INSTALLATION RESTORATION PROGRAM

SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN

SUFFOLK COUNTY AIR NATIONAL GUARD BASE SUFFOLK COUNTY AIRPORT WESTHAMPTON BEACH, NEW YORK

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AUGUST 1990



HAZWRAP SUPPORT CONTRACTOR OFFICE
Oak Ridge, Tennessee 37831
Operated by MARTIN MARIETTA ENERGY SYSTEMS, INC.
For the U.S. DEPARTMENT OF ENERGY under contract DE-AC05-840R21400

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SAMPLING AND ANALYSIS PLAN

SUFFOLK COUNTY AIR NATIONAL GUARD BASE
WESTHAMPTON BEACH, NEW YORK

FINAL DRAFT

Prepared for:

NATIONAL GUARD BUREAU
ANDREWS AIR FORCE BASE
MARYLAND

Submitted to:

HAZWRAP SUPPORT CONTRACTOR OFFICE
OAK RIDGE, TENNESSEE

Operated by:

MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY

Prepared by:

E.C. JORDAN CO.
PORTLAND, MAINE
Job No. 5096-12

AUGUST 1990

SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY AIR NATIONAL GUARD BASE

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1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) was developed for the Site Investigation (SI) phase of the Installation Restoration Program (IRP) being conducted at the Suffolk County Air National Guard Base (SCANGB) in Westhampton Beach, New York (Figure 1-1). The purpose of the SAP is to present overall and site-specific technical approaches for completing the SI at the base.

Section 1.0 consists of an overview of the IRP program, a history of the IRP at SCANGB, and guidelines and considerations used in the development of the SAP. Section 2.0 presents background information relating to the SCANGB and information on specific sites being investigated. Section 3.0 describes the technical approaches with the rationale to be used for the SI at each site. Section 4.0 describes the key deliverables associated with the SI. A recommended SI schedule is presented in Section 5.0.

1.1 INSTALLATION RESTORATION PROGRAM

In 1980, Congress passed into law the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLA created a tax on chemical and petroleum industries to collect money for a trust fund, commonly referred to as Superfund, to clean up uncontrolled hazardous waste sites. The U.S. Environmental Protection Agency (USEPA) was granted the responsibility and authority to administer the Superfund program. Under Superfund, USEPA promulgated regulations and developed policies to identify, evaluate, and remediate sites from which hazardous substances were released to the environment. In 1986, the Superfund Amendments and Reauthorization Act (SARA) was passed in an effort to strengthen prior legislation, clean up federal facilities, and expand state involvement.

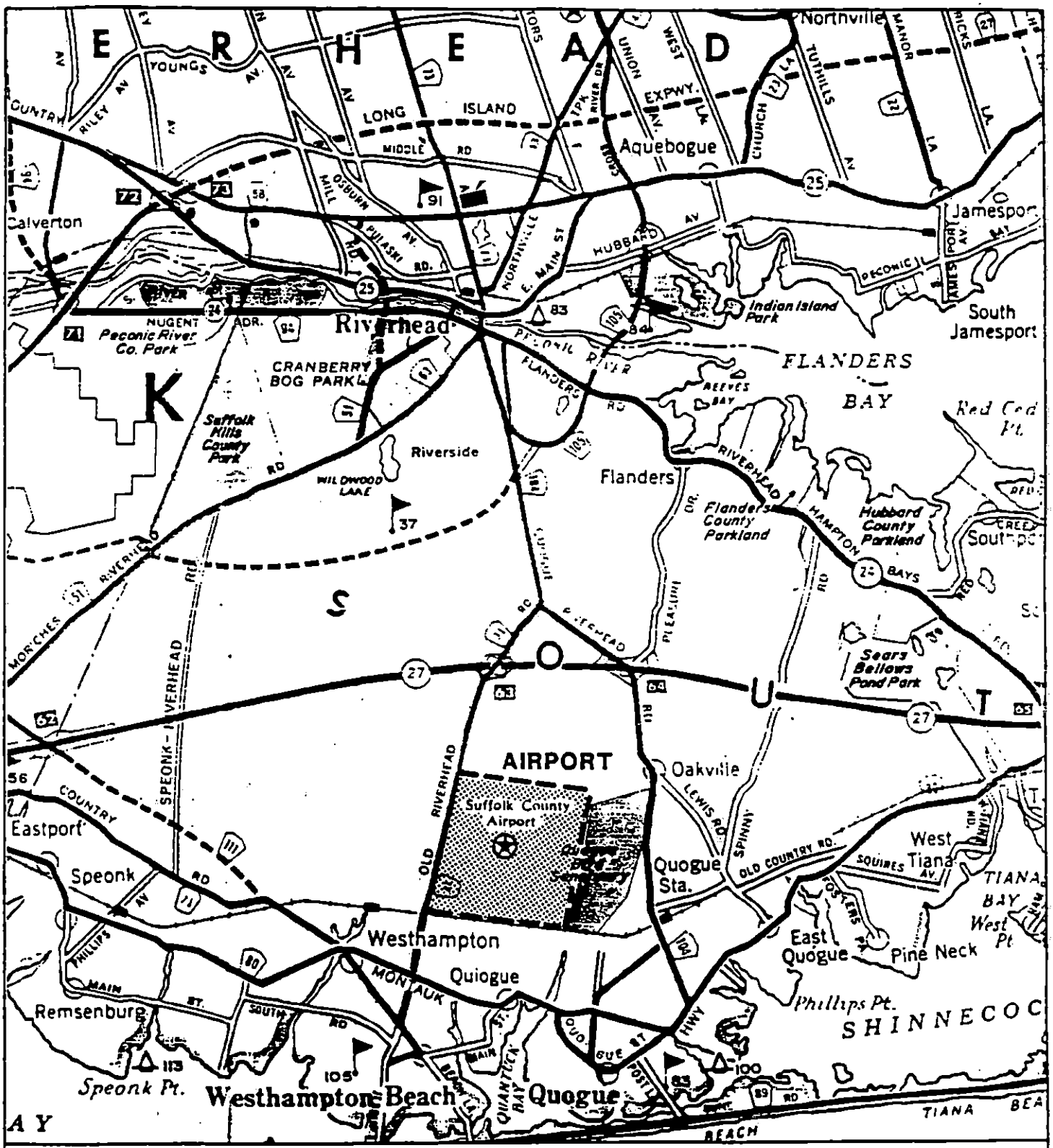
Prior to passage of CERCLA, the Department of Defense (DOD) initiated corrective action at its facilities by establishing the IRP with the objectives of identifying, investigating, and remediating contamination resulting from earlier waste disposal practices or spills. The IRP was defined in 1982 in the Defense Environmental Quality Program Policy Memorandum 81-5, which outlined a program structure consisting of the following four phases:

- Records Search - Phase I
- Site Characterization - Phase II
- Technology Development - Phase III
- Planning and Implementation of Appropriate Control Measures - Phase IV

The goals of both the DOD (with the IRP) and USEPA (with Superfund) are congruent in intent. Initially, however, the procedures, terminology, and authorities of each program were different. The passage of SARA provided a catalyst to move the IRP into adoption of USEPA Superfund terminology. Therefore, the activities of the IRP, now compatible with USEPA, are described as follows:

Preliminary Assessment (PA). Identify and evaluate potentially hazardous waste disposal sites.

Site Investigation (SI). Confirm the presence or absence of contamination.



SOURCE: HAGSTROM ROAD MAP

SCALE
0 0.5 1 2 MILES

FIGURE 1-1
SITE LOCATION MAP
SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

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Remedial Investigation (RI). Quantify contamination and, if applicable, provide a public health evaluation.

Feasibility Study (FS). Develop and design a remedial action plan to solve the contamination problems.

Remedial Action (RA). Implement the selected remedial design.

Technology Development. Develop control technologies to resolve specific problems in situations where known remedial alternatives are inadequate or difficult to apply.

The steps leading to remediation have been supplemented with the concept of a Decision Document (DD) and Focused Feasibility Study/Remedial Measures (FFS/RM). This recent approach provides a mechanism to perform immediate actions during any stage of the IRP, or to address at any point the "no-action" alternative with a DD.

1.2 HISTORY OF THE INSTALLATION RESTORATION PROGRAM AT SCANGB

The National Guard Bureau (NGB) requested the support of the Department of Energy and Martin Marietta Energy Systems, Inc., Hazardous Waste Remedial Actions Program (HAZWRAP) in conducting the IRP for SCANGB in Westhampton Beach, New York. To date, two records searches have been conducted. The first records search was conducted for HAZWRAP by Dames and Moore, and a report was submitted in October 1986 (Dames and Moore, 1986). The second records search was conducted by Dynamac Corporation through the Hazardous Materials Technical Center (HMTC) contract administered by the Defense Logistics Agency; the draft report was published in July 1987 (HMTC, 1987). These records searches are equivalent to the PA stage of the IRP activities, in that they identified known or potential hazardous substance release sites.

On July 7, 1989, HAZWRAP issued E.C. Jordan Co. (Jordan) a request to propose on the SI portion of the program. The proposal was to be based on the Statement of Work (SOW) for SCANGB dated March 2, 1989. The response to this request was in two parts, a technical proposal and a business proposal, submitted September 5, 1989. The technical proposal presented guidelines for investigation of sites identified as having potential for contamination problems.

The SI was initiated with a kick-off meeting at SCANGB on July 24 and 25, 1989. The work plan was developed based on these discussions, a walkover of all sites, a briefing on current NGB SI philosophy, comments from a work plan review meeting, and information obtained from the 1987 HMTC records search. As a result of decisions made at the kick-off meeting, Site 6, identified by HMTC in the records search as the Petroleum, Oils, and Lubricants (POL) Tank Farm, was deleted from the SI program. A Cesspool/Septic Tank Survey (the new Site 6) was added by Amendment 1 to the SOW, dated July 27, 1989.

In addition to the sites identified by HMTC in the records search, Jordan has been investigating a separate site for SCANGB. On March 3, 1987, Jordan was tasked to conduct an RI/FS at the Fire Training Area (FTA) at Suffolk County Airport (SCA). A records search, PA, or SI was not conducted at this site before Jordan's RI. Instead, Jordan conducted a limited records review prior to field activities and used applicable information from the Dames and Moore records search. Jordan installed two series of upgradient and downgradient wells at the FTA in March and April of 1987 and November 1989, and collected soil boring and groundwater samples for laboratory analyses. The RI/FS program at the FTA is still in progress.

1.3 DEVELOPMENT OF THE SAMPLING AND ANALYSIS PLAN

This SAP was developed to provide technical rationale for the program presented in the technical and business proposals submitted to HAZWRAP on September 5, 1989. At that time, only information in the records searches was available as a basis for development of the technical program. Subsequently, information has been made available during a kickoff meeting at the base, discussions with base personnel concerning activities at each site, and site walkovers.

The current philosophy of the Air National Guard (ANG) relative to the conduct of an SI has been followed. The objective of this SI is not only to confirm the presence or absence of contamination, but also to develop enough information to initiate one of the following four alternative actions:

- proceed with the DD based on current SI findings and results of a preliminary risk assessment (i.e., site assessed as having no potential risk and requiring no remedial action)
- initiate FFS/RM
- propose and conduct additional explorations under the current SI to complete a DD or FFS/RM
- recommend further investigation under an RI

A phased approach to the SI will be used when possible. The phased approach used at the site consists of three parts: screening activities, confirmatory activities, and optional activities. Screening activities will include remote sensing geophysical methods, extensive screening activities using field analyses, and installation of piezometers for determination of groundwater flow. Confirmatory activities consist of soil and sediment sampling analyses, monitoring well installation, and soil and groundwater sampling for analyses. Optional activities will be implemented when screening activities indicate the presence of contamination. Optional activities will consist of additional soil boring investigations, monitoring well installations, and associated sampling for analyses.

2.0 SITE HISTORY AND PHYSICAL SETTING

This section outlines the available information regarding individual sites from existing published information and previous investigations. A brief setting of each site is described, including significant geologic and hydrogeologic characteristics.

SCA is located 2 miles north of the Atlantic Ocean shoreline in Westhampton Beach, New York (see Figure 1-1). SCA, consisting of 11,500 acres, is situated in a relatively flat area just south of the Pine Barrens in the township of Southampton. SCA is bounded to the north and east by Quogue Wildlife Refuge, to the west by Old Riverhead Road, and to the south by Long Island Railroad.

The entire SCA facility is currently owned by Suffolk County; the ANG leases approximately 70 acres in the southwestern portion (Figure 2-1). SCANGB has been in this location since 1971, after Suffolk County Air Force Base was retired in 1969. The ANG has had several types of aircraft with different missions stationed at the facility; the current mission is represented by the 106th Aerospace Rescue Group. Land use surrounding the facility consists of mixed commercial, industrial, and residential. Residential areas, located primarily to the south, are heavily populated during summer months.

2.1 SITE DESIGNATIONS

The same site designations presented in the 1987 records search report will be used in the SI for Sites 1 through 5 (Figure 2-2). The POL was assigned a site designation (i.e., Site 6) in the HMTC records search report and was listed in the original SOW for the RI/FS program (HMTC, 1987). However, HAZWRAP eliminated the POL site from the SI phase of the IRP; this was documented in Amendment 1 to the SOW. In addition to the sites identified in the records search, cesspools, septic tanks, and a dry well associated with industrial and maintenance buildings will be investigated in the SI. This portion of the program is referred to herein as the Cesspool/Septic Tank Survey; the individual sites are identified at Sites 6A through 6L.

Site designations, with site locations illustrated in Figure 2-1, are as follows:

Site 1: Aviation Gasoline (AVGAS) Spill Site. This site is located in the elevated parking lot north of the corner of Smith Avenue and Moen Street.

Site 2: Former Hazardous Waste Storage Facility (Prior to 1984). This site is located in the northeastern portion of Building 358, adjacent to the current loading dock.

Site 3: Recent Hazardous Waste Storage Facility (1984-1989). This site was designated as the Current Hazardous Waste Storage Facility in the records search. It is located at the site of Building 282, south of the corner of Smith Avenue and Moen Street. Wastes are no longer stored in the building because it was demolished in 1989.

Sites 4A and 4B: Aircraft Refueling Apron (4A) and Ramp Drainage Outfall (4B). Site 4A is located northeast of the helicopter hangar (Building 395), in the grassy area adjacent to the northeast-southwest runway. Site 4B is located approximately 800 feet south of the refueling apron.

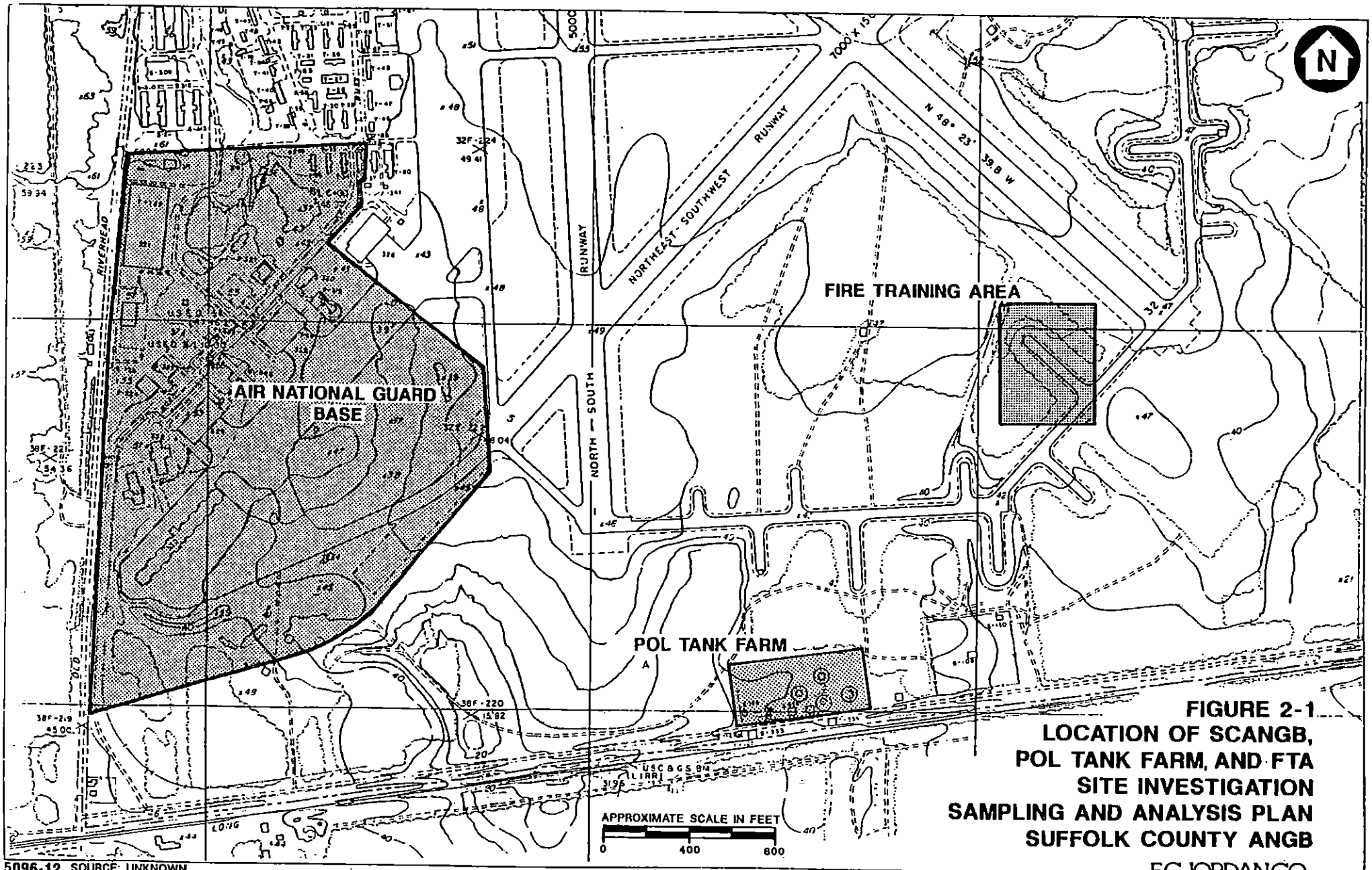


FIGURE 2-1
LOCATION OF SCANGB, POL TANK FARM, AND FTA
SITE INVESTIGATION
SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

5096-12 SOURCE: UNKNOWN

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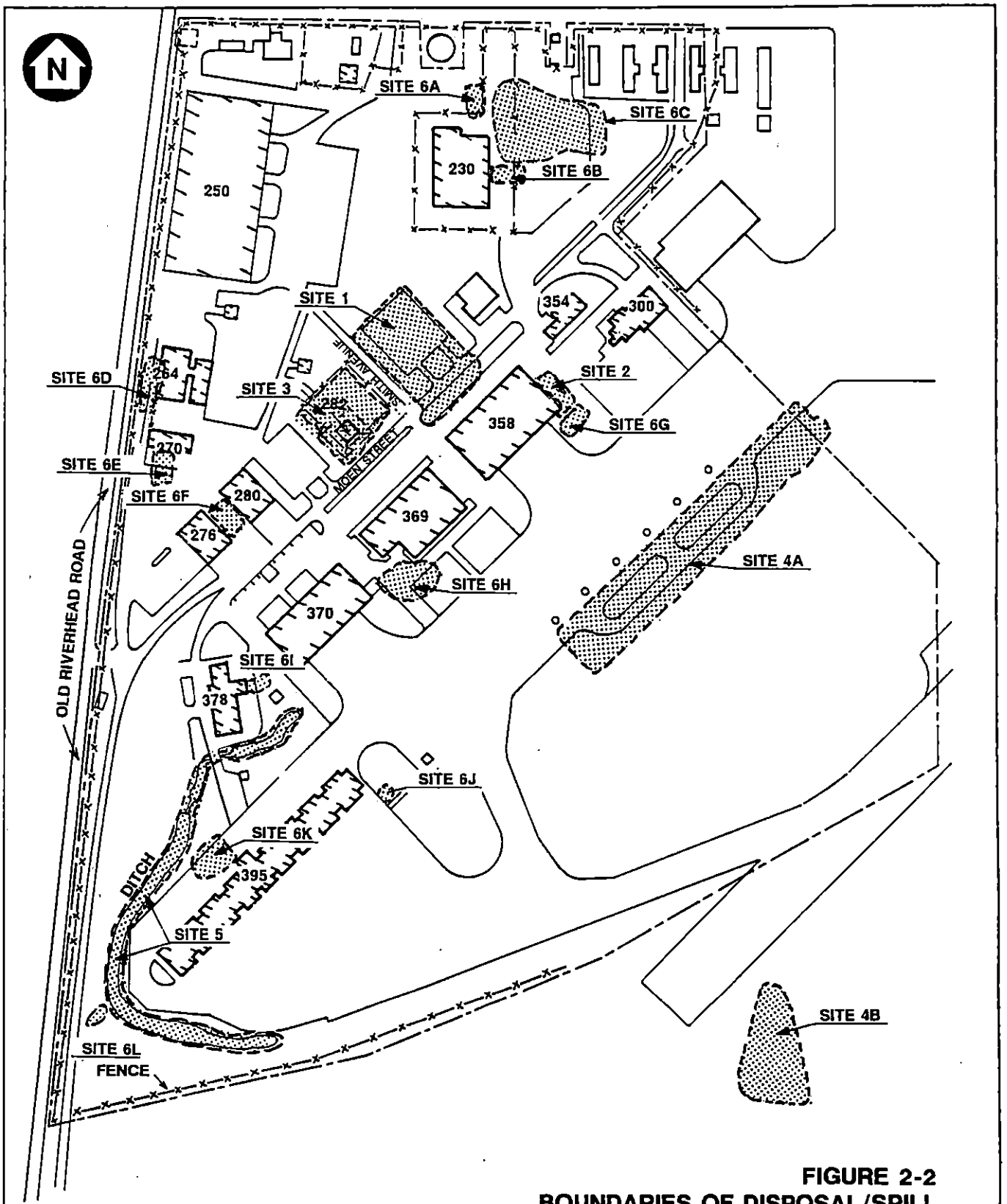


FIGURE 2-2
BOUNDARIES OF DISPOSAL/SPILL INVESTIGATION SITES
SITE INVESTIGATION
SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

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Site 5: Southwest Storm Drainage Ditch. This site is the drainage swale that lies east and west of Building 395. The ditch is located just off the paved areas surrounding the building.

Sites 6A through 6L: Cesspool/Septic Tank Survey. This survey is actually a composite of cesspools, septic tanks, and two dry wells that receives discharges from several buildings or individual buildings where industrial and/or equipment maintenance activities occurred (Table 2-1).

2.2 PREVIOUS STUDIES

Several investigations were conducted at SCANGB, including the records searches by HMTC from January 27 to 29, 1986, and by Dames and Moore from August 4 to 6, 1986. The records searches involved the following activities:

- an on-site visit, including interviews with nine base employees
- acquisition and analysis of information and records on hazardous materials used or potentially generated, and the disposal of those wastes
- review of available chemical and physical data regarding the site
- identification of sites at SCANGB that have the potential to be contaminated with hazardous materials

The records searches indicated certain areas and facilities that had potential for hazardous material releases. These sites, highlighted in the HMTC records search report as needing further investigation, are summarized in Subsection 2.1.

2.3 GEOLOGY AND HYDROGEOLOGIC SETTING

Topography at SCA is generally flat with subtle rolling terrain and steeper stream channels that flow primarily due south (U.S. Geological Survey, 1956). Topography is primarily a function of geology in the region. The airport is located on a glacial outwash plain south of the Ronkonkoma Moraine, which forms the long east-to- west trending ridge visible from SCA. Glacial outwash materials form the surface geology and surface features at the airport. Based on data from explorations at the FTA (see Figure 2-1) and from published reports, these sand and gravel deposits are approximately 100 to 200 feet thick at the site, increasing in thickness to the south (Figure 2-3).

Surface soils at the site belong to either the Riverhead-Plymouth-Carver Association or the Plymouth-Carver Association, the latter comprising approximately 95 percent of the soils at SCANGB (Warner et al., 1975). As their names suggest, these soil associations are similar, with only subtle variations between the separate units. The soils can be characterized as deep, excessively well drained, fine- to coarse-textured loamy sands over thick layers of stratified coarse sand and gravel. These glacially generated soils have very low moisture capacity and are generally not suitable for agricultural purposes, supporting only selected natural vegetation.

Published data indicate that a clay unit termed Gardiners Clay lies beneath the glacial deposit and pinches out north of SCA. However, this unit was not encountered in any borings completed during previous investigations at the site (one boring was advanced to a 155-foot depth). This clay unit reportedly consists of a 40-foot-thick layer of green and gray clay, silt, and clayey or silty sand with some clayey gravel. The unit has a low bulk hydraulic conductivity and tends to confine water in the underlaying aquifer.

TABLE 2-1
LIST OF CESSPOOLS AND SEPTIC TANKS
TO BE SURVEYED

SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY AIR NATIONAL GUARD BASE

SITE DESCRIPTIONS	BUILDING	CESSPOOLS/SEPTIC TANKS/DRY WELLS
6A	230	Oil and Mud Trap and 2 attached cesspools, 11,500 gallons each
6B	230	1 septic tank (3,000 gallons) and attached cesspool(11,500 gallons)
6C	218, 220, 222, 329	1 septic tank (unknown capacity) 8 cesspools
6D	264	2 cesspools (unknown capacity)
6E	270	1 cesspool (2,310 gallons)
6F	276	1 septic tank (897 gallons) and attached cesspool (3,384 gallons)
6G	358	1 septic tank (3,840 gallons) and 2 attached cesspools (13,356 gallons each)
6H	370	5 cesspools (12,690 gallons) shared with Building 369
6I	378	1 septic tank (2,229 gallons), 1 cesspool (5,875 gallons), and 1 dry well
6J	395	1 dry well
6K	395	1 septic tank (1,000 gallons) and 3 attached cesspools (3,000 gallons each)
6L	395	1 abandoned septic tank (unknown capacity) and 1 abandoned cesspool (unknown capacity)

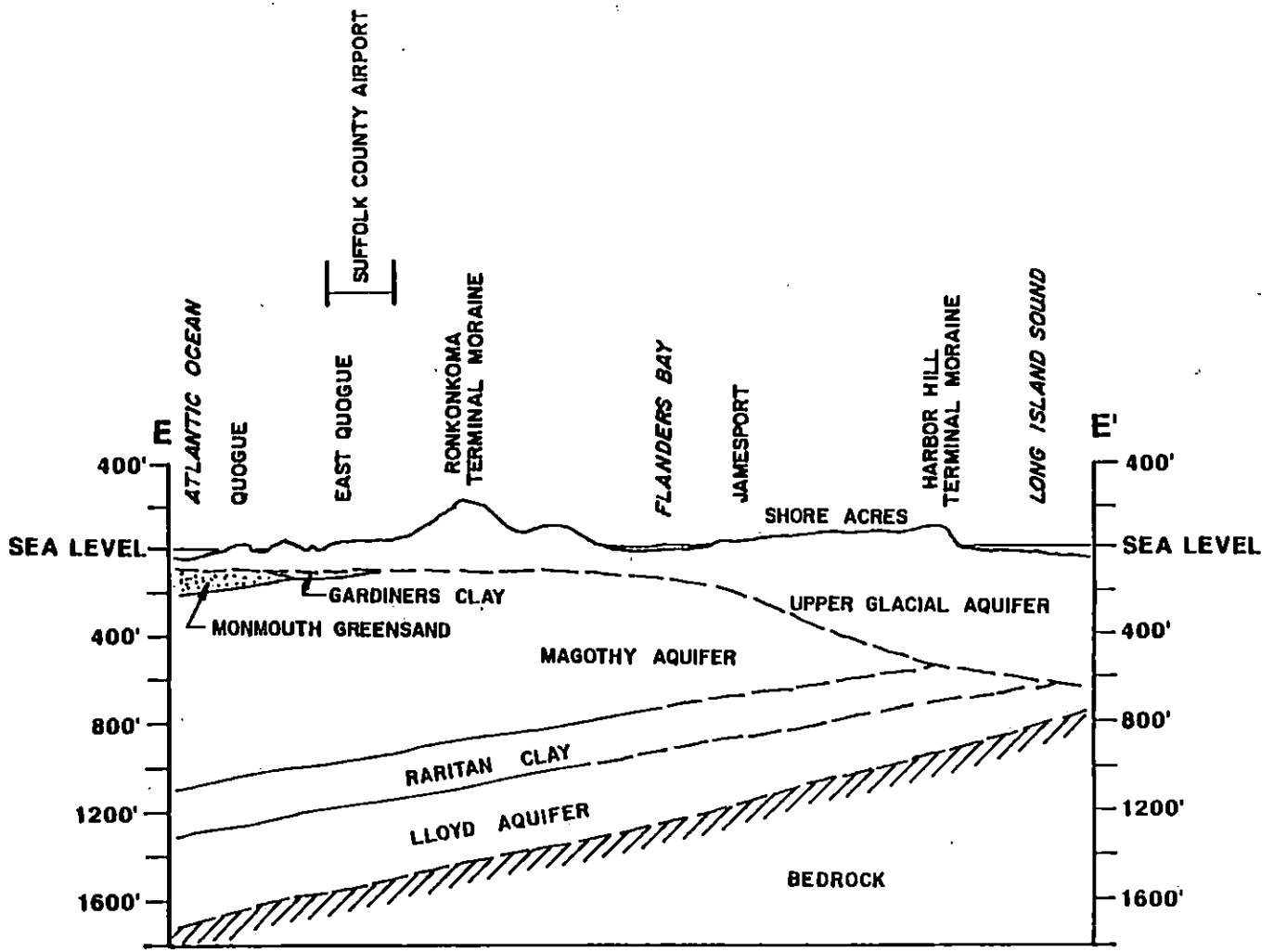


FIGURE 2-3
REGIONAL STRATIGRAPHY BENEATH SUFFOLK COUNTY AIRPORT
SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

SOURCE: HYDROGEOLOGY OF SUFFOLK COUNTY, LONG ISLAND, NEW YORK, U.S.G.S. PUBLICATION.

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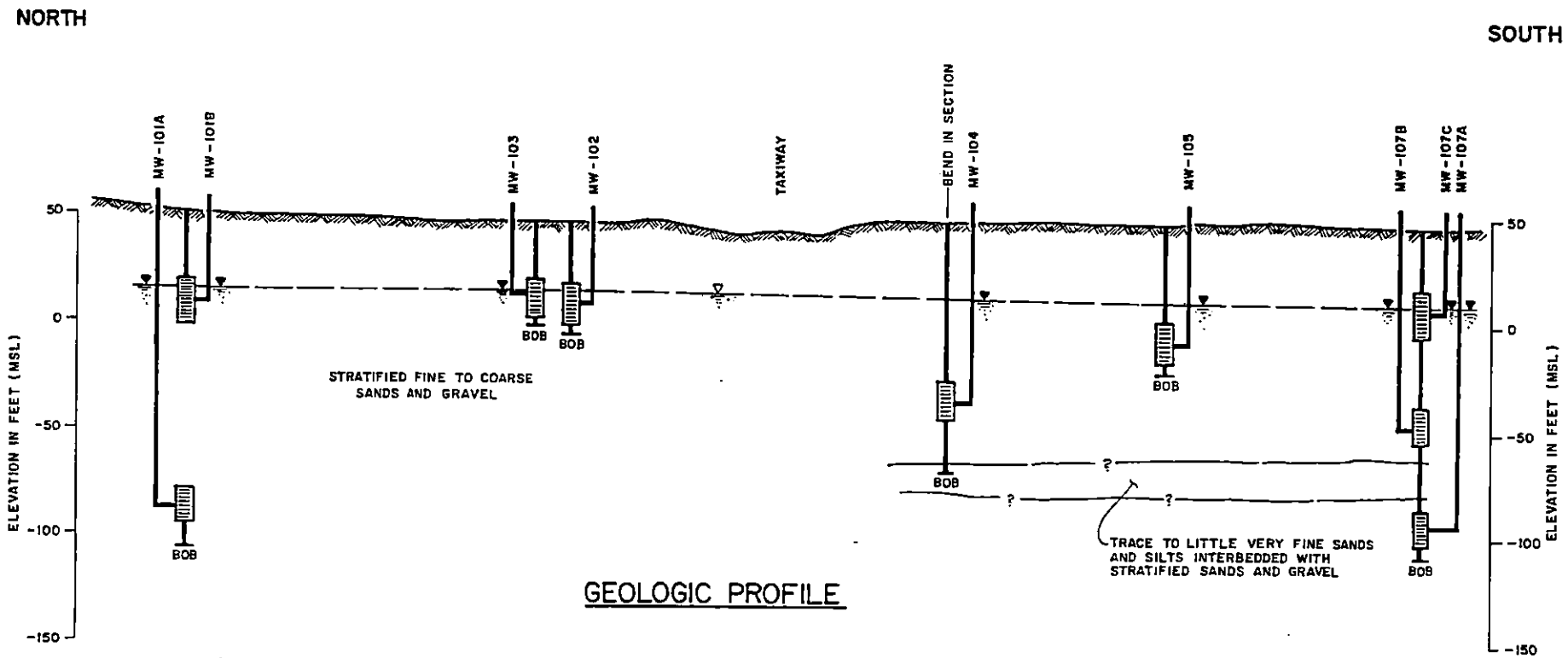
Underlying these deposits is the Magothy Formation and the Raritan Formation (consisting of a clay layer underlain by the Lloyd Sand member). Bedrock encountered in two borings 18 miles west of the airport indicates that bedrock depth is about 1,600 feet below ground surface. The bedrock consists of Precambrian or Cambro-Ordivician Age, dense schists, gneiss, or granites.

The geohydrology or groundwater hydrology beneath SCA can be summarized as consisting of five units acting as alternating aquifers and aquitards (Jensen and Soren, 1974). The uppermost unit (i.e., glacial outwash sands) is the highest yielding and most accessible aquifer. This highly permeable unit is widely used for drinking water supplies in the area, and is also the most susceptible to contamination from surface sources. The risk assessment conducted at the FTA indicates that there are no known drinking water wells located immediately south of SCANGB. The underlying unit, the Gardiners Clay, is considered an aquitard; it separates the surficial outwash materials from the underlying Magothy Formation aquifer. The Magothy Formation is considered an important alternate aquifer to the outwash aquifer.

Depth to groundwater at the site varies from approximately 5 feet at the southern end of the base, to 35 to 40 feet at the highest ground surface elevations. The groundwater elevations equate to a range of elevations from 15 to 20 feet above Mean Sea Level (MSL) (Suffolk County Department of Health Services, 1985). The upper glacial soils are highly permeable; however, flow rates are primarily controlled by the generally low horizontal groundwater gradients.

The aquifer of primary concern in the SI is the glacial outwash aquifer. This aquifer directly receives leachate from any ground surface contamination and surface water bodies in the area. The two major surface water drainages are Aspatuck Creek (south of SCA) and Quantuck Creek (southeast of SCA). Located just southeast of SCA is the Old Ice Pond, which is connected to the Quantuck Creek system. Surface water drainage from the 70 acres comprising SCANGB flows primarily to Aspatuck Creek.

Jordan completed soils borings for monitoring well installations in 1986 and 1989 at the FTA. Several of the borings were completed to over 150 feet deep. Soil boring logs contained in the appendices of the final site characterization report indicate that the soils encountered at the site consist of stratified, current-bedded, fine-to-coarse sands and gravels (E.C. Jordan Co., 1989a). The glacial outwash unit was the only soil unit encountered in all borings at the site. An interpretive cross section is shown in Figure 2-4. Results of groundwater flow studies at this site indicate that flow is approximately 300 feet per year. This velocity should be used only as an approximate value for the base, because flow velocity is highly dependent on groundwater gradients, which may vary.



GEOLOGIC PROFILE

LEGEND

MW-101	MONITORING WELL LOCATION
	GROUND SURFACE
	OBSERVED WATER LEVEL (FEET, MSL) APRIL 1, 1987
	WELL SCREEN
BOB	BOTTOM OF BORING

GEOLOGIC DESCRIPTION:
GLACIAL OUTWASH DEPOSITS OF STRATIFIED FINE TO COARSE SAND AND GRAVEL

NOTE: PROFILE IS BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE EXPLORATIONS AT THE FIRE TRAINING AREA AT SUFFOLK COUNTY AIRPORT. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.

SCALE IN FEET
0 50 100 200
VERTICAL EXAGGERATION 2:1

SOURCE: FINAL SITE CHARACTERIZATION REPORT, SUFFOLK COUNTY AIRPORT FIRE TRAINING AREA; E.C. JORDAN CO., JUNE 1989.

FIGURE 2-4
INTERPRETIVE GEOLOGIC PROFILE
SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

5096-12

E.C. JORDAN CO.

3.0 SITE INVESTIGATION FIELD PROGRAM AND SITE-SPECIFIC BACKGROUND

This section summarizes the SI field techniques and procedures, and describes the site-specific programs.

3.1 TECHNICAL APPROACH

The purposes of the SI are to confirm the presence or absence of contamination at potentially contaminated sites identified in the 1987 HMTC records search, and to provide data that will facilitate future decision-making at each site. With respect to general site conditions, the SI will also assess basewide hydrogeologic conditions to determine potential contaminant migration pathways and potential receptors. This information may also be used for planning and scoping an RI at any site, if necessary.

The SI program was designed using a phased approach, in compliance with ANG policy. The program includes a series of remote sensing, field-screening, and exploratory investigative activities coupled with decision-making points. The decision-making points have been positioned at junctures between field efforts to enable evaluation of current data and possible redirection of future efforts. Each decision point will involve examining the currently available data from each site and planning the next step. If contamination is detected during any step of the screening process, additional explorations may be recommended through an optional exploration program. Sufficient data will be collected so that decisions regarding the fate of a site might be concluded upon completion of the SI phase of the IRP for SCANGB. Table 3-1 is an outline of the phased components of the field program for the SI at SCANGB.

Prior to initiation of field efforts, the available data relative to each site will be reviewed, including previous investigations, published data, boring logs for construction projects at SCANGB, and available utilities and plan maps. Available files pertaining to shipment, storage, use, and disposal of hazardous materials will be reviewed to possibly guide exploration locations. Available historic aerial photographs will also be reviewed before field activities commence. Aerial photographs often indicate areas of activity relating to material storage and handling, location of vehicle and aircraft parking where potential releases may have occurred, and surface features that may influence subsurface migration.

Field efforts will commence with remote sensing or noninvasive types of investigation before implementing intrusive methods. Field analytical techniques (i.e., field-screening) will be used to obtain data to guide SI activities with minimal delay and without remobilization of equipment. Once screening techniques have been performed and evaluated, confirmatory activities will be initiated to verify screening activities. An optional exploration program may be implemented based on results of screening and confirmatory activities.

3.2 FIELD METHODS

Field methods used during SI activities at SCANGB are separated into three phases: screening activities, confirmatory activities, and optional activities. These activities will be completed sequentially with only a brief interim decision period between each phase for evaluation and possible repositioning of confirmatory explorations.

Many of the field methods used during the SI are typical of procedures used at other facilities during preliminary investigations and RI/FS programs.

TABLE 3-1
PHASED APPROACH FOR SITE INVESTIGATION FIELD PROGRAM

SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY AIR NATIONAL GUARD BASE

SCREENING ACTIVITIES

Ground-Penetrating Radar
Soil organic vapor survey
Background soils and groundwater sampling
Permanent piezometer installation
Preliminary elevation survey
Soil borings
Cesspool/septic tank sampling

CONFIRMATORY ACTIVITIES

Soil sampling at boring locations
Surface soil sampling
Sediment sampling
Monitoring well installation
Groundwater sampling
Cesspool/septic tank analytical sampling
Elevation survey

OPTIONAL ACTIVITIES

Soil borings/soil analytical sampling
Monitoring well installation/groundwater analytical sampling
Elevation survey

General descriptions and summaries of the actual methods used in the investigation are discussed in subsequent subsections of this SAP. Detailed methods, descriptions, and practices used in the field and laboratory that are not discussed in the SAP are outlined in the Program Quality Assurance Project Plan (QAPP) prepared for HAZWRAP (E.C. Jordan Co., 1989b). Components of the QAPP that are site-specific at SCANGB are presented in the Site-specific QAPP, (see Appendix B), which refers to sections of the SAP, Program QAPP, and Standard Operating Procedures (SOPs) that describe in detail the methods used in the SI. Specific procedures and methodologies not included in this SAP, the Program QAPP, or the Site-specific QAPP are considered either proprietary information or unique or novel methods or technologies that will be available as SOPs to field personnel during implementation of this SAP.

3.2.1 Screening Activities

Screening activities at SCANGB will consist of six field activities using extensive screening techniques. The screening techniques will be used to locate confirmatory explorations and sample locations.

The first field effort will commence with Ground-Penetrating Radar (GPR) to locate buried utilities or other subsurface objects that may pose a hazard where intrusive activities are expected to occur. These areas will be highlighted and physically marked on the surface to guide subsequent explorations. Next, a Soil Organic Vapor (SOV) survey will be conducted at most sites to provide contaminant distribution information necessary to select locations of soil borings and confirmatory monitoring wells. Following the SOV survey, piezometers will be installed at six locations across the base. The borings will be advanced without soil sampling to a depth of 15 feet into the saturated zone. The piezometers will be installed and an elevation survey will be conducted to determine direction of groundwater flow across the base. Samples of the sediment and liquid from the cesspools or septic tanks will be collected to determine which ones warrant confirmatory activities. These samples will be field-screened to evaluate the potential for contamination by various compounds and metals. Finally, soil borings will be completed in the potential source areas to assess possible contamination by field-screening soil samples collected from the borings. At Site 5, sediment samples will be field-screened to determine the location of soils borings. Field analyses will be conducted with Level II Data Quality Objectives (DQOs) (HAZWRAP, 1988).

3.2.1.1 Ground-Penetrating Radar. A GPR survey will be conducted at every site except Site 4B, which is not located near buried objects. The primary objective is to locate utilities and other subsurface hazards and obstructions before intrusive explorations begin.

The GPR technique uses high-frequency radio waves to determine the presence of subsurface objects and structures. Energy is radiated downward into the subsurface from an antenna that is pulled slowly across the ground at speeds varying from approximately 0.25 to 5 miles per hour, depending on the amount of detail desired and the nature of the target. The radio-wave energy is reflected from surfaces where there is a contrast in the electrical properties of subsurface materials. These surfaces may be naturally occurring geologic horizons (e.g., soil layers, changes in moisture content, and voids and fractures in bedrock) or manmade structures (e.g., buried utilities, tanks, and drums). The signal of the reflected energy is processed and displayed as a continuous strip-chart recording of distance versus time (where time can be thought of as proportional to depth). Interpretation of the GPR recordings enables determination of the depth, size, and location of various buried targets. SOPs for geophysical methods will be available to field personnel.

It is anticipated that the GPR survey at each site will average approximately 5 to 6 hours; however, actual time will vary depending on the number of

subsurface features encountered and the area to be covered. The GPR survey will be conducted by a Jordan geophysicist and the site geologist. The geologist will indicate possible areas to be investigated, and the geophysicist will survey those identified areas. Any subsurface features detected will be marked on the surface by pin flags or spray paint.

3.2.1.2 Soil Organic Vapor Survey. An SOV survey will be conducted at Sites 1 through 4. Actual SOV sampling locations will be determined in the field based on the GPR survey, historical information, and field conditions. The SOV samples will be collected by driving a hollow-stem probe into unsaturated soil to an approximate depth of 5 feet. Actual probe depth will be determined in the field, dependent on site conditions such as soil type, location of underground utilities, source of potential contamination, and types of contaminants expected. Once the probe is situated, a tube connected to a suction pump will be attached to the probe and the probe will be pulled back 1 to 2 inches. The pump will be used to pull a sample of soil vapor into the tube, which will be extracted from the tube with a syringe before it reaches the pump.

The samples will be analyzed using a gas chromatograph (GC) equipped with a flame ionization detector (FID)-electron capture detector (ECD). Fuel product constituents such as benzene, toluene, and xylenes, and chlorinated solvents such as trichloroethylene, tetrachloroethylene, dichloroethylene, and 1,1,1-trichloroethane, will be used as standards for calibration of the GC. Data plotting and evaluation in the field will be accomplished using personal computers (PCs) and application-specific software where appropriate. Jordan SOPs describing the specific details of the procedures to be used will be available during the field program.

The SOV survey program is anticipated to be completed in approximately eight days.

3.2.1.3 Background Soil and Groundwater Sampling. Soil borings will be completed and three upgradient monitoring wells will be installed in two locations on the northern perimeter of SCANGB. These borings and wells will serve the following purposes:

- Soil samples will be collected at three depths in the soil boring: at the ground surface, the groundwater table, and an intermediate depth.
- An additional surface soil sample will be collected to yield a total of three locations for background surface soil samples.
- The seven soil samples will be submitted to the laboratory for analysis to confirm the field-screening results and to provide data on background concentrations of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals to use for comparative evaluations of the data generated during the SI.
- Soil samples will be screened for VOCs, SVOCs, and metals. VOCs and SVOCs will be field-screened using a GC equipped to detect and quantify target compounds. Metals will be screened using X-ray fluorescence. The six samples will be used to establish ambient background levels for soils at the base. These background levels will be used as a criterion for determining whether any subsequent soil or sediment sample collected and screened for any of the three parameters is considered contaminated. Specifically, these parameters will be assessed during the cesspool/septic tank survey (see Subsection 3.2.2.6).

The upgradient monitoring wells will consist of a single water table well at one location, and a water table/deeper well pair at the other location at Building 230 (Figure 3-1). The deeper monitoring well will be advanced without sampling to a depth of at least 10 to 15 feet below the bottom of the screened section of the shallow monitoring well. The monitoring well will be installed in the same manner as the shallow monitoring well, except that the deeper well will be sealed 10 to 15 feet below the screened section of the shallow well. Upon completion of these wells (see Subsection 3.2.2.4), the groundwater will be sampled and screened for the same parameters as the soils (i.e., VOCs, SVOCs, and metals). Similarly, background levels for the groundwater will be established for comparative analyses of all other groundwater screening samples.

The background values will also be used to determine whether drill cuttings and fluids are considered contaminated. The level of contamination of drill cuttings and fluids may differ from that established for soils and groundwater; however, the level established will be used to determine whether cuttings or fluids should be containerized. Cuttings and fluids will be field-screened. Cuttings and fluids that contain target VOCs greater than 10 parts per million above background levels will be sampled for laboratory analyses and containerized. If cuttings and fluids are containerized, they will be placed in 55-gallon drums and the contents will be marked. Final disposition of the drums is the responsibility of the SCANGB Environmental Coordinator.

3.2.1.4 Permanent Piezometer Installation. Installation of six permanent piezometers is planned for the SI at the appropriate locations shown in Figure 3-1. Exact locations of the permanent piezometers will be selected after clearing based on GPR and SOV data. Piezometer borings will be advanced between 10 and 25 feet below the water table using 4.25-inch inside diameter (ID) hollow-stem augers. No soil samples will be collected during boring advancement. Visual soil descriptions will be obtained from the auger flights.

Construction details of the permanent piezometers are illustrated in Figure 3-2. Permanent piezometers will be constructed of 5-foot-long, 2-inch ID flush-jointed Schedule 40 polyvinyl chloride (PVC) piezometer tips with 0.008-inch slotted openings. The piezometer tips will be installed so that the tops of the slotted sections are below the water table. A silica sandpack will be used to backfill the annulus around all piezometer tips to a depth of at least 2 feet above the top of the slot openings. The annular space above the sandpack will be backfilled with a layer of bentonite pellets (3 feet thick), which will be hydrated after installation. The remainder of the annulus will be backfilled with VOLCLAY or another equivalent high-solids bentonite grout.

A protective casing with locking cover (4-inch ID and 6 feet long) will be installed in locations where an aboveground installation is required. Some aboveground installations may require steel/concrete bucking posts, as shown in Figure 3-3. Some observation/monitoring wells will require flush-to-the-ground (i.e., flush-mounted) installations, as shown in Figure 3-4. The flush-mounted protective casing will be a Morris Flush Mount Box or an approved equivalent.

The permanent piezometer will be installed to obtain hydrogeologic information for the site. Confirmatory monitoring wells will be installed to obtain groundwater samples for analyses. Water levels will be measured in the permanent piezometers and the monitoring wells that were installed during subsequent activities at SCANGB to develop a water level measurement data base. The permanent piezometers will not be used to obtain groundwater samples for laboratory analyses.

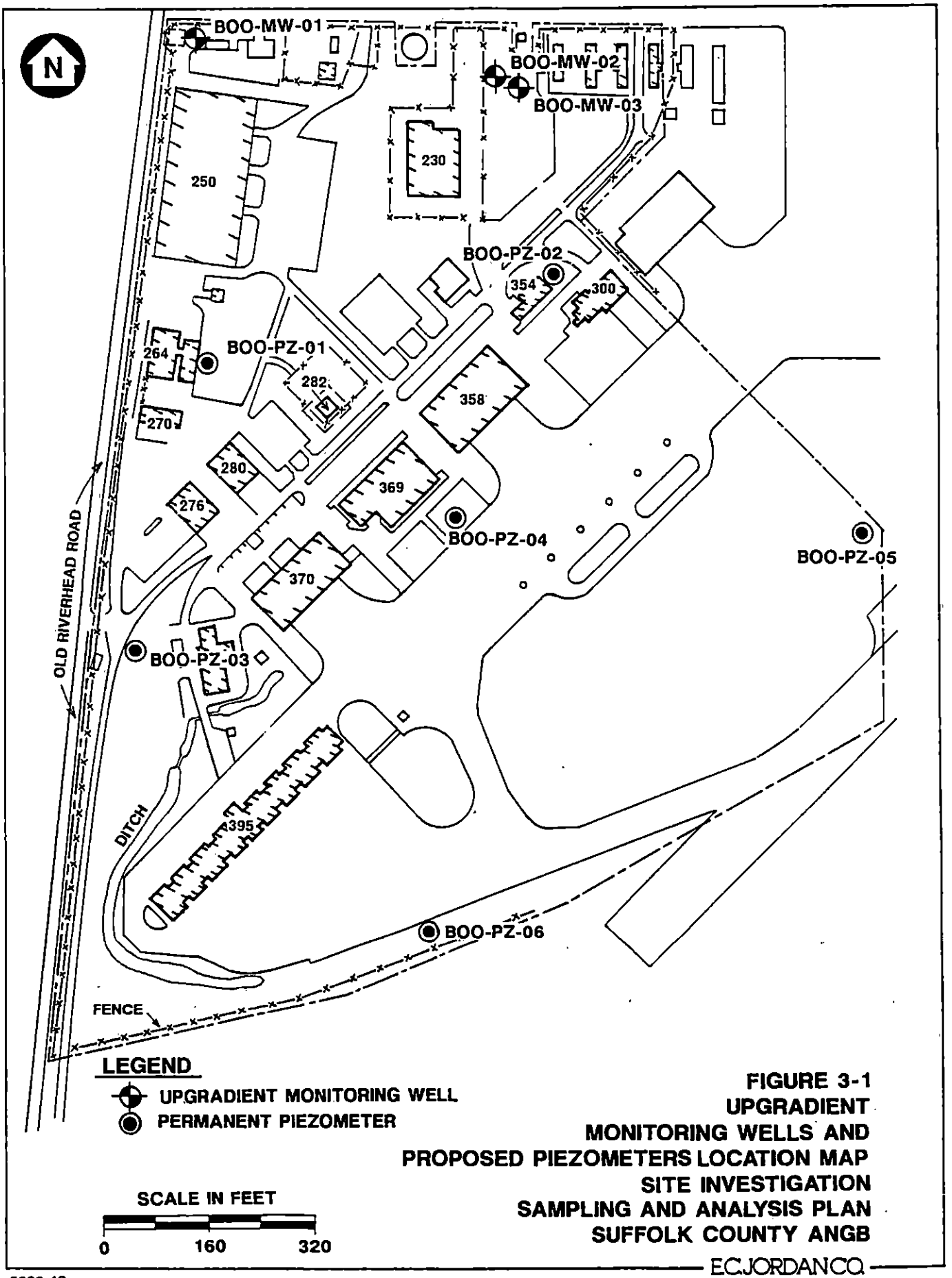


FIGURE 3-1
UPGRADIENT MONITORING WELLS AND PROPOSED PIEZOMETERS LOCATION MAP
SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

ECJORDANCO

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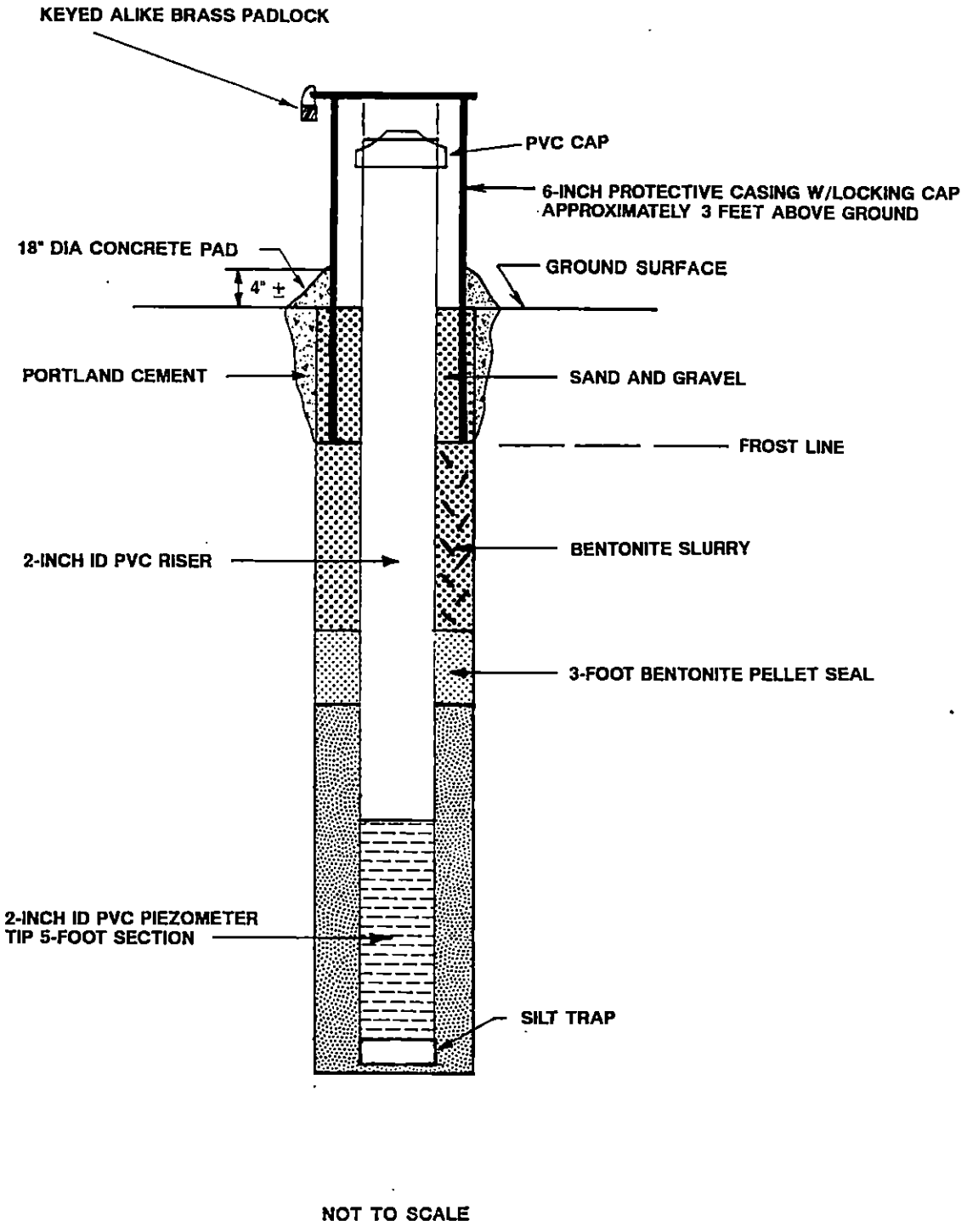
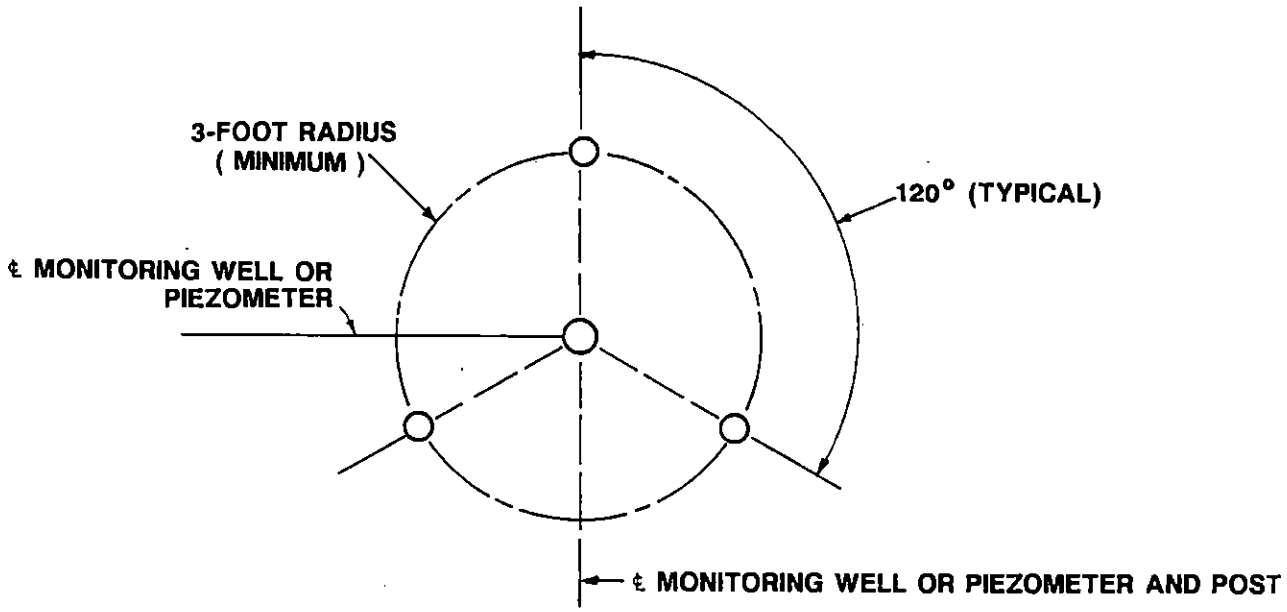
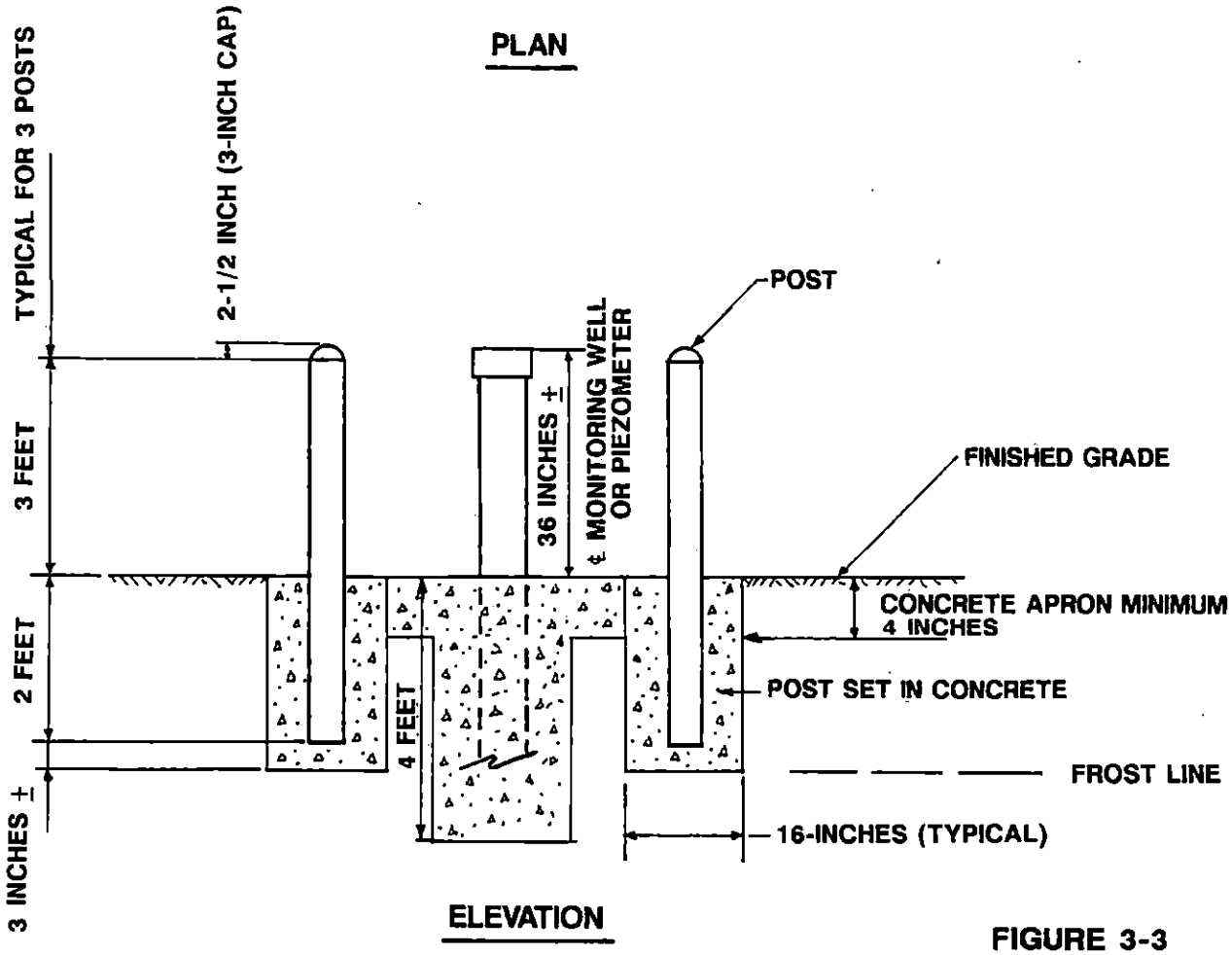


FIGURE 3-2
PERMANENT RAISED PIEZOMETER INSTALLATION DETAIL
SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

ECJORDANCO



PLAN



ELEVATION

NOTE SEE FIGURE 3-2 FOR TYPICAL INSTALLATION DETAIL

FIGURE 3-3
PLAN VIEW OF PIEZOMETER/MONITORING WELL BUCKING POSTS
SITE INVESTIGATION AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

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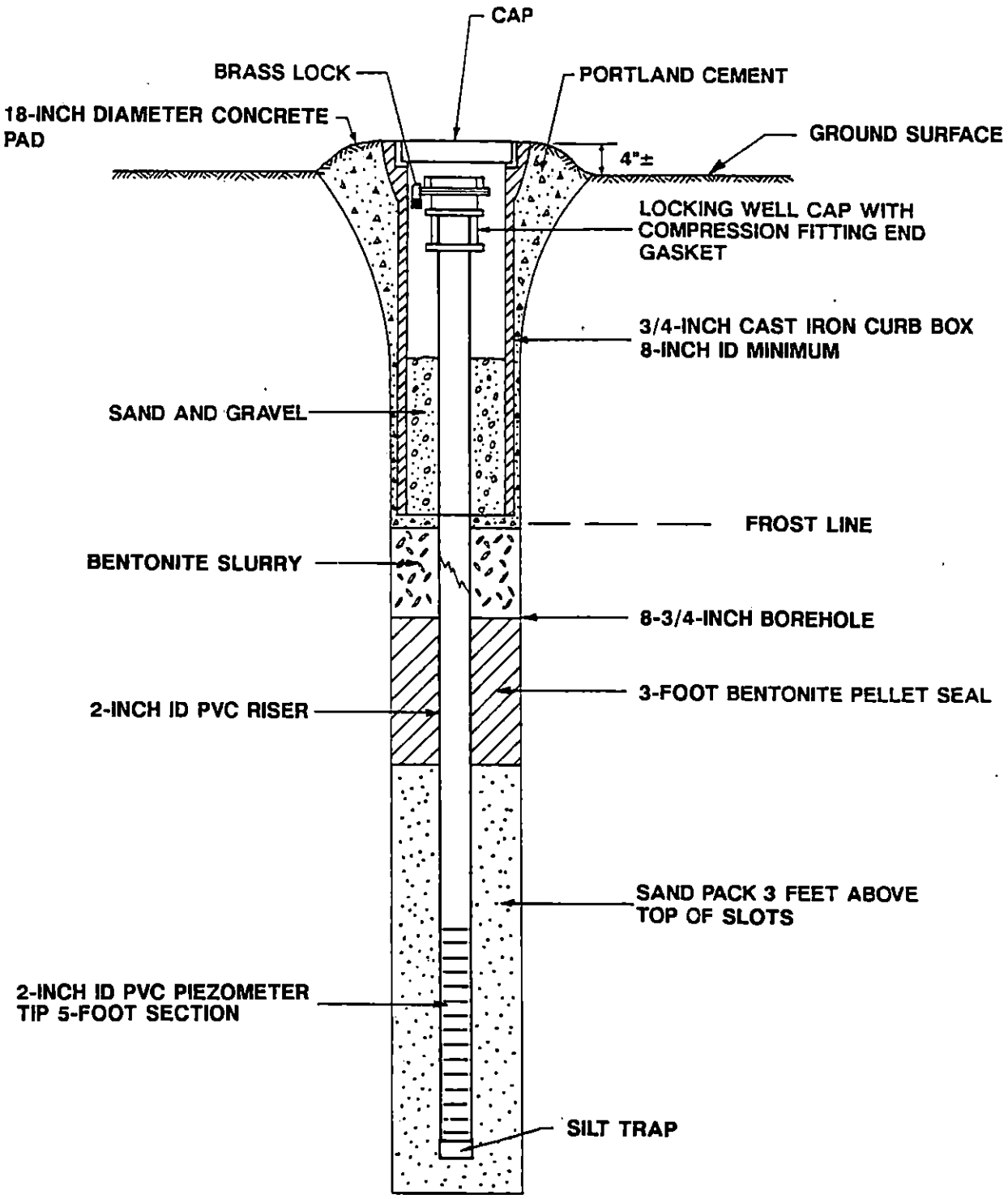


FIGURE 3-4
PERMANENT PIEZOMETER FLUSH-MOUNT INSTALLATION DETAIL
SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

NOT TO SCALE

A data management system for tracking and identifying explorations and samples will be used during the SI. Exploration identifiers are illustrated for each site in Figure 3-1, as well as in the figures cited in Subsection 3.3. Permanent piezometers will be designated with the prefix PZ (e.g., B01-PZ-01); monitoring wells with the prefix MW (e.g., B01-MW-01). The Program QAPP contains detailed discussions of Jordan's data management system.

Ambient air will be monitored during site operations for VOCs using a photoionization detector (PID). Work conducted at the site is anticipated at Health and Safety Level D protection (see Appendix A). Samples of drill cuttings and fluids generated during the drilling phase will be screened with the on-site GC. Based on background levels established in upgradient background locations, it will be determined whether drill cuttings and any fluids should be containerized.

3.2.1.5 Preliminary Elevation Survey. Upon completion of the permanent piezometer installations, Jordan or an approved subcontractor will conduct a preliminary elevation survey. Ground surface and the top of PVC riser pipes will be surveyed to a U.S. Geological Survey (USGS) benchmark previously established by the surveying subcontractor. The elevation survey will be conducted to calculate groundwater elevations from water levels observed in the piezometers and upgradient monitoring wells. The groundwater elevation will be used to prepare a groundwater potentiometric map to interpret groundwater flow directions across the site. These data will be used for locating subsequent monitoring wells.

3.2.1.6 Soil Borings. Soil borings will be conducted at every site, and potentially at every cesspool/septic tank survey location. Soil borings will be completed to collect samples of subsurface soil for the following purposes:

- o visual classification
- o field-screening
- o laboratory analysis based on the field-screening

A total of 24 soil borings is proposed for completion at Sites 1 through 5. Another 16 optional soil borings may be completed if contamination is present in the initial borings. Soil borings will be located based on historical data, the GPR and SOV surveys, and groundwater flow direction. Borings will be advanced through the unsaturated zone until groundwater is encountered. Split-spoon samples will be collected at maximum 5-foot intervals. The stainless steel split-spoon sampler will have a 1.75-inch ID and will be driven with a 140-pound hammer dropped 30 inches, in accordance with American Standards and Test Methods (ASTM) D-1586 Standard Penetration Testing. The split-spoon will be removed from the boring and opened; the soil sample will be visually inspected, logged, and sampled by an on-site geologist. The sample will be screened with a PID for VOCs and then placed in a field-screening bottle, analytical container(s), and a reference container. The sample for screening will be immediately transported to the on-site GC and screened for the target VOCs (see Subsection 3.2.1.3). If a significant level of contamination is detected from the field-screening, the associated analytical sample will be a candidate for Contract Laboratory Program (CLP) analysis. In instances where more than one field-screened sample indicates potential contamination, the samples from the depth with the highest level of potential contamination will be submitted for analyses. If the screening analyses do not detect contamination in the boring, a sample collected at the saturated zone will be submitted for analysis. The boring will be advanced to its completion depth, as determined by the on-site geologist.

3.2.1.7 Cesspool/Septic Tank Screening. During the SI work plan kickoff meeting and the subsequent work plan review meeting, 12 separate cesspool/septic tank locations were selected for investigations. Only cesspools and septic tanks at SCANGB that received discharges from buildings

housing base industrial and/or maintenance activities are included in these investigations. The locations were based on the 106th Civil Engineering Squadron (CES) knowledge of activities that occurred in buildings that discharged to particular cesspools. Each location may receive discharge from a single or separate buildings. These separate locations consist of one to 15 cesspools, usually one or two septic tanks, or a single dry well hooked up in sequence or as a cluster to distribute discharge at that location. An estimated 47 septic tanks, cesspools, and dry wells at SCANGB receive(d) discharges from various industrial and equipment maintenance locations on the base. Table 2-1 is a complete list of cesspools and septic tanks to be included in the SI. Each set of cesspools and septic tanks will be referred to by its letter designation as part of Site 6 (e.g., Site 6A) (see Table 2-1).

With assistance from personnel of the 106th CES, Jordan personnel will use existing utility maps to locate the cesspools, septic tanks, and dry wells to be investigated. Once these are located and confirmed by GPR, CES personnel will remove the lids or covers to each tank or cesspool, after which the ambient air will be monitored with a portable PID to evaluate whether volatile organic vapors are present in the working zone. Samples of both the liquid and sediment inside the cesspool or tank will be collected and field-screened for VOC, SVOC, and metals constituents. The tank lid will be replaced and the next cesspool or tank sample will be collected.

Field-screening for SVOCs will be conducted similar to VOC screening. A portable GC equipped with an EDC/FID will be used to screen for target SVOCs. Field-screening methodology and target compounds will be described in SOPs, which will be available for review before field activities. Field- screening for metals will be conducted using a portable X-ray fluorescence analyzer to scan samples for selected target metals. Field-screening methodology and target compounds will also be described in SOPs.

Screened auger borings will be completed at cesspool and septic tank locations indicating no detection or detection of target compounds in the sediment or liquid screening samples. The screened borings will be completed with a screened lead auger at least 4.25 inches in diameter. The screened section of the auger will consist of stainless-steel monitoring well screens, with 0.010-inch screen slots as an integral part of the lead auger, or laser-slotted openings. The augers will be advanced without any sampling until the augers have penetrated the groundwater table. A water level measurement will be taken inside the auger and a submersible pump will be lowered into the auger for development. The pump will be removed once the development water is no longer turbid or when a minimum of three to five well volumes has been removed. A stainless-steel bailer will be lowered into the auger to collect the actual screening sample.

3.2.2 Confirmatory Activities

Confirmatory activities consist of methods that confirm the findings of screening activities. Most confirmatory activities consist of sampling and laboratory analyses. Laboratory analyses will be conducted at Level IV DQOs to precisely define and quantify the presence or absence of contamination at each site. The confirmatory data can be used to conduct a preliminary risk assessment or an FFS, or to write a DD or serve as the basis for an RI/FS work plan.

Confirmatory activities consist of sampling soils, sediments, and water for laboratory analyses. Soil samples will be collected at the surface from borings. Sediment and water samples will be collected from cesspools and septic tanks that indicated potential contamination in field-screening samples. Monitoring wells will be installed and confirmatory groundwater

samples will be collected for laboratory analyses. Soil, sediment, and groundwater sampling methods are described in Subsections 3.4.1 and 3.4.2.

Analytical parameters will include USEPA Target Compound List (TCL) VOCs, SVOCs, and USEPA Priority Pollutant (PP) metals. At fuel spill sites (Sites 1 and 4A), analyses for lead will be substituted for PP metals. At the request of the Suffolk County Department of Health Services (SCDOHS), groundwater samples from sites where aircraft de-icing fluids may have been released will be analyzed for ethylene glycol as total glycol using a New York Department of Health colorimetric procedure. Site-specific analyses are discussed in Subsection 3.3.

3.2.2.1 Soil Sampling at Boring Locations. Subsurface soil samples for laboratory analyses will be collected from the soil borings. Soil samples will be collected from the depths at which field-screened samples indicate potential contamination. If the field-screening results do not detect contamination, samples just above the saturated zone will be collected for analyses. When more than one field-screened sample indicates potential contamination, the samples from the depth with the highest level of potential contamination will be submitted for analyses. Specific analyses for each sample are described in the site-specific discussions in Subsection 3.3.

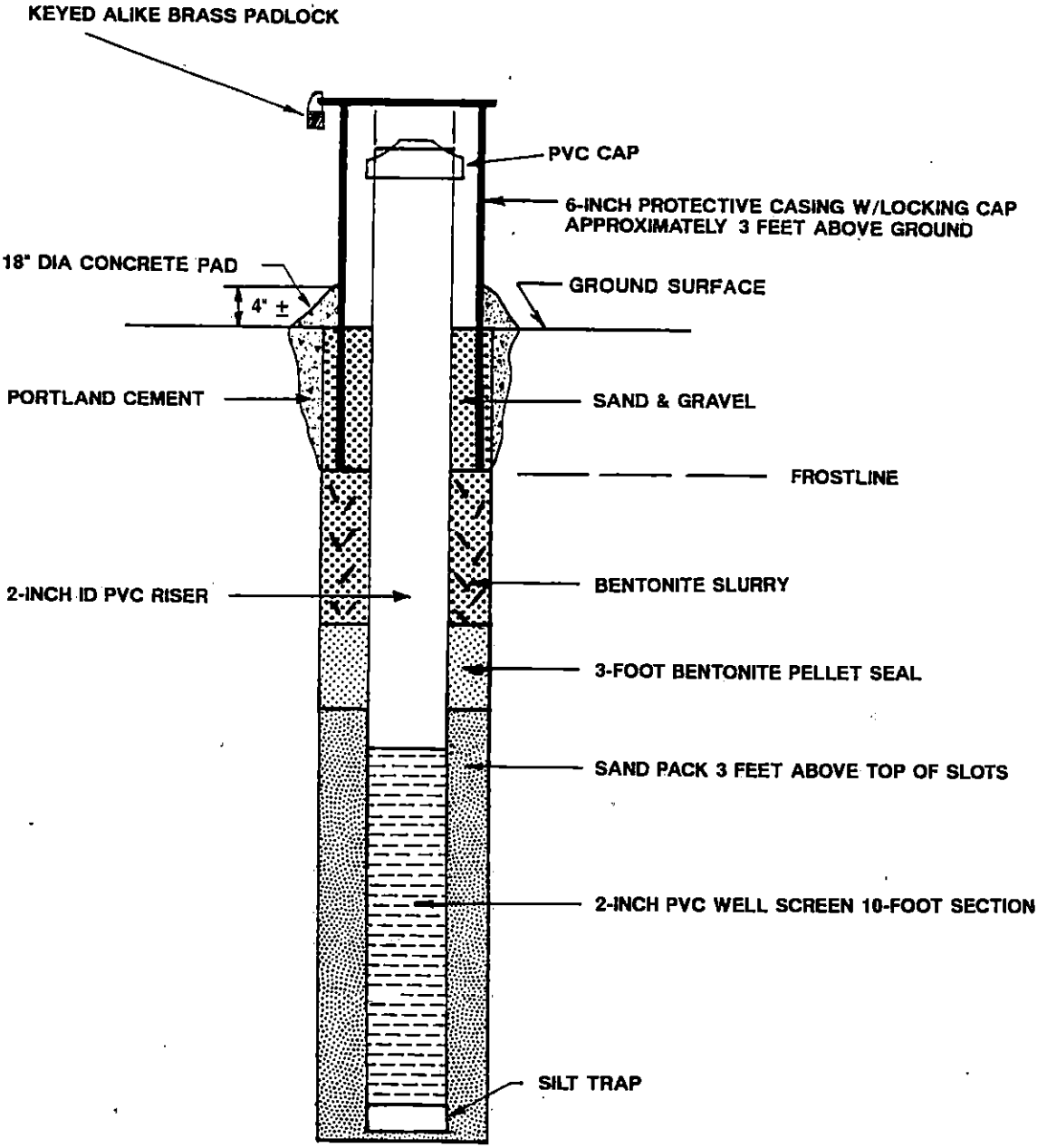
3.2.2.2 Surface Soil Sampling. Surface soil samples will be collected from Site Nos. 1, 2, and 3 and analyzed for the same analytical parameters as the subsurface soil samples at the same site. The samples will characterize risk via direct contact of surface soils and inhalation of particulates at the site. The samples will be collected during the soil boring activities and at boring locations as much as possible. Details concerning surface soil sampling activities are discussed in Subsection 3.3.

3.2.2.3 Sediment Sampling. Sediment samples will be collected in the Ramp Drainage Outfall comprising Site 4B and at the ditch comprising Site 5. Sediment samples will be collected from the top several inches at sediment sampling locations. Site-specific analyses are discussed in Subsection 3.3.

3.2.2.4 Monitoring Well Installation. Monitoring wells will be installed at upgradient locations, Sites 1 through 5, and at the Cesspool/Septic Tank Survey sites (if contamination is detected in cesspools during screening activities) (see Subsections 3.2.1.3 and 3.2.1.7, and Figure 3-1). The monitoring well locations will be determined based on historical data, the GPR survey, SOV data, and soil boring or cesspool/septic tank field-screening data. If no contamination is detected before well installation, the monitoring well will be positioned in a direction downgradient from the suspected source area.

The monitoring well boring will be advanced without sampling to a depth of approximately 10 to 15 feet into the saturated zone. Monitoring well construction details are illustrated in Figure 3-5. The monitoring well will be constructed of 2-inch ID, Schedule 40 PVC pipe with 0.008-inch machine slots. Typically, the slotted section will be 10 feet long; the well screen will be situated so that the slots straddle the water table. A solid 2-inch ID, Schedule 40 PVC riser pipe will extend to or above ground surface. A silica sandpack will be used to backfill the annulus around the well screens to a depth of at least 3 feet above the top of the well screen. The annular space above the sandpack will be backfilled with a minimum 3-foot-thick bentonite pellet seal. Once the installed pellets have been hydrated, VOLCLAY grout or an equivalent high-solids bentonite grout will be used to backfill the remainder of the annular space to the ground surface.

A protective casing with locking cover (4-inch ID and 6 feet long) will be installed in locations where an aboveground installation is required (see Figure 3-5). Some aboveground installations may require steel/concrete



NOT TO SCALE

FIGURE 3-5
TYPICAL RAISED MONITORING WELL INSTALLATION DETAIL
SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

bucking posts (see Figure 3-3). Other installations will require flush-to-the-ground (i.e., flush-mounted) installations (Figure 3-6). The flush-mounted protective casing will be a Morris Flush Mount Box or an approved equivalent. Protective casings will be sealed at the ground surface with a concrete cap.

Once the installation is completed, the monitoring well will be developed using a combination of pumping and purging until the development water is free of sediment. A sample of the groundwater will be collected for GC screening for VOCs to evaluate the potential for groundwater contamination, and whether optional additional monitoring wells should be installed.

3.2.2.5 Groundwater Sampling. To allow the monitoring wells to stabilize, groundwater sampling will be conducted several weeks after the wells have been developed. Specific analyses scheduled for each well are discussed in Subsection 3.3. Monitoring wells will be sampled using the procedures described in Subsection 3.4.2.

3.2.2.6 Cesspool/Septic Tank Analytical Sampling. Analytical samples will be collected during the field-screening activities, from cesspool and septic tank sediment and liquid, soil from soil borings completed adjacent to the cesspools and septic tanks, or groundwater from screened augers at the bottom of the borings adjacent to the cesspools and septic tanks. Screening results will determine which confirmatory activities will be conducted and which type of sampling will occur. Analytical containers (for laboratory analyses) will be filled any time screening samples are collected. If any screening results indicate the presence of contamination, the associated analytical sample will be submitted for laboratory analysis.

During screening of the cesspools and septic tanks, both screening and analytical containers will be collected for analyses for VOCs, SVOCs, and metals. Depending on whether contamination is detected in the Cesspool/Septic Tank screening phase, a monitoring well will be installed downgradient and a groundwater sample will be collected and submitted as part of the groundwater sampling program (see Subsection 3.2.2.4). If no contamination is indicated by field-screening of cesspool and septic tank samples, a soil boring with screened auger will be advanced to the groundwater table (see Subsection 3.3.6). A confirmatory groundwater sample will also be submitted if contamination is present in the screening sample from the screened auger. A confirmatory soil sample from the soil boring will be submitted for laboratory analysis if contamination is detected by field-screening of soil samples from the soil boring. If contamination is detected by field-screening of soil borings and screened auger samples, then a monitoring well will be installed at the boring location.

3.2.2.7 Elevation Survey. A preliminary survey will be conducted during screening activities to obtain elevations of piezometers. This survey will be conducted to obtain elevations relative to each piezometer, and not to a known datum.

A second survey will be conducted by a New York-licensed survey subcontractor for the piezometers and monitoring wells to obtain elevations to be used in calculating basewide groundwater elevations of the well riser and ground surface relative to MSL. The survey will be tied to existing benchmarks on or near the base. Elevation of the piezometers and monitoring wells will be surveyed to an accuracy of 0.01 foot; the horizontal coordinates to an accuracy of 0.1 foot.

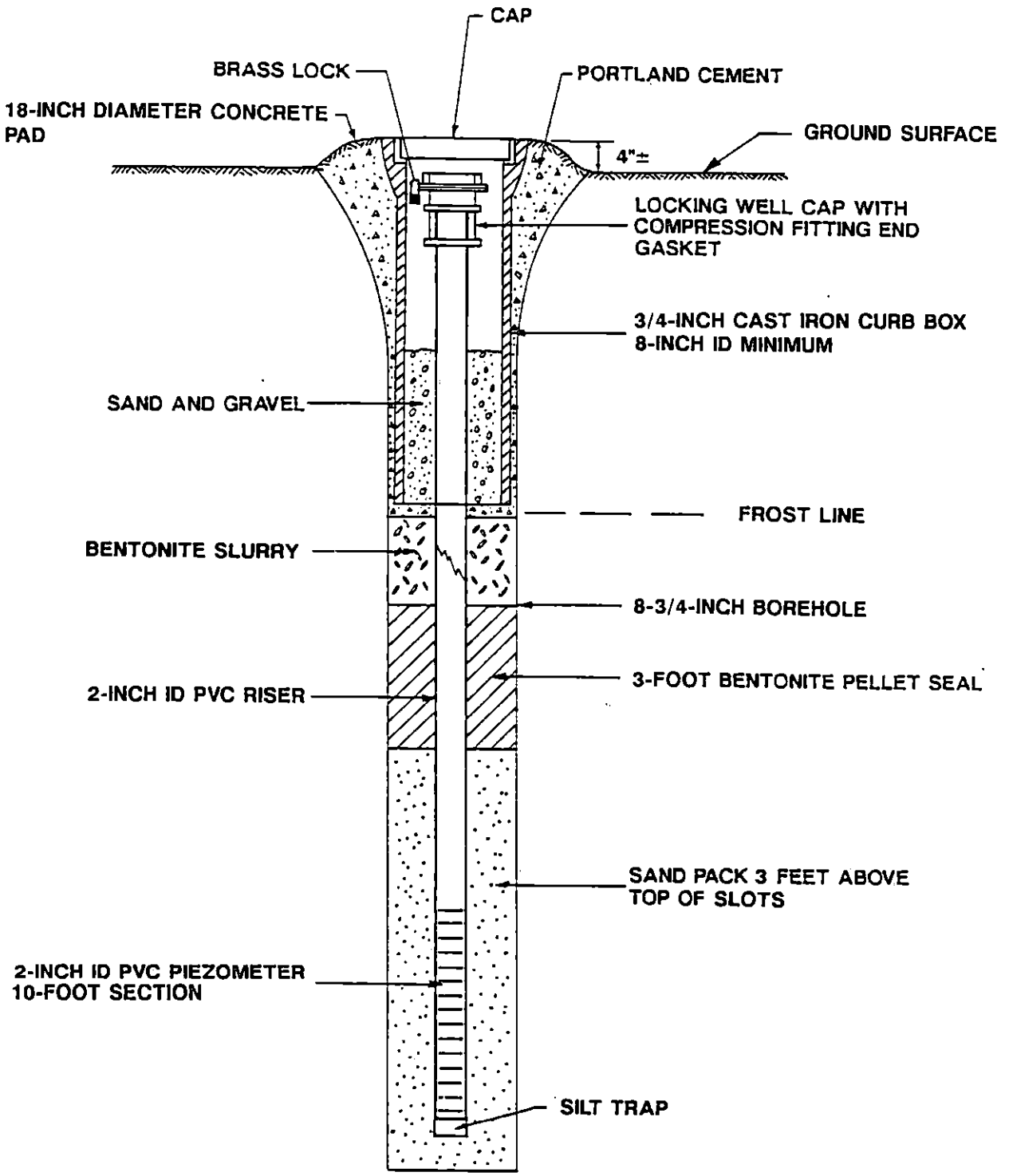


FIGURE 3-6
TYPICAL MONITORING WELL FLUSH-MOUNT INSTALLATION DETAIL
SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

NOT TO SCALE

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3.2.3 Optional Activities

Optional activities consist of additional soil borings or monitoring wells that can be installed if screening data indicate the presence of contamination. The optional soil borings and monitoring wells will be completed and sampled in the same manner as those described in the screening and confirmatory activities (see Subsections 3.2.1 and 3.2.2). Details of the number and type of optional activities are described for each site in Subsection 3.3. An elevation survey will be completed on all optional monitoring wells.

3.3 EXPLORATION AND SAMPLING PROGRAM

This subsection describes site-specific investigation programs and discusses background data from the records search report and recent interviews with base personnel, and also describes field activities and site-specific analyses. Based on available data, the following activities were planned for most sites: GPR survey, SOV survey, elevation survey, soil borings, monitoring well installation/groundwater screening, and soil and groundwater sampling and analysis. Site-specific cesspool and septic tank screening and analytical samples will be conducted at Sites 6A through 6L. Basewide activities, including installation of piezometers and upgradient monitoring wells, and background soil sampling, will be conducted before site-specific activities (see Subsections 3.2.1.3 and 3.2.1.4).

In the following site-specific discussions, tables summarizing screening, confirmatory, and optional activities for each site are presented, along with text describing the planned activities.

3.3.1 Site 1 - AVGAS Spill Site

Site 1 is located north of the corner of Moen Street and Smith Avenue in the center of the SCANGB complex (Figure 3-7). The site consists of an elevated parking lot, two entrance driveways, and a small drainage swale on the southern side of Moen Street. The entire site is approximately 1 acre in size.

3.3.1.1 Site 1 Background. In 1965, a tanker truck parked in the elevated parking lot released a maximum of 5,000 gallons of AVGAS. Little is known about the actual details of the spill except that the fuel may have accumulated in the drainage swale southeast of the parking lot, on the southern side of Moen Street. The AVGAS reportedly ponded in the swale and in the street. No recovery of the AVGAS was attempted, and the fuel dissipated through evaporation and infiltration in the soil.

3.3.1.2 Site 1 Exploration and Sampling and Analysis Program. The activities to be conducted at Site 1 are summarized in Table 3-2. The first field activity will be to conduct a GPR survey, which will clear the subsurface in the area to be investigated for soil gas, soil borings, and monitoring well locations.

An SOV survey will then be conducted to evaluate the possible lateral area of subsurface contaminants in the groundwater. Approximately 20 SOV points (i.e., a one-day survey) will be conducted in the area outlined in Figure 3-7. The first SOV points will be driven in the areas where the AVGAS reportedly ponded; the survey will then proceed radially outward. If an elevated SOV value is detected, points will be added to form a tighter grid. This procedure will be repeated until the trend is identified or the apparent boundaries of the contamination are determined.

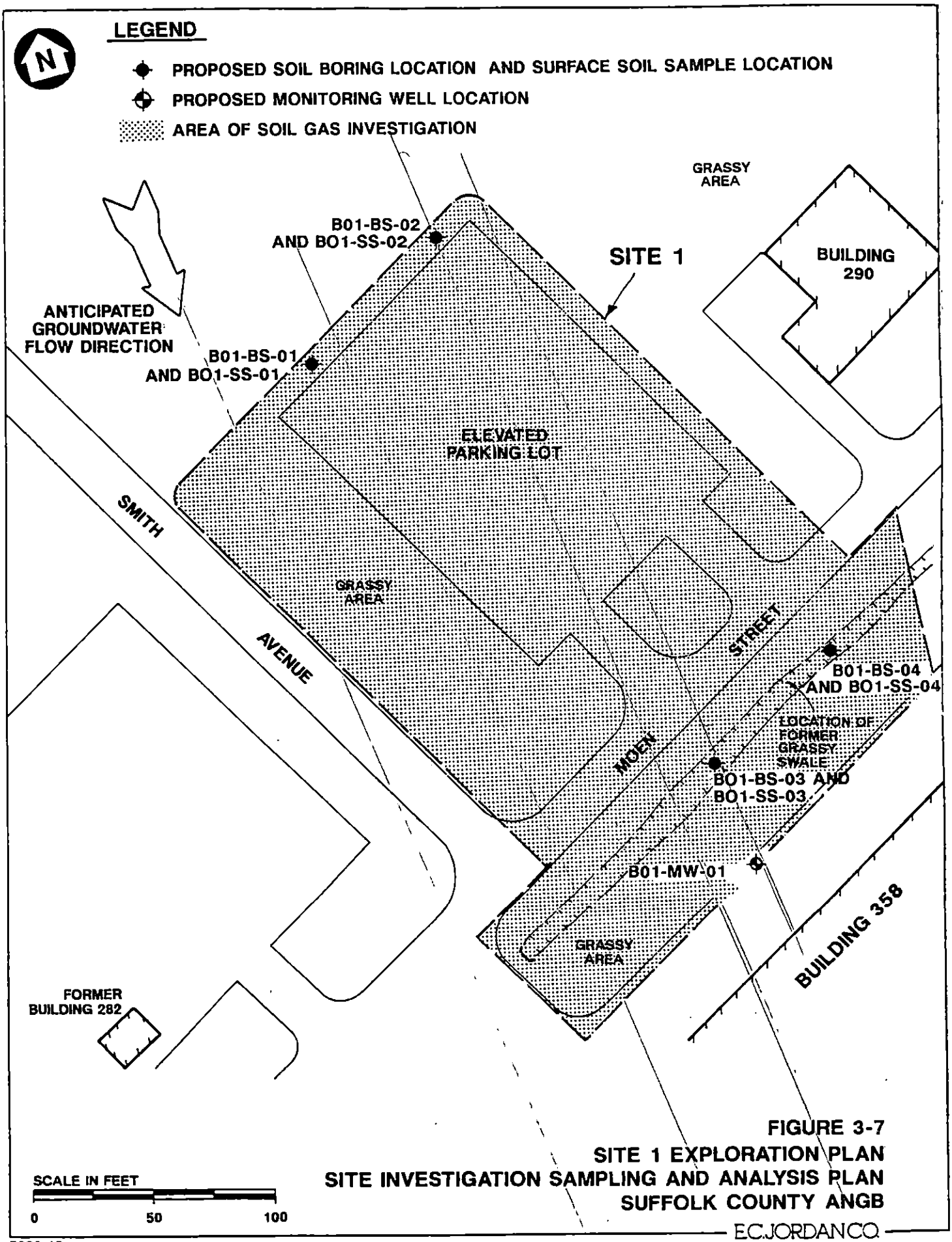


FIGURE 3-7
SITE 1 EXPLORATION PLAN
SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

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TABLE 3-2
SUMMARY OF SITE 1 ACTIVITIES

SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY AIR NATIONAL GUARD BASE

Conduct GPR survey of proposed SOV survey, soil borings, and monitoring well locations to identify utilities and potential hazards.

Conduct SOV surveys in grassy areas surrounding the parking lot and in the ditch across the street.

Complete four borings (two to rear of lot and two in ditch), and field-screen soil samples for VOCs using gas chromatography.

Complete two optional borings between the parking lot and street (i.e., grassy area) if field-screening of soil samples from the initial borings indicate potential contamination.

Install one monitoring well approximately 15 to 25 feet downgradient of the borings in the ditch area, and field-screen water samples for VOCs.

Install one or two optional downgradient wells if contamination is indicated in the initial monitoring well.

Collect at least three surface soil samples for laboratory analyses for TCL VOCs, TCL SVOCs, and lead. Up to six optional subsurface soil samples will be collected for laboratory analyses only if field-screening indicates potential contamination.

Collect at lease one (and possibly one optional) groundwater sample for laboratory analyses of TCL VOCs, TCL SVOCs, and lead.

NOTES:

GPR = Ground-Penetrating Radar
SOV = Soil Organic Vapor
TCL = Target Compound List
VOC = volatile organic compound

EXPLORATION SUMMARY:

4 Soil Borings (2 optional)
1 Monitoring Well (1 analysis) (2 optional)
3 Surface Soil (3 analyses)
6 Optional Subsurface Soil
TCL VOC, TCL SVOC, and lead (all analyses)

Locations of the soil borings will be based on those suggested by the SOV survey. If there are no SOV hits, two borings will be situated within the swale adjacent to Moen Street and two will be situated west of the parking lot (see Figure 3-7). Each soil boring will be advanced by collecting split-spoon samples continuously for the first 10 feet, and then at 5-foot intervals, advancing to the groundwater table.

The soil samples will immediately be transported to the field GC for VOC screening. One subsurface soil sample will be selected from each soil boring for laboratory analysis. Three surface soil samples will be sent to the laboratory for analyses. The soil samples will be analyzed for TCL VOCs, TCL SVOCs, and lead, which are the principal hazardous constituents of AVGAS. If the screening results do not indicate detection of contaminants, one monitoring well will be installed in a downgradient location in the area between Moen Street and the Building 358 parking lot (see Figure 3-7). A sample of the groundwater will be collected for field screening. If VOC contamination is present in the borings, up to two optional soil borings may be completed. Soil samples from the optional borings will be field-screened and, if contamination is detected, samples will be submitted to the laboratory for analyses.

Because AVGAS is less dense than water, it is anticipated that the monitoring well(s) will be installed at the top of the saturated zone. The 10-foot well screen will straddle the water table with 3 feet of the screen above the water table.

The initial monitoring well will be developed using a combination of purging and pumping until the development water is free of sediment or a minimum of three well volumes have been removed, whichever occurs first. The well will then be sampled for field analysis. If results of the screening indicate the presence of contaminants, an optional one or two monitoring wells may be installed under the optional exploration program. If field-screening indicates the initial monitoring well has no contaminants, the exploration program will be considered complete at this site; the monitoring well will be sampled later for CLP analysis. The groundwater sample(s) collected for laboratory analysis will be analyzed for TCL VOCs, TCL SVOCs, and lead.

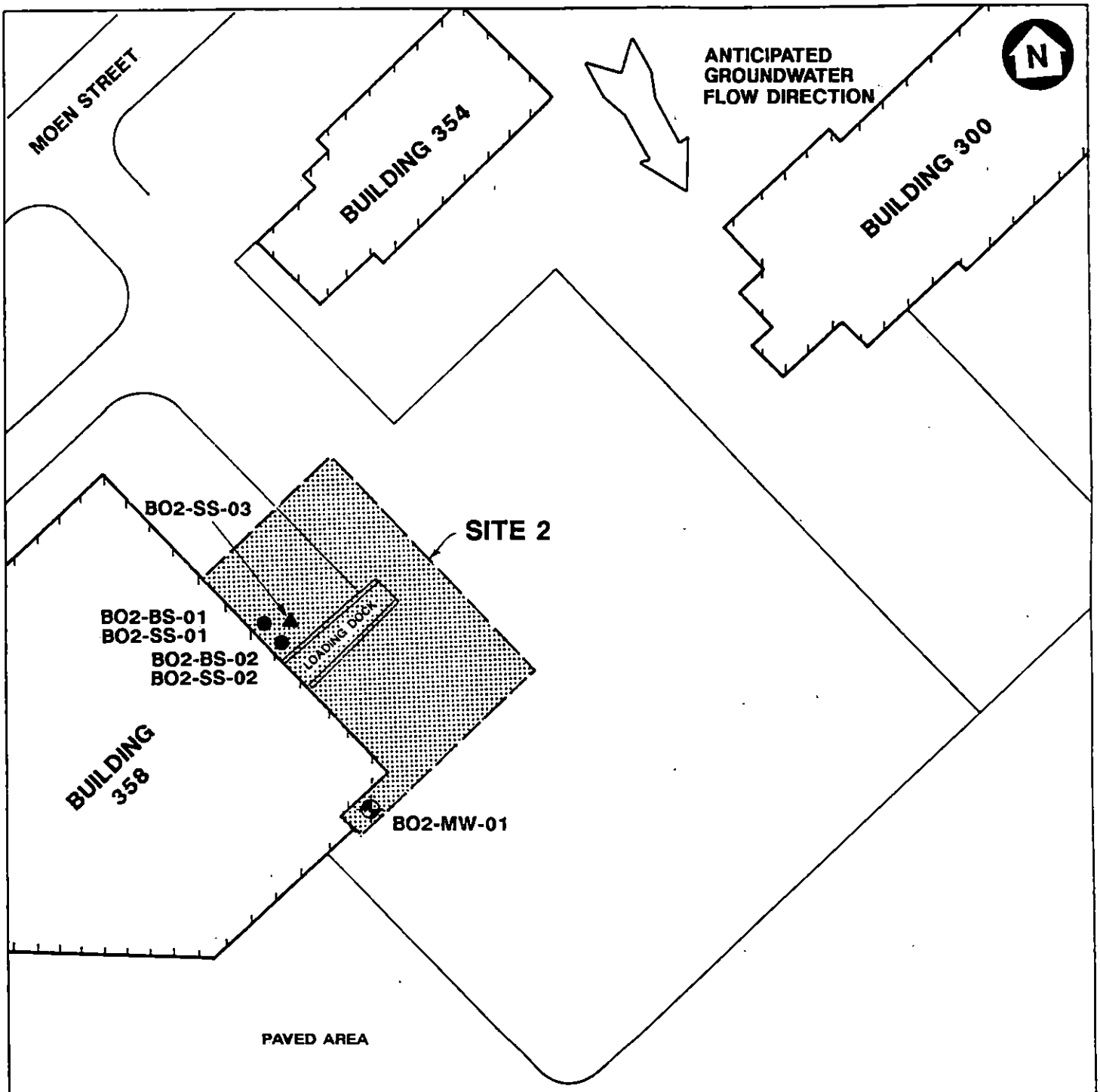
3.3.2 Site 2 - Former Hazardous Waste Storage Area (Prior to 1984)

Site 2 is located adjacent to the northeastern corner of Building 358 between a loading ramp and a parking lot (Figure 3-8). This area is mostly grassed; however, some areas are covered with asphalt and concrete. The area is less than 1,000 square feet in size.

3.3.2.1 Site 2 Background. This site was used until 1984 for the storage of shop wastes and recovered fuels and oils from various areas of SCANGB. The storage area does not have a containment structure. It was reported that the drums of wastes were stored next to the building and adjacent to the loading dock (see Figure 3-8). The HMTC records search report states that surface soil contamination was evident during the site visit (HMTC, 1987). Spills have not been reported at this site.

The compounds that were stored at the site are varied and originate from various sources. Shop wastes included waste PD-680 and recovered fuels and oils. There was no reported bulk storage of wastes at the site. Use of the storage area was discontinued in 1984; wastes were subsequently stored at Site 3.

3.3.2.2 Site 2 Exploration and Sampling and Analysis Program. The activities to be conducted at Site 2 are summarized in Table 3-3. Proposed exploration activities at Site 2 are similar to those outlined for Site 1. The first activity at the site will be to conduct a GPR survey to locate underground



LEGEND

- PROPOSED MONITORING WELL LOCATION
- PROPOSED SOIL BORING LOCATION AND SURFACE SOIL SAMPLE LOCATION
- AREA OF SOIL GAS INVESTIGATION
- ▲ PROPOSED SURFACE SOIL SAMPLE LOCATION

SCALE IN FEET

0 50 100

FIGURE 3-8
SITE 2 EXPLORATION PLAN
SITE INVESTIGATION
SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

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TABLE 3-3
SUMMARY OF SITE 2 ACTIVITIES

SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY AIR NATIONAL GUARD BASE

Conduct GPR survey of proposed SOV survey, soil borings, and monitoring well locations to identify utilities and potential hazards.

Conduct SOV survey in the former storage area and in the paved areas surrounding the site.

Complete two soil borings in storage area location and field-screen samples for VOCs.

Complete one optional boring if potential contamination is indicated in the initial borings.

Install one downgradient monitoring well and field-screen water samples for VOC contamination.

Install one optional monitoring well if field-screening indicates potential contamination in the initial monitoring well.

Collect three sets of surface soil samples and two subsurface soil samples for laboratory analyses for TCL VOCs, TCL SVOCs, and PP metals. Subsurface soil samples will be analyzed only if field-screening indicates potential contamination.

Collect at least one set of groundwater samples (and possibly one optional set) for TCL VOCs, TCL SVOCs, PP metals, and ethylene glycol (as total glycol) analyses. (Analyses for ethylene glycol as total glycol are being done at the request of Suffolk County officials.)

NOTES:

GPR - Ground-Penetrating Radar
PP - Priority Pollutant
SOV - Soil Organic Vapor
SVOC - semivolatile organic compound
TCL - Target Compound List
VOC - volatile organic compound

EXPLORATION SUMMARY:

2 Soil Borings (1 optional)
1 Monitoring Well (1 analyses) (1 optional)
3 Surface Soil (3 analyses)
3 Subsurface Soil Samples (2 analyses) (1 optional)
TCL VOC, TCL SVOC, and PP metals (all analyses)
Ethylene glycol as total glycol (all groundwater analyses)

utilities and subsurface obstructions. Areas to be avoided when conducting subsurface explorations will be marked on the ground surface with pin flags or spray paint.

An SOV investigation will be conducted in the area within and surrounding the storage area (see Figure 3-8), and will include 20 SOV points, which require approximately one day to complete. Locations for the SOV survey will be determined from historic data, visual inspection, and the GPR survey. Most of the SOV sampling locations will come from the grassy area where drums were stored. The remaining points will be taken from areas surrounding the storage area currently covered with asphalt or concrete.

Upon completion of the SOV survey, SOV data will be evaluated to help position the soil borings. Two soil borings will be located in the storage area (see Figure 3-8) or at a location determined from the soil gas survey or other data. The boring will be sampled continuously for 10 feet and then at 5-foot intervals. The soil samples will be immediately screened with the on-site GC for VOCs. The GC screening sample with the highest value will be submitted for laboratory analysis, or a sample will be collected at the water table if contamination is not indicated in the screening process.

A minimum of three surface soil samples will be collected from the surficial soil at the site to gather data necessary for characterization of risks at the site. These samples will be submitted for laboratory analysis for TCL VOCs, TCL SVOCs, and PP metals. Two of these samples will be collected at the boring locations.

The monitoring well boring will be advanced without sampling to a depth of 10 to 15 feet into the saturated zone. A PVC monitoring well will be installed in compliance with the procedures outlined in Subsection 3.2.2.4. Once the monitoring well is installed, preliminary development and purging will commence to obtain a groundwater screening sample. If the screening sample indicates the presence of contamination, an optional monitoring well may be installed. A groundwater sample(s) from the monitoring well(s) will be collected and submitted for laboratory analysis for TCL VOCs, TCL SVOCs, PP metals, and ethylene glycol as total glycol.

An optional soil boring may be completed (most likely downgradient of the source area) if contamination is detected in either of the first two soil borings or in the initial monitoring well. The optional boring will be completed in the same manner as the other borings. An analytical sample will be submitted for VOC, SVOC, and metals analyses. The depth at which this sample will be collected will be based on GC screening.

3.3.3 Site 3 - Recent Hazardous Waste Storage Area (until 1989)

(NOTE: This site was identified in the records search as the Current Hazardous Waste Storage Area.) Site 3 is located in a paved parking lot in a gravel area which used to be the floor of Building 282. The building was used as the Hazardous Waste Storage Area until it was removed in 1989. Wastes are no longer stored at this site (Figure 3-9).

3.3.3.1 Site 3 Background. During the mid-1980s, this area became the location for storage of shop wastes, recovered oils, and waste fuels at SCANGB. Air Force drawings indicate that this area was used as a hazardous waste storage area prior to ANG operations. This use was discontinued when the Air Force left. In the HMTC records search report, the site was described as consisting of a small building in a state of disrepair, with numerous holes in the steel roof, no doors or windows, and an open gravel floor (HMTC, 1987). The building reportedly contained drums that were stored both on their sides and upright; precipitation accumulated on the upright drums. Discolored

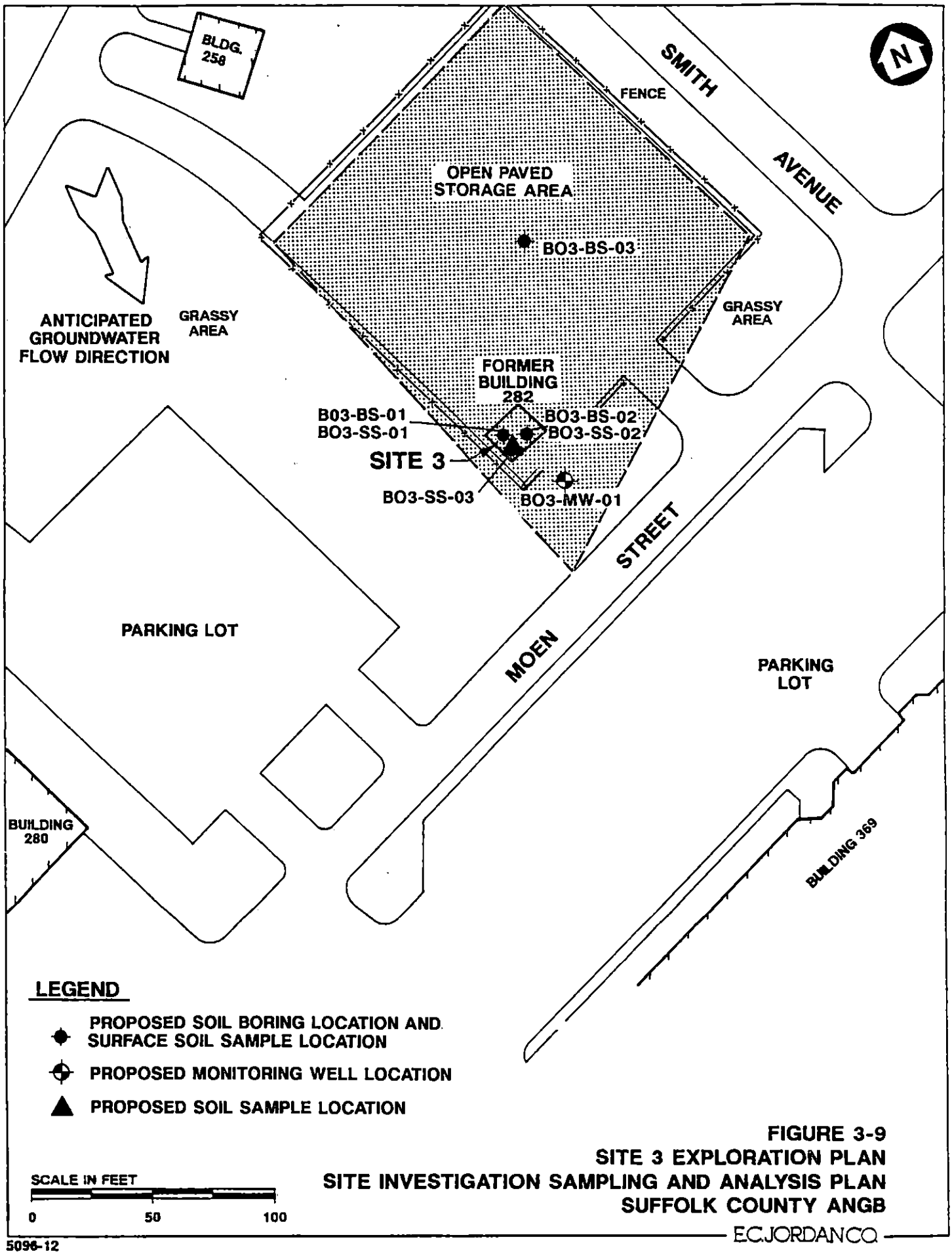


FIGURE 3-9
SITE 3 EXPLORATION PLAN
SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

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gravel and soil were observed throughout the facility. No spills have been recorded at this site. The types of wastes reportedly stored in Building 282 were solvents, POL products, and strippers.

3.3.3.2 Site 3 Exploration and Sampling and Analysis Program. The activities to be conducted at Site 3 are summarized in Table 3-4. The first activity at the site will be to conduct a GPR survey to locate underground utilities and subsurface obstructions. Areas to be avoided when conducting subsurface explorations will be marked on the ground surface with pin flags or spray paint.

Approximately 20 SOV points (i.e., a one-day soil gas investigation) will be conducted in the area within and surrounding the storage area (see Figure 3-9). The locations for the SOV survey will be determined from the historic data, visual inspection, and GPR survey. SOV points will be concentrated in the former building area; however, points will be completed within the entire paved area within the fence because of fuel trucks that were parked there.

Upon completion of the SOV survey, the data will be evaluated to position the three soil borings. Two soil borings will be located in the center of the former storage area (see Figure 3-9), or at a location determined from the soil gas survey or other data. Another soil boring will be completed at a location in the paved area indicated by the SOV survey. Soils will be sampled continuously for the first 10 feet. One soil sample from each boring will be submitted to the laboratory for analysis for TCL VOCs, TCL SVOCs, and PP metals, based on soil screening. In addition, three surface soil samples will be collected from the former building area for risk characterization (see Subsection 3.2.2.2).

The monitoring well boring will be advanced without sampling to a depth of 10 to 15 feet into the saturated zone. A PVC monitoring well will be installed according to procedures outlined in Subsection 3.2.2.4. Once the monitoring well is installed, preliminary development and purging will commence to obtain a groundwater screening sample. If the screening sample indicates the presence of contamination, an optional one or two monitoring wells may be installed. A groundwater sample(s) from the monitoring well(s) will be collected and submitted for laboratory analyses for TCL VOCs, TCL SVOCs, and PP metals. SCANGB 106th CES personnel do not believe ethylene glycol was stored at Site 3; therefore, it will not be analyzed for on groundwater samples collected at this site.

Up to four optional soil borings may be completed (most likely downgradient of the source area) if contamination is detected in any of the first three soil borings or initial monitoring well. The optional borings will be completed in the same manner as the other borings.

3.3.4 Sites 4A and 4B - Aircraft Refueling Apron and Ramp Drainage Outfall

Site 4A is located southeast of the refueling apron, which is east of Building 395 (Figure 3-10). The site consists mostly of the grassy area just south of the refueling apron. The actual size of the site is unknown; it is probably less than 2 acres. Site 4B, the Ramp Drainage Outfall, is located approximately 800 feet south of the refueling apron (see Figure 3-10). The outfall discharges to a willow depression, which broadens rapidly within 100 feet of the outfall.

3.3.4.1 Sites 4A and 4B Background. In the records search report, HMTC identified the Aircraft Refueling Apron site (Site 4A) as a potential source of contamination because of its prolonged use as the probable site of routine fuel dripping, hydraulic fluid leaks, and solvent use. This area has been used for years as an aircraft refueling apron for various types of aircraft. The site consists of a concrete pad with flush fuel outlets located near the

TABLE 3-4
SUMMARY OF SITE 3 ACTIVITIES

SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY AIR NATIONAL GUARD BASE

Conduct GPR survey of proposed SOV survey, soil borings, and monitoring well locations to identify utilities and potential hazards.

SOV surveys will be conducted throughout the fenced-in paved area surrounding the former storage building location, as well as in the former building location and grassy areas downgradient of the site.

Complete two borings in the former building area and one in the paved area, and field-screen soil samples for VOC contamination.

Install up to four optional borings depending on the results of the field-screening of initial boring samples.

Collect three surface soil samples from the former building location area and three subsurface soil samples will be collected for laboratory analyses for TCL VOCs, SVOCs, and PP metals. No surface soil samples will be collected from the fenced-in paved area because the SVOCs in the pavement would interfere with data evaluation. Up to three optional subsurface soil samples will be collected for laboratory analyses only if potential contamination is indicated by field-screening.

Install one downgradient monitoring well and field-screen groundwater for VOCs.

Install one to two optional monitoring wells if field-screening indicates potential contamination in the initial well.

Collect at least one set of groundwater samples (and possibly two optional sets) for laboratory analyses for TCL VOCs, TCL SVOCs, and PP metals. There is no evidence that ethylene glycol was ever stored at this location; therefore, it will not be analyzed for in groundwater samples from this site.

NOTES:

GPR = Ground-Penetrating Radar
PP = Priority Pollutant
SOV = Soil Organic Vapor
SVOC = semivolatile organic compound
TCL = Target Compound List
VOC = volatile organic compound

EXPLORATION SUMMARY:

3 Soil Borings (4 optional)
3 Surface Soil (3 analyses)
1 Monitoring Well (1 analyses) (2 optional)
3 Subsurface Soil Samples (3 analyses) (3 optional)
TCL VOC, TCL SVOC, and PP metals (all analyses)

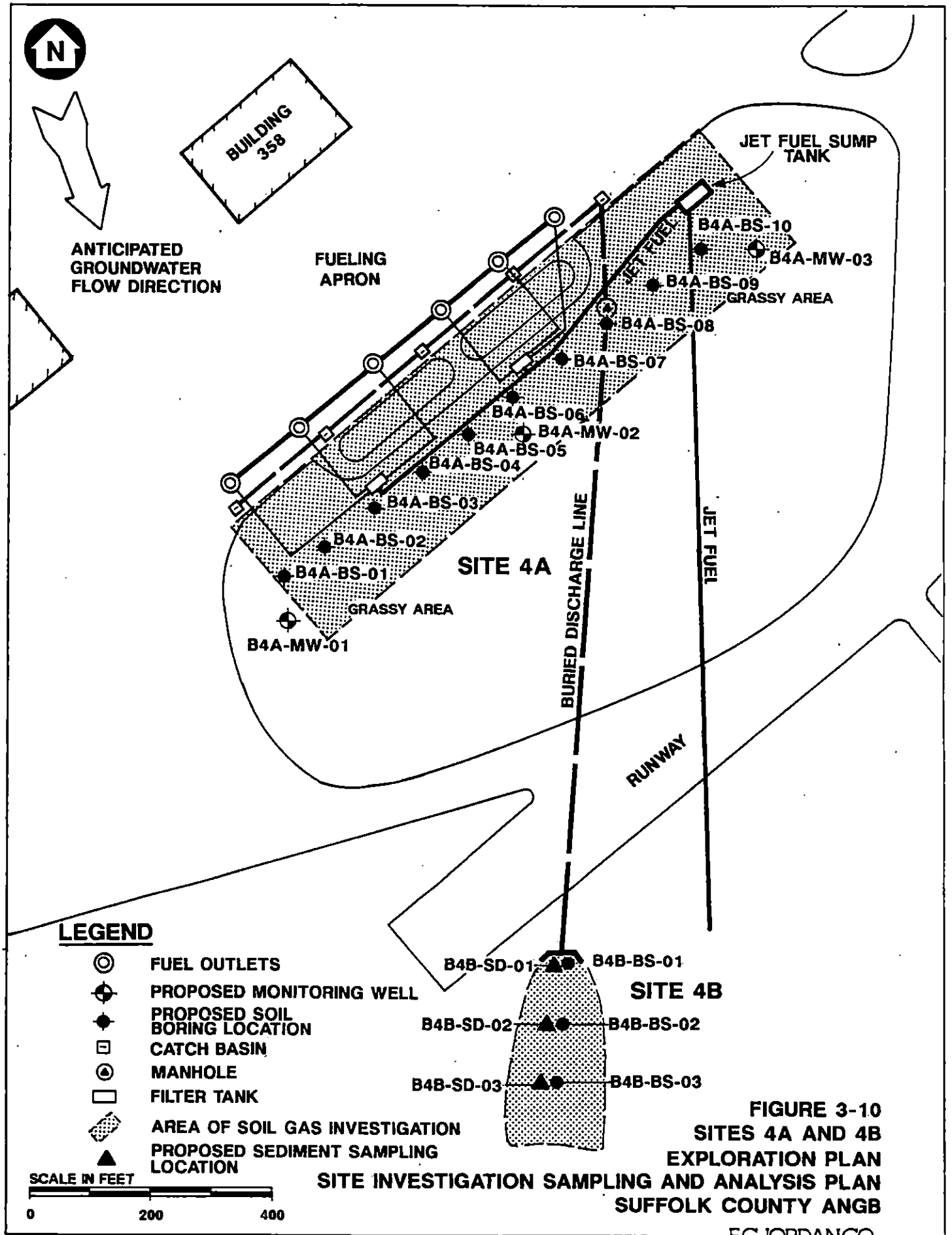


FIGURE 3-10
SITES 4A AND 4B
EXPLORATION PLAN
SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

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edge of the apron. The fuel outlets are located within a depression in the refueling area. Consequently, spills and runoff would not run from the refueling area onto the adjacent grassy area. HMTC did not observe any visible signs of contamination in the grassy area adjacent to the refueling apron.

Fuel from the POL Tank Farm located south of SCANGB is pumped to the refueling apron (see Figure 2-1). The fuel is pumped directly to fuel outlets through an underground pipe that lies parallel to the taxiway and apron. Unused fuel is then pumped back to the POL in another underground pipe via a jet fuel sump tank located northeast of the refueling apron (see Figure 3-10). A recent leak detection study conducted by Tracer Research Corporation (Tracer) indicated potential leaks in the fuel lines at locations parallel to the refueling apron (Tracer, 1989). These locations corresponded to areas of fuel outlets and the sump tank, possibly where pipe joints would be located. SI activities at Site 4A will focus on potential subsurface releases from these areas of the fuel line.

The surface drainage for the refueling apron is collected in five catch basins located along the alignment of the fuel outlets in the refueling aprons. The catch basins are located on 200-foot centers that straddle the fuel outlets, and receive runoff from the fueling apron area. The surface drainage flows through underground pipes to a location just north of the jet fuel sump tank and then runs over 1,000 feet to where it discharges approximately 800 feet south of the refueling apron (see Figure 3-10). This discharge is identified in the SI work plan review meetings as the Ramp Drainage Outfall site; hereinafter, it is designated as Site 4B.

3.3.4.2 Sites 4A and 4B Exploration and Sampling and Analysis Program. The activities planned for Sites 4A and 4B are summarized in Table 3-5. The first activity at Site 4A will be to conduct a GPR survey to locate underground utilities and subsurface obstructions. Areas to be avoided when conducting subsurface explorations will be marked on the ground surface with pin flags or spray paint. The GPR survey will be conducted along the entire alignment of the fuel line to the jet fuel sump tank.

Approximately 40 SOV points (i.e., a two-day SOV investigation) will be conducted in the area within and surrounding the refueling apron area. Locations for the SOV survey will be determined from data in the Tracer report, visual inspection, and the GPR survey (Tracer, 1989). Most of the SOV sampling locations will be in the grassy area adjacent to the refueling apron. The remaining locations will be in areas surrounding the refueling area that are currently covered with either asphalt or concrete.

Upon completion of the SOV survey, the data will be evaluated to locate the positions of up to 10 soil borings at Site 4A. The soil borings will be located along the alignment of the fuel pipeline along 100-foot centers, or based on SOV data. If the SOV data indicate no detects or are inconclusive, borings may be located adjacent to points along the pipeline highlighted by Tracer.

Soil borings will be sampled continuously for the first 10 feet and at 5-foot intervals thereafter. Soil samples will be screened for VOCs. A minimum of two soil samples from each boring will be selected for laboratory analysis. The samples will be selected on the basis of potential contamination as indicated by field-screening, or the samples just below the level of the fuel line and at the water table will be collected if screening does not detect contamination. The soil samples will be analyzed for TCL VOCs, TCL SVOCs, and lead.

TABLE 3-5
SUMMARY OF SITES 4A AND 4B ACTIVITIES

SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY AIR NATIONAL GUARD BASE

SITE 4A - REFUELING APRON

Conduct GPR survey to identify location of fuel lines and defueling tank.

Conduct SOV surveys at a minimum of 40 locations, approximately 25 feet on center, over an area extending lengthwise about 900 feet parallel to the apron. The "hot spots" identified in the Tracer report will serve as initial reference points.

Complete a maximum of 10 soil borings as near to the fuel line as possible at a maximum distance of 100 feet from each other, and perform GC field analyses for VOCs in soil samples from the borings.

Complete five optional soil borings if potential contamination is indicated in initial borings.

A minimum of two subsurface soil samples, one just below the depth of the fuel line and one just above the water table, will be sent to the laboratory for analyses for TCL VOCs, TCL SVOCs, and lead.

No surface soil samples will be collected from the refueling apron area.

Install three downgradient monitoring wells, and field-screen water samples for VOCs.

Install two optional downgradient monitoring wells if contamination is indicated in the initial monitoring wells.

Collect three sets of groundwater samples (and possibly two optional sets) for analyses for TCL VOCs, TCL SVOCs, lead, and ethylene glycol and total glycol.

SITE 4B - RAMP DRAINAGE OUTFALL

No GPR survey is necessary, based on SCANGB Civil Engineering Squadron knowledge of this area.

Conduct SOV survey at approximately 10 locations in the outfall area.

Collect three sediment samples at the edge of the pipe, approximately 100 feet downslope, and at the low area approximately 200 feet downslope.

Complete three borings to groundwater near the sediment sample locations and field-screen soil samples for VOCs.

Complete one optional boring and install one optional monitoring well if contamination is indicated in initial borings and/or sediment samples.

Install one additional optional monitoring well if contamination is indicated by field-screening of samples from the initial optional monitoring well.

TABLE 3-5
(continued)
SUMMARY OF SITES 4A AND 4B ACTIVITIES

SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY AIR NATIONAL GUARD BASE

Three sets of sediment samples, one set of samples from each boring, and an optional set of monitoring well groundwater samples (if collected) will be sent to the laboratory for analyses for TCL VOCs, TCL SVOCs, and lead. One monitoring well groundwater sample will also be analyzed for ethylene glycol as total glycol.

NOTES:

GC = gas chromatography
GPR = Ground-Penetrating Radar
SOV = Soil Organic Vapor
TCL = Target Compound List
VOC = volatile organic compound

EXPLORATION SUMMARY:

Site 4A

10 Soil Borings (5 optional)
20 Subsurface Soil (20 analyses) (10 optional)
3 Monitoring Wells (1 analysis) (2 optional)
TCL VOC, TCL SVOC, and lead (all analyses)
Ethylene glycol as total glycol (all groundwater analyses)

Site 4B

3 Sediment Samples
3 Soil Borings (1 optional)
1 Optional Monitoring Well
TCL VOC, TCL SVOC, and lead (all analyses)
Ethylene glycol as total glycol (optional groundwater analyses)

Up to five optional soil borings may be completed (most likely downgradient of the source area) if contamination is detected in any of the soil borings. Theoptional borings will be completed and sampled in the same manner as the other soil borings.

The monitoring well borings will be advanced without sampling to a depth of 10 to 15 feet into the saturated zone. PVC monitoring wells will be installed in compliance with the procedures outlined in Subsection 3.2.2.4. Once themonitoring wells are installed, preliminary development and purging will commence to obtain a groundwater screening sample from each well. If the screening sample indicates the presence of contamination, two optional monitoring wells may be installed.

Groundwater from all new wells will be sampled and submitted to the laboratory for TCL VOCs, TCL SVOCs, lead, and ethylene glycol as total glycol analyses. The analyses for VOCs, SVOCs, and lead will be to assess whether hazardous constituents of fuel oil are present in the groundwater. Analysis for ethylene glycol will be performed because it is the principal constituent of de-icing fluids sprayed on aircraft on the nearby taxiway.

At Site 4B, approximately 10 SOV points (i.e., a half-day program) will be conducted at and near the Ramp Drainage Outfall. Locations of the SOV points will be determined by observation of stressed vegetation, outfall appearances, and physical characteristics.

Upon completion of the SOV survey, three sediment samples will be collected at the edge of the pipe, approximately 100 feet downslope, and the low area approximately 200 feet downslope.

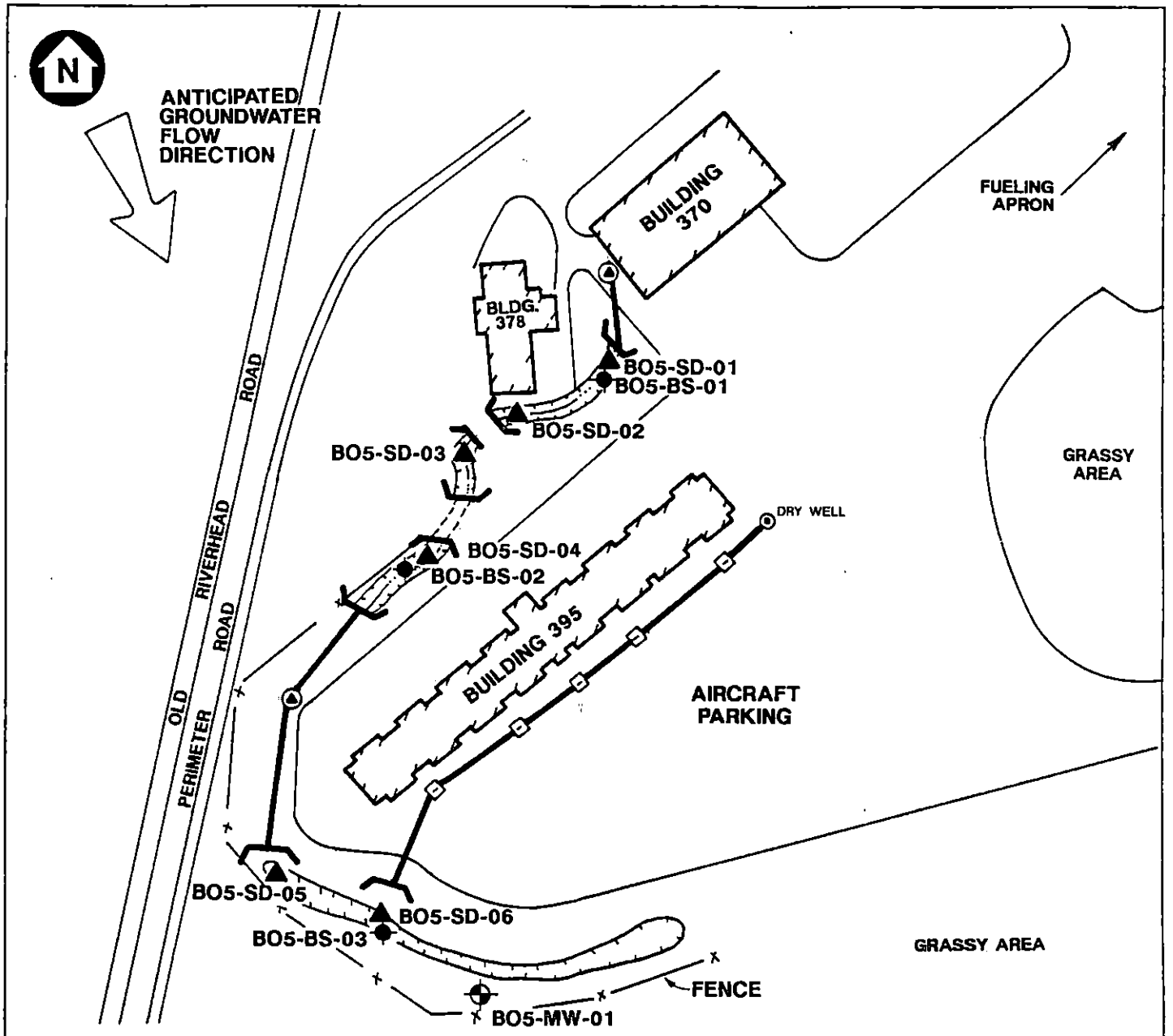
The sediment samples will be immediately screened for VOCs and placed in analytical containers for VOC, SVOC, and lead analyses. Based on the sediment screening, three soil borings will be completed to the groundwater table. It is anticipated that the groundwater is very shallow at these locations; therefore, the boring will be sampled continuously. Soils in the soil boring will be screened for VOC target compounds. Based on results of the soil screening, one soil boring sample will be selected for laboratory analyses for TCL VOCs, TCL SVOCs, and lead.

An optional soil boring may be completed if contamination is detected in any of the first three soil borings. The optional boring will be completed in the same manner as the other borings. The optional monitoring well boring would be advanced without sampling to a depth of 10 to 15 feet into the saturated zone. A PVC monitoring well would be installed in compliance with procedures outlined in Subsection 3.2.2.4. Once the monitoring well was installed, preliminary development and purging would commence to obtain a groundwater screening sample. If the screening sample indicates the presence of contamination, an additional optional monitoring well may be installed. Monitoring wells would be sampled for TCL VOCs, TCL SVOCs, PP metals, and ethylene glycol as total glycol analyses.

3.3.5 Site 5 - Southwest Storm Drainage Ditch

This site, located west and south of Building 395 (i.e., the aircraft hangar), consists of the large surface drainage ditch surrounding the building (Figure 3-11). The ditch starts as an outfall for Building 370, runs through a culvert underneath an access road to Building 395, and is exposed the entire distance around Building 395. The ditch ranges from 5 to 15 feet in depth.

3.3.5.1 Site 5 Background. The storm drainage ditch receives runoff from roof drains and several large paved areas in the southwestern portion of the base. HMTC reported that during its interviews with past and current base personnel, it was disclosed that an oily sheen had been observed in the ditch



LEGEND

- CATCH BASIN
- MANHOLE
- PROPOSED SEDIMENT SAMPLING LOCATION
- PROPOSED SOIL BORING LOCATION
- PROPOSED MONITORING WELL LOCATION

SCALE IN FEET

0 200 400

FIGURE 3-11
SITE 5 EXPLORATION PLAN
SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

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during occasional episodes of heavy precipitation. HMTC also reported vegetative stress during the site walkovers (HMTC, 1987).

3.3.5.2 Site 5 Exploration and Sampling and Analysis Program. The activities to be conducted at Site 5 are summarized in Table 3-6. The first activity at the site will be to conduct a GPR survey to locate underground utilities and subsurface obstructions. The next activity will be to obtain six sediment samples from the ditch. Sediment samples will be collected in areas thatappear to have low flow and/or stressed vegetation. Samples will be collected and screened with the on-site GC to provide data to assist in locating borings. The six sediment samples will be collected for laboratory analyses for TCL VOCs, TCL SVOCs, and PP metals to characterize risks at the site.

Upon completion of the sediment screening, data will be evaluated to locate the best locations for soil borings. Three soil borings will be completed in sediments of the ditch using a motorized tripod rig in areas of stressed vegetation or contaminated sediments (based on GC screening results).

Three borings will be located as follows:

- One boring will be completed at the outfall of the discharge pipe from Building 370 (see Figure 3-11). This location is considered the beginning of the ditch.
- The two remaining borings will be located based on sediment screening data. If sediment screening data do not indicate contamination, the borings will be located in broad, flat areas where sediment can accumulate, and/or at the eastern terminus of the ditch where no additional discharge is received.

The borings will be advanced with soil samples being collected at 1-foot intervals. If field-screening indicates no detection, the soil boring will be terminated after the third sample. If contamination is detected in the sample, the boring will be continued to the groundwater table (estimated to be 10 to 15 feet deep).

One set of soil samples from each boring will be selected for laboratory analysis based on field-screening of soil boring and sediment samples. The samples will be analyzed for TCL VOCs, TCL SVOCs, and PP metals. If contamination is detected in either sediment or soil screening samples, three optional borings may be completed and sampled accordingly.

One monitoring well will be installed in the interpreted downgradient location at the site. The monitoring well will be advanced without sampling to a depth of 15 feet into the saturated zone. A PVC monitoring well will be installed in compliance with the procedures in Subsection 3.2.2.4. Once the monitoring well is installed, preliminary development and purging will commence to obtain a groundwater screening sample. If contamination is detected, up to two optional monitoring wells may be installed. Wells will be sampled for laboratory analyses for TCL VOCs, TCL SVOCs, PP metals, and ethylene glycol as total glycol.

3.3.6 Sites 6A through 6L - Cesspool/Septic Tank Survey

Several septic tanks, cesspools, and dry wells at SCANGB have received discharges from locations where various industrial and equipment maintenance activities occurred on the base (Figures 3-12 through 3-20). These facilities will be investigated to determine the potential impact of the discharges. Each set of cesspools or septic tanks will be referred to by a letter designation as part of Site 6 (e.g., Site 6A). Buildings that discharge to the cesspool/septic tank system may have either an individual or a cluster of

TABLE 3-6
SUMMARY OF SITE 5 ACTIVITIES

SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY AIR NATIONAL GUARD BASE

Conduct GPR survey of proposed soil borings and monitoring well locations to identify utilities and potential subsurface hazards.

Sediment samples for VOC field-screening will be collected perpendicular to stream flow across the sides and bottom of the ditch where appropriate, particularly in areas where deposition of fine-grained material occur.

Collect sediment samples from the top 2 inches at six locations with the highest potential for contamination (based on field-screening) for laboratory analyses of TCL VOCs, SVOCs, and PP metals.

Complete three borings in the ditch using a motorized tripod rig. One boring will be located at the Building 370 discharge pipe outfall. Other boring locations will be determined on the basis of VOC field-screening of sediment samples. Soil samples will be collected at 1-foot intervals and field-screened for VOCs. If three consecutive negative results are obtained, the boring will be terminated. If contamination is indicated by field-screening of sediment samples or boring samples, the boring will be advanced to the groundwater table.

Collect one set of soil samples from each boring location for laboratory analyses for TCL VOCs, SVOCs, and PP metals.

Complete up to three optional borings if contamination is indicated in initial borings, and collect samples for laboratory analyses where contamination is indicated.

Install one monitoring well and field-screen water sample for VOCs.

Install two optional monitoring wells if contamination is indicated in initial monitoring well and/or borings.

Collect one set of groundwater samples (and possibly two optional sets) from each monitoring well for laboratory analyses for TCL VOCs, SVOCs, PP metals, and ethylene glycol as total glycol.

NOTES:

GPR - Ground-Penetrating Radar
PP - Priority Pollutant
SVOC - semivolatile organic compound
TCL - Target Compound List
VOC - volatile organic compound

EXPLORATION SUMMARY:

6 Sediment Samples
3 Soil Borings (3 analyses) (3 optional)
1 Monitoring Well (1 analysis) (2 optional)
TCL VOC, TCL SVOC, and PP metals (all analyses)
Ethylene glycol as total glycol (groundwater only)

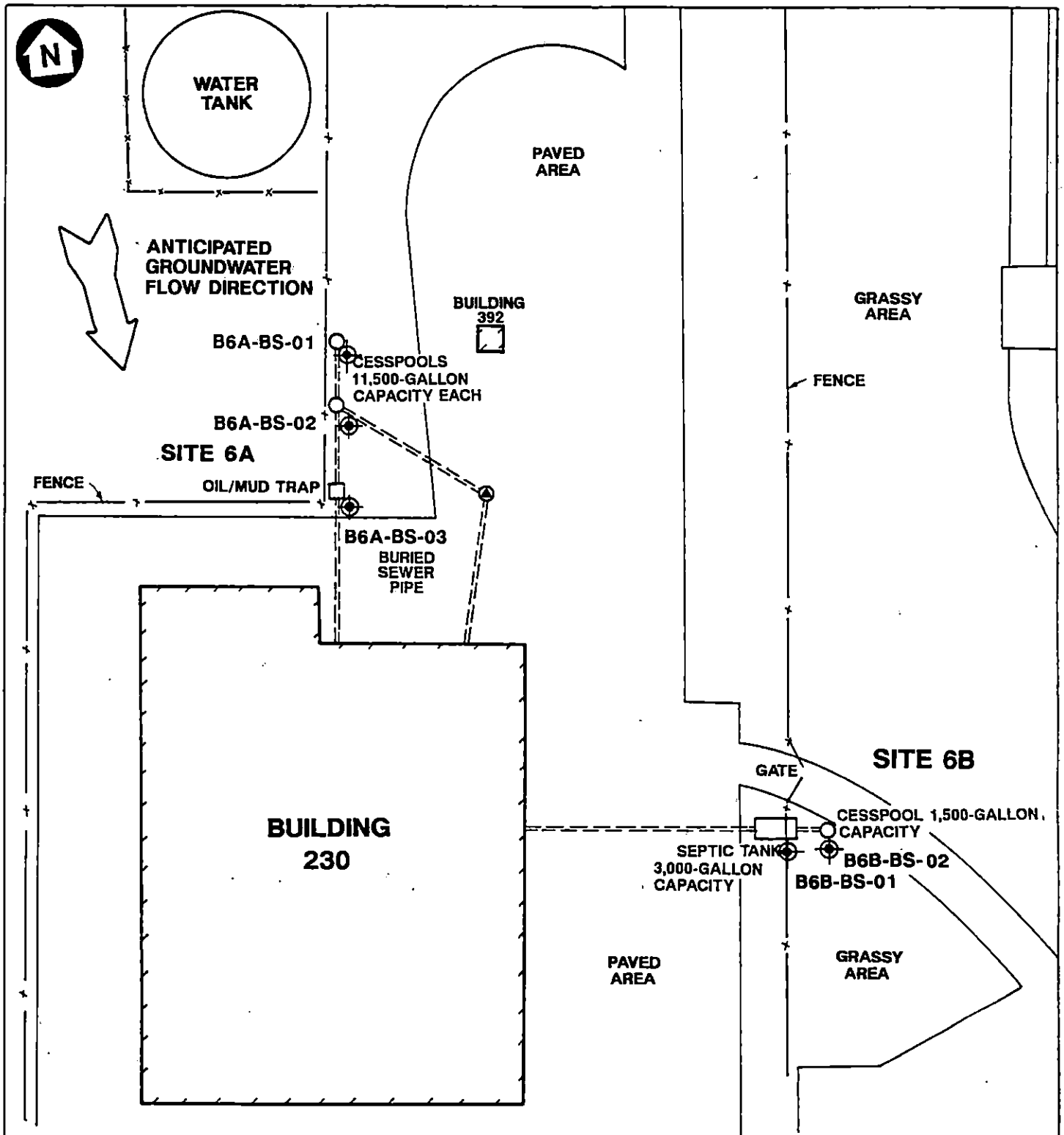


FIGURE 3-12
SITES 6A AND 6B EXPLORATION PLAN
SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

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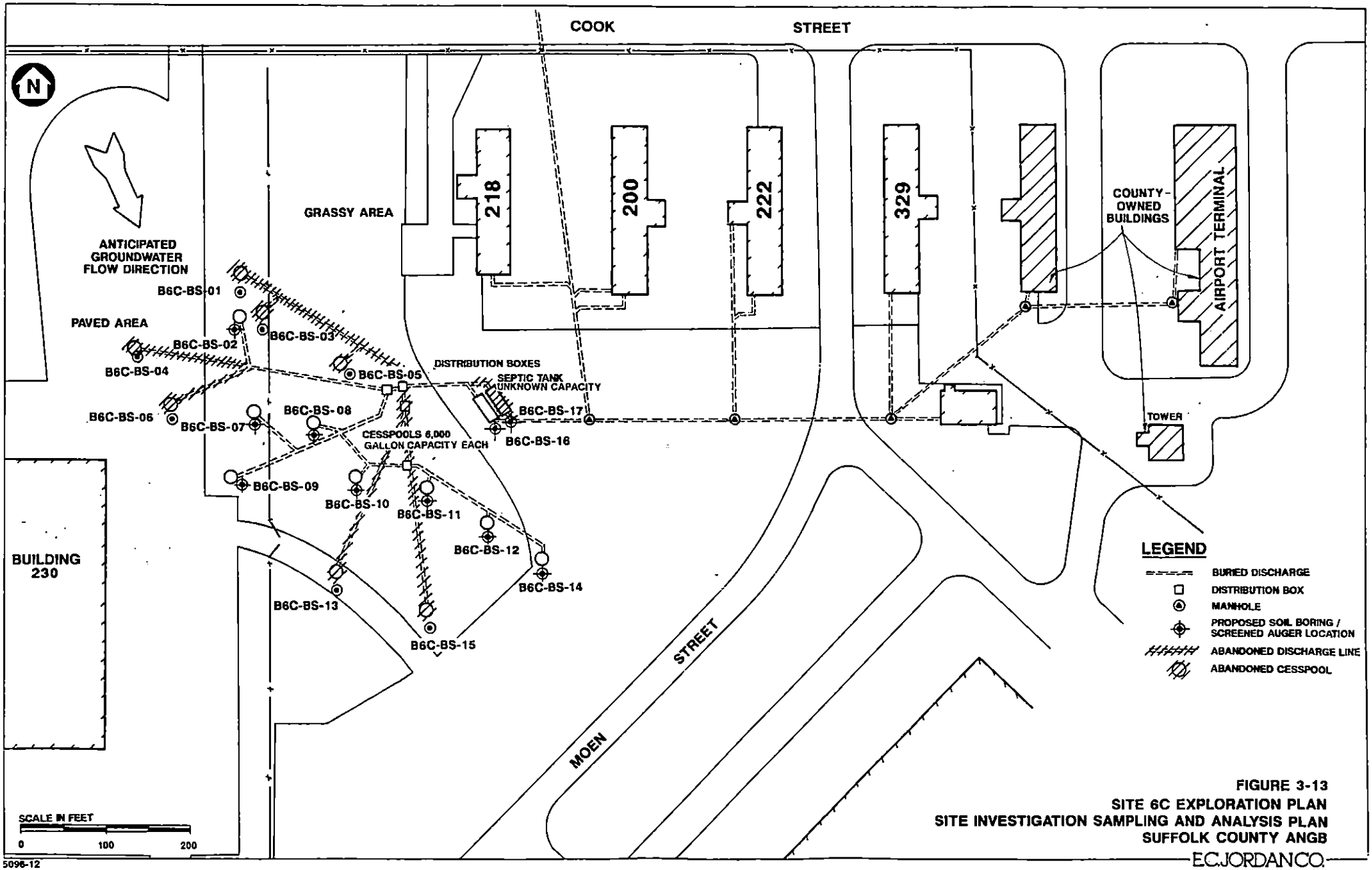


FIGURE 3-13
SITE 6C EXPLORATION PLAN
SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

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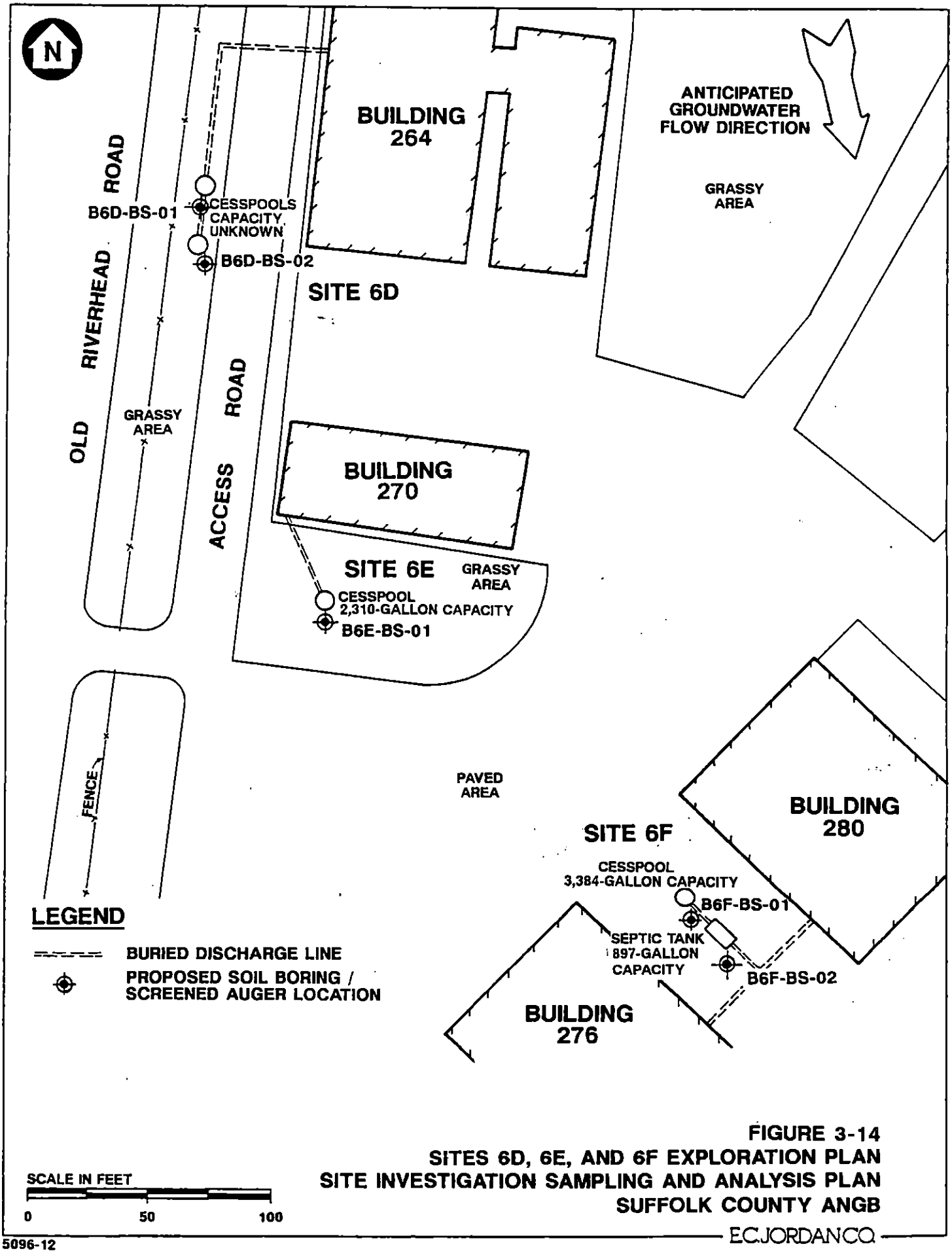
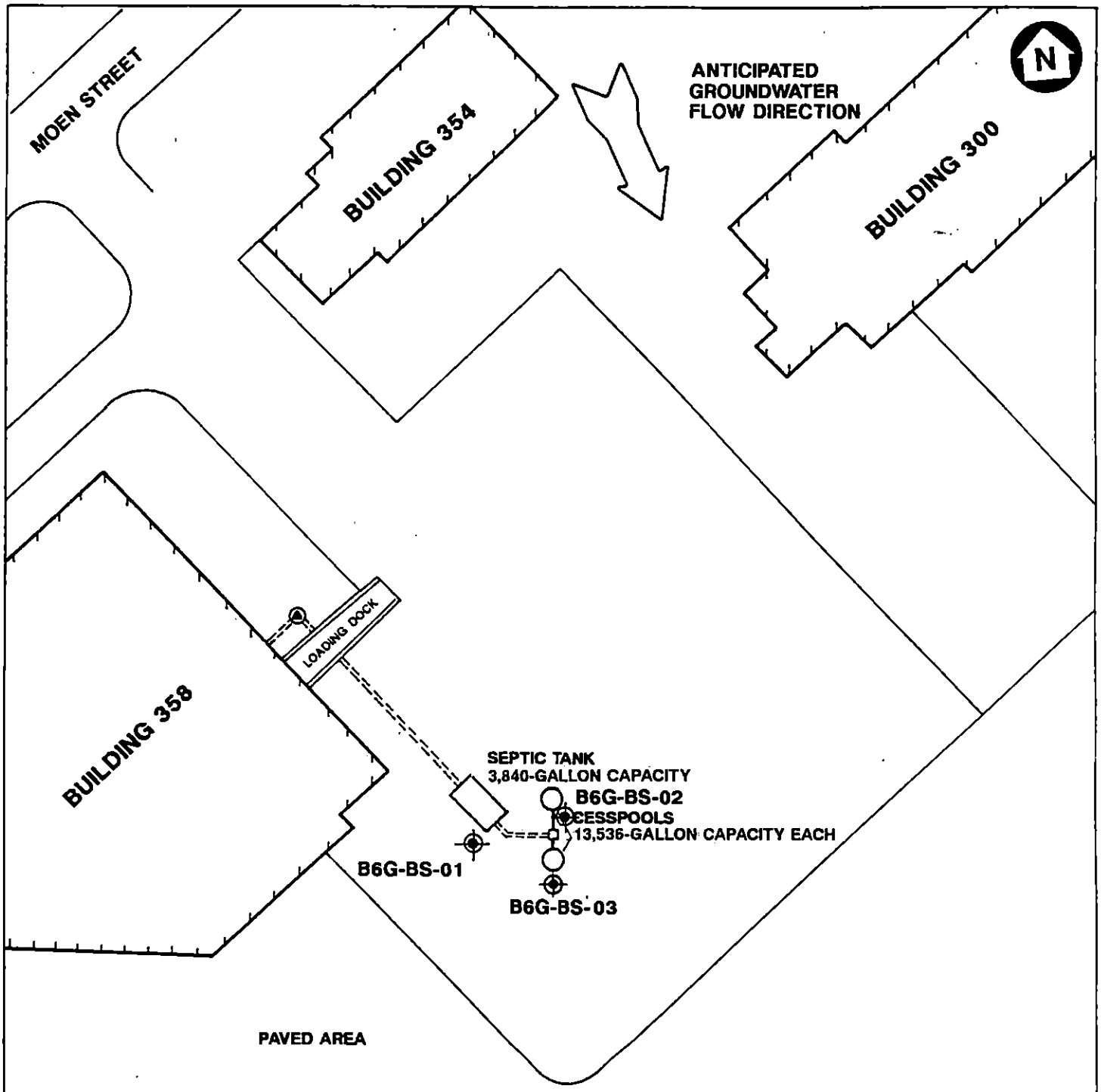


FIGURE 3-14
SITES 6D, 6E, AND 6F EXPLORATION PLAN
SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

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LEGEND

- PROPOSED SOIL BORING / SCREENED AUGER LOCATION
- MANHOLE

SCALE IN FEET

0 50 100

FIGURE 3-15
SITE 6G EXPLORATION PLAN
SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

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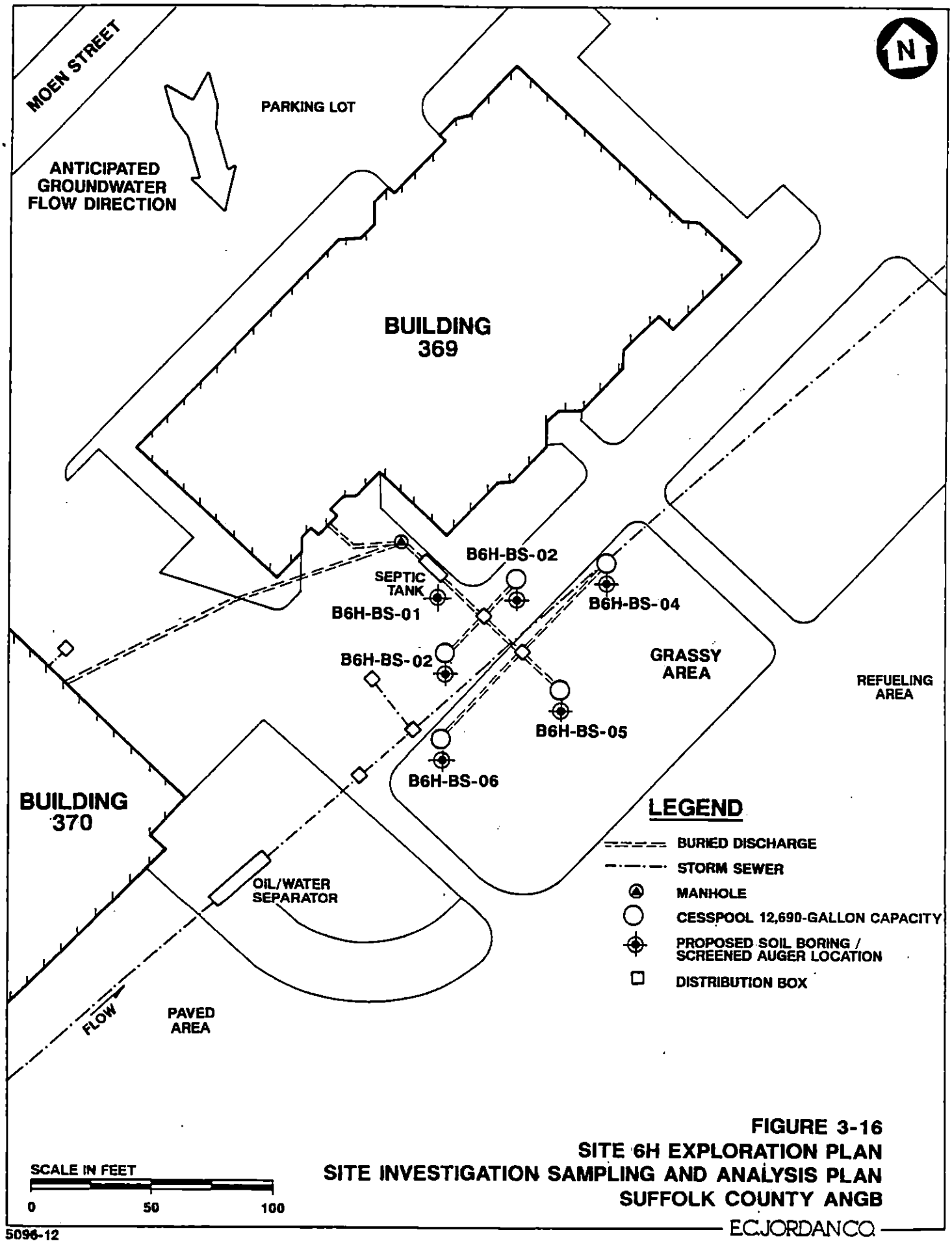


FIGURE 3-16
SITE 6H EXPLORATION PLAN
SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

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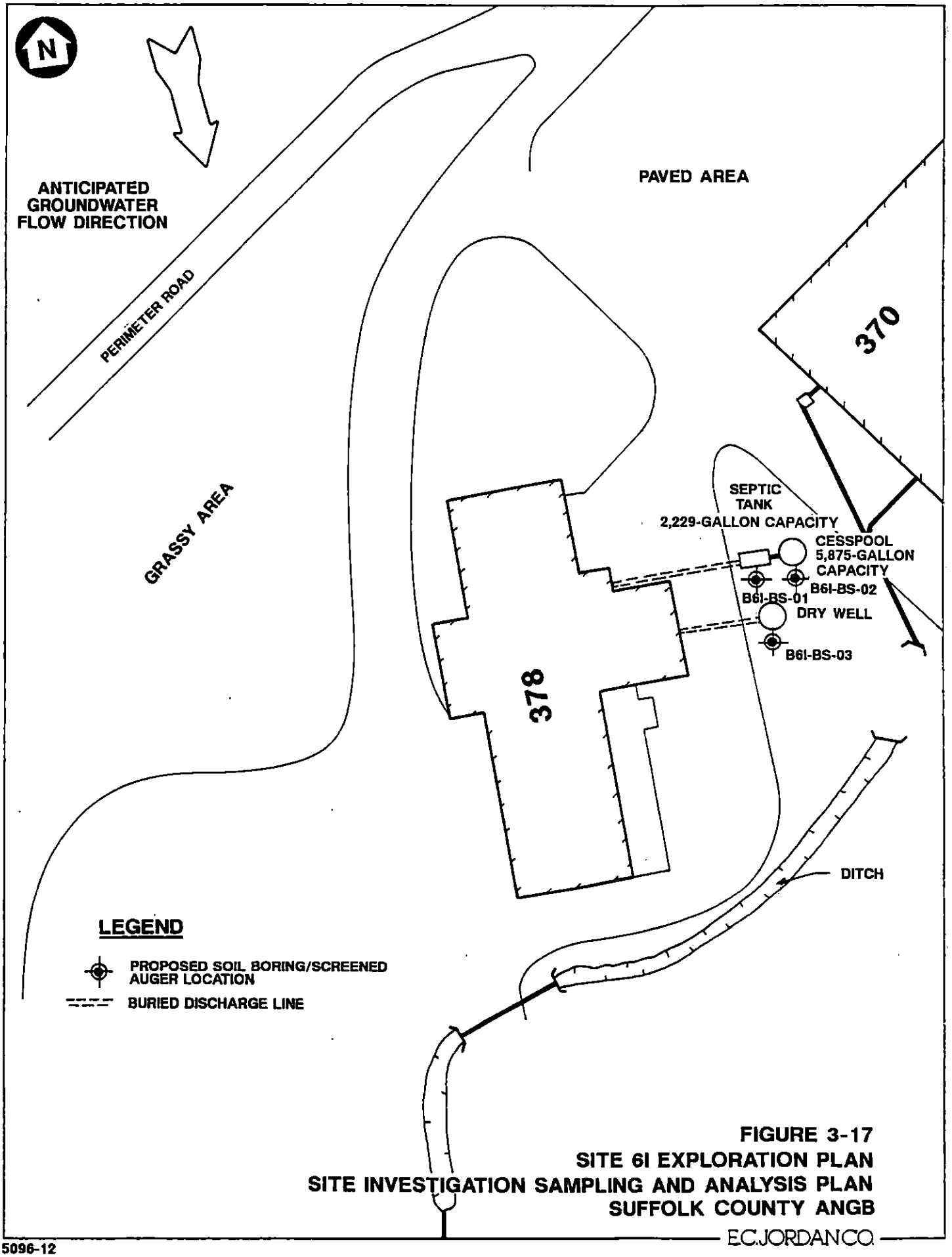


FIGURE 3-17
SITE 6I EXPLORATION PLAN
SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

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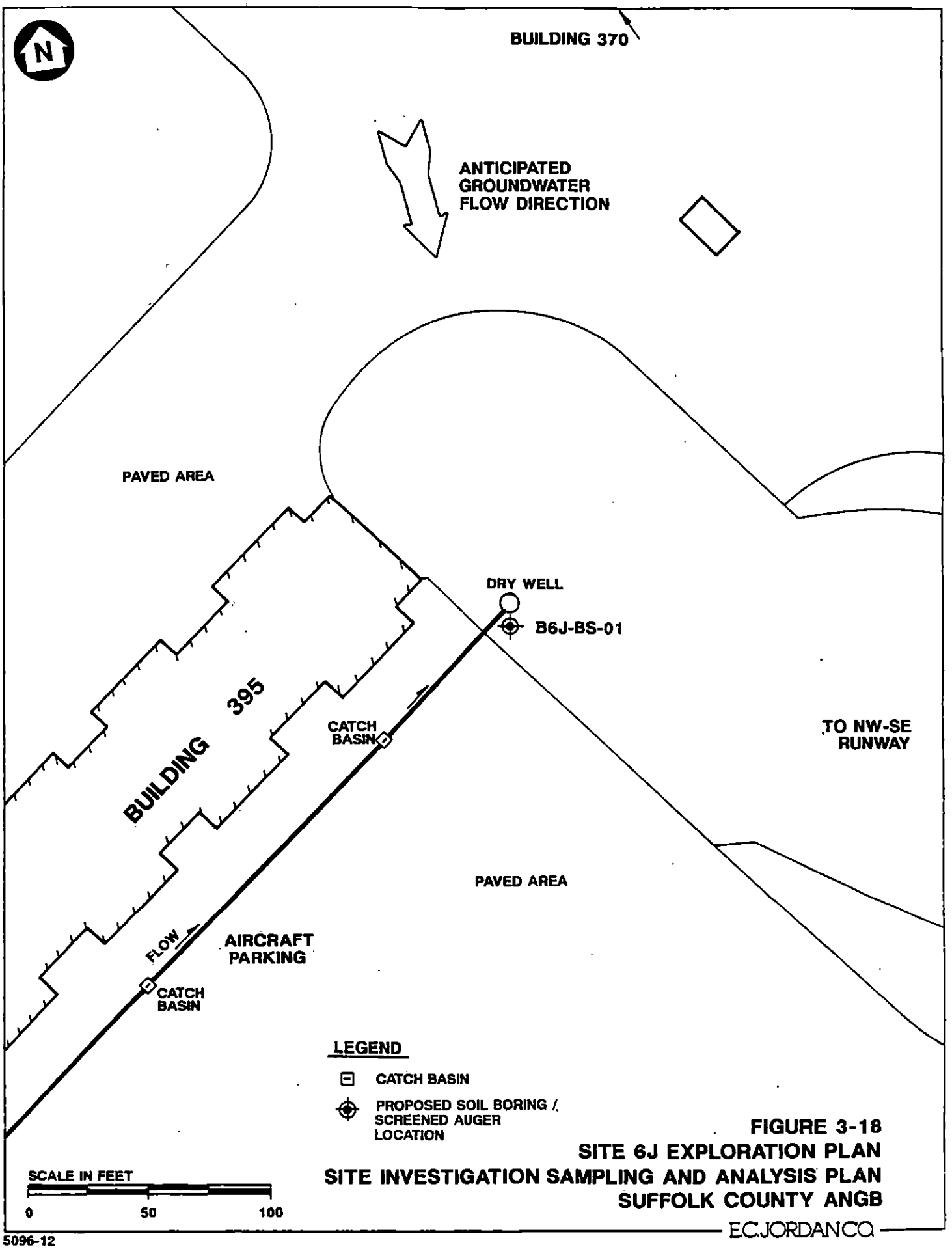


FIGURE 3-18
SITE 6J EXPLORATION PLAN
SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

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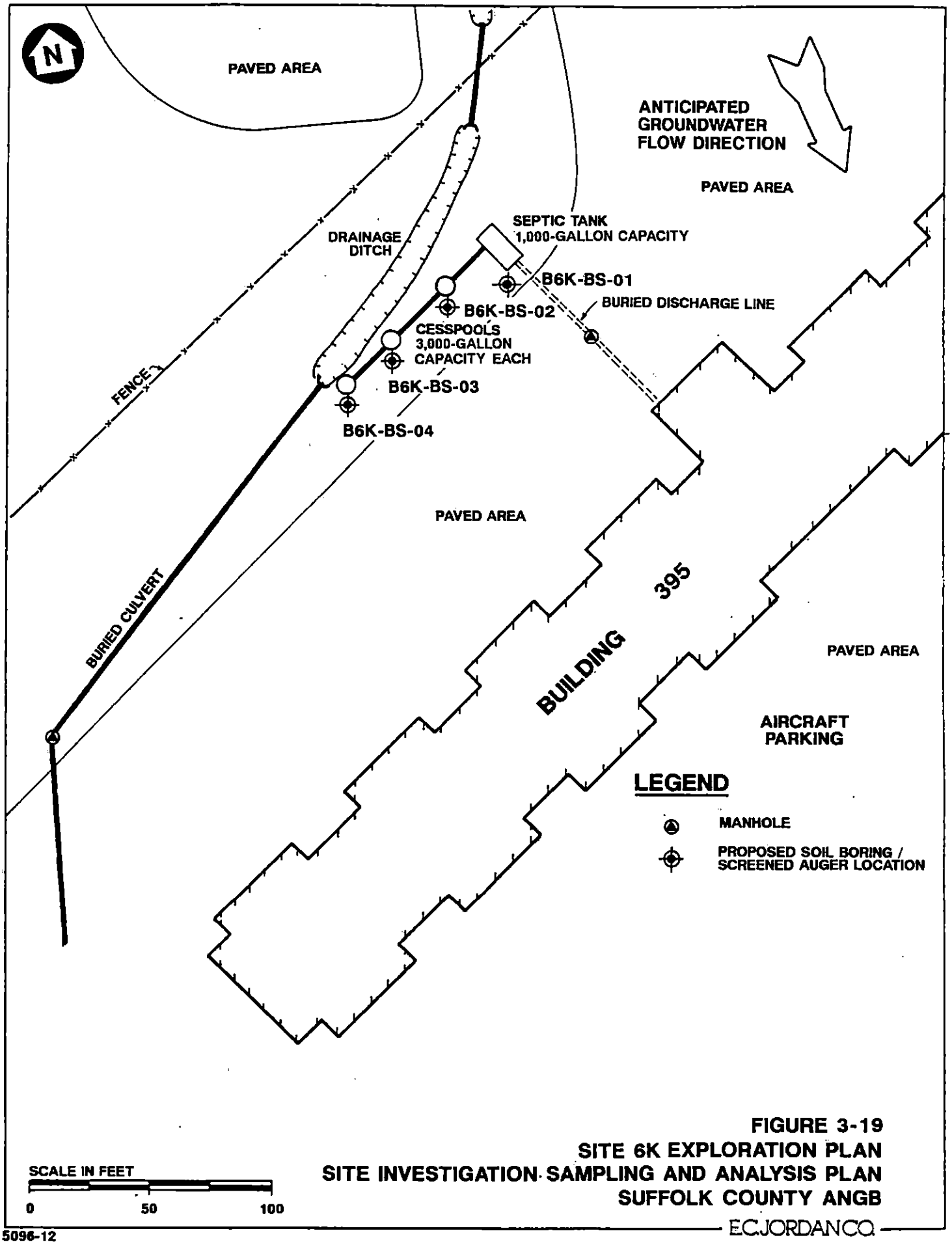


FIGURE 3-19
SITE 6K EXPLORATION PLAN
SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

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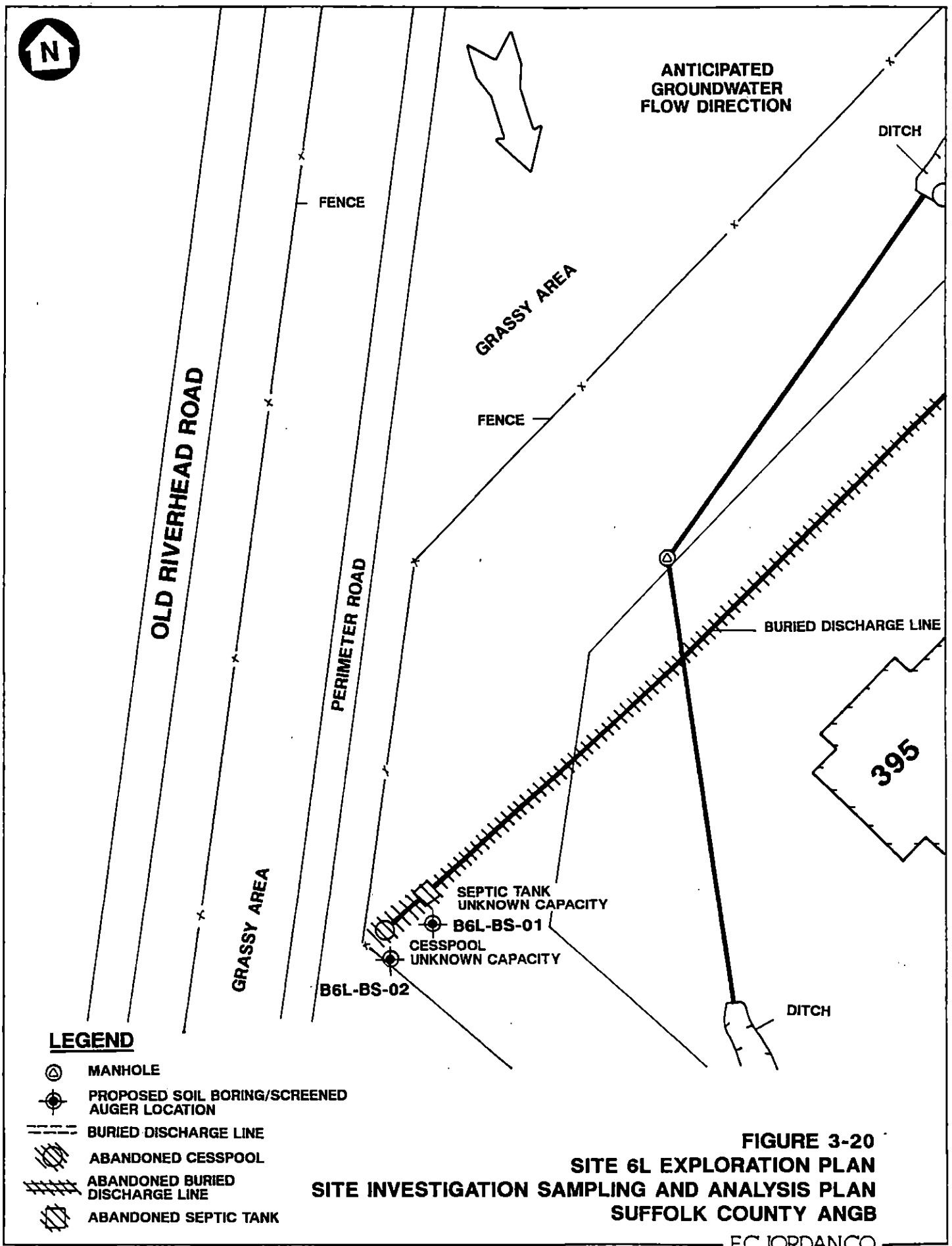


FIGURE 3-20
SITE 6L EXPLORATION PLAN
SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

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cesspools/septic tanks/dry wells. Cesspool and septic systems from 14 separate buildings will be considered for program purposes in the survey of Sites 6A through 6L. Table 2-1 is a list of these cesspools, septic tanks, dry wells, and the associated buildings and capacities.

3.3.6.1 Cesspool/Septic Tank Background. Little background information is available because these sites were not identified or considered during previous investigations. It was decided to investigate these sites in response to concerns expressed by SCDOHS during the SI kickoff meeting. The sites were selected during the SI kickoff meeting and the SI work plan review meeting based on the knowledge of CES personnel regarding historical uses of the buildings.

3.3.6.2 Cesspool/Septic Tank Exploration and Sampling and Analysis Program. The activities to be conducted at Sites 6A through 6L are summarized in Table 3-7. As discussed previously, no summary information was available for these sites before the start of this investigation. Therefore, the following types of information will be reviewed, depending on availability: utility maps, building plans, shipping manifests that route hazardous materials to each building, and maintenance records. Base personnel familiar with operations will also be interviewed, and locations of the systems at each building will be determined as best as possible.

The first field activity at the sites will be to conduct GPR surveys to locate these facilities and other underground utilities and subsurface obstructions. The next activity will be to collect a field-screening sample from each cesspool, septic tank, or dry well being investigated to provide information about current contamination source areas, as well as to determine whether there are potential risks associated with future construction activities that may involve excavation of the waste disposal systems. At some locations, there is only a single cesspool, septic tank, or dry well.

At all locations, attempts will be made to remove the cesspool and septic tank covers, and to sample the free liquid and sediments in the tank. Jordan understands that in some locations, the covers are either very massive or even buried or covered. The 106th CES personnel will be prepared to accompany Jordan personnel when the tanks or cesspools are opened, and will provide equipment and personnel not provided by Jordan for gaining access. There may be locations where access to the cesspool, septic tank, or dry well is not possible. A sample of sediment and liquid from each cesspool or septic tank will be field-screened for target VOCs and SVOCs using GC, and for target metals using X-ray fluorescence.

As discussed in Subsection 3.2.2.6, background samples for soil and groundwater will be obtained from soil borings and monitoring wells installed upgradient of the base. Based on the screening values established for VOCs, SVOCs, and metals from these background locations, confirmatory action levels will be established that will result in implementation of confirmatory activities at Sites 6A through 6L.

If field-screening of a sediment or liquid sample from a cesspool or septic tank indicates potential VOC, SVOC, or metals contamination above the selected action level, then the following sequence of activities will occur:

- Confirmatory sediment and water samples will be submitted for laboratory analyses for TCL VOCs, TCL SVOCs, and PP metals.
- A soil boring will be completed immediately downgradient of that cesspool or septic tank. The boring will be advanced into the saturated zone. Soil samples will be collected according to the procedures outlined in Subsection 3.2.1.6.

TABLE 3-7
SUMMARY OF CESSPOOL/SEPTIC TANK SURVEY (SITES 6A-6L) ACTIVITIES

SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY AIR NATIONAL GUARD BASE

Conduct a GPR survey of each cesspool complex to locate connecting lines and utilities.

Sample water and sediment at each cesspool or septic tank, depending on condition of cesspool and ease of access.

Field-screen water and sediment samples for VOCs and SVOCs using GC, and for metals using X-ray fluorescence.

If cesspool/septic tank field-screening indicates contamination:

- A boring will be completed immediately downgradient of the cesspool. Soils from the boring will be collected for field-screening for VOCs. Soil sample depth for confirmatory analyses will be selected based on the results of field-screening.
- A monitoring well may be installed in the boring, or one or more monitoring wells will be installed at the sites of cesspool/septic tank clusters.

If cesspool field-screening does not indicate contamination, a boring will be installed immediately downgradient of the cesspool, and advanced into the water table using screened augers. The screened-auger water samples (collected from the screened augers) will be field-screened for VOCs.

If all field-screening results are negative, the screened auger boring will be abandoned. However, if contamination is indicated, a monitoring well will be installed in the boring.

Samples will be collected from cesspools, borings, and monitoring wells where contamination is indicated, and sent to the laboratory for analyses for TCL VOCs, SVOCs, and PP metals.

NOTES:

GC - gas chromatography
GPR - Ground-Penetrating Radar
PP - Priority Pollutant
SVOC - semivolatile organic compound
TCL - Target Compound List
VOC - volatile organic compound

EXPLORATION SUMMARY:

47 Cesspool/Septic Tank/Drywell screening samples (liquid and sediment)
47 Soil Borings or 47 screened auger borings (any combination of both, dependent on screening)
Up to 18 Monitoring Wells (dependent on screening)
Up to 94 Laboratory Analyses of liquid and/or sediment
Up to 18 Monitoring Well Groundwater Samples
TCL VOC, TCL SVOC, and PP metals (all analyses)

- A monitoring well will be installed in either the boring or in a downgradient location (as described in the following paragraph), according to procedures outlined in Subsection 3.2.2.4. An on-site screening sample and an analytical sample will be collected from the monitoring well and screened for VOCs. If the screening sample indicates the presence of contamination, an optional monitoring well may be installed farther downgradient.

At sites where cesspool/septic tank field-screening indicates potential contamination, borings will be completed immediately downgradient of each contaminated cesspool or septic tank to assess the extent of contamination in soil. One or more monitoring wells will be installed to detect potential groundwater contamination resulting from the discharges at each cesspool site where contamination is indicated. The water from the initial monitoring wells will also be field-screened to decide if optional monitoring wells are necessary. The monitoring well may be installed either in the boring or at a downgradient location, depending on the nature of the site. Two types of approaches will be considered for locating initial monitoring wells, as follows:

- If the site consists of only one contaminated cesspool, septic tank, or dry well as indicated by field-screening (e.g., Site 6E) or multiple contaminated systems aligned parallel to groundwater flow (e.g., Site 6D), then a single monitoring well will be installed either in the single boring, or in the farthest downgradient boring for multiple systems.

- If the site consists of multiple contaminated systems aligned crossgradient to groundwater flow, the data from field-screened boring samples will be evaluated to decide on the best location of monitoring wells. This will allow for optimization of monitoring well installations to evaluate potentially broad areas of contamination from multiple sources at a single site (e.g., Sites 6A and 6H).

If the sediment or liquid from the cesspool or septic tank does not indicate potential contamination, then the following sequence of activities will occur:

- A confirmatory sample will not be submitted for laboratory analysis.

- A screened auger boring will be completed directly downgradient of the cesspool or septic tank. The boring will be advanced so that the screened auger is located within the saturated zone. The screened auger will be developed and a groundwater sample will be collected for field-screening for VOCs.

- If the screened auger groundwater sample indicates no detectable levels of VOCs, the boring will be appropriately abandoned, and it will likely be recommended that no further investigations be conducted at that location.

- If contamination is indicated in the screened auger sample, a monitoring well will be installed in the boring or in a downgradient location (as described in the preceding paragraph). The well will be developed, purged, screened, and sampled for laboratory analysis.

- All confirmatory soil and groundwater laboratory analyses will be for TCL VOCs, TCL SVOCs, and PP metals constituents.

3.4 ENVIRONMENTAL SAMPLING

Environmental sampling planned for SCANGB will include subsurface soils, surface soils, and groundwater. Table 3-8 summarizes the SI field investigation sampling plan. The following subsections describe the sampling programs in more detail.

3.4.1 Subsurface Soils and Surface Soils

Soil samples will be collected at SCANGB during the SI program for the following three purposes:

- to obtain samples of surface soils at various sites for laboratory analyses that will be used to characterize risks; samples will be field GC-screened before selection of samples for laboratory analyses
- to obtain subsurface soil samples to identify potential source areas of hazardous substance and/or fuel releases
- to obtain samples from the subsurface soils for classification of soils for geologic and hydrogeologic purposes

Soil samples will be collected during drilling activities using a stainless-steel split-spoon sampler. The split-spoon will be driven into the ground according to ASTM D-1586 Standard Penetration Testing.

At least one analytical soil sample will be collected from every soil boring conducted at each site (unless contamination is not detected at Site 1). The soil sample will be analyzed for TCL VOCs, TCL SVOCs, and/or site-specific parameters (see Table 3-8).

3.4.2 Groundwater Samples

Groundwater screening samples will be collected from each new monitoring well for field GC screening prior to analytical sampling. The purpose of this field-screening event is to ensure that monitoring wells are positioned correctly and to evaluate whether additional investigations are required at each site.

The newly installed wells will be pumped immediately with a rod (pitcher) pump, which is constructed of PVC with a foot value attached to the bottom end. The rod is actuated and water is discharged at the top of the rod. The well will be developed until the discharge water is sediment-free or three volumes have been removed, whichever is greater. The pump will be decontaminated between wells.

Analytical samples will be collected during a sampling event approximately two weeks after completion of the last monitoring well. Each well will be purged and sampled according to approved methods for that analyte. The analyses for each groundwater sample will be for site-specific parameters described in Table 3-8.

Monitoring wells will be sampled using the following procedures:

- The protective monitoring well cover will be opened, the ambient air in the well head will be scanned with a portable PID, and a water level measurement will be obtained in the well.
- One well volume will be calculated based on the height of the water column in the well. A submersible pump will be used to purge the monitoring well. The pump will be lowered to the water

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TABLE 3-8
SUMMARY OF SITE INVESTIGATION SAMPLES FOR EACH SITE

SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY AIR NATIONAL GUARD BASE

SAMPLE SOURCE	MEDIA	TCL VOC	(OPT.)	TCL SVOC	(OPT.)	PP METALS	(OPT.)	LEAD	(OPT.)	ETHYLENE GLYCOL	(OPT.)
SITE 1	SOIL	7	(2)	7	(2)	0		7	(2)	0	
	WATER	1	(2)	1	(2)	0		1	(2)	0	
SITE 2	SOIL	5	(1)	5	(1)	5	(1)	0		0	
	WATER	1	(1)	1	(1)	1	(1)	0		1	(1)
SITE 3	SOIL	6	(3)	6	(3)	6	(3)	0		0	
	WATER	1	(2)	1	(2)	1	(2)	0		0	
SITES 4A & 4B	SOIL	26	(20)	26	(20)	0		26	(20)	0	
	WATER	3	(3)	3	(3)	0		3	(3)	0	(3)
SITE 5	SOIL	9	(3)	9	(3)	9	(3)	0		0	
	WATER	1	(2)	1	(2)	1	(2)	0		1	(2)
SITES 6A	SOIL	0	(94)	0	(94)	0	(94)	0		0	
THROUGH 6L	WATER	0	(68)	0	(68)	0	(68)	0		0	
BASEWIDE	SOIL	7		7		7		0		0	
	WATER	2		2		2		0		0	
SUBTOTAL OF	SOIL	60	(123)	60	(123)	27	(101)	33	(22)	0	0
SITE SAMPLES	WATER	9	(78)	9	(78)	5	(73)	4	(5)	2	(6)
FIELD (10%)	SOIL	6	(14)	6	(12)	3	(10)	3	(2)	0	0
DUPLICATES	WATER	1	(8)	1	(8)	1	(7)	1	(1)	1	(1)
EQUIPMENT (20%)	SOIL	3	(8)	3	(8)	2	(6)	2	(2)	0	0
RINSATES	WATER	1	(5)	1	(5)	1	(4)	1	(1)	1	(1)
TRIP BLANKS	SOIL	10		0		0		0		0	
(EVERY SHIPMENT)	WATER	10		0		0		0		0	
FIELD BLANKS (EVERY OTHER DAY)	WATER	1	(5)	1	(5)	1	(4)	1	(1)	1	(1)
FILTRATION BLANK	WATER	0		0		1	(4)	0		0	
MS/MSD (20%)	SOIL	3	(8)	3	(8)	2	(6)	2	(2)	0	0
	WATER	1	(5)	1	(5)	1	(4)	1	(1)	1	(1)
SUBTOTAL	SOIL	82	(153)	72	(151)	34	(123)	36	(28)	0	0
	WATER	23	(101)	13	(101)	10	(92)	8	(9)	6	(10)
TOTAL ANALYTICAL		105	(254)	85	(252)	44	(215)	44	(42)	6	(10)

NOTES:

ANALYSES	METHOD
VOC	CLP-COP
SVOC	CLP-COP
METALS	CLP-CIP
LEAD	CLP-CIP
ETHYLENE GLYCOL	New York State

Indicates that value within parenthesis is an estimated value for samples to be collected during the optional phase.
Cyanide will not be analyzed for CLP-CIP.
Ethylene glycol (as total glycol) method developed by New York Department of Health.
TCL = Target Compound List
VOC = Volatile Organic Compounds
SVOC = Semivolatile Organic Compounds
PP = Priority Pollutants
MS/MSD = Matrix Spike/Matrix Spike Duplicate

table, then turned on and slowly lowered into the well. The pump will be lowered to the bottom of the monitoring well, remaining there until the well is purged (i.e., three to five well volumes). After each volume from the well has been removed, field parameters will be measured and purging will continue until the readings stabilize.

- o Inorganic samples will be collected through the submersible pump; however, organic samples will be obtained with a stainless-steel bailer.

- o Samples will be placed in the appropriate container with a computerized label with an assigned data base sample code affixed to the container. Samples will be appropriately preserved and shipped to the laboratory.

Groundwater samples will also be analyzed in the field for pH, temperature, and specific conductance. Groundwater and soil sampling will be conducted according to approved quality assurance/quality control (QA/QC) methods. Sufficient QA samples will be collected for each medium sampled. Sampling is anticipated to be conducted at Health and Safety Level D.

3.5 AQUIFER TESTING

Aquifer testing will be conducted to characterize groundwater flow patterns and to assess aquifer characteristics.

3.5.1 In Situ Hydraulic Conductivity Testing

In situ hydraulic conductivity testing will be conducted on one monitoring well at each site and in two piezometers. Because of the geologic homogeneity anticipated at the site, testing is not likely to be required at each monitoring well that may be installed during the cesspool and septic tank survey. Therefore, testing will be conducted at Sites 1 through 5 and at selected piezometer locations. This testing is designed to provide data to use for calculating groundwater aquifer characteristics, including permeability and groundwater flow velocities. Either rising- or falling-head tests will be conducted, depending on the position of the water table and the well screen.

The methodology commonly known as slug-testing provides approximate values of hydraulic conductivity of the overburden strata within a several-foot radius of the well screen. It is anticipated that all wells except one will be partially screened above the water table, thereby requiring rising-head tests.

An electronic water-level indicator and a calibrated pressure transducer will be used to measure water levels during the testing. Water levels are anticipated to recover too quickly for manual recording of times and water levels. Data generated from the tests will be recorded on a digital recorder and then downloaded on a PC diskette. Test data will be reduced and analyzed by PC. An appropriate data reduction method will be used, depending on test conditions (Bouwer and Rice, 1976; and Hvorslev, 1951). Permeability testing is anticipated to be conducted at Health and Safety Level D.

3.5.2 Water Level Measurements

One complete round of water level measurements will be obtained from all monitoring wells at completion of the SI field investigation. Additional water levels will be collected during the groundwater sampling event, and during the investigation as time allows. The water level elevations will be used to construct groundwater elevation contour maps, from which groundwater

flow directions will be interpreted. Vertical hydraulic gradients will be calculated from water level data at the well pair.

Groundwater level measurements are particularly important upon completion of each permanent piezometer. The groundwater elevation determined from a field elevation survey, along with regional flow patterns, will be used to position monitoring wells appropriately, in successive phases of the investigation.

3.6 SURVEY CONTROL AND MAP PREPARATION

This subsection outlines a two-phased ground survey program that will be conducted at the site to obtain the following:

- elevation control of all observation wells and monitoring wells that will be installed at the site
- ground surface control of key features at SCANGB that would be used to produce an anticipated new base map that contains 2-foot contour intervals

3.6.1 Initial Survey

The first activity will be conducted in two phases. The initial phase will be conducted immediately upon completion of the piezometer installation program. This elevation survey will be conducted to obtain ground surface and piezometer riser pipe elevations. The elevations will be used to calculate groundwater potentials so that groundwater flow directions may be estimated for use in positioning the soil borings and monitoring wells at each site.

This initial survey phase will be conducted by establishing several temporary elevation benchmarks across the site, as established by the surveying subcontractor, so that the wells can be surveyed to a consistent datum. This datum will be based on USGS benchmarks. Upon completion of the last observation well, the survey will be conducted on all observation wells. An entire round of groundwater level measurements will be conducted, and groundwater level elevations will be calculated.

3.6.2 Final Survey

Upon completion of the monitoring well program, a New York State-certified surveyor will conduct a horizontal and vertical survey of explorations conducted at the site. The survey will also serve to obtain ground control for a new digitized base map that will be produced for SCANGB using aerial photogrammetric techniques. Current technology for creation of base maps requires that surveyed elevations for points on the ground, which can be easily seen from aerial photographs, be obtained before the map is created. This activity will be completed prior to photogrammetric activities. The obvious points on the ground surface will have associated horizontal and vertical locations input directly into the computer that generates the new map from the photographs. These control points are used as a base so that surrounding points can be interpolated photogrammetrically. The new base map will be produced at a scale of 1 inch equals 100 feet with 2-foot elevation contours.

3.7 ANALYTICAL PROGRAM

The site-specific sampling and analysis programs for SI field investigations are summarized in Subsection 3.3. The analytical procedures appropriate for samples collected during the SI will comply with the USEPA CLP and standard USEPA methods, and will include the analyses of both soil and water samples.

The CLP was chosen for the analytical program at SCANGB because the data will be used to support future RI/FS studies. A combination of TCL VOCs, TCL SVOCs, and PP metals analyses will be performed on sediment, surface, and subsurface soil samples. Soil and groundwater analyses are site-specific and are presented in Table 3-8. Analytical methods for the SI are presented in Table 3-9; the analytical program for the SI is summarized in Table 3-8. Details of the ethylene glycol methodology are discussed in Appendix B.

3.7.1 Data Quality Objectives

DQOs are based on the concept that different data uses may require different quality data (HAZWRAP, 1988). Data quality is the degree of certainty with respect to precision, accuracy, reproducibility, statements specifying the required quality of data needed to support RI/FS activities (including site screening), and characterization, and may be used to support engineering alternative evaluations and selection decisions. The five HAZWRAP levels of data quality used by Martin Marietta Energy Systems, Inc., in the RI/FS process are described in the Jordan Quality Assurance Project Plan (E.C. Jordan Co., 1989b) and the site-specific QAPP in Appendix B of this SAP.

Data from the SI at SCANGB will be used for several purposes, depending on the specific task and the medium of concern. DQOs for the SI are identified by medium as follows:

- Groundwater, sediments, and soil samples collected during the SI field program at SCANGB will be analyzed by CLP methods to provide Level D data.
- Soil gas samples will be analyzed in the field by FID-ECD/GC to provide Level B screening data for assistance in locating potential areas of contamination for placing test borings and monitoring wells.
- Air quality will be monitored by PID to provide Level A data.
- Temperature, pH, and specific conductance will be monitored in the field for groundwater samples to provide Level A and Level B data.
- Subsurface soils collected during drilling will be screened with a PID to provide Level A data.

Table 3-10 presents DQOs for the SI analytical program that will be used at SCANGB.

3.7.2 Data Validation

Validation of the laboratory data is a systematic process to provide assurance that the data are adequate for the intended use. The process includes the following activities:

- auditing measurement system calibration and calibration verification
- auditing QC activities
- reviewing data for technical credibility relative to the sample site setting
- auditing field sample data records and chain-of-custody

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TABLE 3-9
SUMMARY OF EXPLORATION AND SAMPLING PROGRAM

SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY AIR NATIONAL GUARD BASE

		EXPLORATIONS			ANALYTICAL			
SITE	TYPE OF ACTIVITY	SOV POINTS	BORINGS SOIL	-WELL/ PIEZO	SUBSURFACE SOILS	SEDIMENT SAMPLING	SURFACE SOIL	GROUNDWATER
SITE 1	SCREENING	20	4	0	56	0	3	1
	CONFIRMATION	0	0	1	0	0	3	1
	OPTIONAL	0	2	2	28	0	0	2
SITE 2	SCREENING	20	2	0	28	0	3	1
	CONFIRMATION	0	0	1	0	0	3	1
	OPTIONAL	0	1	1	14	0	0	0
SITE 3	SCREENING	20	3	0	42	0	3	1
	CONFIRMATION	0	0	1	0	0	3	1
	OPTIONAL	0	4	2	56	0	0	2
SITES 4A & 4B	SCREENING	60	13	0	55	3	0	3
	CONFIRMATION	0	0	3	23	3	0	3
	OPTIONAL	0	6	4	10	0	0	3
SITE 5	SCREENING	0	3	0	9	6	0	1
	CONFIRMATION	0	0	1	2	6	0	1
	OPTIONAL	0	3	2	57	0	0	2
SITES 6A	SCREENING	0	0	0	0	46	0	46 **
THROUGH 6L	CONFIRMATION	0	30	0	0	0	0	0 **
	OPTIONAL	0	0	21	46	46	0	67
BASEWIDE *	SCREENING	20	0	3	28	0	3	3
	CONFIRMATION	0	0	6	4	0	3	3
	OPTIONAL	0	0	0	0	0	0	0
	SCREENING	140	25	3	218	55	12	56
TOTAL	CONFIRMATION	0	30	13	29	9	12	10
	OPTIONAL	0	16	32	211	46	0	76
	TOTAL	140	71	48	458	110	24	142

NOTES:

* Basewide explorations consist of 6 piezometers and 3 upgradient monitoring wells, from which 3 background monitoring wells will be installed and 6 background soil samples will be collected.

** Cesspool water samples included in this catergory.

SOV = Soil Organic Vapor

M-WELL = Monitoring Well

PIEZO = Piezometer

Soil borings at Site 6 consist of either screened augers or soil borings.

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TABLE 3-10
DATA QUALITY OBJECTIVES FOR THE SITE INVESTIGATION ANALYTICAL PROGRAM

SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY AIR NATIONAL GUARD BASE

MEDIA	FIELD LABORATORY ANALYSIS	PARAMETER	METHOD	DQO LEVEL
Drill Cuttings	Field	VOCs	PID	A
		VOCs	GC/ELCD; GC/PID	B
Soils/Sediments	Field	VOCs	PID	A
		VOCs	GC/ELCD; GC/PID	B
	Laboratory	VOCs	GC/MS	D
		SVOCs	GC/MS	D
		Metals	GFAA; AES	D
		Leads	GFAA; AES	D
Cesspool Sediments	Field	VOCs	PID	
		VOCs	GC/ELCD; GC/PID	B
		SVOCs	GC/FID	B
		Metals	XRF	B
	Laboratory	VOCs	GC/MS	D
		SVOCs	GC/MS	D
		Metals	GFAA; AES	D
Cesspool Liquids	Field	VOCs	GC/ELCD; GC/PID	B
		SVOCs	GC/FID	B
		Metals	XRF	B
	Laboratory	VOCs	GC/MS	D
		SVOCs	GC/MS	D
		Metals	GFAA; AES	D
Groundwater	Field	VOCs	GC/ELCD; GC/PID	B
		SVOCs	GC/FID	B
		Metals	XRF	B
	Laboratory	VOCs	GC/MS	D
		SVOCs	GC/MS	D
		Metals	GFAA; AES	D
		Ethylene glycol	NY-DOH	B

NOTES:
AES = Inductively Coupled Plasma Atomic Emission Spectroscopy
GC/ELCD = Gas Chromatography/Electrolytic Conductivity Detector
GC/FID = Gas Chromatography/Flame Ionization Detector
GC/PID = Gas Chromatography/Photoionization Detector
GFAA = Graphite Furnace Atomic Absorption
Metals = Field: Target compounds to be selected
Laboratory: USEPA Priority Pollutant Metals
NY-DOH = New York State Department of Health - Colorimetric determination of total glycols
PID = photoionization detector
SVOC = semivolatile organic compound
Field: Target compounds to be selected
Laboratory: USEPA Priority Pollutant Metals
VOC = volatile organic compound
Field: Target compounds to be selected
Laboratory: USEPA Target Compound List
XRF = X-ray Fluorescence

- checking intermediate calibration
- certifying the process

Data validation will be performed by Jordan personnel using USEPA procedures (USEPA, 1988a and 1988c). For analytical methods other than CLP, Jordan will conduct data reviews based on functional guidelines for laboratory blank contamination and laboratory QC.

HAZWRAP Level D QC, as described in Requirements for Quality Control of Analytical Data (HAZWRAP, 1988), will be followed for laboratory analytical samples.

Samples of drummed drill cuttings will be collected and analyzed using Level D QA/QC. Level E is appropriate for analysis of contents of underground tanks, drums, pure waste samples, and other storage tanks where there is low probability of litigation.

QC during sample analysis is described by USEPA's CLP - Caucus Organic Protocol and CLP - Caucus Inorganic Protocol. QC for other aspects of the analytical program will be in accordance with USEPA guidelines for the analytical methods presented in Table 3-3.

3.8 CONTAMINATION ASSESSMENT

The contamination assessment describes the nature and extent of identified chemical contamination, selects those chemicals considered to be contaminants, and addresses their fate and transport. The summary data from data validation will be evaluated, by medium, to determine the distribution of chemicals and select the site-related contaminants.

Data will be presented on maps characterizing the distribution of contamination in the various media. Where appropriate, depth profiles of chemical concentrations will be included on maps and figures. The product of this assessment will be presentation of the spatial distribution and characterization of possible contaminant sources.

The contaminant selection criteria may include comparison to background chemical concentrations, site history, and Applicable or Relevant and Appropriate Requirements (ARARs). Examples include the following:

- chemicals present in soils and sediments at concentrations greater than site-specific background levels or above normal concentration ranges for U.S. soils (Kabata-Pendias and Pendias, 1984; and Shacklette and Boerngen, 1984)
- chemicals present in groundwater at SCANGB at concentrations greater than USEPA Maximum Contaminant Levels (MCLs), Maximum Contaminant Level Goals (MCLGs), or Health Advisories, all promulgated under the Safe Drinking Water Act
- chemicals present in surface water at SCANGB in concentrations above Clean Water Act levels and/or federal Ambient Water Quality Criteria (AWQC)

The purpose of the contaminant fate and transport assessment is to determine the potential for contaminant migration. By the qualitative application of the chemical and physical behavior of the contaminants, this analysis links the analytical data, field observations, and site geology and hydrogeology with the public health risks and environmental media impacts. Site history and background information will be used, in addition to the data gathered

during the SI, to support this assessment. The end product of the contamination assessment is the distribution of site contaminants in each medium and the potential for migration to other media or the likely changes in concentration within media with time.

3.9 PRELIMINARY RISK EVALUATION

The preliminary risk evaluation for this SI is a screening process that will be used to identify those sites that have chemicals of potential concern (COPC) and exposure pathways, and that will be recommended for further investigation during an RI. If a site poses an imminent threat to public health or the environment, immediate removal action will be recommended. It will also identify those sites that have no risk and for which a DD can be written. The overall SI, contamination assessment, and risk evaluation process to be applied to SCANGB is discussed in detail herein. Figure 3-21 is a flow diagram illustrating this process. For this screening, a generic exposure scenario will be developed that can be applied to each site at SCANGB. This generic exposure scenario is appropriate because (1) SCANGB is a base of limited size, (2) the population exposed will be the same at each site, and (3) access to the base is limited, which controls the potentially exposed population.

The field investigation and analytical programs presented in this SAP were developed partly in response to the data requirements to support preliminary risk evaluations. Using the information generated by the field and analytical programs, a preliminary risk evaluation will be conducted to identify potential threats to public health or the environment that may be posed by the sites of concern. The methodology employed for the risk evaluation phase of the project will be based on principles contained in USEPA guidance documents (USEPA, 1988b and 1989).

The risk evaluation process consists of the following four components:

- general Basewide Exposure Scenario (BES) development
- identification of COPC
- identification of ARARs
- risk evaluation

3.9.1 Exposure Scenario Development

As described previously, a generic BES will be developed to be used in screening the sites at SCANGB. The potentially exposed populations and the routes of exposure will be identified. The exposed populations consist primarily of ANG personnel and their contractors, official visitors, and a limited wildlife population (i.e., small mammals and birds). The routes and frequencies of exposure will be determined based on expected generic job functions. The routes of exposure are primarily ingestion, inhalation, and dermal contact. The BES will be described in a technical memorandum that will be submitted to HAZWRAP and the regulators for review and agreement (see Section 5.0).

3.9.2 Identification of Chemicals of Potential Concern

The objective of this task will be to screen the information available on hazardous substances present at the site and to identify those contaminants by media which could be associated with potential adverse effects to the exposed human or environmental receptors. COPC are a subset of chemicals selected from the site-related contaminants identified in the contamination assessment. The selection of COPC will be based on toxicity, concentration, frequency of

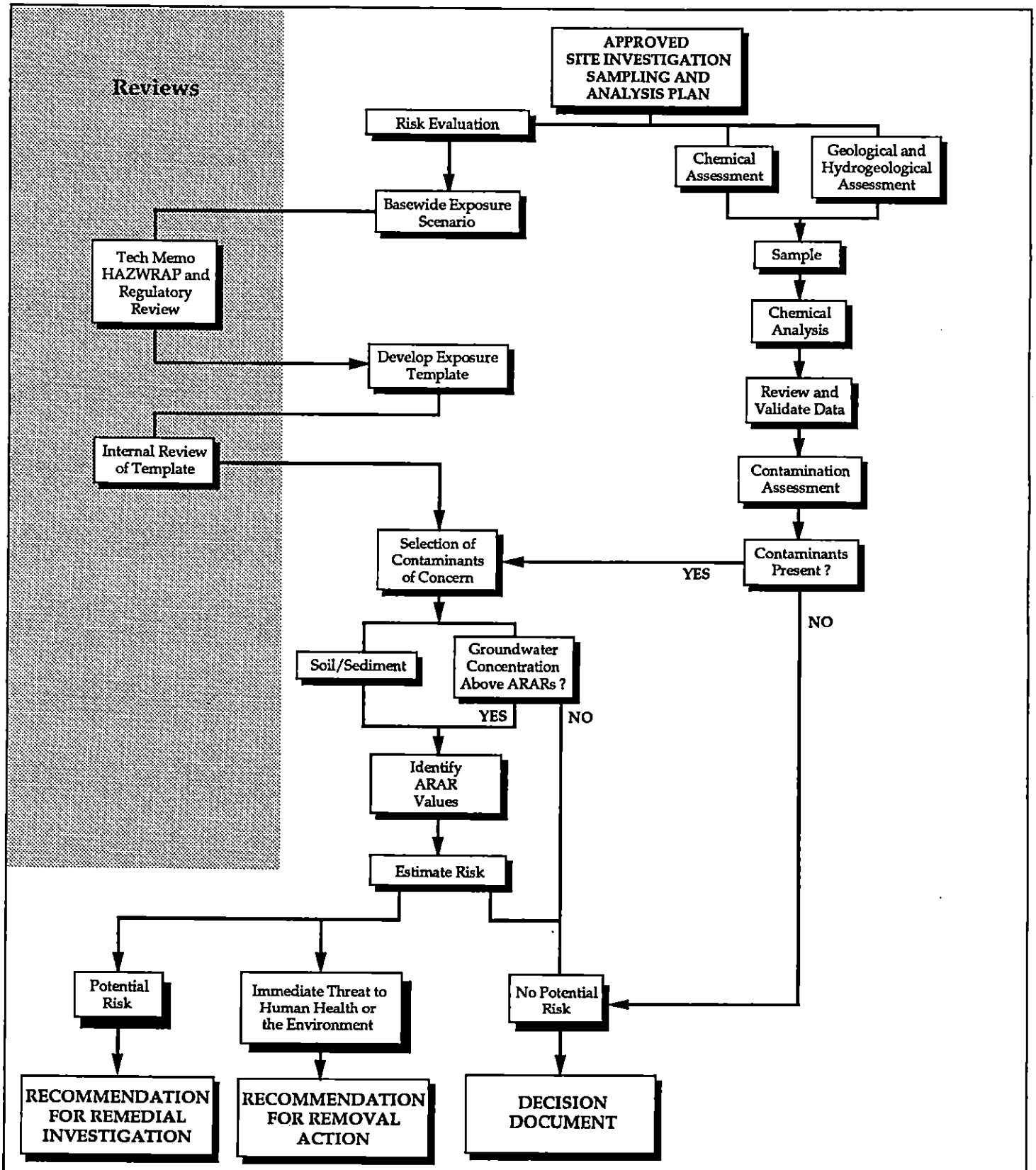


FIGURE 3-21
SITE INVESTIGATION
RISK EVALUATION AND
CONTAMINATION ASSESSMENT PROCESS
SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

detection, and potential routes of exposure. COPC will be identified as carcinogens or noncarcinogens with brief descriptions of the potential toxic effects of each chemical.

3.9.3 Appicable or Relevant and Appropriate Identification of Chemical Standards and Guidance Values

The purpose of this step is to identify available chemical-specific federal and/or state regulatory standards and guidance values, including USEPA MCLs and MCLGs for drinking water, AWQC, Health Advisories, and applicable State of New York public health or environmental protection criteria. Applicable standards and/or criteria for the COPC are identified in this subsection and will be used to evaluate the chemical concentrations reported in the appropriate media.

3.9.4 Risk Estimation

The final component of this risk evaluation process will be the risk estimation. This component integrates the processes of COPC selection with potential exposure pathway determination. If the generic BES indicates that human or environmental receptors could potentially be exposed, it will be used to define the need for further investigation of the site, such as further sampling of specific media or the need for immediate removal action.

If COPC and routes of exposure do not exist, the site will be recommended for the DD process. If a site poses an immediate threat to public health or the environment, immediate removal action will be recommended.

Quantification of any potential risk will not be a component of the SI risk evaluation process. If the SI risk evaluation recommends that a site proceed to the RI stage, quantification of potential risk will be addressed at that time.

4.0 SITE INVESTIGATION REPORTS

Three documents will be generated from the SI efforts: (1) the BES technical memorandum, (2) the Community Relations Plan (CRP), and (3) the SI report.

4.1 BASEWIDE EXPOSURE SCENARIO TECHNICAL MEMORANDUM

The BES technical memorandum will be developed as discussed in Subsections 3.9 and 3.9.1. After internal draft approval, this document will be submitted to regulators for review, comment, and approval of the exposure scenarios to be used for characterization of risks.

4.2 COMMUNITY RELATIONS PLAN

The CRP will be developed as described in Subsection 5.1.4 of the accompanying Project Management Plan (PMP). The CRP will outline community relations activities to be implemented by SCANGB for the RI/FS process. The CRP will provide a better understanding of the RI/FS program for the public and an opportunity for community input to the decision-making process for selection of remedial measures. The PMP discusses the goals of the CRP and community relations support activities.

4.3 SITE INVESTIGATION REPORT

The SI report will be produced after completion of the field investigation, preliminary risk assessment, and additional explorations. It will be a presentation of data, analysis and interpretation of data, and conclusions drawn from the data.

The SI report will contain information generated from the total SI SAP and recommendations for future work. Potential alternatives for future work include the following: (1) take no further action (DD required); (2) initiate preparation of engineering plans and specifications for removal of contamination; (3) conduct an FFS/RM; and (4) acquire additional data (RI). The contents will include but not be limited to the following:

- Executive Summary
- Background
- Technical Approaches
- Summary of Work Accomplished
- Site-by-site Reports (i.e., Site Description, Site Investigation Program, Geology/Hydrogeology, Data Summary, Conclusions, and Recommendations)
- Basewide Groundwater Study
- BES
- Contamination Assessment
- Preliminary Risk Assessment

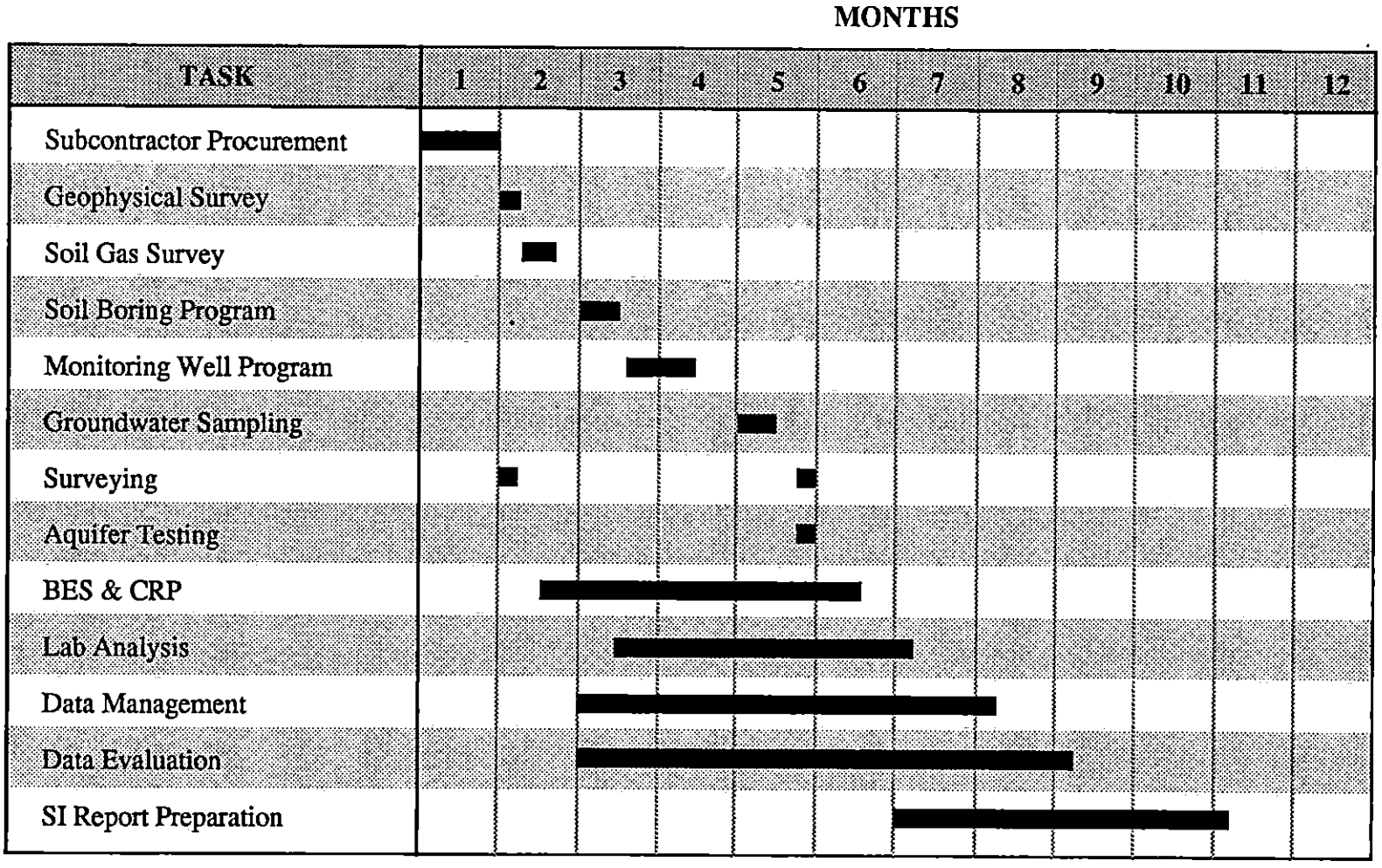
- SI Program Conclusions and Recommendations
- Appendices (e.g., Analytical Results and Boring Logs)

5.0 SCHEDULE

A schedule for SI activities at SCANGB is presented in Figure 5-1. The program is based on a 12-month duration, with August 1990 as the anticipated start date (Month 1). Upon approval of all regulatory agencies, and HAZWRAP's Notice to Proceed, field activities will begin for an approximate four-and-a-half-month duration. Each task in the field activities is separated by a brief interim period to evaluate the data before the next phase of work begins.

The schedule does not reflect any additional field investigations under the SI program. If additional investigations were deemed necessary at the conclusion of the initial field investigation, those investigations should occur before submittal of the SI report. If additional investigations are needed, the submittal of a final SI report could require another six to 10 months.

Key project deliverables, important milestones, distribution requirements, and associated planned dates are listed in Table 5-1.



NOTES: BES = Basewide Exposure Scenario

CRP = Community Relations Plan

FIGURE 5-1
SITE INVESTIGATION SCHEDULE
SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY ANGB

E.C. JORDAN CO.

TABLE 5-1
KEY PROJECT DELIVERABLES

SITE INVESTIGATION SAMPLING AND ANALYSIS PLAN
SUFFOLK COUNTY AIR NATIONAL GUARD BASE

ITEM	DATE	DISTRIBUTION
SI WORK PLAN (Draft)	7/90	SCANGB, NGB, HAZWRAP, NYSDEC, USEPA
Regulatory Review Meeting	9/90	N/A
SI Work Plan (Final)	10/90	SCANGB, NGB, HAZWRAP, NYSDEC, USEPA, SUFFOLK COUNTY
Field Mobilization	11/90	N/A
Initiate CRP and Development of BES	12/90	N/A
Submit CRP and BES Tech Memo (Internal Draft)	2/91	SCANGB, NGB, HAZWRAP
Submit CRP and BES Tech Memo (Draft)	3/91	SCANGB, NGB, HAZWRAP, SUFFOLK COUNTY, NYSDEC, USEPA
Submit CRP and BES Tech Memo (Final)	4/91	SCANGB, NGB, HAZWRAP, SUFFOLK COUNTY, NYSDEC, USEPA, Public
Field Work Complete	4/91	N/A
Data Evaluation Complete	7/91	N/A
SI Report (Internal Draft)	9/91	SCANGB, NGB, HAZWRAP
SI Report (Draft)	10/91	SCANGB, NGB, HAZWRAP, SUFFOLK COUNTY, NYSDEC, USEPA
SI Report (Final)	11/91	SCANGB, NGB, HAZWRAP, SUFFOLK COUNTY, NYSDEC, USEPA, Public

NOTES:
SI Work Plan = Project Management Plan and Sampling and Analysis Plan
NYSDEC = New York State Department of Environmental Conservation
CRP = Community Relations Plan
BES = Basewide Exposure Scenario
SCANGB = Suffolk County Air National Guard Base
NGB = National Guard Bureau
HAZWRAP = Hazardous Waste Remedial Actions Program
USEPA = U.S. Environmental Protection Agency
N/A = Not Applicable

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ANG	Air National Guard
ARAR	Applicable or Relevant and Appropriate Requirement
ASTM	American Standards and Tests Methods
AVGAS	aviation gasoline
AWQC	Ambient Water Quality Criteria
BES	Basewide Exposure Scenario
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CES	Civil Engineering Squadron
CLP	Contract Laboratory Program
COC	Chain of Custody
COPC	chemicals of potential concern
CRP	Community Relations Plan
DD	Decision Document
DOD	Department of Defense (U.S.)
DQO	Data Quality Objective
ECD	electron capture detector
FFS	Focused Feasibility Study
FID	flame ionization detector
FS	Feasibility Study
FTA	Fire Training Area
GC	gas chromatograph
GPR	Ground-Penetrating Radar
HASP	Health and Safety Plan
HAZWRAP	Hazardous Waste Remedial Actions Program
HMTC	Hazardous Materials Technical Center
ID	inside diameter
IRP	Installation Restoration Program
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MSL	Mean Sea Level
NGB	National Guard Bureau
PA	Preliminary Assessment
PARCC	precision, accuracy, representativeness, completeness, and comparability
PC	personal computer
PID	photoionization detector
PMP	Project Management Plan
POL	petroleum, oils, and lubricants
PP	Priority Pollutant
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RA	Remedial Action
RI	Remedial Investigation
RM	Remedial Measures

GLOSSARY OF ACRONYMS AND ABBREVIATIONS
(continued)

SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SCA	Suffolk County Airport
SCDOHS	Suffolk County Department of Health Services
SCANGB	Suffolk County Air National Guard Base
SI	Site Investigation
SOP	Standard Operating Procedures
SOV	Soil Organic Vapor
SOW	Statement of Work
SVOC	semivolatile organic compound
TCL	Target Compound List
TOM	Task Order Manager
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geologic Survey
VOC	volatile organic compound

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APPENDIX A

SITE-SPECIFIC HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN
FOR
SITE INVESTIGATION

Prepared for:

SUFFOLK COUNTY AIR NATIONAL GUARD BASE
SUFFOLK COUNTY AIRPORT
WESTHAMPTON, NEW YORK

Prepared by:

E.C. JORDAN CO.
PORTLAND, MAINE

Job No. 5096-12

JULY 1990

5096-12

HEALTH AND SAFETY PLAN
SUFFOLK COUNTY AIR NATIONAL GUARD BASE

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1.0 INTRODUCTION

The 106th Aerospace Rescue Group (ARG) is located at the New York Air National Guard, Suffolk County Air National Guard Base, Westhampton Beach, New York, hereinafter referred to as the Base. The Air National Guard Base has been active since 1971, and over the years the types of military aircraft based and serviced there have varied. Past operations there have involved the use of hazardous materials and disposal of hazardous wastes. Because of the use of hazardous material and disposal of hazardous waste, the Air National Guard (ANG) has implemented its Installation Restoration Program (IRP).

1.1 SCOPE AND PURPOSE

This Health and Safety Plan (HASP) was prepared in conformance with the E.C. Jordan Health and Safety Program, and is intended to meet the requirements found in 29 CFR 1910.120. As such, the HASP addresses all activities associated with site investigation (SI) field operations at the Suffolk County Air National Guard Base (SCANGB). Compliance with this HASP is required of all E.C. Jordan (JORDAN) personnel, contractor personnel, or third parties entering the site.

1.2 HEALTH AND SAFETY PERSONNEL

The following subsections briefly describe the health and safety designations and general responsibilities that will be employed for the SI.

1.2.1 Health and Safety Manager

The Health and Safety Manager (HSM) for E.C. Jordan, Cynthia Sundquist, can be reached at (207) 775-5400 x101, in Portland, Maine. The HSM has final authority to resolve health and safety issues that are not resolved at the site or through the Health and Safety Supervisor (HSS), and has overall responsibility for ensuring that the policies and procedures of this HASP are implemented by the Health and Safety Officer (HSO). In the various regions, the HSM may delegate additional functions to the Regional HSS.

1.2.2 Health and Safety Supervisor

The HSS for Jordan, Averill Rance, may be reached at (201) 992-2323, in Roseland, New Jersey. The HSS is the health and safety professional serving as the E.C. Jordan HSM's designee for this project. As such, the HSS will be responsible for (1) approval of the individual chosen to serve as the site HSO for this field operation; (2) review and approval of site-specific HASPs developed by the HSO, as well as any significant changes made over time to the site HASP; (3) oversight of the daily efforts of the HSO; (4) resolution of site disputes involving health and safety issues; and (5) implementation of the HASP by the HSO. The HSS will notify the HSM of any Stop Work Orders issued by an HSO.

1.2.3 Health and Safety Officer

Vicki Miller has been approved as the HSO for the SCANGB SI by the JORDAN HSS. The HSO is responsible for developing and implementing this site-specific HASP in accordance with the E.C. Jordan Health and Safety Program. The HSO will conduct safety inspections and investigate all accidents, illnesses, and incidents occurring on-site. The HSO will also conduct safety briefings and site-specific training for on-site personnel. As necessary, the HSO will accompany all U.S. Environmental Protection Agency (USEPA), Occupational Safety and Health Administration (OSHA), or other governmental agency personnel visiting the site in response to health and safety issues. The HSO, in consultation with the HSS, is responsible for updating and modifying this HASP as site or environmental conditions change.

The HSO is vested with the authority to stop site operations (STOP WORK AUTHORITY) if he determines that an imminent health or safety hazard or other potentially dangerous situation exists. The HSO is to immediately notify the HSS of any Stop Work Orders issued. The HSO may also recommend to the HSS or HSM that the downrange authorization of individual site personnel be revoked for health and/or safety reasons.

The HSO, through the HSS, ensures that all personnel entering work site areas are qualified for downrange deployment, in accordance with the JORDAN Health and Safety Program requirements.

1.3 TRAINING

Training, as defined under the JORDAN Health and Safety Program, Section 4.5.3, and meeting the requirements of 29 CFR 1910.120, is required for all personnel entering potentially contaminated areas of this site. Personnel without the required training will not be permitted in a downrange position.

1.4 MEDICAL SURVEILLANCE

All personnel entering potentially contaminated areas of this site must be medically qualified for site assignment as determined by a medical surveillance program, such as that outlined in the JORDAN Health and Safety Program, Section 3.0. Personnel without medical clearance will not be permitted in a downrange position.

2.0 SITE CHARACTERIZATION AND ANALYSIS

2.1 SITE NAME, LOCATION, AND SIZE

The 106th ARG is located at Suffolk County Airport, formerly known as Suffolk County Air Force Base. The airport is located on Old Riverhead Road, approximately 2 miles north of Westhampton Beach, New York. The 106th occupies the area south of Cook Street on the west side of the airport.

2.2 SCOPE OF WORK

The scope of this Site Investigation is limited to the activities outlined by the IRP for Federal facilities under the IRP program. Basically, the SI phase of work is implemented to find the presence and absence of contamination at the facility. Base activities will consist of:

- o geophysical survey
- o soil gas investigation
- o soil boring/field screening activities
- o soil boring and monitoring well installation
- o groundwater sampling

These activities are outlined in Section 3.0 of the work plan.

2.3 SITE HISTORY

In 1941, the U.S. Civil Aeronautics Authority began leasing parcels of land in Suffolk County for construction of an air base. They accumulated about 11,500 acres of land for the base. In May 1943, the base was activated for gunnery training. After World War II, the base was deactivated and was leased to the Arabian American Oil Company between 1948 and 1951.

The base was reactivated in 1951 (as a result of the Korean War) and was occupied by various U.S. Air Force and Air National Guard groups between 1951 and 1969. In 1969, the base again closed and the land was acquired by Suffolk County.

In 1971, the Air National Guard leased approximately 70 acres on the west side of the airport. The ANG has maintained operations at Suffolk County Airport since 1971. The missions and types of aircraft have varied over the years, beginning with the arrival of KC-97 tankers in 1971. In December 1972, the KC-97s were replaced with F-102 fighter interceptors. The fighters left in 1975 and were replaced with HH-3 helicopters and HC-130/HC-130P fixed wing aircraft.

The present mission of the 106th is aerospace rescue and recovery. The U.S. Coast Guard frequently coordinates with the 106th ARG for rescue and recovery missions.

2.4 HAZARDOUS SUBSTANCES/CONDITIONS

Potential hazards encountered during explorations at the Base include:

- o inhalation of volatilized organic compounds or other chemicals sorbed to dust
- o dermal contact with contaminated soils and fluids
- o physical hazards associated drilling equipment and site conditions

The major operations of the 106th ARG that have used and disposed of hazardous materials/hazardous wastes include aircraft maintenance; aerospace ground equipment (AGE) maintenance; ground vehicle maintenance; petroleum, oil, and lubricant (POL) management and distribution; and fire department training. The operations involve such activities as corrosion control, nondestructive inspection (NDI), fuel cell maintenance, engine maintenance, and pneudraulics. Varying quantities of waste oils, recovered fuels, spent cleaners, strippers, and solvents were generated and disposed of by these activities.

The hazardous waste materials generated by these operations are being disposed of by the Defense Reutilization and Marketing Office (DRMO).

Interviews with nine base personnel and a field survey conducted during the Phase I, Records Search and a field survey resulted in the identification of five disposal and/or spill sites at the base.

The five sites at the base that are potentially contaminated with hazardous materials are:

Site No. 1 - AVGAS Spill Site
Site No. 2 - Former Hazardous Waste Storage Area
Site No. 3 - Current Hazardous Waste Storage Facility
Site No. 4 - Aircraft Refueling Apron
Site No. 5 - Southwest Storm Drainage Ditch

Investigations shall also be included at 10 separate locations that shall be referred to as the Industrial Cesspools and Septic Tanks Survey.

2.5 INITIAL SITE ENTRY

2.5.1 Initial Level of Protection

Initial level of protection employed at the Base will be Modified Level D, Level C dermal and Level D respiratory protection, with environmental monitoring.

2.5.2 Initial Monitoring

Where the development of site information either shows the potential for or is unable to rule out the possibility of ionizing radiation or "immediately dangerous to life or health" (IDLH) conditions, initial monitoring will consist (at a minimum) of an ionizing radiation survey and air monitoring using devices such as a combustible gas indicator, oxygen meter, and photoionization detector (PID). It is intended that real-time monitoring instrumentation will be used to assist in the determination of the appropriate level of protection for the initial site entry team.

2.6 SITE RISKS

2.6.1 Health Hazards

Potential health hazards at the Base include:

- o inhalation of volatilized organic compounds or other chemicals sorbed to dust
- o dermal contact with contaminated soils and fluids

The hazardous substances most likely to be encountered are AVGAS, JP-4, and fuel oil. The most hazardous constituents of these substances are the aromatics; benzene, toluene, and xylenes. PD-680 was reported to have been stored at the hazardous waste storage areas, Sites 2 and 3.

Field activities planned for the Base SI will involve contact with potentially contaminated soils during the drilling activities. Monitoring well sampling and sediment sampling may bring workers into contact with potentially contaminated water. All intrusive activities planned for the site may result in the release of volatile and semivolatile organic compounds to the atmosphere.

2.6.2 Safety Hazards

Potential safety hazards at the Base involve the physical risks associated with existing site conditions, the use of drilling equipment and the use of heavy equipment near fuel lines, underground tanks and septic tanks. Heavy equipment, such as drill rigs, present a potential safety problems for site workers. Such hazards can be minimized by the use of safe work practices.

2.6.3 Conclusions/Risk Assessment

In order to minimize the hazard to site workers, protective measures must be taken to prevent worker exposure and/or injury. Intrusive site activities will require Modified Level D protection to prevent worker contact with contaminated soils and fluids. The level of respiratory protection and the air monitoring protocol will be based on benzene, which has the lowest regulatory exposure limit (see Section 4.3.3).

3.0 SITE CONTROL

3.1 ZONATION

Safety zones for the SI field activities at the Base will be established at each of the 6 sites. Each site will be divided into three zones: the area of intrusive explorations will be considered the Exclusion Zone, with limited areas designated as the Support Zone, and an area for decontamination called the Contamination Reduction Zone (CRZ).

3.1.1 Exclusion Zone

The Exclusion Zone isolates the area of contaminant generation and restricts (to the extent possible) the spread of contamination from active areas of the site to support areas and off-site locations. The Exclusion Zone is demarcated by the Hot Line (i.e., a tape line or physical barrier). Personnel entering the Exclusion Zone must (1) enter through the CRZ; (2) wear the prescribed level of protection (see Section 4.3.1); and (3) be otherwise authorized to enter the Exclusion Zone (see Section 1.3, 1.4, and 9.1). Any personnel, equipment, or materials exiting the Exclusion Zone will be considered contaminated. Personnel will be subject to decontamination; equipment and materials will either be subject to decontamination or containerized in uncontaminated devices.

Within the Exclusion Zone, specific locations or restricted areas (clearly marked or identified) will be established as necessary for particular locations or around specific site operations. In the case of well drilling or excavation operations, a restricted area will be established that includes a minimum 30-foot radius from the drill rig or excavation operation. Other restricted areas may include drum areas, active site areas, sources of combustible gases or air contaminants, or other dangerous areas as they are identified. Specific access for emergency services to areas of specific site operations will be established.

3.1.2 Contamination Reduction Zone

Moving out from the Exclusion Zone, starting at the Hot Line and continuing to the Contamination Control Line, is the CRZ. The CRZ is a transition zone between contaminated and uncontaminated areas of the site. When "hot" or contaminated personnel, equipment, or materials cross the Hot Line, they are assumed to be as "hot" or contaminated as they are going to be from site operations. Being subjected to the decontamination process, they become less contaminated; when they reach the Contamination Control Line, they are clean and can exit this zone without spreading contamination.

Within the CRZ is the Contamination Reduction Corridor (CRC), where materials necessary for full personnel and portable equipment decontamination are kept. A separate facility will be established for heavy equipment decontamination. In addition, certain safety equipment (e.g., emergency eye wash, fire extinguisher, stretcher, and first aid kit) are staged in this zone.

3.1.3 Support Zone

The Support Zone is the outermost zone of the site, separated from the CRZ by the Contamination Control Line; it is considered a clean area. Movement of personnel and materials from this zone into the CRZ is generally unrestricted, except as required through access points controlled for administrative purposes. However, only uncontaminated/decontaminated personnel or materials may enter this zone from the CRZ.

The Support Zone contains the necessary support facilities (including personal hygiene facilities) for site operations. It also serves as the communications center and source of emergency assistance for operations in the Exclusion Zone and CRZ. A log of all persons entering the site will be maintained by the HSO, the field operations leader, or the site designee.

3.2 MEDICAL ASSISTANCE

ROUTES TO EMERGENCY MEDICAL FACILITIES

Primary source of medical assistance for the Suffolk County Air National Guard Base:

Central Suffolk Hospital
1300 Roanoke Avenue
Riverhead, New York 11901
548-6000

Directions to hospital for medical assistance:

- Exit site. Turn right onto Old Riverhead Road.
- Proceed north to junction with County Route 104.
- Turn left onto Route 104.
- Proceed north into downtown Riverhead.
- Turn right onto Main Street (NYS Route 25).
- Make an immediate left onto Roanoke Avenue (County Route 73-North).
- Follow Roanoke Avenue to traffic circle.
- Hospital is on north east side of circle.

4.0 ENGINEERING CONTROLS, WORK PRACTICES, AND PERSONAL PROTECTIVE EQUIPMENT

4.1 ENGINEERING CONTROLS

No engineering controls are planned for the field investigation at this site.

4.2 WORK PRACTICES

Workers are expected to adhere to established safe work practices for their respective specialties (e.g., drilling, laboratory analysis, or construction). The need to exercise caution in the performance of specific work tasks is made more acute due to (1) weather conditions; (2) restricted mobility and reduced peripheral vision caused by the protective gear itself; (3) the need to maintain the integrity of the protective gear; and (4) the increased difficulty in communicating caused by respirators. Work at the site will be conducted according to established protocols and guidelines for the safety and health of all involved. Among the most important of these principles for working at a hazardous waste site are the following:

- In any unknown situation, always assume the worst conditions and plan responses accordingly.
- Use the buddy system. Under no conditions will any person be permitted to enter the Exclusion Zone alone. Establish and maintain communication. In addition to radio communications, it is advisable to develop a set of hand signals, because conditions may greatly impair verbal communications.
- Because no personal protective equipment is 100-percent effective, all personnel must minimize contact with excavated or contaminated materials. Plan work areas, decontamination areas, and procedures accordingly. Do not place equipment on drums or the ground. Do not sit on drums or other materials. Do not sit or kneel on the ground in the Exclusion Zone or CRZ. Avoid standing in or walking through puddles or stained soil.
- Smoking, eating, or drinking in the work area and before decontamination will not be allowed. Oral ingestion of contaminants is the second most likely means of introducing toxic substances into the body (inhalation is the first).
- Avoid heat and other work stresses related to wearing protective gear. Work breaks should be planned to prevent stress-related accidents or fatigue.
- To the extent feasible, handling of contaminated materials should be done remotely, particularly when drummed or other containerized hazardous waste materials are found on-site. Every effort should be

made to identify the contents of containers found on-site before they are subject to material-handling applications.

- Personnel must be observant of not only one's own immediate surroundings, but also those of others. Everyone will be working under constraints; therefore, a team effort is needed to notice and warn of impending dangerous situations. Extra precautions are necessary when working near heavy equipment and while utilizing personal protective gear because vision, hearing, and communication can be restricted.

- Contact lenses are not allowed to be worn on-site; if corrosive or lachrymous substances enter the eyes, proper flushing is impeded.

- All facial hair that interferes with the face piece fit, must be removed prior to donning a respirator at all sites requiring Level C or B protection.

- Rigorous contingency planning and dissemination of plans to all personnel minimizes the impact of rapidly changing safety protocols in response to changing site conditions.

- Personnel must be aware that chemical contaminants may mimic or enhance symptoms of other illnesses or intoxication. Avoid excess use of alcohol or working while ill during field investigation assignments.

- The site leader, HSO, and sampling personnel will maintain project records in a bound notebook (e.g., daily activities, meetings, incidents, and data). Notebooks will remain on-site for the duration of the project so that replacement personnel may add information, thereby maintaining continuity. These notebooks and daily records will become part of the permanent project file.

4.3 PERSONAL PROTECTIVE EQUIPMENT

4.3.1 Levels of Protection

The following descriptions provide the basic composition of the generally recognized protective ensembles to be used for site operations. Specific components for any level of protection will be selected based on hazard assessment; additional elements will be added as necessary. Disposable protective clothing, gloves, and other equipment, exclusive of respirators, should be used when feasible to minimize risks during decontamination and possible cross-contamination during sample handling.

Level B

- Pressure-demand full-face piece ASR (if ASR is an airline respirator, it must have an escape SCBA)

- chemical-resistant clothing (i.e., coveralls and long-sleeved jacket; hooded, one- or two-piece chemical-splash suit; disposable chemical-resistant one-piece suit)
- inner and outer chemical-resistant gloves
- chemical-resistant safety boots/shoes
- hardhat
- coveralls*
- disposable boot covers*
- face shield*

Level C

- full-face piece; air-purifying respirator with appropriate sorbents
- chemical-resistant clothing (i.e., coveralls and long-sleeved jacket; hooded, one- or two-piece chemical-splash suit; disposable chemical-resistant one-piece suit)
- inner and outer chemical-resistant gloves
- chemical-resistant safety boots/shoes
- hardhat
- coveralls*
- disposable boot covers*
- face shield*
- escape mask*

Level D

- coveralls
- safety boots/shoes
- safety glasses or chemical-splash goggles
- hardhat
- gloves*
- escape mask*

- face shield*

* optional

4.3.2 Other Protective Equipment

No other personal protective devices or equipment are planned for use on-site.

4.3.3 Operational Levels of Protection

Initial level of protection employed for intrusive work at the six sites on the Base will be Modified Level D (Level C dermal and Level D respiratory protection) whenever there is a splash potential or a potential of coming in contact with contaminated soil, with provision to upgrade to Level C respiratory and dermal should a change in site conditions warrant such a move. Workers will monitor the air with a PID. Should breathing zone levels read steadily above background, a benzene Draeger tube (Benzene 0.5/a) will be used to determine if levels exceed 1 ppm. If benzene levels exceed 1 ppm, upgrade to Level C. If benzene levels are below 1 ppm in the breathing zone, work may proceed at Modified Level D until PID levels exceed 20 ppm, at which time workers will upgrade to Level C.

If at any time PID breathing zone levels exceed 50 ppm, workers will monitor with another benzene Draeger tube (Benzene 5/b). If breathing zone levels of benzene exceed 50 ppm, workers will upgrade to Level B PPE. Otherwise work can continue at Level C until PID readings exceed 500 ppm.

Intrusive activities planned for the site include soil gas sampling, piezometer installation, soil test borings, monitoring well installation, sediment sampling, and groundwater sampling.

5.0 MONITORING

The work environment will be monitored to ensure that IDLH or other dangerous conditions are identified. At a minimum, monitoring will include evaluations for combustible atmospheres, oxygen-deficient environments, hazardous concentrations of airborne contaminants, and radioactivity.

5.1 AIR SAMPLING: EQUIPMENT, CALIBRATION, AND MAINTENANCE

To the extent feasible, the presence of airborne contaminants will be evaluated through the use of direct-reading instrumentation. Information gathered will be used to ensure the adequacy of the levels of protection being employed at the site, and may be used as the basis for upgrading or downgrading levels of protection, at the discretion of the site HSO.

- ISD Dual Detector. This meter monitors for combustible gases and oxygen. It can be used to determine (1) if an area contains concentrations of combustible gases with readings in percentage of the lower explosive limit; and (2) the percentage of oxygen. This equipment will be calibrated in accordance with the manufacturer's instructions. The dual detector will be used for activities at the site.

- HNU IS101 Photoionization Detector (PID) and Thermo-Environmental 580A Organic Vapor Monitor (OVM). The PID operates on the basis of ionization of the contaminant, which results in a meter deflection proportional to the concentration of the contaminant. In the PID, ionization is caused by a UV light source. The strength of the UV (measured in electron volts [eV]) determines which contaminants can be ionized. The HNU can use three different strength UV sources, including 9.6, 10.2, and 11.7 eV. Only the 10.2- and 11.7-eV probes are currently available for field use. The OVM operates using a UV light source of 10.0 eV. Calibration and maintenance will be performed in accordance with the manufacturer's instructions. A PID will be used to monitor VOC concentrations in the air during all intrusive activities.

- Detector Tubes (MSA and Draeger). A colorimetric detector tube is a direct-reading instrument that consists of a glass tube impregnated with an indicating chemical, which is connected to a piston cylinder or bellows-type pump. A known volume of air is drawn through the glass tube. The contaminant in the air reacts with the indicator chemical, producing a stain the length of which is proportional to the contaminant's concentration. Care must be taken when using the detector tubes because reliability of the results depends on proper calibration, the degree of stability of the reacting chemical, and the ambient temperature. Interfering gases or vapors can also positively or negatively affect measured results. Calibration and maintenance will be performed in accordance with the manufacturer's instructions.

5.2 PERSONAL MONITORING: EQUIPMENT, MAINTENANCE, AND CALIBRATION

Personal monitoring will be undertaken to characterize exposure of high-risk employees to hazardous substances encountered on-site.

- Thermoluminescent Dosimetry (TLD) Body Badges. These devices are nonmechanical collection devices used to monitor for x-ray, beta, and gamma radiation exposure. They are worn by an employee and sent to Tech/Ops Landauer, Inc., for analysis on a quarterly basis. Thermoluminescent dosimetry (TLD) body badges will be worn by all C-EE field personnel while on the base.

5.3 OTHER

No other sampling equipment will be used to evaluate potential employee exposures on-site.

6.0 DECONTAMINATION/DISPOSAL

All personnel and/or equipment leaving contaminated site areas are subject to decontamination, which occurs in the CRZ (see Section 3.1).

6.1 PERSONNEL DECONTAMINATION

Personnel will be required to follow decontamination protocol when leaving the Exclusion Zone. The decontamination equipment will be located in the CRZ

Decontamination procedures are followed by all personnel leaving hazardous waste sites. Under no circumstances (except emergency evacuation) will personnel be allowed to leave the site prior to decontamination. Generalized procedures for removal of protective clothing are as follows:

1. Drop tools, monitors, samples, and trash at designated drop stations (i.e. plastic containers or drop sheets).

2. Step into the designated shuffle pit area and scuff feet to remove gross amounts of dirt from outer boots.

3. Scrub outer boots and outer gloves with decon solution or detergent and potable water. Rinse with water.

4. Remove tape from outer boots and remove boots; discard in disposal container.

5. Remove tape from outer gloves and remove gloves; discard in disposal container.

6. If the worker has left the exclusion zone to change the air tank on his/her SCBA, or the canister on his/her air purifying respirator, this is the last step in the decontamination procedure. The tank or cartridge should be exchanged, new outer gloves and boot covers donned, the joints taped, and the worker returns to duty.

7. Remove outer garments and discard in disposal container.

8. Remove respirator and place or hang in the designated area.

9. Remove inner gloves and discard in disposal container.

NOTE: Disposable items (i.e., Tyvek coveralls, inner gloves, and latex overboots) will be changed on a daily basis unless there is reason to change sooner. Dual respirator canisters will be changed daily, unless more frequent changes are deemed appropriate by site surveillance data or personnel assessment.

Respirators, when used, will be decontaminated daily and taken from the drop area. The masks will be disassembled, the cartridges set aside, and all other parts placed in a cleansing solution. Parts will be pre-coded (e.g., #1 on all parts of Mask #1). After an appropriate time in the solution, the parts will be removed and rinsed with tap water. Old cartridges will be marked to indicate length of usage (i.e., if means to evaluate the cartridges' remaining utility are available) or will be discarded in the contaminated trash container for disposal. In the morning, the masks will be reassembled and new cartridges installed, if appropriate. Personnel will inspect their own masks and readjust the straps for proper fit.

All disposable personnel protection equipment and decontamination fluids will be drummed at the site. Full drums will be moved to a drum staging area as designated by Suffolk County Air National Guard Base Environmental Coordinator.

6.2 SMALL EQUIPMENT DECONTAMINATION

Small equipment will be protected from contamination as much as possible by draping, masking, or otherwise covering the instruments with plastic, to the extent feasible, without hindering operation of the unit. For example, the HNU meter can be placed in a clear plastic bag to allow reading the scale and operating the knobs. The HNU sensor can be partially wrapped, keeping the sensor tip and discharge port clear.

The contaminated equipment will be taken from the drop area and the protective coverings removed and disposed of in appropriate containers. Any dirt or obvious contamination will be brushed or wiped with a disposable paper wipe. The units can then be taken inside in a clean plastic tub, wiped off with damp disposable wipes, and dried. The units will be checked, standardized, and recharged as necessary for the next day's operation, and then prepared with new protective coverings.

Sampling equipment, such as split spoons and spatulas, will be decontaminated according to the following procedures:

- liquinox detergent and water wash
- steam cleaning
- DI water rinse

Decontamination fluids will be collected in drums and transported to the drum staging area if necessary.

6.3 HEAVY EQUIPMENT DECONTAMINATION

It is anticipated that the drilling rig will be contaminated during borehole activities. It will be cleaned with high-pressure water or steam at an area adjacent to each drilling location or other designated area. The person performing this activity will usually be at least at the level of protection utilized during the drilling activity.

6.4 DISPOSAL OF DECONTAMINATED MATERIALS

All protective gear, decontamination fluids (for both personnel and small equipment), and other disposable materials will be containerized. Decontamination fluids used to decontaminate sampling equipment [e.g., split spoons and groundwater sampling pump]) will be stored in DOT-approved 55-gallon drums if necessary. Disposable materials (e.g., gloves and Tyveks) will be double-bagged and stored as is, or placed in DOT-approved 55-gallon drums if necessary.

Drums of decontamination fluids and disposable safety material (along with drummed soil cuttings and development water) will be temporarily stored on the Base at the drum staging area as designated by SCANGB. Final disposition of the drums will be determined at the end of the field program. C-EE will help SCANGB fill out all manifests and other related documents, and SCANGB will sign the manifests.

7.0 EMERGENCY/CONTINGENCY PLAN

This section identifies the emergency contingency planning undertaken for operations at this site. Other sections provide further information to be used under emergency conditions. Refer to Appendix D for emergency telephone numbers, routes to emergency medical facilities, and emergency signals.

7.1 PERSONNEL ROLES, LINES OF AUTHORITY, AND COMMUNICATION

The site HSO is the primary authority for directing site operations under emergency conditions. All communications both on- and off-site will be directed through the HSO.

7.2 EVACUATION

The need to evacuate, and the location where site workers will be safe if an evacuation is necessary, will depend on the type of emergency (i.e., fire, explosion, chemical release, or personal injury). The most likely situation at the sites on Base will be the need to evacuate and upgrade level of personal protection. Types of evacuation are listed in the following sections.

7.2.1 Withdrawal Upwind

The work party will continually note general wind directions while on-site. (A windsock may be set up near the work site for visual determinations.) When conditions warrant moving away from the work site, the crew will relocate upwind a distance of approximately 100 feet or farther, as indicated by site monitoring instruments. Donning an SCBA and a safety harness and line, the HSO and a member of the crew (the buddy system must be used) may return to the work site to determine if the condition noted was transient or persistent. If persistent, an alarm should be raised to notify on-site personnel of the situation and the need to leave the site or don an SCBA. An attempt to decrease emissions should be made only if greater respiratory protection is donned. The HSS and client will be notified of conditions. When site access is restricted, thus hindering escape, the crew may be instructed to evacuate the site rather than move upwind, especially if withdrawal upwind moves the crew away from escape routes.

7.2.2 Site Evacuation

When conditions warrant site evacuation, the work party will proceed upwind of the work site and notify the security force, HSO, and field office of site conditions. If the decontamination area is upwind and greater than 500 feet from the work site, the crew will pass quickly through decontamination to remove contaminated outer suits. If the hazard is toxic gas, respirators will be retained. The crew will proceed to the field office to assess the situation. If instrumentation indicates an acceptable condition, respirators may be removed. As more information is received from the field crew, it will be

relayed to the appropriate agencies. The advisability and type of further response action will be coordinated and carried out by the HSO.

7.2.3 Evacuation of Surrounding Area

When the HSO determines that conditions warrant evacuation of downwind residences and commercial operations, local agencies will be notified and assistance requested. Designated on-site personnel will initiate evacuation of the immediate off-site area without delay.

7.3 EMERGENCY MEDICAL TREATMENT/FIRST AID

First aid will be rendered to any person injured on-site, as appropriate. The injured person will then be transported to medical personnel for further examination and/or treatment. The preferred transport method is a professional emergency transportation service; however, when this is not readily available or would result in excessive delay, other transport is authorized. Under no circumstances will injured persons transport themselves to a medical facility for emergency treatment.

When an injury occurs in a downrange position, provisions for decontamination of the victim will be made. However, life-threatening conditions may preclude normal decontamination procedures. In such cases, arrangements will be made with the medical facility and transporter to provide for the situation.

8.0 OTHER

8.1 ILLUMINATION

Site operations will not be permitted without adequate lighting. Therefore, unless provisions are made for artificial light, downrange operations must halt in time to permit personnel and equipment to exit the Exclusion Zone and proceed through decontamination before dusk. Conversely, operations will not be permitted to begin until lighting is adequate.

8.2 SANITATION

Provisions will be made for use of the base sanitation facilities. Should this be impossible, portable sanitation facilities will be provided.

8.3 EXCAVATION

Site excavations created during site operations will be shored or sloped to prevent accidental collapse, and otherwise conducted in accordance with 29 CFR 1926 (Subpart P). Under no circumstances will site personnel enter excavations that are not adequately shored or sloped. When entry into an excavation does occur, and the excavation is considered a confined space, such an entry will be done in accordance with the confined space entry program (see Section 8.4).

8.4 CONFINED SPACE ENTRY

Confined space entry presents special problems and substantial risks to involved personnel (including those who might be called upon to attempt a rescue of initial entrants). Therefore, entry into a confined space is a MEANS OF LAST RESORT, and will only be permitted where no other mechanism is feasible to achieve the desired goal. If confined space entry is necessary, it will be conducted under provisions outlined in JORDAN Health and Safety Plan.

9.0 ADMINISTRATIVE

9.1 PERSONNEL AUTHORIZED DOWNRANGE

Personnel authorized to participate in downrange activities at this site have been reviewed and certified for site operations by the Site Manager and HSS. Certification involves the completion of appropriate training, a medical examination, and a review of this site-specific HASP. All persons entering the site must utilize the buddy system, and check in with the Site Manager and/or HSO before proceeding downrange.

Certified JORDAN Team Personnel:

Richard Hebert*	Project Manager
Charles Lyons*	Technical Leader/Field Operation Leader
Vicki Miller*+	Health and Safety Officer
Charles Goodwin*+	GC Operator

Other Certified Personnel:

Cindy Sundquist*	

* Current First Aid Training
\+ Current CPR Training

9.2 HASP APPROVALS

By signature, the undersigned approve this HASP for applicability in the protection of the health and safety of all persons entering the SCANGB.

Health and Safety Officer	Date
Project Manager	Date
JORDAN Health and Safety Supervisor	Date

9.3 FIELD TEAM REVIEW

I have read and reviewed the HASP for the MANGB understand the information contained, and agree to comply.

	NAME	DATE
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		
19.		

SITE/PROJECT: Site County Air National Guard Base/Site Inspection

9.4 MEDICAL DATA SHEET

This Medical Data Sheet will be completed by all on-site personnel and will be kept in the Support Zone during site operations. It is in no way a substitute for the Medical Surveillance Program requirements consistent with the E.C. JORDAN Corporate Health and Safety Program for Hazardous Waste Sites. This data sheet will accompany any personnel when medical assistance or transport to hospital facilities is required. If more information is required, use the back of this sheet.

Project: _____
Name: _____
Address: _____
Home Phone: Area Code ( ) _____
DOB: _____ Height: _____ Weight: _____
In case of emergency, contact: _____ (name)
Address: _____
Telephone: Area Code ( ) _____
Do you wear contacts? ( ) Yes ( ) No
Allergies: _____
List medication taken regularly: _____
Particular sensitivities: _____
Previous/recent illness or exposures to hazardous chemicals:
_____
_____
Name of Personal Physician: _____
Telephone: Area Code ( ) _____

APPENDIX A-1

CHRIS DATA SHEETS/MATERIAL SAFETY DATA SHEETS FOR CONTAMINANTS OF CONCERN

BENZENE

BNZ

Common Synonyms	Watery liquid	Colorless	Gasoline-like odor
Benzol Benzole	Floats on water. Flammable, irritating vapor is produced. Freezing point is 42°F.		

Avoid contact with liquid and vapor. Keep people away.
Wear goggles and self-contained breathing apparatus.
Shut off ignition sources and call fire department.
Stop discharge if possible.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear goggles and self-contained breathing apparatus.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause headache, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Issue warning-high flammability
Restrict access

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: C_6H_6
3.3 IMO/UN Designation: 3.2/1114
3.4 DOT ID No.: 1114
3.5 CAS Registry No.: 71-43-2

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Aromatic; rather pleasant aromatic odor; characteristic odor

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Hydrocarbon vapor canister, supplied air or a hose mask; hydrocarbon-insoluble rubber or plastic gloves; chemical goggles or face splash shield; hydrocarbon-insoluble apron such as neoprene.
5.2 Symptoms Following Exposure: Dizziness, excitation, pallor, followed by flushing, weakness, headache, breathlessness, chest constriction. Coma and possible death.
5.3 Treatment of Exposure: SKIN: flush with water followed by soap and water; remove contaminated clothing and wash skin. EYES: flush with plenty of water until irritation subsides. INHALATION: remove from exposure immediately. Call a physician. IF breathing is irregular or stopped, start resuscitation, administer oxygen.
5.4 Threshold Limit Value: ~~10 ppm~~ 1 ppm
5.5 Short Term Inhalation Limits: 75 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 Late Toxicity: Leukemia
5.8 Vapor (Gas) Irritant Characteristics: If present in high concentrations, vapors may cause irritation of eyes or respiratory system. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 4.68 ppm
5.11 IDLH Value: 2,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 12°F C.C.
6.2 Flammable Limits in Air: 1.3%-7.9%
6.3 Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back
6.7 Ignition Temperature: 1097°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 8.0 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity:
5 ppm/6 hr/minnow/lethal/distilled water
20 ppm/24 hr/sunfish/TL_m/tap water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD):
1.2 lb/lb, 10 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity:
Industrial pure .....99+%
Thiophene-free .....99+%
Nitration .....99+%
Industrial 90% .....85+%
Reagent ..... 99+%
9.2 Storage Temperature: Open
9.3 Inert Atmosphere: No requirement
9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-T-U-V-W

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations:
Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	3
Water Pollution	
Human Toxicity	3
Aquatic Toxicity	1
Aesthetic Effect	3
Reactivity	
Other Chemicals	2
Water	1
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 78.11
12.3 Boiling Point at 1 atm:
176°F = 80.1°C = 353.3°K
12.4 Freezing Point:
42.0°F = 5.5°C = 278.7°K
12.5 Critical Temperature:
552.0°F = 288.9°C = 562.1°K
12.6 Critical Pressure:
710 psia = 48.3 atm = 4.89 MN/m²
12.7 Specific Gravity:
0.879 at 20°C (liquid)
12.8 Liquid Surface Tension:
28.9 dynes/cm = 0.0289 N/m at 20°C
12.9 Liquid Water Interfacial Tension:
35.0 dynes/cm = 0.035 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: 2.7
12.11 Ratio of Specific Heats of Vapor (Gas):
1.061
12.12 Latent Heat of Vaporization:
169 Btu/lb = 94.1 cal/g =
3.94 X 10^5 J/kg
12.13 Heat of Combustion: —17,460 Btu/lb = —9698 cal/g = —406.0 X 10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 30.45 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 3.22 psia

NOTES

BNZ	BENZENE

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
55	55.330
60	55.140
65	54.960
70	54.770
75	54.580
80	54.400
85	54.210
90	54.030
95	53.840
100	53.660
105	53.470
110	53.290
115	53.100
120	52.920
125	52.730
130	52.540
135	52.360
140	52.170
145	51.990
150	51.800
155	51.620
160	51.430
165	51.250
170	51.060
175	50.870

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
45	.394
50	.396
55	.398
60	.400
65	.403
70	.405
75	.407
80	.409
85	.411
90	.414
95	.416
100	.418

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
75	.988
80	.981
85	.975
90	.969
95	.962
100	.956
105	.950
110	.944
115	.937
120	.931
125	.925
130	.919
135	.912
140	.906
145	.900
150	.893
155	.887
160	.881
165	.875
170	.868

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
55	.724
60	.693
65	.665
70	.638
75	.612
80	.588
85	.566
90	.544
95	.524
100	.505
105	.487
110	.470
115	.453
120	.438

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
77.02	.180

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
50	.881
60	1.171
70	1.535
80	1.989
90	2.547
100	3.227
110	4.049
120	5.033
130	6.201
140	7.577
150	9.187
160	11.060
170	13.220
180	15.700
190	18.520
200	21.740
210	25.360

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
50	.01258
60	.01639
70	.02109
80	.02681
90	.03371
100	.04196
110	.05172
120	.06317
130	.07652
140	.09194
150	.10960
160	.12980
170	.15270
180	.17850
190	.20750
200	.23970
210	.27560

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.204
25	.219
50	.234
75	.248
100	.261
125	.275
150	.288
175	.301
200	.313
225	.325
250	.337
275	.349
300	.360
325	.371
350	.381
375	.392
400	.402
425	.412
450	.421
475	.431
500	.440
525	.449
550	.457
575	.465
600	.474

ETHYLBENZENE

ETB

Common Synonyms	Liquid	Colorless	Sweet, gasoline-like odor
Phenylethane EB	Floats on water. Flammable, irritating vapor is produced.		

Avoid contact with liquid and vapor. Keep people away.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Shut off ignition sources and call fire department.
Stop discharge if possible.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause dizziness or difficult breathing.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Will burn skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic hydrocarbon
3.2 Formula: $C_6H_5CH_2CH_3$
3.3 IMO/UN Designation: 3.3/1175
3.4 DOT ID No.: 1175
3.5 CAS Registry No.: 100-41-4

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Aromatic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Self-contained breathing apparatus; safety goggles.
5.2 Symptoms Following Exposure: Inhalation may cause irritation of nose, dizziness, depression. Moderate irritation of eye with corneal injury possible. Irritates skin and may cause blisters.
5.3 Treatment of Exposure: INHALATION: if ill effects occur, remove victim to fresh air, keep him warm and quiet, and get medical help promptly; if breathing stops, give artificial respiration. INGESTION: induce vomiting only upon physician's approval; material in lung may cause chemical pneumonitis. SKIN AND EYES: promptly flush with plenty of water (15 min. for eyes) and get medical attention; remove and wash contaminated clothing before reuse.
5.4 Threshold Limit Value: 100 ppm
5.5 Short Term Inhalation Limits: 200 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg (rat)
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Causes smarting of the skin and first-degree burns on short exposure; may cause secondary burns on long exposure.
5.10 Odor Threshold: 140 ppm
5.11 IDLH Value: 2,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 80°F O.C.; 59°F C.C.
6.2 Flammable Limits in Air: 1.0%-6.7%
6.3 Fire Extinguishing Agents: Foam (most effective), water fog, carbon dioxide or dry chemical.
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Irritating vapors are generated when heated.
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to the source of ignition and flash back.
6.7 Ignition Temperature: 860°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: 5.8 mm/min.
6.10 Adiabatic Flame Temperature: Data Not Available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data Not Available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity: 29 ppm/96 hr/bluegill/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 2.6% (theor.), 5 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research grade: 99.96%; pure grade: 99.5%; technical grade: 99.0%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	2
Liquid or Solid Irritant	2
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 106.17
12.3 Boiling Point at 1 atm: 277.2°F = 136.2°C = 409.4°K
12.4 Freezing Point: −139°F = −95°C = 178°K
12.5 Critical Temperature: 651.0°F = 343.9°C = 617.1°K
12.6 Critical Pressure: 523 psia = 35.6 atm = 3.61 MN/m²
12.7 Specific Gravity: 0.867 at 20°C (liquid)
12.8 Liquid Surface Tension: 29.2 dynes/cm = 0.0292 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 35.48 dynes/cm = 0.03548 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.071
12.12 Latent Heat of Vaporization: 144 Btu/lb = 80.1 cal/g = 3.35 X 10^5 J/kg
12.13 Heat of Combustion: −17,780 Btu/lb = −9877 cal/g = −413.5 X 10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data Not Available
12.26 Limiting Value: Data Not Available
12.27 Reid Vapor Pressure: 0.4 psia

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data Not Available
6.12 Flame Temperature: Data Not Available

ETB ETHYLBENZENE

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
40	54.990
50	54.680
60	54.370
70	54.060
80	53.750
90	53.430
100	53.120
110	52.810
120	52.500
130	52.190
140	51.870
150	51.560
160	51.250
170	50.940
180	50.620
190	50.310
200	50.000
210	49.690

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
40	.402
50	.404
60	.407
70	.409
80	.412
90	.414
100	.417
110	.419
120	.421
130	.424
140	.426
150	.429
160	.431
170	.434
180	.436
190	.439
200	.441
210	.443

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
—90	1.065
—80	1.056
—70	1.047
—60	1.037
—50	1.028
—40	1.018
—30	1.009
—20	1.000
—10	.990
0	.981
10	.971
20	.962
30	.953
40	.943
50	.934
60	.924
70	.915
80	.906
90	.896
100	.887
110	.877
120	.868
130	.859
140	.849
150	.840
160	.830

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
40	.835
50	.774
60	.719
70	.670
80	.626
90	.586
100	.550
110	.518
120	.488
130	.461
140	.436
150	.414
160	.393
170	.374
180	.356
190	.340
200	.325
210	.311

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
68.02	.020

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
80	.202
100	.370
120	.644
140	1.071
160	1.713
180	2.643
200	3.953
220	5.747
240	8.147
260	11.290
280	15.320
300	20.410
320	26.730
340	34.460
360	43.800
380	54.950

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
80	.00370
100	.00654
120	.01099
140	.01767
160	.02734
180	.04087
200	.05926
220	.08363
240	.11520
260	.15510
280	.20490
300	.26570
320	.33910
340	.42620
360	.52850
380	.64720

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
—400	—.007
—350	.026
—300	.060
—250	.093
—200	.125
—150	.157
—100	.187
—50	.217
0	.246
50	.274
100	.301
150	.327
200	.353
250	.377
300	.401
350	.424
400	.446
450	.467
500	.487
550	.507
600	.525

GASOLINES: AVIATION (< 4.86g lead/gal)

GAV

Common Synonyms	Watery liquid	Red, blue, green, brown or purple	Gasoline odor

Floats on water. Flammable, irritating vapor is produced.

Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Extinguish with dry chemical, foam or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled will cause dizziness, headache, difficult breathing or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea or vomiting.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area
Disperse and flush

2. LABEL

2.1 **Category:** Flammable liquid
2.2 **Class:** 3

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Not listed
3.2 **Formula:** Not pertinent
3.3 **IMO/UN Designation:** 3.1/1203
3.4 **DOT ID No.:** 1203
3.5 **CAS Registry No.:** Data not available

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid
4.2 **Color:** Red, blue, green, brown, purple
4.3 **Odor:** Gasoline

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Protective goggles, gloves.
5.2 **Symptoms Following Exposure:** INHALATION causes irritation of upper respiratory tract; central nervous system stimulation followed by depression of varying degrees ranging from dizziness, headache, and incoordination to anesthesia, coma, and respiratory arrest; irregular heartbeat is dangerous complication. ASPIRATION causes severe lung irritation with coughing, gagging, dyspnea, substernal distress, and rapidly developing pulmonary edema; later, signs of bronchopneumonia and pneumonitis; acute onset of central nervous system excitement followed by depression. INGESTION causes irritation of mucous membranes of throat, esophagus, and stomach; stimulation followed by depression of central nervous system; irregular heartbeat.
5.3 **Treatment of Exposure:** Seek medical attention. INHALATION: maintain respiration; give oxygen if needed. ASPIRATION: enforce bed rest; administer oxygen. INGESTION: do NOT induce vomiting; lavage carefully if appreciable quantity was ingested; guard against aspiration into lungs. EYES: wash with copious quantity of water. SKIN: wipe off and wash with soap and water.
5.4 **Threshold Limit Value:** 300 ppm
5.5 **Short Term Inhalation Limits:** 500 ppm for 30 min.
5.6 **Toxicity by Ingestion:** Grade 2; LD_{50} = 0.5 to 5 g/kg
5.7 **Late Toxicity:** None
5.8 **Vapor (Gas) Irritant Characteristics:** Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 **Liquid or Solid Irritant Characteristics:** Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 **Odor Threshold:** 0.25 ppm
5.11 **IDLH Value:** Data not available

6. FIRE HAZARDS

6.1 **Flash Point:** -50°F C.C.
6.2 **Flammable Limits in Air:** 1.2%-7.1%
6.3 **Fire Extinguishing Agents:** Foam, carbon dioxide, dry chemical
6.4 **Fire Extinguishing Agents Not to be Used:** Water may be ineffective
6.5 **Special Hazards of Combustion Products:** None
6.6 **Behavior in Fire:** Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back.
6.7 **Ignition Temperature:** 824°F
6.8 **Electrical Hazard:** Class I, group D
6.9 **Burning Rate:** 4 mm/min.
6.10 **Adiabatic Flame Temperature:** Data not available
6.11 **Stoichiometric Air to Fuel Ratio:** Data not available
6.12 **Flame Temperature:** Data not available

7. CHEMICAL REACTIVITY

7.1 **Reactivity With Water:** No reaction
7.2 **Reactivity with Common Materials:** No reaction
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent
7.7 **Molar Ratio (Reactant to Product):** Data not available
7.8 **Reactivity Group:** Data not available

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** 90 ppm/24 hr/juvenile American shad/TL_m/fresh water
91 ppm/24 hr/juvenile American shad/TL_m/salt water
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** 8%, 5 days
8.4 **Food Chain Concentration Potential:** None

9. SHIPPING INFORMATION

9.1 **Grades of Purity:** Grades 80/87, 100/130, and 115/145: Specification MIL-G-5572e
9.2 **Storage Temperature:** Ambient
9.3 **Inert Atmosphere:** No requirement
9.4 **Venting:** Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U-V-W

11. HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:** Flammable liquid
11.2 **NAS Hazard Rating for Bulk Water Transportation:**

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	2
Aesthetic Effect	2
Reactivity	
Other Chemicals	0
Water	0
Self Reaction	0

11.3 **NFPA Hazard Classification:**

Category	Classification
Health Hazard (Blue)	1
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Liquid
12.2 **Molecular Weight:** Not pertinent
12.3 **Boiling Point at 1 atm:** 160—340°F = 71—171°C = 344—444°K
12.4 **Freezing Point:** <76°F = <24.4°C = <297.6°K
12.5 **Critical Temperature:** Not pertinent
12.6 **Critical Pressure:** Not pertinent
12.7 **Specific Gravity:** 0.711 at 15°C (liquid)
12.8 **Liquid Surface Tension:** 19—23 dynes/cm = 0.019—0.023 N/m at 20°C
12.9 **Liquid Water Interfacial Tension:** 49—51 dynes/cm = 0.049—0.051 N/m at 20°C
12.10 **Vapor (Gas) Specific Gravity:** 3.4
12.11 **Ratio of Specific Heats of Vapor (Gas):** (est.) 1.054
12.12 **Latent Heat of Vaporization:** 130—150 Btu/lb = 71—81 cal/g = 3.0—3.4 X 10^5 J/kg
12.13 **Heat of Combustion:** —18,720 Btu/lb = —10,400 cal/g = —435.4 X 10^5 J/kg
12.14 **Heat of Decomposition:** Not pertinent
12.15 **Heat of Solution:** Not pertinent
12.16 **Heat of Polymerization:** Not pertinent
12.25 **Heat of Fusion:** Data not available
12.26 **Limiting Value:** Data not available
12.27 **Reid Vapor Pressure:** Data not available

NOTES

GAV GASOLINES: AVIATION (< 4.86g lead/gal)

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot (estimate)
35	45.040
40	44.880
45	44.730
50	44.570
55	44.410
60	44.260
65	44.100
70	43.950
75	43.790
80	43.630
85	43.480
90	43.320
95	43.160
100	43.010
105	42.850
110	42.700
115	42.540
120	42.380
125	42.230
130	42.070
135	41.920
140	41.760
145	41.600
150	41.450
155	41.290
160	41.140

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
10	.466
15	.468
20	.471
25	.474
30	.476
35	.479
40	.482
45	.484
50	.487
55	.490
60	.492
65	.495
70	.498
75	.500
80	.503
85	.506
90	.508
95	.511
100	.514
105	.516

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F (estimate)
40	.909
50	.900
60	.891
70	.883
80	.874
90	.865
100	.856
110	.847
120	.838
130	.829
140	.821
150	.812
160	.803
170	.794
180	.785
190	.776

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise (estimate)
35	.519
40	.501
45	.485
50	.469
55	.454
60	.440
65	.426
70	.414
75	.401
80	.390
85	.379
90	.368
95	.358
100	.348
105	.339
110	.330
115	.322
120	.314
125	.306
130	.299
135	.291
140	.285
145	.278
150	.272
155	.266
160	.260

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
	INSOLUBLE

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
	DATA NOT AVAILABLE

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
	NOT PERTINENT

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
	DATA NOT AVAILABLE

JET FUELS: JP-4

JPF

Common Synonyms	Watery liquid	Colorless	Fuel oil odor
	Floats on water.		

Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Avoid contact with liquid.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

Dangerous to aquatic life in high concentrations.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Miscellaneous Hydrocarbon Mixtures
3.2 Formula: C_nH_{2n+2}
3.3 IMO/UN Designation: 3.2/1863
3.4 DOT ID No.: 1863
3.5 CAS Registry No.: Data not available

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless to light brown
4.3 Odor: Like fuel oil

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Protective gloves; goggles or face shield.
5.2 Symptoms Following Exposure: Vapor causes slight irritation of eyes and nose. Liquid irritates stomach; if taken into lungs, causes coughing, distress, and rapidly developing pulmonary edema.
5.3 Treatment of Exposure: ASPIRATION: enforce bed rest; administer oxygen; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: wash with plenty of water. SKIN: wipe off and wash with soap and water.
5.4 Threshold Limit Value: 200 ppm
5.5 Short Term Inhalation Limits: 2500 mg/m³ for 60 min.
5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 1 ppm
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: −10°F to +30°F C.C.
6.2 Flammable Limits in Air: 1.3%-8.0%
6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 464°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: 4 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 33

8. WATER POLLUTION

8.1 Aquatic Toxicity: 500 ppm*/salmon fingerling/lethal/fresh water
*Time period not specified
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 53%, 5 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: 100%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	1
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	1
Aesthetic Effect	3
Reactivity	
Other Chemicals	0
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	1
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: Not pertinent
12.3 Boiling Point at 1 atm: 349-549°F = 176-287°C = 449-560°K
12.4 Freezing Point: < −54°F = < −48°C = <225°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 0.81 at 20°C (liquid)
12.8 Liquid Surface Tension: (est.) 25 dynes/cm = 0.025 N/m at 20°C
12.9 Liquid Water Interfacial Tension: (est.) 50 dynes/cm = 0.05 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): (est.) 1.030
12.12 Latent Heat of Vaporization: 140 Btu/lb = 78 cal/g = 3.3×10^5 J/kg
12.13 Heat of Combustion: −18,540 Btu/lb = −10,300 cal/g = -431.24×10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

NOTES

JPF

JET FUELS: JP-4

12.17 SATURATED LIQUID DENSITY		12.18 LIQUID HEAT CAPACITY		12.19 LIQUID THERMAL CONDUCTIVITY		12.20 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit-inch per hour-square foot-F	Temperature (degrees F)	Centipoise
34	51.740	0	.444	0	.926	—35	2.106
36	51.670	10	.449	10	.924	—30	1.994
38	51.600	20	.454	20	.921	—25	1.890
40	51.530	30	.459	30	.919	—20	1.794
42	51.460	40	.464	40	.917	—15	1.705
44	51.390	50	.469	50	.915	—10	1.622
46	51.320	60	.474	60	.913	—5	1.544
48	51.260	70	.479	70	.911	0	1.472
50	51.190	80	.484	80	.909	5	1.405
52	51.120	90	.489	90	.907	10	1.342
54	51.050	100	.494	100	.905	15	1.283
56	50.980	110	.499	110	.903	20	1.228
58	50.910	120	.504	120	.901	25	1.176
60	50.840	130	.509	130	.899	30	1.128
62	50.770	140	.514	140	.897	35	1.082
64	50.700	150	.519	150	.895	40	1.039
66	50.630	160	.524	160	.893	45	.999
68	50.560	170	.529	170	.891	50	.961
70	50.490	180	.534	180	.889	55	.925
72	50.420	190	.539	190	.887	60	.891
74	50.350	200	.544	200	.885	65	.859
76	50.280	210	.549	210	.883	70	.829
78	50.220					75	.800
80	50.150						
82	50.080						
84	50.010						

12.21 SOLUBILITY IN WATER		12.22 SATURATED VAPOR PRESSURE		12.23 SATURATED VAPOR DENSITY		12.24 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
	I	0	.319		N		D
	N	10	.411		O		A
	S	20	.525		T		T
	O	30	.663				A
	L	40	.829		P		
	U	50	1.028		E		N
	B	60	1.264		R		O
	L	70	1.542		T		T
	E	80	1.868		I		
		90	2.246		N		A
		100	2.684		E		V
		110	3.187		N		A
		120	3.762		T		I
		130	4.416				L
		140	5.155				A
		150	5.988				B
		160	6.922				L
		170	7.965				E
		180	9.125				
		190	10.410				
		200	11.830				
		210	13.390				

KERESENE

KRS

Common Synonyms	Watery liquid	Colorless	Fuel oil odor
Illuminating oil Kerosine Range oil Fuel oil No. 1 Jet Fuel: JP-1	Floats on water.		

Stop discharge if possible.
Call fire department.
Avoid contact with liquid.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

Dangerous to aquatic life in high concentrations.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Miscellaneous Hydrocarbon Mixtures
3.2 Formula: C_nH_{n+2}
3.3 IMO/UN Designation: 3.3/1223
3.4 DOT ID No.: 1223
3.5 CAS Registry No.: 8008-20-6

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless to light brown
4.3 Odor: Characteristic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Protective gloves; goggles or face shield.
5.2 Symptoms Following Exposure: Vapor causes slight irritation of eyes and nose. Liquid irritates stomach; if taken into lungs, causes coughing, distress, and rapidly developing pulmonary edema.
5.3 Treatment of Exposure: ASPIRATION: enforce bed rest; administer oxygen; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: wash with plenty of water. SKIN: wipe off and wash with soap and water.
5.4 Threshold Limit Value: 200 ppm
5.5 Short Term Inhalation Limits: 2500 mg/m³ for 60 min.
5.6 Toxicity by Ingestion: Grade 1; LD_{50} = 5 to 15 g/kg
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 1 ppm
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: 100°F (min.)C.C.
6.2 Flammable Limits in Air: 0.7%-5%
6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 444°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: 4 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 33

8. WATER POLLUTION

8.1 Aquatic Toxicity: 2990 ppm/24 hr/bluegill/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 53%, 5 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Light hydrocarbon distillate: 100%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester)

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Combustible liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	2
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	1
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	1
Aesthetic Effect	3
Reactivity	
Other Chemicals	0
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	0
Flammability (Red)	2
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: Not pertinent
12.3 Boiling Point at 1 atm: 392-500°F = 200—260°C = 473—533°K
12.4 Freezing Point: —50°F = —45.6°C = 227.6°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 0.80 at 15°C (liquid)
12.8 Liquid Surface Tension: 23-32 dynes/cm = 0.023-0.032 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 47-49 dynes/cm = 0.047-0.049 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: 110 Btu/lb = 60 cal/g = 2.5 X 10^5 J/kg
12.13 Heat of Combustion: —18,540 Btu/lb = —10,300 cal/g = —431.24 X 10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 0.1 psia

NOTES

KRS

KEROSENE

12.17 SATURATED LIQUID DENSITY	
Temperature (degrees F)	Pounds per cubic foot
34	50.810
36	50.740
38	50.670
40	50.600
42	50.530
44	50.460
46	50.390
48	50.320
50	50.250
52	50.180
54	50.110
56	50.040
58	49.970
60	49.900
62	49.830
64	49.760
66	49.700
68	49.630
70	49.560
72	49.490
74	49.420
76	49.350
78	49.280
80	49.210
82	49.140
84	49.070

12.18 LIQUID HEAT CAPACITY	
Temperature (degrees F)	British thermal unit per pound-F
0	.434
10	.439
20	.444
30	.449
40	.454
50	.459
60	.464
70	.469
80	.474
90	.479
100	.484
110	.489
120	.494
130	.499
140	.504
150	.509
160	.514
170	.519
180	.524
190	.529
200	.534
210	.539

12.19 LIQUID THERMAL CONDUCTIVITY	
Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
0	.926
10	.924
20	.921
30	.919
40	.917
50	.915
60	.913
70	.911
80	.909
90	.907
100	.905
110	.903
120	.901
130	.899
140	.897
150	.895
160	.893
170	.891
180	.889
190	.887
200	.885
210	.883

12.20 LIQUID VISCOSITY	
Temperature (degrees F)	Centipoise
—35	6.727
—30	6.065
—25	5.482
—20	4.965
—15	4.508
—10	4.101
—5	3.739
0	3.416
5	3.127
10	2.867
15	2.634
20	2.424
25	2.235
30	2.064
35	1.909
40	1.768
45	1.641
50	1.525
55	1.419
60	1.322
65	1.233
70	1.152
75	1.078

12.21 SOLUBILITY IN WATER	
Temperature (degrees F)	Pounds per 100 pounds of water
	I
	N
	S
	O
	L
	U
	B
	L
	E

12.22 SATURATED VAPOR PRESSURE	
Temperature (degrees F)	Pounds per square inch
70	.041
80	.056
90	.075
100	.099
110	.130
120	.168
130	.217
140	.277
150	.350
160	.440
170	.548
180	.679
190	.835
200	1.021
210	1.241
220	1.500
230	1.802
240	2.154
250	2.562
260	3.033
270	3.573
280	4.192
290	4.896
300	5.695

12.23 SATURATED VAPOR DENSITY	
Temperature (degrees F)	Pounds per cubic foot
	N
	O
	T
	P
	E
	R
	T
	I
	N
	E
	N
	T

12.24 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	British thermal unit per pound-F
	D
	A
	T
	A
	N
	O
	T
	A
	V
	A
	I
	L
	A
	B
	L
	E

MINERAL SPIRITS

MNS

Common Synonyms	Watery liquid	Colorless	Gasoline-like odor
Petroleum spirits Naphtha	Floats on water.		

Stop discharge if possible.
Call fire department.
Avoid contact with liquid.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
Extinguish with water, dry chemical, foam, or carbon dioxide.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Miscellaneous Hydrocarbon Mixtures
3.2 Formula: Not applicable
3.3 IMO/UN Designation: 3.3/1300
3.4 DOT ID No.: 1300
3.5 CAS Registry No.: Data not available

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Like gasoline

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Plastic gloves; goggles or face shield (as for gasoline).
5.2 Symptoms Following Exposure: INHALATION: mild irritation of respiratory tract. ASPIRATION: severe lung irritation and rapidly developing pulmonary edema; central nervous system excitement followed by depression. INGESTION: irritation of stomach.
5.3 Treatment of Exposure: INHALATION: remove victim to fresh air. ASPIRATION: enforce bed rest; give oxygen; call a doctor. INGESTION: do NOT induce vomiting; guard against aspiration into lungs. EYES: wash with copious amounts of water. SKIN: wipe off and wash with soap and water.
5.4 Threshold Limit Value: Data not available
5.5 Short Term Inhalation Limits: 4000-7000 ppm for 60 min.
5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapors are nonirritating to the eyes and throat.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: Data not available
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: 105—140°F C.C., depending on grade
6.2 Flammable Limits in Air: 0.8%-5.0%
6.3 Fire Extinguishing Agents: Foam, carbon dioxide, dry chemical
6.4 Fire Extinguishing Agents Not to be Used: Do not use straight hose water stream.
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 540°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: 4 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 33

8. WATER POLLUTION

8.1 Aquatic Toxicity: Data not available
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 8%, 5 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Various grades available. 70-100% of the materials are derived from petroleum, and 0-30% are aromatic hydrocarbons like benzene and toluene. Flash points vary with the exact composition but are usually above 100°F.
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester)

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Combustible liquid
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	0
Flammability (Red)	2
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: Not pertinent
12.3 Boiling Point at 1 atm: 310—395°F = 154—202°C = 428—475°K
12.4 Freezing Point: Not pertinent
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 0.78 at 20°C (liquid)
12.8 Liquid Surface Tension: Data not available
12.9 Liquid Water Interfacial Tension: Data not available
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): (est.) 1.030
12.12 Latent Heat of Vaporization: Data not available
12.13 Heat of Combustion: Data not available
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 0.13 psia

NOTES

MNS	MINERAL SPIRITS

12.17 SATURATED LIQUID DENSITY		12.18 LIQUID HEAT CAPACITY		12.19 LIQUID THERMAL CONDUCTIVITY		12.20 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot (estimate)	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit-inch per hour-square foot-F	Temperature (degrees F)	Centipoise (estimate)
50	48.690	10	.433	10	.925	50	9.343
52	48.690	15	.435	20	.919	52	8.841
54	48.690	20	.438	30	.914	54	8.370
56	48.690	25	.440	40	.908	56	7.927
58	48.690	30	.443	50	.903	58	7.511
60	48.690	35	.445	60	.897	60	7.119
62	48.690	40	.448	70	.892	62	6.751
64	48.690	45	.450	80	.886	64	6.404
66	48.690	50	.453	90	.881	66	6.078
68	48.690	55	.455	100	.875	68	5.770
70	48.690	60	.458	110	.869	70	5.481
72	48.690	65	.460	120	.864	72	5.207
74	48.690	70	.462	130	.858	74	4.950
76	48.690	75	.465	140	.853	76	4.707
78	48.690	80	.467	150	.847	78	4.477
80	48.690	85	.470	160	.842	80	4.260
82	48.690	90	.472	170	.836	82	4.056
84	48.690	95	.475	180	.831	84	3.862
86	48.690	100	.477	190	.825	86	3.679
88	48.690	105	.480	200	.820	88	3.506
90	48.690			210	.814	90	3.342
92	48.690			220	.808	92	3.187
94	48.690			230	.803	94	3.040
96	48.690			240	.797	96	2.901
98	48.690			250	.792	98	2.770
100	48.690			260	.786	100	2.645

12.21 SOLUBILITY IN WATER		12.22 SATURATED VAPOR PRESSURE		12.23 SATURATED VAPOR DENSITY		12.24 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch (estimate)	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
	I	90	.094		N		N
	N	100	.124		O		O
	S	110	.163		T		T
	O	120	.211				
	L	130	.272		P		P
	U	140	.347		E		E
	B	150	.440		R		R
	L	160	.553		T		T
	E	170	.691		I		I
		180	.856		N		N
		190	1.054		E		E
		200	1.290		N		N
		210	1.569		T		T
		220	1.897				
		230	2.281				
		240	2.728				
		250	3.247				
		260	3.846				
		270	4.535				
		280	5.323				
		290	6.221				
		300	7.241				
		310	8.394				
		320	9.695				
		330	11.160				
		340	12.790				

TOLUENE

TOL

Common Synonyms	Watery liquid	Colorless	Pleasant odor
Toluol Methylbenzene Methylbenzol	Floats on water. Flammable, irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to "knock down" vapor.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear goggles and self-contained breathing apparatus.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause nausea, vomiting, headache, dizziness, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting or loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

Dangerous to aquatic life in high concentrations.
Fouling to shorelines.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Issue warning-high flammability
Evacuate area

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: $C_6H_5CH_3$
3.3 IMO/UN Designation: 3.2/1294
3.4 DOT ID No.: 1294
3.5 CAS Registry No.: 108-88-3

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Pungent; aromatic, benzene-like; distinct, pleasant

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Air-supplied mask; goggles or face shield; plastic gloves.
5.2 Symptoms Following Exposure: Vapors irritate eyes and upper respiratory tract; cause dizziness, headache, anesthesia, respiratory arrest. Liquid irritates eyes and causes drying of skin. If aspirated, causes coughing, gagging, distress, and rapidly developing pulmonary edema. If ingested causes vomiting, griping, diarrhea, depressed respiration.
5.3 Treatment of Exposure: INHALATION: remove to fresh air, give artificial respiration and oxygen if needed; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 Threshold Limit Value: 100 ppm
5.5 Short Term Inhalation Limits: 600 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg
5.7 Late Toxicity: Kidney and liver damage may follow ingestion.
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 0.17 ppm
5.11 IDLH Value: 2,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 40°F C.C.; 55°F O.C.
6.2 Flammable Limits in Air: 1.27%-7%
6.3 Fire Extinguishing Agents: Carbon dioxide or dry chemical for small fires, ordinary foam for large fires.
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 997°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 5.7 mm/min.
6.10 Adiabatic Flame Temperature: Data not available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity: 1180 mg/l/96 hr/sunfish/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 0%, 5 days; 30% (theor), 6 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research, reagent, nitration-all 99.8 + %; industrial: contains 94 + %, with 5% xylene and small amounts of benzene and nonaromatic hydrocarbons; 90/120: less pure than industrial.
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 92.14
12.3 Boiling Point at 1 atm: 231.1°F = 110.6°C = 383.8°K
12.4 Freezing Point: −139°F = −95.0°C = 178.2°K
12.5 Critical Temperature: 605.4°F = 318.6°C = 591.8°K
12.6 Critical Pressure: 596.1 psia = 40.55 atm = 4.109 MN/m²
12.7 Specific Gravity: 0.867 at 20°C (liquid)
12.8 Liquid Surface Tension: 29.0 dynes/cm = 0.0290 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 36.1 dynes/cm = 0.0361 N/m at 25°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.089
12.12 Latent Heat of Vaporization: 155 Btu/lb = 86.1 cal/g = 3.61×10^5 J/kg
12.13 Heat of Combustion: −17,430 Btu/lb = −9686 cal/g = -405.5×10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 17.17 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 1.1 psia

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

TOL	TOLUENE

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
—30	57.180
—20	56.870
—10	56.550
0	56.240
10	55.930
20	55.620
30	55.310
40	54.990
50	54.680
60	54.370
70	54.060
80	53.750
90	53.430
100	53.120
110	52.810
120	52.500

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.396
5	.397
10	.399
15	.400
20	.402
25	.403
30	.404
35	.406
40	.407
45	.409
50	.410
55	.411
60	.413
65	.414
70	.415
75	.417
80	.418
85	.420
90	.421
95	.422
100	.424
105	.425
110	.427
115	.428
120	.429
125	.431

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
0	1.026
10	1.015
20	1.005
30	.994
40	.983
50	.972
60	.962
70	.951
80	.940
90	.929
100	.919
110	.908
120	.897
130	.886
140	.876
150	.865
160	.854
170	.843
180	.833
190	.822
200	.811
210	.800

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
0	1.024
5	.978
10	.935
15	.894
20	.857
25	.821
30	.788
35	.757
40	.727
45	.700
50	.673
55	.649
60	.625
65	.603
70	.582
75	.562
80	.544
85	.526
90	.509
95	.493
100	.477

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
68.02	.050

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
0	.038
10	.057
20	.084
30	.121
40	.172
50	.241
60	.331
70	.449
80	.600
90	.792
100	1.033
110	1.332
120	1.700
130	2.148
140	2.690
150	3.338
160	4.109
170	5.018
180	6.083
190	7.323
200	8.758
210	10.410

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
0	.00070
10	.00103
20	.00150
30	.00212
40	.00296
50	.00405
60	.00547
70	.00727
80	.00954
90	.01237
100	.01584
110	.02007
120	.02518
130	.03127
140	.03850
150	.04700
160	.05691
170	.06840
180	.08162
190	.09675
200	.11400
210	.13340

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.228
25	.241
50	.255
75	.268
100	.281
125	.294
150	.306
175	.319
200	.331
225	.343
250	.355
275	.367
300	.378
325	.389
350	.400
375	.411
400	.422
425	.432
450	.443
475	.453
500	.462
525	.472
550	.482
575	.491
600	.500

TRICHLOROETHYLENE

TCL

Common Synonyms	Watery liquid	Colorless	Sweet odor
Trichloroethylene Trilene; Algylen Chlorylen Gemalgene Trethylene Trichloran; Trilene	Sinks in water. Irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Avoid contact with liquid and vapor.
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
POISONOUS GASES ARE PRODUCED IN FIRE.
Wear goggles and self-contained breathing apparatus.
Extinguish with dry chemical, carbon dioxide, or foam.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause nausea, vomiting, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, difficult breathing, or loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Halogenated hydrocarbon
3.2 Formula: $CHCl=CCl_2$
3.3 IMO/UN Designation: 6.0/1710
3.4 DOT ID No.: 1710
3.5 CAS Registry No.: 79-01-6

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Chloroform-like; ethereal

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Organic, vapor-acid gas canister; self-contained breathing apparatus for emergencies; neoprene or vinyl gloves; chemical safety goggles; face-shield; neoprene safety shoes; neoprene suit or apron for splash protection.
5.2 Symptoms Following Exposure: INHALATION: symptoms range from irritation of the nose and throat to nausea, an attitude of irresponsibility, blurred vision, and finally disturbance of central nervous system resulting in cardiac failure. Chronic exposure may cause organic injury. INGESTION: symptoms similar to inhalation. SKIN: defatting action can cause dermatitis. EYES: slightly irritating sensation and lachrymation.
5.3 Treatment of Exposure: Do NOT administer adrenalin or epinephrine; get medical attention for all cases of overexposure. INHALATION: remove victim to fresh air; if necessary, apply artificial respiration and/or administer oxygen. INGESTION: have victim drink water and induce vomiting; repeat three times; then give 1 tablespoon epsom salts in water. EYES: flush thoroughly with water. SKIN: wash thoroughly with soap and warm water.
5.4 Threshold Limit Value: 50 ppm
5.5 Short Term Inhalation Limits: 200 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 50 ppm
5.11 IDLH Value: 1,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 90°F C.C.; practically nonflammable
6.2 Flammable Limits in Air: 8.0%-10.5%
6.3 Fire Extinguishing Agents: Water fog
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Toxic and irritating gases are produced in fire situations.
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 770°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not pertinent
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 38

8. WATER POLLUTION

8.1 Aquatic Toxicity: 660 mg/l/40 hr/daphnia/kill/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Technical; dry cleaning; degreasing; extraction
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-X-Y

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: ORM-A
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	1
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	2
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	1

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	1
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 131.39
12.3 Boiling Point at 1 atm: 189°F = 87°C = 360°K
12.4 Freezing Point: −123.5°F = −86.4°C = 186.8°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.46 at 20°C (liquid)
12.8 Liquid Surface Tension: 29.3 dynes/cm = 0.0293 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 34.5 dynes/cm = 0.0345 N/m at 24°C
12.10 Vapor (Gas) Specific Gravity: 4.5
12.11 Ratio of Specific Heats of Vapor (Gas): 1.116
12.12 Latent Heat of Vaporization: 103 Btu/lb = 57.2 cal/g = 2.4×10^5 J/kg
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 2.5 psia

NOTES

TCL TRICHLOROETHYLENE

12.17 SATURATED LIQUID DENSITY	
Temperature (degrees F)	Pounds per cubic foot
0	94.669
5	94.410
10	94.150
15	93.889
20	93.629
25	93.370
30	93.110
35	92.849
40	92.589
45	92.330
50	92.070
55	91.809
60	91.549
65	91.290
70	91.030
75	90.770
80	90.509
85	90.250
90	89.990
95	89.730
100	89.469
105	89.209
110	88.950
115	88.690
120	88.429
125	88.169

12.18 LIQUID HEAT CAPACITY	
Temperature (degrees F)	British thermal unit per pound-F
0	.220
10	.221
20	.223
30	.225
40	.226
50	.228
60	.230
70	.231
80	.233
90	.235
100	.236
110	.238
120	.240
130	.241
140	.243
150	.245
160	.246
170	.248

12.19 LIQUID THERMAL CONDUCTIVITY	
Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
	NOT PERTINENT

12.20 LIQUID VISCOSITY	
Temperature (degrees F)	Centipoise
15	.800
20	.775
25	.750
30	.727
35	.705
40	.684
45	.664
50	.645
55	.627
60	.610
65	.593
70	.577
75	.562
80	.548
85	.534
90	.521
95	.508
100	.496
105	.485
110	.474
115	.463
120	.453

12.21 SOLUBILITY IN WATER	
Temperature (degrees F)	Pounds per 100 pounds of water
77.02	.110

12.22 SATURATED VAPOR PRESSURE	
Temperature (degrees F)	Pounds per square inch
40	.508
50	.678
60	.894
70	1.166
80	1.507
90	1.929
100	2.448
110	3.081
120	3.846
130	4.765
140	5.862
150	7.163
160	8.695
170	10.490
180	12.580
190	15.010
200	17.810
210	21.020

12.23 SATURATED VAPOR DENSITY	
Temperature (degrees F)	Pounds per cubic foot
40	.01245
50	.01628
60	.02105
70	.02695
80	.03418
90	.04296
100	.05354
110	.06619
120	.08120
130	.09891
140	.11960
150	.14380
160	.17180
170	.20390
180	.24080
190	.28280
200	.33040
210	.38420

12.24 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	British thermal unit per pound-F
0	.136
25	.139
50	.143
75	.146
100	.149
125	.152
150	.155
175	.157
200	.160
225	.162
250	.165
275	.167
300	.169
325	.172
350	.174
375	.176
400	.177
425	.179
450	.181
475	.182
500	.184
525	.185
550	.186
575	.187
600	.188

m-XYLENE

XLM

Common Synonyms	Watery liquid	Colorless	Sweet odor
1, 3-Dimethylbenzene Xylol	Floats on water. Flammable, irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Call fire department.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear self-contained breathing apparatus.
Extinguish with foam, dry chemical, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose, and throat.
If inhaled, will cause headache, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, or loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: m-$C_6H_4(CH_3)_2$
3.3 IMO/UN Designation: 3.2/1307
3.4 DOT ID No.: 1307
3.5 CAS Registry No.: 108-38-3

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Like benzene; characteristic aromatic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots.
5.2 Symptoms Following Exposure: Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma; can be fatal. Kidney and liver damage can occur.
5.3 Treatment of Exposure: INHALATION: remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 Threshold Limit Value: 100 ppm
5.5 Short Term Inhalation Limits: 300 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50 to 500 g/kg
5.7 Late Toxicity: Kidney and liver damage.
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard, if spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 0.05 ppm
5.11 IDLH Value: 10,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 64°F C.C.
6.2 Flammable Limits in Air: 1.1%-6.4%
6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective.
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 986°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 5.8 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity: 22 ppm/96 hr/bluegill/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 0 lb/lb, 5 days; 0% (theor.), 8 days
8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research: 99.99%; Pure: 99.9%; Technical: 99.2%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 106.16
12.3 Boiling Point at 1 atm: 269.4°F = 131.9°C = 405.1°K
12.4 Freezing Point: −54.2°F = −47.9°C = 225.3°K
12.5 Critical Temperature: 650.8°F = 343.8°C = 617.0°K
12.6 Critical Pressure: 513.8 atm = 34.95 psia = 3.540 MN/m²
12.7 Specific Gravity: 0.864 at 20°C (liquid)
12.8 Liquid Surface Tension: 28.8 dynes/cm = 0.0288 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 36.4 dynes/cm = 0.0364 N/m at 30°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.071
12.12 Latent Heat of Vaporization: 147 Btu/lb = 81.9 cal/g = 3.43 X 10^4 J/kg
12.13 Heat of Combustion: −17,554 Btu/lb = −9752.4 cal/g = −408.31 X 10^6 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 26.01 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 0.34 psia

NOTES

XLM	m-XYLENE

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
15	55.400
20	55.260
25	55.130
30	54.990
35	54.850
40	54.710
45	54.570
50	54.430
55	54.290
60	54.160
65	54.020
70	53.880
75	53.740
80	53.600
85	53.460
90	53.320
95	53.180
100	53.050

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
40	.387
50	.393
60	.398
70	.404
80	.410
90	.415
100	.421
110	.426
120	.432
130	.437
140	.443
150	.448
160	.454
170	.460
180	.465
190	.471
200	.476
210	.482

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
35	.962
40	.953
45	.944
50	.935
55	.926
60	.917
65	.908
70	.899
75	.890
80	.881
85	.873
90	.864
95	.855
100	.846

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
15	.938
20	.898
25	.862
30	.827
35	.794
40	.764
45	.735
50	.708
55	.682
60	.658
65	.635
70	.613
75	.592
80	.572
85	.554

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
	I
	N
	S
	O
	L
	U
	B
	L
	E

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
60	.090
70	.127
80	.177
90	.242
100	.326
110	.434
120	.571
130	.743
140	.956
150	1.219
160	1.538
170	1.924
180	2.388
190	2.939
200	3.590
210	4.355
220	5.247
230	6.282
240	7.476
250	8.846
260	10.410

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
60	.00172
70	.00238
80	.00324
90	.00435
100	.00577
110	.00754
120	.00975
130	.01247
140	.01577
150	.01977
160	.02455
170	.03023
180	.03691
190	.04473
200	.05382
210	.06431
220	.07635
230	.09009
240	.10570
250	.12330
260	.14310

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.247
25	.260
50	.273
75	.286
100	.299
125	.311
150	.324
175	.336
200	.348
225	.360
250	.371
275	.383
300	.394
325	.406
350	.417
375	.427
400	.438
425	.449
450	.459
475	.469
500	.479
525	.489
550	.499
575	.508
600	.517

APPENDIX A-2

OSHA JOB SAFETY & HEALTH PROTECTION POSTER

JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Requirements of the Act include the following:

Employers

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm to employees. Employers must comply with occupational safety and health standards issued under the Act.

Employees

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job.

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct jobsite inspections to help ensure compliance with the Act.

Inspection

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaint

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides that employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discrimination.

Citation

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

Proposed Penalty

The Act provides for mandatory penalties against employers of up to $1,000 for each serious violation and for optional penalties of up to $1,000 for each nonserious violation. Penalties of up to $1,000 per day may be proposed for failure to correct violations within the proposed time period. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to $10,000 for each such violation.

Criminal penalties are also provided for in the Act. Any willful violation resulting in death of an employee, upon conviction, is punishable by a fine of not more than $10,000, or by imprisonment for not more than six months, or by both. Conviction of an employer after a first conviction doubles these maximum penalties.

Voluntary Activity

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

Such voluntary action should initially focus on the identification and elimination of hazards that could cause death, injury, or illness to employees and supervisors. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can provide considerable help and advice on solving safety and health problems or can refer you to other sources for help such as training.

Consultation

Free consultative assistance, without citation or penalty, is available to employers, on request, through OSHA supported programs in most State departments of labor or health.

[illegible] OFFICE

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More Information

Additional information and copies of the Act, specific OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

Atlanta, Georgia
Boston, Massachusetts
Chicago, Illinois
Dallas, Texas
Denver, Colorado
Kansas City, Missouri
New York, New York
Philadelphia, Pennsylvania
San Francisco, California
Seattle, Washington

Telephone numbers for these offices, and additional area office locations, are listed in the telephone directory under the United States Department of Labor in the United States Government listing.

Washington, D.C.
1985
OSHA 2203

William E. Brock, Secretary of Labor

U.S. Department of Labor
Occupational Safety and Health Administration

Under provisions of Title 29, Code of Federal Regulations, Part 1903.2(a)(1) employers must post this notice (or a facsimile)

APPENDIX A-3

EMERGENCY INFORMATION

(TO BE POSTED IN THE TRAILER)

POST IN TRAILER

EMERGENCY TELEPHONE NUMBERS

(Local) Police Department	728-3400
(Local) Rescue Service	728-3400
(Local) Fire Department	ext. 233
Major Gerald Harris, Environmental Coordinator	288-4200
Poison Control Center	(800) 542-2323
***National Response Center (U.S. Coast Guard)	(800) 424-8802
Regional USEPA Emergency Response	(215) 597-9898
Chemical Manufacturers Association	
Chemical Referral Center	(800) 262-8200
Site HSO: Vicki Miller	(207) 775-5401
Site Manager: (Richard Hebert)	(207) 775-5401
Regional HSS: Averill Rance	(201) 992-2323 x264
C-E Environmental HSM: C.E. Sundquist	(207) 775-5401 x755

*Suffolk County Sheriff's Department	548-3200
**Control Suffolk Hospital Emergency Room	548-6026
***Environmental Health Services - Hazardous and Toxic Materials & Oil Spills	451-4627

POST IN TRAILER

ROUTES TO EMERGENCY MEDICAL FACILITIES

Primary source of medical assistance for the Suffolk County Air National Guard Base:

Central Suffolk Hospital
1300 Roanoke Avenue
Riverhead, New York 11901
548-6000

Directions to hospital for medical assistance:

- Exit site. Turn right onto Old Riverhead Road.
- Proceed north to junction with County Route 104.
- Turn left onto Route 104.
- Proceed north into downtown Riverhead.
- Turn right onto Main Street (NYS Route 25)
- Make an immediate left onto Roanoke Avenue (County Route 73-North)
- Follow Roanoke Avenue to traffic circle.
- Hospital is on north east side of circle.

POST IN TRAILER

EMERGENCY SIGNALS

In most cases, field personnel will carry portable radios for communications. If this is the case, a transmission that indicates it is of an emergency nature will take priority over all other transmissions. All other site radios will yield the frequency to the emergency transmissions.

Where radio communication is not available, the following air-horn signals will be used:

HELP	three short blasts	(. . .)
EVACUATION	three long blasts	(_ _ _)
ALL CLEAR	alternating long and short blasts	(_._.)

APPENDIX B

SITE-SPECIFIC QUALITY ASSURANCE PROJECT PLAN

INSTALLATION RESTORATION PROGRAM
QUALITY ASSURANCE PROJECT PLAN

SUFFOLK COUNTY AIR NATIONAL GUARD BASE
SUFFOLK COUNTY AIRPORT
WESTHAMPTON BEACH, NEW YORK

Prepared for:

NATIONAL GUARD BUREAU
ANDREWS AIR FORCE BASE
MARYLAND

Submitted to:

HAZWRAP SUPPORT CONTRACTOR OFFICE
OAK RIDGE, TENNESSEE

Operated by:

MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY

Prepared by:

E.C. JORDAN CO.
PORTLAND, MAINE
Job No. 5096-12

AUGUST 1990

QUALITY ASSURANCE PROJECT PLAN
SUFFOLK COUNTY AIR NATIONAL GUARD BASE

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QUALITY ASSURANCE PROJECT PLAN
SUFFOLK COUNTY AIR NATIONAL GUARD BASE

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1.0 PROJECT DESCRIPTION

1.1 HISTORY OF THE INSTALLATION RESTORATION PROGRAM AT SCANGB

(Refer to Subsection 1.2 of the SAP.)

1.2 SITE HISTORY AND PHYSICAL SETTING

(Refer to Section 2.0 of the SAP [except the first paragraph].)

1.3 SITE DESIGNATIONS

(Refer to Subsection 2.1 of the SAP.)

1.4 PREVIOUS STUDIES

(Refer to Subsection 2.2 of the SAP.)

1.5 GEOLOGY AND HYDROGEOLOGY

(Refer to Subsection 2.3 of the SAP.)

2.0 PROJECT ORGANIZATIONAL RESPONSIBILITIES

2.1 ORGANIZATION

The Jordan organizational structure for activities to be conducted for SCANGB maintains the basic elements that have been applied successfully at more than 15 bases in Jordan's IRP efforts (Figure 2-1). The Task Order Manager (TOM) is the focal point of the structure and is responsible for all activities. He is responsible to five different groups: three internal (the Corporate Officer, Program Manager, and Technical Review Committee) and two external (the HAZWRAP Project Manager and the NGB).

Reporting to the TOM are a Contracts and Administration Manager and a Technical Leader for the SI program. The organization supporting the SI Leader, or Technical Director, includes a chemist to evaluate and manage the analytical samples and data received from the laboratory; an Operations Leader for the field efforts; and a person to address public health and environmental impact concerns through the preliminary risk assessments.

2.2 PERSONNEL

The following subsections describe the key roles and team members for activities to be performed at SCANGB.

2.2.1 Key Roles

The personnel selected to fill key positions during the SCANGB Task Order have acquired considerable experience with the IRP during Jordan's four-year involvement. Each key individual is familiar with the working relationships between the NGB and HAZWRAP, and among the NGB and regulatory agencies; it is important that these relationships be understood and maintained if programs are to be successful. The key roles for SI work at SCANGB are designated in the following paragraphs.

Corporate Officer. The Corporate Officer is William R. Adams, P.E., a Jordan vice president. He is responsible for committing the corporate resources necessary to conduct the program work activities, supplying corporate-level input for problem resolution, and assisting the Program Manager and TOM, as needed, in project implementation.

Program Manager. The Program Manager, Allan Ikalainen, P.E., is responsible for oversight and management of the overall multi-installation IRP program for Region II. In this position, Mr. Ikalainen is able to perceive overall program needs, promote technology and other information transfers among various IRP projects, and direct resources as appropriate for effective and timely completion of program activities.

Task Order Manager. The TOM for SCANGB Task Order is Richard Hebert. He is responsible for evaluating the appropriateness and adequacy of the technical or engineering services provided for the Task Order, and for developing the technical approaches and levels of effort required to address each SAP task. He also is responsible for day-to-day conduct of the work, including the integration of supporting disciplines and subcontractors (i.e., field investigation, drilling, and laboratory subcontractors). Mr. Hebert will be reviewing the ongoing QC during performance of the work, the technical integrity of conclusions and recommendations, and the clarity and usefulness of all project work products.

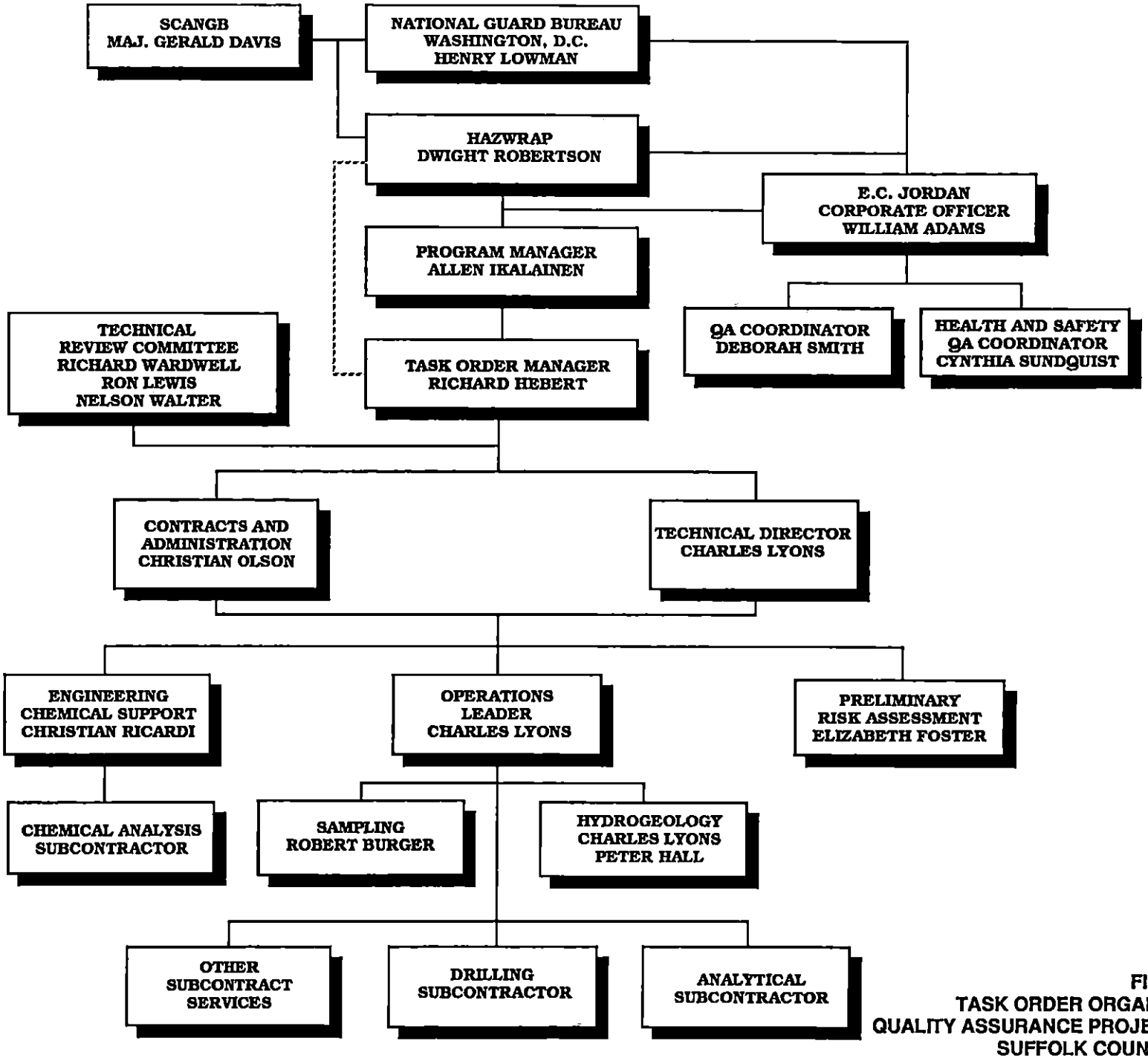


FIGURE 2-1
TASK ORDER ORGANIZATION
QUALITY ASSURANCE PROJECT PLAN
SUFFOLK COUNTY ANGB
E. C. JORDAN CO.

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Specific responsibilities of this role include the following:

- o overall technical responsibility for the project
- o initiation of project activities
- o participation in SAP preparation and staff assignments
- o identification and fulfillment of equipment and other resource requirements
- o oversight of task activities to ensure compliance with established budget, schedules, and scope of work
- o regular interaction with HAZWRAP and NGB representatives, the Corporate Officer, and others (as appropriate) regarding project status

Technical Review Committee. The Technical Review Committee was carefully chosen, with both technical background and program experience as criteria. A committee, made up of senior technical staff from the Jordan team, will assist the TOM by reviewing the technical aspects of the project to ensure that services reflect the accumulated experience of the firm, are produced in accordance with corporate policy, and meet the intended needs of the IRP team. The primary function of the committee is to ensure the application of technically sound methodologies and the development of litigation-defensible data, interpretation, and conclusions. Richard Wardwell, Ph.D. and P.E., Ronald Lewis, and Nelson Walter comprise the Technical Review Committee. Jordan believes this involvement appropriate and essential for maintaining quality throughout the project.

Quality Assurance and Health and Safety Coordinators. The TOM is supported by a QA Coordinator and a Health and Safety (H&S) Coordinator. These staff-level positions will report to the Corporate Officer and the TOM, respectively. Deborah Smith will serve as the QA Coordinator for this Task Order. The QA Coordinator will ensure that appropriate IRP and USEPA protocols are followed on the SCANGB Task Order, and will be responsible for development of the Quality Assurance Plan. The QA Coordinator also works with the Program Manager/TOM to ensure that established QC procedures are implemented. Cynthia Sundquist will serve as the H&S Coordinator. On-site conformance with safety protocols will be ensured by periodic site visits by Ms. Sundquist and day-to-day supervision by leaders of the site characterization activities. The H&S Coordinator is responsible for ensuring that the project team complies with the company's Health and Safety Plan (HASP) when conducting site operations. She is also responsible for seeing that the HASP is developed for implementation of selected alternatives.

2.2.2 Team Members

Key positions in this Task Order are the administrative and technical activity leaders (i.e., the senior and/or most experienced individual in each administrative-technical area of the project). These activity leaders, as shown on the organizational chart, are described in the following paragraphs (see Figure 2-1).

Contracts and Administration Manager. The staff-level position of Contracts and Administration Manager is established because of the importance of the day-to-day scope, schedule, and budget monitoring for the SCANGB Task Order, both within Jordan and between Jordan and the IRP team. It is expected that program decisions will be occurring frequently. Therefore, it is necessary to anticipate and immediately implement the administrative actions (i.e., initiate internal work orders, follow up on support needs, amend subcontracts,

and track costs) to carry out the program plans. To achieve maximum efficiency and timeliness of response, Christian Olson will be responsible for these areas for Jordan through the TOM and will be a principal communication link with the client for these areas. Mr. Olson will be responsible for the following specific tasks:

- o establishing and overseeing all subcontracts for support services
- o preparing monthly technical/management/cost progress reports
- o ensuring that appropriate financial records are maintained and that reporting requirements are met

Site Investigation. Charles Lyons, C.G., will be the Technical Leader for all site investigation studies. He will be responsible for all field explorations and groundwater and surface water studies, with support from Peter Hall. Also, he will be responsible for development of the RI work plan, if one is required.

Engineering Chemical Support. Christian Ricardi will be responsible for all activities supporting the program in analytical areas, including laboratory analysis, sampling, and chemistry-related needs.

Receptor Evaluation. Elizabeth Foster will be responsible for the contamination assessment and associated risk assessment activities.

Sampling. Robert Burger will be responsible for field sampling activities to support the program. His responsibilities include training of personnel, and maintenance and advancement of sampling technologies.

Personnel for each major task are listed in Figure 2-1. Resumes of all individuals listed, included in Appendix A of the Project Management Plan, discuss their hazardous waste qualifications and experience.

3.0 QUALITY OBJECTIVES FOR MEASUREMENT

DQOs are based on the premise that different data uses require different levels of data quality. Data quality refers to a degree of certainty with respect to precision, accuracy, representativeness, completeness, and comparability (PARCC). Specific objectives for each characteristic are established to identify applicable sampling protocols, documentation, sample handling, and measurement system procedures. These objectives are established based on site conditions, project objectives, and available measurement systems. Data obtained during the investigation are intended to determine the presence or absence of contaminants and other uses consistent with an SI. Subsequent use of measurements in calculations and evaluations is subject to aspects of this QAPP, as described in the following subsections and Subsection 3.7.1 of the SAP.

3.1 PRECISION AND ACCURACY

Precision, the ability to replicate a value, and accuracy, the ability to obtain a true value, are addressed for all generated data. DQOs for precision and accuracy are established for each major parameter to be measured at the site, and are discussed in the analytical program (see Subsection 3.5). These objectives are based on knowledge of the capabilities of the measurement system to be employed, and are selected in accordance with project requirements. Precision and accuracy requirements vary, depending on intended data uses. For example, a screening tool to identify the general extent of contaminant distribution (i.e., presence or absence) will not require the same precision and accuracy needed to define the exact nature and amount of contaminant at specific locations.

3.2 REPRESENTATIVENESS

Representativeness expresses the degree to which sample data depict an existing environmental condition. Representativeness is accomplished through proper selection of sampling locations and sampling techniques and collection of a sufficient number of samples.

At SCANGB, sampling locations were chosen by a biased, phased approach. Initial sampling sites were biased to detect contamination based on personal interviews and historical information. The phased approach provides for screening, followed by confirmation, and provides for optional additional explorations. This approach is described in detail in Section 3.0 of the SAP.

Measurements will be taken so results are as representative of the medium and conditions being measured as possible. Sampling protocols will be developed to ensure that collected samples represent the media. Sample handling protocols were selected to protect the representativeness of the collected sample. Proper documentation will establish that protocols have been followed and sample identification and integrity ensured.

3.3 COMPLETENESS

The characteristic of completeness is a measure of the amount of valid data obtained compared to the amount expected to be obtained under normal conditions. The SCANGB SAP allows for a sufficient number of samples to be collected to accomplish the project objectives (see Subsection 1.3). Because sampling and waste characterization activities often rely on a field protocol, the SAP provides an estimate of the number of samples to be collected (see Tables 3-2 through 3-7 of the SAP). Technical difficulties encountered in the

field may prevent acquisition of the predetermined number of samples. However, the use of field analysis (Levels A and B) allows invalid measurements to be repeated because of minimal delay between acquisition and analysis. Levels C, D, and E allow for a high degree of completeness for laboratory analysis. Critical samples will be identified using screening techniques before laboratory analysis and plans are made to achieve valid data.

The extent of completeness and its importance relative to project goals that depend on specific site conditions will be reviewed after sample collection and analysis activities.

3.4 COMPARABILITY

The characteristic of comparability reflects the confidence with which one data set can be compared with other measurements, and the expression of results consistent with other organizations reporting similar data. This is accomplished through the use of standard techniques for sample collection and analysis, and the reporting of results in appropriate units.

Comparability of measuring procedures is also addressed. This characteristic implies using analytical methodologies that produce results comparable in terms of precision, accuracy, and effective range of calibration.

3.5 DATA QUALITY OBJECTIVES

DQOs are based on the premise that different data uses require different levels of data quality. Data quality refers to a degree of certainty with respect to PARCC. Specific objectives for each characteristic are established to develop sampling protocols, and to identify applicable documentation, sample handling procedures, and measurement system procedures. DQOs are established based on site conditions, project objectives, and knowledge of available measurement systems. Data obtained during the investigation are intended to be used for site characterization, determination of the vertical and horizontal distribution of contaminants, and other uses consistent with an SI. The subsequent use of measurements in calculations and evaluations is also subjected to aspects of the SAP. Five HAZWRAP levels of data quality, applicable to the SI process at SCANGB, are summarized as follows (HAZWRAP, 1988):

Level A. Field analysis data for qualitative information for identification of sampling locations and health and safety monitoring (e.g., PID screening of soils samples).

Level B. Field analysis data based on qualitative/quantitative methods conducted on-site (e.g., field GC analysis). These data may provide quantitative chemical-specific information, but are not measured under controlled laboratory conditions and do not include rigorous QC measures (e.g., matrix spikes, duplicates, and reference standards).

Level C. Laboratory analysis data obtained using USEPA-approved procedures that can be methods other than CLP Routine Analytical Services protocol. These data are both qualitative and quantitative. For samples analyzed under Level C, CLP-equivalent deliverables will be generated.

Level D. Laboratory analysis data obtained using CLP methods. Full CLP deliverables will be generated for all samples.

Level E. Laboratory analysis data obtained using non-CLP methods. However, USEPA methods or equivalent must be used. Level E also can be used on samples that are primarily pure product or waste.

The data validation process is described in Subsection 8.2 of this QAPP.

4.0 SAMPLING PROCEDURES AND QUALITY CONTROL SAMPLES

Field methods and sampling procedures were developed using other reference sources (E.C. Jordan Co., 1989a; and HAZWRAP, 1988). Specific procedures are discussed in Subsections 3.3 and 3.4 of the SAP.

QC samples will be collected during each sampling event. A brief description of QC samples to be collected and the intended purposes for them are as follows:

Trip Blanks. A trip blank will be included with each cooler/container of water samples scheduled for VOC analysis, and will be analyzed with the associated VOC samples. Trip blanks are required to assess the potential for contaminating samples with VOCs during sampling or in transit. The trip blank consists of a VOC sample container shipped to the site with the other VOC sample containers and filled on-site with deionized water.

Field Duplicates. Field duplicate samples are collected to assess homogeneity of the sampled media and precision of the sampling protocol. Duplicates of groundwater, surface water, soil, and sediment samples will be submitted for analysis for all parameters specified for the original samples at a rate of 10 percent of the samples analyzed (HAZWRAP, 1988).

Equipment Rinsates. A sampler blank, analyzed for all analytes specified in the plan, is collected to ensure that decontamination procedures provide adequate cleaning of sampling equipment.

A minimum of one sampler blank every other day for all sampling equipment is scheduled during sampling episodes. If high contaminant concentrations are encountered, a rinsate may be collected per day for the period during which high contaminant concentrations are encountered.

Contaminants within sampling equipment are assessed by collecting a sample of deionized water passed through the sampling apparatus after decontamination is complete. Discrete samples are collected for each analytical method.

Filtration Blanks. Groundwater monitoring well samples scheduled for analysis of inorganic parameters will be filtered. QED Environmental Systems, Inc., disposable 0.45-micron canister filters (or equivalent) will be used. Deionized water will be run through a filter and submitted as a blank sample to assess potential for contamination. The specific number and type of QC samples that will be collected and analyzed are identified in Table 3-8 of the SAP.

5.0 SAMPLE CUSTODY

Sample chain of custody (COC), initiated during bottle preparation by the laboratory, will be maintained through sample collection, shipment, storage, and analysis as a legal record of sample possession. Possession will be traceable by means of a COC form, which will remain with the samples at all times and bear the name of the person responsible for the samples. Procedures for maintaining appropriate sample custody information will be followed according to Jordan's QAPP, Technical Support for Environmental Programs at Federal Installations (E.C. Jordan Co., 1989b).

6.0 CALIBRATION PROCEDURES AND FREQUENCY

The following subsections describe calibration procedures and frequency to be used at SCANGB.

6.1 CALIBRATION PROCEDURES FOR LABORATORY EQUIPMENT

Calibration procedures used by contract laboratories are specified by the CLP/ Caucus Organic Protocol Program and are addressed in QA documents for the laboratory subcontractor.

6.2 CONTROL OF MEASURING AND TEST EQUIPMENT

Inspection, measurement, and test equipment will be controlled, calibrated, adjusted, and maintained at prescribed intervals to ensure accuracy (see Subsection 3.1). Critical spare parts will be kept on inventory to minimize downtime. Calibration will be performed on certified equipment using standards with known valid relationships to nationally recognized standards. If no national standard exists, the basis for calibration will be documented.

The method and interval of calibration for each item will be defined and based on equipment type, stability characteristics, required accuracy, and other considerations affecting measurement control. Special calibration will be performed when equipment accuracy becomes suspect. When inspection, measurement, or test equipment is found to be out of tolerance (see Subsection 3.1), an evaluation will be made of the validity and acceptability of items previously inspected or tested. If any inspection, measurement, or test equipment is found to be consistently out of calibration, it will not be made available for use. Records will be maintained and equipment suitably marked to indicate calibration status.

6.3 FIELD INSTRUMENT CALIBRATION

Each piece of equipment will be calibrated daily before each use, or as specified by the manufacturer. Data are recorded on a form similar to that shown in the E.C. Jordan Co. IRP QAPP (E.C. Jordan Co., 1989b). Manufacturer calibration procedures will be followed. The manufacturer and lot number of all standards will be noted on the field instrument QA record under chemicals used. The types of field measurements that may be used include but are not limited to the following:

- VOCs using field GC (soil and water)
- SVOCs using field GC (soil and water)
- temperature (water)
- specific conductance (water)
- pH (water)
- metals (using X-ray fluorescence)

7.0 ANALYTICAL PROCEDURES

The criteria for selecting procedures are in other reference documents (HAZWRAP, 1988; and E.C. Jordan Co., 1989b). Analytical program methods are summarized in Table 3-8 of the SAP.

7.1 FIELD SCREENING

The field GC screening program to be employed at SCANGB will use the purge-and-trap technique to detect VOCs in water and soil. Direct injection into the GC will be used for screening SVOCs in water and soil. X-ray fluorescence will be used to screen for elements in soils. The screening methods are described in Subsection 3.1 of the SAP and in the test-specific SOP.

Screening results will be used to select soil samples to be analyzed by the laboratory for TCL VOCs, TCL SVOCs, and TCL metals. The GC purge-and-trap screening data also will be used to evaluate volatile contaminant profiles in groundwater for placement of monitoring wells. These and other screening data will be used to assess surface and subsurface extent of selected parameters. The data also may be used to help support risk assessments where appropriate.

7.2 METHOD BLANKS

Before analyzing any samples or standards, the chemist will ensure that the system is free from interferences. A method blank run will be analyzed as the first run of the day, as well as after the calibration check standard and any high-level sample to ensure that carry-over is not occurring (see Subsection 3.1 of the SAP).

7.3 CALIBRATION

Calibration standards are prepared according to guidelines established in the SOP (GGCSTD-001-01). The GC system will be calibrated using the external standard technique. For each analyte of interest, calibration standards are prepared at three concentrations; these calibration standards are analyzed in the same manner as the samples. Target analyte retention times are determined and the response factor is calculated by dividing the total peak area by the nanograms of the standard injected. These results are used to prepare a calibration curve for each analyte. Sample results are then compared to the retention times and the calibration curve to identify and quantitate target analytes.

8.0 DATA MANAGEMENT

The following subsections describe the data management program for this project.

8.1 REDUCTION

Calculations made during data reduction are described in the referenced analytical methods and in the participating laboratories' QA program documents. Upon receipt, analytical data packages are given to the data management staff for reduction to standard data tabulations, which may occur in one of the following three ways:

- o data are entered manually into data table templates
- o data are downloaded directly from the laboratory computer
- o data are loaded from magnetic media supplied with the data package by the laboratory

In all cases, the electronic version of the standard data tabulation is checked for transcription errors against the hardcopy laboratory report of analysis forms.

Completed data tabulations are provided to the data validation staff along with the original data packages. Original data, tabulations, and magnetic media are stored in a secure and retrievable fashion.

8.2 VALIDATION

Validation of measurements by Jordan is a systematic process of reviewing a body of data to ensure the data are adequate for intended use. Validation or blank correction of laboratory data will be performed according to USEPA guidance (USEPA, 1988a and 1989), as well as appropriate USEPA Region II revisions to these protocols. Full validation includes the following activities:

- o auditing measurement system calibration and calibration verification
- o auditing QC activities
- o screening data sets for outliers
- o reviewing data for technical credibility versus the sample site setting
- o auditing field sample data records and COC
- o checking intermediate calculations
- o certifying the entire process

These guidelines provide criteria for data validation that evaluates the QC data deliverables accompanying the different analytical procedure outputs.

Before data collection, determinations are made regarding data to be gathered in the field and the methodology to be used. Once data are obtained, they will be reviewed and assessed regarding adequacy.

Data validation results are used to evaluate data utility. At a minimum, evaluations will include the following:

- o trip blanks, field blanks, and method blanks for potential laboratory or field sampling contamination
- o matrix spike/matrix spike duplicate recoveries for analytical precision and accuracy
- o field duplicates to assess sampling precision and environmental matrix heterogeneity
- o trip blanks, field blanks, and method blanks for potential laboratory or field sampling contamination

8.3 REPORTING

Three presentations of analytical data will be prepared by Jordan's environmental chemistry group. The data tables will represent the following:

- o raw data as received from the laboratory, tabulated by medium and analytical fraction
- o annotated data resulting from the validation process, in tabulated format
- o a summary table, presenting only data that survive the validation process and are considered suitable for site interpretation

Validated data comprise the formal presentation of analytical data, including the following information in a table format suitable for review:

- o sample number
- o date sampled
- o sample numbers of associated analyses (i.e., field, trip, and equipment blanks)
- o analyte name
- o reporting units
- o detection limit
- o analytical results
- o validation qualifiers
- o any required footnotes

9.0 INTERNAL QUALITY CONTROL

QA activities undertaken during work for HAZWRAP ensure that the service, designs, and documents produced meet currently accepted professional standards. Small assignments or tasks entail periodic discussions among the technical staff, Task Leader, and Project Manager. QC on larger assignments may require that review personnel be involved in periodic QC meetings, which are scheduled routinely and considered an integral part of the design, writing, and checking phases of a project. The Jordan QAPP, Technical Support for Environmental Programs at Federal Installations, describes various means for ensuring QC of a project (E.C. Jordan Co., 1989b).

10.0 PERFORMANCE AND SYSTEMS AUDITS

Performance audits are generally associated with data generation systems. All participating laboratories have successfully passed a HAZWRAP performance evaluation and audit and are certified to participate in the IRP program.

Systems audits may be conducted on systems components to evaluate appropriate selection and use. The project systems audit includes evaluation of field, office, and laboratory procedures. Systems audits may address the following components:

- organization and personnel
- facilities and equipment
- analytical methodology
- sampling and sample handling procedures
- data handling

The Jordan QAPP, Technical Support for Environmental Programs at Federal Installations, describes the function and objectives of the audits in greater detail (E.C. Jordan Co., 1989b). HAZWRAP will conduct field surveillances to monitor field performance and compliance.

11.0 PREVENTIVE MAINTENANCE

A schedule will be developed that provides for major preventive maintenance of field instruments. Documentation of preventive maintenance will be kept in bound notebooks. Preventive maintenance for major field analytical equipment will be available in the field. Preventive maintenance of laboratory equipment will be according to the laboratory QA plan.

12.0 DATA ASSESSMENT PROCEDURES

Data collected from various investigative activities will be evaluated and assessed to decide if the data meet technical objectives. Field screening data including calibration and method blank results will be reviewed by the project chemist. Positive target compound results will be verified by laboratory analysis using CLP methodologies and Level D DQOs (see Subsections 3.4 and 3.7 of the SAP). Results of the field screening and laboratory analyses will be reviewed for precision, accuracy, and comparability.

The contamination assessment will evaluate the nature and distribution of contamination at each site. The identification and concentration of chemicals will be evaluated with reference to appropriate water quality standards (i.e., federal and state MCLs and MCLGs and background levels). Chemicals selected as contaminants will be further evaluated relative to potential transport mechanisms that allow or may allow contaminant migration from the site. Estimated quantities, types, forms, and concentrations of contaminants in the pertinent media will be evaluated. A quantitative evaluation of observed and potential contaminant migration also will be provided to evaluate whether further study or remedial action is warranted.

Data will be collected to assess human population exposure to the chemicals of concern, exposure pathways, concentrations of chemicals, and (by medium) size and distribution of potentially exposed populations. Data also will be collected and assessed to support an environmental risk assessment similar to that for the public health risk assessment. Both assessments will be presented in the RI/FS. These data will be used to characterize the source of contamination, evaluate the fate and transport of contaminants, identify populations at risk, calculate the exposure to potential receptors, and assess contaminant impacts.

13.0 CORRECTIVE ACTIONS

Corrective or preventive actions to improve project quality will be implemented if potential or existing conditions are identified that may have an adverse impact on data quantity or quality. Corrective actions may be immediate or long-term, and are taken according to the QAPP, Technical Support for Environmental Programs at Federal Installations (E.C. Jordan Co., 1989b).

14.0 QUALITY ASSURANCE REPORTS

QA reporting and documentation will be conducted consistent with the QAPP, Technical Support for Environmental Programs at Federal Installations (E.C. Jordan Co., 1989b).

ATTACHMENT A

TENTATIVE METHOD FOR THE DETERMINATION OF ETHYLENE GLYCOL IN WATER

APC-44

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH
DIVISION OF ENVIRONMENTAL SCIENCES

Tentative Method for the Determination of Ethylene Glycol in Water

1. Scope and Application

This method is applicable to the measurement of total glycols as ethylene glycol in raw and treated water. A minimum concentration of 50 µg/liter of total glycols as ethylene glycol can be determined by this method.

2. Summary of Method

A water sample is passed through an ion exchange column to remove interferences. The sample is then reacted with meta-periodate to produce formaldehyde. The resulting formaldehyde is determined by the chromotropic acid procedure. The amount of formaldehyde originally present in the sample is determined in a separate analysis, omitting the oxidation step. The difference is reported as total glycols measured as ethylene glycol.

3. Interferences

3.1 Theoretically, 2.5 µg of propylene glycol per ml produces a color intensity equivalent to 1 µg of ethylene glycol per ml. If it is known that the sample contains only one kind of glycol, eg. propylene glyol, the standard curve should be prepared with that glycol, and concentrations should be reported directly in µg/L of the glycol. Higher molecular weight α, β glycols produce even less color intensity.

3.2 Theoretically, 1 µg of formaldehyde per ml produces a color intensity equivalent to 1 µg of ethylene glycol per ml. Formaldehyde can be measured

independently by performing the chromotropic acid analytical procedure on the sample, omitting oxidation by meta-periodate.

3.3 Saturated aldehydes other than formaldehyde give less than 0.01% positive interference. Ethanol and higher molecular weight alcohols and olefins are negative interferences.

3.4 Nitrates produce a yellow color and a proportional decrease in optical density measurement. Passing the sample through an ion exchange resin eliminates this interference.

3.5 Phenols result in a 10 to 20% negative interference when present in an 8:1 excess over ethylene glycol.

4. Apparatus

4.1 Spectrophotometer or colorimeter - an instrument capable of measuring the absorbance of the color-developed solution at 580nm.

4.2 Test tubes, 50 ml capacity or larger, Pyrex, such as Corning #8240.

4.3 Volumetric flasks, 100 ml size.

4.4 Pipets, various sizes, volumetric, Mohr, and Eppendorf.

4.5 Poly-Prep disposable chromatography columns, Bio-Rad Cat. # 731-1550.

4.6 Transfer pipets, disposable polyethylene, Fisher Catalog #13711-7. Cut approximately one inch off tip to accommodate resin beads.

4.7 Magnetic stirrer and spin bar.

4.8 Test tube racks to hold 50 ml test tubes and Poly-Prep ion exchange columns.

5. Reagents

5.1 Chromotropic acid reagent, 1% - Dissolve 0.10 grams of

4,5-dihydroxy-2,7-naphthalene disulfonic acid disodium salt (Eastman Kodak Company, Rochester, New York, Catalog number P 230, in 10 ml of distilled water. Make up fresh daily.

5.2 Concentrated sulfuric acid.

5.3 Distilled deionized water.

5.4 Ethylene glycol stock solution - weigh approximately 0.1 gram of reagent grade ethylene glycol (to the nearest 0.1 mg) into a tared 100 ml volumetric flask. Add about 50 ml of distilled deionized water and mix well. Dilute to 100 ml with distilled deionized water. The concentration of ethylene glycol in micrograms per milliliter is:

$$S = \frac{F-T}{100} \times 10^6 \quad \text{or} \quad S = 10{,}000\ (F-T)$$

where:

S = Concentration of ethylene glycol stock solution (approximately 1000 µg/ml).

F = Weight of volumetric flask plus ethylene glycol, grams.

T = Tare weight of volumetric flask, grams.

100 = Final volume of stock solution (100 ml).

10^6 = Conversion from grams of ethylene glycol to micrograms of ethylene glycol.

This solution is stable for at least six months.

5.5 Ethylene glycol, 10 µg/ml working standard - Dilute an amount (A) of

the ethylene glycol stock solution to 100 ml in a volumetric flask using distilled, deionized water to obtain a concentration of 10 micrograms of ethylene glycol per ml:

$$A = \frac{1000}{S}$$

where:

A = ml of ethylene glycol stock solution to be diluted to 100 ml to prepare a working standard of 10 µg/ml.

S = Concentration of ethylene glycol stock solution, µg/ml. Prepare fresh on the day of analysis.

5.6 Sodium bisulfite, 2% - Dissolve 2 grams of sodium bisulfite in distilled, deionized water in a 100 ml volumetric flask. Dilute to 100 ml with distilled, deionized water. Prepare fresh on the day of analysis.

5.7 Potassium meta-periodate, 0.01M - Dissolve 0.23 grams of reagent grade potassium meta-periodate in distilled, deionized water. Dilute to 100 ml in a volumetric flask. Prepare fresh on the day of analysis.

AVAILABLE FROM FISHER SCIENTIFIC CO.

5.8 Rexyn 300 (H-OH) ion exchange resin, a mixture of strong acid cation exchanger in hydrogen form and strong base anion exchanger in hydroxyl form, medium porosity, 16 - 50 mesh. Place approximately 25 - 30 ml of resin in a 300 ml Erlenmeyer flask. Add distilled deionized water to form a slurry. Swirl and decant the liquid. Repeat twice. Add about 100 ml of distilled deionized water and cap the Erlenmeyer flask. Store the resin in this manner until the day of analysis.

6. Preparation of Standard Curve

6.1 Prepare a series of standards in the following manner: Into 100 ml volumetric flasks, pipet the indicated amounts:

Concentration of Standard	ml of 10 µg/ml Working Standard
0.05 µg/ml	0.5 ml
0.10 µg/ml	1.0 ml
0.25 µg/ml	2.5 ml
0.50 µg/ml	5.0 ml
1.0 µg/ml	10.0 ml
3.0 µg/ml	30.0 ml

Dilute all standards to 100 ml with distilled deionized water.

7. Preparation of Sample

7.1 Each sample is passed through an ion exchange column before analysis to eliminate interferences in the sample matrix. A set of standards and a water blank are treated in the same manner.

7.2 Prepare one Poly-Prep ion exchange chromotography column for each sample, standard and water blank in the following manner:

Place Poly-Prep columns in a test tube rack with a waste receptacle under each column. Rinse the ion exchange resin, which was stored under distilled deionized water (section 5.8) with at least three changes of distilled deionized water. After decanting the last portion of rinse water,

add approximately 100 ml of deionized distilled water to the Erlenmeyer flask. Place a magnetic stirring bar in the Erlenmeyer flask and stir the resin slurry slowly to keep the resin suspension uniformly distributed. While stirring, remove aliquots of resin using a plastic transfer pipet (with cut off tip) and transfer the aliquots to a Poly-Prep plastic chromatography column until a total volume of approximately 2 ml of resin has been added. In this manner, fill each column.

If it is known that the samples are high in salt content, a higher capacity ion exchange column such as the 10 ml Econo Column (Bio Rad) can be substituted for the 2 ml Poly-Prep column.

7.3 Add at least 10 ml of distilled deionized water to each column and collect the eluant in the waste receptacle. Add 10 ml of sample, standard, or distilled deionized water (for the water blank) to the respectively labeled columns, and collect the eluant in the waste receptacle. Replace each waste receptacle with a labeled 50 ml Erlenmeyer flask. Add two 10 ml aliquots of sample, standard, or distilled deionized water (for the water blank) to each respectively labeled column and collect the eluant in the labeled 50 ml Erlenmeyer flasks.

These deionized samples, standards, and water blank are analyzed for total glycols (as ethylene glycol) as described in section 8.0.

8. Analysis of Glycols

8.1 Into labeled 50 ml pyrex test tubes, pipet 3.0 ml of each deionized standard, sample, and water blank.

8.2 Add 100 µl of 0.01M potassium meta-periodate solution to each test tube. Mix well and place tubes in a hot water bath (≈ 60°C) for 15 minutes.

8.3 Add 500 µl of 2% sodium bisulfite solution. Mix well. Let stand 5 minutes.

8.4 Add 100 µl of 1% chromotropic acid reagent to each tube and mix.

8.5 Pipet 6 ml of concentrated sulfuric acid slowly and cautiously into each test tube. The solution becomes extremely hot during the addition of the sulfuric acid. If the acid is not added slowly, some loss of sample could occur due to spattering. Mix well while adding the acid.

8.6 Allow all solutions to cool to room temperature. Read at 580nm with a suitable spectrophotometer using a 1 cm cell. Zero the instrument with distilled deionized water.

8.7 Determine the glycol content (as ethylene glycol) from a standard curve. Plot absorbance vs micrograms of ethylene glycol per ml.

8.8 If the presence of formaldehyde is suspected, analyze an aliquot of the deionized sample (as prepared in section 7) for formaldehyde as directed in APC-29, "Determination of Formaldehyde in the Atmosphere" by the Chromotropic Acid Method. (See reference in Section 12.3) Determine the concentration in µg/ml of sample.

9. Quality Control, Ethylene Glycol

9.1 Analyze at least one sample in duplicate.

9.2 Spike at least one deionized sample. Pipet 2 ml of deionized sample into a 50 ml Pyrex test tube. Add 1 ml of 1.0 µg/ml ethylene glycol standard. Analyze along with each sample batch and calculate the recovery of the spike. If the concentration of the sample is known, prepare a spike with 1 ml of a standard, approximately equal in concentration to the sample, plus 2 ml of sample.

9.3 To monitor the ion exchange procedure, plot the absorbances of the water blank and the 1.0 µg/ml standard. Determine the control and warning limits after several batches have been analyzed. Out of control blank values or 1.0 µg/ml standard absorbance values indicate the need for reanalysis.

10. Calculations

10.1 If the ethylene glycol analysis indicates the presence of glycols, the sample must be analyzed for formaldehyde content and the difference calculated.

$$R = G - F$$

where: R = µg/ml Glycols as ethylene glycol

G = µg/ml Total glycols result obtained in section 8.7

F = µg/ml Formaldehyde result obtained in section 8.8.

10.2 Report the glycols as ethylene glycol result in µg/L. Minimum reportable concentration is 50 µg/L.

$$\mu g \text{ glycol/L} = 1000\ R$$

where: R = Result from Section 10.1

11. Stability

11.1 Stability studies show that water samples should be preserved to pH < 2 and kept refrigerated until analysis. To preserve, add 1 ml of 1 + 1 hydrochloric acid to a quart sample. The absorbance of the color-reacted sample is stable at least 24 hours.

12. References

12.1 Methods of Air Sampling and Analysis, 3rd Edition, American Public Health Association, Washington, D.C. 1989, pp. 274-278, "Determination of Formaldehyde Content of the Atmosphere (Colorimetric Method)".

12.2 Critchfield, F.E. and J.B. Johnson, "Colorimetric Determination of Ethylene Oxide by Conversion to Formaldehyde", Analytical Chemistry, Volume 29, No. 5, May, 1957, pp. 797-800.

12.3 "Determination of Formaldehyde in the Atmosphere", APC-29, New York State Department of Health, Wadsworth Center for Laboratories and Research, Division of Environmental Sciences.

12.4 "Determination of Ethylene Glycol in Air", APC-38, New York State Department of Health, Wadsworth Center for Laboratories and Research, Division of Environmental Sciences.