DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
U.S. ARMY CORPS OF ENGINEERS

HYDROLOGIC INVESTIGATIONS
ATLAS HA-546 (SHEET 2 OF 3)

QUALITY OF WATER

QUALITY OF WATER

The chemical and physical characteristics of natural waters are determined largely by the geology, soils, and hydrologic conditions in an area. Man frequently modifies these characteristics when using surface- and ground-water resources; these modifications may degrade water quality, or, at times, be designed to improve it. The chemical and physical characteristics of surface waters may change rapidly in response to changes in streamflow or to changes in man's day-to-day use. Ground waters usually change less rapidly.

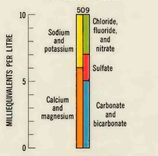
Samples of surface water were obtained in July 1973 during a period of base flow, when water is usually more highly mineralized than at other times. Chemical analyses made by the U.S. Geological Survey are given in the accompanying table; they are illustrated by means of bar diagrams on the map. The analyses show that waters having a dissolved-solids concentration of less than 500 mg/l (milligrams per litre) have calcium and bicarbonate as their principal dissolved substances. Waters having a dissolved-solids concentration exceeding 500 mg/l usually have proportionally more sodium, chloride, and sulfate, and the proportion tends to increase as the dissolved-solids concentration increases. Hardness ranges from 300 to 1,020 mg/l, an amount sufficient to class the waters as very hard. In general, surface waters are suitable for municipal, industrial, agricultural, and recreational uses. At some locations, however, high hardness, sulfate, chloride, and dissolved-solids concentrations make waters unsuitable for many uses.

The chemical characteristics of ground water are illustrated by graphically plotting the concentrations of dissolved ions. Because little data for ground waters in the minor stream basins are available, the analyses of ground waters adjacent to these basins have been illustrated at a few locations. Water quality within the basins probably does not differ appreciably from that of adjacent areas. All analyses were made by the Michigan Department of Health.

Water obtained from glacial drift is similar to surface water at base flow, with the exception that ground water having dissolved-solids concentration of less than 500 mg/l has a more variable calcium-sodium ratio than does surface water. The hardness of ground water from glacial drift at some locations is less than the hardness of surface water. Water obtained from bedrock generally is of a calcium sulfate type, and has a higher dissolved-solids concentration than does water from drift. With the exception of highly mineralized water at a few locations, most wells yield water that is generally suitable for municipal, industrial, agricultural, and recreational uses.

EXPLANATION

SURFACE WATER



The chemical characteristics of surface waters are illustrated by bar diagrams. The number above the diagram is dissolved-solids concentration, in milligrams per litre

⑥ Index number and location of data collection site

GROUND WATER

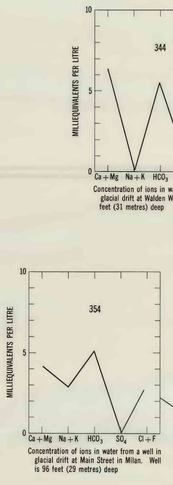
The chemical characteristics of ground waters are illustrated by plotting the concentration of selected ions on graphs. The number on the graph is dissolved-solids concentration, in milligrams per litre

CONVERSION FACTORS

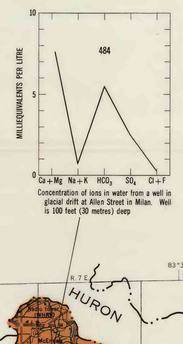
Milliequivalents per litre to milligrams per litre

ION	DIVIDE BY
Calcium (Ca)	0.04990
Magnesium (Mg)	.08226
Sodium (Na)	.04350
Potassium (K)	.02557
Bicarbonate (HCO_3)	.01639
Sulfate (SO_4)	.02082
Chloride (Cl)	.02821
Fluoride (F)	.05264
Nitrate (NO_3)	.01613

Basin boundary

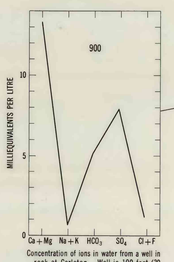


Concentration of ions in water from a well in glacial drift at Walden Woods. Well is 101 feet (31 metres) deep

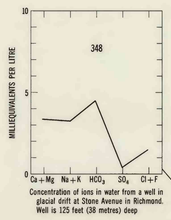


Concentration of ions in water from a well in glacial drift at Allen Street in Milan. Well is 100 feet (30 metres) deep

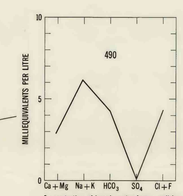
Concentration of ions in water from a well in glacial drift at Main Street in Milan. Well is 96 feet (29 metres) deep



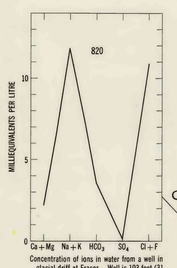
Concentration of ions in water from a well in rock at Carleton. Well is 100 feet (30 metres) deep



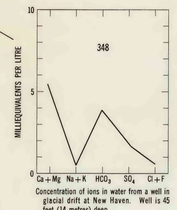
Concentration of ions in water from a well in glacial drift at Stone Avenue in Richmond. Well is 125 feet (38 metres) deep



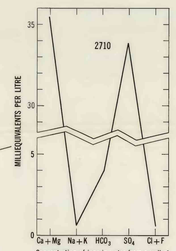
Concentration of ions in water from a well in glacial drift at North Main Street in Richmond. Well is 238 feet (66 metres) deep



Concentration of ions in water from a well in glacial drift at Fraser. Well is 103 feet (31 metres) deep



Concentration of ions in water from a well in glacial drift at New Haven. Well is 45 feet (14 metres) deep



Concentration of ions in water from a well at North Shores subdivision. Well is 301 feet (91 metres) deep

Base from U.S. Geological Survey, 1:250 000

SCALE 1:250 000

5 0 5 10 15 MILES

5 0 5 10 15 KILOMETRES

CONTOUR INTERVAL 50 FEET
WITH SUPPLEMENTARY CONTOURS AT 25 FOOT INTERVALS
DATUM IS MEAN SEA LEVEL

INFILTRATION RATES

EXPLANATION

Minimum infiltration rates, in inches (millimetres) per hour

- 1 to 2 (25–51)
- 4 to 8 (102–203)
- >12 (>305)

Area boundary

Basin boundary

Adapted from Schneider and Erickson

INFILTRATION RATES

Information on infiltration rates provides a basis for analyzing drainage characteristics of soils. Infiltration is an important factor in the reductions of peak flows after storms. Also, it is by infiltration that water becomes available for vegetation and for replenishment of groundwater reservoirs.

The infiltration rates shown on the above map are for the predominant soils and were determined by the Soil Science Department, Michigan State University, for Michigan Agriculture Project 413 (Schneider and Erickson). The rates are for surface horizons of soils covered with sod and were determined with a water head of 2 inches (25.4 millimetres). The map is a generalization based on a statewide sampling program of several soil types. Within local areas there may be soils with properties outside the designated range.

Except for small areas adjacent to the River Raisin basin and in the more inland areas, infiltration rates for the minor stream basins are small. Streams with little or no flow during droughts (see table of results of base-flow investigations, sheet 1) attest to the low infiltration rates in the basins.

Chemical analyses, in milligrams per litre except as indicated

Stream	Index No. on map	Date	Discharge[1] (cfs)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (as N)	Dissolved solids (Residue at 180°C)	Hardness as Ca, $CaCO_3$)	Specific conductance (micromhos per cm at 25°C)	pH (units)	Color (Pt-Co scale)	Turbidity (JTU)	Temperature (°C)
Swan Creek	1	7/19/73	0.04	1.2	83	23	30	6.4	214	0	46	96	0.5	0.1	466	300	706	7.4	55	15	22.5
Salt River	2	7/19/73	.89	10	87	29	94	9.4	292	0	80	140	.6	3.0	636	340	1,040	7.2	23	42	19.5
Ecorse River	3	7/19/73	.74	1.4	100	31	120	6.6	233	0	110	230	.6	.2	774	380	1,240	7.3	17	2	21.5
South Branch Ecorse River	4	7/19/73	.88	2.3	95	34	180	13	210	0	120	330	.6	.2	958	380	1,530	7.3	23	12	28.0
Frank and Poet Drain	5	7/19/73	.62	.1	91	27	90	9.5	202	0	130	170	.6	.5	678	340	1,060	7.2	24	47	27.0
Marsh Creek	6	7/19/73	.61	.0	120	29	170	16	262	0	160	280	.7	.2	972	420	1,530	7.4	37	9	26.0
Swan Creek	7	7/16/73	1.6	7.1	110	20	22	5.5	228	0	100	65	.6	.7	452	360	669	7.5	15	4	--
North Branch Swan Creek	8	7/16/73	.53	8.5	110	19	36	3.6	258	0	82	94	.3	.6	514	350	787	7.5	25	5	--
Little Swan Creek	9	7/16/73	.12	9.9	110	27	14	4.2	270	0	110	44	.4	.8	492	390	710	7.6	30	5	--
Stony Creek	10	7/16/73	13	11	110	22	16	2.4	292	0	84	42	.3	.8	462	360	686	7.8	10	7	--
Stony Creek	11	7/17/73	18	9.8	110	20	16	2.7	294	0	87	44	.3	.6	486	360	691	7.6	20	7	--
Sandy Creek	12	7/16/73	1.3	11	150	29	21	3.5	392	0	190	48	.6	1.2	658	490	889	7.9	30	2	--
Plum Creek	13	7/16/73	4.4	6.1	320	54	18	3.4	252	0	740	44	1.0	.3	1,440	1,020	1,570	7.7	15	2	21.0
North Branch Otter Creek	14	7/16/73	.36	19	110	16	17	2.5	226	0	43	43	.4	.6	446	340	656	7.7	25	4	24.0
South Branch Otter Creek	15	7/16/73	.27	16	120	23	18	3.1	340	0	72	50	.4	1.6	520	390	748	7.7	35	30	21.0
Otter Creek	16	7/16/73	5.4	7.6	100	19	13	2.5	246	0	89	42	.3	1.1	412	330	624	8.0	25	3	24.0
Little Lake Creek	17	7/16/73	1.5	8.1	98	24	14	3.1	268	0	79	40	.3	1.5	498	340	629	7.7	25	3	20.0
Halfway Creek	18	7/16/73	3.2	10	150	30	37	2.7	260	0	220	88	.5	.7	708	500	988	7.7	10	2	19.0
North Branch Tenmile Creek	19	7/16/73	.90	.6	81	25	17	2.5	240	0	73	44	.3	.1	380	310	595	7.6	30	6	22.0

[1] Other discharge measurements are shown on sheet 1

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WATER RESOURCES OF BASINS FOR MINOR STREAMS DRAINING INTO ST. CLAIR RIVER, LAKE ST. CLAIR, DETROIT RIVER, AND LAKE ERIE, SOUTHEASTERN MICHIGAN

By
F. R. Twenter, R. L. Knutilla, and T. R. Cummings

1975