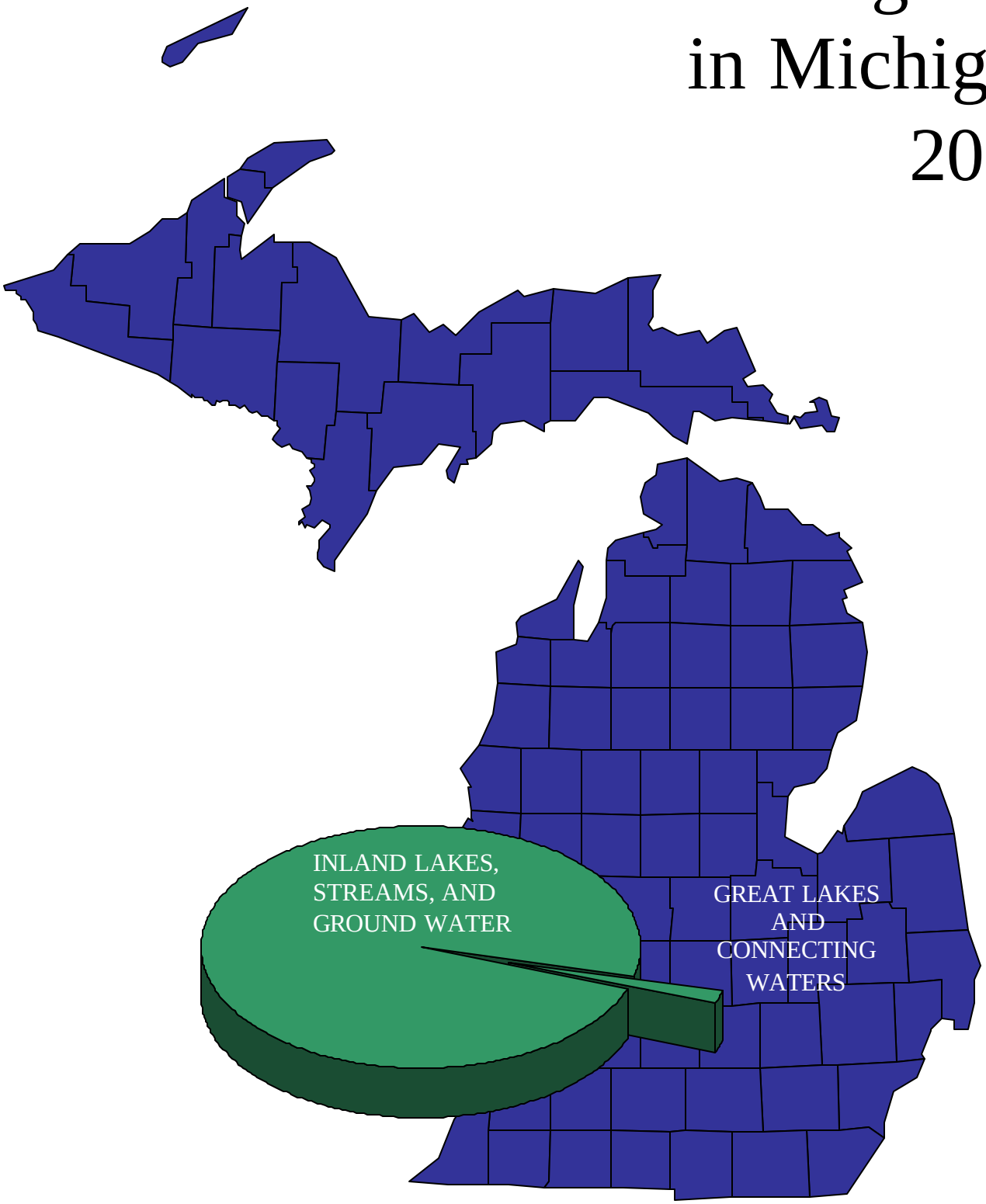
Water Withdrawals for Golf Course Irrigation in Michigan 2004



Water Withdrawals for Golf Course Irrigation in Michigan: 2004

Introduction

This report has been prepared by the Michigan Department of Environmental Quality to summarize golf course irrigation information compiled in Michigan's Water Use Reporting Program. The overall goal of the program is to establish an environmental baseline and continuing assessment of major water uses in the state, including power generation, industrial, irrigation, and public water supply. This fulfills key requirements of the Great Lakes Charter, a regional agreement signed by the Great Lakes states and Canadian provinces in 1985, and Michigan's water use reporting law (Part 327, Great Lakes Preservation, Natural Resources and Environmental Protection Act, 1994 PA 451, as amended).

Detailed water use information from the states and provinces is maintained by the Great Lakes Commission to facilitate regional policy-making and strengthen the legal defense against unwarranted diversions of Great Lakes water. It also provides essential water use information for state and regional water resources planning to support power generation, industrial, irrigation, and public water supply activities in a manner consistent with sound environmental management.

Background

The artificial application of irrigation water on golf courses is a commonplace practice utilized to maintain healthy turf grass and improve the recreational value of golf course lands. Irrigation water is used primarily for greens, tees, and fairways, although some golf courses irrigate rough areas of higher turf adjacent to fairways. Irrigation practices vary depending on management objectives and available water sources. Typically, more water is applied per unit of area for greens and tees than for fairways and rough. Application methods include sprinkler irrigation, micro-irrigation, and subsurface irrigation.

The amount of irrigation water used to irrigate golf courses depends on a variety of environmental, economic, and legal factors. They include course design, acreage, soils, irrigation system development and operational costs, local irrigation practices, and prevailing water laws. Perhaps most important is the availability of adequate surface water and ground water sources that can be used without creating water use conflicts among the golf course and surrounding water users. Since consumptive water loss rates are not only high for golf course irrigation, but also concentrated during the summer months of naturally lowered stream flows and lake levels, water supply issues are of primary management concern. The viability of irrigation depends in large part upon a reasonable balancing of shared water rights under common law.

Overall irrigation water use is a function of basic irrigation management decisions and available water supply. While water use efficiencies vary with the type of system used, the predominate method of irrigating golf courses remains the sprinkler system. The application efficiency of sprinkler irrigation varies from 60 to 95 percent, with water losses primarily due to evaporation and wind drift. Application efficiency also depends on how well a sprinkler system is designed, managed, and maintained. Sprinkler configurations generally offer greater flexibility in this regard, since they can be operated separately or in an integrated fashion.

Michigan Summary

There were 619 irrigated golf courses registered in the Michigan Water Use Reporting Program in 2004. These courses, which represent about 65 percent of the total number of golf courses in the state, reported having irrigation systems with the capacity to withdraw 100,000 gallons of self-supplied water per day for a 30-day period. This is the reporting threshold established under the Great Lakes Charter. Most of the remaining courses were either supplied by public water systems or fell below the reporting threshold for irrigation water use. A relatively small number of golf courses did not irrigate at all.

During 2004, irrigated golf courses in Michigan reported self-supplied water withdrawals of nearly 34 million gallons per day (MGD) to irrigate 40,014 acres throughout the state. The majority of the courses irrigated a combination of tees, greens, and fairways, although a small portion irrigated areas of rough as well. Over 58 percent of the water withdrawn for all golf courses in the state came from ground water sources, with about 41 percent from inland lakes, streams, or other surface sources. Only 1.2 percent of golf course irrigation water was withdrawn from the Great Lakes.

Table 1 summarizes water withdrawals for golf course irrigation in Michigan on a county basis. Oakland County had the largest golf course irrigation water use in 2004, accounting for about 14 percent (4.60 MGD) of the self-supplied irrigation withdrawals in the state. The next largest water-withdrawal counties were Kent, Macomb, Wayne, and Kalamazoo. Together, these four counties accounted for an additional 18 percent of the total golf course irrigation withdrawals statewide. Most golf courses irrigated with water withdrawn from inland lakes, streams, and ground water. A small number of courses used Great Lakes water in counties such as Wayne, Saint Clair, Macomb, Sanilac, Muskegon, Leelanau, Mackinac, Delta, Menominee, Bay, and Keweenaw.

Table 2 summarizes golf course irrigation water use by U.S. Geological Survey hydrologic basins in Michigan. Water withdrawals were reported in 50 of the 57 basins in the state during 2004. The largest withdrawals were from the Clinton Watershed (Basin 04090003), which accounted for nearly 10 percent of the total golf course irrigation withdrawals statewide. Four other hydrologic basins (Huron, Kalamazoo, Detroit, and Boardman-Charlevoix) collectively accounted for an additional 27 percent of Michigan's golf course irrigation. Self-supplied courses in these basins relied primarily on inland lakes, streams, and ground water sources.

Longer-term trend analysis will be undertaken as golf course irrigation water use data are compiled under Michigan's Water Use Reporting Program. Present trends indicate that the rapid expansion of golf course development in the state over the past decade has slowed significantly in the past few years. To determine the overall demand for irrigation water in Michigan, golf course irrigation data will be combined with estimated agricultural irrigation data. This information will provide a continuing baseline to ensure the continued protection and wise management of the waters of the Great Lakes Basin.

Table 1:

2004 Water Withdrawals for Golf Course Irrigation in Michigan, by County*

County	Number of Courses	Irrigated Acres	Water Withdrawn (MGD)			
			Great Lakes	Surface Water	Ground Water	Total
Alcona	4	201	0.00	0.11	0.05	0.16
Allegan	12	660	0.00	0.16	0.28	0.44
Alpena	2	143	0.00	0.09	0.05	0.13
Antrim	6	495	0.00	0.13	0.49	0.62
Arenac	1	75	0.00	0.02	0.11	0.13
Barry	6	317	0.00	0.06	0.26	0.33
Bay	5	214	0.01	0.08	0.06	0.15
Benzie	5	336	0.00	0.00	0.41	0.41
Berrien	13	720	0.00	0.35	0.22	0.57
Branch	4	110	0.00	0.07	0.07	0.13
Calhoun	11	543	0.00	0.11	0.26	0.37
Cass	5	462	0.00	0.08	0.29	0.37
Charlevoix	6	379	0.00	0.12	0.18	0.30
Cheboygan	3	150	0.00	0.07	0.12	0.19
Chippewa	4	208	0.00	0.08	0.03	0.10
Clare	3	144	0.00	0.10	0.05	0.15
Clinton	5	175	0.00	0.05	0.11	0.16
Crawford	2	115	0.00	0.01	0.11	0.13
Delta	6	237	0.13	0.06	0.07	0.26
Dickinson	3	99	0.00	0.09	0.06	0.14
Eaton	7	378	0.00	0.10	0.03	0.13
Emmet	9	1,223	0.00	0.00	0.73	0.73
Genesee	23	1,362	0.00	0.68	0.22	0.91
Gladwin	2	83	0.00	0.00	0.03	0.03
Grand Traverse	7	558	0.00	0.09	0.38	0.47
Gratiot	5	255	0.00	0.09	0.07	0.15
Hillsdale	5	194	0.00	0.10	0.08	0.18
Houghton	1	60	0.00	0.02	0.00	0.02
Huron	5	335	0.00	0.04	0.21	0.25
Ingham	12	730	0.00	0.17	0.29	0.46
Ionia	7	210	0.00	0.02	0.15	0.18
Iosco	5	262	0.00	0.15	0.30	0.45
Iron	1	110	0.00	0.00	0.03	0.03

County	Number of Courses	Irrigated Acres	Water Withdrawn (MGD)			
			Great Lakes	Surface Water	Ground Water	Total
Isabella	8	421	0.00	0.38	0.02	0.40
Jackson	18	761	0.00	0.07	0.52	0.59
Kalamazoo	16	1,042	0.00	0.57	0.82	1.39
Kalkaska	2	100	0.00	0.00	0.08	0.08
Kent	32	1,884	0.00	0.48	1.22	1.69
Keweenaw	1	18	0.01	0.00	0.00	0.02
Lake	1	50	0.00	0.00	0.05	0.05
Lapeer	6	272	0.00	0.04	0.09	0.14
Leelanau	7	333	0.02	0.13	0.14	0.29
Lenawee	7	245	0.00	0.13	0.20	0.33
Livingston	15	1,577	0.00	0.61	0.41	1.02
Luce	1	125	0.00	0.06	0.00	0.06
Mackinac	3	59	0.02	0.00	0.08	0.10
Macomb	24	1,926	0.03	1.15	0.28	1.46
Manistee	7	420	0.00	0.00	0.47	0.47
Marquette	4	211	0.00	0.24	0.05	0.29
Mason	3	106	0.00	0.07	0.06	0.13
Mecosta	5	518	0.00	0.34	0.09	0.43
Menominee	2	85	0.01	0.03	0.00	0.04
Midland	2	102	0.00	0.09	0.02	0.11
Missaukee	1	70	0.00	0.00	0.05	0.05
Monroe	12	875	0.00	0.03	0.72	0.75
Montcalm	8	472	0.00	0.17	0.10	0.27
Montmorency	2	200	0.00	0.15	0.00	0.15
Muskegon	14	813	0.02	0.09	0.82	0.92
Newaygo	5	238	0.00	0.03	0.44	0.47
Oakland	62	5,556	0.00	1.90	2.71	4.60
Oceana	5	200	0.00	0.13	0.24	0.37
Ogemaw	5	308	0.00	0.14	0.11	0.25
Ontonagon	1	18	0.00	0.00	0.01	0.01
Osceola	2	111	0.00	0.01	0.07	0.09
Oscoda	3	553	0.00	0.29	0.32	0.61
Otsego	12	1,258	0.00	0.09	0.72	0.81
Ottawa	13	679	0.00	0.36	0.27	0.63
Presque Isle	2	103	0.00	0.00	0.13	0.13
Roscommon	6	467	.00	0.02	0.39	0.41

County	Number of Courses	Irrigated Acres	Water Withdrawn (MGD)			
			Great Lakes	Surface Water	Ground Water	Total
Saginaw	12	544	0.00	0.44	0.05	0.50
Saint Clair	13	693	0.05	0.18	0.05	0.27
Saint Joseph	3	153	0.00	0.34	0.03	0.37
Sanilac	4	179	0.02	0.00	0.12	0.14
Schoolcraft	1	73	0.00	0.10	0.00	0.10
Shiawassee	4	145	0.00	0.08	0.05	0.13
Tuscola	4	231	0.00	0.07	0.06	0.12
Van Buren	6	319	0.00	0.08	0.34	0.42
Washtenaw	24	1,596	0.00	0.36	0.61	0.97
Wayne	30	2,002	0.09	0.94	0.39	1.41
Wexford	6	360	0.00	0.02	0.33	0.34
Total	619	40,014	0.41	13.70	19.55	33.65

*This report is provided by the Michigan Department of Environmental Quality and was generated using data collected for the water use reporting program.

Index Map of Michigan Counties

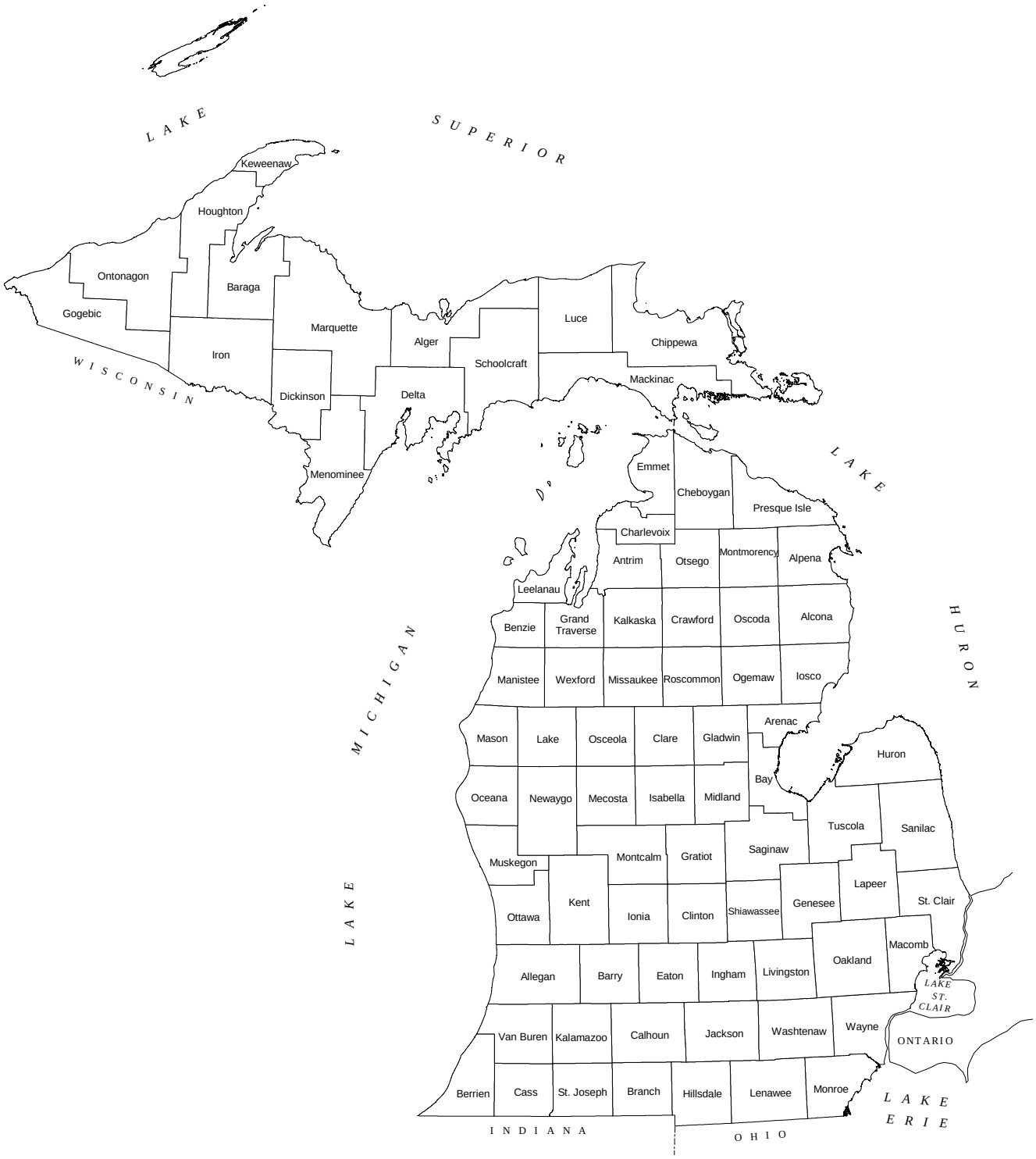


Table 2: 2004 Water Withdrawals for Golf Course Irrigation in Michigan, by Hydrologic Basin*

Hydrologic Basin Code	Number of Courses	Irrigated Acres	Water Withdrawn (MGD)			
			Great Lakes	Surface Water	Ground Water	Total
04020103	3	96	0.01	0.02	0.01	0.04
04020105	2	126	0.00	0.05	0.05	0.10
04020202	1	125	0.00	0.06	0.00	0.06
04020203	1	40	0.00	0.05	0.00	0.05
04030106	1	110	0.00	0.00	0.03	0.03
04030108	4	149	0.00	0.11	0.06	0.17
04030109	2	38	0.01	0.00	0.01	0.02
04030110	2	85	0.00	0.19	0.00	0.19
04030111	4	209	0.13	0.06	0.04	0.23
04030112	1	25	0.00	0.00	0.02	0.02
04040001	3	120	0.00	0.12	0.02	0.13
04050001	31	1,772	0.00	1.01	0.81	1.82
04050002	8	325	0.00	0.21	0.21	0.42
04050003	43	2,336	0.00	0.71	1.63	2.34
04050004	35	1,779	0.00	0.34	0.81	1.15
04050005	4	219	0.00	0.03	0.07	0.10
04050006	42	2,391	0.00	0.70	1.40	2.10
04050007	12	511	0.00	0.19	0.21	0.40
04060101	19	956	0.02	0.21	0.96	1.19
04060102	24	1,709	0.00	0.49	1.34	1.83
04060103	9	606	0.00	0.02	0.46	0.48
04060104	15	843	0.00	0.19	0.80	0.99
04060105	30	2,771	0.02	0.28	1.85	2.15
04060106	1	73	0.00	0.10	0.00	0.10
04060107	1	20	0.00	0.00	0.08	0.08
04070001	4	172	0.00	0.02	0.03	0.05
04070002	1	35	0.01	0.00	0.00	0.01
04070003	4	151	0.00	0.05	0.12	0.17
04070004	8	824	0.00	0.02	0.59	0.61
04070005	1	58	0.00	0.00	0.08	0.08
04070006	6	513	0.00	0.31	0.13	0.43
04070007	14	1,389	0.00	0.59	0.82	1.41
04080101	10	525	0.00	0.17	0.39	0.56
04080102	5	165	0.00	0.04	0.08	0.11

Hydrologic Basin Code	Number of Courses	Irrigated Acres	Water Withdrawn (MGD)			
			Great Lakes	Surface Water	Ground Water	Total
04080103	4	211	0.01	0.09	0.06	0.15
04080104	4	295	0.07	0.00	0.14	0.21
04080201	8	324	0.00	0.21	0.10	0.31
04080202	12	633	0.00	0.56	0.04	0.60
04080203	25	1,502	0.00	0.72	0.73	1.45
04080204	27	1,541	0.00	0.76	0.25	1.01
04080205	9	418	0.00	0.16	0.10	0.26
04080206	1	80	0.00	0.04	0.01	0.05
04090001	10	568	0.00	0.14	0.11	0.26
04090002	9	505	0.03	0.16	0.19	0.38
04090003	44	3,917	0.00	2.09	1.15	3.23
04090004	43	3,185	0.09	1.24	0.91	2.23
04090005	46	4,070	0.00	1.00	1.49	2.48
04100001	12	958	0.00	0.02	0.74	0.76
04100002	12	450	0.00	0.17	0.35	0.52
04100006	2	91	0.00	0.00	0.10	0.10
Total	619	40,014	0.41	13.70	19.55	33.65

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Hydrologic Basins in Michigan: U.S. Geological Survey

04020103	Keweenaw Peninsula	04050007	Thornapple	04080103	Pigeon-Wiscoggin
04020105	Dead-Kelsey	04060101	Pere Marquette-White	04080104	Birch-Willow
04020202	Tahquamenon	04060102	Muskegon	04080201	Tittabawassee
04020203	Waiska	04060103	Manistee	04080202	Pine
04030106	Brule	04060104	Betsie-Platte	04080203	Shiawassee
04030108	Menominee	04060105	Boardman-Charlevoix	04080204	Flint
04030109	Cedar-Ford	04060106	Manistique	04080205	Cass
04030110	Escanaba	04060107	Brevoort-Millecoquin	04080206	Saginaw
04030111	Tacoosh-Whitefish	04070001	St. Marys	04090001	St. Clair
04030112	Fishdam-Sturgeon	04070002	Carp-Pine	04090002	Lake St. Clair
04040001	Little Calumet-Galien	04070003	Lone Lake-Ocqueoc	04090003	Clinton
04050001	St. Joseph	04070004	Cheboygan	04090004	Detroit
04050002	Black-Macatawa	04070005	Black	04090005	Huron
04050003	Kalamazoo	04070006	Thunder Bay	04100001	Ottawa-Stony
04050004	Upper Grand	04070007	Au Sable	04100002	Raisin
04050005	Maple	04080101	Au Gres-Rifle	04100006	Tiffin
04050006	Lower Grand	04080102	Kawkawlin-Pine		

Index Map of Michigan Hydrologic Basins