

**VOLUNTARY RESPONSE ACTION PROGRAM
SUMMARY REPORT**

**GENERAL ALUM AND
CHEMICAL CORPORATION
SEARSPORT, MAINE**

FILE COPY

VOLUME I - REPORT

JULY 1995

Prepared by

**Sevee & Maher Engineers, Inc.
Cumberland, Maine**

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1.0 INTRODUCTION

1.1 Purpose and Scope

At the request of General Alum and Chemical Corporation, Sevee & Maher Engineers has compiled this summary report for submittal to the Voluntary Response Action Program (VRAP) in the Bureau of Hazardous Materials and Solid Waste Control at the Maine Department of Environmental Protection. The purpose of this report is to summarize data gathered during a series of four investigations conducted from 1992 through 1994 by Sevee & Maher Engineers to evaluate the nature and extent of volatile organic compounds, primarily trichloroethene, found in the vicinity of the Polymers Building and the Old Ammonia Plant at the General Alum and Chemical Corporation site in Searsport, Maine.

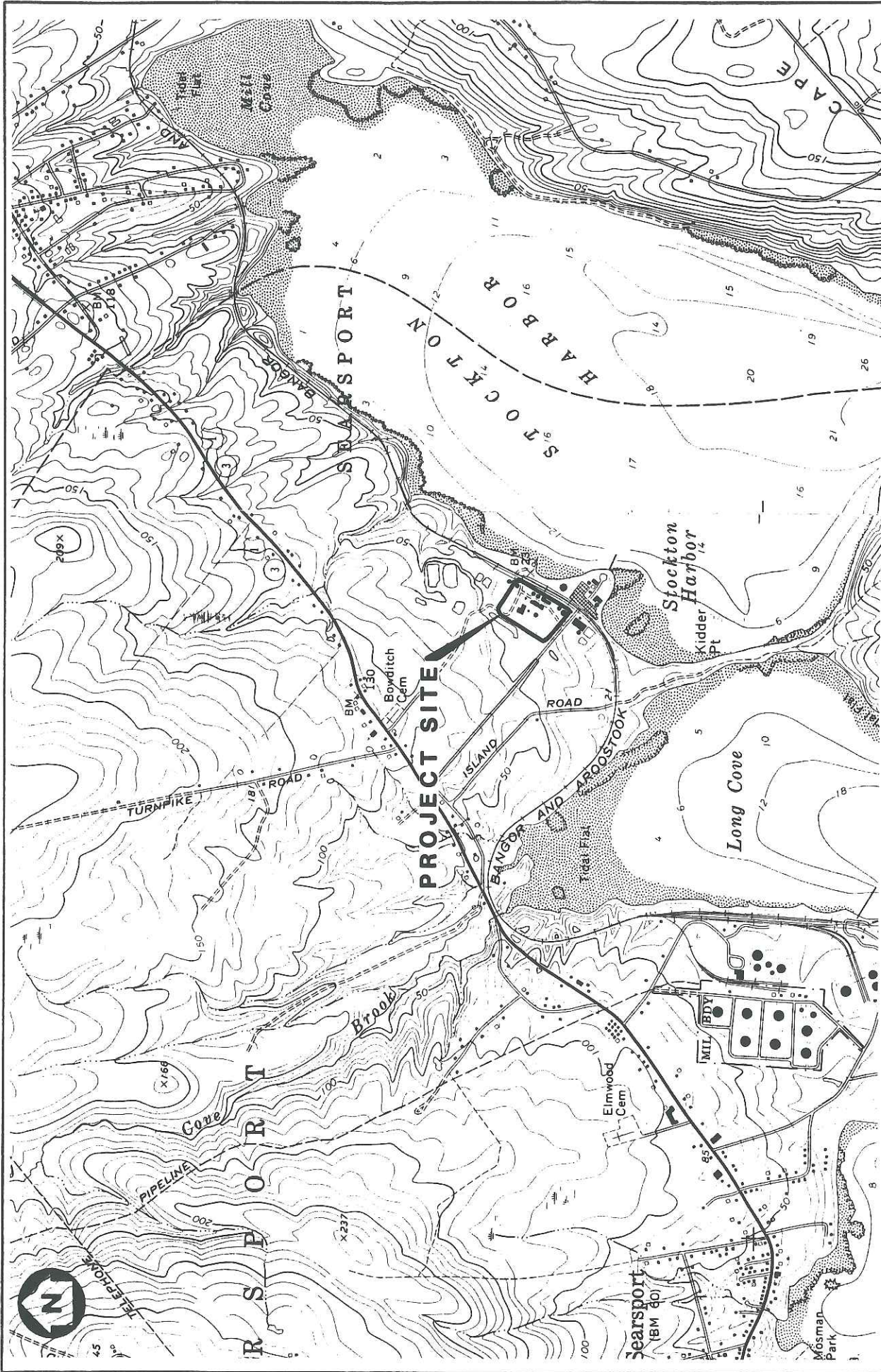
1.2 Site Description

The General Alum and Chemical Corporation site consists of a 157-acre parcel situated on the east shore of Stockton Harbor in Searsport, Maine. The topography of the site ranges in elevation from mean sea level to approximately 80 feet (NVDG datum) and slopes gently from west to east toward Stockton Harbor. Man-made features at the site consist of the plant and administration buildings; chemical storage tanks; and a closed landfill. The

area of interest in this investigation is located in the central portion of the site in the vicinity of the Polymers Building and Old Ammonia Plant as shown on Figure 1-1. A detailed map of the site in the vicinity of the investigations is presented in Figure 1-2.

1.3 Operational History

Site development began in 1927 and consisted of an agricultural fertilizer manufacturing plant which was owned and operated by the Summers Fertilizer Company. In 1943, Northern Chemical, Inc. a division of Summers Fertilizer, assumed operation of the site and expanded the manufacturing operation to include production of super-phosphates, sulfuric acid, and ammonium sulfate. In 1953, an aluminum sulfate process was added to the site. In 1956, an ammonia plant, an ammonia nitrate plant and a nitric acid plant were constructed at the site. In 1966, W.R. Grace & Company leased the manufacturing facility. The ammonia production was then discontinued. By early 1970, W.R. Grace discontinued the production of super phosphates, ammonium nitrate and nitric acid. In 1970 Delta Chemicals purchased the facility from W.R. Grace & Company. In 1994 (?) General Alum and Chemical Corporation purchased the manufacturing facility. General Alum and Chemical Corporation manufactures and sells aluminum sulfate, ammonium



BASE MAP ADAPTED FROM 7.5 MIN.
 USGS TOPOGRAPHIC QUADRANGLES
 SEARSPORT, MAINE - 1973
 CASTINE, MAINE - 1973



FIGURE 1-1
 SITE LOCATION MAP
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 SEARSPORT, MAINE
 SEVEE & MAHER ENGINEERS

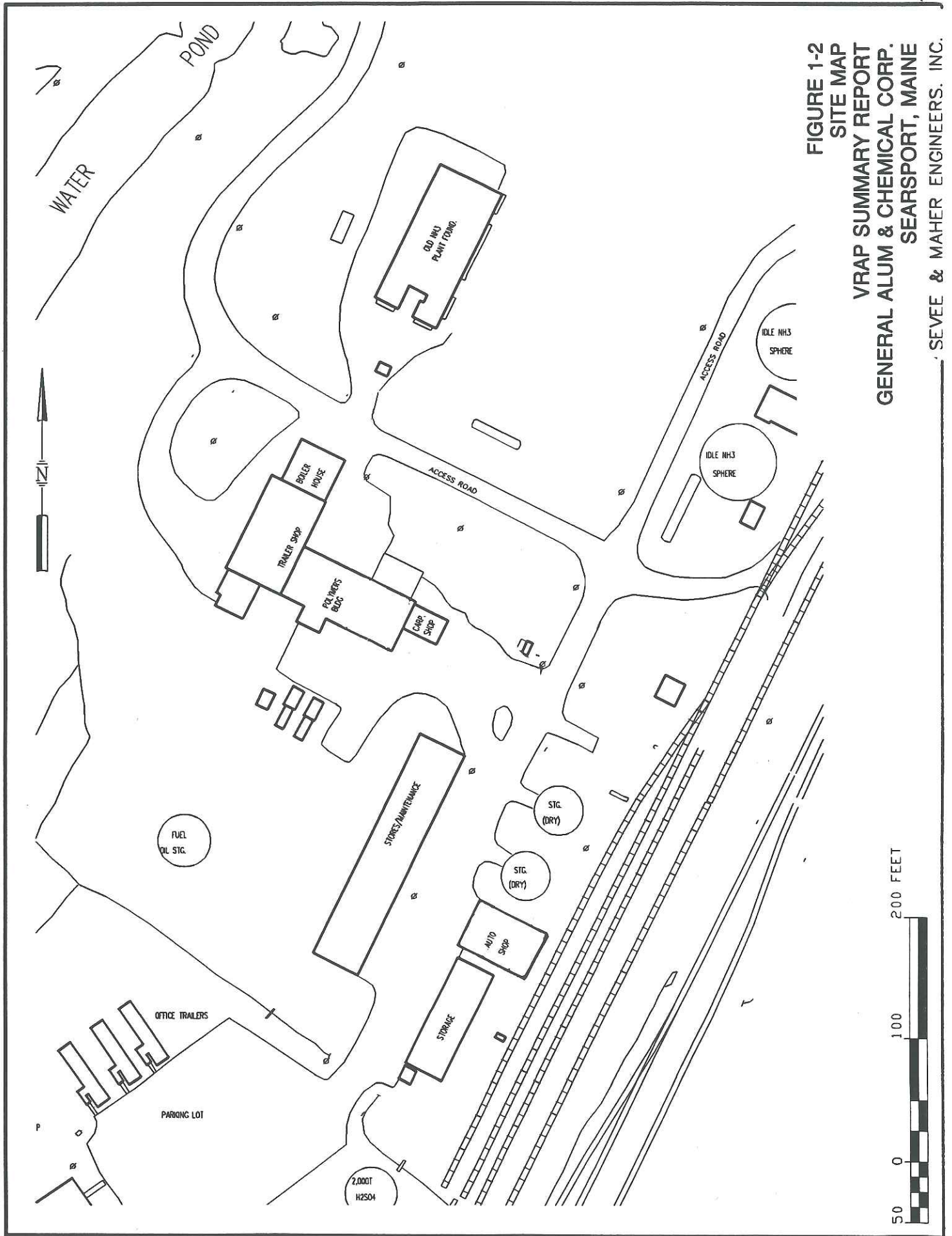


FIGURE 1-2
 SITE MAP
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sulfate, sodium aluminate and polyacrylamide based water soluble polymers.

1.4 History of the Solvent Problem

Information gathered during an environmental site evaluation of the former Delta Chemicals, Inc. facility conducted in 1992 by a prospective buyer suggested that volatile organic compounds (VOCs) may be present in soils and groundwater in the vicinity of the Polymers Building at the site. In subsequent discussions with former Delta employees, it was revealed that there were some areas on-site where potential solvent use and handling may have occurred during the 1950s and 1960s. Solvents were used for parts cleaning; no solvents were used in the manufacturing process at the plant. The potential areas of solvent use identified by plant personnel encompassed approximately 10 acres on-site and included:

- o the present Auto Shop where parts were cleaned;
- o an area adjacent to the former Nitric Acid Production Polymers Building¹ where preheaters for the nitric acid operation were cleaned;

1. The Nitric Acid Production Building was converted to polymer production in 1986. For the remainder of the report, the building will be referred to as the Polymers Building.

- o an old maintenance building;
- o an abandoned leachfield;
- o the area south of the Old Ammonia Plant where heat exchangers were cleaned; and
- o an area east of the Old Ammonia Plant where burners were cleaned.

The location of these areas are shown in Figure 1-3.

Sevee and Maher Engineers, Inc. (SME) was retained in 1992 to conduct a preliminary subsurface investigation in the areas of suspected solvent use. This investigation was completed in September 1992. Following completion of the preliminary investigation, during the period from September 1992 to 1994, three additional subsurface field investigations were conducted at the General Alum site to further evaluate the nature and extent of VOCs in the vicinity of the Polymers Building and the Old Ammonia Plant. A summary of the field sampling and analysis programs associated with these investigations is shown in Table 1-1. Information obtained during each of the field

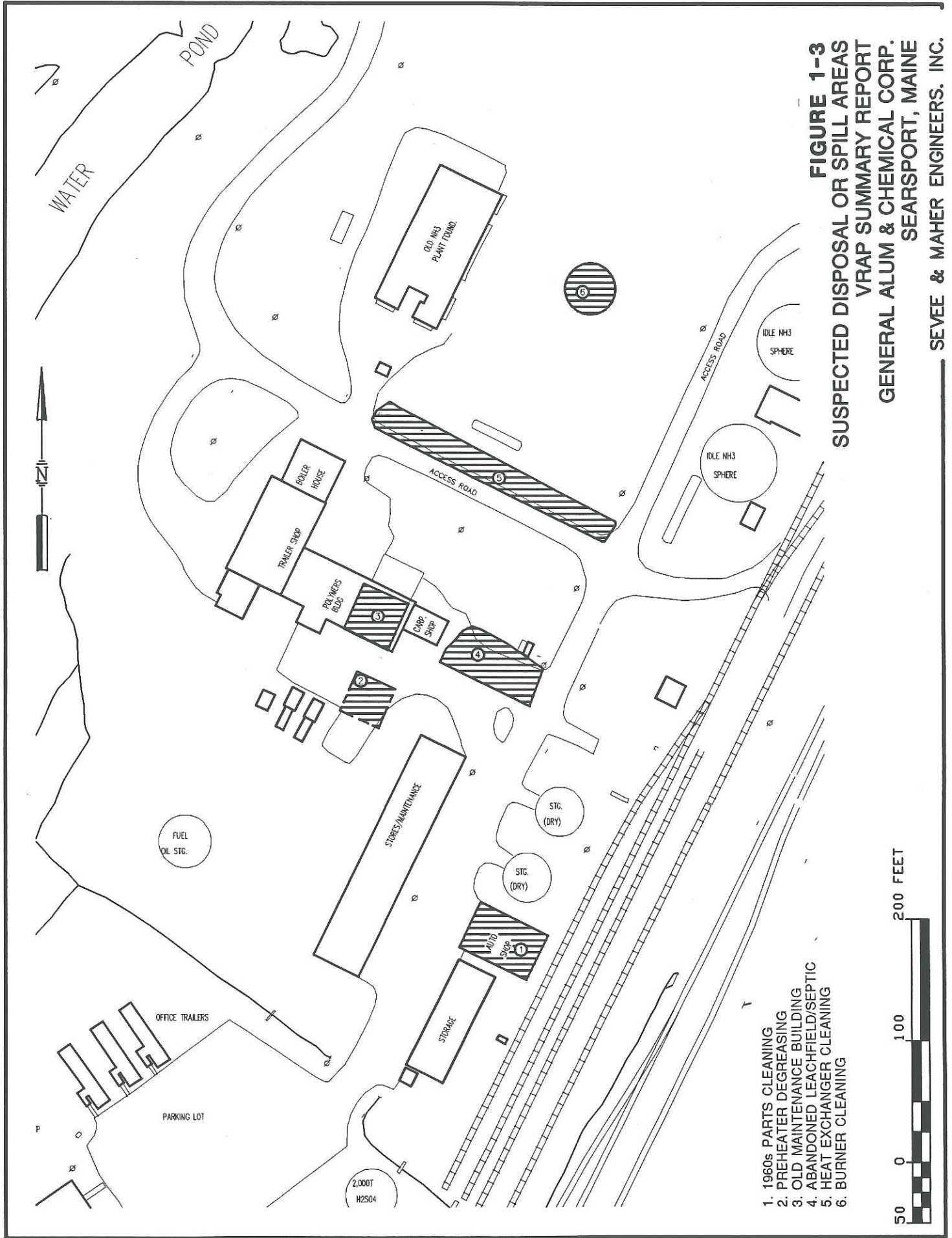


FIGURE 1-3
SUSPECTED DISPOSAL OR SPILL AREAS
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TABLE 1-1

SUMMARY OF FIELD INVESTIGATION PROGRAMS
 AT GENERAL ALUM AND CHEMICAL CORPORATION FACILITY
 SEARSPORT, MAINE

Investigation	Date	Boring I.D.s	No. of Field Screened Soil Samples	PID ¹	No. of Laboratory Analyzed Samples	
					Soil U.S.EPA Method	Water U.S.EPA Method
Phase 1	Sep-Oct 92	B1 - B20		121	47/8010	17/8010 2/8240
Phase 1 Supplement	Jan 93	B21 - B26		62	5/8240	6/8240
Phase 2	Sep 93	B101 - B155		301	11/8010	-
Phase 3	Jun 94	B201 - B206		34	21/8240	3/8240

Notes:

1. ThermoEnvironmental photoionization detector; Phase 2 includes 90 samples with Hewlett Packard 5890 gas chromatograph; modification of U.S.EPA Methods 3810/8020.

Analytical Laboratories

- Phase 1 - PACE, Inc. Hampton, New Hampshire
- Phase 1 Supplement - PACE, Inc. Hampton, New Hampshire
- Phase 2 - Analytical Environmental Laboratory, Inc., Portsmouth, New Hampshire
- Phase 3 - Analytical Environmental Laboratory, Inc., Portsmouth, New Hampshire

investigation programs was described in the following reports prepared by SME:

1. *Preliminary Field Investigation in the Vicinity of the Polymers Building and Ammonia Plant; October 1992. (Phase I, Part 1)*
2. *Preliminary Field Investigation in the Vicinity of the Polymers Building and Ammonia Plant, Supplement I; January 1993. (Phase I, Part 2)*
3. *Phase 2 Field Investigation in the Vicinity of the Polymers Building and Ammonia Plant; December 1993.*
4. *Phase 3 Field Investigation in the Vicinity of the Polymers Building and Ammonia Plant; July 1994.*

The primary intent of these field investigations was to provide an assessment of site-related VOCs in near-surface soils and shallow groundwater. Chemical analysis of soil and groundwater samples collected during these four field investigations confirmed the presence of VOCs, predominantly trichloroethene (TCE), at some locations on-site. The following report provides an overall summary of the field and sampling programs associated with the four investigations conducted by SME.

Data from previous studies conducted at the facility was also used to aid in the interpretation of the geologic and hydrogeologic conditions at the site. The following reports were reviewed during the preparation of this summary report:

1. *Environmental Audit and Preliminary Hydrogeological Survey*, Normadeau Associates, September 1983.
2. *Hydrogeologic Study and Groundwater Quality Assessment for Delta Chemicals, Inc., Searsport, Maine*, Normandean Associates, July 1984.
3. *Soil and Groundwater Quality Assessment, Delta Chemicals Inc., Searsport, Maine*, E.C. Jordan Company, November 1984.
4. *Hydrogeologic Evaluation and Landfill Closure Plan for Delta Chemicals, Inc. Searsport, Maine*, Sevee and Maher Engineers, Inc. November 1991.

2.0 FIELD INVESTIGATIONS

2.1 Subsurface Field Exploration Programs

Since 1992, as part of SME's investigations at the site, a total of 87 shallow soil borings have been drilled in the six areas where facility personnel had indicated solvents potentially were used during earlier plant operations. The locations of the borings are shown on Figure 2-1. A total of 518 soil samples were collected for field VOC screening and analysis, and geologic logging. A portion of the soil samples were submitted to a laboratory for chemical analysis. In addition, groundwater samples from temporary wells installed in twenty-five borings and from an existing monitoring well cluster (M-2A, M-2B, and M-2C), were collected for laboratory chemical analysis.

2.1.1 Drilling and Split Spoon Sampling. All borings were drilled using hollow-stem auger drilling methods (ASTM 1452). Phase 1 borings were completed to a maximum depth of 27 feet; Phase 2 and 3 borings generally ranged from depths of 10 to 20 feet. Soil samples were collected from each boring with a 2-inch O.D. split-barrel sampler driven two feet for standard penetration testing (ASTM 1586). Samples were obtained at either a continuous 2-foot sampling interval, a 5-foot sampling interval, or a combination of both. Soils were visually

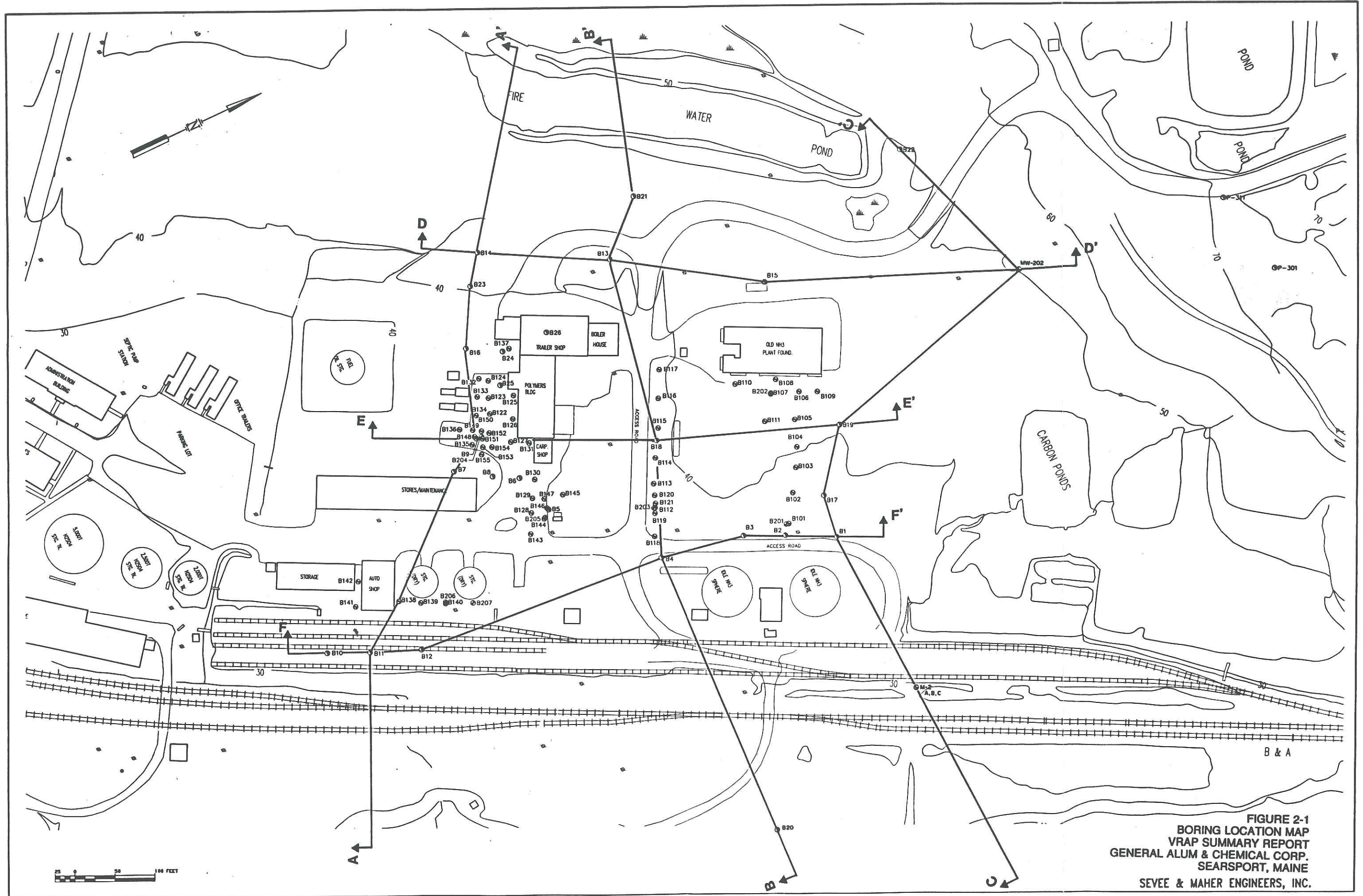


FIGURE 2-1
BORING LOCATION MAP
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SEARSPORT, MAINE
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classified for soil description and the standard penetration resistance (expressed as the N-value) recorded on the respective boring log. Soil material was collected for soil-jar headspace field screening for total VOCs with a portable photoionization detector (PID) and additional soil was obtained for laboratory chemical analysis. Soil boring logs from all four investigations are provided in Appendix A.

At the completion of each drilling phase, boring locations were determined by SME using taping techniques and referencing boreholes to existing local features and previous site topographic mapping conducted at the facility.

2.1.2 Decontamination. Two decontamination regimes were used during the field investigations to minimize cross-contamination between borings. During Phase 1, drilling supplies and split-spoon samplers were decontaminated with a high-pressure steam wash. Water for the steam washer was obtained from the public water supply system. During the Phase 2 and Phase 3 investigations, decontamination of drilling tools and split-spoon samplers was achieved by a soap and water rinse on the split-spoons and heating the equipment with a propane torch.

2.1.3 Installation of Temporary Wells. During the Phase 1 investigation, temporary wells were installed in 25 of the 26

borings (B1 through B18, and B20 through B26) drilled to collect a groundwater sample for laboratory analysis. Temporary wells were not installed during the Phase 2 or Phase 3 field investigations. When drilling of the boring had been completed, the hollow-stem augers were retracted and a 2-inch I.D. Schedule 40 PVC flush-jointed casing and well screen was positioned near the bottom of the open borehole. Well screens consisted of a 10-foot section of 0.01-inch slotted PVC. The annular space between the well material and the formation was not backfilled or sealed, nor were the temporary wells developed prior to sampling. After the groundwater sample had been collected, the PVC well material was removed from the borehole and boring backfilled to the ground surface with concrete cement.

2.2 Volatile Organic Screening and Chemical Analyses of Soil Samples

To evaluate the distribution of VOCs in the shallow soils in vicinity of the Polymers Building and the Old Ammonia Plant, samples of soil were screened on-site with a PID meter. A total of 518 jar headspace readings were collected from the 87 borings drilled during the three phases of the field investigations. A selected number of samples were submitted to off-site analytical laboratories for confirmatory chemical analysis.

2.2.1 Field Screening with a Photoionization Detector. Field screening consisted of soil jar headspace analysis using a portable photoionization detector (PID) calibrated to a TCE equivalent standard. Either a Photovac/MicroTIP Model HL-2000 or a Thermo Environmental Instruments Model 580B, equipped with a 10.6 or 10.0 electron volt lamp, respectively, were used to measure total volatile concentrations in the soil jar headspace. Approximately 250 grams of soil was placed into a quart size glass jar (Mason-style jar) and immediately sealed with aluminum foil and a threaded jar lid. Samples were kept in a warm location (ambient air or a vehicle during colder weather) for 20 to 30 minutes prior to inserting the PID probe through the foil cover to obtain the headspace readings. Jar headspace values (expressed in parts per million [ppm]) and calibration logs are recorded on field data sheets in Appendix B. A vertical profile of headspace readings are also included on each soil boring log in Appendix A.

2.2.2 Field Gas Chromatograph Screening. During the Phase 2 program (September - October 1993), approximately 95 soil samples also were submitted to SME's field laboratory in South Plainfield, New Jersey, for analysis on a Hewlett Packard 5890 gas chromatograph (GC) using a modification of U.S.EPA Methods 3810/8020. Generally, samples with jar headspace values of greater than 5 ppm were selected for subsequent field GC analysis

during the Phase 2 program. The SME field GC was equipped with a PID and calibrated to the following organic compounds:

trans-1,2-dichloroethene	cis-1,2-dichloroethene
1,1-dichloroethene	tetrachloroethene
1,1-dichloroethane	1,1,1-trichloroethane
methylene chloride	toluene
	trichloroethene

Soil samples were received at the field laboratory in 125 ml VOA jars with little or no headspace. Samples were stored at 4° C until they were analyzed. To prepare a sample for analysis, 5 grams of soil was removed from the sample jar and placed in 30 ml of organic-free water in a 40 ml VOA vial. After heating the vial in a water bath (50 degree centigrade) for at least 1 hour, an aliquot of headspace was injected into the field gas chromatograph (GC). Typically an undiluted aliquot (i.e. 200 µl injection) was run first.

A response for a target compound must fall within the calibrated range of the instrument to be considered valid. A response of

less than 50 percent of the reporting limit was considered non-detect. A response of 50-100 percent of the reporting limit or above the calibration range was reported as an estimated value. Estimated values are reported with a "J" modifier. In some cases where the response exceeded the calibrated range, a diluted sample was run. If a dilution was required, a reduced injection volume was used (i.e. a 20 μ l injection to achieve a ten-fold dilution) or the headspace was diluted in a gastight bulb. The detection limits for the compounds increase by the same factor as the dilution. Diluted values are reported with a "D" modifier.

Appendix C contains a summary report of the samples analyzed for the nine volatile organic compounds by the field GC. The boring number and sample depth, along with the detection limits for each compound are summarized on this report.

2.2.3 Laboratory Chemical Analysis of Soil Samples. Since 1992, 84 soil and 28 groundwater samples have been submitted for off-site laboratory analysis of VOCs as part of the field investigations. Soil samples were selected based on the PID jar headspace readings and the concentration of target VOCs detected in the field GC analysis. Generally PID values greater than 2 to 5 ppm were submitted to the laboratory for analysis. Phase 1 and Phase 3 soil samples were analyzed within the method

required holding times. During the Phase 2 investigation, 11 soil samples (B-100 series) were selected for confirmatory analysis pending results of SME's GC screening in a field laboratory in Plainfield, New Jersey. The time delay between field GC analysis and sample selection resulted in Phase 2 soil samples being analyzed outside of the specified holding times for the referenced methods. These samples are reported with a qualifier (J) that indicates that concentration is estimated because the holding time was exceeded.

Soil samples were analyzed for volatile organic compounds in accordance with U.S.EPA Methods 8010 and 8240. During the Phase 1 program, samples were submitted to Pace Incorporated, in Hampton, NH. Laboratory samples collected during Phase 2 and Phase 3 were analyzed by Analytics Environmental Laboratory, Inc. in Portsmouth, NH. Laboratory reports of the soils analyses are presented in Appendix D.

2.3 Collection and Chemical Analysis of Groundwater Samples

During the Phase 1 field investigation, groundwater samples were collected from 25 of the temporary wells for VOC analysis. These samples consisted of the water that had recharged the temporary well for one to two days following installation. The procedure used in sampling the temporary wells was as follows: (1) water

levels were measured in each well immediately before the well was sampled; (2) a disposable bailer was used to remove two bailer volumes of water from the well (a new bailer was used for each well); and (3) a water sample was collected with the bailer and placed in a 40-milliliter glass vial with Teflon-lined septa, preserved with hydrochloric acid and maintained at 4 degrees centigrade. Existing monitoring wells M-2A, M-2B, and M-2C, located approximately 450 east of the Old Ammonia Plant, where sampled during the Phase 3 field investigation. Monitoring well sample purging forms for the latter three wells are contained in Appendix E.

Groundwater samples were analyzed for VOCs in accordance with U.S.EPA Methods 8010 and 8240. During the Phase 1 program, groundwater samples were submitted to PACE, Inc. in Hampton, New Hampshire. Groundwater samples collected during Phase 3 were analyzed by Analytics Environmental Laboratory, Inc. in Portsmouth, New Hampshire. Laboratory reports of the groundwater sample analyses are presented in Appendix E.

3.0 SITE CHARACTERIZATION

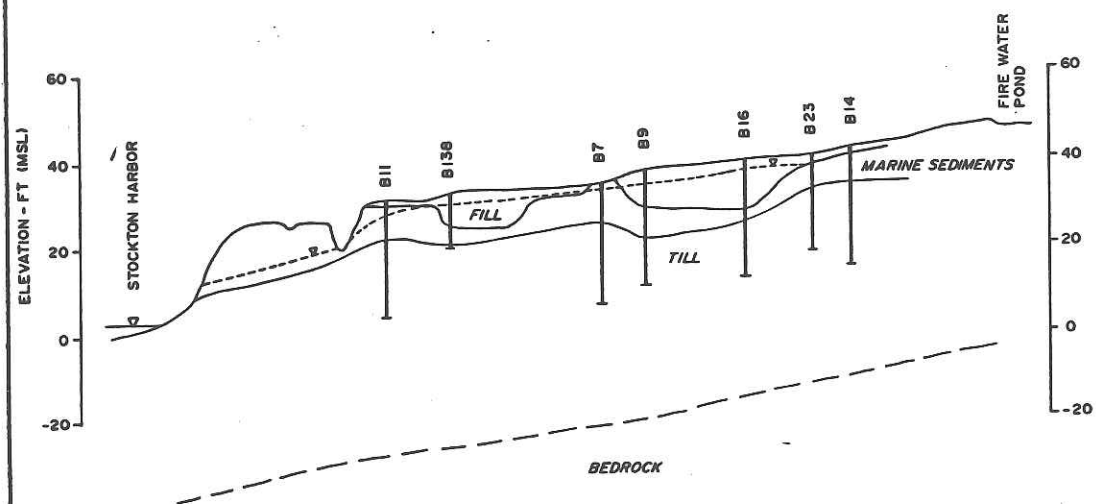
3.1 Site Geology

3.1.1 Surficial Geology. The Maine Geological Survey (MGS) has mapped the regional surficial geology near the General Alum facility to consist predominantly of fined-grained glacial marine deposits and an undifferentiated glacial till (Thompson et al., 1977). Geologic logging of soil borings drilled during the field investigations near the Polymers Building are consistent with the mapped geology, and with information obtained from other previous investigations at the General Alum site (NAI, 1994; SME, 1991). Interpretive geologic profiles compiled from data obtained from the soil boring programs during the three phases of the field investigation program are presented in Figure 3-1.

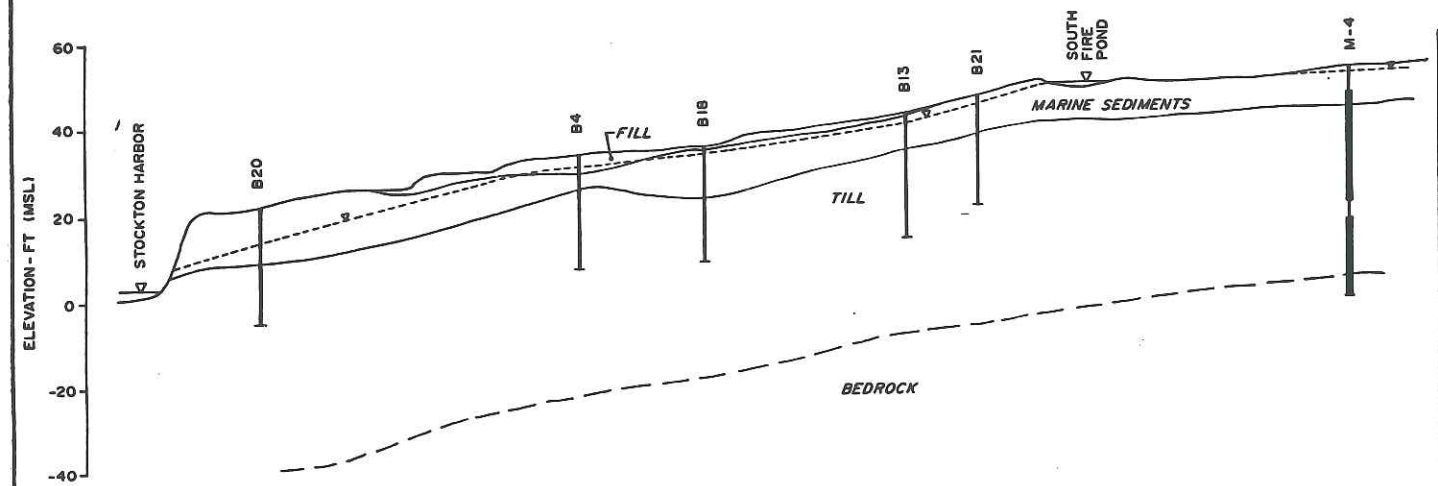
The stratigraphy encountered within the study area generally consists of (in order of descending position) fill, glaciomarine silts and clays, and glacial till overlying bedrock. A brief description of each unit follows:

3.1.1.1 Fill Material

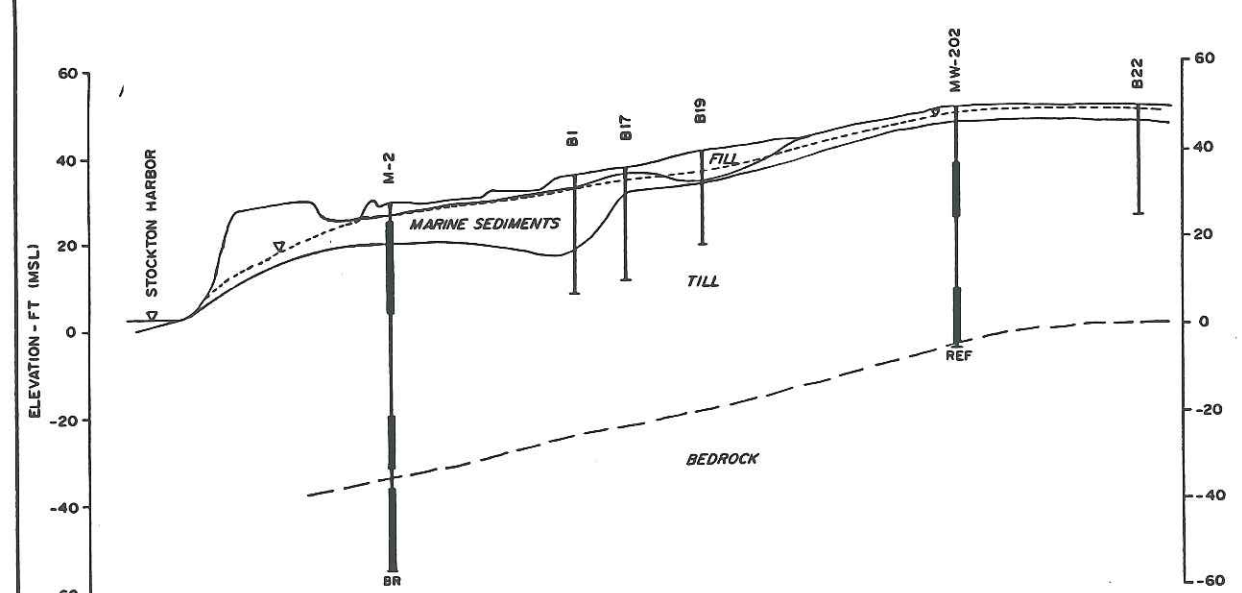
Generally, the uppermost portion of overburden in the site area investigated during the program has been reworked or



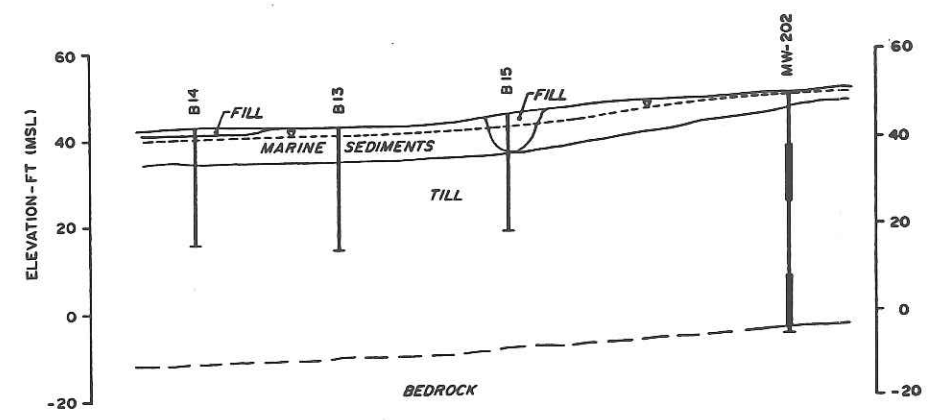
PROFILE A-A'



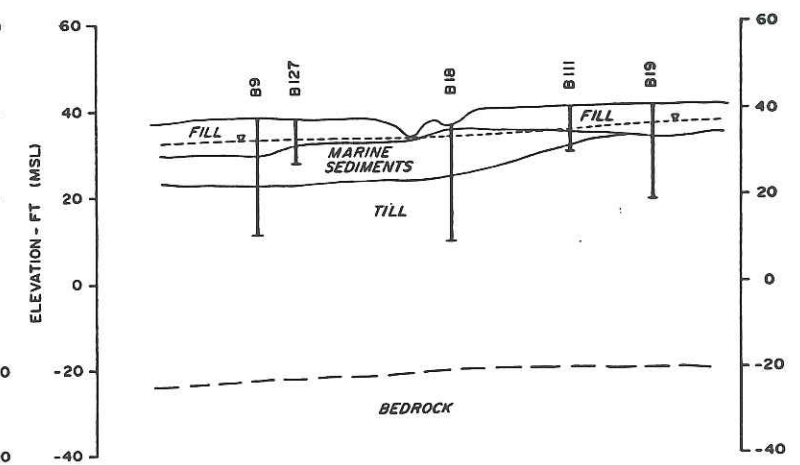
PROFILE B-B'



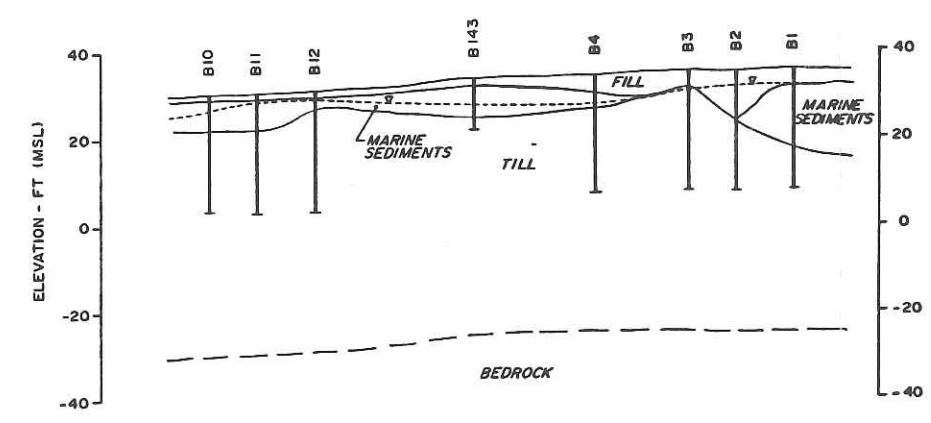
PROFILE C-C'



PROFILE D-D'

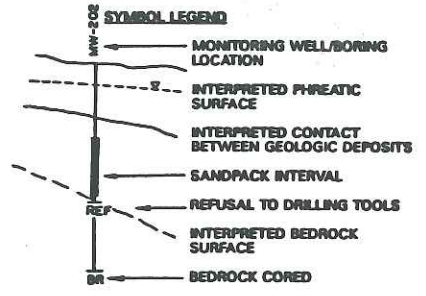


PROFILE E-E'



PROFILE F-F'

- GEOLOGIC DESCRIPTIONS**
- FILL** - MIXTURE OF GRAVELLY SANDS/SANDY GRAVELS TO SILTY SANDS, OCCASIONALLY CONTAINING PIECES OF METAL, ASPHALT, WOOD, BLACK CARBON DEPOSITS, AND ALUM MUD; NATIVE SILTY CLAY DEPOSITS ALSO WERE USED AS SITE FILLS.
 - GLACIO-MARINE** - OLIVE BROWN TO GRAY, MOTTLED SILTY CLAY WITH PARTINGS OF FINE SAND, SOFT TO VERY STIFF, SLIGHTLY TO MODERATELY PLASTIC, GENERALLY WEATHERED; PRESUMSCOT FORMATION.
 - TILL** - BROWN TO GRAY SILTY SANDS TO SANDY SILTS WITH GRAVEL AND CLAY, AND THIN LAYERS/INTERBEDS OF SAND, LOOSE TO VERY DENSE, GLACIAL TILLS.
 - BEDROCK** - BLACK, GRAY, AND GREEN SULFIDIC AND CARBONACEOUS PELLITES WITH OCCASIONAL NEAR-VERTICAL FRACTURES; PENOBSCOT FORMATION.



- NOTES**
1. GEOLOGIC UNITS ARE SHOWN SCHEMATICALLY. FIGURE SHOULD NOT BE USED FOR ENGINEERING DESIGN, QUANTITY TAKE-OFFS, GRADES, ETC.
 2. THE GEOLOGIC UNITS REPRESENT AN INTERPRETATION OF TEST BORING RESULTS. CONDITIONS MAY VARY FROM THAT SHOWN BETWEEN THE EXPLORATIONS. BOUNDARIES BETWEEN VARIOUS GEOLOGIC UNITS MAY VARY FROM THAT SHOWN AND MAY BE GRADATIONAL.
 3. INTERPRETATION OF PHREATIC SURFACE CONTOURS BASED ON WATER LEVEL READINGS TAKEN IN DECEMBER 1994 AND FROM HISTORIC WATER LEVEL OBSERVATIONS. ACTUAL CONFIGURATION OF PHREATIC SURFACE MAY VARY FROM THAT SHOWN. THE PHREATIC SURFACE SHOULD BE USED ONLY FOR INDICATING GENERAL TRENDS IN THE PHREATIC SURFACE AND NOT USED FOR DESIGN OR QUANTITY ESTIMATES.
 4. SURFACE TOPOGRAPHY TAKEN FROM PHOTOGRAMMETRIC MAPPING AND GROUND CONTROL PROVIDED BY JAMES W. SEWALL COMPANY; DATE OF PHOTOGRAPH NOVEMBER 20, 1980.
 5. VERTICAL EXAGGERATION OF PROFILES IS 5 TO 1.
 6. SEE FIGURE 2-1 FOR LOCATIONS OF PROFILES.
 7. REFUSAL INTERPRETED AS BEDROCK.

HORIZONTAL SCALE
0 50 100 200 FEET

**FIGURE 3-1
GEOLOGIC PROFILES
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excavated, and replaced with fill material. The thickness of fill materials ranged from 0 feet to 10 feet or more in borings drilled near the Polymers Building, and adjacent to the access road across from the former ammonia spheres. The fill material consists of a mixture of gravelly sand/sandy gravel to silty sand, crushed gravel, with occasional pieces of metal, asphalt, and wood or wood fibers. Black carbon deposits were found mixed in with the site fills in some locations (e.g., B2, B24, B102, B103, B130, and B131). Fine-grained glaciomarine sediments were observed mixed in with the fill material in many of the samples collected from Phase 1, 2, and 3 borings. Fill material was not encountered in the majority of the borings drilled in the undeveloped area west of the Trailer Shop (see Figure 1-2 and Figure 3-1).

3.1.1.2 Glaciomarine Deposits

Glaciomarine deposits encountered in the site area consist of a firm to very stiff, mottled, olive brown and gray silty clay with thin partings of fine sand. This unit has been mapped by the MGS as glaciomarine sediments of the Presumpscot Formation. Glaciomarine sediment samples analyzed for grain size as part of the evaluation for the landfill closure plan contained approximately 84 percent (by

weight) of soil particles finer than the No. 200 sieve (SME, 1991). Moisture content determinations made for the same study ranged from 19 to 22 percent.

The thickness of the glaciomarine deposits varied across the site, ranging from 0 to more than 15 feet. The thickness of this unit appears to be a function of the amount of cutting and filling associated with previous construction activity at the facility. The clay unit is generally continuous across the site, except in the vicinity of the Old Ammonia Plant, and near the Auto Shop adjacent to the railroad tracks. At these locations, it appears that the glaciomarine sediments were excavated and replaced with fill materials. Glaciomarine sediments are not present in upland areas of the facility (i.e., west of the Polymers Building at elevations greater than 65 to 70 feet MSL, based on observations made during a previous site investigation (SME, 1991).

3.1.1.3 Glacial Till

Underlying the glaciomarine sediments, a glacial till unit was encountered in the vicinity of the Polymers Building. This unit is generally continuous across the General Alum facility, based on the geology observed in deeper borings

installed during previous site investigations (NAI, 1984; SME, 1991). Geologic logs prepared during the Phase 1 through Phase 3 field investigations describe the shallow till as consisting of sandy silt to silty sand-sized particles, with varying amounts of gravel and clay. Occasional thin layers of sand was observed interbedded within the upper portion of the till. Physical property testing of till samples collected during a 1991 hydrogeologic evaluation of the facility landfill yielded fines content ranging from 36 to 58 percent, and soil moistures ranging from 9 to 17 percent (SME, 1991).

The glacial till unit at the site appears to correlate to the "upper till" unit described in a 1984 hydrogeologic study of the facility (NAI, 1984). Borings drilled in proximity to the Polymers Building and the Old Ammonia Plant only penetrated the top of the till; however, stratigraphic information from nearby borings drilled to bedrock (i.e., M-2 and MW-202) indicate that the till in this area of the facility is approximately 50 to 55 feet thick (NAI, 1984; SME, 1991).

3.1.2 Bedrock Geology. Regional mapping by the MGS indicates the bedrock in the vicinity of General Alum generally consists of sulfidic/carbonaceous pelrites (e.g. slates) of the Penobscot

Formation (Osberg et al., 1985). No major faults or other structural features in the bedrock have been mapped within the limits of property. High altitude aerial photographs were examined by SME for the existence of photolineaments during preparation of a landfill closure plan for the facility (SME, 1991). Photolineaments, often indicative of faults or fractures in bedrock, were not observed on any portion of the facility.

As part of a 1984 hydrogeologic assessment of the General Alum facility conducted by Normandeau Associates, Inc., bedrock core samples were obtained from four borings drilled on the property (NAI, 1984). Bedrock was logged by NAI as a sulfidic slate, generally weathered at the contact with the overlying unconsolidated deposits. Near vertical fractures parallel to the foliation of the slate were reported in the NAI core samples.

The focus of the Phase 1 through Phase 3 field investigations in the vicinity of the Polymers Building and the Old Ammonia Plant was on the shallow geology; therefore, borings were not drilled to bedrock. However, information obtained from deeper borings drilled during the 1984 and 1991 hydrogeologic investigations of General Alum site and the facility landfill, and data from the 1984 seismic survey indicate bedrock depths on the property ranging from 35 to 80 feet below ground surface (NAI, 1984; SME, 1991). The highest bedrock elevation was encountered in the

northwest portion of the site (i.e., MW-205); the lowest bedrock elevation was found near the Alum Plant Process Lagoons (i.e., M-1). A contour map showing our interpretation the elevation of the bedrock surface was constructed of the available information (Figure 3-2). These data suggest that the elevation of bedrock beneath the area investigated ranges from 10 to 30 feet above MSL, to approximately 60 feet below MSL moving west to east towards Stockton Harbor. This is equivalent to 55 to 65 feet of overburden overlying bedrock within the study area.

3.2 Site Hydrogeology

The areas examined during the Phase 1 through 3 investigations near the Polymers Building and the Old Ammonia Plant focused on an evaluation of the shallow overburden geology. Only limited hydraulic information was collected during these field programs. However, for the purpose of this report, relevant data from two previous hydrogeologic evaluations (i.e., NAI, 1984 and SME, 1991) at the General Alum facility were integrated with the limited site-specific information collected during the Phases 1 through 3 field investigation to interpret the hydrogeologic conditions near the study area.

3.2.1 Surface Water Features. The study area in the vicinity of the Polymers Building and the Old Ammonia Plant is situated in a

locality of gentle to moderate topography lying roughly between elevation 25 to 45 feet MSL. The terrain gently slopes (approximately 3 percent) down from west to east toward Stockton Harbor. The nearest surface water body is the South Fire Pond, a man-made pond located approximately 250 feet west of the Polymers Building (Figure 1-2). This pond is bordered by a swampy area to the west. Seepage and drainage from the fire pond generally flows in a southerly direction towards the Alum Plant Mud Storage area south of Kidder Road. Part of this drainageway branches to the east near the fuel oil storage tank south of the Polymers Building, potentially collecting runoff from southern portions of the study area, then flows into topographic depressions adjacent to the Bangor and Aroostook railroad tracks.

Surface runoff from the area between the Polymers Building and the Old Ammonia Plant collects in an easterly running ditch along the access road that separates these two structures. Drainage in this ditch then flows to the south, passes through a culvert and joins with a catch basin adjacent to the service road east of the Polymers Building. From the catch basin, flow is directed to the east beneath the railroad tracks through culverts, eventually discharging into Stockton Harbor. Site reconnaissance suggests that most of the ditch flow occurs during precipitation runoff events.

Surface drainageways have also been identified in the vicinity of the two former carbon ponds (i.e., Cells 1 and 2), located northeast of the Old Ammonia Plant, during a previous evaluation of the facility landfill (SME, 1991). The carbon ponds and nearby runoff control cells have since been regraded during the summer of 1994 as part of the ongoing landfill closure. Surface runoff in this area presently flows through culverts beneath the railroad tracks and exits into Stockton Harbor.

3.2.2 Significant Aquifers. The nearest mapped sand and gravel aquifer is approximately five miles west of the General Alum facility and extends into the town of Belfast (Caswell, 1979). This sand and gravel aquifer is associated with esker and deltaic deposits, with reported yields of 50 or more gallons per minute (gpm). Bedrock wells (typically 100 to 300 feet deep) have been mapped upgradient of the facility having yields in the 10 to 20 gpm range (Caswell, 1975). Seven bedrock water supply wells were identified on the General Alum facility in a 1984 environmental audit of the plant (NAI, 1984). These wells were abandoned prior to 1984 due to salt water intrusion.

3.2.3 Groundwater Flow Directions. The interpretation of the direction of groundwater flow is based on a composite of groundwater elevations obtained from the following sources: 1) estimated groundwater elevations from measurements collected in

shallow temporary wells installed during Phase 1 (B1 through B26); 2) December 1994 groundwater elevation survey of permanent monitoring wells and piezometers installed near the facility landfill (M-2, M-3, 200 and 300-series wells); and 3) some historical groundwater elevations obtained for other on-site wells no longer monitored (M-1 and M-4). The approximate configuration of the phreatic surface is illustrated in Figure 3-3, and appears to generally correspond to the local ground surface topography. Based on this interpretation, groundwater beneath the study area flows southeasterly to east southeasterly towards Stockton Harbor under a horizontal hydraulic gradient of between 0.03 to 0.04.

Water level measurements from paired monitoring wells installed during the 1984 and 1991 hydrogeologic investigations (i.e., NAI, 1984 and SME, 1991) were used to estimate vertical seepage gradients in the till. These data, summarized in Table 3-1, suggest downward gradients through the till ranging from 0.23 to 0.48 when comparing monitoring well pairs screened in the upper and lower portions of the unit. Figure 3-4 is an interpretive equipotential profile along cross-section C-C'.

3.2.4 Hydraulic Conductivity. To estimate hydraulic conductivities of the overburden soils in the vicinity of the

TABLE 3-1

VERTICAL GRADIENT DATA
AT GENERAL ALUM AND CHEMICAL CORPORATION FACILITY
SEARSPORT, MAINE

Well I.D.	Midpoint of Sand Packed Interval (ft-MSL)	Elev. (ft/MSL)	Maximum Calculated Gradient (H/d) (ft/ft)
M-1D (A) Rock	91.6	8.0H (12/29/94)	
1I (B) DT	53	9.2H	0.25
1S (C) CL/UT	18.5	17.9H	
M-2A Rock	75.4	16.4 (12/94)	
B CL	55.4	18.2	0.23
C CL/UT/DT	15.3	27.3	
M-3A Rock	79.6	38.2	
B DT	49.2	29	0.29
C UT	19.1	37.7	
M-4I (A) DT/Rock	44	42.4H (3/84)	0.35
S (B) UT/DT	18.8	51.1H	
202A DT	48	35.2 (12/94)	0.48
B UT	18.7	49.3	
204A DT	52.4	23.9	0.28
B UT	11.8	35.4	
206A DT	73	22.1	0.47
B UT	16.3	48.9	

Notes

Measured fluctuations in 3A have varied by as much as 22 feet depending on time of survey.

Abbreviations

CL - clay

UT - upper till

DT - dense deeper till

H - historic groundwater elevation