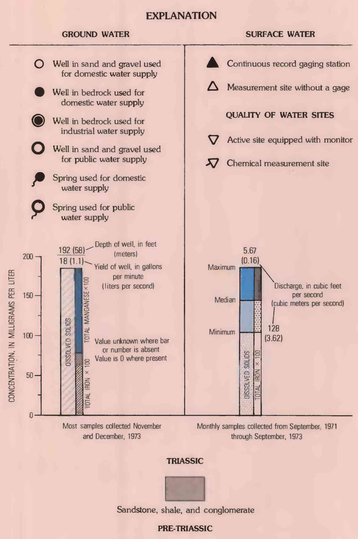
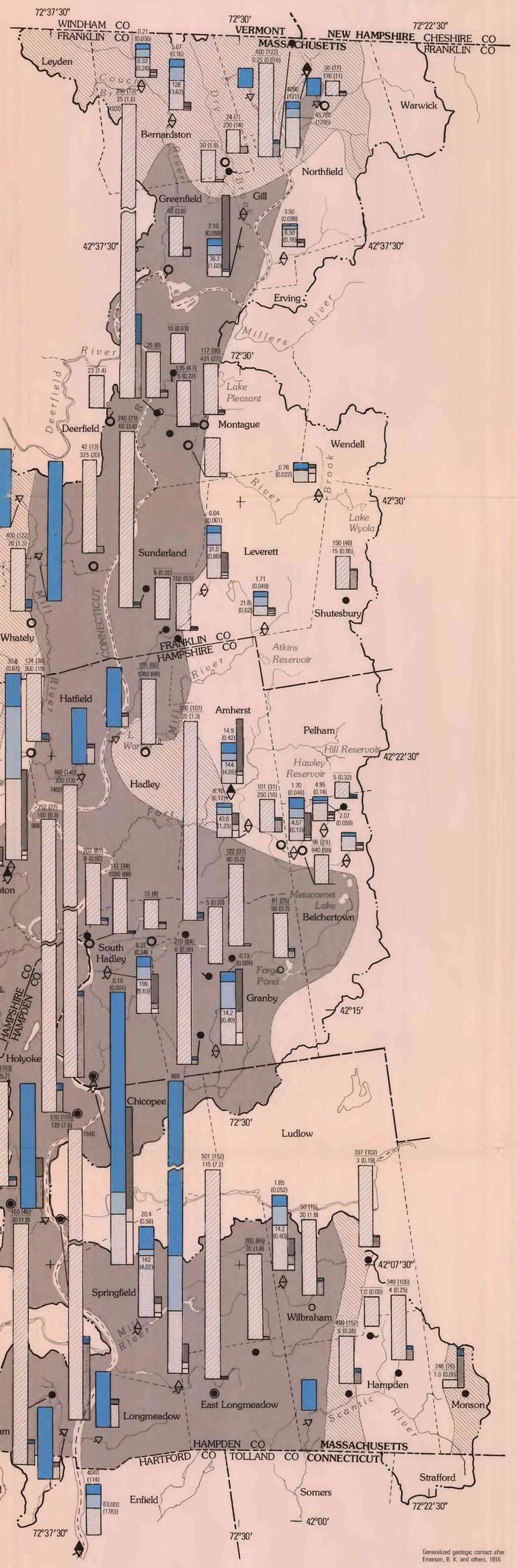
QUALITY OF WATER





WATER-QUALITY SUMMARY

Water in the Connecticut River lowlands of Massachusetts is of acceptable chemical quality for most uses. Dissolved-solids concentration averages 100 milligrams per liter (mg/l) in stream water, 93 mg/l in water from pre-Triassic granitic and metamorphic aquifers, 75 mg/l in water from sand and gravel aquifers, and 600 mg/l in water from Triassic sedimentary aquifers. Dissolved-solids concentration in stream water varies seasonally; it is highest during low-flow periods and lowest during high-flow periods. Surface water in the basin is generally soft; 75 percent of the water bodies sampled have water containing less than 60 mg/l of hardness. Water from unconsolidated sand and gravel and pre-Triassic granitic and metamorphic rock aquifers is soft to moderately hard, but water from Triassic sedimentary aquifers is generally moderately hard to very hard. Thirty percent of the samples from Triassic sedimentary rock aquifers contained sulfate in excess of the 250 mg/l upper limit recommended for public drinking water supplies (table 4). Thirty percent of the samples from Triassic and pre-Triassic aquifers contained iron and manganese in concentrations exceeding the recommended upper limits for drinking water supplies (table 4).

All water-quality data interpreted in this atlas result from samples analyzed by the U.S. Geological Survey and the Massachusetts Department of Public Health.

SELECTED REFERENCES

Durfor, C. N., and Becker, Edith, 1964, Public water supplies of the 100 largest cities in the United States, 1962: U.S. Geol. Survey Water-Supply Paper 1812, 364 p.

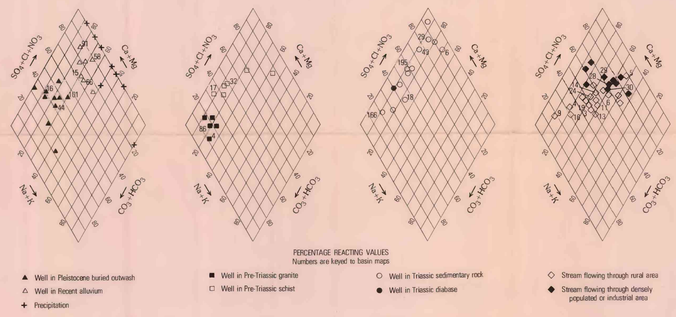
Emerson, B. K., 1916, Preliminary geologic map of Massachusetts and Rhode Island, *in* Geology of Massachusetts and Rhode Island: U.S. Geol. Survey Bull. 597, pl. X.

Hem, J. D., 1970, Study and interpretation of the chemical characteristics of natural water (2d edition): U.S. Geol. Survey Water-Supply Paper 1473, 363 p.

U.S. Geological Survey, 1971–74, Water resources data for Massachusetts, New Hampshire, Rhode Island, and Vermont—pt. 1, surface water records, pt. 2, water-quality records: Boston, Mass., Water Resources Div., issued annually.

U.S. Public Health Service, 1962 (revision), Public Health Service drinking water standards: U.S. Dept. Health, Education and Welfare, Public Health Service pub. no. 956, 61 p.

DISSOLVED SOLIDS, IRON, AND MANGANESE CONCENTRATION OF SURFACE AND GROUND WATER.—High, low, and median values of dissolved solids and iron concentration determined from monthly specific conductance and iron analyses were obtained during a 3-year period (1971–73) for 41 surface-water-sampling sites and chemical analyses of ground water from 54 sites were obtained. Iron and manganese in some areas occur in concentrations exceeding the upper limits recommended for public drinking water supplies (table 4).



WATER IN THE BASIN IS PREDOMINANTLY OF TWO TYPES: CALCIUM SULFATE AND CALCIUM BICARBONATE.—Wells tapping Triassic rocks yield water of the calcium sulfate or calcium bicarbonate type and the calcium sulfate type characteristically has higher dissolved solids concentration than the calcium bicarbonate type. Wells tapping pre-Triassic granite and metamorphic rocks generally yield water of the calcium bicarbonate type, but water from those tapping metamorphic rocks contains more chloride than those tapping granite. Water from unconfined sand and gravel aquifers is of the calcium sulfate type and that from confined sand and gravel aquifers is predominantly of the calcium bicarbonate type. Greater than normal concentrations of chloride (more than 20 mg/l) and nitrate (more than about 1 mg/l) indicate probable contamination from wastes or fertilizers. Streams draining densely populated and industrialized areas contain higher chloride concentrations than those draining rural areas.

Table 4.—Recommended limits for public drinking water supplies which should not be exceeded when more suitable supplies can be made available*

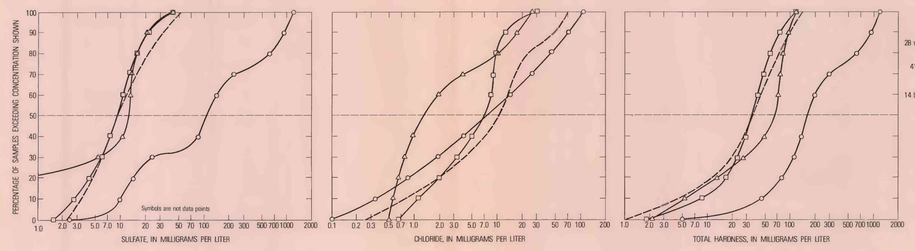
Constituent	Concentration, in milligrams per liter
Iron (Fe)	0.30
Manganese (Mn)	.05
Sulfate (SO_4)	250
Chloride (Cl)	250
Dissolved solids	500

*U.S. Public Health Service, 1962.

Table 5.—Range of hardness concentration*

Hardness range (milligrams per liter of $CaCO_3$)	Description
0–60	Soft
61–120	Moderately hard
121–180	Hard
More than 180	Very hard

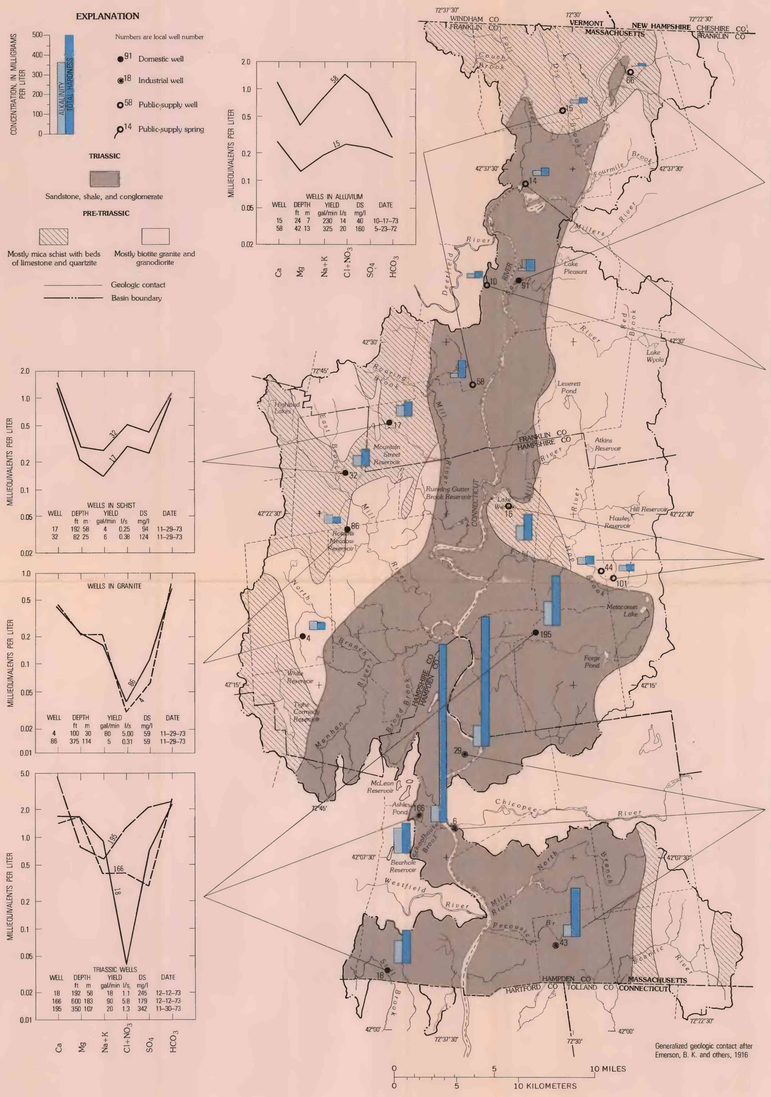
*Durfor and Becker, 1964.



SULFATE, CHLORIDE, AND TOTAL HARDNESS.—Dissolved solids, sulfate, and hardness were highest in water from Triassic sedimentary rock. Sulfate occurred in concentrations in excess of the recommended upper limits (table 4) for drinking water only in samples from deep wells in Triassic sedimentary rock.

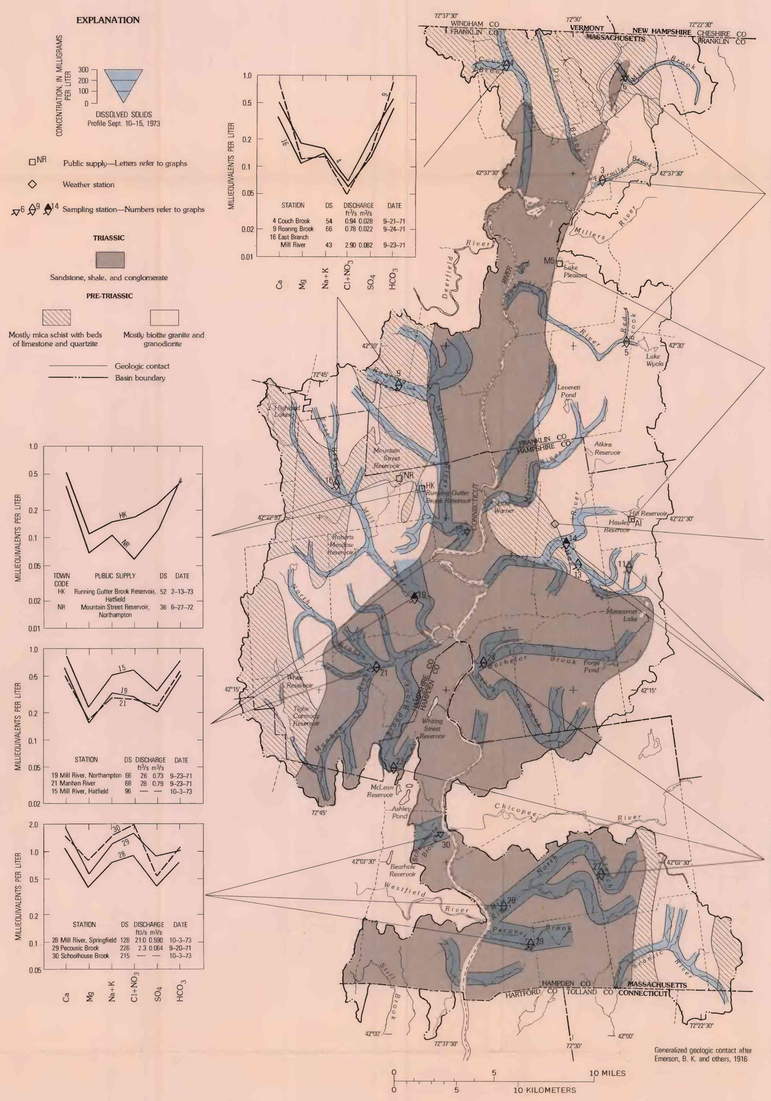
None of the sampled surface or ground water contained chloride in excess of the recommended limits (table 4).

GROUND WATER

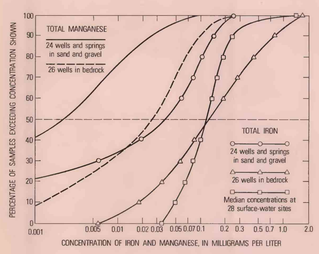


CHEMICAL CHARACTER OF GROUND WATER.—Some water from Triassic sedimentary rocks is highly mineralized and contains sulfate in excess of the recommended upper limits (table 4). Ground water is generally more highly mineralized than surface water because the time of contact and area of contact between minerals and water is greater in the ground than on its surface. The degree of mineralization of ground water also depends on the solubility of minerals in the aquifers. For these reasons, water from the Triassic sedimentary rocks is more mineralized than water from other aquifers in the Connecticut River lowlands. Dissolved-solids concentration averages 600 mg/l (milligrams per liter) in the Triassic sedimentary rocks, 93 mg/l in pre-Triassic granitic and metamorphic rocks, and 75 mg/l in sand and gravel.

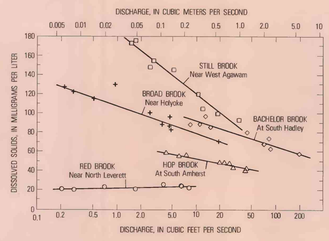
SURFACE WATER



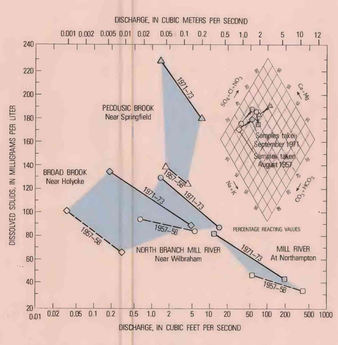
CHEMICAL CHARACTER OF SURFACE WATER.—Surface water in the basin is generally low in dissolved solids and soft (table 5); 75 percent of the sites sampled had less than 60 mg/l of hardness and no objectionable amounts of sulfate or chloride (table 4). Streams such as Bachelor, Broad, and Pecousic Brooks that drain densely populated areas and industrialized areas in the southern part of the basin are of the calcium bicarbonate or calcium chloride type—they contain more dissolved solids, sodium, and chloride and have lower calcium to magnesium ratios than streams in the less populated areas. Stream water in the sparsely populated northern part of the basin is of either the calcium bicarbonate or calcium sulfate type. Streams draining pre-Triassic metamorphic rocks west of the Connecticut River are of the calcium bicarbonate type, and streams draining pre-Triassic granitic rocks east of the river are of the calcium sulfate type. Monthly composite precipitation samples were collected at Amherst College from June 1972 to December 1973.



IRON AND MANGANESE.—Iron and manganese generally occur in lower concentrations in surface water and in water from sand and gravel aquifers than in water from consolidated rock aquifers. About 30 percent of the samples from wells tapping consolidated rock contained iron in excess of the recommended limit (table 4), but only 5 percent of the samples of surface water contained iron in excess of the limit.



RELATIONSHIP BETWEEN STREAM DISCHARGE AND DISSOLVED SOLIDS FOR SELECTED STREAMS.—Dissolved-solids concentration of streams varies seasonally; it is high during low-flow periods in late summer and early fall, when streams are fed almost entirely by ground water and waste discharges, and low in spring, when streamflow is derived mostly from snowmelt and overland runoff. Because waste waters usually contain higher concentrations of dissolved solids than natural stream water, dissolved-solids concentration of stream water usually varies directly with the quantity of waste introduced and inversely with streamflow. Average dissolved-solids concentration is higher, and seasonal variation of dissolved-solids concentration is more pronounced in the southern part of the basin than in the northern part because of waste discharges. Because Red Brook drains an undeveloped area and because its low flow is sustained by swamps, the stream's water quality remains relatively constant.



URBAN STREAMS SHOW AN INCREASE IN DISSOLVED SOLIDS AND RELATIVE PERCENTAGE OF CHLORIDE SINCE 1957.

Base from U.S. Geological Survey

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA.—1977—W76218

STREAMFLOW AND WATER QUALITY IN THE CONNECTICUT RIVER LOWLANDS, MASSACHUSETTS

By
S. W. Wandle, Jr., and W. W. Caswell

1977