ENGINEERING INVESTIGATIONS AT INACTIVE HAZARDOUS WASTE SITES

PHASE 1 INVESTIGATION

Old Quogue Landfill

Site No. 152050

Village of Quogue, Suffolk County

Final - June 1987

New York State Department of Environmental Conservation

50 Wolf Road, Albany, New York 12233
Henry G. Williams, Commissioner

Division of Solid and Hazardous Waste
Norman H. Nosenchuck, P.E., Director

Prepared by:

EA SCIENCE AND TECHNOLOGY
A Division of EA Engineering, Science, and Technology, Inc.

EA REPORT DEC63A

ENGINEERING INVESTIGATIONS AT INACTIVE HAZARDOUS WASTE SITES IN THE STATE OF NEW YORK PHASE I INVESTIGATIONS

OLD QUOGUE LANDFILL
VILLAGE OF QUOGUE, SUFFOLK COUNTY
NEW YORK I.D. NO. 152050

Prepared for

Division of Solid and Hazardous Waste
New York State Department of Environmental Conservation
50 Wolf Road
Albany, New York 12233-0001

Prepared by

EA Science and Technology
R.D. 2, Goshen Turnpike
Middletown, New York 10940

A Division of EA Engineering, Science, and Technology, Inc.

June 1987

CONTENTS

1. EXECUTIVE SUMMARY

The Old Quogue landfill (New York I.D. No. 152050, EPA No. NYD981184146) is an inactive municipal landfill located along Old Country Road in the Village of Quogue, Suffolk County, New York (Figures 1-1 and 1-2). The landfill is owned by the Village of Quogue. It is approximately 2 acres in size and situated just inside the northern edge of the Village limits. Landfilling began at this site around 1930 and ended in 1973. The site was used by village residents, commercial garbage collectors, builders, and local businesses. Refuse was almost exclusively generated in the incorporated village limits of Quogue, which has no industry. Refuse was burned for many years until this practice was forbidden. After that, refuse was deposited in the landfill and periodically covered over with dirt. The landfill was covered with 1-2 ft of sand when it was finally closed.

According to the Village of Quogue, no hazardous waste of any significant quantity was ever deposited at this site. No environmental testing or monitoring has been done, nor is any planned. The most recent inspections of the site by New York State Department of Environmental Conservation Region 1 staff confirm that the site has been closed and is inactive, except for an occasional load of brush or leaves that is brought in, evidently by someone who has a key to the landfill entrance gate. Consulting engineers Holzmacher, McLendon, and Murell estimate that only (approximately) 5,500 cubic yards of refuse were deposited at this site and (because burning was normal practice at the site), they anticipate that the total amount of leachate produced here will be quite small and will probably be readily attenuated in the subsurface environment. Suffolk County Department of Health Services indicates they do not believe that hazardous waste was ever buried at the site, and they did not intend that this site be put on the New York State Registry of Inactive Hazardous Waste Disposal Sites.

EA has researched all pertinent agency files, interviewed the site owner's representative, conducted a site inspection, and has found no documented hazardous waste or contamination at this site. Therefore, it is not appropriate to provide a Hazard Ranking Score (or documentation) for this site. In order to prepare a final HRS score for this site, analytical data regarding the quality of the ground water will be necessary, thus requiring performance of a Phase II investigation. The proposed Phase II study would include the installation of three test borings/observation wells, and the collection and analysis of ground-water samples. The estimated total cost to complete a Phase II investigation of the Quogue Landfill site is $67,000.

Site Coordinates:

Latitude: 40° 50' 12"
Longitude: 72° 36' 21"

OLD QUOGUE LANDFILL

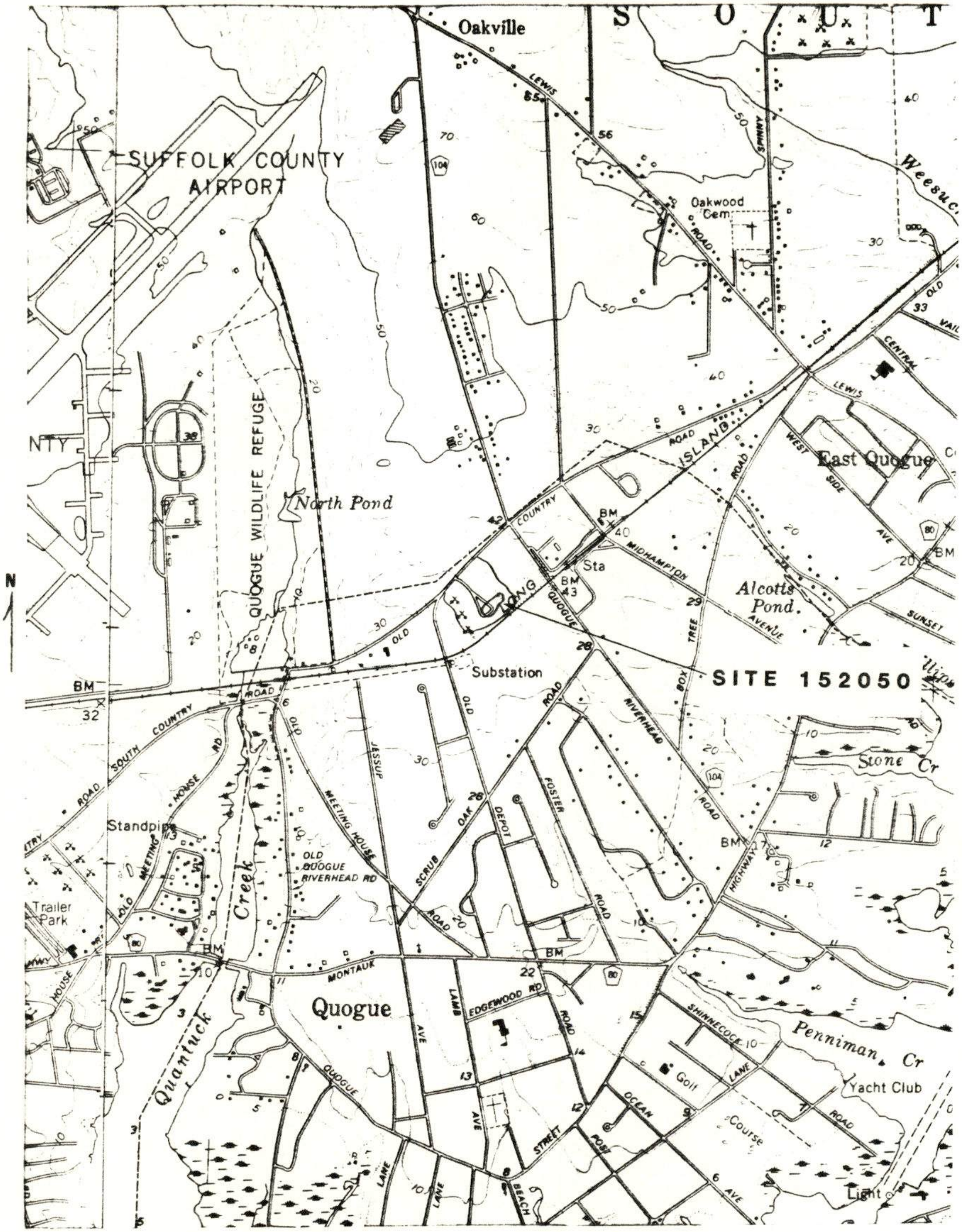


Figure 1-1. **QUOGUE & EASTPORT QUADS.**

Scale 1:24,000

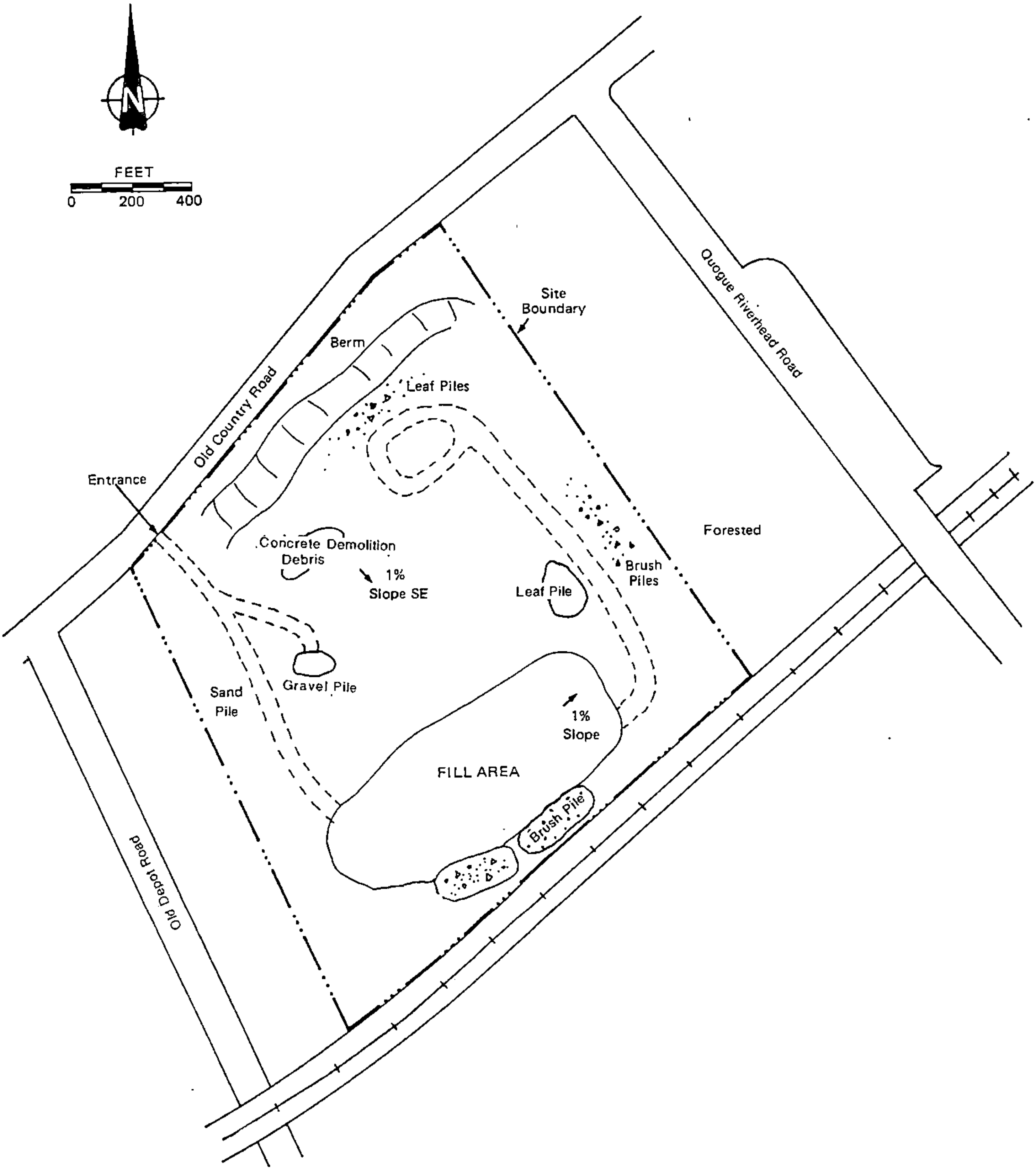


Figure 1-2. Site sketch. Old Quogue Landfill, 21 January 1986.

2. PURPOSE

The Old Quogue landfill was listed on the New York State Registry of Inactive Hazardous Waste Sites because it is an inactive municipal landfill and the nature of the waste deposited is unknown.

The goal of the Phase I investigation of this site was to: (1) obtain available records on the site history from state, federal, county, and local agencies; (2) obtain information on site topography, geology, local surface water and ground-water use, previous contamination assessments, and local demographics; (3) interview site owners, operators, and other groups or individuals knowledgeable of site operations; (4) conduct a site inspection to observe current conditions; and (5) prepare a Phase I report. The Phase I report includes an assessment of the available information and a recommended work plan for Phase II studies.

3. SCOPE OF WORK

The Phase I investigation of the Old Quogue landfill site involved a site inspection by EA Science and Technology, as well as record searches and interviews. The following agencies or individuals were contacted:

Contact	Information Received
Mr. Edwin Shuttleworth Village of Quogue Jessup Avenue Quogue, New York 11959 (516) 653-4498	Interview/site history
Mr. George Mathies Georges Sanitation 3 Oak Court Hampton Bays, New York (516) 653-6666	Intervew/site history
Ms. Barbara Meduski K&M Sanitation Company East Quogue, New York (516) 653-5636	Interview/site history
Mr. Anthony Candela, P.E. Senior Sanitary Engineer New York State Department of Environmental Conservation Division of Solid Waste SUNY Campus - Building 40 Stony Brook, New York 11794 (516) 751-7900	No file/information
Mr. James Pim, P.E. Suffolk County Department of Health Services 15 Horseblock Road Farmingville, New York 11738 (516) 451-6434	Interivew and site file
Mr. Steve Carey/Mr. Dennis Moran Suffolk County Department of Health Services Bureau of Water Resources 225 Rabro Drive East Hauppage, New York 11788 (516) 348-2893	Ground-water use; public water supplies and ground-water monitoring information

Contact	Information Received
Mr. Dan Fricke Suffolk County Cooperative Extension Association 264 Griffing Avenue Riverhead, New York 11901 (516) 727-7850	Ground-water and surface water use for irrigation
Mr. William Schickler/Mr. Robert Bowen Suffolk County Water Authority Sunrise Highway and Pond Road Oakdale, New York 11769 (516) 589-5200	Public water supply and distribution
Mr. Doug Pica New York State Department of Environmental Conservation Division of Water SUNY Campus - Building 40 Stony Brook, New York 11794 (516) 751-7900	Ground-water use for irrigation
Mr. Allan S. Connel District Conservationist U.S. Department of Agriculture Soil Conservation Survey 127 East Main Street Riverhead, New York 11901	Ground-water use for irrigation
Mr. David DiSunno Chief Fire Inspector 159 Pantigo Road East Hampton, New York 11937 (516) 267-8585	Information regarding the threat of fire and/or explosion at the site
Mr. Kevin Walter, Atty. New York State Department of Environmental Conservation Division of Hazardous Waste Enforcement 50 Wolf Road Albany, New York 12233-0001 (518) 457-5637	No file/information
Mr. John Iannotti, P.E. New York State Department of Environmental Conservation Bureau of Remedial Action 50 Wolf Road Albany, New York 12233-0001 (518) 457-5637	No file/information

Contact	Information Received
Mr. Earl Barcomb New York State Department of Environmental Conservation Landfill Operations Vatrano Road Albany, New York 12205 (518) 457-2051	No file/information
Mr. Peter Skinner, Atty. New York State Attorney General's Office Room 221 Justice Building Albany, New York 12224 (518) 474-2432	No file/information
Mr. Ron Tramontano/Mr. Charlie Hudson Bureau of Toxic Substance Assessment New York State Department of Health Tower Building 84 Holland Avenue Albany, New York 12237 (518) 473-8427	No file/information
Mr. James Covey, P.E. New York State Department of Health Nelson A. Rockefeller Empire State Plaza Albany, New York 12237 (518) 473-4637	Community Water Atlas Supply Atlas
Mr. Rocky Paggione, Atty. Mr. Louis A. Evans, Atty. New York State Department of Environmental Conservation Division of Environmental Enforcement 202 Mamaroneck Avenue White Plains, New York 10601-5381 (914) 761-6660	No file/information
Mr. Marsden Chen New York State Department of Environmental Conservation Bureau of Site Control 50 Wolf Road Albany, New York 12233-0001 (518) 457-0639	Site file

Contact	Information Received
Mr. John W. Ozard Senior Wildlife Biologist New York State Department of Environmental Conservation Wildlife Resources Center Significant Habitat Unit Delmar, New York 12054 (518) 439-7486	Significant habits
Mr. Perry Katz U.S. Environmental Protection Agency Region III Room 757 26 Federal Plaza New York, New York 10278 (212) 264-4595	No file/information

4. SITE ASSESSMENT - OLD QUOGUE LANDFILL

4.1 SITE HISTORY

Old Quogue landfill is an inactive municipal landfill located along Old Country Road, approximately 1 mi north of the populated portion of the Village of Quogue in Suffolk County, New York. The landfill proper is approximately 2 acres in size, on a 16-acre lot which is owned by the Village of Quogue and situated just inside the northern edge of the village limits. The remainder of the 16-acre lot is presently used for storage of sand, brush, and street sweepings (EA Site Inspection).

Landfilling began at the site around 1930 and ended in 1973. The site has no liner. The site was used by village residents, commercial garbage collectors, builders, and local businesses (Appendixes 1.1.1 through 1.1-3). Refuse was almost exclusively generated in the incorporated village limits of Quogue which has no industry (Appendixes 1.1-1, 1.1-2, and 1.1-4). Refuse was burned for many years until this practice was forbidden. After that, refuse was deposited in the landfill and periodically covered with dirt. Household garbage, scrap wood from building construction, tree and brush debris, paper and cardboard, broken concrete, and unusable dirt fill from construction have been buried at the site (Appendix 1.1-1). The landfill was covered with 1-2 ft of sand when it was finally closed.

According to the Village of Quogue, no hazardous waste of any significant quantity was ever deposited at this site. No environmental testing or monitoring has been done, nor is any planned (Appendix 1.1-1). The most recent inspections of the site by New York State Department of Environmental Conservation Region 1 staff confirm that the site has been closed and is inactive, except for an occasional load of brush or leaves that is brought in, evidently by someone who has a key to the landfill entrance gate (Appendixes 1.1-5 and 1.1-6). Consulting engineers Holzmacher, McLendon, and Murell estimate that only (approximately) 5,500 cubic yards of refuse were deposited at this site and (because burning was normal practice at the site) they anticipate that the total amount of leachate produced here will be quite small and will probably be readily attenuated in the subsurface environment (Appendix 1.1-7). Suffolk County Department of Health Services indicates they do not believe that hazardous waste was ever buried at the site, and they did not intend that this site be put on the New York State Registry of Inactive Hazardous Waste Disposal Sites (Appendix 1.1-8).

4.2 SITE TOPOGRAPHY

The Old Quogue Landfill is located along the south shore of Long Island in Suffolk County, at an elevation of approximately 35 ft above mean sea level (Appendix 1.2-1). Regional slope is 1-2 percent to the southeast. The site itself, approximately 2 acres in size, is essentially flat. The site is bordered on the south by the Long Island Railroad, on the west by a sand pit, and to the north and east by Village property, which is currently being used for storage of sand, brush, and street sweepings.

The site is fenced along the south and west perimeter, and an earthen berm restricts vehicular access along the south and northwestern perimeters (EA Site Inspection). The nearest surface waterbody is Old Ice Pond, located 0.53 mi west of the site. Outflow from this pond flows south into Quantuck Creek and on into Quantuck Bay. The nearest commercial establishment is located 0.1 mi west of the site on Old Depot Road. The nearest residence is located 0.05 mi south of the site, off Scrub Oak Road. The nearest well is located at a private residence 0.33 mi north of the site above Route 104 (Appendix 1.2-1 and EA Site Inspection).

4.3 SITE HYDROGEOLOGY

The site is directly underlain by Pleistocene Age glacial deposits. This deposit is then in turn underlain by Cretaceous Age Magothy Formation, the Clay Member and Lloyd Member of the Raritan Formation and finally by Precambrian Age gneiss and schist bedrock (Appendixes 1.3-1 and 1.3-2). The ground surface elevation at the site ranges from approximately 35 to 40 ft above MSL. The Pleistocene deposits are estimated to be 100 ft in thickness (Appendix 1.3-3) and largely comprised of sand and gravel. Appendix 1.3-4 provides the geologic log of two nearby municipal wells to document the regional presence of sand and gravel to a depth of at least 175 ft below grade: Well S-20688 (78-ft total borehole depth) located approximately 5,000 ft southwest of the site, and Well S-53593 (175-ft total borehole depth) located approximately 7,000 ft northeast of the site.

Aquifers underlying Suffolk County are the sole source of water for public supply, agriculture, and industry (Appendix 1.3-5). The glacial and Magothy aquifers act as a single hydrologic unit (Appendix 1.3-5). Apparently only the glacial aquifer portion has been developed for water supply within 3 mi of the site, however, both the glacial and Magothy aquifers are designated as the aquifer of concern.

Recharge to the upper glacial aquifer is derived entirely from precipitation. The average annual precipitation in the area is 45 in. of which approximately 22 in. is estimated to infiltrate to the water table (Appendix 1.3-6). The remainder of the precipitation is returned to the atmosphere by evaporation and transpiration, except for a small amount of runoff to streams. Recharge to the Magothy aquifer is derived entirely from the downward movement of water from the overlying glacial aquifer.

Site specific permeability data are not available. However, infiltration tests performed in the upper Pleistocene glacial deposits in the vicinity of the Brookhaven National Laboratory (Warren et al. 1968) indicate that water may move from the land surface to the water table at rates of up to 30 ft/day (Appendix 1.3-6). Warren et al. (1968) also reports an average porosity value of 0.33 and vertical permeabilities ranging from 75-350 gpd/ft^2 for the saturated portion of the upper Pleistocene glacial deposits (upper glacial aquifer).

Based upon the March 1985 ground-water table contour map (Suffolk County Department of Health Services), the depth to ground water is estimated to be approximately 43-48 ft below ground surface, and the regional ground-water natural (unaffected by pumping) flow direction appears to be toward the south.

Within 3 mi of the site, the aquifer of concern has been reportedly developed by two Suffolk County Water Authority (SCWA) well fields and numerous private wells.

Appendix 1.3-7 provides a list of the municipal wells located within 3 mi of the site. The developed area within 3 mi of the site is served by the SCWA and numerous private wells. SCWA indicates that their wells are currently in compliance with all applicable drinking water standards, and that there are no water quality problems (Appendix 1.3-8).

4.4 SITE CONTAMINATION

Waste Types and Quantities

Household garbage, scrap wood from building construction, tree and brush debris, paper and cardboard, broken concrete, and unusable dirt fill from construction have been buried at the site. According the the Village of Quogue, no hazardous waste of any significant quantity was ever deposited at the site (Appendix 1.1-1).

Ground Water

No data available.

Surface Water

No data available.

Soil

No data available.

Air

During EA's site inspection on 21 January 1986, total volatiles were measured using a photoionization detector (HNU). No readings above background were recorded. No other air quality data are available (Chapter 3).

OLD QUOGUE LANDFILL
TOWN OF SOUTHAMPTON, SUFFOLK COUNTY

The Old Quogue landfill is an inactive municipal landfill located along Old Country Road, approximately 1 mi north of the populated portion of the Village of Quogue, Suffolk County, New York. The landfill is owned by the Village of Quogue and is situated within the northern edge of the Village limits. It is approximately 2 acres in size. Landfilling began at this site around 1930 and ended in 1973. The site was used by village residents, commercial garbage collectors, builders, and local businesses. Refuse was almost exclusively generated in the incorporated village limits of Quogue, which has no industry.

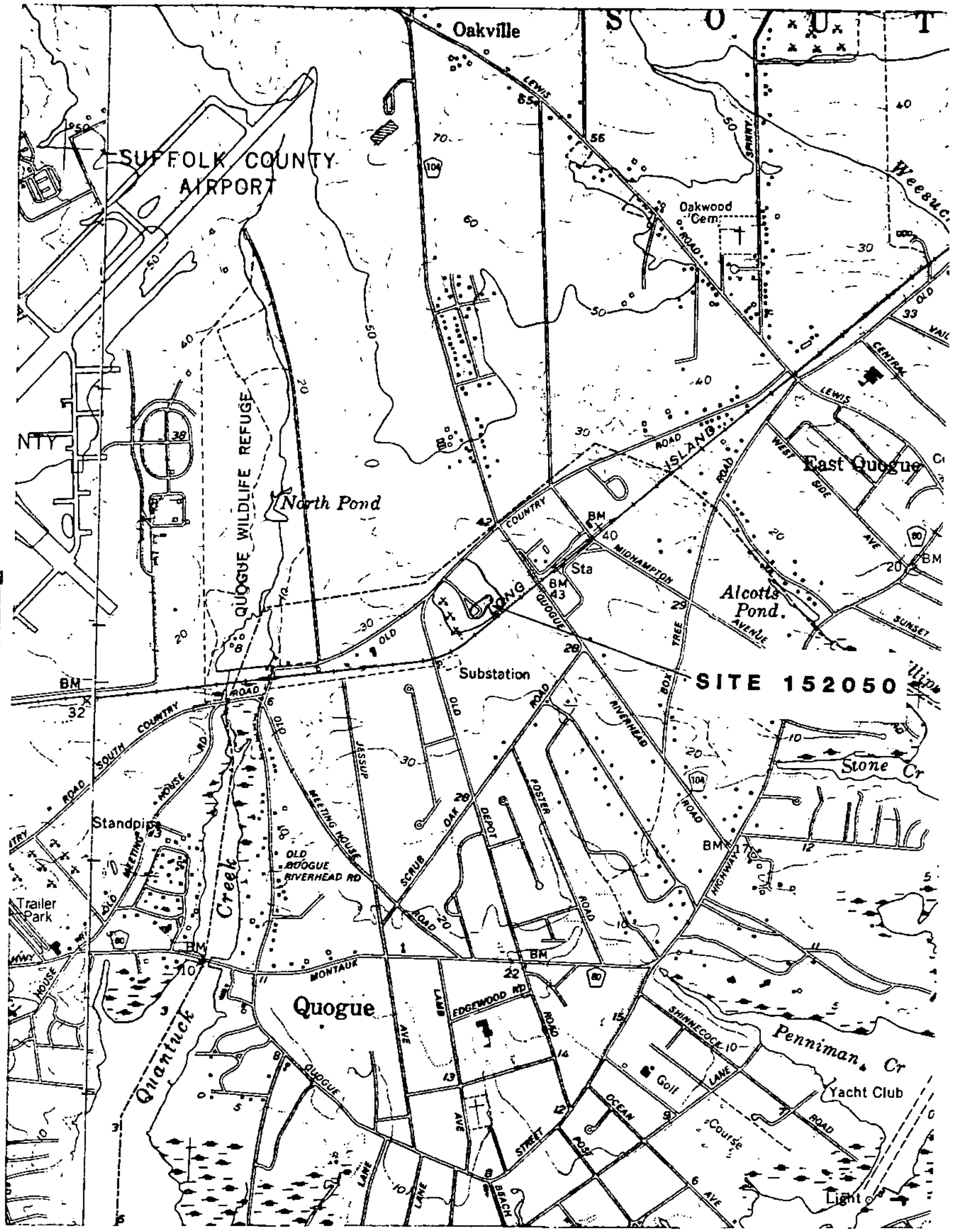
According to the Village of Quogue, no hazardous waste of any significant quantity was ever deposited at this site. No environmental testing or monitoring has been done, nor is any planned. The most recent inspections of the site by NYSDEC Region 1 staff confirm that the site has been closed and is inactive, except for an occasional load of brush or leaves. SCDHS indicates they do not believe that hazardous waste was ever buried at the site, and they did not intend that this site be put on the New York State Registry of Inactive Hazardous Waste Sites.

EA has researched all pertinent agency files, interviewed the site owner's representative, conducted a site inspection, and has found no documented hazardous waste or contamination at this site.

Site Coordinates:

Latitude: 40° 50' 12"
Longitude: 72° 36' 21"

OLD QUOGUE LANDFILL



QUOGUE & EASTPORT QUADS.

Scale 1:24,000

Facility name: Old Quogue Landfill

Location: Village of Quogue, Suffolk County

EPA Region: II

Person(s) in charge of the facility: Village of Quogue
Jessup Avenue
Quogue, New York 11959

Name of Reviewer: EA Science and Technology   Date: 27 February 1986

General description of the facility:
(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility, contamination route of major concern; types of information needed for rating; agency action, etc.)

The site is a 2-acre landfill located along the south shore of Long Island at an elevation of approximately 35 ft. The regional slope is 1-2 percent to the southeast. The site is flat. Landfilling began at this site around 1930 and ended in 1973. Household garbage, scrap wood, tree and brush debris, broken concrete and dirt fill have been buried at the landfill. According to the Village of Quogue, no hazardous waste of any significant quantity was ever deposited there.*

Scores: S_M = (S_{gw} = S_{sw} = S_a =)
S_{FE} =
S_{DC} =

FIGURE 1
HRS COVER SHEET

*NYSDEC occasionally inspects the site. SCDHS does not believe that hazardous waste was ever buried there.

EA has researched all pertinent agency files, interviewed the site owner's representative, conducted a site inspection, and has found no documented or alleged hazardous waste or contamination at this site. Therefore, because the EPA Hazard Ranking System is designed to evaluate migration pathways of identified hazardous substances from a site, and because there are apparently none in this case, it is not appropriate to provide a Hazard Ranking Score (or documentation) for this site.

DOCUMENTATION RECORDS
FOR
HAZARD RANKING SYSTEM

INSTRUCTIONS: The purpose of these records is to provide a convenient way to prepare an auditable record of the data and documentation used to apply the Hazard Ranking System to a given facility. As briefly as possible, summarize the information you used to assign the score for each factor (e.g., "Waste quantity = 4,230 drums plus 800 cubic yards of sludges"). The source of information should be provided for each entry and should be a bibliographic-type reference that will make the document used for a given data point easier to find. Include the location of the document and consider appending a copy of the relevant page(s) for ease in review.

FACILITY NAME: Old Quogue Landfill

LOCATION: Village of Quogue, Suffolk County

DATE SCORED: 12 March 1986

PERSON SCORING: EA Science and Technology

PRIMARY SOURCE(S) OF INFORMATION (e.g., EPA region, state, FIT, etc.)

Village of Quogue
Suffolk County Department of Health Services

FACTORS NOT SCORED DUE TO INSUFFICIENT INFORMATION:

COMMENTS OF QUALIFICATIONS:

EA has researched all pertinent agency files, interviewed the site owner's representative, conducted a site inspection, and has found no documented hazardous waste or contamination at this site. Therefore, it is not appropriate to provide a Hazard Ranking Score (or documentation) for this site.

United States
Environmental Protection
Agency

Office of Emergency and
Remedial Response
Washington, DC 20460

EPA Form 2070-12
July, 1981

Old Quogue Landfill

EPA

Potential Hazardous Waste Site

Preliminary Assessment

EPA

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT
PART 1 - SITE INFORMATION AND ASSESSMENT

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
NY	New

II. SITE NAME AND LOCATION

01 SITE NAME (Legal, common, or descriptive name of site): Old Quogue Landfill	02 STREET, ROUTE NO., OR SPECIFIC LOCATION IDENTIFIER: Old Country Road
03 CITY: Quogue	04 STATE: NY; 05 ZIP CODE: 11959; 06 COUNTY: Suffolk; 07 COUNTY CODE: ; 08 CONG DIST:
09 COORDINATES LATITUDE: 40° 50' 12." LONGITUDE: 72° 36' 21."	

10 DIRECTIONS TO SITE (Starting from nearest public road)

Exit 64 south off Route 27 on Route 104. Right onto Riverhead-Quogue Road. Right onto Old Country Road. Site os on left.

III. RESPONSIBLE PARTIES

01 OWNER (If known): Village of Quogue	02 STREET (Business, mailing, residential): Jessup Avenue
03 CITY: Quogue	04 STATE: NY; 05 ZIP CODE: 11959; 06 TELEPHONE NUMBER: (516) 653-4498
07 OPERATOR (If known and different from owner): Same as owner	08 STREET (Business, mailing, residential):
09 CITY:	10 STATE: ; 11 ZIP CODE: ; 12 TELEPHONE NUMBER: ( )

13 TYPE OF OWNERSHIP (Check one)
☐ A. PRIVATE ☐ B. FEDERAL: ________ (Agency name) ☐ C. STATE ☐ D. COUNTY ☒ E. MUNICIPAL
☐ F. OTHER: ________ (Specify) ☐ G. UNKNOWN

14 OWNER/OPERATOR NOTIFICATION ON FILE (Check all that apply)
☐ A. RCRA 3001 DATE RECEIVED: __/__/__ (MONTH DAY YEAR) ☐ B. UNCONTROLLED WASTE SITE (CERCLA 103 c) DATE RECEIVED: __/__/__ (MONTH DAY YEAR) ☐ C. NONE

IV. CHARACTERIZATION OF POTENTIAL HAZARD

01 ON SITE INSPECTION
☒ YES DATE 1/21/86 (MONTH DAY YEAR)
☐ NO

BY (Check all that apply)
☐ A. EPA ☐ B. EPA CONTRACTOR ☐ C. STATE ☒ D. OTHER CONTRACTOR
☐ E. LOCAL HEALTH OFFICIAL ☐ F. OTHER: ________ (Specify)

CONTRACTOR NAME(S): EA Science and Technology

02 SITE STATUS (Check one)
☐ A. ACTIVE ☒ B. INACTIVE ☐ C. UNKNOWN

03 YEARS OF OPERATION
1930s (BEGINNING YEAR) | 1973 (ENDING YEAR) ☐ UNKNOWN

04 DESCRIPTION OF SUBSTANCES POSSIBLY PRESENT, KNOWN, OR ALLEGED

Municipal refuse from Village residents, commercial haulers, builders, and local businesses.

05 DESCRIPTION OF POTENTIAL HAZARD TO ENVIRONMENT AND/OR POPULATION

Unknown.

V. PRIORITY ASSESSMENT

01 PRIORITY FOR INSPECTION (Check one. If high or medium is checked, complete Part 2 - Waste Information and Part 3 - Description of Hazardous Conditions and Incidents)
☐ A. HIGH (Inspection required promptly) ☐ B. MEDIUM (Inspection required) ☐ C. LOW (Inspect on time available basis) ☐ D. NONE (No further action needed, complete current disposition form)

VI. INFORMATION AVAILABLE FROM

01 CONTACT	02 OF (Agency Organization)			03 TELEPHONE NUMBER
Rebecca Ligotino	EA Science and Technology			(914) 692-6706
04 PERSON RESPONSIBLE FOR ASSESSMENT	**05 AGENCY**	**06 ORGANIZATION**	**07 TELEPHONE NUMBER**	**08 DATE**
Larry Wilson		EA	(914) 692-6706	3/27/86

EPA FORM 2070-12 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT
PART 2 - WASTE INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
NY	New

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 PHYSICAL STATES (Check all that apply)

- [X] A. SOLID
- [ ] B. POWDER, FINES
- [ ] C. SLUDGE
- [ ] D. OTHER ______ (Specify)
- [ ] E. SLURRY
- [ ] F. LIQUID
- [ ] G. GAS

02 WASTE QUANTITY AT SITE (Measures of waste quantities must be independent)

TONS ______

CUBIC YARDS Unknown

NO. OF DRUMS ______

03 WASTE CHARACTERISTICS (Check all that apply)

- [ ] A. TOXIC
- [ ] B. CORROSIVE
- [ ] C. RADIOACTIVE
- [ ] D. PERSISTENT
- [ ] E. SOLUBLE
- [ ] F. INFECTIOUS
- [ ] G. FLAMMABLE
- [ ] H. IGNITABLE
- [ ] I. HIGHLY VOLATILE
- [ ] J. EXPLOSIVE
- [ ] K. REACTIVE
- [ ] L. INCOMPATIBLE
- [X] M. NOT APPLICABLE

III. WASTE TYPE Unknown

CATEGORY	SUBSTANCE NAME	01 GROSS AMOUNT	02 UNIT OF MEASURE	03 COMMENTS
SLU	SLUDGE			
OLW	OILY WASTE			
SOL	SOLVENTS			
PSD	PESTICIDES			
OCC	OTHER ORGANIC CHEMICALS			
IOC	INORGANIC CHEMICALS			
ACD	ACIDS			
BAS	BASES			
MES	HEAVY METALS			

IV. HAZARDOUS SUBSTANCES (See Appendix for most frequently cited CAS Numbers) Not applicable

01 CATEGORY	02 SUBSTANCE NAME	03 CAS NUMBER	04 STORAGE/DISPOSAL METHOD	05 CONCENTRATION	06 MEASURE OF CONCENTRATION

V. FEEDSTOCKS (See Appendix for CAS Numbers) Not applicable

CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER	CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER
FDS			FDS		
FDS			FDS		
FDS			FDS		
FDS			FDS		

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Edwin Shuttleworth, Town Administrator, Village of Quogue personal communication, 21 January 1986.

Suffolk County Department of Health Services files.

United States
Environmental Protection
Agency

Office of Emergency and
Remedial Response
Washington, DC 20460

EPA Form 2070-13
July, 1981

Old Quogue Landfill

EPA

Potential Hazardous Waste Site

Site Inspection Report

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 1 - SITE LOCATION AND INSPECTION INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
NY	NYD98118416

II. SITE NAME AND LOCATION

01 SITE NAME (Legal, common, or descriptive name of site)	02 STREET, ROUTE NO., OR SPECIFIC LOCATION IDENTIFIER
Old Quogue Landfill	Old Country Road

03 CITY	04 STATE	05 ZIP CODE	06 COUNTY	07 COUNTY CODE	08 CONG DIST
Quogue	NY	11959	Suffolk		

09 COORDINATES: LATITUDE 40° 50' 12" LONGITUDE 72° 36' 21"

10 TYPE OF OWNERSHIP (Check one): ☐ A. PRIVATE ☐ B. FEDERAL ☐ C. STATE ☐ D. COUNTY ☒ E. MUNICIPAL ☐ F. OTHER ☐ G. UNKNOWN

III. INSPECTION INFORMATION

01 DATE OF INSPECTION (MONTH DAY YEAR)	02 SITE STATUS	03 YEARS OF OPERATION
01/21/86	☐ ACTIVE ☒ INACTIVE	1930 (BEGINNING YEAR) / 1973 (ENDING YEAR) ___ UNKNOWN

04 AGENCY PERFORMING INSPECTION (Check all that apply)

☐ A. EPA ☐ B. EPA CONTRACTOR ________ (Name of firm) ☐ C. MUNICIPAL ☐ D. MUNICIPAL CONTRACTOR ________ (Name of firm)

☐ E. STATE ☒ F. STATE CONTRACTOR EA Science and Tech (Name of firm) ☐ G. OTHER ________ (Specify)

05 CHIEF INSPECTOR	06 TITLE	07 ORGANIZATION	08 TELEPHONE NO.
A. Lapins	Geologist	EA	(914) 692-6706

09 OTHER INSPECTORS	10 TITLE	11 ORGANIZATION	12 TELEPHONE NO.
L. Wilson	Environmental Scientist	EA	(914) 692-6706
			( )
			( )
			( )
			( )

13 SITE REPRESENTATIVES INTERVIEWED	14 TITLE	15 ADDRESS	16 TELEPHONE NO
Edwin Shuttleworth	Village Adm.	Jessup Avenue, Quogue	(516) 653-4498
			( )
			( )
			( )
			( )
			( )

17 ACCESS GAINED BY (Check one)	18 TIME OF INSPECTION	19 WEATHER CONDITIONS
☒ PERMISSION ☐ WARRANT	1600-1700	Clear, breezy, 9 C, no snow cover

IV. INFORMATION AVAILABLE FROM

01 CONTACT	02 OF (Agency/Organization)	03 TELEPHONE NO.
R. Ligotino	EA Science and Technology	(914) 692-6706

04 PERSON RESPONSIBLE FOR SITE INSPECTION FORM	05 AGENCY	06 ORGANIZATION	07 TELEPHONE NO.	08 DATE (MONTH DAY YEAR)
L. Wilson		EA	(914) 692-6706	03/12/86

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 2 - WASTE INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
NY	NYD98118416

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 PHYSICAL STATES (Check all that apply)

- ☒ A. SOLID
- ☐ B. POWDER, FINES
- ☐ C. SLUDGE
- ☐ D. OTHER ______ (Specify)
- ☐ E. SLURRY
- ☐ F. LIQUID
- ☐ G. GAS

02 WASTE QUANTITY AT SITE (Measures of waste quantities must be independent)

- TONS ______
- CUBIC YARDS est. 5,500
- NO. OF DRUMS ______

03 WASTE CHARACTERISTICS (Check all that apply)

- ☐ A. TOXIC
- ☐ B. CORROSIVE
- ☐ C. RADIOACTIVE
- ☐ D. PERSISTENT
- ☐ E. SOLUBLE
- ☐ F. INFECTIOUS
- ☐ G. FLAMMABLE
- ☐ H. IGNITABLE
- ☐ I. HIGHLY VOLATILE
- ☐ J. EXPLOSIVE
- ☐ K. REACTIVE
- ☐ L. INCOMPATIBLE
- ☒ M. NOT APPLICABLE

III. WASTE TYPE mixed municipal solid waste

CATEGORY	SUBSTANCE NAME	01 GROSS AMOUNT	02 UNIT OF MEASURE	03 COMMENTS
SLU	SLUDGE			
OLW	OILY WASTE			
SOL	SOLVENTS			
PSD	PESTICIDES			
OCC	OTHER ORGANIC CHEMICALS			
IOC	INORGANIC CHEMICALS			
ACD	ACIDS			
BAS	BASES			
MES	HEAVY METALS			

IV. HAZARDOUS SUBSTANCES (See Appendix for most frequently cited CAS Numbers) unknown

01 CATEGORY	02 SUBSTANCE NAME	03 CAS NUMBER	04 STORAGE/DISPOSAL METHOD	05 CONCENTRATION	06 MEASURE OF CONCENTRATION

V. FEEDSTOCKS (See Appendix for CAS Numbers) N/A

CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER	CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER
FDS			FDS		
FDS			FDS		
FDS			FDS		
FDS			FDS		

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Interview, Edwin Shuttleworth, Administrator, Village of Quogue
Appendix 1.1-2

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION
01 STATE: NY
02 SITE NUMBER: NYD98118416

II. HAZARDOUS CONDITIONS AND INCIDENTS none known

01 ☐ A. GROUNDWATER CONTAMINATION — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______ — 04 NARRATIVE DESCRIPTION

01 ☐ B. SURFACE WATER CONTAMINATION — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______ — 04 NARRATIVE DESCRIPTION

01 ☐ C. CONTAMINATION OF AIR — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______ — 04 NARRATIVE DESCRIPTION

01 ☐ D. FIRE/EXPLOSIVE CONDITIONS — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______ — 04 NARRATIVE DESCRIPTION

01 ☐ E. DIRECT CONTACT — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______ — 04 NARRATIVE DESCRIPTION

01 ☐ F. CONTAMINATION OF SOIL — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
03 AREA POTENTIALLY AFFECTED: ______ (Acres) — 04 NARRATIVE DESCRIPTION

01 ☐ G. DRINKING WATER CONTAMINATION — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______ — 04 NARRATIVE DESCRIPTION

01 ☐ H. WORKER EXPOSURE/INJURY — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
03 WORKERS POTENTIALLY AFFECTED: ______ — 04 NARRATIVE DESCRIPTION

01 ☐ I. POPULATION EXPOSURE/INJURY — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______ — 04 NARRATIVE DESCRIPTION

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	NYD98118416

II. HAZARDOUS CONDITIONS AND INCIDENTS (Continued) None known

01 ☐ J. DAMAGE TO FLORA — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ K. DAMAGE TO FAUNA — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION (Include name(s) of species)

01 ☐ L. CONTAMINATION OF FOOD CHAIN — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ M. UNSTABLE CONTAINMENT OF WASTES (Spills/Runoff/Standing liquids, Leaking drums) — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ______ 04 NARRATIVE DESCRIPTION

01 ☐ N. DAMAGE TO OFFSITE PROPERTY — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ O. CONTAMINATION OF SEWERS, STORM DRAINS, WWTPs — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ P. ILLEGAL/UNAUTHORIZED DUMPING — 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

05 DESCRIPTION OF ANY OTHER KNOWN, POTENTIAL, OR ALLEGED HAZARDS

III. TOTAL POPULATION POTENTIALLY AFFECTED: ______

IV. COMMENTS

No documented hazardous waste at this site.

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

EA Site Inspection, 21 January 1986.
Appendixes 1.1-1 and 1.1-2.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION
PART 4 - PERMIT AND DESCRIPTIVE INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	NYD98118416

II. PERMIT INFORMATION

01 TYPE OF PERMIT ISSUED (Check all that apply)	02 PERMIT NUMBER	03 DATE ISSUED	04 EXPIRATION DATE	05 COMMENTS
☐ A. NPDES				
☐ B. UIC				
☐ C. AIR				
☐ D. RCRA				
☐ E. RCRA INTERIM STATUS				
☐ F. SPCC PLAN				
☐ G. STATE (Specify)				
☐ H. LOCAL (Specify)				
☐ I. OTHER (Specify)				
☒ J. NONE				

III. SITE DESCRIPTION

01 STORAGE/DISPOSAL (Check all that apply)	02 AMOUNT	03 UNIT OF MEASURE
☐ A. SURFACE IMPOUNDMENT		
☐ B. PILES		
☐ C. DRUMS, ABOVE GROUND		
☐ D. TANK, ABOVE GROUND		
☐ E. TANK, BELOW GROUND		
☒ F. LANDFILL estimated	5,500	CY
☐ G. LANDFARM		
☐ H. OPEN DUMP		
☐ I. OTHER ____ (Specify)		

04 TREATMENT (Check all that apply)

- ☐ A. INCENERATION
- ☐ B. UNDERGROUND INJECTION
- ☐ C. CHEMICAL/PHYSICAL
- ☐ D. BIOLOGICAL
- ☐ E. WASTE OIL PROCESSING
- ☐ F. SOLVENT RECOVERY
- ☐ G. OTHER RECYCLING/RECOVERY
- ☐ H. OTHER ____ (Specify)

05 OTHER

- ☐ A. BUILDINGS ON SITE

06 AREA OF SITE

2.0 (Acres)

07 COMMENTS

Household garbage, scrap wood, tree and brush debris, paper, and cardboard, and dirt fill have been buried at the landfill. There are no documented hazardous wastes buried at the site.

IV. CONTAINMENT No documented hazardous waste.

01 CONTAINMENT OF WASTES (Check one)

☐ A. ADEQUATE, SECURE ☐ B. MODERATE ☐ C. INADEQUATE, POOR ☐ D. INSECURE, UNSOUND, DANGEROUS

02 DESCRIPTION OF DRUMS, DIKING, LINERS, BARRIERS, ETC.

The site does not have a liner.

V. ACCESSIBILITY

01 WASTE EASILY ACCESSIBLE: ☐ YES ☒ NO

02 COMMENTS

The site is fenced; all wastes are buried.

VI. SOURCES OF INFORMATION (Cite specific references, e.g. state files, sample analysis, reports)

Appendixes 1.1-1, 1.1-2, and 1.1-10.
EA Site Inspection.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 5 - WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
NY	NYD98118416

II. DRINKING WATER SUPPLY

01 TYPE OF DRINKING SUPPLY (Check as applicable)

	SURFACE	WELL
COMMUNITY	A. ☐	B. ☒
NON-COMMUNITY	C. ☐	D. ☒

02 STATUS

ENDANGERED	AFFECTED	MONITORED
A. ☐	B. ☐	C. ☒
D. ☐	E. ☐	F. ☐ unknown

03 DISTANCE TO SITE

A. 1.0 (mi)
B. 0.3 (mi)

III. GROUNDWATER

01 GROUNDWATER USE IN VICINITY (Check one)

☒ A. ONLY SOURCE FOR DRINKING
☐ B. DRINKING (Other sources available) COMMERCIAL, INDUSTRIAL, IRRIGATION (No other water sources available)
☐ C. COMMERCIAL, INDUSTRIAL, IRRIGATION (Limited other sources available)
☐ D. NOT USED, UNUSEABLE

02 POPULATION SERVED BY GROUND WATER 19,099

03 DISTANCE TO NEAREST DRINKING WATER WELL 0.33 (mi)

04 DEPTH TO GROUNDWATER 43-48 (ft)

05 DIRECTION OF GROUNDWATER FLOW S

06 DEPTH TO AQUIFER OF CONCERN 43-48 (ft)

07 POTENTIAL YIELD OF AQUIFER 4.5×10^6 (gpd)

08 SOLE SOURCE AQUIFER ☒ YES ☐ NO

09 DESCRIPTION OF WELLS (including usage, depth, and location relative to population and buildings)

SCWA has 2 well fields within 3 mi of the site. The Spring Road and the Meeting House Road well fields consist of 13 wells which all penetrate the upper Glacial aquifer. Their depths range from 46-161 ft. They serve the Westhampton Water District. There are several private residences north of the site with private *

10 RECHARGE AREA
☒ YES
☐ NO
COMMENTS

11 DISCHARGE AREA
☐ YES
☒ NO
COMMENTS

IV. SURFACE WATER

01 SURFACE WATER USE (Check one)

☒ A. RESERVOIR, RECREATION DRINKING WATER SOURCE
☐ B. IRRIGATION, ECONOMICALLY IMPORTANT RESOURCES
☐ C. COMMERCIAL, INDUSTRIAL
☐ D. NOT CURRENTLY USED

02 AFFECTED/POTENTIALLY AFFECTED BODIES OF WATER

NAME	AFFECTED	DISTANCE TO SITE
Old Ice Pond	☐	0.53 (mi)
Quantuck Creek	☐	0.66 (mi)
	☐	(mi)

V. DEMOGRAPHIC AND PROPERTY INFORMATION

01 TOTAL POPULATION WITHIN

ONE (1) MILE OF SITE A. 981 NO. OF PERSONS
TWO (2) MILES OF SITE B. 4,365 NO. OF PERSONS
THREE (3) MILES OF SITE C. 7,673 NO. OF PERSONS

02 DISTANCE TO NEAREST POPULATION 0.05 (mi)

03 NUMBER OF BUILDINGS WITHIN TWO (2) MILES OF SITE

04 DISTANCE TO NEAREST OFF-SITE BUILDING 0.05 (mi)

05 POPULATION WITHIN VICINITY OF SITE (Provide narrative description of nature of population within vicinity of site, e.g., rural, village, densely populated urban area)

Site is located in the Village of Quogue, a small residential area on the south shore of Long Island.

EPA FORM 2070-13 (7-81)

*wells, and a mobile home park east of the site with a private well.

EPA

POTENTIAL HAZARDOUS WASTE SITE SITE INSPECTION REPORT
PART 5 - WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATION
01 STATE: NY | 02 SITE NUMBER: NYD98118416

VI. ENVIRONMENTAL INFORMATION

01 PERMEABILITY OF UNSATURATED ZONE (Check one)

☐ A. $10^{-6} - 10^{-8}$ cm/sec ☐ B. $10^{-4} - 10^{-6}$ cm/sec ☐ C. $10^{-4} - 10^{-3}$ cm/sec ☒ D. GREATER THAN 10^{-3} cm/sec

02 PERMEABILITY OF BEDROCK (Check one)

unknown

☐ A. IMPERMEABLE (Less than 10^{-6} cm/sec) ☐ B. RELATIVELY IMPERMEABLE ($10^{-4} - 10^{-6}$ cm/sec) ☐ C. RELATIVELY PERMEABLE ($10^{-2} - 10^{-4}$ cm/sec) ☐ D. VERY PERMEABLE (Greater than 10^{-2} cm/sec)

03 DEPTH TO BEDROCK: 1,600 (ft)

04 DEPTH OF CONTAMINATED SOIL ZONE: unknown (ft)

05 SOIL pH: 4.8

06 NET PRECIPITATION: 22 (in)

07 ONE YEAR 24 HOUR RAINFALL: 2.8 (in)

08 SLOPE: SITE SLOPE <1 % | DIRECTION OF SITE SLOPE: E | TERRAIN AVERAGE SLOPE: 1-2 %

09 FLOOD POTENTIAL: SITE IS IN N/A YEAR FLOODPLAIN

10 ☐ SITE IS ON BARRIER ISLAND, COASTAL HIGH HAZARD AREA, RIVERINE FLOODWAY

11 DISTANCE TO WETLANDS (5 acre minimum)

ESTUARINE A. 0.66 (mi) OTHER B. ____ (mi)

12 DISTANCE TO CRITICAL HABITAT (of endangered species)

____ (mi)

ENDANGERED SPECIES: None within 1 mi

13 LAND USE IN VICINITY

DISTANCE TO:

COMMERCIAL/INDUSTRIAL	RESIDENTIAL AREAS; NATIONAL/STATE PARKS, FORESTS, OR WILDLIFE RESERVES	AGRICULTURAL LANDS: PRIME AG LAND	AGRICULTURAL LANDS: AG LAND
A. 0.1 (mi)	B. 0.05 (mi)	C. 0.88 (mi)	D. 0.88 (mi)

14 DESCRIPTION OF SITE IN RELATION TO SURROUNDING TOPOGRAPHY

Landfill is located along the south shore of Long Island at an elevation of 35 ft. Regional slope is 1-2 percent to the southeast. The site is relatively flat. An earthen berm restricts vehicular access along the south and east perimeters.

VII. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

EA Site Inspection, 21 January 1986.
Calvin, G. 1986. NYSDEC Division of Marine Resources. Personal Communication, 2 Sept.
Ozard, J. 1986. NYSDEC, Significant Habitat Unit. Personal Communication, 6 March.
LIRPB. 1985. Population Survey. Current Population Estimates for Nassau and Suffolk Counties, Hauppage, New York.
USGS. 1967. Map of Flood-Prone Areas. Quogue Quad. 7.5-Minute Series.
USGS. 1956. Quogue Quad. 7.5-Minute Series.

NYSDOH 1982. NYS Atlas of Community Water System Services.
LIRPB. 1982. Quantification and Analysis of Land Use for Nassau and Suffolk Counties. Appendixes 1.3-1 through 1.3-8.

POTENTIAL HAZARDOUS WASTE SITE SITE INSPECTION REPORT PART 6 - SAMPLE AND FIELD INFORMATION

EPA

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
NY	NYD98118416

II. SAMPLES TAKEN none

SAMPLE TYPE	01 NUMBER OF SAMPLES TAKEN	02 SAMPLES SENT TO	03 ESTIMATED DATE RESULTS AVAILABLE
GROUNDWATER			
SURFACE WATER			
WASTE			
AIR			
RUNOFF			
SPILL			
SOIL			
VEGETATION			
OTHER			

III. FIELD MEASUREMENTS TAKEN

01 TYPE	02 COMMENTS
Volatile organics	Measured using a photoionization detector (HNU). No readings above background.
Slopes	Suunto clinometer.
Bearings	Compass.

IV. PHOTOGRAPHS AND MAPS

01 TYPE ☒ GROUND ☒ AERIAL

02 IN CUSTODY OF EA Science and Technology
(Name of organization or individual)

03 MAPS ☒ YES ☐ NO

04 LOCATION OF MAPS
EA Science and Technology

V. OTHER FIELD DATA COLLECTED *(Provide narrative description)*

VI. SOURCES OF INFORMATION *(Cite specific references, e.g., state files, sample analysis, reports)*

EA Site Inspection, 21 January 1986,

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 7 - OWNER INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	NYD98118416

II. CURRENT OWNER(S)

01 NAME	02 D+B NUMBER	08 NAME	09 D+B NUMBER
Village of Quogue			

03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	10 STREET ADDRESS (P.O. Box, RFD #, etc.)	11 SIC CODE
Jessup Avenue			

05 CITY	06 STATE	07 ZIP CODE	12 CITY	13 STATE	14 ZIP CODE
Quogue	NY	11959			

PARENT COMPANY (If applicable)

01 NAME	02 D+B NUMBER	08 NAME	09 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	10 STREET ADDRESS (P.O. Box, RFD #, etc.)	11 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	12 CITY	13 STATE / 14 ZIP CODE
01 NAME	02 D+B NUMBER	08 NAME	09 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	10 STREET ADDRESS (P.O. Box, RFD #, etc.)	11 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	12 CITY	13 STATE / 14 ZIP CODE
01 NAME	02 D+B NUMBER	08 NAME	09 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	10 STREET ADDRESS (P.O. Box, RFD #, etc.)	11 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	12 CITY	13 STATE / 14 ZIP CODE

III. PREVIOUS OWNER(S) (List most recent first) / IV. REALTY OWNER(S) (If applicable; list most recent first)

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE
01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE
01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Appendix 1.1-1.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 8 - OPERATOR INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	NYD98118416

II. CURRENT OPERATOR *(Provide if different from owner)*

01 NAME	02 D+B NUMBER
03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE
08 YEARS OF OPERATION	09 NAME OF OWNER

OPERATOR'S PARENT COMPANY *(If applicable)*

10 NAME	11 D+B NUMBER
12 STREET ADDRESS *(P.O. Box, RFD #, etc.)*	13 SIC CODE
14 CITY	15 STATE / 16 ZIP CODE

III. PREVIOUS OPERATOR(S) *(List most recent first; provide only if different from owner)*

01 NAME	02 D+B NUMBER
03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE
08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD
01 NAME	02 D+B NUMBER
03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE
08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD
01 NAME	02 D+B NUMBER
03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE
08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD

PREVIOUS OPERATORS' PARENT COMPANIES *(If applicable)*

10 NAME	11 D+B NUMBER
12 STREET ADDRESS *(P.O. Box, RFD #, etc.)*	13 SIC CODE
14 CITY	15 STATE / 16 ZIP CODE
10 NAME	11 D+B NUMBER
12 STREET ADDRESS *(P.O. Box, RFD #, etc.)*	13 SIC CODE
14 CITY	15 STATE / 16 ZIP CODE
10 NAME	11 D+B NUMBER
12 STREET ADDRESS *(P.O. Box, RFD #, etc.)*	13 SIC CODE
14 CITY	15 STATE / 16 ZIP CODE

IV. SOURCES OF INFORMATION *(Cite specific references, e.g., state files, sample analysis, reports)*

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 9 - GENERATOR/TRANSPORTER INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	NYD98118416

II. ON-SITE GENERATOR

01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE

III. OFF-SITE GENERATOR(S)

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE
01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE

IV. TRANSPORTER(S)

01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
Andrew Nash		K&M Refuse	
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
Rte. 2, Box 120, Osborne Ave.			
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE
Riverhead	NY	East Quogue	NY
01 NAME	02 D+B NUMBER	01 NAME	02 D+B NUMBER
George's Sanitation			
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE	03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
#3 Oak Court			
05 CITY	06 STATE / 07 ZIP CODE	05 CITY	06 STATE / 07 ZIP CODE
Hampton Bays	NY		

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Appendixes 1.1-1 and 1.1-3.

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 10 - PAST RESPONSE ACTIVITIES

EPA

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	NYD98118416

II. PAST RESPONSE ACTIVITIES none

01 ☐ A. WATER SUPPLY CLOSED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ B. TEMPORARY WATER SUPPLY PROVIDED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ C. PERMANENT WATER SUPPLY PROVIDED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ D. SPILLED MATERIAL REMOVED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ E. CONTAMINATED SOIL REMOVED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ F. WASTE REPACKAGED — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ G. WASTE DISPOSED ELSEWHERE — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ H. ON SITE BURIAL — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ I. IN SITU CHEMICAL TREATMENT — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ J. IN SITU BIOLOGICAL TREATMENT — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ K. IN SITU PHYSICAL TREATMENT — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ L. ENCAPSULATION — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ M. EMERGENCY WASTE TREATMENT — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ N. CUTOFF WALLS — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ O. EMERGENCY DIKING/SURFACE WATER DIVERSION — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ P. CUTOFF TRENCHES/SUMP — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ Q. SUBSURFACE CUTOFF WALL — 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

EPA	POTENTIAL HAZARDOUS WASTE SITE SITE INSPECTION REPORT PART 10 - PAST RESPONSE ACTIVITIES	I. IDENTIFICATION 01 STATE: NY 02 SITE NUMBER: NYD98118416

II PAST RESPONSE ACTIVITIES (Continued) None

01 ☐ R. BARRIER WALLS CONSTRUCTED 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ S. CAPPING/COVERING 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ T. BULK TANKAGE REPAIRED 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ U. GROUT CURTAIN CONSTRUCTED 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ V. BOTTOM SEALED 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ W. GAS CONTROL 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ X. FIRE CONTROL 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ Y. LEACHATE TREATMENT 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ Z. AREA EVACUATED 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ 1. ACCESS TO SITE RESTRICTED 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ 2. POPULATION RELOCATED 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

01 ☐ 3. OTHER REMEDIAL ACTIVITIES 02 DATE ______ 03 AGENCY ______
04 DESCRIPTION

III. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Appendixes 1.1-1 and 1.1-2.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 11 - ENFORCEMENT INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
NY	NYD981118416

II. ENFORCEMENT INFORMATION

01 PAST REGULATORY/ENFORCEMENT ACTION ☐ YES ☒ NO

02 DESCRIPTION OF FEDERAL, STATE, LOCAL REGULATORY/ENFORCEMENT ACTION

III. SOURCES OF INFORMATION *(Cite specific references, e.g., state files, sample analysis, reports)*

Appendixes 1.1-1 and 1.1-2.

6. ASSESSMENT OF DATA ADEQUACY AND RECOMMENDATIONS

6.1 ADEQUACY OF EXISTING DATA

The available data are considered insufficient to prepare a final HRS score for this site. There is no documentation of hazardous waste disposal and no records available related to specific waste types or quantities. Also, ground-water quality data are lacking.

6.2 RECOMMENDATIONS

In order to prepare a final HRS score for this site, analytical data regarding the quality of the ground water will be necessary, thus requiring performance of a Phase II investigation. The proposed Phase II study would include the installation of three test borings/observation wells, and the collection and analysis of ground-water.

6.3 PHASE II WORK PLAN

6.3.1 Task 1 - Mobilization and Site Reconnaissance

Project mobilization includes review of the Phase I report and updating the site database with any new information made available since completion of the Phase I report. Based on that review, a draft scope of work for this site will be agreed to and a project schedule developed. At this time, a draft Quality Assurance/Quality Control (QA/QC) document will be prepared in accordance with the most up-to-date NYSDEC guidelines.

Site reconnaissance will be performed to examine general site access for Phase II studies. Site reconnaissance will familiarize key project personnel with the site, enable the project Health and Safety Officer to develop specific health and safety requirements for the field activities. Emergency, fire, and hospital services will be identified. Standard practice during site reconnaissance is an air survey with a photoionization detector (HNU or similar instrument). The air survey would be performed around the site perimeter and throughout the site for safety purposes. Detection of releases to air during site reconnaissance may warrant further confirmation studies. Based on the Phase I study, it is expected that field activities will require only Level D health and safety protective measures.

6.3.2 Task 2 - Geophysics

Multidepth EM and earth resistivity surveying will be performed around the site area perimeter to evaluate the potential presence of ground-water contaminant plumes and stratigraphic conditions. The number of stations and value of depth settings will be determined on the basis of field conditions. Results of the geophysics will be used to refine the specifications for locations, depths, and number of observation wells to be installed.

6.3.3 Task 3 - Preparation of Final Sampling Plan

All data collected during Tasks 1 and 2 will be evaluated to finalize sampling and boring/well locations. The final sampling plan will be developed and submitted to NYSDEC for approval. The plan will include final sampling locations, boring and well specifications, and reference pertinent portions of the QA/QC Plan. A final budget will be developed to complete the drilling and sampling program.

6.3.4 Task 4 - Test Borings and Observations Wells

Because there are several hundreds of feet of unconsolidated sediment overlying bedrock, EA recommends that the subsurface investigation be confined, at this time, to the shallow glacial aquifer to confirm if ground-water contamination is present. If ground-water contamination is detected, then the investigations could be expanded to include the installation and sampling of monitoring wells completed to greater depths. Based upon currently available information, EA recommends the installation of three test borings/observations wells. This work would be performed under the fulltime supervision of a geologist. It is anticipated that the hollow-stem auger drilling method will be used. Prior to the drilling of each boring/well, and at the completion of the last boring/well, the drilling equipment which comes in contact with subsurface materials will be steam-cleaned, as well as the split-spoon sampler after obtaining each sample. Soil sampling will be performed using a split-spoon sampler at approximately 5-ft intervals and at detected major stratigraphic changes. An HNU, or similar instrument, would be used to monitor the potential organic vapors emitted during drilling operations and from each soil sample. Samples of major soil/unconsolidated sediments will be collected for grain-size and/or Atterburg Limits analysis.

It is anticipated that the wells to be installed at this site will be completed in the unconsolidated sediment, approximately 10-20 ft below the ground-water table. Standard construction of such a well would include 10-20 ft of 2-in. diameter threaded-joint PVC screen and an appropriate length of PVC riser with a bottom plug cap, sand pack, bentonite seal, and protective surficial steel casing with a locking cap.

Upon completion and development of the wells by air surging/pumping, the vertical elevation of the upper rim of each well casing and the horizontal location will be surveyed in order to aid in evaluation of the ground-water flow direction. Depending upon the yield of each Phase II well, a short-term, low-yield pumping test will be performed in each well.

For cost estimating purposes, it is assumed that:

a. The depth of one of the three monitoring wells (upgradient) will be 60 ft below ground surface. The depth of each of the remaining two monitoring wells (downgradient) will be 55 ft below grade.

b. The three wells will require 9 days to install, develop, and test.

c. All drill sites are accessible by truck-mounted drilling rigs as determined by the driller.

d. There are no excessive amounts of cobbles/boulders which would increase drilling time.

e. Steam-cleaning of drilling/sampling equipment will be performed at each boring/well location. The fluids will be discharged to ground surface.

f. All drill cuttings, fluids, and development water will be left on, or discharged to, the ground surface in the immediate area of the activity.

g. That permission from appropriate land owners to drill borings/wells on their property will be a simple process (expedited by the NYSDEC, if necessary) so that delays during field operations are not incurred.

6.3.5 Task 5 - Sampling

All sampling and analysis will be conducted in accordance with the project QA/QC Plan. The analytical program for every water sample will include the 130 organic and 25 inorganic parameters listed in Statement of Work No. 784, New York State Department of Environmental Conservation Superfund and Contract Laboratory Protocol, January 1985. Also, all additional non-priority pollutant GC/MS major peaks will be identified and quantified. Major peaks will be considered as those whose area is 10 percent or greater than the calibrating standard(s). Based upon the currently available information, collection and analysis of the following numbers and types of samples is recommended:

3 Ground-water samples (one from each Phase II well).

6.3.6 Task 6 - Contamination Assessment

EA will evaluate the data obtained during the records search and field investigation: prepare final HRS scores and documentation forms; complete EPA Form 2070-13; summarize site history, site characteristics, available sampling and analysis data; and determine the adequacy of the existing data to confirm release, and if there is a population at risk.

6.3.7 Task 7 - Remedial Cost Estimate

EA will evaluate remedial alternatives for the site and develop a list of potential options given the information available on the nature and extent of contamination. Approximate cost estimates for the selected potential remedial options will be computed. This work is not intended to be, or a substitute for, a formal cost effectiveness analysis of potential remedial actions.

6.3.8 Task 8 - Final Phase II Report

In accordance with current (January 1985) NYSDEC guidelines, the Phase II report will include:

a. The results of the Phase II investigation, complete with boring logs, photos, and sketches developed as part of the Phase II field work.
b. Final HRS scores with detailed documentation.
c. Selected potential remedial alternatives and associated cost estimates.

In addition to the final Phase II report, the following raw data and resulting reduction would be provided to NYSDEC:

a. geophysical

b. well logs

c. all sampling forms and data

d. all analytical data

e. chain-of-custody forms

f. other pertinent collected information.

6.3.9 Task 9 - Project Management/Quality Assurance

A Project Manager will be responsible for the supervision, direction, and review of the project activities on a day-to-day basis. A Quality Assurance Officer will ensure that the QA/QC Program protocols are maintained and that the resultant analytical data are accurate.

6.4 PHASE II COST ESTIMATE

Based on the scope of work and assumptions described above, the estimated costs to complete the Phase II investigation of the Old Quogue Landfill site are as follows:

Consultant Costs (including labor, direct costs, fee)	$38,300
Drilling Contractor	22,700
Laboratory	6,000
Total	$67,000

Office of the
Village of Quogue, N.Y.
Quogue, New York 11959

(516) 653-4498

T. DECKER ORR
Mayor

MARJORIE E. BECKWITH
Village Clerk

Appendix 1.1-1
p1 of 2

OLD QUOGUE LANDFILL

I. D. 152050

A. Generators of wastes deposited at the site:

This site was used by village residents, commercial garbage collectors, builders and local businesses. Refuse was almost exclusively generated in the incorporated village limits of Quogue.

B. Types and quantities of wastes:

Household garbage, scrap wood from building construction, tree and brush debris, paper and cardborad, broken concrete and unusable dirt fill from construction.

C. Period of time site was operated:

From 1930 to 1973 (approximate).

D. Description of site operating practices:

Refuse was burned for many years until this practice was forbidden. After that refuse was deposited in a landfill operation and periodically capped over with dirt. The site is now closed with a locked gate.

E. Environmental problems and monitoring:
&
F. To the best of our knowledge no hazardous waste of any significant quantity was ever deposited at this site. No testing or monitoring has been done or is planned.

EA SCIENCE AND TECHNOLOGY
A Division of EA Engineering, Science, and Technology, Inc.

(A1-1-1) p.2 of 2

COMMUNICATIONS RECORD FORM

#152050

Distribution: ( ) Old Quogue Landfill, ( ) ______
( ) ______, ( ) ______
( ) Author

Person Contacted: Mr. Orr Date: 11-25-86

Phone Number: 516 653 4498 Title: Mayor

Affiliation: Village of Quogue Type of Contact: phone

Address: Jessup Ave
Quogue NY 11959
Person Making Contact: L. Wilson

Communications Summary: Mr. Orr spoke with Carl Carydon who stated that the total area filled on the 16 acre lot owned by the town was no more than 2 acres. The fill was covered with 1-2 feet of local soil.

(see over for additional space)

Signature: Lawrence Wilson

Appendix 1.1-2

RECEIVED FEB 19 1986

INTERVIEW ACKNOWLEDGEMENT FORM

Site Name: Old Quoque Landfill

I.D. Number: 152050

Person Contacted: Ted Shuttleworth

Date: 21 January 1986

Title: Village Administrator

Affiliation: Village of Quoque

Phone No.: (516) 653-4498

Address: Jessup Avenue
Quoque, New York 11959

Persons Making Contact:
EA Representatives:

Type of Contact:

Interview Summary:

To the best of my knowledge, no toxic material has ever been dumped at the Old Quoque Landfill, only household refuse and wood debris. According to Carl Cardo, no cesspool waste was ever dumped there. No records exist of quantities of refuse. The population of the Village was quite small during the period the dump was in operation from the 1930s to 1973. Trash was brought to the site by four haulers: Andrew Nash, George's Sanitation, K&M Refuse, and John Seduski. All waste at the dump was limited to refuse from the Village which has no industry. At present, the site is used to deposit street sweepings and brush, though no permit for this has been granted by the Department of Environmental Conservation (DEC). Concrete rubble is also kept here. The last official inspection of the site was by Robert Fry of the DEC. The nearest private well is approximately 3/4 mile away. All residences near the site are on city water.

Acknowledgement:

I have read the above transcript and I agree that it is an accurate summary of the information verbally conveyed to EA Science and Technology interviewers, or as I have revised below, is an accurate account.

Revisions (please write in corrections to above transcript):

____

____

____

____

____

Signature: Edwin [signature] ______________ **Date**: 2/18/86

Appendix 1.1-3
p1 of 4

EA SCIENCE AND TECHNOLOGY
A Division of EA Engineering, Science, and Technology, Inc.

COMMUNICATIONS RECORD FORM

Distribution: ( ) ____________, ( ) ____________
( ) ____________, ( ) ____________
( ) Author

Person Contacted: George Mathies Date: 11-4-86

Phone Number: (516) 653-6666 Title: owner

Affiliation: Georges' Sanitation Type of Contact: Phone

Address: 3 Oak Ct Person Making Contact: L. Wilson
Hampton Bays N.Y.

Communications Summary: Hauled only house-hold trash from the incorporated town of Quogue from 1958 until the site closed in 1973. The trash was burned and then buried early in the fill operation and later just buried.

(see over for additional space)

Signature: Larry Wilson

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EA SCIENCE AND TECHNOLOGY
A Division of EA Engineering, Science, and Technology, Inc.

COMMUNICATIONS RECORD FORM

Distribution: ( ) ______________, ( ) ______________
( ) ______________, ( ) ______________
( ) Author

Person Contacted: John Annis Date: 11-4-86

Phone Number: no. disconnected Title: Hauler

Affiliation: ______________ Type of Contact: Phone

Address: 3 Young St Riverhead Person Making Contact: L. Wilso

Communications Summary: unable to contact

(see over for additional space)

Signature: Larry Wilso

EA SCIENCE AND TECHNOLOGY
A Division of EA Engineering, Science, and Technology, Inc.

p344

COMMUNICATIONS RECORD FORM

Distribution: ( ) ____________, ( ) ____________
( ) ____________, ( ) ____________
( ) Author

Person Contacted: andrew Nash Date: 11-4-86

Phone Number: (516) 727-1258 Title: Hauler

Affiliation: Nash Carting Type of Contact: Phone

Address: Rte 2, Box 120 Person Making Contact: L. Wilson
Osborne Ave, Riverhead N.Y.

Communications Summary: unable to contact

(see over for additional space)

Signature: Larry Wilson

EA SCIENCE AND TECHNOLOGY
A Division of EA Engineering, Science, and Technology, Inc.

COMMUNICATIONS RECORD FORM

Distribution: ( ) ________, ( ) ________
( ) ________, ( ) ________
( ) Author

Person Contacted: Barbara Meduski Date: 3-3-86

Phone Number: (516) 653-5636 Title: Billing Clerk

Affiliation: K&M Sanitation Co. Type of Contact: Phone

Address: East Quogue NY Person Making Contact: L. Wilson

Communications Summary: Mrs Meduski stated that her husband, Ronald Meduski's carting service dumped refuse at Old Quogue from 1968 through 1973. Household garbage was the only type of waste dumped by K&M.

(see over for additional space)

Signature: Larry Wilson

Appendix 1.1-4

p1 of 2

July 7, 1971

Dear

Please be advised that your permit to remove trash and garbage from residences and places of business in Quogue and to deposit such trash or garbage in the Quogue Village Dump has expired.

The renewal of this permit must be applied for in the Quogue Village Office (fee $1.00) without delay and will be subject to the provision that no trash, refuse or garbage not removed from addresses within the Village of Quogue may be deposited in the Quogue Village Dump. A violation of the terms of this permit (Village Ordinances # 2 and # 3) is subject to a fine of $100.00 and an immediate cancellation of the scavenger permit.

In this connection it should be noted that the taking of some refuse picked up in Quogue to a Town Dump <u>does not</u> justify the deposit of a like quantity of refuse from outside of Quogue in the Quogue Village Dump.

Very truly yours,

Malcolm [illegible]
Mayor

Mc/s

Andrew Nash
Rte. 2., Box 120
Osborne Ave.
Riverhead, N. Y. (1966)

Georges Sanitation Service
c/o George Mathys
#3 Oak Ct.
Hampton Bays, N. Y. (1969)

John Annis
3 Youngs St.
Riverhead, N. Y. (1967)

K & M Sanitation Co.
c/o Ronald Meduski
East Quogue, N. Y. (1968)

John Swerdewski, Inc.
Westhampton Beach, N. Y.

09-17-1 (5/76)
Formerly GA-4

DEC Reg 1

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Received from NYSDEC Region 1

p1 of 4

TRANSMITTAL SLIP

TO Bob Beckerer – Region 1, Stoney Brook

Appendix 1.1-5

FROM Tom Koch – Hazardous Site Control

DATE 4/9/84

RE:

Bob – I've attached a copy of the report that I prepared about our trip to the sites in the town of Southampton. I hope that it will be of benifit to you.

FOR ACTION AS INDICATED:

- ☐ Please Handle
- ☐ Prepare Reply
- ☐ Prepare Reply for ________ Signature
- ☐ Information
- ☐ Approval
- ☐ Prepare final/draft in ______ Copies
- ☐ Comments
- ☐ Signature
- ☐ File
- ☐ Return to me
- ☐ ________
- ☐ ________

RECEIVED
APR 12 ...
SOLID WASTE MANAGEMENT
DEC REGION I

5/14/84

Phil,
I think you'll find the attached very interesting. Especially #4, 5, 9 and 11
Bob

p2/4

RECEIVED APR 12 1984
SOLID WASTE MANAGEMENT
DEC REGION I

15 (12/75)

New York State Department of Environmental Conservation

MEMORANDUM

TO: Robert Olazagasti, Supervisor, Site Control Section
FROM: Thomas Koch, Solid Waste Management Specialist II, Site Control Section
SUBJECT: Investigation of Potential Inactive Hazardous Waste Sites in the Town of Southampton, Suffolk County, Region I
DATE: April 4, 1984

On the 27th and 28th of March, we met with members of an environmental group called the "Concerned Citizens of Southampton Town". The intent of our meeting was to investigate sites in the town that the group believes contain hazardous waste. The Concerned Citizens Group is headed by Elaine Bennett and has been instrumental in the investigation of potentially harmful inactive hazardous and septage waste sites in the town.

Our meeting began on the morning of March 27. Attending from the Concerned Citizens Group were the following:

Elaine Bennett
Cindy Hulse
Virginia Styler

Attending the meeting from the Region I office was Bob Beckerer. Before proceeding to visit the alleged hazardous waste sites, Elaine Bennett outlined her perception of the problems that the Town of Southampton faced. Basically, there are three main concerns. First, the soil on the eastern part of Long Island is primarily sand and gravel and consequently, it is extremely permeable. Therefore, any hazardous waste that may have been dumped anywhere on the surface of the ground would tend to perculate down to the water table where it could potentially contaminate the drinking water supply of the residents. Unfortunately, almost all of the drinking water supply for the eastern part of the Island is taken from groundwater. The second concern is the fact that there used to be a large number of potato farms on the eastern part of the Island. A tremendous amountof pesticides and herbicides were used in raising the potato crop over the years. Most of the spent pesticides and herbicides were disposed of in totally unsecured "dumps" where the residue was able to pass through the soil and enter ground-water. Also, it has been alleged that the scavenger waste haulers in the eastern part of the Island have mixed waste solvents, etc., in with septage and also dumped it at unsecured "dumps" throughout the eastern part of the Island. The third concern mentioned was the fact that the political leaders of the Town of Southampton are totally unconcerned with the proper operation of their existing landfill at North Sea and the transfer stations at Westhampton, Qugue, East Quogue and Sag Harbor.

After our discussion of the basic problems encountered in eastern Long Island, we proceeded to visit the sitesfor a

f ... e.

p3/4

5. Suffolk County Airport Canine Kennel Corp. Site, Westhampton

About ¼ mile northeast of the "demo" site was another innocent looking site. It consisted of two old buildings adjacent to each other and a small shallow pit of about 500 feet^2. Almost immediately evident was the pungent-sweet odor of PCB carrier gas. Closer inspection revealed several large capacitors half buried in the shallow pit. One of the capacitors was oozing PCB fluid which was rapidly volitizing in the heat of the direct sun. Sampling is definitely warranted for this site and should be considered for the summer.

6. Old Quogue Landfill, South Country Road, Quogue 152050

This was at one time a municipal landfill for the Hamlet of Quogue. By all appearances it has been very nicely closed. In fact, there is virtually no way of knowing that this was once a landfill except for the fact that there were several old car bodies and a boat hull onsite. There are also several piles of clean brush and a few plastic bags filled with leaves.

...ird 100 ? Phase I

7. Dog Pound Dump, East Quogue

This site was allegedly a municipal landfill at some time in the past. At the present, the site is a small transfer station. There were about 20 Dempster Dumpsters on location at the time of our visit. Behind the dumpsters was an open field bordered by woods. No evidence of protruding refuse could be seen. It is possible that pesticides may have been disposed of here sometime in the past, but by current appearance, you would never suspect it.

8. Hampton Bays Transfer Station, Jackson Avenue, Hampton Bays 152054

This transfer station was operated as a landfill up until 1978. Allegedly, a substantial amount of pesticides were dumped here up to that time. Currently, the site is extremely well maintained. There was no evidence of protruding refuse, and the area was well graded and seeded.

NUS Report

On the morning of March 28, we set out to investigate the second set of sites. Attending our meeting on the second day were the following:

Elaine Bennett
Virginia Styler
Sue Berkowski
Rudy Graneri
Bob Beckerer from Region I

9. Bridgehampton, Narrow Lane, Bridgehampton

There were actually two sites at this location. One was to the east of Narrow Lane and the other was to the west. The site on the east side of Narrow Lane was operated as a

p444

base of the pit which was at least one acre in surface area and probably 2-3 feet deep. There was significant refuse, old rotted animal carcasses and numerous dead seagulls in the pond and on the shores of it. About 300 feet south of this excavated abomination was the septage pit lagoon system. It consisted of about 20 deep pits interconnected by trenches. There was a substantial amount of septage that had already been dumped here. According to Mrs. Bennett, the septage has definitely been contaminated with something not yet determined. This was discovered in recent tests performed on the sludge back in March of 1983.

This facility definitely warrants sampling. It might also be a good idea to consider groundwater sampling downgradient from the site both in and out of the leachate plume. According to Mrs. Bennett, several drinking water supply wells are severely contaminated already and the residents must bring in water from elsewhere.

In conclusion, our trip to the Town of Southampton was extremely enlightening. We now have evidence of three new sites that deserve to be added to the Registry. Those three sites being the Suffolk County Airport Demo Site, the Suffolk County Airport Canine Kennel Corp site and the Bridgehampton sites, east and west. These three sites warrant a classification of 2a at this time. Obviously, sampling must be done to determine the true extent of the problems there. The North Sea Landfill truly deserves the attention of Phase I investigation. Judging from the number of drums that were noted protruding through the soil, it could be construed that there could be a very significant amount of hazardous waste leaching into the groundwater. Hopefully, we will be able to initiate a sampling schedule for many of the sites this coming summer. In the meantime, we will keep in contact with the Concerned Citizens Group to keep them abreast of our schedule for sampling. Hopefully, someday we will initiate remediation for some of these sites.

TMK:cl

cc: C. Goddard

cc: B. Beckerer

CAR Appendix 1.1-6

Ple opk. D.

New York State Department of Environmental Conservation
Division of Solid/Hazardous Waste
Building 40, SUNY
Stony Brook, New York 11794
(516) 751-2617

Henry G. Williams
Commissioner

May 8, 1985

Village Clerk
Village of Quogue
Jessup Avenue
Quogue, New York 11959

Dear Sir or Madam:

On April 11, 1985, I inspected your landfill on Old Country Road, Quogue, New York.

All my previous inspections of that landfill indicated the site to be closed. However, on April 11, the gate was open and some brush had been recently deposited on the west side adjacent to the Cardo property.

Please be advised that if you intend to operate this site, a permit must be applied for and granted by this office.

Kindly respond to this office, in writing, by May 22, 1985 with your intentions in this matter.

Very truly yours,

Robert T. Frey
Principal Engineering Technician

RTF:dm
cc: T. Sanford
R. Becherer

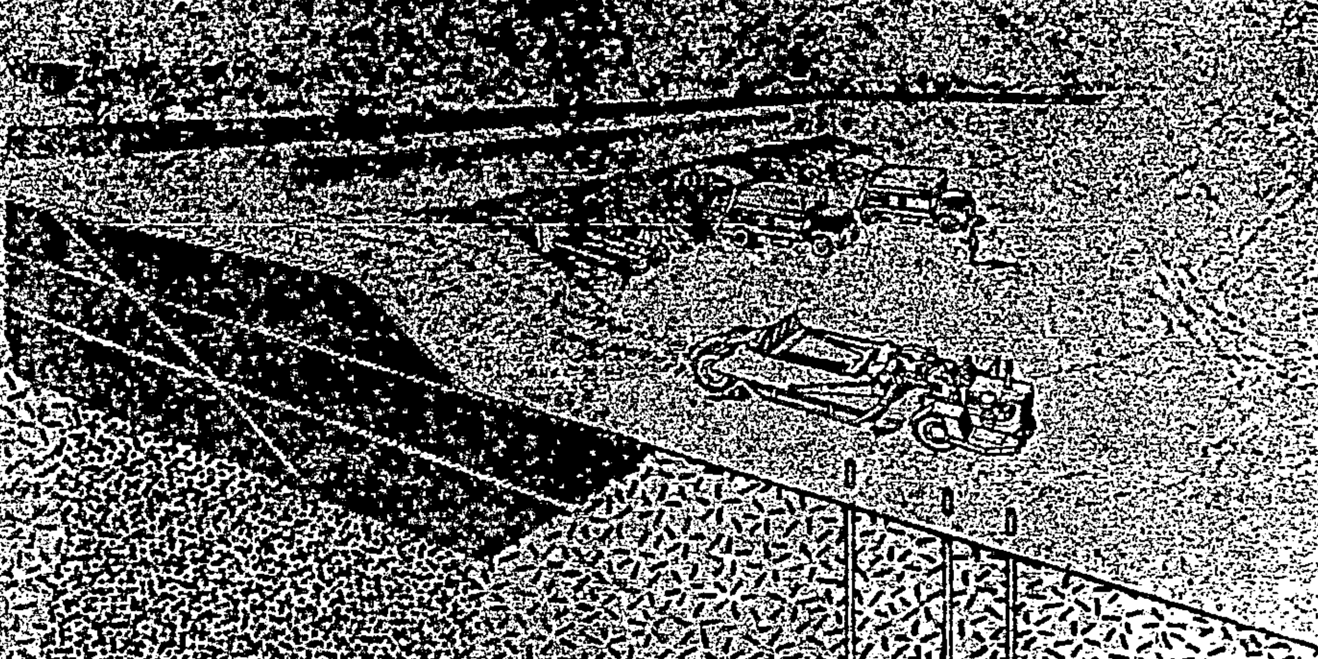
Appendix 1.1-7

p1 of 46

DEPARTMENT OF ENVIRONMENTAL CONTROL

SUFFOLK COUNTY, NEW YORK

JOHN M. [illegible], P.E., COMMISSIONER



STUDY OF LEACHATE AT LANDFILL SITES 1975

VOLUME I

HOLZMACHER, McLENDON and MURRELL, P.C.

Consulting Engineers Melville, New York

North Sea Site:

The North Sea landfill site is located on Majors Path, south of Great Hill Road. Approximately 36 acres of land are now or have been used for landfill purposes. A total area of approximately 70 acres is available to the Town for solid waste disposal. Salvaging is permitted at the site and some oversized, bulky materials are removed from the site as part of this practice. Scavenger wastes are deposited on a high pile of refuse, which is designed to act as a buffer to prevent groundwater pollution. This site has been operating for approximately ten years. During this time 362,600 cubic yards of waste materials and cover have been deposited in the site, with an estimated 18,500 tons deposited in 1974.

Quogue Site:

The Quogue site was operated as a dump by the Village of Quogue until it was closed by order of the New York State Department of Environmental Conservation early in the 1970's. The site, which is just south of Old Country Road and west of Quogue-Riverhead Road, occupies approximately 12 acres of land. Three core borings were drilled in the site, and although old signs directing different categories of refuse to special areas were still in existence, the borings failed to penetrate any refuse. A later meeting with the Village Mayor confirmed our earlier belief that the borings were located in areas where the depth of the fill should be

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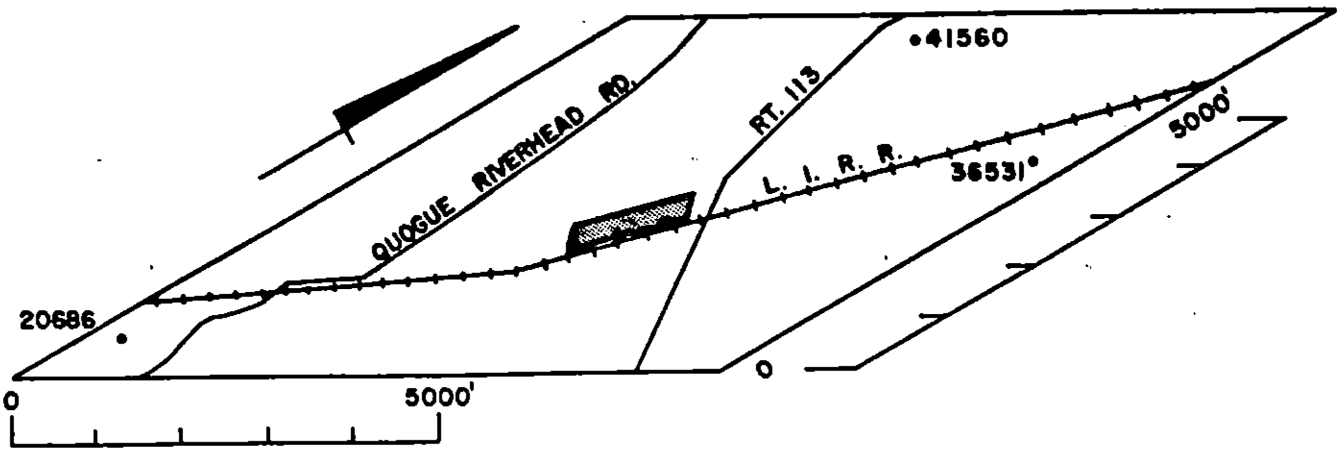
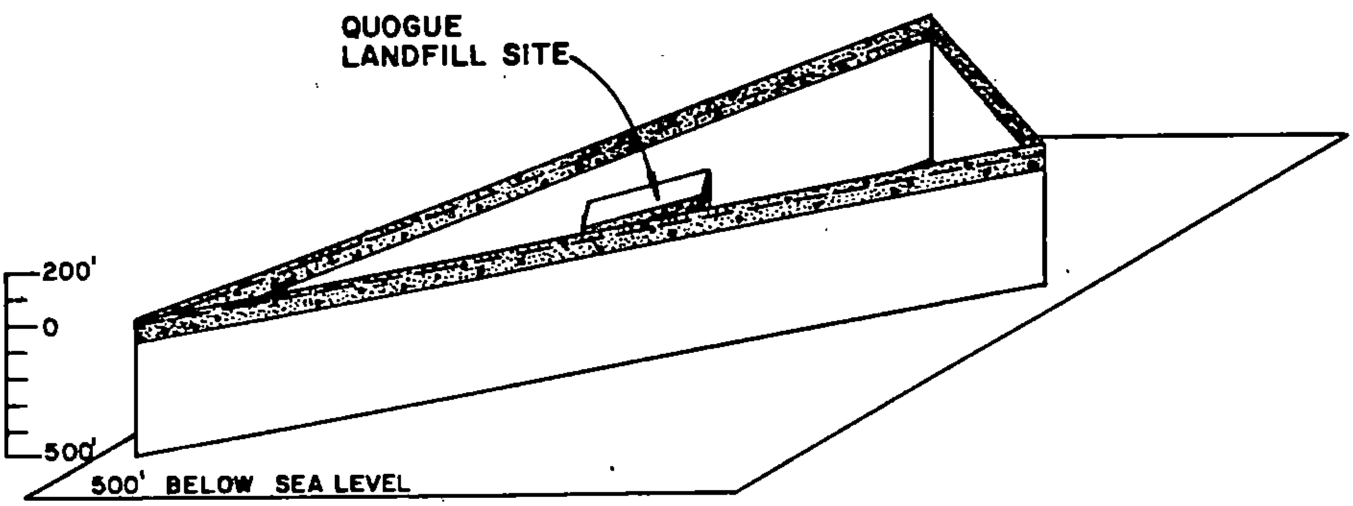
10-12 feet. Since burning of refuse was a normal practice at the site, the initial volume may have been significantly reduced. On the basis of the Mayor's information, we estimate that only 5,500 cubic yards of refuse had been deposited in the dump during its operational period. Because of this, and the fact that the site is no longer operational, we anticipate that the total amount of leachate produced here will be quite small and will probably be readily attenuated in the subsurface environment. We, therefore, recommend that a leachate monitoring system need not be installed at this site.

Sag Harbor Site:

The Sag Harbor site was operated as an open dump until the late 1960's. It is located west of the Sag Harbor-Bridgehampton Turnpike, approximately 1,500 feet south of Laurel Lane. The dump was then covered and has been maintained since as a transfer station. Shrubs and tree stumps are still deposited at one locality at the site, and shellfish wastes are still placed in another area in the site. The core borings revealed that all types of refuse had been deposited in the site, including automobiles. It is estimated that 17,500 cubic yards of refuse lies beneath the present surface of the site.

p4of6





GEOLOGIC
FENCE DIAGRAM FOR QUOGUE SITE

TOWN OF SOUTHAMPTON

SUFFOLK COUNTY DEPARTMENT OF
ENVIRONMENTAL CONTROL

STUDY OF LEACHATE AT LANDFILL SITES

HOLZMACHER, McLENDON & MURRELL, P. C. CONSULTING ENGINEERS, MELVILLE, N. Y.

SC 73-3

p5-16

Quogue Landfill Site

The Quogue (Village of Quogue) landfill site is located in south central Suffolk County. The site is situated on sands and gravels typical of the glacial outwash plain. Available data provides evidence that the sand and gravel layer is at least 120 feet thick (Figure 1o).

The elevation of the ground-water table is approximately ten feet above mean sea level. The direction of ground-water flow beneath the Quogue landfill is south or south-east based on the inferred ground water contours in the area surrounding the site.

Three core borings at the site failed to penetrate any refuse even though they were drilled directly in the filled area suggested by the Mayor of the Village of Quogue. The Mayor, however, has informed the consultant that the depth of the fill is 10 to 12 feet. This would place the base of the refuse material approximately 20 feet above the ground-water table.

Frequent burning of the refuse had occurred periodically during the period in which the site was in operation. The process of incineration of the refuse may have destroyed enough of the refuse volume to mask its identity during core borings. In effect, the character of the leachate may also

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have been significantly altered in such a way as to reduce overall leachate concentration. In addition, the total volume of the landfill site is so small as to reduce the importance of the landfill as a potential source of ground-water pollution.

Sag Harbor Landfill Site:

The Sag Harbor (Town of Southampton) landfill site is located on the South Fork. The site is situated on the Ronkonkoma moraine in an area of rolling hills and small ponds. Beneath the landfill site there is approximately 40 feet of till, which is then underlain by sand, and gravel and sand layers.

There was no ground-water level data in the vicinity of the landfill site, and core borings in the landfill did not penetrate the surface of the ground-water table. The ground-water table contour map as presented by G. Kimmel (1971) was used to approximate the direction of ground-water flow. Based on this map, the ground-water elevation is between 10 to 14 feet above sea level and the direction of flow is northerly.

The minor amount of leachate produced in this now inactive, small landfill (transfer station) will pass through a zone of aeration between six- to 25-feet thick. The poorly sorted till should cause rapid attenuation of the leachate.

Appendix 1.1-8.
p1 of 2

EA SCIENCE AND TECHNOLOGY
A Division of EA Engineering, Science, and Technology, Inc.

COMMUNICATIONS RECORD FORM

Distribution: ( ) Old Quogue LF, ( ) ______
( ) ______, ( ) ______
( ) Author

Person Contacted: Mr. James Pim, P.E. Date: 10 December 1985

Phone Number: 516 451 4634 Title: Public Health Engineer

Affiliation: SCDHS - Haz. Mat. Mngt. Type of Contact: In Person

Address: 15 Horseblock Rd Farmingville NY Person Making Contact: Going

Communications Summary: Old Quogue LF #152050

Mr Pim indicated that it is his belief that the Old Quogue landfill probably did not receive hazardous waste, and furthermore, he did not intend for this site to be put on the NYS Superfund list.

The attached list indicates that Mr Pim is not particularly concerned about a threat at the Quogue Landfill.

(see over for additional space)

Signature: William Going

p2of2

LANDFILL LOCATION MAP NOS. 1 & 2

INFORMATIONAL STATUS SHEET

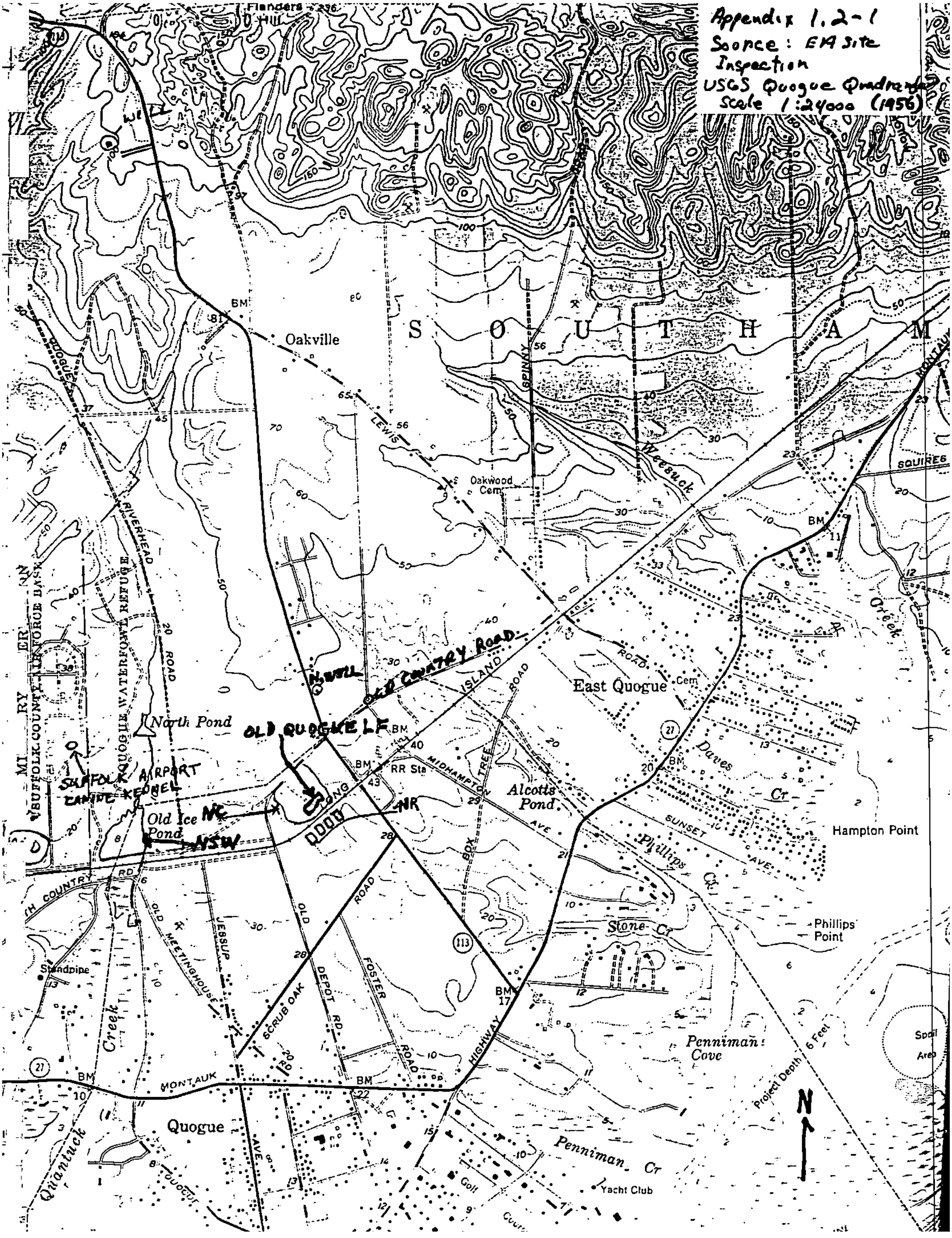
A - Active
C - Closed
T - Transfer
B - Brush

S - Scavenger
L - Compost
W - Waste Oil
R - Resource Recovery

	LOCATION	STATUS
	Babylon - Gleam St., W. Babylon	A S
	Huntington - Old Deposit Rd., E. Northport	A, R, W
3	Smithtown - Baler & Landfill, Old Northport Rd., Kings Park	A, R, W, B
	Smithtown Landfill - Old Northport Rd., Kings Park	C
	Islip - Sonja Rd., Deer Park	C S
6	Saltaire Incineration - Fire Island, NY	A
	Fire Island Pines - Utilizing Barges	C
	Montclair Avenue, Smithtown	C
	S. Montclair Avenue, Rear Highway Dept.	C
	Islip Landfill, Blydenburgh Rd., Hauppauge	A S
	Islip Landfill, Lincoln Avenue, Sayville	A, B, W, R S
	Brookhaven Landfill, Holtsville	C
	Pine Road Ecology, Coram	A, L
	Brookhaven Landfill, Horseblock Rd., Yaphank	A, B, R, W
	Brookhaven National Laboratory	A
	Brookhaven Landfill, Paper Mill Rd., Manorville	A, T, L S
	Brookhaven Landfill, Yaphank Rd., Center Moriches	C
	Riverhead Landfill, N/S Youngs Rd., Riverhead	C S
	Riverhead Landfill, S/S Youngs Rd., Riverhead	A, R, N S
	Eastport Landfill, Rte. 27, Eastport	C
	Westhampton, Old Country Rd., Westhampton Beach	A, C, T, S
	Westhampton Landfill, S. Country Road, Quogue	C S
	Old Quogue Landfill, S. Country Road, Quogue	C
	Hampton Bays, Jackson Ave., Hampton Bays	A, T, B, C
	Southold Landfill, Sound Ave., Cutchogue	A, S, R, W
	Old North Sea Landfill	C S
	North Sea Landfill, Major Path	A, S
	Shelter Island Landfill	A, R, S
	Sag Harbor Landfill, Sag Harbor Tpke., Bridgehampton	A, B, T S
	Bulls Path Landfill	~~A~~, B C
	East Hampton Landfill, Springs, East Hampton	A, R, S
32	Hither Hills Landfill, Main Rd., Montauk	A, R, S
	Fishers Island Landfill	A S

Landfills which may have received hazardous wastes

Appendix 1.2-1
Source: EA Site Inspection
USGS Quogue Quadrangle
Scale 1:24000 (1956)



HYDROGEOLOGIC DATA FROM SELECTED WELLS AND TEST HOLES IN SUFFOLK COUNTY, LONG ISLAND, NEW YORK

By

H. M. Jensen and Julian Soren

LONG ISLAND WATER RESOURCES

LONG ISLAND WATER RESOURCES BULLETIN NUMBER 3

Prepared by the U. S. Department of Interior, Geological Survey, in cooperation with the New York State Department of Environmental Conservation, the Nassau County Department of Public Works, the Suffolk County Department of Environmental Control, and the Suffolk County Water Authority.

Published by

SUFFOLK COUNTY DEPARTMENT OF ENVIRONMENTAL CONTROL

1971

HYDROGEOLOGIC DATA FROM SELECTED WELLS AND TEST HOLES IN SUFFOLK COUNTY, LONG ISLAND, NEW YORK

By

H. M. Jensen and Julian Soren

INTRODUCTION

Suffolk County, N. Y., comprising roughly the eastern two-thirds of Long Island along with several smaller islands has an area of about 920 square miles (fig. 1). The western half of the county is mainly suburban; the eastern half is more rural. The population of Suffolk County has increased sharply from less than 200,000 in 1940 to about 1.1 million in 1970. However, most of the increase has occurred since 1950, when the population was about 275,000.

The fresh-water supply for the county is obtained solely from the underlying ground-water reservoir. The major hydrogeologic units in the ground-water reservoir are summarized in table 1, and a generalized section showing the vertical relation of these units is shown in figure 2. Ground-water pumpage increased from an average of about 42 mgd (million gallons per day) in 1950 to about 131 mgd in 1969 (New York State Conservation Department, written commun., May 1970). The projected water use in Suffolk County in 1990 for an estimated population of 2 million is about 300 mgd (New York State Conservation Department, Division of Water Resources, 1970, p. 26-27).

Water-related problems associated with increased population and attendant increased ground-water development are of considerable concern to the water-resources managers of Suffolk County. To help supply the hydrologic information needed to anticipate and cope with these problems, the U.S. Geological Survey is participating in a cooperative program of water-resources studies with the Suffolk County Water Authority, the Suffolk County Department of Environmental Control, and the New York State Department of Environmental Conservation. Several reports have been published as a result of the cooperative program. (See "Selected References.") One of the best known and most widely used of those reports is New York State Water Power and Control Commission Bulletin GW-18, "Mapping of geologic formations and aquifers of Long Island, New York" (Suter, de Laguna, and Perlmutter, 1949). That report includes three major sections: (a) a fairly detailed description of the surface and the subsurface geology of Long Island; (b) a detailed table of geologic correlations of well logs; and (c) a series of maps showing pertinent surficial features and structure contours on the tops of key hydrogeologic units.

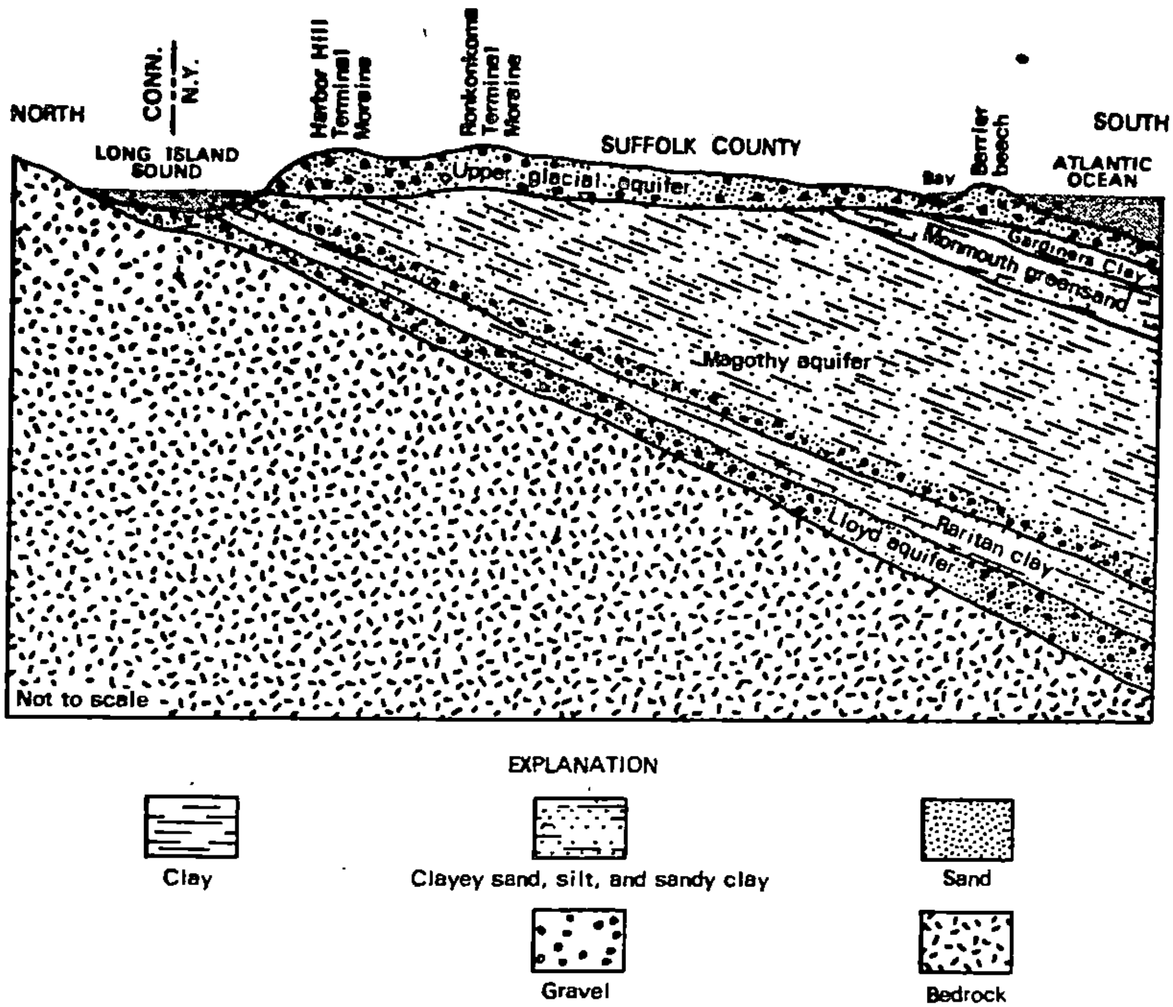


Figure 2.--Generalized section showing major hydrogeologic units in Suffolk County, N.Y.

Table 1.--Major hydrogeologic units in Suffolk County, N. Y.

Hydrogeologic unit 1/	Geologic name	Approximate thickness (feet)	Description and water-bearing character
Upper glacial aquifer	Holocene and upper Pleistocene deposits, and Mannetto Gravel	0-750	Mainly brown and gray sand and gravel of moderate to high hydraulic conductivity; also includes deposits of clayey glacial till and lacustrine clay of low hydraulic conductivity. A major aquifer.
Gardiners Clay	Gardiners Clay	0-75	Green and gray clay, silt, clayey and silty sand, and some interbedded clayey and silty gravel; of low hydraulic conductivity. Unit tends to confine water in underlying aquifer.
Jameco aquifer	Jameco Gravel	Not known	Not identified in Suffolk County.
Monmouth greensand 2/	Monmouth Group	0-200	Interbedded marine deposits of dark-gray, olive-green, dark-greenish-gray, and greenish-black glauconitic and lignitic clay, silt, and clayey and silty sand. Unit has low hydraulic conductivity and tends to confine water in underlying aquifer.
Magothy aquifer	Matawan Group-Magothy Formation, undifferentiated	0-1,100	Gray and white fine to coarse sand of moderate hydraulic conductivity. Generally contains sand and gravel beds of low to high hydraulic conductivity in basal 100 to 200 feet. Contains much interstitial clay and silt, and beds and lenses of clay, of low hydraulic conductivity. A major aquifer.
Raritan clay	Clay member of the Raritan Formation	0-200	Gray, black, and multicolored clay and some silt and fine sand. Unit has low hydraulic conductivity and tends to confine water in underlying aquifer.
Lloyd aquifer	Lloyd Sand Member of the Raritan Formation	0-500	White and gray fine-to-coarse sand and gravel of moderate hydraulic conductivity and some clayey beds of low hydraulic conductivity. Not highly developed as an aquifer.
Bedrock	Undifferentiated crystalline rocks	Not known	Mainly metamorphic rocks of low hydraulic conductivity; surface generally weathered; considered to be the bottom of the ground-water reservoir. Not a source of water in Suffolk County.

1/ Adapted largely from Cohen and other (1968, p. 18).

2/ Name adopted in this report.

Appendix 1.3-2
1 of 19

Geology of Brookhaven National Laboratory and Vicinity, Suffolk County New York

By WALLACE DE LAGUNA

STUDIES OF SITES FOR NUCLEAR ENERGY FACILITIES—
BROOKHAVEN NATIONAL LABORATORY

GEOLOGICAL SURVEY BULLETIN 1156-A

This report concerns work done on behalf of the U.S. Atomic Energy Commission

This series of reports provides a basis for evaluating results of a possible nuclear incident upon the hydrologic environment

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON: 1963

STUDIES OF SITES FOR NUCLEAR ENERGY FACILITIES—BROOKHAVEN NATIONAL LABORATORY

GEOLOGY OF BROOKHAVEN NATIONAL LABORATORY AND VICINITY, SUFFOLK COUNTY, NEW YORK

By Wallace de Laguna

ABSTRACT

In connection with the construction and operation of atomic research facilities at the Brookhaven National Laboratory, the U.S. Geological Survey made a study of the geologic and ground-water conditions at and near the Laboratory. The area is in central Suffolk County, about 60 miles east of New York City, and extends in a 26-mile-wide strip across the island from Long Island Sound on the north to the Atlantic Ocean on the south. The geologic fieldwork consisted of examination of surface outcrops and the supervision of the drilling of and examination of samples from shallow test wells 100 to 200 feet deep and two deep test wells about 1,600 feet deep.

The gently rolling land surface at the Laboratory is bordered by two lines of hills; the Harbor Hill moraine on the north, and the Ronkonkoma moraine on the south. A broad flat, relatively featureless outwash plain extends south from the Ronkonkoma moraine to the tidal swamps, bays, and barrier beaches, which form the southern boundary of the area. The Carmans, Forge, and Peconic Rivers, and their tributaries, carry most of the surface water.

Six principal stratigraphic units, some containing subdivisions of local importance, were recognized in the test holes and surface exposures. At the bottom is the southeasterly sloping bedrock of Precambrian age, which is at a depth of about 1,500 feet beneath the Laboratory. Above the bedrock is the Raritan formation of Cretaceous age about 500 feet thick, which is divided into the lower Lloyd sand member and an upper clay member. Resting on the clay member of the Raritan formation is about 900 feet of sand, sandy clay, and some gravelly beds, which have been tentatively assigned to the Magothy(?) formation. The Gardiners clay, an interglacial deposit of Pleistocene age, overlies the Magothy(?) formation in much of the area. The Gardiners is 10 to 20 feet thick at Brookhaven National Laboratory, but it thickens appreciably to the south. Above the Gardiners clay are upper Pleistocene deposits, which have a maximum thickness of about 200 feet. Locally these deposits are divided into an unidentified unit of sand and gravel characterized by a greenish color, a unit of silt and clay recognized near Manorville, and the Harbor Hill and Ronkonkoma moraine deposits and associated outwash deposits. Recent deposits of gravel, sand, silt, and clay are restricted to stream channels, bays, and beaches, and are generally less than 40 feet thick.

2 of 19

Fresh water under artesian pressure occurs in several permeable zones in the Raritan and Magothy(?) formations. Most of the water in the upper Pleistocene deposits is unconfined and fresh, and it is the principal source of supply. Recent deposits are not a source of water except for small supplies at scattered localities on the barrier beaches.

INTRODUCTION

PURPOSE AND SCOPE OF INVESTIGATION

In the fall of 1946, the War Department, then in charge of the atomic energy program, requested the U.S. Geological Survey to prepare a preliminary report on the possible water-supply problems of the proposed nuclear research laboratory at Camp Upton. In the fall of 1947, the Geological Survey began a detailed investigation of the ground-water conditions in the vicinity of the Laboratory with particular reference to the effect of a hypothetical accidental release to the environment of radioactive wastes. The routine operation of Brookhaven National Laboratory does not constitute a hazard because of the very stringent precautions that the Laboratory exercise in handling and disposing of radioactive materials. The work on which the present report is based began in March 1948. During the first 2 years, 2 deep test wells and about 12 shallow observation wells were drilled. As a guide to the installation of test wells, an attempt was made to obtain information on the subsurface geology by earth-resistivity observations, but the method was found to be poorly adapted to the conditions in the area.

During this same period, 95 samples of surface and ground waters were collected and shipped to Washington for analysis. On the basis of the data provided by this work, a second water-sampling program was set up in November 1950 to monitor the surface-water and ground-water supplies of the area, but this sampling was stopped in the summer of 1953 because the program was felt to be unsound.

Some instrumental leveling was done in the first year or two, and in 1949 the Topographic Division of the Geological Survey established a network of bench marks covering the area of immediate interest. This made it possible to convert water-level measurements to a sea-level datum so that accurate water-table contour maps could be drawn.

A more detailed study of the hydrology began in 1950; a detailed pumping test was run at the end of that year. In 1951 the observation-well net was expanded, and in 1952 a study was made of the hydrology of the Carmans River. At the same time, an attempt was made to estimate the amount of water lost annually by evaporation and by transpiration so that an estimate could be made of the recharge to the ground-water reservoir.

Attempts were made during the first year to measure the rate of movement of the ground water directly by tracers. The work provided answers which seemed to be valid, but it was dropped because of the complexity of the theoretical and practical problems involved. Some laboratory work with dye solutions was attempted later to illustrate the pattern of movement of contaminated liquids, but again problems involved in faithfully representing natural conditions were not satisfactorily solved.

The investigation was made under the immediate supervision of M. L. Brashears, Jr., and J. E. Upson, former district geologists. The organization and preparation of the report were coordinated by C. V. Theis and J. E. Upson.

PREVIOUS INVESTIGATIONS

Previous work on the hydrology and geology of Long Island has dealt either with Long Island as a whole or with the western part. In 1903 the water-supply problems of Greater New York were studied in detail by the Commission on Additional Water Supplies and described in a report by Burr, Hering, and Freeman (1904). This report related primarily to the occurrence and availability of ground water in Nassau County and western Suffolk County. In 1906, this study was enlarged to investigate the possibility of developing 250 mgd. (million gallons per day) of water from Suffolk County by extending the Brooklyn aqueduct eastward along the south shore through Patchogue, Moriches, and Quogue. Branches and collecting works were to tap, among other sources, the Carmans River and the lower Peconic. A report on this study was made by Spears (1908). Because of the general interest in the problem of water supply at this time, and as the result of a cooperative agreement with the Commission on Additional Water Supply, the U.S. Geological Survey made a study of both the geology and the hydrology of all Long Island in the years 1902–05. The results of this investigation were published under the authorship of Veatch and others (1906). Later, geologic investigations were made by Fuller (1914).

In 1932, the U.S. Geological Survey returned to the study of Long Island under cooperative agreements with the New York State Water Resources Commission (formerly Water Power and Control Commission) and with Nassau County. Later, these agreements were extended to include Suffolk County.

The principal publications dealing with central Suffolk County that have resulted from these cooperative investigations are listed under "References cited." These reports are concerned mainly with the problem areas of western Long Island, and little has been published for Suffolk County except for the reports on the mapping of the aquifers by Suter, de Laguna, and Perlmutter (1949), and the mapping of the water table by Lusczynski and Johnson (1952). Among the independent workers who have contributed to the glacial geology of Long Island are MacClintock and Richards (1936) and Fleming (1935).

LOCATION OF AREA

Brookhaven National Laboratory is on the site of Camp Upton, formerly an Army post during World Wars I and II. It is nearly in the geographical center of Long Island, about 60 miles east of New York City. (See fig. 1) The Laboratory tract is an irregular polygon that is roughly rectangular and about 2.5 miles on a side.

Brookhaven National Laboratory lies in a strip across the island about 13 miles wide extending approximately north-south between long 72°45′ and 73° W. This area (fig. 1) is referred to in this report as the Upton area from the post office address of the Laboratory, and it is the area of principal concern in the hydrologic part of this report.

The geologic studies cover a somewhat wider area (fig. 1), as it was felt desirable to include some information from adjoining areas where wells had been drilled deep enough to reach beds of Cretaceous age. This larger area, extending from about long 73°07′30″ W. on the west to long 72°37′30″ W. on the east, a distance of about 26 miles, is here called central Suffolk County.

WELL-NUMBERING SYSTEM

Numbers of wells mentioned in the text and shown on illustrations of this report are those assigned by the New York State Water Resources Commission. Wells are numbered serially and are designated by letter prefix according to the county in which they are: S for Suffolk County and N for Nassau County. Records and logs of wells referred to in this report are either published in Bulletins GW 4, 9, and 31 of the New York Water Resources Commission or may be examined at the Geological Survey office at 1505 Kellum Place, Mineola, N.Y. The location of wells referred to in this report are shown on plate 1.

TOPOGRAPHY

Brookhaven National Laboratory is on gently rolling ground in the upper part of the Peconic River valley, which is bordered by two lines of low hills. These extend beyond the limits of the valley east and west nearly the full length of Long Island and form its most prominent topographic features. The northern line of hills, known as the Harbor Hill moraine, lies along the north shore of Long Island; the

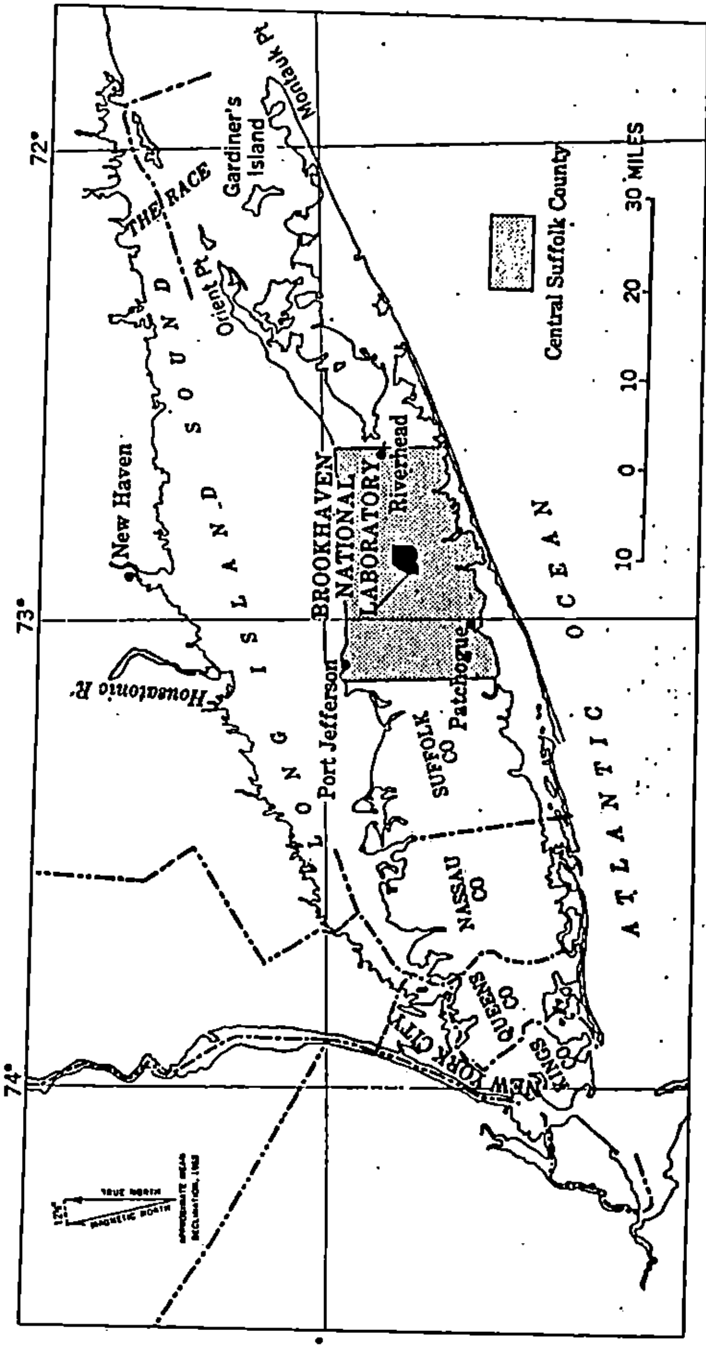


FIGURE 1.—Outline of map of Long Island, showing location of Brookhaven National Laboratory and adjoining areas.

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southern line of hills, the Ronkonkoma moraine, trends along the center of Long Island and passes just south of Brookhaven National Laboratory. (See pl. 1.)

Just west of Brookhaven National Laboratory, the two moraines are connected by a narrow north-south ridge, which gives the neighboring hamlet of Ridge its name. East of this ridge, and enclosed by it and two moraines, is the Manorville basin (pl. 1), on the relatively high west margin of which are the main Laboratory grounds. The basin forms the upper drainage area of the Peconic River. It is partly enclosed on the east south of Calverton by Bald Hill, a salient of the Ronkokoma moraine, so that the surface drainage of the Manorville basin is poor, and much of the land near the river is swampy. East of Calverton, the valley widens and forms the Riverhead basin (pl. 1).

West of the north-south ridge is the narrow, straight valley of the Carmans River, branches of which formerly drained Artist Lake and a pond at Middle Island. To the east, along the south margin of the Harbor Hill moraine are two large kettle holes, Long Pond and Deep Pond.

Just west of the Carmans River, another ridge extends north from Coram Hill and nearly joins one of the wide low spurs extending south from the Harbor Hill moraine. West of this ridge, between the two moraines, is the Selden basin (pl. 1), a wide shallow basin that has no surface-drainage outlet.

South of the Ronkonkoma moraine is a comparatively flat featureless plain of irregular width. This surface slopes gently to the south, where it merges into a swamp and then passes under Great South Bay and Moriches Bay. The shoreline is indented by many small estuaries that are the drowned mouths of the small streams that drain the plain. The principal irregularities of the plain south of Brookhaven National Laboratory are the valleys of the Carmans River, which head north of the moraine, and the much shorter Forge River which heads in the Ronkonkoma moraine just south and southeast of the Laboratory.

Between the mouths of the Carmans and the Forge Rivers, the south shore bays are divided by a wide tongue of land which extends nearly across to Fire Island Beach. This tongue is occupied by the summer community of Mastic and by the southern part of another community called Mastic Beach. To the east is Moriches Bay; to the west is Great South Bay. The bays are bordered on the south by a long narrow line of barrier beaches.

The north shore of central Suffolk County is bordered by a long line of steep bluffs overlooking Long Island Sound. These bluffs form a series of shallow arcs, concave northward, each of which is 8 to

10 miles long. The line of bluffs is broken by several small embayments such as at Mount Sinai Harbor and Wading River. These embayments have flat swampy bottoms and are bordered on the south by an abrupt line of hills. West of Port Jefferson the shoreline is much less regular, because it comprises a succession of bays and necks.

SUMMARY OF STRATIGRAPHY

Six principal stratigraphic units, some of which include subdivisions of minor importance, were recognized in the test drilling at Brookhaven National Laboratory and have been identified in well logs and at exposures in central Suffolk County (table 1). Their general relationships are indicated diagrammatically in figure 2, and their lithology, as determined in the two deep test wells at Brookhaven National Laboratory, is indicated in figure 3. Plate 2 shows the lithologic characteristics of the uppermost units, particularly those of Pleistocene age. Plate 1 shows the location of wells used in preparing the report; the cross sections are shown in plate 2.

At the base is the oldest of the stratigraphic units, the bedrock of pre-Cretaceous age, to which no formational name has been attached. Above the bedrock is the Raritan formation of Cretaceous age, which is as much as 500 feet thick. This formation has two members. The lower, as much as 300 feet thick, called the Lloyd sand member, is composed of coarse-grained sand, gravel, and some clay. The upper member, as much as 200 feet thick, is mostly clay and is called the clay member of the Raritan formation. Overlaying the Raritan formation is the Magothy(?) formation, also of Cretaceous age. Beneath Brookhaven National Laboratory this formation consists of about 900 feet of mostly clayey sand, and it includes beds of clay and of sand and gravel.

Beneath most of the laboratory tract, and in general beneath the southern half of central Suffolk County, the Magothy(?) formation is overlain unconformably by the Gardiners clay of Pleistocene age. Within Brookhaven National Laboratory and for a few miles to the south, test wells showed the Gardiners clay to be 10 to 20 feet thick and to be composed of clay containing sand and gravel. Still farther south, along the ocean shore, the Magothy(?) formation is overlain by 150 feet or more of clay, silt, and clayey sand, which in texture, color, and composition is somewhat like the Gardiners clay, but which resembles neither the Magothy(?) below nor the upper Pleistocene deposits above. This material is tentatively referred to as the Gardiners clay, although it is possible that detailed paleontologic studies may show that other units are present in some places (Perlmutter and Crandell, 1959).

TABLE 1.—*Physical character and water-bearing properties of the geologic units underlying central Suffolk County*

System	Series	Geologic unit		Approximate thickness (feet)	Physical character of deposits	Water-bearing properties
Quaternary	Recent	Recent deposits		0–40	Gravel, sand, silt, some clay, organic matter, and shell fragments.	Permeable beds contain fresh and salt water near shoreline. Clay and silt are local confining units.
Quaternary	Pleistocene	Upper Pleistocene deposits	Moraine deposits and outwash	0–150	Moraine deposits composed of unsorted boulders, gravel, silt and clay; compact in places. Outwash composed chiefly of gravel and sand. Locally, thin loesslike deposits of silt and clay at and near surface.	Moraine deposits generally of low permeability but permeable sandy zones are common. Outwash generally highly permeable and productive. Water-table conditions prevail almost everywhere.
Quaternary	Pleistocene	Upper Pleistocene deposits	Clay at Manorville	0–60	Silt and clay, laminated, gray and brown.	Relatively impermeable local confining unit.
Quaternary	Pleistocene	Upper Pleistocene deposits	Unidentified unit	0–50	Fine to coarse sand, greenish; some silt and clay.	Contains water under water-table conditions. Tapped by few wells.
		---- Unconformity? ----				
Quaternary	Pleistocene	Gardiners clay		0–150	Clay and silt, grayish-green; some lenses of sand and gravel.	Relatively impermeable. Confining unit in southern part of area.
		---- Unconformity ----				
Cretaceous	Upper Cretaceous	Magothy(?) formation		0–1, 000	Sand, fine to coarse, clayey, lenses of clay; coarse basal zone containing gravel. Lignite is abundant. Light and dark gray are predominant colors.	Low to high permeability. Tapped by few wells but has several productive zones. Water is under artesian pressure.
		---- Unconformity ----				
Cretaceous	Upper Cretaceous	Raritan formation	Clay member	150–200	Clay and silt, dark- and light-gray; some red and white; some lenses of sand.	Relatively impermeable, extensive confining unit.
Cretaceous	Upper Cretaceous	Raritan formation	Lloyd sand member	130–300	Sand and gravel, gray; some beds of sandy clay and clay and silt.	Permeable zones are potential sources of water. Not tapped by pumping wells at present. Water is under artesian pressure.
		---- Unconformity ----				
Precambrian(?)		Bedrock		----------	Granitic-gneiss, upper 30–50 feet moderately to highly weathered.	Relatively impermeable. Not an aquifer.

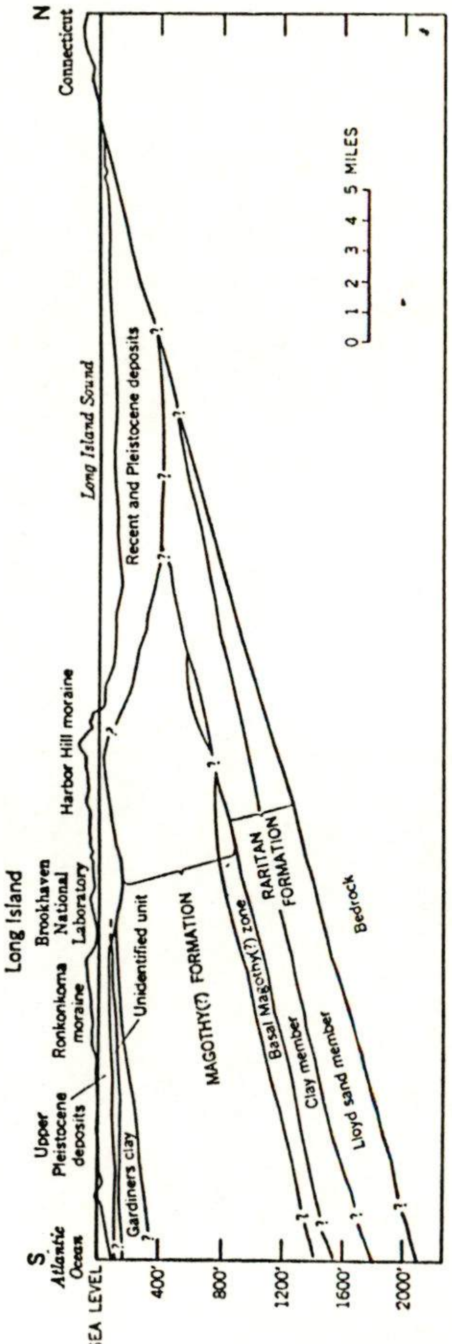

FIGURE 2.—Generalized cross section along long 72°52'30" W. in central Suffolk County.

The sixth major stratigraphic unit is called the upper Pleistocene deposits, an informal term used to describe the glacial deposits which, in nearly all Long Island, overlie the Gardiners clay or the Magothy(?) formation. Most of these deposits consist of sand and gravel which, with local silt and clay, form the stratified outwash and morainal deposits of presumed Wisconsin age. Their maximum known thickness is about 200 feet. The formational units into which Fuller (1914, p. 80–176) divided these deposits have not been recognized within the area of this report. However, some distinctive subdivisions were recognized. For example, overlying the Gardiners clay in the southern half of the report area is a greenish sand 25- to 50-feet thick of uncertain origin, but apparently the oldest outwash material in this area. It has not been named and, therefore, is called here the unidentified unit. At Manorville, and probably beneath a surrounding area of several square miles, there is a varved clay in the middle of the upper Pleistocene deposits. In the lower part of the Peconic River valley, beneath the south-shore beaches and in a buried valley south of Mount Sinai Harbor, the upper Pleistocene deposits include a complex series of alternating layers of sand, silt, and clay, some fossiliferous, which may in part represent the Gardiners clay. Despite these variations, however, most of the upper Pleistocene deposits form a comparatively uniform blanket of sand and gravel.

The current differentiation of stratigraphic units on Long Island is the result of gradual refinement of knowledge based largely on data from wells. Substantial contributions were made by Thompson, Wells, and Blank (1937), and more recently by Suter, de Laguna, and Perlmutter (1949). Most of the formations recognized here occur nearly everywhere beneath Long Island.

BEDROCK

The bedrock which underlies the unconsolidated deposits is known principally from well records. It includes hard, dense schist, gneiss, and granite similar in character to that which underlies much of the mainland in nearby parts of New York and Connecticut. These rocks were previously thought to be of Precambrian age, but now many geologists believe that some of them are metamorphosed early Paleozoic age sediments. Data from well records and samples on Long Island do not warrant any identification except of rock type.

Two deep test wells (S6409 and S6434, pl. 1) penetrated bedrock at a depth of nearly 1,600 feet beneath Brookhaven National Laboratory. The bedrock was found to be a hard, banded, granitic gneiss. Microscopic examination showed it to be composed of about 50 percent plagioclase (oligoclase and andesine) feldspar, about 50 percent quartz, about 1 percent biotite, and a trace of garnet. The plagioclase feldspar in the sample from well S6434 contained a little more sodium than that from S6409; otherwise, the two samples were identical.

This bedrock contains no openings capable of holding or transmitting appreciable quantities of water, thus it forms the base of the water-bearing material beneath Brookhaven National Laboratory.

In Connecticut, the bedrock includes, in addition to the gneiss and ehist, a body of sandstone, shale, and diabase of Triassic age which ould conceivably extend south from New Haven as far as Long Iand. Seismic studies (Oliver and Drake, 1951, p. 1295) suggest hat it does not. No rocks of Triassic age have been found in any vells drilled on Long Island.

CONFIGURATION OF THE BEDROCK SURFACE

The shape of the upper surface of the bedrock of Long Island is est known beneath the west end of the island (de Laguna and Brashears, 1948). Here the bedrock surface, as indicated by well recrds, has a maximum relief of about 100 feet, except where it is near he surface and may have been modified by erosion in Pleistocene or Recent time. The apparent low relief and local deep weathering of he bedrock in western Long Island as shown by well logs (de Laguna nd Brashears, 1948, p. 8) suggest that the surface had reached an dvanced stage of peneplanation. Indeed, the surface is considered o be part of the Fall Zone peneplain (Von Engeln, 1942, p. 353). The most recent map of the bedrock surface underlying Long Island Suter, and others, 1949, pls. 8, 9, and 10) shows that this surface lopes southeast about 80 feet per mile beneath most of Long Island. t seems to slope more southerly at the east end of Long Island. If he surface represents a peneplain, the relief on the bedrock surface in he Brookhaven area is not likely to be greater than 50 to 100 feet.

FORMATIONS OF LATE CRETACEOUS AGE

RARITAN FORMATION

The Raritan formation rests directly on highly to slightly weathred bedrock. The formation is probably entirely continental and as laid down as a costal-plain deposit by streams flowing off the plifted Fall Zone peneplain. The name Raritan was applied to the ong Island deposits by Veatch and others (1906, p. 23) who corelated the formation with deposits of the same name in New Jersey. On Long Island the formation has two fairly distinct members; the Lloyd sand member below, and a clay member above.

The formation probably occurs beneath all central Suffolk County. Northward the Lloyd sand thins and probably pinches out beneath Long Island Sound, and the clay member may do likewise. Southward the formation extends a considerable distance offshore, possibly as far as the continental shelf (about 100 miles), where the beds probably have lithologic characteristics different from those beneath Long Island.

At many wells the position of the contact with overlying deposits, and in fact between the members themselves, cannot be defined precisely. Nevertheless, the units are distinctive in their general characteristics.

LLOYD SAND MEMBER OF THE RARITAN FORMATION

The Lloyd sand member is a fairly uniform and extensive unit consisting predominantly of sand and gravel with some clay. It is known only from well logs. At the two deep test wells (S6409 and S6434) at Brookhaven National Laboratory, it is separated from the hard crystalline bedrock by 15 to 30 feet of tough, white, structureless clay containing scattered angular grains of quartz, which is considered to be weathered bedrock. At the same wells, the upper contact of the Lloyd sand member with the overlying clay member is fairly definitely marked by a change in the lithology of the sediments.

As shown by the columnar section (fig. 3) of well S6409, the Lloyd sand member is about 300 feet thick. It is largely composed of fine to coarse sand containing silt and clay in the interstices. It also includes beds of clay or sandy clay and coarser textured beds that contain gravel. Near the middle, the unit consists chiefly of sand and coarse gravel, which contains some pebbles at least 2 inches in diameter. The voids between the pebbles are for the most part filled with sand and some clay. The porosity of the unit is, therefore, appreciably less than that of a well-sorted sand or gravel. A somewhat similar sequence of material was found at well S6434. The dominantly sandy material which makes up the bulk of the unit here rests directly on highly weathered bedrock.

The pebbles and the sand found in the Lloyd member at Brookhaven National Laboratory and elsewhere on Long Island are composed almost entirely of quartz. This composition suggests that the material was derived from a region in which the climate was warm and the rate of erosion slow, so that all but the most resistant material was entirely decomposed. The clay is entirely or dominantly kaolinite, a mineral indicative of complete weathering.

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The cores, the drill cuttings, the rate of drilling, and other evidence suggests that the Lloyd found at Brookhaven National Laboratory is in many respects similar to that found in western Suffolk, Nassau, Queens, and Kings Counties where more than a hundred wells have been drilled into it. In both the Laboratory wells and in a well drilled at Port Jefferson, however, the interstitial clay seems to be tougher and more tightly packed than it is farther west.

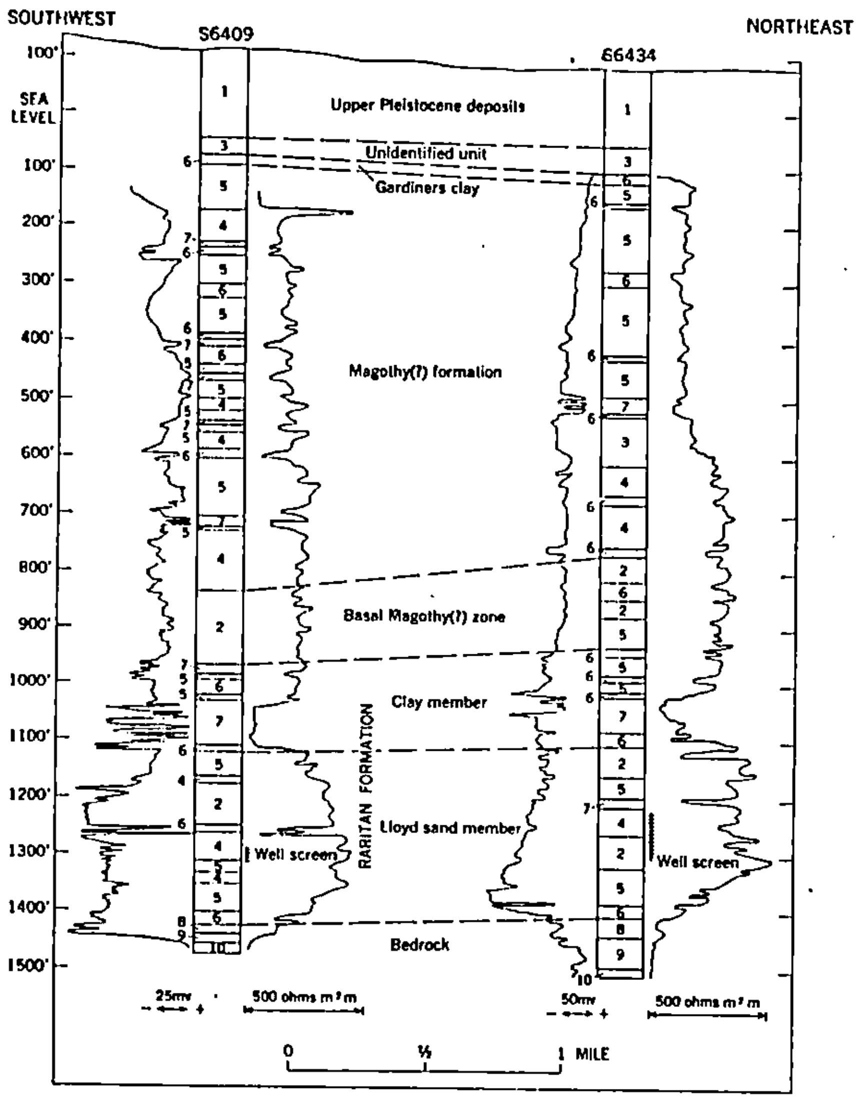

FIGURE 8.—Columnar sections and electric log of deep test wells at Brookhaven National Laboratory.

EXPLANATION

Numbers arranged in order of estimated decreasing permeability

Unit No.	Description of unit
1	Sand, or sand and gravel, clean; little or no silt or clay.
2	Sand, coarse, or sand and gravel; includes some clay.
3	Sand, fine or medium; includes some clay.
4	Sand, coarse, or sand and gravel; mixed with considerable clay and containing beds of clay.
5	Sand, fine to medium; mixed with considerable clay and containing beds of clay.
6	Clay, mixed with some sand, and containing beds of clayey sand.
7	Clay, tough; containing little sand.
8	Bedrock weathered. Original rock texture no longer visible, but material has not been transported or sorted by water.
9	Bedrock, weathered. Original igneous texture visible, but most minerals except quartz much altered chemically.
10	Bedrock, fresh. May show some staining or discoloration.

In the western part of Long Island, the Lloyd ranges in thickness from about 350 feet on the south shore to a few tens of feet along the north shore, where in a few places it is absent. These variations in thickness apparently represent the form in which the Lloyd was originally deposited. At Port Jefferson the Lloyd has a thickness of 135 feet, which shows that it thins to the north in central Suffolk County also. Indeed, it is possible that beneath Long Island Sound, the Lloyd sand pinches out and that the overlying clay member of the Raritan overlaps it and extends beyond it. (See fig. 2.) Thus, although penetrated by only a few wells in the report area, the Lloyd probably is a continuous unit of substantial thickness.

CLAY MEMBER OF THE RARITAN FORMATION

The clay member, which overlies the Lloyd sand, makes up the balance of the Raritan formation. At Brookhaven National Laboratory, the top of the clay member is 975 feet below sea level at well S6409 and 940 feet below at S6434. In both wells, its thickness was less than 200 feet. It is largely composed of tough dark-gray or black lignitic clay and some red and white clay and includes some sandy layers and thin lenses of gravel. It also contains some light-gray silty and sandy clay. It is not clearly bedded, as the textures and colors grade into one another. Zones which contain well marked, narrow bands of light silty clay alternate with darker clay which may represent annual variations in rate of deposition, as between a rainy and dry season.

The clay member shows little if any systematic variation in thickness on Long Island. In most of the carefully logged wells that penetrate it, the clay is about 200 feet thick, and at least some of the greater or lesser thicknesses reported may be due to difficulty in placing the contacts, for these depend only on differences in lithology. In parts of King County, and in northern Queens and Nassau Counties, where the top of the clay member is at or near sea level, the member is much less than 200 feet thick and in places it may be absent. This is probably due to local erosion, most of which probably took place in late Tertiary or Pleistocene time. Where the clay member is found at greater depths, as in central Suffolk County, there is no evidence of erosion, but the data are scanty. Thompson, Wells, and Blank (1937, p. 455) suggest that in Kings and Queens Counties, channels were cut into the clay member at the close of Raritan time and then filled with sand or other permeable material at the beginning of Magothy(?) deposition. There is no evidence that such deep erosion and deposition took place within the area investigated; the Lloyd member in central Suffolk County is everywhere covered by the clay member.

Like the Lloyd member below and the Magothy(?) formation above, the clay member has not yielded any fossils except plant remains and is probably nonmarine. The scattered pieces and grains of lignite, the widely distributed spores and pollen, the casts of twigs and leaves, and the possible varving suggest deposition on a coastal plain by generally sluggish but sometimes flooded rivers, that drained a deeply weathered area of moderate relief. It is possible, but unlikely, that some of the rivers crossing this plain maintained their channels in the same place over long periods of time, because aggrading streams commonly build up both their banks and their beds and then shift some distance laterally to lower ground. Accordingly, the coarser grained materials found locally probably are lenses of limited extent both horizontally and vertically. However, at places these may act as relatively permeable but devious paths for the movement of water.

WATER-BEARING PROPERTIES

The Lloyd sand is one of the most important aquifers on Long Island largely because it yields adequate supplies of good quality water in areas, generally beneath the margins of Long Island, where supplies from overlying formations are inadequate or are contaminated by or readily subject to contamination by sea water. The Lloyd can supply water under these circumstances because it is overlain by the relatively impermeable and virtually continuous blanket of the clay member.

The problem of how fresh water moves into and out of the Lloyd has been considered by many investigators. Such movement may occur by means of valleys cut through the clay member or by slow

seepage of water through the clay (Suter, and others, 1949, p. 16). As there is little evidence of deep buried valleys in the clay member in central Suffolk County, it is likely that most of the movement of water into and out of the Lloyd is by means of slow seepage through the overlying clay. Lusczynski (oral communication) speculates that if the clay member has an average permeability of 0.2 to 0.3 gpd per square ft, then quite possibly all the water in the Lloyd reaches the unit by percolation through the clay member. Wenzel (1942, p. 13) gives the permeability of a clay (sample No. 2278) that is similar to the clay member of the Raritan as 0.2 gpd per ft, which suggests that there is no compelling need to assume permeable channelways. In any event, movement of water through the clay member of the Raritan either up or down doubtless is very slow in most places.

Although the water from the Lloyd is relatively high in iron content, the usefulness of the aquifer in central Suffolk County is more seriously compromised by the probability of poor yield, as exemplified by the two Brookhaven National Laboratory wells. In the western part of the island, many wells tapping the Lloyd sand member have a specific capacity between 10 and 20, which means that they yield 10 to 20 gpm per ft of drawdown. Test well S6409 at Brookhaven National Laboratory was finished with 25 feet of screen and had a specific capacity of about 2. The other deep test well, S6434, was underreamed and gravel-packed and finished with 80 feet of screen, but it had a specific capacity of only 2.5. The principal reason for these low yields seems to be the toughness of the interstitial clay in the deposits, which made it difficult to wash the clay out thoroughly during the development. Much of the same type of tough interstitial clay was found in the cores from test well S5901 at Port Jefferson.

MAGOTHY(?) FORMATION

The Magothy(?) formation in central Suffolk County is a thick body of continental deposits composed of lenses of sand, sandy clay, clay, and some gravel. It rests on the Raritan formation and is in turn unconformably overlain by upper Pleistocene deposits. The greatest thickness, revealed by drilling, is about 1,000 feet. The present upper surface of the Magothy(?) on Long Island is an erosional surface, and the original total thickness is not known.

The type area of the Magothy formation is in Maryland along the Magothy River, where it was first described by Darton (1893, p. 407–419). W. O. Crosby (1910) and later Horace R. Blank (written communication, 1935) suggested that the Cretaceous deposits overlying the Raritan formation on Long Island were a greatly thickened extension of the Magothy formation of New Jersey. Later work (Perlmutter and Crandell, 1959, p. 1060–1076) shows that the uppermost part of the Magothy(?) formation beneath the south shore of Suffolk County includes marine beds possibly equivalent in age to the Monmouth group of New Jersey. In this report, as in recent publications by Survey authors, the name Magothy when applied to the upper part of the Long Island Cretaceous, is followed by a question mark to indicate the doubt. Examination of pollen and spores may lead to both a reliable correlation of the Cretaceous deposits on Long Island with those of New Jersey and to the establishment of a useful type sequence for Long Island itself.

The Magothy(?) formation underlies most of Long Island except for parts of Kings and Queens Counties and northwestern Nassau County where it was removed by erosion. It may extend beneath Long Island Sound, but is probably truncated by erosion and overlain by Pleistocene deposits. (See fig. 2.) To the south, the Magothy(?) formation, like the Raritan, extends out under the sea, where it also probably changes from a terrestrial to a marine deposit.

The formation crops out at only a few places on Long Island, most of them in northern Nassau County, so that the formation is known chiefly from well records. At test wells S6409 and S6434, the Magothy(?) is about 885 and 819 feet thick, respectively. (See fig. 3.) Well S5901 at Port Jefferson, 12 miles northwest of Brookhaven National Laboratory, passed through nearly 500 feet of the Magothy(?) formation, and well S128 about 5 miles southwest of the Laboratory penetrated about 760 feet of the Magothy(?) and did not reach the bottom of the formation.

The Magothy(?) at Brookhaven National Laboratory has about the same characteristics as elsewhere on Long Island. It is composed of beds of poorly sorted quartzose sand mixed with and interbedded with silt and clay, and locally it contains pebbles or small lenses of gravel. Sandy clay and clayey sand make up most of the fine beds, but there are also several thick beds of clay. In both of the deep test wells (S6409 and S6434), the basal 100–150 feet of the Magothy(?) contains a greater proportion of coarse-grained material. This consists partly of coarse sand and gravel that contains pebbles as much as 2 or 3 inches in diameter. The voids are largely filled with silt and soft clay, however, and the coarse-grained beds are separated by beds of sandy clay. A similar coarse-grained zone can be distinguished in most reliable well logs in other parts of Long Island (J. J. Geraghty, written communication, 1953). It is best described as a zone, immediately overlying the clay member of the Raritan, in which relatively coarse-grained permeable material is commonly found.

The Magothy(?) formation typically contains several clay layers, some of them as much as 50 feet thick. Where the Magothy(?) itself

is thick, the aggregate thickness of the clay beds is nearly as great as that of the clay member of the Raritan. Even in the western part of the Island, where wells are close together, it is difficult or impossible to trace any of these clay beds from one well to the next; hence, they are probably lenticular and individually of small extent. Thus, they probably do not constitute as effective a barrier to the movement of ground water as the clay member of the Raritan formation.

WATER-BEARING PROPERTIES

Although it consists in part of beds of dense clay and layers of coarse sand and gravel, by far the greater part of the Magothy(?) formation is made up of sandy clay and clayey sand. Thus, although the formation as a whole is probably less permeable than the Lloyd because of its thickness it can transmit and store large amounts of ground water. Also, there are no effective barriers to the movement of water through the formation except locally. Wells that are constructed and developed carefully generally yield large quantities of water from all but the most clayey parts of the formation. In other parts of Long Island, the beds of gravel at the base of the Magothy(?) and the lenses of sand and gravel of smaller extent that occur at various zones within the formation also yield substantial quantities of water. The Magothy(?) is important as an alternate aquifer in the event that the water in the overlying upper Pleistocene deposits becomes contaminated.

A well near Brookhaven National Laboratory that produces water from the Magothy(?) is S5902 at Port Jefferson. The aquifer tapped by this well is apparently not the basal Magothy, but a coarse-grained zone 100 feet higher. Well S5901, only 0.2 mile from S5902, did not penetrate productive water-bearing material in the Magothy(?) and was abandoned. This is one of a very few places in central Suffolk County where difficulty has been encountered in obtaining water. At most other places, where adequate supplies of water are not available from the upper Pleistocene, ample supplies have been developed from the Magothy(?) formation.

The highly productive beds of the Magothy(?) are by no means confined to the basal zone, but there is no other zone in which a reliable supply can be predicted. Rather it is a case of drilling carefully until material of appropriate grain size and permeability is found. Both of the deep wells at Brookhaven National Laboratory penetrated considerable material in the Magothy(?) from which water might be obtained. Well S6434 was screened temporarily between 656 and 676 feet and tested by pumping. Even with only 20 feet of screen, no gravel pack, and little development the zone yielded water at a specific capacity of 15 gpm per ft of drawdown.

CONFIGURATION OF THE MAGOTHY(?) SURFACE

Between the Late Cretaceous and the end of Tertiary time, the Raritan and Magothy(?) formations were tilted gently to the south and considerably dissected by streams. The shape of the land surface thus formed is important for it is related to the thickness and distribution of the younger deposits resting on it. As these younger deposits have somewhat different hydrologic properties than the Cretaceous beds, their thickness is a matter of considerable importance to this report. In particular, extensive valleys now filled with permeable deposits occur in the western part of Long Island. If similar valleys are present in central Suffolk County, they might provide buried channelways for the movement of ground water. Although few wells penetrate to the Cretaceous in central Suffolk County, the general shape of the surface may be inferred from its configuration in the western part of the Island, where more data are available, and by inference from the general geology.

When the coastal plain formed on the Magothy(?) deposits began to be eroded, the lower reaches of the ancestral Housatonic and Connecticut Rivers probably were the first main streams flowing south or southeast across the area which subsequently became Long Island. As these streams trenched themselves, tributaries called subsequent streams developed along the outcrops of the less resistant beds and in particular along the contact of the Cretaceous deposits and the crystalline bedrock. As the main streams cut deeper, the tributaries which followed this contact migrated southward down the slope of the surface of the more resistant bedrock and removed in the process a wider and wider strip of the Cretaceous cover. The inner lowland so formed is the site of Long Island Sound, and the cuesta ridge to the south of it forms the core of Long Island. Thus, in general, the surface of the Cretaceous deposits of Long Island in pre-Pleistocene time probably consisted of gentle south-dipping slopes (dipslopes), steep north-facing slopes (scarp slopes) scarred by short steep valleys, and a few main stream valleys, the original consequent streams, which traversed across or detoured around the cuesta ridges.

Whether or not such a major stream valley crossed central Suffolk County is not known. Veatch and others (1906, pl. 6*A*) suggest that the ancestral Housatonic River at first crossed the area not far west of the present site of Brookhaven National Laboratory. Well records suggest that there is a buried valley extending at least a few miles south of Mount Sinai Harbor, but there is no evidence to show that this valley extends across the island. Even if the Housantonic River crossed the island, such a remnant of its valley might well be a short segment only across the higher part of the postulated cuesta ridge.

Veatch (1906, pls. 6*B and* 6*C*) believed that the ancient Housatonic and Connecticut Rivers were eventually deflected westward where they entered the inner lowland, as the result of steam piracy, and flowed across the west end of Long Island as the ancient Sound River. Veatch thought that this river flowed to the west rather than to the east, partly because the Delaware, Susquehanna, and Potomac Rivers turn west where they cross the basal Cretaceous beds, and partly because well records revealed segments of buried valleys in southern Queens County and in south-central Kings County. Veatch (1906, pl. 6*D*) suggested also that the ancestral Housatonic and Connecticut Rivers were deflected east around the end of Long Island during the late Pleistocene time.

Many of the well records in central Suffolk County are generalized, and the correlations are somewhat questionable. However, within and a short distance south of the Laboratory area, several test wells were cored and the samples carefully studied. Interpretations as to the position of the Cretaceous surface at these wells are considered to be reasonably accurate. Data were particularly sought in the area south and southeast of Brookhaven National Laboratory, for this is the general direction of movement of the ground water from the Laboratory. These core identifications show that the Cretaceous surface is 92 feet below sea level at the southwest corner of the laboratory tract (well S6409, pl. 2). From here the surface slopes down gently to the south and southeast to 149 feet below sea level at well S6457 near Route 27, and it slopes down to about 140 feet below sea level at well S6460 (pl. 2). Still farther south, the position of the upper surface of the Cretaceous beds is uncertain, but it may be as much as 250 to 300 feet below sea level to the south according to interpretation of drillers' logs. Conceivably some of the clay correlated as Gardiners may be part of the Magothy(?) formation.

Beneath Brookhaven National Laboratory north of well S6409, the Cretaceous surface slopes to the north and is 161 feet below sea level at the northeast corner of Brookhaven National Laboratory (well S6458, pl. 2). Still farther north, few reliable well records are available, but the surface probably rises along the north shore in the vicinity of Shoreham, perhaps even to altitudes above sea level. West along the north shore, near Mount Sinai Harbor, is the valley already referred to, and still farther west, in Port Jefferson, well records and one exposure show clearly that the Cretaceous surface is 50 feet or more above sea level. A small buried ridge which appears to trend east-west beneath the southern boundary of Brookhaven National Laboratory may be part of a minor cuesta.

East of Brookhaven National Laboratory, beneath the valley of the modern Peconic River, there may be a buried valley of considerable

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extent. Wells at Manorville and Riverhead reached the Magothy(?) at considerable depths below sea level.

The total relief on the surface of the Cretaceous deposits in central Suffolk County is about 400 feet. Except for parts of the north shore, which are outside of the area of immediate interest to Brookhaven National Laboratory, the Cretaceous surface is very gently sloping, and the valleys and ridges referred to are but very minor undulations on a generally flat and nearly level surface.

DEPOSITS OF PLEISTOCENE AGE

During the Pleistocene epoch there were four major glacial stages. These were separated by three relatively warm interglacial stages. Long Island is about at the southern limit of the last major advance of the ice, the Wisconsin stage, and perhaps near the limit of the ice front of the earlier glacial stages.

In central Suffolk County, the deposits of Pleistocene age comprise: the Gardiners clay, believed to be a shallow marine deposit of the last major interglacial stage; and a complex sequence of glacial and nonglacial deposits, probably all of Wisconsin age, grouped under the name upper Pleistocene deposits. (See pl. 2.) The Jameco gravel found in western Long Island and the Mannetto gravel identified near the Nassau-Suffolk County boundary have not been recognized in central Suffolk County.

GARDINERS CLAY

In about the southern half of central Suffolk County, the Magothy(?) formation is overlain unconformably by a fossiliferous marine clay that probably is the equivalent of the Gardiners clay as defined and described by Fuller (1914, p. 92). The type locality of this formation is on Gardiners Island at the east of Peconic Bay. It is not possible to trace the deposits from the type locality to Long Island proper; therefore, the name Gardiners clay in this report is restricted to the fossiliferous clay beneath much of the southern part of the area that is between the upper Pleistocene deposits above and the Magothy(?) formation below.

In most of Long Island, except where it has locally been deformed by ice shove, the top of the Gardiners clay is about 50 feet or more below present sea level. In central Suffolk County, it is everywhere about 100 feet below sea level or deeper. The nonmarine clays exposed at or about sea level along the north shore of Long Island, described by Fuller as Gardiners clay, are no longer believed to be part of that formation (Weiss, 1954, p. 148).

As used in this report, the Gardiners clay comprises three somewhat different types of material that occur in three separate bodies and

that may or may not be contiguous with one another. These bodies are somewhat different lithologically and thus have somewhat different effects on the movement of ground water.

One of these is a thin body of clay or clay and sand that extends, in the area where it is best known, from about the northern border of Brookhaven National Laboratory as far south as Route 27 at well S6457 (pls. 1, 2). Similar deposits were penetrated by wells S128 and S95 to the west. Most wells in the area do not penetrate the Cretaceous beds, so the extent and continuity of the Gardiners is not known. However, it appears to underlie a belt around 6 miles wide north and south, roughly north of Route 27, and extending east and west across central Suffolk County. In this belt, the Gardiners clay is about 10 feet thick. The altitude of its upper surface is 101 feet below seal evel at S6456 (pl. 2), 91 feet below at S 6459 (pl. 2), and 130 feet below at S 6457 (pl. 1). Where penerated by these wells, the formation is composed of tough dark-gray to green sandy clay that contains a few pebbles. The green color is in part due to a small amount of glauconite and a small amount of green clay minerals.

A few pelecypod and gastrapod shells were found in the Gardiners clay at several of the wells in this area. At well S6409, a thin layer of dark brown peat underlies the clay. None of this material was particularly diagnostic; the peat being described by E. S. Barghoorn (Harvard Univ., written communication, 1952) as yielding only conifer pollen grains, Lycopodium spores, and other evidence of arboreal flora, which suggests a climate similar to, or more probably, slightly colder than the present.

Microfossils in the Gardiners were somewhat more indicative. Lawrence Weiss, formerly of the Geological Survey, prepared a report (1954) of the foraminifera obtained from cores and other samples. The foraminifera, and to a lesser degree the diatoms (K. E. Lohman, written communication, 1950), suggest strongly that the thin northern part of the formation in the vicinity of the laboratory was deposited in a shallow body of brackish water, not unlike the bays that fringe the southern shore of Long Island today. The fossil forms are largely identical with those living in the present bays. They do not resemble the forms living in the less well protected and more saline water of Long Island Sound. Similar forms are also found in protected waters to the north along the New England coast, which suggests that the Gardiners clay was formed during an interglacial period when the climate was similar to or perhaps a little colder than now. This conclusion agrees with the less conclusive evidence furnished by the peat. Also indicative of a somewhat colder climate is the altitude of the top of the clay, which suggests that sea level at the time of deposition was 50 to 100 feet lower than at present. This could be true if the glaciers and polar icecaps of the time were more extensive than those of today. MacClintock and Richards (1936, p. 330–331) suggest that the Gardiners clay is the equivalent of the Cape May formation of New Jersey, and they indicated on a map the probable position of the shoreline in New Jersey, New York, and Connecticut when the Cape May formation and the Gardiners clay were deposited. On this map, the sea level is shown as higher than at present in New Jersey, but lower than at present in Long Island and Connecticut. This would suggest that the land had been susequently tilted, or that the two formations are not actually contemporaneous.

The second body of the Gardiners clay, as here considered, comprises the thick clay penertated by wells S5591, S8549, and others (pl. 2), south of Route 27. The upper surface of this clay is at about 130 feet below sea level, but the lower contact slopes seaward so that the unit attains its greatest apparent thickness at well S8549 (pl. 2), where it consists of a nearly continuous body of tough generally green clay. A similar sequence, not quite so thick, was penetrated in well S5591 (pl. 2). Predominantly clay beds, as much as 80 feet thick, occur at depths of 130 feet below sea level at other southerly wells such as S6187 and S152. Thus, these thick clays may extend along the entire shore from Blue Point to Westhampton Beach and possibly beyond.

Clays of such thickness seem to be inconsistent with the apparent mode of deposition of the thin clay to the north. Also, the basis for an age determination is not firm. Hence, the thick clay may not be entirely of Gardiners age and may include beds of the Magothy(?) formation. Similar thick clays have been found farther west beneath Fire Island Beach, and Cretaceous foraminifera have been found in some of them (Perlmutter and Crandell, 1959, p. 1066–1067). However, the writer feels that lithologically the clay here discussed is not typical of the Magothy(?), and believes that if it is not Gardiners it must wholly or partly belong to some intervening formation hitherto unidentified.

A third body of deposits tentatively correlated with the Gardiners clay comprises certain fossiliferous sands and clays found in wells in the Riverhead area and south of Mount Sinai Harbor. As explained in foregoing paragraphs, it is likely that valleys were cut into the surface of the Magothy(?) formation at both of these places during the Tertiary. These valleys may have been invaded by the sea during deposition of the Gardiners clay. At well S5140 in Riverhead, Weiss (1954) found microfossils similar to those present in the Gardiners clay beneath Brookhaven National Laboratory and considered that the beds represent a shore facies of the Gardiners clay. These fossils

were present in two sand layers and in an intervening clay penetrated between depths of 70 and 101 feet below sea level. Shells also were reported in fine sand at 33 feet below sea level at about 1.5 miles east-northeast, but no samples were available for study. The fossiliferous sand 33 feet below sea level is presumably pre-Wisconsin if it is overlain by glacial outwash. However, at this comparatively shallow depth, the overlying material may be of Recent age.

In the Mount Sinai Harbor area, clay or sand and clay containing shells have been found in several wells at depths below sea level as follows: S43, −60 to −200 feet; S2650, −10 feet; S9087, −60 to −70 feet; and S108 at about −100 feet. These are approximate figures, and as the area was overridden by later ice sheets, the clay may have been deformed by ice shove. The foraminifera from well S2650 were briefly examined by N. M. Perlmutter who found them similar to those described by Weiss from the Gardiners clay. The material is therefore, like the sand at Riverhead, probably interglacial, and possibly contemporaneous with the Gardiners clay.

WATER-BEARING PROPERTIES

With respect to water-bearing properties, the chief concern is with the predominantly clayey parts of the Gardiners that lie beneath and south of Brookhaven National Laboratory. Beneath the laboratory and roughly north of Route 27, the thin supposedly lagoonal portion of the Gardiners, as here distinguished, lies between the highly permeable upper Pleistocene deposits above and the moderately permeable Cretaceous formations below. The effectiveness of this part of the Gardiners clay as a barrier to ground-water movement is an important factor in determining whether contamination reaching the ground water in the glacial sands would be carried down to the lower aquifers. The beds of tough clay are probably relatively impermeable, but they do not appear to occur in sufficiently thick and continuous strata to form a fully effective barrier to ground-water movement. If the Gardiners clay was indeed formed in a bay such as those which now fringe the south shore of the Island, and if the sea level rose from −140 feet to −90 feet during deposition, the formation would then probably consist of overlapping lenses of clay with zones of coarser grained silt and sand around the margins and local silty or sandy zones throughout. Indeed, the logs of wells S6457 and S6459 indicate that such sandy zones exist. Accordingly, this part of the Gardiners clay is apparently not a continuous and complete barrier to ground-water movement over the whole area, although the tough clay zones probably are effective barriers locally.

Certain hydrologic data, discussed more fully by de Laguna (written communication, 1962) bear out this conclusion. The hydraulic head differential across the clay in the area south of the Laboratory, as measured at wells S6456, S6459, and S6460 is on the order of half a foot. The clay therefore must be sufficiently impermeable to restrict somewhat the movement of water, which here is from upper to lower strata. However, the sandy zones in the clay, which as far as is known may occur anywhere, would offer relatively little restriction to the movement of water, which could then pass downward wherever the hydraulic gradient is favorable. Thus, taking the unit as a whole, water can pass through the Gardiners clay, although at a slow rate, in small amounts and probably at most places only by circuitous routes.

The thicker beds of clay and sand and clay beneath the south shore of the island, which were referred to the Gardiners clay, are doubtless appreciably more effective as a barrier to the movement of ground water than the thin beds of clay farther north. This is due not only to their greater thickness but also to the inferred greater continuity of the clays, although the log of well S1592 (pl. 2) suggests that there are sandy zones even in this material. However, the significance of these characteristics is less than in the clay to the north, because the southern clay beds lie within the area where ground water is moving upward rather than downward. The thick clay in the vicinity of well S5591 and southward greatly retards the actual movement of water from the deeper formations. In fact, it may force relatively large amounts of water to discharge upward in more northern areas, perhaps through more permeable deposits such as those penetrated by well S1592.

The scattered fossiliferous sands and clays in the Riverhead and Mount Sinai Harbor areas are impossible to evaluate hydrologically as their structure and distribution are not known. It would appear, however, that they are but a part of a geologically complex filling of the buried valleys in these areas, and that the details of the hydrology of these areas is likely to be similarly complex. These areas are remote from the Laboratory and their hydrology is of correspondingly small importance to the basic problems of this report.

UPPER PLEISTOCENE DEPOSITS

The term upper Pleistocene deposits was used by the writer in 1948 (de Laguna, 1948, p. 16) to include all the Pleistocene deposits on Long Island above the Gardiners clay. Fuller (1914, p. 106–176) divides this material into three formations: the Jacob sand, thought to grade downward into the Gardiners clay; the Manhasset formation, thick glacial deposits presumably of Illinoian age; and a thin, surficial veneer considered to be Wisconsin drift. Subsequent work

suggests that the Jacob sand is not a separate formation, and that the Manhasset formation is actually largely, if not entirely, of Wisconsin age.

The Jacob sand, as described by Fuller (1914, p. 106), consists of very fine sand, silt, and rock flour, which are plastic when wet, but which contain little true clay. The color is very light gray, or yellow or buff. Fuller gives no thickness for the unit. According to Fuller, the Jacob sand is exposed at several places in wave-cut bluffs at or near sea level along the north shore of Long Island and at the type area at Jacobs Point, 15 miles northeast of Brookhaven National Laboratory. At places, the Jacob sand grades downward into a brown silty clay which Fuller believed to be the Gardiners clay, but this clay contains no fossils and is no longer believed to be Gardiners. Also, Fuller's suggestion (1914, p. 105–106 and fig. 77) that the nonfossiliferous Jacob sand at the type locality and elsewhere along the north shore is equivalent to fine-grained fossiliferous sand which overlies the Gardiners clay on Gardiners Island probably is incorrect. This fossiliferous sand probably should be considered part of the Gardiners clay (MacClintock and Richards, 1936). In its type area the Jacob sand does not appear to be a true stratigraphic unit, but rather to comprise beds and lenses, each of rather limited extent, of fine sand, silt, and rock flour probably deposited in quiet water ponded along the ice front. Deposits comparable to the Jacob sand are not recognized in well logs beneath the central or southern part of Long Island.

The type locality of the Manhasset formation of Fuller is in Manhasset in northern Nassau County, where thick deposits of glacial sand and gravel contain a thin intercalated bed of clayey till. The lower gravel Fuller called the Hempstead gravel member, the till was called the Montauk till member (after the type locality at Montauk Point), and the gravel above the till was called the Herod gravel member, although the correlation of this particular gravel with the sand and gravel at Herod Point in central Suffolk County is also uncertain. Fuller believed that only the top few feet of till which overlies the Manhasset formation at the type locality was deposited by the Wisconsin ice sheet. This belief was based on an interpretation of the physiography with which subsequent workers have not been in agreement. Wells (1935, p. 121–122) and Fleming (1935, p. 222) state that they could find no evidence of weathering or erosion to indicate that there was an interglacial period at any time subsequent to the deposition of the Gardiners clay. The writer agrees with this opinion.

Fleming (1935, p. 216–238) proposes a three-fold subdivision of the post-Gardiners glacial material into Herod, Montauk, and Latest, as he believes that three separate advances of the Wisconsin ice were represented. The writer found no evidence in central Suffolk County, however, of three ice sheets. The glacial deposits observed in the Brookhaven National Laboratory area appear to be the product of two ice advances similar in character and probably both of Wisconsin age.

The Ronkonkoma and Harbor Hill moraines as mapped by Fuller (1914, pl. 1) are accepted with slight modification; and the bulk of the upper Pleistocene deposits are considered to be outwash from the same glaciers that formed the moraines. The chief points of disagreement with Fuller are: (1) the Manhasset formation, as defined by Fuller, is not considered to occur within the area and does not underlie the two outwash deposits at shallow depth as he believed; (2) the outwash is believed to be substantially thicker than Fuller thought; and (3) the thin till (supposedly ground moraine of the Ronkonkoma advance), which Fuller maps as underlying central Suffolk County and considerable territory to the north and west, is not believed to be present. This last unit is here replaced by Ronkonkoma and Harbor Hill outwash as discussed in the following paragraphs.

On the other hand, some units are here recognized in the upper Pleistocene that Fuller had little or no chance of observing. The first of these, called the unidentified unit (Weiss, 1954, p. 148), occurs at the base of the upper Pleistocene deposits. The second unit is clay, some of it varved, which is best known from cores from a test well at Manorville. Lastly are some thin surficial fine-grained deposits, not typical outwash, that occur in the upper part of the Harbor Hill outwash in the headwaters of the Peconic River in or near the eastern part of Brookhaven National Laboratory.

Thus in summary, the upper Pleistocene deposits in the vicinty of Brookhaven National Laboratory comprise the Harbor Hill and Ronkonkoma moraine deposits and outwash, which are indistinguishable on the basis of texture and composition alone, but which occupy somewhat different physiographic positions; and three minor units, differentiated on the basis of their composition: the unidentified unit, the clay at Manorville, and fine-grained surficial deposits of limited but uncertain extent.

UNIDENTIFIED UNIT

South of Brookhaven National Laboratory, and for an unknown distance east and west, the Gardiners clay is overlain by 25 to 50 feet of sand or clay and sand characterized by a greenish color which is referred to as the unidentified unit. Beneath the southern half of the laboratory tract, and south to Route 27, this material forms the basal part of the upper Pleistocene deposits. Its relation to the other units

in this area is shown in plate 2. Similar greenish deposits are reported in wells as far west as Patchogue (well S7519) and as far east as West Hampton Beach (wells S9973 and S152). It probably extends beyond these areas. The northern limit of the unit has been located only at Brookhaven National Laboratory where test drilling indicates that this unit extends north of well S6459 (pl. 2). To the south, the unit can be traced nearly as far as well S1592 (pl. 2), but beyond this point the greenish deposits cannot be distinguished in well logs from similar material that may be part of the Gardiners clay or older deposits. The data from other wells along the south shore of the Island are not adequate to define the unit.

The unidentified unit, in the vicinity of Brookhaven National Laboratory, where it is most clearly defined, is composed of fine- to medium-grained white and gray sand, and 5 to 10 percent of interstitial green clay. The sand grains consist mostly of quartz, but some other minerals also are present, principally feldspar, amphibole, and garnet. The green clay was identified by Clarence Ross (written communication, 1949) as nontronite, but probably there are other clay minerals present. Some broken grains of reworked glauconite are also present; and the nontronite may well have been formed by the weathering of glauconite. Elsewhere, the unit apparently contains considerable clay or sandy clay.

Samples of sand were collected for mechanical analysis from well S6456. The texture of the sample of greenish sand is not distinctive. The amounts and proportions of fine and medium sand are similar to those in some of the upper Pleistocene outwash; the content of coarse and very coarse material is small. Mineralogically the greenish sand differs from the overlying outwash mainly in the apparent absence of biotite and the presence of glauconite. It appears to have a more varied mineral content than the Gardiners clay.

The origin of the unit is uncertain, but it is here considered to be part of the upper Pleistocene deposits because of its general mineralogic and lithologic similarity to the sands of those deposits. The glauconite may well have been derived from the shallow marine deposits in Long Island Sound, then dry, by the first advance of the ice across this area, and it need not have come from the area of the Atlantic Ocean to the south.

WATER-BEARING PROPERTIES

The unidentified unit, although very similar in texture to much of the outwash, contains less coarse sand, and probably on the average a little more clay. The difference is difficult to estimate quantitatively.

However, it may be inferred that the movement of the ground water in the unidentified unit is somewhat slower than it is in the overlying material. Even a small difference may be of some importance. As shown in a later section, a body of contaminated liquid of even slightly greater density than the normal ground water will tend to sink to the bottom of the aquifer. Also, the adsorptive and ion-exchange capacity of the nontronite and glauconite in the unit is appreciably higher than that of the overlying outwash. It is concluded, therefore, that following a spill or leak, any contaminated water which sinks into the unidentified unit at the bottom of the upper Pleistocene, will move less rapidly and be subject to more adsorption than it would be in the overlying material.

MORAINE DEPOSITS AND OUTWASH

The moraine deposits and outwash comprise four separate units: the Ronkonkoma moraine, outwash and other meltwater deposits from the Ronkonkoma ice, the Harbor Hill moraine, and outwash from the Harbor Hill ice. These units are distinguishable topographically, but not lithologically with present information.

The Ronkonkoma moraine is a line of irregular hills that lies immediately south of Brookhaven National Laboratory (pl. 1). It extends eastward past South Manor, where it forms the south side of the Manorville Basin, and still farther east through Bald Hill. It also extends westward, paralleling the Carmans River valley at Yaphank, and then crosses that valley and includes Coram Hill and others to the west.

The Ronkonkoma outwash underlies and forms the sloping but fairly smooth terrain south of Brookhaven National Laboratory, and also the irregular hills on and among which the main Laboratory tract is situated. These hills are considered to be kames formed during the late stages of melting of the Ronkonkoma glacier.

The Harbor Hill moraine (pl. 1) lies along the north shore of Long Island and is of little direct concern in connection with the groundwater problems of the Laboratory. Outwash from the Harbor Hill ice, however, extends southward to within about 1½ miles of the north boundary of Brookhaven National Laboratory, and to the east it extends south of the Peconic River and underlies most of the Manorville Basin. It is believed that meltwater from the Harbor Hill ice flowed down the site of the Carmans River, through the gap in the Ronkonkoma moraine, and into the narrow tongue that broadened at the south to form a fanlike feature; the broad, flat area where the communities of Mastic and Mastic Beach are now located (pl. 1).

Within the Laboratory tract, except for the thin, surficial clay and silt described below, all these morainal and outwash deposits are lithologically inseparable and form virtually a single water-bearing unit. As a unit, these deposits rest upon the unidentified unit and, where that unit is missing or unrecognizable, upon the Gardiners clay. At places, where the Gardiners is missing, it rests on the Magothy (?) formation. In the laboratory area, it is from 100 to more than 200 feet thick. Its thickness, altitude, relationships to underlying formations, and general lithologic characteristics are shown by the cross sections in plate 2.

The moraine and outwash deposits are a crudely stratified body of clean sand and gravel which contains very little clay or silt, and only locally a few boulders. The sand grains are mostly quartz with small amounts of alkali feldspar, mica, amphibole, and other minerals. As indicated by a few exposures, the sand is well but coarsely bedded. Individual beds are difficult to define, as variations in texture are gradational.

Cores from some of the test holes reveal thin layers of silt or clay, which at most are 1 to 2 inches thick. Thicker lenses of clay are absent in the immediate vicinity of the Laboratory, but they are exposed locally along the north shore, especially at Wildwood State Park and Rocky Point (pl. 1). These lenses of silt and clay were probably deposited in small lakes formed between the retreating face of the Harbor Hill ice sheet and the Harbor Hill moraine. They are not more than 20 to 30 feet thick, and the majority are less than 10 feet thick. They appear to be at most a few hundred yards long. All these beds of silt and clay are near sea level, and they are evidently the material identified as the Jacob sand and the Gardiners clay by Fuller (1914).

No systematic variations in texture were actually observed in the glacial outwash or moraine deposits, and indeed to detect any would probably require a statistical study of a considerable number of large samples. The data available, however, suggest that the Ronkonkoma outwash becomes finer grained south of the Ronkonkoma moraine, and that the lower part of the outwash is somewhat finer than the upper part. No such generalization appears to hold for the material north of the Ronkonkoma moraine.

WATER-BEARING PROPERTIES

Because of their similarity in structure and texture, the moraine and outwash deposits are considered a hydrologic unit. In the Laboratory area, the water table lies within what is probably the Ronkonkoma outwash, so that this deposit is of primary concern. The clean, coarse sand and gravel is very porous and highly permeable. It makes a porous soil, so that a high proportion of the rainfall infiltrates where it falls; there is virtually no surface runoff. Because of their high porosity, the deposits store large quantities of water. Because of their high permeability, the deposits yield large quantities of water to wells and are the source of nearly all the ground water pumped in central Suffolk County.

So far as is known there are no effective barriers to the movement of water anywhere in the unit. However, because the deposits are lenticular, there may be substantial variation in permeability over short distances. The permeability of the deposits south of the Ronkonkoma moraine may decrease slightly with depth and with distance to the south.

Some of these minor variations in water-bearing characteristics might become significant in connection with possible movement of a contaminant. As the moraine deposits and outwash were deposited by water flowing in general from north to south, it is reasonable to suppose that individual lenses of sand and gravel are themselves elongated in this direction. Thus, there may be threads of relatively permeable material along which water might move a little more rapidly under proper hydraulic conditions. Also, there may be either fine- or coarse-grained deposits localized beneath and along the valleys of the principal streams, such as the Carmans or Forge Rivers.

Finally, as discussed by de Laguna (written communication, 1962) there is apparently a substantial difference between permeabilities in the horizontal and vertical directions.

CLAY AT MANORVILLE

A test well (S10,384) drilled by a private contractor near Manorville (pl. 1) penetrated a bed of tough clay which was underlain and overlain by outwash sand and gravel, between 2 and 33 feet below sea level. The lower part of this clay has typical glacial varving, which indicates that it was deposited in a lake left in the Manorville basin during the ice retreat. Similar clay was found in well S6422 from 4 to 62 feet below sea level. East, in the Riverhead basin, several wells penetrated what are probably equivalent beds of clay 15 to 30 feet below sea level. Three of these reached the bottom of the clay at 74, 81, and 130 feet below sea level. It is tentatively suggested that the varved clay at well S10,384 is possible interglacial, at least intersubstage, and may separate Ronkonkoma from Harbor Hill outwash. Whether the clays penetrated by the other wells to the east and to the west are of the same unit is not known. There are, however, clay and silt of Gardiners age at about these depths in the eastern part of the Riverhead basin, and in well logs it would be impossible to distinguish between them and the clay at Manorville. Wells for which there are reliable logs are not so located as to permit a determination of the continuity and extent of this clay. However, if the clay is post-Ronkonkoma, the temporary lake in which it formed presumably would have been limited to the north of the Ronkonkoma moraine, and the clay itself should occur correspondingly. It was not found in the Laboratory area, nor to the south of Brookhaven National Laboratory. West of the Laboratory, in the upper valley of the Carmans River, there are few data, and none to indicate the presence of a comparable clay.

The clay at Manorville, if laterally extensive, probably exerts a considerable influence on the movement of the ground water in the upper Pleistocene deposits in the area where it occurs. The water table is some 35 feet above sea level at Manorville, so that there is about 35 feet of saturated sand and gravel above the clay. The clay at well S10,384 is about 31 feet thick, and it is underlain by about 42 feet of sand and gravel. Movement of water between the upper and lower strata is certainly considerably impeded by the clay, and presumably artesian conditions prevail in the lower strata, although water-level measurements are not available to indicate the head difference. It is also possible that in some parts of the Manorville basin the water in the deposits beneath the clay flows southeastward toward and eventually to the south shore, whereas the water in the deposits above the clay discharges into the Peconic River. The clay appears to terminate, however, well to the east of the Laboratory, so that it does not influence directly the movement of ground water in the areas of potential contamination, but it may well be an important factor in the hydrology of the central and lower Peconic River valley.

SURFICIAL SILT AND CLAY

In the east third of the Laboratory area, test drilling and shallow excavations have revealed in places thin deposits of silt and clay. The material is discontinuous and unevenly distributed. It is at most 5 or 10 feet thick, and is generally found at or very near the surface; and not deeper than 20 to 30 feet. It appears to be more widespread in the slightly lower land along the Peconic River and minor headwater tributaries than in higher ground. It may have been first deposited by the wind as loess, shortly after the retreat of the ice sheets and before a vegetative cover had developed; and subsequently moved by running water and redeposited on lower land. Some of it may have originated as waterlain material, and some may be unreworked loess. The extent of the deposits is determined in part by hydrologic data.

These deposits are sufficiently fine grained so that they appreciably impede the movement of shallow ground water. They hold water at or near the land surface, and thus locally form swampy areas or ponds.

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Also, they impede the downward movement of water enough so that at times when the level in the main underlying water body declines, they support perched or semiperched water bodies. Similarly, when the level in the main underlying water body rises, these fine-grained deposits confine the water under slight artesian pressure. These relationships are areally complex because the deposits are discontinuous and occur close to the water table. The deposits affect the movement of shallow water into and out of the Peconic River and associated ponds, swamps, and drainage ditches in a rather complex way, and thus they have a bearing on the possible movement of contaminated waters in and outside the eastern part of the Laboratory area.

DEPOSITS OF RECENT AGE

Deposits of Recent age comprise gravel and sand on beaches, organic matter, silt and clay in tidal swamps, gravel, and sand and silt in stream channels. These deposits are thin and discontinuous, and they occur chiefly along the shores of the present Long Island Sound, the open ocean, bays behind barrier beach and various bars, and along the channels of the few larger streams. They are not sufficiently extensive to make it important to differentiate them from underlying deposits (almost everywhere the upper Pleistocene deposits) upon which they rest unconformably.

They are generally neither thick enough nor extensive enough to comprise any appreciable ground-water reservoirs. Nearly all these deposits are remote from the Laboratory and there is no immediate problem in regard to their possible contamination.

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Appendix 1-3-3
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Dan Raviv Associates, Inc.
Consultants in ground water hydrology, water quality and landfill hydrology

PHASE I EVALUATION
GEOHYDROLOGIC/WATER QUALITY CONDITIONS
SUFFOLK COUNTY AIRPORT AND VICINITY
WESTHAMPTON, NEW YORK

Job No. 83C146

Prepared
for the

Environmental Protection Bureau
New York State Department of Law

Attention: Nancy Sterns, Esq.
Norman Spiegel, Esq.
Greg Shkuda, Ph.D.

October 25, 1983
Revised: April 1984

5 Central Avenue, West Orange, New Jersey 07052 (201) 325-0806

(2) Well or sample depth (when available); and

(3) Month sampled

Water quality data presented on Figure 6 ranges from non-detected concentrations to about 1,000,000 ppb. Many of the compounds were reported as present and were not quantified. Taking into account that the high concentrations may have been an analytical error, a contaminated ground water area south of the tank farm can nevertheless be delineated.

Number of Detected Compounds

A graphic representation of the most frequently detected organic compounds in ground water versus the type of compound found was constructed (Figure 7).

The reported detection for the monitoring wells were tabulated for all compounds detected in two or more samples and were placed on the graph. This graph represents the frequency of compounds detected in ground water samples regardless of their concentrations.

4.2 Geology

The geology of the region has been extensively studied, primarily because of the importance of ground water to Long Island. Glacial deposits, consisting of till and outwash sands and gravels of Pleistocene Age, mantle much of Long Island. In this area, they are found to a depth of about 100 feet below sea level and unconformably overlie the sediments of the Cretaceous Magothy Formation on an erosional surface. The Magothy Formation consists of silts, sands, gravels, and clays and is reported to be 800 to 1,200 feet thick in this area (Jacob, 1968; Anderson & Berkebile, 1976). The underlying Cretaceous sediments and bedrock are not considered here because they are found well below the depth of the fresh water aquifer and the contamination.

Descriptions of samples obtained during drilling for installation of monitoring wells in the vicinity of the Suffolk County Airport indicate that the glacial material is composed primarily of fine to coarse sand with some silt and gravel. Glacial material is often variable in lithology and depositional mode within relatively small areas. Local variations could affect ground water quality, in particular clay particles may adsorb organic compounds in percolating water. Variations in depositional mode, resulting in different bedding structures, could affect ground water flow paths. Detailed logs, continuous from the surface to the total depth of any monitoring well should be obtained whenever possible.

The constructed hydrogeologic profiles (Figures 4 and 5) display the depths of some of the wells and the lithologies encountered. Based on available information about the area, the lithology is described in the profiles as fine to coarse glacial sands and gravels.

4.3 Geohydrology

Geohydrologic conditions of the region are known based on numerous investigations (Nemickas, 1982; Berkebile, 1975; Holzmacher, McLendon and Murrel, 1968). Underneath Long Island fresh ground water occurs in a lenticular shaped deposit overlying salt water. The deposit is thickest toward the center of the island, thinning rapidly along the coasts. The fresh ground water near the Suffolk County Airport is usually under phreatic water table conditions. As a result, the elevation of the water table generally parallels the topography. The principal aquifers in the area are the upper Glacial aquifer and the deeper Magothy aquifer. These aquifers have hydraulic properties which are similar. For the purpose of this study, we are mainly concerned with the upper Glacial aquifer. The transmissivity of the upper Glacial aquifer ranges from about 45,000 to 75,000 gallons per day per foot (gpd/ft) (Nemickas, 1982). The horizontal hydraulic conductivity is on the average about 350 ft/day and the specific yield ranges from 0.20 to 0.30. The saturated thickness of the aquifer is about 50 feet.

The water level contour map, constructed from the March 1982 measurements in the NYDOT wells indicate that the water table in the study area generally slopes to the south and is affected by streams to the SE and SW (Figure 3). We have assumed that these measurements indicate "static" conditions because: (a) most private wells in the area have not been in use since 1977; (b) we do not have pumping records from the SCWA supply wells along Meetinghouse Road to indicate variations in the pumping rate from 3,000 gpm; and (c) water level measurements have not been obtained from the monitoring wells on a consistent basis to indicate water level changes with time. Based on the water table elevations from Figure 3, the hydraulic gradient is on the order of 1.5×10^{-3} ft/ft. The velocity of ground water flow in the glacial aquifer is computed from on Darcy's Law:

$$v = \frac{Ti}{dn} \qquad (1)$$

where: v = acutal velocity of ground water, ft/day

T = transmissivity - ranges from 6,000 to 10,000 ft^2/day

i = hydraulic gradient, ft/ft

d = saturated thickness of the aquifer, feet

n = porosity, assumed equal to specific yield

The computed groundwater velocity is therefore about 0.6 to 1.5 ft/day.

The depth to water in the vicinity of the tank farm is on the order of 30-36 feet. The NYDOT elevations are tied into an assumed elevation which was adjusted for the construction of the contour map (Figure 3). Most of the elevations of the few other wells in which water levels have been measured are not known. Water levels in private wells usually cannot be measured due to the inaccessibility of the wells. Without water level measurements tied into an elevation, and taken at regular intervals over a period of time, it is difficult to correlate water table fluctuations with precipitation, stream flow, artificial recharge, or variations in pumpage. Since many of the wells are only installed into the top of the water table, relatively large variations in the water table elevation may not be measurable. As stated earlier, we have assumed that the NYDOT well measurements reflect current conditions. We have also assumed that the water table elevation does not fluctuate more than an inch or two in response to factors mentioned above and its configuration remains relatively constant.

The available depths to water were indicated on the hydrogeologic profiles (Figures 4 and 5). Some surface elevations, which were not available from the files, were approximated from the contours on the regional topographic sheet. These profiles display the general topography with relationship to the depth to water. In addition, considering the fact that the aquifer extends to a depth between 50 and 100 feet below land surface, it is apparent from the hydrogeologic profiles that ground water sampling is not representative of the total aquifer depth. In most cases, only the top few feet of the aquifer were sampled.

4.4 Surface Water and Recharge

The area south of the airport is bounded by two streams (Aspatuck and Quantuck Creeks) that join to form Quantuck Bay to the south. The Quogue Wildlife Refuge ponds and streams, which are on the east side of the airport, drain south into Quantuck Creek. Aspatuck Creek also flows south on the western side of Peters Lane. Although no culvert is present under the railroad and road to the north of Aspatuck Creek, it was noted through our field observation that this area (which is adjacent to the tank farm) slopes toward the creek.

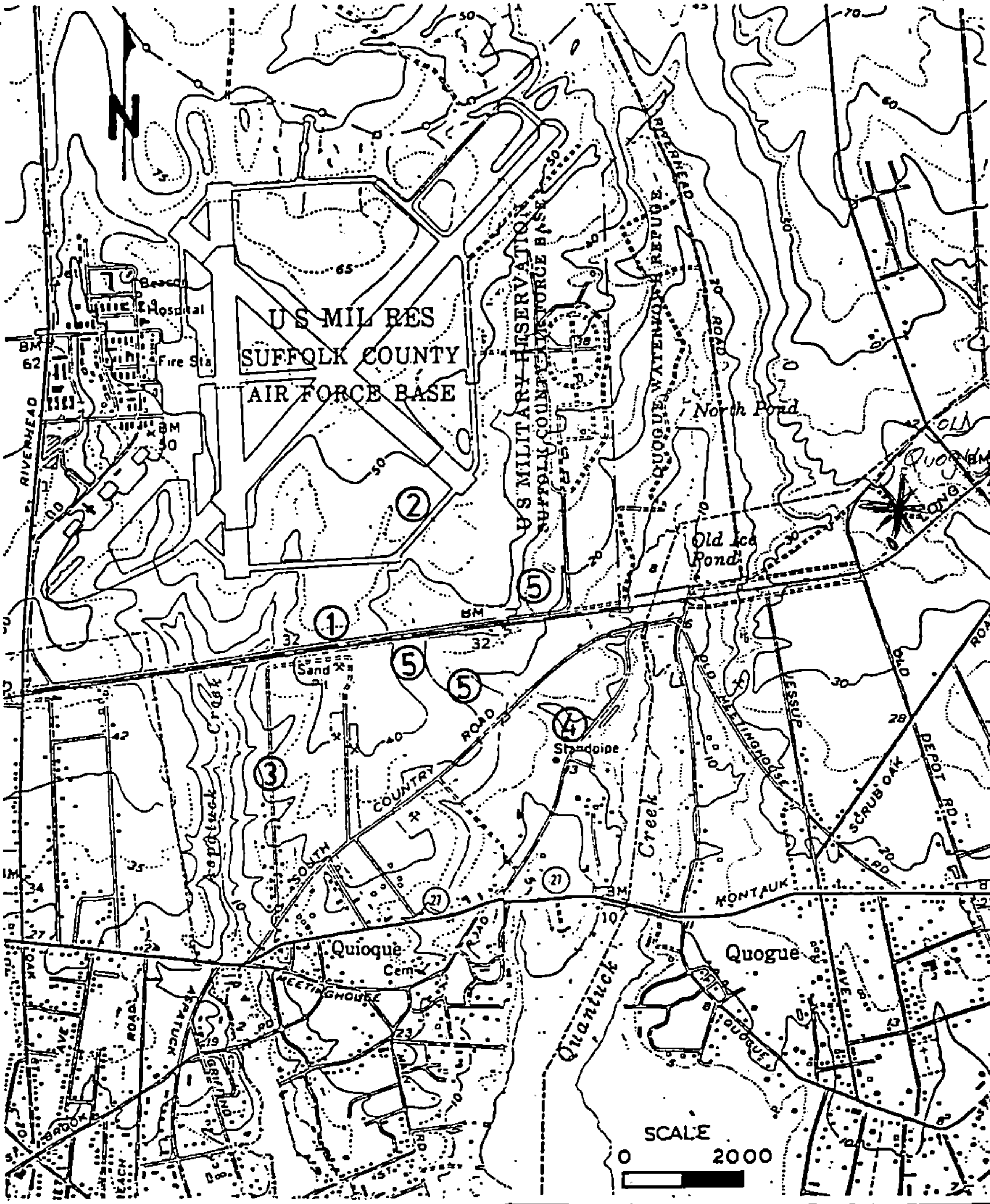
The average precipitation for the area is 43 inches per year, based on the 30-year precipitation records of the National Weather Service (Nemickas, 1982). The amount of overland runoff from precipitation is relatively low because the soil and subsurface are highly permeable. Much of the precipitation is infiltrated through the unsaturated zone to the water table. Therefore, the surface water consists mainly of ground water discharge.

The division between infiltration and runoff of a contaminant "slug" such as the 10,000 gallons of fuel spilled is dependent upon several factors including: precipitation amount and duration, land surface slope and the characteristics of the unsaturated material above the water table. It is generally assumed that the soils and glacial sands allow for rapid infiltration and recharge. However, based on local drainage, a spill of such magnitude could in part reach surface water bodies.

4.5 Water Quality

4.5.1 Ground Water

The water quality of the glacial aquifer in the area has generally been found to be potable in most parts. Iron, chloride and nitrate often occur in concentrations higher than drinking water standards of background concentrations. Concentrations of iron in the majority of water samples (March 1983) taken from the wells installed adjacent to the Quogue Wildlife Refuge were found to be above the New York State limits for drinking water (0.3 mg/l). The remaining parameters tested were within the drinking water standards. No volatile organics were detected in the surface water of the Wildlife Refuge. Other studies of the glacial aquifer ground water have found the water to be of good quality (Nemickas and Koszalka, 1982).



APPROXIMATE
LOCATION OF:

① TANK FARM

② FIRE PIT

③ PETERS LANE

④ SCWA WELL FIELD

⑤ LANDFILL

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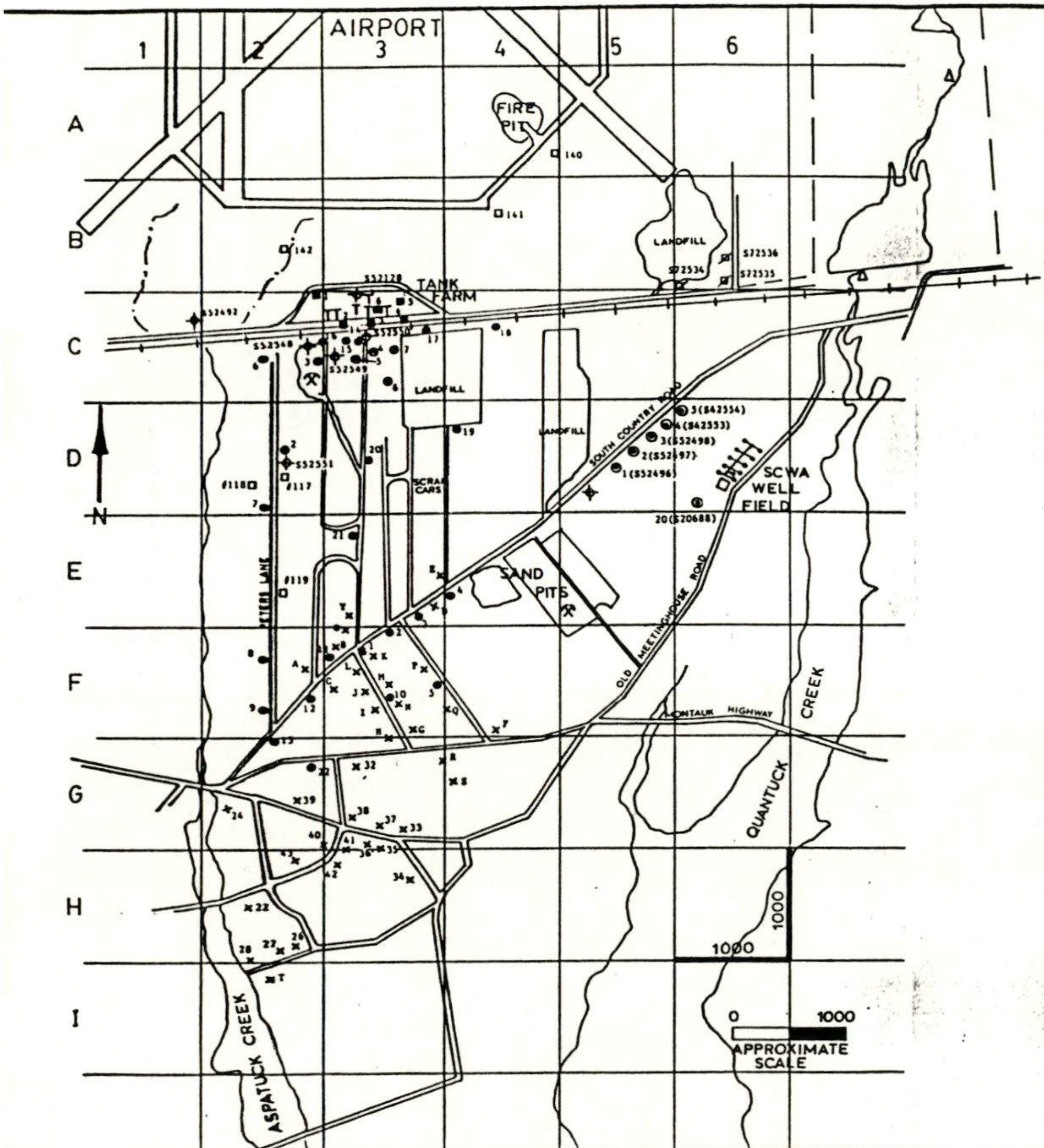
SUFFOLK COUNTY AIRPORT
PROJECT LOCATION MAP

NEW YORK DEPARTMENT OF LAW
ENVIRONMENTAL PROTECTION BUREAU

Prepared By JMH	Date AUG./SEPT. 1983
Job No. 83C146	Figure No. 1



WELL DESIGNATION AND DATA

SYMBOL	WELL NO.	DATE DRILLED	WELL DEPTH (ft.)	COMMENTS
■	NEW YORK AIR GUARD			
	1	MAY 1982	38	
	2	MAY 1982	38	
	3	MAY 1982	38	
	4	MAY 1982	38	
	5	MAY 1982	38	
	6	MAY 1982	26	
●	NEW YORK DEPARTMENT OF TRANSPORTATION (DOT)			
	1 - 22	MARCH 1982	-	SCREENED IN THE TOP OF THE WATER TABLE
⊗	SUFFOLK COUNTY DEPARTMENT OF HEALTH (SCDH)			
	2	DECEMBER 1981	82	REMOVED
	3	DECEMBER 1981	82	
	4	DECEMBER 1981	37	
	5	DECEMBER 1981	82	REMOVED
	6	DECEMBER 1981	40	
	7	DECEMBER 1981	40	
□	SCDH INVESTIGATION (MARKEL)			
	117	JUNE 1977	80	
	118	JUNE 1977	80	
	119	JUNE 1977	80	
	140	JULY 1977	80	
	141	JULY 1977	85	
	142	JULY 1977	85	
Ø	S72534	March 1982	62	
	S72535	March 1982	62	
	S72536	March 1982	22	
⌖	MONITORING WELLS OF SCDH SYSTEM			
	S52170	JUNE 1974	37	
	S52492	JULY 1974	8	
	S52548	AUGUST 1974	40	
	S52549	AUGUST 1974	43	
	S52550	AUGUST 1974	44	
	S52551	AUGUST 1974	29	
⊙	SUFFOLK COUNTY WATER AUTHORITY (SCWA) MONITORING WELLS			
	1(S52496)	AUGUST 1974	26	
	2(S52497)	AUGUST 1974	23	
	3(S52498)	AUGUST 1974	21	
	4(S52553)	AUGUST 1974	18	
	5(S52554)	AUGUST 1974	19	
	20(S20688)	JANUARY 1962	78	
	SCWA SUPPLY WELL FIELD			
	SUCTION SYSTEM	FROM 1903 TO 1962	FROM 46 TO 58	
X	PRIVATE, RESIDENTIAL			
	A	-	-	
	B	-	-	
	C	-	70	
	D	-	-	
	E	-	98	
	F	-	-	
	G	-	34	
	H	-	150	
	I	-	70	
	J	-	45	
	K	-	70	
	L	-	34	
	M	-	-	
	N	-	33	
	O	-	23	
	P	-	-	
	Q	-	-	
	R	-	28	
	S	-	-	
	T	-	-	
	Y	-	-	
	24	-	-	
	25	-	-	
	26	-	30	ESTIMATED DEPTH
	27	-	20	
	28	-	-	
	32	-	-	
	33	-	-	
	34	-	21	ESTIMATED DEPTH
	35	-	-	
	36	-	-	
	37	-	54	ESTIMATED DEPTH
	38	-	-	
	39	-	-	
	40	-	-	
	41	-	25	ESTIMATED DEPTH
	42	-	32	ESTIMATED DEPTH
	43	-	50	ESTIMATED DEPTH
	36	-	-	

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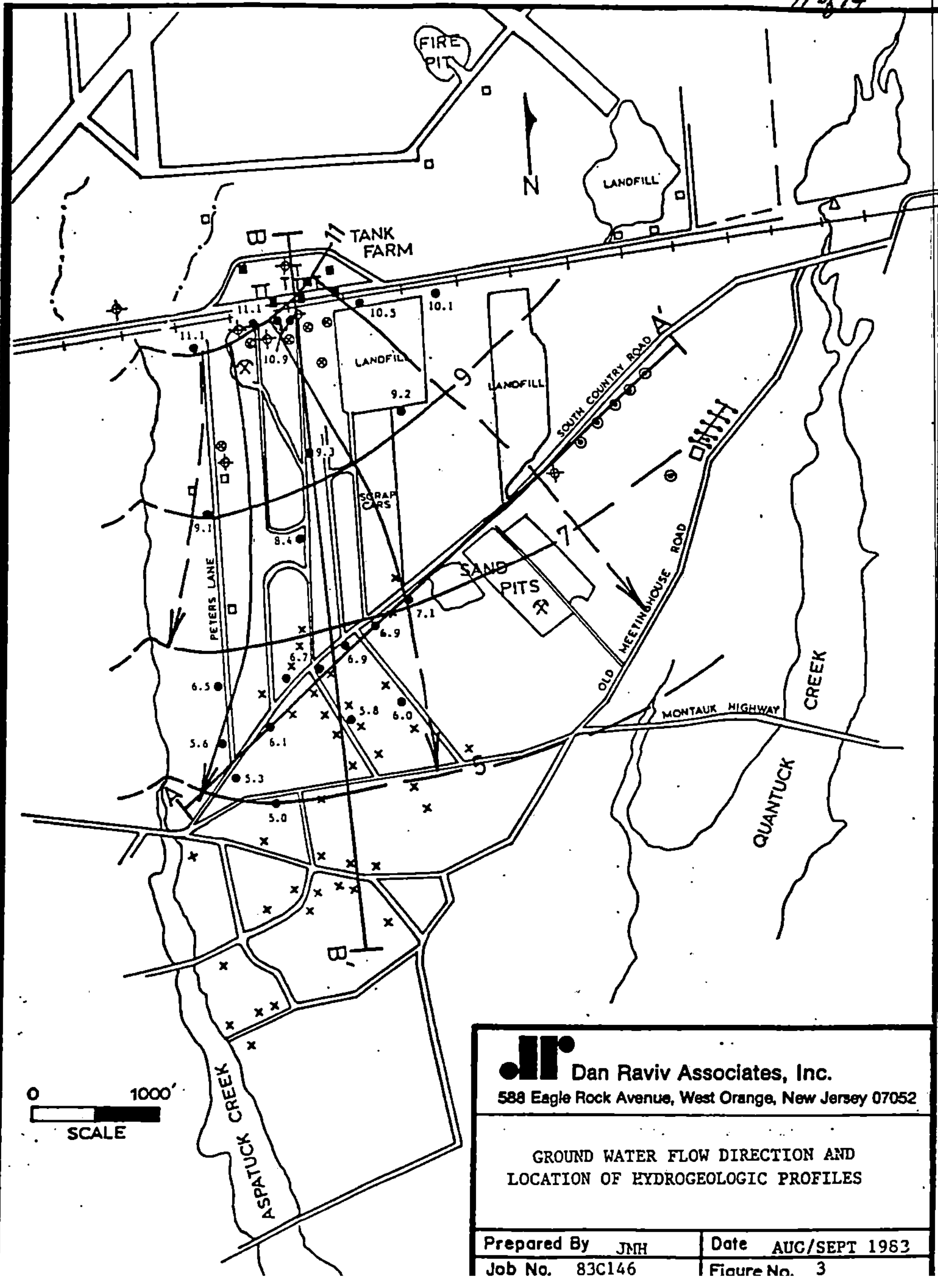
WELL LOCATION, OWNERSHIP, DESIGNATION AND INFORMATION

SUFFOLK COUNTY AIRPORT - NYSDOL

Prepared By JMH	Date AUG/SEPT 1983
Job No. 83C146	Figure No. 2



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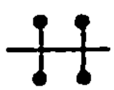
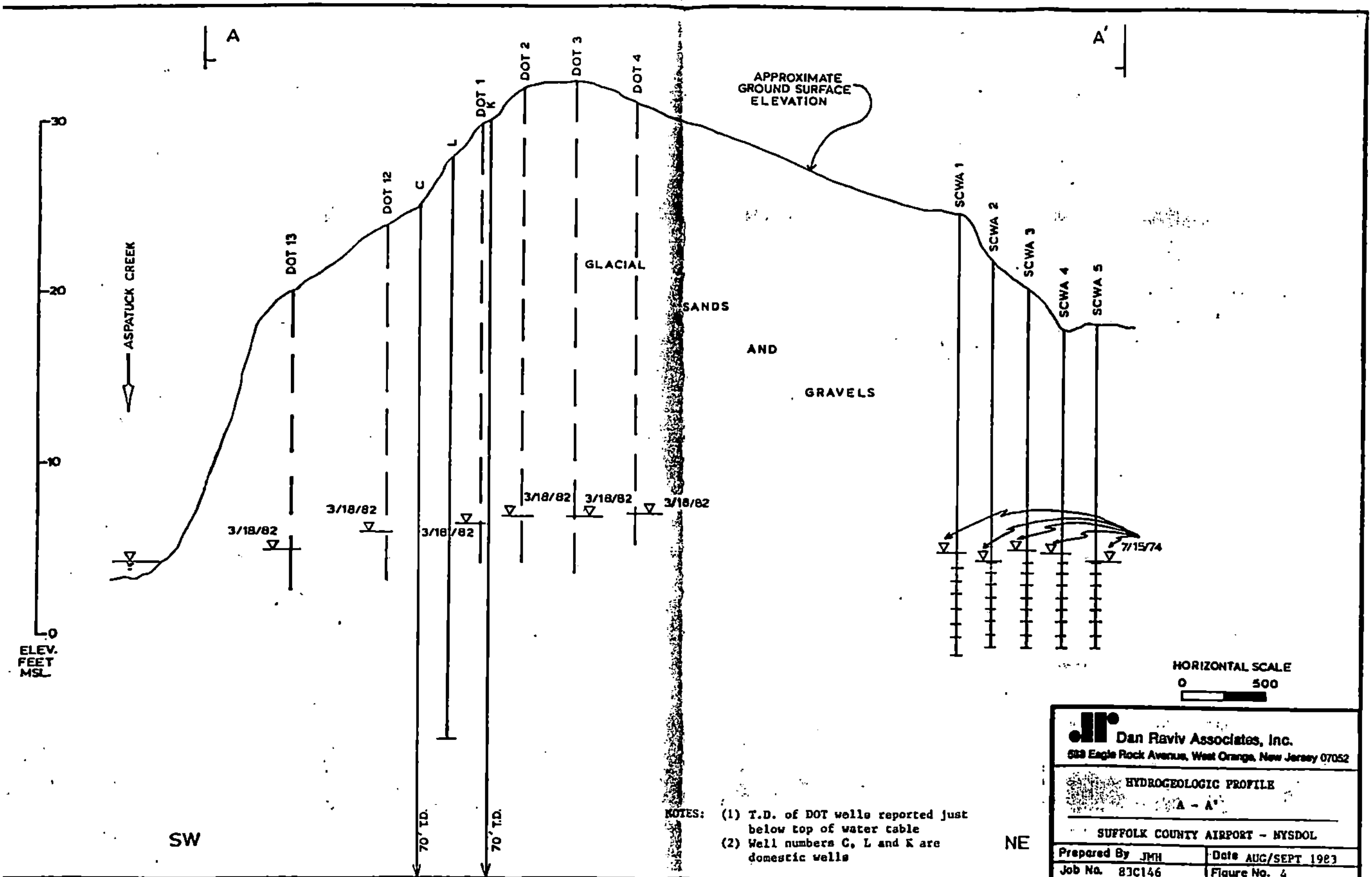
GROUND WATER FLOW DIRECTION AND LOCATION OF HYDROGEOLOGIC PROFILES

Prepared By JMH	Date AUG/SEPT 1983
Job No. 83C146	Figure No. 3

Figure No. 3 cont'd

EXPLANATION

SYMBOL	DESCRIPTION
●	NEW YORK DEPARTMENT OF TRANSPORTATION WELL Sampled 3/82
×	PRIVATE, RESIDENTIAL WELL Sampled 2-3/82
⊗	SUFFOLK COUNTY DEPARTMENT OF HEALTH (SCDH) WELL Sampled 12/81 & 3/82
⊙	SUFFOLK COUNTY WATER AUTHORITY(SCWA) MONITORING WELL Sampled 12/81 & 1/82
	SCWA PUBLIC SUPPLY WELLS
■	NEW YORK AIR GUARD WELL Sampled 5/82
△	QUOGUE WILDLIFE REFUGE WELL OR SURFACE WATER SAMPLE POINT Sampled 3/83
⌖	"S" MONITORING WELL OF SCDH SYSTEM
□	SCDH INVESTIGATION WELL (no sample data since 1977)



NOTES: (1) T.D. of DOT wells reported just below top of water table
(2) Well numbers C, L and K are domestic wells

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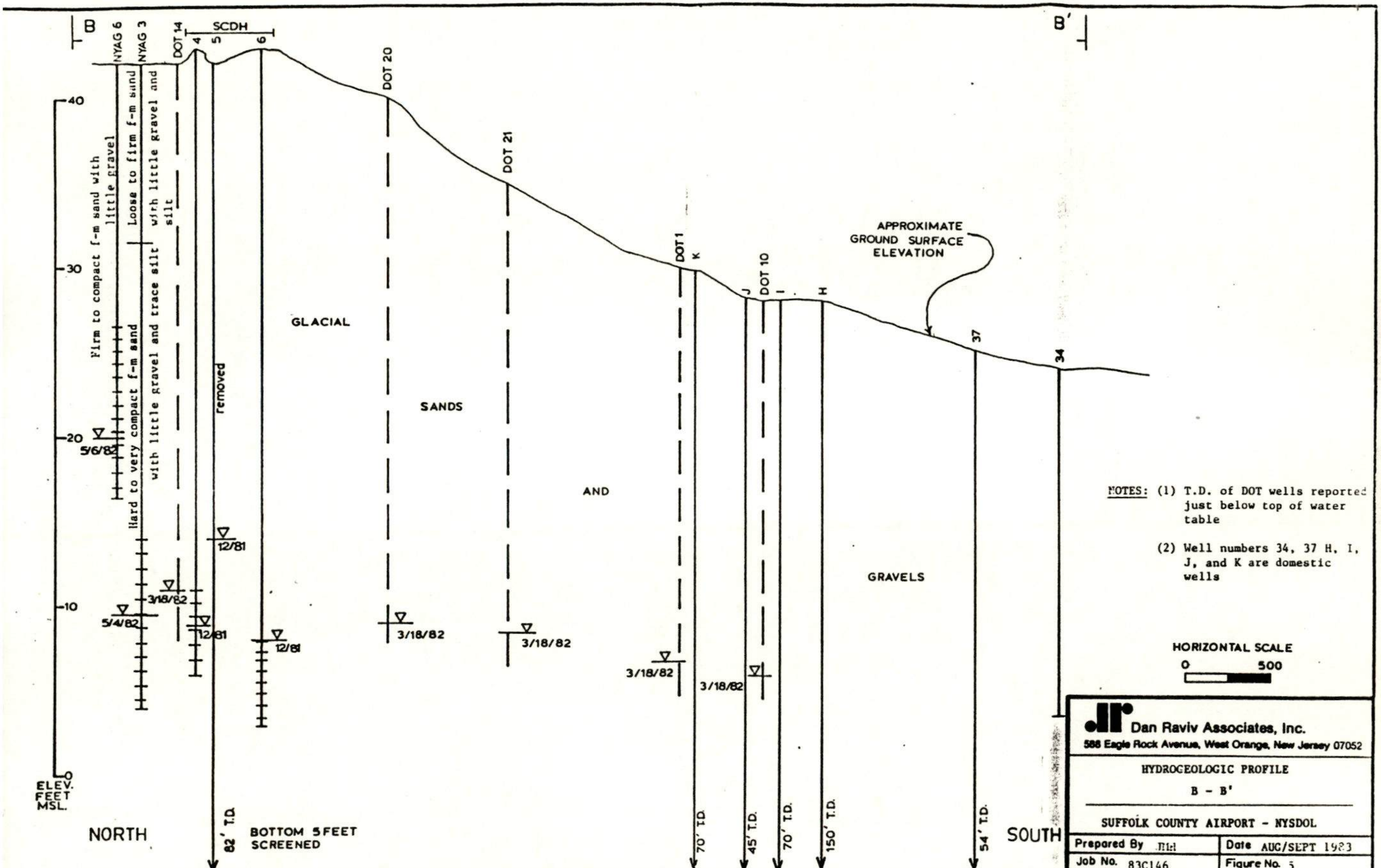
HYDROGEOLOGIC PROFILE
A - A'

SUFFOLK COUNTY AIRPORT - NYSDOL

Prepared By JMH	Date AUG/SEPT 1983
Job No. 83C146	Figure No. 4



B
B'
NYAG 6
NYAG 3
DOT 14
SCDH
4
5
6
DOT 20
DOT 21
DOT 1
K
J
DOT 10
I
H
37
34
Firm to compact f-m sand with little gravel
Loose to firm f-m sand with little gravel and silt
Hard to very compact f-m sand with little gravel and trace silt
removed
GLACIAL
SANDS
AND
GRAVELS
APPROXIMATE GROUND SURFACE ELEVATION
40
30
20
10
0
ELEV. FEET MSL.
5/6/82
5/4/82
3/18/82
12/81
3/18/82
12/81
12/81
3/18/82
3/18/82
3/18/82
3/18/82
NORTH
82' T.D.
BOTTOM 5 FEET SCREENED
70' T.D.
45' T.D.
70' T.D.
150' T.D.
54' T.D.
SOUTH
NOTES: (1) T.D. of DOT wells reported just below top of water table
(2) Well numbers 34, 37 H, I, J, and K are domestic wells
HORIZONTAL SCALE
0 500
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HYDROGEOLOGIC PROFILE
B - B'
SUFFOLK COUNTY AIRPORT - NYSDOL
Prepared By JHH
Date AUG/SEPT 1983
Job No. 83C146
Figure No. 5

148/14

Appendix 1.3-4
1 of 6

County Suffolk

ORIGINAL—TO COMMISSION

Well No. S-20688 (on preliminary report)

State of New York
Department of Conservation
Division of Water Resources

LOG

Ground Surf., El. ....ft. above s ....ft.

COMPLETION REPORT—LONG ISLAND WELL

Top of Well

Owner Suffolk County Water Authority, Layne #15

Address Oakdale, N. Y.

Meeting House Rd. Field

Location of well Quiogue, Southampton, N. Y.

Depth of well below surface 75' feet

Depth to ground water from surface 11' 3" feet

CASINGS:

Diameter	16 in.	16 in.	in.	in.
Length	50 ft.	1' 10" ft.	ft.	ft.

Sealing

Casings removed

SCREENS: Make Cook Openings Wire Wapped

Diameter	10 in.	in.	in.	in.
Length	26' 5-1/2" ft.	ft.	ft.	ft.

Depth to top from top of casing 48' 6" ft.

PUMPING TEST: Date 4/17/62 Test or permanent pump? Test

Duration of Test .... days 3 hours

Maximum Discharge 901 gallons per minute

Static level prior to test 11' 3" ft. .... in. below top of casing

Level during Max. Pumping .... ft. .... in. below top of casing

Maximum Drawdown .... ft.

Approx. time of return to normal level after cessation of pumping .... hours .... minutes

PUMP INSTALLED: NONE INSTALLED

Type .... Make .... Model .... H.P. 40

Motive power Electric Make U.S.

Capacity 700 g.p.m. against .... ft. of discharge head

No. bowls or stages .... ft. of total head

Avail 700 gpm

STATE OF NEW YORK WATER RESOURCES COMMISSION JUL 12 1962 REC'D

DROP LINE: SUCTION LINE:

Diameter .... in. .... in.

Length .... ft. .... ft.

Use of water Public Water Supply

Work started 2/19/62 Completed 4/17/62

Date 6/29/62 Driller Layne-New York Co. Inc.

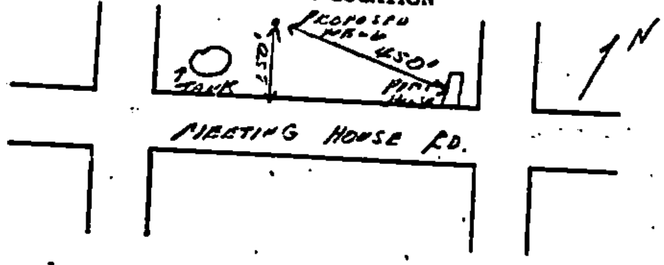
License No. 5

NOTE: Show log of well—materials encountered, with depth below ground surface, water bearing beds and water levels in each, casings, screens, pump, additional pumping tests and other matters of interest. Describe repair job.

See Instructions as to Well Drillers' Licenses and Reports—pp. 5-7.

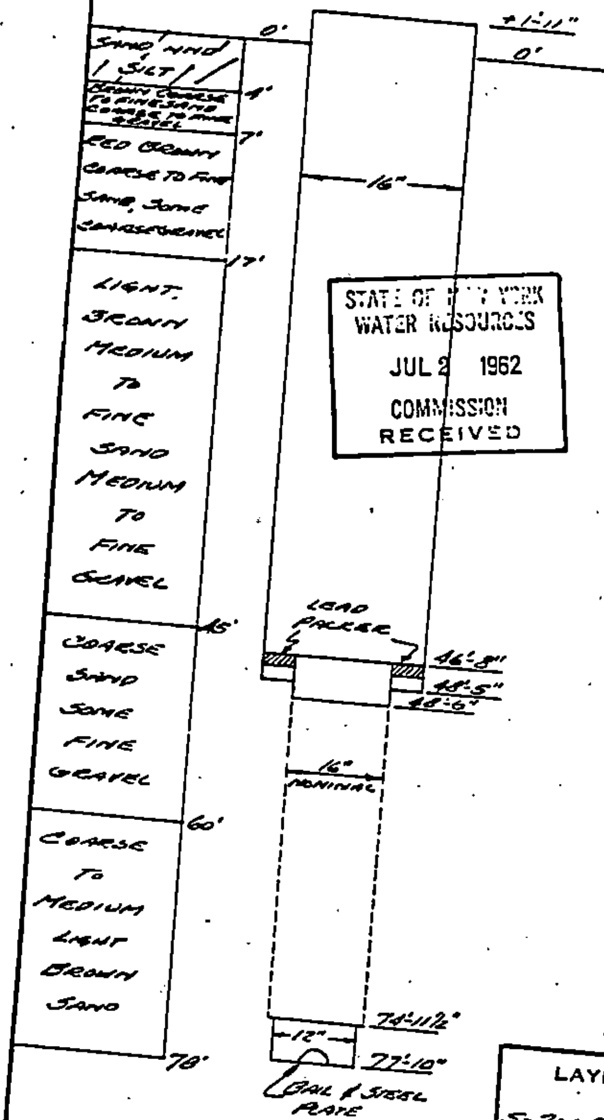
Blueprint of well attached. Static Level 11' 3"

SKETCH OF LOCATION



Locate well with respect to at least two streets or roads, showing distance from corner and front of lot.

Show North Point



Material

Pit: 50'-4" of 16" steel pipe welded
1'-10" of 16" nominal Everdur Cook blank with lead packer

Screen: 26'-5½" of 16" nominal Cook Everdur Type NN #25 slot

Plug: 2'-10½" of 12" steel pipe with bail & steel plate

Pump

Type	Shop No.
Setting	Size
Suction	Stages
Basket	Impellers
Discharge	Head
Tubing	Press B. P.
Shafting	Air Line

Motor

Make	Type
Volts	Cycle
Phase	Amp.
H. P.	R. P. M.
Frame	Form
Model	Serial
Upper Brg.	Lower Brg.

Well

Started 2-19-62	Static Level 11'-3"
First Test 4-17-62	Production 901
Final Test	Pumping Level 36'-3"
Accepted	Guarantee
Clear Depth	Press.
Method Cable Tool	

Driller: T. Gunderman

Installer:

LAYNE-NEW YORK CO. INC. LINDEN, N. J.
WATER SUPPLY CONTRACTORS

S-20688 Contract 364

Suffolk County Water Auth.
Meeting House Rd.,
Quiogue, Town of Southampton,
New York

DRAWN BY S&B
APPROVED BY
LAYNE WELL NO. 15
DRAWING NO.

County Suffolk

ORIGINAL—TO COMMISSION

Well No. S-53593

(on preliminary report)

State of New York
Department of Conservation
Division of Water Resources

LOG

Ground Surf., El.........ft. above
^
.........ft.
v
Top of Well

SEE ATTACHED

COMPLETION REPORT—LONG ISLAND WELL

Owner Suffolk County Water Authority

Address Pond Road, Oakdale, N.Y.

Location of well Spinney Rd, 300' N of Lewis Rd, E. Quogue

Depth of well below surface 161' feet

Depth to ground water from surface 38' 7¾" feet

CASINGS:

Diameter 20 in. ..... in. ..... in. ..... in.

Length 112' ft. ..... ft. ..... ft. ..... ft.

Sealing 50' Cement

Casings removed None

SCREENS: Make Johnson 316 SS Openings 60 Slot

Diameter 10" I.D. in. ..... in. ..... in. ..... in.

Length 40' ft. ..... ft. ..... ft. ..... ft.

Depth to top slot from top of casing 118' ft.

PUMPING TEST: Date 12/17/74 Test or permanent pump? Test

Duration of Test ..... days 8 hours

Maximum Discharge 1016 gallons per minute

Static level prior to test 38 ft. 7¾ in. below top of casing

Level during Max. Pumping ..... ft. ..... in. below top of casing

Maximum Drawdown 20 ft.

Approx. time of return to normal level after cessation of pumping ..... hours 2 minutes

PUMP INSTALLED:

Type ..... Make By others Model No. .....

Motive power ..... Make ..... H.P. .....

Capacity ..... g.p.m. against ..... ft. of discharge head

No. bowls or stages .... ft. of total head

D. E. C. REGION I
ENVIRONMENTAL ANALYSIS
JAN 13 1975
RECEIVED

DROP LINE: SUCTION LINE:

Diameter ..... in. ..... in.

Length ..... ft. ..... ft.

Method of Drilling (Rotary, cable tool, etc.) Reverse Rotary

Use of Water Public Supply

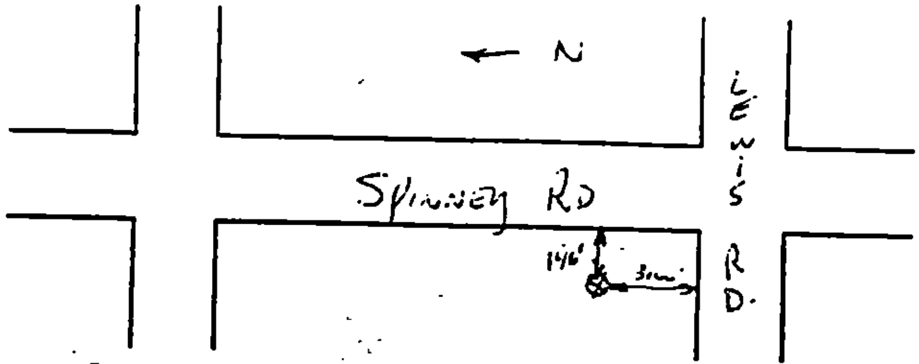
Work started 11/15/74 Completed 12/27/74

Date 1/9/75 Driller Strata Well Corp.

License No. 1000

NOTE: Show log of well—materials encountered, with depth below ground surface, water bearing beds and water levels in each, casings, screens, pump, additional pumping tests and other matters of interest...

SKETCH OF LOCATION



Locate well with respect to at least two streets or roads, showing distance from corner and front of lot.

Show North Point

STRATA WELL CORP.

2 Beech St.
ISLIP, N. Y. 11751
Phone 516 581-7100

WELL LOG

NAME Spinney Road [illegible]

TION 3,100 [illegible] Lewis Rd. E. [illegible] W.R.C. WELL NO. S-53593

RENCE PT. Grade S. W. L. [illegible]

STARTED 11/15/74 COMPLETED 12/27/74 DRILLER [illegible]

SAMPLE No.	Actual Depth	Lgth	Blows	Formation	Thickness	Depth	Remarks
				Sandy Loam	5	5	
				Coarse Sand & Gravel	100	105	
				Fine Brown Sand & Mica	6	111	
				Coarse Brown Sand, Gravel Stones to 5" Dia.	49	160	
				Fine Brown Sand, Mica	7	167	
				Brown Sand & Gravel (Fine to Med)			
				Hole Terminated At 175'			

Appendix 1.3-5
1 of 3

Hydrogeology of Suffolk County, NY
Jensen + Soren
1974.

UNITS

QUATERNARY

TERTIARY(?)

MAP UNITS

ARSH DEPOSITS
IDIFFERENTIATED
LAINE

L MORAINE

RAINE

ORAINE

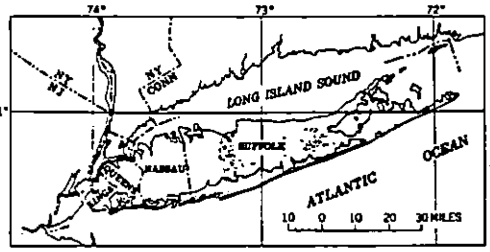
DIFFERENTIATED

NTIATED

INTRODUCTION

WATER NEEDS OF SUFFOLK COUNTY

Water pumped from aquifers underlying Suffolk County (index map) is the sole source of water used for public supply, agriculture, and industry. The county's population grew from less than 200,000 in 1940 to 1.1 million in 1970. Most of the growth occurred after 1950. Ground-water pumpage increased from 40 mgd (million gallons per day) in 1950 to 155 mgd in 1970 (New York State Department of Environmental Conservation, written commun., June 1, 1971). The projected ground-water use for an anticipated population of 2 million in the county by 1990 is 300 mgd (New York State Conservation Department, 1970, p. 26–27).



INDEX MAP SHOWING LOCATION (SHADED) OF SUFFOLK COUNTY

PURPOSE AND SCOPE

The large and growing demand for ground water in Suffolk County has created a need for a detailed knowledge of the geometry and the hydrologic characteristics of the ground-water reservoir. Mapping of subsurface geology and hydraulic heads in the aquifers are important prerequisites to obtaining this information. Maps of the subsurface geologic units of Long Island were first shown in a report by Suter and others (1949, pls. VIII to XXI). But those maps were highly generalized, because there were few data on deep borings and wells in the county when the report was prepared. Since 1949, additional data from many deep borings and wells in the county have been collected.

In 1968, as part of a continuing cooperative program of water-resources studies with the Suffolk County Water Authority and Suffolk County Department of Environmental Control, the U.S. Geological Survey began an updating of the hydrogeologic and hydrologic maps of all the county. The basic data in Jensen and Soren (1971), the first product of the program, are the basis for the hydrologic maps in this report.

ACKNOWLEDGMENTS

The authors appreciate the cooperation of well-drilling companies, their employees, and the many officials of public and private water companies who furnished geologic and hydrologic data for use in this report.

GEOLOGIC AND HYDROGEOLOGIC UNITS

Pleistocene glacial drift generally mantles the county's surface. Pleistocene deposits overlie unconsolidated deposits of Late Cretaceous age. The Cretaceous strata lie on a peneplain that was developed on Precambrian(?) crystalline rocks.

Major landforms include ridges, valleys, and plains. These landforms are roughly oriented in belts parallel to the county's length. The northern and the central parts are traversed by irregular sandy and gravelly ridges of terminal moraine. The crest of the northern ridge ranges in height from 100 to 300 feet above sea level and the crest of the central ridge from 150 to 400 feet. The highest altitudes in the inter-ridge area range from 100 to 200 feet. Irregular plains and rolling hills, formed from sandy and gravelly ground moraine and outwash deposits of sand and gravel lie in the area between the ridges. An outwash plain slopes at a near-uniform gradient from the southern base of the central ridge, which is about 100 feet above sea level, southward to Great South Bay and the ocean. Along the north shore, steep bluffs as high as 100 feet and generally narrow sandy and gravelly beaches face Long Island Sound. The barrier-bar system at the southernmost side of the county is composed of sandy beach and dune deposits. The highest altitudes of the barrier bars generally range from 10 to 45 feet.

The ground-water reservoir system of Suffolk County is composed of hydrogeologic units that include lenses and layers of clay, silt, clayey and silty sand, sand, and gravel. A hydrogeologic unit consists of a geologic unit or a group of contiguous geologic units classified by hydraulic characteristics. These units include aquifers, which are principal water sources, and confining layers, which separate the aquifers. The aquifers are, from the land surface downward, the upper glacial aquifer, the Magothy aquifer, and the Lloyd aquifer. The major areal confining layers are, in descending order, the Gardiners Clay, the Monmouth greensand, and the Raritan clay. The base of the ground-water reservoir is the crystalline bedrock. Characteristics of the geologic and the hydrogeologic units are summarized in the table, and the following data of hydrologic significance are shown on the maps: base of ground-water reservoir, altitudes of aquifers, altitudes and limits of confining layers, and distribution of surficial deposits. The hydrogeologic sections show the vertical relations of the units to each other.

The sharp angular shapes of some of the contours reflect the fact that in places the contours are drawn on stratigraphic tops of the hydrogeologic units and in places the contours are drawn on erosional surfaces. The sharp angles result from the juncture of a stratigraphic top and an eroded surface.

GROUND-WATER SYSTEM

RECHARGE AND DISCHARGE OF FRESH GROUND WATER

Precipitation is the sole source of fresh-water recharge in the county. Average annual precipitation is about 45 inches; it generally ranges from 40 inches at the eastern end of the county to 50 inches in the middle and is nearly evenly distributed over the year (Miller and Frederick, 1969, plate 1). About half the precipitation seeps into the ground and percolates downward to the water table to become ground water; nearly half the precipitation is returned to the atmosphere by evaporation and plant transpiration; and a small amount of the precipitation, about 5 percent, enters streams by direct runoff (Cohen and others, 1968, p. 36–40, and Cohen and others, 1970, p. 11 and 14).

Ground water moves to discharge seaward mainly by subsurface outflow to salty ground water that is hydraulically connected with the sea and by seepage into streams that discharge into tidewater.

More than 50 streams discharge fresh water into the bordering bays, Long Island Sound, and the ocean. Most of the surface divide for the streams that drain the county lies in the northern half and extends from Melville, on the west, eastward through the Centereach area to the vicinity of the Brookhaven National Laboratory. From the area of the Brookhaven National Laboratory, the divide bifurcates into branches that approximately traverse the central lengths of the county's north and south forks. Streams flow to tidewater north and south of the divides, except for the Peconic River, which flows eastward to tidewater from the branching of the divides.

The total annual streamflow discharging into tidewater from about 1945 to 1971 averaged 390 cfs (cubic feet per second), or 253 mgd, distributed as follows (D.E. Vaupel, written commun., January 1969, and A.G. Spinello, oral commun., August 1971): most of the discharge, 280 cfs, from the southern part of the county into Great South Bay and, to a lesser extent, into the ocean; 60 cfs into Peconic Bay and other bays, between the north and south forks; and 50 cfs from the northern part of the county into Long Island Sound. Ground-water seepage constitutes about 95 percent of stream outflow.

MAN-MADE CONDITIONS

The effects of man's development on the ground water of Suffolk County has primarily been the diversion of part of it by wells and a return of the used, and generally chemically altered, ground water to the soil and ground-water reservoir. Used ground water is currently returned to the ground-water reservoir principally through cesspools. Some waste water from industrial processes returns to the ground through seepage pits; and ground water pumped for air conditioning and industrial cooling is returned, with higher temperatures, through recharge wells to the ground-water reservoir. Ground water pumped for crop irrigation and lawn sprinkling mostly represents a net loss from the system by evapotranspiration. Artificial filling of marshy shore areas has probably reduced evapotranspiration.

In 1970, gross ground-water pumpage in Suffolk County was 155 mgd (New York State Department of Environmental Conservation, written commun., June 1, 1971). An unknown amount of the pumpage was consumed by evapotranspiration, and virtually all the remainder (probably more than 75 percent) was returned to the ground through local waste-disposal facilities.

MOVEMENT OF GROUND WATER

Ground water moves from three major drainage subareas toward discharge at or near the shore. These subareas are (1) the main land area of the county from the Nassau County boundary to a point near the Brookhaven National Laboratory, (2) the north fork, from the Brookhaven National Laboratory to Orient Point, and (3) the south fork, from the Brookhaven National Laboratory to Montauk Point. The ground-water divides of these subareas form a "Y"-shaped pattern that approximately coincides with the major surface-water drainage divides. The arms of the Y radiate from the general area of the Brookhaven National Laboratory through the centers of the north and the south forks. Ground water moves northward toward Long Island Sound and southward toward Great South Bay and the ocean; lesser amounts in the Brookhaven National Laboratory and Riverhead areas percolate eastward toward Peconic Bay. Ground-water drainage from the north-fork area moves northward to

QUALITY OF THE GROUND WATER

The concentrations of chemical constituents in the ground water in most of Suffolk County are generally below the recommended maximum limits of the U.S. Public Health Service (1962, p. 7). However, some local water-quality problems exist, both natural and man-made.

ACIDITY

The pH of ground water ranges from 5.5 to 7.2 but is generally less than 7.0. The water commonly is sufficiently acidic to be corrosive. The Public Health Service has set no standards on acidity of drinking water other than that it should not be excessively corrosive to the supply system (1962, p. 7). Accordingly, water from many public-supply systems is treated with alkaline compounds to reduce acidity before distribution.

DISSOLVED IRON

According to the U.S. Public Health Service (1962, p. 7), dissolved iron concentrations in drinking and culinary water should not exceed 0.3 mg/l (milligram per liter). Excessive iron impairs the taste of water and of food and beverages prepared with the water; it also stains laundry and stains and clogs plumbing fixtures. High iron concentrations, locally more than 1 mg/l, are common in water from the Magothy and the Lloyd aquifers. As a result, many public-water suppliers remove excessive iron.

CHLORIDE

Along the seaward margins of the county, the fresh ground water is underlain and bordered by salty ground water that is hydraulically connected to the ocean, the bays, or Long Island Sound. Zones of mixed water, called zones of diffusion, separate the fresh and the salty ground water. The thickness of these zones probably ranges from a few feet in the upper glacial aquifer to as much as 500 feet in the Magothy aquifer (Lusczynski and Swarzenski, 1966, p. 23). The chloride content of the ground water in the zone of diffusion ranges from less than 10 mg/l to that of sea water—about 18,000 mg/l.

Contamination of the fresh ground water with salty ground water associated with the upward and landward movement of the zones of diffusion has not resulted in the abandonment of many wells in Suffolk County. However, the long-term potential threat of increased contamination of this type is of concern to numerous agencies and individuals in the county. A detailed discussion of this potential problem is beyond the scope of this report; however, considerable insight to the problem can be obtained from reports by Crandell (1962, p. 17–19, and 1963, p. G28–G31), Perlmutter and DeLuca (1963, p. B31–B34), Lusczynski and Swarzenski (1966, p. F66–F69), Holzmacher, McLendon, and Murrell (1970, p. 247–271), Collins and Gelhar (1970, p. 144–150), and Soren (1971b, p. A31–A34).

DETERGENT CONSTITUENTS (MBAS)

More than 95 percent of the ground water used for domestic supply in Suffolk County is returned to the ground through cesspools, septic tanks, and similar structures. As a result, the ground water and the ground-water-fed streams locally contain measurable amounts of certain substances of sewage origin, including foaming agents derived from synthetic detergents, commonly referred to as MBAS or methylene blue active substance. MBAS has been noted mainly in water from the upper glacial aquifer (Perlmutter and Guerrera, 1970, p. B14) and in the streams (Cohen, Vaupel, and McClymonds, 1971). Apparently, little or no MBAS had been found in water in the Magothy and the Lloyd aquifers. Where MBAS has been found in the water, the content is commonly less than 0.5 mg/l, the maximum limit in public-supply water recommended by the U.S. Public Health Service (1962, p. 24). However, locally, as much as 5 mg/l has been found in the ground water; and in some areas the MBAS content of the water seems to be increasing. As a result, the Suffolk County Legislature recently (1971) passed a law banning the sale of certain detergents in the county. In addition, plans have been developed for the construction of widespread sanitary-sewer systems that will discharge treated waste water into the sea.

NITRATE

The amount of nitrate in the ground water of Suffolk County is of concern of water managers and health officials. According to the U.S. Public Health Service (1962, p. 7)

... Bays and Block Island Sound and southward into Moriches and Shinnecock Bays and the ocean.

Movement of water in the aquifers of Suffolk County is more rapid horizontally than vertically. This partly reflects the low vertical hydraulic conductivity of the near-horizontal interbedded clay and silt lenses and beds. The estimated average rates of horizontal movement in the upper glacial, the Magothy, and the Lloyd aquifers are 0.5, 0.2, and 0.1 foot per day, respectively, in areas remote from pumping wells, and hundreds of feet per day near the screens of pumping wells (Soren, 1971a, p. 16). Vertical rates of movement are described in the following section.

HYDRAULIC INTERCONNECTION OF AQUIFERS

The aquifers of Long Island are hydraulically interconnected. Layers of clay and silt within an aquifer, or clayey and silty units between aquifers, confine the ground water; but these units do not completely prevent the vertical movement of water through them.

On the average, the vertical hydraulic conductivity of and rates of vertical flow through the upper glacial aquifer are greater than those of all other hydrogeologic units in Suffolk County. The vertical movement of water through the Magothy aquifer is impeded by intercalated lenses and beds of clay and silt; but, locally, vertical movement through the aquifer is facilitated by the lateral discontinuity of clay and silt beds. Vertical movement of water through clay and silt beds of the Magothy aquifer is very slow. The Raritan clay effectively confines water in the underlying Lloyd aquifer because the Raritan clay is thick, is areally persistent, and is of very low hydraulic conductivity. Movement through the bedrock is negligible.

The contact between the upper glacial and the Magothy aquifers is not a smooth plane. Glacial deposits fill buried valleys that were cut in the Magothy aquifer, and these deposits are in lateral contact with truncated beds in the Magothy aquifer. In the buried valleys, water enters the Magothy aquifer at depths of hundreds of feet directly from the upper glacial aquifer. Near Huntington, a buried valley cuts completely through the Magothy aquifer and extends into the Raritan clay; in the Ronkonkoma basin, the Magothy aquifer seems to be nearly completely cut through; and along the north shore, where locally all the pre-Pleistocene deposits were completely eroded, the upper glacial aquifer is in contact with the full thickness of the Magothy aquifer. (See map showing altitude of top of Magothy aquifer and hydrogeologic sections, sheet 1.)

Where the upper glacial aquifer lies directly on sandy beds of the Magothy aquifer, good vertical hydraulic continuity exists between the two aquifers. Head losses between the water table in the upper glacial aquifer and the base of the Magothy aquifer in the area of the main ground-water divide in western Suffolk County (a vertical distance of as much as 900 feet) in 1968 generally were less than 2 feet (Soren, 1971a, p. 17–19). Furthermore, in areas of Long Island where ground-water withdrawals from both the upper glacial and the Magothy aquifers are large, the cones of depression in their water-level surfaces caused by pumping are similar in areal extent and configuration (Soren, 1971b, p. 15; and Kimmel, 1971, p. B227–B228). These observations confirm the high degree of hydraulic continuity between the two aquifers in many parts of the county.

In the south shore area, the Gardiners Clay and the Monmouth greensand effectively confine water in the Magothy aquifer; and the high degree of confinement helps to prevent the downward movement of salty ground water into the Magothy aquifer. Wells that tap the Magothy aquifer on the barrier bars yield fresh water and commonly flow at land surface.

Recharge to the Lloyd aquifer results from downward movement of water from the Magothy aquifer and from the upper glacial aquifer through the Raritan clay. The main recharge area of the Lloyd aquifer seems to be in the Ronkonkoma area. Head losses across a thickness of 150 to 180 feet of Raritan clay in the county generally ranged from 6 to 42 feet in 1968 (Soren, 1971a, p. 17).

GROUND-WATER LEVELS

THE WATER TABLE

The water table on Long Island was first mapped in 1903 (Veatch and others, 1906, pl. 12). At that time its highest point in Suffolk County was 100 feet above sea level, near Melville on the main ground-water divide near the Nassau County border, and was 70 feet above sea level at another high point on the divide in the Lake Ronkonkoma-Selden area. Subsequent maps show that water-table altitudes have continued to be highest in these two areas but had declined to 80 and 65 feet respectively in both 1943 and 1951 (Jacob, 1945, pl. 1; and Lusczynski and Johnson, 1951, pls. 1–2); recovered to 90 and 70 feet by 1958 (Lubke, 1964, pl. 5); and had reached new lows of 70 and 65 feet by 1968 (Soren, 1971a, p. 20). This latest significant decline probably resulted mainly from a regional drought from 1962 to 1966 (Cohen, Franke, and McClymonds, 1969, p. 1).

The water-table map shows the altitude of the water table in early 1971. At that time, in the Melville area it was about 5 feet higher than in 1968, and in the Lake Ronkonkoma-Selden area it was about 6 feet [illegible]

ground level of nitrate in ground water of Nassau and Suffolk Counties was less than 1 mg/l (less than 0.2 mg/l NO_3-N).

Numerous wells in Kings County (G.E. Kimmel, written commun., August 1971), Queens County (Soren, 1971b, p. A30–A31), Nassau County (Perlmutter and Koch, 1972), and Suffolk County (Harr, 1971) yield water containing more than 0.2 mg/l NO_3-N. Moreover, at least 50 wells on Long Island yield water containing more than 10 mg/l NO_3-N.

The amount of water having more than 0.2 mg/l NO_3-N, its rate of increase, and the depth at which it is found seem to increase westward on Long Island as a whole, as well as in Suffolk County. These relations probably largely reflect the westward increase in population density, the westward increase in the age of the communities, and the associated degree of contamination of the ground water related to man's activities.

In Suffolk County, the two major sources of nitrate nitrogen in the ground water are (1) disposal of waste water into the ground and (2) agricultural activities, especially those involving the use of fertilizers. A planned countywide sanitary-sewer system is intended to reduce sewage as a source of nitrate nitrogen in the ground water of Suffolk County.

GROUND-WATER PUMPAGE

Pumpage from Suffolk County's aquifers increased from about 40 mgd in 1950 to about 155 mgd in 1970, to supply a population that has been increasing rapidly since the end of World War II. The greatest increases in population and ground-water pumpage have been in the western part of the county. Before about 1960, wells tapping the upper glacial aquifer supplied nearly all the water used in Suffolk County. Since then, pumpage from the Magothy aquifer has increased, and in 1970, the wells tapping the Magothy aquifer supplied about one-third the water used. (See map showing areal distribution of major pumpage by aquifer 1970.)

CHANGES OF GROUND WATER IN STORAGE

An area of about 140 square miles in west-central Suffolk County is underlain by about 4.5 trillion gallons of fresh water (Soren, 1971a, p. 20). By extrapolation, the total fresh ground water beneath all the county is probably 4 to 5 times this volume.

Withdrawals of ground water have caused the water table in some parts of the county to decline as much as 25 feet from earliest known levels in 1903 (map showing net change in the position of the water table) and have probably caused a small regional but generally undetected landward advance of salty ground water. The decline of the water table reflects a loss of 60 to 80 billion gallons of fresh water from the ground-water reservoir between 1903 and 1971. However, this loss of ground water from storage is less than 1 percent of the total ground water in storage in Suffolk County.

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Appendix 1.3-6
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Hydrology of Brookhaven National Laboratory and Vicinity Suffolk County, New York

By M. A. WARREN, WALLACE DE LAGUNA *and* N. J. LUSCZYNSKI

STUDIES OF SITES FOR NUCLEAR ENERGY FACILITIES—
BROOKHAVEN NATIONAL LABORATORY

GEOLOGICAL SURVEY BULLETIN 1156-C

This report concerns work done on behalf of the U.S. Atomic Energy Commission

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STUDIES OF SITES FOR NUCLEAR ENERGY
FACILITIES—BROOKHAVEN NATIONAL LABORATORY

HYDROLOGY OF BROOKHAVEN NATIONAL LABORATORY AND VICINITY, SUFFOLK COUNTY, NEW YORK

By M. A. Warren, Wallace de Laguna, and N. J. Lusczynski

ABSTRACT

The Brookhaven Natonal Laboratory is in central Suffolk County, Long Island, New York. The area studied surrounds and includes the Laboratory and is referred to herein as the Upton area. It extends across the island in a band about 13 miles wide from the Atlantic Ocean to Long Island Sound between longitudes 72°45′ and 73°00′. Its climate is characterized by mild winters and relatively cool summers. Precipitation averages about 45 inches a year evenly distributed throughout the year. The soil and the immediately underlying sediments are generally sandy and highly permeable. Water penetrates them readily and except in periods of intense precipitation there is very little direct overland runoff to streams.

Permeable Pleistocene deposits, 100–200 feet thick, constitute the uppermost aquifer. It receives recharge from precipitation (the only source of fresh water on the island) and discharges mainly into streams, the ocean, and the sound and to a some lesser extent into lower aquifers. The lower aquifers, several hundred feet in total thickness, transmit water under artesian pressure from the high central part of the island toward its edges where it is discharged into streams or into bodies of salt water. Streamflow is supported throughout the year very largely by ground-water discharge.

Within this broad pattern the details of the movement and behavior of water are determined by the geology, the topography, and the seasonal and local distribution of precipitation. Tests at the Laboratory site indicated that under favorable conditions water may move from the land surface to the water table at a rate of about 30 feet per day. Under less favorable conditions it may move 1 foot a day or less.

The topography of the water table conforms only generally to that of the land surface. Ground-water divides between the small streams in the area differ significantly from topographic divides and explain apparent differences in the rates of discharge per square mile. At the Laboratory site most of the ground-water movement is southward toward the Atlantic Ocean, but part of it is eastward to Peconic Bay. Ground-water movement in a part of the Laboratory area is either to the south or to the east, depending upon the stage of the water table, and is controlled by the presence of relatively impermeable beds near the surface.

5 to 10 feet above mean high tide. Long Island was also visited by two hurricanes in 1954. Unconfined ground water in low-lying areas near the shore is salted by sea water blown inland during hurricanes.

The maximum depth of freezing in the soil zone is 15 inches; the average is much less. Because the soil is not frozen during most of the winter season, recharge to the water table is possible during the winter, and because evapotranspiration is low, most of the ground-water recharge does, in fact, take place during the colder months, from December to May.

PRECIPITATION

Precipitation, the only source of fresh water for the streams and ground water in the Upton area, is used here as the starting point of the hydrologic cycle. The average precipitation ranges from about 42 inches in the western part to about 46 inches in the eastern part of Long Island. In an average year, about 120 days have 0.01 inch or more of precipitation. Long Island is supplied with moisture from the Gulf of Mexico and from the Atlantic Ocean through the action of winds of cyclonic storms. The general current of the prevailing westerlies plays only a small part in producing precipitation in Long Island. Natural variations in precipitation are largely due to physiographic and storm-pattern factors.

The Upton area of Long Island has little relief and thus monthly, and especially yearly, precipitation does not differ much from one locality to another within the area. Such differences as do occur are due largely to local summer storms or to differences in the local details of the rain gage or its exposure. But, though geographic variations are not large, a careful study of cummulative records shows some variation in rainfall within the Upton area.

RECORDS AVAILABLE

Precipitation records for eight stations within a 13-mile radius of the center of the Brookhaven National Laboratory are used in this report. Three of these stations are on the Laboratory grounds; no two stations are more than 20 miles apart (fig. 1). The length of record at the end of 1953 ranges from 5 complete years (at two gages within the Laboratory area) to nearly 69 complete years at Setauket (tables 1 and 2). The earliest records are for 1864–82 at the village of Brookhaven. The record at Setauket began in 1885.

The rainfall records and the values for average, minimum, and maximum precipitation proved satisfactory for correlating precipitation with surface-water stages and flows and with ground-water levels. Precipitation data for periods of less than a month are discussed briefly, because they have some bearing on the problems of ground-water contamination (de Laguna, 1966).

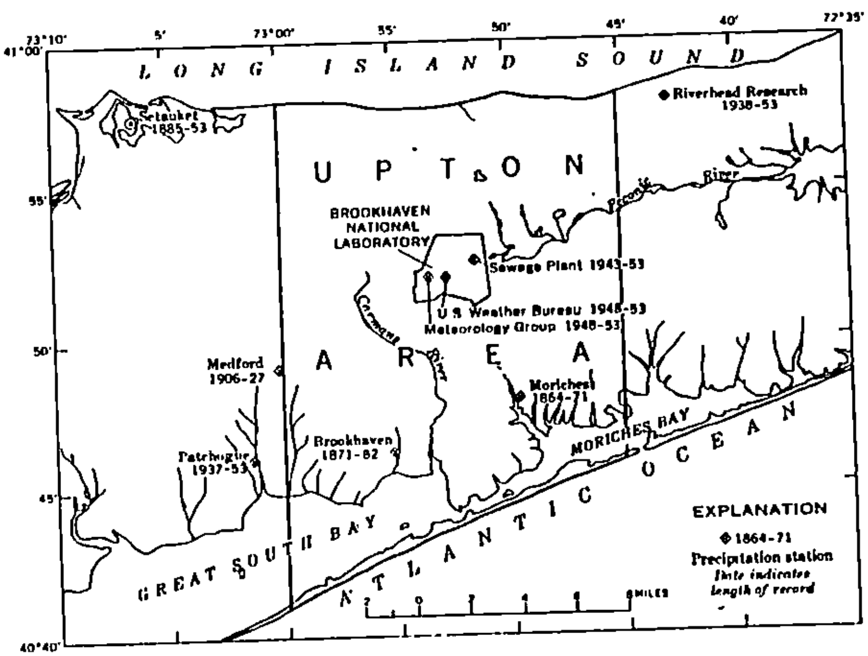

FIGURE 1.—Location of study area and precipitation stations.

The precipitation data for the 1864–71 period, listed for the village of Brookhaven, were actually collected at Moriches about 5 miles to the east. From 1871 to 1882 the data were collected at the village of Brookhaven, about 7 miles south of the present Laboratory area. This record, started under the sponsorship of the Smithsonian Institute (tables 1 and 2) before the establishment of the U.S. Weather Bureau, show that the average annual precipitation from 1864 to 1882 was 46.20 inches. This precipitation record includes the maximum and minimum yearly rainfalls for the Upton area, a high of 71.38 inches in 1869 (a year of a hurricane) and a low of 27.65 inches in 1881. The 2-year average for 1868–69 was 65.51 inches; the 3-year average for 1867–69 was 62.05 inches; and the 5-year average from 1865–69 was 59.61. These are all records and are considerably in excess of any recent data.

These data, especially those for 1865–69, are accepted with some reservation because they are much greater than those recorded at other stations along the northeastern seaboard. For example, precipitation in the city of New York, about 57 miles to the west, averaged 48.45 inches during this period, or about 11.16 inches less than that at Brookhaven. The present-day average at New York City is only 2–4 inches less than that for the Brookhaven area. Furthermore, the average precipitation reported for 1865–69 at Brookhaven was 0.35 inch higher

The average annual infiltration plus overland runoff for the 12 years was 22.59 inches. This value may also be computed from the average mean monthly temperatures and average precipitation for each of the calendar months, from which one may calculate average monthly evapotranspiration. From these 12 monthly averages, an average yearly rate of infiltration plus overland runoff of 22.06 inches may be calculated; it is 0.53 inch less than the average annual value found by computing by individual months (table 5), a difference of less than 5 percent.

SUMMARY OF COMPUTED RECHARGE

During the 12 water years from October 1941 to September 1953, the precipitation averaged 43.64 inches, evapotranspiration averaged 21–22 inches, and the residual (mostly recharge to ground water) averaged about 22 inches. During this period, the residual varied appreciably from month to month and from year to year. It was over 7 inches on 3 different months and was zero for about 2–3 months in an average year. The annual rate of infiltration (plus overland runoff) was as much as 31.99 inches in 1951–52, 29.33 inches in 1947–48, 26.93 inches in 1952–53, and as little as 11.70 inches in 1946–47.

Over a 50- to 100-year period, precipitation in the Upton area varies from a minimum of perhaps less than 30 inches per year to a maximum of perhaps more than 60 inches per year. The average annual evapotranspiration, over a similar period, will range from a minimum of 15 inches per year where the soil is very sandy to a maximum of 30 inches per year, and perhaps more, in swampy areas. Replenishment to ground water in the Upton area may, therefore, be as low as 10 inches in some areas in dry years and as much as 35 inches in other areas in wet years. Locally, recharge to ground water may even vary from practically nothing in some swampy localities, when precipitation is extremely low, to as much as 45 inches in sandy localities, when precipitation is extremely high.

GROUND WATER IN UPPER PLEISTOCENE DEPOSITS

OCCURRENCE

The 200 feet of upper Pleistocene deposits in the Upton area consists of sand and gravel, some silt and clay layers, and also some till in the two morainal areas. Water first enters through the soil zone. The zone of aeration, about 50–60 feet in average depth, serves both as a sizable underground reservoir and also as the conduit for water moving downward to the zone of saturation. Locally within the zone of aeration are bodies of perched and semiperched water, held up by layers of relatively impermeable material, one each in the northern, northwestern, and eastern sections of the Laboratory tract, and one east of the Laboratory tract beyond the peconic River. A few small areas of this kind occur in the extreme west-central section of the Upton area. The major areas underlain by relatively impermeable layers above the zone of saturation are shown on plates 1–4.

The zone of saturation in the upper Pleistocene deposits averages about 140–150 feet in thickness. This zone serves both as an immense storage reservoir and also as the principal conduit for water moving from points of recharge to points of discharge.

THE WATER TABLE

MAPS OF THE WATER TABLE

The water table in the Upton area is defined by the position of the static water level in wells ending in the zone of saturation in the upper Pleistocene and Recent deposits. Plates 1 and 2 show the position of the water table on August 29–31, 1951, and July 28–30, 1952. The water-level contours are based on readings in about 120 wells, 50 of them inside the Laboratory area, and also on the altitudes of the water surface in streams, ditches, ponds, and lakes at about 35 additional points. Only a few of the wells are plotted on plates 1 and 2. Plates 3 and 4 show the position of the water table on October 1–3, 1952, and April 25, 1953, and also the locations of all the observation wells within the Laboratory area.

NETWORK OF OBSERVATION WELLS

A table giving complete information on the location, owner, use, depth, method of construction, size of casing, screen setting, altitude of measuring point, and height above land surface for all wells used in this study is on file with the U.S. Geological Survey and State and Laboratory authorities. The well numbers, assigned by the New York State Water Power and Control Commission in chronological order, have no particular geographical significance. The letter S preceding the number signifies Suffolk County. The code numbers of the points used in determining surface-water stages were assigned by the Survey staff at Brookhaven National Laboratory. Letters C and P preceding the number are for measuring points on or near the Carmans and Peconic Rivers, respectively. Some points on the larger lakes or ponds are identified only by their names. The tables on file also give information on the location of all measuring points other than wells, and also their descriptions, altitudes, and the altitude of the accompanying bench marks.

Third-order accuracy (or better) was maintained in the leveling used to determine the altitudes of the measuring points at wells, of the surface-water observation stations, and of bench marks; that is, the error of closure of the level circuit, in feet, did not exceed the length of circuit, in miles, divided by 0.5. For short runs the allowable error of closure, in feet, did not exceed the number of setups divided by 0.008. All levels are referred to the 1929 mean sea-level datum of the U.S. Coast and Geodetic Survey. Observed water levels are accurate within at least 0.1 foot.

RELATION OF WATER TABLE TO SHALLOW, PARTLY CONFINING LAYERS

In some areas (see pls. 1–4) of low permeability, beds of silt or clay occur in the zone of aeration. In these areas, where shallow water is perched or semiperched, the water table is defined by water levels in wells screened below this material. The maximum depth of this retarding zone below land surface is about 30 feet; only at well S9123 east of the Laboratory was the bottom of the less permeable material found to be deeper, at about 50 feet below land surface. The water surface, mapped in plates 1–4 will be referred to as the water table, even though the water is confined to some degree part of the time in localities where less permeable material occurs at shallow depths.

In the Peconic River valley east of the Laboratory, from about Manorville to Riverland, an intersubstage (de Laguna, 1963, p. 32) occurs at about middepth in the glacial sands. In this locality the water-table map is based on levels in wells ending above this clay.

SIGNIFICANT FEATURES OF THE WATER TABLE

The shape of the water table reflects the location of areas of recharge, areas of discharge, and of the ground-water divides. (See pls. 1–4; fig. 34A.) The water table in the Upton area suggests the cross section of a bullet, flattened at the tip and pointing eastward; the south side is somewhat irregular. The depressions and troughs in the contour pattern are ground-water discharge areas.

In the Upton area, the main ground-water divides lies about 3–5 miles south of Long Island Sound and roughly parallel to it. East of the eastern boundary of the Laboratory tract a second ground-water divide appears, which defines the southern boundary of the area contributing ground water to the Peconic. The north branch of the divide extends beyond the Upton area into the North Fork of Suffolk County, and the south branch extends into the South Fork. There are not enough water-level data to define the south branch accurately.

North of the divide, ground water moves northward to Long Island Sound. South of the divide, the ground water moves southward to Great South Bay and Moriches Bay, either directly or by way of streams. In general, the ground water from the area between the two branches of the divide moves out eastward to the Peconic River and

Peconic Bay. Details of the movement vary with the stage and slope of the water table.

The highest part of the water table in the Upton area is the west-central section where it is about 55 feet above sea level; the lowest is along the shoreline, where it stands at about mean sea level. A few miles west of the Upton area (fig. 34A), the water table is about 60 feet above sea level (Lusczynski and Johnson, 1951). The slope of the water table ranges from more than 10 feet per mile to less than 2 feet per mile; in the Laboratory tract, the slope averages about 5 feet per mile.

DEPTH TO WATER TABLE

The depth to the water table in the Upton area ranges from less than 0.1 foot along the shorelines to more than 200 feet under the higher hills on the north shore and averages about 50–60 feet. North of the ground-water divide; and along the south branch of the divide, the average depth to the water table is about 80 feet; between the divides and to the south it is about 40 feet. Figure 8 gives five north-south profiles (pls. 1, 2) showing the water-table altitudes as of July 28–30, 1952, when the water table was slightly below the average stage for 1941–53. As the sections show, from the north shore the land surface rises abruptly about 150 feet or more to a line of hills, part of the Harbor Hill moraine. Here the depths to water are from 75 to 150 feet and locally even 200 feet. Just south of the Laboratory area, the water table is also relatively deep beneath another line of east-west hills known as the Ronkonkoma moraine. Profiles showing the approximate altitudes of the land surface and the water table are shown in figure 8. In the low land between the two moraines the water table is at somewhat shallower depths, and because this wide valley slopes gently eastward, in the eastern part of the Laboratory area and in the Manorville area the water table is even shallower, within 5–10 feet of the land surface. The Peconic River originates in this valley and flows eastward between the two moraines. The headwaters of the Carmans River also lie in this intermoraine belt. South of the Ronkonkoma moraine, the land slopes gently toward the south, and the depth to water decreases southward, so that the land surface and the water table converge.

Figure 9 shows the depth from the land surface to the water table in the Laboratory tract. The depths vary from less than 10 feet along streams in the eastern and northern parts of the Laboratory, to more than 80 feet in a belt extending from the center of the Laboratory tract, near the reactor, to the hospital in the southwest corner. The average depth to the water table is about 45 feet. Land-surface altitudes for this depth-to-water map were taken from the 10-foot con-

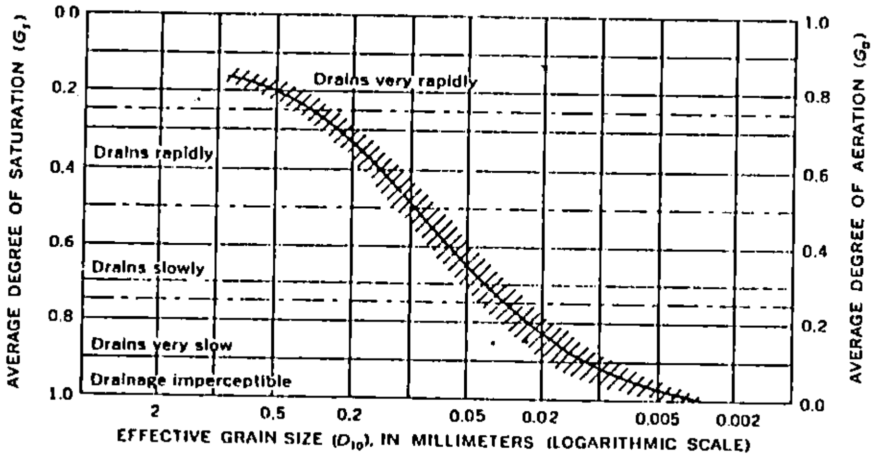

FIGURE 15.—Relation of effective grain size to average degree of liquid saturation in pores of unconsolidated formations (from field observations after Terzaghi, 1949). Diagonal lines represent probable range of seasonal variations.

to that of a sand composed entirely of grains of the effective size. The uniformity coefficient, also defined by Hazen, is the ratio of D_{60}/D_{10}, or the ratio of that grain size chosen so that 60 percent of the sample by weight is of a smaller grain size, to the effective size.

The effective size of nine samples from the upper 135 feet of well S6456 (table 6) near the center of the Laboratory area averaged 0.134 mm; the uniformity coefficient was 4.7. Samples from three wells, S6456, S6458, and S4660, selected by visual inspection as typical glacial outwash sand, were somewhat coarser grained, having effective sizes of 0.25, 0.17, and 0.30 mm and uniformity coefficients of 2.0, 2.4, and 1.8. Figure 15 shows that for a sand having an effective size of 0.20 mm, the percentage of liquid saturation ranges seasonally from 0.28 to 0.38.

TABLE 6.—*Effective size and uniformity coefficient of samples of sand, silt, and clay from well S6456*

Depth, in feet below land surface	Type of sample	Effective size, millimeter	Uniformity coefficient 60 percent size to 10 percent size
0–10	Auger	0. 23	2. 3
10–20	Core	. 35	15. 4
20–30	Bailer	. 16	2. 5
30–40	Bailer	. 18	2. 9
40–50	Bailer	. 088	4. 3
83	Bailer	. 096	4. 9
104	Bailer	. 15	3. 0
118	Bailer	. 085	5. 3
134	Bailer	. 19	2. 0
159	Bailer	. 14	2. 3
168	Bailer	. 20	2. 0
177	Bailer	. 092	2. 0
215	Core	. 13	3. 2

Such values appear reasonable for the glacial outwash sand in the Upton area. Both the porosity and the degree of liquid saturation of the glacial sand in the Upton area vary between wide limits under natural hydrologic conditions. Locally, under certain artificial conditions, the percent saturation has approached 100.

Veatch (Veatch and others, 1906) made many laboratory determinations of the porosity of the upper Pleistocene of Long Island, and the approximate average of these, 0.33, is used here. Specific yield and specific retention were determined from field tests; no attempt was made to determine these values in the laboratory from samples. The specific yield of the outwash sand in the Laboratory area was determined, from a 7-day pumping test, to be 0.24. The specific yield, found by filling and draining the pore space in a lysimeter built by de Laguna in 1953, was 0.26. This lysimeter, installed in the southeastern part of the Laboratory area where the average depth to the water table is 13 feet from land surface, is a vertical metal cylinder 12 feet deep and 5 feet in diameter and open at the top. It was set about 7 feet below land surface so that the bottom was 6 feet in the zone of saturation. In excavating and backfilling, care was taken to keep the material in approximately its original sequence and to compact it as nearly as possible to its original degree of compaction. However, the value of 0.24 from the pumping test is preferred because a much larger volume of sediments was involved.

A porosity of 0.33 and a specific yield of 0.24 gives a specific retention of 0.33−0.24, or 0.09. On the assumption that 0.28, the low value in the range of liquid saturation in figure 15, is approximately the fraction of the void space filled by specific retention, then specific retention is computed to be 0.28×0.33, or 0.092, which is in good agreement.

The flow-line pattern (fig. 19) in the vicinity of the well pumped during an aquifer test in December 1950 in the Laboratory area suggests that the vertical permeability of the outwash sand in the zone of saturation is about a fourth that of the horizontal permeability, or about 350 gpd per square foot. Results of an infiltration test, discussed in the following section, indicate that the vertical permeability may be as low as 75 gpd per square foot, or about one-eighteenth of the horizontal permeability.

RATE OF MOVEMENT IN THE LABORATORY AREA

High rates

If the sand is saturated with water, if the vertical permeability is 350 gpd per square foot, and if the porosity is one-third, then water will move downward in the zone of aeration at a rate of 140 feet a day.

DIRECTION AND RATE OF MOVEMENT OF GROUND WATER UNDER NATURAL CONDITIONS

Plates 1 and 2 show water-table contours for August 29–31, 1951, when the water table was about a half a foot below average, and for July 28–30, 1952, when the water table was 12 feet above average. The direction of ground-water flow may be taken as normal to these contours because the formation is almost isotropic. The rate of flow may be approximately determined by either of two independent methods, one of which is based on consideration of the quantities of water involved, and the other on the relation between transmissibility and the ground-water gradient.

The transmissibility of the upper Pleistocene aquifer is very close to 200,000 gpd at unit gradient. The water-table gradient is about 5 feet to the mile, so that in the Laboratory area each 1-foot width of the aquifer is carrying about 200 gpd, or 26.7 cubic feet per day, which represents a ground-water velocity of about 0.535 foot per day, or about one-third the velocity derived from consideration of the volume of recharge. Thus, in the belt between the Laboratory and the water-table divide, a large proportion of the ground-water recharge, perhaps two-thirds of the total, apparently moves into the deeper Cretaceous aquifers, and only the smaller part moves laterally through the upper Pleistocene aquifer.

A more detailed study of the direction and rate of movement of the ground water in the upper Pleistocene may be based on the map shown in figure 29. The solid flow lines in this figure are based on the water-table map for August 29–31, 1951, and the dashed flow lines on the map for July 28–30, 1952. In general, these lines follow much the same pattern, but, the slight changes in the contours of lines *C–D* and *C′–D′* produced a marked difference in the ultimate destination of the water.

The average annual recharge to the water table is about 22 inches. A strip of land 1 foot wide extending from the water-table divide for a distance of 1 mile in the direction of ground-water flow would contribute annually a volume of about 9,700 cubic feet. The water would flow from the lower end of the strip through the saturated part of the aquifer, about 150 feet thick, which has a porosity of about 0.33. The rate of movement is the same as if 9,700 cubic feet of water a year flowed through an opening 50 feet high and 1 foot wide, or about 195 feet per year or 0.535 foot per day. According to this method of analysis, the rate of movement at any point is directly proportional to the flow-line distance from the water-table divide; thus, under the center of the Laboratory tract, 2.5 miles from the divide, the rate of movement of the ground water would be about 1.6 feet per day.

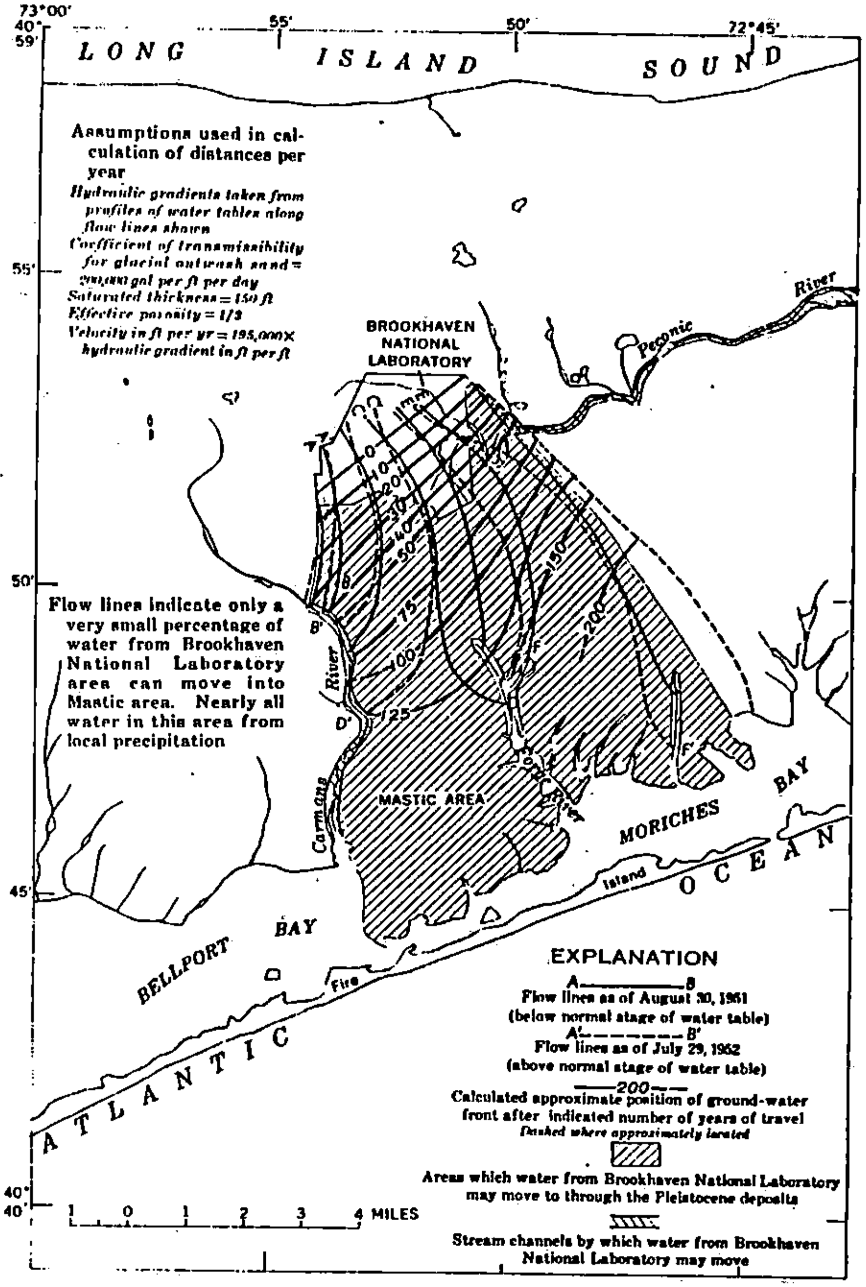

FIGURE 29.—Direction and time of travel of ground water laterally in upper Pleistocene deposits from the Brookhaven National Laboratory area to points of discharge.

Appendix 13-7
p1 of 1

WORKSHEET: COMMUNITY WATER SUPPLIES WITHIN A 3-MI RADIUS OF THE SITE Old Quogue Landfill

Community Water Supply	Water District	Well Field	Well	Depth (ft)	Aquifer
SCWA	WB	Spinney Rd	15-23184	118	Glacial
			25-53593	161	Glacial
	WB	Meeting House Rd	1S 01345	46	Glacial
			12S 27383	47	Glacial
			13-S 10328	47	Glacial
			14-S 10733	58	Glacial
			15-S 12702	56	Glacial
			16-S 17577	58	Glacial
			17-S 17576	56	Glacial
			18-S 20686	55	Glacial
			19-S 20687	55	Glacial
			20-S 20688	78	Glacial
			21-S 64716	59	Glacial

Sources:

SCDHS Water Resources Division. Supply and Monitoring Well Location Maps.
SCWA. 1984. Well Descriptions.
SCWA. 1985. Distribution System Plates: 16-18H, 16-18G, 17-18I.
SCWA. 1986. Active Services Estimates and Service Area Map.
NYSDOH. 1982. New York State Atlas of Community Water System Sources
SCWA 1986. Data from Mr. Wm. Schickler, Chief Engineer.

* These wells are all part of a suction header system

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COMMUNICATIONS RECORD FORM

Distribution: ( ) L. Wilson, ( ) ______
( ) ______, ( ) ______
( ) Author A. Lapins

Person Contacted: Dennis Moran Date: 2/4/86

Phone Number: 518/348-2891 Title: Public Health Engineer

Affiliation: SCDHS, Div. of Envtal Health Services Type of Contact: ______

Address: ______ Person Making Contact: Andris Lapins

Communications Summary: Re: Town of Southampton's Municipal Well Fields -> Quiogue and Hampton Bays

- Both well fields probably owned by SCWA
- Quiogue well fields:
  - 2 wells on Meeting House Rd -> S10345 and S20688
  - Both wells currently in use and are in compliance with all applicable drinking water standards -> no ~~[illegible]~~ water quality problems.
  - 1 well is 78" deep, screened into the glacial aquifer and has an approved capacity of 700 gpm. Not sure which well and has no data on other well; can get detailed info. from SCWA directly.
  - in 1980 pumped 194 million gals. over ->

(see over for additional space)

Signature: Andris Lapins

Communications Summary (cont.): Hampton Bays " " water District

- 2 well fields 7 wells total
  - 3 wells located on Bellows Rd:
    558350, 558351, 558352

  - 558350 → 150' deep, 26' of screen, "glacial wells", 500 gpm approved capacity.
  - 558351 → 146' deep, 26' of screen, 500 gpm
  - 558352 → 136' deep, 26' of screen, 500 gpm

- 4 wells located on Punk Log Rd:

515687	524848	531636	550970
108' deep	123'	120'	208'
22' of screen	23'	30'	20'
500 gpm Approv. Capac.	500 gpm	750 gpm	750'

- All wells in Hampton Bays water district are in compliance w/ all applicable drinking water standards i.e. - No water quality problems.

- For further information contact Suffolk Co. Water Authority (SCWA)
  Re: Well specs,

Signature: [signature]

Note:
- Quiogue well fields located w/in 1 mile (downgradient) of Quiogue LF, Old Quogue LF, and Suffolk Airport sites (C & D & K-4) sites.
- Hampton Bays well field located w/in 1.5 miles (downgradient) of Hampton Bays LF site.

(47-15-11 (10/83)

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

DIVISION OF SOLID AND HAZARDOUS WASTE

INACTIVE HAZARDOUS WASTE DISPOSAL SITE REPORT

PRIORITY CODE: ______ SITE CODE: 152050

NAME OF SITE: Old Quogue Landfill REGION: I

STREET ADDRESS: Old Country Road

TOWN/CITY: Quogue COUNTY: Suffolk

NAME OF CURRENT OWNER OF SITE: Village of Quogue

ADDRESS OF CURRENT OWNER OF SITE: Jessup Avenue, Quogue, New York 11959

TYPE OF SITE: OPEN DUMP [X] STRUCTURE [ ] LAGOON [ ] LANDFILL [X] TREATMENT POND [ ]

ESTIMATED SIZE: 2 ACRES

SITE DESCRIPTION:

Site is 2-acre landfill located along south shore of Long Island at an elevation of 35 ft. Regional slope is 1-2 percent to the northeast, site is flat. Landfilling began around 1930 and ended in 1973. Household garbage, scrap wood, tree and brush debris, broken concrete, and old dirt fill were buried at this site. Much of the garbage was burned over the years. The site has been covered with 1-2 ft of soil and officially closed.

HAZARDOUS WASTE DISPOSED: CONFIRMED [ ] SUSPECTED [ ]

TYPE AND QUANTITY OF HAZARDOUS WASTES DISPOSED:

TYPE	QUANTITY (POUNDS, DRUMS, TONS, GALLONS)
None documented.	

TIME PERIOD SITE WAS USED FOR HAZARDOUS WASTE DISPOSAL:

________, 19 ___ TO ________, 19 ___

OWNER(S) DURING PERIOD OF USE: Village of Quogue

SITE OPERATOR DURING PERIOD OF USE: Same

ADDRESS OF SITE OPERATOR: Jessup Avenue, Quogue, New York 11959

ANALYTICAL DATA AVAILABLE: AIR [ ] SURFACE WATER [ ] GROUNDWATER [ ] SOIL [ ] SEDIMENT [ ] NONE [X]

CONTRAVENTION OF STANDARDS: GROUNDWATER [ ] DRINKING WATER [ ] SURFACE WATER [ ] AIR [ ]

SOIL TYPE: sandy loam

DEPTH TO GROUNDWATER TABLE: 30 ft

LEGAL ACTION: TYPE: ________ STATE [ ] FEDERAL [ ]

STATUS: IN PROGRESS [ ] COMPLETED [ ]

REMEDIAL ACTION: PROPOSED [ ] UNDER DESIGN [ ]

IN PROGRESS [ ] COMPLETED [ ]

NATURE OF ACTION: ________

ASSESSMENT OF ENVIRONMENTAL PROBLEMS:

None documented.

ASSESSMENT OF HEALTH PROBLEMS:

None documented.

PERSON(S) COMPLETING THIS FORM:

FOR NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION	NEW YORK STATE DEPARTMENT OF HEALTH
NAME EA Science and Technology	NAME
TITLE	TITLE
NAME	NAME
TITLE	TITLE
DATE: 19 June 1986	DATE: