EPA WORK ASSIGNMENT NO: 076-2JZZ
EPA CONTRACT NO: 68-W8-0110
FOSTER WHEELER ENVIRONMENTAL CORPORATION
ARCS II PROGRAM

# FINAL
# SCREENING SITE INSPECTION (SSI)
# BAY SHORE GAS PLANT
# BAY SHORE
# SUFFOLK COUNTY, NEW YORK
# CERCLIS NO: NYD986881654

SEPTEMBER 1997

VOLUME I OF III

NOTICE

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FOSTER WHEELER ENVIRONMENTAL CORPORATION

September 30, 1997
ARCS II-97-076-0035

Ms. Catherine E. Moyik
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US Environmental Protection Agency
290 Broadway
18th Floor
New York, New York 10007

**SUBJECT: ARCS II PROGRAM - EPA CONTRACT NO. 68-W8-0110**
**WORK ASSIGNMENT 076-2JZZ**
**SCREENING SITE INSPECTION (SSI) REPORT**
**BAY SHORE GAS PLANT**

Dear Ms. Moyik:

The following is a summary of the Screening Site Inspection (SSI) evaluation of the Bay Shore Gas Plant site, CERCLIS No. NYD986881654, located in Bay Shore, Suffolk County, New York (See Figure 1).

**General Description and Site History**

The Bay Shore Gas Plant property consists of two parcels of land separated by Clinton Avenue; Bay Shore property - 4.5 acres to the east, and Brightwaters Yard - 5.8 acres to the west. The former plant property is located in a mixed commercial and residential area shared by the Villages of Bay Shore and Brightwaters in the Town of Islip, Suffolk County, New York (Ref. 3, p. 16 of 145). The former gas plant manufactured carburetted water gas from 1898 to 1952, and oil gas from 1952 through 1973 (Ref. 4, p. 2 of 14). Manufactured gas operations took place on the Bay Shore Property, and fuel oil and various process byproducts were stored in the Brightwaters Yard (Figure 2; Ref. 3, p. 16 of 145). The Long Island Lighting Company (LILCO) currently owns the property and conducted the gas operations at the facility (Ref. 3, p. 16 of 145).

A short history of gas manufacturing activities at the Bay Shore Gas Plant indicates that the original plant was built in 1898, with three expansions to increase capacity in the years 1927, 1940, and 1947 (Ref. 4, p. 2 of 14). Prior to 1952, the plant produced carburetted water gas. Subsequent to the nationwide introduction of natural gas in 1952, the distribution system was

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SCALE: 1" = 2000'

FIGURE 1
SITE LOCATION MAP
BAY SHORE GAS PLANT SITE
BAY SHORE, NY

N
W E
S

Prepared By
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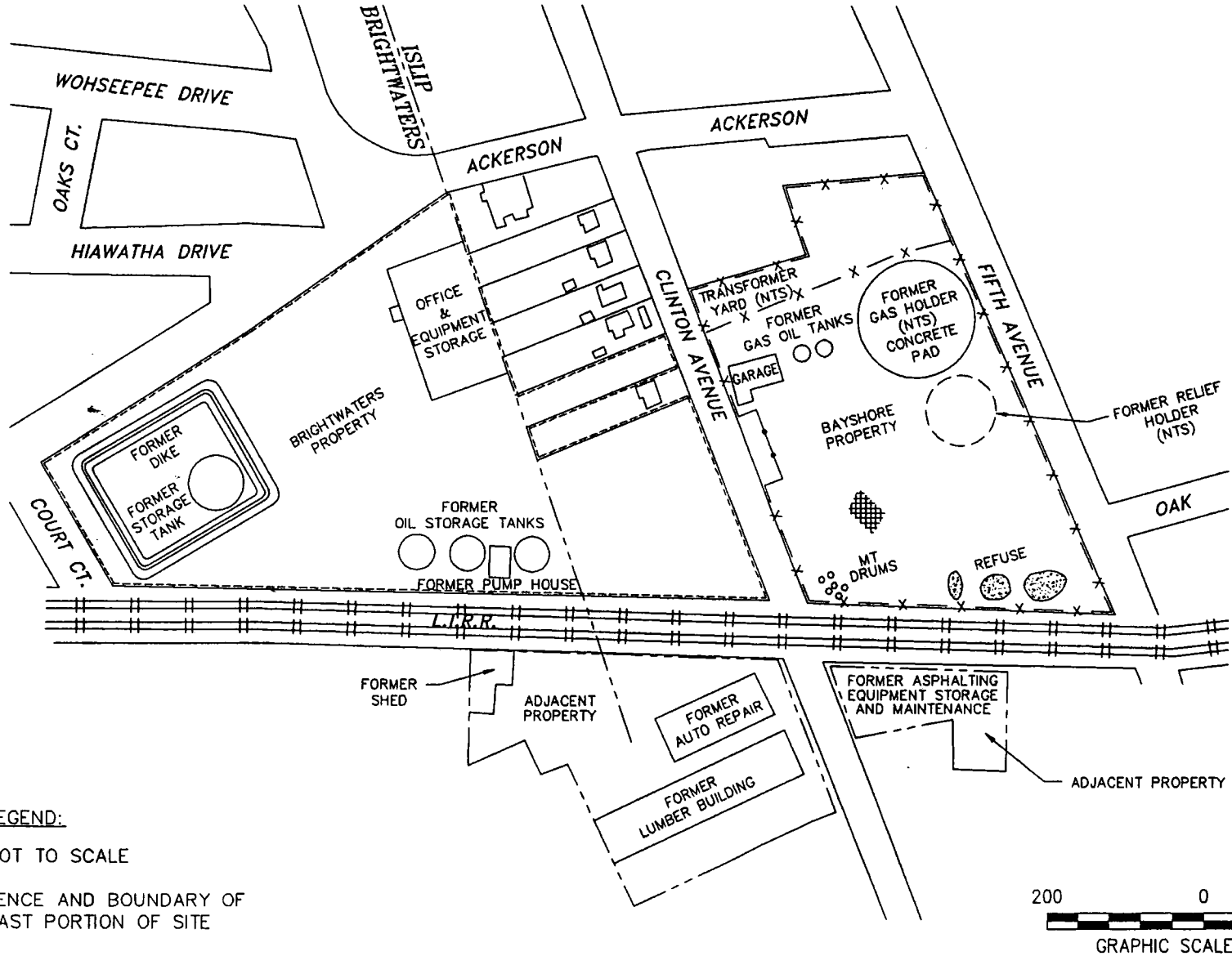


LEGEND:

(NTS) – NOT TO SCALE

—x— FENCE AND BOUNDARY OF EAST PORTION OF SITE

------- INFERRED BOUNDARY OF WEST PORTION OF SITE

FORMER LOCATION OF LEACHING PIT (NTS)

—•—•— GATE (NTS)

## SITE MAP

**BAY SHORE GAS PLANT**
**BAY SHORE, N.Y.**

**FOSTER WHEELER ENVIRONMENTAL CORPORATION**

**FIGURE 2**

converted to natural gas delivery, and the plant itself was converted to producing oil gas to augment the natural gas supply and to act as a training and equipment testing facility (Ref. 4, p. 2 of 14).

Various fuels were utilized in the production of the manufactured gas as the production process was modified over the years. Original design for the plant called for coke and "gas oil" (No. 2 fuel oil) to be used in obtaining the gas end product (Ref. 4, p. 2 of 14). From 1947 to 1952, No. 6 fuel oil was added to the process mix (Ref. 4, p. 2 of 14). Processed gas was "scrubbed" by wash boxes and condensers, before entering a relief holder aboveground storage tank for temporary storage, followed by further cooling and purification and final storage (Ref. 4, p. 2 of 14). The introduction of the oil gas process in 1952 required the use of naptha (napthalene) as the basis for gas production (Ref. 4, p. 3 of 14).

Transfer systems for the fuel oils (Nos. 2 and 6), naptha, and later a fuel known as H-fuel, moved the fuel from storage locations on the Brightwaters Yard across the property to the plant location on the Bay Shore Property (Ref. 4, p. 3 of 14). There was potential for various process wastes such as scrubber, condensing, and purification tars and condensed oils to be stored (prior to re-sale) on the Brightwaters Yard as well, or disposed of in on-site disposal pits or an on-site wastewater treatment system (Ref. 4, p. 3 of 14).

Investigations at the site were initiated in 1949, when LILCO received complaints from residents directly south of the plant along Fifth Avenue concerning oil in basements. This oil was tentatively identified as drip oil, the condensable fraction of the gas. The investigation revealed that the storage and transfer system for the drip oil was severely corroded, which resulted in the oil storage system being removed from service in 1949, and the transfer system was removed in 1952. A ground oil recovery system was installed in 1949 and was operated until 1953. The oil recovery system was terminated after 1953, due to the lack of oil recovery and the cessation of neighbor complaints. The site received occasional complaints of oil in the ground in the late 1950's and early 1960's, which were associated with abnormally high water table levels (Ref. 4, p. 4 of 14).

The gas plant facility was closed in 1973, and the plant and most of the associated buildings were subsequently demolished in 1976 (Ref. 3, p. 16 of 145). All that remains on the Bay Shore property are the building foundations and one original storage building. LILCO maintains an active natural gas regulator substation on the northernmost portion of the Bay Shore property (Ref. 5, p. 5 of 19). LILCO also maintains a natural gas construction and maintenance operations base in the Brightwater Yard section of the property. There is an active training facility, vehicle parking areas, and equipment storage/offices present (Ref. 3, pp. 16, 18 and 19 of 145).

Between November 24 and 30, 1976, the Suffolk County Department of Environmental Control (SCDEC) collected samples of groundwater from the leaching pit on-site (during demolition activities at the site) and seven groundwater samples on-site and downgradient of the site. One sample was collected from a well located 1,500 feet south of the site. According to site records, the odors and colors of the samples were similar and diminished with increasing distance from the site (Ref. 6, p. 1 of 2).

In December 1976, SCDEC installed and sampled two wells downgradient of the site. Groundwater was encountered at 7.8 feet in Well No. 1 and 7.25 feet in Well No. 2, located 525 feet and 930 feet south of the site, respectively. The results of this sampling event revealed contaminated groundwater running roughly in a southerly direction from the site (Ref. 7, p. 1 of 1). Chemical analyses of the samples indicated the presence of various organic compounds potentially similar to the plant's various waste or fuel products (Ref. 8, p. 4 of 29).

The SCDEC completed a Groundwater Contamination Survey of the site in February 1977, after a worker for the Suffolk County Water and Sewer Division found potentially contaminated groundwater in dry sewer lines that were placed in the vicinity of the plant (Ref. 9, p. 2 of 3). After a series of interviews with area residents and inspections of the neighboring properties, it was confirmed that subsurface and groundwater contamination may exist at the site and may have migrated. Several neighbors complained of odors in their basements, and oily residues were noted on the basement floors and walls of several homes (Ref. 9, pp. 1 and 2 of 3). The Summers Lumber Co., which was located at 70 North Clinton Avenue, had tar-like odors entering the building from the basement (Ref. 10, p. 6 of 15). LILCO purchased and demolished one house just south of the lumber yard in the 1950's due to persistent odor complaints by the owner (Ref. 5, p. 12 of 19; Ref. 9, p. 1 of 3).

In February 1978, New York State Department of Environmental Conservation (NYSDEC) and the SCDEC requested that LILCO undertake a groundwater investigation (Ref. 8, p. 4 of 29). Geraghty & Miller installed 12 well clusters (three wells each) upgradient, on-site, and downgradient of the site. Each well cluster allowed three discrete, screened interval samples to be collected from the upper, middle, and lower parts of the aquifer (Ref. 8, pp. 6 and 7 of 29). The results of the Geraghty & Miller investigation showed the upgradient well was not contaminated with constituents consistent with former operations at the site and the wells on-site and downgradient of the site indicated the presence of naphthalene (Ref. 3, pp. 111 through 114 of 145).

In June 1981, LILCO filed a 103(c) Superfund notification with the US Environmental Protection Agency (USEPA) for six manufacturing gas plants, of which the Bay Shore Gas Plant was included (Ref. 34, pp. 1 and 2 of 3). In early 1989, the EPA Region II Field Investigation Team (Region II FIT) conducted a preliminary assessment of the site indicating a concern regarding groundwater contamination and the close proximity of municipal wells (Ref. 10, p. 15 of 15).

In May 1992, LILCO contracted Malcolm Pirnie Inc. to conduct a site investigation. The results of this investigation indicated the presence of a naphthalene plume in the groundwater downgradient from the Bay Shore Property of the site. Analytical data from this investigation also indicated the presence of benzene, toluene, ethylbenzene, and xylenes (BTEX) downgradient from the Brightwaters Yard (Ref. 3, pp. 109 and 111 of 145).

An on-site reconnaissance was conducted at the LILCO property in August 1997 (Ref. 5, p. 1 of 19). The purpose of the reconnaissance was to ascertain the current conditions existing at the property. A walkover of the Brightwaters Yard portion of the property indicated that berm

material was still present in the former location of the H-fuel tank, but recycled asphalt was recently spread around the general vicinity to expand site use for operations (Ref. 5, pp. 1 and 2 of 19). Much of the Brightwaters Yard is utilized currently for heavy equipment storage and vehicle parking (both employee and company trucks/backhoes, etc.), and one office building is in use (Ref. 5, pp. 10, 14 and 15, 16 and 19 of 19). Former oil storage tanks and the H-fuel tank have all been removed (Ref. 5, pp. 2 and 3 of 19). The entire property is fenced, (LIRR) with barbed wire at the top (Ref. 5, pp. 7 and 9 of 19). There is an active Long Island Rail Road right-of-way bordering the southern part of the property, and some indications of the former rail siding used in past plant operations are visible (Ref. 5, pp. 2, 4 and 7 of 19). On the east side of the property, along Clinton Avenue, the ground surface between the street and the property (where the sidewalk is located) is raised above the general site topography (Ref. 5, p. 5 of 19).

On the opposite side of Clinton Avenue is the Bay Shore Property (the property that once contained the gas plant). This property contains an electrical substation and switching station, a natural gas metering station, and a concrete area that once served as the foundation for the gas holder (Ref. 5, pp. 5 and 6, and 17 through 19 of 19). Extensive vegetation (which appears to be thriving) covers the areas not covered by building footprints, graveled station yards, or concrete (Ref. 5, p. 17 of 19).

It was noted during the on-site reconnaissance that approximately five consumer gas stations on Akerson Street (to the north of the facility) historically have had fuel spills (Ref. 5, pp. 3 and 8 of 19).

Additional information that developed from the reconnaissance detailed that a former lumber yard, an autobody shop, and an asphalt storage property (all south of the LIRR right-of-way) were bought by LILCO between 1994 and 1995. Existing buildings on these properties were demolished shortly thereafter (Ref. 29, p. 1 of 1). Also in late 1995, three leaking fuel storage tanks were discovered during routine operations. They are still in place but are filled with groundwater seepage, since the contents were removed (Ref. 30, p. 1 and 2 of 2; Ref. 31, p. 2 of 8). These tanks contained gasoline and diesel fuel utilized for maintenance vehicle refueling.

The NYSDEC is currently negotiating an Administrative Consent Order (ACO) with LILCO to initiate remediation efforts at the Bay Shore Gas Plant property (Ref. 14, p. 1 of 1).

**Evaluation of Existing Information**

Information from the various previous investigative studies, together with population information, groundwater supply, and sensitive environment information, were utilized in this evaluation. Data generated during the Malcolm Pirnie, Inc. investigation were used to evaluate the potential sources at the site and to characterize waste components. Although extensive analytical documentation is present, the data were not validated in accordance with USEPA Region II QA/QC requirements, proper background sample procedures were lacking (detailing nearby constituent concentrations as found in this urban industrial environment), and documentation of sample locations and sample chain-of-custody were not available. The data from the various investigations were used for screening purposes only.

In addition, actual attribution of many contaminants across both the Brightwaters Yard section, the Bay Shore Property (former gas plant location) and the various properties located to the south of the LILCO property is problematic as the various contaminants are common constituents in the various base fuels utilized and/or released by leaking aboveground and underground storage tanks by the plant over its 99-year history. These fuels are excluded from consideration by the Petroleum Exclusion in CERCLA, and additional co-mingling by present day usage of the properties for vehicle storage, storage of recycled asphalt prior to use as ground cover, and the urban environment in which the properties are located prevent clear attribution and evidence of migration of contaminants leaving the former relief holder source area.

**Hazard Assessment**

Updated and additional information and data collected to further evaluate the site to determine the need for further CERCLA remedial action included historical file information, the 4-mile radius population distribution, wetland and sensitive environment information, and public and private water supply information.

**Waste Source Description**

The majority of wastes generated by the site were sold to the chemical processing industry (Ref. 3, p. 16 of 145). According to historical site information, some oily wastes and tars from the water gas process may have been disposed of on the surface of the ground in the Brightwaters Yard. LILCO was permitted by the New York State Department of Health (NYSDOH) to discharge liquids, which consisted of steam used to heat the holder seals, condensation from the gas in the holder itself, rainwater caught in the holder tank, and entrained water pumped with the tar from the tar separator, into an on-site leaching pit (Ref. 4, pp. 4 and 11 through 14 of 14).

Analytical results of samples collected by Malcolm Pirnie, Inc. from surface, soil borings and test pits in the area showed soil contamination greatest between the relief holder and the former tar separator tanks on the Bay Shore Property (Ref. 3, pp. 27, 31, 90, 92, 96, 103 and 105 of 145). Contaminants in this area include benzene, toluene, naphthalene, mixed xylenes, phenanthrene and pyrene (Ref 16, p. 4 of 5). Cyanide, a characteristic inorganic constituent associated with manufactured gas plant wastes, was also detected in soil samples.

Test pits TP-10, TP-10A, TP-14 and TP-14A were dug in this area and samples were collected by Malcolm Pirnie, Inc. on July 28, 1992. Analytical results of sample TP-10 indicated the presence of benzene, toluene, xylenes, naphthalene, phenanthrene, pyrene, and cyanide (Ref. 3, p. 96 of 145).

**Groundwater Pathway**

The site is underlain by unconsolidated sediments of Cretaceous, Tertiary, and Quaternary age, which overlie crystalline bedrock of Precambrian or possibly early Paleozoic age. In sequential order overlying the bedrock is the Raritan Formation of Cretaceous Age consisting of the Lloyd Sand Member and the Raritan Fire Clay Member. Above the Raritan Formation is a thick

sequence of deposits of late Cretaceous age, the Magothy Formation (Ref. 17, p. 8 of 12). The site is immediately underlain by an approximately 75-foot thick sequence of sand and gravel of moderate to high permeability known as the Upper Glacial Aquifer (Ref. 17, p. 11 and 12 of 12). Groundwater occurs within approximately 6 to 8 feet of the ground surface and flows southerly toward the Great South Bay, which is the regional discharge zone. Two small creeks, Lawrence Creek and Watchougue Creek, locally influence groundwater movement (Ref. 3, pp. 21 and 23 of 145). The Magothy Aquifer is an intermediate artesian aquifer that lies at depths between 75 and 154 feet below the ground surface in the vicinity of the site (Ref. 3, p. 21 of 145). The Magothy Formation, in which the aquifer is contained, consists of fine to coarse sand, gravel, interstitial clay and silt, and beds and lenses of clay (Ref. 17, p. 9 of 12). The Gardeners Clay layer, a unit consisting of clay, silt, clayey and silty sand, and clayey and silty gravel overlies the Magothy Formation, and exists in the area of the site, but there is no evidence to indicate it is continuous throughout a 2-mile radius around the site (Ref. 10 pp. 12 through 15). Previous investigations at the site found Pleistocene outwash deposits of approximately 70 to 75 feet thick which consist of medium to coarse sand.

The hydraulic conductivity was estimated to be $10^{-2}$ cm/sec for the Upper Glacial Aquifer and $10^{-4}$ cm/sec for the Magothy Formation based on the description of the individual strata (Ref. 1, HRS Table 3-6). Although a clay unit, interpreted as the Gardiners Clay layer, was found in the area of the site, there is no documentation that it extends radically greater than 2 miles from the site and the aquifers are considered interconnected (Ref. 8, pp. 12 through 15 of 29). New York State Wellhead Protection Program and Suffolk County Department of Health Services require wellhead protection area delineation. The delineation for the Upper Glacial Aquifer is a 1,500-foot radius upgradient and a 500-foot radius downgradient of wellfields. Deep flow recharge areas for the Magothy and Lloyd Aquifers also are protected but are not within the nearby vicinity of the LILCO property (Ref. 26, p. 12 of 15; Ref. 27, p. 6 of 6). The closest wellfield to the site is approximately 0.36 miles (1,900 feet) upgradient of the site (Ref. 28, p. 1 of 1).

The 4-mile radial vicinity encompasses 10 towns, and the Suffolk County Water Authority (SCWA) is their primary supplier of public water. The SCWA has municipal wells located within a 4-mile distance (Ref. 22, pp. 1, 2 and 9 through 13 of 30). The Fifth Avenue wellfield, which is closest to the site, has 3 active wells (Ref. 22, p. 10 of 30). The estimated population served by SCWA is 156,675. The total estimated population served by private wells is 1,187 (Ref. 22, p. 5 of 30; Ref. 23, p. 3 of 4). The Brentwood Water District (BWD) also owns three active wells in the 4-mile radius. The three wells supply a population of approximately 14,000 (Ref. 22, p. 5 of 30; Ref. 28, p. 1 of 1).

**Surface Water Pathway**

The site has very little surface relief at its location on the glacial outwash plain. Regionally, there is a slight slope to the south toward the Great South Bay (Ref. 3, p. 19 of 145). There is a low potential for stormwater runoff to migrate overland from the LILCO property. Surface soils in those areas not covered by building footprints, paved roadways and parking areas, gravel pads, or other engineered features, exhibit high infiltration rates consistent with the medium to course sandy surface soils. Intervening features including an elevated LIRR ballast and rail system

along the southern border of the site precludes offsite migration of runoff except to Clinton Avenue. On the Brightwaters Yard section of the property, the sidewalk along Clinton Avenue is elevated above the general property also acting as an impediment to overland flow (Ref. 3, pp. 17 through 19 of 145; Ref. 5, pp. 1, 1A, 4 and 5, 7, 9 and 13 through 19 of 19); Ref. 19, p. 3 of 3). The 2-year, 24-hour rainfall is 3.5 inches (Ref. 18, p. 2 of 2). The site is located outside of a 500-year floodplain (Ref. 19, p. 3 of 3).

The nearest perennially present surface water body is the Lawrence Creek, classified by NYSDEC as a Class I saline surface water body, in which best usages include secondary contact recreation and fishing (Ref. 20, pp. 4 and 6 of 7). This water body is also designated for fish propagation and survival (Ref 20, p. 6 of 7). According to the NYSDEC Fish and Wildlife Division, fisheries are present in the area. There is no health advisory regarding consumption for the species of fish present in the area (Ref. 21, p. 1 of 1).

**Soil Exposure Pathway**

The surface soils on the site contained low concentrations of BTEX and polycyclic aromatic hydrocarbons (PAHs), but are not subject to dust generation due to the extensive vegetative cover, use of crushed asphalt as ground cover in parking areas, paving, and the various building footprints (including concrete foundations of various former gas plant structures). Access to the site is limited due to a chain-linked fence that surrounds each parcel of the site (Ref. 5, pp. 1 and 14 through 18 of 19). There are no residences, day-care centers, schools or terrestrial sensitive environments on or within 200 feet of the site (Ref. 5, p. 11 of 19).

**Air Pathway**

Air quality monitoring conducted during site characterization activities indicated there were no volatile organic compounds detected in on-site and background ambient air sampling activities conducted by Malcolm Pirnie, Inc. in 1992 (Ref. 3, pp. 133 and 134 of 145).

The site has been closed since 1973 and there are no on-site residences. The Brightwaters Yard is currently used for equipment storage and parking (Ref. 5, pp. 13 through 16 of 19). There is no individual assigned to perform any type of full-time activity on the Bay Shore property (Ref. 5, pp. 17 through 19 of 19). The closest residence is approximately 200 feet southeast of the site (Ref. 5, p. 12 of 19). There are approximately 1,030 people within the 0 to 0.25 mile radius; 3,238 people within the 0.25 to 0.5 mile radius; 8,670 people within the 0.5 to 1.0 mile radius; 28,700 people within the 1.0 to 2.0 mile radius; 51,320 people with the 2.0 to 3.0 mile radius; and 61,570 people within the 3.0 to 4.0 mile radius of the site. The estimated population within the 4-mile vicinity is 154,540 (Ref. 23, pp. 3 and 4 of 4). There are approximately 815 acres of wetlands in the 4-mile radius of the site (Ref. 24, pp. 1 and 3 of 3). A sighting of an osprey, a New York State threatened species, has occurred within the 2 to 3 mile radius of the plant property, and a sighting of a least tern, a New York State endangered species, has occurred within the 3 to 4 mile distance from the site (Ref. 25, p. 2 of 16).

## Summary

The existing information and newly collected data are sufficient to evaluate the site. Various previous investigative studies including the 1992 site investigation were used to characterize the wastes and the presence of constituents in the soils and groundwater beneath the LILCO property. Although extensive analytical and anecdotal evidence is present, data was not validated in accordance with USEPA Region II QA/QC requirements, proper background sample procedures were lacking, etc.; the data were used for screening purposes. Former waste-related constituents are present in the soils within a very small area of the gas plant's former location. The constituents found throughout the Brightwaters Yard and in areas south of the general property location are difficult to attribute to plant-generated wastes due to the extensive spills and/or leakage of various fuels over the 99-year history of operations. These fuels and their components are excluded from consideration by the Petroleum Exclusion in CERCLA, and additional co-mingling by present day use of the properties for vehicle and recycled asphalt storage, and the urban environment in which the properties lie prevent clear attribution and evidence of migration of constituents.

Groundwater use for potable supply occurs within the 4-mile vicinity of the site. The primary supplier of public potable water has wells located within the site vicinity, and the combined total of all municipal supplies service approximately 170, 675 residents. Shallow groundwater flow is to the south of the property. Descending beneath the site location is an extensive system of aquifers and confining layers, with potable supplies drawing from the two upper, interconnected aquifers well below any surficial groundwater flow.

Overland flow within the site property is limited by the surrounding intervening features impeding runoff from leaving the site. In addition, surface soils in those areas not covered by building footprints, or paved roadways/parking areas, exhibit high infiltration rates consistent with the medium to coarse sandy surface soils. Additional off-site intervening features to overland flow are the elevated LIRR ballast and rail system and the urban surroundings (streets, etc.) between the property and the nearest perennially-present waterbody. The Lawrence Creek is considered a classified surface water body supportive of recreation and fishing.

There are no persons living on or within 200 feet of the site and no day-care facilities or schools are in the nearby vicinity. The site is enclosed completely by fencing topped with barbed wire, and no sensitive environments are present on the property.

Air quality monitoring conducted during the 1992 site investigation indicated there were no releases detected in on-site and background ambient air sampling.

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4. Letter from Steven V. Dalton of LILCO to Joan Wagner of NUS Corporation, April 12, 1989.

5. Site Logbook and Photographs of Site Reconnaissance performed by Foster Wheeler Environmental Corporation on August 14, 1997.

6. Suffolk County Department of Environmental Control Interoffice Memorandum from Roy Gilbert to James Pim, December 2, 1976.

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11. Letter of Transmittal for the Groundwater Investigation Report from Steven V. Dalton, Manager of Water Quality Control Division at LILCO to James Pim, Chief of Enforcement Section at SCDEC, October 10, 1978.

12. Letter from Raymond J. Driscoll, Manager of Environmental Engineering Department at LILCO to James Pim, Chief of Enforcement Section at SCDEC, June 11, 1980.

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26. New York State Wellhead Protection Program, New York State Department of Environmental Conservation, September 1990.

27. Suffolk County Sanitary Code, Article 7, Water Pollution Control, last amended June 30, 1993.

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29. Telecon Note: Conversation Between Richard J. Schmitz, Senior Environmental Engineer, LILCO and Michelle Brooks, Environmental Engineer, Foster Wheeler Environmental Corporation: Subject Summers Lumber Yard Purchase

30. Telecon Note: Conversation Between Ted Leissing, Principal Engineer, LILCO and Michelle Brooks, Environmental Engineer, Foster Wheeler Environmental Corporation: Subject UST Discovered in 1995/1996.

31. Transmital Slip to A.J. Shah from Jim Van Hoesen, DHWR with Letter from Patrick J. Van Rossen, LILCO to Robert Seyfarth SCDHS, January 17, 1996.

32. Summary of Operations, Spills and Investigations at Bay Shore Gas Plant Site, September 1997.

33. Letter to Robert Seyfarth, SCDHS from Steven V. Dalton, Div. Mgr, LILCO Environmental Engineering Department, June 12, 1996.

34. LILCO 103(c) Superfund Notification Letter to the United States Environmental Protection Agency Region II, June 9, 1981.

35. Cover Page to the NUS Preliminary Assessment Off Site Reconnaissance Information Reporting Form, April 12, 1989.

36. Feasibility Analysis Report, Bay Shore Manufactured Gas Plant, Bay Shore, New York, December 1993

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**REFERENCE 1**

federal register

Friday
December 14, 1990



Part II

# Environmental Protection Agency

40 CFR Part 300
Hazard Ranking System; Final Rule

Recycled Paper

**REFERENCE 2**

United States
Environmental Protection
Agency

Solid Waste and
Emergency Response
(5204G)

PB94-963506
EPA 540-R-94-00
February 1997

EPA

# Superfund Chemical Data Matrix

Ref 2
1 of 1

**REFERENCE 3**

Ref 3, p. 1 of 145

# SITE INVESTIGATION REPORT

# BAYSHORE MANUFACTURED GAS PLANT

# BAYSHORE, NEW YORK

March 1993

Prepared for

Long Island Lighting Company
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# LILCO BAYSHORE MGP SITE

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| J | Permeability Test Data |
| K | Land Use Data Base |
| L | Full Laboratory Data Package |
| M | Photo Log |




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# 1.0 SUMMARY AND CONCLUSIONS

## 1.1 GENERAL

The LILCO Bayshore Manufactured Gas Plant (MGP) is located in a mixed commercial and residential area in the Villages of Bayshore and Brightwaters in the Town of Islip, Suffolk County, New York. Carburetted water gas and oil-gas operations were conducted on the site from 1898 through 1973 when the plant was demolished. Manufactured gas operations took place on the Bayshore property and fuels, naphtha, drip oils and tarry wastes were stored on the Brightwaters Yard.

Oil was found leaking into basements along Clinton Avenue on the adjacent property in 1949. A groundwater and oil recovery system was operated until 1953 when the oil was reported to have stopped leaking into the basements. A subsequent groundwater investigation conducted in 1979 documented the presence of a long, narrow contaminant plume extending from the site to Lawrence Creek.

The site is underlain by a 75 foot thick sequence of sand and gravel of moderate to high permeability known as the Upper Glacial Aquifer. Groundwater occurs within six to eight feet of the ground surface and flows southerly toward the Great South Bay which is the regional discharge zone. Two small creeks, Lawrence Creek and Watchogue Creek, locally influence groundwater movement.

The population of Bayshore and Brightwaters is approximately 25,000 persons. There are 10 potentially sensitive receptors within one-half mile of the site, six of which are located downgradient of the site. Suffolk County maintains two water supply wells located approximately one-half mile upgradient of the site, but both wells are deep (784 feet) and do not tap the Upper Glacial Aquifer. There are no other known groundwater users within a one-mile radius of the site.

## 1.2 PHYSICAL CHARACTERISTICS

The site is characterized by a thin veneer of sandy topsoil with abundant vegetation which inhibits the generation of dust from the site. The topsoil is underlain by a highly cohesive clayey sand layer approximately one to three feet thick. This clayey sand layer,



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which typically contains piping, utility lines and remnant foundations from the demolished MGP, is a dense low permeability material.

Beneath the clayey upper sand layer is a non-cohesive, well sorted sand layer which varies in thickness from 5 to 10 feet and comprises the bulk of the vadose zone. Depth to water is typically six to eight feet below ground surface across the site and the water table occurs in the deeper non-cohesive sand. This deeper non-cohesive sand occurs to depths of 45 to 50 feet below ground surface. There were no distinct clay confining units found in the sandy material.

Groundwater movement is to the south at a moderate hydraulic gradient of 0.002 to 0.003 ft/ft. Data from this investigation (1992) indicates that the sands are moderately permeable (493 gallons per day per square foot) and the groundwater velocity ranges from 0.25 to 0.8 feet per day. The main component of groundwater movement both on and off site is horizontal, although upward hydraulic gradients occur near Lawrence Creek and the Great South Bay.

## 1.3 EXTENT OF CONTAMINATION

In general, the types of contaminants found on the former LILCO Bayshore MGP are typical of manufactured gas plant sites as reported in the Gas Research Institute (GRI) publication "Management of Manufactured Gas Plant Sites, Volume I, Wastes and Chemicals of Interest." The most common compounds associated with MGP sites and found on LILCO's properties are volatile aromatics, including benzene, toluene, ethylbenzene and xylenes (BTEX) and polycyclic aromatic hydrocarbons (PAHs), most notably naphthalene, fluorene, phenanthrene and pyrene. Other common MGP chemicals, including metals, cyanide and phenols, were not particularly prevalent on the LILCO properties. Contamination at the site is mainly characterized by BTEX and PAHs. However, some non-MGP contaminants were detected on the adjacent properties that are believed to be attributable to the auto repair activities or asphalting equipment storage and maintenance operations as additional contributing sources on that property.

### 1.3.1 Air Quality

Air quality under existing conditions on the site is good. The were no volatile organic compounds detected in the on-site and background ambient air samples. PAHs



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were detected in the background ambient air samples as well as on site, indicating that PAHs in the air are not wholly attributable to the site. Concentrations of BTEX and PAHs in air increased during excavation of test pits, indicating that controls may be needed on-site if large scale excavation is chosen as a remedial action. However, even during test pit excavation air quality at the edges of the property remained good. No BTEX compounds were detected in the up or downwind areas, although PAHs were detected slightly above the background levels measured prior to excavation.

### 1.3.2 Soil Contamination

The surface soils on the LILCO properties, as well as on the adjacent properties, contain low concentrations of BTEX and PAHs, but are not subject to dust generation due to extensive vegetative cover and paving. Contaminants in surface soil were detected near the abandoned relief holder on the Bayshore property and behind the auto repair facility on the adjacent property.

Subsurface soils contain much higher concentrations of contaminants particularly at locations corresponding to specific past activities where soil staining and odors were prevalent. The highest concentrations of BTEX and PAHs in the soil were found around the abandoned relief holder, the tar storage tanks and the tar separator tanks in the central portion of the Bayshore property. Concentrations of contaminants in the soils tend to decrease with increasing distance away from this central area and were not detected at the edges of or off the LILCO property since the MGP activities were restricted to LILCO property. Two smaller areas of soil contamination were detected on the Brightwaters parcel. One is located south of the former H-fuel tank and the other is in the southeast corner of the yard near the reported former location of the oil-water separator. Again the contamination does not extend off of the northern, eastern or western LILCO property boundary.

Limited soil contamination was found on the adjacent properties, but is believed to be attributable to activities conducted by the adjacent property occupants. Although the suite of contaminants found on the adjacent properties is similar to that found on LILCO's property, the areas of contamination were detected next to the auto repair building and in the area used for asphalting equipment storage and maintenance. These activities produce BTEX and PAH wastes and contaminants similar to those associated with the MGP.

The soil contamination is still generating volatile organic vapors. Soil gas measurements across the site correlate very well with the areas of soil contamination. Although the PAHs do not volatilize readily, the BTEX compounds do. Soil gas measurements were particularly high on the Bayshore property and the soil gasses have the potential to migrate off site.

### 1.3.3 Groundwater Contamination

Groundwater quality upgradient of the site was generally good. None of the target compounds associated with MGP wastes such as BTEX or PAHs were detected moving onto the LILCO properties from an upgradient source.

On the Brightwaters property, groundwater contamination was detected at two locations corresponding to the areas of soil contamination. High concentrations of BTEX compounds and naphthalene were detected in the shallow groundwater south of the former H-fuel tank. A sheen was noted on the groundwater sample but no measurable layer of free product was present. Groundwater contamination was not detected in the sample from the deeper well indicating that the contamination is restricted to the water table in this area. This contamination occurs at the southern, or downgradient edge of the Brightwaters property, indicating the potential for off-site migration of a small plume at this location.

Minor concentrations of BTEX and naphthalene were also detected in the shallow groundwater in southeast corner of the Brightwaters Yard, near the location of the former oil-water separator. Contamination was not detected in the deeper groundwater indicating that the contamination is restricted to the water table. This area is located at the southern, or downgradient edge of the Brightwaters Yard, northwest and upgradient of the auto repair facility on the adjacent property. However, monitoring wells located at the auto repair facility on the adjacent property yielded groundwater samples containing higher concentrations of contaminants than were detected on the corresponding portion of the LILCO property. The monitoring wells on the adjacent property also contained concentrations of several solvents and degreasers (trichloroethene and 1,1,1,trichloroethane) which were not detected on the LILCO property. This indicates that an additional contributing source of groundwater contamination exists on the adjacent property in this area.

On the Bayshore property, high concentrations of BTEX and PAHs were detected in both shallow and deep groundwater zones adjacent to and downgradient of the east central portion of the site which contains the area of highest soil contamination. A sheen



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was noted on one shallow groundwater sample, but no measurable layer of free product was present. This area is associated with the abandoned relief holder, the tar storage tanks and the tar separator tanks. Analyses of groundwater samples from the downgradient area on the adjacent property east of Clinton Avenue detected a similar suite of compounds. The shallow wells had consistently higher concentrations of contaminants than the deep wells, indicating contribution from a surface source on the adjacent property east of Clinton Avenue occupied by the asphalting equipment storage and maintenance operation.

The downgradient plume remains similar in shape and concentration as reported in 1979 with two exceptions. Groundwater samples collected at additional locations during this investigation were used to further delineate the width and length of the plume. Based on naphthalene and total PAH concentrations, the plume is slightly wider at the downgradient edge and a small secondary plume occurs in the area between the Brightwaters Yard and O-Co-Nee Lake. The detection of naphthalene at location TR-9, albeit very low (1 ug/L), combined with the concentration of naphthalene detected south of the former H-fuel tank on the Brightwaters Yard, indicates the presence of a second, smaller and more narrow plume in this area.

The delineation of the downgradient plume based on Total PAHs, as well as on individual PAHs, is very similar to the 1979 reported configuration and concentration. BTEX concentrations in the downgradient plume are sporadic but the compounds were detected in several of the shallow wells. Although the plume has not spread any farther downgradient toward the Great South Bay, nor has it migrated beneath or beyond Lawrence Creek, the consistency in configuration and concentration indicates that a continuing source still exists. The presence of soil contamination on both the Bayshore and Brightwaters properties, and the lack of upgradient contributors indicates that the contamination remaining on LILCO's property appears to be this continuing source.

Although the plume is migrating and discharges to Lawrence Creek, the sediments in Lawrence Pond and Lawrence Creek do not contain contaminants attributable to the plume. The sediments do not contain any BTEX, naphthalene or fluorene, the most indicative compounds of the MGP wastes and the groundwater plume.



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# 2.0 INTRODUCTION

The Long Island Lighting Company (LILCO) conducted a detailed Phase 2 site investigation during the summer and fall of 1992 at their former Bayshore Manufactured Gas Plant (MGP) and the adjacent properties known as the Brightwaters Yard, the Summer's Lumber Properties, and the area between the sites and Lawrence Creek, all in Suffolk County, New York. Previous investigations revealed the presence of groundwater contamination potentially attributable to past operation and waste disposal practices at the former Manufactured Gas Plant. The focus of this investigation was to determine the presence of, and characterize, on-site and off-site soil and groundwater contamination. The associated environmental risks were also evaluated to determine the need for remediation and, if necessary, to identify and select appropriate remedial action. The appropriate remedial action would result in the remediation of the site to the point that the associated risks to human health or the environment are minimized. Details of the Risk Assessment and Remedial Alternatives feasibility analysis are presented in companion documents to this report which describes the site investigation.

Although the site is not currently subject to state, federal or local regulatory action, the site remedy must satisfy potential regulatory requirements should these agencies become involved in the future. The former Bayshore Manufactured Gas Plant is currently listed on the USEPA CERCLIS (EPA ID No. NYD986881654). The site is not on the Superfund List, but has been subjected to Site Discovery and Preliminary Assessment by the USEPA. However, the USEPA has not taken any action or conducted any activities related to the site since September 1989. The Suffolk County Department of Health Services (SCDHS) has assumed the role of Lead Agency with concurrence of the New York State Department of Environmental Conservation (NYSDEC).

## 2.1 PURPOSE OF THE FIELD INVESTIGATION

The purpose of the field investigation was to obtain representative data to detect and evaluate areas of soil and groundwater contamination including on-site sources and the previously identified (1979) off-site plume, by evaluating the nature, depth and extent of contamination resulting from past MGP activities as well as other potential sources such as

the auto repair and asphalting equipment storage and maintenance areas on the adjacent properties. In addition, the field investigation assessed migration pathways from suspected source areas and evaluated contamination on the adjacent properties and in the area between the site and the Great South Bay.

For the purpose of discussion in this report, the properties owned by LILCO will be referred to individually as the Brightwaters Yard and the Bayshore property, or combined as the LILCO property. The properties located south of LILCO and owned by Summer's Lumber and Supply Corporation will be referred to as the adjacent properties with further reference to specific occupants and activities. The combined area encompassed by the Brightwaters Yard, the Bayshore property and the Summer's Lumber properties will be referred to as the LILCO and adjacent properties. The term "off-site" will refer to the area between the LILCO and adjacent properties and the Great South Bay.

The data generated during this field investigation are being used to assess environmental risks that may have resulted from past operations on the Bayshore property and associated activities in the Brightwaters Yard. Based on these data, it will be determined whether the contaminants are of sufficient concentration to warrant remedial action. If so, the data can be used to select the most appropriate site remediation.

## 2.2 REPORT ORGANIZATION

This report is divided into eight sections, the first of which is the Summary and Conclusions. Section 2.0 discusses the purpose of the project and the organization of this report. Section 3.0 provides background information, including a description and history of the site, geology, hydrogeology, and the results of previous investigations. Section 4.0 provides detailed descriptions of the methods used to conduct the field investigation. Section 5.0 describes the physical characteristics of the study area as determined during this investigation, and Section 6.0 presents the chemical characteristics of the soil and groundwater in the study area. Section 7.0 discusses the fate and transport of the compounds detected at the site. Section 8.0 lists references cited in the report.



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# 3.0 SITE BACKGROUND

## 3.1 DESCRIPTION

### 3.1.1 Site Location

The LILCO Manufactured Gas Plant subject to this investigation is located in the Villages of Bayshore and Brightwaters in the Town of Islip, Suffolk County, New York. The site is near the south shore of Long Island, approximately 6,000 feet north of the Great South Bay. The surrounding area is suburban, and land use is mostly commercial and residential with some light industry. The LILCO property is bounded on the east, north and west by residences and small commercial businesses, and to the south by the Long Island Railroad (LIRR). Immediately south of the LIRR are a few residences and the adjacent commercial lumber property including tenants engaged in auto repair activities and in the storage and maintenance of asphalting or paving equipment. Farther south are residences and Lawrence Lake and Lawrence Creek. Figure 3-1 shows the location of the properties.

### 3.1.2 Site History

The LILCO property consists of a 4.5 acre parcel on the east side of Clinton Avenue (Bayshore property) and a 5.8 acre parcel on the west side of Clinton Avenue (Brightwaters Yard) as shown on Figure 3-2. Carburetted water gas and oil-gas operations were conducted on the site from 1898 through 1973. Manufactured gas operations took place only on the Bayshore property and fuel oils, naphtha, drip oils, and tarry wastes were stored in the Brightwaters Yard. The vast majority of the wastes generated by the Bayshore MGP were sold to the chemical processing industry. From the 1920's through the mid-to-late 1930's, LILCO used a ground disposal pit pursuant to a New York State Department of Health permit. A waste treatment system was installed in the 1940's. Above ground and underground storage tanks removed from the Brightwaters Yard in the mid-1970's were reported to be corroded and leaking.

The gas plant and most of the associated buildings were demolished in the mid-1970's, and all that remains on the Bayshore property are the building foundations and one old storage building. LILCO maintains a gas regulator station on the northern most portion of the Bayshore property, and a gas Construction and Maintenance operations base which



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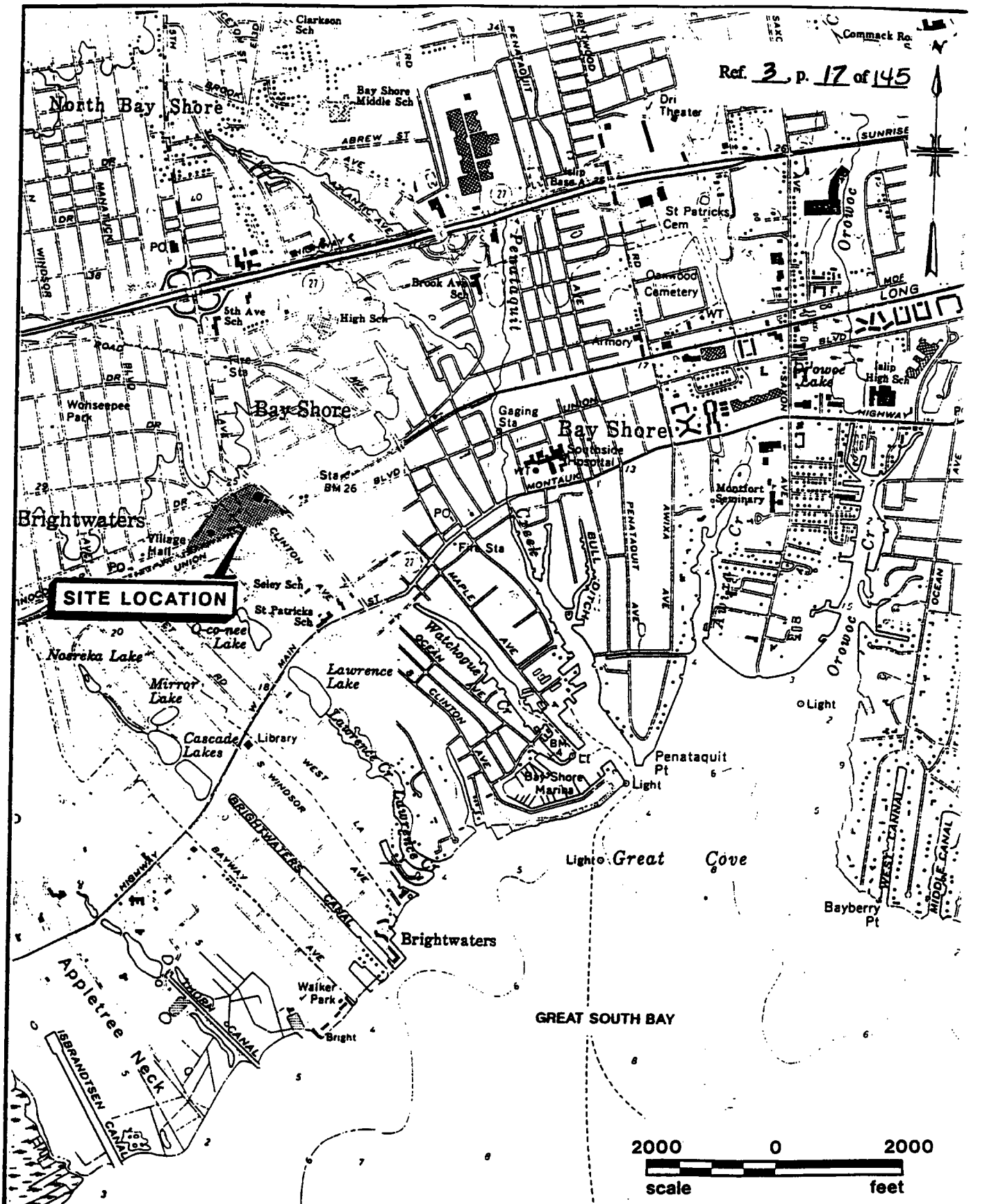


SOURCE: BAY SHORE EAST AND WEST, NEW YORK USGS QUADRANGLE

| MALCOLM PIRNIE | LONG ISLAND LIGHTING COMPANY<br>BAYSHORE GAS PLANT<br>SITE LOCATION MAP | MALCOLM PIRNIE, INC.<br>FIGURE 3-1 |
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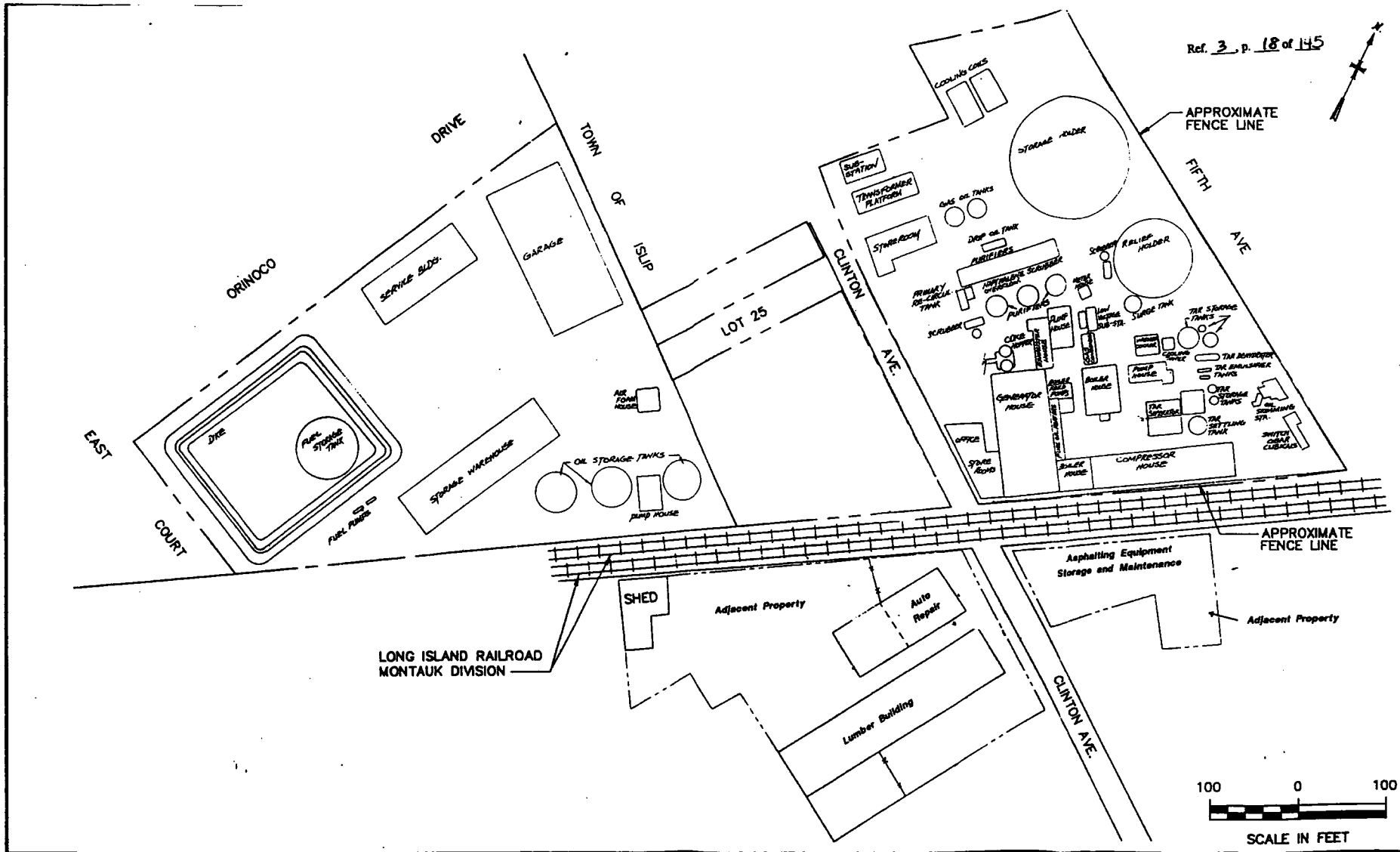


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LONG ISLAND LIGHTING COMPANY
BAYSHORE GAS PLANT
**FORMER FACILITY LAYOUT**

MALCOLM PIRNIE, INC.

FIGURE 3-2

includes storage of GC&M equipment, a training facility and a vehicle parking area in the Brightwaters Yard.

### 3.1.3 Previous Investigations

Available records indicate that in 1949, oil was found leaking into the basements of buildings along the west side of Clinton Avenue on the adjacent property directly south of the LILCO property. A groundwater and oil recovery system was installed and operated until 1953 when the oil stopped leaking into the basements. As a result of odors encountered during construction of a sewer system nearby, the Suffolk County Department of Health Services and the NYSDEC requested LILCO to conduct a groundwater investigation in 1979 which included the installation of 12 monitoring well clusters consisting of three wells each. During the 1979 investigation, the presence of 16 polycyclic aromatic hydrocarbons (PAHs) indicative of the materials used and wastes generated in the gas manufacturing operations were discovered in the groundwater on and downgradient of the site. Naphthalene was the most prevalent compound detected, but some lighter compounds such as benzene, toluene, and xylenes were also detected. Although these compounds are indicative of the gas manufacturing operations and the fuel oils stored at the site, they are also commonly associated with gasoline spills and with leaks from underground storage tanks at gas stations and other commercial operations.

The 1979 investigation delineated a contaminant plume in the groundwater extending from the site to Lawrence Creek where it discharged to the surface water. The plume was delineated as long but very narrow and conformed closely with the southward groundwater flow direction. Figure 3-3 shows the overall study area targeted in this investigation.

## 3.2 ENVIRONMENTAL SETTING

### 3.2.1 Topography and Drainage

The site has very little surface relief due to its location on the glacial outwash plain and to activities during the life of the plant. Regionally, there is a slight slope to the south toward the Great South Bay. Across the site, the slope is also very low, approximately one percent.





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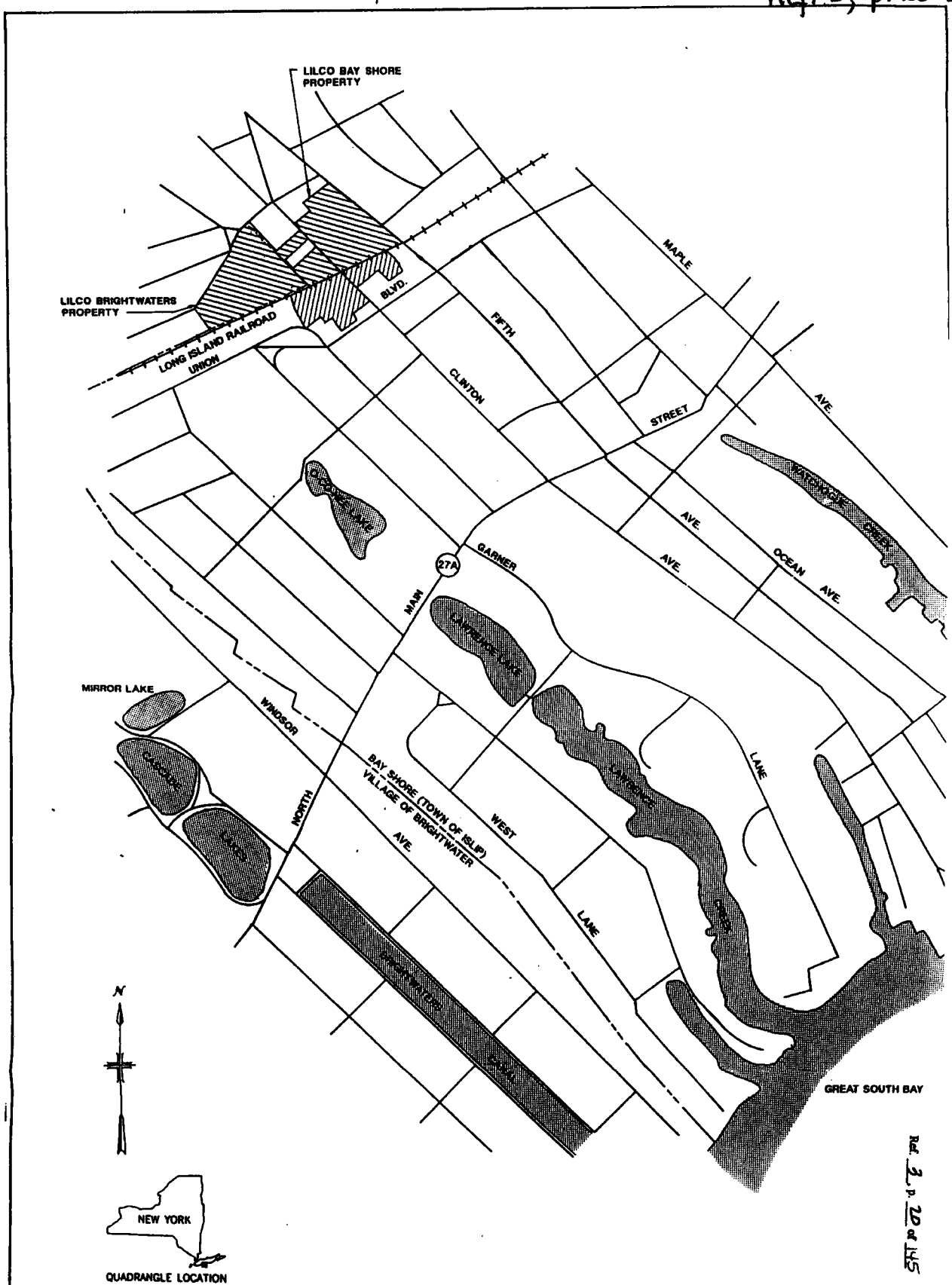


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SOURCE: USGS TOPOGRAPHIC MAP 7.5 MINUTE - BAY SHORE EAST QUAD (PHOTOREVISED 1979) AND BAY SHORE WEST QUAD (PHOTOREVISED 1979)

600 0 600 feet
scale

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STUDY AREA LOCATION MAP

FIGURE 3-3

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### 3.2.2 Soils

According to the Soil Conservation Services (SCS), the site and immediate surrounding areas are classified as urban land (Ur), implying that more than 80% is covered by buildings and pavement (Figure 3-4). Similar soil classification plus some urbanized cut and fill (CuB) land extends south of the site, down to Montauk Highway (Route 27A). The surrounding soils have been classified as gently sloping cut and fill land and include areas that have been altered in grading operations for non-agricultural purposes (i.e., residential, commercial or industrial use). These soils (CuB, RdA, and RhB) tend to be sandy and of low quality, with limited growing potential. They are typically unsuitable for agricultural or ornamental plant establishments such as lawns and gardens (SCS 1975).

### 3.2.3 Geology

The study area is located near the south shore of Long Island. The surficial materials are underlain by Pleistocene outwash deposits. These deposits consist of medium to coarse sands and gravels of moderate to high permeability and comprise the Upper Glacial Aquifer. The Pleistocene outwash deposits generally overlie a zone of low permeability material consisting of clay units within the Cretaceous Matawan Group (Magothy Formation) which includes the Magothy Aquifer. The Magothy Formation is composed of poorly to moderately permeable fine to medium sand interbedded with sand and clay lenses. In some places, the lowermost limit of the Pleistocene outwash deposits is the 20 to 40 foot thick interglacial Gardiners Clay. The Gardiners Clay typically lies between the Magothy Formation and the Pleistocene outwash; however the lateral extent of the Gardiners Clay is limited to an east-west band extending about one mile north of Great South Bay. (Pluhowski and Kantrowitz, 1964).

Previous investigations in the study area (1979) found that the Pleistocene outwash deposits are approximately 70 to 75 feet thick in the study area and consist of medium to coarse sand. A clay unit which was interpreted as the Gardiners Clay was found at a depth of approximately 75 feet. The deepest boring drilled during the 1992 investigation extended to a depth of approximately 45 feet and penetrated medium to coarse sand with some gravel throughout its depth.

### 3.2.4 Hydrogeology

The water table occurs in the Upper Glacial Aquifer typically at depths ranging from



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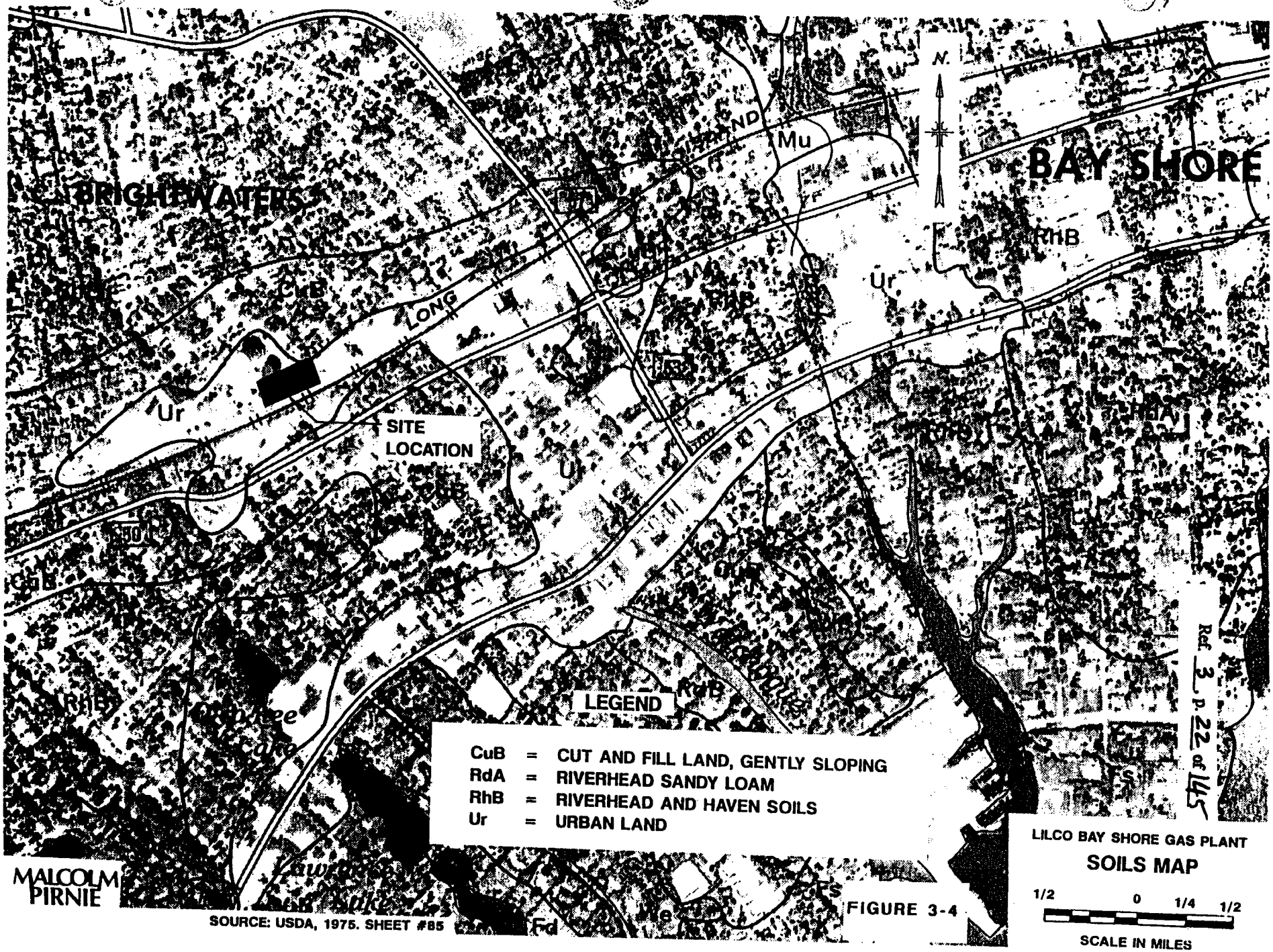
BRIGHTWATERS
BAY SHORE
N.
LONG
ND
Mu
Ur
RhB
CuB
RdA
SITE
LOCATION
LEGEND
CuB = CUT AND FILL LAND, GENTLY SLOPING
RdA = RIVERHEAD SANDY LOAM
RhB = RIVERHEAD AND HAVEN SOILS
Ur = URBAN LAND
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LILCO BAY SHORE GAS PLANT
SOILS MAP
1/2 0 1/4 1/2
SCALE IN MILES
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SOURCE: USDA, 1975. SHEET #85

FIGURE 3-4

four to eight feet below ground surface across the site. The Upper Glacial Aquifer is moderately to highly permeable and is separated from the Magothy Aquifer in places by the Gardiners Clay which acts as a confining unit. The Magothy is typically a confined aquifer comprised of moderately permeable fine sand.

Groundwater in the Upper Glacial Aquifer discharges into southward draining streams and into the Great South Bay. These streams receive groundwater discharge along their entire length. The streams are separated by north-south trending local interstream groundwater divides. One of these divides occurs in the study area and separates Watchogue Creek to the east from Lawrence Creek to the west.

Groundwater measurements from previous investigations have shown that groundwater flow from the site is generally to the south toward the Great South Bay. However, the headwaters of Lawrence and Watchogue Creeks begin just south of the study area and influence local groundwater movement approaching the Great South Bay. Most of the groundwater from the Bayshore Gas Plant discharges to Lawrence Creek.

The 1979 LILCO investigation reported permeability in this part of the Upper Glacial Aquifer at 1,080 gallons per day per square foot, with a specific yield of 25 percent. The horizontal hydraulic gradient ranged from 0.0030 to 0.0068 feet per foot and the assumed groundwater velocity ranged from 1.7 to 3.9 feet per day. Data from this investigation (1992) has been used to update and more accurately calculate the groundwater velocity. Evaluation of vertical groundwater flow indicated a horizontal flow component on the site changing to an upward vertical flow near Lawrence Creek and the Great South Bay.





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# 4.0 SCOPE OF INVESTIGATION

A comprehensive field investigation was conducted both on and off-site between June and September 1992. The proposed field activities were detailed in a Field Investigation Plan (FIP) approved by the Suffolk County Department of Health Services in May 1992. The investigation included the following tasks:

* Conducting geophysical surveys
* Conducting soil gas surveys
* Collection and analysis of surface soil samples
* Excavation of test pits
* Drilling of soil borings
* Installation of monitoring wells
* Collection of ground water samples
* Measurement of water levels
* Conducting aquifer tests
* Collection of sediment samples
* Collection of air samples
* Compilation of land use information

The field work was conducted by Malcolm Pirnie, Inc. and selected subcontractors and was continuously observed by a LILCO representative. Portions of the field work were observed by representatives of the Suffolk County Department of Health Services. Each of the above activities is described in detail in the following sections.

## 4.1 GEOPHYSICAL SURVEY

Between July 7 and July 9, 1992, an integrated geophysical survey was conducted at the site by Layne Geosciences, Inc. (LGI). The geophysical equipment was calibrated, in proper working order and met the requirements of all industry standards. The objective of the survey was to locate buried structures, utilities, and areas of possible soil and groundwater contamination prior to any intrusive work at the site. Locating these features by non-intrusive methods helped define those areas requiring intrusive investigation and aided in the placement of soil gas probes, soil borings, test pits, and monitoring wells. The investigation consisted of an electromagnetic and magnetometer/gradiometer survey, followed by a ground penetrating radar (GPR) survey. Used in conjunction, these geophysical methods detected the presence of subsurface objects and features.



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The effectiveness of these techniques was evaluated as the work proceeded and it was determined that the methods were producing usable data. The presence of overhead power lines, fences and railroad tracks caused interference to the geophysical surveys but the combination of techniques resulted in the detection of several anomalies. Anomalies are defined as areas exhibiting responses to the various geophysical instruments that deviate in excess of normally expected or established variation.

To locate and delineate any anomalous areas, an electromagnetic (EM) induction method was used to map near surface electrical conductivity variations to locate conductive objects such as underground utilities and buried metal or other construction debris. The EM survey provided an exploration depth of up to approximately 15 feet below the ground surface. The magnetometer/gradiometer survey was conducted to locate shallow buried magnetic objects such as utility pipes and metal debris to supplement the EM survey. Anomalous areas identified by EM and magnetics were further characterized by ground penetrating radar (GPR). GPR methods are less susceptible to external EM interferences such as metal fences and overhead power lines.

A summary of the results of the geophysical survey can be found in Section 5.1. The detailed geophysical investigation report in contained in Appendix A.

## 4.2 SOILS AND VADOSE ZONE INVESTIGATION

The soils and vadose zone investigation consisted of a soil gas survey, test pit program, soil boring program, and surface soil program. These investigations were conducted on the LILCO properties as well as on the adjacent properties where impact has been documented or suspected.

### 4.2.1 Soil Gas Survey

In July 1992, a soil gas survey was conducted to detect the presence of volatile organic vapors such as BTEX as well as some of the lighter PAHs in the vadose zone at the site. However, due to the low vapor pressure of most PAH compounds it can be difficult to detect their presence in the shallow soil gas under certain conditions. Therefore, to evaluate the applicability of a soil gas investigation, an initial soil gas profile was conducted as a field screening tool. Soil gas data were recorded at 50-foot spacings along the profile lines located at the southern LILCO property line parallel to the Long Island Railroad. The





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southern LILCO property lines were selected because they are the most likely areas to find soil gas vapors emanating from the site. This profile was originally planned to extend along the northern property line of the adjacent properties, but was precluded by logistical considerations. However, this same area was investigated by more thorough means as described below.

A more comprehensive soil gas investigation was conducted on the LILCO and the adjacent properties between July 14 and July 27, 1992 by Tracer Research Corporation. A 50-foot by 50-foot grid was used initially and tightened to 25-foot centers where strong anomalies were identified.

A total of 121 soil gas samples were collected on the LILCO properties during the investigation. Fifty-two samples were collected in the Brightwaters Yard and 69 samples were collected on the Bayshore property. In addition, 35 samples were collected on the adjacent properties. Twenty-four samples were collected on the parcel west of Clinton Avenue and 11 samples were collected on the parcel east of Clinton Avenue. The soil gas sampling locations along with a detailed discussion of methods and procedures are included in the soil gas report contained in Appendix B.

A summary of the results of the soil gas investigation is presented in Section 6.1, and further discussion of the soil gas sampling methods is given in Appendix C.

### 4.2.2 Test Pit Program

Between July 28 and August 3, 1992, a test pit program was conducted by Riley Excavating & Contracting, Inc.. Test pits were excavated in and around suspected or potential contamination source areas to provide detailed data on the shallow stratigraphy of the site, to provide information on the nature and extent of subsurface contamination, to collect samples of soil, and to assess whether subsurface soils were a potential source of groundwater contamination. A total of 23 test pits were excavated on the LILCO properties. Eight test pits were excavated on the Brightwaters Yard and 15 on the Bayshore property. The locations of these test pits were based on the prior history and use of areas on the site, and on the results of the geophysical and soil gas surveys. The locations of the test pits are shown on Figure 4-1.

A total of 30 soil samples were collected in the test pits and analyzed by EcoTest Laboratories, a New York State Department of Health (NYSDOH) certified laboratory located in North Babylon, New York. Each of the 30 samples was analyzed for BTEX





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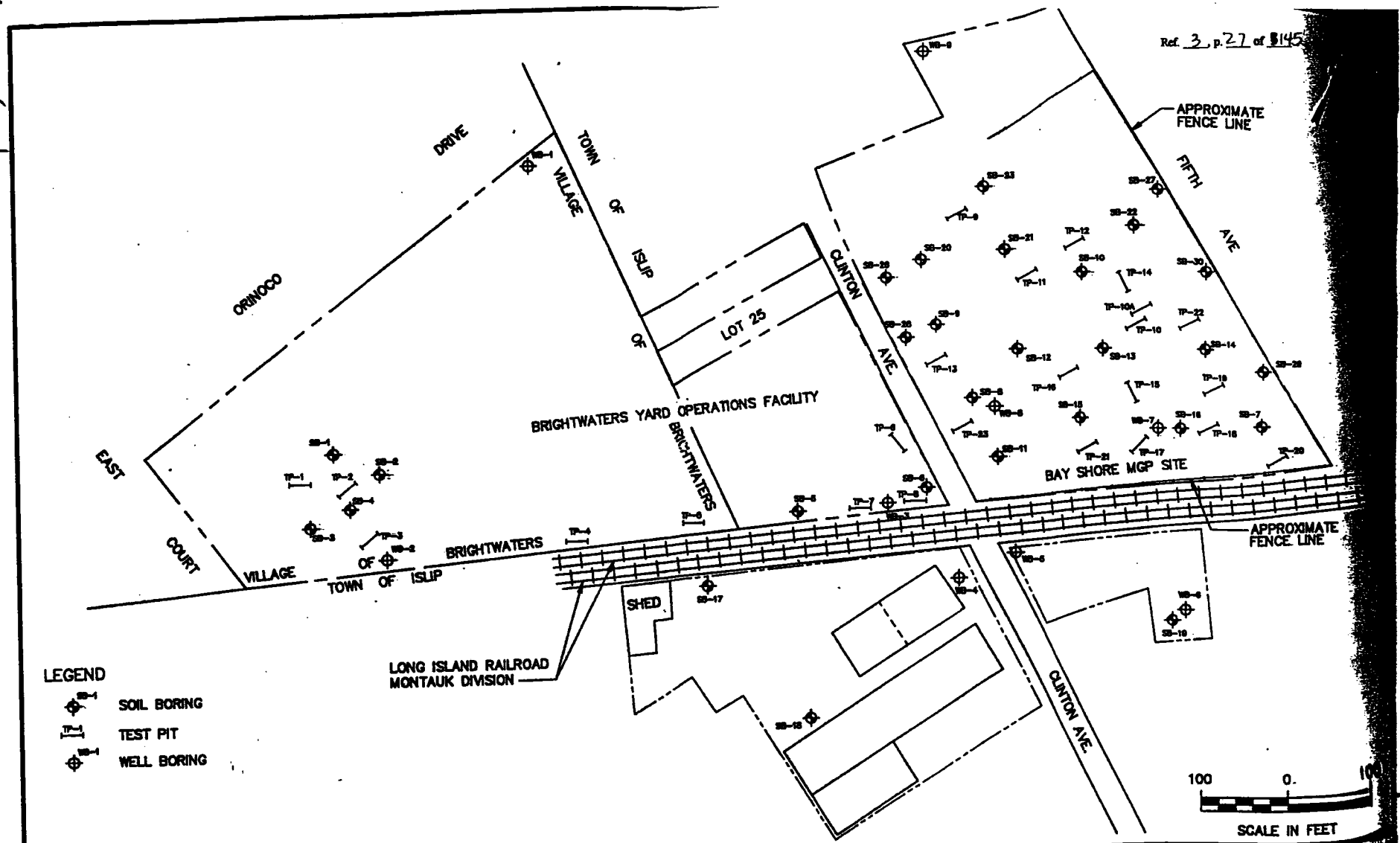


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LOCATIONS OF SOIL BORINGS, WELL BORINGS AND TEST PITS

FIGURE 4-1

(benzene, toluene, ethylbenzene, and total xylenes), PAHs (polycyclic aromatic hydrocarbons), total phenols and total cyanide. Three of the samples were also analyzed for total organic carbon (TOC) and pH, and two of the samples were submitted for the full target compound list (TCL) and target analyte list (TAL) analyses. In addition, six of the samples were also analyzed for TCLP and RCRA waste characteristics. Four samples were also analyzed for grain size distribution as part of the physical testing program of the soils. The results of these chemical and physical tests can be used to assess environmental and health risks and for remedial planning purposes.

Each test pit was excavated to the water table and samples for laboratory analyses were collected from the soil layer directly above the groundwater surface. Strong evidence of contamination was detected in seven of the test pits. A sample was also collected in the shallow soil zone of each of those pits where contamination was most evident. Photographs were taken of the test pits and the soils in the trenches were classified according to modified Burmeister method.

Further discussion of the sampling methods is given in Appendix C. A discussion of the physical characteristics of soils observed in the test pits is given in Section 5.2 and the test pit logs are given in Appendix D. The photographic log is given in Appendix M. The analytical results are presented in Section 6.1.

### 4.2.3 Soil Boring Program

The soil borings program was conducted between August 5 and August 31, 1992 by Land, Air, Water Environmental Services, Inc.. The purpose of this program was to characterize the stratigraphy on the site, and to collect soil samples for chemical analyses to further assess the presence, nature, and extent of contamination between and beyond the test pits and around potential source areas.

A total of 28 soil borings were drilled during this program plus an additional 9 well borings as discussed in Section 4.2.4. Twenty-five soil borings were drilled on the LILCO properties and three were drilled on the adjacent properties. Of the 25 borings drilled on the LILCO property, 6 are in the Brightwaters Yard and 19 are on the Bayshore property. Of the three borings drilled on the adjacent properties, one was drilled on the property east of Clinton Avenue and two were drilled on the parcel west of Clinton Avenue. One soil sample was collected in each of nineteen of the borings for laboratory analyses. In order to bias the sampling toward the worst case, the most contaminated soil samples were





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selected for analysis based on visual evidence of contamination and response on the HNu meter. Where no evidence of contamination was observed, the soil sample was collected from the interval directly above the water table. The remaining 9 borings, all on the Bayshore property were visually inspected and screened with an HNu photoionization detector to refine the horizontal delineation of the extent of soil contamination on the Bayshore property.

The original locations of the soil borings were proposed in and around suspected source areas. The final locations were modified based on findings from the soil gas survey and test pit program and on the presence of buried rubble throughout the site. The additional nine soil borings were drilled along the perimeter of the site where earlier borings had not fully defined the horizontal extent of soil contamination. The locations of the borings are shown on Figure 4-1.

Each of the 19 soil samples were analyzed by the laboratory for BTEX, PAH's, total phenols, and total cyanide. Three of the samples were also analyzed for TOC and pH, and one sample was analyzed for TCLP and RCRA waste classification.

Photographs were taken of each split-spoon sample from each boring and the soils were visually classified according to the modified Burmeister System. The number of hammer blows required to advance the sampler over each six-inch interval was recorded to aid in estimating the in-situ consistency of the soils on-site.

Further discussion of drilling and sampling methods is given in Appendix C. The physical characteristics of the soils are discussed in Section 5.2 and the soil boring logs are given in Appendix E. The chemical characteristics of the soil boring samples are discussed in Section 6.1.

#### 4.2.4 Well Boring Program

In addition to the 28 soil borings described in Section 4.2.3, 9 well borings were drilled during the installation of the monitoring well clusters. Each of these borings was drilled and logged during the installation of the deep well in each cluster except in the case of MW-9S where only a shallow well was installed. Soil samples from these borings were used to characterize the shallow and deep stratigraphy across the site and to collect additional soil samples for chemical analyses. Three of the borings were drilled in the Brightwaters Yard and three on the Bayshore property. On the adjacent properties, two well borings were drilled on the east side of Clinton Avenue and one boring was drilled on





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the west side of Clinton Avenue. The locations of these borings are shown on Figure 4.1.

Nine soil samples were collected in the well borings and were analyzed for BTEX, PAH's, total phenols, and total cyanide. The sample from well boring WB-4 was also analyzed for the full TCL/TAL list. In addition to the chemical analyses, one grain size distribution analysis was conducted on the sample collected from the deep screened interval in WB-1 to determine the physical characteristics of this zone in the aquifer.

Photographs were taken of each of the samples from the well borings and the soils were classified according to the modified Burmeister System. The number of hammer blows required to advance the sampler over each six-inch interval was recorded to aid in estimating the in-situ consistency of the soils on-site.

Further discussion of the drilling and sampling method is given in Appendix C. The physical characteristics of the soils across the site are discussed in Section 5.2, and the well boring logs are given in Appendix F. The chemical characteristics of the samples are discussed in Section 6.1.

#### 4.2.5 Surface Soil Program

Surface soil samples were collected on September 15 and 16, 1992 for physical and chemical analyses. The data was used to assess the presence, nature, and extent of surface soil contamination and to support an assessment of the risk associated with exposure to surface soils on the LILCO and adjacent properties.

Ten surface soil samples were collected from the top one foot of soil. Three grab samples and three composite samples, each composite consisting of five homogenized grab samples, were collected on the LILCO properties. Two of the composite samples and one grab sample were collected from the Brightwaters Yard, and two grab samples and one composite sample were collected from the Bayshore property. Four samples were collected on the adjacent properties. One grab sample and one composite sample were collected from the parcel on the east side of Clinton Avenue and one grab sample and one composite sample were collected from the parcel on the west side of Clinton Avenue. The location of each surface soil sample is shown on Figure 4-2.

Eight of the surface soil samples were analyzed for BTEX, PAHs, total phenols, and total cyanide. Two samples were analyzed for the full TCL/TAL list as well as total phenols and total cyanide. Of these 10 samples, 2 were also analyzed for TOC and pH.

The first composite sample (CS-1) was collected in the area south of the former H-





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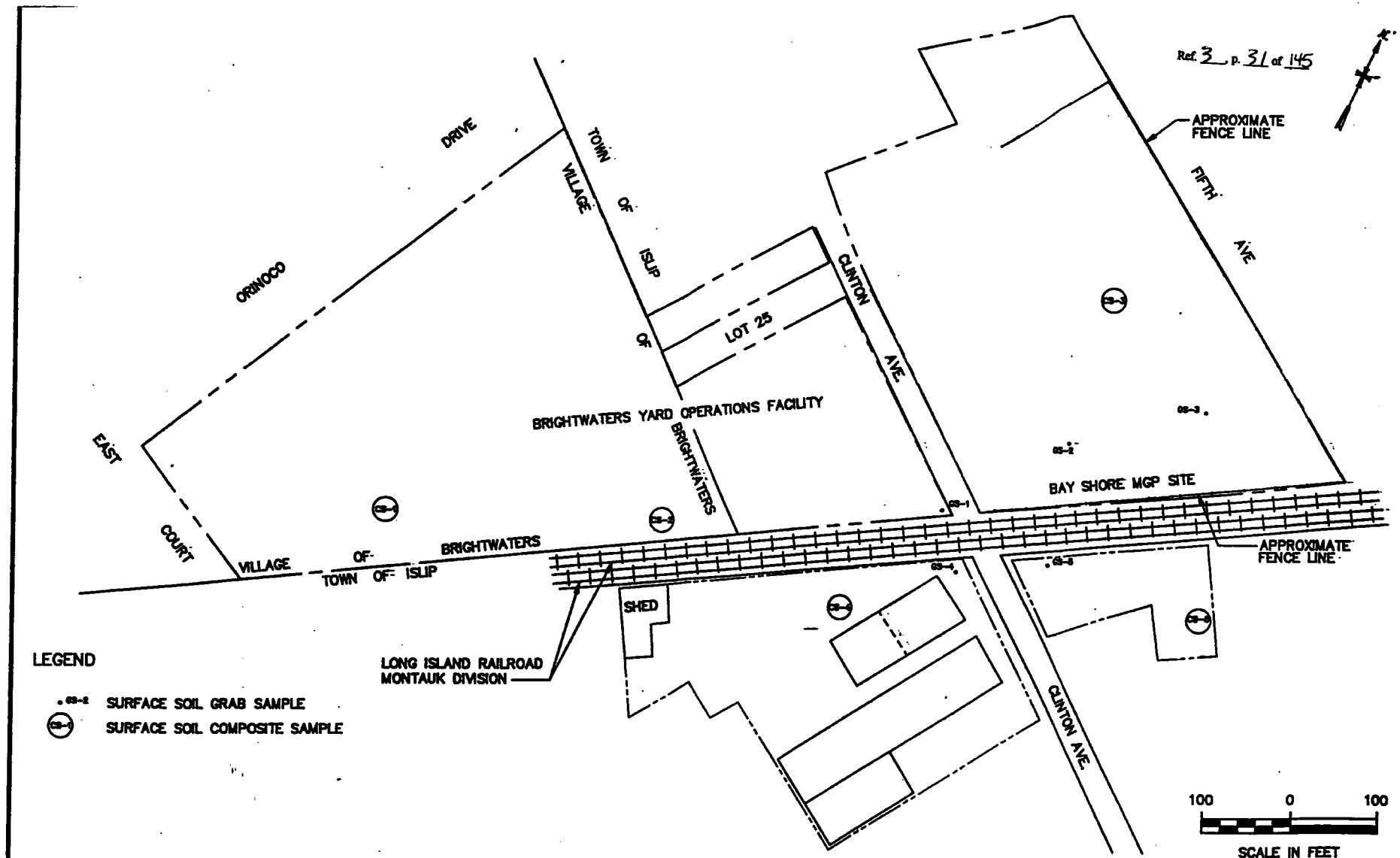


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**SURFACE SOIL SAMPLE LOCATIONS**

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FIGURE 4-2

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fuel tank in the western corner of the Brightwaters Yard. The second composite sample (CS-2) was collected in the area directly south of the concrete pad from the middle oil storage tank on the Brightwaters Yard. Grab sample GS-1 from the Brightwaters Yard was collected from the southeast corner of the site, south of soil boring SB-6.

Composite sample CS-3 was collected on the Bayshore property using five locations west of the concrete foundation for the gas relief holder and approximately 20 feet west of test pit location TP-14. Small patches of loose asphalt and tar material were present on the ground surface in this area but were not included as part of the sample. Grab sample GS-2 was collected on the Bayshore property approximately eight feet west of soil boring SB-15. The third grab sample, GS-3, was collected on the Bayshore property east of test pit TP-15 and north of soil boring SB-16.

Composite sample CS-4 was collected on the adjacent property west of Clinton Avenue behind the auto repair building. At the time of sample collection, this location was being used for parking of several passenger vans, some of which were inoperable and evidence of surface soil contamination was observed beneath them.

Grab sample GS-4 was collected on the adjacent property west of Clinton Avenue in front of the auto repair building south of the Long Island Railroad tracks. A duplicate sample, GS-6, was collected at the GS-4 location and analyzed for the same suite of analyses as GS-4.

Composite sample CS-5 was collected on the adjacent property east of Clinton Avenue. This parcel of land is apparently used by a paving contracting company as a staging and storage area for equipment and materials. The sample was collected in the southeastern corner of the parcel in the area where monitoring well cluster MW-6 and soil boring SB-19 are located.

Grab sample GS-5 was also collected on the adjacent property east of Clinton Avenue approximately 15 feet east of monitoring well cluster MW-5 and south of the Long Island Railroad tracks.

Two additional surface soil samples were collected from the LILCO properties to undergo grain size analysis. These sample analyses were used to evaluate the potential for generation of contaminated fugitive dust. The top two inches of soil were collected at one location on each of the LILCO properties considered representative of the average soil type on each parcel. The first sample, FD-1, was collected from the Brightwaters Yard close to test pit TP-3 and monitoring well cluster MW-2. The second sample, FD-2, was collected





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from the Bayshore property near the driveway in front of the LILCO storeroom.

Further discussion of the sampling methods is given in Appendix C. The results of this physical testing program are presented in Appendix G. The chemical characteristics of the surface soils are discussed in Section 6.2.

## 4.3 GROUNDWATER INVESTIGATIONS

Groundwater investigations were conducted on the LILCO and adjacent properties and in the surrounding area to assess the presence, nature, and extent of groundwater contamination which may have resulted from past operations at the Bayshore MGP. A previous investigation (1979) documented a plume of contaminated groundwater migrating southward from the site and discharging into Lawrence Creek. During the current investigation (1992), groundwater samples were collected from 38 on-site and off-site wells for further groundwater plume definition. An additional 31 groundwater samples were collected using Tracer probe or HydroPunch methods. Ten new monitoring wells (four clusters consisting of one deep well and one shallow well each) were installed on the LILCO properties. Three monitoring well clusters (of two wells each) were installed on the adjacent properties. A discussion of the installation and sampling procedure is found in Appendix C. The seven existing off-site well clusters installed during the 1979 investigation were resampled during this investigation. The monitoring well locations are shown on Figure 4-3.

Monitoring wells were also used to measure water level elevations and to evaluate the presence of free product. Two rounds of synoptic water level measurements, one on September 15, 1992 and the second on October 30, 1992, were used to prepare water level contour maps and to assess vertical head gradients. A discussion of these water level measurements is presented in Section 5.3. Hydraulic conductivity tests were conducted on September 23, 1992 using six monitoring wells, four on the LILCO properties and two on the adjacent property, to estimate the hydraulic conductivity of the saturated zone around each monitoring well. This information is also presented in Section 5.3.

Groundwater samples were collected at off-site sampling locations by using either the Tracer probes or the HydroPunch groundwater sampling methods. Detailed discussions of the sampling procedures are found in Appendix C.





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### 4.3.1 Monitoring Well Inventory

On June 3 and 4, 1992 an inventory of the existing off-site and on-site wells installed during the previous investigation was compiled. Seven of the original nine off-site well clusters were found downgradient of the site. These seven clusters, each consisting of a shallow, intermediate and deep well, were found to be undamaged and the individual wells were tested to insure proper hydraulic connection to the aquifer. The hydraulic connection of each of the wells was confirmed and it was determined that these wells were usable for sample collection and water level measurements. Three four-inch diameter PVC wells were found on the Bayshore property and determined to be connected to the surrounding aquifer. In addition to these seven wells, two steel well points were also found on the Bayshore property and determined to be usable during this investigation. One of the four-inch diameter PVC wells was used as the shallow well in cluster MW-8, while the remaining wells and well points were used only for measuring water levels during the investigation.

### 4.3.2 Installation of Monitoring Wells

Sixteen new monitoring wells were installed between August 11 and August 30, 1992. Ten of these wells were installed on the LILCO properties; 6 wells (three clusters) were installed on the Brightwaters Yard and 4 wells (one cluster, one individual shallow well, and one deep well paired with an existing shallow well) were installed on the Bayshore property. The remaining six wells were installed on the adjacent properties. Two wells (one cluster) were installed on the parcel west of Clinton Avenue and four wells (two clusters) were installed on the parcel east of Clinton Avenue. The locations of these wells are shown on Figure 4-4.

The shallow wells were designed to bridge the water table with a minimum of two feet of the screen set above the water table and eight feet below to allow for seasonal fluctuation of the water table and the detection and sampling of floating product. A 10-foot screen was used for each of the wells and is sufficient to account for temporal fluctuations of the water table in the Long Island area. The deep wells were installed with the well screens set approximately 35 to 45 feet below the ground surface. Monitoring well design and installation conformed with NYSDEC requirements.

The 17 new monitoring wells and the shallow existing well on the Bayshore property, renamed MW-8S, were developed upon completion to assure good hydraulic connection between the well and the aquifer and to remove fine sediment from the well. Prior to



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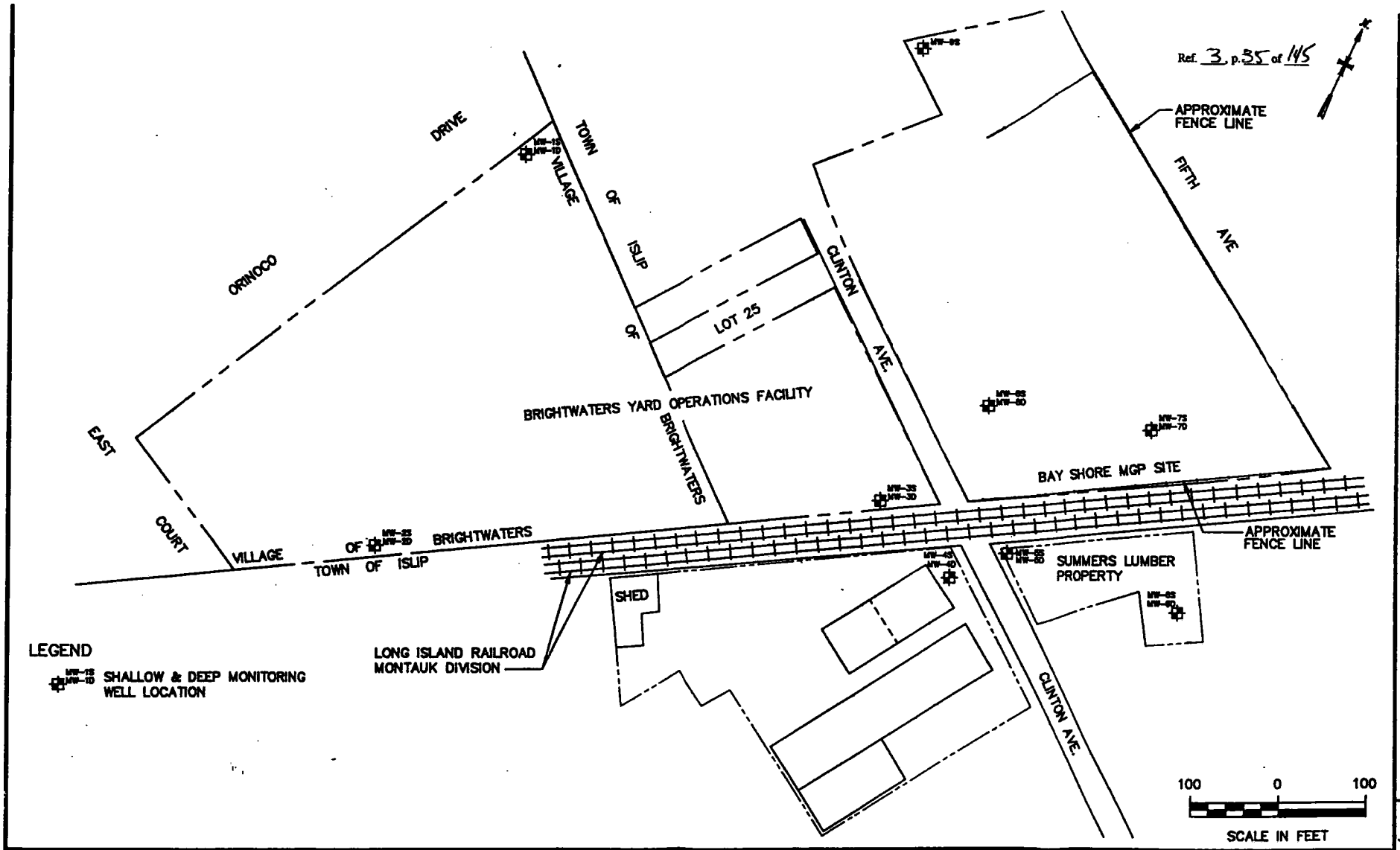


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LILCO & ADJACENT PROPERTY MONITORING WELL LOCATIONS

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FIGURE 4-4

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development, the water in each well was inspected by retrieving a sample in a one-inch diameter clear disposable bailer to check for the presence of non-aqueous phase liquids. The water from MW-7S was the only sample which showed an oily sheen, but free product was not observed.

Following installation, a LILCO survey crew measured the elevation of the top of each well casing relative to Mean Sea Level (MSL) datum. The horizontal locations were also surveyed and tied to the LILCO site coordinate system.

Further discussion of the well installation and development procedures is given in Appendix C, and the well construction logs are given in Appendix H.

### 4.3.3 Groundwater Sampling and Analyses

Three separate phases of groundwater sampling were conducted during the investigation. During the first phase, shallow groundwater samples were collected using the Tracer probes on the adjacent properties and at locations both upgradient and downgradient of the site. During the second phase, the HydroPunch method was used to collect samples from both the shallow and intermediate groundwater depths on the Brightwaters Yard and also upgradient and downgradient of the site. The third phase included collection of groundwater samples from the monitoring wells at on and off-site locations.

#### 4.3.3.1 Tracer Groundwater Sampling

On July 28 and 29, 1992, Tracer probes were used to collect a total of 18 shallow groundwater samples ranging in depth from 6 to 13 feet below ground surface. Six samples were collected from the adjacent properties, six samples were collected upgradient of the LILCO properties to evaluate background water quality, and six samples were collected in the off-site downgradient plume area. The locations of the groundwater samples collected on the adjacent properties are indicated in Figure 4-5 and the samples collected at the off-site locations are on Figure 4-6.

Of the 18 Tracer groundwater samples collected, 13 were sent to the laboratory for analyses. The six samples collected upgradient of the site were analyzed for the full TCL volatile and semi-volatile list, and the remaining seven samples were collected and analyzed for BTEX, PAHs, total phenols, and total cyanide. One of these seven samples (TR-6), was collected on the adjacent property in front of the auto repair building, and six were collected in the downgradient plume area. The remaining five samples, collected on the adjacent





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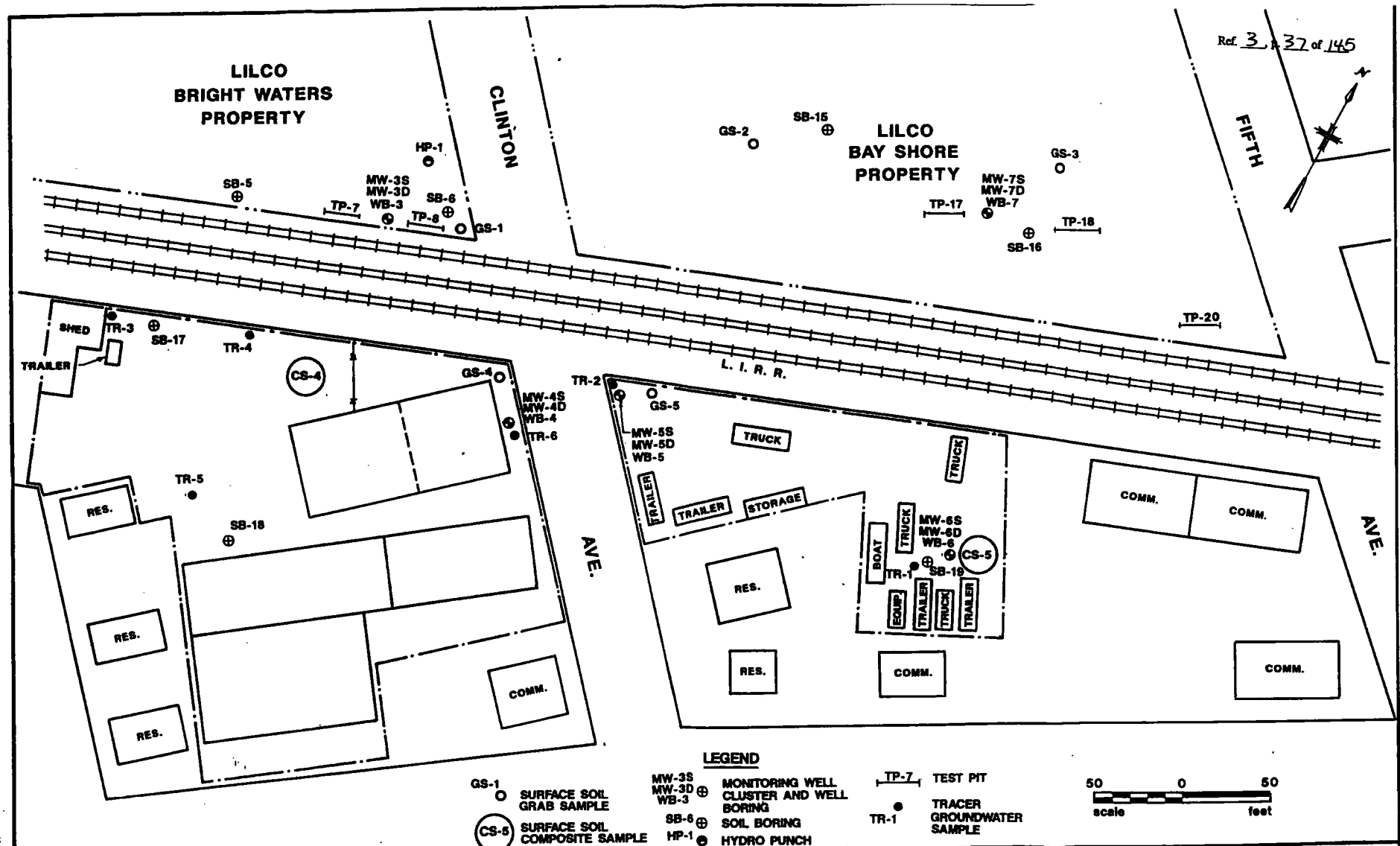


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LILCO & ADJACENT PROPERTY SAMPLING LOCATIONS

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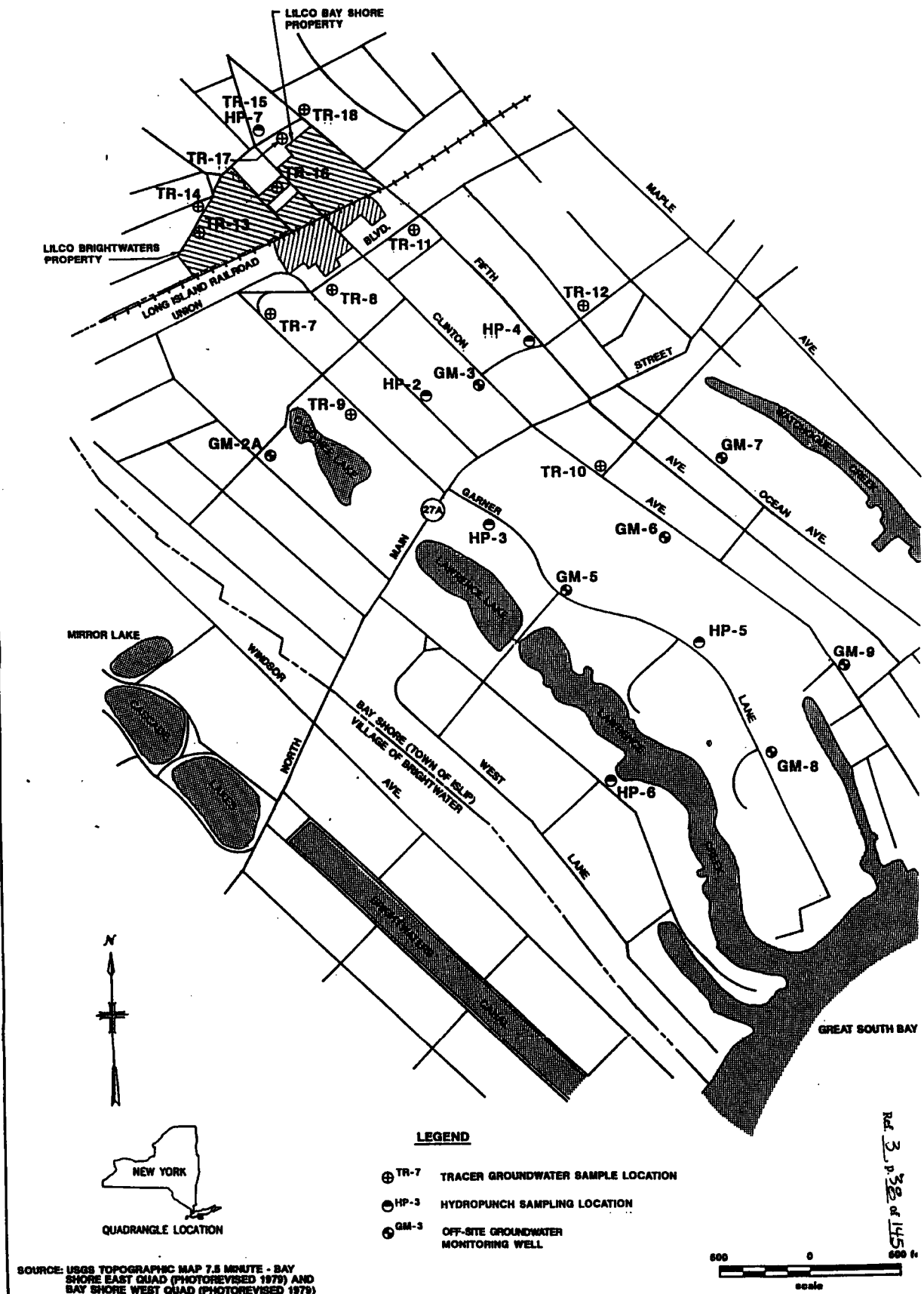
FIGURE 4-5




SOURCE: USGS TOPOGRAPHIC MAP 7.5 MINUTE - BAY SHORE EAST QUAD (PHOTOREVISED 1979) AND BAY SHORE WEST QUAD (PHOTOREVISED 1979)

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OFF-SITE GROUNDWATER SAMPLING LOCATIONS

FIGURE 4

properties, were analyzed for BTEX and total volatile hydrocarbons using the portable field GC.

Further discussion of this sampling method is included in Appendix C, and a discussion of the chemical characteristics of these groundwater samples is found in Section 6.1.

#### 4.3.3.2 HydroPunch Groundwater Sampling

Between September 1 and September 10, 1992, the HydroPunch method was used to collect a total of 13 groundwater samples. Two samples, one shallow and one deep, were taken on the Brightwaters Yard. One additional deep sample was taken upgradient of the site. The remaining 10 samples were taken at five locations in the downgradient plume area. A shallow and a deep groundwater sample was collected at each location. The shallow samples were collected at depths varying between 3 and 11 feet below ground surface, while the deep samples were collected from depths varying between 42 and 45 feet below ground. Figure 4-6 shows the HydroPunch sample locations. The 13 groundwater samples were sent to the laboratory and analyzed for BTEX, PAHs, total phenols, and total cyanide.

Further discussion of the sampling procedure is given in Appendix C. A discussion of the chemical characteristics of both the shallow and deep HydroPunch groundwater samples is found in Section 6.1.

#### 4.3.3.3 Monitoring Wells

Between September 15 and September 18, 1992, 40 groundwater samples were collected from a total of 38 wells including the 16 newly installed monitoring wells, one existing on-site shallow well (MW-8S), and the seven existing off-site well clusters (GM-2A, GM-3, GM-5, GM-6, GM-7, GM-8, and GM-9). Samples were collected at least two weeks after the newly installed monitoring wells were developed to allow for stabilization within the saturated zone. The monitoring well locations on the LILCO and adjacent properties, and in the downgradient plume area are shown on Figure 4-3.

Each of the 40 groundwater samples were analyzed by the laboratory for BTEX, PAHs, total phenols, and total cyanide. The samples collected from monitoring well clusters MW-4, MW-5, and MW-6 on the adjacent properties were analyzed for the full TCL volatile organic list. Sample MW-7S from the Bayshore property was also analyzed for the full

TCL/TAL list. This location was chosen because it represented the worst case groundwater quality based on field observations and instrument screening.

Field parameters for pH, temperature, and specific conductivity were also recorded during sampling at each location and are included on the sample collection logs given in Appendix I.

A discussion of the sampling procedures is given in Appendix C and the chemical characteristics of the groundwater samples are presented in Section 6.1.

#### 4.3.3.4 Data Validation

The laboratory data were subjected to a data validation process to verify that the analytical results were obtained following the specific protocols and are of sufficient quality to be relied upon for use in the risk assessment, for selecting potential remedial alternatives or other uses. The laboratory Tier II (ASP Category B) QA/QC data package was checked to assure that holding times were met, equipment calibration and tuning were achieved, spikes and duplicates were within required ranges, and that other laboratory standard operating procedures met compliance requirements. A discussion of the data validation results is given in Section 6.1.6.

### 4.3.4 Water Level Measurements

Two rounds of synoptic water levels were measured in the monitoring wells during the field investigation. The first round of water levels was measured on September 15, 1992 and the second on October 30, 1992.

Each round of water level measurements was completed within a three hour time period to constitute a synoptic event. This was done to take into consideration any effect of tidal influences within the study area. A discussion of the water level measuring procedure is included in Appendix C and groundwater movement at the site is described in Section 5.3.

### 4.3.5 Hydraulic Conductivity Testing

On September 23, 1992, hydraulic conductivity tests were conducted in six of the newly installed monitoring wells. These tests were conducted to obtain an order-of-magnitude estimate of the hydraulic conductivity of the unconsolidated water bearing material around the screened interval. Four wells were tested on the LILCO property,





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MW-1S and MW-1D on the Brightwaters Yard and MW-9S and MW-8D on the Bayshore property. Wells MW-5S and MW-5D east of Clinton Avenue were tested on the adjacent property. Falling and rising head slug tests were conducted at each monitoring well location; however, only rising head test data were evaluated at the shallow wells because the well screens in these wells bridged the water table. While this screen placement is advantageous for chemical quality sampling, it will not provide accurate data when a falling head test is conducted.

The test data was analyzed using the slug test analysis program, SLUGIX, which calculates the hydraulic conductivity using a method developed by Bouwer and Rice (1976). A discussion of the testing procedure is included in Appendix C, and the test data is given in Appendix J. The results of this analysis are discussed in Section 5.3.

## 4.4 SEDIMENT INVESTIGATION

Five sediment samples were collected from four locations in Lawrence Lake and Lawrence Creek as shown on Figure 4-7. Samples were collected using a hand controlled piston core sampler fitted with CAB (Cellulate Acetate Butyrate) tubing. A discussion of the sampling procedure is included in Appendix C.

Samples were analyzed in the field for conductivity, pH, dissolved oxygen, temperature and salinity. Dissolved oxygen data were lost due to instrument malfunction. However, the samples were submitted to the laboratory for the analyses as discussed in Section 6.1.4.

## 4.5 AIR QUALITY INVESTIGATION

Air quality sampling was conducted at the LILCO properties from July 27 to July 29, 1992. This program was undertaken to evaluate whether site specific volatile organic air emissions could affect air quality on and around the site under existing conditions or during remedial activities, if warranted.

Background samples were collected for PAHs and VOCs at two locations prior to test pit excavation on the site. One PAH sample, collected over a 24-hour time period, and one VOC sample, collected over an 8-hour time period, was taken at each location. These locations, AS-N and AS-S, were at the perimeter of the site on the north and south ends of





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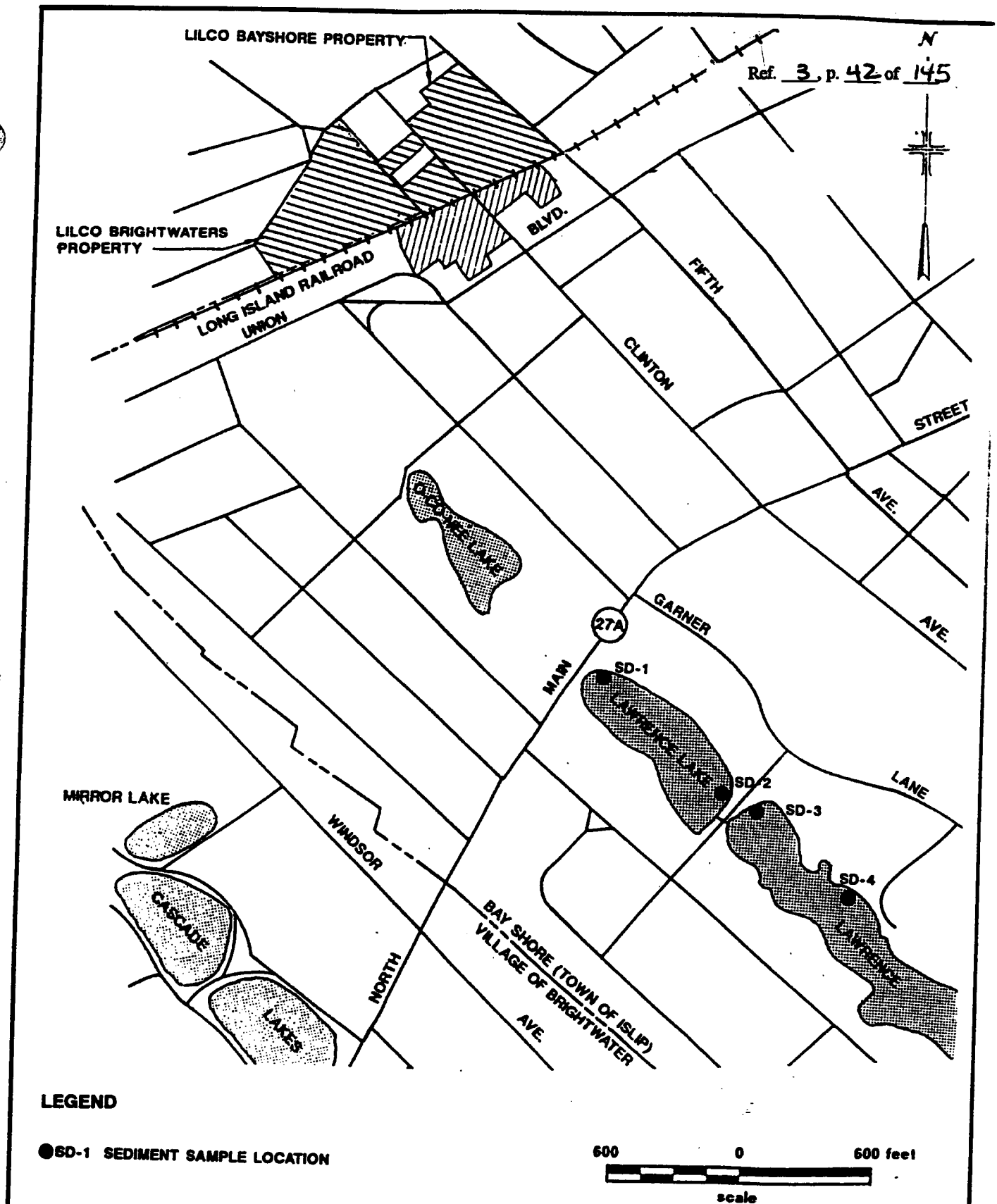


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SEDIMENT SAMPLE LOCATIONS

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FIGURE 4-7

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the property, which are upwind and downwind of the test pit excavation area. On the following day a third location, AS-P, was added directly adjacent to test pit TP-22 in the center of the site. This test pit was excavated and air sampling occurred at the three locations for a period of 24-hours. Again, the PAH samples were collected over 24-hours and the VOC samples were collected over 8-hours. These sampling locations are shown on Figure 4-8. Wind directions were variable between the northwest and south portions of the site. Wind speeds varied between calm and seven miles per hour. An instantaneous grab sample, analyzed for VOCs, was also collected from the soil emissions from the material excavated from TP-22.

PAH samples were collected using PS-1 High Volume Air Samplers in conjunction with quartz fiber and polyurethane foam (PUF) filters. The quartz fiber filters are used to catch ambient air dust particles. Catching the dust particles is important because semi-volatile compounds are often attached to them. The semi-volatiles that are not attached to dust particles are captured downstream by the polyurethane foam filter. These samples were collected over a 24-hour time period at a controlled rate. The PUF samples were sent to Triangle Laboratories in Durham, North Carolina for analysis by high resolution gas chromatography and a mass spectroscopy in accordance with EPA Method 8270.

VOC samples were collected using SUMMA canisters. Air entered the canisters, which are under vacuum, at a controlled rate via a flow regulator to draw in an eight hour composite sample. The samples were sent to Enseco Air Toxics Laboratory in El Monte, California for analyses in accordance with EPA Method TO-14.

A discussion of these air quality sampling results is in Section 6.1.

## 4.6 LAND USE SURVEY

The information contained in the land use inventory was collected from a number of different sources. The Long Island Regional Planning Board (LIRPB) provided census data and a regional land use report completed in 1981. LILCO provided supplementary population data based on their records of active residential electric meters. Sensitive receptors were identified based on the critical facility list obtained from LILCO's Customer Relations Department. Potential pollution contributors (e.g., automobile industries and dry cleaners) were identified using the USEPA's Facility Index Database Systems (FINDS). Both sensitive receptor and potential pollution contributing industry inventories were





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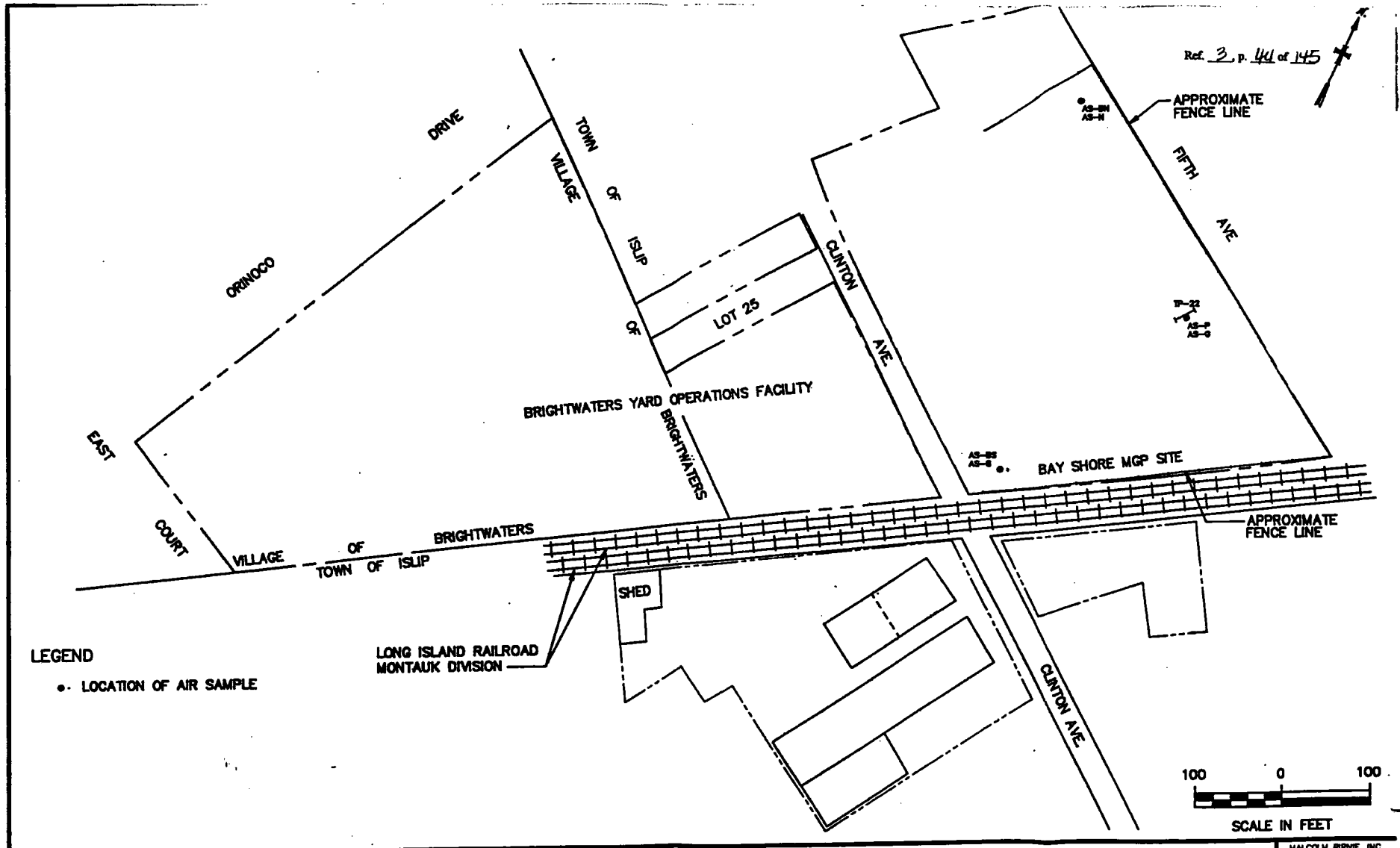


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**AIR SAMPLE LOCATIONS**

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FIGURE 4-6

Ref. 3, p. 44 of 145

confirmed based on telephone book listings. Tax maps, village maps, and additional land use information were obtained from the Village Hall of Brightwaters and Islip Town Hall. The land use data base information is included in Appendix K.

# 5.0 PHYSICAL CHARACTERISTICS OF STUDY AREA

## 5.1 GEOPHYSICAL SURVEY RESULTS

The integrated geophysical survey, which was designed to locate buried structures and utilities and areas of possible soil and groundwater contamination, was conducted on July 9, 1992 as described in Section 4.1. Locating these features by nonintrusive methods helped define those areas requiring intrusive investigation and aided in the placement of soil gas probes, soil borings, test pits and monitoring wells.

The electromagnetic (EM) induction method was used to map near surface electrical conductivity variations to locate conductive objects such as underground utilities and buried metal or other construction debris. The magnetometer/gradiometer survey was conducted to locate shallow buried magnetic objects such as utility pipes and metal debris to supplement the EM survey. Anomalous areas identified by EM and magnetics were further characterized by ground penetrating radar (GPR) which is less susceptible to external EM interferences such as metal fences and overhead power lines. The electromagnetic, magnetic, and ground penetrating radar data collected was reviewed for data integrity, and any single outlying data points were deleted if the response was deemed excessively high or low. Final data files were smoothed and contoured. The full geophysical report is contained in Appendix A.

The electromagnetic survey revealed several anomalous areas. On the Bayshore property these anomalies were generally located near the southern corner, corresponding to the foundation of the former generator and compressor house. Figure 3-2 shows these features as part of the former facility layout. There was also an area of strong electromagnetic anomalies south of the storeroom and the foundations of the gas oil tanks. A smaller anomalous area was found south of the relief holder foundation. This anomaly weakens toward the west. The in-phase portion of this survey better defined the extent of each anomalous area. Strongly negative (or positive, depending on target orientation) EM readings indicate the presence of metallic objects. However, due to the high level of response, no interpretation was possible regarding an inorganic plume or the presence of shallow groundwater variations. No major EM anomalies were recorded in the northernmost portion of the Bayshore property.

There were several strong anomalies evident on the Brightwaters Yard. The strongest was located near the eastern boundary along Clinton Avenue. This anomalous zone corresponds with several former structures including the pump house, light oil recovery equipment and tunnel which extends beneath Clinton Avenue. There were also some strong anomalies in the area of the three oil storage tanks and pump house.

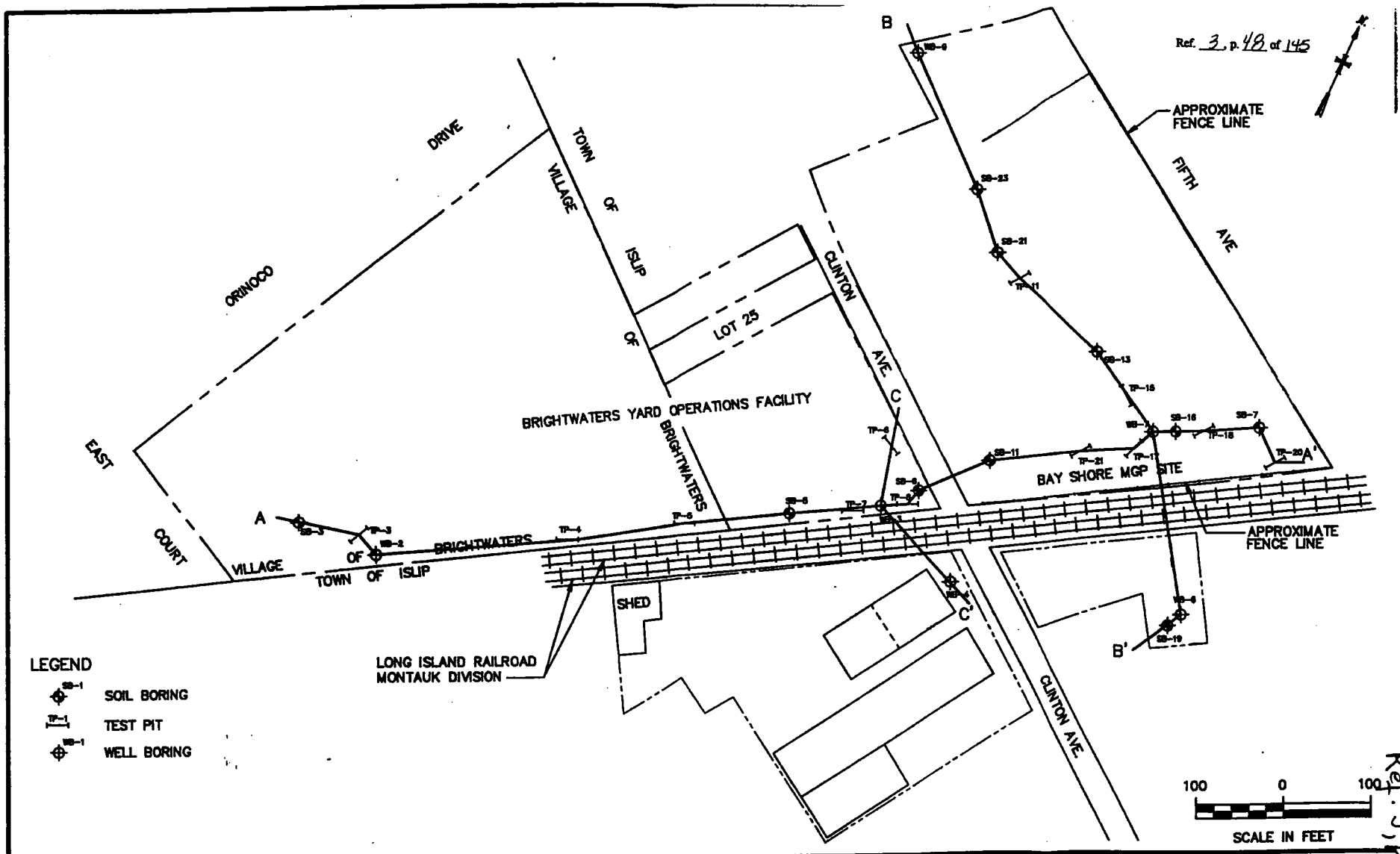
During the magnetic survey, strong anomalies were again detected in the southern corner of the Bayshore property. The magnitude and location of these anomalies correlate well with the electromagnetic data. A detailed examination of the results of this survey revealed that many positive anomalies were surrounded by negative areas. This is a typical magnetic response resulting from buried metal or dense foundations. On the Brightwaters Yard several magnetic anomalies were recorded in the area bordering Clinton Avenue and in the area of the former oil storage tanks. Again, these correlate well with the electromagnetic data in these areas.

A ground penetrating radar survey was conducted after the electromagnetic and magnetic surveys were completed. The GPR survey provided insight into the source of some anomalies detected in the other surveys. Few strong anomalies were recorded and most reflections were due to shallow discontinuous pipes, rebar, and filled or disturbed areas. The strongest anomaly was recorded in the area between the storage holder and relief holder.

These data were used in conjunction with soil gas survey and historical operating information to guide placement of soil borings and monitoring wells. A detailed discussion of the geophysical program and maps of anomaly locations can be found in the geophysical investigation report in Appendix A.

## 5.2 GEOLOGIC INVESTIGATION

The geologic investigation consisted of a test pit program, soil and well boring program, and a surface soil sampling program conducted on the LILCO and the adjacent properties. Results and observations of this investigation helped characterize the stratigraphy beneath the study area. Geologic cross sections were constructed along the lines shown on Figure 5-1.

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LOCATION OF GEOLOGIC CROSS SECTIONS

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FIGURE 5-1

Ref. 3, p. 48 of 145

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### 5.2.1 Test Pit Program

On the Brightwaters Yard, three test pits (TP-1 through TP-3) were excavated in the western portion of the site in the area surrounding the former H-fuel tank (Figure 3-2). The water table was encountered at approximately 2.5 feet below ground surface in this area. A layer of top soil extended across this area to a depth of approximately six inches underlain by a three foot layer of sand. Below this sand layer was a one to two foot layer of black, organic rich peat material. The peat had a slight odor, but no organic vapors were detected with the HNu. A sand zone was found beneath the peat which extended to the base of each of these test pits. In test pit TP-1 this zone appeared uncontaminated; however, in test pits TP-2 and TP-3 this sand was stained a grayish color and emanated a strong fuel odor.

The remaining test pits were located along the southern property boundary of the Brightwaters Yard next to the fence line bordering the Long Island Railroad tracks and along Clinton Avenue. Four of these test pits were excavated beneath an abandoned leg of the railroad tracks (Figure 3-2) which once extended onto the site. The upper six inches in these test pits were top soil, underlain by a one to three foot thick layer of black sand and black cinders. This material is believed to be part of the abandoned railroad bedding which extended onto the site. The fifth test pit, TP-6, was located near Clinton Avenue, and had the same stratigraphic characteristics as the other test pits in this area. The only variation within these five test pits was that a layer of gray silt was encountered at the base of test pit TP-4.

On the Bayshore property, a layer of top soil varying in depth from six inches to one and one-half feet was found at each test pit location. At several of the test pit locations this top soil was underlain by a layer of sandy silt mixed with construction debris. This debris is probably from the old gas plant which had been demolished in 1973 and buried throughout the site. Beneath the debris is a zone of sand which continues to below the water table. This sand zone was observed where debris was not present and continued beneath the water table at these locations also. Evidence of contamination, such as staining, odor and HNu response, was most evident at the water table in the sand. One exception was in test pit TP-20 where no odor or visible contamination was present. There are also areas on the Bayshore property where zones of gray clayey silt were found. The vertical extent of the clayey silt varied between depths of 5.5 and 10 feet in test pits TP-11, TP-13, TP-16, and TP-17.



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Samples were collected in test pits TP-11, TP-14, and TP-19 for grain size analyses. These samples were collected from the various soil types encountered on the site. The samples collected in TP-14 and TP-19 consisted primarily of sand with small amounts of gravel and silt and clay present. The sample collected in TP-11 contained a larger amount of silt and clay and less sand and gravel. The grain size distribution curves are given in Appendix G.

A detailed geologic description of each test pit and the sample intervals are on the test pit logs in Appendix D.

### 5.2.2 Soil Boring Program

Soil borings were drilled to further characterize site stratigraphy below the depths of the test pits but above the water table. Deeper borings were drilled as part of monitoring well installation and are described in Section 5.2.3. Logs of the soil borings are given in Appendix E.

Four borings (SB-1 through SB-4) were drilled in the western corner of the Brightwaters Yard in the area of the former H-fuel tank. A shallow water table was found in this area consistent with observations from test pits TP-1 through TP-3. These soil borings revealed a thin layer of top soil underlain by a layer of sand extending to a depth of 2.5 feet below grade. Beneath this sand was a layer of organic peat which varied in thickness from a few inches to 1.5 feet. A second zone of sand was found beneath the peat layer to approximately 4.5 feet below ground where another thin layer of organic material was present. In soil boring SB-3 this organic material was also seen near the base of the borehole, but in borings SB-1, SB-2, and SB-4, the organic material was underlain by a grayish sand. This sand layer, as well as the organic layer in SB-3, had a strong fuel odor and high HNu readings were recorded. These findings were consistent with the findings made during the test pit program in this area.

The remaining two soil borings on the Brightwaters Yard were drilled in the southeastern corner of the property. This area contained a thin layer of top soil underlain by a layer of sand which was continuous to the water table. In soil boring SB-5 a thin layer of silt was found at five feet below ground surface. A layer of gray silty clay was found at 7.5 feet below ground surface. Samples from this boring did not show evidence of contamination. The sand in soil boring SB-6 gradually graded from a tan color to grayish-





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black with strong tar-like odors. The shallow stratigraphy beneath the Brightwaters Yard is shown on the geologic cross sections in Figures 5-2 and 5-3.

A layer of top soil was present across the entire Bayshore property. A mixture of sandy silt and construction debris was found beneath the top soil in most areas. This debris was probably generated and distributed across the site during demolition of the plant in 1973. Native sand was found beneath the top soil and construction debris. Zones of gray silt and clay were discovered at depths ranging from 4 to 10 feet below ground in some of the borings. The shallow stratigraphy on the Bayshore property is shown on the cross sections in Figures 5-2 and 5-3.

Based on these 19 soil borings, the visible evidence of contamination characterized by stained soil, odor and the presence of organic vapors measured as HNu response was found to extend east and west across almost the entire Bayshore parcel. However, samples from soil borings SB-7 and SB-29 in the southeastern corner of the site, and borings SB-23 and SB-27 in the northern and eastern portions of the site, showed no odor or visible evidence of contamination. Additional borings drilled along the Clinton Avenue and Fifth Avenue boundaries of the Bayshore property also did not show visible evidence of contamination.

Two of the three borings drilled on the adjacent properties were located on the west side of Clinton Avenue. Soil boring SB-17 was drilled at the fence line south of the Long Island Railroad tracks. A thin layer of top soil was found underlain by sand which extended below the water table. No odor, staining or HNu responses were detected in any of the split spoon samples collected at this location. Soil boring SB-18 was drilled beneath a paved area north of the lumber storage building on the adjacent property. A layer of asphalt and fill extended to a depth of two feet below ground at this location. This was underlain by a layer of sand to a depth of five feet. Beneath this sand was a thin layer of gray clay underlain by another sand zone. Again, no odor or visual evidence of contamination was detected at this location.

The third boring drilled on the adjacent property (SB-19) was located east of Clinton Avenue near the asphalting equipment storage and maintenance area. This boring was also drilled through a paved area, and the first 2.5 feet contained asphalt and fill material. Beneath the fill was a layer of sand which extended beneath the water table. Strong evidence of contamination (odor, staining, HNu response) was seen in this sand.





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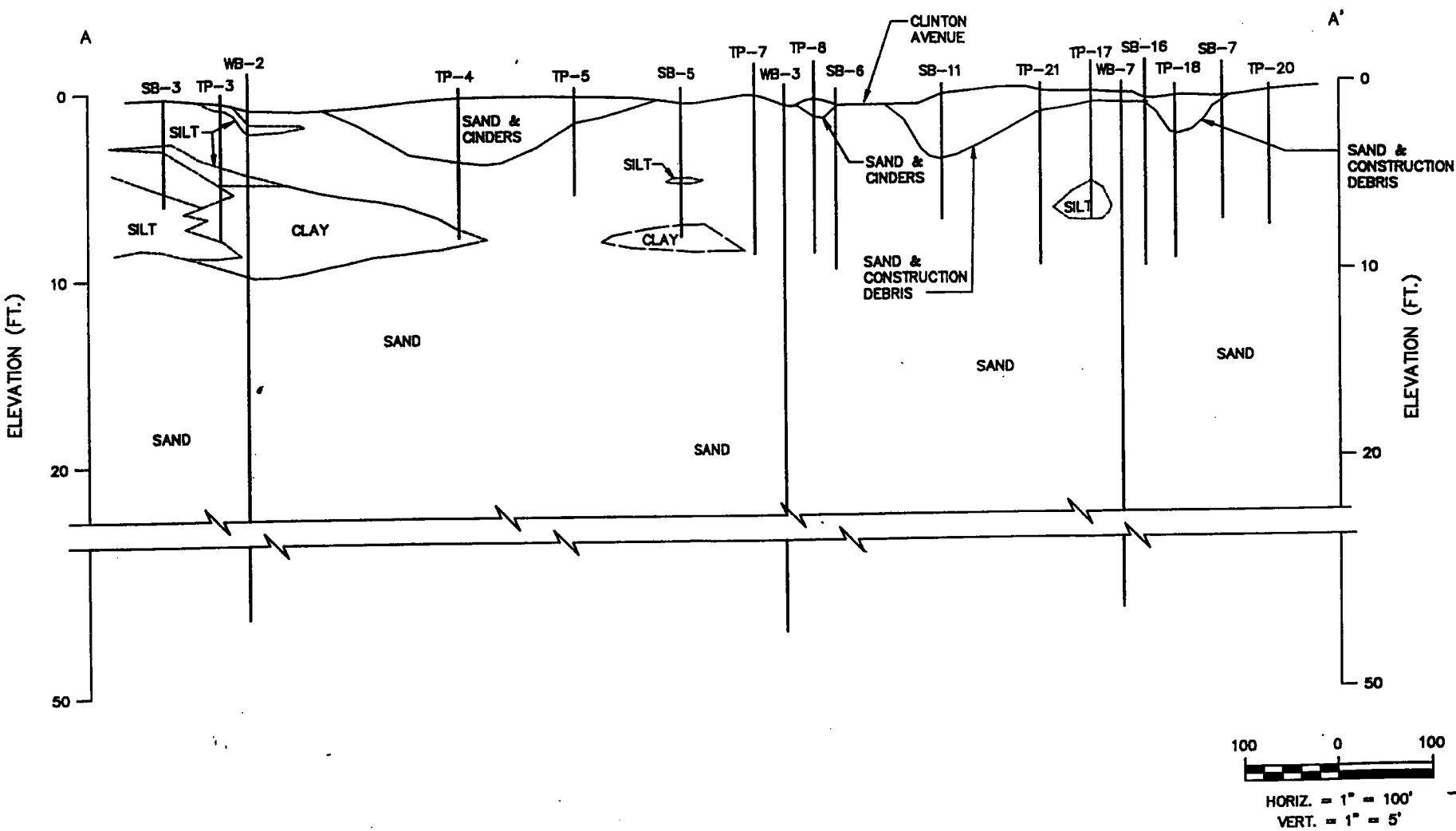


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GEOLOGIC CROSS SECTION A - A'

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FIGURE 5-2

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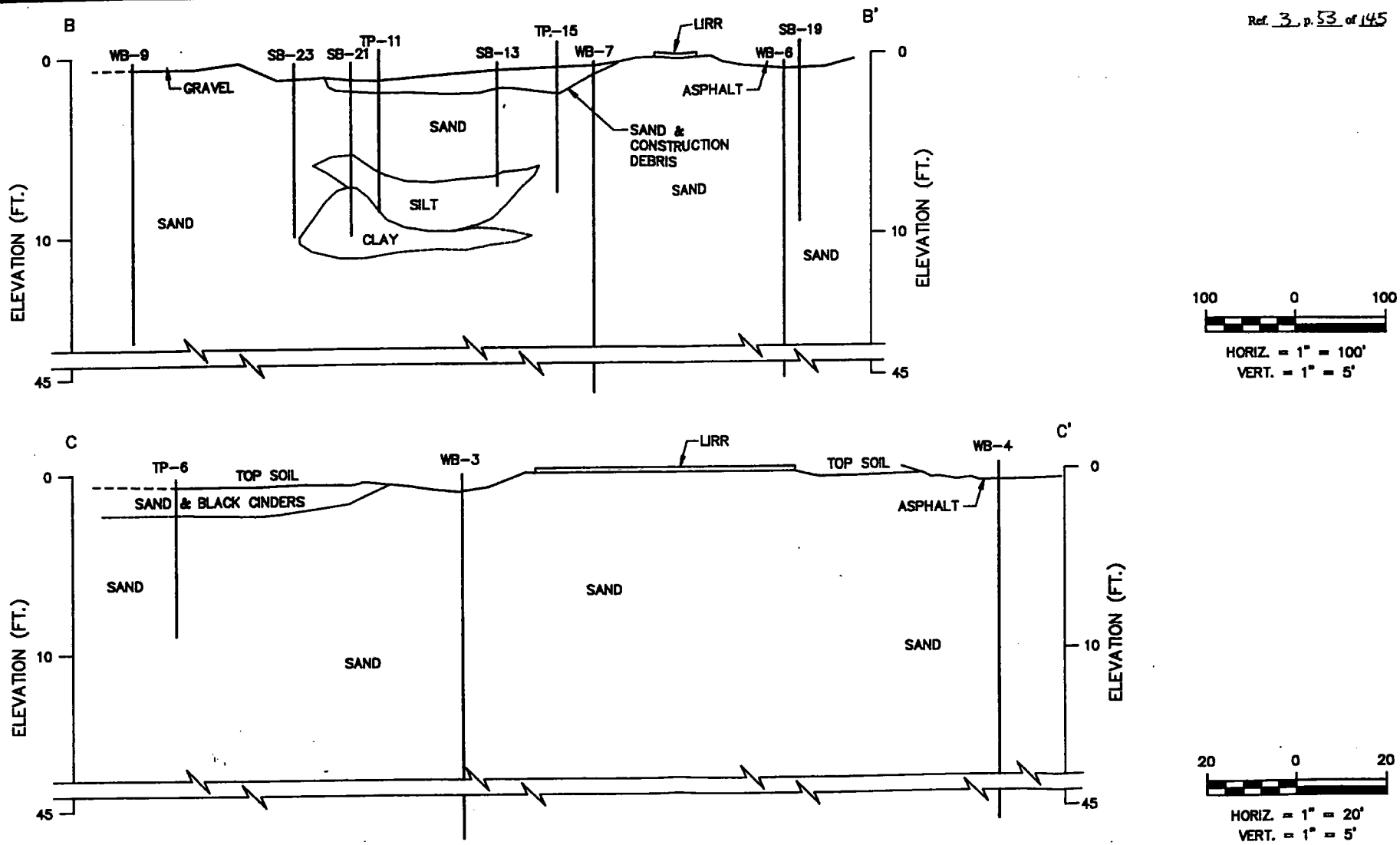
Ref. 3, p. 53 of 145

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GEOLOGIC CROSS SECTIONS B - B' AND C - C'

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FIGURE 5-3

Ref. 3, p. 53 of 145

A detailed geologic description of each soil boring and the sample intervals are on the soil boring logs in Appendix E.

### 5.2.3 Well Boring Program

Well borings were drilled for the installation of monitoring wells and to further characterize site stratigraphy to depths of 50 feet below ground surface. Logs of these borings are given in Appendix F.

Well boring WB-1 was drilled at the location of monitoring well cluster MW-1 north of the LILCO GC&M building on the Brightwaters Yard. A thin layer of top soil was found underlain by an orange-brown sand that extended down to the water table. Below the water table this sand became a tan color and continued to a depth of 47 feet below the ground surface. A soil sample was collected from a depth of 40 feet for grain size analysis. This sample contained 98 percent sand and 2 percent silt and clay. No odor or visible evidence of contamination was detected in this area.

Well boring WB-2 was drilled in the area south of the former H-fuel tank (Figure 3-2) on the Brightwaters Yard. Consistent with observations made while drilling soil borings and excavating test pits in this area, a thin layer of top soil was present underlain by a layer of sand which extended to 2.5 feet below ground surface. Beneath this sand was a thin layer of organic peat underlain by alternating layers of gray clay and reddish-brown sand which continued to a depth of 16 feet below the ground surface. At 24 feet below ground surface this reddish-brown sand graded into a tan sand which contained to the base of the borehole at 46 feet. A shallow water table was interpreted in this area based on the presence of water saturated red-brown sand at four feet below ground. Visible evidence of contamination (staining) was present at approximately 2 feet below ground, and odors and HNu responses continued to a depth of 29 feet.

Well boring WB-3 was drilled in the south east corner of the Brightwaters Yard along the fence line at the Long Island Railroad boundary. At this location, a thin layer of top soil was underlain by a tan sand which extended to a depth of seven feet where a one foot thick zone of black sand was found. Below the black sand was another tan sand layer which continued to the base of the borehole at a depth of 47 feet. The water table in this area was at eight feet below ground surface based on the occurrence of saturated sands.

Of the three well borings drilled on the Bayshore property, one shallow boring (WB-9) was drilled in the gas regulator area upgradient of the former gas plant buildings. Only





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a shallow boring was installed at this location and no contamination was detected. A layer of gravel 1.5 feet thick was underlain by a bed of orange-brown sand which graded into a tan sand at the water table six feet below ground surface. This zone of tan sand extended to the end of the borehole at 16 feet below ground surface.

Well boring WB-7 was drilled at monitoring well cluster location MW-7 just north of the compressor house foundation (Figure 3-2) which was near the Long Island Railroad boundary in the southern part of the Bayshore property. In this area a layer of top soil was present, and as discovered during the earlier soil investigations, the top soil is underlain by a layer of sandy silt and construction debris. Beneath the debris is a sand layer which continued for the full depth of the borehole at 46 feet. Visible evidence of contamination, as odors, oily sheens and HNu response, was detected for the entire depth of the boring.

Well boring WB-8 was installed next to an existing four-inch PVC monitoring well located on the Bayshore property south of the LILCO storeroom and east of Clinton Avenue. The stratigraphy in this area was similar to that found in well boring WB-7. The only difference between these two locations was the vertical extent of contamination. The sand zone beneath the construction debris in WB-8 was contaminated to a depth of 24 feet below ground surface. The sand graded in color from black at the water table to gray at a depth of 24 feet to tan to the base of the borehole. The water table in this area was at approximately six feet below ground.

Two of the three well borings drilled on the adjacent properties were drilled on the parcel east of Clinton Avenue. Well borings WB-5 and WB-6 were drilled at the locations of monitoring well clusters MW-5 and MW-6 respectively. At both locations a thin layer (less than one foot thick) of silty sand and top soil was present beneath a layer of asphalt. Beneath the sandy top soil was a sand layer which extended to the bottom of the borehole at 45 feet below ground surface. At both locations this sand was tan in color above the water table and graded to a stained dark brown and grayish black below the water table. This stained zone, which also emitted odors, was observed in each boring to a depth of 25 feet. The water table occurred 7 feet below ground in WB-5 and at 10 feet below ground in WB-6.

Well boring WB-4 was drilled on the adjacent property in front of the auto repair building on the west side of Clinton Avenue in a paved area used as a parking lot. Beneath the asphalt was a layer of silty sand to two feet below ground surface. A continuous sand zone was observed beneath the silty sand to the bottom of the boring at 46 feet below





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ground. This sand zone varied in color from a grayish-tan above the water table to a tan sand at approximately six feet below ground surface. The tan sand continued to 39 feet where a brown sand was present to 46 feet below ground surface.

A detailed geologic description of each well boring can be found in Appendix F.

## 5.3 GROUNDWATER INVESTIGATION

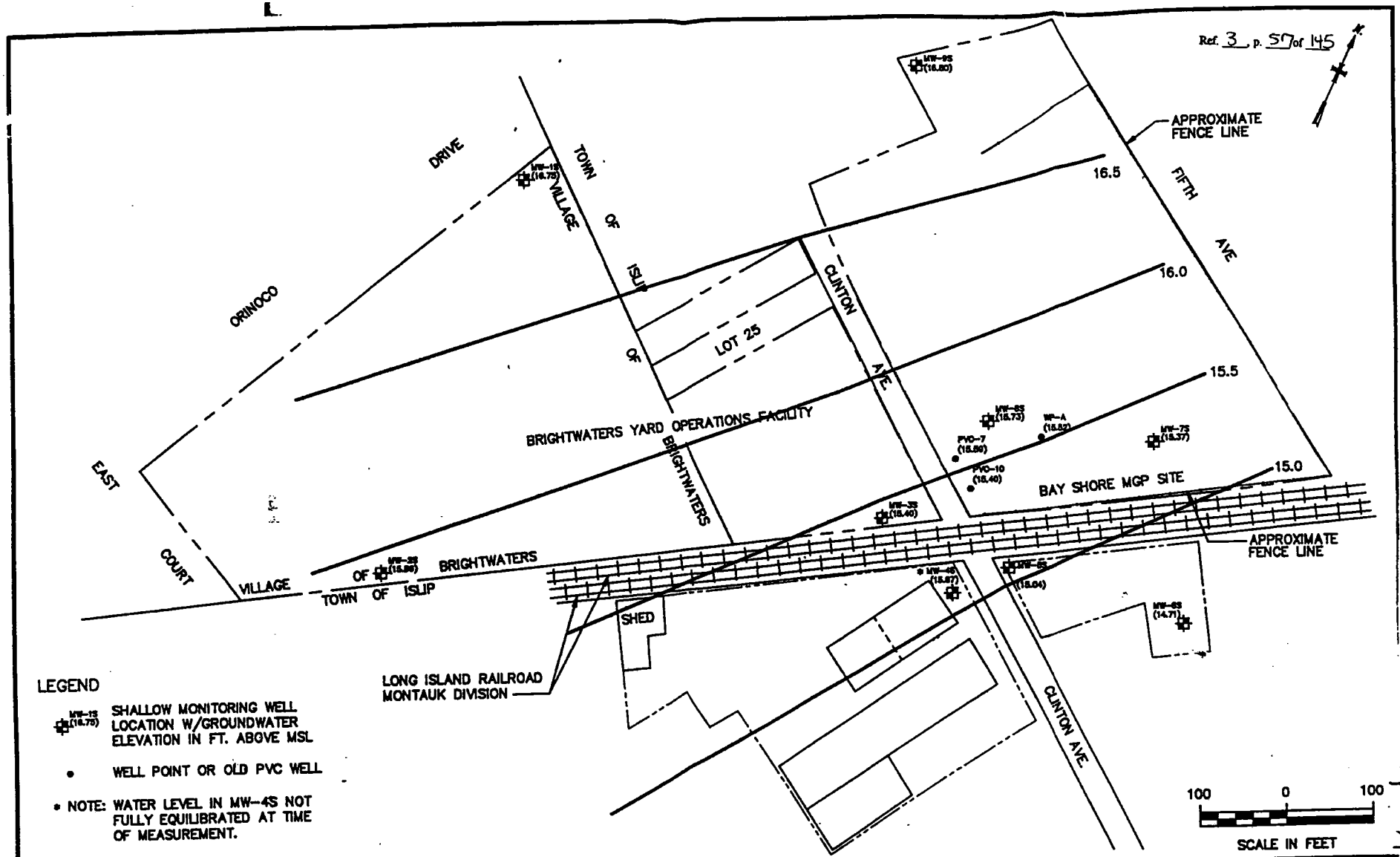
Groundwater levels were measured on the site and in the surrounding area to characterize the direction and velocity of groundwater flow. Two rounds of synoptic water level measurements were used to prepare water level contour maps and to assess vertical head gradients. In-situ permeability tests were conducted to obtain estimates of the hydraulic conductivity of the saturated zone around each monitoring well.

### 5.3.1 Potentiometric Measurements

Synoptic groundwater elevations were measured in 46 wells and piezometers on the LILCO and adjacent properties and at off-site downgradient locations on September 15, 1992 and again on October 30, 1992. The water elevations for both events are given in Table 5-1. Figures 5-4 through 5-7 show the water elevation contours at the shallow (water table) and intermediate (35 to 45 foot) depths on the LILCO and adjacent properties.

Water table elevations range from 16.80 feet above mean sea level (MSL) in well MW-9S at the northern limit of the Bayshore property to 14.44 feet MSL in well MW-6S at the southern limit of the adjacent property east of Clinton Avenue. Groundwater elevations in the intermediate depth wells are similar to the water table. Since groundwater flows from areas of high head (elevation) to areas of lower head, this data indicates that the general direction of groundwater movement is from north to south across the LILCO and adjacent properties and toward the Great South Bay. The groundwater elevations were generally 0.2 to 0.3 feet lower during the October 30 event than during the September 15 event. This difference is interpreted to be a result of the regional decline that typically occurs on Long Island during this season.

The horizontal hydraulic gradient is defined as the difference in water elevation over the distance between the measuring points in the direction of the steepest change. The hydraulic gradient at the water table across the Bayshore property and onto the adjacent property is between 0.002 to 0.003 ft/ft toward the southeast. The horizontal gradient in

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SHALLOW GROUNDWATER ELEVATIONS - SEPTEMBER 15, 1992

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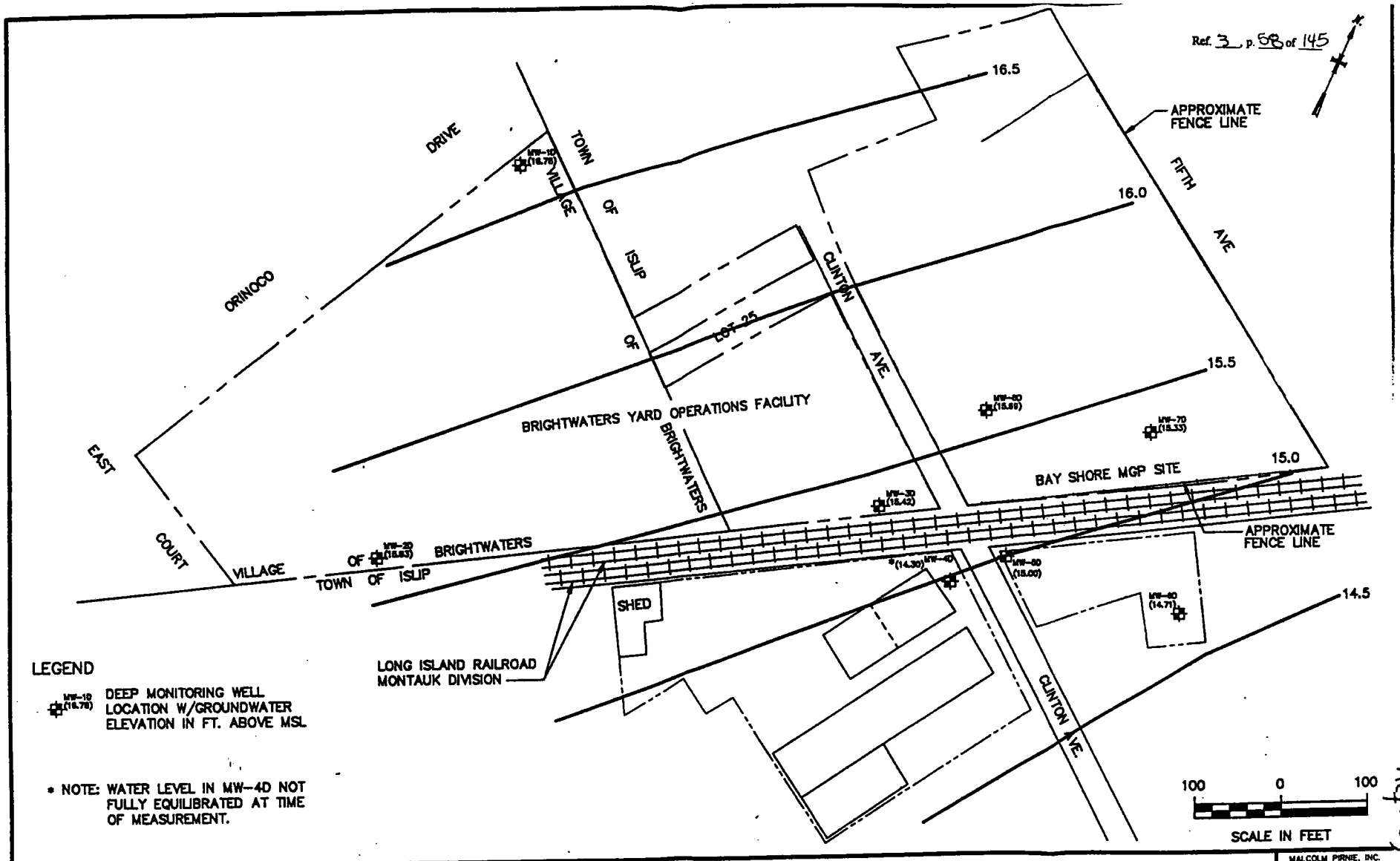
FIGURE 5-4

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DEEP GROUNDWATER ELEVATIONS - SEPTEMBER 15, 1992

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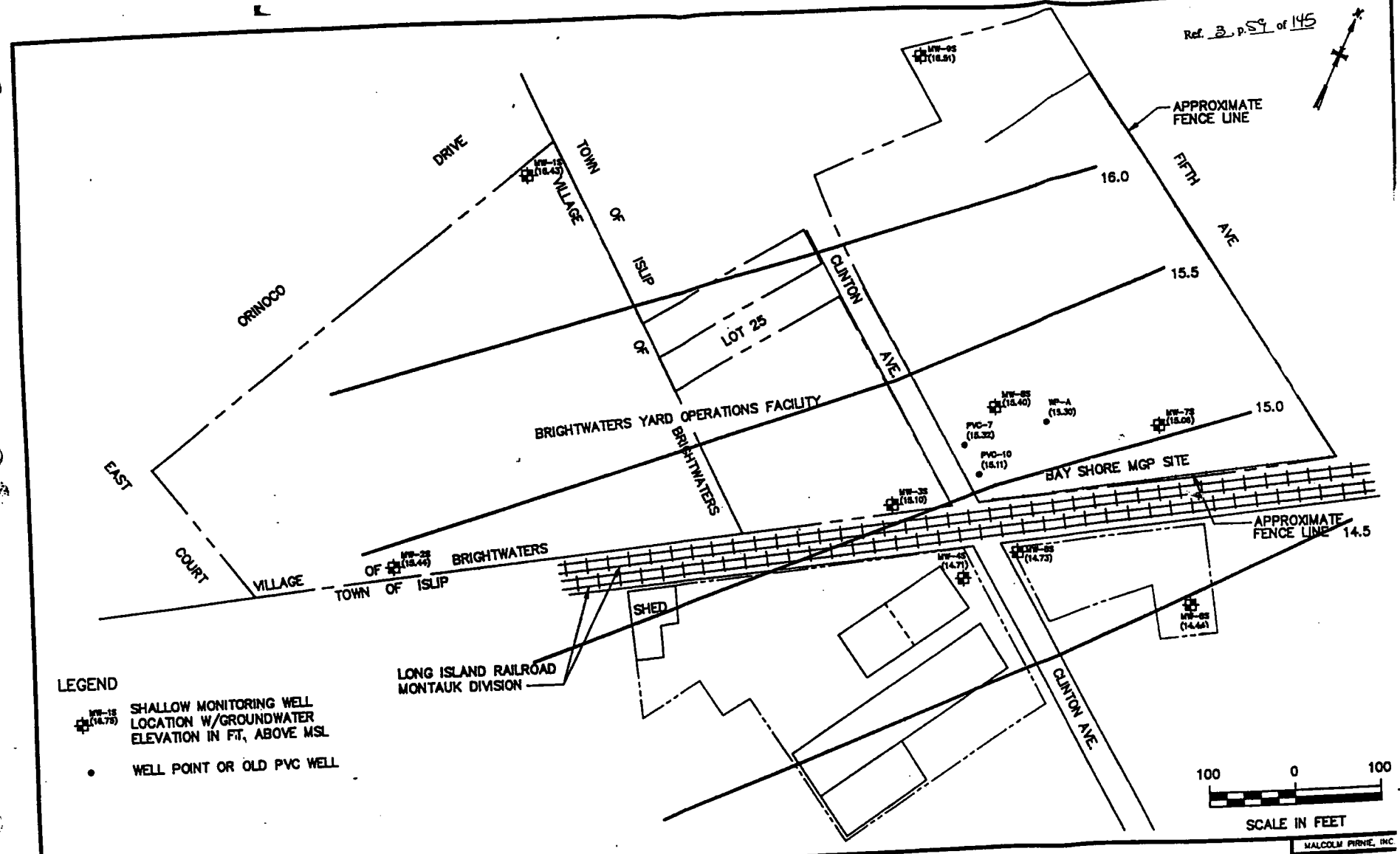
FIGURE 5-5

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LONG ISLAND LIGHTING COMPANY
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SHALLOW GROUNDWATER ELEVATIONS - OCTOBER 30, 1992

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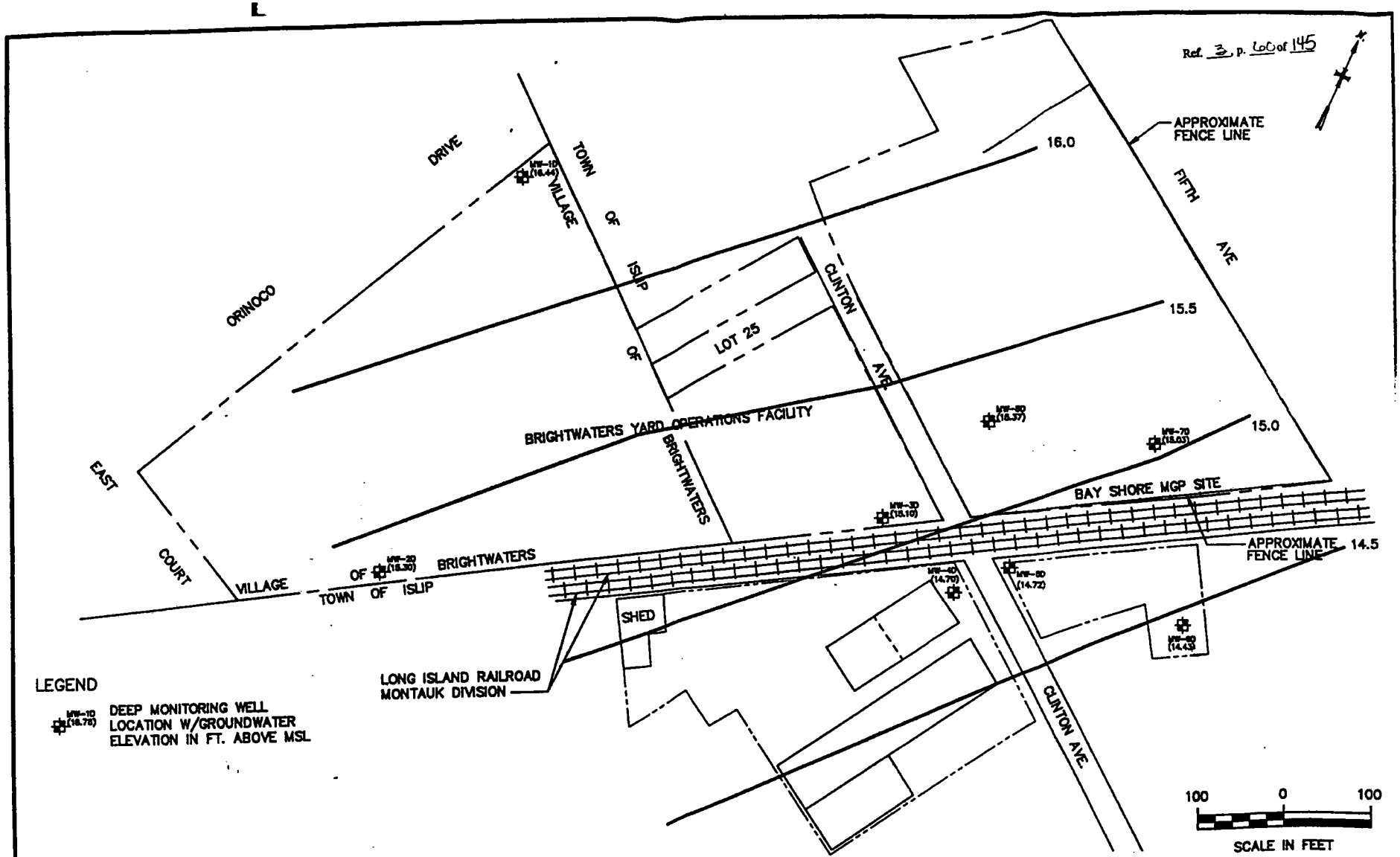
FIGURE 5-6

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DEEP GROUNDWATER ELEVATIONS - OCTOBER 30, 1992

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FIGURE 5-7

# TABLE 5-1
## LILCO BAY SHORE MGP SITE
## GROUNDWATER ELEVATION DATA

| | | | September 15, 1992 | | October 30, 1992 | |
|---|---|---|---|---|---|---|
| Well ID* | Ground Elevation (MSL) | MP** Elevation (MSL) | Depth to Water (Ft.) | Groundwater Elevation (MSL) | Depth to Water (Ft.) | Groundwater Elevation (MSL) |
| MW-1S | 21.66 | 20.89 | 4.14 | 16.75 | 4.46 | 16.43 |
| MW-1D | 21.59 | 21.18 | 4.40 | 16.78 | 4.74 | 16.44 |
| MW-2S | 20.69 | 22.62 | 6.66 | 15.96 | 7.18 | 15.44 |
| MW-2D | 20.70 | 22.69 | 7.06 | 15.63 | 7.39 | 15.30 |
| MW-3S | 21.80 | 23.88 | 8.48 | 15.40 | 8.78 | 15.10 |
| MW-3D | 21.73 | 23.81 | 8.39 | 15.42 | 8.71 | 15.10 |
| MW-4S | 21.40 | 21.30 | 5.63 | 15.67 | 6.59 | 14.71 |
| MW-4D | 21.34 | 20.62 | 6.32 | 14.30 | 5.92 | 14.70 |
| MW-5S | 22.05 | 21.17 | 6.13 | 15.04 | 6.44 | 14.73 |
| MW-5D | 22.03 | 21.58 | 6.58 | 15.00 | 6.86 | 14.72 |
| MW-6S | 24.05 | 23.43 | 8.72 | 14.71 | 8.99 | 14.44 |
| MW-6D | 24.04 | 23.65 | 8.94 | 14.71 | 9.22 | 14.43 |
| MW-7S | 22.79 | 25.36 | 9.99 | 15.37 | 10.30 | 15.06 |
| MW-7D | 22.71 | 25.31 | 9.98 | 15.33 | 10.28 | 15.03 |
| MW-8S | 23.13 | 25.81 | 10.08 | 15.73 | 10.41 | 15.40 |
| MW-8D | 23.31 | 26.14 | 10.45 | 15.69 | 10.77 | 15.37 |
| MW-9S | 24.17 | 26.44 | 9.64 | 16.80 | 9.93 | 16.51 |
| PVC-7 | 22.77 | 23.24 | 7.65 | 15.59 | 7.92 | 15.32 |
| PVC-10 | 22.51 | 22.61 | 7.21 | 15.40 | 7.50 | 15.11 |
| WP-A | 23.07 | 26.01 | 10.49 | 15.52 | 10.71 | 15.30 |
| WP-E | 23.08 | 23.51 | 7.92 | 15.59 | 8.17 | 15.34 |
| GM-2AS | 22.48 | 22.31 | 10.35 | 11.96 | 10.60 | 11.71 |
| GM-2AI | 22.48 | 22.27 | 10.30 | 11.97 | 10.54 | 11.73 |
| GM-2AD | 22.48 | 22.27 | 10.15 | 12.12 | 10.32 | 11.95 |
| GM-3S | 17.45 | 16.97 | 6.35 | 10.62 | 6.57 | 10.40 |
| GM-3I | 17.45 | 17.10 | 6.45 | 10.65 | 6.66 | 10.44 |
| GM-3D | 17.45 | 17.14 | 6.53 | 10.61 | 6.62 | 10.52 |
| GM-5S | 7.98 | 7.42 | 3.08 | 4.34 | 3.25 | 4.17 |
| GM-5I | 7.98 | 7.61 | 3.09 | 4.52 | 3.23 | 4.38 |
| GM-5D# | 7.98 | 7.58 | -1.13 | 8.71 | -1.17 | 8.75 |
| GM-6S | 11.73 | 11.15 | 6.32 | 4.83 | 6.56 | 4.59 |
| GM-6I | 11.73 | 11.06 | 6.35 | 4.71 | 6.59 | 4.47 |
| GM-6D | 11.73 | 11.31 | 6.46 | 4.85 | 6.70 | 4.61 |

TABLE 5-1 (Continued)
LILCO BAY SHORE MGP SITE
GROUNDWATER ELEVATION DATA

| | | | September 15, 1992 | | October 30, 1992 | |
|---|---|---|---|---|---|---|
| Well ID* | Ground Elevation (MSL) | MP** Elevation (MSL) | Depth to Water (Ft.) | Groundwater Elevation (MSL) | Depth to Water (Ft.) | Groundwater Elevation (MSL) |
| GM-7S | 12.98 | 12.15 | 8.26 | 3.89 | 8.44 | 3.71 |
| GM-7I | 12.98 | 12.08 | 8.20 | 3.88 | 8.37 | 3.71 |
| GM-7D | 12.98 | 12.29 | 8.41 | 3.88 | 8.58 | 3.71 |
| GM-8S | 5.94 | 5.38 | 3.13 | 2.25 | 3.26 | 2.12 |
| GM-8I | 5.94 | 5.50 | 3.30 | 2.20 | 3.41 | 2.09 |
| GM-8D | 5.94 | 5.36 | 3.11 | 2.25 | 3.24 | 2.12 |
| GM-9S | 5.10 | 4.85 | 2.59 | 2.26 | 2.77 | 2.08 |
| GM-9I | 5.10 | 5.00 | 2.78 | 2.22 | 2.95 | 2.05 |
| GM-9D | 5.10 | 4.68 | 2.46 | 2.22 | 2.62 | 2.06 |

* Wells labeled MW were installed during this investigation, and wells labeled GM were installed during the previous investigation.

** Measuring point elevation above mean sea level.

\# Well is artesian. A piece of PVC was added to well and measurement was made up from measuring point.

the intermediate zone is almost the same at about 0.0025 ft/ft. The water table gradient across the Brightwaters Yard is 0.002 ft/ft to the southeast, and the horizontal gradient in the intermediate zone is comparable at 0.003 ft/ft.

Vertical head differences measured in the well clusters on the LILCO and adjacent properties are very small. The difference ranges from 0.01 feet to 0.03 feet (Table 5-1), showing that the predominant component of groundwater across the two sites is horizontal. Large vertical differences in water levels indicate a greater potential for vertical movement of groundwater. A strong upward gradient, where the head in the deeper zone is higher than the head in the shallow zone, may indicate a discharge zone where water will move from the deeper zone to the shallow zone if no intervening clay layer is present to impede that movement. This condition is noted near Lawrence Creek as discussed below. A strong downward gradient, where the head in the shallow well is higher than the head in the deeper well, may indicate a recharge area where groundwater will move from the shallow to the deeper zones if no impeding clay layer is present. The vertical head differences in well cluster MW-2 measured 0.14 and 0.33 feet downward during the two measuring events. Well clusters MW-7 and MW-8 have a small downward gradient, on the order of 0.03 to 0.04 feet.

Figures 5-8 through 5-13 show potentiometric contours based on measurements made in the shallow, intermediate and deep wells located between the site and Lawrence Creek. Groundwater elevations range from approximately 15 feet above MSL near the LILCO and adjacent properties to about 2 feet above MSL approaching the Great South Bay. Water elevations in the off-site wells were also generally 0.2 to 0.3 feet lower during the October 30 event than during the September 15 event. Again, this is indicative of the regional water level trend in the mid to late fall season.

The regional horizontal hydraulic gradient on the water table between the LILCO and adjacent properties and the Great South Bay is 0.003 ft/ft to the southeast. The horizontal gradient between the shallow, intermediate and deep zones is the same except when approaching discharge areas such as Lawrence Creek and the other surface water bodies. Well cluster GM-5, which is the closest to Lawrence Creek, shows the largest upward head (the deep well actually flows at the ground surface) indicating that Lawrence Creek is a groundwater discharge area. Conversely, well cluster MW-7, which is located farthest from any surface water body, showed no vertical head difference during the October 30 measuring event. In general, a flat to slightly upward head was observed was observed





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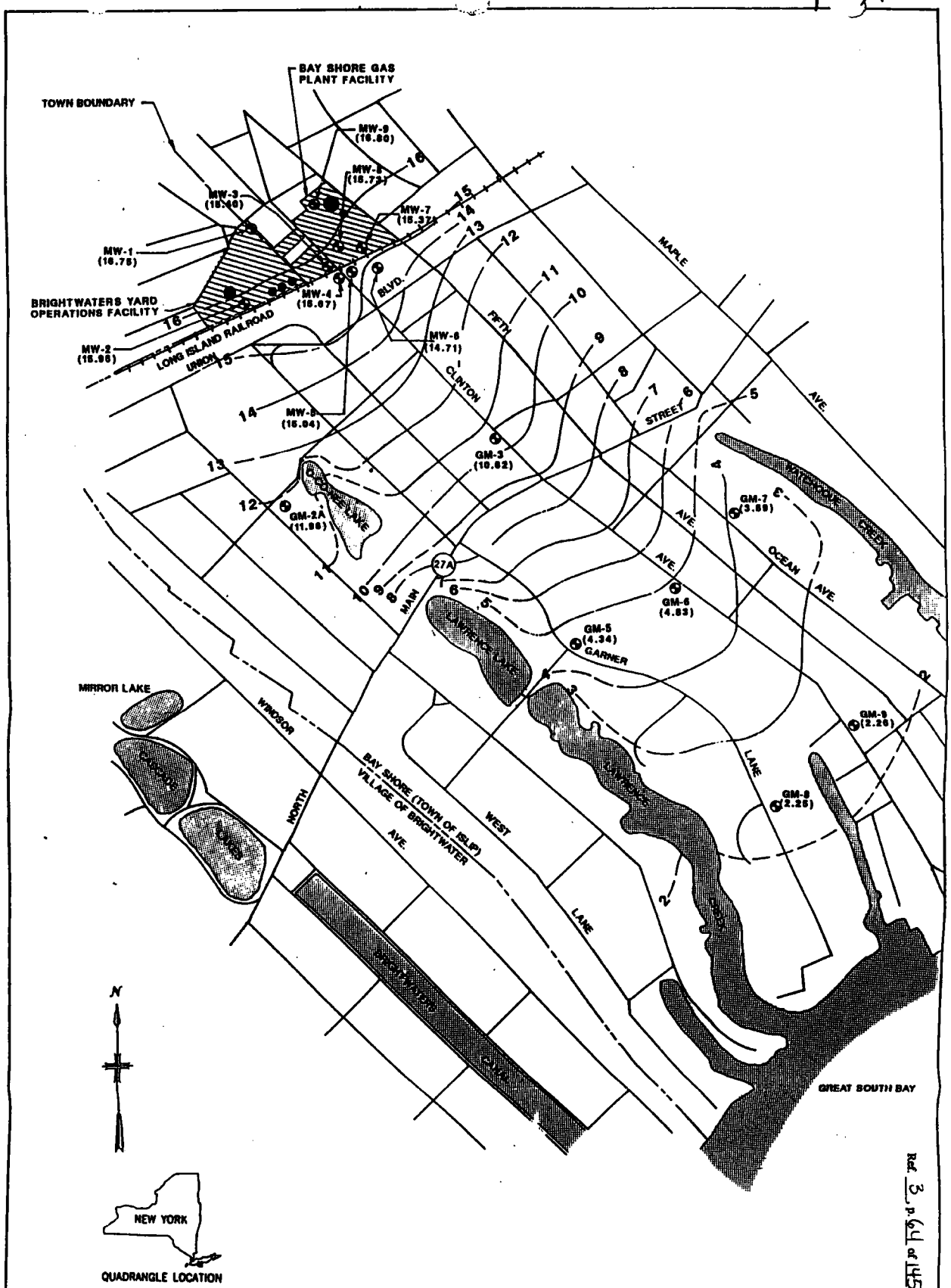
Ref. 3, p. 64 of 145




Ref. 3, p. 64 of 145

SOURCE: USGS TOPOGRAPHIC MAP 7.5 MINUTE - BAY SHORE EAST QUAD (PHOTOREVISED 1979) AND BAY SHORE WEST QUAD (PHOTOREVISED 1979)

500 0 500 feet
scale

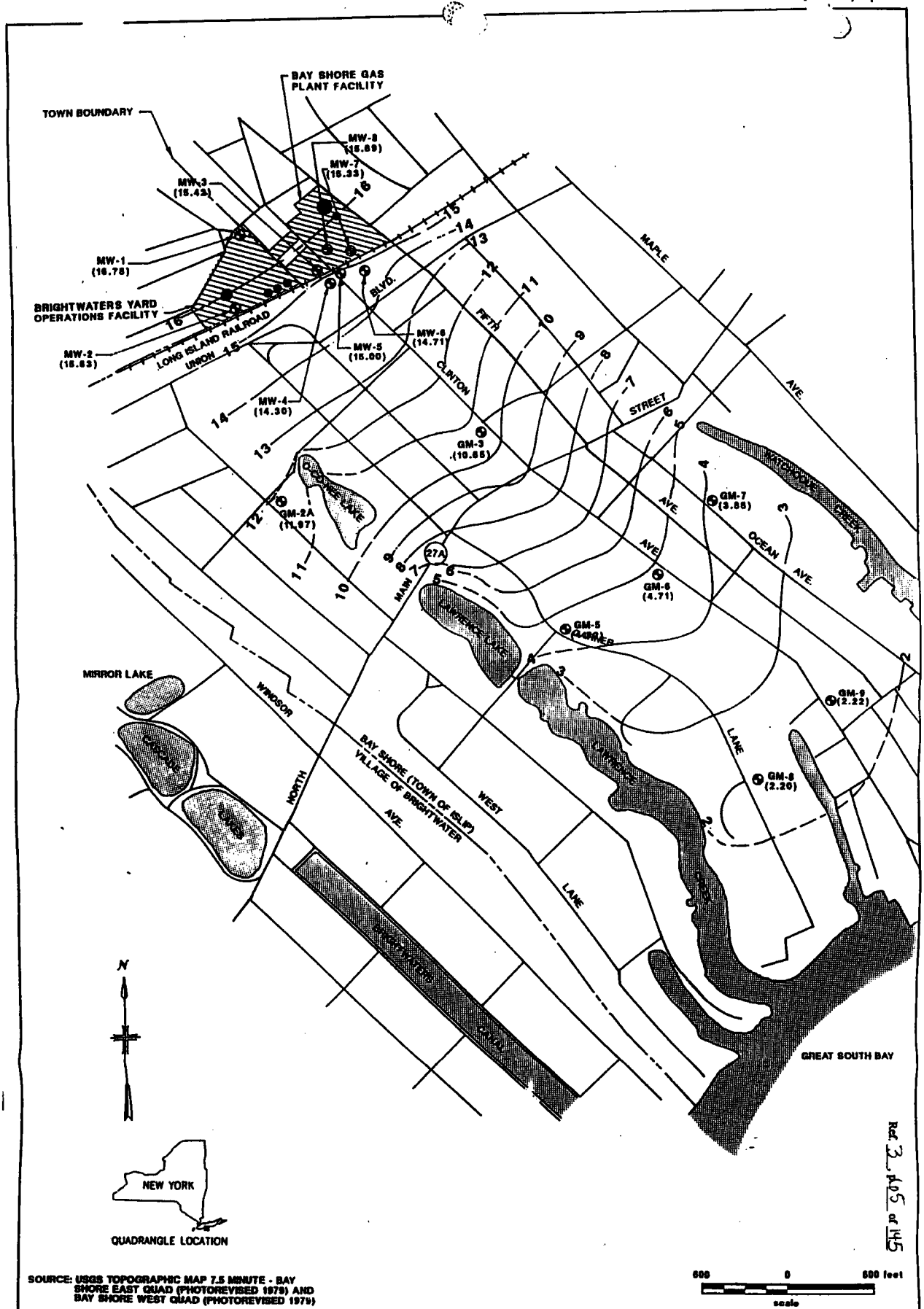
MALCOLM PIRNIE

LONG ISLAND LIGHTING COMPANY

**SHALLOW GROUNDWATER TABLE**
**SEPTEMBER 15, 1992**

FIGURE 5-8

Ref. 3, p. 65 of 145




SOURCE: USGS TOPOGRAPHIC MAP 7.5 MINUTE - BAY SHORE EAST QUAD (PHOTOREVISED 1979) AND BAY SHORE WEST QUAD (PHOTOREVISED 1979)

Ref. 3, p. 65 of 145

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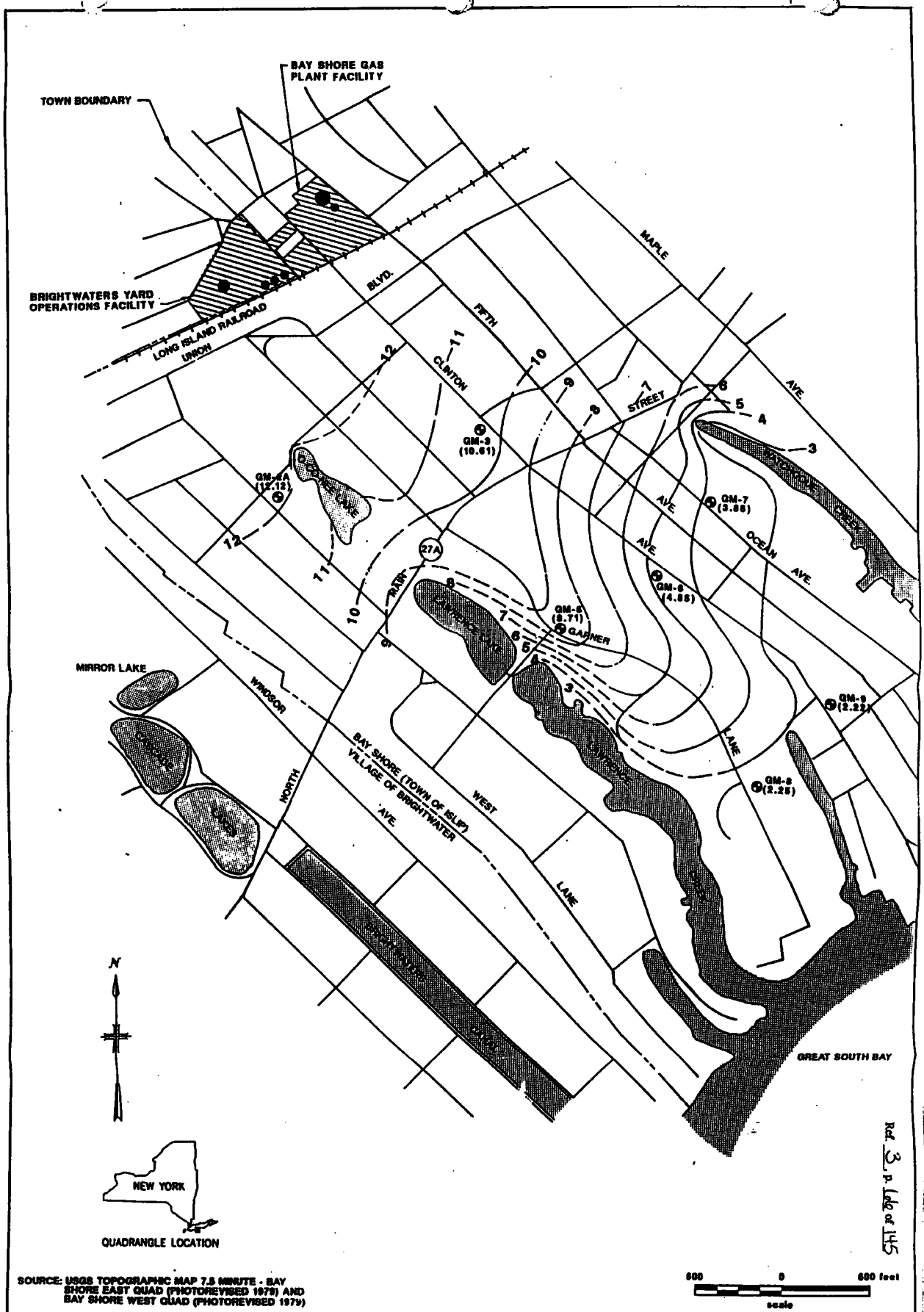
**INTERMEDIATE GROUNDWATER ZONE**
**SEPTEMBER 15, 1992**

FIGURE 5-9




SOURCE: USGS TOPOGRAPHIC MAP 7.5 MINUTE - BAY SHORE EAST QUAD (PHOTOREVISED 1979) AND BAY SHORE WEST QUAD (PHOTOREVISED 1979)

Ref. 3, p. 66 of 145

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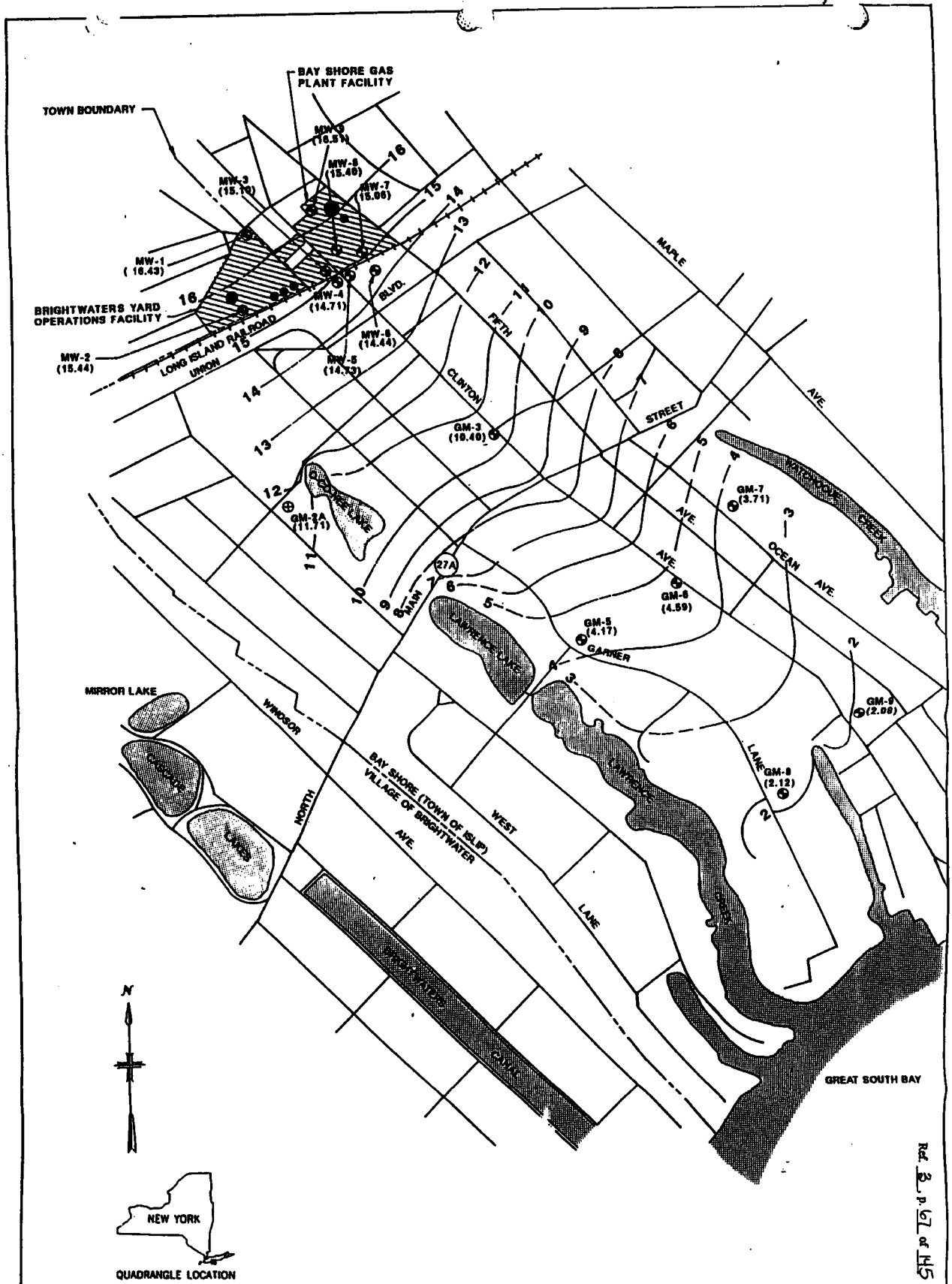
**DEEP GROUNDWATER ZONE**
**SEPTEMBER 15, 1992**

FIGURE 5-10

Ref. 3, p. 67 of 145




Ref. 3, p. 67 of 145

SOURCE: USGS TOPOGRAPHIC MAP 7.5 MINUTE - BAY SHORE EAST QUAD (PHOTOREVISED 1979) AND BAY SHORE WEST QUAD (PHOTOREVISED 1979)

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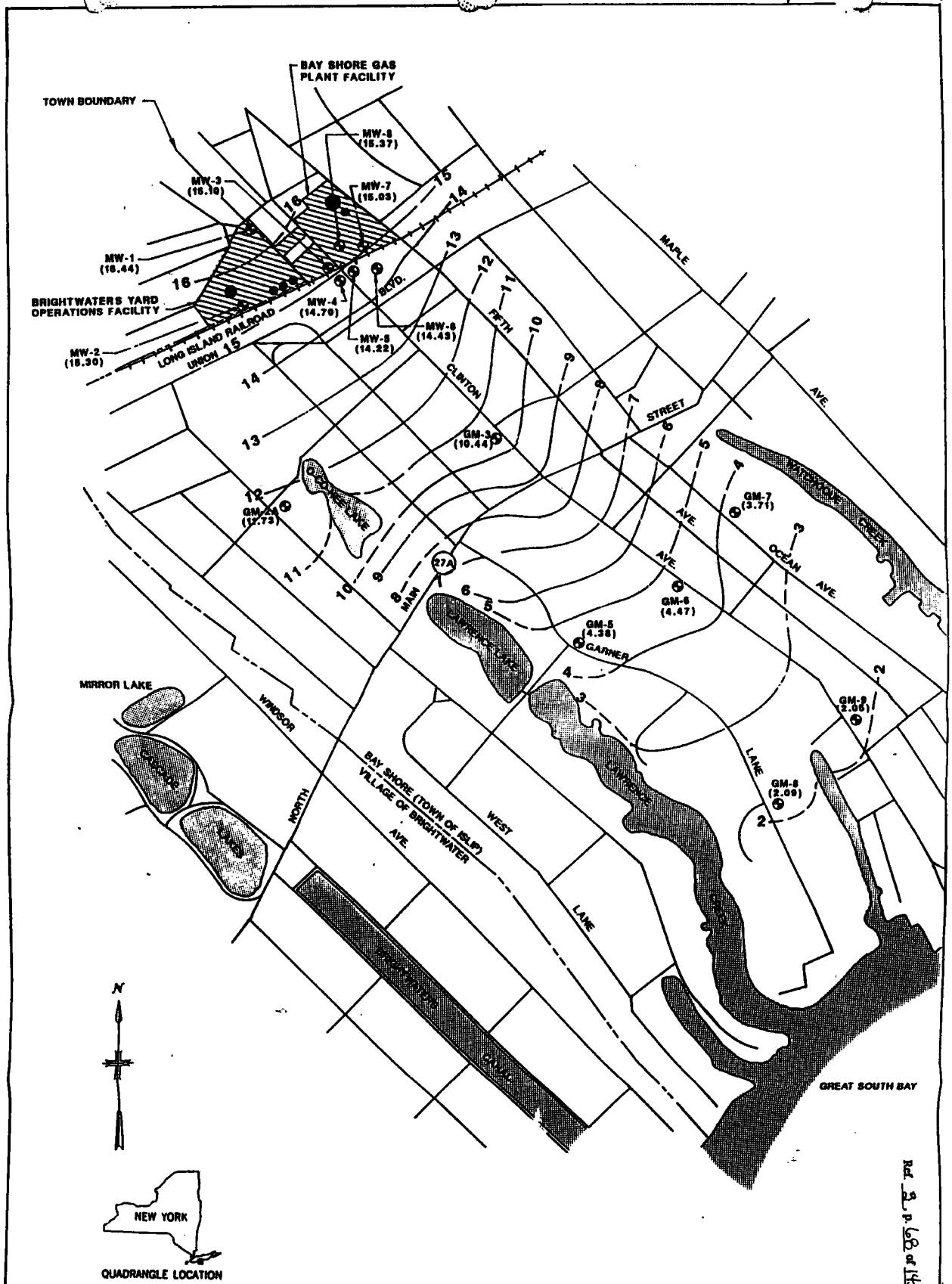
LONG ISLAND LIGHTING COMPANY

**SHALLOW GROUNDWATER TABLE**
**OCTOBER 30, 1992**

FIGURE 5-11

Ref. 3, p. 68 of 145




SOURCE: USGS TOPOGRAPHIC MAP 7.5 MINUTE - BAY SHORE EAST QUAD (PHOTOREVISED 1979) AND BAY SHORE WEST QUAD (PHOTOREVISED 1979)

500 0 500 feet
scale

Ref. 3, p. 68 of 145

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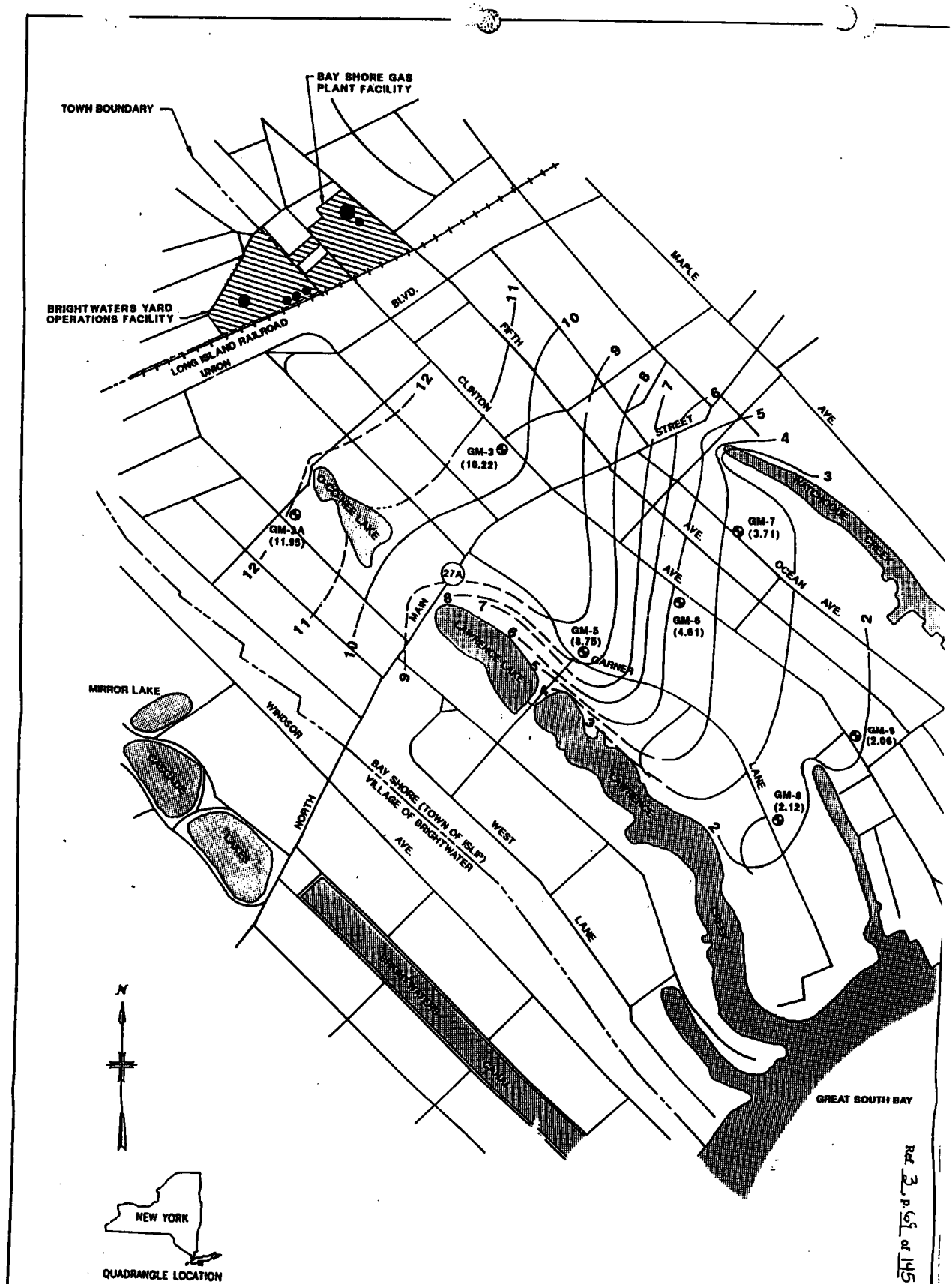
INTERMEDIATE GROUNDWATER ZONE
OCTOBER 30, 1992

FIGURE 5-12

Ref. 3, p. 69 of 145




SOURCE: USGS TOPOGRAPHIC MAP 7.5 MINUTE - BAY SHORE EAST QUAD (PHOTOREVISED 1979) AND BAY SHORE WEST QUAD (PHOTOREVISED 1979)

600 0 600 feet
scale

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**DEEP GROUNDWATER ZONE**
**OCTOBER 30, 1992**

FIGURE 5-13

in most of the off-site downgradient wells. Figure 5-14 shows a groundwater flow section between the site and Lawrence Creek. The general direction of groundwater movement, including the discharge area at Lawrence Creek, is consistent with the findings of the 1979 investigation.

### 5.3.2 Groundwater Movement

The direction of groundwater movement across the LILCO and adjacent properties is to the southeast. This direction of flow occurs at the water table as well as in the intermediate zone. Although the direction of flow and gradient are consistently to the southeast, one local anomaly occurred at MW-4 in front of the auto repair facility on the adjacent property during the September 15, 1992 event only. This anomaly was not observed during the October 30, 1992 event, and is probably attributable to the time needed for the head in the new well to fully equilibrate.

The direction of groundwater movement downgradient of the site is also to the southeast toward the Great South Bay and its tributary creeks and canals. A groundwater divide occurs between Lawrence Creek and Watchogue Creek which becomes more pronounced approaching the Great South Bay. Lawrence Creek, and to some lesser extent Lawrence Pond, are groundwater discharge areas and influence the direction of nearby groundwater movement. The generally southeastward flow bends toward Lawrence Creek causing a westward component to the direction of groundwater movement (Figures 5-8 through 5-13). Watchogue Creek exerts a similar local influence on the direction of groundwater movement. This flow pattern is similar in the shallow, intermediate and deep zones and was observed during both water level measuring events. It is also consistent with the findings of the 1979 investigation.

### 5.3.3 Hydraulic Conductivity Testing Results

In-situ hydraulic conductivity (permeability) tests were conducted in six of the newly installed monitoring wells to obtain an order-of-magnitude estimate of the hydraulic conductivity of the unconsolidated water bearing material around the screened interval. Four wells were tested on the LILCO properties, MW-1S and MW-1D on the Brightwaters Yard and MW-9S and MW-8D on the Bayshore property. Wells MW-5S and MW-5D east of Clinton Avenue were tested on the adjacent property. Falling and rising head slug tests were conducted in each monitoring well. However, only rising head test data were evaluated





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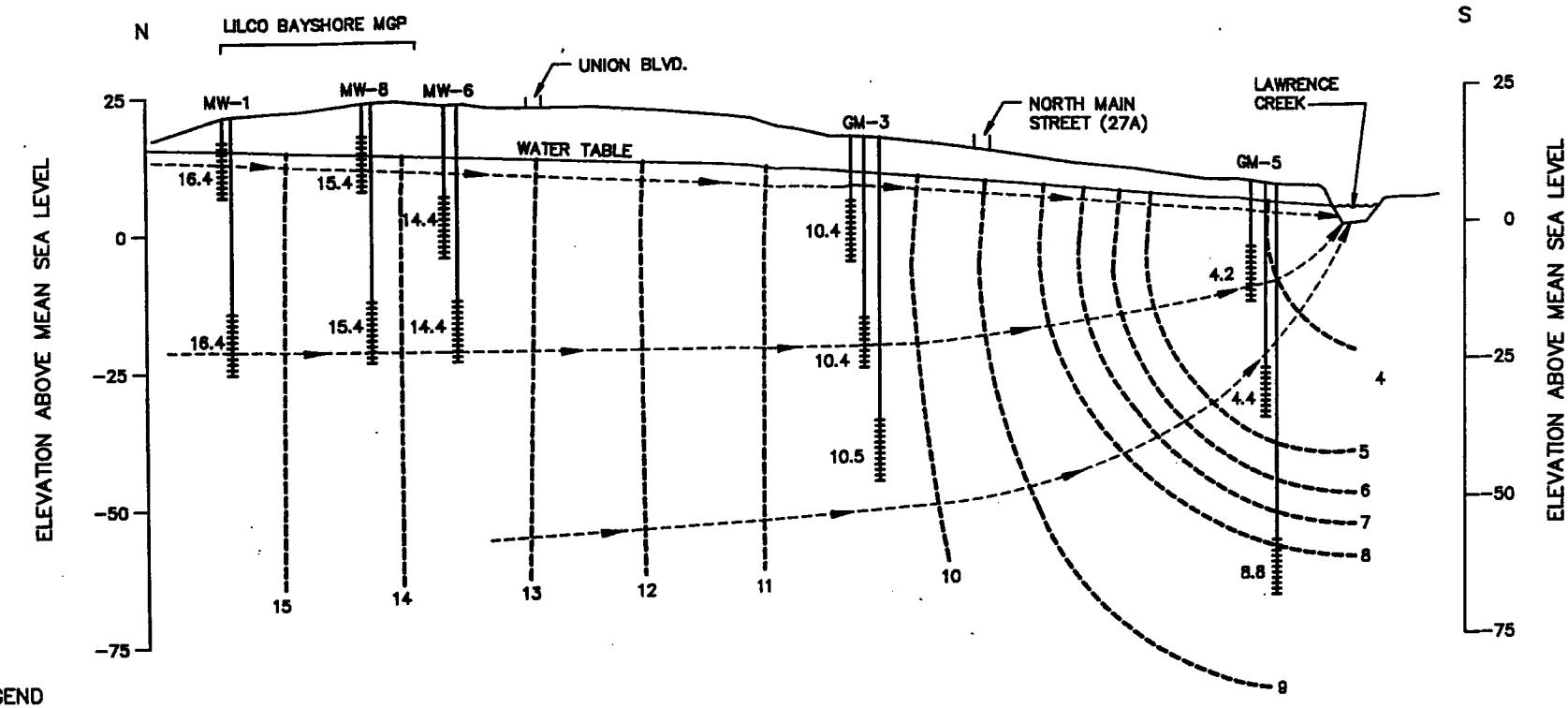


LEGEND

TRACE OF EQUIPOTENTIAL SURFACE IN PLANE OF SECTION (5)

GENERALIZED GROUNDWATER FLOW DIRECTION

CASING

SCREEN

14.4 WATER LEVEL IN FEET ABOVE MSL, OCTOBER 30, 1992

40 0 40

SCALE IN FEET
VERTICAL EXAGERATION = 20X

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BAYSHORE GAS PLANT

**GENERALIZED HYDROGEOLOGIC FLOW SECTION BETWEEN BAYSHORE MGP AND LAWRENCE CREEK**

MALCOLM PIRNIE, INC.

FIGURE 5-14

Ref. 3, p. 71 of 145

in the shallow wells because the well screens in these wells bridged the water table. While this screen placement is advantageous for chemical quality sampling, it will not provide accurate data when a falling head test is employed.

Two of the wells on the LILCO properties (MW-1S and MW-9S) were shallow wells in which the screened intervals bridged the water table and only the data from the rising head test was evaluated. The remaining two wells (MW-1D and MW-8D) were screened at depths of 35 to 45 feet below ground and both rising and falling head tests were analyzed. The results of the hydraulic conductivity tests are given in Table 5-2. Hydraulic conductivity ranged from 2.0 to 21.2 feet per day in the shallow zone and from 8.0 to 66.3 feet per day in the deeper zone. The hydraulic conductivity test data collected in monitoring wells MW-5S and MW-5D showed less than two-hundredths of a foot of change in the water levels and almost immediate recovery when the slug was added or removed from the wells. These data do not permit calculation of the hydraulic conductivity, but do show rapid movement of groundwater into the well indicating a high hydraulic conductivity of the material around both the shallow and deep screened zone.

The results of these tests are typical of hydraulic conductivities found in sands on Long Island. The material surrounding the screen zones was typically described as a fine to medium grained sand with a trace of gravel. The grain size analysis on the material in well boring WB-1 at MW-1D contained 98 percent sand, which is expected given the results of this hydraulic conductivity testing.

The slug test data calculations and plots are given in Appendix J.

### 5.3.4 Groundwater Velocity

The ground water flow rate across the site and in the area between the site and Lawrence Creek can be calculated (Heath, 1983) using the measured horizontal hydraulic gradients, the results of the hydraulic conductivity tests and published data for effective porosity of the sands as follows:

$$V = \frac{KI}{n_e}$$

where:

V = Average groundwater velocity in feet per day
K = Hydraulic Conductivity
I = Hydraulic Gradient
$n_e$ = Effective Porosity





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**TABLE 5-2**
**HYDRAULIC CONDUCTIVITY TEST RESULTS**

| Well ID | Test Type | Hydraulic Conductivity | |
|---|---|---|---|
| | | Ft/Day | CM/Sec |
| MW-1S | Rising | 21.26 | $7.505 \times 10^{-3}$ |
| MW-1D | Rising | 9.311 | $3.287 \times 10^{-3}$ |
| MW-1D | Falling | 35.62 | $1.257 \times 10^{-2}$ |
| MW-9S | Rising | 2.005 | $7.078 \times 10^{-4}$ |
| MW-8D | Rising | 8.007 | $2.827 \times 10^{-3}$ |
| MW-8D | Falling | 66.34 | $2.342 \times 10^{-2}$ |

**NOTE:** Results for MW-5S and MW-5D not shown due to rapid response of water levels which precluded analysis for those wells.

Using an effective porosity of 0.25 as typical for the sands in this area (Fetter, 1980) the ground water velocity at the water table across the site ranges from 0.02 to 0.25 feet per day, and from 0.08 to 0.79 feet per day in the intermediate zone. Ground water velocity off site ranges from 0.02 to 0.25 feet per day at the water table, and from 0.1 to 0.8 feet per day in the intermediate and deep zones.

These groundwater velocities are less than reported in the 1979 investigation due to the use of different values for hydraulic conductivity and gradient. The hydraulic conductivity used to calculate groundwater velocities in 1979 was assumed to be twice the highest value measured during the 1992 investigation. The highest hydraulic gradient used in 1979 was also twice that measured during 1979. However, the currently calculated velocities of 0.25 to 0.8 feet per day still represent average to fairly rapid groundwater movement.

## 5.4 LAND USE SURVEY RESULTS

### 5.4.1 Land Use

Land use in the region consists primarily of mixed medium density, single family, residential areas and commercial and light industrial areas with lots approximately 1/4 to 1/2 acre in size. A commercial strip runs along Union Boulevard immediately south of the LIRR, along Orinoco Drive in Brightwaters, and along Route 27A. According to the land use inventory compiled by the Long Island Regional Planning Board (LIRPB) in 1981, the village of Brightwaters covers 652 acres, of which 78.5% are medium density, residential areas.

Because Bayshore is not an incorporated village, but only considered a hamlet of Islip, absolute statistics were unobtainable. Land use figures were inferred from the grid cell statistics compiled by the LIRPB (1981). The Bayshore community was considered to include grid cells 266, 280 and 281. Approximately 59% of the area is comprised of medium density residential areas. Low, intermediate, and high density housing account for an additional 15% of the total land area. Other significant land uses include institutional and recreational facilities (9 and 9.5%, respectively). Table 5-3 summarizes the land use classifications for the Brightwaters and Bayshore communities.

The downtown business area of Brightwaters runs immediately west of the LILCO properties, along Orinoco Drive to Asharoken Road, the village's western border.

**TABLE 5-3**
**SUMMARY OF LAND USE CLASSIFICATION**
**IN BRIGHTWATERS AND BAYSHORE, NY[1]**

**LILCO BRIGHTWATERS OPERATIONS FACILITY**

| LAND USE CLASSIFICATION | BRIGHTWATERS | | BAYSHORE[2] | |
|---|---|---|---|---|
| | Acres | % Total | Acres | % Total |
| Low Density Residential[3] | 0 | 0 | 154 | 5.6 |
| Medium Density Residential[4] | 512 | 78.5 | 1605 | 58.6 |
| Intermediate Density[5] | 44 | 6.7 | 187 | 6.8 |
| High Density[6] | 6 | 0.9 | 68 | 2.5 |
| TOTAL RESIDENTIAL | 562 | 86.2 | 2014 | 73.5 |
| Commercial | 0 | 0 | 59 | 2.2 |
| Industrial | 3 | 0.5 | 37 | 1.3 |
| Transportation/Utility | 5 | 0.8 | 24 | 0.9 |
| Institutional | 16 | 2.5 | 245 | 8.9 |
| Recreational/Open Space | 45 | 6.9 | 260 | 9.5 |
| Agricultural | 21 | 6.9 | 102 | 3.7 |
| Vacant | | | | |
| TOTAL | 652 | 100 | 2714 | 100 |

[1] LIRPB, 1981.
[2] Grid cells 266, 280, and 281 (LIRPB, 1981)
[3] Less than 1 designated use per acre
[4] 2-4 designated uses per acre; lot sizes range from 1/4 to 1/2 acre
[5] 5-10 designated users per acre; lot sizes ~60 x 100 feet
[6] 11 or more designated uses per acre; includes multi-residential complexes

Commercial and industrial businesses in Brightwaters are concentrated along this strip. In recent years, the village has worked with the LIRPB and invested in revitalizing the business district, which has been neglected largely due to the convenience of near-by shopping malls (Suffolk County Planning Department, 1989).

Sensitive Receptors and Other Potential Contributors The LIRPB designated ten areas within a 1/2 mile radius of the site as institutional; this classification includes schools, churches, hospitals, and other public buildings. Fifteen additional areas occur within one mile. Six of these facilities lie in the downgradient path of potential contamination from the site. Table 5-4 lists the six sensitive receptors located downgradient of the site which are also shown on Figure 5-15. The potentially sensitive receptors were identified from the LIRPB's land use inventory, the critical customer facility list compiled by LILCO and telephone book addresses. Figure 5-15 also shows other potential contributors to groundwater contamination which are listed in Table 5-5.

Other industries or commercial operations may affect groundwater and air pollution. Table 5-5 lists potential contributors located within 1/2 mile upgradient of the site. The facilities were first identified by the Facility Index Database Systems (FINDS). FINDS is organized by the USEPA and contains information on all facilities that are regulated or tracked by the USEPA. Records are compiled from other USEPA databases and cross-referenced or indexed in the FINDS database. A description of the database and the listed facilities are given in Appendix K. Additional automobile-related businesses, asphalt or paving related operations, and dry cleaners in the vicinity of the site were identified based on telephone book addresses.

Suffolk County Water Authority operates two public supply well fields in the area, neither of which is downgradient of the site. The first well field is located at 180 5th Avenue almost 1/2 mile north of the site. The well field consists of two water supply wells which are both 776 feet deep and draw water from the Magothy Aquifer. The second well field is located at Union Boulevard and Windsor Avenue approximately 3/4 mile west of the site. This well field consists of three wells which are 600, 719 and 732 feet deep, respectively, and also draw water from the Magothy Aquifer. These wells are routinely monitored and water quality analyses from August 1992 indicated that the water remains uncontaminated. No other groundwater users were identified within a one-mile radius of the site.





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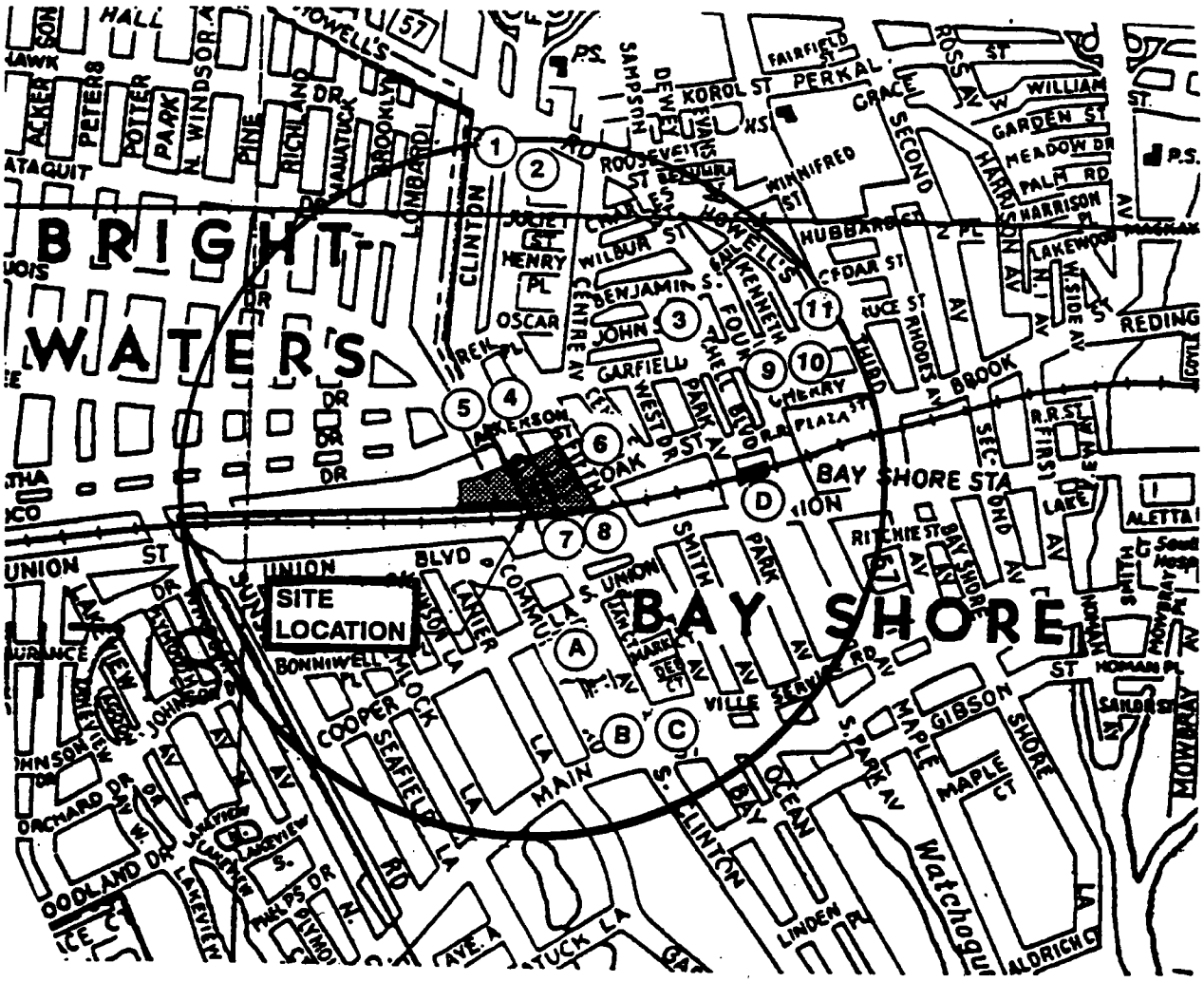
Ref. 3, p. 77 of 145 N.




SOURCE: HAGSTROM, 1990 SHEET #9

NOTE: Letter and number identifiers correspond to locations listed in Tables 5-4 and 5-5.

0 1/4 1/2

SCALE IN MILES

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POTENTIAL SENSITIVE RECEPTORS AND POLLUTION CONTRIBUTORS

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FIGURE 5-15

159381

**TABLE 5-4**

**SENSITIVE RECEPTORS WITHIN 1/2 MILE OF LILCO'S BRIGHTWATERS OPERATIONS FACILITY**

| | SENSITIVE RECEPTOR | ADDRESS |
|---|---|---|
| A | Jewish Center of Bayshore (Day Care Center) | 34 North Clinton Avenue Bayshore, NY |
| B | St. Patrick's Church and School | Montauk Highway and Clinton Avenue Bayshore, NY |
| C | John Anderson (medically related facility) | 5 North Clinton Avenue Bayshore, NY |
| D | Community Park | Union Boulevard Bayshore, NY |
| | Other Potential | Downgradient Receptors |
| | Open Gate Association (medically related facility) | 36 South Clinton Avenue Bayshore, NY |
| | Bayshore Marina Park | Clinton Avenue Bayshore, NY |

Note: Letters correspond to locations shown on Figure 5-15.

**TABLE 5-5**

**POTENTIAL POLLUTION SOURCES WITHIN ONE HALF MILE OF LILCO'S BAYSHORE PROPERTIES**

| | |
|---|---|
| 1. | Mobil Oil Corporation SS# M2H |
| 2. | Bayshore Fire Department |
| 3. | New York Telephone |
| 4. | Greco and Ganly Auto Body, Inc. |
| 5. | Brightside Auto Repair Service |
| 6. | Bruno's Truck and Auto Repair Service |
| 7. | Seal Masters, Inc. |
| 8. | RPM Auto and Welding, Inc. |
| 9. | JP Custom Painting |
| 10. | BBC Performance |
| 11. | Galaxie Auto Body and Refinishing |

**NOTE:**

Numbers correspond to locations shown on Figure 5-15.

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### 5.4.2 Demography

Population During the past twelve years, the U.S. Census data indicate that the populations of Brightwaters and Bayshore have remained relatively stable. From 1980 to 1990, the population of Brightwaters declined less than 1%, from 3,286 to 3,265 persons. In the Bayshore hamlet, the census recorded an almost 1.5% population increase, from 21,003 to 21,279 persons. LILCO projected similar numbers based on their records of active residential electric meters for 1990 and 1991. According to the census results of the last fifty years, Islip Township's population exploded between the years of 1950 and 1970 and has since leveled off. A population summary for Islip township is given in Table 5-6.

LILCO has also compiled data from their sources, the New York State Department of Commerce and the LIRPB to project future populations of Long Island townships. Islip Township has a projected 8% increase during the next 30 years, from the 1986 estimate of 302,416 persons up to 327,600 persons in 2010. Table 5-7 lists the projected populations for the Islip Township on a five-year basis.

Age Distribution The majority of residents in the Bayshore and Brightwaters communities are under the age of 40. Figure 5-16 portrays the combined total population structures of both communities and shows the distribution in age group intervals of ten years. The largest age class is between 30 and 39, which includes 18% of the total population. The median age for the Islip Township is 36.1 (LILCO, 1992).

Housing The majority of houses surrounding the LILCO site are in medium-dense, residential areas, where lots usually range between 1/4 and 1/2 acre in size. In Islip Township, 80.3% of the homes are owner occupied, and 19.7% are renter occupied. Brightwaters includes an estimated 1,127 households with an average 2.9 members per household. Bayshore has approximately 7,406 households with an average 2.8 persons per household. (LILCO, 1992).



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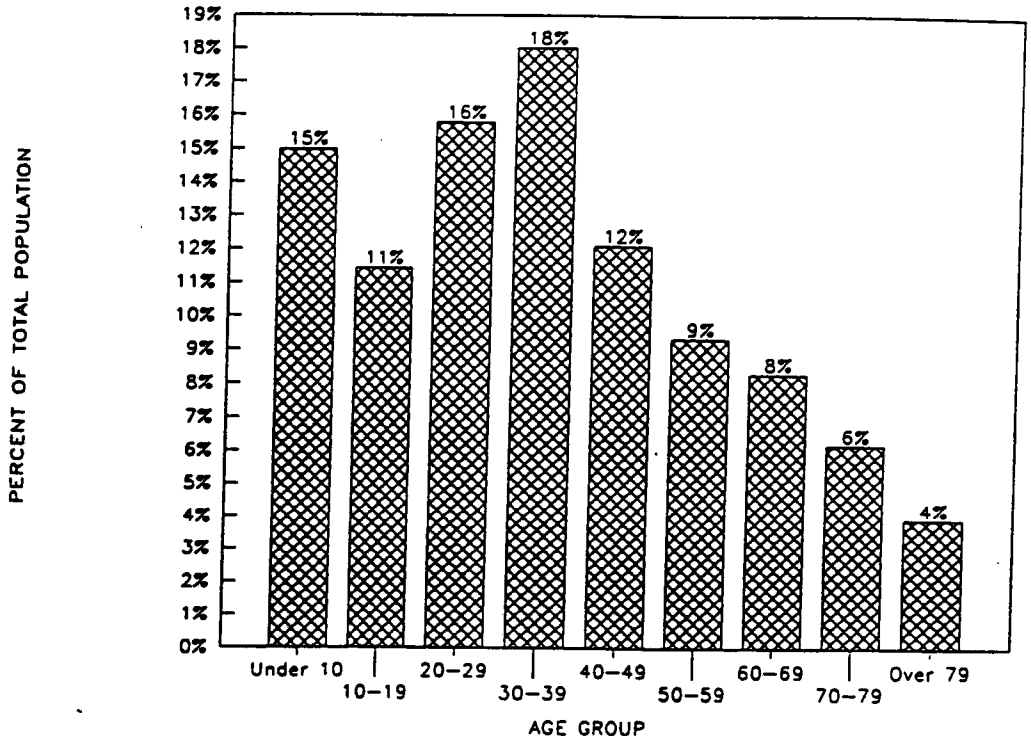


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BAYSHORE GAS PLANT

TOTAL POPULATION STRUCTURE

MALCOLM PIRNIE, INC.

FIGURE 5-16

**TABLE 5-6**
**POPULATION SUMMARY FOR THE ISLIP TOWNSHIP**
**LILCO: BRIGHTWATERS OPERATION FACILITY**

| U.S. CENSUS YEAR | POPULATION ESTIMATE |
|---|---|
| 1940 | 51,182 |
| 1950 | 71,465 |
| 1960 | 172,959 |
| 1970 | 278,880 |
| 1980 | 298,897 |
| 1990 | 299,587 |

**TABLE 5-7**
**1986 ESTIMATED POPULATION AND**
**POPULATION PROJECTIONS FOR 1990 THROUGH 2010[1]**
**ISLIP TOWNSHIP**

**LILCO: BRIGHTWATERS OPERATION FACILITY**

| YEAR | PROJECTED POPULATION |
|---|---|
| 1986 estimate | 302,416 |
| 1990 | 311,000 |
| *1990 Census* | *298,897* |
| *1992 LILCO estimate* | *299,906* |
| 1995 | 319,350 |
| 2000 | 322,600 |
| 2005 | 325,600 |
| 2010 | 327,600 |

[1] SOURCE: Long Island Lighting Company, 1992.

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# 6.0 NATURE AND EXTENT OF CONTAMINATION

The nature and extent of contamination on the LILCO and adjacent properties and in the area downgradient of the site was evaluated through the extensive sampling and analysis program described above. Initially, soil gas surveys were conducted in the vadose zone as a screening tool to assess the presence of MGP wastes in potential source areas and to provide information about potential contaminant migration.

The soil gas surveys were followed by an extensive soil sampling program which helped identify areas of potential groundwater contamination. Groundwater samples were collected using various techniques to further identify potential source areas and to delineate the plume of contaminated groundwater reported in the 1979 investigation.

In general, the types of contaminants found at the former LILCO Bayshore MGP and surrounding area are typical of manufactured gas plant sites as reported in the Gas Research Institute (GRI) publication "Management of Manufactured Gas Plant Sites, Volume I, Wastes and Chemicals of Interest." The most common compounds associated with MGP sites and seen at LILCO's properties are volatile aromatics, including benzene, toluene, ethylbenzene and xylenes (BTEX) and polycyclic aromatic hydrocarbons (PAHs), most notably naphthalene, fluorene, phenanthrene and pyrene. Other common MGP chemicals, including metals, cyanide and phenolics, were not particularly prevalent at the LILCO properties. However, contamination at the site is mainly characterized by BTEX and PAHs as described in more detail below.

The extent of soil contamination closely correlates to the areas of operation of the former Bayshore MGP. Soil contamination is greatest between the relief holder and tar separator tanks on the Bayshore property and just south of the former H-fuel tank and fuel pumps on the Brightwaters Yard. Contaminated soil was found from within one foot of the surface to just below the water table at about six to eight feet below ground surface in these areas. Soil contamination was not detected at the eastern, northern and western borders of either the Brightwaters Yard or the Bayshore property as would be expected since the MGP activities were restricted to LILCO's properties. Soil contamination was found on the adjacent properties, but is believed to be a result of auto repair and asphalting activities conducted by the adjacent property occupants.



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The extent of groundwater contamination on-site correlates closely with areas of soil contamination. Groundwater downgradient of the former H-fuel tank and pumps on the Brightwaters Yard is contaminated primarily with BTEX and lesser amounts of PAHs. Groundwater down-gradient of the area of highest soil contamination around the relief holder and tar storage and separator tanks on the Bayshore property is contaminated with PAHs and BTEX. The plumes of contaminated groundwater in both of these areas appear to be migrating off-site and the highest concentrations occur in the shallow water table zone.

The extent of groundwater contamination off-site is consistent with the findings of the 1979 investigation. Analysis of groundwater quality upgradient of the site did not detect the presence of MGP wastes, or other contaminants as well, as seen in the groundwater beneath or downgradient of the site. A plume of moderate to weakly contaminated groundwater was found to extend from the site downgradient to Lawrence Creek. The long and narrow shape of the plume and the concentrations are much the same as they were in 1979, indicating a continuing source on the site. Although the plume is most clearly delineated in the shallow and intermediate groundwater zones, the highest concentration of naphthalene still occurs in the deep groundwater zone but is restricted to a limited area about halfway between the site and Lawrence Creek (GM-3). The groundwater flow pattern, which has a strong upward component just south of GM-3, is responsible for maintaining this pattern of contamination and limiting the lower extent of the plume. However, concentrations of naphthalene and other PAHs were detected between the Brightwaters Yard and O-Co-Nee Lake indicating the presence of a second small and narrow plume of very low concentration.

Certain solvents associated with degreasing operations but not associated with MGP wastes were found in the groundwater in front of the auto repair building on the adjacent property but not on LILCO property. This indicates that although the major portion of the plume of contaminated groundwater may originate on LILCO property, there is some contribution from downgradient sources on the adjacent property as well.

## 6.1 VADOSE ZONE

The soil gas investigations at the LILCO facility were conducted from July 14 to 28, 1992. Soil gas samples were collected at 156 locations on the Brightwaters property, the Bayshore property, and on the adjacent properties. Samples were analyzed for benzene,





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toluene, ethylbenzene, xylenes (BTEX), and total volatile hydrocarbons (TVHC). The complete soil gas report is contained in Appendix B. The results of the soil gas survey were used to identify potential areas of contamination and to help select locations for collection of soil samples.

High concentrations of benzene were detected in the soil gas across the Bayshore property as shown on Figure 2 of Appendix B. The highest concentration measured (12,000 ug/L) was detected at a location southeast of the abandoned relief holder near the old cooling tower and tar storage tanks (Figure 3-2). Other areas of benzene concentrations were detected near the former tar separator building, fuel oil and tar heaters, and near the old tank locations in the former generator house. Benzene was detected at lower concentrations at four additional locations on the Bayshore property. In general, the concentrations of benzene decrease with increasing distance from the central areas of highest concentration. Benzene concentrations were detected in only two small areas on the Brightwaters Yard. These were both located south of the former H-fuel tank. On the adjacent property, one area containing benzene (300 ug/L) in the soil gas was found in front of the auto repair facility.

Figure 3 in Appendix B is the isoconcentration map for toluene. As with benzene, toluene is found across much of the Bayshore property, but detected concentrations are confined to a much smaller area on the Brightwaters Yard. The highest concentration of toluene detected (5,300 ug/L) was found on the Brightwaters property at a location south of the former H-fuel tank. A second area with concentrations of toluene in the soil gas was also detected near the former H-fuel tank but further south, adjacent to the Long Island Railroad (LIRR) tracks. There were no detected concentrations of toluene above 1 ug/L on the adjacent properties.

The concentrations of ethylbenzene in soil gas are shown on Figure 4 in Appendix B. The highest concentrations of ethylbenzene (3,200 ug/L) were found on the Bayshore property, again in the vicinity of the abandoned relief holder and the former storage tanks. One location on the Brightwaters property, southeast of a former oil storage tank, had a detected concentration of ethylbenzene at 52 ug/L. There were no detections of ethylbenzene on the adjacent properties.

An isoconcentration map for xylenes is shown in Figure 5 of Appendix B. Xylenes were detected in the soil gas across much of the Bayshore property. Three locations had concentrations of xylenes equal to or greater than 1,400 ug/L; east of the abandoned relief





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holder near the old tanks in the former generator house, and between the old scrubbers and Clinton Avenue. There were two locations with detected concentrations of xylenes on the Brightwaters property, south of the former H-fuel tank (3,500 ug/L) and adjacent to the railroad tracks (560 ug/L). The highest detected concentration of xylenes on the adjacent properties was found in front of the auto repair facility at 12,000 ug/L, which is much higher than any detected on LILCO's properties.

The detected concentrations of TVHC are shown on Figure 6 of Appendix B. The same pattern observed in the maps for the individual compounds are observed for total volatiles. Soil gas concentrations of TVHC are observed across most of the Bayshore property, with the locations of highest concentration in the area east of the abandoned relief holder and adjacent to Clinton Avenue. Two locations with concentrations of TVHC were found on the Brightwaters property south of the former H-fuel tank. The highest concentrations of TVHC (21,000 ug/L) were also found in front of the auto repair facility on the adjacent property.

## 6.2 SOIL

Seventy-three soil samples were collected from various depths on the LILCO Properties and on the adjacent properties. Five of the soil samples were analyzed for the full TCL/TAL parameter list, the remainder of the samples were analyzed for BTEX and PAHs. Surface soil samples were collected as well as soils at depth from soil borings, test pits, and well borings. The analytical results are presented in Tables 6-1 through 6-5, and are discussed below.

### 6.2.1 TCL/TAL Analyses

Five soil samples, two from test pits (TP-22, TP-22A), one from a well boring (WB-4), and two composited surface soil samples (CS-3, CS-5), were analyzed for complete TCL/TAL parameters to determine if there were other contaminants of concern at the site in addition to BTEX and PAH compounds. A summary of compounds detected in these five samples is given in Table 6-1. The only non-BTEX VOCs detected were carbon disulfide at a concentration of 0.1 mg/kg in TP-22A and styrene at a concentration of 5.5 mg/kg in TP-22. Neither of these compounds were detected in any other sample and are





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TABLE 6-1
LILCO BAYSHORE MGP SITE
SUMMARY OF TCL/TAL COMPOUNDS DETECTED IN SOIL SAMPLES

| Sample Number | TP-22 | TP-22A | WB-4 | CS-3 | CS-5 | FB-TP | FB-SB | FB-SS |
|---|---|---|---|---|---|---|---|---|
| Sample Depth | 4-5 | 8-8.5 | 3.5-6 | -- | -- | -- | -- | -- |
| Date Sampled | 07/28/92 | 07/28/92 | 09/01/92 | 09/15/92 | 09/15/92 | 07/28/92 | 08/07/92 | 09/15/92 |
| TCL Volatile Organics mg/Kg | | | | | | | | |
| Carbon disulfide | <0.04 | 0.10 | <0.002 | <0.05 | <0.001 | <0.001 | <0.01 | <0.001 |
| Benzene | 6.5 | 2.6 | <0.002 | 0.25 | <0.001 | <0.001 | <0.001 | <0.001 |
| Toluene | 25 | 0.32 | <0.002 | 0.44 | <0.001 | <0.001 | <0.001 | <0.001 |
| Ethyl Benzene | 23 | 58 | 0.012 | 0.47 | <0.001 | <0.001 | <0.001 | <0.001 |
| Styrene | 5.5 | <0.1 | <0.002 | <0.005 | <0.001 | <0.001 | <0.01 | <0.001 |
| m+p Xylene | 25 | 29 | 0.021 | 0.68 | <0.002 | <0.002 | <0.002 | <0.001 |
| o Xylene | 2.8 | 10 | 0.008 | 0.29 | <0.001 | <0.001 | <0.001 | <0.001 |
| TCL Semi Volatile Organics mg/Kg | | | | | | | | |
| Naphthalene | 380 | 100 | 0.25 | 19 | <0.2 | <0.001 | <0.001 | <0.001 |
| 2-Methylnaphthalene | 170 | 48 | 0.31 | 13 | <0.2 | <0.001 | <0.001 | <0.001 |
| Acenaphthylene | 70 | 1.7 | <0.1 | 16 | <0.2 | <0.001 | <0.001 | <0.001 |
| Acenaphthene | 11 | 16 | <0.1 | 8.0 | <0.2 | <0.001 | <0.001 | <0.001 |
| Fluorene | 56 | 11 | 0.12 | 12 | <0.2 | <0.001 | <0.001 | <0.001 |
| Phenanthrene | 160 | 2.9 | 0.28 | 41 | 0.30 | <0.001 | <0.001 | <0.001 |
| Anthracene | 38 | 8.8 | <0.1 | 8.8 | <0.2 | <0.001 | <0.001 | <0.001 |
| Fluoranthene | 43 | 7.4 | 0.14 | 32 | 0.70 | <0.001 | <0.001 | <0.001 |
| Pyrene | 16 | 16 | 0.22 | 110 | 0.70 | <0.001 | <0.001 | <0.001 |
| Benzo(a)anthracene | 30 | 5.0 | <0.1 | 30 | 0.30 | <0.001 | <0.001 | <0.001 |
| Chrysene | 40 | 6.3 | <0.1 | 40 | 0.40 | <0.001 | <0.001 | <0.001 |
| Benzo(b)fluoranthene* | 12 | 1.9 | <0.1 | 21 | 0.60 | <0.001 | <0.001 | <0.001 |
| Benzo(k)fluoranthene* | 12 | 1.9 | <0.1 | 21 | 0.60 | <0.001 | <0.001 | <0.001 |
| Benzo(a)pyrene | 26 | 3.7 | <0.1 | 41 | 0.60 | <0.001 | <0.001 | <0.001 |
| Indeno(1,2,3-cd)pyrene | 8.0 | 1.1 | <0.1 | 14 | <0.2 | <0.001 | <0.001 | <0.001 |
| Benzo(g,h,i)perylene | 10 | 1.4 | <0.1 | 18 | <0.2 | <0.001 | <0.001 | <0.001 |
| TCL Pesticides/PCBs mg/Kg | | | | | | | | |
| Heptachlor Epoxide | <0.02 | <0.005 | <0.002 | <0.01 | 0.006 | <0.00005 | <0.00005 | <0.00005 |
| P,P-DDT | <0.12 | <0.03 | <0.004 | <0.02 | 0.02 | <0.0001 | <0.0001 | <0.0001 |
| Chlordane | <0.08 | <0.02 | <0.008 | 0.110 | 0.31 | <0.0002 | <0.0002 | <0.0002 |
| Arochlor 1245 | <0.4 | <0.1 | <0.04 | <0.2 | 0.086J | <0.001 | <0.001 | <0.001 |

* Sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene represents total, unable to separate isomers.
J – Detected below quanitification limit.

**TABLE 6-1 (Continued)**
**LILCO BAYSHORE MGP SITE**
**SUMMARY OF TCL/TAL COMPOUNDS DETECTED IN SOIL SAMPLES**

| Sample Number | TP-22 | TP-22A | WB-4 | CS-3 | CS-5 | FB-TP | FB-SB | FB-SS |
|---|---|---|---|---|---|---|---|---|
| Sample Depth (feet) | 4-5 | 8-8.5 | 3.5-6 | -- | -- | -- | -- | -- |
| Date Sampled | 07/28/92 | 07/28/92 | 09/01/92 | 09/15/92 | 09/15/92 | 07/28/92 | 08/07/92 | 09/15/92 |
| TAL Metals (mg/kg) | | | | | | | | |
| Aluminum | 9100 | 660 | 620 | 3000 | 3200 | <0.2 | <0.2 | <0.20 |
| Antimony | <0.05 | <0.05 | <0.10 | <0.10 | <0.10 | <0.005 | <0.005 | <0.005 |
| Arsenic | 0.077 | 0.26 | 0.23 | 4.2 | 5.5 | <0.002 | <0.002 | <0.002 |
| Barium | 25 | 2.2 | 1.8 | 60 | 91 | <0.05 | <0.05 | <0.05 |
| Beryllium | 0.25 | 0.04 | 0.035 | 0.10 | 0.15 | <0.001 | <0.001 | <0.001 |
| Cadmium | 0.050 | <0.01 | 0.007 | 0.44 | 0.7 | <0.001 | <0.001 | <0.001 |
| Calcium | 1300 | 41 | 45 | 5900 | 21000 | <0.20 | 0.35 | <0.20 |
| Chromium | 8.0 | 1.1 | 1.5 | 9.2 | 6.6 | <0.02 | <0.005 | <0.02 |
| Cobalt | 2.6 | 0.38 | 0.93 | 2.8 | 2.1 | <0.05 | <0.05 | <0.05 |
| Copper | 7.5 | 1.1 | 0.95 | 21 | 21 | <0.02 | <0.02 | <0.02 |
| Iron | 9000 | 920 | 740 | 17000 | 5600 | <0.05 | 0.17 | <0.05 |
| Lead | 50 | 0.67 | 0.78 | 300 | 250 | <0.005 | <0.005 | 0.005 |
| Magnesium | 1500 | 110 | 150 | 1700 | 10000 | <0.05 | <0.05 | <0.05 |
| Manganese | 80 | 7.7 | 7.5 | 100 | 85 | <0.02 | <0.02 | <0.02 |
| Mercury | 0.055 | 0.068 | 0.0093 | 0.82 | 0.12 | <0.001 | <0.001 | <0.00025 |
| Nickel | 6.5 | 1.1 | 1.0 | 9.6 | 6.2 | <0.10 | <0.10 | <0.10 |
| Potassium | 350 | 51 | 63 | 170 | 170 | <0.50 | <0.5 | <0.50 |
| Selenium | 0.25 | 0.087 | <0.05 | 0.33 | 0.33 | <0.002 | <0.002 | <0.002 |
| Silver | 0.10 | 0.06 | <0.05 | <0.10 | <0.10 | <0.01 | <0.001 | <0.001 |
| Sodium | 72 | 4.9 | 8.3 | 180 | 63 | 0.33 | 0.33 | 0.80 |
| Thallium | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.005 | <0.005 | <0.05 |
| Vanadium | 16 | 1.7 | 1.6 | 20 | 17 | <0.10 | <0.10 | <0.10 |
| Zinc | 26 | 4.4 | 1.8 | 200 | 150 | <0.02 | <0.02 | <0.02 |

considered to be isolated occurrences at the site. The only other organic compounds detected in the TCL analyses were PAHs.

Concentrations of metals generally were within normal concentration ranges for soils in the eastern U.S. (Hawkes and Webb) (NYSDEC), which is the criteria recommended for metals in the NYSDEC TAGM: Determination of Soil Cleanup Objectives and Cleanup Levels. These results confirmed that the primary contaminants of concern at the site are the BTEX and PAH compounds typical of MGP wastes and support the approach of limiting the bulk of the analytical program to these classes of compounds.

### 6.2.2 Surface Soils

Five grab samples and five composite samples were collected across the LILCO and adjacent properties (Figure 4-2). The analytical results are given in Table 6-2. Of the six samples collected on the LILCO property, BTEX compounds were detected only in sample CS-2 at a concentration of 0.02 mg/kg and in CS-3 at a concentration of 2.13 mg/kg. In the four samples collected on the adjacent properties, BTEX was detected at a concentration of 6.81 mg/kg in composite sample CS-4, located behind the auto repair building and lumber warehouse buildings. The low concentrations of total BTEX are consistent with the volatile nature of the compounds.

Concentrations of total PAHs in surface soil samples collected on the LILCO property ranged from 9.69 mg/kg in GS-1 located in the southeastern corner of the Brightwaters Yard, to 445 mg/kg in CS-3 located near the abandoned relief holder on the Bayshore property (Figure 3-2). Concentrations of PAHs in samples collected on the adjacent property ranged from 2.54 mg/kg in GS-5 located at the border of the LILCO property, to 28.19 mg/kg in CS-4 located behind the auto repair building. The higher molecular weights and resulting lower volatility of PAH compounds cause these compounds to be more persistent in surface soils than volatile compounds.

Naphthalene was detected in 9 of the 11 surface soil samples at concentrations ranging from 0.2 mg/kg in sample GS-4 to 19 mg/kg in sample CS-3. Fluorene was detected sporadically in the surface soil samples. Phenanthrene and pyrene were also detected but at very low concentrations (Table 6-2).

Samples CS-3 and CS-5 were also analyzed for TAL metals as part of the TCL/TAL analyses. Concentrations of most metals were within the ranges found in soils in the eastern U.S. (Hawkes and Webb). Concentrations of lead were detected in both CS-3 (300 mg/kg)



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**TABLE 6-2**
**LILCO BAYSHORE MGP SITE**
**SUMMARY OF TARGET COMPOUNDS DETECTED IN SURFACE SOIL SAMPLES**
**AUGUST 1992**

| Sample Number | GS-1 | GS-2 | GS-3 | GS-4 | GS-6** | GS-5 | CS-1 | CS-2 | CS-3 | CS-4 | CS-5 | FB-SS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date Sampled | 09/15/92 | 09/15/92 | 09/15/92 | 09/15/92 | 09/15/92 | 09/15/92 | 09/15/92 | 09/15/92 | 09/15/92 | 09/15/92 | 09/15/92 | 09/15/92 |
| **Volatile Organics (BTEX) mg/Kg** | | | | | | | | | | | | |
| Benzene | <0.001 | <0.001 | <0.002 | <0.001 | <0.001 | <0.001 | 0.004 | <0.001 | 0.25 | 0.11 | <0.001 | <0.001 |
| Toluene | <0.001 | <0.001 | <0.002 | <0.001 | <0.001 | <0.001 | 0.010 | <0.001 | 0.44 | 0.66 | <0.001 | <0.001 |
| Ethyl Benzene | <0.001 | <0.001 | <0.002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.47 | 0.14 | <0.001 | <0.001 |
| m+p Xylene | <0.002 | <0.002 | <0.004 | <0.002 | <0.002 | <0.002 | 0.004 | <0.002 | 0.68 | 3.1 | <0.002 | <0.002 |
| o Xylene | <0.001 | <0.001 | <0.002 | <0.001 | <0.001 | <0.001 | 0.002 | <0.001 | 0.29 | 2.8 | <0.001 | <0.001 |
| Total BTEX (mg/Kg) | -- | -- | -- | -- | -- | -- | 0.020 | -- | 2.13 | 6.81 | -- | -- |
| **Polynuclear Aromatic Hydrocarbons (PAH) mg/Kg** | | | | | | | | | | | | |
| Acenaphthene | <0.4 | <0.4 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <1.0 | 8.0 | <1.0 | <0.2 | <0.001 |
| Acenaphthylene | 0.40 | 2.4 | <0.2 | 0.90 | 0.80 | <0.2 | 0.90 | 12 | 16 | 1.1 | <0.2 | <0.001 |
| Anthracene | <0.4 | 0.88 | 1.1 | 0.50 | 0.30 | <0.2 | 0.30 | 6.7 | 8.8 | 0.43J | <0.2 | <0.001 |
| Benzo(a)anthracene | 0.70 | 2.5 | 2.0 | 0.90 | 0.70 | 0.20 | 0.40 | 13 | 30 | 2.4 | 0.30 | <0.001 |
| Benzo(a)pyrene | 0.70 | 2.9 | 3.2 | 1.3 | 1.1 | 0.27 | 0.20 | 9.0 | 41 | 1.9 | 0.60 | <0.001 |
| Benzo(b)fluoranthene* | 0.75 | 2.0 | 2.6 | 2.0 | 1.7 | 0.22 | 0.56 | 7.5 | 21 | 2.35 | 0.60 | <0.001 |
| Benzo(k)fluoranthene* | 0.75 | 2.0 | 2.6 | 2.0 | 1.7 | 0.22 | 0.56 | 7.5 | 21 | 2.35 | 0.60 | <0.001 |
| Benzo(g,h,i)perylene | 0.67 | 4.3 | 0.60 | 0.40 | 0.40 | 0.20 | 0.50 | 6.7 | 18 | 1.6 | <0.2 | <0.001 |
| Chrysene | 0.90 | 3.3 | 2.4 | 1.3 | 1.1 | 0.29 | 0.70 | 15 | 40 | 3.1 | 0.40 | <0.001 |
| Dibenzo(a,h)anthracene | 0.30J | 1.1 | 0.30 | <0.2 | <0.2 | 0.08J | 0.20 | 2.3 | <8.0 | 0.94J | <0.2 | <0.001 |
| Fluoranthene | 1.3 | 3.6 | 3.0 | 1.0 | 0.90 | 0.49 | 1.2 | 20 | 32 | 3.2 | 0.70 | <0.001 |
| Fluorene | <0.4 | 0.46 | 0.70 | <0.2 | <0.2 | <0.2 | 0.20 | 3.3 | 12 | <1.0 | <0.2 | <0.001 |
| Naphthalene | 0.46 | 0.34J | 0.60 | 0.20 | 0.2 | <0.2 | 7.0 | 2.6 | 19 | 0.65J | <0.2 | <0.001 |
| Pyrene | 1.7 | 7.1 | 5.5 | 2.0 | 1.7 | 0.43 | 1.3 | 51 | 110 | 5.9 | 0.70 | <0.001 |
| Phenanthrene | 0.60 | 2.5 | 1.9 | 0.70 | 0.50 | 0.22 | 1.6 | 25 | 41 | 0.87J | 0.30 | <0.001 |
| Indeno(1,2,3-cd)pyrene | 0.46 | 2.1 | 0.60 | 0.40 | 0.40 | 0.14J | 0.30 | 4.3 | 14 | 1.4 | <0.2 | <0.001 |
| Total PAHs (mg/Kg) | 9.69 | 37.48 | 27.10 | 13.60 | 11.50 | 2.76 | 15.92 | 185.9 | 431.8 | 28.19 | 4.20 | -- |
| **Cyanide and Phenols mg/Kg** | | | | | | | | | | | | |
| Cyanide | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 |
| Phenols | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.001 |

J - Detected below quanitification limit.
* Sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene represents total, unable to separate isomers.
** Duplicate of GS-4
GS samples are grab samples
CS samples are composite samples consisting of five homogenized grab samples
FB-SS is the field equipment rinsate blank

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and CS-5 (250 mg/kg) and mercury was detected in CS-3 (0.82 mg/kg). Comparison of these concentrations to the NYSDEC proposed TAGM cleanup levels is included in the Feasibility Analysis report.

Total organic carbon (TOC) and pH were also measured in three of the surface soil samples, and the results are presented in Table 6-3. The measured values for TOC ranged from 3,000 mg/kg to 4,200 mg/kg, which are within the normal range of values for sandy soils.

### 6.2.3 Subsurface Soils

Sixty-three subsurface soil samples were collected on the LILCO and adjacent properties (Figure 4-1). Samples were collected at depths ranging from 1-foot to 11 feet below ground surface. Samples were analyzed for BTEX, PAHs, cyanide, and phenols. Analytical results are given in Tables 6-4, 6-5, and 6-6.

Figures 6-1 through 6-6 are isoconcentration maps showing the aerial distribution of contaminants in the soil. BTEX contamination in the soil is most extensive on the Bayshore property (Figure 6-1). The areas of highest concentration (up to 1,022 ppm) occur in the central portion of the site near the abandoned relief holder, the tar storage and tar settling tanks, and around the old scrubbers (Figure 3-2). Concentrations tend to decrease away from the central area of the site. There are two areas where BTEX concentrations were detected in the soils on the Brightwaters property. The first is in the southeast corner of the property where the former oil/water separator was located, near the intersection of Clinton Avenue and the LIRR tracks where up to 20 ppm was detected in the soil. The second area is south of the former H-fuel tank. On the adjacent property, BTEX was detected in the soils east of Clinton Avenue in the area used for asphalting equipment storage and maintenance.

PAH contamination of the soil is most extensive on the Bayshore property as shown on Figure 6-2. As with the total BTEX, the highest concentrations of PAHs(up to 4,480 ppm total PAHs) are found in the area of the abandoned relief holder and the tar storage tanks. Concentrations tend to decrease away from this area to the west, south, and east. There are two apparently isolated areas of only slightly elevated PAH concentrations on the Brightwaters property. The first area is near the intersection of Clinton Avenue and the LIRR where up to 53 ppm total PAHs were detected. The second is south of the former H-fuel tank where up to 183 ppm total PAHs were detected at the southern property





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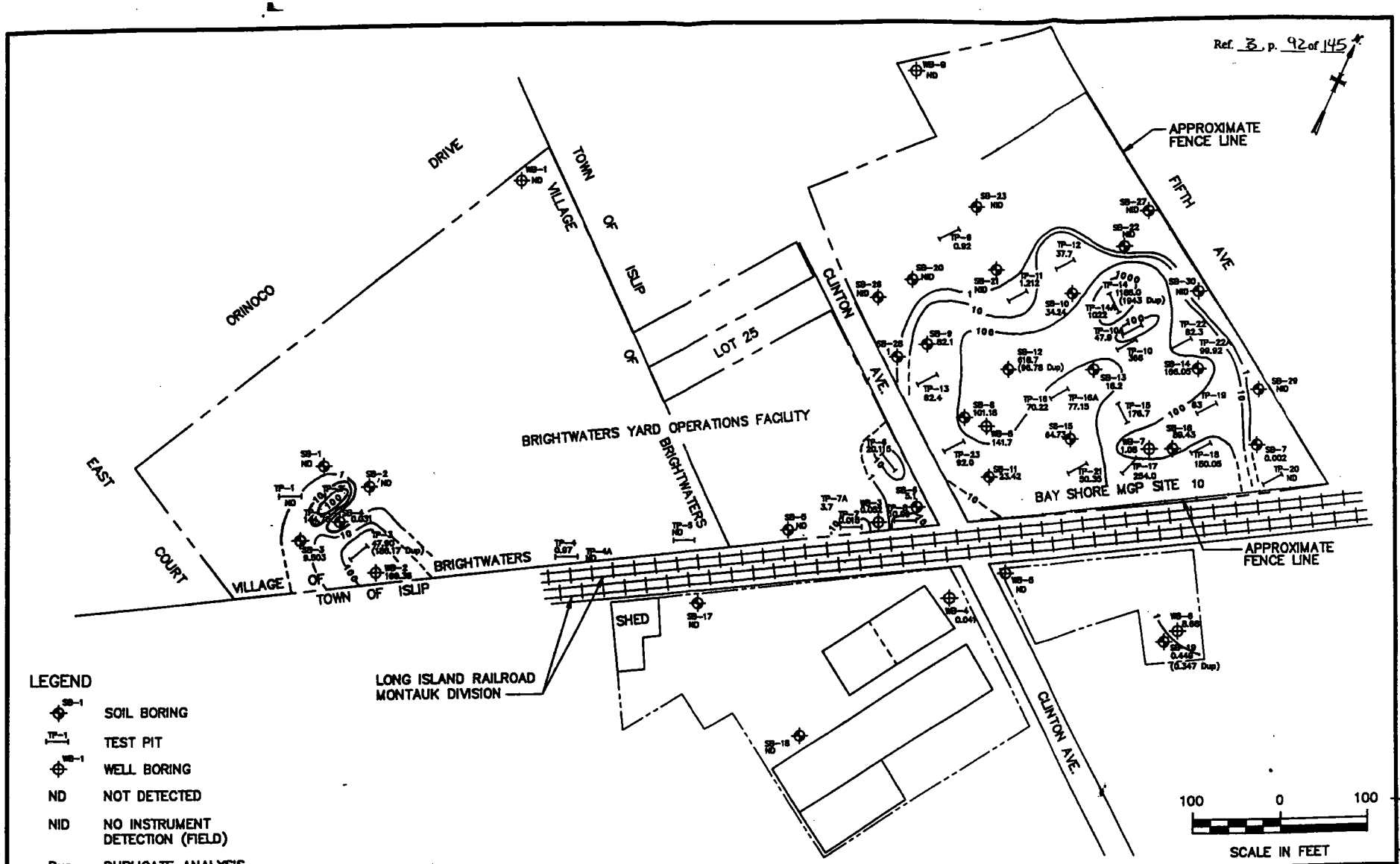


MALCOLM PIRNIE

LONG ISLAND LIGHTING COMPANY
BAYSHORE GAS PLANT

TOTAL BTEX CONCENTRATIONS IN SOIL (ppm)

MALCOLM PIRNIE, INC.

FIGURE 6-1

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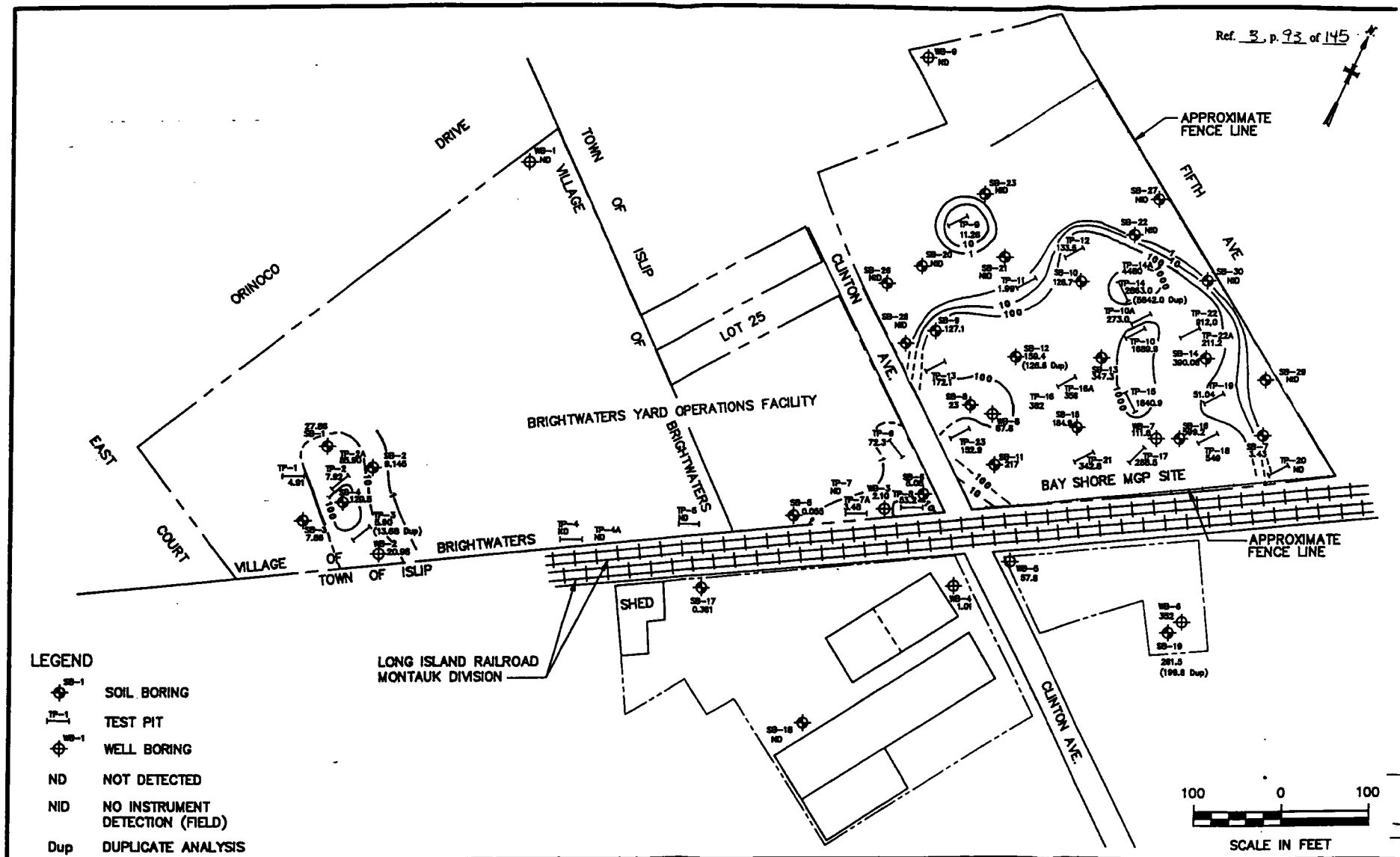


MALCOLM PIRNIE

LONG ISLAND LIGHTING COMPANY
BAYSHORE GAS PLANT

**TOTAL PAH CONCENTRATIONS IN SOIL (ppm)**

MALCOLM PIRNIE, INC.

FIGURE 6-2

dBJ : 12490230000\J:\ACAD\PROJ\12490230\FIG6-2 SCALE: 1:100 11/01, 1993 at 13:01

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TABLE 6-3
LILCO BAYSHORE MGP SITE
TOTAL ORGANIC CARBON AND pH RESULTS IN SOIL SAMPLES

| Sample Number | TOC(mg/kg) | pH(std. units) |
|---|---|---|
| TP-21 | 2400 | 6.5 |
| FB-TP | <1 | 6 |
| SB-5 | 490 | 7.3 |
| SB-11 | 2700 | 9.3 |
| SB-19 | 1800 | 6.8 |
| SB-24* | 1800 | 6.6 |
| FB-SB | <1 | 6.8 |
| GS-4 | 3000 | 7.4 |
| GS-6 | 3400 | 7.7 |
| CS-3 | 4200 | 8.3 |
| FB-SS | <1 | 7.7 |

FB-TP, FB-SB and FB-SS are the field equipment rinsate blank samples.
*Duplicate of SB-19.

TABLE 6-4
LILCO BAYSHORE MGP SITE
SUMMARY OF TARGET COMPOUNDS DETECTED IN TEST PIT SOIL SAMPLES
JULY/AUGUST 1992

| Sample Number | TP-1 | TP-2 | TP-2A | TP-3 | TP-34** | TP-4 | TP-4A | TP-5 | TP-6 | TP-7 | TP-7A |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Depth (feet) | 1.5-2.5 | 1-2 | 8-9 | 7-8 | 7-8 | 3-4 | 5-6 | 5.5-6.5 | 6.5-7.5 | 5.5-6.5 | 6.5-7.5 |
| Date Sampled | 08/03/92 | 08/03/92 | 08/03/92 | 08/03/92 | 08/03/92 | 08/03/92 | 08/03/92 | 08/03/92 | 08/03/92 | 08/03/92 | 08/03/92 |
| **Volatile Organics (BTEX) mg/Kg** | | | | | | | | | | | |
| Benzene | <0.001 | 0.38 | <0.05 | 0.20 | 0.17 | 0.15 | <0.001 | <0.001 | 0.065 | <0.005 | <0.05 |
| Toluene | <0.001 | 0.26 | 1.7 | 15 | 41 | 0.30 | <0.001 | <0.001 | 0.45 | 0.015 | 0.30 |
| Ethyl Benzene | <0.001 | 0.65 | 15 | 5.7 | 25 | 0.05 | <0.001 | <0.001 | 4.1 | <0.005 | 1.0 |
| m+p Xylene | <0.002 | 0.34 | 91 | 19 | 84 | 0.30 | <0.002 | <0.002 | 8.1 | <0.01 | 1.1 |
| o Xylene | <0.001 | 0.26 | 37 | 8.0 | 36 | 0.17 | <0.001 | <0.001 | 7.4 | <0.005 | 1.3 |
| Total BTEX (mg/Kg) | -- | 1.89 | 144.70 | 47.90 | 186.17 | 0.97 | -- | -- | 20.115 | 0.015 | 3.70 |
| **Polynuclear Aromatic Hydrocarbons (PAH) mg/Kg** | | | | | | | | | | | |
| Acenaphthene | <.08 | <0.04 | 0.68 | <0.1 | <0.1 | <0.4 | <0.04 | <0.04 | <0.2 | <0.1 | <0.4 |
| Acenaphthylene | 1.4 | 0.32 | 3.9 | 0.20 | 0.27 | <0.4 | <0.04 | <0.04 | <0.2 | <0.1 | <0.4 |
| Anthracene | 0.47 | 0.18 | 0.54 | 0.10 | 0.13 | <0.4 | <0.04 | <0.04 | <0.2 | <0.1 | 0.52 |
| Benzo(a)anthracene | <0.08 | 0.40 | <0.1 | <0.1 | <0.1 | <0.4 | <0.04 | <0.04 | 1.7 | <0.1 | <0.4 |
| Benzo(a)pyrene | 0.22 | 0.48 | 0.11 | <0.1 | <0.1 | <0.4 | <0.04 | <0.04 | <2 | <0.1 | <0.8 |
| Benzo(b)fluoranthene* | 0.39 | 0.50 | <0.2 | <0.2 | <0.2 | <0.4 | <0.08 | <0.08 | <4 | <0.2 | <0.8 |
| Benzo(k)fluoranthene* | 0.39 | 0.50 | <0.2 | <0.2 | <0.2 | <0.4 | <0.08 | <0.08 | <4 | <0.2 | <0.8 |
| Benzo(g,h,i)perylene | 0.88 | 0.56 | <0.1 | <0.1 | <0.1 | <0.4 | <0.04 | <0.04 | <2 | <0.1 | <0.4 |
| Chrysene | <0.08 | 0.52 | <0.1 | <0.1 | <0.1 | <0.4 | <0.04 | <0.04 | 1.8 | <0.1 | <0.04 |
| Dibenzo(a,h)anthracene | <0.08 | 0.23 | <0.1 | <0.1 | <0.1 | <0.4 | <0.04 | <0.04 | <2 | <0.1 | <0.04 |
| Fluoranthene | <0.08 | 0.52 | 0.48 | 0.15 | 0.19 | <0.4 | <0.04 | <0.04 | 6.6 | <0.1 | 0.28 |
| Fluorene | 0.14 | 0.08 | 2.3 | 0.20 | 0.23 | <0.4 | <0.04 | <0.04 | 3.6 | <0.1 | <0.04 |
| Naphthalene | <0.08 | 2.0 | 75 | 4.6 | 12 | <0.4 | <0.04 | <0.04 | 32 | <0.1 | 0.22 |
| Pyrene | 0.26 | 0.80 | 0.59 | 0.17 | 0.25 | <0.4 | <0.04 | <0.04 | 4.6 | <0.1 | 1.9 |
| Phenanthrene | <0.08 | 0.35 | 2.3 | 0.48 | 0.61 | <0.4 | <0.04 | <0.04 | 22 | <0.1 | 0.56 |
| Indeno(1,2,3-cd)pyrene | 0.76 | 0.48 | <0.1 | <0.1 | <0.1 | <0.4 | <0.04 | <0.04 | <2 | <0.1 | <0.4 |
| Total PAHs (mg/Kg) | 4.91 | 7.92 | 85.90 | 5.90 | 13.68 | -- | -- | -- | 72.30 | -- | 3.48 |
| **Cyanide and Phenols mg/Kg** | | | | | | | | | | | |
| Cyanide | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 |
| Phenols | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |

* Sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene represents total, unable to separate isomers.
**Duplicate of TP-3.

TABLE 6–4 (Continued)
LILCO BAYSHORE MGP SITE
SUMMARY OF TARGET COMPOUNDS DETECTED IN TEST PIT SOIL SAMPLES
JULY/AUGUST 1992

| Sample Number | TP–8 | TP–9 | TP–10 | TP–10A | TP–11 | TP–12 | TP–13 | TP–14 | TP–35** | TP–14A |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample Depth (feet) | 6.5–7.5 | 9–10 | 2–3 | 8–9 | 8–8.5 | 9–10 | 8–9 | 1–2 | 1–2 | 7.5–8.5 |
| Date Sampled | 08/03/92 | 07/31/92 | 7/28/92 | 07/28/92 | 07/31/92 | 07/30/92 | 07/30/92 | 07/30/92 | 07/30/92 | 07/30/92 |
| **Volatile Organics (BTEX) mg/Kg** | | | | | | | | | | |
| Benzene | <0.05 | <0.02 | 44 | 1.2 | <0.02 | <0.1 | <0.2 | 86 | 63 | 190 |
| Toluene | 0.16 | <0.02 | 90 | 2.6 | 0.032 | 0.20 | 0.40 | 300 | 560 | 210 |
| Ethyl Benzene | 2.0 | 0.51 | 130 | 27 | 0.64 | 16 | 18 | 300 | 460 | 300 |
| m+p Xylene | 6.0 | 0.27 | 72 | 13 | 0.26 | 8.5 | 31 | 340 | 570 | 230 |
| o Xylene | 1.9 | 0.14 | 30 | 4.1 | 0.28 | 13 | 13 | 160 | 290 | 92 |
| Total BTEX (mg/Kg) | 10.06 | 0.92 | 366 | 47.90 | 1.212 | 37.70 | 62.40 | 1186.0 | 1943.0 | 1022.0 |
| **Polynuclear Aromatic Hydrocarbons (PAH) mg/Kg** | | | | | | | | | | |
| Acenaphthene | 3.5 | <0.2 | 32 | 18 | <0.2 | 14 | 6.9 | 200 | 480 | 140 |
| Acenaphthylene | 3.8 | 0.40 | 90 | 15 | <0.2 | 4.7 | 14 | 68 | 130 | 210 |
| Anthracene | <0.2 | <0.2 | 64 | 12 | <0.2 | 12 | <2 | 120 | 180 | 150 |
| Benzo(a)anthracene | <0.2 | 0.81 | 48 | 5.7 | <0.2 | 6.1 | 5.8 | 130 | 190 | 120 |
| Benzo(a)pyrene | 1.0 | 0.57 | 36 | 4.5 | <0.2 | 4.0 | 4.2 | 79 | 140 | 110 |
| Benzo(b)fluoranthene* | <4 | 0.41 | 20 | 2.1 | <0.4 | <8 | 2.3 | 38 | 66 | 55 |
| Benzo(k)fluoranthene* | <4 | 0.41 | 20 | 2.1 | <0.4 | <8 | 2.3 | 38 | 66 | 55 |
| Benzo(g,h,i)perylene | <2 | 0.29 | 11 | 2.1 | <0.2 | <4 | <2 | 40 | <40 | <40 |
| Chrysene | 1.1 | 0.97 | 50 | 5.9 | <0.2 | 6.4 | 3.6 | 120 | 170 | 120 |
| Dibenzo(a,h)anthracene | <2 | <0.2 | 6.9 | <2 | <0.2 | <4 | <2 | <40 | <40 | <40 |
| Fluoranthene | 2.6 | 2.0 | 76 | 12 | <0.2 | 9.3 | 15 | 120 | 230 | 190 |
| Fluorene | 7.0 | <0.2 | 96 | 16 | <0.2 | 14 | 21 | 180 | 370 | 240 |
| Naphthalene | 17 | <0.2 | 700 | 120 | <0.2 | <4 | 19 | 760 | 2000 | 2000 |
| Pyrene | 4.2 | 2.2 | 110 | 19 | 0.49 | 19 | 24 | 370 | 720 | 250 |
| Phenanthrene | 13 | 3.0 | 320 | 37 | 1.5 | 44 | 54 | 600 | 1100 | 840 |
| Indeno(1,2,3–cd)pyrene | <2 | 0.2 | 10 | 1.6 | <0.2 | <4 | <2 | <40 | <40 | <40 |
| Total PAHs (mg/Kg) | 53.20 | 11.26 | 1689.90 | 273.0 | 1.99 | 133.50 | 172.10 | 2863.0 | 5842.0 | 4480.0 |
| **Cyanide and Phenols mg/Kg** | | | | | | | | | | |
| Cyanide | <2 | <2 | 2.5 | <2 | <2 | <2 | <2 | 6.5 | 5.0 | <2 |
| Phenols | <0.1 | <0.1 | <2 | <0.1 | <0.1 | <0.1 | <0.1 | 1.0 | 1.2 | 4.6 |

* Sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene represents total, unable to separate isomers.
***Duplicate of TP–14.

TABLE 6-4 (Continued)
. LILCO BAYSHORE MGP SITE
SUMMARY OF COMPOUNDS DETECTED IN TEST PIT SOIL
JULY/AUGUST 1992

| Sample Number | TP-15 | TP-16 | TP-16A | TP-17 | TP-18 | TP-19 | TP-20 | TP-21 | TP-22 | TP-22A | TP-23 | FB-TP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Depth (feet) | 8-8.5 | 7.5-8.5 | 10-11 | 6-7 | 7-8 | 7-8 | 6-7 | 7.5-8.5 | 4-5 | 8-8.5 | 7-8 | -- |
| Date Sampled | 07/28/92 | 07/30/92 | 07/30/92 | 07/29/92 | 07/29/92 | 07/29/92 | 07/29/92 | 07/29/92 | 07/28/92 | 07/28/92 | 07/30/92 | 07/28/92 |
| Volatile Organics (BTEX) mg/Kg | | | | | | | | | | | | |
| Benzene | 3.1 | 0.22 | 1.9 | 20 | 1.4 | 7.4 | <0.001 | 0.34 | 6.5 | 2.6 | <0.2 | <0.001 |
| Toluene | 4.6 | <0.2 | 0.25 | 43 | 0.65 | 0.2 | <0.001 | 0.11 | 25 | 0.32 | <0.2 | <0.001 |
| Ethyl Benzene | 91 | 31 | 35 | 76 | 65 | 27 | <0.001 | 29 | 23 | 58 | 33 | <0.001 |
| m+p Xylene | 54 | 20 | 20 | 81 | 49 | 19 | <0.002 | 17 | 25 | 29 | 42 | <0.002 |
| o Xylene | 24 | 19 | 20 | 34 | 34 | 9.4 | <0.001 | 3.9 | 2.8 | 10 | 17 | <0.001 |
| Total BTEX (mg/Kg) | 176.70 | 70.22 | 77.15 | 254.0 | 150.05 | 63.0 | -- | 50.35 | 82.3 | 99.92 | 92.0 | -- |
| Polynuclear Aromatic Hydrocarbons (PAH) mg/Kg | | | | | | | | | | | | |
| Acenaphthene | 130 | 44 | 35 | 21 | 52 | 5.0 | <0.04 | 26 | 11 | 16 | <2 | <0.001 |
| Acenaphthylene | 68 | 12 | 13 | 11 | <4 | 1.1 | <0.04 | 13 | 70 | 1.7 | <2 | <0.001 |
| Anthracene | 92 | 29 | 29 | 21 | 30 | 3.4 | <0.04 | 25 | 38 | 8.8 | <2 | <0.001 |
| Benzo(a)anthracene | 52 | 18 | 17 | 17 | 15 | 2.6 | <0.04 | 13 | 30 | 5.0 | 2.4 | <0.001 |
| Benzo(a)pyrene | 48 | 12 | 12 | 7.9 | 11 | 2.0 | <0.04 | 9.7 | 26 | 3.7 | 2.0 | <0.001 |
| Benzo(b)fluoranthene* | 22 | 7.0 | 6.5 | 5.0 | 6.5 | 1.0 | <0.04 | 4.7 | 12 | 1.9 | <4 | <0.001 |
| Benzo(k)fluoranthene* | 22 | 7.0 | 6.5 | 5.0 | 6.5 | 1.0 | <0.04 | 4.7 | 12 | 1.9 | <4 | <0.001 |
| Benzo(g,h,i)perylene | 17 | 4.0 | 4.0 | 2.3 | 4.0 | 1.2 | <0.04 | 8.6 | 10 | 1.4 | <2 | <0.001 |
| Chrysene | 56 | 20 | 18 | 15 | 17 | 2.6 | <0.04 | 13 | 40 | 6.3 | 2.8 | <0.001 |
| Dibenzo(a,h)anthracene | 8.9 | <4 | <4 | 1.1 | <4 | 0.39 | <0.04 | <4 | <10 | <1 | <2 | <0.001 |
| Fluoranthene | 100 | 29 | 25 | 29 | 31 | 5.4 | <0.04 | 27 | 43 | 7.4 | 5.6 | <0.001 |
| Fluorene | 110 | 39 | 38 | 25 | 44 | 4.2 | <0.04 | 33 | 56 | 11 | 11 | <0.001 |
| Naphthalene | 720 | 5.0 | <4 | 32 | 180 | 1.4 | <0.04 | 32 | 380 | 100 | 96 | <0.001 |
| Pyrene | 150 | 52 | 48 | 35 | 48 | 6.0 | <0.04 | 40 | 16 | 16 | 9.1 | <0.001 |
| Phenanthrene | 230 | 100 | 100 | 59 | 100 | 1.3 | <0.04 | 88 | 160 | 29 | 24 | <0.001 |
| Indeno(1,2,3-cd)pyrene | 15 | 4.0 | 4.0 | 2.2 | 4.0 | 0.75 | <0.04 | 5.1 | 8.0 | 1.1 | <2 | <0.001 |
| Total PAHs (mg/Kg) | 1840.90 | 382.0 | 356.0 | 288.50 | 549.0 | 39.34 | -- | 342.80 | 912.00 | 211.20 | 152.90 | -- |
| Cyanide and Phenols mg/Kg | | | | | | | | | | | | |
| Cyanide | 0.9 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <0.02 |
| Phenols | <2 | 0.7 | 0.8 | 0.1 | 0.9 | <0.1 | <0.1 | <0.1 | 0.8 | 0.001 | <0.1 | <0.001 |

* Sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene represents total, unable to separate isomers.
FB-TB is the field equipment rinsate blank sample.
TP-22 and TP-22A TCL/TAL results are presented in Table 6-5.

TABLE 6-5
LILCO BAYSHORE MGP SITE
SUMMARY OF TARGET COMPOUNDS DETECTED IN SOIL BORING SAMPLES
AUGUST 1992

| Sample Number | SB-1 | SB-2 | SB-3 | SB-4 | SB-5 | SB-6 | SB-7 | SB-8 | SB-9 | SB-10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample Depth (feet) | 1-3 | 2-4 | 2-4 | 0-2 | 4-6 | 6-8 | 2-6 | 8-10 | 3-8 | 4-8 |
| Date Sampled | 08/06/92 | 08/06/92 | 08/06/92 | 08/06/92 | 08/06/92 | 08/07/92 | 08/06/92 | 08/06/92 | 08/06/92 | 08/06/92 |
| Volatile Organics (BTEX) mg/Kg | | | | | | | | | | |
| Benzene | <0.001 | <0.001 | 0.003 | 0.003 | <0.001 | <0.05 | <0.001 | 0.81 | 1.6 | 2.7 |
| Toluene | <0.001 | <0.001 | <0.002 | 0.007 | <0.001 | <0.05 | <0.001 | 0.37 | 1.5 | 0.24 |
| Ethyl Benzene | <0.001 | <0.001 | 2.6 | 0.006 | <0.001 | 2.1 | 0.002 | 39 | 32 | 21 |
| m+p Xylene | <0.002 | <0.002 | 5.1 | 0.010 | <0.002 | 1.4 | <0.002 | 41 | 30 | 3.2 |
| o Xylene | <0.001 | <0.001 | 1.8 | 0.005 | <0.001 | 1.6 | <0.001 | 20 | 17 | 7.1 |
| Total BTEX (mg/Kg) | -- | -- | 9.503 | 0.031 | -- | 5.10 | 0.002 | 101.18 | 82.10 | 34.24 |
| Polynuclear Aromatic Hydrocarbons (PAH) mg/Kg | | | | | | | | | | |
| Acenaphthene | <0.08 | 0.087 | 0.23 | 1.2 | <0.04 | <0.4 | <0.067 | <1 | 8.7 | 22 |
| Acenaphthylene | 2.2 | 1.0 | 0.18 | 5.8 | <0.04 | 0.64 | 0.29 | <1 | <2 | <2 |
| Anthracene | 0.88 | 0.40 | 0.21 | 4.9 | <0.04 | <0.4 | 0.17 | <1 | <2 | <2 |
| Benzo(a)anthracene | 2.2 | 0.52 | 0.27 | 9.0 | <0.04 | <0.4 | 0.21 | <1 | 2.5 | 4.0 |
| Benzo(a)pyrene | 2.0 | 0.89 | <0.67 | 11 | <0.04 | 0.41 | 0.31 | <1 | 2.2 | 2.3 |
| Benzo(b)fluoranthene* | 2.2 | 0.55 | <1.3 | 6.5 | <0.08 | <0.8 | 0.17 | <2 | <4 | <4 |
| Benzo(k)fluoranthene* | 2.2 | 0.55 | <1.3 | 6.5 | <0.08 | <0.8 | 0.17 | <2 | <4 | <4 |
| Benzo(g,h,i)perylene | 2.8 | 0.80 | <0.67 | 6.1 | <0.04 | <0.04 | 0.25 | <1 | <2 | <2 |
| Chrysene | 3.4 | 0.76 | 0.34 | 13 | <0.04 | 0.78 | 0.28 | <1 | <2 | 5.0 |
| Dibenzo(a,h)anthracene | <0.8 | <0.4 | <0.67 | 1.4 | <0.04 | <0.04 | <0.067 | <1 | <2 | <2 |
| Fluoranthene | 1.8 | 0.76 | 0.47 | 15 | <0.04 | 1.2 | 0.27 | 1.0 | 5.9 | 8.4 |
| Fluorene | 0.28 | 0.17 | 0.51 | 2.0 | <0.04 | <0.04 | 0.13 | 3.0 | 9.2 | 14 |
| Naphthalene | 0.54 | 0.048 | 3.5 | <1 | <0.04 | 0.45 | <0.067 | 10 | 70 | 24 |
| Pyrene | 4.4 | 1.5 | 0.85 | 22 | 0.055 | 2.6 | 0.61 | 2.0 | 8.6 | 15 |
| Phenanthrene | 0.96 | 0.64 | 1.3 | 11 | <0.040 | 2.0 | 0.42 | 7.0 | 20 | 34 |
| Indeno(1,2,3-cd)pyrene | 2.0 | 0.47 | <0.67 | 5.1 | <0.040 | <0.040 | 0.15 | <1 | <2 | <2 |
| Total PAHs (mg/Kg) | 27.86 | 9.145 | 7.86 | 120.50 | 0.055 | 8.08 | 3.43 | 23.00 | 127.10 | 128.70 |
| Cyanide and Phenols mg/Kg | | | | | | | | | | |
| Cyanide | 3.5 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | 2.5 | <2 |
| Phenols | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 0.5 |

* Sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene represents total, unable to separate isomers.

TABLE 6-5 (Continued)
LILCO BAYSHORE MGP SITE
SUMMARY OF TARGET COMPOUNDS DETECTED IN SOIL BORING SAMPLES
AUGUST 1992

| Sample Number | SB-11 | SB-12 | SB-25** | SB-13 | SB-14 | SB-15 | SB-16 | SB-17 | SB-18 |
|---|---|---|---|---|---|---|---|---|---|
| Sample Depth (feet) | 4.5-8 | 4.5-8 | 4.5-8 | 4-8 | 7-10 | 5-9 | 6-8 | 2-4 | 2-4 |
| Date Sampled | 08/05/92 | 08/05/92 | 08/05/92 | 08/05/92 | 08/05/92 | 08/07/92 | 08/07/92 | 08/10/92 | 08/10/92 |
| **Volatile Organics (BTEX) mg/Kg** | | | | | | | | | |
| Benzene | <0.05 | 30 | 3.0 | 1.9 | 8.5 | 0.48 | 4.2 | <0.001 | <0.001 |
| Toluene | 0.12 | 2.7 | 0.78 | 0.40 | 0.55 | 0.25 | 0.23 | <0.001 | <0.001 |
| Ethyl Benzene | 5.5 | 270 | 40 | 10 | 77 | 30 | 49 | <0.001 | <0.001 |
| m+p Xylene | 6.8 | 220 | 36 | 3.3 | 55 | 19 | 23 | <0.002 | <0.002 |
| o Xylene | 11 | 96 | 17 | 2.6 | 25 | 15 | 13 | <0.001 | <0.001 |
| Total BTEX (mg/Kg) | 23.42 | 618.70 | 96.78 | 18.20 | 166.05 | 64.73 | 89.43 | -- | -- |
| **Polynuclear Aromatic Hydrocarbons (PAH) mg/Kg** | | | | | | | | | |
| Acenaphthene | 22 | 19 | <4 | 11 | 22 | 17 | 68 | <0.04 | <0.04 |
| Acenaphthylene | 8.0 | <4 | <4 | 26 | <0.4 | 4.9 | 16 | <0.04 | <0.04 |
| Anthracene | 15 | <4 | <4 | 27 | 8.8 | <2 | 40 | <0.04 | <0.04 |
| Benzo(a)anthracene | 9.7 | <4 | <4 | 36 | 6.8 | 8.0 | 24 | 0.04 | <0.04 |
| Benzo(a)pyrene | 6.6 | <4 | <4 | 23 | 4.8 | 5.6 | 20 | 0.04 | <0.04 |
| Benzo(b)fluoranthene* | 3.8 | <8 | <8 | <8 | 2.4 | 2.8 | 8.0 | <0.08 | <0.08 |
| Benzo(k)fluoranthene* | 3.8 | <8 | <8 | <8 | 2.4 | 2.8 | 8.0 | <0.08 | <0.08 |
| Benzo(g,h,i)perylene | 2.1 | <4 | <4 | 6.8 | 1.5 | 2.3 | 7.6 | <0.04 | <0.04 |
| Chrysene | 11 | 4.2 | <4 | 35 | 6.4 | 9.0 | 26 | 0.057 | <0.04 |
| Dibenzo(a,h)anthracene | <2 | <4 | <4 | <4 | 0.76 | <2 | 3.3 | <0.04 | <0.04 |
| Fluoranthene | 20 | 6.2 | 5.5 | 48 | 16 | 13 | 48 | 0.05 | <0.04 |
| Fluorene | 20 | <4 | 15 | 31 | 14 | 18 | 56 | <0.04 | <0.04 |
| Naphthalene | 15 | 80 | 64 | 12 | 230 | 40 | 84 | <0.04 | <0.04 |
| Pyrene | 30 | 11 | 9.1 | 10 | 13 | 26 | 64 | 0.11 | <0.04 |
| Phenanthrene | 50 | 39 | 33 | 76 | 60 | 34 | 120 | 0.064 | <0.04 |
| Indeno(1,2,3-cd)pyrene | <2 | <4 | <4 | 5.5 | 1.2 | 1.5 | 6.3 | <0.04 | <0.04 |
| Total PAHs (mg/Kg) | 217.00 | 159.40 | 126.60 | 347.30 | 390.06 | 184.90 | 596.20 | 0.361 | -- |
| **Cyanide and Phenols mg/Kg** | | | | | | | | | |
| Cyanide | <2 | 6.5 | 3.5 | <2 | <2 | <2 | <2 | <2 | <2 |
| Phenols | <0.1 | 1.1 | 1.0 | <0.1 | 0.5 | <0.1 | <0.1 | <0.1 | <0.1 |

* Sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene represents total, unable to separate isomers.
**Duplicate of SB-12

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TABLE 6-5 (Continued)
LILCO BAYSHORE MGP SITE
SUMMARY OF TARGET COMPOUNDS DETECTED IN SOIL BORING SAMPLES
AUGUST 1992

| Sample Number | SB-19 | SB-24*** | FB-SB |
|---|---|---|---|
| Sample Depth (feet) | 6-8 | 6-8 | -- |
| Date Sampled | 08/10/92 | 08/10/92 | 08/07/92 |
| Volatile Organics (BTEX) mg/Kg | | | |
| Benzene | <0.005 | <0.005 | <0.001 |
| Toluene | <0.005 | <0.005 | <0.001 |
| Ethyl Benzene | 0.030 | 0.020 | <0.001 |
| m+p Xylene | 0.019 | 0.017 | <0.002 |
| o Xylene | 0.40 | 0.31 | <0.001 |
| Total BTEX (mg/Kg) | 0.449 | 0.347 | -- |
| Polynuclear Aromatic Hydrocarbons (PAH) mg/Kg | | | |
| Acenaphthene | 24 | 16 | <0.001 |
| Acenaphthylene | 8.5 | 6.9 | <0.001 |
| Anthracene | 19 | 14 | <0.001 |
| Benzo(a)anthracene | 15 | 12 | <0.001 |
| Benzo(a)pyrene | 10 | 8.5 | <0.001 |
| Benzo(b)fluoranthene* | 5.0 | 4.4 | <0.001 |
| Benzo(k)fluoranthene* | 5.0 | 4.4 | <0.001 |
| Benzo(g,h,i)perylene | 3.1 | 2.0 | <0.001 |
| Chrysene | 18 | 13 | <0.001 |
| Dibenzo(a,h)anthracene | <2 | <2 | <0.001 |
| Fluoranthene | 28 | 22 | <0.001 |
| Fluorene | 26 | 19 | <0.001 |
| Naphthalene | 9.3 | 3.4 | <0.001 |
| Pyrene | 46 | 40 | <0.001 |
| Phenanthrene | 42 | 32 | <0.001 |
| Indeno(1,2,3-cd)pyrene | 2.6 | 2.0 | <0.001 |
| Total PAHs (mg/Kg) | 261.50 | 199.60 | -- |
| Cyanide and Phenols mg/Kg | | | |
| Cyanide | <2 | <2 | <0.02 |
| Phenols | <0.1 | <0.1 | <0.001 |

* Sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene represents total, unable to separate isomers. ** Duplicate of SB-19
FB-SB is the field equipment rinsate blank sample.
***Duplicate of SB-19.

TABLE 6-6
LONG ISLAND LIGHTING COMPANY
SUMMARY OF TARGET COMPOUNDS DETECTED IN WELL BORING SOIL SAMPLES
AUGUST 1992

| Sample Number | WB-1 | WB-2 | WB-3 | WB-4 | WB-5 | WB-6 | WB-7 | WB-8 | WB-9 |
|---|---|---|---|---|---|---|---|---|---|
| Sample Depth (feet) | 2.5-6 | 2-4.5 | 6-8 | 3.5-6 | 5-7 | 8-9 | 3-5.5 | 2.5-5.5 | 4-6 |
| Date Sampled | 08/13/92 | 08/11/92 | 08/17/92 | 09/01/92 | 08/24/92 | 08/24/92 | 08/19/92 | 08/20/92 | 08/18/92 |
| **Volatile Organics (BTEX) mg/Kg** | | | | | | | | | |
| Benzene | <0.001 | 0.36 | <0.002 | <0.002 | <0.001 | <0.05 | 0.25 | 1.0 | <0.001 |
| Toluene | <0.001 | 43 | 0.002 | <0.002 | <0.001 | <0.05 | 0.18 | 0.7 | <0.001 |
| Ethyl Benzene | <0.001 | 22 | 0.020 | 0.012 | <0.001 | 0.88 | 0.40 | 55 | <0.001 |
| m+p Xylene | <0.002 | 73 | <0.004 | 0.021 | <0.002 | 3.7 | 0.15 | 59 | <0.002 |
| o Xylene | <0.001 | 31 | 0.030 | 0.008 | <0.001 | 4.1 | 0.10 | 26 | <0.001 |
| Total BTEX (mg/Kg) | -- | 169.36 | 0.052 | 0.041 | -- | 8.68 | 1.08 | 141.7 | -- |
| **Polynuclear Aromatic Hydrocarbons (PAH) mg/Kg** | | | | | | | | | |
| Acenaphthene | <0.04 | 0.22 | <0.1 | <0.1 | <4 | 16 | 6.8 | <0.4 | <0.04 |
| Acenaphthylene | <0.04 | 0.71 | <0.1 | <0.1 | 12 | 12 | 5.6 | 6.0 | <0.04 |
| Anthracene | <0.04 | <0.2 | 0.24 | <0.1 | <4 | 28 | 6.8 | <0.4 | <0.04 |
| Benzo(a)anthracene | <0.04 | <0.2 | 0.26 | <0.1 | <4 | 24 | 6.4 | 1.8 | <0.04 |
| Benzo(a)pyrene | <0.04 | <0.2 | 0.22 | <0.1 | 136 | 20 | 6.5 | <4 | <0.04 |
| Benzo(b)fluoranthene* | <0.08 | <0.4 | <0.2 | <0.1 | 5.4 | 10 | 4.3 | <8 | <0.08 |
| Benzo(k)fluoranthene* | <0.08 | <0.4 | <0.2 | <0.1 | 5.4 | 10 | 4.3 | <8 | <0.08 |
| Benzo(g,h,i)perylene | <0.04 | <0.2 | <0.1 | <0.1 | 9.2 | 8.0 | 5.6 | <4 | <0.04 |
| Chrysene | <0.04 | <0.2 | 0.33 | <0.1 | <4 | 24 | 7.6 | 2.2 | <0.04 |
| Dibenzo(a,h)anthracene | <0.04 | <0.2 | <0.1 | <0.1 | <4 | 4.0 | <4 | <4 | <0.04 |
| Fluoranthene | <0.04 | 0.21 | 0.36 | 0.14 | <4 | 40 | 8.8 | 3.6 | <0.04 |
| Fluorene | <0.04 | 0.51 | <0.1 | 0.12 | <4 | 24 | 7.6 | 5.6 | <0.04 |
| Naphthalene | <0.04 | 180 | <0.1 | 0.25 | <4 | 8.0 | 1.3 | 52 | <0.04 |
| Pyrene | <0.04 | 0.39 | 0.69 | 0.22 | 4.8 | 64 | 18 | 5.6 | <0.04 |
| Phenanthrene | <0.04 | 0.94 | <0.1 | 0.28 | <4 | 52 | 18 | 11 | <0.04 |
| Indeno(1,2,3-cd)pyrene | <0.04 | <0.2 | <0.1 | <0.1 | 7.2 | 8.0 | 4.0 | <4 | <0.04 |
| Total PAHs (mg/Kg) | -- | 182.98 | 2.10 | 1.01 | 180.00 | 352.00 | 111.60 | 87.80 | -- |
| **Cyanide and Phenols mg/Kg** | | | | | | | | | |
| Cyanide | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 |
| Phenols | <0.1 | <0.1 | <0.1 | <0.001 | <0.1 | 0.4 | <0.1 | <0.1 | <0.1 |

* Sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene represents total, unable to separate isomers.

boundary. PAHs were also found on the adjacent property east of Clinton Avenue in the area used for asphalting equipment storage and maintenance.

Isoconcentration maps have also been prepared for four individual PAHs, naphthalene, fluorene, phenanthrene and pyrene (Figures 6-3 through 6-6). As expected, these compounds show similar distribution patterns as total PAHs. The individual compounds are most widespread on the Bayshore property, with the highest concentrations generally in the area of the abandoned relief holder.

On the Brightwaters property, BTEX compounds were detected in 14 of the 21 soil samples. Concentrations ranged from 0.015 mg/kg in TP-7 located at the southern border of the Brightwaters property, to 186 mg/kg in TP-34 (duplicate of TP-3) located south of the former H-fuel tank. PAHs were detected in 16 of the 21 soil samples from the Brightwaters property. Concentrations of total PAHs ranged from 0.055 mg/kg in SB-5, a soil boring located at the southern property boundary, to 182 mg/kg in sample WB-2, located south of the former H-fuel tank. Naphthalene was detected in 12 soil samples at concentrations ranging from 0.048 mg/kg in SB-2 to 180 mg/kg in WB-2. Fluorene was detected in 12 samples, and concentrations ranged from 0.08 mg/kg in TP-2 to 7.0 mg/kg in TP-8. Pyrene, which was detected in 16 samples, had concentrations that ranged from 0.17 mg/kg in TP-3 to 22 mg/kg in Sb-4. Phenanthrene was detected in 13 samples and concentrations ranged from 0.35 mg/kg in TP-2 to 22 mg/kg in TP-6. Cyanide was detected in one sample, SB-1, at a concentration of 3.5 mg/kg. Phenols were not detected in any of the samples from the Brightwaters property.

On the Bayshore property, BTEX compounds were detected in 32 of the 34 samples. Concentrations of total BTEX ranged from 0.002 mg/kg in SB-7 in the southeast corner of the property, to 1,943 mg/kg in TP-35 (duplicate of TP-14) just south of the abandoned relief holder. Concentrations of total PAHs, which were also detected in 32 of the samples, ranged from 1.99 mg/kg in TP-11 to 5,842 in sample TP-35 (duplicate of TP-14). Naphthalene was detected in 27 samples, and concentrations ranged from 0.25 mg/kg in WB-4 to 2,000 mg/kg in TP-14A and TP-35 (duplicate of TP-14). Fluorene was detected in 29 samples at concentrations ranging from 0.13 mg/kg in SB-7 to 370 mg/kg in TP-35 (duplicate of TP-14). Phenanthrene was detected in 32 samples at concentrations ranging from 0.42 mg/kg in SB-7 to 1,100 mg/kg in TP-35 (duplicate of TP-14).

Cyanide was detected in six of the 34 samples on the Bayshore property at concentrations ranging from 0.9 mg/kg in TP-15 to 6.5 mg/kg in TP-14 and SB-12. Phenols





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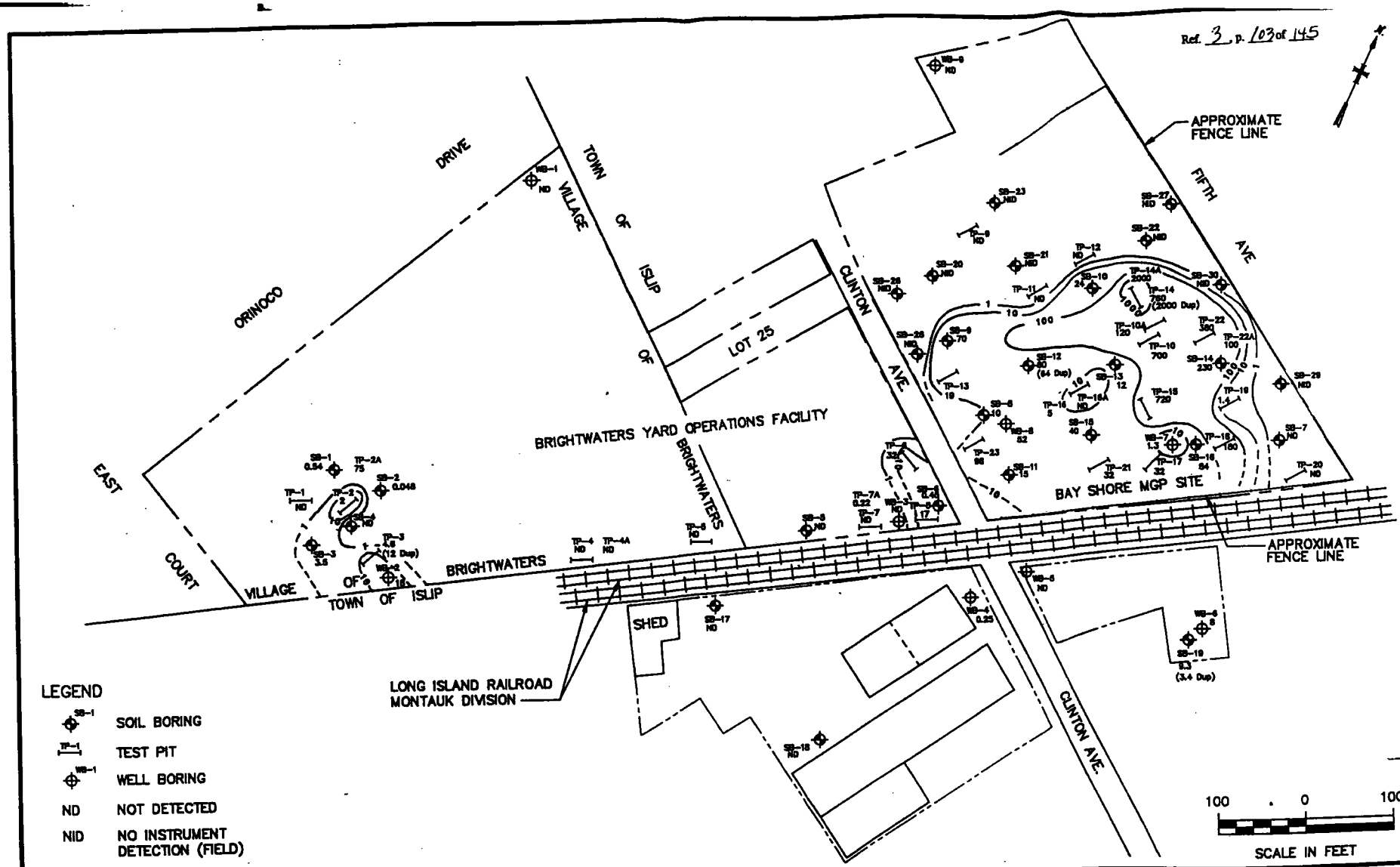


MALCOLM PIRNIE

LONG ISLAND LIGHTING COMPANY
BAYSHORE GAS PLANT

NAPHTHALENE CONCENTRATIONS IN SOIL (ppm)

MALCOLM PIRNIE, INC

FIGURE 6-3

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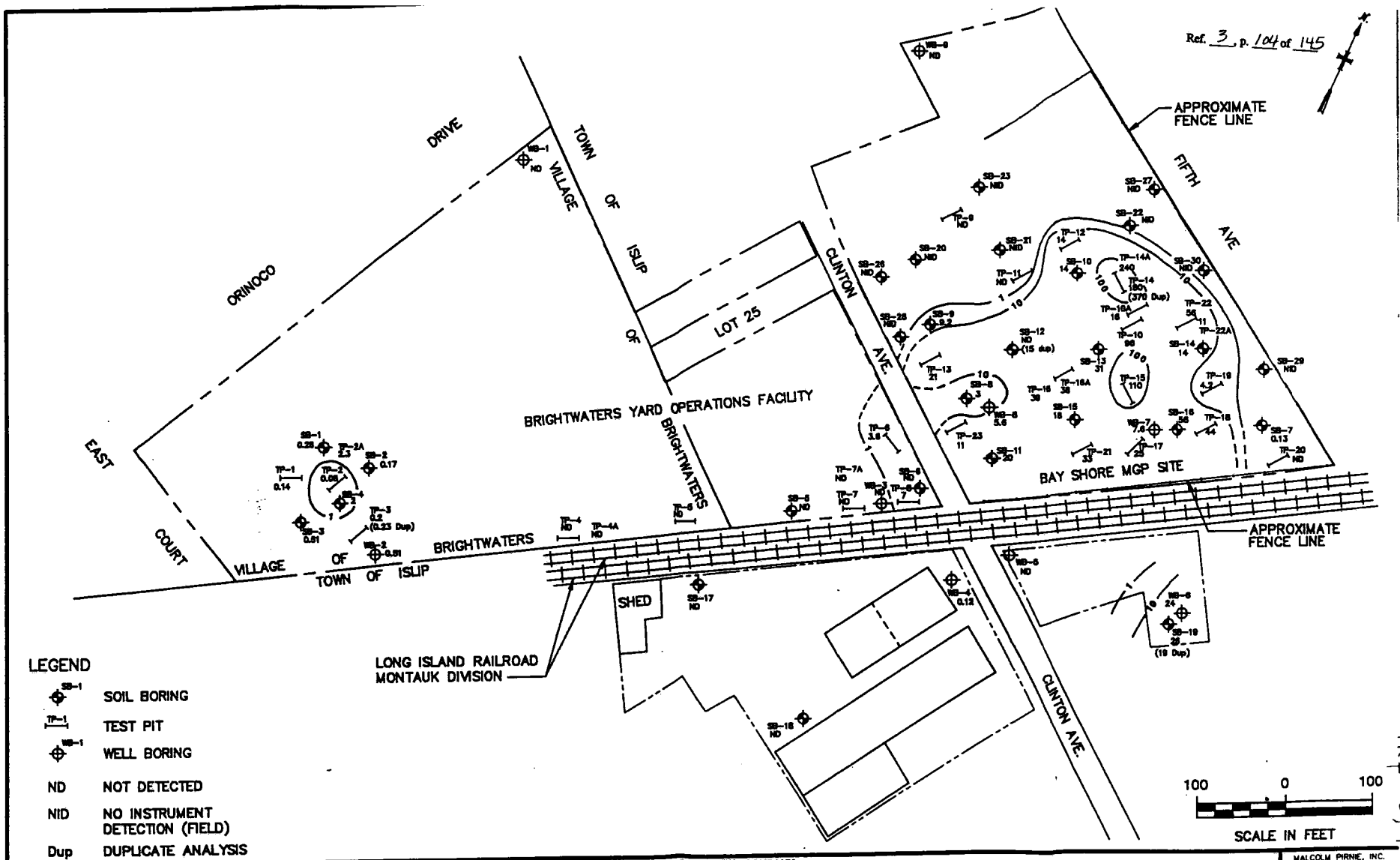


MALCOLM PIRNIE

LONG ISLAND LIGHTING COMPANY
BAYSHORE GAS PLANT

FLUORENE CONCENTRATIONS IN SOIL (ppm)

MALCOLM PIRNIE, INC.

FIGURE 6-4

5683 : 12490230\V:\ACAD\PROJ\12490230\FIG6-4 SCALE: 1:1001 11/01, 1993 at 13:36

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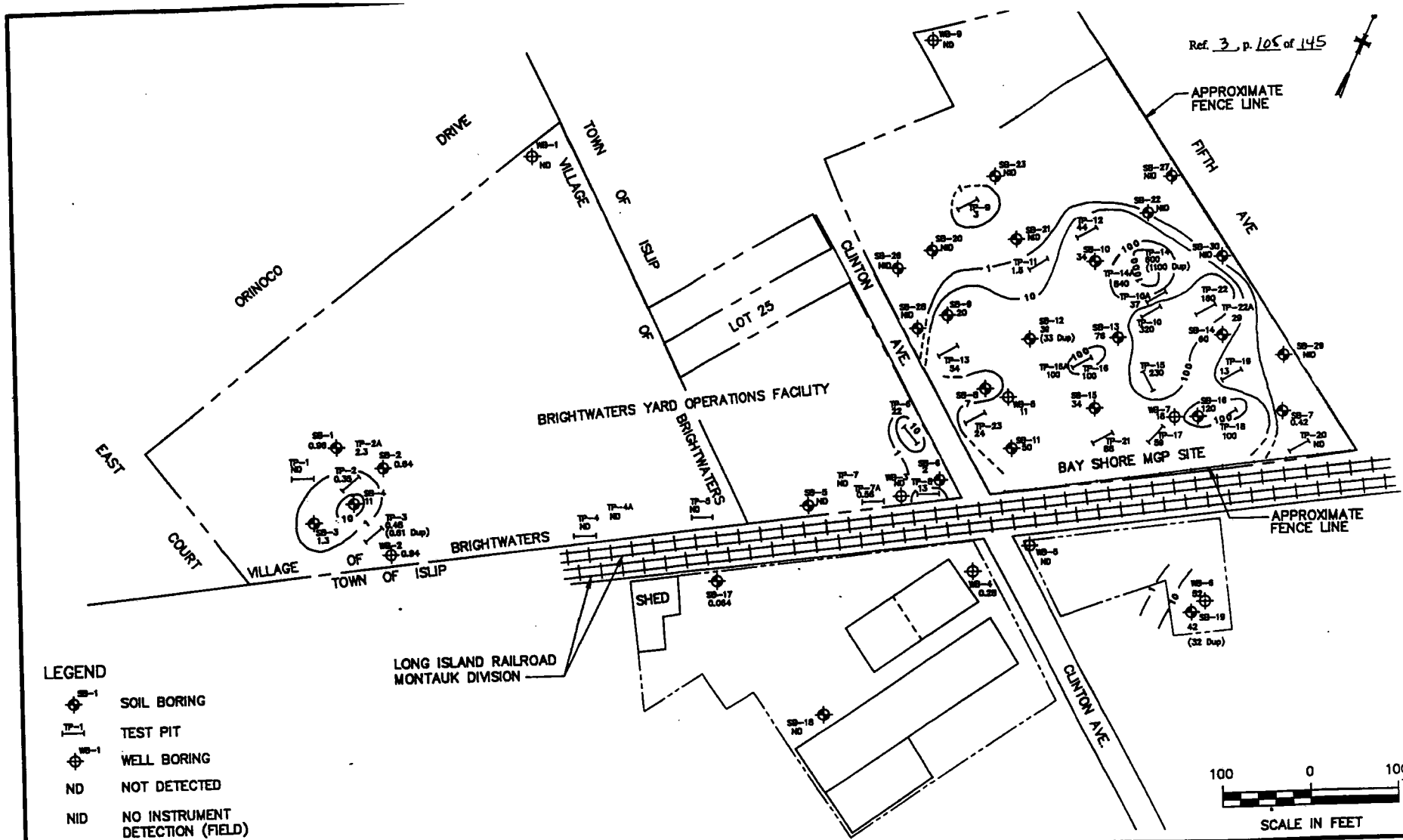


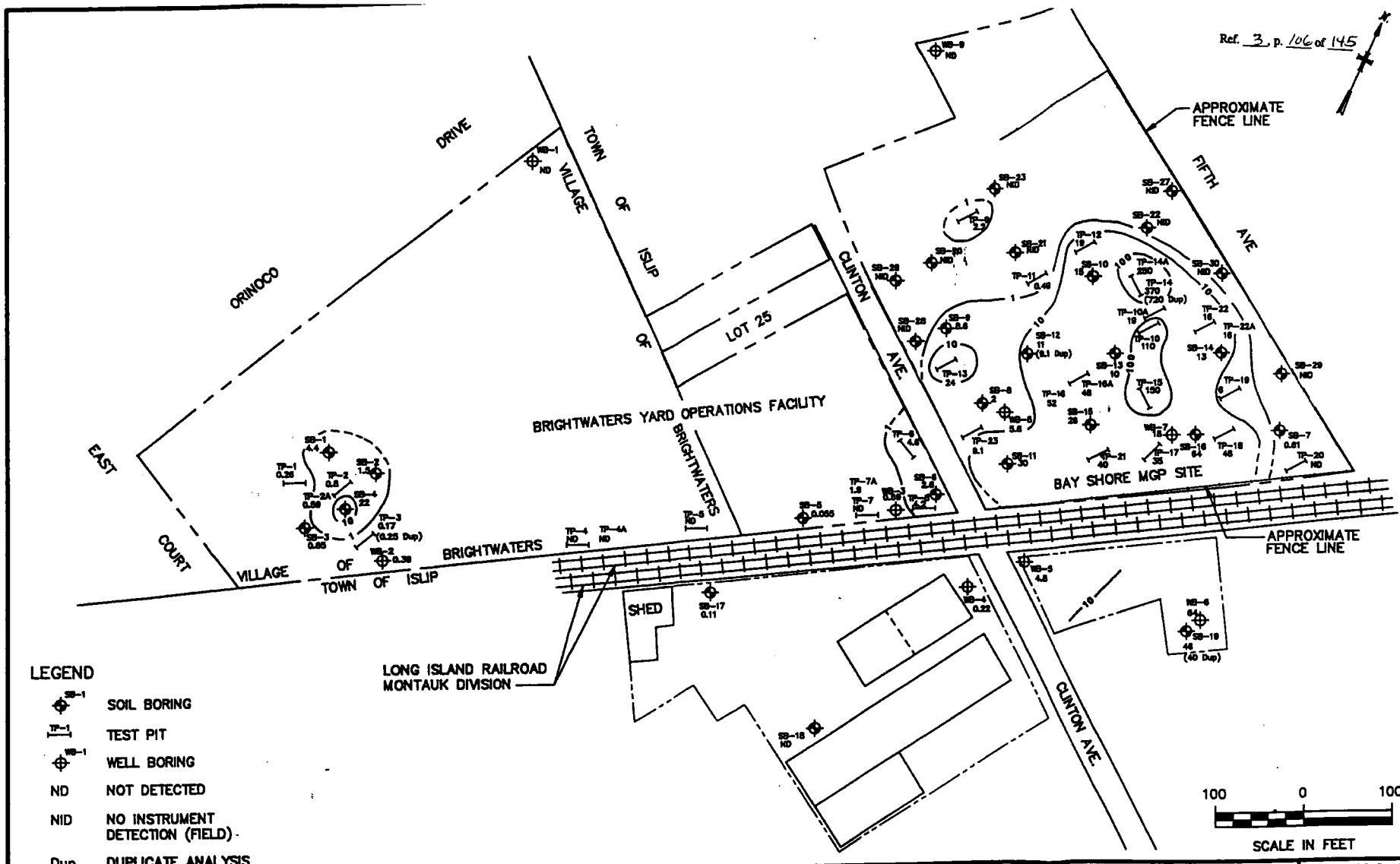

MALCOLM PIRNIE

LONG ISLAND LIGHTING COMPANY
BAYSHORE GAS PLANT

PHENANTHRENE CONCENTRATIONS IN SOIL (ppm)

MALCOLM PIRNIE, INC.

FIGURE 6-5




MALCOLM PIRNIE

LONG ISLAND LIGHTING COMPANY
BAYSHORE GAS PLANT

**PYRENE CONCENTRATIONS IN SOIL (ppm)**

MALCOLM PIRNIE, INC.

FIGURE 6-6

were detected in 11 of the 34 samples, and ranged from 0.001 mg/kg in TP-22A to 4.6 mg/kg in sample TP-14A.

On the adjacent properties, BTEX compounds were detected in four of six subsurface soil samples collected. Total BTEX concentrations ranged from 0.041 mg/kg in WB-4 to 8.68 mg/kg in WB-6 located east of Clinton Avenue in the area used for asphalting equipment storage and maintenance. PAHs were detected in six samples, and total PAH concentrations ranged from 0.36 mg/kg in SB-17 to 352 mg/kg in WB-6. Naphthalene was detected in three of the samples at concentrations ranging from 0.25 mg/kg in WB-4 to 9.3 mg/kg in SB-19. Fluorene was also detected in three samples, at concentrations that ranged from 0.12 mg/kg in WB-4 to 26 mg/kg in SB-19. Pyrene was detected in five of the samples, and the detected concentrations ranged from 0.11 mg/kg in SB-17 to 64 mg/kg in WB-6. Phenanthrene was detected in five samples at concentrations ranging from 0.064 mg/kg in SB-17 to 52 mg/kg in WB-6. Cyanide was not detected in any of the samples from the adjacent properties, and phenol was detected only in WB-6 at a concentration of 0.4 mg/kg.

TOC and pH were measured in six subsurface soil samples from five locations, and the results are shown in Table 6-3. TOC concentrations ranged from 490 mg/kg to 2,700 mg/kg, which are within the common range of values for sandy soils. The measured pH values ranged from 6.0 to 9.3 but most were close to neutral.

Eight subsurface soil samples were analyzed for TCLP parameters and RCRA waste characteristics. The analytical results are presented in Table 6-7. Concentrations of leachable organic compounds and metals in all of the eight samples were lower than the regulatory limits given in 40 CFR Part 261. All samples were also below RCRA regulatory levels that define hazardous wastes, indicating that the soil would not be classified as characteristic hazardous waste if excavated.

## 6.3 GROUNDWATER

One extensive round of groundwater sampling and analysis was conducted as part of this investigation. Sixty-six groundwater samples were collected, along with QA/QC samples and analyzed for target compounds indicative of MGP wastes. In addition, selected samples were analyzed for full TCL/TAL parameters or expanded VOC and Semi-volatile analyses to confirm the validity of the target analyses and to check for the presence of other





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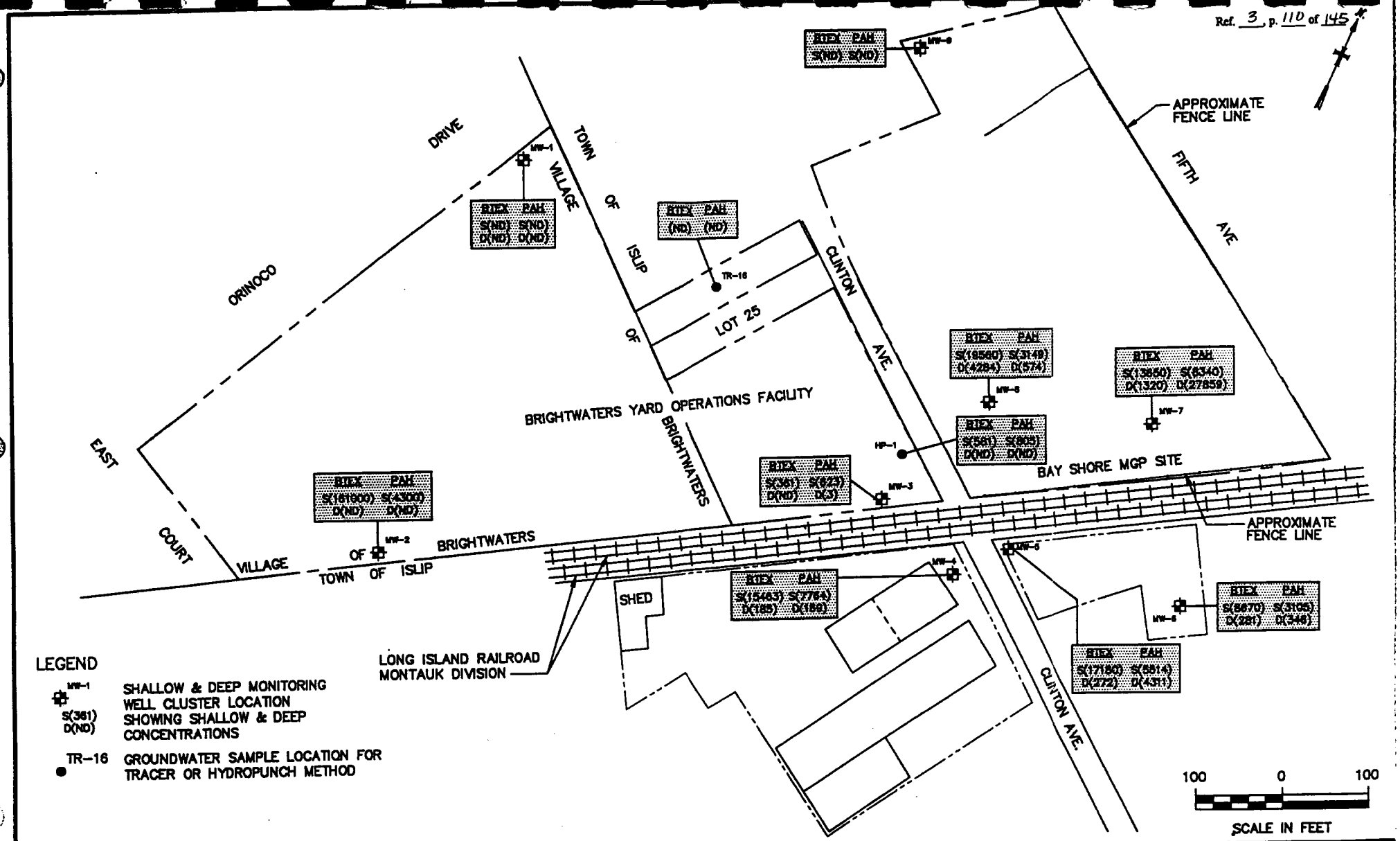
TABLE 6-7
LILCO BAYSHORE MGP SITE
SUMMARY OF COMPOUNDS DETECTED IN TCLP ANALYSIS
JULY/AUGUST 1992

| Sample Number | TP-2 | TP-11 | TP-21 | TP-22 | TP-22A | TP-23 | SB-9 | WB-5 | Regulatory Level 40 CFR Part 261* |
|---|---|---|---|---|---|---|---|---|---|
| Sample Depth (feet) | 1-2 | 8-8.5 | 7.5-8.5 | 4-5 | 8-8.5 | 7-8 | 3-8 | 5-7 | |
| Date Sampled | 08/03/92 | 07/31/92 | 07/29/92 | 07/28/92 | 07/28/92 | 07/30/92 | 08/06/92 | 08/24/92 | |
| **TCLP Organics ug/L** | | | | | | | | | |
| Chlorobenzene | <1 | <1 | <4 | <4 | <4 | 380 | <4 | <1 | 100000 |
| Chloroform | <1 | <1 | <2 | <2 | <2 | 4 | <2 | <1 | 6000 |
| 1,4-Dichlorobenzene | <2 | <2 | <4 | <4 | <4 | 320 | <4 | <2 | 7500 |
| 1,1-Dichloroethene | <1 | <1 | 2 | <2 | <2 | 3 | <2 | <1 | 700 |
| Benzene | 2 | <1 | 13 | 340 | 14 | 7 | 25 | <1 | 500 |
| **TCLP Metals mg/L** | | | | | | | | | |
| Arsenic | <0.005 | <0.05 | <0.005 | <0.005 | <0.005 | <0.005 | 0.008 | <0.005 | 5.0 |
| Barium | 0.16 | 0.22 | 0.21 | 0.27 | <0.05 | 0.34 | 0.15 | 0.15 | 100.0 |
| Cadmium | <0.002 | 0.001 | 0.002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 1.0 |
| Chromium | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | 5.0 |
| Lead | 0.036 | <0.005 | 0.009 | 0.06 | <0.005 | 0.01 | 0.29 | <0.005 | 5.0 |
| Mercury | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.001 | <0.001 | 0.2 |
| Selenium | <0.005 | 0.12 | <0.005 | <0.005 | 0.007 | <0.005 | <0.005 | <0.005 | 1.0 |
| Silver | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 5.0 |
| **Waste Characteristics** | | | | | | | | | |
| Ignitability (deg. Celsius) | >100 | >100 | >100 | >100 | >100 | 65 | 94 | >100 | <60 |
| Corrosivity (mm/yr) | Neg <6.35 | Neg <6.35 | Neg <6.35 | Neg <6.35 | Neg <6.35 | Neg <6.35 | Neg. <6.35 | Neg. <6.35 | >6.35 |
| Sulfide Reactivity (mg/kg) | <2 | <2 | <2 | | <2 | <2 | <2 | <2 | >500 |
| Cyanide Reactivity (mg/kg) | <2 | <2 | <2 | <2 | <2 | <2 | 2.5 | <2 | >250 |

*The Regulatory Level is the concentration at or above which the chemical is defined as a hazardous waste.




MALCOLM PIRNIE

LONG ISLAND LIGHTING COMPANY
BAYSHORE GAS PLANT

**TOTAL BTEX & TOTAL PAH CONCENTRATIONS IN GROUND WATER ON-SITE (ppb)**

MALCOLM PIRNIE, INC.

FIGURE 6-7

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MW-3S. Monitoring wells MW-4D also contained concentrations of 1,1,1 trichloroethane and trichloroethene, commonly used as solvents and degreasers, which were not detected on the LILCO property. These chemical data indicate a contributing source downgradient of the LILCO property.

On the Bayshore property, high concentrations of BTEX and PAHs were detected in monitoring well clusters 7 and 8 in both the shallow and deep wells as shown on Figure 6-7. Lead was also detected in the groundwater sample from MW-7S at concentrations approaching TAGM guidelines. These wells are located just downgradient of the soil contamination areas associated with the abandoned relief holder, the tar storage tanks and the tar separator tanks. Groundwater samples from monitoring well clusters MW-5 and MW-6 on the adjacent property east of Clinton Avenue showed a similar suite of compounds. The water samples collected in the shallow wells on the adjacent property had significantly higher concentrations than the deep wells. Well clusters MW-5 and MW-6 are both located in the area used for asphalting equipment storage and maintenance which is a potential source for these compounds. The fact that the shallow groundwater had higher concentrations of these compounds than the deep wells also suggests a local source.

The downgradient plume remains similar in shape and concentration as reported in 1979. The plume is still long and narrow as previously mapped. The horizontal extent of the plume near the site is slightly wider than mapped in 1979 based on new data near Union Boulevard, but remains basically the same. Horizontal and vertical delineation of the plume based on naphthalene concentrations (Figures 6-8 and 6-9) still indicates that the plume is primarily limited to the shallow and intermediate groundwater zones throughout most of its length, and contamination is only detected in the shallow zone near the discharge area at Lawrence Creek. Although the highest concentration of naphthalene was detected in the deep zone at GM-3, naphthalene was not detected in the deep zones at adjacent well locations indicating the limited extent of contamination in the deep zone. This distribution of naphthalene is controlled by the groundwater flow system between the shallow, intermediate and deep zones. Groundwater movement near the site and downgradient to the general vicinity of GM-3 is primarily horizontal. However, a major upward component of flow is introduced approaching Lawrence Creek and the Great South Bay. The vertical delineation of naphthalene from GM-5 to Lawrence Creek correlates directly to the vertical movement of groundwater as can be seen on the groundwater flow section shown in Figure 5-14. The overall horizontal component to groundwater flow near the site combined with





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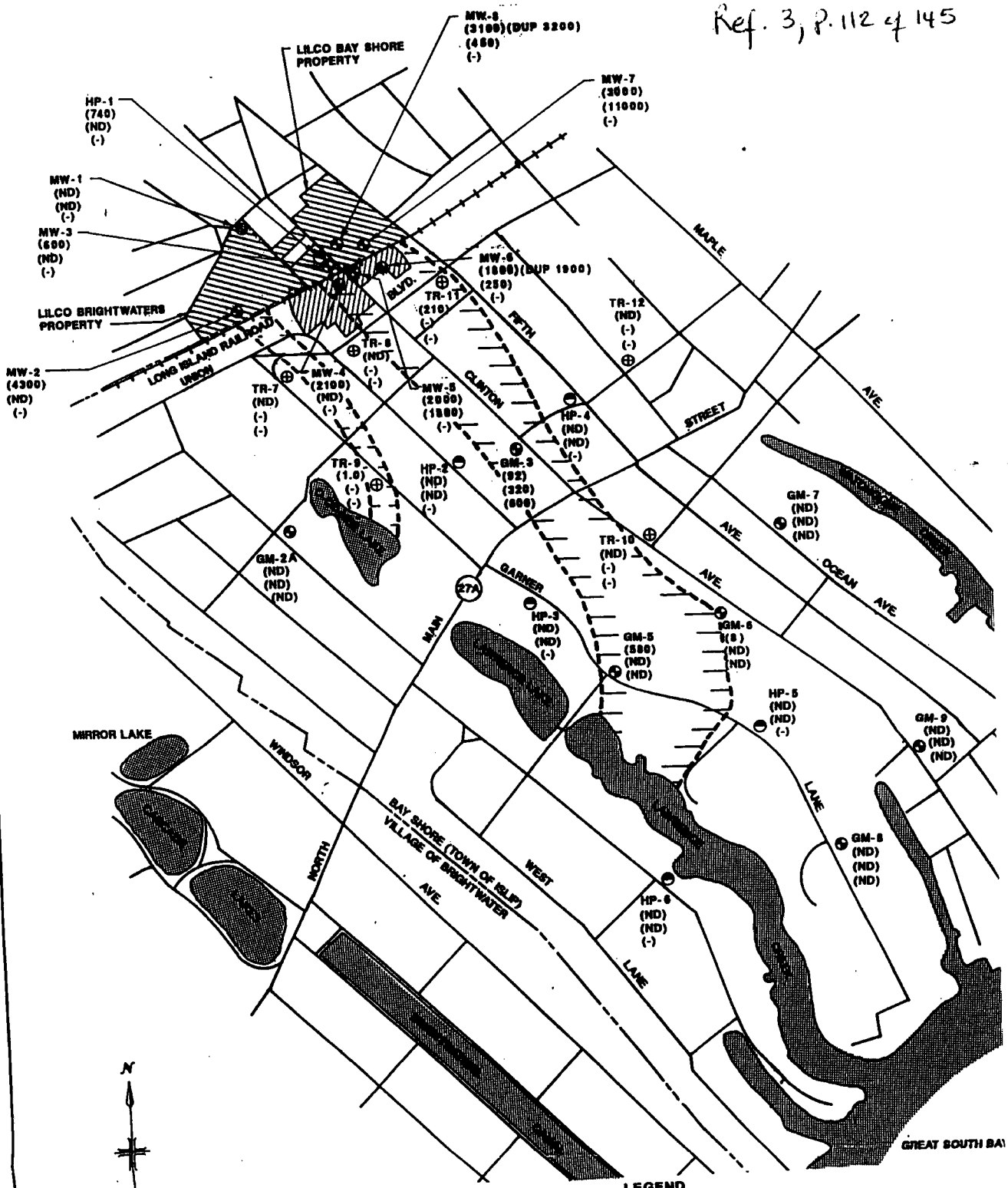



**LEGEND**

HP-3 (ND) (ND) (-) — HYDROPUNCH SAMPLES W/NAPHTHALENE CONCENTRATIONS IN SHALLOW AND INTERMEDIATE GROUNDWATER ZONES.

TR-7 (ND) (-) (-) — TRACER GROUNDWATER SAMPLES W/ NAPHTHALENE CONCENTRATIONS IN SHALLOW GROUNDWATER ZONES.

GM-5 (580) (ND) (ND) — OFF-SITE WELLS W/NAPHTHALENE CONCENTRATIONS IN SHALLOW, INTERMEDIATE, AND DEEP GROUNDWATER ZONES.

MW-6 (2200) (292) (-) — NEW WELLS W/NAPHTHALENE CONCENTRATIONS IN SHALLOW AND INTERMEDIATE GROUNDWATER ZONES.

**NOTES**

DUP DUPLICATE ANALYSIS

(-) INDICATES NO SAMPLE COLLECTED FROM THIS GROUNDWATER ZONE.

(ND) NOT DETECTED

Ref. 3, p. 112 of 145

500 0 500
scale

SOURCE: USGS TOPOGRAPHIC MAP 7.5 MINUTE - BAY SHORE EAST QUAD (PHOTOREVISED 1979) AND BAY SHORE WEST QUAD (PHOTOREVISED 1979)

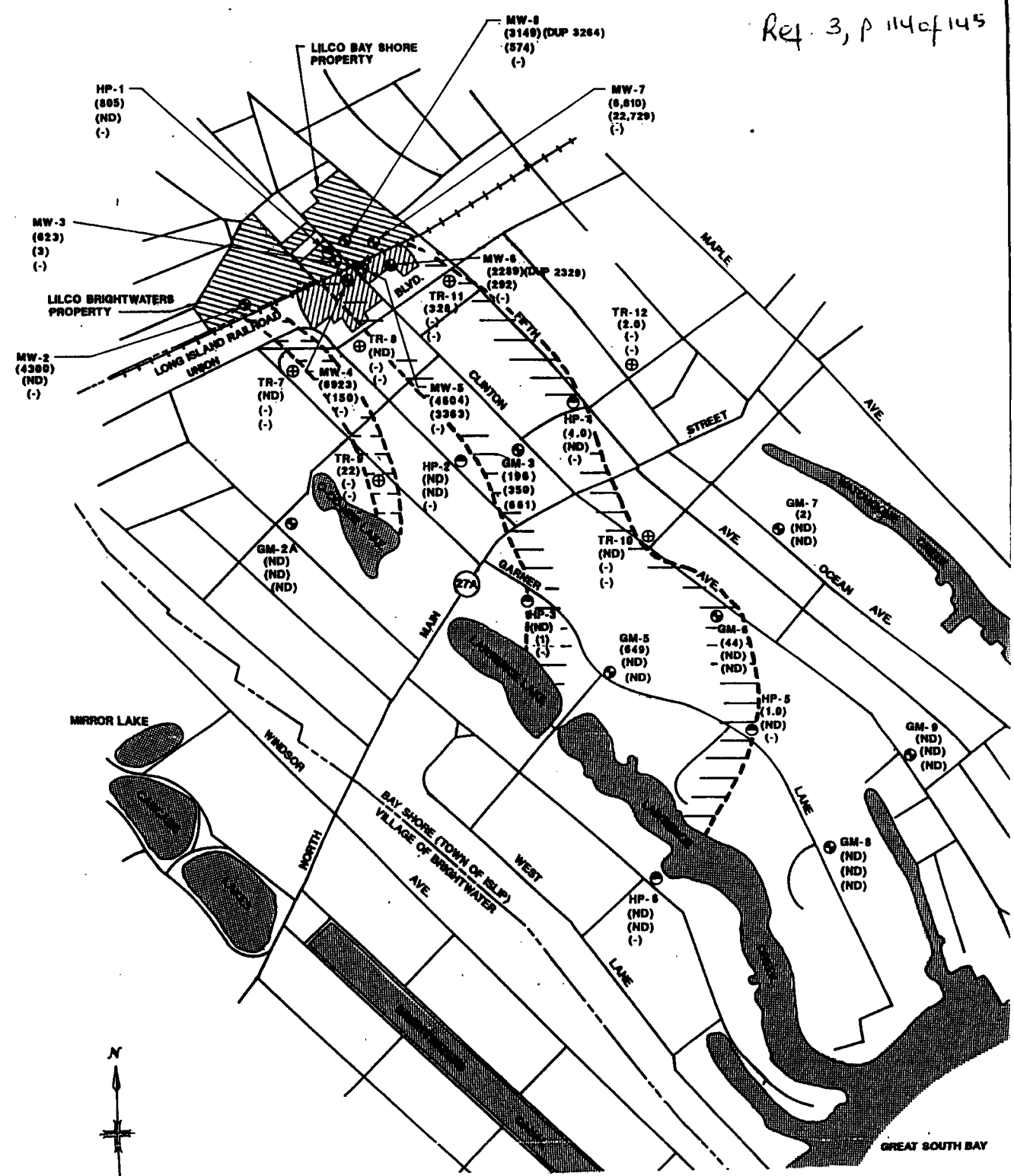
MALCOLM PIRNIE

LONG ISLAND LIGHTING COMPANY
BAYSHORE GAS PLANT

NAPHTHALENE CONCENTRATIONS IN THE DOWNGRADIENT PLUME AREA (PPB)

FIGURE

Ref. 3, p 114 of 145



QUADRANGLE LOCATION

SOURCE: USGS TOPOGRAPHIC MAP 7.5 MINUTE - BAY SHORE EAST QUAD (PHOTOREVISED 1979) AND BAY SHORE WEST QUAD (PHOTOREVISED 1979)

**LEGEND**

HP-3 (ND) (ND) (-) — HYDROPUNCH SAMPLES W/TOTAL PAH CONCENTRATIONS IN SHALLOW AND INTERMEDIATE GROUNDWATER ZONES.

TR-7 (ND) (-) (-) — TRACER GROUNDWATER SAMPLES W/ TOTAL PAH CONCENTRATIONS IN SHALLOW GROUNDWATER ZONES.

GM-5 (649) (ND) (ND) — OFF-SITE WELLS W/TOTAL PAH CONCENTRATIONS IN SHALLOW, INTERMEDIATE AND DEEP GROUNDWATER ZONES.

MW-6 (2289) (292) (-) — NEW WELLS W/TOTAL PAH CONCENTRATIONS IN SHALLOW AND INTERMEDIATE GROUNDWATER ZONES.

**NOTES**

DUP DUPLICATE ANALYSIS

(-) INDICATES NO SAMPLE COLLECTED FROM THIS GROUNDWATER ZONE.

(ND) NOT DETECTED

Ref. 3, p. 114 of 145

500 0 500 feet
scale

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BAYSHORE GAS PLANT

TOTAL PAH CONCENTRATIONS IN DOWNGRADIENT PLUME (PPB)

FIGURE 6-10

the strong upward component of flow downgradient of the site is responsible for limiting the lower extent of the plume throughout the area.

Groundwater samples were collected at additional locations during this investigation to further delineate the width and length of the plume. Two exceptions to the 1979 plume delineation are seen based on naphthalene and total PAH concentrations (Figure 6-10), which indicate that the plume is similar except at well cluster location GM-6 and in the area between the Brightwaters Yard and O-Co-Nee Lake. The sample from the shallow well in cluster GM-6 analyzed during this investigation contained 8 ug/L of naphthalene; naphthalene was not detected at this location in 1979. The net effect of this detection is to make the plume slightly wider at its downgradient end. Samples collected downgradient of GM-6 did not contain naphthalene. In addition, the presence of naphthalene at location TR-9, albeit very low (1 ug/L), combined with the concentration of total PAHs at TR-9 (22 ug/L) and the high concentration of naphthalene detected in MW-2S (4,300 ug/L) on the Brightwaters Yard, indicates the presence of a second, smaller plume between the Brightwaters Yard and O-Co-Nee Lake. However, this smaller plume is very narrow based on the non-detection of naphthalene at locations TR-7 and TR-8.

The delineation of the downgradient plume based on total PAHs as well as on other individual PAHs (Figures 6-11 and 6-12) is very similar to the naphthalene plume. BTEX concentrations in the downgradient plume (Figure 6-13) are much more sporadic, but were detected in the shallow well in cluster GM-6. This data, along with the naphthalene data for this same well, supports the wider delineation of the downgradient edge of the plume. However, the groundwater sample from HP-6, located on the west side of Lawrence Creek, did not contain any BTEX or PAH compounds, indicating that the plume has not migrated beneath or beyond Lawrence Creek.

### 6.3.2 Tracer Groundwater Samples

Tracer probes were used to collect six groundwater samples at six locations upgradient of the site and eight groundwater samples from seven locations downgradient of the site. Samples from the upgradient locations were analyzed by the laboratory for TCL compounds, and samples from the downgradient locations were analyzed by the laboratory for BTEX, PAHs, phenol, and cyanide. The analytical results are presented in Tables 6-8 and 6-9.





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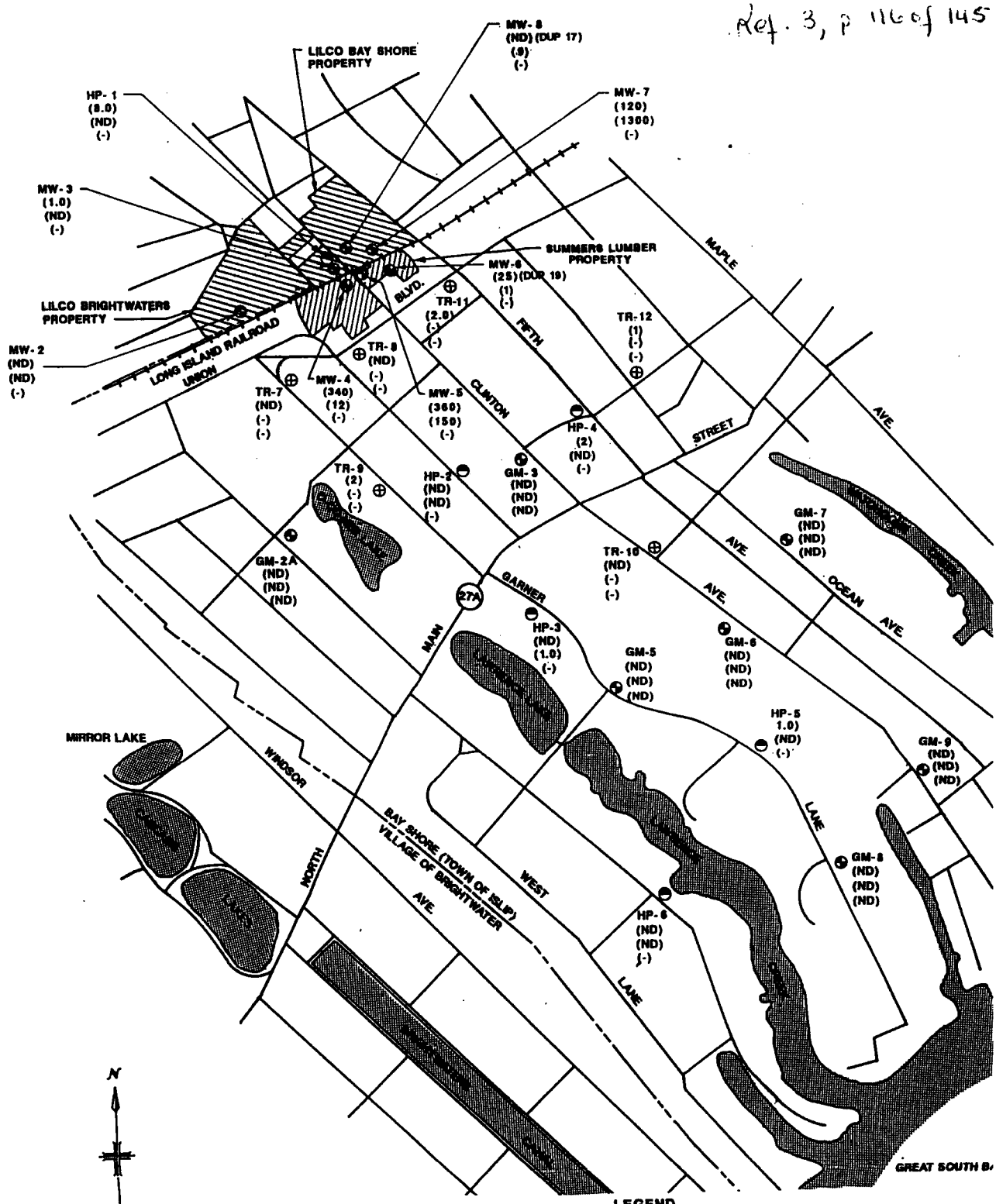



## LEGEND

HP-3 (ND) (ND) (-) — HYDROPUNCH SAMPLES W/TOTAL PAH CONCENTRATIONS IN SHALLOW AND INTERMEDIATE GROUNDWATER ZONES.

TR-7 (ND) (-) (-) — TRACER GROUNDWATER SAMPLES W/ TOTAL PAH CONCENTRATIONS IN SHALLOW GROUNDWATER ZONES.

GM-5 (649) (ND) (ND) — OFF-SITE WELLS W/TOTAL PAH CONCENTRATIONS IN SHALLO INTERMEDIATE AND DEEP GROUNI WATER ZONES.

MW-6 (2289) (292) (-) — NEW WELLS W/TOTAL PAH CONCE TRATIONS IN SHALLOW AND INTE MEDIATE GROUNDWATER ZONES.

## NOTES

DUP DUPLICATE ANALYSIS

(-) INDICATES NO SAMPLE COLLECTED FROM THIS GROUNDWATER ZONE.

(ND) NOT DETECTED

Ref. 3, p. 116 of 145

600 0 600
scale

SOURCE: USGS TOPOGRAPHIC MAP 7.5 MINUTE - BAY SHORE EAST QUAD (PHOTOREVISED 1979) AND BAY SHORE WEST QUAD (PHOTOREVISED 1979)

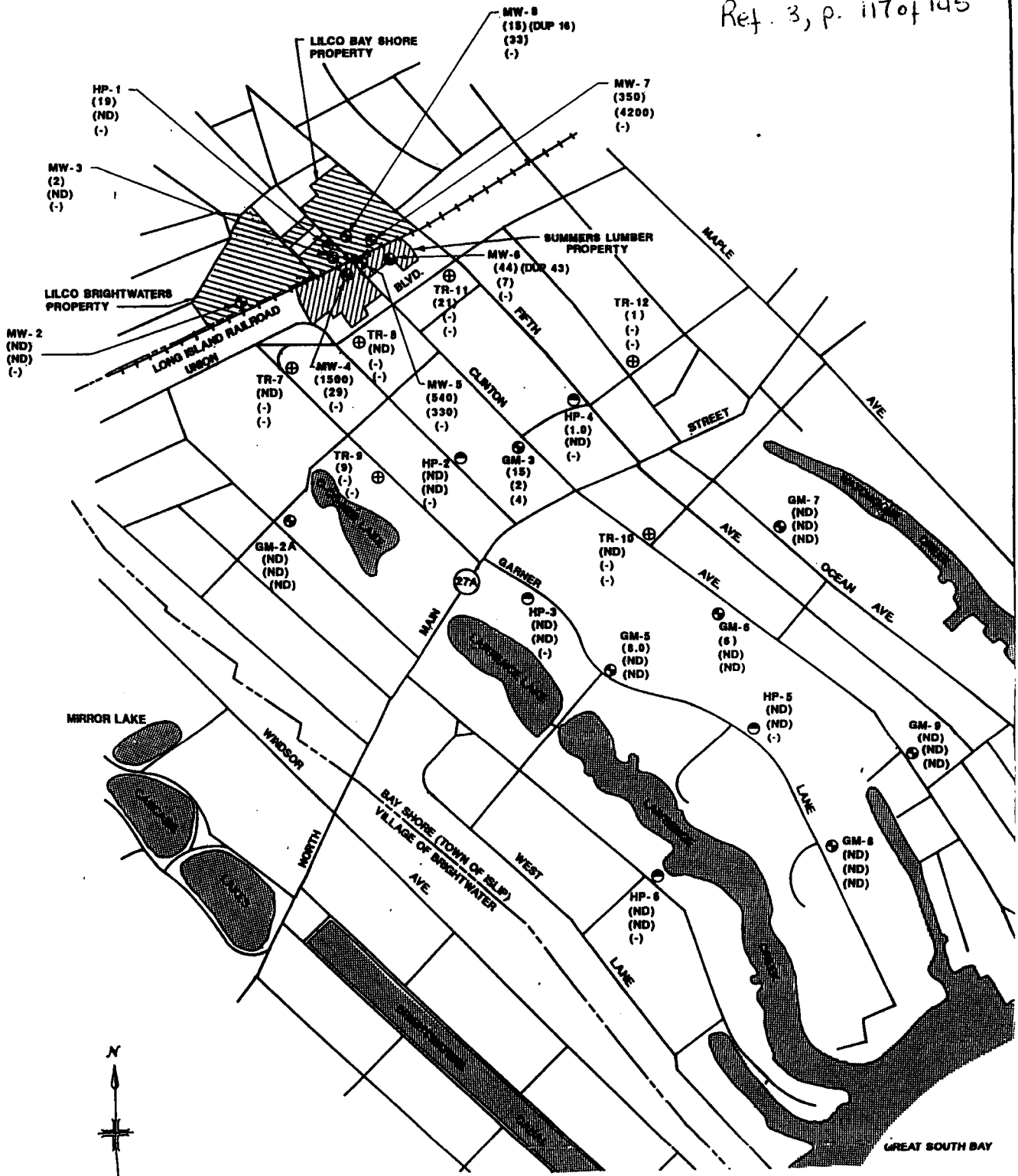
MALCOLM PIRNIE

LONG ISLAND LIGHTING COMPANY
BAYSHORE GAS PLANT

PYRENE CONCENTRATIONS IN THE DOWNGRADIENT PLUME AREA (PPB)

FIGURE

Ref. 3, p. 117 of 145




## LEGEND

- HP-3 (ND) (ND) (-) — HYDROPUNCH SAMPLES W/TOTAL PAH CONCENTRATIONS IN SHALLOW AND INTERMEDIATE GROUNDWATER ZONES.
- TR-7 (ND) (-) (-) — TRACER GROUNDWATER SAMPLES W/ TOTAL PAH CONCENTRATIONS IN SHALLOW GROUNDWATER ZONES.
- GM-5 (849) (ND) (ND) — OFF-SITE WELLS W/TOTAL PAH CONCENTRATIONS IN SHALLOW, INTERMEDIATE AND DEEP GROUND-WATER ZONES.
- MW-6 (2289) (292) (-) — NEW WELLS W/TOTAL PAH CONCENTRATIONS IN SHALLOW AND INTERMEDIATE GROUNDWATER ZONES.

## NOTES

DUP DUPLICATE ANALYSIS

(-) INDICATES NO SAMPLE COLLECTED FROM THIS GROUNDWATER ZONE.

(ND) NOT DETECTED

Ref. 3, p. 117 of 145

500 0 500 feet
scale

SOURCE: USGS TOPOGRAPHIC MAP 7.5 MINUTE - BAY SHORE EAST QUAD (PHOTOREVISED 1979) AND BAY SHORE WEST QUAD (PHOTOREVISED 1979)

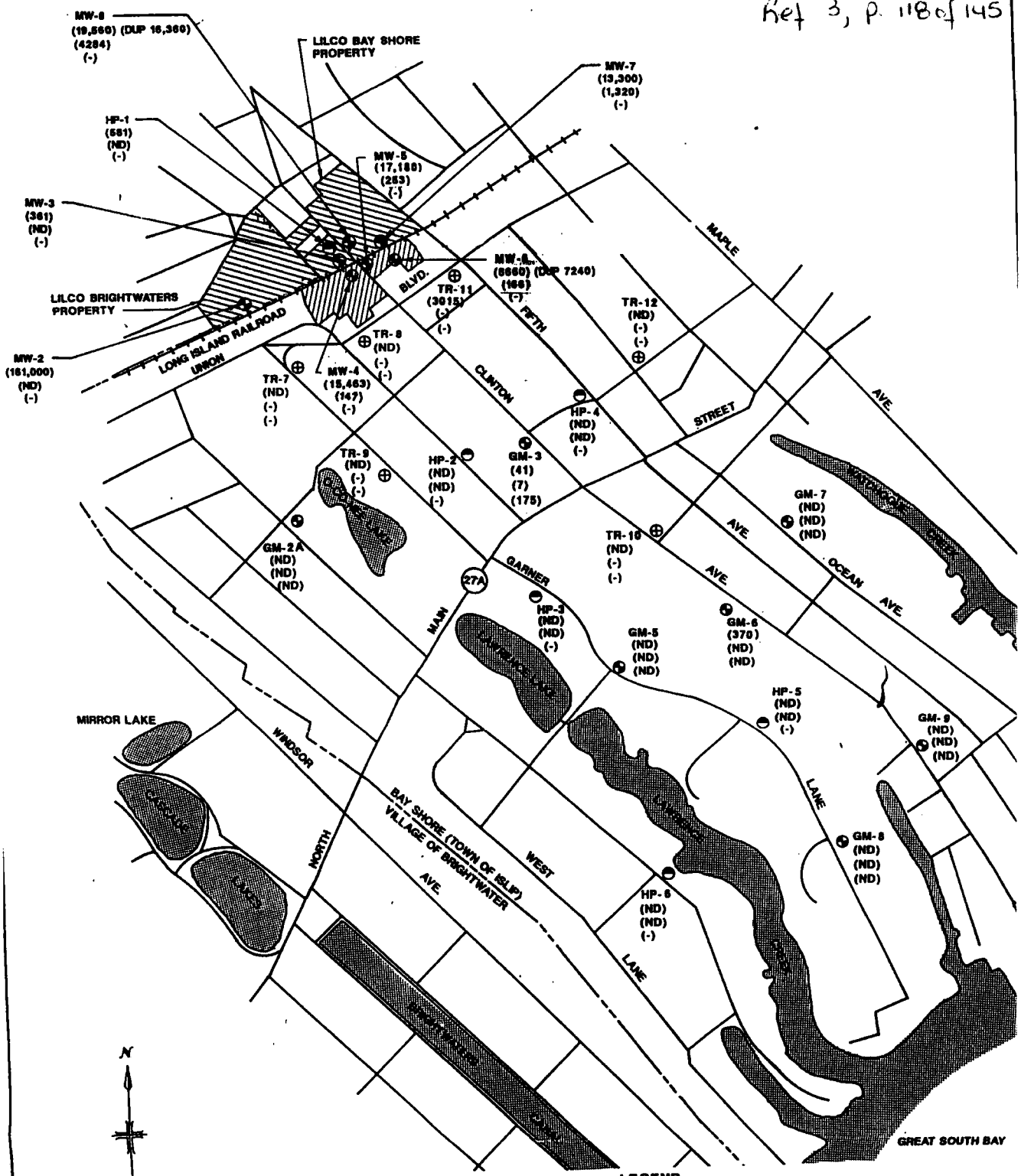
MALCOLM PIRNIE

LONG ISLAND LIGHTING COMPANY
BAYSHORE GAS PLANT

PHENANTHRENE CONCENTRATIONS IN THE DOWNGRADIENT PLUME AREA (PPB)

FIGURE 6-12

Ref 3, p. 118 of 145



QUADRANGLE LOCATION

## LEGEND

HP-3 (ND) (ND) (-) — HYDROPUNCH SAMPLES W/TOTAL BTEX CONCENTRATIONS IN SHALLOW AND INTERMEDIATE GROUNDWATER ZONES.

TR-7 (3015) (-) (-) — TRACER GROUNDWATER SAMPLES W/ TOTAL BTEX CONCENTRATIONS IN SHALLOW GROUNDWATER ZONES.

GM-5 (41) (7) (175) — OFF-SITE WELLS W/TOTAL BTEX CONCENTRATIONS IN SHALLOW, INTERMEDIATE AND DEEP GROUND-WATER ZONES.

MW-6 (8670) (281) (-) — NEW WELLS W/TOTAL BTEX CONCENTRATIONS IN SHALLOW AND INTER-MEDIATE GROUNDWATER ZONES.

## NOTES

DUP DUPLICATE ANALYSIS

(-) INDICATES NO SAMPLE COLLECTED FROM THIS GROUNDWATER ZONE.

(ND) NOT DETECTED

Ref. 3, p. 118 of 145

500 0 500 feet
scale

SOURCE: USGS TOPOGRAPHIC MAP 7.5 MINUTE - BAY SHORE EAST QUAD (PHOTOREVISED 1979) AND BAY SHORE WEST QUAD (PHOTOREVISED 1979)

MALCOLM PIRNIE

LONG ISLAND LIGHTING COMPANY
BAYSHORE GAS PLANT

TOTAL BTEX CONCENTRATIONS IN DOWNGRADIENT PLUME AREA (PPB)

FIGURE 6-1

TABLE 6-8
LILCO BAYSHORE MGP SITE
SUMMARY OF TCL ORGANIC COMPOUNDS DETECTED IN UPGRADIENT GROUNDWATER
SAMPLES COLLECTED IN TRACER RESEARCH PROBES
JULY 1992

| Sample Number | TR-13 | TR-14 | TR-15 | TR-16 | TR-17 | TR-18 | FB-TR |
|---|---|---|---|---|---|---|---|
| Sample Depth (feet) | 7 | 7 | 9.5 | 7.5 | 7.5 | 7.5 | -- |
| Date Sampled | 07/29/92 | 07/29/92 | 07/29/92 | 07/29/92 | 07/29/92 | 07/29/92 | 07/29/92 |
| TCL Semi Volatiles ug/L | | | | | | | |
| Acenaphthylene | 3 | <1 | <1 | <1 | <1 | <1 | <1.5 |
| Diethyl Phthalate | 1 | <1 | <1 | <1 | <1 | <1 | <1.5 |
| Fluorene | 4 | <1 | <1 | <1 | <1 | <1 | <1.5 |
| Phenanthrene | 23 | <1 | <1 | <1 | <1 | <1 | <1.5 |
| Anthracene | 4 | <1 | <1 | <1 | <1 | <1 | <1.5 |
| Di-n-Butyl Phthalate | 2 | <1 | <1 | <1 | <1 | <1 | 3 |
| Fluoranthene | 7 | <1 | <1 | <1 | <1 | <1 | <1.5 |
| Pyrene | 11 | <1 | <1 | <1 | <1 | <1 | <1.5 |
| Benzo(a)anthracene | 3 | <1 | <1 | <1 | <1 | <1 | <1.5 |
| Chrysene | 3 | <1 | <1 | <1 | <1 | <1 | <1.5 |
| Bis(2-ethylhexyl)phthalate | 5 | 7 | 14 | 8 | 2 | 15 | 6 |
| Di-n-octyl Phthalate | <1 | 32 | <1 | <1 | <1 | <1 | 9 |
| Benzo(b)fluoranthene* | 2 | <2 | <2 | <2 | <2 | <2 | <3.0 |
| Benzo(k)fluoranthene* | 2 | <2 | <2 | <2 | <2 | <2 | <3.0 |
| Benzo(a)pyrene | 3 | <1 | <1 | <1 | <1 | <1 | <1.5 |
| Indeno(1,2,3-cd)pyrene | 1 | <1 | <1 | <1 | <1 | <1 | <1.5 |
| Benzo(g,h,i)perylene | 1 | <1 | <1 | <1 | <1 | <1 | <1.5 |
| Total Semi Volatiles ug/Kg | 75 | 39 | 14 | 8 | 2 | 15 | 18 |

TCL=Target Compound List (USEPA CLP SOW)
*Sum of Benzo(k)fluoranthene and Benzo(b)fluoranthene represents total, unable to separate isomers.
FB-TR is the field equipment rinsate blank sample.
NOTE: There were no TCL Volatile Organic Compounds detected.

**TABLE 6-9**
**LILCO BAYSHORE MGP SITE**
**SUMMARY OF TARGET COMPOUNDS DETECTED IN DOWNGRADIENT GROUNDWATER SAMPLES**
**COLLECTED IN TRACER RESEARCH PROBES**
**JULY 1992**

| Sample Number | TR-6 | TR-19* | TR-7 | TR-8 | TR-9 | TR-10 | TR-11 | TR-12 |
|---|---|---|---|---|---|---|---|---|
| Sample Depth (feet) | 10.5 | 10.5 | 10 | 11 | 6 | 7 | 13 | 9.5 |
| Date Sampled | 07/28/92 | 07/28/92 | 07/28/92 | 07/28/92 | 07/28/92 | 07/28/92 | 07/29/92 | 07/29/92 |
| **Volatile Organics (BTEX) ug/L** | | | | | | | | |
| Benzene | 100 | 85 | <1 | <1 | <1 | <1 | 2300 | <1 |
| Toluene | 360 | 340 | <1 | <1 | <1 | <1 | 15 | <1 |
| Ethyl Benzene | 5300 | 4900 | <1 | <1 | <1 | <1 | 350 | <1 |
| m+p Xylene | 6800 | 6200 | <2 | <2 | <2 | <2 | 130 | <2 |
| o Xylene | 2700 | 2400 | <1 | <1 | <1 | <1 | 220 | <1 |
| Total BTEX (ug/L) | 15260 | 13925 | -- | -- | -- | -- | 3015.0 | -- |
| **Polynuclear Aromatic Hydrocarbons (PAH) ug/L** | | | | | | | | |
| Acenaphthene | 9 | 6 | <1 | <1 | <1 | <1 | 42 | <1 |
| Acenaphthylene | 5 | 2 | <1 | <1 | 1 | <1 | 3 | <1 |
| Anthracene | 7 | 1 | <1 | <1 | 2 | <1 | 20 | <1 |
| Benzo(a)anthracene | 4 | <1 | <1 | <1 | <1 | <1 | 3 | <1 |
| Benzo(a)pyrene | 2 | <1 | <1 | <1 | <1 | <1 | 2 | <1 |
| Benzo(b)fluoranthene* | <1 | <1 | <1 | <1 | <1 | <1 | 1** | <1 |
| Benzo(k)fluoranthene* | <1 | <1 | <1 | <1 | <1 | <1 | 1** | <1 |
| Benzo(g,h,i)perylene | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chrysene | 5 | <1 | <1 | <1 | 1 | <1 | 1 | <1 |
| Dibenzo(a,h)anthracene | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Fluorathene | 9 | <1 | <1 | <1 | 3 | <1 | 6 | <1 |
| Fluorene | 10 | 4 | <1 | <1 | 3 | <1 | 16 | <1 |
| Naphthalene | 660 | 730 | <1 | <1 | 1 | <1 | 210 | <1 |
| Pyrene | 13 | <1 | <1 | <1 | 2 | <1 | 2 | 1 |
| Phenanthrene | 22 | 6 | <1 | <1 | 9 | <1 | 21 | 1 |
| Indeno(1,2,3-cd)pyrene | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Total PAHs (ug/L) | 746.0 | 749.0 | -- | -- | 22.0 | -- | 328.0 | 2.0 |
| **Cyanide and Phenols mg/L** | | | | | | | | |
| Cyanide | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Phenols | <0.038 | <0.037 | <0.022 | <0.001 | <0.012 | <0.001 | 0.27 | 0.10 |

* TR-6 Duplicate
** Unable to separate isomers, represents sum of benzo(b)fluoranthene and benzo (k) fluoranthene.

Only TCL semivolatile compounds were detected in the samples collected at the upgradient locations. Concentrations of total semivolatiles ranged from 2 ug/L in TR-17 to 75 ug/L in TR-13. Fluorene was detected in a single sample, TR-13, at a concentration of 4 ug/L. Phenanthrene was detected at a concentration of 23 ug/L in TR-13. Pyrene was also detected only in TR-13, at a concentration of 11 ug/L. Bis(2-ethylhexyl)phthalate was detected in all samples including the field blank. Naphthalene was not detected in any of the samples from the upgradient locations.

BTEX compounds were detected in three of the eight samples collected at downgradient locations. Concentrations of total BTEX ranged from 3,015 ug/L in TR-11 to 15,260 ug/L in TR-6. PAHs were detected in five of the eight groundwater samples. Concentrations of total PAHs ranged from 2 ug/L in TR-12 to 749 ug/L in TR-19 (duplicate of TR-6). Fluorene was detected in four of the eight samples, at concentrations that ranged from 3 ug/L in TR-9 to 16 ug/L in TR-11. Naphthalene was detected in four of the eight samples at concentrations ranging from 1 ug/L in TR-9 to 730 ug/L in TR-19. Pyrene was detected in four of the eight samples at concentrations ranging from 1 ug/L in TR-12 to 13 ug/L in TR-6. Phenanthrene was detected in five of the eight samples, at concentrations ranging from 1 ug/L in TR-12 to 22 ug/L in TR-6. Phenol was detected in only one sample, TR-11, at a concentration of 0.27 mg/L.

### 6.3.3 Hydropunch Groundwater Samples

Fourteen groundwater samples were collected using the Hydropunch sampling tool at seven locations and were analyzed the laboratory for BTEX compounds, PAHs, cyanide, and phenols. The analytical results are given in Table 6-10. BTEX compounds were detected in only one sample, HP-1S, at a concentration of 581 ug/L. PAHs were detected in four samples, and concentrations ranged from 1 ug/L in HP-5S to 805 ug/L in HP-1S. Fluorene was detected in HP-1S at a concentration of 13 ug/L. Naphthalene was also detected only in HP-1S, at a concentration of 740 ug/L. Pyrene was detected in four samples, at concentrations ranging from 1 ug/L in Hp-3D and HP-5S to 8 ug/L in HP-1S. Phenanthrene was detected in three samples; concentrations ranged from 1 ug/L HP-4S to 19 ug/L in HP-1S. Phenol was detected in HP-1S at a concentration of 0.031 mg/L. No cyanide was detected in any of the samples.





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TABLE 6-10
LILCO BAYSHORE MGP SITE
SUMMARY OF TARGET COMPOUNDS DETECTED IN HYDROPUNCH GROUNDWATER SAMPLES
SEPTEMBER 1992

| Sample Number | HP-1S | HP-1D | HP-2S | HP-2D | HP-3S | HP-8S* | HP-3D | HP-4S | HP-4D |
|---|---|---|---|---|---|---|---|---|---|
| Sample Depth (feet) | 8.5 | 42 | 8.5 | 42 | 5.5 | 5.5 | 43.5 | 11 | 43.5 |
| Date Sampled | 09/03/92 | 09/03/92 | 09/02/92 | 09/02/92 | 09/01/92 | 09/01/92 | 09/01/92 | 09/02/92 | 09/02/92 |
| **Volatile Organics (BTEX) ug/L** | | | | | | | | | |
| Benzene | 16 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Toluene | 5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ethyl Benzene | 160 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| m+p Xylene | 180 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 |
| o Xylene | 220 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Total BTEX (ug/L) | 581.0 | -- | -- | -- | -- | -- | -- | -- | -- |
| **Polynuclear Aromatic Hydrocarbons (PAH) ug/L** | | | | | | | | | |
| Acenaphthene | 6 | <2 | <1 | <2 | <1 | <1 | <1 | <1 | <2 |
| Acenaphthylene | 5 | <2 | <1 | <2 | <1 | <1 | <1 | <1 | <2 |
| Anthracene | 6 | <2 | <1 | <2 | <1 | <1 | <1 | <1 | <2 |
| Benzo(a)anthracene | 1 | <2 | <1 | <2 | <1 | <1 | <1 | <1 | <2 |
| Benzo(a)pyrene | <1 | <2 | <1 | <2 | <1 | <1 | <1 | <1 | <2 |
| Benzo(b)fluoranthene | <1 | <2 | <1 | <2 | <1 | <1 | <1 | <1 | <2 |
| Benzo(k)fluoranthene | <1 | <2 | <1 | <2 | <1 | <1 | <1 | <1 | <2 |
| Benzo(g,h,i)perylene | <1 | <2 | <1 | <2 | <1 | <1 | <1 | <1 | <2 |
| Chrysene | 2 | <2 | <1 | <2 | <1 | <1 | <1 | <1 | <2 |
| Dibenzo(a,h)anthracene | <1 | <2 | <1 | <2 | <1 | <1 | <1 | <1 | <2 |
| Fluoranthene | 5 | <2 | <1 | <2 | <1 | <1 | <1 | 1 | <2 |
| Fluorene | 13 | <2 | <1 | <2 | <1 | <1 | <1 | <1 | <2 |
| Naphthalene | 740 | <2 | <1 | <2 | <1 | <1 | <1 | <1 | <2 |
| Pyrene | 8 | <2 | <1 | <2 | <1 | <1 | 1 | 2 | <2 |
| Phenanthrene | 19 | <2 | <1 | <2 | <1 | <1 | <1 | 1 | <2 |
| Indeno(1,2,3-cd)pyrene | <1 | <2 | <1 | <2 | <1 | <1 | <1 | <1 | <2 |
| Total PAHs (ug/L) | 805.0 | -- | -- | -- | -- | -- | -- | 4.0 | -- |
| **Cyanide and Phenols mg/L** | | | | | | | | | |
| Cyanide | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Phenols | 0.031 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 |

*Duplicate of HP-3S.

TABLE 6-10 (Continued)
LILCO BAYSHORE MGP SITE
SUMMARY OF TARGET COMPOUNDS DETECTED IN HYDROPUNCH GROUNDWATER SAMPLES
SEPTEMBER 1992

| Sample Number | HP-5S | HP-5D | HP-6S | HP-6D | HP-7D | FB-HP | TB-HP |
|---|---|---|---|---|---|---|---|
| Sample Depth (feet) | 6 | 43.5 | 6.5 | 43.5 | 42.5 | -- | -- |
| Date Sampled | 09/10/92 | 09/10/92 | 09/04/92 | 09/04/92 | 09/10/92 | 09/10/92 | 08/19/92 |
| **Volatile Organics (BTEX) ug/L** | | | | | | | |
| Benzene | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Toluene | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ethyl Benzene | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| m+p Xylene | <2 | <2 | <2 | <2 | <2 | <2 | <2 |
| o Xylene | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Total BTEX (ug/L) | -- | -- | -- | -- | -- | -- | -- |
| **Polynuclear Aromatic Hydrocarbons (PAH) ug/L** | | | | | | | |
| Acenaphthene | <1 | <2.2 | <1 | <2 | <1.5 | <1 | |
| Acenaphthylene | <1 | <2.2 | <1 | <2 | <1.5 | <1 | |
| Anthracene | <1 | <2.2 | <1 | <2 | <1.5 | <1 | |
| Benzo(a)anthracene | <1 | <2.2 | <1 | <2 | <1.5 | <1 | |
| Benzo(a)pyrene | <1 | <2.2 | <1 | <2 | <1.5 | <1 | |
| Benzo(b)fluoranthene | <2 | <4.4 | <1 | <2 | <3.0 | <2 | |
| Benzo(k)fluoranthene | <2 | <4.4 | <1 | <2 | <3.0 | <2 | |
| Benzo(g,h,i)perylene | <1 | <2.2 | <1 | <2 | <1.5 | <1 | |
| Chrysene | <1 | <2.2 | <1 | <2 | <1.5 | <1 | |
| Dibenzo(a,h)anthracene | <1 | <2.2 | <1 | <2 | <1.5 | <1 | |
| Fluoranthene | <1 | <2.2 | <1 | <2 | 2.0 | <1 | |
| Fluorene | <1 | <2.2 | <1 | <2 | <1.5 | <1 | |
| Naphthalene | <1 | <2.2 | <1 | <2 | <1.5 | <1 | |
| Pyrene | 1 | <2.2 | <1 | <2 | 3.0 | <1 | |
| Phenanthrene | <1 | <2.2 | <1 | <2 | 4.0 | <1 | |
| Indeno(1,2,3-cd)pyrene | <1 | <2.2 | <1 | <2 | <1.5 | <1 | |
| Total PAHs (ug/L) | 1.0 | -- | -- | -- | 9.0 | -- | |
| **Cyanide and Phenols mg/L** | | | | | | | |
| Cyanide | <0.02 | <0.52 | <0.02 | <0.02 | <0.02 | <0.02 | |
| Phenols | <0.001 | <0.002*** | <0.001 | <0.001 | <0.001 | <0.001 | |

* Sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene represents total; unable to separate isomers.
***Sample volume required a dilution for distilation of phenols.
FB-HP is the field equipment rinsate blank sample.
TB-HP is the sample cooler trip blank sample analyzed for volatile organics only.

MALCOLM PIRNIE

### 6.3.4 Monitoring Wells

Groundwater samples were collected from the 17 new monitoring wells installed on the LILCO and adjacent properties for this investigation. In addition to these new wells, groundwater samples were also collected from 21 existing monitoring wells installed for previous investigations. A total of 40 samples were collected for chemical analysis from the 38 wells. Samples from nine wells were analyzed for full VOCs and semivolatiles and the remainder were analyzed for target BTEX and PAH compounds. The analytical results are presented in Table 6-11. Additionally, two groundwater samples were submitted for the full TCL/TAL analyses and the results are shown on Table 6-12.

Volatile organic compounds were detected in 18 samples. Concentrations of total volatiles ranged from 7 ug/L in GM-7I to 161,000 ug/L in MW-2S. As observed in the soil samples, the VOCs detected in the samples analyzed for TCL volatiles detected primarily BTEX compounds. The major exceptions to this were a detection of carbon disulfide at 70 ug/L in MW-6D and 1,2-dichloroethane at 130 ug/L in MW-7S.

Semivolatile organics, including PAHs, were detected in 21 samples. Concentrations of total semivolatiles ranged from 2 ug/L in GM-7S to 22,729 ug/L in MW-7D. Fluorene was detected in 17 samples, at concentrations that ranged from 3 ug/L in GM-6S to 1,100 ug/L in MW-7D. Naphthalene was detected in 18 of the samples, ranging in concentration from 8 ug/L in Gm-6S to 11,000 ug/L in MW-7D. Pyrene was detected in 12 samples; concentrations ranged from 1 ug/L in MW-6D to 1,300 ug/L in MW-7D. Phenanthrene, detected in 18 samples, ranged in concentration from 2 ug/L in MW-3S to 4,200 ug/L in MW-7D.

## 6.4 SEDIMENT

The five sediment samples collected in Lawrence Lake and Lawrence Creek were analyzed in the field for conductivity, pH, dissolved oxygen, temperature and salinity, and were also sent for laboratory analysis for BTEX, PAHs, cyanide, and phenols. The analytical results are presented in Table 6-13. BTEX compounds were not detected in any of the samples. Very low concentrations of PAHs were detected in two samples; 0.86 mg/kg in SD-2 and 5.58 mg/kg in SD-1. Cyanide and phenols were not detected in any of the sediment samples. Conductivity, pH, temperature and salinity were all within the normal range expected for this area.



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**TABLE 6-11**
**LILCO BAYSHORE MGP SITE**
**SUMMARY OF COMPOUNDS DETECTED IN MONITORING WELL GROUNDWATER SAMPLES**
**SEPTEMBER 1992**

| Sample Number | MW-1S | MW-1D | MW-2S | MW-2D | MW-3S | MW-3D | MW-4S | MW-4D | MW-5S | MW-5D |
|---|---|---|---|---|---|---|---|---|---|---|
| Screen Interval | 4-14 | 35-45 | 2-12 | 35-45 | 3-13 | 35-45 | 4-14 | 35-45 | 4-14 | 35.5-45.5 |
| Date Sampled | 09/15/92 | 09/15/92 | 09/15/92 | 09/15/92 | 09/15/92 | 09/15/92 | 09/15/92 | 09/15/92 | 09/15/92 | 09/15/92 |
| **Volatile Organics ug/L** | | | | | | | | | | |
| Carbon Disulfide | NA | NA | NA | NA | <1 | <1 | <5 | <1 | <5 | <1 |
| 1,1-Dichloroethene | NA | NA | NA | NA | <1 | <1 | <5 | 5 | <5 | <1 |
| 1,1-Dichloroethane | NA | NA | NA | NA | <1 | <1 | <5 | 13 | <5 | 1 |
| 1,2-Dichloroethane | NA | NA | NA | NA | <1 | <1 | <5 | <1 | <5 | <1 |
| 1,1,1-Trichloroethane | NA | NA | NA | NA | <1 | <1 | <5 | 19 | <5 | 1 |
| Trichloroethene | NA | NA | NA | NA | <1 | <1 | <5 | 1 | <5 | 4 |
| Benzene | <1 | <1 | 15000 | <1 | 3 | <1 | 73 | <1 | 180 | 2 |
| Toluene | <1 | <1 | 110000 | <1 | 10 | <1 | 490 | 1 | 6100 | 32 |
| Ethyl Benzene | <1 | <1 | 8700 | <1 | 28 | <1 | 4900 | <1 | 3300 | <1 |
| Styrene | NA | NA | NA | NA | <1 | <1 | <5 | <1 | <5 | 13 |
| m+p Xylene | <2 | <2 | 19000 | <2 | 150 | <2 | 6500 | 93 | 5000 | 150 |
| o Xylene | <1 | <1 | 8300 | <1 | 170 | <1 | 3500 | 53 | 2600 | 69 |
| **Semi Volatile Organics ug/L** | | | | | | | | | | |
| Acenaphthene | <1 | <1 | <10 | <1 | <1 | <1 | 450 | 46 | 200 | 54 |
| Acenaphthylene | <1 | <1 | <10 | <1 | 1 | <1 | 230 | 4 | 180 | 420 |
| Anthracene | <1 | <1 | <10 | <1 | <1 | <1 | 400 | 11 | 200 | 100 |
| Benzo(a)anthracene | <1 | <1 | <10 | <1 | <1 | <1 | 240 | 1 | 150 | 54 |
| Benzo(a)pyrene | <1 | <1 | <10 | <1 | <1 | <1 | 150 | 1 | 97 | 35 |
| Benzo(b)fluoranthene* | <1 | <1 | <10 | <1 | <1 | <1 | 85 | <1 | 65 | 18 |
| Benzo(k)fluoranthene* | <1 | <1 | <10 | <1 | <1 | <1 | 85 | <1 | 65 | 18 |
| Benzo(g,h,i)perylene | <1 | <1 | <10 | <1 | <1 | <1 | 55 | <1 | 32 | <10 |
| Bis(2-ethylhexyl)phthalate | NA | NA | NA | NA | 3 | 3 | 11 | <1 | <10 | 19 |
| Chrysene | <1 | <1 | <10 | <1 | <1 | <1 | 200 | 1 | 150 | 50 |
| Dibenzo(a,h)anthracene | <1 | <1 | <10 | <1 | <1 | <1 | 24 | <1 | <10 | <10 |
| Dibenzofuran | NA | NA | NA | NA | <1 | <1 | <10 | 2 | <10 | 19 |
| Diethyl Phthalate | NA | NA | NA | NA | <1 | <1 | <10 | 3 | <10 | <10 |
| Di-n-Butyl Phthalate | NA | NA | NA | NA | <1 | <1 | <10 | 1 | <10 | <10 |
| Di-n-octyl Phthalate | NA | NA | NA | NA | <1 | <1 | <10 | 6 | <10 | <10 |
| Fluoranthene | <1 | <1 | <10 | <1 | <1 | <1 | 590 | 10 | 260 | 94 |
| Fluorene | <1 | <1 | <10 | <1 | <1 | <1 | 430 | 35 | 280 | 230 |
| Naphthalene | <1 | <1 | 4300 | <1 | 600 | <1 | 2100 | <1 | 2000 | 1800 |
| 2-Methylnaphthalene | NA | NA | NA | NA | 16 | <1 | 830 | 5 | 910 | 910 |
| Pyrene | <1 | <1 | <10 | <1 | 1 | <1 | 340 | 12 | 360 | 150 |
| Phenanthrene | <1 | <1 | <10 | <1 | 2 | <1 | 1500 | 29 | 540 | 330 |
| Indeno(1,2,3-cd)pyrene | <1 | <1 | <10 | <1 | <1 | <1 | 44 | <1 | 25 | 10 |
| **Cyanide and Phenols mg/Kg** | | | | | | | | | | |
| Cyanide | <0.02 | <0.02 | 0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Phenols | <0.001 | <0.001 | 0.28 | <0.001 | 0.005 | <0.001 | 0.046 | <0.001 | 0.042 | 0.010 |

NA-Compound was not analyzed for.

* Sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene represents total, unable to separate isomers.

TABLE 6-11 (Continued)
LILCO BAYSHORE MGP SITE
SUMMARY OF COMPOUNDS DETECTED IN MONITORING WELL GROUNDWATER SAMPLES
SEPTEMBER 1992

| Sample Number | MW-6S | MW-11S* | MW-6D | MW-7S | MW-7D | MW-8S | MW-10S* | MW-8D | MW-9S | FB-GW1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Screen Interval | 6.25-16.25 | 6.25-16.25 | 35.08-45.08 | 2-12 | 35-45 | | | 35-45 | 4-14 | -- |
| Date Sampled | 09/17/92 | 09/17/92 | 09/17/92 | 09/17/92 | 09/17/92 | 09/16/92 | 09/16/92 | 09/16/92 | 09/17/92 | 09/16/92 |
| **Volatile Organics ug/L** | | | | | | | | | | |
| Carbon Disulfide | <5 | <5 | 70 | <5 | <50 | NA | NA | NA | NA | <1 |
| 1,1-Dichloroethene | <5 | <5 | <1 | <5 | <50 | NA | NA | NA | NA | <1 |
| 1,1-Dichloroethane | 5 | <5 | 1 | <5 | <50 | NA | NA | NA | NA | <1 |
| 1,2-Dichloroethane | <5 | 33 | <1 | 130 | <50 | NA | NA | NA | NA | <1 |
| 1,1,1-Trichloroethane | 5 | <5 | 1 | <5 | <50 | NA | NA | NA | NA | <1 |
| Trichloroethene | <5 | <5 | <1 | <5 | <50 | NA | NA | NA | NA | <1 |
| Benzene | 1700 | 1600 | <1 | 7000 | 230 | 960 | 860 | 44 | <1 | <1 |
| Toluene | 160 | 140 | 25 | 1100 | 70 | 1300 | 1300 | 280 | <1 | <1 |
| Ethyl Benzene | 1600 | 1400 | 8 | 1700 | 370 | 7300 | 6100 | 1600 | <1 | <1 |
| Styrene | <5 | <5 | 43 | 220 | <50 | NA | NA | NA | NA | <1 |
| m+p Xylene | 3300 | 2600 | 87 | 2200 | 430 | 6600 | 5300 | 1600 | <2 | <2 |
| o Xylene | 1900 | 1500 | 46 | 1300 | 220 | 3400 | 2800 | 760 | <1 | <1 |
| **Semi Volatile Organics ug/L** | | | | | | | | | | |
| Acenaphthene | 37 | 35 | 2 | 120 | 1200 | <10 | <10 | 21 | <1 | <1.5 |
| Acenaphthylene | 48 | 44 | 24 | 370 | 680 | 19 | 16 | 8 | <1 | <1.5 |
| Anthracene | 15 | 15 | 1 | 690 | 620 | <10 | <10 | 11 | <1 | <1.5 |
| Benzo(a)anthracene | 76 | 67 | <1 | 320 | 420 | <10 | <10 | 3 | <1 | <1.5 |
| Benzo(a)pyrene | 43 | 36 | <1 | 250 | 300 | <10 | <10 | 2 | <1 | <1.5 |
| Benzo(b)fluoranthene* | 24 | 20 | <1 | 120 | 140 | <10 | <10 | 1 | <1 | <1.5 |
| Benzo(k)fluoranthene* | 24 | 20 | <1 | 120 | 140 | <10 | <10 | 1 | <1 | <1.5 |
| Benzo(g,h,i)perylene | 13 | 10 | <1 | 110 | 150 | <10 | <10 | <1 | <1 | <1.5 |
| Bis(2-ethylhexyl)phthalate | 15 | <10 | 14 | <10 | <20 | NA | NA | NA | NA | 8.8 |
| Chrysene | 85 | 69 | <1 | 330 | 400 | <10 | <10 | 3 | <1 | <1.5 |
| Dibenzo(a,h)anthracene | <10 | <10 | <1 | <10 | 69 | <10 | <10 | <1 | <1 | <1.5 |
| Dibenzofuran | 31 | 29 | <1 | 230 | 130 | NA | NA | NA | NA | <1.5 |
| Diethyl Phthalate | <10 | <10 | <1 | <10 | <20 | NA | NA | NA | NA | <1.5 |
| Di-n-Butyl Phthalate | <10 | <10 | 1 | <10 | <20 | NA | NA | NA | NA | 2.0 |
| Di-n-octyl Phthalate | <10 | <10 | <1 | <10 | <20 | NA | NA | NA | NA | 8.0 |
| Fluoranthene | 18 | 16 | 1 | 720 | 900 | <10 | <10 | 13 | <1 | <1.5 |
| Fluorene | 26 | 26 | 6 | 190 | 1100 | 15 | 15 | 19 | <1 | <1.5 |
| 2-Methylnaphthalene | 770 | 770 | 39 | 1300 | 5000 | NA | NA | NA | NA | <1.5 |
| Naphthalene | 1800 | 1900 | 250 | 3000 | 11000 | 3100 | 3200 | 450 | <1 | <1.5 |
| Pyrene | 25 | 19 | 1 | 120 | 1300 | <10 | 17 | 9 | <1 | <1.5 |
| Phenanthrene | 44 | 43 | 7 | 350 | 4200 | 15 | 16 | 33 | <1 | <1.5 |
| Indeno(1,2,3-cd)pyrene | 11 | 9 | <1 | <10 | 110 | <10 | <10 | <1 | <1 | <1.5 |
| **Cyanide and Phenols mg/Kg** | | | | | | | | | | |
| Cyanide | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | 0.08 | 0.10 | <0.02 | <0.02 | <0.02 |
| Phenols | 0.18 | 0.20 | 0.010 | 0.32 | 0.029 | 0.060 | 0.12 | 0.015 | 0.004 | <0.001 |

NA-Compound was not analyzed for.
FB-GW1 is a field equipment rinsate blank sample.
*Sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene represents total, unable to separate isomers.
**Duplicate of MW-6S

TABLE 6-11 (Continued)
LILCO BAYSHORE MGP SITE
SUMMARY OF COMPOUNDS DETECTED IN MONITORING WELL GROUNDWATER SAMPLES
SEPTEMBER 1992

| Sample Number | GM-2AS | GM-2A1 | GM-2AD | GM-3S | GM-3I | GM-3D | GM-5S | GM-5I | GM-5D | FB-GW2 |
|---|---|---|---|---|---|---|---|---|---|---|
| Screen Interval | 8.91-23.91 | 35.24-50.24 | 59.8-74.9 | 6.78-21.78 | 30.03-45.03 | 53.18-68.18 | 5.10-20.10 | 35.05-48.05 | 60.95-75.95 | -- |
| Date Sampled | 09/16/92 | 09/16/92 | 09/16/92 | 09/18/92 | 09/18/92 | 09/18/92 | 09/18/92 | 09/18/92 | 09/18/92 | 09/18/92 |
| **Volatile Organics ug/L** | | | | | | | | | | |
| Benzene | <1 | <1 | <1 | 27 | 7 | <1 | <1 | <1 | <1 | <1 |
| Toluene | <1 | <1 | <1 | <1 | <1 | 15 | <1 | <1 | <1 | <1 |
| Ethyl Benzene | <1 | <1 | <1 | <1 | <1 | 25 | <1 | <1 | <1 | <1 |
| m+p Xylene | <2 | <2 | <2 | 4 | <2 | 50 | <2 | <2 | <2 | <2 |
| o Xylene | <1 | <1 | <1 | 10 | <1 | 85 | <1 | <1 | <1 | <1 |
| **Semi Volatile Organics ug/L** | | | | | | | | | | |
| Acenaphthene | <1 | <1 | <1 | 19 | 2 | 9 | 7 | <1 | <1 | <1 |
| Acenaphthylene | <1 | <1 | <1 | 51 | 19 | 38 | 42 | <1 | <1 | <1 |
| Anthracene | <1 | <1 | <1 | 3 | 1 | <1 | <1 | <1 | <1 | <1 |
| Benzo(a)anthracene | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Benzo(a)pyrene | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Benzo(b)fluoranthene* | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Benzo(k)fluoranthene* | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Benzo(g,h,i)perylene | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chrysene | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibenzo(a,h)anthracene | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Fluoranthene | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Fluorene | <1 | <1 | <1 | 16 | 6 | 10 | 12 | <1 | <1 | <1 |
| Naphthalene | <1 | <1 | <1 | 92 | 320 | 600 | 580 | <1 | <1 | <1 |
| Pyrene | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Phenanthrene | <1 | <1 | <1 | 15 | 2 | 4 | 8 | <1 | <1 | <1 |
| Indeno(1,2,3-cd)pyrene | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| **Cyanide and Phenols mg/Kg** | | | | | | | | | | |
| Cyanide | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Phenols | <0.001 | <0.001 | 0.009 | 0.020 | <0.001 | <0.001 | 0.011 | <0.001 | <0.001 | <0.001 |

* Sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene represents total, unable to separate isomers.
FB-GW2 is a field equipment rinsate blank sample.

TABLE 6-11 (Continued)
LILCO BAYSHORE MGP SITE
SUMMARY OF COMPOUNDS DETECTED IN MONITORING WELL GROUNDWATER SAMPLES
SEPTEMBER 1992

| Sample Number | GM-6S | GM-6I | GM-6D | GM-7S | GM-7I | GM-7D | GM-8S | GM-8I | GM-8D | FB-GW3 |
|---|---|---|---|---|---|---|---|---|---|---|
| Screen Interval | 8.97-23.97 | 35.4-50.4 | 60.05-75.05 | 9.75-24.75 | 29.6-44.6 | 50.3-65.3 | 6.35-21.35 | 29.95-44.95 | 48.25-63.25 | -- |
| Date Sampled | 09/18/92 | 09/18/92 | 09/18/92 | 09/17/92 | 09/17/92 | 09/17/92 | 09/17/92 | 09/17/92 | 09/17/92 | 09/17/92 |
| **Volatile Organics ug/L** | | | | | | | | | | |
| Benzene | 330 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Toluene | 2 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Ethyl Benzene | 14 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| m+p Xylene | 7 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 |
| o Xylene | 17 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| **Semi Volatile Organics ug/L** | | | | | | | | | | |
| Acenaphthene | 7 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Acenaphthylene | 20 | <1 | <1 | 2 | <1 | <1 | <1 | <1 | <1 | <1 |
| Anthracene | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Benzo(a)anthracene | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Benzo(a)pyrene | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Benzo(b)fluoranthene* | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Benzo(k)fluoranthene* | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Benzo(g,h,i)perylene | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chrysene | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Dibenzo(a,h)anthracene | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Fluoranthene | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Fluorene | 3 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Naphthalene | 8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Pyrene | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Phenanthrene | 6 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Indeno(1,2,3-cd)pyrene | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| **Cyanide and Phenols mg/Kg** | | | | | | | | | | |
| Cyanide | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Phenols | 0.015 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.009 | 0.018 | <0.001 | <0.001 |

* Sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene represents total, unable to separate isomers.
FB-GW3 is a field equipment rinsate blank sample.

TABLE 6-11 (Continued)
LILCO BAYSHORE MGP SITE
SUMMARY OF COMPOUNDS DETECTED IN MONITORING WELL GROUNDWATER SAMPLES
SEPTEMBER 1992

| Sample Number | GM-9S | GM-9I | GM-9D | TB-GW1 | TB-GW2 |
|---|---|---|---|---|---|
| Screen Interval | 4.7-19.7 | 28.7-43.7 | 48.35-63.35 | -- | -- |
| Date Sampled | 09/16/92 | 09/16/92 | 09/16/92 | 09/16/92 | 09/16/92 |
| **Volatile Organics ug/L** | | | | | |
| Benzene | <1 | <1 | <1 | <1 | <1 |
| Toluene | <1 | <1 | <1 | <1 | <1 |
| Ethyl Benzene | <1 | <1 | <1 | <1 | <1 |
| m+p Xylene | <2 | <2 | <2 | <2 | <2 |
| o Xylene | <1 | <1 | <1 | <1 | <1 |
| **Total Semi Volatile Organics ug/L** | | | | | |
| Acenaphthene | <1 | <1 | <1 | | |
| Acenaphthylene | <1 | <1 | <1 | | |
| Anthracene | <1 | <1 | <1 | | |
| Benzo(a)anthracene | <1 | <1 | <1 | | |
| Benzo(a)pyrene | <1 | <1 | <1 | | |
| Benzo(b)fluoranthene* | <1 | <1 | <1 | | |
| Benzo(k)fluoranthene* | <1 | <1 | <1 | | |
| Benzo(g,h,i)perylene | <1 | <1 | <1 | | |
| Chrysene | <1 | <1 | <1 | | |
| Dibenzo(a,h)anthracene | <1 | <1 | <1 | | |
| Fluoranthene | <1 | <1 | <1 | | |
| Fluorene | <1 | <1 | <1 | | |
| Naphthalene | <1 | <1 | <1 | | |
| Pyrene | <1 | <1 | <1 | | |
| Phenanthrene | <1 | <1 | <1 | | |
| Indeno(1,2,3-cd)pyrene | <1 | <1 | <1 | | |
| **Cyanide and Phenols mg/Kg** | | | | | |
| Cyanide | <0.02 | <0.02 | <0.02 | | |
| Phenols | <0.001 | <0.001 | 0.005 | | |

* Sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene represents total, unable to separate isomers.
TB-GW1 and TB-GW2 are the sample cooler trip blank samples, analyzed for volatile organics only.

TABLE 6-12
LILCO BAYSHORE MGP SITE
SUMMARY OF FULL TCL/TAL COMPOUNDS DETECTED IN GROUNDWATER SAMPLES

| Sample Number | MW-4S | MW-7S | FB-GW1 |
|---|---|---|---|
| Sample Depth | | | |
| Date Sampled | 09/18/92 | 09/17/92 | 09/16/92 |
| **TCL Volatile Organics ug/L** | | | |
| 1,2 Dichloroethane | <5 | 130 | <1 |
| Benzene | 73 | 7000 | <1 |
| Toluene | 490 | 1100 | <1 |
| Ethyl Benzene | 4900 | 1700 | <1 |
| Styrene | <5 | 220 | <1 |
| m+p Xylene | 6500 | 2200 | <2 |
| o Xylene | 3500 | 1300 | <1 |
| **TCL Semi Volatile Organics ug/L** | | | |
| Naphthalene | 2100 | 3000 | <1.5 |
| 2-Methylnaphthalene | 830 | 1300 | <1.5 |
| Acenaphthylene | 230 | 370 | <1.5 |
| Acenaphthene | 450 | 120 | <1.5 |
| Dibenzofuran | <10 | 230 | <1.5 |
| Fluorene | 430 | 190 | <1.5 |
| Phenanthrene | 1500 | 350 | <1.5 |
| Anthracene | 400 | 690 | <1.5 |
| Di-n-Butyl Phthalate | <10 | <10 | 2.0 |
| Fluoranthene | 590 | 720 | <1.5 |
| Pyrene | 340 | 120 | <1.5 |
| Benzo(a)anthracene | 240 | 320 | <1.5 |
| Chrysene | 200 | 330 | <1.5 |
| Bis (2-ethylhexyl) phthalate | 11 | <10 | 8.8 |
| Di-n-octyl Phthalate | <10 | <10 | 8.0 |
| Benzo(b)fluoranthene* | 85 | 120 | <1.5 |
| Benzo(k)fluoranthene* | 85 | 120 | <1.5 |
| Benzo(a)pyrene | 150 | 250 | <1.5 |
| Indeno(1,2,3-cd)pyrene | 44 | <10 | <1.5 |
| Dibenzo (a,h) anthracene | 24 | <10 | <1.5 |
| Benzo(g,h,i)perylene | 55 | 110 | <1.5 |

* Sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene represents total, unable to separate isomers.

TABLE 6-12 (Continued)
LILCO BAYSHORE MGP SITE
SUMMARY OF FULL TCL/TAL COMPOUNDS DETECTED IN GROUNDWATER SAMPLES

| Sample Number | MW-4S | MW-7S | FB-GW1 |
|---|---|---|---|
| Sample Depth (feet) | | | |
| Date Sampled | 09/18/92 | 09/17/92 | 09/16/92 |
| Date Analyzed | | | |
| TAL Metals (mg/L) | | | |
| Aluminum | 9.9 | 18 | <0.20 |
| Arsenic | <0.002 | 0.029 | <0.002 |
| Barium | 0.07 | 0.23 | <0.05 |
| Beryllium | <0.001 | 0.001 | <0.001 |
| Calcium | 23 | 200 | 0.30 |
| Chromium | <0.02 | 0.04 | <0.005 |
| Copper | 0.03 | 0.08 | <0.02 |
| Iron | 38 | 40 | <0.05 |
| Lead | 0.028 | 0.16 | <0.005 |
| Magnesium | 8.0 | 14 | <0.05 |
| Manganese | 0.33 | 0.46 | <0.02 |
| Mercury | <0.001 | 0.0012 | <0.00025 |
| Potassium | 2.7 | 9.6 | <0.50 |
| Silver | 0.0025 | <0.001 | <0.001 |
| Sodium | 53 | 13 | <0.20 |
| Zinc | 0.24 | 0.49 | <0.02 |
| TCL AE ug/L | | | |
| 4 Methylphenol (p-cresol) | <10 | 33 | <1.5 |
| 2,4-Dimethylphenol | <10 | 91 | <1.5 |

# TABLE 6-13
## LILCO BAYSHORE MGP SITE
## SUMMARY OF TARGET COMPOUNDS DETECTED IN SEDIMENT SAMPLES
## SEPTEMBER 1992

| Sample Number | SD-1 | SD-2 | SD-3 | SD-5** | SD-4 | FB-SD |
|---|---|---|---|---|---|---|
| Date Sampled | 09/16/92 | 09/16/92 | 09/16/92 | 09/16/92 | 09/16/92 | 09/16/92 |
| **Volatile Organics (BTEX) mg/Kg** | | | | | | |
| Benzene | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.001 |
| Toluene | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.001 |
| Ethyl Benzene | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.001 |
| m+p Xylene | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.002 |
| o Xylene | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.001 |
| **Total BTEX (mg/Kg)** | -- | -- | -- | -- | -- | -- |
| **Polynuclear Aromatic Hydrocarbons (PAH) mg/Kg** | | | | | | |
| Acenaphthene | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.001 |
| Acenaphthylene | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.001 |
| Anthracene | 0.21 | <0.1 | <0.1 | <0.1 | <0.1 | <0.001 |
| Benzo(a)anthracene | 0.41 | 0.06J | <0.1 | <0.1 | <0.1 | <0.001 |
| Benzo(a)pyrene | 0.36 | 0.07J | <0.1 | <0.1 | <0.1 | <0.001 |
| Benzo(b)fluoranthene* | 0.45 | 0.10 | <0.1 | <0.1 | <0.1 | <0.001 |
| Benzo(k)fluoranthene* | 0.45 | 0.10 | <0.1 | <0.1 | <0.1 | <0.001 |
| Benzo(g,h,i)perylene | 0.09J | 0.06J | <0.1 | <0.1 | <0.1 | <0.001 |
| Chrysene | 0.50 | 0.1 | <0.1 | <0.1 | <0.1 | <0.001 |
| Dibenzo(a,h)anthracene | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.001 |
| Fluoranthene | 1.2 | 0.13 | <0.1 | <0.1 | <0.1 | <0.001 |
| Fluorene | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.001 |
| Naphthalene | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.001 |
| Pyrene | 1.0 | 0.13 | <0.1 | <0.1 | <0.1 | <0.001 |
| Phenanthrene | 0.80 | 0.07J | <0.1 | <0.1 | <0.1 | <0.001 |
| Indeno(1,2,3-cd)pyrene | 0.11 | 0.04J | <0.1 | <0.1 | <0.1 | <0.001 |
| **Total PAHs (mg/Kg)** | 5.58 | 0.86 | -- | -- | -- | -- |
| **Cyanide and Phenols mg/Kg** | | | | | | |
| Cyanide | <2 | <2 | <2 | <2 | <2 | <0.02 |
| Phenols | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.001 |
| **Field Measurements** | | | | | | |
| Conductivity (umhos) | 235 | 210 | 33000 | NA | 33000 | NA |
| pH (S.U.) | 7.2 | 7.9 | 7.2 | NA | 8.0 | NA |
| Temperature (C) | 27 | 24.5 | 23.5 | NA | 24 | NA |
| Salinity (ppt) | 0 | 0 | 21.5 | NA | 21 | NA |

FB-SD is the field equipment rinsate blank sample.
* Sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene represents total, unable to separate isomers.
J - Detected below quantification limit.
**Duplicate of SD-3
NA - Not Analyzed for

In general, the sediments are relatively clean. The only PAHs were detected in Lawrence Lake which is predominantly a fresh water body recharged by urban runoff. Of the PAHs detected, naphthalene and fluorene (indicative of the MGP plume) were noticeably absent. The low concentrations of other PAHs detected can be attributed to urban runoff, oil discharges from motor boats and other urban activities.

## 6.5 AIR

Upwind (As-Bn) and downwind (As-Bs) air samples were collected throughout a day when no on-site activities were taking place to represent background conditions. These same locations were sampled during excavation activities to allow an assessment of off-site migration of air borne contaminants which might be generated during remedial actions. During the excavation of test pit 22 (located in the most highly contaminated soil area of the Bayshore property), long-term composite air samples were collected to assess the potential impact to on-site workers directly exposed to air emissions during excavation or other remedial activities. The analytical results of this study are shown in Table 6-14.

Eight VOCs were detected during the sampling study. No VOCs were detected in background samples collected prior to excavation activities. During excavation no VOCs were detected at the sampling location AS-S. Freon 113 was the only VOC detected at sampling location AS-N, but it was not detected anywhere else. Benzene, toluene, ethylbenzene, and xylene were detected at three feet above ground level at sampling location AS-P (directly adjacent to test pit 22), ranging in concentration from 8.5 parts per billion (ppb) for toluene to 44 ppb for benzene. An additional grab (instantaneous) sample was collected from freshly excavated soil from test pit 22. This sample contained the same four compounds found as AS-P in addition to three other VOCs. Concentrations in the grab sample ranged from 140 to 18,000 ppb.

Eight PAHs were detected during the sampling study. Five of these eight PAHs were detected prior to excavation activities. PAHs were detected at all sampling locations with the highest concentrations occurring at AS-P (directly adjacent to test pit 22). The highest concentration reported at this location was naphthalene at 10 micrograms per cubic meter (ug/m$^3$). Total PAHs at sampling locations AS-S and AS-N were approximately 25% higher on the day of excavation than in the background samples collected the day before.





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TABLE 6-14
LILCO BAYSHORE MGP SITE
SUMMARY OF TARGET COMPOUNDS DETECTED IN AIR SAMPLES

| Sample Type | Background | | During Excavation | | | Grab (c) |
|---|---|---|---|---|---|---|
| Sample Number | AS-BN | AS-BS | AS-N | AS-S | AS-P(b) | AS-G |
| Date Sampled | 07/27/92 | 07/27/92 | 07/28/92 | 07/28/92 | 07/28/92 | 07/28/92 |
| **Volatile Organic Compounds ppb (a) 8-Hour Composite** | | | | | | |
| Benzene | ND | ND | ND | ND | 44 | 14000 |
| Toluene | ND | ND | ND | ND | 8.5 | 140 |
| Ethyl Benzene | ND | ND | ND | ND | 40 | 18000 |
| Xylenes | ND | ND | ND | ND | 23 | 15000 |
| Freon 113 (d) | ND | ND | 10 | ND | ND | ND |
| 4-Ethyltoluene | ND | ND | ND | ND | ND | 4700 |
| 1,3,5-Trimethylbenzene | ND | ND | ND | ND | ND | 610 |
| 1,2,4-Trimethylbenzene | ND | ND | ND | ND | ND | 1400 |
| Total VOCs | ND | ND | 10 | ND | 115.5 | 53850 |
| **Polynuclear Aromatic Hydrocarbons (ug/m3) (a) 24-Hour Composite** | | | | | | |
| Naphthalene | 0.209 | 0.214 | 0.256 | 0.278 | 10.003 | NA |
| 2-Methylnaphthalene | 0.075 | 0.077 | 0.097 | 0.13 | 4.127 | NA |
| Acenaphthene | 0.009(J) | 0.013(J) | 0.011(J) | 0.018(J) | ND | NA |
| Fluoranthene | 0.011(J) | 0.012(J) | 0.011(J) | 0.016(J) | 0.152 | NA |
| Phenanthrene | 0.018(J) | 0.020(J) | 0.023(J) | 0.030(J) | 0.152 | NA |
| Flouranthene | ND | ND | 0.004(J) | 0.004(J) | 0.009(J) | NA |
| Anthracene | ND | ND | ND | ND | 0.012(J) | NA |
| Pyrene | ND | ND | 0.006(J) | ND | ND | NA |
| Total PAHs | 0.322 | 0.336 | 0.408 | 0.476 | 14.455 | NA |

Notes:

(a) The compounds listed here are only those VOCs and PAHs that were detected at one or more of the above sampling locations. A full list of the VOCs analyzed for and the detection limits for VOCs and PAHs can be found in the laboratory report.

(b) AS-P was a composite sample collected at TP-22, which remained open during the sampling period.

(c) AS-G was a grab (Instantaneous) sample, collected off freshly excavated soil from TP-22 and analyzed for VOCs only.

(d) Freon 113 synonym is (1,1,2-Trichloro-1,2,2-Trifluoroethane).

(J) The compound was detected but the amount was below the quantitation limit. Reported concentrations should be considered an estimate.

ND - Not Detected

Overall air quality during no activity periods is not impacted by emissions from the site. However, during excavation BTEX, other VOCs and PAHs were released into the air adjacent to the test pit. The concentrations related to on-site worker exposure, the Threshold Limit Value (TLV) for either Time Weighted Average (TWA) or Short Term Exposure Limit (STEL) is further discussed in the Risk Assessment Report.

BTEX and other VOCs attributable to site conditions were not detected at the property boundaries during excavation. PAHs were detected before excavation activity as well as during excavation and may be considered ubiquitous to this area. Overall, air emissions during excavation do not appear to impact off-site areas. Further discussion of the effect of air emissions is included in the Risk Assessment report.

## 6.6 DATA VALIDATION RESULTS

The soil and groundwater data for the LILCO Bayshore field investigation have been reviewed for accuracy, precision and overall validity to assure that the data is of usable quality. Samples were analyzed for volatile organic compounds, semivolatile organic compounds, pesticides, PCBs, TAL metals, cyanide, phenols, and total organic carbon. Data and QA/QC deliverables were reviewed for compliance with holding times, lab and field blank concentrations, duplicates, reference standards, and spike recoveries specified in the analytical methods used. Data on surrogate recoveries were also provided for volatile and semivolatile compounds. Some sample analyses included library searches for volatile and semivolatile compounds; review of these data included a check of the GC chromatograms and MS spectra provided. The QA/QC documentation indicates that the overall quality of the data is acceptable, and that they can be used for the purposes intended. Each class of parameter is discussed below.

### 6.6.1 Volatile Organic Compounds

Volatile samples were analyzed within the holding times specified in the work plan, and the blanks indicated no contamination of samples. Standard and spike recoveries were within acceptable ranges. Percent differences for duplicate analyses were generally less than 30%, indicating acceptable precision. Surrogate recoveries were generally within the specified limits for the methods, with only isolated high or low values found.





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### 6.6.2 Semivolatile Organic Compounds

Semivolatile samples were extracted and analyzed within the specified holding times, and the blanks indicated no secondary contamination of samples. Duplicates, standards, and spike recoveries were within acceptable ranges. Generally, surrogate recoveries were within the limits for the method. However, the surrogates were diluted from the samples listed in Table 6-15 due to the presence of high concentrations of one or more semivolatile compounds in each of the samples. This dilution, which is standard laboratory practice, is necessary to obtain accurate analyses in the presence of high concentrations of contaminants. Low or missing surrogates would indicate a possible low bias in samples containing low concentrations of semivolatile compounds. However, since the analyses indicated high concentrations of contaminants even after the dilution, the data are still usable for delineation of contamination.

### 6.6.3 Pesticides/PCBs

Sample analyses for pesticides and PCBs met the specified holding times and blanks indicated no secondary contamination. Standard and spike recoveries were within acceptable limits, as were percent differences for duplicate analyses.

### 6.6.4 Phenols

Sample analyses for phenols met the indicated holding times, and blanks indicated no secondary contamination. Recoveries of standards and spikes were within acceptable limits. Duplicate analyses were within acceptable ranges.

### 6.6.5 Inorganics

All metals and cyanide analyses were performed within the specified holding time. Blanks indicated no secondary contamination, and recoveries of standards and spikes were within acceptable limits. Duplicates indicated acceptable precision.



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TABLE 6-15

LILCO BAYSHORE MGP SITE
DATA VALIDATION - SURROGATE DILUTIONS

**FOR ACID EXTRACTABLE ANALYSES:**

MW-5D
MW-5S
MW-4S

**FOR BASE/NEUTRAL EXTRACTABLE ANALYSES:**

| | |
|---|---|
| CS-3 | TP-16 |
| MW-2S | TP-16A |
| MW-8S | TP-12 |
| MW-10S | TP-4 |
| MW-7D | SB-14 |
| MW-7S | SB-13 |
| MW-6D | SB-11 |
| MW-6S | SB-12 |
| MW-11S | SB-25 |
| TP-23 | SB-8 |
| TP-14 | SB-19 |
| TP-14A | SB-24 |

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# 7.0 FATE AND TRANSPORT OF CONTAMINANTS

Although the typical suite of compounds expected from a manufactured gas plant were found on the LILCO site, only a few of these compounds were detected in the downgradient area. Most of the compounds, primarily the PAHs, would not be expected to migrate from the site given their chemical characteristics. However, naphthalene in particular was detected consistently at certain downgradient locations. An examination of the factors affecting the fate and transport of the compounds of concern at the LILCO site helps explain their distribution as well as the development and composition of the downgradient plume.

## 7.1 FATE AND TRANSPORT FACTORS

The transport and ultimate fate of an organic contaminant in the environment are controlled by several factors, some of which are due to the chemical properties of the compound and some of which are due to the physical and chemical conditions in the formation through which the contaminated groundwater is moving. Compound specific factors which influence fate and transport include solubility in water, volatility, specific gravity, and organic carbon/water partition coefficient, which is a measure of the compound's tendency to adsorb to organic carbon relative to its tendency to dissolve in water. Site specific or formation specific factors which can influence the fate and transport of a compound include the organic carbon content of the soil, the distribution coefficient for the compound and the soil at the site, the average soil particle size, the presence or absence of cover material, and the amount of precipitation.

Other physical and chemical processes that may take place in the environment and affect the transport of a contaminant include hydrolysis, oxidation-reduction, volatilization, biodegradation, and adsorption. Several researchers (Mehran and Olson, 1990; McCarthy et al., 1981) have reviewed the chemical parameters and processes in detail, and have concluded that biodegradation and adsorption processes are the major reactions in controlling the transport and fate of organic chemicals in groundwater.



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### 7.1.1 Adsorption

The adsorption of an organic compound onto the soil surfaces in a formation is of major importance in determining the rate of movement of that compound through the groundwater. A compound that is strongly adsorbed onto the surface of the soil matrix will not migrate as quickly as a compound that is not strongly adsorbed. A distribution coefficient, $K_d$, has been defined as the ratio between the mass of solute adsorbed onto the solid matrix to the concentration of the solute in solution. $K_d$ is proportional to the fraction of organic carbon in the matrix, the solubility of the compound in water, and to the organic carbon/water partition coefficient. It is given by the following equation:

$$K_d = K_{oc} \times foc$$

where:

$K_{oc}$ = the organic carbon partition coefficient
foc = the fraction of organic carbon in the solid matrix

It is possible to define a retardation factor, R, which describes the retardation of movement of the organic compound through the matrix relative to the movement of water. R is given by:

$$R = 1 + pK_d/n = v/v_e$$

where:
p = the bulk density of the solid matrix
n = the effective porosity
v = the average linear pore water velocity
$v_e$ = the average velocity of the retarded compound

Table 7-1 presents initial retardation factors, flow rates and calculated travel times in the shallow zone for several parameters of concern at the Bayshore MGP site. These have been calculated using a bulk density of 1.80 (Brady, 1974) and an effective porosity of 0.25 (Fetter, 1980), which are reasonable values for the type of deposits at the LILCO site. Analyses for TOC in soil yielded an average foc of $1.85 \times 10^{-3}$. Contaminant velocities and times to travel 100 feet were calculated for velocities of 0.02 ft/day and 0.25 ft/day, which are the range of values calculated from the results of permeability tests conducted during the site investigation. For a groundwater velocity of 0.02 ft/day, the calculated time to travel 100 feet ranged from 16.7 years for acenaphthene to 44,743 years for chrysene. At



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TABLE 7-1

RETARDATION FACTORS AND CALCULATED VELOCITIES OF GROUNDWATER CONTAMINANTS

| Parameters | log $K_{oc}$ | $K_d$ | R | $V_c$, for V = 0.02 ft/day | Travel Time per 100 feet (yr) | $V_c$, for V = 0.25 ft/day | Travel Time per 100 feet (yr) |
|---|---|---|---|---|---|---|---|
| Benzene | 1.89 | 0.14 | 2.01 | $9.95 \times 10^{-3}$ | 27.5 | 0.12 | 2.20 |
| Ethylbenzene | 2.20 | 0.29 | 3.09 | $6.47 \times 10^{-3}$ | 42.4 | 0.08 | 3.39 |
| Toluene | 2.12 | 0.24 | 2.73 | $7.33 \times 10^{-3}$ | 37.4 | 0.09 | 2.99 |
| m-Xylene | 3.20 | 2.93 | 22.10 | $9.05 \times 10^{-4}$ | 302 | 0.01 | 24.2 |
| p-Xylene | 2.31 | 0.38 | 3.74 | $5.35 \times 10^{-3}$ | 51.3 | 0.07 | 4.10 |
| o-Xylene | 2.11 | 0.24 | 2.73 | $7.33 \times 10^{-3}$ | 37.4 | 0.09 | 2.99 |
| 1,1-Dichloroethane | 1.81 | 0.12 | 1.86 | $1.40 \times 10^{-2}$ | 19.7 | 0.17 | 1.57 |
| 1,2-Dichloroethane | 1.21 | 0.03 | 1.22 | $1.64 \times 10^{-2}$ | 16.8 | 0.20 | 1.34 |
| 1,1-Dichloroethene | 1.81 | 0.12 | 1.86 | $1.08 \times 10^{-2}$ | 25.5 | 0.13 | 2.04 |
| 1,1,1-Trichloroethane | 2.10 | 0.23 | 2.66 | $7.52 \times 10^{-3}$ | 36.4 | 0.09 | 2.92 |
| Acenaphthene | 1.25 | 0.03 | 1.22 | $1.64 \times 10^{-2}$ | 16.7 | 0.20 | 1.34 |
| Acenaphthylene | 3.68 | 8.84 | 64.65 | $3.09 \times 10^{-4}$ | 886 | $3.83 \times 10^{-3}$ | 70.9 |
| Anthracene | 4.28 | 35.52 | 256.74 | $7.79 \times 10^{-5}$ | 3,517 | $9.74 \times 10^{-4}$ | 281 |
| Naphthalene | 3.13 | 2.47 | 18.78 | $1.06 \times 10^{-3}$ | 257 | 0.01 | 20.6 |
| 2-Methylnaphthalene | 3.90 | 14.68 | 106.70 | $1.87 \times 10^{-4}$ | 1,462 | $2.34 \times 10^{-3}$ | 117 |
| Fluorene | 3.70 | 9.26 | 67.67 | $2.96 \times 10^{-4}$ | 927 | $3.69 \times 10^{-3}$ | 74.2 |
| Fluoranthene | 4.62 | 77.02 | 555.54 | $3.60 \times 10^{-5}$ | 7,610 | $4.50 \times 10^{-4}$ | 609 |
| Phenanthrene | 4.22 | 30.90 | 223.48 | $8.95 \times 10^{-5}$ | 3,061 | $1.12 \times 10^{-4}$ | 245 |
| Chrysene | 5.39 | 453.51 | 3,266.27 | $6.12 \times 10^{-6}$ | 44,743 | $7.65 \times 10^{-5}$ | 3,580 |
| Pyrene | 4.84 | 127.40 | 918.28 | $2.18 \times 10^{-5}$ | 12,579 | $2.72 \times 10^{-4}$ | 1,006 |

NOTE: p - 1.80 g/cc
n = 0.25
foc = $1.85 \times 10^{-3}$

a groundwater velocity of 0.25 ft/day, the calculated time to travel 100 feet ranged from 1.34 years for acenaphthene and 1,2-dichloroethane to 3,580 years for chrysene. For naphthalene, travel times per 100 feet ranged from 20.6 years to 257 years. Benzene travel times per 100 feet ranged from 2.20 years to 27.5 years.

The initial calculations, which are conservative and approximate only, assume isotropic conditions in the shallow zone, constant hydraulic gradients, constant flow velocities, and use a mean value for the fraction of organic carbon in the soil. Variations in any one of these factors could result in variations in the calculated velocities and travel times. In these calculations the value of foc is the factor most likely to vary. The value used, $1.85 \times 10^{-3}$, is the average of the values measured in samples collected on the LILCO and adjacent properties. Sandy sediments of the type found beneath the LILCO and adjacent properties generally have a low organic carbon content, often lower than the foc value of 0.001 that is most often used as a lower limit for this type of retardation calculations. Because the analytical method for TOC does not differentiate between naturally occurring organic carbon and organic carbon from contaminants in the soil, the high TOC values found in several soil samples may be due in part to the presence of the contaminants themselves. For comparison, Table 7-2 shows transport velocities and travel times calculated for several compounds, including several carcinogenic PAHs, using an foc value of 0.001, which would represent the minimum retardation by organic adsorption. For naphthalene, the time to travel 100 feet with a groundwater velocity of 0.02 ft/day decreased to 146 years; with a groundwater velocity of 0.25 ft/day the travel time decreased to 11.65 years per 100 feet. The travel times for the benzene, chrysene and pyrene are also decreased, but movement of the PAHs remains very slow.

Naphthalene, however, appears to be more mobile than the other PAHs. Using groundwater velocities and retardation factors, it is possible to calculate the time necessary for naphthalene to migrate from the downgradient property boundary to GM-3, a distance of approximately 1,500 feet. Because naphthalene was detected in the deep zone in GM-3, the retardation factor was calculated using an foc value of 0.001 and the contaminant velocity relative to a groundwater velocity of 0.8 ft/day, which is the value determined for the deep zone on the LILCO property. This approach results in a predicted travel time of 55 years for naphthalene to migrate the distance to GM-3, which is within the time period since the LILCO facility began operations.





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TABLE 7-2

CALCULATED RETARDATION FACTORS
AND VELOCITIES FOR SELECTED CONTAMINANTS

| Parameter | log $K_{oc}$ | $K_d$ | R | $V_c$ for V = 0.02 ft/day | Travel time per 100 feet (year) | $V_c$ for V = 0.25 ft/day | Travel time per 100 feet (year) |
|---|---|---|---|---|---|---|---|
| Benzene | 1.89 | 0.08 | 1.56 | $1.28 \times 10^{-2}$ | 21 | 0.16 | 1.71 |
| Naphthalene | 3.13 | 1.34 | 10.63 | $1.88 \times 10^{-3}$ | 146 | 0.02 | 11.65 |
| Chrysene | 5.39 | 245.47 | 1,768.39 | $1.13 \times 10^{-5}$ | 24,225 | $1.41 \times 10^{-4}$ | 1,938 |
| Pyrene | 4.84 | 68.96 | 497.48 | $4.02 \times 10^{-5}$ | 6,815 | $5.03 \times 10^{-4}$ | 545 |
| Benzo (a) anthracene | 6.14 | 1,380.38 | 9,939.77 | $2.01 \times 10^{-6}$ | 136,161 | $2.52 \times 10^{-5}$ | 10,893 |
| Benzo (b) fluoranthene | 5.74 | 549.54 | 3,957.69 | $5.05 \times 10^{-6}$ | 54,215 | $6.32 \times 10^{-5}$ | 4,337 |
| Benzo (k) fluoranthene | 6.65 4 | 4,365.16 | 31,430.14 | $6.36 \times 10^{-7}$ | 430,550 | $7.95 \times 10^{-6}$ | 34,444 |
| Benzo (a) pyrene | 5.95 | 891.25 | 6,418.01 | $3.12 \times 10^{-6}$ | 87,918 | $3.90 \times 10^{-5}$ | 7,033 |
| Dibenzo (a,h) anthracene | 6.22 | 1,659.59 | 11,949.03 | $1.57 \times 10^{-6}$ | 163,685 | $2.09 \times 10^{-5}$ | 13,095 |
| Indeno (1,2,3-cd) pyrene | 7.49 | 30,902.95 | 222,501.27 | $8.99 \times 10^{-8}$ | 3,047,962 | $1.12 \times 10^{-6}$ | 243,837 |

NOTE: p = 1.80 g/cc
n = 0.25
foc = 0.001

As stated above, these calculations are approximate only and do not take into account other processes that may be affecting contaminant transport rates at the same time. For example, McCarthy and Zachara (1981) found that colloids in groundwater can adsorb organic compounds and stabilize them in a mobile phase. This process results in compounds having higher apparent transport velocities than calculated from groundwater velocities and retardation factors alone, and may help explain why some PAHs have been detected at greater distances than others. The flow and retardation factor calculations do, however, provide a range of likely flow velocities and travel times for the contaminants of concern at the LILCO site and provide a framework for analysis of the groundwater quality data.

### 7.1.2 Biodegradation

Most organic compounds are susceptible to enzymatic degradation in soil and in groundwater. Many of these reactions occur primarily under aerobic conditions, although there may be some degradation under anaerobic conditions as well. The most common degradation processes include dehalogenation, hydroxylation, the cleaving of double and triple bonds, the reduction of aromatic rings to cyclic hydrocarbons, hydrolysis, oxidation, and reduction. Each degradation product is also subject to further degradation, and compounds are rarely degraded completely. This can result in a far more complex mix of chemicals in a plume downgradient of the source than at the source. The extent and rate of degradation observed is dependent on several factors, including the composition and size of the microbial population, the acidity of the system, temperature, the concentration of the organic compounds, other chemical constituents in the groundwater, and the extent of adsorption of the organic compounds onto the solid matrix of the soil. If all factors are at optimum levels for each compound of concern, the rate of biodegradation would be at a maximum. If, however, even one factor is not optimum, the degradation rate for the affected compound would be significantly reduced.

Naphthalene, which is of concern at the LILCO site, is subject to aerobic degradation in the soil by several species of soil microbes. Pseudomonads metabolize naphthalene to 1,2-dihydro-1,2-dihydroxynaphthalene which transforms to 1,2-dihydroxynaphthalene (Dagley, 1972). This can be further degraded to several other products, including 2-hydroxybenzaldehyde (Davies and Evans, 1962). *Cuninghamella elegans* biodegraded naphthalene under aerobic conditions to alpha-naphthol, beta-naphthol, trans-1,2-dihydroxy-1,2-dihydronaphthalene, 4-hydroxy-1-tetralene, and 1,4-naphthoquinone. Also





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under aerobic conditions, *Agnenellum*, *Oscillatoria*, and *Anabaena* biodegraded naphthalene into 1-naphthol, cis-1,2-dihydroxy-1,2-dihydronaphthalene, and 4-hydroxy-1-tetralene (Kobayashi and Rittman, 1982).

From this information it seems likely that naphthalene is undergoing biodegradation to some extent in the soils at the LILCO site and that some of the degradation products may also be degraded. Because the microbes shown to degrade naphthalene are aerobic bacteria, it is unlikely that this bioactivity continues once the naphthalene reaches the groundwater.

## 7.2 GROUNDWATER QUALITY

Review of the analytical results for groundwater samples collected from wells on and downgradient of the LILCO site indicates that the ground water contains volatile and semivolatile organic compounds. The volatile compounds are primarily benzene, ethylbenzene, toluene, and xylenes (BETX), which are typical constituents of lighter petroleum products such as gasoline. The semivolatile compounds detected were primarily polynuclear aromatic hydrocarbons (PAHs), which are typical constituents of heavier oils.

Kramer and Hayes (1987) found in their mixing experiments that the greatest concentrations of groundwater contaminants from both gasoline and fuel oil were from non targeted compounds rather than from the targeted priority pollutant compounds. Because of this, we also reviewed the tentatively identified compounds (TICs) detected in the groundwater. In general, the TICs detected are substituted benzene and other aromatic compounds. This suite of compounds is typical of TICs seen in groundwater contaminated by petroleum or petroleum derived products. As with the targeted compounds, the concentrations of the TICs were higher in the shallow groundwater than in the deep groundwater. Concentrations of the TICs in MW-4, MW-5, and MW-6 were also generally higher than the TIC concentrations detected in MW-3 and MW-7, which is consistent with the results found for the targeted compounds.

Comparison of the TICs detected on the LILCO and adjacent properties indicated that there were several compounds detected in the groundwater on the adjacent property that were not found in groundwater on the LILCO site. Most of these are substituted aromatics, primarily substituted benzenes and substituted naphthalenes, but there were also several long chain alkanes ($C_{11}$ to $C_{35}$) found. These compounds are not breakdown products





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of the PAHs found on the LILCO property and their presence suggests the possibility of an additional source of contamination, possibly petroleum products with a different mixture from the ones used by LILCO or possibly a completely different petroleum or petroleum derived product.





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**REFERENCE 4**

LILCO LONG ISLAND LIGHTING

LONG ISLAND LIGHTING COMPANY

175 EAST OLD COUNTRY ROAD · HICKSVILLE, NEW YORK 11801

Direct Dial Number

April 12, 1989

Ms. Joan Wagner
NUS Corporation
1090 King Georges Post Road
Suite 1103
Edison, New Jersey 08837

RECEIVED
APR 19 REC'D
NUS CORPORATION
SENT TO REGION II

Preliminary Assessment Investigation
Bay Shore Gas Manufacturing Site

Dear Ms. Wagner:

As indicated in my March 6, 1989 letter, I have attached information relative to the demolished Bay Shore Gas Plant to assist you in conducting the CERCLA Preliminary Assessment for this site. The attachments include a summary of the site history and operations, and a report entitled "Ground-Water Investigation at the LILCO Gas Plant Site" prepared for LILCO by Geraghty and Miller, Inc.

LILCO trusts the information provided will be useful to your investigation. If you have any questions, please feel free to call me at (516) 420-6132.

Very truly yours,

Steven V. Dalton

Steven V. Dalton,
Manager
Environmental Sciences Division

RJS/man

cc: Mr. Jeffrey Gaal, USEPA Region II

# Bayshore Gas Plant

The following summary has been prepared in response to concerns expressed by the New York State Department of Environmental Conservation and Suffolk County Department of Environmental Control over contamination of the groundwater in the vicinity of the Bayshore Gas Plant. It represents, to the best of our ability, a reconstruction of the plant's operating history.

The Bayshore Gas Plant was built in 1898 with an original capacity of 1000 MCF/day of manufactured gas (1 MCF = 1000 cubic feet). Plant expansions in 1927, 1940 and 1947 increased the total capacity to approximately 17,000 MCF/day.

Two types of manufacturing processes were utilized at Bayshore. Until 1952, the plant operated as a base load facility and produced carburetted water gas with a heating value of 537 BTU/CF. After 1952, the LILCO gas system was converted to natural gas supplied by pipelines from the southwest and the plant was converted to a peak shaving facility which produced oil gas (1000 BTU/CF) at an original capacity of 7,000 MCF/day. In 1963 the plant's capacity was expanded to 17,000 MCF/day. As a peak shaving facility, the plant was used only to augment the natural gas supply during periods of high gas demand and later for occasional operator training and equipment testing.

In general, the plant produced small amounts of oil gas (1,000 - 30,000 MCF/year) until 1973. The last time gas was made for production purposes was on February 4, 1972 when the plant operated for four hours and produced 1,146 MCF. The last time the facility operated for any purpose was on December 14, 1973 when 493 MCF was made during a 2 hour test period. Table 1 provides the annual quantities of carburetted water gas and oil gas produced since 1950.

The following is a brief description of the caburetted water gas and oil gas manufacturing processes. Schematic diagrams of these processes are shown in Figures 1 & 2. Carburetted water gas was produced in a "generator" by passing air and steam through hot coke. A gas, rich in carbon monoxide (CO) and hydrogen ($H_2$), was formed which entered a "carburettor" where "Gas Oil" (No. 2 type oil) was introduced and thermally cracked by the hot gases. From 1947 to 1952, No. 6 oil was cracked along with Gas Oil. The process formed a mixture of noncondensibles or permanent gases and condensibles. The hot carburetted water gas then flowed to a wash box and condenser (i.e., washer cooler) where heavy condensibles were removed. The gas then entered a relief holder followed by additional cooling and purification equipment (i.e., tar separators) and finally to a storage holder from which it supplied local distribution gas mains. Generally, direct contact cooling water systems were designed as a closed loop, except for the water lost in the tar separators or condensation points such as the storage

and relief holders and piping in general.

Oil gas was produced by heating checker brick to incondesence and simply cracking naptha, a light distillate, which had a nominal boiling range of 115° to 290°F. The gas stream went to the relief holder, was cooled in a counter current "air" cooled condenser and a direct contact water cooler and then scrubbed using a "wash" oil. As in the carburetted gas process hydrogen sulfide was removed through contact with iron oxide ($Fe_2O_3$) in purifier boxes. The gas was stored for distribution into the gas system. Figures 1 and 2 are one-line diagrams showing typical process flows for the two methods.

Obvious potential sources of groundwater contamination are the fuel or process oil storage and transfer system, gas scrubbing, condensing and purification system, oil separation and storage facilities and any in ground pits designed for waste disposal.

During the early years of plant operation (approximately from 1898 to the early 1920's) it is believed that some oily wastes and tars (no estimate of the quanties could be made) from the water gas process were disposed on the surface of the ground on the LILCO property west of Clinton Ave. (i.e., Brightwaters Yard). In addition, cooling waters and other aqueous wastes were discharged to Watchogue Creek. Coincident with the plant's expansion in 1926, the Company was required by the New York State Department of Health to install a waste water treatment system. This system was designed to separate and transfer non-contaminated wastes and runoff for discharge to Watchogue Creek. Contaminated wastes were treated for oil and tar removal in separators.

The tars and oils were burned in the plant's boiler or were sold and the clarified water was recycled back to the 100,000 cf holder for seal water make-up. Any excess water, which consisted of steam used to heat the holder seals, condensation from the gas in the holder itself, rainwater caught in the holder tank, and entrained water pumped with the tar from the tar separator was discharged into an onsite "cesspool" or leaching pit. It was estimated at the time that the flow would average 500 gpd with a maximum flow of 5,000 gpd.

It was this pit that was observed by SCDEC inspectors in 1976 during plant demolition. Application for this discharge was filed with the State Department of Health on April 16, 1925. A permit, attached, was issued on March 4, 1926 to discharge unpolluted wastes waters from the gas plant of this Company at Bayshore into the waters of Watchogue Creek at Oak Street and to discharge polluted wastes from their gas plant at Bayshore in the Town of Islip into the groundwaters tributary to Watchogue Creek.

Based on a review of the available records this pit was the only unlined pit on the site and was the only deliberate discharge to ground. In addition it appears that it was no longer used for routine waste disposal after 1939 when additional tar demulsification equipment was installed at the site. The pit may have been used during the early 1940's for infrequent tar disposal, but to our knowledge, nothing was disposed of in the pit after the early 1940's.

A new wastewater treatment system was built as part of the 1940 plant expansion and was modified during the 1947 expansion. Figure 3 is a one-line flow diagram of the 1947 system which treated all contaminated wastes. Attached are the discharge permits issued by the New York State Department of Health in 1941 and 1949 for the waste treatment system.

Condensed oils (commonly called drip oil) removed from the carburetted water gas in the relief holder and storage holder were collected and routed by underground piping to a above grade storage tank on the Brightwaters Yard. The drip oil was then pumped into either railroad cars or tank trunks and sold. During 1949, the Company received numerous complaints from neighbors directly south of the plant along Fifth Avenue concerning oil in basements. This oil was identified as primarily drip oil. Drip oils contain appreciable quantities of benzene, toluene, napthelenes and other organic compounds.

It appears that most of the drip oil leaked to the ground through the underground transfer and storage system which was observed to be extensively corroded. The leaking drip oil storage tank was taken out of service in 1949. The transfer system was removed from service during the 1952 conversion to a peak shaving facility. Additional amounts of oil could have come from a buried fuel oil tank (installed in the 1920's) which, when removed in 1947, was observed to be extensively corroded.

A ground oil recovery system was installed and operated until about 1953. There are no records available concerning the amount of oil removed. The system consisted of two well points that pumped groundwater to the plant's waste treatment system for clean up. Figure 4 is a diagram showing the location of the oil recovery system. It appears that the system was not operated after 1953 because no additional oil was being collected and no additional complaints were received from neighbors. Occasional complaints of oil in the ground occurred in the late 1950's and early 1960's and were associated with abnormally high water table levels due to hurricanes. No complaints have been received since the early 1960's.

The 1952 conversion to oil gas production resulted in a substantially refurbished plant with new oil transfer systems and above grade, diked oil storage tanks. All wastewaters produced during the limited production and testing runs were treated by the existing treatment system and discharged to Watchogue Creek. There were no direct discharges nor any known indirect discharges to the ground during the production of oil gas. In addition there were no unexplained losses of oil which would indicate leaking tanks or leaking transfer systems.

In summary there was only one leaching pit at the Bayshore Plant. It was used from 1927 until about 1939 and was authorized by a permit issued by the New York State Department of Health. There were no other deliberate discharges to the ground. There were, however, accidental losses of oils due to corroded drip oil transfer piping and storage tank and a corroded underground fuel oil storage tank. These losses occurred prior to 1952 and efforts were made from 1950 to 1953 to clean up the contamination both on site and south of the plant. After 1952 no additional contamination occurred because the plant processes were modified, new transfer piping and storage tanks were installed, very little gas was manufactured and all wastes were treated and discharged to Watchogue Creek.

SVD/dd

September 1977

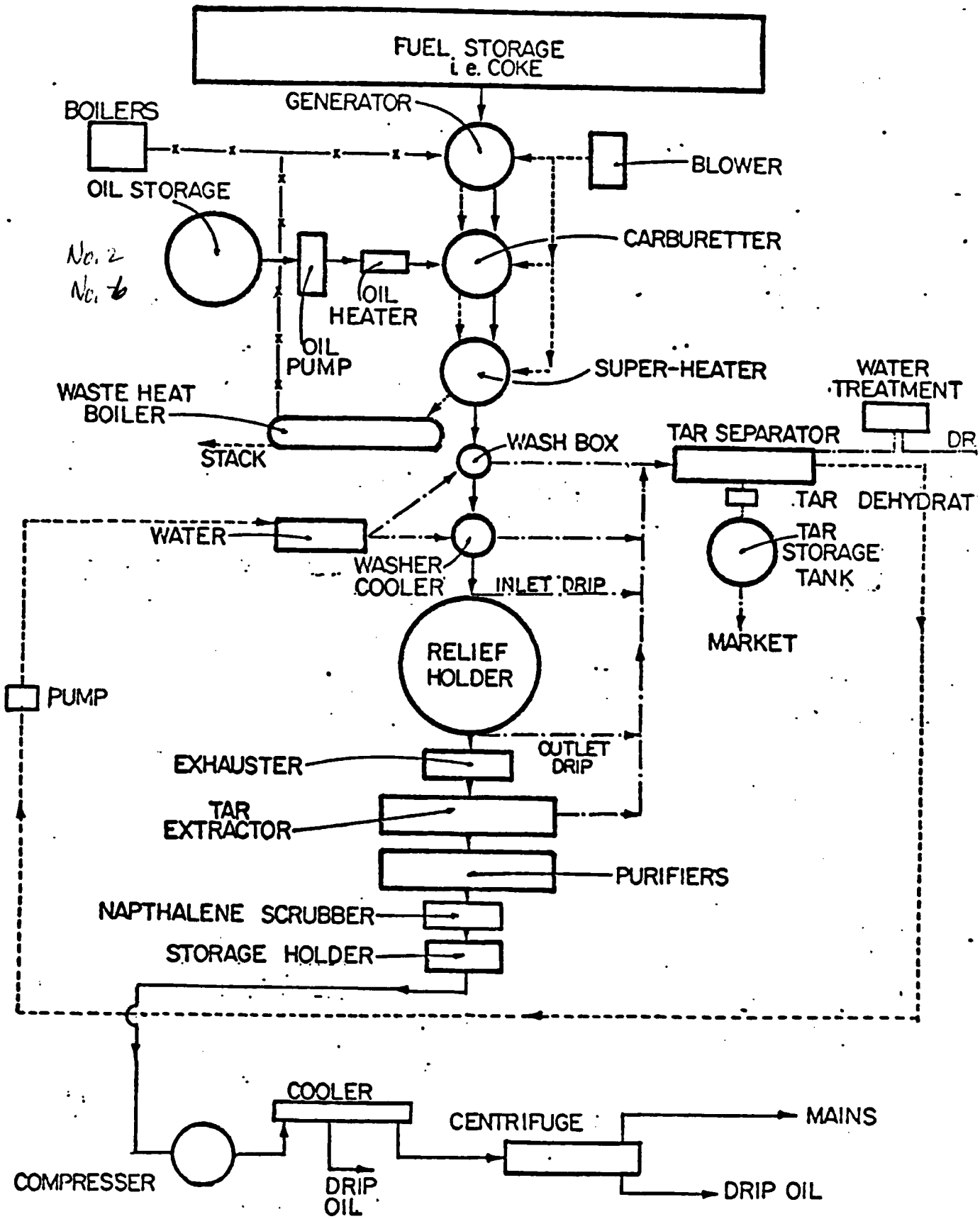
Table I

Gas Production at Bayshore Gas Plant Since 1950

| Year | Carburetted Water Gas (MCF) | Oil Gas (MCF) |
|---|---|---|
| 1950 | 2,412,000 | - |
| 1951 | 421,000 | - |
| 1952 | 14,000 | 8,000 |
| 1953 | - | 10,000 |
| 1954 | - | 2,000 |
| 1955 | - | 14,000 |
| 1956 | - | 5,000 |
| 1957 | - | 30,000 |
| 1958 | - | 10,000 |
| 1959 | - | 1,000 |
| 1960 | - | 2,000 |
| 1961 | - | 4,000 |
| 1962 | - | 4,000 |
| 1963 | - | 16,000 |
| 1964 | - | 29,000 |
| 1965 | - | 9,000 |
| 1966 | - | 7,000 |
| 1967 | - | 5,000 |
| 1968 | - | 4,000 |
| 1969 | - | 5,000 |
| 1970 | - | 2,000 |
| 1971 | - | 6,000 |
| 1972 | - | 2,000 |
| 1973 | | 1,000 |

FUEL OR GAS
AIR OR WASTES GASES
WATER OR TAR
STEAM

FIGURE 1
TYPICAL FLOW SHEET FOR CARBURETTED WATER GAS PLANT



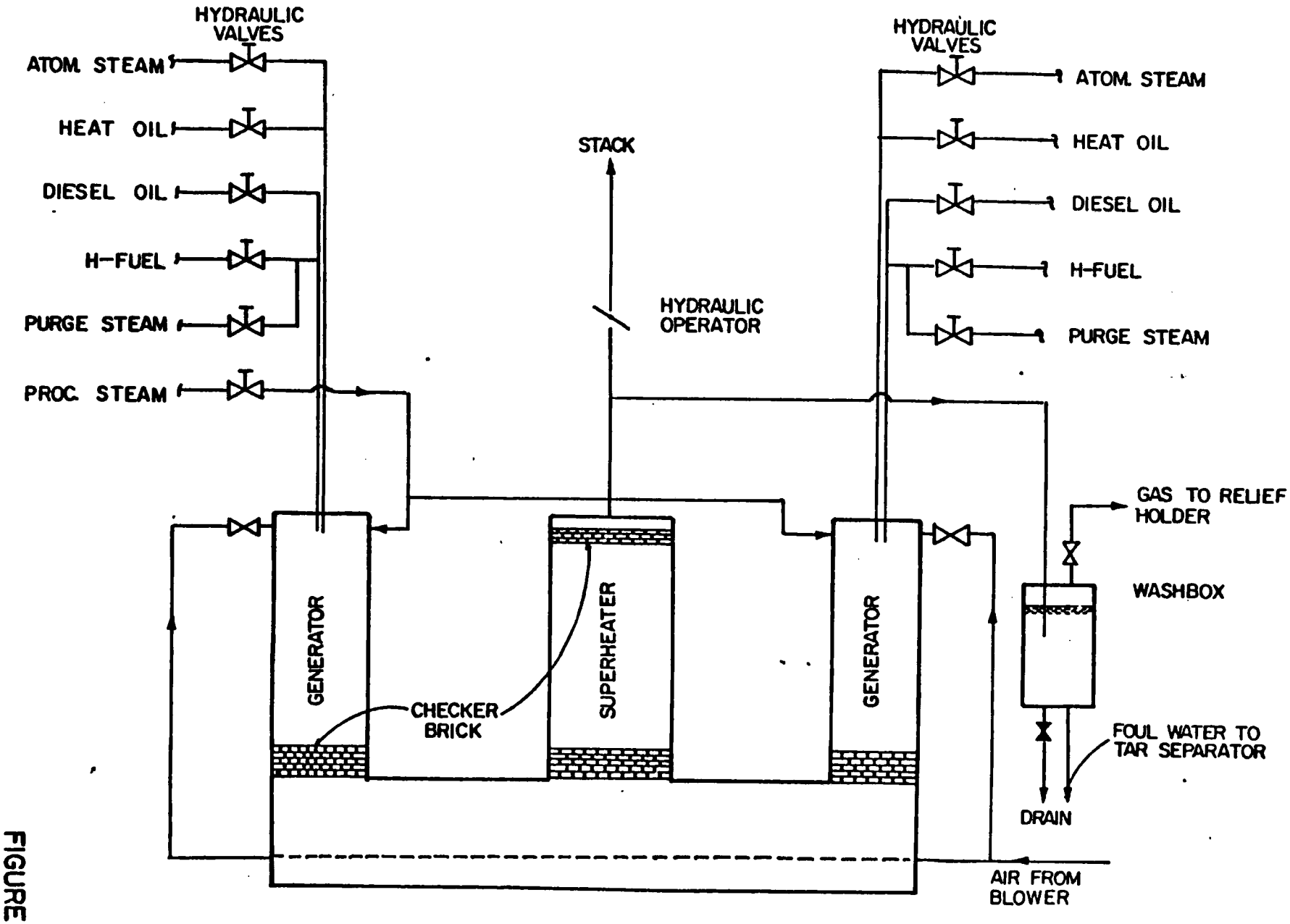



FIGURE 2
TYPICAL FLOW SHEET
FOR
OIL GAS PLANT

Ref. 4, p. 8 of 14

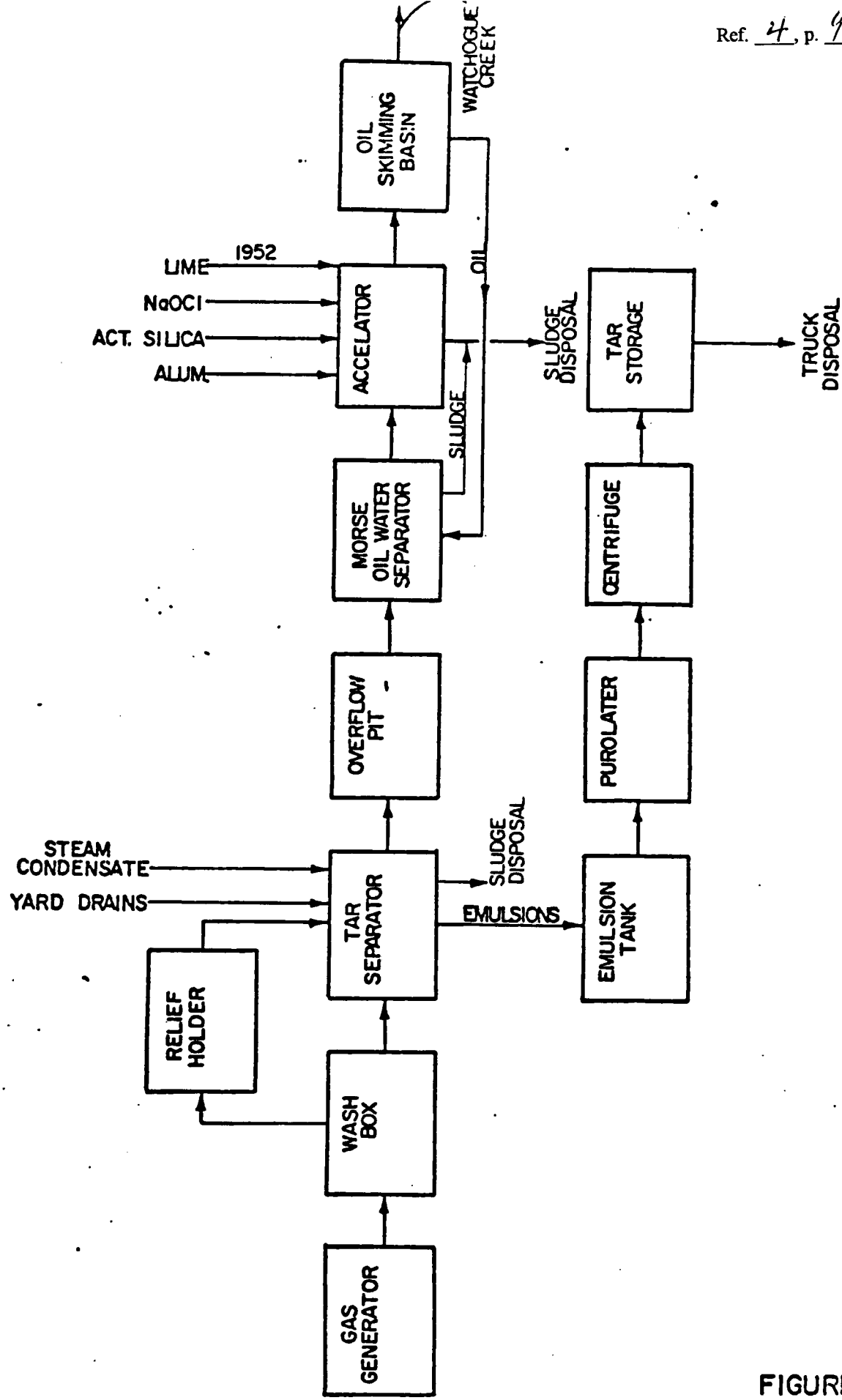



FIGURE 3
BAYSHORE GAS PLAN
WASTE TREATMENT
1947

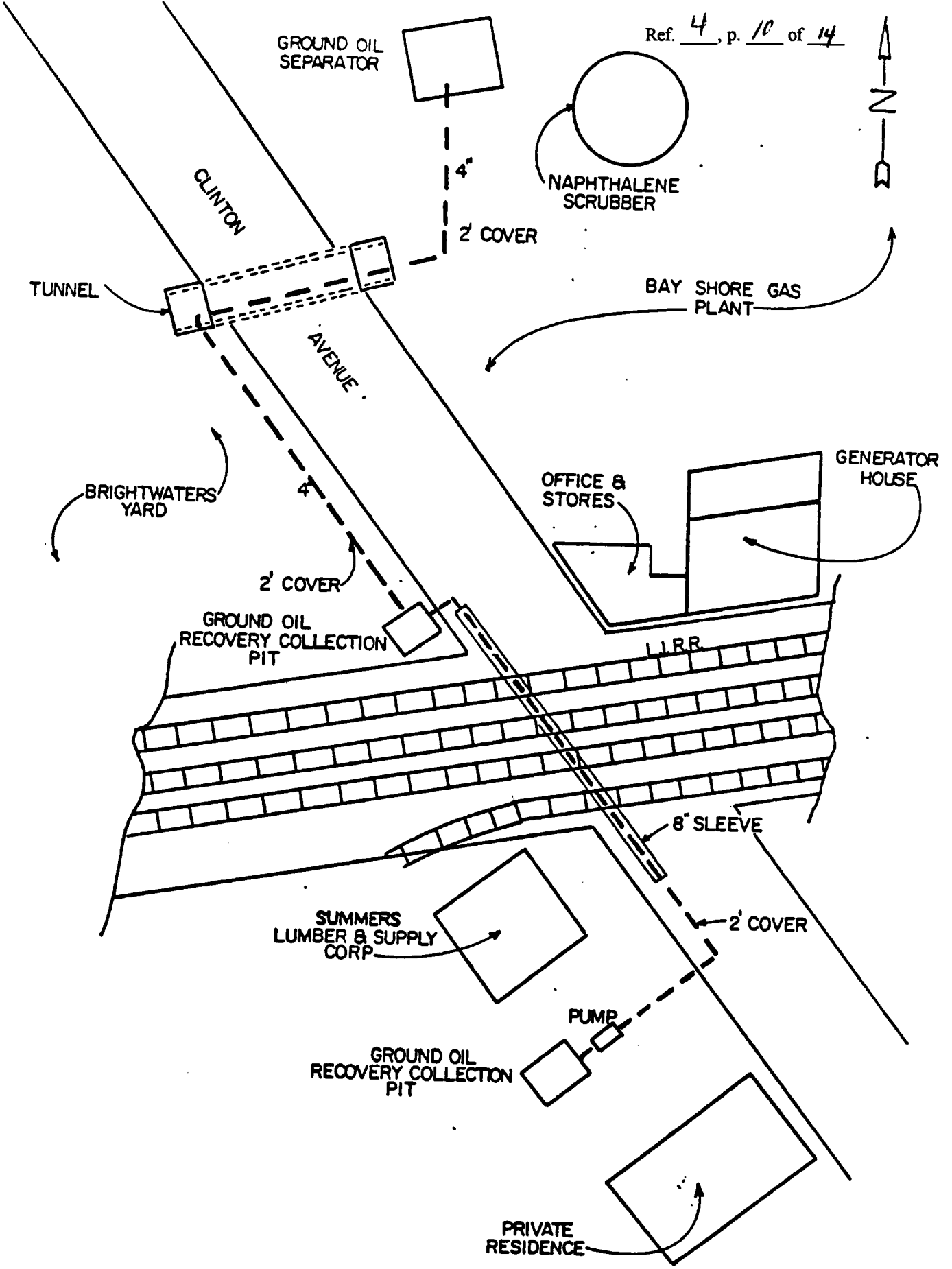



FIGURE 4
GROUND OIL
RECLAIMING SYST
1950 - 1953

STATE OF NEW YORK

STATE ENGINEER AND SURVEYOR

ALBANY

JOURNAL BUILDING - PLAZA
P. O. Box 524

March 4, 1926.

Long Island Lighting Co.,
50 Church Street,
New York City.

Gentlemen:

I am enclosing the plans for the disposal of the wastes from the gas plant of your Company at Bay Shore in the town of Islip, Suffolk County, New York, approved by me on March 4, 1926, together with a copy of the report of our Bureau of Sanitary Engineering on the examination of the plans dated March 4, 1926.

A copy of the approved plans is being forwarded to the State Commissioner of Health.

Very truly yours,

Roy G. Finch,
State Engineer,

By

(Signed) Thos. L. Watkins

Assistant Deputy.

Encl.

V.

W.022075

Original of this letter is in Legal Dept. file

W.022075

STATE OF NEW YORK

DEPARTMENT OF HEALTH

ALBANY

March 8, 19

Long Island Lighting Company,
50 Church Street,
New York City.

Gentlemen:

I am sending you herewith the permit granted this day allowing the discharge of unpolluted waste water and polluted wastes from your gas plant at Bay Shore in the town of Islip, shown on plans approved by the State Engineer on March 4, 1926.

To become operative, this permit must first be recorded in the County Clerk's office of Suffolk County. Kindly see that the permit is so recorded.

Very truly yours,

(Signed) C.A. Holmquist

Director, Division
of Sanitation.

HO
Encl.

W.O.22075 FILED BY

Note — Original Approval copies of E.P.C. dwgs 11958, 11854 & 11964 approved by State E. on file with original permit papers in Dept of E.

NEW YORK

STATE DEPARTMENT OF HEALTH

ALBANY

Permit to Discharge Sewage or Wastes into the Waters of the St

Application having been duly made to the State Commissioner of Hea provided by Article V of the Public Health Law, permission is here given to Long Island Lighting Company to discharge unpolluted waste waters from the gas plant of this Company at Bay Shore into the wate of Watchogue creek at Oak Street, Bay Shore, and to discharge pollut wastes from their gas plant at Bay Shore in the town of Islip into t ground waters tributary to Watchogue creek on their property, shown plans approved by the State Engineer on March 4, 1926, within the TO of ISLIP, SUFFOLK COUNTY, N.Y. under the following conditions:

I. THAT the proposed waste disposal works shown on the plans approved by the State Engineer on March 4, 1926, shall be fully constructed in complete conformity with those plans or approved amendments thereto.

II. THAT only unpolluted cooling water and rain water and no sanitary sewage or tar, oils, or other wastes from the manufacture of gas, nor any water contaminated with such sewage or wastes in any quantity whatsoever shall be discharged or allowed to flow directly or indirectly into Watchogue creek or into any other water course or into any body of water.

III. THAT whenever required by the State Commissioner of Health, additional or more adequate works for the collection or disposal of sewage, tar, oils or other wastes from the manufacture of gas shall be installed and put in operation, plans for which shall first be submitted to and receive the approval of the State Engineer.

W.O. 22075 FILED BY

..March.8th,....1926... (Signed)..Paul.B..Brooks.....
Deputy State Commissioner o

NOTE: Before this permit becomes operative and effective it must be recorded in the County Clerk's Office of .....SUFFOLK..County, and plans for the installation must be approved by the State Engineer.

CAH:MC

NO. 2 11-22-36-8000-MT
S. GODFREY, JR., M. D.
COMMISSIONER
S. BROOKS, M. D
DEPUTY COMMISSIONER

NEW YORK
STATE DEPARTMENT OF HEALTH
ALBANY

DIVISION OF SANITATION
CHARLES A. HOLMQUIST, E
DIRE
EARL DEVENDORF, M. S.
ASSOCIATE DIRE

# PERMIT TO DISCHARGE SEWAGE OR WASTES

# INTO THE WATERS OF THE STATE

Application having been duly made to the State Commissioner of Health as provided by Article V of the Publ. Health Law, permission is hereby given to the Long Island Lighting Company to discharge waste effluent from the waste treatment works to serve the Bay Shore Gas Works in the town of Islip, as shown on the plans approved this day, into Watchogue Creek through an existing outlet sewer

within the TOWN of ISLIP, SUFFOLK COUNTY, NEW YORK
under the following conditions:

I. THAT this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification or change shall become necessary.

II. THAT the waste disposal works shown on the plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereto.

III. THAT no sanitary or domestic sewage shall be admitted to the waste disposal works.

IV. THAT the waste treatment works shall be operated at all times to the satisfaction of the State Commissioner of Health.

V. THAT whenever required by the State Commissioner of Health additional or more adequate works for the collection or disposal of industrial wastes shall be installed and put in operation, plans for which shall first be submitted to and receive the approval of the State Department of Health.

Dated December 5, 1941.
AWE:EV

Director, Division of Sanitation

**REFERENCE 5**

Aug. 14th

Departed office @ 8:00 am

arrived @ ALCO Bayshore

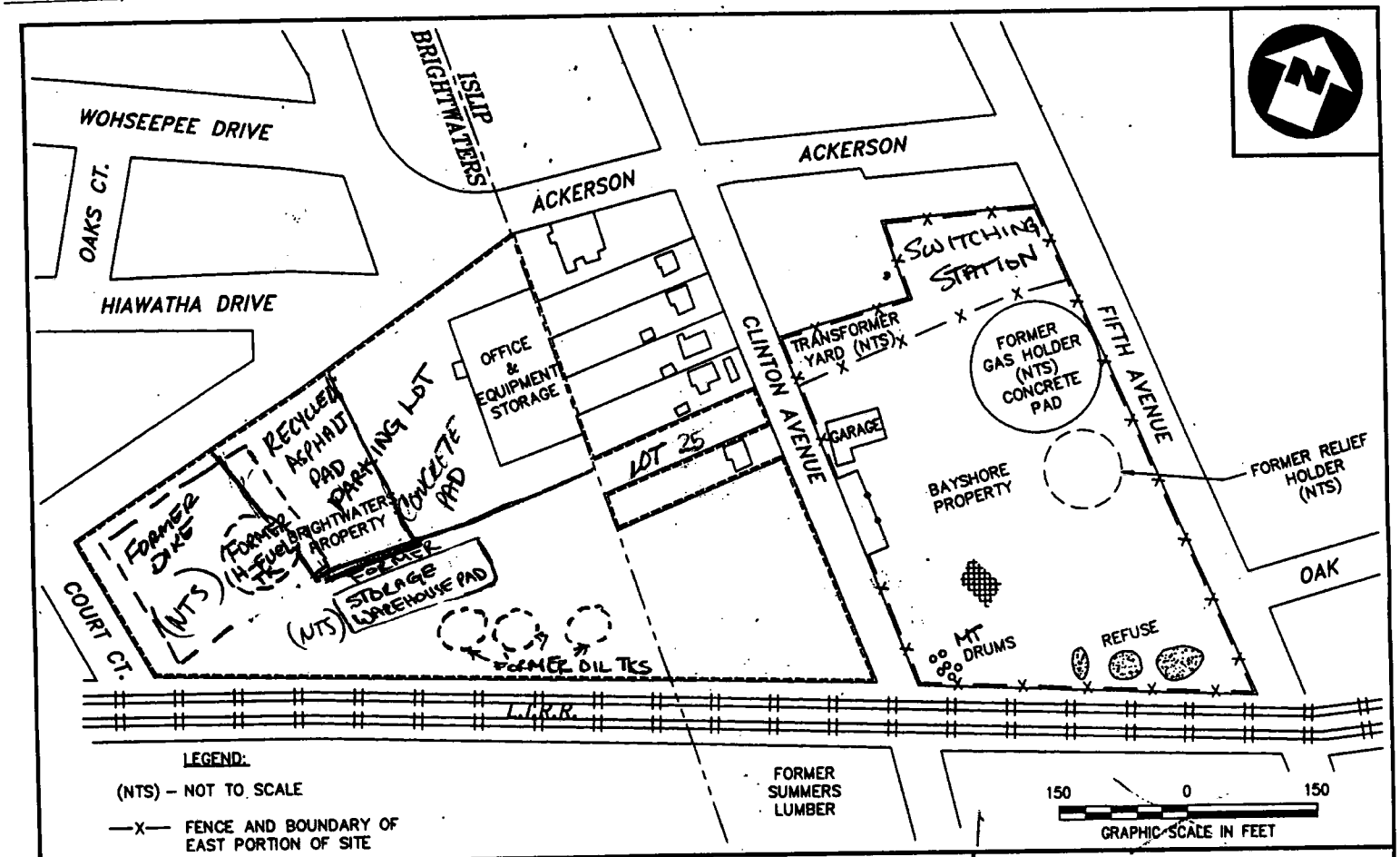
site @ 10 am

Weather: sunny + dry
about 75° F ~~[illegible]~~

pictures: start @ exposure
# 18 (left *see pg. 7 ①

gravel, recycled asphalt,
~~[illegible]~~ asphalt + tall weeds
covering the ground
tank removed in late 1970's
↳ no soil removed
some of the surface
dike still exists along
perimeter

entire area is
fenced in




**SITE MAP**

**BAY SHORE GAS PLANT**
**BAY SHORE, N.Y.**

**FOSTER WHEELER ENVIRONMENTAL CORPORATION**

**FIGURE 2**

Ref. 5, p. 1A of 19

Supplies kept on the property:
non-contaminated sand piles
used for daily activities { construction vehicles
piping

BTEX plume discovered by DEC after local complaint see pg. 7 (2)

LIRR tracks run alongside site see pg. 7 (3)

Former
↑ H-fuel above ground storage tank or piping suspected to be the source of BTEX (4) (see map for location). see pg. 7

in the process of negotiating a consent order w/ the site (5) see pg. 8

spill investigation w/ DEC

2 separate problems
1) fuel
2) haz. waste · See pg. 8 (6)

they now own the property that used to be the lumber yard.

complaint was last Dec.

5 gas stations in the area
5th & Axerson

oil spills upgradient of site
SEWA water company
gas stations

See pg. 8 (7)

~~pampno~~ H-fuel tank
piping was largely above ground & has been removed.

parallel RR used to run thru site - fill to existing RR
Coke rail beds still visible - tracks have been removed.

recycled ~~coke~~ asphalt to patch pile for temporary road repair on conc. tank pad.

some conc. foundations still exist on property - all clean

LI RR nearby is diesel

no topsoil varies.

* Picture of vegetation from Clinton Ave

~~area~~ Mar & construction works office on other side of strip of site that puts out.

Ref. 5, p. 44 19

has on one side of strip of site, construction office — on other side of strip (see map)

* picture taken of substation + switching station on other portion of site. - no contamination noted

surface water percolates into the ground. see pg. 9 (2)

sidewalk along Clinton ave. higher than land so water does not tend to run to St. where there are some ~~storm~~ storm sewers

* small section of property past RR tracks is where lumberyard used to be.

next to switch yard - to the rt. used to be office bldgs.

Clarifications 8/19/97

① (from pg. 1)
the roll of film already has several pictures on it - 18 pictures on the roll (the last 18) are of the Bayshore site

from pg. 2 1/2 mile south of the site TD

② last Dec., Dec. 1996, a local family placed a complaint after noticing an unusual smell in their basement - DEC came & investigated the Bay Shore site in response to this complaint & discovered a BTEX plume that originated on the property

③ railroad tracks border the side of the property (see map) they are active.

④ the tank & piping have been removed.

(5)
- LILCO - owner of the Bay Shore property - is in the process of negotiating a consent order w/ the state for cleanup of the Bay Shore property + possibly several other sites under their ownership

(6)
- There is contamination due to both fuel + hazardous waste @ this site

(7)
- At least 5 gas stations have been in operation in close vicinity during the history of the site, upgradient of the site spills have occurred at other businesses, i.e. gas station + water company
- Some contamination may be attributable to these sources + not LILCO

(8) Storm water mainly percolates into the ground - probably only runs off site in extreme situations due to the fact that the sidewalk which separates the street & the site, is raised higher than the property ground

(9) Access to site is restricted by fence with barbed wire @ the top. Both parcels completely surrounded.

T. Veracco 8/19/97

8/26/97 Late Note

TRACY VERACCO AND MICHELLE BROOKS OF FOSTER WHEELER MET WITH RICHARD SCHMITZ AND THEODORE LEISSING, JR OF LILCO AT THE BAYSHORE GAS PLANT IN BAYSHORE NEW YORK ON 8/14/97.

SITE RECONNAISSANCE:
BRIGHTWATER YARD

- Currently the Brightwaters yard is used store equipment for LILCO. There is an office on site with approximately 10 employees and ~~and~~ MB other employees pick up and drop off vehicles.

- A part of the site, the former H-fuel storage tank area was recently cover with recycled asphalt for additional parking.

Michelle R Brooks

No school or Day care in area > 200 ft.

Recent development with contamination @ BRIGHTWATERS YARD, PLUME FROM H-FUEL TANK IN RESIDENT'S BASEMENT, approximately ½ mile SOUTH OF SITE.

PRELIMINARY ANALYTICAL BY LILCO CONFIRM SOURCE AS H-Fuel HEAVIER THAN GASOLINE & LIGHTER THAN 2 OIL.

AQUIFER 6" BELOW BASEMENT LEVEL OF GROUND WATER HIGHER THAN NORMAL +1'

LAWRENCE CREEK APPROXIMATELY ½ MILE FROM SITE

NO RECENT INVESTIGATION AT SITE SINCE REMEDIAL INVESTIGATION IN 1993.

Michelle R Brooks

Late note continue

The closest residence to the site is located approximately 200 feet on Clinton Ave, South of the site.

HLCO now owns the property that housed the Lumber yard at 70 Clinton Avenue. The building have been demolished.

HLCO also purchased and demolished residence in the 1950's. ACCORDING TO Richard J. Schmitz of HLCO ONLY ONE PROPERTY WAS PURCHASED AND DISTROYED.

Michelle R Boots

BAY SHORE GAS PLANT
BAY SHORE, N. Y

August 14, 1997

Looking north in Brightwaters Yard at the Former LILCO Bay Shore Gas Plant . Currently used as field office and equipment storage.

Looking towards the north, LILCO equipment in Brightwaters yard. Ground recently paved with recycled asphalt to creat additional storage area.

BAY SHORE GAS PLANT
BAY SHORE, N. Y

August 14, 1997

Looking toward the east in Brightwaters Yard. Picture taken from location of former H-Fuel storage tank. Area recently cover with recycled asphalt.

Looking toward the south-east in Brightwaters Yard. Picture taken from location of former H-Fuel storage tank. Area recently cover with recycled asphalt.

BAY SHORE GAS PLANT
BAY SHORE, N. Y

August 14, 1997

Looking toward the south-west in Brightwaters Yard. Picture taken from location of former H-Fuel storage tank. Area recently cover with recycled asphalt.

Looking toward the south-west in Brightwaters Yard. Picture taken from location of former H-Fuel storage tank. Area recently cover with recycled asphalt.

BAY SHORE GAS PLANT
BAY SHORE, N. Y

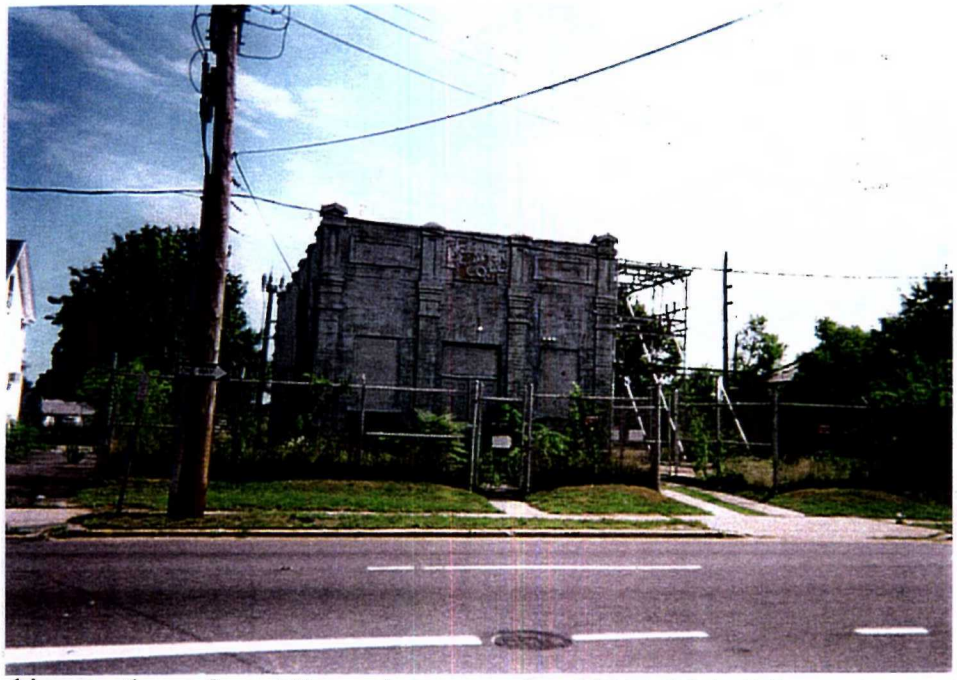
August 14, 1997

Looking south-west in Brightwaters Yard. Storage pile of recycled asphalt on concrete pad.

Looking towards the south, inside fence along south border parallel to Long Island Railroad tracks.

BAY SHORE GAS PLANT
BAY SHORE, N. Y

August 14, 1997



Looking northeast from Clinton Avenue at the old LILCO building and Transformer yard.

Looking west at gas pipes from the gate on Fifth Avenue. LILCO Regulator Station.

BAY SHORE GAS PLANT
BAY SHORE, N. Y

August 14, 1997

Looking southwest from Fifth Avenue at the Bay Shore property of the former LILCO gas plant.

Looking southwest from Fifth Avenue at the Bay Shore property of the former LILCO gas plant.

BAY SHORE GAS PLANT
BAY SHORE, N. Y

August 14, 1997

Looking towards the south-east from inside the Bay Shore Property. Picture taken on the concrete pad for the former Gas Holder Tank.

**REFERENCE 6**

INTER-OFFICE MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL CONTROL

TO: James Pim

DATE: Dec. 2, 1976

FROM: Roy Gilbert

SUBJECT: LILCO GAS PLANT
BAYSHORE

**********

On Nov. 24, 1976 Bob Falk collected a sample of groundwater contaminated by a petroleum type substance from a pit on the premises of the LILCO gas plant. On Nov. 30, 1976 seven additional groundwater samples were obtained by Rich Markel at the location and depths noted on the attachments. Please note than well #4 is approximately 1500 feet from the gas plant.

The odors and colors of all the above samples were quite similar. The intensity of the odor and color diminished with increasing distance from the LILCO site, however, even at well #4 the odor was quite strong.

Of particular concern is the fact that whatever material was discharged into the groundwater by LILCO many years ago, incomplete degradation appears to have occurred. The contamination may have originally been a petroleum material but in the groundwater samples no separation by floatation occurred. This leads to the conclusion that the contaminants are in solution. Additionally, since contamination was noted at various depths below the water table, it may be assumed that its density is great enough to cause continued depression in the saturated soils until a confining stratum is reached.

To provide a valid and logical basis to assume that the contamination downstream is essentially the same material as found on the LILCO site, it is recommended that gas chromatography be performed on all samples with an analysis of the similarity of the peaks observed. Identification of the peaks is useful but not essential to prove the samples contain the same materials. Once such a similarity can be clearly established, it may provide a legal basis to hold LILCO responsible for any actions proposed.

Once such similarities are shown, further quantification without identification will be very difficult if not impossible.

The big problem, which may be encountered is that the gas chromatograph is not as sensitive as the human nose, so that

o: James Pim
om: Roy Gilbert



Dec. 2, 1976

hough an odor may be detected, its chemical nature may not e by the gas chromatograph. Another problem is that the ntaminants downstream may have lost a great deal of the latile components and hence will be missing a significant mber of peaks present in the chromatograph of the sample tained from LILCO's premises.

ur comments are requested as are your recommendations for rther steps to be taken by this office.

Gilbert
rt
tt.

**REFERENCE 7**

INTER-OFFICE MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL CONTROL

TO: FOR THE RECORD

DATE: Jan. 11, 1977

FROM: Roy Gilbert

SUBJECT: LILCO Gas Plant
Bay Shore

**********

On Dec. 21, 1976 Rich Markel and I with a well drilling crew drilled 2 wells presumably into the plume of contamination from LILCO Gas Plant in Bay Shore.

At 11:00 a.m. well #1 was drilled 175 yards South of LILCO's fence on the E/S of Clinton Ave. A gallon of water was skimmed from the surface of the water table and was deposited into a clean glass jug for later analysis. At this location groundwater was contacted 7.8' below surface of the ground. The sample obtained from the surface of the groundwater had a fairly strong odor similar to that in the sample procured by Robert Falk several weeks ago.

At 11:50 a.m. a sample from 14' below the water table was obtained after pumping formation water for 2 - 3 minutes at about 75 gal. per minute. This sample had the same distinct odor only more intense and a gallon of this water was deposited in a glass jug for later analysis.

At 1:10 p.m. well #2 was drilled to groundwater (approx. 7.25') about 310 yards South of LILCO's fence and a sample of groundwater was skimmed from the surface of the water table and was deposited in a 1 gal. glass jug for later analysis. This sample had the same distinct odor only it was quite faint.

At about 2:30 p.m. a sample from well #2 was obtained from about 34' from the surface of the water table. This sample also had the same distinctive odor and of the 4 samples procured on the above mentioned date the odor was strongest in this sample. A gallon of this water was deposited in a glass jug for later analysis.

It would appear that there is a substantial plume of contaminated groundwater running roughly in a Southerly direction from LILCO's property. Judging by odor alone the concentration of contaminants appears to increase with increasing depth into the water table and increasing distance South of LILCO's property.

RG

Roy Gilbert
RG/rt

**REFERENCE 8**

# GROUND-WATER INVESTIGATION
# AT THE
# LONG ISLAND LIGHTING COMPANY GAS PLANT SITE
# BAY SHORE, LONG ISLAND, NEW YORK

June 1979

Geraghty & Miller, Inc.
Consulting Ground-Water Geologists and Hydrologists
North Shore Atrium
6800 Jericho Turnpike
Syosset, New York 11791

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## PLATES

1. Generalized Water-Table Map, December 1, 1978 . . . . . In Pocket

2. Approximate Extent of Contamination as Indicated by the Concentrations of Naphthalene in Ground Water . . . . . In Pocket

## APPENDIX

A. Chemical Analyses Supporting Groundwater Investigations in the Vicinity of the LILCO Bay Shore Gas Plant

# GROUND-WATER INVESTIGATION
# AT THE
# LONG ISLAND LIGHTING COMPANY GAS PLANT SITE
# BAY SHORE, LONG ISLAND, NEW YORK

## INTRODUCTION

The Long Island Lighting Company (LILCO) Bay Shore gas plant produced carbureted water gas from 1898 to 1953 and limited quantities of oil gas from 1953 to 1973. By-products from these processes probably included benzene, toluene, naphthalene, indene, phenols, and oils (hydrocarbons). Details of LILCO's gas production, gas purification, and waste disposal techniques as well as previous indications of ground-water contamination and the firm's recovery efforts have been provided to the New York State Department of Environmental Conservation (NYSDEC) and the Suffolk County Department of Environmental Control (SCDEC) by LILCO.

The SCDEC installed two small-diameter monitoring wells adjacent to the LILCO site. Chemical analyses of ground water from these wells indicated the presence of organic compounds and some of the compounds identified by mass spectrometry corresponded to the plant's various waste products.

As a result of these findings, the NYSDEC and the SCDEC requested that LILCO undertake a ground-water investigation and in February 1978, Geraghty & Miller, Inc. was retained by LILCO to define the extent of ground-water pollution at the plant site and in the adjacent area (Figure 1). LILCO also selected Grumman Aerospace Corporation Analytical Chemical Laboratory

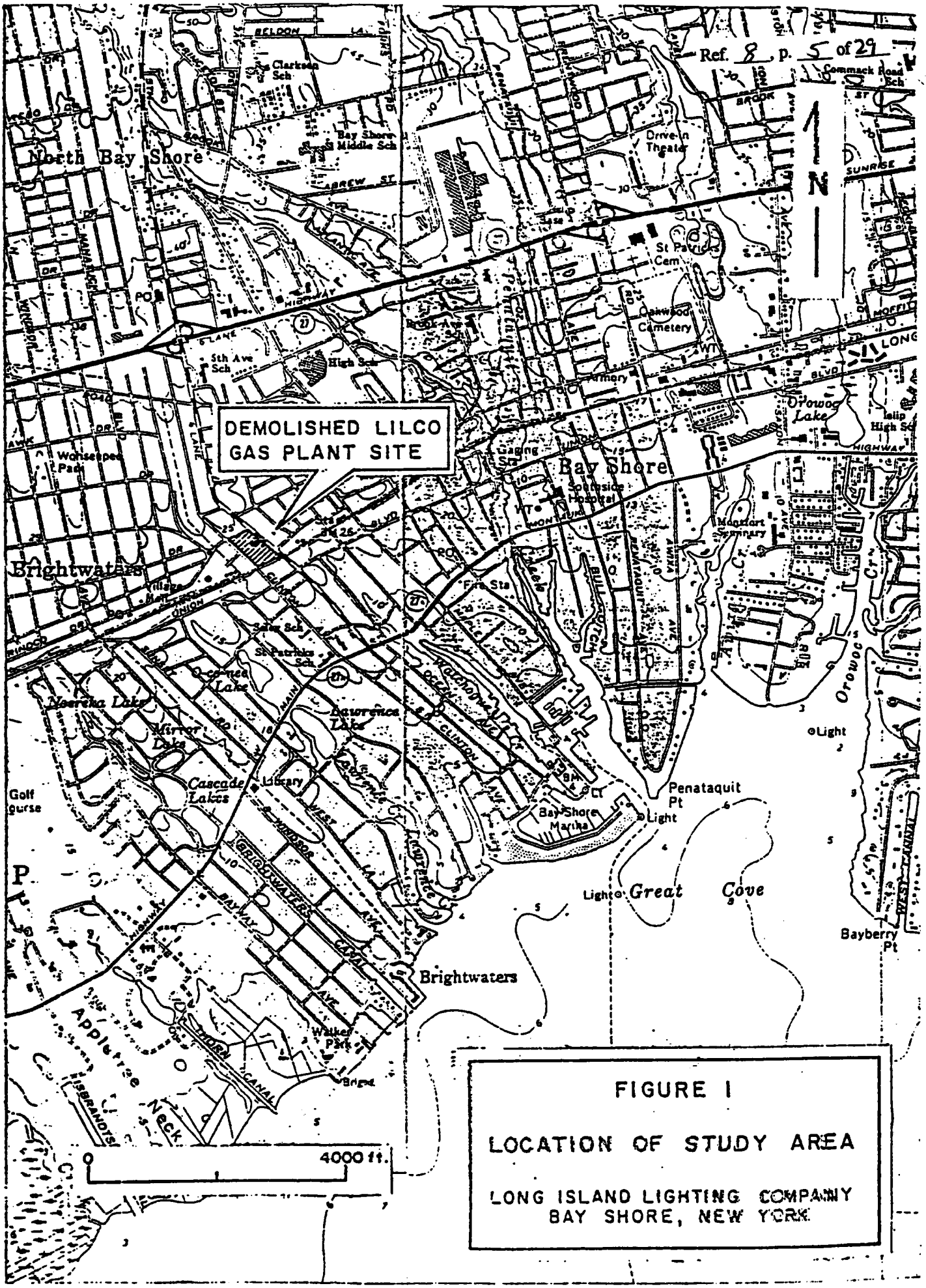


FIGURE I

LOCATION OF STUDY AREA

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to perform the water quality analyses. The objectives of the investigation were defined by the regulatory agencies, and include the determination of the lateral and vertical extent of ground-water contamination caused by LILCO's operations, and to determine the nature and approximate degree of pollution within the adjacent area.

Geraghty & Miller, Inc.'s investigation was divided into two phases so that the results of the initial drilling and sampling program could be used to select locations for subsequent observation wells. This report describes the results of both phases of the investigation. The report by Grumman Chemical Engineering Department's Analytical Chemical Laboratory contains the analytical results and is included as Appendix A in this report.

## METHOD OF INVESTIGATION

Twelve well clusters of three wells each were drilled in two phases to delineate the extent of contamination. During the first phase of the study, Clusters A, 1, 2A, 2, 3, and 4 were drilled and after the analysis of ground-water samples collected from the initial 18 wells, an additional six clusters (18 wells) were drilled to further define the areal extent of the contamination. Well Clusters 5 through 10 were installed as part of the second phase of the investigation. The locations of the 12 well clusters are shown on Plate 1. Well Cluster A is located approximately 1,200 feet north of the gas plant site to provide background water-quality data, Cluster 1 is located at the gas plant site, and the remaining well clusters are located at selected locations downgradient of the plant site.

The arrangement of three discrete, screened intervals permits ground-water samples to be collected from the lower, middle, and upper parts of the aquifer at a single location, and allows the vertical component of ground-water flow to be determined in this part of the aquifer.

A bore hole was drilled at each site to a depth of 65 to 75 feet below land surface with a 6-inch I.D. hollow stem auger. After drilling to the desired depth, 1¼-inch diameter PVC well casing and screen, with slot openings of 0.20 inch, were set inside the auger stem. As the auger was pulled out of the hole, the annular space around the screen was filled with clean gravel to approximately one foot above the top of the screen. A one-foot sand cap was placed on the gravel to insure that clay from the seal would not be pumped into the well during development. A 5-foot thick clay seal was then placed above the sand cap to prevent the vertical migration of ground water within the annulus. After the auger was pulled back to about 6 feet above the top of this screen, a second screen and casing was installed in the same bore hole. During pull back, the formation caved in on the drilled hole, backfilling the hole from the top of the clay seal to the bottom of the next screen setting. This procedure was repeated again until three separate wells had been completed in the original bore hole.

After the three wells were installed, a concrete ring was set around the wells to a depth of approximately 1.5 feet. A steel meter box was cemented on the ring at land surface to protect against vandalism. The screen in each of the shallow wells was installed to intercept and extend above the water table to insure that sampling at the water table would cap-

ture any floating contaminants. Typical construction of the observation well clusters is shown on Figure 2; depth data are shown in Table 1.

After the well cluster was installed, each well was developed with a small centrifugal pump. Development continued until the water was clear and nearly free of sediment so that low-turbidity samples could be collected for analysis.

## HYDROGEOLOGY

### Regional

The study area is located near the south shore of Long Island and is underlain by upper Pleistocene outwash plain deposits. These deposits consist of medium to coarse sands and gravels of moderate to high permeability which allow relatively rapid movement of ground water and comprise the upper glacial water-table aquifer. The upper glacial aquifer generally overlies a transitional zone of low permeability, consisting of clay units within the Magothy Formation. The Magothy Formation is a confined aquifer composed of poorly to moderately permeable fine to medium sand interbedded with sand and clay lenses. In some areas, the lowermost limit of the water-table aquifer is the interglacial Gardiners Clay confining unit. The Gardiners Clay overlies the Magothy Formation and underlies the upper glacial Pleistocene deposits. The Gardiners Clay is approximately 20 to 40 feet thick and is generally not found more than a mile north of Great South Bay (Pluhowski and Kantrowitz, 1964).

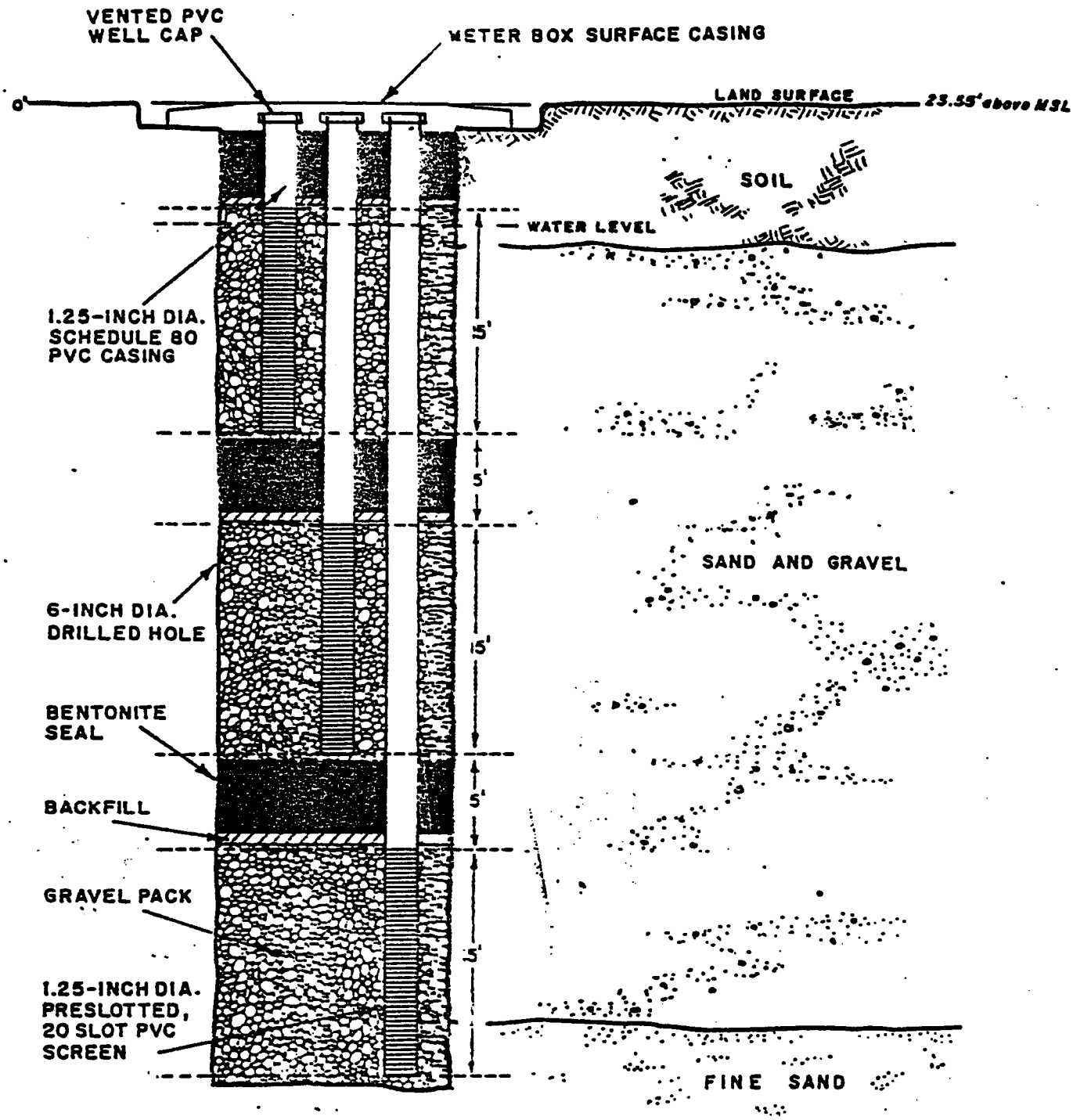


FIGURE 2

TYPICAL CONSTRUCTION OF OBSERVATION WELL CLUSTERS

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BAY SHORE, NEW YORK

Table 1. Summary of Construction Details for Observation Wells, LILCO Gas Plant Site, Bay Shore, Long Island, New York.

| Location Number | Date Drilled | Total Depth (feet below land surface) | Screened Interval (feet below land surface) | Ground Elevation (feet above mean sea level) a) |
|---|---|---|---|---|
| A | 8- 8-78 | 23.82 | 8.82 - 23.82 | 27.36 |
| | | 42.05 | 27.05 - 42.05 | 27.36 |
| | | 63.05 | 48.05 - 63.05 | 27.36 |
| 1 | 8- 4-78 | 21.61 | 6.61 - 21.61 | 23.51 b) |
| | | 42.52 | 27.52 - 42.52 | 23.51 b) |
| | | 63.72 | 48.72 - 63.72 | 23.51 b) |
| 2 | 8-10-78 | 23.63 | 8.63 - 23.63 | 17.87 |
| | | 48.94 | 33.94 - 48.94 | 17.87 |
| | | 71.65 | 56.65 - 71.65 | 17.87 |
| 2A | 8-14-78 | 23.91 | 8.91 - 23.91 | 22.48 |
| | | 50.24 | 35.24 - 50.24 | 22.48 |
| | | 74.80 | 59.80 - 74.80 | 22.48 |
| 3 | 8-15-78 | 21.78 | 6.78 - 21.78 | 17.45 |
| | | 45.03 | 30.03 - 45.03 | 17.45 |
| | | 68.18 | 53.18 - 68.18 | 17.45 |
| 4 | 8-16-78 | 23.83 | 8.83 - 23.83 | 19.95 |
| | | 45.29 | 30.29 - 45.29 | 19.95 |
| | | 68.63 | 53.63 - 68.63 | 19.95 |
| 5 | 11- 1-78 | 20.10 | 5.10 - 20.10 | 7.98 |
| | | 48.05 | 35.05 - 48.05 | 7.98 |
| | | 75.95 | 60.95 - 75.95 | 7.98 |
| 6 | 11- 2-78 | 23.97 | 8.97 - 23.97 | 11.73 |
| | | 50.40 | 35.40 - 50.40 | 11.73 |
| | | 75.05 | 60.05 - 75.05 | 11.73 |
| 7 | 11- 3-78 | 24.75 | 9.75 - 24.75 | 12.98 |
| | | 44.60 | 29.60 - 44.60 | 12.98 |
| | | 65.30 | 50.30 - 65.30 | 12.98 |
| 8 | 11- 6-78 | 21.35 | 6.35 - 21.35 | 5.94 |
| | | 44.95 | 29.95 - 44.95 | 5.94 |
| | | 63.25 | 48.25 - 63.25 | 5.94 |

Table 1. (Continued)

| Location Number | Date Drilled | Total Depth (feet below land surface) | Screened Interval (feet below land surface) | Ground Elevation (feet above mean sea level) |
|---|---|---|---|---|
| 9 | 11- 7-78 | 19.70 | 4.70 - 19.70 | 5.10 |
| | | 43.70 | 28.70 - 43.70 | 5.10 |
| | | 63.35 | 48.35 - 63.35 | 5.10 |
| 10 | 11- 8-78 | 19.65 | 4.65 - 19.65 | 6.46 |
| | | 36.25 | 21.25 - 36.25 | 6.46 |
| | | 65.15 | 50.15 - 65.15 | 6.46 |

Note

a) Top of meter box (measuring point datum) is equal to the ground elevation.

b) Elevation of measuring point datum (top of meter box) resurveyed subsequent to Phase I study.

Ground water in the upper glacial aquifer discharges into the southward-draining streams and enters Great South Bay as underflow. These streams are generally effluent (ground water discharges into them) for their entire length. Adjacent streams are separated by "local interstream divides" which may be regarded as imaginary vertical planes trending north-south between two discharge areas. In the study area, ground-water flow to the east of the ground-water divide would be toward Watchogue Creek and to the west, toward Lawrence Creek.

Local

The observation wells are screened in the upper glacial aquifer, which is approximately 75 feet thick in the study area. Geologic samples were collected during the drilling, and are described in Table 2. Locally, these deposits consist of sand and fine gravel with a clay unit found at approximately 70 to 75 feet below land surface at Clusters 6 through 10. This clay unit is believed to be the Gardiners Clay formation.

Water levels were measured in each of the observation wells on November 9 and again on December 1, 1978 (Table 3), to determine the configuration of the water table, which would provide information on ground-water flow rates and directions. The water table on December 1, 1978 is shown on Plate 1 where the contour lines represent equal ground-water elevations with flow perpendicular to these contours.

The water-table map indicates that ground-water flow within the study area is generally toward Great South Bay. Lawrence and Watchogue Creeks,

Table 2. Geologic Logs of Observation Wells at the LILCO Gas Plant Site, Bay Shore, Long Island, New York.

| Description | Depth (feet below land surface) | Thickness (feet) |
|---|---|---|
| **Cluster A** | | |
| Soil, brown to black; with medium to coarse sand | 0 - 1 | 1 |
| Sand, fine to medium, yellowish tan to light brown; with well rounded pebbles, predominately quartz with minor percentage mafic minerals | 1 - 71 | 70 |
| **Cluster 1** | | |
| Soil, silty, black; with very fine quartz sand | 0 - 1 | 1 |
| Sand, fine, light tan to brown; with coarse gravel and pebbles, orthoquartzic rock fragments | 1 - 60 | 59 |
| Sand, fine, tan to light brown; with silt; quartz sand with minor percentage mafic minerals | 60 - 65 | 5 |
| **Cluster 2** | | |
| Soil, brownish black; with medium to coarse sand | 0 - 1 | 1 |
| Sand, fine to medium, yellowish tan to light brown; with well rounded orthoquartzic rock fragments | 1 - 25 | 24 |
| Sand, medium, dark greenish to black; with well rounded pebbles; sample contains a high organic content and a $H_2S$ odor | 25 - 75 | 50 |
| **Cluster 2A** | | |
| Soil, light to medium brown; with sand, fine to medium; well rounded pebbles | 0 - 5 | 5 |
| Sand, fine to medium, tan to light brown; with pebbles and cobbles in upper section | 5 - 75 | 70 |
| **Cluster 3** | | |
| Sand, fine to medium, light tan; with pebbles | 0 - 35 | 35 |
| Sand, medium, light tan to brown; with pebbles | 35 - 70 | 35 |
| **Cluster 4** | | |
| Soil, brown to black; with sand | 0 - 4 | 4 |
| Sand, coarse, tan to brown; with gravel and pebbles | 4 - 70 | 66 |

Table 2. (Continued)

| Description | Depth (feet below land surface) | Thickness (feet) |
|---|---|---|
| **Cluster 5** | | |
| Sand, fine to medium, tan; trace of fine gravel, subround to subangular, predominantly quartz with minor percentage of mafic minerals | 0 - 76 | 76 |
| **Cluster 6** | | |
| Sand, medium to coarse, tan; trace of fine gravel and sand, subrounded to subangular, quartz with minor percentage of mafic minerals | 0 - 25 | 25 |
| Sand, medium to coarse, tan; fine gravel and very coarse sand; subrounded to subangular, quartz with minor percentage of rock fragments | 25 - 74 | 49 |
| Clay, gray; fine sand | 74 - 75 | 1 |
| **Cluster 7** | | |
| Sand, medium to coarse, tan; with fine gravel subrounded to subangular, quartz with minor percentage of mafic minerals | 0 - 5 | 5 |
| Sand, medium to coarse, tan; with fine gravel and very coarse sand, subrounded to subangular, quartz with minor percentage of mafic minerals | 5 - 65 | 60 |
| Clay, gray | 65 - 75 | 10 |
| **Cluster 8** | | |
| Soil, brown; fine sand, tan | 0 - 2 | 2 |
| Clay, gray; with high percentage of sand | 2 - 5 | 3 |
| Sand, fine to coarse, light brown; with very coarse sand and fine gravel, subrounded to subangular; quartz with minor percentage of mafic minerals | 5 - 20 | 15 |
| Sand, fine to coarse, tan, with very coarse sand and fine gravel, subrounded to subangular; quartz with monor percentage of mafic minerals | 20 - 65 | 45 |
| Clay, gray | 65 - 69 | 4 |

Table 2. (Continued)

| Description | Depth (feet below land surface) | Thickness (feet) |
|---|---|---|
| **Cluster 9** | | |
| Sand, coarse to medium, light brown; with fine gravel and very coarse sand, subrounded to subangular, quartz with minor percentage of mafic minerals | 0 - 5 | 5 |
| Sand, coarse to medium, tan; with fine gravel and very coarse sand, subrounded to subangular, quartz with minor percentage of mafic minerals | 5 - 40 | 35 |
| Sand, coarse to medium, tan; with fine gravel, quartz with minor percentage of mafic minerals | 40 - 70 | 30 |
| Clay, gray | 70 | |
| **Cluster 10** | | |
| Sand, medium to coarse, tan; with fine gravel and very coarse sand, subrounded to subangular, quartz with minor percentage of mafic minerals | 0 - 60 | 60 |
| Same as above, with trace of gravel and coarse sand | 60 - 68 | 8 |
| Clay, gray | 68 - 70 | 2 |

Table 3. Water-Table Elevations in Observation Wells, November 9 and December 1, 1978, LILCO Gas Plant Site, Bay Shore, Long Island, New York.

| Location No. | Total Depth (feet below land surface) | Ground Elevation[1] (feet above mean sea level) | November 9, 1978 Depth to Water (feet) | November 9, 1978 Water-Table Elevation (feet) | December 1, 1978 Depth to Water (feet) | December 1, 1978 Water-Table Elevation (feet) |
|---|---|---|---|---|---|---|
| A Shallow | 23.82 | 27.36 | 8.80 | 18.56 | 8.62 | 18.74 |
| Intermediate | 42.05 | 27.36 | 8.88 | 18.48 | 8.67 | 18.69 |
| Deep | 63.05 | 27.36 | 8.86 | 18.50 | 8.68 | 18.68 |
| 1 Shallow | 21.61 | 23.51[2] | 8.03 | 15.48 | 7.78 | 15.73 |
| Intermediate | 42.52 | 23.51[2] | 8.03 | 15.48 | 7.79 | 15.72 |
| Deep | 63.72 | 23.51[2] | 8.02 | 15.49 | 7.78 | 15.73 |
| 2 Shallow | 23.63 | 17.87 | 6.84 | 11.03 | 6.62 | 11.25 |
| Intermediate | 48.94 | 17.87 | 6.88 | 10.99 | 6.69 | 11.18 |
| Deep | 71.65 | 17.87 | 6.84 | 11.03 | 6.66 | 11.21 |
| 2A Shallow | 23.91 | 22.48 | 11.01 | 11.47 | 10.62 | 11.86 |
| Intermediate | 50.24 | 22.48 | 10.99 | 11.49 | 10.63 | 11.85 |
| Deep | 74.80 | 22.48 | 10.65 | 11.83 | 10.36 | 12.12 |
| 3 Shallow | 21.78 | 17.45 | 6.97 | 10.48 | 6.75 | 10.70 |
| Intermediate | 45.03 | 17.45 | 6.98 | 10.47 | 6.73 | 10.72 |
| Deep | 68.18 | 17.45 | 6.93 | 10.52 | 6.71 | 10.74 |
| 4 Shallow | 23.83 | 19.95 | 9.39 | 10.56 | 9.23 | 10.72 |
| Intermediate | 45.29 | 19.95 | 9.41 | 10.54 | 9.24 | 10.71 |
| Deep | 68.63 | 19.95 | 9.40 | 10.55 | 9.24 | 10.71 |
| 5 Shallow | 20.10 | 7.98 | 3.80 | 4.18 | 3.61 | 4.37 |
| Intermediate | 48.05 | 7.98 | 3.21 | 4.77 | 3.64 | 4.34 |
| Deep | 75.95 | 7.98 | 0.54 | 7.44 | 0.52 | 7.46 |
| 6 Shallow | 23.97 | 11.73 | 7.29 | 4.44 | 6.93 | 4.80 |
| Intermediate | 50.40 | 11.73 | 7.26 | 4.47 | 6.96 | 4.77 |
| Deep | 75.05 | 11.73 | 7.26 | 4.47 | 6.95 | 4.78 |
| 7 Shallow | 24.75 | 12.98 | 9.27 | 3.71 | 9.21 | 3.77 |
| Intermediate | 44.60 | 12.98 | 9.23 | 3.75 | 9.21 | 3.77 |
| Deep | 65.30 | 12.98 | 9.23 | 3.75 | 9.23 | 3.75 |
| 8 Shallow | 21.35 | 5.94 | 3.72 | 2.22 | 3.53 | 2.41 |
| Intermediate | 44.95 | 5.94 | 3.72 | 2.22 | 3.52 | 2.42 |
| Deep | 63.25 | 5.94 | 3.79 | 2.15 | 3.65 | 2.29 |

Table 3. (Continued)

| Location No. | Total Depth (feet below land surface) | Ground Elevation[1] (feet above mean sea level) | November 9, 1978 Depth to Water (feet) | November 9, 1978 Water-Table Elevation (feet) | December 1, 1978 Depth to Water (feet) | December 1, 1978 Water-Table Elevation (feet) |
|---|---|---|---|---|---|---|
| 9 Shallow | 19.70 | 5.10 | 2.98 | 2.12 | 2.77 | 2.33 |
| Intermediate | 43.70 | 5.10 | 2.95 | 2.15 | 2.77 | 2.33 |
| Deep | 63.35 | 5.10 | 3.14 | 1.96 | 3.07 | 2.03 |
| 10 Shallow | 19.65 | 6.46 | 4.67 | 1.79 | 4.29 | 2.17 |
| Intermediate | 36.25 | 6.46 | 4.66 | 1.80 | 4.29 | 2.17 |
| Deep | 65.15 | 6.46 | 4.78 | 1.68 | 4.55 | 1.91 |

Note:

1) Top of meter box (measuring point datum) is equal to the ground elevation.

2) Elevation of measuring point datum (top of meter box) resurveyed subsequent to Phase 1 study.

however, which bound the study area to the east and west, exert a substantial influence on the local flow and, along with Great South Bay, are areas of ground-water discharge.

Ground-water flow patterns indicate that the ground water beneath the site discharges into Lawrence Creek. There is also an indication that small amounts of ground water from the plant site may discharge into Watchogue Creek and directly into Great South Bay. However, ground-water quality data do not indicate measureable contamination migrating from the LILCO site to discharge areas other than Lawrence Creek.

Utilizing published data and calculated hydraulic gradients, ground-water flow rates were calculated from Wenzel (1942) where:

$$V = \frac{KI}{7.48\ Sy}$$

and:

V = average ground-water volocity in feet/day
K = coefficient of permeability in gpd/square feet
I = hydraulic gradient
Sy = specific yield of the aquifer in percent

Permeability is estimated to be 1,080 gpd/sq ft (gallons per day per square foot) (McClymonds and Franke, 1972), and specific yield is estimated at 25 percent (Pluhowski and Kantrowitz, 1964). Hydraulic gradients for the study area ranged from 0.0030 to 0.0068 ft/ft. The flow rate calculated from these values ranges from 1.7 to 3.9 feet per day.

Ground-water flow in the vertical dimension is shown in the hydrogeologic cross section (Figure 3). Differences in water-level elevations in

the three wells at each cluster provide information on vertical flow within the aquifer.

Figure 3 indicates that ground water flows horizontally downgradient from Cluster Locations A to 1 to 3. In contrast, a vertical component of flow exists from Cluster Locations 3 to 5, as indicated by a 3-foot head difference between Observation Wells 5 deep and 5 shallow. It is not possible to precisely identify the cause of this substantial upward flow from the limited data base; however, Cluster 5 is located near Lawrence Creek (discharge area), and some upward flow would be expected.

## GROUND-WATER QUALITY

Ground-water samples were collected from each observation well and were analyzed for organic chemicals. The analyses were performed by Grumman Chemical Engineering Department's Analytical Chemical Laboratory; their report is included as Appendix A. Sampling during the Phase I investigation was done using a hand-actuated suction pump, and two to three times the volume of water in the casing was removed prior to sampling. In the Phase II investigation, a minimum of one volume of water was pumped from the well prior to sampling and samples were collected by bailing to eliminate the possibility of cross contamination. The bailer was washed with clean water, acetone, and again with clean water, prior to sampling each well. Samples were collected, sealed, packed in ice, and brought to the Grumman Laboratory for analysis.

Subsequent to sampling the Phase II wells, all 36 wells were resampled

at least once and selected wells were resampled several times. All resampling was done with a bailer, using the rinse procedure outlined above.

Water-quality analyses were done through gas chromatography (GC), mass spectrometry (MS), ultraviolet spectroscopy, and colorimetry. The analytical results are shown in Tables 4 and 5. The analyses indicate that at least 16 individual organic compounds are present in Cluster 1. The compounds found in highest concentrations were identified as: $C_2$ benzenes, $C_3$ benzenes, methyl indene or divinyl benzene, naphthalene, and $C_2$ naphthalenes. Neither benzene nor toluene was detected at any location.

Mass spectra were produced from 14 GC peaks separated from the shallow well sample collected from Cluster 5. The following compounds were identified on the basis of matching with reference spectra: $C_3$ alkyl benzene, indene, methyl indene, naphthalene, methyl naphthalene, and acenaphthene. Methyl styrene, dimethyl naphthalene, fluorene, a $C_{14}H_{10}$ polynuclear aromatic hydrocarbon, and a phthalic acid ester were tentatively identified. The latter compounds were not confirmed because their extremely low concentrations prevented the production of enough definitive ion peaks in the MS.

Similar spectra were produced from the sample collected from the shallow well in Cluster 9. The only confirmed compound identification was for dibutyl phthalate. Another phthalic acid ester (or mixture)

Table 4. Concentrations of Naphthalene in Ground Water From Observation Wells at the LILCO Gas Plant Site, Bay Shore, Long Island, New York. (Concentrations in ug/l.)

| Location Number | Date | Shallow Well | Intermediate Well | Deep Well |
|---|---|---|---|---|
| A | 8-11-78 | <2 | <2 | <2 |
| | 1-24-79 | <1 | <1 | <1 |
| 1 | 8-11-78 | 3,900 | 36 | 18 |
| | 9- 1-78 | 1,500 | 3 | <1 |
| | 9- 7-78 | 1,500 | - | - |
| | 12- 4-78 | 2,050 | - | <1 |
| | 1-30-79 | 3,000 | 49 | <1 |
| 2 | 8-16-78 | 2 | <2 | <2 |
| | 9- 1-78 | <1 | - | - |
| | 9- 7-78 | 8 | - | - |
| | 1-24-79 | <1 | <1 | <1 |
| | 3-23-79 | <1 | <1 | <1 |
| 2A | 8-17-78 | <2 | <2 | <2 |
| | 12- 4-78 | - | <1 | 1.1 |
| | 1-24-79 | <1 | <1 | <1 |
| 3 | 8-16-78 | 800 | 2,800 | 15 |
| | 9- 1-78 | 600 | 3,900 | <1 |
| | 9- 7-78 | 800 | - | - |
| | 12- 4-78 | - | 5,040 | - |
| | 1-29-79 | 390 | 6,880 | 120 |
| | 3-23-79 | 163 | 8,700 | 137 |
| 4 | 8-17-78 | 6 | 3 | <2 |
| | 9- 1-78 | - | 1 | - |
| | 9- 7-78 | 13 | - | - |
| | 1-29-79 | 15 | <1 | <1 |
| 5 | 11- 3-78 | 1,540 | 13 | 2.5 |
| | 11-29-78 | 60 | <1 | <1 |
| | 1-16-79 | 212 | <1 | <1 |
| | 3-23-79 | 1,410 | <1 | <1 |
| 6 | 11- 6-78 | <1 | <1 | 1.2 |
| | 11-29-78 | <1 | <1 | <1 |
| | 1-16-79 | <1 | <1 | <1 |
| | 3-23-79 | <1 | <1 | <1 |
| 7 | 11- 6-78 | <1 | <1 | <1 |
| | 11-30-78 | <1 | <1 | <1 |
| | 1-15-79 | <1 | <1 | <1 |

Table 4. (Continued)

| Location Number | Date | Shallow Well | Intermediate Well | Deep Well |
|---|---|---|---|---|
| 8 | 11- 8-78 | <1 | <1 | <1 |
| | 11-30-78 | <1 | <1 | <1 |
| | 1-16-79 | <1 | <1 | <1 |
| 9 | 11- 8-78 | <1 | <1 | <1 |
| | 11-30-78 | 1 | <1 | <1 |
| | 1-15-79 | <1 | <1 | <1 |
| 10 | 11- 9-78 | <1 | <1 | <1 |
| | 11-30-78 | <1 | <1 | <1 |
| | 1-15-79 | <1 | <1 | <1 |
| Well on creek bank | 3-30-79 | <1 | - | - |
| Lawrence Creek | | | | |
| Upstream | 3-30-79 | <1 | - | - |
| | 4-10-79 | <1 | - | - |
| Downstream | 3-30-79 | <1 | - | - |

Note:

- Indicates sample not collected

Table 5. Concentrations of Phenols in Ground Water From Observation Wells at the LILCO Gas Plant Site, Bay Shore, Long Island, New York. (Concentrations in ug/l.)

| Location Number | Date | Shallow Well | Intermediate Well | Deep Well |
|---|---|---|---|---|
| A | 8-11-78 | < 3 | < 3 | < 3 |
| 1 | 8-11-78 | 22 | < 3 | < 3 |
| 1 | 12- 4-78 | 19 | 3 | 2 |
| 2 | 8-16-78 | < 2 | < 2 | < 2 |
| 2A | 12- 4-78 | 2 | 2 | 2 |
| 3 | 8-16-78 | 9 | < 2 | < 2 |
| 3 | 12- 4-78 | 13 | 2 | 2 |
| 4 | 8-17-78 | 3 | < 2 | < 2 |
| 5 | 11- 3-78 | 32 | 24 | 20 |
| 6 | 11- 6-78 | 25 | 35 | 40 |
| 7 | 11- 6-78 | 24 | 32 | 50 |
| 8 | 11- 8-78 | 25 | 25 | 32 |
| 9 | 11- 8-78 | 28 | 31 | >50 |
| 10 | 11- 9-78 | 32 | 32 | >50 |

was indicated by an ion peak of 149 m/e in the spectrum, but the concentration was less than the minimum for identification. No naphthalene was detected or even suggested in this sample.

A semi-quantitative species distribution analysis, utilizing GC/MS techniques, identified naphthalene as the constituent present in highest concentrations. Results indicate that naphthalene constitutes approximately 50 percent (75 percent if $C_1$ and $C_2$ naphthalenes are included) of the organic compounds identified. Its presence was used as an indicator of ground-water contamination. Phenols were determined by a standard colorimetric method.

Phenols are a potential contaminant from gas conversion plants, however, phenol was not detected in a pattern that would indicate its origin as a product of LILCO's gas plant. Low phenol levels were detected in most ground-water samples, but this is not surprising as phenols are natural products of the decomposition of organic matter and are found in ground water far removed from man-derived sources of contamination.

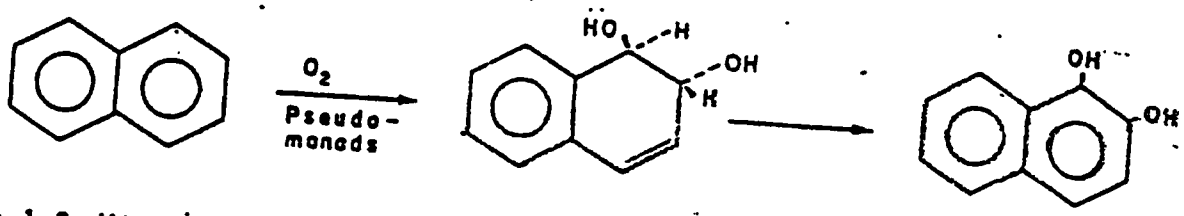
Naphthalene-contaminated ground water was found in a plume extending from Cluster Locations 1 to 5 (Plate 2). Naphthalene concentrations are high in at least one observation well at Clusters 1, 3, and 5 (Table 4). The plume of contaminated ground water appears limited in lateral extent (± 500 feet) and extends approximately 3,500 feet from

the plant site to a discharge area at Lawrence Creek. Other ground-water samples collected in the study area have virtually no significant concentrations of naphthalene. Lawrence Creek was sampled at two points on April 30, 1979 (Plate 2). The upstream sample was collected within the plume's discharge area, and the downstream sample was collected near the mouth of the creek. Neither sample contained detectable levels of naphthalene (Table 4).

A well was installed on the northeast bank of Lawrence Creek on the Town of Brightwaters property, to further define the approximate extent of the plume of contaminated ground water and its discharge to Lawrence Creek (Plate 2). The well was installed on April 10, 1979 by hand augering to 2.5 feet below the water table and a 2-inch diameter PVC pipe was hand slotted for 2.5 feet and lowered into the hole. The screen was set so that it intersected the water table, and the well was developed with a hand pump. A sample was collected from the well and another from Lawrence Creek (within the plume's discharge area) on this date. Neither sample contained detectable concentrations of naphthalene (Table 4).

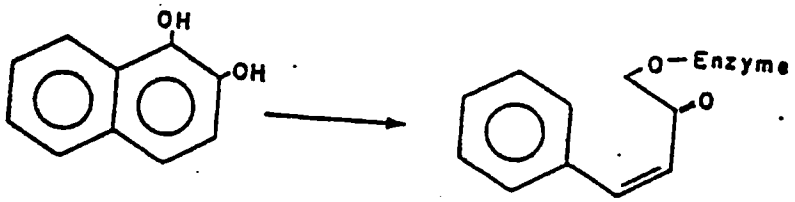
As naphthalene is the major constituent moving toward marine waters in the contaminated ground water, a limited literature search was made to find evidence indicating whether soil or marine microorganisms could decompose the chemical.

Naphthalene is metabolized by soil soil microbes through D-trans-1,2-dihydro-1,2-dihydroxynaphthalene to 1,2-dihydroxynaphthalene which subsequently undergoes ring cleavage (I).



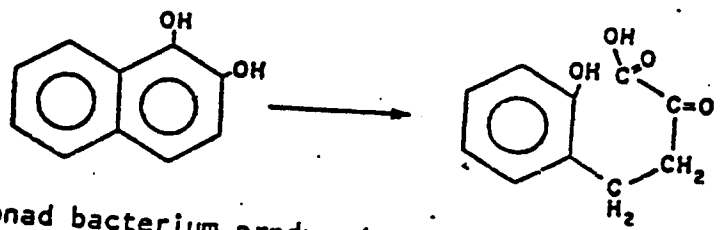

I

When 1,2-dihydroxynaphthalene was the substrate, o-coumarinate appeared as a metabolic product (II).



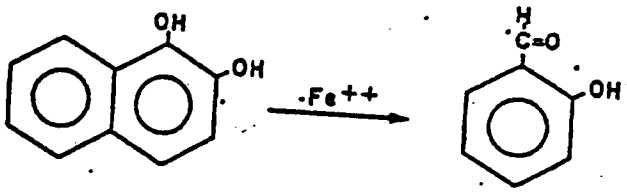

II

Davies and Evans (1962) investigated the decomposition of 1,2-dihydroxynaphthalene and found a product having the same properties as o-hydroxybenzalpyruvic acid (III).




III

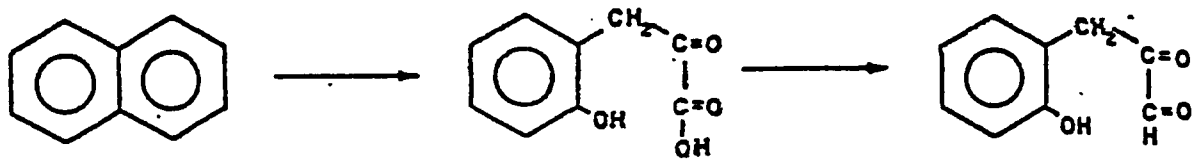
The same Pseudomonad bacterium produced salicylaldehyde from 1,2-dihydroxynaphthalene (IV).




IV

These observations support the view that ring fission of 1,2-dihydroxynaphthalene by this bacterium occurs at the bond between the carbon shared by the rings, and the number 1 carbon. This scission gives o-hydroxybenzal-

pyruvate, which undergoes decarboxylation to o-coumaric aldehyde, followed by oxidation to o-coumarinate.




Metabolism of naphthalene is also possible in the marine environment. Davis (1967) reports on the production of naphthenic acids by bacterial action on petroleum by denitrifying Pseudomonads and sulfate-reducing bacteria.

There is reasonable evidence to support the hypothesis that naphthalene may undergo decomposition in the soil. Once it reaches ground water, however, lack of oxygen and a microbial population reduces the rate of further degradation. Should naphthalene reach the bay or creek with discharging ground water, further decomposition at an accelerated rate would be expected because microorganisms and oxygen will be restored. note

The vertical distribution of the contaminants indicates that the plume is probably moving downward in the aquifer from the shallow well at Cluster Location 1 to the intermediate well at Location 3. This vertical configuration of the plume would be expected under normal conditions of ground-water flow and, as the plume moves through the aquifer, it is displaced downward by recharge.

From Cluster Locations 3 to 5, the contaminants appear to be migrating upward in the aquifer as indicated by the contamination of the shallow well at Location 5. At Cluster Location 5, an upward component of flow is indicated by the differences in head between the wells (Table 3). Both hydrogeologic and chemical data indicate this upward movement of the contaminants.

## CONCLUSIONS

1. Geologic deposits in the study area consist of predominantly fine to medium sand with high permeabilities. A clay unit (probably the Gardiners Clay) was encountered at approximately 70 feet below land surface.

2. Ground water in the study area is flowing southward at a rate of approximately 2 to 4 feet per day.

3. Sixteen organic compounds were identified in the shallow ground water.

4. Based on chemical data, it appears that ground water at Clusters A, 2A, 2, 6, 7, 8, 9, and 10 is not contaminated by constituents that would characterize LILCO's former operations at the site.

5. Ground water from Cluster 4 contains relatively low concentrations (15 or fewer micrograms per litre) of naphthalene. Naphthalene was present in highest concentrations, about 1.5 to 8.7 mg/l (milligrams per litre), at the plant site (Cluster 1) and at two locations (Clusters 3 and 5) south of the site.

6. A relatively narrow plume of contaminated ground water, as indicated by the concentrations of naphthalene, extends from Cluster Location 1 to Locations 3 and 5.

7. The plume appears to be moving downward in the aquifer from Location 1 to Location 3 and upward from 3 to 5. This is indicated by both

chemical analyses of water samples and ground-water head relationships.

8. The plume of contaminated ground water appears to be discharging into Lawrence Creek. The limits of the discharge area can only be approximated since they are modified by natural changes in the water-table configuration.

Respectfully submitted,

GERAGHTY & MILLER, INC.

William Sarni
Hydrogeologist

Olin C. Braids
Senior Scientist

John Isbister
Vice President

June 18, 1979

EPA WORK ASSIGNMENT NO: 076-2JZZ
EPA CONTRACT NO: 68-W8-0110
FOSTER WHEELER ENVIRONMENTAL CORPORATION
ARCS II PROGRAM

# FINAL
# SCREENING SITE INSPECTION (SSI)
# BAY SHORE GAS PLANT
# BAY SHORE
# SUFFOLK COUNTY, NEW YORK
# CERCLIS NO: NYD986881654

SEPTEMBER 1997

VOLUME II OF III

NOTICE

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**REFERENCE 9**

TO: FOR THE RECORD DATE: Feb. 3, 1977

FROM: Robert Falk, Environmentalist II, S.C.D.E.C.

SUBJECT: LILCO Bayshore Gas Plant
Groundwater Contamination Survey

**********

On Nov. 16, 1976 I interviewed Mr. Burt Flamberg, an officer of Summer's Lumber Co., 70 N. Clinton Ave., Bayshore. The following is a summary of that interview and subsequent inspection:

1. Just after W.W. II Summer's Lumber began complaining to LILCO of strong tarry gaseous odors entering their building from the basement. Prior to 1950, LILCO provided an exhaust fan for the basement to help alleviate odors.

2. If exhaust fan breaks down, the odor permeates the entire building.

3. If groundwater level rises, which happens once or twice a year, an inch or so of "terribly smelling" water oil emulsion enters the basement and the exhaust fan helps only minimally to control odors.

4. Inspection of basement found that over the years oil and tar had seeped through the walls. The odor of this residue was identical to that of those odors found at the LILCO site. Oily residue could be seen on the basement floor, resulting from groundwater fluctuations.

5. Mr. Flamberg spoke of two homes which had been located just South of the lumber yard. One was owned by [redacted] Ex. 6, now residing in Arizona (c/o [redacted] Ex. 6 [redacted] Ex. 6). The other was owned by [redacted] Ex. 6. Due to persistent odor complaints by these owners, LILCO bought and destroyed these homes in the 1950's.

Nov. 17, 1976 interview with Joseph Wind, owner of Midtown Automotive, N/W corner of Union Blvd. and Clinton Ave., Bayshore. Midtown was built on the property owned by [redacted] Ex. 6 and [redacted] Ex. 6:

1. After LILCO demolished the 2 homes, the land lay vacant for 7 or 8 years until Midtown built their shop in 1965. As construction began for the garage, Wind noticed very strong odors emanating from the ground. He, therefore,

The redacted information consists of names, addresses and/or phone numbers of private individuals. Disclosure of this information would constitute a clearly unwarranted invasion of personal privacy and thus is exempt from mandatory disclosure by virtue of Exemption 6 of the FOIA, 5 U.S.C. § 552(b)(6).

decided to place 2 sheets of heavy polyurethane sheeting on the ground to separate his concrete pad from the smelly earth. Odors remained in his building for about 6 months.

2. In 1975 when the road in front of Midtown was opened to lay sewers for the S.W.S.D. the workers stopped work due to heavy gaseous odors and called LILCO, thinking there was a gas leak. No leak was found.

Inspection of basement at 65 Clinton Ave., Bayshore on Nov. 17, 1976:

1. Tarry oily odors identical to those found at LILCO site evident in basement. Some seepage could be seen up to 1' above the floor.

Brief interview with [redacted] Ex. 6 on Nov. 17, 1976:

1. [redacted] Ex. 6 complained of serious long term odor problems in her basement. She had complained on numerous occasions to LILCO to no avail.

Interview with [redacted] Ex. 6, electrician, [redacted] Ex. 6 on Jan. 27, 1977:

1. Just before W.W.II one Mr. Pathey, who owned Pathey Florists, sued LILCO for damages to his greenhouse located 2 blocks South of the LILCO plant. Gaseous odors had emanated from the earth and rendered the house useless.

2. In 1933 [redacted] Ex. 6 had been asked to drill a well for his brother-in-law residing on Smith St., Bayshore, approximately 300 feet North of Montauk Highway. The well was driven 20' and the resulting groundwater had the odor of the gas plant located 5 or 6 blocks away. When the depth was increased to 40' the odors subsided. At this same time many area residents with hand pump wells drilled to around 15' were forced to abandon them.

**SUMMARY -**

This investigation was prompted by a complaint from workers on the S.W.S.D. They found that the "dry sewer" lines placed in the area of the LILCO plant were full of odorous water. They

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To: FOR THE RECORD
Re: LILCO Bayshore Gas Plant  Feb. 3, 1977

recognized the odor as being identical to that of the old LILCO site and suspected illegal dumping into the sewers.

I was skeptical of this explanation as the sewers do not have any easy access for dumping. Additionally, since groundwater depth in the area is 6', I felt it possible that the water in the sewer lines was actually contaminated groundwater intrusion.

This theory was substantiated by interviews with area residents long familiar with the area South of the LILCO site. This area coincides with the direction of groundwater flow. It appears that contaminants from the LILCO plant have been allowed to join the groundwater and that this may have started as early as the early 1900's.

Further work on this contamination should be conducted. The full extent of contamination must be determined. Many questions must be answered such as: Are there any potable water sources now included in the plume? Will there be any detrimental effects on the marine ecology of the Great South Bay? Or has there already been? And, finally, will the contamination reach the potable water supplies of various Fire Island communities?

Robert Falk
RF/rt
RMF

**REFERENCE 10**

02-8904-18-PA
REV. NO. 0

# FINAL DRAFT
# PRELIMINARY ASSESSMENT
# BAY SHORE GAS PLANT
# BAY SHORE, NEW YORK

PREPARED UNDER

TECHNICAL DIRECTIVE DOCUMENT NO. 02-8904-18
CONTRACT NO. 68-01-7346

FOR THE

ENVIRONMENTAL SERVICES DIVISION
U.S. ENVIRONMENTAL PROTECTION AGENCY

AUGUST 23, 1989

NUS CORPORATION
SUPERFUND DIVISION

SUBMITTED BY:

JOANN L. WAGNER
PROJECT MANAGER

GERALD V. GILLILAND
SITE MANAGER

REVIEWED/APPROVED BY:

RONALD M. NAMAN
FIT OFFICE MANAGER

NYD986881654
BAY SHORE
SUFFOLK
N

NUS CORPORATION
A Halliburton Company



# FIELD INVESTIGATION TEAM ACTIVITIES AT UNCONTROLLED HAZARDOUS SUBSTANCES FACILITIES — ZONE I

NUS CORPORATION
SUPERFUND DIVISION

# POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT

## PART I: SITE INFORMATION

1. Site Name/Alias Bay Shore Gas Plant

   Street Fifth Avenue near Jackerson Street

   City Bay Shore State New York Zip 11706

2. County Suffolk County Code 103 Cong. Dist. 02

3 EPA ID No. NYD986881654

4. Latitude 40° 43' 26"N Longitude 73° 15' 29"W

   USGS Quad. Bay Shore West, New York, 7.5 minute series

5. Owner Long Island Lighting Co. (LILCO) Tel. No. (516) 420-6132

   Street 175 East Old Country Road

   City Hicksville State New York Zip 11801

6. Operator Same as Owner Tel. No. _____

   Street _____

   City _____ State _____ Zip _____

7. Type of Ownership

   ☒ Private ☐ Federal ☐ State
   ☐ County ☐ Municipal ☐ Unknown ☐ Other _____

8. Owner/Operator Notification on File

   ☐ RCRA 3001 Date _____ ☐ CERCLA 103c Date _____
   ☐ None ☒ Unknown

9. Permit Information

| Permit | Permit No. | Date Issued | Expiration Date | Comments |
|---|---|---|---|---|
| NY State Dept. of Health Permit to Discharge Sewage or Wastes into the Waters of the State | Unknown | 3/8/26 | Unknown | Discharge unpolluted wastewaters into Watchogue Creek at Oak St.; discharge polluted wastes "into groundwaters tributary to Watchogue Creek" on LILCO property. |

9. **Permit Information (Cont'd)**

| Permit | Permit No. | Date Issued | Expiration Date | Comments |
|---|---|---|---|---|
| NY State Dept. of Health Permit to Discharge Sewage or Wastes into the Waters of the State | Unknown | 12/5/41 | Unknown | Waste effluent into Watchogue Creek through an existing outlet sewer. |
| NY State Dept. of Health Permit to Discharge Sewage or Wastes into the Waters of the State | Unknown | 6/10/49 | Unknown | Waste effluent into Watchogue Creek through an existing outlet sewer. Apparently no discharges to the ground after 1952 conversion to oil gas. All waters treated and discharged to Watchogue Creek since that time. |

10. **Site Status**

☐ Active ☒ Inactive ☐ Unknown

11. **Years of Operation** 1898 to 1973

12. **Identify the types of waste units (e.g., landfill, surface impoundment, piles, stained soil, above- or below-ground tanks or containers, land treatment, etc.) on site. Initiate as many waste unit numbers as needed to identify all waste sources on site.**

(a) **Waste Management Areas**

| Waste Unit No. | Waste Unit Type | Facility Name for Unit |
|---|---|---|
| 1 | Leaching Pit | Tar and Drip Collecting Pit |

(b) **Other Areas of Concern**

**Identify any miscellaneous spills, dumping, etc. on site; describe the materials and identify their locations on site.**

Approximately from 1898 until the early 1920s, it is believed that some oily wastes and tars from the water gas process were dumped directly onto the ground surface at the LILCO property west of Clinton Ave. (referred to as the Brightwaters Yard). No estimate of the quantities could be made.

In 1949, neighbors to the south of the site on Fifth Ave. complained of oil in their basements. It was found that the underground drip oil storage tank and transfer system on site were extensively corroded. Drip oil contains benzene, toluene, and naphthalene. The storage tank and transfer system were removed from service in 1949 and 1952, respectively. A ground oil recovery system was used until 1953. Occasional complaints of oil in the ground were received in the late 1950s and early 1960s.

In 1976, Suffolk Water and Sewer Department (SWSD) workers found that "dry sewer" lines placed in the vicinity of the LILCO plant were full of odorous water and recognized the odor as identical to that at the old LILCO site. Their complaints prompted an investigation by a Suffolk County Department of Environmental Control (SCDEC) representative, which included interviews with longtime area residents and subsequent inspections. Several neighbors south of the site complained of long-term oily odor problems in their basements. Oily residues were noted on the basement floors and walls of several houses. A representative of the Summer's Lumber Co., located at 70 N. Clinton Ave., said that just after World War II, the company complained to LILCO of strong tarry odors entering its building from the basement. LILCO provided an exhaust fan to alleviate odors. During the interview in 1976, it was reported that when the fan breaks down, the odor permeates the entire building. The representative also reported that LILCO bought and destroyed two houses just south of the lumber yard in the 1950s because of persistent odor complaints by the owners. Another interviewee reported drilling a well 20 feet deep in 1933 and encountering groundwater with the odor of the gas plant, which was located five or six blocks away. When the well depth was increased to 40 feet, the odor subsided.

A Ground-Water Investigation by Geraghty and Miller, Inc. completed in June 1979 identifies a narrow groundwater contamination plume, based on naphthalene concentrations, emanating south from the site to Lawrence Creek.

Ref. Nos. 1 through 8

13. **Information available from**

| | | |
|---|---|---|
| **Contact** Amy Brochu | **Agency** U.S. EPA | **Tel. No.** (201) 906-6802 |
| **Preparer** Gerald V. Gilliland | **Agency** NUS Corp. Region 2 FIT | **Date** 8/23/89 |

## PART II: WASTE SOURCE INFORMATION



**For each of the waste units identified in Part I, complete the following six items.**

**Waste Unit** 1 - Leaching Pit, Tar and Drip Collecting Pit

1. **Identify the RCRA status and permit history, if applicable, and the age of the waste unit.**

   A permit to discharge polluted wastes into the groundwaters tributary to Watchogue Creek was issued on March 8, 1926. The leaching pit was used until the early 1940s.

2. **Describe the location of the waste unit and identify clearly on the site map.**

   The leaching pit was located 195 feet due north of the southwest corner of the eastern portion of the site, near the intersection of Clinton Avenue and the railroad tracks that parallel the south property boundary.

3. **Identify the size or quantity of the waste unit (e.g., area or volume of a landfill or surface impoundment, number and capacity of drums or tanks). Specify the quantity of hazardous substances in the waste unit.**

   It was estimated that at the time of disposal an average flow of 500 gallons per day (gpd) and a maximum flow of 5000 gpd of wastewater went into the leaching pit.

4. **Identify the physical state(s) of the waste type(s) as disposed of in the waste unit. The physical state(s) should be categorized as follows: solid, powder or fines, sludge, slurry, liquid, or gas.**

   The material discharged into the leaching pit was described by LILCO as steam used to heat the holder seals, condensation from the gas in the holder itself, rainwater caught in the holder tank, and entrained water pumped with the tar from the tar separator. The leaching pit was used in the 1940s for infrequent tar disposal. A SCDEC representative described the waste found in the leaching pit in 1976 as sludge oils.

5. **Identify specific hazardous substance(s) known or suspected to be present in the waste unit.**

   A January 20, 1977 SCDEC inter-office memorandum from its Chem Lab indicates that analysis of an "extract of the pit source material" found that toluene, indene, naphthalene, a- or B-methylnaphthalene or both, and dimethylnaphthalene (10 possible isomers) were present as major components. The leaching pit is referred to on a Plan of Gas Works as the Tar and Drip Collecting Pit. The term drip refers to drip oil, which contains naphthalene, benzene, and toluene. A groundwater contamination plume emanating from the site, as based on naphthalene concentrations, was described in 1979. Also, due to the nature of the facility and the wastes which may have been disposed of in the leaching pit, the potential exists for any one, or a number, of the following specific hazardous substances to be present:

| | | |
|---|---|---|
| benzene | benzo(a)pyrene | boron |
| toluene | perylene | copper |
| xylenes | benzo(g,h,i)perylene | lead |
| phenol | benzo(b)chrysene | fluorine |
| cresols | dibenz(a,h)anthracene | manganese |
| xylenols | polychlorinated biphenyls | mercury |
| pyridine | aluminum | molybdenum |
| naphthalene | iron | nickel |
| methylnaphthalene | magnesium | selenium |
| dimethylnaphthalenes | titanium | tellurium |
| acenaphthene | sodium | thallium |
| carbazole | potassium | tin |
| fluoranthene | sulphur | uranium |
| anthracene | phosphorous | vanadium |
| pyrene | antimony | zinc |
| chrysene | arsenic | |
| benz(a)anthracene | barium | |
| benzo(k)fluoranthene | beryllium | |

6. **Describe the containment of the waste unit as it relates to contaminant migration via groundwater, surface water, and air.**

A representative of the Suffolk County Department of Health Services and formerly of the SCDEC described the leaching pit as a large rectangular underground concrete box with perforated sides, found in 1976 to contain sludge oils. Wastewaters were discharged into the pit and allowed to infiltrate into the ground. The narrow groundwater contamination plume described by Geraghty and Miller, Inc., based on naphthalene concentrations, extends south from the eastern portion of the site to the edge of Lawrence Creek, a groundwater discharge area, but contaminants were not detected in the creek.

Ref. Nos. 1, 2, 4 through 11

# PART III: HAZARD ASSESSMENT



## GROUNDWATER ROUTE

1. **Describe the likelihood of a release of contaminant(s) to the groundwater as follows: observed, alleged, potential, or none. Identify the contaminant(s) detected or suspected, and provide a rationale for attributing the contaminant(s) to the facility.**

   A groundwater contamination plume emanating south from the site, based on naphthalene concentrations, was described in the 1979 Geraghty and Miller, Inc. report. An outline of the plume is included in the report. Other contaminants identified in groundwater samples collected during the investigation include $C_2$ benzenes, $C_3$ benzenes, methyl indene, methylnaphthalene, acenaphthene, dibutyl phthalate, and phenols. An analysis of an "extract of the pit source material" in 1977 indicated that it contained naphthalene, indene, toluene, a- or B-methylnaphthalene or both, and dimethylnaphthalene (10 possible isomers). Many of the compounds found in the groundwater samples and in the pit source material are typically found in manufactured gas plant tars.

   Ref. Nos. 5, 7, 9

2. **Describe the aquifer of concern; include information such as depth, thickness, geologic composition, permeability, overlying strata, confining layers, interconnections, discontinuities, depth to water table, groundwater flow direction.**

   The Magothy Aquifer is the aquifer of concern in the vicinity of the Bay Shore Gas Plant. Its surface lies at depths between 75 and 154 feet below the ground surface in the vicinity of the site. The undifferentiated Matawan Group-Magothy Formation, in which the aquifer is contained, consists of fine to coarse sand, gravel, interstitial clay and silt, and beds and lenses of clay. The unit generally has a moderate hydraulic conductivity and is approximately 800 to 900 feet thick in the vicinity of the site. The Gardiners Clay, a unit consisting of clay, silt, clayey and silty sand, and clayey and silty gravel overlies the Magothy Formation, but it is not continuous throughout the 3-mile radius around the site. The Gardiners Clay is 0 to 30 feet thick in the area. The unit has a low hydraulic conductivity and tends to confine water in the underlying Magothy Aquifer. The Magothy, however, is to some degree hydraulically connected through the unit to the overlying Upper Glacial Aquifer, which extends from the top of the Gardiners Clay (where present) to the surface, is approximately 50 to 150 feet thick, and contains the water table. The Upper Glacial Aquifer consists mainly of sand and gravel of moderate to high permeability. Beneath the site, the water table is at a depth of approximately 7 feet below ground surface. Groundwater is moving south.

   Ref. Nos. 5, 12, 13, 14

3. **Is a designated sole source aquifer within 3 miles of the site?**

   The site is located within the area delineated as the sole source aquifer area underlying Suffolk and Nassau Counties as published in the Federal Register, Vol. 43, No. 120, June 21, 1978.

   Ref. No. 15

4. **What is the depth from the lowest point of waste disposal/storage to the highest seasonal level of the saturated zone of the aquifer of concern?**

   The lowest point of waste disposal was in the leaching pit, the depth of which is unknown. A depth of 6 feet below ground surface will be assumed. The water table is approximately 7 feet below ground surface at the site, so the depth from the lowest point of waste disposal to the water table is approximately 1 foot.

   Ref. Nos. 2, 5, 6, 7, 8

5. **What is the permeability value of the least permeable continuous intervening stratum between the ground surface and the aquifer of concern?**

The least permeable continuous stratum in the unsaturated zone between the ground surface and the Magothy Aquifer, the surficial Upper Glacial Aquifer deposits, has a permeability value estimated to be greater than $10^{-3}$ cm/sec.

Ref. Nos. 12, 16

6. **What is the net precipitation for the area?**

The net annual precipitation in the vicinity of the site is approximately 14 inches.

Ref. No. 16

7. **Identify uses of groundwater within 3 miles of the site (i.e., private drinking source, municipal source, commercial, industrial, irrigation, unusable).**

Groundwater within 3 miles of the site is known to be used for municipal water supply, and is probably also used for industrial, commercial, and other freshwater supply purposes.

Ref. Nos. 12, 13, 15, 17

8. **What is the distance to and depth of the nearest well that is currently used for drinking or irrigation purposes?**

**Distance** 0.4 mile **Depth** 592, 775, and 776 feet

Ref. Nos. 13, 18

9. **Identify the population served by the aquifer of concern within a 3-mile radius of the site.**

Approximately 171,000 people use groundwater obtained within 3 miles of the facility as a potable supply.

Ref. Nos. 17, 18

**SURFACE WATER ROUTE**

10. **Describe the likelihood of a release of contaminant(s) to surface water as follows: observed, alleged, potential, or none. Identify the contaminant(s) detected or suspected, and provide a rationale for attributing the contaminants to the facility.**

The plume of contaminated groundwater described by Geraghty and Miller, Inc. in 1979 emanated south from the eastern portion of the site to the edge of Lawrence Creek, a groundwater discharge area. Contaminants were not detected in Lawrence Creek, but there is potential for contaminants to proceed toward and enter into the creek. There is little potential for contaminant migration through overland runoff because there is a railroad spur adjacent to the southern edge of the site (in the downslope direction).

Ref. Nos. 5, 13

**11. Identify and locate the nearest downslope surface water. If possible, include a description of possible surface drainage patterns from the site.**

The facility slopes very slightly to the south. The nearest downslope surface water is the O-co-nee Lake, approximately 1600 feet south of the site. However, there is a railroad spur adjacent to the southern edge of the site. It is unknown whether runoff passes under the spur (i.e., as through a storm drain) and continues to the lake or whether runoff follows the path of the railroad spur. There are also several roads between the site and O-co-nee Lake.

Ref. No. 13

**12. What is the facility slope in percent? (Facility slope is measured from the highest point of deposited hazardous waste to the most downhill point of the waste area or to where contamination is detected.)**

The facility slope is estimated to be less than 1 percent to the south.

Ref. No. 5

**13. What is the slope of the intervening terrain in percent? (Intervening terrain slope is measured from the most downhill point of the waste area to the probable point of entry to surface water.)**

The intervening terrain slope is estimated to be less than 1 percent. The elevation change from the site to the O-co-nee Lake is approximately 9 feet, and the shortest possible overland route is approximately 1600 feet, assuming that runoff passes under the railroad spur rather than along it, and over or under the roads between the site and the lake.

Ref. No. 13

**14. What is the 1-year 24-hour rainfall?**

The 1-year 24-hour rainfall in the vicinity of the site is approximately 2.75 inches.

Ref. No. 16

**15. What is the distance to the nearest downslope surface water? Measure the distance along a course that runoff can be expected to follow.**

The O-co-nee Lake is approximately 1600 feet downslope from the site, assuming that the runoff path is under the railroad spur and roads rather than along them.

Ref. No. 13

**16. Identify uses of surface waters within 3 miles downstream of the site (i.e., drinking, irrigation, recreation, commercial, industrial, not used).**

Surface waters within 3 miles downstream of the site are not used for drinking or irrigation. The small lakes and streams are classified as suitable for use for fishing and for secondary contact recreational activities such as boating. Actual uses are unknown.

Ref. Nos. 13, 19, 20

17. **Describe any wetlands, greater than 5 acres in area, within 2 miles downstream of the site. Include whether it is a freshwater or coastal wetland.**

There are no coastal or freshwater wetlands greater than 5 acres in area within 2 miles downstream of the site.

Ref. No. 13

18. **Describe any critical habitats of federally listed endangered species within 2 miles of the site along the migration path.**

There are no critical habitats of federally listed endangered species within 2 miles of the site along the migration path.

Ref. No. 21

19. **What is the distance to the nearest sensitive environment along or contiguous to the migration path (if any exist within 2 miles)?**

No sensitive environments exist within 2 miles of the site along the potential migration route.

Ref. Nos. 13, 21

20. **Identify the population served or acres of food crops irrigated by surface water intakes within 3 miles downstream of the site and the distance to the intake(s).**

No surface water intakes are known to exist along the potential migration route.

Ref. Nos. 12, 13, 15, 17, 19, 20

21. **What is the state water quality classification of the water body of concern?**

The state water classification of the O-co-nee and Lawrence Lakes is "C". Class "C" waters are considered suitable for fishing and fish propagation. Such waters are also considered suitable for primary and secondary contact recreation, even though other factors may limit the use for that purpose. The state water classification of the Lawrence and Watchogue Creeks is "I". Class "I" waters are considered suitable for secondary contact recreation and any other usage except for primary contact recreation and shellfishing for market purposes.

Ref. Nos. 19, 20

22. **Describe any apparent biota contamination that is attributable to the site.**

No biota contamination was noted in available background information or during the off-site reconnaissance conducted by NUS Corporation Region 2 FIT on April 17, 1989.

Ref. Nos. 1, 2, 3, 4

**AIR ROUTE**

23. **Describe the likelihood of a release of contaminant(s) to the air as follows: observed, alleged, potential, none. Identify the contaminant(s) detected or suspected, and provide a rationale for attributing the contaminant(s) to the facility.**

There has never been a documented incidence of a release of contaminants from the site to the air. The site has been inactive for approximately 16 years, except for its use as a substation for transmission of electricity. The potential for release of contaminants from the site to the air is low.

Ref. Nos. 2, 22

**24. What is the population within a 4-mile radius of the site?**

The population within 4 miles of the site is approximately 144,700.

Ref. No. 23

**FIRE AND EXPLOSION**

**25. Describe the potential for a fire or explosion to occur with respect to the hazardous substance(s) known or suspected to be present on site. Identify the hazardous substance(s) and the method of storage or containment associated with each.**

There have been no documented incidences of fire or explosion at the facility. The site has been inactive for 16 years, except for its use as a substation for transmission of electricity. The mineral oil transformers used on site contain less than 500 parts per million (ppm) of polychlorinated biphenyls (PCBs). The potential for fire or explosion to occur with respect to hazardous substances at the facility is low.

Ref. Nos. 2, 22

**26. What is the population within a 2-mile radius of the hazardous substance(s) at the facility?**

The population within 2 miles of the site is approximately 39,700.

Ref. No. 23

**DIRECT CONTACT/ON-SITE EXPOSURE**

**27. Describe the potential for direct contact with hazardous substance(s) stored in any of the waste units on site or deposited in on-site soils. Identify the hazardous substance(s) and the accessibility of the waste unit.**

The gas plant facility was demolished in 1976, at which time the leaching pit and its contents were uncovered and removed. However, the Geraghty and Miller, Inc. investigation in 1979 identified a groundwater plume, based on naphthalene concentrations, emanating south from the site. There may be residual contamination left on site. There is a hole in the fence on the east side of the site.

Ref. Nos. 3, 5

**28. How many residents live on a property whose boundaries encompass any part of an area contaminated by the site?**

Several residents and businesses south of the site complained of gaseous tarry odors in their basements. LILCO supplied an exhaust fan to Summer's Lumber Co., located just south of the site, to eliminate odors. LILCO also bought and destroyed two houses south of the lumber yard in the 1950s because of persistent complaints by the residents of strong tarry odors in their basements. Oily residues were noticed in several basements in 1976. The extent of the groundwater plume, as defined by Geraghty and Miller, Inc., underlies many commercial and residential properties south of the site.

Ref. Nos. 2, 4, 5

**29. What is the population within a 1-mile radius of the site?**

The population within 1 mile of the site is approximately 10,600.

Ref. No. 23

## PART IV: SITE SUMMARY AND RECOMMENDATIONS

The Bay Shore Gas Plant Site is located in a suburban area in Bay Shore, Suffolk County, New York, approximately 1.5 miles north of the southern shore of Long Island. From 1898 until 1952, the facility was used by Long Island Lighting Company (LILCO) to produce carburetted water gas. After 1952, the LILCO system was converted to natural gas supplied by pipelines from the southwest. From 1952 until 1973, the Bay Shore facility was used to produce oil gas to augment the natural gas supply during high demand periods and also later for occasional operator training and equipment testing. Gas production at the facility ceased completely in 1973. Most of the features of the gas manufacturing facility were removed during demolition work on site in 1976.

The site consists of two portions, one on either side of Clinton Avenue below Jackerson Street, that were connected by an underground tunnel while the site was active. The 2-acre property east of Clinton Avenue is currently used as a substation for the transmission of electricity. Mineral oil transformers that contain less than 500 ppm of PCBs are used to step down voltage from 23 kilovolts (kv) out of the power station to 13 kv out of the site's substation. During an off-site reconnaissance by NUS Corporation Region 2 FIT on April 17, 1989, the features observed to be on site were the transformer substation, two abandoned buildings, and a concrete slab that may have been the foundation for a large gas storage tank formerly on site. Drums and refuse along the southern boundary and a hole in the fence on the east side of the site were also observed. The 1-acre west portion of the site, referred to by LILCO as the Brightwaters Yard, was not observed during the reconnaissance.

During the early years of gas production at the Bay Shore Gas Plant, approximately from 1898 until the 1920s, it is believed that some oil wastes and tars were disposed of onto the ground surface at the Brightwaters Yard. At the same time, aqueous wastes were discharged into Watchogue Creek. Expansion of the site in 1926 led to the installation of a wastewater treatment system. Non-contaminated wastes and runoff were still discharged to Watchogue Creek, while contaminated wastes were treated for oil and tar removal in separators. Excess water was discharged into an on-site leaching pit. An average flow of 500 gallons per day (gpd) and a maximum of 5000 gpd were discharged into the pit. According to LILCO, the leaching pit had not been used since the early 1940s.

The leaching pit was discovered by the Suffolk County Department of Environmental Control (SCDEC) during demolition work in 1976. The pit was described by an SCDEC representative as a large rectangular underground concrete box with perforated sides, filled with sludge oils.

**PART IV: SITE SUMMARY AND RECOMMENDATIONS (CONT'D)**

An analysis of the pit source material by the SCDEC indicated that toluene, indene, naphthalene, a- or B-methylnaphthalene or both, and dimethylnaphthalene (10 possible issomers) were present as major components. The leaching pit and its contents, as well as many other site features, were removed during the demolition. The large gas holder was knocked over and its contents, oil and tarry sludges, were allowed to spill onto the ground surface of the site before being removed.

Many neighbors south of the site had complained over a period of many years of oily and tarry odors in their basements. Around 1950, LILCO provided an exhaust fan to Summer's Lumber Company, located just south of the gas plant, to alleviate strong tarry odors coming into the company's basement. A Summer's representative stated in an interview in 1976 that the odor permeates the entire building when the fan breaks down. In the 1950s, LILCO bought and destroyed two houses south of the lumber yard because of persistent odor complaints by the owners. In 1976, complaints by sewer workers of odorous water filling "dry sewer" lines in the area led to an SCDEC inspection. During the inspection, an SCDEC representative noted oily residues on the floors and walls of basements in several residences south of the site. A Ground-Water Investigation by Geraghty and Miller, Inc., completed in June 1979, identified a narrow groundwater contamination plume, based on naphthalene concentrations, emanating south from the site to the edge of Lawrence Creek, a groundwater discharge area. Other contaminants found in groundwater during the investigation include $C_2$ benzenes, $C_3$ benzenes, methyl indene, methylnaphthalene, acenaphthene, dibutyl phthalate, and phenols. Contaminants were not detected in samples taken from Lawrence Creek at the time of the investigation.

The site is given a recommendation of **HIGH PRIORITY** for further action under CERCLA. The recommendation is based on the following factors:

- Contaminants attributable to the site have been identified in the area's groundwater.
- There are municipal supply wells within one-half mile of the site.
- The site is located within an area delineated as a sole source aquifer area.

Further action should include the identification of all wells, public and private, within 1 mile of the site, and a sampling plan to determine whether a source of contamination still exists at the site and to define the full and exact extent of groundwater contamination attributable to the site.

**REFERENCE 11**

1969-1

LILCO LONG ISLAND LIGHTING

LONG ISLAND LIGHTING COMPANY

175 EAST OLD COUNTRY ROAD · HICKSVILLE, NEW YORK 11801

October 10, 1978

Mr. James Pim, P.E. Chief
Enforcement Section
Suffolk County Dept. of
Environmental Control
65 Jetson Lane
Hauppauge, New York 11787

Bay Shore Groundwater Investigation

Dear Mr. Pim:

Enclosed is a copy of Geraghty and Miller's Phase I Report of the Bay Shore Groundwater Investigation which was discussed at the September 26 meeting among yourself, E. Koch (SCDEC), G. Robbins (NYSDEC), representatives of Geraghty and Miller and myself. The report summarizes the results of the Phase I field effort including a discussion of the geology and hydrology found in the area and presents the results of the groundwater sampling program. In general, of the 18 wells installed as part of Phase I, three show evidence of contamination in the low part per million range, while the other wells show either no contamination or, if present, at the low part per billion level.

As agreed at the September 26 meeting, naphthalene is an appropriate indicator parameter to the contamination and we will proceed with the Phase II investigation to determine the southern boundary of the contamination. It was also agreed that the Phase II wells (i.e. locations 5-10) will be located between Lawrence and Watchogue Creeks only since the results from Phase I indicated that no contamination extended east or west of the creeks. In addition, if we believe that locations 8-10 are not required, we will contact your prior to completing the Phase II investigation.

If you have any questions, please do not hesitate to contact us.

Very truly yours,

Steven V. Dalton

Steven V. Dalton, Manager
Water Quality Control Division

SVD/cg

cc: Mr. G. Robbins, NYSDEC
Mr. E. Koch, SCDEC

**REFERENCE 12**

LONG ISLAND LIGHTING COMPANY
175 EAST OLD COUNTRY ROAD · HICKSVILLE, NEW YORK 11801

Direct Dial Number

June 11, 1980

Mr. James H. Pim, P.E., Chief
Industrial Waste and Hazardous
Materials Control Section
Suffolk County Department of Health Services
65 Jetson Lane
Hauppauge, New York 11787

Bay Shore Groundwater Investigation

Dear Mr. Pim:

As you are aware, since the Spring of 1979 we have been monitoring periodically a network of observation wells on and immediately adjacent to the Bay Shore Gas Plant property. A limited quantity of oil similar to No. 2 oil was initially determined to exist near the southwest corner of the property. However, as described in detail in the attached report, no significant amounts of oil have been observed since October, 1979 in the affected test wells nor did the oil appear in the additional monitoring wells installed during subsequent stages of the investigation to redefine its location.

Approximately seven months have now passed since the oil was last observed and the water table has risen and fallen in response to natural fluctuations without causing the oil to reappear. Therefore, we request that the County relieve us of any further investigation or action associated with the Bay Shore site and to consider the matter resolved.

If you have any questions, please do not hesitate to contact me.

Very truly yours,

Raymond J. Driscoll, P.E.
Manager
Environmental Engineering Dept.

SVD/cg

cc: Mr. A. LaRuffer NYSDEC

**REFERENCE 13**

LILCO
LONG ISLAND LIGHTING COMPANY
175 EAST OLD COUNTRY ROAD · HICKSVILLE, NEW YORK 11801

Direct Dial Number

Ref. 13, p. 1 of 7

February 8, 1983

Mr. James H. Pim, P.E.
Hazardous Materials Management
Suffolk County Department of
Health Services
15 Horseblock Place
Farmingville, NY 11738

Bay Shore

Dear Mr. Pim:

Enclosed are results of the monitoring you and I conducted on February 1, 1983 at the above mentioned site. In addition, results of monitoring conducted by LILCO personnel on January 7 and January 13, 1983 are included for your records.

As we discussed, the one inch diameter steel pipe wells were installed by LILCO crews as a "screening" technique to determine the need for additional, more expensive, 4 inch PVC monitoring wells installed by a contractor. The pipe wells (#s 5,7,8,11,12,13,14,15,16 & 27) only have a five foot screen at an unrecorded depth whereas the 4 inch wells have a ten foot screen and are drilled to a depth of approximately 15 feet which places 5 feet of screen above and below the water table. In addition, the pipe wells, unlike the 4 inch PVC wells, cannot be monitored with a thief. Any other device, such as a ruler, will not provide an accurate indication of the quantity of oil in the well. For example, based on findings in well #7 (pipe well), we were requested to drill a 4 inch well in that location. The new well (only 6 inches from #7) has not shown any measurable amount of product. Therefore, as I mentioned Tuesday, we do not consider observations made on the one inch pipe wells to be valid and since LILCO has had numerous 4 inch wells installed by a professional firm, the pipe wells should be abandoned as monitoring points.

Very truly yours,

Kenneth A. Yager
Environmental Engineering

KAY/mf

Attachment

Depth of Product (inches)

| Well # | 1-7-83 | 1-13-83 | 2-1-83 |
|---|---|---|---|
| 1 | clean | | |
| 2 | clean | | |
| 3 | clean | | |
| 4 | clean | | clean |
| 6 | sheen | clean | clean |
| 7 | | | oil |
| 9 | clean | clean | clean |
| 10 | clean | clean | clean |
| 11 | | | oil |
| 17 | clean | | |
| 18 | dry | | |
| 19 | clean | | |
| 20 | clean | | |
| 21 | clean | | |
| 22 | clean | | |
| 26 | | | clean |
| 27 | | | clean |
| 28 | clean | | clean |
| 30 | clean | | clean |
| 31 | clean | | clean |
| 32 | clean | | clean |
| 33 | < 1/8 | clean | clean |
| 34 | clean | | clean |
| 35 | clean | | clean |
| 36 | clean | | clean |
| 37 | 6-8 | 4 | 1/2 |
| 38 | trace | trace | clean |
| 39 | < 1/8 | 1/4 | 1/8 |

Depth of Product (inches)

| Well # | 1-7-83 | 1-13-83 | 2-1-83 |
|---|---|---|---|
| 40 | trace | clean | clean |
| 41 | clean | | clean |
| 42 | 2 1/2 | 3/4 | 1/2 |

| Well # | 10-14 | 11-23 | 11-30 | 12-3 |
|---|---|---|---|---|
| 1 (18) | clean | | | |
| 2 (17) | clean | | | |
| 3 (15) | clean | | | |
| 4 (14) | clean | clean | clean | clean |
| 5 (30) | clean | clean | | |
| 6 (20) | 1/4 | 1/8-1/4 | < 1/8 | 1/16 |
| 7 (28) | clean | oil | | oil |
| 8 (10A) | clean | | | clean |
| 9 (10) | 2 1/2 | 1/4-1/2 | < 1/8 | trace |
| 10 (4) | -- | 1/4 | < 1/8 | 1/16 |
| 11 (26) | clean | | | trace |
| 12 (24) | oil | oil | | |
| 13 (23) | oil | | | oil |
| 14 (25) | clean | clean | | |
| 15 (27) | clean | clean | | clean |
| 16 (29) | clean | clean | | clean |
| 17 (16) | -- | | | |
| 18 (21) | dry | dry | | |
| 19 (13) | clean | | | |
| 20 (3) | clean | | | |
| 21 (2) | -- | | | |
| 22 (1) | odor-sheen | | | |
| 23 (5) | -- | | | |
| 24 (6) | -- | | | |
| 25 (7) | -- | | | |
| 26 (8) | -- | | | |

| Well # | 10-14 | 11-23 | 11-30 | 12-3 |
|---|---|---|---|---|
| 27 (22) | clean | | | |
| 28 (9) | -- | | | |
| 29 (19) | -- | | | |
| 30 | | | clean | sheen |
| 31 | | | clean | sheen |
| 32 | | | murky | 1/16 |
| 33 | | | < 1/8 | 1/16 |
| 34 | | | murky | clean |
| 35 | | | clean | clean |
| 36 | | | clean | clean |
| 37 | | | | |
| 38 | | | | |
| 39 | | | | |
| 40 | | | | |
| 41 | | | | |

12-15-82

| 2/1/83 | Well # | Depth To Liquid | Product (inches) |
|---|---|---|---|
| | 1 | 8'3" | clean |
| | 2 | 8' | clean |
| | 3 | 8' | clean |
| c | 4 | 8'7" | clean |
| c | 6 | 8' | 1/8 |
| oil | 7 | | oil |
| | 8 | | clean |
| c | 9 | 7'6" | clean |
| c | 10 | 7' | trace |
| oil | 12 | | oil |
| | 14 | | clean |
| | 17 | 8'2" | clean |
| | 20 | 7'11" | clean |
| | 21 | 7'4" | clean |
| | 22 | 7' | clean |
| c | 30 | 8' | clean |
| c | 31 | 8' | clean |
| c | 32 | 7'2" | clean |
| trace | 33 | 8'1" | trace |
| c | 34 | 6' | clean |
| c | 35 | 8'4" | clean |
| c | 38 | 8'1" | brown water (unsettled) |
| jf | 39 | 8'6" | 1/2-1 |
| | 40 | 9' | brown water (unsettled) |
| | 41 | 9' | brown water (unsettled) |
| | 42 | 8'6" | ¼-½ |

12-23-82

| Well # | Depth To Liquid | Product (inches) |
|---|---|---|
| 6 | | < 1/8 |
| 9 | | clean |
| 30 | | clean |
| 31 | | clean |
| 33 | | clean |
| 34 | | clean |
| 35 | 8'4" | clean |
| C 36 | | clean |
| 37 | 8'3" | 1/4-1/2 |
| 38 | | sheen |
| 39 | | 1/2-3/4 |
| 40 | | clean |
| 41 | | clean |
| 42 | | < 1/8 |

**REFERENCE 14**

# FOSTER WHEELER ENVIRONMENTAL CORPORATION

## RECORD OF TELEPHONE CONVERSATION

DATE: July 97

TO: Site File

FROM: Michelle Brooks

CLIENT/PROJECT: EPA / BAYSHORE GAS PLANT SITE

SUBJECT: Adminstrative Consent Order for Site

DISCUSSION WITH: Gardiner Cross of NYSDEC, Site Manager
(518) 457-9280

Mr Cross informed me that NYSDEC was negotiating an Adminstrative consent Order with LILCO to remediate in some way the Bay shore Gas plant site.

NAME: Michelle R Brooks DATE: Sept. 2, 97

**REFERENCE 15**

**New York State Department of Environmental Conservation**
**50 Wolf Road, Albany, New York 12233-7010**

**John P. Cahill**
**Commissioner**

FAX

JUL 31 1997

Mr. Steven Dalton
Long Island Lighting Company
175 East Old Country Road
Hicksville, NY 11801

Dear Mr. Dalton:

The New York State Department of Environmental Conservation (NYSDEC) has reviewed the 1993 Field Investigation Report and the subsequent Risk Assessments and Feasibility Study for the former manufactured gas plant (MGP) in Bay Shore, NY Several gaps in the site characterization have been identified, which will need to be addressed in order to complete an acceptable Remedial Investigation and Feasibility Study (RI/FS) for the site. This additional site characterization data is likely to require a substantial revision of the Risk Assessment and Feasibility Study portions of the RI/FS.

Please note that full assessments of human health risks will be performed by the New York State Department of Health (NYSDOH), which has not been involved in this stage of the review process.

## SITE CHARACTERIZATION

### Source Area Delineation

The 1993 Field Investigation Report does not adequately define the vertical and horizontal extent of MGP related wastes. Nearly all of the borings and test pits to date have terminated at or above the water table. Of the few borings which have progressed significant distances below the water table, at least two (MW-5 and MW-7) have detected evidence of significant downward migration of dense, non-aqueous phase liquid (DNAPL). Horizontal migration of NAPL appears also to have taken place.

### Vertical NAPL Migration

At MW-7, the boring was terminated at 45 feet BGS. NAPL was still visible at this depth, over 35 feet below the water table. The visual identification, coupled with the fact that the deeper well is far more contaminated than the shallow well in an area of minimal downward groundwater gradient, supports the notion that substantial downward DNAPL migration has taken place in this area. Similar downward migration is likely farther north in the area near the relief holder; however, no deep wells or borings exist in this area to test this possibility.

**Horizontal NAPL Migration**

MW-5 is located off the LILCO property, some distance from the former manufacturing and storage facilities. Oily sheens were noted 15 feet below the water table, indicating a substantial degree of horizontal NAPL migration. A second off-site well, MW-4, yielded evidence of NAPL at shallow depths, both in the boring log and in very high levels of groundwater contamination. Both of these wells contain organic contaminants at concentrations in excess of their aqueous solubilities. Oil seeps were noted in basements in this area during the late 1940's, so the existence of significant off site NAPL migration in the past has been firmly established. Oddly, although the suite of groundwater contaminants at locations MW-4, MW-5, and MW-7 is broadly similar, there is little evidence of downward NAPL penetration at MW-4.

**Areal Extent of Soil Contamination**

The characterization of soil contamination along the northwest boundary of the Bay Shore site on Figures 6-1 through 6-6 is misleading. Borings SB-20, SB-21, SB-26, and SB-28 are all shown with "no field instrument detection" notations. Yet the boring logs for all four show elevated HNu readings (as high as 85 ppm, comparable with the most contaminated zones), with sheens and "strong odors" noted for some intervals. The edge of the contaminated area here will need to be determined more precisely via laboratory analysis of subsurface samples.

Likewise, the eastern boundary of contamination near Fifth Avenue is undefined. Borings SB-22 and SB-30 are presented as "no field instrument detection" locations to delimit the zone of soil contamination. However, elevated HNu readings were noted in both borings. In addition, all borings and test pits along this edge of the property were terminated at the water table. Given the proximity of the former gas holders to the property line, it is possible that DNAPL has spread below the water table and beneath the eastern site boundary.

Although the holder foundation pads appear today as clean concrete surfaces, there is no information available to determine whether contamination penetrated through these pads (or predecessor structures) in the past. Soil borings and monitoring wells should be completed through each of the holder foundations to determine whether this has occurred.

**Off-Site Groundwater Plume**

The reported chemical makeup of the off-site groundwater plume is highly unusual, in that the relatively immobile PAH compounds have apparently migrated over 3000 feet--farther than the more soluble BTEX compounds. This will need to be verified with at least one additional round of sampling of the existing off-site monitoring wells. Careful examination of the shallow wells in each well cluster should be performed to verify that no floating oil layer is present. Such a layer, if present, would offer an explanation for the extraordinary

transport of PAH compounds. Full QA/QC reporting (category B deliverables) will be necessary at least for the first sampling round.

The groundwater plume originating at the H-tank area on the Brightwaters Yard needs to be more thoroughly characterized. If there is a floating product problem at this site, the H-tank appears to be a likely source. Permanent, multi-level monitoring wells will be required.

**Implications for the Feasibility Study**

The likely presence of DNAPL below the water table may have profound consequences for remedy selection. DNAPL which has penetrated below the water table will continue to function as a potent source of groundwater contamination even if contaminated soils in the vadose zone are successfully capped, treated or removed. Likewise, the likely presence of NAPL spreading beyond the LILCO property line changes the scope of the environmental problem. Off-site spreading has clearly taken place in the past, as indicated by the complaints of oil seeps in basements along Clinton Avenue in the 1940's and 50's. It would be remarkable if remnants of this material were *not* still present in the area, and boring logs from MW-4 and MW-5 strongly indicate that it is. The curious distribution of contaminants in the downgradient plume raises the possibility that a PAH-rich LNAPL is floating on the water table for a distance of several thousand feet downgradient of the MGP site. This material will continue to contaminate groundwater which comes into contact with it, and surrounding land uses greatly limit the remedial options which can be applied.

**RISK ASSESSMENT**

As noted above, our review of the risk assessment document is limited in scope. Such reviews are normally undertaken by the New York State Department of Health (NYSDOH). Some general trends, however, can be discerned in a cursory review.

It is very likely that substantial revision of the Risk Assessment will be required following completion of a more comprehensive site investigation. As noted above, MGP wastes appear to have spread more widely than has been acknowledged so far; consequently, the definition of exposure zones which forms the basis for this document will probably have to be changed.

The possible existence and use of domestic water wells in the area downgradient of the site needs to be more thoroughly described. If there are legal or administrative measures already in place to control such exposure (such as local ordinances dealing with groundwater use), these should be described.

Given the likelihood of off-site spreading of undissolved MGP wastes, the possibility for human exposure through contamination of basement air in neighboring buildings needs to be assessed.

Naphthalene should be added to the list of compounds which are considered in the inhalation exposure pathway for underground utility workers.

## FEASIBILITY ANALYSIS

As noted earlier, if further investigation verifies the spreading of non-aqueous phase liquids into off-site areas or vertically downward into the aquifer, then substantial revision of the Feasibility Analysis will be required.

During the site visit in early July, I was informed of a pilot test which had been conducted using soil vapor extraction and sparging in the area just south of the former relief holder. The results of this test should be incorporated in the FS.

### Remedial Action Objectives

The discussion of remedial action objectives for groundwater in Section 2.1.3 should note that the proper cleanup objective for class GA groundwater is attainment of drinking water standards. Further evaluation will determine whether this objective is technically feasible, and on what time frame it might be accomplished.

The Technical and Administrative Guidance Memorandum (Number 4046) referenced in Section 2.2.1 has been revised as of January 24, 1994. This revision should be noted and incorporated throughout the FS document.

### Identification and Screening of Technologies

The discussion of bioventing in Section 3.3.2.4 should note that some of the nutrients which would likely be added to stimulate biological activity (most notably, nitrate ion) are themselves common groundwater contaminants for which maximum contaminant levels have been established. Consequently, nutrient addition systems must either use very low concentrations of nutrients (below the MCL) or be accompanied by a groundwater capture system which eliminates the potential for off site migration of the added nutrients.

In the discussion of excavation and on site biotreatment in Section 3.3.3.1, the need to conduct treatment in an enclosure is noted as a drawback to this specific technology. Such an enclosure may be required over any excavation site which encounters concentrated MGP wastes. Consequently, this disadvantage may apply to all remedial options which require excavation, including those which involve off site disposal. This should be mentioned here and also in the subsequent sections dealing with off site treatment and disposal. What is the basis for screening out this alternative but retaining other excavation-based alternatives?

The existence of building foundations is noted in several discussions throughout the document as an impediment to remediation. While these foundations may represent a

significant inconvenience and added expense, it appears that this problem could be readily dealt with by removing the foundations. This option needs to be discussed, including the differential impacts on cost and implentability for each remedial alternative.

The discussion of horizontal wells in Section 3.4.2.2 should note that there are directional drilling techniques available for placement of these wells beneath foundations, railroad tracks, and other surface features which would prohibit trench-and-cover installations. This option should be retained for further analysis.

The possibility of using permeable reaction walls as a groundwater control measure should be discussed in this section.

Development and Analysis of Alternatives

In Section 4.2.2.4, the statement that "...soil excavation will result in the removal of the source of groundwater contamination" is likely to prove incorrect, unless the excavation proceeds to extreme depths. As noted earlier in this letter, there is abundant evidence that DNAPL migration has progressed to significant distances below the water table, beyond the reach of excavation technologies. Groundwater contamination in the main body of the plant, as shown by the only available well cluster (MW-7, is significantly worse at depth than near the water table. Excavation of soils above the water table will address direct contact exposures and will remove *some part of* the source of groundwater contamination, but is not likely to remove all of it.

It is not clear why the recharge of treated groundwater in Alternative 4 (Section 4.2.4) is to be done with wells. In a relatively uniform, sandy material such as is present in the subsurface here, it seems that the use of infiltration galleries would achieve more uniform recharge (and thus, more dependable plume containment). Experience at other sites also indicates that bacterial and chemical fouling is less common in infiltration galleries than in wells, so operation and maintenance costs should be lower as well.

The discussion of groundwater treatment alternatives in Section 4.2.8 makes mention of the length of time required to pump three pore volumes of groundwater from the site. What is the relevance of this figure? In the absence of some form of source treatment or control, it is very unlikely that a ten-year pumping period would accomplish any permanent reduction in groundwater contamination.

DEVELOPMENT OF A FULL RI/FS

The current state of knowledge of site conditions does not allow a complete evaluation of human health risks or selection of a remedy. The spatial distribution of contaminants has not been established, leading to serious uncertainty as to the effectiveness of different

remedial technologies and the physical areas where they would be applied. To allow a meaningful evaluation of these technologies, the following areas need to be investigated in greater detail, with the results incorporated into a revised risk assessment and feasibility study:

Vertical Distribution of Contamination: The depth extent of contamination beneath the site needs to be determined. This will require installation of several additional borings and well clusters throughout the former manufacturing and storage portions of the site. At least some of these clusters should include wells screened immediately above the first significant aquitard, which appears to be the Gardiners Clay at a depth of roughly 75 feet. Pooling of NAPL at this depth is possible. All borings must be continuously sampled, either using continuous split spoon sampling or some other drilling technology which provides continuous samples, such as rotasonic coring.

Horizontal Distribution of NAPL: The potential for off-site migration of NAPL past the eastern and southern boundaries of the site needs to be investigated. The area along Clinton Avenue where floating oil was discovered in the 1940's and 1950's is of particular interest, as is the area south of the former H-fuel tank. The area along Fifth Avenue, east of the site should also be included. Both DNAPL and LNAPL migration need to be considered, which will require groundwater monitoring at multiple levels.

Horizontal Distribution of Soil Contamination: The northern boundary of contaminated soil was not established during the field investigation. Additional borings need to be placed in this area, with samples collected for laboratory analysis to determine the volume and location of contaminated soils.

Downgradient Groundwater Plume: Those permanent wells which still exist should be sampled during high water and low water periods, with full QA/QC review of at least the first round of monitoring data. Initial inspection of each well should include the use of a clear bailer to determine whether floating product is present.

Downgradient Water Use: The potential for exposure to the plume through domestic wells needs to be more thoroughly investigated. County Health Department officials should be contacted. It may be necessary to contact individual homeowners in the residential areas closest to the site, where exposure to non-aqueous phase liquids is most likely.

If you have any questions regarding this site, please contact Gardiner Cross of my staff at (518) 457-9280.

Sincerely,

James Van Hoesen

James Van Hoesen
Chief, Central Field Services Section
Bureau of Construction Services
Division of Environmental Remediation

cc: C. Sullivan
D. Riccobono

**REFERENCE 16**

THE 7TH NATIONAL CONFERENCE ON

# MANAGEMENT OF UNCONTROLLED HAZARDOUS WASTE SITES

DECEMBER 1-3, 1986 • WASHINGTON, DC

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National Solid Waste Management Association

# Town Gas Plants—History, Problems And Approaches to Study

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## ABSTRACT

Town gas plant sites are receiving increasing attention from the utility industry and regulatory communities. This attention has been prompted by greater environmental awareness of impacts due to past disposal practices and the understanding that gas plant wastes contain a wide range of chemical constituents that have persisted in the environment.

This paper discusses the history of the town gas plant industry, the various processes utilized and the resultant by-products and wastes. Potential problem areas relating to these sites as well as potential approaches to site characterization are addressed. Included are recommendations for the phasing of site investigations and the use of relatively inexpensive and rapid field screening techniques to identify contamination.

## INTRODUCTION

Town gas plants, utilized throughout the United States in the late 1800s and early 1900s to manufacture gas for illumination, cooking and heating purposes, are of growing concern to the utility industry and regulatory communities. These plants (well over 1,000 across the country), as well as gas storage holders, gas cleanup areas and waste and by-product disposal areas, are undergoing scrutiny because of the array of wastes that were generated and/or disposed of at many of these sites. The wastes commonly found at these sites can contain heavy metals, cyanides, phenolics, polynuclear aromatics and volatile compounds. Some of these chemical constituents can be characterized as mobile, while others are persistent in the environment.

This paper discusses the history of town gas plants, the potential problems posed by town gas plant sites and site characterization procedures to evaluate these sites. Cost-saving field screening techniques developed to identify volatiles and polynuclear aromatic compounds will be discussed.

This paper also will discuss a ranking system that has been implemented successfully to prioritize site characterization at multiple sites. This system will interest utilities confronted with multiple site evaluations. In some cases, this ranking system has been used as a basis for selecting the no action alternative.

## HISTORY OF TOWN GAS PLANTS

Town gas plants had their roots in the 1700s with the discovery that coal carbonization was a major means of producing coal gas, coal tar, light oils, coke and ammonia liquor. These by-products were utilized as source materials for the production of various materials used in diverse industries. Manufactured gas was initially a major source of fuel for illumination in many cities in England, Germany and the United States. The uses of manufactured gas expanded to include those which utilize natural gas today.

In addition to manufactured gas, the use of coal tars and light oils grew to major importance in the chemical manufacturing industry. The tars and oils were used as base materials for the formulation of a variety of products, including paints and coatings, road tars, roofing and water-proofing materials, pipeline enamel fiber conduit and fiber pipe saturants, carbon electrode binder foundry compounds, industrial fuels and wood preserving oils ar chemicals. The refined chemicals from coal tar and light oil we the starting materials for synthetic organic chemicals of the da including dyestuffs, drugs, disinfectants, insecticides, antiseptic flavoring components, vitamins, food preservatives, perfume photographic materials, plastics and elastomers. Coke and tars we used as heating materials in both the domestic (coke only) ar industrial sectors.

The manufactured gas industry in the United States becam prominent during the two world wars. Peak production of co tar products in the U.S. occurred in the years prior to Worl War II. This era was a period of marked changes in coal tar produ patterns. Petroleum asphalts became favored over road ta produced from coal and demand decreased dramatically. Creoso production fell mainly because of the reduced demand for creosote crossties by American railroad lines. Light-oil recovery decrease due to foreign imports and the growing use of petroleum-derive products. Finally, as natural gas became available by pipeline i the northeast, it was no longer economically feasible to maintai aging facilities which produced manufactured gas for domestic use

## MANUFACTURED GAS PROCESSES

The manufactured gas processes changed significantly over th years that the industry operated. However, the basic process con sisted of the following three general operations:

- *Distillation*—heating coal, coke or oil to drive off or crack organic carbon-based materials (in the presence of steam, in some cases)
- *Condensation*—cooling the manufactured gas to remove the condensible fraction (tars)
- *Purification*—washing and/or making contact with iron oxide-soaked chips and other materials to remove toxic materials from the gas

In addition to these three processes, enrichment processes wer utilized in some cases. For example, carburetion was one of th earliest enrichment processes in which a petroleum distillate wa mixed with the hot gases and cracked in a brick chamber. Late enrichment processes utilized catalysts to modify the chemica makeup of the gas constituents.

Manufactured gas was generated from many different processes however, there are five basic types into which all of these processe generally fell: blue gas, carbureted water gas, coke oven gas catalytically cracked gas and oil gas.

Blue gas (or water gas) was a mixture of carbon monoxide anc hydrogen with a heating value of approximately 300 Btu/ft$^3$. Th blue gas was produced by passing steam over coal or incandescen coke with a resultant endothermic reaction. A cyclic process o air blasts was used to control the temperature and thereby minimiz the production of excess nitrogen and carbon monoxide. Figure

diagram of a typical blue gas producer.

Carbureted water gas was basically an enriched blue gas. Hot blue gas was enriched in a carburetor with a petroleum distillate (e.g., Bunker C) and then passed through a superheater (e.g., a preheated brick chamber) to crack the distillate. Figure 2 is a flow diagram of a typical water gas producer. The process was cyclical to control excessive nitrogen and carbon dioxide contamination of the gas and reduce the overheating of the carburetor and superheater.

Coke oven gas was a mixture of hydrogen, methane, carbon monoxide and illuminants (e.g., ethylene) with a heating value of approximately 500 Btu/ft$^3$. The gas was produced in steel coke ovens and normally was cleaned at the steel manufacturing plant to remove tars, ammonia, light oils, naphthalene and some sulfuric compounds which were sold as separate by-products. Figure 3 is a flow diagram of a typical coke oven gas process.

Catalytically cracked gas was a mixture of carbon monoxide and hydrogen with a heating value of approximately 300–400 Btu/ft$^3$. This process was similar to carbureted water gas in that a low Btu was enriched by cracking a petroleum distillate over a nickel oxide catalyst with regulated amounts of steam.

**BLUE GAS PRODUCER**
**GAS PROCESS FLOW**

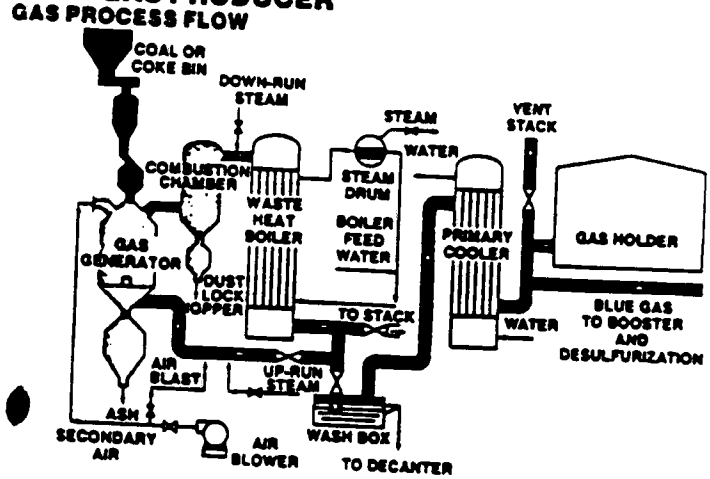


Figure 1

**CARBURETED WATER GAS PRODUCER**
**GAS PROCESS FLOW**

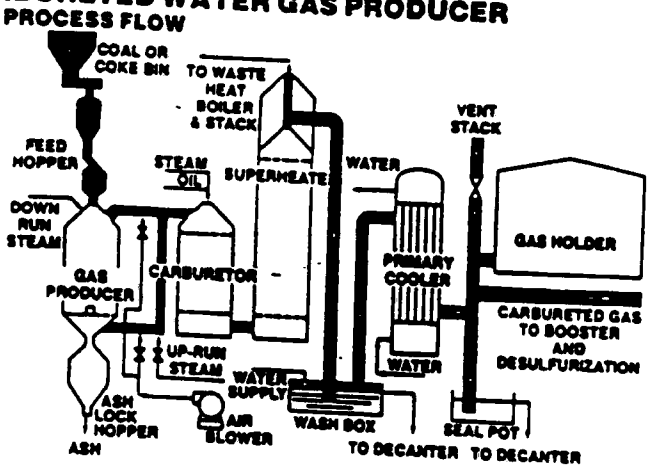


Figure 2

Oil gas was basically a cracked petroleum distillate (i.e., ranging from kerosene to Bunker C fuel oil). The oil gas was rich in methane, ethane, hydrogen and light hydrocarbons with a heating value of approximately 1,000 Btu/ft$^3$. The thermal cracking of the

**COKE OVEN**
**GAS PROCESS FLOW**

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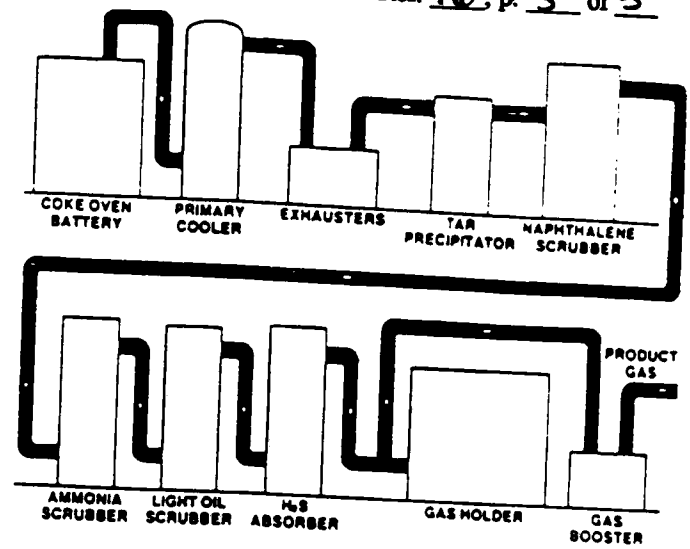


Figure 3

petroleum distillate was achieved by spraying it onto hot brickwork (e.g., a superheater similar to that utilized in the production of carbureted water gas) or a bed of hot catalyst.

## BY-PRODUCT/WASTE GENERATION

By-products and wastes generated by the processes of coal/coke gasification, gas cooling and gas cleaning are linked below:

| Process | By-products | Wastes |
|---|---|---|
| Coal/Coke Gasification | Gas | Ash, slag and clinkers |
| Gas Cooling | Tar | Wastewater and sludges |
| Gas Cleaning | Clean Gas | Spent iron oxide |
| | Ammonium Sulfate | |

Gas cooling resulted in the condensation of organic material that was removed as tar. Gas cleaning was performed to remove ammonia and toxic compounds. Ammonia scrubbing occurred primarily at coke oven gas facilities. Other facilities which produced carbureted water gas and catalytically cracked gas did not typically include ammonia scrubbing. The removal of ammonia occurred by simply passing the gas stream through a sulfuric acid solution with the resultant formation of ammonium sulfate that was normally sold for the production of fertilizer.

Subsequent to tar removal, toxic compounds (i.e., hydrogen sulfide and cyanide) were removed. The most common process for the removal of these compounds utilized fixed bed purifier boxes. The purifier boxes contained wooden chips that were treated with iron oxide which was used as a scavenger for hydrogen sulfide in the gases. The iron oxide was regenerated by cycling the purifier boxes (i.e., blowing air through the beds, thereby releasing sulfur dioxide into the atmosphere). Over time, the iron oxide/wood chip beds lost their usefulness because of the formation of extremely stable ferric/ferrous cyanide complexes on the wood chips.

## ENVIRONMENTAL CONCERNS

In the evaluation of manufactured gas plant sites, the areas of potential concern result primarily from the following past practices:

- Spills and leaks of products/by-products during normal operation and closure of facilities
- Products/by-products that may not have been utilized or were left in place during closure (e.g., left in process pipes and tanks)
- Wastes that were deposited on-site or off-site
- Wastewaters that were discharged on-site and off-site

The specific environmental concerns relative to these operations and/or practices include:

- Leaching of metals from ash, slag and clinkers land-filled on-site
- Contamination of soils, groundwater, or surface water by spent iron oxide which contains high concentrations of sulfur and significant concentrations of various cyanides. Table 1 summarizes compounds that may be identified in spent oxide waste
- Contamination of soils, groundwater or surface water by tars and light oils. These wastes typically are a complex mixture of polynuclear aromatic (PNA) compounds and phenols as shown in Table 2. Environmental concerns stem from the fact that some of these compounds are known or suspected carcinogens

**Table 1**
**Typical Analysis of Spent Oxide[2]**

| Compound | Concentration (%) |
|---|---|
| Free sulfur | 44.70 |
| Moisture | 18.88 |
| Ferric monohydrate | 5.26 |
| Ferrous monohydrate | 6.25 |
| Basic ferric sulfate | 1.25 |
| Ferric ammonium ferrocyanide | 3.80 |
| Ferrocoferric ammonium ferrocyanide | 2.50 |
| Ferric pyridic ferrocyanide | 1.20 |
| Organic matter peat fiber | 4.68 |
| Tar | 1.21 |
| Silica | 1.05 |
| Naphthalene | 0.72 |
| Pyridine sulfate | 0.77 |
| Ammonium sulfate | 2.06 |
| Calcium sulfate | 0.12 |
| Ferrous sulfate | 0.02 |
| Ammonium thiocyanate | 1.30 |
| Sulfur otherwise combined | 1.33 |
| Organic matter soluble in alkalies (humus) | 1.54 |
| Combined water and loss (by difference) | 2.36 |
| | 100.0 |

**Table 2**
**Characteristic Compounds Found In Manufactured Gas Plant Tars[1]**

Benzene
Toluene
Xylenes
Phenol
Cresols
Xylenols
Pyridine
Naphthalene
Methylnaphthalenes
Dimethylnaphthalenes
Acenaphthene
Carbazole
Fluoranthene
Anthracene
Phenanthrene
Fluoranthene
Pyrene
Chrysene
Benz(a)anthracene
Benzo(k)fluoranthene
Benzo(a)pyrene
Perylene
Benzo(g,h,i)perylene
Benzo(b)chrysene
Dibenz(a,h)anthracene

Reference: ERT/Koppers.[2]

## SITE INVESTIGATIONS



The major steps in conducting site investigations and remedia studies at town gas plants are as follows:

- Site Identification/Preliminary Assessment
- Site Ranking
- Phased Site Investigations
- Identification of Problem (Risk Assessment)
- Evaluation and Selection of Remedial Measures

The balance of this paper overviews each of the first three step of the preceding paragraphs.

### Site Identification/Preliminary Assessment

Identification by a utility of town gas plant sites for which i is responsible can be prompted by:

- Complaints of visible contamination either at the site or as . result of a discharge to surface water
- Interaction with other utilities due to current and/or prior owner ship of a town gas plant site
- Follow-up Superfund 103CC filings on these sites
- Regulatory inquiries
- Internal concerns relative to the potential existence of these site

Once identified, a preliminary assessment of the site to gather site-related information is advisable. This assessment shoulc identify the potential for on-site by-product deposits, site features that would indicate potential exposure pathways and available information on site stratigraphy, geohydrology and community attitudes that would be used to design the site investigatior program.

Examples of potential sources of information that can be usec for the preliminary assessment are identified in Table 3. The overal objective of Site Identification/Preliminary Assessment is tc develop a data base from which sites can be evaluated as to the need for future action. In such cases where a utility may have responsibilities at multiple sites, site ranking typically is utilized to prioritize the subsequent evaluations. Our firm has found cases where no further investigation was deemed necessary based upon preliminary assessments.

**Table 3**
**Potential Sources of Information For The Preliminary Assessment**

| Source | Information/Remarks |
|---|---|
| Interviews with Former Employees | • Plant practices and operation<br>• Waste disposal areas<br>• Plant closure |
| Water Resource Department (or equivalent) | • Location of wells (domestic and industrial) in site vicinity<br>• Well boring logs (site stratigraphy)<br>• Water quality |
| Utility Records | • Past plant practices and operations<br>• Aerial photographs<br>• Title searches<br>• Former plant layouts |
| State/Local Agencies | • Regulatory requirements<br>• Study objectives<br>• Results from prior studies |
| US FEMA | • Locaiion in 100-year flood plain |
| US Soil Conservation Service | • Classification of soils in site vicinity |
| USGS | • Locaiion of wells<br>• Topographical maps |
| Site Visit | • Evaluate site conditions<br>• Evidence of contamination<br>• Impediments to site investigations<br>• Adjacent land use |

For utilities faced with multiple site evaluations, site prioritization may be appropriate and desirable to allocate resources in a cost-effective manner. Advantages include:

- Dedication of utility resources to those sites that are considered the most important and require additional site investigations
- A sound basis for developing site investigation schedules for multiple sites
- Prioritization of sites in response to regulatory agency inquiries

WESTON uses a modification of the Edison Electric Institute Ranking System in its approach to ranking town gas plants[2]. The system results in a relative ranking of site importance based on the following factors:

- Site Characteristics
  - Size
  - Location
  - Current Use
  - Planned Use
- Waste Characteristics
  - Operating Period
  - Visible Surface Waste Deposits
  - Odor Problems
  - Water Problems
- Resource Characteristics
  - Surface Water Proximity
  - Surface Water Use
  - Groundwater Proximity
  - Groundwater Use
- Process Type

For each subcategory under Site, Waste and Resource Characteristics, and for the category of Process Type, a site is ranked on a scale of 1 to 5. A score of 1 indicates little importance, while a score of 5 indicates high importance. The site score is the sum of the individual scores and the site with the highest score is ranked the most important (i.e., recommended for additional site investigations).

**Phased Site Investigations**

Site investigations are conducted to achieve the following objectives:

- Confirm the presence of plant by-products and wastes at a site due to former town gas plant operations as well as determine the lateral and vertical extent of the source material
- Determine the direction, rate and concentrations of constituents-of-concern moving off-site
- Gather adequate site information to assess potential site problems and, if necessary, develop and select remedial measures
- Determine if any immediate remedial measures should be implemented to mitigate environmental concerns

A phased approach is strongly recommended to cost-effectively achieve the above-listed objectives. In addition, phasing allows utilization of information from a previous phase to guide subsequent phases of potential activity.

An example of a phased field investigation program for a gas plant site is summarized below:

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*Phased Field Investigation Program*

Phase 1—Shallow soil and sediment samples are collected on-site for full priority pollutant analysis. Based on the results, "indicator" parameters are selected for analysis in subsequent phases. The results of the shallow soil sampling will indicate if the site poses any immediate threats and whether site access should be restricted. During sample collection, volatile aromatic and PNA field screening techniques are applied. Correlations can be identified between field and laboratory results and used in subsequent investigation phases.

Phase 2—Test pits are subsequently excavated to locate the source material on-site. Additional soil samples are collected and analyzed for the "indicator" parameters. During backfilling, piezometers are placed down to the groundwater table in selected test pits. These piezometers are surveyed and used to measure groundwater levels to determine groundwater direction.

Phase 3—Upgradient, downgradient and on-site wells are installed based on the groundwater flow direction identified. After well development, groundwater samples are collected for chemical analysis. Permeability testing is performed to derive soil permeability data and calculate groundwater flowrates.

Field screening methods are expedient, effective and inexpensive ways to locate the lateral and vertical extent of contamination. Even during intense soil sampling efforts at a site, field screening can be used to increase knowledge of the site. Relevant to town gas plant sites, our firm has developed and had the U.S. EPA validated field screening methods for the determination of total polynuclear aromatics (PNAs) and volatile aromatics in both soils and water.

The PNA screening method, which is being implemented at two Superfund sites, consists of rapid extraction and analysis using UV flourescence spectrophotometry. The volatile aromatic screening technique entails collection of a headspace sample from a field sample in a closed container. The gaseous sample then is injected into a portable gas chromatograph (Photovac model 10A10).

## CONCLUSIONS

Gas plant wastes contain a wide range of chemical constituents that have persisted in the environment. The approach to site characterization should consist of site identification/preliminary assessment, site ranking and phased site investigations. Site ranking can be used to prioritize multiple sites for further investigations. In some cases, this ranking system has been used as a basis for selecting the No Action alternative.

The phasing of site investigations results in cost savings through the use of field screening techniques, "indicator" parameters for analysis and the collection of on-site data prior to investigating off-site locations. Finally, WESTON has developed field screening techniques for volatile aromatics and PNAs, two classes of compounds typically found in town gas plant wastes. Advantages in using these methods include reductions in laboratory costs, quicker turnaround times and greater knowledge of site contamination.

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**REFERENCE 17**

# Hydrology of the Babylon-Islip Area Suffolk County Long Island, New York

By E. J. PLUHOWSKI and I. H. KANTROWITZ

GEOLOGICAL SURVEY WATER-SUPPLY PAPER 176

*Prepared in cooperation with the Suffolk County Board of Supervisors, Suffolk County Water Authority, and the New York State Water Resources Commission*

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UNI

# HYDROLOGY OF THE BABYLON-ISLIP AREA, SUFFOL COUNTY, LONG ISLAND, N.Y.

By E. J. Pluhowski and I. H. Kantrowitz

## ABSTRACT

The report area comprises 270 square miles, and includes most of the Towns Babylon and Islip, and parts of the Towns of Huntington, Smithtown, a Brookhaven, in southwestern Suffolk County, New York.

~~Almost all the water used in the area is obtained from wells screened in permeab zones of the ground-water reservoir which consists of unconsolidated deposits gravel, sand, silt, and clay as much as 1,600 feet thick. The ground-water reservoir contains three principal aquifers.~~ From the surface down these are (a) surficial deposits of sand and gravel of Pleistocene age, (b) sands of the Magothy(?) Formation of Cretaceous age, and (c) the Lloyd Sand Member of the Raritan Formatio of Cretaceous age. ~~At present only the upper two aquifers are tapped by wells.~~

Natural replenishment of the ground-water reservoir in the area takes plac entirely by infiltration of precipitation and averages about 215 mgd (millio gallons per day). Average ground-water runoff to streams above tidewater 114 mgd, and it is estimated that an additional 54 mgd is discharged into tide reaches of streams. Ground-water evapotranspiration is computed to be about 10 mgd and submarine outflow from the area is estimated to be 18 mgd.

The average streamflow of the area above tidewater is 120 mgd. ~~Because of the permeable soils and low relief, direct runoff is only about 5 percent of the average streamflow.~~ Streams are perennial along their middle and lower reaches and exhibit well-sustained low flows. Flooding rarely occurs although continue urbanization may result in minor flooding problems as additional storm sewe are constructed.

Water in most of the area is generally of good quality; however, it may be contaminated locally. Some streams and parts of the water-table aquifer contain low concentrations of synthetic detergents and other dissolved constituents from domestic and industrial wastes. Salty water occurs in parts of the water-table aquifer in the area under and bordering Great South Bay and under the barrier beaches. Present information, however, indicates that submarine outflow in the artesian aquifers is sufficient to maintain the fresh water-salt water interfac some distance seaward of the barrier beaches.

Ground-water withdrawals in 1960 averaged 39 mgd, most of which was returned to the ground through cesspools, leaching beds, and recharge wells pumpage did not appreciably affect the natural water balance of the ground water reservoir. If withdrawals continue to be artificially recharged, pumpage can be increased at least fivefold before consumptive losses materially reduce ground-water levels. However, if the area were completely sewered in the future, an adequate supply of ground water for a substantially increased population could not be obtained without (a) reducing the amount of ground water in storage in the reservoir or (b) recharging treated-sewage effluent.

Ref. 17, p. 49/2

# INTRODUCTION

## PURPOSE

The rapid expansion of population and industry in southwestern Suffolk County, particularly since 1950 (fig. 2), has resulted in sharply increased withdrawals from the ground-water reservoir which, at present, supplies all water used in the area. However, the fact that there is substantial streamflow from the area indicates that additional development of the water resources is possible. Because an adequate water supply is essential to the continued growth of the area, knowledge of the occurrence, quality, and availability of water, both underground and in streams, is required by industry and the public. Because the source of all water on Long Island is precipitation, evaluation of the water potential of the area requires following the path of water from its inception as precipitation to its ultimate return to the atmosphere.

The objectives of the investigation were (a) to evaluate and summarize present data on quantity, quality, and availability of both ground water and surface water; (b) to determine the interrelation of ground water and surface water; (c) to evaluate the water balance for the ground-water reservoir, and (d) to evaluate any existing or potential water-supply problems.

This report is part of a continuing cooperative program sponsored jointly by the U.S. Geological Survey, the Suffolk County Water Authority, the Suffolk County Board of Supervisors, and the New York State Water Resources Commission.

## LOCATION AND EXTENT OF AREA

The report area includes the Town of Babylon, virtually all of the Town of Islip, and small parts of the Towns of Huntington, Smithtown, and Brookhaven in southwestern Suffolk County, and a small area in the southeastern part of Nassau County (fig. 1). The area comprises about 270 square miles, of which 190 square miles are on the main part of Long Island; the barrier beaches, islands, and Great South Bay comprise the remainder. The area is roughly rectangular in shape; it is about 20 miles long and from 11 to 13 miles wide. The western boundary is mainly along the interstream ground-water divide west of Carman Creek near Amityville (pl. 7). The eastern boundary is mainly along the interstream ground-water divide east of Tuthills Creek near Patchogue (pl. 7). Both eastern and western boundaries extend south to the barrier beaches. The northern boundary is along the main ground-water divide that traverses Long Island and the southern boundary is the Atlantic Ocean.

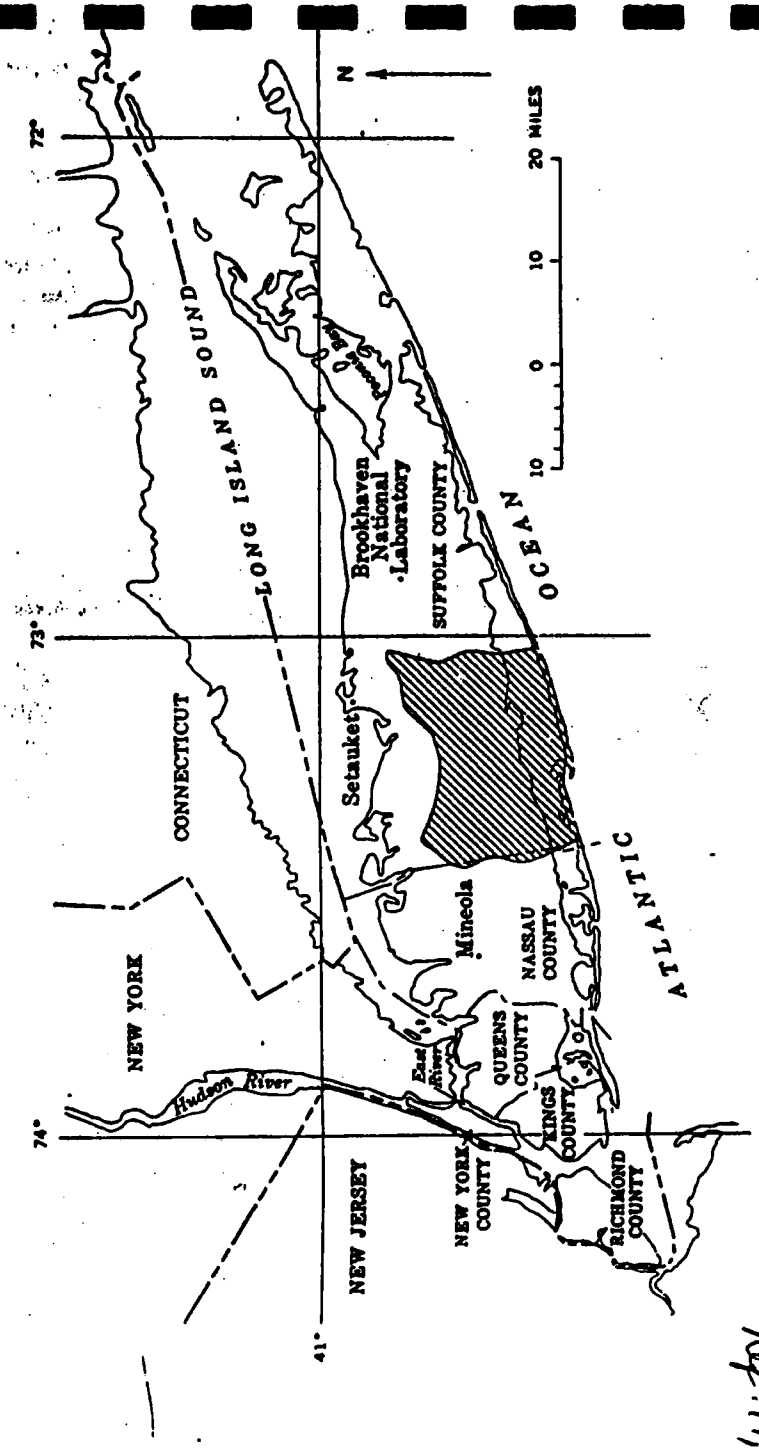


FIGURE 1.—Map of Long Island, New York, showing area of investigation.

Ref. 17, p. 5 & 12

## METHODS OF INVESTIGATION

Fieldwork began in July 1958 and was completed in March 1961. Well and geologic data were obtained from the files of the New York State Water Resources Commission and from records collected in the field. During the summer of 1958, 44 water-table observation wells were driven in areas where data were scanty. Water-level measurements were obtained at all available observation wells and at several public, industrial, and institutional supply wells. Water samples were collected from the observation wells and analyzed for selected constituents. In October 1958, a water-temperature and water-stage recorder was installed at Champlin Creek at Islip. In November 1958, four temporary recorders were placed in operation on streams for which continuous records of stage were not previously available. The partial-record stream-gaging program in Suffolk County was expanded to include several streams that had never been measured. Three streams, Santapogue River at Lindenhurst, Sampawams Creek at Babylon, and Champlin Creek at Islip, were selected for seepage studies, and discharge measurements were obtained bimonthly at selected sites. In December 1958, a three-element thermograph was placed in operation at Sampawams Creek at Babylon to obtain stream, air, and ground-water temperatures simultaneously.

During May 1959, three lines of shallow observation wells, each line consisting of four wells, were driven adjacent to Champlin Creek to study the relation of ground water to surface water. In addition, three wells were driven directly into the streambed at selected sites to study vertical changes in hydraulic head below the stream. Another line of four wells was driven, in October 1960, just upstream from the gaging station to aid in preparation of a water-table map and to provide additional sampling points for obtaining data on quality of water. To study the effect of ground-water evapotranspiration, a shallow water-table well was dug in August 1960 adjacent to Sampawams Creek, and a recorder was installed to detect water-level fluctuations.

Water samples were collected from selected wells and streams in August 1959, March 1960, September 1960, and March 1961 for determination of synthetic-detergent content. Water samples from four selected wells tapping different aquifers were collected for chemical analysis.

To facilitate office computations of streamflow data, the records of six primary gaging stations in the area and the records for Massapequa Creek at Massapequa in Nassau County were processed by an electronic computer. The processed data included duration tables of daily flow by water years and minimum-mean discharges for selected periods within each climatic year (April 1–March 31).



## PREVIOUS INVESTIGATIONS

A study of the water resources of Long Island by Veatch and other (1906), contains some descriptive data on ground water and surface water in the Babylon-Islip area. Maps of the water table of Long Island including the report area have been prepared by Burr and others (1904), Veatch (1906), Suter (1937), Jacob (1945), and Lusczynski and Johnson (1952). A map of the surficial geology of Long Island (Fuller, 1914) and contour maps of the subsurface formations (Suter, deLaguna, and Perlmutter, 1949) contain geologic data on the report area. A report on the geology and hydrology of the nearby Towns of Huntington and Smithtown (Lubke, 1961) has been freely drawn upon for data in the parts of those towns included in the area covered by this report. Perlmutter and Crandell (1959) have described geologic conditions and the occurrence of ground water beneath the barrier beaches. Many of the well logs utilized in the subsurface mapping of geologic units are included in publications of the New York State Water Resources Commission (Leggette and others, 1938; Roberts and Brashears, 1945; and Johnson and others 1952). Water-level measurements for some observation wells, records of daily discharge for gaging stations, and results of discharge measurements made at partial-record sites, are published in annual water-supply papers and open-file reports of the U.S. Geological Survey.

## ACKNOWLEDGMENTS

The writers acknowledge the assistance of well drillers, the New York State Department of Public Works, and the Suffolk County Water Authority, in furnishing hydrologic and geologic data. The New York State Department of Health, the Suffolk County Department of Health, the Suffolk County Water Authority, and several privately owned laboratories furnished much of the chemical data included in the report. R. L. Barnell, formerly of the U.S. Geological Survey, supervised the construction of observation wells, and prepared a preliminary map of the water table.

# GEOGRAPHY

## TOPOGRAPHY

The Babylon-Islip area lies within the Atlantic Coastal Plain physiographic province and may be subdivided into a small northern region of irregular hills and a large southern region composed of a broad gently sloping plain. These topographic features are mostly depositional in origin and are only slightly modified by stream erosion.

The region of hilly topography corresponds to the distribution of

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geologic units mapped as Ronkonkoma terminal moraine and Mannetto Gravel (pl. 1). The highest land surface altitude on Long Island, about 400 feet above sea level, is on the Ronkonkoma terminal moraine, about 3 miles southwest of Huntington Station. Summit altitudes on the terminal moraine and adjacent hills are commonly as much as 150 feet or more above the outwash plain, which abuts the hills at an altitude of about 120 feet above sea level. The outwash plain is characterized by a gently rolling land surface, which slopes southward at about 20 feet per mile.

Marshlands, at or slightly above mean sea level, fringe the south shore of the area, adjacent to Great South Bay. The bay, which separates the main part of Long Island from the narrow low-lying barrier beaches, is generally less than 3 feet deep in the western part of the area and less than 10 feet deep in the eastern part. In boat channels the depth may be as much as 30 feet.

## POPULATION

The substantial population upsurge in Suffolk County since 1950 is primarily the result of migration from New York City. Figure 2 illustrates the rate of population growth in the Towns of Babylon and Islip. The combined population of both towns was 117,021 in 1950, and 315,268 in 1960, an increase of nearly 170 percent. The Town of Babylon had a slightly greater rate of growth than the Town of Islip between 1950 and 1960, which was probably due to its closer location to New York City. The major factor contributing to urbanization of western Suffolk County is the improved rail and highway transportation.

With the exception of the northwestern part which is largely an area of cemeteries, population density in the Town of Babylon is fairly uniform (pl. 6). Centers of greatest population are near the south shore and in eastern parts of the town. In the Town of Islip, population density is greatest west of Connetquot River. Pilgrim State Hospital, the largest hospital in the world, is in the extreme northwestern part of the Town of Islip. Another center of high population density is Central Islip State Hospital, northeast of the headwaters of Champlin Creek. Large areas adjacent to and east of Connetquot River are still in their natural state. The extensive construction activity in western Suffolk County has just begun to reach the eastern part of the Town of Islip, which is still predominantly rural (1961).

## INDUSTRY

Industrial growth in the Towns of Babylon and Islip has paralleled population growth. Industrialization of the area has resulted in large measure from decentralization of New York City's industrial core.



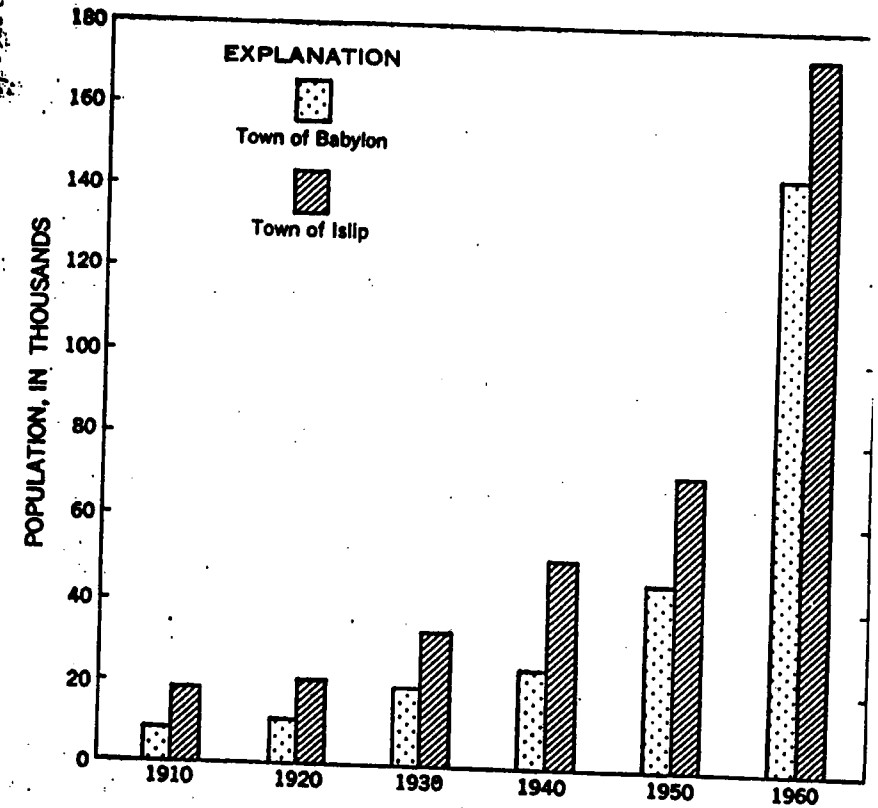


FIGURE 2.—Population of the Towns of Babylon and Islip, 1910-60.

Nearly two-thirds of the companies in the area have been established since the end of World War II. Most concerns are small, employing fewer than 100 people; however, two large plants, Republic Aviation Corp. and Fairchild Engine and Aircraft Co., each employ several thousand. Republic Aviation Corp., which is in the northwestern part of the Town of Babylon, is the largest industrial concern in Suffolk County, and employed 16,000 persons in 1958. Of the 625 industrial plants in Suffolk County in June 1956, nearly 60 percent were in the Towns of Babylon and Islip (Leonard and Stonier, 1956, p. 51).

The major industries in Suffolk County are aviation, instruments, electronics, and fabrication of metals; smaller industries include furniture, printing and publishing, textiles, and apparel. The aviation industry has been well established on Long Island since the end of World War I. Production of scientific and professional instruments came as a natural adjunct to the aviation industry. Similarly,

Ref. 17, p. 7812

the development of the all-metal airplane created a need for metal-fabricating shops. The post-World War II boom in electronics and electrical equipment found Suffolk County well prepared for the new industry owing to its established aviation firms, and the presence of the required skilled personnel.

## AGRICULTURE AND VEGETATION

Although the value of crops produced and marketed in Suffolk County ranks highest of all the counties in New York State, agricultural production in the Babylon-Islip area is relatively small. The soils in the southern and eastern parts of the area have been classified by Lounsberry and others (1928, p. 13) as Sassafras Sandy Loam and Dukes Loamy Sand. These soils are not as productive as the soils in the northern and eastern parts of the county. The Sassafras Loam soils in the northwestern and north-central parts of the area are fairly productive. Proximity of this area to metropolitan markets spurred the development of numerous truck farms. The major crops produced by these farms are tomatoes, cauliflower, corn, string beans, peas, and cucumbers. Intensive urbanization, however, has reduced farm acreage so sharply that only a few farms remained in 1961.

Extensive tracts of natural vegetation are limited principally to the northern and eastern parts of the area. Much of the hilly area of the Ronkonkoma terminal moraine is forested with well-developed stands of deciduous trees. Low moisture retention characterizes the sandy, well-drained soils of the eastern part of the area and thereby precludes extensive forest development. Stands of scrub oak or pitch pine are common here in conjunction with an undergrowth of huckleberry, sweetfern, and wintergreen.

# GEOLOGY

The composition, thickness, and geologic history of the deposits underlying the Babylon-Islip area determine the water-bearing characteristics, and the lateral and vertical extent of aquifers and aquicludes that form the hydrologic environment. The stratigraphy of the geologic formations is known almost exclusively from well records and samples, as outcrops, especially those of Cretaceous age, are rare.

## STRATIGRAPHY

The Babylon-Islip area is underlain by unconsolidated sediments of Cretaceous, Tertiary, and Quaternary age, which lie on crystalline bedrock of Precambrian or early Paleozoic(?) age (table 1 and pl. 1). Directly overlying the bedrock is the Raritan Formation of Cretaceous age consisting of the Lloyd Sand Member and an unnamed clay member. Above the Raritan Formation is a thick sequence deposits of late Cretaceous age which is in part, correlative with t Magothy Formation of New Jersey, but also includes some formatio that are younger than the Magothy (Perlmutter and Crandell, 195 p. 1066). Pending a more specific identification, these beds a referred to as the Magothy(?) Formation. Deposits of Quaternar and possibly Tertiary age overlie the Cretaceous deposits. The consist, from oldest to youngest, of the Mannetto Gravel of doubtf Tertiary (Pliocene ?) age, the Gardiners Clay, and the upper Pleist cene and Recent deposits.

TABLE 1.—*Summary of stratigraphy of the Babylon-Islip area*

| Era | Period | Epoch | Geologic unit | | Remarks |
|---|---|---|---|---|---|
| Cenozoic | Quaternary | Recent | Recent deposits | | Stream, beach, and marsh posits; small areal extent. |
| | | Pleistocene | Upper Pleistocene deposits | | Till and outwash deposits of Wisconsin Glaciation. |
| | | | Gardiners Clay | | Fossiliferous marine clay of pr able Sangamon age. |
| | Tertiary(?) | Pliocene(?) | Mannetto Gravel | | Formerly believed to be an o wash deposit but now regard as a stream-terrace depo small areal extent. |
| Mesozoic | Cretaceous | Late Cretaceous | Magothy(?) Formation | | Interbedded sand, silt, and cla |
| | | | Raritan Formation | Clay member | Dominantly clay but may co tain some silty and sandy so locally. |
| | | | | Lloyd Sand Member | Sand, gravel, and interbedd clay and silt. |
| Precambrian and early Paleozoic(?) | | | Bedrock | | Schist and gneiss containing so granitic intrusions. |

## THE BEDROCK

No wells in the Babylon-Islip area have reached bedrock. However, information obtained from wells in nearby parts of Long Islan (Suter and others, 1949, p. 30–32, pls. 8 and 9) suggests that the bedrock in the area consists chiefly of schist and gneiss and contains some granitic intrusions. The bedrock is probably correlative in part with igneous and metamorphic rocks of Connecticut.

The bedrock surface dips southeastward at a rate of approximately 50 to 100 feet per mile. The altitude of the surface ranges from about 1,200 feet below sea level in the northwestern part of the area to about 1,800 feet below sea level in the extreme southeastern part. This bedrock surface represents the lower limit of the ground-water reservoir.

Ref. 17 p. 84
12

The Raritan Formation of Late Cretaceous age directly overlies the bedrock. It is divided into the Lloyd Sand Member below and an unnamed clay member above, and has been correlated with the Raritan Formation of New Jersey on the basis of lithology and stratigraphic position. Because the Raritan Formation has been penetrated by only one test well in the area, its lithology, thickness, and altitude are inferred from data obtained in adjacent areas.

### LLOYD SAND MEMBER

The ~~Lloyd Sand Member~~ of the Raritan Formation lies directly on the bedrock surface. ~~It has an estimated thickness of [illegible] feet and is thickest in the southern part of the area. The altitude of the~~ top of the Lloyd is estimated to be ~~approximately [illegible] 1,000 feet below sea level~~, being lowest in the southeast under Fire Island. It is inferred from examination of cores from wells N3355[1] and S6409 (1½ miles northwest of the northwest corner of the Town of Babylon, and approximately 15 miles east of Lake Ronkonkoma, respectively), and the log of well S42 (pl. 1) that the Lloyd Sand Member underlying the area is probably composed of light-colored sand and gravel and lenses of clay and silty clay. Logs of several wells in eastern Suffolk County, indicate that the Lloyd Sand Member may be more clayey in that area, possibly because of a facies change along the northeasterly strike of the formation.

### CLAY MEMBER

On the basis of descriptions of samples from wells in other parts of Long Island and the log of well S42 in the area, the clay member of the Raritan Formation probably consists of 170 to 300 feet of gray, blue, black, red and white clay, silt, and some very fine to fine sand. The altitude of the top of the clay member at well S42 in the northwest corner of the Town of Islip is 670 feet below sea level, and under Fire Island the clay member may be as much as 1,300 feet below sea level.

### MAGOTHY(?) FORMATION

The Magothy(?) Formation of Late Cretaceous age has been completely penetrated by only one well (S42) in the area; therefore, its thickness and the nature of its contact with the underlying clay member of the Raritan Formation is known only approximately. The Magothy(?) is about 600 to 700 feet thick in the northern part of the area, and 1,000 to 1,200 feet thick in the southern part. The

[1] Wells in each county on Long Island are numbered serially by the New York State Water Resources Commission. The well number is prefixed by the initial letter of the county in which the well is located. Thus, well N3355 is in Nassau County and well S6409 is in Suffolk County.



altitude of the top of the formation ranges from 200 feet above more than 100 feet below sea level. Relief on the Magothy surface is due to stream erosion, mostly during late Pliocene Pleistocene time. Contour lines on the Magothy(?) surface are sho on plate 2.

The Magothy(?) Formation consists mostly of nonfossilifer beds and lenses of gray and white fine quartz sand, clayey and s sand and clay. However, the upper 50 to 200 feet of the format beneath the barrier beaches consists of beds of fossiliferous gr and gray glauconitic clay and sandy clay, which have been tentativ correlated with the Monmouth Group of New Jersey (Perlmut and Crandell, 1959, p. 1066). Layers of lignite, pyrite, and ir oxide concretions are common. Medium to coarse sand occurs lenses irregularly throughout the formation, particularly in the up and lower zones. West and north of the Babylon-Islip area, wh the formation has been more fully explored, a gravel-bearing zone much as 200 feet thick is found in the lower (basal) zone of the M gothy(?). Records of a few wells suggest that the gravelly zo occurs also in the area.

### MANNETTO GRAVEL

The Mannetto Gravel, which consists of stratified and crossbedc quartz gravel, containing some highly weathered erratic materi was considered by Veatch (1906) and Fuller (1914) to represent t earliest deposit of Pleistocene age on Long Island. Currently it considered to be of doubtful Tertiary (Pliocene(?)) age (Suter a other, 1949, p. 9) and probably correlative with the Bryn Ma terrace-gravel deposits of Pennsylvania (Cooke, Gardiner, a Woodring, 1943).

The Mannetto Gravel has been recognized only in the northweste part of the Babylon-Islip area where it crops out in the West and t Half Hollow Hills. It is difficult to distinguish the Mannetto drillers' logs from the overlying glacial deposits, and its subsurfa distribution is not well known.

### PLEISTOCENE DEPOSITS

Deposits of Pleistocene age comprise the uppermost 50 to 150 feet sediments in most of the area. The Jameco Gravel, a major aquifer western Long Island, is not found in the Babylon-Islip area. T oldest formation of Pleistocene age is the Gardiners Clay, an inte glacial deposit. The Gardiners Clay is overlain by upper Pleistoce deposits of Wisconsin age.

### GARDINERS CLAY

The Gardiners Clay is a marine interglacial deposit of probab Sangamon age and has been recognized in wells along the south sho

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[redacted]he a[redacted]l. 2[redacted]end[redacted] it is [redacted] found more than a mile north of Great South Bay, although it occurs in the middle of Long Island, at Brookhaven National Laboratory (Weiss, 1954), 11 miles east of the Babylon-Islip area. The Gardiners Clay is overlain by upper Pleistocene deposits of Wisconsin age. It is difficult to determine the lower boundary of the Gardiners Clay from drillers' logs in some places because the underlying Magothy(?) Formation contains beds of similar lithology. The abundance of biotite and chlorite and the presence of foraminifers are used to differentiate the Gardiners from the Magothy(?) Formation where samples are available.

The Gardiners Clay is generally 20 to 40 feet thick, and the altitude of the top of the formation ranges from about 50 to 110 feet below sea level (p. 2). The formation consists of dark-colored clay, lenses of green silt and very fine sand, and thin layers of fine gravel. The layers of clay and silt are generally fossiliferous.

UNI

### UPPER PLEISTOCENE DEPOSITS

The upper Pleistocene deposits include (a) outwash deposits of stratified medium to coarse sand and gravel, (b) terminal moraine deposits consisting of till and ice-contact deposits of stratified sand and gravel, (c) till, composed of unstratified clay, sand, gravel, and boulders in the form of ground moraine (not exposed), and (d) glacio-lacustrine deposits of clay and silt (not exposed). The surficial distribution of the till and outwash deposits is shown on Plate 1.

Outwash is the most extensive upper Pleistocene deposit in the area. The outwash is underlain by the Gardiners Clay and Magothy(?) Formation, and is partly overlain by younger glacial and Recent deposits. The thickness of the outwash ranges from zero where it abuts Cretaceous and Tertiary sediments in the northwestern part of the area, to more than 100 feet in the eastern part. In parts of the area as much as 120 feet of poorly to well stratified ice-contact deposits are found above the outwash. These deposits form the bulk of the Ronkonkoma terminal moraine, a discontinuous ridge marking the maximum advance of a continental glacier. Quartz is by far the most abundant mineral in the outwash and ice-contact deposits; however, igneous and metamorphic rock particles, muscovite, biotite, and some heavy minerals are common in many beds.

A buried till sheet probably underlies the outwash deposits north of the Ronkonkoma moraine, but the till has not been definitely identified (Lubke, 1961, p. 38). A glacial clay, which underlies much of the Town of Smithtown (Lubke, 1961, p. 39), extends into the northeastern part of the area, but the data are too scanty to define the southern limit.



### RECENT DEPOSITS

Deposits of Recent age are found along stream channels, in mar and ponds, on the barrier beaches, and under Great South I Stream channel deposits consist of a veneer of discontinuous rewor outwash deposits. Beds of very fine sand, silt, and clay are accumu ing in marshes and ponds, and under Great South Bay. The ba beaches consist of beach and dune sands as much as 50 feet th The Recent deposits commonly contain shells of mollusks.

## GEOLOGIC HISTORY

A knowledge of the geologic history is important in understand the nature and distribution of the geologic formations. The foll ing summary is adapted largely from a report by Suter, and ot (1949, p. 29–46).

During the Cretaceous Period, sediments derived from highland northeastern North America were deposited on a relatively flat b rock surface sloping in a general southeasterly direction. The s ments thus deposited form a part of the present-day coastal pl extending from Long Island to the Gulf of Mexico. Long Isla which was approximately at the strand line of the Cretaceous received mostly continental deposits. The great thickness of s ments deposited near sea level suggest concurrent depression of bedrock surface during deposition. The variable and lenticu nature of the Cretaceous sediments indicates that deposition t place in shifting river channels, flood plains, swamps, and marshes

The apparent absence of deposits of Tertiary age on Long Isla except for the nonmarine Mannetto Gravel, suggests either nondep tion or deposition followed by extensive erosion. The present tribution of the Mannetto Gravel is a remnant of the formerly ext sive stream deposit.

Large continental glaciers, which were formed at the beginning the Pleistocene Epoch, resulted in a general lowering of sea lev This lowering, in turn, caused stream rejuvenation and widespre erosion of pre-Pleistocene sediments and deepening of existing valle The area was drained then, as now, primarily by southward flowi streams, which cut partly into the Magothy(?) deposits but probal nowhere removed them completely. The eroded surface of t Magothy(?) is shown by contours on plate 2. The high area on t Cretaceous surface in the northwestern part of the area is a remna of a dissected former divide between northward- and southwar flowing streams.

It is generally believed that the Pleistocene Epoch included fo major glaciations, and therefore four cycles of eustatic sea lev changes. The first three glacial advances did not reach Long Islan

Pg. 17, p. 10 of 12

The onl[redacted]iden[redacted] the [redacted]esence [redacted]ear Long Island is the Jameco Gravel, an outwash deposit found in some parts of the island, but not in the Babylon-Islip area. The Gardiners Clay was deposited in shallow water during an interglaciation (Sangamon) when sea level was relatively high, but about 50 feet below its present altitude. The final, or Wisconsin glaciation of the Pleistocene Epoch, consisted of the Ronkonkoma and Harbor Hill stades. During the first Wisconsin ice advance, meltwater deposited outwash, which was partially overridden by the ice until stagnation occurred. During this stagnation period, stratified sand and gravel in the form of outwash was deposited south of the glacier by meltwater streams, and stratified ice-contact deposits were deposited along the southern terminus of the glacier to form the Ronkonkoma terminal moraine. Melting of the ice left a thin sheet of unstratified ground moraine, which was subsequently buried by younger outwash. The second Wisconsin ice advance did not move as far south as the first. Meltwater streams from the second advance deposited stratified sand and gravel north of the Ronkonkoma terminal moraine and, in places, breached the moraine so that Harbor Hill outwash may be found above the outwash of the Ronkonkoma Stade from which it cannot be distinguished readily.

Some of the large streams in the area did not erode their present valleys, but occupy valleys eroded by streams which issued from glaciers during the Pleistocene Epoch. The largest valleys in the area, those of Carlls River, Connetquot River, and Sampawams Creek, can be traced northward to breaches in the Ronkonkoma moraine (pl. 1).

Melting of the continental glaciers was accompanied by a rise in sea level to its present position. Erosion by stream and wave action is presently occurring simultaneously with deposition by these same agents.

## HYDROLOGY

### HYDROLOGIC ENVIRONMENT

Water in the Babylon-Islip area occurs in the interstices of unconsolidated sediments and in streams and ponds. The ground-water reservoir consists of saturated unconsolidated deposits ranging in thickness from 1,300 to 1,800 feet. The water table, which forms the boundary between the zone of saturation and the overlying zone of aeration (unsaturated zone), is the upper limit of the reservoir, and the impervious bedrock is the lower limit. Water in marshes, ponds, or streams in the Babylon-Islip area is nearly always hydraulically connected with the water table. The availability of ground water and surface water for man's use is controlled to a large extent by the



physical characteristics of the aquifers, streams, and ponds. Th characteristics include the capacity of ponds, size and gradient streams, and the extent, nature of boundaries, and water-bea properties of aquifers.

### AQUIFERS

Three aquifers of wide areal extent are recognized in the depo underlying the Babylon-Islip area: (a) a shallow water-table aqui (b) an intermediate artesian aquifer, and (c) a deep artesian aqui Perched water may occur locally in the northern part of the area lenses of sand and gravel separated from the main water table deposits of clay or glacial till. The hydrologic environment perched-water bodies is similar to that of the water-table aqui except that perched-water bodies are small and localized and genera are not a dependable source of supply.

### WATER-TABLE AQUIFER

The water-table aquifer is composed almost entirely of highly p meable upper Pleistocene deposits that constitute the uppermost zo of the ground-water reservoir. The upper surface of this aquifer the water table, or top of the zone of saturation. The configurati of the water table (pl. 3) is controlled by the topography, and by t thickness, water-bearing properties, and quantity of recharge to a discharge from the aquifer.

The water table is a subdued replica of the topography. A co spicuous "high" on the water table occurs under the West Hills, sou of Huntington Station, where the land surface reaches altitudes high as 400 feet. Another "high" northeast of Lake Ronkonkoma coincident in part with the Ronkonkoma terminal moraine where t land surface altitude is commonly as high as 300 feet. The saddle the ground-water divide south of Hauppauge is probably largely t result of substantial quantities of ground-water discharge into t relatively deep valleys of the Nissequogue and Connetquot rive situated north and south of the divide, respectively.

Depth of the water table below land surface is shown on plate In general, the depth to water increases northward from zero alo Great South Bay and stream channels to as much as 200 to 300 fe beneath parts of the Ronkonkoma terminal moraine, West Hills, ar Half Hollow Hills. The southern half of the area is drained by mar effluent streams and depths to water are commonly 25 feet or less.

The lower boundary of the water-table aquifer is defined in most the area by the occurrence of beds of predominantly low permeabilit in the upper part of the Magothy(?) Formation. Where the upp part of the Magothy(?) is composed of permeable material, these bed form a part of the water-table aquifer, and the lower surface of th

Kgl. 17
P. 1, 8/12

[redacted] the [redacted] im[redacted]eab[redacted]e [redacted] below the top of the Magothy(?). In the extreme southern part of the area, the Gardiners Clay forms the lower boundary of the water-table aquifer.

The water-table aquifer is present everywhere in the Babylon-Islip area, but it very thin in some places and contains salt water in others. In the northwestern part of the area, the water table is mainly in the Magothy(?) Formation rather than in upper Pleistocene deposits. As a result, the water-table aquifer is thin, owing to the clayey nature of most of the saturated beds. The Recent and upper Pleistocene deposits which compose the water-table aquifer beneath Great South Bay contain only salt water. Beneath the barrier beaches, fresh water in the water-table aquifer occurs in small discontinuous lenses in beach and dune deposits of Recent age. These fresh-water lenses are underlain by salt water.

The approximate thickness of the water-table aquifer may be determined by subtracting algebraically the altitude of the top of the Magothy(?) Formation, or Gardiners Clay where it is present (pl. 2), from that of the water table (pl. 3). The thickness of the water-table aquifer ranges from almost zero in the northwestern part of the Babylon-Islip area to more than 100 feet in the eastern part. The average thickness is about 75 feet. Wells screened in the outwash deposits yield as much as 1,500 gpm (gallons per minute). Specific capacities may be as high as 135 gpm per foot of drawdown, but are commonly 40 to 75 in thoroughly developed, large-diameter wells. The specific capacity of a well is a useful parameter for estimating water-bearing properties of an aquifer. Coefficients of transmissibility estimated from specific capacities (Theis and others, 1954) were used to compute the approximate coefficients of permeability of the outwash deposits given in the following table:

*Estimated permeabilities of outwash deposits in the water-table aquifer*

| Well | Screened zone (ft below land) | Yield (gpm) | Specific capacity (gpm per ft) | Approximate thickness of aquifer (feet) | Field coefficient of permeability (gpd per sq ft) |
|---|---|---|---|---|---|
| S10,760T | 59-81 | 500 | 37 | 73 | 800 |
| S11,151 | 50-61 | 60 | 20 | 84 | 300 |
| S12,016 | 50-65 | 1,525 | 98 | 67 | 2,200 |
| S12,421 | 54-75 | 360 | 45 | 70 | 1,000 |
| S12,710 | 40-70 | 1,500 | 100 | 75 | 1,600 |
| S12,873 | 73-103 | 1,212 | 76 | 91 | 1,100 |
| S13,478 | 38-60 | 330 | 42 | 70 | 900 |
| S16,176 | 81-117 | 1,529 | 71 | 85 | 1,200 |
| S16,608 | 110-140 | 1,000 | 77 | 88 | 1,200 |



The hydraulic coefficients of the water-table aquifer at one near Central Islip State Hospital are given below:

*Hydraulic coefficients of outwash deposits in the water-table aquifer*

[Determination by the Hydrologic Laboratory, U.S. Geol. Survey]

| Well | Depth (feet) | Specific retention (percent) | Specific yield (percent) | Porosity (percent) | Coefficie permeabi (gpd pe ft) |
|---|---|---|---|---|---|
| S16,809 | 27-82 | 2.2 | 25 | 27.2 | |

Because of the high permeability of the beds and generally shal depth to the water table, wells are both productive and economica most of the area underlain by outwash deposits (pl. 1). The wat table aquifer presently (1961) supplies approximately 84 percent of total pumpage of ground water in the Babylon-Islip area.

### INTERMEDIATE ARTESIAN AQUIFER

The intermediate artesian aquifer is composed of lenticular p meable deposits of the Magothy(?) Formation. The upper surface the clay member of the Raritan Formation defines the lower bound of the aquifer. Clayey and silty lenses in the upper part of Magothy(?) Formation and the Gardiners Clay, where present, c stitute the upper boundary. Unlike the top of the water-ta aquifer, the upper boundary of the intermediate artesian aqui generally is not a sharply defined surface such as the water table, b is a transitional zone of relatively low permeability. Where clay confining beds are replaced by sandy zones, hydraulic continui exists between the water-table and intermediate artesian aquifers.

Because permeable zones in the Magothy(?) Formation are lentic lar, it is difficult to predict their occurrence and thickness, except a basal zone. As in many parts of western Long Island, an extensi zone of sand and gravel about 100 feet thick probably lies immediate above the clay member of the Raritan Formation in the Babylon-Isl area but the data are too scanty to permit mapping the zone as separate unit. (See well S42, pl. 1.) Test drilling is generally nece sary to locate permeable zones which can yield as much as 1,500 gp to individual wells. Specific capacities of wells range from 1 to gpm per foot of drawdown. Those wells tapping zones compos chiefly of sand and gravel commonly have specific capacities rangi from 20 to 40 gpm per ft. The method of computing transmissibiliti

Ref. 17, p. 12

**REFERENCE 18**

U.S. DEPARTMENT OF COMMERCE

WEATHER BUREAU

TECHNICAL PAPER NO. 40

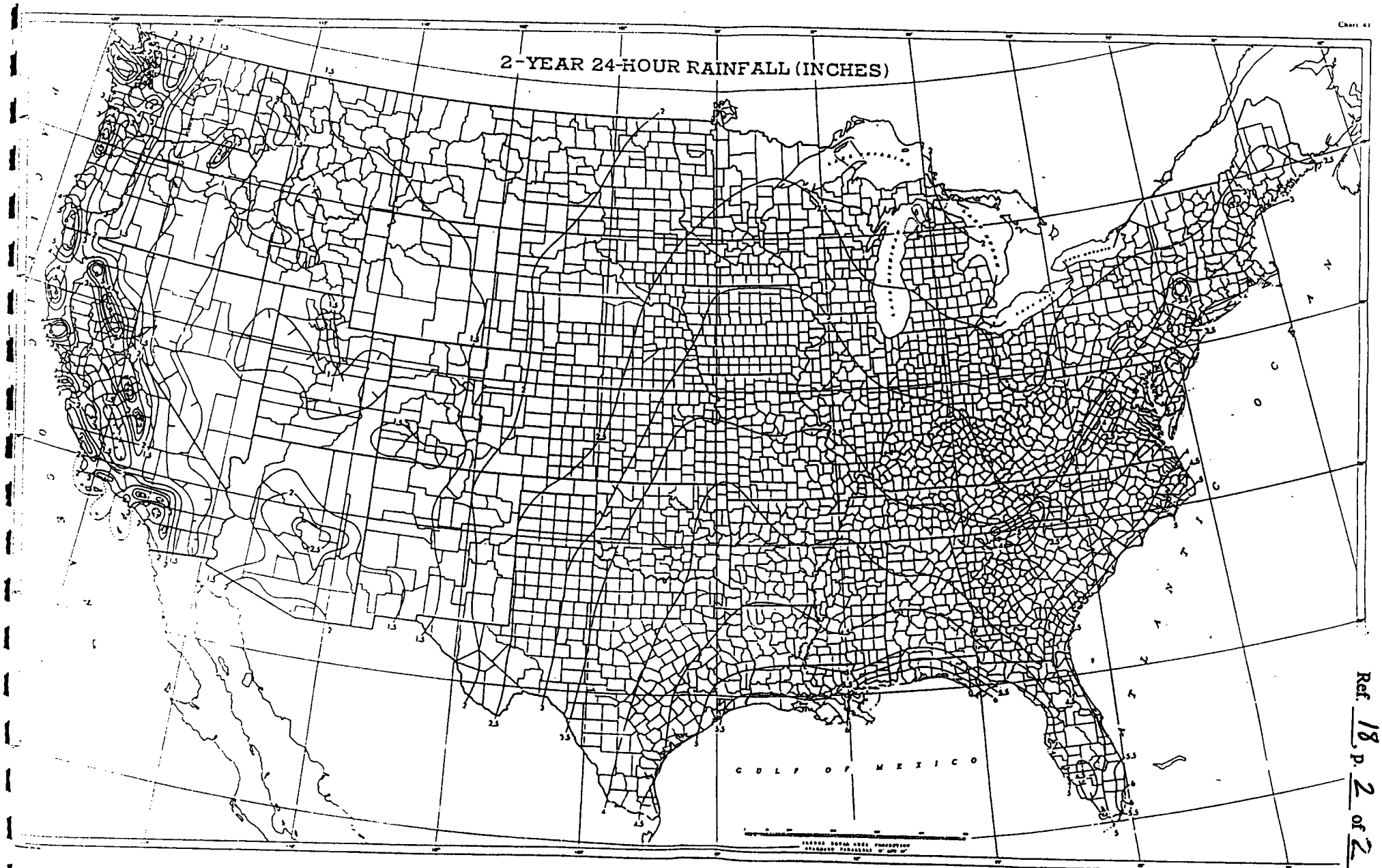
# RAINFALL FREQUENCY ATLAS OF THE UNITED STATES

## for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years

WASHINGTON, D.C.
1961

K2.32
R

Ref. 18, p. 1 of 2




Ref. 18, p. 2 of 2

**REFERENCE 19**

NATIONAL FLOOD INSURANCE PROGRAM

# FIRM
## FLOOD INSURANCE RATE MAP

TOWN OF
# ISLIP, NEW YORK
SUFFOLK COUNTY

PANEL 17 OF 40
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
365337 0017 D

MAP REVISED:
JULY 2, 1987

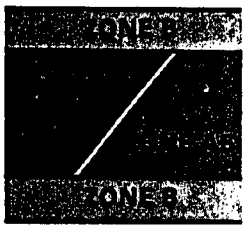
Federal Emergency Management Agency

## KEY TO MAP

500-Year Flood Boundary

100-Year Flood Boundary

Zone Designations*




100-Year Flood Boundary

500-Year Flood Boundary

Base Flood Elevation Line With Elevation In Feet** — 513

Base Flood Elevation in Feet Where Uniform Within Zone** — (EL 987)

Elevation Reference Mark — RM7×

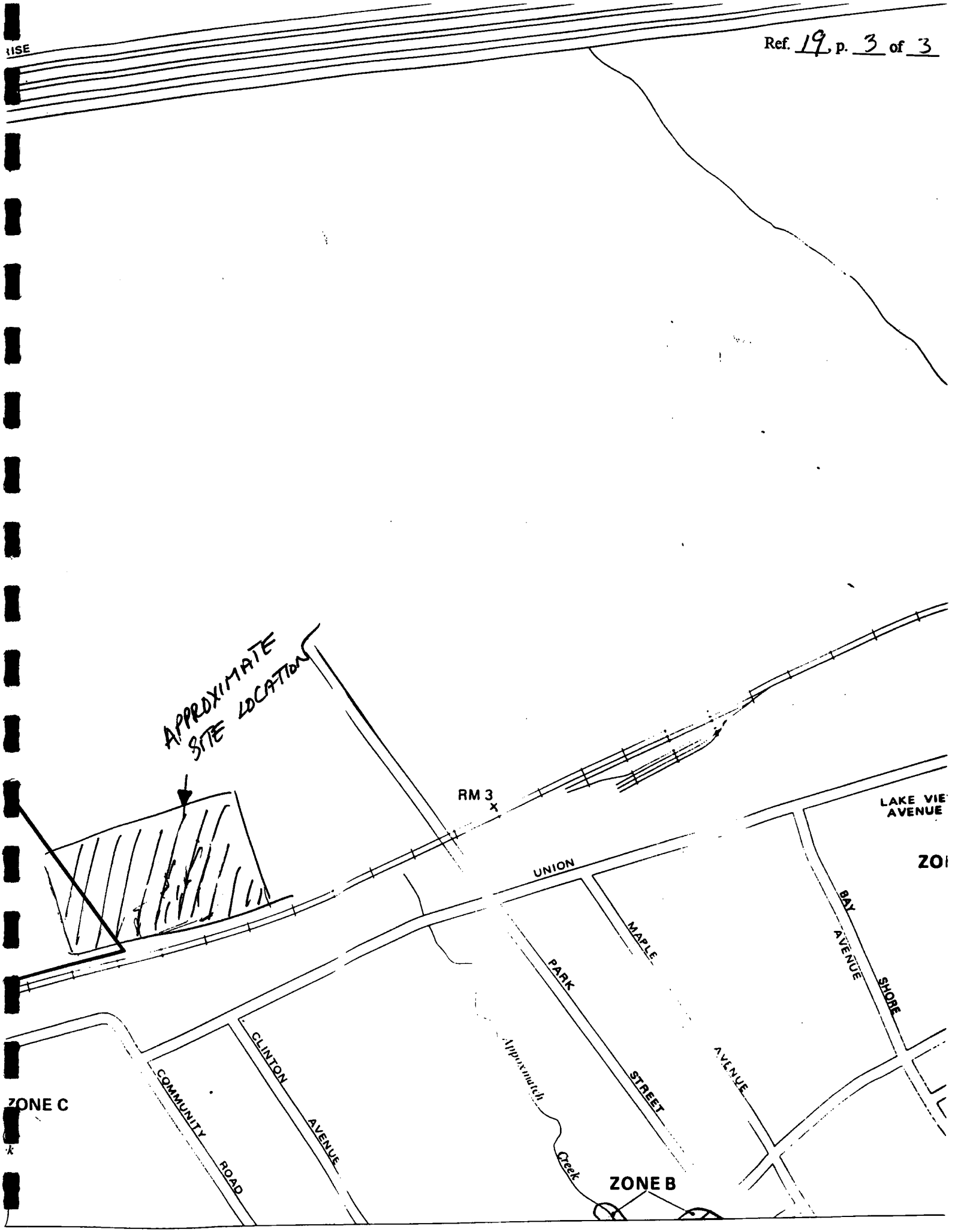
Zone D Boundary

River Mile — •M1.5

**Referenced to the National Geodetic Vertical Datum of 1929

## *EXPLANATION OF ZONE DESIGNATIONS

| ZONE | EXPLANATION |
|---|---|
| A | Areas of 100-year flood; base flood elevations and flood hazard factors not determined. |
| A0 | Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined. |
| AH | Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined. |
| A1-A30 | Areas of 100-year flood; base flood elevations and flood hazard factors determined. |
| A99 | Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined. |
| B | Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading) |
| C | Areas of minimal flooding. (No shading) |
| D | Areas of undetermined, but possible, flood hazards. |
| V | Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined. |
| V1-V30 | Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined. |


APPROXIMATE SITE LOCATION
RM 3
UNION
LAKE VIE
AVENUE
ZO
MAPLE
PARK
STREET
BAY
AVENUE
SHORE
AVENUE
Appoxmatch
Creek
CLINTON
AVENUE
COMMUNITY
ROAD
ZONE C
ZONE B

**REFERENCE 20**

# Part 925 - Western Suffolk County Waters

History

**§925.1 Adopting order.**

(a) Pursuant to article 12 of the Public Health Law, the Water Resources Commission, after proper study and following public hearings conducted by the commission, held on due notice, hereby adopts and assigns the following classifications and standards of quality and purity to all surface waters within the designated drainage basin of western Suffolk County as hereinafter described.

(b) This adoption and assignment of standards of quality and purity to the above designated waters shall be effective September 22, 1965.

**§925.2 Designated waters.**

The Western Suffolk County Waters drainage basin shall be deemed to include the following:

(a) All land and surface areas within Suffolk County, State of New York, lying east of the Nassau County - Suffolk County boundary line and within the topographical limit lines shown on the reproduced reference maps herein. The easterly limit line of this basin is coterminous with the westerly limit line of Great South Bay (easterly section) drainage basin.

(b) All of the Western Suffolk County Waters as defined in Table I included herein.

**§925.3 Definitions and conditions.**

The several terms, words or phrases hereinafter mentioned shall be construed as follows:

(a) Item No. In Table I an item number is assigned consecutively to each specifically designated waters or portion thereof.

(b) Waters index number as appearing in Table I shall mean that number or abbreviation assigned to any designated waters or portion thereof for the purpose of identification.

(1) The numbering or index system used to identify specific waters of New York State was adapted from that used by the New York State Conservation Department in its biological survey series of reports on watersheds of the State. The primary waters of a drainage area, such as a river, large lake, bay or sound, is usually referred to by name or an abbreviation. Tributaries of primary river waters are consecutively numbered progressing upstream from the mouth. Tributaries of primary lake, bay or sound waters are consecutively numbered in clockwise order from a defined point, usually the outlet of the primary waters. Subtributaries are numbered as

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| | | | |
|---|---|---|---|
| S-26nw | Amityville | 1954 | U.S. Geological Su |
| S-27nw | Bay Shore East | 1955 | U.S. Geological Su |
| S-27ne | Sayville | 1955 | U.S. Geological Su |

(g) Class, as appearing in Table I and denoted by the letters B, C, SA, SC or SD or the Roman numeral I opposite each specifically designated waters, shall mean Class B, C, SA, SC or SD, as the case may be, as set forth in Part 701, supra; and in the case of Roman numeral I shall mean Class I as set forth in Part 702, supra.

(h) Standards, as appearing in Table I and denoted by the letters B, C, SA, SC or SD or the Roman numeral I opposite each specifically designated waters, shall mean the quality standards established for Class B, C, SA, SC, SD or I, as the case may be, as set forth in Parts 701 and 702, supra. The symbol (T) appearing after any class designation shall mean that the designated waters are trout waters and that the dissolved oxygen specification for trout waters shall apply thereto. The symbol (TS) after any class designation shall mean that the designated waters are suitable for trout spawning and that the dissolved oxygen specification for trout spawning waters shall apply thereto.

(i) The term trout as used in this Part means any fish in the following genera: Coregonus, Oncorhynchus, Prosopium, Salmo, Salvelinus and Thymallus.

**§925.4 Special conditions.**

(a) All streams, ponds, estuaries or other bodies of water which appear as lines, to indicate natural waters, on the reference maps herein, and which are not specifically designated in Table I, shall be assigned the same classes and standards of quality and purity as the specifically designated waters to which they are directly tributary.

(b) All streams, ponds, estuaries or other bodies of water which are not shown on the reference maps herein shall be assigned to Class D, as set forth in Part 701, supra, except that any continuous flowing natural stream which is not shown on the reference maps shall have the same classification and assigned standards as the waters to which it is directly tributary; or, if they be tidal salt waters, such waters which are not shown on the reference maps herein shall be assigned to Class SD, as set forth in Part 701, supra, except that any continuous flowing natural stream which is not shown on the reference maps shall have the same classification and assigned standards as the waters to which it is directly tributary.

(c) Unless otherwise expressly defined in Table I, the mouth of any stream or estuary shall be considered to be represented by a continuation of the shoreline of the bay, cove, river, estuary or creek to which such stream or estuary is tributary across the channel axis of such tributary stream or estuary.

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## §925.6 Table I.

TABLE I CLASSIFICATIONS AND STANDARDS OF QUALITY AND PURITY ASSIGNED TO FRESH SURFACE WATERS AND TIDAL SALT WATERS OF WESTERN SUFFOLK COUNTY, NEW YORK

| Item No. | Waters index Number | Name | Description | Map Ref. No. | Class | Sta |
|---|---|---|---|---|---|---|
| 1 | LIS | Long Island Sound | East from Nassau-Suffolk county line to a line running north from Miller Place Beach and north to the New York-Connecticut boundary. | R-26nw R-26ne R-27nw R-27ne | SA | |
| 2 | CSH | Cold Spring Harbor | Within Suffolk County including Inner Harbor. | R-26nw | SA | |
| 3 | CSH-50 portion | Trib. of Cold Spring Harbor | Mouth to trib. 1a within Suffolk County. | R-26sw | C | C |
| 4 | CSH-50 portion | Trib. of Cold Spring Harbor | From trib. 1a to source. | R-26sw | C | |
| 5 | CSH-50-P158, P 159 | Subtribs. of Cold Spring Harbor | Within Suffolk County. | R-26sw | C | C |
| 6 | CSH-P 200 | Trib. of Cold Spring Harbor | | R-26sw | C | |
| 7 | CSH-51 | Trib. of Cold Spring Harbor | Tidal portion. | R-26nw | 1 | |
| 8 | CSH-P 202, P 203, P 203a | Tribs. of Cold Spring Harbor | | R-26nw | C | |
| 9 | CSH-P 204 | Trib. of Cold Spring Harbor | | R-26nw | I | |
| 10 | CSH-52 including P 206 | Tribs. of Cold Spring Harbor | | R-26nw | SA | |
| 11 | CSH-52-1 including P 207 | Subtrib. of Cold Spring Harbor | | R-26nw | C | |
| 12 | LIS-P 209 | Unnamed pond | R-26nw | I | I | |
| 13 | HB | Huntington Bay | Area bounded on west by a line running south from East Beach, on the east by a line running south from West Beach and on the north by a line running east from East Fort Point. | R-26nw | SA | |
| 14 | HB-P 210 | Trib. of Huntington | | R-26nw | C | |

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| | | | | | |
|---|---|---|---|---|---|
| | P 338 | | | | |
| 64 | SB-SBH-64 | West Meadow Creek | | R-27nw | SA |
| 65 | SB-SBH-64-1 | Trib. of West Meadow Creek | | R-27nw | C |
| 68 | LIS-65 | Trib. of Long Island Sound | | R-27nw | SA |
| 67 | LIS-P 339 | Flax Pond | | R-27nw | SA |
| 68 | LIS-PJH portion | Port Jefferson Harbor | From harbor entrance south to a line running between LILCO bulkhead and beach house at end of Beach Road, Belle Terre; excluding Setauket Harbor and Conscience Bay. | R-27ne | SA |
| 69 | LIS-PJH portion | Port Jefferson Harbor | Remainder. | R-27ne | SC |
| 70 | [Repealed] | | | | |
| 71 | LIS-PJH-SH | Setauket Harbor | | R-27ne | SA |
| 72 | [Repealed] | | | | |
| 73 | LIS-PJH-CB | Conscience Bay | | R-27ne 27nw | SA |
| 74 | LIS-PJH-CB-66 portion | Trib. of Conscience Bay | Mouth to outlet of P 340a. | R-27ne | I |
| 75 | LIS-PJH-CB-66 portion | Trib. of Conscience Bay | From inlet of P 340a to source. | R-27ne | C |
| 76 | LIS-PJH-CB-P 340a | Trib. of Conscience Bay | | R-27ne | C |
| 77 | LIS-P 343 | Unnamed pond | | R-27ne | C |
| 78 | LIS-P 346, P 349 | Unnamed ponds | | R-27ne | C |
| 79 | LIS-MSH | Mount Sinai Harbor | | R-27ne | SA |
| 80 | LIS-MSH-67a | Trib. of Mount Sinai Harbor | | R-27ne | C |
| 81 | AO | Atlantic Ocean | To three miles out, Nassau county line east to line running south of Blue Point and Water Island. | S-26sw S-26nw S-27nw S-27ne | SA |
| 82 | GSB | Great South Bay | Excluding all adjacent creeks and canals. | S-26nw S-26ne S-27nw S-27ne | SA[AA] |
| 83 | GSB-188a | Namkee Creek | | S-27ne | SC |
| 84 | GSB-188b | Herman's Creek | | S-27ne | SC |

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| | | | | | | |
|---|---|---|---|---|---|---|
| 114.1 | GSB-194-P 912-1 | Trib. of Knapp's Lake | Enters from the east. | S-27nw | C | |
| 115 | GSB-194b, 194c, 195 | Tribs. of Great South Bay | | S-27nw | I | |
| 116 | GSB-P 910a | Unnamed pond | | S-27nw | C | |
| 117 | GSB-196 portion | Orowoc Creek | From mouth to Montauk Highway. | S-27nw | I | |
| 118 | GSB-196 portion | Orowoc Creek | From Montauk Highway to source. | S-27nw | C | C |
| 119 | GSB-196-1 including P 915, P 915b | Trib. of Orowoc Creek | | S-27nw | C | C |
| 120 | GSB-196-1-P 915a | Subtrib. of Orowoc Creek | | S-27nw | C | |
| 121 | GSB-196-P 916 | Trib. of Orowoc Creek | | S-27nw | C | C |
| 122 | GSB-197 portion | Awixa Creek | From mouth to Montauk Highway. | S-27nw | I | |
| 123 | GSB-197 portion | Awixa Creek | From Montauk Highway to source. | S-27nw | C | |

| Item No. | Waters index Number | Name | Description | Map Ref. No. | Class | Sta |
|---|---|---|---|---|---|---|
| 124 | GSB-198 porion | Penataquit Creek | From mouth to Montauk Highway. | S-27nw | I | |
| 125 | GSB-198 portion and trib. 2 | Penataquit Creek | From Montauk Highway to source. | S-27nw | C | |
| 126 | GSB-199 | Watchogue Creek | | S-27nw | I | |
| 127 | GSB-199a | Trib. of Great South Bay | | S-27nw | I | |
| 128 | GSB-200 | Lawrence Creek | | S-27nw<br>S-26ne | I | |
| 129 | GSB-200-P 922, P 923, P 923a | Tribs. of Lawrence Creek | | S-26ne | C | |
| 130 | GSB-201 | Brightwaters Canal | | S-26ne | I | |
| 131 | GSB-201-P 924 | Cascade Lake | | S-26ne | C | |
| 132 | GSB-201-P 925 | Mirror Lake | | S-26ne | C | |
| 133 | GSB-201-P 925a | Nosreka Lake | | S-26ne | C | |
| 134 | GSB-201-P 925b | Lagoon | | S-26ne | C | |
| 135 | GSB-202 | Thorn Canal | | S-26ne | I | |
| 136 | GSB-202-P 927, P 928, P 929 | Tribs. of Thorn Canal | | S-26ne | C | |
| 137 | GSB-202a | Isbrandsen Canal | | S-26ne | I | |
| 138 | GSB-203 portion | Thompsons Creek | From mouth to Montauk Highway. | S-26ne | I | |

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# Part 701 - Classifications Surface Waters and Groundwaters

History

## §701.1 General conditions applying to all water classifications.

The discharge of sewage, industrial waste or other wastes shall not cause impairment of the best usages of the receiving water as specified by the water classifications at the location of discharge and at other locations that may be affected by such discharge.

## FRESH SURFACE WATERS

## §701.2 Class N fresh surface waters.

(a) The best usages of Class N waters are the enjoyment of water in its natural condition and, where compatible, as a source of water for drinking or culinary purposes, bathing, fishing, fish propagation, and recreation.

(b) There shall be no discharge of sewage, industrial wastes, or other wastes, waste effluents or any sewage effluents not having had filtration resulting from at least 200 feet of lateral travel through unconsolidated earth. A greater distance may be required if inspection shows that, due to peculiar geologic conditions, this distance is inadequate to protect the water from pollution.

(c) These waters shall contain no deleterious substances, hydrocarbons or substances that would contribute to eutrophication, nor shall they receive surface runoff containing any such substance.

## §701.3 Class AA-Special (AA-S) fresh surface waters.

(a) The best usages of Class AA-S waters are: a source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. The waters shall be suitable for fish propagation and survival.

(b) These waters shall contain no floating solids, settleable solids, oil, sludge deposits, toxic wastes, deleterious substances, colored or other wastes or heated liquids attributable to sewage, industrial wastes or other wastes.

(c) There shall be no discharge or disposal of sewage, industrial wastes or other wastes into these waters.

(d) These waters shall contain no phosphorus and nitrogen in amounts that will result in growths of algae, weeds and slimes that will impair the waters for their best usages.

## §701.4 Class A-Special (A-S) fresh surface waters.

(a) The best usages of Class A-S waters are: a source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. The waters shall be suitable for fish propagation and survival.

(b) This classification may be given to those international boundary waters that, if subjected to approved treatment, equal to coagulation, sedimentation, filtration and disinfection with additional treatment, if necessary,

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to reduce naturally present impurities, meet or will meet New York State Department of Health drinking water standards and are or will be considered safe and satisfactory for drinking water purposes.

**§701.5 Class AA fresh surface waters.**

(a) The best usages of Class AA waters are: a source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. The waters shall be suitable for fish propagation and survival.

(b) This classification may be given to those waters that, if subjected to approved disinfection treatment, with additional treatment if necessary to remove naturally present impurities, meet or will meet New York State Department of Health drinking water standards and are or will be considered safe and satisfactory for drinking water purposes.

**§701.6 Class A fresh surface waters.**

(a) The best usages of Class A waters are: a source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. The waters shall be suitable for fish propagation and survival.

(b) This classification may be given to those waters that, if subjected to approved treatment equal to coagulation, sedimentation, filtration and disinfection, with additional treatment if necessary to reduce naturally present impurities, meet or will meet New York State Department of Health drinking water standards and are or will be considered safe and satisfactory for drinking water purposes.

**§701.7 Class B fresh surface waters.**

The best usages of Class B waters are primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.

**§701.8 Class C fresh surface waters.**

The best usage of Class C waters is fishing. These waters shall be suitable for fish propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

**§701.9 Class D fresh surface waters.**

The best usage of Class D waters is fishing. Due to such natural conditions as intermittency of flow, water conditions not conductive to propagation of game fishery, or stream bed conditions, the waters will not support fish propagation. These waters shall be suitable for fish survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

## SALINE SURFACE WATERS

**§701.10 Class SA saline surface waters.**

The best usages of Class SA waters are shellfishing for market purposes, primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.

**§701.11 Class SB saline surface waters.**

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The best usages of Class SB waters are primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.

**§701.12 Class SC saline surface waters.**

The The best usage of Class SC waters is fishing. These waters shall be suitable for fish propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

**§701.13 Class I saline surface waters.**

The best usages of Class I waters are secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.

**§701.14 Class SD saline surface waters.**

The best usage of Class SD waters is fishing. These waters shall be suitable for fish survival. This classification may be given to those waters that, because of natural or man-made conditions, cannot meet the requirements for primary and secondary contact recreation and fish propagation.

## GROUNDWATERS

**§701.15 Class GA fresh groundwaters.**

The best usage of Class GA waters is as a source of potable water supply. Class GA waters are fresh groundwaters.

**§701.16 Class GSA saline groundwaters.**

The best usages of Class GSA waters are as a source of potable mineral waters, for conversion to fresh potable waters, or as raw material for the manufacture of sodium chloride or its derivatives or similar products. Class GSA waters are saline groundwaters.

**§701.17 Class GSB saline groundwaters.**

The best usage of Class GSB waters is as a receiving water for disposal of wastes. Class GSB waters are saline groundwaters that have a chloride concentration in excess of 1,000 milligrams per liter or a total dissolved solids concentration in excess of 2,000 milligrams per liter.

**§701.18 Assignment of groundwater classifications.**

(a) The groundwater classifications defined in section 701.15 through 701.16 are assigned to all the groundwaters of New York State.

(b) The Class GSB shall not be assigned to any groundwaters of the state, unless the commissioner finds that adjacent and tributary groundwaters and the best usages thereof will not be impaired by such classification.

**§701.19 Discharge Restriction Categories.**

Discharge restriction categories may be assigned to surface waters or groundwaters by the department. When used, the discharge restriction category will be applied to such classified waters along with the applicable best

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**REFERENCE 21**

# FOSTER WHEELER ENVIRONMENTAL CORPORATION

## RECORD OF TELEPHONE CONVERSATION

DATE: 8/14/97

TO: File

FROM: Michelle Brooks

CLIENT/PROJECT: EPA / BAY SHORE GAS PLANT

SUBJECT: Conversation w/ NYS Fish & Wildlife, Aquatic

DISCUSSION WITH: Mr. Gregory Kozlowski, Biologist One with New York State Fish & Wildlife.

I inquired about warning for fishing in the Lawrence creek. Mr Kozlowski informed me that there are no warning. There is a State recommendation for fresh water fish, "Do not consume more than 1 meal of fish per week ~ ½ lb". There is no recommendation for water that are Tidal. Mr. Kozlowski suspects Lawerence creek to have Sun, Bass and Carp and there is almost a guarentee of American Eel being present.

NAME: Michelle A. Brooks DATE: 8/19/97

**REFERENCE 22**

To: File of Bay Shore Gas Plant Site

From: Michelle Brooks

Date: September 8, 1997

Subject: Groundwater Target Apportionment

Information on the usage of potable groundwater within the 4-mile target distance limit (TDL) of the Bay Shore Gas Plant was obtained for this evaluation. It was determined that ten municipalities (North Babylon, West Islip, West Bay Shore, Brightwaters, Bay Shore, North Bay Shore, Pine Aire, Brentwood, Islip Terrace and East Islip) are within the 4-mile vicinity of the site. The Suffolk County Water Authority (SCWA) provides potable water to the users of these municipalities. Except for the Brentwood District.

The following calculation sheet detail the wells, pumpage, depth and other details of the wells the SCWA has in the TDL.

BY M. BROOKS DATE 8/19/97 SHEET ____ OF ____

CHKD. BY ____ DATE ____ OFS NO. ____ DEPT. NO. ____

CLIENT EPA

PROJECT BAY SHORE GAS PLANT SITE

SUBJECT GROUND WATER TARGET APPORTIONMENT

Suffolk County Water Authority

ACCORDING TO FROST REPORT; POPULATION IN 4-mile radius = 154,536
" " " " ; # house " " " " = 49.653

~ Population/house = 154,536/49,653 = 3.11

INTERCONNECTED SYSTEM HAS ~ 128,000 connections
& ~ 122 wells

$$\text{Person/well} = 3.11 \times \frac{128,000}{122} = 3263$$

BAYSHORE has ~ 50,000 connection to 35 wells (including fisher Ave well field which is not in the 4-mile radius)

$$3.11 \times \frac{50,000}{35} = 4443 \text{ person/well}$$

USED IN REPORT → $3.11 \times \frac{50,000}{32} = 4859$ person/well

MR. MILLER OF SCWA
PROVIDED ~ # connections

WATER NOT LIKELY TO GET FROM THE BAYSHORE PLANT TO OTHER SECTIONS OF THE SYSTEM SO THE MOST CONSERVATIVE ESTIMATE FOR POPULATION WAS USED.

# FOSTER WHEELER ENVIRONMENTAL CORPORATION

BY M. BROOKS DATE 8/20/97 SHEET ____ OF ____

CHKD. BY ____ DATE ____ OFS NO. ____ DEPT. NO. ____

CLIENT EPA

PROJECT BAY SHORE GAS PLANT SITE

SUBJECT GROUNDWATER TARGET APPORTIONMENT

## Suffolk County Water Authority

| Well Field Name | Well # | Pumpage (GPM) | Status | Depth (ft) | Aquifer | Population | Mile Ring | 4-mile Radius Map # |
|---|---|---|---|---|---|---|---|---|
| Smith Street | 6 | 1,000 | Active | 500 | Magothy | 4859 | 3-4 | 1 |
| | 7 | 1,100 | " | 336 | " | " | " | |
| | 8 | 1,400 | " | 314 | " | " | " | |
| Industry Court | 1 | 1,200 | Active | 283 | Magothy | 4859 | 3-4 | 2 |
| | 2 | 1,200 | " | 654 | " | " | " | |
| Locust Drive | 1 | 650 | Active | 128 | Glacial | 4859 | 2-3 | 3 |
| | 2 | 500 | " | 130 | " | " | " | |
| | 3 | 1,200 | " | 611 | Magothy | " | " | |
| (New "9B") | 4 | 1,300 | inactive | 632 | " | " | " | |
| 41st street | 4 | 1,400 | Active | 725 | Magothy | 4859 | 2-3 | 4 |
| | 5 | 1,300 | " | 633 | " | " | " | |
| Moffit Blvd | 1 | 1,200 | Active | 551 | Magothy | 4859 | 3-4 | 5 |
| | 2 | 1,300 | " | 538 | " | " | " | |
| Sunrise Hwy | 1 | 1,300 | Active | 232 | Magothy | 4859 | 1-2 | 6 |
| | 2 | 1,400 | " | 308 | " | " | " | |
| | 3 | 1,300 | " | 718 | " | " | " | |
| Harvest Lane | 2 | 1,100 | Active | 465 | Magothy | 4859 | 2-3 | 7 |
| | 3 | 1,100 | " | 622 | " | " | " | |
| | 1A | unknown | " | 467 | " | " | " | |
| Brook Avenue | 2 | 1,200 | Active | 440 | Magothy | 4859 | 3-4 | 8 |
| | 3 | 1,200 | " | 307 | " | " | " | |
| | 4 | 1,400 | " | 362 | " | " | " | |
| | 1A | unknown | " | 448 | " | " | " | |

BY M. BROOKS DATE 8/8/97 SHEET ____ OF ____

CHKD. BY ____ DATE ____ OFS NO. ____ DEPT. NO. ____

CLIENT EPA

PROJECT BAY SHORE GAS PLANT SITE

SUBJECT GROUND WATER TARGET APPORTIONMENT

SUFFOLK COUNTY WATER AUTHORITY cont.

| Well Field Name | Well # | Pumpage (GPM) | Status | Depth (ft) | Aquifer | Population | mile ring | 4-mile radius map # |
|---|---|---|---|---|---|---|---|---|
| East Forks Rd. | 4 | 1,200 | Active | 306 | Magothy | 4859 | 2-3 | 9 |
| | 5 | 1,300 | " | 800 | " | " | " | |
| THOMAS AVE | 1 | 1,350 | Active | 712 | Magothy | 4859 | 1-2 | 10 |
| | 2 | 1,400 | " | 667 | " | " | " | |
| 5TH AVENUE | 32 | 1,000 | Active | 776 | Magothy | 4859 | 1/4-1/2 | 11 |
| | 33 | 1,000 | " | 776 | " | " | " | |
| | 34 | 1,300 | " | 593 | " | " | " | |
| UNION STREET | 1 | 1,200 | Active | 731 | Magothy | 4859 | 1/2-1 | 12 |
| | 2 | 1,200 | " | 600 | " | " | " | |
| | 3 | 1,400 | " | 721 | " | " | " | |

5th AVENUE WELL FIELD CONTAINS THE CLOSEST WELL, IN THE MAGOTHY AQUIFER, TO THE SITE. APPROXIMATELY 0.38 MILES NORTH OF THE SITE

LOCUST DRIVE WELL FIELD CONTAINS WELLS, IN THE GLACIAL AQUIFER, TO THE SITE. APPROXIMATELY 2.8 MILES NORTH WEST OF SITE.

BY _____ DATE _____ SHEET _____ OF _____

CHKD. BY _____ DATE _____ OFS NO. _____ DEPT. NO. _____

CLIENT _____

PROJECT _____

SUBJECT _____

Summary of Suffolk County Water Authority Well Info.

Upper Glacial Aquifer (4859 person/well)

| Mile Ring | # Municipal Wells | # Private* Wells dug | Municipal Population | Private Well Population | Total Population |
|---|---|---|---|---|---|
| 0-0.25 | 0 | 0 | 0 | 0 | 0 |
| 0.25-0.50 | 0 | 0 | 0 | 0 | 0 |
| 0.50-1.0 | 0 | 30 | 0 | 81 | 81 |
| 1.0-2.0 | 0 | 78 | 0 | 224 | 224 |
| 2.0-3.0 | 2 | 124 | 9718 | 407 | 10,125 |
| 3.0-4.0 | 0 | 110 | 0 | 351 | 351 |
| | 2 | | | 1,063 | 10,781 |

MAGOTHY AQUIFER (4859 Person/Municipal well)

| | | | | | |
|---|---|---|---|---|---|
| 0.0-0.25 | 0 | 0 | 0 | 0 | 0 |
| 0.25-0.50 | 3 | 0 | 14,577 | 0 | 14,577 |
| 0.50-1.0 | 3 | 0 | 14,577 | 0 | 14,577 |
| 1.0-2.0 | 5 | 1 | 24,295 | 3 | 24,298 |
| 2.0-3.0 | 8 | 1 | 38,872 | 3 | 38,875 |
| 3.0-4.0 | 11 | 37 | 53,449 | 118 | 53,567 |
| | MB ~~33~~ 30 9/8/97 | | | 124 | 145,894 |

* Information on private wells obtained from Frost Associates Report Dug wells were assumed to be in the glacial aquifer and drilled wells in the Magothy aquifer.

Total population = 1,063 + 124 + 10,781 + 145,894 = ~~154,902~~ 157,863 MB

= 156,675

$\frac{156,675}{154,536} \times 100 = 102\%$

Frost Report → Ref 23 p. 3 of 4

**FOSTER WHEELER ENVIRONMENTAL CORPORATION**

BY M. BROOKS DATE 9/8/97 SHEET ____ OF ____

CHKD. BY ____ DATE ____ OFS NO. ____ DEPT. NO. ____

CLIENT EPA ARCS II

PROJECT BAY SHORE GAS PLANT

SUBJECT GROUNDWATER APPORTIONMENT

BRENTWOOD WATER DISTRICT

~6800 connections
~28,000 people
6 wells

See p. 5B of 30

| Well Location | Well # | Pumprate (gpm) | Status | Depth (ft) | Aquifer | Mile Ring | Population | 4-mile radius map # |
|---|---|---|---|---|---|---|---|---|
| AMERICAN Blvd. | 3-1 | 1,400 | Active | | Magothy | 3-4 | 4,667 | 13 |
| 1st Third Ave | 1-3 | 1,200 | " | | " | 3-4 | 4,667 | 14 |
| " | 1-4 | 1,200 | " | | " | 3-4 | 4,667 | " |

The three remaining Brentwood wells 2-1, 2-3 & 2-2 are outside TDL.

population / well = 28,000 / 6 = 4,667 person/well

Summary

| mile ring | # wells | Population municipal |
|---|---|---|
| 3-4 | 3 | 3 x 4,667 = 14,000 (Magothy aquifer) |

~~total population in 3-4 mile radius for Magothy aquifer is~~ MB

~~156,567 + 14,000 = 67,567 170,567~~ ? MB

OK

MB

Total population in 3-4 mile radius (For Magothy ~~4-mile~~) = 53,567 + 14,000 = 67,567

" " " 4-mile = 170,567 + 1187 = 171,754

156,675 + 14000 = } —— Municipal → 170,567 ; 1187 → Private

Ref. 22, P. 5B of 30

**MEMORANDUM OF CONVERSATION**

M Mr. Mike Nelson OF Brentwood Water District

JOB: Mckinzie Chemical PRES DATE: 11/3/93

JOB NUMBER: 576-048 TIME: 1245 PM

CONCERNING: wells owned by Brentwood Water District

AND DECIDED:

1) Well 3-1 - located on Pacific Blvd ~ 2100 ft South of 2nd Ave, 1400 gpm pumping rate. drilled in Magothy

2) Well 1-3 - located at 51 3rd Ave, 1300-150 ft west of Fifth Ave, 1200 gpm in Magothy

Well 1-4 same location at 1-3. 1400 gpm drilled in Magothy

3) Well 2-1 located on Morris St 200 ~~East~~ west of Lincoln Ave 1200 gpm in Glacial not bacteriated

Well 2-2 ~~not being~~ in same location at 2-1 1200 gpm in Magothy

Well 2-3 in same location as 2-1, 1400 gpm in Magothy.

6500 connections serving 24,000 people

CC: SIGNED: [illegible]

CC: SIGNED:

LMS Lawler, Matusky & Skelly Engineers

# FOSTER WHEELER ENVIRONMENTAL CORPORATION

## RECORD OF TELEPHONE CONVERSATION

DATE: 8/20/97

TO: file

FROM: Michelle Brooks

CLIENT/PROJECT: EPA / BAY SHORE GAS PLANT

SUBJECT: SUFFOLK COUNTY WATER AUTHORITY

DISCUSSION WITH: Herman Miller SCWA

There are approximately 128,000 connections which 122 well supply water of which the 32 wells in the four mile radius are included.

NAME: Michelle R Brooks DATE: 8/20/97

# FOSTER WHEELER ENVIRONMENTAL CORPORATION

## RECORD OF TELEPHONE CONVERSATION

DATE: 8/19/97

TO: File

FROM: Michelle Brooks

CLIENT/PROJECT: EPA / BAY SHORE GAS PLANT

SUBJECT: GROUND WATER - Suffolk County WATER Authority (516) 589-5200

DISCUSSION WITH: Herman Miller, Suffolk County Water Authority

Mr. Miller informed me that there are approximately 50,000 connection for the Bayshore area within the 4-mile radius of the site.

There are 38 wells in the 4-mile radius connected. All wells in the system is not interconnected (over 404 wells in system)

Mr. Miller also provided the information for Locust Dr well field.

3 active wells

| NYS # | Well # | Depth (ft) | Aquifer | Actual capacity |
|---|---|---|---|---|
| 15898 | 1 | 128 | Glacial | 650 gpm |
| 16175 | 2 | 130 | Glacial | 500 gpm |
| 36460 | 3 | 611 | Magothy (?) | 1200 gpm |
| To be installed by 98 | 4 | 632 | Magothy (?) | 1,300 gpm |

Well head Protection Area(s)?

NAME: Michelle R Brooks DATE: 8/19/97

# FOSTER WHEELER ENVIRONMENTAL CORPORATION

## RECORD OF TELEPHONE CONVERSATION

DATE: 8/21/97

TO: file

FROM: Michelle Brooks

CLIENT/PROJECT: EPA / Bay Shore Gas Plant

SUBJECT: Suffolk County Water Authority Wells

DISCUSSION WITH: Herman Miller, SCWA (516) 589-5200

Wells closed (retired)

Smith Street #5

East Forks Rd #s 1, 2, & 3

NAME: Michelle R Brooks DATE: 8/21/97

BABYLON DISTRICT
SHEET #8

| WELL FIELD NAME | # OF WELLS | WELL # | DEPTH | ACTUAL CAPACITY |
|---|---|---|---|---|
| Wicks Rd. | 3 | | | |
| | | 1 | 374' | 1200 gpm |
| | | 2 | 409' | 1100 gpm |
| | | 3 | 418' | 1200 gpm |
| Plymouth St. | 1 inactive<br>3 active | | | |
| | | 1 | 377' | 900 gpm |
| | | 3 | 415' | 1000 gpm |
| | | 2A | 228' | ? |
| Emjay Blvd.<br>(Bayshore District) | 3 | | | |
| | | 1 | 607' | 1125 gpm |
| | | 2 | 659' | 1200 gpm |
| | | 3 | 634' | 1400 gpm |
| ✓Industry Ct. | 2 | | | |
| | | 1 | 283' | 1200 gpm |
| | | 2 | 654' | 1200 gpm |
| ✓ Locust Dr.<br>(not in book) | 3 | NY<br>1 15898<br>2 16175<br>3 36460 | ~~to~~ C | Glacial<br>650<br>500<br>1200<br>8/19/97<br>Herman Miller |
| | | 4 | | 1,300 Magothy future (1998) |

Ref. 22 p. 9 of 30

BAYSHORE DISTRICT
SHEET #9

| WELL FIELD NAME | # OF WELLS | WELL # | DEPTH | ACTUAL CAPACITY |
|---|---|---|---|---|
| ✓Union St. | 3 | | | |
| | | 1 | 731' | 1200 gpm |
| | | 2 | 600' | 1200 gpm |
| | | 3 | 721' | 1400 gpm |
| ✓ 5th Ave. | 14 inactive<br>3 active | | | |
| | | 32 | 776 | 1000 gpm |
| | | 33 | 776 | 1000 gpm |
| | | 34 | 593 | 1300 gpm |
| Banana St.<br>(already done) | | | | |
| ✓41st Street | 3 inactive<br>2 active | 4 | 725' | 1400 gpm |
| | | 5 | 633' | 1300 gpm |
| Bellmore Ave | 4 | | | |
| | | 1 | 117' | 1000 gpm |
| | | 2 | 120' | 1150 gpm |
| | | 3 | 307' | 1200 gpm |
| | | 4 | 721' | 1300 gpm |
| Fisher Ave. | 3 | | | |
| | | 1 | 316' | 1200 gpm |
| | | 2 | 311' | 1350 gpm |
| | | 3 | 663' | 1400 gpm |
| ✓Moffitt Blvd | 2 | | | |
| | | 1 | 551' | 1200 gpm |
| | | 2 | 538' | 1300 gpm |

BAYSHORE DISTRICT
SHEET #9

| WELL FIELD NAME | # OF WELLS | WELL # | DEPTH | ACTUAL CAPACITY |
|---|---|---|---|---|
| ✓ Brook Ave. | 1 inactive/ perm. out of svc 4 active | | | |
| | | 2 | 440' | 1200 gpm |
| | | 3 | 307' | 1200 gpm |
| | | 4 | 362' | 1400 gpm |
| | | 1A | 448' | ? |
| ✓ East Forks Rd. | 5 | | | |
| | | ~~1~~ | ~~119'~~ | ~~900 gpm~~ |
| | | ~~2~~ | ~~117'~~ | ~~900 gpm~~ |
| | | ~~3~~ | ~~376'~~ | ~~1100 gpm~~ |
| | | 4 | 306' | 1200 gpm |
| | | 5 | 800' | 1300 gpm |
| ✓ Harvest Ln. see proceeding – done already | | | | |
| ✓ Sunrise Hgwy see proceeding – done already | | | | |
| ✓ Thomas Ave. | 2 | | | |
| | | 1 | 712' | 1350 gpm |
| | | 2 | 667' | 1400 gpm |

8/26/97 per MKB

Ref. 22, p. 11 of 30

BABYLON DISTRICT
SHEET #4

| WELL FIELD NAME | # OF WELLS | WELL # | DEPTH | ACTUAL CAPACITY |
|---|---|---|---|---|
| ✓Harvest Lane (Bayshore District) | 1 inactive 3 active | | | |
| | | 2 | 465' | 1100 gpm |
| | | 3 | 622' | 1100 gpm |
| | | 1A | 467' | unknown |
| ✓Sunrise Hgwy (Bayshore District) | 3 | | | |
| | | 1 | 232' | 1300 gpm |
| | | 2 | 308' | 1400 gpm |
| | | 3 | 718' | 1300 gpm |
| Prospect Ave. | 3 | | | |
| | | 1 | 675' | 1200 gpm |
| | | 2 | 673' | 1200 gpm |
| | | 3 | 441' | 1400 gpm |
| Sawyer Ave. | 5 | | | |
| | | 1 | 80' | 00 out of servic |
| | | 2 | 669' | 1000 gpm |
| | | 3 | 746' | 1200 gpm |
| | | 4 | 759' | 2100 gpm |
| | | 2A | 628' | ? |
| ✓ Smith St. | 4 inactive 4 active | | | |
| | | ~~5~~ | ~~59'~~ | ~~700 gpm~~ MRB 8/26/97 |
| | | 6 | 500' | 1000 gpm |
| | | 7 | 336' | 1100 gpm |
| | | 8 | 314' | 1400 gpm |

Ref. 22, p. 12 of 30

BABYLON DISTRICT
SHEET #4

| WELL FIELD NAME | # OF WELLS | WELL # | DEPTH | ACTUAL CAPACITY |
|---|---|---|---|---|
| 12th St. | 1 inactive<br>3 active | | | |
| | | 2 | 337' | 1200 gpm |
| | | 3 | 328' | 1000 gpm |
| | | 4 | 625' | 1400 gpm |
| Gordon Ave. | 2 | | | |
| | | 1 | 652' | 1400 gpm |
| | | 2 | 660' | 1400 gpm |
| August Rd. | 1 inactive<br>3 active | | | |
| | | 2 | 600' | 1000 |
| | | 3 | 627' | 1200 |
| | | 4 | 636 | 1000 |
| ✓ Brook Ave. | 1 inactive<br>4 active | | | |
| | | 2 | 440' | 1200 gpm |
| | | 3 | 307' | 1200 gpm |
| | | 4 | 362' | 1400 gpm |
| | | 1A | 448' | unknown |

RUN DATE: 11/10/93 @ 10:32 SCWA Production Control Department

BUS DATE: 11/10/93 D.E.C. PRODUCTION REPORT PRODCTN PAGE 1

PERIOD: 10/93 ZONE: 1 SOUTH SHORE LOW

| PUMP STATION | PUMPAGE (THOUSANDS) | AVERAGE FLOW (GPM) | WELL NO | OPERATING HOURS | AQUIFER | NYS WELL NUMBER |
|---|---|---|---|---|---|---|
| 12TH ST | 820 | 1,138 | 2 | O/S | M | S-021497 |
| | | | 3 | 2 | M | S-040330 |
| | | | 4 | 10 | M | S-051457 |
| 41ST ST | 40,268 | 1,145 | 4 | 288 | M | S-045839 |
| | | | 5 | 298 | M | S-064847 |
| 5TH AV | 5,718 | 1,013 | 32 | O/S | M | S-020565 |
| | | | 33 | 41 | M | S-026535 |
| | | | 34 | 53 | M | S-071038 |
| ALBANY AV | 35,142 | 1,126 | 4 | O/S | M | S-034595 |
| | | | 5 | 266 | M | S-047886 |
| | | | 6 | 254 | M | S-063205 |
| ALBIN AV | 11,198 | 1,034 | 9 | 27 | M | S-020955 |
| | | | 10 | 608 | M | S-031038 |
| | | | 11 | 29 | M | S-066657 |
| AUGUST RD | 34,844 | 686 | 2 | 72 | M | S-016256 |
| | | | 3 | 37 | M | S-020635 |
| | | | 4 | 737 | M | S-037861 |
| BANANA ST | 15,534 | 485 | 4 | 76 | M | S-039531 |
| | | | 5 | 457 | M | S-054957 |
| BARTON AV | 49,453 | 920 | 1 | 311 | G | S-021297 |
| | | | 2 | O/S | G | S-028767 |
| | | | 3 | 270 | M | S-037494 |
| | | | 4 | 314 | M | S-062022 |
| BAY SHORE RD | 6,296 | 1,399 | 1 | 46 | M | S-059347 |
| | | | 2 | 29 | M | S-072917 |
| BELLMORE AV | 25,722 | 1,214 | 1 | 19 | G | S-019565 |
| | | | 2 | 272 | G | S-020479 |
| | | | 3 | 45 | M | S-027533 |
| | | | 4 | 17 | M | S-069024 |
| BLUE POINT RD | 63,379 | 983 | 1 | 143 | G | S-038320 |
| | | | 2 | 377 | M | S-038321 |
| | | | 3 | 227 | M | S-042761 |
| | | | 4 | 327 | G | S-057074 |

RUN DATE: 11/10/93 @ 18:32 SCWA Production Control Department

BUS DATE: 11/10/93 D.E.C. PRODUCTION REPORT PRODCTN PAGE

PERIOD: 10/93 ZONE: 1 SOUTH SHORE LOW

| PUMP STATION | PUMPAGE (THOUSANDS) | AVERAGE FLOW (GPM) | WELL NO | OPERATING HOURS | AQUIFER | NYS WELL NUMBER |
|---|---|---|---|---|---|---|
| BROOK AV | 36,790 | 1,272 | 1A | 8 | M | S-098523 |
| | | | 2 | 172 | M | S-025617 |
| | | | 3 | 147 | M | S-039744 |
| | | | 4 | 155 | M | S-055163 |
| CHINA RD | 7,940 | 1,017 | 1 | 55 | M | S-060812 |
| | | | 2 | 75 | M | S-073492 |
| CHURCH ST BOH | 23,760 | 1,010 | 1 | 188 | G | S-052126 |
| | | | 2 | 150 | G | S-057871 |
| | | | 3 | 54 | M | S-068532 |
| CHURCH ST HOL | 12,966 | 960 | 1 | 204 | G | S-027259 |
| | | | 2 | O/S | G | S-071917 |
| | | | 3 | 21 | M | S-017035 |
| EAST FORKS RD | 57,033 | 1,210 | 4 | 263 | M | S-038192 |
| | | | 5 | 517 | M | S-071083 |
| FISHER AV | 28,866 | 1,038 | 1 | 250 | M | S-075077 |
| | | | 2 | 231 | M | S-037140 |
| | | | 3 | 076 | M | S-012517 |
| GORDON AV | 46,822 | 1,108 | 1 | O/S | M | S-051298 |
| | | | 2 | 704 | M | S-065505 |
| GREAT NECK RD | 28,174 | 1,248 | 1 | 153 | M | S-051224 |
| | | | 2 | 223 | M | S-054569 |
| GREENBELT PY | 55,530 | 1,161 | 1 | 253 | M | S-054730 |
| | | | 2 | 201 | M | S-059744 |
| | | | 3 | 168 | M | S-066187 |
| | | | 4 | 175 | M | S-066184 |
| GREENE AV | 46,023 | 1,029 | 7 | 2 | M | S-032501 |
| | | | 8 | 743 | M | S-047887 |
| HARVEST LA | 39,579 | 1,060 | 1 | 93 | M | S-021766 |
| | | | 2 | 107 | M | S-022897 |
| | | | 3 | 422 | M | S-039024 |

RUN DATE: 11/10/93 [illegible] SCWA Production Control Department

RUN DATE: 11/10/93 D.E.C. PRODUCTION REPORT PRODCTN PAGE 3

PERIOD: 10/93 ZONE: 1 SOUTH SHORE LOW

| PUMP STATION | PUMPAGE (THOUSANDS) | AVERAGE FLOW (GPM) | WELL NO | OPERATING HOURS | AQUIFER | NYS WELL NUMBER |
|---|---|---|---|---|---|---|
| HEAD OF THE NECK RD | 4,805 | 1,380 | 2 | 16 | G | S-014710 |
| | | | 3 | 42 | M | S-069364 |
| INDUSTRY CT | 16,022 | 14,505 | 1 | 68 | M | S-040497 |
| | | | 2 | 54 | M | S-046830 |
| LAFAYETTE RD | 19,440 | 1,090 | 1 | 112 | M | S-028503 |
| | | | 2 | 86 | M | S-033005 |
| | | | 3 | 89 | M | S-047435 |
| LAKEVIEW AV | 464 | 594 | 1 | 3 | G | S-000872 |
| | | | 2 | 4 | G | S-000871 |
| | | | 3 | 3 | G | S-009839 |
| | | | 4 | 3 | M | S-020408 |
| LAMBERT AV COB | 32,714 | 1,446 | 1 | 736 | M | S-022551 |
| LINCOLN AV | 34,085 | 752 | 1 | 337 | G | S-038701 |
| | | | 2 | O/S | M | S-047453 |
| | | | 3 | 418 | M | S-054305 |
| LOCUST AV | 16,333 | 775 | 1 | O/S | G | S-020045 |
| | | | 2 | 176 | G | S-022711 |
| | | | 3 | 179 | G | S-034522 |
| | | | 4 | 4 | M | S-067074 |
| | | | 5 | 7 | M | S-068490 |
| LOCUST DR | 23,740 | 940 | 1 | 173 | G | S-015898 |
| | | | 2 | O/S | G | S-016175 |
| | | | 3 | 283 | M | S-036460 |
| MAPLE AVE | 61,030 | 1,418 | 1 | 705 | M | S-071705 |
| | | | 2 | 12 | M | S-072222 |
| MOFFITT BL | 42,370 | 1,317 | 1 | 89 | M | S-063610 |
| | | | 2 | 447 | M | S-099960 |
| MONTAUK HY | 1,430 | 1,083 | 1 | O/S | G | S-003813 |
| | | | 2 | O/S | G | S-003815 |
| | | | 3 | O/S | G | S-003814 |
| | | | 4 | 4 | M | S-037963 |
| | | | 5 | 18 | M | S-050630 |

RUN DATE: 11/10/93 @ 18:32 SCWA Production Control Department

BUS DATE: 11/10/93 D.E.C. PRODUCTION REPORT PRODCTN PAGE

PERIOD: 10/93 ZONE: 1 SOUTH SHORE LOW

| PUMP STATION | PUMPAGE (THOUSANDS) | AVERAGE FLOW (GPM) | WELL NO | OPERATING HOURS | AQUIFER | NYS WELL NUMBER |
|---|---|---|---|---|---|---|
| N 5TH ST | 7,000 | 1,143 | 1 | 102 | M | S-029491 |
| PECONIC ST | 14,052 | 1,501 | 1 | 156 | M | S-077010 |
| SAWYER AV | 58,610 | 1,385 | 2 | 382 | M | S-019003 |
| | | | 3 | 194 | M | S-040498 |
| | | | 4 | 129 | M | S-051673 |
| SMITH ST | 26,964 | 702 | 6 | 151 | M | S-021375 |
| | | | 7 | 365 | M | S-036748 |
| | | | 8 | 124 | M | S-045840 |
| STATION RD LO | 1,070 | 495 | 1 | 36 | G | S-033826 |
| | | | 2 | O/S | G | S-042499 |
| SUNRISE HY | 121,490 | 1,288 | 1 | O/S | M | S-053733 |
| | | | 2 | O/S | M | S-053734 |
| | | | 3 | 278 | M | S-066429 |
| TENEYCK AV | 11,191 | 971 | 2 | 87 | M | S-020460 |
| | | | 3 | 105 | M | S-037681 |
| THOMAS AV | 533 | 1,110 | 1 | 0 | M | S-018235 |
| | | | 2 | O/S | M | S-050546 |
| UNION PL | 38,404 | 1,105 | 1 | 194 | M | S-018048 |
| | | | 2 | 174 | M | S-021244 |
| | | | 3 | 211 | M | S-042762 |
| WATERWORKS RD | 2,027 | 1,089 | 1 | 31 | M | S-060486 |
| WYANDANCH AV | 53,424 | 1,200 | 1 | O/S | M | S-023848 |
| | | | 2 | O/S | M | S-025674 |
| | | | 1A | 742 | M | S-028322 |

ZONE: 1 STATIONS LISTED: 44 1,227,155

PEAK DAY FOR ZONE 48,854,000 GALLONS ON 10/10/93

STATION BROOK AVE. WELL NO. 1A AUTH NO. ABL - 11768

REFERENCE POINT ORIG. GRADE ELEV. 64.5 MSL CONTRACT NO. 4146

98523 CONTRACTOR HYDRO

- ~~23046~~

DRILLER'S LOG AND DESCRIPTION

Ref. 22, p. 13 of 30

| DEPTH (FT) | FORMATION |
|---|---|
| 0-2' | TOP SOIL |
| 2'-3' | CLAY - BROWN |
| 3'-10' | FINE SAND |
| 10'-106' | FINE-MED.-COARSE SAND, GRAVEL & COBBLES |
| 106'-112' | HARD GRAY CLAY |
| 112'-302' | FINE BROWN SAND, STREAKS OF PYRITE, GRAY CLAY, TAN CLAY, & FINE TO MED. GRAVEL. |
| 302'-337' | GREY SAND, LIGNITE, STREAKS OF GRAY CLAY |
| 337'-342' | HARD GRAY CLAY, LIGNITE |
| 342'-363' | FINE GREY SAND |
| ?'-365' | GREY CLAY w/ LIGNITE |
| 365'-450' | FINE GREY SAND, STREAKS OF GREY CLAY, LIGNITE, PYRITE |
| 450'-453' | SOFT GRAY CLAY |
| 453'-457' | GREY SAND |
| 457'-459' | SOFT GRAY CLAY |
| | TERM. 18" @ 460' (7-16-91) |

S ~~23046~~ 98533 CONTRACT NO. 4146

Reference Point ORIG. GRADE Elev. 64.5' msl CONTRACTOR HYDRO

Core Log and Description

Ref. 22, p. 19 of 30

| FORMATION | Core # | Sample Depth | Blows | Recovery | Remar |
|---|---|---|---|---|---|
| FINE BROWN SILTY SAND w/CLAY | 1 | 305' | | | P |
| BROWN FINE-MED. CLAYEY SAND | 2 | 315' | | | P |
| BROWN SILTY - CLAY | 3 | 325' | | | VP |
| GRAY FINE SILTY CLAY | 4 | 335' | | | VP |
| GRAY FINE SILTY SAND w/CLAY | 5 | 345' | | | P |
| GRAY FINE SILTY SAND w/CLAY | 6 | 355' | | | P |
| SOLID BROWN CLAYEY SILT | 7 | 365' | | | VP |
| BROWN FINE SILTY SAND w/CLAY | 8 | 375' | | | P |
| BROWN FINE SILTY SAND w/CLAY & LIGNITE | 9 | 385' | | | P |
| BROWN FINE SAND w/CLAY | 10 | 395' | | | F |
| BROWN FINE SAND w/CLAY | 11 | 405' | | | F-G |
| BROWN FINE SILTY SAND w/CLAY | 12 | 415' | | | F |
| FINE GREY SILTY SAND w/CLAY | 13 | 425' | | | F |
| DITTO w/MORE CLAY | 14 | 435' | | | F |
| FINE GREY SILTY SAND w/CLAY | 15 | 445' | | | F |
| SOLID & SANDY BLACK CLAY | 16 | 455' | | | VP |
| DITTO | 17 | 460' | | | VP |

1.1463



Brook Avenue well No. 4
STATION WELL NO.

AUTH No. ABL-7030
CONTRACT No. 2089
CONTRACTOR [illegible]

DRILLER -
HELPER(S) -
REFERENCE POINT original grade ELEVATION Approx. +62' MSL

Core ~~[illegible]~~ LOG & DESCRIPTION

| FORMATION | CORE No. | ACTUAL SAMPLE DEPTH | RECOVERY | BLOWS | REMARKS JS | REMARKS VA. [illegible] |
|---|---|---|---|---|---|---|
| Fine Gray & Orange Sandy Clay | C-1 | 253' | 20 | | D | P-F |
| Med Very Clayey Orange Gray Sd - 3" Gray Clay | 2 | 263' | 20 | | P-F | VP-F |
| Med Tan Clayey Sd | 3 | 273' | 20 | | F-G | G |
| do | 4 | 283' | 20 | | F-G | G |
| Med Gray Clayey Sd | 5 | 293' | 20 | | F-G | G |
| do | 6 | 303' | 20 | | F-G | G |
| Fine-Laminated Clayey Sd & Silty Clay | 7 | 313' | 20 | | P | P |
| Med Gray Clayey Sd | 8 | 323 | 20 | | F | F |
| do | 9 | 333 | 20 | | F | F-G |
| Med to Fine Gray Clayey Sd | 10 | 343 | 20 | | F | F-G |
| Med Gray Clayey Sd | 11 | 353 | 20 | | F-G | G |
| do | 12 | 363 | 20 | | F-G | G |
| Fine Gray Clayey Sd | 13 | 373 | 20 | | P | P |

Brook Avenue Well No. 4
STATION WELL NO.

AUTH No. ABL-7030
CONTRACT No. 2088
CONTRACTOR Layne-N.Y.

DRILLER - D. Booth, D. Cirogna
HELPER(S) -
REFERENCE POINT original grade
ELEVATION Approx. +62' MSL

DRILLER'S LOG & DESCRIPTION

| DEPTH (FEET) | FORMATION | SAMPLE DATA: FLUME OR CORE NO. | ACTUAL SAMPLE DEPTH | RECOVERY | BLOWS | REMARKS |
|---|---|---|---|---|---|---|
| 0-4 | Loam | | | | | |
| 4-107 | Coarse Brown Sd, Gravel, Some Clayey | | | | | |
| 107-110 | Gray Clay | | | | | |
| 110-112 | Fine to Crs Gray Sd + Gravel, Streaks Clay + Hardpan | | | | | |
| 112-129 | Gray Clay + Hardpan | | | | | |
| 129-131 | Fine to Crs Brn Sd | | | | | |
| 131-145 | Solid Gray Clay | | | | | |
| 145-180 | Fine to Crs Brn Sd w/ Streaks Clay | | | | | |
| 180-259 | Fine to Med Brn Sd, Streaks Multicolored Clay + Hardpan | | | | | |
| 259-270 | Multicolored Clay, Hardpan, Pyrite, Streaks Fine Sd | | | | | |
| 270-288 | Fine to Crs Brn Sd, Streaks Multicolored Clay, Hardpan | | | | | |
| 288-312 | Fine to Med Gray Sd, Streaks Gray Clay + Lignite | | | | | |
| 312'-? | Fine Gray Clayey Sd, Pyrite | | | | | |
| | 2.5" ϕ hole terminated at depth 373' (8-7-75) | | | | | |

Driller's log

Surface Log

Ref. 22, p. 22 of 30

Harvest Lane No. 3
STATION WELL NO.

AUTH No. ABS-5236
CONTRACT No. 1452
CONTRACTOR Strata

DRILLER - C. Hyatt, J. Barker
HELPERS - J. Kernely, L. Kasper
REFERENCE POINT Original Grade ELEVATION +14.94' MSL

| DEPTH (FEET) | DRILLER'S LOG & DESCRIPTION: FORMATION | SAMPLE DATA: FLUME OR CORE No. | ACTUAL SAMPLE DEPTH | RECOVERY | BLOWS | REMARKS |
|---|---|---|---|---|---|---|
| 0-3 | Top Soil & Sandy Clay | | | | | |
| 3-43 | Cr Brn Sand & Gravel | | | | | 4 |
| 43-78 | Med Brn Sd | | | | | 3 |
| 78-87 | Fine Silty Brn Sd | | | | | |
| 87-100 | Fine Rusty Brn Sd w/Gravel | | | | | 1 |
| 100-102 | Dk Gray Silty Clay | | | | | |
| 102-133 | Fine Gray Sd w/Some Lignite | | | | | 31 |
| 133-138 | Layers Gray Clay, Gray Sand & Lignite | | | | | 5 |
| 138-162 | Lt Gray Clay, Dk Gray Clay & Pyrite | | | | | 2 |
| 162-165 | Fine Gray Sd & Sandy Gray Clay w/Strks of Pyrite | | | | | 3 |
| 165-170 | Fine Gray Sd Strks of Gray Clay | | | | | |
| 170-189 | Sandy Gray Clay & Silty Fine Gray Sand | | | | | 1 |
| 189-208 | Fine Gray Sand, Strks Clay | | | | | 1 |
| 208-217 | Sandy Gray Clay w/Strks of Fine Gray Clayey Sand | | | | | 4 |
| 217-227 | Fine Gray Sd | | | | | 15 |
| 227-231 | Gray Clay | | | | | 4 |
| 231-239 | Fine Gray Sand Strks of Lignite | | | | | |
| 239-241 | Sandy Gray Clay w/Lignite | | | | | 2 |
| 241-249 | Clayey Fine Gray Sd, Strks of Lignite, Sandy Gray Clay & Pyrite | | | | | |
| 249-260 | Fine Gray Sd | | | | | 1 |
| 260-266 | Dk Gray Clay & Lignite | | | | | 6 |
| 266-274 | Fine Gray Sd | | | | | |
| 274-277 | Dk Gray Clay, Lignite, Pyrite & Fine Sand | | | | | 3 |
| 277-361 | Fine Gray Sd, Strks Lignite, Silty Gray Clay (Drills Hard & Hard) | | | | | |
| 361-367 | Sandy Gray Clay | | | | | 6 |
| 367-372 | Fine Gray Sd, Strks Lignite, Gray Clay & Pyrite | | | | | |
| 372-379 | Sandy Gray Clay, Strks of Pyrite & Lignite | | | | | |
| 379-401 | Fine Gray Clayey Sand, Strks of Sandy Gray Clay & Lignite | | | | | |
| 401-422 | Fine Gray Sand, some mica (Drills Good) | | | | | |
| 422-453 | Fine Gray Sand w/Strks of Pyrite & Lignite - very hard | | | | | |
| 453-490 | Fine Gray Sand | | | | | |
| 490-495 | Sandy Gray Clay | | | | | |
| -539 | Fine Gray Sand w/Layers of Gray Clay & Pyrite | | | | | |
| 539-544 | Gray Clay | | | | | |
| 544-600 | Fine Gray Sand, Strks of Pyrite & Lignite & Gray Clay | | | | | |
| | | Harvest 3 | | Dr 71 | Ins | |

Sheet 2 of 2

S-39024

Harvest Lane No. 3
STATION WELL NO.

AUTH NO. ARS-5236
CONTRACT NO. 1152
CONTRACTOR Strata

DRILLER - C. Hyatt, J. Barker
HELPER(S) - J. Kornely, L. Kasper
REFERENCE POINT Original Grade
ELEVATION [illegible] 94' MSL

| DEPTH (FEET) | DRILLER'S LOG & DESCRIPTION: FORMATION | SAMPLE DATA: FLUME OR CORE NO. | ACTUAL SAMPLE DEPTH | RECOVERY | BLOWS | REMARKS |
|---|---|---|---|---|---|---|
| 600-620 | Fine Gray Sand | | | | | |
| 620-623 | Layers of Crs Sand, Gray Clay & Lignite | | | | | |
| 623-628 | Gray Clay | | | | | |
| 28-646 | Med to Crs Gray Sand, Bits of Gray Clay | | | | | |
| 46-652 | Solid Gray Clay | | | | | |
| 652-? | Med Gray Sand, Bits of Gray Clay | | | | | |
| | 36"ø Hole Terminated at Depth 303' | | | | | |
| | 24"ø Hole Terminated at Depth 655' | | | | | |

STATION WELL NO. HOLE NO.

S-101321 CONTRACT NO. 4301 Ref. 22, p. 24 of 30

Reference Point Or. Grade Elev. +43.7 msl CONTRACTOR Gregor

Core Log and Description

| FORMATION | Core # | Sample Depth | Blows | Recovery | Remarks |
|---|---|---|---|---|---|
| Soft gray clay | 1 | 252 | | | P |
| Fine gray silty sand, lignite | 2 | 262 | | | F |
| F-M gray silty sand | 3 | 272 | | | F-G |
| do | 4 | 282 | | | F-G |
| F-M gray sand | 5 | 292 | | | G |
| Med gray sand, w/ clay and lignite | 6 | 302 | | | G |
| do | 7 | 312 | | | G |
| do | 8 | 322 | | | G |
| do | 9 | 332 | | | G |
| do | 10 | 342 | | | G |
| do | 11 | 352 | | | G |
| do | 12 | 362 | | | G |
| Solid gray clay | 13 | 372 | | | P |
| Really solid gray clay | 14 | 382 | | | VP |
| F-M gray sand | 15 | 392 | | | G-E |
| F-M clayey gray sand, lignite | 16 | 402 | | | F-G |
| do | 17 | 412 | | | F-G |
| do | 18 | 422 | | | F-G |
| M-C gray sand | 19 | 432 | | | G |
| M-C gray sand | 20 | 442 | | | G-E |
| M-C clayey gray sand, lignite | 21 | 452 | | | G |
| do | 22 | 462 | | | G |
| Fine gray slightly sandy clay | 23 | 466 | | | P |

Terminated at 466'

Sunrise Hwy No. 3
STATION WELL NO.

AUTH NO. ABS-8206
CONTRACT NO. 2610
CONTRACTOR Layne-NY

DRILLER -
HELPERS -
REFERENCE POINT original grade ELEVATION +37.6' MSL

Core ~~[illegible]~~ LOG & DESCRIPTION

| FORMATION | SAMPLE DATA: FLUME OR CORE NO. | ACTUAL SAMPLE DEPTH | RECOVERY Inches | BLOWS | REMARKS TS |
|---|---|---|---|---|---|
| Silt, Fine Sandy Gray | C-1 | 541 | 18 | | P |
| Clay, Solid, Sandy Gray | 2 | 551 | 18 | | V.P. |
| Sand, Med Gray Clayey w/ Rich Clay | 3 | 561 | 18 | | F |
| Sand, Med Gray Clayey | 4 | 571 | 18 | | F |
| Sand, Med Gray w/ Lignite | 5 | 581 | 18 | | F |
| Sand, Med Gray-Olive Clayey | 6 | 591 | 18 | | P-F |
| Sand, Fine to Med Gray | 7 | 601 | 18 | | F |
| Sand, Fine to Med Light Gray | 8 | 611 | 18 | | F |
| Sand, Med Gray Clayey | 9 | 621 | 18 | | F |
| Sand, Med Light Gray Clayey | 10 | 631 | 18 | | F |
| ditto | 11 | 641 | 18 | | F |
| Sand, Med to Coarse Gray-Olive | 12 | 651 | 18 | | F |
| Sand, Fine Gray Clayey | 13 | 661 | 18 | | F-P |
| 1/2 Lignite - 1/2 Sand, Fine Gray | 14 | 671 | 18 | | P |
| Sand, Med Gray | 15 | 681 | 18 | | F |
| ditto | 16 | 691 | 18 | | F |
| Sand, Fine Gray Clayey | 17 | 701 | 18 | | P |
| Sand, Med Gray | 18 | 711 | 18 | | F |
| Sand, Fine Gray Clayey | 19 | 721 | 18 | | P |

Continued

Sunrise Hwy No. 3
STATION WELL NO.

AUTH NO. ABS-8206
CONTRACT NO. 2610
CONTRACTOR Layne-NY

DRILLER-
HELPERS-
REFERENCE POINT Original grade ELEVATION +37.6' MSL

| DEPTH (FEET) | DRILLER'S LOG & DESCRIPTION: FORMATION | SAMPLE DATA: FLUME OR CORE NO. | NATURE SAMPLE DEPTH | RECOVERY | BLOWS | REMARKS |
|---|---|---|---|---|---|---|
| 0-3 | Topsoil: loam | | | | | |
| 3-99 | Sand, Fine to Coarse Brown w/ Gravel | | | | | |
| 99-102 | Sand, Fine to Med Brown w/ Stripe Brown Clay & Lignite | | | | | |
| 102-129 | Sand, Fine to Med Gray w/ Stripe Gray Clay & Lignite | | | | | |
| 129-132 | Clay, Solid Gray & Lignite | | | | | |
| 132-155 | Sand, Fine Gray w/ Stripe Gray Clay, Lignite, Pyrite | | | | | |
| 155-160 | Clay, Gray with Stripe Sand & Lignite | | | | | |
| 160-178 | Sand, Fine Gray with Stripe Gray Clay, Lignite, Pyrite | | | | | |
| 178-183 | Clay, Solid Gray w/ Lignite & Pyrite | | | | | |
| 183-188 | Sand, Fine Gray w/ Stripe Gray Clay, Lig, Pyr | | | | | |
| 188-262 | Sand, Medium to Coarse Gray with Stripe Clay, Lig, Pyr | | | | | |
| 262-266 | Clay, Gray w/ Lignite | | | | | |
| 266-351 | Sand, Fine Gray w/ Stripe Clay, Lig, Pyr | | | | | |
| 351-356 | Clay, Gray | | | | | |
| 356-406 | Sand, Fine Gray w/ Stripe Gray Clay & Lignite | | | | | |
| 406-427 | Clay, Sandy w/ Lig & Pyr | | | | | |
| 427-448 | Clay, Sandy Gray with Layers Gray Clay, Lig, Pyr | | | | | |
| 448-484 | Sand, Medium to Fine Gray w/ Stripe Gray Clay | | | | | |
| 484-489 | Clay Hard Gray | | | | | |
| 489-526 | Sand, Fine Gray w/ Stripe Gray Clay | | | | | |
| 526-530 | Clay, Gray | | | | | |
| 530-538 | Sand, Fine to Medium Gray w/ Stripe Gray Clay | | | | | |
| 538-541 | Clay, Gray | | | | | |
| 541-563 | Sand, Very Fine Gray Clayey with Stripe Clay & Lignite | | | | | |
| 563-575 | Sand, Fine Gray w/ Stripe Gray Clay, Lig, Pyr | | | | | |
| 575-592 | Sand, Fine to Medium Gray w/ Lignite (Good) | | | | | |
| 592-600 | Sand, Silty & Clayey Gray w/ Stripe Clay | | | | | |
| 600-656 | Sand, Medium to Fine Gray (Good) | | | | | |
| 656-669 | Sand, Fine Gray Clayey w/ Stripe Clay | | | | | |
| 669-675 | Sand, Fine Gray w/ Stripe Gray Clay & Lignite (Poor) | | | | | |
| 675-679 | Clay, Gray with Lignite & Stripe Sand | | | | | |
| 679-719 | Sand, Fine to Medium Gray w/ Stripe Clay & Lignite (Good) | | | | | |
| 719-? | Clay, Solid Gray | | | | | |
| | 26" Pilot hole to depth 540' | | | | | |
| | 24" pilot terminated at depth 721' (7-13-79) | | | | | |

Driller's Log

Sunrise Highway Well No. 1
STATION WELL NO.

AUTH No. ABS-7069
CONTRACT No. 2091
CONTRACTOR [illegible]

DRILLER - C. Miller, L. Kasper
HELPER(S) -
REFERENCE POINT original grade
ELEVATION +38' Approx. MSL

Core ~~Formations~~ Log & Description

| FORMATION | SAMPLE DATA: Approx. Core No. | Actual Sample Depth | Recovery | Blows | Remarks | |
|---|---|---|---|---|---|---|
| Med brown fd w/ black Clay | C-1 | 142' | 12 | | EG | E |
| Med brown fd w/ 2" layer Clay | C-2 | 152' | 12 | | E | E |
| Med brown fd w/ Clay | C-3 | 162' | 12 | | E | E |
| do | C-4 | 172' | 12 | | E | E |
| Med white fd | C-5 | 182' | 12 | | G | [illegible] |
| Med Gray fd | C-6 | 192' | 12 | | E | [illegible] |
| do | C-7 | 202 | 12 | | E-G | [illegible] |
| Gray brown fd | C-8 | 212 | 12 | | G | [illegible] |
| Med Gray fd | C-9 | 222 | 12 | | [illegible] | F-[illegible] |
| Med light brown fd | C-10 | 232 | 12 | | E-P | F-P |
| do | C-11 | 242 | 12 | | E | E |
| | | | Core | Log | | |

Sunrise Highway Well No. 1
STATION WELL NO.

AUTH No. ABS-7069
CONTRACT No. 2091
CONTRACTOR Dolto

DRILLER - C. Miller, L. Kasper
HELPERS -
REFERENCE POINT Original grade
ELEVATION +38' approx. MSL

DRILLER'S LOG & DESCRIPTION

| DEPTH (FEET) | FORMATION | SAMPLE DATA: FLUME OR CORE NO. | RATING SAMPLE DEPTH | RECOVERY | FLOW | REMARKS |
|---|---|---|---|---|---|---|
| 0-2 | Loam & Clay | | | | | |
| 2-12 | Med to Crs Sd | | | | | |
| 12-77 | Crs Sd & Gravel | | | | | |
| 77-89 | Fine Brn Sd | | | | | |
| 89-95 | Crs Brn Sd & Gravel | | | | | |
| 95-105 | Crs Gray Sd & Gravel Lignite, Hardsand | | | | | |
| 105-170 | Fine to Med Gray Sd, Lignite, Mica, Hard sand, Streaks Gray Clay | | | | | |
| 170-234 | Fine to Med Gray Sd, Streaks Lignite & Clay (Trace water) | | | | | |
| 234-238 | Clay & Lignite w/ Fine Gray Sd | | | | | |
| 238-? | Fine Gray Sd, Clay & Lignite | | | | | |
| | 38' hole terminated at depth 242' | (7-19-75) | | | | |

Driller's Log

Sunrise Highway Test Boring — STATION — WELL NO.

AUTH No. ABS-7069
CONTRACT No. 2001
CONTRACTOR Layne-N.Y.

DRILLER - D. Booth, D. Cicogna
HELPER(S)
REFERENCE POINT original grade — ELEVATION +38.30' MSL

Core ~~Formation~~ LOG & DESCRIPTION — SAMPLE DATA

| FORMATION | ~~Note on~~ CORE No. | ACTUAL SAMPLE DEPTH | RECOVERY Inches | Blows | REMARKS TS | REMARKS Cor'l Vis. |
|---|---|---|---|---|---|---|
| Fine to Med Tan Sd - Traces Gravel | 1 | 61' | 12 | | G | G |
| Fine to Med Tan Sd | 2 | 81' | 18 | | G | G |
| 2/3 Med Tan Sd - 1/3 Med Gray Sd | 3 | 101' | 18 | | G | G |
| Med to Crs Gray Sd | 4 | 121' | 18 | | G | G-F |
| Fine to Med Gray Clayey Sd | 5 | 141' | 18 | | F-P | F |
| Med to Fine Gray Clayey Sd | 6 | 161' | 18 | | F-P | F |
| Med to Crs Gray Sd | 7 | 181' | 18 | | F-G | F |
| do | 8 | 201' | 13 | | G-F | G |
| Med Lt. Gray Sd | 9 | 221' | 13 | | F-G | G |
| Med Gray Clayey Sd w/ Stringers Gray Clay & Lig. | 10 | 241' | 18 | | F-P | F-P |
| Med Gray Sd | 11 | 261' | 18 | | F | F-G |
| Med to Crs Gray Sd | 12 | 281' | 13 | | F-G | G-F |
| Med Lt Gray Sd | 13 | 301 | 12 | | G | G |
| Med Gray Clayey Sd | 14 | 321' | 18 | | F-G | G |
| Med to Crs Gray Clayey Sd w/ Lig | 15 | 341' | 18 | | F | F-P |
| Fine to Med Gray Clayey Sd | 16 | 361' | 18 | | F-P | F |
| Med Gray Clayey Sd | 17 | 381' | 18 | | F | G |
| Fine to Med Gray Clayey Sd. w/ Stringers Clay | 18 | 401 | 13 | | P-F | F |
| ~~Silty~~ Gray Silt | 19 | 421 | 18 | | VP | VP |
| Very Fine Sandy Silt | 20 | 441 | 18 | | P-VP | VP |
| Med Gray Clayey Sd | 21 | 461 | 18 | | F | F |
| do | 22 | 481 | 14 | | F | F |
| do | 23 | 501 | 18 | | F | F-G |
| Fine to Med Gray Clayey Sd | 24 | 521 | 18 | | P-F | F |
| do | 25 | 541 | 18 | | F-P | F |
| Fine Gray Sandy Clay | 26 | 561 | 18 | | P | P |
| Med to Crs Gray Sd | 27 | 581 | 18 | | G | G |
| Fine to Med Gray Clayey Sd | 28 | 601 | 18 | | F-P | F |
| Med Gray Clayey Sd | 29 | 621 | 18 | | G | G |
| do | 30 | 641 | 18 | | G | G |
| Fine to Med Gray Clayey Sd | 31 | 661 | 18 | | F | F |
| Med Gray Sd | 32 | 681 | 18 | | G | G |
| Med to Crs Gray Sd | 33 | 701 | 18 | | G | G+ |
| Very Fine Sandy Silty Clay | 34 | 711 | 18 | | VP | P |
| Crs to Very Crs Gray Clayey Sd | 35 | 721 | 18 | | G | G |

Sunrise Highway Test Borings
STATION WELL NO.

AUTH No. 25-7061
CONTRACT No. 2001
CONTRACTOR Layne-N.Y.

DRILLER - D. Booth, D. Cicogna
HELPER(S) -
REFERENCE POINT Original grade ELEVATION ±33.30' MSL

| DEPTH (FEET) | DRILLER'S LOG & DESCRIPTION: FORMATION | SAMPLE DATA: FRAME OR CORE No. | ROTARY SAMPLE DEPTH | RECOVERY | Blows | Remarks |
|---|---|---|---|---|---|---|
| 0-3 | Loam. | | | | | |
| 3-102 | Fine to Crs Brn Sd & Gravel | | | | | |
| 102-132 | Fine to med Gray Sd - Strks Lignite | | | | | |
| 132-135 | Dark Gray Solid Clay | | | | | |
| 135-233 | Fine to med Gray Sd. Strks Gray Clay & Lig | | | | | |
| 238-245 | Gray Clay w/ Strks Sd & Lig | | | | | |
| 245-347 | Fine Gray Sd w/ Mica & Lig | | | | | |
| 347-350 | Sdy Gray Clay & Lig w/ Mica | | | | | |
| 350-357 | Solid Gray Clay | | | | | |
| 357-378 | Very Fine Clayey Gray Sd w/ Strks Gray Clay | | | | | |
| 378-387 | Fine Gray Sd w/ Strks Gray Clay - Mica | | | | | |
| 387-394 | Sandy Gray Clay | | | | | |
| 394-406 | Fine Gray Sd w/ Strks Gray Clay - Mica | | | | | |
| 406-420 | Solid Gray Clay | | | | | |
| 420-454 | Clayey Sand w/ Mica (Gray) | | | | | |
| 454-533 | Fine to med Gray Sd w/ Strks Gray Clay | | | | | |
| 533-540 | Solid Gray Clay | | | | | |
| 540-552 | Fine Gray Sd w/ Strks Gray Clay | | | | | |
| 552-565 | Very Fine Gray Clayey Sd w/ Lig | | | | | |
| 565-589 | Med to Fine Gray Sd w/ Strks Gray Clay, Pyrite, Lig | | | | | |
| 589-612 | Fine Gray Sd w/ Strks Gray Clay | | | | | |
| 612-698 | Fine to Med Gray Sd w/ Strks Gray Clay, Pyr & Lig | | | | | |
| 698-710 | Fine to Crs Gray Sd | | | | | |
| 710-717 | Solid Gray Clay | | | | | |
| 717-? | Crs Gray Clayey Sd | | | | | |
| | 17" ø test hole terminated at depth 722' (2-7-75) | | | | | |
| | | | | Driller's Log | | |

**REFERENCE 23**

# FROST ASSOCIATES

P.O. Box 495, Essex, Connecticut 06426
(860) 767-7644 FAX (860) 767-1971

July 4, 1997

To: Foster Wheeler Environmental Corp.
8 Peach Tree Hill
Livingston, NJ 07039

Attn: Edgar Aguado

Fr: Bob Frost
Frost Associates
P.O. Box 495
Essex, Conn 06426

Tel: (860) 669-5859
Fax: (203) 669-5859

Sub: Bay Shore Gas
Bayshore, NY

CERCLIS:

Job: 40003

Site Longitude: 73-15-27 73.257500
Site Latitude : 40-43-24 40.723331

The CENTRACTS report below identifies the population, households, and private water wells of each Block Group that lies within, or partially within, the 4, 3, 2, 1, .5, and .25, mile "rings" of the latitude and longitude coordinates above. CENTRACTS may have up to ten radii of any length. 1000 block groups, and 15000 block group sides.

CENTRACTS uses the 1990 Block Group population and Block Group house count data found in the Census Bureau's 1990 STF-1A files. The sources of water supply data are from the Bureau's 1990 STF-3A files. The boundary line coordinates of the Block Groups were extracted from the Census Bureau's 1990 TIGER/Line Files.

CENTRACTS reports are created with programs written by Frost Associates, P.O. Box 495, Essex, Conn. The code was written using Microsoft's Quick-Basic Ver. 4.5.

Latitude and Longitude coordinates identifying a site are entered in degrees and decimal degrees. One or more county files holding Block Group boundary lines are selected for use by CENTRACTS by determining whether the site coordinates fall within the minimum and maximum Lat\Lon coordinates of each county in the state.

Each Block Group line segment has Lat\Lon coordinates representing the "From" and "To" ends of that line. All coordinates from the selected county files are read and converted from degrees, decimal degrees to X\Y miles from the site location. Each line segment is then examined whether it lies within or partially within the maximum ring from the site.

The unique Block Group ID numbers of each line segment that lie within the maximum ring are retained. All Block Group boundary lines matching the Block Group numbers are then extracted from the respective county files to obtain all sides of the included Block Groups. Boundary records are then sorted in adjacent side order to determine the shape and area of each Block Group polygon.

Bay Shore Gas
Bayshore, NY

A method to solve for the area of a polygon is to take one-half the sum of the products obtained by multiplying each X-coordinate by the difference between the adjacent Y-coordinates. For a polygon with coordinates at adjacent angles A, B, C, D, and E. The formula can be expressed:

Area = 1/2{Xa(Ye-Yb)+ Xb(Ya-Yb)+ Xc(Yb-Yd)+ Xd(Yc-Ye)+ Xe(Yd-Ya)}

For each ring, the selected Block Groups will be inside, outside, or intersected by the ring. When a polygon is intersected, the partial Block Group area within that ring is calculated using the method described below.

When a ring intersects a Block Group, the intersect points are solved and plotted at the points where the ring enters and exits the shape. The chord line, a line within the circle connecting the intersect points is determined. This chord line is used to calculate the segment area, the half moon shape between the chord line and the ring, and the sub-polygon created by the chord line and the Block Group boundaries that lie outside the ring.

The segment area is subtracted from the sub-polygon area to determine the area of the sub-polygon outside the ring. The area outside the ring is then subtracted from the area of the entire polygon to arrive at the inside area. This inside area is then divided by the tract's total area to determine the percentage of area within the ring. This process is repeated for each block group that is intersected by one of the rings. The total area, partial area, and percentage of partial area of those block groups within, or partially within a ring, are held in memory for the report.

On occasion, the algorithm described above is unable to determine the area of the partial area. Within the report program is a "Paint" routine which allows an enclosed shape to be highlighted. Another routine calculates the percentage of highlighted screen pixels to the pixels within the polygon. A manual entry is allowed. Both the "paint" method and manual entry method over ride the calculated method.

CENTRACTS lists, starting on page 4, all Block Groups in State, County, Census Tract, and Block Group ID order that lie within, or partially within, the maximum ring. Each Block Group is identified by a City or Town name and by the Block Group's State, County, Tract and Block Group ID number. Following is the Block Group's 1990 populu tion and house count extracted from the Census Bureau's 1990 STF-1A files.

The next four columns display water source data from the 1990 STF-3A files. The first column is "Units with Public system or private company source of water", followed by "Units with individual well, Drilled, source of water"; "Units with individual well, Dug, source of water" and "Units with Other source of water".

For each ring, CENTRACTS then shows the Block Groups that are within that ring, the Block Group's total area in square miles, the partial area of the Block Group within that ring, and the partial percentage within the ring. The areas of the included Block Group and the partial areas are then totaled.

The last section tallies the demographic data within each ring. The percentage of area for each Block Group is multiplied times the census data for that Block Group and totaled for all Block Group's within the ring. Ring totals are then determined by subtracting the three mile data from the four mile, the two mile from the three mile, one from the two, etc... Population on private wells is calculated using the formula: ((Drilled + Dug Wells) / Households) * Population

Bay Shore Gas
Bayshore, NY

## Population Density

========== Site Data ==========

| | |
|---|---|
| Population: | 154536.27 |
| Households: | 49652.90 |
| Drilled Wells: | 37.71 |
| Dug Wells: | 342.04 |
| Other Water Sources: | 48.12 |

$\frac{\text{Population}}{\text{households}} = \frac{154,537}{49,653} = 3.11$

========== Partial (RING) data ==========

---- Within Ring: 4 Mile(s) and 3 Mile(s) ----

| | |
|---|---|
| Population: | 61569.19 |
| Households: | 19265.85 |
| Drilled Wells: | 37.04 |
| Dug Wells: | 109.79 |
| Other Water Sources: | 40.36 |
| ** Population On Private Wells: | 469.24 |

Population on Drilled wells — Assume Magothy

$\frac{469}{(37+110)} \times (37) = 118$

Population on Dugged well — Upper Glacial

$\frac{469}{(37+110)} \times 110 = 351$

---- Within Ring: 3 Mile(s) and 2 Mile(s) ----

| | |
|---|---|
| Population: | 51327.38 |
| Households: | 15612.56 |
| Drilled Wells: | 0.52 |
| Dug Wells: | 124.38 |
| Other Water Sources: | 7.54 |
| ** Population On Private Wells: | 410.62 |

$\frac{410}{(1+124)} = 3$

$410 - 3 = 407$

---- Within Ring: 2 Mile(s) and 1 Mile(s) ----

| | |
|---|---|
| Population: | 28701.23 |
| Households: | 9887.24 |
| Drilled Wells: | 0.16 |
| Dug Wells: | 78.12 |
| Other Water Sources: | 0.22 |
| ** Population On Private Wells: | 227.23 |

$\frac{227}{1+78} = 3$

$227 - 3 = 224$

---- Within Ring: 1 Mile(s) and .5 Mile(s) ----

| | |
|---|---|
| Population: | 8669.83 |
| Households: | 3170.91 |
| Drilled Wells: | 0.00 |
| Dug Wells: | 29.74 |
| Other Water Sources: | 0.00 |
| ** Population On Private Wells: | 81.32 |

$\frac{81}{0+30} \times 0 = 0$

81

Population w/in 1 mile

$$\begin{array}{r} 8670 \\ +\ 3238 \\ +\ 1030 \\ \hline 12,938 \end{array}$$

Bay Shore Gas
Bayshore, NY

| | | Population on Drilled Wells | Population on Dugged Wells |
|---|---|---|---|
| ---- Within Ring: .5 Mile(s) and .25 Mile(s) ---- | | | |
| Population: | 3238.34 | | |
| Households: | 1289.23 | | |
| Drilled Wells: | 0.00 | | |
| Dug Wells: | 0.00 | 0 | 0 |
| Other Water Sources: | 0.00 | | |
| ** Population On Private Wells: | 0.00 | | |
| ---- Within Ring: .25 Mile(s) and 0 Mile(s) ---- | | | |
| Population: | 1030.30 | | |
| Households: | 427.11 | | |
| Drilled Wells: | 0.00 | | |
| Dug Wells: | 0.00 | 0 | 0 |
| Other Water Sources: | 0.00 | | |
| ** Population On Private Wells: | 0.00 | | |

**REFERENCE 24**

# FOSTER WHEELER ENVIRONMENTAL CORPORATION

BY M. BROOKS DATE 8/21/97 SHEET 1 OF 1

CHKD. BY _____ DATE _____ OFS NO. _____ DEPT. NO. _____

CLIENT EPA

PROJECT BAY SHORE GAS PLANT SIP

SUBJECT WETLANDS ACRAGE IN 4-MILE RADIUS TDL

| Mile Radius | ACRAGE |
|---|---|
| 0.0 - 0.25 | 0 |
| 0.25 - 0.50 | 0 |
| 0.50 - 1.0 | $2+1+3+3+\frac{1}{2}+\frac{1}{2} = \underline{\underline{10}}$ |
| 1.0 - 2.0 | $18+16+43+5+61+3+2+2+6+8+2+3+10+8 = \underline{\underline{187}}$ |
| 2.0 - 3.0 | $106+1\frac{1}{2}+5+1\frac{1}{2}+10+1+1+10+4+2+3+7+27+6+30+20+1+32+3 = \underline{\underline{271}}$ |
| 3.0 - 4.0 | $1+6+4+4+118+3+6+9+68+104+3+2+7+2+7+13 = \underline{\underline{357}}$ |

TABLES A8 & A9 of the Hazard Ranking System Guidance Manual were USED TO DETERMINE QUALIFING WETLANDS.

**FOSTER WHEELER ENVIRONMENTAL CORPORATION**

BY M. Brooks DATE 9/2/97 SHEET ____ OF ____

CHKD. BY ____ DATE ____ OFS NO. ____ DEPT. NO. ____

CLIENT ____

PROJECT BAY SHORE GAS PLANT

SUBJECT Wetlands FRONTAGE

QUADANGLES: BAY SHORE East and Bay Shore West

4-mile radius map > 100 miles

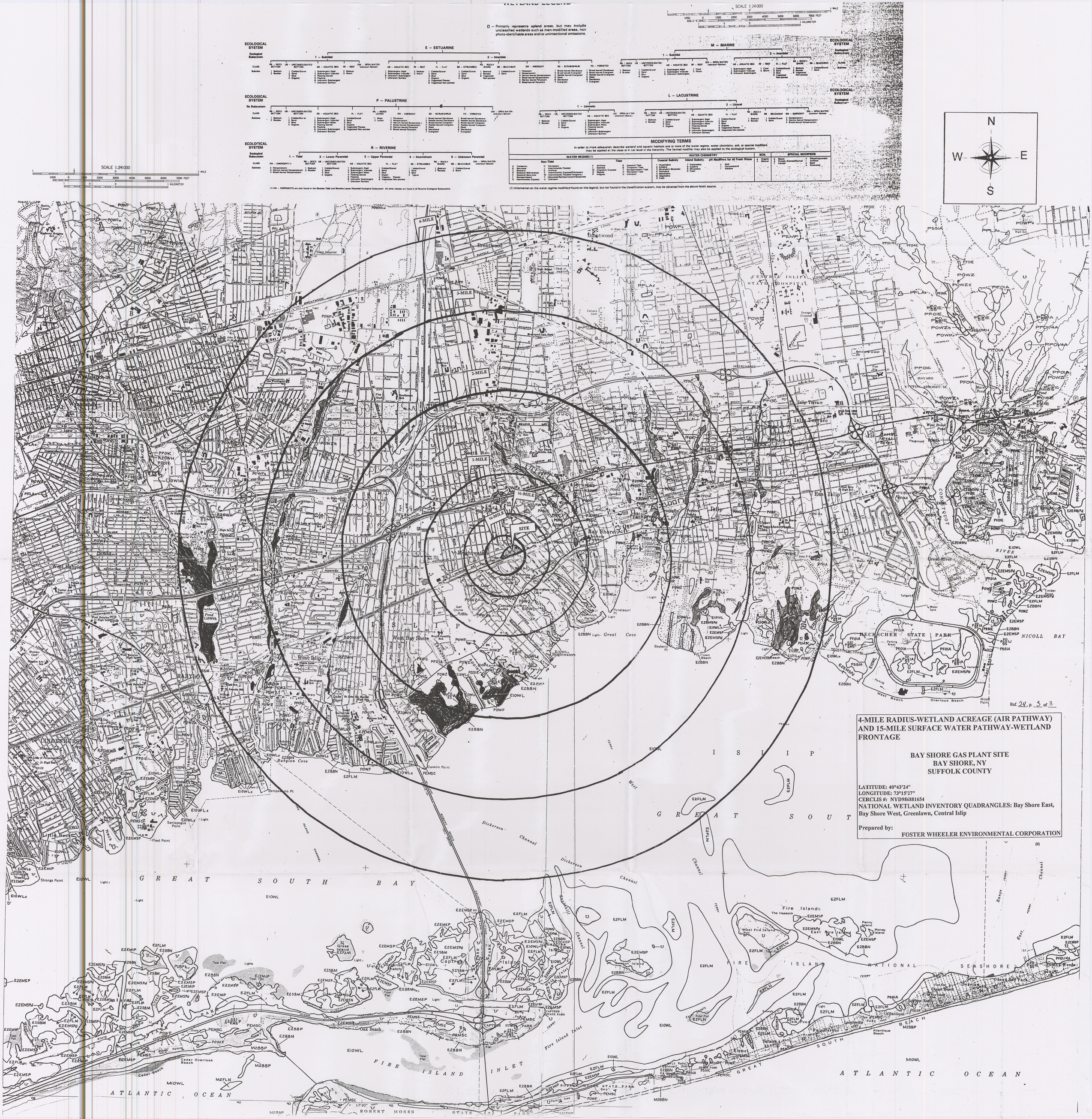
Due to the vast amount of wetland frontage in the 15 mile segment for this site, only the sections included on Bay Shore East and Bay Shore West Quadangles were measured and the measurement was not exact, where tidal influence areas were not all included.

Lawrence Creek frontage 2 x 3,229 = 6458' ~ 1.2 miles

Distance of Lawrence Creek from site 3527'

" " Great South Bay 3,229 + 3527 =

~ 1.3 mile


WETLAND LEGEND
SCALE 1:24 000
1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER
0 – Primarily represents upland areas, but may include unclassified wetlands such as man-modified areas, non photo-identifiable areas and/or unintentional omissions.
ECOLOGICAL SYSTEM
Ecological Subsystem
CLASS
Subclass
E – ESTUARINE
1 – Subtidal
2 – Intertidal
M – MARINE
P – PALUSTRINE
L – LACUSTRINE
1 – Limnetic
2 – Littoral
R – RIVERINE
1 – Tidal
2 – Lower Perennial
3 – Upper Perennial
4 – Intermittent
5 – Unknown Perennial
(1) EM – EMERGENTS are only found in the Riverine Tidal and Riverine Lower Perennial Ecological Subsystem. All other classes are found in all Riverine Ecological Subsystems.
MODIFYING TERMS
In order to more adequately describe wetland and aquatic habitats one or more of the water regime, water chemistry, soil, or special modifiers may be applied at the class or lower level in the hierarchy. The termed modifier may also be applied to the ecological system.
WATER REGIME(1)
Non-Tidal
Tidal
Coastal Salinity
Inland Salinity
WATER CHEMISTRY
pH Modifiers for all Fresh Water
SOIL
SPECIAL MODIFIERS
(1) Information on the water regime modifiers found on this legend, but not found in the classification system, may be obtained from the above listed source.
N
W
E
S
4-MILE
3-MILE
2-MILE
1-MILE
½-MILE
¼-MILE
SITE
Brentwood
Central Islip
Bay Shore
Islip
West Islip
Great South Bay
Fire Island
Atlantic Ocean
Ref. 24, p. 5 of 3
4-MILE RADIUS-WETLAND ACREAGE (AIR PATHWAY) AND 15-MILE SURFACE WATER PATHWAY-WETLAND FRONTAGE
BAY SHORE GAS PLANT SITE
BAY SHORE, NY
SUFFOLK COUNTY
LATITUDE: 40°43'24"
LONGITUDE: 73°15'27"
CERCLIS #: NYD986881654
NATIONAL WETLAND INVENTORY QUADRANGLES: Bay Shore East, Bay Shore West, Greenlawn, Central Islip
Prepared by:
FOSTER WHEELER ENVIRONMENTAL CORPORATION

**REFERENCE 25**

**New York State Department of Environmental Conservation**
**Wildlife Resources Center**
**700 Troy-Schenectady Road**
**Latham, New York 12110-2400**
**(518) 783-3932**



**John P. Cahill**
**Commissioner**

August 6, 1997

Matthew Peles
Foster Wheeler Environmental Corporation
8 Peach Tree Hill Road
Livingston, New Jersey 07039

Re: Bay Shore Gas Plant

Dear Mr. Peles:

We have reviewed the New York Natural Heritage Program files with respect to your recent request for biological information concerning a Pre Remedial Site Investigation #076-2JZZ, as indicated on your enclosed map, located in the Town of Bay Shore, Suffolk County, New York State.

Enclosed is a computer printout covering the area you requested to be reviewed by our staff. The information contained in this report is considered sensitive and may not be released to the public without permission from the New York Natural Heritage Program.

Our files are continually growing as new habitats and occurrences of rare species and communities are discovered. In most cases, site-specific or comprehensive surveys for plant and animal occurrences have not been conducted. For these reasons, we can only provide data which have been assembled from our files. We cannot provide a definitive statement on the presence or absence of species, habitats or natural communities. This information should not be substituted for on-site surveys that may be required for environmental assessment.

This response applies only to known occurrences of rare animals and/or significant wildlife habitats. You should contact our regional office, Division of Regulatory Affairs, at the address enclosed for information regarding any regulated areas or permits that may be required (e.g., regulated wetlands) under State Law.

If this proposed project is still active one year from now we recommend that you contact us again so that we may update this response.

Sincerely,

Deborah Albert

Deborah L. Albert
Information Services
NY Natural Heritage Program

Encs.
cc: Reg. 1, Wildlife Mgr.
Reg. 1, Fisheries Mgr.
Peter Nye, ESU, Delmar

BIOLOGICAL AND CONSERVATION DATA SYSTEM - ELEMENT OCCURRENCE REPORT, 04 AUG 1997
Prepared by N.Y.S.D.E.C. Natural Heritage Program, Latham New York

(This report contains sensitive information which should be treated in a sensitive manner. Refer to the users guide for explanation of codes and ranks.)

| * COUNTY & TOWN | USGS TOPO MAP/ LAT. & LONG. | PRECISION | LAST SEEN | EO RANK | SCIENTIFIC AND COMMON NAME | ELEMENT TYPE | NY STATUS | US STATUS | HERITAGE RANKS | OFFICE USE | OFFICE | USE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ISLIP | BAY SHORE EAST 404253 731230 | S | 1988 | E | PANDION HALIAETUS OSPREY (mite ring 2-3) | BIRD | T | | G5 S4 | ESU | 4007362 | 24 |
| ISLIP | BAY SHORE EAST 404219 731138 | S | 1986 | D | STERNA ANTILLARUM LEAST TERN (3-4) | BIRD | E | | G4 S3B | ESU | 4007362 | 8 |
| ISLIP | BAY SHORE EAST 404357 731358 | S | 1987 | E | AGALINIS FASCICULATA FASCICLED FALSE FOXGLOVE | VASCULAR PLANT | R | | G5 S3 | | 4007362 | 39 |
| ISLIP | BAY SHORE EAST 404328 731419 | M | 1909 | H | ASTER CONCOLOR SILVERY ASTER | VASCULAR PLANT | E | | G4? S1 | | 4007362 | 20 |
| ISLIP | BAY SHORE EAST 404355 731235 | M | | H | CAREX HORMATHODES MARSH STRAW SEDGE | VASCULAR PLANT | R | | G4G5 S2S3 | | 4007362 | 19 |
| ISLIP | BAY SHORE EAST 404245 731238 | M | 1987 | E | HELIANTHUS ANGUSTIFOLIUS SWAMP SUNFLOWER | VASCULAR PLANT | T | | G5 S2 | | 4007362 | 5 |
| ISLIP | BAY SHORE EAST 404253 731253 | S | 1986 | C | LOBELIA NUTTALLII NUTTALL'S LOBELIA | VASCULAR PLANT | R | | G4G5 S3 | | 4007362 | 33 |
| ISLIP | BAY SHORE EAST 404328 731446 | M | 1909 | H | POLYGALA LUTEA YELLOW MILKWORT | VASCULAR PLANT | E | | G5 S1 | | 4007362 | 21 |
| ISLIP | BAY SHORE EAST 404437 731330 | S | 1995 | B | PROSERPINACA PECTINATA COMB-LEAVED MERMAID-WEED | VASCULAR PLANT | R | | G5 S2 | | 4007362 | 27 |
| ISLIP | BAY SHORE EAST 404433 731204 | S | 1987 | CD | SCLERIA TRIGLOMERATA WHIP NUTRUSH | VASCULAR PLANT | R | | G5 S2 | | 4007362 | 1 |
| ISLIP | BAY SHORE EAST 404456 731250 | S | 1987 | C | SOLIDAGO LATISSIMIFOLIA COASTAL GOLDENROD | VASCULAR PLANT | U | | G5 S1 | | 4007362 | 6 |

Ref. 25, p. 2 of 16

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|---|---|---|---|---|---|---|---|---|---|---|---|
| ISLIP | BAY SHORE EAST 404257 731135 | S | 1989 | BC | UTRICULARIA RADIATA SMALL FLOATING BLADDERWORT | VASCULAR PLANT | R | | G4 S2 | | 4007362 37 |
| ISLIP | BAY SHORE WEST 404240 731714 | S | 1991 | BC | ALETRIS FARINOSA STARGRASS | VASCULAR PLANT | U | | G5 S2 | | 4007363 27 |
| ISLIP | BAY SHORE WEST 404159 731539 | S | 1990 | C | CAREX HORMATHODES MARSH STRAW SEDGE | VASCULAR PLANT | R | | G4G5 S2S3 | | 4007363 35 |
| ISLIP | BAY SHORE WEST 404159 731539 | S | 1990 | AB | ELEOCHARIS ELLIPTICA VAR PSEUDOPTER SLENDER SPIKERUSH | VASCULAR PLANT | U | | G5T? S1 | | 4007363 35 |
| ISLIP | BAY SHORE WEST 404111 731802 | M | | H | HELIANTHUS ANGUSTIFOLIUS SWAMP SUNFLOWER | VASCULAR PLANT | T | | G5 S2 | | 4007363 34 |
| ISLIP | BAY SHORE WEST 404159 731539 | S | 1990 | AB | HELIANTHUS ANGUSTIFOLIUS SWAMP SUNFLOWER | VASCULAR PLANT | T | | G5 S2 | | 4007363 35 |
| ISLIP | BAY SHORE WEST 404240 731714 | S | 1991 | BC | HYPERICUM PROLIFICUM SHRUBBY ST. JOHN'S-WORT | VASCULAR PLANT | T | | G5 S2 | | 4007363 27 |
| ISLIP | BAY SHORE WEST 404240 731714 | S | 1990 | E | JUNCUS MARGINATUS VAR ODORATUS LARGE GRASS-LEAVED RUSH | VASCULAR PLANT | U | | G5T5 S1 | | 4007363 27 |
| ISLIP | BAY SHORE WEST 404240 731714 | S | 1990 | E | JUNCUS SCIRPOIDES SCIRPUS-LIKE RUSH | VASCULAR PLANT | U | | G5 S1 | | 4007363 27 |
| ISLIP | BAY SHORE WEST 404159 731539 | S | 1990 | BC | LOBELIA NUTTALLII NUTTALL'S LOBELIA | VASCULAR PLANT | R | | G4G5 S3 | | 4007363 35 |
| ISLIP | BAY SHORE WEST 404159 731539 | S | 1990 | B | SABATIA CAMPANULATA SLENDER MARSH-PINK | VASCULAR PLANT | E | | G5 S1 | | 4007363 35 |

Ref. 25, p. 3 of 16

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ISLIP | BAY SHORE WEST<br>404159 731539 | S | 1990 | A | SOLIDAGO LATISSIMIFOLIA<br>COASTAL GOLDENROD | VASCULAR PLANT | U | | G5<br>S1 | | 4007363 | 35 |
| ISLIP | BAY SHORE WEST<br>404159 731539 | S | 1996 | CD | VERBESINA ALTERNIFOLIA<br>WINGSTEM | VASCULAR PLANT | T | | G5<br>S2 | | 4007363 | 35 |
| ISLIP | CENTRAL ISLIP<br>404643 731419 | M | 1926 | H | ASTER CONCOLOR<br>SILVERY ASTER | VASCULAR PLANT | E | | G4?<br>S1 | | 4007372 | 40 |
| ISLIP | CENTRAL ISLIP<br>404643 731436 | M | 1944 | H | LESPEDEZA STUEVEI<br>VELVETY LESPEDEZA | VASCULAR PLANT | R | | G4?<br>S2 | | 4007372 | 8 |
| ISLIP | CENTRAL ISLIP<br>404502 731249 | S | 1996 | C | LIATRIS SCARIOSA VAR NOVAE-ANGLIAE<br>NEW ENGLAND BLAZING-STAR | VASCULAR PLANT | R | | G5?T3Q<br>S2 | | 4007372 | 47 |
| ISLIP | CENTRAL ISLIP<br>404634 731444 | M | 1926 | H | LINUM MEDIUM VAR TEXANUM<br>SOUTHERN YELLOW FLAX | VASCULAR PLANT | T | | G5T5<br>S2 | | 4007372 | 5 |
| ISLIP | CENTRAL ISLIP<br>404518 731155 | S | 1986 | C | LOBELIA NUTTALLII<br>NUTTALL'S LOBELIA | VASCULAR PLANT | R | | G4G5<br>S3 | | 4007372 | 83 |
| ISLIP | GREENLAWN<br>404603 731520 | S | 1989 | C | PITCH PINE-SCRUB OAK BARRENS<br>PITCH PINE-SCRUB OAK BARRENS | COMMUNITY | U | | G2<br>S1 | | 4007373 | 4 |
| ISLIP<br>HUNTINGTON<br>BABYLON | GREENLAWN<br>404653 731824 | S | 1992 | B | PITCH PINE-SCRUB OAK BARRENS<br>PITCH PINE-SCRUB OAK BARRENS | COMMUNITY | U | | G2<br>S1 | | 4007373 | 5 |
| ISLIP | GREENLAWN<br>404603 731519 | S | 1985 | D | HEMILEUCA MAIA MAIA<br>COASTAL BARRENS BUCKMOTH | MOTH | U | SC | G4T2T3<br>S2 | ESU | 4007373 | 4 |
| ISLIP | GREENLAWN<br>404603 731519 | S | 1985 | AB | LESPEDEZA STUEVEI<br>VELVETY LESPEDEZA | VASCULAR PLANT | R | | G4?<br>S2 | | 4007373 | 4 |

Ref. 25, p. 4 of 16

BIOLOGICAL AND CONSERVATION DATA SYSTEM - ELEMENT OCCURRENCE REPORT, 04 AUG 1997
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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ISLIP | GREENLAWN<br>404622 731700 | S | 1987 | D | LIATRIS SCARIOSA VAR NOVAE-ANGLIAE<br>NEW ENGLAND BLAZING-STAR | VASCULAR PLANT | R | | G5?T3Q<br>S2 | | 4007373 | 6 |

43 Records Processed

BIOLOGICAL AND CONSERVATION DATA SYSTEM - ELEMENT OCCURRENCE REPORT, 04 AUG 1997
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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * NASSAU | | | | | | | | | | | | |
| BABYLON | BAY SHORE WEST<br>403807 731947 | S | 1992 | A | CHENOPODIUM RUBRUM<br>RED PIGWEED | VASCULAR PLANT | U | | G5<br>S2 | | 4007363 | 43 |
| HEMPSTEAD | AMITYVILLE<br>403733 732904 | S | 1987 | AB | PANOQUINA PANOQUIN<br>SALT MARSH SKIPPER | BUTTERFLY or SKIPPER | U | | G5<br>SU | | 4007364 | 17 |
| HEMPSTEAD | AMITYVILLE<br>403758 732919 | S | 1986 | D | RYNCHOPS NIGER<br>BLACK SKIMMER | BIRD | P | | G5<br>S2 | | 4007364 | 11 |
| HEMPSTEAD | AMITYVILLE<br>403830 732929 | S | 1986 | D | STERNA HIRUNDO<br>COMMON TERN | BIRD | T | | G5<br>S3B | ESU | 4007364 | 10 |
| HEMPSTEAD | AMITYVILLE<br>403758 732919 | S | 1986 | D | STERNA HIRUNDO<br>COMMON TERN | BIRD | T | | G5<br>S3B | ESU | 4007364 | 11 |
| HEMPSTEAD | AMITYVILLE<br>403830 732929 | S | 1985 | D | STERNA NILOTICA<br>GULL-BILLED TERN | BIRD | P | | G5<br>S1 | | 4007364 | 10 |
| HEMPSTEAD | AMITYVILLE<br>403913 732939 | M | 1929 | H | SCUTELLARIA INTEGRIFOLIA<br>HYSSOP-SKULLCAP | VASCULAR PLANT | U | | G5<br>S1 | | 4007364 | 39 |
| HEMPSTEAD | WEST GILGO BEACH<br>403659 732902 | S | 1986 | D | STERNA HIRUNDO<br>COMMON TERN | BIRD | T | | G5<br>S3B | ESU | 4007354 | 5 |
| HEMPSTEAD | WEST GILGO BEACH<br>403721 732904 | S | 1986 | CD | STERNA HIRUNDO<br>COMMON TERN | BIRD | T | | G5<br>S3B | ESU | 4007354 | 6 |
| OYSTER BAY | AMITYVILLE<br>403803 732541 | S | 1986 | C | STERNA HIRUNDO<br>COMMON TERN | BIRD | T | | G5<br>S3B | ESU | 4007364 | 14 |
| OYSTER BAY | AMITYVILLE<br>404018 732808 | S | 1992 | AB | CAREX BARRATTII<br>BARRATT'S SEDGE | VASCULAR PLANT | E | | G4<br>S1 | | 4007364 | 19 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OYSTER BAY | AMITYVILLE 404018 732801 | S | 1986 | AB | CAREX BULLATA BUTTON SEDGE | VASCULAR PLANT | T | | G5 S1 | | 4007364 | 16 |
| OYSTER BAY | AMITYVILLE 404003 732856 | S | 1992 | D | CHAMAECYPARIS THYOIDES ATLANTIC WHITE CEDAR | VASCULAR PLANT | R | | G4 S3 | | 4007364 | 23 |
| OYSTER BAY | AMITYVILLE 403955 732810 | M | 1923 | F | GENTIANA SAPONARIA SOAPWORT GENTIAN | VASCULAR PLANT | R | | G5 S1 | | 4007364 | 35 |
| OYSTER BAY | AMITYVILLE 404014 732807 | S | 1990 | CD | HYPERICUM HYPERICOIDES SSP MULTICAU ST. ANDREW'S CROSS | VASCULAR PLANT | E | | G5T4 S1 | | 4007364 | 36 |
| OYSTER BAY | AMITYVILLE 404003 732856 | S | 1989 | C | JUNCUS DEBILIS WEAK RUSH | VASCULAR PLANT | T | | G5 S1 | | 4007364 | 23 |
| OYSTER BAY | AMITYVILLE 404030 732757 | M | 1987 | E | LECHEA PULCHELLA VAR MONILIFORMIS BEAD PINWEED | VASCULAR PLANT | T | | G5T4 S1 | | 4007364 | 7 |
| OYSTER BAY | AMITYVILLE 404017 732801 | S | 1985 | A | LECHEA RACEMULOSA ILLINOIS PINWEED | VASCULAR PLANT | R | | G5 S3 | | 4007364 | 16 |
| OYSTER BAY | AMITYVILLE 404054 732742 | M | 1918 | H | LESPEDEZA STUEVEI VELVETY LESPEDEZA | VASCULAR PLANT | R | | G4? S2 | | 4007364 | 6 |
| OYSTER BAY | AMITYVILLE 404047 732758 | M | 1923 | F | OXYPOLIS RIGIDIOR STIFF COWBANE | VASCULAR PLANT | U | | G5 SH | | 4007364 | 1 |
| OYSTER BAY | AMITYVILLE 404015 732811 | S | 1992 | D | POLYGONUM HYDROPIPEROIDES VAR OPELO OPELOUSA SMARTWEED | VASCULAR PLANT | U | | G5 S3 | | 4007364 | 41 |
| OYSTER BAY | AMITYVILLE 404030 732757 | M | 1938 | H | POLYGONUM SETACEUM VAR INTERJECTUM SWAMP SMARTWEED | VASCULAR PLANT | U | | G5T4 S1S2 | | 4007364 | 7 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OYSTER BAY | AMITYVILLE 404018 732801 | S | 1992 | B | SCLERIA TRIGLOMERATA WHIP NUTRUSH | VASCULAR PLANT | R | | G5 S2 | | 4007364 | 16 |
| OYSTER BAY | AMITYVILLE 404030 732757 | M | 1924 | F | SCUTELLARIA INTEGRIFOLIA HYSSOP-SKULLCAP | VASCULAR PLANT | U | | G5 S1 | | 4007364 | 7 |
| OYSTER BAY | AMITYVILLE 404030 732757 | M | 1992 | E | SMILAX PSEUDOCHINA FALSE CHINA-ROOT | VASCULAR PLANT | E | | G4G5 S1 | | 4007364 | 7 |
| OYSTER BAY | AMITYVILLE 404030 732757 | M | 1926 | H | SPHENOPHOLIS OBTUSATA VAR OBTUSATA PRAIRIE WEDGEGRASS | VASCULAR PLANT | U | | G5T5 S1 | | 4007364 | 7 |
| OYSTER BAY | WEST GILGO BEACH 403649 732622 | S | 1979 | E | ASIO FLAMMEUS SHORT-EARED OWL | BIRD | P SC | | G5 S2 | ESU | 4007354 | 16 |
| OYSTER BAY | WEST GILGO BEACH 403637 732628 | S | 1992 | B | LYCOPODIELLA CAROLINIANA CAROLINA CLUBMOSS | VASCULAR PLANT | E | | G5 S1 | | 4007354 | 8 |
| * SUFFOLK | | | | | | | | | | | | |
| BABYLON | AMITYVILLE 403732 732232 | M | 1979 | E | ASIO FLAMMEUS SHORT-EARED OWL | BIRD | P SC | | G5 S2 | ESU | 4007364 | 31 |
| BABYLON | AMITYVILLE 403834 732324 | S | 1986 | D | STERNA HIRUNDO COMMON TERN | BIRD | T | | G5 S3B | ESU | 4007364 | 15 |
| BABYLON | AMITYVILLE 404028 732448 | M | 1937 | H | DIGITARIA FILIFORMIS SLENDER CRABGRASS | VASCULAR PLANT | R | | G5 S2 | | 4007364 | 24 |
| BABYLON | AMITYVILLE 404018 732451 | M | 1928 | H | GENTIANA SAPONARIA SOAPWORT GENTIAN | VASCULAR PLANT | R | | G5 S1 | | 4007364 | 22 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BABYLON | AMITYVILLE 404031 732455 | M | 1928 | H | LINUM MEDIUM VAR TEXANUM SOUTHERN YELLOW FLAX | VASCULAR PLANT | T | | G5T5 S2 | | 4007364 | 3 |
| BABYLON | AMITYVILLE 404008 732452 | M | 1929 | X | RHYNCHOSPORA TORREYANA TORREY'S BEAKRUSH | VASCULAR PLANT | U | | G4 SH | | 4007364 | 20 |
| BABYLON | BAY SHORE WEST 403807 731947 | S | 1995 | AB | BRACKISH INTERDUNAL SWALES BRACKISH INTERDUNAL SWALES | COMMUNITY | U | | G3G4 S1S2 | | 4007363 | 43 |
| BABYLON | BAY SHORE WEST 403844 732013 | S | 1993 | C | ARDEA ALBA GREAT EGRET | BIRD | P | | G5 S2 | | 4007363 | 5 |
| BABYLON | BAY SHORE WEST 403852 731653 | S | 1986 | D | ARDEA ALBA GREAT EGRET | BIRD | P | | G5 S2 | | 4007363 | 38 |
| BABYLON OYSTER BAY | BAY SHORE WEST 403732 732201 | S | 1995 | AB | CHARADRIUS MELODUS PIPING PLOVER | BIRD 15 mile | E | LELT | G3 S2B | ESU | 4007363 | 12 |
| BABYLON | BAY SHORE WEST 403858 732000 | S | 1984 | F | CHARADRIUS MELODUS PIPING PLOVER | BIRD 15 mile | E | LELT | G3 S2B | ESU | 4007363 | 13 |
| BABYLON | BAY SHORE WEST 403727 731834 | S | 1995 | C | CHARADRIUS MELODUS PIPING PLOVER | BIRD 15 mile | E | LELT | G3 S2B | ESU | 4007363 | 9 |
| BABYLON | BAY SHORE WEST 403844 732013 | S | 1993 | C | EGRETTA CAERULEA LITTLE BLUE HERON | BIRD | P | | G5 S2 | | 4007363 | 5 |
| BABYLON | BAY SHORE WEST 403844 732013 | S | 1993 | B | EGRETTA THULA SNOWY EGRET | BIRD | P | | G5 S2S3 | | 4007363 | 5 |
| BABYLON | BAY SHORE WEST 403844 732013 | S | 1992 | F | EGRETTA TRICOLOR TRICOLORED HERON | BIRD | P | | G5 S2 | | 4007363 | 5 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BABYLON | BAY SHORE WEST 403828 731928 | S | 1984 | E | LATERALLUS JAMAICENSIS BLACK RAIL | BIRD | | P SC | | G4 S1B | ESU | 4007363 | 28 |
| BABYLON | BAY SHORE WEST 403844 732013 | S | 1984 | F | NYCTANASSA VIOLACEA YELLOW-CROWNED NIGHT-HERON | BIRD | | P | | G5 S2 | | 4007363 | 5 |
| BABYLON | BAY SHORE WEST 403817 731925 | M | 1992 | F | NYCTANASSA VIOLACEA YELLOW-CROWNED NIGHT-HERON | BIRD | | P | | G5 S2 | | 4007363 | 46 |
| BABYLON | BAY SHORE WEST 403852 731653 | S | 1984 | D | PLEGADIS FALCINELLUS GLOSSY IBIS | BIRD | | P | | G5 S2 | | 4007363 | 38 |
| BABYLON | BAY SHORE WEST 403844 732013 | S | 1993 | B | PLEGADIS FALCINELLUS GLOSSY IBIS | BIRD | | P | | G5 S2 | | 4007363 | 5 |
| BABYLON | BAY SHORE WEST 403749 732059 | S | 1995 | B | RYNCHOPS NIGER BLACK SKIMMER | BIRD | | P | | G5 S2 | | 4007363 | 14 |
| BABYLON | BAY SHORE WEST 403749 732059 | S | 1989 | F | RYNCHOPS NIGER BLACK SKIMMER | BIRD | | P | | G5 S2 | | 4007363 | 14 |
| BABYLON OYSTER BAY | BAY SHORE WEST 403732 732201 | S | 1995 | AB | STERNA ANTILLARUM LEAST TERN | BIRD | 15 mile | E | | G4 S3B | ESU | 4007363 | 12 |
| BABYLON | BAY SHORE WEST 403727 731834 | S | 1995 | D | STERNA ANTILLARUM LEAST TERN | BIRD | 15 mile | E | | G4 S3B | ESU | 4007363 | 9 |
| BABYLON | BAY SHORE WEST 403858 732000 | S | 1984 | F | STERNA ANTILLARUM LEAST TERN | BIRD | 15 mile | E | | G4 S3B | ESU | 4007363 | 13 |
| BABYLON | BAY SHORE WEST 403749 732059 | S | 1995 | C | STERNA DOUGALLII ROSEATE TERN | BIRD | 15 mile | E | LELTNL | G5 S1B | ESU | 4007363 | 14 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BABYLON | BAY SHORE WEST 403749 732059 | S | 1995 | A | STERNA HIRUNDO COMMON TERN | BIRD 15 mile | T | | G5 S3B | ESU | 4007363 | 14 |
| BABYLON | BAY SHORE WEST 403908 731648 | S | 1986 | AB | STERNA HIRUNDO COMMON TERN | BIRD 15 mile | T | | G5 S3B | ESU | 4007363 | 25 |
| BABYLON | BAY SHORE WEST 403727 731834 | S | 1995 | D | STERNA HIRUNDO COMMON TERN | BIRD | T | | G5 S3B | ESU | 4007363 | 9 |
| BABYLON | BAY SHORE WEST 403749 732059 | S | 1984 | F | STERNA NILOTICA GULL-BILLED TERN | BIRD | P | | G5 S1 | | 4007363 | 14 |
| BABYLON | BAY SHORE WEST 403848 731753 | M | 1914 | X | AMARANTHUS PUMILUS SEABEACH AMARANTH | VASCULAR PLANT | U | LT | G2 S1 | | 4007363 | 1 |
| BABYLON | BAY SHORE WEST 403728 731824 | S | 1991 | C | AMARANTHUS PUMILUS SEABEACH AMARANTH | VASCULAR PLANT | U | LT | G2 S1 | | 4007363 | 41 |
| BABYLON | BAY SHORE WEST 404153 731938 | M | 1928 | X | ASCLEPIAS RUBRA RED MILKWEED | VASCULAR PLANT | U | | G4G5 SX | | 4007363 | 21 |
| BABYLON | BAY SHORE WEST 404204 731937 | M | 1926 | H | ASTER SOLIDAGINEUS FLAX-LEAF WHITETOP | VASCULAR PLANT | U | | G5 S2 | | 4007363 | 7 |
| BABYLON | BAY SHORE WEST 404135 732117 | M | 1927 | H | ASTER SOLIDAGINEUS FLAX-LEAF WHITETOP | VASCULAR PLANT | U | | G5 S2 | | 4007363 | 29 |
| BABYLON | BAY SHORE WEST 403807 731947 | S | 1992 | E | DIPLACHNE MARITIMA SALT-MEADOW GRASS | VASCULAR PLANT | U | | G5T3T4 S1 | | 4007363 | 43 |
| BABYLON | BAY SHORE WEST 404142 731959 | M | 1933 | H | GENTIANA SAPONARIA SOAPWORT GENTIAN | VASCULAR PLANT | R | | G5 S1 | | 4007363 | 11 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BABYLON | BAY SHORE WEST 404120 731953 | M | 1898 | H | HELIANTHUS ANGUSTIFOLIUS SWAMP SUNFLOWER | VASCULAR PLANT | T | | G5 S2 | | 4007363 | 18 |
| BABYLON | BAY SHORE WEST 404204 731937 | M | 1926 | H | LESPEDEZA STUEVEI VELVETY LESPEDEZA | VASCULAR PLANT | R | | G4? S2 | | 4007363 | 7 |
| BABYLON | BAY SHORE WEST 404416 732037 | S | 1985 | C | MAGNOLIA VIRGINIANA SWEETBAY MAGNOLIA | VASCULAR PLANT | U | | G5 S1 | | 4007363 | 17 |
| BABYLON | BAY SHORE WEST 404208 731942 | M | 1915 | H | PANICUM SCOPARIUM VELVET PANIC GRASS | VASCULAR PLANT | U | | G5 S1 | | 4007363 | 24 |
| BABYLON | BAY SHORE WEST 404135 732117 | M | 1935 | H | POLYGALA LUTEA YELLOW MILKWORT | VASCULAR PLANT | E | | G5 S1 | | 4007363 | 29 |
| BABYLON | BAY SHORE WEST 404046 731953 | M | 1895 | X | POLYGONUM GLAUCUM SEABEACH KNOTWEED | VASCULAR PLANT | U | | G3 S3 | | 4007363 | 22 |
| BABYLON | BAY SHORE WEST 403723 731826 | S | 1991 | B | POLYGONUM GLAUCUM SEABEACH KNOTWEED | VASCULAR PLANT | U | | G3 S3 | | 4007363 | 42 |
| BABYLON | BAY SHORE WEST 403807 731947 | S | 1991 | B | POLYGONUM GLAUCUM SEABEACH KNOTWEED | VASCULAR PLANT | U | | G3 S3 | | 4007363 | 43 |
| BABYLON | BAY SHORE WEST 403807 731947 | S | 1992 | D | RUMEX MARITIMUS VAR FUEGINUS GOLDEN DOCK | VASCULAR PLANT | T | | G5T5 S1 | | 4007363 | 43 |
| BABYLON | BAY SHORE WEST 403807 731947 | S | 1992 | B | SCIRPUS MARITIMUS SEASIDE BULRUSH | VASCULAR PLANT | U | | G5 S1 | | 4007363 | 43 |
| BABYLON | BAY SHORE WEST 404148 731957 | M | 1898 | H | SCLERIA PAUCIFLORA VAR CAROLINIANA FEWFLOWER NUTRUSH | VASCULAR PLANT | T | | G5T4T5 S1 | | 4007363 | 10 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BABYLON | BAY SHORE WEST<br>404208 731942 | M | | H | SCUTELLARIA INTEGRIFOLIA<br>HYSSOP-SKULLCAP | VASCULAR PLANT | U | | G5<br>S1 | | 4007363 | 24 |
| BABYLON | BAY SHORE WEST<br>403844 732013 | S | 1995 | B | WESTERN HEMISPHERE ROOKERY<br>WESTERN HEMISPHERE ROOKERY | OTHER | U | | G5<br>S3 | | 4007363 | 5 |
| BABYLON | WEST GILGO BEACH<br>403726 732453 | S | 1986 | D | ARDEA ALBA<br>GREAT EGRET | BIRD | P | | G5<br>S2 | | 4007354 | 10 |
| BABYLON | WEST GILGO BEACH<br>403726 732453 | S | 1985 | D | EGRETTA CAERULEA<br>LITTLE BLUE HERON | BIRD | P | | G5<br>S2 | | 4007354 | 10 |
| BABYLON | WEST GILGO BEACH<br>403725 732453 | S | 1984 | D | EGRETTA TRICOLOR<br>TRICOLORED HERON | BIRD | P | | G5<br>S2 | | 4007354 | 10 |
| BABYLON | WEST GILGO BEACH<br>403726 732453 | S | 1985 | B | PLEGADIS FALCINELLUS<br>GLOSSY IBIS | BIRD | P | | G5<br>S2 | | 4007354 | 10 |
| BABYLON | WEST GILGO BEACH<br>403718 732503 | S | 1986 | D | STERNA HIRUNDO 15-mile<br>COMMON TERN | BIRD | T | | G5<br>S3B | ESU | 4007354 | 7 |
| BABYLON<br>OYSTER BAY | WEST GILGO BEACH<br>403624 732616 | S | 1996 | B | AMARANTHUS PUMILUS 15 mile<br>SEABEACH AMARANTH | VASCULAR PLANT | U | LT | G2<br>S1 | | 4007354 | 15 |
| BABYLON | WEST GILGO BEACH<br>403709 732318 | S | 1991 | BC | POLYGONUM GLAUCUM<br>SEABEACH KNOTWEED | VASCULAR PLANT | U | | G3<br>S3 | | 4007354 | 13 |
| BROOKHAVEN | HOWELLS POINT<br>404137 725925 | S | 1993 | F | CHARADRIUS MELODUS 15-mile<br>PIPING PLOVER | BIRD | E | LELT | G3<br>S2B | ESU | 4007268 | 3 |
| BROOKHAVEN | HOWELLS POINT<br>404137 725925 | S | 1996 | B | STERNA ANTILLARUM 15-mile<br>LEAST TERN | BIRD | E | | G4<br>S3B | ESU | 4007268 | 3 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BROOKHAVEN | HOWELLS POINT<br>404454 725922 | S | 1996 | D | STERNA ANTILLARUM<br>LEAST TERN | BIRD 15-mile | E | | G4<br>S3B | ESU | 4007268 | 4 |
| BROOKHAVEN | HOWELLS POINT<br>404137 725925 | S | 1990 | F | STERNA HIRUNDO<br>COMMON TERN | BIRD 15-mile | T | | G5<br>S3B | ESU | 4007268 | 3 |
| BROOKHAVEN | HOWELLS POINT<br>404134 725917 | M | 1968 | H | SUAEDA LINEARIS<br>NARROW-LEAF SEA-BLITE | VASCULAR PLANT | U | | G5<br>S1 | | 4007268 | 14 |
| BROOKHAVEN | PATCHOGUE<br>404641 730120 | S | 1984 | E | APHREDODERUS SAYANUS<br>PIRATE PERCH | FISH | U | | G5<br>S1 | | 4007371 | 3 |
| BROOKHAVEN | PATCHOGUE<br>404610 730114 | M | 1845 | H | LEMNA VALDIVIANA<br>PALE DUCKWEED | VASCULAR PLANT | U | | G5<br>SH | | 4007371 | 13 |
| BROOKHAVEN | PATCHOGUE<br>404610 730114 | M | XXXX | H | POLYGONUM HYDROPIPEROIDES VAR OPELO<br>OPELOUSA SMARTWEED | VASCULAR PLANT | U | | G5<br>S3 | | 4007371 | 13 |
| BROOKHAVEN | SAYVILLE<br>403919 730638 | S | 1985 | AB | MARITIME OAK-HOLLY FOREST<br>MARITIME OAK-HOLLY FOREST | COMMUNITY | U | | G2G3<br>S1 | | 4007361 | 6 |
| BROOKHAVEN | SAYVILLE<br>404355 730516 | M | 1928 | H | CYPERUS FLAVESCENS VAR FLAVESCENS<br>YELLOW FLATSEDGE | VASCULAR PLANT | U | | G5T?<br>S1 | | 4007361 | 10 |
| BROOKHAVEN | SAYVILLE<br>403915 730720 | M | 1924 | H | RUMEX MARITIMUS VAR FUEGINUS<br>GOLDEN DOCK | VASCULAR PLANT | T | | G5T5<br>S1 | | 4007361 | 3 |
| ISLIP | BAY SHORE EAST<br>403823 731028 | S | 1995 | E | CHARADRIUS MELODUS<br>PIPING PLOVER | BIRD 15-mile | E | LELT | G3<br>S2B | ESU | 4007362 | 44 |
| ISLIP | BAY SHORE EAST<br>403823 731028 | S | 1995 | E | STERNA ANTILLARUM<br>LEAST TERN | BIRD 15-mile | E | | G4<br>S3B | ESU | 4007362 | 44 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ISLIP | BAY SHORE EAST<br>404219 731138 | S | 1986 | D | STERNA ANTILLARUM 15-mile<br>LEAST TERN | BIRD | E | | G4<br>S3B | ESU | 4007362 | 8 |
| ISLIP | BAY SHORE EAST<br>404256 730823 | S | 1984 | D | STERNA ANTILLARUM 15-mile<br>LEAST TERN | BIRD | E | | G4<br>S3B | ESU | 4007362 | 9 |
| ISLIP | BAY SHORE EAST<br>404204 731030 | S | 1988 | F | STERNA ANTILLARUM 15-mile<br>LEAST TERN | BIRD | E | | G4<br>S3B | ESU | 4007362 | 35 |
| ISLIP | BAY SHORE EAST<br>403814 731107 | S | 1990 | D | AMARANTHUS PUMILUS<br>SEABEACH AMARANTH | VASCULAR PLANT | U | LT | G2<br>S1 | | 4007362 | 2 |
| ISLIP | BAY SHORE EAST<br>404448 730901 | S | 1988 | BC | CARDAMINE LONGII<br>LONG'S BITTERCRESS | VASCULAR PLANT | U | | G3Q<br>S2 | | 4007362 | 31 |
| ISLIP | BAY SHORE EAST<br>404447 730842 | S | 1988 | BC | CARDAMINE LONGII<br>LONG'S BITTERCRESS | VASCULAR PLANT | U | | G3Q<br>S2 | | 4007362 | 32 |
| ISLIP | BAY SHORE EAST<br>404245 731238 | M | 1987 | E | HELIANTHUS ANGUSTIFOLIUS<br>SWAMP SUNFLOWER | VASCULAR PLANT | T | | G5<br>S2 | | 4007362 | 5 |
| ISLIP | BAY SHORE EAST<br>403758 731304 | M | 1985 | E | SPOROBOLUS CLANDESTINUS<br>ROUGH RUSH-GRASS | VASCULAR PLANT | U | | G5<br>S1 | | 4007362 | 46 |
| ISLIP | BAY SHORE EAST<br>404257 731135 | S | 1989 | BC | UTRICULARIA RADIATA<br>SMALL FLOATING BLADDERWORT | VASCULAR PLANT | R | | G4<br>S2 | | 4007362 | 37 |
| ISLIP | BAY SHORE WEST<br>403838 731514 | S | 1986 | D | STERNA HIRUNDO 15-mile<br>COMMON TERN | BIRD | T | | G5<br>S3B | ESU | 4007363 | 26 |
| ISLIP | BAY SHORE WEST<br>404111 731802 | M | | H | HELIANTHUS ANGUSTIFOLIUS<br>SWAMP SUNFLOWER | VASCULAR PLANT | T | | G5<br>S2 | | 4007363 | 34 |

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BIOLOGICAL AND CONSERVATION DATA SYSTEM - ELEMENT OCCURRENCE REPORT, 04 AUG 1997
Prepared by N.Y.S.D.E.C. Natural Heritage Program, Latham New York

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| * COUNTY & TOWN | USGS TOPO MAP/ LAT. & LONG. | PRECISION | LAST SEEN | EO RANK | SCIENTIFIC AND COMMON NAME | ELEMENT TYPE | NY STATUS | US STATUS | HERITAGE RANKS | OFFICE USE | OFFICE | USE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ISLIP | SAYVILLE 404414 730424 | S | 1994 | E | HELIANTHUS ANGUSTIFOLIUS SWAMP SUNFLOWER | VASCULAR PLANT | T | | G5 S2 | | 4007361 | 21 |
| ISLIP | SAYVILLE 404443 730436 | M | 1941 | H | POLYGALA LUTEA YELLOW MILKWORT | VASCULAR PLANT | E | | G5 S1 | | 4007361 | 16 |
| ISLIP | SAYVILLE 404314 730639 | S | 1992 | C | SAGINA DECUMBENS SMALL-FLOWERED PEARLWORT | VASCULAR PLANT | U | | G5 S1 | | 4007361 | 14 |

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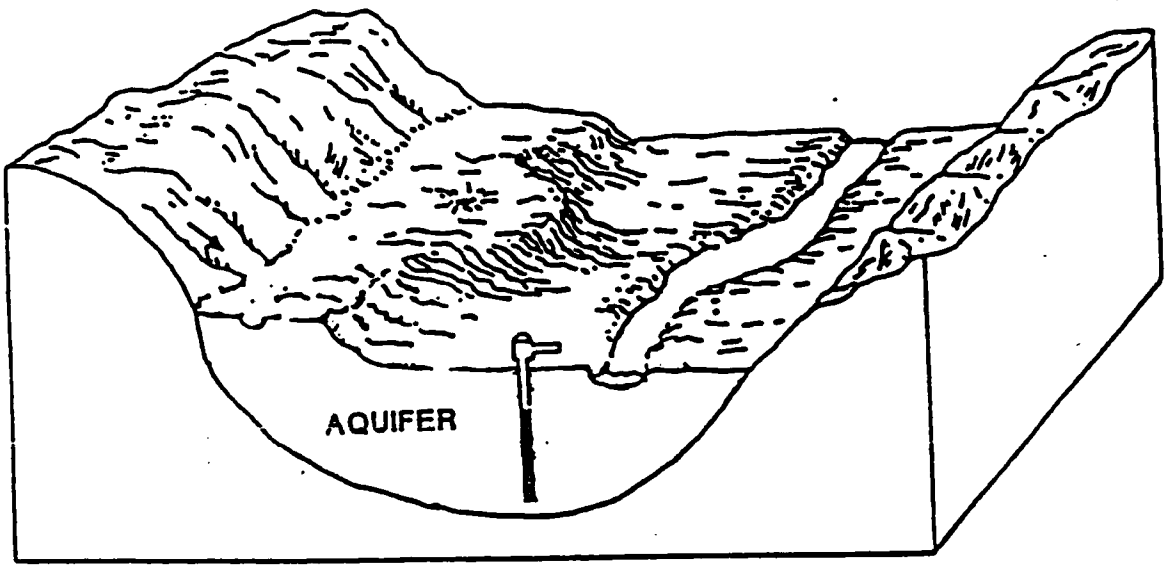
Department of Environmental Conservation

# NEW YORK STATE WELLHEAD PROTECTION PROGRAM




**Submittal**
**to**
**United States Environmental Protection Agency**

New York State Department of Environmental Conservation
MARIO M. CUOMO, *Governor* THOMAS C. JORLING, *Commissioner*

***September 1990***

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# NEW YORK STATE WELLHEAD PROTECTION PROGRAM

SUBMITTAL
TO
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
IN
APPLICATION FOR IMPLEMENTATION FUNDS

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF WATER
ALBANY, NY

SEPTEMBER 1990

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# PREFACE

This report represents a revision of the Proposed New York State Wellhead Protection Program, submitted to the U.S. Environmental Protection Agency on June 19, 1989. Following the June 1989 submittal, there was an additional review by the New York State Wellhead Protection Advisory Committee (see ACKNOWLEDGEMENTS) and by key program managers and regional staff of the NYS Department of Environmental Conservation. The initial comments of the USEPA concerning the submittal were received by New York in January 1990. In March 1990, the USEPA, in accordance with the provisions of the Safe Drinking Water Act amendments, notified the state that the submittal was incomplete. A public hearing was held in August, 1990 to complete the process. Comments received were used in revising this document, and are also discussed in an attachment to this Submittal. The revisions contained in this document primarily include many clarifications of statements made in the original document, but also include additional items to complete the original submittal (e.g., public participation summary) and items to address the adequacy concerns of USEPA.

The wellhead protection activities of the Department of Environmental Conservation in the intervening period have included further development of new source management programs (e.g., chemical bulk storage), incorporation of wellhead protection in existing programs (e.g., water supply permit program), assistance to regional planning agencies in wellhead protection activities (e.g., 205(j) projects on source identification), regional and statewide outreach and education efforts, and providing geologic information and unconsolidated aquifer delineation information.

Most importantly, the interest of county agencies and municipal governments in New York in wellhead protection has grown considerably since the June 1989 submittal, with significant activity by key counties and municipalities in Upstate New York, by the Long Island Regional Planning Board concerning Long Island's Special Groundwater Protection Areas, and by Long Island's major water suppliers. Substantial interest in training (including delineation models and management tools), and in developing protection ordinances has been expressed.

Agencies and local government associations apart from the Department of Environmental Conservation have initiated public discussion and training activities concerning wellhead protection and groundwater management.

These activities demonstrate the desired evolution of local wellhead protection programs that the New York State Wellhead Protection Program is designed to foster.

## ACKNOWLEDGEMENTS

The New York State Department of Environmental Conservation gratefully acknowledges the assistance and recommendations of the members of the Wellhead Protection Advisory Committee. To date, these members have included the following:

- Aldo Andreoli, Suffolk County Dept. of Health Services
- Donald Beavers, Temporary Commission on Tug Hill
- Donald Bingham, U.S. Geological Survey
- Jessica Breiten, Herkimer-Oneida Planning Dept.
- James Coon, NYS Dept. of State;
- Robert Denz, Broome County Health Dept
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- Robert Fickles, NYS Geological Survey
- William Gollnitz, Chautauqua Co. Health Dept.
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- John Kent, Herkimer-Oneida Planning Dept.
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- Sarah Meyland, Suffolk Co. Water Authority
- Todd Miller, U.S. Geological Survey
- Jacqueline Moody, NYS Dept. of Agriculture & Markets
- James Napoli, Dutchess Co. Health Dept.
- Donald O'Dell, NYS Dept. of State
- Francis Padar, Nassau Co. Dept. of Health
- Kenneth Pokalsky, Business Council of NYS
- Keith Porter, NYS Water Resources Institute-Cornell University
- George Proios, NYS Legislative Comm. on Water Resource Needs of L.I.
- Thomas Reamon, NYS Dept. of Health
- Joseph Salvato, American Water Works Association
- Ronald Slotkin, Broome Co. Health Dept.
- David Stern, NYS Legislative Comm. on Water Resource Needs of L.I.
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The original submittal (June 19, 1989) was prepared by Allan Tedrow, Kevin Roberts and James Lister of the NYS Department of Environmental Conservation, Division of Water, Groundwater Management Section. The revised document (September, 1990) was prepared by Kevin Roberts and Allan Tedrow.

The typing of this document by Barbara J. Crier, of the Department of Environmental Conservation, is also gratefully acknowledged.

# CHAPTER 3

# WELLHEAD PROTECTION AREA DELINEATION

## 3.1. Introduction and Institutional Processes

### 3.1.1. Introduction

The comprehensive New York State Groundwater Management Program, developed in the early 1980's and published in revised and final documents in 1986 (for Long Island) and 1987 (for Upstate), recommended key policies and program initiatives endorsing geographic targeting and critical area protection. These concepts were forerunners of the Safe Drinking Water Act's Wellhead Protection Program. Significant progress has been made in different aspects of geographic targeting of programs and in different parts of New York State. New York acknowledges these accomplishments as an integral part of its overall Wellhead Protection Program.

Delineation determines geographic areas for which different levels of groundwater protection activities are to be instituted. The Wellhead Protection Program in New York State is intended to accomplish a wider recognition of targeting objectives by all levels of government, by citizens in general, and to begin an evolutionary process toward improved targeting and protective program implementation.

The basic wellhead protection delineation approach in New York State recognizes aquifers as the fundamental geographic unit for targeting management efforts. This approach must be modified where aquifers are broad regional systems (DEC considers this case to occur only on Long Island), or where aquifers are not well characterized (considered to be the case for bedrock aquifers, in general). Elsewhere, the unconsolidated aquifers of New York tend to be of limited areal extent and they generally include the important recharge areas within their boundaries. These unconsolidated aquifers also are the source of the large majority of groundwater-derived public water supply systems.

The New York State Wellhead Protection Program proposes that unconsolidated aquifer boundaries (the land surface overlying the aquifer) serve as the baseline definition for the overall wellhead protection area (WHPA). For the baseline definition, both confined and unconfined unconsolidated aquifers are grouped together. Revisions are allowable based on site-specific evaluations. This aquifer boundary approach is proposed to be modified on Long Island and for wells in bedrock aquifers as described in Section 3.2. For all public water supply wells, specific proposed WHPA delineation policies are described in Section 3.2.

The aquifer boundary approach for the overall WHPA has several distinct advantages. It takes advantage of considerable recent and ongoing work in mapping and detailed assessments of aquifer boundaries. Incorporating this work directly into the Wellhead Protection Program provides a practical way for more effective targeting to move forward rapidly rather than being constrained by the need to perform modeling to delineate protection areas.

The aquifer approach also encompasses other non-public wells and potential future well sites, and places major focus on the high-yielding groundwater resources which are most important and most vulnerable. This last aspect is considered very important in the education component of wellhead protection, both for local officials and for the general public.

Wellhead protection area delineation is an evolutionary process. The first need for refinement is the further subdivision of the total wellhead protection area, as required for differentiated management objectives. A second area for potential refinement is delineation of the overall WHPA in the Glacial Aquifer on Long Island and in bedrock aquifers. Issues related to these topics are reviewed in both Sections 3.2 and 3.3. Flexibility for refinement or revision is very important due to the wide variability in

hydrogeologic settings, data availability, and local degree of contamination threat in New York State.

### 3.1.2 Institutional Processes for Overall Delineation Policies

Advisory committee and work group input into the original comprehensive Groundwater Management Program was substantial. The basic concept of geographic targeting was set forth in that program. The groups included:

- Federal Agencies (EPA, USGS)
- State Agencies (DEC, DOH, DOT, Agriculture & Markets, Energy Office, Geological Survey)
- Cornell University
- County Agencies (Health, Planning)
- Associations (Conference of Mayors, American Water Works Association, Business Council)
- Citizen Groups (NRDC, League of Women Voters)

DEC reconvened most of the original contributors into an advisory committee to assist in guiding the Wellhead Protection Program, with particular emphasis on delineation issues. Added to the original group have been:

- State Agencies (Department of State)
- County Agencies (a wider range of county participants)
- Regional Agencies and Commissions (additional planning and legislative commissions)
- Associations (Association of Towns, American Water Resources Association)

The new group, the Wellhead Protection Advisory Committee, has also included additional participation from the U.S. Geological Survey and DEC geological staff.

The delineation approach proposed in this submittal was recommended by the DEC Groundwater Management Section (responsible for developing the program) and agreed to by the Wellhead Protection Advisory Committee (members listed in front of submittal). The delineation approach directly conforms with the policies in the formally adopted Upstate New York Groundwater Management Program and Long Island Groundwater Management Program.

The DEC has also established a Memorandum of Understanding (MOU) with the DOH concerning the development of the Wellhead Protection Program. Additional MOU's will be developed as needed to institutionalize interagency working arrangements.

To support the technical needs of DEC and of local governments in carrying out and refining delineations, DEC plans to convene an ongoing Delineation Technical Workgroup consisting of geologists and groundwater management staff of DEC, DOH, State Geological Survey, USGS, and local governments. This group would consider revisions or improvements in the overall delineation approach, and would essentially be concerned with hydrogeologic aspects of the program rather than administration or contamination source control. The mission of this group is to provide recommendations to the DEC staff responsible for the overall Wellhead Protection Program. It will be convened upon EPA approval of New York State's submittal and will meet on at least a semi-annual basis or as needed.

Local authorities involved in wellhead protection may vary, as discussed elsewhere in this submittal. Therefore, uniform institutional processes at the local level will not be proposed across the entire state. Local agencies may act according to their own needs and authority. However, in all cases where Watershed Rules and Regulations are utilized as the local wellhead protection approach, the existing requirements of the New York State Department of Health (DOH) will be followed. Similarly, for all new wells, the institutional requirements of the New York State Department of Environmental Conservation's (DEC) Water Supply Permit Program will apply.

The proposed responsibility for initiating refinements of the baseline delineations described in this submittal will depend upon the regulatory approach adopted. Delineation refinements to be incorporated in Watershed Rules and Regulations approaches will be initiated and performed by water purveyors. Delineation refinements to be incorporated in county, town, village or city ordinances (including local public health ordinances) will be initiated and performed by the corresponding political authority. Delineation refinements to be incorporated in state-level regulatory programs will be performed by DEC.

In practice, most local activities will involve coordination with the State DEC and DOH. Each Department routinely reviews local activities to ensure that there are no conflicts with respect to policies and procedures and advises on the availability of technical information for delineation purposes. The overall coordination for aspects specifically related to the WHPP is the responsibility of DEC.

Other institutions, particularly the U.S. Geological Survey and Cornell and other universities, may be involved in special projects or case studies, as coordinated by DEC.

## 3.2. Defineation Criteria, Thresholds and Methods

### 3.2.1. Background - Existing Geographic Targeting

The existing, and still evolving, geographic targeting framework for groundwater protection provides a priority system for managing risks to groundwater. Following is a brief summary:

- Groundwater Classification - 6 NYCRR Part 703

  Ambient water quality standards and guidelines apply to all Class GA (fresh) groundwaters. Class GA groundwaters are defined as having best use as a source of drinking water and must meet New York State's drinking water standards in addition to the ambient standards. State management programs use this framework for protection of all fresh groundwaters in New York State.

- Unconsolidated Aquifers

  Mapping of unconsolidated aquifers has progressed significantly including State-defined primary and principal aquifers which are subsets of the unconsolidated aquifers. Site-specific detailed mapping is still in progress.

  Primary and principal aquifers are generally similar geologically (both are highly productive unconsolidated deposits); primary aquifers are those which have large populations using them as drinking water sources. Primary aquifers have high priority for mapping additional hydrogeologic data through the DEC/USGS cooperative program, and in special Long Island programs.

  These delineations are used in the process for siting new waste disposal facilities.

- Long Island Hydrogeologic Zones

  Eight hydrogeologic zones have been delineated, covering all of Long Island. Three of these together comprise the Deep Flow Recharge Area. Management program initiatives (e.g., hazardous substance storage) are based on this Deep Flow Recharge Area.

- Special Groundwater Protection Areas

  Nine Special Groundwater Protection Areas have been delineated within the Deep Flow Recharge Area in both Nassau and Suffolk Counties and are currently the subject of a planning project by the Long Island Regional Planning Board.

- Other Geographic Targeting Approaches

  Suffolk County has specifically defined "Water Supply Sensitive Areas" which include zones 500 feet downgradient to 1,500

set upgradient of public wells in the Upper Glacial Aquifer.

Watershed Rules and Regulations are promulgated by the NYS Department of Health upon initiation by local water purveyors. These include delineations of protection management zones for public water supply wells. The WRR delineations do not conflict with the wellhead protection area delineation policies proposed in this submittal.

The NYS Solid Waste Management Program, in 6 NYCRR Part 360, has defined "public water supply wellhead area" as the surface and subsurface area between a public water supply well or wellfield and the 99% theoretical maximum extent of the stabilized cone of depression of that well or wellfield considering all flow system boundaries and seasonal fluctuations. New landfills are banned in these areas, in addition to all primary and principal aquifers in the Upstate area. Special provisions are defined in law for Long Island siting. As with the Watershed Rules and Regulations, there is no conflict in terminology between the Part 360 public water supply wellhead area and the overall wellhead protection area proposed in this submittal. The overall protection area includes, and is larger than, the Part 360 wellhead itself. For landfill siting, Part 360 regulations will prevail. Part 360 determinations are made only for proposed landfill siting cases.

Other setback requirements have been utilized in various state or local management programs. When used, such as for pesticides (e.g., aldicarb) or septic tanks, the setbacks apply to all wells, public or private. As with the other targeting approaches, such setbacks do not conflict with the proposed wellhead protection area policies.

- Well Construction Specifications

Direct protection of the wellhead itself is achieved through adoption of construction specifications and standards. These are administered by the New York State Department of Health and follow the "Recommended Standards for Water Works" (NYS Health Department Bulletin #42, 1982). They apply to public water supply wells.

### 3.2.2. Wellhead Protection Area Delineation Objectives

The USEPA guidance for development of wellhead protection programs (Guidance for Applicants for State Wellhead Protection Program Assistance Funds under the Safe Drinking Water Act, EPA 440/6-87-011) contains the expectation that proposed programs will be designed to provide protection from three types of threats: direct introduction of contaminants in the immediate well area, microbial contaminants, and chemical contaminants. The first is dealt with through well construction and completion standards to be applied at the wellhead itself. The second is managed by delineating a zone to keep potential sources sufficiently distant from the well to allow die-off of the microorganisms. Establishing a minimum distance by measurement or by time-of-travel is the most common procedure for delineating areas for protection against microbial contamination.

To achieve protection against chemical contamination, EPA suggests three delineation approaches: delineation of wellfield management areas, contamination attenuation zones, or remedial action zones. Since chemicals can travel long distances, all or part of the recharge area for a well becomes the zone to be delineated for protection efforts.

The overall goals of New York State's delineation approach are essentially a combination of the wellfield management and remedial action zone goals described by EPA.

Wellfield management is used to define areas where heightened levels of protection will be

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emphasized. A number of different zones may be delineated for a single water supply to provide different levels of management. The management options may range from selected land use prohibitions to specialized design specifications, enhanced facility inspections, or increased monitoring and education.

The remedial action area approach excludes high risk activities from a specifically defined zone but still allows them in more distant recharge areas. This may be refined by varying exclusions in different zones according to risk or the importance of the activity. The remedial action area concept is best applied to new or changing land uses, whereas wellfield management may be applied to existing or new land uses.

The contamination attenuation zone approach described by EPA is difficult to strictly apply due to limited capabilities to accurately predict chemical migration and persistence. In addition, the New York State groundwater standards apply to all fresh groundwaters, reducing the utility of an attenuation zone approach.

### 3.2.3. Delineation Policy

The underlying objective of delineation is to use different degrees of management to control risks to water supplies. The significant diversity in geological conditions, aquifer use, and in local government capabilities across New York State indicates that the approach to delineation can not be uniform and rigid for all locations.

The ideal technical goal of wellhead delineation is to have sufficient knowledge of the hydrogeology of each public water supply well or wellfield to allow precise determination of the catchment area along with accurate times-of-travel for the entire flow system. Such information is not uniformly available across the state. New information will become available unevenly as funding from various local, state and federal sources is applied to specific priority areas.

In this setting, the New York State Wellhead Protection Program proposes general recognition of high-yielding aquifers (both confined and unconfined) as the fundamental wellhead protection area units. As described in Section 3.2.4., this policy recognizes that more targeted delineations will be necessary on Long Island because it is entirely an aquifer. Also, bedrock aquifers are not adequately characterized now to allow this approach; however, most of the major, high-yielding aquifers in New York are in unconsolidated deposits. Within the wellhead protection area, delineation of an area designated as the remedial action area is proposed, as described in Sectin 3.2.5.

This policy is intended to reinforce public and management program recognition of the need to protect high-yielding aquifers. It takes advantage of considerable past and ongoing work on aquifer mapping and delineation and will permit further progress in communities which have already delineated aquifer boundaries and protection areas. These communities may directly proceed to management implementation or may utilize available funds on more advanced hydrogeologic evaluations within the WHPA, depending on local needs and goals.

Within this framework, utilization of alternative delineation approaches (such as time-of-travel) is allowed and encouraged. In most cases, such alternative approaches would be applied to subdividing the WHPA within the unconsolidated aquifer boundaries for applying different levels of management. The WHPA itself would remain the area defined by aquifer boundaries. In some cases, such as for bedrock aquifers, the alternative approaches may be used to redefine the WHPA itself. The Department of Environmental Conservation will be responsible for providing guidance for such alternative approaches.

### 3.2.4. Wellhead Protection Area Delineations

The wellhead protection area delineation approach is summarized in Table 3.1. It recognizes that the aquifer system on Long Island and bedrock aquifers in Upstate New York must be treated differently than the unconsolidated aquifers in Upstate. The unconsolidated aquifer boundaries for the wellhead protection areas are those delineated on a series of maps titled

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| TABLE 3.1. WELLHEAD PROTECTION AREA DELINEATION SUMMARY | | |
|---|---|---|
| Geographic Region | Aquifer Area | Wellhead Protection Area Baseline Delineation |
| Long Island | Magothy & Lloyd Aquifers | Deep Flow Recharge Area |
| | Glacial Aquifer | Simplified Variable Shape:<br>1,500 ft. radius upgradient<br>500 ft. radius downgradient |
| Upstate | Unconsolidated Aquifers | Aquifer Boundaries (land surface) |
| | Bedrock Aquifers | Fixed Radius: 1,500 ft. radius |

"Potential Yields of Wells in Unconsolidated Aquifers in Upstate New York" by the U.S. Geological Survey. Specifically, these maps, distributed for sale by the U.S. Geological Survey, are as follows:

1. Bugliosi, E.F., et al., 1988. Potential Yields of Wells in Unconsolidated Aquifers in Upstate New York - Lower Hudson Sheet. Water Resources Investigations Report 87-4274. U.S. Department of the Interior, Geological Survey, Albany, NY.

2. Bugliosi, E.F., et al., 1988. Potential Yields of Wells in Unconsolidated Aquifers in Upstate New York - Hudson Mohawk Sheet. Water Resources Investigations Report 87-4275, U.S. Department of the Interior, Geological Survey, Albany, NY.

3. Bugliosi, E.F., et al., 1988. Potential Yields of Wells in Unconsolidated Aquifers in Upstate New York - Adirondack Sheet. Water Resources Investigations Report 87-4276, U.S. Department of the Interior, Geological Survey, Albany, NY.

4. Miller, T.S., 1988. Unconsolidated Aquifers in Upstate New York - Finger Lakes Sheet. Water Resources Investigations Report 87-4122, U.S. Department of the Interior, Geological Survey, Albany, NY.

5. Miller, T.S., 1988. Potential Yields of Wells in Unconsolidated Aquifers in Upstate New York - Niagara Sheet. Water Resources Investigations Report 88-4076. U.S. Department of the Interior, Geological Survey, Albany, NY.

The boundaries illustrated on these maps serve as the total wellhead protection areas for public water supplies utilizing those aquifers. In certain cases, more detailed aquifer boundary maps or determinations for primary or principal aquifers (subsets of the full range of unconsolidated aquifers) have been or will be made by the U.S. Geological Survey or NYS Department of Environmental Conservation. These more detailed boundary determinations will generally supersede boundaries illustrated on the above referenced maps as "revised" delineations of wellhead protection areas.

Both unconfined and confined unconsolidated aquifers are included on these maps and both are included in this definition of the overall wellhead protection area.

For all public water supplies utilizing groundwater, the overall wellhead protection area (WHPA) delineation will be subdivided into two parts. The innermost zone is referred to as the Remedial Action Area. The remainder of the WHPA is referred to as the Wellfield Management Area. The terminology is derived from the EPA guidance referenced earlier. Depending on local management objectives for groundwater protection, local hydrogeology, and data availability and resource availability, the Wellfield Management Area may be further subdivided. This further subdivision of the Wellfield Management Area would be considered a refinement of the "baseline" delineation. Methodologies, criteria and thresholds used for such revisions are flexible. Approaches proposed by local water purveyors will be evaluated and approved or disapproved upon submittal to the New York State Department of Environmental Conservation.

The term "baseline" delineation, as used in this submittal, is intended to represent the initial WHPA delineation advocated by the Department of Environmental Conservation. The delineation may be directly utilized in implementing management activities for groundwater protection. However, if site-specific conditions suggest that alternative delineations are appropriate (including the further subdivision of the Wellfield Management Area already cited), those delineations may be accepted by the Department of Environmental Conservation. The evolution of improved delineation techniques, the growing availability of hydrogeologic information, and the longer-term enhancements of groundwater protection programs may lead to a redefinition of the baseline delineations by the Department of Environmental Conservation.

These baseline delineations apply to public water supply wells. Applicants for new public water supply wells may be required to perform

2. Rationale:

Fixed-shape zones are not based on calculated time-of-travel or drawdown. The proposed definition is consistent with Water Supply Sensitive Areas already delineated by Suffolk County (which contains nearly all of the Glacial wells on Long Island) and for which enhanced protection programs have already been implemented in the Suffolk County Sanitary Code. Approximately half of the Glacial wells are within the Deep Flow Recharge Area and are thus protected within a larger overall WHPA. Significant expansion of the WHPA for all Glacial wells may not provide any reasonable geographic targeting benefits, as most of the WHPA's would intersect or nearly intersect. All fresh groundwaters in the Glacial aquifer are already covered by substantial protection programs which utilize a rigorous set of ambient water quality standards.

3. Mapping and Case Studies:

Mapping of the WHPA's for Glacial wells in Suffolk County has been completed through the Water Supply Sensitive Area delineations. For the relatively few Glacial wells in Nassau County, mapping will be completed according to the phasing priorities described in Section 3.3. Case studies of fixed-shape delineations are not considered to be of significant benefit. As proposals for revisions based on alternative approaches are submitted to the Department of Environmental Conservation, they will be evaluated for potential use as models for other Glacial well delineations.

4. Public Water Supply Significance:

As stated previously, approximately one-fourth of the public water supplies in Suffolk County are based in Glacial wells that are outside of the Deep Flow Recharge Area. If Nassau County is included, only about one-eighth of the water supply dependency is from Glacial wells outside of the Deep Flow Recharge Area.

### 3.2.5. Remedial Action Areas

For all community public water supply wells, regardless of setting, a remedial action area will be delineated within the WHPA. For those supply wells, the proposed baseline delineation of this area will be a fixed radius zone of 200 feet radius from the well. Revisions may be made after evaluation by the Department of Environmental Conservation. For non-community public water supply wells (e.g., isolated public buildings, etc.), the existing New York State Department of Health standards for well separations (e.g., from waste disposal facilities) are to be followed.

The rationale for this baseline delineation is based upon general observations in the past that such a zone has been adequate for protection against microbiological contamination. An alternative time-of-travel basis for delineating revised remedial action area boundaries would be to use a time-of-travel from a minimum of 60-days up to one year. The 60-day period has been used in New York State and in many European countries (USEPA, EPA 440/6-87-010, Guidelines for Delineation of Wellhead Protection Areas). A one-year period is considered conservative. In certain cases, the site-specific hydrogeology (e.g., confined aquifer conditions or long times-of-travel) and the nature of existing land uses and management options may allow remedial action areas smaller than 200 feet radius.

### 3.2.6. Potential Refinements and Summary

Table 3.1 summarizes the baseline delineations for wellhead protection areas.

Refinements may include:

- Subdivision of the Wellfield Management Area portion of the WHPA, to allow application of different levels of management within the WHPA.
- Revision of the Remedial Action Area portion of the WHPA, according to alternative methods, including time-of-travel or drawdown analysis.

- Revised boundary determinations of the unconsolidated aquifers in Upstate, including primary and principal aquifers, or of the Deep Flow Recharge Area on Long Island.

- Alternative hydrogeologic determinations of appropriate WHPA's in bedrock aquifers or for wells in the Glacial aquifer on Long Island.

### 3.3. Phasing Considerations

The published unconsolidated aquifer maps cited in the previous section complete the baseline WHPA delineations for all public water supply wells within those aquifers. The completed delineation of the Deep Flow Recharge Area on Long Island has been defined according to road boundaries. That delineation defines the WHPA for all public water supply wells in the Magothy and Lloyd aquifers. The baseline WHPA boundaries for public water supply wells using the Glacial aquifer in Suffolk County have been determined by the Suffolk County Department of Health Services through its Water Supply Sensitive Area designations.

The remaining baseline WHPA boundary determinations that are needed consist of a relatively small set of Glacial aquifer wells and public water supply wells in bedrock aquifers. The phasing priorities for these groups are, in order:

1. Municipal community wells

2. Non-municipal community wells

3. Non-community public wells

Within each priority group additional phasing may be generally ordered by population dependency with modifications made if there are significant known or suspected threats to the wells.

It is emphasized that the baseline WHPA delineations for the very large majority of public water supply wells (by population served) are completed. The delineations for the remaining bedrock wells and Glacial wells will be performed as resources permit.

### 3.4. Summary

The baseline wellhead protection area delineations are considered to be completed through the published aquifer maps cited in this chapter. These cover both confined and unconfined aquifers and low- and high-yielding aquifers. The Deep Flow Recharge Area on Long Island has also been delineated. It is noted that the Deep Flow Recharge Area on Long Island also includes many wells using the shallow Glacial aquifer, and thus provides an added layer of protection.

Refinements (i.e., delineation of additional sub-zones of the overall WHPA) have been completed in many areas. However, such refinements are optional. Their evaluation and delineation will be a goal of future efforts in wellhead protection

**REFERENCE 27**

Ref. 27, p. 1 of 6

ROBERT J. GAFFNEY
County Executive

MARY E. HIBBERD M.D., M.P.H.
Commissioner

SUFFOLK COUNTY
DEPARTMENT OF HEALTH SERVICES

# SUFFOLK COUNTY SANITARY CODE

## ARTICLE 7

## WATER POLLUTION CONTROL

*(Adopted 5/22/1985, Amended 4/9/1986, 1/14/1987, 1/24/1990, 11/4/1992, 6/30/1993)*

constitutes an immediate danger to public health, and determines that it could appear prejudicial to the public interest to delay action, the Commissioner may serve an order upon the permit holder, or if there is no permit upon the person in charge of the facility or site, citing such conditions and specifying the corrective action to be taken and a time period of less than fifteen (15) days within which such action shall be taken.

Such order may state that a permit is immediately suspended and/or that all operations are to be discontinued forthwith.

Any order requiring certain action or the cessation of certain activities immediately or within a specified period of less than fifteen (15) days shall provide such person an opportunity to be heard, which hearing shall be scheduled for a time no more than fifteen (15) days after the date the order is served.

## §760-705 GENERAL RESTRICTIONS AND PROHIBITIONS

A. Construction of a Disposal System

1. It shall be unlawful for any person to construct, reconstruct, install or substantially modify any disposal system without first having obtained a permit therefor issued by or acceptable to the Commissioner, pursuant to Department standards.

2. §760-705.A.1 does not apply to stormwater disposal systems unless there is an actual or potential discharge into the system of industrial wastes, toxic or hazardous materials, or sewage.

B. Discharge

1. It shall be unlawful for any person to discharge sewage, industrial wastes, offensive materials, toxic or hazardous materials or other wastes to any surface waters or groundwaters, to the surface of the ground or to a disposal system unless such discharge is specifically in accordance with a State Pollutant Discharge Elimination System (SPDES) Permit or other permit issued by or acceptable to the Commissioner for that purpose.

2. No permits, as stipulated in §760-705.B.1, are required for the following types of discharges:

a. discharge of sewage from an existing residential structure to a private or individual sewage disposal system, or from any residential structure, houseboat or housebarge to a communal sewage system or municipal sewage system that does not contravene standards or result in a public health nuisance;

b. discharge of sewage from a commercial or industrial facility to a communal sewage system or municipal sewage system;

c. discharge of stormwater to a disposal system unless there is an actual or potential discharge into the system of industrial wastes or toxic or hazardous materials or sewage.

3. For existing discharges not prohibited by law prior to the effective date of this Article, a permit shall be obtained within the time limit provided in §760-707.

C. Construction or Operation of a Treatment System

1. It shall be unlawful for any person to construct, modify or operate a treatment system without first obtaining a permit therefor issued by or acceptable to the Commissioner.

D. Commingling

1. It shall be unlawful for any person to commingle stormwater runoff, cooling water, sewage or industrial wastes in any disposal system not approved for that purpose pursuant to this Article.

E. Stormwater Discharges

1. It shall be unlawful for any person to develop or use land in such a manner as to cause stormwater runoff from that land to become contaminated and discharged in contravention of the other provisions of this Article.

F. Marinas

1. It shall be unlawful for any marina to permit overnight docking of any houseboat or housebarge unless the marina has a waste pump-out facility. Construction of said pump-out facilities shall be in accordance with standards which may be promulgated by the Commissioner.

## §760-706 DEEP RECHARGE AREAS AND WATER SUPPLY SENSITIVE AREAS

The following additional restrictions and prohibitions shall apply in deep recharge areas and water supply sensitive areas.

A. It shall be unlawful for any person to discharge any restricted toxic or hazardous materials or to discharge industrial wastes from any facility containing restricted toxic or hazardous materials to the groundwaters, to the surface of the ground, beneath the surface of the ground, to a municipal or communal sewage system, or to a disposal system except as follows:

1. application of fertilizers, pesticides or other agricultural chemicals approved for that purpose by the appropriate state and federal agencies; or

2. application of road surfacing or road construction materials or deicing salts to roadways, walkways, and parking areas; or

3. discharge from an establishment to a municipal or communal sewage system with effluent disposal to marine surface waters or recharge outside of the deep recharge areas and water supply sensitive areas, and the following minimum requirements are satisfied pursuant to a permit issued by or acceptable to the Commissioner:

a. Dual plumbing systems shall be installed, one for sanitary wastes and one for industrial wastes.

b. Sampling access approved by the administrative head of the municipal or communal sewage system and the Department shall be provided for both the sanitary and industrial waste systems.

c. The administrative head of the municipal or communal sewage system, with approval of the Department, shall determine which industrial wastes are acceptable to "hold and haul" and which require pretreatment prior to discharge to the collection system in order to assure compliance with the applicable sewer use ordinance.

d. Personnel authorized by the administrative head of the municipal or communal sewage system or other individual(s) acceptable to the Commissioner, pursuant to Department standards, shall operate at each establishment its pretreatment facility for industrial wastes prior to discharge to the collection system.

e. Only batch pretreatment of industrial wastes will be permitted. Batch facilities and facilities for storage of drums containing toxic or hazardous wastes shall be located in an area accessible at all times by district personnel, in or adjacent to the industrial building, with heat and power provided by the owner.

f. Personnel authorized by the administrative head of the municipal or communal sewage system or other individual(s) acceptable to the Commissioner, will be responsible for collection and disposal of pretreatment sludges, and other "hold and haul" materials.

g. The owner shall allow the personnel authorized by the administrative head of the municipal or communal sewage system or other individual(s) acceptable to the Commissioner, access, from time to time, to wet process areas to perform their duties and inspections.

h. Industrial process-area floors shall be provided with adequate means to contain any spill of restricted toxic or hazardous materials. The design of containment facilities shall be subject to the approval of the Commissioner.

i. A minimum of four (4) groundwater monitoring wells shall be installed at the owner's expense.

j. Financial assurance shall be provided to pay for cleanup of spills. This cost shall be entered as a judgment upon notice against the owner, occupant, tenant, or lessee responsible for such spill or spills.

B. It shall be unlawful to use or store any restricted toxic or hazardous materials on any premises except as follows:

1. a. the intended use of the product stored is solely for on-site heating, or intermittent stationary power production such as stand-by electricity generation or irrigation pump power; and

b. the facility for such storage is intended solely for the storage of kerosene, number 2 fuel oil, number 4 fuel oil, number 6 fuel oil, diesel oil or lubricating oil; and

c. the facility for such storage is constructed in accordance with the requirements of Article 12 of the Suffolk County Sanitary Code for new construction; and

d. the materials so stored are not industrial wastes from processes containing restricted toxic or hazardous materials; and

e. the materials stored are not intended for resale; or

2. a. for buildings with gross floor area of less than or equal to 20,000 square feet (s.f.), the materials so stored are in containers where the total liquid capacity stored at any time does not exceed 250 gallons and where the dry storage in bags, bulk or small containers does not exceed 2,000 pounds; and

b. for buildings with gross floor area greater than 20,000 square feet (s.f.), the materials so stored are in containers where the total liquid capacity stored at any time does not exceed 0.0125 gals/s.f. of gross floor area and where the dry storage in bags, bulk or small containers does not exceed 0.1 pounds/s.f. of gross floor area; and

c. for the purpose of determining quantity of allowable storage, the internal fluids within production machinery shall not be included; and

d. if storage of restricted toxic or hazardous materials at a facility exceeds 1250 gallons or 10,000 pounds dry storage, then an annual environmental audit is to be conducted of the property, buildings and appurtenances, and the audit will conform to any standards which may be promulgated by the Commissioner; or

3. a. the materials so stored are intended solely for treatment or disinfection of water or sewage in treatment processes located at the site; or

4. a. the materials are stored solely incident to office operations, or wholesale/retail sales on premises and are not processed, pumped, packaged, or repackaged at the site; and

b. for the purpose of these regulations, Office Operations means a place in which business, clerical or professional activities are exclusively conducted and there are no manufacturing or other industrial activities; and

c. wholesale storage shall be limited to 5 gallon maximum size containers and the total storage capacity shall not exceed the storage allowed under §760-706 B.2.b or 5,000 gallons or 40,000 pounds of dry storage in bags, bulk, or small containers, whichever is greater; or

5. a. the materials are stored at a service station or similar installation solely incident to the distribution of gasoline, kerosene, diesel oil or other petroleum products for motor vehicular uses and repair; and

b. the facility for such storage is constructed in accordance with the requirements of Article 12 of the Suffolk County Sanitary Code for new construction; or

6. a. the materials are stored at an establishment for which a permit has been secured in accordance with §760-706.A.3, and a permit for such storage has been granted by the Department.

7. a. the materials are stored on a farm site solely incident to on-premises use, and consist of fertilizers, pesticides, or other agricultural chemicals to be applied in accordance with the provisions of §760-706.A.1.

C. The provisions of §760-706.A and §760-706.B of this Article shall not apply to residential facilities, but shall be applicable:

1. immediately for all non-residential facilities which have not been approved, constructed, or put into operation prior to the effective date of this Article; and

2. immediately for all non-residential facilities which were approved, constructed, or put into operation prior to the effective date of this Article upon:

a. any change in use or process which results in an increase of mass loading in the discharge of restricted toxic or hazardous materials, or introduces a toxic or hazardous material not previously discharged; or

b. any change in use or process which results in an increase of the storage or change of type of restricted toxic or hazardous materials.

D. When upgraded in accordance with the time schedule specified in Article 12, existing facilities, including those for petroleum products, not otherwise covered by items §760-706.A., §760-706.B. or §760-706.C., above, shall conform to the requirements of Article 12. for new construction. These requirements do not apply to facilities upgraded in accordance with Article 12 prior to the effective date of this Article.

**§760-707 PERMITS**

A. All permits required by this Article shall be applied for in accordance with the provisions of Article 3 of the Suffolk County Sanitary Code.

B. All persons required to obtain a permit by reason of any law, rule or regulation in effect prior to the effective date of this Article shall be governed by such law, rule or regulation in determining when said permit shall be obtained.

C. All persons newly required to obtain a permit by this Article due to any act or condition in existence as of the date this Article becomes effective, shall apply for said permit within one (1) year of that date.

D. All persons required to obtain a permit by this Article due to any act or condition not in existence on the effective date of this Article must apply for and receive said permit prior to undertaking such act or creating such condition.

**§760-708 EMERGENCY EMBARGO; SEIZURE**

A. In accordance with the general provisions of Article 2 of the Suffolk County Sanitary Code, the Commissioner or his authorized agent is authorized to seize and embargo materials consisting of industrial wastes, toxic or hazardous materials, or any combination thereof when in the judgment of the Commissioner, the nature and condition of said material constitutes an actual or potential hazard to the source of drinking water supply.

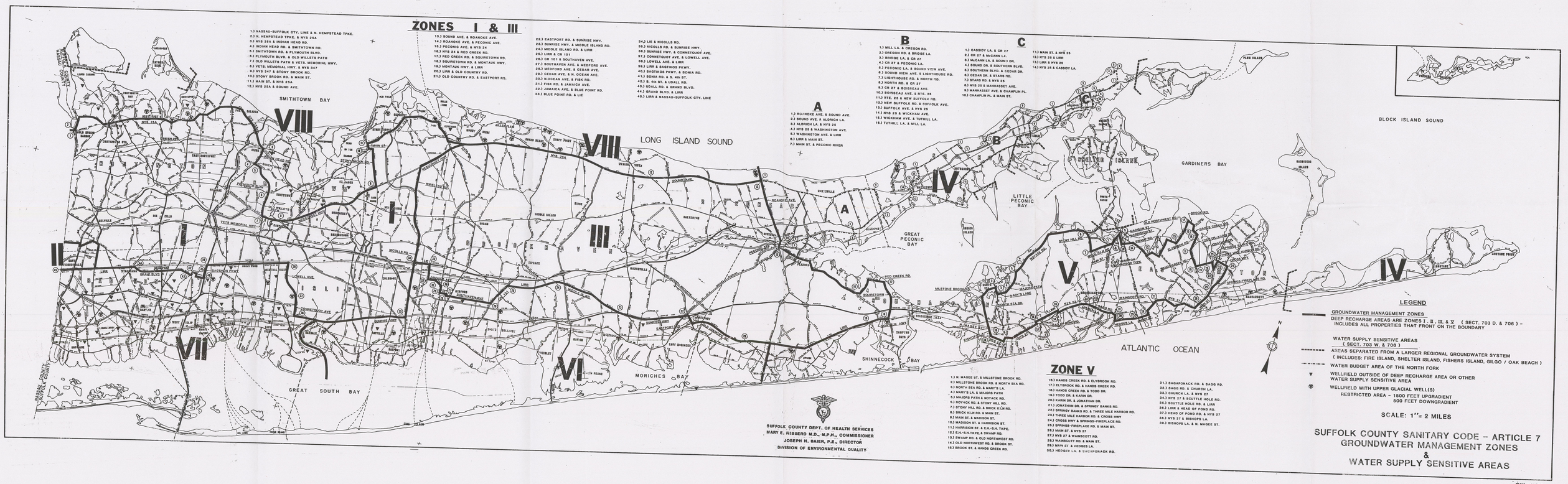
B. The following additional requirements shall also apply:

1. When materials are embargoed or seized pursuant to subsection A. above, they shall not be moved, used or removed except by or under the direction of an agent authorized by the Commissioner.

2. It shall be unlawful for a person not authorized by the Commissioner to remove or alter an embargo order or tag.

3. After having embargoed, condemned or otherwise seized materials pursuant to this section, the Commissioner shall afford the owner of the seized material an opportunity to be heard at a hearing held within ninety-six (96) hours after the seizure. The Commissioner may then vacate the order or sustain it and order a proper and safe disposition of the material seized.

4. Unless ordered otherwise, removal shall be at the expense of the owner.


ZONES I & III
1.3 NASSAU-SUFFOLK CTY. LINE & N. HEMPSTEAD TPKE.
2.3 N. HEMPSTEAD TPKE. & NYS 25A
3.3 NYS 25A & INDIAN HEAD RD.
4.3 INDIAN HEAD RD. & SMITHTOWN RD.
5.3 SMITHTOWN RD. & PLYMOUTH BLVD.
6.3 PLYMOUTH BLVD. & OLD WILLETS PATH
7.3 OLD WILLETS PATH & VETS. MEMORIAL HWY.
8.3 VETS. MEMORIAL HWY. & NYS 347
9.3 NYS 347 & STONY BROOK RD.
10.3 STONY BROOK RD. & MAIN ST.
11.3 MAIN ST. & NYS 25A
12.3 NYS 25A & SOUND AVE.
18.3 SOUND AVE. & ROANOKE AVE.
14.3 ROANOKE AVE. & PECONIC AVE.
15.3 PECONIC AVE. & NYS 24
16.3 NYS 24 & RED CREEK RD.
17.3 RED CREEK RD. & SQUIRETOWN RD.
18.3 SQUIRETOWN RD. & MONTAUK HWY.
19.3 MONTAUK HWY. & LIRR
20.3 LIRR & OLD COUNTRY RD.
21.3 OLD COUNTRY RD. & EASTPORT RD.
22.3 EASTPORT RD. & SUNRISE HWY.
23.3 SUNRISE HWY. & MIDDLE ISLAND RD.
24.3 MIDDLE ISLAND RD. & LIRR
25.3 LIRR & CR 101
26.3 CR 101 & SOUTHAVEN AVE.
27.3 SOUTHAVEN AVE. & MEDFORD AVE.
28.3 MEDFORD AVE. & CEDAR AVE.
29.3 CEDAR AVE. & N. OCEAN AVE.
30.3 N.OCEAN AVE. & FISK RD.
31.3 FISK RD. & JAMAICA AVE.
32.3 JAMAICA AVE. & BLUE POINT RD.
33.3 BLUE POINT RD. & LIE
34.3 LIE & NICOLLS RD.
35.3 NICOLLS RD. & SUNRISE HWY.
36.3 SUNRISE HWY. & CONNETIQUOT AVE.
37.3 CONNETIQUOT AVE. & LOWELL AVE.
38.3 LOWELL AVE. & LIRR
39.3 LIRR & SAGTIKOS PKWY.
40.3 SAGTIKOS PKWY. & SONIA RD.
41.3 SONIA RD. & S. 4th ST.
42.3 S. 4th ST. & UDALL RD.
43.3 UDALL RD. & GRAND BLVD.
44.3 GRAND BLVD. & LIRR
45.3 LIRR & NASSAU-SUFFOLK CTY. LINE
A
1.3 ROANOKE AVE. & SOUND AVE.
2.3 SOUND AVE. & ALDRICH LA.
3.3 ALDRICH LA. & NYS 25
4.3 NYS 25 & WASHINGTON AVE.
5.3 WASHINGTON AVE. & LIRR
6.3 LIRR & MAIN ST.
7.3 MAIN ST. & PECONIC RIVER
B
1.3 MILL LA. & OREGON RD.
2.3 OREGON RD. & BRIDGE LA.
3.3 BRIDGE LA. & CR 27
4.3 CR 27 & PECONIC LA.
5.3 PECONIC LA. & SOUND VIEW AVE.
6.3 SOUND VIEW AVE. & LIGHTHOUSE RD.
7.3 LIGHTHOUSE RD. & NORTH RD.
8.3 NORTH RD. & CR 27
9.3 CR 27 & BOISSEAU AVE.
10.3 BOISSEAU AVE. & NYS 25
11.3 NYS. 25 & NEW SUFFOLK RD.
12.3 NEW SUFFOLK RD. & SUFFOLK AVE.
13.3 SUFFOLK AVE. & NYS 25
14.3 NYS 25 & WICKHAM AVE.
15.3 WICKHAM AVE. & TUTHILL LA.
16.3 TUTHILL LA. & MILL LA.
C
1.3 CASSIDY LA. & CR 27
2.3 CR 27 & McCANN LA.
3.3 McCANN LA. & SOUND DR.
4.3 SOUND DR. & SOUTHERN BLVD.
5.3 SOUTHERN BLVD. & CEDAR DR.
6.3 CEDAR DR. & STARS RD.
7.3 STARS RD. & NYS 25
8.3 NYS 25 & MANHASSET AVE.
9.3 MANHASSET AVE. & CHAMPLIN PL.
10.3 CHAMPLIN PL. & MAIN ST.
11.3 MAIN ST. & NYS 25
12.3 NYS 25 & LIRR
13.3 LIRR & NYS 25
14.3 NYS 25 & CASSIDY LA.
ZONE V
1.3 N. MAGEE ST. & MILLSTONE BROOK RD.
2.3 MILLSTONE BROOK RD. & NORTH SEA RD.
3.3 NORTH SEA RD. & MARY'S LA.
4.3 MARY'S LA. & MAJORS PATH
5.3 MAJORS PATH & NOYACK RD.
6.3 NOYACK RD. & STONY HILL RD.
7.3 STONY HILL RD. & BRICK KLN RD.
8.3 BRICK KLN RD. & MAIN ST.
9.3 MAIN ST. & MADISON ST.
10.3 MADISON ST. & HARRISON ST.
11.3 HARRISON ST. & E.H.-S.H. TKPE.
12.3 E.H.-S.H.TKPE.& SWAMP RD.
13.3 SWAMP RD. & OLD NORTHWEST RD.
14.3 OLD NORTHWEST RD. & BROOK ST.
15.3 BROOK ST. & HANDS CREEK RD.
16.3 HANDS CREEK RD. & ELVBROOK RD.
17.3 ELVBROOK RD. & HANDS CREEK RD.
18.3 HANDS CREEK RD. & TODD DR.
19.3 TODD DR. & KARIN DR.
20.3 KARIN DR. & JONATHAN DR.
21.3 JONATHAN DR. & SPRINGY BANKS RD.
22.3 SPRINGY BANKS RD. & THREE MILE HARBOR RD.
23.3 THREE MILE HARBOR RD. & CROSS HWY
24.3 CROSS HWY & SPRINGS-FIREPLACE RD.
25.3 SPRINGS-FIREPLACE RD. & MAIN ST.
26.3 MAIN ST. & NYS 27
27.3 NYS 27 & WAINSCOTT RD.
28.3 WAINSCOTT RD. & MAIN ST.
29.3 MAIN ST. & HEDGES LA.
30.3 HEDGES LA. & SAGAPONACK RD.
31.3 SAGAPONACK RD. & SAGG RD.
32.3 SAGG RD. & CHURCH LA.
33.3 CHURCH LA. & NYS 27
34.3 NYS 27 & SCUTTLE HOLE RD.
35.3 SCUTTLE HOLE RD. & LIRR
36.3 LIRR & HEAD OF POND RD.
37.3 HEAD OF POND RD. & NYS 27
38.3 NYS 27 & BISHOPS LA.
39.3 BISHOPS LA. & N. MAGEE ST.
LONG ISLAND SOUND
BLOCK ISLAND SOUND
SMITHTOWN BAY
GREAT SOUTH BAY
MORICHES BAY
SHINNECOCK BAY
GREAT PECONIC BAY
LITTLE PECONIC BAY
GARDINERS BAY
ATLANTIC OCEAN
SHELTER ISLAND
FISHERS ISLAND
GILGO ISLAND
OAK BEACH
FIRE ISLAND
NASSAU COUNTY
SUFFOLK COUNTY
I
II
III
IV
V
VI
VII
VIII
LEGEND
GROUNDWATER MANAGEMENT ZONES
DEEP RECHARGE AREAS ARE ZONES I, II, III, & V ( SECT. 703 D. & 706 ) - INCLUDES ALL PROPERTIES THAT FRONT ON THE BOUNDARY
WATER SUPPLY SENSITIVE AREAS ( SECT. 703 W. & 706 )
AREAS SEPARATED FROM A LARGER REGIONAL GROUNDWATER SYSTEM ( INCLUDES: FIRE ISLAND, SHELTER ISLAND, FISHERS ISLAND, GILGO / OAK BEACH )
WATER BUDGET AREA OF THE NORTH FORK
WELLFIELD OUTSIDE OF DEEP RECHARGE AREA OR OTHER WATER SUPPLY SENSITIVE AREA
WELLFIELD WITH UPPER GLACIAL WELL(S)
RESTRICTED AREA - 1500 FEET UPGRADIENT
500 FEET DOWNGRADIENT
SCALE: 1" = 2 MILES
SUFFOLK COUNTY SANITARY CODE - ARTICLE 7
GROUNDWATER MANAGEMENT ZONES
&
WATER SUPPLY SENSITIVE AREAS
SUFFOLK COUNTY DEPT. OF HEALTH SERVICES
MARY E. RIBBERD M.D., M.P.H., COMMISSIONER
JOSEPH H. BAIER, P.E., DIRECTOR
DIVISION OF ENVIRONMENTAL QUALITY
TJK 10/93

Ref. 27, p. 6 & 6

**REFERENCE 28**

## WELL FIELD IDENTIFICATION (LOCATION)

### SUFFOLK COUNTY WATER AUTHORITY

| | | | |
|---|---|---|---|
| 1 | SMITH STREET | 3 ACTIVE WELLS | (3-4 MILE) |
| 2 | INDUSTRY CT. | 2 ACTIVE WELLS | (3-4 MILE) |
| 3 | LOCUST DRIVE | 3 ACTIVE WELLS | (2-3 MILE) |
| 4 | 41ST STREET | 2 ACTIVE WELLS | (2-3 MILE) |
| 5 | MOFFIT BLVD. | 2 ACTIVE WELLS | (3-4 MILE) |
| 6 | SUNRISE HWY. | 3 ACTIVE WELLS | (1-2 MILE) |
| 7 | HARVEST LN. | 3 ACTIVE WELLS | (2-3 MILE) |
| 8 | BROOK AVE. | 4 ACTIVE WELLS | (3-4 MILE) |
| 9 | EAST FORKS RD. | 5 ACTIVE WELLS | (2-3 MILE) |
| 10 | THOMAS AVE. | 2 ACTIVE WELLS | (1-2 MILE) |
| 11 | 5TH AVENUE | 3 ACTIVE WELLS | (¼-½ MILE) |
| 12 | UNION STREET | 3 ACTIVE WELLS | (½-1 MILE) |

### BRENTWOOD WATER DISTRICT

| | | | |
|---|---|---|---|
| 13 | AMERICAN BLVD. | 1 ACTIVE WELL | (3-4 MILE) |
| 14 | THIRD AVENUE | 2 ACTIVE WELLS | (3-4 MILE) |

SCALE 1:24 000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
THE RELATIONSHIP BETWEEN THE TWO DATUMS IS VARIABLE
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS 2.6 FEET IN THE ATLANTIC OCEAN
AND 0.6 FEET IN GREAT SOUTH BAY

# 4-MILE RADIUS VICINITY WELL LOCATION MAP

**BAY SHORE GAS PLANT SITE**
**BAY SHORE, NY**
**SUFFOLK COUNTY**

LATITUDE: 40°43'24"
LONGITUDE: 73°15'27"
CERCLIS #: NYD986881654

Ref. 28, p. 1 of 1

NATIONAL WETLAND INVENTORY QUADRANGLES: Bay Shore East, Bay Shore West, Greenlawn and Central Islip

Prepared by:
FOSTER WHEELER ENVIRONMENTAL CORPORATION

**REFERENCE 29**

Key. 29, p. 1 of 1

# FOSTER WHEELER ENVIRONMENTAL CORPORATION

## RECORD OF TELEPHONE CONVERSATION

Sheet 1 of 1

DATE: 9/9/97

TO: FILE

FROM: MICHELLE BROOKS

CLIENT/PROJECT: EPA ARCS II CONTRACT

SUBJECT: SUMMERS LUMBER YARD PURCHASE BY LILCO

DISCUSSION WITH: RICHARD J. SCHMITZ, SENIOR ENVIRONMENTAL ENGINEER AT LILCO (516) 391-6143.

I INQUIRED OF MR. SCHMITZ: EN WAS THE SUMMERS PROPERTIES PURCHASED BY LILCO AND WHY?

ACCORDING TO MR. SCHMITZ, THE PURCHASE OCCURRED SOMETIME IN LATE 1994 OR EARLY 1995, HE WAS NOT CERTAIN OF THE EXACT TIME, HOWEVER IS WAS CERTAIN IT WAS AFTER THE RESULTS OF THE 1992 MALCOLM PIRNIE, INC. 1992 REMEDIAL INVESTIGATIONS WAS REPORTED. THE LUMBER YARD, THE AUTO SHOP AND THE ASPHALT EQUIPMENT STORAGE YARD PROPERTY WERE ALL OWNED BY SUMMERS AND PURCHASED BY LILCO AT THE SAME TIME. THE MALCOLM PIRNIE INVESTIGATION REVEALED CONTAMINATION ON BOTH PARCELS OF PROPERTY OWNED BY SUMMERS AND ADJACENT TO LILCO PROPERTIES SEPARATED BY THE LIRR TRACTS.

ALL OF THE STRUCTURES WERE DEMOLISHED AFTER THE PURCHASE BECAUSE THE WERE THOUGH TO BE A FIRE HAZARD. THE BASEMENT OF THE MAIN BUILDING WAS LEFT IN TACT WITH HOLES PUNCHED IN THE BOTTOM TO PREVENT WATER FROM COLLECTING INSIDE.

HISTORICALLY THE ASPHALT EQUIPMENT STORAGE YARD WAS LEASED BY DIFFERENT BUSINESS AS A STORAGE FACILITY. AT THE TIME OF THE MALCOLM PIRNIE INVESTIGATION THE PROPERTY WAS BEING USED FOR STORING ASPHALT EQUIPMENT. PRIOR TO THAT LEASES INCLUDE A SMALL TRANSPORT BUS COMPANY AND A LANDSCAPING COMPANY.

MR. SCHMITZ IS NOT AWARE OF ANY PLANS LILCO HAS FOR THIS PROPERTY AT THIS TIME.

NAME: Michelle R Brooks DATE: 9/9/97

**REFERENCE 30**

# FOSTER WHEELER ENVIRONMENTAL CORPORATION

## RECORD OF TELEPHONE CONVERSATION

Sheet 1 of 2

DATE: 8/19/97

TO: File

FROM: Michelle Brooks

CLIENT/PROJECT: EPA - BAY SHORE GAS PLANT

SUBJECT: Underground Storage Tanks Discovered in 1995 in BRIGHTWATERS YARD

DISCUSSION WITH: Mr. Ted Leissing, Principal Engineer, LILCO
(516) 391-6143

I spoke with Mr. Leissing about the three UST discovered in Late 1995 EARLY 1996 ACCORDING TO INFORMATION FOUND IN DEC STONEY BROOK OFFICE FILES. MR LEISSING INFORMED ME THAT THE TANKS WERE DISCOVERED IN LATE 1995 DURING NORMAL FACILITY MAINTENANCE. THE TANKS WERE (ARE) LOCATED ON SOUTHSIDE OF THE BUILDING IN BRIGHTWATERS YARD. THERE WERE THREE TANKS, (1) ~ 275 gallons WASTE OIL and (2) 2,000 - 5,000 gallons fuel storage tanks for gasoline and Diesel. These TANKS WERE NOT PART OF THE MANUFACTURING of gas, they were used ~~to~~ HB in former operations in the Brightwaters Yard for filling vehicles. MR. LEISSING confirmed that these tanks were emptied and will be addressed (removed) during planned remediation for the Brightwaters Yard.

I inquire if the material from these tanks was involved in the recent complaint from Lanier Lane.

(refer to sheet 2 for Continuation)

NAME: Michelle R Brooks DATE: 8/19/97

FOSTER WHEELER ENVIRONMENTAL CORPORATION

RECORD OF TELEPHONE CONVERSATION (continued)

Sheet 2 of 2

DATE:

SUBJECT: UST Discovered in 1995 in BRIGHTWATER YARD @ BAY SHORE GAS PLANT SITE

Mr. Leissing informed me that the former contents of the three UST is not the source of the spill that entered (odors) the basement of the residence on Lanier Lane.

Because preliminary analytical results of material in the groundwater was finger printed and ~~the~~ HB matched the finger print of H-fuel stored in the ~~H-fuel~~ HB AST in Brightwaters Yard.

He also noted that H-fuel is a by-product of oil refining, heavier than gasoline and lighter than 2 oil.

H-fuel was used to produce gas (1,000 BTU gas).

Michelle Brooks

**REFERENCE 31**

Ref. 31, p. 1 of 8

# TRANSMITTAL SLIP

TO: A.J. Shah — JAN 31 1996 — DATE: 1/26/96

FROM: Jim Van Hoesen DHWR BCS

RE: Lilco Manufacture Gas Plants

Attached is a copy of a letter from Lilco to Suffolk Co. DOH about ~~cleanup~~ removal of underground ~~storage~~ tanks. You may want to send a copy to Spills. Lilco is moving slowly in negotiating a consent order on 6 MGP sites including Bay Shore. I ~~will try~~ talked to ~~contact~~ Robert Seyfarth on Jan 29 & ~~and~~ informed him ~~inform~~ of status of Lilco negotiations and it may be a while before the site is remediated.

FOR ACTION AS INDICATED:

- ☐ Please Handle
- ☐ For Your Information
- ☐ Comments
- ☐ Approval/Signature
- ☐ File
- ☐ Return to me by _____
- ☐ Prepare Reply for _____ Signature
- ☐ _____

Ref. 31, p. 388

If you have any questions, or require any additional information, please call me at 391-6058.

Sincerely,

Patrick J. Van Rossem

Patrick J. Van Rossem
Environmental Engineering Department

cc: Mr. James H. Pim, P.E., SCDHS
Mr. Alexander M. Santino, P.E., SCDHS
Mr. James Van Huessen, NYSDEC-Albany

Ref. 31, p. 4 of 8

# SYSTEM LABORATORY REPORT


CHEMICAL DIVISION
PO Box 426, Glenwood Landing, NY 11547
(516) 759-8518


Laboratory ID: M-95-00455
Date Received: 08/10/1995 @ 11:25
Label ID: 00156
Date Sampled : 08/09/1995
Sampled by : T. Campbell, Brightwaters Storage

DESCRIPTION:
Soil/NW-IL 2'-3' Interval Brightwaters Storage Yard

| | | | |
|---|---|---|---|
| Benzene | ug/kg dry wt. | | 700 |
| Carbon Tetrachloride | ug/kg dry wt. | < | 45 |
| Chlorobenzene | ug/kg dry wt. | | 3290 |
| 1,2-Dichlorobenzene | ug/kg dry wt. | | 7890 |
| Ethylbenzene | ug/kg dry wt. | | 1690 |
| Methylene Chloride | ug/kg dry wt. | | 480 |
| 1,1,1Trichloroethane | ug/kg dry wt. | | 106 |
| Tetrachloroethylene | ug/kg dry wt. | | 47.7 |
| Toluene | ug/kg dry wt. | | 3450 |
| Trichloroethylene | ug/kg dry wt. | < | 45 |
| Xylenes, Total | ug/kg dry wt. | | 6310 |
| Acenapthene | ug/kg dry wt. | | 16300 |
| Acenaphthylene | ug/kg dry wt. | | 31600 |
| Anthracene | ug/kg dry wt. | | 20800 |
| Benzo(a)anthracene | ug/kg dry wt. | | 15900 |
| Benzo(b)fluoranthene | ug/kg dry wt. | | 34300 |
| Benzo(k)fluoranthene | ug/kg dry wt. | | 22900 |
| Benzo(ghi)perylene | ug/kg dry wt. | | 20300 |
| Benzo(a)pyrene | ug/kg dry wt. | | 27200 |
| Chrysene | ug/kg dry wt. | | 18500 |
| Dbenzo(ah)anthracene | ug/kg dry wt. | | 30000 |
| Indeno(1,2,3-cd)pyrene | ug/kg dry wt. | | 21400 |
| Fluoranthene | ug/kg dry wt. | | 42200 |
| Fluorene | ug/kg dry wt. | | 47500 |
| Naphthalene | ug/kg dry wt. | | 525000 |
| Phenanthrene | ug/kg dry wt. | | 57800 |
| Pyrene | ug/kg dry wt. | | 48700 |

Date Analyzed: 08/19/1995 by GK

COMMENTS:

DISTRIBUTION:
T. Campbell

Laboratory Director Kenneth A. Yager
Kenneth A. Yager

Date Printed 09/21/1995

Ref. 31, p. 5 of 8

# SYSTEM LABORATORY REPORT


## CHEMICAL DIVISION

PO Box 426, Glenwood Landing, NY 11547
(516) 759-8518


Laboratory ID: M-95-00455
Date Received: 08/10/1995 @ 11:25
LABEL ID : 00156-
Date Sampled : 08/09/1995
Sampled by : T. Campbell, Brightwaters Storage

DESCRIPTION:
Soil/NW-IL 2'-3' Interval Brightwaters Storage Yard

| | | | |
|---|---|---|---|
| MTBE | ug/kg dry wt. | < | 1200 |
| Acetone | ug/kg dry wt. | < | 150 |
| 1,3 Dichlorobenzene | ug/kg dry wt. | | 15600 |
| 1,4 Dichlorobenzene | ug/kg dry wt. | | 3660 |
| 1,1 Dichloroethylene | ug/kg dry wt. | < | 150 |
| Trans 1,2 Dichloroethane | ug/kg dry wt. | < | 150 |
| 1,1 Dichloroethane | ug/kg dry wt. | < | 150 |
| Chloroform | ug/kg dry wt. | < | 150 |
| 1,2 Dichloroethane | ug/kg dry wt. | < | 150 |
| 1,2 Dichloropropane | ug/kg dry wt. | < | 150 |
| Bromodichloromethane | ug/kg dry wt. | < | 150 |
| Trans 1,3 Dichloropropane | ug/kg dry wt. | < | 150 |
| Cis 1,3 Dichloropropane | ug/kg dry wt. | < | 150 |
| 1,1,2 Trichloroethane | ug/kg dry wt. | < | 150 |
| Dibromochloroethane | ug/kg dry wt. | < | 150 |
| Bromoform | ug/kg dry wt. | < | 150 |
| 1,1,2,2 Tetrachloroethane | ug/kg dry wt. | < | 150 |

Date Analyzed: 08/19/1995 by GK
COMMENTS:

DISTRIBUTION:
T. Campbell

Laboratory Director Kenneth A. Yager

Date Printed 09/21/1995

# SYSTEM LABORATORY REPORT

CHEMICAL DIVISION
PO Box 426, Glenwood Landing, NY 11547
(516) 759-8518

Water Analyses

Laboratory ID: W-95-00834

Date Received: 08/24/1995 @ 07:31

Date Sampled : 08/23/1995

---

LOCATION: Brightwaters Ops.
Blank

| | | | |
|---|---|---|---|
| Benzene | ug/L | < | 0.2 |
| Ethylbenzene | ug/L | < | 0.2 |
| MTBE | ug/L | < | 3.1 |
| Toluene | ug/L | | 1.0 |
| Xylenes, Total | ug/L | < | 0.6 |
| Chlorobenzene | ug/L | < | 0.25 |
| 1,2 Dichlorobenzene | ug/L | < | 0.15 |
| Methylene Chloride | ug/L | | 4.15 |
| 1,1,1 Trichloroethane | ug/L | | 0.89 |
| Carbon Tetrachloride | ug/L | < | 0.12 |
| Trichloroethylene | ug/L | < | 0.12 |
| Tetrachloroethylene | ug/L | < | 0.03 |
| 1,1 Dichloroethylene | ug/L | < | 0.4 |
| Trans 1/2 Dichloroethene | ug/L | < | 0.4 |
| 1,1 Dichloroethane | ug/L | < | 0.4 |
| Chloroform | ug/L | < | 0.4 |
| 1,2 Dichloroethane | ug/L | | 1.26 |
| 1,2 Dichloropropane | ug/L | < | 0.4 |
| Bromodichloromethane | ug/L | < | 0.4 |
| Trans1,3 Dichloropropane | ug/L | | 0.69 |
| Cis 1,3 Dichloropropane | ug/L | < | 0.4 |
| 1,1,2 Trichloroethane | ug/L | < | 0.4 |
| Dibromochloroethane | ug/L | < | 0.4 |
| Bromoform | ug/L | < | 0.4 |
| 1,1,2,2 Tetrachloroethane | ug/L | < | 0.4 |
| 1,3 Dichlorobenzene | ug/L | < | 0.4 |
| 1,4 Dichlorobenzene | ug/L | | 0.4 |

Date Analyzed: 08/29/1995 by GK
COMMENTS:

DISTRIBUTION:

T. Campbell

Laboratory Director Kenneth A. Yager

Date Printed 09/12/1995

LILCO

Ref. 31, p. 7 of 8

# SYSTEM LABORATORY REPORT


## CHEMICAL DIVISION

PO Box 426, Glenwood Landing, NY 11547
(516) 759-8518


Water Analyses

Laboratory ID: W-95-00836

Date Received: 08/24/1995 @ 07:31

Date Sampled : 08/23/1995

---

LOCATION: Brightwaters Ops.
BW-#2L

| | | | |
|---|---|---|---|
| Benzene | ug/L | < | 0.2 |
| Ethylbenzene | ug/L | < | 0.2 |
| MTBE | ug/L | < | 3.1 |
| Toluene | ug/L | | 3.8 |
| Xylenes, Total | ug/L | < | 0.6 |
| Chlorobenzene | ug/L | | 2.36 |
| 1,2 Dichlorobenzene | ug/L | | 4.98 |
| Methylene Chloride | ug/L | | 1.80 |
| 1,1,1 Trichloroethane | ug/L | | 0.57 |
| Carbon Tetrachloride | ug/L | < | 0.12 |
| Trichloroethylene | ug/L | < | 0.12 |
| Tetrachloroethylene | ug/L | | 0.08 |
| 1,1 Dichloroethylene | ug/L | < | 0.4 |
| Trans 1,2 Dichloroethene | ug/L | < | 0.4 |
| 1,1 Dichloroethane | ug/L | < | 0.4 |
| Chloroform | ug/L | < | 0.4 |
| 1,2 Dichloroethane | ug/L | | 1.61 |
| 1,2 Dichloropropane | ug/L | < | 0.4 |
| Bromodichloromethane | ug/L | < | 0.4 |
| Trans1,3 Dichloropropane | ug/L | < | 0.4 |
| Cis 1,3 Dichloropropane | ug/L | < | 0.4 |
| 1,1,2 Trichloroethane | ug/L | < | 0.4 |
| Dibromochloroethane | ug/L | < | 0.4 |
| Bromoform | ug/L | < | 0.4 |
| 1,1,2,2 Tetrachloroethane | ug/L | < | 0.4 |
| 1,3 Dichlorobenzene | ug/L | < | 0.4 |
| 1,4 Dichlorobenzene | ug/L | | 0.68 |

Date Analyzed: 08/29/1995 by GK
COMMENTS:

DISTRIBUTION:
T. Campbell.

Laboratory Director Kenneth A. Yager

Date Printed 09/12/1995

Ref. 31, P. 8 of 8

# LILCO
# SYSTEM LABORATORY REPORT


## CHEMICAL DIVISION
PO Box 426, Glenwood Landing, NY 11547
(516) 759-8518


Water Analyses

Laboratory ID: W-95-00835

Date Received: 08/24/1995 @ 07:31

Date Sampled : 08/23/1995

---

LOCATION: Brightwaters Ops.
BW-#1L

| | | | |
|---|---|---|---|
| Benzene | ug/L | | 0.4 |
| Ethylbenzene | ug/L | | 15.3 |
| MTBE | ug/L | < | 3.1 |
| Toluene | ug/L | | 20.1 |
| Xylenes, Total | ug/L | | 23.8 |
| Chlorobenzene | ug/L | | 15.38 |
| 1,2 Dichlorobenzene | ug/L | | 10.83 |
| Methylene Chloride | ug/L | | 1.93 |
| 1,1,1 Trichloroethane | ug/L | | 0.94 |
| Carbon Tetrachloride | ug/L | < | 0.12 |
| Trichloroethylene | ug/L | < | 0.12 |
| Tetrachloroethylene | ug/L | | 0.08 |
| 1,1 Dichloroethylene | ug/L | < | 0.4 |
| Trans 1/2 Dichloroethene | ug/L | < | 0.4 |
| 1,1 Dichloroethane | ug/L | < | 0.4 |
| Chloroform | ug/L | < | 0.4 |
| 1,2 Dichloroethane | ug/L | | 1.85 |
| 1,2 Dichloropropane | ug/L | < | 0.4 |
| Bromodichloromethane | ug/L | < | 0.4 |
| Trans1,3 Dichloropropane | ug/L | < | 0.4 |
| Cis 1,3 Dichloropropane | ug/L | < | 0.4 |
| 1,1,2 Trichloroethane | ug/L | < | 0.4 |
| Dibromochloroethane | ug/L | < | 0.4 |
| Bromoform | ug/L | < | 0.4 |
| 1,1,2,2 Tetrachloroethane | ug/L | < | 0.4 |
| 1,3 Dichlorobenzene | ug/L | < | 0.4 |
| 1,4 Dichlorobenzene | ug/L | | 0.53 |

Date Analyzed: 08/29/1995 by GK
COMMENTS:

DISTRIBUTION:

T. Campbell

Laboratory Director Kenneth A. Yager

Date Printed 09/12/1995

**REFERENCE 32**

# BAY SHORE GAS PLANT SITE

## SUMMARY OF OPERATIONS, SPILLS AND INVESTIGATIONS

Refer to Reference 4, pages 2 and 3 for brief descriptions of the carburetted water gas and oil gas manufacturing processes.

Reference 4, p. 3 and para. two noted "obvious potential sources of groundwater contamination are fuel or process oil storage and transfer system, gas and scrubbing condensing and purification system, oil separation and storage facilities and any in ground pits designed for waste disposal."

### Brightwaters Yard

No gas manufacturing was performed on the this parcel of land, only storage of fuels and oil. An above ground fuel storage tank and pumps for "H-Fuel", a petroleum by-product that is heavier than gasoline and lighter than No. 2 fuel oil (Ref. 3, p. 18 of 145 and Ref. 30, p. 1 of 2). In addition to the H-Fuel storage tank, there were three other above ground storage tanks (AST) for oil storage (drip oil) (Ref. 3, p. 18 of 145 and Ref. 4, p. 4, para. three).

There were three underground storage tanks (UST's) discovered in late 1995 early 1996 during normal facility maintenance (Ref. 30, p. 1 of 2). One UST was used for storing waste oil (approximately 275-gallon), and other two UST's were fuel storage tanks for gasoline and diesel (2,000 - 5,000 gallons each). The approximate location of the tanks is the south of the building in the Brightwaters Yard. These tanks were not part of the manufacturing of gas at the Bay Shore Plant. They were used for filling vehicles.

There was also an on site dry well (Ref. 31, p. 2 of 8). *No other information on dry well encountered.*

There was a ground oil recovery collection pit located in the eastern end of the yard used in the ground oil recovery efforts from 1949 to 1953 (Ref. 4, p. 10 of 14).

### Bay Shore Property

All gas manufacturing was done on this parcel of land. All process equipment were located on the Bay Shore Property. In addition to process equipment, there were two small gas oil storage tanks west of the former storage holder and one drip oil storage tank east of the gas oil storage tanks. Storage tanks for tar were also located on this parcel of land (Ref. 4, p. 10 of 14 and Ref. 3, p. 18 of 145).

The ground oil separator for the ground oil recovery efforts from 1949 to 1953 was located in the manufacturing plant (Ref. 4, p. 10 of 14).

There was also a permitted leaching pit in the manufacturing plant for untreated water (Ref. 4, p. 3, para. five and line six).

**Adjacent Property**

There was a ground oil recovery collection pit located in Summers Lumber yard used in the oil recovery efforts from 1949 to 1953 (Ref. 4, p. 10 of 14).

**Fuel and Oil Use and Produce at the Plant**

- Fuel (H-Fuel, No. 2 oil, and No. 6 oil) was used in the manufacturing of gas (Ref. 4, p. 3 of 14 and Ref. 30, o, 2 of 2).

- Condensed gas (commonly called drip oil) was removed from the carburetted water gas in the relief holder and storage holder. The drip oil was routed via underground piping to Brightwaters Yard (Ref. 4, p. 4 para three, line three). Drip oil and tar from the process was sent to a tar separator, the water would be treated and the tar sold (Ref. 4, p. 7 of 14)

**Permitted Discharge and Spills**

1. Discharge of polluted wastes and tar into the on site leach pit on the Bay Shore property occurred from 1926 to 1940 (Ref. 4, pp. 3 and 4 of 14).

2. In 1949, complaints of oil in basements south of site and an investigation revealed the drip oil leaked to the ground through the underground transfer system (Ref. 4, p. 4, para four). An oil recovery system was installed and operated from 1949 to 1953. No complaints was received after the early 60's (Ref. 4, p. 4, last sentence).

3. After the discovery of the three UST in the Brightwaters Yard, two monitoring wells were installed at the request of the Suffolk County Department of Health Services. Soil samples collected from drill cuttings, 2'-3' depth, and were analyzed. The results showed BTEX and naphthalene. Analytical results of groundwater samples collected also had BTEX (Ref. 31, pp. 2 and 4 through 8 of 8). The tanks were emptied soon after discovery and subsequently refilled with water indicating the tanks were severely corroded (Ref. 33, p. 1 of 1).

4. In mid 1997, a resident complained of odors in basement. the residence is located on Lanier Lane approximately ½ mile south of the Brightwaters yard (Ref. 5, p. 11 of 19 and Ref. 30, p. 2 of 2). Preliminary analytical results of the material in the groundwater relating to complaint, were finger printed and matched the finger print for the H-Fuel formally stored in Brightwaters Yard.

## Investigations

In 1979, Geraghty and Miller, Inc. performed a groundwater investigation and a naphthalene plume was discovered in emanating from the Bay Shore Plant to the Lawrence Creek (Ref. 8, p. 28 of 29).

In 1992, Malcolm Pirnie, Inc. performed a remedial investigation at the site and confirmed the existence of the naphthalene plume emanating from the Bay Shore parcel to Lawrence Creek. A smaller naphthalene and BTEX plume between Brightwaters Yard and O-Co-Nee Lake was discovered during this investigation(Ref. 3, pp. 13 and 112 of 145).

## Conclusions

1. Contamination from the leach pit cannot be used to evaluate the site. The contamination resulted from a permitted activity with no evidence of exceeding allowable discharge levels (no levels established).

2. The spill of the contents of the three UST cannot be used to evaluate the site due to the petroleum exclusion for CERCLA.

3. The spill of H-Fuel cannot be used to evaluate the site based on the petroleum exclusion for CERCLA.

4. Soil and groundwater contamination from the drip oil spilled in the late 1940's can used to evaluate the site. The drip oil is a by-product of Manufacturing Gas Plant.

5. It is not certain if the groundwater contamination resulted from the 1940 drip oil spill or from the leach pit, however there is soil contamination at the site that is upgradient of the leach pit, that resulted from the relief holder. The site will be evaluated using contamination in this area.

**REFERENCE 33**

FYI Ref. 33, p. 1 of 1
BOB

LILCO LONG ISLAND LIGHTING

# LONG ISLAND LIGHTING COMPANY

445 BROAD HOLLOW ROAD · MELVILLE, NEW YORK 11747

June 12,1996

Mr.Robert Seyfarth
Suffolk County Department of
Health Services
15 Horseblock Place
Farmingville,New York 11738

JUL 12 1996

Re: Lilco - Brightwaters Storage Yard
1 Orinoco Drive, Brightwaters, NY
Disposition of Recently Discovered
Underground Storage Tanks

Dear Mr.Seyfarth:

As discussed in your telephone message of Wednesday, May 29, 1996, and per your direction, this letter is being sent to document our agreement concerning the removal of the three (3) recently discovered underground storage tanks located at Lilco's Brightwaters Storage Yard in Brightwaters, NY.

Since discovering these tanks Lilco has drawn and analyzed samples from the tanks, copy of results attached for your reference, and has had the tanks pumped. Subsequently, the tanks have refilled with ground water.

As we discussed on Tuesday May 28, 1996 and agreed at this time, as these tanks are located within the boundries of an MGP site presently being investigated under an Administrative Consent Order being negotiated by Lilco and the State Department of Environmental Conservation and as discussed and agreed to with yourself and Mr.J. Gladysz of your office, it is Lilco's intent to disposition the removal of these tanks under the MGP remediation plans when developed.

If you have any questions or wish to discuss this further please contact me on 391 - 6132.

Sincerely,

Steven V. Dalton

Steven V. Dalton Div.Mgr., Lilco Environmental Engineering Department

GHK/gk

Attachments

7/12/96
CC: to R. Stern
by W. Parish

**REFERENCE 34**

Ref. 34, p. 1 of 3

LILCO

# LONG ISLAND LIGHTING COMPANY

175 EAST OLD COUNTRY ROAD • HICKSVILLE, NEW YORK 11801

Direct Dial Number

Bay Shore Gas Plant
NYD 986851654

June 9, 1981

United States
Environmental Protection Agency
Region II
Sites Notification - Rm. 1000
New York, NY 10278

Dear Sir:

In accordance with Section 103(c) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 ("Superfund") and the Environmental Protection Agency's notice and policy statement interpreting Superfund (45 Fed. Reg. 22144), the Long Island Lighting Company ("LILCO" or "the Company") has reviewed its past and present operations to determine whether a notification is required. The Company believes that it is not required to file a Section 103(c) Superfund notification, but because of ambiguities in the reporting requirements and the RCRA hazardous waste definitions, is providing the agency with the following information and rationale for this conclusion.

In most cases, consideration of the Company's waste handling operations for purposes of the Superfund notification requirement has not been difficult because the operations are on-going and familiar to Company personnel. In other instances, however, review was more difficult because the operations which were considered occurred years ago. For example, from the 1890's to no later than the 1950's, LILCO, or its predecessors, owned and operated six gas plants located throughout the Company's service territory.(1) Before they were retired, the plants manufactured carburetted water gas. The plant operators would pass air and steam through hot coke and mix the gas produced in the process with oil to improve its BTU content. In the gas manufacturing process, a mixture of waste oil and tars would also be produced. To the best of the Company's knowledge, most of the tars and oils were used as boiler fuels or sold as a valuable resource. In other cases, th tars and oils were

Ref. 34, p. 2 of 3

disposed of either on- or off-site. The Company has concluded that such disposal activities are not subject to Superfund for at least two reasons: (1) discharge of waste oils are specifically exempt from the definition of "hazardous waste" by Superfund, and (2) although the discharges may have contained certain wastes now listed in EPA's regulations implementing the Resource Conservation and Recovery Act ("RCRA") at 40 CFR Section 261.33(f), we believe the waste does not exhibit any of the characteristics of hazardous waste set forth at Subpart C, Part 261 of the RCRA regulations. (See, 45 Fed. Reg. 33121). Thus, the Company has concluded that Superfund does not require it to file any notification for the activities which occurred at least thirty years ago at the now demolished gas plants.

We are confident that the rationale supporting the conclusion reached above is consistent with the agency's definitions of the Superfund reporting requirements. If you have any questions, please do not hesitate to contact me.

Very truly yours,

Raymond J. Driscoll

Raymond J. Driscoll
Manager
Environmental Engineering

RJD/lac
bcc: Ms. M. Lerner
Mr. J. J. Kearney

(1) Plant Names and Locations

Patchogue Gas Plant
Main St. & River Ave.
Patchogue, NY

Hempstead Gas Plant
2nd Ave. & Franklin Ave.
Hempstead, NY

Rockaway Park Gas Plant
Rockaway Park
Queens, NY

Bay Shore Gas Plant
Fifth Ave.
Bay Shore, NY

Glen Cove Gas Plant
Round Swamp Road
Glen Cove, NY

Sag Harbor Gas Plant
Bridge St. & Meadow St.
Sag Harbor, NY

Ref. 34, p. 3 of 3

# Preliminary Assessment Review Form

ID # - NYD986881652

Site Name: Bay Shore Gas Plant
Aliases:
Address: Fifth Avenue
City: Bayshore
County: Suffolk
State: NY
Priority Rating Given: High
(By State or Contractor)

Agree: ✓
Disagree:
(Check One)

If Disagree, Why?

Other Comments: Contaminants attributable to the site have been identified in the area's groundwater, municipal supply wells are w/i 1/2 mi. It is a sole source aquifer

Recommendation:
Final (By EPA) High

Reviewer: Sandra C. Hansen
Date: 9-14-89

**REFERENCE 35**

Ref. 35, p. 1 of 1



# PRELIMINARY ASSESSMENT
# OFF SITE RECONNAISSANCE
# INFORMATION REPORTING FORM

Date: April 12, 1989

Site Name: Bay Shore Gas Plant TDD: 02-8904-18

Site Address: 5th & Jackerson
Street, Box, etc.

Bay Shore
Town

Suffolk
County

NY
State

NUS Personnel:

| Name | Discipline |
|---|---|
| ~~Virginia G. Gilliland~~ D. Cohen | Chem Eng |
| R. Hubner | Biologist |
| | |

Weather Conditions (clear, cloudy, rain, snow, etc.):

Sunny, clear

Estimated wind direction and wind speed: ~~[illegible]~~ DS 4/17/89 10-15 NW

Estimated temperature: 60°F

Signature: [illegible] Date: 4/17/89

Countersigned: [illegible] Date: 4/17/89

**REFERENCE 36**

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LILCO

# FEASIBILITY ANALYSIS REPORT
# BAYSHORE MANUFACTURED GAS PLANT
# BAYSHORE, NEW YORK

For:

Long Island Lighting Company
Melville, New York

DECEMBER 1993

Project: 1249-02-5

MALCOLM PIRNIE

Printed on Recycled Paper

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Ref. 36, p. 2 of 5

# FEASIBILITY ANALYSIS REPORT
# LILCO BAYSHORE MGP SITE

## LONG ISLAND LIGHTING COMPANY
## MELVILLE, NY

DECEMBER 1993


Malcolm Pirnie, Inc.

One International Blvd.
Mahwah, New Jersey 07495

2 Corporate Park Drive
P.O. Box 751
White Plains, New York 10602

MALCOLM PIRNIE

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# REMEDIAL RISK ASSESSMENT REPORT
# BAY SHORE MANUFACTURED GAS PLANT

BAY SHORE, NEW YORK

JULY 1994

PREPARED FOR:

LONG ISLAND LIGHTING COMPANY
445 BROADHOLLOW ROAD
MELVILLE, NEW YORK 11747

Prepared By:

MALCOLM PIRNIE, INC.

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1249-02-4000

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