40	-0.1772	Y	
ELK	ANTRIM	8.2	38.3	0.2447	Y	
LAKE OF THE WOODS	ANTRIM	7.8	30	-0.6272	Y	
TORCH	ANTRIM	8.4	35	0.3454	Y	
WILSON	ANTRIM	8.1	41	0.2416	Y	
ASSININS WETLAND (POND)	BARAGA	7.6	11	-1.7314	N	
BEAUFORT	BARAGA	7.7	6.2	-1.8228	N	
KING	BARAGA	7.5	3.4	-2.198	N	
PARENT	BARAGA	6.1	10	-3.6454	N	
PRICKETT DAM BACKWATER	BARAGA	6.8	30	-1.8732	N	
VERMILAC	BARAGA	7.5	3.5	-2.1935	N	
BARLOW	BARRY	8.7	36.6	0.7912	Y	
CHIEF	BARRY	8	40	0.072	Y	
CROOKED	BARRY	8.3	33.4	0.1488	Y	
DEEP	BARRY	8.5	41.4	0.758	Y	
DUNCAN	BARRY	8.5	70	2.045	Y	
FINE	BARRY	8.6	29.9	0.3651	Y	

GUN	BARRY	8.4	35	0.3454	Y
JORDAN	BARRY	7.9	56	0.6674	Y
THORNAPPLE	BARRY	8.1	52.3	0.7501	Y
BIG PLATTE	BENZIE	7.9	44	0.1274	Y
CRYSTAL	BENZIE	8.2	37.6	0.2132	Y
HEREMDEEME	BENZIE	8.9	26.1	0.5679	Y
LAKE ANN	BENZIE	8.2	41	0.3662	Y
LOWER HERRING	BENZIE	8.6	39.5	0.7971	Y
STEVENS	BENZIE	8.1	3.9	-1.4279	N
TURTLE	BENZIE	9	20.8	0.454	Y
UPPER HERRING	BENZIE	8.4	43.2	0.7144	Y
PAW PAW	BERRIEN	8.6	33.5	0.5271	Y
COLDWATER	BRANCH	8.3	41.9	0.5313	Y
CRAIG	BRANCH	8.3	56.5	1.1883	Y
EAST LONG	BRANCH	8.6	60.4	1.7376	Y
MARBLE	BRANCH	7.7	77.4	1.3812	Y
MATTESON	BRANCH	8	55	0.747	Y
MORRISON	BRANCH	8.4	55.6	1.2724	Y
NORTH	BRANCH	7.85	58.5	0.7176	Y
RANDALL	BRANCH	8.9	56.6	1.9404	Y
SILVER	BRANCH	8.2	40	0.3212	Y
UNION	BRANCH	8.9	39.7	1.1799	Y
DUCK	CALHOUN	8.2	30	-0.1288	Y
GOUGAC	CALHOUN	8.2	30	-0.1288	Y
HOMER	CALHOUN	9.2	41.3	1.6257	Y
WABASCON	CALHOUN	7.55	60	0.4113	Y
WINNIPEG	CALHOUN	8	51.4	0.585	Y
BELAS	CASS	7.45	35	-0.8383	N
BIRCH	CASS	8.2	35	0.0962	Y
CHRISTIANA	CASS	8	50	0.522	Y
DIAMOND	CASS	7.3	30	-1.2502	N
DONNELL	CASS	7.7	35	-0.5268	Y
HARWOOD	CASS	8.1	30	-0.2534	Y
JUNO	CASS	8.1	50	0.6466	Y
KIRK	CASS	8	46.4	0.36	Y
NORTH TWIN	CASS	7.9	30	-0.5026	Y
PARADISO	CASS	7.7	40	-0.3018	Y
SHAVERHEAD	CASS	8.5	43.3	0.8435	Y
STONE	CASS	8.1	20	-0.7034	N
DEER	CHARLEVOIX	8.6	39.4	0.7926	Y
HOFFMAN	CHARLEVOIX	8.1	40	0.1966	Y
LAKE CHARLEVOIX	CHARLEVOIX	8.2	43.7	0.4877	Y
SIX MILE	CHARLEVOIX	7.8	50	0.2728	Y
SUSAN	CHARLEVOIX	8.5	30	0.245	Y
THUMB	CHARLEVOIX	8.4	35	0.3454	Y
WALLOON	CHARLEVOIX	8.2	35	0.0962	Y
BLACK	CHEBOYGAN	8.4	38.8	0.5164	Y
BURT	CHEBOYGAN	8.4	40	0.5704	Y
LANCASTER	CHEBOYGAN	8.3	40	0.4458	Y
LONG	CHEBOYGAN	7.9	26.8	-0.6466	N
MULLETT	CHEBOYGAN	8.2	40.4	0.3392	Y
SILVER	CHEBOYGAN	8.5	30	0.245	Y
CARIBOU	CHIPPEWA	8.3	18.8	-0.5082	Y
CARP	CHIPPEWA	8.35	30.5	0.0806	Y

SHELLDRAKE	CHIPPEWA	7.9	6.7	-1.5511	N
BIG LONG	CLARE	8.5	25	0.02	Y
BUDD	CLARE	8.5	34.7	0.4565	Y
CRANBERRY	CLARE	8	20	-0.828	N
FIVE LAKES	CLARE	8.05	35	-0.0907	Y
LILY	CLARE	9.2	12	0.3072	Y
MUD	CLARE	8	16.6	-0.981	N
PERCH	CLARE	8.8	12	-0.1912	Y
WINDOVER	CLARE	8.4	25	-0.1046	Y
LAKE OVID	CLINTON	8.2	56.1	1.0457	Y
PARK	CLINTON	8.7	45.8	1.2052	Y
JONES	CRAWFORD	7.9	39.4	-0.0796	Y
LK MARGRETHE	CRAWFORD	8.4	38.1	0.4849	Y
SECTION ONE	CRAWFORD	8	25	-0.603	Y
SHUPAC	CRAWFORD	8.4	27.8	0.0214	Y
CAMP	DELTA	7.5	9.6	-1.919	N
CORNER	DELTA	8.3	28	-0.0942	Y
JACK PINE	DELTA	7.4	8.2	-2.1066	N
PEACOCK	DELTA	7.8	18.7	-1.1357	N
ROUND	DELTA	8.3	11.9	-0.8187	N
SKEELS	DELTA	8.7	27.7	0.3907	Y
SPRING	DELTA	8	20.5	-0.8055	N
LAKE ANTOINE	DICKINSON	8.6	23	0.0546	Y
PARLEMEE	DICKINSON	8.3	21.4	-0.3912	Y
SAWYER	DICKINSON	7.8	3.1	-1.8377	N
CROOKED	EMMET	8.4	40	0.5704	Y
LARKS	EMMET	8.6	20	-0.0804	Y
PARADISE	EMMET	8.2	30	-0.1288	Y
PICKERAL	EMMET	8.3	40	0.4458	Y
ROUND	EMMET	8.7	25	0.2692	Y
CS MOTT IMP.	GENESEE	8.5	60	1.595	Y
FENTON	GENESEE	8.2	37	0.1862	Y
HOLLOWAY RES.	GENESEE	8	62.1	1.0665	Y
LK PONEMAH	GENESEE	7.7	40	-0.3018	Y
LOBDELL	GENESEE	8.5	24.4	-0.007	Y
THREAD	GENESEE	8.4	65	1.6954	Y
LAKE FOUR	GLADWIN	8.2	37.3	0.1997	Y
PRATT	GLADWIN	8.8	30	0.6188	Y
SECORD	GLADWIN	8.9	45	1.4184	Y
WIGGINS	GLADWIN	8.6	50.3	1.2831	Y
WIXOM	GLADWIN	8.5	45	0.92	Y
ALLEN	GOGEBIC	7.7	2	-2.0118	N
BASS	GOGEBIC	7.9	7	-1.5376	N
BEATPMS	GOGEBIC	7.1	6	-2.5794	N
BLACK R	GOGEBIC	7.7	7.1	-1.7823	N
BOBCAT	GOGEBIC	6.7	8	-2.9878	N
CHANEY	GOGEBIC	7.9	17	-1.0876	N
CISCO	GOGEBIC	7.5	11	-1.856	N
CLARK	GOGEBIC	6.6	1.3	-3.4139	N
CLEARWATER	GOGEBIC	6.4	5	-3.4966	N
DINNER	GOGEBIC	8.1	5	-1.3784	N
DUCK	GOGEBIC	8	5	-1.503	N
EEL	GOGEBIC	9	14	0.148	Y
HELEN	GOGEBIC	6.1	1.3	-4.0369	N

HENRY	GOGEBIC	5.7	1	-4.5488	N
IMP	GOGEBIC	6.3	1	-3.8012	N
KING	GOGEBIC	5.8	2.2	-4.3702	N
LITTLE OXBOW	GOGEBIC	7.3	4	-2.4202	N
LK GOGEBIC	GOGEBIC	7.8	8.4	-1.5992	N
LK LANGFORD	GOGEBIC	8	8.8	-1.332	N
LK POMEROY	GOGEBIC	8.45	9.6	-0.7353	N
MARION	GOGEBIC	7.6	3	-2.0914	N
MCDONALD	GOGEBIC	6.5	9	-3.192	N
MOON	GOGEBIC	7.8	2	-1.8872	N
MOOSEHEAD	GOGEBIC	7.5	17	-1.586	N
MORAINÉ	GOGEBIC	7	8	-2.614	N
ORMES	GOGEBIC	5.3	1	-5.0472	N
POMEROY	GOGEBIC	7.5	10.2	-1.892	N
QUEEN	GOGEBIC	5.8	2.4	-4.3612	N
SNAP JACK	GOGEBIC	6.1	1.4	-4.0324	N
SUNDAY	GOGEBIC	7.4	7	-2.1606	N
TAYLOR	GOGEBIC	7.8	5	-1.7522	N
THOUSAND ISL	GOGEBIC	7.5	13	-1.766	N
ARBUTUS	GRAND TRAVERSE	8.2	41.2	0.3752	Y
BASS	GRAND TRAVERSE	8.2	13	-0.8938	N
BOARDMAN	GRAND TRAVERSE	8.3	45	0.6708	Y
BREWSTER	GRAND TRAVERSE	8.4	45	0.7954	Y
BROWN BRIDGE POND	GRAND TRAVERSE	8.5	40	0.695	Y
CEDAR	GRAND TRAVERSE	8.4	45	0.7954	Y
DUCK	GRAND TRAVERSE	8.55	35	0.5323	Y
ELK	GRAND TRAVERSE	8.2	37	0.1862	Y
ELLIS	GRAND TRAVERSE	8.4	36.3	0.4039	Y
FIFE	GRAND TRAVERSE	8.2	40	0.3212	Y
FISH	GRAND TRAVERSE	7.4	24	-1.3956	N
GRASS	GRAND TRAVERSE	7.7	38	-0.3918	Y
GREEN	GRAND TRAVERSE	8.6	34	0.5496	Y
ISLAND	GRAND TRAVERSE	8	19.9	-0.8325	N
LONG	GRAND TRAVERSE	8.2	23	-0.4438	Y
PRESCOTT	GRAND TRAVERSE	8	29	-0.423	Y
RENNIE	GRAND TRAVERSE	8.6	29	0.3246	Y
SAND	GRAND TRAVERSE	8.7	39	0.8992	Y
SILVER	GRAND TRAVERSE	8.4	29	0.0754	Y
SKEGEMOG	GRAND TRAVERSE	8.4	41.6	0.6424	Y
SPIDER	GRAND TRAVERSE	8.5	29	0.2	Y
BAW BEESE	HILLSDALS	8.1	30	-0.2534	Y
BIRD	HILLSDALS	8.1	45	0.4216	Y
CUB	HILLSDALS	7.4	40	-0.6756	N
ROUND	HILLSDALS	8.55	35	0.5323	Y
BOB	HOUGHTON	6	2	-4.13	N
BOSTON	HOUGHTON	6.5	20	-2.697	N
PORTAGE	HOUGHTON	7.9	12.3	-1.2991	N
RICE	HOUGHTON	7.6	4.1	-2.0419	N
SANDY	HOUGHTON	4.5	3	-5.954	N
LK LANSING	INGHAM	8.5	43	0.83	Y
LONG	IONIA	7.75	29	-0.7345	N
MORRISON	IONIA	8.6	65	1.9446	Y
WOODARD	IONIA	8.1	20	-0.7034	N
FOOTE DAM POND	IOSCO	8.3	40	0.4458	Y

LONDO	IOSCO	8.2	30	-0.1288	Y
LOON	IOSCO	8.15	27.8	-0.2901	Y
LOUD DAM POND	IOSCO	8.3	40	0.4458	Y
ROUN	IOSCO	8.4	25	-0.1046	Y
SAND	IOSCO	8.7	25	0.2692	Y
TAWAS	IOSCO	8.3	40	0.4458	Y
VAN ETTEN	IOSCO	8.5	31.8	0.326	Y
BASS	IRON	7.4	5	-2.2506	N
BRULE	IRON	8.7	10	-0.4058	Y
BUCK	IRON	8.2	15	-0.8038	N
CABLE	IRON	7.4	9	-2.0706	N
CAMP	IRON	9.1	23	0.6776	Y
CHICAGON	IRON	8.5	24.6	0.002	Y
DEER	IRON	7.6	15	-1.5514	N
FIRST FORTUNE	IRON	8.15	25	-0.4161	Y
GIBSON	IRON	6.9	2	-3.0086	N
GOLDEN	IRON	6	2	-4.13	N
HAGER,AM	IRON	8.5	13.7	-0.4885	Y
HANNAH WEBB	IRON	5.6	1	-4.6734	N
IRON	IRON	7.3	8	-2.2402	N
JAMES	IRON	4.6	2	-5.8744	N
KIDNEY	IRON	7.4	11	-1.9806	N
LITTLE SMOKY	IRON	6.7	2	-3.2578	N
MICHIGAMME RES.	IRON	7.55	6.9	-1.9782	N
NORWAY	IRON	4.9	1	-5.5456	N
OTTAWA	IRON	8.9	24	0.4734	Y
PERCH	IRON	8	9.9	-1.2825	N
RUNKLE	IRON	7.8	7	-1.6622	N
SMOKY	IRON	7.8	3.3	-1.8287	N
STAGER	IRON	8.6	26	0.1896	Y
STANLEY	IRON	9	21	0.463	Y
SWAN	IRON	7.8	19	-1.1222	N
TAMARACK	IRON	8.4	12	-0.6896	N
TEEPEE	IRON	5.4	1	-4.9226	N
WINSLOW	IRON	7.1	12	-2.3094	N
HALLS	ISABELLA	9	20	0.418	Y
LITTLEFIELD	ISABELLA	8.35	45.7	0.7646	Y
STEVENSON	ISABELLA	8.05	50	0.5843	Y
CENTER	JACKSON	8.1	30	-0.2534	Y
CLARK	JACKSON	7.9	30	-0.5026	Y
CRISPELL	JACKSON	7.9	35	-0.2776	Y
GILLETTS	JACKSON	8	25	-0.603	Y
GRASS	JACKSON	8	30	-0.378	Y
PLEASANT	JACKSON	7.85	32.8	-0.4389	Y
PORTAGE	JACKSON	7.8	39.3	-0.2087	Y
ROUND	JACKSON	8.1	30	-0.2534	Y
SWAINS	JACKSON	7.8	40	-0.1772	Y
S. LIME	JACKSON	8	50	0.522	Y
VANDERCOOK	JACKSON	8	60	0.972	Y
VINEYARD	JACKSON	7.7	40	-0.3018	Y
WAMPLERS	JACKSON	8.5	35	0.47	Y
AUSTIN	KALAMAZOO	9.3	20	0.7918	Y
BARTON	KALAMAZOO	8	55.5	0.7695	Y
EAGLE	KALAMAZOO	8.5	51.3	1.2035	Y

EAGLE	KALAMAZOO	8.9	12	-0.0666	Y
GULL	KALAMAZOO	8.3	40	0.4458	Y
INDIAN	KALAMAZOO	8.6	50.1	1.2741	Y
LONG	KALAMAZOO	8.2	31.1	-0.0793	Y
MORROW	KALAMAZOO	8.05	80	1.9343	Y
PAW PAW	KALAMAZOO	8.6	45	1.0446	Y
PORTAGE	KALAMAZOO	8.5	48.6	1.082	Y
RUPPERT	KALAMAZOO	8.5	58.9	1.5455	Y
SUGARLOAF	KALAMAZOO	8.3	40	0.4458	Y
WEST	KALAMAZOO	8.7	29.4	0.4672	Y
WHITFORD	KALAMAZOO	8.4	38.4	0.4984	Y
BIG BLUE	KALKASKA	8.2	42.3	0.4247	Y
BIG GUERNSEY	KALKASKA	8.45	30	0.1827	Y
BIG TWIN	KALKASKA	8.3	30.4	0.0138	Y
BLUE	KALKASKA	8.2	4	-1.2973	N
CUB	KALKASKA	8.55	25	0.0823	Y
EAST	KALKASKA	6.25	4	-3.7285	N
INDIAN	KALKASKA	8.4	19	-0.3746	Y
MANISTEE	KALKASKA	7.8	25	-0.8522	N
PICKERAL	KALKASKA	8.3	25	-0.2292	Y
STARVATION	KALKASKA	7.8	17.5	-1.1897	N
BAILEY	KEEWENAW	7.8	40	-0.1772	Y
GRATIOT	KEEWENAW	8	6.6	-1.431	N
LAC LA BELLE	KEEWENAW	7.7	6.7	-1.8003	N
THAYERS	KEEWENAW	6.9	20	-2.1986	N
BASS	KENT	8.6	20	-0.0804	Y
BIG PINE	KENT	8.6	30	0.3696	Y
BIG WABASIS	KENT	8.6	40	0.8196	Y
CAMP	KENT	8.7	30	0.4942	Y
CAMPBELL	KENT	8.7	30	0.4942	Y
LIME	KENT	8.5	41.9	0.7805	Y
LINCOLN	KENT	7.65	40.6	-0.3371	Y
PRATT	KENT	8.3	36.1	0.2703	Y
BIG BASS	LAKE	8.7	24	0.2242	Y
BIG STAR	LAKE	8.1	15.7	-0.8969	N
HARPER	LAKE	8.7	30	0.4942	Y
IDLEWILD	LAKE	8.8	30	0.6188	Y
PARADISE	LAKE	8.8	16.3	0.0023	Y
REED	LAKE	9	26.1	0.6925	Y
WOLF	LAKE	6	4.5	-4.0175	N
BIG FISH	LAPEER	8.4	30	0.1204	Y
DAVIDSON	LAPEER	8.7	30	0.4942	Y
LAKE MINNEWANNA	LAPEER	8.5	59.8	1.586	Y
OTTER	LAPEER	8.6	25	0.1446	Y
FLORENCE	LEELANAU	7.6	13	-1.6414	N
GLEN	LEELANAU	8.03	30	-0.34062	Y
LINE	LEELANAU	8.45	40	0.6327	Y
LITTLE GLEN	LEELANAU	8.4	30	0.1204	Y
LK MANITOU	LEELANAU	8.8	28	0.5288	Y
L TRAVERSE	LEELANAU	8.58	40	0.79468	Y
N. LK LEELANAU	LEELANAU	8.5	45.1	0.9245	Y
SCHOOL	LEELANAU	8.78	20	0.14388	Y
TAMARACK	LEELANAU	8.4	7.7	-0.8831	N
DAVIS	LENAAWEE	8.8	20.7	0.2003	Y

DEEP	LENAWEE	7.6	45	-0.2014	Y
ROUND	LENAWEE	8.3	37.7	0.3423	Y
SAND	LENAWEE	7.6	25	-1.1014	N
BASE LINE	LIVINGSTON	7.7	61.4	0.6612	Y
BISHOP	LIVINGSTON	8.6	30	0.3696	Y
CHILSON POND	LIVINGSTON	8.2	40	0.3212	Y
CROOKED	LIVINGSTON	8.2	44.5	0.5237	Y
HILAND	LIVINGSTON	8.15	65.7	1.4154	Y
LK CHEMUNG	LIVINGSTON	7.8	43.3	-0.0287	Y
LOWER CHILSON PD	LIVINGSTON	8.1	40	0.1966	Y
SCHOOL	LIVINGSTON	7.9	35	-0.2776	Y
STRAWBERRY	LIVINGSTON	7.8	62.3	0.8263	Y
THOMPSON	LIVINGSTON	8.6	35	0.5946	Y
WHITMORE	LIVINGSTON	8.15	38.9	0.2094	Y
WOODLAND	LIVINGSTON	8	41.6	0.144	Y
W. CROOKED	LIVINGSTON	8.5	1	-1.06	N
MUSKALLONGE	LUCE	8.95	10.6	-0.0673	Y
N. MANISTIQUE	LUCE	8.35	89.1	2.7176	Y
BOEDNE BAY CAMP	MACKINAC	9	26	0.688	Y
MANISTIQUE	MACKINAC	8.65	47.4	1.2149	Y
MILAKOKIA	MACKINAC	8.3	20	-0.4542	Y
MILLECOQUINS	MACKINAC	8.85	27.6	0.5731	Y
S. MANISTIQUE	MACKINAC	8.35	23.9	-0.2164	Y
STONY CK IMP.	MACOMB	8.2	50	0.7712	Y
BEAR	MANISTEE	8.5	23.5	-0.0475	Y
HEALY	MANISTEE	8.3	23.3	-0.3057	Y
MANISTEE	MANISTEE	8.3	44.3	0.6393	Y
PINE	MANISTEE	8.8	24	0.3488	Y
PORTAGE	MANISTEE	8.3	32.1	0.0903	Y
ANDERSON	MARQUETTE	8.2	20	-0.5788	Y
ARFELIN	MARQUETTE	7.9	4	-1.6726	N
BANCROFT	MARQUETTE	7.9	10	-1.4026	N
BASS	MARQUETTE	8.5	30	0.245	Y
BASS	MARQUETTE	8.5	11.4	-0.592	Y
BIG SHAG	MARQUETTE	8.3	8	-0.9942	N
DEAD	MARQUETTE	6.8	7	-2.9082	N
EMGMAN	MARQUETTE	6.8	12	-2.6832	N
GREENWOOD	MARQUETTE	6.6	7	-3.1574	N
HORSESHOE	MARQUETTE	8.6	21	-0.0354	Y
JOHNSON	MARQUETTE	8.4	20	-0.3296	Y
LITTLE	MARQUETTE	8.4	20	-0.3296	Y
LITTLE SHAG	MARQUETTE	7.9	5	-1.6276	N
LK INDEPENDENCE	MARQUETTE	8.45	11.2	-0.6633	N
LK MICHIGAMME	MARQUETTE	7.55	3.5	-2.1312	N
SPORLEY	MARQUETTE	8.3	5	-1.1292	N
SQUAW	MARQUETTE	8.7	23.7	0.2107	Y
WOLF	MARQUETTE	7.4	3	-2.3406	N
BASS	MASON	9	30	0.868	Y
FORD	MASON	8.4	29.8	0.1114	Y
HACKERT	MASON	8.7	25	0.2692	Y
HAMLIN	MASON	8.5	35	0.47	Y
LINCOLN	MASON	8.4	40	0.5704	Y
PERE MARQUETTE	MASON	8.3	38.1	0.3603	Y
PLINESS	MASON	8.2	20	-0.5788	Y

ROUND	MASON	8.5	20	-0.205	Y
BLUE	MECOSTA	8.45	32.9	0.3132	Y
CHIPPEWA	MECOSTA	8.25	31.5	0.001	Y
CLEAR	MECOSTA	9	12	0.058	Y
HORSEHEAD	MECOSTA	8.4	29	0.0754	Y
MARTINY	MECOSTA	8.8	30	0.6188	Y
MERRILL	MECOSTA	8.7	25	0.2692	Y
PRETTY	MECOSTA	9.1	25	0.7676	Y
ROGERS DAM PD	MECOSTA	8.3	39.9	0.4413	Y
ROUND	MECOSTA	8.2	32.2	-0.0298	Y
SCHOOL SECTION	MECOSTA	8.1	25	-0.4784	Y
TOWNLIN	MECOSTA	8.6	25	0.1446	Y
SANFORD	MIDLAND	8.25	35.5	0.181	Y
CROOKED	MISSAUKEE	8.6	14.7	-0.3189	Y
GOOSE	MISSAUKEE	6.5	10	-3.147	N
LK MISSAUKEE	MISSAUKEE	8.4	26.6	-0.0326	Y
LONG	MISSAUKEE	7.6	15	-1.5514	N
SAPPHIRE	MISSAUKEE	8.6	21.6	-0.0084	Y
BALDWIN	MONTCALM	9	18	0.328	Y
BASS	MONTCALM	8.4	14.1	-0.5951	Y
COWDEN	MONTCALM	7.95	14.6	-1.1333	N
CRYSTAL	MONTCALM	8.35	39.8	0.4991	Y
HALFMOOD	MONTCALM	8.4	38.5	0.5029	Y
L WHITEFISH	MONTCALM	8.1	37.3	0.0751	Y
MUD	MONTCALM	9	20	0.418	Y
RAINBOW	MONTCALM	8.8	30	0.6188	Y
ROCK	MONTCALM	8.3	31.1	0.0453	Y
TAMARACK	MONTCALM	9.1	35	1.2176	Y
TOWNLIN	MONTCALM	8.2	37	0.1862	Y
WHITEFISH	MONTCALM	8.4	37.4	0.4534	Y
WINFIELD	MONTCALM	8.3	47.4	0.7788	Y
ATLANTA IMP.	MONTMORENCY	8.15	50	0.7089	Y
E. TWIN	MONTMORENCY	8.4	24	-0.1496	Y
GAYLANTA	MONTMORENCY	8.6	19	-0.1254	Y
GRASS	MONTMORENCY	8.3	28.1	-0.0897	Y
LONG	MONTMORENCY	8.4	33.7	0.2869	Y
MCCORMICK	MONTMORENCY	8.35	55	1.1831	Y
RUSH	MONTMORENCY	8.5	40	0.695	Y
SAGE	MONTMORENCY	8.2	35	0.0962	Y
W. TWIN	MONTMORENCY	8.8	22.7	0.2903	Y
BEAR	MUSKEGON	8.65	40	0.8819	Y
DUCK	MUSKEGON	8.7	25	0.2692	Y
E. TWIN	MUSKEGON	8.35	12	-0.7519	N
HALF-MOON	MUSKEGON	7.8	30	-0.6272	Y
MONA	MUSKEGON	9.1	30	0.9926	Y
MUSKEGON	MUSKEGON	8.5	33.7	0.4115	Y
NORTH	MUSKEGON	7.7	6.2	-1.8228	N
WEST	MUSKEGON	7.8	9.9	-1.5317	N
WHITE	MUSKEGON	8.05	33.6	-0.1537	Y
W. TWIN	MUSKEGON	7.8	10	-1.5272	N
BAPTIST	NEWAYGO	8.4	10	-0.7796	N
BILLS	NEWAYGO	8.6	30	0.3696	Y
BLANCH	NEWAYGO	8	30	-0.378	Y
BOBINSON	NEWAYGO	8.6	35	0.5946	Y

BROOKS	NEWAYGO	8.2	35	0.0962	Y
CRYSTAL	NEWAYGO	8	13.9	-1.1025	N
EMERALD	NEWAYGO	8.4	37	0.4354	Y
EMGLEWRIGHT	NEWAYGO	8.5	30	0.245	Y
FREMONT	NEWAYGO	8.5	33	0.38	Y
HESS	NEWAYGO	8.7	40	0.9442	Y
KIMBALL	NEWAYGO	8.95	34.9	1.0262	Y
NICHOLS	NEWAYGO	7.9	25	-0.7276	N
PICKERAL	NEWAYGO	7.9	30	-0.5026	Y
SYLVAN	NEWAYGO	8.5	35.9	0.5105	Y
BIG SEVEN	OAKLAND	8.35	42.2	0.6071	Y
CASS	OAKLAND	8	45	0.297	Y
CEDAR	OAKLAND	8.3	57.9	1.2513	Y
DEER	OAKLAND	8.15	61.6	1.2309	Y
DICKINSON	OAKLAND	8.5	44.1	0.8795	Y
HERON	OAKLAND	8.5	36.7	0.5465	Y
KENT	OAKLAND	7.8	54.7	0.4843	Y
LAKEFILLE	OAKLAND	8.65	38	0.7919	Y
LK ORION	OAKLAND	7.8	40	-0.1772	Y
LONG	OAKLAND	8.5	45	0.92	Y
LOON	OAKLAND	8.3	50	0.8958	Y
LOTUS	OAKLAND	8.2	52.8	0.8972	Y
MACEDAY	OAKLAND	8.2	52.8	0.8972	Y
MIDDLE	OAKLAND	8.2	65	1.4462	Y
ORCHARD	OAKLAND	9.8	32	1.9548	Y
SQUAW/CLEAR	OAKLAND	8	40	0.072	Y
TIPSICO	OAKLAND	8.5	22	-0.115	Y
UNION	OAKLAND	8.35	45.6	0.7601	Y
UPPER PROUD	OAKLAND	8.3	90	2.6958	Y
VALLEY	OAKLAND	7.8	30	-0.6272	Y
WHITE	OAKLAND	8.3	29.8	-0.0132	Y
WILDWOOD	OAKLAND	7.8	25	-0.8522	N
WOLVERINE	OAKLAND	7.85	30	-0.5649	Y
CRYSTAL	OCEANA	8	6	-1.458	N
HESPERIA DAM PD	OCEANA	7.8	45	0.0478	Y
MCLAREN	OCEANA	8	40	0.072	Y
PENTWATER	OCEANA	8.4	34.9	0.3409	Y
SCHOOLSECTION	OCEANA	8.4	18	-0.4196	Y
SILVER	OCEANA	8.65	30.7	0.4634	Y
STONY	OCEANA	8.7	36.5	0.7867	Y
AU SABLE	OGEMAW	8.6	30	0.3696	Y
BUSH	OGEMAW	8	30	-0.378	Y
LK GEORGE	OGEMAW	8.2	50	0.7712	Y
RIFLE	OGEMAW	7.95	26	-0.6203	Y
TEE	OGEMAW	8.2	35.7	0.1277	Y
LK GOGEBIC	ONTONAGON	8.3	8.3	-0.9807	N
BIG	OSCEOLA	8.35	30.8	0.0941	Y
DIAMOND	OSCEOLA	8.8	14	-0.1012	Y
SUNRISE	OSCEOLA	8.5	4	-0.925	N
TODD	OSCEOLA	8.9	30	0.7434	Y
WELLS	OSCEOLA	9.1	7.7	-0.0109	Y
MCCOLLUM	OSCODA	8.5	35	0.47	Y
MIO DAM PD	OSCODA	8.2	34.4	0.0692	Y
BIG BASS	OTSEGO	7.7	18	-1.2918	N

DIXON	OTSEGO	8.1	30	-0.2534	Y
EMERALD	OTSEGO	8.2	35	0.0962	Y
HEART	OTSEGO	7.5	26.2	-1.172	N
LK MANUKA	OTSEGO	8.2	2.7	-1.3573	N
LK TWENTY SEVEN	OTSEGO	8.3	26.3	-0.1707	Y
OPAL	OTSEGO	8.3	33.4	0.1488	Y
OTSEGO	OTSEGO	8.35	22.4	-0.2839	Y
PICKEREL	OTSEGO	8.6	34	0.5496	Y
CROCKERY	OTTAWA	8.1	40	0.1966	Y
PIGEON	OTTAWA	7.65	40	-0.3641	Y
SPRING	OTTAWA	8.75	45	1.2315	Y
BIG TOMAHAWK	PRESQUE ISLE	8.8	21.8	0.2498	Y
EMMA	PRESQUE ISLE	8.3	35	0.2208	Y
GRAND	PRESQUE ISLE	8.2	45.6	0.5732	Y
LK ESSAU	PRESQUE ISLE	8.6	52.9	1.4001	Y
LK MAY	PRESQUE ISLE	7.7	17.4	-1.3188	N
LOST	PRESQUE ISLE	8.9	15	0.0684	Y
SHOEPAC	PRESQUE ISLE	8.2	17	-0.7138	N
SPORTSMANS	PRESQUE ISLE	8	40	0.072	Y
SUNKEN	PRESQUE ISLE	8.35	50	0.9581	Y
HIGGINS	ROSCOMMON	8.3	30.3	0.0093	Y
HOUGHTON	ROSCOMMON	8.3	20.3	-0.4407	Y
LK ST. HELEN	ROSCOMMON	8.2	18.2	-0.6598	N
BIG BASS	SCHOOLCRAFT	8	16.7	-0.9765	N
BOOT	SCHOOLCRAFT	7.3	13.7	-1.9837	N
BYERS	SCHOOLCRAFT	7.3	5.4	-2.3572	N
CLEAR	SCHOOLCRAFT	7.5	9.4	-1.928	N
COLWELL	SCHOOLCRAFT	7.9	14.5	-1.2001	N
COLWELL	SCHOOLCRAFT	9	15	0.193	Y
CROOKED	SCHOOLCRAFT	8.2	22.8	-0.4528	Y
EAST	SCHOOLCRAFT	8.3	22.5	-0.3417	Y
INDIAN	SCHOOLCRAFT	8.2	35.4	0.1142	Y
IRON JAW	SCHOOLCRAFT	8.1	15.6	-0.9014	N
MCDONALD	SCHOOLCRAFT	8.5	21	-0.16	Y
MCKEEVER	SCHOOLCRAFT	7.9	24.3	-0.7591	N
NINETEEN	SCHOOLCRAFT	7.6	12.1	-1.6819	N
OSTRANDER	SCHOOLCRAFT	6.7	4.3	-3.1543	N
PETES	SCHOOLCRAFT	8.4	30	0.1204	Y
PETES	SCHOOLCRAFT	8.1	30.2	-0.2444	Y
RED	SCHOOLCRAFT	8.4	26.5	-0.0371	Y
SAND	SCHOOLCRAFT	6.4	2.4	-3.6136	N
STEBEN	SCHOOLCRAFT	7.4	16.7	-1.7241	N
SWAN	SCHOOLCRAFT	6.4	2.5	-3.6091	N
THUNDER	SCHOOLCRAFT	8.4	19.7	-0.3431	Y
TRIANGLE	SCHOOLCRAFT	7.6	12.2	-1.6774	N
TWILIGHT	SCHOOLCRAFT	5.9	1.5	-4.2771	N
CLEAR	ST JOSEPH	8	30	-0.378	Y
COREY	ST JOSEPH	8.6	25	0.1446	Y
CROTCH	ST JOSEPH	8.4	35	0.3454	Y
KLINGER	ST JOSEPH	8.2	38.3	0.2447	Y
LONG	ST JOSEPH	7.9	57.7	0.7439	Y
PALMER	ST JOSEPH	8.1	64.9	1.3171	Y
PLEASANT	ST JOSEPH	8.2	30	-0.1288	Y
PORTAGE	ST JOSEPH	8.5	57.9	1.5005	Y

SAND	ST JOSEPH	8.2	45	0.5462	Y
STURGEON	ST JOSEPH	8	70	1.422	Y
THOMPSON	ST JOSEPH	8.4	50	1.0204	Y
THREE RIVERS IMP	ST JOSEPH	8.1	70	1.5466	Y
MURPHY	TUSCOLA	8.7	30	0.4942	Y
NORTH	TUSCOLA	8.6	25	0.1446	Y
ACKLEY	VAN BUREN	8.2	35	0.0962	Y
BANKSONS	VAN BUREN	7.65	20	-1.2641	N
BRANDYWINE	VAN BUREN	7.8	8.8	-1.5812	N
BROWNWOOD	VAN BUREN	8.5	30	0.245	Y
CEDAR	VAN BUREN	8.5	27	0.11	Y
CHRISTIE	VAN BUREN	8.6	24	0.0996	Y
CLEAR	VAN BUREN	7.8	40	-0.1772	Y
CLEAR	VAN BUREN	8.9	40	1.1934	Y
CORA	VAN BUREN	8.4	21	-0.2846	Y
CROOKED	VAN BUREN	8.5	27	0.11	Y
EAGLE	VAN BUREN	9	22	0.508	Y
FISH	VAN BUREN	8.1	42	0.2866	Y
GRAVEL	VAN BUREN	8.4	30	0.1204	Y
GRAVEL	VAN BUREN	7.5	30	-1.001	N
GREAT BEAR	VAN BUREN	8.5	37	0.56	Y
HUZZYS	VAN BUREN	7.6	20	-1.3264	N
KEELER	VAN BUREN	8.1	6.1	-1.3289	N
KNICKERBOCKER	VAN BUREN	7.6	1.8	-2.1454	N
LK ELEVEN	VAN BUREN	8.8	35	0.8438	Y
LK FOURTEEN	VAN BUREN	7.9	30	-0.5026	Y
LK OF THE WOODS	VAN BUREN	8.3	48.1	0.8103	Y
LOWER REYNOLDS	VAN BUREN	8.2	20	-0.5788	Y
MAPLE	VAN BUREN	8.2	55	0.9962	Y
MERRIMANS	VAN BUREN	8.6	43	0.9546	Y
MILL	VAN BUREN	7.6	18	-1.4164	N
MUSKRAT	VAN BUREN	8.8	24	0.3488	Y
N. SCOTT	VAN BUREN	8	32	-0.288	Y
ROUND	VAN BUREN	8.3	10	-0.9042	N
RUSH	VAN BUREN	8.8	25	0.3938	Y
SADDLE	VAN BUREN	8	28	-0.468	Y
SADDLE	VAN BUREN	8.1	25	-0.4784	Y
SCHOOL SECTION	VAN BUREN	8.1	31	-0.2084	Y
SHAFFER	VAN BUREN	8.7	29	0.4492	Y
SILVER	VAN BUREN	7.8	17	-1.2122	N
THREE MILE	VAN BUREN	8.5	12	-0.565	Y
UPPER JEPHTHA	VAN BUREN	8.3	41	0.4908	Y
UPPER REYNOLDS	VAN BUREN	8.7	20	0.0442	Y
VAN AUKEN	VAN BUREN	8.6	30	0.3696	Y
BIG PORTAGE	WASHTENAW	7.7	56.7	0.4497	Y
BRUIN	WASHTENAW	8.2	50	0.7712	Y
CEDAR	WASHTENAW	8.1	30	-0.2534	Y
CROOKED	WASHTENAW	8.6	25	0.1446	Y
FORD	WASHTENAW	8.35	68.1	1.7726	Y
FOUR MILE	WASHTENAW	8.3	45	0.6708	Y
GREEN	WASHTENAW	8.5	20	-0.205	Y
HALF-MOON	WASHTENAW	7.4	60	0.2244	Y
JOSLIN	WASHTENAW	8.1	40	0.1966	Y
MILL	WASHTENAW	8.3	40	0.4458	Y

MUD	WASHTENAW	8.1	30	-0.2534	Y
NORTH	WASHTENAW	8.3	25	-0.2292	Y
SOUTH	WASHTENAW	8.5	45	0.92	Y
SUGAR LOAF	WASHTENAW	8.6	30	0.3696	Y
BERRY	WEXFORD	6.6	6	-3.2024	N
CADILLAC	WEXFORD	8.3	15.3	-0.6657	N
HODENPYL	WEXFORD	8.9	40	1.1934	Y
LONG	WEXFORD	8.5	18	-0.295	Y
MITCHELL	WEXFORD	8.3	14.2	-0.7152	N