TOWN OF SOUTHAMPTON

SUFFOLK COUNTY, NEW YORK

NORTH SEA LANDFILL

Remedial Investigation Report

Volume 1 of 2

APRIL 1988

H2MGROUP
HOLZMACHER, McLENDON & MURRELL, P.C.
CONSULTING ENGINEERS · ARCHITECTS · PLANNERS · SCIENTISTS · SURVEYORS
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GROUP

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April 29, 1988

Ms. Caroline Kwan
U.S. Environmental Protection Agency
26 Federal Plaza
New York, N.Y. 10078

Re: North Sea Landfill
SHMP 86-05

Dear Ms. Kwan:

We are pleased to submit to you, on behalf of the Town of Southampton, two (2) copies of the draft Remedial Investigation Report, Volumes I and II.

One set of the CLP analytical reports has been sent under separate cover to the oversight contractor, Versar, Inc. in Springfield, VA. These are listed under Appendix G in Volume II.

We request that all reviewing parties provide their comments to you so that they may be consolidated. When the review is complete, please forward the review comments to our firm in Melville, New York. If, in the meantime, you have any questions, please feel free to contact us at (516) 756-8000.

Very truly yours,

HOLZMACHER, McLENDON & MURRELL, P.C.

Paul W. Grosser, Ph.D., P.E.

PWG/CLV/vmm
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cc: w/encl.
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TOWN OF SOUTHAMPTON

SUFFOLK COUNTY, NEW YORK

PRELIMINARY REMEDIAL INVESTIGATION REPORT

NORTH SEA LANDFILL

PHASE I

REMEDIAL INVESTIGATION

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EXECUTIVE SUMMARY

This executive summary presents conclusions and recommendations for the North Sea Landfill Remedial Investigation (RI). The conclusions and recommendations are supported by evidence collected during several environmental investigations at the site during the Fall of 1987.

CONCLUSIONS

As part of the scoping of this remedial investigation, two sources of contamination were identified for investigation. These two sources were the landfill cell number 1 (Source 1) and the septic sludge lagoon area (Source 2). The entire field investigation was focused at these two areas and did not address the potential of contamination from landfill cell number 2. As the study progressed, a third source of contamination was identified in an area previously used for the storage of road salt (Source 3).

The key release mechanism of site contaminants is via precipitation and infiltration to groundwater at the source areas. Contaminants from Source 1 travel via the groundwater environmental pathway northwest from the source to discharge (locally) at Fish Cove. It is not known at this time how far contaminants from Sources 2 and 3 have traveled, but it can be expected that this plume runs parallel to the Source 1 plume and has the same receptor areas.

The key receptor areas, or areas at risk, would be downgradient groundwater and surface water at Fish Cove. Surficial soils at or near the suspected source areas would be secondary risk areas. Air was found not to be at risk. Based on RI analytical data, minimal potential risks are expected in the key receptor areas. This is only a preliminary evaluation, and a more detailed evaluation is normally performed as part of the feasibility study.

Data to support these major conclusions are discussed by environmental pathway (i.e., release media). These are: groundwater, surface water, soil and air.

• Groundwater

The hydrogeologic investigation reconfirmed the presence of the leachate plume (Plume 1). There was also evidence of two more plumes originating at the landfill site. All plumes are evident at shallow to medium depths of the Upper Glacial aquifer. There was evidence of less permeable strata in the deeper part of the Upper Glacial aquifer, but not enough to claim that these strata are continuous. However, these strata tend to retard and divert groundwater flow which is supported by the water quality data indicating that the plume is relatively shallow.

Plume 1 most likely generates from Cell 1 which is capped, but unlined. The plume consists primarily of leachate constituents. The highest concentrations were evident at mid-depth Well MW-3B, which is just northwest of Cell 1 on the landfill property. Groundwater analytical data also confirmed localized discharge of Plume 1 to Fish Cove.

Groundwater analytical data from stainless steel wells indicated the presence of certain priority pollutant contaminants in Plume 1, but not at hazardous levels. Where available, concentrations were compared against applicable, relevant and appropriate requirements (ARARs). Filtered metal results were used for this and considered more representative of metals dissolved in groundwater. However, priority pollutant purgeable organics were significant at well MW-3B. Trichloroethene (TCE) and tetrachloroethene (PCE) were detected at a maximum of 7 ppb. This value is higher than proposed MCLs of 5 ppb. Note that organic results detected below 10 ppb are plus or minus 40 percent reliable and results in the second round of sampling indicated concentrations less than 5 ppb.

Plume 1 consisted primarily of leachate constituents such as ammonia (as nitrogen), iron and TOC. These leachate constituents were used to identify the plume. Additional groundwater analytical data from PVC and residential wells confirm the presence and extent of Plume 1.

Plume 2 emanates from the filled septic lagoon area. The presence of nitrate and nitrite (as nitrogen) in groundwater confirms the presence of septics in the area at well MW-6. Well MW-2 was installed downgradient from this source area and also indicated elevated levels of nitrate and nitrite (as nitrogen). More data is necessary if the areal extent of the plume is to be identified. The recently constructed landfill expansion wells may help in defining the areal extent of this plume.

Plume 3 appears to be emanating from the salt pile source near well MW-2. Groundwater results were high in sodium and chloride. Otherwise, results may not be reliable because the well was not fully developed and inconsistent data were obtained between rounds 1 and 2 of sampling.

- Surface Water

Sampling stations were strategically located in the southern portion of Fish Cove to indicate both impacted and background water quality. This area is open to shellfishing. This water body has been consistently classified as fresh water when it is in fact brackish. Salinity tests on water samples proved this point.

Certain priority pollutant metals were detected in water samples which were above federal and state ARARs for surface water. These were cadmium (3 locations), copper (1 location), and mercury (1 location). Both copper and mercury were found at locations intended to illustrate background surface water quality. The levels were not indicative of severe contamination.

Leachate parameters which were consistently detected in water samples were ammonia, iron and manganese. There are no ARARs for these parameters. Historical water quality data from nearby areas were available for comparison for nitrogen. The average nitrogen readings in Fish Cove were .77 mg/l versus .41 mg/l for similar enclosed bay areas near Flander's Bay.

The greatest risk is primarily to local aquatic organisms. If toxic levels are reached, cadmium, copper, mercury or nitrogen could have a detrimental effect on local aquatic populations. Toxic levels were not indicated in this investigation. Since metals may accumulate in shellfish tissue, humans are next in the food chain to be affected. Historical bioassay data of Fish Cove clams (NYSDEC) indicate the presence of certain metals in clam tissue, but at acceptable federal guidelines for food.

Coliform bacteria, which had been found in numerous locations in Fish Cove in the past, point to septic and stormwater discharges from the surrounding area. These discharges could well adversely impact the variability of aquatic life.

- <u>Soil Investigation</u>

H2M collected four types of soils. These were: (1) surface soils at various locations throughout the landfill; (2) soils from the filled lagoon area; (3) saturated soils from well boreholes, and (4) sediment from Fish Cove.

All soil samples were analyzed for priority pollutant metals (total digestion) and E.P. Toxicity metals (extraction procedure). The E.P. Toxicity extraction procedure was used to demonstrate the leachability, presence and mobility of metals.

ARARs are not clearly defined for metals in soil. Thus, all metals in soil data were compared against New Jersey DEP and New York State DEC "action levels" and typical concentrations of metals in U.S. soils (Lindsay, 1979). Almost all metals were below action levels and/or within typical concentration ranges. Cadmium was above action levels in four lagoon soil samples. Silver was above action levels in one lagoon sample and a saturated soil sample (borehole for MW-3C). Mercury has no action level, but exceeded the typical soil range at surface soil locations near the active cell and the excavated area.

Overall, none of the soil samples analyzed for leachability exceeded the recommended E.P. Toxicity concentration levels. However, cadmium and lead were detected in the soil, but at below recommended levels for leaching potential. Mercury and silver, on the other hand, were not detected in the soil, but were leached out at a very low concentration for certain samples. This is not uncommon due to anomalies in sampling and analytical procedures.

All soil samples were analyzed for semi-volatile organics (base neutral-acid extractables). Soil from the filled lagoon was also analyzed for pesticides, PCBs and volatile organics.

The key organic contaminants in soils were the phthalate esters and polycyclic aromatic hydrocarbons (PAHs). All phthalates and PAHs were below recommended levels. One surface soil sample from the north of the inactive cell indicated the greatest variety of PAHs, but levels were below action levels. The sources of these compounds are unknown.

Purgeable organics data from lagoon soil samples are unreliable, but the results for chloroform are reliable. Chloroform was detected in the western portion of the filled lagoon area at all three depths of Boring 4. Pesticides and PCBs were not detected in any of these lagoon soil samples.

The risks to public health were based on surficial soils only. The workers at the landfill would be most vulnerable, but these values indicate a very low risk.

- Air Investigation

The air investigation was performed to determine whether air quality levels may be deleterious to worker health at the landfill. The investigation consisted of a general survey, collection of air samples and collection of wind data before all other field investigations commenced.

The ambient air survey indicated acceptable air quality at the RI work zones at the landfill. Air samples were analyzed for purgeable organics and all results were below detection levels.

Wind data were gathered before, during and after air sampling at a centrally located station on the landfill property. The predominant wind direction during September through October was out of the west, north and northwest with a predominant wind speed range of 5 to 10 mph.

RECOMMENDATIONS

Two general categories of recommendations were identified. These are: (1) recommended remedial actions, and (2) recommended additional investigative data.

• Recommended Remedial Actions

The Remedial Investigation indicates low risk to public health and the environment. In light of this, the required remedial actions are minimal, since many of the more extensive actions have already been completed by the Town previous to the RI.

The most feasible remedial action is to combine several response actions. There are three groups of response actions: no action, source control and migration control. Several response actions within these groups have already been implemented and should continue to be implemented.

1. No Action

It is recommended that groundwater monitoring be continued. Additional wells have been installed on the site. Further monitoring will track the dispersion of Plume 1 off-site and of suspected Plumes 2 and 3 on the landfill property.

Groundwater monitoring should be done in conjunction with on-going response actions. The on-going actions are: (1) supplying alternative water supplies for affected residents, and (2) continue required source control measures. Groundwater monitoring will track the effectiveness of response actions.

2. Source Controls

Source controls are designed to prevent or minimize migration of hazardous materials from the source areas.

Source 1 (Cell 1) has already been capped. Source 2 (filled septic lagoons) has already been substantially excavated and filled. However, Source 3 (salt pile) should receive attention, either by no longer using the site for salt storage or by the construction of a salt brine collection system or enclosing the salt pile.

3. Migration Control

Exceeding ARARs, with high risk to public health and the environment, would warrant the use of migration control methods. However, based on the RI, this is not the case at the North Sea Landfill.

- Recommended Additional Environmental Monitoring

1. Hydrogeologic Data

The prime objective of obtaining additional hydrogeologic data is to further define flow patterns. The following recommendations are given:

- Obtain depth to water measurements on a bi-monthly basis of all wells. It should be noted that the PVC wells should be surveyed for elevation and location.
- To understand site-specific flow patterns at Fish Cove, a Stevens Recorder is recommended for recording water levels over a 24-hour period. This would help in understanding tidal fluctuations at that location. In addition, the Fish Cove area wells should be surveyed using a tide gauge as a bench mark.

Some of these recommendations could be performed in conjunction with additional groundwater monitoring.

2. Groundwater Quality Monitoring Data

The recommendation to pursue additional groundwater monitoring data is needed to support the no-action remedial response action. Additional groundwater monitoring data will:

- Track the effectiveness of any additional response actions.
- Confirm the presence of Sources 2 and 3.
- Be compared with 1987 RI data.

Additional data can be acquired from existing RI stainless steel wells and recently installed stainless steel wells done in conjunction with the landfill expansion project for the NYSDEC. All wells could be used in conjunction with the next round of quarterly and annual sampling as well.

3. Limnology/Biology of Fish Cove

Such a study would generate more information on:

- Changes in water quality parameters over time.
- Effects, if any, on key Fish Cove aquatic organisms.

On a periodic basis, water samples would be analyzed for target compound list metals and leachate indicators. These data would be compared to other local water quality data.

The effects on key Fish Cove aquatic organisms may be adsorption of metals in organism tissue and/or toxic effects on populations. Bioassays of shellfish or fish tissue would be analyzed for metals. Laboratory toxicity tests could be performed on local specimens to determine toxic levels.

TOWN OF SOUTHAMPTON

SUFFOLK COUNTY, NEW YORK

REMEDIAL INVESTIGATION REPORT

NORTH SEA LANDFILL

MARCH 1988

This Remedial Investigation (RI) report will describe the major findings of the remedial investigation conducted at the North Sea Landfill. The findings are based on water, soil and air investigations at the study site and environs. The resulting data demonstrate that there are minimal risks to public health and the environment. Subsequently, minimal remedial actions are required.

The USEPA presented an administrative order on consent to the Town of Southampton in February 1987. The Town owns the North Sea Landfill site which is on the National Priority List of Sites. The Town is a potentially responsible party (PRP) under Sections 107 (a) (1) and (2) of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA). The consent order was pursuant to the amended version of CERCLA (Superfund Amendments and Reauthorization Act of 1986), Section 106. The Town gave its consent to initiate the remedial investigation on March 31, 1987. The remedial investigation was under the direction of Region II USEPA.

This Remedial Investigation (RI) report is divided into four chapters. The first chapter covers introductory sections which discuss the site and the RI in general. The second chapter summarizes and presents key RI data as a result of several environmental investigations. The third chapter is a preliminary public health evaluation. The fourth chapter is a discussion of potential remedial alternatives which may be feasible for the site. The fifth chapter summarizes the main conclusions and recommendations. Following the main chapters of the RI report are appendices which contain unreduced data, methodologies, analytical data, and other pertinent information. This report was written under the specifications described in "Guidance on Remedial Investigations Under CERCLA".

1.0 - INTRODUCTION

The introduction of this RI report includes the following sections: (1) a discussion of the objectives of the RI, (2) a description of all the tasks performed, (3) a discussion of the nature and extent of the problems at the North Sea Landfill site, and (4) a detailed description of the site before the RI was performed.

1.1 OBJECTIVES OF THE REMEDIAL INVESTIGATION

The overall objectives of the remedial investigation (RI) are to determine, through a phased approach, significant potential health risks posed by the North Sea Landfill and to identify potential remedial actions for the site.

The specific objectives of the RI are as follows: (1) determine the horizontal and vertical extent of the plume beneath the site and downgradient, as well as at the Fish Cove area; (2) determine the background groundwater quality upgradient from the landfill; (3) determine the impact, if any, due to the scavenger lagoons; and (4) perform a qualitative public health evaluation (PHE). A full sampling program for priority pollutant chemicals present in the exposure pathways (water, soil and air) with full United States Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) analyses procedures used to achieve the overall and specific objectives of the RI.

The potential environmental pathways of exposure in order of priority are: (1) groundwater and surface water; (2) soil; and (3) air. These environmental media were investigated as part of Phase I of this RI.

1.1.1 - Groundwater and Surface Water

A contaminated plume has been detected moving northwest from the site. This plume is primarily composed of landfill leachate constituents. The capped (inactive) cells on the site are the probable source of this contamination. Currently, exposure to the plume is limited since the homes which had been utilizing this water in the past for potable use are now served by public water.

The potential also exists for the groundwater plume to discharge to surface water at Fish Cove, northwest of the landfill. However, tidal influence may be significant in reducing contaminant concentration. There are no other surface water exposure routes at this site.

Analysis of groundwater samples included priority pollutant chemicals to define the presence of hazardous inorganic and organic constituents present at the site. Direct confirmatory sampling of groundwater was necessary to determine hazardous levels of contaminants.

1.1.2 - Soil

Direct ingestion of soil and exposure to contaminated soil is the second most critical exposure route at this site. Exposure would be highest for the people who actually work at or near the landfill cells and/or sludge pit area. This pathway is also directly related to air exposure due to resuspension of contaminated soils.

Prior to the RI, there were data deficiencies on soil contamination at this site. This applied to surface and subsurface soils as well as lagoon sludge. Data that were provided for in the Phase I RI are soil analyses for organic and inorganic priority pollutant hazardous substances. The subsurface soil quality data added in defining the vertical extent of contamination at the site and the potential for contaminated soil to act as a secondary source for future migration.

1.1.3 - Air

Exposure for the people who work at the landfill to airborne organic and inorganic contaminants is possible. Prior to the RI, the exact health risk had not been documented.

Airborne contaminants may be due either to (1) volatilization and resuspension of substances from surface soils around landfill cells and scavenger lagoons, or (2) volatilization of hazardous substances from the septic sludge in the scavenger lagoon area. Air quality was monitored for priority pollutant volatiles.

The second overall objective of the RI/FS Study was to identify and evaluate potential remedial (cleanup) actions for the site. This involved consideration of any identified potential source areas, as well as the downgradient plume.

1.2 - TASK DESCRIPTIONS

Discussed below are the major tasks of the actual Remedial Investigation in conformance with the consent order between the Town and EPA and the contract between the Town and H2M. These include: field operations, sample analyses, data analyses and the actual preparation of the RI report.

1.2.1 - Field Operations

This task consists of well drilling operations and field sampling activities.

Well drilling operations consisted of the following activities: subcontacting procedures, site survey, well installation and completion.

Subcontracting activities took place concurrently with the preparation and review of the site investigation plan. The bid was prepared by H2M and sent out to several potential bidders. The lowest qualified bidder was accepted. This was Warren George, Inc., of Jersey City, N.J.

An inventory of H2M's existing wells used for previous groundwater monitoring studies was assessed as part of the site survey. Also, an inventory of the existing homeowner wells was inventoried and assessed.

Holes for well placement were drilled. The wells were then installed, completed and developed by the well drilling contractor. Following this, the wells were surveyed for elevation and location by an MBE subcontractor (I.J. Handa, P.C., New York City).

The following environmental media were then sampled: (1) groundwater; (2) landfill surface soil; (3) subsurface soil (sludge lagoon areas); (4) saturated soil at well boreholes; (5) surface water and sediment (Fish Cove); and (6) air. An MBE subcontractor (R & R International, Akron, OH) was chosen to collect air samples and analyze wind data. All other samples were collected by H2M.

1.2.2 - Sample Analyses

Sample analyses employing the USEPA CLP procedures were documented and performed by H2M Labs, Inc. All analytical data report packages are in the appendix.

1.2.3 - Data Analyses

This task covers the interpretation of laboratory analytical data and hydrogeologic data in application to future activities.

All laboratory analytical data generated were statistically analyzed under CLP procedures. The data were validated, reduced and evaluated.

Hydrogeologic data obtained from the investigation were used to evaluate the vertical and lateral extent of contaminated groundwater and soil, and to predict plume migration. These data were also useful in the preliminary public health evaluation for determining potential environmental exposure pathways and thus risks along those pathways.

1.2.4 - Preliminary Public Health Evaluation

A qualitative preliminary assessment of public health and environmental impacts of all practical remedial alternatives was performed. Short and long-term public health and environmental impacts were distinguished. The assessment was performed in compliance with State and Federal guidelines (including CERCLA/NCP).

1.3 - NATURE AND EXTENT OF THE PROBLEM

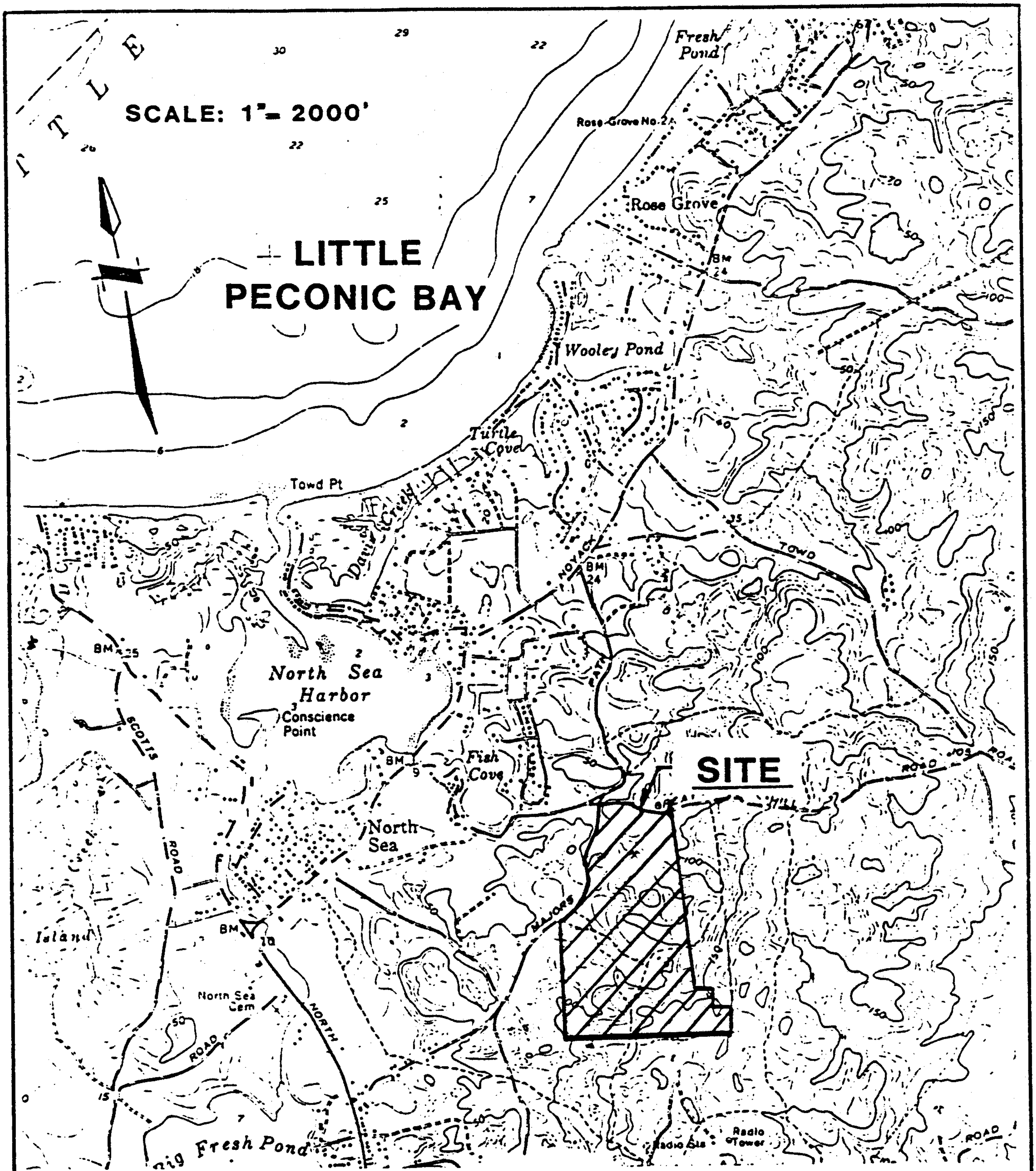
The North Sea Landfill is an active municipal landfill, owned and operated by the Town of Southampton. The site encompasses a total of 131 acres located southeast of the intersection of Major's Path and Old Fish Cove Road, in the Township of Southampton, Suffolk County, New York (Figure 1-1).

The landfill was initially constructed in 1963 for the disposal of municipal solid wastes, refuse, debris and septic system wastes. Significant features of the site include two existing landfill cells, of which only one is currently accepting wastes, and a total of 12 scavenger sludge lagoons which have been decommissioned and filled (Figure 1-2).

Cell 1 consists of two earlier landfill areas and totals approximately 13 acres. Cell 1 received septic system sludges in the early 1960's in addition to municipal solid wastes. Upon reaching capacity, it was subsequently closed in 1985. Closure of the cell consisted of capping with a 20 mil PVC membrane to minimize infiltration into the mound and covering it with approximately 2 feet of sand. A stormwater collection system was also installed which collects runoff from the landfill, and directs the stormwater to a recharge basin at the western edge of the site. The total quantity of wastes in Cell 1 is estimated at 1.3 million cubic yards.

1.3.1 - Prior Investigation

In the late 1960's, a series of 12 scavenger sludge lagoons, approximately 50 feet long, 10 feet deep and 50 feet above the water table were constructed at the southern portion of the property. These lagoons, currently inactive and filled, accepted septic system wastes from both commercial and residential sources. Septic sludges were deposited into these lagoons, allowed to drain and dry, and subsequently disposed of into landfill Cell 1.



NORTH SEA LANDFILL LOCATION MAP

SOURCE: USGS SOUTHAMPTON QUADRANGLE, 1956

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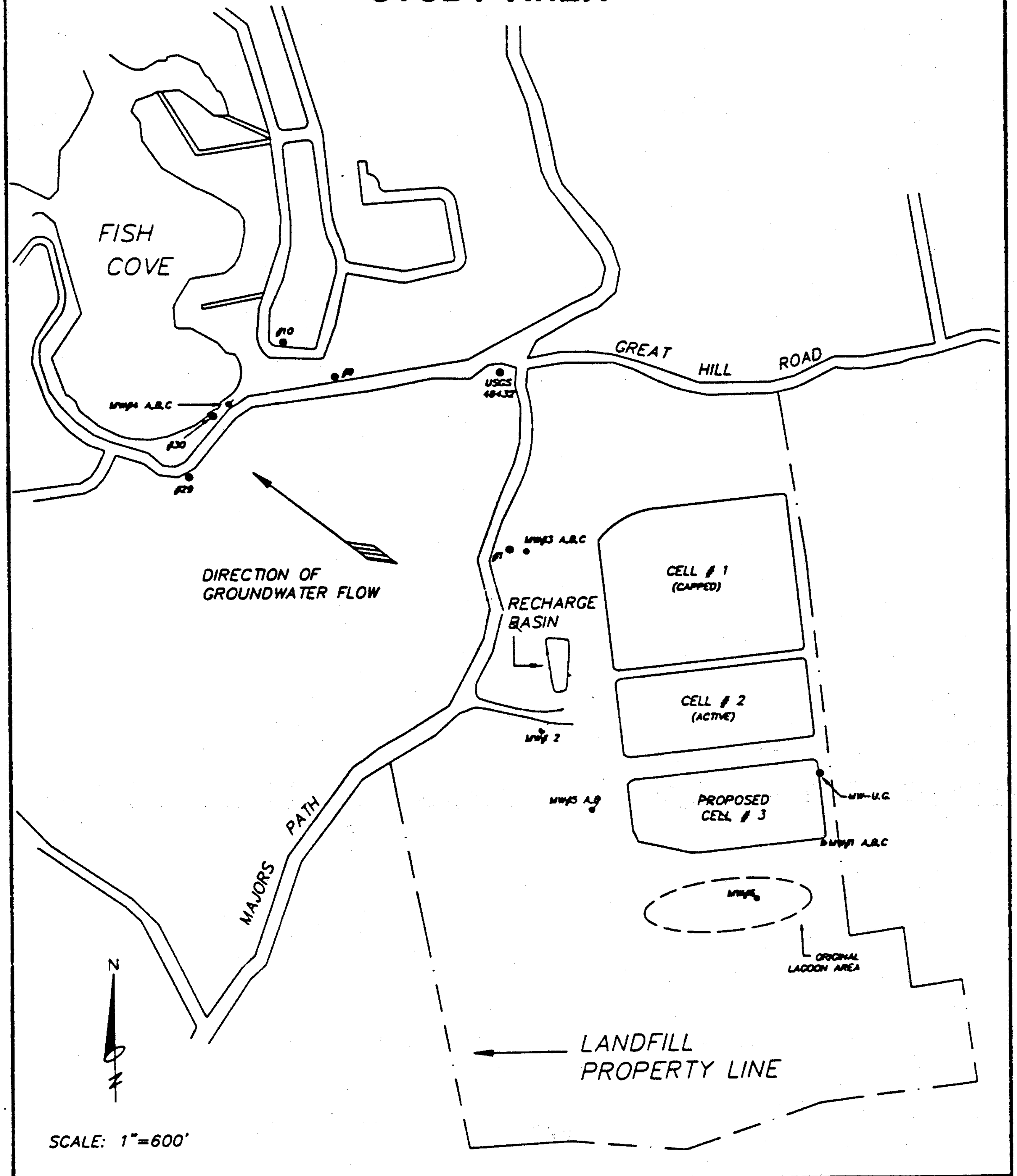
FIGURE 1-2

NORTH SEA LANDFILL RI STUDY AREA



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Throughout the active life of these sludge lagoons, it is estimated that they received a total of 11 million gallons of septic wastes. A formal closure plan for the lagoon area was not developed. Although there is no formal documentation as to the extent of remediation of these lagoons, the area has reportedly been excavated to about 12 feet and filled with sand and gravel.

The remaining active landfill cell (Cell 2) is approximately 7 acres in size and constructed with a bottom double liner of natural on-site clay (Ebasco, 1986) about 20 feet above the water table, and a leachate collection system in accordance with 6NYCRR Part 360. An underground fire destroyed the cell's leachate pumping system in 1987. However, a new well and pump has been installed to receive leachate. The new system is designed to pump leachate to a truck for off-site treatment. The cell currently accepts approximately 80,000 tons of municipal wastes annually. Seasonal disposal rates are approximately 400 tons per day in the summer months, and 100 tons per day in the winter. Upon reaching capacity, the Town will close and cap the landfill cell in accordance with State requirements, and will begin operation on the proposed new landfill cell.

The proposed landfill cell (Cell 3) is separated from the active cell (Cell 2) by a 100-foot buffer strip. This area is currently an excavated pit of about 7 acres. Cell 3 will be constructed to the design criteria given in 6 NYCRR, Part 360. The proposed double liner of the cell will consist of a 60 mil PVC liner with an overlying 80 mil HDPE liner. The cell will include a leachate collection system and stormwater control system. Closure plans for the cell will be developed in compliance with Part 360 regulations.

Methane monitoring probes were installed by the Town of Southampton for the purpose of monitoring methane concentrations emanating from the existing landfill cells. Past surveys, dating from 1977 to 1981, indicate that the methane concentrations were below the explosive range of five to ten percent methane in air. A summary of past methane monitoring data can be found in the "Town of Southampton, Study and Report, North Sea Landfill" prepared by Louis K. McLean Associates, P.C. and Holzmacher, McLendon & Murrell, P.C. (H2M), January 1981. There has been no other monitoring of methane to date. In 1984, the site was evaluated by the EPA for development of a Hazard Ranking Score (HRS). At that time, fire and explosive potential was determined to be zero. No system currently exists to vent methane.

Several investigations have been conducted since 1979 to characterize groundwater quality in the vicinity of the North Sea Landfill. Studies were performed by both SCDHS and the Town of Southampton.

The purpose of the SCDHS investigation was to assist the Town of Southampton in determining the extent of the leachate plume emanating from the vicinity of the North Sea Landfill. As part of the study, SCDHS installed a total of 14 monitoring wells on site and downgradient of the landfill. Elevated levels of iron and manganese were detected in monitoring wells NS-1, 9, 10, 29 and 30 (see Figure 2 for well locations). However, the SCDHS did not find the presence of heavy metals at that time and that groundwater exceeded none of the state primary drinking water standards.

A study conducted by H2M for the Town of Southampton included sampling and analysis of 16 private residential wells located northwest of the landfill for various water quality parameters. Initial testing indicated that some of the private wells had evidence of leachate contamination, but not at levels that exceed the Federal Primary Drinking Water Standards, established for health purposes. The results, however, indicated that parameters for secondary drinking water standards (i.e. iron, manganese), were exceeded at several of the wells. Since testing, these wells are no longer used as drinking water supplies. Water mains have been installed to provide public water to these homes at the Town's expense.

Both reports consistently indicated the presence of a groundwater contaminant plume flowing to the northwest towards Fish Cove from the vicinity of the North Sea Landfill. Approximate boundaries of the contaminant plume were defined based on monitoring well data, private residential well sample data, and groundwater flow direction. The plume of contamination exists from the landfill to Fish Cove. Recommendations from these two studies included continued groundwater monitoring of the landfill, and securing an alternate water supply for the affected homes within the defined plume zone. As a result, the Town of Southampton provided for the extension of water mains and service lines from the SCWA system to replace the few individual private water supply wells affected by the plume.

In September 1981, at the request of the Town of Southampton, H2M initiated an annual water sampling and analysis program that consisted of quarterly and annual groundwater sampling to determine the amount and extent of leachate migration from the North Sea Landfill. The groundwater was analyzed quarterly for several leachate indicator parameters: ammonia, chlorides, nitrates, detergent (MBAS), iron, specific conductivity, total organic carbon (TOC), total dissolved solids (TDS), pH and lead, as required by NYSDEC in the Town of Southampton's Part 360 Solid Waste Permit. Further sampling of the wells were also performed on an annual basis for an abbreviated list of priority pollutant compounds (volatile organics, phenols and metals), as well as PCBs and aldicarb (Temik). A summary and review of the 1981 to 1987 groundwater monitoring data is presented in the December 1987 "Annual Groundwater Monitoring Report North Sea Landfill" prepared by H2M.

Samples were collected from a total of six downgradient monitoring wells (SCDHS Wells No. 1, 9, 10, 29, 30 and USGS Well S-48432), and one upgradient monitoring well. (See Figure 2 for monitoring well locations). Analytical data from the network of downgradient wells monitor for changes in the areal extent of the leachate plume, and any notable changes in chemical constituents of the plume. An upgradient well was installed in early 1983 to establish background water quality, and to indicate the contribution of landfill leachate to groundwater contamination.

Monitoring wells 1, 9 and 30, located within the defined leachate plume, continue to display characteristically high concentrations of landfill leachate constituents in the groundwater. Samples taken from these wells were found to exceed the NYS Groundwater Classification Standards (GA waters) for iron, lead and manganese, and NYS Groundwater guidelines for leachate indicator parameters, TOC, ammonia, specific conductivity and pH. The lead concentration within the leachate plume seems to have progressively diminished in Wells No. 1 and 9 and the concentrations do not exceed the current NYS Drinking Water Standard of 25 ug/l. These lead samples were obtained without filtering which allows non-dissolved particles (i.e., soils to which metals adhere) to be included in the analysis. The RI/FS samples were filtered and will be used to determine if the lead is actually in a dissolved state. Wells No. 10, 29 and S-48432 have also exceeded State Groundwater Classification Standards for iron, lead and manganese on several occasions.

As summarized in the report, a review of the water quality data indicates that the leachate plume has not expanded significantly since 1979 either in the longitudinal or lateral direction. Wells No. 1, 9 and 30 consistently show the highest contaminant levels of leachate indicator parameters and metals concentrations among the six downgradient monitoring wells. An examination of contaminant levels in Wells No. 10, 29 and S-48432 show that these wells remain relatively unaffected by leachate contamination when compared to the contaminant levels in Wells No. 1, 9 and 30. Well No. 29 in particular indicated significant levels of chloride and TDS but no signficant concentrations of iron or manganese. The TOC content of Well No. 29 is less than that in Well No. 9. Well No. 10 is located just beyond the tip of the leachate plume, and Wells No. 29 and S-49432 are located on either side of the defined plume. Therefore, it appears that the leachate plume is relatively undispersed, and is traveling at a relatively slow rate to the northwest, as predicted in 1979. Water level measurements recorded throughout the sampling period confirm that the groundwater flow direction has not changed, and remains in the northwesterly direction, towards Fish Cove.

It is not conclusive that all the contaminants detected in the six downgradient monitoring wells are solely attributed to North Sea Landfill leachate as a contamination source. Elevated levels of iron, lead and phenols were detected in the upgradient well samples in excess of State standards. However, the iron concentration was not above typical concentrations found in uncontaminated groundwater on Long Island. Additionally, pH measurements of background water samples have also been found to periodically fall below the acceptable pH range of 6.5 to 8.5. This is a common occurrence in uncontaminated groundwater on Long Island. In addition, the average level of phenol in the upgradient well is substantially higher than the downgradient wells.

More recently, annual and quarterly groundwater monitoring has continued. Annual (March 1987) results indicate that the parameters found above groundwater standards were iron for all wells and pH for Wells No. 1 and 9. Quarterly results for July indicate pH (Wells No. 9 and 30), iron (all wells except upgradient well), and lead (Wells No. 9 and 30). Quarterly results for October indicate elevated pH (Well No. 19), iron (all wells) and lead (Well No. 9).

In addition to the inorganic compounds, a limited number of low concentration priority pollutant volatile organic compounds were detected in the groundwater samples during the monitoring period. Cis-1,2-dichloroethene and 1,1-dichloroethane were detected at trace levels in two downgradient monitoring wells at 2 parts per billion (ppb) and 6 ppb, respectively. Vinyl chloride was also detected on one occasion in Well No. 1 at 17 ppb in November 1983. However, the well was resampled in February 1984, but vinyl chloride was not found at the detection limit of 3 ppb. Highest detected concentrations of methylene chloride and chloroform were measured at 42 ppb and 14 ppb, respectively, in January/February 1985. However, the same constituents were found in the upgradient background sample, suggesting the possibility of alternate contaminant sources. No detectable levels of pesticides were found in any of the groundwater samples. The most recent annual sampling results (March 1987) indicate that all organics, including pesticides, are below detection levels except for total trihalomethanes at Well No. 29, which was 2 ug/l and the upgradient well at 1 ug/l.

1.4 - SITE DESCRIPTION

The North Sea Landfill site and environs are described in terms of the following: (1) geomorphology, (2) geology and hydrogeology, (3) sensitive environments, and (4) human factors.

1.4.1 - Geomorphology

The South Fork of Long Island is located in the Atlantic Coastal Plain physiographic province of the United States. The physiographic features of the South Fork are grouped into five geomorphic units: (1) the Ronkonkoma moraine; (2) kame deposits north of the moraine; (3) the south sloping outwash plain; (4) the dune spit; and tombolo complex to the east; and (5) shoreline and barrier beaches.

The North Sea Landfill is located in till deposits north of the Ronkonkoma moraine. North of the moraine are kame deposits. These deposits reach a maximum altitude of about 100 feet and mark areas of disintegrated, stagnant ice from the last glacial period.

1.4.2 - Geology and Hydrogeology

The North Sea Landfill is situated above fresh water aquifers which overlie deeper salt water aquifers. The unconsolidated deposits of Cretaceous and Quaternary Age rest unconformably on the Precambrian-Upper Paleozoic basement complexes (see Figure 1-3). The Upper Cretaceous deposits include, in ascending order, (1) the Raritan formation consisting of the Lloyd sand member and an overlying clay member; (2) the Magothy Formation-Matawan Group, undifferentiated; and (3) the Monmouth Group. Except for the Monmouth Group, the three units are continuous throughout the North Sea study area. Cretaceous deposits are overlain by Pleistocene and Holocene (recent) deposits. The Pleistocene deposits consist of glaciofluvial deposits of the Upper Glacial aquifer. Of immediate concern to the study site are the Cretaceous Magothy fresh water aquifer, the Upper Glacial fresh water aquifer, and surficial soils of more recent age.

Magothy Aquifer

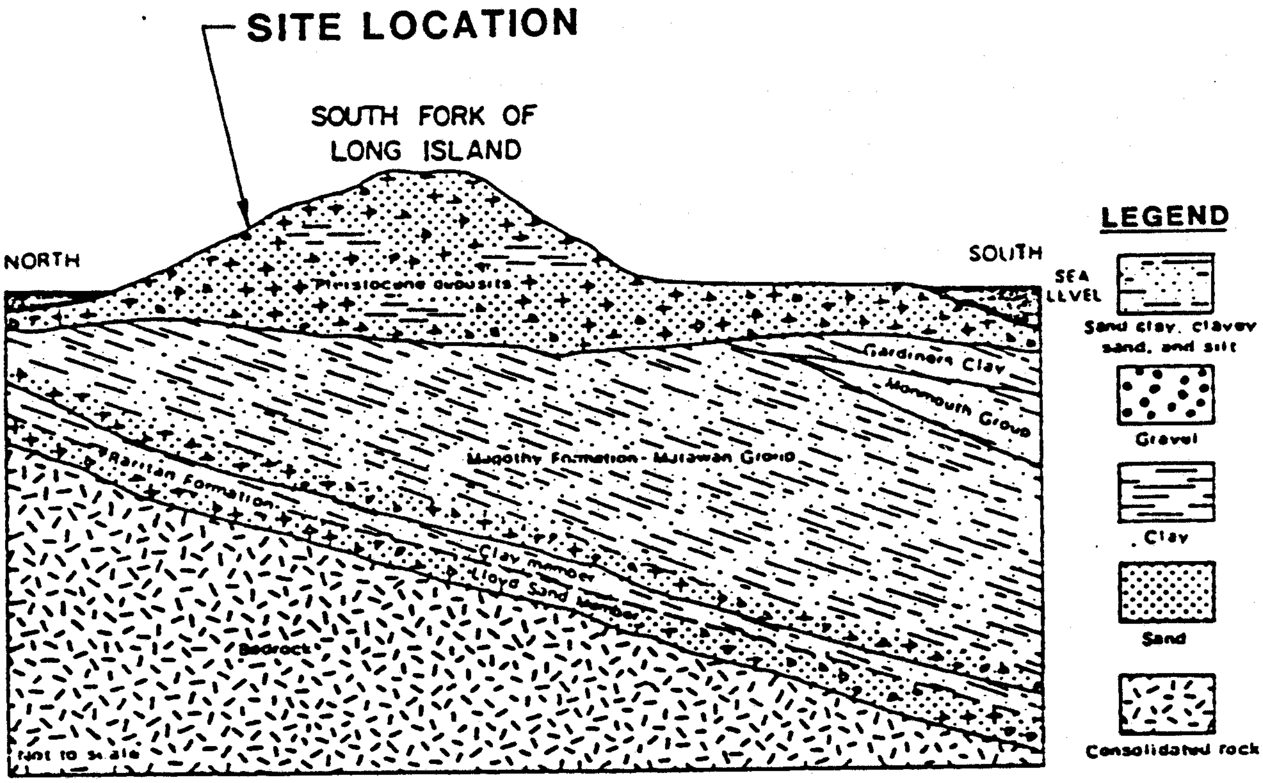
The Magothy aquifer is the deepest fresh water bearing zone. The top of the Magothy occurs at a depth of about 150 feet below mean sea level at the study area. This is also the formational contact with the bottom of the Upper Glacial aquifer. The Magothy is composed of layers of clay, sandy clay and silty clay. These layers are lower in hydraulic conductivity than the more permeable zones in the unit. The average horizontal hydraulic conductivity including all lithologic types in this unit is about 70 feet per day. Aquifer tests indicate transmissivity ranges from 607 square feet per day to 24,064 square feet per day (Fetter, 1971).

Salt water is present below depths of 380 to 400 feet. The upper boundary of the fresh water bearing zone is the base of the Upper Glacial aquifer. The lower limit is the fresh water/saline water interface.

Upper Glacial Aquifer

The Upper (water table) Glacial fresh water aquifer is estimated to be about 200 to 300 feet thick in the area of the landfill. It is primarily composed of Pleistocene deposits of sand and gravel. Most wells in the area are completed in this aquifer.

FIGURE 1-3



GENERALIZED GEOLOGIC CROSS SECTION OF THE SOUTH FORK OF LONG ISLAND

Recent studies (Sirkin and Buscheck, 1977) indicate that the Upper Glacial is composed of two superimposed drift sheets in the South Fork. From a hydrologic standpoint, the Upper Glacial is considered one hydraulic unit, as the drift sheets are indistinguishable and highly permeable. The lower drift sheet was deposited in the early Wisconsin glaciation. It consists of a thick sheet of outwash.

The Montauk till caps the lower outwash sheet. In the study area, the till may be about 10 to 30 feet thick. There may be evidence of channeling of the lower drift sheet occurring in the mid-Wisconsin glaciation (during a 22,000 year erosional interval). This could be significant hydrologically, thus affecting vertical groundwater migration through the Montauk till.

The upper drift sheet was deposited in the late Wisconsin glaciation period. This also consists of outwash, up to 60 m thick. The greatest thickness of the upper sheet is in the moraine north of Southampton on the north shore of the South Fork.

Site-specific data (a well log of monitoring Well NS-1 or S-67533) indicates clay may be present near the base of the Upper Glacial aquifer. If continuous, somewhat in areal extent, it could prevent vertical hydrologic communication with the Magothy formation.

Horizontal hydraulic conductivity of the Upper Glacial aquifer is greater than the Magothy aquifer. Thus, vertical migration into the Magothy is retarded. The average hydraulic conductivity of the Upper Glacial aquifer of the South Fork is 1250 gpd/ft^2 (5.9×10^{-2} cm/sec). However, pumping test data for a well near the site indicate a hydraulic conductivity of 325 gpd/ft^2 (1.5×10^{-2} cm/sec). Transmissivity is estimated to be 6,450 gpd/ft (Fetter, 1971). These values are in the general range of other values found in the literature. Hydraulic properties will vary with variations in geology. A reasonable value for storativity has been assumed to be about 0.18 for this study area (H2M, 1986).

Soils

Surficial soils have been identified from the United States Department of Agriculture, Soil Conservation Service Report (Soil Survey of Suffolk County, New York 1975). Two major soil associations within and surrounding the landfill are Carver and Plymouth Sands, 3 to 15 percent slope, and "made" land.

The soils of Suffolk County were deposited as a result of glaciation during the Wisconsin Age. The glacial outwash consists of sorted sand and gravels.

The Carver/Plymouth Soils Association are found on rolling moraines and side slopes of drainage channels of outwash plains. The Carver Series consist of deep, excessively drained coarse textured soils. Carver soils are formed of sand and are too droughty to be used as topsoil.

"Made" land consists of concrete, bricks, trash, wire, etc. - anything but natural soil. This defines the landfill area.

Hydrology

Groundwater is replenished primarily from recharge via precipitation and lateral underground flow of fresh water. Total average precipitation per year is 45 inches. Average annual snowfall is 31 inches.

Loss of recharge occurs through evapotranspiration and runoff. As precipitation hits the land surface, a portion evaporates. Another portion is absorbed by vegetation and transpired back into the atmosphere.

Precipitation less evapotranspiration and runoff losses amounts to a recharge of about 18 inches per year.

The precipitation which reaches the main aquifer continues to flow through the zone of saturated gravel of the Upper Glacial aquifer at a rate of movement proportional to the slope of the water table. Water flows from higher to lower potential (e.g. high to low elevation) and can flow from lower to higher elevation in areas of discharge. This flow of water through the aquifer which eventually reaches the salt water is called underflow. This underflow is recharged water which is not withdrawn and is discharged to the ocean and bays.

There are two major types of groundwater movement at the site - the deep flow system and shallow groundwater subsystem. The shallow subsystem is governed by watershed boundaries and follows local topography until it discharges into streams or salt water bodies. These overlie a deeper flow system.

Underflow maintains the brackish water environment which is basic to the ecology of the estuarine community and it maintains the position of the fresh water/salt water interface. Underflow also provides the major portion (95%) of the water which flows in the fresh water streams of Long Island.

Spatially, the fresh water of the South Fork forms several roughly elliptical lenses of water which float on denser salty water underneath. These lenses are entirely contained in the porous glacial sand and gravel, and have no connection to any other fresh water source.

The upper boundary of the fresh water lens is called the water table and the lower boundary of the lens is a mixing zone between fresh and salt water.

The interface between fresh water and saline water is assumed to be a thin zone for the South Fork. The fresh water/salt water interface thickness of the southern portion of the South Fork can be approximated from the Ghyben-Herzberg model for oceanic islands. There is typically a ratio of 40 to 1 of fresh water below sea level to fresh water above sea level. However, in the northern part, where the landfill is located, the calculated depth to the interface is greater than what the model would indicate. This is probably due to increased degree of anisotropy in the geologic units (Nemickas & Koszalka, 1982).

Geologic evidence for the South Fork indicates that the Upper Glacial aquifer is in direct contact with the ocean or bay floor at the shore and extends seaward.

Generally, the water table rises to the end of April when vegetation is dormant and thus evapotranspiration is at its lowest. The water table generally begins to decline in May and reaches its lowest levels in early October. Water levels in the area of the landfill range from an elevation of 10 feet (upgradient) to 5 feet (downgradient).

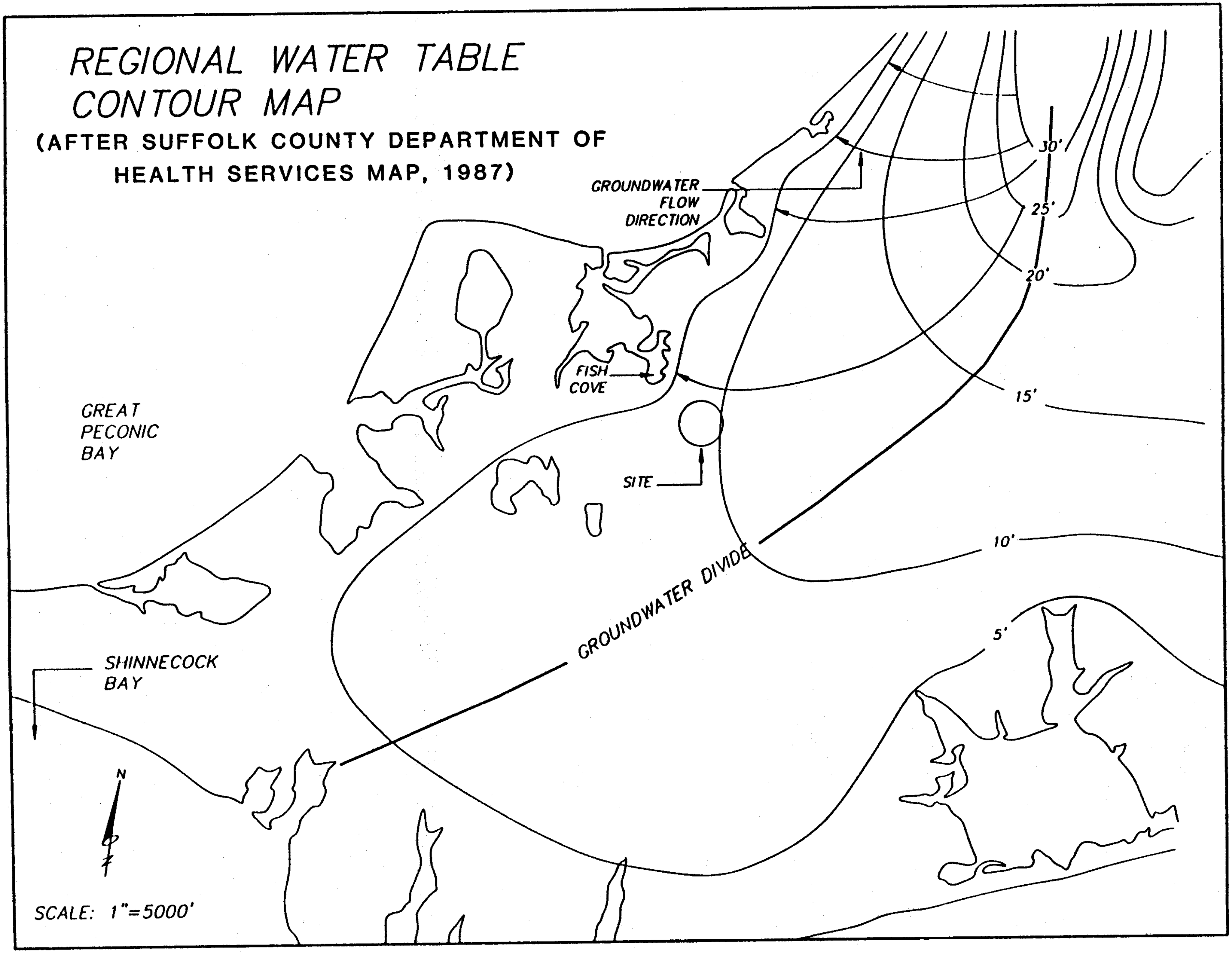
The largest observed water level fluctuations are in areas where the water table is high (near the east-west centerline of the South Fork or groundwater divide). Seasonal fluctuations north (and south) of the groundwater divide are less than 2 feet. Water levels in wells near the shore are influenced by tides and fluctuate around 1 foot.

Mounding (elevated water table) may occur in areas of varying lithology. Mounding is a characteristic typical of the area beneath landfill cells.

A regional water table contour map is shown in Figure 1-4. The regional hydraulic gradient is about .002 ft/ft. Groundwater in the Upper Glacial aquifer flows from the site to the northwest, toward Fish Cove and Little Peconic Bay. The path of the leachate plume follows the direction of groundwater flow at a slow rate, which has been estimated to be 135 ft/year in the site study area (H2M, 1986).

Due to anisotropic conditions, the vertical conductivity in the South Fork is lower than the horizontal conductivity. The ratio of vertical to horizontal hydraulic conductivity on the northern part of the South Fork is typically on the order of 1 to 100 (Nemickas and Koszalka, 1982). From H2M's experience, a ratio of 1 to 10 may be more reasonable.

FIGURE 1-4



REGIONAL WATER TABLE CONTOUR MAP

(AFTER SUFFOLK COUNTY DEPARTMENT OF HEALTH SERVICES MAP, 1987)

Diversions in groundwater flow direction from pumping wells will distort the plume. The plume is not diluted with the entire body of groundwater and tends to remain as an intact body with only slight dispersion and diffusion along the edges. The thickness of the plume will probably increase with distance downgradient from the source.

The extent and movement of various constituents in the plume will vary due to their chemical nature and the effects of attenuation. The leachate constituents can actually move faster than the average groundwater velocity due to hydrodynamic disperson. Also, changes in lithology within the aquifer and soil horizons will affect ion movement. For example, adsorption of ions to clay layers will retard the movement. Finally, organic constituents in particular may be degraded via chemical or biological processes.

1.4.3 - Sensitive Environments (Interscience, 1985)

Fish Cove is a body of salt water with marshes connected via a tidal inlet to the North Sea Harbor. The low marshes are relatively stable and productive, supporting a variety of marine invertebrates, juvenile fish species and water fowl. The intertidal marsh is dominated by salt marsh cone grass. The marsh area is about 45,000 square feet consisting of both intertidal and high marsh (NYSDEC Tidal Wetland Land Use Regulations, 6NYCRR Part 661). Waters provide nursery grounds for a variety of marine fishes, a habitat for marine invertebrates and the immediate shoreline and wetlands provide feeding, resting and nesting areas for a variety of shore and wading birds and other waterfowl.

Fish Cove is generally classified by the NYSDEC as a Class B fresh surface water area. (NYCRR, Chapter X, Subchapter B, Part 895, Article 16, 924.6, p. 4020). However, Fish Cove is actually a tidal estuary. The NYSDEC classification means that the best use of the water is for primary contact recreation. Based on available data, the northern part of the cove has unacceptable coliform content for shellfish harvesting. However, shellfishing is permitted in the southern portion where coliform concentrations are acceptable. The central portion is also acceptable for coliform. However, the entire cove indicates unacceptable fecal coliform concentrations (Personal Communication with NYSDEC, 1/15/87), which are probably the result of stormwater runoff and nearby septic systems.

Shellfish examined by the NYSDEC Marine Resources Monitoring Program from Fish Cove were found to contain arsenic, mercury, nickel, cadmium, lead and chromium. Of all these, Federal guidelines for food lists only mercury, which was below the standards level. Pesticides are also on the Federal standards for food and were found to be below detectable levels.

1.4.4 - Human Factors

The total population of the South Fork was estimated to be 26,776 in 1970. The total population for the eastern part of the Town of Southampton was estimated to be 15,796 in 1970, 17,538 in 1975, and 27,540 for 1995.

Within a quarter mile radius from the site there are approximately 15 homes. Within a half mile radius from the site there are approximately 100 homes. Most of the residents are located north, northwest and west of the site and downgradient from the landfill. There are no population centers to the east, which is predominantly wooded. The Village of Southampton lies 2.4 miles to the south of this site.

Most of the homes obtain their drinking water from private domestic wells tapping the highly permeable Pleistocene deposits of the Upper Glacial aquifer. Approximately a dozen private wells northeast of the site have been closed by the Suffolk County Department of Health Services (SCDHS) and are now connected to public water supply. Public water supply is provided through the Suffolk County Water Authority (SCWA). Public supply well pumpage is on the order of 3 million gallons per day from the Upper Glacial aquifer in the South Fork (Jensen and Soren, 1974).

Land usage within a half mile radius of the site is primarily zoned for private homes. However, there are signficiant industrial/commercial properties nearby. To the west of the site is an automobile salvage yard, located about 0.6 mile south of the landfill entrance. Additionally, a sand/gravel pit is located west of Major's Path betwen the landfill and Fish Cove.

On the west side of Major's Path, approximately 1,000 feet west of the site's property line, is an old landfill site operated by the Village of Southampton prior to the early 1960's when the subject landfill began operation. The old landfill was operated as a "burn and bury" dump. However, there are no known records detailing its operation.

2.0 - REMEDIAL INVESTIGATION FINDINGS

The remedial investigation consisted of several investigations of various environmental media. This section discusses the major findings of these investigations. The investigations include: soil, hydrogeologic, surface water and air investigations. Figure 2-1 depicts the locations of all sampling points, well locations and borings.

For each investigation performed, analytical results are discussed. The following procedure was used to select reported values for further analysis:

First, a summary table was constructed for each sampling matrix, i.e., soil, water or air. Values reported above detection levels were selected for further analysis. Values labeled with a "U" (for organics) or "<" (for inorganics) were omitted from further evaluation because they are below detection levels.

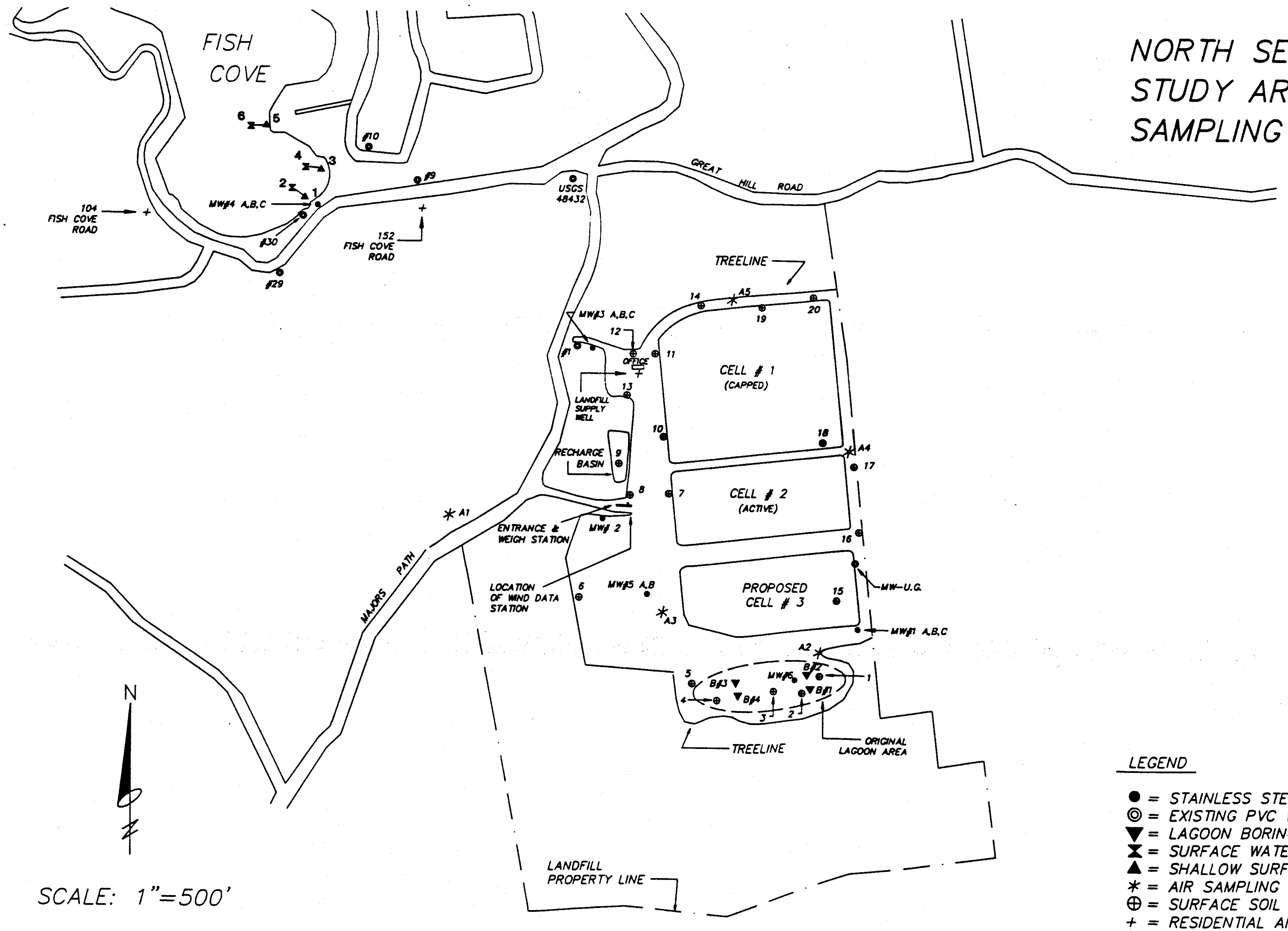
Certain values above detection levels were flagged. Contract Laboratory Protocol requires extensive QA/QC procedures when reporting laboratory data. Analytical results which do not meet those requirements are reported, but flagged. These values are thus carefully scrutinized along with the case narratives to properly define these flagged values.

Inorganic results are routinely flagged with an "N", "E", "S", and/or "*". An "N" flag indicates that the spike sample recovery is not within control limits. An "E" flag indicates that a value is estimated or not reported due to suspected interferences. If one sample in a matrix is flagged, then the entire group analyzed in that matrix is flagged. An "S" flag indicates acceptable values and that the value was determined by the method of standard addition.

A flag of "*" indicates that a duplicate analysis is not within control limits. These values are still acceptable, but are not acceptable when the duplicate analysis cannot be repeated. In this case, the correlation coefficient for the method of standard addition is less than .995 and is labeled with a "+". Values flagged with a "+" were excluded from further evaluation.

Organic results are routinely labeled with a "J" or a "B". If a value was labeled "J", it was also considered as part of the analysis. "J" indicates an estimated value. This typically applies to situations where the concentration of the identified compound is less than the specified detection limit, but greater than zero. It is also used when estimating a concentration of tentatively identified compounds where a 1:1 response is assumed.

NORTH SEA RI STUDY AREA AND SAMPLING LOCATIONS



LEGEND

● = STAINLESS STEEL MONITORING WELL
◎ = EXISTING PVC WELL
▼ = LAGOON BORING
⧗ = SURFACE WATER
▲ = SHALLOW SURFACE WATER AND SEDIMENT
✳ = AIR SAMPLING STATION
⊕ = SURFACE SOIL SAMPLING POINT
\+ = RESIDENTIAL AND SUPPLY WELL

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Organic values flagged with a "B" are suspect, but included in the evaluation. The "B" flag indicates that the analyte was found in the laboratory blank as well as a sample. For example, one compound that was detected in all sample laboratory blanks was bis-(2-ethyl-hexyl) phthalate or DOP. DEHP is the most common plasticizer in PVC and is used in blood tubing, plasma packs and gloves.

Further steps taken after considering the reported values for further analysis are described within each investigation performed.

2.1 - SOIL INVESTIGATIONS

The soil investigations consisted of soil-gas surveys, surface soil sampling, unsaturated soil sampling, saturated soil sampling and sediment (from Fish Cove) sampling.

For each soil investigation, the selected laboratory analytical data are discussed. The discussion for each is divided into inorganic and organic results. Values above detection levels for each category were considered significant in terms of frequency of occurrence and/or variability of parameters evident per sampling location. Range and representative concentrations are given where appropriate.

Inorganic results include E.P. Toxicity extraction results for soil, in addition to priority pollutant metals in soil. The E.P. Toxicity procedure was utilized as an aid to interpreting total digestion procedure results. Whereas, the total digestion procedure quantifies the total concentration of a material in soil, the E.P. Toxicity procedure demonstrates the leachability, presence and mobility of the material. This is particularly important for metals which can be naturally occurring at high levels in soil and which, if deposited in soil, adhere to the soil particles and do not transport readily. The E.P. Toxicity extraction procedure analyzes for arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver.

A general rule of thumb is that E.P. Toxicity results should be twenty times less than the corresponding priority pollutant metals results. However, keep in mind that the E.P. Toxicity results represent the simulation of metals leaching into solution as a result of acid rain, not the amount of metal in soil. Thus, the direct correlation of E.P. Toxicity results to priority pollutant digestion procedure results is questionable and in some cases may be a higher value (in mg/l) than the soil values (in mg/kg).

The results were compared against typical soil concentration ranges and available "action levels" (Table 2-1). This was done because background level concentrations of metals in soil at this site are questionable and may be variable. However, it can safely be assumed that background levels of organics should be below detection levels for any organic compound, since most are from unnatural sources.

In addition to the mass spectral library of organic compounds identified, there were several tentatively identified and unknown organic compounds. Please refer to Appendix F for further information on these compounds. Some commonly found, tentatively identified organic compounds were: 1,1,2,2-tetrachloroethane, hexadecanoic acid and 1,1,3-tetradecadiene.

TABLE 2-1

ACTION LEVELS FOR INORGANIC AND ORGANIC CONSTITUTENTS IN SOIL

PARAMETER	ACTION LEVELS (mg/kg dry wt)		HAZARDOUS WASTE CRITERIA FOR E.P. TOXICITY TESTS (RCRA) (mg/l)
	NYSDEC	NJDEP	
A.B. = Three to five times above the background soil concentration			
Inorganics:			
As	A.B.	20	5.0
Ba	A.B.	400	100.0
Cd	A.B.	3	1.0
Cr (Total)	A.B.	100	5.0
Cu	A.B.	170	-
CN	A.B.	12	-
Pb	A.B.	250-1000	5.0
Hg	A.B.	1	0.2
Ni	A.B.	100	-
Se	-	4	1.0
Ag	A.B.	5	5.0
Zn	A.B.	350	-
Organics:			
Volatile Organics	10	1	-
Base Neutrals*	-	10	-
PCBs	10	1-5	-
Petroleum Hydrocarbons	10	100	-
Pesticides	1		

*For Example, PAHs, Phthalates

2.1.1 - Soil Gas Surveys

Two surface soil gas surveys were performed. The first was part of the overall general survey performed before field activities commenced. The second survey was performed in conjunction with surface soil sampling. Both surveys included ambient air readings at each station. Each station was also a surface soil sampling location. All readings were taken with a photoionization detector (PID) or flame ionization detector (FID). Both units can measure a wide range of organics in the surface soil gas or air. Data can be seen in Tables 2-2a (general survey) and 2-2b (surface soil locations). The locations probed can be seen in Figure 2-1.

Surface soil was probed with an FID (organic vapor analyzer) for the general survey. Readings indicate organic levels including methane in the soil. The general survey included soil probing of well drilling locations and air monitoring stations for methane, total organics, methylene chloride and vinyl chloride.

The soil gas probing (using an FID) results for the general survey indicated various areas of very high total organic readings. Total organics cover a wide range of low to high molecular weight organics. These areas were generally located downgradient and in areas behind the active cell. Areas of very high total organic readings existed in the area where the sludge lagoons used to be, in the recharge basin, east of the active cell, and the active roadway west of the inactive cell. Screening for methane, a low molecular weight, indicated that the high total organic readings were generally methane. Methane is a bi-product of the decomposition of organic material, as would be expected at a landfill or septic disposal area. Soil samples collected from these areas provided more definitive information as to what organic contaminants may exist at these locations.

2.1.2 - Surface Soil

Surface soil samples were analyzed for semi-volatiles and metals. The organic analytical results are discussed first, then the inorganic analytical results are discussed. There were twenty surface soil sampling locations on the site. Surface soil samples were not obtained off the Town property (see Figure 2-2).

- Organics. Surface soil samples were analyzed for semi-volatiles (see Table 2-3). Several phthalates were found. All values were labeled "J" except for DEHP. Present in all samples and the blanks was DEHP (or bis-(2-ethyl-hexyl) phthalate). This compound was considered a laboratory contaminant and was also was found in trip and field blanks. This compound was eliminated from further evaluation.

TABLE 2-2a

GENERAL SOIL GAS SURVEY

STATION/LOCATION	TOTAL ORGANICS* (ppm)	METHANE* (ppm)	VINYL CHLORIDE**	METHYLENE CHLORIDE**
1) Surface Soil Sample Locations:				
1 Filled Lagoon Area	600	280		
2 Filled Lagoon Area	>1000	>1000		
3 Filled Lagoon Area	>1000	>1000		
4 Filled Lagoon Area	2.8	1.2		
5 Filled Lagoon Area	.2	0		
6 W/O Burn'g Leaf Pile	2.6	3.0		
7 W/O Active Cell	6.8	6.0		
8 Entrance to Landfill	1.1	.8		
9 Recharge Basin	180	140		
10 Active Rd. W/O Inactive Cell	>1000	>1000		
11 Active Rd. W/O Inactive Cell	>1000	>1000		
12 Near Office	.4	.2		
13 Near Office	920	>1000		
14 N/O Inactive Cell	140	50		
15 Proposed Cell	.2	.2		
16 E/O Active Cell	30	12		
17 E/O Active Cell	>1000	>1000		
18 E/O Active Cell	13	13		
19 N/O Inactive Cell	>1000	>1000		
20 N/O Inactive Cell	4.0	4.0		
2) Air Station Locations:				
1 Majors Path	0	0	<100	<5
2 Filled Lagoon	0	0	<100	<5
3 W/O Proposed Cell	420	32	<100	<5
4 E/O Active Cell	>1000	>1000	<100	<5
5 N/O Inactive Cell	>1000	>1000	<100	<5
3) Well Locations:				
MW-2	.6	.4	<100	<5
MW-3	0	0	<100	<5
MW-4	.1	0	<100	<5

* An FID was used for this survey.
**Drager tubes used.

TABLE 2-2b

PID RESPONSES FROM SURFACE SOIL SAMPLING LOCATIONS

(TAKEN DURING SURFACE SOIL SAMPLING)

SAMPLE NO.	BACKGROUND	READING	NET RESPONSE
1	1.3	10.0	8.7
2	1.3	11.2	9.9
3	1.4	3.0	1.6
4	1.3	3.6	2.3
5	1.4	2.0	.6
6	1.3	3.2	1.9
7	1.3	3.2	1.9
8	1.5	2.5	1.0
9	1.5	3.5	2.0
10	1.5	2.5	1.0
11	3.2	3.2	0
12	1.8	3.5	1.7
13	1.7	2.8	1.1
14	1.2	2.8	1.6
15	1.0	3.2	2.2
16	1.4	3.6	2.2
17	1.2	5.4	4.2
18	1.2	1.2	0
19	1.2	1.2	0
20	1.4	3.2	1.8

FIGURE 2-2

NORTH SEA RI
SOIL BORING LOCATIONS AND SURFACE SOIL SAMPLING LOCATIONS

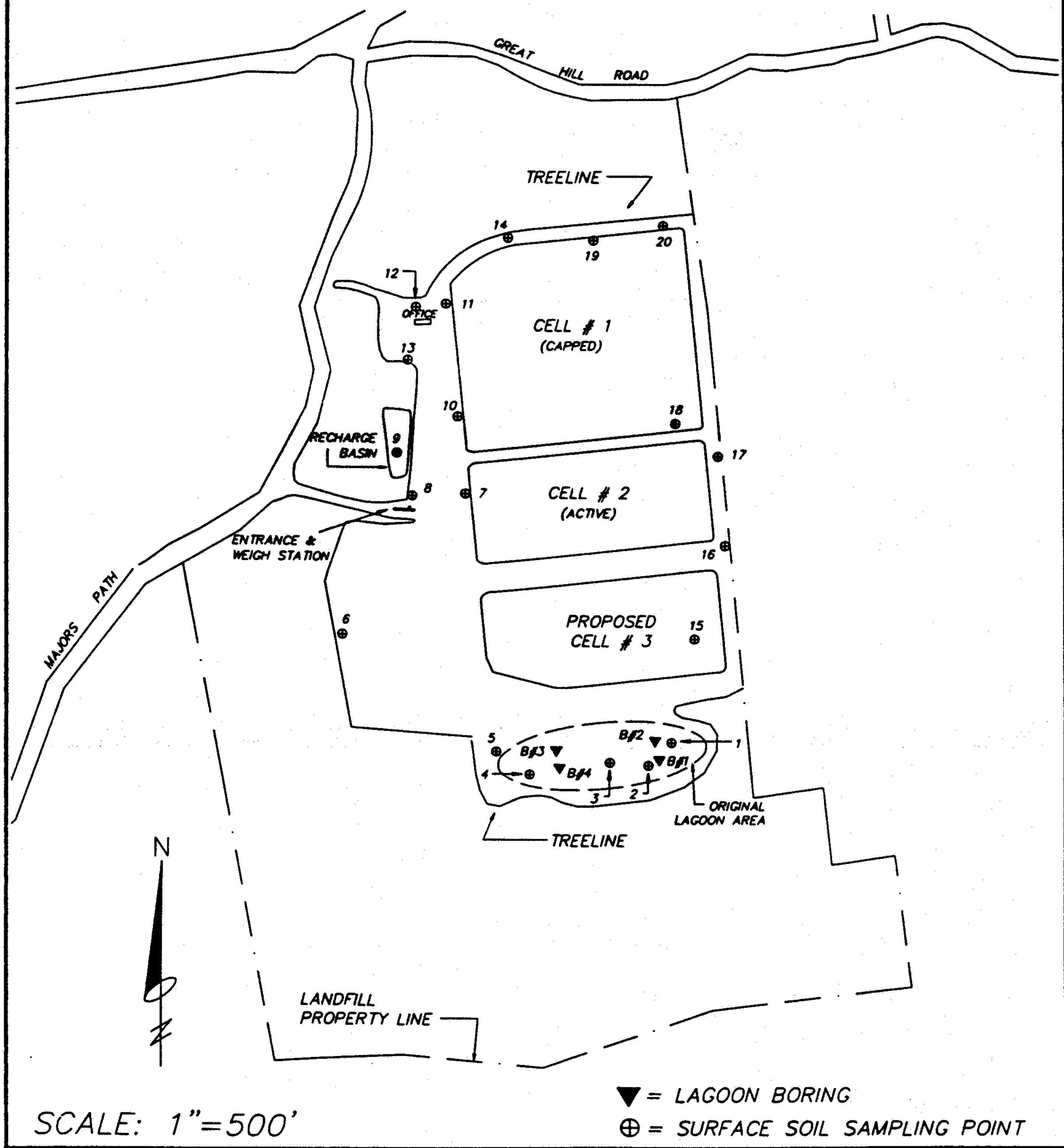

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TABLE 2-3

ORGANIC CONTAMINANTS QUANTIFIED
IN SURFACE SOILS @ NORTH SEA LANDFILL
RESULTS IN (ug/kg)

CONTAMINANTS QUANTIFIED	DATE SAMPLED	SURFACE SOIL #1	SURFACE SOIL #2	SURFACE SOIL #3	SURFACE SOIL #4	SURFACE SOIL #5	SURFACE SOIL #6	SURFACE SOIL #7	SURFACE SOIL #8	SURFACE SOIL #9	SURFACE SOIL #10	FIELD BLANK	TRIP BLANK
SEMI-VOLATILES													
DI-N-BUTYLPHTHALATE	10/13	ND	ND	ND	ND	ND	ND	49J	ND	61J	51J	2J	ND
DIETHYLPHTHALATE	10/13	ND	52J	ND	ND	ND	63J	61J	ND	ND	ND	ND	ND
BIS(2-ETHYLHEXYL)-PHTHALATE	10/13	1800B	350JB	910B	2300B	1300B	9900B	1600B	3300B	2200B	2700B	110B	63B
SEMI-VOLATILES		SURFACE SOIL #11	SURFACE SOIL #12	SURFACE SOIL #13	SURFACE SOIL #14	SURFACE SOIL #15	SURFACE SOIL #16	SURFACE SOIL #17	SURFACE SOIL #18	SURFACE SOIL #19	SURFACE SOIL #20	FIELD BLANK	TRIP BLANK
DI-N-BUTYLPHTHALATE	10/14	57J	ND	72J	350J	ND	ND	ND	ND	160J	ND	1J	1J
DIETHYLPHTHALATE	10/14	ND	ND	ND	48J	ND	ND	ND	ND	ND	ND	ND	ND
BIS(2-ETHYLHEXYL)-PHTHALATE	10/14	2600B	3100B	790B	3700B	300JB	1800B	ND	740B	620B	8100B	130B	28B
FLUORANTHENE	10/14	ND	ND	ND	140J	ND	ND	ND	ND	ND	ND	ND	ND
PYRENE	10/14	ND	ND	ND	140J	ND	ND	ND	ND	ND	ND	ND	ND
BUTYLBENZYLPHTHALATE	10/14	ND	ND	ND	170J	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(a)ANTHRACENE	10/14	ND	ND	ND	95J	ND	ND	ND	ND	ND	ND	ND	ND
CHRYSENE	10/14	ND	ND	ND	150J	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(b)FLUORANTHENE	10/14	ND	ND	ND	250J	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(k)FLUORANTHENE	10/14	ND	ND	ND	110J	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(a)PYRENE	10/14	ND	ND	ND	110J	ND	ND	ND	ND	ND	ND	ND	ND
INDENO(123cd)PYRENE	10/14	ND	ND	ND	71J	ND	ND	ND	ND	ND	ND	ND	ND
BENZO(ghi)PERYLENE	10/14	ND	ND	ND	57J	ND	ND	ND	ND	ND	ND	ND	ND

ND - NOT DETECTABLE
B - ANALYTE ALSO DETECTED IN INSTRUMENT BLANK
J - ANALYTE DETECTED WITH CONFIDENCE BUT BELOW DETECTION LIMIT

Di-n-butyl phthalate was evident in the samples from locations #7, 9, 10, 11, 13, 14 and 19. However, the field and trip blanks also exhibited the presence of this compound. Another phthalate, DEP (di-ethyl phthalate), did not occur in field and trip blanks and was found in four soil samples (Nos. 2, 6, 7 and 14). NJDEP action level of 10 mg/kg was not exceeded.

Overall, the phthalates seem to be ubiquitous in the environment. Sources may simply be various forms of plastics. The environmental behavior is similar to PAHs. DEHP is probably the most well studied of all phthalates. Adsorption of phthalates is high, along with complexation with natural organic substances. Therefore, it is reasonable to conclude that leaching of phthalates to the groundwater will be limited.

Several types of PAHs (polycyclic aromatic hydrocarbons) were found at location 14. These include fluoranthene, pyrene, benzo-(a)-anthracene, benzo-(b)-fluoranthene, benzo-(k)-fluoranthene, benzo-(a)-pyrene, indeno-(1,2,3-cd)-pyrene, and benzo-(g, h,i)-perylene. PAHs, in general are related to combustion products and are strongly adsorbed onto particulate matter, especially particulates high in organic content.

- Inorganics (Table 2-4, a-n) - Soil samples were analyzed for priority pollutant metals and E.P. Toxicity metals. Overall, inorganic analytical results for the 20 surface soil samples collected throughout the North Sea Landfill do not indicate any significant priority pollutant metal contamination. The predominant metals detected in these samples were cadmium, chromium, copper and zinc. The levels at which these analytes were found were either at or below background levels, well within the typical soil ranges, and below guidance action levels for these metals.

Results from the E.P. Toxicity extractions on these soils quantified concentrations for lead and mercury only. The concentrations of mercury were at significantly low levels (.0002-.05 mg/l), all well below the E.P. Toxicity standard of 0.2 mg/l. Similarly, the concentration of lead was low and well below the E.P. Toxicity level of 5.0 mg/l. The presence of these metals was not positively confirmed in the digestion procedure.

2.1.3 - Unsaturated Soil

During the well installation phase of the Remedial Investigation, four unsaturated soil borings were drilled in the area of the old sludge lagoons (Figure 2-2). Split spoon soil samples were collected every five (5) feet until the boring terminated at the top of the water table. These borings were sectioned off to shallow (0-25'), medium (30-50'), and deep (55-75') zones. The samples collected from each zone were composited prior to laboratory analysis. Within each zone, the highest OVA reading observed on a sample was set aside and analyzed for purgeable organics.

INORGANIC CONTAMINANTS QUANTIFIED IN SOILS

ANTIMONY

SURFACE SOIL	TOTAL CONC. (mg/kg)	EP.TOX. CONC. (mg/l)	FIELD BLANK (mg/l)	TRIP BLANK (mg/l)	DETECTION LIMIT (mg/kg)	EP. TOX LIMIT (mg/l)	NJDEP ACTION LEVEL (mg/kg)
1	ND	NA	ND	ND	7.0	NA	-
2	ND	NA	ND	ND	7.0	NA	-
3	ND	NA	ND	ND	7.0	NA	-
4	ND	NA	ND	ND	7.0	NA	-
5	ND	NA	ND	ND	7.0	NA	-
6	ND	NA	ND	ND	7.0	NA	-
7	ND	NA	ND	ND	7.0	NA	-
8	ND	NA	ND	ND	7.0	NA	-
9	ND	NA	ND	ND	7.0	NA	-
10	ND	NA	ND	ND	7.0	NA	-
11	<6.7NE	NA	ND	ND	7.0	NA	-
12	<7.6NE	NA	ND	ND	7.0	NA	-
13	<6.4NE	NA	ND	ND	7.0	NA	-
14	<6.3NE	NA	ND	ND	7.0	NA	-
15	<6.1NE	NA	ND	ND	7.0	NA	-
16	<6.3NE	NA	ND	ND	7.0	NA	-
17	<6.6NE	NA	ND	ND	7.0	NA	-
18	<6.5NE	NA	ND	ND	7.0	NA	-
19	<6.7NE	NA	ND	ND	7.0	NA	-
20	<6.3NE	NA	ND	ND	7.0	NA	-
LAGOON BORING							
1(0-25')	ND	NA	ND	ND	7.0	NA	-
1(25-55')	ND	NA	ND	ND	7.0	NA	-
1(55-75')	ND	NA	ND	ND	7.0	NA	-
2(0-25')	ND	NA	ND	ND	7.0	NA	-
2(25-55')	ND	NA	ND	ND	7.0	NA	-
2(55-75')	ND	NA	ND	ND	7.0	NA	-
3(0-25')	ND	NA	ND	ND	7.0	NA	-
3(25-55')	ND	NA	ND	ND	7.0	NA	-
3(55-75')	ND	NA	ND	ND	7.0	NA	-
4(0-25')	ND	NA	ND	ND	7.0	NA	-
4(25-55')	ND	NA	ND	ND	7.0	NA	-
4(55-75')	ND	NA	ND	ND	7.0	NA	-
SATURATED SOIL							
MW1A	ND	NA	ND	ND	7.0	NA	-
MW1B	ND	NA	ND	ND	7.0	NA	-
MW1C	ND	NA	ND	ND	7.0	NA	-
MW2	<7.1NE	NA	ND	ND	7.0	NA	-
MW3A	ND	NA	ND	ND	7.0	NA	-
MW3B	ND	NA	ND	ND	7.0	NA	-
MW3C	<7.1NE	NA	ND	ND	7.0	NA	-
MW4A	ND	NA	ND	ND	7.0	NA	-
MW4B	ND	NA	ND	ND	7.0	NA	-
MW4C	ND	NA	ND	ND	7.0	NA	-
MW6	ND	NA	ND	ND	7.0	NA	-
SURFWATER SEDIMENT							
1	ND	NA	ND	ND	7.0	NA	-
2	ND	NA	ND	ND	7.0	NA	-
3	ND	NA	ND	ND	7.0	NA	-

TABLE 2-4

INORGANIC CONTAMINANTS QUANTIFIED IN SOILS

ARSENIC

SURFACE SOIL	TOTAL CONC. (mg/kg)	EP.TOX. CONC. (mg/l)	FIELD BLANK (mg/l)	TRIP BLANK (mg/l)	DETECTION LIMIT (mg/kg)	EP. TOX LIMIT (mg/l)	NJDEP ACTION LEVEL (1) (mg/kg)
1	ND	ND	ND	ND	1.0	5.0	20.0
2	1.5	ND	ND	ND	1.0	5.0	20.0
3	ND	ND	ND	ND	1.0	5.0	20.0
4	8.10 B	ND	ND	ND	1.0	5.0	20.0
5	6.50 B	ND	ND	ND	1.0	5.0	20.0
6	7.8	ND	ND	ND	1.0	5.0	20.0
7	ND	ND	ND	ND	1.0	5.0	20.0
8	3.3	ND	ND	ND	1.0	5.0	20.0
9	ND	ND	ND	ND	1.0	5.0	20.0
10	ND	ND	ND	ND	1.0	5.0	20.0
11	<11.0 NE	ND	ND	ND	1.0	5.0	20.0
12	8.7NE+	ND	ND	ND	1.0	5.0	20.0
13	<11.0 NE	ND	ND	ND	1.0	5.0	20.0
14	<1.0 NE	ND	ND	ND	1.0	5.0	20.0
15	<1.0 NE	ND	ND	ND	1.0	5.0	20.0
16	<1.0 NE	ND	ND	ND	1.0	5.0	20.0
17	<1.1NE	ND	ND	ND	1.0	5.0	20.0
18	<11.0 NE	ND	ND	ND	1.0	5.0	20.0
19	<1.1NE	ND	ND	ND	1.0	5.0	20.0
20	<11.0 NE	ND	ND	ND	1.0	5.0	20.0
LAGOON BORING							
1(0-25')	12.0SNE	ND	ND	ND	1.0	5.0	20.0
1(25-55')	ND	ND	ND	ND	1.0	5.0	20.0
1(55-75')	13.0	ND	ND	ND	1.0	5.0	20.0
2(0-25')	14.0SNE	ND	ND	ND	1.0	5.0	20.0
2(25-55')	23.0SNE	ND	ND	ND	1.0	5.0	20.0
2(55-75')	13.0SNE	ND	ND	ND	1.0	5.0	20.0
3(0-25')	ND	ND	ND	ND	1.0	5.0	20.0
3(25-55')	ND	ND	ND	ND	1.0	5.0	20.0
3(55-75')	31.0SNE	ND	ND	ND	1.0	5.0	20.0
4(0-25')	15.3SNE	ND	ND	ND	1.0	5.0	20.0
4(25-55')	<15.0SNE	ND	ND	ND	1.0	5.0	20.0
4(55-75')	17.7	ND	ND	ND	1.0	5.0	20.0
SATURATED SOIL							
MW1A	ND	ND	ND	ND	1.0	5.0	20.0
MW1B	<1.0 NE	<0.01NE	ND	ND	1.0	5.0	20.0
MW1C	ND	ND	ND	ND	1.0	5.0	20.0
MW2	ND	ND	ND	ND	1.0	5.0	20.0
MW3A	ND	ND	ND	ND	1.0	5.0	20.0
MW3B	ND	ND	ND	ND	1.0	5.0	20.0
MW3C	ND	ND	ND	ND	1.0	5.0	20.0
MW4A	ND	ND	ND	ND	1.0	5.0	20.0
MW4B	ND	ND	ND	ND	1.0	5.0	20.0
MW4C	4.5B	ND	ND	ND	1.0	5.0	20.0
MW6	ND	ND	ND	ND	1.0	5.0	20.0
SURFWATER SEDIMENT							
1	ND	ND	ND	ND	1.0	5.0	20.0
2	ND	ND	ND	ND	1.0	5.0	20.0
3	ND	ND	ND	ND	1.0	5.0	20.0

INORGANIC CONTAMINANTS QUANTIFIED IN SOILS

BARIUM

SURFACE SOIL	TOTAL CONC. (mg/kg)	EP.TOX. CONC. (mg/l)	FIELD BLANK (mg/l)	TRIP BLANK (mg/l)	DETECTION LIMIT (mg/kg)	EP. TOX LIMIT (mg/l)	NJDEP ACTION LEVEL (1) (mg/kg)
1	NA	ND	NA	NA	0.2	100.0	5.0
2	NA	ND	NA	NA	0.2	100.0	5.0
3	NA	ND	NA	NA	0.2	100.0	5.0
4	NA	ND	NA	NA	0.2	100.0	5.0
5	NA	ND	NA	NA	0.2	100.0	5.0
6	NA	ND	NA	NA	0.2	100.0	5.0
7	NA	ND	NA	NA	0.2	100.0	5.0
8	NA	ND	NA	NA	0.2	100.0	5.0
9	NA	ND	NA	NA	0.2	100.0	5.0
10	NA	ND	NA	NA	0.2	100.0	5.0
11	NA	ND	NA	NA	0.2	100.0	5.0
12	NA	ND	NA	NA	0.2	100.0	5.0
13	NA	ND	NA	NA	0.2	100.0	5.0
14	NA	ND	NA	NA	0.2	100.0	5.0
15	NA	ND	NA	NA	0.2	100.0	5.0
16	NA	ND	NA	NA	0.2	100.0	5.0
17	NA	ND	NA	NA	0.2	100.0	5.0
18	NA	ND	NA	NA	0.2	100.0	5.0
19	NA	ND	NA	NA	0.2	100.0	5.0
20	NA	ND	NA	NA	0.2	100.0	5.0
LAGOON BORING							
1(0-25')	NA	ND	NA	NA	0.2	100.0	5.0
1(25-55')	NA	ND	NA	NA	0.2	100.0	5.0
1(55-75')	NA	ND	NA	NA	0.2	100.0	5.0
2(0-25')	NA	ND	NA	NA	0.2	100.0	5.0
2(25-55')	NA	ND	NA	NA	0.2	100.0	5.0
2(55-75')	NA	ND	NA	NA	0.2	100.0	5.0
3(0-25')	NA	ND	NA	NA	0.2	100.0	5.0
3(25-55')	NA	ND	NA	NA	0.2	100.0	5.0
3(55-75')	NA	ND	NA	NA	0.2	100.0	5.0
4(0-25')	NA	ND	NA	NA	0.2	100.0	5.0
4(25-55')	NA	ND	NA	NA	0.2	100.0	5.0
4(55-75')	NA	ND	NA	NA	0.2	100.0	5.0
SATURATED SOIL							
MW1A	NA	ND	NA	NA	0.2	100.0	5.0
MW1B	NA	ND	NA	NA	0.2	100.0	5.0
MW1C	NA	ND	NA	NA	0.2	100.0	5.0
MW2	NA	0.39	NA	NA	0.2	100.0	5.0
MW3A	NA	ND	NA	NA	0.2	100.0	5.0
MW3B	NA	ND	NA	NA	0.2	100.0	5.0
MW3C	NA	0.36	NA	NA	0.2	100.0	5.0
MW4A	NA	ND	NA	NA	0.2	100.0	5.0
MW4B	NA	ND	NA	NA	0.2	100.0	5.0
MW4C	NA	ND	NA	NA	0.2	100.0	5.0
MW6	NA	ND	NA	NA	0.2	100.0	5.0
SURFWATER SEDIMENT							
1	NA	ND	NA	NA	0.2	100.0	5.0
2	NA	ND	NA	NA	0.2	100.0	5.0
3	NA	ND	NA	NA	0.2	100.0	5.0

INORGANIC CONTAMINANTS QUANTIFIED IN SOILS

BERRYLIUM

SURFACE SOIL	TOTAL CONC. (mg/kg)	EP.TOX. CONC. (mg/l)	FIELD BLANK (mg/l)	TRIP BLANK (mg/l)	DETECTION LIMIT (mg/kg)	EP. TOX LIMIT (mg/l)	NJDEP ACTION LEVEL (1) (mg/kg)
1	ND	NA	ND	ND	0.6	NA	-
2	ND	NA	ND	ND	0.6	NA	-
3	ND	NA	ND	ND	0.6	NA	-
4	ND	NA	ND	ND	0.6	NA	-
5	ND	NA	ND	ND	0.6	NA	-
6	ND	NA	ND	ND	0.6	NA	-
7	ND	NA	ND	ND	0.6	NA	-
8	ND	NA	ND	ND	0.6	NA	-
9	ND	NA	ND	ND	0.6	NA	-
10	ND	NA	ND	ND	0.6	NA	-
11	ND	NA	ND	ND	0.6	NA	-
12	ND	NA	ND	ND	0.6	NA	-
13	ND	NA	ND	ND	0.6	NA	-
14	ND	NA	ND	ND	0.6	NA	-
15	ND	NA	ND	ND	0.6	NA	-
16	ND	NA	ND	ND	0.6	NA	-
17	ND	NA	ND	ND	0.6	NA	-
18	ND	NA	ND	ND	0.6	NA	-
19	ND	NA	ND	ND	0.6	NA	-
20	ND	NA	ND	ND	0.6	NA	-
LAGOON BORING							
1(0-25')	ND	NA	ND	ND	0.6	NA	-
1(25-55')	ND	NA	ND	ND	0.6	NA	-
1(55-75')	ND	NA	ND	ND	0.6	NA	-
2(0-25')	ND	NA	ND	ND	0.6	NA	-
2(25-55')	ND	NA	ND	ND	0.6	NA	-
2(55-75')	ND	NA	ND	ND	0.6	NA	-
3(0-25')	ND	NA	ND	ND	0.6	NA	-
3(25-55')	ND	NA	ND	ND	0.6	NA	-
3(55-75')	ND	NA	ND	ND	0.6	NA	-
4(0-25')	ND	NA	ND	ND	0.6	NA	-
4(25-55')	ND	NA	ND	ND	0.6	NA	-
4(55-75')	ND	NA	ND	ND	0.6	NA	-
SATURATED SOIL							
MW1A	ND	NA	ND	ND	0.6	NA	-
MW1B	ND	NA	ND	ND	0.6	NA	-
MW1C	ND	NA	ND	ND	0.6	NA	-
MW2	ND	NA	ND	ND	0.6	NA	-
MW3A	ND	NA	ND	ND	0.6	NA	-
MW3B	ND	NA	ND	ND	0.6	NA	-
MW3C	ND	NA	ND	ND	0.6	NA	-
MW4A	ND	NA	ND	ND	0.6	NA	-
MW4B	ND	NA	ND	ND	0.6	NA	-
MW4C	ND	NA	ND	ND	0.6	NA	-
MW6	ND	NA	ND	ND	0.6	NA	-
SURFWATER SEDIMENT							
1	ND	NA	ND	ND	0.6	NA	-
2	ND	NA	ND	ND	0.6	NA	-
3	ND	NA	ND	ND	0.6	NA	-

INORGANIC CONTAMINANTS QUANTIFIED IN SOILS

CADMIUM

SURFACE SOIL	TOTAL CONC. (mg/kg)	EP.TOX. CONC. (mg/l)	FIELD BLANK (mg/l)	TRIP BLANK (mg/l)	DETECTION LIMIT (mg/kg)	EP. TOX LIMIT (mg/l)	NJDEP ACTION LEVEL (1) (mg/kg)
1	0.5	ND	ND	ND	0.5	1.0	3.0
2	1.0	ND	ND	ND	0.5	1.0	3.0
3	0.7	ND	ND	ND	0.5	1.0	3.0
4	1.0	ND	ND	ND	0.5	1.0	3.0
5	2.2	ND	ND	ND	0.5	1.0	3.0
6	1.0	ND	ND	ND	0.5	1.0	3.0
7	1.0	ND	ND	ND	0.5	1.0	3.0
8	1.0	ND	ND	ND	0.5	1.0	3.0
9	ND	ND	ND	ND	0.5	1.0	3.0
10	0.8	ND	ND	ND	0.5	1.0	3.0
11	0.8	ND	ND	ND	0.5	1.0	3.0
12	0.8	ND	ND	ND	0.5	1.0	3.0
13	0.6	ND	ND	ND	0.5	1.0	3.0
14	0.5	ND	ND	ND	0.5	1.0	3.0
15	0.6	ND	ND	ND	0.5	1.0	3.0
16	ND	ND	ND	ND	0.5	1.0	3.0
17	ND	ND	ND	ND	0.5	1.0	3.0
18	0.8	ND	ND	ND	0.5	1.0	3.0
19	ND	ND	ND	ND	0.5	1.0	3.0
20	ND	ND	ND	ND	0.5	1.0	3.0
LAGOON BORING							
1(0-25')	1.1	ND	ND	ND	0.5	1.0	3.0
1(25-55')	ND	ND	ND	ND	0.5	1.0	3.0
1(55-75')	ND	ND	ND	ND	0.5	1.0	3.0
2(0-25')	0.9	ND	ND	ND	0.5	1.0	3.0
2(25-55')	1.6	ND	ND	ND	0.5	1.0	3.0
2(55-75')	ND	ND	ND	ND	0.5	1.0	3.0
3(0-25')	ND	ND	ND	ND	0.5	1.0	3.0
3(25-55')	ND	ND	ND	ND	0.5	1.0	3.0
3(55-75')	2.0	ND	ND	ND	0.5	1.0	3.0
4(0-25')	ND	ND	ND	ND	0.5	1.0	3.0
4(25-55')	2.3	ND	ND	ND	0.5	1.0	3.0
4(55-75')	ND	ND	ND	ND	0.5	1.0	3.0
SATURATED SOIL							
MW1A	ND	ND	ND	ND	0.5	1.0	3.0
MW1B	1.1	ND	ND	ND	0.5	1.0	3.0
MW1C	ND	ND	ND	ND	0.5	1.0	3.0
MW2	1.2	0.005	ND	ND	0.5	1.0	3.0
MW3A	ND	ND	ND	ND	0.5	1.0	3.0
MW3B	ND	ND	ND	ND	0.5	1.0	3.0
MW3C	1.2	0.006	ND	ND	0.5	1.0	3.0
MW4A	ND	0.005	ND	ND	0.5	1.0	3.0
MW4B	ND	ND	ND	ND	0.5	1.0	3.0
MW4C	0.8	ND	ND	ND	0.5	1.0	3.0
MW6	1.2	0.01	0.01	0.01	0.5	1.0	3.0
SURFWATER SEDIMENT							
1	1.1	0.01	0.01	0.01	0.5	1.0	3.0
2	1.7	ND	0.01	0.01	0.5	1.0	3.0
3	1.1	ND	0.01	0.01	0.5	1.0	3.0

INORGANIC CONTAMINANTS QUANTIFIED IN SOILS

CHROMIUM

SURFACE SOIL	TOTAL CONC. (mg/kg)	EP.TOX. CONC. (mg/l)	FIELD BLANK (mg/l)	TRIP BLANK (mg/l)	DETECTION LIMIT (mg/kg)	EP. TOX LIMIT (mg/l)	NJDEP ACTION LEVEL (1) (mg/kg)
1	ND	ND	ND	ND	1.2	5.0	100.
2	2.2	ND	ND	ND	1.2	5.0	100.
3	ND	ND	ND	ND	1.2	5.0	100.
4	1.0	ND	ND	ND	1.2	5.0	100.
5	4.4	ND	ND	ND	1.2	5.0	100.
6	4.4	ND	ND	ND	1.2	5.0	100.
7	1.0	ND	ND	ND	1.2	5.0	100.
8	2.0	ND	ND	ND	1.2	5.0	100.
9	2.2	ND	ND	ND	1.2	5.0	100.
10	ND	ND	ND	ND	1.2	5.0	100.
11	4.8	ND	ND	ND	1.2	5.0	100.
12	4.8	ND	ND	ND	1.2	5.0	100.
13	7.2	ND	ND	ND	1.2	5.0	100.
14	2.3	ND	ND	ND	1.2	5.0	100.
15	3.6	ND	ND	ND	1.2	5.0	100.
16	2.1	ND	ND	ND	1.2	5.0	100.
17	1.9	ND	ND	ND	1.2	5.0	100.
18	03.9	ND	ND	ND	1.2	5.0	100.
19	1.7	ND	ND	ND	1.2	5.0	100.
20	4.4	ND	ND	ND	1.2	5.0	100.
LAGOON BORING							
1(0-25')	7.7	ND	ND	ND	1.2	5.0	100.
1(25-55')	11.0	ND	ND	ND	1.2	5.0	100.
1(55-75')	11.0	ND	ND	ND	1.2	5.0	100.
2(0-25')	8.4	ND	ND	ND	1.2	5.0	100.
2(25-55')	12.0	ND	ND	ND	1.2	5.0	100.
2(55-75')	12.0	ND	ND	ND	1.2	5.0	100.
3(0-25')	5.1	ND	ND	ND	1.2	5.0	100.
3(25-55')	6.4	ND	ND	ND	1.2	5.0	100.
3(55-75')	14.0	ND	ND	ND	1.2	5.0	100.
4(0-25')	8.2	ND	ND	ND	1.2	5.0	100.
4(25-55')	16.0	ND	ND	ND	1.2	5.0	100.
4(55-75')	8.1	ND	ND	ND	1.2	5.0	100.
SATURATED SOIL							
MW1A	2.8	ND	ND	ND	1.2	5.0	100.
MW1B	5.7	ND	ND	ND	1.2	5.0	100.
MW1C	4.2	ND	ND	ND	1.2	5.0	100.
MW2	6.0	0.01	ND	ND	1.2	5.0	100.
MW3A	1.2	ND	ND	ND	1.2	5.0	100.
MW3B	2.4	ND	ND	ND	1.2	5.0	100.
MW3C	6.0	ND	ND	ND	1.2	5.0	100.
MW4A	ND	ND	ND	ND	1.2	5.0	100.
MW4B	1.3	ND	ND	ND	1.2	5.0	100.
MW4C	5.3	ND	ND	ND	1.2	5.0	100.
MW6	3.5	ND	ND	ND	1.2	5.0	100.
SURFWATER SEDIMENT							
1	1.3	ND	ND	ND	1.2	5.0	100.
2	2.6	ND	ND	ND	1.2	5.0	100.
3	ND	ND	ND	ND	1.2	5.0	100.

INORGANIC CONTAMINANTS QUANTIFIED IN SOILS

COPPER

SURFACE SOIL	TOTAL CONC. (mg/kg)	EP.TOX. CONC. (mg/l)	FIELD BLANK (mg/l)	TRIP BLANK (mg/l)	DETECTION LIMIT (mg/kg)	EP. TOX LIMIT (mg/l)	NJDEP ACTION LEVEL (1) (mg/kg)
1	5.5NE	NA	ND	ND	2.8	NA	170.
2	7.6NE	NA	ND	ND	2.8	NA	170.
3	9.8NE	NA	ND	ND	2.8	NA	170.
4	7.6NE	NA	ND	ND	2.8	NA	170.
5	7.6NE	NA	ND	ND	2.8	NA	170.
6	4.4NE	NA	ND	ND	2.8	NA	170.
7	4.4NE	NA	ND	ND	2.8	NA	170.
8	6.5NE	NA	ND	ND	2.8	NA	170.
9	5.5NE	NA	ND	ND	2.8	NA	170.
10	3.3NE	NA	ND	ND	2.8	NA	170.
11	6.3*	NA	ND	ND	2.8	NA	170.
12	25.*	NA	ND	ND	2.8	NA	170.
13	13.*	NA	ND	ND	2.8	NA	170.
14	5.8*	NA	ND	ND	2.8	NA	170.
15	6.6*	NA	ND	ND	2.8	NA	170.
16	12.*	NA	ND	ND	2.8	NA	170.
17	7.4*	NA	ND	ND	2.8	NA	170.
18	6.3*	NA	ND	ND	2.8	NA	170.
19	3.2*	NA	ND	ND	2.8	NA	170.
20	12.*	NA	ND	ND	2.8	NA	170.
LAGOON BORING							
1(0-25')	35.0	NA	ND	ND	2.8	NA	170.
1(25-55')	7.6	NA	ND	ND	2.8	NA	170.
1(55-75')	5.6	NA	ND	ND	2.8	NA	170.
2(0-25')	6.9	NA	ND	ND	2.8	NA	170.
2(25-55')	9.3	NA	ND	ND	2.8	NA	170.
2(55-75')	7.7	NA	ND	ND	2.8	NA	170.
3(0-25')	6.9	NA	ND	ND	2.8	NA	170.
3(25-55')	5.9	NA	ND	ND	2.8	NA	170.
3(55-75')	8.7	NA	ND	ND	2.8	NA	170.
4(0-25')	7.8	NA	ND	ND	2.8	NA	170.
4(25-55')	10.0	NA	ND	ND	2.8	NA	170.
4(55-75')	5.5	NA	ND	ND	2.8	NA	170.
SATURATED SOIL							
MW1A	ND	NA	ND	ND	2.8	NA	170.
MW1B	ND	NA	ND	ND	2.8	NA	170.
MW1C	ND	NA	ND	ND	2.8	NA	170.
MW2	7.2	NA	ND	ND	2.8	NA	170.
MW3A	7.8	NA	ND	ND	2.8	NA	170.
MW3B	3.8	NA	ND	ND	2.8	NA	170.
MW3C	4.8	NA	ND	ND	2.8	NA	170.
MW4A	ND	NA	ND	ND	2.8	NA	170.
MW4B	3.8	NA	ND	ND	2.8	NA	170.
MW4C	9.9	NA	ND	ND	2.8	NA	170.
MW6	4.2	NA	0.04	0.04	2.8	NA	170.
SURFWATER SEDIMENT							
1	9.3	NA	ND	ND	2.8	NA	170.
2	4.8	NA	ND	ND	2.8	NA	170.
3	19.0	NA	ND	ND	2.8	NA	170.

INORGANIC CONTAMINANTS QUANTIFIED IN SOILS

LEAD

SURFACE SOIL	TOTAL CONC. (mg/kg)	EP.TOX. CONC. (mg/l)	FIELD BLANK (mg/l)	TRIP BLANK (mg/l)	DETECTION LIMIT (mg/kg)	EP. TOX LIMIT (mg/l)	NJDEP ACTION LEVEL (1) (mg/kg)
1	<0.5NE	ND	ND	ND	0.5	5.0	100.
2	<0.5NE	ND	ND	ND	0.5	5.0	100.
3	<0.5NE	ND	ND	ND	0.5	5.0	100.
4	<0.5NE	ND	ND	ND	0.5	5.0	100.
5	<0.5NE	ND	ND	ND	0.5	5.0	100.
6	3.3NES	ND	ND	ND	0.5	5.0	100.
7	2.4NE	0.12	ND	ND	0.5	5.0	100.
8	5.5NE	ND	ND	ND	0.5	5.0	100.
9	6.8NES	ND	ND	ND	0.5	5.0	100.
10	5.5NES	0.006	ND	ND	0.5	5.0	100.
11	4.6	ND	ND	ND	0.5	5.0	100.
12	17.1	ND	ND	ND	0.5	5.0	100.
13	6.9	ND	ND	ND	0.5	5.0	100.
14	10.4	ND	ND	ND	0.5	5.0	100.
15	0.7	ND	ND	ND	0.5	5.0	100.
16	4.3	ND	ND	ND	0.5	5.0	100.
17	25	ND	ND	ND	0.5	5.0	100.
18	1.9	ND	ND	ND	0.5	5.0	100.
19	1.2	ND	ND	ND	0.5	5.0	100.
20	17.4	ND	ND	ND	0.5	5.0	100.
LAGOON BORING							
1(0-25')	13.0SNE	ND	ND	ND	0.5	5.0	100.
1(25-55')	3.3SNE	ND	ND	ND	0.5	5.0	100.
1(55-75')	4.1SNE	ND	ND	ND	0.5	5.0	100.
2(0-25')	5.5SNE	ND	ND	ND	0.5	5.0	100.
2(25-55')	4.8SNE	ND	ND	ND	0.5	5.0	100.
2(55-75')	4.0+NE	ND	ND	ND	0.5	5.0	100.
3(0-25')	2.8SNE	ND	ND	ND	0.5	5.0	100.
3(25-55')	3.3SNE	ND	ND	ND	0.5	5.0	100.
3(55-75')	5.1SNE	ND	ND	ND	0.5	5.0	100.
4(0-25')	5.6SNE	ND	ND	ND	0.5	5.0	100.
4(25-55')	7.2SNE	ND	ND	ND	0.5	5.0	100.
4(55-75')	5.0SNE	ND	ND	ND	0.5	5.0	100.
SATURATED SOIL							
MW1A	1.6	0.05	ND	ND	0.5	5.0	100.
MW1B	3.5	ND	ND	ND	0.5	5.0	100.
MW1C	<0.5NE	0.025	ND	ND	0.5	5.0	100.
MW2	3.8	0.009	ND	ND	0.5	5.0	100.
MW3A	16.0	ND	ND	ND	0.5	5.0	100.
MW3B	12.0	ND	ND	ND	0.5	5.0	100.
MW3C	3.3	0.0125	ND	ND	0.5	5.0	100.
MW4A	7.0	ND	ND	ND	0.5	5.0	100.
MW4B	15.0	ND	ND	ND	0.5	5.0	100.
MW4C	14.0	ND	ND	ND	0.5	5.0	100.
MW6	1.2	ND	ND	ND	0.5	5.0	100.
SURFWATER SEDIMENT							
1	5.15S	ND	ND	ND	0.5	5.0	100.
2	4.91S	0.007	ND	ND	0.5	5.0	100.
3	2.3	0.012	ND	ND	0.5	5.0	100.

INORGANIC CONTAMINANTS QUANTIFIED IN SOILS

MERCURY

SURFACE SOIL	TOTAL CONC. (mg/kg)	EP.TOX. CONC. (mg/l)	FIELD BLANK (mg/l)	TRIP BLANK (mg/l)	DETECTION LIMIT (mg/kg)	EP. TOX LIMIT (mg/l)	NJDEP ACTION LEVEL (1) (mg/kg)
1	1.9	0.05	ND	ND	10.0	0.2	-
2	ND	0.0008	ND	ND	10.0	0.2	-
3	ND	ND	ND	ND	10.0	0.2	-
4	ND	ND	ND	ND	10.0	0.2	-
5	ND	ND	ND	ND	10.0	0.2	-
6	ND	0.0004	ND	ND	10.0	0.2	-
7	ND	ND	ND	ND	10.0	0.2	-
8	ND	0.003	ND	ND	10.0	0.2	-
9	ND	ND	ND	ND	10.0	0.2	-
10	ND	0.0003	ND	ND	10.0	0.2	-
11	ND	0.0003	ND	ND	10.0	0.2	-
12	ND	0.0003	ND	ND	10.0	0.2	-
13	ND	0.0003	ND	ND	10.0	0.2	-
14	ND	0.0003	ND	ND	10.0	0.2	-
15	0.5	0.0002	ND	ND	10.0	0.2	-
16	ND	0.0008	ND	ND	10.0	0.2	-
17	ND	0.0004	ND	ND	10.0	0.2	-
18	ND	0.0004	ND	ND	10.0	0.2	-
19	ND	0.0003	ND	ND	10.0	0.2	-
20	ND	0.0004	ND	ND	10.0	0.2	-
LAGOON BORING							
1(0-25')	0.1	ND	ND	ND	10.0	0.2	-
1(25-55')	ND	ND	ND	ND	10.0	0.2	-
1(55-75')	ND	ND	ND	ND	10.0	0.2	-
2(0-25')	ND	ND	ND	ND	10.0	0.2	-
2(25-55')	ND	ND	ND	ND	10.0	0.2	-
2(55-75')	ND	ND	ND	ND	10.0	0.2	-
3(0-25')	ND	ND	ND	ND	10.0	0.2	-
3(25-55')	ND	0.0004	ND	ND	10.0	0.2	-
3(55-75')	ND	ND	ND	ND	10.0	0.2	-
4(0-25')	ND	ND	ND	ND	10.0	0.2	-
4(25-55')	ND	ND	ND	ND	10.0	0.2	-
4(55-75')	ND	ND	ND	ND	10.0	0.2	-
SATURATED SOIL							
MW1A	ND	ND	ND	ND	10.0	0.2	-
MW1B	ND	ND	ND	ND	10.0	0.2	-
MW1C	ND	ND	ND	ND	10.0	0.2	-
MW2	ND	ND	ND	ND	10.0	0.2	-
MW3A	ND	ND	ND	ND	10.0	0.2	-
MW3B	ND	ND	ND	ND	10.0	0.2	-
MW3C	ND	0.014	ND	ND	10.0	0.2	-
MW4A	ND	ND	ND	ND	10.0	0.2	-
MW4B	ND	ND	ND	ND	10.0	0.2	-
MW4C	ND	0.0004	ND	ND	10.0	0.2	-
MW6	ND	0.0005	ND	ND	10.0	0.2	-
SURFWATER SEDIMENT							
1	0.1	0.0002	ND	ND	10.0	0.2	-
2	ND	0.0004	ND	ND	10.0	0.2	-
3	ND	0.0004	ND	ND	10.0	0.2	-

TABLE 2-4 J

INORGANIC CONTAMINANTS QUANTIFIED IN SOILS

NICKEL

SURFACE SOIL	TOTAL CONC. (mg/kg)	EP.TOX. CONC. (mg/l)	FIELD BLANK (mg/l)	TRIP BLANK (mg/l)	DETECTION LIMIT (mg/kg)	EP. TOX LIMIT (mg/l)	NJDEP ACTION LEVEL (1) (mg/kg)
1	11.0	NA	ND	ND	4.6	NA	400
2	17.0	NA	ND	ND	4.6	NA	400
3	12.0	NA	ND	ND	4.6	NA	400
4	21.0	NA	ND	ND	4.6	NA	400
5	8.7	NA	ND	ND	4.6	NA	400
6	5.7	NA	ND	ND	4.6	NA	400
7	8.7	NA	ND	ND	4.6	NA	400
8	11.0	NA	ND	ND	4.6	NA	400
9	5.5	NA	ND	ND	4.6	NA	400
10	9.5	NA	ND	ND	4.6	NA	400
11	10.0	NA	ND	ND	4.6	NA	400
12	ND	NA	ND	ND	4.6	NA	400
13	ND	NA	ND	ND	4.6	NA	400
14	ND	NA	ND	ND	4.6	NA	400
15	ND	NA	ND	ND	4.6	NA	400
16	ND	NA	ND	ND	4.6	NA	400
17	ND	NA	ND	ND	4.6	NA	400
18	ND	NA	ND	ND	4.6	NA	400
19	ND	NA	ND	ND	4.6	NA	400
20	ND	NA	ND	ND	4.6	NA	400
LAGOON BORING							
1(0-25')	ND	NA	ND	ND	4.6	NA	400
1(25-55')	6.1	NA	ND	ND	4.6	NA	400
1(55-75')	5.2	NA	ND	ND	4.6	NA	400
2(0-25')	ND	NA	ND	ND	4.6	NA	400
2(25-55')	ND	NA	ND	ND	4.6	NA	400
2(55-75')	ND	NA	ND	ND	4.6	NA	400
3(0-25')	ND	NA	ND	ND	4.6	NA	400
3(25-55')	ND	NA	ND	ND	4.6	NA	400
3(55-75')	6.5	NA	ND	ND	4.6	NA	400
4(0-25')	ND	NA	ND	ND	4.6	NA	400
4(25-55')	5.4	NA	ND	ND	4.6	NA	400
4(55-75')	ND	NA	ND	ND	4.6	NA	400
SATURATED SOIL							
MW1A	ND	NA	ND	ND	4.6	NA	400
MW1B	ND	NA	ND	ND	4.6	NA	400
MW1C	ND	NA	ND	ND	4.6	NA	400
MW2	ND	NA	ND	ND	4.6	NA	400
MW3A	ND	NA	ND	ND	4.6	NA	400
MW3B	ND	NA	ND	ND	4.6	NA	400
MW3C	ND	NA	ND	ND	4.6	NA	400
MW4A	ND	NA	ND	ND	4.6	NA	400
MW4B	ND	NA	ND	ND	4.6	NA	400
MW4C	ND	NA	ND	ND	4.6	NA	400
MW6	3.4	NA	ND	ND	4.6	NA	400
SURFWATER SEDIMENT							
1	ND	NA	ND	ND	4.6	NA	400
2	ND	NA	ND	ND	4.6	NA	400
3	ND	NA	ND	ND	4.6	NA	400

INORGANIC CONTAMINANTS QUANTIFIED IN SOILS

SILVER

SURFACE SOIL	TOTAL CONC. (mg/kg)	EP.TOX. CONC. (mg/l)	FIELD BLANK (mg/l)	TRIP BLANK (mg/l)	DETECTION LIMIT (mg/kg)	EP. TOX LIMIT (mg/l)	NJDEP ACTION LEVEL (1) (mg/kg)
1	2.2	ND	ND	ND	1.1	5.0	5.0
2	ND	ND	ND	ND	1.1	5.0	5.0
3	ND	ND	ND	ND	1.1	5.0	5.0
4	ND	ND	ND	ND	1.1	5.0	5.0
5	ND	ND	ND	ND	1.1	5.0	5.0
6	ND	ND	ND	ND	1.1	5.0	5.0
7	ND	ND	ND	ND	1.1	5.0	5.0
8	ND	ND	ND	ND	1.1	5.0	5.0
9	ND	ND	ND	ND	1.1	5.0	5.0
10	ND	ND	ND	ND	1.1	5.0	5.0
11	<1.3NE	ND	ND	ND	1.1	5.0	5.0
12	<1.3NE	ND	ND	ND	1.1	5.0	5.0
13	<1.3NE	ND	ND	ND	1.1	5.0	5.0
14	<1.3NE	ND	ND	ND	1.1	5.0	5.0
15	<1.3NE	ND	ND	ND	1.1	5.0	5.0
16	<1.3NE	ND	ND	ND	1.1	5.0	5.0
17	<1.3NE	ND	ND	ND	1.1	5.0	5.0
18	<1.3NE	ND	ND	ND	1.1	5.0	5.0
19	<1.3NE	ND	ND	ND	1.1	5.0	5.0
20	<1.3NE	ND	ND	ND	1.1	5.0	5.0
LAGOON BORING							
1(0-25')	ND	ND	ND	ND	1.1	5.0	5.0
1(25-55')	ND	0.01	ND	ND	1.1	5.0	5.0
1(55-75')	ND	ND	ND	ND	1.1	5.0	5.0
2(0-25')	ND	ND	ND	ND	1.1	5.0	5.0
2(25-55')	ND	ND	ND	ND	1.1	5.0	5.0
2(55-75')	110	ND	ND	ND	1.1	5.0	5.0
3(0-25')	ND	ND	ND	ND	1.1	5.0	5.0
3(25-55')	ND	ND	ND	ND	1.1	5.0	5.0
3(55-75')	ND	ND	ND	ND	1.1	5.0	5.0
4(0-25')	ND	ND	ND	ND	1.1	5.0	5.0
4(25-55')	ND	ND	ND	ND	1.1	5.0	5.0
4(55-75')	ND	ND	ND	ND	1.1	5.0	5.0
SATURATED SOIL							
MW1A	ND	ND	ND	ND	1.1	5.0	5.0
MW1B	ND	0.4	ND	ND	1.1	5.0	5.0
MW1C	ND	ND	ND	ND	1.1	5.0	5.0
MW2	ND	ND	ND	ND	1.1	5.0	5.0
MW3A	ND	ND	ND	ND	1.1	5.0	5.0
MW3B	ND	ND	ND	ND	1.1	5.0	5.0
MW3C	19.0	ND	ND	ND	1.1	5.0	5.0
MW4A	ND	ND	ND	ND	1.1	5.0	5.0
MW4B	ND	ND	ND	ND	1.1	5.0	5.0
MW4C	ND	ND	ND	ND	1.1	5.0	5.0
MW6	ND	ND	ND	ND	1.1	5.0	5.0
SURFWATER SEDIMENT							
1	ND	ND	ND	ND	1.1	5.0	5.0
2	ND	ND	ND	ND	1.1	5.0	5.0
3	ND	ND	ND	ND	1.1	5.0	5.0

TABLE 2-4

INORGANIC CONTAMINANTS QUANTIFIED IN SOILS

THALLIUM

SURFACE SOIL	TOTAL CONC. (mg/kg)	EP.TOX. CONC. (mg/l)	FIELD BLANK (mg/l)	TRIP BLANK (mg/l)	DETECTION LIMIT (mg/kg)	EP. TOX LIMIT (mg/l)	NJDEP ACTION LEVEL (1) (mg/kg)
1	ND	NA	ND	ND	1.0	NA	-
2	ND	NA	ND	ND	1.0	NA	-
3	ND	NA	ND	ND	1.0	NA	-
4	ND	NA	ND	ND	1.0	NA	-
5	ND	NA	ND	ND	1.0	NA	-
6	ND	NA	ND	ND	1.0	NA	-
7	ND	NA	ND	ND	1.0	NA	-
8	ND	NA	ND	ND	1.0	NA	-
9	ND	NA	ND	ND	1.0	NA	-
10	ND	NA	ND	ND	1.0	NA	-
11	ND	NA	ND	ND	1.0	NA	-
12	ND	NA	ND	ND	1.0	NA	-
13	ND	NA	ND	ND	1.0	NA	-
14	ND	NA	ND	ND	1.0	NA	-
15	ND	NA	ND	ND	1.0	NA	-
16	ND	NA	ND	ND	1.0	NA	-
17	ND	NA	ND	ND	1.0	NA	-
18	ND	NA	ND	ND	1.0	NA	-
19	ND	NA	ND	ND	1.0	NA	-
20	ND	NA	ND	ND	1.0	NA	-
LAGOON BORING							
1(0-25')	<1.1NE	NA	ND	ND	1.0	NA	-
1(25-55')	<1.0NE	NA	ND	ND	1.0	NA	-
1(55-75')	<1.0NE	NA	ND	ND	1.0	NA	-
2(0-25')	<1.1NE	NA	ND	ND	1.0	NA	-
2(25-55')	<1.1NE	NA	ND	ND	1.0	NA	-
2(55-75')	<1.2NE	NA	ND	ND	1.0	NA	-
3(0-25')	<1.1NE	NA	ND	ND	1.0	NA	-
3(25-55')	<1.1NE	NA	ND	ND	1.0	NA	-
3(55-75')	<1.1NE	NA	ND	ND	1.0	NA	-
4(0-25')	<1.0NE	NA	ND	ND	1.0	NA	-
4(25-55')	<1.1NE	NA	ND	ND	1.0	NA	-
4(55-75')	<1.0NE	NA	ND	ND	1.0	NA	-
SATURATED SOIL							
MW1A	ND	NA	ND	ND	1.0	NA	-
MW1B	<1.0NE	NA	ND	ND	1.0	NA	-
MW1C	ND	NA	ND	ND	1.0	NA	-
MW2	1.2NE	NA	ND	ND	1.0	NA	-
MW3A	ND	NA	ND	ND	1.0	NA	-
MW3B	ND	NA	ND	ND	1.0	NA	-
MW3C	1.2NE	NA	ND	ND	1.0	NA	-
MW4A	ND	NA	ND	ND	1.0	NA	-
MW4B	ND	NA	ND	ND	1.0	NA	-
MW4C	ND	NA	ND	ND	1.0	NA	-
MW5	ND	NA	ND	ND	1.0	NA	-
SURFWATER SEDIMENT							
1	<12.0NE	NA	ND	ND	1.0	NA	-
2	<11.0NE	NA	ND	ND	1.0	NA	-
3	<12.0NE	NA	ND	ND	1.0	NA	-

TABLE 2-4M

INORGANIC CONTAMINANTS QUANTIFIED IN SOILS

SELLENIUM

SURFACE SOIL	TOTAL CONC. (mg/kg)	EP.TOX. CONC. (mg/l)	FIELD BLANK (mg/l)	TRIP BLANK (mg/l)	DETECTION LIMIT (mg/kg)	EP. TOX LIMIT (mg/l)	NJDEP ACTION LEVEL (1) (mg/kg)
1	<0.5NE	ND	ND	ND	0.6	1000	-
2	<5.3NE	ND	ND	ND	0.6	1000	-
3	<0.5NE	ND	ND	ND	0.6	1000	-
4	<5.2NE	ND	ND	ND	0.6	1000	-
5	<5.3NE	ND	ND	ND	0.6	1000	-
6	<5.5NE	ND	ND	ND	0.6	1000	-
7	<0.5NE	ND	ND	ND	0.6	1000	-
8	<0.5NE	ND	ND	ND	0.6	1000	-
9	<0.5NE	ND	ND	ND	0.6	1000	-
10	<0.5NE	ND	ND	ND	0.6	1000	-
11	ND	ND	ND	ND	0.6	1000	-
12	ND	ND	ND	ND	0.6	1000	-
13	ND	ND	ND	ND	0.6	1000	-
14	ND	ND	ND	ND	0.6	1000	-
15	ND	ND	ND	ND	0.6	1000	-
16	ND	ND	ND	ND	0.6	1000	-
17	ND	ND	ND	ND	0.6	1000	-
18	ND	ND	ND	ND	0.6	1000	-
19	ND	ND	ND	ND	0.6	1000	-
20	ND	ND	ND	ND	0.6	1000	-
LAGOON BORING							
1(0-25')	<6.0NE	ND	ND	ND	0.6	1000	-
1(25-55')	<6.0NE	ND	ND	ND	0.6	1000	-
1(55-75')	<0.6NE	ND	ND	ND	0.6	1000	-
2(0-25')	<6.0NE	ND	ND	ND	0.6	1000	-
2(25-55')	<6.0NE	ND	ND	ND	0.6	1000	-
2(55-75')	<6.0NE	ND	ND	ND	0.6	1000	-
3(0-25')	<0.6NE	ND	ND	ND	0.6	1000	-
3(25-55')	<0.6NE	ND	ND	ND	0.6	1000	-
3(55-75')	<6.0NE	ND	ND	ND	0.6	1000	-
4(0-25')	<6.0NE	ND	ND	ND	0.6	1000	-
4(25-55')	<6.0NE	ND	ND	ND	0.6	1000	-
4(55-75')	<6.0NE	ND	ND	ND	0.6	1000	-
SATURATED SOIL							
MW1A	ND	ND	ND	ND	0.6	1000	-
MW1B	ND	ND	ND	ND	0.6	1000	-
MW1C	ND	ND	ND	ND	0.6	1000	-
MW2	0.6NE	ND	ND	ND	0.6	1000	-
MW3A	ND	ND	ND	ND	0.6	1000	-
MW3B	ND	ND	ND	ND	0.6	1000	-
MW3C	0.6NE	ND	ND	ND	0.6	1000	-
MW4A	ND	ND	ND	ND	0.6	1000	-
MW4B	ND	ND	ND	ND	0.6	1000	-
MW4C	ND	ND	ND	ND	0.6	1000	-
MW6	ND	ND	ND	ND	0.6	1000	-
SURFWATER SEDIMENT							
1	<5.0NE	ND	ND	ND	0.6	1000	-
2	<5.0NE	ND	ND	ND	0.6	1000	-
3	<5.0NE	ND	ND	ND	0.6	1000	-

INORGANIC CONTAMINANTS QUANTIFIED IN SOILS

ZINC

SURFACE SOIL	TOTAL CONC. (mg/kg)	EP.TOX. CONC. (mg/l)	FIELD BLANK (mg/l)	TRIP BLANK (mg/l)	DETECTION LIMIT (mg/kg)	EP. TOX LIMIT (mg/l)	NJDEP ACTION LEVEL (1) (mg/kg)
1	5.5NE	NA	ND	ND	2.3	NA	350
2	14.0NE	NA	ND	ND	2.3	NA	350
3	13.0NE	NA	ND	ND	2.3	NA	350
4	9.0NE	NA	ND	ND	2.3	NA	350
5	15.0NE	NA	ND	ND	2.3	NA	350
6	7.6NE	NA	ND	ND	2.3	NA	350
7	8.7NE	NA	ND	ND	2.3	NA	350
8	11.0NE	NA	ND	ND	2.3	NA	350
9	14.0NE	NA	ND	ND	2.3	NA	350
10	8.7NE	NA	ND	ND	2.3	NA	350
11	11.0	NA	ND	ND	2.3	NA	350
12	33.0	NA	ND	ND	2.3	NA	350
13	21.0	NA	ND	ND	2.3	NA	350
14	9.2	NA	ND	ND	2.3	NA	350
15	3.9	NA	ND	ND	2.3	NA	350
16	8.3	NA	ND	ND	2.3	NA	350
17	6.4	NA	ND	ND	2.3	NA	350
18	7.5	NA	ND	ND	2.3	NA	350
19	4.3	NA	ND	ND	2.3	NA	350
20	13.4	NA	ND	ND	2.3	NA	350
LAGOON BORING							
1(0-25')	50.0	NA	ND	ND	2.3	NA	350
1(25-55')	10.0	NA	ND	ND	2.3	NA	350
1(55-75')	11.0	NA	ND	ND	2.3	NA	350
2(0-25')	15.0	NA	ND	ND	2.3	NA	350
2(25-55')	19.0	NA	ND	ND	2.3	NA	350
2(55-75')	15.0	NA	ND	ND	2.3	NA	350
3(0-25')	8.4	NA	ND	ND	2.3	NA	350
3(25-55')	12.0	NA	ND	ND	2.3	NA	350
3(55-75')	21.0	NA	ND	ND	2.3	NA	350
4(0-25')	17.0	NA	ND	ND	2.3	NA	350
4(25-55')	23.0	NA	ND	ND	2.3	NA	350
4(55-75')	10.0	NA	ND	ND	2.3	NA	350
SATURATED SOIL							
MW1A	1.9	NA	ND	ND	2.3	NA	350
MW1B	8.0	NA	ND	ND	2.3	NA	350
MW1C	4.2	NA	ND	ND	2.3	NA	350
MW2	12.0	NA	ND	ND	2.3	NA	350
MW3A	3.6	NA	ND	ND	2.3	NA	350
MW3B	3.6	NA	ND	ND	2.3	NA	350
MW3C	5.4	NA	ND	ND	2.3	NA	350
MW4A	ND	NA	ND	ND	2.3	NA	350
MW4B	7.8	NA	ND	ND	2.3	NA	350
MW4C	11.0	NA	ND	ND	2.3	NA	350
MW6	4.3	NA	ND	ND	2.3	NA	350
SURFWATER SEDIMENT							
1	12.0	NA	ND	ND	2.3	NA	350.
2	10.0	NA	ND	ND	2.3	NA	350.
3	27.0	NA	ND	ND	2.3	NA	350.

The soil samples collected during this phase of the investigation were analyzed for volatile and semi-volatile organics, PCBs/pesticides, priority pollutant metals and E.P. Toxicity metals. Laboratory analytical results are compared to NYSDEC and NJDEP action levels for soils, as well as typical ranges expected to be found normally in the earth's crust. As of February 1988, the USEPA does not have action levels for soils. Therefore, New York State and New Jersey guidelines were utilized.

The organic compounds which were quantified were all detected at levels well below the state guidelines (Table 2-5). The concentrations of arsenic quantified in borings 2 and 3 were above the state guidelines, but within the typical ranges expected to be found in the earth's crust. The concentrations of cadmium detected were all below the state guidelines and above the concentrations expected to be found in the earth's crust. Silver was detected in lagoon boring No. 2 at 110 mg/kg. This quantification is extremely high, and it exceeds both state regulations and the typical ranges within the earth's crust. All results were below the E.P. Toxicity limits (see Tables 2-4, a-n).

Previous analytical data obtained from this area of the landfill included the results of aqueous samples collected in the scavenger lagoons and leaching pools. Prior to the disposal or excavation of the area, sanitary waste samples were collected to determine the destination of the waste. Lagoon soil samples No. 1-4 were collected at areas trending from east (solids lagoon) to west (leaching pools). Analytical results can be found in Appendix D.

The laboratory results are indicative of septic waste with characteristic high ammonia, total Kjeldahl nitrogen and various other contaminants. Arsenic was not one of the analytes, but silver was detected at slightly elevated readings. This could explain the anomaly detected in boring No. 2.

The lagoons and leaching pools were excavated and fill was deposited in their place in 1986. The evidence of sludge remains in boring No. 1 clearly indicates that not all the material was excavated. Groundwater contamination resulting from these lagoons should be detected in well MW-6. In addition, as part of the landfill expansion, a cluster (MW-7) has been installed in the northeast portion of the field. A deeper well was also drilled adjacent to MW-6 which will help determine the vertical extent of contamination.

It should be noted that although wells MW-6B and cluster 7 were installed for the landfill expansion project, they will be useful in determining the extent of contamination as a result of the scavenger lagoons. Once groundwater quality is obtained from these locations, results will be available for review.

ORGANIC CONTAMINANTS QUANTIFIED
LAGOON BORING SAMPLES
RESULTS IN (ug/kg)

CONTAMINANTS QUANTIFIED	LAGOON BORING NO.1			LAGOON BORING NO.2			LAGOON BORING NO.3			LAGOON BORING NO.4			TRIP BLANK
VOLATILE ORGANICS (ug/kg)	5-7'	35-37'	60-62'	10-12'	35-37'	70-72'	20-22'	45-47'	70-72'	10-12'	45-47'	60-62'	
METHYLENE CHLORIDE	48B	61B	58B	120B	120B	140B	39B	7JB	62B	110B	39B	75B	16B
1,1 DICHLOROETHENE	4JB	4JB	4JB	8JB	8JB	21JB	5JB	6JB	ND	13JB	11JB	8J	4JB
CHLOROFORM	ND	ND	ND	ND	ND	ND	ND	ND	ND	10J	4J	4J	ND
1,1 DICHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1J
COMPOSITE SAMPLES	0-25'	30-50'	55-72'	0-25'	30-50'	55-72'	0-25'	30-50'	55-72'	0-25'	30-50'	55-72'	
SEMI-VOLATILES (ug/kg)													
DIETHYLPHTHALATE	ND	290J	120J	270J	ND	290J	170J	130J	ND	190J	170J	ND	ND
BIS(2-ETHYLHEXYL)-PHTHALATE	1300B	1600B	3000B	5800B	4900B	1400B	4500B	7700B	2900B	6000B	3400B	6600B	22B

ND- NOT DETECTED
B- ANALYTE DETECTED IN INSTRUMENT BLANK
J- ANALYTE DETECTED WITH CONFIDENCE BUT BELOW THE DETECTION LIMIT

2.1.4 - Saturated Soil

Saturated soil samples were collected during the drilling of boreholes for all stainless steel monitoring wells. The samples were collected in the area at the midpoint of where the screen would be placed. Samples were analyzed for priority pollutant metals, E.P. Toxicity metals and semi-volatiles. Figure 2-4 depicts the locations of saturated soil samples which later became the locations of the stainless steel monitoring wells.

Data were generally grouped for comparison by borehole depth. All wells were considered shallow (at the water table), medium depth (in the area of the plume), or at a deep depth (below the plume) in the Upper Glacial aquifer.

- Organics (Table 2-6)

Saturated soil samples were analyzed for semi-volatile compounds. All semi-volatile parameters were undetected except for the presence of phthalates. Analysis for volatile organics was not required by E.P.A.

Bis (2-ethyl hexyl) phthalate occurred in all samples. However, this phthalate occurred in the trip and laboratory blanks as well. This is most likely a laboratory contaminant.

Two other types of phthalates also occurred in the well boreholes. These include diethyl phthalate, or DEP, and Di-n-butyl phthalate. DEP occurred in all borehole samples, except for MW-1A, MW-1B, MW-4B and MW-6. All were flagged "J", except for MW-3C which may be in the laboratory blank as well. Di-n-butyl phthalate occurred in MW-1C (deep), MW-4B (medium) and MW-6 (shallow).

For the above two phthalates, the limit of detection is normally 260 ug/kg. Overall, phthalates are detected in many types of soils and the probable source is plastic products. In this case, the phthalates discussed are there, but the source at this depth is questionable. The source could be a field error, i.e., use of plastic utensils or gloves.

In any event, phthalates as a class have a high affinity for adsorption to soil. Thus, leaching is slow from soil. Phthalates would also complex with other natural organic substances.

- Inorganics (Refer to Tables 2-4, a-n)

Chromium, lead and zinc occurred in almost all well boreholes. Cadmium occurred in five borehole samples and copper in seven borehole samples. The rest of the constituents occurred overall at frequencies of two or less above detection levels.

FIGURE 2-3

NORTH SEA RI
LOCATIONS OF
SATURATED SOIL SAMPLES
& MONITORING WELLS

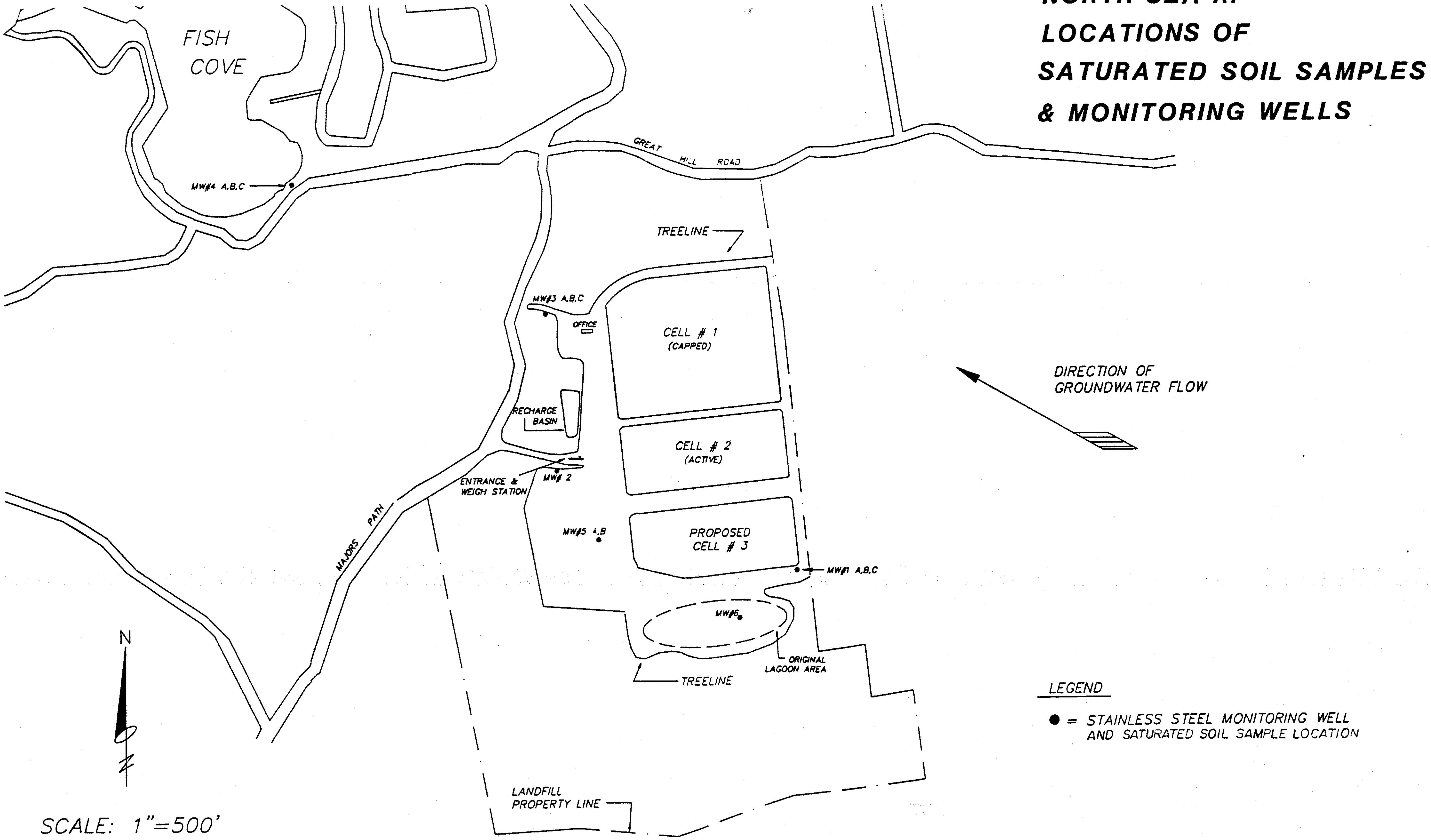

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TABLE 2-6

ORGANIC CONTAMINANTS QUANTIFIED
IN SATURATED SOILS @ NORTH SEA LANDFILL
RESULTS IN (ug/kg)

CONTAMINANTS QUANTIFIED	MW1A	MW1B	MW1C	MW2	MW3A	MW3B	MW3C	MW4A	MW4B	MW4C	MW6
DEPTH OF COMPOSITE SAMPLE IN FT. BELOW GRADE	90-92 95-97 100-102	149-151 155-157 158-160	220-221	70-74 75-79	50-54	100-104	174-178	25-27	70-74	136-138 140-141 145-147	90-92 100-102
SEMI-VOLATILES (ug/kg)											
DI-N-BUTYLPHTHALATE	ND	ND	76J	ND	ND	ND	ND	ND	60J	ND	110J
DIETHYLPHTHALATE	ND	ND	89J	330JB	200J	160J	490JB	190J	ND	160J	ND
BIS(2-ETHYLHEXYL)-PHTHALATE	840B	1500B	1900B	8700B	1000B	1700B	4300B	820B	240JB	610B	440B
FLUORANTHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PYRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PHENANTHRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND- NOT DETECTED
B - ANALYTE ALSO DETECTED IN INSTRUMENT BLANK
J - ANALYTE DETECTED WITH CONFIDENCE BUT BELOW DETECTION LIMIT

The well borehole saturated soil samples with the greatest amount of constituents were MW-3C and MW-2. MW-6 and MW-4C came in next. E.P. Toxicity results were above detection levels, but well below E.P. Toxicity limits for barium, cadmium, chromium, lead and mercury.

The deep borehole with the greatest presence of metals was MW-3C, followed by MW-4C and MW-1C. Well MW-3C also had the greatest amount of parameters above detection levels for all well boreholes. Chromium was present in all four deep boreholes.

The medium depth well boreholes all indicated the presence of four constituents. All contained chromium, lead and zinc. Well borehole MW-1B indicated cadmium. Well boreholes MW-3B and MW-4B indicated copper.

The shallow well with the greatest amount of parameters was MW-2, followed by MW-6, MW-3A, MW-1A and finally MW-4A. MW-2 had the greatest amount of parameters, including thallium.

Lead occurred in all five shallow borehole samples. Also present in all boreholes were chromium, zinc and copper, except for MW-4A. MW-4A indicated only one parameter, lead.

2.1.5 - Sediment

Sediment was collected at Fish Cove during low tide at the same locations where surface water samples 1, 3 and 5 were taken. Sediments were analyzed for semi-volatiles, priority pollutant metals and E.P. Toxicity metals. Tables 2-4, a-n summarizes significant inorganic results for the sediment. Sample locations are seen in Figure 2-4. Sample locations No. 5 and 6 were originally chosen to represent background conditions at Fish Cove.

Organics

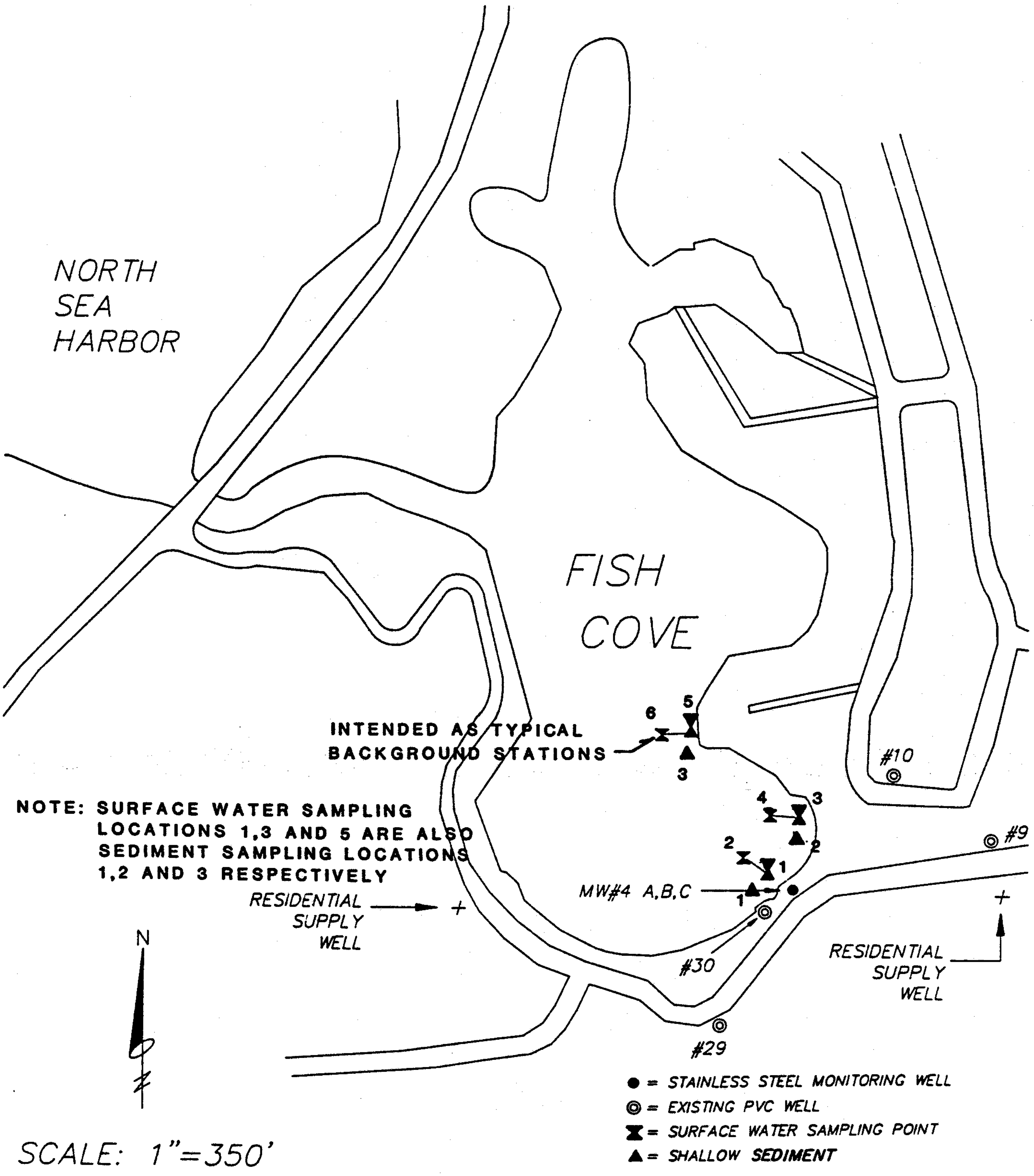
Phthalates and PAHs were detected. DEHP again, as with all soil samples analyzed, appeared in all sediment samples and in the laboratory blank.

Di-n-butyl phthalate occurred in locations 1 and 2. Butyl benzl phthalate also occurred in locations 1 and 2. All were flagged "J". This means the phthalates were detected below accepted detection levels. These values were well below NJDEP action levels of 10 mg/kg for phthalates.

The PAHs detected were fluoranthene (locations 1 and 2) and pyrene (location 2 only). All values reported were below NJDEP action levels of 10 mg/kg for PAHs.

FIGURE 2-4

NORTH SEA RI
FISH COVE AREA
SAMPLING LOCATIONS



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Inorganics (refer to Tables 2-4, a-n)

Occurring in all three locations was evidence of cadmium, chromium, copper, lead and zinc. Mercury occurred at location 1 (.1 mg/kg). All values were below NJDEP action levels and within typical ranges. In addition, typical values found in coastal sediments on Long Island (Islip area) are comparable (Nassau-Suffolk Regional Planning Report, 1975). E.P. Toxicity results indicated that mercury (all three locations) and lead (locations 2 and 3) had leaching potential. All values were well below E.P. Toxicity limits.

2.1.6 - Summary

Organics

All soil samples were analyzed for semi-volatiles. The lagoon soil borings were also analyzed for volatile organics, pesticides and PCBs. All values were compared against NJDEP action levels were available. The key semi-volatiles detected were phthalates and polyaromatic hydrocarbons (PAHs).

Bis-(2-ethyl hexyl) phthalate or DEHP occurred in practically all samples at a range from about 3200 ug/kg to 10,000 ug/kg. One sediment (Fish Cove location No. 2) was way out of range at 19,000 ug/kg. All samples with DEHP were suspect due to possible laboratory contamination. The NJDEP action level for DEHP is 10,000 ug/kg and all values were below this except for the one Fish Cove sample.

All other phthalates detected were well below the NJDEP action level of 10 mg/kg. DEHP occurred in saturated, lagoon and surface soil samples. Di-n-butyl phthalate occurred in saturated, sediment and surface soil, but not in lagoon soil samples. Butyl-benzyl-phthalate occurred in Fish Cove sediment (locations 1 and 2).

PAHs were also well below the NJDEP action level of 10 mg/kg in surface soil and Fish Cove sediment. The predominant forms were fluoranthene and pyrene. Surface soil sample 14 had the greatest variety of PAHs and is located north of inactive cell #1. The presence of PAHs may be due to combustion activities in the area.

The lagoon borings indicated that pesticides and PCBs were below detection levels in that area. Certain volatile organics were detected, but were still well below the action level of 1000 mg/kg. The compounds detected were methylene chloride (dichloromethane), chloroform and 1,1-DCE. The soil samples with 1,1-DCE or methylene chloride were evident in the laboratory blank as well. The presence of chloroform was clearly evident in all three composite samples from lagoon boring No. 4.

Inorganics

All soil samples were analyzed for priority pollutant metals. As with the organic compounds detected, all values above detection limits were compared against NJDEP action levels and typical soil concentrations (Lindsay, 1979). A summary plot of metals in soil concentration versus priority pollutant metals can be seen in Figure 2-5. This figure depicts concentration values detected in all soils analyzed and the NJDEP action levels for soils. Table 2-1 lists the typical U.S. soil concentration ranges for the priority pollutant metals.

The following metals were below action levels and within the typical soil concentration range: cadmium, copper, chromium, lead, nickel, selenium (note no action level), mercury, silver (except for 2 samples) and zinc. There is no NJDEP action level for selenium and mercury.

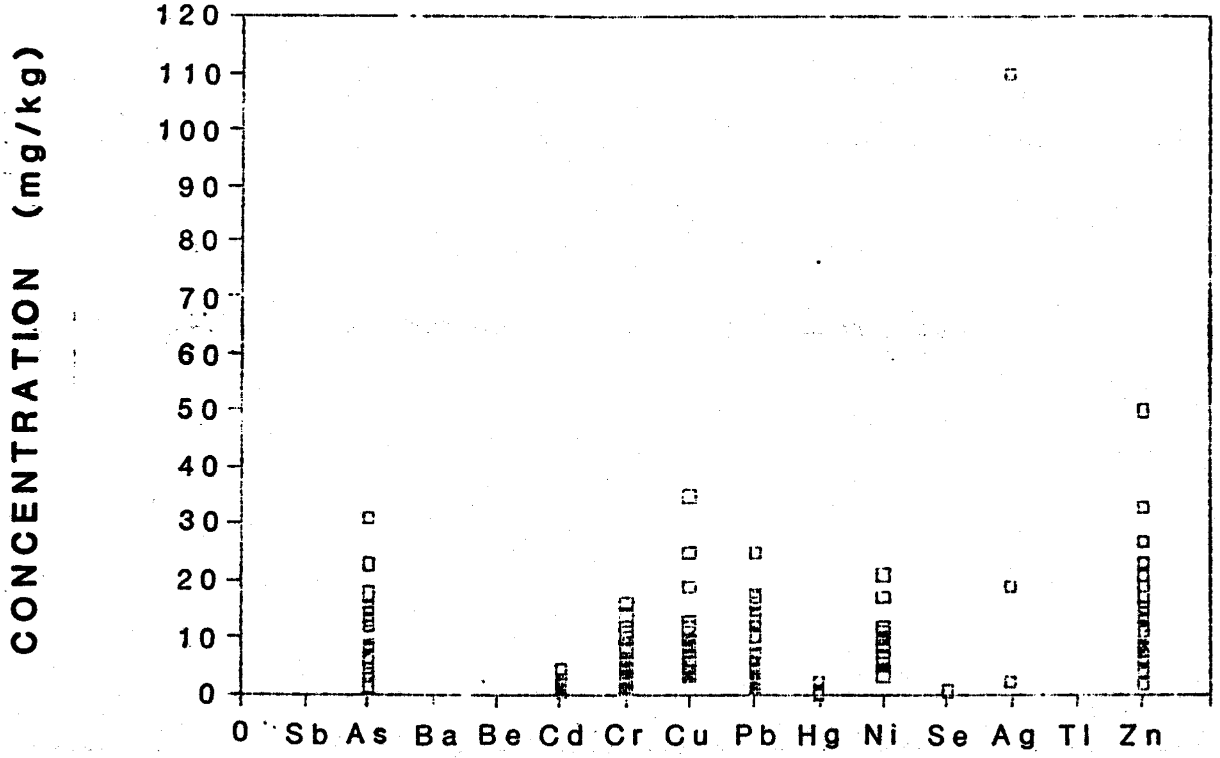
From this, it is reasonable to conclude that for the above metals, there are no adverse conditions in the soils. However, arsenic and silver were above action levels for several samples. For arsenic, there were 2 samples from lagoon soils which were above action levels, but not excessively. The NJDEP action level is 20 mg/kg. For lagoon boring soil sample 2 (25 to 55 feet from grade), arsenic was detected at 31.0. Both results were flagged "SNE", meaning that the results are acceptable, but interferences are suspected.

Silver was detected above the typical range and action level in two samples. One is a saturated soil sample from MW-3C at 19.0 mg/kg. Another is a lagoon soil sample (#2) from 55 to 72 feet from grade at 110 mg/kg. The presence of silver may be attributed to septic waste from the lagoon area.

There are two samples above the typical soil range from surface soil samples for mercury. This occurred at location 1 (1.9 mg/kg) and 15 (.5 mg/kg). Location 1 is adjacent to well MW-6 and location 15 is located in the excavated area adjacent to active cell #2. There is no action level for mercury at this time.

Also note that there is no action level for selenium or thallium. There also is no typical soil concentration range for thallium. Two saturated soil samples from well boreholes MW-2 and MW-3C indicated levels of 1.2 mg/kg (both flagged NE).

PRIORITY POLLUTANT METALS IN SOILS



NJDEP
ACTION
LEVEL
(mg/kg)

— 20 — — 3 100 170 100 — 100 — 5 — 350

2.2 - HYDROGEOLOGIC INVESTIGATION

This is a summary of the site hydrogeology, as determined through data gathered during the RI. This section discusses the general geology of the site, aquifer properties, groundwater flow, groundwater sample analytical results and the plumes of contamination.

2.2.1 - General Geology

The purpose of the hydrogeologic investigation was to define the hydrogeology of the area as it relates to the transport of contaminants from the site to possible downstream receptors. Of major concern in this investigation was the nature and extent of vertical groundwater flow and the discharge to Fish Cove.

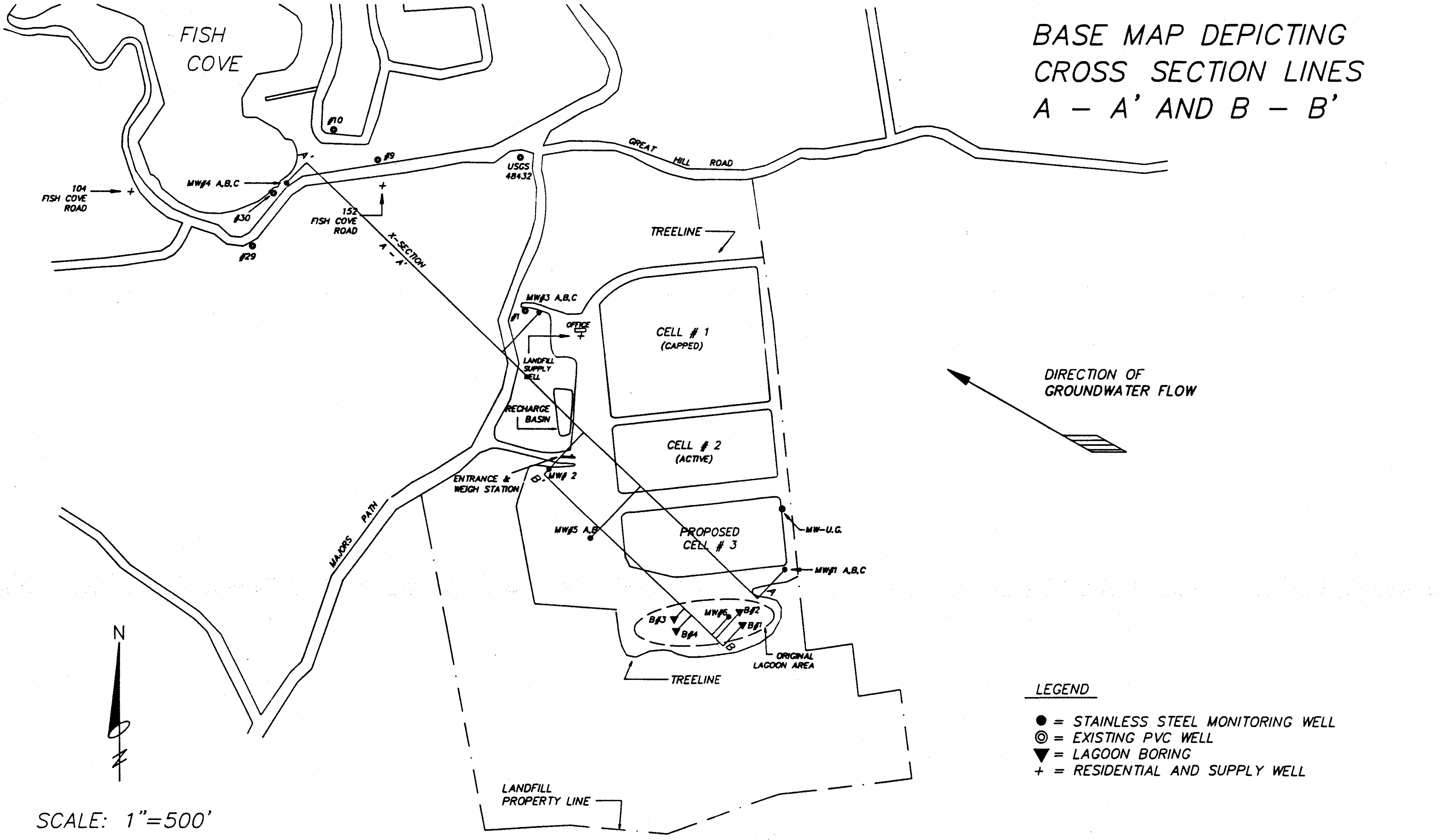
The stratigraphy was inferred from data gathered during the well installation phase of the RI. Geologic logs recorded the visual description of lithology with depth. Geophysical logs were recorded and compared against the geologic logs. Grain size analysis curves were generated for selected (saturated) soil samples in order to further define lithologies and to estimate hydraulic conductivity. The United Soil Classification (USC) procedure was used to classify those soil samples which underwent grain size analysis. USCs were estimated for those samples which were not analyzed for grain size. All of these data can be viewed in Appendix A. The resulting cross section A-A' depicts the general geology of the study area. The cross section was drawn as a midline through the inferred plume area (Figure 2-6 and Figure 2-7).

As can be seen, there is evidence of finer silts and clays mixed with predominantly sand in the bottom portion of the Upper Glacial aquifer. This is part of the lower (early Wisconsin) drift, as described in the literature. The lower drift sheet includes the entire saturated portion of the aquifer and the Montauk Till. All classified soils in the saturated zone consisted primarily of coarse grained material (i.e., more than 50 percent of material was larger than the No. 200 sieve size).

Horizontal hydraulic conductivities were also estimated from grain size analysis curves. Soils classified as predominantly sand with little or no silt had higher estimated hydraulic conductivities (usually an order of magnitude higher) than the soils classified as silty or clayey sands (30 to 60 feet/day). Estimated hydraulic conductivities can be seen in Appendix A. The methods used to estimate these values are described in Appendix B.

FIGURE 2-6

BASE MAP DEPICTING CROSS SECTION LINES A – A' AND B – B'



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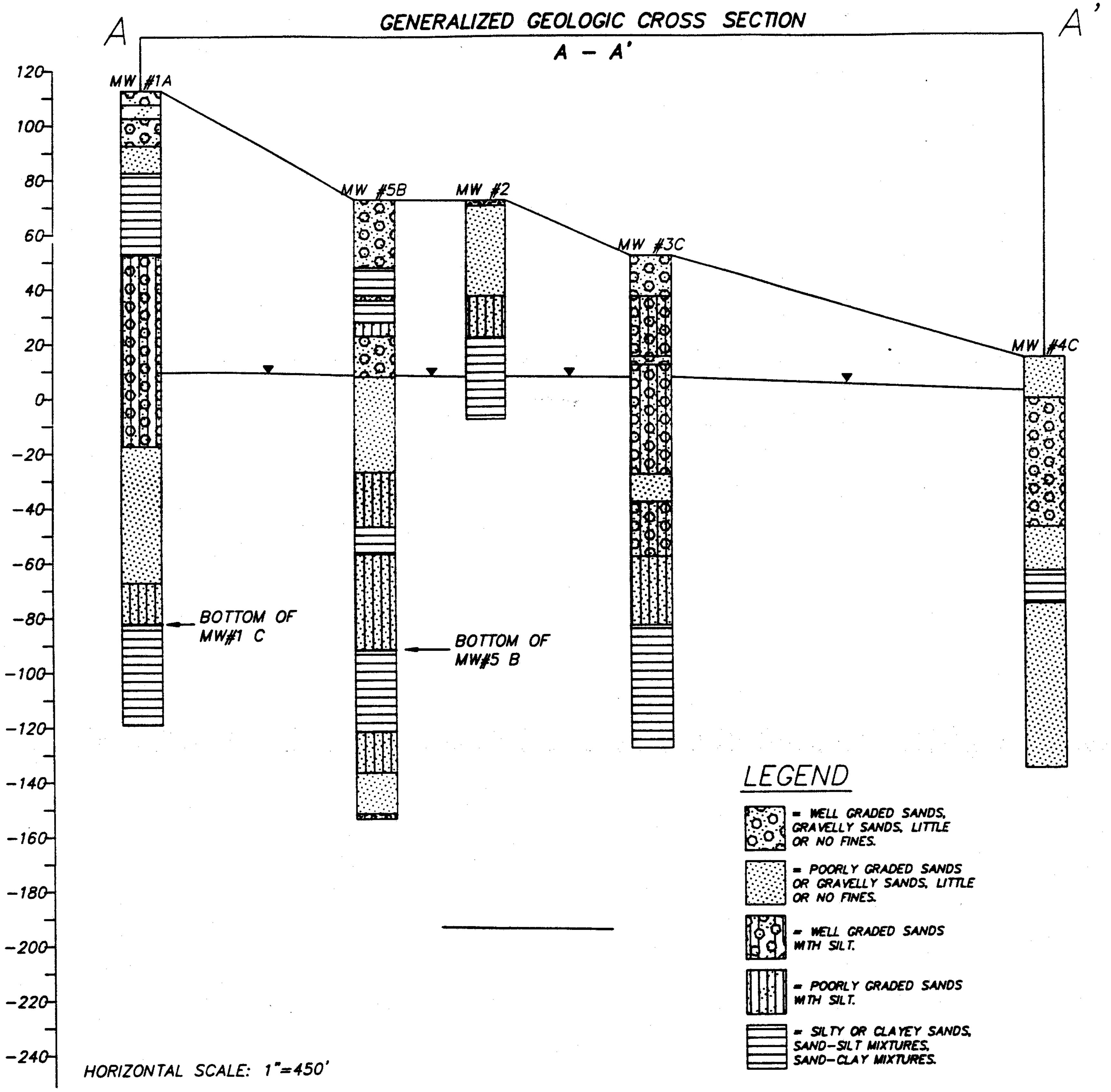
INFERRED STRATIGRAPHY			
GEOLOGIC AGE		HYDROGEOLOGIC UNIT	
SYSTEM	SERIES		
QUATERNARY	PLEISTOCENE (WISCONSINAN GLACIATION)	UPPER GLACIAL AQUIFER	UNSATURATED SATURATED
CRETACEOUS	UPPER CRETACEOUS	MAGOTHY AQUIFER	



In accordance with glacial facies models and local studies, as discussed in Section 1.0, zones of finer grained material are expected. The landfill is located in primarily stratified outwash in lodgment till deposits just north of the Ronkonkoma moraine on the South Fork.

In summary, there are layers of more impermeable material in the bottom portion of the Upper Glacial aquifer. However, data indicate that these layers are predominantly sand mixed with finer silts and clays. These layers are not composed predominantly of clay or silt. Also, there is not sufficient evidence to state that the lower permeability material is continuous. Discontinuous lenses of the material are more likely. A further discussion of the hydraulic implications of these data follow in the next section.

The soils collected from the filled sludge lagoon area indicate the top 10-25 feet of fill. This fill was deposited after the Town excavated the old lagoons. Lagoon boring No. 1 exhibited sludge within the first 10-15 feet. The confining silty sand layer beneath the area is not continuous. Soil boring logs from this area can be seen in Appendix A.

2.2.2 - Groundwater Flow

The introduction of this report gave an overview of the regional and probable localized groundwater flow patterns in the Upper Glacial aquifer. Additional data collected during the RI demonstrate the probable flow patterns in the RI study area.

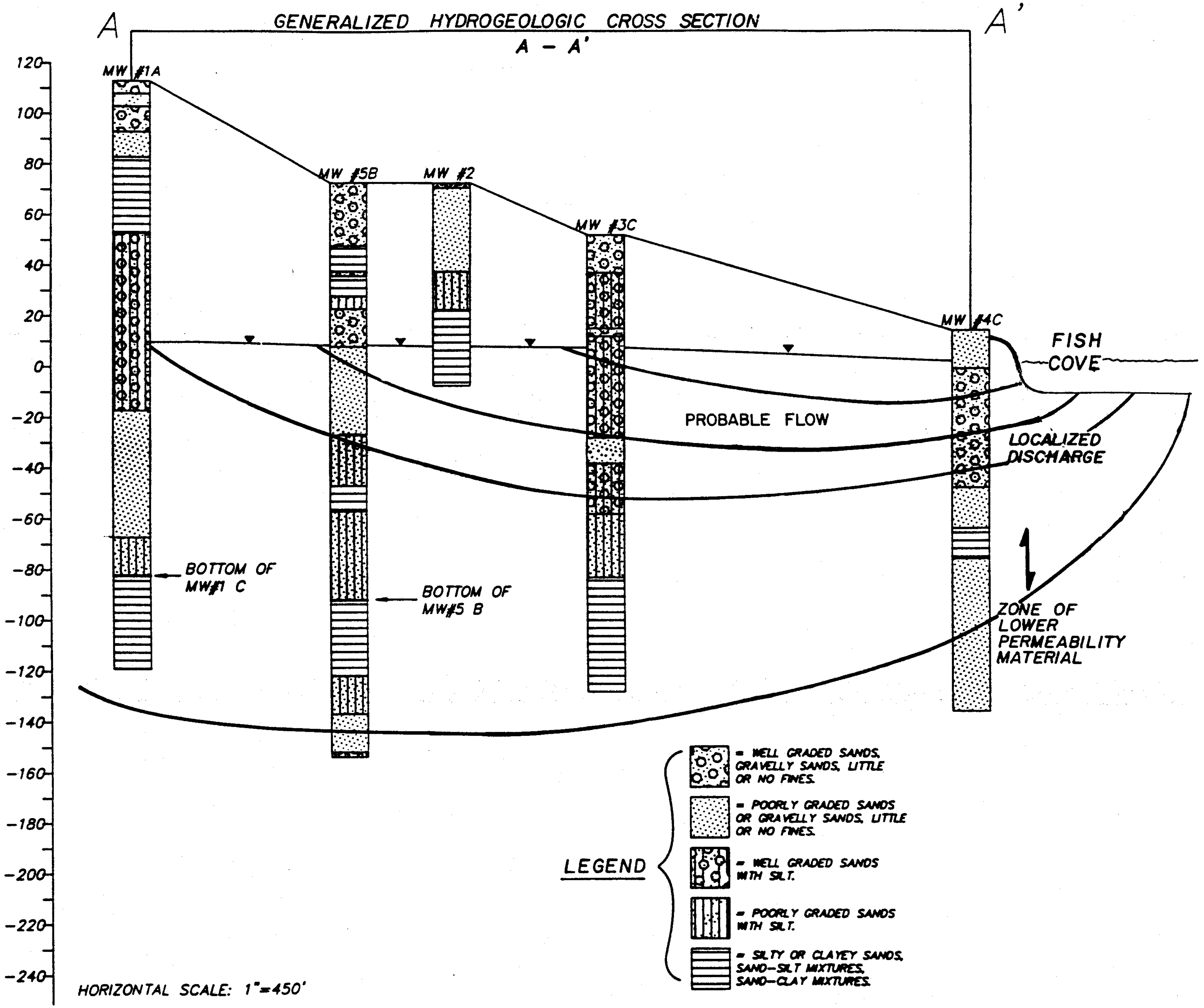
The following is a comparison between regional and probable localized flow patterns in the Upper Glacial aquifer. The following parameters are included: flow direction, hydraulic properties, recharge/discharge point and salt water/fresh water interactions.

Regional and local groundwater flow is generally to the northwest. A site-specific diagram of local groundwater has not been included here due to lack of sufficient data point coverage. Due to variations in saturated hydraulic permeabilities, there may be slight deviations from the general direction. Sufficient background data indicate that the horizontal hydraulic conductivity in the study area is about 60 feet/day. Estimated hydraulic conductivities from saturated soil samples indicate slight deviations from this value.

Hydrogeologic cross section A-A' depicts the general geology, groundwater elevations in each well and probable patterns (Figure 2-8). Identified in the lower portion of the Upper

INFERRED STRATIGRAPHY

GEOLOGIC AGE		HYDROGEOLOGIC UNIT	
SYSTEM	SERIES		
QUATERNARY	PLEISTOCENE (WISCONSINAN GLACIATION)	UPPER GLACIAL AQUIFER	UNSATURATED
			SATURATED
CRETACEOUS	UPPER CRETACEOUS	MAGOTHY AQUIFER	



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Glacial aquifer is a low permeability zone. This is a generalized zone and affects flow patterns, locally and regionally. The zone may consist of discontinuous lenses of sand mixed with silt and/or clay.

The zone of low permeability has localized affects on flow. The depth to water for example in the deep wells of the clusters MW-1 and MW-3 were deeper than adjacent shallow wells of the same clusters.

Well MW-4C of cluster MW-4, however, indicated a shallow depth to water despite the presence of a more impermeable layer at the base of MW-4B. This phenomenon is due to localized discharge.

The less permeable zone would also retard vertical movement and thus retard communication with the Upper Magothy. The landfill study area is not a regional recharge area and thus major vertical movement is not expected here. This is confirmed by the water quality analyses. The regional recharge area is further upgradient from the site. Figure 1-4 depicts the regional groundwater divide. However, the local phenomenon of mounding in landfill cells typically occurs. Mounding is expected, but there is no evidence available to demonstrate this at the landfill study area. Mounding may contribute to localized recharge and thus vertical movement of groundwater and leachate.

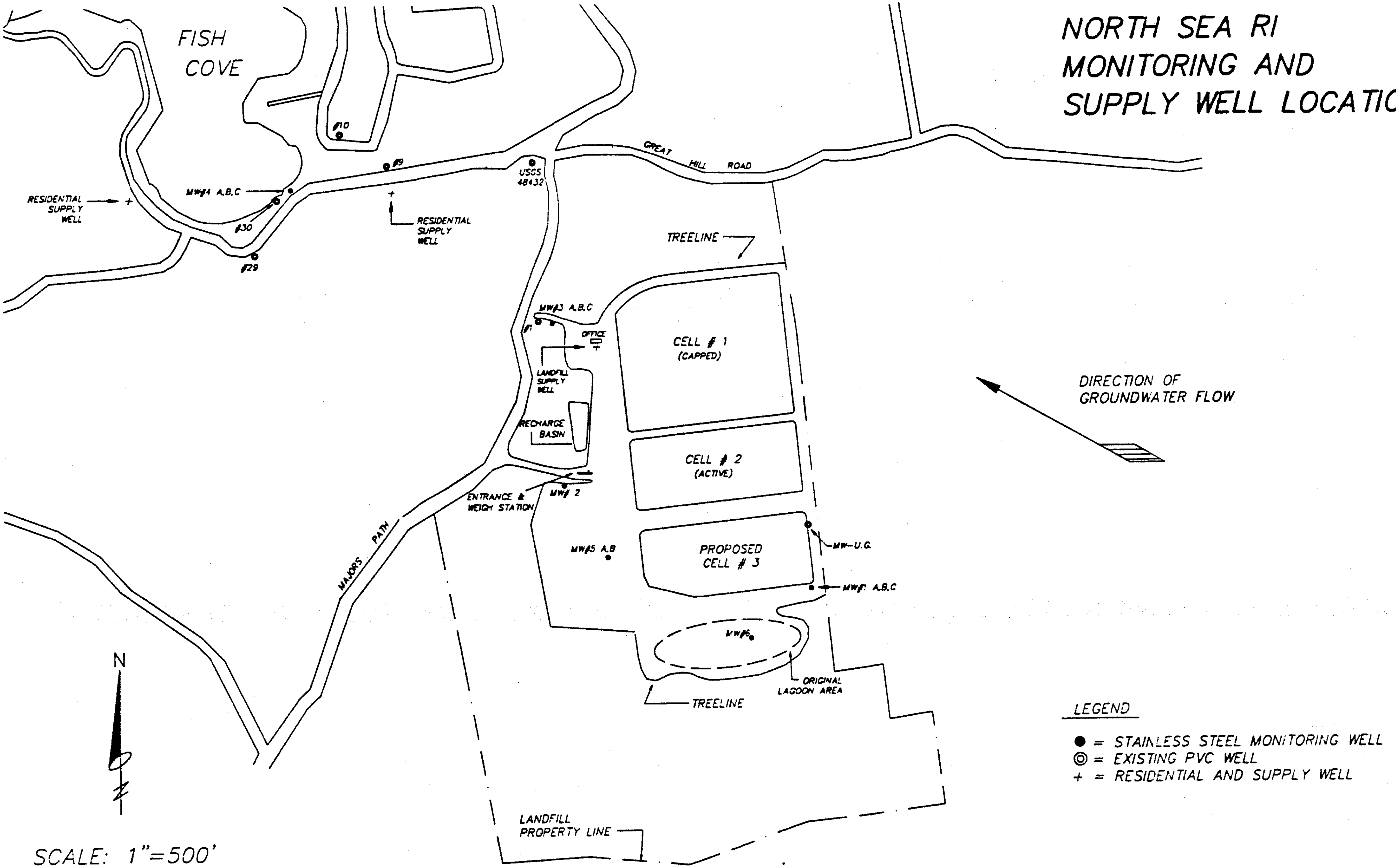
Considering the geology and the probable flow patterns, the leachate plume discharges locally at Fish Cove. The next section uses groundwater analytical data to further support this statement.

The regional discharge area is Peconic Bay. Tidal effects would be most pronounced in this coastal area. The initial location of the salt water/fresh water interface probably occurs in this area. However, since the South Fork can be considered an oceanic island, the Ghyben-Herzberg relationship applies for the entire island. Thus, the interface can be predicted using groundwater elevation data at each well, taking into account some of the localized anomalies just discussed.

2.2.3 - Groundwater Sample Analytical Results

Groundwater samples were collected from all the newly installed stainless steel monitoring wells on two separate occasions (Figure 2-9). Round I occurred during October and Round II in December. These two sampling occasions were intended to confirm any anomalies encountered during Round I. Hardly any anomalies were encountered and usually Round II results conformed with Round I, except where noted. Results are tabulated for inorganic parameters in Figures 2-7, a-i. Significant organic results are in Table 2-8. Field test results are seen in Table 2-9.

NORTH SEA RI MONITORING AND SUPPLY WELL LOCATIONS



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INORGANIC CONTAMINANTS QUANTIFIED IN GROUNDWATER

ANTIMONY
(RESULTS IN ppm)

WELL NO.	ROUND NO.	TOTAL CONC.	FILTERED CONC.	FIELD BLANK	TRIP BLANK	DETECT. LIMIT	EPA MCL (1)	NYSDEC STD./GV (2)
MW1A	1	ND	ND	ND	ND	0.06	-	0.003
	2	ND	ND	ND	NA	0.06	-	0.003
MW1B	1	ND	ND	ND	ND	0.06	-	0.003
	2	ND	ND	ND	NA	0.06	-	0.003
MW1C	1	ND	ND	ND	ND	0.06	-	0.003
	2	ND	ND	ND	NA	0.06		0.003
MW2	1	ND	ND	ND	ND	0.06	-	0.003
	2	ND	ND	ND	NA	0.06	-	0.003
MW3A	1	ND	<0.06NE	ND	ND	0.06	-	0.003
	2	ND	ND	ND	NA	0.06	-	0.003
MW3B	1	ND	<0.06NE	ND	ND	0.06	-	0.003
	2	ND	ND	ND	NA	0.06	-	0.003
MW3C	1	ND	<0.06NE	ND	ND	0.06	-	0.003
	2	ND	ND	ND	NA	0.06	-	0.003
MW4A	1	ND	ND	ND	ND	0.06	-	0.003
	2	ND	ND	ND	NA	0.06	-	0.003
MW4B	1	ND	ND	ND	ND	0.06	-	0.003
	2	ND	ND	ND	NA	0.06	-	0.003
MW4C	1	ND	ND	ND	ND	0.06	-	0.003
	2	ND	ND	ND	NA	0.06	-	0.003
MW6	1	ND	ND	ND	ND	0.06	-	0.003
	2	ND	ND	ND	NA	0.06	-	0.003

* - SEE NOTES AT END OF TABLE.2-7

ARSENIC
(RESULTS IN ppm)

WELL NO.	ROUND NO.	TOTAL CONC.	FILTERED CONC.	FIELD BLANK	TRIP BLANK	DETECT. LIMIT	EPA MCL (1)	NYSDEC STD./GV (2)
MW1A	1	ND	ND	ND	ND	0.01	0.05	0.025
	2	ND	ND	ND	NA	0.01	0.05	0.025
MW1B	1	ND	ND	ND	ND	0.01	0.05	0.025
	2	ND	ND	ND	NA	0.01	0.05	0.025
MW1C	1	ND	ND	ND	ND	0.01	0.05	0.025
	2	ND	ND	ND	NA	0.01	0.05	0.025
MW2	1	ND	ND	ND	ND	0.01	0.05	0.025
	2	ND	ND	ND	NA	0.01	0.05	0.025
MW3A	1	<0.01NE	<0.01NE	ND	ND	0.01	0.05	0.025
	2	0.012	ND	ND	NA	0.01	0.05	0.025
MW3B	1	<0.01NE	<0.001NE	ND	ND	0.01	0.05	0.025
	2	0.014	0.013	ND	NA	0.01	0.05	0.025
MW3C	1	<0.10NE	<0.01NE	ND	ND	0.01	0.05	0.025
	2	ND	ND	ND	NA	0.01	0.05	0.025
MW4A	1	ND	ND	ND	ND	0.01	0.05	0.025
	2	ND	ND	ND	NA	0.01	0.05	0.025
MW4B	1	ND	ND	ND	ND	0.01	0.05	0.025
	2	ND	ND	ND	NA	0.01	0.05	0.025
MW4C	1	ND	ND	ND	ND	0.01	0.05	0.025
	2	ND	ND	ND	NA	0.01	0.05	0.025
MW6	1	ND	ND	ND	ND	0.01	0.05	0.025
	2	ND	ND	ND	NA	0.01	0.05	0.025

TABLE 2-73

INORGANIC CONTAMINANTS QUANTIFIED IN GROUNDWATER

BERRYLIUM
(RESULTS IN ppm)

WELL NO.	ROUND NO.	TOTAL CONC.	FILTERED CONC.	FIELD BLANK	TRIP BLANK	DETECT. LIMIT	EPA MCL (1)	NYSDEC STD./GV (2)
MW1A	1	ND	ND	ND	ND	0.005	–	0.003
	2	ND	ND	ND	NA	0.005	–	0.003
MW1B	1	ND	ND	ND	ND	0.005	–	0.003
	2	ND	ND	ND	NA	0.005	–	0.003
MW1C	1	ND	ND	ND	ND	0.005	–	0.003
	2	ND	ND	ND	NA	0.005	–	0.003
MW2	1	ND	ND	ND	ND	0.005	–	0.003
	2	ND	ND	ND	NA	0.005	–	0.003
MW3A	1	ND	ND	ND	ND	0.005	–	0.003
	2	ND	ND	ND	NA	0.005	–	0.003
MW3B	1	ND	ND	ND	ND	0.005	–	0.003
	2	ND	ND	ND	NA	0.005	–	0.003
MW3C	1	ND	ND	ND	ND	0.005	–	0.003
	2	ND	ND	ND	NA	0.005	–	0.003
MW4A	1	ND	ND	ND	ND	0.005	–	0.003
	2	ND	ND	ND	NA	0.005	–	0.003
MW4B	1	ND	ND	ND	ND	0.005	–	0.003
	2	ND	ND	ND	NA	0.005	–	0.003
MW4C	1	ND	ND	ND	ND	0.005	–	0.003
	2	ND	ND	ND	NA	0.005	–	0.003
MW6	1	ND	ND	ND	ND	0.005	–	0.003
	2	ND	ND	ND	NA	0.005	–	0.003

CADMIUM
(RESULTS IN ppm)

WELL NO.	ROUND NO.	TOTAL CONC.	FILTERED CONC.	FIELD BLANK	TRIP BLANK	DETECT. LIMIT	EPA MCL (1)	NYSDEC STD./GV (2)
MW1A	1	0.01	0.01	0.01	0.01	0.005	0.01	0.01
	2	0.01	ND	ND	NA	0.005	0.01	0.01
MW1B	1	0.01	0.01	0.01	0.01	0.005	0.01	0.01
	2	0.01	0.01	ND	NA	0.005	0.01	0.01
MW1C	1	0.02	ND	0.01	0.01	0.005	0.01	0.01
	2	0.05	ND	ND	NA	0.005	0.01	0.01
MW2	1	0.04	0.02	0.01	0.01	0.005	0.01	0.01
	2	0.02	0.02	ND	NA	0.005	0.01	0.01
MW3A	1	0.02*	ND	ND	0.01	0.005	0.01	0.01
	2	ND	ND	ND	NA	0.005	0.01	0.01
MW3B	1	0.01*	0.01	ND	0.01	0.005	0.01	0.01
	2	ND	ND	ND	NA	0.005	0.01	0.01
MW3C	1	0.02*	ND	ND	0.01	0.005	0.01	0.01
	2	ND	ND	ND	NA	0.005	0.01	0.01
MW4A	1	0.05	ND	ND	0.05	0.005	0.01	0.01
	2	ND	ND	ND	NA	0.005	0.01	0.01
MW4B	1	ND	ND	ND	0.05	0.005	0.01	0.01
	2	ND	ND	ND	NA	0.005	0.01	0.01
MW4C	1	0.05	ND	ND	0.05	0.005	0.01	0.01
	2	ND	ND	ND	NA	0.005	0.01	0.01
MW6	1	0.02	ND	0.01	0.01	0.005	0.01	0.01
	2	0.01	ND	ND	NA	0.005	0.01	0.01

TABLE 2-73

INORGANIC CONTAMINANTS QUANTIFIED IN GROUNDWATER

CHROMIUM
(RESULTS IN ppm)

WELL NO.	ROUND NO.	TOTAL CONC.	FILTERED CONC.	FIELD BLANK	TRIP BLANK	DETECT. LIMIT	EPA MCL (1)	NYSDEC STD./GV (2)
MW1A	1	0.02	ND	ND	ND	0.01	0.05	-
	2	0.09	ND	ND	NA	0.01	0.05	-
MW1B	1	0.01	ND	ND	ND	0.01	0.05	-
	2	0.06	0.02	ND	NA	0.01	0.05	-
MW1C	1	0.03	ND	ND	ND	0.01	0.05	-
	2	0.18	ND	ND	NA	0.01	0.05	-
MW2	1	0.550	0.01	ND	ND	0.01	0.05	-
	2	2.7	0.53	0.02	NA	0.01	0.05	-
MW3A	1	ND	ND	ND	0.02	0.01	0.05	-
	2	0.06	ND	ND	NA	0.01	0.05	-
MW3B	1	ND	ND	ND	0.02	0.01	0.05	-
	2	ND	ND	ND	NA	0.01	0.05	-
MW3C	1	0.02	ND	ND	0.02	0.01	0.05	-
	2	0.03	0.01	ND	NA	0.01	0.05	-
MW4A	1	0.03NE	ND	ND	ND	0.01	0.05	-
	2	0.22	0.02	0.02	NA	0.01	0.05	-
MW4B	1	0.03NE	ND	ND	ND	0.01	0.05	-
	2	0.11	0.02	0.02	NA	0.01	0.05	-
MW4C	1	<0.01NE	ND	ND	ND	0.01	0.05	-
	2	0.02	0.01	0.02	NA	0.01	0.05	-
MW6	1	0.02	ND	ND	ND	0.01	0.05	-
	2	0.05	ND	0.02	NA	0.01	0.05	-

COPPER
(RESULTS IN ppm)

WELL NO.	ROUND NO.	TOTAL CONC.	FILTERED CONC.	FIELD BLANK	TRIP BLANK	DETECT. LIMIT	EPA MCL (1)	NYSDEC STD./GV (2)
MW1A	1	0.1	0.08	ND	ND	0.025	-	1.0
	2	0.18	ND	0.08	NA	0.025	-	1.0
MW1B	1	0.18	0.04	ND	ND	0.025	-	1.0
	2	0.26	0.05	0.08	NA	0.025	-	1.0
MW1C	1	0.18	ND	ND	ND	0.025	-	1.0
	2	0.22	0.04	0.06	NA	0.025	-	1.0
MW2	1	0.28	0.20	ND	ND	0.025	-	1.0
	2	0.80	0.88	0.06	NA	0.025	-	1.0
MW3A	1	0.09NE	0.04	ND	ND	0.025	-	1.0
	2	0.08	ND	ND	NA	0.025	-	1.0
MW3B	1	0.08NE	0.03	ND	ND	0.025	-	1.0
	2	0.10	ND	ND	NA	0.025	-	1.0
MW3C	1	0.27NE	0.04	ND	ND	0.025	-	1.0
	2	0.11	0.02	ND	NA	0.025	-	1.0
MW4A	1	0.04*	0.03	ND	ND	0.025	-	1.0
	2	0.08	0.03	0.06	NA	0.025	-	1.0
MW4B	1	0.12	ND	ND	ND	0.025	-	1.0
	2	0.08	0.07	0.06	NA	0.025	-	1.0
MW4C	1	0.06	0.03	ND	ND	0.025	-	1.0
	2	ND	0.05	0.06	NA	0.025	-	1.0
MW6	1	0.12	0.07	ND	ND	0.025	-	1.0
	2	0.13	0.05	0.06	NA	0.025	-	1.0

TABLE 2-7D

INORGANIC CONTAMINANTS QUANTIFIED IN GROUNDWATER

LEAD
(RESULTS IN ppm)

WELL NO.	ROUND NO.	TOTAL CONC.	FILTERED CONC.	FIELD BLANK	TRIP BLANK	DETECT. LIMIT	EPA MCL (1)	NYSDEC STD./GV (2)
MW1A	1	0.03	0.007	ND	ND	0.005	0.05	0.025
	2	0.052	0.03 S	0.01	NA	0.005	0.05	0.025
MW1B	1	0.155 S	0.007	ND	ND	0.005	0.05	0.025
	2	0.227 S	0.024 S	0.01	NA	0.005	0.05	0.025
MW1C	1	0.048	0.05	ND	ND	0.005	0.05	0.025
	2	0.029	0.006	0.01	NA	0.005	0.05	0.025
MW2	1	0.185	ND	0.01	ND	0.005	0.05	0.025
	2	0.254 S	0.165	ND	NA	0.005	0.05	0.025
MW3A	1	0.021NE	ND	ND	ND	0.005	0.05	0.025
	2	0.05 +	ND	ND	NA	0.005	0.05	0.025
MW3B	1	0.006NE	ND	ND	ND	0.005	0.05	0.025
	2	0.017 S	ND	ND	NA	0.005	0.05	0.025
MW3C	1	0.05NE	ND	ND	ND	0.005	0.05	0.025
	2	0.42 S	ND	ND	NA	0.005	0.05	0.025
MW4A	1	ND	0.005	ND	ND	0.005	0.05	0.025
	2	0.044	ND	0.01	NA	0.005	0.05	0.025
MW4B	1	0.006	ND	0.01	ND	0.005	0.05	0.025
	2	0.008	0.01	ND	NA	0.005	0.05	0.025
MW4C	1	0.01	0.009	0.01	ND	0.005	0.05	0.025
	2	0.01	ND	ND	NA	0.005	0.05	0.025
MW6	1	0.031	0.006	ND	ND	0.005	0.05	0.025
	2	0.023	ND	0.01	NA	0.005	0.05	0.025

MERCURY
(RESULTS IN ppm)

WELL NO.	ROUND NO.	TOTAL CONC.	FILTERED CONC.	FIELD BLANK	TRIP BLANK	DETECT. LIMIT	EPA MCL (1)	NYSDEC STD./GV (2)
MW1A	1	ND	ND	ND	ND	0.0002	0.002	0.002
	2	0.0003	0.0002	ND	NA	0.0002	0.002	0.002
MW1B	1	ND	ND	ND	ND	0.0002	0.002	0.002
	2	0.0005	ND	ND	NA	0.0002	0.002	0.002
MW1C	1	ND	ND	ND	ND	0.0002	0.002	0.002
	2	0.0004	ND	ND	NA	0.0002	0.002	0.002
MW2	1	ND	ND	ND	ND	0.0002	0.002	0.002
	2	0.0013	0.0005	ND	NA	0.0002	0.002	0.002
MW3A	1	ND	<.0002NE	ND	ND	0.0002	0.002	0.002
	2	ND	ND	ND	NA	0.0002	0.002	0.002
MW3B	1	ND	<.0002NE	ND	ND	0.0002	0.002	0.002
	2	0.0003	0.0003	ND	NA	0.0002	0.002	0.002
MW3C	1	ND	<.0002NE	ND	ND	0.0002	0.002	0.002
	2	0.0004	ND	ND	NA	0.0002	0.002	0.002
MW4A	1	ND	ND	ND	ND	0.0002	0.002	0.002
	2	ND	ND	ND	NA	0.0002	0.002	0.002
MW4B	1	ND	ND	ND	ND	0.0002	0.002	0.002
	2	ND	ND	ND	NA	0.0002	0.002	0.002
MW4C	1	ND	ND	ND	ND	0.0002	0.002	0.002
	2	0.0002	ND	ND	NA	0.0002	0.002	0.002
MW6	1	ND	ND	ND	ND	0.0002	0.002	0.002
	2	0.0007	ND	ND	NA	0.0002	0.002	0.002

TABLE 2-7E

INORGANIC CONTAMINANTS QUANTIFIED IN GROUNDWATER

NICKEL
(RESULTS IN ppm)

WELL NO.	ROUND NO.	TOTAL CONC.	FILTERED CONC.	FIELD BLANK	TRIP BLANK	DETECT. LIMIT	EPA MCL (1)	NYSDEC STD./GV (2)
MW1A	1	ND	ND	ND	ND	0.04	–	–
	2	ND	ND	ND	NA	0.04	–	–
MW1B	1	ND	ND	ND	ND	0.04	–	–
	2	0.04	ND	ND	NA	0.04	–	–
MW1C	1	ND	ND	ND	ND	0.04	–	–
	2	0.12	ND	ND	NA	0.04	–	–
MW2	1	0.15	0.08	ND	ND	0.04	–	–
	2	0.15	0.20	ND	NA	0.04	–	–
MW3A	1	0.04	0.05	ND	ND	0.04	–	–
	2	ND	ND	ND	NA	0.04	–	–
MW3B	1	0.10	ND	ND	ND	0.04	–	–
	2	ND	ND	ND	NA	0.04	–	–
MW3C	1	0.06	0.05	ND	ND	0.04	–	–
	2	ND	ND	ND	NA	0.04	–	–
MW4A	1	0.04	0.04	0.05	ND	0.04	–	–
	2	ND	ND	ND	NA	0.04	–	–
MW4B	1	ND	0.04	0.05	ND	0.04	–	–
	2	0.04	ND	ND	NA	0.04	–	–
MW4C	1	0.05	0.06	0.05	ND	0.04	–	–
	2	ND	ND	ND	NA	0.04	–	–
MW6	1	ND	ND	ND	ND	0.04	–	–
	2	0.06	ND	ND	NA	0.04	–	–

SELLENIUM
(RESULTS IN ppm)

WELL NO.	ROUND NO.	TOTAL CONC.	FILTERED CONC.	FIELD BLANK	TRIP BLANK	DETECT. LIMIT	EPA MCL (1)	NYSDEC STD./GV (2)
MW1A	1	<0.005NE	ND	ND	ND	0.005	0.01	0.02
	2	ND	ND	ND	NA	0.005	0.01	0.02
MW1B	1	<0.005NE	ND	ND	ND	0.005	0.01	0.02
	2	ND	ND	ND	NA	0.005	0.01	0.02
MW1C	1	<0.05NE	ND	ND	ND	0.005	0.01	0.02
	2	ND	ND	ND	NA	0.005	0.01	0.02
MW2	1	ND	ND	ND	ND	0.005	0.01	0.02
	2	ND	ND	ND	NA	0.005	0.01	0.02
MW3A	1	ND	ND	ND	ND	0.005	0.01	0.02
	2	ND	ND	ND	NA	0.005	0.01	0.02
MW3B	1	ND	ND	ND	ND	0.005	0.01	0.02
	2	ND	ND	ND	NA	0.005	0.01	0.02
MW3C	1	ND	ND	ND	ND	0.005	0.01	0.02
	2	ND	ND	ND	NA	0.005	0.01	0.02
MW4A	1	<0.0005E	ND	ND	ND	0.005	0.01	0.02
	2	ND	ND	ND	NA	0.005	0.01	0.02
MW4B	1	ND	ND	ND	ND	0.005	0.01	0.02
	2	ND	ND	ND	NA	0.005	0.01	0.02
MW4C	1	ND	ND	ND	ND	0.005	0.01	0.02
	2	ND	ND	ND	NA	0.005	0.01	0.02
MW6	1	ND	ND	ND	ND	0.005	0.01	0.02
	2	ND	ND	ND	NA	0.005	0.01	0.02

TABLE 2-7F

INORGANIC CONTAMINANTS QUANTIFIED IN GROUNDWATER

SILVER
(RESULTS IN ppm)

WELL NO.	ROUND NO.	TOTAL CONC.	FILTERED CONC.	FIELD BLANK	TRIP BLANK	DETECT. LIMIT	EPA MCL (1)	NYSDEC STD./GV (2)
MW1A	1	ND	ND	ND	ND	0.01	0.05	0.05
	2	0.01	ND	ND	NA	0.01	0.05	0.05
MW1B	1	ND	ND	ND	ND	0.01	0.05	0.05
	2	ND	ND	ND	NA	0.01	0.05	0.05
MW1C	1	ND	ND	ND	ND	0.01	0.05	0.05
	2	ND	ND	ND	NA	0.01	0.05	0.05
MW2	1	0.01	0.01	ND	ND	0.01	0.05	0.05
	2	0.07	0.03	ND	NA	0.01	0.05	0.05
MW3A	1	ND	ND	ND	ND	0.01	0.05	0.05
	2	ND	ND	ND	NA	0.01	0.05	0.05
MW3B	1	ND	ND	ND	ND	0.01	0.05	0.05
	2	ND	ND	ND	NA	0.01	0.05	0.05
MW3C	1	ND	ND	ND	ND	0.01	0.05	0.05
	2	ND	ND	ND	NA	0.01	0.05	0.05
MW4A	1	ND	ND	ND	ND	0.01	0.05	0.05
	2	ND	ND	ND	NA	0.01	0.05	0.05
MW4B	1	ND	ND	ND	ND	0.01	0.05	0.05
	2	ND	ND	ND	NA	0.01	0.05	0.05
MW4C	1	ND	ND	ND	ND	0.01	0.05	0.05
	2	ND	ND	ND	NA	0.01	0.05	0.05
MW6	1	ND	ND	ND	ND	0.01	0.05	0.05
	2	ND	ND	ND	NA	0.01	0.05	0.05

THALLIUM
(RESULTS IN ppm)

WELL NO.	ROUND NO.	TOTAL CONC.	FILTERED CONC.	FIELD BLANK	TRIP BLANK	DETECT. LIMIT	EPA MCL (1)	NYSDEC STD./GV (2)
MW1A	1	ND	ND	ND	ND	0.01	-	0.004
	2	ND	ND	ND	NA	0.01	-	0.004
MW1B	1	ND	ND	ND	ND	0.01	-	0.004
	2	ND	ND	ND	NA	0.01	-	0.004
MW1C	1	ND	ND	ND	ND	0.01	-	0.004
	2	ND	ND	ND	NA	0.01	-	0.004
MW2	1	ND	<0.1NE	ND	ND	0.01	-	0.004
	2	ND	ND	ND	NA	0.01	-	0.004
MW3A	1	ND	ND	ND	ND	0.01	-	0.004
	2	ND	ND	ND	NA	0.01	-	0.004
MW3B	1	ND	ND	ND	ND	0.01	-	0.004
	2	ND	ND	ND	NA	0.01	-	0.004
MW3C	1	ND	ND	ND	ND	0.01	-	0.004
	2	ND	ND	ND	NA	0.01	-	0.004
MW4A	1	ND	ND	ND	ND	0.01	-	0.004
	2	ND	ND	ND	NA	0.01	-	0.004
MW4B	1	ND	ND	ND	ND	0.01	-	0.004
	2	ND	ND	ND	NA	0.01	-	0.004
MW4C	1	ND	ND	ND	ND	0.01	-	0.004
	2	ND	ND	ND	NA	0.01	-	0.004
MW6	1	ND	ND	ND	ND	0.01	-	0.004
	2	ND	<0.01NE	ND	NA	0.01	-	0.004

TABLE 2-7G

INORGANIC CONTAMINANTS QUANTIFIED IN GROUNDWATER

ZINC
(RESULTS IN ppm)

WELL NO.	ROUND NO.	TOTAL CONC.	FILTERED CONC.	FIELD BLANK	TRIP BLANK	DETECT. LIMIT	EPA MCL (1)	NYSDEC STD./GV (2)
MW1A	1	0.10	0.10	ND	ND	0.02	–	5.0
	2	0.18	0.10	0.02	NA	0.02	–	5.0
MW1B	1	0.18	0.04	ND	ND	0.02	–	5.0
	2	0.26	ND	0.02	NA	0.02	–	5.0
MW1C	1	0.23	ND	ND	ND	0.02	–	5.0
	2	0.11	0.03	0.02	NA	0.02	–	5.0
MW2	1	0.20	0.14	ND	ND	0.02	–	5.0
	2	0.11	0.11	ND	NA	0.02	–	5.0
MW3A	1	0.04	0.02	ND	ND	0.02	–	5.0
	2	0.10	0.04	0.03	NA	0.02	–	5.0
MW3B	1	0.16	0.03	ND	ND	0.02	–	5.0
	2	0.09	0.05	0.03	NA	0.02	–	5.0
MW3C	1	0.30	0.03	ND	ND	0.02	–	5.0
	2	0.08	0.02	0.03	NA	0.02	–	5.0
MW4A	1	0.09	0.02	ND	ND	0.02	–	5.0
	2	0.07	0.02	ND	NA	0.02	–	5.0
MW4B	1	0.05	0.06	ND	ND	0.02	–	5.0
	2	0.04	0.04	ND	NA	0.02	–	5.0
MW4C	1	0.06	0.05	ND	ND	0.02	–	5.0
	2	0.04	0.03	ND	NA	0.02	–	5.0
MW6	1	0.16	0.06	ND	ND	0.02	–	5.0
	2	0.08	0.04	ND	NA	0.02	–	5.0

IRON
(RESULTS IN ppm)

WELL NO.	ROUND NO.	TOTAL CONC.	FILTERED CONC.	FIELD BLANK	TRIP BLANK	DETECT. LIMIT	EPA MCL (1)	NYSDEC STD./GV (2)
MW1A	1	8.5	0.05	ND	ND	0.02	–	0.30
	2	18.8	0.22	0.18	NA	0.02	–	0.30
MW1B	1	6.5	0.08	ND	ND	0.02	–	0.30
	2	21.0	0.32	0.18	NA	0.02	–	0.30
MW1C	1	16.5	0.03	ND	ND	0.02	–	0.30
	2	9.1	0.16	0.18	NA	0.02	–	0.30
MW2	1	61.4	13.5	ND	ND	0.02	–	0.30
	2	32.7	22.3	0.35	NA	0.02	–	0.30
MW3A	1	13.0	0.28	ND	ND	0.02	–	0.30
	2	33.8	0.60	0.11	NA	0.02	–	0.30
MW3B	1	29.1	25.3	ND	ND	0.02	–	0.30
	2	36.4	30.0	0.11	NA	0.02	–	0.30
MW3C	1	45.8	0.15	ND	ND	0.02	–	0.30
	2	27.0	0.18	0.11	NA	0.02	–	0.30
MW4A	1	25.8	0.07	ND	ND	0.02	–	0.30
	2	29.7	0.09	0.35	NA	0.02	–	0.30
MW4B	1	2.18	0.12	ND	ND	0.02	–	0.30
	2	2.06	1.33	0.35	NA	0.02	–	0.30
MW4C	1	1.63	0.10	ND	ND	0.02	–	0.30
	2	2.60	0.13	0.35	NA	0.02	–	0.30
MW6	1	16.2	0.04	ND	ND	0.02	–	0.30
	2	16.5	0.17	0.35	NA	0.02	–	0.30

TABLE 2-7H

INORGANIC CONTAMINANTS QUANTIFIED IN GROUNDWATER

MANGANESE
(RESULTS IN ppm)

WELL NO.	ROUND NO.	TOTAL CONC.	FILTERED CONC.	FIELD BLANK	TRIP BLANK	DETECT. LIMIT	EPA MCL (1)	NYSDEC STD./GV (2)
MW1A	1	0.70	0.38	ND	ND	0.02	–	0.30
	2	0.84	0.39	ND	NA	0.02	–	0.30
MW1B	1	0.29	0.03	ND	ND	0.02	–	0.30
	2	0.54	ND	ND	NA	0.02	–	0.30
MW1C	1	0.59	ND	ND	ND	0.02	–	0.30
	2	0.22	ND	ND	NA	0.02	–	0.30
MW2	1	9.6	9.1	ND	ND	0.02	–	0.30
	2	4.9	4.4	0.06	NA	0.02	–	0.30
MW3A	1	0.31	0.11	ND	ND	0.02	–	0.30
	2	0.38	0.17	ND	NA	0.02	–	0.30
MW3B	1	3.0	2.94	ND	ND	0.02	–	0.30
	2	3.04	3.01	ND	NA	0.02	–	0.30
MW3C	1	1.61	0.12	ND	ND	0.02	–	0.30
	2	0.09	0.03	ND	NA	0.02	–	0.30
MW4A	1	0.93	0.06	ND	ND	0.02	–	0.30
	2	1.01	0.32	0.06	NA	0.02	–	0.30
MW4B	1	0.21	0.17	ND	ND	0.02	–	0.30
	2	1.34	1.87	0.06	NA	0.02	–	0.30
MW4C	1	0.06	0.02	ND	ND	0.02	–	0.30
	2	0.06	ND	0.06	NA	0.02	–	0.30
MW6	1	1.38	1.05	ND	ND	0.02	–	0.30
	2	0.95	0.49	0.06	NA	0.02	–	0.30

NITROGEN (AS NH3+NO2/3)
(RESULTS IN ppm)

WELL NO.	ROUND NO.	TOTAL CONC.	FIELD BLANK	TRIP BLANK	DETECT. LIMIT	EPA MCL (1)	NYSDEC STD./GV (2)
MW1A	1	0.28	ND	ND	0.12	–	10.0
	2	0.37	ND	NA	0.12	–	10.0
MW1B	1	ND	ND	ND	0.12	–	10.0
	2	ND	ND	NA	0.12	–	10.0
MW1C	1	0.30	ND	ND	0.12	–	10.0
	2	0.04	ND	NA	0.12	–	10.0
MW2	1	3.66	ND	ND	0.12	–	10.0
	2	3.65	ND	NA	0.12	–	10.0
MW3A	1	0.41	ND	0.60	0.12	–	10.0
	2	0.47	ND	NA	0.12	–	10.0
MW3B	1	25.2	ND	0.60	0.12	–	10.0
	2	44.5	ND	NA	0.12	–	10.0
MW3C	1	0.05	ND	0.60	0.12	–	10.0
	2	ND	ND	NA	0.12	–	10.0
MW4A	1	0.40	ND	ND	0.12	–	10.0
	2	3.60	ND	NA	0.12	–	10.0
MW4B	1	1.50	ND	ND	0.12	–	10.0
	2	5.0	ND	NA	0.12	–	10.0
MW4C	1	0.23	ND	ND	0.12	–	10.0
	2	0.20	ND	NA	0.12	–	10.0
MW6	1	12.2	ND	ND	0.12	–	10.0
	2	7.66	ND	NA	0.12	–	10.0

TABLE 2-7I

INORGANIC CONTAMINANTS QUANTIFIED IN GROUNDWATER

AMMONIA
(RESULTS IN ppm)

WELL NO.	ROUND NO.	TOTAL CONC.	FIELD BLANK	TRIP BLANK	DETECT. LIMIT	EPA MCL (1)	NYSDEC STD./GV (2)
MW1A	1	0.08	ND	ND	0.02	-	-
	2	0.17	ND	NA	0.02	-	-
MW1B	1	ND	ND	ND	0.02	-	-
	2	ND	ND	NA	0.02	-	-
MW1C	1	ND	ND	ND	0.02	-	-
	2	ND	ND	NA	0.02	-	-
MW2	1	0.26	ND	ND	0.02	-	-
	2	0.25	ND	NA	0.02	-	-
MW3A	1	0.31	ND	ND	0.02	-	-
	2	0.37	ND	NA	0.02	-	-
MW3B	1	25.2	ND	ND	0.02	-	-
	2	44.5	ND	NA	0.02	-	-
MW3C	1	0.05	ND	ND	0.02	-	-
	2	ND	ND	NA	0.02	-	-
MW4A	1	ND	ND	ND	0.02	-	-
	2	2.6	ND	NA	0.02	-	-
MW4B	1	1.5	ND	ND	0.02	-	-
	2	4.6	ND	NA	0.02	-	-
MW4C	1	0.23	ND	ND	0.02	-	-
	2	ND	ND	NA	0.02	-	-
MW6	1	0.32	ND	ND	0.02	-	-
	2	0.06	ND	NA	0.02	-	-

NITRATE/NITRATE
(RESULTS IN ppm)

WELL NO.	ROUND NO.	TOTAL CONC.	FIELD BLANK	TRIP BLANK	DETECT. LIMIT	EPA MCL (1)	NYSDEC STD./GV (2)
MW1A	1	0.20	ND	ND	0.01	-	10.0
	2	0.20	ND	NA	0.01	-	10.0
MW1B	1	ND	ND	ND	0.01	-	10.0
	2	ND	ND	NA	0.01	-	10.0
MW1C	1	0.30	ND	ND	0.01	-	10.0
	2	0.40	ND	NA	0.01	-	10.0
MW2	1	3.4	ND	ND	0.01	-	10.0
	2	3.4	ND	NA	0.01	-	10.0
MW3A	1	0.10	ND	ND	0.01	-	10.0
	2	0.10	ND	NA	0.01	-	10.0
MW3B	1	ND	ND	ND	0.01	-	10.0
	2	ND	ND	NA	0.01	-	10.0
MW3C	1	ND	ND	ND	0.01	-	10.0
	2	ND	ND	NA	0.01	-	10.0
MW4A	1	0.40	ND	ND	0.01	-	10.0
	2	1.0	ND	NA	0.01	-	10.0
MW4B	1	ND	ND	ND	0.01	-	10.0
	2	0.40	ND	NA	0.01	-	10.0
MW4C	1	ND	ND	ND	0.01	-	10.0
	2	0.20	ND	NA	0.01	-	10.0
MW6	1	11.8	ND	ND	0.01	-	10.0
	2	7.6	ND	NA	0.01	-	10.0

INORGANIC CONTAMINANTS QUANTIFIED IN GROUNDWATER

TOTAL DISSOLVED SOLIDS
(RESULTS IN ppm)

WELL NO.	ROUND NO.	TOTAL CONC.	FIELD BLANK	TRIP BLANK	DETECT. LIMIT	EPA MCL (1)	NYSDEC STD./GV (2)
MW1A	1	210	20	ND	5.0	-	10.0
	2	90	ND	NA	5.0	-	10.0
MW1B	1	270	20	ND	5.0	-	10.0
	2	200	ND	NA	5.0	-	10.0
MW1C	1	280	20	ND	5.0	-	10.0
	2	140	ND	NA	5.0	-	10.0
MW2	1	20,400	5.0	230	5.0	-	10.0
	2	46,000	ND	NA	5.0	-	10.0
MW3A	1	130	ND	0.60	5.0	-	10.0
	2	100	ND	NA	5.0	-	10.0
MW3B	1	140	ND	0.60	5.0	-	10.0
	2	460	ND	NA	5.0	-	10.0
MW3C	1	630	ND	0.60	5.0	-	10.0
	2	180	ND	NA	5.0	-	10.0
MW4A	1	100	20	10	5.0	-	10.0
	2	60	ND	NA	5.0	-	10.0
MW4B	1	180	20	10	5.0	-	10.0
	2	170	ND	NA	5.0	-	10.0
MW4C	1	90	20.	10	5.0	-	10.0
	2	140	ND	NA	5.0	-	10.0
MW6	1	390	5.0	230	5.0	-	10.0
	2	240	ND	NA	5.0	-	10.0

TOTAL ORGANIC CARBON
(RESULTS IN ppm)

WELL NO.	ROUND NO.	TOTAL CONC.	FIELD BLANK	TRIP BLANK	DETECT. LIMIT	EPA MCL (1)	NYSDEC STD./GV (2)
MW1A	1	1.5	ND	ND	0.05	-	-
	2	2.4	ND	NA	0.05	-	-
MW1B	1	0.9	ND	ND	0.05	-	-
	2	2.1	ND	NA	0.05	-	-
MW1C	1	0.8	ND	ND	0.05	-	-
	2	3.8	ND	NA	0.05	-	-
MW2	1	2.0	ND	ND	0.05	-	-
	2	7.3	ND	NA	0.05	-	-
MW3A	1	2.5	ND	ND	0.05	-	-
	2	1.8	ND	NA	0.05	-	-
MW3B	1	12.2	ND	ND	0.05	-	-
	2	13.1	ND	NA	0.05	-	-
MW3C	1	2.0	ND	ND	0.05	-	-
	2	3.3	ND	NA	0.05	-	-
MW4A	1	2.9	ND	ND	0.05	-	-
	2	1.8	ND	NA	0.05	-	-
MW4B	1	2.5	ND	ND	0.05	-	-
	2	5.1	ND	NA	0.05	-	-
MW4C	1	1.1	ND	ND	0.05	-	-
	2	0.67	ND	NA	0.05	-	-
MW6	1	3.2	ND	ND	0.05	-	-
	2	10.4	ND	NA	0.05	-	-

NOTES:
ND- NOT DETECTABLE
NA- NOT ANALYZED
N- SPIKED SAMPLE RECOVERY NOT WITHIN CONTROL LIMITS.
*- DUPLICATE SAMPLE ANALYSIS NOT WITHIN CONTROL LIMITS.
E- VALUE ESTIMATED OR NOT REPORTED DUE TO INTERFERENCES.
S- VALUE DETERMINED BY METHOD OF STANDARD ADDITION.
+ - CORRELATION COEFFICIENT FOR METHOD OF STANDARD ADDITION <0.995.
(1) NYSDEC GOUNDWATER STANDARD OR GUIDANCE VALUE.
(2) EPA MAXIMUM CONTAMINANT LEVEL.

ORGANIC CONTAMINANTS QUANTIFIED
IN STAINLESS STEEL WELLS
RESULTS IN (ppb)

CONTAMINANTS QUANTIFIED	ROUND NO.	MW1A	MW1B	MW1C	FIELD BLANK	TRIP BLANK	MW2	MW6	FIELD BLANK	TRIP BLANK	MW3A	MW3B	MW3C	FIELD BLANK	TRIP BLANK	MW4A	MW4B	MW4C	FIELD BLANK	TRIP BLANK	NYSDEC STD/GV (1)	EPA MCL (2)
PURGEABLE ORGANICS																						
METHYLENE CHLORIDE	1	11B	15B	8B	10B	11B	24B	15B	43B	12B	26B	12B	12B	65B	24B	7B	7B	7B	170B	43B	-/50	-
	2	12B	10B	15B	43B	ND	ND	ND	ND	29J	ND	2JB	2JB	6B	1JB	ND	2JB	ND	ND	2JB		
1,1 DICHLOROETHENE	1	ND	ND	ND	ND	ND	16B	4JB	6B	3JB	ND	ND	ND	ND	ND	ND	ND	ND	1J	ND	-/0.07	0.7
	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
1,1 DICHLOROETHANE	1	ND	ND	ND	ND	ND	2J	ND	ND	ND	ND	3J	ND	ND	ND	ND	ND	ND	ND	ND	-/50	-
	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3J	ND	ND	ND	ND	ND	ND	ND	ND		
1,2 DICHLOROETHANE	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1J	2J	2J	ND	-/0.8	0.5
	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
TRICHLOROETHENE	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7	ND	ND	ND	1J	ND	ND	ND	ND	10/-	0.5
	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3J	ND	ND	ND	ND	ND	ND	ND	ND		
TETRACHLOROETHENE	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7	ND	ND	ND	ND	ND	ND	ND	ND	-/0.7	-
	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4J	ND	ND	ND	ND	ND	ND	ND	ND		
TOLUENE	1	1J	2J	2J	ND	3J	ND	ND	ND	ND	2JB	6B	2JB	2JB	3JB	ND	1J	2J	2J	2J	-/50	-
	2	ND	ND	2J	ND	ND	ND	2J	ND	3J	ND	2J	3J	2J	2J	ND	2J	2J	ND	3J		
CHLOROFORM	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2J	ND	ND	ND	100./-	[illegible]
01																						
	2	ND	1J	1J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3J	ND	ND	ND		
BENZENE	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-/1.0	5.0
	2	1JB	ND	ND	ND	1JB	ND	ND	ND	ND	ND	1J	ND	ND	ND	ND	ND	ND	ND	ND		
CIS/TRANS 1,2 - DICHLOROETHENE	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4J	ND	ND	ND	ND	ND	ND	ND	ND	-/50	-
	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2J	ND	ND	ND	ND	ND	ND	ND	ND		
SEMI-VOLATILES																						
DI-N-BUTYLPHTHALATE	1	ND	ND	ND	ND	ND	ND	ND	3J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-/-	-
	2	ND	ND	ND	ND	NS	ND	ND	ND	NS	ND	ND	ND	ND	NS	ND	ND	ND	ND	NS		
BUTYLBENZYLPHTHALATE	1	ND	11.0	2J	ND	ND	ND	ND	ND	ND	9JB	5JB	5JB	ND	ND	24B	9J	9J	10.0	ND	50.0/-	-
	2	ND	ND	ND	ND	NS	ND	ND	ND	NS	ND	ND	ND	ND	NS	ND	ND	ND	ND	NS		
BIS(2-ETHYLHEXYL) PHTHALATE	1	52B	55B	42B	39B	95B	29B	74B	170B	110B	59B	85B	240B	190B	140B	120B	120B	39B	380B	260B	4.2/-	-
	2	19B	37B	82B	360B	NS	30B	62B	50B	NS	59B	350B	250B	72B	NS	[illegible]	94B	35B	50B	NS		
PESTICIDES/PCB'S																						
ENDOSULFAN I	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.15B	0.14B	0.27B	0.27	0.11	0.20	ND	ND	-	-
	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
ENDOSULFAN II	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.11B	0.05JB	0.21B	0.19	0.07J	0.15	ND	ND	-	-
	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		

ND- NOT DETECTABLE
B- ANALYTE FOUND IN INSTRUMENT BLANK
J- ANALYTE QUANTIFIED WITH CONFIDENCE BUT BELOW THE DETECTION LIMIT
(1) NYS DEC GROUNDWATER STANDARD OR GUIDANCE VALUE
(2) EPA MAXIMUM CONTAMINANT LEVEL

TABLE 2-8

GROUNDWATER FIELD TESTS

WELL NO.	ROUND NO.	pH	NYSDEC GW STD/GV (1)	COND. (UMHOS)	TEMP. °C
MW1A	1	5.2	6.5-8.5	20	11.0
	2	5.1	6.5-8.5	105	9.0
MW1B	1	6.8	6.5-8.5	70	11.0
	2	9.0	6.5-8.5	135	9.0
MW1C	1	10.1	6.5-8.5	200	10.0
	2	10.0	6.5-8.5	135	9.0
MW2	1	5.4	6.5-8.5	>5000	14.6
	2	5.1	6.5-8.5	34,500	12.0
MW3A	1	5.6	6.5-8.5	270	16.9
	2	5.4	6.5-8.5	206	13.0
MW3B	1	7.2	6.5-8.5	1000	14.5
	2	6.7	6.5-8.5	1100	14.0
MW3C	1	7.7	6.5-8.5	325	15.0
	2	8.0	6.5-8.5	250	15.0
MW4A	1	5.3	6.5-8.5	130	14.5
	2	6.9	6.5-8.5	390	12.1
MW4B	1	7.4	6.5-8.5	160	12.7
	2	6.9	6.5-8.5	450	11.1
MW4C	1	6.9	6.5-8.5	150	12.0
	2	7.5	6.5-8.5	100	10.0
MW6	1	6.7	6.5-8.5	500	13.8
	2	7.3	6.5-8.5	360	7.8

Both rounds of groundwater sampling from stainless steel wells included analysis for priority pollutant metals, semi-volatiles, purgeable organics, pesticides/PCBs and inorganic analysis for iron, manganese, ammonia, nitrates/nitrites, total dissolved solids and total organic carbon. These latter analytes are commonly indicative of leachate contamination.

Prior to analysis of the priority pollutant metals, the samples were filtered through a .45 micron filter. The procedure was performed as a result of previous information obtained from a Superfund site in Hyde Park, New York (Holzmacher, et al. 1986). Throughout the Hyde Park investigation, it was discovered that the total metal results were not indicative of water quality of residential supply wells around the site. Due to development of the monitoring wells and use of these wells, fine sediment accumulates in the bottom. Thus, samples were filtered and analyzed. These results were compared with the unfiltered sample analytical results.

In the course of well development at North Sea, the purge water which was evacuated from each well was carted and disposed of in the recharge pit on site. This procedure was a limiting factor to proper well development. Although conductivities of the well water had stabilized, water clarity was not all that it should have been. Heavy metals would adhere to small particles in suspension, resulting in metal analyses which did not represent flowing groundwater. With these factors in mind and the information provided, the filtered metal results were used in determining plume contamination.

This body of data shows that the level of priority pollutants in both the upgradient and downgradient wells is well below NYSDEC standards. These data also bring into question the results of analyses done at the site during the period 1980-1986 when the samples were <u>not being filtered</u>. In 1979, the Suffolk County Department of Health Services, in the first analyses of groundwater, reported:

> "...heavy metals were absent from all samples analyzed. While the water within the leachate presents evidence as to the presence of contamination, and its physical properties (color, odor) further confirm this, none of the State primary drinking water standards are exceeded."

Subsequent analyses of 16 private wells draining water from the aquifer also showed the level of priority pollutants to be below the NYSDEC standards. Therefore, we can conclude that there has been, throughout this period of time, no substantive contribution of primary pollutants at the landfill to the groundwater.

Wells MW-1A, MW-1B and MW-1C were installed upgradient to provide a source of control for background concentrations. The pH was slightly high in MW-1C and was confirmed during Round II. The concentration of iron in MW-1B during Round II was slightly elevated (.38 mg/l) and just above the NYSDEC standard value for groundwater. Toluene was quantified in well MW-1C during Round II and chloroform in Wells 1B and 1C. Both results were flagged with a "J" which denotes that the concentration was detected with confidence but below the detection limit. No priority pollutants, semi-volatile organics and/or pesticide/PCBs were quantified in these wells. Priority pollutant metals, lead and cadmium, were detected in these wells and the concentrations were at least as high as those in the downgradient wells.

Wells MW-3A, MW-3B and MW-3C were installed directly downgradient of the capped landfill cell. These wells, screened in 3 depth zones, show a clear distinction between the zones. MW-3A showed a slightly elevated iron reading in Round II and MW-3C had a slightly elevated conductivity reading in Round I. The other contaminants analyzed for in these two wells were all quantified at levels substantially below the USEPA maximum contaminant levels (MCLs) for NYSDEC groundwater standards.

Concentrations of iron, nitrogen, total organic carbon and conductivity were all elevated in MW-3B. Iron concentrations were consistently in the 25-30 ppm range. This includes concentrations of 25.2 ppm for Round I and 44.5 ppm for Round II. Nitrogen was quantified in both rounds as 100 percent ammonia. The conductivity and total organic carbon readings were above the leachate indicator values of 300 umhos and 5.0 ppm, respectively. These values are not state or federal regulations, but are used throughout the annual monitoring at North Sea (Holzmacher, et al. 1987) and where allowed by the Suffolk County Department of Health Services (SCDHS) in its 1979 report. Concentrations of phenol were slightly above the NYSDEC standard. A few organic compounds were also quantified in MW-3B. Trichloroethene (TCE), tetrachloroethene (PCE), and cis-trans-1,2-dichloroethene (cis-trans-1,2-DCE) were all quantified with confidence in Rounds I and II, but below the detection level for the particular compound. However, TCE and PCE were detected above detection levels (7 ppb) in Round I samples. No pesticides/PCBs and/or priority pollutant metals were quantified above NYS standards and/or USEPA MCLs in any of the three wells at location 3.

Wells MW-4A, MW-4B and MW-4C are located on Fish Cove Road adjacent to Fish Cove. The conductivity reading at MW-4A was slightly elevated during Round II and trichloroethene and chloroform were quantified in Round I. The concentrations of these organic compounds were quantified with confidence, but below the detection limit. MW-4B had elevated ammonia readings in Round I and the nitrogen, total organic carbon and conductivity readings were significantly increased in Round II. Endosulfan I and II were detected in Round I samples from well MW-4C. Toluene was also detected at 2 ppb during Round II as well MW-4C.

The pesticide/PCB analysis of all three wells quantified concentrations of endosulfan I and II. These analytes were also detected in the method blank for that day. However, since the concentration in the method blank was not confirmed on the primary column, the samples analyzed on the same day as the method blank could not be flagged with a "B" (detected in method blank). With this in mind, the pesticide results quantified in wells MW-4A, MW-4B and MW-4C should be looked upon with some skepticism.

Well No. 6 was an additional well installed after screening lagoon boring No. 1. This indicated remnant sludge in the first ten feet. MW-6 was drilled 80 feet downgradient of lagoon boring No. 1, and is indicative of any groundwater contamination from the lagoons. Round I analysis of this well indicated high nitrogen and conductivity readings. These elevated results were confirmed in Round II with an elevated total organic carbon reading. The nitrogen concentrations in both rounds were 99 percent nitrates and nitrites. Nitrate/nitrite was detected at 11.8 ppm during Round I and at 7.6 ppm during Round II. Nitrate/nitrite is indicative of septic waste which has undergone aeration. Organic analysis during both rounds confirmed no contamination. Priority pollutant metal analysis was also below detection.

Well No. 2 was originally installed in its downgradient location to determine any impact from the scavenger lagoons. Well No. 2 is also installed adjacent to the salt pile used by the Town on the roads in the winter. The concrete pad on which the salt resides was only recently installed. This is an explanation of the extremely elevated sodium and chloride readings in this well. Sodium and chloride are non-CLP parameters applicable to samples collected in conjunction with a landfill expansion project.

MW-2 was drilled with a hollow stem auger rig and problems were encountered during its installation. The well is screened in a very silty zone which caused great difficulties when trying to pull the augers up. The original intent was to screen this well from 60-80 feet below grade. Because of the problems which were encountered, this well is screened from 52-72 feet and there is only 15 feet of water in the well.

This well was also not developed properly. Because of the minimal amount of water in the well, water could not be pumped out of it. The well was developed by bailing it dry and allowing it to recover. This procedure was executed for the course of a week but little progress was made on clearing out the well. With these problems in mind, the laboratory results of this well will be discussed.

Inorganic analysis from Rounds I and II indicated elevated readings of cadmium, iron, nitrogen (as 94 percent nitrate/nitrite in both rounds at 3.4 ppm) and conductivity. During Round II, extremely high readings of chromium and lead were also detected. Organic analysis quantified concentrations of 1,1-dichloroethane during Round I. No pesticides or PCBs were quantified at either sampling period.

The pH values in groundwater ranged from five to ten. The higher pH value may be due to the grout used in well construction, as seen in the upgradient wells.

The organic analysis of these groundwater samples which required the identification of non-target compounds yielded quantification of tentatively identified compounds. Discussion of these results is addressed in Appendix F.

2.2.4 - Plume Definition

In summary, the laboratory results indicate that there are two, possibly three, sources of contamination and the plume cores reside in the medium depth zone. Figure 2-10 depicts the estimated areal extent of these plumes.

Plume No. 1 is emanating from the capped landfill cell No. 1. Figure 2-11 depicts plume No. 1 in cross section A-A'. The key indicators of this contamination are iron, ammonia (as N), elevated conductivities and TOCs in excess of 5.0 ppm. Plume 1 is a qualitative interpolation of these parameters. Groundwater results of the shallow and deep wells in the area of plume 1 indicate little or no critical concentrations of these leachate indicators. However, these key indicators can be found in wells 3B and 4B, PVC wells 9 and 30 and the residential well at 152 Fish Cove Road. Laboratory analysis of these additional wells can be seen in Tables 2-10 and 2-11, respectively.

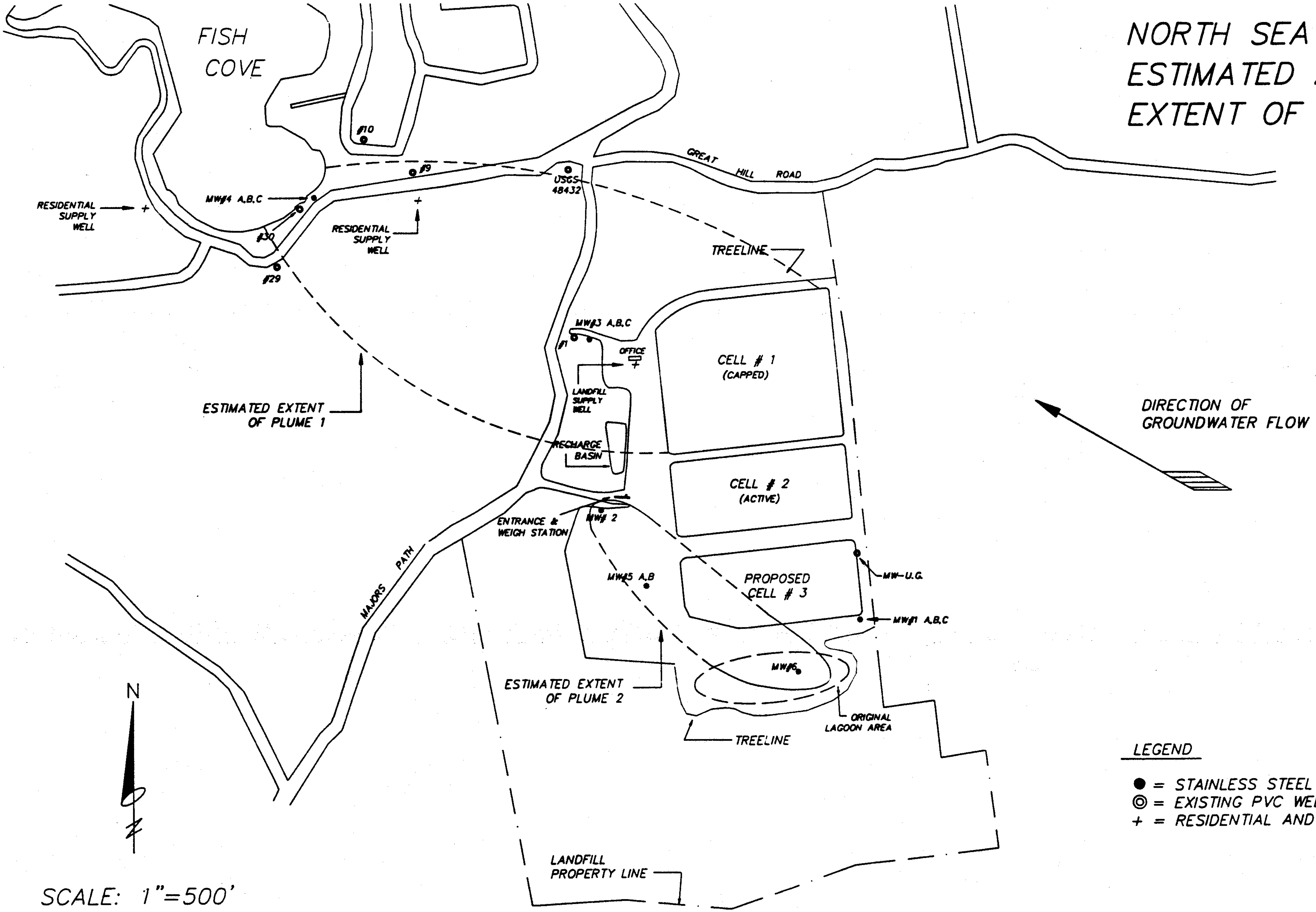
All of these wells are screened at intervals between -25 to -60 feet below MSL. As seen in Figure 2-9, groundwater flow tends to "bend" upwards as it approaches Fish Cove. This explains why the key indictors are detected in shallower wells when traveling further away from the source.

Plume No. 2 appears to be emanating from the area of the old sludge lagoons. Figure 2-12 depicts cross section B-B' of plume 2. The base map of the cross sectional line B-B' is in Figure 2-6. Key indicators of this plume are nitrogen (as NO_2 and NO_3), conductivity and TOC in excess of 5.0 ppm. MW-6 and MW-2 exhibit elevated readings of these contaminants.

As illustrated in Figure 2-12, little or no contamination of these indicators is observed in wells 5A or 5B. This can also be attributed to groundwater flow. Just recently, an additional

FIGURE 2-10

NORTH SEA RI
ESTIMATED AREAL
EXTENT OF PLUMES



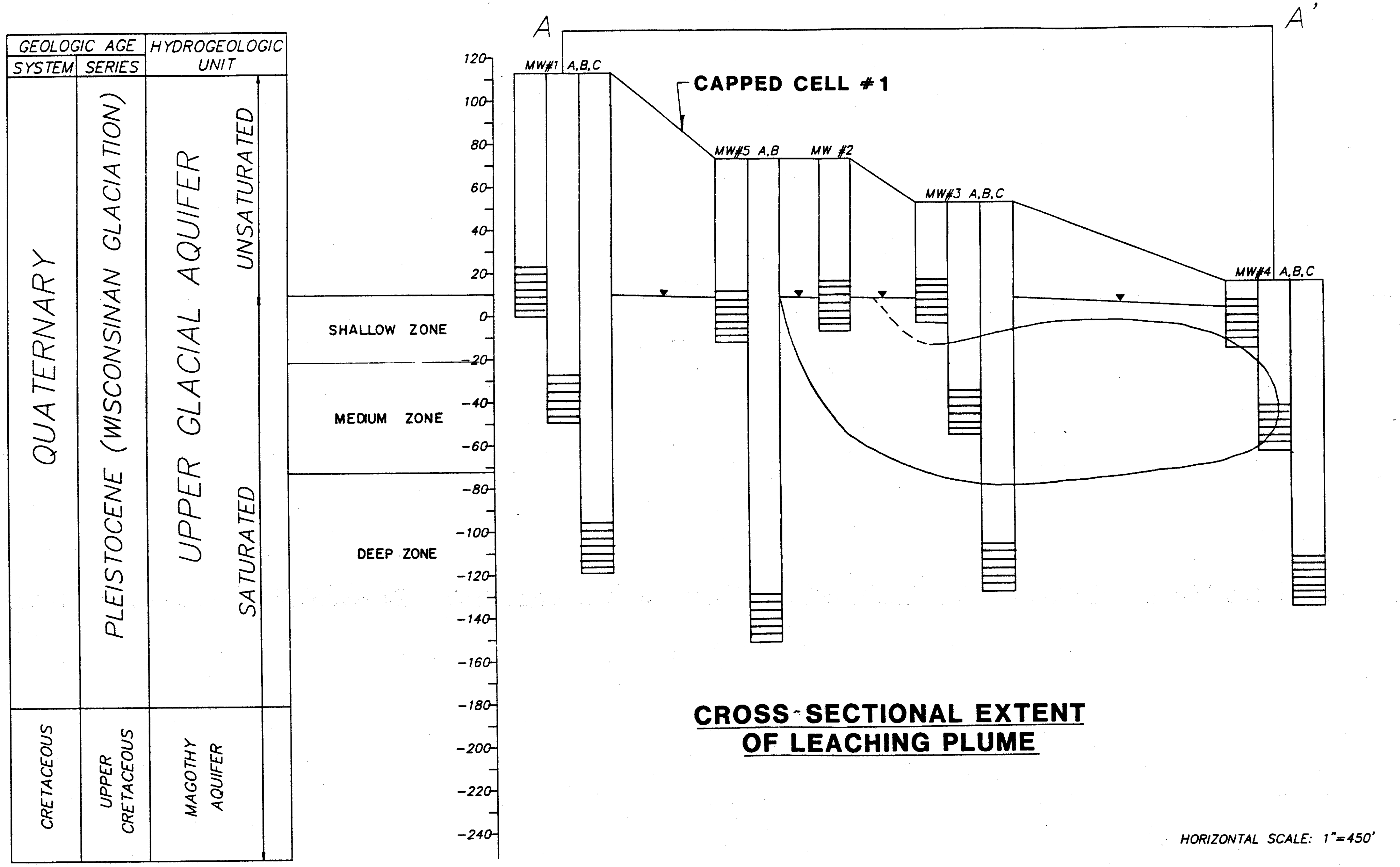
SCALE: 1"=500'

LEGEND

● = STAINLESS STEEL MONITORING WELL
◎ = EXISTING PVC WELL
+ = RESIDENTIAL AND SUPPLY WELL

H2M GROUP ENGINEERS · ARCHITECTS · PLANNERS · SCIENTISTS
MELVILLE, N.Y. RIVERHEAD, N.Y. FAIRFIELD, N.J.

FIGURE 2-11



CROSS-SECTIONAL EXTENT OF LEACHING PLUME

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TABLE 2-10

CONTAMINANTS
QUANTIFIED IN PVC WELLS
RESULTS IN (ppm)

	MW#9		MWW#10		MW#29		MW#30		UP GRADIENT WELL		NYSDEC GW STD./GV	EPA MCL
P.P. METAL	UNFILTERED	FILTERED	UNFILTERED	FILTERED	UNFILTERED	FILTERED	UNFILTERED	FILTERED	UNFILTERED	FILTERED	(1)	
ANTIMONY	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.003	-
ARSENIC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.025	0.05
BERRYLIUM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.003	-
CADMIUM	0.10	ND	ND	0.01	0.01	ND	0.01	0.01	0.01	ND	0.01	0.01
CHROMIUM	0.03*	0.02	0.05	0.03	0.03	0.03	0.03	0.03	0.01*	0.03	-	0.05
COPPER	ND	0.04	0.03	0.03	ND	0.025	0.23	ND	ND	0.04	1.0	-
LEAD	0.011	ND	0.011	0.005	0.005	ND	ND	0.005	ND	ND	0.025	0.05
MERCURY	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.002	0.002
NICKEL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-
SELLENIUM	<.05NE	ND	ND	ND	ND	ND	ND	ND	<0.005NE	ND	0.02	0.01
SILVER	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.05	0.05
THALLIUM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.004	-
ZINC	0.02	0.03	0.02	ND	ND	ND	0.05	0.02	0.00042	0.00036	5.0	-
LEACHATE INDICATORS												
IRON	5.09	0.16	3.7	0.14	0.76	0.3	39.4	20.6	0.15	0.14	0.3	-
MANGANESE	0.87	0.55	0.45	ND	0.04	0.03	4.8	4.5	ND	ND	0.3	-
NO2/3	ND		ND		ND		ND		ND		10.0	-
AMMONIA	1.5		ND		ND		26.4		ND		-	-
TOC	5.0		1.4		1.1		8.6		0.5		-	-
TDS	30.0		40.0		90.0		310		70.0		-	-
pH	6.6		7.1		6.7		7.0		7.0		6.5-7.5	-
COND.	270		84		510		920		61		-	-
TEMP (°C)	11.5		10.8		10.8		12.3		10.0		-	-

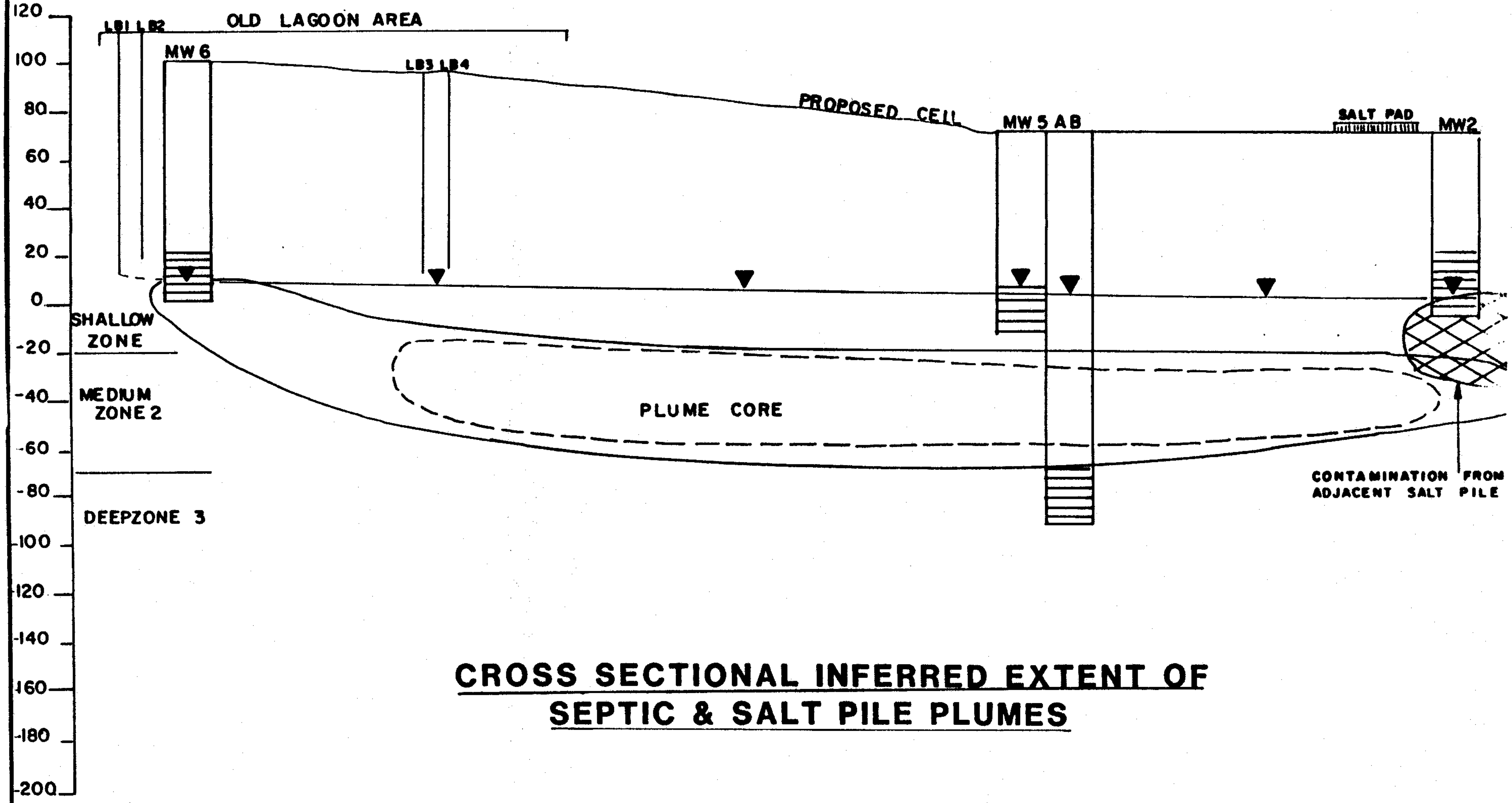
ND- NOT DETECTED
*- QA/QC DUPLICATE SAMPLE NOT WITHIN CONTROL LIMITS
(1) NYS DEC GROUNDWATER STANDARD OR GUIDANCE VALUE
(2) EPA MAXIMUM CONTAMINANT LEVEL

TABLE 2-11

CONTAMINANTS QUANTIFIED IN
SUPPLY WELLS @ NORTH SEA
RESULTS IN (PPM)

PP METALS	LANDFILL SUPPLY	104 FISH COVE RD.	152 FISH COVE RD.	NYS GW STD OR G.V.	EPA MCL
ANTIMONY	ND	ND	ND	0.003	-
ARSENIC	ND	ND	ND	0.25	0.05
BERRYLIUM	ND	ND	ND	0.003	-
CADMIUM	ND	0.01	ND	0.01	0.01
CHROMIUM	0.02	ND	0.01*	-	0.05
COPPER	0.04	0.05	ND	1.0	-
LEAD	0.008	ND	0.01	0.25	0.05
MERCURY	ND	ND	ND	0.002	0.002
NICKEL	ND	ND	ND	-	-
SELLENIUM	ND	ND	<0.005NE	0.02	0.01
SILVER	ND	ND	ND	0.05	0.05
THALLIUM	ND	ND	ND	0.004	-
ZINC	0.28	90.0	0.130	5.0	-
LEACHATE INDICATOR					
IRON	0.20	0.28	17.7	0.3	-
MANGANESE	0.05	0.02	1.4	0.3	-
NO2/3	0.20	0.30	ND	-	-
AMMONIA	0.31	ND	2.9	10.0	-
TOC	0.50	0.30	1.6	-	-
TDS	50.	40.	80.	-	-
pH	7.5	7.7	7.6	-	-
COND.	90	107	170	-	-
TEMP('C)	13.2	13.3	10.0	-	-

ND- NOT DETECTED
N- QA/QC SAMPLE NOT WITHIN CONTROL LIMITS
E- SUSPECTED INTERFERENCES
* - QA/QC SAMPLE NOT WITHIN CONTROL LIMITS
- NO STANDARD OR GUIDANCE VALUE LISTED



CROSS SECTIONAL INFERRED EXTENT OF SEPTIC & SALT PILE PLUMES

FIGURE 2-12

medium depth well was installed at location 5 and future lab analysis may confirm contamination from this second plume in that zone.

The third plume of contamination appears to be emanating from the area where the Town places salt for the roads in winter (Figure 2-12). It was only recently that a concrete pad was laid down on which to store the salt. Prior to this, precipitation of rain and/or snow could have percolated through the pile, transporting Na^+ and Cl^- ions in solution through the ground. This would account for the extremely high sodium and chloride ions detected in MW-2. This factor, in addition to the poor development of this well, may have resulted in the interferences during lab analyses and/ or erroneous results. The only way to confirm these assumptions is through future monitoring, and/or additional wells downgradient of MW-2.

2.2.5 - Additional Groundwater Analytical Results

Throughout the course of sampling at North Sea, additional lab analysis was done on other wells in the area.

Four PVC wells, which are currently used to monitor the landfill, were sampled. Stainless steel wells 5A and 5B, which were installed in conjunction with a landfill expansion project, were sampled. Two residential wells and the landfill supply well were also sampled. All wells, except for 5A and 5B, were sampled under CLP guidelines. Laboratory results are presented in Table 2-12.

Analysis of these results help further define plume 1. Well 30 which is among cluster MW-1A, B and C shows the same fingerprint as wells 3B and 4B. High iron and conductivity readings were observed in Well 29 and MW-9 exhibits high TOC and NH_3 readings. These two wells help define the fringe of the plume.

The residential well sampled at 152 Fish Cove Road indicated high ammonia and iron readings. The depth of this well is unknown, but it does appear to be on the edge of the plume.

No organic analysis was run on these wells. The residential and supply wells were sampled directly from the spout. Therefore, any volatiles in the sample would volatilize from the agitation of the pump. The PVC wells were not sampled for organics because it was felt that they would result in biased analysis. There is some skepticism as to whether or not organic compounds adsorb to the PVC casing (Ebasco, 1986).

Groundwater analytical data were obtained from wells 5A and 5B. The nitrate/nitrite as nitrogen in wells 5A and 5B was .9 mg/l and 1.1 mg/l, respectively. The only other analyte indicative of contamination from source 2 was TOC. MW-5A showed 5.4

TABLE 2-12

ADDITIONAL NON-CLP ANALYSIS .
FROM STAINLESS STEEL WELLS
RESULTS IN (PPM)

CONTAMINANT	MW2	MW6	MW5A	MW5B	MW1A	MW1B	MW1C	NYS GW STD OR G.V. (1)	EPA MCL (2)
BORON	ND	ND	ND	ND	ND	ND	ND	0.125	NL
TKN	0.91	0.69	0.22	0.35	0.22	ND	1.0	NL	NL
BOD	4.0	4.0	11.0	ND	ND	ND	ND	NL	NL
COD	944.0	16.0	28.0	32.0	120.0	ND	ND	NL	NL
SULFATE	100.0	18.0	10.0	15.0	4.0	6.0	7.0	250.	NL
F.ALUMINUM	50.0	15.4	ND	ND	ND	0.4	13.2	NL	NL
F.SODIUM	5700.0	73.0	19.9	26.1	9.3	15.6	17.5	NL	NL
MBAS	ND	ND	ND	ND	ND	ND	ND	NL	NL
F.CALCIUM	560.0	44.0	19.3	3.4	3.4	4.6	13.6	NL	NL
F.MAGNISIUM	74.0	14.0	8.6	0.7	2.4	1.3	5.1	35.0	NL
HARDNESS	1700.0	167.0	83.5	11.4	18.3	16.8	54.9	NL	NL
CHLORIDE	1280.0	21.0	40.0	27.0	17.0	14.0	13.0	250.0	NL
TURBIDITY	3.0	73.0	44.0	3.6	12.0	98.0	68.0	NL	NL
ALKALINITY	41.0	130.0	82.0	60.0	50.0	40.0	110.0	NL	NL
COLOR	80.0	20.0	10.0	60.0	ND	ND	ND	NL	NL
ODOR	ND	ND	ND	ND	18.0	28.0	62.0	NL	NL
HEX-CHROME	0.10	ND	ND	ND	ND	ND	ND	0.05	NL
F.ANTIMONY	-	-	ND	ND	-	-	-	0.003	NL
F.ARSENIC	-	-	ND	ND	-	-	-	0.025	0.05
F.BERRYLIUM	-	-	ND	ND	-	-	-	0.003	NL
F.CADMIUM	-	-	ND	ND	-	-	-	0.01	0.01
F.CHROMIUM	-	-	ND	ND	-	-	-	NL	0.05
F.COPPER	-	-	ND	ND	-	-	-	1.0	NL
F.LEAD	-	-	ND	ND	-	-	-	0.025	0.05
F.MERCURY	-	-	ND	ND	-	-	-	0.002	0.002
F.NICKEL	-	-	ND	ND	-	-	-	NL	NL
F.SELLENIUM	-	-	ND	ND	-	-	-	0.02	0.01
F.SILVER	-	-	ND	ND	-	-	-	0.05	0.05
F.THALLIUM	-	-	ND	ND	-	-	-	0.004	NL
F.ZINC	-	-	0.06	ND	-	-	-	5.0	NL
CYANIDE	-	-	ND	ND	-	-	-	0.2	NL
PHENOL	-	-	0.003	0.012	-	-	-	0.001	NL
NO2/3	-	-	0.90	1.1	-	-	-	10.0	NL
AMMONIA	-	-	0.13	0.06	-	-	-	NL	NL
T.O.C.	-	-	5.4	1.30	-	-	-	NL	NL
TDS	-	-	160.	180.0	-	-	-	NL	NL
F.IRON	-	-	ND	0.15	-	-	-	0.3	NL
F.MANGANESE	-	-	0.90	ND	-	-	-	0.3	NL

(1) - NYS DEC GROUNDWATER STANDARD OR GUIDANCE VALUE
(2) - EPA MAXIMUM CONTAMINANT LEVEL
- ANALYZED IN CONJUNCTION WITH THE RI/FS, UNDER CLP GUIDELINES.
NL - NO STANDARD OR GUIDANCE VALUE LISTED

ppm TOC during sampling in October. As mentioned previously, the additional installation of MW-5C (medium depth well) may provide more data relative to source 2.

2.3 - SURFACE WATER INVESTIGATION

2.3.1 - Description

The surface water sampling regime of the Remedial Investigation played an important role in determining the impact of groundwater flow on Fish Cove. Six sampling stations were stratigically positioned in the southern portion of the Cove (refer to Figure 2-4). Three shoreline locations were chosen. The other three locations were 50 feet from these stations, along a transect representing deeper water quality. Samples were collected from all six stations during high and low tide. Stations 5 and 6 were originally chosen to represent background water quality.

The samples along the shore were accessible with waiters, while the deeper locations were accessed with the use of an inflatable raft. Samples were collected from each station with a dedicated glass I chem bottle, which was rinsed once with representative water prior to collecting the sample. The samples collected were analyzed for priority pollutant metals, NH_3, NO_2, NO_3, TDS, Fe, Mn and salinity. Temperature, pH and conductivity were measured in the field. It should be noted that during sampling at high tide, the combined pH, conductivity, temperature probe malfunctioned and results for the field parameters were unobtainable.

2.3.2 - Analytical Results

The NYSDEC classifies surface waters on the basis of salinity and/or water quality. Once this body of water is classified, water quality results must maintain the respective guidance values and/or standards for that specified class. NYSDEC has classified Fish Cove as a "B" surface water body. This classification is for a fresh water body whose best use is primary contact recreation, and it cannot be used as a source of drinking water. The salinity readings observed at Fish Cove are indicative of a brackish water body. According to the August 1987 publication, "Reclassification of Certain Fresh Waters in the Atlantic Ocean - Long Island Sound Drainage Basin", Fish Cove is still classified by NYS as a class "B" fresh water body.

The USEPA maintains water quality criteria for the protection of human health and aquatic life. These guidelines, along with the NYSDEC guidelines for saline waters, are used when discussing the analytical results of Fish Cove.

Excessively high concentrations were not detected in the priority pollutant analysis of the surface water in Fish Cove. Cadmium, copper and mercury were detected at levels above state or federal guidelines. Chromium was quantified at 10 ppb at surface location 6 during high tide, which is below EPA standards.

Cadmium was quantified at three separate locations during high tide. At all the locations, the quantification value was 10 ppb. This concentration exceeds the state guidelines for a saline water body and it also exceeds the federal regulations for chronic toxicity to aquatic organisms.

Copper was detected during high tide at surface water location 6. The quantification value was 30 ppb which exceeds the state and federal guidelines by 10 percent. Mercury was quantified at .2 ppb at location 5 which also exceeds the state regulations and the federal guidelines for toxicity to humans through ingestion of water and/or organisms.

The state and federal guidelines which list the allowable concentrations for priority pollutant metals in surface waters do not have any guidelines listed for the leachate parameters analyzed for in the surface water samples. Ammonia, iron and manganese are the three elements consistently detected in Fish Cove. Tables 2-13a and 2-13b lists the inorganic analytical results for these samples.

The Nassau-Suffolk Regional Planning Board, directed by Dr. Lee E. Koppelman, conducted a study in June of 1975 which determined the biological constraints of coastal water quality. Within this document were several tables which list the toxicity of various compounds to aquatic organisms. Table 2-14 is a concise version of the various tables from this document. From this table, the following observations can be made:

Cadmium, copper, mercury and nitrogen are the four elements which have potential toxic effects on aquatic organisms. The concentrations at which cadmium and mercury were quantified in Fish Cove have no toxic effect on the aquatic organisms and therefore are not listed in Table 2-14.

Copper was quantified at .03 mg/l and at this concentration inhibits the growth of the Coccochloris elabus and is the minimal lethal concentration to effect Gymnodinium breve. Both species are phytoplankton. At a concentration of .00025 mg/l, copper causes death after 10-12 hours of exposure to the Neries diversiculor, a type of worm. Whether or not these species have or do inhabit Fish Cove has not yet been determined. If, in fact, these species do inhabit Fish Cove, it is unlikely that they would be found at or near surface water location 6 at high tide.

Concentrations of nitrogen (as NH_3) were quantified at all the surface water sampling locations. Concentrations ranged from .05-2.3 mg/l. At these concentrations, it is lethal after two days of exposure to Salmo gairdoneii (rainbow trout), and after 193 minutes of exposure it is lethal to Squalis ciphalis (shark). Neither of these species would inhabit the waters of Fish Cove.

LEACHATE PARAMETERS
QUANTIFIED IN FISH COVE
RESULTS IN (ppm)

LEACHATE PARAMETERS	S.W. LOCATION # 1		S.W. LOCATION # 2		S.W. LOCATION # 3		S.W. LOCATION # 4		S.W. LOCATION # 5		S.W. LOCATION # 6		FIELD BLANK		TRIP BLANK	
	L.T.	H.T.	L.T.	H.T.	L.T.	H.T.	L.T.	H.T.	L.T.	H.T.	L.T.	H.T.	L.T.	H.T.	L.T.	H.T.
IRON	0.81	1.1	0.53	0.29	0.55	0.54	0.3	0.29	0.22	0.36	0.30	0.31	ND	ND	ND	ND
MANGANESE	0.60	0.85	0.42	0.16	0.22	0.3	0.33	0.19	0.09	0.38	0.13	<0.19	ND	ND	ND	ND
T.O.C.	2.6	0.3	2.5	1.4	2.8	1.7	2.7	3.3	2.2	2.0	2.7	1.4	ND	ND	ND	ND
NO2/3	0.40	ND	0.2	ND	0.4	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AMMONIA	2.3	2.2	1.2	0.11	0.67	0.38	0.53	0.08	0.05	0.23	0.21	0.23	ND	ND	ND	ND
T.D.S	1.2%	2.7%	2.08%	2.5%	1.76%	2.6%	2.3%	2.5%	2.7%	2.6%	2.55%	2.6%	ND	ND	ND	ND
COND.	19000	42,700*	37,000	40,800*	27,400	40,600*	40,400	*	43,300	*	40,000	*	ND	ND	ND	ND
pH	7.0	7.1	7.3	7.8*	6.95	7.2*	7.7	8.0*	8.0	*	8.2	*	ND	ND	ND	ND
TEMP.('C)	16.5	13.0	16.5	10.0	16.5	13.0	15	12.0	16.0	13.0	15.0	13.0	ND	ND	ND	ND
SALINITY (ppt)	13.2	20.	21.9	27.0	16.1	23.3	21.0	22.8	25.2	23.3	23.8	23.0	ND	ND	ND	ND

ND- NOT DETECTED
+ - TYPICAL SEA WATER SALINITY = 34 (ppt)
*- COMBINED pH,CONDUCTIVITY PROBE MALFUNCTIONED.
FIELD FARAMETERS UNOBTAINABLE.

PRIORITY POLLUTANT METALS
QUANTIFIED IN FISH COVE
RESULT IN (ppm)

P.P.METAL	S.W. LOCATION # 1		S.W. LOCATION # 2		S.W. LOCATION # 3		S.W. LOCATION # 4		S.W. LOCATION # 5		S.W. LOCATION # 6		FIELD BLANK		TRIP BLANK		NYS SURF. H2O STDS	TOXICITY TO ORGANISMS		TOXICITY TO HUMANS	
	L.T.	H.T.	L.T.	H.T.	L.T.	H.T.	L.T.	H.T.	L.T.	H.T.	L.T.	H.T.	L.T.	H.T.	L.T.	H.T.		S.W. ACUTE	S.W. CHRONIC	INJEST H2O & ORGS.	INJEST ORGS. ONLY
ANTIMONY	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	.146	.450
ARSENIC	<0.1NE	<0.1NE	<0.01NE	<.1NE	<0.01NE	<.1NE	<0.01NE	<0.1NE	<0.1NE	<0.1NE	<0.1NE	<0.1NE	ND	ND	ND	ND	0.063*	0.069	.036	-	-
BERRYLIUM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-	-	-	-
CADMIUM	0.008	0.01	ND	ND	0.01	0.01	ND	ND	ND	ND	ND	0.01	0.01	ND	ND	ND	0.0027	0.043	.093	.01	-
CHROMIUM	ND	<.01NE	ND	<.01NE	ND	<.01NE	ND	<.01NE	ND	<.01NE	ND	0.01	ND	ND	ND	ND	-	1.1	.05	.05	-
COPPER	<.025NE	ND	<.025NE	ND	<.025NE	ND	<0.025NE	ND	<0.025NE	ND	<0.025NE	0.03	ND	ND	ND	ND	0.002	.0029	-	-	-
LEAD	<.005NE	<.005NE	<.005NE	<.05NE	<.005NE	<.05NE	<0.005NE	<.05NE	<.05NE	<.05NE	<.05NE	<.05NE	ND	0.01	ND	ND	0.0086	.140	.0056	.05	-
MERCURY	ND	ND	ND	<.0002NE	ND	<.0002NE	ND	<.0002NE	.0002	<.0002NE	ND	<.0002NE	ND	ND	ND	ND	0.0001	.0021	.0025	0.000144	0.000146
NICKEL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0071	.140	.0071	.0134	.10
SELLENIUM	<.050NE	<.050NE	0.5NE+	<.050NE	<.050NE	<.050NE	<.050NE	<.050NE	<.050NE	<.050NE	<.050NE	<.050NE	ND	ND	ND	ND	-	.410	.054	.01	-
SILVER	<.010E	<.010E	<.010E	<.010E	<.010E	<.010E	<.010E	<.010E	<.010E	<.010E	<.010E	<.010E	ND	ND	ND	ND	-	.0023	-	.05	-
THALLIUM	<.10NE	<.10NE	<.10NE	<.10NE	<.10NE	<.10NE	<.10NE	<.10NE	<.10NE	<.10NE	<.10NE	<.10NE	ND	ND	ND	ND	-	-	-	.013	.048
ZINC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.058	.170	.058	-	-

ND- NOT DETECTED
N- QA/QC SAMPLE NOT WITHIN CONTROL LIMITS
E- SUSPECTED INTERFERENCES
+- FILTERED RESULT

TABLE 2-13AB

TABLE 2-14*

TOXIC EFFECTS OF CERTAIN METALS ON AQUATIC LIFE

TOXIC SUBSTANCE	TOXIC CONC. (mg/l)	ENDANGERED ORGS.
Copper	.03	Coccochloris elabus
Copper	.03	Gymnodinium breve
Copper	.00025	Neries diversicolor
Nitrogen	0.5 - 2.54	Salmo gairdneri
Nitrogen	1.2	Squalis cephalis

* Extrapolated from Determination of Biological Constraints of Coastal Water Quality - Nassau-Suffolk Regional Planning Board, Lee E. Koppelman, Director, p. 3.88-3.105

2.3.3 - Previous Analytical Studies

Of the predominant contaminants detected in the groundwater, it appears that iron and ammonia are also predominant in the surface water. Whether or not these analytes are a result of groundwater discharge is still questionable. Analytical results from Fish Cove prior to 1960 are scarce.

In 1984, the NYSDEC conducted a shellfish and bacteriological water quality study of Fish Cove. Samples were taken at locations in the north, west and south portions of the Cove. Table 2-15 summarizes the key results of this study.

Two sample stations exceed the acceptable limits for total coliform. Station 10 in 1984 and station 8 in 1985 both exceeded the >10 percent population exceeding 330 MPN/100 ml. However, all the stations exceeded the >10 percent population exceeding 49 MPN/100 ml in both 1984 and 1985. Closure of the northern portion of the Cove was based on these bacteriological data.

Bioassays were also run on soft and hard clams collected from the same locations as the water quality tests. A summary of these analyses can be seen in Table 2-16.

USEPA has guidelines to determine the toxicity to humans if ingesting an organism with certain concentrations of contaminants. These guidelines are in mg/l, and the laboratory results on the clams from Fish Cove are in mg/kg. Assuming a 1:1 ratio of liters of clams to kg of clams, the specimens analyzed are below these standards.

Additional information was also obtained from laboratory analyses of Flanders Bay water. Suffolk County Department of Health Services (SCDHS) conducted an investigation of water quality in Flanders Bay and numerous sampling points were investigated. Although North Sea Harbor and Fish Cove were not included in this regime, points of similar locale can be used to compare average concentrations of NH_3. (Results of these analyses can be found in Appendix D).

The average nitrogen (NH_3, NO_2 and NO_3) readings observed in Fish Cove were .77 mg/l. The average nitrogen readings in the middle of Flanders Bay were about .03 mg/l. Readings obtained from similar enclosed environments around Flanders Bay exhibit average nitrogen concentrations of .41 mg/l.

In comparing Fish Cove to similar environs around Flanders Bay, nitrogen readings are slightly elevated. The impact of these concentrations on the aquatic or biotic lives of Fish Cove has not yet been determined. A biologic inventory should be conducted prior to any conclusions of detrimental impacts.

TABLE 2-15

BACTERIOLOGICAL WATER QUALITY*

NORTH SEA HARBOR/FISH COVE

1984-1985

	STATION 8 (N)	STATION 9 (W)	STATION 10 (S
Median Total Coliform-1984	59	68	33
% >330 MPN/ 100 ml	0	0	12.5
Median Fecal Coliform-1984	33	43	16
% (49 MPN/ 100 ml	12.5	12.5	12.5
Median Total Coliform-1985	33	68	43
% >330 MPN/ 100 ml	12.5	0	6.2
Median Fecal Coliform-1985	23	19	19
% >49 MPN/ 100 ml	25	25	18.7

* Using a 3 tube MPN test, bacteriological water quality at a station is acceptable if the median total coliform MPN/100 ml is 70 or less and no more than 10 percent of the samples exceed a total coliform MPN/100 ml of 330; or if the median fecal coliform MPN/100 ml is 14 or less and no more than 10 percent of the samples exceed a fecal coliform MPN/100 ml of 49.

TABLE 2-16

ANALYTICAL RESULTS OF SOFT AND HARD CLAMS FROM FISH COVE (APRIL 1984)

RESULTS IN mg/kg

PARAMETERS	SAMPLE #1 (SOUTH)	SAMPLE #2 (WEST)	SAMPLE #3 (WEST)
Arsenic	.065	0.12	0.12
Mercury	.027	0.014	0.019
Nickel	<.50	0.75	<0.50
Cadmium	0.22	0.07	0.19
Lead	0.45	0.90	0.35
Chromium	0.10	0.50	<0.10
Cyanide	<0.1	<0.1	<0.1
Iron	43	150	38
Manganese	8.4	18	8.0
Zinc	39	19	27

PARAMETERS	SAMPLE #1 (NORTH)	SAMPLE #2 (NORTH)	SAMPLE #3 (SOUTH)
Arsenic	0.13	0.058	0.18
Mercury	0.17	0.017	0.035
Nickel	0.50	1.0	<.50
Cadmium	0.18	0.23	0.075
Lead	0.55	0.80	0.55
Chromium	0.70	0.10	0.55
Cyanide	<0.1	<0.1	<0.1
Iron	135	30	105
Manganese	23	9.0	18
Zinc	25	28	27

In summary, water quality data on Fish Cove prior to 1960 is scarce. Therefore, the data recently collected cannot be compared to data prior to the area being used for landfilling purposes. Priority pollutant analyses of Fish Cove shows no severe contamination, but nitrogen concentrations are slightly elevated. No quality standard or guidance value is listed for nitrogen in surface water, but this parameter should be monitored.

2.4 - AIR INVESTIGATIONS

There were two types of air investigations performed at the North Sea Landfill: (a) a general survey of the ambient air at all sampling locations, and (b) an air sampling program.

2.4.1 - Ambient Air Survey

The general survey was performed to determine ambient air quality at all work zones at the site and to probe the soil for soil gases. This survey was done in conjunction with the health and safety precautions to be undertaken for all field sampling activities. Air investigations of this sort have never been performed at this site before the RI. However, the site was evaluated for the hazardous rank score (HRS) in 1983. The score for the air and fire/explosive routes was determined to be zero at that time.

Table 2-17 lists the ambient air readings. The general survey was done with an FID (flame ionization detection unit). The second survey was done concurrently with surface soil sampling with a PID (photoionization detection unit). Both surveys give a general indication of total organics in ambient air.

The general site survey indicated that air quality was acceptable for Level D work in all proposed sampling and work zones at the landfill. However, total organic readings were high at the top of the landfill active cell and downwind in front of the cell. Soil gas survey data at these two locations indicate the predominance of methane, a lower molecular weight organic compound (see Table 2-2a), and the ambient air readings are also probably predominantly methane. Nevertheless, a contingency plan to Level C was recommended in case of extreme conditions.

A wind monitoring station was proposed to be set in an area adjacent to the active cell. This would record daily variable wind patterns which affect air quality. Also, five air sampling locations were chosen, based on this survey (Figure 2-13).

2.4.2 - Air Analytical Results

Air samples were obtained at five locations at the landfill. These locations differ somewhat from the general survey. The purpose of air sampling was to monitor airborne organic constituents which may pose a threat to public health. Figure 2-13 depicts the five air sampling stations.

Ambient air was also measured with an HNu at each location during air sampling. The readings did not indicate any deleterious levels during sampling activities. All readings along with air sampling methods can be seen in Appendix B.

TABLE 2-17

BACKGROUND AMBIENT AIR

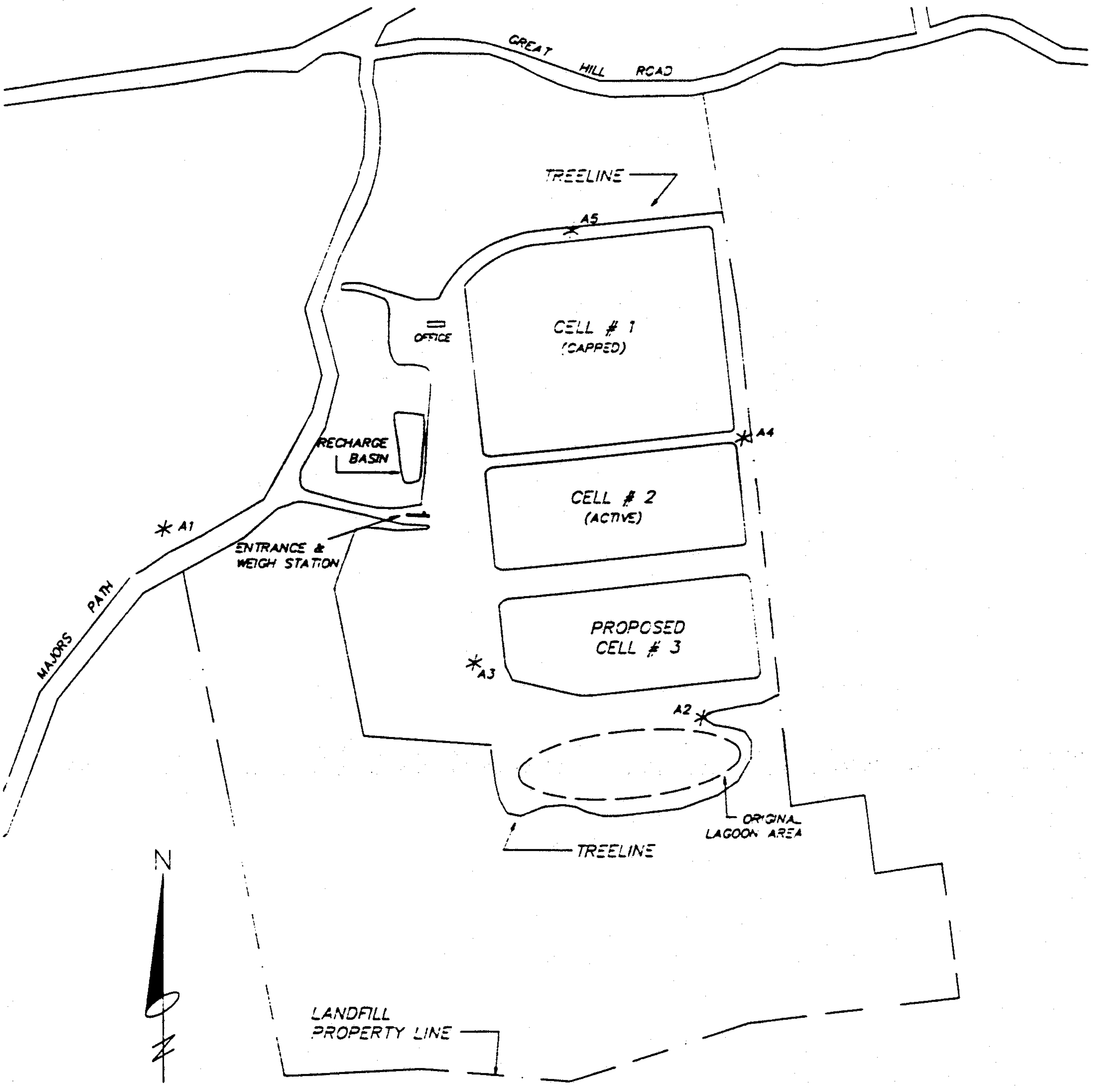
	GENERAL SURVEY FID* (ppm)	SURFACE SOIL SAMPLING - PID** (ppm)
SURFACE SOIL:		
1	3.8	1.3
2	3.9	1.3
3	4.0	1.4
4	4.0	1.3
5	4.0	1.4
6	3.8	1.3
7	7.0	1.3
8	3.6	1.5
9	8.0	1.5
10	6.0	1.5
11	4.0	3.2
12	4.0	1.8
13	3.8	1.7
14	4.0	1.2
15	3.8	1.0
16	20*	1.4
17	100-140*	1.2
18	13	1.2
19	20*	1.2
20	5.0	1.4
MW-2	.8-5.0	-
MW-3	3.0	-
MW-4	.2	-
AIR MONITORING STATION:		
1	3.8	-
2	.2	-
3	10-50	-
4	4.0-8.6	-
5	8-10	-

* OVA is calibrated to methane and can detect organic compounds with an ionization potential (IP) of 15.7 or less.

** HNu is calibrated to benzene and can detect organic compounds with an IP of 10.2 or less.

FIGURE 2-13

NORTH SEA RI/FS
AIR SAMPLING
STATION LOCATIONS



SCALE: 1"=500'

* = AIR SAMPLING STATION

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The air samples were analyzed for a complete list of priority pollutant purgeable organics. The results can be seen in Appendix G. Compared against federal and state air standards, these values are acceptable since all were below detection levels.

2.4.3 - Meteorological Data

Wind data were also collected before, during and after air sampling. The wind setup location was an open area near the guardhouse at the entrance and just northwest of the active cell. A summary of data collected from September 22nd through October 17, 1987 is seen in Table 2-18 and depicted as a wind rose in Figure 2-14. For this period of time, the predominant wind directions are out of the west, north and northwest. The predominant wind speed was in the range of 5.5 to 10.0 mph. All of the wind data collected can be seen in Appendix B.

TOTAL WIND SUMMARY
BY DIRECTION AND SPEED

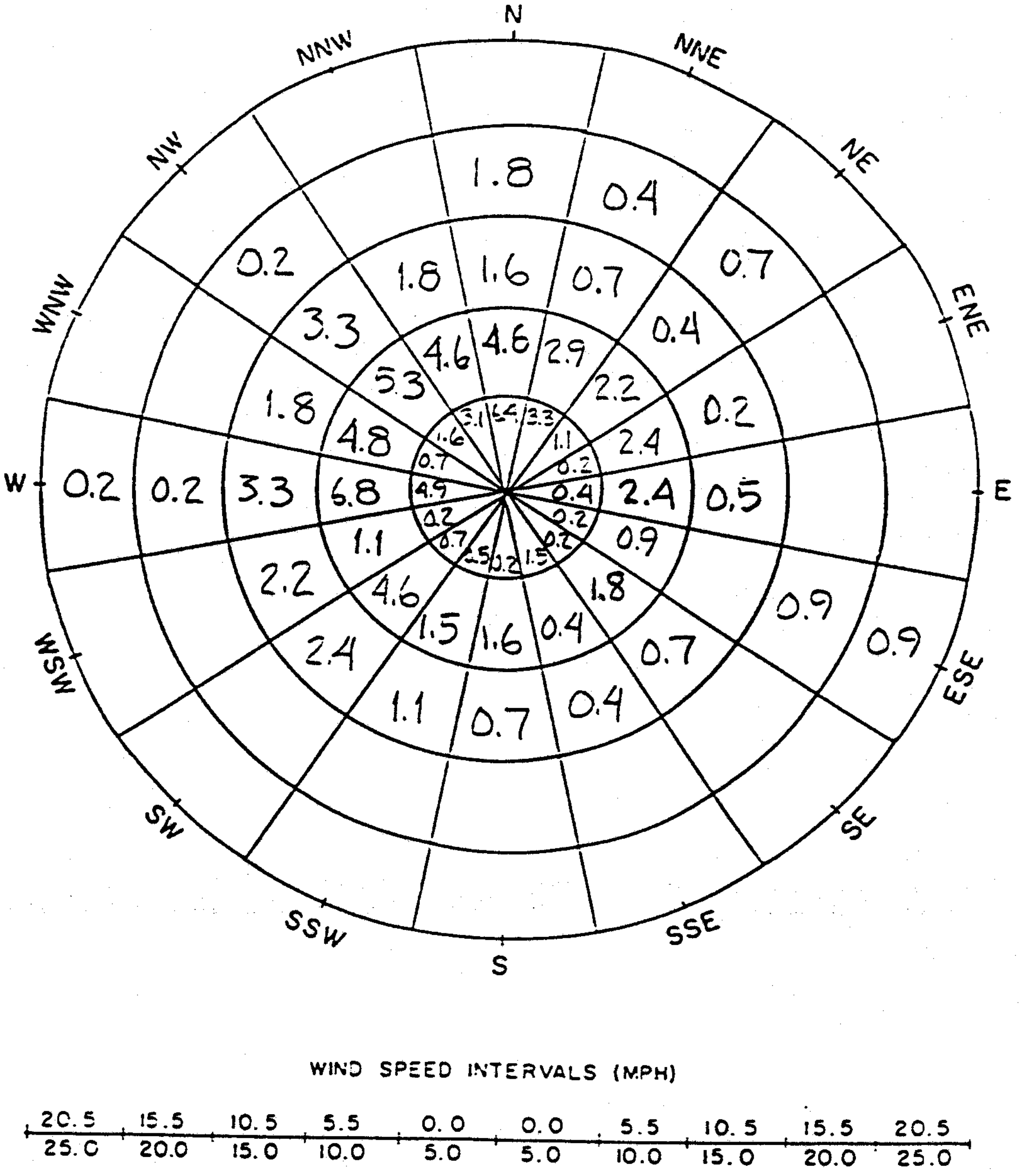
CLIENT: HOLZMACHER, McLENDON & MURREL DATE: 9/22/87 to 10/17/87
PROJECT: NORTH SEA LANDFILL WIND DATA
PROJECT NO.: 870910

	SPEED GROUP OBSERVATIONS(MPH)								
DIRECTION	1.0-5.0	5.5-10.0	10.5-15.0	15.5-20.0	20.5-25.0	OBS.	PERCENT	SUM	MEAN
N	35	25	10	11		81	14.84%	662.5	8.18
NNE	16	16	4	2		40	7.33%	284.5	7.11
NE	6	12	2	4		24	4.40%	222	9.25
ENE	1	13	1			15	2.75%	128	8.53
E	2	13	3			18	3.30%	156.5	8.69
ESE	1	5		5	5	16	2.93%	245.5	15.34
SE	1	10	4			15	2.75%	143	9.53
SSE	8	2	2			12	2.20%	73	6.08
S	1	9	4			14	2.56%	125	8.93
SSW	3	8	6			17	3.11%	160.5	9.44
SW	4	25	13			42	7.69%	378.5	9.01
WSW	1	6	12			19	3.48%	213	11.21
W	27	37	18	1	1	84	15.38%	663.9	7.90
WNW	4	26	10			40	7.33%	349	8.72
NW	9	29	18	1		57	10.44%	492.5	8.64
NNW	17	25	10			52	9.52%	396	7.62
TOTALS	138	261	117	24	6	546	100.00%	4693.4	8.60
PERCENT	25.27%	47.80%	21.43%	4.40%	1.10%				
MEAN SPD.	4.16	8.03	12.60	17.50	21.41				

FIGURE 2-14

WIND ROSE DIAGRAM

(OCCURRENCE PERCENTAGE)



CLIENT: Holzmacher, McLendon and Murrell

DATE: 9-22-87 TO 10-17-87

PROJECT: North Sea Landfill

COMMENTS: SUMMARY WIND ROSE FOR ENTIRE PROJECT.

PROJ. NO. 870910

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3.0 - PRELIMINARY PUBLIC HEALTH EVALUATION

This is a preliminary public health evaluation. A brief discussion of the potential effects of contaminants follows. The discussion is based on remedial investigation data. The preliminary public health evaluation (PHE) will follow the baseline evaluation procedures as outlined in the Superfund Public Health Evaluation Manual (ICF, 1986) in a qualitative manner.

This evaluation first discusses significant contaminants discovered in water, soil and air as part of the sampling phase of the RI. Then, the potential routes of exposure and potential receptors are discussed via several environmental media. Representative and maximum ("worst case") concentrations are then compared to federal and state applicable or relevant and appropriate requirements ("ARARs") and non-enforceable ("other") criteria. Indicator chemicals which had "ARARs" were omitted from further evaluation. Indicator chemicals which did not have "ARARs" were assessed further for estimated intakes, toxicity and potential risk.

3.1 - SIGNIFICANT CONTAMINANTS

Based on remedial investigation data, certain organic and inorganic compounds have been identified as significant contaminants or "indicator chemicals".

Samples were acquired from water, soil and air environmental media and analyzed for inorganic and organic contaminants. In the evaluation process, the range of reported values was listed for each chemical. The range could extend from undetected (where the value is assumed to be equal to zero) to the maximum reported value. The representative concentration was determined through a simple arithmetic mean of all values. The representative and maximum concentrations were the key values used in the entire evalution process. Air results were omitted from further evaluation, since all values were below detection limits.

The water environmental media included results from groundwater and surface water samples. In the evaluation, the higher values of the two media were chosen in further steps. For groundwater priority pollutant metals, iron and manganese, filtered values were used. Only values from two rounds of sampling from stainless steel wells were analyzed.

Surface water samples for metals were not filtered. These samples were not analyzed for organic parameters. Surface water inorganic results are critical for determining potential environmental (i.e., affects on biota), as well as public health effects. Considering the fact that all residences downgradient from the landfill are connected to a public water supply, surface water is equally important in terms of potential health effects priority.

Only surficial soil samples were chosen for this evaluation, since they present the most risk to human health, if any. The surficial soils at the landfill, the top 25 feet at the filled lagoon area and Fish Cove sediments were all included in this evaluation.

Table 3-1 lists the selected indicator chemicals. Each indicator chemical is a potential carcinogen (PC) and/or non-carcinogen (NC). PC chemicals are given a toxicologic category. NC chemicals are given a rating. For both NC and PC chemicals, the total indicator score (IS) was calculated from the sum of representative concentration times available toxicity constants.

Several chemicals were listed in the USEPA non-carcinogen tables, but did not have the appropriate toxicity constants. This includes the following chemicals prevalent in groundwater and surface water: iron, manganese, chromium, nitrate/nitrite and endosulfan. In surface soils, there were PAHs (at location 14), phthalates and chromium. These chemicals are considered as well but do not have toxicity constants.

Environmental fate criteria was also critical for the final selection of indicator chemicals. The key criteria are the organic carbon partition coefficient (KOC), fish concentration factors and water solubility. These are basic physical and chemical properties of the indicator chemicals.

The KOC is a sorption potential measure for organics, especially for aqueous pathways. This value is a tendency of organic chemicals to be adsorbed, which is also dependent on properties and is directly related to the retardation factor. The normal range is 1 to 10^7. For groundwater, low KOC values indicate more leaching and more mobility of the contaminant. In surface water, high KOC indicates tight binding of organics to soil and therefore less will dissolve in site runoff. However, a low KOC in soil indicates that the chemical may be released to groundwater in the future with high mobility. A high KOC also indicates a tendency to bioaccumulate. The KOC is essential in evaluating the efficiency of a chemical to be adsorbed by activated carbon as a treatment process.

The water solubility is the maximum concentration of a chemical that dissolves in pure water at a specific temperature and pH. Water solubility affects environmental fate of a chemical, since highly soluble chemicals leach rapidly into groundwater.

TABLE 3-1

SELECTED INDICATOR CHEMICALS FOR PRELIMINARY PUBLIC HEALTH EVALUATION*

Potential Carcinogens

- Volatile Organics:

Benzene
Chloroform
PCE
TCE

Non-Carcinogens (NC)

- Metals:

Cadmium
Chromium
Copper (1 SW)
Lead
Mercury

- Semi-Volatile Organics:

Endosulfan I and II
Butyl Benzyl Phthalate

- Volatile Organics:

Benzene
1,1-Dichloroethane
Cis-trans-DCE
PCE
Toluene
TCE

Other Chemicals of Concern (Leachate Indicators)

Ammonia (as Nitrogen)
Iron
Manganese
TOC

* Selection based on representative concentration, toxicity indicator score, environmental media and related environmental fate of the chemical. The number of samples which exceeded ARARs is in parenthesis next to the chemical. For volatile organics, this is the number of above detection levels.

Soluble chemicals are also more readily biodegradable. Highly soluble components are less strongly adsorbed on both surface and groundwater. High solubility is also generally associated with lower volatilization.

The bioconcentration factor is a measure of the tendency of the chemical contaminant in water to accumulate in fish tissue. This factor is important in determining human intakes via the aquatic food ingestion route.

3.2 - POTENTIAL ROUTES OF EXPOSURE AND RECEPTORS

This section summarizes the probable environmental pathways of exposure and probable receptors, both human and environmental, of the significant chemical contaminants at the site. For each environmental pathway, a potential source, a release transport medium, release mechanism, and exposure points where the human population comes in direct contact with the contaminant are discussed.

The potential environmental pathways of exposure in order of importance are: (1) groundwater and surface water, and (2) soil. The predominant potential sources of contamination at the North Sea site are the landfill cells. While one cell is inactive and capped, another cell is still currently active. A secondary source of contamination at the site is the decommissioned sludge lagoon area.

The release mechanism from the source area to the release/transport media is the physical and/or chemical process that the chemical contaminant will theoretically experience. The release mechanism is dependent on the physical/chemical properties of the contaminant and the interaction with the various transport media of the site.

Additionally, exposure factors related to each release/transport media and human exposure are considered. The media includes groundwater, surface water, soil and air. For each release/transport media, the probable exposure routes and exposure points are identified. Many of these pathways represent only minor exposures to the human population due to low contaminant concentrations.

3.2.1 - Groundwater and Surface Water

The primary environmental exposure route of chemical contaminants at the North Sea site is through the Upper Glacial aquifer. A contamination plume has been detected moving northwest at a slow migration rate from the landfill site. All homes in the affected area are currently connected to a public water supply for drinking, showering and cooking purposes. However, potential exposure to the plume is possible for those few private wells which are used for irrigation and watering.

The hydrogeology was analyzed as part of the remedial investigation. This helped to identify the natural groundwater flow patterns, natural rate of flow, total area and volume of the inferred plume of contamination and the effect of other factors, as discussed in the previous sections. The plume is still moving to the northwest. Exposure concentrations were estimated using a graphical technique (nomograph) as based on the Wilson-Miller dispersion equation (see Appendix C).

The plume locally discharges to a surface water body (Fish Cove) northwest of the landfill. Tidal exchange of these estuarine waters may be significant in reducing contaminant concentration in Fish Cove, as evidenced by RI surface water results. The area of probable discharge is brackish and open to shellfishing. This water body is rated as Class B, which is suitable for primary contact recreation. Ammonia was the key contaminant found at Fish Cove and was analyzed further for toxic effects.

3.2.2 - Soil

Direct ingestion of soil and exposure to contaminated soil was considered a potential exposure route at this site. However, the probability of this occurring is low. Exposure is highest for people who actually work at or near the landfill cells and/or decommissioned sludge lagoon areas. This pathway is also directly related to air exposure due to resuspension of contaminated soils.

3.2.3 - Air

Exposure to airborne organic and inorganic contaminants is possible for the people who work at the landfill. Airborne contamination is due either to: (1) volatilization and resuspension of substances from surface soils around landfill cells and scavenger lagoons, or (2) volatilization of hazardous substances from the filled sludge lagoon septic sludges. However, the RI air results do not indicate any cause for immediate attention to this exposure route.

3.2.4 - Applicable or Relevant and Appropriate Requirements

The applicable or relevant and appropriate requirements (ARARs) were compared with RI data. This includes a determination of the extent to which federal, state and other environmental and public health requirements are applicable or relevant and appropriate to the RI study site. Such criteria, advisories or guidance and standards are to be used in developing appropriate remedial action for the site. All tables of chemicals quantified in groundwater and surface water in Section 2.0 list the available ARARs for groundwater and surface water. Refer to Table 2-1 for recommended action levels for inorganic and organic constituents in soil.

3.3.1 - Estimate of Organic Chemical Intakes and Toxicity Assessment

The estimation for organic chemical intakes in mg/kg/day has been performed for the ingestion route only via groundwater, surface water and soil. From these data, chronic daily intakes (CDIs) were calculated based on representative (lower) concentrations and sub-chronic daily intakes (SDIs) were calculated based on worst case concentrations. This is a very conservative approach. Only the main exposure points were chosen. The prime groundwater exposure points are private drinking water wells, but contamination was not found in any of the active wells used for potable water. Surface water exposure points include exposure due to water recreation activities and intakes due to shellfish ingestion. There is a medium probability that shellfish from Fish Cove will be ingested. Soil intake, on the other hand, is not likely to occur, but was considered in the intake evaluation just the same.

The major assumption regarding the calculation of CDIs and SDIs is that the human intake factor is based on human adult body weight of 70 kg and an average drinking water consumption rate of 2 liters per day.

For the toxicity assessment, available acceptable daily intake for sub-chronic (AIS) and acceptable daily intake for chronic (AIC) exposures (in mg/kg/day) were compared against SDIs and CDIs, respectively. AIS and AIC values are listed under toxicity data for non-carcinogenic effects and some of the indicator chemicals do not have these values listed. None of the SDI and CDI calculations exceeded the corresponding acceptable intake levels.

3.3.2 - Risk Assessment for Indicator Non-Carcinogenic and Carcinogenic Organic Indicator Chemicals

The risk assessment was performed to investigate potential risks of non-carcinogenic and carcinogenic organic chemical indicator contaminants. Summarized below are major conclusions from these estimates:

- Non-Carcinogens

The SDIs and CDIs calculated in the previous step were compared against acceptable intakes (AISs and AICs) for sub-chronic and chronic exposure for the oral route. All available acceptable intakes were for potential non-carcinogens. Calculated versus acceptable intakes were compared by simple ratios for sub-chronic and chronic cases. All contaminants were within acceptable intake levels, as based on the summation of the ratios.

"Applicable" requirements are defined as federal requirements for hazardous substances that would be legally applicable or enforceable by either a federal or an authorized state program if this response were not undertaken pursuant to CERCLA, Section 104 or 106. Certain federal requirements, such as those under RCRA, are "applicable" although other federal requirements may not be "applicable".

"Relevant and appropriate" requirements are defined as those federal requirements designed to apply to problems similar to those encountered at the CERCLA site and their application is appropriate, even though they are not "legally applicable". All the requirements are in the "relevant and appropriate" category. These include SDWA Primary Drinking Water Standards (maximum contaminant levels), Federal Water Quality Criteria (Clean Water Act), Federal and State Occupational Safety and Health requirements, and State Drinking Water Standards. In the other category are MCLGs (maximum contaminant level goals), EPA Health Advisories, Federal and State Groundwater Protection Standards, RCRA Groundwater Protection Standards, Federal and State Wetland Protection Requirements and Federal and State Endangered Species requirements.

3.3 - RISK CHARACTERIZATION

ARARs were primarily available for inorganic chemical indicators, but not for organic chemical contaminants. This risk characterization consists of estimates of human intakes, toxicity and risks of organics to potential receptors. Ammonia has also been included in this characterization and is the only inorganic to be evaluated. The representative and maximum concentrations represent the concentrations expected in the receptor (exposure) areas.

The organic chemicals for groundwater include a variety of purgeable oranics and endosulfan. For groundwater and surface water, ammonia is predominant, but critical to surface water. PAHs and phthalates are predominant in surficial soils. Surface soil from the lagoon area was analyzed for purgeable organics. Chloroform was the ony significant purgeable organic identified in the surface soils.

Some values exist for water quality criteria for comparison of organics, but overall sufficient criteria is lacking. In the near future, New York State may be enforcing a drinking water criteria of 5 ppb for principal organic contaminants. ARARs (Federal and New York State) exist for benzene and trichloroethene.

The sum of ratios for the sub-chronic or chronic hazard index indicated a total less than the reference value of one in both cases. Therefore, there are no health hazards based on these data at this point in time. If the ratio summation exceeds the reference value of one, the compounds must be segregated in the mixture and separate hazard indices must be determined for each effect.

In the future, AIS and AIC values may become available for the other contaminants which do not have them now. Thus, the total sum or hazard index will increase. The hazard index sum may also increase if more inhalation route data becomes available.

- Carcinogens

The risks for potential carcinogens are estimated as probabilities and based on chronic daily adult intake (CDI) and carcinogenic potency factor. The route specific risks were calculated for the ingestion route and estimated for the inhalation route, for additive effects of each chemical as a separate class and for the effects of multiple carcinogens. The risks were estimated for all potentially carcinogenic indicator organic chemicals found at the site: benzene, chloroform, tetrachloroethene and trichloroethene. The total risk is assumed to be additive and independent.

The risk estimates are indicative of a worst case total lifetime exposure to maximum organic chemical concentrations at an assumed constant rate. Table 3-2 summarizes worst-case (i.e., based on maximum concentrations) risk estimates for the chosen chemical carcinogenic contaminants and includes their EPA weight of evidence for carcinogenity, chronic daily adult intake estimate, carcinogenic potency factor and the calculated route specific risk via ingestion.

The total risk for each organic chemical was 10^{-7} or a low potential risk of 1 in 10,000,000 in the receptor area. This is less than the risk utilized in setting current drinking water standards of 1 in 1,000,000.

In reality, conditions may change which in turn effects the total risk. In this case, risk due to organic contaminants is most likely an overestimate and may decrease with time. This will be due naturally to groundwater flow, dispersion of contaminants, and decrease in concentration. It is also highly unlikely that each resident will intake the same concentration over their lifetime, or consume drinking water with all contaminants present.

TABLE 3-2

TOTAL LIFETIME RISK DUE TO THE INGESTION OF POTENTIAL CARCINOGENIC CONTAMINANTS.

CHEMICAL	EPA CARCINOGENIC WEIGHT OF EVIDENCE VIA THE INGESTION ROUTE	CDI CHRONIC DAILY INTAKE (ADULT) (mg/kg/day)	CARCINOGENIC POTENCY FACTOR (mg/kg/day)	ROUTE SPECIFIC RISK ##
BENZENE	A	2.0E-6	5.2E-2	1.5E-7
CHLOROFORM	B2	1.0E-5	8.0E-5	8.1E-7
TETRACHLOROETHENE	B2	1.4E-5	5.1E-2	7.1E-7
TRICHLOROETHENE	B2	1.4E-5	1.1E-2	1.5E-7

A = HUMAN CARCINOGEN (SUFFICIENT EVIDENCE).
B2 = PROBABLE HUMAN CARCINOGEN (ANIMAL EVIDENCE, SOME HUMAN EVIDENCE).

= CUMULATIVE RISK = 1.8E-6

4.0 - PRELIMINARY DISCUSSION OF REMEDIAL ACTION TECHNOLOGIES

The feasibility study process, as outlined in Section F of the National Contingency Plan (NCP), requires identification and screening of potentially applicable remedial technologies and remedial action alternatives. The full screening process is outlined in "Guidance on Feasibility Studies Under CERCLA" (USEPA Report 5401G-85/003, June 1985).

For this preliminary report, the screening process has been somewhat abbreviated. This includes a review of site problems (as discussed in the introduction of this report) and an overview of general response actions. The scope of this preliminary feasibility study does not provide for development or selection of alternatives.

General site problems associated with the landfill cells in the North Sea study area are typical landfill-related problems. Therefore, the response actions for the cells would be similar. Some sample problems include vertical and horizontal leachate migration and infiltration of precipitation to form leachate. However, the North Sea site has an additional problem area - a decommissioned sludge lagoon area.

The following conclusions have been made to date in regard to the site:

(1) Based on our recent investigations, there has been no evidence of drummed hazardous materials on site and there is no evidence of explosive hazards.

(2) In regard to surface runoff, soils are naturally highly permeable. Thus, little overland migration of surface contaminants is expected. In regard to the capped landfill cells, most stormwater runoff is discharged to the on-site recharge basin.

4.1 - GENERAL RESPONSE ACTIONS

General response actions are grouped into three main categories: no action, source control and migration control. The three general response categories were considered for this site in relation to landfill related problems:

- No Action - This response action is a feasible migration control action. The objective of the RI was to provide a more adequate data base to establish health risks. Based on the available data collected to date, it can be demonstrated that groundwater contamination, in particular, is not severe. The RI data has also provided information on the air, soil and surface water pathways. A preliminary (qualitative) public health evaluation based on RI data indicates that these pathways are probably not deleterious to human health.

The Town has already taken source control and migration control response actions. Alternative water supplies have been provided for affected residential wells. Residential well drinking water affected by the leachate plume downgradient from the landfill has been replaced by municipally supplied well water. Outside of the contaminated zone, residences are supplied with water monitored by the Suffolk County Department of Health Services.

Available analytical data indicate that the no-action alternative is a feasible approach. The Town has been providing source control through proper closure of Cell 1 and operation of Cell 2. Additionally, the Town continues to monitor groundwater quality on an annual and quarterly basis.

- Source Controls - Source controls are designed to prevent or minimize migration of hazardous materials from the source area. The on-site facilities may be classified into two potential source areas, the landfill cell 1 (capped) and the filled sludge lagoon area. Typical source control response actions could include capping of the landfill cell or excavation and removal of lagoon sediments. The feasibility study screening process will identify other feasible response actions or simply modifications of present source control measures. Source control measures have already been implemented or are planned for these two general source areas at the landfill site.

As discussed in a previous section on the nature and extent of the problem, aside from the groundwater plume, which is generally an off-site issue, there are three on-site situations present which pose remediation considerations: (1) two capped (inactive) landfill areas (Cell 1), (2) an active landfill cell which is lined and destined to be capped by 1990 (Cell 2), and (3) a proposed expansion area which would be an active, double-lined cell. The active cell has a leachate collection system. A similar system is proposed for proposed Cell 3.

The old sludge lagoon area has already been substantially excavated and the contents removed. Results from surficial soil sampling thus far from the RI study indicates that further removal activities may be necessary on the northeast corner of where the sludge lagoons originally existed.

Finally, a salt pile near well MW-2 has been identified as yet another source (of chloride). PAHs were also found at source soil location 14, but the levels were so low that further remediation is not warranted.

- Migration Control - Contaminated groundwater migration controls are initiated when hazardous substances have migrated from the original source and pose a threat to public health and the environment. General response actions include collection, containment, treatment and discharge of the contaminant plume. If ARAR's are exceeded and potential human receptors are identified, groundwater migration controls may be warranted.

At the North Sea site, the existence of a groundwater contaminant plume has been confirmed. The purpose of the RI study was to characterize the nature and concentration of hazardous contaminants. If hazardous levels were indicated, then design of a feasible means of controlling the plume would be started, such as pumping with subsequent treatment of recovered water. With this scenario, the location of groundwater recovery wells would generally be downgradient, but toward the middle of the inferred areal extent of the plume. A migration control option which is considered not practical at this site because of the large area affected, is the use of in-situ treatment techniques. This option is generally employed only on smaller, source area remediation projects.

5.0 - CONCLUSIONS AND RECOMMENDATIONS

Conclusions and recommendations are based on the remedial investigative data presented in Section 2.0.

5.1 - CONCLUSIONS

Conclusions are grouped by environmental pathway (i.e., release media). In decreasing order of importance, these are groundwater, surface water, soil and air.

5.1.1 - Groundwater

The following conclusions were made based on the hydrogeologic investigation. This investigation includes the collection and interpretation of geologic and analytical water quality data.

1. Plume 1

The investigation reconfirmed the presence of leachate. Plume 1 originates from Cell 1 on the North Sea Landfill site. Cell 1 is capped, but unlined.

Plume 1 consists primarily of leachate constituents, such as ammonia, iron, manganese and TOC. These parameters were used to identify the plume on-site and off-site. Groundwater samples were obtained from stainless steel, PVC and residential wells. On-site, the highest concentration of the leachate plume was evident in well MW-3B. This mid-depth well is just northwest of Cell 1 on the landfill property.

Off-site, the water quality data confirmed the localized discharge of this plume at Fish Cove. Well MW-4B is used to demonstrate this.

Because the concentrations of priority pollutants in both downgradient and upgradient wells are below standards and statistically essentially the same, there is no significant contribution of priority pollutants to groundwater.

2. Plume 2

Plume 2 was confirmed. Plume 2 emanates from the filled septic lagoon area on-site. The presence of nitrate/nitrite (as nitrogen) in groundwater from well MW-6 confirms the presence of septics in the source area. Well MW-2 was installed downgradient from this area and also indicated levels of nitrate and nitrite (as nitrogen). It is expected that this plume will travel northwest with groundwater flow. The areal extent of the plume was based on these available data. There are wells which were installed after the RI in conjunction with the landfill expansion.

Data from these wells in the future will supply more data for defining the areal extent of the plume.

3. Plume 3

Plume 3 appears to be amanating from the area near well MW-2. A salt pile is evident on the surface near well MW-2. Groundwater data indicate high levels of sodium and chloride. It is not known how far these contaminants have traveled, but it probably parallels the leachate plume from source 1.

It is not possible to fully develop well MW-2 to acceptable levels. This may have somewhat affected the results. Inconsistent results were evident between the two rounds of sampling. Even though the groundwater samples were filtered for metals, the results exceeded ARARs for cadmium, chromium, lead, iron and manganese.

4. Geology

The major conclusion regarding the geology of the Upper Glacial aquifer in this area is that there are less permeable strata in the deeper part of the aquifer. This is evidenced by the presence of the plume and shallow to medium depths in the aquifer. Thus, the plume is retarded and diverted with groundwater flow. There are not enough data to state that the more impermeable strata are continuous.

5. Groundwater Analytical Data

ARARs were available for most of the priority pollutant parameters. If the parameters were below ARARs, they were considered non-hazardous and certain priority pollutant parameters were above detection levels.

Out of 176 analyses for priority pollutant volatile organics, only 2 were above NYS standards (7 ppb in well MW-3B) and these are within the accuracy of the analytical method.

The average level of cadmium in downgradient wells is the same as the upgradient. This level is 0.005 mg/l and below the standard of 0.01 mg/l. The average downgradient level of lead is 16 mg/l and this is below the upgradient well level of 20 mg/l. Both upgradient and downgradient wells are below the standard of 25 mg/l for lead. This indicates that there may not be any contribution of these metals to groundwater and is probably true for all priority pollutant metals.

Priority pollutant purgeable organic compounds were detected below 10 ppb in samples. TCE and PCE were detected at 7 ppb in well MW-3B. This is higher than the current standard of 5 ppb. Other organic compounds were below detection levels.

6. Groundwater Flow

Groundwater flow is to the northwest with localized discharge at Fish Cove. The key release mechanism of contaminants is via precipitation and infiltration at the source areas. Receptor areas are thus downgradient from these source areas. The key receptor areas are downgradient groundwater and surface water (Fish Cove).

5.1.2 - Soil

H2M collected four types of soils. These were: (1) surface soils at various locations throughout the landfill; (2) soils from the filled lagoon area; (3) saturated soils from well boreholes, and (4) sediment from Fish Cove. Conclusions are based on all of the data collected. Overall, there is very little contamination in soils.

1. E.P. Toxicity

In general, if a sample indicated E.P. Toxicity leaching potential, the concentration was way below the recommended levels. Cadmium and lead are two examples.

However, certain soil sample metal parameters were undetectable for total metals analysis, but indicated leaching potential. This occurred for mercury and silver. This is a common occurrence in analytical procedures. These levels were also well below E.P. Toxicity recommended levels.

2. Metals in Soils

Very few samples exceeded state action levels for inorganics. The exceptions were cadmium (4 lagoon samples) and silver (1 lagoon sample and 1 saturated soil sample at depth). Mercury has no action level, but was found to exceed typical soil concentrations at 2 surface soil locations (near the active cell and the excavated area).

3. Phthalates were evident in most soils. DEHP was found to be a laboratory contaminant. The source of phthalates may be common plastic materials. All levels of phthalates in soils were well below action levels.

4. PHAs were evident in greatest variety at a surface soil location north of the inactive cell. Otherwise, PAHs were not that common in soils.

5. The purgeable organic results in lagoon soils were for the most part unreliable except for chloroform. Chloroform was evident in lagoon boring 4.

6. Pesticides and PCBs were not evident in the lagoon soils.

5.1.3 - Surface Water

1. The surface water body known as Fish Cove should be reclassified by the NYSDEC to be a saline water body. Salinity data indicate a brackish water body.

2. Sampling locations 5 and 6 were intended to represent background conditions. However, copper (location 6) and mercury (location 5) exceeded ARARs at one location each.

3. Three sampling locations exceeded ARARs for cadmium. These are sampling locations one, three and six.

4. Ammonia, iron and manganese were detected consistently at all locations. These are leachate indicators. Ammonia in particular is evident in other enclosed bay areas in the South Fork. These levels were similar to Fish Cove and of the same order of magnitude.

5. Toxic levels of cadmium, copper, mercury or nitrogen were not indicated for aquatic organisms. Further monitoring data is preferred.

Historical bioassay data of clams from Fish Cove indicate low levels of priority pollutant metals. Mercury was found to be at an acceptable federal level for food.

5.1.4 - Air

1. The ambient air survey indicated acceptable air quality in the RI work zones at the landfill.

2. Purgeable organic compounds were not detected in any of the air samples collected.

3. Wind data collected during the RI indicated a wind direction out of the west, north and northwest with a speed range of 5-10 miles per hour.

5.2 - RECOMMENDATIONS

Recommendations have been grouped into three areas: (1) recommended additional hydrogeologic information, (2) recommended limnological study of Fish Cove, and (3) recommended remedial actions.

5.2.1 - Recommendation 1 - Hydrogeologic Data

Additional hydrogeologic data would aid in plume definition and migration. Thus, further data on groundwater flow patterns and groundwater quality would be required.

1. Groundwater Flow

Two areas need further study. These are: seasonal/regional flow patterns in the study area and flow patterns at Fish Cove, the local discharge area.

In order to monitor seasonal and regional flow patterns, depth to water measurements should be obtained on a bi-monthly basis from all wells on and off-site. Off-site wells which have not been surveyed for elevation and location should be done. Specifically, this includes PVC wells NS-9, NS-10, NS-29 and NS-30. These wells are all in the Fish Cove area.

Wells in the Fish Cove area will aid in understanding localized flow patterns at this location. A Stevens recorder can be used to monitor water level fluctuations over a 24-hour period on wells located at the edge of Fish Cove (MW-4A, B and C and NS-30). The water level in these wells is directly affected by tidal fluctuations in Fish Cove.

Wells MW-4A, B and C should be resurveyed using a tide gauge as a bench mark. The resurvey should be done at mean sea level time when the tidal fluctuations can be measured directly from the tide gauge. Thus, the local discharge of groundwater can be studied more accurately.

2. Groundwater Monitoring

There will be an ample amount of wells for groundwater monitoring. In addition to the wells used for the RI, stainless steel wells were installed after the RI. These wells are part of the landfill expansion project for the NYSDEC.

The additional groundwater analytical data will confirm the presence of Plumes 2 and 3 on the landfill site. Additional data will also demonstrate the effects of natural attenuation and the effectiveness of the no-action remedial alternative or other remedial actions. The additional monitoring activities could be done in conjunction with on-going quarterly and annual monitoring. In the past, this monitoring has used PVC wells only.

All data collected will be compared with RI data. This would be done in a statistical manner.

5.2.2 - Recommendation 2 - Fish Cove Study

A study of Fish Cove would be limnological in nature and would include a study of water quality and key aquatic organisms.

Water samples would be collected over a period of time. Any trends in the data would be analyzed. The data would be compared against any other local water quality data. An attempt to predict concentrations of discharged leachate to actual levels would be done.

Bioassays of shellfish tissue may confirm the presence of metal intake. Shellfish are filter feeders and siphon in the water for food. Laboratory bench scale toxicity tests could be performed as well on shellfish. The toxic concentration in terms of LD_{50} could be determined. These toxic concentrations would be compared to actual surface water concentrations of key inorganics.

5.2.3 - Recommendation 3 - Remedial Response Actions

There are three groups of remedial response actions - no-action, source control and migration control. Based on the RI data, a combination of no-action and required source control measures may be most appropriate.

The no-action response required continued groundwater monitoring. Groundwater monitoring should be done in conjunction with (1) supplying alternative water supplies for residents located downgradient and (2) required source control measures.

Required source control measures for Source 1 (the capped Cell 1) have been done. Source 2 (filled septic lagoon) will not require excavation, as based on analytical soil data. Source 3 (salt pile) will require removal as per NYSDOT regulations.

Exceedance of ARARs with high risk to public health and the environment would warrant the use of migration control methods. However, this is not the case at the North Sea Landfill. If this method is chosen, the groundwater would be pumped and subsequently treated.

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