WORK PLAN FOR ON-SITE REMEDIAL INVESTIGATION/FEASIBILITY STUDY AT THE SYOSSET LANDFILL, SYOSSET, NEW YORK

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SYOSSET WORK PLAN

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INTRODUCTION

This work plan was developed to meet the requirements of a Remedial Investigation/Feasibility Study (RI/FS) as outlined in the Guidance Documents for Remedial Investigations and Feasibility Studies, dated June, 1985. The RI/FS process was developed by the USEPA to investigate and remediate CERCLA sites, to insure consistency with the National Contingency Plan (NCP) for CERCLA funded investigations.

The project team from Geraghty and Miller, Inc. is given on Figure 1.1. which also indicates responsibilities and chain of command. Geraghty & Miller, Inc. will be responsible for performing most of the investigative work. Geraghty & Miller, Inc. is under subcontract to the firm of Lockwood, Kessler and Bartlett (LKB), who will provide engineering expertise throughout the RI/FS.

REMEDIAL INVESTIGATION

1. Scoping

1.1 Site History and Description

The Syosset Landfill is located in the Town of Oyster Bay. The landfill, as shown in Figure 1.2, encompasses approximately 44 acres and is bounded by the Long Island Expressway and Miller Place to the south, the Long Island Railroad to the northwest and the Cerro Wire and Cable Company plant to the southeast. Single family residences and an elementary school border the site to the north and northeast. Offices and storage

yards for the Town of Oyster Bay Sanitation and Highway Departments occupy the southern portion of the site along Miller Place.

Refuse disposal at the Syosset Landfill reportedly began in 1933 and continued until 1975. Between 1933 and 1957, no restrictions were imposed upon the types of wastes accepted at the landfill. After 1957, the landfill accepted only rubbish, brush, demolition debris and scavenger (sludge) wastes until closing in early 1975.

There are few written records describing operational procedures at the site. The existing information indicates that the landfill was excavated to as much as 90 feet below grade and backfilled with waste. The northern and western portions of the site were reportedly excavated and filled to within approximately 20 feet of the current fence line.

1.2 Hydrogeology

In the vicinity of the Syosset Landfill, the Upper Glacial Formation is found at land surface and is approximately 75 feet thick. In this area, the Upper Glacial Formation is an outwash deposit composed of layers of medium to coarse sand and gravel. The unsorted Ronkonkoma Terminal Moraine deposits are found approximately one quarter of a mile from the site.

Directly beneath the Upper Glacial Formation, the Magothy Formation is found from about 120 feet above sea level to about 450 feet below sea level. The Magothy consists of layers of fine to medium sand, silt and clay. The composition of the Magothy Formation is variable both horizontally and vertically and is characterized by discontinous layers of clay and silt.

The water table is in the Magothy in the vicinity of Syosset Landfill. Water-level data from monitoring wells installed at the Syosset Landfill (ERM, 1984) show that the depth to ground water is approximately 100 feet below land surface and the ground-water flow direction is north-northwest. Due to the absence of deep screened monitoring wells at the landfill, the vertical head gradient in the upper portions of the Magothy is not known at this time.

1.3 Ecology

Since the Syosset Landfill is located in an suburban area, little of the original habitat exist. The site is largely devoid of vegetation except for weeds such as Queen Anne's Lace, goldenrod and grasses around the perimeter of the site. Wildlife at the site is expected to be typically suburban and to consist of mammals such as field mice, raccoon, possum, rabbit, squirrels and other rodents. Song bird species typical of suburban areas are probably also present.

There are no significant wildlife areas in close proximity to the Syosset Landfill. The areas south and west of the site are zoned for commerical activity and the areas north and northeast of the site are residential.

1.4 Statement of the Problem

The history of the Syosset Landfill is documented in the reports identified in the next section. In addition to providing insight into the activities of the Syosset landfill, these reports also indicate potential mi-

gration of contaminants via ground water and subsurface gas movement. The findings in these reports indicate that contaminants migrating via ground water and subsurface gas movement may affect potential receptors such as commercial establishments, residences and public water supply wells.

It is the intention of the Town of Oyster Bay to remediate the Syosset landfill in order to reduce the potential for contaminant migration and make the site available for other uses consistent with post-closure status. This investigation has been designed to supply the data needed for selection and preliminary design of a technically and economically effective remediation and closure program.

It is recognized that the existing data base is inadequate (detailed in the next sections) both in quantity and quality to satisfy the EPA requirements for remediation studies. However, the data are sufficient to eliminate certain contaminant pathways from consideration. The following pathways do not merit investigation, for the stated reasons:

- Surface water transport: The site is not within proximity of any surface-water bodies.
- Air transport (other than subsurface migration): Previous studies have indicated only intermittent traces of non-methane (potentially toxic) gases confined in the subsurface. These trace amounts of gases which emanate directly from the landfill are diluted quickly as they enter the atmosphere above the landfill. However, air monitoring will be conducted during the investigation as part of the Health and Safety Program.

1.5 Summary of Existing Reports

There have been many studies done on the site and in the region which contain data and information pertinent to this investigation; these studies are summarized in Tables 1.1 and 1.2.

1.6 Identification of Data Gaps

The studies identified in Section 1.4 were done for a specific purpose or in response to a reported health hazard rather than for CERCLA compliance. Consequently, there are gaps in the data base, which the RI/FS will fill in preparation for remediation of the site. The specific data gaps which will be addressed in this RI/FS are as follows:

1) The extent of ground-water contamination beneath the site has not been determined.
2) The potential existence of an off-site plume of contaminated ground water has not been addressed.
3) The direction of ground-water flow at and around the site has not been well defined.
4) The chemical composition of the in-place wastes has not been characterized.
5) The areal extent and total depth of the landfill is not known with any certainty.
6) The lithology of the formation (sand or clay) directly beneath the landfill is not known.
7) The distance between the bottom of the landfill and the water table has not been accurately determined.

8) Gas migration from the landfill has only been addressed in a limited area.

9) There has been no recent testing for gases (or vapors) other than methane.

1.7 Criteria for Acceptance of Data

It is recognized that procedures used to collect data and samples during environmental investigations are critical in obtaining meaningful results. The protocols used in earlier studies have not been included in their respective reports, in most cases. While improperly collected data or samples should not be entirely disregarded, they should be appropriately noted. As part of the sampling plan, G&M, Inc. will contact each firm or agency in order to document the data/sample collection protocol used in their study. If the protocol does not meet with 1) the QA/QC plan for this study or 2) the QA/QC given in USEPA technical manuals, then that data will be so noted before incorporation into the G&M, Inc. Data Management System (described in the QA/QC Plan).

1.8 Health and Safety General Site Reconnaissance

An initial site reconnaissance will be conducted by an investigation team in order to fully evaluate the existing site conditions. Several objectives have been identified for the site reconnaissance:

- Perform health and safety reconnaissance
- Locate physical hazards and features
- Perform geologic and hydrologic field reconnaissance

- Evaluate site conditions for location of soil sampling points and monitoring well installation points
- Conduct air sampling using an Organic Vapor Analyzer

1.9 Site-Specific Health and Safety Requirements

Site-specific Health and Safety Requirements will be developed for the Syosset Landfill to provide safety protection requirements and procedures for site field crews and subcontractors.

Based on the field reconnaissance and the available data, a preliminary Health and Safety Plan will be prepared. The levels of protection determined during the field reconnaissance will be modified as necessary to reflect new data acquired in the course of the site investigation. Key elements of the requirements established will be included in the site operations plan.

1.10 Site-Specific Quality Assurance Requirements

Quality Assurance Requirements will be developed for the Syosset Landfill site. These requirements will include details on sampling, field testing, surveying, chain-of-custody, sample handling, packing, preservation and shipping, and recordkeeping and documentation. Appropriate Quality Assurance Requirements will be imposed on all subcontractors. Analytical methods will be given along with other procedures needed for Remedial Investigation/Feasibility Studies at the site.

1.11 Develop Site Operations Plan

A site operations plan will be developed. The plan will include the Quality Asurance and Health and Safety Requirements developed in 1.9 and 1.10 and will include procedures for sampling various media expected to be found both on and off site. The Site Operations Plan will include decontamination procedures for equipment and well construction material, and a description of necessary sampling and drilling equipment.

Sampling locations will be established, where possible, for the initial soil and ground water samples. These locations will be based on site data obtained during the field reconnaissance and from detailed review of existing reference sources.

The Site Operations Plan will be submitted to the EPA for review and approval prior to the commencement of sampling activities.

2. Sampling Plan

2.1 Data Verification, Data Base Establishment and Aerial Photo Study

As discussed in Section 1.4, Geraghty & Miller, Inc. will attempt to contact each firm or agency who has conducted studies on the Syosset Landfill to determine what data/sample collection protocols were employed. The following designations will then be assigned to each result:

U = collection protocol unknown

N = collection protocol not satisfactory

S = collection protocol satisfactory

The assignment of a designation will be based on whether the protocol is consistent with guidance given in USEPA manuals on ground-water investigation and sampling (see References). The designation will be clearly noted on each data sheet, or the report cover.

Water-level and water-quality data from these previous studies will be entered into the computerized data management system. This system will reproduce the data in tabular form; examples of the tables are given in Appendix A. Data generated during the RI/FS will also be entered into this system.

A division of LKB conducts aerial surveys of Long Island. LKB will provide aerial photographs of the Syosset Landfill taken during the years when landfilling operations were underway. These photographs, along with those provided by the USEPA, will be studied with the intention of pinpointing the likely areas and depths in the present landfill which contains industrial wastes. The determination of potential "hotspots" at the Syosset landfill will be used to guide the selection of sampling depths in the Landfill Dimension study.

2.2 On-Site Ground-Water Study

The initial ground-water investigation at the site (ERM, 1983) identified leachate impacts to the ground water under the site. The proposed study has been designed to determine the extent of these impacts on-site, to determine the potential for off-site migration and to develop a plan for delineating off-site, ground-water contamination. The investigation will rely on accurate water-table and vertical piezometric head measurements to determine flow directions. A more detailed and comprehensive geologic and

geochemical data base than currently available will be developed so that factors controlling contaminant migration and attenuation in the aquifer are understood.

2.2.1 Well Installation

In order to establish ground-water conditions in the water-table zone around the site, two new shallow wells will be installed at the locations shown on Figure 2.1. These wells will be drilled to depths similar to the existing monitoring wells (approximately 140 feet). The wells will be installed in an 8-inch diameter borehole drilled by the mud-rotary method using a bentonite and water mixture as the circulation fluid. Bentonite is a mixture of 90% sodium-montmorillonite clay and 10% polymers. The composition of the bentonite, which will be used during the well installation program, is given in Appendix C. The well will be constructed of threaded flush joint 4-inch I.D. PVC casing and screen (10 feet in length). No solvents or glues shall be used to join casings or screens. The annulus around the screen will be gravel packed, and the remaining borehole annulus will be sealed with a bentonite slurry. The top of the well will be fitted with a vandal-resistant locking steel cover, cemented in place to a depth of at least two feet below grade. Figure 2.2 shows the construction detail for the monitoring well. Well SY-2 has been found to be damaged and will be replaced with a monitoring well of similar depth, constructed in the manner just described.

In order to determine the depth of contaminated ground water, four deeper wells will be installed. Each of these wells will be approximately 200 feet in depth; proposed locations are shown on Figure 2.1. The con-

struction details for the deeper wells are similar to the shallow wells just described. All monitoring wells installed during the investigation will be leveled and located by a licensed surveyor. Measuring point elevations (top of the well casing) will be leveled to an accuracy of 0.01 foot in elevation with respect to the U.S. Geological Survey mean sea level datum.

When the shallow and deep borings are drilled to the proposed depths, each borehole will be geophysically logged by gamma and electric methods. The results will be analyzed to determine the presence, depth and thickness of confining clay beds and to accurately select the most appropriate screen settings. Split-spoon formation core samples will be collected from the borings at 5-foot intervals and at changes in the lithology. Samples will be described, with special attention given to identifying fill materials encountered while drilling. The wells will be developed using a submersible pump and/or a surge-block. Several times the amount of standing water will be removed, until a visibly clear discharge is obtained. All split-spoon samples will be screened for volatile organic compounds (VOCs). In addition, soil samples will be collected at 30-foot intervals, stored in VOA bottles and sent to the laboratory for analysis using EPA Method 601/602. At this time, it is anticipated that 15 samples will be submitted for analysis.

2.2.2 Monitoring

Water-level meaurements will be taken from the new and previously installed on-site wells on a monthly basis (see schedule), during the Remedial Investigation. Two rounds of water-quality samples will be taken from

the new and previously installed on-site wells after all the wells are installed; the rounds will be approximately one month apart.

The wells which will be installed as part of this program will be equipped with dedicated, electric submersible pumps (Grundfos, all stainless steel pump, with PVC riser pipe). Samples from the existing (ERM) wells will be taken by the bailer method.

The first round of samples taken from the on-site wells will be analyzed for the list of selected USEPA Priority Pollutants and additional parameters given in Appendix A. The organic analyses for this first round will be done by gas chromatograph/ mass spectrometer (GC/MS) methods. The only exception to the above is the PCB analysis, which will be done by the GC method (EPA 608) which allows a lower detection limit. Thereafter, GC methods will be employed for most organic analyses.

The compounds included in the Acid and Base/ Neutral Extractables and PCBs generally exhibit very little, if any, mobility in the ground-water environment. Their inclusion in the list of analytical parameters was done in the broad interest of a complete investigation, and not in the expectation that these are likely ground-water contaminants. Therefore, any or all of these three classes of compounds will be deleted from the analytical list if the following criteria are met:

1) Analytical results for samples taken during the Landfill Dimension Study show the actual waste to contain only trace or non-detectable concentrations of these compounds.
2) None of these compounds is detected in ground-water samples taken during the first two rounds of sampling.

2.3 Landfill Dimension Study

The previous landfill dimension study (Bowne, 1983) reported the depth of the landfill to range from 36 to 91 feet; the landfill is apparently deeper in the southeast section. The previous study also indicated "... that the wastes in the landfill are already highly decomposed", based on the results of waste samples from their borings.

The RI/FS landfill dimension study has been designed to 1) provide further definition of the depth of the landfill and 2) provide a chemical characterization of the wastes in the landfill. Data for determining the dimensions of the landfill and characterization of wastes will be collected by installing borings directly through the landfill.

2.3.1 Installation of Borings

Four borings will be drilled through the fill at locations shown on Figure 2.3. The wash-boring method, using potable water, will be used. The addition of potable water during drilling will prevent ignition of potentially explosive subsurface gas mixtures by restricting the movement of gas through the drill column and by saturating the formation and preventing sparking in the event that the drilling tools strike metal in the subsurface fill. Each boring will penetrate the total depth of the landfill and will be terminated 10 feet below the water table. Split-spoon samples will be collected at five-foot intervals, and a geologic description entered in the log by a hydrogeologist. Samples of the formation, taken from below the fill, will be subjected to grain size analysis to estimate permeability values.

All split-spoon samples will be screened for VOCs according to the protocol in Appendex B. Additionally, three samples of the landfill subsurface material from each boring will be selected for laboratory analysis in accordance with the following priorities:

1. First priority - Soil samples, which have an obvious chemical odor, or discolored.

2. Second priority - Depths identified by the aerial photo survey as likely locations of industrial waste.

3. Third priority - An evenly spaced top-middle-bottom set of depths will be selected for each boring. The depths will be determined by estimating the thickness of the fill based on the borings in the 1983 Sidney B. Bowne report.

The samples will be analyzed for the selected list of USEPA Priority Pollutants given in Appendix A (organic analyses by GC/MS, except PCBs as explained previously). The portion of the sample used for metals analysis will be extracted by the EP procedure.

2.3.2 Well Construction

As shown on Figure 2.3, two of the borings will be completed as monitoring wells. The wells will be constructed of flush joint, 2-inch I.D. PVC casing with a 10-foot screen (no glues will be used). The screen will be installed so that the upper two or three feet are above the water table. The annulus around the screen will be gravel packed, and the remaining borehole annulus will be sealed with a bentonite slurry. The top of each

well will be fitted with a vandal-resistant, locking, steel cover, cemented in place to a depth of at least two feet below grade. The well construction is depicted on Figure 2.4. The wells will be developed by bailing several times the amount of water in the casing, until relatively clear water is obtained.

2.3.3 Monitoring

Water-quality samples will be taken from the two wells installed as part of the Landfill Dimension Study. The water-quality samples will be collected on the same schedule and for the same parameters as the wells installed in the On-Site Ground-Water Study.

2.4 Off-Site Ground-Water Study

An off-site ground-water investigation will be undertaken if the results of the on-site investigation indicate the likelihood of an off-site leachate plume.

To date, there has been no investigation of off-site ground-water contamination from the Syosset Landfill, although Well N4133 was closed in 1973 due to aesthetic problems possibly related to landfill leachate (ERM, 1983). While the closing of Well N4133 is regarded to be the result of off-site leachate migration, the existence of a plume is not confirmed and pumpage of Well N4133 may have been the most significant factor affecting contamination. Upon completion of the on-site ground-water study, the extent of on-site contamination and the local hydrogeology will be defined. This will be related to regional hydrogeology and the geologic conditions which control leachate migation and/or attenuation.

2.4.1 Work Plan

If an off-site ground-water investigation is deemed necessary, a detailed work plan will be prepared and submitted to USEPA and NYSDEC for review and approval. Ground-water flow directions (horizontal and vertical), water-quality data, local geology and geochemistry will form the basis for selecting new off-site monitoring well sites, existing wells for sampling, and for generally determining the area(s) of off-site investigation. The work plan would be submitted prior to the Final RI Report (see schedule). Wells installed as part of an off-site investigation will be sampled twice (one month apart), along with the on-site wells. The selection of the monitoring well casing and screen materials will depend upon the results of the ground-water samples from the on-site monitoring wells. If these results show that stainless steel is necessary to further define or quantify concentrations of a potential off-site plume, the wells will be constructed using stainless steel casing and screen. However, if the ground-water results indicate that stainless steel is not required to define a potential off-site plume, the wells will be constructed using PVC casing and screen. Water levels will also be measured in the off-site and on-site wells.

2.5 Subsurface Gas Study

This study has been designed to determine the nature and extent of subsurface landfill gases, both on-site and off-site. The results of this study will be used to evaluate venting systems for capping option and closure of the site.

This study will employ a network of shallow gas monitoring wells. The gas monitoring wells will be sampled and analyzed for VOCs. Sampling shallow soil gases followed by analysis for hydrocarbons is a technique which has been used for several decades in geochemical prospecting for petroleum. Application of this technique to landfill investigations and monitoring of subsurface contamination has been discussed by USEPA (1983), USEPA (1985), Lappala and Thompson (1983), and Lobasso and Barber (1983).

2.5.1 Construction of Gas Monitoring Wells

The gas monitoring wells will be constructed of hand-slotted 1-inch I.D. PVC casing, installed in 2-inch boreholes drilled with a hand-operated auger. The borehole will be backfilled with pea gravel to within one foot of land surface, and then sealed with a bentonite slurry. The gas monitoring wells will be installed at depths of 4 to 5 feet below land surface. This depth will place the lower portion in the refuse (Bowne, 1983 reported 6 inches to 4 feet of clean fill over the refuse). The construction details of a typical gas monitoring well are shown on Figure 2.5. The top of the well will be capped and fitted with short lengths of polyethylene and silicone tubing to allow attachment of sampling and gas monitoring equipment.

2.5.2 On-Site Study

A total of 19 gas monitoring wells will be installed at the locations shown on Figure 2.6. Once installed, these wells will be regularly monitored using a Century Systems Model 118 Organic Vapor Analyzer (OVA). It

is anticipated that weekly readings will be collected from the wells using the OVA. Preferential periods of measurement will be during episodes of low barometric pressure. A description of the OVA and its application to contamination investigations has been discussed by USEPA (1983), USEPA (1985), Barber and Braids (1982), and Lobasso and Barber (1983). Measurement will be taken with the standard OVA probe and with an activated charcoal filter probe (which adsorbs essentially all other organic vapors and gases except methane); the OVA probe will be inserted directly into the silicone tubing, which provides an air-tight fit. Readings will be recorded as "Total" and "Methane," as parts per million in air by volume (ppmv). The OVA will be calibrated to methane according to the manufacturer's instructions prior to each round of sampling.

Lobasso and Barber (1983) have indicated that the highest readings occur after five minutes of pumping. The OVA will be used to pump (about 2 L/min) selected wells for one hour each and measure hydrocarbons. Concentration vs. time profiles will then be constructed.

If the concentration of gas exceeds the range of the OVA (1,000 ppm), a peristaltic pump and MSA Explosimeter will be used. This information will be used to determine the period of pumping necessary to reach the highest concentation of gases.

After optimum times are established and two full rounds of OVA measurements are completed (at least one week apart), samples for laboratory analysis will be collected from the 10 gas monitoring wells which have the

highest readings of non-methane compounds (i.e., "Total" concentration minus "Methane" concentration). These samples will be analyzed for volatile organic compounds (VOCs) listed in Appendix A.

The typical protocol for this type of sampling would employ a charcoal tube and desorption with carbon disulfide (NIOSH Method). In conversations with a proposed subcontract laboratory, we have found that this method is not entirely suitable for the purposes of this investigation because of the following factors:

1. Vinyl chloride breakthrough
2. High detection limits, depending on concentrations
3. Not applicable to all VOCs listed.

Consequently, we propose to use an innovative technique, which will overcome these problems. The technique is based on using a laboratory trap instead of the charcoal tube for sample collection; this is the standard trap used in the Purge and Trap technique (Tekmar, Supelco, or equivalent). After sampling, the trap is then simply connected to the gas chromatograph and thermally desorbed. The setup of this sampling apparatus is shown on Figure 2.7. Weekly OVA readings will be taken from these wells during the on-site and off-site investigations.

Each well will be tested to determine if gases are venting under pressure. This will be done by attaching a one liter air sampling bag to the well and recording the time it takes to fill. Bags will be left on for a maximum of one hour.

2.5.3 Off-Site Subsurface Gas Study

In the event that significant concentrations of gases are found at the boundaries of the landfill, the investigation will be extended off-site. Significant concentrations are defined as follows:

1. Potentially explosive amounts of methane (25% of the Lower Explosive Limit or greater)
2. Exceeding occupational exposure limits published by OSHA or ACGIH.

The investigation will be extended until the extent of migration of subsurface gases is defined; this investigation will be conducted concurrently with the off-site ground-water investigation. The previously described monitoring and construction techniques will be used in the off-site study.

3. Feasibility Study

The feasibility study will be conducted concurrently with the remedial investigation and will follow the format given in the USEPA Guidance Document (June 1985):

- Development of a range of alternatives
- Technical and economic evaluation of alternatives
- Identification of the best alternative, or combination of alternatives

At this time it is anticipated that the range of remedial alternatives (in addition to capping) to be considered during a remedial feasibility

study of the Syosset Landfill will include source control, subsurface gas control and water-supply protection. Under each control categtory a number of remedial actions are evaluated. Categories and potential actions are outlined as follows:

	Potential Actions
1. Source Control	- Total Waste Removal
	- Partial Waste Removal ("Hot Spots")
	- Capping with runoff control
2. Subsurface Gas Control	- Venting of methane and other landfill gases including treatment if required
3. Ground-Water Control	- Low permeability barriers (slurry walls, etc.)
	- Hydraulic barriers (pumping wells)
	- Combinations of the above
4. Water-Supply Protection	- Long-term, ground-water monitoring
	- Water-supply monitoring
	- Water-supply replacement (relocation of affected wells)
	- Water-supply treatment to potable quality

Remedial actions which may be implemented are methane control and capping of the landfill as provided under RCRA and NYSDEC Part 360 regulations for Solid Waste Management Facilities. These are established techniques for closure of a variety of waste management units and the Town of Oyster Bay has indicated a desire to expedite the capping of this site in anticipation of the proposed Landia Station.

4. Deliverables and Schedule

4.1 Deliverables

Throughout the performance of the RI/FS tasks, data will be regularly provided to representatives of USEPA and NYSDEC as it becomes available. Four official documents are planned for the tasks described in this work-plan:

1. Off-site Investigation Work Plan - In the event that off-site work is necessary, a detailed work plan will be submitted for approval. This work plan will be issued in advance of the Interim Remedial Investigation Report. A meeting with USEPA and NYSDEC will be held before preparation of the work plan so that their comments can be incorporated and the approval process accelerated.

2. Interim Remedial Investigation Report - This report will be prepared after the completion of the on-site tasks. It will be an interpretive report based on the data collected during the on-site tasks and will address the data gaps identified in Section 1.6 of this work plan. In addition, the results of the on site investigation will be analyzed to determine if there is a possibility of risk to the public health and the environment due to activity at the Syosset Landfill. The Interim R.I. Report will be submitted to the EPA and the NYSDEC for review and comment within the dictates of the overall program schedule.

3. Final Remedial Investigation Report - In the event that it is clear that off-site work is not necessary, the Interim Report will be designated as the Final Report. In the event that off-site work is necessary, this report will be an interpretive report summarizing the entire investigation and will include the data collected during the off-site investigation. The Final R.I. Report will be submitted to the EPA and NYSDEC for comment.

4. Feasibility Study Work Plan - This work plan will be prepared in coordination with the remedial investigation tasks. The work plan will be submitted fifteen days after the issuance of the Final Report on the RI. The work plan will be submitted after meeting with the USEPA and NYSDEC to allow for incorporation of their recommendations.

4.2 Schedule

The schedule for tasks described in this work plan is given on Figure 4.1 and Table 4.1. The starting date for the schedule is the date of official approval of the RI/FS work plan by USEPA and NYSDEC. The time allowances shown are reasonable estimates based on Geraghty & Miller, Inc. experience, with minor additional allowances for frequent problems such as inclement weather, mechanical failure, etc. In the event of a major problem such as a strike, alterations to the schedule may be necessary. The schedule does not provide for EPA review and approval of various tasks during the course of the program. The time necessary for EPA review and approval will be added to the program schedule.

A close working relationship between the technical representatives of the Town, USEPA and NYSDEC is anticipated. Such a relationship 1) allows for timely resolution of problems, 2) assures that all parties are kept up to date and 3) expedites the approval process for work plans.

Respectfully Submitted,

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TABLE 4.1 TIME SCHEDULE FOR REMEDIAL INVESTIGATION

SYOSSET LANDFILL

TASKS	TIME (Week No. Following Official Approval to Proceed)	TOTAL TIME (Weeks)
1. Development of Site Operations Plan		
• Sampling Plan	1,2,3,4	4
• QA/QC Plan	1,2,3,4	4
• Health & Safety Plan	1,2,3,4	4
2. Evaluation of Existing Database and Aerial Photographs	7,8,9,10	4
3. Subcontractor Procurement		
• Bid Preparation	7,8,9,10	4
• Response, Selection	13,14,15,16	4
4. Phase I Field Activities		
• On-Site Groundwater Monitoring Well Installation	18,19,20,21,22, 23,24,25,26,27	10
• Landfill Borings	20,21,22,23,24	5
• Sampling	29,33,57,61	4
• Water Level Measurements	29,33,37,41,45, 49,53,57,61,65	10
• On-Site Gas Monitoring Well Installation	10	1
• Sampling	11,12,13,14,15, 41,45,49,53,57,61	35
5. Evaluation of Phase I Data	18,19,20,.....69	51
6. Phase II Field Activities		
• Development of Phase II Work Plan	35,36	2
• Implementation of Phase II Activities (Includes development of a SOP; bid preparation, response & selection; off-site groundwater & gas well installation; sampling; and evaluation of Phase II data)	*39,40,41,.....69	30

*Tentative, based upon EPA's approval of Phase II Work Plan and notice to proceed.

Table 1.2 Site Studies for the Syosset Landfill.

Report	Author/Organization	Date	Content
Site Specific Studies			
"Landfill Gas Migration Study"	Malcolm Pirnie, Inc. for for the Syosset Central School District	June, 1982	Report presents the findings of the study of the Syosset landfill and the Syosset Central School property. Methane has been found, but not other gases. Reports by NCDH and others are appended to this report.
"Investigation of Landfill Impact on Ground-	ERM-Northeast for the Nassau County Dept. of Health	Jan, 1983	Report on study of ground-water conditions at the Syosset landfill. The investigation included the installation of 7 on-site monitoring wells. The report concluded that groundwater quality was being impacted by landfill leachate. Elevated heavy metal concentrations are present in the leachate.
"Preliminary Remedial Action Master Plan (RAMP) for the Syosset Landfill"	C.C. Johnson, Inc./ CDM for the USEPA	May, 1983	RAMP report summarizes the previous work done at the Syosset landfill and forms the basis for the RI/FS.
"Capping and Closure of the Syosset Landfill"	Sidney B. Bowne and Son	Dec., 1983	Conceptual design of cap and gas control measures. Includes data on 5 borings installed through the landfill.

Table 1.2 (Continued).

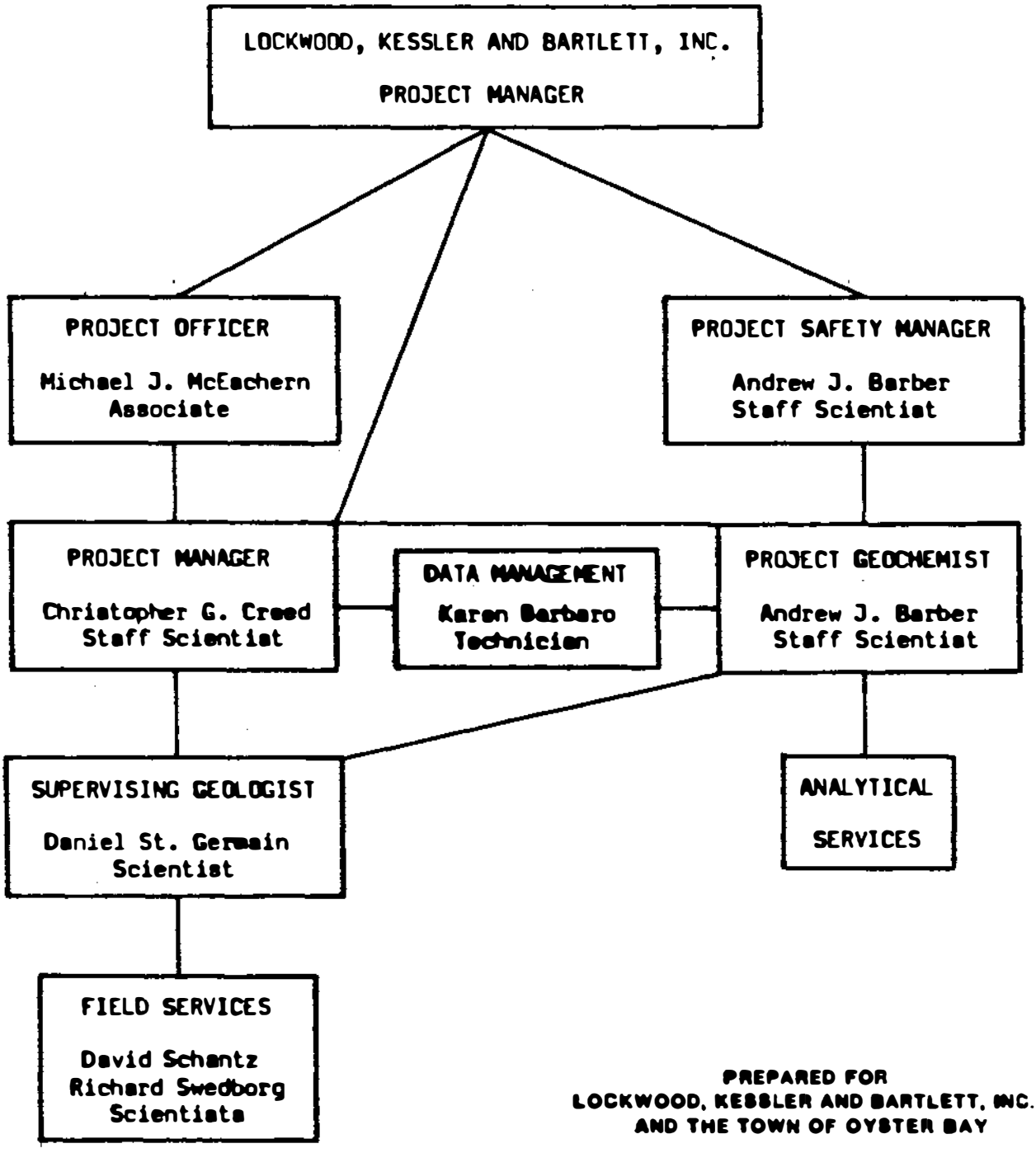
Report	Author/Organization	Date	Content
Site Specific Studies			
Landfill Migration Study - Updating Supplement	Malcolm Pirnie, Inc. for the Syosset Central School District	Dec., 1983	Review of data and issues on the Syosset landfill since 1982 report. The report includes testing for non-methane compounds and evaluation of gas intercept trench.
"Draft Environmental Impact Statement (DIES) for the Proposed Construction of a 1500 Car Computer Parking Facility at Landia (Syosset).	Nassau County Planning Dept.	April, 1984	The DIES summarizes previous work done at the site and assesses potential environmental impacts of the proposed Landia station.
Water-Quality Data (unpublished)	Nassau County	Continuous	NCDH has collected samples from nearby supply wells and the on-site ERM wells.

TASKS	TIME (Week No. Following Official Approval to Proceed)	TOTAL TIME (Weeks)
7. Development of the RI Report	37,38,39,40	4
8. Feasibility Study		
• Development of FS Work Plan	69,70	2
9. Deliverables		
• Phase II Work Plan	37	-
• Phase I RI Report	41	-
• Final RI Report	69	-
• FS Work Plan	71	-

Table 1.1 Regional Studies Pertinent to the Syosset Landfill.

Report	Author/Organization	Date	Content
Regional Studies			
"Geology and Hydrology of Northeastern Nassau County, Long Island, New York"	Isbister/USGS	1966	Isbister, 1966 describes the regional hydrology and geology, and includes data on ground-water pumpage, movement, recharge, discharge, and quality.
"Groundwater Studies for Section 208 Plan, Nassau and Suffolk Counties, Long Island, New York	Nassau-Suffolk Regional Planning Board	Oct, 1977	The Nassau/Suffolk 208 Plan describes a program of well installation, sampling and aquifer testing on Long Island. The report includes data on a well cluster installed at the Syosset landfill.
"Areawide Waste Treatment Management Plan, Ground-Water Conditions" (208 plan - interim)	Nassau-Suffolk Regional Planning Board	Dec, 1977	Part of the 208 study, this section report discusses availability of ground-water, sources of contamination, and ground-water quality for Long Island.
"Long Island Comprehensive Waste Treatment Management Plan" (208 plan - final)	Long Island Regional Planning Board	July, 1978	The final version of the 208 Plan compiles the findings of the earlier studies . Pertinent information is presented on ground-water quality and quantity for Long Island.

GERAGHTY & MILLER, INC.
Ground-Water Consultants



PREPARED FOR
LOCKWOOD, KESSLER AND BARTLETT, INC.
AND THE TOWN OF OYSTER BAY

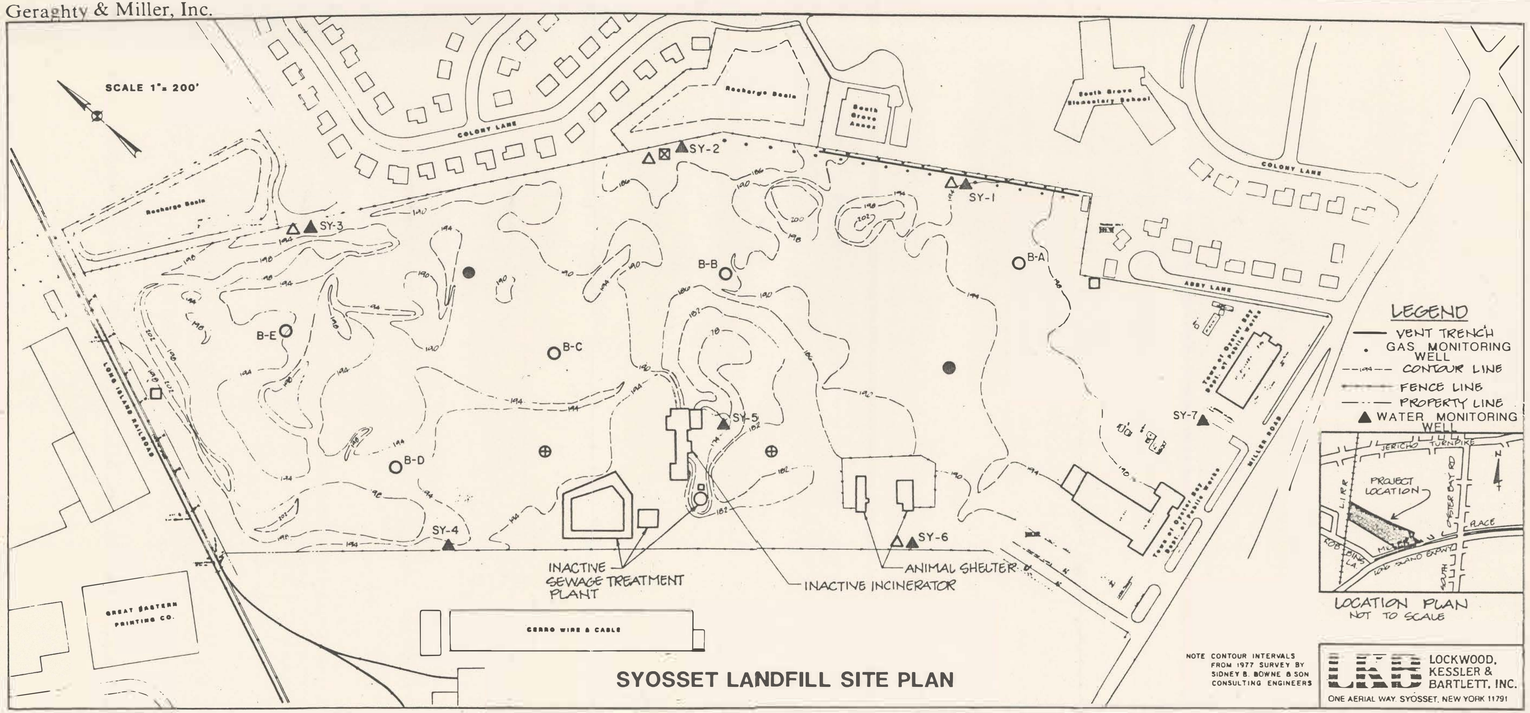
SYOSSET LANDFILL
SYOSSET, NEW YORK

PROJECT TEAM

FIGURE 1.1

830-

Geraghty & Miller, Inc.



SYOSSET LANDFILL SITE PLAN

EXPLANATION

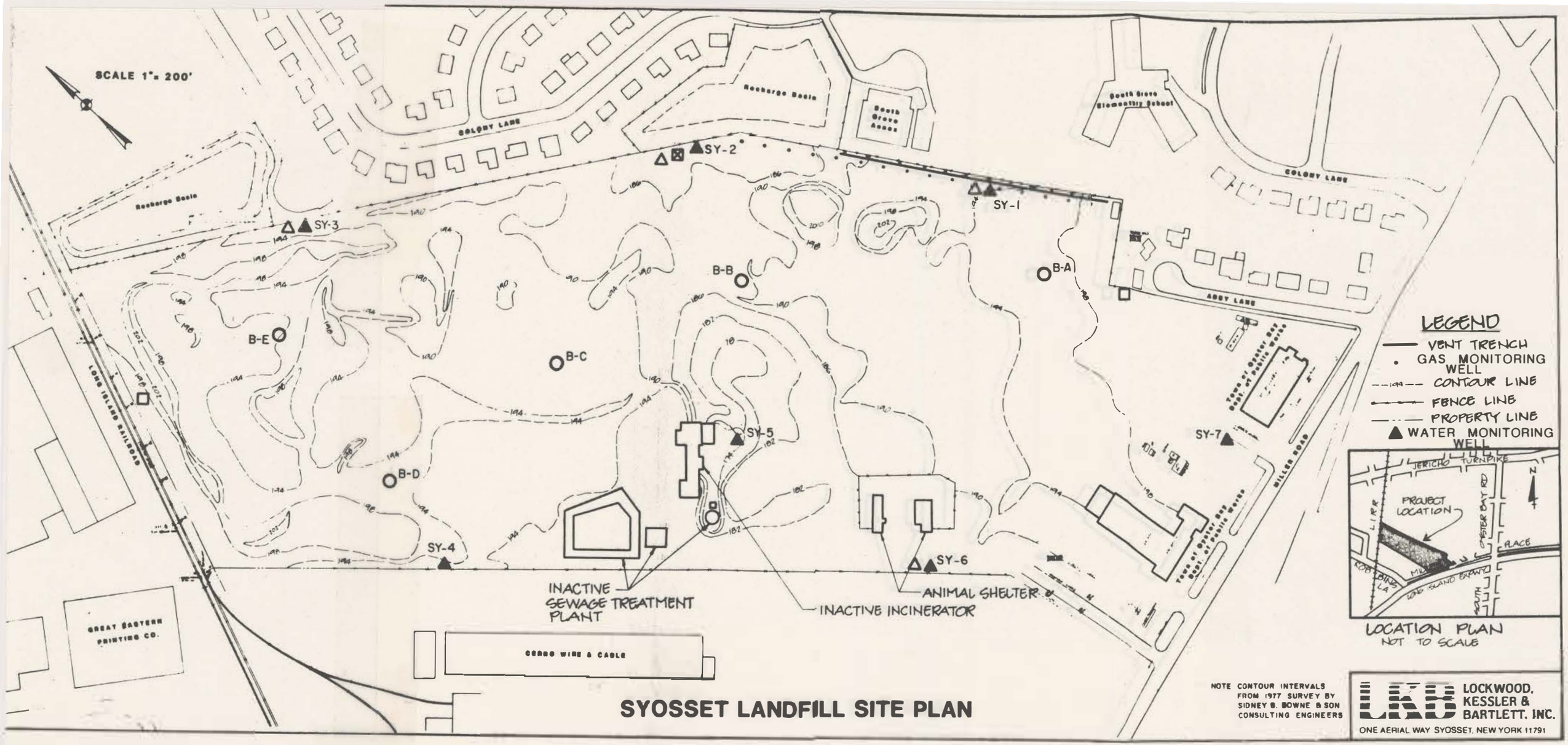
- ▲ MONITORING WELL INSTALLED UNDER THE SUPERVISION OF ERM-NORTHEAST
- ⊠ REPLACEMENT WELL FOR WELL SY-2
- □ PROPOSED SITE FOR SHALLOW WELL
- △ PROPOSED SITE FOR WELLS DRILLED TO THE 200 FT. DEPTH
- ⊕ PROPOSED SOIL BORING LOCATION
- ● PROPOSED SOIL BORING LOCATION WHERE MONITORING WELL WILL BE INSTALLED
- ○ SOIL BORING DRILLED UNDER THE SUPERVISION OF LOCKWOOD KESSLER AND BARTLETT, INC.

PROPOSED WELL AND SOIL BORING LOCATIONS

FIGURE 1.2

000979

SCALE 1"= 200'



LEGEND

- VENT TRENCH
- GAS MONITORING WELL
- CONTOUR LINE
- FENCE LINE
- PROPERTY LINE
- WATER MONITORING WELL

LOCATION PLAN
NOT TO SCALE

NOTE CONTOUR INTERVALS FROM 1977 SURVEY BY SIDNEY B. BOWNE & SON CONSULTING ENGINEERS

LKB LOCKWOOD, KESSLER & BARTLETT, INC.
ONE AERIAL WAY SYOSSET, NEW YORK 11791

SYOSSET LANDFILL SITE PLAN

EXPLANATION

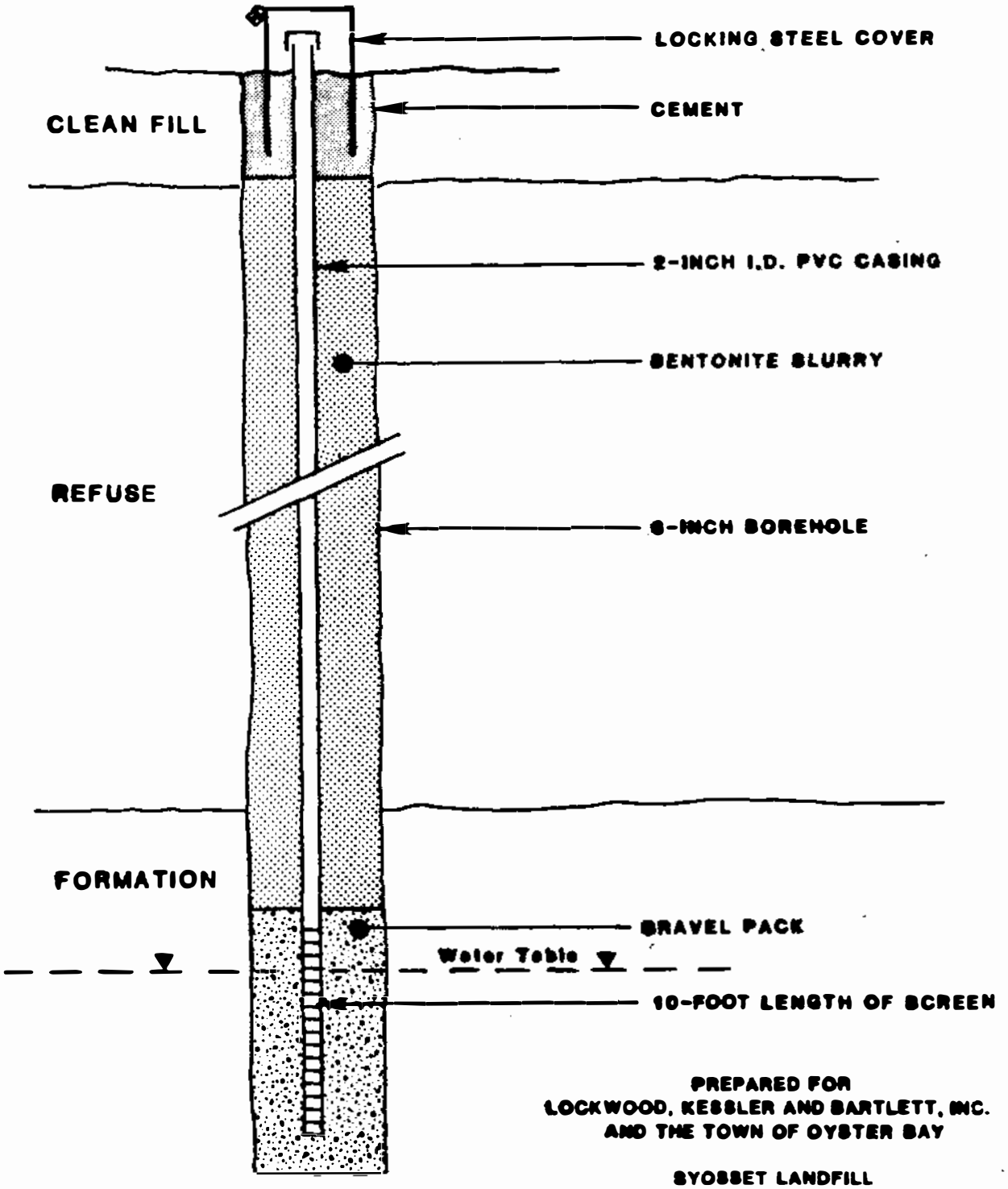
- ▲ MONITORING WELL INSTALLED UNDER THE SUPERVISION OF ERM-NORTHEAST
- ⊠ REPLACEMENT WELL FOR WELL SY-2
- □ PROPOSED SITE FOR SHALLOW WELL
- △ PROPOSED SITE FOR WELLS DRILLED TO THE 200 FT. DEPTH
- ○ SOIL BORING DRILLED UNDER THE SUPERVISION OF LOCKWOOD KESSLER AND BARTLETT, INC.

PROPOSED MONITORING WELL LOCATIONS

FIGURE 2.1

000480

GERAGHTY & MILLER, INC.
Ground-Water Consultants



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AND THE TOWN OF OYSTER BAY

SYOSSET LANDFILL
SYOSSET, NEW YORK

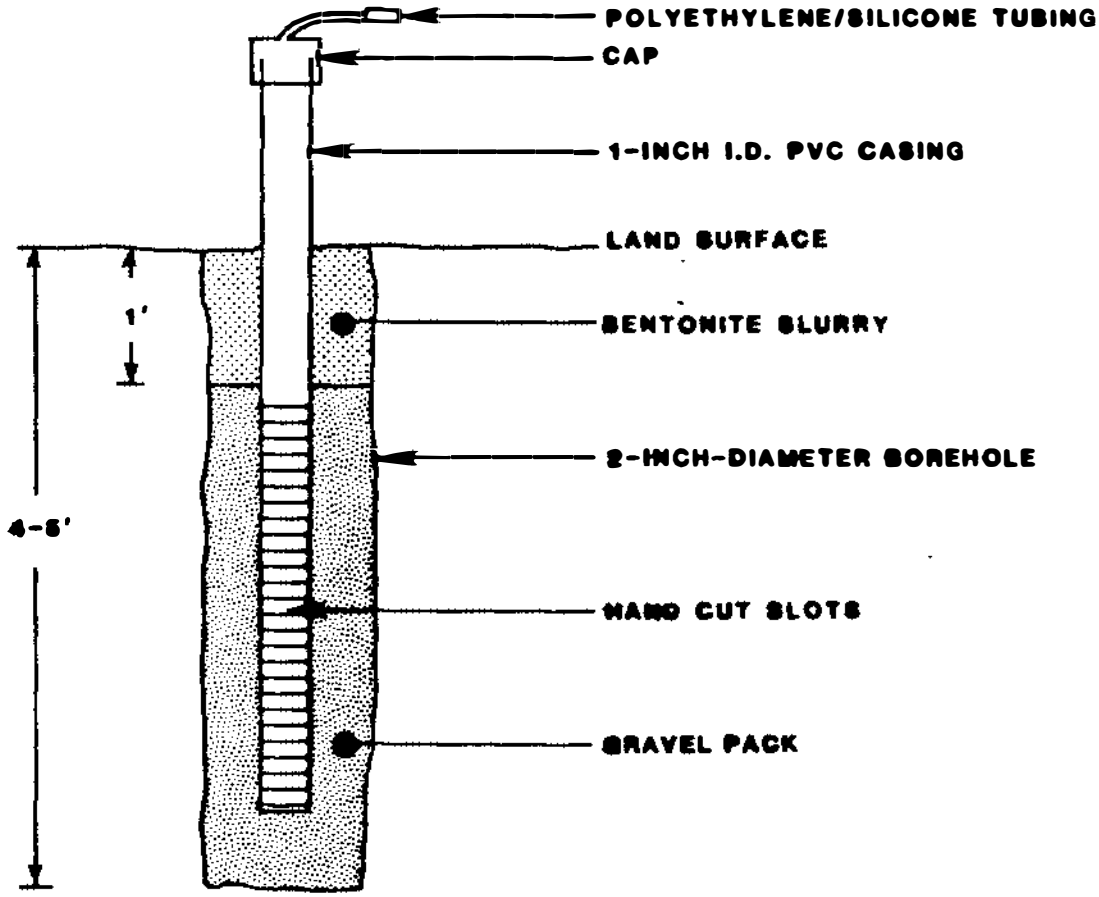
CONSTRUCTION OF WELLS PLACED IN LANDFILL BORINGS

FIGURE 2.4

830-

000481

GERAGHTY & MILLER, INC.
Ground-Water Consultants



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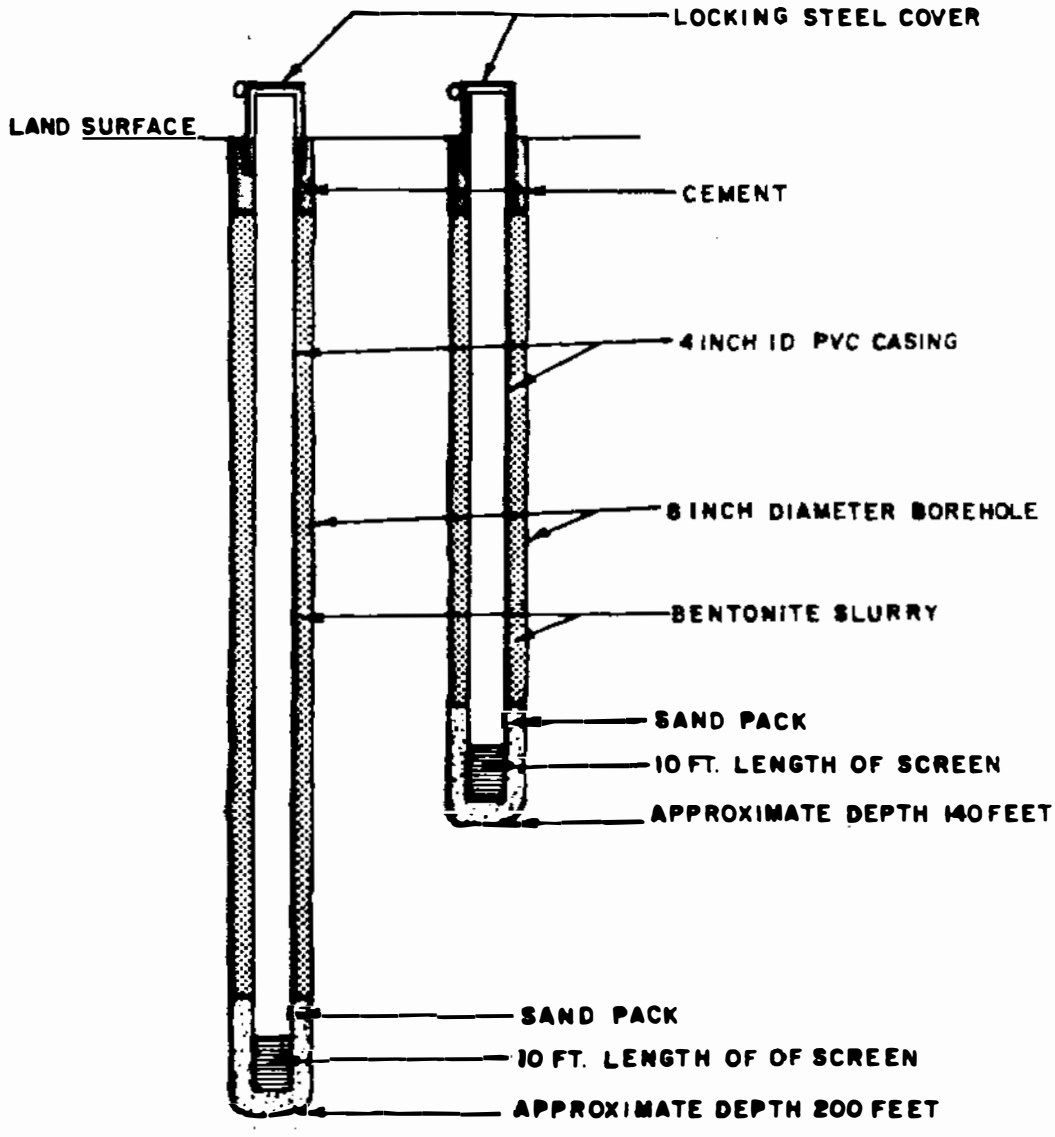
AND THE TOWN OF OYSTER BAY

BYOSSET LANDFILL
SYOSSET, NEW YORK

TYPICAL GAS
MONITORING WELL

000482

FIGURE 2.5



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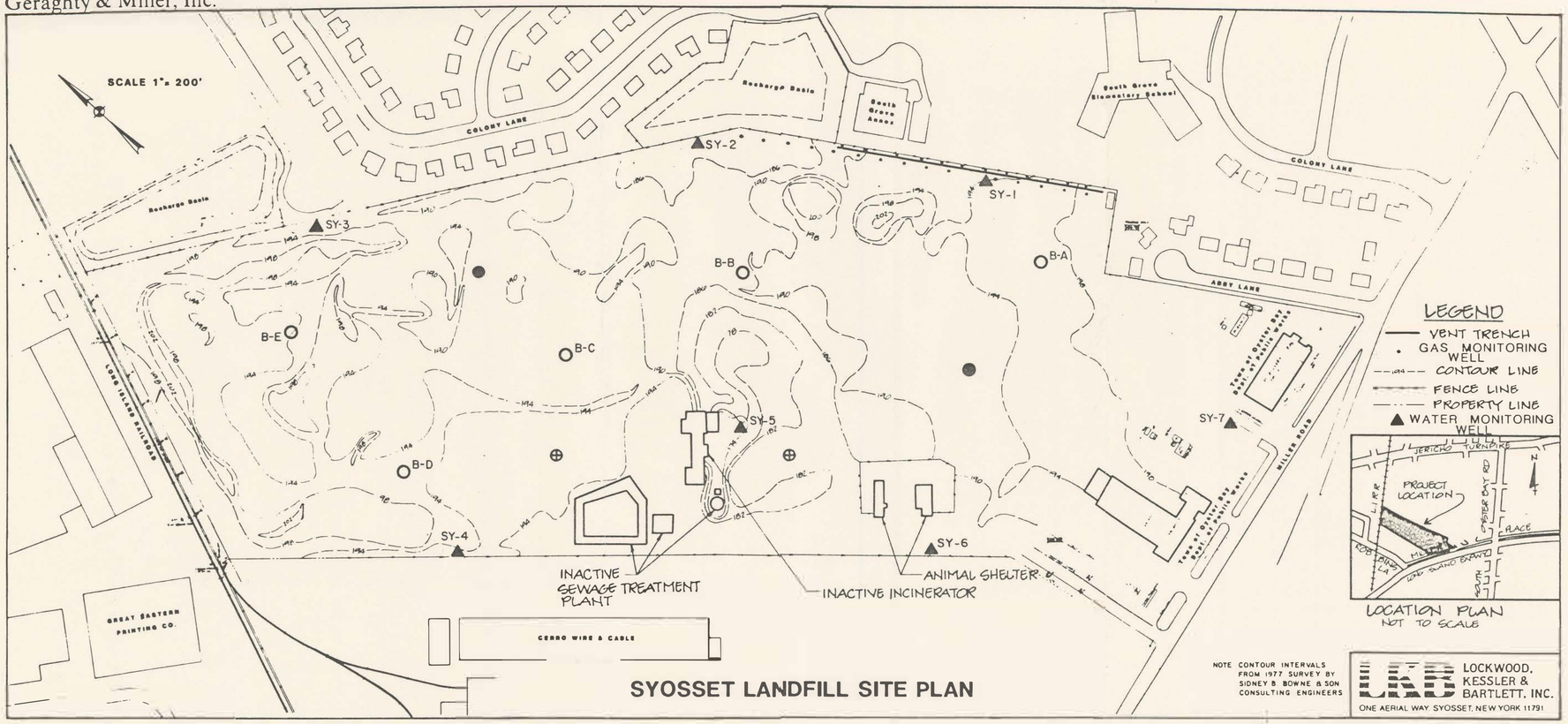
AND THE TOWN OF OYSTER BAY

SYOSSET LANDFILL
SYOSSET, NEW YORK

CONSTRUCTION DETAILS OF THE MONITORING WELLS

C10433

FIGURE 2.2



LOCATION PLAN
NOT TO SCALE

SYOSSET LANDFILL SITE PLAN

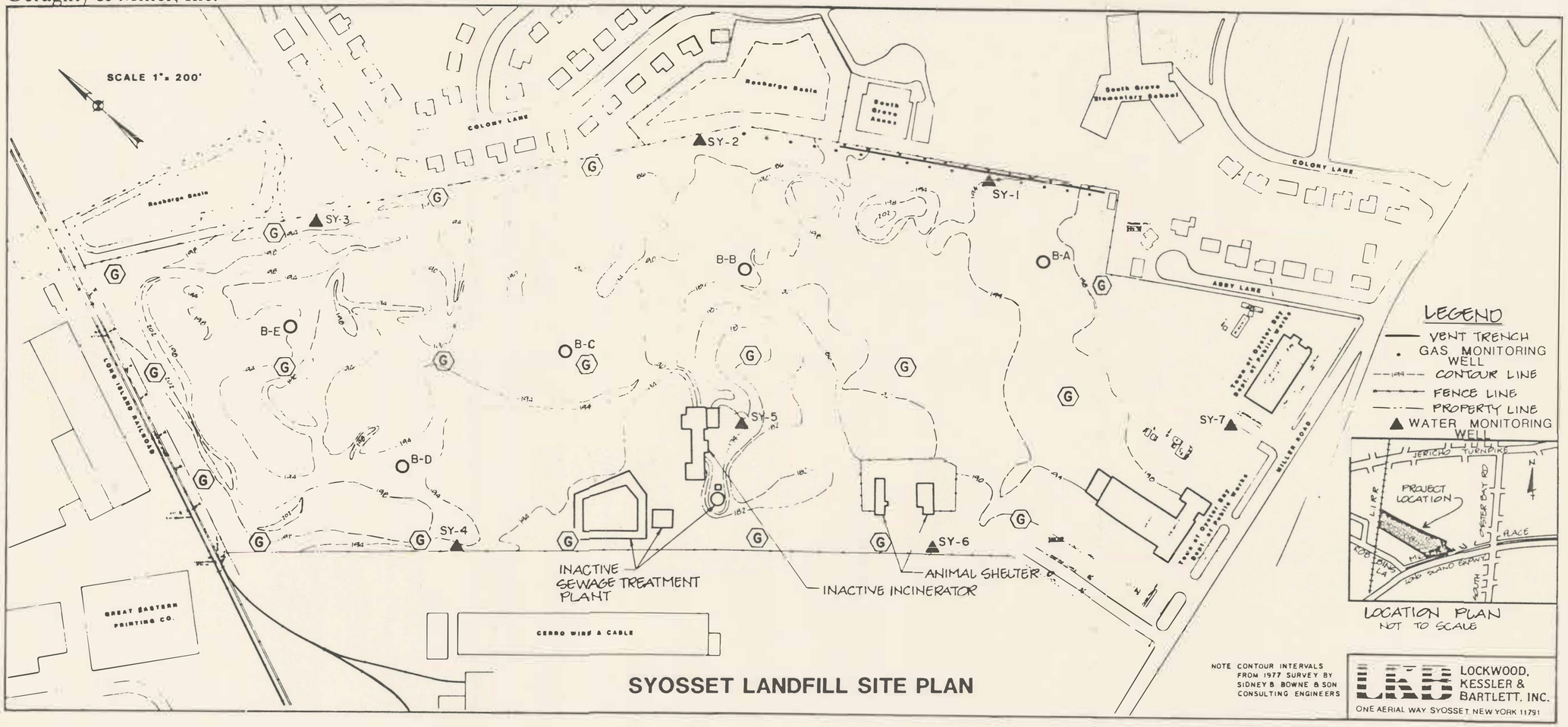
EXPLANATION

- ▲ MONITORING WELL INSTALLED UNDER THE SUPERVISION OF ERM-NORTHEAST
- ○ SOIL BORING DRILLED UNDER THE SUPERVISION OF LOCKWOOD KESSLER AND BARTLETT, INC.
- ● PROPOSED SOIL BORING LOCATION WHERE MONITORING WELL WILL BE INSTALLED
- ⊕ PROPOSED SOIL BORING LOCATION

PROPOSED LANDFILL BORING LOCATIONS

000484

FIGURE 2.3



SYOSSET LANDFILL SITE PLAN

EXPLANATION

▲ MONITORING WELL INSTALLED UNDER THE SUPERVISION OF ERM-NORTHEAST

SOIL BORING DRILLED UNDER THE SUPERVISION OF LOCKWOOD KESSLER AND BARTLETT, INC.

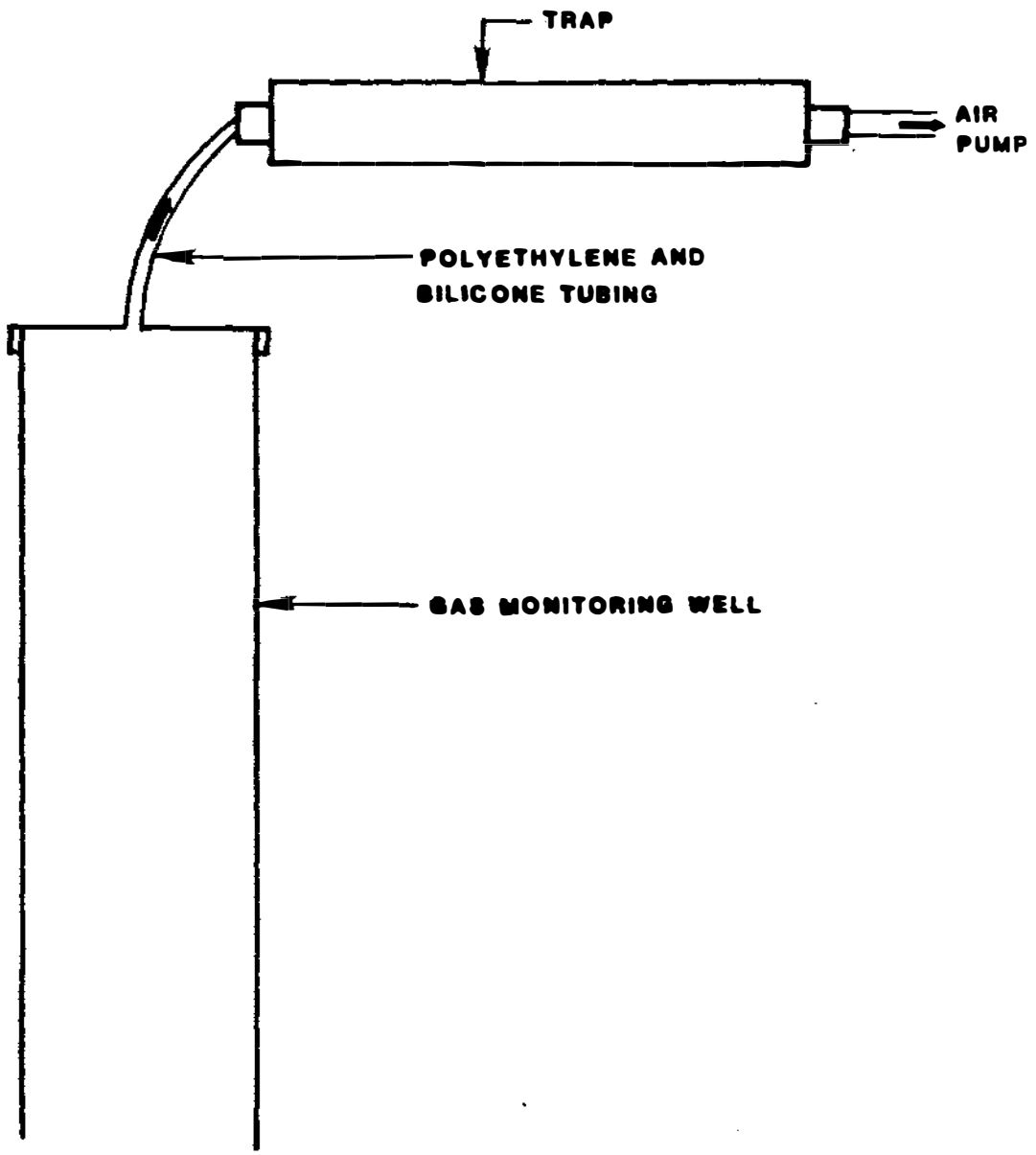
(G) PROPOSED GAS MONITORING WELL LOCATION

PROPOSED GAS MONITORING WELL LOCATIONS

000435

FIGURE 2.6

GERAGHTY & MILLER, INC.
Ground-Water Consultants



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AND THE TOWN OF OYSTER BAY

SYOSSET LANDFILL
SYOSSET, NEW YORK

GAS MONITORING WELL
SAMPLING APPARATUS

C00436

FIGURE 2.7

830-

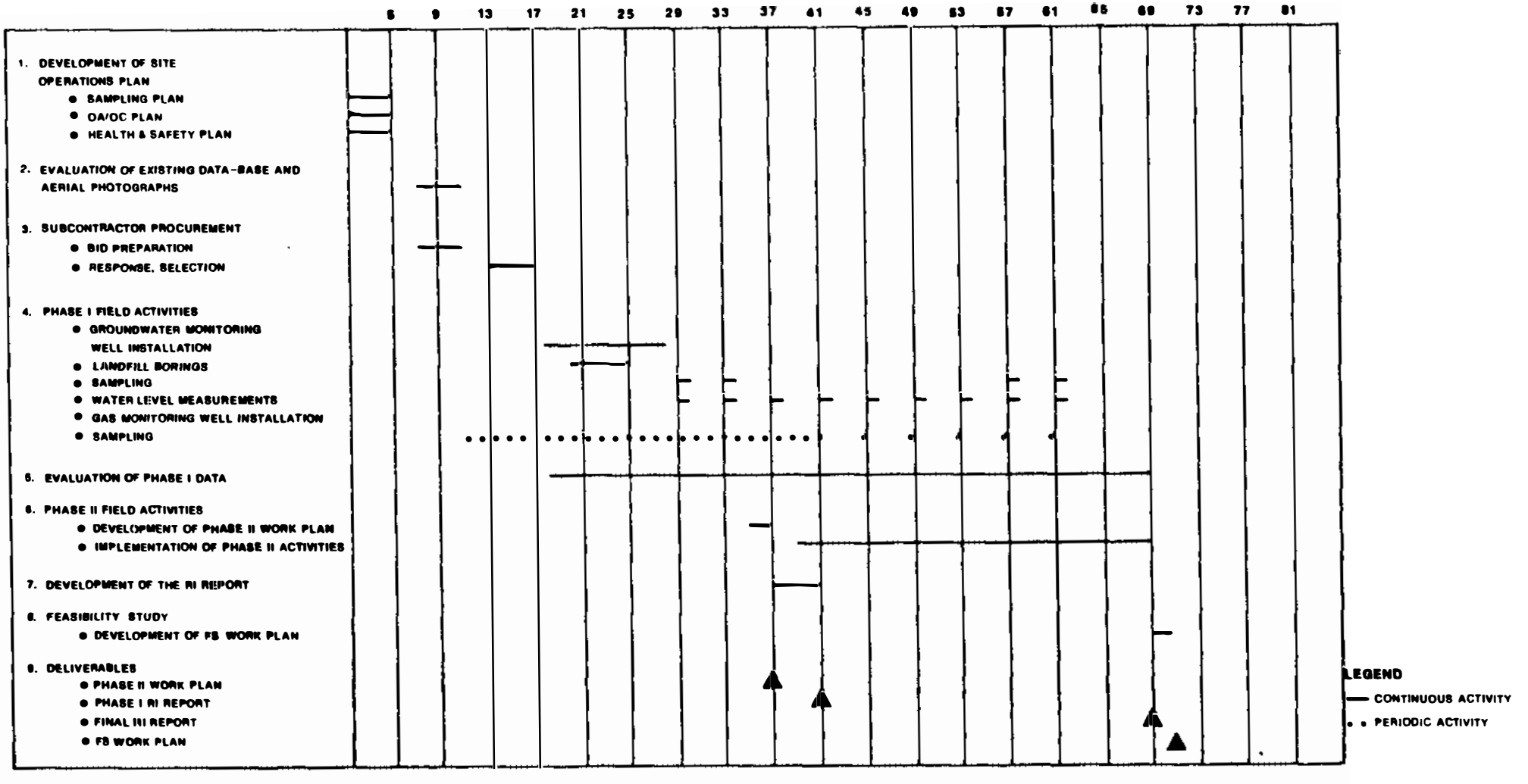

FIGURE 4.1

SYOSSET LANDFILL
REMEDIAL INVESTIGATION SCHEDULE

APPENDIX A

Analytical Parameters

APPENDIX A

SELECTED ENVIRONMENTAL PROTECTION AGENCY PRIORITY POLLUTANTS

Base-Neutral Extractable Organics

Acenaphthene
Acenaphthylene
Anthracene
Benzidine
Benzo(a)anthracene
Benzo(a)pyrene
3,4-Benzofluoranthene
Benzo(ghi)perylene
Benzo(k)fluoranthene
bis(2-Chloroethoxy) methane
bis(2-Chloroethyl) ether
bis(2-Chlorisopropyl) ether
bis(2-Ethylhexyl) phthalate
4-Bromophenyl phenyl ether
Butyl benzyl phthalate
2-Chloronaphthalene
4-Chlorophenyl phenyl ether
Chrysene
Dibenzo(a,h)anthracene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
3,3'-Dichlorobenzidine
Diethyl phthalate
Dimethyl phthalate
Di-n-butyl phthalate
2,4-dinitrotoluene
2,6-dinitrotoluene
Di-n-octyl phthalate
1,2-diphenylhydrazine
Fluoranthene
Fluorene
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane
Indeno(1,2,3-c,d)pyrene
Isophorone
Naphthalene
Nitrobenzene
N-Nitrosodimethylamine
N-Nitrosodi-n-propylamine
N-Nitrosodiphenylamine
Phenanthrene
Pyrene
1,2,4-Trichlorobenzene

Volatile Organics

Benzene
Bromoform
Carbon tetrachloride
Chlorobenzene
Chlorodibromomethane
Chloroethane
2-Chloroethyl vinyl ether
Dichlorobromomethane
Dichlorodifluoromethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethylene
1,2-Dichloropropane
1,3-Dichloropropylene
Ethylbenzene
Methyl bromide
Methyl chloride
Methylene chloride
1,1,2,2-Tetrachloroethane
Tetrachloroethylene
Toluene
1,2-trans-Dichloroethylene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethylene
Trichlorofluoromethane
Vinyl chloride

Acid Extractable Organics

2-chlorophenol
2,4-Dichlorophenol
2,4-Dimethylphenol
4,6-Dinitro-o-cresol
2,4-Dinitrophenol
2-Nitrophenol
4-Nitrophenol
p-Chloro-m-cresol
Pentachlorophenol
Phenol
2,4,6-Trichlorophenol

Metals

Antimony
Arsenic
Beryllium
Cadmium
Chromium
Copper
Lead
Mercury
Nickel
Selenium
Silver
Thallium
Zinc

PCBs

PCB-1242
PCB-1254
PCB-1221
PCB-1232
PCB-1248
PCB-1260
PCB-1016

Additional Parameters

Total cyanides
Total Dissolved Solids
Specific Conductance
pH
Chloride
Nitrate
Ammonia
Hardness
Bicarbonate
Carbonate
Sulfate
Sodium
Potassium
Barium
Iron

Analysis	Method Number
Volatile Organics	EPA 601 and 602 or EPA 624
Base/Neutral Extractables	EPA 625
Acid Extractables	EPA 604 or EPA 625
PCBs	EPA 608
Metals	
Antimony	EPA 204
Arsenic	EPA 206
Beryllium	EPA 210
Cadmium	EPA 213
Chromium	EPA 218
Copper	EPA 220
Lead	EPA 239
Mercury	EPA 245
Nickel	EPA 249
Selenium	EPA 270
Silver	EPA 272
Thallium	EPA 279
Zinc	EPA 289
Additional Parameters	
Total Cyanide	SM 412D, EPA 335.2
Total Phenols	SM 510B
Total Dissolved Solids	SM 209D
Specific Conductance	SM 205
pH	SM 423
Chloride	SM 407A
Nitrate	SM 418F, EPA 353.2
Ammonia	SM 417B, EPA 350.2
Hardness	SM 314B, EPA 130.2
Bicarbonate	SM 403, EPA 310.1
Carbonate	SM 403, EPA 310.1
Sulfate	SM 426C, EPA 375.4
Sodium	SM 303A, EPA 273.1
Potassium	SM 303A, EPA 258.1
Iron	SM 303B, EPA 236.1
Barium	SM 304, EPA 208.2

APPENDIX B

Protocol for Screening Soil Samples for VOCs

APPENDIX B

Protocol for Screening Soil Samples for Volatile Organic Compounds

Equipment:

TIP or HNU

Sample jars with lids (approximately 250 ml)

Polyethylene sheeting

Rubber band

Procedure:

1. Transfer a representative portion of the sample into the sample jar and fill it approximately halfway.

2. Seal the jar with a piece of the polyethylene sheeting and secure it with a rubber band.

3. Store the sample for at least one hour in a warm area (25°C minimum).

4. In order to take a measurement, push the intake probe of the instrument through the plastic, taking care not to allow soil or water to enter the intake.

5. Record the highest reading, which usually occurs within 5 seconds of puncturing the seal. Record measurement on log. Allow meter to return to zero before next measurement.

APPENDIX C

Chemical Composition of Bentonite

APPENDIX C

Composition of Bentonite Drilling Fluid

Component	Approximate Percentage
Montmorillonite (sodium base)	85.00%
Quartz	5.00%
Feblspars	5.00%
Cristobalite	2.00%
Illite	2.00%
Calcite	0.50%
Gypsum	0.50%
Polymers*	0.01%

*Polymers (polyacrylate or polyacrylamide) are added to most bentonite mixtures to enhance viscosity and stability. The molecular weight of the polymers employed is greater than 10^5 AMU.

Sources: American Colloid, 1986; Brobst and Buszka, 1986.