QUALITY OF WATER

Ground water is generally soft or moderately hard and mildly acid; however, hardness has been increasing, especially since about 1960. Similar increases in chloride concentration occurred. Nitrate generally has increased, but the increase did not become more pronounced during the 1960's. Nitrate concentration in 1968 was generally less than 5 mg/l (milligrams per liter). An auger hole at Westwood was the only known location in the study area where ground water contained chloride (2,400 mg/l) in excess of the U.S. Public Health Service recommended limit of 250 mg/l. Chloride concentration in ground water in most places is less than 30 mg/l, but in a few others the concentration approaches 150 mg/l. Manganese exceeds the recommended limit (0.05 mg/l) in much of the study area and a concentration as high as 0.9 mg/l has been reported. Iron is usually not a problem, but small areas with excessive concentration (>0.3 mg/l) exist. Color is usually less than the recommended limit (15 units), but there are areas where color is excessive.

During this study, one or two samples were collected during low-flow periods from most streams in the basins, and eight streams were sampled periodically for about a year. Analyses indicate that surface water in the basins is usually soft or moderately hard and mildly acid. Most of the streams contain excessive amounts of manganese, and about half have excessive amounts of iron. Analyses of samples from Purgatory Brook near Norwood (downstream from the auger hole at Westwood) show chloride concentration at times above the recommended limit. All of the surface-water samples contained a nitrate concentration lower than the recommended limit. Data suggest that at times most of the streams exceed the recommended limit (5 units) for turbidity.

No evidence was found of excessive fluoride (>1.3 mg/l) or sulfate (>250 mg/l) in either surface water or ground water.

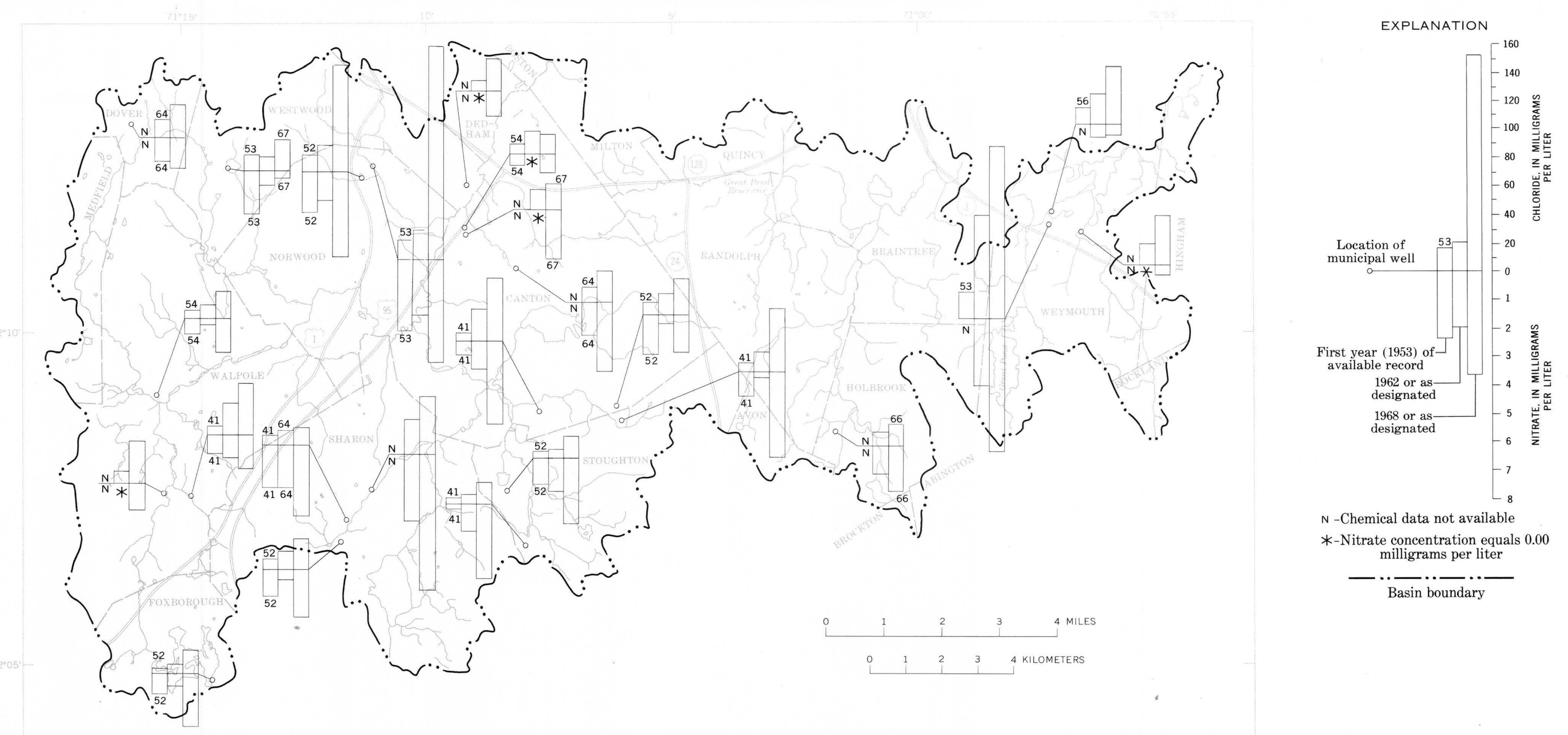
Both surface water and ground water are subject to large changes in chemical quality. The changes in ground water are usually the result of the release of waste material. The changes are usually much more abrupt in surface water because the chemicals are transported by the water much faster than in ground water. Therefore, it must be noted that data on water quality, in general, and surface water, in particular, may represent conditions at the time and place of sampling only.

GROUND WATER

MAP SHOWING HARDNESS AND COLOR OF GROUND WATER IN STRATIFIED DRIFT

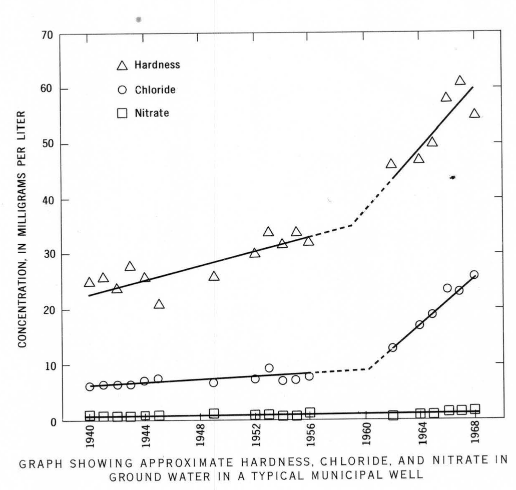
Most ground water is soft; however, hardness has been increasing in many areas during the last several decades. The rate of increase accelerated considerably about 1960. The largest increases occurred near highways. Sodium chloride and calcium chloride are commonly used as highway de-icers.

The hardness may have increased directly by infiltration of the calcium in calcium chloride and indirectly by the ion exchange of sodium for calcium in the overburden. Data collected since 1940 indicate color levels have remained fairly constant.

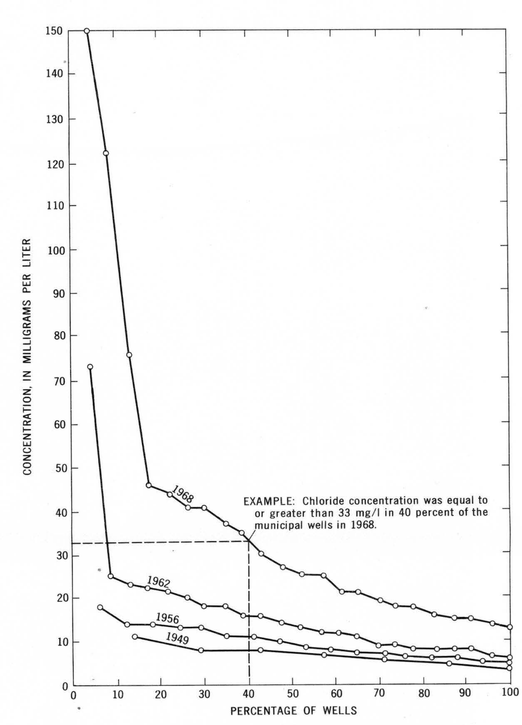


MAP SHOWING NITRATE AND CHLORIDE CONCENTRATIONS IN GROUND WATER IN MUNICIPAL WELLS
(Most of the wells have undergone increases in both nitrate and chloride concentrations)

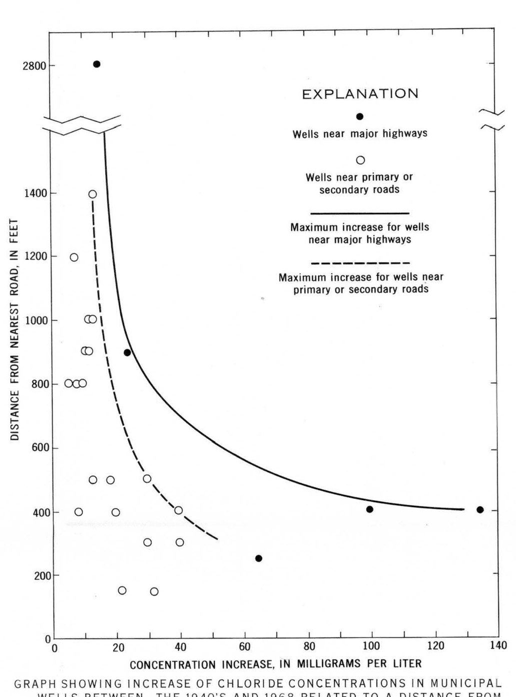
Generally, the nitrate concentration of water from municipal wells gradually increased during 1940–68 (see map above and graph at lower left). Chloride concentration also increased gradually during the 1940's and 1950's; however, during the 1960's, the increase became more rapid (see map above and center graph below). Nitrate and chloride are added to ground water by solution of minerals in rock and from degradation by sewage, industrial waste, and fertilizer. The gradual rise of nitrate and chloride probably was the result of sewage from the expanding population. The more rapid increase of chloride during the 1960's was apparently caused by adulterants that did not contain appreciable nitrate. Chloride-concentration increases tend to be larger at wells near roads (see graph at lower right). It is probable, therefore, that the more rapid rate of increase in concentration during the 1960's was caused by road salting, which has been intensified during recent winters. In all but one location, chloride concentration in 1968 was below the recommended limit of 250 mg/l (milligrams per liter) established by the U.S. Public Health Service for drinking water used in interstate commerce.



GRAPH SHOWING APPROXIMATE HARDNESS, CHLORIDE, AND NITRATE IN GROUND WATER IN A TYPICAL MUNICIPAL WELL



GRAPH SHOWING DISTRIBUTION OF CONCENTRATIONS OF CHLORIDE IN MUNICIPAL WELLS



GRAPH SHOWING INCREASE OF CHLORIDE CONCENTRATIONS IN MUNICIPAL WELLS BETWEEN THE 1940'S AND 1968 RELATED TO A DISTANCE FROM THE NEAREST ROAD

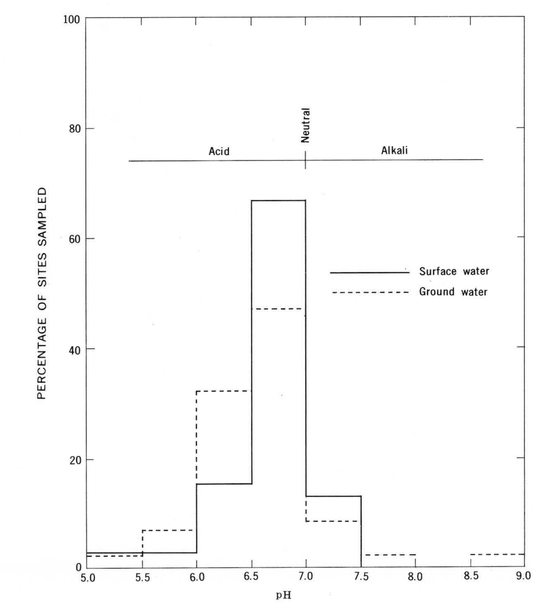
MAP SHOWING MANGANESE AND IRON IN GROUND WATER IN STRATIFIED DRIFT

The areal extent and concentration of manganese in ground water shown on the map above is based on chemical analyses from 44 wells. Interpretation of the occurrence of iron is based on data from 56 wells. The data indicate that quality of ground water varies considerably within short distances. Because of the sparse data, the map is highly generalized. Undoubtedly in many areas the concentrations are different from that shown.

Most of the ground water analyzed contained iron within the recommended limit for drinking water established by the U.S. Public Health Service. Locations where ground water contains excessive concentrations of iron are designated on the map.

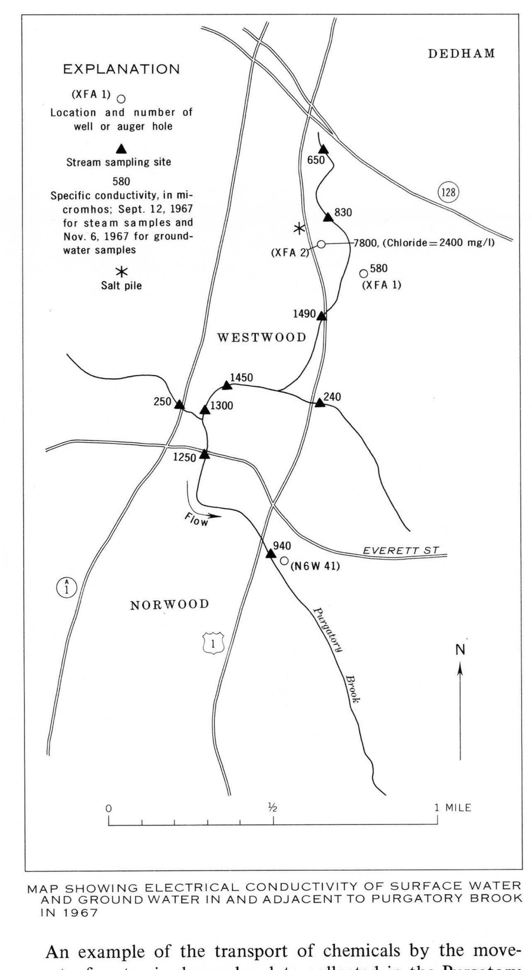
Data collected since 1940 indicate iron and manganese concentrations have remained fairly steady.

GROUND WATER AND SURFACE WATER



GRAPH SHOWING DISTRIBUTION OF pH VALUES OF WATER SAMPLED AT 39 STREAM AND 47 GROUND-WATER SITES

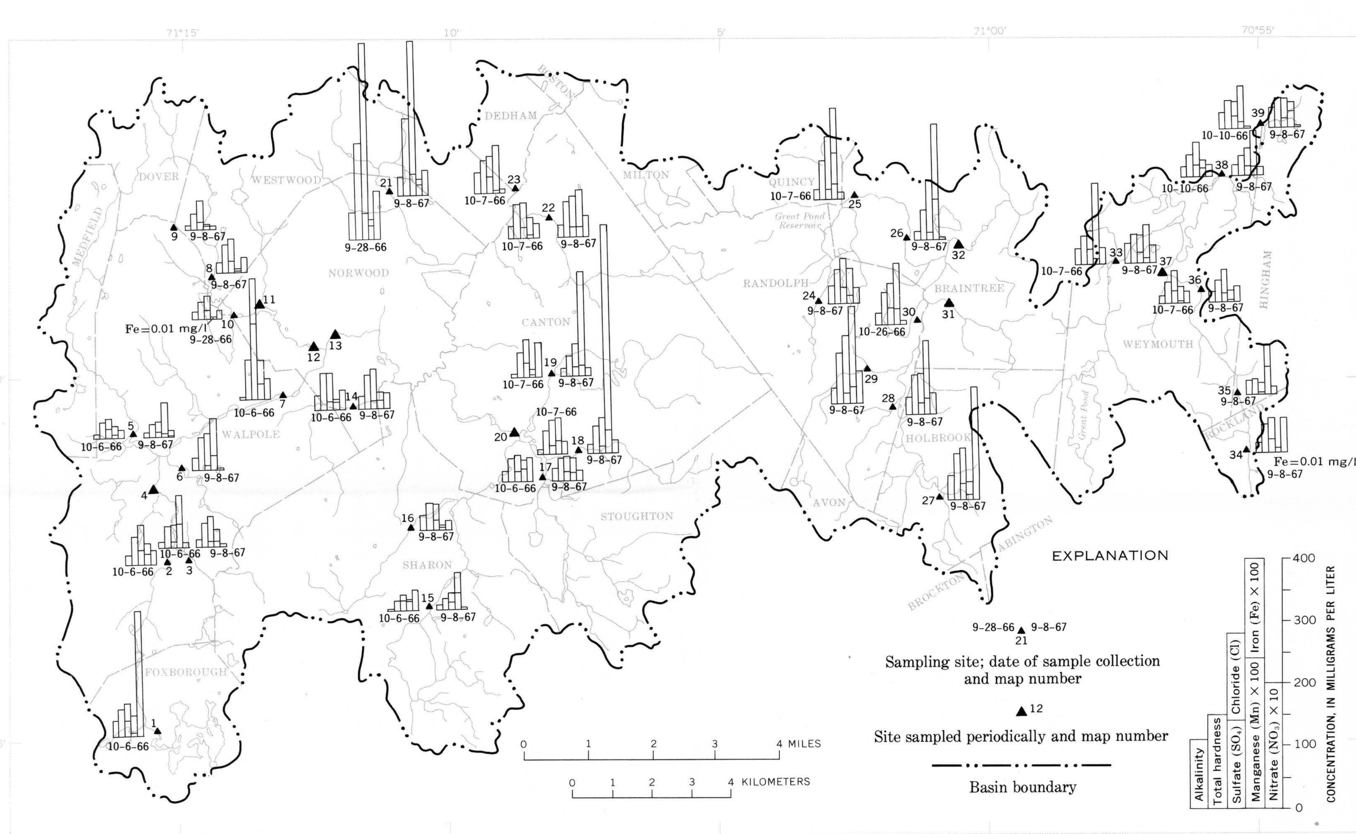
The pH of most of the ground-water and surface-water samples was between 6.0 and 7.0 or slightly acid. Under usual conditions, pH, a measure of hydrogen ion activity, indicates the acidity or alkalinity of water. Acid water tends to be corrosive depending on the degree of acidity and will attack such objects as metal pipes or concrete bridge abutments. Data from 1940 to 1968 indicate pH of ground water has been essentially constant.



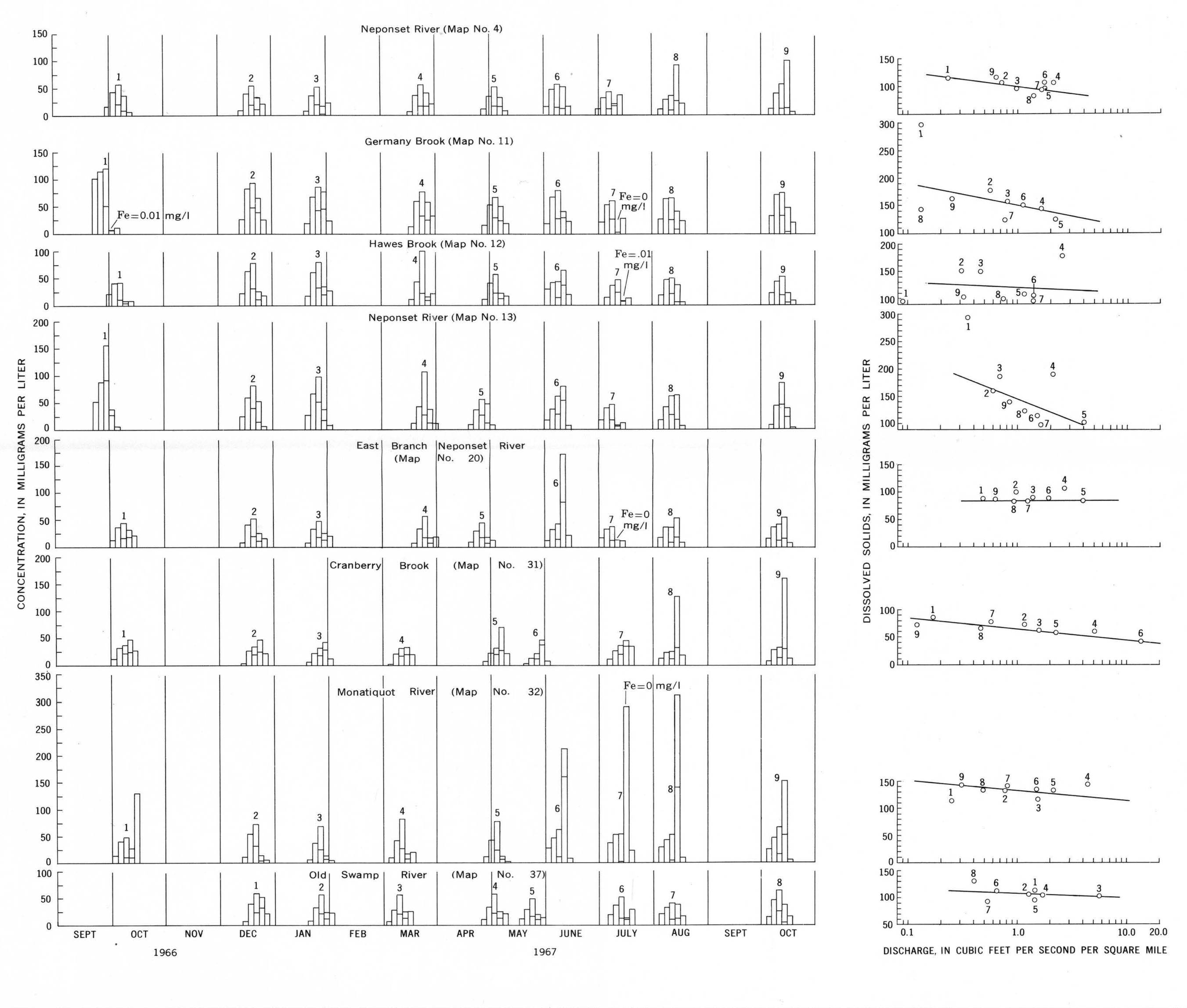
MAP SHOWING ELECTRICAL CONDUCTIVITY OF SURFACE WATER AND GROUND WATER IN AND ADJACENT TO PURGATORY BROOK IN 1967

An example of the transport of chemicals by the movement of water is shown by data collected in the Purgatory Brook basin. Electrical conductivity of water is an index of the dissolved-solids concentration. High conductivity of ground water in auger hole XFA 2 is probably the result of infiltration of precipitation charged with salt from a nearby storage pile. Sodium and chloride are the major elements in the water sample collected from this hole. Increased conductivity in Purgatory Brook downstream from auger hole XFA 2 suggests ground water from the vicinity of the hole discharges into the brook. The chloride concentration in well N6W 41 increased seven-fold from 1962 to 1968. Infiltration of water from the brook may have contributed to this increase. As shown by this example, the quality of ground water or surface water at practically any site can be affected by chemicals from sources far removed from the site.

SURFACE WATER



Map No.	Stream	Site description
1	Neponset River	At outlet of Crackrock Pond, Foxborough
2	Neponset River	South St., below Cedar Swamp, Walpole
3	School Meadow Brook	Washington St., Walpole
4	Neponset River	State Highway 1A south of center of Walpole
5	Mine Brook	At inlet to Turner Pond, Walpole
6	Spring Brook	200 feet below Memorial Pond, Walpole
7	Neponset River	Washington St., East Walpole
8	Mill Brook	500 feet above inlet to Pettee Pond, Westwood
9	Bubbling Brook	North St., Westwood-Walpole
10	Willett Pond Outlet	At outlet of Willett Pond, Norwood
11	Germany Brook	Nichols St., Norwood
12	Hawes Brook	Washington St., Norwood
13	Neponset River	Pleasant St., Norwood
14	Traphole Brook	Sumner St., Norwood
15	Massapoag Brook	Ames St., Sharon
16	Beaver Brook	Maskwonicut St., Sharon
17	Steep Hill Brook	Bailey St., Canton
18	Redwing Brook	Pleasant St., Canton
19	Pequid Brook	Pleasant St., Canton
20	East Branch Neponset River	Washington St., Canton
21	Purgatory Brook	U.S. Highway 1, Norwood
22	Ponkapog Brook	Elm St., Canton
23	Neponset River	Greenlodge St., Canton-Norwood
24	Norroway Brook	Oak St., Randolph
25	Farm River	West St., Braintree
26	Farm River	Pond St., Braintree
27	Trout Brook	0.2 mile above Lake Holbrook, Holbrook
28	Mary Lee Brook	800 feet above mouth, Randolph
29	Glovers Brook	North St., Randolph
30	Cochato River	At culvert on railroad line west of Braintree Highlands
31	Cranberry Brook	State Highway 37, Braintree
32	Monatiquot River	Jefferson St., Braintree
33	Mill River	Front St., Weymouth
34	Old Swamp River	Forest St., Rockland
35	Old Swamp River	Sharp St., Hingham
36	Old Swamp River	Pleasant St., Weymouth
37	Old Swamp River	State Highway 3, Weymouth
38	Whitmans Pond Outlet	Pleasant St., Weymouth
39	Fresh River	0.4 mile above mouth, Hingham



Alkalinity and total hardness are shown in terms of an equivalent amount of calcium carbonate. The difference between alkalinity and total hardness is equal to noncarbonate hardness. The water samples depicted on the map were collected during periods of low flow. In general, concentration of dissolved solids increases as streamflow decreases (see graphs). However, reservoirs, swamps, non-uniform waste disposal, and soluble chemicals used for highway de-icing and agricultural purposes tend to mask this relationship in some streams.

MAP AND GRAPHS SHOWING CHEMICAL CHARACTERISTICS OF SELECTED PRINCIPAL STREAMS

HYDROLOGY AND WATER RESOURCES OF THE NEPONSET AND WEYMOUTH RIVER BASINS, MASSACHUSETTS

By
R. A. Brackley, W. B. Fleck, and W. R. Meyer

1973