NASSAU COUNTY
WATER QUALITY ASSESSMENT REPORT
1976 REPORT YEAR

JOHN J. DOWLING, M.D., M.P.H., COMMISSIONER
NASSAU COUNTY DEPARTMENT OF HEALTH

CONTENTS

FOREWORD

The 1976 Water Quality Assessment Report has been prepared by the following members of the Division of Environmental Health:

Donald H. Myott, Bureau of Water Resources, Groundwater Quality Report, (Section 5) Bruce F. Mackay, Bureau of Water Pollution Control, Atlantic Ocean Macrobenthic Study (Section 3) Thomas F. Maher, Bureau of Water Pollution Control, Ocean Sludge Disposal Site Report (Section 4) George P. Gaige, Bureau of Water Pollution Control, Surface Water Quality Report (Section 1), Bathing Water Quality Report (Section 2) and Summary

Sample collection, result analysis, equipment operation and other related activities necessary for the production of the report were performed by other members of the bureaus of Water Pollution Control and Water Resources, which are under the direction of Robert D. Cusumano and Michael Alarcon, respectively. Chemical and bacteriological samples were analyzed by the Department's Division of Laboratories and Research, under the direction of Dr. Irving Abrahams.

Mr. Sheldon O. Smith, Director of Environmental Conservation Programs, provided guidance in the preparation of the report.

The report is part of the continuing programs in Environmental Health administered by Francis V. Padar, Assistant Deputy Commissioner and Director of the Division of Environmental Health.

Purpose

This Water Quality Assessment Report has been prepared by the Nassau County Department of Health in an effort to combine the results of all of the water quality monitoring programs within the Division of Environmental Health into a complete, but still concise assessment of the condition of Nassau's groundwaters and surface waters. The report has been requested by the New York State Department of Environmental Conservation, which is currently reviewing water quality monitoring programs as part of a statewide assessment of Water Quality problems.

Report Content

The report consists of a summary and five sections. Sections 1 through 5 contain the monitoring results of each of the following programs:

Summary - Combines the conclusions of the following five sections into an overall assessment of surface water and groundwater quality.

Section 1 - Surface Water Bacteriological and Chemical Monitoring Program - Sampling Results from October 1975 thru September 1976

Section 2 - Bathing Water Quality Bacteriological Monitoring Program - Sampling Results from April 1976 to September 1976

Section 3 - Atlantic Ocean Macrobenthic Study - Sampling Results May 1975

Section 4 - Impact of Ocean Disposal of Sewage Sludge on Atlantic Ocean Water and Sediment Quality - Sampling Results - September 1975 (This was originally scheduled to be an addendum to the 1975 Water Quality Assessment Report)

Section 5 - Groundwater Chemical Monitoring Program - Sampling Results from October 1975 thru September 1976

Eight appendices have also been prepared. These contain the detailed, specific data collected in these monitoring programs.

Appendix IA contains the computer print-out of all of the bacteriological results of the surface water monitoring program. In addition, surface water and bathing water coliform bacteria results have been combined by a computer program to produce coliform "maps" of most of the surface water areas of the County. These "Symaps" are further explained in Appendix IA.

Appendix IB contains the computer print-out of all of the chemical results of the surface water monitoring program. In addition, dissolved oxygen levels in all of the surface water areas are summarized in graphical form.

Appendices IIA and IIB contain the computer print-outs of the bacteriological sampling results of the bathing water quality monitoring program. All of the print-outs in Appendices IA, IB, IIA and IIB contain tide and weather information for each sample result.

Appendix III contains the complete report of the Atlantic Ocean Macrobenthic Study: Distribution of Benthic Invertebrates in the Nearshore Ocean Sediments of Nassau County, including Areas impacted by Ocean Disposal of Sewage Sludge

Appendix IV contains the details of the September 1975 sampling cruises and data analysis used to determine the impact of the ocean disposal of sewage sludge on Atlantic Ocean water and sediment quality.

Appendix V contains the standards used for the analysis of groundwater quality, 10 NYCRR 170, Sources of Water Supply.

Appendix VI contains the raw groundwater data used for this report. The data is listed by NYSDEC registration number for each of the three major aquifers. Information on each well includes the location and depth. Sample data includes date of sample, the laboratory which performed the analysis, and the following constituents: pH, turbidity, ammonia, barium, chloride, hexavalent chromium, copper, nitrate, sodium sulfate, total dissolved solids oxygen consumed and phenols.

SUMMARY

Groundwater Quality

Water in the Glacial aquifer has become increasingly degraded during the past several decades and has virtually been abandoned as a source of public water supply. In 1976, 43% of the Glacial wells tested did not meet one or more State Health Department standards for sources of water supply. Private sewage disposal systems have leached nitrogen in the form of ammonia, detergents, chlorides, sodium, sulfate and total solids into the shallow groundwater. Nitrogen in the nitrate form is widespread in the natural recharge area of central Nassau and in localized areas on the northern shore. Ammonia is found on the south shore where conversion to nitrate is not complete. Detergents are also found on the south shore, but levels are decreasing due to sewering and the use of biodegradable surfactants. Localized problems with hexavalent chromium due to industrial waste discharges (Massapequa, Franklin Square and Mineola) and chlorides due to saltwater intrusion (Kings Point), road salt storage (Mineola), sand mining (Port Washington) and incinerator operation (Valley Stream) have been detected.

The Magothy aquifer underlies and is recharged by water from the Glacial. In 1976, 11% of the Magothy wells tested did not meet one or more State Health Department standards for sources of water supply. In the natural recharge area where the major component of groundwater flow is vertical, nitrates have penetrated deep into the Magothy reaching the bottom in the Garden City Park area. Other sewage derived constituents (chlorides, sodium, sulfate and dissolved solids) are increasing in the high nitrate areas, but levels are well below existing standards. Localized problems with copper in one well in Hicksville and with organics in the southeast area of the County have been detected. A comprehensive public water supply source sampling program for organics was begun in 1976.

The Lloyd aquifer is protected by the overlying Raritan Clay formation and is relatively free of contamination, with only 5% not meeting State Health Department standards for sources of water supply. During 1975, three Lloyd wells on the barrier beaches in Long Beach and Lido Beach experienced high chlorides. Leaks in the casings and not salt water intrusion into the Lloyd were responsible.

Excessive natural iron and low pH are problems in the three major aquifers throughout the County.

Since sewage-derived constituents are the major contaminants in Nassau County's groundwater, and degradation due to these constituents is continuing, the rapid completion of county-wide sewering to eliminate this source is needed. Wastewater renovation and recharge must be perfected and practiced, if feasible, in conjunction with expanded sewering to assure an adequate as well as safe supply of water for the future. A 5 mgd test project has been undertaken by the County to determine the feasibility of renovation and recharge.

SURFACE WATER QUALITY

Atlantic Ocean

Atlantic Ocean water quality in the vicinity of Nassau County is generally very good to excellent, containing extremely low average coliform bacteria densities. The quality of these waters, however, has been increasingly threatened by several sources in recent years.

Water quality and sediment analyses indicate that the ocean disposal of municipal sewage sludge at a point approximately 10 miles south of Atlantic Beach results in the shoreward movement of this material during the summer months. Bottom sediments as close as five to six miles off Atlantic Beach and four to five miles off Long Beach, appear to be contaminated by the sewage sludge.

On the other hand, the disposal appears to have one beneficial effect: studies indicate that while the immediate dump site area is severely impacted by this sludge, the fringe areas bordering the dump site are somewhat enriched by this material, resulting in increased biological activity in the sediment of these fringe areas. This "enrichment" appears to be limited to the organisms in the sediments of the fringe areas, which are an important link in the food chain leading to man. However, the potential for bio-magnification of harmful contaminants must be considered before any beneficial effects of the sludge dumping operation can be assumed.

The Department has recommended that due to the projected volumetric increase in sewage sludge and the potential public health threat posed by the ocean disposal of this material, continued surveillance of the area be maintained. This monitoring should be coordinated with the United States Environmental Protection Agency, the National Oceanic and Atmospheric Administration, and the Permittee Ocean Dumping Surveillance Program.

The quality of the ocean waters also has been threatened by the appearance of large amounts of floating debris including sewage-related material on the ocean beaches. This material appeared in greatest abundance in June of 1976. Although the material accompanied a noticeable increase in coliform bacteria levels at Jones Beach, no change was evident in Long Beach. Although the increased levels at Jones Beach were still well within State bathing water standards, and water quality was still rated very good to excellent. The public was cautioned to avoid contact with tar balls and grease balls in the debris, some of which were found to contain high coliform bacteria levels. The appearance of the floating sewage-related debris on the beaches has been attributed mainly to the discharge of untreated sewage into New York Harbor.

Because of unusually strong and persistent south or southwest winds, the floatable portions of this sewage were driven onto Nassau (and Suffolk) ocean beaches. There is no reason to believe that these conditions will not recur until the discharge of raw sewage and combined sewer overflows by New York City is stopped.

The Department has concluded that the ocean disposal of sewage sludge and the explosion of two sewage sludge storage tanks in Hempstead Bay did not contribute measureably to the occurrence of the debris on the ocean beaches.

South Shore Bays

During 1976, seasonal average bacterial levels were at their lowest levels of the past several years at most of the south shore bays' beaches. Of the eleven beaches located on the south shore bays, eight showed improved water quality and three were unchanged over 1975 quality. Improvement of five of these eight beaches was at least partially the result of water pollution abatement efforts recommended by this Department. The remaining improvements were believed due mainly to reduced rainfall in 1976.

The open water areas of the south shore bays also improved in bacterial quality from 1975 to 1976, largely due to the reduced rainfall which occurred. Even the tragic explosion of two sewage sludge storage tanks in the middle of Hempstead Bay on June 2, 1976, resulted in only a one-day increase in coliform levels on Hempstead Bay. Although these levels were three to five times above normal on June 3, 1976, they were back to normal by June 4 and remained at normal levels throughout the report year. Dissolved oxygen levels were similarly affected by the explosion. These were depressed by one part per million on June 3, and back to normal by June 4.

Seventy-three (73%) percent of the surface water sampling locations were in conformance with assigned classification standards for coliform bacteria in 1976, while 56% of the chemical sampling points were in conformance with their dissolved oxygen standards.

Chemical levels in 1976 again indicate that Hempstead Bay is the most stressed of the four south shore bays. Since this bay receives approximately 68% of the municipal sewage discharged in the County, it is not surprising that it has the highest average ammonia and phosphate levels and the lowest average dissolved oxygen levels of the four south shore bays.

The condition of Middle Bay is greatly affected by the quality of the waters of Hempstead Bay. This is demonstrated by coliform bacteria, dissolved oxygen, ammonia, nitrate and phosphate levels, all of which indicate the greatest pollutional levels on the west side of the bay, near Hempstead Bay.

East Bay and South Oyster Bay are similar in their low levels of chemical contaminants, when compared with Hempstead and Middle Bays. Coliform bacteria levels have been low in large areas of these two bays for the past two years. Since these levels have been low enough to warrant their serious consideration as safe shellfishing waters, this Department recommends that they be considered by the State Department of Environmental Conservation for re-opening. Approximately one third of East Bay and two thirds of South Oyster Bay should be re-evaluated for this purpose.

North Shore Surface Water Quality

Water quality of the north shore waters varies widely. Of the twenty-eight beaches located on the north shore, seven improved in water quality over 1975 and six declined, with fifteen remaining unchanged. Most of the improvement is due to reduced rainfall in 1976, although water pollution abatement activities of this Department may have helped to improve water quality at three of the four beaches on Manhasset Bay. An interruption of treatment at New York City's Bowery Bay treatment plant for three days after Hurricane "Belle" struck the Island on August 9, 1976, resulted in elevated coliform bacteria levels at many north shore beaches. However, State bathing water standards were met by the beaches and no interruptions to bathing were required.

Little Neck Bay and western Long Island Sound have the highest coliform bacteria levels and the lowest conformance to assigned classification coliform standards. Only 14% of the sampling locations in these two areas conformed to their standards. The cause of this poor water quality is widely known to be the City of New York, which discharges hundreds of millions of gallons of untreated sewage daily, and discharges even greater volumes of combined storm water and sewage flows during rainfall periods. A permanent reduction in Little Neck Bay and western Long Island Sound bacterial levels will not take place until these raw discharges are treated and some method of storm water control is effected by New York City.

Manhasset Bay has much lower levels of coliform bacteria than Little Neck Bay and western Long Island Sound. Manhasset Bay is affected as much by internal pollution sources as by external sources. Ponds and drains on the bay's east shore threaten the bathing water quality at the bay's beaches.

Hempstead Harbor waters continue to be impacted to a great degree by pollution sources in the lower and mid-harbor region. Pollution sources in the area include the Roslyn sewage treatment plant, the Roslyn duck pond and several storm drainage systems.

Water quality at two beaches on Hempstead Harbor, Tappen and Bar beaches, has shown increasing trends in coliform bacteria levels over the past nine years. The reason for the increase at Tappen appears to be the influence of adjacent Scudders Pond. The Department has recommended that the Town of Oyster Bay relocate the pond's outfall pipe to a location less harmful to bacterial quality at the beach.

Further recommendations to alleviate the pollution loading into the harbor include sewering of the Glenwood Landing area to eliminate sewage contamination of the area's storm drainage system and repair of portions of Glen Cove City's sewage collection system to reduce the contamination of Glen Cove Creek in the upper harbor area.

In Oyster Bay, Cold Spring Harbor, and Long Island Sound East waters coliform bacteria levels were generally low, and in 100% conformance to assigned classification standards. Dissolved oxygen levels were also in conformance to their standards.

A recent decline in water quality in the Mill Neck Creek area of Oyster Bay is currently being investigated by the Department. This may explain the slight decline at Oyster Bay area beach water quality in recent years.

SECTION 1

SURFACE WATER QUALITY

Surface Water Program Description

Assessment of the condition of Nassau's marine waters is dependent upon regular water quality monitoring. For this reason, the department maintains a sampling program year-round to monitor conditions in fourteen major surface water areas. During the 1976 report year, 180 locations in these areas were scheduled to be monitored on a monthly basis for total and fecal coliform levels and 65 of these points were also scheduled to be monitored for various chemical parameters.

Sampling frequency was not as regular in 1976 as had been the case in previous years, due to several interfering circumstances. Surface water sampling conducted by the department under contract for the Area-wide Wastewater Management Study (208 Project) had to be scheduled so as to allow intensive sampling of one area before moving on to other areas. This accounts, for example, for the large numbers of samples at certain locations in Manhasset Bay during July and in the south shore bays in September, while in other months, only one sampling run was conducted in these areas.

Several water pollution emergencies also interrupted normal scheduling of surface water sampling during the 1976 report year. The explosion of two sewage sludge storage tanks on an island in the middle of Hempstead Bay on June 2, 1976, caused considerable concern about the possible effect on the area's water quality and the health of its residents. Accordingly, the department conducted extensive sampling operations and water quality analyses, during June, in the area, reducing or eliminating the normal surveillance operations scheduled for other non-critical areas.

The appearance of sewage-related debris on Nassau ocean beaches beginning approximately on June 16th, also drained the resources of the department away from routine surface water monitoring programs because of the need to conduct daily sampling and inspections of the affected beaches. In summary, any interpretation of the 1976 report year sampling results should be tempered by the departure from normal sampling frequency which has occurred.

Chemical parameters monitored in the surface water quality program have normally included pH, suspended solids, chlorides, dissolved oxygen (at three depths), biochemical oxygen demand (BOD), ammonia, nitrate, and nitrite nitrogen, ortho and total phosphate, turbidity and salinity (at three depths). Field readings have also been taken for clarity (secchi disk) and temperature (at three depths). In 1976, however, various modifications were made to the analyses schedules in order to satisfy the particular needs of the sampling situation and many samples were only partially analyzed in order to minimize the laboratory effort required in each situation. In addition, multi-depth analyses for dissolved oxygen, salinity and temperature were found to be unnecessary in many cases. These cases included the North Shore Bay and Sound waters where an analysis of prior years' data indicated that no significant differences in dissolved oxygen, salinity or temperature occurred within the top twenty feet of the water column, except during the summer months. For this reason, top and twenty foot depth sampling for these parameters was discontinued in many cases.

Chemical levels described throughout this report refer to samples collected at a depth of five feet below the surface unless otherwise indicated.

The individual results of surface water sampling for bacteriological and chemical parameters are contained in two appendices to this report. Appendix IA contains the raw data from bacteriological sampling, along with tide and weather conditions for all sample days. This appendix also contains computer-produced "symaps" of most of the surface water areas sampled. This program uses the coliform bacteria data from bathing beach and surface water sampling locations in the area to predict or estimate the values for the bacterial levels throughout the area. A more complete explanation of the symap program precedes the maps in Appendix IA. Appendix IB contains all of the chemical sampling data for the 1976 report year. In addition, the dissolved oxygen levels at the chemical sampling points (at a five foot depth) are summarized in graphs for each area. These graphs indicate the highest, lowest and average dissolved oxygen level at each point and are very helpful in comparing the areas with each other and with their classification standards.

Sampling Procedures

All results reported herein, refer to water samples collected by department personnel and analyzed by the department's division of laboratories and research. All analyses were performed in accordance with Standard Methods for the Analysis of Water and Wastewater, 15th edition.

Total and fecal coliform and fecal streptococcus determinations were made using the multiple tube fermentation method.

Sample collection was also performed according to Standard Methods, with the waters for bacterial analysis being collected in sterile glass bottles and kept refrigerated until examination. All sampling has been done at offshore positions from boats operated by the Department in most cases, but in some cases by the Nassau

County Police Department's Marine Bureau or the town of North Hempstead's Harbor Patrol.

Assigned Classifications of Surface Waters

Section 1 of the Water Quality Assessment Report summarizes the sampling results of the surface water program. Total and fecal coliform and dissolved oxygen are the key parameters for determining compliance of marine waters to "best use" standards established by the State. These standards have classified all the State's surface water areas specifically for their best intended use, and establish minimum levels of dissolved oxygen and maximum coliform bacteria levels which determine whether or not the areas meet the standards of their best use classification.

Marine waters are classified SA, SB, SC or SD. Waters whose best use would be shellfishing are classified "SA" and are required to have a median total coliform level below 70 MPN/100 ml. Waters whose classification is "SB" would be best used for primary contact recreation and "SC" waters would be best used for secondary contact recreation. Total and fecal coliform criteria are progressively less stringent as the shift is made from SA to SB to SC classifications, but the minimum dissolved oxygen level is the same. This must be at least 5.0 mg/l at all times in order to meet SA, SB, or SC classifications. To meet SD classifications, the minimum dissolved oxygen level must be at least 3.0 mg/l at all times, but there is no maximum coliform level for SD classified waters. SD classified waters cannot meet the requirements of the other uses.

Some waters are classified as "I" waters. These are required to meet the same coliform standard as SC classified waters, and are also best used for secondary contact recreation, but these waters must have a minimum dissolved oxygen level at all times of at least 4.0 mg/l. Tables 1-1 and 1-2 summarize the conformance of the fourteen surface water areas with the standards for their assigned classifications. It should be noted that our surface water sampling results are somewhat difficult to compare with SB and SC standards. This is because sampling is usually done only once per month while SB and SC standards are based on medians or geometric means of at least five samples collected during a thirty day period. For the purpose of comparing the available data with the standards for the areas, the yearly median for total coliform and yearly geometric means for total and fecal coliform were used and listed in Table 1-3. This table also contains the lowest dissolved oxygen readings obtained at those locations which are also chemical sampling points. Where sampling results have disclosed that these areas do not meet the standards for their assigned classification, the results are asterisked. The next table, Table 1-4, lists the area-wide average coliform levels for the fourteen surface water areas and conveniently compares them. One other comparison has been made in order to compare the waters with their assigned classifications. An average coliform bacteria level has been calculated by classification for each of the 14 major surface water areas. This information is contained in Table 1-5. With this table, we can see, for example, that the average total coliform level in all the SA classified waters of Middle Bay during the 1976 report year was 54 MPN/100 ml. In other words, Middle Bay's SA waters conformed, in general, to their assigned classification coliform standards. Maps locating all of the bacteriological and chemical sampling points which are routinely sampled are included at the end of this section. These maps also include the assigned classifications for the fourteen areas sampled and indicate which points are in conformance with their assigned classifications.

Appended to the Water Quality Assessment Report are several sets of data pertaining to sampling results during the 1976 report year. Appendices IA and IB contain all the surface water quality data. This includes bacteriological and chemical sampling results, tide and weather conditions for all samples, dissolved oxygen result summaries and computer-produced "symaps" of most of the surface water areas. These "symaps" use the coliform bacteria data from the specific surface water and beach sampling points to estimate bacteria levels throughout the area. A more complete explanation of the symap program precedes the maps in Appendix I.

Atlantic Ocean Results (Areas 1 & 2)

Offshore sampling of routine surface water points in Atlantic Ocean waters was extremely sporadic during the 1976 report year, as indicated earlier in this section. However, during the occasions when sampling was conducted, all 21 points met their assigned classification coliform standards. Insufficient chemical sampling was done at most of the ocean area chemical points to reasonably compare the ocean waters with their dissolved oxygen classification standards. The exception was point number 401 in East Rockaway Inlet which was sampled once in October 1975, once in June 1976 and six times in September 1976, and did not conform to its dissolved oxygen standard on one of these occasions in September when dissolved oxygen reached a low of 2.0 mg/l.

Ocean waters were measurably, but not significantly, impacted by abnormal amounts of sewage-related floating debris especially during June. This is evident from total coliform bacteria levels which were two to three times above previous June levels at Jones Beach area beaches. Even with these increases, water quality at the beaches was considered to be "very good" to "Excellent." Ocean bathing water quality is explained in more detail in Section 2 of this report.

Sampling of ocean waters and sediments to determine the effect of the ocean disposal of municipal sludge was performed during 1976. However, analysis of these results is not yet completed. Analysis of sampling results from the September 1975 cruises has been completed. The conclusions reached tend to substantiate the predictions reached from the May 1975 sampling cruises which were reported in the 1975 report year Water Quality Assessment Report. Due to the existence of both a strong thermocline in the New York Bight and the onshore current and wind conditions which prevail during the summer months, there appears to be an increased shoreward movement of sludge from the dump site toward Nassau County. Bottom sediments within five to six miles of Atlantic Beach and four to five miles of Long Beach again appear to be contaminated by the ocean disposal of sewage sludge. These results definitely indicate that continued surveillance of this area is necessary in order to prevent the transport of the sludge nearer the shore where it could pose a direct threat to the public health and welfare at the ocean beaches.

Hempstead Bay Results-Area 3

Hempstead Bay continues to be the most stressed of the four south shore bays, although average bacterial levels were lower than in 1975. The average total coliform level for all points in the bay during the 1976 Report year was only 157 MPN/100 ml, compared with an average of 237 for the 1975 Report year. Average fecal coliform was also reduced from 60 MPN/100 ml in 1975 to 47 MPN/100 ml in 1976. This reduction is most likely due to lower rainfall in 1976 and improved chlorination practices at the Bay Park Sewage Treatment Plant.

However, even with the lower average coliform levels, ten of the twelve sampling points in SA classified waters did not meet the coliform standard for this classification. Both of the points which met this standard are located in the northern section of the bay. This is in keeping with previous years findings, which have determined that sewage effluents discharged in the southern portion of the bay adversely affect water quality in that area. All of the thirteen sampling points located in SB classified portions of Hempstead Bay met their assigned classification standards for total and fecal coliform.

Only one of the seven chemical sampling points on Hempstead Bay met the dissolved oxygen standard for its classification. This point is located at the westernmost end of Reynolds Channel and reflects the influence of the more oxygen-rich waters of the Atlantic Ocean.

The explosion of two sewage sludge storage tanks in Hempstead Bay on June 2, 1976, appears to have had little impact upon bay water quality. Sampling was conducted at the twenty-six routine surface water points on June 3rd, 4th, 5th, 6th and 7th, and with the exception of June 3rd, coliform bacteria levels were normal or lower than normal for this time of year. Coliform levels were three to five times above normal levels on June 3rd.

Dissolved oxygen levels were even less affected by the sludge tank explosion. The average dissolved oxygen level at all of the bays chemical sampling points was 5.8 mg/l on June 3rd. This compares with a "normal" June average of 6.7 mg/l. Dissolved oxygen had returned to normal levels by June 4th (averaging 7.0 mg/l) and maintained normal levels for the remainder of the year.

A sludge accident of lesser magnitude occurred on the morning of June 18, 1976, when 10,000 gallons of sludge was spilled from a storage trough at the Lawrence sewage treatment plant and eventually entered the western end of Reynolds Channel. This accident also produced a temporary increase in coliform bacteria levels in the bay, with a quick return to normal levels soon after the incident.

The observation of levels of chemical constituents other than dissolved oxygen provides further insight into the condition of Hempstead Bay. Patterns in levels of Ammonia, Nitrates and Phosphates are of particular interest because of the functions these constituents serve in the food chain. The bay's ecology is continuously stressed by four sewage treatment plants discharging a total of 76 million gallons per day of treated effluent into the bay. Although the plants are designed to remove 80 to 90% of the carbonaceous material present in the sewage, large amounts of nitrogen and phosphorous remain in their effluents and are discharged into Hempstead Bay. The natural cycle of increased oxygen demand during summer months because of increased biological activity and lower oxygen-carrying capability of warmer waters is tremendously aggravated by the addition of nitrogen-bearing sewage effluents to the bay. The net result is that the bay can no longer maintain minimum dissolved oxygen levels during the warmer months of the year, and annual average dissolved oxygen levels have declined in the last seven years.

The widespread dispersion of nitrogen-laden waters from the effluents discharging into Reynolds Channel is apparent from the ammonia levels found at the seven routine monitoring points on the bay. The annual average ammonia levels at five of these points are similar, ranging from a high of 0.58 mg/l at point number 412 in Hog Island Channel to a low of 0.44 mg/l at point number 415 in post lead. The two points in Reynolds Channel, point number 418 and point number 416, exhibit lower average levels (0.19 mg/l and 0.37 mg/l, respectively), due to tidal flushing from the cleaner waters of the Atlantic Ocean.

The high levels of ammonia are significant to the bay's ecology, particularly because they may have a limiting effect on phytoplankton growth. The phytoplankton are the first link in the food chain of the bay, converting inorganic nitrogen into living cell tissue, to be utilized by the other members of the biological community.

Despite the fact that ammonia levels during the 1976 Report year were the highest of the last four years at all seven chemical sampling points, nitrate levels were the lowest of the last four years at six of these seven locations.

Phosphate levels appear to be about the same in 1976 as in previous years, with even less diversity from point to point than was evident in the 1976 ammonia and nitrate levels. With the exception of points 418 and 416 in Reynolds Channel, average total phosphate levels in 1976 ranged from a low of 0.16 mg/l at point number 401 near Hewlett Beach to a high of 0.20 mg/l at point number 415 in post lead. Since phosphates are essential to plant growth, and therefore essential to the food chain in the bay, their presence in these concentrations should represent no threat to the normal ecology of the bay.

Middle Bay-Area 4

Average coliform bacteria levels in Middle Bay are lower than those found in Hempstead Bay. The average total and fecal coliform levels in Middle Bay during the 1976 Report year were 88 and 28 MPN/100 ml, respectively. This compares with 159 and 45 MPN/100 ml during the 1975 Report year.

The influence of Hempstead Bay water on Middle Bay's quality is evident from examination of sampling results at points 49, 54, 59, 402 and 403. These points are located on Reynolds and Barnums Channels and have five of the six highest average coliform levels of the twenty sampling locations on the bay. Waters flowing from Reynolds Channel into Middle Bay on flood tides carry the sewage effluents discharged to Hempstead Bay into Middle Bay. This is also true of Barnum's Channel, although cooling waters discharged into Barnum's Channel from LILCO's Oceanside power plant may also contribute to higher bacterial counts in the Barnum's Channel area by warming the area's waters and allowing for longer coliform survival. Land runoff from

Hempstead Town's Oceanside Incinerator may also contribute to the degradation of water quality in this area.

Conformance to surface water classification standards for coliform bacteria was improved over 1975. Eleven of the fourteen points in SA classified waters and all of the six points in SB or SC classified waters met their coliform bacteria standards. This represents a 79% conformance and is an obvious improvement over the 65% conformance found during the 1975 report year. Symaps 3 and 4 in Appendix IA, help to illustrate the coliform levels evident in Middle Bay.

Conformance to dissolved oxygen standards was not improved over 1975 levels. Only three of the seven chemical sampling poimts met their standards in 1976, while five of these points met their standards in 1975. The lowest dissolved oxygen level found in Middle Bay was 3.0 mg/l at point number 93.

The influence of Hempstead Bay on Middle Bay water quality is once again obvious from examination of chemical sampling results. Points 403 and 49, closest to Hempstead Bay, contain the lowest average dissolved oxygen levels and the highest average ammonia and phosphate levels of the seven chemical sampling points on Middle Bay.

East Bay-Area 5

Water quality in East Bay during the 1976 report year was essentially unchanged from 1975 report year quality. Although the average total coliform level for the bay's fourteen sampling locations was 98 MPN/100 ml, slightly lower than the 119 MPN/100 ml average for 1975, fecal coliform averaged about the same, (45 MPN/100 ml in 1976 and 44 MPN/100 ml in 1975). Conformance to assigned classification coliform bacteria standards was slightly improved with eight of the fourteen sampling locations in conformance, resulting in a 57% areawide conformance (conformance was 50% in 1975).

The stability of coliform levels in East Bay is remarkable in comparison to the three other South Shore bays. These three other bays fluctuated widely in coliform content between 1975 and 1976, largely due to the great difference in rainfall (and stormwater runoff) which occurred (rainfall totalled approximately 52 inches during 1975 but only 35 inches during 1976). East Bay however, varied very little in the average coliform level of its waters.

The chemical content of East Bay waters during 1976 further emphasizes its relatively healthy condition. Conformance to assigned classification standards for dissolved oxygen was identical to that which occurred in 1975. Five of the six chemical sampling points met the standard, resulting in an 83% areawide conformance. The single point which failed to meet the standard was point number 173, which had a dissolved oxygen content of 4.0 mg/l on September 23, 1976.

Ammonia content in East Bay's waters averaged only 0.07 mg/l, much lower than Hempstead Bay's average of 0.45 mg/l or Middle Bay's average of 0.24 mg/l. Nitrates were slightly higher in East Bay (0.12 mg/l) than in Hempstead (0.11 mg/l) or Middle Bay (0.11 mg/l) possibly indicating the greater ability of Nitrogen fixing bacteria to convert the available ammonia to the nitrate form, which is of most benefit to the phytoplankton, first link in the bay's food chain. Total phosphate levels averaged 0.08 mg/l, and were the lowest of the four south shore bays indicating that East Bay had the greatest degree of biological activity of the four south shore bays.

All of these observations indicate that East Bay is in a healthy condition, and is relatively unaffected by rainfall fluctuations from year to year. This data would support a decision to re-open portions of East Bay to shellfishing. (all of Hempstead, Middle and East Bay and most of South Oyster Bay are presently closed to shellfishing). At least one-third of the bay's area has met shellfish water standards during 1975 and 1976 and should be considered safe for shellfishing.

Symaps 5 and 6 in Appendix IA clearly depict the relatively clean waters of the lower portions of East Bay.

South Oyster Bay-Area 6

During 1976, as in 1975, South Oyster Bay had the lowest areawide average coliform levels of the four south shore bays. Total coliform averaged 33 MPN/100 ml, while fecal coliform averaged 16 MPN/100 ml. As was the case in Hempstead and Middle Bays, the 1976 coliform levels were much lower than 1975 levels, largely due to the reduced rainfall in 1976.

South Oyster Bay averaged 64 and 24 MPN/100 ml for total and fecal coliforms during the 1975 report year. The lower coliform levels during 1976 increased the area's conformance to assigned classification coliform standards from 85% in 1975 to 90% in 1976.

The chemical content of South Oyster Bay waters also indicates that these waters are the least stressed of the four South Shore bays. Dissolved oxygen during the 1976 report year averaged 8.5 mg/l in South Oyster Bay, compared with 8.3, 8.0 and 7.9 mg/l for East, Middle and Hempstead Bay, respectively. Six of the seven chemical sampling points met their assigned classification dissolved oxygen standard in 1976, for an 86% conformance, compared with a 56% conformance in 1975. The only location to have a dissolved oxygen level below the standard of 5.0 mg/l was point number 19, where the level was 4.4 mg/l on September 23, 1976. Dissolved oxygen levels were low throughout the South Shore bays on this date, indicating that the low levels were probably due to calm weather conditions prevailing throughout the area or to some other regional condition, and not due to a local polluting source.

Ammonia levels in South Oyster Bay are the lowest of the four South Shore bays. They averaged 0.05 mg/l during the 1976 report year, compared to 0.45, 0.24 and 0.07 mg/l for Hempstead, Middle and East Bays, respectively. This low ammonia level is an important indication of the low pollution loading of the bay.

Nitrate levels in South Oyster Bay are also the lowest of the four South Shore bays averaging 0.07 mg/l. This is not a drastic difference from the three other South Shore bays, where the maximum yearly average was 0.12 mg/l (East Bay). Phosphate levels were approximately equal to levels found in the other South Shore bays.

The only major water quality problem indicated in South Oyster Bay is the Massapequa Cove area, where the discharge from Massapequa Lake enters South Oyster Bay and affects the water quality of Alhambra Road and Biltmore Beach Club beaches. However, the opening of an additional spillway from the lake and efforts to mix the lake water more completely with the tidal water prior to reaching these beaches has apparently resulted in a reduction of the lake's impact on these beaches and on South Oyster Bay. Reduced rainfall during 1976 definitely lowered the coliform bacteria levels in the bay. The result is that most of South Oyster Bay meets the assigned classification standards for shellfishing waters. Since this was also the case in 1975, it is strongly recommended that these areas be considered for reopening to shellfishing. Symaps 7 and 8 in Appendix IA describe the large areas of South Oyster Bay where coliform density is low enough to permit safe shellfishing.

Little Neck Bay-Area 8

All six of Little Neck Bay's sampling locations are located in SB classified waters and all six failed to meet the fecal coliform standard for SB classified waters. The Report year averages for fecal coliform ranged from 831 MPN/100 ml to 2157 MPN/100 ml. Total coliform standards for SB classified waters were exceeded at four of the six points and average levels at the six points ranged from a low of 2342 to a high of 8537 MPN/100 ml. Areawide averages for total and fecal coliform were 4176 and 1239 MPN/100 ml, respectively. While all of these figures indicate a decline in average water quality when compared with 1975 quality, it must be stated that only one sampling run was conducted between June and September 1976. This is the period when seasonal chlorination is practiced at New York City sewage treatment plants, resulting in lower coliform bacteria levels in western Nassau North Shore waters. During the 1975 Report year, roughly half of the samples collected in Little Neck Bay were collected during the June-Sept. period. This difference is probably responsible for the seemingly higher average coliform levels in 1976.

Conformance to dissolved oxygen standards for SB classified waters is conversely prejudiced by the lack of sample data during the period when dissolved oxygen is expected to be lowest in the bay. Only one dissolved oxygen reading is available for each of the two chemical sampling points in Little Neck Bay for the June-Sept. period. This probably accounts for the 100% conformance of these points to their dissolved oxygen standard.

Little Neck Bay's poor water quality is further emphasized by its average ammonia level, which at .23 mg/l is the highest of the 8 north shore surface water areas, and its high nitrate level which at .25 mg/l is the highest of all the 14 Nassau County surface water areas. The poor water quality which exists in Little Neck Bay is widely known to be caused by combined sewage and storm water discharges from the citv of New York. Symaps 9 and 10 in Appendix IA illustrate the progressively increasing coliform levels in Long Island Sound and Little Neck Bay of the waters approaching the New York City area.

Manhasset Bay-Area 9

Water quality in Manhasset Bay is greatly superior to that of its neighboring areas, Little Neck Bay and western Long Island

Sound. Coliform bacteria during the 1976 report year averaged 215 MPN/100 ml for total coliform and 51 MPN/100 ml for fecal coliform, compared with 4176 and 1239 for Little Neck Bay and 1509 and 524 for western Long Island Sound. Manhasset Bay's conformance to assigned classification coliform standards was obviously superior to its neighbors', with 67% of its points in conformance, compared to 0% for Little Neck Bay and 25% for western Long Island Sound. Manhasset Bay bacterial quality was slightly below that of 1975, when 77% of its sampling locations met their coliform standards.

Conformance with dissolved oxygen standards was lower than in 1975. Only three of the five chemical sampling points maintained dissolved oxygen levels above 5.0 mg/l for the entire year, (60% conformance) compared with the 100% conformance of 1975.

Average ammonia and nitrate levels in Manhasset Bay, while somewhat similar to the levels found in Little Neck Bay and Hempstead Harbor, indicate that Manhasset Bay receives slightly less pollution loading than either of these two bays. Ammonia averaged 0.19 mg/l in Manhasset Bay, while it was 0.23 mg/l in Little Neck Bay and 0.21 mg/l in Hempstead Harbor. The average nitrate level in Manhasset Bay was 0.17 mg/l compared with 0.25 and 0.23 mg/l in Little Neck Bay and Hempstead Harbor. Manhasset Bay's average total phosphate level of 0.16 mg/l was comparable to Little Neck Bay's 0.15 mg/l average and Hempstead Harbor's 0.20 mg/l average.

Manhasset Bay sampling data points to the conclusion that the bay is affected at least as much by internal pollution sources such as ponds and drains as by sources external to the bay (New York City combined sewage and storm water flows.) This is visually evident in Symaps 11 and 12 in Appendix IA, where the expanse of relatively "clean" water in the central portion of the bay separates the areas of external influence on the northwest from the areas of internal influence on the east.

<u>Hempstead Harbor - Areas 10 and 11</u>

These areas show a slight improvement in surface water bacteriological quality over 1975 levels. Total and fecal coliform report year log averages were slightly lower than 1975 averages, and % conformance to assigned classification standards was slightly improved:

	Log Avg. Total Coliform		Log Avg. Fecal Coliform		Area-Wide % Conformance to Classif. Standards	
	1976	1975	1976	1975	1976	1975
Upper Hempstead Harbor	121	185	24	31	38	44
Lower Hempstead Harbor	624	695	137	216	86	43

Improvement in the chemical quality of these waters is not evident. Conformance to assigned classification dissolved oxygen standards was 0%, as was the case in 1975. The two chemical sampling points in lower Hempstead Harbor had levels as low as 1.4 mg/l, the lowest levels found in any of the fourteen surface water areas this year.

A clear distinction exists between lower and upper harbor water quality, as indicated by the average coliform levels already related. Chemical levels also demonstrate this distinction. Dissolved oxygen averaged 9.3 mg/l in the upper harbor waters and 8.3 mg/l in the lower harbor waters. Ammonia averaged 0.15 mg/l in the upper harbor, while averaging 0.27 mg/l in the lower harbor. Nitrates averaged 0.18 mg/l in the upper harbor and 0.29 mg/l in the lower harbor. Phosphates also were higher in the lower harbor (0.24 mg/l) than in the upper harbor (0.16 mg/l) These levels establish the lower portion of Hempstead Harbor as the most stressed of the North Shore bays, even though coliform bacteria levels are higher in Little Neck Bay.

The poor water quality of lower Hempstead Harbor is due to several sources. These include the Roslyn sewage treatment plant, the Roslyn duck pond and several storm drainage systems, one of which has a dry weather flow of up to 1 million gallons per day and an average total coliform concentration over 20,000 MPN/100 ml.

Symaps 13 and 14 in Appendix IA illustrate the great effect of the lower harbor on the water quality of the upper harbor.

Oyster Bay-Area 12

All of Oyster Bay's nineteen sampling locations are located in SA classified waters and met their assigned classification coliform standards during the 1976 report year. In addition, all seven chemical sampling locations met their dissolved oxygen standard. Coliform levels in Oyster Bay were the lowest of the eight North Shore surface water areas, averaging 12 and 6 MPN/100 ml for total and fecal coliform, respectively, during th 1976 report year. Average nitrate and phosphate levels in Oyster Bay were also the lowest of the eight North Shore surface water areas, and ammonia was lower only in Cold Spring Harbor.

While all of these levels indicate excellent water quality, it should be realized that no chemical sampling was conducted in Oyster Bay during June or July of 1976. If sampling had been possible during these months, higher average levels of pollutant indicators probably would have resulted. Based on previous years' sampling results, however, it is most likely that Oyster Bay would still be ranked as one of the least stressed areas on the North Shore of the county.

Symaps 15 and 16 in Appendix IA illustrate the low coliform densities of Oyster Bay waters.

Cold Spring Harbor-Area 13

Average total and fecal coliform levels in Cold Spring Harbor during the 1976 report year were among the lowest of the eight North Shore areas, averaging 19 and 11 MPN/100 ml, respectively. In addition, all of the harbor's sampling locations met their assigned classification standards for total coliform and dissolved oxygen (all seven locations are in SA classified waters).

The same interpretation of these results must be applied as was the case in Oyster Bay, because chemical sampling was not conducted each month during the 1976 report year. However, as with Oyster Bay, past sampling experience has shown that Cold Spring Harbor also is among the least stressed of the county's surface water areas.

Symaps 17 and 18 in Appendix IA illustrate the average coliform densities in Cold Spring Harbor.

Long Island Sound-West Area 14

Despite higher average coliform bacteria levels, waters of the western Long Island Sound area were more in conformance with assigned classification standards during 1976 than during 1975. Coliform bacteria averaged 1509 and 524 MPN/100 ml for total and fecal coliform, respectively, during the 1976 report year, compared with 1086 and 369 MPN/100 ml in 1975. Conformance of the four chemical sampling points with their standards for dissolved oxygen was 75% in 1976, compared with 50% during the 1975 report year.

Irregular sampling frequencies can once again be cited as the cause for the discrepancy between higher average coliform levels and greater percent conformance to assigned classification standards. Some of the sampling locations in the western Long Island Sound area were sampled along with Manhasset Bay and Hempstead Harbor waters when these waters were surveyed as part of the areawide wastewater management study (208 Study). For example, point number 423 was sampled ten times in July and only once in November, January, February, March, April, May and August. Other points in the area were not sampled as part of the "208" Study and therefore, have very few results during the 1976 report year. Point number 422, for example was not sampled at all for dissolved oxygen during June, July or September.

While these irregularities preclude any firm interpretation of chemical levels in the area during 1976, the sampling which was conducted is comparable with previous years' results, and similar conclusions can be drawn.

Water quality in the western Long Island Sound area is drastically affected by combined storm and sewage flows during rainfall periods, and by the discharge of untreated sewage flows, all originating from the City of New York.

Symaps 9 and 10 in Appendix IA illustrate the decreasing coliform densities of waters which increase in distance from the New York City area.

Long Island Sound East-Area 15

Interpretation of water quality in this area also suffered from the irregular sampling frequency of 1976 (four of the five chemical sampling points were only sampled five times in 1976). However, as with Oyster Bay and Cold Spring Harbor, the area has been regularly monitored in previous years and this year's limited results compare very well with those of previous years for the months sampled. Moreover, there is no reason to suspect that more complete sampling of eastern Long Island Sound waters would have resulted in significant differences in average chemical levels, with the exception of average dissolved oxygen which would have been lower if sampling had occurred in June, July, August and September.

During the limited sampling which was conducted, the seven sampling locations in eastern Long Island Sound had a 100% conformance with their assigned classification standards for coliform and for dissolved oxygen. The 1976 report year log averages for total and fecal coliform were 19 and 7 MPN/100 ml, respectively, comparing favorably with the 25 and 10 MPN/100 ml averages for the 1975 report year.

Symaps 19 and 20 in Appendix IA show the huge areas of extremely low average coliform densities in the eastern Long Island Sound area.

TABLE 1-1

Conformance of Surface Water Sampling Points With Assigned Classification Standards For Total Coliform and Fecal Coliform

Area Number	Name	Number of Sampling Points In Classification			Points in Conformance with Standard (percent)			Area-wide Conformance (percent)
		SA	SB	SC	SA	SB	SC	
1	Atlantic Ocean West	12	0	0	100	-	-	100
2	Atlantic Ocean East	9	0	0	100	-	-	100
3	Hempstead Bay	12	13	0	17	100	-	60
4	Middle Bay	14	4	2	79	100	100	85
5	East Bay	13	0	1	54	-	100	57
6	South Oyster Bay	18	0	2	89	-	100	90
8	Little Neck Bay	0	6	0	-	0	-	0
9	Manhasset Bay	5	8	2	0	100	100	67
10	Upper Hempstead Harbor	7	1	0	29	100	-	38
11	Lower Hempstead Harbor	0	7	0	-	86	-	86
12	Oyster Bay	19	0	0	100	-	-	100
13	Cold Spring Harbor	7	0	0	100	-	-	100
14	L.I. Sound West	4	4	0	0	50	-	25
15	L.I. Sound East	7	0	0	100	-	-	100

TABLE 1-2

Conformance of Surface Water Sampling Points With Assigned Classification Standards for Dissolved Oxygen

Area Number	Name	Number of Sampling Points In Classification			Points in Conformance with Standard (percent)			Area-wide (percent)
		SA	SB	SC	SA	SB	SC	
1	Atlantic Ocean West	4			75			75
2	Atlantic Ocean East	3			100			100
3	Hempstead Bay	3	4		0	25		14
4	Middle Bay	4	3		50	33		43
5	East Bay	5		1	80		100	83
6	South Oyster Bay	7			86			86
8	Little Neck Bay		2		--	100		100
9	Manhasset Bay	2	2	1	50	100	0	60
10	Upper Hempstead Harbor	2			0			0
11	Lower Hempstead Harbor		2		-	0		0
12	Oyster Bay	7			100			100
13	Cold Spring Harbor	2			100			100
14	Long Island Sound West	2	2		50	100		75
15	Long Island Sound East	5			100			100

Table 1-3

Oct. 1975 to Sept. 1976 Report Year

Bacteriological Data Summary By

Sampling Point

Area	Sampling Point Number	Assigned Classification	Median Total Coliform MPN/100 ml.	Log Avg. Total Coli MPN/100 ml.	Log Avg. Fecal Coli MPN/100 ml.	Minimum Dissolved Oxygen Content at 5 ft. depth
Atlantic Ocean West Area 1	401.0	SA	23.0	24.1	13.9	2.0*
	402.0	SA	29.5	29.0	21.6	
	403.0	SA	23.0	19.4	18.5	7.8
	404.0	SA	23.0	19.0	14.7	
	405.0	SA	23.0	16.6	14.7	7.0
	406.0	SA	23.0	16.7	13.7	
	407.0	SA	29.5	20.0	10.3	
	408.0	SA	23.0	12.7	10.6	
	409.0	SA	16.0	11.0	8.7	7.2
	410.0	SA	33.0	55.9	23.0	
	411.0	SA	13.3	8.7	8.7	
	412.0	SA	23.0	26.8	16.9	
Atlantic Ocean East Area 2	401.0	SA	33.0	30.1	18.9	7.4
	402.0	SA	3.0	4.3	4.3	
	403.0	SA	3.0	4.3	3.2	6.2
	404.0	SA	3.0	3.0	3.0	
	405.0	SA	3.0	3.2	3.0	
	406.0	SA	3.0	3.2	3.0	
	407.0	SA	3.0	3.2	3.2	
	408.0	SA	3.0	3.0	3.0	
	409.0	SA	3.6	6.3	3.0	7.6

* Exceeds Classification Standard

Table 1-3 (continued)

Oct. 1975 to Sept. 1976 Report Year

Bacteriological Data Summary By

Sampling Point

Hempstead Bay Area 3

Sampling Point Number	Assigned Classification	Median Total Coliform MPN/100 ml.	Log Avg. Total Coli MPN/100 ml.	Log Avg. Fecal Coli MPN/100 ml.	Minimum Dissolved Oxygen Content at 5 ft. depth
401.0	SA	43.0	59.8	28.5	4.4*
402.0	SA	93.0*	123.4	38.5	
403.0	SA	235.0*	196.8	65.1	
404.0	I	240.0	249.9	52.5	
405.0	SB	93.0	138.7	38.2	
406.0	SB	67.0	113.7	37.7	
407.0	SB	93.0	193.6	41.9	
408.0	SB	240.0	280.9	66.8	4.4*
409.0	SB	240.0	267.1	74.9	
410.0	SA	93.0*	132.1	35.8	
411.0	SA	93.0*	111.0	36.8	
412.0	SB	185.0	114.7	39.6	4.2*
413.0	SA	41.0	51.0	26.3	
414.0	SA	240.0*	148.3	74.8	
415.0	SA	93.0*	116.9	38.7	4.0*
416.0	SB	83.0	120.6	38.0	2.8*
417.0	SB	93.0	85.1	27.8	
418.0	SB	43.0	49.8	18.5	5.8
419.0	SA	315.0*	293.2	61.1	4.4*
420.0	SA	93.0*	131.7	58.4	4.0*
421.0	SA	190.0*	164.6	44.7	
422.0	SB	230.0	202.0	56.3	
423.0	SA	151.5*	122.2	41.4	
424.0	SB	240.0	237.5	66.4	
425.0	SB	235.0	196.7	56.6	
426.0	SB	240.0	191.2	45.1	

* Exceeds Classification Standard

Table 1-3 (continued)

Oct. 1975 to Sept. 1976 Report Year

Bacteriological Data Summary By

Sampling Point

	Sampling Point Number	Assigned Classification	Median Total Coliform MPN/100 ml.	Log Avg. Total Coli MPN/100 ml.	Log Avg. Fecal Coli MPN/100 ml.	Minimum Dissolved Oxygen Content at 5 ft. depth
	49.0	SB	240.0	264.8	72.4	4.2*
	52.0	SB	93.0	95.9	31.9	
	54.0	I	121.0	190.5	61.0	
	56.0	SA	91.0*	99.7	27.2	
	59.0	SA	166.5*	161.6	31.3	
	64.0	SA	36.0	55.6	12.5	
	70.0	SA	84.0*	93.9	45.1	
	78.0	SA	23.0	31.7	15.7	
	80.0	SA	36.0	42.4	22.8	3.4*
	85.0	SA	43.0	45.1	16.6	
Middle Bay Area 4	93.0	SB	93.0	78.5	46.8	3.0*
	102.0	SA	23.0	30.7	14.3	7.2
	108.0	SA	43.0	50.5	30.9	
	110.0	SC	36.0	96.1	18.6	
	112.0	SC	240.0	233.5	22.1	
	116.0	SA	36.5	50.6	28.9	5.2
	118.0	SA	23.0	20.2	15.8	
	121.0	SA	23.0	20.2	12.1	
	123.0	SA	23.0	17.7	9.1	3.4*
	402.0	I	92.0	103.6	36.2	
	403.0	SB	170.0	122.2	39.0	5.0
	404.0	SA	43.0	41.7	15.7	

* Exceeds Classification Standard

Table 1-3 (continued)

Oct. 1975 to Sept. 1976 Report Year

Bacteriological Data Summary By

Sampling Point

	Sampling Point Number	Assigned Classification	Median Total Coliform MPN/100 ml.	Log Avg. Total Coli MPN/100 ml.	Log Avg. Fecal Coli MPN/100 ml.	Minimum Dissolved Oxygen Content at 5 ft. depth
	126.0	SA	23.0	23.5	12.3	6.0
	130.0	SA	23.0	26.7	10.6	
	159.0	SA	84.0*	104.3	45.9	
	160.0	SC	390.0	345.4	119.8	6.0
East Bay Area 5	164.0	SA	93.0*	85.8	35.1	
	166.0	SA	84.0	104.3	42.1	
	167.0	SA	43.0	101.3	55.9	
	171.0	SA	93.0*	86.0	40.7	
	173.0	SA	43.0	56.2	34.4	4.0*
	174.0	SA	33.0	39.1	29.2	
	176.0	SA	33.0	52.9	31.0	6.2
	178.0	SA	43.0	81.1	42.3	5.8
	401.0	SA	93.0*	134.1	51.3	
	402.0	SA	166.5*	135.7	81.5	6.0

* Exceeds Classification Standard

Table 1-3 (continued)

Oct. 1975 to Sept. 1976 Report Year

Bacteriological Data Summary By

Sampling Point

	Sampling Point Number	Assigned Classification	Median Total Coliform MPN/100 ml.	Log Avg. Total Coli MPN/100 ml.	Log Avg. Fecal Coli MPN/100 ml.	Minimum Dissolved Oxygen Content at 5 ft. depth
	2.0	I	68.0	68.8	29.0	
	4.0	SA	93.0*	73.2	35.5	
	9.0	SA	43.0	55.2	25.1	5.8
	11.0	SA	43.0	47.1	27.9	
	13.1	I	43.0	65.6	25.8	
	15.0	SA	43.0	52.9	32.5	
	19.0	SA	43.0	29.4	15.5	4.4*
South Oyster Bay Area 6	20.0	SA	23.0	19.0	7.1	
	23.0	SA	9.1	10.6	4.9	
	24.0	SA	9.1	8.4	5.4	
	25.0	SA	9.1	10.5	5.4	
	26.0	SA	6.3	9.3	5.4	
	28.0	SA	9.1	8.7	6.0	7.2
	32.0	SA	15.0	17.2	11.5	6.8
	34.0	SA	15.0	12.6	9.0	6.8
	401.0	SA	93.0*	77.1	32.6	6.8
	402.0	SA	33.0	39.4	12.8	
	490.0	SA	23.0	20.4	9.9	
	491.0	SA	16.0	15.6	8.8	7.4
	492.0	SA	23.0	26.2	11.8	

* Exceeds Classification Standard

Table 1-3 (continued)

Oct. 1975 to Sept. 1976 Report Year

Bacteriological Data Summary By

Sampling Point

Bay / Area	Sampling Point Number	Assigned Classification	Median Total Coliform MPN/100 ml.	Log Avg. Total Coli MPN/100 ml.	Log Avg. Fecal Coli MPN/100 ml.	Minimum Dissolved Oxygen Content at 5 ft. depth
Little Neck Bay, Area 8	401.0	SB	4600.0*	4198.9	1327.6*	
	402.0	SB	2400.0	2342.4	436.3*	
	403.0	SB	2400.0	2426.7	831.1*	6.4
	404.0	SB	4600.0*	3132.2	1051.4*	
	405.0	SB	4600.0*	4416.4	1628.8*	6.2
	406.0	SB	7800.0*	8536.7	2157.4*	
Manhasset Bay, Area 9	403.0	SB	220.0	149.3	24.1	
	406.0	SB	150.0	135.3	30.3	6.4
	407.0	SB	93.0	133.0	34.7	
	408.0	SB	121.5	125.3	33.7	
	409.0	SB	121.5	137.1	32.1	5.4
	411.0	SA	230.0*	173.6	37.7	
	412.0	SA	240.0*	153.7	48.1	4.6*
	413.0	SC	235.0	136.7	36.3	3.8*
	414.0	SA	1500.0*	1213.9	288.6	6.0
	415.0	SA	240.0*	269.7	61.9	
	416.0	SB	121.5	117.2	31.0	
	417.0	SA	93.0*	132.0	22.5	
	418.0	SC	93.0	108.1	34.0	
	419.0	SB	93.0	131.8	29.6	
	420.0	SB	93.0	113.7	21.2	

* Exceeds Classification Standard

Table 1-3 (continued)

Oct. 1975 to Sept. 1976 Report Year

Bacteriological Data Summary By

Sampling Point

	Sampling Point Number	Assigned Classification	Median Total Coliform MPN/100 ml.	Log Avg. Total Coli MPN/100 ml.	Log Avg. Fecal Coli MPN/100 ml.	Minimum Dissolved Oxygen Content at 5 ft. depth
Upper Hempstead Harbor Area 10	42.0	SA	93.0*	81.0	24.2	
	43.0	SA	195.0	176.1	40.6	
	44.0	SA	240.0*	218.0	40.9	
	48.0	SA	93.0*	118.6	25.9	2.8*
	49.0	SA	166.5*	108.6	20.1	
	49.1	SA	43.0	65.2	12.7	2.8*
	50.0	SB	93.0	95.5	14.3	
	50.1	I	930.0	1180.8	48.1	4.6
	51.0	SA	23.0	43.2	10.0	
Lower Hempstead Harbor Area 11	45.0	SB	240.0	256.6	55.0	
	46.0	SB	240.0	323.0	80.3	1.4*
	47.0	SB	240.0	287.9	60.8	
	47.1	SB	965.0	1781.6	435.2*	
	401.0	SB	240.0	438.0	101.3	
	402.0	SB	430.0	654.8	87.8	1.4*
	403.0	SB	430.0	627.5	141.1	

* Exceeds Classification Standard

Table 1-3 (continued)

Oct. 1975 to Sept. 1976 Report Year

Bacteriological Data Summary By

Sampling Point

Area	Sampling Point Number	Assigned Classification	Median Total Coliform MPN/100 ml.	Log Avg. Total Coli MPN/100 ml.	Log Avg. Fecal Coli MPN/100 ml.	Minimum Dissolved Oxygen Content at 5 ft. depth
Oyster Bay Area 12	1	SA	23.0	19.7	8.0	
	2	SA	3.6	7.0	4.5	6.0
	3	SA	9.1	14.1	6.2	
	4	SA	9.1	9.7	5.5	
	6	SA	14.0	11.9	5.9	6.0
	7	SA	16.0	12.7	5.6	
	8	SA	23.0	13.0	6.9	6.2
	11	SA	3.6	7.7	5.3	
	13	SA	9.1	11.4	5.5	6.2
	16	SA	3.6	5.5	3.4	
	18	SA	3.6	5.5	3.5	
	21	SA	9.1	6.7	4.1	
	22	SA	5.1	6.5	4.0	5.0
	23	SA	3.6	6.2	4.2	6.0
	401	SA	23.0	35.3	6.2	6.2
	402	SA	3.6	4.7	3.7	
	403	SA	9.1	12.6	9.1	
	404	SA	23.0	19.6	7.8	
	405	SA	22.0	20.5	11.7	
Cold Spring Harbor Area 13	401	SA	3.6	6.5	4.2	
	402	SA	9.1	6.7	4.7	
	403	SA	23.0	11.7	8.5	7.4
	404	SA	9.1	11.8	9.6	
	405	SA	23.0	12.1	8.6	7.6
	406	SA	23.0	22.1	14.0	
	407	SA	43.0	64.0	29.8	

* Exceeds Classification Standard

Table 1-3 (continued)

Oct. 1975 to Sept. 1976 Report Year

Bacteriological Data Summary By Sampling Point

	Sampling Point Number	Assigned Classification	Median Total Coliform MPN/100 ml.	Log Avg. Total Coli MPN/100 ml.	Log Avg. Fecal Coli MPN/100 ml.	Minimum Dissolved Oxygen Content at 5 ft. depth
L.I. Sound West Area 14	39.0	SA	93.0*	88.3	17.6	
	407.0	SB	11000.0*	8362.7	3166.7*	5.0
	417.0	SB	2400.0	1914.0	607.6*	
	418.0	SB	930.0	864.0	173.0	6.2
	419.0	SB	240.0	414.7	98.3	
	421.0	SA	240.0*	219.2	65.7	
	422.0	SA	200.0*	123.4	42.6	7.6
	423.0	SA	93.0*	88.0	21.7	3.8*
L.I. Sound East Area 15	41.0	SA	43.0	35.5	12.0	
	54.0	SA	23.0	20.4	7.7	8.2
	401.0	SA	23.0	31.8	10.8	
	402.0	SA	12.0	13.1	4.1	7.6
	403.0	SA	15.0	13.5	5.1	8.0
	404.0	SA	9.1	9.8	4.1	8.2
	405.0	SA	3.6	5.4	3.6	8.2

* Exceeds Classification Standard

TABLE 1-4

AREA WIDE AVERAGE COLIFORM LEVELS
1976 REPORT YEAR

Area #	Name	Log Average Total Coliform MPN/100 ml.	Log Average Fecal Coliform MPN/100 ml.
1	Atlantic Ocean West	22	15
2	Atlantic Ocean East	7	5
3	Hempstead Bay	157	47
4	Middle Bay	88	28
5	East Bay	98	45
6	South Oyster Bay	33	16
8	Little Neck Bay	4176	1239
9	Manhasset Bay	215	51
10	Upper Hempstead Harbor	121	24
11	Lower Hempstead Harbor	624	137
12	Oyster Bay	12	6
13	Cold Spring Harbor	19	11
14	L.I. Sound West	1509	524
15	L.I. Sound East	19	7

TABLE 1-5

1976 REPORT YEAR AVERAGE
COLIFORM LEVELS BY SURFACE WATER CLASSIFICATIONS

	SA Areas		SB Areas		SC Areas	
	Average Total Coliform Level	Average Fecal Coliform Level	Average Total Coliform Level	Average Fecal Coliform Level	Average Total Coliform Level	Average Fecal Coliform Level
Atlantic Ocean West	22	15	-	-	-	-
Atlantic Ocean East	7	6				
Hempstead Bay	127	46	169	46		
Middle Bay	54	21	140	48	165	20
East Bay	79	39	-	-	345	120
South Oyster Bay	30	15	-	-	-	-
Little Neck Bay	-	-	4176	1893	-	-
Manhasset Bay	389	92	130	30	122	35
Upper Hempstead Harbor	116	25	96	14	-	-
Lower Hempstead Harbor	-	-	624	137	-	-
Oyster Bay	12	6	-	-	-	-
Cold Spring Harbor	21	11	-	-	-	-
Long Island Sound West	130	37	2889	1011	-	-
Long Island Sound East	19	7	-	-	-	-

TABLE 1-6

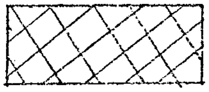
1976 REPORT YEAR AVERAGE
CHEMICAL LEVELS BY AREA

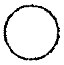
	Total # Samples	Dissolved Oxygen	Ammonia Nitrogen	Nitrate Nitrogen	Total Phosphate
Atlantic Ocean West	14	7.2	.06	.01	.07
Atlantic Ocean East	6	7.4	.02	.01	.06
Hempstead Bay	167	7.9	.45	.11	.16
Middle Bay	128	8.0	.24	.11	.11
East Bay	76	8.3	.07	.12	.08
South Oyster Bay	101	8.5	.05	.07	.10
Little Neck Bay	18	9.9	.23	.25	.15
Manhasset Bay	83	10.4	.19	.17	.16
Hempstead Harbor	59	8.8	.21	.23	.20
Oyster Bay	74	10.4	.09	.12	.10
Cold Spring Harbor	11	9.9	.10	.24	.10
L.I. Sound West	40	8.9	.14	.16	.11
L.I. Sound East	29	11.1	.07	.23	.14

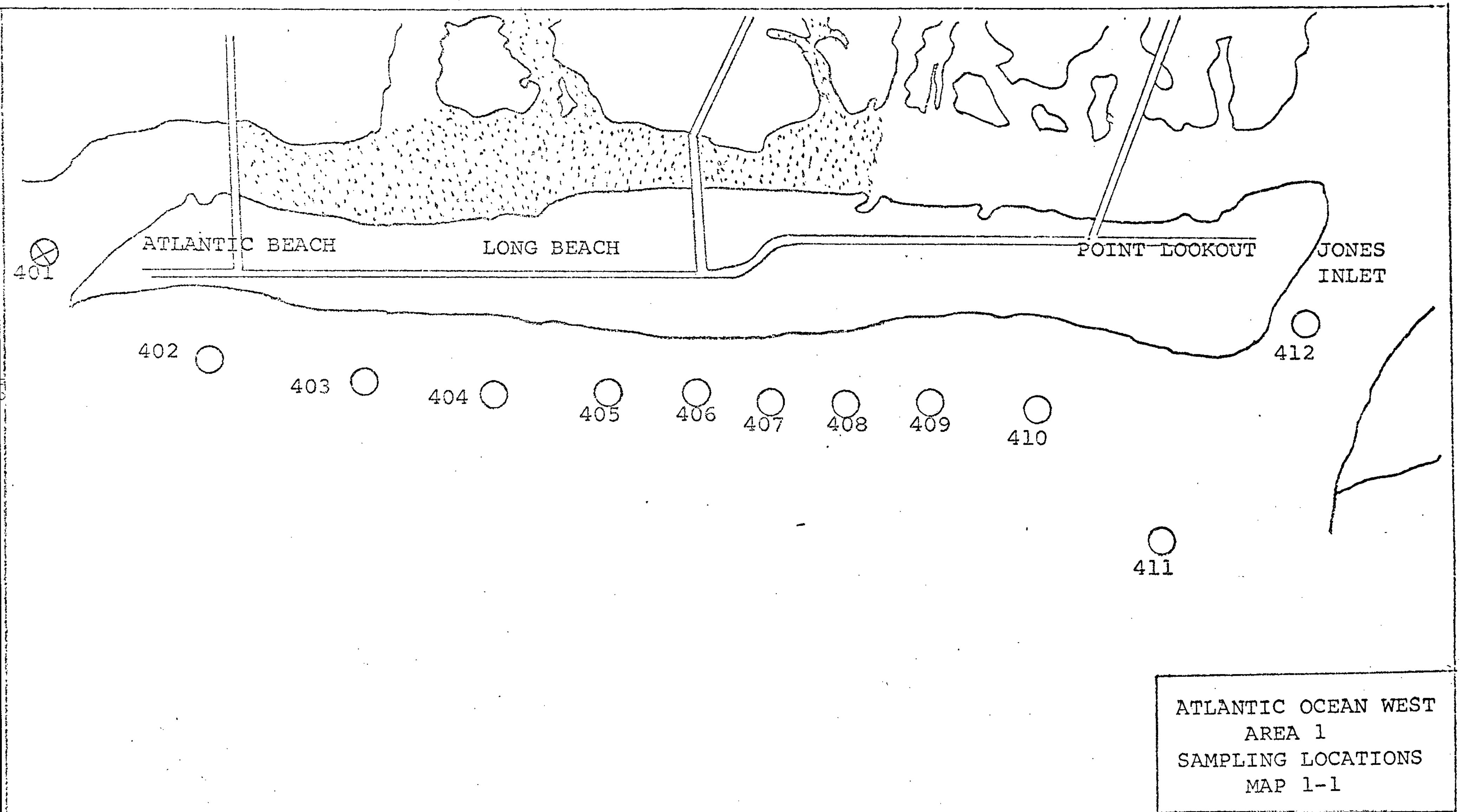
All results expressed as mg/l

SURFACE WATER
SAMPLING LOCATION
AND ASSIGNED CLASSIFICATION
CONFORMANCE MAPS

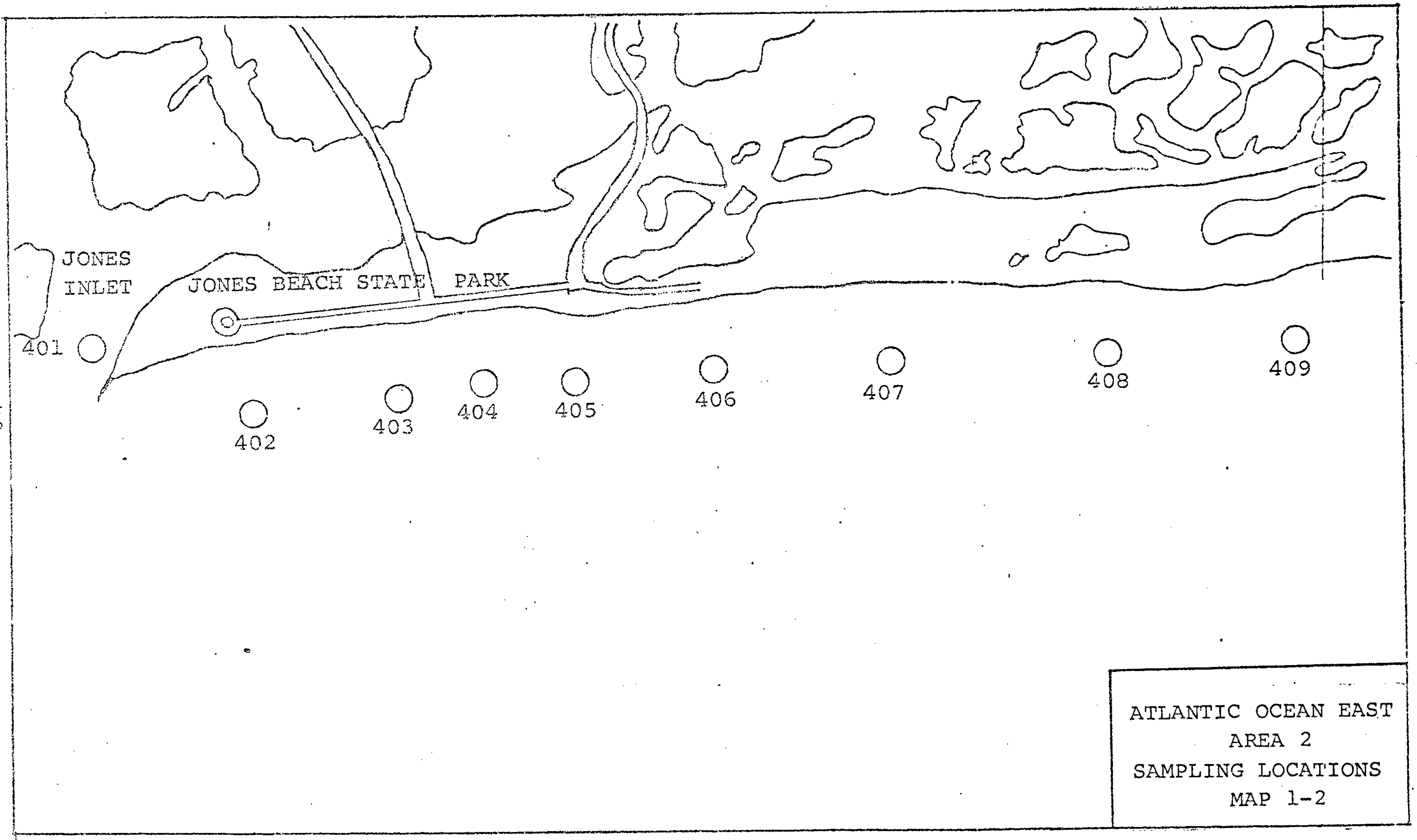
MAP LEGENDS

CLASSIFICATION	CODE
SA	
SB	
SC	
I	

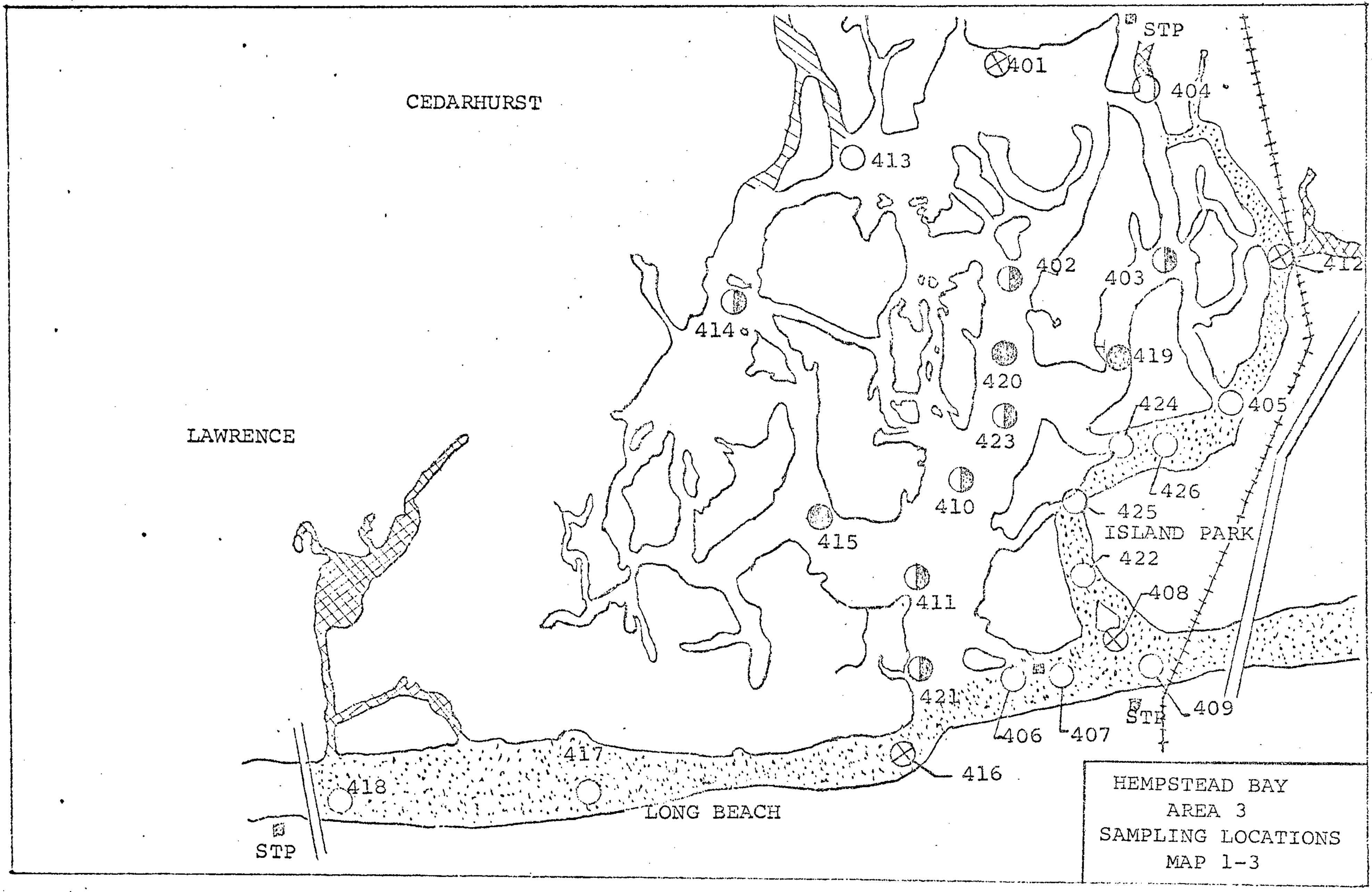
CODE	
	Meets all standards for classification
	Fails Dissolved Oxygen standard for classification
	Fails Coliform standard for classification
	Fails both Coliform and Dissolved Oxygen standards for classification



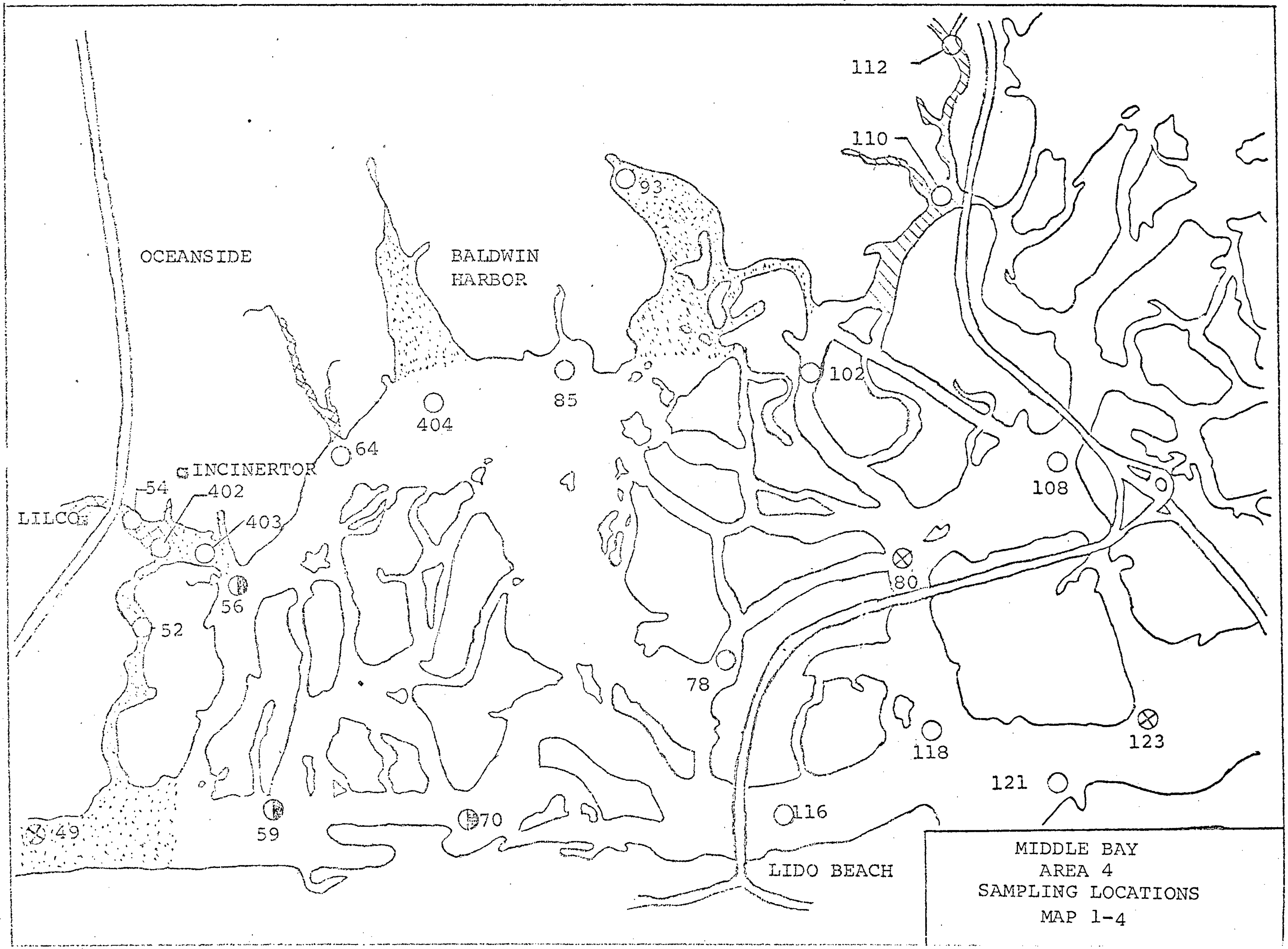
ATLANTIC OCEAN WEST
AREA 1
SAMPLING LOCATIONS
MAP 1-1



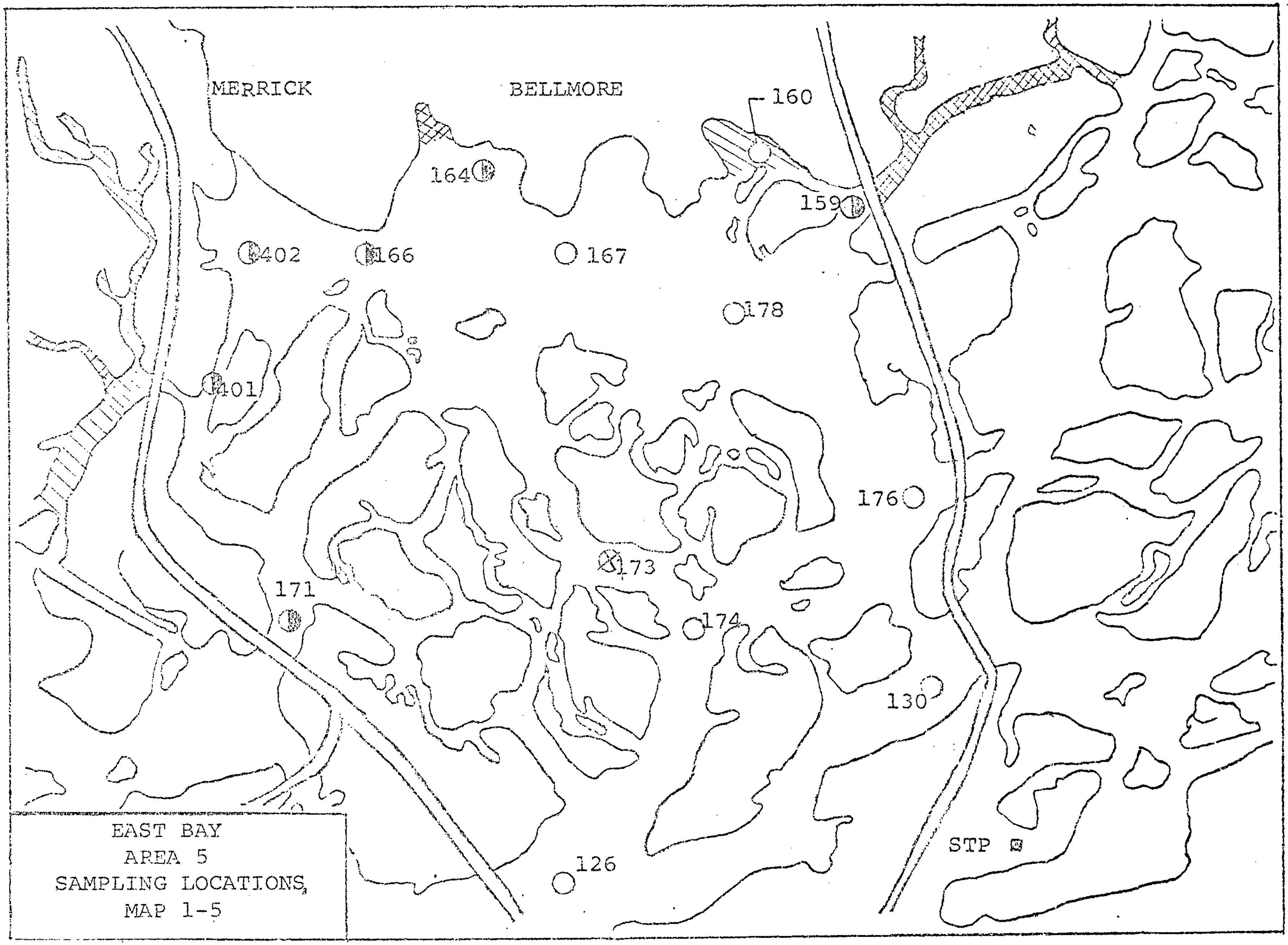
ATLANTIC OCEAN EAST
AREA 2
SAMPLING LOCATIONS
MAP 1-2



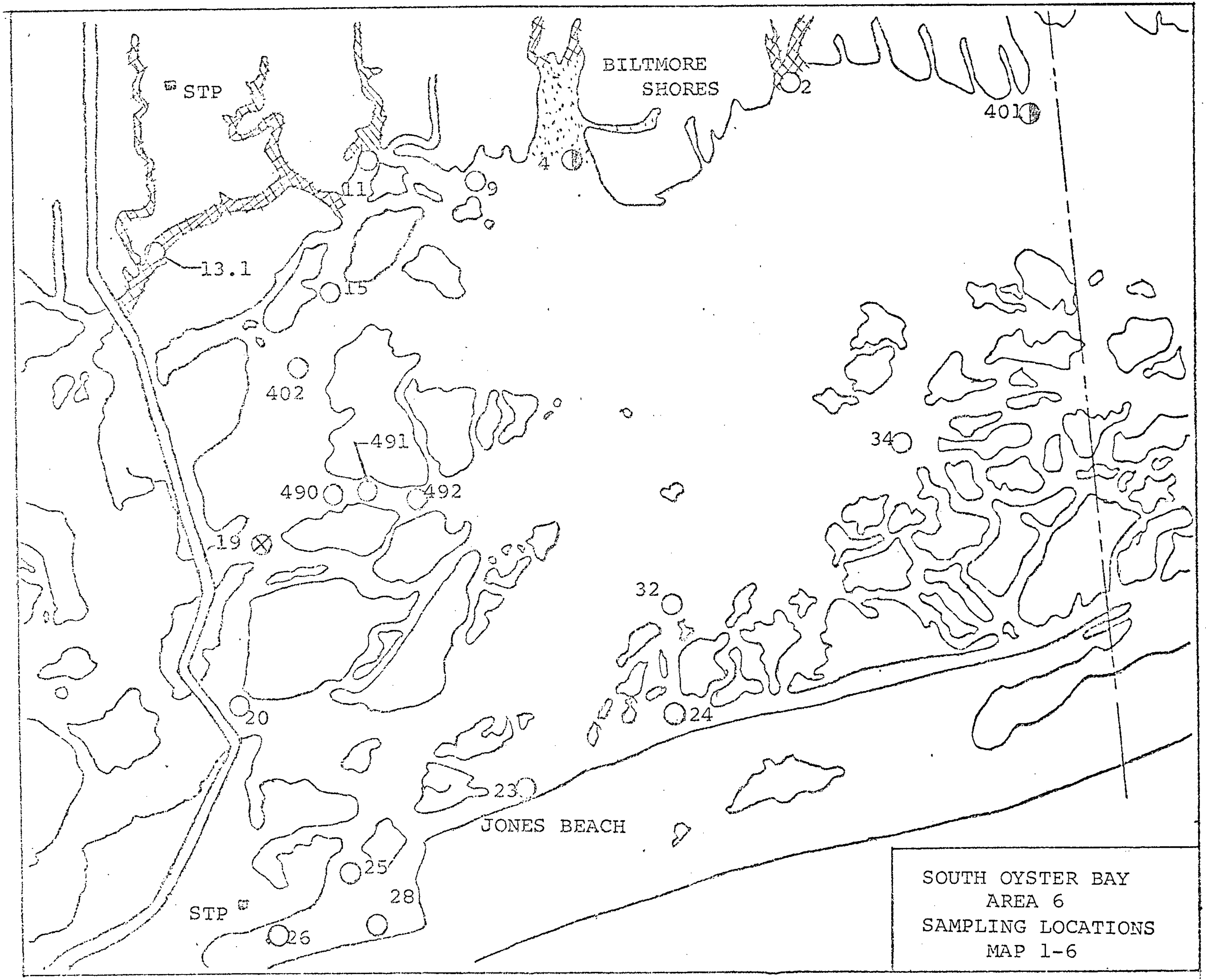
HEMPSTEAD BAY
AREA 3
SAMPLING LOCATIONS
MAP 1-3



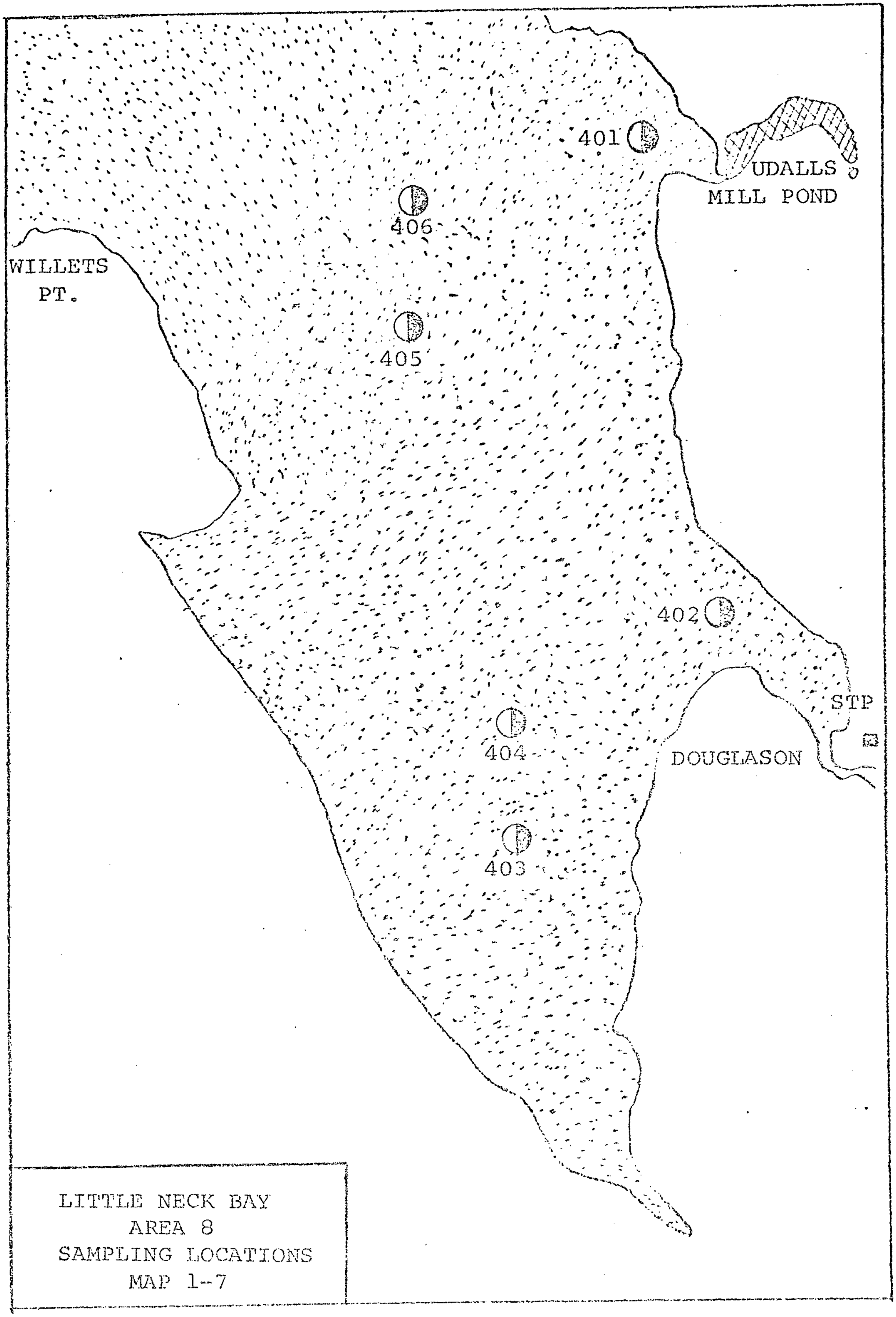
MIDDLE BAY
AREA 4
SAMPLING LOCATIONS
MAP 1-4



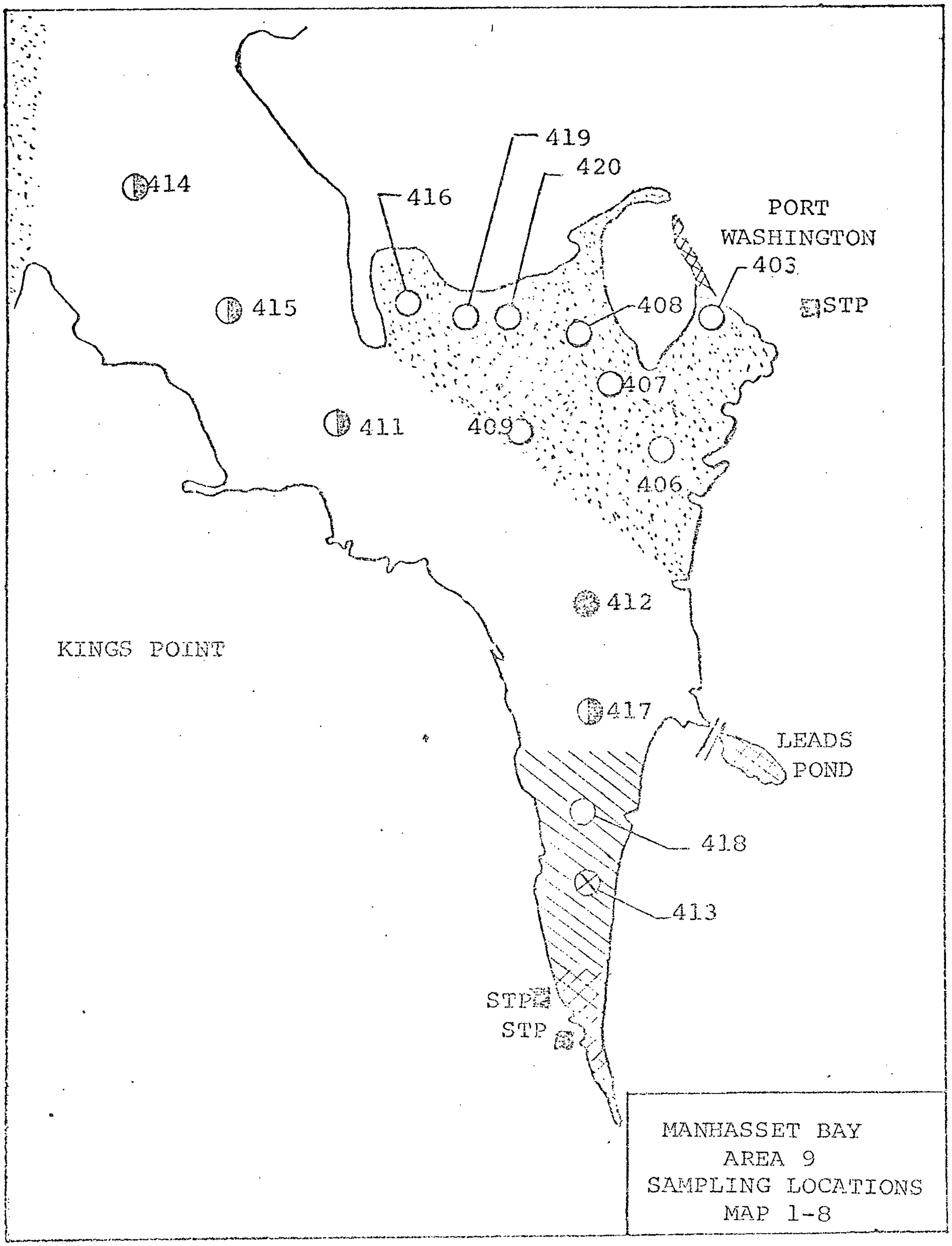
EAST BAY
AREA 5
SAMPLING LOCATIONS,
MAP 1-5



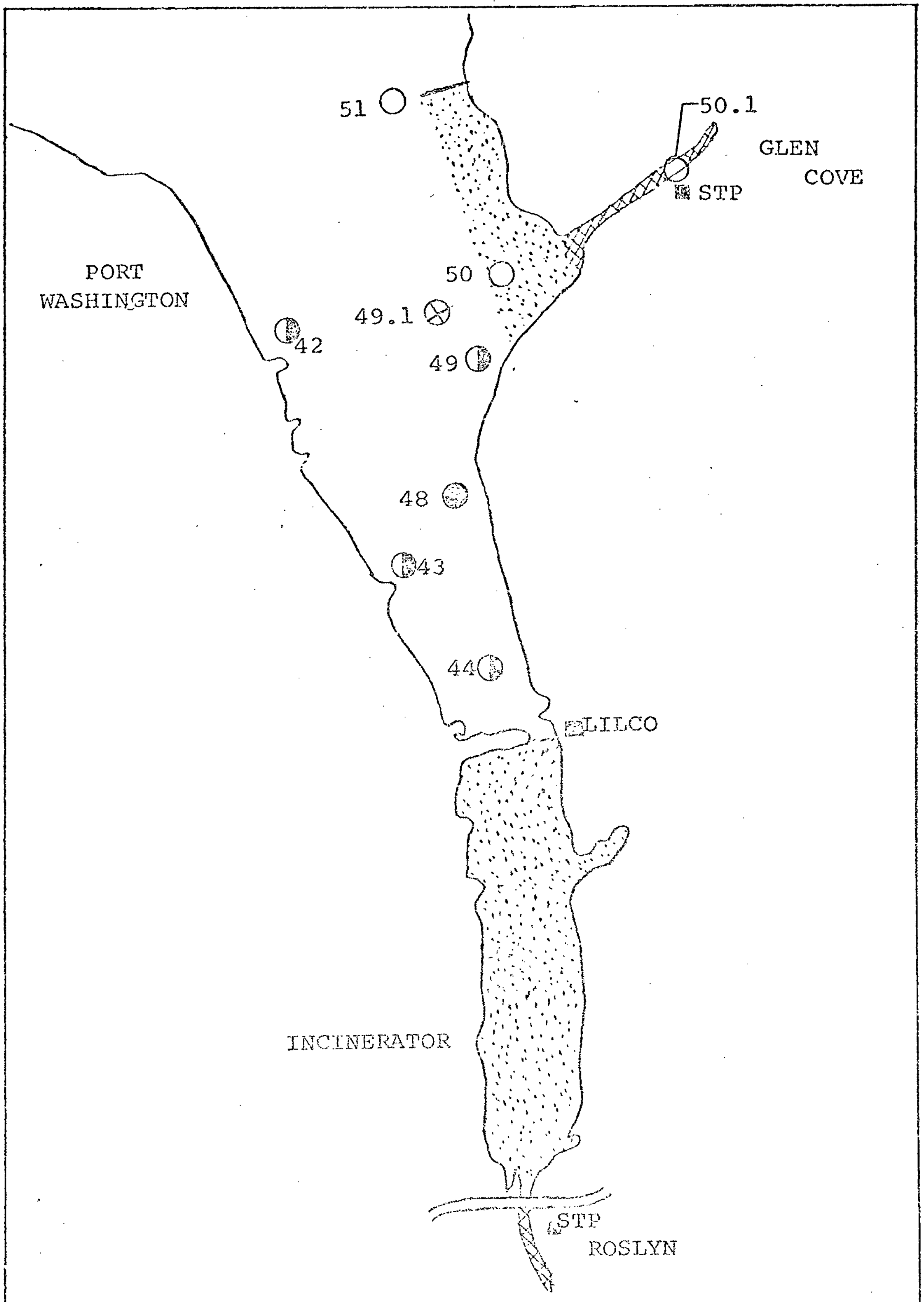
SOUTH OYSTER BAY
AREA 6
SAMPLING LOCATIONS
MAP 1-6



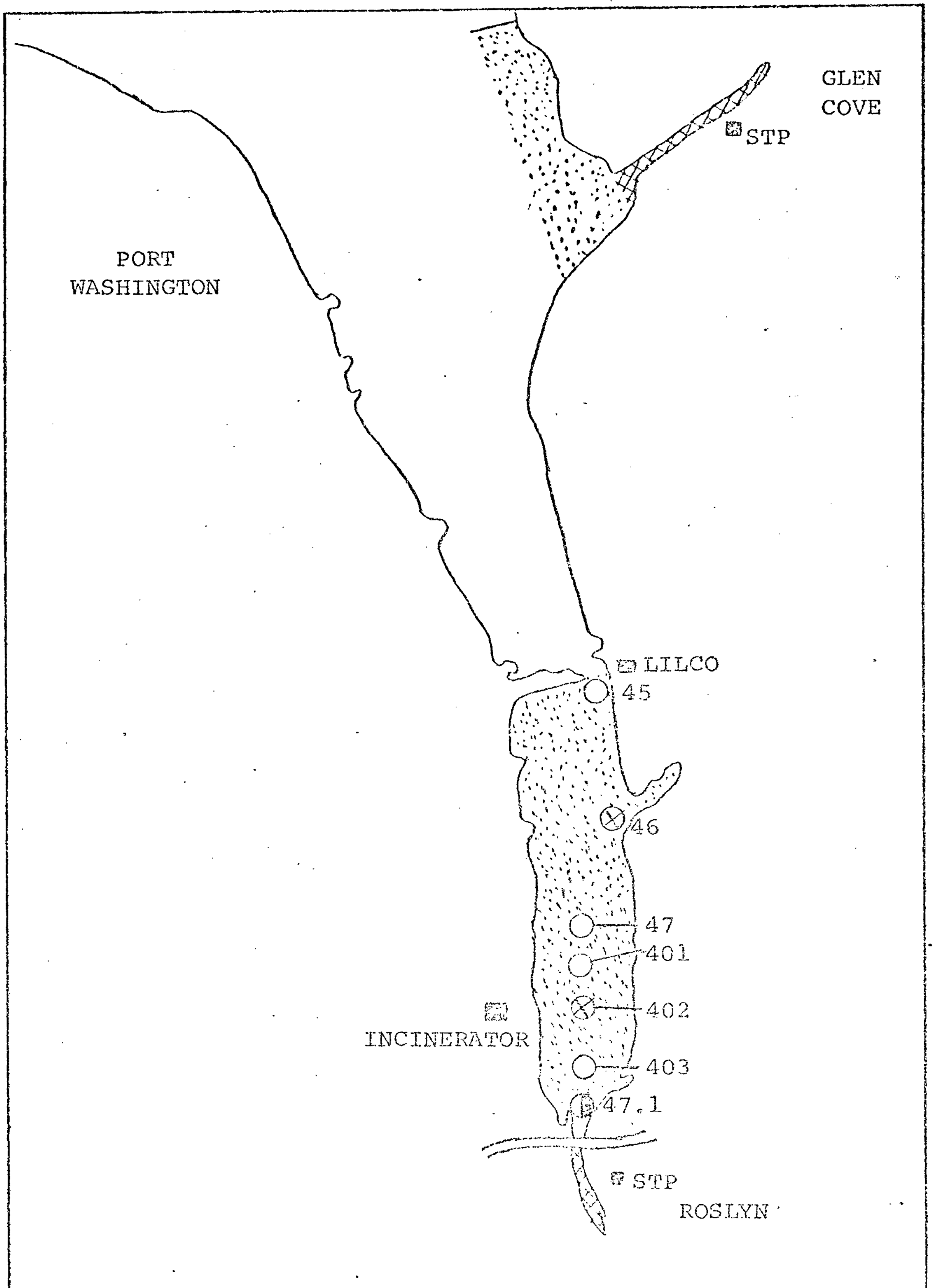
LITTLE NECK BAY
AREA 8
SAMPLING LOCATIONS
MAP 1-7



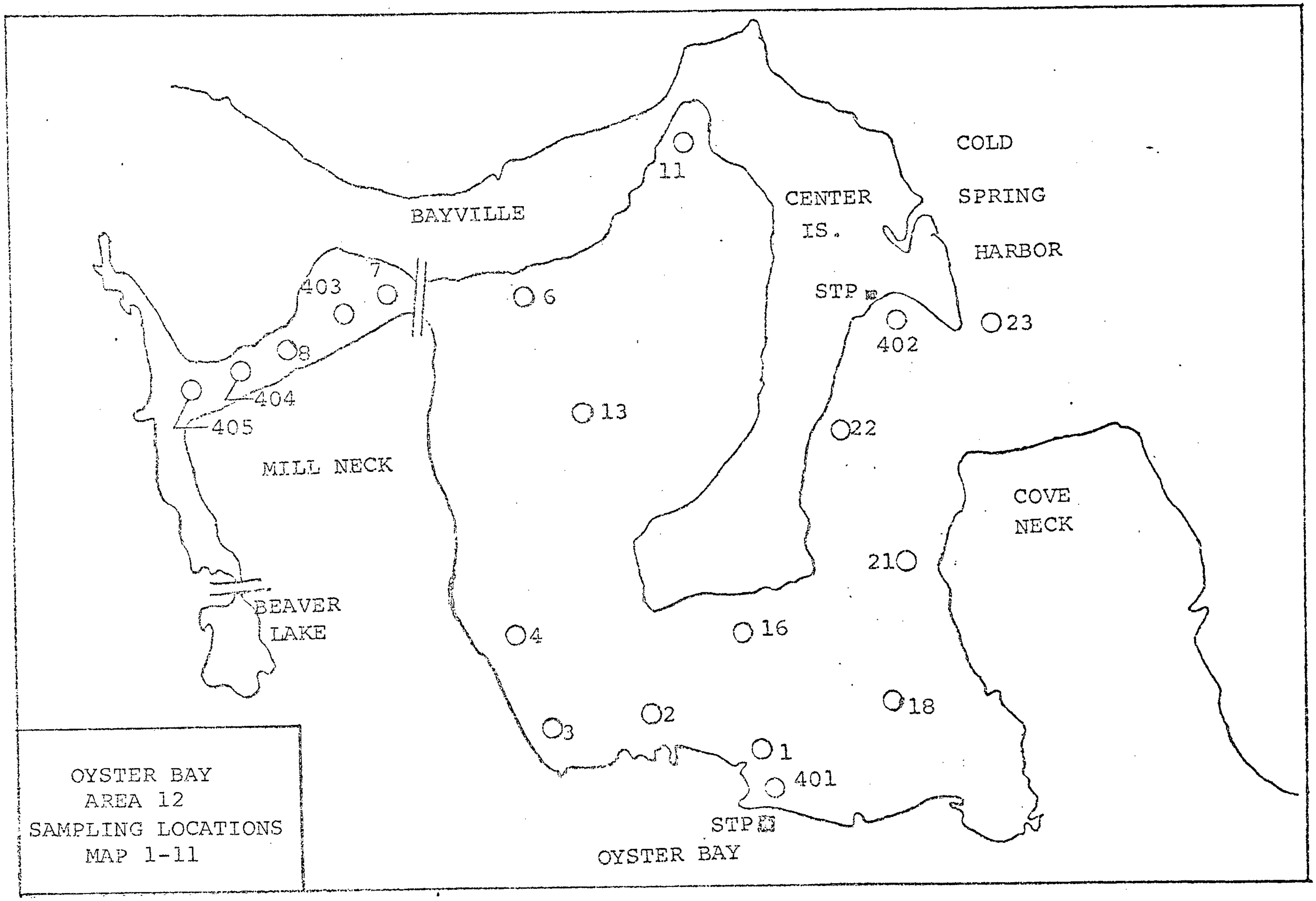
MANHASSET BAY
AREA 9
SAMPLING LOCATIONS
MAP 1-8

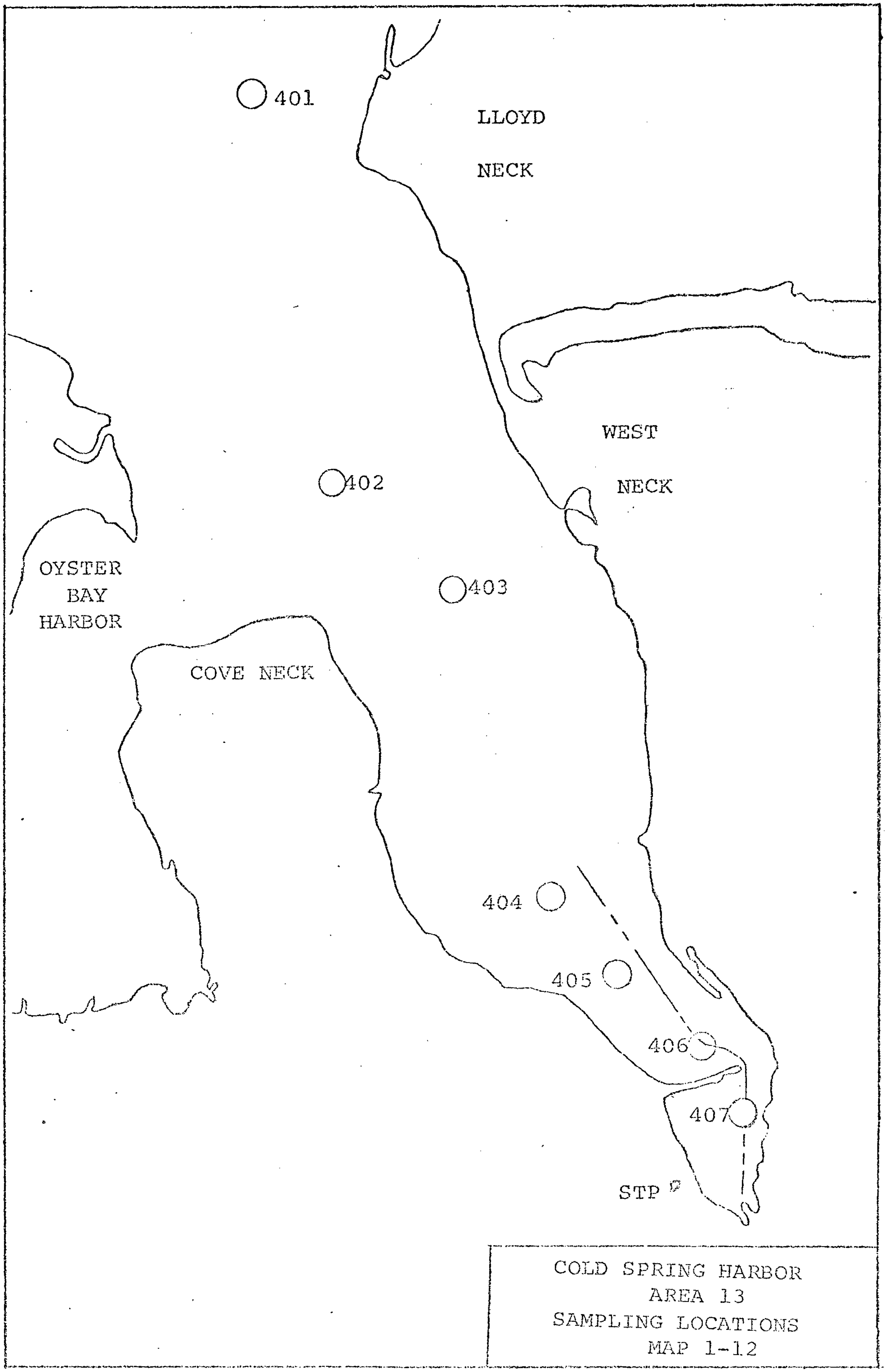


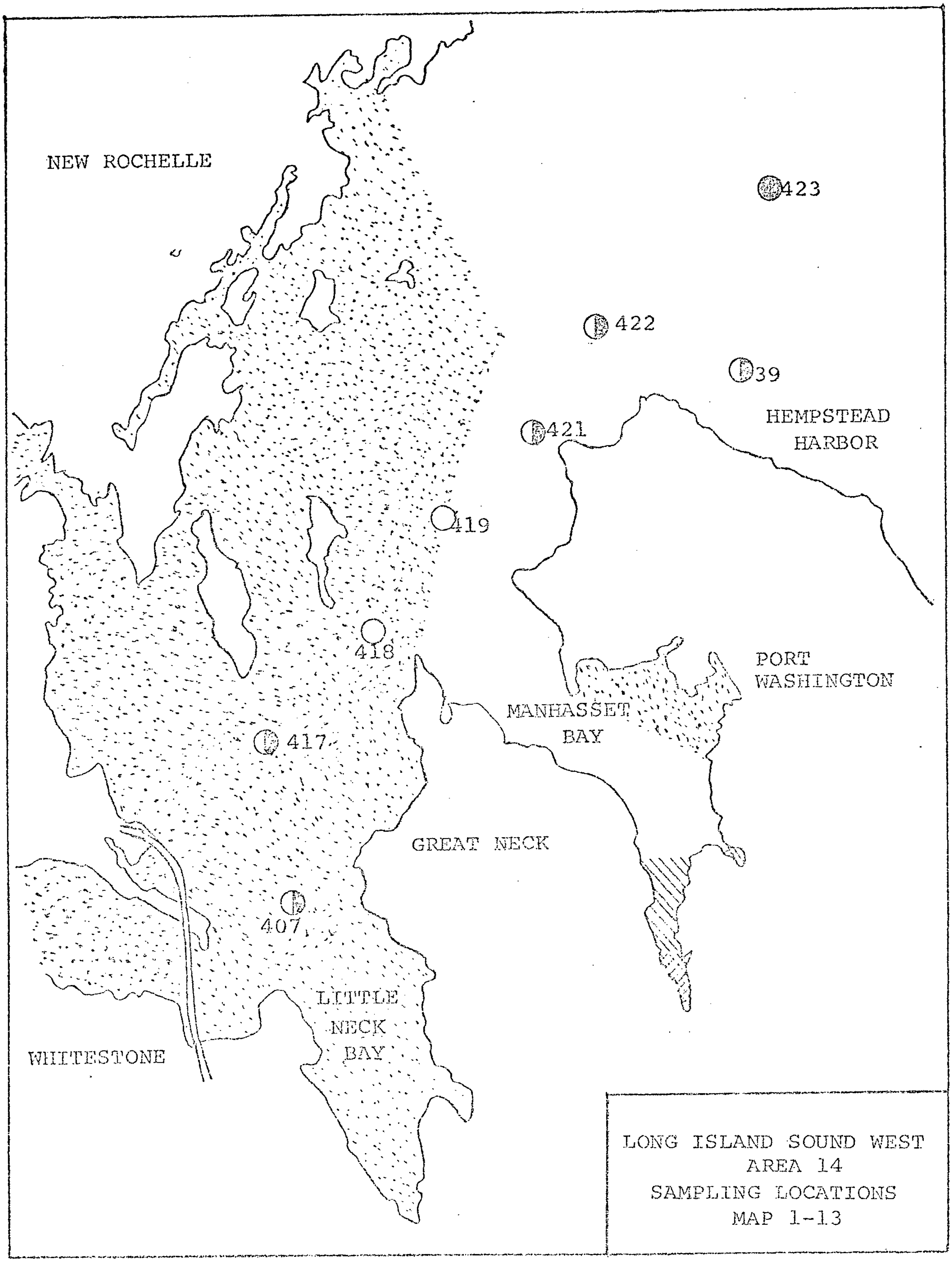
UPPER HEMPSTEAD HARBOR
AREA 10
SAMPLING LOCATIONS
MAP 1-9

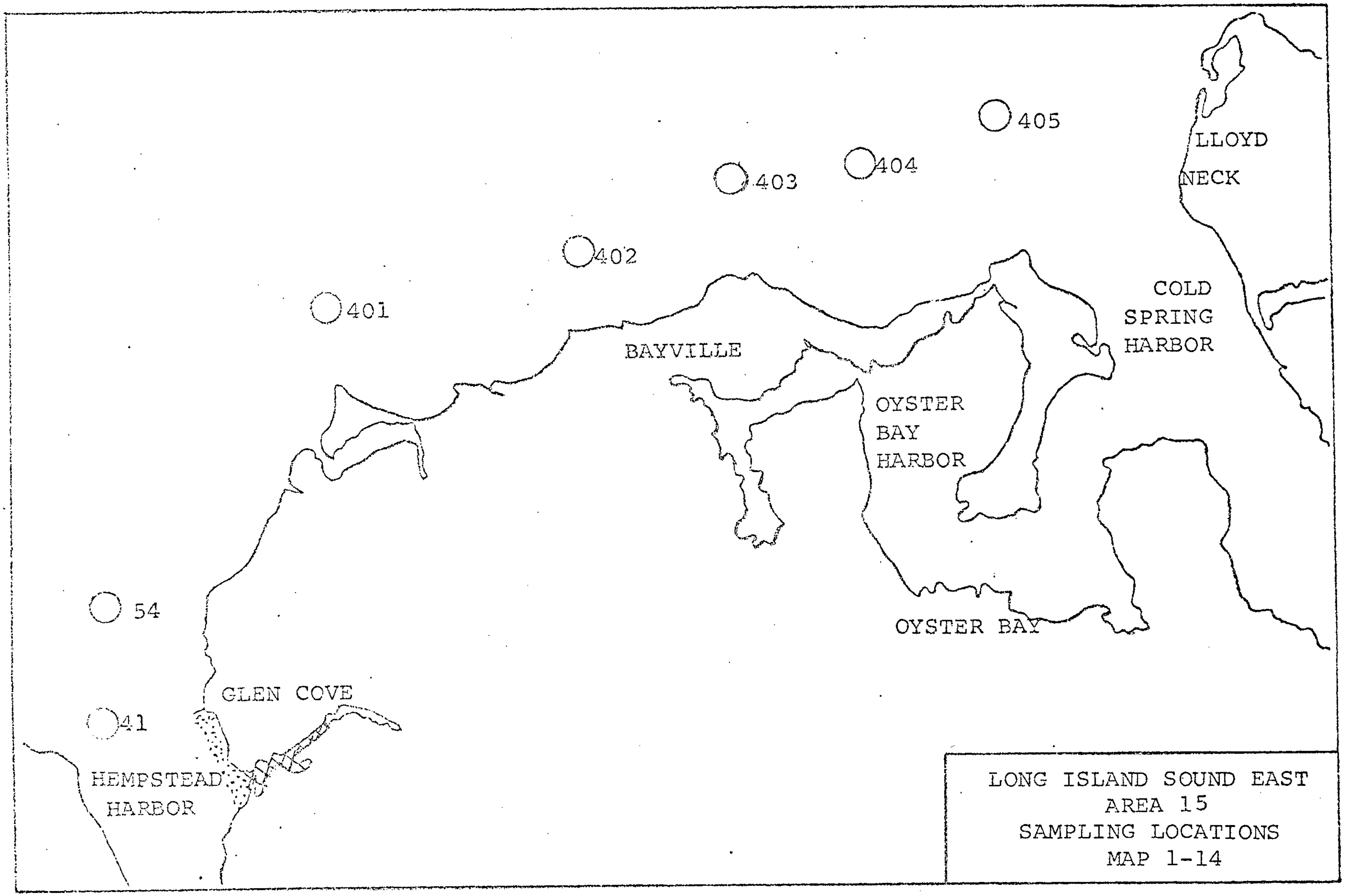


LOWER HEMPSTEAD HARBOR
AREA 11
SAMPLING LOCATIONS
MAP 1-10


BAYVILLE
11
CENTER
IS.
COLD
SPRING
HARBOR
STP
7
403
6
402
23
8
404
405
13
22
MILL NECK
COVE
NECK
21
BEAVER
LAKE
4
16
18
3
2
1
401
STP
OYSTER BAY
OYSTER BAY
AREA 12
SAMPLING LOCATIONS
MAP 1-11


401
LLOYD
NECK
WEST
NECK
402
OYSTER
BAY
HARBOR
403
COVE NECK
404
405
406
407
STP
COLD SPRING HARBOR
AREA 13
SAMPLING LOCATIONS
MAP 1-12


NEW ROCHELLE
423
422
39
421
HEMPSTEAD
HARBOR
419
418
PORT
WASHINGTON
MANHASSET
BAY
417
GREAT NECK
407
LITTLE
NECK
BAY
WHITESTONE
LONG ISLAND SOUND WEST
AREA 14
SAMPLING LOCATIONS
MAP 1-13



LONG ISLAND SOUND EAST
AREA 15
SAMPLING LOCATIONS
MAP 1-14

SECTION 2
BATHING WATER QUALITY

Introduction

The Department samples waters directly at permitted beaches (primary sampling points) and also at sources of waters surrounding beaches (secondary sampling points) which are likely to affect the quality of the water at permitted beaches. Sampling is scheduled at least five times per month during the months of April through September. In 1976 there were 38 primary sampling points and 46 secondary sampling points in the program.

The sampling results are run periodically in a computer program which compares all the results to-date with the applicable standards for bathing water quality and computes a verbal "rating" for each sampling point. The rating is a convenient way to understand how water quality compares from point to point and from year to year without a detailed knowledge of coliform levels or State and Federal standards. The best water quality is rated "Excellent," followed by "Very Good," "Good," "Fair," "Passable" and "Does Not Meet New York State Standards." (Bathing water quality does not meet New York State Standards when the total number of organisms of the coliform group exceeds a logarithmic average of 2400/100 ml. for a series of five or more samples in any thirty day period or when twenty percent of the total number of samples exceeds 5000 MPN/100 ml.)

Water quality ratings for Nassau's seventy-seven beaches for 1975 and 1976 are contained in Figure 2-1 which follows. The beach locations are shown in Figure 2-2. Figure 2-3 describes the specific standards which apply to each of the possible rating categories from "Excellent" to "Does Not Meet New York State Health Department Standards."

Figure 2-1

WATER QUALITY RATING FOR BEACHES OPERATED IN 1976

Seasonal Rating (April-September 30)

Map* Location	Name of Beach	Town	1975 Rating	1976 Rating
24	Atlantic Beach Club	H	Excellent	Excellent
14	Atlantic Beach Est. Park District	H	Excellent	Excellent
19	Atlantic Beach Hotel & Cabana Club	H	Excellent	Excellent
59	Bar Beach	NH	Passable	Fair#
38	Bay Park Beach	H	Passable	Very Good
57	Beacon Hill Bungalow Association	NH	Passable	Passable
56	Beacon Hill Residents Association	NH	Passable	Passable
75	Beekman Beach	OB	Good#	Fair#
49	Biltmore Beach Club	OB	Passable+	Good#
25	Capri Beach Club	H	Excellent	Excellent
4	Catalina Beach Club	H	Very Good	Very Good
72	Center Island Bay	OB	Excellent	Very Good
71	Center Island Sound	OB	Very Good	Very Good
67	Creek Club	OB	Excellent	Excellent
74	Creek Road Beach (Bayville Beach)	OB	Good#	Good
64	Crescent Beach	OB	Fair	Fair
10	Dutchess Boulevard	H	Very Good	Very Good
26	East Atlantic Beach	H	Excellent	Excellent
3	Eldorado Beach	H	Very Good	Very Good
48	Florence Avenue Beach	OB	Very Good	Very Good
51	Galloway Beach	NH	Passable+	Fair#
11	Genesee Beach	H	Excellent	Excellent
55	Harbor Acres Beach	NH	Passable	Passable
41	Harbor Isle Beach Club	H	Fair#	Good
58	Hempstead Harbor Beach	NH	Passable	Passable
37	Hewlett Point Park	H	Fair#	Good
54	IBM Country Club	NH	Passable	Passable
15	Inwood Beach Club	H	Excellent	Excellent

- Indicates beach rated "Passable" for some previous month during season.

+ - Indicates beach rated "Exceed Standard" for some previous month during season.

* See Figure 2-2

Figure 2-1 (cont'd)

WATER QUALITY RATING FOR BEACHES OPERATED IN 1976

Map Location *	Name of Beach	Town	1975 Rating	1976 Rating
	Seasonal Rating (April-September 30)			
40	Island Park (V) Pershing Place	H	Fair#	Fair#
39	Island Park (V) Waterford Road	H	Fair#	Good
13	Jefferson Boulevard Beach	H	Excellent	Excellent
42	Jones Beach State Park (Ocean Beaches)	H	Excellent	Very Good
66	Lattingtown Beach	OB	Excellent	Excellent
77	Laurel Hollow	OB	Good	Very Good
22	Lawrence Beach Club	H	Excellent	Excellent
30	Lido Beach Park District	H	Very Good	Very Good
31	Lido Beach Park (TOH)	H	Very Good	Very Good
29	Lido Cabana Club	H	Very Good	Very Good
28	Lido Hotel Beach	H	Very Good	Very Good
33	Lido Town House Apts.	H	Very Good	Very Good
17	Little Plaza Beach	H	Excellent	Excellent
27	City of Long Beach	H	Very Good	Very Good
50	Manhasset Bay Est.	NH	Passable+	Fair
53	Manorhaven Beach	NH	Fair+	Good
47	Merrick Estates Civic Association	H	Passable	Good#
16	Montgomery Boulevard Beach	H	Excellent	Excellent
62	Morgan Memorial Bay	OB	Passable	Fair
63	Morgan Memorial Sound	OB	Very Good	Very Good
34	Nassau Beach	H	Very Good	Very Good
8	New Nautilus Hotel	H	Very Good	Very Good
21	Ocean Club	H	Excellent	Excellent
68	Piping Rock Club	OB	Excellent	Good
7	Plaza Beach Club	H	Very Good	Very Good

\# - Indicates beach rated "Passable" for some previous month during season.

\+ - Indicates beach rated "Exceed Standard" for some previous month during season.

* See Figure 2-2

Figure 2-1 (cont'd)

WATER QUALITY RATING FOR BEACHES OPERATED IN 1976

Seasonal Rating (April-September 30)

Map * Location	Name of Beach	Town	1975 Rating	1976 Rating
6	Plaza Blvd. Beach	H	Very Good	Very Good
36	Point Lookout Park District	H	Very Good	Very Good
35	Point Lookout Town Park	H	Very Good	Very Good
52	Port Washington Est. Assoc.	NH	Passable+	Fair+
65	Pyribil Beach	OB	Excellent	Excellent
18	Putnam Blvd. Beach	H	Excellent	Excellent
70	Ransom Beach	OB	Excellent	Good
76	Roosevelt Memorial Park	OB	Very Good	Very Good
23	Sands @ Atlantic Beach	H	Excellent	Excellent
32	Sands Beach Club	H	Excellent	Very Good
9	Sea Cliff Beach Club	H	Very Good	Very Good
61	Sea Cliff (V) Beach	OB	Fair#	Fair#
2	Silver Point Beach Club	H	Very Good	Very Good
69	Stehli Beach	OB	Excellent	Good
1	Sun & Surf	H	Very Good	Very Good
60	Tappen Beach	OB	Fair#	Passable
44	Tobay Beach Bay	OB	Passable	Very Good
43	Tobay Beach Ocean	OB	Excellent	Very Good
46	Tobay Marina Beach	OB	Passable	Very Good
20	Vernon Beach	H	Excellent	Excellent
73	West Harbor Beach	OB	Excellent	Very Good
5	Westbury Atlantic Beach	H	Very Good	Very Good
12	Westbury Beach Club	H	Excellent	Excellent
44	Zach's Bay, Jones Beach	H	Passable	Very Good

- Indicates beach rated "Passable" for some previous month during season.

+ - Indicates beach rated "Exceed Standard" for some previous month during season.

* See Figure 2-2

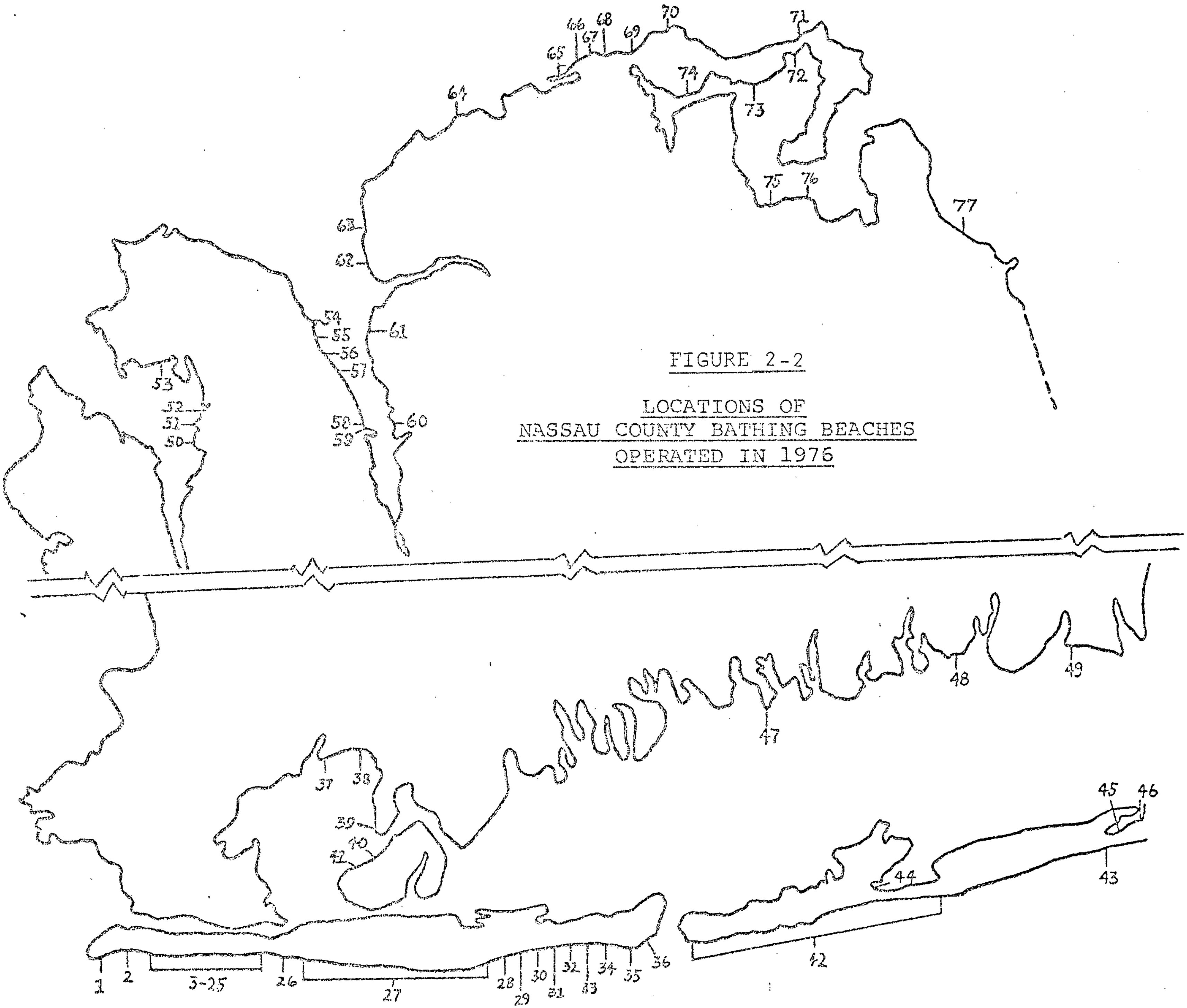


FIGURE 2-2

LOCATIONS OF
NASSAU COUNTY BATHING BEACHES
OPERATED IN 1976

Figure 2-3

1976

BATHING WATER QUALITY RATING CRITERIA

EXCELLENT - To obtain this rating, a bathing beach must have a cumulative (seasonal) log average of total coliform of not greater than 70 and individual total coliform counts of greater than 330 shall not have appeared in more than 10 percent of the total number of samples. If fecal coliform test is performed, no 30 day log average of fecal coliform shall be over 200, during the current month.

VERY GOOD - To obtain this rating, a bathing beach must meet the following:

a) its cumulative (seasonal) log average of total coliform must not be greater than 240;
b) no 30 day running log average result of total coliform shall be greater than 500;
c) individual total coliform counts shall not be greater than 5,000 for 20 percent or more of the total number of samples.
d) if fecal coliform test is performed, no 30 day log average of fecal coliform shall be over 200, during the current month.

GOOD - To obtain this rating a beach shall:

a) have a cumulative log average of total coliform not greater than 240;
b) individual total coliform counts shall not be greater than 5,000 for 20 percent or more of the total number of samples.
c) if fecal coliform test is performed, no 30 day log average of fecal coliform shall be over 200, during the current month.

FAIR - To obtain this rating a beach must have the following:

a) no 30 day fecal coliform log average shall be greater than 200; during the current month.
b) no 30 day total coliform log average shall be greater than 2,400; during the current month.
c) individual total coliform counts shall not be greater than 5,000; for 20 percent or more of the total number of samples.

PASSABLE - Meets "Fair" rating and has a 30 day fecal coliform log average exceeding 200 MPN during the current month.

EXCEEDS N.Y.S.H.D. STANDARDS - A beach is rated "Exceeds N.Y. State Health Department Standards" when the 30 day log average for total coliforms goes over 2,400 at any time during the month, or when 20 percent or more of the season's samples contain total coliform counts in excess of 5,000.

Rating with # symbol indicates beach was passable at some time previously during the season, but has improved from this rating during the current month.

Rating with + symbol indicates beach exceeded N.Y. State standards previously during the season, but has improved from this rating during the current month.

SOUTH SHORE WATER POLLUTION EMERGENCIES

During 1976, bathing was interrupted several times at Nassau County beaches because of significant water pollution emergencies which threatened the bacterial quality of the bathing waters.

Sludge Storage Tank Explosion

The explosion of two sludge storage tanks in the middle of Hempstead Bay on the evening of June 2, 1976 discharged over one million gallons of sewage sludge into the surrounding waters and necessitated the temporary prohibition of bathing at all the area's beaches. Although most of the beaches had not yet been officially opened to bathing, pre-season beach goers were warned by the Commissioner of Health to avoid bathing in the waters of Hempstead Bay and the Atlantic Ocean from East Rockaway Inlet to Jones Inlet. After extensive testing of the area's waters, the Department came to the conclusion that bacterial contamination was short-lived and limited in area to Hempstead Bay. Coliform bacteria levels in Hempstead Bay, which were one and one half to five times above normal levels twelve hours after the explosion, were back to their normal levels thirty-six hours after the explosion. Figure 2-4 shows the tanks' locations in Hempstead Bay.

An analysis of results from water quality sampling for the five days following the explosion resulted in removal of the bathing prohibition at the ocean beaches by Monday, June 7th. Bathing at the Hempstead Bay beaches was prohibited until June 25th, because of dredging at the tank site to remove sludge deposited on the bay bottom.

Lawrence Sewage Treatment Plant Accident

A second sludge accident occurred in June at the Lawrence sewage treatment plant in southwestern Nassau. Approximately 10,000 gallons of sewage sludge was discharged into Bannister Creek when a storage trough collapsed on the morning of June 18, 1976. Some of the sludge was carried by the creek into Reynold's Channel. This accident also briefly raised coliform bacteria levels in the bay to above-average levels, but no health affect was realized because the bay was already closed to bathing due to dredging of the bay bottom in the area of the June 2nd tank explosion. Sampling conducted six days after the Lawrence accident indicated that the bay had returned to its normal condition and all beaches in the bay were permitted to re-open at that time.

Sewage Debris Encroachment

The third occurrence to interrupt bathing at Nassau County beaches was the encroachment on Ocean Beaches of sewage-related debris and material. This material was first noticed on Nassau County ocean beaches on June 16. The debris included tar balls and grease balls from pebble to fist size, tampon inserters, condoms, straws, plastic material, combs and food wastes. The occurrence of this material was extremely unpredictable, appearing for several days, vanishing for days and reappearing again. The heaviest accumulations occurred from June 21 to June 25 and from July 8 to July 9. The extent of wash-ups was likewise very variable, occurring on some days from Suffolk County through Nassau and into Queens, and on other days occurring in two or three mile stretches only.

The appearance of this debris on Nassau County ocean beaches represented another potential threat to the health of bathers, because of the sewage-related material which was present. Accordingly, on June 22, 1976, the Commissioner of Health again ordered Nassau ocean beaches closed to bathing until testing of the ocean waters could be completed. In addition to daily water testing at 12 ocean beach points, the Department also began daily watches of the entire ocean shoreline for signs of further debris deposits. Ocean beaches were permitted to re-open on June 24 when tests indicated that bacterial water quality had not been seriously impaired by the floating debris. (Because some of the tar balls in the debris were found to contain high bacterial levels, beach operators were requested to remove the debris promptly and the public was cautioned to avoid contact with the material). An investigation into the causes for the beaches' fouling included analysis of organic material deposited on shore, expanded offshore sampling, analysis of wind and current information and data compilation on sewage disposal throughout the New York Metropolitan area.

Review of this information, together with previous studies of the New York Bight apex has lead to the conclusion that the sewage floatables washed ashore on Nassau County ocean beaches originated primarily from raw sewage discharged directly or indirectly into New York Harbor and not primarily from ocean disposal of municipal sewage sludge. Areas of raw sewage discharges are shown in Figure 2-5. The mechanism of transport from New York harbor to Nassau ocean beaches is readily demonstrated by the cyclical pattern of wind direction and intensity which correlates with

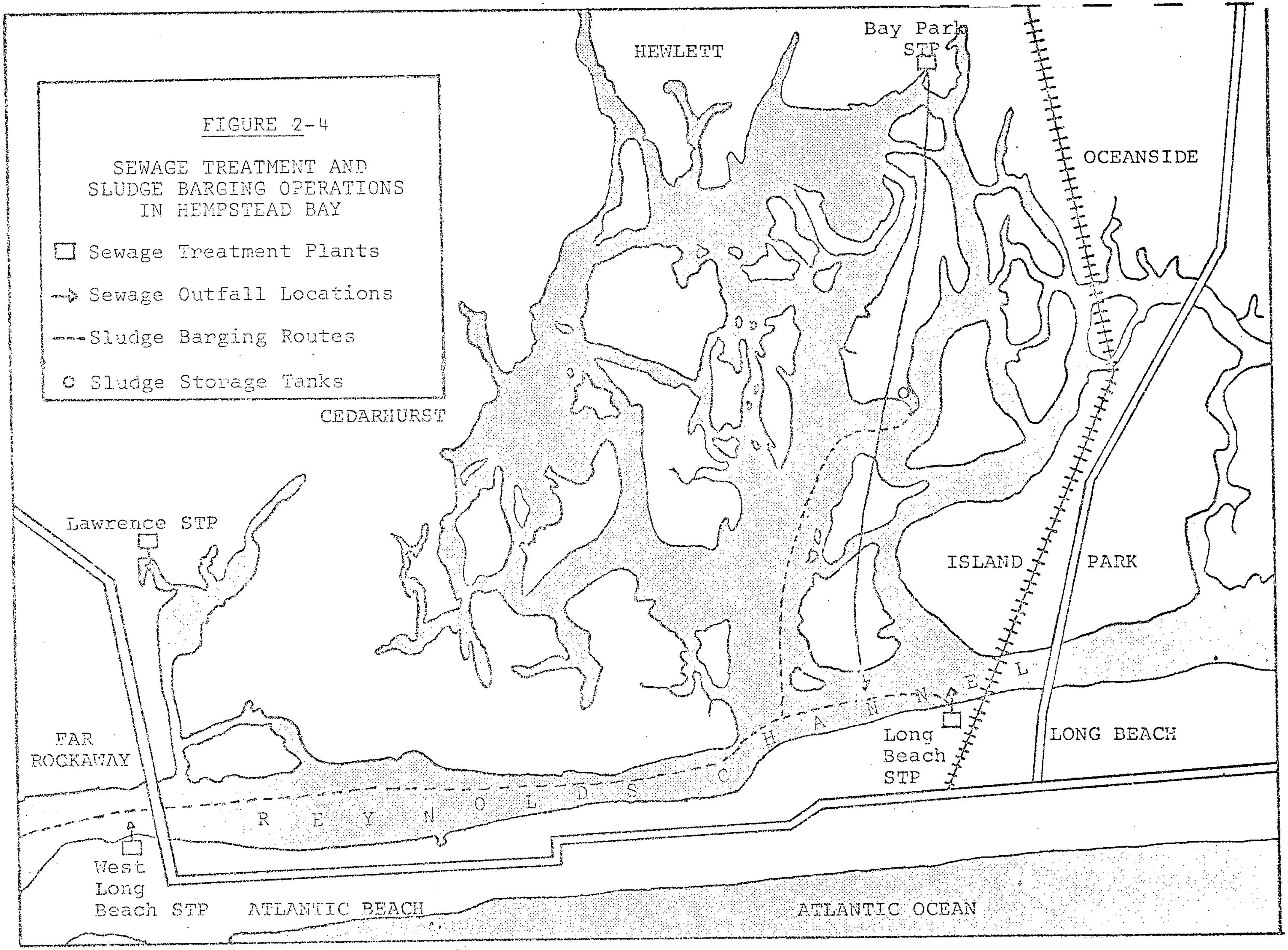


FIGURE 2-4
SEWAGE TREATMENT AND SLUDGE BARGING OPERATIONS IN HEMPSTEAD BAY
Sewage Treatment Plants
Sewage Outfall Locations
Sludge Barging Routes
Sludge Storage Tanks
HEWLETT
Bay Park STP
OCEANSIDE
CEDARHURST
Lawrence STP
ISLAND PARK
FAR ROCKAWAY
REYNOLDS CHANNEL
Long Beach STP
LONG BEACH
West Long Beach STP
ATLANTIC BEACH
ATLANTIC OCEAN

the arrival of the material on the beaches. Unusually persistent south and southwest winds prevailed during June and early July of 1976 in comparison to observations made during the previous ten years.

Although some of the organic solids contained high bacterial densities, fortunately, the floating debris which washed up on Nassau County's ocean beaches had minimal impact on coliform levels in the water. The bacterial quality at Long Beach beaches was undisturbed from previous years' levels. Although bacterial levels were three times higher than previously experienced at Jones Beach beaches, they were still well within acceptable State Bathing Water Standards. (Jones Beach ocean waters normally contain an average total coliform level of approximately 50 MPN/100 ml. During June and July of 1976, these waters contained an average of up to 150 MPN/100 ml; well within the State limit of 2400 MPN/100 ml.)

Because of the minimal impact on bacterial quality of the ocean waters, bathing was permitted to resume by June 24, although the public was warned to avoid contact with material deposited on shore and beach operators were asked to remove shore deposits as quickly as possible.

The fouling of Nassau's ocean beaches was most probably caused by the unusual wind conditions prevailing at the time and there is no reason to believe that these conditions will not recur. The only remedy which would prevent a recurrence is elimination of the discharge of raw sewage and combined sewer overflows by New York City and this elimination is not expected in the near future.

EFFECT OF WATER POLLUTION INCIDENTS ON BATHING WATER QUALITY

Water pollution incidents in 1976 had no significant effect on overall county bathing water quality on the south shore. Seasonal average bacterial levels were at their lowest levels of the past several years at most of the south shore bay's beaches. This can be attributed partly to slightly less than average rainfall for the period and partly to abatement efforts made by this and other agencies.

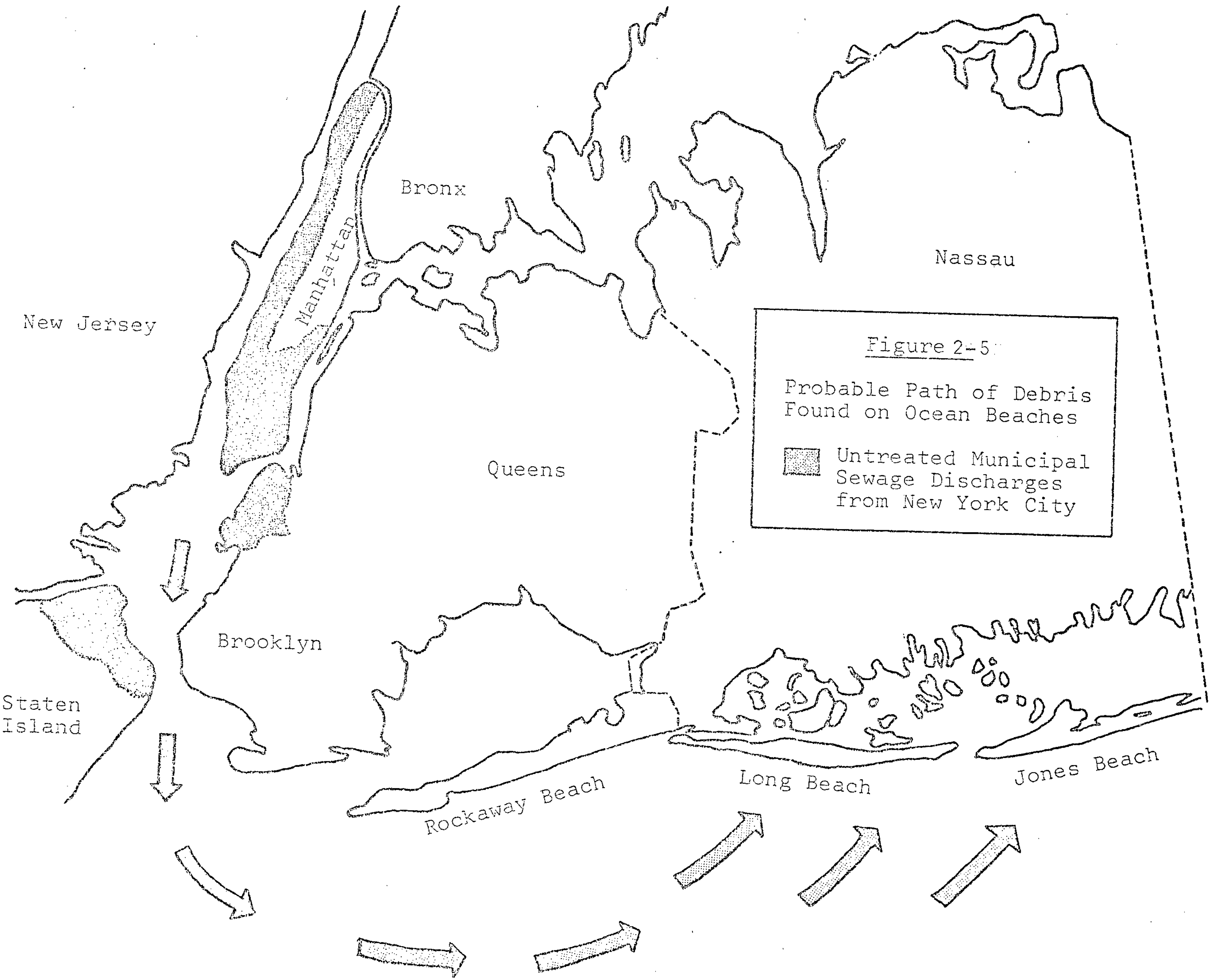


Figure 2-5

Probable Path of Debris Found on Ocean Beaches

Only 18.8 inches of rain was recorded on the south shore between April 1, 1976 and Sept. 30, 1976. This is slightly less than the average of 20.8 inches for this period recorded during the previous ten years. The rainfall factor is important to bathing water bacterial quality because rainfall washes animal feces, nutrient material and other debris into the bays, elevating coliform bacteria levels in the process.

Water pollution abatement efforts included improvements in the effluent quality of the Bay Park Sewage Treatment plant (which reduced coliform bacterial levels at three beaches in Island Park) and improved drainage from Massapequa Lake, resulting in decreased coliform bacteria levels at Biltmore Beach Club in Massapequa. Improvements to the Bay Park plant's treatment processes resulted in increased retention and improved sewage settling in the secondary treatment stage. Replacement of chlorine weighing equipment also was accomplished, allowing for continuous effluent chlorination, which previously had been unreliable.

In Massapequa, drainage from Massapequa Lake was improved by the opening of the East Spillway, which had been closed since 1971. This reduced the impact of the lake's water on Biltmore Beach to the south. Prior to this, all the flow from the lake was carried by the west spillway. Biltmore Beach bathing water quality was significantly improved in 1976 compared with 1975 quality, partially because of this action.

NORTH SHORE WATER QUALITY

An interruption of treatment at New York City's Bowery Bay sewage treatment plant after Hurricane "Belle" on August 9, 1976, caused concern about possible effect on North Shore Bathing Water Quality. For a period of three days, electricity was off at the plant, resulting in the discharge of approximately fifty million gallons per day of raw sewage to western Long Island Sound. Although an elevation of coliform bacteria levels at many beaches on the Sound was evident from August 9th through August 13, State bathing water standards were still met by the beaches. Unfortunately, it is impossible to distinguish the plant's effect from the effect of the 7.43 inches of rainfall which accompanied the hurricane (the occurrence of as little as 0.10 inches of rain can elevate coliform bacteria levels at beaches.)

Manhasset Bay

Although two of the four beaches located on Manhasset Bay experienced their lowest seasonal average coliform levels of the last few years, two of these beaches experienced peak coliform bacteria levels in July which approached the State bathing water maximum permissable level. One beach exceeded the maximum. Port Washington Estates Association beach experienced a log average of total coliform of approximately 3900 MPN/100 ml. for the 30 day period ending July 2, 1976. This was well in excess of State bathing water quality standards which specify a maximum total coliform log average of 2400 MPN/100 ml. for any thirty day period. The two beaches which approached the maximum permissable level were Galloway and Manhasset Bay Estates Association beaches. Thirty day log averages of total coliform at these beaches reached 1800 MPN/100 ml. during 1976.

Hempstead Harbor

Tappen and Bar beaches, on Hempstead Harbor, were unimproved in 1976 despite below average rainfall. Tappen Beach had its highest seasonal average of total coliform of the last nine years. While both beaches have shown an increasing trend of coliform bacteria levels over the past nine years, the rate of increase is much greater at Tappen than at Bar Beach. The other seven beaches in the area do not show a significant increasing trend in coliform levels over the past nine years. These are Hempstead Harbor Park in the middle portion of the bay and Sea Cliff Village Beach, IBM County Club Beach, Harbor Acres, Beacon Hill Bungalow Association Beach, Beacon Hill Residents Association Beach and Morgan Beach at the northern end of the bay.

The increasing trend in coliform bacteria levels at Tappen and Bar Beaches is of concern to the Department and the Towns of North Hempstead and Oyster Bay. These beaches are affected by several pollution sources in the bay including some which have been partially controlled in recent years. Apparently, additional control will be necessary in the future in order to reverse the trend of increasing coliform levels at these beaches. A major source of contamination at these two beaches appears to be the large drain which discharges just north of the LILCO power plant in Glenwood Landing. This drain provides storm drainage for a 3.5 square mile area of Glenwood Landing, but also has a dry weather flow of approximately 1.1 million gallons per day with an average total coliform bacterial density of 20,000 MPN/100 ml. Despite the elimination of several illegal sewage discharges into this system, the drain continues to have high coliform bacteria concentrations. This Department continues to recommend that this area be sewered in order to eliminate sewage contamination of surface and ground waters in the area.

Another source of bacterial contamination, particularly at Tappen Beach, is the discharge of Scudder's Pond. Although bacterial densities in the pond are only one-tenth of those found in the powerhouse drain, the pond discharges right on Tappen Beach and certainly is partially responsible for high bacterial levels at Tappen Beach.

Oyster Bay

Bacterial densities at Oyster Bay area beaches also increased over 1975 levels despite decreased rainfall. While none of these five beaches shows a significant trend of increasing bacterial levels over the past several years, the fact that there was no decrease in 1976 corresponding to the decrease in rainfall, is disturbing. This can only lead to the conclusion that factors other than storm drainage are primarily responsible for the coliform levels present at Oyster Bay area beaches. A study was begun in 1976 into the reasons for increasing bacterial levels in the Mill Neck Creek area of Oyster Bay, but this work has not yet been completed.

Long Island Sound

Eight of the nine beaches on Long Island Sound continue to enjoy good to excellent bathing water quality. These show only a slight increase over the past eight years of sampling. The exception is Crescent Beach in Glen Cove, which generally follows a pattern of increased bacterial levels with increased rainfall occurrence. This is believed due to its location, directly adjacent to the discharge of a pond and two storm drains. These would account for the beach experiencing only "fair" water quality when other Long Island Sound beaches experience "good" to "excellent" water quality.

Seasonal log average total coliform levels for all the beaches under permit in 1976 are presented in Appendix II for comparison with prior years' seasonal levels since 1971.

SECTION 3

ATLANTIC OCEAN MACROBENTHIC STUDY

Introduction

In 1975, the Nassau County Department of Health initiated an ocean sampling program to monitor the impacts that ocean disposal of sewage sludge, 10 nautical miles south of Atlantic Beach may have on the County's surface waters and sediments.

As part of this program, a macrobenthic study was carried out on 21 sediment samples retrieved from areas south of Long Island's East Rockaway and Jones Beach Inlets during the spring of 1975. Samples taken along two north-south transects include sediments from areas which are designated to be impacted by the dumping and migration of sewage sludge south of Atlantic Beach.[1] (Locations appear in Fig. 3-1 and Table 3-1)

Standard qualitative and quantitative macrobenthic analyses consisting of sediment sieving, microscopic examination, taxonomic classification and enumeration, provide data for understanding relationships between observed sediment types, dominant species and numbers and kinds of organisms, and for defining the types of biological communities found.

Data from this study which is described in Appendix III provides a basis for comparison for future studies to detect biological changes which may occur due to seasonal cycles and/or the halting or continuation of the sludge dumping operations.

Benthic populations are important tools in assessing the health of an ecosystem and determining effects that natural or man-made stresses may have on these systems due to their constant presence, somewhat long lives, sedentary habits and differing tolerance to stresses.

Discussion and Findings

In general, the success of a community depends upon a complex group of conditions, and any condition which approaches or exceeds the tolerance limits for the biota becomes a limiting factor. Usually, the total number of species is reduced when conditions become severe. The concentration levels and distribution of organic and inorganic material within an environment are important instruments in controlling the nature of the substrates in which the community resides.

1 March 1976, "Report On The Impact of Ocean Sludge Disposal On The Nearshore Water and Sediment Quality, Nassau County, New York", Nassau County Department of Health

Substrate type is a prime factor affecting the distribution of benthic species and the communities they comprise. Species present are related to the substrate by both their feeding mechanisms and their physical adaptations for burrowing, tube building, sessile attachment or mobile living.

In most sediments of Transect #1, south of East Rockaway Inlet, fine particulates composed of silts, clays, muds, and organic detritis accumulate to produce low energy silty sand environments inhabited primarily by deposit-feeding organisms. These species extract their nutrition from the organic-rich particles composing the sediment. They plow and rework the upper sediment layers producing a silty surface layer which is easily resuspended by currents. This "fecal surface," so named by Rhoads (1970) in Pratt (1973), clogs the filtering mechanisms of suspension feeders, buries newly-settled larvae and prevents attachment of sessile forms.

In this transect, the exceptions to these silty communities are found in the gravelly sediment retrieved from station #2, 1 nautical mile offshore and the sandy area beneath the surface dump site station 11 and 11S, 10 and 10 1/2 nautical miles offshore, respectively where depressed communities were found. (See Kite Graph, Fig. 3-2) A coarse, gravelly substrate such as that located at station #2 inherently offers an inhospitable environment for burrowing organisms as illustrated by the presence of only three species, the ubiquitous Nematodes, the suspension feeders Mytilus edulis (blue mussel) and Mya arenaria (steamers). The sandy "dump site" supported only a few nematodes and tube dwelling polychaete worms (fragments). Also present were 1/2 shells of Spisula solidissima (surf clam) and Pitar morhuana (a hard clam).

The sandy sediment 1/2 mile south of the dump site, which was both chemically and physically similar to the dump site sediment, shows repopulation by benthic organisms. This sediment contained live Spisula, Tellina and Pitar (clams) species, all of which, according to Pratt (1973), are inhabitants of high energy sandy sediments. These environments contain little or no silts, clays or muds, and much of the organic material remains suspended in the water at or near the sediment surface due to currents and other physical phenomena. The inhabitants are primarily suspension feeding (filter-feeding) species adapted for movement and recovery from burial, and obtain their nutrition from organically-rich suspended particles. The area 1/2 nautical mile north of the dump site, is also highly populated. This sediment contains more silt and higher chemical parameter levels than those sands at and south of the dump site.

Pratt (1973), using work by Thorsen (1957), Wigley (1958), and others, outlines basic faunal groups found in sediments on the continental shelf of the mid-Atlantic Bight region. Species listed in his work as being common to sandy and silty sand habitats were exemplified in this study.

On the basis of chemical analysis of sediment for heavy metals and organic contents, the presence of "sewage artifacts" and bacterial analysis, it has been concluded (Nassau County Department of Health March 1976 Sludge Report) that the leading edge of the sludge migration is within 5 miles south of Atlantic Beach easterly to within 6 miles south of Jones Inlet. The shoreward migration of the sludge may be enriching the sediments on the outer perimeter of the dumping zone. This potential beneficial effect of the sludge dumping operation becomes evident at station #6, five nautical miles north of the dump site. Here the highest chemical parameter levels and the greatest amount of silt are contained in a sediment which supports a record 20 species (Fig. 3-2) of tolerant organisms normally consistent with silty sand faunal communities.

High energy sandy communities composed of suspension and deposit-feeding organisms are found in most areas of Transect #5 south of Jones Inlet. These communities were also reported in another 1975 Health Department Benthic Study carried out in the vicinity of the Cedar Creek Water Pollution Control Facility Ocean Outfall located approximately four nautical miles to the east of Transect #5. In the outfall study, <u>Spisula solidissima</u> was reported to be the dominant organism in most stations. In this sludge study, only low numbers of live infant species were noted, but many dead were seen as half-shells at most stations. This is not uncommon in that the spat of any species is subject to high mortality in the natural environment.

A silty-sand community of deposit feeders is found in the enriched sediment from station #6 on Transect #5, a distance 8 nautical miles east and 4 nautical miles north of the dump site area. The sediments in this area are somewhat similar physically, chemically, and biologically to corresponding silty-sand areas in Transect #1 and again seem to show a certain enrichment, possibly from sewage sludge migration.

Conclusions

The limited data obtained from this initial sampling indicates that the sediments studied are not abiotic. On the contrary, sediment enrichment, possibly resulting from sludge disposal, has produced some highly populated areas whose inhabitants are an important basis for the food chain leading to man. However, the potential for biomagnification of harmful contaminants must be considered before any beneficial affects of the sludge dumping operation can be realized.

Recommendations

- The Benthic sampling as part of the overall Sludge Monitoring Program should continue. Sampling of Transects #1 and #5 should be carried out at different seasons so that any temporal differences in community structures may be noted.

- In order to better establish a "control" situation, sampling should be carried out from a Transect "O" located to the west of Transect #1 and from a Transect further to the east of Transect #5.

- Sampling by other agencies, such as the New York State Department of Environmental Conservation, in the areas of fin and shell fisheries production would give more insight into the overall productivity and the potential for "bio-concentration" of heavy metal contaminants found within this environment.

- The term "dump site" should be reserved for a surface designation and not be used relative to bottom stations. The term "sludge settling area" may be substituted to more correctly depict the differences between surface and bottom phenomena.

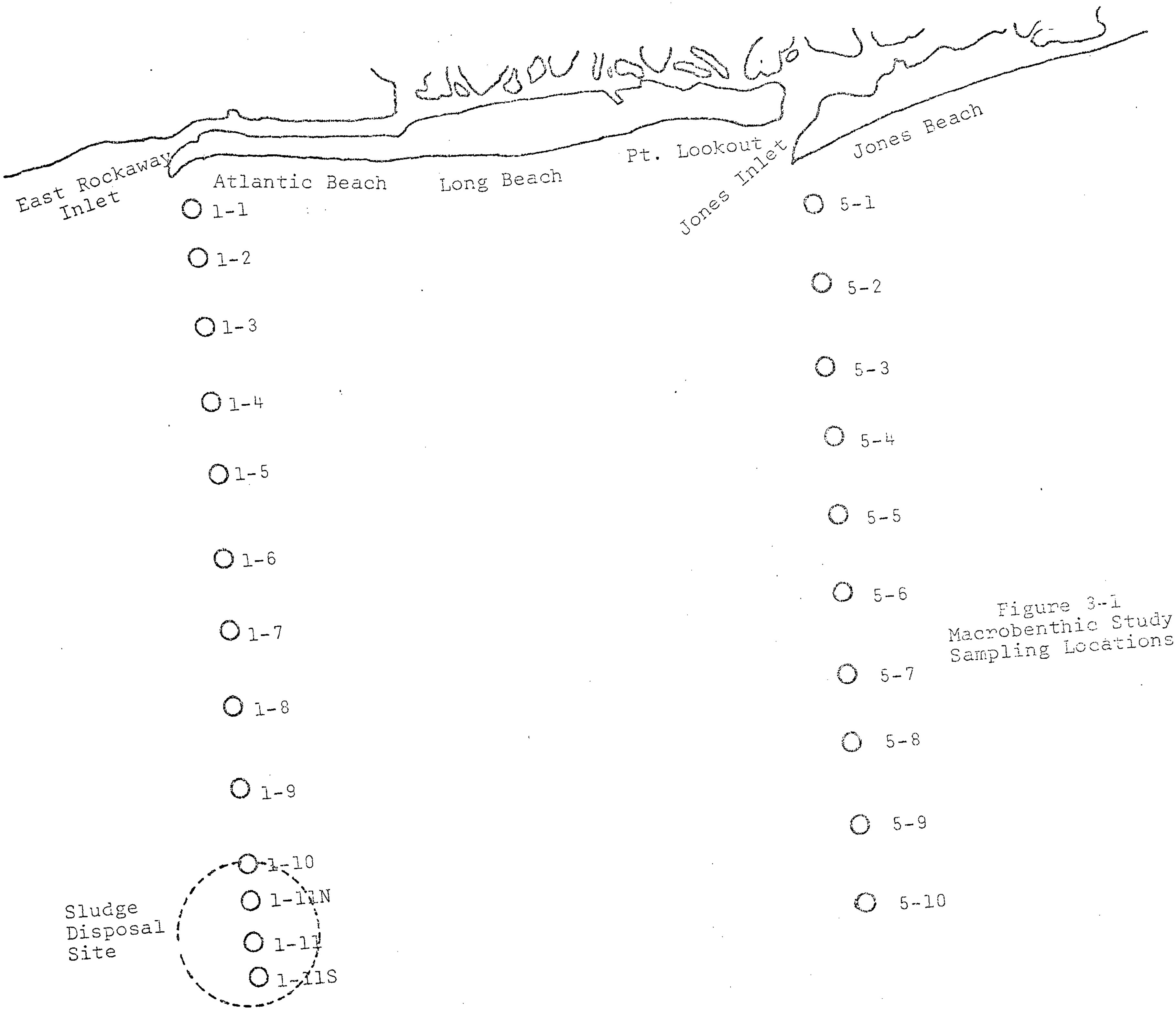


Figure 3-1
Macrobenthic Study
Sampling Locations

figure 3 - 2

KITE GRAPH: NUMBER OF SPECIES vs LOCATION SAMPLED

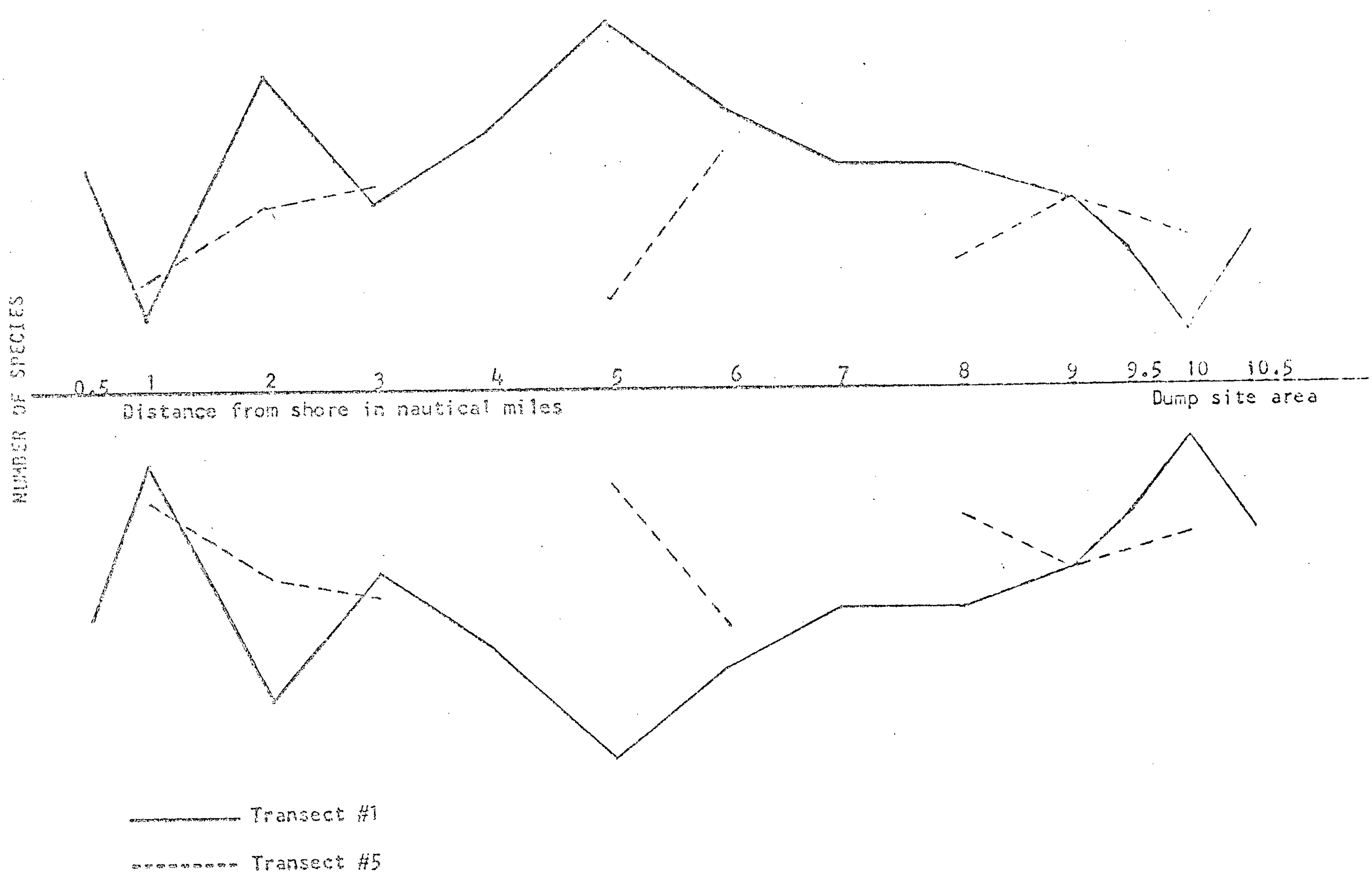


TABLE 3-1

SAMPLING STATION LOCATION AND SEDIMENT DESCRIPTION - MAY 1975

Station	Latitude	Longitude	Depth (Ft.)	Physical Description
1-1	40°34'30"	73°45'00"	32	Fine Sand-Some Silt
1-2	40°34'00"	73°45'00"	40	Fine & Coarse Gravel
1-3	40°33'00"	73°45'00"	51	Silty Sand
1-4	40°32'00"	73°45'00"	60	Silty Sand
1-5	40°31'00"	73°45'00"	70	Silty Sand
1-6	40°30'00"	73°45'00"	77	Silty Sand
1-7	40°29'00"	73°45'00"	86	Silty Sand
1-8	40°28'00"	73°45'00"	86	Silty Sand
1-9	40°27'00"	73°45'00"	88	Silty Sand
1-10	40°26'00"	73°45'00"	92	Silty Sand
1-11N	40°25'15"	73°45'00"	93	Silty Sand
1-11	40°25'00"	73°45'00"	83	Yellow Sand
1-11S	40°25'45"	73°45'00"	75	Yellow Sand
5-1	40°34'00"	73°45'00"	25	Fine & Coarse Sand
5-2	40°33'00"	73°45'00"	40	Fine Sand-Little Silt
5-3	40°32'00"	73°45'00"	49	Fine Sand-Little Silt
5-4	40°31'00"	73°45'00"	58	No Sample
5-5	40°30'00"	73°45'00"	60	Coarse Sand & Gravel
5-6	40°29'00"	73°45'00"	75	Heavy Silt-Mid Globs
5-7	40°28'00"	73°45'00"	75	No Sample
5-8	40°27'00"	73°45'00"	77	Silty Sand
5-9	40°26'00"	73°45'00"	80	Large Gravel-Silty Sand
5-10	40°25'00"	73°45'00"	82	Fine & Medium Sands

SECTION 4

REPORT ON THE IMPACT OF OCEAN SLUDGE DISPOSAL ON THE NEARSHORE WATER AND SEDIMENT QUALITY

Introduction

Concern over possible environmental impacts of the ocean dumping of sewage sludge into the coastal waters of the New York Bight prompted the National Oceanic and Atmospheric Administration (NOAA) to initiate a comprehensive study of the problem in 1973. The preliminary results of this study indicated sludge migration to within four miles of Long Island and some evidence as close as two miles. In late 1973 and early 1974, the Department of Geology, Brooklyn College, reported that the leading edge of the sludge bed was three miles south of Atlantic Beach with traces found less than one-half mile from the shore. These reports prompted further investigations by several governmental agencies, including the United States Environmental Protection Agency (USEPA).

Upon the review of available data there was an apparent lack of agreement among the various agencies and institutions, not only as to the extent of sludge movement towards Long Island, but also as to whether the sludge exists as a mass or in scattered pockets, the criteria for sludge identification, and the method of transport.

Subsequently, the Nassau County Executive charged the Commissioner of Health to obtain the necessary data to determine the situation relative to sludge movement and the extent of the public health hazard, if any. The Nassau County Department of Health commenced a semi-annual ocean sampling program in May, 1975 to monitor the quality of both the water and sediment from within one-half mile south of Long Beach barrier island to a distance twelve miles offshore. Results of the May, 1975 sampling cruises were reported in the 1975 Water Quality Assessment Report.

This section of the 1976 Water Quality Assessment Report summarizes most of the findings of the September, 1975 sampling cruises. Findings of the macrobenthic analysis of these sediments have been reported in section 3 of this report.

SUMMARY AND CONCLUSIONS
SAMPLING CRUISES
SEPTEMBER 1975

Subsequent to the initial ocean sampling cruise, which was conducted in May 1975 as part of this Department's municipal sludge monitoring program in the New York Bight, a second survey was conducted during September 1975. The purpose of this fall survey was to determine to seasonal variation in both water and sediment quality in the area north of the sewage sludge dump site and is report herein.

The results of the September 1975 offshore sampling cruise tend to substantiate the prediction advanced in the initial sludge monitoring report issued by this Department in March 1976, that due to the existence of both a strong thermocline in the New York Bight and the onshore current and wind conditions which prevail during the summer months, there appears to be increased shoreward movement of sludge from the dump site toward Nassau County.

The bacteriological water quality findings demonstrate the effect of the thermocline which entrains that portion of the sewage sludge, whose bulk density is less than that of sea water, in the upper layers of the water column. The suspended sludge is subsequently subjected to ambient advection which is shoreward towards Long Island during the summer months. This summer condition differs markedly from the spring period dispersion characteristic which demonstrates the rapid decent of sludge to the bottom within the immediate area of the dump site. (See Figures 4-1 and 4-2)

The shoreward transport and the subsequent deposition of the suspended sewage sludge during the summer period, results in significant increases in the bacteriological and the chemical concentration levels in the bottom sediment north of the sewage sludge dump site. This area of deposition, as defined by the September 1975 survey, extends from the dump site, which is located twelve miles south of Long Island, to within five to six miles of Atlantic Beach.

Although there was a two-fold increase in the contaminant concentration levels in the bottom sediments during the period from May to September 1975, which include coliform bacteria, organic material and heavy metals, there did not appear to be a spatial extension of the contaminated area north of the dump site towards Atlantic Beach during the summer period of 1975. (See Figure 4-3 thru 4-6)

The comparison of the May and September 1975 results does, therefore, indicate a net seasonal shoreward transport of contaminants resulting from the ocean disposal of sewage sludge to within five to six miles south of Atlantic Beach. Because of this apparent seasonal transport variation, which potentially poses a threat to the nearshore waters of Nassau County during the recreational summer season and the anticipated increase in the amount of ocean sludge disposal, it is essential that this monitoring program continue to insure the protection of the public health and welfare.

Continued monitoring also now becomes especially imperative in light of the recent Long Island ocean beach pollution problem which probably was, in part, caused by the ocean disposal of sewage sludge. Although the sewage material which impaired the beaches during June and July 1976 consisted of floating debris, the distinct possibility does exist that sewage sludge suspended in the water column could contaminate the nearshore bathing waters should the abnormally persistent onshore hydrographic and meteorological conditions continue and increase in magnitude.

RECOMMENDATIONS

The results of this Department's May and September 1975 ocean monitoring surveys indicate that there are areas within five to six miles of Atlantic Beach and four to five miles of Long Beach which appear to be contaminated by the ocean disposal of sewage sludge. Due to the projected volumetric increase in sewage sludge and the probable recurrence of the persistent onshore wind events which occurred during the summer of 1976, the potential exists for the transport of sludge nearer to shore where it could pose a direct threat to the public health and welfare.

It is therefore recommended, because of the potential health hazard created by the ocean disposal of sewage sludge, that the Nassau County Department of Health continue its ocean surveillance program to verify the seasonal variation and to determine the extent of both water and sediment quality impairment resulting from the ocean disposal of sewage sludge.

Sampling surveys should be scheduled quarterly to establish the seasonal distribution of contaminants within the study area. These cruises should be conducted each year as long as the ocean disposal of sewage sludge continues at the existing dump site. Monthly surveys, on a reduced scale, should also be conducted during the period from May thru September due to the dynamics of the New York Bight Apex, the effect of which has been graphically demonstrated by the recent Long Island beach sewage debris problem. The most latent damaging hydrographic and meteorological conditions exist during the same period that the potentially impacted waters are most utilized.

It is also recommended that during 1977, this monitoring effort be coordinated with the United States Environmental Protection Agency, National Oceanic and Atmospheric Administration, and the Permittee Ocean Dumping Surveillance Program.

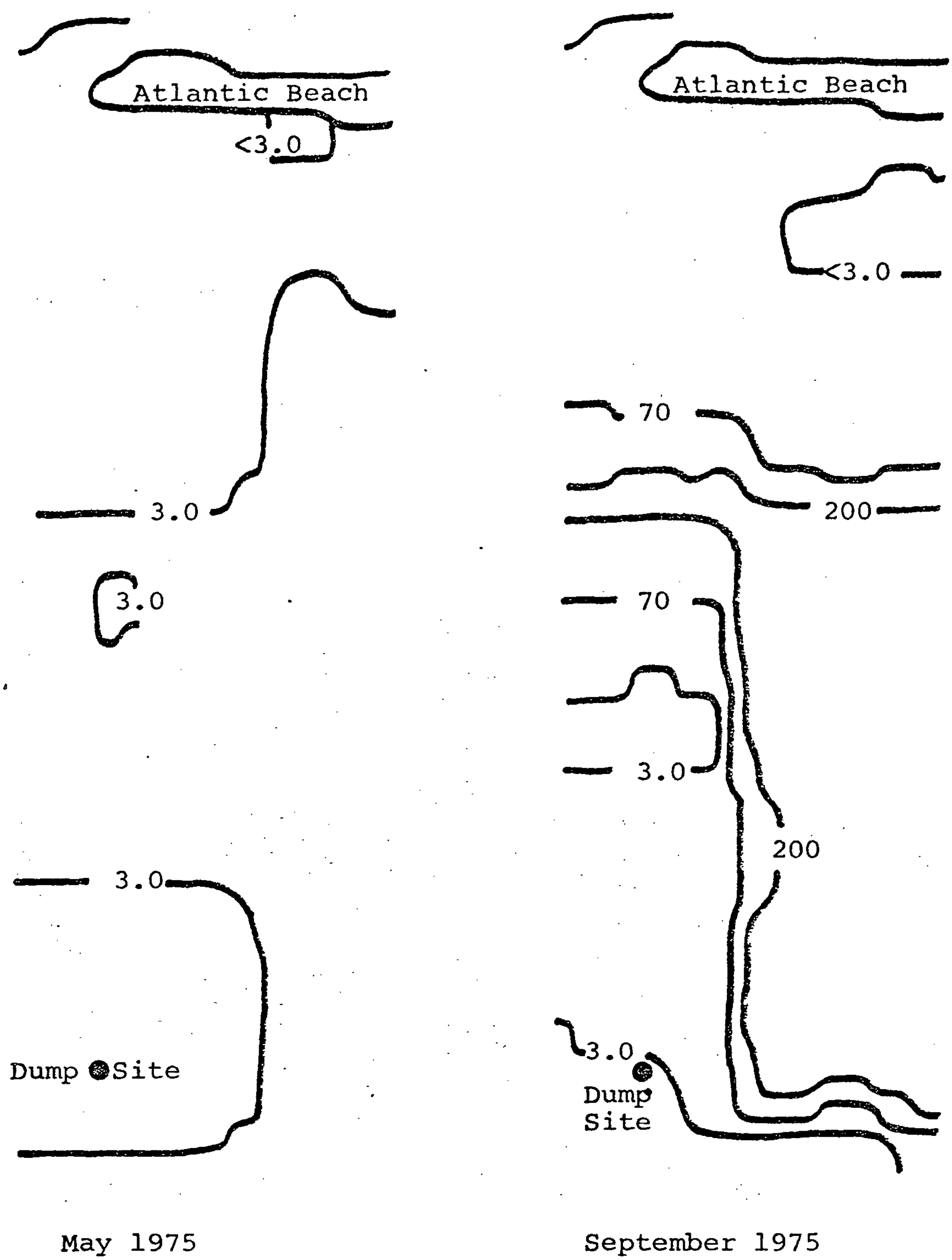


Figure 4-1 - Distribution of total coliform bacteria (MPN/100 ml) in the surface of the water column

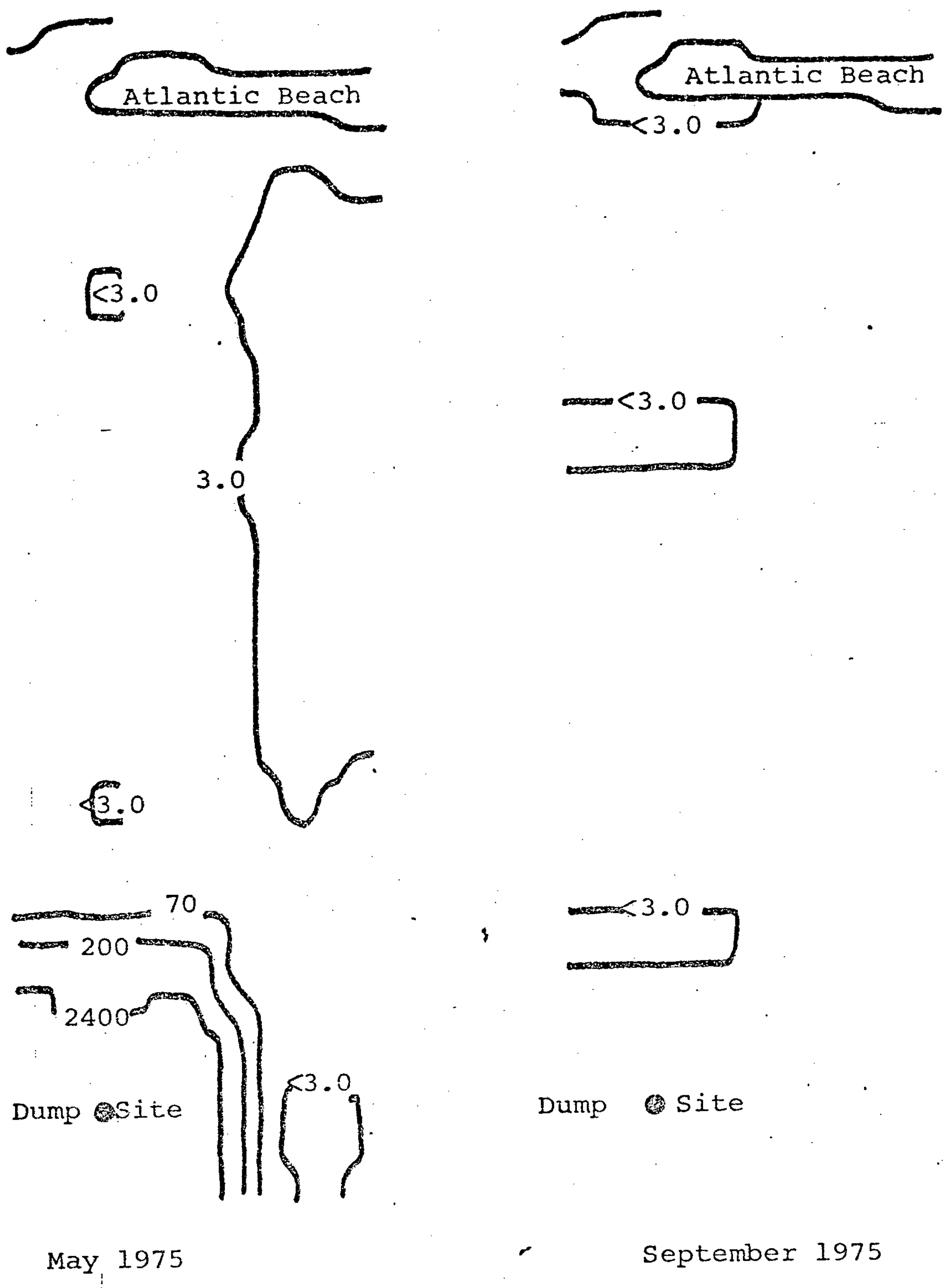


Figure 4-2 - Distribution of total coliform bacteria (MPN/100 ml) in the bottom of the water column

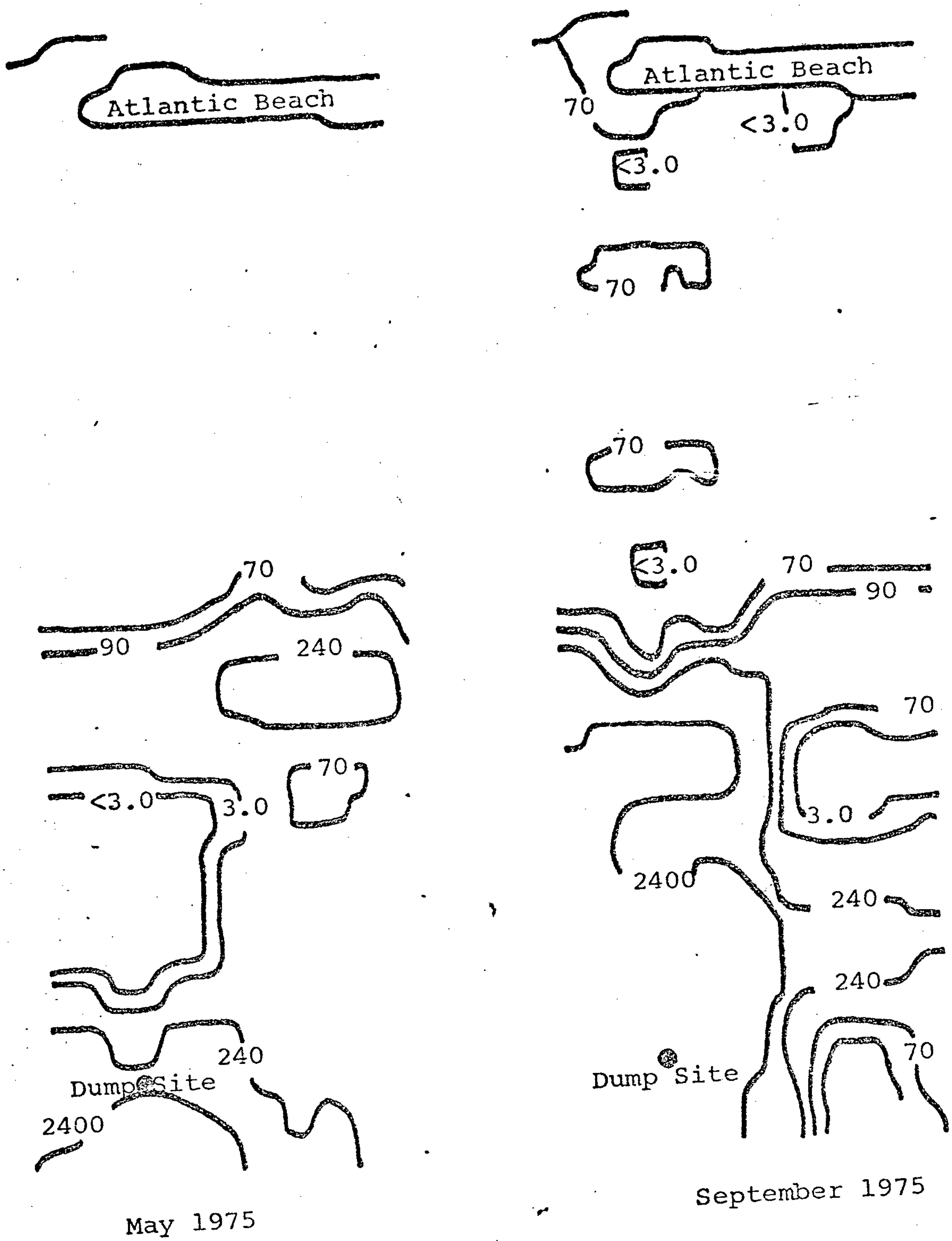
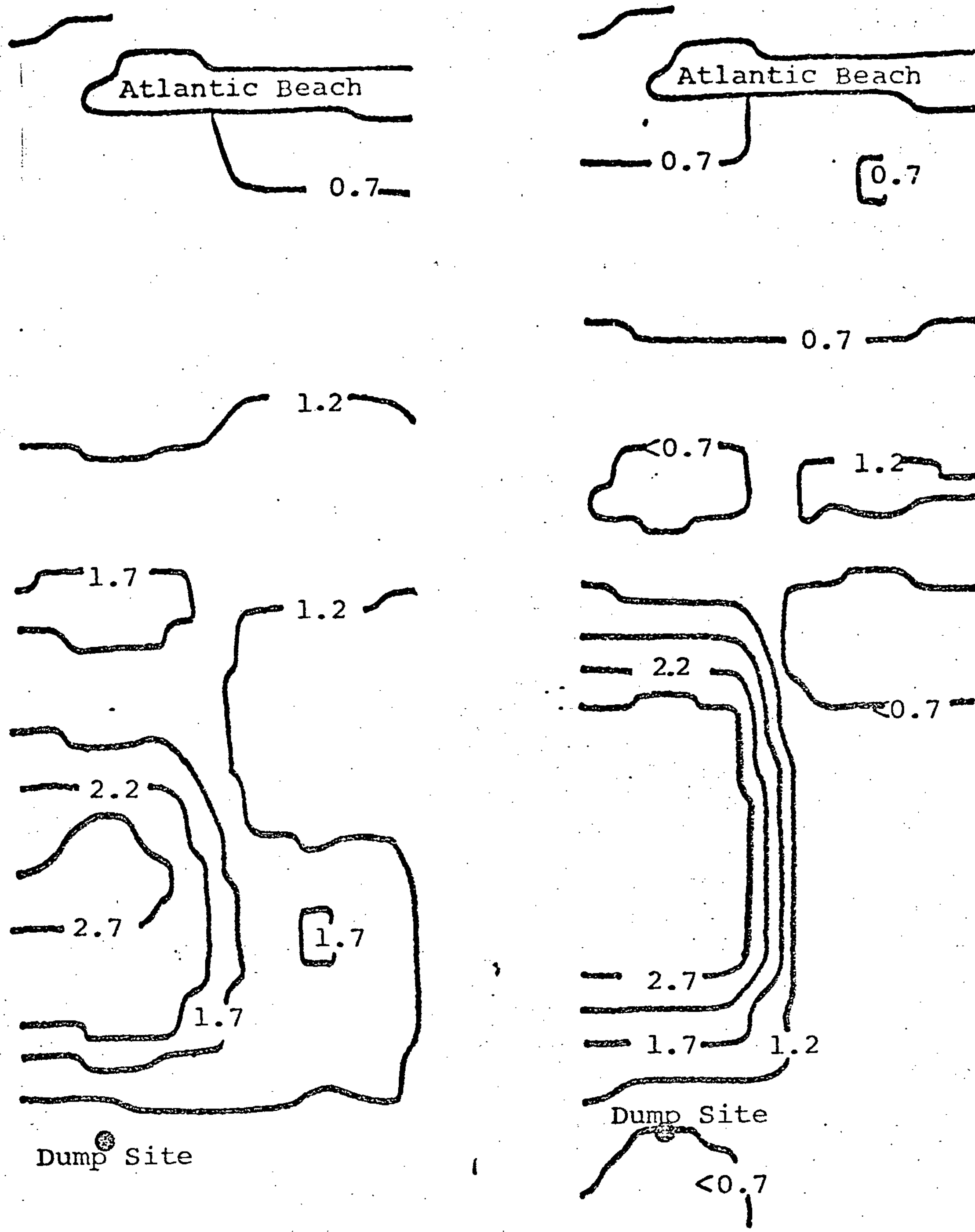


Figure 4-3 - Distribution of total coliform bacteria (MPN/1cc) in the bottom sediment



May 1975 September 1975

Figure 4-4 - Distribution of volatile solids (%-dry weight) in the bottom sediment

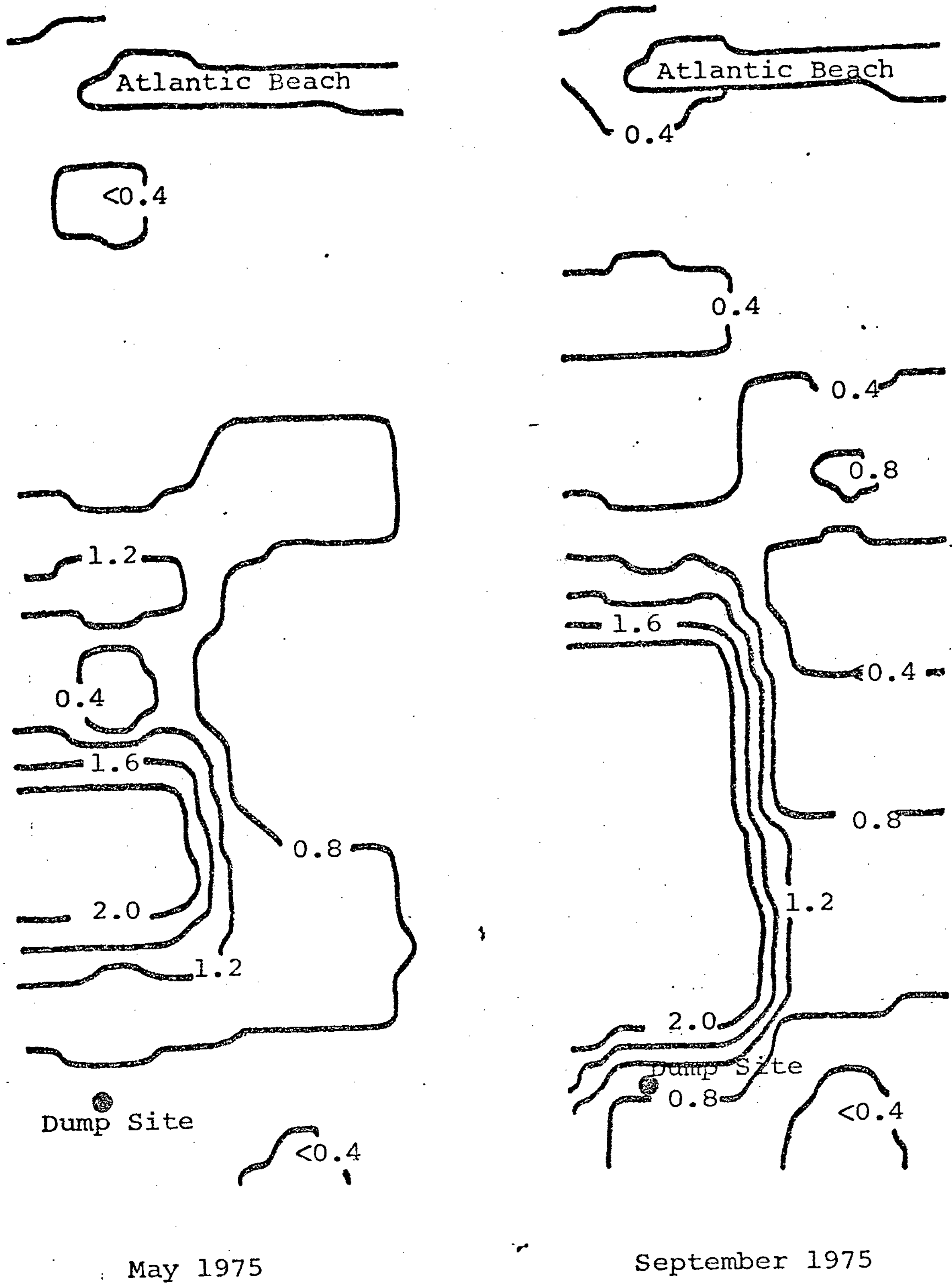


Figure 4-5 - Distribution of chemical oxygen demand (%-dry weight) in the bottom sediment

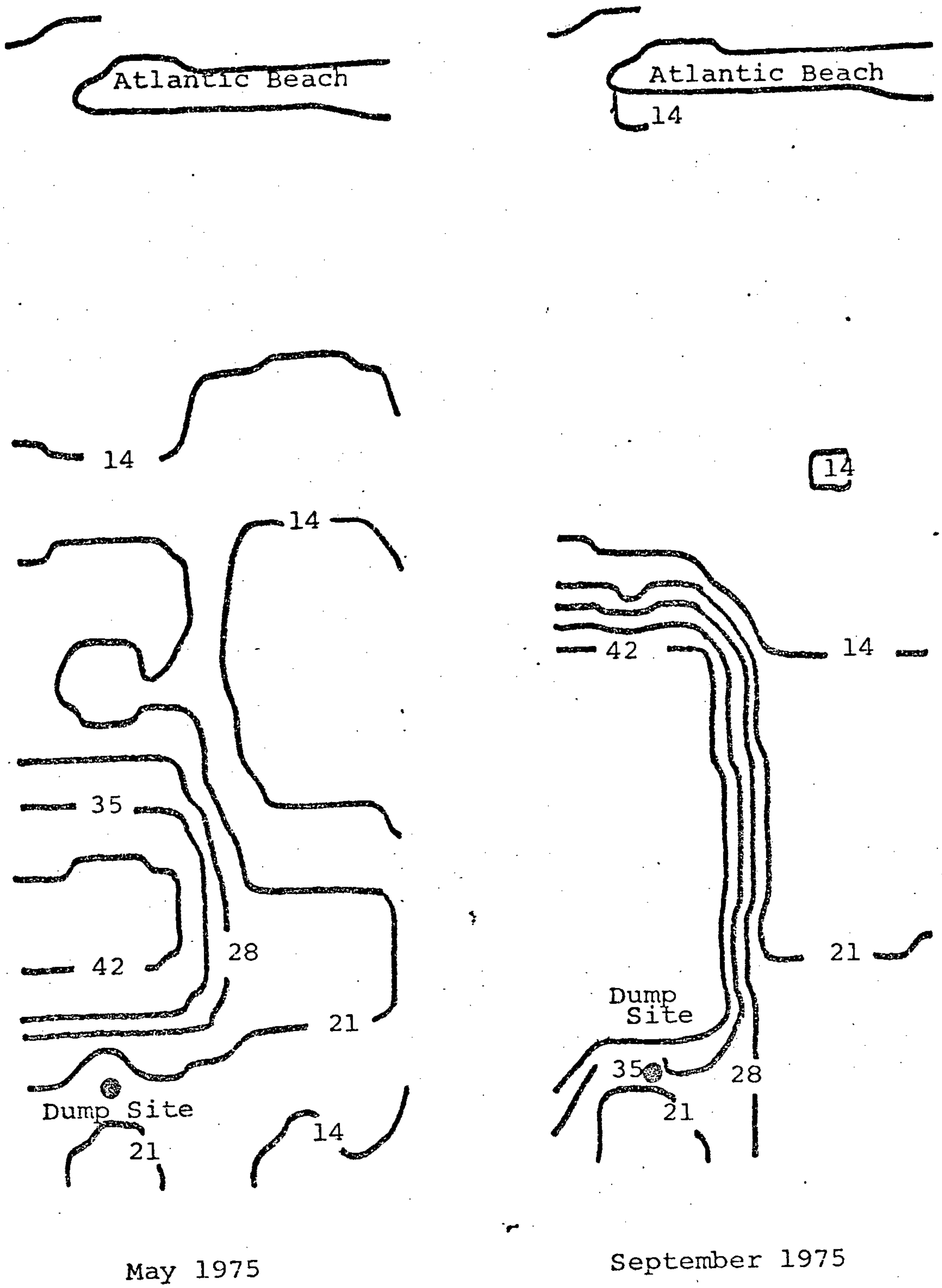


Figure 4-6 - Distribution of lead (mg/kg-dry weight) in the bottom sediment

SECTION 5

GROUNDWATER QUALITY ASSESSMENT

Groundwater Quality

Water in the Glacial aquifer has become increasingly degraded during the past several decades and has virtually been abandoned as a source of public water supply. In 1976, 43% of the Glacial wells tested did not meet one or more State Health Department standards for sources of water supply. Private sewage disposal systems have leached nitrogen in the form of ammonia, detergents, chlorides, sodium, sulfate and total solids into the shallow groundwater. Nitrogen in the nitrate form is widespread in the natural recharge area of central Nassau and in localized areas on the northern shore. Ammonia is found on the south shore where conversion to nitrate is not complete. Detergents are also found on the south shore, but levels are decreasing due to sewering and the use of biodegradable surfactants. Localized problems with hexavalent chromium due to industrial waste discharges (Massapequa, Franklin Square and Mineola) and chlorides due to saltwater intrusion (Kings Point), road salt storage (Mineola), sand mining (Port Washington) and incinerator operation (Valley Stream) have been detected.

The Magothy aquifer underlies and is recharged by water from the Glacial. In 1976, 11% of the Magothy wells tested did not meet one or more State Health Department standards for sources of water supply. In the natural recharge area where the major component of groundwater flow is vertical, nitrates have penetrated deep into the Magothy reaching the bottom in the Garden City Park area. Other sewage derived constituents (chlorides, sodium, sulfate and dissolved solids) are increasing in the high nitrate areas, but levels are well below existing standards. Localized problems with copper in one well in Hicksville and with organics in the southeast area of the County have been detected. A comprehensive public water supply source sampling program for organics was begun in 1976.

The Lloyd aquifer is protected by the overlying Raritan Clay formation and is relatively free of contamination, with only 5% not meeting State Health Department standards for sources of water supply. During 1975, three Lloyd wells on the barrier beaches in Long Beach and Lido Beach experienced high chlorides. Leaks in the casings and not salt water intrusion into the Lloyd were responsible.

Excessive natural iron and low pH are problems in the three major aquifers throughout the County.

Since sewage-derived constituents are the major contaminants in Nassau County's groundwater, and degradation due to these constituents is continuing, the rapid completion of county-wide sewering to eliminate this source is needed. Wastewater renovation and recharge must be perfected and practiced, if feasible, in conjunction with expanded sewering to assure an adequate as well as safe supply of water for the future. A 5 mgd test project has been undertaken by the County to determine the feasibility of renovation and recharge.

Monitoring System

The Nassau County Department of Health groundwater quality monitoring system was composed of 639 wells in 1976. These wells are municipal public supply wells, non-municipal public supply wells, private wells (industrial, irrigation and air-conditioning) and observation wells. Of these wells, 423 are screened in the Magothy aquifer, 158 in the Glacial aquifer, 59 in the Lloyd aquifer and 5 in the Jameco aquifer.

The Magothy wells are spread throughout the County. Glacial wells are generally located south of the groundwater divide and on the North Shore peninsulas. Lloyd wells are located on the South Shore barrier beaches and in the extreme northern portion of the County. Jameco wells are located on the Great Neck and Port Washington peninsulas.

The municipal public supply wells (386 wells) are sampled yearly by the Department and at least yearly by the supplier. Non-municipal public supply wells (71 wells) are sampled yearly by the Department and the supplier. Private and observation wells (182 wells) are sampled yearly by the Department.

The Department's routine analysis consists of bacteriological, physical and chemical quality constituents. The analysis includes agar plate count (APC), total coliform, color, turbidity, odor (hot and cold), total iron, manganese, free carbon dioxide, free ammonia, nitrite, nitrate, chloride, hardness (total and calcium), total alkalinity, pH, total solids, specific conductance, MBAS (detergents), dissolved oxygen, total chromium, temperature, copper, sodium, sulfate, and total organic carbon (TOC). In addition, special sampling is done for hexavalent chromium, zinc, lead, cadmium, nickel, phenols, fluoride, cyanide, aluminum, and silver.

Groundwater Quality

Routine groundwater monitoring results for the 12 month period, October 1975 through September 1976, were analyzed versus Sources of Water Supply Standards, 10 NYCRR 170.4 (Appendix V). The raw data used for this report is tabulated in Appendix VI.

The number and percentage of wells with significant trends for each constituent analyzed in this report are summarized by aquifer in Table 5-1. Constituent trends are routinely determined for each well with five or more analyses as part of the historical record. Trends are determined by calculating the trend line of best fit using the least mean squares method, computing the slope and testing the trend line for its significance. In 1976, 446 wells (55 Glacial, 340 Magothy and 45 Lloyd) were analyzed. Except for pH, increasing or positive trends indicate a deterioration in quality, while decreasing or negative trends indicate water quality improvement.

Table 5-1

Water Quality Trends in Wells - 1976

	Glacial (55)				Magothy (346)				Lloyd (45)				Total (446)			
	Increase		Decrease		Increase		Decrease		Increase		Decrease		Increase		Decrease	
Constituents	Wells	%	Wells	%	Wells	%	Wells	%	Wells	%	Wells	%	Wells	%	Wells	%
pH	10	18	0	0	16	5	27	8	4	9	3	7	30	7	30	7
Turbidity	0	0	2	4	2	<1	13	4	1	2	1	2	3	<1	16	4
Ammonia-N	1	2	2	4	13	4	39	11	0	0	2	5	14	3	43	10
Chloride	33	60	1	2	180	52	8	2	12	37	0	0	225	50	9	2
Chromates	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitrate-N	15	27	11	20	130	38	19	6	12	27	3	7	157	35	33	7
Sodium	3	9	1	3	9	3	6	2	2	6	0	0	14	4	7	2
Sulfate	4	11	1	3	36	11	28	9	2	5	1	3	42	11	30	8
Total Solids	16	31	2	4	112	33	3	<1	7	17	2	5	135	31	7	2
Ox. Consumed	4	9	1	2	16	5	37	11	1	2	3	7	21	5	41	10
Detergents	0	0	6	11	0	0	8	2	0	0	0	0	0	0	14	3
Iron	4	7	3	5	33	10	27	8	1	2	5	11	38	9	35	8
Manganese	4	7	1	2	19	6	2	<1	9	20	1	2	32	7	4	<1

Present conditions and trends, localized and widespread problems, and sources of contamination are discussed for each constituent in the following sections. The asterisk (*) in the table associated with each constituent indicates the groundwater standard (Part 170) and the number of wells exceeding the standard.

pH

Aquifer	Wells Analyzed	<4.5	pH(standard units) 4.5 to 8.5	>8.5
Glacial	98	0	98	0
Magothy	341	6	335	0
Lloyd	42	0	41	1

Groundwater in the County is naturally acidic. By adjusting the lower limit of the pH standard, 6.5 to 8.5, to 4.5, to reflect this naturally acidic condition, 6 wells have a pH below the limit. These are Magothy wells located on the south shore. Trends for 440 wells show an increase in 30 wells and a decrease in 30 wells. Corrosion due to the low pH is a problem; however, 42 of the major 46 public supplies in the County practice some form of corrosion control treatment.

Turbidity

Aquifer	Wells Analyzed	<1	Turbidity(units) ≥1 to ≤5	>5*
Glacial	84	44	27	13
Magothy	337	282	43	12
Lloyd	23	18	5	0

Turbidity greater than the standard of 5 units was found in 25 of 444 wells (6%). All 25 wells contain high iron levels, generally greater than 1.0 mg/l, which is responsible for the turbidity. These wells are located on the south shore.

Ammonia-Nitrogen

Aquifer	Wells Analyzed	≤0.002	Ammonia-Nitrogen(mg/l) >0.002 to <2.0	≥2.0*
Glacial	98	45	48	5
Magothy	340	217	121	2
Lloyd	32	20	12	0

Ammonia levels greater than the standard of 2.0 mg/l were found in 7 of 470 wells (2%). These wells are shallow (<100 feet), located in the southern portion of the County (5 of 7). Ammonia levels in 14 wells are increasing while levels in 43 wells are decreasing. Shallow groundwater in the southern portion of the County contains ammonia levels up to 10.8 mg/l due to the shallow unsaturated zone and the lack of dissolved oxygen in the groundwater which readily convert ammonia to nitrate in other areas. Ammonia, which is subject to ion exchange reactions, tends to be absorbed by the soil and remains in the shallow groundwater. The major source of this ammonia is the leachate from individual private sewage systems.[1]

(1) "Report on Nitrate in Groundwater," S. Smith and J. Baier. Nassau County Department, 1969.

Shallow groundwater in the Glacial aquifer on the north shore, and the deeper groundwater of the Magothy and the Lloyd aquifers throughout the County show no evidence of high ammonia. An exception occurs in one 455 foot Magothy well located in Locust Grove (N4133). This well has exhibited elevated ammonia levels since 1960, and in 1976 the ammonia level was 3.2 mg/l. The source of this ammonia is believed to be a scavenger cesspool waste dumping station operated by the Town of Oyster Bay until January, 1975.

Two of 5 wells less than 200 feet deep (N2239 and N4118) operated by the West Hempstead-Hempstead Gardens Water District have exhibited ammonia concentrations greater than 0.10 mg/l since the early 1960's. Since 1970, Well N2239 has been above 1.0 mg/l. This increase is unusual in a sewered area and is believed to be due to organic decomposition of natural materials and not cesspool leachate.

Barium

Barium was not tested for during the year. Between 1974 and 1976 all public supply wells were analyzed and no barium was detected.

Chloride

Aquifer	Wells Analyzed	Chloride(mg/l) ≤250	Chloride(mg/l) >250*
Glacial	95	94	2
Magothy	339	339	0
Lloyd	42	41	1

Chloride greater than the standard of 250 mg/l was found in 3 of 476 (< 1%) wells. Increasing trends exist in 225 of 446 wells with decreasing trends in 9 wells. The widespread occurrence of increasing chlorides is due to cesspool leachate, landfill leachate, road salting, road salt storage and salt water intrusion.

Since all wells were not sampled during the reporting period, the data presented with this report does not truly reflect chloride problems existing in other localized areas. These areas include the Kings Point and Port Washington areas on the north shore, Long Beach and Lido Beach on the barrier islands of the south shore, Mineola and Valley Stream.

Two wells in Kings Point serving the Citizens Water Supply Company (N30 and N2214) have shown elevated chloride levels and are presently not being used. N-30 early in 1974 exceeded 1000 mg/l of chloride, and N-2214 contained 170 mg/l in 1976. A third Citizens Water Supply Company Well, N-31, increased to 162 mg/l of chloride in 1976, but is still being used. Observation well N-6717 had a level of 300 mg/l in 1975. The source of the chloride has not been determined and is under study by the United States Geological Survey.

In Port Washington, chlorides from 1000 to 9000 mg/l have been detected in shallow observation wells at the new Town of North Hempstead landfill. The source is believed to be wash water formerly used by sand and gravel operations in the area.

In 1975, three Lloyd public supply wells on the south shore barrier beaches developed chlorides over 1000 mg/l. Tests performed on Wells N-8011 and N-7776 in Long Beach indicated that the problem was caused by cracked casings and not intrusion into the Lloyd aquifer. The third Well, N-8354 in Lido Beach, was also determined to have a cracked casing. Similar casing problems have occurred in wells in this area in the past.

In Mineola a shallow private well, N-8093, exceeded the chloride standard in 1975 (320 mg/l). The level dropped to 245 mg/l in 1976. High chloride is unusual in this area and has not been detected in other wells. The source was determined to be a local road salt storage facility.

A shallow private well in Valley Stream (N-8896) exceeded the chloride standard in 1975 (340 mg/l). Chlorides in this well, located at the Village of Valley Stream Incinerator, may be due to the recharge of quench water at the incinerator.

Hexavalent Chromium

Hexavalent chromium was not detected in any of the 157 wells analyzed. In the past, hexavalent chromium has been detected in shallow groundwater in three locations in the County. One plume located in the South Farmingdale-Massapequa area is moving toward the south shore but remains in the shallow groundwater. The area, rate of travel and source of the plume is well documented [2] and poses no threat to the overall groundwater reservoir. Chromates were also detected in one 60 foot well in Franklin Square (N-7744) in 1971 (0.55 mg/l). The level has decreased yearly since that time, and in 1975, no chromates were detected. The source of the chromates was an eletroplating plant located 1/2 mile north of the well which dumped chromate waste until 1955. The extent of the plume has not been determined.

In 1975, two shallow wells (87 and 108 feet) located in Mineola were found to contain chromates from 0.02 to 0.89 mg/l. Other shallow and deep well water in the area was analyzed, but no chromates were detected. The source appears to be chromate waste from a plating plant located next to these wells which discharged to the ground until 1960. Further study is required in this area to determine the extent of the problem.

Copper

Aquifer	Wells Analyzed	Copper (mg/l) <0.05	≥0.05 to <.2	≥0.2*
Glacial	60	28	22	10
Magothy	191	117	66	8
Lloyd	16	9	7	0

Copper was found in varying amounts in 113 of 267 wells (42%) sampled. However, only 18 wells (7%) contained copper greater than the standard of 0.2 mg/l. The 18 wells greater than 0.2 mg/l are located through-

(2) "Dispersal of Plating Wastes and Sewage Contaminants In Groundwater and Surface Water, South Farmingdale-Massapequa Area, Nassau County, New York," USGS, 1970.

out the County. The levels may be caused by corrosion within the wells resulting from insufficient run-time before sampling. One of these wells, N-6191 in Hicksville, which is screened between 500 and 550 feet, maintains a high copper level even after extended pumpage. The problem was discovered in 1974, and a pumpage test in 1975 showed the level to be 1.95 mg/l at start up and 0.93 mg/l after one hour. The source and extent of the copper are unknown, but many years of industrial waste discharges north of this well in Syosset is the most probable source. Other deeper and shallower wells in the vicinity of N-6191 are not presently experiencing elevated copper levels.

Nitrate-Nitrogen

Aquifer	Wells Analyzed	Nitrate-N (mg/l) ≤1.0	>1.0 to≤10.0	>10.0*
Glacial	96	19	73	4
Magothy	339	159	168	12
Lloyd	32	24	8	0

In 467 wells sampled, nitrate greater than 1.0 mg/l was detected in 265 wells (57%) with 16 wells (<3%) over the nitrate standard of 10.0 mg/l. Increasing nitrate levels were found in 157 of 446 wells (35%) with decreasing levels in 33 wells (7%). Nitrate infiltration (>1.0 mg/l) into the Glacial aquifer is spread throughout the entire County except on the south shore where nitrification of cesspool leachate, the chief nitrate source, is not complete (See ammonia section.) In the central portion of the County and in localized north shore areas (Glen Cove and Bayville), nitrate levels greater than 5.0 mg/l are widespread. Nitrate in the Magothy aquifer greater than 5.0 mg/l is located in a central band extending from Queens to Suffolk County. This band of nitrate enriched water conforms roughly to the natural recharge area where groundwater flow has a strong downward component, population density is high and groundwater is heavily pumped. Therefore, Magothy wells in this area receive water from the shallow, nitrate enriched Glacial aquifer more readily than those on the south shore where groundwater flow is more nearly horizontal in the Glacial. In the Garden City Park area, for example, nitrate up to 10.0 mg/l extends to the bottom of the Magothy. Nitrate infiltration into the County's groundwater is well documented as to source and extent in References 1 and 3.

Sodium

Aquifer	Wells Analyzed	Sodium (mg/l) <3.0	≥3.0 to<20.0	≥20.0*
Glacial	78	1	47	30
Magothy	280	19	250	11
Lloyd	18	2	15	1

(3) "Effect of Cesspool Discharge on Groundwater Quality on Long Island New York," S. Smith and D. Myott, AWWA Journal, August, 1975.

Analyses from 367 wells showed sodium levels equal to or greater than the standard of 20 mg/l in 42 wells (11%). Levels in 14 wells were increasing, while 7 wells showed a decrease. In 24 of the high sodium wells, chloride levels greater than 40.0 mg/l are present, while the remaining 18 have nitrate greater than 5.0 mg/l or ammonia greater than 1.0 mg/l. It is evident that sodium levels are directly associated with both salt water and cesspool leachate contamination.

Sulfate

In the 439 wells analyzed, no sulfate results were found over the standard of 250 mg/l. Trend data indicates that levels are increasing in 42 wells and decreasing in 30 wells. Sulfate, being a sewage derived constituent, is more prevalent in shallow groundwater averaging 36 mg/l in the Glacial aquifer while the deeper Magothy aquifer averages less than 10 mg/l.

Total Dissolved Solids

Aquifer	Wells Analyzed	T.D.S. (mg/l) ≤500	T.D.S. (mg/l) >500*
Glacial	86	82	4
Magothy	332	332	0
Lloyd	23	22	1

Total dissolved solids above the standard of 500 mg/l were found in 5 of 441 wells (1%). Increasing solids were found in 135 wells while 7 wells showed decreasing levels. The occurrence of total solids in Nassau County groundwater parallels that of chloride, and the 5 wells that exceeded the total solids standard are also high chloride wells.

Oxygen Consumed

Aquifer	Wells Analyzed	Oxygen Consumed (mg/l) ≤2.0	Oxygen Consumed (mg/l) >2.0*
Glacial	46	41	5
Magothy	157	156	1
Lloyd	14	14	0

Oxygen consumed greater than the standard of 2.0 mg/l was detected in 6 of 217 wells analyzed (3%). The level of oxygen consumed shows an increase in 21 wells and a decrease in 41 wells. The wells with levels greater than 2.0 mg/l are located on the south shore where ammonia levels are high. Although the oxygen consumed test measures only the readily oxidizable carbonaceous organic matter in the water, higher levels were found in wells with elevated organic nitrogen. Since the organic nitrogen is derived from cesspool leachate, the carbonaceous organic matter apparently derives from the same source.

Phenols

Limited sampling for phenols was conducted during the year by the Department. No phenols were detected in the 16 wells tested. The detection of phenols in 4 wells at the Grumman Aerospace Corporation in Bethpage in 1974-75 led to the discovery of other organic contaminants in groundwater (See organics section).

Other Constituents From Part 170

Other Part 170, Sources of Water Supply, constituents are not tested for routinely by either the Health Department or the individual water suppliers. Data on these constituents is, however, available from United States Geological Survey-New York State Department of Health cooperative studies begun in 1971. The following table summarizes the results obtained from these studies:

Constituent	Samples	Constituent Detected	Wells Over Standard Glacial	Wells Over Standard Magothy	Wells Over Standard Lloyd
Arsenic	62	39	0	0	0
Boron	64	57	1	0	0
Cadmium	62	1	0	0	0
Cyanide	60	15	0	0	0
Lead	62	38	0	0	0
Mercury	62	5	0	0	0
Selenium	61	29	0	0	0
Silver	62	3	0	0	0
Zinc	62	37	2	1	0
Organic Nitrogen	48	42	2	8	0
Aldrin	8	0	0	0	-
Chlordane	8	0	0	0	-
DDT	8	0	0	0	-
Dieldrin	8	0	0	0	-
Endrin	8	0	0	0	-
Heptachlor	8	0	0	0	-
Heptachlor epoxide	6	0	0	0	-
Herbicides	8	2	0	0	-
Lindane	8	0	0	0	-
Organic Phosphates and Carbamates	8	3	0	0	-
Toxaphene	6	0	0	0	-

Based on this limited information, these trace elements and pesticides do not appear to be widespread in Nassau County groundwater. Boron of 1.3 mg/l and zinc of 1.0 mg/l were detected in a shallow observation well in New Hyde Park adjacent to an old landfill site. Zinc over the standard of 0.3 mg/l was detected in a Glacial observation well near a stormwater recharge basin in Levittown (0.33 mg/l) and in a shallow Magothy well in Old Westbury (0.58 mg/l). The source of this zinc is unknown. More data on these constituents is needed before an accurate assessment of their effect on the groundwater reservoir can be made.

Organics

Organic testing was begun in 1975 to determine the cause of taste and odor problems which had affected wells at the Grumman Aerospace Corporation in Bethpage. Analysis of two wells in August 1975 indicated the presence of vinyl chloride (50 ppb), 1,1,2 trichloroethylene (500 ppb) and tetrachloroethylene (88ppb).

Further testing of Grumman wells detected vinyl chloride in 3 wells 1,2 dichloroethylene in 5 wells, 1,1,2 trichloroethylene in 6 wells, tetrachloroethylene in 6 wells, 1,1,1 trichloroethane in 6 wells and chloroform in 6 wells.

Sampling of 4 public supply wells adjacent to the Grumman complex detected no organic contamination except for traces of chloroform in 2 wells. In a shallow private well south of Grumman, all organics found in the Grumman wells with the exception of vinyl chloride were detected. The source of the organic contamination appears to be industrial waste discharges in the Grumman area.

The extent and future implications of this organic contamination are presently being determined. A program of organic sampling of wells in the County is presently in progress. As of May 13, 1977, 155 wells had been tested (339 samples), and 18 public supply wells (9 at Grumman and 9 in water districts surrounding Grumman) were requested closed by the Department. The organic problem will be addressed in more detail in the next assessment report.

Overall Water Quality

Aquifer	Wells Tested	Wells Meeting Standards	%
Glacial	100	57	57%
Magothy	349	309	89%
Lloyd	42	40	95%
Total	491	406	83%

Groundwater in Nassau County as determined by sampling between October, 1975, and September, 1976, generally meets Part 170 standards. Of 491 wells tested, 406 wells (83%) met the standards for all Part 170 constituents routinely analyzed. Wells not meeting the standards are mainly Glacial and shallow Magothy wells. These wells are most susceptible to contamination by various pollutional sources.