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GEOLOGICAL SURVEY

NITROGEN IN WATER IN NASSAU AND SUFFOLK COUNTIES, LONG ISLAND, NEW YORK, IN 1971

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by Brian G. Katz, Stephen E. Ragone, and C. Albert Harr LC
GS

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Prepared in cooperation with the

Nassau County Department of Public Works,

Suffolk County Department of Environmental Control, and

Suffolk County Water Authority

Syosset, New York
1977

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CONVERSION FACTORS AND ABBREVIATIONS

Factors for converting English units to metric units are shown to three or four significant figures. However, in the text the metric equivalents are shown only to the number of significant figures consistent with the values for the English units.

English	Multiply by	Metric
inches (in.)	2.54	centimeters (cm)
feet (ft)	.3048	meters (m)
miles (mi)	1.609	kilometers (km)
gallons (gal)	3.785	liters (L)
gallons per minute (gal/min)	.06309	liters per second (L/s)
million gallons per day (Mgal/d)	.004381	cubic meters per second (m^3/s)
cubic feet per second (ft^3/s)	28.3	liters per second (L/s)
pounds (lb)	.4536	kilograms (kg)
tons (T)	.9072	tonne (t)
	907.2	kilograms (kg)
pounds per day (lb/d)	.4536	kilograms per day (kg/d)
--	--	grams per second (g/s)
--	--	milligrams per liter (mg/L)

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ABSTRACT

The concentration of inorganic nitrogen was measured in samples from 521 wells in the upper glacial and Magothy aquifers and from 46 streams in Nassau and Suffolk Counties during May 1971. The predominant form of dissolved nitrogen was nitrate. Nitrate concentrations (as N) in the upper glacial aquifer in both counties ranged from 0 to 20 milligrams per liter (mg/L); those in the Magothy aquifer ranged from 0 to 20 mg/L but were generally much lower in Suffolk County than in Nassau County. Nitrate concentrations (as N) decreased with depth in both counties; below 400 feet, concentrations ranged from 0 to 0.2 mg/L.

Nitrate concentrations (as N) of streams ranged from 0 to 11 mg/L, which is an indication of the general quality of water in much of the upper glacial aquifer, the source of most of the streamflow. Generally, concentrations of total nitrogen in streams draining the sewered area of Nassau County were lower than those in streams draining the unsewered area. Median concentrations of total inorganic nitrogen (as N) were 1.3 mg/L for the sewered area and 7.5 mg/L for the unsewered area. About 5,500 pounds of nitrate (as N) was estimated to be discharged daily in surface flow to tidewater from Nassau and Suffolk Counties.

INTRODUCTION

Purpose and Scope of Study

Ground water is the sole source of freshwater for more than 2.7 million residents of Nassau and Suffolk Counties on Long Island, New York (fig. 1). Under natural conditions, the ground-water reservoir

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Figure 1 (caption on next page) belongs near here.

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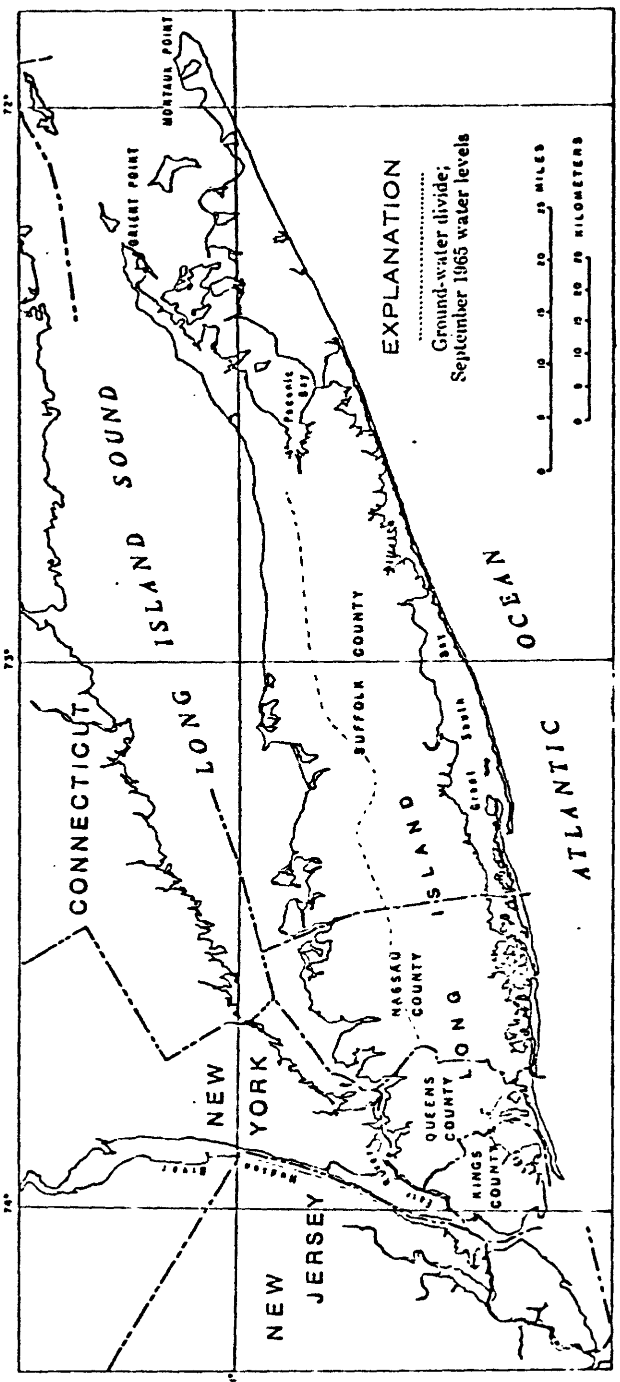
would be recharged only by local precipitation. Rapidly increasing demands for freshwater resulting from population growth and urbanization on the island and the consequent increasing discharge of wastewater through cesspools and septic tanks threaten the quality of the ground-water supply.

In Nassau and Suffolk Counties, contamination of ground water by nitrate has become a matter of vital concern for local planners and water managers. Knowledge of the nitrate concentration in Long Island water sources is necessary in judging the potability of water, especially because methemoglobinemia is a potential health hazard associated with high nitrate concentrations in drinking water (Deeb and Sloan, 1975).

Figure 1.--Location of study area and ground-water divide.



CONNECTICUT
NEW YORK
NEW JERSEY
LONG ISLAND SOUND
ATLANTIC OCEAN
LONG ISLAND
SUFFOLK COUNTY
NASSAU COUNTY
QUEENS COUNTY
KINGS COUNTY
ORIENT POINT
MONTAUK POINT
72°
73°
74°
41°
EXPLANATION
Ground-water divide; September 1965 water levels
MILES
KILOMETERS

Samples of water were collected from 521 wells and 46 streams in Nassau and Suffolk Counties during May 18-26, 1971, in order to delineate the extent of the water-quality degradation on Long Island resulting from dissolved inorganic nitrogen compounds. These samples were analyzed for ammonium (NH_4^+), nitrite (NO_2^-), and nitrate (NO_3^-) within several hours of the time of collection with two automated analyzers housed in a mobile laboratory. Concentrations of nitrogen species in the upper glacial and Magothy aquifers in selected streams and in sewered and unsewered areas of Nassau and Suffolk Counties were compared. Maps showing the areal distribution of the nitrate concentrations were computer-generated, and calculations of the amount of nitrogen species in surface water discharging to the bays of the ocean and Long Island Sound were made.

This study of water from selected wells and streams was made by the U.S. Geological Survey as part of a continuing program of water-resources studies in cooperation with the Nassau County Department of Public Works, the Suffolk County Department of Environmental Control, and the Suffolk County Water Authority.

Previous Studies

Several previous studies regarding nitrate concentration in relation to chemical quality of ground water and surface water have been made in Nassau and Suffolk Counties. De Laguna (1964) reported on the nitrate concentration of ground water near Brookhaven National Laboratory in Suffolk County, and Isbister (1966) discussed nitrate in ground water in northeastern Nassau County. A statistical evaluation of the trends of nitrate concentration in water from public-supply wells in Nassau County was made by Smith and Baier (1969). The Nassau-Suffolk Research Task Group (1969) reported the results of a study of nitrogen concentration in domestic sewage near cesspool and septic-tank systems at six sites in Nassau and Suffolk Counties. Perlmutter and Koch (1971 and 1972) appraised the nitrate concentration in ground water and surface water in southern Nassau County. In a more recent study, Smith and Myott (1975) described the distribution and change in nitrate levels in Nassau County.

Acknowledgments

The authors wish to thank the several agencies, organizations, and individuals who assisted in collecting water samples. These include employees of water districts and private water-supply companies in Nassau and Suffolk Counties; also, the Nassau County Department of Public Health, the Suffolk County Department of Health, the Suffolk County Water Authority, and the Suffolk County Department of Environmental Control.

CONCENTRATION OF NITROGEN SPECIES IN GROUND WATER

Three major sources of nitrogen in ground water on Long Island are domestic and industrial wastes, fertilizers, and precipitation. Because the input from these sources is not uniform (even nitrogen concentration in precipitation may vary from place to place), the concentration of nitrogen in ground water does not remain constant. Three ranges of nitrogen concentration (as N)[1/] are used in this report to characterize ground water on

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Long Island:

(1) Less than 0.20 mg/L (native quality). Perlmutter and Koch (1972) estimated the natural level of nitrogen in ground water to be less than 0.20 mg/L.

(2) From 0.21 to 10.0 mg/L (contaminated). This range represents concentrations that exceed the estimated natural nitrogen-concentration levels but are less than the 10-mg/L maximum concentration level established for drinking water by the U.S. Environmental Protection Agency (1975).

(3) Greater than 10.0 mg/L (not potable). These concentrations exceed the U.S. Environmental Protection Agency interim standards (1975) for drinking water.

Inorganic nitrogen occurs in various forms in ground water--the predominant ones are nitrate ion (NO_3^-), nitrite ion (NO_2^-), and the ammonium ion (NH_4^+). The form in which nitrogen occurs depends on the source and geochemical, microbiological, and hydrologic conditions. Nitrate (NO_3^-) is the predominant form of inorganic nitrogen in ground water on Long Island (table 1).

Footnote[1/].--Nitrogen is reported in the literature in two ways--in species concentration or as equivalent concentration as elemental nitrogen (N). In this report, concentrations of nitrogen species are reported as nitrogen (as N). Nitrogen concentrations can be converted to species concentrations by multiplying by the factor (species atomic weight/nitrogen atomic weight). For example, to convert concentrations expressed in terms of elemental nitrogen (N) to species concentrations, multiply the former by 1.29 for ammonium, by 4.43 for nitrate, and by 3.28 for nitrite.

Table 1.--Comparison of nitrate, nitrite, and ammonium concentrations in water from selected wells in upper glacial, Magothy, and Lloyd aquifers, Nassau and Suffolk Counties, May 18-26, 1971

[in milligrams per liter as N]

	Nitrate		Nitrite		Ammonium	
	Median	Range	Median	Range	Median	Range
Nassau County (167 samples)	3.15	0.0-20.0	0.0	0.0-0.06	0.01	0.0-3.40
Suffolk County (354 samples)	1.20	0.0-18.0	0.0	0.0-0.18	0.01	0.0-6.40

Overall Distribution of Nitrate by Aquifer and County

In the upper glacial aquifer, the distribution of nitrate (as N) in Nassau County was similar to that in Suffolk County because most of the concentrations were in the 0.21- to 10-mg/L range (table 2). Of the 242 wells sampled, 216 (89 percent) contained water with nitrate (as N) concentrations in excess of 0.21 mg/L.

In the Magothy aquifer, the distribution of nitrate in Nassau County was different from that in Suffolk County (table 2). In Nassau County, 115 of the 141 samples analyzed (82 percent) were in the 0.21- to 10-mg/L range, whereas in Suffolk County, the nitrate concentrations (as N) were about equally divided between the 0.0- to 0.20-mg/L range and 0.21- to 10.0- mg/L range.

Data on the Lloyd aquifer were insufficient to allow comparison of nitrogen concentrations in Nassau County with those in Suffolk County, but concentrations in the samples from Nassau County wells were predominantly in the 0.21- to 10.0-mg/L range.

The background concentration of nitrate (as N) in the Lloyd aquifer may be naturally high, or it may have been increased through its contact with the upper glacial aquifer in specific areas of Nassau County. In some areas on the north shore of Nassau County, the two aquifers are hydraulically connected because the clay member of the Raritan Formation, which generally separates the Lloyd aquifer from overlying units, is missing from some deep buried valleys near the north shore (Isbister, 1966). As a result, contaminated water from the upper glacial aquifer can move virtually unimpeded into and mix freely with the deeper water of the Lloyd aquifer.

Table 2.--Distribution of samples from selected wells in major Long Island aquifers, by nitrate concentration

	Range in nitrate concentrations (as N)							
	Nassau County				Suffolk County			
	<0.20 mg/L	0.21-10.0 mg/L	>10.0 mg/L	Total	<0.20 mg/L	0.21-10.0 mg/L	>10.0 mg/L	Total
Upper glacial aquifer								
Number of samples	1	12	4	17	25	188	12	225
Percentage of samples	6	71	23	100	11	84	5	100
Magothy aquifer								
Number of samples	16	115	10	141	61	65	0	126
Percentage of samples	11	82	7	100	48	52	0	100
Lloyd aquifer								
Number of samples	1	8	0	9	0	1	0	1
Percentage of samples	11	89	0	100	0	100	0	100

Areal Distribution of Nitrate by Aquifer and County

Virtually all of the upper glacial aquifer in Suffolk County contained water with nitrate concentrations (as N) in the 0.21- to 10-mg/L range[2/]

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(fig. 2), but in the upper glacial aquifer in Nassau County, the number of

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Figure 2 (caption on page 20) is in the pocket.

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wells samples was few and their distribution poor, which made it impossible to delineate the areal distribution of nitrate concentrations in that county (fig. 3).

Figure 3 (caption on page 20) is in the pocket.

The Magothy aquifer had a sufficient number and an adequate distribution of wells tapping it in both Nassau County and western Suffolk County, so that the areal distribution on nitrate concentrations could be delineated (figs. 4 and 5).

Figures 4 and 5 (captions on page 20) is in the pocket.

Footnote 2/.--All maps of areal distribution (figs. 2-5) are generalized. The hydrology, geology, point sources, and other factors may cause anomalously high or low nitrate concentrations that are not indicated in the figures.

Figure 2.--Areal distribution of nitrate concentrations (as N) in the upper glacial aquifer, Suffolk County. (in pocket)

Figure 3.--Areal distribution of nitrate concentrations (as N) in the upper glacial aquifer, Nassau County. (in pocket)

Figure 4.--Areal distribution of nitrate concentrations (as N) in the Magothy aquifer, Nassau County. (in pocket)

Figure 5.--Areal distribution of concentrations of nitrate (as N) in the Magothy aquifer, Suffolk County. (in pocket)

In the southern part of both counties, the Magothy aquifer had nitrate concentrations (as N) in the native range--less than 0.20 mg/L. There seemed to be a clearly defined boundary between water in the less than 0.20 mg/L concentration range and water in the 0.21- to 10-mg/L range. This boundary was noted in Nassau County and was called the "nitrate front" in a paper by Perlmutter and Koch (1972), and they attributed it chiefly to the difference between natural flow patterns and flow patterns affected by pumping. Geochemical processes (reduction of nitrate to nitrite or ammonium ions) could also possibly affect the position of the nitrate front in the Magothy aquifer (Perlmutter and Koch, 1972). Another possible influence on the front is the vertical distribution of the wells in both counties. Wells in the Magothy aquifer are generally screened deeper in the southern part of both counties, where they may be pumping water that is less contaminated than that from wells screened closer to the water table. This factor is discussed in the following section.

Vertical Distribution of Nitrate in the Magothy Aquifer

The Magothy aquifer underlies the upper glacial aquifer in most places on Long Island, and, in many parts of the study area, these two aquifers are hydraulically connected. The Magothy aquifer thickens gradually toward the southeast and slopes southeastward at an average rate of 65 ft/m (Franke and McClymonds, 1972). Less than half the water that enters the upper glacial aquifer through natural recharge reaches the Magothy aquifer (Cohen and others, 1968). Water that does reach the Magothy aquifer moves northward and southward toward the shores and away from the ground-water divide near the center of the island (fig. 1). As a result of the hydrologic conditions that control the flow pattern, the age of water in the Magothy aquifer ranges from several hours at shallow depths near the ground-water divide to hundreds of years on the south shore and at greater depths (Franke and Cohen, 1972).

Wells in the Magothy aquifer are commonly screened deeper in the southern part than the northern part of Nassau and Suffolk Counties; Ku and others (1975) have shown that the depth at which wells are screened depends on the degree of potential contamination, the desired rate of withdrawal, the cost of drilling, and possibly other factors.

In general, water quality can be expected to improve with increasing depth below the water table. This relationship was confirmed statistically for nitrate in both Nassau and Suffolk Counties (table 3). Significant correlations (at the 99-percent confidence level) among the large number of wells sampled showed that as the depth of the screened interval of a well in the Magothy aquifer increased, the concentration of nitrate decreased. Because some of the wells sampled had more than one screened interval, the top of the screened interval refers in this report to the top of the uppermost screen, and the bottom of the screened interval refers to the bottom of the lowermost screen. All wells, whether they contained one or more screened interval, were included in the analysis for the correlation coefficient.

Table 3.--Correlation coefficients significant at 99-percent confidence level for depth vs. nitrate concentration in Magothy aquifer.

	Number of wells	Correlation coefficient: Between land surface and top of uppermost screened interval[1/]	Correlation coefficient: Between land surface and bottom of lowermost screened interval[1/]
Nassau County	141	-0.378	-0.414
Suffolk County	126	-0.314	-0.318

1/ Some wells had more than one screened interval.

On the basis of the observed relationship between depth and concentration of nitrate, the Magothy aquifer was divided into four 200-ft depth intervals (table 4). Samples from the two intervals above 400 ft in Suffolk County had much lower nitrate concentrations than those from the corresponding depths in Nassau County. In both counties, nitrate concentrations (as N) in the two lower intervals were in the native range--less than 0.20 mg/L.

Table 4.--Distribution of nitrate concentrations (as N) at successive depth intervals in Magothy aquifer in Nassau and Suffolk Counties

Depth Interval	< 0.20 mg/L		0.21-10.0 mg/L		> 10.0 mg/L		Median concentration (mg/L)	Total number of samples
	Number of samples	Percentage of samples	Number of samples	Percentage of samples	Number of samples	Percentage of samples		
0-200 feet								
Nassau County	2	3	53	90	4	7	3.90	59
Suffolk County	5	15	29	85	0	0	1.0	34
200-400 feet								
Nassau County	9	13	60	83	3	4	2.55	72
Suffolk County	32	50	32	50	0	0	.50	64
400-600 feet								
Nassau County	5	71	2	29	0	0	.10	7
Suffolk County	20	83	4	17	0	0	.10	24
600-800 feet								
Nassau County	1/	--	1/	--	1/	--	1/	--
Suffolk County	5	83	1	17	0	0	.00	6

1/ Data not available

Comparison of Nitrate Concentrations in the Sewered and Unsewered Areas of Nassau County

The southern two-thirds of Nassau County can be divided into a western, sewered area and an eastern, unsewered area, which are hydrologically similar (fig. 6). Most of the western area, which includes approximately

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Figure 6 (caption on next page) belongs near here.

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75 mi^2, was sewered between 1952 and 1964. The eastern area, which includes approximately 105 mi^2, was still virtually unsewered in 1971. The distribution of nitrate concentrations in the upper glacial aquifer seemed to be similar for both areas, but the sampling was too sparse for this to be regarded as conclusive (table 5). Perlmutter and Koch (1972) found that nitrate concentrations (as N) of ground water from about 200 randomly located wells in the upper glacial aquifer averaged 6.3 mg/L in the sewered area and 8.1 mg/L in the unsewered area. They attributed some of the lower nitrate concentrations to village-owned sewer systems, some of which had been in operation since before the early 1950's, and others to tracts of undeveloped land, where infiltration of sewage was minimal.

In the Magothy aquifer, a relatively large number of wells were sampled. As in the upper glacial aquifer, very little difference between nitrate concentrations in the two areas was observed.

Figure 6.--Location of sewered and unsewered areas of Nassau County.

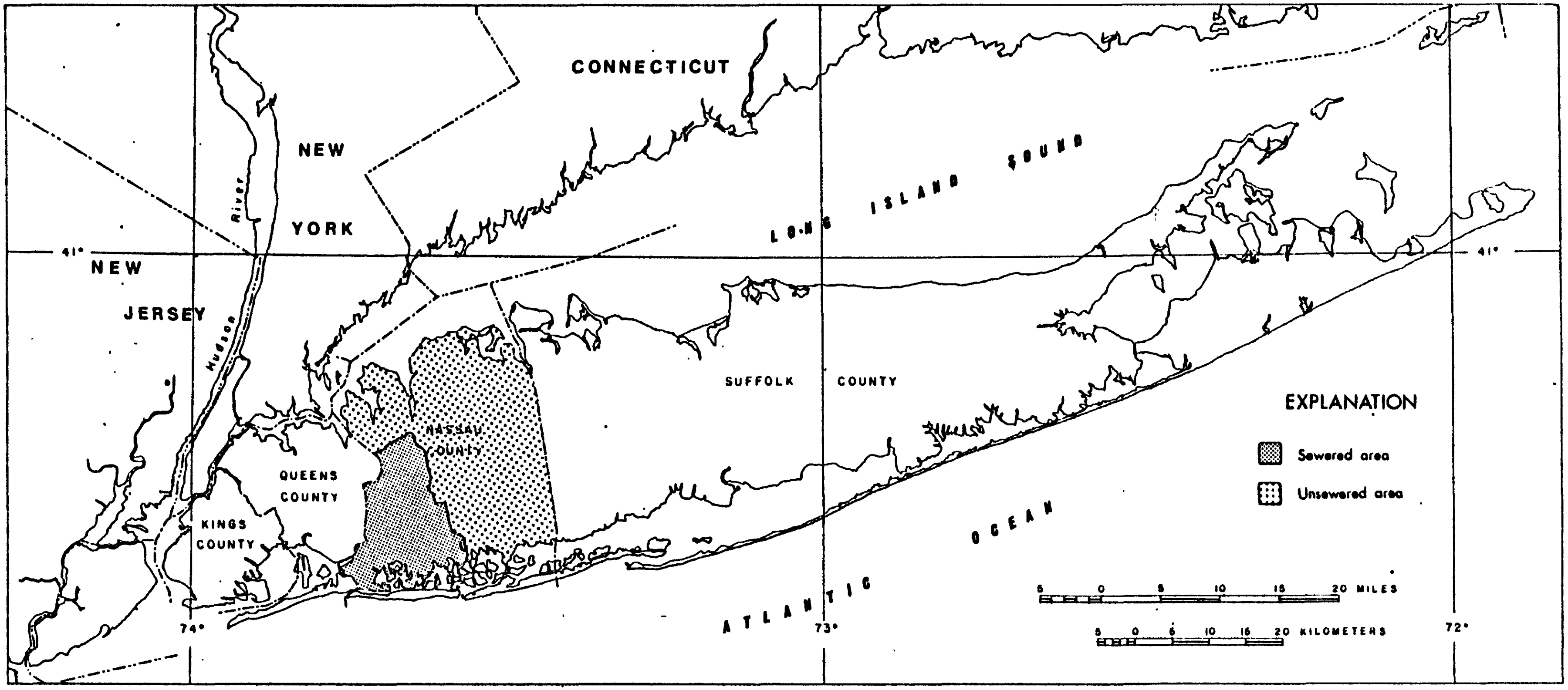
CONNECTICUT
NEW
YORK
NEW
JERSEY
Hudson
River
LONG ISLAND SOUND
SUFFOLK COUNTY
NASSAU COUNTY
QUEENS COUNTY
KINGS COUNTY
ATLANTIC OCEAN
EXPLANATION
Sewered area
Unsewered area
5 0 5 10 15 20 MILES
5 0 5 10 15 20 KILOMETERS
41°
74°
73°
72°

Table 5.--Distribution of nitrate concentrations (as N) in samples from wells in upper glacial and Magothy aquifers, in sewered and unsewered areas of Nassau County

	Upper glacial aquifer				Magothy aquifer			
	Less than 0.20 mg/L	0.21-10.0 mg/L	More than 10.0 mg/L	Total	Less than 0.20 mg/L	0.21-10.0 mg/L	More than 10.0 mg/L	Total
Sewered area								
number of samples	1	7	2	10	8	43	3	54
percentage of samples	10	70	20	100	15	80	5	100
Unsewered area								
number of samples	0	2	1	3	7	47	6	60
percentage of samples	0	67	33	100	12	78	10	100

The similarity between nitrate distribution in the sewered and unsewered areas in both aquifers may arise from a variety of factors: (1) the drought of 1962-66 reduced the amount of nitrate leaching into the upper glacial aquifer, and this may have masked any differences between nitrate distribution in the two areas; (2) the time since completion of sewering in the western area may not have been sufficient for resulting changes in the Magothy aquifer to become detectable, owing to the considerable length of time necessary for downward movement of water in that aquifer (Franke and Cohen, 1972); (3) differences in rates of pumping and total pumpage between the sewered and unsewered areas have complicated the interpretation of available data.

CONCENTRATION OF NITROGEN SPECIES IN SURFACE WATER

Most of the streamflow on Long Island is derived from water discharging from the upper glacial aquifer (Franke and McClymonds, 1972). In a study of 19 continuously gaged streams for the 1958 and 1964 water years, it was found that, on the average, 87 percent of the streamflow had been contributed by ground-water discharge. The percentage of ground-water contribution to annual stream discharge was lower in highly urbanized areas than in rural areas. The chemical quality of streams on Long Island reflects the general chemical quality of shallow water in much of the upper glacial aquifer.

Analyses for ammonia, nitrite, and nitrate were made on samples from 46 streams draining to Long Island Sound and to parts of the bays south of Long Island (Harr, 1971). As with ground-water samples, the predominant inorganic nitrogen species in stream samples was nitrate. The significant variation in median concentrations of samples from streams on different parts of Long Island (table 6) directly reflects the varying quality of the ground water that discharges into streams and indirectly reflects the effect of urbanization on ground-water quality. Estimates of daily loads of total inorganic nitrogen (NH_4^+, NO_2^-, and NO_3^- in streamflow were computed from: (1) the concentration of inorganic nitrogen in stream samples, (2) the discharge measured at the time of sampling (during base-flow conditions), and (3) the mean daily discharge (tables 7A to 7H). It was assumed in the calculation of estimated daily loads that the stream discharge and the concentration of nitrogen at the time of sampling would remain constant for the entire day.

The average percent flow duration at the time of sampling, determined from stream-data curves for continuously gaged streams (D. E. Vaupel, oral commun., 1976) and from discharges recorded at the time of sampling, was about 50 percent. Thus, these discharge values represent the median discharge. However, the instantaneous discharges exceeded the year's (1971) daily discharge on all continuously gaged streams. Thus, the estimated values of daily load are only coarse approximations of the actual daily load on any particular day.

Table 6.--Concentration of nitrogen species in water from selected streams in Nassau and Suffolk Counties, by drainage area (From Harr, 1971).

[in milligrams per liter]

Drainage area	Number of streams	Concentrations (as N), in milligrams per liter					
		Ammonium		Nitrite		Nitrate	
		Range	Median	Range	Median	Range	Median
Drainage to Long Island Sound	10	0.00-0.90	0.14	0.00-0.07	0.02	0.00-4.9	1.75
Drainage to South Bays, eastern Suffolk County	12	.02-5.3	.05	.00- .11	.00	.00-2.1	.60
Drainage to South Bays, western Suffolk County	10	.22-3.6	1.20	.02- .17	.02	.25-4.3	2.03
Drainage to South Bays, unsewered area--Nassau County	8	.00-5.0	2.00	.02- .10	.04	2.7 -11	6.3
Drainage to South Bays, sewered area--Nassau County	6	.10- .54	.26	.00- .04	.01	.05-2.3	.09

Large variations in average load were observed among the streams draining different parts of Long Island (fig. 7). The lowest daily load

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Figure 7 (caption on next page) belongs near here.

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to a saltwater body was estimated to be 21.6 lbs, received by Peconic Bay (table 7C), and the highest was estimated to be 1,202 lbs, received by South Oyster Bay and Western Great South Bay (table 7F).

Figure 7.--Selected drainage areas in Nassau and Suffolk Counties for which data on discharges and estimated loads of nitrate (as N) are given in table 7.

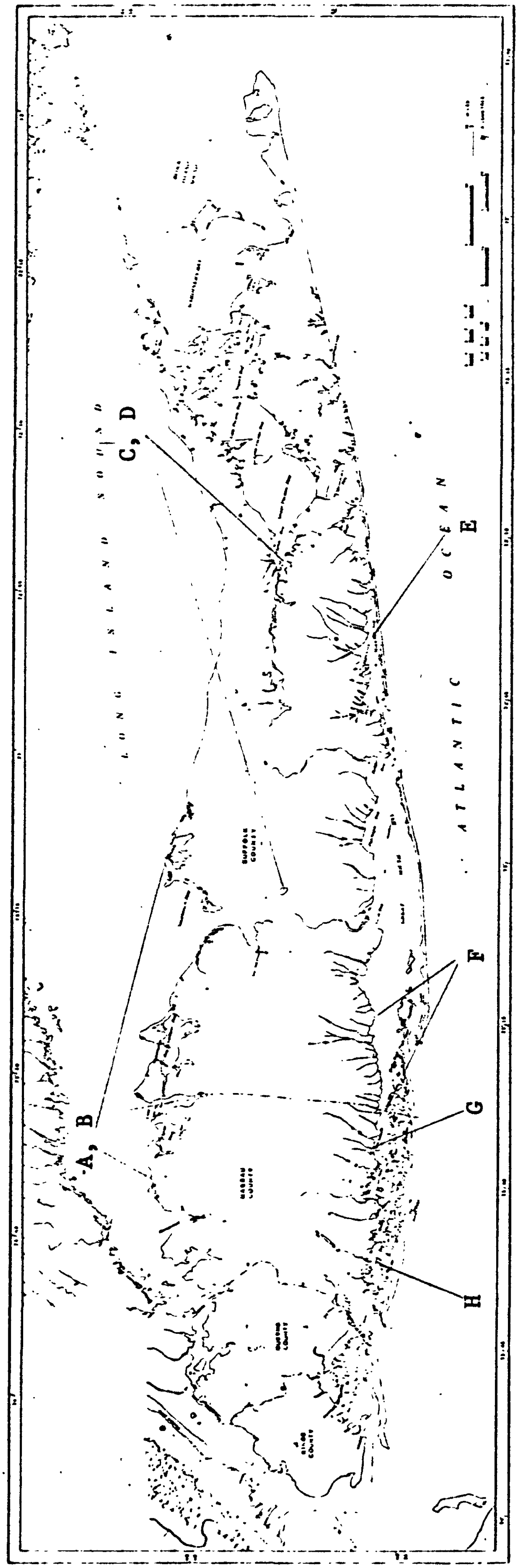
A, B
C, D
E
F
G
H
LONG ISLAND SOUND
ATLANTIC OCEAN

Table 7.--Data on discharges and loads for selected Long Island Streams

Station	Stream Name	Discharge at time of sampling[1/] (ft³/s)	Concentration of inorganic nitrogen[3/] (as N) (mg/L)	Load at time of sampling (g/s)	Average daily discharge (for water year 1971) (ft³/s)	Estimated load (lb/d)
	A. Drainage to Long Island Sound - Nassau County					
01302200	Whitney Lake Outlet at Manhasset	2.5	0.75	0.05	2/	10.0
01302300	Roslyn Brook at Roslyn	1.8	5.13	.26	2/	49.8
01302500	Glen Cove Creek at Glen Cove	6.79	3.67	.71	5.56	134.4
01302800	Island Swamp Creek at Lattingtown	.9	2.41	.06	2/	11.7
01303000	Mill Neck Creek at Mill Neck	8.98	.20	.05	6.75	9.7
01303500	Cold Spring Brook at Cold Spring Harbor	2.24	.32	.02	2.93	3.9
						219.5
	B. Drainage to Long Island Sound - Suffolk County					
01303600	Mill Creek near Huntington	3.0	3.85	0.33	2/	62.3
01303700	Stony Hollow Run at Centerport	1.2	2.09	.07	2/	13.5
01304000	Nessequogue River near Smithtown	40.2	.64	.73	36.5	138.7
01304100	Wading River at Wading River	1.0	.02	.001	2/	.1
						214.6

1/ Value also represents mean daily discharge, in ft^3/s.

2/ No data available.

3/ NH_4^+, NO_2^-, and NO_3^-

Table 7.--Data on discharges and loads for selected Long Island streams (Cont'd.)

Station	Stream Name	Discharge at time of sampling 1/ (ft^3/s)	Concentration of inorganic nitrogen 3/ (as N) (mg/L)	Load at time of sampling (g/s)	Average daily discharge (for water year 1971) (ft^3/s)	Estimated load (lb/d)
		C. Drainage to Peconic Bay				
01304500	Peconic River at Riverhead	34	0.11	0.11	28.9	20.2
01304530	Little River near Riverhead	4.4	.06	.01	2/	1.4
		D. Intermorainal drainage				
01306405	Lake Ronkonkoma at Lake Ronkonkoma inlet	0.6	.41	.007	2/	1.3

1/ Value also represents mean daily discharge, in ft^3/s.

2/ No data available.

3/ NH_4^+, NO_2^-, and NO_3^-

Table 7.--Data on discharges and loads for selected Long Island streams (Cont'd.)

Station	Stream Name	Discharge at time of sampling 1/ (ft^3/s)	Concentration of inorganic nitrogen 3/ (as N) (mg/L)	Load at time of sampling (g/s)	Average daily discharge (for water year 1971) (ft^3/s)	Estimated load (lb/d)
	E. Drainage to Moriches Bay and eastern Great South Bay - Suffolk County					
01304779	Aspatuck Creek at Westhampton	2.2	1.30	0.08	2/	15.4
01304800	Beaverdam Creek near Westhampton	2.4	1.23	.08	2/	15.9
01304860	Seatuck Creek at Eastport	5.7	.53	.085	2/	16.3
01304959	West Mill Pond outlet at Moriches	9.6	4.40	1.20	2/	227.1
01305000	Carmans River at Yaphank	22.6	.55	.35	17.5	67.0
01305200	Motts Brook at Bellport	1.8	2.13	.11	2/	20.7
01305300	Mud Creek at East Patchogue	5.4	5.82	.89	2/	169.3
01305500	Swan River at East Patchogue	12.3	1.03	.36	9.83	68.4
01305800	Patchogue River near Patchogue	20.6	1.71	1.0	2/	169.9
01306400	Green Creek at West Sayville	4.5	1.80	.23	2/	43.7
01306500	Connetquot River near Oakdale (Gage 1)	37.5	.55	.58	31.1	111.1
01306700	Rattlesnake Brook near Oakdale	9.2	.30	.08	2/	14.9
					TOTAL	974.6

1/ Value also represents mean daily discharge, in ft^3/s

2/ No data available.

3/ NH_4^+, NO_2^-, NO_3^-

Table 7.--Data on discharges and loads for selected Long Island streams (Cont'd.)

Station	Stream Name	Discharge at time of sampling 1/ (ft^3/s)	Concentration of inorganic nitrogen 3/ (as N) (mg/L)	Load at time of sampling (g/s)	Average daily discharge (for water year 1971) (ft^3/s)	Estimated load (lb/d)
F. Drainage to South Oyster Bay and western Great South Bay - Suffolk County						
01307000	Champlin Creek at Islip	7.3	2.44	0.50	2/	96.1
01307200	Orowoc Creek at Islip	2.6	2.36	.17	2/	33.1
01307300	Pardees Pond outlet at Islip	6.1	1.02	.18	2/	33.5
01307400	Awixa Creek at Islip	1.9	4.00	.22	2/	41.0
01307500	Pentaquit Creek at Bay Shore	6.2	3.86	.68	6.01	129.0
01307600	Cascade Lakes outlet at Brightwaters	2.5	2.62	.19	2/	35.3
01308000	Sampawams Creek at Babylon	9.3	4.53	1.19	7.21	227.1
01308500	Carlls River at Babylon	25.8	2.98	2.18	18.1	414.5
01309200	Neguntatogue Creek at Lindenhurst	3.8	6.44	.69	2/	131.9
01309350	Amityville Creek at Amithville	3.5	3.23	.32	2/	60.9
						1202

1/ Value also represents mean daily discharge, in ft^3/s.

2/ No data available.

3/ NH_4^+, NO_2^-, NO_3^-

Table 7.--Data on discharges and loads for selected Long Island streams (Cont'd.)

Station	Stream Name	Discharge at time of sampling 1/ (ft^3/s)	Concentration of inorganic nitrogen 3/ (as N) (mg/L)	Load at time of sampling (g/s)	Average daily discharge (for water year 1971) (ft^3/s)	Estimated load (lb/d)
	G. Drainage to South Oyster Bay - unsewered area Nassau County					
01309400	Carmans Creek at Amityville	4.2	5.62	0.67	2/	127.2
01309500	Massapequa Creek at Massapequa	11.2	7.76	2.46	6.31	468.6
01309700	Seaford Creek at Seaford	1.9	4.33	.23	2/	44.3
01309900	Seamans Creek at Seaford	1.9	4.76	.26	2/	48.7
0131000	Bellmore Creek at Bellmore (gage 1)	10.4	9.53	2.80	6.18	534.3
01310100	Newbridge Creek at Merrick	2.3	8.26	.54	2/	102.5
01310200	Cedar Swamp Creek at Merrick	8.4	7.18	1.71	2/	325.2
01310500	East Meadow Brook at Freeport	16.3	9.34	4.04	5.85	770.4
						2421

1/ Value also represents mean daily discharge, in ft^3/s.

2/ No data available.

3/ NH_4^+, NO_2^-, NO_3^-

Table 7.--Data on discharges and loads for selected Long Island streams (Cont'd.)

Station	Stream Name	Discharge at time of sampling 1/ (ft^3/s)	Concentration of inorganic nitrogen 3/ (as N) (mg/L)	Load at time of sampling (g/s)	Average daily discharge (for water year 1971) (ft^3/s)	Estimated load (lb/d)
	H. Drainage to Middle Bay - sewered area Nassau County					
01310600	Milburn Creek at Baldwin	8.5	7.96	1.91	2/	364.7
01310700	Parsonage Creek at Baldwin	4.1	2.32	.07	2/	12.5
01310800	South Pond outlet at Malverne	2.9	.57	.05	2/	8.9
01311000	Pines Brook at Malverne	4.37	.25	.03	0.86	5.9
01311200	Motts Creek at Valley Stream	2.1	2.88	.17	2/	32.6
01311500	Valley Stream at Valley Stream	3.38	.36	.03	.74	6.6
						431.1

1/ Value also represents mean daily discharge, in ft^3/s.

2/ No data available.

3/ NH_4^+, NO_2^-, NO_3^-

The marked difference between estimated daily loads of streams draining the sewered sections and those of streams draining the unsewered sections of Nassau County (table 7, sections G and H, respectively), cannot be adequately appraised without knowledge of the drainage areas for each section. However, the median concentrations of 1.3 mg/L total inorganic nitrogen (as N) for streams draining sewered areas (which ranged in concentration from 0.25 to 7.96 mg/L) and 7.5 mg/L for streams draining unsewered areas (which ranged from 4.33 to 9.53 mg/L) in Nassau County, reflect the nitrate contribution from ground-water bodies to surface-water bodies and the possible beneficial effect of sewering on the quality of surface water.

The observed difference between total inorganic nitrogen concentration of surface water draining sewered areas and of those draining unsewered areas can be attributed only partly to sewering. Since 1971, streams draining the sewered area have had zero flow for one-half to two-thirds of the time (D. E. Vaupel, oral commun., 1976); and ground-water inflow to Valley Stream and Pines Brook decreased, respectively, from 68 percent to 48 percent and from 74 percent to 51 percent of the total annual discharge between the 1958 to 1964 water years (Franke and McClymonds, 1972). Hence, the loads of these streams include a considerable contribution from overland runoff, and this contribution could raise the estimated daily load by about 50 percent.

SUMMARY AND CONCLUSIONS

Ground water in Nassau and Suffolk Counties--the sole source of supply for domestic, municipal, irrigation, and industrial use--has deteriorated in chemical quality as a result of the large amounts of nitrogen, principally nitrate, from domestic wastes that have entered the ground-water reservoir through cesspools, septic tanks, and inland disposal basins. Nitrogen from fertilizers that have been applied in excess of plant requirements has also contributed to ground-water degradation and locally may represent a large percentage of the nitrogen content. Also, small amounts of nitrogen are derived from precipitation.

Analyses of samples collected in Nassau and Suffolk Counties indicated considerable degradation of water in the upper glacial aquifer by nitrate. Nitrate concentrations in the Magothy aquifer were much higher in Nassau County than in Suffolk County: 7 percent of the samples collected from the Magothy aquifer in Nassau County had nitrate concentrations in excess of the limit recommended by the U.S. Environmental Protection Agency (1975) for drinking water, whereas no samples from the Magothy aquifer in Suffolk County had concentrations that exceeded this limit. Furthermore, 50 percent of the samples collected from the Magothy aquifer in Suffolk County had nitrate concentrations less than 0.2 mg/L, whereas only 11 percent of the samples from the Magothy aquifer in Nassau County had concentrations of less than 0.2 mg/L, which was considered by Perlmutter and Koch (1972) to represent native levels.

Water quality improved markedly with increasing depth in the Magothy aquifer in both Nassau and Suffolk Counties. Water below a depth of 400 feet had nitrate concentrations (as N) of generally less than 0.2 mg/L in both counties.

Most of the streamflow in Nassau and Suffolk Counties consists of outflow from shallow ground-water subsystems; hence, the chemical quality of streams represents the general quality of ground water in much of the upper glacial aquifer. Nitrate concentrations (as N) in streams ranged from 0 mg/L to 11 mg/L. The total daily load of nitrate entering tidewater from streams in Nassau and Suffolk Counties was estimated to be 5,500 lbs.

Generally, concentrations of inorganic nitrogen loads in streams draining the sewered area of Nassau County were lower than those in streams draining the unsewered area. Median concentrations of inorganic nitrogen (as N) were 1.3 mg/L for the sewered area and 7.5 mg/L for the unsewered area.

Further changes in the nitrate concentrations of ground water and surface water are expected as a result of continued population growth, changing population distribution, and the planned extension of sewering.

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