Appendix 1. Historic and Projected County Population[a]

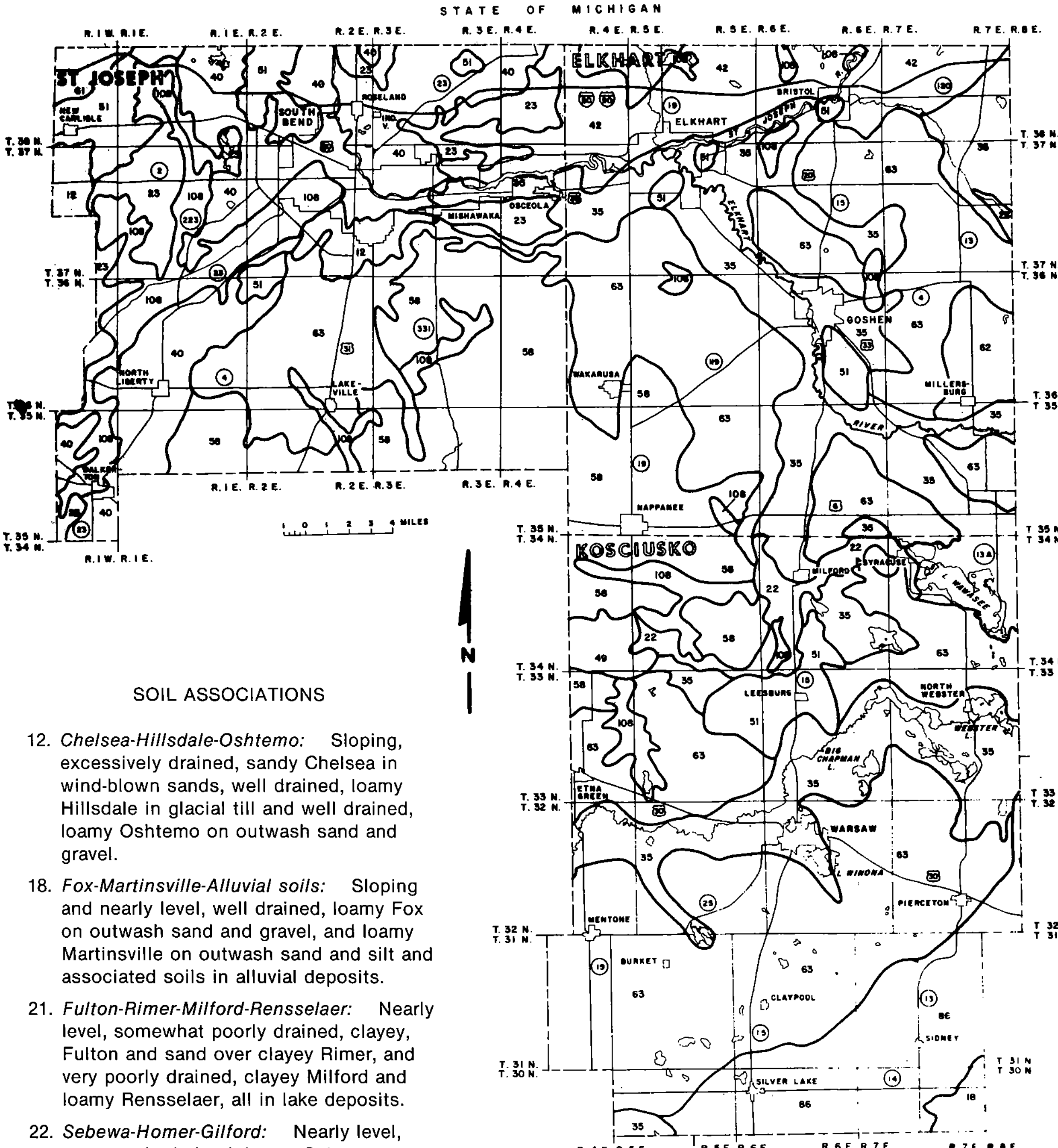
County	1900	1910	1920	1930	1940	1950	1960	1970	1980	1985	1990	1995	2000
Dekalb	650	634	648	630	626	658	715	780	850	873	895	918	938
	25711	25054	25600	24911	24756	26023	28271	30837	33606	34500	35400	36300	37100
Elkhart	43399	47209	54315	66347	69968	81410	102870	121885	132290	137078	141894	146325	150371
	45052	49008	56384	68875	72634	84512	106790	126529	137330	142300	147300	151900	156100
Kosciusko	5995	5755	5587	5663	6090	6798	8317	9914	12268	13369	14440	15388	16171
	29109	27936	27120	27488	29561	33002	40373	48127	59555	64900	70100	74700	78500
LaGrange	15284	15148	14009	13780	14352	15347	17380	20890	25556	27700	30000	32300	34600
	15284	15148	14009	13780	14352	15347	17380	20890	25556	27700	30000	32300	34600
Noble	17156	17503	16381	16333	16604	18280	20530	22877	25838	27046	28212	29305	30399
	23533	24009	22470	22404	22776	25075	28162	31382	35443	37100	38700	40200	41700
St. Joseph	52881	75721	92777	143726	145333	184163	214299	220075	216996	214376	213478	212490	211413
	58881	84312	103304	160033	161823	205058	238614	245045	241617	238700	237700	236600	235400
Steuben	11566	10848	10154	10173	10442	12986	13060	15321	18767	20140	21432	22420	23256
	15219	14274	13360	13386	13740	17087	17184	20159	24694	26500	28200	29500	30600
TOTAL	146931	172818	193871	256652	263415	319642	377171	411742	432565	440582	450351	459146	467148
	212789	239741	262247	330877	339642	406104	476774	522969	557801	571700	587400	601500	614000

[a]Upper Figures: Division of Water estimates, in-basin portion only.
Lower Figures: U.S. Census Bureau, total county (1900-1980); Indiana State Board of Health, 1983, total county (1985-2000).

Appendix 2. Agricultural Land Use[a]

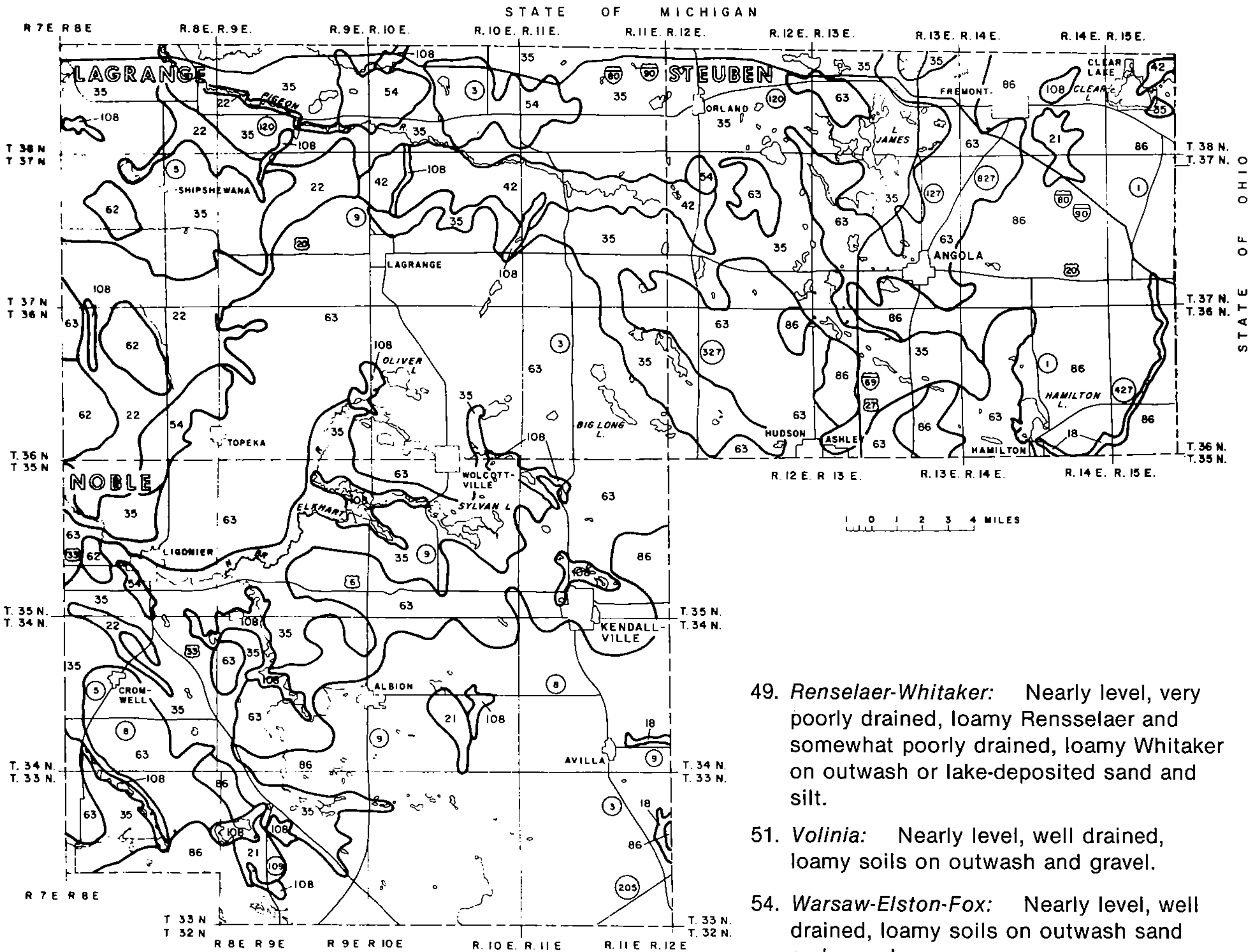
Counties	St. Joseph	Elkhart	LaGrange	Kosciusko	Noble	Steuben
Approximate Land Area (Acres)	293,817	298,291	243,161	345,382	264,057	197,094
Land in Farms	173,814	213,225	194,035	274,364	201,388	142,580
Percent in Farms	59.2	71.5	79.8	79.4	76.3	72.3
Increase/Decrease (Acreage) 1982 from 1978	Decrease	Increase	Decrease	Decrease	Decrease	Decrease
Increase/Decrease (Acreage) 1982 from 1978 (Ave. Farm Size)	Increase	Decrease	Decrease	Increase	Increase	Increase
Cropland (Acres)	149,693	182,178	152,043	226,490	164,553	113,610
Woodland (Acres)	11,904	14,587	17,954	24,921	18,590	13,546

[a]All values from U.S. Census Bureau, 1982 Census of Agriculture (county data).



SOIL ASSOCIATIONS

12. *Chelsea-Hillsdale-Oshtemo:* Sloping, excessively drained, sandy Chelsea in wind-blown sands, well drained, loamy Hillsdale in glacial till and well drained, loamy Oshtemo on outwash sand and gravel.
18. *Fox-Martinsville-Alluvial soils:* Sloping and nearly level, well drained, loamy Fox on outwash sand and gravel, and loamy Martinsville on outwash sand and silt and associated soils in alluvial deposits.
21. *Fulton-Rimer-Milford-Rensselaer:* Nearly level, somewhat poorly drained, clayey, Fulton and sand over clayey Rimer, and very poorly drained, clayey Milford and loamy Rensselaer, all in lake deposits.
22. *Sebewa-Homer-Gilford:* Nearly level, very poorly drained, loamy Sebewa, somewhat poorly drained, loamy Homer, and very poorly drained, loamy Gilford on outwash sand and gravel.
23. *Maumee-Gilford-Renssalaer:* Nearly level, very poorly drained, sand, Maumee and loamy Gilford and Rensselaer in outwash or lake deposited sand and silt.
35. *Oshtemo-Fox:* Nearly level and sloping, well drained, loamy soils on outwash sand and gravel.
40. *Plainfield-Tyner-Oshtemo:* Sloping, excessively drained, sandy Plainfield in wind-blown sands and sloping and nearly level, excessively drained, sand Tyner and well drained, loamy Oshtemo on outwash sand and gravel.
42. *Plainfield-Chelsea:* Sloping, excessively drained, sandy soils in wind-blown sands.



49. *Renselaer-Whitaker:* Nearly level, very poorly drained, loamy Rensselaer and somewhat poorly drained, loamy Whitaker on outwash or lake-deposited sand and silt.
51. *Volinia:* Nearly level, well drained, loamy soils on outwash and gravel.
54. *Warsaw-Elston-Fox:* Nearly level, well drained, loamy soils on outwash sand and gravel.
58. *Crosier-Brookston:* Nearly level, somewhat poorly drained, loamy Crosier and very poorly drained, loamy Brookston in glacial till.
61. *Blount-Morley-Pewamo:* Nearly level, somewhat poorly drained, clayey Blount and very poorly drained, clayey Pewamo and sloping, well drained, clayey Morley in glacial till.
62. *Blount-Pewamo:* Nearly level, somewhat poorly drained, clayey Blount and very poorly drained, clayey Pewamo in glacial till.
63. *Miami-Riddles-Crosier:* Sloping, well drained, loamy Miami and Riddles and nearly level, somewhat poorly drained, loamy Crosier in glacial till.
86. *Morley-Blount:* Sloping, well drained, clayey Morley and nearly level, somewhat poorly drained, Blount in glacial till.
108. *Mucks and peats:* Nearly level, very poorly drained soils developed in organic materials.

General Soil Map

N

AGRICULTURAL EXPERIMENT STATION AND COOPERATIVE EXTENSION SERVICE, PURDUE UNIVERSITY; AND THE SOIL CONSERVATION SERVICE, U.S. DEPARTMENT OF AGRICULTURE

Note: This map is intended for general planning. Each delineation contains soils different from those shown in the legend. For operational planning, use detailed soil maps that may be available in published or unpublished form at the local Soil and Water Conservation District Office.

Appendix 3. Soil Associations

Appendix 4. Bedrock sequence* underlying the St. Joseph River basin

System/Series	Rock Unit	Thickness in meters (feet)	Description
Quaternary Holocene Pleistocene		15-150 (49-490)	Unconsolidated material
Mississippian	Coldwater Sh.	50 (165)	Shale: gray to greenish-gray, slightly silty
	Sunbury Sh.	3 (10)	Shale: black
	Ellsworth Sh.	12-60 (39-196)	Shale: alternating gray-green and black in bottom part; grayish-green and containing some limestone dolomite lenses in top part
Devonian	Antrim Sh.	18-66 (59-216)	Shale: black, fissile; greenish-gray shale in places in lower third; pyrite common in bottom part
	Traverse Fm.	6-37 (20-121)	Limestone and dolomitic limestone: brown, tan and gray, very fine grained to coarse grained, biofragmental; light-colored to tan fine-grained oolitic dolomitic limestone common in top part
	Detroit River Fm.	5-50 (16-164)	Limestone and dolomite: mostly tan to gray, variably fine grained, argillaceous, bioclastic, sublithographic, and, in places, brecciated and mottled; contains a gray to tan fine-grained argillaceous dolomite in lower part and a tan lithographic limestone near the top
Silurian	Wabash Fm.	30-61 (98-200)	In upper part, limestone and dolomotic limestone: light-colored, granular, fossil-fragmental, cherty, slabby bedded. In lower part, dolomotic siltstone and silty dolomite: gray, dense to fine-grained, argillaceous, thick-bedded to massive. Carbonate bank, reef, and reef-detrital facies throughout, mostly dolomite: light-colored, granular, vuggy, notably fossiliferous
	Pleasant Mills Fm.	37-91 (121-298)	Dolomite and dolomitic limestone: light-, medium-, and dark-brown, dense to medium-grained; finely vuggy in part, algal laminated in part
	Salamonie Dol.	45-80 (148-262)	In upper part, mostly fairly pure dolomite: light-colored, granular, vuggy, very porous, partly reefy. In lower part, mostly dolomite: gray and tan, dense to fine-grained, argillaceous, partly cherty

Continued

Appendix 4. Continued

System/Series	Rock Unit		Thickness in meters (feet)	Description
Silurian	Cataract Fm.		6-25 (20-82)	Dolomite or limestone: light- to medium-brown, fine- to medium-grained, impure, cherty, and shaly in parts
Ordovician	Maquoketa Grp.		75-250 (246-820)	In upper and lower parts, shale: in middle part, gray dolomite and calcareous shale
	Trenton Ls.		50-70 (164-230)	Dolomitic limestone and dolomite: tan, fossilferous
	Black River Grp.		30-75 (98-246)	Limestone: tan, very finely crystalline to lithographic, argillaceous and dolomitic
	St. Peter Ss.		0-18 (59)	Sand and friable sandstone: fine to medium, in well-sorted, rounded, and frosted quartz grains
	Joachim Dol.		0-30 (98)	In upper part, dolomite: light- to dark-colored, very fine to fine-grained, silty to very argillaceous; interbedded with greenish to black shales. In middle part, dolomite and limestone: very fine to fine-grained; interbedded with greenish argillaceous dolomite
	Knox Dol.		50-105 (164-344)	Dolomite: gray to tan, fine crystalline; very cherty in the upper part
Cambrian	Franconia Fm.	Davis Fm.	45 (148)	Franconia--sandstone: light-gray, fine-grained, friable; some glauconitic and gray compact dolomite
	Ironton Ss.			Ironton--sandstone: white to medium-gray; some dolomitic sandstone and dolomite
	Galesville Ss.			Galesville--sandstone: fine- to coarse-grained, clean
				Davis (replaces other formations in eastern part of area)--dolomite: brownish-gray, fine- to medium-grained; dolomitic siltstone: yellowish-gray; shale: dark-gray, brittle; and limestone: brownish-gray, shaly
	Eau Claire Fm.		120-185 (394-607)	Dolomitic sandstone: pink; shale: green, maroon, and black; and silty dolomite: tan
	Mt. Simon Ss.		90-530 (295-1738)	Sandstone: pink to white, fine- to very coarse grained, in angular to subrounded quartz grains, mostly poorly cemented but well-indurated in some places
PreCambrian				Granite, basalt, and arkose

*Compiled from Becker and Hreha (1978), Gray and others (in preparation), Doheny and others, (1975), Droste and others (1982), Rexroad and Droste (1982), Keller and Burger (1970), and Shaver and others (in press). Thicknesses are not scaled into vertical height of table.

Appendix 5. Effects of Lake Michigan on the Climate of the St. Joseph Basin

Lake Michigan has a considerable effect on the temperature and precipitation regimes of the western St. Joseph Basin. Nearest the lake (from shore to approximately 15 miles inland), there is a one- to two-week lag in springtime warming, because water heats more slowly than land. Average spring and summer temperatures remain slightly lower just inland of the lake, while fall and winter temperatures are slightly warmer. In autumn, the first killing frosts arrive one to two weeks later due to the water's warmth relative to the quicker cooling of the land.

Warm, moisture-laden air from the lake is also largely responsible for increased cloudiness (particularly during winter) and greater snowfall amounts in western areas of the basin. "Lake-effect snows" most commonly extend 35 miles inland of Lake Michigan, and thus primarily affect that part of the St. Joseph River basin bounded on the east by a line extending from Kalamazoo, Michigan to near Elkhart, Indiana. However, strong westerly and northwesterly winds can occasionally cause these snowfalls over most parts of the basin.

In Indiana, the heaviest snows occur in the South Bend-Elkhart area. Since 1966, the South Bend weather station has recorded five seasons having more than 100 inches of total snowfall, including the record 172 inches during the winter of 1977-78. During the unusually snowy seasons between 1976-77 and 1981-82, snowfall averaged nearly 115 inches per year (roughly equivalent to 11.5 inches of rain) and accounted for about 27 percent of the average annual precipitation for that period. Similar heavy snows have been reported in the Michigan portion of the basin. For example, record amounts were reported during the 1976-77 season, when 155.5 inches accumulated at Paw Paw. (Normal seasonal snowfall in Michigan ranges from 45 inches in some inland areas to more than 60 inches in western counties and from 70 to 80 inches in far northwestern areas of the basin.)

Despite the heavy snowfall amounts in western areas, the total influence of lake-effect snows upon annual precipitation is not well defined. For example, normal annual precipitaion totals within the basin are greatest at Niles, Michigan (39.2 inches) and South Bend, Indiana (38.2 inches), although Hillsdale, Michigan--more than 100 miles east of the lake--averages 37.8 inches. Amounts in other parts of the basin vary from about 34 to 36 inches but in no descernible pattern with respect to the lake effect. Nearest the lakeshore, greater precipitation totals during winter can be offset by lesser amounts during summer, since summertime convection is often reduced near the lake due to the stabilizing influence of the colder water surface. Further away, however, other factors influence the precipitation regime. A combination of lake-effect snows and apparent urban-related increases in summer rainfall (Huff and Changnon, 1971), for example, may explain the higher precipitation amounts near South Bend.

Appendix 6. Major Lakes[a]

Lake	Drainage Area (mi^2)	Surface Area[b] (acres)	Capacity[b] (MG)	Established Level	Records Available	Trophic Class[d]	Lake Management Group[d]
STEUBEN							
Barton	-	94	436	-	-	II	VII B
Bass	0.39	61	146	979.68	1954-66	II	VII A
Bell	-	38	166	-	-	II	VII A
Big Otter	21.30	69	580	965.18	1946-53	II	IV D
Big Turkey	35.8	450	2378	926.61	1945-66	II	VII B
Crooked	10.40	828	3440	988.17	1946-	I	VII A
Fish	-	59	244	-	-	III	IV B
Fox	1.25	142	1026	1018.83	1946-53	II	IV A
Hog	-	48	185	-	-	-	-
Hogback	103.00	146	472	948.50	1946-	III	IV B
Gage	17.30	332	3304	954.25	1946-	I	II B
George	14.70	488	-	985.28	1946-	I	II B
Golden	88.80	119	589	948.50	1946-71, 76-	III	IV B
James	47.80	1034	10943	964.96	1943-49	I	II B
Jimmerson	51.60	434	1431	964.66	1946-	I	II B
Lime	17.50	57	139	954.25	1946-	IV	V
Little Turkey	-	58	254	-	-	-	-
Little Otter	15.70	34	241	965.18	1946-53	III	IV D
Long	67.90	92	501	-	1946-	III	IV B
Loon	2.13	138	205	1011.98	1954-66	IV	V
Marsh[c]	14.90	56	-	-	1967-69	III	IV B
McClish	1.28	35	394	951.09	1951-74, 76-	I	II C
Otter	6.91	118	638	934.15	1954-66	II	VII B
Pigeon	35.20	61	303	988.24	1954-63	III	IV B
Pleasant	1.12	53	387	960.95	1946-66	I	II A
Pleasant	3.18	424	1137	961.50	1954-69, 71-	II	II C
Shallow[c]	-	65	-	-	-	IV	V
Silver	3.79	238	827	959.40	1945-53	II	VII A
Snow	40.20	310	2606	964.96	1943-49	I	II B
Walters	-	53	179	-	-	IV	V

Appendix 6. Continued

Lake	Drainage Area (mi^2)	Surface Area[b] (acres)	Capacity[b] (MG)	Established Level	Records Available	Trophic Class[d]	Lake Management Group[d]
LAGRANGE							
Adams	5.62	308	2505	953.59	1946-	I	VI A
Appleman	-	52	192	-	-	II	VII A
Atwood	1.23	170	508	899.99	1948-53	-	-
Big Long	4.77	388	-	956.21	1954-	II	II C
Blackman	0.98	67	394	974.20	1953-59	II	VI A
Cass	0.68	89	284	873	1970-	-	-
Cedar	1.60	120	332	871.90	1948-51	I	V
Dallas	39.80	283	3248	897.36	1945-	II	II C
Emma	13.60	42	228	880.87	1954-66	II	VII A
Eve	-	31	218	-	-	II	VI A
Fish	10.60	100	1319	936.50	1945-	II	II C
Fish	6.21	139	834	814.42	1954-73, 76-	-	-
Hackenburg	55.40	42	166	897.36	1945-	II	VII A
Lake of the Woods	5.25	136	1782	951.09	1951-74, 76	I	II A
Little Turkey	56.50	135	505	925.72	1945-66	II	VII A
Martin	4.93	26	290	899.45	1945-	U	II C
Messick	56.40	68	472	897.36	1945-	II	VI A
Mongo Reservoir[c]	213.00	76	237	-		III	V
North Twin	1.54	135	690	843.56	1953-	I	V
Olin	5.81	103	2991	899.45	1945-	I	II B
Oliver	11.10	362	5005	899.45	1945-	I	II B
Ontario Millpond[c]	-	31	175	-		-	-
Pigeon	-	61	377	-		II	VII B
Pretty	2.89	184	1538	965.50	1949-53 63-65	I	VI A
Royer	4.69	69	531	936.50	1952-	II	VI A
Shipshewana	6.74	202	439	852.04	1951-	III	IV A
South Twin	2.22	116	1173	843.56	1953-70	I	II A
Still	-	30	202	-		I	VI A
Stone	1.51	152	671	818.76	1954-73, 76-	I	V
Wall	1.61	141	534	942.25	1953-54	I	V
Westler	37.80	88	576	897.36	1945-	II	VI A
Witmer	36.10	204	2293	897.36	1945-	II	II C

Appendix 6. Continued

Lake	Drainage Area (mi^2)	Surface Area[b] (acres)	Capacity[b] (MG)	Established Level	Records Available	Trophic Class[d]	Lake Management Group[d]
NOBLE							
Bear	6.98	136	987	894.60	1943-	II	VI B
Bixler	5.28	120	681	963.65	1945-	II	VII B
Bowen	-	30	351	-	-	II	VII B
Bristol	-	27	241	-	-	-	-
Cree	4.85	58	296	945.23	1949-66	II	VII B
Diamond	4.80	105	840	-	1946-	II	VII A
Eagle	3.22	81	342	-	1946-48	-	-
Engle	4.19	48	218	878.90	1956-71, 77-	II	VII A
Gordy	9.40	31	221	876.68	1953-66	II	VII B
High	4.43	123	404	896.35	1961-	II	VII B
Jones	70.30	114	312	885.55	1948-	-	-
Knapp	6.02	88	990	878.25	1946-	II	VII A
Latta	2.52	42	293	918.71	1954-66	II	VI A
Little Long	4.55	71	570	954.50	1954-	II	VI A
Long	12.00	40	205	895.82	1954-71	II	VII B
Lower Long	4.35	66	508	889.81	1946-52	-	-
Marl	-	30	166	-	-	-	-
Muncie	42.80	47	188	-	1954-	II	VII C
Pleasant	0.29	20	175	-	1952-53	II	VI A
Round	3.47	99	697	954.50	1954-	II	VI A
Sacarider	1.43	33	241	-	1954-63	II	VI A
Sand	14.90	47	413	893.56	1946-51	II	VI A
Skinner	14.00	125	570	927.74	1945-72, 77-	III	VII C
Steinberger	24.30	73	518	885.55	1948-	II	VI A
Sylvan	33.80	669	1951	916.20	1943-	III	IV C
Tamarack	15.90	50	286	885.55	1948-	II	VII A
Tamarack	19.40	84	436	-	-	-	-
Upper Long	2.08	86	619	891.19	1956-	II	VI A
Waldron	134.00	216	1016	885.55	1948-	II	VII C
Wible	-	49	211	-	-	III	IV B
Williams	-	46	348	-	-	-	-

Appendix 6. Continued

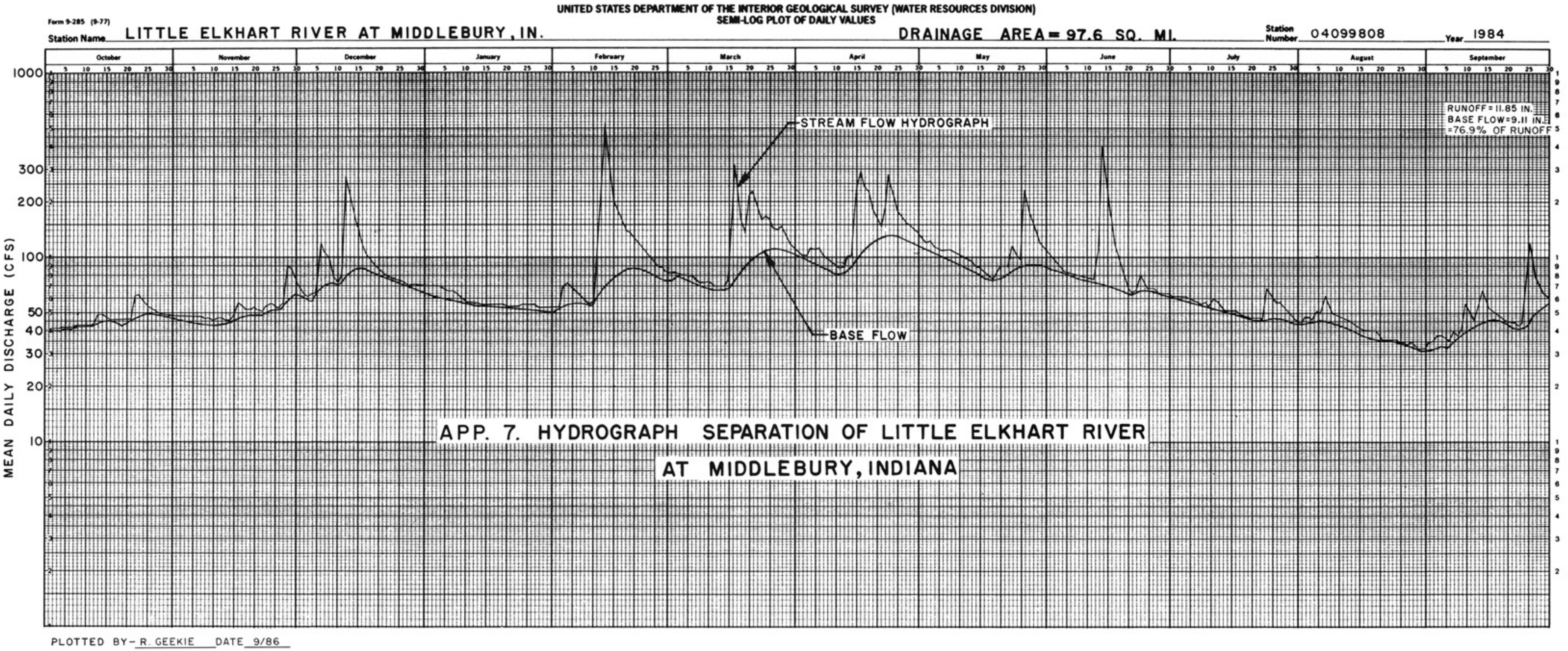
Lake	Drainage Area (mi^2)	Surface Area[b] (acres)	Capacity[b] (MG)	Established Level	Records Available	Trophic Class[d]	Lake Management Group[d]
DEKALB							
Upper Story	3.16	77	332	942.20	1946, 54-66	III	IV B
ELKHART							
Goshen Pond[c]	-	164	358	-	-	-	-
Heaton	9.33	87	208	767.30	1946-53 69-74, 76-	I	V
Hunter	0.51	99	364	856.90	1946-53	I	VII A
Indiana	0.62	122	1107	759.73	1946-53	I	II A
Simonton	7.44	282	508	772.19	1946-	I	II A
Wolf[c]	1.29	100	-	813.00	1947-57	-	-
KOSCIUSKO							
Dewart	8.05	551	2932	867.70	1945-	II	VII B
Flatbelly[c]	4.66	326	-	-	1964-69	III	IV B
Papakeechie[c]	5.52	300	488	-	1964-69	-	-
Shock	-	37	394	-	-	II	II C
Syracuse	38.20	414	1746	858.87	1943-	I	V
Wabee	14.60	187	1547	829.79	1946-53	III	IV D
Wawasee	36.90	3410	21900	858.89	1943-66	I	I

[a]having a surface area of at least 50 acres and/or capacity of at least 500 acre-feet

[b]at established level

[c]no lake map available

[d]data from revised Indiana Lake Classification System and Management Plan (1986), Indiana Department of Environmental Management



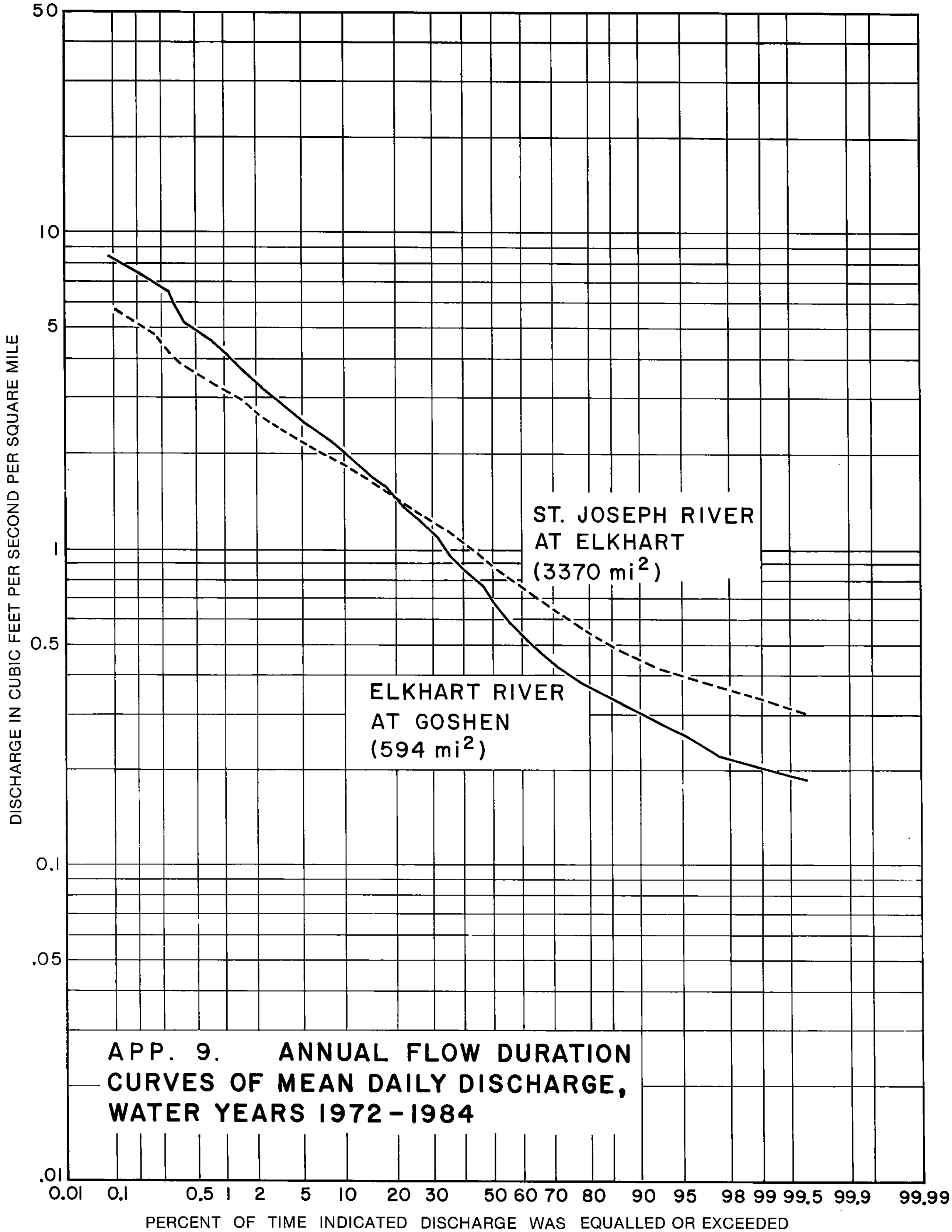
APP. 7. HYDROGRAPH SEPARATION OF LITTLE ELKHART RIVER AT MIDDLEBURY, INDIANA

Appendix 8. Hydrograph for Regulated Streams

Station Number		Drainage Area[a] (Mi^2)	Dry Year[b]					Normal Year[c]				
			RO[d] (in)	DR[e] (in)	GW[f] (in)	DR %	GW %	RO[d] (in)	DR[e] (in)	GW[f] (in)	DR %	GW %
04099510	Pigeon Ck. near Angola IN.	102[b]/106[c]	2.59	0.97	1.62	37	63	12.69	4.02	8.67	32	68
04100500	Elkhart R. at Goshen IN.	580[b]/594[c]	4.62	1.02	3.53	24	76	11.38	3.49	7.89	31	69
04101000	St. Joseph R. at Elkhart IN.	3339[b]/3370[c]	5.23	1.76	3.47	34	66	13.05	4.38	8.67	34	66
04101500	St. Joseph R. at Niles MI.	3666	5.43	1.59	3.84	29	71	12.57	3.37	9.20	27	73

a. Some drainage areas have changed as a result of re-measurement or gage re-siting.
b. Water year 1964.
c. Water year 1975.
d. RO = Runoff.
e. DR = Direct runoff.
f. GW = Ground water or base flow.

The peaks of the hydrograph in Appendix 7 represent the response of stream flow to precipitation events. These peaks generally are composed of overland flow and interflow, and sometimes include ground-water flow. An increase in ground-water discharge during a peak is probably due to local ground-water flow as opposed to regional ground-water flow. The gradual seasonal variation of the hydrograph (base flow) represents a slow response of regional ground-water flow to precipitation events (Freeze and Cherry, 1979). The graph of base flow (as shown) was used to compute the total annual volume of base flow in inches.


50
10
5
1
0.5
0.1
.05
.01
DISCHARGE IN CUBIC FEET PER SECOND PER SQUARE MILE
ST. JOSEPH RIVER
AT ELKHART
(3370 mi2)
ELKHART RIVER
AT GOSHEN
(594 mi2)
APP. 9. ANNUAL FLOW DURATION CURVES OF MEAN DAILY DISCHARGE, WATER YEARS 1972-1984
0.01 0.1 0.5 1 2 5 10 20 30 50 60 70 80 90 95 98 99 99.5 99.9 99.99
PERCENT OF TIME INDICATED DISCHARGE WAS EQUALLED OR EXCEEDED

Appendix 10. Selected Recommended Water Quality Standards[1]

	Aquatic Life	Public Supply	Irrigation	Stock
Arsenic (As)	.44[8]	.05[2,4]	0.1[6,7]	0.2[6]
Barium (Ba)	---	1.0[2,4]	---	---
Boron (B)	---	---	.75[6,7]	5.0[6]
Cadmium (Cd)*	.0063[8]	.01[2,4]	.01[6]	.05[6]
Chloride (Cl)	---	250[3,5]	---	---
Chromium (Cr)*	(Hex).021[8]	(Hex).05[2,4]	.1[6]	1.0[6]
Copper (Cu)*	.043[8]	1.0[5]	---	---
Cyanide (CN) (free)	.052[8]	---	---	---
Dissolved Solids (TDS)	---	500[5]	500-1000[7]	5,000[7]
Fluoride (F)	---	2.4[2,4]	1.0[6]	2.0[6]
Iron (Fe)	1.00[7]	.3[5]	---	---
Lead (Pb)*	.400[8]	.05[2,4]	5.0[6]	.1[6]
Manganese (Mn)	---	.05[5]	---	---
Mercury (Hg)*	.0041[8]	.002[2,4]	---	.001[7]
Nickel (Ni)*	3.1[8]	---	.1[7]	---
Nitrate (NO_3 as N)	---	10.0[2,4]	---	10.0[6]
pH	6.0-9.0[3]	5.0-9.0[5]	4.5-9.0[7]	---
Sulfate (SO_4)	---	250[3,5]	---	---
Zinc (Zn)*	.570[8]	5.0[5]	---	---

[1]Values represent maximum values. All values except pH are in mg/l; in the case of multiple uses the most protective standard applies. Refer to 330 IAC 2-4 for water quality regulations on natural salmonid areas.
[2]Indiana Environmental Management Board, Regulation EMB-4 (320 IAC 3-3.1), Drinking Water Standards, 1979.
[3]Indiana Stream Pollution Control Board, Regulation 330 IAC 1-1, 1985.
[4]U.S. EPA National Interim Primary Drinking Water Regulations, 1979a.
[5]U.S. EPA National Secondary Drinking Water Regulations, 1979b.
[6]U.S. Environmental Protection Agency, 1973.
[7]U.S. Environmental Protection Agency, 1976.
[8]U.S. Environmental Protection Agency, 1980.
*Values are maximum allowable at anytime at 200 mg/l hardness (as provided by IDEM). Values vary with hardness.

Appendix 11. Selected Aquatic Life Standards

<table>
<tr><th colspan="2">Fish Community</th><th>Minimum Concentration of Dissolved Oxygen</th><th>Temperature</th></tr>
<tr><td colspan="2">[1]Warm Water Fish</td><td>4.0 mg/l (5.0* mg/l)</td><td>Streams +5°F (2.8°C)**
Lakes +3°F (1.7°C)**</td></tr>
<tr><td rowspan="4">Cold Water Fish</td><td>[1]Areas designated for for Put-and-take trout</td><td>6.0 mg/l</td><td>Streams<65°5F (18.3°C) or +5° F (2.8°C)**
Lakes no heat added</td></tr>
<tr><td>[2]Areas designated for Salmonid Fish</td><td rowspan="2">6.0 mg/l (7.0 mg/l-spawning season)</td><td rowspan="2">No heat added</td></tr>
<tr><td>Spawning or rearing or imprinting</td></tr>
<tr><td>Migration route</td><td>5.0 mg/l
6.0 mg/l* (also limit during migration)</td><td>85°F (29.4°C) or +2°F (1.1°C)**
70°F (21.1°C) during migration</td></tr>
</table>

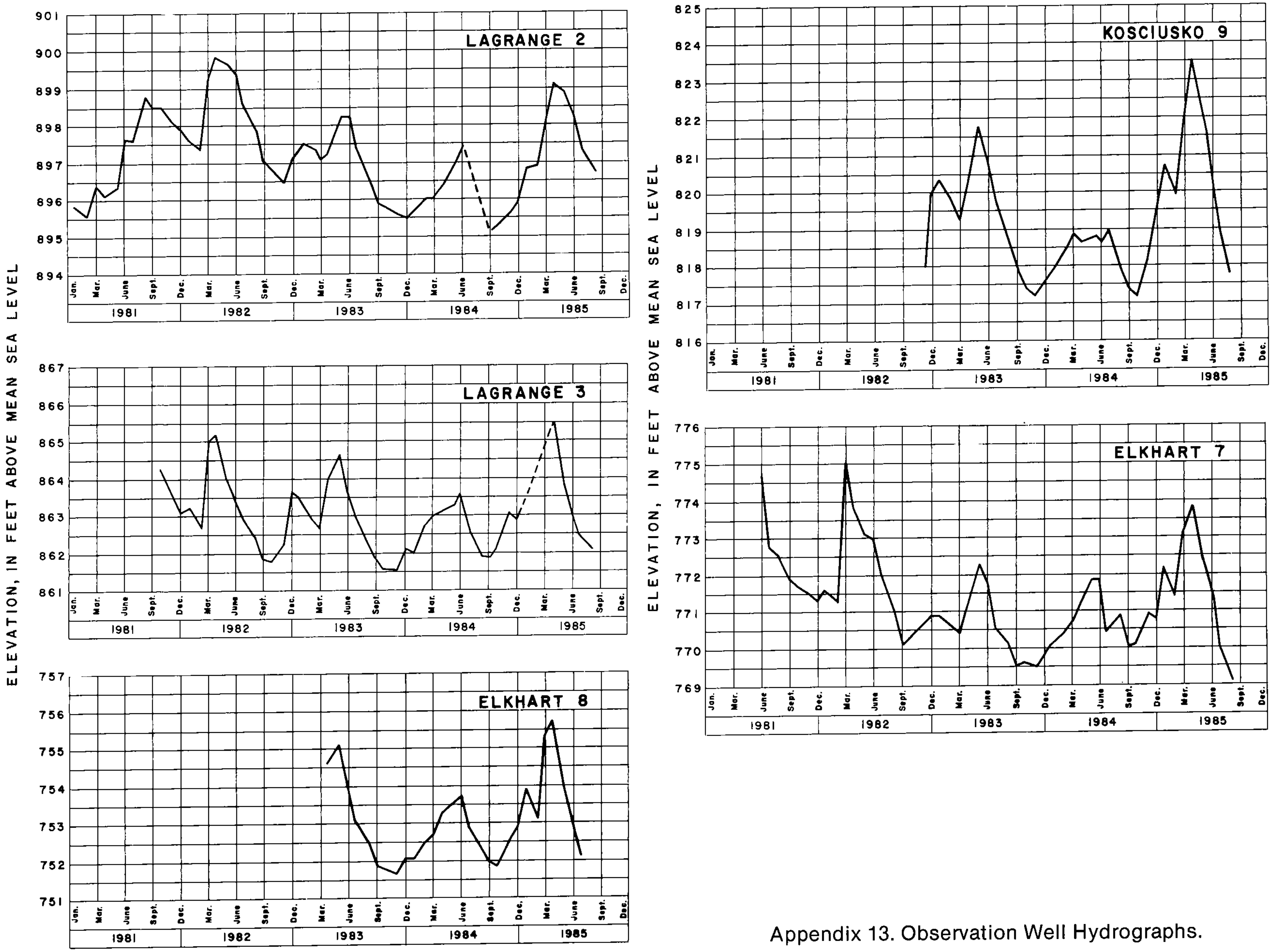
*Average per day.
**Maximum rise above natural temperature.

[1]Indiana Stream Pollution Control Board Reglation 330 IAC 1-1, 1984.
[2]Indiana Stream Pollution Control Board Regulation 330 IAC 2-4, 1985.

Appendix 12. Trophic Classes and Lake Management Groups

Trophic Class		Lake Management Groups		
Bonhomme Trophic Index	Characteristics	Group	Characteristics	General Management Approach
I (1-25 points)	Least eutrophic, best water quality, few aquatic plants and algae, low nutrient levels.	I	large size (>3,000), good water quality (16-20 points).	Maintain good conditions, protect by curbing nutrients.
II (26-50 points)	Mesotrophic, medium water quality, diverse communities of plants and algae, stable ecosystem	IIa	best water quality (1-16 points), intermediate mean depths of 17.6-31 ft.	Protect and maintain present water quality and natural features.
		IIb	best water quality (3-25 points) large mean depths of 31.2-45 ft.	
		IIc	medium water quality (18-41 points), large mean depths of 32.7-40.5 ft.	For group IIc, improve water quality by curbing nutrients. Other techniques depend on lake.
III (51-75 points)	Eutrophic, large supply of nutrients, shallow, always support extensive communities of plants and algae, organic rich bottom sediment, can have low D.O. level caused by decomposition of organics.	III	large bodies of water (1,291-1,864 acres), medium water quality (23-48 points), mean depths of 5-24.5 ft.	Prevent further degradation by curbing nutrients; for problem lakes, use macrophyte harvesting, sediment consolidation.
			Lakes with poorest water quality (50-75 points)	Problem lakes, improve water quality as quickly as possible through restorative measures and nutrient abatement program. Specific restoration techniques depend on individual lakes.
		IVa	very shallow from 2-7.3 ft.	
		IVb	mean depths of 7.9-20 ft.	
		IVc	no distinction from other subgroups	
		IVd	mean depth 21-31.1 ft.	
IV (75 points)	Remnant lakes, very shallow, extensive plant and algae communities.	V	good water quality (2-18 points), shallow mean depths of 5-16 ft.	Maintain present good condition.
		VI	good-med. water quality (13-39 points) mean depth of 15-27 ft.	Main priority-limitation of nutrient inputs-depends on lake condition.
		VII	trophic state 18-54 points mean depth of 5-19.6 ft.	Limit nutrient inputs. Other techniques depend on lake.

Source of data: Indiana Lake Classification System and Management Plan (1980); Indiana Department of Environmental Management



Appendix 13. Observation Well Hydrographs.

Appendix 14. Results of Chemical Analysis from Selected Water Wells (in mg/l except as indicated)

Location number: *, anomalous analysis (EPM balance error >5%); +, analysis of softened water; -, composite sample from two wells in same aquifer; #, incomplete analysis.

Well Owner: d, deep; Elk, Elkhart; N, north; obs, observation well; s, shallow; S., south; S.B., South Bend; t, test; (122), sample number for well sampled in joint IDNR and IGS study, summer 1985.

Well depth: n.a., not available.

Date sampled: month and year.

Aquifer System: STJ, St. Joseph and Tributary Valley; HOW, Howe; HIL, Hilltop; TOP, Topeka; NAT, Natural Lakes and Moraines; KEN, Kendallville; NAP, Nappanee.

Remarks: For location and information on well type and major source of data, see location map.

[1]Field measurement; results in pH units; [2]TDS values are the calculated sum of major constituents expected in an anhydrous residue of a ground-water sample.

Location Number	Well Owner	Township (N)	Range (E)	Section	Well Depth (feet)	Aquifer System	Date Sampled	pH[1]	Hardness as $CaCO_3$	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Iron (Fe)	Manganese (Mn)	Alkalinity as $CaCO_3$	Chloride (Cl)	Sulfate (SO_4)	Fluoride (F)	Nitrate (NO_3 as N)	Total Dissolved[2] Solids (TDS)
	ST. JOSEPH COUNTY																				
1	Wedgewood Park	38	2	12	77	STJ	01/66	6.8	228	55.0	22.0	3.0	1.0	0.40	.1	166.0	3.0	56.0	0.1	0	241
2	River Commons	38	2	14	151	STJ	11/73	7.7	250	64.0	22.0	4.0	.9	1.20	.07	198.0	12.0	48.0	0.1	<.1	271
3	R. Bartsch (22)	38	2	16	202	STJ	06/85	8.3	307	78.2	27.1	4.3	0.7	<.10	<0.1	249.7	9.8	69.4	0.2	<0.2	499
4#	German Twp.	38	2	19	160	STJ	11/60	.	292	.	.	.		0.30		289.0	4.0	70.0	.		345
5	Christ King Ch. (21)	38	2	24	71	STJ	06/85	8.4	360	99.8	26.9	38.8	2.1	<0.10	<0.1	312.7	61.8	47.0	0.2	3.1	677
6	S. Bend Pinhook 1	38	2	26	131	STJ	09/76	7.4	328	78.0	32.0	12.0	2.0	0.90	.13	250.0	30.0	55.0	0.2	<.1	360
	S. Bend Pinhook 3	38	2	26	131	STJ	09/76	7.8	320	76.0	32.0	15.0	2.0	1.00	.11	260.0	23.0	54.0	0.1	<.1	359
7#	C. Wiggins	38	2	29	100	STJ	01/60	.	360	.	.	.		.50		326.0	8.0	90.0	.	.	415
8	S. Bend Arpt 1	38	2	33	103	STJ	09/77	7.8	368	88.0	36.0	18.0	3.0	<0.10	<.02	288.0	35.0	58.0	0.2	1.6	592
	S. Bend Arpt 2	38	2	33	96	STJ	09/77	8.0	339	80.0	34.0	9.0	3.0	<0.10	<.02	280.0	16.0	49.0	0.1	1.1	360
	★ S. Bend Arpt 3 (74)	38	2	33	108	STJ	06/85	7.1	310	80.5	26.6	4.5	0.9	<0.10	0.1	270.2	23.5	57.0	0.1	0.3	529
9	Drewrys Ltd	38	2	34	157	STJ	07/54	7.9	310	74.0	30.0	3.6	.7	1.80	.13	257.0	3.8	46.0	0.0	.4	328
10	S. Bend N. 5	37	2	1	105	STJ	12/61	7.9	305	78.0	27.0	5.0	1.0	0.00	.1	224.0	8.0	85.0	0.1	.1	478
	S. Bend N. 6	37	2	1	106	STJ	12/61	7.9	343	88.0	30.0	10.0	2.0	0.60	.1	251.0	13.0	101.0	0.1	0	551
	S. Bend N. 7	37	2	1	112	STJ	12/61	7.9	336	86.0	29.0	6.0	2.0	0.10	.05	247.0	13.0	78.0	0.1	.2	516
11	S. B. Bait Co.	37	2	13	78	STJ	08/54	7.7	303	76.0	27.0	3.9	1.0	0.28	0	242.0	6.3	41.0	0.1	4.3	334
12#	Walker Fld t-81A	37	2	14	120	HIL	06/81	7.8	364	.	.	.		0.20	0.1	285.0	61.0	32.0	.		.

Location Number	Well Owner	Township (N)	Range (E)	Section	Well Depth (feet)	Aquifer System	Date Sampled	pH[1]	Hardness as $CaCO_3$	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Iron (Fe)	Manganese (Mn)	Alkalinity as $CaCO_3$	Chloride (Cl)	Sulfate (SO_4)	Fluoride (F)	Nitrate (NO_3 as N)	Total Dissolved[2] Solids (TDS)
13	S. Bend Oliver 1	37	2	15	169	STJ	01/74	7.2	348	90.0	30.0	7.0		<0.10	0.2	276.0	16.0	46.0	.	2.6	528
	S. Bend Oliver 2	37	2	15	165	STJ	01/74	7.1	432	114.0	36.0	31.0		1.80	.05	304.0	68.0	82.0	.	3.3	707
	S. Bend Oliver 3	37	2	15	155	STJ	09/77	7.3	580	164.0	41.0	79.0	3.0	< 0.10	.44	302.0	100.0	250.0	0.1	7.1	.
	S. Bend Oliver 4	37	2	15	192	STJ	09/77	7.8	448	136.0	26.0	20.0	2.0	< 0.10	<.02	318.0	44.0	95.0	0.1	1.6	713
14	S. Bend S. 1	37	2	23	93	HIL	09/77	7.9	310	78.0	28.0	19.0	2.0	<0.10	<.02	260.0	37.0	27.0	0.1	2.6	511
	S. Bend S. 2	37	2	23	92	HIL	05/66	7.2	300	75.0	27.0	9.0	1.0	<0.05	.03	250.0	10.0	33.0	0.0	3.5	464
	S. Bend S. 3	37	2	23	100	HIL	05/76	7.4	354	94.0	28.0	21.0	2.0	<0.10	<.02	272.0	50.0	37.0	0.1	4.1	568
15	S. B. Erskine	37	2	25	175	HIL	05/76	7.6	316	85.0	25.0	7.0	2.0	<0.10	<.02	248.0	25.0	30.0	0.1	3.9	481
16	Forest Hay Sch.	37	2	36	124	HIL	08/56	7.7	220	57.0	19.0	1.6	1.2	0.01	.0	187.0	1.8	23.0	0.1	4.1	245
17#	F. D. Wilson	36	2	3	177	HIL	11/58		216					.10	.	456.0	12.0				359
18	Knollwood C.C. (23)	38	3	9	156	STJ	06/85	8.0	254	64.8	22.4	2.9	0.5	<0.10	<0.1	240.0	3.8	32.2	0.2	<.02	425
19#	P. Van Es	38	3	17	92	STJ	07/58	.	232	.	.	.		<0.10		244.0	16.0	.	.		240
20	S.B. Car. Hills 2	38	3	20	117	STJ	08/82	7.5	316	78.0	29.0	13.0	1.1	0.08	.06	245.0	29.0	43.0	0.2	2.7	495
21	IN Dept. Hwy (29)	38	3	23	70	STJ	06/85	7.4	311	80.9	26.5	25.0	1.0	<0.10	<0.1	253.1	37.1	36.5	0.3	10.6	568
22#	Clay Twp.	38	3	30	163	STJ	01/60	.	360	.	.	.		< .1		282.0	16.0	115.0	.	.	421
23	S.B. Edison 2 (20)	37	3	5	200	STJ	06/85	8.2	307	78.6	26.5	14.8	0.7	0.70	0.1	260.2	33.1	47.3	0.2	<.02	526
	S.B. Edison 3	37	3	5	204	STJ	09/77	7.7	302	77.0	27.0	10.0	1.0	1.20	.10	220.0	26.0	57.0	0.2	< .1	468
24	Mishawaka 2	37	3	11	97	STJ	07/83	7.0	306	83.0	24.0	14.0	2.0	0.34	.13	242.0	25.0	65.0	0.1	.5	509
	Mishawaka 3	37	3	11	89	STJ	06/83	7.1	294	86.0	19.0	18.0	2.2	0.10	.04	236.0	32.0	57.0	0.1	1.2	504
	Mishawaka 4	37	3	11	84	STJ	06/83	7.4	280	78.0	21.0	11.0	1.9	0.21	.05	222.0	20.0	42.0	0.1	1.3	409
	Mishawaka 5	37	3	11	329	STJ	06/83	7.4	336	79.0	34.0	13.0	1.5	0.65	.02	254.0	15.0	74.0	0.2	< .1	539
	Mishawaka 6	37	3	14	100	STJ	06/83	7.2	420	122.0	28.0	31.0	3.0	<.05	.06	294.0	54.0	87.0	0.1	1.8	686
	Mishawaka 7	37	3	14	91	STJ	06/83	7.4	280	77.0	21.0	13.0	1.8	0.17	.06	208.0	24.0	52.0	0.1	.9	444
	Mishawaka 8	37	3	11	89	STJ	06/83	7.4	282	79.0	20.0	12.0	2.0	0.11	.04	218.0	23.0	49.0	0.1	.6	452
	Mishawaka 9	37	3	11	85	STJ	06/83	7.5	260	74.0	18.0	9.0	1.9	0.12	.04	204.0	17.0	39.0	0.2	.9	409
	Mishawaka 10	37	3	14	107	STJ	06/83	7.3	316	90.0	22.0	20.0	1.9	1.00	.26	242.0	31.0	63.0	0.2	.3	525
25	Twin Branch 1 (17)	37	3	12	133	STJ	06/85	8.3	262	66.8	22.8	13.8	0.7	<0.10	0.4	229.6	15.8	54.6	0.3	<.02	463
	Twin Branch 2	37	3	12	144	STJ	06/80	7.7	196	48.0	18.0	10.0	1.0	0.05	.22	188.0	5.0	16.0	0.2	.1	329
26#	NIPSCO	37	3	12	111	STJ	10/79	7.3	.	.	.	.	.	0.10	.24	218.0	.	48.0	0.2	.2	.
27#	Bendix Aviation	37	3	14	125	STJ		.	453	.	.	.	.	2.00		348.0	.	.	.	.	362
28	Byrkit 6	37	3	15	70	STJ	06/83	7.4	328	101.0	18.0	10.0	1.8	<.05	<.02	238.0	20.0	63.0	0.2	3.9	508

Location Number	Well Owner	Township (N)	Range (E)	Section	Well Depth (feet)	Aquifer System	Date Sampled	pH[1]	Hardness as $CaCO_3$	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Iron (Fe)	Manganese (Mn)	Alkalinity as $CaCO_3$	Chloride (Cl)	Sulfate (SO_4)	Fluoride (F)	Nitrate (NO_3 as N)	Total Dissolved[2] Solids (TDS)
29	Concrete Products	37	3	20	129	HIL	06/54	7.8	313	76.0	30.0	3.2	.8	0.06	.1	265.0	3.7	23.0	0.0	5.2	334
30#	J. Kurth	37	3	21	176	HIL	12/58	.	232	.	.	.	.	0.50		327.0	6.0	.	.	.	280
31	John Ringle (65)	37	3	23	38	STJ	11/86	7.7	302	85.1	21.9	15.7	1.2	< 0.1	< 0.1	242.3	39.9	37.9	0.2	4.5	524
32	D. Murphy (18)	37	3	28	203	HIL	06/85	7.8	338	90.9	26.9	5.4	0.5	0.20	0.2	357.2	2.9	14.0	0.2	< .02	585
33#	R. Parcell	36	3	2	131	NAP	12/58		240	.	.	.	.	1.20		292.0	10.0	.	.	.	266
34	C. Contat (19)	36	3	3	100	NAP	06/85	8.0	353	90.2	28.3	4.9	0.5	6.40	0.1	365.8	3.0	16.5	0.3	< .02	605
35#	C. Shafer	36	3	7	210	NAP	11/58		204					0.80		283.0	106.0	.	.	.	345
36	Standard Oil Co.	38	4	18	80	STJ	05/60	7.5	228	55.0	22.0	2.6	1.3	0.05	.01	169.0	8.6	48.0	0.2	3.0	263
37#	Indiana Toll Road	38	4	21	73	STJ	04/55	.	118	.	.	.		0.70		54.0	14.0	2.0	.		.
38	John Rake (24)	38	4	29	50	STJ	06/85	7.5	260	68.3	21.1	3.6	0.5	1.30	0.1	199.4	19.4	50.6	0.2	< .02	413
39#	Moran School	37	4	17	114	STJ	01/60	.	264	.	.	.	.	1.00		273.0	8.0	125.0	.		386
40	F. Besinger (9)	36	4	5	125	NAP	06/85	8.6	213	46.8	22.5	39.3	1.5	1.70	<0.1	307.5	15.4	< 0.1	0.9	< .02	510
41 +	W. Copp (8)	36	4	18	128	NAP	06/85	8.8	73	17.0	7.4	91.1	1.6	0.10	<0.1	269.6	13.8	1.5	1.2	< .02	468
42	R. Eberhart (7)	36	4	29	153	NAP	06/85	8.6	259	59.6	25.8	21.5	0.9	2.10	<0.1	326.3	5.0	<0.1	0.5	< .02	522
	ELKHART COUNTY																				
43	USGS Elk 47	38	4	15	24	STJ	06/78	7.9	220	65.0	14.0	95.0	4.7	0.00	.01	143.0	190.0	16.0	.01	3.1	578
44	USGS Elk 34 s	38	4	23	24	STJ	06/78	7.3	190	46.0	19.0	4.0	.5	2.00	.08	138.0	7.0	44.0	.0	0.1	293
	USGS Elk 34 d	38	4	23	240	STJ	06/78	7.8	230	56.0	21.0	38.0	1.7	0.91	.09	237.0	45.0	2.0	.0	.01	465
45	IN Toll Rd. Ser. 5	38	4	24	60	STJ	11/73	7.8	216	58.0	17.0	2.0	.8	1.00	.06	180.0	2.0	36.0	< .1	.1	33.7
46	USGS Elk A-1	38	4	25	135	STJ	04/79	8.0	230	56.0	21.0	14.0	6.8	0.42	.13	220.0	11.0	11.0	.	.00	401
	USGS Elk A-2	38	4	25	17	STJ	04/79	8.7	160	46.0	12.0	13.0	1.2	0.00	.002	37.0	55.0	23.0	.	16.00	215
47	USGS Elk 49 s	38	4	25	27	STJ	06/78	7.6	370	100.0	30.0	3.0	1.0	0.00	.0	75.0	12.0	250.0	0.0	7.3	496
48	USGS Elk 32 s	38	4	27	24	STJ	06/78	8.2	160	43.0	13.0	4.0	1.1	0.04	.07	74.0	16.0	35.0	0.0	7.8	208
49	USGS Elk I-1	38	4	36	172	STJ	04/79	7.7	190	46.0	19.0	11.0	1.1	0.79	.03	215.0	5.0	2.0	.06	.0	341
50	USGS Elk L-2	38	4	36	183	STJ	04/78	7.6	230	61.0	19.0	4.0	0.9	0.78	.17	157.0	8.0	63.0	0.1	.05	349
51	USGS Elk B-1	38	4	36	475	STJ	04/79	8.3	210	49.0	21.0	57.0	2.1	0.32	.05	250.0	62.0	1.0	.03	.07	510
	USGS Elk B-3	38	4	36	135	STJ	04/79	8.5	230	61.0	20.0	3.0	0.6	0.24	.23	129.0	23.0	71.0	.	.00	362
	USGS Elk B-4	38	4	36	173	STJ	04/79	8.4	200	52.0	18.0	3.0	0.6	0.32	.16	172.0	3.0	30.0	.	.00	328

Location Number	Well Owner	Township (N)	Range (E)	Section	Well Depth (feet)	Aquifer System	Date Sampled	pH[1]	Hardness as $CaCO_3$	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Iron (Fe)	Manganese (Mn)	Alkalinity as $CaCO_3$	Chloride (Cl)	Sulfate (SO_4)	Fluoride (F)	Nitrate (NO_3 as N)	Total Dissolved[2] Solids (TDS)
52	USGS Elk C-1	38	4	36	340	STJ	04/79	7.1	240	59.0	22.0	11.0	1.1	0.38	.88	230.0	8.7	1.5	0.1	.00	406
	USGS Elk C-3	38	4	36	195	STJ	04/79	7.7	220	56.0	20.0	5.0	0.6	0.17	.15	212.0	4.0	21.0	.	.00	339
	USGS Elk C-4	38	4	36	128	STJ	04/79	8.0	220	56.0	20.0	5.0	0.7	0.51	.08	239.0	2.0	5.0	.03	.00	382
53	USGS Elk D-2	38	4	36	174	STJ	04/79	8.4	200	51.0	18.0	5.0	0.8	0.65	.16	193.0	4.0	14.0	.	.03	338
54	USGS Elk E-1	38	4	36	80	STJ	04/79	7.9	300	92.0	26.0	88.0	3.1	1.20	.06	376.0	36.0	96.0	.	.0	660
	USGS Elk E-3	38	4	36	174	STJ	04/79	8.1	240	58.0	22.0	10.0	0.9	0.50	.03	245.0	7.0	10.0	.	.05	426
55	USGS Elk 20 s	37	4	2	27	STJ	06/78	7.8	200	58.0	14.0	22.0	1.5	0.00	0	134.0	44.0	35.0	.0	3.9	338
56	USGS Elk 18 s	37	4	10	27	STJ	04/79	7.7	250	72.0	18.0	25.0	.9	0.01	.001	198.0	60.0	35.0	.	4.2	435
	USGS Elk 18 d	37	4	10	126	STJ	04/79	7.9	180	52.0	12.0	70.0	.7	0.23	.04	248.0	51.0	40.0	.	2.0	509
57	USGS Elk 17 s	37	4	12	25	STJ	04'79	7 7	250	69.0	19.0	8.0	.8	0.64	.16	220.0	14.0	40.0	.	.3	408
	USGS Elk 17 d	37	4	12	190	STJ	04/79	7.4	250	66.0	20.0	8.0	1.0	0.84	.12	261.0	9.0	10.0	.	0	408
58	El Paco Manor	37	4	12	99	STJ	05/66	7.5	235	65.0	18.0	28.0	2.0	0.10	.2	187.0	34.0	52.0	.	.1	427
59	USGS Elk 4 s	37	4	27	32	STJ	06/78	7.2	210	55.0	18.0	3.0	1.3	0.01	.01	142.0	10.0	33.0	.01	6.1	307
60	J. Luse (2)	37	4	27	86	NAP	06/85	7.5	293	74.2	25.9	13.8	0.8	0.30	0.2	298.9	6.4	38.4	<0.1	<.02	532
61	E. Squibb (3)	37	4	36	49	NAP	06/85	7.8	315	76.9	28.1	11.2	0.8	4.10	0.1	312.1	13.2	31.3	.3	<.02	553
62	E. Eby (4)	36	4	12	90	NAP	06/85	8.1	304	70.7	30.7	15.1	1.1	<0.10	0.5	325.0	4.9	26.4	0.5	1.2	559
63	E. Davidhizar (6)	36	4	27	47	NAP	06/85	8.6	291	68.1	28.5	16.3	1.0	2.00	<0.1	347.9	4.0	<0.1	0.7	<0.02	554
64	Wakarusa 1	36	4	36	155	NAP	01/75	7.9	278	78.0	20.0	10.0	1.0	3.10	.04	284.0	3.0	4.0	0.6	.1	466
	Wakarusa 2	36	4	36	131	NAP	05/77	7.5	292	77.0	24.0	10.0	1.0	3.20	.02	282.0	6.0	19.0	0.5	0.9	485
65	W. Harter (5)	35	4	1	125	NAP	06/85	8.2	295	74.7	25.6	12.7	0.8	1.90	<0.1	340.4	3.1	<0.1	0.5	<.02	544
66	Nappanee 1	35	4	36	154	NAP	06/82	7.8	318	88.0	24.0	11.0	1.1	1.60	.02	336.0	5.0	5.0	0.5	0.1	546
	Nappanee 2	35	4	36	150	NAP	01/75	7.7	320	81.0	28.0	10.0	1	2.20	.04	334.0	2.0	1.0	0.5	.1	246
	Nappanee 2a	35	4	36	164	NAP	06/82	7.7	330	87.0	27.0	11.0	1.0	1.50	.03	338.0	5.0	5.0	.5	.1	551
67	USGS Elk 46 s	38	5	7	45	STJ	06/78	7.9	260	63.0	24.0	3.0	.7	0.08	.02	181.0	5.0	21.0	0.1	11.0	458
68	USGS Elk 43 s	38	5	10	27	STJ	03/79	8.1	140	35.0	12.0	4.0	.6	0.00	.01	88.0	8.0	22.0	.	6.20	190
	USGS Elk 43 d	38	5	10	172	STJ	03/79	7.5	260	63.0	26.0	28.0	1.0	1.10	.1	266.0	36.0	6.0	.	.04	490
69	USGS Elk 35 s	38	5	20	25	STJ	06/78	7.9	170	50.0	11.0	170.0	1.7	0.80	0	198.0	210.0	25.0	0.1	4.20	723
	USGS Elk 35 d	38	5	20	131	STJ	06/78	7.7	260	63.0	26.0	12.0	1.7	0.51	.16	261.0	7.0	4.0	0.2	.02	445
70	USGS Elk 30 s	38	5	27	24	STJ	03/79	8.5	160	43.0	12.0	13.0	1.8	0.00	0.0	105.0	23.0	29.0	.	4.2	260
	USGS Elk 30 d	38	5	27	172	STJ	03/79	7.8	230	56.0	22.0	31.0	2.1	0.00	.18	248.0	26.0	9.0	.	.0	451
71	Miles Lab	38	5	31	42	STJ	06/54	8.0	166	43.0	13.0	4.0	.8	.14	.04	131.0	3.1	29.0	0.1	1.7	183

Location Number	Well Owner	Township (N)	Range (E)	Section	Well Depth (feet)	Aquifer System	Date Sampled	pH[1]	Hardness as $CaCO_3$	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Iron (Fe)	Manganese (Mn)	Alkalinity as $CaCO_3$	Chloride (Cl)	Sulfate (SO_4)	Fluoride (F)	Nitrate (NO_3 as N)	Total Dissolved[2] Solids (TDS)
72★	USGS Elk 21 s	38	5	32	24	STJ	06/78	7.3	290	75.0	26.0	19.0	2.2	0.36	.17	243.0	30.0	18.0	0.1	0.28	481
73	Elkhart 1 North	38	5	32	44	STJ	11/58	7.8	205	49.0	20.0	4.0	1.0	0.30	.2	188.0	4.0	19.0	0.1		327
	Elkhart 1a North	38	5	32	58	STJ	05/77	7.5	254	62.0	24.0	7.0	1.0	0.10	.06	216.0	16.0	28.0	0.2	.4	269
	Elkhart 2a North	38	5	32	50	STJ	04/75	8.0	246	63.0	21.0	6.0	1	0.30	.09	208.0	10.0	27.0	0.1	.3	383
	Elkhart 2b North	38	5	32	50	STJ	04/83	7.4	240	59.0	22.0	6.0	0.9	0.20	0.08	208.0	12.0	28.0	0.1	0.6	383
	Elkhart 3 North	37	5	5	44	STJ	05/77	7.5	238	59.0	22.0	5.0	2.0	<.10	.02	204.0	14.0	28.0	0.2	< 0.1	379
	Elkhart 4 North	38	5	32	46	STJ	05/77	7.5	240	62.0	21.0	7.0	2.0	<.10	.03	204.0	17.0	27.0	0.2	0.1	385
	Elkhart 5 North	38	5	32	61	STJ	04/83	7.4	240	63.0	20.0	6.0	1.2	<.05	.02	196.0	11.0	28.0	0.1	1.2	327
	Elkhart 6 North	38	5	32	60	STJ	04/83	7.4	232	60.0	20.0	6.0	1.3	<.05	<.02	196.0	11.0	25.0	1.0	1.0	364
	Elkhart 7 North	38	5	32	58	STJ	04/83	7.3	248	62.0	23.0	6.0	1.1	<.05	.03	206.0	12.0	25.0	0.1	0.8	381
	Elkhart 8 North	38	5	32	54	STJ	04/83	7.3	240	65.0	19.0	6.0	1.1	<.05	.02	208.0	12.0	24.0	0.1	0.9	383
	Elkhart 9 North	37	5	5	62	STJ	04/83	7.4	264	74.0	19.0	11.0	1.6	<.05	.03	216.0	22.0	39.0	0.1	0.8	431
	Elkhart 10 North	38	5	32	62	STJ	04/83	7.2	282	78.0	21.0	16.0	1.9	0.11	.07	226.0	30.0	42.0	0.1	0.6	466
	Elkhart A North	38	5	32	44	STJ	04/83	7.4	220	59.0	17.0	5.0	1.3	<.05	<.02	188.0	10.0	24.0	0.2	1.1	347
	Elkhart B North	38	5	32	41	STJ	04/75	7.9	224	51.5	21.0	5.0	2.0	< .1	<0.2	188.0	8.0	26.0	0.2		347
	Elkhart C North	38	5	32	46	STJ	04/83	7.4	234	59.0	21.0	6.0	1.2	<.05	.05	194.0	11.0	27.0	0.1	0.9	363
	Elkhart D North	38	5	32	45	STJ	04/83	7.4	238	65.0	18.0	6.0	1.4	0.63	.13	204.0	12.0	25.0	0.1	0.4	378
	Elkhart E North	38	5	32	44	STJ	05/77	7.5	254	66.0	22.0	10.0	2.0	0.20	.06	206.0	20.0	30.0	0.2	0.3	402
74	USGS Elk 23 s	37	5	2	24	STJ	04/79	7.6	280	78.0	21.0	43.0	1.6	0.04	.04	203.0	93.0	30.0	.	1.6	534
	USGS Elk 23 d	37	5	2	140	STJ	04/79	7.9	230	60.0	20.0	15.0	1.4	2.10	.1	245.0	13.0	1.0	.	.0	406
75	Elkhart Bower 1	37	5	6	67	STJ	04/75	7.8	180	48.0	15.0	13.0	3.0	2.50	.1	158.0	21.0	26.0	0.2	.1	322
	Elkhart Bower 2	37	5	6	68	STJ	04/75	7.8	196	56.0	14.0	10.0	3.0	1.20	.3	164.0	15.0	41.0	0.2	.5	341
	Elkhart Bower 3 (92)	37	5	6	143	STJ	07/85	7.7	220	61.0	16.3	11.0	0.9	0.20	0.3	184.8	38.3	29.2	0.3	<.02	389
76	Elkhart South 1	37	5	17	104	STJ	04/83	7.3	338	98.0	22.0	11.0	2.0	0.96	.19	246.0	27.0	77.0	0.2	0.4	539
	Elkhart South 2	37	5	17	100	STJ	04/83	7.2	402	124.0	22.0	28.0	3.8	1.40	.50	316.0	40.0	100.0	0.1	0.2	706
	Elkhart South 3	37	5	17	102	STJ	04/83	7.3	326	97.0	20.0	16.0	2.2	0.64	.14	256.0	28.0	78.0	0.1	1.7	556
77★	USGS Elk 15 s	35	5	17	24	STJ	06/78	7.5	320	95.0	21.0	27.0	2.2	0.00	0.0	209.0	36.0	40.0	0.0	.17	501
78	USGS Elk 7 s	37	5	19	34	STJ	06/78	7.8	170	48.0	13.0	20.0	1.0	0.09	.01	154.0	30.0	15.0	0.1	.49	318
79	Dunlap School	37	5	26	138	STJ	09/72	7.7	306	80.0	26.0	.		0.56	0.0	231.0	0.0	48.0	0.3		370
80	Earthmovers Inc. (10)	37	5	32	105	NAP	06/85	7.2	393	96.2	36.4	7.9	0.8	1.90	< 0.1	300.9	21.6	116.0	0.3	<.02	655
81	D. Imhoff (11)	36	5	9	71	NAP	06/85	8.4	316	78.2	28.3	8.6	0.7	2.10	0.1	337.1	3.2	11.6	0.5	<.02	553
82	W. Jessup (13)	36	5	11	82	NAP	06/85	8.1	313	85.5	23.9	3.4	0.5	0.80	<0.1	312.7	2.2	28.0	0.4	< .02	533

Location Number	Well Owner	Township (N)	Range (E)	Section	Well Depth (feet)	Aquifer System	Date Sampled	pH[1]	Hardness as $CaCO_3$	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Iron (Fe)	Manganese (Mn)	Alkalinity as $CaCO_3$	Chloride (Cl)	Sulfate (SO_4)	Fluoride (F)	Nitrate (NO_3 as N)	Total Dissolved[2] Solids (TDS)
83	M. Loucks (66)	36	5	18	76	NAP	11/86	7.4	323	85.8	26.5	8.5	.5	2.50	0.1	347.1	16.0	< 0.1	0.4	<.02	575
84★	J. Martin (12)	36	5	29	104	NAP	06/85	8.3	214	56.0	17.9	13.9	0.9	0.30	<0.1	270.0	1.1	< 0.1	1.4	<.02	430
85	J. Ramer (68)	35	5	2	58	NAP	06/85	7.3	306	75.7	28.1	9.7	0.8	0.80	<0.1	289.0	11.3	50.4	0.3	<.02	536
86	L. Martin (67)	35	5	8	113	NAP	06/85	6.9	315	72.4	32.2	17.7	1.1	1.20	<0.1	389.0	1.1	<0.1	0.8	.02	611
87	E. Kulp (38)	35	5	13	92	NAP	06/85	7.2	280	68.6	26.0	9.3	0.7	0.80	<0.1	292.0	18.4	0.3	0.6	<.02	489
88	A. Martin (14)	35	5	16	155	NAP	06/85	8.1	310	78.5	27.1	10.4	0.7	1.30	<0.1	354.9	1.6	< 0.1	0.5	<.02	563
89	R. Hahn (16)	35	5	17	185	NAP	06/85	7.9	363	91.7	32.2	7.6	0.6	0.80	<0.1	379.7	1.7	27.6	0.4	<.02	634
90	R. Hahn (15)	35	5	18	140	NAP	06/85	7.9	307	74.5	28.8	12.5	0.7	1.20	<0.1	363.5	1.3	< 0.1	0.7	<.02	572
91★	J. Weaver (85)	35	5	22	52	NAP	06/85	7.3	379	95.6	33.8	7.9	0.8	0.90	<0.1	221.8	19.6	102.0	0.4	<.02	537
92	USGS Elk 41 s	38	6	8	24	STJ	04/79	8.3	140	40.0	10.0	4.0	1.1	0.00	.0	78.0	14.0	27.0	.	8.1	193
	USGS Elk 41 d	38	6	8	214	STJ	04/79	7.6	280	66.0	28.0	6.0	1.1	1.00	1.3	270.0	4.0	13.0	.	.01	448
93	Elk 7 obs	38	6	9	60	STJ	06/81	6.8	290	79.0	22.0	4.0		0.64	.16	180.0	16.0	76.0	0.0	.66	418
94	USGS Elk 38 s	38	6	21	24	STJ	06/78	7.8	300	82.0	24.0	3.0	0.9	0.00	.01	178.0	18.0	32.0	0.0	15.0	405
95	Bristol 1	38	6	27	51	STJ	04/83	7.4	252	71.0	18.0	4.0	0.9	<.05	.02	212.0	7.0	27.0	0.1	1.3	388
	Bristol 2	38	6	27	52	STJ	04/83	7.4	252	68.0	20.0	4.0	0.8	<.05	<.02	212.0	7.0	26.0	0.1	2.1	387
96	USGS Elk 28 s	38	6	27	26	STJ	06/78	7.4	360	100.0	27.0	10.0	1.2	0.05	.01	316.0	13.0	19.0	0.1	5.7	587
97	USGS Elk 29 s	38	6	30	24	STJ	04/79	7.7	190	54.0	14.0	13.0	1.3	0.01	0.0	120.0	37.0	30.0	0.0	4.4	300
98	USGS Elk 26 s	37	6	4	24	STJ	04/79	7.6	210	58.0	15.0	3.0	0.6	0.00		158.0	8.0	23.0	.	5.2	308
	USGS Elk 26 d	37	6	4	256	STJ	04/79	7.5	240	59.0	23.0	33.0	3.3	0.81	.28	276.0	22.0	4.0	.	0.0	474
99★	USGS Elk 14 s	37	6	7	24	STJ	06/78	7.8	180	50.0	13.0	2.0	0.8	0.00	0.0	111.0	14.0	16.0	0.0	0.0	236
100★	USGS Elk 13 s	37	6	15	39	NAT	12/77	6.1	270	72.0	22.0	17.0	1.3	1.10	.09	230.0	7.0	13.0	0.1		414
101	USGS Elk 10 s	37	6	17	44	STJ	04/79	7.9	210	56.0	17.0	3.0	0.8	0.28	.14	171.0	4.0	43.0	.	.01	331
	USGS Elk 10 d	37	6	17	193	STJ	04/79	8.2	250	65.0	21.0	7.0	1.0	1.10	.17	259.0	2.0	2.0	.	.01	416
102	USGS Elk 12 s	37	6	22	55	STJ	12/77	7.0	280	78.0	20.0	15.0	2.3	0.14	.01	250.0	17.0	25.0	0.1		463
103	USGS Elk 11 s	37	6	28	37	STJ	12/77	7.1	350	99.0	24.0	4.0	2.6	3.80	.16	311.0	14.0	11.0	0.1	.01	538
104	G. Wood (70)	37	6	35	58	NAT	06/85	7.2	301	79.6	24.9	4.2	0.5	<.10	<0.1	216.4	36.4	26.7	0.2	11.7	494
105	P. Yoder (69)	36	5	1	27	STJ	06/85	6.0	249	68.1	18.7	5.0	0.6	1.10	<0.1	236.6	1.5	31.2	0.3	<.02	422
106	Goshen 1	36	6	9	165	STJ	01/61	7.7	238	63.0	20.0	6.0	2.0	1.90	.05	246.0	3.0	11.0	0.0	.09	407
	Goshen 1 A	36	6	9	170	STJ	04/83	7.3	332	98.0	21.0	17.0	1.5	1.40	.12	244.0	45.0	67.0	0.1	0.1	549
	Goshen 2	36	6	9	145	STJ	04/83	7.5	234	70.0	15.0	7.0	1.0	2.20	.06	238.0	6.0	<5.0	0.2	0.3	392
	Goshen 3	36	6	9	159	STJ	04/83	7.4	272	74.0	21.0	6.0	1.0	2.30	.06	246.0	13.0	17.0	0.2	0.3	435

Location Number	Well Owner	Township (N)	Range (E)	Section	Well Depth (feet)	Aquifer System	Date Sampled	pH[1]	Hardness as $CaCO_3$	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Iron (Fe)	Manganese (Mn)	Alkalinity as $CaCO_3$	Chloride (Cl)	Sulfate (SO_4)	Fluoride (F)	Nitrate (NO_3 as N)	Total Dissolved[2] Solids (TDS)
	Goshen 4	36	6	9	171	STJ	04/83	7.3	288	80.0	21.0	9.0	1.2	1.20	.09	248.0	20.0	29.0	0.7	<.1	465
	Goshen 5	36	6	9	166	STJ	04/83	7.3	294	82.0	22.0	10.0	1.2	1.10	.10	248.0	22.0	34.0	0.1	<.1	475
	Goshen 6	36	6	9	154	STJ	04/83	7.3	298	83.0	22.0	10.0	1.2	1.10	0.1	252.0	24.0	34.0	0.1	<.1	483
	Goshen 7	36	6	9	170	STJ	04/83	7.3	312	92.0	20.0	18.0	1.6	1.60	0.11	252.0	34.0	52.0	0.1	0.3	527
107	Goshen 10 (81)	36	6	15	183	STJ	04/85	7.3	293	85.1	19.2	6.4	0.7	0.60	<0.1	233.9	23.1	51.2	0.3	<.02	478
	Goshen 11	36	6	15	177	STJ	08/63	7.8	282	78.0	21.0	4.0	1.0	1.60	.05	226.0	5.0	54.0	0.1	.1	301
108	R. Hay (82)	36	6	17	62	STJ	06/85	7.4	262	78.3	16.1	4.1	0.8	<0.1	<0.1	197.6	15.6	24.8	0.8	12.1	440
109	Goshen Milk	36	6	15	80	STJ	06/54	7.7	292	83.0	21.0	112.0	1.2	1.30	0.0	223.0	180.0	45.0	0.0	.5	596
110	C. Garber (83)	36	6	22	46	STJ	06/85	7.0	309	91.1	19.1	3.4	6.0	1.20	0.6	236.6	16.7	74.7	0.9	<.02	506
111★	D. Harper (46)	36	6	26	72	STJ	06/85	7.4	316	87.4	23.4	5.5	0.7	0.70	<0.1	282.8	16.2	56.8	0.2	<.02	541
112	Elkhart 4	36	6	35	62	STJ	06/67	7.7	292	79.0	23.0	3.0	2.0	0.78	.05	239.0	4.5	45.0	0.1	.2	315
113	L. Jones (47)	35	6	1	78	STJ	06/85	7.5	289	79.8	21.5	3.2	0.7	0.90	<0.1	279.4	3.5	41.1	0.2	<.02	498
114	Brookview Farms (84)	35	6	5	88	NAP	11/86	7.9	279	71.5	24.5	9.5	0.5	3.00	0.1	303.7	5.3	15.2	0.4	<.02	509
115	N. Maurer (43)	35	6	13	180	NAT	06/85	7.1	270	76.7	18.6	3.9	0.9	0.90	<.1	276.3	4.3	13.8	0.3	<.02	463
116	Hoskins (25)	35	6	21	80	STJ	06/85	8.0	303	84.6	22.2	3.4	0.7	<.1	<0.1	244.0	9.7	45.7	0.2	4.0	486
	Hoskins (26)	35	6	21	234	STJ	06/85	8.8	240	54.8	25.0	116.0	2.4	<.1	<0.1	309.4	11.2	177.0	0.4	<.02	773
117	M. Myers (39)	35	6	32	43	STJ	06/85	7.4	304	84.6	22.0	5.2	0.6	1.00	<0.1	269.8	7.5	45.8	0.3	<.02	503
118	R. Eisenhour (42)	35	6	35	184	NAT	06/85	7.1	266	65.2	25.0	14.9	0.9	0.20	<0.1	308.8	2.7	4.9	0.4	<.02	501
119	D. Murphy (75)	38	7	15	30	STJ	06/85	7.6	195	57.1	12.6	69.7	1.6	0.20	0.1	141.1	135.0	42.2	0.9	<.02	496
120	K. Shaw (93)	38	7	19	52	STJ	07/85	7.7	183	56.5	10.1	30.3	1.3	<0.1	<0.1	148.0	53.8	24.7	0.2	.9	366
121	R. Mauk (73)	38	7	23	44	HOW	06/85	7.6	239	74.1	13.1	5.8	0.5	<0.1	<0.1	200.3	26.4	20.7	0.1	<.02	389
122★	R. Zickafoose (72)	38	7	23	80	NAT	06/85	7.0	274	78.2	19.1	4.2	0.6	0.20	<0.1	274.2	13.8	22.7	0.2	<.02	480
123	Middlebury 3	37	7	10	159	STJ	04/83	7.3	266	67.0	24.0	12.0	1.1	1.30	.08	256.0	8.0	7.0	1.3	<.10	434
	Middlebury 4	37	7	3	158	STJ	03/82	7.6	244	66.0	19.0	13.0	1.1	1.10	.10	254.0	7.0	5.0	1.9	.2	424
124	State Line S&G (71)	37	7	8	215	NAT	06/85	7.1	250	66.6	20.0	6.5	0.7	0.40	0.1	256.8	9.6	12.9	0.3	<.02	438
125	A. Yoder (1)	37	7	21	230	NAT	06/85	7.8	249	65.8	20.4	5.3	0.6	0.40	0.1	289.7	3.2	2.5	0.3	<.02	428
126	A. Miller (175)	37	7	25	50	STJ	07/85	7.4	414	116.1	30.0	9.3	1.5	0.50	<0.1	287.1	25.3	28.3	<.1	13.3	628
127	E. Chupp (52)	36	7	1	130	NAP	06/85	7.1	349	81.2	34.6	9.3	0.7	1.90	<0.1	402.5	2.7	2.4	0.5	<.02	634
128	E. Miller (51)	36	7	2	44	NAP	06/85	7.0	370	98.8	30.0	4.0	0.7	<.10	<0.1	285.8	20.2	50.4	0.5	13.6	619
129	A. Yoder (48)	36	7	16	188	NAP	06/85	7.3	213	55.0	18.2	6.3	0.8	0.20	0.1	249.1	1.6	<0.1	0.3	<.02	394
130	Clinton Frame Mennonite Church (44)	36	7	16	224	NAP	11/86	7.4	216	59.1	16.6	10.3	0.4	<0.10	0.1	240.8	3.2	<0.1	0.3	<.02	393

Location Number	Well Owner	Township (N)	Range (E)	Section	Well Depth (feet)	Aquifer System	Date Sampled	pH[1]	Hardness as $CaCO_3$	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Iron (Fe)	Manganese (Mn)	Alkalinity as $CaCO_3$	Chloride (Cl)	Sulfate (SO_4)	Fluoride (F)	Nitrate (NO_3 as N)	Total Dissolved[2] Solids (TDS)
131★	L. Schrock (50)	36	7	22	119	NAP	06/85	7.7	254	64.0	22.2	4.5	0.5	1.50	<0.1	292.1	2.0	1.7	0.2	<.02	462
132	E. Mast (45)	36	7	19	56	NAP	06/85	7.6	274	69.2	24.0	10.1	0.7	1.20	<0.1	323.9	1.4	<0.1	0.4	<.02	510
133	Millersburg 2	36	7	34	153	NAP	09/80	7.4	312	78.0	28.0	6.0	1.0	1.40	.05	300.0	<5.0	15.0	0.3	<0.1	501
	Millersburg 3	36	7	34	142	NAP	09/80	7.5	304	75.0	28.0	6.0	0.9	1.95	0.05	296.0	<5.0	17.0	0.3	<0.1	496
134	W. Whirledge (49)	36	7	35	213	NAP	06/85	7.7	302	76.7	25.6	7.4	0.7	2.90	0.1	328.3	3.1	9.6	0.3	<.02	534
135	G. Showalter (64)	35	7	16	112	NAT	06/85	7.4	299	81.4	22.7	8.5	0.7	1.20	<0.1	263.3	43.5	23.8	0.3	<.02	512
136	T. Hire (113)	35	7	26	24	NAT	07/85	7.3	266	79.3	16.6	6.8	0.6	<.10	<0.1	230.0	10.7	20.2	0.2	7.3	451

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Location Number	Well Owner	Township (N)	Range (E)	Section	Well Depth (feet)	Aquifer System	Date Sampled	pH[1]	Hardness as $CaCO_3$	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Iron (Fe)	Manganese (Mn)	Alkalinity as $CaCO_3$	Chloride (Cl)	Sulfate (SO_4)	Fluoride (F)	Nitrate (NO_3 as N)	Total Dissolved[2] Solids (TDS)
137	R. Hoffer (36)	34	5	6	65	NAP	06/85	7.3	356	91.0	31.2	4.3	0.5	0.30	0.2	243.9	17.9	111.0	0.3	<.02	561
138	D. Mikel (35)	34	5	10	102	NAP	06/85	7.0	285	71.6	25.4	11.9	0.9	0.80	<0.1	317.4	2.6	<0.1	0.5	<.02	511
139	J. Gingerick (37)	34	5	11	155	NAP	06/85	7.3	262	65.3	23.5	30.4	1.6	1.40	<0.1	325.0	5.1	13.2	0.4	<.02	547
140	D. McIntire (34)	33	5	1	80	STJ	06/85	6.9	401	117.2	25.9	9.8	0.9	1.00	<0.1	279.0	46.4	97.5	0.5	<.02	644
141	USGS B-116-ID	34	4	4	130	NAT	12/81	7.5	332	82.0	31.0	7.7	1.0	1.20	.06	324.0	5.0	21.0	0.4	.1	280
142	USGS Kos. 9	34	6	5	102	STJ	12/81	7.5	302	82.0	24.0	5.2	1.0	1.10	.08	248.0	11.0	53.0	0.2	.1	340
143	USGS R-101-2	34	6	6	76	STJ	06/81	7.3	200	60.0	12.0	3.0	0.7	0.65	.05	181.0	5.0	25.0	0.2	.1	328
144	Milford 1	34	6	8	52	STJ	07/82	7.5	396	119.0	24.0	8.0	5.8	0.08	.21	300.0	27.0	62.0	0.1	10.7	623
	Milford 2	34	6	8	48	STJ	07/83	7.8	322	106.0	14.0	6.0	1.4	1.30	.10	213.0	20.0	80.0	0.1	.4	489
145	H. Beer (40)	34	6	18	30	STJ	06/85	7.1	302	86.6	20.4	2.7	0.4	1.10	<0.1	235.8	7.8	76.2	0.2	<.02	488
146	H. Miller (41)	34	6	19	147	STJ	06/85	7.6	278	78.8	19.7	3.4	0.6	0.30	<0.1	266.0	2.2	25.1	0.2	<.02	462
147	Maple Leaf Farm (30)	34	6	26	92	NAT	06/85	7.1	417	120.0	28.6	5.0	1.0	<.1	<.1	298.0	18.6	49.4	0.2	20.3	681
	Maple Leaf Farm (31)	34	6	26	210	NAT	06/85	7.3	314	88.0	22.4	2.8	0.6	0.90	<0.1	283.4	4.8	45.8	0.2	<.02	518
148	D. Morgan (33)	34	6	31	36	STJ	06/85	7.3	217	61.0	15.2	7.7	0.6	1.00	<0.1	237.4	1.8	5.7	0.4	<.02	391
149	K. Miller (32)	34	6	34	104	NAT	06/85	7.1	279	75.1	21.9	8.9	0.7	0.70	<0.1	300.1	2.9	11.8	0.4	1.4	503
150	Leesburg Sch. (27)	33	6	8	140	STJ	06/85	7.2	385	110.0	26.4	22.7	1.4	0.50	0.2	285.4	58.2	90.1	2.7	<.02	665
151	C. Zimmerman (28)	33	6	18	130	STJ	06/85	7.5	305	89.0	20.2	6.1	0.5	<0.1	<0.1	265.3	7.9	31.1	0.4	3.0	496
152	D. Longenecker (192)	33	5	13	65	STJ	08/85	7.3	339	94.7	25.0	1.5	0.4	<0.1	<0.1	270.9	3.7	47.3	0.1	1.1	513
153	M. Crow (59)	34	7	4	68	NAT	06/85	7.5	344	90.9	28.2	3.3	0.5	0.70	<0.1	282.8	13.2	78.3	0.7	<.02	567
154	Syracuse 1	34	7	6	112	NAT	10/73	7.7	350	92.0	29.0	9.0	1.0	1.50	.02	316.0	11.0	28.0	0.3	<.1	562

Location Number	Well Owner	Township (N)	Range (E)	Section	Well Depth (feet)	Aquifer System	Date Sampled	pH[1]	Hardness as $CaCO_3$	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Iron (Fe)	Manganese (Mn)	Alkalinity as $CaCO_3$	Chloride (Cl)	Sulfate (SO_4)	Fluoride (F)	Nitrate (NO_3 as N)	Total Dissolved[2] Solids (TDS)
154a	Syracuse 2	34	7	6	172	NAT	10/73	8.0	246	59.0	24.0	11.0	2.0	2.30	.02	256.0	4.0	1.0	0.5	0.4	417
154b	Syracuse 3	34	7	6	111	NAT	10/73	7.8	332	89.0	27.0	6.0	1.0	2.20	.04	294.0	7.0	35.0	0.3	<0.1	343
155	M. Yoder (148)	34	7	11	160	NAT	07/85	7.1	284	76.3	22.0	16.5	0.7	1.40	<0.1	296.2	3.0	17.2	0.7	<.02	510
156	H. Gants (87)	34	7	35	85	NAT	06/85	6.6	355	92.3	30.0	8.3	1.0	0.90	<0.1	334.7	2.0	22.9	0.8	<.02	574
313	A. Peterson (86)	34	6	11	100	NAT	06/85	6.5	292	77.9	23.3	5.6	0.7	0.70	<0.1	305.1	3.4	16.8	0.2	<.02	509

LA GRANGE COUNTY

Location Number	Well Owner	Township (N)	Range (E)	Section	Well Depth (feet)	Aquifer System	Date Sampled	pH[1]	Hardness as $CaCO_3$	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Iron (Fe)	Manganese (Mn)	Alkalinity as $CaCO_3$	Chloride (Cl)	Sulfate (SO_4)	Fluoride (F)	Nitrate (NO_3 as N)	Total Dissolved[2] Solids (TDS)
157	E. Miller (80)	38	8	21	46	HOW	06/85	7.4	220	59.8	17.1	4.6	0.4	<.10	<0.1	160.0	3.6	28.3	0.3	15.1	382
158	S. Chupp (79)	38	8	25	53	HOW	06/85	7.6	257	73.2	17.7	10.4	0.7	0.30	0.3	285.0	15.1	1.2	0.5	<.02	475
159	Shipshewanna Church of Nazarene	37	8	10	43	HOW	11/86	6.4	329	95.5	22.0	6.5	0.7	<.10	0.1	213.6	31.5	91.6	0.8	<0.02	513
160	Shipshewanna 1	37	8	11	210	HOW	06/79	7.9	250	69.0	19.0	11.0	1.0	3.00	0.15	272.0	<5.0	<5.0	0.4	0.4	444
	Shipshewanna 2	37	8	11	220	HOW	06/79	7.9	242	67.0	18.0	11.0	1.0	1.00	0.17	260.0	<5.0	8.0	0.4	0.3	428
161★	O. Yoder (173)	37	8	15	134	NAT	07/85	7.7	248	72.1	15.5	5.5	0.5	2.10	0.1	228.5	2.5	<.1	0.5	<.02	386
162	S. Weaver (147)	37	8	25	45	NAT	07/85	7.2	289	87.4	16.5	4.0	0.5	1.60	0.1	219.0	7.9	73.3	0.6	<.02	464
312	M. Yoder (174)	37	8	31	92	NAP	07/85	7.5	324	79.7	28.4	6.3	0.6	4.60	0.1	311.8	2.9	<.1	0.5	<.02	513
163	E. Lehman (58)	36	8	7	26	STJ	06/85	7.3	271	74.3	20.4	4.7	0.4	0.50	0.3	257.9	5.4	29.1	0.3	<.02	456
164	A. Beachy (53)	36	8	17	43	STJ	06/85	7.0	321	92.4	18.0	2.8	0.5	8.90	0.3	297.0	3.9	38.6	0.2	<.02	532
165	M. Miller (54)	36	8	14	44	NAT	06/85	7.2	334	90.5	25.7	15.0	0.8	1.30	<0.1	394.7	3.2	3.0	0.7	<.02	633
166	S. Kauffman (55)	36	8	14	102	NAP	06/85	7.7	326	90.4	21.7	3.4	0.7	6.00	<0.1	312.2	14.0	36.8	0.3	<.02	561
167	F. Miller (57)	36	8	28	98	NAT	06/85	7.6	302	89.0	18.8	2.5	0.5	1.60	<0.1	243.8	5.1	66.6	0.2	<.02	487
168	L. Eash (56)	36	8	33	91	NAT	06/85	7.4	317	97.3	15.0	4.8	0.5	6.60	0.1	312.2	2.9	36.6	0.2	<.02	554
169★	D. Phillips (101)	38	9	25	62	HOW	07/85	7.3	248	73.5	15.5	2.3	0.6	0.30	<0.1	210.3	20.3	41.1	0.3	<.02	414
170★	C. Troyer (94)	38	9	34	177	HOW	07/85	7.9	174	67.0	1.0	9.2	0.8	2.00	.02	264.0	7.0	5.0	0.2	.2	414
171★	C. Troyer (100)	38	9	34	255	HOW	07/85	7.2	250	70.6	17.0	10.1	0.7	2.00	<0.1	278.5	23.6	3.2	0.4	<.02	474
314	LaGrange obs. 3	38	9	36	40	HOW	06/81	7.2	300	89.0	20.0	4.7	1.3	0.89	.12	200.0	12.0	82.0	0.1	.49	455

Location Number	Well Owner	Township (N)	Range (E)	Section	Well Depth (feet)	Aquifer System	Date Sampled	pH[1]	Hardness as $CaCO_3$	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Iron (Fe)	Manganese (Mn)	Alkalinity as $CaCO_3$	Chloride (Cl)	Sulfate (SO_4)	Fluoride (F)	Nitrate (NO_3 as N)	Total Dissolved[2] Solids (TDS)
172	M. Burgi (102)	37	9	2	39	HOW	07/85	7.6	308	91.7	17.7	7.2	0.6	3.20	0.1	271.6	10.3	34.5	0.3	<.02	503
173	Sandy Lane Farm (78)	37	9	7	50	HOW	06/85	7.5	317	93.2	20.3	3.0	0.6	0.60	<0.1	247.3	15.0	77.2	0.5	<.02	517
174	M. Atwater (77)	37	9	17	81	HOW	06/85	7.5	332	96.2	21.8	3.6	0.6	1.00	0.4	276.9	9.2	64.9	1.2	<.02	544
175	Lambrights's Inc. (95)	37	9	27	59	NAT	07/85	7.5	370	103.0	27.4	5.5	0.6	0.30	<0.1	209.3	22.0	148.0	0.2	<.02	568
176	P. Yoder (99)	36	9	6	104	NAT	07/85	7.2	284	82.3	18.5	4.8	0.5	1.40	<0.1	292.9	12.7	9.1	0.4	<.02	496
177	Y. Lehman (91)	36	9	7	57	NAT	06/85	7.4	266	76.3	18.0	5.9	0.5	0.90	<0.1	276.9	1.8	2.3	0.6	<.02	453
178	M. Hershberger (97)	36	9	10	31	NAT	07/85	7.1	362	104.0	24.8	2.9	0.6	<.10	<0.1	243.9	26.8	52.1	0.3	8.2	550
179★	L. Byler (96)	36	9	12	75	NAT	07/85	7.5	278	70.9	23.9	14.6	0.7	1.30	0.1	329.6	12.6	<0.1	0.8	<.02	538
180	G. Beachy (98)	36	9	16	93	NAT	07/85	7.3	284	78.1	20.7	8.0	0.6	2.10	<0.1	317.9	1.5	1.5	0.6	<.02	513
181	G. Yoder (176)	36	9	18	61	NAT	07/85	7.5	274	70.5	23.1	9.9	0.50	1.60	<0.1	271.4	11.5	31.4	0.6	<.02	488
182	Topeka 1	36	9	31	29	NAT	01/85	7.5	280	78.0	21.0	4.0	3.0	0.00	0.0	242.0	5.0	19.0	0.0	3.3	278
	Topeka 3	36	9	31	105	NAT	06/79	7.5	400	110.0	30.0	3.0	1.1	1.50	.04	328.0	7.0	78.0	0.2	<.1	428
	Topeka 4	36	9	31	107	NAT	06/79	7.6	381	106.0	28.0	2.0	1.0	1.10	.04	322.0	<5.0	62.0	0.2	<.1	394
183	Toll Rd. 5A S.A. 7	38	10	13	108	HOW	11/73	7.8	270	78.0	18.0	5.0	0.8	1.40	.08	250.0	4.0	21.0	0.2	.3	279
184	USGS Howe B-45-1	38	10	19	128	HOW	12/81	7.5	292	85.0	19.0	3.4	0.8	0.23	.23	224.0	7.0	69.0	0.1	.1	310
185	USGS Howe B-45-4	38	10	21	148	HOW	12/81	7.5	280	80.0	19.0	7.2	1.3	0.88	.16	232.0	8.0	45.0	0.2	.1	300
186	USGS Howe B-5-10	38	10	22	152	HOW	12/81	7.4	312	86.0	23.0	3.4	1.0	0.83	.10	240.0	11.0	59.0	0.2	.1	250
187	FBI Farms (201)	38	10	23	65	HOW	08/85	7.4	330	94.4	22.8	1.7	0.6	0.30	0.1	234.6	10.4	67.5	<0.1	<.02	489
188	USGS Howe B-49-1	38	10	36	83	HOW	12/81	7.4	276	77.0	20.0	11.0	1.0	0.18	.15	268.0	5.0	32.0	0.1	.1	330
189	Curtis Creek (202)	37	10	2	n.a.	HOW	08/85	7.3	320	89.6	23.2	4.5	0.6	0.10	0.1	292.0	5.4	24.2	<0.10	<.02	511
	Curtis Creek 1	37	10	2	77	HOW	05/76	7.4	303	82.0	24.0	8.0	1.0	1.80	.07	279.0	5.0	24.0	0.3	<.1	313
	Curtis Creek 3	37	10	2	66	HOW	04/80	7.4	294	81.0	22.0	8.0	1.0	1.90	.06	288.0	8.0	22.0	0.3	<.1	250
	Curtis Creek old well	37	10	2	73	HOW	05/76	8.0	308	86.0	22.0	11.0	<1.0	1.80	.09	282.0	14.0	22.0		<.1	370
190★	A. Hochstetler (120)	37	10	10	93	NAT	07/85	7.4	268	75.2	19.5	4.4	0.6	0.20	<0.1	246.0	11.7	45.3	0.8	<.02	465
191	LaGrange 2	37	10	19	120	NAT	10/76	7.4	272	75.0	20.0	9.0	1.0	3.10	.06	274.0	9.0	5.0	0.3	<.1	287
192	LaGrange 3	37	10	19	110	NAT	10/76	7.6	264	74.0	19.0	7.0	1.0	1.40	.19	270.0	6.0	2.0	0.3	<.1	274
193	Earnest Miller (181)	37	10	28	81	NAT	07/85	7.2	392	111.6	26.9	11.8	0.9	1.30	0.2	373.3	38.2	22.5	<.1	<.02	676
194	R. Ackerman (111)	36	10	2	148	KEN	07/85	7.0	262	74.1	17.4	8.3	0.6	2.90	0.1	300.3	1.2	<0.1	0.5	<.02	480
195	E. Bontrager (150)	36	10	5	252	NAT	07/85	7.1	266	72.0	20.0	13.8	0.8	2.30	<0.1	295.2	1.4	<0.1	0.7	<.02	482
196	LaGrange Animal Shelter (149)	36	10	7	54	NAT	07/85	7.0	356	99.3	24.9	7.1	0.5	2.90	0.1	286.2	6.3	87.0	0.4	<.02	586

Location Number	Well Owner	Township (N)	Range (E)	Section	Well Depth (feet)	Aquifer System	Date Sampled	pH[1]	Hardness as $CaCO_3$	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Iron (Fe)	Manganese (Mn)	Alkalinity as $CaCO_3$	Chloride (Cl)	Sulfate (SO_4)	Fluoride (F)	Nitrate (NO_3 as N)	Total Dissolved[2] Solids (TDS)
197	J. Gaff (119)	36	10	23	183	KEN	07/85	7.2	289	83.8	18.0	3.3	0.5	3.30	< 0.1	265.7	2.5	35.7	0.6	<.02	479
198	Wolcottville 2	36	10	34	86	NAT	10/77	7.1	292	82.0	21.0	5.0	<1.0	1.80	.06	276.0	4.0	13.0	0.5	<.1	469
	Wolcottville 3	36	10	34	92	NAT	10/77	7.2	296	82.0	22.0	5.0	1.0	1.50	.07	281.0	.	13.0	0.5	0.8	469
	Wolcottville 5	36	10	34	86	NAT	03/66	7.0	292	82.0	21.0	7.0	2.0	3.10	.05	297.0	3.0	11.0	0.4	0.4	308
199	USGS Howe B-44-1	38	11	15	109	HOW	12/81	7.5	292	81.0	22.0	5.8	0.9	1.10	.11	284.0	5.0	20.0	0.2	0.1	200
200	R. Miller (103)	38	11	28	69	HOW	07/85	6.1	310	89.6	21.0	2.3	0.4	0.10	< 0.1	251.3	15.7	17.0	0.2	11.9	511
201	USGS Howe B-13-2	38	11	30	164	HOW	12/81	7.5	281	78.0	21.0	6.4	1.0	0.80	.19	284.0	5.0	17.0	0.2	0.1	190
202	Pigeon R. Creek Inn Station	37	11	9	51	HOW	08/79	7.5	264	72.0	20.0	4.0	0.7	2.20	.11	246.0	5.0	25.0	0.2	0.2	273
203★	J. Flint (195)	37	11	14	124	HOW	08/85	7.3	255	67.9	20.3	8.9	0.7	1.40	< 0.1	296.1	1.9	6.8	0.7	<.02	479
204	R. Hall (104)	37	11	17	62	HOW	11/86	7.6	309	93.1	18.7	42.7	1.0	<0.10	.0	264.0	76.6	29.3	0.3	5.87	614
205	P. Herman (199)	37	11	28	76	HOW	08/85	7.3	302	83.0	22.3	2.9	0.5	1.70	<0.1	283.0	1.6	28.4	0.3	<.02	494
206	G. Bolen (105)	37	11	31	76	KEN	07/85	7.2	289	81.7	19.8	3.1	0.5	1.70	<0.1	272.1	5.7	42.3	0.3	<.02	494
207	A. Hutchen	36	11	15	28	KEN	08/63	7.3	308	84.0	24.0	2.1	0.9	0.59	.08	272.0	4.0	40.0	0.1	0.1	331
208	H.D. Kaough	36	11	15	90	KEN	07/63	7.4	330	91.0	25.0	3.4	1.1	1.50	.04	307.0	2.0	30.0	0.4	1.3	358
209	P. Iammarino (106)	36	11	16	190	KEN	07/85	7.4	271	71.8	20.0	5.6	0.7	5.00	< 0.1	303.0	0.7	7.2	0.6	<.02	490
210	R. Wolheater (107)	36	11	16	43	KEN	07/85	7.0	385	109.0	27.4	27.3	1.2	0.10	< 0.1	291.8	87.1	40.1	0.3	7.2	685
211	Lyall Elect. (144)	36	11	29	125	KEN	07/85	7.4	359	99.3	25.6	4.4	0.7	3.10	0.1	315.3	3.9	52.1	0.6	<.02	582
212★	T. Mahan (152)	36	11	35	128	KEN	07/85	7.6	216	43.6	25.3	18.9	1.0	1.80	< 0.1	279.7	11.5	2.5	1.4	<.02	467
	NOBLE COUNTY																				
213	J. Miller (90)	35	8	2	32	TOP	06/85	7.2	427	126.5	26.9	12.9	39.6	0.10	<0.1	306.5	28.5	63.1	0.5	30.3	810
214	E. Moser (178)	35	8	6	182	NAT	07/85	7.3	310	86.4	22.3	4.8	0.5	1.00	0.5	317.3	6.4	8.4	0.3	<.02	526
215	J. Yoder (112)	35	8	7	25	NAT	07/85	6.3	327	98.8	19.1	2.9	0.8	0.50	0.2	244.4	13.8	63.7	0.2	4.5	521
216	E. Peterson (177)	35	8	10	137	TOP	07/85	7.4	350	100.5	23.9	2.2	0.5	0.20	0.2	259.8	24.9	78.0	<.1	<.02	553
217	Monsanto Co. (60)	35	8	21	99	NAT	06/85	7.5	329	92.7	23.5	3.7	0.8	0.60	<0.1	297.5	5.8	58.6	0.4	<.02	555
218	Ligonier 1	35	8	22	130	NAT	05/77	7.8	360	99.0	27.0	4.0	1.0	1.30	.05	300.0	6.0	48.0	0.6	< 0.1	367
	Ligonier 2	35	8	22	120	NAT	02/74	7.3	362	99.0	28.0	3.0	1.0	1.70	.05	296.0	3.0	61.0	0.2	< 0.1	558
219	R. Murphy (61)	35	8	26	91	NAT	06/85	7.3	308	85.8	22.2	6.7	0.6	1.40	<0.1	305.8	10.4	27.8	0.4	<.02	530

Location Number	Well Owner	Township (N)	Range (E)	Section	Well Depth (feet)	Aquifer System	Date Sampled	pH[1]	Hardness as $CaCO_3$	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Iron (Fe)	Manganese (Mn)	Alkalinity as $CaCO_3$	Chloride (Cl)	Sulfate (SO_4)	Fluoride (F)	Nitrate (NO_3 as N)	Total Dissolved[2] Solids (TDS)
220	G. Guyos (62)	35	8	28	87	NAT	06/85	7.3	364	104.0	25.2	5.8	2.6	0.40	0.1	268.7	29.2	96.4	0.2	<.02	595
221★	M. Moser (63)	35	8	30	62	NAT	06/85	7.3	284	81.0	19.4	3.5	0.7	0.90	< 0.1	248.2	12.5	57.0	0.3	<.02	484
222	T. Wigent (89)	35	8	36	85	NAT	06/85	7.0	380	107.5	26.9	4.1	1.0	0.70	< 0.1	274.2	27.5	91.2	0.4	<.02	598
223#	W. Noble School 1	34	8	3	115	NAT	09/84	7.5	.	.	.	3.0		5.40	.06	256.0	.	67.0	.	.	.
#	W. Noble School 2	34	8	3	127	NAT	06/75	7.4	330	.	.	.		0.25	<.1	270.0	4.0	.	.		313
#	W. Noble School	34	8	3	132	NAT	06/75	7.4	335	.	.			1.87	<.1	255.0	4.0	.	.		306
224	H. Alfrey (179)	34	8	5	148	STJ	07/85	7.4	298	83.6	21.2	4.5	0.5	1.40	<0.1	298.7	6.2	9.0	0.3	<.02	499
225	H. Alfrey (180)	34	8	5	75	STJ	07/85	7.2	397	112.1	27.6	4.6	0.6	2.00	0.1	291.1	12.4	111.0	<.1	.6	634
226	Cromwell 1	34	8	16	112	NAT	06/79	7.6	316	88.0	23.0	3.0	0.8	2.50	.06	286.0	<5.0	44.0	0.3	<.1	337
	Cromwell 2	34	8	16	118	NAT	06/79	7.6	322	90.0	24.0	3.0	0.8	2.30	.05	276.0	<5.0	55.0	0.3	.1	346
227	R. Reasoner (88)	34	8	26	82	NAT	06/85	6.8	371	107.0	21.3	3.4	0.8	8.80	0.2	295.7	4.9	75.0	0.6	<.02	590
228	NIPSCO (125)	35	9	2	43	NAT	07/85	7.3	312	90.6	19.8	5.1	0.4	2.20	<0.1	227.2	14.3	94.1	0.5	<.02	510
229	M. Kendall (118)	35	9	13	95	NAT	07/85	7.5	217	60.5	15.4	11.8	0.7	1.60	<0.1	255.6	1.4	<.1	0.8	<.02	413
230	Wawaka Church (187)	35	9	27	26	NAT	08/85	7.4	309	86.3	22.2	4.4	0.5	1.40	<0.1	271.4	4.2	40.6	0.4	<.02	499
231	J. Rosenogle (186)	35	9	33	90	NAT	08/85	7.4	255	68.3	19.9	7.8	0.5	1.20	<0.1	268.9	2.5	2.7	0.7	<.02	442
232	W. Phares (185)	34	9	6	205	NAT	08/85	7.2	289	78.4	22.2	8.7	0.7	0.90	<0.1	312.3	4.0	2.2	0.4	<.02	508
233	E. Peffer (114)	34	9	10	64	NAT	07/85	7.3	315	86.2	22.7	7.0	0.8	3.60	<0.1	265.7	6.8	60.9	0.5	<.02	519
234	H. Koenig (191)	34	9	12	131	NAT	08/85	7.4	340	96.0	23.6	3.0	0.7	1.80	0.1	266.4	7.9	60.0	0.2	<.02	525
235	M. Richman (115)	34	9	14	123	NAT	07/85	7.2	372	103.5	25.9	3.9	0.7	3.90	<0.1	296.6	9.5	86.1	0.4	<.02	603
236	J. Marsh (142)	34	9	19	147	NAT	07/85	7.2	333	95.3	22.2	2.7	0.8	2.00	0.1	267.8	4.5	56.8	0.3	<.02	515
237	Albion 1	34	9	24	98	NAT	10/77	7.2	326	82.0	29.0	11.0	2.0	2.10	.02	302.0	6.0	24.0	0.9	.2	338
	Albion 2	34	9	24	110	NAT	10/77	7.3	274	70.0	24.0	18.0	2.0	1.70	.04	298.0	<.1	4.0	1.0	.3	300
238	J. Steffe (141)	34	9	31	68	STJ	07/85	7.2	388	110.0	26.8	10.6	1.2	1.90	< 0.1	317.3	15.0	100.0	0.2	<.02	658
239	T. Bortner (188)	34	9	33	66	NAT	08/85	7.2	356	98.8	25.5	2.6	0.9	2.20	<0.1	310.8	4.3	41.8	0.5	<.02	564
240	H. Staller (189)	34	9	34	45	NAT	08/85	7.0	513	141.7	36.6	4.5	0.8	4.60	0.2	374.3	13.6	117.0	0.3	<.02	784
241	J. Carson (140)	33	9	9	80	STJ	07/85	7.1	407	117.0	25.6	28.2	2.6	5.40	0.2	337.4	73.8	62.2	0.3	<.02	732
242-	Cp. Lutherhaven (190)	33	9	11	94/117	STJ	08/85	7.6	260	58.5	27.3	18.0	1.3	0.80	<0.1	296.1	3.2	5.2	1.2	<.02	491
243	M. Rowland (138)	33	9	12	48	NAT	07/85	7.0	344	104.0	18.6	2.0	0.7	4.30	0.2	340.9	2.7	41.5	0.5	<.02	595
244★	C. Shively (139)	33	9	21	176	NAT	07/85	7.5	243	65.8	18.5	7.2	0.7	1.40	<0.1	289.3	0.7	<0.1	0.8	<.02	458
245	B. Parks (151)	35	10	1	63	KEN	07/85	7.1	369	102.9	26.1	3.4	0.7	2.50	0.2	275.2	10.0	71.9	0.3	<.02	559
246	Fidler Inc. (109)	35	10	3	190	NAT	07/85	7.1	273	78.6	18.4	3.4	2.6	0.40	<0.1	278.0	1.3	22.5	0.5	<.02	472

Location Number	Well Owner	Township (N)	Range (E)	Section	Well Depth (feet)	Aquifer System	Date Sampled	pH[1]	Hardness as $CaCO_3$	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Iron (Fe)	Manganese (Mn)	Alkalinity as $CaCO_3$	Chloride (Cl)	Sulfate (SO_4)	Fluoride (F)	Nitrate (NO_3 as N)	Total Dissolved[2] Solids (TDS)
247	J. McCormick (110)	35	10	5	131	NAT	07/85	7.2	278	77.5	19.4	5.5	0.7	2.40	<0.1	306.7	0.7	< 0.1	0.6	<.02	490
248	J. Bidwell (193)	35	10	8	129	NAT	08/85	7.5	275	77.5	19.1	2.5	0.5	1.60	<0.1	250.2	1.1	26.6	0.2	<.02	442
249	Gene Stratton Porter	35	10	22	30	KEN	11/79	7.6	288	74.0	25.0	9.0	1.2	6.30	.05	284.0	3.0	9.0	0.6	0.2	475
250	Sharon Ranly (197)	35	10	23	51	KEN	08/85	7.3	300	84.0	21.4	1.4	0.7	1.10	0.1	262.8	1.4	30.8	<.1	<.02	468
251	R. Wysong (194)	35	10	25	87	KEN	08/85	7.3	337	89.4	25.7	4.4	0.8	4.20	<0.1	318.2	2.1	27.0	0.6	<.02	552
252	F. Weber (117)	35	10	29	50	NAT	07/85	7.3	286	86.4	15.9	2.6	1.2	2.70	0.1	222.6	8.6	60.2	0.3	<.02	452
253	Max Bruce	35	10	29	64	NAT	12/79	6.9	434	124.0	30.0	10.0	2.0	8.80	.31	352.0	23.0	69.0	0.1	0.1	478
254-	Lyall Elec. Co. (126)	35	10	35	138/125	KEN	07/85	7.3	291	78.0	22.4	7.5	0.8	2.40	<0.1	314.6	2.4	13.3	0.8	<.02	521
255	T. Trowbridge (128)	34	10	1	75	KEN	07/85	7.1	423	120.0	28.5	5.3	0.8	3.10	0.2	310.7	7.9	117.0	0.3	<.02	668
256	R. Bauman (127)	34	10	2	115	KEN	07/85	7.1	443	125.3	30.2	3.6	0.8	3.00	0.1	314.6	9.6	134.0	0.4	<.02	696
257	Larry Ober (116)	34	10	8	105	NAT	07/85	7.4	307	76.9	26.8	10.1	1.0	2.50	<0.1	328.0	1.5	10.4	1.0	<.02	543
258	James Shrock (132)	34	10	16	80	KEN	07/85	7.1	358	104.0	21.4	8.0	0.8	5.80	<0.1	319.9	5.0	70.9	0.7	<.02	617
259★	A. Bauman (133)	34	10	13	212	KEN	07/85	7.6	180	42.9	17.0	42.1	0.8	1.40	<0.1	299.3	2.6	<.1	1.2	<.02	479
260★	B. Bower (130)	34	10	28	150	KEN	07/85	7.6	191	50.0	15.5	20.5	0.7	1.50	<0.1	288.4	1.1	5.8	1.0	<.02	457
261★	H. Hickman (137)	34	10	32	112	NAT	07/85	7.3	335	74.0	35.0	12.6	1.3	2.30	<0.1	402.9	0.8	12.0	1.2	<.02	642
262★	R. Foster (131)	34	10	35	240	KEN	07/85	7.8	213	50.5	20.1	21.8	0.9	2.40	<0.1	292.4	0.8	<.1	1.2	<.02	463
263	Chain-O-Lakes Saddle Barn	33	10	5	75	NAT	10/78	7.4	296	68.0	31.0	18.0	2.0	0.50	0.2	316.0	1.0	8.0	1.1	0.1	516
264	Chain-O-Lakes Norman Lake	33	10	6	98	NAT	10/78	7.3	260	65.0	24.0	17.0	2.0	1.70	.02	284.0	2.0	9.0	1.0	0.1	291
265	Chain-O-Lakes Campground	33	10	9	175	KEN	10/78	7.2	414	118.0	28.0	3.0	1.0	3.20	.05	312.0	4.0	92.0	0.4	0.1	437
315	USGS obs 8	33	10	9	149	KEN	06/67	7.7	359	101.0	26.0	3.3	1.2	1.70	0.0	297.0	3.0	61.0	0.4	0.2	392
266	C. Rensberger (108)	35	11	8	90	KEN	07/85	7.2	284	76.0	21.9	9.5	0.9	2.30	<0.1	299.3	6.0	12.3	0.8	<.02	504
267	D. DeGroff (196)	35	11	15	95	KEN	08/85	7.0	445	122.3	33.6	1.6	0.8	0.60	0.1	341.4	5.5	94.7	<.1	<.02	681
268★	R. Burkley (135)	35	11	20	320	KEN	07/85	7.5	252	67.3	19.7	9.5	0.8	1.40	<0.1	298.5	0.8	5.0	1.0	<.02	480
269★	W. Sexton (136)	35	11	28	215	KEN	07/85	7.2	262	71.1	19.4	11.2	0.9	2.40	<0.1	314.6	0.7	5.1	0.9	<.02	506
270	R. Muesing (143)	35	11	27	116	KEN	07/85	7.6	347	94.0	25.3	5.6	0.7	4.10	0.1	320.8	2.2	44.3	0.7	<.02	577
271+	R. Strater (129)	35	11	30	118	KEN	07/85	7.2	3	0.7	0.4	149.7	0.4	<0.10	<0.1	313.8	1.0	33.0	0.5	<.02	576
272	Kendallville 6	35	11	34	215	KEN	06/82	7.6	316	87.0	24.0	6.0	1	1.70	0.0	313.0	2.0	7.0	0.3	0	511
273	H. Walburn (134)	34	11	8	112	KEN	07/85	7.5	300	76.2	25.6	8.0	0.9	2.30	<0.1	296.3	1.5	21.3	1.1	<.02	508
274	W. Short (184)	34	11	10	260	KEN	07/85	7.5	274	70.2	23.7	16.9	0.8	0.70	0.1	318.8	3.5	1.2	0.8	<.02	517

Location Number	Well Owner	Township (N)	Range (E)	Section	Well Depth (feet)	Aquifer System	Date Sampled	pH[1]	Hardness as $CaCO_3$	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Iron (Fe)	Manganese (Mn)	Alkalinity as $CaCO_3$	Chloride (Cl)	Sulfate (SO_4)	Fluoride (F)	Nitrate (NO_3 as N)	Total Dissolved[2] Solids (TDS)
	STEUBEN COUNTY																				
275#	Fawn River Hatchery	38	12	20	108	HOW	10/77	7.5	294	.	.	7.0		1.00	0.14	280.0	4.0	17.0	0.3	<.1	360
276	Orland 2 (198)	38	12	29	97	HOW	08/85	7.4	283	81.9	18.7	2.2	0.5	0.90	0.2	245.2	4.5	36.1	<.1	<.02	451
277	H. Smith (121)	37	12	33	123	KEN	07/85	7.2	322	91.8	22.4	4.5	0.7	0.20	<0.1	270.9	9.1	57.0	0.7	1.5	530
278	T. Gose (122)	36	12	6	100	KEN	07/85	7.3	372	99.0	28.9	4.2	1.0	3.20	<0.1	331.2	2.4	71.8	0.8	<.02	623
279	A. Perrine (123)	36	12	7	238	KEN	07/85	7.7	287	71.8	22.7	12.7	0.9	8.00	<0.1	318.1	4.7	2.0	0.8	<.02	522
280	F. Walter (169)	36	12	11	160	KEN	07/85	7.2	304	71.4	29.8	16.6	1.0	2.00	<0.1	341.9	3.9	9.8	1.4	<.02	566
281	S. Ringler (170)	36	12	14	79	KEN	07/85	7.1	408	106.3	32.6	7.5	0.8	4.60	0.1	345.4	21.8	60.3	0.9	<.02	665
282	E.R. Oetling (183)	36	12	20	148	KEN	07/85	7.4	294	78.8	23.3	7.8	0.7	0.80	<0.1	305.7	2.7	4.5	0.6	<.02	502
283	G. Anderson (124)	36	12	29	292	KEN	07/85	7.4	276	74.0	21.5	7.8	0.8	1.60	<0.1	306.8	1.5	7.7	0.8	<.02	499
284	R. Lochamire (145)	36	12	33	114	KEN	07/85	7.3	345	92.9	26.0	6.5	0.7	3.00	<0.1	344.9	3.1	38.3	0.6	<.02	601
285	J. Flaugh (146)	36	12	33	70	KEN	07/85	7.6	272	73.5	20.8	7.8	0.6	1.70	0.1	282.7	1.7	2.4	0.7	<.02	464
286	C. Tompkins (172)	36	12	36	93	KEN	07/85	7.3	272	67.5	24.4	10.4	0.8	1.80	<0.1	282.2	4.7	26.3	1.0	<.02	492
287	Pokagon Boys Camp	38	13	33	150	HOW	08/79	7.5	298	78.0	25.0	7.0	1.1	1.50	.11	300.0	5.0	12.0	0.4	0.3	497
288	Pokagon Shelter Area	38	13	33	60	HOW	08/79	7.5	295	78.0	24.0	9.0	1.2	1.30	.10	296.0	5.0	11.0	0.4	0.3	492
289	Pokagon-Potawatomi Inn South	38	13	34	87	HOW	11/83	7.6	339	94.0	26.0	8.0	1.4	2.00	.06	287.0	24.0	23.0	0.3	3.2	545
	Pokagon-Potawatomi Inn Old	38	13	34	80	HOW	11/83	7.4	313	82.0	26.0	8.0	2.0	2.00	.05	294.0	15.0	23.0	0.2	0.2	517
290	Roy Reed (162)	37	13	19	99	HOW	07/85	7.4	244	68.2	16.9	2.7	0.5	2.20	<0.1	225.1	9.7	27.6	0.6	<.02	409
291	Angola 3	37	13	26	149	KEN	01/75	7.7	370	99.0	30.0	7.0	2.0	2.30	.1	328.0	8.0	40.0	0.6	0.1	589
	#Angola 6	37	13	26	130	KEN	01/48	7.7	.	.	.	.		2.00	0.0	296.0	.	.	0.3	0.0	.
	Angola 7	37	13	26	143	KEN	04/54	7.5	433	109.0	39.0	9.0	1.0	1.30	.1	340.0	18.0	79.0	0.3	0.0	460
	Angola 8	37	13	26	145	KEN	03/74	7.4	338	96.0	24.0	26.0	3.0	0.92	.24	306.0	32.0	33.0	0.6	<.1	589
	Angola 9 (200)	37	13	26	111	KEN	08/85	6.9	576	157.5	42.4	14.1	2.2	4.70	0.2	398.3	56.8	128.0	0.3	<.02	899
292	N. Brady (163)	36	13	4	120	KEN	07/85	7.2	308	80.8	24.6	8.1	0.8	2.40	<0.1	316.3	12.5	21.0	0.9	<.02	547
293★	Favorite Farms (166)	36	13	8	93	KEN	07/85	7.0	29	6.4	3.1	186.1	2.4	0.20	<0.1	319.3	29.5	139.0	0.2	<.02	761
	Favorite Farms (167)	36	13	8	70	KEN	07/85	7.0	463	133.0	30.5	7.2	1.2	2.70	0.2	333.3	25.5	144.0	<.1	<.02	755
294	H. Hinen (168)	36	13	8	235	HOW	07/85	7.3	288	72.3	24.9	19.4	0.9	3.00	0.1	309.8	18.6	6.6	0.7	<.02	535

Location Number	Well Owner	Township (N)	Range (E)	Section	Well Depth (feet)	Aquifer System	Date Sampled	pH[1]	Hardness as $CaCO_3$	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Iron (Fe)	Manganese (Mn)	Alkalinity as $CaCO_3$	Chloride (Cl)	Sulfate (SO_4)	Fluoride (F)	Nitrate (NO_3 as N)	Total Dissolved[2] Solids (TDS)
295	L. Gilbert (164)	36	13	15	115	HOW	07/85	6.9	436	131.2	24.9	13.9	2.2	2.90	0.2	305.3	35.2	121.0	0.3	<.02	708
296	F. Murden (165)	36	13	29	135	KEN	07/85	7.2	303	79.4	23.9	8.1	0.7	3.40	< 0.1	307.3	12.6	8.4	0.6	<.02	521
297	B. Kuckuck (171)	36	13	30	84	KEN	07/85	7.1	389	93.7	36.0	10.5	1.1	4.00	< 0.1	382.0	15.6	20.4	0.9	<.02	661
298	Ashley 1	35	13	6	120	KEN	04/79	7.4	356	98.0	27.0	8.0	2.0	8.50	.11	300.0	13.0	52.0	0.6	<0.1	575
299	Ashley 2	36	13	31	138	KEN	04/79	7.5	306	84.0	23.0	6.0	1.0	4.30	0.04	304.0	4.0	12.0	0.4	<0.1	506
300	L. Penner (153)	38	14	13	93	KEN	07/85	8.9	249	67.4	19.0	12.5	0.7	1.20	0.5	289.2	13.3	0.6	0.7	<.02	478
301	Steve Gard (160)	38	14	19	192	KEN	07/85	7.1	331	91.7	24.4	5.9	0.8	0.30	0.4	335.8	19.8	9.6	0.4	<.02	572
302	D. Schaeffer (182)	38	14	19	107	KEN	07/85	7.3	340	94.6	24.9	3.2	0.7	0.30	0.5	326.9	8.0	23.8	.1	<.02	562
303★	D. Becher (159)	38	14	27	52	KEN	07/85	7.2	362	102.7	23.5	2.2	0.6	4.90	0.1	279.2	21.4	78.3	0.4	<.02	579
304	Fremont 1	38	14	28	110	KEN	02/58	7.5	524	141.0	42.0	34.0	6.0	0.50	0.1	398.0	68.0	118.0	0.0	0.3	649
	Fremont 2	38	14	28	110	KEN	03/66	6.8	556	158.0	39.9	88.0	5.0	1.40	.1	385.0	194.0	75.0	0.0	.2	791
305	Fremont Sewage Treatment	38	14	30	160	KEN	04/82	8.1	394	125.0	20.0	27.0	2.3	0.07	0.04	297.0	75.0	46.0	0.2	1.4	660
306	IN Toll Rd. Ser. 8	38	14	30	51	KEN	11/73	7.8	442	122.0	33.0	21.0	3.0	0.20	0.06	342.0	60.0	58.0	0.2	<.1	714
307★	D. Smith (158)	38	14	32	93	KEN	07/85	7.5	221	43.2	27.1	19.7	1.3	1.00	<0.1	297.2	10.0	6.0	1.6	<.02	503
308	D. Nedele (157)	37	14	4	77	KEN	07/85	7.2	381	107.1	26.2	6.3	0.6	3.30	0.1	298.2	25.1	79.3	0.6	<.02	620
309	B. Shultz (156)	37	14	18	117	KEN	07/85	7.4	259	54.9	28.9	17.7	1.0	1.70	<0.1	296.2	11.2	7.0	1.7	<.02	507
310★	P. Gordon (154)	37	14	27	185	KEN	07/85	7.5	219	49.9	22.4	27.3	1.0	1.00	<0.1	273.7	27.7	1.9	1.1	<.02	477
311	R. Condon (155)	37	14	30	60	KEN	07/85	7.0	425	115.1	31.7	4.6	1.1	3.60	0.2	346.4	21.5	79.6	0.7	< .02	688

Appendix 15. Recommended water quality standards and remarks for selected chemical constituents

Constituent	U.S. EPA's Recommended concentration limit, mg/l	Remarks
Total Dissolved Solids (TDS)	500[1]	Water with concentrations greater than 500 mg/l may have a disagreeable taste. High values (>1000 mg/l) my accelerate corrosion of well screens, pumps and casings and cause foaming and scaling in boilers.
Iron (Fe)	.3[1]	Concentrations exceeding .3 mg/l cause staining of laundry, utensils and fixtures and may impart a metallic taste. Values above .5 mg/l may cause well screens to become encrusted. Large quantities stimulate the growth of iron bacteria.
Manganese (Mn)	.05[1]	Manganese and iron have similar characteristics. Concentrations above .2 mg/l discolors food during cooking and stains laundry utensils and fixtures black. Food and water my have a metallic taste at amounts above .5 mg/l. Amounts as low as .1 mg/l stimulate growth of certain bacteria. Mn tends to precipitate at concentratins above .05 mg/l and may form a filter clogging sludge or slime.
Chloride (Cl)	250[1]	Concentrations in excess of 250 mg/l in combination with high sodium may impart a salty taste. Amounts above 1000 mg/l may be physiologically unsafe. Large amounts may accelerate corrosion.
Sulfate (SO_4)	250[1]	Concentrations greater than 500 mg/l in combination with ions (expecially sodium and magnesium) can impart odors and a medicinal or bitter taste to water. Amounts above 600 mg/l have a laxative effect for people unaccustomed to sulfate-rich water.
Nitrate (NO_3 as N)	10[2]	Concentrations above 20 mg/l impart a bitter taste to drinking water. Concentrations greater than 10 mg/l causes infant methemoglobinema, a disease characterized by cyanosis or a bluish coloration of the skin.
Fluoride (F)	1.4-2.4[2]	Fluoride concentrations ranging from about .9 mg/l to 1.7 mg/l help prevent tooth decay. Amounts above recommended concentration limits may cause mottled teeth. Serious mottling of teeth and skeletal defects can occur with concentrations above 6.0 mg/l. (Limit varies on basis of climate (temperature) and intake amount.)

[1]U.S. EPA National Secondary Drinking Water Regulations, 1979b.
[2]U.S. EPA National Interim Primary Drinking Water Regulations, 1979a.
Other references: Hunn and Rosenshein, 1969; GWRSC, 1980; Lehr and others, 1980; Todd, 1980.

Appendix 16. Public Water Supply Projections

The projections of future water withdrawals in the St. Joseph River basin were developed using the methodology of the Governor's Water Resource Study Commission report (1980). Appendix One of that report describes the methodology used to project future water withdrawals.

While the Governor's study published water use projections for regions, the St. Joseph basin covers only portions of regions 2 and 3a, and a very small part of Region 3b. Therefore, some recalculations were necessary to make water use projections on a county basis, or in some cases, only that part of the county that lay within the basin. In addition, projections were based upon historical data through the year 1980.

Future projections of withdrawals were computed by multiplying the projected per capita usage (gallons per person per day) by the projected population served for the year in question. Both the projected per capita usage and the projected population served were for only that part of each county in the basin.

As part of the Governor's study, an analysis was undertaken of the service characteristics of 17 counties across the state. It was found that the percent of population served remained stable over the study period in most counties. In a few counties where there was as abundance of ground water, the percent served was declining. In a few more counties, the percent served was increasing.

In counties where percent served was declining, the trend line of the percent served decreased about seven percent over 25 years from the year 1975 to the year 2000. The Governor's study used a decrease in percent served of 1 percent from 1975 to 1980, a decrease of 3 percent from 1980 to 1990 and another decrease of 3 percent from 1990 to 2000. Since this report has data for 1980, water use projections were made only for 1990 and 2000. However, the 3 percent decreases from 1980 to 1990 and 1990 to 2000 were still used to compute the percent served.

All counties in the St. Joseph basin had decreasing percent served except LaGrange and St. Joseph counties whose percent served remained unchanged.

The projected population served for 1990 or 2000 was determined by multiplying the projected county population in the basin by the projected percent served.

The projected per capita usages for the years 1990 and 2000 were developed from historical data. First, a least-squares-error linear equation was fit through historical data of public utilities serving more than 1000 persons in each county or that part of a county that lay within the basin. The data covered a period from 1950 through 1980. Next, the 1980 per capita usage water calculated for all utilities, that is, utilities serving populations greater than 1000 as well as utilities serving populations less than 1000. Finally, the 1990 per capita usage was then calculated by multiplying the slope of the least squares line by 10 and adding this number to the 1980 per capita usage. The 2000 per capita usage was calculated by multiplying the slope of the least squares line by 10 and adding this number to the 1990 per capita projection.

The results of the computations of projected water withdrawals are shown in the text under the topic of public water supplies.